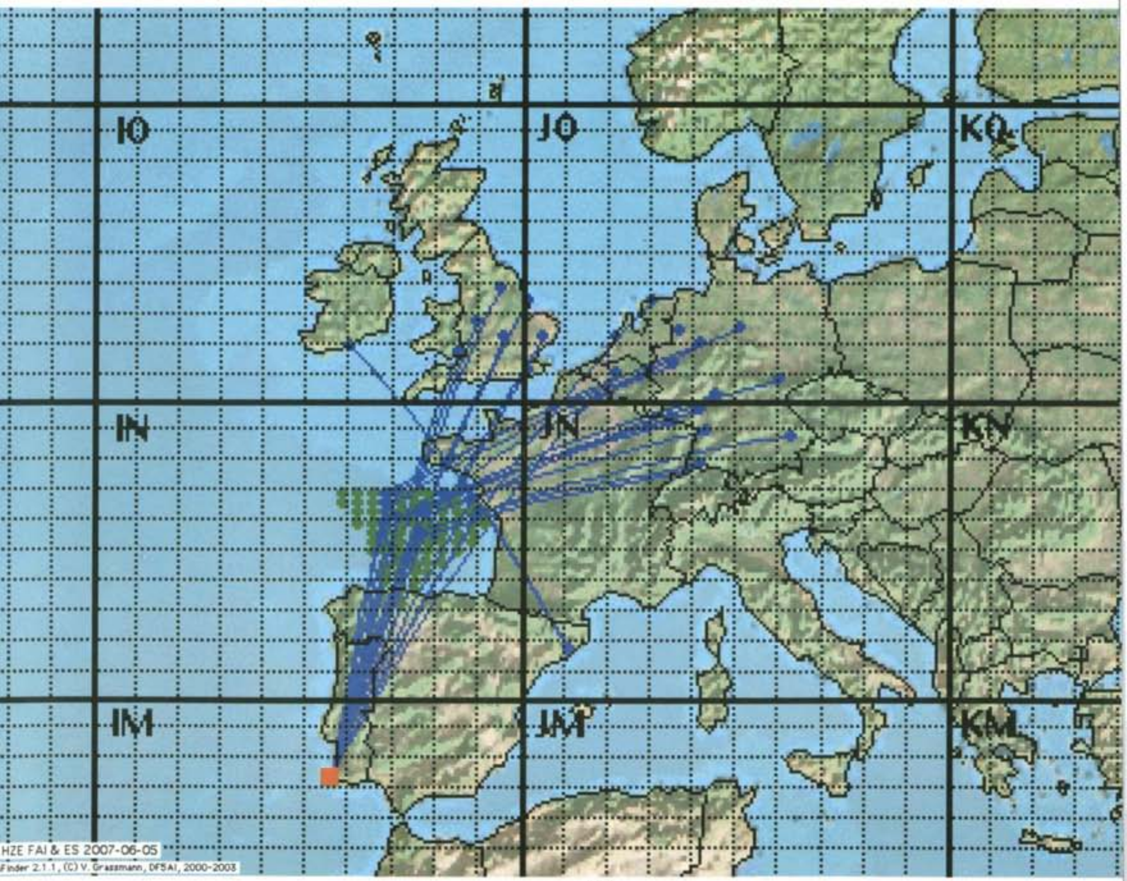
DUBUS

3/2007

Vol.36 3.Quarter

Unusual 2m Backscatter DX



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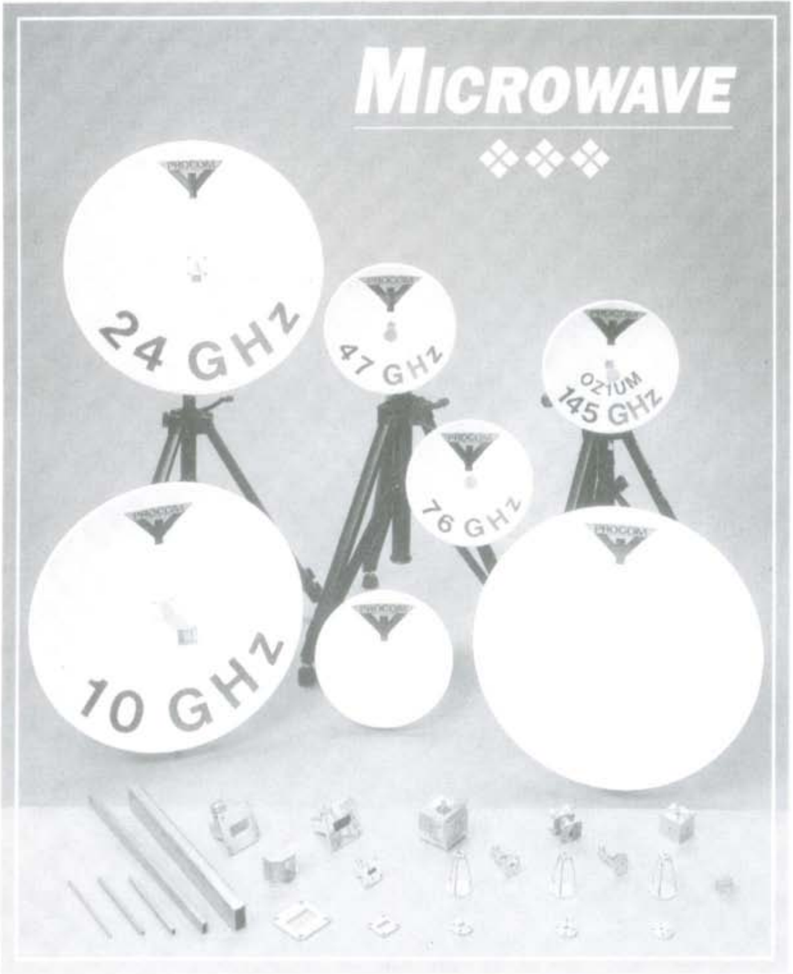
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10 GHz

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Content / Inhalt 3/07

Title: Unusual 2m Backscatter QSOs made by CT1HZE, IM57NH - See QSOs in detail in 2m Es column p. 102 and analysis from DF5AI p. 69

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	Michael Kuhne, DB6NT, Scheibenacker 3, D-95180 Berg email: kuhne.db6nt@t-online.de
	Luis Cupido, CT1DMK, R. S. Joao, Lote 5, St. Joana, 3810 Aveiro, Portugal. email: cupido@mail.ua.pt
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DL8HCZ, Grützmühlenweg 23,
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email: DUBUS@web.de info@dubus.de
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Norbert Goettsche, DL8LAQ, Tulpenweg 3,
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Phone: ++49 4191 959913
email: DUBUS@web.de info@dubus.de

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DUBUS Distributoren
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Austria	OE1WRS, Werner Roedl,Mappesgasse 2/1/3, 2320 Schwechat, Tel: +43-664-3564584 Fax: +43-1-7073181, email: roedl@attglobal.net
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Japan	Michaiki Watanabe, JH1KRC, Jingumae 2-2-39-702, Shibuya-ku, Tokyo 150-0001 Phone: +81-3-3404-6064 email: jh1krc@syd.odn.ne.jp
Malta	Joseph Falzon, 9H1VW, « Babs » 104, Sir William Reid Street, Gzira, GZR02 9h1vw@maltanet.net or danielg@maltanet.net
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Ukraine	Sergej Lysenko, UR5LX, Zolochev Reg., Iwaschki, Kharkov Obl, Ukr. 62211 email: ur5lx@vhf-dx.net
United Kingdom	Roger Blackwell, GM4PMK, Willowbank, Pennyghael, Isle of Mull, PA70 6HB email: dubus@marsport.org.uk
USA	Janet and Ed Cole, KL7UW, P.O. Box 8672, Nikiski, AK (Alaska) 99635-8672 email: dubususa@hotmail.com
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Editorial

Dear DUBUS Reader!

Here is the summer issue 2007. This time a bit earlier than usual. - Untill the end of June most operators from central Europe had the impression that there is less sporadic E on 2m than in summer 2006. For me, CT1HZE it was the other way arround: Already 872 Es QSOs are in the log on 2m untill June 22nd. This is a new record for me including the highlight to work Israel via double hop over 4008km. Also the opening from June 5 – see title page - was quite remarkable. See the article from Volker, DF5AI in this issue for more. - On 6m took place already several multihop Es openings into Japan and the JA stations have been heard even from Portugal again over 11200km. - A first ever sporadic E crossband QSO took place on 4m/6m between England and Canada in the end of June. So far this has been done "only" via F2 in the solar cycle maximum. So we will see what will be added in July and August and make our final conclusions about 2007 in next issue.

In this issue we have the result of the EU EME CW contest 2007. We have 50% more entries this year! This proves that CW is still alive. Probably the experimental software for the new CW-P mode will bring new impulses for EME. You find the relating article from Klaus, DJ5HG in this issue.

The DUBUS 2m beacon projects have excited quite some interest from all over the world. There are several groups and individuals now in remote areas wanting to erect beacons. If you want to help with hardware (TX, keyers, PA, cable, antenna, PSU) or financial support you are welcome! We want to thank Tim, G4LOH for his generous financal contribution for these beacon projects!

Please keep sending your technical articles and activity reports to keep the magazine interesting and alive! Thank you!

73 from Joe, DL8HCZ / CT1HZE
and the DUBUS team!

P.S. Please register at the new DUBUS Portal on the web! See link at www.DUBUS.de or www. DUBUS.org

Liebe DUBUS Leser!

Hier ist die Sommer-Ausgabe für 2007, mit der wir etwas eher dran sind als gewöhnlich. – Bis Ende Juni hatten die meisten Amateure in Europa den Eindruck, dass die Es-Saison in diesem Jahr schlechter ist als in 2006. Für mich, CT1HZE, war es bisher genau umgekehrt: 872 Es-QSOs sind auf 2m im Log bis zum 22.6. Das ist ein neuer Rekord für mich, inklusive dem Highlight eines Doppelhop-QSOs mit Israel über 4008km. Auch die Öffnung vom 5. Juni (siehe Titelbild) war recht bemerkenswert. Mehr dazu im Artikel von Volker, DF5AI, in dieser Ausgabe. – Auf 6m gab es bereits mehrere Multihop-Es-Öffnungen nach Japan. Selbst aus Portugal konnten die Japaner wieder gehört werden (11200km). – Ein allerestes Es-Crossband-QSO auf 4m/6m gab es Ende Juni von England nach Kanada. Das gab es bisher „nur" via F2 im Sonnenfleckenmaximum. Wir werden sehen, was der Juli und August noch bringen werden, und dann ein Fazit für 2007 in der nächsten Ausgabe ziehen.

In dieser Ausgabe haben wir das Ergebnis des EU EME CW Kontests. Wir haben 50% mehr Teilnehmer diesmal! Das zeigt, dass CW lebt. Die neue experimentelle Software für den CW-P Mode wird hier wohl auch neue Impulse bringen. Der zugehörige erste Teil einer Artikel-Serie von Klaus, DJ5HG, findet sich in dieser Ausgabe.

Die 2m-Bakenprojekte von DUBUS haben weltweit einiges an Resonanz hervorgerufen. Mehrere Gruppen und einzelne OPs aus exotischen Gebieten möchten nun auch Baken aufbauen. Hierfür nehmen wir gerne Spenden in Form von Material (TX, Keyer, Kabel, Antennen, PA, Netzteile) oder auch finanzielle Unterstützung entgegen. Wir bedanken uns bei Tim, G4LOH, für seine grosszügige Spende für die Bakenprojekte!

Bitte senden Sie weiter Ihre technischen Artikel und Aktivitätsberichte an DUBUS, vielen Dank!

Vy 73 von Joachim, DL8HCZ / CT1HZE
und vom ganzen DUBUS-Team!

P.S. Bitte melden Sie sich beim neuen DUBUS Portal im Netz an. Siehe Link unter www.DUBUS.de oder www.DUBUS.org

High-Efficiency Feedhorns for Prime-focus Dishes

Part 2 — Chaparral-style feedhorns

Paul Wade, W1GHZ ©2006 - w1ghz@arrl.net
Measurements by Tommy Henderson, WD5AGO - wd5ago@arrl.net

Chaparral-style feeds

The Chaparral-style feed (Chaparral Communications makes feedhorns for satellite TV) has multiple smaller rings around the circular waveguide (Figure 19). The original description was a paper by Wohlleben[7], and the late Tay Howard, W6HD, was involved in the commercial development for Chaparral.

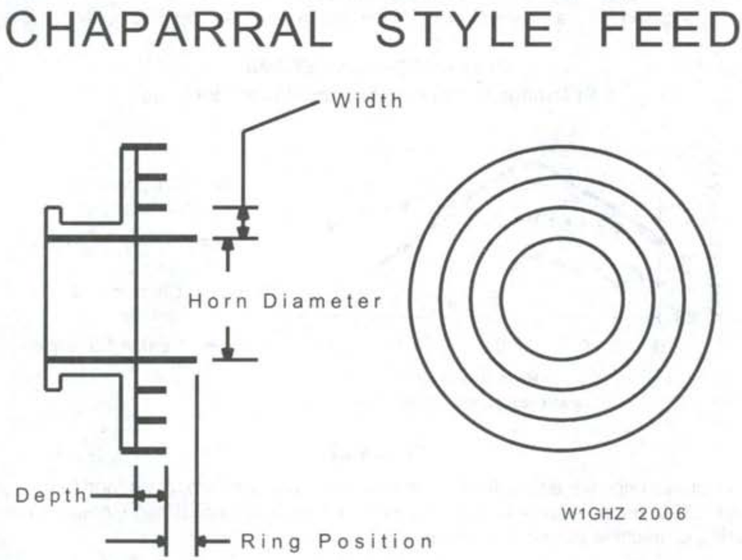


Figure 19

The multiple rings, typically slightly more than ¼λ deep and spaced less than ¼λ, create what electromagnetics professionals call a "soft" surface – one that reflects energy like a surface but does not conduct surface currents, thus reducing the edge currents that generate sidelobes. Adding multiple rings of different sizes to the horn makes a search for an optimum combination prohibitively large, so I limited analysis to combinations with uniform rings, with all rings on each variation having the same width and depth. I started with some dimensions suggested by WD5AGO, then added a few variations to attempt to understand the effect of the multiple rings. Finally, the ring dimensions were varied to improve efficiency.

The first version has three rings, each 0.17λ wide and 0.3λ deep. The total width of the three rings is 0.51λ, almost exactly the same as the original VE4MA ring, so there is no blockage penalty for the additional rings; both feeds have a total shadow 1.7λ in diameter. The performance, summarized in Figure 20, shows higher efficiency than the original VE4MA feed discussed in part 1, particularly for deeper dishes with **f/D** in the 0.3 to 0.4 range.

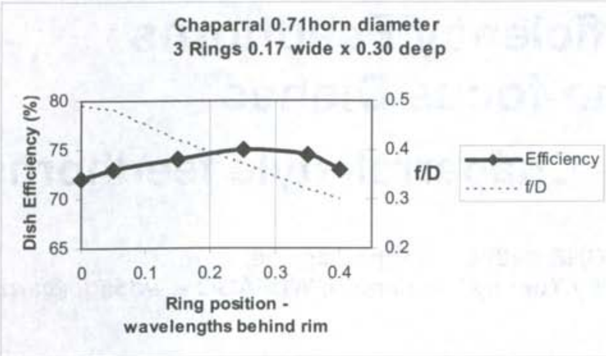


Figure 20

A second version has three rings, each 0.20λ wide and 0.33λ deep. The total width of 0.60λ adds slightly more blockage, 1.9λ in diameter, but the calculated efficiency is a bit higher, so it is worth considering for all but the smallest dishes. The super-VE4MA feed with the same 1.9λ blockage has even higher efficiency, but over a smaller range of ***f*/D**. Figure 21 compares these two Chaparral versions with the two VE4MA versions, original (1.7λ) and Super (1.9λ) – the improvements should be apparent.

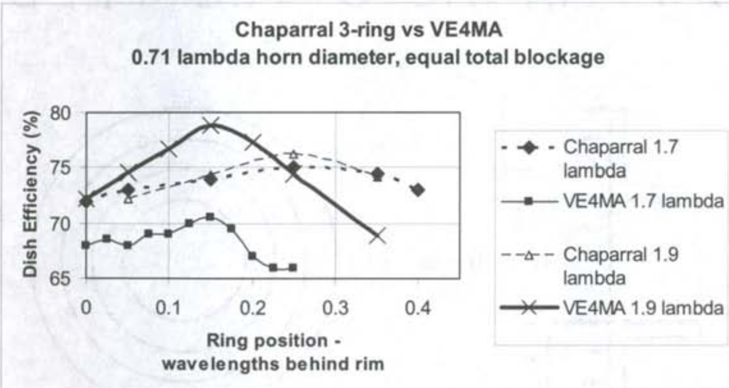
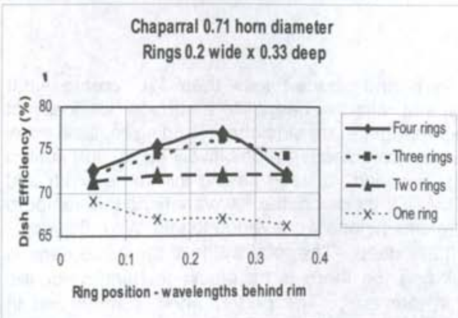


Figure 21

To see if the additional rings were beneficial, I tried versions with one, two, three, and four rings, each ring 0.20λ wide and 0.33λ deep. Figure 22 below shows that each additional ring increases dish efficiency, but the fourth ring is reaching diminishing returns.



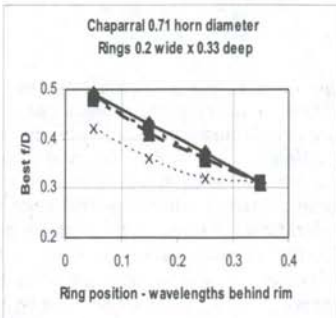


Figure 22

Is the increase in efficiency with more rings due to the number of rings or the larger size? To test this question, I tried two additional variants with the same overall width, 0.60λ, as the three ring version above: two rings, each 0.30λ wide, and four rings, each 0.15λ wide. Figure 23 suggests that that two or three rings are about equal, with excellent efficiency, but adding more rings, closely spaced in the same overall width, has no benefit. Efficiency is not quite as high as the super-VE4MA with the same blockage, but the Chaparral is better for deep dishes.

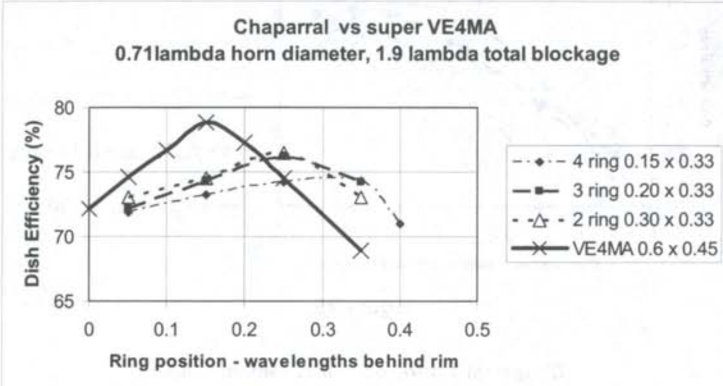


Figure 23

The next experiment was to vary ring width, with three rings. Figure 24 shows only a slight increase in efficiency as the width of each ring is increased from 0.17λ to 0.27λ - the small increase can probably be attributed to the much larger overall diameter of the horn. So neither additional rings nor very wide rings offer enough improvement to justify additional blockage.

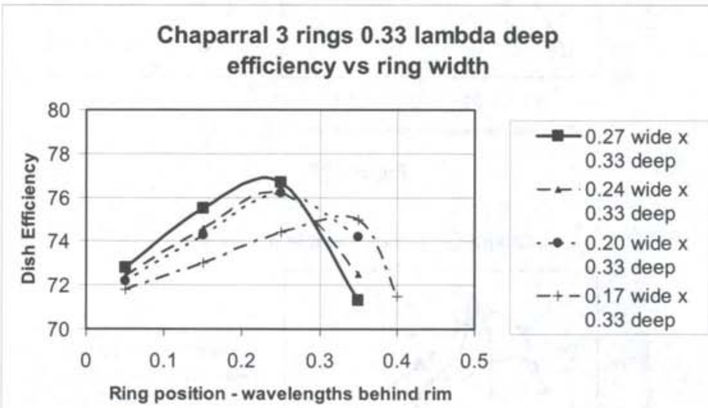


Figure 24

The final variable is ring depth. For large tapered corrugated horns with many rings, depths between ¼ λ and ½ λ have been shown[7] to work well, with performance degradation outside this range. For the three-ring Chaparral-style feed, however, efficiency increases as the ring depth is decreased from 0.33λ down to 0.15λ, then decreases for even shallower depths. For a ring width of 0.20λ, shown in Figure 25, best efficiency is nearly as good as the Super-VE4MA feed.

A narrower ring width, 0.17λ, shows similar behavior in Figure 26 as ring depth is decreased. Figure 27, plotting efficiency vs. **f/D** for some of the best Chaparral dimensions, suggests that the narrower rings are better for deeper dishes, with **f/D** < 0.35, than either the wider ring version or the Super-VE4MA feed. The calculated efficiencies for the best Chaparrals are nearly as high as the Super-VE4MA feed, and are high over a wider range of **f/D.**

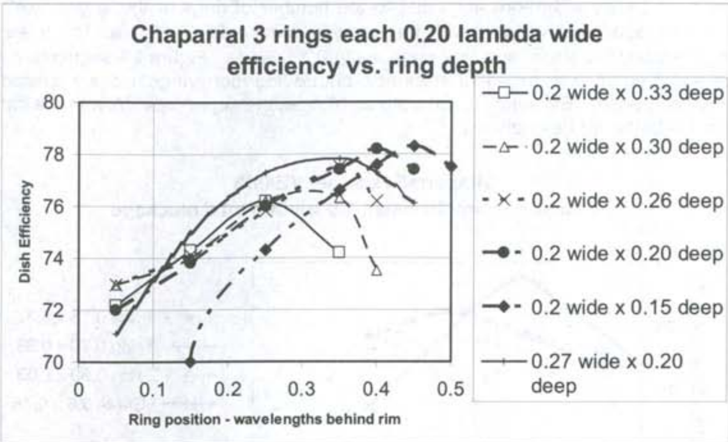


Figure 25

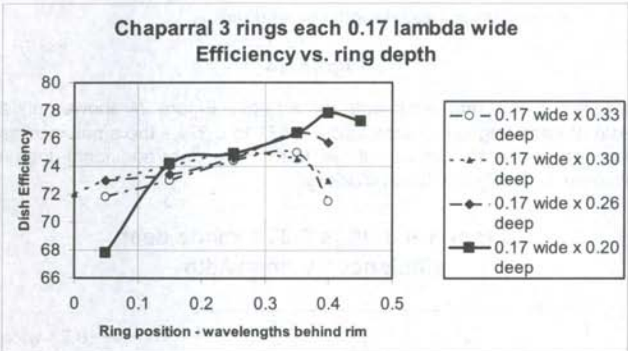


Figure 26

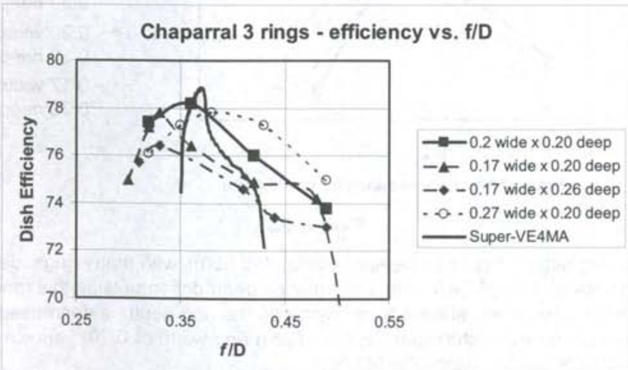


Figure 27

An efficiency plot for the highest efficiency Chaparral-style feed, with 3 rings 0.20λ wide x 0.20λ deep, 0.4λ behind the rim, is shown in Figure 28. Calculated best efficiency is 78.2% for an **f/D** around 0.35. A similar feed, with the same rings on a larger cylindrical horn, 0.76λ in diameter, has a calculated efficiency

Chaparral Feed 0.71λ horn diameter
3 Rings 0.20λ wide x 0.20λ deep, 0.40λ behind rim
Figure 28

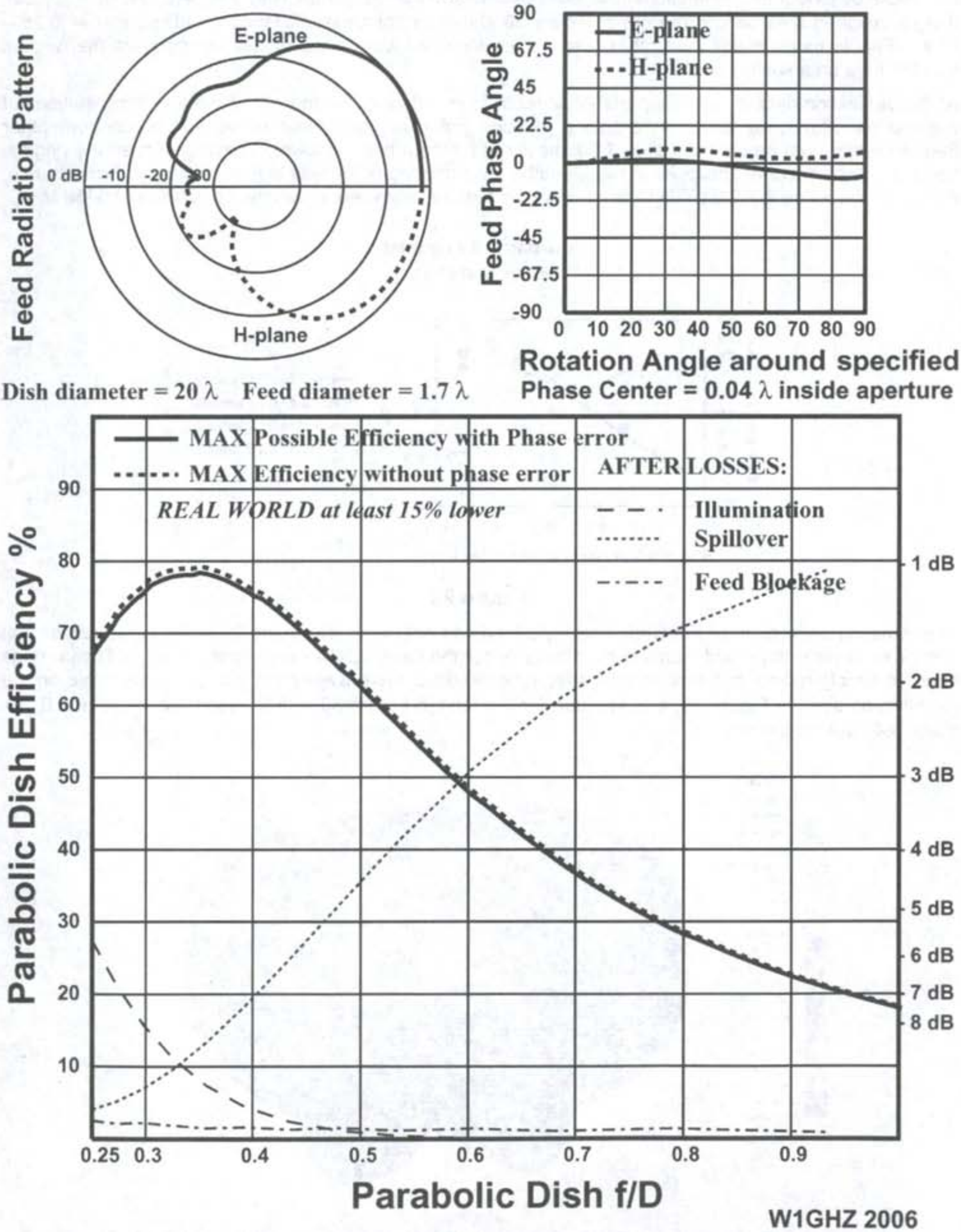


Figure 28

of 78.7%. Figure 29 shows that the horn diameter only makes a small difference. Sun noise measurements by WD5AGO, in Appendix A, on these two feeds measured 64% efficiency for the 0.76λ horn diameter and 63% for the 0.71λ horn diameter. Thus, both calculated and measured efficiencies are only slightly lower than the Super-VE4MA feed – by 1% and 2% respectively.

An efficiency plot of the dimensions that looks best for very deep dishes, with 3 rings 0.17λ wide x 0.26λ deep positioned 0.4λ behind the rim in Figure 30 shows pretty good efficiency for ***f*/D** as low as 0.25 – 71%. This is much better than other feed choice for these very deep dishes, as good as the original VE4MA feed on a shallower dish.

All the simulation data for the Chaparral-style feeds is included in Appendix C. Nearly all combinations of dimensions offer quite good performance, making potential conversion of surplus feeds from other frequencies to ham bands attractive. In particular, if the ham band is lower in frequency than the original band, the rings become shallower in wavelengths, thus offering potentially higher efficiency. For instance, a feed for the 3.7 to 4.2 GHz TVRO band would be a good candidate for amateur operation at 3456 MHz.

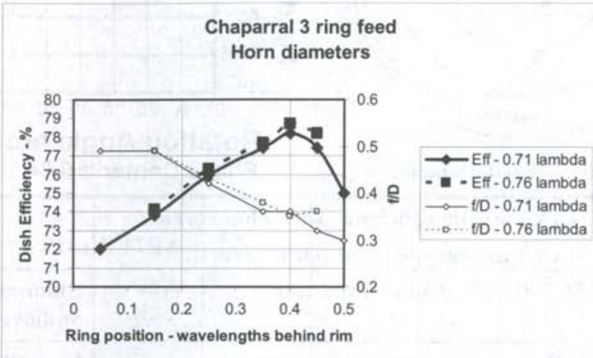


Figure 29

The radiation patterns from the Chaparral-style feeds do not demonstrate the large dip in the center that seems to provide improved illumination efficiency for the best VE4MA variations. The additional rings seem to simply reduce radiation in undesired lobes and put more even energy over a wide angle on the reflector, as seen in Figure 31, a 3D pattern for the feed in Figure 30 with 3 rings 0.17λ wide and 0.26λ deep, 0.4λ behind the rim.

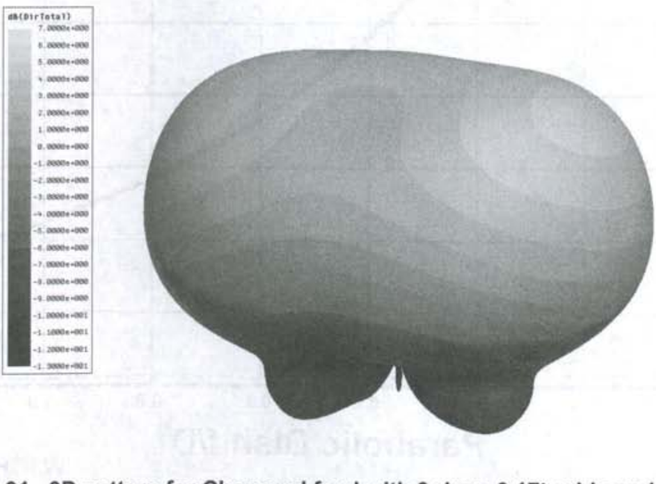


Figure 31. 3D pattern for Chaparral feed with 3 rings 0.17λ wide and 0.26λ deep, back 0.40λ

Chaparral Feed 0.71λ horn diameter
3 Rings 0.17λ wide x 0.26λ deep, 0.40λ behind rim
Figure 30

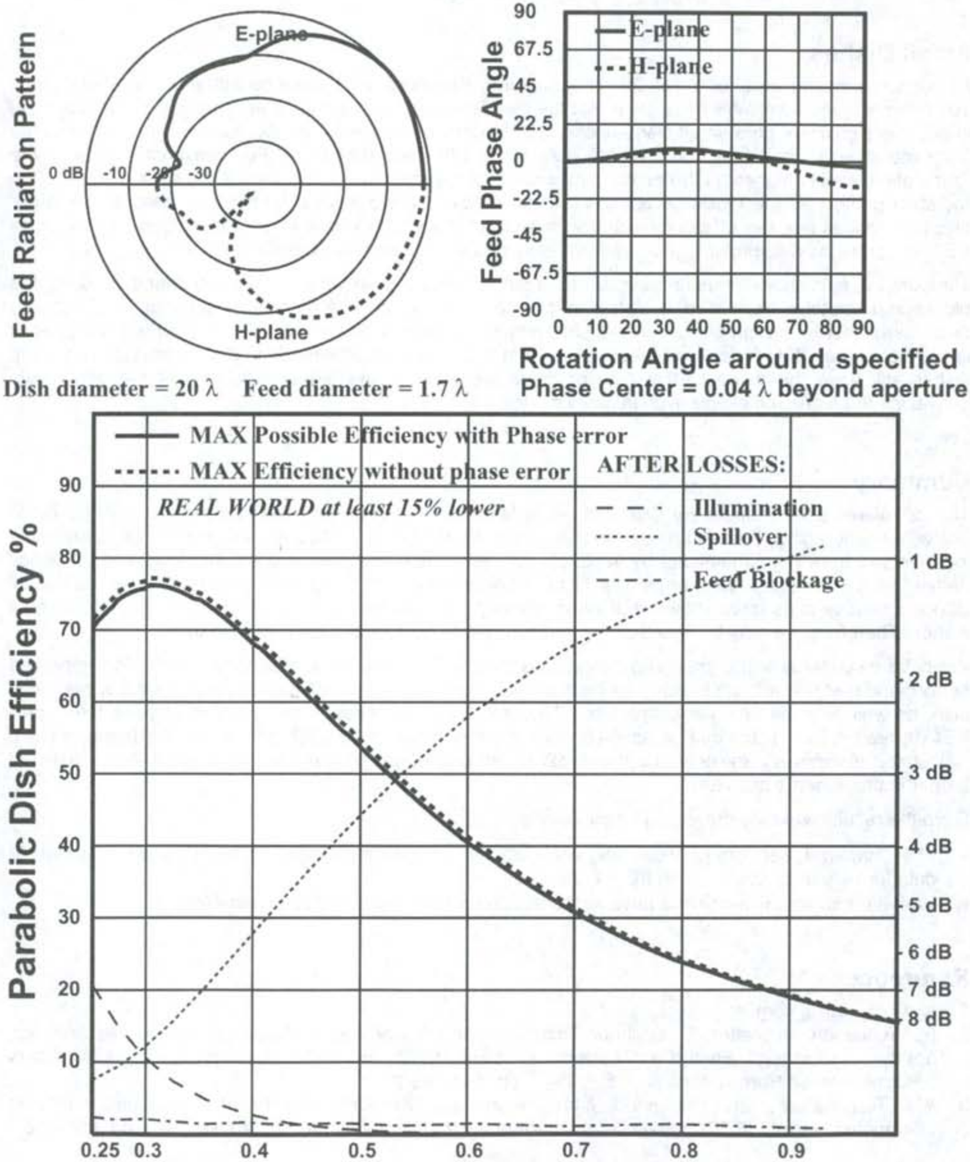


Figure 30

The advantage of the Chaparral-style feeds over the simpler VE4MA is very high efficiency over a wider range of ***f*/D**, and probably over a broader bandwidth. The bandwidth was not investigated explicitly, since all amateur operation is in relatively small bandwidths. However, the dimensions can be recalculated in wavelengths over a range of frequencies and performance at each frequency estimated from the data in Appendix C.

Small Dishes

All our comparisons were for a dish 20λ in diameter. Many hams must make do with much smaller dishes, 10λ or smaller diameter. We have seen that the best feeds are 1.9λ in diameter or larger, so the blockage shadow is significant on a small dish – close to 20% of the diameter for a 10λ dish. In terms of area, the blockage is less significant, 3.6% of the area for a 1.9λ feed diameter. For conventional feeds, the illumination level is highest in the center, while some of the improved feeds have a dip in the center of the radiation pattern so the blockage doesn't hurt as much. So we have a tradeoff — whether the larger blockage makes the dish efficiency with the larger feed lower than with a smaller feed. Some of the small VE4MA variations also provide good performance, and would have less blockage

In Figure 32, efficiency curves for several of the better feeds are plotted for a 10λ diameter dish, using the blockage diameter of each feed. It is clear that the larger super-VE4MA feed is still superior for all but very deep dishes. Even though the calculated efficiency is significantly lower than than it is for larger dishes, it is still higher than the efficiency of other feeds. Similarly, the Chaparral feeds that were best for very deep dishes still have the highest efficiency for these dishes. So the higher efficiency of the best feeds outweighs the higher blockage even in small dishes.

Summary

The calculated performances for Chaparral-style feeds with varying dimensions tabulated in Appendix C are very encouraging. The sun noise measurements by WD5AGO in Appendix A, Part 1, are completely independent from the simulations by W1GHZ, yet the comparable results are consistent. The efficiency derived from sun noise measurements is 12 to 14% lower than efficiency calculated from simulations in all cases. Previous tests have shown real world efficiency to be about 15% lower than simulation for small dishes. Therefore, we may believe that the measurements validate the simulation results.

We have discovered some improved dimensions for the Chaparral-style feedhorns which offer improved performance. Measured efficiencies as high as 64% surpass previous amateur results for a prime-focus dish, as well as most commercial results. The calculated efficiency is not quite as high as the super-VE4MA feed in Part 1, but can be achieved over a wider range of dish ***f*/D**, particularly for deeper dishes. Calculated efficiencies are only about one dB below perfection, so it is hard to imagine that significant further improvements are likely.

From the results, we may draw some conclusions:

- The Chaparral feedhorn provides very good efficiency for a wide range of dish ***f*/D**, and the highest to date for very deep dishes, with ***f*/D ~ 0.25**.
- Variations with shallower rings have higher efficiency than more traditional dimensions.

References

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3. A.J. Terzuoli, Jr., J.H. Richmond, & L. Peters, Jr., "Shielding Effectiveness of Corrugations in Corrugated Horns," *IEEE Transactions on Antennas and Propagation*, September 1978, pp. 654-658.

Feed choices for 10λ diameter Dish

Figure 32

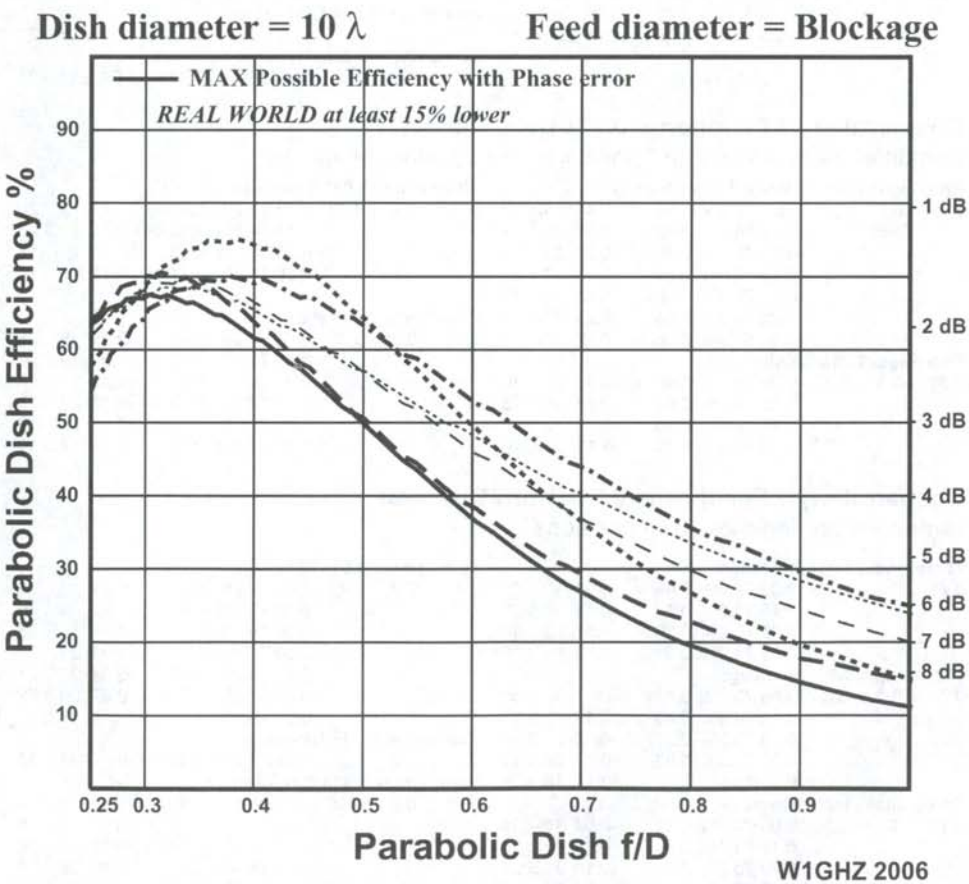

Figure 32

- Appendix C – Anhang C

W1GHZ 2006

Chaparral-style Feedhorns 0.77λ Horn Diameter

with different ring sizes and positions

Horn Diam.	Ring width	Ring depth	behind rim	Dish efficiency	f/D best	Phase center	Return Loss	Front /Back
λ	λ	λ	λ			λ	dB	dB
One ring (VE4MA), 1.11λ Blockage								
0.71	0.2	0.33	0.05	69%	0.42	0	17	21
			0.15	67%	0.36	-0.03	18.5	18
			0.25	67%	0.32	-0.03	21	16
			0.35	66%	0.31	0.014	21	13
Two rings, 1.51λ Blockage								
0.71	0.2	0.33	0.05	71.3%	0.49	-0.06	17	26
			0.15	72%	0.41	-0.13	19	23
			0.25	72%	0.36	-0.11	22	17
			0.35	72%	0.31	0.11	20	14
Three rings, 1.91λ Blockage								
0.71	0.2	0.33	0.05	72.2%	0.48	-0.11	19	29
			0.15	74.3%	0.42	-0.18	19.5	23
			0.25	76.2%	0.36	-0.11	22	18
			0.35	74.2%	0.31	0.13	19	16

Horn Diam.	Ring width	Ring depth	behind rim	Dish efficiency	f/D best	Phase center	Return Loss	Front /Back
λ	λ	λ	λ			λ	dB	dB
Four rings, 2.31λ Blockage								
0.71	0.2	0.33	0.05	72.6%	0.49	-0.16		33
			0.15	75.4%	0.43	-0.21	19.5	26
			0.25	76.8%	0.37	-0.08	22	21
			0.35	72.0%	0.31	0.1	22	18
Three rings, 1.73λ Blockage								
0.71	0.17	0.3	0	72%	0.49	0	15.5	30
			0.05	73%	0.48	-0.04	16.5	31
			0.15	74%	0.42	-0.14	21	26
			0.25	75%	0.37	-0.14	18	19
			0.35	74.5%	0.32	0.1	21.5	17
			0.4	73%	0.3	0.13	18.5	15
Four rings, 2.07λ Blockage								
0.71	0.17	0.3	0.25	75.3%	0.37	-0.16	21.5	21
Three rings, 2.33λ Blockage								
0.71	0.27	0.3	0.25	76.7%	0.37	-0.09	21.5	21

Chaparral-style Feedhorns 0.71λ Horn Diameter

with different ring sizes and positions and constant blockage

Horn Diam.	Ring width	Ring depth	behind rim	Dish efficiency	f/D best	Phase center	Return Loss	Front /Back
One ring (Super VE4MA), 1.91λ Blockage								
0.71	0.6	0.45	0	72.2%	0.43	-0.4	15.5	22
			0.05	74.6%	0.42	-0.37	16.5	23
			0.1	76.7%	0.38	-0.3	17	22
			0.15	78.8%	0.37	-0.14	17	21
			0.2	77.3%	0.353	0.13	17	21
			0.25	74.5%	0.35	0.23	17	19
			0.35	68.9%	0.36	0.17	17	21
Two rings, 1.91λ Blockage								
0.71	0.3	0.33	0.05	73.0%	0.49	-0.13	17	30
			0.15	74.5%	0.42	-0.18	19.5	23
			0.25	76.5%	0.36	-0.1	22	18
			0.35	73.0%	0.31	0.13	18	16

Horn Diam.	Ring width	Ring depth	behind rim	Dish efficiency	f/D best	Phase center	Return Loss	Front /Back
Three rings, 1.91λ Blockage								
0.71	0.2	0.33	0.05	72.2%	0.48	-0.11	19	29
			0.15	74.3%	0.42	-0.18	19.5	23
			0.25	76.2%	0.36	-0.11	22	18
			0.35	74.2%	0.31	0.13	19	16
Four rings, 1.91λ Blockage								
0.71	0.15	0.33	0.05	71.9%	0.48	-0.11	19	28
			0.15	73.2%	0.42	-0.2	19.5	24
			0.25	74.2%	0.35	-0.13	22	19
			0.25	74.2%	0.35	-0.13	22	19
			0.35	74.3%	0.28	0.1	30	17
			0.4	71.0%	0.27	0.13	17.5	17

Chaparral-style Feedhorns 0.71λ Horn Diameter

Variations on ring sizes and positions

Horn Diam.	Ring width	Ring depth	behind rim	Dish efficiency	f/D best	Phase center	Return Loss	Front /Back
Three rings, 1.91λ Blockage								
0.71	0.2	0.33	0.05	72.2%	0.48	-0.11	19	29
			0.15	74.3%	0.42	-0.18	19.5	23
			0.25	76.2%	0.36	-0.11	22	18
			0.35	74.2%	0.31	0.13	19	16
Three rings, 1.91λ Blockage								
0.71	0.2	0.3	0.05	73.0%	0.49	-0.07	16	33
			0.15	74.0%	0.43	-0.17	18.5	27
			0.25	76.2%	0.37	-0.16	21.3	30
			0.35	76.3%	0.33	0.07	20.5	17
			0.4	73.5%	0.3	0.14	18.3	16
Three rings, 1.91λ Blockage								
0.71	0.2	0.26	0.05	73.0%	0.49	-0.04	15	35
			0.15	74.1%	0.44	-0.13	17	32
			0.25	75.8%	0.41	-0.14	20.5	25
			0.35	77.5%	0.35	-0.04	22	19
			0.4	76.2%	0.31	0.09		18

Horn Diam.	Ring width	Ring depth	behind rim	Dish efficiency	f/D best	Phase center	Return Loss	Front /Back
Three rings, 1.91λ Blockage								
0.71	0.2	0.2	0.05	72.0%	0.49	0.04	13	30
			0.15	73.8%	0.49	-0.1	16	35
			0.25	76.0%	0.42	-0.16		33
			0.35	77.4%	0.36	-0.11	21	27
			0.4	78.2%	0.36	-0.04	21	24
			0.45	77.4%	0.32	0.07	20.5	22
			0.5	75.0%	0.3	0.11	18.5	17
Four rings, 2.31λ Blockage								
0.71	0.2	0.2	0.4	78.2%	0.35	0	21	27
Three rings, 1.91λ Blockage								
0.71	0.2	0.15	0.05	35.0%	~.65	-0.1	13	9
			0.15	70.0%	0.5	-0.17	15	18
			0.25	74.3%	0.44	-0.17	17	24
			0.35	76.6%	0.41	-0.16	20	27
			0.4	77.6%	0.37	-0.1	21	26
			0.45	78.3%	0.35	-0.02	21	23
			0.5	77.5%	0.33	0.08	20	21

Horn Diam.	Ring width	Ring depth	behind rim	Dish efficiency	f/D best	Phase center	Return Loss	Front /Back
λ	λ	λ	λ			λ	dB	dB
Three rings, 1.91λ Blockage								
0.71	0.2	0.1	0.4	68.4%	0.43	-0.23	21.5	16
			0.5	70.7%	0.37	-0.11	21.3	
Three rings, 1.73λ Blockage								
0.71	0.17	0.33	0.05	71.8%	0.48	-0.07	17	28
			0.15	73.0%	0.42	-0.16	19.4	23
			0.25	74.4%	0.36	-0.11	21.5	17
			0.35	75.0%	0.31	0	19.4	14
			0.4	71.5%	0.3	0.14	17.2	15
Three rings, 1.73λ Blockage								
0.71	0.17	0.3	0	72.0%	0.49	0	15.5	30
			0.05	73.0%	0.48	-0.04	16.5	
			0.15	74.0%	0.42	-0.14	21	26
			0.25	75.0%	0.37	-0.14	18	19
			0.35	74.5%	0.32	0.1	21.5	17
			0.4	73.0%	0.3	0.13	18.5	15
Three rings, 1.73λ Blockage								
0.71	0.17	0.26	0.05	73.0%	0.49	-0.01	15.5	35
			0.15	73.4%	0.44	-0.1	17.5	30
			0.25	74.6%	0.41	-0.14	19.5	24
			0.35	76.4%	0.33	-0.04	21.5	18
			0.4	75.7%	0.31	0.04	20.5	17
			0.45	72.9%	0.3	0.13		17
Three rings, 1.73λ Blockage								
0.71	0.17	0.2	0.05	67.8%	0.51	-0.23	16	11
			0.15	74.2%	0.48	-0.11	16	23
			0.25	74.9%	0.42	-0.14	18	33
			0.35	76.4%	0.36	-0.11	21	26
			0.4	77.8%	0.33	-0.06	21.8	23
			0.45	77.2%	0.32	0.03	21	20
			0.5	75.0%	0.3	0.1		17
Three rings, 2.15λ Blockage								
0.71	0.24	0.33	0.05	72.4%	0.48	-0.14	17.3	31
			0.15	74.6%	0.43	-0.21	19.4	24
			0.25	76.2%	0.36	-0.11	22	19
			0.35	72.5%	0.3	0.14	19.3	17

Chaparral-style Feedhorns 0.71λ Horn Diameter

Variations on ring sizes and positions

Three rings, 2.33λ Blockage								
0.71	0.27	0.33	0.05	72.8%	0.49	-0.17	21	33
			0.15	75.5%	0.43	-0.23	19.5	25
			0.25	76.7%	0.37	-0.09	21.5	21
			0.35	71.3%	0.32	0.11	19	17
Three rings, 2.33λ Blockage								
0.71	0.27	0.2	0.05	71.1%	0.48	0	13.5	40
			0.15	75.0%	0.49	-0.14	16	35
			0.25	77.3%	0.43	-0.16	18	35
			0.35	77.8%	0.38	-0.1	21	27
			0.4	77.3%	0.35	0.01	21	24
			0.45	76.1%	0.32	0.07	20	23

Chaparral-style Feedhorns 0.76λ Horn Diameter

Three rings, 1.96λ Blockage								
0.76	0.2	0.2	0.15	74.1%	0.49	-0.09		43
			0.25	76.3%	0.43	-0.13		36
			0.35	77.7%	0.38	-0.1		28
			0.4	78.7%	0.35	-0.04	22.5	26
			0.45	78.2%	0.36	0.07		23

Hocheffektive Erreger für Spiegel mit Primärfokus

Teil 2 - Chaparral-Feedhorn

Paul Wade, W1GHZ ©2006 - w1ghz@arrl.net
Messungen: Tommy Henderson, WD5AGO - wd5ago@arrl.net

Chaparral-Feeds

Das Chaparral-Feed (Chaparral Communications stellt Feedhörner für Satelliten-TV her) hat mehrere kleinere Ringe um den zirkularen Wellenleiter (Abb. 19). Die ursprüngliche Beschreibung steht in einer Abhandlung von Wohlleben[7] und Tay Howard, W6HD, war dann an der kommerziellen Entwicklung für Chaparral beteiligt.

Die multiplen Ringe – typischerweise etwas mehr als ¼λ tief und im Abstand von etwas weniger als ¼λ - erzeugen, wie Profis es nennen, eine „weiche" Oberfläche, die Energie wie eine eine Oberfläche reflektiert, aber nicht Oberflächenströme leitet, so dass die Ströme an den Kanten, die die Nebenzipfel hervorrufen, reduziert sind.

Das Hinzufügen vieler Ringe unterschiedlicher Größe zum Horn macht eine Suche nach einer optimalen Kombination abschreckend schwierig, weshalb ich die Analyse auf Kombinationen mit gleichförmigen Ringen beschränkt habe, wobei die Ringe immer alle die gleiche Weite und Tiefe haben.
Ich habe mit Abmessungen angefangen, die von WD5AGO vorgeschlagen wurden, dann habe ich einige Variationen hinzugefügt, um zu versuchen, die Wirkung von multiplen Ringen zu verstehen. Schließlich wurden die Dimensionen variiert, um die Effektivität zu verbessern.
Die erste Version hat drei Ringe, jeder 0.17λ weit und 0.3λ tief. Die gesamte Weite der drei Ringe beträgt 0.51λ, fast genau die selbe Weite, wie beim originalen VE4MA-Ring; es gibt also keine „Bestrafung" durch Blockierung bei den zusätzlichen Ringen. Beide Feeds haben einen totalen Schatten von 1.7λ im Durchmesser. Die Leistungsdaten, die in Abb. 20 zusammengefaßt sind, zeigen eine höhere Effektivität als beim originalen VE4MA-Feed, das in Teil 1 dieses Artikels diskutiert wurde, besonders für tiefere Spiegel mit **f/D** im Bereich von 0.3 bis 0.4.

Eine zweite Variation hat drei Ringe, jeder 0.20λ weit und 0.33λ tief. Die gesamte Weite von 0.60λ fügt eine leicht höhere Blockierung hinzu, von 1.9λ im Durchmesser, aber die berechnete Effektivität ist ein bißchen größer, so dass es Wert ist, das in Betracht zu ziehen, außer für die kleinsten Spiegel.
Das Super-VE4MA-Feed mit der selben 1.9λ Blockierung hat sogar eine höhere Effektivität allerdings über einen kleineren **f/D**-Bereich. Abb. 21 vergleicht diese beiden Chaparral-Versionen mit den beiden VE4MA-Versionen, Original (1.7λ) und Super (1.9λ) – die Verbesserungen sollten deutlich werden.

Um zu sehen, ob die zusätzlichen Ringe von Vorteil sind, habe ich Versionen mit einem, zwei, drei und vier Ringen ausprobiert, jeder Ring 0.20λ weit und 0.33λ tief. Abb. 22 zeigt, dass jeder zusätzliche Ring die Effektivität des Spiegels erhöht, aber beim vierten Ring wird eine abnehmender Gewinn erreicht.

Kommt die Zunahme der Effektivität mit mehr Ringen durch die Anzahl der Ringe oder durch das Mehr an Größe? Um diese Frage zu untersuchen, habe ich zwei weitere Varianten mit der selben gesamten Weite von 0.60λ untersucht, so wie die oben erwähnte 3-Ring-Version: zwei Ringe, jeder 0.30λ weit und vier Ringe, jeder 0.15λ weit. Abb. 23 legt nahe, dass zwei oder drei Ringe nahezu gleich sind, bei exzellenter Effektivität, aber das Hinzufügen von mehr Ringen, in engem Abstand über die gleiche Gesamtweite keinen Vorteil bringt. Die Effektivität ist nicht ganz so hoch, wie beim Super-VE4MA-Feed mit der selben Blockierung, aber das Chaparral-Feed ist besser für tiefe Spiegel.

Das nächste Experiment bestand darin, die Weite der Ringe mit drei Ringen zu variieren. Abb 24 zeigt nur einen geringen Zuwachs an Effektivität, wenn die Weite von jedem Ring von 0.17λ auf 0.27λ vergößert wird – der kleine Zuwachs kann wahrscheinich dem viel größeren Gesamtdurchmesser des Horns zugeschrieben werden. Also bringen weder zusätzliche Ringe noch sehr weite Ringe genug Verbesserung, um eine zusätzliche Blockierung zu rechtfertigen.

Die letzte Variable ist die Tiefe des Ringes. Für große konisch gewölbte Hörner mit vielen Ringen wurde gezeigt[7], dass Tiefen zwischen ¼ λ und ½ λ gut funktionieren, mit einem Leistungsabfall außerhalb dieses Bereiches. Für ein Drei-Ring-Caparral-Feed jedoch erhöht sich die Effektivität, wenn die Ringtiefe von 0.33λ herunter auf 0.15λ verringert wird, dann nimmt sie ab, sogar für flachere Spiegel.
Für eine Ring-Weite von 0.20λ, gezeigt in Abb. 25, ist die beste Effektivität nahezu so gut wie beim Super-VE4MA-Feed.

Eine engere Ring-Weite, 0.17λ, zeigt ähnliches Verhalten, siehe Abb. 26, wenn die Ring-Tiefe verringert wird. Abb. 27, wo die Effektivität aufgetragen gegen ***f*/D** für einige der besten Chaparral-Abmessungen gezeigt wird, legt nahe, dass die engeren Ringe besser für tiefere Spiegel mit ***f*/D** < 0.35 sind, als sowohl die weitere Ring-Version oder auch das Super-VE4MA-Feed. Die gerechneten Effektivitäten für die besten Chaparral-Feeds sind nahezu gleich hoch wie die für das Super-VE4MA-Feed, und sie sind hoch über einen größeren ***f*/D**-Bereich.

Einen Plot der Effektivität für das Chaparral-Feed mit der höchsten Effektivität, mit 3 Ringen 0.20λ weit x 0.20λ tief, 0.4λ hinter dem Rand, ist in Abb. 28 gezeigt. Die errechnete größte Effektivität beträgt 78.2% für ein ***f*/D** von etwa 0.35. Ein ähnliches Feed mit den selben Ringen auf einem größeren zylindrischen Horn, 0.76λ im Durchmesser, hat eine errechnete Effektivität von 78.7%. Abb. 29 zeigt, dass der Durchmesser des Horns nur einen kleinen Unterschied ausmacht. Messungen des Sonnenrauschens von WD5AGO im Anhang A (siehe Teil 1 dieses Artikels), haben für diese beiden Feeds 64% Effektivität für den 0.76λ Horn-Durchmesser und 63% für den 0.71λ Horn-Durchmesser ergeben. Folglich sind beide, die errechnete und gemessene Effektivität nur leicht niedriger als die beim Super-VE4MA-Feed – nämlich 1% bzw. 2%.

Ein Plot der Effektivität der Dimensionen, wie sie am besten für sehr tiefe Spiegel sind, mit 3 Ringen 0.17λ weit und 0.26λ tief, 0.4λ hinter dem Rand positioniert, in Abb. 30 zeigt mit 71% ziemlich gute Effektivität für ***f*/D** bis herunter auf 0.25. Dies ist viel besser als eine andere Feed-Wahl für diese sehr tiefen Spiegel und so gut wie das originale VE4MA-Feed bei einem flacheren Spiegel.

Die gesamten simulierten Daten für die Chaparral-Feeds sind in Anhang C beigefügt. Nahezu alle Kombinationen der Abmessungen bieten eine recht gute Leistung, was eine potentielle Unwandlung von Surplus-Feeds von anderen Frequenzen für die Amateurbänder attraktiv macht. Speziell, wenn das Amateurband in der Frequenz niedriger liegt als das originale Band, dann werden die Ringe flacher in Wellenlängen, so dass potentiell höhere Effektivität ermöglicht wird. Z.B. wird ein Feed für das 3.7 bis 4.2 GHz TVRC-Band ein guter Kandidat für Amateurbetrieb auf 3456 MHz sein.

Die Strahlungsdiagramme von Chaparral-Feeds zeigen nicht den großen Abfall im Zentrum, der die verbesserte Illuminations-Effektivität für die besten VE4MA-Variationen hervorzurufen scheint. Die zusätzlichen Ringe scheinen einfach die Strahung unerwünschter Nebenzipfel zu reduzieren und mehr erwünschte Energie über einen weiten Winkel auf dem Reflektor zu verteilen, wie in Abb. 31 zu sehen, einem 3D-Diagramm für das Feed in Abb. 30 mit 3 Ringen 0.17λ weit und 0.26λ tief und 0.4λ hinter dem Rand.

Der Vorteil von Chaparral-Feeds gegenüber dem einfacheren VE4MA-Feed ist die sehr hohe Effektivität über einen breiteren ***f*/D**-Bereich und wahrscheinlich auch über eine größere Bandbreite. Die Bandbreite wurde nicht explizit untersucht, da alle Amateuranwendungen in relativ schmalen Bandsegmenten stattfinden. Die Abmessungen können aber in Wellenlängen über einen Bereich von Frequenzen nachberechnet werden und die Leistung für jede Frequenz kann anhand der Daten in Anhang C abgeschätzt werden.

Kleine Spiegel

Alle unsere Vergleiche waren für Spiegel mit einem Durchmesser von 20λ. Viele Amateure müssen mit viel kleineren Spiegeln arbeiten, 10λ oder weniger. Wir haben gesehen, dass die besten Feeds einen Durchmesser von 1.9λ oder mehr haben, so dass der Blockierungschatten signifikant bei einem kleinen Spiegel wird, nahezu 20% des Durchmessers bei einem 10λ-Spiegel. Betrachtet man die Fläche, wird die Blockierung weniger bedeutsam: 3.6% der Fläche bei 1.9λ Feeddurchmesser. Für konventionelle Feeds, ist die Stärke der Illumination im Zentrum am höchsten, während einige der verbesserten Feeds einen Abfall im Zentrum des Strahlungsdiagramms haben, so dass die Blockierung nicht so sehr schmerzt. Also haben wir die Konflikt-Frage, ob die größere Blockierung mit dem größeren Feed die Spiegel-Effektivität kleiner macht als mit dem kleineren Feed. Einige der kleinen VE4MA-Variationen liefern auch gute Leistungsdaten und würden geringere Blockierung haben.

In Abb. 32 sind Effektivitätskurven für einige der besseren Feeds aufgetragen für einen Spiegel von 10λ Durchmesser unter Verwendung des Blockierungsdurchmessers eines jeden Feeds. Es ist ganz klar, dass die größeren Super-VE4MA-Feeds immer noch besser sind in allen Fällen, außer für die ganz tiefen Spiegel. Auch wenn die berechnete Effektivität signifikant niedriger ist, als bei größeren Spiegeln, so ist sie immer noch höher als die Effektivität von anderen Feeds.
Genauso haben die Chaparral-Feeds, die am besten für die sehr tiefen Spiegel sind, immer die höchste Effektivität für diese Spiegel. Also überwiegt die höhere Effektivität der besten Feeds die größere Blockierung auch im Fall der kleineren Spiegel.

Zusammenfassung

Die berechneten Leistungsdaten für Chaparral-Feeds mit variierenden Abmessungen, die im Anhang C aufgelistet sind, sind sehr ermutigend. Die Messungen des Sonnenrauschens von WD5AGO, die im Anhang A im Teil 1 des Artikels wiedergegeben sind, sind völlig unhabhängig von den Simulationen von W1GHZ, die vergleichbaren Resultate sind übereinstimmend. Die aus den Messungen des Sonnenrauschens abgeleitete Effektivität ist in allen Fällen 12 bis 14% niedriger als die in den Simulationen berechnete Effektivität. Frühere Tests bei kleinen Spiegeln haben gezeigt, dass die Effektivität in der Realität um etwa 15% niederiger lag, als die Simulation. Deshalb können wir annehmen, dass die Messungen die Ergebnisse der Simulation bestätigen.

Wir haben einige verbesserte Abmessungen für Chaparral-Feeds gefunden, die bessere Leistungsdaten ermöglichen. Die gemessenen Effektivitäten von bis zu 64% übertreffen die bisherigen Resultate von Funkamateuren bei primärfokalen Spiegeln genauso wie die meisten komerziellen Ergebnisse.
Die errechnete Effektivität ist nicht ganz so hoch wie die des Super-VE4MA-Feeds aus Teil 1, aber kann über einen breiteren **f/D**-Bereich erreicht werden, insbesondere bei tieferen Spiegeln. Die errechneten Effektivitäten liegen nur etwa 1 dB unterhalb der Perfektionsgrenze, so dass es schwer vorstellbar ist, dass zukünftig noch weitere signifikante Verbesserungen möglich sein werden.

Aus den Ergebnissen können einige Schlüsse gezogen werden:

- Das Chaparral-Feedhorn liefert eine sehr gute Effektivität über einen weiten Bereich des **f/D** des Spiegels, und bislang die höchste für sehr tiefe Spiegel mit ***f*/D ~ 0.25**.
- Variationen mit flacheren Ringen haben höhere Effektivitäten als die bisher gebräuchlicheren Abmessungen.

Referenzen

Siehe englischer Text oben.

New Housings for 47-, 76- and 122 GHz Transverters

by Philipp Prinz, DL2AM

The many emails and pictures I have recently had from all over the world have inspired me to try new approaches on these frequencies. On 122 GHz the activity in home construction seems to be still a little low but on 76 GHz the activity is high. I am sure if one has success with 76 GHz then also 122 GHz will become more popular. I want to motivate active Microwave amateurs for new tests.

Over the last 5 months I have built and tested improved transverters for 47, 76 and 122 GHz which should make success easier to achieve, even for inexperienced amateurs. These are based on my article in DUBUS 4/2006 where I described a transverter with new RF housings and a frequency generation scheme from 30 to 60 GHz and then to 122 GHz. The new housings described here have the advantage that they can be used for 47, 76 and 122 GHz, have good efficency and are easy to mill. Almost no tuning flags are necessary for adjustment and even without any tuning there is measureable power output.
These new housings can also be used as a CW transmitter or beacon. As regards the OCXOs from DK2DB and the multiplier from DB6NT nothing has changed compared to my previous publications. Many hints on how to measure and construct these have been described by me in the past in DUBUS and have been copied to several homepages on the web. So I think it is not necessary to repeat this here.
The resourcefulness of radioamateurs allows nowadays obtaining measurement equipment like the HP 432 + HP-R486A or K486A (120 Euro), or for better results a HP 141 combined with a homemade mixer, in order to be able to make adjustments. 10 years ago all this equipment was quite expensive.

Now to our subject: The CMA 382400 tripler (see pictures 1, 2, 3 and 4) is mounted in such a way that the 38 GHz signal comes out through the milled R28 waveguide directly to the coupling probe and then arrives at the short circuit slider with the tuning element. Thus a good match is obtained both to the 50 Ohm line and the input of the diode, respectively. This can be verified by measurement. The coupling probe (picture 11), that looks into the 38 GHz WR28 waveguide should have a length of about 1.5 mm. For a PCB the No. 29 from DB6NT is used.

For the adjustment the tuning elements at the input and output have to be tuned for maximum output power and at the same time the IF power on 144 MHz can be adjusted. I want to draw attention again to these microwave tuning elements because they are much better than the usually used tuning screws. These tuning elements also can be press-fitted if the hole is drilled 1/20 mm undersize. They are available from DB6NT. The higher the LO power the higher can be the IF power. With about 100 mW LO power a maximum of 15 mW IF power is required. In front of the mixer diode as far as the 76 GHz circular waveguide, and only there, the power of the upper and lower sideband can be adjusted. But this is only possible with the help of an analyzer. Pictures 5 and 6 show the levels of the 76 GHz LO and the SSB signal. One can see the lower sideband, the LO and the upper sideband. The best LO suppression on SSB is possible with the antiparallel diode pair MA4E1318. Using the single diode MA4E1317 results in a 10 dB larger LO signal. Mounting 2 SMA jacks for the 144 MHz IF on the RF and IF housings allows measuremant and control of the power. When the single diode MA4E1317 is used as CW transmitter for 76 or 122 GHz one absolutely has to bias it to get maximum power.

If the antiparallel diode pair MA4E1318 is used for SSB, this is not absolutely necessary because we get a load from the potentiometer for 144 MHz in the IF part, depending on the position. Picture 7 shows the test setup with potentiometer for the diode matching. The MA4E1317 and 1318 diodes are very good on these high frequencies and useable both for transmit and receive purposes. In the latest field tests on 122 GHz on April 7th 2007 with Dieter, DG7MHT, on 2-way SSB a distance of 23 km could be covered easily. The S-meter on the FT-290 showed S1 to S2 without any signal, meaning that the S00-4079 multiplier used delivers 20 mW when in receive mode with a supply voltage of 5.1 V. For me these values produce the best signal to noise ratio. In the test QSO the S-meter reading then increased to S9. Both of us used SSB transverters using the MA4E1317. I have had good results shipping these RF diodes MA4E1317 and 1318. I put them with their back on to adhesive tape and one can spot them easily due to the projecting gold pins and take them out again with tweezers.

The IF housing (picture 8) was constructed so that the IF power can still be adjusted when assembled. As one can see from the picture I have glued a small 10-turn 100 Ohm potentiometer to the side of the housing. One of the M2.5 screws used to mount the SMA jack is removed and then the potentiometer can be reached with a screwdriver. I have changed the SMA resistor in front of the just mentioned potentiometer on the IF PCB to 100 Ohm. With this the IF power of the transceiver used can be adjusted from about 80 mW to 2 W to obtain the necessary mixer power of 10 to 15 mW.

For 76 GHz I have used the same switching circuit (picture 9 and 10) as described for 122 GHz in cq-DL magazine 6/2006. The supply voltage is +5 V for transmit and down to +2 V for receive. The large multiplier CMA382400 has no problems operating with voltages between 5 and 2 V DC, just the RF power is reduced to more than the half at + 3 V. With this voltage switch the S/N ratio is improved about 3 dB on receive. At this frequency a DSB power of 1.5 mW was obtainable at several units (picture 6).

I have added some special LCD panel displays (picture 20) for my CW transmitters for 76 and 122 GHz which show me the bias voltage of the mixer diode. The LCD is from Conrad/Germany (see below). This is very helpful to check if there is output power. At 122 GHz I measure 2 V when I have 900 µW output. This makes a working load of 110 Ohm.

Now we come to the more difficult – at least for beginners – frequency of 122 GHz. The RF housing is different in this case and is designed for the small tripler S00-4079. The milled edge in the waveguide for 40.7 GHz here is WR19. The mixer PCB is also from DB6NT, it is No. 31. The coupling probe for this waveguide should have a length of about 1.4 mm (picture 11). This RF housing can also be used with alteration for the large tripler or the quadrupler CMA382400. Unfortunately the large CMA382400 only delivers 70 mW at 40.7 GHz, what does not permit high output power on 122 GHz. Otherwise it is similar to that described for 76 GHz.

For 76 GHz the measurements were similar for several units, but on 122 GHz the SSB performance varied widely. If only a CW transmitter or a beacon is required this is much easier to align. These large differences result mainly from the variation of the RF diode, the gluing, impure and rough waveguides and bad matching. My measurement equipment now reaches partly 170 GHz, but the more one can measure the more becomes unintelligible at these high frequencies. It takes days to prove for oneself why certain pictures from the analyzer look so different.

To get somewhat accurate measurement results with the analyzer and power meter, one must use an isolator or an attenuator suitable for these high frequencies. This was confirmed also by my measurements, if I have measured without or with isolator.
After many setups (picture 12) and trials with different PCBs, diodes and RF housings I was able to show 1 mW measured RF on 122 GHz. Therefore I use the diode MA4E1317 and the small multiplier S00-4079, that delivers 130 mW output power. A real microwave freak never stops because he always wants better results. After several measurements and tests the MA4E1317 delivered just only 150 µW. At first I thought that the high dissipation loss had destroyed the diode because it gets quite warm at this drive level. Then I have changed the MA4E1317 fort a new one and applied some cooling air from a fan. With this diode I have reached an output power of 700 µW. After some tests and adjustments the diode died again. This made me think. But now I know what has happened: one should not produce such high power without any proper matching even if it is only 1 mW. One can see a waveguide output without any termination has been the problem. The fan was taken away again and now my 900 µW (picture 13) kept also for longer transmit periods. By the way, too high IF power can also destroy the mixer diode. Pictures 14 and 15 show the levels at 122 GHz of the LO and SSB, respectively.

I want to indicate the connectors of the CMA 382400: 1 = black = ground, 2 = red or grey = + 5 V, 3 = grey or red = + 8 - 9 V, 4 = green minus 5 V.

For experiments multiplying from 30 to 60 GHz and from 60 to 122 GHz I refer to the PCBs No 39 and 40 from DB6NT. On 47 GHz I have used a doubler from 12 to 24 GHz giving 150 mW on 24 GHz.
This brought instant and good success considering the experience I have had with 76 GHz so far.
In the next future I will build a 24 GHz amplifier with waveguide output and driving this with a doubler from 12 to 24 GHz. I will experiment with this. Now there was no time left for any more tests.

Precision radiators for 47, 76 and 122 GHz: For constructing precision radiators I have designed three different devices. Without such devices it is impossible to build a perfect rotationally-symmetric radiator (see picture 16 with the separate parts).

Also I have checked the 50 cm dish from Procom and I have measured the accuracy of the parabola which is quite good as the focus change is only about 5 mm (picture 17). This dish is available from UKW-Berichte. The latest version has got a broadened rim. This was really necessary for better stability. Anyway I have added in the middle of the dish a round back-plate of 100 mm diameter which contains holes for the waveguide and for mounting the transverter (picture 18). This back-plate is glued to the dish with two-component adhesive. This brings significantly better stability. For the older 50 cm dishes without the broadened rim this is mandatory. This dish has an f/D of 0.4 and the focus is located at 18.9 cm, measured and calculated. Compared to the 25 cm Procom dish this one has a four times larger area and should bring theoretically 6 dB more gain. During my reception experiments I could measure indeed a 6 dB improvement. The length of the waveguide in the dish is 18.5 mm; the distance from radiator to waveguide is 7.4 mm. With the 50 cm dish a little change of this distance has a great effect on the illumination, which is understandable due to the larger radiating area.

If one is using the tuning elements from Tecelec e.g. the AT6924-0SL, for the 24 and 47 GHz filters from OE9PMJ (sk), adjustment gets substantially easier. One gets definite values when one turns these tuning elements in and out. Force fitting of these tuning elements is also easily possible. The drillings have to be made just 1/20 mm smaller. Huber Kruse has already supplied me a sample and it works perfectly. These tuning elements should also be used for the 76 GHz filter.

I would be happy if this article inspires new amateurs to try these frequencies.

Greetings, DL2AM - Philipp

Acknowledgements

I want to thank Nico from NAK-Elektronik-Messtechnik, for his great support to secure GHz measurement equipment and to Hubert Krause for the precise milling of several housings and filters. Also I want to thank Werner Nägele, DK5TZ, for making the PCBs.

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LDC-Panel, Bestell.Nr. 134473: Fa.Conrad, Hirschau

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Neue Gehäuse für 47-, 76- und 122-GHz-Transverter

von Philipp Prinz, DL2AM

Die vielen e-mails mit Fotos, die ich weltweit in letzter Zeit bekommen habe, haben mich veranlaßt, neue Wege zu versuchen auf diesen Frequenzen. Bei 122 GHz ist das Nachbauen wohl noch etwas zurückgeblieben, aber auf 76 GHz ist die Aktivität groß. Ich denke, wenn der Erfolg auf 76 GHz da ist, wird auch 122 GHz mehr angenommen. Ich möchte aber auch aktive GHz-Amateure zu neuen Versuchen anregen.

Seit 5 Monaten versuche ich bessere und für Ungeübtere leichter zum Erfolg führende Transverter für 47, 76 und 122 GHz zu bauen und zu testen. Dies resultiert aus der Veröffentlichung im Dubus 4/2006, wo ich einen Transverter mit neuen HF-Gehäusen beschrieben habe mit der Frequenzaufbereitung von 30 auf 60 GHz und dann auf 122 GHz. Die jetzt vorgestellten Gehäuse haben den Vorteil, daß diese für 47, 76 und 122 GHz verwendet werden können und bei guter Wirkungsweise einfach herzustellen sind. Zum Abgleich sind kaum noch Fähnchen nötig und ohne Abgleich ist schon messbare Leistung vorhanden. Diese neuen Gehäuse können auch als CW-Sender oder Bake benutzt werden. An den OCXOs von DK2DB und Vervielfacher von DB6NT ändert sich gegenüber vorhergehenden Veröffentlichungen von mir nichts. Viele Tricks, Messmittel und deren Anwendungen sind von mir schon in letzter Zeit in Dubus beschrieben worden und diese sind auch in verschiedenen Homepages von Funkamateuren veröffentlicht. Ich finde es nicht erforderlich, dies nochmals zu wiederholen. Bei dem Einfallsreichtum der Funkamateure ist es heute doch möglich, Meßmittel z.B. HP 432 + HP-R486 A oder K486 A (120 Euro) und für noch bessere Ausrüstung einen HP 141 mit einem selbstgebauten Mischer zu besorgen, um Agleicharbeiten zu erleichtern. Vor 10 Jahren waren diese Geräte ja wesentlich teurer.

Nun zum Thema: Der Verdreifacher CMA 382400 (siehe Fotos 1, 2, 3 und 4) wird so angebracht, daß die 38-GHz-Frequenz durch den gefrästen R28 Hohlleiter direkt an die Koppelsonde und weiter an den Kurzschlußschieber mit Tuningelement ankommt und somit gut an die 50-Ohm-Leitung bzw. Dioden-Eingang angepaßt wird, was ich auch messen kann. Die Koppelsonde (Foto 11), die in den 38-GHz-Hohlleiter WR 28 ragt, sollte ca. 1,5 mm Länge haben. Als PCB nehme ich die mit der Bezeichung 29 von DB6NT.

Beim Abgleich sind die beiden Tuningelemente am Ein- und Ausgang auf maximale Ausgangsleistung zu trimmen und gleichzeitig kann die 144-MHz-ZF-Leistung angepaßt werden. Ich möchte nochmals auf diese Microwave-Tuning-Elements hinweisen, da diese einen großen Vorteil haben gegenüber den gewöhnlichen Abstimmschrauben. Diese Tuning-Elements können bei 1/20 mm kleinerer Bohrung auch eingepreßt werden. DB6NT bietet diese auch an. Je höher die LO-Leistung ist, desto höher kann auch die ZF-Leistung sein. Bei ca. 100 mWatt LO-Leistung sind maximal 15 mWatt ZF-Leistung notwendig. Vor der Mischer-Diode bis zum 76-GHz-Rund-Hohlleiter, und nur dort, kann noch die Leistung am unteren und oberen Seitenband abgeglichen werden. Dies ist aber nur möglich mit einem Analyzer. Foto 5 und 6 zeigen den Pegel bei 76 GHz vom LO und vom SSB-Signal. Man sieht das untere, den LO und das obere Seitenband. Die größere LO-Unterdrückung in SSB ist nur mit der Antiparallelen-Diode MA4E1318 möglich. Wenn die Single-Diode MA4E1317 benutzt wird, ist der LO um mehr als 10 dB höher. Durch das Anbringen von 2 SMA-Buchsen am HF- und ZF-Gehäuse für das 144-MHz-ZF-Signal kann da noch die Leistung zur Kontrolle gemessen werden. Als CW-Sender für 76 und 122 GHz muß bei Verwendung der Single-Diode MA4E1317 diese unbedingt vorgespannt werden, um maximale Leistung zu erhalten.

Wenn aber die Antiparallel-Diode MA4E1318 für SSB benutzt wird, ist dies nicht unbedingt notwendig, da ja eine Belastung durch das Poti für 144 MHz im ZF-Teil je nach Stellung dazu beiträgt. Das Bild 7 zeigt den Versuchsmeßaufbau mit Poti zur Dioden-Anpassung. Die MA4E1317- und 1318-Dioden sind für diese hohen Frequenzen gut verwendbar und für Sende- und Empfangszwecke zu benutzen. Bei den letzten Feldversuchen auf 122 GHz am 7. April 2007 mit Dieter, DG7MHR, war in 2-Wege SSB 23 km leicht zu überbrücken. Das S-Meter des FT290 zeigte ohne Signal S 1 bis 2 an, dies bedeutet, daß der verwendete Multiplier S00-4079 bei Empfang 20 mWatt abgibt und die Versorgungsspannung dafür 5,1 Volt ist. Diese Einstellung ergibt bei mir den besten Signal-Rausch-Abstand. Bei diesem Test stieg es dann auf S 9 an. An beiden verwendeten SSB-Transvertern sind die MA4E1317 in Verwendung. Beim Verschicken von diesen genannten HF-Dioden MA4E1317 und 1318 habe ich gute Erfahrungen gemacht, da ich diese auf dem Rücken liegend auf den Tesafilm lege. Somit kann man durch die oben liegenden Goldplättchen diese leicht erkennen und mit der Pinzette wegnehmen.

Das ZF-Gehäuse (Foto 8) habe ich so ausgeführt, daß die ZF-Leistung im zusammengebauten Zustand noch abgeglichen werden kann. Wie man aus dem Foto ersehen kann, habe ich ein kleines 10-Gang-100-Ohm-Wendelpoti an die Seitenwand des Gehäuses geklebt. Die M 2,5 mm Schraube zur Befestigung der SMA-Buchse wird herausgedreht und so kann man mit dem Schraubenzieher an das Poti ran. Den SMA-Widerstand vor dem eben erwähnten Poti auf der ZF-PCB ändere ich auf 100 Ohm.

Somit kann die ZF-Leistung vom benutzten Transceiver von ca. 80 mWatt bis 2 Watt auf die notwendige Mischerleistung von 10 - 15 mWatt eingestellt werden.

Für 76 GHz habe ich die gleiche Umschaltung (Foto 9+10) angewendet, wie ich schon auf 122 GHz im cqdl 6/2006 beschrieben habe. Somit kann die Versorgungsspannung + 5 Volt zum Senden und bei Empfang bis auf + 2 Volt zurückgeregelt werden. Der große Multiplier CMA382400 macht keine Probleme bei einer Spannung zwischen 5 und 2 Volt DC, dabei geht die HF-Leistung bei + 3 Volt um mehr als die Hälfte zurück. Das Signalrauschverhältnis kann bei Empfang durch diese Maßnahme um ca. 3 dB verbessert werden. Bei dieser Frequenz ist bei mehreren Aufbauten eine DSB-Leistung von 1,5 mWatt erreichbar (Foto 6).

Von Fa. Conrad habe ich spezielle LCD-Paneel-Instrumente (Foto 20) für meinen CW-Sender für 76 und 122 Gz eingebaut, damit bringe ich die Vorspannung der Mischer-Diode zur Anzeige, was sehr hilfreich ist, um zu sehen, ob utput vorhanden ist. Bei 122 GHz stehen bei mir 2 Volt an, wenn ich 900 µWatt Output habe. Das ergibt einen Arbeitswiderstand von 110 Ohm.

Nun zu der nicht mehr so einfachen 122 GHz Frequenz, zumindest für SSB-Anwender: Das HF-Gehäuse dafür hat eine Änderung und ist für den kleinen Verdreifacher S00-4079 ausgelegt. Die Hohlleiter-Ausfräsung für 40,7 GHz ist hier WR19. Die Mischer-PCB ist auch von DB6NT mit der Bezeichnung 31. Die Koppelsonde für diesen Hohlleiter sollte eine Länge von ca. 1,4 mm aufweisen (Foto 11). Dieses HF-Gehäuse kann auch für den großen Verdreifacher bzw. Vervierfacher CMA382400 durch eine Änderung benutzt werden. Leider gibt der große CMA382400 nur etwa 70 mWatt bei 40,7 GHz ab, was dann bei 122 GHz nicht die hohe Ausgangsleistung ergibt. Ansonsten ist alles ähnlich wie auf 76 GHz schon beschrieben.

Auf 76 GHz sind die Messdaten bei verschiedenen Aufbauten ähnlich, aber auf 122 GHz liegen diese, wenn man SSB machen möchte, weit auseinander. Wenn nur ein CW-Sender oder Bake gemacht wird, ist dies wesentlich leichter zu realisieren. Diese großen Unterschiede resultieren in erster Linie aus den Streuungen der HF-Diode, dessen Einklebung, unsaubere und rauhe Hohlleiter und schlechte Anpassung. Mein Meß-Equipment reicht jetzt teilweise bis 170 GHz, aber je mehr man messen kann, desto so mehr wird bei diesen hohen Frequenzen unverständlich. Da versucht man einige Tage lang sich zu beweisen, warum bestimmte Analyzer-Bilder so verschieden aussehen.

Um einigermaßen genaue Meßergebnisse am Analyzer und Leistungsmesser zu haben, sollte unbedingt ein Isolator oder ein Dämpfungsglied für diese hohen Frequenzen benutzt werden, was sich bei meinen Messungen auch bestätigt hat, wenn ohne oder mit einem Isolator gemessen wird.

Nach vielen Aufbauten (Foto 12) und Versuchen mit verschiedenen PCBs, Dioden und HF-Gehäusen hatte ich doch auf 122 GHz gemessene 1 mWatt HF vorzuweisen. Ich verwende dafür die Diode MA4E1317 und den kleinen Multiplier S00-4079, der eine Leistung von 130 mWatt abgibt. Ein echter GHz-Freak gibt ja keine Ruhe, da er immer bessere Ergebnisse anstrebt.
Nach mehreren Messungen und Tests gab die MA4E1317 nur noch 150 µWatt ab. Zuerst dachte ich, daß die hohe Verlustleistung die Diode zerstört hat, da diese doch ganz schön warm wird bei Ansteuerung. Daraufhin habe ich die MA4E1317 gegen eine neue ausgetauscht und anschließend einen kleinen Ventilator an das HF-Gehäuse blasen lassen. Bei dieser Diode habe ich eine Ausgangsleistung von 700 µWatt HF erreicht. Nach einigen Tests und Schraubungen war diese Diode wieder gestorben. Das machte mich aber dann stutzig. Jetzt weiß ich, was passiert ist: Man darf ohne Anpassung keine so hohe Leistung machen, auch wenn es nur 1 mWatt ist. Man sieht, ein Hohlleiter-Ausgang ohne Abschluß war das Problem. Den Ventilator habe ich wieder ausgebaut und meine jetzt 900 µWatt (Foto 13) bleiben erhalten auch bei langen Trägern. Übrigens, auch bei zu hoher ZF-Leistung kann die Mischer-Diode zerstört werden. Die Bilder Nr. 14 und 15 zeigen die Pegel bei 122 GHz nur des LOs und dann in SSB.

Ich möchte noch auf die Anschlüsse des CMA 382400 hinweisen: 1 = schwarz = Masse, 2 = rot oder grau = + 5 Volt, 3 = grau oder rot = + 8 - 9 Volt, 4 = grün minus 5 Volt

Bei Versuchen von 30 auf 60 GHz und von 60 auf 122 GHz verweise ich auf die PCB Nr. 39 + 40 von DB6NT. Auf 47 GHz habe ich einen Verdoppler von 12 auf 24 GHz benutzt, der auf 24 GHz 150 mWatt abgibt. Diese Anordnung hat gleich sehr guten Erfolg gebracht, bei Berücksichtigung der Erfahrungen, die ich bei 76 GHz gemacht habe. Ich werde in nächster Zeit einen 24 GHz-Verstärker mit Hohlleiter-Ausgang bauen, diesen mit einem Verdoppler von 12 auf 24 GHz ansteuern und damit Versuche machen. Für weitere Versuche war jetzt keine Zeit mehr vorhanden.

Zur Herstellung von Präzisions-Strahlern für 47, 76 und 122 GHz habe ich drei verschiedene Vorrichtungen hergestellt. Ohne solche Vorrichtungen ist ein genau rotationssymmetrischer Strahler nicht anzufertigen (Foto der Einzelteile in Bild 16).
Auch habe ich den 50-cmSpiegel von Procom getestet und vermessen auf die Parabolgenauigkeit. Diese habe ich für gut befunden, da sich der Focus-Punkt um nur 5 mm veränderte (Foto 17). Der Parabolspiegel ist von UKW-Berichte prompt geliefert worden. Dieser neue Spiegel hat jetzt einen verbreiterten Außenrand, was sehr notwendig war. Trotzdem habe ich für die Mitte eine runde Kalotte von 100 mm Durchmesser gedreht (Foto 18), versehen mit Bohrungen für Hohlleiter und Befestigungen für den Transverter. Diese Kalotte wurde mit Zweikomponenten-Kleber versehen und dann angepreßt. Diese Maßnahme hat die Stabilität noch wesentlich erhöht. Bei den älteren 50-cm-Spiegeln ohne den verstärkten Außenrand ist dies zwingend notwendig. Dieser Spiegel hat ein f/D von 0,4 und der Fokus liegt bei 18,9 cm, gemessen und gerechnet. Gegenüber dem 25-cm-Procom-Spiegel hat dieser ca. 4 x so viel Fläche und sollte dabei rechnerisch 6 dB Signalerhöhung bringen. Bei meinen Empfangsversuchen hatte ich tatsächlich 6 dB Erhöhung messen können. Die Hohlleiterlänge im Spiegel beträgt 18,5 mm. Der Abstand zwischen Strahler und Hohlleiter beträgt 7,4 mm. Bei dem 50-cm-Spiegel hat eine kleine Änderung dieses Abstandes

großen Einfluß auf die Ausleuchtung, was auch nachvollziebar ist, durch die größere Strahlungsfläche.

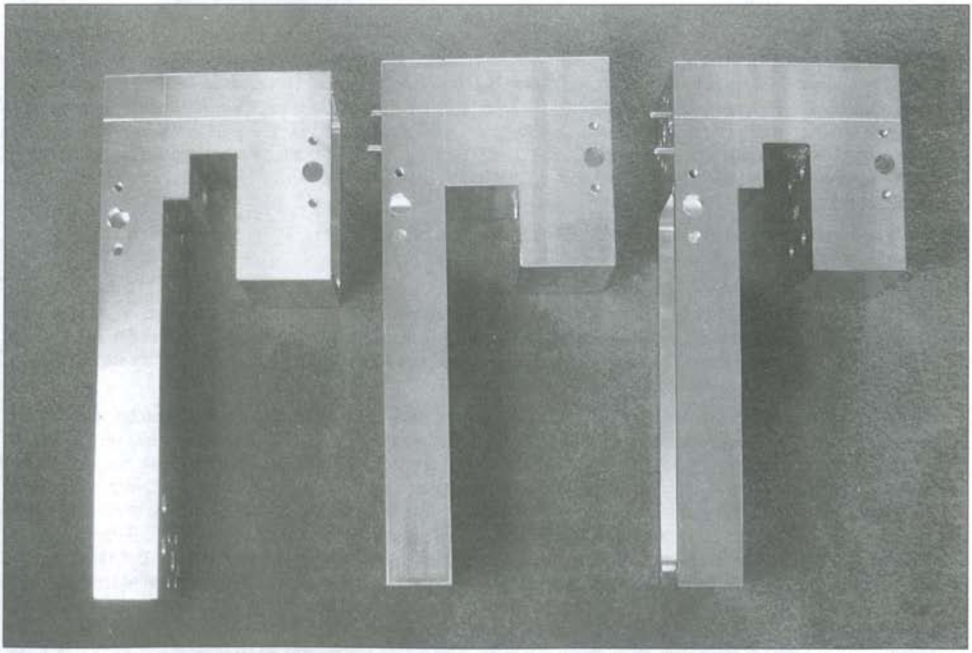
Wenn für die 24- und 47-GHz-Filter nach OE9PMJ (sk) Tuning-Elemente, z.B. AT6924-0SL von Tecelec, eingesetzt werden (Foto 19), ist ein Abgleich wesentlich leichter zu machen. Beim Aus- und wieder Eindrehen dieser Tuning-Elemente hat man definierte Werte. Die Einpreßbohrung für diese Tuning-Elemente wird 1/20 mm kleiner gemacht, somit lassen sich diese Elemente auch leicht einpressen. Hubert Krause hat mir schon die ersten Muster gemacht und sie funktionieren sehr gut. Am 76-GHz-Filter sind diese Tuning-Elemente auch zu verwenden.

Es würde mich freuen, wenn ich durch diese Veröffentlichung nochmals neue Amateure für diese Frequenzen begeistern könnte.

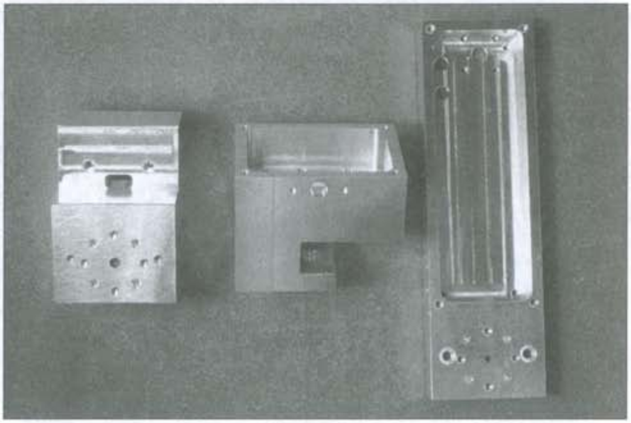
Es grüßt DL2AM - Philipp

Bedanken möchte ich mich bei Nico von NAK-Elektronik-Messtechnik, den ja jeder Afumarkt-Besucher kennt, aufgrund seiner unverwechselbaren Mütze, für die große Unterstützung bei der Beschaffung von GHz-Messgeräten und bei Hubert Krause für das präzise Anfertigen verschiedener Gehäuse und Filter, ebenso bei Werner Nägele, DK5TZ, für die PCB-Anfertigung.

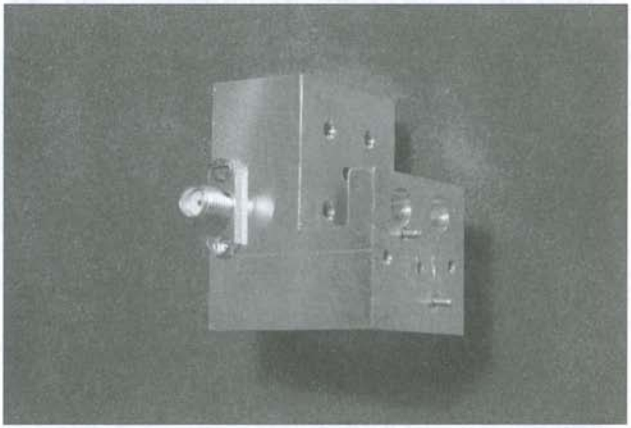
Literatur und Bezugsquellen siehe oben am Ende des englischen Textes.



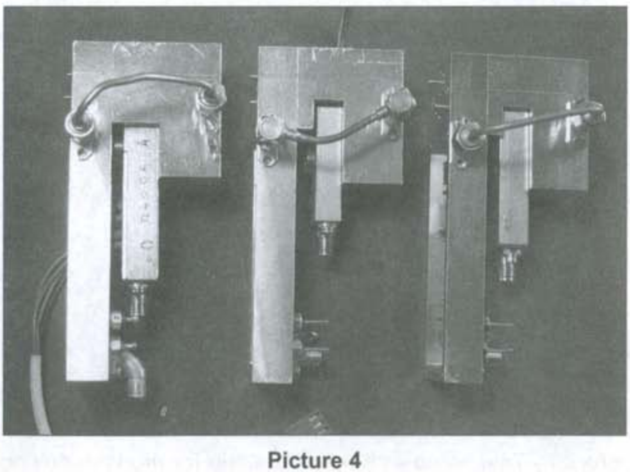
Picture 1 - New housings for 47, 76 and 122 GHz transverters



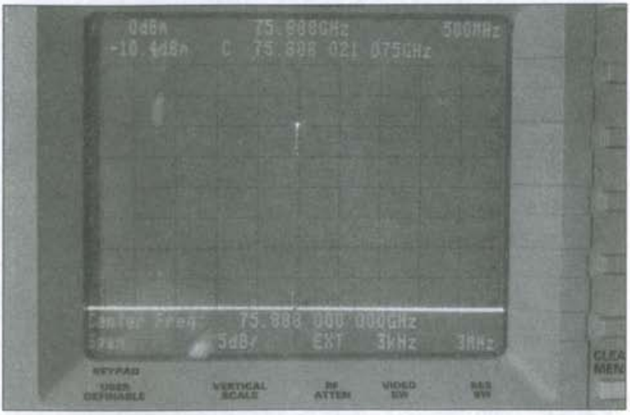
Picture 2



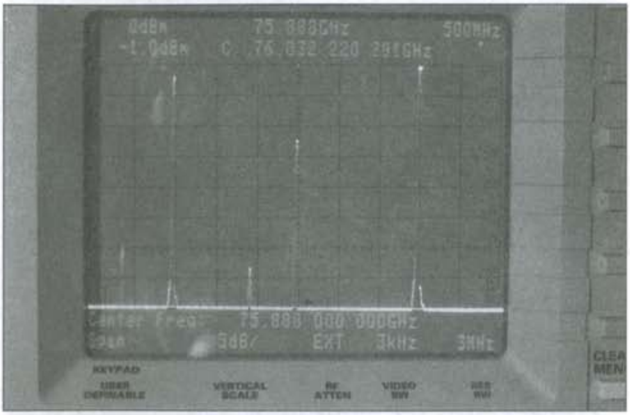
Picture 3



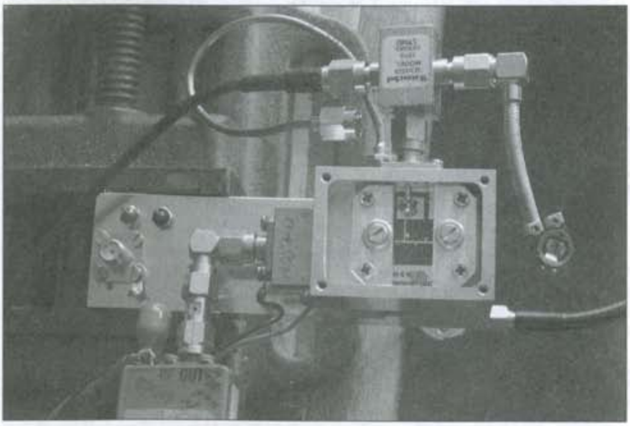
Picture 4



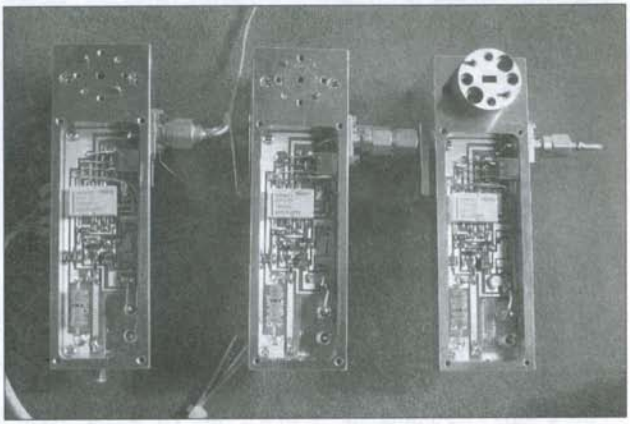
Picture 5 – Level of the 76 GHz LO signal



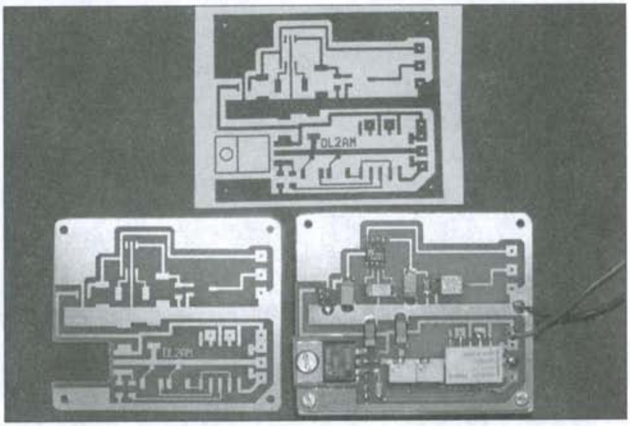
Picture 6 - Level of the 76 GHz LO and the SSB signal.
One can see the lower sideband, the LO and the upper sideband



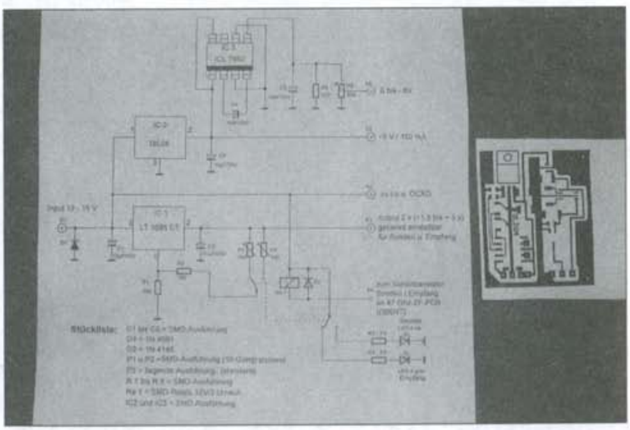
Picture 7 - Test setup with potentiometer for diode matching



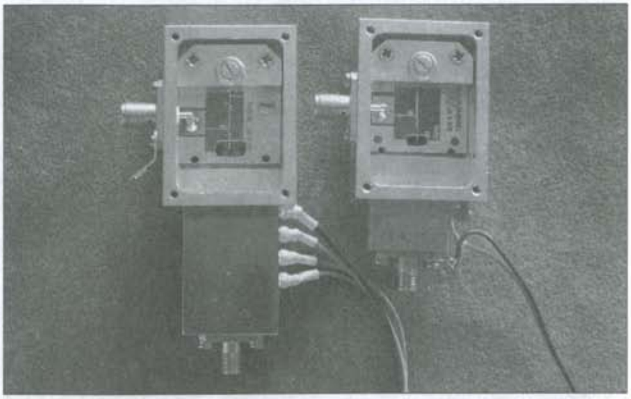
Picture 8 – IF housing with potentiometer accessible through the SMA jack hole



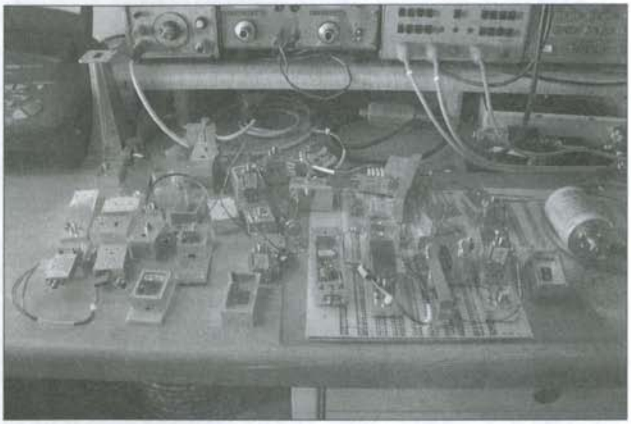
Picture 9 – PCB for supply voltage switching circuit



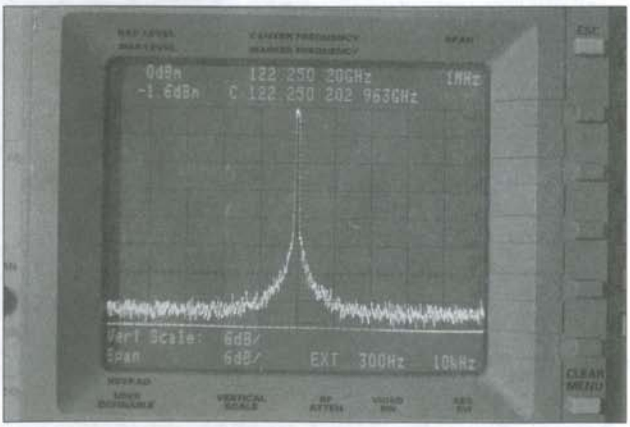
Picture 10 – Supply voltage circuit for +8V (TX) and +3V (RX) and -5V



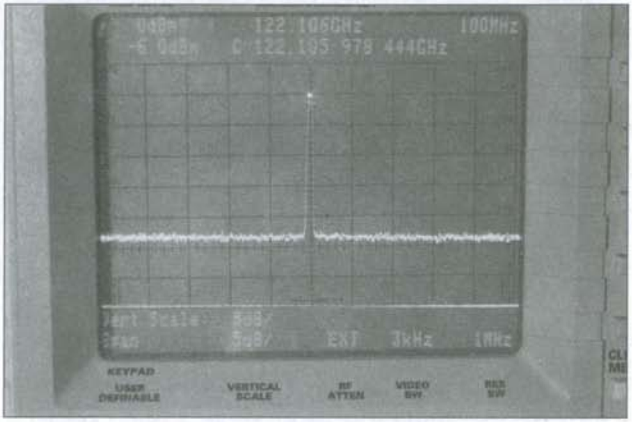
Picture 11 – left in the centre: 1.5mm coupling probe into the 38 GHz WR28 WG for 76 GHz
Right in the centre: 1.4mm coupling probe into the 40.7 GHz WR19 WG for 122 GHz



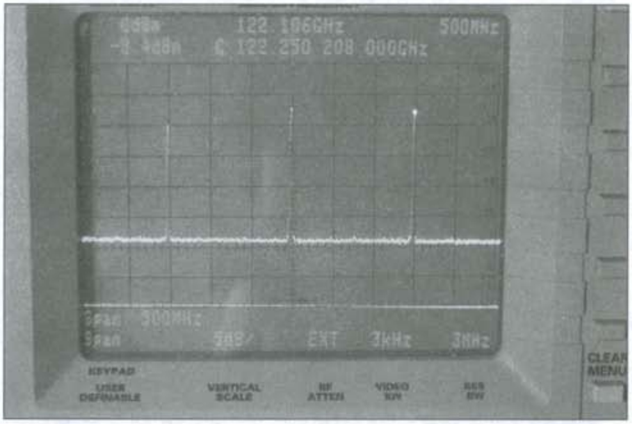
Picture 12 - Many setups and trials with different PCBs, diodes and RF casings



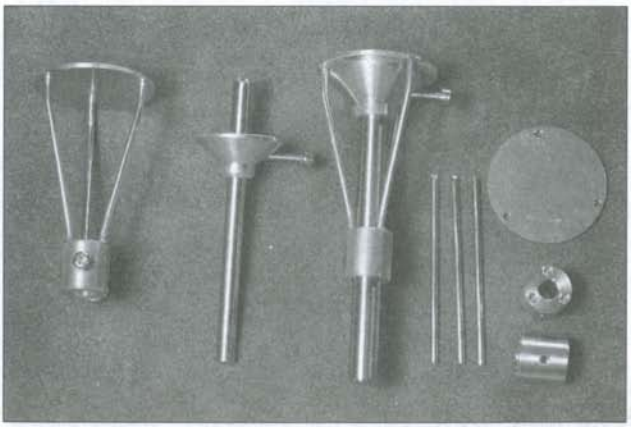
Picture 13 – The result: 900 µW on 122 GHz



Picture 14 – LO level on 122 GHz

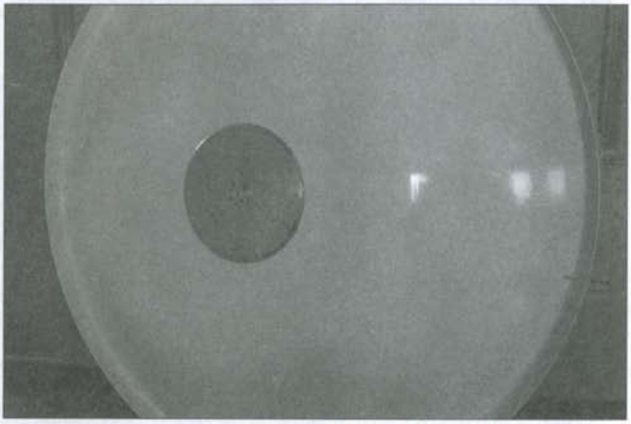


Picture 15 - Level of the 122 GHz LO and the SSB signal (LSB & USB)

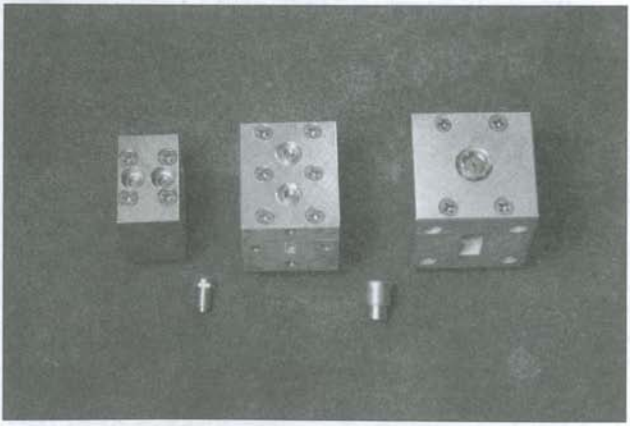


Picture 16 - Precision radiators for 47, 76 and 122 GHz

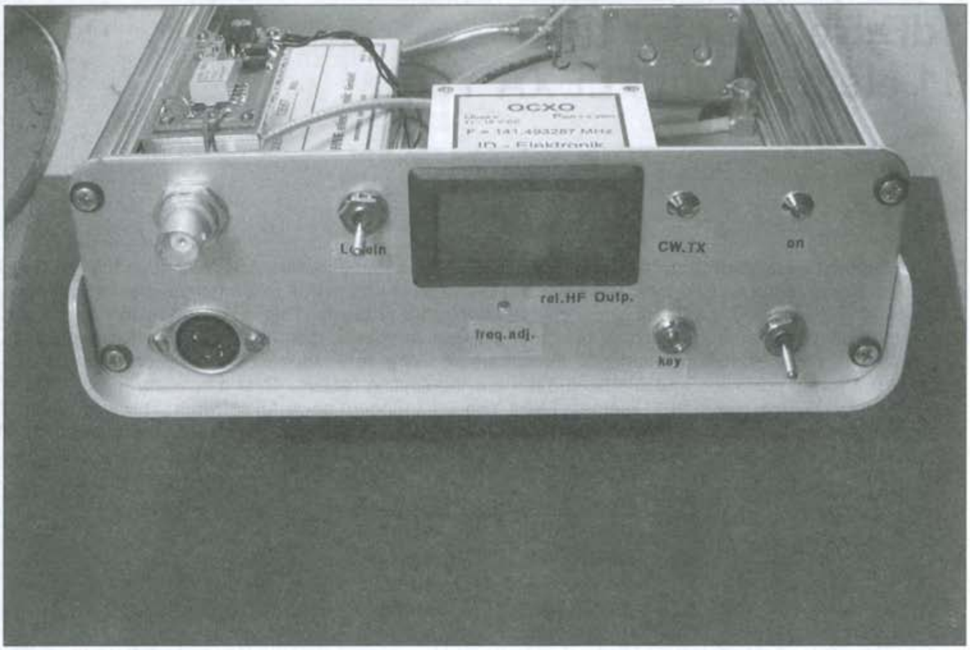
Picture 17 – 50 cm dish from Procom with feed



Picture 18 – Dish with back-plate for more stability



Picture 19 – OE9PMJ filters for 122, 76 and 47 GHz with tuning elements



Picture 20 - 122 GHz beacon TX with LC readout

Picture 21 - DL2AM – portable Microwave station

1dB Booster for the 11 element 2m FLEXA Yagi

by Ljubisa Popa – Pop, YU7EF

The 11 element Fexa Yagi (DL6WU design) is available for about 25 years now. Allthough the design is rather old this antenna is used by many EME and DX stations on 2m due to it`s unique mechanical data. The weight and windload is extremely low compared to other products. This is caused mainly by the thin 2mm stainless steel elements which on the other side cause a lower gain of about 0.35 dB compared to antennas with 6mm aluminium elements. For amateurs living very close to saltwater or in zones with regular high winds corrosion and windload often are the limiting factors. Thus it is worth to consider to redesign or modify this common 11 element Flexa Yagi by a modern powerful software. This was reached within one day on the computer by adding 3 new elements and extending the boom to a total length of 6.9m instead of 4.9m before. The dimensions are shown in table 1.

Part	Pos.	Length	Remark
RE	0	1035	same
DE	390	984	same
D1	525	955	same
D2	847	945	same
D3	1222	940	same
D4	1762	935	same
D5	2332	930	same
D6	2902	925	same
D7	3562	920	same
D8	4222	915	same
D9	4882	*910*	*CHANGED*
D10	*5542*	*905*	*NEW*
D11	*6202*	*900*	*NEW*
D12	*6895*	*885*	*NEW*

Table 1: Additional elements and required changes for the 11 element FLEXA Yagi

With the addition of these three elements the gain of the antenna is improved by 1.13 dB to 14.78 dBi (12.63 dBD). Note that impedance is IDENTICAL to the one with original antenna, so, whatever SWR one had with the old antenna it will remain just the same.

	FX 224 Original	FX 224 Extended	FX224 Extended 4 x stack
Gain dBi	13.65	14.78	20.54 H stack
Ta K	262.1	259.3	250.8
G/T dB	-10.53	-9.36	-3.45

Table 2: Simulated data for FX224 versions

Optimal stacking distance for the original version is 3.2m horizontal and 2.9m vertical, optimal stacking distance for the modified version with the 3 new elements is 3.5m horizontal and 3.2m vertical.
From following diagrams you can see radiation pattern (Fig. 1 and 2) and SWR (Fig. 3 and 4).

The necessary parts for the elements and boom and mounting clamps and screws can be taken from another shorter Flexa yagi or ordered separately from the manufacturer.

This antenna modification was built an tested with success in practice by Joe, CT1HZE.

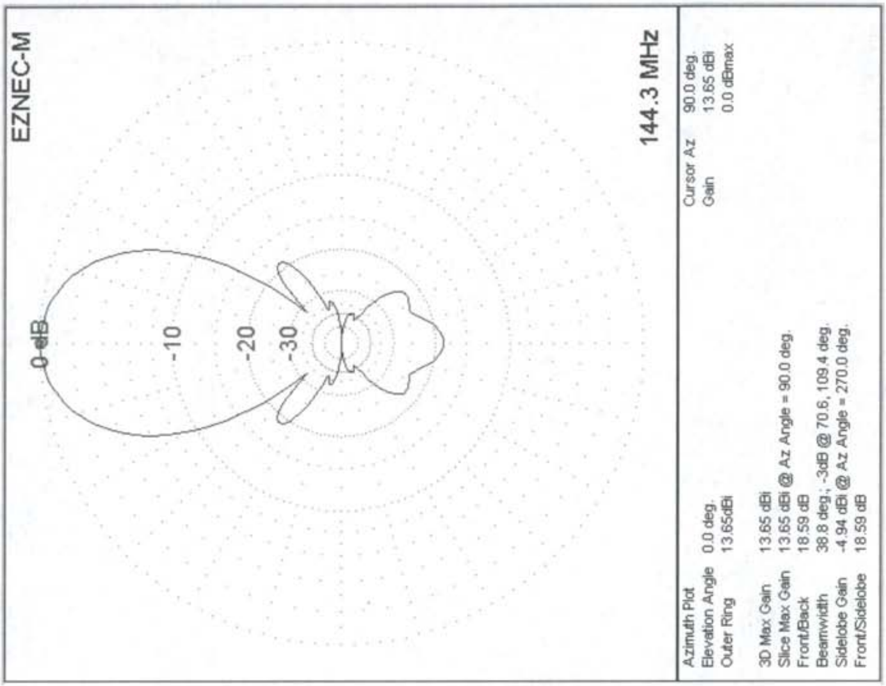
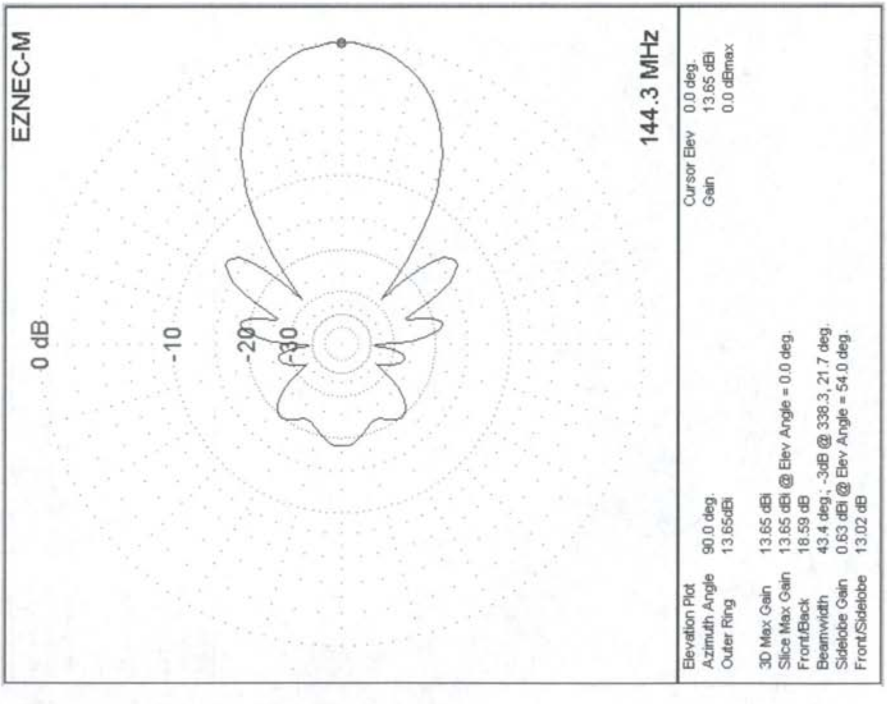
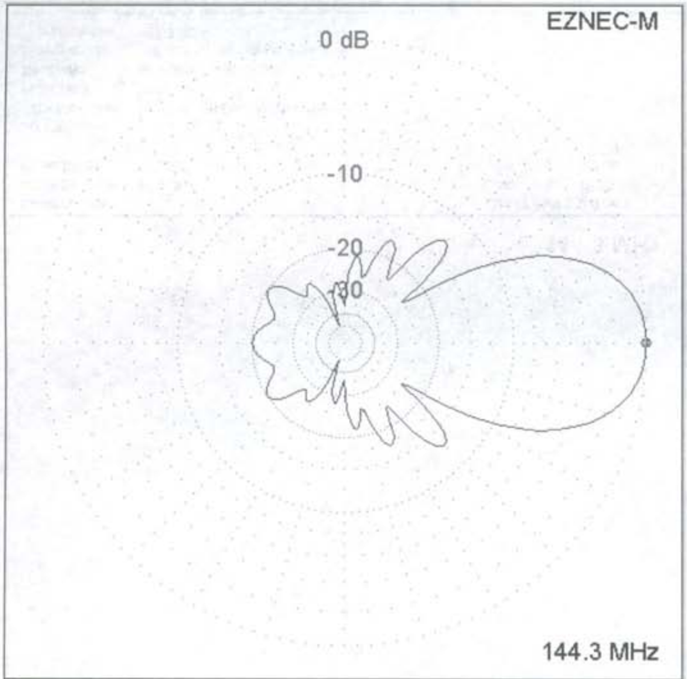
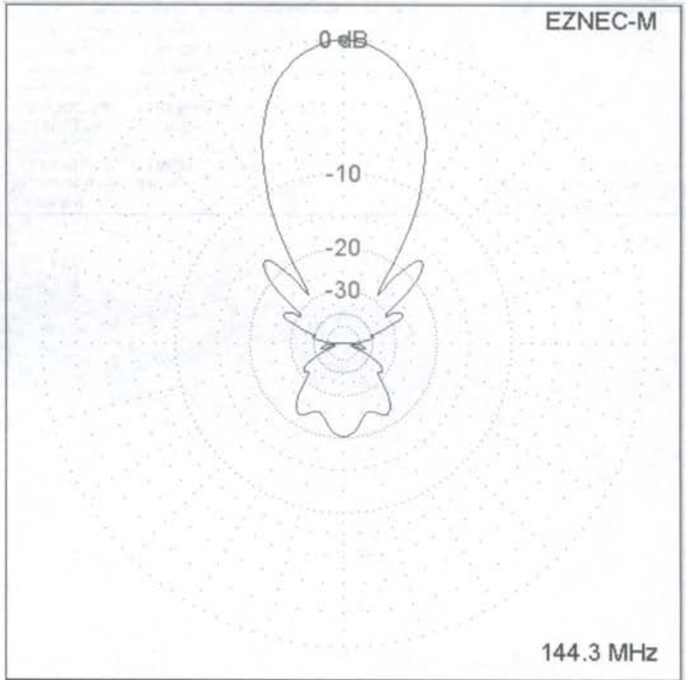


Fig. 1a and 1b: 11 Element Flexa Yagi original – H and E pattern





Elevation Plot		Cursor Elev	0.0 deg.
Azimuth Angle	90.0 deg.	Gain	14.78 dBi
Outer Ring	14.78dBi		0.0 dBmax
3D Max Gain	14.78 dBi		
Slice Max Gain	14.78 dBi @ Elev Angle = 0.0 deg.		
Front/Back	20.21 dB		
Beamwidth	37.0 deg.; -3dB @ 341.5, 18.5 deg.		
Sidelobe Gain	1.84 dBi @ Elev Angle = 314.0 deg.		
Front/Sidelobe	12.94 dB		



Azimuth Plot		Cursor Az	90.0 deg.
Elevation Angle	0.0 deg.	Gain	14.78 dBi
Outer Ring	14.78dBi		0.0 dBmax
3D Max Gain	14.78 dBi		
Slice Max Gain	14.78 dBi @ Az Angle = 90.0 deg.		
Front/Back	20.21 dB		
Beamwidth	34.2 deg.; -3dB @ 72.9, 107.1 deg.		
Sidelobe Gain	-2.06 dBi @ Az Angle = 46.0 deg.		
Front/Sidelobe	16.84 dB		

Fig. 2a and 2b: 14 Element Flexa Yagi modified version – H and E pattern

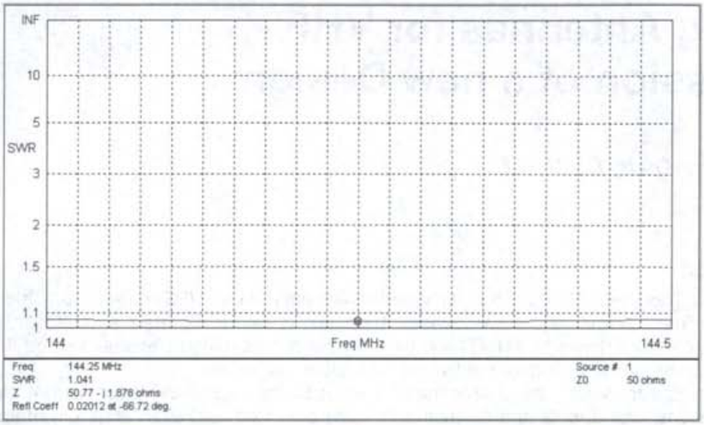
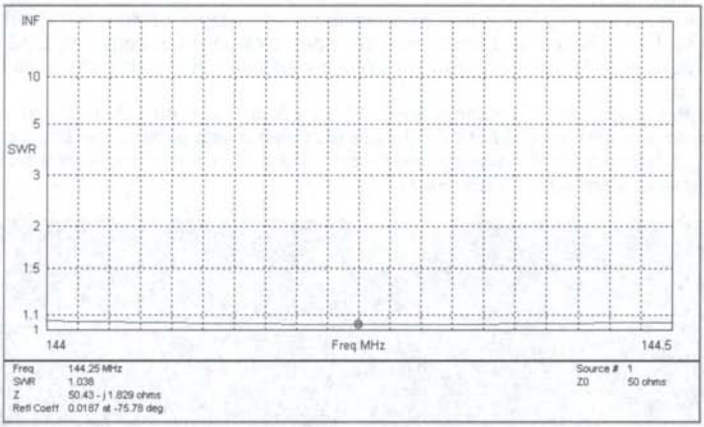


Fig. 3 (top) Simulated SWR response FX224 original – Fig. 4 (bottom) modified



Deutsche Fassung: Die 11 Element Fexa Yagi (DL6WU Design) gibt es seit etwa 25 Jahren. Obwohl das Design ziemlich veraltet ist, wird diese Antenne von vielen EME und DX-Stationen auf 2m verwendet, weil sie einzigartige mechanische Eigenschften hat. Gewicht und Windlast sind sehr niedrig im Verlgeich zu anderen Produkten. Dies wird haupsächlich durch die 2mm dünnen Edelstahlselemente ermöglicht, die auf der anderen Seiten einen Verlust von etwa 0.35 dB Gewinn gegenüber Antennen mit Elementen auf 6mm Alu mit sich bringen. Für Amteure, die sehr nahe am Salzwasser leben oder in Gebieten, mit oft auftretenden hohen Windgeschwindigkeiten, sind Korrosion und Windlast oft die entscheidenden Faktoren. Deshalb ist es Wert darüber nachzudenken, ein Redesign oder eine Modifikation dieser verbreiteten 11 Element Flexa Yagi mit einer modernen leistungfähigen Software vorzunehmen. Dies wurde innerhalb eines Tages am Computer erreicht, indem weitere 3 Elemente hinzugefügt wurden und der Boom von 4.9m um 2m auf 6.9m verlängert wird. Die Abmessungen zeigt Tabelle 1.

Das Hinzufügen der 3 Elemente bewirkt eine Gewinnsteigerung von 1.13 dB auf 14.78 dBi (12.63. dbD). Die Impedanz ist identisch mit der der originalen Version, d.h. das SWR bleibt unverändert.

Der optimale Stockungsabstand für die Original-Version ist 3.2m horizontal und 2.9m vertikal, für die verlängerte Version 3.5m horizontal und 3.2m vertikal. Die Strahlungdiagramm der originalen 11 Ele. zeigt Abb. 1 und 2, die der verlängerten Antenne Abb. 3 und 4.

Die nötigen Teile für die neuen Elemente, Boom, Klammern und Schrauben kann man von einer kürzeren weiteren Flexa-Yagi nehmen oder einzeln direkt vom Hersteller beziehen.

Die modifizierte Antenne wurde nachgebaut und mit Erfolg in der Praxis von Joachim, CT1HZE, getestet.

Oblong Antennas for VHF - Discussion of a new Design

by Joachim Kraft, DL8HCZ

Introduction

Recently Andra Todorovic, YU1QT, has designed a new antenna for VHF, called the "Oblong Antenna". A few amateurs from Serbia who have already tried this antenna reported a "fantastic F/B ratio" and "extremely high" gain. Thanks to YU1QT we have all the details (dimensions, simulated diagrams) about his design which he has supplied for publishing in DUBUS magazine.

YU1QT first started to design these antennas for short boomlengths and with 3 and 4 elements. In the meantime versions with 6, 8, 9 and 13 elements were designed and even tested in practice by YU1EV see Fig. 1) who reports extraordinary results. Even longer versions with 17 and 19 elements were designed but not built yet.

YU1QT writes that his Oblong design tries to combine the advantages of Yagi and Quad antennas and was optimized for best F/B ratio and lowest possible noise pick-up. He reports that EME signals on 2m were stronger with one 9 element oblong antenna (6m boom) than with 2 stacked 10 element Yagis (4.5m boom).

He states that the short Oblong Antennas have 1.0 to 1.5 dB more gain than a Yagi and the longer versions (>3 lambda boom) have about 0.5 dB more gain than a yagi of the same boomlength. For the 8 element Oblong Antenna YU1QT reports a measured F/B of 81 (!) db. And for several simulated stacked systems the F/B rations are in the 35 dB range.

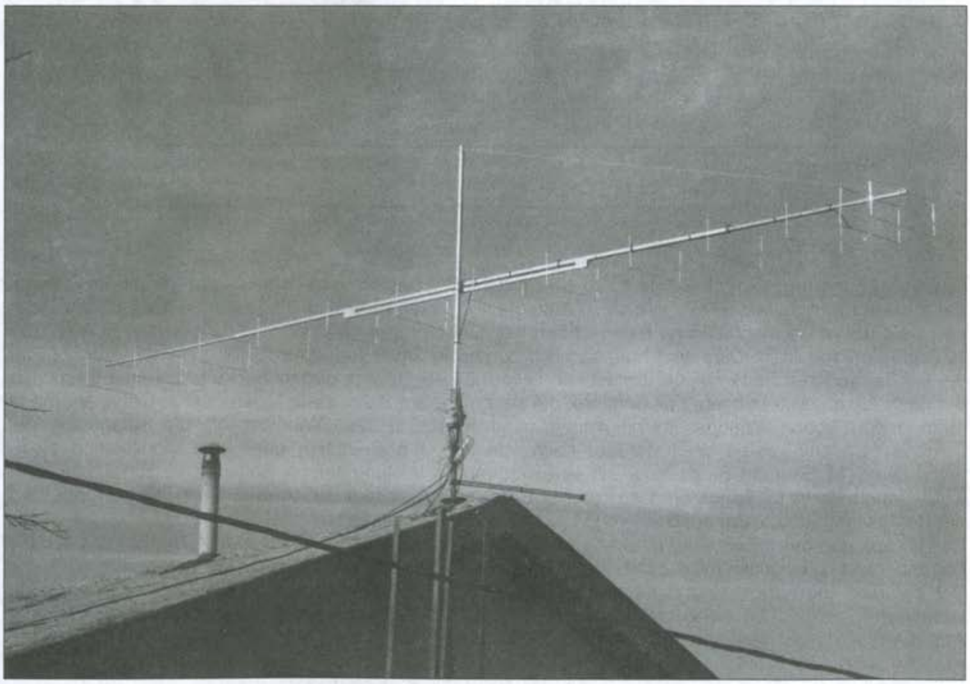


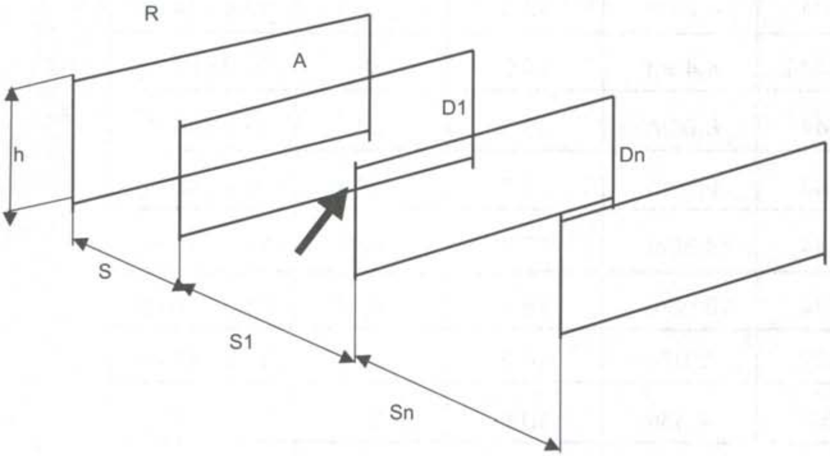
Fig. 1: 13 element oblong YU1QT antenna at the QTH of YU1EV

Geometric data

The elements of the YU1QT oblong antenna are rectangular, with a ratio from 3.3:1 (Reflector, R) to 2:1 for the last director (Dn). The distances between the elements vary depending on the boomlength:

S = distance from reflector to radiator: 0.09 to 0.2 lambda
S1 = distance from radiator to director 1: 0.18 to 0.24 lambda
Sn = distance from director 1 to next director: 0.35 to 0.48 lambda (0.385 lambda on average)
H = Height of the elements: 0.14 lambda

The feed is located in the middle of the longer side of the radiator (A). The connection (mount) from the elements to the boom are made from simple terminal blocks which also join the element ends to form loops. The elements are made from 4mm aluminium wire for 2m (for the 6m band versions 8mm tube was used and on 70cm 1.5mm aluminium wire).



R = Reflector   A = Radiator, Strahler
D1 = Director 1   Dn= Director n   H = element hight   = Feed point

Fig. 2: Geometry of the YU1QT oblong antenna design

Versions

The following prototypes have been built so far:
2m band: 4el (0.625L); 6el (1.25L); 8el (2.15L); 9el (2.89L); 13 el (4.61L);
70cm band: 5el (0.99L); 12el (3.0L);
6m band: 4el (0.71L); 5el (1.0L);

Additionally designed and simulated versions:
2m band: 17el (6.42L);
19 el (5.38L)
70cm band: 19el (7.24L)
6m band: 7el (1.38L);
8el (2.05L)

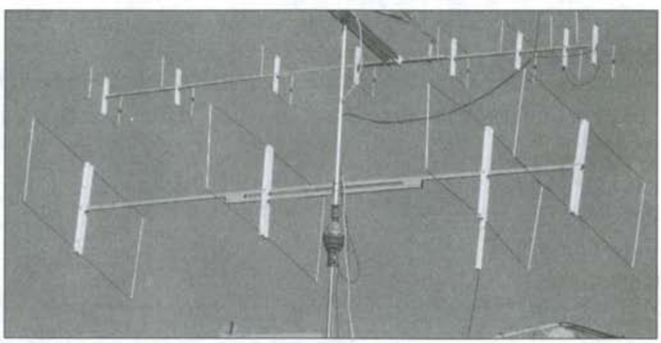


Fig. 2: 8 element oblong antenna for 2m and 4 element oblong antenna for 6m at YU1DO`s QTH

Performance Data

The performance data which were simulated by YU1QT with NEC4 are shown in table 1.

SINGLE ANTENNA				
Modell	length	FS gain dBi	F/B dB	1.st Lobe dB
4 el 144	1,35m	10,4	37,4	-29,7 / 116 dg
6 el 144	2,61m	12,5	37	-22,0 / 74 dg
8 el 144	4,31m.	13,5	40,1	-19,4 / 54 dg
8 el 144 L	4,46m	14,0	38	-19,0 / 62 dg
9 el 144	6,00m	15,0	33	-19,7 / 44 dg
13 el 144	9,59m	16,7	37	-15,4 / 46 dg
17 el 144	13,30m	17,6	47,5	-14,7 / 42 dg
19 el 144	15,05m	18,1	41,5	-13,6 / 30 dg
12 el 432	2,07m	14,9	39,9	-16,9 / 46 dg
4 el 50	4,33m	10,6	27	-27,6 / 134 dg
5 el 50	6,00m	11,8	33	-24,7 / 70 dg
7 el 50	8,38m	12,5	39	-21,9 / 64 dg

Table 1: Performance data, simulation results by YU1QT

Modell	E / H stack	FS gain dBi	F/B dB	1.st Lobe dB
H4x13el 144	4,0 / 3,4m	21,9	34,5	-18,1 / 46 dg
V4x13el 144	4,0 m	22,5	38,3	-18,1 / 46 dg

Table 2: Performance data by YU1QT for a 4 x 13 element stack

Dimensions

The dimensions for a selection of some of the YU1QT oblong antennas from table 1 are listed below.

YU1QT 4el OBLONG 144 MHz

R = 0.833 / 0
A = 0.756 / 0.350
D1 = 0.716 / 0.720
D2 = 0.634 / 1.35

h = 0.289m
V STACK = 2.0m
H STACK = 1.5m

YU1QT 6el OBLONG 144 MHz

R = 0.820 / 0
A = 0.760 / 0.230
D1 = 0.712 / 0.610
D2 = 0.672 / 1.30
D3 = 0.676 / 2.00
D4 = 0.630 / 2.61m
h = 0.290m
V STACK = 2.5m
H STACK = 1.8m

YU1QT 9el OBLONG 144 MHz

R = 0.859 / 0
A = 0.765 / 0.370
D1 = 0.725 / 0.915
D2 = 0.702 / 1.67
D3 = 0.674 / 2.49
D4 = 0.657 / 3.41
D5 = 0.655 / 4.27
D6 = 0.617 / 5.18
D7 = 0.620 / 6.00
h = 0.268m

V STACK = 3.7m
H STACK = 2.5m

YU1QT 13el OBLONG 144MHz

R = 0.826 / 0
A = 0.754 / 0.326
D1 = 0.704 / 0.835
D2 = 0.680 / 1.62
D3 = 0.650 / 2.45
D4 = 0.646 / 3.37
D5 = 0.632 / 4.24
D6 = 0.626 / 5.2
D7 = 0.628 / 6.09
D8 = 0.620 / 7.03
D9 = 0.626 / 7.87
D10 = 0.600 / 8.87
D11 = 0.628 / 9.59

h = 0.292
V STACK = 4.0m
H STACK = 3.4m

YU1QT 19el OBLONG 144MHz

R = 0.832 / 0
A = 0.757 / 0.336
D1 = 0.714 / 0.842
D2 = 0.694 / 1.54
D3 = 0.656 / 2.39
D4 = 0.636 / 3.28
D5 = 0.627 / 4.18
D6 = 0.612 / 5.11
D7 = 0.609 / 6.06
D8 = 0.605 / 7.00
D9 = 0.603 / 7.91
D10 = 0.598 / 8.87
D11 = 0.614 / 9.83
D12 = 0.633 / 10.70
D13 = 0.585 / 11.52
D14 = 0.623 / 12.71
D15 = 0.622 / 13.41
d16 = 0.627 / 14.39
d17 = 0.608 / 15.05
h = 0.290m
V STACK = 4.4m
H STACK = 3.0m

YU1QT 12el OBLONG 432.500 MHz

AL wire 1.5mm
R = 0.271 / 0
A = 0.251 / 0.076
D1 = 0.234 / 0.202
D2 = 0.219 / 0.432
D3 = 0.220 / 0.670
D4 = 0.214 / 0.866
D5 = 0.198 / 1.03
D6 = 0.205 / 1.25
D7 = 0.196 / 1.46
D8 = 0.198 / 1.62
D9 = 0.202 / 1.85
D10 = 0.200 / 2.07
h = 0.1m

V STACK = 1.2m
H STACK = 1.0m

YU1QT 5el OBLONG 50 MHz

AL pipe 8mm
R = 2.409 / 0
A = 2.216 / 0.78
D1 = 2.067 / 2.16
D2 = 2.039 / 4.26
D3 = 1.897 / 6.00
h = 0.78m

Diagrams

For all antenna versions from table 1 we have got complete sets of diagrams from YU1QT. We have chosen the 13 ele oblong as an example and are showing the results of the simulation from YU1QT in the following figures 3, 4, 5, 6 and 7.

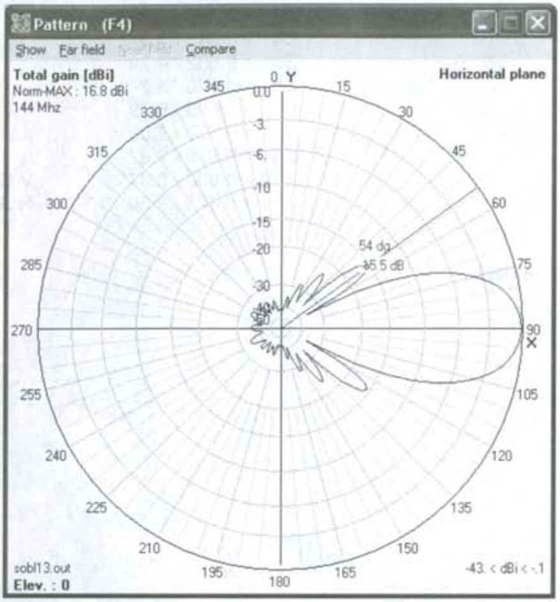


Fig. 3: 13 ele oblong antenna H plot simulation by YU1QT

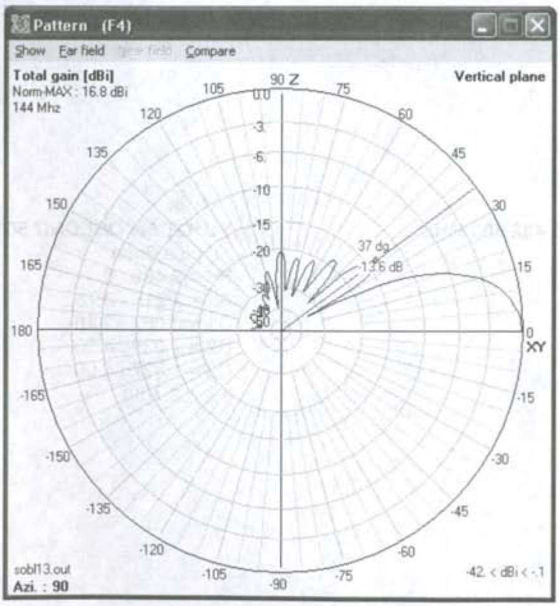


Fig. 4: 13 ele oblong antenna V plot simulation by YU1QT

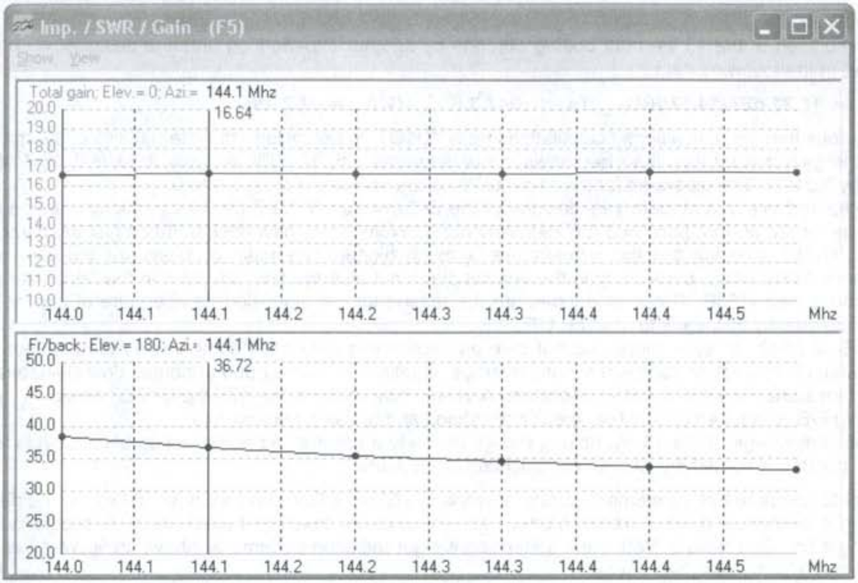


Fig. 5: 13 ele oblong antenna gain and F/B simulation by YU1QT

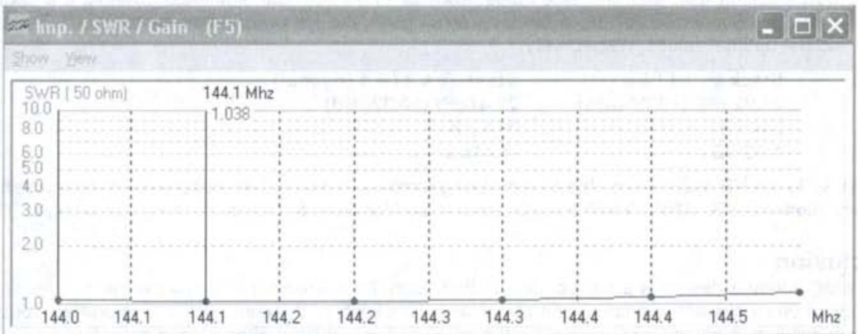


Fig. 6: 13 ele oblong antenna SWR simulation by YU1QT

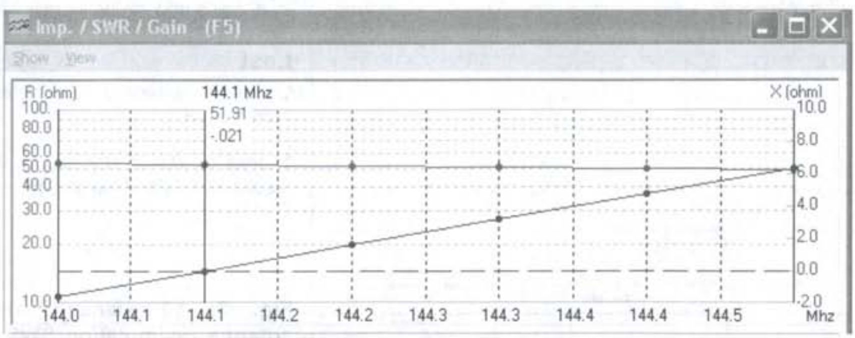


Fig. 7: 13 ele oblong antenna impedance simulation by YU1QT

Discussion

A re-simulation of the 13 element oblong antenna by another experienced antenna designer with NEC4 resulted in the following data:

Gain = 16.72 dBi (14.57dBD) Ta = 247.3 K G/T = -7.21dB

It is obvious that the simulations / calculations from YU1QT do not include the internal loss of the material. Thus the gain is a bit less than he shows in his diagrams with 16.8dBi. Anyway in table 1 16.7 dB are listed by YU1QT. The diagrams for the re-simulations are shown in Fig. 7, 8 and 9.
So, compared to e.g. a modern yagi design like the EF0214 from YU7EF the 13 ele oblong antenna has a rather moderate performance and it is definitely not a revolutionary new design. It has just the same gain as the YU7EF antenna but the temperature is much higher. The main problem are the very poorly suppressed side lobes, particularly in the vertical plane but also the first side lobe in the horizontal plane at no more than -15dB. These side lobes are the reason for the quite poor temperature of almost 250K and consequently this leads to -7.21dB G/T.
The F/B of 35dB (or even more) will not give any noticeable difference compared to the commonvalue 25dB which is more than sufficient for any average situation. So some good attributes (low sidelobes) are wasted for something that is not so important. A very similar mistake like with the DK7ZB design.
Such big F/B is required only in few specific situations and not as a general rule.
The only advantage of the 13 ele oblong design is surely a lower static noise pickup because it is a loop design but that is something we can not calculate or measure.

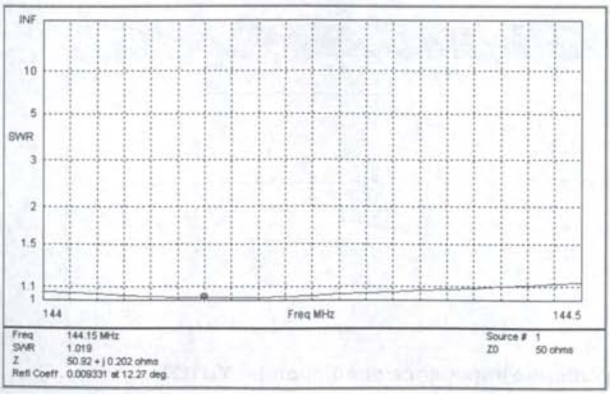
In order to compare this 13 element oblong antenna in VE7BH`s G/T chart we have to look on the data for stacking 4 antennas in an H frame. YU1QT recommends for horizontal stacking 3.4m and for vertical stacking 4.0m. See table 2. With such a stacking we get radiation patterns as shown in figure 10 and 11. The gain is >0.5dB less than optimal!
The single antenna has 27.8° horizontal beamwidth and 28.8° vertical beamwidth thus the optimum stacking should be 4.3m for horizontal and 4.1m for vertical, as per the DL6WU stacking formula and for about 5.8dB stacking gain and first side lobes down to 11-12 dB. The simulated patterns are shown in figure 12 and 13. Simulation for the 4 antenna array gives the following result for the YU1QT stacking values and the optimal values, respectively.

	Stack @ 3.4 / 4.0	Stack @ 4.3 / 4.1 (opimal)
Gain	**21.92 dBi (19.77 dBd)**	**22.47dBi (20.32dBd)**
Ta	**244.0 K**	**244.3 K**
G/T	**-1.95 dB**	**-1.41dB**

If one looks to the VE7BQH chart, this 13 ele oblong antenna is worse than many even shorter antennas - only exception is the SHARK 20 which is even worse and far away from a modern YU7EF design.

Conclusion

The oblong antenna design is a correct design that might be interesting to a few people and for specific situations. If one looks at the amount of material and complexity of the construction one probably doubts if it is worth building. Also one has to consider the much higher windload of an oblong antenna.
These oblong antennas are a below average antenna for EME but can be considered as a good Tropo antenna if you need to eleminate local noise and strong signals.



Last

Complete antennas are available from YU1JB.

Thanks to YU1QT for supplying the results and data of his design!

Fig. 7: 13 element oblong antenna resimulation SWR plot with linear scale

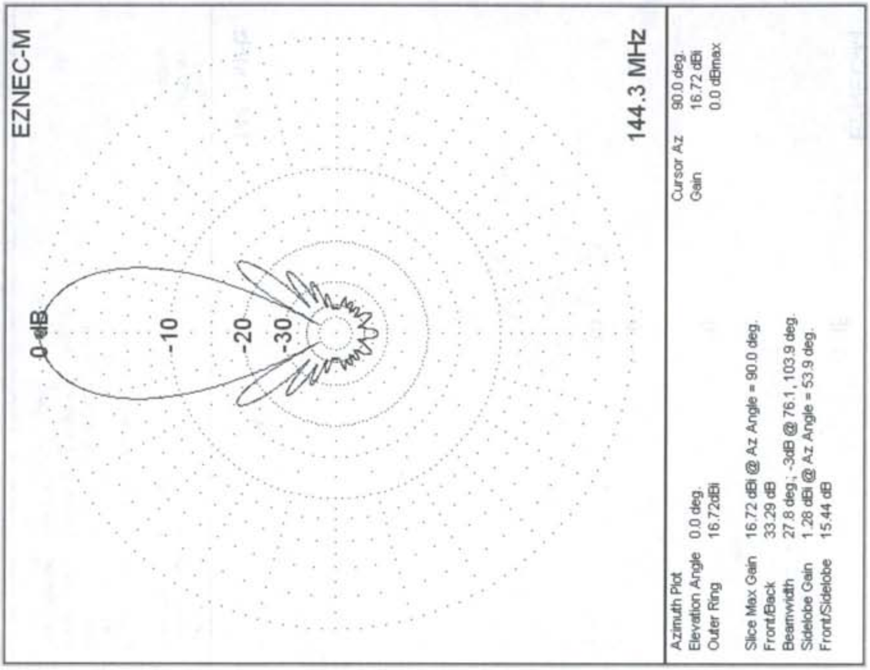


Fig. 8: 13 element oblong antenna resimulation with internal losses included – H plot

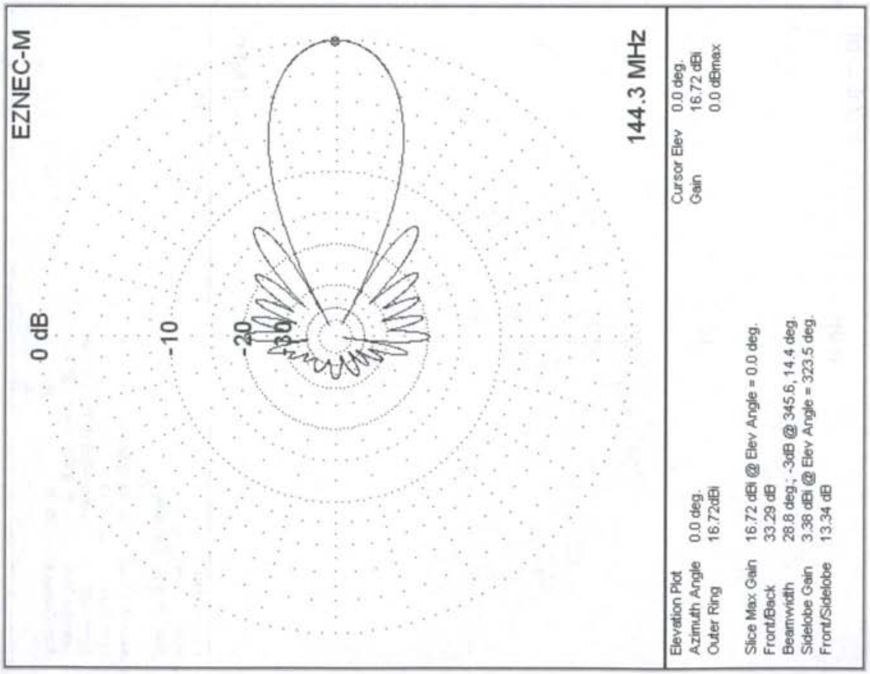


Fig. 9: 13 element oblong antenna resimulation with internal losses included – V plot

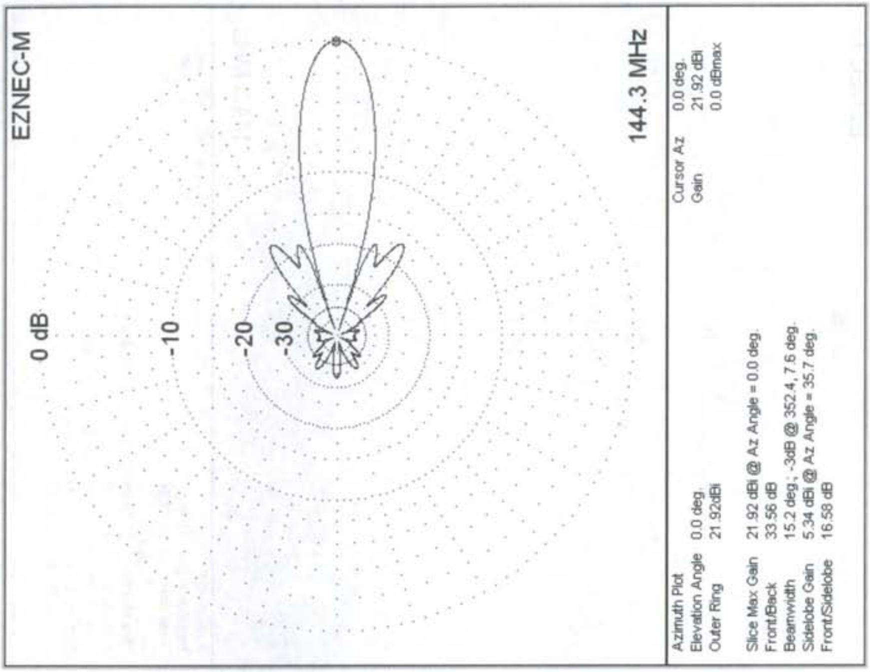


Fig. 10: 4 x 13 ele oblong stacked according to YU1QT – H plot

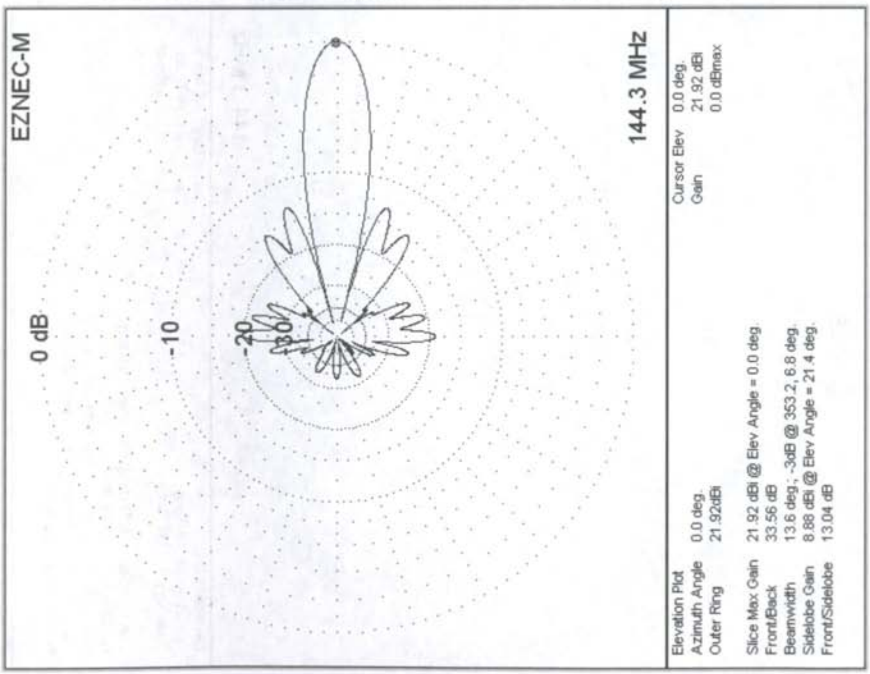


Fig. 11: 4 x 13 ele oblong stacked according to YU1QT – V plot

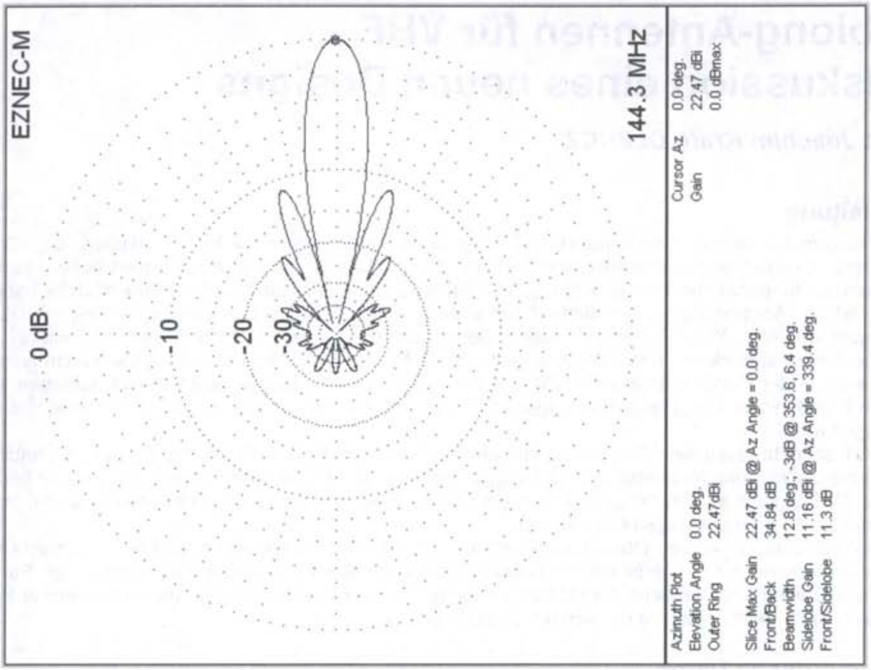


Fig. 12: 4 x 13 ele oblong stacked according to DL6WU – H plot

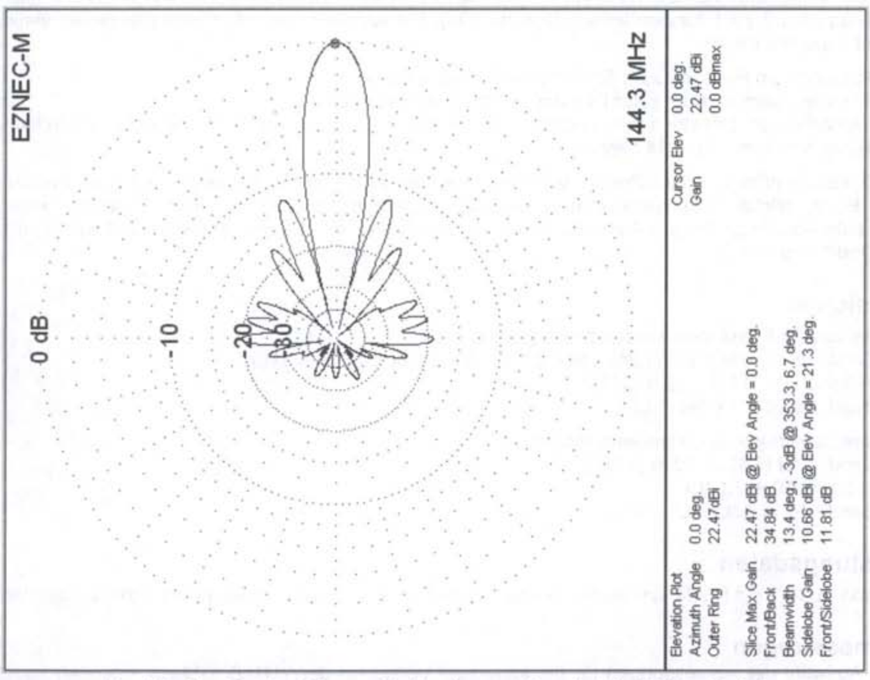


Fig. 13: 4 x 13 ele oblong stacked according to DL6WU – V plot

Oblong-Antennen für VHF - Diskussion eines neuen Designs

von Joachim Kraft, DL8HCZ

Einleitung

Vor kurzem hat Andra Todorovic, YU1QT, eine neue Antennenform ür VHF entwickelt, die "Oblong-Antenna". Einige wenige Amateure aus Serbein, die die Antenne bereits auspropbiert haben, berichten von einem „fantastischen Vor-Rückverhältnis (F/B)" und extrem hohem Gewinn. Dank YU1QR haben wir alle Details (Abmessungen, simulierte Diagramme) seines Designs zur Veröffentlichung im DUBUS-Magazin erhalten. YU1QT begann zuerst dieses Design für kurze Boomlängen und mit 3 und 4 Elementen zu entwickeln. In der Zwischenzeit wurden Versionen mit 6, 8, 9 und 13 Elementen entwickelt und auch in der Praxis u.a. von YU1EV getestet (siehe Abb. 1). Dieser berichtet von außergewöhnlich guten Ergebnissen. Längere Ausführungen mit 17 und 19 Elementen wurden berechnet, aber noch nicht nachgebaut.

YU1QT schreibt, dass sein Oblong-Design versucht, die Vorteile von Yagis und Quads zu kombinieren und eine Optimierung für bestes F/B und möglichste niedrige Störaufnahme gemacht wurde. Er berichtet, dass, EME-Signale auf 2m mit einer 9 Element Oblong-Antenne (6m Boom) lauter waren, als mit mit zwei gestockten 10 Element Yagis (4.5m Boom).

Er gibt an, dass die kurzen Oblong-Antennen 1.0 bis 1.5 dB mehr Gewinn haben als eine Yagi und die längeren Versionen (>3 Lambda Boom) etwa 0.5 dB mehr Gewinn als eine gleichlange Yagi. Für die 8 Element-Oblong-Antenne berichtet YU1QT von gemessenen 81 dB für F/B. Für diverse gestockte System sollen die F/B-Verhältnisse im Bereich um 35 dB liegen.

Geometrische Daten

Die Elemente der YU1QT Oblong-Antenne haben eine rechteckige Form im Verhältnis 3.3 zu 1 (Reflektor) bis 2 zu 1 für den letzten Direktor (Dn). Die Abstände zwischen den Elementen variieren je nach Länge des Booms.

S = Abstand vom Reflektor zum Strahler: 0.09 to 0.2 lambda
S1 = Abstand vom Strahler zurm Direktor 1: 0.18 to 0.24 lambda
Sn = Abstand vom Direktor 1 zum nächten Direktor: 0.35 to 0.48 lambda (0.385 lambda im Durchschnitt)
H = Höhe der Elemente: 0.14 lambda

Die Speisung erfolgt in der Mitte der längeren Seite des Strahlers (A). Die Befestigung der Elemente auf dem Boom erfolgt mit Lüsterklemmen, die dann auch das Element zu einem Loop schliessen. Die Elemente werden für 2m aus 4mm Alu-"Draht" gemacht (auf 6m wird 8mm Alu-Rohr und auf 70cm 1.5mm Alu-Draht verwendet).

Versionen

The folgenden Prototypen wurden bisher gebaut:
2m-Band: 4el (0.625L); 6el (1.25L); 8el (2.15L); 9el (2.89L); 13 el (4.61L);
70cm-Band: 5el (0.99L); 12el (3.0L);
6m-Band: 4el (0.71L); 5el (1.0L);

Weitere berechnete und simulierte Versionen:
2m-Band: 17el (6.42L); 19 el (5.38L)
70cm-Band: 19el (7.24L)
6m-Band: 7el (1.38L); 8el (2.05L)

Leistungsdaten

Die von YU1QT mit NEC4 simulierten Leistungsdaten sind in Tabelle 1 (siehe engl. Text) aufgelistet.

Abmessungen

Eine Auswahl der Abmessungen für die folgenden Versionen der YU1QT Oblong-Antennen findet man oben im engl. Text:

YU1QT 4el OBLONG 144 MHz
YU1QT 9el OBLONG 144 MHz
YU1QT 19el OBLONG 144 MHz
YU1QT 12el OBLONG 432.500 MHz
YU1QT 6el OBLONG 144 MHz
YU1QT 13el OBLONG 144MHz
YU1QT 5el OBLONG 50 MHz

Diagramme

Für alle Antennen aus Tabelle 1 haben wir komplette Diagrammsätze von YU1QT erhalten. Wir haben exemplarisch die 13 Element Oblong ausgewählt und zeigen die Resultate von YU1QT in den Abbildungen 3, 4, 5, 6 und 7.

Diskussion

Eine Nachsimulation der 13 Element Oblong-Antenne durch einen bekannten erfahrenen Antennen-Entwickler mit NEC4 ergibt die folgenden Daten:

Gewinn = 16.72 dBi (14.57dBD) Ta = 247.3 K G/T = -7.21dB

Es ist offensichtlich, dass die Simulationen / Berechnungen von YU1QT die internen Verluste des Materials nicht beinhalten. Folglich ist der Gewinn etwas niedriger als in seinen H- und V-Plots mit 1.8dBi angegeben. In seiner Tabelle 1 gibt YU1Q allerdings nur 16.7 dB an. Die Diagramme der Nachsimulation zeigen Abb. 7, 8 und 9.

Verglichen mit einem modernen Yagi-Design, wie z.B. der EF0214 von YU7EF, zeigt die 13 Element Oblong-Antenne recht bescheidene Leistungsdaten und es handelt sich mit Sicherheit nicht um ein revolutionäres neues Design. Der Gewinn ist genauso hoch wie der der YU7EF-Antenne, aber die Rauschtemperatur ist viel höher. Das Hauptproblem sind die nur sehr schlecht unterdrückten Nebenzipfel, besonders im vertikalen Diagramm, aber auch der 1. Nebenzipfel in der horizontalen Ebene ist nicht mehr als 15 dB unterdrückt. Diese Nebenzipfel sind der Grund für die ziemlich schlechte Rauschtemperatur von fast 250 K und das führt zu -7.21dB G/T.

Das F/B von 35 dB (oder sogar mehr) bringt kaum einen wahrnehmbaren Unterschiend zu den üblichen 25 dB, die mehr als ausreichend sind für jede Durchschnittssituation. So werden einige gute Eigenschaften (niedige Nebenzipfel) verschwendet für etwas, was nicht so wichtig ist. Einen ganz ählicher Fehler wie auch beim DK7ZB-Design. Solch eine großes F/B ist nur in einigen wenigen spezifischen Situationen nötig, aber nicht als generelles Designziel.

Der einzige Vorteil der 13 Element Oblong-Antenne ist sicher die geringere Aufnahme von statischen Störungen, weil es sich um ein Loop-Design handelt. Aber das ist etwas, was wir nicht berechnen oder messen können.

Um diese 13 Element-Oblong-Antenne in VE7BQH`s G/T-Liste vergleichen zu können, müssen wir die Daten für eine 4-fach im H gestocke Antenne betrachten. YU1QT empfiehlt für horizontale Stockung 3.4m und für vertikale 4.0m. Siehe Tabelle 2. Mit solch einer Stockung erhalten wir Strahlungsdiagramme, die in Abb. 10 und 11 gezeigt sind. Der Gewinn ist über 0.5 dB schlechter als bei optimaler Stockung.

Die einzelne Antenne hat 27.8° horizontalen Öffnungswinkel und 28.8° vertikalen. Nach DL6WU`s Stockungsformel ergeben sich damit 4.3m für horizontale und 4.1m für vertikale Stockung für 5.8dB Stockungsgewinn und erste Nebenzipfel um 11-12 dB abgesenkt. Die simulierten Diegramme hierfür sind in Abb. 12 und 13 wiedergegeben. Die Simulation für eine 4er-Gruppe gibt die folgenden Ergebnisse für die Stockungs-Werte von YU1QT bzw. DL6WU:

	Stockung @ 3.4 / 4.0	Stockung @ 4.3 / 4.1 (opimal)
Gewinn	21.92 dBi (19.77 dBd)	22.47dBi (20.32dBd)
Ta	244.0 K	244.3 K
G/T	-1.95 dB	-1.41dB

Wenn man in die VE7BQH-Liste schaut, sieht man, dass diese 13 Element Oblong-Antenne schlechter ist als viele sogar kürzere Antennen. Die einzige Ausnahme ist die SHARK 20, die sogar noch schlechter ist und Welten von einem modernen YU7EF-Design entfernt.

Schluß

Das Design der Oblong-Antenne ist korrekt und eventuell für einige wenige Amateure in spezifischen Situationen interessant. Wenn man sich aber die Menge des benötigten Materials und die Komplexität der Konstruktion vor Augen führt, werden einem Zweifel kommen, ob es Wert ist, diese Antenne zu bauen. Auch muss man die viel höhere Windlast beruchsichtigen. Diese Oblong-Antennen sind weniger als eine Durchschnittsantenne für EME und können als gute Tropo-Antennen eingestuft werden, mit denen man lokale Störungen und starke Signale ausblenden kann. YU1JB bietet komplette Antennen zum Verkauf an. Wir danken YU1QT für das zur Verfügung stellen der Daten und Ergebnisse seines Designs.

CW for Weak Signal Applications: CWP

by Klaus von der Heide, DJ5HG

1. Introduction

CW is an extremely simple traditional mode with human encoding and human decoding. For decades it was the most-suited mode for weak signals and bad propagation conditions. But today, with the aid of powerful computers, especially designed digital modes like JT65 are better by several dB. Many of us in the ham-radio community do not have more than a basic knowledge on the principles of digital communication. To get some more insight the author takes the classic CW as an example for a digital mode. It is the aim of this paper to fix the weaknesses of classic CW, and to show up ways to overcome these weaknesses at least partly. As a result, a computer-generated and computer-decoded CW called CWP is proposed. CWP primarily was designed for teaching purposes. Although it can well compete with JT65 it was not designed to defend CW against other digital methods. It will not be able to compete with future digital methods. But it retains the charme of CW to transmit variable-length uncoded text. And the human ear even cannot hear any difference to CW.

2. Classic CW: Advantages and Drawbacks

2.1. The Synchronization

2.1.1. Classic CW

Before making any decision a digital receiver must synchronize its symbol clock to the clock used at the transmitter. There are many ways to achieve that. JT65 uses an extra tone modulated with a fixed pseudo-random pattern for symbol and packet synchronization. That costs half the transmitted energy. Another simple method for binary digital modes is the Manchester Code that encodes the binary values 0 and 1 into the pairs (01) and (10) respectively. The receiver decodes the detected transitions from 0 to 1 as a 0 and the transition from 1 to 0 as a 1. The clock therefore is transmitted by the code. Since the number of binary values to be transmitted is twiced by the code this also results in a loss of (at least) 3 dB. There are five clocks in the CW mode which are illustrated in figure 1:

(1) The packet clock that determines the start and the end of a transmission
(2) The character clock that determines the start of the characters encoded by the Morse code
(3) The symbol clock that determines the start of the dashes and dots
(4) The nibble clock runs half the speed of the binary clock
(5) The binary clock as the basis for all other clocks determines the speed of the transmission

CW achieves synchronism by its code. It uses the basic binary symbols 0 and 1 at the level of the binary clock. Dash, dot, and character separator are coded by the following binary words:
dash => 1110 ; dot => 10 ; character separator => 00 . It can easily be proven that every sequence of these binary words can uniquely get decoded if at least one dot and one dash is present (but „TTTTTTTT" cannot be distiguished from the error indicator with 8 dots if there is no prior knowledge on the binary clock). Moreover, the binary clock and the symbol clock can be retrieved.

Since characters are separated by the character separator also the character clock immediately can be taken from the signal. It is this very simple restoration of the clocks that makes CW so robust. Even after severe fading, synchronism immediately reappears when dots and dashes can be copied again. The binary clock even may vary within a transmission. Indeed, a hand keying operator can express emotions this way or simply a personal note. As long as the personal note does not shorten the character separator or the dashes too much, CW remains well readable. The packet synchronization usually is done by an explicit change over command „K",„KN" or „BK" at the end of a transmission or it is implicity clear by a „?" followed by silence.

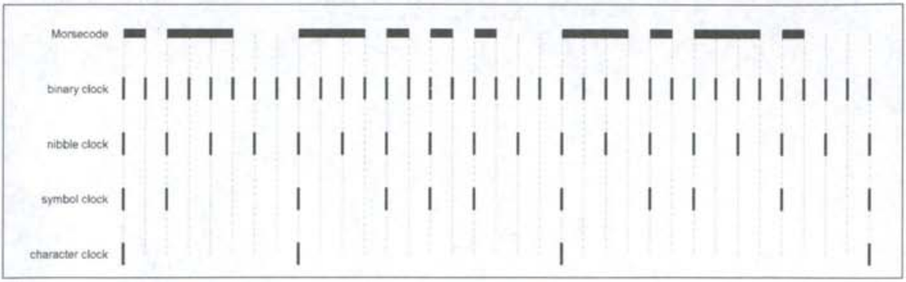


Figure 1. The binary clock in a CW-signal and its derivatives. The CWP-receiver restores the nibble clock as the master clock. The symbol clock is not used. The CWP-receiver directly decodes full characters just as a skilled human operator does.

2.1.2. Synchronization with Weak Signals

The greatest problem with weak signals is to copy an explicitly sent change over command. It is therefore good practise to use a predefined packet size aligned at a common clock that is available by other means than the radio path. In EME and MS periods of 1 minute or ½ minute, aligned at the minutes of UTC, are used. If a CQ is sent in even minutes the answer will come in odd minutes. These roles will not be changed until the end of the QSO. This rigid packet timing, of course, is a severe drawback compared to the dynamic packet length of normal CW, but it is a simple way to guarantee packet synchronization without any costs in energy.

All the other clocks are derived from the binary clock. So the synchronization of the binary clock is the basic task. The human ear-brain system synchronizes locally in time. One single character or at maximum three characters in sequence suffice to define the local phase of the binary clock. As a consequence, the synchronization is lost locally in fading conditions. This cannot be tolerated in weak signal applications. The way out is to use a very precise binary clock at transmitter and receiver. Then the synchronization can be made after the reception of the whole packet. The binary clock then is known throughout the packet, including periods of fading. The drawbacks of this method are (1) the decoding cannot be done on the fly and (2) the charme of the personal note of a hand-keyed transmission is lost. But the gain is that synchronization will not be the primary reason for loosing information.

2.2. Modulation

CW uses Amplitude Shift Keying (ASK). Its advantage is the simple realization by keying a carrierwave. But there are several drawbacks:

(1) The decision between „keyed" and „not keyed" at the receiving end demands for a threshold value that must dynamically be reconstructed from the received signal (approximately at half the detected amplitude extremely low-pass filtered). The problem especially occurs with the fading of multipath channels, i.e. EME. Figure 2 illustrates the situation. In contrast, both FSK and PSK, use the natural value „zero" for the optimal threshold, independently of fading.

(2) The unipolar keying between „not keyed" and „keyed" is 3 dB worse than bipolar keying between „keyed with phase 0°" and keyed with phase 180°" which is equivalent to BPSK. This is illustrated by figure 3. Indeed, the distance is doubled which is a gain of 6 dB, but all binary clock cycles are keyed instead of only half of them which costs -3 dB.

(3) The human ear is insensitive to the carrierphase. This results in a loss of 3 dB compared to a sophisticated system with coherent demodulation. The difference is caused by the fact that all signals and the noise can be separated into a cosine (real) part and a sine (imaginary) part. If the phase of the signal is controlled such that its sine part gets zero then the cosine part contains all the energy of the signal but only half of the noise energy. Of course, if earphones are connected to the cosine part the ear also can profit from this gain of 3 dB.
Since CW from principle is ASK, the 3 dB of (2) cannot be won. But a coherent detection could gain the 3 dB of (3). The problem of (1) in any case remains as a technical problem that may cause a slight loss depending on the fading conditions.

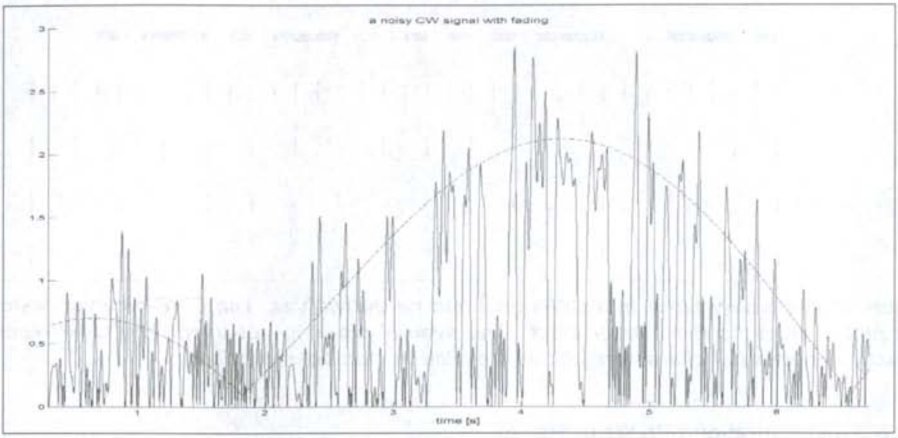


Figure 2. For an optimum decision the amplitude must be reconstructed from the received signal.

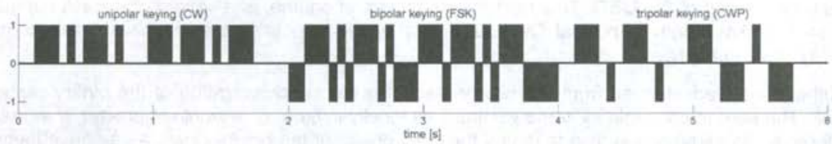


Figure 3. Unipolar, bipolar, and uni/bipolar keying. When modulated, a 0 results in an unkeyed carrier, a 1 is the keyed carrier, and a -1 is the keyed carrier with a different frequency (FSK) or a phase shift by 180° (BPSK). To be compatible with CW, CWP uses BPSK-uni/bipolar keying.

2.3. Bandwidth and Matched Filter

The spectrum of a switched carrier is infinitely wide and inacceptable. There are different ways to narrow the spectrum, i.e. to reduce the clicks. Usually lowpass filtering of the keyed baseband signal or bandpass filtering of the keyed HF-signal is used or a DDS directly generates a smooth keying instead of the squarewaves. Figure 4 shows the spectrum of such a smoothed CW signal. A digital mode would even smooth the square waves down to Gaussian pulses or similar forms which only need a bandwidth slightly larger than the binary clock frequency. But the human ear-brain system needs a larger bandwidth for optimum decoding. The author uses a bandwidth of four times the binary clock if the SNR is very low. At better SNR a larger bandwidth is much more comfortable.

One of the most important questions at the design of a communication system is: Which filter at the receiving end maximizes the SNR at the stage where the decision has to be made? This is not the place to discuss the theory. It's result is simple for the case of Gaussian white noise: Use a filter after the demodulator with an impulse response that equals the symbol pulse at the transmitting end, but mirrored in time. This is called a *matched filter*. The matched filter for hard-keyed CW therefore has an impulse respone equal to a single dot of the Morse code. It is the response of an *integrator* over one binary clock cycle. The optimum method to decode a demodulated CW-signal therefore is (1) to retrieve the binary clock, (2) to integrate the received signal within all binary clock cycles, and (3) to use these real values as an input to a soft-decoder. This optimal system does not use any filter in the HF part. The only filter is realized by the integrator. It's frequency response is shown as a dashed line in figure 4. In practise there is the anti-click filter at the transmitter. This modifies the matched filter slightly. So the optimum in practise is: Use a filter in the HF-path that is as wide as the anti-click filter at the transmitter (say 250 Hz). This is necessary to stop unwanted signals which do not occur in the theoretical model of Gaussian white noise. Then demodulate and use the sampled and mirrored pulseform as the coefficients of a digital filter.

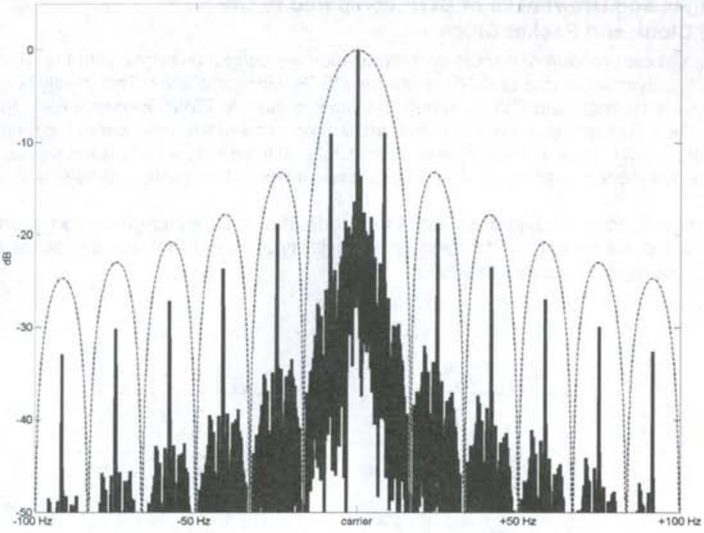


Figure 4. The spectrum of a CW-signal (at the same binary clock as CWP and filtered like CWP). The dashed line shows the frequency response of a matched filter for hard-keyed (unfiltered) CW at the same speed.

2.4. Coding by Repetition

The CW-transmission per se is uncoded in respect to forward error correction (FEC). There is no possibility to use efficient coding. The only way is the repetition of the most important parts. It can easily be shown, in fact, that with gaussian white noise and no fading there is no gain by repetition. Even worse, sending the same only once at lower speed and decoding it at lower bandwidth is the better way if the decoding is done by a human because humans cannot exactly add the repetitions. If all the repetitions are at an SNR such that nothing can be copied then there is no chance to average something. A computer could do that. On the other hand, there is a considerable gain even with human decoding in the case of fading if the length of the text to be repeated matches the length of the signal peaks.

3. CWP

3.1. The CWP-Signal

In order to minimize the problems of synchronization CWP uses (1) a fixed packet size of 1 minute and (2) a fixed binary clock of 16.6667 Hz. The only difference to CW is a phase switch of 180° at every key-down. This corresponds to a signal in the baseband with the three possible values 0, +1, -1 in contrast to the values 0 and 1 with classic CW as shown in figure 3. It should be noted that the phase modulation does not carry any information. Indeed, any given CW signal could automatically translated into a CWP-signal without knowledge about the Morse code. CWP allows texts of different length that are repeated as often as they fit into the packet of one minute. To ease the detection of the period only six different predefined period lengths are used. By mathematical reasons texts are sent 2, 3, 5, 7, 11 or 29 times. These numbers must not have any common divisor since otherwise the period may not be unique. If for example 2, 4, and 8 would be used then a transmission with 8 repetitions also would have the periods 4 and 2. The lengths of the periods are 464, 310, 186, 132, 84, 32 binary clock cycles, respectively. The total length of the transmission then is 2*464, 3*310, 5*186, ... that is between 924 and 930 binary clock cycles. The division of this number by the binary clock frequency is the whole length of the transmission: 55.44 ... 55.80 seconds. The CWP-transmitter automatically appends blanks to a message to reach the fitting period, but the operator should try to fill the period with meaningful text because it is difficult for the CWP receiver to reconstruct the carrier if there are large gaps without a signal.

3.2. Advantages and Drawbacks of CWP compared to CW

3.2.1. Binary Clock and Packet Clock

Because of the severe problem of packet synchronization we cannot dispense with the fixed packet length of one minute. It prevents the use of CWP in normal QSOs with good SNR. This surely is a drawback, but the same is done in normal EME-CW. Another drawback is that the CWP decoder needs the full period as its input. The decoding process takes considerable time. Therefore, one cannot directly answer to a received message, but only two minutes later. In principle, at least with a fairly good signal, CWP could be decoded on the fly ignoring later repetitions. In that case, it would be possible to have a real dialog as with normal EME-CW.
The binary clock is fixed to a medium-speed Morse code. It is a computer-generated dead signal without any personal note of the operator. Of course, the possibility of longer free text messages allow a little bit more personal messages compared to JT65.

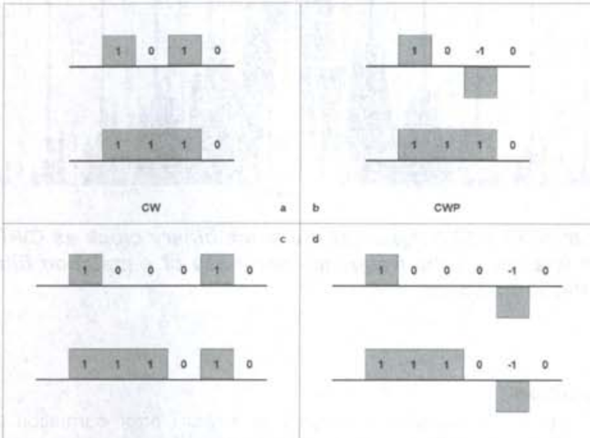


Figure 5. This figure demonstrates why CWP gains over CW. Two common situations are shown: (a) and (b) show the difference between two dots and a dash (type I<=>T) while (c) and (d) show the difference between two separated dots vs. a dash and a dot (type EE<=>N). The distance in each case is the squareroot taken from the sum of the squares of the differences of the values in all binary clock cycles. The relation of the smallest distances of CWP and CW is 6.99 dB.

3.2.2. Distance between Dot and Dash

CW suffers from the low distance between dots and dashes. A very weak dash also could be copied as two dots. On the binary level this corresponds to the difference between the binary words 1110 and 1010 (figure 5a). The Euklidian distance between these both words is the squareroot of the sum of squares of all bit-differences: sqrt((1-1)2+(0-1)2+(1-1)2+(0-0)2) = 1. In the case of CWP the distance is sqrt((1-1)2+(0-1)2+(-1-1)2+(0-0)2) = 2.24 (figure 5b). This corresponds to a gain of 7 dB at the same transmitted energy. As a consequence of this large distance a „T" very seldom is copied as an „I" or an „N" as a „S" and so on. So the most probable errors of CW are not probable in CWP.

3.2.3. Distance between Morse texts

It was shown above that errors of the type T<=>I and N<=>S are not probable. What are the most probable errors in CWP? These are two-bit errors. Two-bit errors in CW correspond to two-bit errors with the same distance in CWP. Figure 5c/d show an example with the distance sqrt((0-0)2+(0-1)2+(0-1)2+(0-0)2+(1-1)2+(0-0)2) = 1.414 for CW and for CWP. This error is not so frequent as the case discussed above by two reasons: (1) The distance 1.414 is considerably larger than the 1.0 of the first case. (2) The

error only can occur between two adjacent Morse-characters, and only when one of the Morse codes has a dot at the right place, and only when the resulting new Morse code is valid. For example, the Morse code -.-. --.- for „CQ" cannot be affected by this type of error because the resulting -.----.- is not a valid code. I.e. there must be a third bit error in this case to allow this type.
Also dot-interchanges beween Morse characters are two-bit errors. They are of the type TA<=>NT, NN<=>TR, RN<=>AR etc.. Also in this case „CQ" cannot be affected because in the resulting code -.- .--.- the second is not valid. It turns out here that the Morsecode indeed has some forward error correcting capabilities.

3.3. Some Results from Simulations

As shown above most errors should occur with adjacent characters. This is well confirmed by simulations. Figure 6 presents the statistics of the number of characters in error. In all these simulations the simple text „ ABCDEFGH" was sent. Including the blank, these are 9 characters. So, a received message may have 0 ... 9 errors. Since the Morse code is a variable-length code we could get much more than 9 „E"s and „T"s, and indeed this occurs. Therefore not the wrong characters are counted but 9 – the number of correct characters in correct sequence. Since the sequence cannot be judged for a single correct character this method cannot detect 8 faults. These cases are counted as full packet loss with 9 faulty characters.

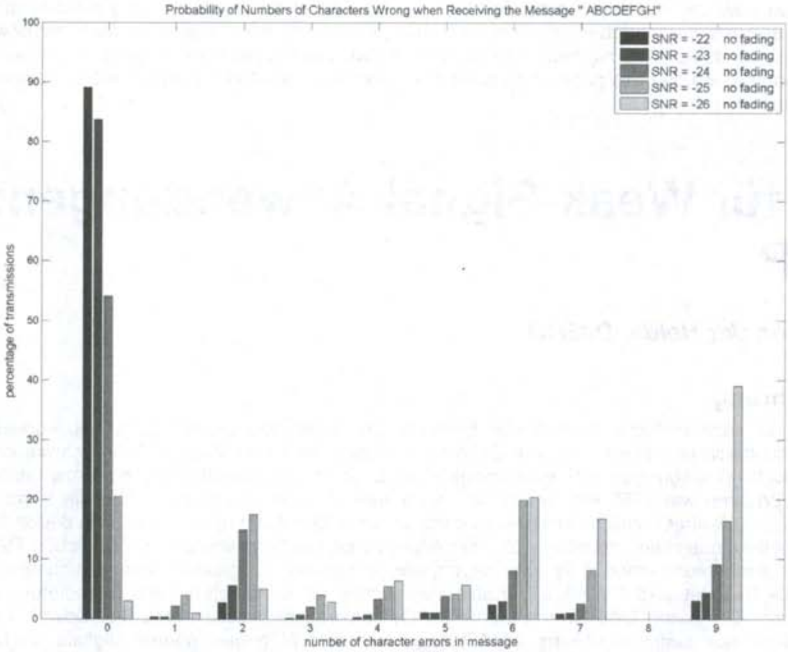


Figure 6. This figure shows the percentage of zero character errors up to all 9 characters in error for the testmessage „ ABCDEFGH" depending on the SNR. It confirms the very low probability of single character errors. The total packet loss (#errors=9) increases with the SNR decreasing from -22dB to -26dB, while the probability of entirely correct packets decreases from 89% to 3%. The SNR is the relation of received signal energy to received noise energy in a bandwidth of 2500 Hz. The graph is based on 7500 simulated transmissions per SNR value. Fading very slightly increases the number of correct messages.

4. Concluding Remarks

The author did not search for an optimized code for the phase shift keying. The idea was simply to increase the distance between the Morse code words without putting any message information into the phase. One probably could use the PSK to integrate an error correcting code that is hidden to the human ear. That probably would prevent such a mode from being entirely understood by all users. Especially, such a mode could be looked at as a digital mode using PSK to transport the message information and using the ASK of classic CW to hide this fact. The author's aim was to construct a simple mode as a bridge between good old CW and modern digital modes which exactly has the same sound as CW and which does not use any extra coding but only needs sophisticated, but understandable, signal processing and decoding at the receiving end.

The author does not write this without some fear. Only a decade ago the author believed that the natural ear-brain system cannot be substituted by a computer system. But now the CWP-decoder by far outperforms the human operator at the most important stage of the receiver: at the stage where the decisions are made. This will happen to all other subsystems that constitute a human. Of course, CWP is constructed by the human brain. That was fun to me, and hopefully will be fun for others.

It is harmless. But we must face the problem that a few humans can invent something that possibly is a danger for all others. And only a few will be able even to detect an attack.

CWP clearly is a digital mode. But it is CW also. Because bandwidth and sound is the same as with CW, CWP clearly should also use the CW-segments of our bands.

This paper will be followed by further ones: *The CWP-Receiver* and *The CWP-Decoder*. The first will describe the structure and the fully Software-Defined implementation while the latter will give a simple overview on how the computer really can find the best-fitting message out of a number of possible messages that is larger than the number of elementary particles in the universe (or the fourth power of the number of seconds from the big bang until today). - It was a wishful thinking to get a simple beta-version of CWP ready at the day this paper is published. Availability of the CWP-program will be announced via Moon-net etc.

CW für Weak-Signal-Anwendungen: CWP

Klaus von der Heide, DJ5HG

1. Einführung

CW ist eine sehr einfache traditionelle Methode der Informationsübertragung mit Kodierung und Dekodierung durch den Menschen. Für Dekaden war dies der beste Weg im Falle schwacher Signale oder schlechter Bedingungen. Heute allerdings ist durch Rechner-Unterstützung mit speziell entwickelten digitalen Verfahren wie JT65 ein Gewinn von mehreren dB über CW möglich. Digitale Verfahren sind verglichen mit CW aber deutlich schwerer zu durchschauen. Der Autor nimmt deshalb in dieser Arbeit CW als Beispiel für ein digitales Verfahren. Ziel der Arbeit ist es, die Schwächen der klassischen Telegraphie deutlich zu machen und einen Weg aufzuzeigen, wie die Mängel wenigstens teilweise umgangen werden können. Als Resultat wird CWP als Verfahren vorgestellt mit Generierung und Dekodierung der CW-Signale durch Computer. CWP wurde primär für Demonstrationszwecke entworfen. Obwohl es gut mit JT65 konkurrieren kann, wurde es nicht entworfen, um CW gegen andere digitale Verfahren zu verteidigen. Mit zukünftigen digitalen Verfahren wird es nicht mithalten können. Aber es bewahrt den Charme von CW, unkodierten freien Text unterschiedlicher Länge übertragen zu können. And das menschliche Ohr kann keinen Unterschied zu CW hören.

2. CW: Vor- und Nachteile

2.1. Die Synchronisation

2.1.1. Klassische CW

Bevor eine Datenentscheidung in einem digitalen Empfänger gemacht werden kann, muss zunächst der Symbol-Takt mit dem des Senders synchronisiert werden. Es gibt mehrere Methoden dafür. JT65 benutzt

einen Extra-Ton (moduliert mit einem festen Pseudo-Zufallsmuster) für die Ermittlung des Symbol-Taktes und für die Paket-Synchronisation. Dies kostet die Hälfte der gesendeten Energie. Ein weiteres einfaches Beispiel für binäre digitale Methoden ist der Manchester-Kode, der die binären Werte 0 und 1 in die Paare (01) and (10) übersetzt. Der Empfänger dekodiert die detektierten Übergänge von 0 nach 1 als 0 und die Übergänge von 1 nach 0 als 1. Der Symboltakt wird also mit dem Kode übertragen. Da die Zahl der zu übertragenden Binärstellen verdoppelt wird, gibt es auch hier einen Verlust von (wenigstens) 3 dB.
Bei CW gibt es fünf verschiedene Takte, die in Bild 1 erläutert werden:

(1) Der Pakettakt bestimmt Anfang und Ende einer Sendung
(2) Der Zeichentakt legt den Beginn eines Morsezeichens fest
(3) Der Symboltakt bestimmt den Beginn der Symbole Strich, Punkt, Zeichenseparator
(4) Der Nibbletakt gibt jeden zweiten Binär-Takt
(5) Der Binärtakt ist die Basis aller vorgenannten Takte

CW erreicht die Synchronisation direkt durch den Morsekode. Auf der Ebene des Binärtaktes werden nur die beiden Binärzeichen 0 und 1 gesendet. Strich, Punkt und Zeichenseparator sind durch folgende Binärwörter kodiert: Strich => 1110; Punkt => 10; Zeichenseparator => 00. Es ist leicht zu erkennen, dass jede Sequenz dieser Binärwörter eindeutig dekodiert werden kann, wenn wenigstens ein Punkt und ein Strich empfangen wird (allerdings ist „TTTTTTTT" nicht von der Irrung mit 8 Punkten zu unterscheiden, wenn kein weiteres Wissen über den Binärtakt vorliegt). Auch Nibbletakt und der Symboltakt können aus der Sequenz der Binärwörter ermittelt werden. Da Morsezeichen durch den Zeichenseparator voneinander getrennt sind, kann auch der Zeichentakt direkt dem Signal entnommen werden. Das ist der Grund für die robuste Erkennung der der Telegraphie innewohnenden Takte, die CW so robust machen. Selbst nach tiefem Fading wird die Synchronisation sofort wieder erreicht, wenn Punkte und Striche zu lesen sind. Der Binärtakt darf während der Übertragung sogar schwanken. Deshalb kann man mit der Handtaste auch Emotionen ausdrücken, oder man hat eben nur seine persönliche Handschrift. Solange dies nicht den Zeichenseparator oder die Striche zu sehr kürzt, bleibt CW dennoch gut lesbar. Der Pakettakt wird üblicherweise durch ein explizites ChangeOver-Kommando am Ende der Sendung als „K", „KN" oder BK" gegeben oder er ergibt sich im schnellen Dialog direkt, etwa durch ein „?", dem offenbar nichts mehr folgt.

2.1.2. Synchronisation im Weak-Signal-Fall

Das größte Problem im Falle schwacher Signale ist der vertrauenswürdige Empfang des ChangeOver-Kommandos. Deshalb hat sich als gute Praxis die Benutzung eines festen Pakettaktes eingebürgert, der auf anderem als dem Funkwege übertragen wird. Bei EME und MS werden Perioden von 1 Minute oder ½ Minute verwendet ausgerichtet an den Minuten der UTC. Wenn man CQ in einer geraden Minute ruft, wird die Antwort in der ungeraden Minuten erwartet. Diese Rollen werden dann bis zum Ende des QSOs beibehalten. Natürlich ist dieser feste Pakettakt ein erheblicher Nachteil gegenüber der dynamischen Paketlänge normaler CW. Es ist aber ein einfacher (und unverzichtbarer) Weg, die Paketsynchronisation ohne Energieverlust zu erreichen. Alle anderen Takte basieren auf dem Binärtakt. Deshalb ist die Ermittlung des Binärtakts (bzw. des mit halber Geschwindigkeit arbeitenden Nibbletaktes) die wichtigste Aktion. Das menschliche Hirn-Ohr-System synchronisiert lokal in der Zeit. Schon ein einziges Morsezeichen oder höchstens drei in Folge genügen, um den Takt festzulegen. Andererseits geht der Takt infolge des zeitlich lokalen Empfindens bei Fading verloren. Das ist bei schwachen Signalen nicht akzeptabel. Deshalb sollte man in diesem Fall auf beiden Seiten einen sehr präzisen Takt verwenden. Dann kann die Synchronisation nach dem Empfang des ganzen Paketes durchgeführt werden. Dadurch ist dann der Binärtakt über das ganze Paket, also auch über Fading hinweg, bekannt. Nachteile dieser Methode sind (1) das Dekodieren kann nicht zeitgleich mit dem Empfang erfolgen und (2) der Charme der persönlichen Note ist natürlich verloren. Der (sehr hohe) Gewinn ist, dass die Synchronisation nicht der Hauptgrund für Informationsverlust ist.

2.2. Modulation

CW benutzt Amplitude Shift Keying (ASK). Der Vorteil ist die einfache Realisierung durch Tasten der Trägerwelle. Es gibt aber mehrere Nachteile:
(1) Die optimale Entscheidung zwischen „getastet" und „nicht getastet" erfordert eine Schwelle, die dynamisch aus dem empfangenen Signal rekonstruiert werden muss (etwa die Hälfte der Amplitude des Signals stark Tiefpass-gefiltert). Das Problem hat man besonders beim Fading von Mehrwege-Kanälen wie EME. Bild 2 illustriert die Situation. FSK und PSK dagegen benutzen den natürlichen Wert „Null" unabhängig von Fading als optimale Schwelle.
(2) Das unipolare Tasten zwischen „nicht getastet" und „getastet" ist 3 dB schlechter als bipolares Tasten

zwischen „getastet mit Phase 0°" und „getastet mit Phase 180°" was äquivalent ist zu BPSK. Dies wird erläutert in Bild 3. Die Distanz wird tatsächlich verdoppelt, was einen Gewinn von 6 dB bringt, aber nun wird in jedem Binärtakt gesendet anstatt nur durchschnittlich in jedem zweiten, was -3 dB kostet.
(3) Das menschliche Ohr ist unempfindlich bezüglich der Phasen. Dadurch ist ein Mensch als CWDekodierer 3 dB schlechter als ein künstliches System mit kohärenter Demodulation. Der Unterschied erklärt sich dadurch, dass sich alle Signale inklusive Rauschen in einen Kosinus-(Realteil) und einen Sinus-Anteil (Imaginärteil) zerlegen lassen. Wenn nun der Empfänger die Phase des Signals so regelt, dass der Sinus-Anteil praktisch verschwindet, dann enthält der Kosinus-Anteil alle Signalenergie, aber nur die Hälfte der Rauschenergie. Natürlich kann auch ein menschlicher Dekodierer von diesen 3 dB profitieren, wenn man das so erzeugte Signal auf den Kopfhörer bringt. Da CW prinzipiell ASK ist, können die 3 dB nach (2) nicht gewonnen werden. Aber, wie eben gezeigt, kann eine kohärente Demodulation die 3 dB nach (3) gewinnen. Das unter (1) genannte Problem bleibt aber immer als technische Schwierigkeit bestehen und wird bei Fading einen Verlust verursachen.

2.3. Bandbreite und angepasstes Filter

Das Spektrum eines getasteten Träger ist unendlich breit und deshalb nicht akzeptabel. Es gibt verschiedene Wege, das Spektrum einzuengen, also die Tastclicks zu mildern. Üblicherweise schickt man das Tastsignal im Basisband durch ein Tiefpassfilter oder das getastete HF-Signal durch ein Bandpassfilter, oder man generiert von vornherein durch DDS ein geglättetes Signal. Bild 4 zeigt das Spektrum eines gefilterten CW-Signals. Digitale Verfahren gehen mit der Glättung meistens so weit, dass nur noch Gauss-Impulse übrig bleiben oder ähnliche Formen, deren Bandbreitebedarf kaum größer als die Frequenz des Binärtaktes ist. Das menschliche Ohr-Hirn-System möchte für das Lesen von Telegraphie allerdings eine größere Bandbreite haben. Der Autor benutzt bei schwachen CW-Signalen eine Bandbreite, die viermal so groß ist wie die Binärtaktfrequenz. Bei besserem SNR ist eine noch größere Bandbreite angenehmer.
Eine der wichtigsten Fragen beim Entwurf eines Kommunikationssystems ist: Welches Filter macht auf der Empfängerseite das SNR direkt vor der die Datenentscheidung vornehmenden Stufe optimal? Hier ist nicht der Ort, die Theorie zu diskutieren. Das Ergebnis ist im Falle von Gauss'schem Rauschen einfach: Benutze nach dem Demodulator ein Filter, dessen Impulsantwort der Form des gesendeten Impulses entspricht, nur in der Zeit gespiegelt. Ein solches Filter wird *angepasstes Filter* oder *matched filter* genannt. Das angepasste Filter für hart getastetes CW hat als Impulsantwort ein Rechteck, welches genau einem getasteten Punkt des Morsekodes entspricht. Ein solches Filter ist ein Integrator über die Länge eines Binärtaktes. Die optimale Methode zur Dekodierung von CW ist deshalb (1) die Rekonstruktion des Binärtaktes, (2) die Integration des Empfangssignals über alle Intervalle des Binärtaktes und (3) die Benutzung der erhaltenen Integralwerte als Input für einen Soft-Dekodierer. Dieses (theoretisch) optimale System benötigt kein Filter im HF-Teil. Das einzige Filter ist der Integrator. Dessen Dämpfungsverhalten im Frequenzbereich ist in Bild 4 gezeigt. In der Praxis sind zwei kleine Änderungen erforderlich: (1) ist das Integrationsfilter an die geglättete Impulsform anzupassen und (2) im HF-Pfad ist ein Bandpassfilter einzufügen, dass einerseits praktisch das gesamte CW-Signal noch durchlässt, andererseits aber auch möglichst alle nicht-Gaussischen Störungen vom Demodulator fernhält.

2.4. Kodierung durch Wiederholung

Telegraphie-Sendungen an sich benutzen keinen Kode für Vorwärts-Fehlerkorrektur (FEC). Ohne Aufgabe des frei lesbaren Textes gibt es keine effiziente Kodierungsmöglichkeit. Der einzige Weg ist die Wiederholung der wichtigsten Teile der Sendung. Man kann aber leicht zeigen, dass man bei reinem Gauss-Rauschen und Abwesenheit von Fading mit Wiederholung nichts gewinnen kann. Im Gegenteil: Sendet man dasselbe einmal sehr langsam anstatt mehrfach schnell, dann ist ersteres besser, wenn die Dekodierung durch einen Menschen erfolgt, weil ein Mensch die Wiederholungen nicht präzise addieren kann. Wenn nämlich alle Wiederholungen so verrauscht sind, dass nichts gelesen werden kann, dann ist da auch nichts zu addieren. Ein Rechner allerdings kann das. Auf der anderen Seite gibt es durch Wiederholungen einen deutlichen Gewinn bei Fading, wenn die wiederholte Textlänge zur Länge der Amplitudenspitzen des Signals passt.

3. CWP

3.1. Das CWP-Signal

Zur Minimierung der Synchronisationsprobleme benutzt CWP (1) eine feste Paketlänge von 1 Minute und (2) einen festen Binärtakt von 16.6667 Hz. Der einzige Unterschied zu CW ist ein Phasensprung von 180°

bei jedem erneuten Tastendruck. Das entspricht einem Basisbandsignal mit drei möglichen Werten 0, +1, -1 im Gegensatz zu den zwei Werten 0 und 1 bei CW (Bild 3). Die Phasenmodulation trägt dabei keine Information. Jedes gegebene CW-Signal könnte ohne Kenntnis des Morsekodes automatisch in ein CWP-Signal übersetzt werden. CWP erlaubt Texte unterschiedlicher Länge. Sie werden jeweils so oft wiederholt, wie sie in die feste Paketlänge von 1 Minute passen. Um die Ermittlung der Textlänge beim Empfänger zu vereinfachen, gibt es aber nur sechs vorgegebene Textlängen. Aus mathematischen Gründen werden diese 2, 3, 5, 7, 11 oder 29 mal gesendet. Diese Zahlen sollten keinen gemeinsamen Teiler haben, weil die Periode sonst nicht eindeutig wird. Wenn zum Beispiel 2, 4, und 8 benutzt würden, dann hätte eine 8 mal wiederholte Sendung auch die Perioden 4 und 2. Die Längen der Perioden sind 464, 310, 186, 132, 84, 32 binäre Takte. Die Gesamtlänge der Aussendung ist dann 2*464, 3*310, 5*186, ... Das liegt zwischen 924 und 930 Binärtakten. Teilt man diese Zahlen durch die Taktfrequenz, so ergibt sich die zeitliche Länge zu 55.44 ... 55.80 Sekunden. Der CWPSender ergänzt automatisch fehlende Blanks zur Erreichung der nächst-passenden Textlänge. Der Operator sollte aber versuchen, die Periode mit sinnvollem Text zu füllen, weil der CWPEmpfänger den Träger nicht über längere Tastpausen hinweg rekonstruieren kann.

3.2. Vor- und Nachteile von CWP gegenüber CW

3.2.1. Binärtakt und Pakettakt

Wegen des gravierenden Problems der Paketsynchronisation ist die feste Paketlänge (hier von 1 Minute) unverzichtbar. Es verhindert allerdings die Benutzung von CWP bei normalen QSOs mit gutem SNR. Das ist sicher ein Nachteil, den man aber bei üblichen EME-QSOs in CW auch hinnimmt. Ein weiterer Nachteil ist, dass der CWP-Dekodierer den gesamten Durchgang als Input benötigt. Darüberhinaus dauert der Dekodiervorgang selbst erhebliche Zeit. Deshalb kann man auf eine empfangene Nachricht nicht unmittelbar reagieren sondern erst zwei Minuten später. Im Prinzip könnte man CWP, zumindest bei gutem Signal, auch simultan dekodieren unter Ignorierung der folgenden Wiederholungen. Dann wäre immerhin ein natürlicher Dialog wie bei EME-CW möglich.
Der Binärtakt ist festgelegt auf einen Morsekode mittlerer Geschwindigkeit. Ein Rechnergeneriertes Morsesignal ist natürlich ohne die persönliche Note des Operators ziemlich tot. Immerhin erlauben die größeren Längen von freien Texten schon etwas mehr an persönlicher Kommunikation als JT65.

3.2.2. Distanz zwischen Strich und Punkt

Der geringe Unterschied zwischen Strich und Punkt ist eine Schwäche von CW. Ein sehr schwacher Strich kann nämlich leicht als zwei Punkte verstanden werden und umgekehrt. Auf der binären Ebene wird dieser Unterschied wiedergegeben durch den Abstand der binären Wörter 1110 und 1010 (Bild 5a). Die Euklidische Distanz zwischen diesen Wörtern ist die Wurzel aus der Summe der Quadrate der Differenzen der einzelnen Binärstellen: $\mathrm{sqrt}((1-1)^2+(0-1)^2+(1-1)^2+(0-0)^2) = 1$. Im Falle von CWP ergibt sich die Distanz $\mathrm{sqrt}((1-1)^2+(0-1)^2+(-1-1)^2+(0-0)^2) = 2.24$ (Bild 5b). Der Unterschied zwischen CW und CWP entspricht einem Gewinn von 7 dB bei derselben gesendeten Energie. Aus diesem Grund wird ein „T“ sehr selten als ein „I“ gelesen oder ein „N“ als „S“ usw.. Die meist-wahrscheinlichen Lesefehler von CW sind also bei CWP ziemlich unwahrscheinlich.

3.2.3. Distanz zwischen Morse-Texten

Oben wurde gezeigt, dass Fehler der Typen T<=>I und N<=>S nicht wahrscheinlich sind. Welches sind dann die meist-wahrscheinlichen Fehler bei CWP? Das sind auf der Bit-Ebene Zweibitfehler. Solche Zweibitfehler entsprechen bei CW denselben Zweibitfehlern mit derselben Distanz. Bild 5c/d zeigt ein Beispiel mit der Distanz $\mathrm{sqrt}((0-0)^2+(0-1)^2+(0-1)^2+(0-0)^2+(1-1)^2+(0-0)^2) = 1.414$ für CW und für CWP. Dieser Fehler ist aber nicht so häufig wie der oben diskutierte Fall aus zwei Gründen: (1) Die Distanz 1.414 ist deutlich größer als die 1.0 des obigen Falles. (2) Dieser Fehler kann nur zwischen zwei benachbarten Morsezeichen auftreten, und auch nur dann wenn eines der Morsezeichen einen Punkt am rechten Platz hat, und auch nur dann wenn das verfälschte Muster einen gültigen Morsekode ergibt. Zum Bespiel kann der Morsekode -.-. --.- für „CQ“ nicht durch diesen Fehlertyp verfälscht werden, weil das Resultat -.----.- keinen gültigen Morsekode ergibt. Punkt-Springer zwischen Morsezeichen sind ebenfalls Zweibitfehler. Sie sind vom Typ TA<=>NT, NN<=>TR, RN<=>AR etc.. Auch dies kann bei „CQ“ nicht passieren, weil im resultierende Kode -.- .--.- das zweite Zeichen ungültig ist. Offenbar hat der Morsekode doch einige Möglichkeiten der Vorwärtsfehlerkorrektur.

3.3. Simulationsergebnisse

Wie oben gezeigt sollten die meisten Fehler zwischen zwei benachbarten Morsezeichen auftreten. Das wird durch Simulationen bestätigt. Bild 6 zeigt eine Statistik der Häufigkeit der Anzahl von Zeichenfehlern.

Bei allen Simulationen wurde der einfache Text „ ABCDEFGH" übertragen. Inklusive Blank sind das 9 Zeichen. Eine empfangene Nachricht kann deshalb 0 bis 9 Fehler haben. Da aber der Morsekode ein Kode mit variabler Länge ist, kann man auch viel mehr als 9 „E"s und „T"s lesen, was tatsächlich vorkommt. Deshalb wurden hier nicht die falschen Zeichen gezählt sondern 9 minus die Anzahl der korrekten Zeichen in korrekter Sequenz. Da die Sequenz bei einem einzigen Zeichen nicht beurteilt werden kann, sind hier alle Fälle mit 8 Fehlern als vollständig falsche Pakete mit 9 Fehlern gezählt.

4. Abschließende Bemerkungen

Der Autor hat bewusst nicht nach einem optimierten Kode für die Phasenumtastung gesucht. Die Idee zu CWP war einfach nur die Vergrößerung der Distanz ohne weitere Information in der Phasentastung unterzubringen. Vermutlich könnte man die PSK nutzen um einen fehlerkorrigierenden Kode unterzubringen, der dem menschlichen Ohr verborgen bleibt. Darunter würde aber das Verständnis bei den meisten Nutzern leiden. Insbesondere könnte solch ein Verfahren angesehen werden als eine digitale Technik, die PSK benutzt um Information zu übertragen und die hörbare Telegraphie benutzt um eben dies zu verbergen. Der Autor wollte nur eine einfache Brücke bauen zwischen der guten alten Telegraphie und modernen digitalen Verfahren. Als Resultat hat CWP denselben Sound wie CW, und seine Dekodierung ist grundsätzlich verständlich, auch wenn dies einige Kenntnisse der Signalverarbeitung erfordert. Nur zehn Jahre zurück glaubte der Autor noch, das menschliche Ohr-Hirn-System sei so optimiert, dass es kaum durch ein technisches System ersetzt werden könne. Nun aber übertrifft der CWPDekodierer den Menschen gerade an der wichtigsten Stelle bei weitem, nämlich dort, wo die Entscheidungen getroffen werden. Das wird mit allen anderen Sinnen des Menschen ebenso passieren. Klar, CWP wurde mit dem menschlichen Hirn konstruiert. Das hat mir Freude gemacht, und wird es hoffentlich auch bei anderen tun. Das ist harmlos. Ein Problem ist aber, dass in Zukunft wenige Menschen auch gefährliche Dinge machen können, und es gibt dann nur wenige, die soetwas aufdecken können. CWP ist zweifellos ein digitales Verfahren. Es ist zugleich CW. Bandbreite und Sound sind genau wie bei CW. Deshalb sollte CWP dieselben Bandsegmente benutzen wie CW.

Dieser Schrift werden zwei weitere folgen: *Der CWP-Empfänger* und *Der CWP-Dekodierer*. Erstere wird die Struktur des vollständig als Rechenprogramm realisierten Empfängers beschreiben. Letztere wird einen einfachen Überblick darüber geben, wie ein Rechner wirklich die am besten passende Nachricht aus einer Anzahl möglicher Nachrichten findet, die größer ist als die Anzahl der Elementarteilchen im Universum (oder die vierte Potenz der Anzahl der Sekunden vom Urknall bis heute).

- Es war geplant, eine einfache Beta-Version von CWP fertigzustellen bis zum Tag dieser Publikation. Über die Verfügbarkeit wird via Moon-net etc. berichtet werden.

Bildunterschriften:

***Bild 1:** Der Binärtakt in einem CW-Signal und die davon abgeleiteten Takte. Der CWP-Empfänger rekonstruiert den Nibbletakt als Basistakt. Der Symboltakt wird nicht gebraucht, denn es werden gleich ganze Morsezeichen durch Korrelation dekodiert.*

***Bild 2:** Für eine optimale Entscheidung muss die Amplitude des Signals rekonstruiert werden.*

***Bild 3:** Unipolare, bipolare, und uni/bipolare Tastung. Bei der Modulation wird eine 0 nicht getastet, eine 1 wird wie bei CW normal getastet, eine -1 wird dagegen mit einer anderen Frequenz (FSK) oder einer Phase von 180° getastet (BPSK). Um mit CW kompatibel zu bleiben benutzt CWP BPSK mit uni/bipolarer Tastung.*

***Bild 4:** Das Spektrum eines CW-Signals (beim selben Binärtakt wie CWP und auch so gefiltert). Die strichlierte Linie zeigt das Durchlassverhalten eines angepassten Filters für harte Tastung bei derselben Geschwindigkeit.*

***Bild 5:** Dieses Bild demonstriert warum CWP einen Gewinn gegenüber CW bringt. Zwei häufige Situationen sind dargestellt: (a) und (b) zeigen die Differenz zwischen zwei Punkten und einem Strich (Typ I<=>T) während (c) und (d) die Differenz zwischen zwei benachbarten Punkten benachbarter Morsezeichen zeigt vs. Strich-Punkt eines Zeichens (Typ EE<=>N). Die Distanz ist in jedem Falle die Wurzel aus der Summe der Quadrate der Differenzen in allen Binärstellen. Es ergibt sich hier ein Gewinn von 6.99 dB gegenüber CW.*

***Bild 6:** Dieses Bild zeigt die Häufigkeit der Fehler bei CWP für die Übertragung des Textes „ ABCDEFGH" in Abhängigkeit von der Anzahl der falschen Zeichen und in Abhängigkeit vom SNR. Das Bild bestätigt die sehr geringe Häufigkeit von einzelnen Fehlern. Der totale Verlust von Paketen (alle 9 Zeichen falsch) nimmt mit sinkendem SNR von -22 dB bis -26 dB zu während die Wahrscheinlichkeit vollständig korrekter Pakete dabei von 89% nach 3% rasch abnimmt. Das SNR ist das Verhältnis zwischen empfangener Signalenergie zur Rauschenergie bei einer Bandbreite von 2500 Hz. Das Bild basiert auf 7500 simulierten Paket-Übertragungen pro SNRWert. Fading verbessert sehr geringfügig die Anzahl vollständig korrekter Pakete.*

Deep Search Cannot Communicate Callsigns

by Klaus von der Heide, DJ5HG

There has been some discussion on the validity of QSOs which use the deep search decoder of JT65 [1,2,3,4]. The goal of this paper is to explain the basic principle of deep search more intuitively, but without loss of correctness.

1. Discussion of a Specific Situation

We first analyse the situation shown in figure 1: My neighbour's LCD-TV radiates into my EMEarray. The noise seems to be white but it has a slight signature depending on the program he looks at. The noise is fed to the left channel of my sound card. A second receiver for 144 MHz directly takes the noise from my own TV and feeds it to the right channel of the sound card. My computer correlates both channels, i.e. it computes a measure of the similarity of both audio channels. This value is displayed at the correlator, one at a time. If I now scan all the TV programs, I get a corresponding set of similarity values. One of these values will be significantly greater than all others. Therefore I am very confident having found the program my neighbour looks at.

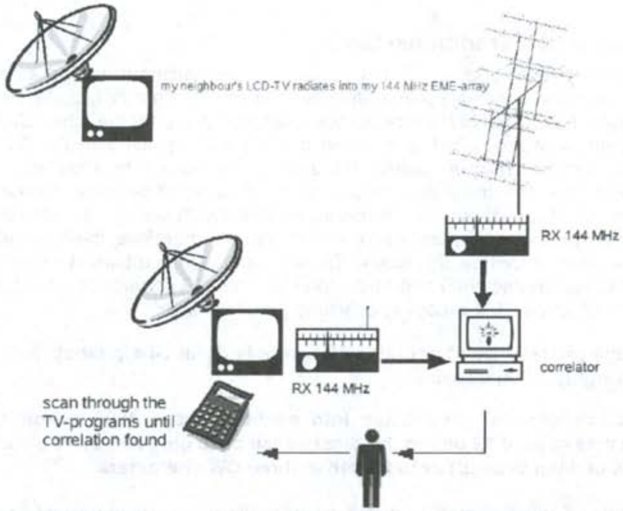


Figure 1. My neighbour's LCD-TV radiates into my EME-array. The noise seems to be white but it has a slight signature depending on the program he looks at. The noise is fed to the left channel of my sound card. A second receiver for 144 MHz directly takes the noise from my own TV and feeds it to the right channel of the sound card. If I now scan all the TV programs, the correlator will measure the similarity of both signals, one at a time. After the scan I choose the TV program that produced the maximum value of similarity. The information flow is indicated by arrows. Please note that information from my EME antenna to my TV screen only flows via my brain and my infrared remote control.

Now I switch to the program my neighbour probably looks at. This corresponds to the action of displaying the result of the decoder. Where does the information that is displayed on my TV screen come from?

Which way does it go? It clearly comes via my TV dish. But, what comes via my EME antenna? Indeed, what I see on the TV screen fully depends on the signal received on 144 MHz! Obviously there are two different informations: (1) the information coming from the satellite dish which leads to the actual scene on the TV screen, and (2) the information which program to choose. Note that the latter information flows via the infrared remote control. There is no other way from my EME antenna to my TV screen. The amount of information that must be received via the 144 MHz channel to get the right TV channel depends on the number of channels to check. Mathematically it is the base-2-logarithm of the number of channels, i.e. 2, 3, 4, 5, 6, 7, 8 bits for 4, 8, 16, 32, 64, 128, 256 channels, respectively. So, in the case of 64 different TV programs to check we must receive 6 bits of information to make a confident choice between all these programs. This information has nothing in common with the actual scene on the TV screen.

2. The Case of Deep Search in JT65

To get the case of the deep search decoder, we have to replace four details of figure 1: (1) my satellite dish by the call3.txt database, (2) my TV and associated 144 MHz receiver by the signal generation of JT65 and my computer screen, (3) me and my remote control by the JT65 program loop that automatically scans the possible messages generated from the database, and (4) the satellite dish and TV of my neighbour by the station calling me on 144 MHz using JT65. The general information flow remains the same. As a consequence, what I see as the decoded result on my computer screen comes from the data base, i.e. the callsigns are not received via the radio path. But the decoded result was selected out of a number of possible messages. Since this number is proportional to the length of the call3.txt database, the number of effective lines in this list is a measure of the difficulty of a QSO. As a consequence, deep search does not comply with the classic QSO rules which demand for the reception of the callsigns via the radio path.

3. A Comparison with a Traditional Mode

CW or SSB with the alphabet „Alpha", „Bravo", ... are not very different. In that case the receiver does know all Morse characters and the spelled alphabet „Alpha", ... (that is his „data base"). Receiving a message, the operator has to select the most similar character one after the other. So, the characters and decimal digits are not received. What is received is the actual choice like: the first is most similar to „Delta", the second is most similar to „Juliet", the third is most similar to „Five" etc. The only difference beween deep search and the traditional modes is the number of possible choices for the complete message which, as we stated above, is a measure of difficulty. If we use 43 different characters in the Morse code we have 43 choices for each received character. Therefore, there are 43*43 and 43*43*43 different messages of two resp. tree characters. Table 1 shows the numbers of different messages for the binary case (only the two characters 0 and 1), for the CW case (43 characters), and for the JT65 case (64 characters called symbols here). It is easy to conclude from this table:

(1) A JT65 message (marked bold) contains 12 symbols of an 64-alphabet. This corresponds to a CW message of roughly 13 characters.

(2) The deep search decoder only takes into account about 4096 possible messages. This corresponds to a message of 12 bits in the binary case or to only two symbols of the original JT65 message (only 1/6 of what is sent!) or to less than three CW characters.

An additional feature of deep search is that it by principle cannot communicate more information by repeated transmissions. Once the program is found in the TV case of figure 1, a repetition of the search only can increase the confidence. The same is true for the JT65 deep search. Since a radio amateur cannot arbitrarily change his callsign there is only one legal message to contact a station. A repetition may increase the confidence into the decoded message, but no additional information is received.

Since a QSO with identification of the calls based on deep search usually are pursued by dual-tone short cuts, the total amout of information received at either station is less than 16 bits which is less than necessary to receive a single callsign. On the other hand, the decoding thresholds of JT65 are set such that the mutual identification based on the call3.txt list is more confident than the identification of a callsign in CW at marginal conditions. But getting „HG" (the two characters only indicate an equivalent to 12 bits) at a confidence of 99.99% is not as good as getting „DJ5HG" at a confidence of only 99%.

message length	binary case	CW	JT65
1	2	43	64
2	4	1849	**4096**
3	8	79507	262144
4	16	3418801	16777216
5	32	147008443	1073741824
6	64	6321363049	68719476736
7	128	271818611107	4398046511104
8	256	11688200277601	281474976710656
9	512	502592611936843	18014398509481984
10	1024	21611482313284249	1152921504606846976
11	2048	929293739471222707	73786976294838206464
12	4096	39959630797262576401	**4722366482869645213696**
13	8192	1718264124282290785243	302231454903657293676544

Table 1. Number of possible messages for the binary case (2 different symbols), the CW case (43 different symbols), and the case of JT65 (64 different symbols). JT65 uses a fixed message of 12 symbols (marked bold in the table). It's number of choices is approximately three times that of a CW message of 13 symbols. The number of possible messages decoded by the deep search decoder is about 4096 which corresponds to a message of two symbols of JT65. A CW message of three symbols already has 79507 possible outcomes, and it, therefore, transports much more information than deep search.

4. A proposal for the Validity-Rules of a QSO

In most sportive disciplines there are clear definitions of the difficulty of actions for example the time to sprint over a distance of 100 m. In ham radio the difficulty of a communication heavily depends on the actual channel and on the amount of information to be communicated via the channel. The simple rule to demand for the exchange of both callsigns may be sufficient for traditional modes. With the advent af advanced digital modes the minimum amount of information should be specified more precisely. The author proposes the following formulation:

A valid contact is one where both operators have
(1) mutually identified each other,
(2) received a report, and
(3) received a confirmation of (a) the successful identification and (b) the reception of the report, and – necessary at one end only - (c) the confirmation.

This formulation avoids the problematic term *copy*. Without loosing any confidence in the QSO, it also respects the fact of the large difference between the two calls that in some sense must be received (I do know my own call in advance, only the other call really is new and must be communicated). Of course, the term *identification* has to be quantified. My suggestion is:

The identification process must be based on, or equal to, a decision out of a number of equally likely possible choices that is larger than the number of licensed radio amateurs throughout the world.

This formulation by no means does restrict any future coding schemes. It simply excludes lossy source coding of callsigns, and guarantees fairness. The formulation also solves the well-known problem of the validity of skeds: The decoder must take into account all possible callsigns. If it only looks for the sked partner that renders the contact invalid. The proposal also avoids any formulation directed to digital or analog methods. It is entirely independent from those parameters.

It should be noted that there are more than 6 billion Morse texts of 6 characters to form a callsign. That is a factor of thousand times the value demanded by the above rule. So, traditional modes like CW or SSB comply with the proposed rules. On the other hand, deep search only tries some thousand possible outcomes instead of some million. The striking difference of a factor of one million between traditional modes (and JT65 without DS) on one hand and deep search on the other hand is the reason for the indignation by some amateurs.

5. A Concluding Challenge

If there is any remaining person believing that deep search can communicate an amount of information as specified above (21 bits) please send me the algorithm **A** that encodes arbitrary 21 binary digits (or 4 upper-case characters plus decimal digits) into a JT65 message and the algorithm **B** that reconstructs these 21 bits (or 4 characters) from what is displayed on the screen by the deep search decoder. The search for these algorithm may provide you with deep insight. So it may not be waste of time although the task is proven to be impossible.

Literature

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Deep Search kann Rufzeichen nicht übertragen

von Klaus von der Heide, DJ5HG

Seit der Einführung des Deep-Search-Dekoders von JT65 gibt es eine Diskussion über die Gültigkeit damit erzielter QSOs [1,2,3,4]. Ziel dieser Schrift ist die intuitive und dennoch korrekte Erläuterung der Deep-Search-Methode.

1. Diskussion einer vergleichbaren Situation

Zunächst analysieren wir die in Bild 1 gezeigte Situation: Das TV-LCD meines Nachbarn strahlt in meine EME-Antenne. Das Rauschen scheint weiss zu sein, hat aber eine geringe vom TVProgramm abhängige Signatur. Dieses Rauschen wird dem linken Kanal der Soundkarte zugeführt. Ein zweiter Empfänger für 144 MHz nimmt direkt das von meinem TV-Display erzeugte Rauschen auf und führt dies auf dem rechten Kanal zur Soundkarte. Mein Rechner korreliert beide Kanäle, d.h. er berechnet einen Wert für die Ähnlichkeit des Rauschens der Kanäle. Jeweils der aktuelle Ähnlichkeitswert wird vom Korrelator angezeigt. Wenn ich nun alle TV-Programme der Reihe nach durchprobiere, erhalte ich einen entsprechenden Satz von Ähnlichkeitswerten. Einer dieser Werte wird deutlich größer als die anderen sein. Deshalb bin ich ziemlich sicher, dass der Nachbar das entsprechende Programm anschaut.
Nach dem Scan schalte ich meinen Fernseher auf das Programm, welches der Nachbar mit hoher Wahrscheinlichkeit anschaut. Dies entspricht der Ausgabe des Dekodierresultats. Woher kommt die Information, die nun auf meinem Fernseher zu sehen ist? Welchen Weg geht sie? Natürlich kommt sie von meiner Satelliten-Antenne. Was aber kommt von meiner EME-Antenne? Tatsächlich hängt doch das, was jetzt auf dem Fernseher läuft, vollständig von dem ab, was meine EME-Antenne lieferte! Es gibt hier offenbar zwei Informationen: (1) die von der Satellitenschüssel gelieferte Information, die die aktuelle Szene auf dem Fernseher bestimmt und (2) die Information, die zur Auswahl des laufenden TV-Kanals führte. Letztere Information fließt nur über mich und meine IRFernbedienung. Ein anderer Weg von meiner EME-Antenne zu meinem Fernsehschirm existiert nicht. Die Menge an Information, die über die EME-Antenne empfangen werden muss, um den vom Nachbarn benutzten Kanal zu finden, hängt von der Anzahl der zu probierenden TV-Kanäle ab. Mathematisch ist es der Logarithmus zur Basis 2 für die Anzahl der Kanäle, also 2, 3, 4, 5, 6, 7, 8 bit für entsprechend 4, 8, 16, 32, 64, 128, 256 Kanäle. Im Falle

von 64 TV-Kanälen ist also eine Informationsmenge vo 6 bit zu empfangen. Diese Information hat nichts zu tun mit der aktuell auf dem TV-Schirm dargestellten Szene.

Bild 1 (siehe engl. Text): Das TV-LCD meines Nachbarn strahlt in meine EME-Antenne. Das Rauschen scheint weiss zu sein, hat aber eine geringe vom TV-Programm abhängige Signatur. Dieses Rauschen wird dem linken Kanal der Soundkarte zugeführt. Ein zweiter Empfänger für 144 MHz nimmt direkt das von meinem TV-Display erzeugte Rauschen auf und führt dies auf dem rechten Kanal zur Soundkarte. Wenn ich nun alle TV-Kanäle durchprobiere, erhalte ich der Reihe nach vom Korrelator entsprechend viele Ähnlichkeitswerte. Danach wähle ich das Programm, das den größten Ähnlichkeitswert ergab. Der Informationsfluss ist durch Pfeile angedeutet. Information von meiner EME-Antenne zu meinem TV-Bildschirm kann nur über mich und meine Infrarot-Fernbedienung fließen.

2. Deep Search bei JT65

Den Fall des Deep-Search von JT65 erhält man aus Bild 1 durch Austausch von vier Details: (1) meine Satellitenschüssel durch die call3.txt Datenbasis, (2) meinen Fernseher und den zugeordneten 144 MHz-Empfänger durch die Signalerzeugung in JT65 und meinen Computer-Bildschirm, (3) mich und meine Fernbedienung durch die Programm-Schleife in JT65, die das automatische Durchprobieren aller aufgrund der Datenbasis möglichen Nachrichten erledigt, und (4) die Satellitenantenne und den Fernseher des Nachbarn durch die mich auf 144 MHz in JT65 rufende Station. Der generelle Informationsfluss bleibt derselbe. Was als dekodiertes Ergebnis auf meinem Computerbildschirm erscheint, stammt folglich aus der Datenbasis. Die angezeigten Rufzeichen wurden nicht über den Funkweg empfangen. Das dekodierte Resultat wurde aber aus einer Menge möglicher Nachrichten ausgewählt. Diese Menge ist proportional zur Länge der call3.txt Datenbasis. Sie ist ein Maß für die Schwierigkeit des QSOs. Damit erfüllt Deep-Search die klassische Forderung nach Übertragung der Rufzeichen auf dem Funkweg zweifelsfrei nicht.

3. Vergleich mit traditionellen Betriebsarten

CW oder SSB mit dem Alphabet „Alpha", „Bravo", ... sind nicht wesentlich anders. In dem Falle kennt der Empfänger nämlich alle Morsezeichen bzw. das Buchstabieralphabet „Alpha", ... (das ist dann die „Datenbasis"). Beim Empfang einer Nachricht hat der Operator jeweils das am besten passende Zeichen zu wählen, eins nach dem anderen. Auch hier werden also nicht die Zeichen als solche empfangen sondern vielmehr die aktuelle Entscheidung wie z.B.: das erste Zeichen ähnelt am meisten „Delta", das zweite „Juliet", das dritte „Five" usw. Der Unterschied zwischen Deep-Search und traditioneller Betriebsart besteht nur in der Anzahl der Möglichkeiten für die komplette Nachricht, was ja ein Maß für die Schwierigkeit des QSOs ist. Mit 43 verschiedenen Morsezeichen haben wir 43 Möglichkeiten pro empfangenem Morsezeichen. Für eine Nachricht aus zwei Zeichen gibt es dann 43*43 Möglichkeiten, für eine aus drei Zeichen 43*43*43 Möglichkeiten. Tabelle 1 gibt die Anzahlen möglicher Nachrichten für den binären Fall (nur die zwei Zeichen 0 und 1), für den CW-Fall mit 43 Zeichen und für den Fall von JT65, das ein Alphabet mit 64 Zeichen benutzt (repräsentiert durch 64 verschiedene Frequenzen). Aus dieser Tabelle ist zu entnehmen:

(1) Die JT65-Nachricht aus 12 Zeichen des 64-Alphabets entspricht etwa einer CW-Nachricht aus 13 Zeichen.

(2) Der Deep-Search-Dekoder lässt ungefähr 4096 mögliche Nachrichten zu. Das entspricht nach der Tabelle einer binären Nachricht aus 12 bit bzw. einer Nachricht aus nur zwei Zeichen des 64-Alphabets (also nur 1/6 der gesendeten Nachricht) oder weniger als drei CW-Zeichen.

Eine zusätzliche Eigenschaft des Deep-Search-Dekoders ist, dass man mit nacheinander übertragenen Nachrichten grundsätzlich nicht eine Vergrößerung der übertragenen Information erreichen kann. Ist nämlich in dem TV-Beispiel von Bild 1 der Kanal des Nachbarn gefunden, so kann eine Wiederholung nur das Vertrauen in das Resultat erhöhen. Dasselbe gilt für Deep-Search in JT65. Weil nämlich Funkamateure ihr Rufzeichen nicht beliebig ändern können, gibt es nur eine legale Nachricht als Anruf, die Deep-Search als Resultat finden kann. Eine Wiederholung kann das Vertrauen (die Konfidenz) in das Resultat erhöhen, aber nicht zusätzliche Information bringen. QSOs, bei denen die Identifizierung mit Deep-Search erfolgte, können deshalb (sofern das Signal nicht erheblich ansteigt) nur mit den speziellen Doppelton-Nachrichten für RO, RRR und 73 fortgesetzt werden. Diese übertragen, da die Reihenfolge festliegt, jeweils nur ein bit. In der Summe über alle empfangenen Durchgänge eines solchen QSOs werden dann weniger als 16 bit empfangen. Das ist insgesamt weniger als eine einzige CW-Nachricht aus drei Zeichen! Positiv an JT65 sind die Schwellwerte für die Identifikation, die dadurch deutlich vertrauenswürdiger ist als bei einem CW-QSO mit schwachen Signalen. Aber der Empfang von „HG" (was andeuten soll, dass dies nur 12 Bit sind) mit einer Konfidenz von 99.99% ist nicht so gut wie der Empfang von „DJ5HG" (volles Rufzeichen) mit einer Konfidenz von nur 99%.

Tabelle 1 (siehe engl. Text): Anzahl der möglichen Nachrichten für den binären Fall (zwei verschiedene Zeichen), den CW-Fall (43 verschiedene Zeichen) und den Fall von JT65 (64 verschiedene Zeichen). JT65 benutzt Nachrichten aus 12 Zeichen (fett gedruckt in der Tabelle). Die Zahl der möglichen Nachrichten ist dabei etwa dreimal so groß wie die einer CW-Nachricht aus 13 Zeichen. Dagegen ist die Zahl der möglichen Nachrichten beim Deep-Search-Dekoder ungefähr gegeben durch 4096, was einer Nachricht aus nur zwei Zeichen des 64-Alphabets entspricht. Eine CW-Nachricht aus drei Zeichen hat schon 79507 Möglichkeiten und enthält damit wesentlich mehr Information als das Resultat des Deep-Search-Dekoders.

4. Ein Vorschlag für neue QSO-Regeln

In den meisten sportlichen Disziplinen gibt es klare Definitionen für das Messen der Leistung, z.B. die benötigte Zeit für einen Sprint über 100 m. Die Schwierigkeit einer Amateurfunkverbindung hängt stark ab von den aktuellen Bedingungen und von der Menge der zu übertragenden Information. Die einfache Regel, den Austausch beider Rufzeichen zu verlangen, mag für traditionelle Betriebsarten angemessen sein. Mit der Einführung digitaler Betriebsarten sollte aber genauer spezifiziert werden, was damit gemeint ist. Andernfalls wäre es jedem anheim gestellt, dieses beliebig zu interpretieren. Dann bräuchten wir keine Regel, hätten aber auch kein faires Maß für Diplome, Erstverbindungen etc.. Der Autor schlägt deshalb folgende Regel vor:

Ein Funkkontakt zählt als gültiges QSO wenn beide Seiten
(1) sich gegenseitig identifiziert haben,
(2) einen Report empfangen haben und
(3) eine Bestätigung empfangen haben für (a) die erfolgreiche Identifikation und
(b) den Empfang des Reports und – notwendig nur auf einer Seite - (c) die Bestätigung.

Diese Formulierung berücksichtigt zwanglos den großen Unterschied zwischen den beiden Rufzeichen, die für die Identifikation auch hier auszutauschen sind (ich kenne mein eigenes Call, erwarte beim Anruf also, dass es passt; nur das anrufende Call ist zunächst unbekannt und muss vollständig übertragen werden). Natürlich muss der Begriff *Identifikation* quantisiert werden. Das ist nach obigen Ausführungen offenbar der Kernpunkt. Mein Vorschlag ist:

Die Identifikation muss auf einer Entscheidung basieren, die eine Nachricht aus einer Anzahl möglicher Nachrichten auswählt, die größer ist als die Zahl der lizensierten Funkamateure weltweit.

Diese Formulierung schränkt mögliche zukünftige Kodierungen in keiner Weise ein. Sie schließt aber verlustbehaftete Quellkodierung von Rufzeichen aus und garantiert Fairness. Sie löst auch das bekannte Problem der Gültigkeit von Skeds: Der Dekoder muss auch hier alle Rufzeichen als möglich ansehen. Wenn er nur nach dem Sked-Partner schaut, ist der Kontakt ungültig. Der Vorschlag vermeidet auch eine Unterscheidung von analogen gegenüber digitalen Betriebsarten. Man beachte, dass es mehr als 6 Milliarden Morsetexte aus 6 Zeichen gibt, die also alle Rufzeichen ohne Zusätze enthalten. Das ist mehr als ein Faktor Tausend größer als die vorgeschlagene Regel verlangt. Traditionelle Betriebsarten erfüllen also die Regel. Deep Search allerdings liegt umgekehrt mit etwa einem Tausendstel des Verlangten weit unter dieser Grenze. Der krasse Unterschied (Faktor eine Million!) zwischen konventionellen Methoden (und JT65 ohne Deep-Search!) einerseits und Deep-Search andererseits erklärt auch die Empörung einiger Amateure über die stillschweigende Akzeptanz solcher Methoden.

5. Eine Aufforderung

Falls noch jemand glaubt, mit Deep-Search könne man die oben genannte untere Grenze an Information übertragen, die ein Rufzeichen enthält (21 bit), der möge mir als Beweis zwei Algorithmen nennen: **A** für die Kodierung der 21 beliebigen Bit (oder auch für 4 lateinische Buchstaben plus Dezimalziffern und Blank) und **B** für die Rekonstruktion dieser Bit (oder 4 Zeichen) aus der vom Deep-Search-Dekoder erzeugten Ausgabe auf dem Bildschirm. Die Suche danach wird vielleicht tiefe Einblicke ermöglichen. Trotz sicherer Erfolglosigkeit muss sie deshalb nicht nutzlos bleiben.

Unusual 144 MHz Sporadic E Scatter

Observation of simultaneous forward- and backscatter radio communications originating from the same Es layer

by Volker Grassmann, DF5AI

1 Introduction

Every year between May and September, radio amateurs report a high number of long distance radio contacts (800 to more than 2.000 kilometers) in the 144 MHz frequency band which are associated with the scattering of electromagnetic waves by sporadic E layers and must not be interpreted, for example, by meteorological effects.

On June 5, 2007, radio amateurs have observed sporadic E forward- and backscatter originating from the same Es layer which has generated high awareness in the ham community [15] because no such event has been reported in ham radio before. This paper discusses the 144 MHz radio observations between 1744 and 1902 UTC and interprets the findings by using the BEAMFINDER analysis software which has been successfully applied in previous amateur radio studies on sporadic E scatter.

It is shown that the June 5, 2007 event has originated from E region scatter located above the Bay of Biscay. This area has enabled forward- and backscatter radio echoes which were observed by many ham operators in Portugal, Spain, Switzerland, Belgium, the Netherlands, Germany, England and Ireland, respectively. During the observation period of more than one hour, the scatter area has shown dynamical behaviour and has apparently moved its position in north-eastern direction which has finally resulted in the longest backscatter communication links ever reported by European radio amateurs. That radio contacts appear to indicate a relatively high scatter altitude and exhibit a significant aspect angle anomaly.

2 Observations

Analysing the observation data supplied by KRAFT (CT1HZE), [14], [15], JÜNKERSFELD (DL8EBW), [12], LANGENOHL (DK5YA), [17], VELDHUIJSEN (PA4EME), [21], and others, the author decided to separate the scenario into four phases which all represent specific characteristics and features demonstrating the variable nature of the June 5, 2007 event.

Phase 1

The first radio observations were made between 1744 and 1811 UTC comprising a number of 144 MHz radio contacts between the south of Portugal and Spain, on the one hand, and England, Ireland, France, Belgium and the Netherlands on the other hand, see ***Fig. 0.1***. Considering the high fieldstrengths, the high signal variability and the antenna headings along the great circle paths, all radio operators have interpreted this extraordinary examples of VHF long distance communication by sporadic E forward scatter (FS).

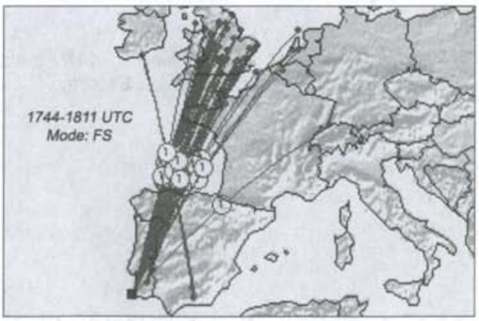

Fig. 0.1. Phase 1 of the June 5, 2007 sporadic E event (forward scatter mode). The circular markers indicate the actual path centers which may be interpreted the geographical position of the corresponding scatter volume.

Phase 2

Around 1811 UTC, the radio operator CT1HZE (south Portugal) has noticed a sudden access to a number of German radio stations (see the left hand side of ***Fig. 0.2***). The radio signals were affected by slight distortions in audio quality and maximum fieldstrength was obtained at the same antenna heading that has enabled radio contacts to England. At 1813 UTC he managed two more radio contacts towards south-west Germany (see the right hand side of ***Fig. 0.2***) which he has now interpreted by sporadic E backscatter (BS) due to the heavy signal distortions similar to Aurora backscatter which is well-known in ham radio. Three minutes later (1816 UTC), he was able to access another British radio station whose radio signals did not show any audio distortions, i.e. this contact was again interpreted by sporadic E forward scatter similar to the radio contacts discussed in phase 1. In Germany, the transition from phase 1 to phase 2 has represented a much more drastic change. In phase 1, Dutch radio stations (all located in the western part of the Netherlands) have managed radio contacts to CT1HZE which has attracted the interest of German radio operators. Contrary to their Dutch colleagues, the German stations have detected maximum fieldstrength not along the great circle path but at antenna headings 10° to 20° further west, i.e. between 240° and 260° azimuth. In Germany, CT1HZE's radio signal was affected by distortions in audio quality which apparently did not exist in the Netherlands.

Fig. 0.2. Phase 2 of the June 5, 2007 event which has enabled forward- (left) and backscatter (right) radio contacts. The lines represent the great circle paths between the actual transmitter and receiver. Note that the great circle paths are identical to the radiowaves' propagation path in forward scatter but are not identical to the radiowaves' propagation path in backscatter.

Phase 3

Between 1820 and 1839 UTC, the station CT1HZE has managed even more radio contacts towards Germany and another one into Switzerland, see ***Fig. 0.3***. In comparison to phase 1 and phase 2, however, the total number of radio contacts is surprisingly small, i.e. the June 5, 2007 event appears to indicate a short period (19 minutes) of minimum activity here. In this period of time, all radio contacts represent backscatter radio communications, i.e. sporadic E forward scatter was apparently not available at all.

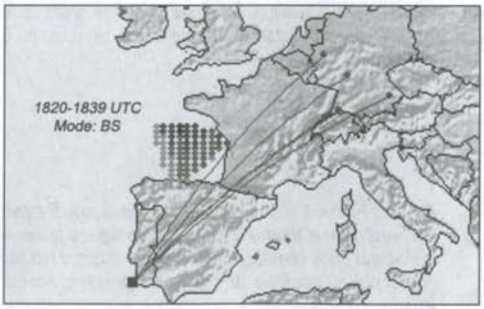

Fig. 0.3. Phase 3 of the June 5, 2007 event representing a phase of low sporadic E activity.

Phase 4

Between 1841 and 1902 UTC, the sporadic E scatter scenario has again enabled forward- and backscatter radio contacts, see ***Fig. 0.4***. Surprisingly, it is phase 4 that has supported the most spectacular backscatter contacts 20 minutes before the sporadic E event has faded away. The backscatter radio contacts displayed on the right hand side of ***Fig. 0.4*** represent the longest communication distances in sporadic E backscatter (more than 2.200 kilometers) ever observed by European radio amateurs. Around 1846 UTC, the north-German radio station DK9OY has received CT1HZE's radio signals (without establishing a 2-way radio contact though) over a great circle distance of 2.244 kilometers which exceeds the ham radio world record in sporadic E backscatter by some kilometers. At 1915 UTC, the event faded away, i.e. all long distance communication links disappeared.

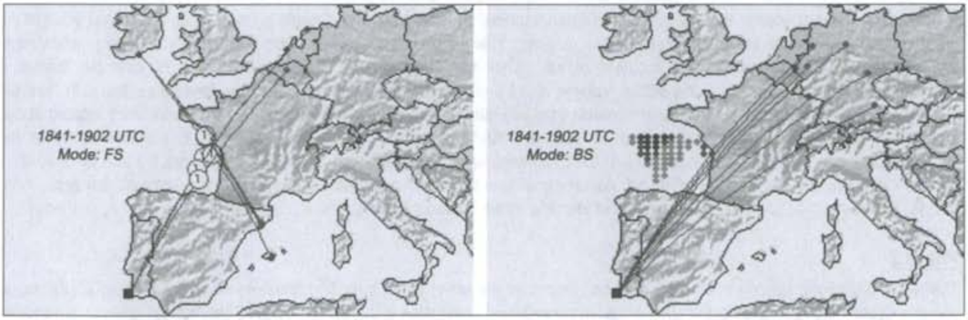

Fig. 0.4. Phase 4 of the June 5, 2007 event showing a mixture of sporadic E forward (left) and backscatter (right) communication links. The radio contacts on the right hand side represent the longest communication distances (along the great circle) in sporadic E backscatter ever observed in Europe.

3 Interpretation

Without addressing the geo- and plasmaphysical details, sporadic E scatter may be briefly described by a temporary accumulation of charged particles within the E region of the ionosphere (105 to 110 kilometers) which may exhibit scattering properties enabling long distance VHF communication along the great circle path. Sporadic E layers may however become instable which causes irregularities aligned to the geomagnetic fieldlines penetrating that layer. In this case, the radiowaves' propagation path is no longer directed along the great circle but shows an angled geometry which has been discussed in many scientific (see, e.g., [2]) and ham radio publications (see, e.g., [13]) in recent decades.

	FS (forward scatter)	BS (backscatter)
Ham radio terminology	Sporadic E (Es)	Field-aligned irregularities (FAI)
Geographical occurence	mid-latitudes, polar latitudes	mid-latitudes 1)
Annual maximum of occurence	May – September 2)	May – September 2)
Diurnal maximum of occurence	late morning, early evening 2)	early evening 2)
Correlation to geomagn. disturbances	no	no
Correlation to geomagn. field direction	no	yes
Observation frequencies	28 – 220 MHz 4)	28 – 144 MHz
Propagation geometry	along the great circle path	angled propagation path
Field strengths	high – very high (S/N ratio > 30dB) 2)	low (S/N ratio < 10dB) 2)
Fading	abrupt signal variations within split seconds	heavy signal variations
Signal distortion	none (voice and morse code communication)	heavy (morse code communication mostly) 2)
Typical communication distance	800 – 2.200 km 2)	700 – 1.400 km 2) 3)
Technical requirements (in ham radio)	all types of antennas including portable transmitters and handhelds, 1 – 10 w rf power	Antenna arrays (10-20 dB gain), 100 – 1000 watts rf power

Notes:

1) field-aligned backscatter in polar latitudes (Aurora backscatter) is neglected here
2) typical values which may vary in practice
3) denotes the great circle distance between the transmitter and the receiver, i.e. the true backscatter path length is considerably longer
4) 220 MHz is not available to European but to U.S. radio amateurs, the next European band higher than 144 MHz is 432 MHz

Table 0.1. Characteristics of the forward- and backscatter propagation mode.

Thus, VHF radio amateurs may observe two versions of mid-latitude sporadic E scatter which are summarised from a phenomenological perspective in ***Table 0.1***. However, the author is not aware of any ham radio report describing a transition between sporadic E forward- and sporadic E backscatter. Because no relevant geophysical data is available, the June 5, 2007 event cannot be analysed on a quantitative basis, unfortunately, i.e. the discussion will focus on plausibility and consistency by referring to the BEAMFINDER analysis software [10] which has been successfully applied in many amateur radio propagation studies (see [9] and the references cited therein).

Phase 1

Referring to ham radio monitoring services (see, e.g., [18], [19] and [20]) a number of sporadic E scatter events have been already observed in May 2007. Thus, the initial phase of the June 5, 2007 event was actually no surprise to the radio amateurs, i.e. phase 1 may be interpreted another example of sporadic E forward scatter similar to the many cases which have been observed by radio amateurs before.

In sporadic E forward scatter, the scatter volume's geographical position may be estimated by calculating the central point of the great circle path between the transmitter and the receiver. This simple approach has been successfully used in practice (see, e.g., [7]) and provides a geographical accuracy of, say better than 50 kilometers; it however neglects, for example, slanted E layers or other scenarios in which the scatter volume is not positioned in the middle of the actual forward scatter path (see the discussion, e.g., in [8]). Analysing all radio contacts that way, the forward scatter has originated from a wide area located above the Bay of Biscay, see the circular markers in ***Fig. 0.1***. Another method of estimating sporadic E positions refers to the intersection of long distance scatter links. Note the radio links between Ireland and Spain which intersect the bulk of radio links between Portugal and England, see ***Fig. 0.1***. Assuming all sporadic E radio contacts correspond to the same scatter area, more or less, the intersection point must be considered identical to the sporadic E position which is again found in the Bay of Biscay.

Phase 2

The signal distortions starting in phase 2 may be interpreted the onset of the transition phase in which the forward scatter mode became accompanied by the backscatter mode. In sporadic E backscatter, a more sophisticated geometrical analysis is required in order to identify the scatter volume's actual geographical position. The BEAMFINDER analysis software supports this type of analyses based on scientific studies from the 1960s analysing Auroral backscatter in the 144 MHz amateur radio band, [2], [16]. With this analysis, the backscatter positions are again identified in the Bay of Biscay, see the black dot marks on the right hand side of ***Fig. 0.2*** which indicate the most likely scatter positions (the gray dot marks, on the other hand, denote scatter positions of less significance).

The left hand side of ***Fig. 0.2*** displays one radio contact from south Portugal into west England which represents sporadic E forward scatter. The remaining radio contacts, however, (see the circle in ***Fig. 0.2***) did not obtain a clear classification by the radio operator CT1HZE. Interpreting these contacts by sporadic E forward scatter, the sporadic layer is found in southern France close to the Atlantic sea coast (see the circular markers in the left panel of ***Fig. 0.2***) which appears inconsistent with the results in phase 1. Interpreting the same radio contacts not by forward- but by backscatter radio communications, the scatter positions are again found in the central area of the Bay of Biscay (see the dot marks in the left panel of ***Fig. 0.2***). From this perspective, the radio contacts during phase 2 must be all interpreted (except the contact towards west England) by sporadic E backscatter. Thus, the two independent calculations in phase 1 and 2 are leading to the same result, i.e. a scatter area above the Bay of Biscay extending over 400 kilometers in longitude and 300 kilometers in latitude. A closer inspection of ***Fig. 0.1*** and ***Fig. 0.2*** appears to indicate, however, that the forward- and backscatter positions were slightly displaced by, say 100 kilometers.

The scatter positions above the Bay of Biscay are fully compatible to the antenna headings reported by the radio amateurs. This is in particular true with the German radio stations which have reported an azimuth deviation of 10° to 20° in western direction compared to the great circle path which indeed corresponds to the direction of the Bay of Biscay. This scenario also explains the findings in south Portugal were all radio contacts were established with identical antenna headings: CT1HZE has permanently addressed the same scatter area, more or less, although the scattering processes within that area have changed considerably. From a purely geometrical perspective, all radio stations must have observed the scatterers at relatively low elevation (less than 3 to 5°). Some radio operators have however reported a much higher antenna elevation, all elevation data is however ignored in this paper (based on previous amateur radio propagation studies, the author generally considers elevation measurements in amateur radio no reliable information).

Phase 3

In phase 3, the scatter area is again found in the Bay of Biscay (see ***Fig. 0.3***). This must not be considered a self-evident result because CT1HZE has addressed stations in west and south-east Germany during phase 3, contrary to the radio contacts in phase 2 which has involved radio stations in south-west Germany and Switzerland.

Phase 4

Fig. 0.4 indicates a remarkable discrepancy in the dynamical behaviour of the forward- and backscatter positions in the E region of the ionosphere. Comparing the left hand side of ***Fig. 0.1*** (phase 1) to the left hand side of ***Fig. 0.4*** (phase 4), the geographical origin of forward scatter has apparently moved in north-eastern direction, i.e. from the southern and central to the eastern part of the Bay of Biscay, see the circular markers and also the radio paths' intersection point close to the French sea coast (***Fig. 0.4***).

Analysing, on the other hand, the scatterers drift motion by referring to the backscatter radio contacts, a confusing picture is obtained. Comparing the right hand side of ***Fig. 0.2*** with the right hand side of ***Fig. 0.4***, the geographical origin of backscatter has apparently moved in western direction (see the black dot marks in both graphics). However, we may also find strong indication of backscatter positions that have moved to the north-east. This is indicated by the three isolated scatter positions (black dots) displayed in the right panel of ***Fig. 0.4*** very close to the French sea coast. These dot marks do not appear significantly at all but they have an important meaning, in fact. Without these three scatter positions, DK9OY's extraordinary radio observation (see above) cannot be explained at all, i.e. the bulk of scatterers in the ocean cannot support backscatter radio communication between the south of Portugal and north Germany. Thus, these three scatter positions must be considered significant indeed and must not be interpreted as an accidental result.

Note that the three scatter positions are located exactly at the radio paths' intersection point which is displayed on the left hand side of ***Fig. 0.4***. Thus, a localised region has been identified close to the French sea coast which has supported forward- as well as backscatter radio communications. The three scatter points correspond to DK9OY's radio observation made at 1846 UTC. The intersection point, on the one hand, corresponds to forward scatter contacts established between Ireland (EI4DQ), on the one hand, and the island of Majorca (EA6DF) and north-east Spain (EA3DXU, EA3DYS, EA3DJL) on the other hand. These radio contacts were made at 1841, 1845, 1847 and 1849 UTC, respectively, i.e. at the same time when DK9OY has made his extraordinary radio observations in northern Germany. Thus, that scatter position close to the French sea coast has simultaneously supported forward- and backscatter radio communications which is indeed very surprising.

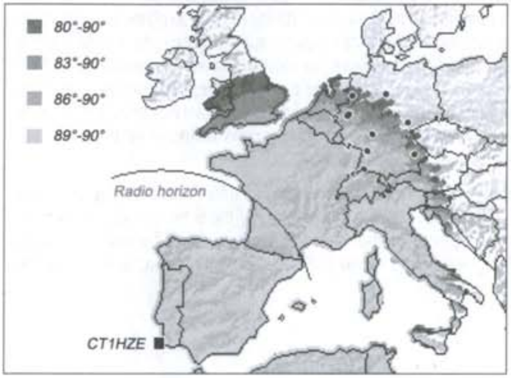

Fig. 0.1. Aspect angle sensitivity controlling the maximum communication distance available in sporadic E backscatter (calculated for the radio station CT1HZE). The black dots denote the backscatter radio contacts reported by CT1HZE in the June 5, 2007 event.

By analysing the backscatter radio contacts in phase 4 in more detail, a considerable violation of the ordinary backscatter geometry has been identified. The sporadic E backscatter geometry generally fulfills the geometrical requirements which were postulated by BOOKER [1] and others in the 1950s, i.e. the difference of the transmitter- and receiver wavevector is directed perpendicular to the actual geomagnetic fieldline penetrating the scatter volume. The angle between the difference vector and the geomagnetic fieldline is referred to as the *aspect angle* in bistatic backscatter. The above statement (90° aspect angle) may be geometrically interpreted by the so-called *scatter cone* whose symmetry axis is directed along the geomagnetic fieldline, see the discussion, e.g., in [3]. It is perhaps worth to mention that scientific publications refer to an complementary angle, i.e. the 90° aspect angle in ham radio terminology corresponds to the 0° aspect angle in scientific publications). Simliar to scientific radar studies, radio amateurs have observed Aurora backscatter violating the 90° aspect angle considerably [4]. In one case, a 70° aspect angle has been identified in Auroral backscatter which is the highest deviation from the ordinary backscatter geometry ever observed in ham radio [5]. No similar observation was however made in mid-latitude backscatter, i.e. all mid-latitude backscatter studies conducted by radio amateurs in recent years comply to the 90° requirement. This is obviously not true for the June 5, 2007 event.

The light gray area in ***Fig. 0.1*** displays all geographical regions which CT1HZE (south Portugal) may access in sporadic E backscatter if the scatter geometry fulfills aspect angles identical or close to 90°. Radio stations in south-west Germany (see the black dot marks) can indeed fulfil this requirement, stations in west, south-east and north Germany, however, cannot. The BEAMFINDER analysis has been extended by allowing deviations from 89° aspect angle in steps of 3° which is indicated by the colour shading in ***Fig. 0.1***. Evidently, two backscatter contacts need to be interpreted by aspect angles deviating from perpendicularity by more than 10°. Analysing DK9OY's (north Germany) backscatter observation of CT1HZE (south Portugal), a very surprising result was obtained: this observation needs to be interpreted by an aspect angle of 70°. In ham radio, this is the first example of an aspect angle anomaly observed in mid-latitude backscatter matching the highest ever observed aspect angle anomaly in Aurora backscatter [5] which is indeed a very surprising result. The BEAMFINDER software considers the sporadic E height an input parameter in the calculations which is typically selected between 105 and 110 kilometers. The author is not aware of any BEAMFINDER analysis in which the sporadic E height has developed into a critical parameter, i.e. the results do not change significantly if the sporadic E height varies between 105 and 110 kilometers. This is not true when analysing the DK9OY's radio observation on June 5, 2007. In addition to the above mentioned 70° aspect angle, a sporadic E height of at least 111 kilometers is required, the calculations will fail otherwise. This value does not appear sensational but the analysis' sensitivity on this parameter is considered a surprising result. We may therefore speculate, that the June 5, 2007 event has employed sporadic E layers in relatively high altitudes.

Thus, phase 4 provides a number of interesting features (high sporadic E backscatter activity, simultaneous forward- and backscatter originating from the same Es layer, longest backscatter distances ever observed in Europe, drifting scatter positions, unusual aspect angles, large scatter heights) just before the June 5, 2007 event has ended. Unfortunately, we cannot resolve the geo- and plasmaphysical background processes but we may speculate that phase 4 represents the period of time in which the sporadic E layer has experienced maximum instability and this may explain the fact that the event faded away very soon.

4 Concluding comments

The author agrees to the interpretation given by the radio operators which postulates a transition from sporadic E forward scatter into sporadic E backscatter – this scenario indeed appears plausible and no alternative interpretation is currently available which could provide indications of similar consistency. Thus, the large variety of radio propagation phenomena in amateur radio has obtained a new element because this type of sporadic E long distance communication has been reported for the very first time. It is perhaps worth to mention that sporadic E backscatter has been exhaustively studied both experimentally and theoretically by many research groups (see, e.g., [11]) which is apparently not true with the forward scatter mode which receives little attention in scientific studies. This might appear surprising because sporadic E forward scatter affects commercial and other types of radio links between 50 and 150 MHz on a regularly basis during the summer months. This discrepancy may be explained, perhaps, by the limited view of scientific radar systems: radar observations of sporadic E forward scatter require bistatic radar systems along very long baselines (1.000 to 2.000 kilometers) but this type of instrumentation does not exist in ionospheric research. In ham radio, on the other hand, we indeed find a large amount of VHF radio stations distributed over the European continent, i.e. both types of sporadic E scatter may be observed by radio amateurs more or less easily. The amateur radio service therefore benefits from a statistical advantage in observing radiowave propagation phenomena which often remain unknown or manifest in a different manner compared to other types of radio services including scientific radar facilities.

The author wishes to address experts in ionospheric research who can provide background information on the geo- and plasmaphysical processes resulting in scenarios as discussed in this paper (this is the reason, by the way, this article does not follow the terminology which is commonly used in ham radio publications). Another question which needs to be resolved should address the surprising fact that this type of effects were never observed before although a huge amount of sporadic E events has been observed by VHF radio amateurs in recent decades.

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ANALOG DEVICES

50 MHz to 6 GHz RF/IF Gain Blocks

Preliminary Technical Data

ADL5541/ADL5542

FEATURES

Fixed gain of 15 dB ADL5541
Fixed gain of 20 dB ADL5542
Operation up to 6 GHz
40.9 dBm Output Third-Order Intercept at 900 MHz ADL5541
40 dBm Output Third-Order Intercept at 900 MHz ADL5542
3.5 dB noise figure at 900 MHz ADL5541
3.0 dB noise figure at 900 MHz ADL5542
Input/output internally matched to 50 Ù
Stable vs. temperature and power supply
5 V power supply
92 mA power supply current
1000 V ESD (Class 1C)

FUNCTIONAL BLOCK DIAGRAM

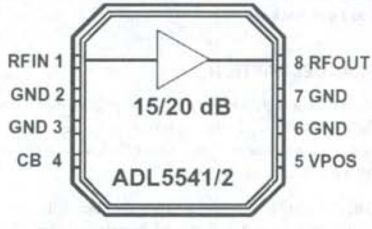


Figure 1.

GENERAL DESCRIPTION

The ADL5541 and ADL5542 are broadband 15 dB and 20 dB linear amplifiers respectively that operate at frequencies up to 6 GHz. The devices can be used in a wide variety of wired and wireless devices including cellular, GSM and WCDMA, and broadband applications. The ADL5541 provides a gain of 15 dB, which is stable over frequency, temperature, power supply, and from device to device. It achieves an OIP3 of 40.9 dBm with an output compression point of 18.2 dBm and a noise figure of 3.5 dB at 900 MHz.

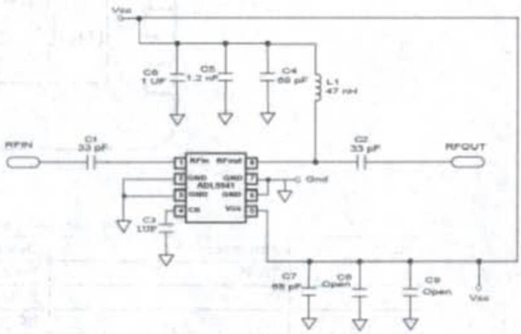
The ADL5542 provides a gain of 20 dB. It achieves an OIP3 of 40 dBm with an output compression point of 20.6 dBm and a noise figure of 3.0 dB at 900 MHz. Both amplifiers are internally matched to 50 Ohm with an input return loss of 10 dB or better up to 6 GHz. Only input/output ac-coupling capacitors, power supply decoupling capacitors, and an external inductor are required for operation. The devices operate with a supply voltage of 5 V with a supply current of 92 mA.

The ADL5541 and ADL5542 are fabricated on an InGaP HBT process and have an ESD rating of 1000 V (Class 1C). The devices are packaged in a 3 mm × 3 mm LFCSP that uses an exposed paddle for excellent thermal impedance. They operate from -40°C to +85°C. A fully populated evaluation board is available.

ABSOLUTE MAXIMUM RATINGS

Parameter Rating
Supply Voltage, VPOS 6.5V
Input Power (re: 50 Ù) 10 dBm
Internal Power Dissipation (Paddle Soldered) 650 mW
èJC (Junction to Paddle) TBD °C/W
Maximum Junction Temperature TBD °C
Operating Temperature Range -40°C to +85°C
Storage Temperature Range -65°C to +150°C

Evaluation Board Configuration Options
Component Function Default Value
C1, C2 AC-coupling capacitors. 33 pF 0402
C3 Low frequency bypass capacitor. 1 uF 0805
L1 DC bias inductor. 47 nH L0603
Vcc & Gnd Clip-on terminals for power supply.
W1 2-pin jumper for connection of ground and supply via cable.
C4,C5,C6, C7,C8,C9 Power supply decoupling capacitors
C4, C7 68 pF 0603 C5 1.2 nF 0603 C6 1uF 0805 C8, C9 Open



Evaluation Board Schematic

(also available: ADL 5534, 20-500 MHz, 20dB gain, NF 2.5dB and ADL 5532 15dB / 3dB)

Rev. PrD 5/07

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A. Tel: 781.329.4700 www.analog.com
Fax: 781.461.3113

ANALOG DEVICES

400 MHz – 4 GHz Low Noise Amplifier

Preliminary Technical Data

ADL5521

FEATURES

Gain of 15.3dB at 1950MHz
Matched 50-Ω input and output
Noise Figure of 0.8dB at 1950MHz
OIP3 of 35.3dBm typ at 1950MHz
Single 5V Supply Operation
Operating current of 65ma at +5V
LFCSP 3x3 mm Package

FUNCTIONAL BLOCK DIAGRAM

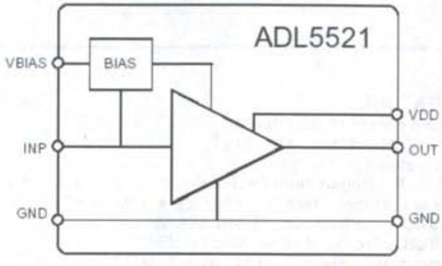


Figure 1.

GENERAL DESCRIPTION

The ADL5521 is a high performance GaAs pHEMT low-noise amplifier. It provides high gain and low noise figure for single down-conversion IF sampling receiver architectures as well as direct down conversion receivers.

The ADL5521 amplifier comes in a compact, thermally enhanced 3x3mm LFCSP package and operates over the temperature range of –40°C to +85°C.

PIN CONFIGURATION AND FUNCTIONAL DESCRIPTIONS

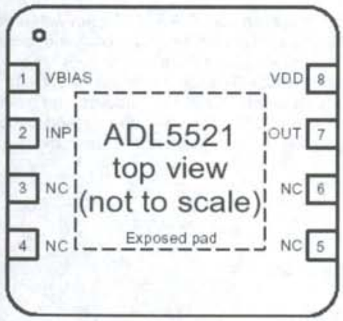


Figure 2. 8-Lead LFCSP

Table 3. Pin Function Descriptions- 8Lead CSP

Pin No.	Mnemonic	Description
1	VBIAS	**Bias:** Internal DC bias
2	INP	**RF Input:** Must be AC-coupled.
3,4,5,6	NC	**NC:** No internal connection
7	OUT	**RF Output:** Must be AC-coupled.
8	VDD	**Supply:** VDD bias needs to be bypassed to ground using low-inductance capacitors.
Exposed pad	EP	**Exposed Paddle:** Connect to a low impedance ground plane

Rev. PrA

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781.329.4700 **www.analog.com**
Fax: 781.326.8703

ANALOG DEVICES

DC to 1000 MHz IF Gain Block

Preliminary Technical Data

ADL5530

FEATURES

OIP3 +37 dBm
Noise Figure 2.5 dB
Gain 16 dB
Operation up to 1000 MHz
Input/output internally matched to 50 Ohms
Temperature and power supply stable
Power supply: 3 V or 5 V

APPLICATIONS

VCO Buffers
General Purpose TX/Rx Amplification

FUNCTIONAL BLOCK DIAGRAM

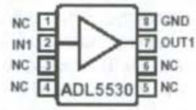


Figure 1. Block Diagram

GENERAL DESCRIPTION

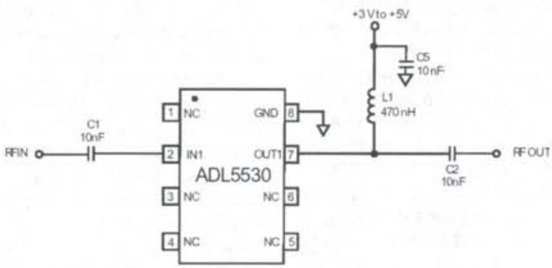
The ADL5530 is a broadband, fixed-gain, linear amplifier that operates at frequencies up to 1000 MHz. It is intended for use in a wide variety of wired and wireless devices, including cellular, broadband, CATV, and LMDS/MMDS applications.

The ADL5530 provides a gain of 16 dB, which is stable over frequency, temperature, power supply and from device to device. It achieves an OIP3 of 37 dBm with an output compression point of +22 dB and a noise figure of 2.5 dB.

This amplifier is single-ended and internally matched to 50 Ohms with an input return loss 12 dB. Only input/output ac-coupling capacitors, a power supply decoupling capacitor, and an external inductor are required for operation.

The ADL5530 operates with supply voltages of either +3V or +5V with a supply current of 110 mA.

The ADL5530 is fabricated on a GaAs PHEMPT process. It is packaged in 3mm x 2mm LFCSP that uses an exposed paddle for excellent thermal impedance. It operates from −40°C to +85°C. A fully populated evaluation board is available.



Basic Connections

Table 3. Evaluation Board Configuration Options

Component	Function	Default Value
C1, C2	AC coupling capacitors.	10 nF 0402
C5	Power supply decoupling capacitor	10nF 0603
L1	DC Bias Inductor	470 nH 1008
J5, J6	Clip on terminals for power supply	J5=VPOS J6=GND

SV9/DL5MAE: Gavdos Island (KM24BT)

This time my goal was to activate a rare grid again in the Mediterrenian sea. So I decided to go to Gavdos Island which is a very small Island located 36km south of Crete in the Libyan Sea. I left Germany with my usual full packed car on the 18th of May towards Italy where the car ferry-boat left Venice on May 19th. Its always very impressive to see Venice and its historic buildings from the ferry-boat. The trip took me along the Adriatic Sea and the ferry-boat stopped in Igoumenitsa (KM09) and Corfu Island. I left the boat in Patras on May 20th, which is located in the north-western corner of the Pelopones. As I came in late I just looked out for an accomodation for one night. The coming day I drove towards Korinthos where I met the famous Greek EMEers Petros (SV3AAF) and Jimmy (SV1BTR). It was a big "HELLO" and I appreciated the meeting very much! It took me 11 years to see Petros again, the last meeting with Jimmy was in 2004. Also, I have to mention that Jimmy did help me alot to make this activity possible at all. The biggest problem to activate Gavdos is the lack of public electricity outside villages and the very unsure ferry-boat schedule.

After a common lunch with my Greek friends I left towards Pireas where my car ferry-boat to Crete was already waiting. I left Pireas in the evening of the 22nd towards Crete (SV9).

Michalis, SV9CVY, was my host for one day. Michalis is a very keen Dxer and meanwhile QRV on 2m EME. I really have to thank him for his hospitality! He really has a impressive station! One can see it on his homepage. I left his QTH in the morning of the 23rd of May towards Chora Sfakion where the ferry-boat goes to Gavdos. Before I left, Michalis called the port authorities and they told him that the boat is full with 12 trucks...I was shocked but I was going to Chora Sfakion anyway. Right after my departure from Michalis QTH I heard I1DMP calling on 144.300MHz. I called him and made a nice Es QSO out of the car (20W, vertical antenna).

In the evening of the 23rd the ferry-boat left towards Gavdos Island. Well, there was only one truck and a few cars on the boat, so there was enough place for my car. I arrived in Gavdos about 2200 local time where my very friendly host picked me up at the port. We drove to my accomodation...I was really going slowly as the road has lots of holes and big stones on it. The next day I started immediately building up the station. For 2m I used a 17elM2 and for shortwave just a vertical. First all seemed to work fine but my amplifier was showing me negative grid current...end of expedition before it started??? There is no chance to get spare parts on the island. Gavdos has 50 inhabitants and 1000 goats but no hard ware shops. I decided to open the PA and found a resistor which was soldered out. I was lucky and got the PA running.

My QTH had no public electricity and I got the power out of an 15KVA generator. It was allowed to me to start the generator whenever I need it. So I started my first high speed meteor scatter activity on May 25th. I fired up the generator in darkness and called CQ. There were already stations waiting for me and I was able to complete with IK4PMB and DL5ROB. Some others were not complete due to bad conditions. Conditions were only good between 02-04 utc, after this they became very flat. Unfortunately another problem occured. The TRX went deaf after getting warm. It took me quite some time until I found out what the faulty element was in my station set-up. The problem was the tx/rx relais of the transceiver which was sticking. So sometimes I had to reduce my TX-periods to about 1 minute to be sure the relais contact going back to RX-position again. My QTH was about 120asl and absolutely quiet. I had a fantastic take-off towards middle-east and heard broadcast stations from 4X, 5A, SU and even HZ on tropo. Towards north my take-off was good, but on clear days I could see the mountains of Crete. Those mountains are almost up to 3000m. Nevertheless I was able to work Steffen, DD0VF, over almost 2000km. Another remarkable QSO took place with Chris, LZ1DP, on tropo over 855km. I did also one test with Jimmy, SV1BTR, on EME. I heard him with 529 but almost at the end of the schedule. I did find the moon (visually) too late and was pointing about 15deg off direction. When I copied Jimmy then the moon was almost 20 degrees up on the horizon. We couldnt complete as Jimmy was not listening very carefully anymore as the sked-time was practically over. On HSCW I was QRV for 7 mornings and was able to complete with 26 stations: IK4PMB, DL5ROB, S54O, DJ5MN, YU1EV, S57TW, YO3FFF, S51WX, DK5MB, YU7EW, S54T, S51AT, HA1BC, IV3NDC, LZ2FO, HA5CW, S53J, HA6NQ, IK2DDR, DK5MV, DJ1OJ, HA3UU, HG3DX, I5WBE, IK0BZY, DD0VF.Some others were heard but not completed. Some QSOs really took long although a got a firework of reflections. Also, NOT beeing in a chat-room seems to be a "disadvantage" these days. Many are used now to computer QSOs and dont listen very good, but perhaps its also a problem of local QRM?? Sporadic E was a big mess, I worked only I1DMP out of the car. On June 6th (when I was back in SV9/Crete) I worked EA6VQ, but this QSO I cannot count as a good one as he copied SV5/... instead of SV9/DL5MAE/m. Gabriel even got KM25, he should know that KM25 is not SV5. On June 2nd it was supposed my boat going back to Crete but it returned on June 3rd. So I removed my RIG on June 1st and packed almost everything back in my car. Remaining was a 7el yagi and a 30W TRX - just in case of Es. Of course, the Es came and I heard DK1KO, DH8BQA, DK1CO and OZ1IEP. They called some stations on 144.300MHz and 144.310MHz. I called CQ myself (in CW) but nobody replied to my QRP-signal. The QRB up to Denmark is about 2600km. Finally on June 3rd the ferry-boat came and SV9/DL5MAE (Gavdos Isl. / KM24BT) was history. I had 3 more remaining days in Crete and settled down in KM15, where I was 17years ago. I build up the QRP station 7el/30W just in case of Es. The place in KM15 has changed dramatically and is very touristic now. Where my antenna was during my 1990 activity one find a restaurant now... I left Crete on June 6th and met Michalis, SV9CVY, again. During my driving on the highway I tried to work EA6VQ but as mentioned above he did not get my call correctly. I heard him also working to 4X. The next morning I met Jimmy, SV1BTR, in Athens again. Then I drove to Nafplio where I was invited by Petros, SV3AAF and his family for lunch. We spent a very nice afternoon together! On June 7th I left Greece and arrived back home on June 9th in the evening. I have to thank everyone who helped me to make this activity possible and congratulations to everyone who worked me on 2m. On HF I worked about 1000 QSOs in my spare time from the very southern point of Europe. vy 73 de DL5MAE, Wolfgang

Microwave Japan

Seiji Fukushima, Ph.D, JH6RTO

New Mitsubishi's Power Module by Yoshihiro, 7L1WQG

A new 23-cm power module, RA18H1213G, has become available from Mitsubishi. I purchased some and tested them. This is a brief report of the module.

The specifications are as follows:
maximum output power: 30W,
maximum input power: 200mW,
frequency range: 1.24-1.30GHz,
VDD: 12.5V,
VGG: 5V (IG=1mA).

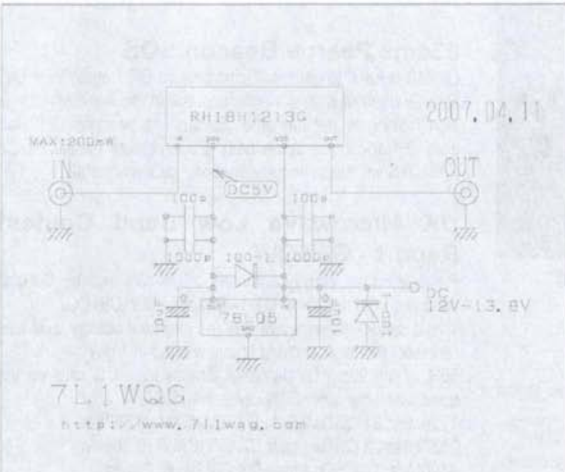


Fig. 1: Test circuit diagram

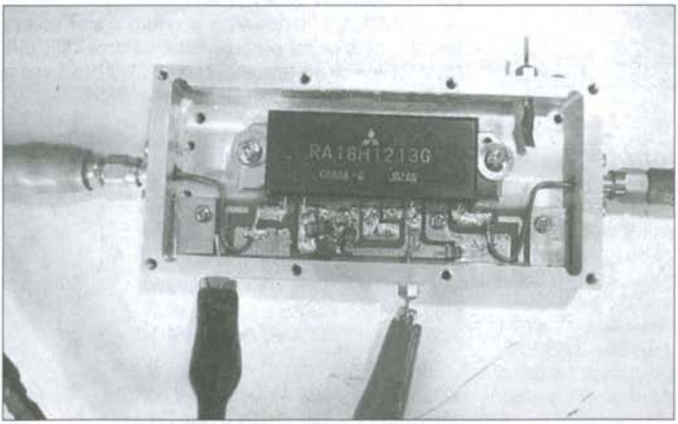


Fig. 2: Photograph of the test circuit

Basic components of the module are MOSFET's and the module includes 3-stage cascaded amplifiers. A gain is controllable by the adjustment of gate bias conditions, 5V, 1mA typically. The power gain was measured as high as 23dB. We have to note that the idle current is larger than 2A at the typical bias conditions. The data sheet suggests the usage of a 0.42 degree/W heat sink.

My test circuit diagram and its photograph are shown in Figs. 1 and 2, respectively. I applied 13.8V to the drain and used a 78L05 to apply 5V to the gate. The input and output terminals are SMA styles. I obtained 33W at the input range of between 150 and 200mW when the frequency was 1295MHz, a Japanese simplex FM calling channel. The module seems saturated at a 150mW input power. At this condition, the measured current was nearly 10A. The efficiency was calculated to be 20% approximately, as is specified. As the frequency was lowered to 1280MHz, the output power was increased to 40W. A slight power dependence on the frequency was observed even in the 23-cm band.

In conclusion, I built a 23-cm test amplifier that employs the new Mitsubishi's power module. This device has a potential to develop an amplifier for EME if some devices are driven in parallel. Further information is available in my web site.

References

http://www.7l1wqg.com/7l1wqg/jisaku/ra18h1213g/ra18h1213g.html
Unfortunately, this is in Japanese. Try web translation services to your language.
http://www.mitsubishichips.com/Japan/content/product/hf/sirfpowermod/1.2g/1.2g/ra18h1213g.pdf

Microwave Europe

Editor: Simon Lewis, DL4PLM
GM4PLM@hotmail.com

Hello and welcome to another Microwave Column. I have just spent an enjoyable weekend in Friedrichshafen at this years Ham Radio show. We had a good weekend and it was nice to see many well known faces at the show. I hope you all made it home safely. There was not so much new stuff this year and the trade show seemed smaller but it was interesting to see the growing club and special interest sections. Lets hope that maybe next year we could see some demos of uwave gear?

DB6NT, Michael – Ham Radio 2007

New Microwave Models seen at Ham Radio

Some new items from Michael DB6NT were visible in the latest 2007/2008 catalogue:
400W 2,4 GHz SSPA - 1,5w drive 400w Out - 28V @ 50A
New G3 versions of 1296, 2320, 3400 and 5760 transverters - Addtional 10 MHz reference osc inputs! Bigger input attenuators (5w max), many with extra power out, resettable fuses. Internal stabilised osc with precision xtal heater.
More info from www.db6nt.de
Seen at FHN - BTW Plus 10 GHz mast mount transverter - based on DB6NT modules - options for QRP and QRO plus 300mm / 600mm dishes.

UK Microwave Group - Info

A reminder that subscriptions for the UK MIcrowave Group are now due. The Group was formed in the Autumn of 1999. In early 2004 it became the representative voice of the UK amateur radio microwave enthusiast after the Radio Society of Great Britain disbanded its own Microwave Committee. As a result, the UK Microwave Group took over the former RSGB Microwave Newsletter and now publishes it as Scatterpoint, which was the Group's own quarterly newsletter up to 2003. The Group is affiliated to thè RSGB and, through the Group Committee, works with the RSGB Spectrum Forum in matters of interest to the amateur microwaver. Membership of the UK Microwave Group is open to all interested in amateur microwaves whether they are resident in the UK or not. Membership benefits include the Group's newsletter, Scatterpoint, which is published ten times a year, discount on Group products, representation via the Group committee on the RSGB Spectrum Forum, fully voting rights at Group meetings, UKuG-organised microwave events in the UK such as contests and "microwave roundtable meetings", operating awards and trophies. The Group's Annual General Meeting is held, each November, at Martlesham, Suffolk. Membership enquiries and applications should be sent to the Group Secretary. A membership form is available at www.microwavers.org/ukugmemb.htm
Scatterpoint subscription rates remain unchanged again this year. * £6 for .pdf version delivered by e-mail
* £12 for printed version delivered by postal service
Europe: £15 Sterling or 25 Euros
USA and other non European countries: £20 Sterling or $35 US. Please check their website at http://www.microwavers.org for more info.

23cms Faeroe Beacon SOS

OY9JD is keen to get the 23cms beacon QRV again from OY. He is is need of Kathrein antennas due to the weather - Jon is also looking to get the other 6m and up beacons QRV too from OY and need some help. EU amateurs please assist! PA3CWN will assist in co-ordination - pa3cwn@tele2.nl

UK Microwave Low Band Contest Report - G8KQW

Please find my activity summary of UKuG Lowband Contest June 3rd from my home QTH - Beacon Hill - IO91OC.
Whilst conditions were average (as ever) the activity level was fantastic, the most stations I have worked in 1 day.
50% of my 23cm QSOs came directly from CQ calls on the band whilst the other 50% came from KST.
1296MHz 34 QSOs - Best DX GM4CXM @ 587km
2320MHz 22 QSOs - best DX G3RCM/P @ 269km
3400MHz 17 QSOs - best DX G3LRP @ 281km

Rain Scatter from TK

On June 20th 2007 there was a nice Rain Scatter opening from Corsica to central and even northern France TK/F5BUU (JN41JS) wkd on 10 GHz at 1734: F6DKW JN18CS and at 1755z F6DWG from JN19AH (997km!) with 55s/54s.

Beacon News

GB3LEF - qrv 3400.955 IO92IQ - A1A QRP 5mW ERP UFN

LA4SHF JO28UO:

1296.890	40w erp colinear south
2320.850	10w erp Log Periodic SW
3400.850	5w erp Log Periodic SW
5760.850	5w erp Log Periodic SW
10368.850	100w erp Double Horn N/S

LA5SHF JO28UX:

1296.820	50w erp 4 x diamond WSW
10368.820	20w erp 20 dB Horn SW
24048.820	5mw erp 7 dbi horn SW

VHF South America

Editor: Flàvio Archangelo, PY2ZX
py2zx_dx@hotmail.com

Radio Expeditions in Brazil

The Japy DX Group made several portable operations in different Brazilian states in the recent months. During the end of April and first days of May, 2007, the group traveled to the Caparaó National Park for climbing on the Pico da Bandeira, the 3rd highest peak of Brazil with 2891 m ASL. Equipment, antenna parts, mast and battery were carried with backpacks of the mountaineers. 2 meters 10 watts SSB with 6 elements DK7ZB Yagi provideed from the peak 31 QSOs with 740 km maximum distance by Tropo. In June the group made two different expeditions for the Brazilian 144 MHz Contest: Morro da Igreja (PV5A, GG51hv, 1700 m ASL), located in the coldest area of Brazil (sometimes with snow, fortunately not happened during this operation, but we faced winds of 100 km/h) and Pedra de São Domingos (ZW4A, GG77ah, 2050 m ASL), building with local hams one of the most competitive stations in the event (more than 230 QSOs, 40.599 km in the sum of distances), maybe even with faster winds than PV5A! Now, as the winter in Southern hemisphere is there, the attention goes toward to future summer TEP operations and related data updates. For information (in portuguese), images and videos about these expeditions, visit www.japydx.org. For Caparaó National Park check www.ibama.gov.br/parna_caparao/

Microwave contacts in Brazil

PY2BS and PY2WG made a QSO of 76 km on C Band 5,7 GHz in February, 2007 using a Kuhne transverter with 200 mW and 90 cm offset dish with horn-feed, according PU9AKN via SHF-Brazil. A similar distance (75,5 km) was achieved by PU2KCX and PY2ANE on the morning of April, 04, 2007 with RS 51 - 41 and QSB in 1,2 GHz.

Chile - Peru

Checking Willian Hepburn´s Tropo Forecast, some areas of the globe are always showing a very good index. The Pacific Coast off South America (south Peru and north Chile) is one of them. Pereira PU2WDV send us this interesting report coming from Manfred Mornhinweg XQ2FOD´s web site: "It's not at all unusual to contact peruvian stations through this repeater, over a distance of close to 2000 km. The repeater sits right inside the duct that forms stably during most of summer". The repeater cited is located in Tamaya Mountain, owned by Radio Club Coquimbo. Very few DX information came about this OA – CE path, so any data, PSE send to DUBUS. The XQ2FOD website is http://ludens.cl/Radiacti/Radiacti.html

Log from Fernando de Noronha

Now there's an online log of the PY0FF station (QTH of PY0FF/B 144,298 MHz DUBUS beacon): www.py2yp.ws/py0ff/logsearch_py0ff.php

Beacon in the city of São Paulo

Horta PY2NI is making experiences with a new beacon located inside the Sao Paulo city (GG66rk) for regional propagation monitoring with 1 Watt output and GP9 on 144,286 MHz. Future plans include power improvement and stacked halos.

BPL/PLC in Brazil

The BPL/PLC industry in Brazil is looking for the governmental recognition by ANATEL. Several VHFers are warning and discussing the subject in mailing lists, however there's a low level of national organized response by radio amateurs. Mateus PP5FMM made one great research and provided by his FTP the access for several BPL/PLC documents and studies at: ftp://www.pp5fmm.qsl.br/pub/mateus/BPL

VHF-DX Callbook

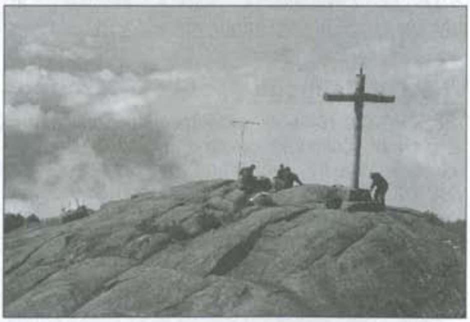
The VHF-DX Network organized one online and permanent callbook devoted to VHF and up activities. Mainly subscribed by Brazilians, the VHF-DX Callbook could be a good source for finding EME and 6 meters DX partners in rare grids. Foreigner inclusions are also accepted so submit your information:
http://creator.zoho.com/py2zx/vhf-dx-callbook/

VHF Forum

For July the first VHF Forum in Brazil is expeceted to take part at the FENARCOM Hamvention. The idea came from the Japy DX Group and the VHF-DX Network and has the support of DUBUS. Several lectures will take place focused on practical aspects of the DX for novices. More information in the next issue of Dubus. About FENARCOM: www.fenarcom.com.br

The pictures on the next side show impressions from the several 2m expeditions in 2007 mentioned above:


Pico da Bandeira
2891 m.
Brasil
PY2ZX
PY2ENO
PY2MTM
PU2WDV
GG99cn
Japy DX




ZW4A
PU2LBD - PU2NYL - PU2WSR - PY2ATA
GG77ah
CB144 - 2007
Pedra de São Domingos
Vista Sul
Camanducaia - MG


JAPY DX
PV5A
PY2ZX - PP5XX - PY2MTM
GG51hv
Pedra Furada vista do
Morro da Igreja Urubici Santa Catarina

2-m-EME News

Heinz Bordé, DM2BHG
e-mail: Heinz.Borde@t-online.de

1. CONTEST RESULTS (REF/DUBUS 144 CW Test)

EA3DXU (Josep) As many others I was QRV time to time on 21, conditions were quite good, unfortunately as always very low activity completed IK3MAC, F3VS, SV1BTR, SP7DCS, RU1AA , LZ2US heard was K5GW. On sunday 22 things went worse: heavy static noise most of daylight time, only 2 more QSOs RN6BN and DK3BU with FB sigs on a very unusual and wonderfull QSO. Heard was RW1AW, RN6MT unfortunately never heard many regulars like IK1FJI, IK2DDR, G3ZIG, OK1MS, YO2AMU sure polarity was also vertical in EA.

OK1TEH (Matej) I was happy to complete new initial on cw with F3VS on Sunday, TNX. Then I was calling SV1BTR, but qso NC and hrd LZ2US with M-T copy. For now I have in my 2m log for CW contacts only: RN6BN, IK3MAC, SV1BTR, SP7DCS, K9MRI, EA6VQ, UA6ANT, W5UN, KB8RQ, RN6MTand now also F3VS.

PA3CWI (Kees) I worked a few stations on 2 meter: SV1BTR, IK3MAC, RU1AA, F1FLA. F3VS and RN6BN. Heard: YO2AMU, SP7DCS (called him more then 30 minutes..), OK1MS, G3ZIG (tropo), RN6MT and LZ2US (called many times...not even QRZ..). Bad conditions and low activity however.. This was probably the last time I was qrv, I will sell my eme equipment and will be qrt on 2 meter eme.

K6PF (Bob) was QRV abt 3 hrs on 4/21 (betweem 1645z - 1945z) & worked 5 stations - F3VS, SV1BTR, K5GW, RU1AA & IK3MAC. Was QRV abt 2 hrs on 4/22 (between 1845z - 2045z) & worked 2 stations - LZ2US & RN6MT. Lots of QRZs today & I called YO2AMU between 2000z to 2035z. Vy weak signal & never could tell if he heard me & was calling me bk. Lots of noise, signals much weaker than normal & deep QSB. Possibly poor condx was due to higher degradation. Heard W6AT vy loud today but too strong of a direct signal to tune for echos with doppler offset. Called CQ for a short time yesterday & today but didn't hear any replies. Either not too many stations QRV or I just wasn't hearing them with all of the noise due to my limited time QRV. Still had fun. Always enjoy hearing that wonderful sound of echos off the moon.

SP7DCS (Chris) At first I would like to thank all of you for nice qsos and good fun.Unfortunatelly I could not be qrv full time. During most of NA window I was QRT. During first part of contest my echo was weak. Condx were changing and I had dificulties with reading signals also these not so weak). So, I made only 20qsos in first part. During second part condx were better for H pol stations and I had more then 20dB echos. Unfortunatelly there was not to many stations qrv.I made 16 qsos in second part. Special thanks for persistance goes to YO5BIN! I had problems with getting his callsign correct, but he insted calling me for a long time Good job and thank you.I worked: 21.04.07 RU1AA G4DHF I3EVK DK3WG G3ZIG OK1KKD YO2AMU-21dB on Winrad CT1HZE LZ2US -22dB SV1BTR-25dB IK3MAC-27dB OK1MS YO9FRJ HA0HO# F1FLA-22dB F3VS-23dB EA3DXU SM2A#? DK3EE-20dB K5GW-20dB
22.04.07 RA6DA JH0WJF LZ1DP SM3AKW DL5MAE DF1CF IK2DDR-20dB SM2CEW-21dB 9H1TX RW1AW I2RV-20dB YO5BIN# RN6MT RN6BN-30dB IV3GBO YU1CF-20dB

OZ6OL(Hans) was qrv sunday on 144 MHz and worked: IK3MAC, F3VS, RN6BN, RU1AA. Hrd: LZ2US, SV1BTR. tnx qso....only 500Watt and 13db ant. with AZand EL.

G4DHF (David) I was QRV for only six hours over the whole weekend due to QRL and the need for station repairs. I found conditions on Saturday morning quite good over a two-hour period and worked Roy, G3ZIG with good echoes. Flashes in my PA alerted me to a problem with the pre-amp c/o relays, one of which had fused o/c. A trail of black sooty smoke around the vent hole suggested some water ingress during the winter rains. I was then QRT for most of the day as I rebuilt the relay and changed the pre-amp, which had been taken-out. During my second two-hour session in the evening, I found conditions highly variable and heard my echoes only very weakly. I missed most of Sunday, but was QRV for a further two hours in the evening. I found conditions bad, with no echoes and seemly low activity. There were times, however, when the polarisation changed and there were some remarkable signals to be worked. I completed with: RU1AA, G3ZIG, SV1BTR, SP7DCS, YO2AMU (FB signal), OK1MS, F3VS, F1FLA, IK3MAC, LZ2US, RN6MT, IK1FJI.

2. AROUND 2-m-EME

SM2ILF (Stefan) I was using my contest call (SM2A) during this weakened (April) and it is no new station it's the same old SM2ILF. Worked: F3VS (CL??), SP7DCS, RU1AA, SV1BTR

IV3GBO - "2m section" -Saturday night 21 to 23GMT, found not good conditions, worked: G3ZIG, 9A9B, -Sunday: 1400 to 2300 GMT, worked: F3VS, SV1BTR, RU1AA, RN6BN, SP7DCS, RW1AW, RN6MT, SM2CEW, LZ2US, I3EVK, YU1CF, IK1FJI, HRD: F1FLA, YU1EV, RA3DA, G0FJK, CT1HZE, G4BUF, DL5MA.

PA2DW Have been looking around on 2m EME last weekend, in between other very busy activities. Worked: KB8RQ in his first JT65b CW QSO. On my side I was using the old hand key Gary :-) - G3ZIG, of course in CW. It looked like Roy first thought I was calling him on tropo, but I had beautifull copy of both his strong tropo and nice 319 echoes. Next time I call you with my KWM2 and 62S-1 Roy! :) - OK1UGA, JT65b. FB signals!

9H1TX (David) I was qrv today for 5 hours then had to qrt as usual due power line noise. Stations worked UA9SL - 17db,DJ3VI -24db initial 250 DL6BF -27db, DK3EE -15db, KC6ZWT -30db initial 251 #298, VE7TIL -23db initial 252 #299 + DXCC

SP7DCS (Chris) At first I would like to thank all for qsos.Unfortunatelly I was not able to be qrv during first part od Dubus Event- there was a thunderstorm in my qth and I was forced to turn my rig off. Before part 2 I was hunting for PJ4EME and I was lucky to put them into my log: Congratulations for whole team for successfull expedition. Conditions were very good during most of time and signals were loud. Some stations were louder than usually.
My log: PJ4EME#288 cw, 56 dxcc cw eme, OK1MS, YO2AMU, K9DX, IK3MAC, SV1BTR, F1FLA, WA4NJP#289 cw, OH6CH, CT1HZE, I3EVK, G4DHF, RA6DA, IK1FJI, SM2CEW.

SV3AAF (Petros) I was very happy to copy a good number of stations during the 144Mhz eme activity event of June 10, 2007. Have been QRV during both windows and my activity report is the following: RU1AA, JH0WJF, SV1BTR, IK2DDR, YO2AMU, OK1MS. Stations called, NOT completed: PJ4EME, SP7DCS, F1FLA. There was quite a pile-up on PJ4 expedition frequency as I could copy 2 to 3 stations on average calling during the odd minutes between 08 to 09 UTC that I was monitoring 062. Congratulations to the 10 stations that managed to work the expedition and to the organisers who devoted time to work CW-random on 2m EME.

EA3DXU (Josep) I was QRV a little time in both windous , activity was quite low and PJ4EME concentrated the CW activity in the second window. Worked: RU1AA, OK1MS, YO2AMU (FB sigs Doru), SV1BTR, Heard: RN6MT, SP7DCS, G4DHF, IK1FJI

OK1MS (Stan) during the 144 MHz EME-CW activity of JUN 10, stations worked: YO2AMU , RU1AA , SV1BTR , EA3DXU, IK2DDR , RA6DA #, PJ4EME #878 CW, DXCC 104, IK3MAC, IK7EZN, SP7DCS, KB8RQ , F1FLA , K9DX , WA4NJP, SV3AAF, G4DHF, IK1FJI, I3EVK, F3VS and RN6MT. HRD: JH0WJH, PA3CWN, LZ2US, OH6CH, SM2CEW.

3. EXPEDITIONS

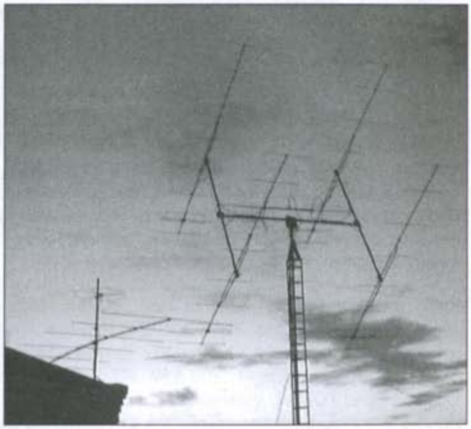
OZ7Z: Now our log and some pictures are online on www.oz7z.dk. QSL-info are also added. As you can see we had a very successfull trip, we made 44 EME qso's and 38 MS qso's, in the 30 hours we were active.

ZB2 DXPedition (Bernd DF2ZC): You can read story, view log and pictures now on
www.df2zc.de/hamradioresults/seite5/022c0a991e127580c/index.html

PJ4EME 2 meter activity from Bonaire, Netherlands Antilles

June 8 to June 25 2007 by René, PE1L and Peter PJ4/PA3CNX to FK52UD

Kralendijk Bonaire Last year, when René, PE1L read the news about Bonaire being a separate DXCC in 2007, he started talking with Peter PA3CNX, a keen VHF dx'er, who would emigrate to Bonaire. The plan was to set up moonbounce activity around the time Bonaire would be a new DXCC. This would take place on the first of July. Stations then could get two new DXCC's, one before the first of July and one after. But unfortunately for us the plan changed. By the end of 2006 it became clear that Bonaire would not be a new DXCC before December 2008. We decided nevertheless to continue our 'Moonbounceplan' from Bonaire. Peter would emigrate by end of March 2007 so from November 2006 to March 2007 there still was plenty of time to make the necessary preparations.
We finally tested our whole setup (except the yagi's) at the PI4UTR clubstation in the Netherlands at the end of February, using an 18 element m2 we already managed to work a few big gun's at moonrise and moonset.
A very big advantage for this activity was the fact that Peter was going to emigrate to Bonaire, all his household and radio stuff was going to be shipped end of March 2007 in a 40' sea container so plenty of space for a 2 meter EME station.
Peter and his xyl Inge arrived safe on Bonaire and between April and beginning of June he already made some preparations for setting up the station. Due to the fact that Peter had bought the container this was also an excellent base mount for the 2 meter mast without having to penetrate the house with unwanted holes and brackets.



PJ4EME

Another essential issue for our activity was the callsign we wanted to obtain –PJ4EME- which we wanted to use for a month. Talking to the Antillean telecom office Peter learned that it was impossible for "foreigners" to obtain a special callsign for longer then 48 hours and that this rule was specially made for HF contesters......
By explaining them more about EME and how necessary it was for us to use a callsign for a month, they came with the idea to change the callsign of a local ham resident into PJ4EME, so Peter contacted the only local ham on Bonaire his good friend, Hans, PJ4LS who brought his ham license within 2 hours and to sign the application letter. Only 4 days later the special callsign was then granted to us!
René arrived on Bonaire in the early morning of Wednesday June 6th and the first day was spent getting used to the climate and the 6 hour time difference. Thursday June 7th we got up early because at midnight the moon would rise and we already announced to start our activity by that time. Due to

good connections with the local metal construction company Peter was allowed to use the workshop for cutting the tubes for the H-frame and create 2 cross clamp brackets out of stainless steel. Other brackets, bolts etcetera where also easy obtainable on the Island or where already shipped in with the container. In the afternoon we got great help of Hans, PJ4LS and early in the evening the whole setup outside was finished. We knew we would start working some bigger stations in the first days so we decided to wait with putting up the mast pre-amp and test it in the shack first.

The setup now was : 4x 9el Wimo DK7ZB yagi of 5 meter long @ 8 meter above groundlevel, Az/El rotor Spid RAS, 15 meter Aircom Plus coax cable an ITB-1000 (1kW) solid state amplifier, a TS2000 transceiver and an Icom R9000 as a second receiver. Unfortunately both our preamps didn't come alive when we tested them (without being near any HF) and up to this day we still don't now what happened to them, but we expected that we wouldn't need them in the first coming days.

Before we really started, we fantasised about making around 100 contacts in about 30 countries in 2,5 weeks time, which turned out to be far away from reality…….

Then we had moonrise at 04:40 UTC, 00:48 local time and only 8 minutes later we made our first contact with Bouke PA0ZH, a few minutes later we worked Peter, OZ1LPR and again a few minutes later we contacted Franz, OE3FVU of course all three where a first contact with PJ4.

Now to some statistics and facts while writing this article with still two moonperiods ahead during the activation:

- At moonset on Friday June 8th already 51 stations and 29 DXCC where in the log, QSO #100 was with KD3UY.
- Apart from 246 unique WSJT we made also 19 CW contacts and 48 DXCC's (46 via the moon)
- Best QRP stations we worked were DD0VF, DG0OPK, PE9DX and OH6UW with ERP's between 6 and 12 kW (!)
- We worked at least 20 single yagi stations
- We noticed quite a few stations who didn't realize that PJ4 is a separate DXCC and not a Dutch callsign
- Different from The Netherlands our best moon conditions appeared to be from our moonrise until 40 degrees of elevation, above this elevation we could hardly copy anything.
- Using 4 horizontally polarised yagi's we still managed to change polarisation so now and then ,as the moon often reached almost 90 degrees of elevation, polarisation could be changed by turning the azimuth rotor
- After QSO #200 we started using our preamp as we got some spare GaAs-fets, sponsored by Kent Electronics (WA5VJB)
- The GaAs-fets were brought to us by N0VD (Kelly), W4PA (Scott) and K4FW (Jim) who of course attended our first Bonaire EME HAM BBQ together with Hans (PJ4LS) on the 15th of June
- Peter, PJ4/PA3CNX will stay active with his station on 2 meter via the moon, meteorscatter, tropo, Es and TEP and later this year his callsign will change to PJ4NX.

Finally we really like to thank all our callers, some of them really tried it for many days and then managed to work us. Also great thank to our sponsors which we really like to mention here:

Wimo Germany, RF Hamdesign (PA4FP), ZHTech (PA0ZH), Kent Electronics (WA5VJB), Peter OZ1LPR, Make More Miles on VHF (www.mmmonvhf.de) and our webdesigner VB2 (www.vb2.nl).

We both hope to work you again after 15 december 2008 when Bonaire will be a new DXCC!

René Hasper, PE1L and Peter de Graaf, PJ4/PA3CNX

HB0 on EME

Erwin, DK5EW, Erich, DF9UX, Stefan, DK5TE and maybe Joachim, DF1GL, will be qrv 2m EME from JN47TC in Lichtenstein with 4 x 10 ele and QRO from Oct. 6th on JT65B random only. Planned freq. are HB0(homecall) TX: 1. per. 144.116 - RX: 114.116 - 118 MHz

KP57 on 2m EME

OH6ZZ/OH8K may be active on 2m EME from KP57AQ ifrom 10.-14. August.

D44TD on 2m EME

DL8YHR and DL8LAQ will be qrv 2m EME from August 1 to 8 as D44TD (HK86no) with 2 yagis and 1 KW. QRG will be TX 144101 MHz and RX 144099 to 144101 MHz so no QRG Changes in JA EU and USA Windows. D44 will be first always. QRV moonrise to moonset.

JT Mongolia on EME

PA4EME plans to be qrv from JT in August 2008 on 2m EME with a good setup. More info later.

4. NEWs AND INFORMATION

13th Int'l EME Conference

The Associazione Radioamatori Italiani (hereafter A.R.I.), through its Comitato Regionale Toscano (hereafter C.R.T.), has started organizing the XIII international EME Conference, to be held in August 2008 in Florence, Italy. The date has been set as Aug. 8-10. As we would like to start sizing up the number of participants, we have prepared a questionnaire available on: **www.ari-crt.it/eme2008/questionnaire.html**

It would be of considerable help to us if the interested parties would take the time to fill it out and send it back to us.The answers do not commit you in any way. We appreciate the cooperation.

SV1BTR (Jimmy): With great satisfaction I saw the revised VHF General Rules by the RSGB Contest Committee. Surely a very important step forward for the advancement of RADIO during a Contest. Not Internet! Moreover, it is very interesting to see that ALL information must be COPIED off air at the time of the QSO and on the band in use. Databases must NOT be used to fill in missing information. So in my understanding, Deep Search Decoder in JT65 using the calls3.txt file, is not allowed in Contest Operation also. Check the Contest Committee web site www.vhfcc.org main page.

Below is what RSGB Contest Committee has decided:

"The RSGB Contest Committee has revised the VHF General Rules relating to the use of the DX Cluster and other spotting/chat networks (including internet facilities for example ON4KST) in RSGB VHF and UHF contests. The revised rules are listed below:

4i. The active use (posting messages, arranging skeds, self spotting etc) of the DX Cluster and other spotting networks (including internet facilities for example ON4KST) to assist an entry to a contest on 6m, 4m,2m and 70cm is banned in all RSGB contests with the exception of three IARU Region 1 co-ordinated contests (50MHz Trophy in June, 144MHz Trophy in September and 432MHz to 248GHz IARU in October) and the 144MHz Marconi contest in November where permitted by the IARU rules for these contests.You may spot a DX station as long as your operating frequency is not given.

4k. All information must be copied off air at the time of the QSO and on the band in use. Databases must not be used to fill in missing information. The DX Cluster, talkback channels etc must not be used for passing or confirming any contest related information.These revised rules take effect from midnight 30th April 2007.

To help operators understand these revised rules, a list of do's and don't are listed below:

* Do spot DX you have worked or heard when tuning the band for the benefit of all.

* Do use the DX cluster to help you find DX during the contest.

* Don't use the DX cluster to help the DX find you.

* Don't ask other stations that you work to "please spot me"

* Don't spot DX you've just worked on your frequency.

* Don't spot your fellow team member (if operating in team/multi band contests eg UKAC, AFS, VHF NFD etc)."

I5WBE (Enrico) during EME Meeting April 29th the Manager I1ANP and IW0BET have assigned the Award of the EME Italian Contest and EME Marathon 2006 to the participants, awards will be send by mail to ops who were absent, TNX for the participation.

SV1BTR (Jimmy) it is with great pleasure that I welcome to cw EME two very good friends of mine who became qrv:

Petro SV3AAF from KM17ko who came back to 2m EME after an absence of 11.5 years. Running 4*8el. and 8877, full elevation. By the end of the month he will also be qrv on 70cm EME with 4*32el. 11wl xpol and GS23b. 70cm ants are up, final touches to the system now.

Michael SV9CVY from KM25ka. Running 4*8el. H pol. and 2*12el. V pol and 2xGU74B, full elevation.

http://www.rethymno.com/sv9cvy/ (EME ants to be uploaded)

For future tests & skeds you can e-mail them direct at:

SV3AAF: pgiog@rocketmail.com

SV9CVY: sv9cvy@rethymno.com

K1JT (Joe) WSJT Version 5.9.7 (r383) is now available for free download from the WSJT homepage, http://physics.princeton.edu/pulsar/K1JT. Some of the changes from Version 5.9.6 (r309) are motivated by the recent explosion of activity using JT65A on the HF bands. Among the new features are band settings for all HF, VHF, and UHF bands; a "Quick decode" menu item especially useful for terrestrial QSOs; double-right-click on callsign to produce Tx messages with callsigns and numerical signal reports; and optional Tx frequency offset at the value of Freeze DF.

A more complete list of program changes is available at http://physics.princeton.edu/pulsar/K1JT/UpdateHistory.txt.

Installable binaries for Linux (in .deb and .rpm format) will be available soon. WSJT also runs on FreeBSD and Macintosh OS/X. As always, we would like to have your feedback -- good or bad! -- on the new version of WSJT.

VK3UM (Doug) The following 3 updates are now available from Peter www.sm2cew.com and Darrell http://www.ve1alq.com/downloads/software/vk3um.htm web sites.

1 .Transmission Line Calculator Ver 1.08

This now includes integrated Help. It has corrected a minor aberration in the parallel conductor line calculation (thanks Nando I1NDP).

2. EMR Calculator Ver 6.02

E and H parameters were inadvertently reversed. (thanks Mark VK5AVQ).

3. EME Calculator Ver 3.05

This now includes integrated Help .. more like a tutorial! hopefully this will explain just how, why and what the terms and parameters that apply to the EME Budget (and receiver System Performance) are, and how to prove or improve your system. Finally, as I mentioned in my last communication, John VK5DJ underwent extensive heart surgery and I am delighted to report is making a rapid recovery (pity he has not learnt to slow down though!). We have now completed interfacing his tracking system to my EME planner and it is undergoing final beta testing. We hope to release it this month. http://www.corprit.net/~jdrew/Amateur_radio.html

ARRL CONTEST 2007 (Joe, K1JT) On behalf of the ARRL's VHF/UHF Advisory Committee (VUAC), I write to let you know that dates and rules for the 2007 ARRL International EME Competition have been posted on the League's web site, http://www.arrl.org/contests/rules/2007/eme.html .

A number of rules changes take effect with the 2007 EME Contest. The most important ones are these:

Separate award categories are provided for Analog, Digital, and Mixed-Mode entries on the 50-1296 MHz bands. No mode distinctions are made on bands at 2.3 GHz and higher.

All active or passive use of spotting aids (loggers, DX Clusters, ...) is forbidden, with the following specific exceptions:

On the 50, 222, and 902 MHz bands, and all bands at 2.3 GHz and above, it is permissible for any station to make real-time schedules, self-spot CQs, or otherwise coordinate activities by non-EME means. Non-EME liaison of any kind is forbidden during a QSO, however.

On the 144, 432, and 1296 MHz bands separate "Assisted" award categories are offered for Single-Operator and Multi-Operator single-band entries, Mixed Mode only. These categories allow the same forms of liaison permitted on the three low-activity bands and the microwave bands. They are intended to encourage smaller stations and operators new to EME.

The dates for the 2007 contest are:
September 29-30 -- 2304 MHz and Up
October 27-28 -- 50 MHz through 1296 MHz
November 24-25 -- 50 MHz through 1296 MHz

5. ONCE THERE WAS A CHAT ABOUT

(Chats of common iterest in INTERNET)

LINRAD (W5UN, Dave): Thanks to all who have helped me so far. Progress is slow, but i do have some things working and am able to see signals on the waterfall, and hear them. My question: at www.nitehawk.com/linrad_dat/linrad_help.html there is a list of keyboard and mouse commands. The mouse commands have reference numbers, but I cannot find a screen shot of Linrad anywhere that shows these reference numbers. Does such a document exist?

***K1JT** (Joe)*: When I was learning to use Linrad I had many of the same questions that you are facing now. The answers are mostly available in the Linrad documentation and Help files, but I found it very helpful to make myself a "cheat sheet" and keep it handy on the operating desk. It is based on Leif's documentation, of course; I added things or edited Leif's text to suit my own needs. In case you or others might find it useful, I have put a copy on the WSJT web server at http://physics.princeton.edu/pulsar/K1JT/Linrad_On-Screen_Controls.pdf

A hard copy of these hints was very useful to me when I was first coming up to speed with Linrad.

4CX1000 (OZ5IQ, Kim): have set up a 4CX1000 with only filament ON, and have slowly raised (over a few hours) the votage up to the normally used ie. 5.8 V measured at the socket. How long time is nessary for achieving the "normal max vacuum"again ??

AA6EG (Pat): It is my understanding that the "Getter" effect you are looking for is not created by the hot filament, but rather a hot Plate, one that shows color due to significant current flow. The hot plate, has a coating that when hot, (The dull brownish or grayish coating on the outside of the plate.) "Gets" the oxygen from the free space in the tube by combining with the plate material... but I may be wrong... As I remember, lighting the filament, without plate voltage/current can help revive a thoriated filament (Like the 4-1000A) by increasing the filament emission by raising to the surface of the filament, the thorium component, and making for more available emission of electrons.

HB9BBD (Dominique) I fully agree with you to do this burning in. I usually let them on for 24hrs, - though I have no 4cx1000 but some Thomson TH327 and other series. It definitely pays off to clean the clima within the tube. The getter will pick up all the pollution molecules which sail within the tube. I then go for some RF and usually the tube is safe.

PA0V (Nanko): check:
http://f1frv.free.fr/main5a_Tetrode_Preparation.html

W9XA (Kermit): Yes, the initial condition of power tubes is a essential, especially for those types of construction that use indirectly heated oxide-coated heaters. One of the details is that the oxide coating tends to gett the gas from the tube and heating it even into the black-heat temperatures (where the filament is hot but below the level needed to give rise to emission) will cause the release of gasses into the tube. Also, you need to heat the various elements slowly since they will outgass at differing temps. The manner I reccomend for the conditioning of tubes that have not been operated recently or the history of which is unknwon is to use a series of methodical steps for conditioning; First raise the filament current slowly over several hours to a day,Then to let it sit for a 24 hours or more without other voltages.Then slowly raise operating voltages - a low plate voltage with sufficient bias with low plate current to start. Then a period of low drive power to the grid at a minimal level to heat the grid(s). And only then slowly increase the voltages and currents up towards the limits being VERY conservative with the tube for the first 10-20 hours of operation. To check the presence of a rough vacuum before the application of plate and grid voltages one can (with the tube disconnected from everyting else) look for the presence of a small voltage on the grid from the field emmission with a high impedance voltmeter - this will indicate that there is sufficient vacuum to establish emission. Then, if one is interested; the gas current can be measured. For triodes; forward biasing an electron flow to the grid (small current limited positive grid voltage with respect to the cathode) and a look for microamps of flow to the plate with a higher voltage which is applied negative with respect to the cathode. 100 volts should be more than sufficient. For a large triode such as the RCA/Burle 7835 it takes about 45 volts of grid, a 2c39 will be as low as a few volts).

Always be careful with your amplifier with respect to electrical safety and be vary careful with total power of that grid current during testing for gas; my advice is not to exceed more than half the grid power rating or half the amount of average grid power encountered during anticipated operation. The gas measurement is complete hyperbole for most applications, but I have constructed a test stand in the shack for this purpose (especially for 2c39 new-old stock). At work, all large tubes are conditioned similarly. If you push a tube too soon it can be counter productive. Other than the interest in measuring gas-load, it has helped me find REAL gassy tubes before I bother to try to use them.... When I measure a tube carefully I can see when you have lost ground when pushing it. Since the commercial flow of high-power tubes is lower than twenty years ago, there is a much higher probabilty that, as hams, we will encounter more tubes with date-codes that are decades old. As a matter of fact, I do not now know of a single source for timed-pulls for the 8877, TH328 or the 4CX1500... I have always tested large tubes before use because of the high operating voltages and rebuilding/replace costs involved. If you measure your tube as you follow a slow conditioning you can see an improvement as you condition the tube, with the evidence I have seen I strongly reccomend the SLOW approach. After 30 years with high power tubes I would reccomend that conditioning not be rushed I have built two amplifiers that used pulled 4cx1500's; both tubes used exhibited signs of higher gas load than I would prefer, a lot more than one would see from new tubes but they do work.

Standard cautions apply - eg your milage may vary and please use care with high voltage.

JT report (SM7BAE, Kjell) I have received some QSLs for JT QSOs. What is the group idea about the validity of QSLs for JT65 QSOs where the report either is filled in as "RRR" or "RO"? Neither is a report I am afraid, the report has been "O". Will the QSL still be valid for DXCC and other awards?

EA6VQ (Gabriel) - I suffer the same pain. It's obvious that many newcomers don't have a clear idea of what the EME report is. I also often receive QSL's with reports like "OOO", "-nn dB", etc.So far I think that ARRL is accepting EME QSL independently of the report on them, but it's always a little dissapointing when I get a QSL card with a wrong report on it, specially when it's from a DX operation. In fact, some time ago I wrote a WEB page explaining all this stuff (http://www.vhfdx.net/emereport.html), just in case someone is interested to read it.

DF2ZC (Bernd) My understanding is: there is but one! A correct report is only "O", nothing else. It can be complemented by a S/N ratio etc, but only the "O" may stand in the report box of a QSL card. However, there is something else re JT QSOs which is frequently done wrong: the mode. Very often I see as mode "WSJT", "JT65" or "JT65b". As far as I'm aware nothing of these three is a valid mode description such as SSB or CW. In QSOs with the WSJT software the mode is "MFSK" - Multi Tone Frequency Shift Keying". Actually it should even be MAFSK since the tones are audio tones injected into the mic line. I have never heard of QSL cards being rejected when somebody wrote JT65 as mode, also with DXCC.

Transco "Y" relay (W1IPL, Wilt) Hello, do any of you have a creative way of heat sinking the Transco "Y" relay?

OZ5IQ, (Kim): To make a general statement abt the Transco Y - relay, vy often used for EME. A datasheet is send to, and kindly published on Darrells, VE1ALQ HP. In general each coil is consuming : 7 W each energized!! This means the relay will be destroyed, IF NOT mounted on suitable "heatsink". The relaybody needs to be mounted on some kind of metal plate , at least 4" x 4" , 3mm Aluminium is fine, and suppports the hole system well. (I DO have destroyed a relay, before the lessen were learned years back)

AA1YN (Lee) - While I do not have any Transco relays, I do have a number of Tohtsu relays - 6 of them in my EME shack. When I designed and built my sequencer, I incorporated series resistors in the relay circuits. When I first pull in a relay, I have 13.8 volts across the relay via a FET to ground. At the same time I also tie the series resistor to ground through another FET. After 1 second, I drop the direct connection and the current through the relay is cut in half. You could apply the same technique to the Transco relays. After about 1 hr energized, I could not feel any heat on the relays. For those interested, here is a link to the current schematic of my sequencer.
http://www.aa1yn.com/projects/Sequencer_V2_schematic.jpg
There are no links from my website as I have not written this project up yet. Maybe if there is enough interest and time. The reply to address is an outgoing address only and will not accept any replies. You may contact me via my website or via the email reflector where this email originated.
http://www.aa1yn.com

Rotator G400 (M0EME, Paul) After being without EME because of a broken Azimuth rotator for what seems ages, I've got a Yaesu G400 from Ebay. While it works fine, I think it turns a little too quickly for my flimsy array of four FO19's. Am I correct in thinking your slow the rotation down by lowering the AC drive frequency to the rotor motor?? If so Is there any tried and tested methods??

WA6KBL (Jeffrey)I did exactly that when I used the 5400 az-el combination on a platform on top of my station wagon to position a 30 inch 10GHz dish while roving. Here is how I did it, and it worked very well.

1. The power transformer in the control box has two secondaries. Leave the one going to the bridge rectifier as-is. Disconnect the wiring from the other secondary going to the motor switches and modify the control box so the power input for the motor comes out the back on a connectorized cable. Add a mating panel connector to the back of the box and wire this to the transformer secondary so that you can plug the new motor plug into it and supply power while connected to the 120/240v AC mains.
2. Build a limited range sine wave oscillator, 20Hz - 100Hz, knob controlled.
3. Buy a JBL or any other cheap car stereo amplifier capable of 50w per channel. Connect the two channels in parallel and drive from the sine wave oscillator.
4. Connect the output to a step up transformer and a plug to power your rotor motor. Adjust the level from the sine wave oscillator to produce 24VAC across the motor while under load. Don't power the box from this.
5. Power the control and display portion of the rotor control box from a cheap AC inverter. It will be very low current now that the motor is not connected to the internal transformer.

F1TE (Lucien): this design work fine, see diagram in PDF file: http://www.kuhne-electronic.de/english/pcbs.htm

6. TREASURY INTERNET

ARI EME MARATHON 2006 Results
http://www.qsl.net/iw0bet/contest/EMERI2006.htm

ARI EME Marathon 2007 Rules
http://www.qsl.net/iw0bet/contest/Emeing2007.pdf

EME CONFERENCE FLORENCE 2008
http://www.ari-crt.it/eme2008/questionnaire.html

Logbook of the World
http://www.arrl.org/lotw

Sequencer:
http://www.aa1yn.com/projects/Sequencer_V2_schematic.jpg

Operation of Tetrodes
http://f1frv.free.fr/main5a_Tetrode_Preparation.html

OZ7Z
www.oz7z.dk

TF/DL1YMK – A Tri-band EME-CW-DXpedition

After last year's CT3-operation Monika and myself knew that it would be very much unlikely we could ever reproduce, rather than outperform such a highlight in our DXpedition career. Nevertheless, we were determined to carry out another moonbounce DXpedition in 2007, just for the fun of it.

Actually, after our return from Madeira we had pretty early identified an interesting destination, but the local telecom authorities refused to grant a high power license, especially for 13cm there was absolutely no way, but the operator definitely wanted to bring in the crop from his latest soldering activities with a HPA for that band. So, already in early autumn 2006 with Iceland a new destination was found, giving the opportunity to legally operate 70, 23 and 13cm at moonbounce power levels. Although TF/G4DHF had already made some 70cm EME contacts back in 1993, there still seemed to be some interest in a new initial also on 70cm.

To operate 3 bands in a portable CW-moonbounce operation in first preference is a mere matter of weight, the weight you have to pay for as air cargo to fly into Keflavik on TF-land. In our particular case this ran up to round about 220 kg, of which Iceland Air was willing to transport 80 kg free of charge after serious negotiations, carried out by my logistics manager. For the rest of it Monika found an air cargo company with, well let's say, prices that cause a collapse, but don't kill you on the spot. In this context we have to thank Joachim, DL8HCZ, who granted us a financial support of 200 Euro's out of the DUBUS DXpedition fund, which made the recovery time from the forementioned collapse a bit shorter. So thanks also to the generous sponsors of the fund.

After intense internet inquieries about suitable locations on Iceland, regarding particularly the average wind speeds (with the EI-experience in our minds...), Monika found a holiday home, which seemed to be a viable compromise in respect to moon window and a calm location, being sheltered by mountains to the East, to shield off the predominantly Southeasterly breeze(??), which was forecasted for May by windguru. The location was called Snorrestadir on the Snaefellness peninsula, grid locator HP84us. Now we have a completely new understanding of the expression 'in the middle of nowhere': the GPS navigator in our hire car insistently refused to know that spot in the outbacks of Western Iceland...just the right place for high power EME, isn't it? The holiday home, a nice little wooden house with its own geothermal hot-pot on the porch, was available from the 10th til the 25th of May, which was coincident with an acceptable moon declination and the DUBUS 23cm contest, in which we intended to take part, just as a multiplier.

Equipment-wise there still was a significant problem in late April, as I had not enough time to finish a lightweight GS35B/HV-SPS combination for 70cm in time due to my father's sudden death. So I desperately asked Bernhard Korte once again , if he would be willing to lend us a SSPA like he did in 2006. Bernhard immediately agreed, surprising me with a new concept of a compact HPA giving at least 700 W out at largely reduced weight by the use of SPS-modules instead of a linear xformer power supply, which he wanted us to field-test. Sounded phantastic, but things really grew problematic, when Bernhard seriously fell ill in the meantime. To cut it short: by inserting some nightshifts after his recovery, Bernhard managed to finish the mere prototype without any gimmicks like a sequencer just two days before we left for TF, enough time to have it express-delivered just in time – uff! When we arrived at Keflavik Airfield in the early afternoon of the 10th, our equipment was already on the island, as the air cargo company told us. After having picked up the hire car, we dropped by the customs – a mere formality, I thought. Well, unfortunately Mr. Murphy meanwhile has been retrained as a customs officer...Hence, I happened to take a glimpse of my treasure boxes in the customs storage facility, but we were told that some papers got lost somewhere in Bruxelles, and guess what: no papers, no rig released by the customs, no matter what.

We had to leave for our holiday home after 3 ineffective hours of discussions without a single alu-box. If it were only for the useless 150km-trip back to Keflavik on the next morning in a pretty bad mood without having had breakfast, but the papers still could not be found the next morning, so again no customs clearance. The whole operation just at a sudden was really more than borderline to be skipped, but I got to know at least, where the last Prussians have their home... We talked to the Iceland Air cargo department in a totally demotivated shape, and they handled the problem in a surprisingly simple way: they offered a deposit of 4000 Euros to the TF-customs as a guarantee that we would leave in 3 weeks again with the complete equipment – and only 15 min later we stuffed 4 huge alu boxes and a long plastic tube into the car. Money rules the world...

On Friday late afternoon I began to install the tripod for the dish, which was a bit difficult on a ground of thick water-soaked tundra grass. Some concrete garden tiles, we were given by our landlord, were most helpful as a platform for the tripod. We had lost a full day by then, so I tried to catch up with time and worked together with Monika till 2300UT in bright daylight (!) to finish the skeleton of our stressed dish. The first 23 cm operation was scheduled for the following Saturday morning, beginning at 0700UT. So we went to a light sleep for a few hours. At 0330UT the alarm clock brought us back to reality, as we knew we would need about 2 hours to put the meshes in and to calibrate the rotator system under normal conditions. This time span is needed in cosy CT3-temperatures with no wind, but at –1°C with wet fingers from the latest sleet shower, the panels wobbling around in a stiff breeze, it just takes somewhat longer – anyway, you have to see things positive, though: if you pierce your ice-fingers with the tie wire for the mesh panels, you simply don't feel the pain, you just see the blood dropping down...

We managed to fire up the station on Saturday morning at around 0700UT, everything seemed to work smoothly. No preamp grilled with the first dashes transmitted for an echo test, the white noise being just as loud as before, when switching back to RX. But absolutely no echoes to be detected, and playing with the rotator did not improve this result. The sun was still inaccessible behind the house, so no fixpoint for the dish heading, which I had roughly set with the aid of a compass, and of course we easily could have been off by 5 degrees in AZ alone (pretty much expected actually, in high Northern latitudes due to magnetic misorientation). For some strange reason I still could not hear any echoes, and the moon was invisible, hidden by thick clouds (so no visual pointing, either). What we needed now, was a 23cm-big gun with a signal, that cannot be overheard. In that moment, of course, there was no internet access, so Monika gave Rainer, DF6NA, a GSM-call, if he would know somebody willing to give us guidance to the moon, as DL0SHF did not answer to our SMS. Rainer actually still was in the bath room (sri), but after a short pause he proposed to contact Willi, LX1DB, to show up on the moon at 0730UT for at least 10 minutes of transmission, if Willi would be availble at all at this time (TF is on UTC!).

Well, Willi was available fortunately..... I nervously tuned around 1296.035, the designed random frequency, nothing! Getting even more nervous, I corrected the dish elevation and azimuth in small steps and you can't figure out how relieved I was, when I heard Willi, LX1DB, calling for TF/DL1YMK, first with a faint, but then with a smashing signal on our random frequency, giving us a beacon to lead the blind to the moon. We exchanged 559/569 in the very first mb-QSO on 23cm from TF at armchair copy, well done, Willi, tnx so much! On this first day of 23cm operation we made 19 initials, mainly random, because most of those caught us before their designed sked slots of the following days, not too bad. The last one to show up in the US window was Bruce, K0YW, who was just back from his great DXpedition to Hawaii.

If you take a look in the log for the reports exchanged, you see pretty good signal levels in average. On our TX-side we adjusted the depth of the dish for optimum illumination with the septum feed, as we had learned from the CT3-event. The biggest impact on the RX-side, however, surely was due to a HB9BBD-made preamp, which was used for the very first time in TF, and helped to a large extent to compensate for the –5dB attenuation of the operator's left ear, hi!

There were no more takers from the US, so we decided to stop after numerous unanswered CQ's, in order to explore a little the nearby area around the Snaefellness glacier. The trip brought us all around the coastal line of the peninsula, mainly on incredible dirt roads, which slowed our 4WD down to some 30 km/h, but it was all worth it for the breathtaking views of a widely untouched, very harsh wilderness. Thus, it took us much longer than originally expected to find our way back home, and we arrived no earlier than 2345UT, however, again in bright daylight. We set the alarm clock for 0500UT, as we had to change the feed and the station for the announced 70cm activity on Sunday morning.

Changing the feed was a matter of less than 10 minutes, although the windscreen of the car was totally frozen, the frost making the ½" cellflex TX-coax hard as a waterpipe, quickly followed by implementing for the first time ever the BeKo prototype HPA into the rest of the station. The mains fuse fortunately did not trip (much better than CT3), because of the soft start feature of this 11 kg beauty. Due to lack of time to test it, I got no idea, if it would fit within the time slots of my homebrew sequencer, but a first shy TX test revealed that everything obviously was fine and the 70cm LNA survived in good shape. All systems were go to make our enterprise a dual-band event, ready for rock 'n' roll!

In the forefield we had asked Jan, DL9KR, to give us a beacon on the moon at 0600UT, in case we really would manage to get operational – and to avoid any heading uncertainty of the mighty ugly dish. We made it right in time and it still should last some more minutes until the moon would come up behind the mountain ridge to our East. I heard Jan immediately, but he was not as loud as usual. Jan's signal actually can't be missed, even with a grilled LNA as attenuator, so I used the time of his call to finetune the heading calibration once again. The BeKo test amp was putting out all it was capable of, when I called Jan. He immediately came back with an O report, which we could improve to 559/549, when the moon got a bit higher, easy loudspeaker copy, that's the way we like it...

After this 70cm number 1 QSO I started to call CQ, as we had communicated to start again with random operation, as we did before on 23cm. And it truly worked out fine that way , the next one to call was Stig, OZ4MM. We made an easy QSO with O/O reports, which was followed by random contacts with UA3PTW, G3LTF, SM2CEW, DK3WG, PA3CSG, F2TU, HB9Q and OE9ERC. Most of the signals actually were at least 549 level, but I prefered to stay with the TMO-system, because our TX-side still was marginal, although noticeably improved against CT3.

Unfortunately there was absolutely no response from the US, which reveals the general situation of 70cm random moonbounce these days. At around 1030UT we faced a sudden increase in windspeed to more than 20m/sec with even stronger gusts, which forced us to tie down the dish and stop operation, as we did not want to risk anything at this point in time. This should happen repeatedly during the following days, mainly at this daytime... Again we used this time-out for touristic sightseeing in Borganes, a small town 40 km East of our location. Other than promised by our service provider, we had a very unstable wireless internet access, and if at all, it was slow GPRS rather than UMTS.

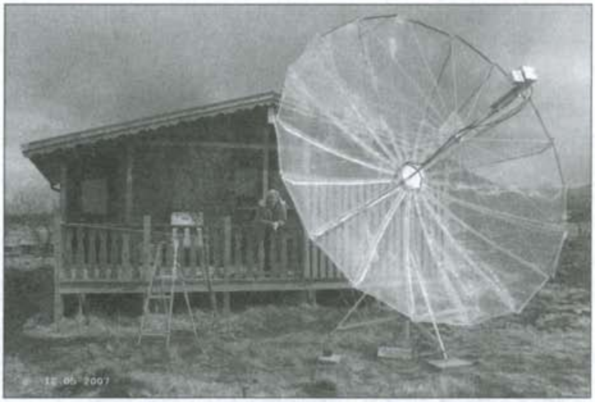
So we took the laptop with us and while we enjoyed an earlier diner in a fish-free kind of grill restaurant, we uploaded a first summary of our activity to DF6NA's reflector and to K1RQG. This procedure was to be regularly repeated the next few days of our operation, leading to a, well let's say, modest type of diet, clearly dominated by 'Austurburger' (Icelandic derivative of a Hamburger with reindeer meat) and chicken wings – at least no fish – so I was happy...

On Monday morning, 14th, we were still on 70cm and completed 3 more contacts with DL7APV, LX1DB and K2UYH. Al should remain the only US-station on 70cm, what a pity. Unfortunately we only had a partial with the OK1KIR-boys at M/M-exchange, but could not complete with them. We again spent some more time with CQ's, but again no takers, which confirms that we definitely need even more power to attract attention of potential takers. Next winter's project, that's for sure...

As far as I could find out, the QSO's with OZ4MM, UA3PTW, HB9Q and LX1DB are first ever TF's on 70cm. Maybe someone knows better?

As Philippe, F2TU, was about to leave for his holiday, he could not make it for the planned 13cm activity slot on Thursday 17th, so he had asked us by mail, if we could just try with him on this Monday, his very last chance. If positive, it would make Phillipe the first tribander with TF. Well, no problem, as a complete band change with our portable set-up just takes 20 minutes maximum, and off we go....normally. Hmm, now I can confess it in the public: all components of the 13cm system have been developed and optimised separately on the workbench. Again, due to lack of time they had never been tested together, nor had I made a 13cm mb-QSO before. In the very last week before our departure I had implemented a 2nd LO to be able to work crossband with the US-boys. You may imagine now, how I felt, when I switched on the 13cm gear.. I activated the preamp, but no increase in noise – shit! Something was wrong, but what the heck was it?? I thoroughly checked again all the cables from the transverter to the sequencer, and immediately saw the problem, I had swapped two coax lines.. If I would have tried toTX with this fault, this Dxpedition would have stayed a dualbander for sure. I quickly corrected the cables, and bingo, the LNA worked. That was very, very close to game tilt....

It just took me a minute or so, to find Philippe's signal and I could not believe how strong he was-incredible! It was a comfortable 559 exchange, a little later we switched to SSB, and this worked also, whow! Not bad for a system that never has been stuck together before, isn't it? In the afternoon we had another sked with Willi, LX1DB, and this worked also brilliantly, making Willi another tribander, congrats! (Willi, did anybody notice you'd been off from work for a while?? We keep it amongst us...) I was just happy – we had made this thing a real triband moonbounce activation, despite this nasty winds. Oh, I just would like to work a few more on 13cm now....Will the WX hold up?



Although our enquiries about the average wind speeds on TF's southwest coast had predicted moderate winds from easterly directions in May, we have had all the way through northerly winds til then, which increased to at least very strong winds with gusts in the afternoon. Whenever we had a 'lift' on GPRS, we logged in to vedur, the official Islandic meteorological site. When we did that in early afternoon, Tuesday 15th - we had changed back to 23cm and made 19 more initials meanwhile – the situation looked by far from optimistic: a depression was expected to move in from the South, bringing South-storm for Wednesday and Thursday. This definitely would urge us to dismantle the dish, as it was not shielded by the log house from this direction. In this case we could not be on for the 13cm activity on Thursday 17th, a bankholiday for most of Europe. We drove to Borganes and dropped a note on this oncoming bad WX on Rainer's moon reflector, asking all stations having skeds with us for Thursday, to come onto 13cm already on Wednesday, whenever possible. A big thanks to those flexible 13cm operators, it really worked out fine, as by the end of Wednesday we already had logged a total of 10 stations on 2320/2304 MHz. Shortly after his 559/569 brilliant random QSO Alex, RW1AW, called us on the cellular phone to say thanks for a new initial and to confirm from the internet that a big front was going to move into Iceland with average speeds of more than 20 m/sec. So our decision to change to 13cm one day earlier got another confirmation.

During the last QSO with Stig, OZ4MM, the dish was already pushed back and forth heavily by gusts, so that the screw anchors of the tripod slowly were torn out of the muddy ground. Hopefully the rotator would manage this stress... In a so-called panic dismantling action we removed the meshes within some 20 minutes, just in time for the depression front. I must say the cooperation with Monika in this respect has widely improved since EI, as she did not get any bump on her frown this time...

Later, when we looked at the dish skeleton from the diner table, it was rocking incredibly although naked now, but we both felt somewhat relieved, the more as we really made it on 13cm for the first time.

The next two days we spent relatively relaxed with touristic activities, including a whale watching tour from the port of Stykkisholmur and now we didn't bother too much about the howling storm. Well, others did even more, as 90 % of the passengers were feeding the fishes on that little boat tour on the open Atlantic....the anti-nausea-tablets, which were distributed by the staff on entering the vessel, obviously being absolutely ineffective in a 10+ meter surf. Yippeeeh!

The last milestone for our DXpedition now still was the promised participation in the 23cm DUBUS-contest, beginning the 19th. Saturday morning it still looked pretty rough, but vedur promised the winds to calm down later. No real surprise, they didn't, but we decided to put the meshes back, even though it could kill the dish, so we took the full risk. Around noontime we were back on the moon on 1296MHz, with pretty good echoes this time. Monika stood out in the cold for more than 4 hours, clinging on to the rear centerpole of the dish, just stabilizing the little rocker a bit in the gusts, which were accompanied by heavy sleet showers. Thus, I gave out the TF-multiplier to another 24 stations, and we even managed to change back to 13cm for a while in the afternoon to complete another 4 QSO's, when the storm suddenly was calming down a bit. Now the 2nd LO proved to be a good bargain, working crossband with the US-boys.

Actually the last QSO on 23cm was done with Doug, VK3UM, on the long path to the Northwest, as we had no common window on the normal path to the East, because of mountains, which cost us at least 12° of elevation. We were just beaming through a little tree, tied back with a rope, at 3 ° elevation, but it worked smoothly at 559/559 levels. Doug even managed to make a soundfile of this contact, tnx agn Doug!! Unfortunately we lost Trevor, VK4AFL, before completion, as the window closed for us rapidly. Sunday night the storm increased again at its best, so early in the morning we decided to stop the operation by dismantling the dish, because we might need it once again, despite the fact that the contest was still on, very sorry!

The last week of our TF-land holiday we started a trip all around the island, seeing huge lavafields, volcanos, glaciers, picturesque harbour villages...and more whales. We even made an exciting ski-doo excursion on top of Vatnajökull-glacier (...and I succeeded to flip the sledge, but this is another story).

We managed to make a total of 94 QSO's via moon, which comprise 13 initials on 70cm, 53 initials on 23cm and another 14 on 13cm. More than 30 country firsts were done with our portable mb station. You may find the detailed logs on the preliminary site www.dl1ymk.de, which was kindly uploaded by Rainer, DF6NA (mni tnx agn!). The score includes two JT65C QSO's with SM5LE and GM3SBC, in which i.e. plain text was transmitted, just for the credit of the dedicated CW-OP (Sven, glad we made it this time!).

This 2007-DXpedition was even more demanding for the crew (and the material) than the rough 2005-EI-trip, but we dare to say now, it was a very successful moonbounce operation, moreover we think it to be the first ever triband EME-DXpedition. The rig worked flawlessly without any defect whatsoever, thus the strictly modular and portable EME-concept for (up to now) three bands paying off. The 2nd OP was cooperative as always, even with nearly frozen fingers, tnx my dear! Now you know, what the hot-pot was meant for...

We do thank all moonbouncers, who gave us their attention, and we apolopize to those we could not dig out of the noise. Maybe next time from ...??? 73/88 de Monika & Michael, DL1YMK

EME News

70cm & up

Editor: Bernd Wilde, DL7APV

Intro: The last months focused 23 & up. The Dubus contest, several good expeditions from KH7X, TF/DL1YMK, OY/DL3OCH, BY4RSA made a boost on higher bands. On 432 K2UYH was in HI, but with little success. GB50EMJ appeared on 70 from with a good signal.
The EME Dxpedition **Found** was given to half and half to DL8YHR & DL1YMK for their 432 MHz activity and is closed.

TF/DL3OCH on the road EME

ARRL Contest Dates

September 29-30 2304 MHz and Up
October 27-28 50 MHz through 1296 MHz
November 24-25 50 MHz through 1296 MHz
Some important **rules have changed** for the 2007 EME Contest, see 2m EME news.

432 MHZ

In June **CW Activity period** were a lot of stations qrv like: GB50EMJ, W8TXT, KL6M, SM2CEW, DK3SE, SM3AKW, KE2N, PA3CSG, VK4AFL, SV1BTR, UA3PTW, DL9KR, SV3AAF, OZ4MM. SP6JLW, EA3DXU, G4RGK and some more.

GB5EMJ: Dave, G4RGK, reports that those active on 70 cm EME on 16/17 June weekend may have heard or worked GB50EMJ. This was a Special event station set up to provide uplink capabilities to the Jodrell Bank Literary Festival celebrating 50 years of the Lovell Telescope, www.jb.man.ac.uk/viscen/events/FirstMove.html.
The main focus was to uplink the audio from the auditorium to the Moon where it was then received by the Lovell Telescope (Earth-Moon-Jodrell) and replayed to the audience in the Auditorium. Those of you who were pointing at the Moon at the time will have heard some strange sounds transmitted on LSB as the poems were read in succession and relayed to the Moon.. During free time CW EME QSOs were made with VK3UM, DL9KR, SM2CEW, UA3PTW, DL7APV, OZ4MM, KL6M, SV1BTR and SM3AKW using the uplink station. All station heard/worked will be sent a special card from Jodrell Bank.

GW8IZR: Paul is QRV on 70 cm with 4 yagis and a GS23 PA. He has worked HB9Q and heard VK3UM and is looking for skeds on CW.

OK3RM is a new station on 432 MHz with 4x38el. 300W. Zdenek is looking for skeds JT/CW.

SV3AAF [KM17]: I was very happy to be back on EME after 12 years of inactivity mostly thanks to the motivation from my good old friend SV1BTR and of course QTH conditions allowing me to have EME antennas without bothering anyone! I have been active during both slots on June 17th '07, 432Mhz Dubus EME activity event and following is the abstract of the log: VK3UM, KL6M, DL9KR, UA3PTW, OZ4MM, DL7APV. In this first run of the 70cm EME system I found out that 1st priority improvement is needed at the RX audio side and I have already started working on it. 73, GL de, Petros. Rig 70cm: 4x11wl crossed yagis, 0.4dbNF preamp, GS23

WA9KRT is trying to get act together on 70 cm with 150 W and 8 yagis. Don has worked DL9KR thus far.

1296 MHz

More HAM Spirit !
What Trevor reports took place also on other bands. Guys please reduce your **elbows and be a real HAM with ham spirit !! Else stop tx**
In my sked with KH7X which had been arranged about two weeks ago. I came up on time only to be greeted by someone else on the frequency trying to work Hawaii so I waited & then someone else called. Later the frequency suddenly went clear for a few seconds only to be occupied once again by no less than 3 stations echo testing. I put out a call & at last I heard KH7X calling me but before I had even a chance to go back absolute bedlam broke loose with at least 4 EU stations swooping in over the top of me [two of them prominent operators] which of course completely ruined any chance I had of completion. The sked list has been published EVERYWHERE in recent weeks so there was no excuse for not knowing who was scheduled at what time. This behaviour is very disappointing & totally unnecessary. There are

more stations out there than I thought that simply want the contact without any consideration to others whatsoever. 73`s, Trevor, VK4AFL.

CT1BYM Miguel from IM58 will be qrv on 23cm EME soon with a 3.2m dish and a few 100W.

GM3SBC Ed is a new station on 23 cm using a 3.2 m dish, circular patch feed and a 125 W SSPA. He worked a number of stations during the Eur EME contest on CW and can also operate JT65. Ed is interested in skeds and can often be found on the ON4KST EME reflector

OK1KIR wkd on 19th April LX1DB, OZ6OL, F2TU. On 20th April RW1AW, WA5WCP #234, G3LTF, G4CCH, AL7RT #235, KL6M, hrd WB2BYP. On 21st.April KH7X #236, DXCC 46, BL field and 1st KH6; OK 23 cm QSO. On 12th May we worked HB9BBD, RW1AW, TF/DL1YMK #237, DXCC 47, HP field 37 and 1st TF-OK 23 cm QSO. In EU contest we worked on 19th May IZ1BPN # 238, OH2DG, TF/DL1YMK, SM3AKW, AD6IW, 20th May AD6IW via east window! ES5PC, BY4RSA JT65C 1st BY-OK 23 cm QSO, VK3UM, DL4MEA #239, DJ9YW, JA6AHB, G3LTF, RW1AW, IW2FZR, OZ4MM, GW3XYW, SP6JLW, LA8AV, SM5LE, RW3BP, ES6RQ, K5JL, W2UHI, OZ6OL, IK2MMB, K4QI, VE6TA, K2UYH, hrd : F5HRY, F5JWF & W7UPF. Vy 73 Jan, ok1vao for team

RW1AW wkd May 11 with his new DUAL MODE feed in focus: DK7LJ 58/58 SSB, HB9BBD 58/58 SSB, G4CCH 57/56 SSB, OK1KIR 579/579 CW, F2TU 58/57 SSB, TF/DL1YMK 569/559 CW, BIG EU pile-up on QRG TF/DL1YMK DXpedition TNX Michael for nice DXpedition! SM3AKW 579/579 CW, IZ1BPN 579/579 CW # - new initial. 73 Alex

23CM Dubus CW Contest:

EA3DXU: I am glad to completed my first EME QSO on 1296 MHz. Josep completed his small 1296 set up (2x35 el M2 + BBD preamp & 70W) very easy see Howard G4CCH calling CQ on 1296.065, then started sked with Howard and we completed after some periods, big drift in my Tx signal, make very difficult to decode at G4CCH side. I see a long job to stabilize my Tx signal, for make posible a better decode, but I am sure I can do some QSOs with medium/big stations on JT65C and sure I will be able to hear on CW. I am really happy for this QSO now QRV on EME on 3 bands 144-1296 73 de Josep

F5JWF: Good activity with a lot of new stations. I worked: VK3UM, OK1CA, HB9Q, OZ4MM, OH2DG, G3LTF, G4CCH, HB9BBD, IK2MMB, IK1BPN, K5JL,K4QI, VE6TA, WA6PY. I have had a problem with my Tx driver and my output power decrease to about 70W. Thanks to WA6PY and OZ4MM who make their best to detect my signal with such low power. Conditions: 3.7m 120W in the focal point NF=0.7dB. I expect to be QRV on 2300 for the fall ARRL contest with about 200W Best 73's to all / Phil

G3LTF: This was a great weekend of CW activity, lots of stations on the band, WAC in 10 hours operating and several new appearances. I worked 52 stations with 46 prefix multipliers. It was fun to work many old friends and also the following new ones, RW3PX, AL7RT and AD6IW. Got-aways were OE9ERC, UA3DJP, W2UHI, JA8ERE, JA4LJB, ON7UN and a partial with RA3RCC, I lost him before getting my final Rs. Yes there was some QRM but we can cope with that most of the time with a good audio filter and some paitence. Thanks to all for the QSOs and the fun. 73, Peter

RW3BP: This year we participated as multi operator QRP station. Second op was Dmitry RA3AQ. Dish was the same as before - partially extended 2.4m offset with equal diameter abt 2.8m. But it was new feed and new preamp. The feed is two mode horn with step section and improved septum polarizer designed by RA3AQ. Preamp is HB with NE334 in front. It gives from 2 to 3 dB improvement in S/N. Sun noise to cold sky ratio improved from 10.5dB to 13.6dB for SF=75. System temperature is better then 30K. As a result 500W (GS34) with 1dB coax loss was too small power. There were few stations we called many times with no reply. Heared and called was SM5LE, LA8AV, NA4N, JA8ERE, PY5ZBU, F5JWF, PA3CSG, W7UPF. Finally we worked 44 stations. As a prize was TF/DL1YMK on random. Thanks to all. 73! Sergey

SM5LE: Fantastic activity and a great weekend. Made 18 QSO:s with my 2.2m dish ! Sorry that I missed those who called me, I need to have more CW practice I noted. Did no SSB QSO - do not know if my PA is linear enough. have to check .73 Sven. 2.2m dish 250W @ feed, 0.4 dB NF

SP7DCS: After a long hard work I am happy to announce my first SWL success on 23cm CW EME. I managed to put up 3m solid dish with Septun Feed. I had 4hours of time during Dubus Contest, but managed to hear: HB9Q, HB9BBD, OH2DG, HB9SV, K2UYH, K5JL, OZ4MM. All signals were good and some of them were just HUGE. First trial I am satisfied I could hear the first signals on 23cm eme. I hope to make better feed mounting, improve my RX and finish gi7b PA. Chris

UN8GC: Mike is planning on being the first station on 23 cm from Kazakhstan. Mike has a septum feed and an IC910. He is looking for a LNA and PA. mike.chirkov@un8gc.com

VK3UM: The highlight of the 23cm DUBUS 2007 Contest for me was in working Michael and Monica TF/DL1YMK. The contact was even more memorable for it was accomplished via the 'long path' during our very limited window. The other difficult QSO was with RA3RCC. It took ~30 minutes to complete given his Tx problem with drift, FM and Chirp. But we made it by sheer persistence! I also had several SSB chats during periods of diminished activity. Again the activity during my window was a lot less than those reported else ware as being active. Wkd VE6TA, AD6IW, K2UYH, K5SO, JA8ERE, JA6AHB, VK4AFL, KL6M, ES5PC, RW3BP, RW1AW, SP6JLW, OK1CA, HB9QGE, OZ4MM, SM5LE, HB9BBD, DL4MEA, IW2FZR, JA4LJB, OH2DG, JA4BLC, G3LTF, F5JWF, 20th May 07 TF/DL1YMK via long path, K5JL, K4QI, WA6PY, N0OY, ES6RQ, IK3COJ, OZ6OL, IK2MMB, RA3RCC, OK1KIR, HB9SV, DL4DTU, VK4TL. 73 Doug

W7UPF: This was quite an EME CW contest this past weekend. I have never heard so many signals on 1296. They were covering each other. With my 3 meter dish and only 200 watts output power I had a hard time making contacts but I did confirm a few: OZ4MM, OK1CA, G4CCH, RW1AW, VE6TA, LA8LF, G3LTF, W4QI. My "waterfall" display was showing many signals and I copied lots of calls and called them but they were quickly "covered" by several at the same time. I enjoyed the contest.

ZS6AXT: Ivo is back on 23 cm EME: With the great help of ZS6CBQ my EL drive works at least temporarily. I am not sure for how long this fix will last. It was running on Friday prior to contest and my measured sunnoise was only 12 dB! At least the output power was close to the old value. With no visible moon on Saturday, it took me a while to find the moon. I was very pleased to hear and work OZ4MM followed by OH2DG, G3LTF, OK1CA, ES5PC, SM3AKW, SP6JLW, JA4BLC, RW1AW, LX1DB, HB9Q, DL4DTU, IK2MMB, TF/DL1YMK for initial #218, HB9SV, IW2FZR, HB9BBD, VE6TA, IZ1BPN #219, K5JL, K5SO, K4QI and G4CCH, and on Sunday OZ6OL, IK3COJ, JA6AHB, RW3BP, OK1KIR, JA8ERE #220, LA8AV, GW3XYW, G3LQR, ES6RQ, K2UYH and AD6IW #221 for a total of 35 contacts. CWNR were K9SLQ and DL4ZA. Also heard were W2UHI, PY5ZBU, ON4BCB and LA8LF plus others. During both days, I had very strong gusty winds from an approaching cold front and on elevations below 15 degrees to the west had very strong QRM - like "falling stones" that completely wiped out PY5ZBU, who probably called me. We have few commercial coms towers in that direction and I never experienced such noise before on 23 cm. Despite the poor RX performance, I worked four new ones. It will take some time to get back on 13 cm, but I am working on a 3 cm EME dish; the equipment is ready. (I am also working on extending my tropo record on 24 GHz, no EME here, sorry). And that is all from here... I am bit better after my doc finally listened to me and examined my lungs, which I complained about. Now he agrees that they are not right and gave me inhalator, which greatly improved my performance. But, I cannot expect miracles, hi.

2304/2320/2424MHz

IW2FZR: wkd in April F2TU cw&ssb, G3LQR, OE9ERC. big signals much activity for me. many tnx for qso.

OK1KIR wkd: Apr 21: ES5PC, F2TU, IW2FZR #61, OH2DG, OZ4MM, DL0SHF #62, OE9ERC, G3LTF, RW1AW, DL4MEA, G3LQR, HB9SV, IK2RTI, SM3AKW, OH2AXH, VE6TA, NA4N, WD5AGO, WA6PY, K2UYH, WW2R and KL6M #63, Apr 22: W5LUA, LX1DB, K5GW, OK1CA for total 26 QSOs. Hrd: VE4MA O/QRZ, JA4BLC 549 fb but due to local QRM on 2424MHz no QSO. Wkd 22.5. in initial sked WA5WCP #66. 13.6. JT65C on 2301.965 MHz VK7MO O/O -18/-25 for 13cm JT #1, first VK-OK 13 cm EME QSO, QE field and new OK ODX 16383 km. It seems that there is the fourth frequency sub-band on 13 cm in VK. For all we had problem with QRH ~ 120 Hz during one JT period + mutual Doppler, we were able to decode Rex signal. 16.6. We worked again at 05:40 VK7MO O/O -15/-18 after improving of stability of our Local Oscillator. Alternation of mutual Doppler was only several Hz in one JT65C relation. The QSO was very easy. We were in QSO for almost one hour. Signal went down to no visible trace on waterfall and back up to -20 dB because of trees on Rex site. Vy 73 Jan, ok1vao, for team

13cm DUBUS contest

DL4MEA did 14 QSO in the first half. I sadly saw that the activity on 2320MHz was high until the moon became visible over N.A. At this moment all stations changed to 2304 and forgot 2320 totally. I could really switch off. Additionally I worked OE9ERC ,W5LUA and WA6PY and second pass. Actually a little bit disappointing from N.A.'s side. This is a total of 17 stations. Heard, but not answering on my 2320MHz calls were: HB9SV, K2UYH, WW2R, K5GW. Thanks a lot for the fun of the contest, and if I may issue a wish: Please improve your crossband behaviour! Probably we can say: As long as you have not worked G3LTF, G3LQR, DL0SHF and DL4MEA (I do not know who else has the limit), always listen on 2320MHz.

Rig: 4.5m dish, 150W@feed, 10dB sun noise 73, Günter

DL0SHF wkd on 23cm KH7X on his CQ. On 13cm I found activity in the beginning very poor, main reason was that I was searching the lower part of the band - simply forgot about the center of activity higher in the band. I worked DL4MEA, OK1CA, RW1AW, F2TU, OK1KIR, OZ4MM, ES5PC, IW2FZR, G3LTF, RW1AW again (SSB), NA4N and VE6TA. Hrd but not wkd were OE9ERC, IK2RTI, HB9SV and OH2DG. I was listening for JA4BLC, JA8IAD, JA6CZD and JA8ERE but nothing was heard. Station is a 6m solid dish and about 300W at the feedpoint. Sunnoise with a SFI of 68 was 14.5dB. Carsten, DL6LAU

F2TU: It was the best contest on 13cm. I had replaced the old W2IMU by a septum with circular flare (RA1AQ design). The results are excellent for my F/D = 0.53. I mdae 31 QSOs. TX/RX classification: 2320/2320(9): ES5PC, DL0SHF, IW2FZR, OZ4MM, DL4MEA, G3LTF, G3LQR, SM3AKW, GW3XYW. 2320/2304(1): HB9SV. 2304/2304(19): OK1KIR, OE9ERC, RW1AW, IK2RTI, OH2DG, OH2AXH, NA4N, VE6TA, WD5AGO, WA6PY, OK1CA, K2UYH, KL6M #58 First qso from Alaska on 13cm. WW2R, LX1DB, VE4MA, W5LUA, K5GW, WA5WCP #59, 2304/2424(2): JA4BLC, JA8IAD . 73 Philippe

G3LTF: Firstly, this was again a very good weekend for 13cm, QRV over 30 Stations. I believe and overall stronger signals as the SSPAs start to make an impact. There is frustration in having to work crossband and on the downside QRM from WiFi etc. I worked 2 way on 2320MHz the following. OZ4MM, ES5PC, F2TU, OK1KIR, RW1AW, DL0SHF, DL4MEA, OE9ERC, SM3AKW, G3LQR, OH2AXH, IW2FZR, VE6TA, OK1CA. Cross band to 2424 MHz JA8IAD, JA4BLC Cross band to 2304 MHz HB9SV, OH2DG, K2UYH, KL6M, WA6PY, WD5AGO, W5LUA, WW2R. Heard and not called NA4N, K5GW CWNR VE4MA, WA5WCP, IK2RTI, Active but not heard, LX1DB. Tnx for the good QSOs and the fun. 73 Peter

IW2FZR wkd: OK1KIR, ES5PC, OK1CA, HB9SV, F2TU, DL4MEA, DL0SHF, OZ4MM, RW1AW, OH2DG, G3LTF, K2UYH, OE9ERC, SM3AKW, OH2AXH, VE6TA, G3LQR, W5LUA, K5GW, KL6M. I am happy for new band, strong signal for all unfortunately small time on radio for job many thanks to all for fun 73 de Dario

OK1KIR worked in EU contest on ES5PC, F2TU, IW2FZR #61, OH2DG, OZ4MM, DL0SHF #62, OE9ERC, G3LTF, RW1AW, DL4MEA, G3LQR, HB9SV, IK2RTI, SM3AKW, OH2AXH, VE6TA, NA4N, WD5AGO, WA6PY, K2UYH, WW2R, KL6M O/O for #63, DXCC 23, BP field 1st KL7-OK 13 cm QSO. 22nd April W5LUA, LX1DB, K5GW, OK1CA. Unfortunately we were not able to QSO any JAs due to local QRM S 7-9 on 2424 MHz from local community WiFi network. On 24th April we worked KH7X 449/449 for #64, DXCC 24, BL field, OK ODX 12044 km and 5th continent. Our moonset was 2 minutes after QSO with Bruce. On 16th May we worked TF/DL1YMK 549/549 for #65, DXCC 25, HP field 19 and 1st TF-OK 13 cm QSO. Vy 73 Jan, ok1vao, for team

RW1AW made 27 QSO and two initials: OE9ERC, HB9SV, OK1CA, IK2RTI, F2TU, DL4MEA, DL0SHF, G3LTF, OK1KIR, OZ4MM, ES5PC, OH2DG, IW2FZR, OH2AXH, SM3AKW, VE6TA, NA4N, WA6PY, K2UYH, KL6M #, G3LQR, W5LUA, WD5AGO, LX1DB, K5GW, VE4MA #, WW2R. I made breaks in Contest QRV for work on 1296 and 5760: 6cm QSOd: JA4BLC#, IK2RTI, DF9QX, hrd JA6CZD, 23cm: fast random QSO with KH7X DXpedition Tnx all, 73 Alex

VE6TA: Definitely one of the best 13cm weekends I have experienced in my limited time on the band. Condx were good for the most part. As well as a dx-pedition and lots of new activity really got things cooking. Wkd: WA6PY, OK1KIR, HB9SV, ES5PC, RW1AW, G3LTF, DL4MEA# 32, OH2AXH #33, SM3AKW, DL0SHF #34, F2TU, OK1CA, OE9ERC, OZ4MM, OH2DG, NA4N, KL6M #35, K2UYH, WW2R, WD5AGO, JA4BLC, IW2FZR #36, G3LQR, W5LUA, K5GW, VE4MA. Hrd were: LX1DB, WA5WCP. I understand IK2RTI, GW3XYW, and JA8IAD were on but perhaps not in the NA window. I felt my new homebrew round septum feed with large scalar ring was well worth the investment as contacts were much improved this year. After the contest I had the extreme pleasure of working WA5WCP and KH7X #37. My appreciation goes out the group who made this dxpedition take place. 73's Grant

3400/3456 MHz

VK3NX: on 22nd May 2007 I completed my first QSO on 3.4 GHz EME with Willi LX1DB. Sigs: 529 /559 (and a very FB and quick QSO!) Rx needs work!! I think this is the first VK contact on 3.4 GHz EME and I am very pleased to be on a new band. I have a lot of work still to do, to optimise the system as I am only just hearing echoes. Hopefully improvememts will come quickly and I can work similar sized stations as mine soon. 73 Charlie. 3.7m dish, 110W, 0.73 dB NF, 10 dB Sun noise, 0.28 dB Moon Noise, CP

June 16/17 Activity Period

G3LTF: This was a very rewarding weekend of eme experimenting and operating. I wkd VK3NX,

OK1KIR, LX1DB, G4NNS, VE4MA, W5LUA & OK1CA. This made 10 QSOs and 6 new initials over the weekend. Rig 6m dish, 30W. 73 Peter

G4DDK: Many thanks to all those who were on 3.4GHz. Hrd were G3LTF, OK1CA, W5LUA, and LX1DB. Seen on Spectran and heard briefly, G4NNS. Only G3LTF and LX1DB would have been workable with my present rx system. G3LTF was 419 and LX1DB 529. Rig 2.3m KTI prime focus. 73 de Sam,

OK1CA wkd LX1DB cw & SSB 57/55!!!, OK1KIR, VE4MA, G3LTF, VK3NX. Total 9 QSO, 8 stations. The contacts with LX, VE and VK is first from OK on 3,4 GHz. Thanks all activity stations on 3,4 GHz, it is very nice weekend for me. 73 Franta

OK1KIR: wkd G3LTF O/569 for #1 and OK1CA O/549 for #2, we heard VK3NX O and own echoes. On 3456 we had better echoes than on 3400 - sri no license. We used 4.5 m solid dish with horn and possibility to rotate with polarization, TX with 20W out. RX 3400/3456 MHz with bad LNA about 4 dB noise. Hopefully we will be back soon. Vy 73 Jan, ok1vao, for team

VK3NX: wkd W5LUA, G3LTF & OK1CA. Hrd OK1KIR. Due to moon declination I had a very small window. I can Rx on 3456 if required (Tx ONLY on 3400). 3 new initials makes for a lot of fun! 73 Charlie

W5LUA: I would tend to agree that shooting for 3400 MHz would be better than 3456 MHz since it does appear that all countries who have 9 cm so far can operate down at 3400 MHz. It was a fun weekend but I still have feed work to be done. I was able to work G3LTF on both 3400 and 3456. and I also worked G4NNS, OK1CA, and VK3NX on 3400 MHz. Best 73 Al

For more info abt 9cm EME see:
http://www.moonbounce.info/3400.htm

5760 MHz

F2TU : First Eme qso with DF9QX this morning on 5760 MHz 529/529. At DF9QX, obstructed a little by the roof of a house and here by the top of a tree on a small part of the dish. DF9QX: 1.8 meter dish and 65 Wout. F2TU: 7.8 meters dish, 32 Wout. 73

RW1AW wkd April 15 first DL/RW QSO with DF9QX 539/529, Matthias, TNX for nice QSO and new initial on 5760. 6m dish, 120W in CP VE4MA feed, 0.65dB LNA vy 73 Alex

10 GHz

F5VKQ: we made it! First contact VK3NX and F5VKQ, 16. April at 05:00 UTC. Both signals are 519 to 529, excellent on frequency, thanks to GPS and Rubidium lock. VK3NX 3,7 meter dish and 25 Watts, F5VKQ 3,1 meter dish and 35 Watts ! F5VKQ STBY for skeds: F5VKQ@wanadoo.fr Thank you Charlie !! 73 to all of you de Hermann, ex DC9UP

IK2MMB: For the pleasure of it, I'd like to inform you about a successful 10GHz EME qso between myself and IQ4DF. The interesting thing is that I used my home-made mesh dish that normally I use for 1296. The antenna is doing quite bad in 10 GHz but I still evaluated a 40dB gain which is equal to a 5 to 6% efficiency only for a 12 foot dish. After few failed attempts, on April 1st we were able to have a full qso. The qso merit goes to IQ4DF of course with all those gears on their side, but I'm still very proud of it. The receiver here is pretty 'sharp' with a 0.65dB NF in WG, the power used was only 27 watts. Both the receiver and tx are unfortunately behind a 0.5-0.6 dB waveguide loss (for now).

KA8ABR: Today Jim and I worked W5LUA and IQ4DF from WC8VOA for our first contacts since getting the station on the air. Unfortunately, we missed F2TU due to some problems on this end. 73 Mike

OK1KIR worked on in EU contest on 25th March OK1CA, VK3NX, #34, IQ4DF, F2TU, SP7JSG, RW1AW CW & SSB! Vy 73 Jan, ok1vao, for team

RW1AW wkd April 18 WC8COA random fast QSO with good reports 539/539, #. TNX Jim - very fine signal, BK QSO and new initial! I heard also very loud signals from F2TU and DF9QX. vy 73 Alex

Expeditions

DL3OCH/BY4RSA: Bodo adds another of firsts on both JT and CW with his China dxpedition (Loc. OM92FA): I worked 4 stations on CW: HB9Q, OE9ERC, OZ4MM and F2TU. The 1.8m dish (100W RF) makes a big difference ~5 dB). I also worked in Eur most of the regulars on JT65C: DJ9YW -22 dB, G4CCH -19 dB, HB9Q -14 dB, etc. In NA only W5LUA was QSO'd with a -22 dB signal. Also wkd in JT65C: PA3CSG, G4CCH, OE9ERC, OK1KIR, ES6RQ, ES5PC. You can not imagine what interest our activity has created. When we first started EME operation there was somebody from the newspaper, a team from a TV station and a lot of local hams. Michael, BD5RV told me that he has been snowed in with e-mails and congratulations directly from the President of the Chinese Amateur Radio Club. Michael told me that our activity created a huge interest. They want to become active on EME and not just 23 cm, but also 2 m and 70 cm. I gave 2 lectures about EME.

They have applied for the call sign BT4EME and have located a huge dish for a special activity, similar to 8N1EME.

BY4RSA dish and operating position (DL3OCH)

D44TD on 70cm EME DL8YHR and DL8LAQ will be qrv 70m EME from August 1 to 8 as D44TD (HK86no) with 2 yagis (20dBD) and about 50W.

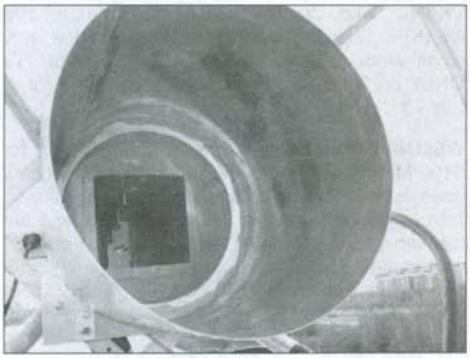
KH7X: Bruce (K0YW) is to be congratulated on an extraordinary EME dxpedition. He completed 60 QSOs with 49 on 23 cm and 11 on 13 cm from Pupukea, Oahu, Hawaii (BL10xp). The QSL manager for KH7X is K2PF, Ralph Fariello, 23 Old Village Rd, Hillsborough, NJ 08844-4008 USA.

OY/DL3OCH and TF/DL3OCH: Bodo had a very successful trip to OY and TF – He writes: I QSO'd from OY/DL3OCH in IP62nb the following stations: HB9Q, G4CCH, DJ9YW, PA3CSG and OE9ERC. This operation was pretty difficult because of heavy fog. The moon and the sun were not visible. Additionally my compass stopped working. Also the operation time was very limited due to the ferry schedule. I arrived the following day in Iceland. It is a wonderful country. Unfortunately I forgot my antenna mast in OY. I used road signs as a mast. The weather was very nice. It was very warm, the moon was visible and there was no wind. I was able to work the following stations in JT65 from IP15it: OE9ERC, PA3CSG, G4CCH, OH2DG, HB9Q, DJ9YW and K2UYH; and from HP95up: OE9ERC, PA3CSG, G4CCH, OH2DG, DJ9YW and K2UYH.

WY6G: Herb and I tried our best on 70 cm, but it seemed that the stars were against this dxpedition from the beginning. Many problems occured like we had to move the dxpedition from 23 to 70 cm, the sun and moon were very close, no luck locating a high power SSPA for 432, ended up using my old 7650 PA, which created considerable complications. Then the equipment was damaged in shipping (my TS2000 was nearly lost). The worst problem was the unexpected birdies and noise. The .030 sked frequency had to be abandoned. The noise was worst when pointed west and we never heard a signal in this direction. We may have had a tracking problem as I later discovered that the wind had caused the yagi's U-bolts to slip Our object was to make both CW and JT QSOs, but we had problems with JT and never decoded a signal even though we copied CW signals. Wkd were HB9Q, OZ4MM, KL6M, K0RZ. I left with WY6G the yagi, Heliax and the 7650 PA. Herb plans to get on 432 and also eventually 1296 EME. I am sure he will make it.

WY6G 13 wl yagi – operating shack is on left

Last



RW1AWs new Dual mode feed

RW1AW is using a new **DUAL MODE** feed for lon focus dish. That's not a original OK1DFC or W2IMU design, but from RA3AQ, Dima and calculated from RW3BP. Tested from RW1AW on 13 & 23cm. More info you find on: http://www.vhfdx.ru description of stepped dual mode horn with square septum for 23cm band. There are sizes, simulation results, construction details and tips to compensate mirror reflections.
Link for download .pdf file is:
http://www.vhfdx.ru/component/option,com_remository/func,fileinfo/id,220/ than click on download icon. For 13cm band:
http://www.vhfdx.ru/component/option,com_remository/func,fileinfo/id,219/ . After several measure sessions Alex is sure this feed will give him eff of ~ 0.75

REF / DUBUS EUROPEAN EME Contest 2007 - CW Results *by DL8HCZ*

144 MHz

Place	Call	Points	QSO (+Sked)	Multi	Pwr OP
1	SV1BTR	262200	57	46	QROSIN
2	IK3MAC	234600	51	47	QROSIN
3	F3VS	215000	50	43	QROSIN
4	SP7DCS	118800	36	33	QROSIN
5	LZ2US	105000	35	30	QROSIN
6	G3ZIG	95700	33	29	QROSIN
7	YO2AMU	84000	30	28	QROSIN
8	I3EVK	42000	21	20	QRP SIN
9	SM2CEW	34200	19	18	QROSIN
10	OK1MS	28900	17	17	QRP SIN
11	RW1AW	24000	16	16	QROSIN
12	DL5MAE	22500	15	15	QRP SIN
12	IK1FJI	22500	15	15	QROSIN
12	CT1HZE	22500	15	15	QROSIN
15	IK2DDR	16900	13	13	QROSIN
16	G4DHF	14400	12	12	QRP SIN
16	JH0WJF	14400	12	12	QRP SIN
16	RA6DA	14400	12	12	QROSIN
19	EA3DXU	6400	8	8	QROSIN
19	LZ1DP	6400	8	8	QROSIN
19	YO5BIN	6400	8	8	QRP SIN
22	K6PF	4900	7	7	QRP SIN
23	9A9B	2500	5	5	QRP SIN
23	ON4DPX	2500	5	5	QRP SIN
23	PA3CWN	2500	5	5	QRP SIN
26	OZ6OL	1600	4	4	QRP SIN
26	SM7WSJ	1600	4	4	QRP SIN
28	4X1IF	900	3	3	QRP SIN
29	SM3AKW	400	2	2	QRP SIN
30	G3LTF	100	1	1	QRP SIN
30	JA0BZC	100	1	1	QRP SIN
Checklog	RU1AA		54	48	

432 MHz

Place	Call	Points	QSO	Multi	Pwr OP
1	KL6M	136800	38	36	QROSIN
2	UA3PTW	115200	36	22	QROSIN
3	OZ4MM	105400	34	31	QROSIN
4	SV1BTR	96000	32	30	QROSIN
5	G3LTF	92800	32	29	QROSIN
6	G4RGK	81200	29	28	QROSIN
7	VK3UM	81000	30	27	QROSIN
8	SM2CEW	70400	23	22	QROSIN
9	JA6AHB	65000	26	25	QROSIN
10	SP6JLW	60000	25	24	QROSIN
11	VE6TA	55200	24	23	QROSIN
12	FR5DN	55000	25	22	QROSIN
13	SM3AKW	46200	22	21	QROSIN
14	OH2DG	38000	20	19	QROSIN
15	OZ6OL	34200	19	18	QRP SIN
15	SM3BYA	34200	19	18	QRP SIN
17	W8TXT	22500	15	15	QRP SIN
18	DL9KR	21000	15	14	QROSIN
19	RW1AW	19600	14	14	QRP SIN
20	EA3DXU	14400	12	12	QRP SIN
21	F3VS	12100	11	11	QRP SIN
22	F2TU	11000	11	10	QROSIN
22	SM3JQU	11000	11	10	QRP SIN
24	RW3PX	10000	10	10	QRP SIN
25	I5CTE	6400	8	8	QRP SIN
25	YO2IS	6400	8	8	QRP SIN
27	JA9BOH	4900	7	7	QRP SIN
28	DL4MEA	3600	6	6	QRP SIN
29	VK4AFL	2500	5	5	QRP SIN
30	JH0WJF	1600	4	4	QRP SIN
31	G3LQR	900	3	3	QRP SIN
32	SP7DCS	400	2	2	QRP SIN

1296 MHz

Place	Call	Points	QSO	Multi	Pwr OP
1	OZ4MM	317200	61	52	QROSIN
2	K5JL	269500	55	49	QROSIN
3	G3LTF	243000	54	45	QROSIN
0	AD6IW	234600	51	46	PRO MUL
4	VE6TA	220000	50	44	QROSIN
5	K4QI	201600	48	42	QROSIN
6	ES5PC	185640	44(+2)	42	QROSIN
7	SM3AKW	184000	46	40	QROSIN
8	RW3BP	167200	44	38	QROMUL
9	RW1AW	166500	45	36	QROSIN
10	G4CCH	163400	43	38	QROSIN
11	OH2DG	155800	41	38	QROSIN
12	KL6M	144300	39	37	QROSIN
13	IW2FZR	136000	40	36	QRP SIN
14	SP6JLW	122100	37	33	QROSIN
15	VK3UM	117800	38	31	QROSIN
16	ZX6AXT	105000	35	30	QRP SIN
17	IK3COJ	104500	34	21	QRP SIN
18	OZ6OL	93000	31	30	QROSIN
19	WA6PY	92800	32	29	QROSIN
20	ES6RQ	89900	31	29	QROSIN
21	K5SO	84100	29	29	QROSIN
21	LA8LF	84100	29	29	QROSIN
23	OK1KIR	78400	28	28	QRP SIN
24	IZ1BPN	78000	30	26	QROMUL
25	JA6AHB	75400	29	26	QROSIN
26	DL4MEA	72800	28	26	QRP SIN
27	JA4BLC	70000	28	25	QROSIN
28	TF/DL1YMK	55200	24	23	QRP SIN
28	HB9BBD	55200	24	23	QROSIN
30	JA8ERE	46200	22	21	QROSIN
31	DL4DTU	42000	21	20	QRP SIN
32	ON7UN	40000	20	20	QROSIN
33	SM5LE	30400	19	16	QRP SIN
34	W2UHI	24000	16	15	QRP SIN
35	PY5ZBU	21000	15	14	QRP SIN
36	F5JWF	19600	14	14	QRP SIN
37	G3LQR	12240	10(+2)	12	QRP SIN

38	NA4N	8100	9	9	QRO SIN
39	JA4LJB	6400	8	8	QRP SIN
40	RA3EC	4900	7	7	QRP SIN
41	W7UPF	4900	7	7	QRP SIN
42	RW3PX	900	3	3	QRP SIN

2300 MHz

1	F2TU	83700	31	27	SIN
2	OK1KIR	62400	26	24	SIN
3	VE6TA	59800	26	23	SIN
3	ES5PC	59800	26	23	SIN
5	G3LTF	57500	25	23	SIN
6	OZ4MM	55000	25	22	SIN
6	RW1AW	55000	25	22	SIN
6	SM3AKW	55000	25	22	SIN
9	IW2FZR	34000	20	17	SIN
10	KL6M	28900	17	17	SIN
11	OH2DG	27200	17	16	SIN
12	DL4MEA	23800	17	14	SIN
13	G3LQR	19500	15	13	SIN
14	WA6PY	18200	14	13	SIN
15	WD5AGO	12100	11	11	SIN
16	DL0SHF	11000	11	10	SIN
16	NA4N	11000	11	10	SIN
18	WW2R	10000	10	10	SIN
19	JA4BLC	6400	8	8	SIN

5700 MHz

1	F2TU	12100	11	11	SIN
1	OK1KIR	12100	11	11	MUL
3	RW1AW	8100	9	9	SIN
4	ES5PC	2500	5	5	SIN
4	WD5AGO	2500	5	5	SIN
6	JA4BLC	1600	4	4	SIN

Results 10000 MHz

0	OK1CA	27000	18	15	SIN	PRO
1	IQ4DF	25600	16	16	MUL	
2	RW1AW	16800	14	12	SIN	
3	F2TU	14300	13	11	SIN	
4	HB9BHU	10000	10	10	SIN	
5	F5JTA	5600	8	7	SIN	
6	G4NNS	4900	7	7	SIN	
7	F5VKQ	3600	6	6	MUL	
7	OK1KIR	3600	6	6	MUL	
9	SP7JSG	3000	6	5	SIN	
10	F/DJ2DY	1600	4	4	SIN	
11	F3VS	900	3	3	SIN	
12	WA6PY	400	2	2	SIN	

MULTIBAND

1.	RW1AW	1.863.900	QRO	SIN
2.	OZ4MM	1.522.500	QRO	SIN
3.	G3LTF	1.342.600	QRO	SIN
4.	VE6TA	1.134.000	QRO	SIN
5.	SM3AKW	1.020.000	QRO	SIN
6.	KL6M	999.999	QRO	SIN
7.	OK1KIR	786.600	QRP	SIN
8.	ES5PC	732.780	QRO	SIN
9.	F2TU	713.900	QRO	SIN
10.	OH2DG	693.500	QRO	SIN
11.	SV1BTR	676.400	QRO	SIN
12.	IW2FZR	424.000	QRP	SIN
13.	VK3UM	394.400	QRO	SIN
14.	SP6JLW	353.400	QRO	SIN
15.	F3VS	381.900	QRO	SIN
16.	DL4MEA	312.800	QRP	SIN
17.	WA6PY	281.000	QRO	SIN
18.	OZ6OL	280.800	QRO	SIN
19.	JA6AHB	280.500	QRO	SIN
20.	JA4BLC	192.400	QRO	SIN
21.	SM2CEW	180.000	QRO	SIN
22.	SP7DCS	133.000	QRO	SIN
23.	G3LQR	120.960	QRP	SIN
24.	WD5AGO	51.200	-	SIN
25.	NA4N	58.900	QRO	SIN
26.	EA3DXU	40.000	QRO	SIN
27.	RW3PX	16.900	QRP	SIN

Congratulations to all winners:
SV1BTR on 2m, KL6M on 70cm, OZ4MM on 23cm, F2TU on 13cm, OK1KIR and F2TU on 6cm, IQ4DF on 3cm and RW1AW on Multiband!
We thank all participitiants for their entries!
Activtiy on 23cm and up was hbetter than in previous years! On some bands there was taking place a real hard competiton.
AD6IW (2m) and OK1CA (3cm) were running professional equipment thus outside the ranking.
Certificates will be sent out in August.
73 Joe, DL8HCZ/CT1HZE

Soapbox

OZ4MM: Great conditions and activity on 1296 and 2320 this year. Sure helped by the expeditions. Couldnot get time to set up the 144 MHz station this time, but will be back. 73 Stig

RW1AW: Many thanks for the UFB contest, I wkd for the first timer ever in a contest on 6 bands: 2m - 70cm - 23cm - 13cm - 6cm - 3cm. 73 untill 2008, Alex

SM2CEW: Unfortunately I could not be QRV on 1296 due to very strong winds the whole weekend. However, I enjoyed every moment of this contest, making random CW EME contacts. It is a pleasure to dig into the noise and look for calls, many thanks to all who participated! I will be QRV on 2.3 GHz later this year, so looking forward to making some noise there in next years contest, adding a new EME band to the score. 73 de Peter SM2CEW

SV1BTR Once more, a great EME WW Contest by DUBUS-REF! I enjoyed myself very much working 89 CW EME

RANDOM QSOs in total, on 2m and 70cm. I look forward to next year's fantastic event with the aim to be qrv on 3 bands meeting old and new cw friends. This year's totals account for 11 QSOs less than last year, but still vy happy considering the unfortunate shift of nowadays operators to jt65 eme being 300 times (-25db) easier than cw; jt65 mode has apparently degraded eme due to the continuous use of internet chat rooms, non stop skeds, self spots, etc.
Finally, I would like to congratulate the organizers for making a Contest entirely devoted to RADIO Random operation and NOT Internet.'

VE6TA (70cm): Had an enjoyable time again this contest despite the substantial ionospheric disturbance at high latitudes and the shortfall in active stations. The auroral effect caused polarity spreading at low elevation angles and and extreme QSB on the weaker stations. Despite this, I managed to work 3 new initials to bring me to 122 on this band.

F2TU: The best contest since 2000 on 5.7Ghz. 11 qsos including initials: BigDish 8N1EME ssb 59/59 # 22, JA4BLC O/O # 23 (2.5m - 20w), WD5AGO O-529/O # 24 (2.5m - 25w). At my moon rise, the first qso with 8N1EME was 559/559 with my dish blocked on more than 60% by the mountain !
The surprise was JA4BLC qrp, unexpected on 6cm, in random. On 10GHz, 12 qsos. All already contacted. But disappointed not to have qso with VK3NX who was obstructed by trees for my window, IK3RTI not qrv (too many wind) and W5LUA its broken relay on 5.7 & 10GHz. To hold 1 day for the 5.7GHz and 1 day for the 10GHz is excellent. It's a pity that all did not follow. On 70cm, only 1 hour qrv with 11 qsos.

FR5DN: All the best and tks again for organizing the contest, as it is always a GREAT time for me, alone with no vhf/uhf dx around, hi! Vy 73 and all the best for all work with all scores. Phil - FR5DN

IK2DDR (2m): Hello, many thanks for organizing a so good Contest. I fully agree your rules. Unfortunately this year i have been active for only a couple of hours, but enough to confirm me that CW still my preferred mode and it still able to give me lot of "old emotions". I wish you all lot of succes on organizing the next contest. 73' de Francesco

SP7JSG (10 GHz): Thanks for all for fine fun and see you next contest!!! vy 73! Czeslaw

YO2IS (70cm): Was glad to run the contest again. Variable and strange conditions. Lots of CWNR, happy to work 4 continents in a single contest, including two rare spots FR5DN and KL6M, always with QRP and EL > 40 degrees. Best 73 & DX, cu via Moon, Szigy

IW2FZQ: Good the participation in the 1296 MHz contest. Much qsb for sun in my location, however signals were strong. The contest on 13 cm has been very positive, experience from 23cm has been useful. For the next year I hope of being active also on the 5.7 GHz. Many thanks to all for big fun in the contest. 73 Dario

SM3AKW: It was great fun especially the 1296 section, but also 2.3 is now getting populated to make us OT on the band happy!! 432 is not what it used to be and needs boosting!
Anyway I think the EU EME contest has found the right form now. Congrats!! Thanks everybody.

VK3UM: I was unfortunately unable to stay for my NA window on Saturday 24th March due to extremely high winds (>80kph) that came with a cold front just after I commenced operating. I had a nervous 20 minutes or so attempting to raise the dish to the parked (bird bath) position as the wind was even two strong for the two 12 ton hydraulic rams to get it past the 30 degree mark. The noise of the wind roaring through the mesh was quite alarming but the dish survival was theoretically never in doubt as the construction is designed for 125 Mph, but one never wishes to prove the point!
The conditions were the worst I have experienced for a very long time. Polarity was changing rapidly and over a wide range, deep fading was evident for the whole period as well. On top of all that Libration was most significant as well. It required considerable patience with the smaller stations to wait until polarisation and QSB combined favorably. There always is a thresh hold where signals above 4 yagis and 1kW, for me, are normally easy to work, even under such conditions but those below that EIRP pose a challenge with my installation. I learnt later from Peter SM2CEW that there was considerable Aurora activity .. that came as no surprise! I did not get the opportunity to measure Sun noise but I would expect it to have been quite elevated.
I regretfully have to make mention about the lack of activity from NA (in my single window) was the worst I have seen in > 20 years. Two USA stations was a little disappointing.
As usual the operating procedure and patience shown by all the operators I worked was just exemplary. And thats what I enjoy most about this mode of EME, the total random nature of all QSO's, and the technical challenge of physically making the QSO's under adverse conditions with no outside electronic help. There was only one caller I failed to drag from the noise and that was between 1111-1135z on Sunday 25th. Who ever it was, thanks for your persistence but my apology for not making it. (7 c z ?) Final claimed tally this year was 30 QSO's, 27 multipliers for 81,000 points.
Best wishes, 73 Doug VK3UM

RW1AW – Multibandwinner 2007

Sporadic E
144 MHz – Reports

All QSOs with "59 59" reports unless otherwise noted, hrd = also with 59, times UT

May 27

G4RRA, IO80BS, wkd:
0850 7X2FB JM16MS 145.5 FM
0910 7X2RO JM16MQ SSB

OD5KU, KM73UW, wkd:
1620 IK4GMH JN54xk 2347
1620 IW3GXW JN65de 2355
1620 IN3ZTI JN55ol 2446
1620 IW4BET JN54ql 2392
Rig: 50w + 5 ele. 700 m asl
Tnx for info Elie!

May 28

EI2IP, IO61CX, wkd:
1744 9H1GB JM75FU 2511

June 2

EA1FDI/p, JN52LW, wkd:
1426 IKØOTA JN61GV 1770
1427 IK4DRY JN64BL 1705
1428 LZ2ZY KN13OT 2591
1439 I5CTE JN53XG 1700
1443 IØUGB JN62BO 1723
1452 IZ8FAV JN7ØET 1946
1456 IWØBET JN61FS 1766
1456 IW6NXR JN72EI 1910
1457 IØRHJ JN61FV 1763
1457 IKØEBA JN61HT 1779
1458 I8MPO JN7ØFP 1958
1459 IØNLK JN62HB 1773
1500 I6BQI JN72AK 1881
1501 IK7YZI JN71QQ 2005
1615 ISØGQX JM49OH 1577

EA8AVI, IL28FC, wkd:
1455 S57O 57 JN86DT 3460
1604 IK2DDR 55 JN55GN 3003
1620 I2VRN 56 JN55BB 2947
1622 I2JWV 55
1630 I5CTE 56 JN53XG 2982
1631 IV3ALA 57 JN65OX 3207
1632 IW3HRT 55JN55TG 3060
1633 IK5YJY 56 JN53 2934
1634 IZ5EME 56 JN52NS 2897
1636 I5RUR 56 JN53PD 2927
1637 IK3MLF 55 JN55WJ 3084
1643 F1PKA 57 JN29WB 2961

EA8/DL6FAW, IL18AT, wkd:
1613 S57C JN76PB 3471
1625 IK4DRZ JN64BL 3175
1626 I4RHP JN54QL 3120

LZ3GM, KN32RL, wkd:
1426 EA2AGZ IN91DV 2391
1438 EA2BFM/P IN83FE 2514

SV1BTR, KM18NO, wkd:
1422 F6HMQ JN18GP
1422 F6DKW JN18
1424 F1DUZ IN97NS
1424 F6CIU JN08GE
1426 HB9SJV JN36BK
1426 F5CT JN08KI
1427 IW2MXY JN45NO
1427 F5FLA JN26KO
1429 F5ELL JN19
1429 F1BJD/p IN98WE 2151km
1433 F6KKR JN08VP
1433 F1RYW JN18EM
1433 F0CXO JN26
1433 F6AQI IN96DW
1434 F5AOL/p JN18DW
1436 F6FTB/p JN27LJ
1436 F8BRK IN99VF
1438 F1HDF JN18IL
1438 F5DQK JN18GR
1438 F6ACA JN18SR
1438 F0DZO JN18GT
1442 F5PMB JN18GW
1442 F1GGD JN18JS
1443 F1ORL JN08VP
1443 F6APE IN97QI
1443 F6CBH JN19BH
1443 F1DRR JN18BX
1443 F0DKT JN18JR
1445 F1CBC JN09BO
1446 F1PYR JN19BC
1446 F5XE JN18ES
1448 F1JTO JN18CS
1449 F1DBE JN19BC
1449 F6GGF JN18DT
1446 F1PHS JN19DA
1453 F4BUC/p JN18GF
1453 F4DRU/p JN18GF
1454 F6FEK JN19GB
1456 F8DHV JN18DW
1456 F6DQZ/p JN19ND
1458 F8KFB JN09XC
1500 F4BXY JN18IS
1500 G6HIE IO90ST 2293
1500 G7RAU IO90IR 2341
1500 G3KHM IO91LC 2344
1504 G7HJN IO90TT 2287
1504 F6BQX IN96IS
1506 F1PWS JN06DM
1508 G3KEQ JO01BH
1510 F1JGN JN19DU
1510 F6KSU IN98HB
1510 F5XU JN15
1513 F5APM IN97HG
1513 F1DRH JN19BK
1516 F4DQK
1516 HB9DKM JN37SL
1518 F4BWS IN93MP
1520 F1AIS JN19MN
1521 F6HPP/M JN19
1521 F8DLS JN19SE
1521 F5JNX JN37PV
1525 F5LWF JN19WI
1526 F5EQR JN19
1526 F5DRD/p JO10GO
1528 F0DSH/p JO10BH
1533 F0ERO JN18JV
1546 PE1HWO JO21GV
1547 DJ9CZ JO31
1547 F1JKA JN29WB
1547 DF1VW JN39HJ
1547 F0DMU JO10KP
1547 DK8VS JN39
1551 DJ0YS JN48GD
1551 ON4POO JO20DP
1552 F6CDZ JN39BE
1552 DF2GB JN48GB
1552 ON5AEN JO10VW
1552 ON4TOR JO10TQ
1552 ON4PS/p JO20
1552 F5SE/p JN19XH
1552 TM5UTF JN38DL
1552 OR0A JO20KW
1553 ON8WW JO21KH
1559 ON4DST/p JO21NA
1559 PA2M JO21IP
1600 PA3FTX JO21DN
1601 DL3NCR JN48QX
1601 DG4FDI JN49GM
1601 DF1LON JO30EM
1601 DF3IAZ JN49EJ
1601 PD2BNH JO21LK
1602 PG1ITR JO21
1602 PA0JMV JO21QM
1604 PA3CSG JO21WD
1604 PA3CMC JO21WI
1605 DF2ZC JO30
1605 DL4FAC JN48SW
1607 OZ1CLL JO65GQ
1607 DL4DSM JN49
1607 OS4S JO11UC
1607 DL8II JN49GP
1607 ON5UE JO11LF
1607 DF4OR JN49
1610 ON4LN JO20
1610 G0KPW JO01RF
1610 DF9IC JN48IW
1610 DL1GI JN49
1610 DJ2DY JN39OI

1610 DK6HN JN48GV
1612 DK2DB JN48FW
1613 DF6IY JN48EU
1613 ON60MWV/p
1613 ON4JX/p JO10
1614 LX1JX JO30AB
1615 DL2CRN JO30EM
1615 G3LQR JO02QF 2262km
1615 ON4RST/p JO20OS
1615 G0UIQ JO02
1615 2E0BFT JO02UL
1620 DL5MCG JN58
1620 DG2KBC JN58MI
1620 DG9MAQ JN58LJ
1622 PA4EL JO21IS
1622 DL8YE JO31MH
1622 DL2VB JO31LN
1622 PA3DOL JO22MT
1624 PA3ECU JO32CF
1624 PA3Z JO21DN
1625 PA3FPQ JO22XE
1625 DO1SMC JN48WV
1625 DL1SGH JN58BU
1626 DK5SO JN58AV
1626 PA3COB JO32MF
1626 PA1GYS JO22XW
1627 DG5YIL JO32
1627 DF9NP JN58LU
1627 PD2EZ JO32EA
1629 DF6NA JN49XS
1629 PD0HCV JO31FW
1629 DL1EAP JO31IK
1630 PE2RMI JO23MH
1630 DK3EE JO41GU
1630 DM2HB JO41EQ
1630 DK5QN JO42
1630 DB3BW JO43AC
1630 PE9GG JO33NA
1630 PA4PS JO33GH
1630 PG9DX JO33MD
1631 PE1OPK JO23
1631 DF5NK JN59PM
1631 DK9ZQ JO41SC
1631 DK4U JO42FD
1632 PA3CWN JO33AH
1632 PA7V JO33IK
1632 DL6NAA JO50WF
1633 DG6JF/p JO43QN
1634 DG5CST JO60DS
1635 DK9OY JO52CK
1635 DK0VHF JO41GU
1635 DL0NF JN59PL
1636 DJ0SP JO32
1636 DL6BF JO32
1637 PA3BRI JO32LF
1637 DL1NUX JO50LE
1637 DF9YF JO42GE
1638 PA0C JO22FD
1638 DF3RU JN59UL
1643 PE1LWT JO22VA
1644 PA2DB JO22MD
1644 PA3CPI JO22IW
1644 DL8EBW JO31NF
1646 PA0PVW JO22VA
1646 PA4EME JO20WX
1646 DL6HCE JO43MR
1649 DK6AS JO52JJ
1649 DK1KO JO53CT
1649 DH2OAA JO42TU
1649 DL5AYI JO51FE
1649 DL6BBR JO43CC
1649 DL5ME JO52SD
1649 DL1AWD JO51KB
1654 DL9OBD JO42QN
1654 DL4OL JO52BC
1654 DJ5HG JO53
1658 I3MEK JN55SJ
1658 IW2DAL JN45NN
1658 DL5WG JO52VK
1658 DG4HAD JO54
1658 DH1MS JO54DD
1659 DL2SWS JO53
1659 DD9LW JO44VO
1700 DL8LAQ JO43XU
1700 DF2LH JO53AR
1703 DD0VF JO61
1703 DL7UDA JO62
1703 DL7FF JO62
1703 DC7TS JO62PO
1703 OK1NI JO70OR
1705 OZ1SKY JO56DG
1708 DD3SP JO72EN
1708 DK1CO JO63
1710 DG0KWJO64MH
1710 DH8BQA JO73CE
1710 SM7FMX JO65KN
1710 OZ1FDH JO65
1710 OZ8ZS JO55RT
1710 OZ1IEP JO55XU
1710 OZ6OL JO65DJ
1715 DL2BSK JO72GH
1715 DF7KB JO72CM
1715 OZ4VW JO54
1716 OZ7U JO45RL
1716 OZ2TF JO46PE
1716 OZ5DI JO55XX
1720 DL9MS JO54WC
1723 OZ1BNN JO55PM 2078k
1723 DG0KWJO64
1726 OZ2AGQ JO65
1726 OZ0TE JO55
1729 DO4ZH JO64MH
1732 DL2NUD JO63MF
1735 DL9GFB JO54WC

YO4AUL, KN44HE, wkd:

1531 EA3XU	JN11CK	2167
1534 F4BWJ	**IN93MP**	**2358**
1555 DL8GP	JN39LH	1739
1555 DF1VW	JN39HJ	1765
1556 DL1GI7	JN49FG	1632
1557 ON4TOR/p	JO10TQ	2003
1557 ON4PS/p	JO20KQ	1917
1558 F1CXW	JO20JC	1909
1559 DJ0MY	JN49HQ	1631
1600 DL6IY	JN49NI	1587
1612 F6REF	IN94UT	2282
1624 F1GTU	JN05IF	2198
1625 IZ1BPN	JN34OT	1695
1627 F5VHX	JN04FT	2224
1629 F6FHP	**IN92TR**	**2334**
1630 IK1EGC	JN35UF	1652
1630 F5DCG	JN25KR	1870
1632 I1JTQ	JN35XX	1630
1633 IK1SPR	JN34TQ	1664
1635 F5NTD	JN25DN	1916
1636 I2KQE	JN45MN	1547
1636 F6BEG	JN25JS	1876
1637 IZ2AAL	JN45OP	1534
1639 F4AVP	JN25JJ	1879
1640 F5XU	JN15MT	2011
1641 F6GRB	JN25KP	1870
1643 F8BMX/p	JN36CD	1765
1712 DC5TD	JN37VP	1651

June 5

EI4DQ, IO51WU, wkd:
1800 EA7AJ IM87CS
1802 EA7ERP IM87EE
1805 EA7DFH IM87DD
1841 EA6DF JM19NL
1845 EA3DXU JN11CM
1847 EA3DYS JN11CK
1849 EA3DJL JN11CP

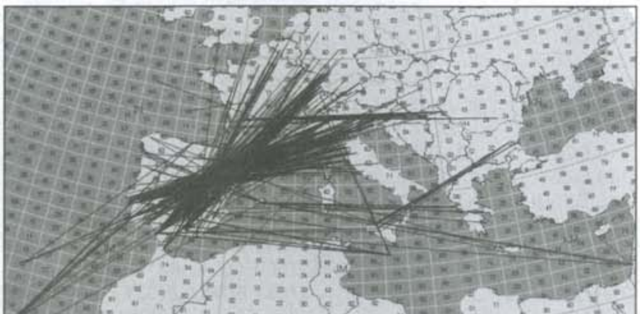
June 6

4X1UN, KM72JB, wkd:
1518 EA6VQ JM19HN 3006km
1612 EA6VQ again
1624 CT1HZE IM57NH 4008km
1607 IT9GSF 55 hrd
1600 TK5JJ for 4sec hrd
1559 IK4DRY 59+ hrd

EA8TX (EB8BTV), IL18QI wkd:

1736 F6HTJ JN12KQ y	**2366**
1756 EA6VQ JM19MP x	2197
1758 F6DRO JN03TJ	**2335**
1819 EA5EH IM99QI x	1912
1820 AO5TT IM99 y	1900
1821 EB3DYS JN11CK x	2241
1830 EB5EA IM99TN z	1943
1838 F1EIT JN03TI x	2332
1838 EA3DXU JN11CM x	2246
1847 EA1BHB IN82EH x	1944
1853 F5FMW JN13DX y	**2417**
1857 F6FHP IN94TR y	**2319**
1904 EA2TO IN83MB x	2042

1905 EB2FJN IN83QE x 2071
1906 G4LOH IO70JC x 2603
1908 F6GPT IN94SW x 2331
1909 EA1MX IN73XK y 2018
1910 EB1TT IN72SF x 1892
1910 EA1FBF IN73WJ x 2011
1911 EB1CIU IN72SF x 1892
1911 EB1ISN IN71SW x 1867
1913 EA1DDU IN73EM z 1951
1914 EA1UU IN83GJ x 2044
1916 EB1YL IN73EM y 1951
1921 EB3JT JN01UK x 2207
1923 EA4WT IN80KN x 1832
1923 EA3DBJ JN00IR x 2093
1926 F8DBF IN78RI x 2453
1929 F6CXO JN03SL y 2335
1929 F0EMK IN93GM x 2162
1932 EA4DB IN80EJ x 1789
1932 EA1GCN IN73DN x 1951
1937 F1VL JN03RX y 2366
1940 EB4EOZ IN80CI x 1775
1940 EB1EB IN83BK x 2027
1940 EB4GLF IN80EJ x 1789
1940 EA1YO IN73XI x 2011
1942 EB1DRO IN70NT x 1750
1943 EA4KR IN80ER x 1815
1954 EC4CLR IN80ER x 1815
1956 EA4EKH IN80AP x 1789
1956 EA4DEI IN80BH x 1767
1957 EB4FJV IN80CP x 1798
2000 EA4TF IM89AT x 1723
2002 EA4BDL IM69TL x 1554
2006 EA2AVM IN82QU x 2043
2007 EA1ASC IN70DX x 1719
x = 51 / 59 exchanged
y = 51 / 55 exchanged
z = 51 / 51 exchanged



Es map June 6th 2007 with 4008km QSO from CT to 4X

June 13

CT3HF, IM12OP, wkd:
1641 F1USF JN23CN 2192
1643 F4DSD JN23JO 2237
1645 F0FGC JN23MU 2267
1648 9H5L JM75FV 2882
1654 9H1IF JM75FV 2882
1732 IS0GQX JM49OH 2444
1733 I8MPO JN70 2952

EA8TX (EB8BTV), IL18QI, wkd:
1634 F4DSD JN23JO x 2552
1654 I5CTE JN53xg z 3040
1702 IK0RWD JN61gq y 3019
1702 IK0SMG JN61FS y 3016
1708 IZ0CBD JN61TT y 3109
1729 IK5YJ JN53pg x 2991
x = 51 / 59 exchanged
y = 51 / 55 exchanged
z = 51 / 57 exchanged

June 14

DK5YA, JN49NX, wkd:
0656 TA7OM KN90ux 2568
0748 TA7A KN91ua 2566

YU7EW, KN05HP, wkd:
0713 ER1AN KN46IX 638 km!!

CT1HZE, IM57nh, wkd

May 23

1620 IK0RWX JN61
1621 IK8YOQ JN70
1622 IK8BIZ JN70
1624 I8MPO JN70
1625 IK0SMG JN61
1626 I0RHJ JN61
1620 IW0BET JN61
1626 IW0FFK JN61
1627 IK0FTA JN61
1628 IZ7EUH JN81
1631 IK0EBA JN61
1631 IK7UKY JN90
1632 IZ0CXV JN
1632 IK0OKY JN61
1634 IW0DHV JN61
1646 IZ6FHZ JN72 new sq
1647 IW7EGJ JN90
1648 IK0LZR JN52
1654 IW7EBE JN71
1655 IW0WGF JN72
1656 IZ0HEL
1703 I7CSB JN71
1706 IK7HIN JN81 new sq
1707 I0JFE JN62
1708 IZ0IIY JN61
1711 IS0QGX JM48
1713 IW0DHV
1715 IZ0AIJ JN
1718 IW0RFE JN62
1719 IK6HCX JN63
1720 IZ7ECT JN81
1720 IZ7KHR JN81
1722 IW0CZC JN62
1722 9A6R JN83
1723 IZ8IBB JN70
1723 IW0HKN JN62
1725 IW0AGX JN61
1726 9A2WA JN83
1729 9A4NF JN73vs new sq
1729 I0NLK JN62
1732 9A5AVS JN83
1734 IZ5EME JN52
1734 IK7UXU JN81
1738 IZ8EYP JM88 new sq
1739 IK6TIJ JN72
1742 IK0GKZ JN61
1743 IZ0ADG JN61
1744 IW0DQJ JN
1746 IW0HLN JN62
1746 IW0DKK JN61
1747 IZ0GKV JN61
1747 IZ0FWE JN62
1749 IZ0CBD JN61
1750 IZ0CUX JN62
1751 IZ0BEE JN62
1752 IK0BZY JN61
1752 I0NNZ JN62
1754 IW0RDZ JN62
90 mins open, 57 QSOs

May 24

As so often a shorter repeat opening to the same area:
1655 IW0BYL JN
1659 IK0SMG JN61
1701 IK0WGS JN52
1701 IW0BET JN61
1710 IK0FFK JN
1710 IK0OKY JN61
15 mins open, 6 QSOs

May 27

0822 OE2UKL JN67

the only station for 15 mins….

0841	DK7LH	JN58
0841	HB0/HB3YDLJN47SC new DXCC	
0841	DL3RBH	JN68
0842	DL3RAM	JN68
0842	DL5MAM	JN68
0842	HB3YPA	JN47
0843	DK5TX	JN58
0844	DL7ULM	JN58
0844	F5FEN	JN25
0844	F4DIA	JN36
0845	IW2MXY	JN45
0846	IK2YXK	JN45
0847	IZ2AAL	JN45
0847	IZ2FOB	JN45
0847	I1JTQ	JN35
0848	IK2QDX	JN45
0848	DL9MDC	JN58
0850	DK5RQ	JN58
0851	F6GRB	JN25
0853	HB9SJV	JN36
0852	F1OMZ	JN23
0853	HB9AOF	JN36
0854	HB9TVT	JN
0854	F4AVP	JN25
0855	HB9QQ	JN47
0855	DL5GAC	JN47
0856	9A3AS/p	JN
0856	IW2NOR	JN45
0857	DC6AH	JN68
0857	I4GBZ	JN54
0858	9A3AEB	JN65
0858	F5AYE	JN36
0859	F6BEG	JN35
0859	F5AYZ	JN13
0859	F6BEG	JN25
0900	DG7RO	JN59
0901	I3MEK	JN55
0901	IN3ZTI/3	JN55
0902	DL1MEV	JN58
0903	F5RRT	JN25
0903	IW1AZJ	JN
0904	IK1EGC	JN
0904	F1BOQ	JN24
0904	DL6MFK	JN
0904	F8CMF	JN36
0905	S57TW	JN
0905	HB9TTU	JN
0906	DJ8RZ	JN58
0906	OE5GWP	JN67
0906	OE2LCM	JN67
0907	I2SVA	JN45
0907	DL2BU	JN
0908	OE5FPL	JN68
0909	9A2LV	JN
0909	HB9CZV	JN
0910	HB9RHM	JN36
0910	DG1MGZ	2.5w 4 ele
0911	F1GCX	JN25
0911	DG2KBC	JN58
0912	HB9TLU	JN37
0912	F5TIL	JN36
0912	DL5RDI	JN58
0912	DL2HN	JN58
0913	DL2AU	JN58
0913	F6DGF	JN
0914	F5RRS	JN36
0914	HB9YBQ	JN47
0914	DK1MAX	JN58
0915	IW2MXY	JN45
0915	HB9DPO	JN47
0916	F5TTO	JN25
0916	HB9ABN	JN47
0916	IW2OHY	JN45
0917	DL1GCY	JN47
0917	F8NZQ	JN35
0917	OE9MCV	JN47
0918	IW2HZN	JN45
0918	I1DMP	JN34
0918	I1BSN	JN34
0919	I1TEX	JN35
0919	F1TDO	JN25
0919	F5NTD	JN25
0920	DL2MHB	JN58
0920	DG7MHR	JN57
0920	DL6SBM	JN58
0921	HB9DWR	JN36
0921	HB9YHT	JN36
0922	HB9KAG	JN37
0923	F5DCG	JN25
0924	**OK1TEH**	**JO70FD 2343**
0924	IV3DXW	JN65
0924	DK1HE	JN47
0925	DG8MDA	JN58
0926	HB9AMH	JN37
0926	HB9DTX	JN36
0927	IV3UJT	JN65
0927	DK5EW	JN47
0928	DL9ZZ	JN47
0928	HB9BLF	JN37
0928	HB9FMN	JN47
0929	DF8MV	JN58
0930	OK1XBF	JN69nj 2213
0933	IK2GSO	JN45
0933	F1SPL	JN23
0934	HB9TRQ	JN47
0936	HB9KAI	JN47
0937	HB9DFG	JN37
0937	HB9DKM	JN37
0937	DL1SMA	JN48
0940	DC7NF	JN69
0940	DC5TD	JN
0941	DG5NFF	JN49
0941	DJ0YS	JN48
0941	DJ1TU	JN48
0942	DF1SO	JN48
0942	DG3GAI	JN48
0942	DL1YD	JN48
0943	DO9BC	JN48
0943	DF5NK	JN58
0943	DL1SGH	JN58
0944	DL4TJ	JN48
0944	DG1NSE	JN59
0944	DG7SF	JN48
0944	DJ4EJ	JN48
0945	OK1FD	JO60cf 2209
0945	F5JNX	JN37
0945	DG4NBI	JN59
0945	DL4SEQ	JN48
0950	DK5SO	JN58
0951	F6BQU	JN38

90 min open, 131 QSOs

1732	DF4OR	JN48
1732	F1DND	JN38
1733	DF5HC	JN49
1734	DL6WU	JN
1734	F4AZF	JN39
1735	DL3ATR	JN39
1735	DK8VS	JN39
1735	DL2FDL	JO40
1736	DF1VW	JN39
1736	F6VCY	JN26
1737	DL0GH	JO40
1737	F0EUI	JN16
1738	F4ACM	JN28
1739	DL3NCR	JN48
1740	DK3SML	JN49
1740	F6ACU	JN38
1743	DJ7UD	JN
1749	F1NSR	JN33

11 mins open, 18 QSOs

May 28

1418	I4GYG	JN54
1421	IK4PMB	JN54
1424	IK4CBO	JN54
1425	I3MEK	JN55
1426	S51WX	JN75
1426	9A2MF	JN65
1426	S51KK	JN76
1427	9A8A	JN86
1428	F6TOM	JN33
1429	S56IHX	JN75
1430	IV3NDC	JN65
1431	9A4QV	JN75
1431	IN3ZTI/3	JN55
1431	I2VRN	JN55
1433	IV3RIK	JN66
1434	I1SBU	JN44
1434	I4CIL	JN64
1436	IV3VCS	JN65
1436	IZ4AIK	JN64
1437	9A9C	JN85
1437	9A3RU	JN85
1437	IW4DHA	JN64
1437	I1ANP	JN44
1438	S57TW	JN
1439	IK4DRY	JN64

1439 S54O JN75
1459 9A2RD JN65
1439 S51AT JN
1440 9A3GE JN75
1440 9A2N JN85
1440 9A1UN JN65
1441 9A7SSY JN65
1441 9A2TE JN85
1441 I1DMP JN35
1441 9A4VM JN85
1442 S51ZO JN86DR 2313
1442 9A9WW JN85
1443 I4MMV JN55
1446 S51CAB JN76
1447 IK4MWA JN54
1447 I0JX JN61
1449 S54M JN86
1451 IT9VDQ JM68
1456 I5MZY JN53
1456 I2ARQ JN45
1457 IV3VKD JN66
1458 I4GBZ JN54
1458 9A6CM JN74
1459 I2PY JN55
1459 IV3IDX JN65
1500 IV3RKD JN66
1500 S56GTW JN
1501 I4ENO JN54
1502 I4BME JN54
1503 HA5OV JN97MJ
new DXCC/sqr 2541km

1504 HA1FV JN87JJ 2377
1504 DL9MDC JN58
1504 OE5UAL JN68
1506 DK5YA JN49
1506 DG0OPK JO50
1506 F6HQM JN23
1507 IC8/IK0BZY JN60 new!
1507 F1DRN JN23
1508 IK0EIE JN61
1508 HA5CW JN97PM 2561
1509 HA5UK JN97OM 2555
1512 I1BER JN
1512 HG1RJD JN87GJ
1513 IK1VBZ JN34
1523 DB8AT JO51
1532 DL8DAU JO40
1533 DL5WG JO52 new sqr
1533 DK3IK JN39
1533 DL4DWA JO61QH 2343
1533 DK3EE JO41
1536 DK9OY JO52
1536 DH4AE JO51
1536 DF5DE JO40
1536 DG6MIB JO52fg 2245
1537 DG5AAG JO51
1537 DK5AL JO51
1537 DK5E JO42
1537 F0EUE JN29
1538 DL1YAW JO41
1538 DL8EBW JO31
1538 DJ9MG JO52
1538 DG0CAI JO52XJ 2331
1539 DL0DET JO42
1539 DG0CAI JO52
1539 DL9DBJ JO
1539 DD3DJ JO31
1540 DJ9FG JO52TC 2295
1540 DL5ME JO52SD 2294
1541 DF7AQ JO51
1541 DK5RQ JN68
1542 DL1RNW JO62GH 2359
new sqr
1542 DJ3HW JO42
1543 DL8CMM JO52VM 2333
1543 DF8AE JO41
1543 DH8WG JO51
1543 DJ9DL JO31
1543 DL3YEL JO41
1544 DK3T JO41
1544 DM2DXG JO51
1544 DG2SRL JO61HN 2315
1546 DB3BW JO42
1546 DC9BG JO42ef 2136
1550 DL8YE JO31
1550 DK5QN JO42
1551 DK0VHF JO41
1551 DB8KJ JO30
1551 DL9OBD JO42
1551 DL8YE JO31
1551 DM1HD JO31
1552 DL4AKI JO51
1553 DL1EJD JO31
1553 DL7FF JO62TJ 2425
1553 DK9ZQ JO41
1553 DL1NFG JO40
1553 DD9FJ JO40
1554 DL6FBS JO40
1554 DK8FM JO40
1554 DL1RNO JO62MM 2401
1555 DH7FB JO62SM 2428
1555 DL1EAP JO31
1555 DJ9CZ JO31
1550 DK3WG JO72GI 2474
new sqr, finally after 7years…

1555 DL5AYI JO51
1555 DL7ANR JO62QL 2416
1555 DC7TS JO62PO 2420
1555 DH3YAK JO31
1556 DN3BW JO42
1557 DH6SN JO30
1557 DD4JC JO31
1557 DK1YY JO31
1557 DJ9FG JO52
1559 DK1PZ JO41
1559 DO6OTH JO41
1602 DL6BR JO31
1602 DL7OK JO31
1603 DL8AJ JO
1603 DL5FN JO40
1603 DG8NGH JO40
1604 DJ3AK JO52GJ 2258
1604 DL3BWG JO62TQ 2443
1604 DG9YIH JO32
1604 ON4PS JO20
1605 F0EUE JN29
1605 DL6BF JO32
1605 PE1GNP JO31
1607 DL6CGC JO52MB 2261
1607 DK1QC JO51
1615 DG4OAI JO52AE 2217
1616 DF2ZC JO30
1619 DK6AJ JO52GH 2252
120 mins open, 155 QSOs

Comment: Big opening with unusual distances. May 28 was a national holiday in DL and many DLs were qrv on this Monday afternoon.
Never hrd any JO52 in the last 7 years and now wkd 9 different stations plus 7 x JO62 over about 2400km and as highlight from DL Jürgen DK3WG from JO72, 2474km who waited so many years for IM57 on Es.

June 2

In the June Contest normally there are always some Es QSOs because there are so many spots qrv at the same time and voila at 1417 I hrd YU stations (2500km) calling cq contest. It was quite difficult to come trough as most of them probably were not beaming to me…

1417 I5CTE JN53
1417 YZ1RA JN94WG 2531
1422 I2PY JN45
1423 YU7EW KN05HP 2613
1424 YU7W KN05AR 2571
1424 YZ1KU KN04GS 2592
1427 YT2C JN95WG 2542
new sqr
1432 IK2DDR JN55
1434 S50C JN76
1434 S50R JN76
1436 S51SL JN76
1440 S57TW JN75
1441 IW2MXY JN45
1447 IW1FZR JN45
1448 IK1EGC JN35
1449 IW2NRI Jn45
1450 IK2DUV JN45
1451 IK2CFR JN45
1451 S51ZO JN86DR 2313

1451 I1JTQ JN35
1552 IV3JER JN66
1452 I1/HB9DUR JN
1452 IZ1ANZ JN45
1452 IK1ZOF Jn35
1454 9A4VS JN85
1455 I1DMP JN35
1455 IWNNZ JN45
1455 IK2UKV JN45
1457 IK2YXK JN45
1457 IW1EHL JN45
1457 IK2CIK JN45
1457 IK4MSV JN54
1458 IN3TNW JN56
1459 DF1CF JN57
1506 I0UGB JN62
1519 9A4QV JN75
1519 I1SBU JN44
1520 IW3HUL JN65
1521 IW3GXW JN55
1521 IZ5ILX JN43
1522 YO2LEA KN06WK 2725
1528 I4GYG JN54
1527 I4BME JN54
1528 IZ5MAO JN54
1528 I4RHP JN54
1533 IW4ARD JN54
1533 I5WBE JN52
1533 IK0SMG JN61
1534 IK0FTA JN61
1534 IK0BZY JN61
1535 IK5EKL JN53
1537 IZ5HET JN53
1538 I8MPO JN70
1554 I4KXX JN63
1550 9A6CM JN74
1556 I5RUR JN53
1557 I5CTE JN53
1559 9A4NF JN73VS new
1600 IZ5AHA JN53
1601 IK0RWX JN61
1602 IW6ASD JN62
1605 IK5/DJ2GM JN52
1607 IK5UZD JN53
1608 I5IAR JN53
1615 I6CXD JN63
1615 I5TAT JN53
1620 IZ5EME JN52
1620 9A2Y JN83
1621 IK8YOQ JN70
1621 IW0RNA JN62
1622 9A5AVS JN83
1622 IW0RGX JN62
1623 IZ0CUV JN62
1627 9A2ZH JN73
1628 IC8FAX JN70
1628 F4CKV/p JN16 totally out of direction
1630 IZ8IBB JN70
1634 TK5EP JN41
new DXCC and sqr
1635 I6BQN JN72
1636 9A2WA JN83
1636 IW0DHV JN62
1638 IZ0GUG JN61
1638 IK0EMM JN61
1639 TK5JJ JN41
1640 I0DPM JN62
1644 IS0QGX JM49
1646 IC8TEM JN70
I8EMG/B hrd

110 mins open 85 QSOs
many I/YU did not realize the Es opening to CT as they had their beams elswhere or may be got QRMed.

June 5

1536 I8MPO JN70
1538 IK8YOQ JN70
1538 IW0AIJ JN61
1538 IZ5EME JN52
1542 IK0FTA JN61
1550 IK0BZY JN61
1551 I6BQI JN72
1556 9A2Y JN83
1556 I0RHJ JN61
1601 IK5YJY JN53
1613 I5WBE JN53
1613 Ik5CQV JN53
12 QSOs, 30 minutes open

1744 M0HKB JO02OB
1744 G4FUF JO01GN
1746 G0KPW JO02RF
1747 G0JJG JO02LE
1748 F6EAS IN98LV
1748 G4CKH JO02UK
1748 G4ZFJ JO01JN
1749 G8IZY IO91VC
1749 G7RAU IO90IR
1753 G4AJC IO91VJ
1754 G4DHF IO92UU
1755 G3LTF IO91GG
1755 M5BFL IO91OO
1755 G4EZT IO92CE
1756 G4TIF IO92FH
1756 G0UKN ?
1756 G0CUZ IO82WM
1757 G1AAR JO00TT
1758 PA5DD JO22IC 55/55
1800 G0UWK IO83VC
1800 G4CBW IO83UB
1801 M0XUK IO91DP
1801 M1IFT IO93NL
1801 M0IKB IO94SG
1801 G4ROB IO93IB
1802 G4URT JO00DU
1802 G4IGO IO80NW
1802 G0NKC IO80QW
1803 G6YIN IO93ET
1804 G8GXP IO93FQ
1804 PE2RMI JO23MH 55
1805 G0HVQ IO81UX
1806 G8TIC IO82VF
1806 M0DDT IO91JR
1806 DK3SE JN37VP 55/57
scattered signal
1806 G4YPV IO93LR
1807 ON5AEN JO10VW 55/55
1807 G4PBP IO82WO
1808 M0NTL IO93FQ
1808 GW7SMV IO81LN
1809 G6HKS IO92OB
1809 M0XDX JO03DI
1809 M5FUN JO00DX
1810 PD2DB JO22MD
1810 PE2HRO ?
1811 2E0FDX ?
1811 DJ9CZ JO31BC
59 59 but scattered
1813 DL8II JN49EP
55/55 scattered
1813 DL8DAU JO40ME
55/55 scattered
1813 DF9IC JN48IW
55/55 scattered 255/10°
1813 DK3SE JN37VP <u>hrd</u>
CT1HZE 52F 260°
1814 DL3YEL JO41EV
55/55 slightly scattered
1815 DF2VJ JN39LI
55/59 slightly scattered
1816 G4FSG JO02MC
1820 DK2DR JN47ET
52F/52F 245/10°
1830 DK5YA JN49NX
53F/53F 245°
1832 HB9DFG JN37SM
52F/51F 260°
1836 DL8EBW JO31NF
52F/53F 250/55 / 15°
1839 DF9RJ JN68GS
52F/52F 255° 2148km
NEW IARU Region 1 record!

1841 PA3CWN JO33AH
559/559
1841 DL2ARD JO60AR <u>hrd</u>
CT1HZE
52F 260° 2230km
1842 PA3BIY JO22EB
1846 DK8VS JN39NF
52F/52F
1846 DK9OY JO52CK hrd
CT1HZE
41F to 51F 235° 2244km!
1850 DL0SG JN68GS
52F/52F 255°
1853 DJ4YJ JN68GS

52F/52F 255°
1856 DK4TG JO31LB
51F/52F
1858 ON7EH JO20FV
559/559
1859 DL/PA4EME/p JO20XX
52F/559 240/15°
1902 DL6BF JO32QI
41F// 53F to 529
Not complete! DL6BF Hrd CT1HZE max. 53F from 255° / 10 el. but also clear 529 at times.

The FAI-Signal from CT1HZE was hrd untill 1915 by DF9IC and DK7DR.
Several stations with 100w and one or 2 yagis were hrd/wkd by CT1HZE. This is normally not possible in "iono" mode. So this should be excluded. Beam-heading for the FAI-QSOs and the Es-QSOs from CT1HZE was 23 to 27 ° and elevation 3 °. The border where signals started to get a FAI sound was the eastern part of JO20. All east and southeast from there was pure A-tone, whilst all west and northwest from this was with clear tone.

DF5AI, Volker, comments:
This was (normal) forward sporadic E developing into sporadic backscatter (FAI, with an ideal aspect angle of 90 deg.) and finally into unusual backscatter involving aspect angles violating the ordinary geometrical rules (aspect angle abt. 80 deg, but an acceptable value).
For all QSOs the hight of the scatterpoint may be 105-110 km. The scatter area was over about 3 grid squares (IN76, 77, 78).
This was the first time such an event was noticed and recorded.

52 Es QSOs + 17 FAI/Scatter

June 6

1444 G4LOH IO70
1528 HA3GR JN86
1530 HA3LV JN97ML 2537
1531 IK5OEA JN53
1532 S57RR JN65
1533 IZ5HET JN53
1533 I5WBE JN53
1534 I1SBU JN44
1536 9A5CW JN65
1536 9A3GE JN75
1536 S57TW JN75
1536 9A1UN JN65
1537 S56HCE JN75
1540 IV3GBO JN66
1541 I4YNO JN54
1541 I4MEK JN54
1541 I1DQQ JN44
1541 IZ1EVF JN44
1542 S51ZO JN86DR 2313
1542 I4ASV JN54
1542 S52RM JN76
1543 IW2HAJ JN45
1543 YO5AXB KN17TQ 2882
2xEs new sqr
1544 YO5OHY KN17SR 2875

1545 S57GTW JN76
1545 IZ2BVP JN45
1545 I2JWU JN45
1546 YO5OCK KN16TS 2864
new sqr
1546 S54AA JN76
1548 IK0BZY JN61
1548 S54O JN75
1548 S51CAB JN76
1549 S57SU JN76
1549 I5ZSS JN53
1549 I1DMP JN35
1540 9H5L JM75
from here on my antenna was fixed to direction 4X
1552 I3PVE JN55
1553 F6EYB IN93TW
new sqr
1553 9H1ET JM75
1554 F6HZL JN23
1554 F1DRN JN23
1557 IK4PMP JN54
1557 F6EPE JN23
1558 F5MPK JN23
1558 IW1GPB JN
1558 I5TWK/8 JN70
1600 F6HQM JN23
1601 F1NSR JN33
1601 IK5FTQ JN53
1602 IK5CQV JN53
1603 IZ5ENZ JN53
1604 F6EGD JN24
1604 IW3GXW JN65
1604 F1EYB JN23
1605 F6HZL JN23
1605 I1JTQ JN35
1606 F5GB JN23
1607 IK2LHP JN45
1608 IZ3ASP JN65
1610 9H1GP JM75
1622 IZ1GCV JN35
1623 4X1UN KM72JB
4008km new DXCC
559 / 599
1623 4X1IF KM72 559 hrd
1624 F4APS JN25
1626 F6DRO JN03
1627 F5GB JN23
1628 IK2YXK JN45
1629 F1EBY JO10
1630 IW1FZR JN45
1635 F1BBI JN24
1636 F1EIT JN25
1636 F6FMB JN24
1637 F6HTJ JN12
1638 IK2XRJ JN45
1639 F4DSD JN23
1639 F1AVP JN17
1640 I5PGC JN53
1642 IZ2AAL JN45
1642 IK1ZOF JN35
1642 IK2CIK JN45
1643 F1NZC JN15
1644 F0FER JN
1649 9A4QV JN75
1650 HB9FAP/M JN46 20w/V
1650 IW3HUL JN65
1651 F9HS JN13
1700 I4RHP JN54
1701 HB9DDS JN47
1702 DF1CF JN57
1721 9H1GB JM75

Comment: 90 QSOs and about 90 mins open
Working over the magic 4000km border on 2m is always a very special thrill. This 4X QSO was a dream in my head for years and my take off to 4X is quite bad with a 2 to 3 deg horizon.

June 13

1555 hearing IG9/I1XOI from JM65HM chatting with a SV9 on 144.300 on Tropo, it me took almost 3 minutes untill he noticed that there is Es to CT…
1557 IG9/I1XOI JM65HM new
1558 9H5L JM75
1600 I1DMP JN35
1601 F0FCC JN23
1603 IK1WVR/p JN44
1603 IK1LBW/p JN44
1604 F1NSR JN33
1604 IK2PTR/4 JN
1604 F2NY JN23
1605 IW1PDP JN44
1606 F6EGD JN24
1606 IK4GRD JN54

1607 IK1JXY JN44
1609 IW9HDD JN67
1612 IW9ACT JM68
1615 IW2OHY JN45
1616 F1SAH JN23
1616 IW2OHY JN45
1617 9H1ET JM75
1621 TK5JJ JN41
1622 IK0SMG JN61
1624 F4FEQ JN33
1625 IV3GTH JN65
1630 9H1TX JM75
1634 I8MPO JN70
1638 IW9DZV JM67
1638 IT9JLG JM68
1650 IZ0CBD JN61
1651 IW0BYL JN61
1652 IK0FTA JN61
1652 I5XDL JN52
1653 IZ0CUK JN61
1654 I6BQI JN72
1656 IZ0FWE JN62
1659 IZ0CUV JN62
1659 EA6DD JM19
1701 EA6VQ JM19
1707 IZ8EPY JM88
1709 IG9/IW1PZC JM65
1710 DJ9CZ JO31
totally off direction
1712 IZ8JHD JM89 new
1712 I8EMG JM89 Mr. BCN
1712 I8YGZ JN70
1713 IK0WGF JN52
1713 I5TWK/8 JN70
1714 IW9DZV JM67
1718 SV3GKE/8 KM08IT 2582
1719 SV3CYM KM08VF 2691
1720 SV8CS KM07JS 2611
new square

1721 9H4DX JM76
1725 9H1AW JM75
1726 9H1GB JM75
1727 IK8VZD JM78tf new
1729 IH9QEG JM56XT
new square
1735 IT9VDQ JM68
1736 DK5YA JM49 QTF
20deg offeset – he also
55 / 55 nothing direct!
1737 I0JX JN61
1738 DH3IAJ JN48
1738 DF2GN JN48
1739 OK1TEH JO70fd 2343
1739 DJ0YS JN48
1740 IK2UJS JN55
1740 DF9NP JN58
1741 DK5RQ JN68
1742 DJ8RZ JN58
1742 DF1CF JN57
1742 IW0BJP JN62
1742 DL5GAC JN47
1742 HB9PJO JN
1743 DK1CL/p JN48
1744 DF9IC JN48
1744 DF5HC JN49
1745 I7CSB JN71
1745 I4YNO JN54
1746 IK0RWX JN61
1747 DL8II JN49
1747 HB9DDS JN47
1747 DL8MAI JN57
1745 IK1SPR JN
1748 DQ5Q JN48
1748 F5ZV JN37
1748 DH9GCD JN
1749 F6HDF/p JN15 3w/V
1749 F6BEG JN
1750 IK7HIN JN81
1750 IK7EXJ JN81
1752 I4RHV JN54
1752 F1OMQ JN25
1752 IK4IDP JN54
1753 IT9GRR JN77 new
1753 IK5QLO JN53
1753 9H1ET JM75
1753 IW3QTG JN65
1754 IZ5MAO JN54
1754 IW3EXW JN
1755 F4DSD JN23
1755 IV3GBO JN66
1755 IV3DXW JN65
1756 IZ8GCP JN70
1756 IK2UJS JN55
1756 IK0BZY JN61
1757 F6EPE JN23
1759 I7CSB JN71
1800 IZ0CBD JN61
1801 I8SGS JN70
1802 9A2WA JN83
1804 9A6R JN83
1804 I0NNZ JN62
1806 SV3GKE/8 KM08IT 2582
1809 IK8BIZ JN70
1811 IK0GKZ JN61
1814 EA6SA/p JN20 new
52F / 519 FAI 60 deg
1818 IZ0CVK JN62
1820 IW0BYL JN61
1836 I8YGZ JN70hr 2064
51F / 529 FAI 60 deg
1836 IK8BIZ JN70
1857 SV3CYM KM08VF 2691
1858 SV3BSF KM08UF 2684
1918 F4DSD JN23 55/55
1918 F0CXO JN26 55/55
1918 IW2BNA JN45
1919 Ik2YXK JN45 55/55
1919 F6GRB JN25
1920 F0CXO JN26
1920 I1DMP JN35
120 mins open
122 QSOs + 2 FAI QSOs

June 19

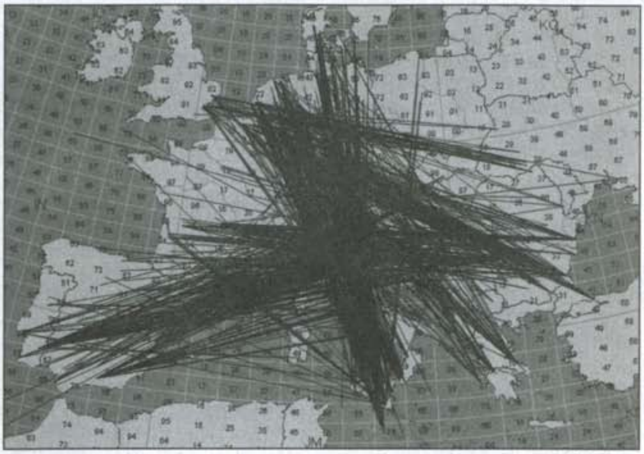
1507 HA5CW JN97PM 2561
55 55 (same minute as
our QSO on May 28 ☺)
1520 IW4EHA JN74
1521 IK4PMP
1521 I5RUR JN53
1529 IK8YOQ JN70
1529 IZ0CKM JN61
1615 I1DMP JN35 55 55
1617 IV3GBO JN66 59 53
1626 I8MPO JN70FP
55F 55F 2044km
53 deg / 285 deg
1630 IK0SMG JN61 hrd
CT1HZE 51F from 330 dg

8 Es + 1 FAI QSO - 13 min open

June 20

From 1220 hrd G chat on .290...
1223 G4DBL IO91
1224 F1BKM IN98
1223 G4GTW IO91
1225 M0HKB JO02
1225 F6EAS IN98
1226 G4FUF JO01
1227 G4DEZ JO03
1227 G4DBL IO91
1231 G3BNE JO01
1231 G4EAT JO01
1234 2E0CVN JO01
1235 G8WXU JO01
1235 G3LQR JO02
1236 M0TTF JO01
1236 G4KIY IO90
1237 G4LOH IO70
1241 M0YEL JO
1241 G4CZP/p IO90
1243 G3SPJ JO01
1244 G4MKF IO91
1244 G4NCG JO
1245 G4CQM IO70
1246 GW6TEO IO71
1246 GW4DGU IO71
1247 2E0VTS IO82
1248 G6TUS JO02
then FM 145.500 and .525:
1250 M3SQG/M JO
1250 M1DCW/M JO
1251 G3PQH JO
1252 G4FUG JO01
1252 G8UYY JO
1253 M0AGI IO80
1253 G7RYN IO83

1253 G6JTP IO
1254 M0BSV IO92
1257 G8HUL/M 2W handy!
1257 GJ7DNI/M IO89
asking "where are u on GJ?" ☺
1257 GW4RVA IO
1257 G4ODM IO91
1258 G0GGU IO92
1258 G0AJJ JO02
1259 G7REE IO81
1300 2E1PDQ IO
1300 M3YLB/M IO
1301 G0NZA IO93
1301 G1TDU IO92
1302 G3WRV IO
1302 M0AIJ IO92
1303 GW4JKR IO73
1303 MW0BLU IO7
1304 M1CQI IO
1304 G7SDF IO90
1305 G0DWE/M IO
1306 GW4DGU IO71
1306 G6UED IO92
1307 G6MTG IO92
1307 G6YWL IO82
1309 G4ZQT IO92
1310 GW3XRM IO73
1310 G4RRA IO80
1310 G0MRL IO83
1311 G6OHM JO02
1312 M3PSF IO
1312 G0KYS IO80
1312 G0RBD IO91
1313 M3TXQ IO
1313 G1YGJ IO92
1314 G4DEZ JO03
1414 G4ASR IO81
1315 2E0VTS IO
1315 M0ZOL/M IO
1316 M3LBY IO
1317 G4KWQ IO92
1317 2E0ZWG IO
1318 M0EKB IO
1318 M0TTY IO93
1318 G4HZW IO83
1319 M1AGY IO
1319 G4UXL IO83
1319 M3UKF/M IO
1320 MW3RUH IO81
1321 G8GXP/M IO93
1321 GW1SXN IO
1321 G4WUH IO81
1322 G0SWO IO93
1323 2E0IXC IO81
1323 G4APJ IO83
1323 GW3WSU IO81
1324 G4PJE IO83
1325 2E0JBD IO
1325 GX3JDY IO93
1326 M3UEX IO



2m Es map from June 2nd 2007

1326 G7CNF IO81
1326 G0ITL IO92
1327 MW0RHD/M IO73
1327 GW1OPE IO81
1328 G1NVY IO83
1328 G0WTD IO83
1329 M0RAR/M IO
1329 GW8ASA IO81
1330 G8JVM IO82
1330 M3SNU IO
1331 M0XDX JO03
1331 M3FWS IO
1331 2E0ODY IO81
1332 GW1MNC IO
1332 G4YER IO93
1333 G7TGN IO85xd
back to SSB:
1337 EI2GLB IO63
1337 EI5FK IO51
1339 MW1FGQ IO
1339 GW8ASD IO
1340 GW0VWD IO81GM
1340 G4IOQ IO82
1341 MW0VKD IO
1351 EI5FK IO51 on FM
1354 EI3GYB IO53 SSB
1418 EI3GYB IO53 FM
1423 EI8JK IO51 SSB
1424 EI2EUB IO52PA new!

120 QSOs, open 130 mins

June 22

From at least 1740 2m was open to E-DL and OK but I was struggling with UT1FG/MM who was in the rare wet square GJ63. DD0VF meeped me already on KST chat because he hrd the CT1ART beacon from IM67ah on 2m already. So we went to 2m and:

1743 DD0VF JO61wb 2358
1755 OK1COM/p JN79fx new sqr – 2334km
1759 OK1TEH JO70fd 2343
1800 OK1FPR JO80ce new sqr – 2456km
1800 DG9MAQ JN58

5 QSOs - 17 mins open

Comment

From May 23 to June 22 within 4 weeks CT1HZE worked 867 2m QSOs, the band was open in total for 907 minutes (about 15 hours). For comparison: In 2006 243 Es QSOs were worked between June 7th and 22nd. In total 752 QSOs were worked 2006 and untill June 7th 2006 not a single 2m Es QSO whist in 2007 untill June 7th already 616 QSOs were in the log. So we can comclude that for CT 2007 was already a great start .
In 2007 so far 41 QSOs above the 2300 km limit and 10 of them beyond 2600km, 17 new squares.

TNX to all for the nice QSOs!

73
Joe, CT1HZE

Maps © G7RAU, TNX!

Tropo Reports

2m, 70cm and up

Editor: Wolfgang Schneider, DJ8ES

DJ8ES@gmx.de

2m

LA0BY, JO59IX, wkd 5./6. May (>1000km):
F1ERG/P (JN27JJ, 1452km); F5SE/P (JN19XH, 1262km); OP5P/P (JO20UF, 1130km); DK0BN (JN39VX, 1128km); ON4POO (JO20DP, 1114km); DF0BG (JO30JF, 1112km); ON6ZT (JO10UU, 1106km); ON4WY (JO11LC, 1100km); ON8SI (JO10VV, 1099km); DF0KO (JO30OH, 1098km)

Stefan writes: extremely loud signals over 1000km. Ducting was exactly as predicted through Hepburn tropo maps. Unfortunately the contact with F5SE/p was not complete. He disappeared into the noise without copying my details. We were very lucky with the tropo conditions again this weekend. I was QRV only 2 h in the evening and another 5 h in the morning. I should have brought 23cm and 3cm equipment as well, but I did not expect condx being that good. It would also not have been easy to handle more than 2 bands from single OP in such condx. tnx for Info Stefan

G8ARM, IO70GD, worked (>700km):

5.5.07 17:10	EB1DNA/p	IN63FI	772km
5.5.07 17:12	EA1DKV/p	IN52RE	917km
5.5.07 17:14	EA1BLA/p	IN53XK	772km
5.5.07 17:16	EA1QS/p	IN52TM	876km
5.5.07 17:19	EA1EBJ/	IN73FL	742km
5.5.07 17:40	EA1FDI/p	IN52LW	848km
5.5.07 18:35	CT3KN/p	IM12NQ	2162km

tnx for info Brian

DK7QX, JO42KH, wkd (>700km):
LA3YNA (JO48OR, 713km); GW8IZR (IO73TI, 896km); EI5FK (IO51RT, 1189km); GW3JXN (IO72RC, 913km); MM0SJT (IO87UE, 896km); GM0TGE (IO87TF, 903km); 2M0DDS (IO87VI, 902km). Rig: 100W, MGF1302, 8 Ele Yagi
tnx for info Eckhard

YO4AUL, KN44HE, wkd Jun ´06 (>600km):

YU1IO	59/59	KN04IQ	631km
YU1EV	59/59	KN04CN	670km
YT1WV	59/59	KN04FP	650km
TC1LZ	59/59	KN41MF	331km
HA0MK/p	59/59	KN08QC	708km

tnx for info Corneliu

DG7TW, JO43SX, wkd May/Jun:
HB9CR (JN47BA, 781km); DL0KB (JN47KW, 674km); ON4WY (JO11LC, 548km); G0UIQ (JO02PW, 559km); 2E0BFT (JO02UL, 548km); G4IDR (IO93BP, 750km); G7RAU (IO90IR, 819km); G0KPW (JO02RF, 574km); ON8SI (JO10VV, 519km); G4RRA (IO80BS, 977km); LA0BY (JO59IX, 671km); G3SVJ/P (IO91RU, 716km); G6HIE (IO90ST, 764km); 2E1DNC (JO01QJ, 621km); G6HKS (IO92OB, 723km); M5BFL (IO91OO, 743km); OK2M (JN69UN, 569km); F1ERG/P (JN27JJ, 805km); F6KSL (JN28QJ, 686km); DL8NAS (JN59KE, 541km); F5APM (IN97HG, 1070km); F8BRK (IN99VF, 855km); HB9GT (JN47MH, 743km); F6KFH (JN39OC, 566km); DL0HEU (JN47NX, 668km); DF1VW (JN39HJ, 548km); DJ5IR (JN48EQ, 594km); DJ7HC/P (JN48KE, 646km); DK0LA (JN68CQ, 617km); OL3Z (JN79FX, 558km); OL8R (JN69JJ, 557km); DF0SX (JN48MW, 562km); DC0ASP (JN48NV, 567km); DP7X (JN48IX, 559km). tnx for Info Thorsten

PA5DD, JO22IC, wkd May/Jun ´07 (>500km):
5Q2M (JO65AM, 615km); DH8BQA (JO73CE, 653km); DL5AG (JO63CT, 538km); OZ/DG3XA (JO47MD, 628km); OZ1ALS (JO45VA, 468km); OZ1BEF (JO46OE, 542km); OZ1DLD/P (JO45SK, 490km); OZ1HDF (JO55UN, 600km); OZ2PBS (JO55XJ, 602km); OZ2TF (JO46PE, 545km); OZ4VW (JO45UT, 528km); OZ7AMG (JO65HP, 653km); OZ7SKV (JO46ML, 563km); OZ9HBO (JO46HF, 526km); OZ9KY (JO45VX, 545km); SK7CY (JO65RJ, 683km); SK7MW (JO65MJ, 660km). tnx for info Uffe

70cm

LA0BY, JO59IX, wkd 5./6. May (>1000km):
ON4POO (JO20DP, 1114km); DF0BG (JO30JF, 1112km); ON4PS/P (JO20KQ, 1097km); DR5A (JO30EM, 1087km); DF1JM (JO30FQ, 1068km); DH8IAB (JO30NO, 1067km); DL0AAN (JO30ER, 1064km); DH4FAJ/P (JO40AQ, 1047km); DF0HS/P (JO31AA, 1038km); DK2OY/P (JO40IT, 1028km). tnx for Info Stefan

G8ARM, IO70GD, worked (>700km):

5.5.07 14.10	EA1FDI/p	IN52LW	848km
5.5.07 14.30	EA1DKV/p	IN52RE	917km

tnx for info Brian

DK7QX, JO42KH, wkd (>600km):
G4DEZ (JO03AE, 602km); G1HLT (IO93JD, 684km); M0GHz (IO81VK, 766km); LA6LCA (JO59FE, 770km); G3LTF (IO91GG, 719km); SP7TEE (JO91QR, 720km); GW8IZR (IO73TI, 896km); GW8ASD (IO83LB, 806km); GW3TKH (IO81JM, 832km); G8VHI (IO92FM, 706km); MM3ERP (IO87RJ, 921km); MM0DQP (IO88KI, 1010km); EA1EBJ (IN73FL, 1451km); F5HGO (JN05AI, 1006km); F5DQK (JN18GR, 600km)
Rig: 65W, MGF1302, 18 Ele Yagi
tnx for info Eckhard

23cm + up

SM7ECM, JO65NQ, wkd

23cm (>500km):

17/04/2007	SM3BEI	JP81NG	663km
17/04/2007	SM4DXO	JP70VO	569km
17/04/2007	DF9IC	JN48IW	809km
17/04/2007	SM3LBN	JP80IO	586km
17/04/2007	SM0EUI	JO99ES	551km
17/04/2007	PA0EZ	JO22OF	645km
17/04/2007	PA5DD	JO22IC	680km
17/04/2007	OH0JFP	KP00AB	635km
05/05/2007	G3XDY	JO02OB	880km
06/05/2007	OK2KKW	JO60JJ	591km
06/05/2007	PA0EZ	JO22OF	645km
06/05/2007	M1CRO/P	JO01PU	888km
06/05/2007	PA0BAT	JO31FX	603km
06/05/2007	DM7A	JO60LK	586km
15/05/2007	SM3BEI	JP81NG	663km
15/05/2007	SM4DXO	JP70VO	569km
15/05/2007	DK2MN	JO32MC	564km
15/05/2007	DF9IC	JN48IW	809km
15/05/2007	PA5DD	JO22IC	680km

13cm (>400km):

24/04/2007	SM0DFP	JO89VL	505km
24/04/2007	SM3LBN	JP80IO	586km
06/05/2007	PA0EZ	JO22OF	645km
22/05/2007	SM5QA	JO89WJ501km	
22/05/2007	SM0SBI	JO99CF	498km
22/05/2007	DL6NAA	JO50VF	614km
22/05/2007	PA3CEG	JO33FB	521km

6cm (>300km):

24/04/2007	SM0DFP	JO89VL	505km
06/05/2007	PA0EZ	JO22OF	645km
22/05/2007	SM6HYG	JO58RG	305km
22/05/2007	SM5QA	JO89WJ	501km
22/05/2007	SM0SBI	JO99CF	498km
25/05/2007	DL7YC	JO62PK	362km
26/05/2007	DM2AFN	JO61WB	517km
27/05/2007	DB6NT	JO50TI	601km
29/05/2007	DL7YC	JO62PK	362km

3cm (>300km):

24/04/2007	SM0DFP	JO89VL	505km
24/04/2007	SM5QA	JO89WJ	501km
04/05/2007	OZ1FF	JO45BO	314km
06/05/2007	PA0EZ	JO22OF	645km
22/05/2007	SM6HYG	JO58RG	305km
22/05/2007	SM0SBI	JO99CF	498km
25/05/2007	DL7YC	JO62PK	362km
25/05/2007	DL6ABC	JO62OM	352km
25/05/2007	DF9QX	JO42HD	492km
25/05/2007	DB6NT	JO50TI	601km
26/05/2007	DL1ATI	JO50QU	550km
26/05/2007	DH0LS	JO50QU	550km
26/05/2007	DB6NT	JO50TI	601km
26/05/2007	SP6GWB	JO80IK	631km
26/05/2007	SP6HED	JO80IK	631km
26/05/2007	DM2AFN	JO61WB	517km
26/05/2007	DG1BHA	JO73DB	302km
26/05/2007	SP9TTG	JO90NU	669km
26/05/2007	SP3JBI	JO91BR	550km
26/05/2007	SP2DDX	JO83VE	410km
27/05/2007	DB6NT	JO50TI	601km
28/05/2007	OK1JKT/P	JO60RN	570km
28/05/2007	DL4DTU	JO61TB	515km
28/05/2007	DL6ABC	JO62OM	352km
29/05/2007	DO1UKA	JO71FE	508km
29/05/2007	DL7YC	JO62PK	362km
29/05/2007	DB6NT	JO50TI	601km
29/05/2007	DH2UAK	JO71FU	435km
29/05/2007	SP2DDX	JO83VE	410km
29/05/2007	SP3TL	JO72OR	356km
29/05/2007	DL7VTX	JO62TM	354km
29/05/2007	DL1HTT	JO61FR	442km
29/05/2007	OZ1FF	JO45BO	314km
07/06/2007	OK1JKT/P	JO60RN	570km
07/06/2007	DL6NCI	JO50VI	600km
07/06/2007	DL1ATI	JO50QU	550km
07/06/2007	DM2AFN	JO61WB	517km
07/06/2007	DL3MR/P	JO71FE	510km
07/06/2007	DL4DTU	JO61TB	515km
07/06/2007	DH2UAK	JO71FU	435km
07/06/2007	DB6NT	JO50TI	601km
07/06/2007	DL7YC	JO62PK	362km
09/06/2007	SP3JBI	JO91BR	550km
09/06/2007	SP2DDX	JO83VE	410km

tnx for info Andy

PA5DD, JO22IC, wkd May/June ´07

23cm: DF9IC (JN48IW, 451km); OZ1BGZ (JO65AP, 623km); OZ1FF (JO45BO, 451km); OZ2LD (JO54TU, 552km); OZ2OE (JO45VV, 538km); OZ6OL (JO65DJ, 620km); OZ9KY (JO45VX, 545km); SK7MW (JO65MJ, 660km); SM7ECM (JO65NQ, 681km).

3cm: DL7QY (JN59BD, 504km); OK1JKT/P (JO60RN, 632km); DF6NA (JN49XS, 450km).

tnx for info Uffe

G8ARM, IO70GD, worked on 23cm (>800km)

5.5.07	14.12	EA1FDI/p	IN52LW	848km
5.5.07	14.32	EA1DKV/p	IN52RE	917km

tnx for info Brian

DJ8ES, JO43SX, wkd May ´06 (>300km):

23cm: M1CRO/p (JO01PU, 601km); PA0EZ (JO22OF, 348km); PA6NL (JO21BX, 425km); G3OHM/p (IO92GB, 765km)

13cm: M1CRO/p (JO01PU, 601km); PA0EZ (JO22OF, 348km); PA6NL (JO21BX, 425km)

DK7QX, JO42KH, wkd on 23cm (>500km):

G3XDY JO02OB 523km); M0GHZ (IO81VK, 766km); G4FSG JO02PC, 517km); G4KIY (IO92WN, 610km); M0GAV (IO93GK, 704km); G8GXP (IO93FQ, 713km); G4AJC (IO91VJ, 631km); G4MKF (IO91HJ, 710km); G4DDK (JO02PA, 518km); G4ZDT (JO02KQ, 543km); LA6LCA (JO59FE, 770km); SM3LBN (JP80IO, 1038km); G7NCG (JO02AM, 599km); G4BEL (JO02BI, 594km); G4KIY (IO92WN, 610km); G4MAP (IO82XH, 741km); GW8ASD (IO83LB, 806km); G4EAT (JO01HR, 568km); G8JVM (IO82SP, 767km); GW3TKH (IO81JM, 832km); G4BEL (JO02BI, 594km); G8VHI (IO92FM, 706km); OE5XBL (JN68PC, 563km); DL3LFA (JN67LU, 575km). Rig: 60W, MGF1302, 44 Ele Yagi. tnx for info Eckhard

OZ1FF, JO45BO, wkd:

1.3GHz (>600km):

17/04/2007 17:44	DF9IC	JN48IW	742km
17/04/2007 19:59	G3XDY	JOØ2OB	600km
17/04/2007 20:38	SM3LBN	JP8ØIO	749km
30/04/2007 19:45	GM4LBV	IO86RQ	671km
01/05/2007 20:22	GM4LBV	IO86RQ	671km
01/05/2007 20:23	GM4CXM	IO75TW	781km
01/05/2007 20:24	GM3SBC	IO85IX	714km
01/05/2007 20:36	G3NEO	IO93II	657km
01/05/2007 20:39	GØDJA	IO93IF	663km
05/05/2007 20:42	M1CRO/P	JOØ1PU	612km
15/05/2007 18:41	DF9IC	JN48IW	742km
15/05/2007 18:53	DB6NT	JO5ØTI	629km
15/05/2007 19:32	G3XDY	JOØ2OB	600km
01/06/2007 14:15	G8GXP	IO93FQ	657km
01/06/2007 14:30	G1MHU	IO93FQ	657km
03/06/2007 05:56	DM7A	JO6ØLK	659km
19/06/2007 16:58	SMØFZH	JO99HI	752km
19/06/2007 17:53	DF9IC	JN48IW	742km
19/06/2007 18:03	DB6NT	JO5ØTI	629km
19/06/2007 20:27	SMØDFP	JO89VL	719km
19/06/2007 20:33	DL6NAA	JO5ØVF	646km

2.3GHz (>500km):

24/04/2007 17:15	DF9IC	JN48IW	742km
24/04/2007 19:57	G3XDY	JOØ2OB	600km
30/04/2007 17:46	DL6NAA	JO5ØVF	646km
30/04/2007 19:55	GM4LBV	IO86RQ	671km
02/05/2007 14:34	GMØUHC	IO85FW	730km
05/05/2007 20:44	M1CRO/P	JOØ1PU	612km
05/05/2007 21:17	OT5D	JO3ØAM	582km
06/05/2007 08:20	SN7V	JO84EK	541km
03/06/2007 06:00	DM7A	JO6ØLK	659km
03/06/2007 06:27	DLØGTH	JO5ØJP	579km
03/06/2007 07:53	DR5A	JO3ØEM	577km

10GHz (>300km):

15/04/2007 09:48	G4EAT	JOØ1HR	655km
24/04/2007 17:56	SM7GEP	JO77IP	462km
24/04/2007 18:12	SM6AFV	JO67GQ	356km
24/04/2007 20:23	SK7MW	JO65MJ	310km
24/04/2007 20:36	SM7ECM	JO65NQ	314km
30/04/2007 20:04	GM4LBV	IO86RQ	671km
01/05/2007 21:09	SM6ESG	JO67CC	302km
01/05/2007 21:50	GØEWN	IO93FK	668km
02/05/2007 14:34	LA3EQ	JO28UX	402km
02/05/2007 21:07	G4DDK	JOØ2PA	599km
03/05/2007 15:22	GM6VXB/P	IO97AQ	658km
04/05/2007 05:54	SM7ECM	JO65NQ	314km
05/05/2007 21:24	OT5D	JO3ØAM	582km
06/05/2007 05:48	DR5A	JO3ØEM	577km
25/05/2007 15:54	DL7YC	JO62PK	487km
27/05/2007 17:22	DL1SUN	JO53PN	305km
29/05/2007 17:30	DL7VTX	JO62TM	496km
29/05/2007 18:53	SM6AFV	JO67GQ	356km

24GHz (>300km):

16/04/2007 20:42	SM6AFV	JO67GQ	356km
02/05/2007 20:50	SM6ESG	JO67CC	302km

tnx for info Kjeld

OE8PGQ, JN76AO, wkd on 10 GHz:

30.04.07	OE5VRL/5	JN78dk	204km
12.05.07	S51ZO	JN86dr	172km
12.05.07	OM2TW	JN88vj	345km
12.05.07	I4XCC	JN63gv	323km
12.05.07	I6XCK/6	JN63qn	342km
22.05.07	OK2ZI	JN89ad	320km
22.05.07	OK2POI	JN99aj	430km
22.05.07	OK2VSO	JN99aj	430km
22.05.07	OK2GM/p	JN99bm	444km

rig: Transverter DL1RQ 4,5W, 60cm Dish
tnx for info Günther

pse ur Tropo-Report to:

DJ 8 ES @ gmx.de

Aurora News

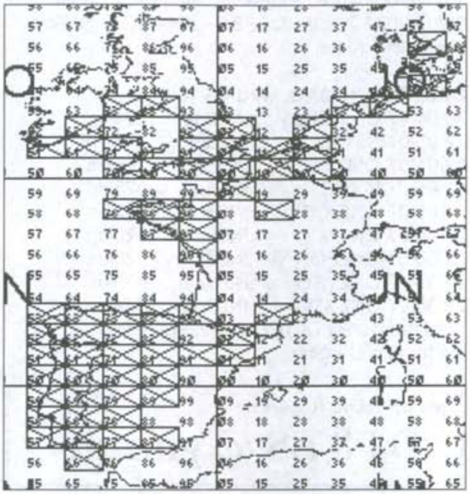
Beacon Reports via Aurora on 2m:

*** = SK2VHF + = LA2VHF JP53 nil = SK4MPI JP70**

Date	UTC	Beacon heard from area / loc.
17.4.	1235-1650	OH5 (KP30), OH6 (KP02)
27.4.	2118	SM2 (KP15)
28.4.	1350-1500	SM2 (KP15), DL (JO53), LA (JO59), OH6 (KP02)
	2155	SM2 (KP15)
7.5.	1530-1730	SM2 (KP15), OH5 (KP30), DL (JO43), ES (KO28)
	2115	OH1 (KP00)
8.5.	2050	SM2 (KP03)
18.5.	1520	SM2 (KP15)
23.5.	1045-1430	UA1 (KP50), LA (JP43), OH5 (KP30),
	2010-2215	OH6 (KP02), LA (JO59), UA1
24.5.	1545	YL (KO37)
	2230*	SM2 (KP03)
26.5.	1150-1220	OH5 (KP30)
4.6.	1745	OH5 (KP30)
8.6.	1740	SM2 (KP15)
14.6.	1635	SM2 (KP03)

EA1FDI/p Tropo Report

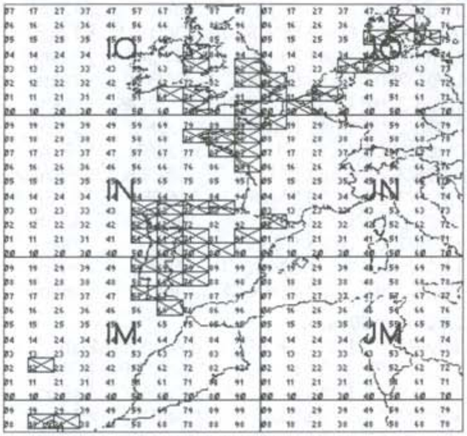
A remarkable Tropo opening took place during the contest on May 5/6. EA1DFI/p, IN52LW, send us his impressive report. Working OZ on 2m/70cm over 2000km from EA1 is for sure a great pleasure during a contest. Even on 23cm 1400km were made into PA. QSO list is QRB sorted.



Wkd squares from EA1FDI/p, IN52LW, on 2m on May 5/6 - Also wkd IM12, IL18 and IL28 from CT3 and EA8

EA1FDI/p, IN52LW, QSOs on 144 MHz >1000km:

06.05.2007	00:28	OZ1FKZ	JO56AA	1991km
06.05.2007	06:14	DL9EE	JO54DF	1885km
05.05.2007	23:17	DG7TG	JO43SV	1824km
05.05.2007	23:16	DLØRSH	JO43SV	1824km
05.05.2007	23:16	DKØPC	JO43SV	1824km
05.05.2007	17:21	EA8BUE/P	IL18OH	1768km
05.05.2007	19:16	EB8CDX	IL18NI	1767km
05.05.2007	14:36	EA8TX	IL18QI	1758km
05.05.2007	14:41	EA8AVI	IL28FC	1749km
05.05.2007	14:47	EA8BPX	IL18SK	1744km
05.05.2007	15:13	EA8BWY/P	IL18UM	1729km
06.05.2007	00:11	DL8BDU	JO43AA	1687km
05.05.2007	23:11	DG6JF/P	JO33QN	1687km
06.05.2007	05:37	PI4GN	JO33II	1638km
05.05.2007	23:14	PA5WT	JO22HG	1453km
05.05.2007	23:22	PA2DW	JO22GD	1440km
06.05.2007	06:03	PA2M	JO21IP	1414km
05.05.2007	22:52	PA6NL	JO21BX	1406km
06.05.2007	05:32	OP5P/P	JO2ØUF	1384km
06.05.2007	00:26	OR1B	JO21IB	1375km
06.05.2007	00:26	OQ4U	JO2ØKV	1374km
05.05.2007	22:41	PI4Z	JO11WM	1360km
05.05.2007	14:49	CT3KN/P	IM12NQ	1330km
06.05.2007	04:53	MØITY	JOØ2RF	1296km
05.05.2007	20:29	GØKPW	JOØ2RF	1296km
05.05.2007	23:34	ON4WY	JO11LC	1282km
05.05.2007	20:25	MØHKB	JOØ2OB	1271km
05.05.2007	20:38	G4UKP	IO83VC	1238km
05.05.2007	20:32	GØUWK	IO83VC	1238km
05.05.2007	23:00	G4CBW	IO83UB	1231km
06.05.2007	05:52	F5TTI	JO1ØIL	1224km
06.05.2007	05:49	F2YT	JO1ØGK	1212km
06.05.2007	05:57	F5APQ	JOØØXU	1211km
05.05.2007	22:54	G8VHI	IO92FM	1202km
05.05.2007	17:18	GW4DRR	IO73RH	1200km
05.05.2007	23:05	G6HKS	IO92OB	1187km
05.05.2007	20:53	G3KEQ	JOØ1BH	1159km
06.05.2007	04:26	F6KCP/P	JN18OU	1151km
06.05.2007	08:01	FØDZO	JN18GT	1107km
06.05.2007	05:13	F5DQK	JN18GR	1102km
06.05.2007	08:07	G4AEP/P	IO91MB	1090km
05.05.2007	20:28	G6HIE	IO9ØST	1090km
05.05.2007	17:48	G7RAU	IO9ØIR	1046km
05.05.2007	15:06	EI8IQ	IO62FF	1039km
05.05.2007	22:50	G3RHH	IO9ØDR	1029km
05.05.2007	21:14	F1CVU/P	JNØ9BO	1021km
05.05.2007	14:52	GW6TEO	IO71LP	1014km
05.05.2007	14:53	EI2IP	IO61CX	1009km

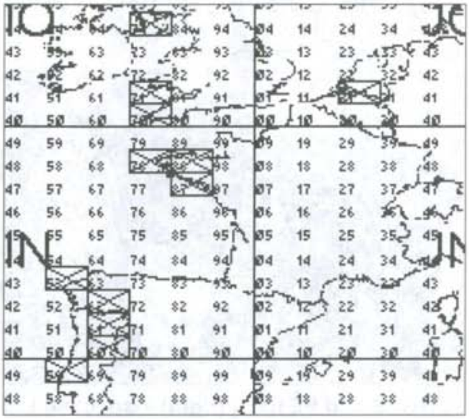


Wkd squares from EA1FDI/p, IN52, on 70cm on May 5/6

EA1FDI/p, IN52LW, QSOs on 432 MHz >1000km:

06.05.2007	00:00	OZ6OL	JO65DJ	2064km
05.05.2007	23:43	OZ1FKZ	JO56AA	1991km
05.05.2007	23:50	OZ1DLD	JO45RL	1924km
05.05.2007	22:02	OZ6HY	JO45WA	1914km
05.05.2007	23:26	DLØRSH	JO43SV	1824km
05.05.2007	23:25	DKØPC	JO43SV	1824km
06.05.2007	08:25	EB8CDX	IL18NI	1767km
05.05.2007	14:54	EA8AVI	IL28FC	1749km
05.05.2007	22:45	DJ6DS	JO43JH	1747km
05.05.2007	14:57	EA8BPX	IL18SK	1744km
05.05.2007	20:59	PI4GN	JO33II	1638km
06.05.2007	06:20	PA2M	JO21IP	1414km
05.05.2007	21:37	PA6NL	JO21BX	1406km
05.05.2007	14:37	GM1GEQ/P	IO74NP	1336km
05.05.2007	15:16	CT3KN/P	IM12NQ	1330km
05.05.2007	14:26	GDØEMG	IO74QD	1287km
05.05.2007	20:45	G3XDY	JOØ2OB	1271km
05.05.2007	20:31	MØHKB	JOØ2OB	1271km

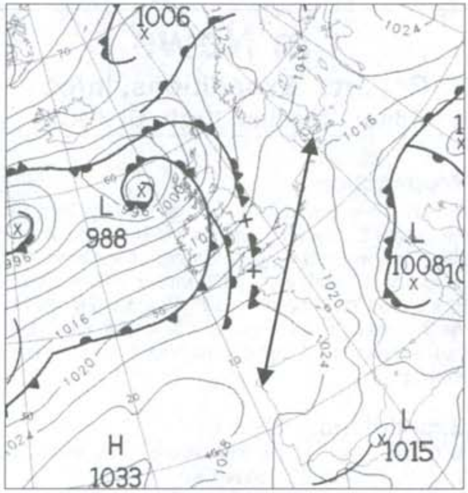
06.05.2007	05:31	F1EBY	JO1ØOP	1263km
06.05.2007	05:04	M1CRO/P	JOØ1PU	1257km
05.05.2007	21:47	G3CKR/P	IO93AD	1249km
05.05.2007	14:18	GW8IZR	IO73TI	1208km
05.05.2007	20:37	G8P	JOØ1QD	1204km
05.05.2007	22:57	G8VHI	IO92FM	1202km
05.05.2007	15:28	GW4DRR	IO73RH	1200km
05.05.2007	14:01	GW4DGU	IO71SV	1053km
05.05.2007	22:54	G3RHH	IO9ØDR	1029km
05.05.2007	21:15	F1CVU/P	JNØ9BO	1021km
05.05.2007	14:17	GW6TEO	IO71LP	1014km
05.05.2007	15:30	EI2IP	IO61CX	1009km



Wkd squares from EA1FDI/p, IN52, on 23cm on May 5/6

EA1FDI/p, IN52LW, QSOs on 1296 MHz >600km:

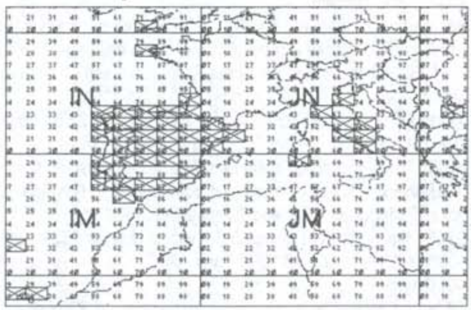
05.05.2007	22:40	PA6NL	JO21BX	1406km
05.05.2007	14:34	GDØEMG	IO74QD	1287km
05.05.2007	14:03	GW4DGU	IO71SV	1053km
05.05.2007	14:15	G8ARM	IO7ØGD	847km
05.05.2007	15:14	F1NUM	IN88AJ	724km
05.05.2007	14:04	F8DBF	IN78RI	696km
05.05.2007	19:17	F6DZD	IN87GS	692km



May 5/6 - H pressure bridge from Spain to Danmark enables Tropo QSOs up to 2000km from EA1FDI/p on 2m/70cm.

Bill Hepburns forcast map (see below on the left) for May 5 covered the EA – OZ path just in the very low level 2 (blue). One really has to learn to read these maps, as blue in "northern" regions can already mean a big opening whilst in "southern" regions even orange or red often means "nothing".

For comparison: EA1FDI/p on June 2/3, 2007



EA1FDI/p result on 2m in the contest on June 2/3, 2007. – No Tropo lifts, no Tropo QSOs >1000km, except the usual always open path to EA8/CT3. EA8AVI was wkd over 1745km even on 23cm. But this time luck on Es: Some QSOs to Italy and a 2xEs even to LZ were logged!
For more see Es column.

Many thanks to Javi, EA1DFI, for sending the interesting reports! (CT1HZE)

6m News

Reports, Expeditions, Infos
Editor: Joachim Kraft, DL8HCZ

Propagation

Es activity over Europe quite low untill mid May. Then first transatlantic Es openings appeared and in the end of June also JA was wkd from many EU countries. JA was even heard on southern CT again over a 11200km path. KH6 was hrd in EA8, JA wkd into W4 and 5 and SV/5B and all EU wkd into the Caribbean. Paths often up to 8000 to 10000km. This is multihop sporadic E propagation, no need to speculate about anything else.

Expeditions & OPs

3X Guinea: UA6JR is qrv as 3XM6JR and RW3AZ as 3XD2Z. They stay 2 years and are qrv on 6m.
9Q Kongo: Gus, 9Q1D, is QRT and has left 9Q on July 1. George, 9Q1EK is qrv permanently now on 6m from Kinshasa. Loc. is JI75pq.
C5 Gambia: Noz, C5DXC ist qrv on 6m with 100w and quadloop. He has a yagi now. Loc.: IK13PK.
D44TD on 6m EME: DL8YHR and DL8LAQ will be qrv 6m EME from August 1 to 8 as D44TD (HK86no) with 2 yagis (13dBD) and 1KW.
DU7 Philippines: DU7/PA0HIP is qrv now from a better QTH in PK10xh with 2 x 5 ele. May be also from PK20ah later on.
EA Spain: 6m was released to all licence classes in the end of April. So also EB/EC prefixes are on the band now. Any square can be qrv on 6m now in EA. Also CEPT operation by foreigners is permitted.
FM Martinique: FM5JC, Eric, has left FM after several years and is back to France and qrv as F5JKK from IN87 now.
IO61 EI2IP has moved permanently to IO61 and is qrv on 6m/4m now.
JP21 LA/PA3FMC + PE1BTV will be qrv 16.-22.8. from JP21GA on 6m
KP57 The OH8K group is qrv from Aug. 10 – 14 also on 6m.
PJ4 Bonaire: PA3CNX has moved permanently to PJ4 and is qrv as PJ4NX with 800w and 1wl yagi. Loc. FK52ud.
ST Sudan: T98A was qrv untill the end of July as ST2A with 100W + 3 Ele. Loc.: KK13FK. After his ST job he will go to **9G**, Ghana.
TZ Mali: ON7ASL is a new resident and qrv as TZ6PVI on 6m. Loc. IK62ao.QSL via ON4LN.
ZA Albania: ZA/UT7DW is qrv permanently from JN91WX.

Beacons

BV2NT/B was active again after a long break in June 2007. PL05SA, 10W, GP.
EA2SIX is a new beacon running since June 2007 from IN91SR.
C6AFP/B has made QSY to 50040.4 kHz and QRO to 30W.
D44DUB HK86NO, is a proposal for 2007 on 50029 MHz.
LW1DZ/B is a new beacon on 50050.7 MHz from GF05OP running with 5W and a loop.
9M4SIX ist the new call of ex 9M2TO/B, OJ05dj, 50.005.
9Q1EK/B (ex 9Q1D/B) 50021.0 JI75pq, 10W, vertical, will be qrv again soon from a new spot (same loc.).
CE3AA/B N3DB Dave is currently organizing a new 6m beacon in Chile (FF46). 30W and loop.
OH1SIX is QRT and will change call/QTH (to KP20bb).
PY0FF 50006.0 HI36TD, will be qrv again soon.
V51VHF is qrv again after many years of silence since January 22nd on 50021.0 MHz from a new QTH in JG87GN (2000m a.s.l.).

PE1BTX Gerard will put up 8 x 11 ele M2 yagis and will be the largest EME array in the world then. The system will have full elevation. The H bar will be 30m. All will be installed on a mobile crane, see picture below. WOW!

PA1GYS and PE1BTX (right) inspecting the new tower for 6m EME

4m News

Reports, Expeditions, Infos
Editor: Joachim Kraft, DL8HCZ

Hungary on 70 MHz

Some 30 HA stations got special permits for 70 MHz operation on July 1st for a limited period of 3 months. These beacons were expected to be qrv on 4m: HG1BVC from JN87FI and HB7BVB from JN97QK.

Crete on 70 MHz

SV9GPV, George, is qrv on 70 MHz with FT847 and a yagi from KM25EH. – SV9/G4XUM planned another 4m operation during his summer holiday.

Transatlantic X-band QSO on June 26!

On June 26th 2007 a transatlantic X-band QSO took place at 2130Z between G7CNF IO81RE and VE9EE FN66NA over a QRB of 4626km. This is about the same distance as the path from CU8 to SV that was observed to be open on 4m severall times in summer 2006.

OY on 4m

OY1CT, Carsten is qrv on 4m and wkd via Es into G in the end of June. The OY 4m beacon was hrd in G, PA, SV, OZ and CT in June several times.

News & Comments

Editor: Joachim Kraft, DL8HCZ
info@DUBUS.de

- Expedition overview

JM48	**IS0/IK0BZY**	Sept. 3 to 9	2m MS + EME, 70cm
JN41-JN40-JM48-JN40	**IS0/OE6IWG**	Aug 24 to Sept 7	2m MS
JP92-JP93-JP84-KP07-KP25	**SM/ and OH/PA3BIY**	Untill Aug. 7th.	144 MHz MS
JO86	**SM7/DK2ZF**	Aug 5 to 16	6m, 2m, 70cm, MS
KO34-KO46-KO07-KO08	**LY/YL/ES/DL1RNW**	Untill Aug. 2nd	2m MS
KO43 + 44	**EW/RA3MR**	Dec 15 to 16	2m MS + EME
KO62	**RA3MR/3**	Aug. 20 to 21	2m MS + EME
KO53	**RA3MR/3**	Aug 4 to 5	2m MS + EME
KO41 + 42	**EW/RA3MR**	July 27 to 30	2m MS + EME
KO97 + KO98	**RA3MR**	Nov. 17 to 19	2m MS + EME
KO31 + 32	**EW/RA3MR**	Aug. 11 to 13	2m MS + EME
LO09	**RA1QAX**	Aug. 12 to 14	2m MS
JP21	**LA/PA3FMC & LA/PE1BTV**	Aug 16 to 22	2m MS, 6m
JP30	**LA/PA2DW**	untill Aug. 20	2m MS
KP57	**OH8K**	Aug 10 to 14	2m MS, 6m
KP52	**RZ4HF/1**	Aug 12 to …	2m MS
HK86	**D44TD**	by DL8HYR + LAQ Aug. 1 to 8	2m, 6m + 70cm EME
KO90+LO00	**RK3QWM/p**	August	2m MS
KP06	**SM2CEW/p**	August	2m MS
JP91	**OH1AM/MM**	Aug 10 to 14	6m, 2m, 70cm
JP31/32	**LA/PE1ITR/p**	July 28 to Aug 8	2m MS
JN60	**IB0/OM0C**	July 25 to 30	2m MS
JP65/55	**LA/PA5DD**	Aug 8 to 13	2m MS
KN15	**YO/HA5CRX**	mid August	2m MS
JN47	**HB0/HB3YIT**	Aug 11 to 14	2m MS, 70cm
IN69	**G3RCV/p & M8C**	July 24 to Aug. 2	2m, 6m
IL27	**EA8/DL4DWA**	untill Aug. 11	2m
JP../KP..	**LA/SM6CMU + SM6CMU/2**	untill mid Aug.	2m MS, 70cm, 6m
8Q	**JM1WBB** plans a 2m EME (JT65) Expedtion to the Maledives in this year.		

- Stations / OPs

JN08 F1MPQ will change his permanent QTH to JN08XS in September and will be active on 2m MS and Tropo.

9K Kuwait: 9K2YC is starting EME on 2m currently with 400W and 1 yagi. He is looking for a QRP PA now. Loc.: LL48CJ.

HZ Saudi Arabia: F1DUZ has often QRL in HZ in the future and will erect a 2m EME station in LL01fh.

VR2KW, Wong, is qrv on 2m EME in JT65 with 13 ele and 200W, Loc. OL72ll, contact: vr2kw@qsl.net

OD5KU is qrv from KM73UW on 2m SSB for Tropo and Es with 50 w and a Yagi and good take off.

DF6QC is a resident on Helgoland Island and qrv now also on 6m from rare JO34we.

T98A, Jovica, who was qrv on 6m as ST2A untill the end of July moves to Ghana, 9G now. Due to his QRL he will visit about 25 different African countries in the next few years and try to activate many of them on 6m.

ZL New Zealand: ZL1RS (ex 4S7CCG) is back in ZL and settling down there. He plans to be back on 2m EME later on.

UK Usbekistan: DL9LBH will move to UK for about 3 years in the end of 2007. He plans to operate 2m EME.

HK Colombia: EA1DDO will be back as HK1DX from FJ29 in 2008 or 2009 qrv. Again 2m and 70cm EME is planned. Maximo wants to erect also a 2m beacon in HK then.

VQ9 Diego Garcia: VQ9JK, Tim is qrv again on 6m from MI62ER.

- Beacons

The follwing information has to be added to the beacons list that has been published in last DUBUS issue 2/07:

BV2NT/B is qrv on 50001.0 since June from PL05SA with 10 W / GP.

IV3ZDL/B 50003.5 MHz, JN65IW, 5W, 5/8 V, is qrv since May.

GB3RAL 70.050 MHz, IO91IN, Proposal. This beacon is planned also for the frequencies 40.050 and 60.050 MHz if a licence can be obtained.

DB0FRE 144.444 MHz, JN37WX, GP, Omni, 1 Watt, 290m a.s.l., new beacon qrv since the end of April.
DB0FRE 432.444 MHz, JN37WX, GP, Omni, 1 Watt, 290m a.s.l., new beacon qrv since the end of April.
DB0FRE 1926.880 MHz, JN37WX, GP, Omni, 1 Watt, 290m a.s.l., new beacon qrv since the end of April.
DB0FRE transmits in CW – RTTY – PSK31! Reports pse to n Baken@db0fre.de
IW0FFK/B 144.449 MHz, JN61IR, 3/0.75 Watt, Omni, 5 dBD horiz., 950 m asl. QRV since 22. April 2007..
LZ1DVK/B 144.419 MHz, KN12QO, 5W, HB9VC, 320 deg. Is a new beacon qrv since May.
SV8CS/B 144.471 KM07LR, 6W, 2 Ele. Horiz. , 330 Grad, 500 m a.sl.
9A0BVS, 144478.5 MHz, JN74BX, 5W, dipole, 450 m a.sl. is a new beacon qrv since June 14 2007.
SZ1SV 144.812.5 , KM18UE, 0.3W, ¼ V, CW, is qrv.
SZ1SV 432.812.5, KM18UW, 0.3W, ¼ V, CW, is qrv.
YO3FOU/B 144.416 MHz, KN34BK, 400mW, 5 Ele Yagi, NNW, 100m üNN. Is qrv temporary only.

EA9A, Mellila, IM85MH, 10.368.910 MHz, 2,5 W, 90° sector horn, 30 m a.s.l., covering direction EA, F and I. Was a proposal.

- News

New 2m EME Word Record

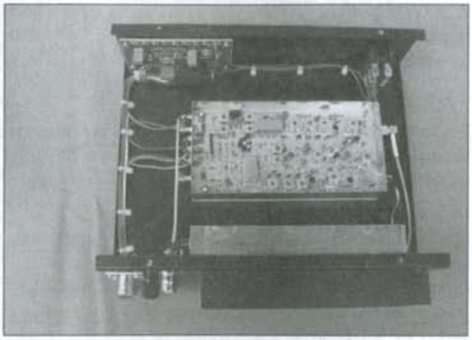
On March 7th a new 2m EME Distance World Record has been set between ZL1WN (RF73HG) and CT1HZE (IM57nh). The QSO took place in JT65B. Terrestrial distance is 19706km, this is 21km more than the previous record. Signals on both sides were peaking –19dB.

Galileo now "public"

The Galileo project will be financed now with tax payers money as the private industry did not meet the necessary deadlines. It does not look promising for the amateur radio 23cm DX-window as exactly this range is allocated to a Galileo channel.

Transverters from HA1YA

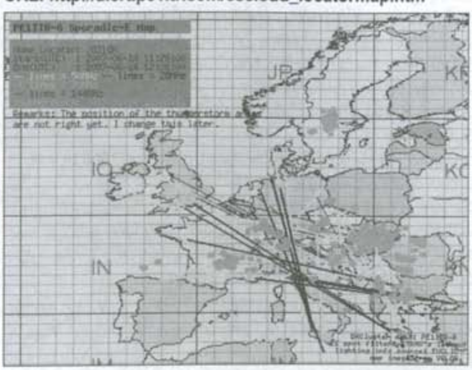
HA1YA offers new transverters from 28 MHz to 50 MHz and to 70 MHz, output is 20 to 25 W. More info on the web at: http://ha1ya.config.hu/transverters.htm



4m transverter from HA1YA

Lightning and Sporadic E map

A lot of discussion goes on about this topic. The first result of a nearly realtime map with es-qso's and lightning areas plotted is now online on the web thanks to Rob, PE1ITR.
Check it out at http://alert.pe1itr.com or directly at:
URL: http://alert.pe1itr.com/escloud_locatormap.htm



New DUBUS Portal on the web

DUBUS is offering a new webportal with a database for any active station on VHF/UHF/SHF. Please check it out and follow the link to DUBUS Portal on www.DUBUS.org or www.DUBUS.de. After registration DUBUS subscribers may send an email to the admin and then have access to the online DUBUS Toplists and Beaconlists with some special features.

First 1 KW transistor for 144 MHz!

In June freescale has announced the first ever 1KW output transistor for VHF: The MRF6VP11KH is a 50 V Lateral N-Channel Broadband RF Power MOSFET for 10 – 150 MHz rated with 1 KW output at 130 MHz and 65% drain efficiency. Drive power is only abt. 5 Watts! (27dB gain, class AB) First samples of this device are expected to be delivered from October 2007.

AGC off mod for FT-847

OZ1PIF, Peter, has described an AGC off modi for the FT-847 on the web at: www.frenning.dk/OZ1PIF_HOMEPAGE/FT-847%20AGC-Off%20Mod.htm

- Dates

Aug 17 to 19: **SP Microwave meeting** in Zieleniec (JO80EI), Poland.

Sept 16: **Crawley Roundtable** (UK)
http://www.microwavers.org/cra-prog.htm

Sept. 15/16: **52nd UKW Tagung Weinheim** (Bensheim): www.ukw-tagung.de/

Oct. 8-12 **European Microwave Week**, Munich (DL)
Web: http://www.eumw2007.com/

Oct. 18 to 20: **Microwave Update 2007**, Philadelphia, Pennsylvania, the INN at Valley Forge. www.microwaveupdate.org/

Nov 10-11 **Martlesham Roundtable** (UK)
http://mmrt.homedns.org/

Aug 8 to 10, 2008 : **Florence EME Conference**:
http://www.ari-crt.it/eme2008/questionnaire.html

- Last

EA8 activity on Micowaves?

Anyone there going for holiday to EA8 in July/August/September and may bring a decent microwave station (2.4 to 24 GHz)?
The path is supposed to be OPEN then most of the time!
I am interested in tests / skeds. CT1HZE, info@dubus.de

Redaktionsschluss für DUBUS 4/2007 ist der 1. November 2007. - Deadline for reports etc. for DUBUS 4/2007 is November 1st 2007.

DUBUS EU-Microwave beacon list (July 2007), by DL8HCZ

QRG	Call	Locator	m asl	Antenna	QTF	Pwr	Info/Keeper	Last Update	Remarks
1296.000	W2ETI	FN21TA		4x rh helix	moon	64dBmi	WA2IKL	06/07 EME-Beacon	Temp. QRT
1296.000	YO2U	KN05PS		10 el Yagi	0°	0.05	YO2IS	05/04 YO2IS	QRT for ever
1296.050	HB9BBD/p	JN47GA	1662	4xDipole	N	18tx	HB9BBD	06/07 HB9BBD	
1296.050	S55ZSE	JN65WP	620	Slot	Omni	0.3tx	S53MV	06/07 S51ZO	
1296.063	S55ZNG	JN65UU	643	V-J Slot	Omni	0.1	S59DKS	05/04 S51KQ	Perm. QRT
1296.090	S55ZMS	JN86CR	350	Slot	Omni	0.3	S53M	06/07 S51ZO	
1296.180	UU9JJ	KN64RO		Dipole	N/S	5 TX	UU9JJ	06/07 UU9JJ	
1296.380	S55ZRS	JN76MC	1219	Dipole	Omni	0.2	S50TA	06/07 S51ZO	
1296.739	F5XBH	JN38PJ	1070	Big wheel	Omni	4	F6BUF	06/07 F6HTJ	
1296.743	DB0LTG	JO31TB	506	2 x Big Wheel	Omni	1	DC0KX	05/07	Lineartransponder Beacon
1296.800	OE8XBK	JN66WQ	1909		Omni	2	OE8ABK	06/07 OEVSV	QRT
1296.800	DB0RHN	JO50AL	930	Dipol	Omni	1 TX	DK9MS	06/07 ex DB0GD	DK9MS QRT
1296.800	DB0HEG	JN59GB	700	4 x Slot	Omni	0.5 TX	DL2QQ	11/06 G3XDY	on .803
1296.800	OE3XMB	JN77TX	1154			0.1	OE3FFC	06/07 OEVSV	QRT
1296.800	SK6MHI	JO57TQ	40	Alford slot	Omni	30 e		06/07 SM6CEN	
1298.800	IK4NYV/B	JN54UG						10/06 IZ4AIB	
1296.805	DB0GP	JN48WQ	780	4 x Yagi Box	Omni	50 e	DG9SQ	06/07 DG9SQ	(call not DB0RIG!)
1296.805	SK6UHI	JO57TX	125	Alford slot	Omni	30 e		06/07 SM6CEN	
1296.810	DB0ZW	JN69EQ	825	Slot	Omni	1 TX	DC9RK	06/07 DC9RK	
1296.810	GB3NWG	JO01BI	180	15/15 Slot Yagi	293°	50	G8BJG	06/07 G4FSG	QRT for ever
1296.810	PI7DIJ	JO33AI	20	9 el Yagi	200°	1	PA4FP	06/07 PA4FP	QRT
1296.810	SK7MHF	JO77IP	360	Alford slot	Omni	30 e	SM7MXO	06/07 SM6CEN	
1296.812	F1XBI	JN37NX	1278	4 el Yagi	135°	1	F1AHO	06/07 F6HTJ	
1296.815	DB0VI	JN39NK	465	Slot	Omni	1	DL4VCG	06/07	QRT
1296.816	F1ZTF	IN95VO	125	Wheel	Omni	10	F1MMR	06/07 F6HTJ	
1296.820	DB0OT	JO32QR	80	Big wheel	Omni	1 TX	DL1BFZ	06/07 DL1BFZ	
1296.820	LA1SHF	JO59JW		14 el Yagi	160°	10	LA4PE	04/04 LA0BY	QRT
1296.822	LA5SHF	JO28UX	70	8 Ele.	250	150 e	LA3EQ	05/07	-> QTH soon JO29OG
1296.825	F5ZRS	JN25UD	1700		Omni	0.1	F5LGJ	06/07 F6HTJ	
1296.825	DB0ABG	JN59WI	522	Slot	Omni	0.5 TX	DJ3TF	04/04 DJ3HW	QRT for ever
1296.825	DB0HF	JO53BO	65	Big wheel	Omni	0.3 TX	DK2NH	02/06 DJ3HW	
1296.825	OE3XAA	JN88BA	834		Omni	0.2	OE1BKW	06/07 OEVSV	Proposal
1296.829	SR6LHZ	JO70SS		3 ele yagi H	40	1 TX	SP6RYH	06/07 SP3BEK	
1296.830	GB3MHL	JO02PB	85	2 x 32 Slot wg	W/E	500	G3XDY	06/07 G3XDY	
1296.835	DB0AJ	JN57	620	12 el Yagi	0°	50	DK2RV	04/04 DJ3HW	QRT
1296.835	SK0UHG	JO89WI	55	Horizontal	Omni	25 e		06/07 SM6CEN	
1296.840	DB0KI	JO50WC	925	Slot	Omni	39	DC9NL	04/07 DC9NL	temp. QRT
1296.840	OH6SHF	KP13GM	55	Dipole	200	30		03/07 OH6DD	on .935
1296.845	DB0LBV	JO61EH	234	4 x Slot	Omni	2 TX	DC6WM	06/07 DC6WM	
1296.845	SR3SHF	JO91CQ	180	2x Helix 6dB	Omni	2 TX	SP3JBI	06/07 SP3JBI	
1296.847	F5XBK	JN18JS	160	Alford Slot	Omni	10	F6ACA	06/07 F6HTJ	
1296.850	IW5EL/B	JN53					IW5EL	03/07	
1296.850	DL0UB	JO62KK	120	4 x Box	Omni	1 TX	DL7ACG	06/07 DL7ACG	
1296.850	RN6BN/B	KN95LC					RN6BN		QRV?
1296.850	GB3FRS	IO91PH	120	Disc	Omni	3	G8ATK	07/07	qrv
1296.854	DB0JO	JO31SL	312	4 x 15 el Yagi	270°	350	DG8DCI	05/07 DF1VB	temp. QRT
1296.855	OZ3UHF	JO56CE	150	5 el Yagi	180°	6	OZ1GMP	03/04 OZ2TG	QRT
1296.855	SK3UHG	JP92FW	200	4 x Big wheel	Omni	10 e	SM3UZS	06/07 SM3UZS	
1296.860	DB0LB	JN48OV	367	Big wheel	Omni	1 TX	DL4SBK	06/07 DL4SBK	.
1296.860	GB3MCB	IO70OJ	300	Yagi		3	2E0YUV	07/07 G3YJX	QRV again!
1296.860	LA8SHF	JO59FB	30	13 dB Horn	180°	60	LA6LCA	06/07 LA0BY	=on .850 exLA1UHG
1296.862	F1XAK	JN23MM	114	Slot W	Omni	200	F1AAM	06/07 F6HTJ	
1296.862	HG5BUB	JN97LM	485	Slot	Omni	0.8	HA5BDJ	06/07 HA1YA	
1296.865	DB0JK	JO30LX	257	4 x 8 el Yagi	Omni	40e	DK2KA	06/07 DK2KA	
1296.865	HB9EME	JN37KB	1422	Slot 10dBi	Omni	12/.012	HB9HLM	06/07 HB9HLM	
1296.870	LA2SHF	JP53					LA1BFA	05/07 LA0BY	Proposal
1296.870	DB0IBB	JO32VG	200	4 x Slot	Omni	170	DB7QW	06/07 DL8YDD	QRT for ever

1296.872	F1ZMT	JN07CX	85	Panel/Wheel	Omni+180	20	F1BJD	06/07 F6HTJ	
1296.875	HB9OK	JN45MW	1601	Alf. Slot	Omni	3.5	HB9DUR	08/06 HB9DUR	
1296.875	FX3UHX	IN78UK	121	Quad	90°	1	F6CGJ	06/07 F6HTJ	
1296.875	GB3USK	IO81QJ	235	Slotted wg	90°	250	GW8AWM	05/07	
1296.880	I8EMG/B	JM89BJ	1400	6 ele	310	1	I8EMG	06/07 I8EMG	
1296.880	DB0FRE	JN37WX	290	GP	Omni	1	DJ8SC	06/07 DJ8SC	
1296.880	LA3SHF	JO38XB	5	2 x 15 el Yagi	180°	10	LA8AK	04/04 LA0BY	QRT
1296.880	ON0SHF	JO10UN	130	Slotted	90°	10	ON5PX	05/07	on .886
1296.883	DB0INN	JN68GI	504	Schlitz	Omni	1 TX	DL3MBG	06/07	not qrv
1296.885	DB0TUD	JO61UA	250	Slot 8dB	Omni	1	DL4DTU	06/07 DL4DTU	Temp. QRT
1296.885	OY6BEC	IP62OA	300		SE	20	OY9JD	01/07 OZ2TG	Proposal
1296.885	OE3XEA	JN78SB	725			1	OE3EFS	06/07 OEVSV	QRT
1296.886	F1XBC	JN06JG	230	Alford Slot	Omni	25	F1AFJ	06/07 F6HTJ	
1296.888	OM0MSA	JN88NE	570	Dipole	90/270°	0.045	OM3ID	06/07	
1296.890	GB3DUN	IO91RV	263	Alford slot	Omni	2	G3ZFP	05/07	qrv again
1296.890	LA4SHF	JO28UO	170	Collinear	180°	45 e	LA9VFA	06/07 LA0BY	on .886
1296.895	ON0RUG	JO11UB	95	Slotted	Omni	20	ON6UG	06/07 ON6UG	long term proposal
1296.897	HG6BUB	KN07AU	1015	Slot	Omni	1 TX	HA5ED	06/07 HA1YA	Proposal
1296.900	DB0AN	JO31SX	100	Big wheel	Omni	1 TX	DF1QE	04/04 DJ3HW	QRV?
1296.900	GB3IOW	IO90IO	250	Alford Slot	Omni	100	G8MBU	06/07 G3PHO	
1296.900	HG9BUA	KN08FB	930	Slot	Omni	1	HG5AZB	06/07 HA1YA	
1296.900+/-	DK2MN/B	JO32PC	168	Slot	Omni	1 TX	DK2MN	06/07 DK2MN	
1296.902	OK0EA	JO70UP	1355	4 x 15 el Yagi	S/SW/W/NW	1.6	OK1AIY	06/07	nominal .910
1296.902	LX0SHF	JN39		2 x Big wheel	Omni	6	LX1CD	06/07 LX1DB	Temp. QRT new QTH
1296.902	OZ5SHF	JO45WX	205	Dipole	N/S	2	OZ2OE	06/07 OZ2TG	
1296.905	DB0AD	JO40AQ	693	dipole	Omni	1	DM8MM	06/07 DM8MM	Proposal
1296.905	GB3CFG	IO74CR	271	slot	Omni	25	GI0GDP	05/07	Proposal
1296.905	OH4SHF	KP31OX	200	Alford Slot	Omni	15		04/04 OH6DD	QRT for ever
1296.906	F5XAJ	JN12LL	1100	Slotted WG	Omni	50	F6HTJ	06/07 F6HTJ	
1296.910	DB0UX	JN48FX	275	4dBD	Omni	1 tx	DK2DB	06/07 DK2DB	
1296.910	DB0UM	JO73CE	60		Omni	1.3 e	DG1BHA	06/07 DG1BHA	Proposal
1296.910	GB3CLE	IO82RL	540	2 x 15/15 Yagi	0°	20	G3UQH	05/07	temp. QRV
1296.915	DB0UBI	JO42GE	165	Horn	45°	2.5 e	DD8QA	04/05 DD8QA	QRT
1296.915	ES0SHF	KO18DN		2 x D-diamond	90°/270°	60/60	ES5PC	04/07 ES5PC	on .922
1296.920	TK5ZMV	JN41JS	635	Panel	NE	100	TK5EP	06/07 F6HTJ	
1296.920	9A0BLB	JN83HG	778	Dipole	1			04/04 9A2MP	NOT QRV
1296.920	DB0VC	JO54IF	300	2 x Big wheel	Omni	10	DL8LAO	06/07 DL8LAO	
1296.920	GB3COA	IO75SU	52	2 x Quagi	0°/90°	10	GM1SXX	06/07	Proposal
1296.923	PI7QHN	JO22KH	20	6 dB Gain	Omni	4 erp	PA0QHN sk	05/07 "CM53b"	on .915
1296.925	DB0AAT	JN67HT HU?	800	Vertical	Omni	1 TX	DL8MCG	09/06 DJ3HW	ex DB0KME
1296.927	EA3UHF	JN01WU	608	2 x 5 el yagi	E+S	10	EA3BB	06/07 EA3BB	on .915
1296.928	OH2SHF	KP20BB	63	10/10dBD	20°+230°	150e	OH2NXX	01/07 OH6DD	
1296.930	GB3MLE	IO93EO	600	Corner Refl.	160°	50	G8AGN	06/07	
1296.930	OK0EL	JO70SQ	900	Horn 5 dB	W/SE	0.8	OK1AIY	05/07	on .932
1296.930	OZ7IGY	JO55WM	95	4 x Big wheel	Omni	25	OZ7IS	06/07 OZ2TG	
1296.933	F5XBF	IN94UW	90	2 x Big wheel	Omni	20	F6DBP	06/07 F6HTJ	
1296.935	DB0YI	JO42XB	455	4 x Quad	Omni	3	DL4AS	04/07 DL4AS	
1296.935	OH5SHF	KP30HV	145	Alford Slot	Omni	25		01/07 OH6DD	
1296.937	HG3BUB	JN96CC	535	Slot	Omni	0.8	HA5SHF	06/07 HA1YA	on .930
1296.940	DB0RG	JO51GO	730	V Dipole	Omni	1	DL4OAN	05/07 DL4OAN	Proposal
1296.940	SK7MHH	JO86GP	45	Alford slot	Omni	10		03/05 SM6CEN	QRT
1296.945	DB0OS	JO40CW	745	6 el array	270°	1	DG6YW	06/07 DJ3HW	
1296.945	HB9F	JN46SW	1015	Corner refl.	0°	15	HB9MHS		QRT
1296.945	OH9SHF	KP36OI	236	10 dBd	200°	30	OH6DD	06/06 OH6DD	
1296.945	LA7SHF	JP20QJ	565		180	15 e	LA3QMA	05/07 LA0BY	Proposal
1296.950	DB0HG	JO40HG	211	Big wheel	Omni	15 e	DL4FCS	05/04 DL1ZBR	Not QRV
1296.950	OZ5UHF	JO65GQ	35	Collinear	Omni	1	OZ3TZ	01/07 OZ2TG	
1296.954	SK3GW/B	JP80JH	90	32 ele	210	10	SM3LBN	06/07 SM6CEN	Temp. QRT
1296.955	OZ1UHF	JO57FJ	150	Big wheel	Omni	10	OZ9NT	06/07 OZ2TG	
1296.960	OK0EJ	JN99FN	1323	Horn	W	0.1	OK2UWF	06/07	

1296.960	DB0WTT	JO40LG	115	Big Wheel	Omni	1	DL1ZBR	05/04	DL1ZBR	.
1296.960	DB0MFI	JN58KR	532		Omni	10 e	DK1MFI	05/07	DK1MFI	Proposal
1296.960	HG7BUB	JN97KR	700	Vert. Coll.	Omni	1	HA5EB	06/07	HA1YA	on .963
1296.960	SK4BX/B	JO79LI	265	Slot	Omni	25 e		05/07	SM6CEN	(ex SK4UHI)
1296.965	DF0ANN	JN59PL	630	Eggbeater	Omni	0.5 tx	DL8ZX	06/07	DL8ZX	
1296.965	GB3ANG	IO86MN	319	Slot Yagi	170°	40	GM4ZUK	06/07		
1296.965	OK0EO	JN89QQ	602	2 Ele	SW	0.05/0.12	OK2VLX	06/07		Proposal
1296.970	OK0EY	JN89HA	220	Dipole	W	0.1	OK2UWH	06/07		Proposal
1296.973	OK0EQ	JN89AR	745	Dipole	SSW/NNE	2	OK2ZI	06/07		Proposal
1296.970	GB3ESB	JO00GP	120	Alford slot	Omni	10	G4PRJ	06/07	G4FSG	QRT for ever
1296.970	SK7MHL	JO65OR	100	Alford slot	Omni	15	SM7ECM	06/07	SM6CEN	
1296.975	HG1BUB	JN87FI	725	Slot	Omni	1.5	HA1YA	06/07	HA1YA	
1296.975	DB0SGA	JN69KA	1024	4 x DQ	Omni	5 TX	DJ4YJ	06/07		Proposal for 2008
1296.975	OH3RNE	KP11UM	210	Big Wheel	Omni	10	rep/beac	03/07	OH6DD	
1296.975	ON4AZC	JO21EE	95	Clover leaf	Omni	1	ON7BPS	06/07	ON7WP	Not existing!
1296.980	DB0EE	JO31CV	80	Helical	Omni	1.0TX	DL1EGF	04/04	DF5EO	ex DB0JU
1296.984	OZ2ALS	JO45WA	65	2 x slot	Omni	10	OZ9DT	03/04	OZ2TG	QRT
1296.985	DB0AS	JN67CR	1565	Dipolfeld	10°	0.5 TX	DL2AS	06/07	OE5VRL	
1296.985	SR1LHX	JO83QP			N/S	1	SP7JSG	04/07	SP3BEK	
1296.990	DB0FB	JN47AU	1495	8el Group	45°	5 TX	DJ3EN	04/04	DJ3EN	QRT for ever
1296.990	GB3EDN	IO85HW	117	2 x Corner Refl	45°/315°	25	GM8BJF	06/07	LA3EQ	
1296.995	DB0WOS	JN68ST	850	4 x DQ	Omni	5	DF8RU	04/04	DF8RU	QRT since 9/03
1297.000	GB3NO	JO02PP						06/07		
1297.010	DB0JW	JO30DU	238	4 x 12 el Yagi	45°	70	DL9KAS	06/07	DJ3HW	
1297.050	GB3FM/B	IO91OF	FM repeater	vertical		1,5		03/07	OZ6OL	
1297.075	GB3PS/B	IO92XA	FM repeater with beacon mode					03/07	OZ6OL	
1298.005	GM6BIG/B	IO85BU						06/07	GM4ISM	
2301.000	ON0EHF	JO21IB	This is a repeater and no beacon!				ON7WP	04/07	ON7WP	Test operation
2304.040	S55ZNG	JN65UU	643	V-J Slot	Omni	0.1	S50M	04/04	S51KQ	Perm. QRT
2304.050	S55ZSE	JN65WP	620	Slot	Omni	0.5tx	S53MV	06/07	S51ZO	also 2320.050!
2304.160	I3D	JN55		Slot	Omni	32	IW3FZQ	12/00	I5WBE	QRT
2304.870	I7G	JN80PU		2 x 25 ele	305/135	20		06/07	ARI/I5WBE	
2320.050	HB9BBD/p	JN47GA	1662	4xDipole	N	8 tx	HB9BBD	06/07	HB9BBD	
2320.050	S55ZSE	JN65WP	620	Slot	Omni	0.5tx	S53MV	06/07	S51ZO	also 2304.050!
2320.090	S55ZMS	JN86CR	350	Slot	Omni	0.5	S53M	06/07	S51ZO	
2320.800	SK6MHI	JO57XQ	135	Slotted WG	Omni	150 e	SM6EAN	06/07	SM6CEN	
2320.810	DB0ZW	JN69EQ	825	6 x Slot	Omni	1	DC9RK	06/07	DC9RK	Proposal
2320.810	SK7MHF	JO77IP	360	2 x Big wheel	Omni	0.1	SM7MXO	06/07	SM6CEN	
2320.814	SK0UHH	JO99BM	90	4 x Horn	Omni	25 e	SM0DFP	06/07	SM6CEN	(ex SK0UX)
2320.815	DB0VI	JN39NK	465	Slot	Omni	1	DL4VCG	04/07		QRT
2320.816	F1ZQU	IN95VO	125	Slot	Omni	2	F1MMR	06/07	F6HTJ	
2320.820	DB0OT	JO32QR	80	Big wheel	Omni	1 TX	DL1BFZ	06/07	DL1BFZ	
2320.825	DB0HF	JO53BO	65	Big wheel	Omni	0.3 TX	DK2NH	02/06	DJ3HW	
2320.825	OE1XTB	JN88EE	170	4 x dipole	Omni	1	OE1MOS	06/07	OE5VRL	QRT for ever
2320.830	DB0JX	JO31FF	115	Double helical	Omni	0.1 TX	DK4TJ	04/04	DK4TJ	QRT for ever
2320.830	GB3MHS	JO02PB	85	Slotted WG	Omni	25	G3XDY	06/07	G3XDY	
2320.832	OH6SHF	KP13GM	56	7dB	180	0.2 w		08/06	OH6DD	
2320.833	DB0FGB	JO50WB	1090	Slot 8dBD	Omni	3.5 tx	DB8UY	06/07	DB8UY	
2320.838	F5XAC	JN12BL	2400	Panel	NE	10	F6HTJ	06/07	F6HTJ	
2320.840	DB0KI	JO50WC	925	Slot	Omni	14	DC9NL	06/07	DC9NL	QRT for ever
2320.842	OH3SHF	KP11VK	222	6 dBi	Omni	125 e		06/06	OH6DD	
2320.845	DB0LBV	JO61EH	234	DQ	135°/225°	1.5 TX	DC6WM	06/07	DC6WM	.
2320.845	SR3LHE	JO91CQ	180	2 x Helix 6dB	Omni	1 TX	SP3JBI	04/07	SP3JBI	
2320.850	DB0GW	JO31JK	80	2 x Helix	Omni	1 tx	DL4JK	06/07	DL4JK	
2320.850	DL0UB	JO62KK	115	Slot	Omni	1 tx	DL7ACG	06/07	DL7ACG	
2320.850	OZ3UHF	JO55						04/07	OZ1CTZ	new?
2320.850	GB3NWK	JO01BI	180	Alford Slot	Omni	5	G8BJG	06/07	G4FSG	QRT for ever
2320.855	DB0SHF	JN48WP	822	3 x Dipole	280°	1	DL1SBE	01/07	DL1SBE	on .885
2320.857	PI7GHG	JO21CV	30	10 el Yagi	270°	30	PE1GHG	03/05	VERON	QRT

2320.860	HG7BUC	JN97KR	700	Slot	Omni	0.3	HA5EB	06/07	HA1YA	Proposal
2320.860	LA8SHF	JO59FB	30	13 dB Horn	180°	50	LA6LCA	06/07	LA0BY	ex LA1UHG
2320.860	DB0LB	JN48OV	367		Omni		DL4SBK	06/07	DL4SBK	Proposal cancelled
2320.862	F1XAH	JN23MM	114	Slotted WG	Omni	15	F1AAM	06/07	F6HTJ	Temp. QRT
2320.862	LA4SHF	JO28UO	170	Log per.	225	10 e	LA3EQ	06/07	LA0BY	nominal .850
2320.864	HG9BUB	KN08FB	930	Slot	Omni	0.7	HG5AZB	06/07	HA1YA	Proposal
2320.865	PI7TGA	JO21VT	75		135°/270°	50	PA0TGA	06/07	PA0EZ	on .880?
2320.870	DB0IBB	JO32VG	200	10 x Slot	Omni	4	DB7QW	06/07	DL8YDD	QRT for ever
2320.870	HG5BUC	JN97LM	485	Slot	Omni	1	HA5BDJ	06/07	HA1YA	
2320.872	F1ZRI	IN98WE	260	14 ele loop	190	80	F1BJD	06/07	F6HTJ	
2320.880	I8EMG/B	JM89BJ	1400	Yagi	310	1	I8EMG	06/07	I8EMG	
2320.880	DB0GO	JO41ED	738	10 x Slot	Omni	50	DL1YMK	06/07	DL1YMK	QRT for ever
2320.880	DB0YI	JO42XB	455	4 x Quad	Omni	3	DL4AS	04/07	DL4AS	
2320.880	LA3SHF	JO38XB	5	2 x 6 dB Horn	90°/180°	1	LA8AK	06/07	LA0BY	QRT for ever
2320.883	DB0INN	JN68GI	504	Slot	Omni	1 TX	DL3MBG	06/07		not qrv
2320.885	DB0TUD	JO61UA	250	Slot 8dB	Omni	1	DL4DTU	06/07	DL4DTU	Temp. QRT
2320.885	HB9EME	JN37KB	1422	Slot WG 14dB	Omni	10	HB9HLM	06/07	HB9HLM	Proposal
2320.885	PI7RMD	JO31AE	100	2 x Quad	180°	10	PE1KXH	03/05	VERON	
2320.886	F5ZMF	JN06JG	230	Slot	Omni	40	F5BJL	06/07	F6HTJ	
2320.888	OM0MTA	JN88NE	570	Dipole	90/270°	0.012	OM3ID	06/07		
2320.890	GB3ANT	JO02PP	75	Alford slot	Omni	5	G8VLL	05/07		on. 892
2320.900	HG3BUC	JN96CC	535	Slot	Omni	1 TX	HA5SHF	06/07	HA1YA	
2320.900	DB0NBB	JO63PN	130		Omni	5 e	DJ2BC	06/07		
2320.900	F6DWG/B	JN09WI	210	WG	Omni	10	F6DWG	06/07	F6HTJ	
2320.900	DK2MN/B	JO32PC	168	Slot	Omni	1 TX	DK2MN	06/07	DK2MN	
2320.900	DB0UX	JN48FX	275	4dBD	Omni	1 tx	DK2DB	06/07	DK2DB	
2320.900	DB0JW	JO30DU	238	6 el Array	45°	25	DL9KAS	04/04	DJ3HW	QRV ?
2320.902	LX0THF	JN39BP	420	Double quad	Omni	1	LX1JX	06/06	LX1DB	QRT perman.
2320.905	GB3SCS	IO80UU	274	Alford slot	Omni	60	G0API	12/06		on .890
2320.910	OK0ER	JN99BK	568				OK2XDX	06/07		Proposal
2320.910	DB0UM	JO73CE	60		Omni	1.3 e	DG1BHA	06/07	DG1BHA	Proposal
2320.912	DB0RG	JO51GO	730	6 x Dipole ?	Omni	5	DL4OAN	06/07	DL4OAN	Proposal
2320.915	DB0UBI	JO42GE	165	Collinear	45°	0.5	DD8QA	04/05	DD8QA	QRT since 2004
2320.920	DB0VC	JO54IF	300	Big wheel	Omni	3	DL8LAO	01/07	DL8LAO	
2320.920	PI7QHN	JO22KH	20		Omni	0.2 TX	PA0QHN	01/02	PE2KP	QRT
2320.925	GB3PYS	IO82HL	436	Alford Slot	270°	10	GW4NQJ	06/07	G4FSG	with ant. problem
2320.928	OH2SHF	KP20BB	63				OH2NXX	02/07	OH2LAK	
2320.930	OK0EL	JO70SQ	900	Horn 5dB	W-S	0.8	OK1AIY	06/07		
2320.930	OZ7IGY	JO55WM	91	Alford slot	Omni	20	OZ7IS	06/07	OZ2TG	
2320.930	PI7PLA	JO33IC	50		Omni	0.15 TX	PA0PLA	06/07	PA0EZ	Perm. QRT
2320.935	OH5SHF	KP30HV	146	10dBD	240	1 e	OH5LK	05/07	OH5LK	
2320.937	DB0JO	JO31SL	312	Horn	270°	0.2 TX	DG8DCI	04/07	DF1VB	Temp. QRT
2320.940	DB0DON	JN58KR	532	Slot	Omni	1	DK1MFI	06/07	DK1MFI	QRT for ever
2320.940	GB3WYE	IO81KO	369	Dipole panel	90°	100	GW8AWM	06/07	G4FSG	QRT for ever
2320.940	SK7MHH	JO86GP	45	30 cm dish	0°	50 e		06/07	SM6CEN	
2320.945	DB0OS	JO40CW	745	8 el array	270°	2	DG6YW	10/06	G3XDY	
2320.950	DB0KP	JN47TS	435	Slot	Omni	0.1 TX	DL1GBQ	06/07	DL1GBQ	QRT since 1997
2320.950	OZ9UHF	JO65HP	30	Slot	Omni	5	OZ2TG	01/07	OZ2TG	QRT
2320.952	ON0KUL	JO20KV	110	Slot	Omni	15e	ON4IY	06/07	ON4IY	Temp. QRT
							nominal on .975 call will change to ON0GHZ			
2320.955	GB3LES	IO92IQ	220	Slot	160°	30	G3TQF	05/07	G3XDY	
2320.955	OZ1UHF	JO57FJ	150	Slot	Omni	8	OZ9NT	06/07	OZ2TG	
2320.960	SK4BX/B	JO79LI	265	Slot	Omni	250 e		06/07	SM6CEN	Temp. QRT
2320.960	DB0MFI	JN58KR	532		Omni	10	DG1MFI	06/07	DK1MFI	Proposal
2320.960	OK0EJ	JN99FN	1323				OK2QW	06/07		Proposal
2320.963	HG6BUC	KN07AU	1015	Slot	Omni	1 TX	HA5ED	06/07	HA1YA	Proposal
2320.965	DB0AJA	JN59AS	364		Omni	10	DL6NDG	06/07	DF6NA	
2320.965	DF0ANN	JN59PL	630	4 x D Q	Omni	2.5 ei	DL8ZX	06/07	DL8ZX	
2320.966	OZ4UHF	JO75LD	130	4xpatch	NE/SW	200		04/07	OZ1FF	on .956
2320.967	DB0AS	JN67CR	1560	28 el Yagi	337°	0.5 TX	DL2AS	06/07	OE5VRL	on .965

2320.970	SK7MHL	JO65OR	100	WG slot	Omni	25 e	SM7ECM	06/07	SM6CEN	
2320.970	OK0EY	JN89HA	220	Slot	Omni	0,1	OK2UWH	06/07		Proposal
2320.973	OK0EQ	JN89AR	745	Dipole	SSW/NNE	2	OK2ZI	06/07		Proposal
2320.975	DB0JL	JO31MC	175	Slot	Omni	0.5	DF1EQ	04/04	DF1EQ	QRT? .
2320.975	HG1BUC	JN87FI	725	Slot	Omni	0.8 TX	HA1YA	06/06	HA1YA	
2320.980	DB0EE	JO31CV	80	Helical	Omni	1 TX	DL1EGF	04/04	DF5EO	ex DB0JU QRV?
2320.987	F1ZSO	JN05MP	417			10	F1DXP	06/07	F6HTJ	Proposal
2320.998	PI7EHG	JO22JH	95		Omni	10	PA0EHG	06/07	PA0EHG	QRT
3400.007	DL0UB	JO62KK	110	4 x Horn	Omni	5 TX	DL7ACG	05/07	DL7ACG	QRT
3400.015	PI7SHF	JO22JH	93	10 dB Slot	Omni	90	PA0EHG	06/07	PA0EHG	QRT
3400.025	DB0HF	JO53BO	65		202°		DK2NH	03/06		QRT
3400.040	DB0KI	JO50WC	925	Slot	Omni	12	DC9NL	06/07	DC9NL	QRT for ever
3400.050	DB0JL	JO31MC	175	D-Helical	Omni	0.15	DF1EQ	04/04	DF1EQ	QRT?
3400.050	S55ZSE	JN65WP	620	Slot	Omni	0.5tx	S53MV	06/07	S51ZO	
3400.060	DB0MFI	JN58KR	532		Omni	10	DK1MFI	05/07	DK1MFI	Proposal
3400.065	GM4LBV/B	IO86RQ	350	Slot panel	120	25eirp	GM4LBV	06/07	GM4ISM	
3400.080	OK0EX	JN79OW	500				OK1FEN	06/07		Proposal
3400.088	OM0MZA	JN88NE	570	Horn	45	0.11	OM3ID	06/07		
3400.090	S55ZMS	JN86CR	350	Slot	Omni	0.5	S53M	06/07	S51ZO	
3400.085	DB0AS	JN67CR	1565	Double 8	10°	0.5TX	DL2AS	06/07	OE5VRL	
3400.170	PI7CKK	JO33		10 dB Slot	Omni	5/30 e	PE1CKK	06/07	PA0EZ	temp.QRT->newQTH
3400.400	OK0EL	JO70SQ	900	Horn 5dB	270°	0.1	OK1AIY	06/07		
3400.800	OH3SHF	KP11VK	222	6 dBi	Omni	15 e		06/06	OH6DD	
3400.800	LA1UHG	JO59FB	30	13 dB Horn	180°		LA6LCA	06/07	LA0BY	
3400.800	DB0KHT	JO40FE	235	Horn	190	1.2	DJ1RV	06/07	DJ1RV	
3400.810	DB0ANU	JN59HH	563		Omni	5	DL3NDX/DK2GR	06/07		QRT for ever
3400.830	GB3MHS	JO02PB	85	Slotted WG	E/W	75	G3XDY	05/07	G3XDY	
3400.833	DB0FGB	JO50WB	1090	Slot 2x8	Omni	2	DB8UY	06/07	DB8UY	
3400.850	DB0GW	JO31JK	80	Double Helic	Omni	1 tx	DL4JK	06/07	DL4JK	
3400.850	LA4SHF	JO28UO	170	Log per	225	2 e	LA3EQ	06/07	LA0BY	
3400.887	GB3OHM	IO92AJ	171	16 Slot wg	Omni	8	G6KOA	05/07		nominal .810
3400.900	ON0VRT	JO20LA	210	Vertical	Omni	50 e	ON7WP	06/07		transmits no ID
3400.900	DK2MN/B	JO32PC	168	Slot	Omni	1 TX	DK2MN	06/07	DK2MN	
3400.905	GB3SCF	IO80UU	274	Alford slot	Omni	60	G0API	06/07		
3400.910	GB3ZME	IO82SQ	215	Slotted WG	Omni	100	G3UKV	05/07	G3XDY	on .915
3400.912	DB0RG	JO51GO	730		Omni	5	DL4OAN	06/07	DL4OAN	Proposal
3400.930	OZ7IGY	JO55WM	97,5	Slot	Omni	100	OZ7IS	06/07	OZ2TG	
3400.945	DB0AJA	JN59AS	364	3 x Sector	Omni	20	DL6NDG	06/07	DF6NA	Proposal
3400.955	OZ1UHF	JO57FJ	150					06/07	OZ2TG	
3400.970	OK0EY	JN89HA	220	Slot	Omni	0.1	OK2UWH	06/07		Proposal
3400.973	OK0EQ	JN89AR	745	Slot	Omni	1	OK2ZI	06/07		Proposal
3456.005	DB0EZ	JO31BS	110	tube	115	0.1	DB9JC	06/07 .		Call deleted
3456.830	DB0JX	JO31FF	115	Helical	Omni	0.1 TX	DK4TJ	04/04	DK4TJ	QRT for ever
3456.855	DB0SHF	JN48WP	822	Horn	280°	0.5 TX	DL1SBE	04/04	DL1SBE	Temp. QRT
3456.883	DB0INN	JN68GI	504	Slot	Omni	1 TX	DL3MBG	06/07		not qrv
3456.885	DB0TUD	JO61UA	260	Slot	Omni	1	DL4DTU	06/07	DL4DTU	Temp. QRT
3400.810	GB3OHM	IO92AJ	171	16 Slot wg	Omni	8	G6KOA	05/07		on .887
3456.965	DF0ANN	JN59PL				2.5 ei	DL8ZX	06/07	DL8ZX	Proposal
5760.010	S55ZSE	JN65WP	620	Slot	Omni	0.5tx	S53MV	06/07	S51ZO	
5760.029	PI7EHG	JO22JH	95	Horizontal	Omni	75	PA0EHG	06/07	PA0EHG	QRT
5760.030	OK0EL	JO70SQ	900	Horn 5dB	W-SE	0.1	OK1AIY	06/07		
5760.040	HB9MPU	JN47HD	1000	3x12dB Horn	N	0.2tx	HB9CAU	04/04	HB9CAU	
5760.040	OK0EA	JO70UP	1355	12 el Slot	Omni	0.7	OK1AIY	06/07		
5760.050	DB0EZ	JO31BS	110	Slot	Omni	1	DB9JC	06/07 .		Call deleted
5760.060	OK0EX	JN79OW	500	Slot	115/315	0.06	OK1FEN	06/07		Proposal
5760.060	F1XAO	IN88HL	326	Slotted WG	Omni	10	F1LHC	06/07	F6HTJ	Temp. QRT
5760.070	DB0JL	JO31MC	175	Slot	Omni	0.5	DF1EQ	04/04	DF1EQ	QRT?
5760.090	S55ZMS	JN86CR	350	Slot	Omni	0.5	S53M	06/07	S51ZO	

5760.210	GM4LBV/B	IO86RQ	350				GM4LBV	05/07 PA0EZ	
5760.590	HB9OK	JN45MW	1601	Slot	Omni	3.5	HB9DUR	04/04 HB9DUR	may be .950?
5760.800	OH3SHF	KP11VK	225	15dBi	Omni	150 e		06/06 OH6DD	
5760.800	DB0KHT	JO40FE	235	Horn	190	0.2 TX	DJ1RV	06/07 DJ1RV	
5760.800	SK6MHI	JO57XQ	135	Sectoral Horn	270°	65 e	SM6EAN	06/07 SM6CEN	
5760.805	DB0GP	JN48WQ	780		Omni	15	DG9SQ	06/07 (not DB0RIG!) QRV?	
5760.810	DB0ANU	JN59HH	563		Omni		DL3NDX/DK2GR	06/07	Perm. QRT
5760.820	F5XBE	JN18JS	160	Slot WG	Omni	120	F5HRY	06/07 F6HTJ	Temp. QRT
5760.830	DB0JX	JO31FF	115	Slot	Omni	0.08 TX	DK4TJ	04/04 DK4TJ	QRT for ever
5760.830	GB3MHC	JO02PB	85	Slotted WG	Omni	2.5	G3XDY	06/07 G3XDY	
5760.833	DB0FGB	JO50WB	1090	Slot 8 dBD	Omni	4.5 tx	DB8UY	05/07 DB8UY	
5760.840	DB0KI	JO50WC	925	Slot	Omni	0.6	DC9NL	06/07 DC9NL	QRT for ever
5760.845	F1XBB	JN07WV	170	Slot	Omni	150	F1JGP	06/07 F6HTJ	Temp. QRT
5760.850	DL0UB	JO62KK	115	Slot	Omni	0.25TX	DL7ACG	05/07 DL7ACG	
5760.850	DB0GW	JO31JK	80	Slotted WG	Omni	0.1 tx	DL4JK	06/07 DL4JK	Proposal
5760.850	I3EME	JN55WV	1430	Slot 10 dB	170°	.022	I3EME	06/07 I3EME	ex I3E
5760.855	DB0SHF	JN48WP	822	Patch Array	280°	0.05	DL1SBE	04/04 DL1SBE	
5760.855	F5ZPR	IN94QT	83	WG slot	E/SE	20	F6CBC	06/07 F6HTJ	
5760.860	DB0ARB	JN69OC	1456	Slot	Omni	3	DJ4YJ	06/07 DJ4YJ	
5760.860	HG5BSA	JN97LM	485	Slot	Omni	0.2	HA5BDJ	06/07 HA1YA	
5760.860	LA8SHF	JO59FB	30	13 dB Horn	180°	25	LA6LCA	06/07 LA0BY	ex LA1UHG
5760.860	OE8XGQ	JN66WQ	1909	Slotted WG	Omni	3	OE8MI	06/07 OE5VRL	on .855
5760.865	HB9EME	JN37KB	1422	Slot	Omni		HB9HLM	06/07 HB9HLM	Proposal
5760.866	F5ZUO	JN12LL	1100	WG	Omni	10	F6HTJ	06/07 F6HTJ	
5760.875	GB3RBY	IO92JJ	165	Slotted WG	Omni	1	G4LRT	06/07 G4FSG	perm. QRT
5760.880	OM0MXA	JN88NE	570	Dipole	45/225°	0.11	OM3ID	06/07	Proposal
5760.883	DB0INN	JN68GI	504	Slot	Omni	1 TX	DL3MBG	06/07	not qrv
5760.885	DB0TUD	JO61UA	260	Slot	Omni		DL4DTU	06/07 DL4DTU	Temp. QRT
5760.885	OE1XVB	JN88FE	350	Slotted WG	Omni	0.1tx	OE1WRS	06/07 OE5VRL	
5760.887	LA4SHF	JO28UO	170	Log per	225	2 e	LA3EQ	05/07 G3XDY	nominal .850
5760.890	HG3BSA	JN96CC	535	Slot	Omni	0.5	HA5SHF	06/07 HA1YA	
5760.900	GB3OHM	IO92AJ	171	Slot wg	Omni		G6KOA	06/07 G4BRK	
5760.900	DK2MN/B	JO32PC	168	Slot	Omni	1 TX	DK2MN	06/07 DK2MN	Proposal
5760.900	I8EMG/B	JM89BJ	1400	Slot	Omni	2	I8EMG	06/07 I8EMG	
5760.900	OZ5SHF	JO45WX	205	WG	Omni	2		06/07 OZ2TG	
5760.900	DB0CU	JN48BI	970	Slot	Omni	5	DC5GF	06/07 DG1GLH	QRT
5760.900	HG6BSA	KN07AU	1015	Slot	Omni	0.3 TX	HA5ED	06/07 HA1YA	Proposal
5760.904	F6DWG/B	JN09WI	210	WG	Omni	80	F6DWG	06/07 F6HTJ	
5760.905+/-	GB3SCC	IO80UU	274	Slotted WG	Omni	6	G0API	06/07	on .885
5760.905+/-	HB9G	JN36BK	1577	Slot	Omni	6.8		02/07 F5HRY	
5760.910	GB3ZME	IO82SQ	215	Slotted WG	Omni	100	G3UKV	05/07	
5760.910	DB0UM	JO73CE	60		Omni	1.3 e	DG1BHA	06/07 DG1BHA	Proposal
5760.912	SK0UX/B	JO99BM	90	WG Slot	Omni	100 e	SM0DFP	06/07 SM6CEN	
5760.912	DB0RG	JO51GO	730		Omni	10	DL4OAN	06/07 DL4OAN	Proposal
5750.920	GB3FNM	IO91OF		Slot		50 e	G4EPX	06/07 G4FSG	Proposal
5760.924	GB3KEU	IO93FB	330	Slotted WG	Omni	5	G3PHO	06/07 G3PHO	Proposal
5760.930	OZ7IGY	JO55WM	91	Slotted WG	Omni	15	OZ7IS	06/07 OZ2TG	
5760.945	DB0AJA	JN59AS	364	Slotted WG	Omni	10	DL6NDG	06/07 DF6NA	
5760.949	F6APE	IN97QI		WG	Omni	30	F6APE	06/07 F6HTJ	Temp. QRT
5760.950	OZ9UHF	JO65HP	30	Slotted WG	Omni	50	OZ2TG	06/07 OZ2TG	
5760.950	F6CXO	JN03RM?	273	WG slot	Omni	2	F6CXO	06/07 F6HTJ	QRT
5760.951	F1BOH	JN14EB	625	WG	Omni	20	F1BOH	06/07 F6HTJ	
5760.950	HG9BSA	KN08FB	930	Slot	Omni	0.1 TX	HG5AZB	06/07 HA1YA	Proposal
5760.955	OZ1UHF	JO57FJ	150	Slotted WG	Omni	8	OZ9NT	06/07 OZ2TG	on .936
5760.960	DB0MFI	JN58KR	532		Omni	10	DK1MFI	06/07 DK1MFI	Proposal
5760.960	OE2XRO	JN67LA	3105	Slotted WG	Omni	35	OE1MCU	06/07 OE5VRL	
5760.960	OK0EJ	JN99FN	1323				OK2QW	06/07	Proposal
5760.960	HG7BSA	JN97KR	700	Slot	Omni	0.2TX	HA5ED	06/07 HA1YA	Proposal
5760.965	DF0ANN	JN59PL				2.5 ei	DL8ZX	06/07 DL8ZX	Proposal

5760.970	SK7MHL	JO65OR	100	WG slot	Omni	10	SM7ECM	06/07	SM6CEN	
5760.970	OK0EY	JN89HA	220	Slot	Omni	0.1	OK2UWH	06/07		Proposal
5760.970	ON0CM	JO20IV					ON4AOD	01/04	ON4AVJ	Proposal?
5760.970+/-	G4LOJ/B	JO02QN					G4LOJ	08/03	F5HRY	
5760.973	OK0EQ	JN89AR	745	Slot	Omni	1	OK2ZI	06/07		Proposal
5760.975	HG1BSA	JN87FI	725	Slot	Omni	0.4 TX	HA1YA	06/07	HA1YA	
5760.975	ON0KUL	JO20KV	110	Slotte WG	Omni	50 e	ON7VQ	06/07	ON4IY	Proposal ->ON0GHZ
5760.985	DB0AS	JN67CR	1565	Double 8	10°	0.5 TX	DL2AS	06/07	OE5VRL	on 5760.100?
10100.000	GB3IOW	IO90IO	250	Slotted WG	Omni	1	G8MBU	06/07	G4FSG	QRT -> QRG chge
10120.000	GB3ALD	IN89VR	90	Sector Horn	30°	1		06/07	G4FSG	Perm. QRT
10368.015	DB0EZ	JO31BS	110	Slot	115	1	DB9JC	06/07	.	Call deleted
10368.031	F6BVA	JN33BD		Parabol	NE	1000	F6BVA	06/07	F6HTJ	
10368.037	PI7SHY	JO21RK	80	16 dBi Horn	300°	1/10 e	PA0SHY	06/07	PA0EY	Temp. QRT
10368.040	HB9MPU/B	JN47HD	1000	3x12dB Horn	N	0.5tx	HB9CAU	06/07	DB6NT	
10368.050	I5JRV/B	JN44XH		Alford	Omni	0.05	I5JRV	06/07	ARI/I5WBE	ex I5X
10368.050	LX1DU/B	JN29XM	280	1.3m Dish	63°	20k e	LX1DU	04/04		Intermittant beacon
10368.035	OK0EL	JO70SQ	900	12 el slot WG	135/270°	0.5	OK1AIY	06/07		
10368.050	OZ9UHF	JO65HP	30	Slotted WG	Omni	3	OZ2TG	01/07	OZ2TG	QRT
10368.053	F5XBD	JN18JS	160	Slot	Omni	60	F5HRY	06/07	F6HTJ	
10368.055	S55ZKP	JN65XM	1055	Slot	Omni	0.4	S51JN	06/07	S51ZO	on .070?
-10368.060	DK4GD/B	JN47FW	700	Slot	Omni	0.5	DK4GD	06/07	DF6TK	
10368.065	OK0EA	JO70UP	1355	12 el Slot	Omni	2	OK1AIY	06/07		
10368.073	GM4ISM/B	IO85BU	370	Slotted WG	Omni	0.5eirp	GM4ISM	06/07	GM4ISM	Temp. QRT
10368.073	S55ZRS	JN76MC	1219	Slot	Omni	0.27	S50TA	06/07	S51ZO	
10368.075+/-	I4X	JN54IG	1350	Dipoles	Omni	0.1	I4BER	06/07	I4XCC	
10368.075	PI7GOE	JO11XL		Slotted WG	Omni	0.1	PE1CIG	07/03	PE2KP	QRT
10368.080+/-	PI7TGA	JO21VT	75	16 dB	omni	4 erp	PA0TGA	06/07	PA0EZ	on.090?
10368.108	F1XAP	IN88HL	326	Slotted WG	Omni	10	F1LHC	06/07	F6HTJ	Temp. QRT
10368.120	DB0JL	JO31MC	175	Slot	Omni	0.2	DF1EQ	04/04	DF1EQ	Temp. QRT
10368.140	IT9JLW/B	JM67LX		Slot	170	1.1		06/07	ARI/I5WBE	on .153?
10368.175+/-	HB9OK	JN45MW	1601	Slot	Omni	3.5	HB9DUR	06/07	HB9DUR	nom. QRG .200
10368.178	DB0AS	JN67CR	1565	Horn	10°	0.5TX	DL2AS	06/07	OE5VRL	
10368.195	PI7EHG	JO22JH	95	13 dBi Slot	Omni	75	PA0EHG	06/07	PA0EHG	QRT
10368.240	GB3SWH	IO91TP	187	Slotted WG	45/225°	1	G4KUJ	06/07		QRT
10368.282	F5ZPS	IN94QT	83	Horns	0°/135°	20/800	F6CBC	06/07	F6HTJ	
10368.291	DB0ZDF	JN49CX	290				DF4WJ?	03/04		QRT
10368.295	DL0WY	JN67AQ	1838	10 dB Slot	W,N,E	0.1 TX	DJ8VY	06/07	OE5VRL	on .305
10368.365	OK0EX	JN79OW	500	Slot	115/315	0.04	OK1FEN	05/07		Temp. QRT
10368.800	OH3SHF	KP11VK	222	17 dBi	Omni	80 e		06/06	OH6DD	
10368.800	SK6MHI	JO57XQ	135	Slotted WG	Omni	5 e	SM6EAN	06/07	SM6CEN	
10368.800	DB0SI	JO53QP	90	Slot	Omni	1	DL1SUZ	05/07	DL1SUZ	
10368.805	DB0UL	JN48XK	630	Slotted WG	Omni	4	DL5EBT	06/07	DF6TK	
10368.810	SK6YH/B	JO57XQ	135	60cm dish	60	10kwe		06/07	SM6CEN	
10368.810	DB0GHZ	JO34WE	55	Slot WG	Omni	45	DK1ZD	06/07		
10368.810	DB0ANU	JN59HH	563	12 dB	Omni		DL3NDX/DK2GR	06/07	DL3NDX	Temp. QRT
10368.810	SR7JSG	KO01BW		Slot WG	Omni	1	SP7JSG	04/04	SP3JBI	QRT
10368.810	GB3XGH	IO83VO	175	Slotted WG	Omni	40	G6GXK	06/07	G6JYB	Call temp. G6XGK
10368.810	IZ0CZW/B	JN61PI					IZ0CZW	06/07	IZ0CZW	new beacon
10368.815	DB0VI	JN39NK	465	Slot	Omni	1	DL4VCG	06/07		QRT
10368.815	DB0MAX	JN58SP	420				DK1MAX	06/07		NOT QRV!
10368.817	OE8XXQ	JN66UO	2166	10dB	Omni	1	OE8MI	06/07	OE5VRL	
10368.820	LA5SHF	JO28UX	70	10 dB Slot	240	12 e	LA3EQ	05/07	LA0BY	-> soon JO29OG
10368.820	DB0KHT	JO40FE	235	Horn	190	0.2 TX	DJ1RV	06/07	DJ1RV	
10368.820	DB0HRO	JO64AD	75	Slot 10 dbD	Omni	0.2TX	DL5CC	06/07	DL5CC	
10368.822	SK3SHH	JP92FW	200	33dB dish	180	10k e	SM3LIC	06/07	SM6CEN	
10368.825	F1XAU	JN27IH	516	Slot WG	Omni	13	F1MPE	06/07	F6HTJ	
10368.830	DB0JX	JO31FF	115	10 dB Slot	Omni	0.09TX	DK4TJ	04/04	DK4TJ	QRT for ever
10368.830	SR6XHZ	JO70SS		Horn	40	1 TX	SP6RYH	06/07	SP6LB	
10368.830	GB3MHX	JO02PB	80	12 Slot WG	Omni	5	G3XDY	06/07	G3XDY	on .834

10368.832	LA8SHF	JO59FB	30	13 dB Horn	180°	10	LA6LCA	06/07 =ex LA1UHG	nominal .860
10368.833	DB0FGB	JO50WB	1090	Slot 8 dBD	Omni	1.3 tx	DB8UY	06/07 DB8UY	
10368.835	DK2MN/B	JO32PC	168	Slot	Omni	1 TX	DK2MN	06/07 DK2MN	
10368.840	DB0JO	JO31SL	312	6 x Slot	Omni	1	DG8DCI	02/07 G4EAT	on .854
10368.842	SK0SHH	JO89XJ	60	60cm dish	237	10kw erp		06/07 SM6CEN	
10368.842	F5ZTR	JO09WI	210	Slot	Omni	70	F6DWG	06/07 F6HTJ	ex F6DWG
10368.845+/-	SR3XHR	JO81SX		WG	Omni	1		04/04 SP3JBI	
10368.845	DB0SZB	JO60JM	767	Slot	Omni	15	DG0YC	04/04 DJ3HW	QRT
10368.846	SK0SHI	JO89XK	70	Horizontal	Omni	1		06/07 SM6CEN	
10368.850	I3EME/B	JN55WV	1430	Slot 10 dB	170°	1.5	I3EME	06/07 I3EME	ex I3F
10368.850	DL0UB	JO62KK	115	Slot	Omni	0.15TX	DL7ACG	06/07 DL7ACG	
10368.850	DB0GW	JO31JK	80	Slotted WG	Omni	0.1	DL4JK	06/07 DL4JK	
10368.850	F1BDB	JN33KQ	1200	Slot	Omni	1	F1BDB	06/07 F6HTJ	
10368.850	GB3SEE	IO91VG	250	Slotted WG	Omni	3	G0OLX	06/07 G0RRJ	
10368.850	LA4SHF	JO28UO	170	2 x Horn	N/S	2	LA3EQ	06/07 OZ1FF	
10368.853	SK1SHH	JO97CJ	52	Dish 33dB	360	10 k e		06/07 SM6CEN	
10368.855	DB0SHF	JN48WP	822	Horn	280°	0.01	DL1SBE	04/04 DL1SBE	
10368.856	SR0CWK	JO90NS	282	Slotted WG	Omni	4	SP9NLY	05/07 SP3JBI	
10368.856	OE8XGQ	JN66WQ	1909	Slotted WG	Omni	1	OE8MI	06/07 OE5VRL	
10368.859	F1DLT	JN27UR		Horn	NE	15	F1DLT	06/07 F6HTJ	Temp. QRT
10368.860	DB0ARB	JN69OC	1456	Slot	Omni	3	DJ4YJ	06/07 DJ4YJ	
10368.861	DB0GG	JN48NR	470	16xSlot	Omni	2 e	DL3SFB	06/07 DF6TK	nom. .850
10368.860	HG5BSB	JN97LM	485	Slot	Omni	0.5	HA5BDJ	06/07 HA1YA	
10368.860	F5XAD	JN12LL	1100	Slotted WG	Omni	2	F6HTJ	06/07 F6HTJ	Temp. QRT
10368.865	DB0JK	JO30LX	244	Slot	Omni	200	DK2KA	06/07 DK2KA	
10368.865	F1XAI	JN07WV	170	Slotted WG	Omni	10	F1JGP	06/07 F6HTJ	
10368.865	HB9EME	JN37KB	1422	Slot	Omni	5	HB9HLM	06/07 HB9HLM	Proposal
10368.870	DB0IBB	JO32VG	200	Slot	Omni	2	DB7QW	06/07 DL8YDD	QRT for ever
10368.870	GB3KBQ	IO80LW	167	Slotted WG	Omni	1	G4UVZ	06/07	
10368.875	OE5XBM	JN78DJ	985	Slot WG 10dB	Omni	1 TX	OE5VRL	06/07 OE5VRL	
10368.875	ON4TNR	JO21EE	95	Call ON4AZA?			ON7BPS	06/07 ON7WP	Not existing!
10368.875	DB0HW	JO51GT	1020	Slot	WNE	0.04	DL3AAS	06/07 DL7YC	
10368.875	HB9G	JN36BK	1600	Slotted WG	Omni	2	HB9PBD	03/07 LX1DB	nominal 885
10368.880	GB3CEM	IO82WO	165	Slotted WG	Omni	30	G4PBP	06/07	
10368.880	OK0EW	JO60RN	875	2 x 8 slot	90°/270°	1.5	OK1JKT	05/07	Temp. QRT
10368.880	HG6BSB	KN07AU	1015	Slot	Omni	1 TX	HA5ED	06/07 HA1YA	Proposal
10368.882+/-	I6X	JN63RO	250	8dB Horn	350	10	I6CXB	06/07 I6XCK	nominal .930
10368.883	DB0INN	JN68GI	504	Slot	Omni	1 TX	DL3MBG	06/07	not qrv
10368.884	F1XAE	JN24PE	1910	Horn	270°	5	F1UNA	06/07 F6HTJ	Temp. QRT
10368.885	OE1XVB	JN88FE	350	Slotted WG	Omni	1 TX	OE1WRS	06/07 OE5VRL	Temp. QRT
10368.885	DB0TUD	JO61UA	285	Slot	Omni	5	DL4DTU	06/07 DL4DTU	Temp. QRT
10368.885	OM0MYA	JN88NE	570	Slot	45/225	0.11	OM3ID	06/07	Proposal
10368.888	DB0UX	JN48FX	275	Slot 12dBD	Omni	0.2tx	DK2DB	06/07 DK2DB	
10368.890	LA9SHF	JO59FS	160	10dB Horn	180	1.3Tx	LA8GKA	05/07 LA0BY	QRT
10368.890	DB0KLX	JN39VK	350	Slot	Omni	1 TX	DC2UG	04/04	QRV ?
10368.890	ON4RUG	JO11UB	95	Slot 11 dB	Omni	0.7 tx	ON6UG	06/07 PA0EHG / ON6UG	
10368.890	HG9BSB	KN08FB	930	Slot	Omni	0.1 TX	HG5AZB	06/07	Proposal
10368.895	LX1DB/B	JN39CO	385	Slot	Omni	400 e	LX1DB	06/07 LX1DB	
10368.895	DB0ECA	JN57UU	705	Slot	Omni	10	DC8EC	06/07 DC8EC	QRT
10368.900	OH1SHF	KP10NJ	15	Dipole	180	0.3		06/06 OH6DD	
10368.900	DB0ELS	JO43FF	26	Slot 10 dB	Omni	0.8	DL9EL	06/07 DL9BL	
10368.900	DB0CU	JN48BI	970	Slot	Omni	5	DC5GF	06/07 DG1GLH	QRT
10368.900	GB3AZA	IO94TF	75	Single 18" dish	50		G8AZA	05/07	QRV again
10368.900	GB3SCX	IO80UU	274	Slotted WG	Omni	1	G0API	07/07 G0RRJ	on .905
10368.900	OZ5SHF	JO45WX	210	Slotted WG	Omni	4	OZ2OE	06/07 OZ2TG	
10368.900	F5XAY	JN24BW	1691	Slot	Omni	2	F6DPH	06/07 F6HTJ	QRT
10368.900	SR6NCI	JO80JG	1150	Slotted WG	Omni	1	SP6GWB	06/07 SP3JBI	
10368.902	LX0CD	JN39BO	420	16 ele	Omni	20 e	LX1JX	06/07 LX1DB	QRT
10368.900	I8EMG/B	JM89BJ	1400	Horn 20dB	315	20 erp	I8EMG	06/07 I5WBE	
10368.910	DB0UM	JO73CE	60		Omni	1	DG1BHA	06/07 DG1BHA	

10368.910	DB0HEX	JO51HT	1242	Slot	N/S	10 e	DG0CBP	06/07 DG0CBP	QRT
10368.910	F6DRO/B	JN03TJ		10dB		2	F6DRO	05/07 F6DRO	Test beacon
10368.910	GB3RPE	IO81AO	60	Slotted WG	Omni	4	GW4ADL	06/07 G4FSG	
10368.910	SK7MHF	JO77IP	505	Slotted WG	Omni	2	SM7MXO	04/04 SM6CEN	QRT for ever
10368.910	GB3MLE	IO93EO	600	Sectoral horns	0/180°	1	G8AGN	06/07	(nominal .930)
10368.910	HG3BSB	JN96CC	535	Slot	Omni	1 TX	HA5SHF	06/07 HA1YA	on.915
10368.912	DB0RG	JO51GO	730		Omni	1	DL4OAN	06/07 DL4OAN	Proposal
10368.915	SR1XHX	JO83QP		2 x 8 Slot	Omni	1	SP7JSG	06/07 SP3JBI	nominal .885
10368.915	OZ4SHF	JO65BV	22	Slotted WG	Omni	10	OZ1UM	06/07 OZ2TG	on .907
10368.917	DB0VC	JO54IF	300	Slot	Omni	10	DL8LAO	05/07 PA0EZ	
10368.925	ON0KUL	JO20KV	110	Slotted WG	Omni	20 e	ON7VQ	06/07 ON4IY	Tmp. Qrt ->ON0GHZ
10368.927	OE3XMB	JN77TX	1154	Slotted WG	Omni	1.5	OE3FFC	06/07 OE5VRL	Temp. QRT
10368.928	OH2SHF	KP20IF	85	10 dB	Omni	15 e	OH2LIY	09/06 OH6DD	
10368.928	F1URI	JN35FU	1660	Dish	E->Mt. Blanc	2200	F1URI	06/07 F6HTJ	
10368.930	DB0HO	JN47QT	843	Slot	Omni	10	DF6TK	06/07 DF6TK	QRT for ever
10368.930	OZ7IGY	JO55WM	92	WG Slot	Omni	5	OZ7IS	06/07 OZ2TG	
10368.932	OE2XBO	JN67MW	740	Slotted WG	Omni	0.1 tx	OE2HFO	06/07 OE5VRL	Temp. QRT
10368.940	DB0DON	JN58JR	532	Slot	Omni	1 tx	DK1MFI	06/07	Proposal
10368.940	GB3CCX	IO81XW	342	Slotted WG	Omni	3	G6AWT	06/07	on .915
10368.940	SK7MHH	JO86GP	45					06/07	not QRV
10368.940	I3CLZ/B	JN55NR	2219			0.6 e	I3CLZ	03/07	
10368.945	DB0OS	JO40CW	780	12xSlot	W	2	DL1DKS	11/06 G4EAT	
10368.945	LA7SHF	JP20QJ	565	17 dB Horn	180	10 e	LA3QMA	05/07 LA0BY	Proposal
10368.946	DB0AJA	JN59AS	337	2xSlot WG	Omni	10	DL6NDG	06/07 DF6NA	
10368.950	F1ZTT	JN24EB	625	Slot	Omni	10	F6CXO	06/07 F6HTJ	on .935
10368.950	OK0EI	JN99BT		Slot	E	30 e	OK2ER	06/07	
10368.950	DB0FHR	JN67UW		Slot	Omni	1.3e	DL5MEA	07/07 DG5MGG	on .945
10368.955	GB3LEX	IO92IQ					G3TQF	06/07	QRV
10368.955	OZ1UHF	JO57FJ	150	Slotted WG	Omni	0.8	OZ9NT	06/07 OZ2TG	on .950
10368.960	GB3CMS	JO01HR	107	Sl. WG 10dB	Omni	30mW	G1EUC	06/07	Proposal
10368.960	SK4BX/B	JO79LI	265	WG Slot	Omni	8 e		06/07 SM6CEN	
10368.960	OK0EJ	JN99FN	1323	Horn 8 dB	W	0.01	OK2UJ	06/07	on .982
10368.960	HG7BSB	JN97KR	700	Slot	Omni	0.1TX	HA5ED	06/07 HA1YA	Proposal
10368.963	DB0NBB	JP63PN	110		Omni	3	DJ2BC	06/07	on .940 +/
10368.965	DF0ANN	JN59PL	630	12 x Slot	Omni	2.5 ei	DL8ZX	06/07 DL8ZX	Temp. QRT
10368.970	OE2XRO	JN67LA	3105	Slotted WG	Omni	1 tx	OE1MCU	06/07 OE5VRL	
10368.970	SK7MHL	JO65OR	100	WG slot	Omni	10	SM7ECM	06/07 SM6CEN	
10368.970	OK0EQ	JN89AR	745	Slot	Omni	1	OK2ZI	06/07	Proposal
10368.970	OK0EY	JN89HA	220	Slot	Omni	0.1	OK2UWH	06/07	Proposal
10368.975	HG1BSB	JN87FI	725	Slot 10 dBD	Omni	0.25TX	HA1YA	06/07 HA1YA	
10369.975	ON0KUL	JN20KV					ON4IY	06/07 ON4IY	parall. RS bcn - Prop
10368.980	HB9AK	JN47LI	1133	10 dB Slot	Omni	0.23	HB9CZF	05/07 DF6TK	
10368.994	F5XBG	JN26KT		Slotted WG	Omni	5	F6FAT	06/07 F6HTJ	
10368.995	DB0KI	JO50WC	925	Slot	Omni	5	DC9NL	06/07 DC9NL	QRT for ever
10369.000	F1XAN	JN09TD	300	Slotted WG	Omni	1.5	F1PBZ	06/07 F6HTJ	QRT
24025.000	GB3IOW	IO90IO	250	Sectoral horn		8	G8MBU	07/07 G4FSG	QRT -> QRG chnge
24048.040	OK0EA	JO70UP	1355	Slot	Omni	1	OK1AIY	06/07	on .070
24048.050+/-	HB9MPU/B	JN47HD	1000	2x6dB Horn	N+W	0.3tx	HB9CAU	05/07 HB9CAU	
24048.050	OK0EL	JO70SQ	900	Slot	W-SE	0.7	OK1AIY	06/07	
24048.050	ON0KUL	JO20KV	110	Slotted WG	Omni	20 e	ON7VQ	06/07 ON4IY	Proposal – ON0GHZ
24048.050	OK0EH	JN99BM	918	Horn	90	10 e	OK2VLT	06/07	Proposal
24048.100	HB9OK	JN45MW	1601				HB9DUR		Proposal
24048.120	DB0HK	JO40OM	753				DJ6BU	06/07 DF6RK	Proposal
24048.127	LX0CBC	JN39CO	385	Slot	Omni	25 e	LX1DB	06/07 LX1DB	
24048.115	DB0QQ	JO31TO						05/07 DL2DR	
24048.135	I3EME/B	JN55WV	1430	Slot 8 dB	170°	0.1	I3EME	06/07 I3EME	ex I3G
24048.170	F5ZTS	JN09WI	210	Dish	29°	1000	F6DWG	06/07 F6HTJ	
24048.180	F6DKW	JN18CS	230	Slot WG	Omni	15	F6DKW	06/07 F6HTJ	
24048.202	PI7EHG	JO22JH	95	24cm dish	267°	238	PA0EHG	06/07 PA0EHG	QRT

24048.202	PI7EHG	JO22JH	95	13 dBD	Omni	16	PA0EHG	06/07 PA0EHG	QRT
24048.550	F1ZPE	JN07WV	170	Slotted WG	Omni	53	F1JGP	06/07 F6HTJ	
24048.800	OH3SHF	KP11VK	222	Slot 18dBi	Omni	30 e	OH3LWP	01/07 OH3LWP	
24048.800	SK6MHI	JO57XQ	135	Slot WG	Omni	10 e	SM6EAN	06/07 SM6CEN	
24048.805	DB0SI	JO53QP	95	Slot	Omni		DL1SUZ	06/07 DL1SUZ	
24048.815	DB0VI	JN39NK	465	Slot	Omni	0.3	DL4VCG	06/07 DL4VCG	not QRVI
24048.820	LA5SHF	JO28UX	70	Horn	180	0.2 e	LA3EQ	05/07 LA0BY	-> soon JO29OG
24048.820	DB0JL	JO31MC	175	Slot	Omni	0.12	DF1EQ	04/04 DF1EQ	QRT?
24048.830	GB3MHK	JO02PB	85	SlottedWG	Omni	25	G3XDY	06/07 G3XDY	Planned
24048.833	DB0FGB	JO50WB	1090	Slot 8dBD	Omni	0.7 tx	DB8UY	06/07 DB8UY	
24048.840	DB0KI	JO50WC	925	Slot	0°	0.5	DC9NL	06/07 DC9NL	QRT for ever
24048.845	OZ5SHF	JO45WX	205	WG	Omni	0.5		06/07 OZ1FF	
24048.850	DB0GW	JO31JK	80	Slotted WG	Omni	1	DL4JK	06/07 DL4JK	
24048.850	GB3MAN	IO83WO		Slot		10e	G6GXK	06/07 G4FSG	Proposal
24048.853	DL0WY	JN67AQ	1838	Sect. horn	W,N,E	0.01	DJ8VY	06/07 OE5VRL	on .834
24048.860	DB0ARB	JN69OC	1456	Parabol	SW	0.03	DJ4YJ	06/07 DJ4YJ	Proposal
24048.865	DB0JK	JO30LX	257	2 x H-Horn	Omni	20e	DK2KA	06/07 DK2KA	Proposal
24048.865	HB9EME	JN37KB	1422	Slot	Omni		HB9HLM	06/07 HB9HLM	Proposal
24048.875	DB0HW	JO51GT	1016	Slot	Omni	1	DL3AAS	04/04 DJ3HW	
24048.875	OE5XBM	JN78DJ	985	Sl. WG 13dBi	Omni	0.1tx	OE5VRL	05/07 OE5VRL	
24048.883	SK6SHG	JO57TX	110	2 x Sector horn	N/S	2x1 e		06/07 SM6CEN	
24048.885	DB0TUD	JO61UA	250	Slot 10dB	Omni	0.01tx	DL4DTU	06/07 DL4DTU	Temp. QRT
24048.890	GB3DUN	IO91RV	260	Slotted WG	Omni	1	G3ZFP	05/07	Proposal
24048.895	DB0ECA	JN57UU	705	Slot	0°	1	DC8EC	06/07 DC8EC	QRT
24048.900	DK2MN/B	JO32PC	168	Slot	Omni	1 TX	DK2MN	06/07 DK2MN	Proposal
24048.900	I8EMG/B	JM89BJ	1400	Horn 23dB	315	20 erp	I8EMG	06/07 I5WBE	
24048.900	DB0CU	JN48BI	970	Horn	180°	5	DC5GF	06/07 DG1GLH	QRT.
24048.905	DB0NCO	JN59MI	405	Horn	Omni	0.3	DL6NCO	06/07 DL6NCO	Temp. QRT
24048.905	GB3SCK	IO80UU	274	Slotted WG	Omni	3	G0API	04/07 G4EAT	
24048.910	GB3ZME	IO82SQ	215	Slotted WG	Omni	10	G3UKV	06/07 G3UKV	QRV
24048.912	DB0RG	JO51GO	730		Omni	1	DL4OAN	06/07	Propoal
24048.920	DB0AJ	JN57	620	Slot	Omni	0.1	DK2RV	04/04 DJ3HW	QRT
24049.920	DC6UW/B	JO44VJ					DC6UW	05/07 OZ1FF	
24048.920	HG3BSC	JN96CC	535	Slot	Omni	0.18TX	HG5AZB	06/07 HA1YA	
24048.920	GB3FNM	IO91OF		Slot		20 e	G4EPX	06/07 G4FSG	Proposal
24048.925	GB3BNL	IO93FB	330	22dB Horn	N/S	0.4tx	G3PHO	06/07 G3PHO	Proposal
24048.930	OZ7IGY	JO55WM					OZ7IS	01/07 OZ2TG	Proposal
24048.930	DB0KHT	JO40FE	235	Horn	190	0.02 TX	DJ1RV	06/07 DJ1RV	Proposal
24048.940	DB0JO	JO31SL	312	6 x Slot	Omni	0.6	DG8DCI	04/04 DJ3HW	ex 24192.055
24048.940	GB3AMU	IO81JN	266	Sect. Horn	135°	1	GW3PPF	06/07 G4FSG	
24048.945	DB0AJA	JN59AS	364	2x8 Slot WG	Omni	0.8	DL6NDG	06/07 DF6NA	ex 24192.945
24048.950	OZ9UHF	JO65HP	30	Slotted WG	Omni	0.5		06/07 OZ2TG	
24048.950	HB9G	JN36BK						04/03 HB9AHL	Planned?
24048.960	DB0MFI	JN58KR	532		Omni	10	DK1MFI	06/07 DK1MFI	Proposal
24048.960	OE2XRO	JN67LA	3105	Slotted WG	Omni	0.5	OE1MCU	06/07 OE5VRL	on .965
24048.960	HG7BSC	JN97KR	700	Slot	Omni	0.1TX	HA5ED	06/07 HA1YA	Proposal
24048.965	DF0ANN	JN59PL	630		Omni	2.5 ei	DL8ZX	06/07 DL8ZX	Proposal
24048.970	SK7MHL	JO65OR	100	WG slot	Omni	1	SM7ECM	06/07 SM6CEN	
24048.985	DB0AS	JN67CR	1565	Horn	10°	0.5 TX	DL2AS	06/07 OE5VRL	
24100.000	GB3ALD	IN89VR	90	Sectoral horn	30°	8	Wideband	06/07 G4FSG	Perm. QRT
24192.000	ON0RUG	JO11UB	95	Slotted	Omni	0.1	ON6UG	06/07 ON6UG	Proposal
24192.070	OK0EX	JN79OW	500	Slot	115/315°	0.02	OK1FEN	06/07	Proposal
24192.180	I6G	JN63RO	30	0.4m Dish	335°	0.155	I6CXB	06/07 I6CXB	Temp. QRT
24192.180	OK0ET	JO70FA					OK1VAO	06/07	Proposal
24192.200	LX0DUF	JN29XM	280	0.4m Dish	63°	1.2k e	LX1DU	06/07 LX1DBF	never been QRV
24192.252	F1XAQ	IN88HL	326	Slotted WG	Omni	0.4	F1LHC	06/07 F6HTJ	Temp. QRT
24192.813	OK0EW	JO60RN	920	2x8 Slot	205	0.06	OK1JKT	06/07 OK1JKT	Proposal
24192.830	F5XAF	JN18DU		Parabol	90°	1	F5ORF	06/07 F6HTJ	QRT
24192.860	LA8SHF	JO59FB	30	13dB Horn	180°	?	LA6LCA	05/07 LA0BY	

24192.875	GB3RBY	IO92JJ	165	Slotted WG	Omni	0.1	G4LRT	04/07 G4FSG	perm. QRT
24192.875	ON4AZC	JO21EE	60	Slotted WG	Omni	1	ON7BPS	06/07 ON7WP	Not existing!
24192.875	HG5BSC	JN97LM	485	Slot	Omni	0.18	HA5BDJ	06/07 HA1YA	
24192.900	OH1SHF	KP10NJ						01/04 OH6DD	Proposal
24192.900	SK0UX/B	JO99BM	90	60cm dish	243	250	SM0DFP	06/07 SM0DFP	QRV
24192.915	OZ4SHF	JO65BV	22	Slotted WG	Omni	10	OZ1UM	05/07 OZ2TG	
24192.930	HG6BSC	KN07AU	1015	Slot	Omni	0,15 TX	HA5ED	06/07 HA1YA	Proposal
24192.955	OZ1UHF	JO57FJ	150	Slotted WG	Omni	0.5	OZ9NT	01/07 OZ2TG	QRT
24192.975	ON4LVN	JO20IV	120	Slotted WG	Omni	0.5	ON4AOD	04/04 ON7WP	
47088.000	OK0EL	JO70SQ	900	Horn	SW	0.07	OK1AIY	06/07	Proposal
47088.050	SK0UX/B	JO99BM	90	Dish	SW	80	SM0DFP	06/07 SM0DFP	qrv on request
47088.080	DB0QQ	JO31TO						05/07 DL2DR	
47088.120	DB0HK	JO40OM	753				DJ6BU	06/07 DF6RK	Proposal
47088.200+/-	PI7EHG	JO22JH	95		Omni	0.01tx	PA0EHG	06/07 PA0EHG	QRT
47088.240	I3H	JN66EB	1570	Horn 25 dB	180°	1.2	I3OIB	06/07 ARI/I5WBE	
47088.250	OK0EA	JO70UP	1355	Horn	W	0.1	OK1AIY	06/07	
47088.820	LA5SHF	JO28UX	70	10 dB Horn	270	0.2 e	LA3EQ	05/07	Proposal – > QTH JO29OG
47088.833	DB0FGB	JO50WB	1090	15 dB Horn	0°	0.02tx	DB8UY	06/07 DB8UY	100° Horn
47088.853	DL0WY	JN67AQ	1830	Horn	0°/90°/270°	0.015	DJ8VY	06/07 OE5VRL	
47088.865	HB9EME	JN37KB	1422	Slot	Omni		HB9HLM	06/07 HB9HLM	Proposal
47088.865	DB0JK	JO30LX	257	2 x H-Horn	Omni	0.4e	DK2KA	06/07 DK2KA	Proposal
47088.875	OE5XBM	JN78DK	855	Sl. WG 20dbi	SW	0.02	OE5VRL	06/07 OE5VRL	
47088.875	HG5BEA	JN97LM	485	Slot	Omni	0.015	HA5BDJ	06/07 HA1YA	Proposal
47088.895	DB0ECA	JN57UU	705	Horn	0°		DC8EC	06/07 DC8EC	QRT
47088.895	LX0CDE	JN39CO	396	Slot	Omni	1 e	LX1DB	06/07 LX1DB	
47088.900	HG3BEA	JN96CC	535	Slot	Omni	.015	HG5AZB	06/07 HA1YA	Proposal
47088.900	HG6BEA	KN07AU	1015	Slot	Omni	.015	HA5ED	06/07 HA1YA	Proposal
47088.905	G8BKE/p	IO80UU	274	20dB Horn	80°	0.01tx	G4JNT	06/07 G4JNT	=GB3SCK qth
47088.912	DB0RG	JO51GO	730		Omni	0.3 e	DL4OAN	06/07 DL4OAN	Proposal
47088.920	GB3FNM	IO91OF		Slot		10 e	G4EPX	06/07 G4FSG	Proposal
47088.985	DB0AS	JN67CR	1565	Horn	10°	0.5 TX	DL2AS	06/07 OE5VRL	
76032.250	OK0EL	JO70SQ	1030	Horn	SW	0.001	OK1AIY	06/07	Proposal
76032.250	OK0EA	JO70UP	1355	Horn	W	0.01	OK1AIY	06/07	
76032.833	DB0FGB	JO50WB	1090	16 dB Horn	0°	0.015tx	DB8UY	06/07 DB8UY	70° Horn
76032.865	HB9EME	JN37KB	1422	Slot	Omni		HB9HLM	06/07 HB9HLM	Proposal
76032.875	HG5BEB	JN97LM	485	Slot	Omni	0.01	HA5BDJ	06/07 HA1YA	Proposal
76032.895	LX0CDF	JN39CO	386	Slot	Omni	0.1 e	LX1DB	06/07 LX1DB	
76032.900	HG3BEA	JN96CC	535	Slot	Omni	0.01	HG5AZB	06/07 HA1YA	Proposal
76032.900	HG6BSB	KN07AU	1015	Slot	Omni	.015	HA5ED	06/07 HA1YA	Proposal
76032.960	DB0MFI	JN58KR	532	Slot	Omni	10 e	DG1MFI	05/07 DK1MFI	Proposal
76032.895	DB0ECA	JN57UU	705	Horn	0°		DC8EC	06/07 DC8EC	QRT
76032.985	DB0AS	JN67CR	1565		10		DL2AS	06/07 OE5VRL	
145152.985	DB0AS	JN67CR	1565		10		DL2AS	06/07 OE5VRL	

Pwr: no entry or "e" = ERP, ei = EIRP, tx = TX-Output Pwr.

This list was compiled completely new! For clearness several "QRT-beacons" are included in this list, because other sources may still list them as "QRV". This list contains the European microwave beacons from 1296 MHz up to 145 GHz. There is only one exception: The W2ETI EME beacon on 23cms. It does not make sense to mix EU and NA microwave beacons in one list. For the very few beacons with a confirmation date before 2006 or with a "?" at remarks we would appreciate to receive any possible update. 73 Joe, DL8HCZ info@dubus.de or dubus@web.de or funk-telegramm@t-online.de

DA5DUB 144.436 MHZ – 8 x 4 ele FLEXA