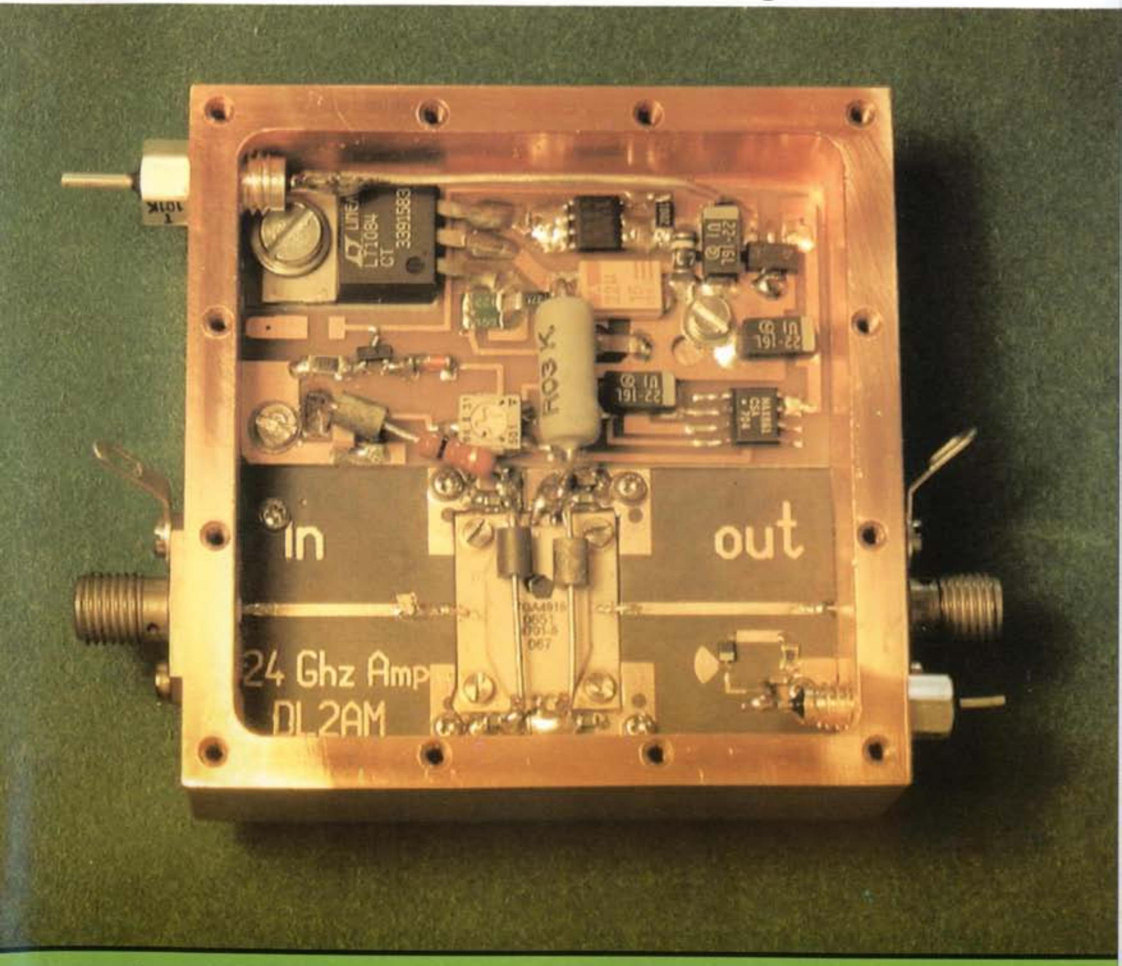
DUBUS

3/2008

Vol.37 3.Quarter

5 Watt PA for 24 GHz by DL2AM



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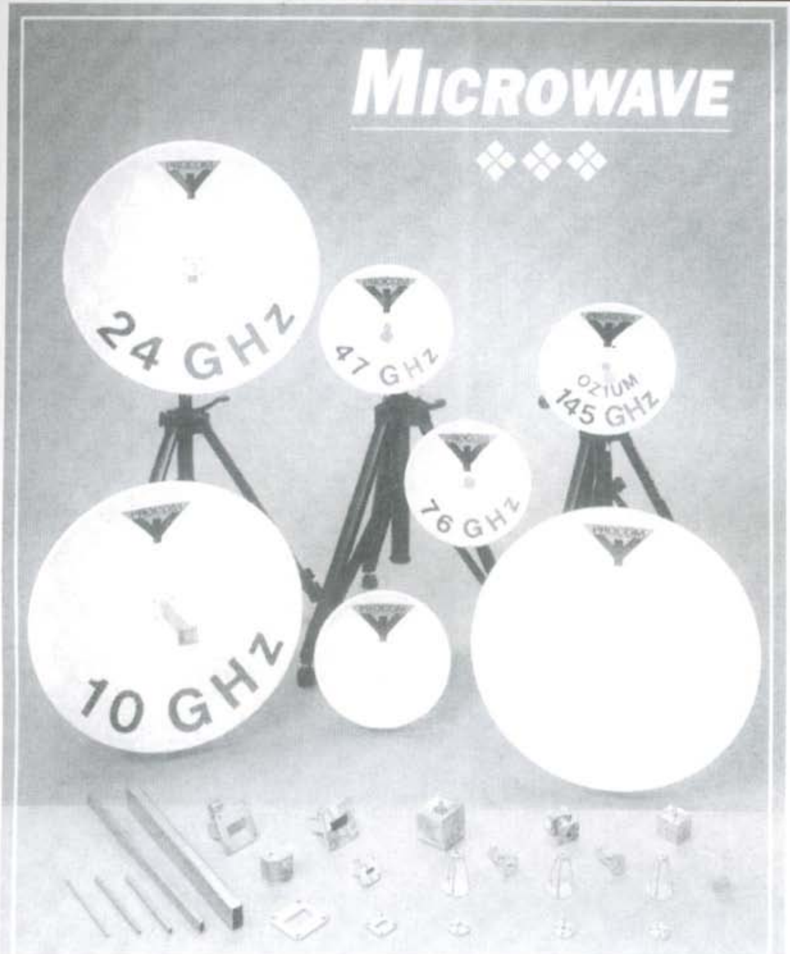
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Content / Inhalt 3/08

Title: 5.5 Watt Amplifier for 24 GHz by DL2AM. See article on page 63.

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Editorial

Dear DUBUS Reader!

We sadly have to inform you that our former publisher and editor-in-chief Rainer Josef Bertelmeier, DJ9BV became a silent key on May 22nd 2008. He was buried on June 2nd on the cemetery in Hamburg-Altona. Rainer was 63 years old. He took over DUBUS magazine in spring 1989 together with DK3LL, DK3UZ and DL8HCZ from DL7QY. Rainer was our technical author and editor untill spring 2002 when he had to leave amateur radio completely due to his disease. In summer 2001 Rainer got the diagnosis that he suffers from a slow growing inoperable tumor in his brain. Rainer has set benchmarks in the 54 DUBUS issues he has made. His powermeter, PANFI, preamps and yagis are still state of art. Rainer always was a perfectionist and he loved it to enjoy top quality also in other fields of life, especially cuisine. We have lost a great person with true ham spirit. Rainer we will never forget you! RIP

As usual nobody in Europe is content with the 2008 2m Es season but the statistical numbers are quite o.k. and 6m Es has been outstanding with very early and very late openings from EU to JA in May and mid August. The 6m Transpacific Es season from JA to Northamerica has been the best ever in history and will hopefully be subject of another article in next issue. On Microwave a new 710km world record was set on 24 GHz, see p. 78.

Please note that we have a new distributor for Ireland. See p. 7. Welcome, Pat!

Wolfgang, DJ8ES plans to retire from all his activities as an author. Thus we look for a new editor for the TROPO column as soon as possible.

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!

Liebe DUBUS Leser!

An dieser Stelle müssen wir leider mitteilen, dass unser ehemaliger Herausgeber und Chefredakteur Rainer Josef Bertelsmeier am 22. Mai 2008 im Alter von 63 Jahren gestorben ist. Rainer wurde am 2. Juni 2008 auf dem Hauptfriedhof Hamburg-Altona beerdigt. Rainer übernahm das DUBUS-Magazin im Frühjahr 1989 zusammen mit DK3LL, DK3UZ und DL8HCZ von DL7QY. Rainer war unser technischer Autor und Redakteur bis zum Frühjahr 2002, als er sämtliche Amateurfunk-aktivitäten wegen seiner Krankheit einstellen musste. Im Sommer 2001 hatte Rainer einen langsam wachsenden, inoperablen Hirntumor diagnostiziert bekommen. Rainer hat in den 54 Ausgaben der DUBUS, die er redigiert hat, Maßstäbe gesetzt. Sein Wattmeter, PANFI, Vorverstärker und Yagi-Antennen sind noch immer Stand der Technik. Rainer war immer Perfektionist und er liebte es, höchste Qualität zu geniessen, und das auch in anderen Bereichen des Lebens, so auch speziell der Esskultur. Wir haben einen großartigen Menschen und Funkamateur verloren, der noch echten Ham-Spirit hatte. Rainer, wir werden Dich nie vergessen! RIP

Wie jedes Jahr sind alle in Europa wieder mit der 2m Es-Saison unzufrieden, die statistischen Zahlen sehen aber ganz o.k. aus und 6m-Es war sogar außergewöhlich gut mit sehr frühen und sehr späten Öffnungen zwischen Europa und Japan im Mai und Mitte August. Die Transpazifik-saison auf 6m zwischen Japan und Nordamerika war sogar die beste, die jemals beobachet wurde und wird hoffentlich Gegenstand eines Artikels in der nächsten Ausgabe sein. Auf den Mikrowellen wurde eine neuer 710km Weltrekord auf 24 GHz aufgestellt, siehe Seite 78.

Wir haben einen neuen Distributor für Irland. Willkommen, Pat. Siehe Seite 7.

Wolfgang, DJ8ES, stellt seine diversen Aktivitäten als Autor zum Jahresende ein. Folglich suchen wir baldmöglichst einen Nachfolger für die Tropo-Rubrik.

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

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

Midlatitude Sporadic E in Correlation to Meteor Mass Input

by Joachim Kraft, DL8HCZ/CT1HZE – funk-telegramm@t-online.de

Introduction

Radio amateurs have been speculating for decades about a possible connection between "meteors" or "meteor showers" and the occurrence of Sporadic E on the VHF bands. However, it has obviously not been possible to prove such a connection or correlation with facts. Hawk, who summarised the knowledge about the causes for Sporadic E in 2001 [1], came to the following conclusion:

"Studies have investigated the occurrence of random meteors and total meteors for correlations to Es. Random meteors, which occur in great numbers every day of the year, have a marked increase in the June-August period. Investigation of this in closer details reveals the peak is several weeks after the Es peak in the Northern hemisphere. Additionally, there is no secondary peak of meteors in the northern hemisphere winter months, as there is with Es. This simple analysis quickly discounts a meteor-related Es catalyst or mechanism."

However, more recent studies [2] with modern radar interferometers for exact meteor counting have made better data available. Contrary to Hawk's conclusion in 2001, a direct correlation between the meteor mass input and foEs has now been demonstrated [3]. This is subject of this article. Also we will try to correlate regional differences in the meteor mass input and the occurrence of midlatitude Sporadic E.

For clarification please note that this article relates to the "mid latitude Es propagation" only. "Equatorial Es propagation" and "Auroral Es propagation" are not covered in this article.

Metal atoms

Midlatitude sporadic E layers form when electrons are converged vertically in a wind shear. The occurrence of sporadic E follows a seasonal dependence marked by a summer maximum, as shown for example in the article in DUBUS issue 1/2008 [4]. Although this has been known for decades, its cause has remained a mystery as it cannot be accounted for by the wind shear theory of Es formation.

The occurrence and strength of sporadic E layers depends directly on the metal ion content, which was measured with the help of rocket experiments. Metal atoms known to be present in the upper atmosphere are Fe, Na, K, Mg, Si and Ca. If these atoms are ionised, by radiation or by collisions with other particles, electrons are set free. Positively-charged metal ions and electrons then move together in a wind shear.

The only relevant source for metal atoms and ions in the upper atmosphere are meteors. The mass input of meteors into the atmosphere is about 1000 kg per day, on annual average. The maximum of the meteoroid mass distribution is at 1.5×10^{-5}g (diameter 200µm), and the size range of the meteoroids typically observable by radar is ~100-400µm.

About 90% of the total mass input over the whole year is caused by SPORADIC meteors! Thus we can forget the well known large showers which are used for Meteor Scatter communication in this context. Focussing on these large showers would probably lead to false results and may explain why a positive correlation between meteor rates and Es has not been possible successfully in the past.

Meteor data

Singer et al. have published data of meteor counts from modern radar interferometers at different geographical locations [2]. The lower left graph in Figure 1 is for a midlatitude location in the northern hemisphere (54 N, Juliusruh in Germany) and it shows the well known maximum in summer (June) and a minimum in February.

Fig. 2 shows the annual variation of foEs for Boulder (Northern Hemisphere) and Concepcion (Southern Hemisphere). One can see clearly the maxima around the local summer solstice, June/July for Boulder and December/January for Concepcion.

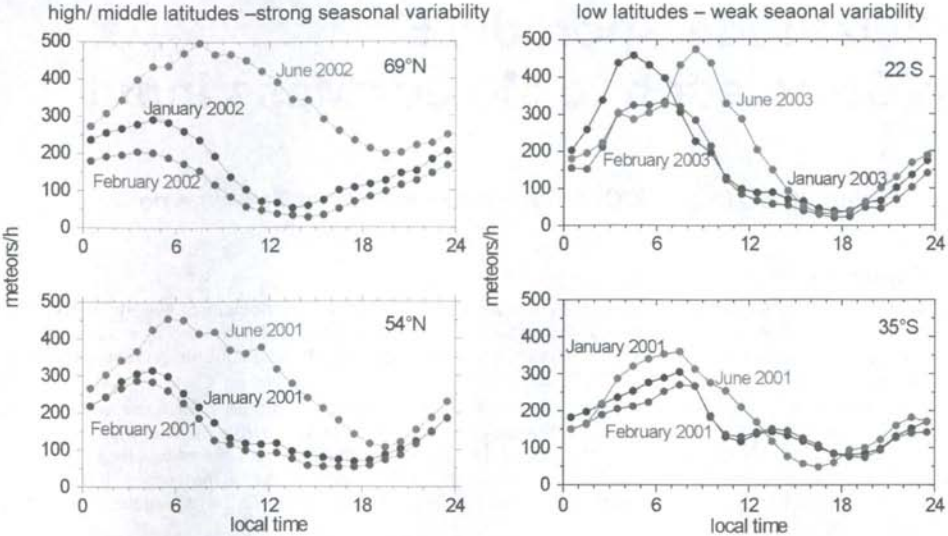


Fig. 1: Diurnal variation of meteor rates* [2]. *Monthly means for each hour of local times: Left: Andenes, Northern Norway (top) and Juliusruh, Northern Germany (bottom). Right: Cachoeira Paulista, Southern Brazil (top) and Delamere, Southern Australia (bottom).

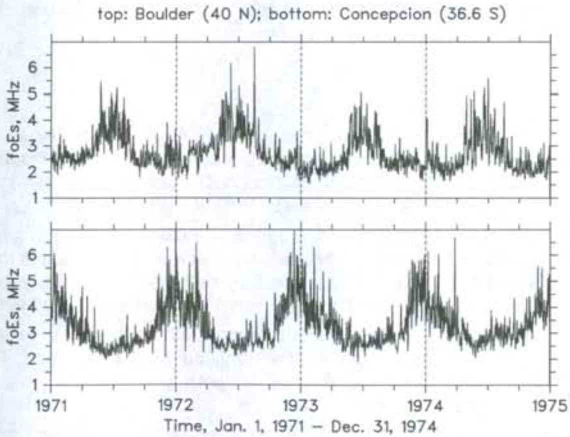


Fig. 2: Typical annual variability of sporadic E critical frequencies foEs measured simultaneously in the Northern (Boulder, 40 N) and Southern (Concepcion, 36.6 S) hemispheres* [3]. *A strong summer maximum dominates in both hemispheres.

Correlation

The paper of Haldoupis et al. [3] shows a correlation graph (Figure 3) for daily meteor counts and foEs for San Vito (40.6 N, Italy) for 2000-2005. Over these six years one can see a very good correlation between the counts and foEs (linear correlation coefficient > 0.7).

Figure 4 shows the averaged counts (about 5 years) vs. foEs for Juliusruh (54 N) and Athens (38 N). Also here we can see a very good correlation. This correlation was discovered thanks to the exact meteor count data from radar interferometers, which cover the sporadic meteor input much better than previous technologies where results have been dominated by the count of the meteors from the big showers.

Such a typical previous result is shown in Figure 5. Here the forward scatter radio echoes of meteors were counted on 66MHz by observers at the University of Ghent (Belgium) [5]. The upper part shows the original data, the bottom part sets an upper cut-off point that removes the excesses of the two most active major showers of 1998 – Perseids and Leonids – allowing us to concentrate on the smaller peaks present on various dates throughout the year. The June peak as seen in Figures 3 and 4 is masked by the two major showers, and the relation to the count rates in August and in the last quarter of the year looks different. A correlation of the upper diagram of Figure 5 to foEs would not bring any positive result, and although the bottom diagram in Figure 5 shows the "midsummer peak" rather better, a correlation to this data obtained using older technology would still be difficult. It is only the more modern radar interferometer technology that allows the correlation to appear.

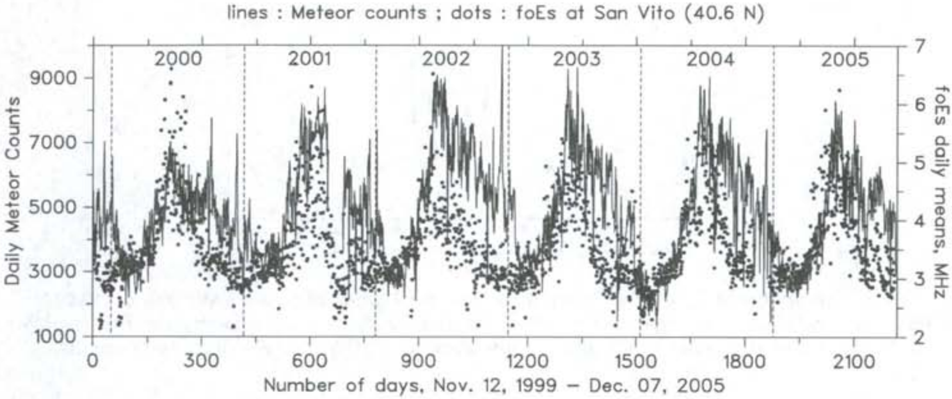


Fig. 3: Comparison of the annual variability of daily meteor counts (solid line) measured in the Northern Hemisphere with mean daily sporadic E critical frequency (foEs) values measured simultaneously with the San Vito ionosonde at 40.6 N [3]. *There is good agreement between the annual variations of both parameters.*

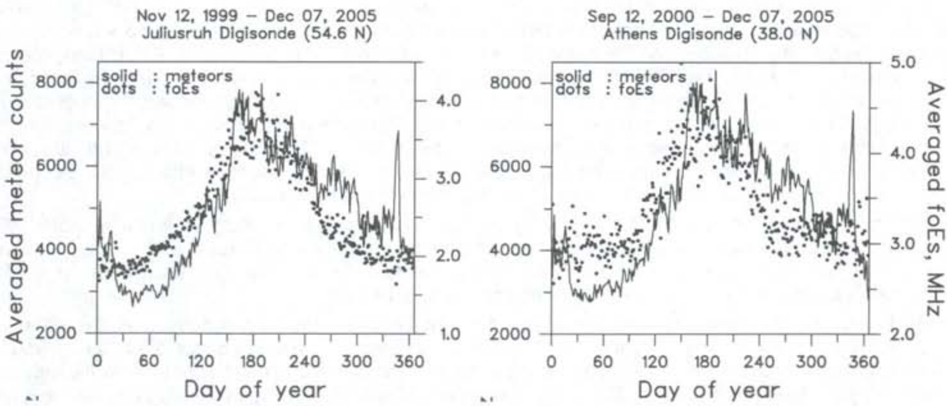
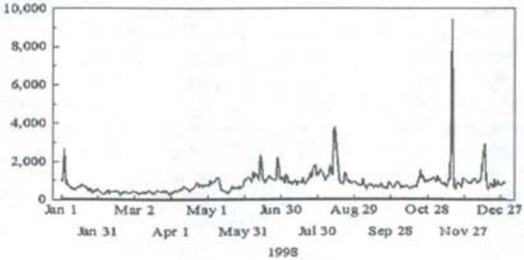


Fig. 4: Comparison of the mean annual variation of meteor counts and foEs for two cases:
(left) for the period from November 1999 to December 2005,
using the Juliusruh (54.6 N) ionosonde, and
(right) for the period from September 2000 to December 2005
and the Athens (38 N) ionosonde [3].



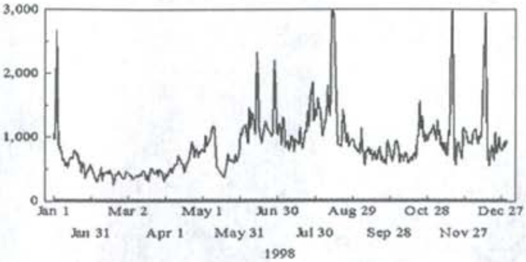


Fig. 5: Meteor counts by 66 MHz forward scatter observation at Ghent (Belgium) in 1998 [5]. The upper part shows the original data, the bottom part sets an upper cut-off point that removes the excesses of the two most active major showers of 1998, the Perseids and Leonids.

Geographical differences

As we can see from Figure 1 there are significant differences in the meteor count data between different regions. On the left side of the figure we see the shapes for Europe (about the same longitude and 15 deg. difference in latitude), with the characteristic summer (June) maximum and the winter (February) minimum. If we compare these with the two graphs on the right side of Figure 1, we can clearly see that the counts at 22 S (Brazil) show maxima in January and in June. However, the mass input is significantly less (about 30 to 40%) than during June in Europe, if we just make a rough estimation of the areas under the curves. This is well in line with the observations of amateurs in Brazil: Es on 2m is VERY rare. Only a very few openings (below 10 in total) have been reported from PY to LU over the last 15 years, mostly between the end of December and February. Although the density of VHF amateurs in PY, LU etc. is very low compared to Europe, there is a quite active group of FM BC DXers in Brazil and their results for 3m Es show about the same differences when compared with Europe. Interestingly the even slightly larger June peak in PY does not result in any enhanced Es propagation on 6m, 3m or 2m in the PY area. Winter Es has never been reported at all by radio amateurs in the PY region. This can be taken as an indication that other factors also are necessary for the E layer formation (summer solstice effect, most electrons occur during daytime at summer solstice, as will be explained in Figure 9 below).

Now to the bottom graph on the right side of Figure 1. This is the graph for Southern Australia (35S). We see that the meteor mass input is also smaller in general compared to Europe and that the annual maxima in January/February and June are much weaker. In VK the 2m Es maximum is in December/January, with much smaller openings compared to Europe.

In South Africa (ZS) there has (almost) never been any reported 2m Es propagation at the summer solstice in December/January, over the last 20 years or so. Even Es on 6m is a rare event there. South Africa is located at about 30 deg latitude on the southern hemisphere. Meteor counts from the closest available location, Ascension Island (ZD8) by Younger and Mitchell [6], do also indicate that in this region there are even lower count rates and little seasonal variation between the summer peak and the spring minimum. As there is no 2m and 3m Es recorded during June in Brazil and Australia, which have even more meteor mass input, we can conclude that 3m and 2m Es in South Africa should be most unlikely to happen around the summer solstice. Even in Europe, there has never been recorded ANY 2m Es opening in December or January in Europe from 1974 to 2007 (one single November Es event was related to an unusually strong aurora event, and thus was almost certainly auroral-E). There have been a few recorded

3m openings in Europe from December to February, but still not more than 1 or 2 per year.

Unfortunately we do not have any diagram with the same kind of display and scale available for North America, but Figure 6 shows a diagram published by Campbell-Brown in 2006 [7] that displays the counts by radio interferometry of only the sporadic meteors for London, Ontario (VE3, 43 N). We cannot compare the absolute mass input with the ones from Figure 1 but we can see that the summer maximum looks different from the one in Europe: it is not so high compared to the rest of the year. Also we see a small depression in June and we can see quite high activity in the end of December and especially in the beginning of January. We know that the absolute number of days with 2m Es in North America from May to August is much lower than in Europe, on both the short and the long term. This would be confirmed by the lower summer peak from Figure 6.

It has always been questioned if the lower number of 2m Es days in NA has been caused by the lack of observing amateurs and large regions without any amateurs or beacons, but that speculation has not been true for many years. We have more reports for winter Es openings on 3m and 2m from NA than from Europe, so their monitoring situation cannot be that bad! Winter 2m openings are certainly rare in NA, but they are documented e.g. for Jan. 1st and 11th 1998. The 3m results from WA5IYX [4] confirm lower results then Europe in summer, but higher in winter. WA5IYX has counted 83 days with 3m FM BC Es from 1972 to 1999 in the month of January; 3 days on average per year, which is clearly more than we see in Europe. Over the same years, he also observed 42 days in February. This tendency is relating well to the meteor counts in Figure 6, and is a strong indication for assuming that the NA January peak in Figure 6 is the cause for the enhanced winter Es in NA. Note that this NA January peak is reaching about the same level than the NA summer peaks! This is quite different from the situation in Europe according to Figure 1.

The slight June depression in Figure 6 also seems to be typical for the NA region. We do not find this in Figure 1 for Europe, for here we have a clear peak in June for both the meteor counts and foEs. If we take a closer look at the top diagram in Figure 2 (Boulder, USA) we can see a slight depression in the foEs data in June at several years, again supporting a direct cause-and-effect relationship between meteor mass input and foEs.

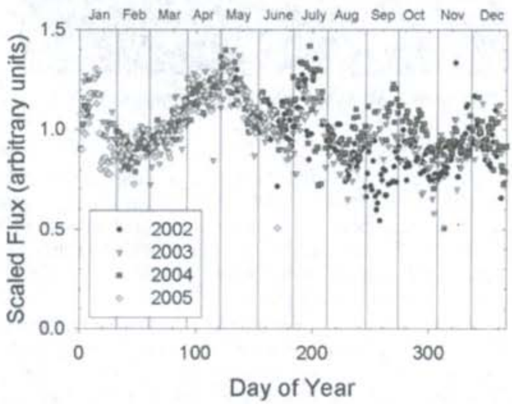


***Fig. 6: Activity of all sporadic meteor sources as measured at 29MHz 2002-2005 in London (Ontario, Canada, 43N, 82W)* [7].**

It would be interesting to find a correlation of this June depression also with Es data from the ham radio bands. For 2m – as far as we know – there is existing only one major study that was published in 1994 by Emil Pocock, W3EP, covering in detail the 18 years from 1976 to 1998 [8]. He found 53 days with 2m Es for June and 51 days for July. However, looking at data for minutes of 2m Es he found about 4300 for June and about 6500 for July. 50% more in July is a significant difference, especially as we know that 2m peak in Europe occurs in June. We do not have data for minutes of 2m Es in Europe, but the day count for the 34 year observation period for Europe shows 397 for June and 327 for July. So here we have 20% more in June. All this could be well interpreted by the difference in the meteor mass input but further long term studies are needed.

Influence of the geomagnetic activity

We always have to keep in mind that midlatitude Es is caused and modulated by several factors. This is what gives Es its "sporadic" nature, and variations in the factors that we are trying to analyse can easily be masked by variations in other factors. One of these masking factors is the influence of the geomagnetic activity. The semiannual (twice yearly) variation of the geomagnetic activity (Figure 7) becomes an important factor in the periods around the equinoxes. As mentioned in [4] a connection with the magnetic field of the earth does exist in the formula that describes the wind shear mechanism in the upper atmosphere, which is believed to be one of the main causes for the concentration of the E-layer electrons into denser layers that enable the reflection of VHF radio waves. Unsettled magnetic fields obviously make the wind shear mechanism less effective. This is the reason why we see less Es (lower foEs in fig. 2) in March/April and September/October for North America than we would expect from the meteor counts for those months in Figure 6. The same is true for September for Europe, where the mass input is also low in March and April – see Figure 8, taken from [2]. Estimation of the meteor mass input from the graphs results in the following order:

<u>June</u> >>> <u>July</u> > <u>August</u> > <u>September</u> > <u>May</u> >>

October ≈ December > April > November > January > March > February.

The underlined months have a significantly higher mass input than all the rest.

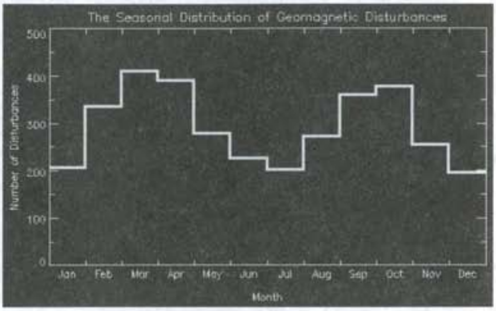


Fig. 7: The seasonal distribution of geomagnetic disturbances

Explanations of the differences

As mentioned above, the metal ion content in the E layer had originally been excluded as the major cause of seasonal Sporadic E variations (Whitehead, 1989 [9]) because it was believed at the time that the origin of sporadic meteors in space is random. Only the very recent studies have shown that this is not the case! In fact the majority of sporadic meteor radiants are not distributed randomly, but are in well defined locations near the ecliptic plane. This results in seasonal differences of the meteor input in accordance with the obliquity of the Earth`s axis to the ecliptic plane.

Even in 1956, Hawkins had found that sporadic meteor radiants are not random in space, measuring with a 53MHz radar at Jodrell Bank (UK) [10]; but unfortunately his results did not find the appropriate attention by the Es researchers. However, the more recent results from Canada [7] show that for the Northern Hemisphere there are five sources relevant for the mass input of sporadic meteors: these are named the North Apex source, Antihelion source, Helion source, South Apex source and Northtoroidal source. These five sources together bring the overall results as displayed in Figure 6. The meteors of the big showers contribute to the metal ion content of the E layer, but as this is only about 10% of the total yearly mass input, one can estimate that they do not have a major effect. In [7] it is also mentioned that at least some of the sources of sporadic meteors may be associated with comets.

Uncertainties

There are several factors which have to be considered for a possible relevant influence to the connection between meteors and sporadic E. Meteors arrive at different velocities in the atmosphere and show a different height distribution. This is different for the several meteor sources, and it is not known if meteors of all heights are contributing to the metal ion content equally or not. Meteors contain different kinds and amounts of metal, depending on their origin, and this must have an influence on the metal ion content of the E layer. Also, the technology for counting meteors has still not been perfected: the most recent radar

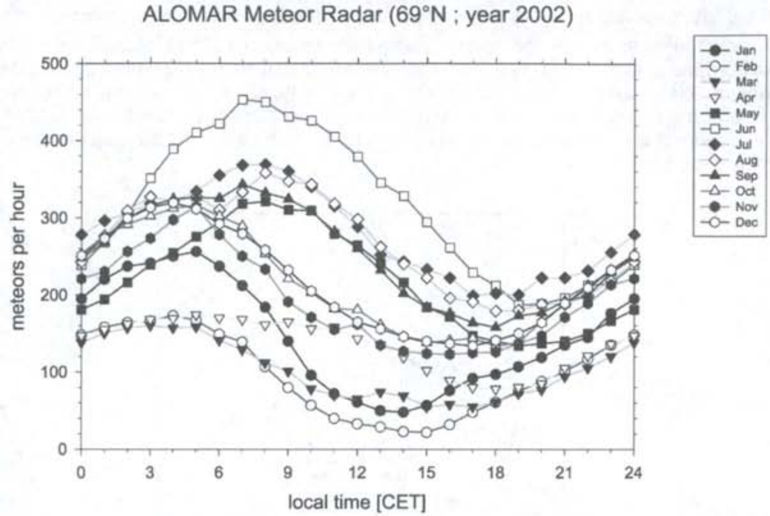


Fig. 8: Monthly means of the diurnal variations in meteor rates throughout the year 2002 [2].

meteor counts may still not be representative of all meteors, or may not be representative of all metal meteors. Also we have to remember that transport effects in the atmosphere are taking place more or less continuously, caused by neutral winds which not only help to concentrate of the metal ions but also affect their final decay. So there is a kind of dynamic equilibrium of meteor mass input and loss due to decay, superimposed upon the local concentration due to wind shear. With all these variable factors operating simultaneously – and above all, with the incorrect belief that the meteor input was truly random – it is not surprising that it has been difficult in the past to find any significant correlation.

Ambiguous meteors

All the above discussion refers to the metal content of meteors that becomes deposited as atoms and ions into the atmosphere. But not all meteor mass input is so finely atomised! Neutral meteor dust particles in the µm diameter range can exhibit high concentrations in the region of the E layer, and a very interesting issue is that such meteor dust particles can trap free electrons – for example, a 1µm diameter dust particle can carry a 45 times higher negative charge than a single electron – and thus can cause a significant reduction in the number of free electrons in the lower E-region [11]. Ablation of meteors that enter the atmosphere with velocities ≈ 15 km/s is the most important source of neutral dust particles of micron sizes in the lower E-region altitudes, where they are known to exist all the time in large numbers, reported to be 5 to 10 percent of the total dust number density.

This reduction in the numbers of free electrons that refract or reflect radio waves can operate during periods of strong meteor shower activity, when the dust particle density at the assumed deposit height of about 103km can reach extreme values (for example $5x10^4$ cm^{-3} of 1µm diameter dust particles). The size and number density of dust particles in the atmosphere could also vary by orders of magnitude from one day to another. Assuming that about 10% of these dust particles get negatively charged [12], one can see that the number of electrons captured by the dust particles is more than $3x10^4$ per cubic centimetre at the dust deposit height of 103km. This is close to the number density of free electrons in the bottom side of the E-region under normal conditions. Since the surface area of dust particle varies as the square of its radius, dust particles of larger diameter can capture larger numbers of electrons. The effect would then be a significantly reduced density of free electrons in the E layer.

Discussion

How can we explain the overall result of the contrary effects of metal atoms and dust? We could assume that the larger dust particles will fall down to the Earth much faster than the much lighter metal atoms and ions. After some time this settling-out effect would reduce the densities of free electrons in the lower regions of the E-layer, leaving relatively larger free electron densities in the upper regions.

We already know that both diurnal and solar cycles affect the amount of free electrons in all three layers of the ionosphere, as shown in Figure 9 [13]. The electron densities are maximum in the afternoon and during periods of solar maximum. Electron densities are also higher in the summer compared to winter, and higher nearer the equator compared to the poles because of the more direct solar radiation. We can also see from Figure 9 that the electron density starts to drop just below 110km, where the influence of the dust begins to become relevant.

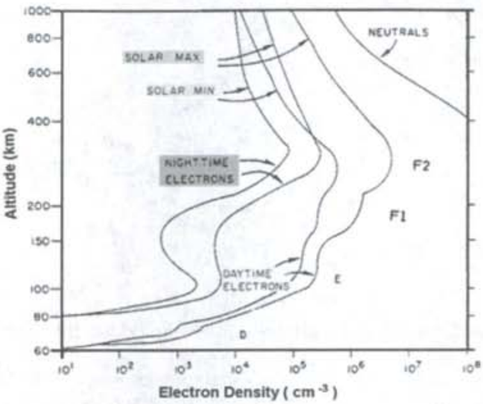


Fig. 9: Summary of Diurnal and Solar Cycle Effects on the D, E and F Layers [13].

Of course, there are also other more important reasons for the existence of this profile. However, it seems quite probable that a wind shear event will not lead to the same result on occasions when there is a huge electron density degradation due to dust effects, just at the height of 105km where E layer propagation usually takes place. Because the dust effect is apparently larger during the major meteor showers, this could well explain the observation that mean foEs values are not further enhanced during the shower periods.

Conclusion

Thanks to new radar technology for detecting sporadic meteors, scientists have recently shown a direct correlation between the random (non-shower) meteor flux and foEs. This overturns the previous belief that no such correlation existed. It is now known that 90% of the relevant meteor mass input to the upper atmosphere is caused by sporadic meteor sources that are not randomly distributed in space, but that there are actually about five fairly discrete sources which can cause seasonal differences in the random meteor input. This has been proven only recently, and has not yet been recognised in the literature for amateur radio propagation.

Differences in the occurrence of Sporadic E on 3m and 2m between the Northern and Southern Hemisphere can be attributed to the different visibility of these sources of meteor flux. The same is true for differences between North America and Europe. The mystery why major showers e.g. the Geminids do not cause any significant foEs enhancement can be attributed to their low percentage of the overall meteor mass input, and perhaps to the electron absorption effect due to higher dust concentrations from the major showers. It would be very interesting to compare meteor flux data from South Africa (ZS) with the data from Europe, as South Africa seems to be a black hole for Es propagation on the VHF bands.

Acknowledgements

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Sporadic E der mittleren Breiten in Korrelation zum Meteoriteneinfall

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Einleitung

Funkamateure spekulieren bereits seit Jahrzehnten über eine mögliche Verbindung von "Meteoren" oder "Meteoritenschauern" und dem Auftreten von Sporadic-E-Öffnungen auf den VHF-Bändern. Es war aber offenbar nicht möglich, solch einen Zusammenhang bzw. eine Korrelation mit Fakten zu beweisen. Hawk [1], der das Wissen über die möglichen Ursachen von Sproadic-E im Jahr 2001 zusammenfasste, kam zu der Schlussfolgerung:

"Studien haben das Auftreten von sporadischen Meteoriten und den gesamten Meteoriten in Korrelation zu Es untersucht. Sporadische Meteoriten, die in großer Zahl täglich das ganze Jahr über auftreten, zeigen eine deutliche Zunahme in der Zeit von Juni bis August. Bei genauerem Hinsehen stellt sich heraus, dass der Peak einige Wochen nach dem Es-Maximum in der nördlichen Hemisphere liegt. Außerdem gibt es keinen zweiten Peak von Meteoriten in den Wintermonaten, so wie es ihn bei Es gibt. Diese einfache Analyse zeigt schnell, dass ein meteoritenbezogener Auslöser bzw. Mechanismus sinnlos ist."

Neuere Studien [2] jedoch, die mit modernen Radarinterferometern zum exakten Zählen von Meteoriten eingesetzt werden, stellen bessere Daten zur Verfügung. Im Gegensatz zur Schlussfolgerung von Hawk aus dem Jahr 2001, konnte nun eine direkte Korrelation zwischen dem Masseneintrag durch Meteoriten und foEs gezeigt werden [3]. Dies ist der Gegenstand dieses Artikels. Es soll auch versucht werden regionale Unterschiede des Meteoriteneinfalls und das Auftreten von Es der mittleren Breiten in Zusammenhang zu bringen.

Metallatome

Sporadische E-Schichten der mittleren Breiten formieren sich, wenn Elektronen vertikal in einem Windscherungsmechanismus konvergieren. Das Auftreten von Sporadic-E folgt einer jahreszeitlichen Abhängigkeit, gekennzeichnet durch ein Sommer-Maximum, wie z.B. im Atikel in der vorletzten DUBUS-Ausgabe gezeigt [4]. Obwohl dies seit Jahrzehnten bekannt ist, blieb der eigentliche Grund dafür mysteriös, da er mit der Windscherungstheorie nicht erklärt werden kann.

Das Auftreten und die Intensität von sporadischen E-Schichten hängt direkt von deren Gehalt an Metall-Ionen ab, was mit Hilfe von Raketen-Experimenten nachgewiesen wurde. Metallatome, von denen bekannt ist, dass sie in der oberen Atmosphäre vorhanden sind, sind Fe, Na, K, Mg, Si und Ca. Wenn diese Atome ionisiert werden, durch Bestrahlung oder Kollision mit anderen Partikeln, werden Elektronen freigesetzt. Die positiv geladenen Metall-Ionen und die Elektronen bewegen sich dann zusammen unter einer Windscherung.

Die einzig relevante Quelle für Metallatome in der oberen Atmosphäre sind Meteoriten. Der Eintrag an Meteoritenmasse in die Atmosphäre beträgt etwa 1000kg pro Tag im Jahresdurchschnitt. Das Maximum der Masseverteilung der Meteoriten liegt bei 1.5×10^{-5}g (200µm Durchmesser) und die Größe der durch Radar typischerweise erfassbaren Meteoriten beträgt ungefähr 100 bis 400µm.

Etwa 90% des gesamten jährlichen Eintrags an Meteoritenmasse wird durch SPORADISCHE Meteoriten verursacht! Folglich kann man in diesem Zusammenhang die gut bekannten großen Meteoritenschauer, die für Meteor-Scatter-Verbindungen genutzt werden, in diesem Zusammenhang (nahezu) vergessen. Ein Konzentrieren auf diese Schauer würde wahrscheinlich zu falschen Ergebnissen führen und kann erklären, warum eine positive Korrelation zwischen Meteorraten und Es in der Vergangenheit nicht möglich war.

Daten von Meteoriten

Singer et al. haben Daten von Meteoriten-Zählungen, die mittels moderner Radar-Interferometer in unterschiedlichen geographischen Regionen gewonnen wurden, veröffentlicht [2]. Die untere linke Kurve in Abb. 1 zeigt die Daten für einen Ort in mittleren Breiten der nördlichen Hemisphäre (54 N, Juliusruh in Deutschland) mit dem gut bekannten Maximum im Simmer (Juni) und einem Minimum im Februar.

Abb. 2 zeigt die jährliche Schwankung von foEs für Boulder (nördliche Hemisphäre) and Concepcion (südliche Hemisphere). Man kann klar die Maxima um die lokale Sommersonnenwende herum erkennen, im Juni/Juli für Boulder und Dezember/Januar für Concepcion.

Korrelation

Die Arbeit von Haldoupis et al. [3] zeigt einen Korrelationsgraphen (Abb. 3) für die täglichen Meteorzahlen und foEs von San Vito (40.6 N, Italien) für die Jahre von 2000 bis 2005. Über diese sechs Jahre kann man eine sehr gute Korrelation zwischen den Zählungen und foEs sehen (der lineare Korrelationskoeffizient ist > 0.7).

Abb. 4 zeigt die über 5 Jahre gemittelten Zählungen im Vergleich zu foEs für Juliusruh (54 N) und Athen (38 N). Auch hier kann meine eine sehr gute Korrelation erkennen. Diese Korrelation wurde aufgrund der exakten Meteor-Zahlen der Radar-Interferometer möglich, die den sporadischen Meteoriteneinfall viel besser erfassen als herkömmliche Techniken, bei denen die Ergebnisse durch das Zählen von Meteoriten der großen Schauer dominiert wurden. Solche ein trypisches herkömmiches Ergebnis ist in Abb. 5 gezeigt. Hier wurden die Radio-Echos von Meteoren durch Vorwärtsscatter-Signalen auf 66 MHz von Beobachtern der Universität von Ghent (Belgien) erfasst [5]. Der obere Teil der Abbildung zeigt die originalen Daten, der untere Teil schneidet die starken Spitzen der beiden aktivsten Schauer des Jahres 1998, Perseiden und Leoniden, ab, so dass man sich auf die kleineren Peaks, die das ganz Jahr über präsent sind, konzentrieren kann. Der Juni-Peak, wie er in Abb. 3 und 4 zu sehen ist, wird durch die beiden großen Schauer maskiert und die Relation zu den Zählraten im August und im letzten Viertel des Jahres sieht anders aus. Eine Korrelation des oberen Diagramms in Abb. 5 zu foEs würde kein positives Ergebnis bringen und, obwohl das untere Diagramm in Abb. 5 den „Sommersonnenwenden-Peak" etwas besser zeigt, ist eine Korrelation zu diesen Daten der alten Technologie immer noch schwierig. Es ist die neue Radarinterferometrie, die diese Korrelation erst möglich macht.

Geographische Unterschiede

Wie man in Abb. 1 erkennen kann, gibt es signifikante regionale Unterschiede bei den Meteoriten-Daten.

Auf der linken Seite sieht man die Kurven für Europa (etwa die selbe Länge und 15 Grad Unterschie in der Breite) mit dem charakteristischen Sommer-Maximum (Juni) und dem Winter-Minimum (Februar). Wenn man diese Kurven mit den beiden auf der rechten Seite der Abb. 1 vergleicht, kann man deutlich erkennen, dass die Zählungen bei 22 S (Brasilien) Maxima im Januar und Juni zeigen. Der Massen-Eintrag ist aber deutlich (etwa 30-40%) geringer als im Juni in Europa, wenn man einfach eine grobe Abschätzung der Fläche unter den Kurven vornimmt. Das ist in Übereinstimmung mit den Beobachtungen der Funkamteure aus Brasilien: Es auf 2m ist dort SEHR selten. Nur ganz wenige Öffnungen (unter 10 insgesamt) wurden in den letzten 15 Jahren – hauptsächlich zwischen Ende Dezember und Februar - zwischen PY und LU festgestellt. Obwohl die Dichte von VHF-Amateuren in PY, LU etc. sehr niedrig ist im Vergleich zu Europa, gibt es doch eine aktive Gruppe von FM-BC-DXern in Brasilien und deren Resultate für 3m Es zeigen in etwa dieselben Unterschiede im Vergleich zu Europa. Interessanterweise produziert der sogar etwas höhere Peak im Juni in PY keine agehobenen Es-Bedingungen auf 6m, 3m oder 2m in dieser Region. Winter-Es wurde bisher noch nie von Amateuren in der Region PY gemeldet. Das kann man als Indiz dafür werten, dass auch andere Faktoren für das Entstehen der sporadischen E-Schicht nötig sind (Sommersonnenwenden-Effekt, die meisten Elektronen treten tagsüber zur Zeit der Sommersonnenwende auf, wie in Abb. 9 weiter unten zu sehen).

Nun zur unteren Kurve rechts in Abb. 1. Diese zeigt die Verhältnisse für Süd-Australien (35 S). Man sieht, dass der Massen-Eintrag auch geringer ist als in Europa, und dass die jährlichen Maxima im Januar/Februar und Juni viel schwächer sind. In VK liegt das 2m-Es-Maximum um Dezember/Januar, wobei viel weniger Öffnungen als in Europa auftreten.

In Südafrika (ZS) wurde bisher (in den letzten 20 Jahren) keinerlei 2-m-Es-Öffnung zur Zeit de Sommersonnenwende im Dezember/Januar gemeldet. Auch auf 6m ist Es dort ein seltenes Ereignis. Südafrika liegt auf etwa 30 Grad auf der Südhalbkugel. Meteoritenzählungen von der am nahesten verfügbaren Beobachtungsstation auf der Insel Ascension (ZD8) von Younger und Mitchell [6] zeigen, dass in dieser Region sogar noch geringere Zahlen gefunden werden und nur eine geringe jahreszeitliche Differenz zwischen dem Sommer-Peak und dem Frühlings-Minimum. Weil bisher keine 2m und 3m-Es-Öffnungen im Juni aus Brasilien und Australien, wo dann sogar mehr Meteoriteneinfall herrscht, gemeldet wurden, können wir folgern, dass 3-m- und 2-m-Es-Öffnungen in Südafrika dann sehr unwahrscheinlich sein müssen. Sogar aus Europa wurde bisher nie eine 2-m-Es-Öffnung im Dezember oder Januar zwischen 1974 und 2008 gemeldet (eine einzige Es-Öffnung im November fand parallel zu einer besonders starken Aurora-Öffnung statt und ist deshalb eher als Aurora-E einzustufen). Es wurden einige wenige 3-m-Es-Öffnungen in Europa von Dezember bis Februar beobachtet, aber nicht mehr als 1 bis 2 pro Jahr.

Leider steht kein Diagramm mit denselben Daten und Maßstab für Nord-Amerika zur Verfügung, aber Abb. 6 zeigt ein Diagramm, das 2006 von Campbell-Brown [7] veröffenlicht wurde, das die Zählungen ausschließlich der sporadischen Meteoriten mittels Radiointerofermetrie für den Ort London in Ontario (VE3, 43 N) darstellt. Man kann den absoluten Massen-Eintrag nicht mit dem aus Abb. 1 vergleichen, aber wir erkennen, dass das Sommer-Maximum anders aussieht als das in Europa: Es ist nicht so hoch im Vergleich mit dem Rest des Jahres. Auch sieht man einen kleinen Abfall im Juni und man sieht hohe Aktivität Ende Dezember und besonders Anfang Januar. Wir wissen, dass die absolute Zahl von Tagen mit 2-m-Es in Nord-Amerika zwischen Mai und August deutlich geringer ist als in Europa, sowohl über kürzere als auch längere Zeiträume betrachtet. Das könnte durch den niedrigen Sommer-Peak in Abb. 6 erklärbar sein. Es wurde immer in Frage gestellt, ob die niedrigere Anzahl von Tagen mit 2-m-Es in Nordamerika durch den Mangel an beteiligten Funkamateuren und große Gebiete ohne irgendwelche Funkamateure und Baken verursacht wurde. Aber diese Aussage ist seit langem nicht haltbar: Wir haben mehr Berichte für Winter-Es-Öffnungen auf 3m und 2m von NA als aus Europa, insofern kann die Beobachtungslage dort nicht so schlecht sein! 2-m-Winter-Es ist sicher auch selten in NA, aber es ist dokumentiert, z.B. für den 1. und 11.1.1998. Die 3-m-Ergebnisse von WA5IYX [4] bestätigen die niedrigeren Zahlen als für Europa im Sommer, aber höhere im Winter. WA5IYX hat 83 Tage mit 3-m-FM-BC-Es von 1972 bis 1999 für den Monat Januar gezählt, als 3 Tage im Schnitt pro Jahr, was sicher mehr ist, als in Europa. Über dieselben Jahre hat er auch 42 Tage im Februar gezählt. Diese Tendenz passt gut zu den Meteoritenzählungen in Abb. 6 und eine starkes Indiz dafür, dass der NA-Januar-Peak in Abb. 6 der Grund für die angehobenen Winter-Es-Bedingungen in NA ist. Man beachte, dass dieser NA-Januar-Peak ungefähr dieselbe Höhe erreicht wie die NA-Sommer-Peaks! Dies ist ein gravierender Unterschied zur Situation in Europa aus Abb. 1.

Die leichte Abnahme im Juni in Abb. 6 scheint auch typisch zu sein für die nordamerikanische Region. Man findet Vergleichbares nicht in Abb. 1 für Europa, wo man einen klaren Peak im Juni sowohl für Meteoritenzahlen als auch für foEs finden. Wenn man Abb. 2 oben genauer betrachtet (Boulder, USA), kann man ein leichtes Absinken der foEs-Werte im Juni in mehreren Jahren erkennen, was die direkte

Urache-Wirkung-Beziehung zwischen Meteoriten-Masse-Eintrag und foEs unterstützt.

Es wäre interessant, auch eine Korrelation dieser Juni-Depression mit Es-Daten der Amateurbänder zu finden. Für 2m – soweit bekannt – gibt es nur eine größere Studie, die 1994 vom Emil Pocock, W3EP, veröffentlicht wurde, und die im Detail die Jahre von 1976 bis 1998 erfasst [8]. Er fand 53 Tage mit 2-m-Es im Juni und 51 Tage im Juli. Wenn man aber die von ihm dokumentierten Minuten-Daten für 2-m-Es berücksichtigt, findet man etwa 4300 für Juni und 6500 für Juli. 50% mehr im Juli ist ein signifikanter Unterschied, besonders, das wir wissen, dass der 2-m-Es-Peak im Juni ist. Wir haben keine Minuten-Daten für 2-m-Es für Europa vorliegen, aber die Tageszählung für die 34-jährige Beobachtungsperiode für Europa zeigt 397 Tage für Juni und 327 für Juli. Hier sind also 20% mehr Tage im Juni. All dies kann gut mittels der Unterschiede im Massen-Eintrag durch die Meteoriten interpretiert werden, aber weitere Langzeitstudien sind nötig.

Einfluß der geomagnetischen Aktivität

Man muss immer daran denken, dass Sporadic-E der mittleren Breiten durch verschiedene Faktoren verursacht und moduliert wird. Das ist das, was Es seine „sporadische" Natur gibt und Schwankungen bei den Faktoren, die wir versuchen zu analysieren, können leicht durch Schwankungen anderer Faktoren maskiert werden. Einer dieser maskierenden Faktoren ist der Einfluß der geomagnetischen Aktivität. Die halbjährliche (zweimal jährliche) Schwankung der geomagnetischen Aktivität (siehe Abb. 7) wird ein wichtiger Faktor zur Seite der Tag-und-Nachtgleiche. Wie in [4] erwähnt, existiert eine Verbindung des Erdmagnetfeldes über die Formel, die den Windscherungsmechanismus in der oberen Atmosphäre beschreibt, von dem angenommen wird, dass er einer der Hauptursachen für die Konzentration der Elektronen in der E-Schicht ist, die es ermöglichen, dass VHF-Radiowellen reflektiert werden können.
Unruhige Magnetfelder machen den Windscherungsmechanismuss offensichtlich weniger effektiv. Dies ist der Grund dafür, dass wir weniger Es (niedrigere foEs in Abb. 2) im März/April und September/Oktober in Nordamerika sehen, als wir von den Meteorraten (Abb. 6) her für diese Monate erwarten würden. Dasselbe sehen wir im September für Europa, wo der Masse-Eintrag auch im März und April niedrig ist, siehe Abb. 8 (entnommen aus [2]). Eine Abschätzung des Masse-Eintrags durch Meteoriten aus den Kurven resultiert in der Reihenfolge:

<u>Juni</u> >>> <u>Juli</u> > <u>August</u> > <u>September</u> > <u>Mai</u> >>

Oktober ≈ Dezember > April > November > Januar > März > Februar.

Die unterstrichenen Monate haben einen signifikant höheren Masse-Eintrag als der ganze Rest.

Erklärung der Unterschiede

Wie oben erwähnt, wurde ursprünglich der Gehalt an Metallionen in der E-Schicht als vorwiegender Grund für die jahreszeitlichen Schwankungen von Spradic-E ausgeschlossen (Whitehead, 1989 [9]), weil man zu der Zeit glaubte, dass die Quellen von sporadischen Meteoriten im All zufällig verteilt sind. Erst die jüngsten Studien haben gezeigt, dass die nicht der Fall ist! Tatsächlich nämlich sind die meisten Radianten von sporadischen Meteoriten nicht zufällig verteilt, sondern befinden sich auf definierten Positionen nahe der Ekliptik. Dies verursacht die jahreszeitlichen Unterschiede des Meteoriteneinfalls in Abhängigkeit zur Neigung der Erdachse bezüglich der Ebene der Ekliptik.

Bereits im Jahr 1956 hatte Hawkins durch Messungen mit dem 53-MHz-Radar in Jordrell Bank (UK) herausgefunden, dass die Radianten der sporadischen Meteore nicht zufällig im Weltraum verteilt sind [10]; leider haben seine Ergebnisse nicht die angemessene Aufmerksamkeit bei den Es-Forschern gefunden. Die aktuellen Resultate aus Kanada jedoch [7] zeigen, dass es für die nördliche Hemisphäre fünf relevante Quellen für den Masse-Eintrag von sporadischen Meteoren gibt. Diese Quellen heissen: North Apex, Antihelion, Helion, South Apex und Northtoroidal. Diese fünf Quellen zusammen bringen das Resultat, so wie es in Abb. 6 gezeigt ist. Die Meteoriten der großen Schauer tragen zum Metallionengehalt der E-Schicht zwar bei, aber da dies nur etwa 10% des gesamten jährlichen Masseeintrags ausmacht, kann man annehmen, dass sie keinen größeren Effekt auf das Geschehen haben werden. In [7] ist auch erwähnt, dass immerhin einige der Quellen der sporadischen Meteore eventuell mit Kometen in Zusammenhang stehen.

Unsicherheiten

Es gibt einige Faktoren, die berücksichtigt werden müssen hinsichtlich einer möglichen Relevanz für einen Einfluß auf die Verbindung zwischen Meteoriten und Sporadic-E. Meteoriten treten mit unterschiedlichen Geschwindigkeiten in die Atmosphäre ein und weisen eine unterschiedliche Höhenverteilung auf. Dies ist je nach Quelle der Meteoriten unterschiedlich und es ist nicht bekannt, ob Metoriten aller Höhen gleich zum Metallionengehalt beitragen oder nicht. Meteoriten beinhalten verschiedene Arten und Mengen von Metallen, je nachdem, woher sie kommen, und das wird einen Einfluss auf den Metallgehalt der E-Schicht haben. Auch ist die Technologie des Erfassens der Meteoriten noch nicht perfekt: Selbst die modernste Radartechnik kann eventuell nicht alle Meteoriten repräsentativ erfassen bzw. nicht repräsentativ für die metallhaltigen Meteoriten sein. Auch muss man bedenken, dass es in der Atmosphäre mehr oder weniger fortwährend Transporteffekte gibt, die durch neutrale Winde verursacht werden, die nicht nur helfen, die die Metallionen zu konzentrieren, aber auch deren letzliches Absinken beeinflussen. Es gibt also ein dynamisches Gleichgewicht von Masseeintrag der Meteoriten und Verlust durch Absinken nach unten, das die lokale Konzentration durch Windscherung überlagert. Mit allen diesen variablen Faktoren, die gleichzeitig arbeiten, und vor allem, dem falschen Glauben, dass der Meteoriteneinfall rein zufällig erfolgt, ist es es nicht überraschend, dass es in der Vergangenheit schwierig war, eine signifikante Korrelation zu finden.

Mehrdeutige Meteoriten

Die obigen Aussagen beziehen sich alle auf den Metallgehalt von Meteoriten, der in Form von Atomen oder Ionen in die Atmosphäre abgelagert wird. Aber nicht der gesamte Masseeintrag der Meteoriten erfolgt so fein atomisiert! Neutrale Meteoriten-Staubpartikel, deren Durchmesser im Mikrometer-Bereich liegen, können hohe Konzentrationen im Bereich der E-Schicht erreichen und eine sehr interessante Tatsache ist, dass solche Meteoriten-Staubpartikel freie Elektronen einfangen können. Zum Beispiel kann ein Staubpartikel mit einem Durchmesser von 1µm eine 45-fach höhere negative Ladung aufnehmen als ein einzelnes Elektron hat, so dass eine signifikante Verringerung der Zahl der freien Elektronen in der E-Schicht bewirkt wird [11].

Schichtabtragung an Meteoriten, die in die Atmosphäre mit Geschwindigkeiten von etwa 15 km/s eintreten, ist die wichtigste Quelle von neutralen Staubpartikeln im Mikron-Bereich in Höhen der unteren E-Region. Man weiss, dass sie dort zu jeder Zeit in hoher Zahl vorkommen und etwa 5 bis 10% der Gesamtstaubmenge ausmachen.

Die Reduzierung der Zahl freier Elektronen, die die Radiowellen brechen oder reflektieren, kann besonders während starker Meteoritenschauer vorkommen, da dann die Dichte von Staubpartikeln in der angenommenen Ablagerungshöhe von etwa 103km extrem hoch werden kann (z.B. $5x10^4$ cm^{-3} für Staubpartikel mit 1µm Durchmesser). Dies liegt nahe am Wert für die Dichte der freien Elektronen im unteren Bereich der E-Schicht unter normalen Bedingungen. Da die Oberfläche von Staubpartikeln mit dem Quadrat des Radius zunimmt, können Staubpartikel größeren Durchmessers größere Mengen von Elektronen einfangen. Der Effekt wäre eine signifikant herabgesetzte Dichte von freien Elektronen in der E-Schicht.

Diskussion

Wie kann man das Gesamtergebnis der beiden Gegenspieler Metallatome und Staub erklären? Man kann annehmen, dass größere Staubpartikel viel schneller auf die Erde fallen werden als die viel leichteren Metallatome und Ionen. Nach einiger Zeit würde dieser Absetzungseffekt die Dichte an freien Elektronen in unteren Regionen der E-Schicht herabsetzten und relativ höhere Dichten von freien Elektronen in den oberen Regionen hinterlassen.

Man weiss bereits, dass tägliche Zyklen und und der solare Zyklus die Menge freier Elektronen in allen drei Schichten der Ionosphäre beeinflussen, wie in Abb. 9 gezeigt [13]. Die Elektronendichten zeigen ein Maximum am Nachmittag und während Zeiten des solaren Maximums. Auch sind die Elektronendichten im Sommer höher als im Winter und höher in Richtung des Äquators als in Richtung der Pole aufgrund der direkteren solaren Einstrahlung. Man kann auch in Abb. 9 sehen, dass die Elektronendichte gerade unterhalb von 110km abzunehmen beginnt, dort wo der Einfluss der Staubpartikel beginnt, relevant zu werden.

Natürlich gibt es auch andere noch wichtigere Gründe für die Existenz dieses Profils. Dennoch ist es sehr wahrscheinlich, dass ein Windscherungsereignis nicht zum gleichen Ergebnis führt, wenn eine starke Elektronenreduzierung in der Höhe von 105km, auf welcher die E-Schicht-Ausbreitung normalerweise stattfindet, gerade aufgrund von Staubeffekten im Gange ist. Weil der Staubeffekt offensichtlich stärker während der größeren Schauer ausgeprägt ist, könnte dies gut die Beobachtung erklären, dass die mittleren foEs-Werte während der Schauerperioden nicht ansteigen.

Zusammenfassung

Dank neuer Radartechnologie zur Erfassung sporadischer Meteoriten haben Wissenschaftler kürzlich eine direkte Korrelation zwischen dem sporadischen (keine Schauer) Meteoritenflux und foEs nachgewiesen. Das widerlegt den bisherigen Glauben, dass solch ein Zusammenhang nicht existiert. Man weiss nun, dass 90% des relevanten Meteoriten-Masseeintrags in die obere Atmosphäre durch Quellen sporadischer Meteoriten verursacht werden, die nicht zufällig im Weltraum verteilt sind. Vielmehr handelt es sich um fünf recht eigenständige Quellen, die die jahreszeitlichen Unterschiede beim Einfall der sporadischen Meteoriten verursachen. Das wurde erst in jüngster Zeit nachgewiesen und hat bisher keinen Eingang in der Literatur gefunden, die sich mit Ausbreitungsphänomenen im Amateurfunk beschäftigt.

Unterschiede beim Auftreten von Sporadic-E auf 3m und 2m zwischen der Nord- und Südhalbkugel können der unterschiedlichen Sichtbarkeit dieser Quellen für den meteoren Flux zugeschrieben werden. Gleiches gilt für die Unterschiede zwischen Nordamerika und Europa. Das Rätsel, warum große Schauer, wie z.B. die Geminiden im Dezember, keine signifikante Erhöhung der foEs-Werte bewirken, kann durch ihren geringen Anteil am gesamten Masseeintrag erklärt werden und vielleicht auch durch den Elektronen-Absorptionseffekt aufgrund der dann herrschenden höheren Staubkonzentrationen.

Es wäre sehr interessant, Meteor-Flux-Daten von Südafrika (ZS) mit den parallelen Daten aus Europa zu vergleichen, da Südafrika anscheinend ein schwarzes Loch für Es-Ausbreitung auf den VHF-Bändern zu sein scheint.

Danksagung

Ich danke Herrn Christos Haldoupis von der Universität Kreta und Herrn Wolfgang Singer vom Leibniz-Institut für Atmosphärenphysik in Kühlungsborn für die Kommunikation, wertvolle Daten und Artikel.

Referenzen

Siehe oben, engl. Text.

<u>Bildunterschriften</u>

Abb. 1: Tagliche Schwankung von Metoriten-Raten* [2]. *Monatliche Mittelwerte für jede Stunde der Ortszeit.

Links: Andenes, Nord-Norwegen (oben) und Juliusruh, Nord-Deutschland (unten). Rechts: Cachoeira Paulista, Süd-Brasilien (oben) und Delamere, Süd-Australien (unten).

Abb. 2: Typische jährliche Schwankung der kritischen Sporadic-E-Frequenz foEs, gleichzeitig gemessen in der nördlichen (Boulder, 40 N) und südlichen(Concepcion, 36.6 S) Hemisphäre* [3]. *Ein ausgeprägtes Sommer-Maximum dominiert in beiden Hemisphären.

Abb. 3: Vergleich der jährlichen Schwankung der täglichen Meteoritenzahlen (durchgezogene Linie), gemessen in der nördlichen Hemisphäre mit den gemittelten Werten der täglichen kritischen Sproradic-E-Frequenz (foEs), gleichzeitig gemessen mit der Ionosonde in San Vito auf 40.6 N* [3]. *Es gibt eine gute Übereinstimmung zwischen der jährlichen Schwankung beider Parameter.

***Abb. 4: Vergleich der gemittelten jährlichen Schwankung der Meteoritenzahlen und fEs für zwei Fälle: (links) für die Periode von November 1999 bis Dezember 2005 und die Ionosonde in Juliusruh (54.6 N, und (rechts) für die Periode von September 2000 bis Dezember 2005 und die Ionosonde in Athen (38 N)* [3].**

Abb. 5: Meteoritenzahlen von 1998 mittels 66-MHz-Vorwärtsscatter-Beobachtungen in Ghent [5]. Oben die originalen Daten, unten ohne die Spitzen der beiden großen Schauer (Perseiden und Leoniden.

***Abb. 6: Aktivität aller sporadischen Meteoritenquellen, gemessen bei 29MHz von 2002-2005 in London (Ontario, Kanada, 43N, 82W)* [7].**

Abb. 7: Die jahreszeitliche Verteilung von geomagnetischen Störungen

Abb. 8: Monatliche Mittelwerte der täglichen Schwankung der Meteorraten im Jahr 2002 [2]

***Abb. 9: Zusammenfassung der tageszyklischen und solarzyklischen Effekte auf die D-, E- und F-Schichten* [13].**

Pipe-Cap Filters Revisited

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Pipe-cap filters have been used in amateur microwave equipment for at least 20 years, but are still not well understood, and design information is lacking. WA5VJB[1] borrowed the idea from a transverter by DJ6EP and DC0DA[2] and published some measured data which was enough to get others started. I used ½" pipe-cap filters in a 10 GHz mixer[3] and ¾" pipe-cap filters in a 5760 MHz mixer[4,5], but my implementations were cut-and-try. I later expanded these mixers into single-board transverters: one[6] for 5760 with five pipe-caps, and then one[7] for 10.368 GHz with seven ½" pipe-cap filters plus two ¾" caps in the LO chain. The number of filters was needed to get adequate selectivity on both transmit and receive without excessive filter loss, plus some margin to allow for reproducibility, since neither the selectivity nor the loss was well quantified. Both single-board transverters have been improved by Down-East Microwave[8] and made available in kit or finished form. The DB6NT[9] 10 GHz transverter uses a similar style of filter.

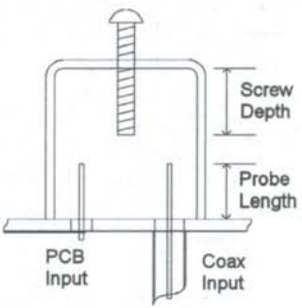

Fig. 1

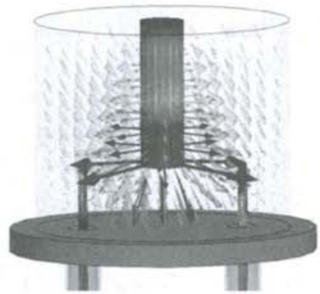

Fig. 2

Pipe-Cap Resonators

The usual configuration for a pipe-cap filter is sketched in Figure 1: a metal plate shorting the open end, with probes for input and output, and a central tuning screw through the top of the cap. Two varieties of probe are shown in the figure. There has been some speculation about various cavity modes operating in these filters, but simulation with electromagnetic software, Ansoft **HFSS**10, shows the electric field configuration with a tuning screw, seen in Figure 2. The pipecap filter is a simple coaxial quarter-wave resonator (which hams often call a cavity). The tuning screw acts as the coax center conductor, with a radial electric field around it; the field intensity increases toward the open end of the screw. The resonant frequency is determined by the inserted length of the screw; Figure 3 shows that the same screw length produces the same resonant frequency in three different sizes of pipe caps. The other dimensions do not affect the frequency, as they would if a waveguide cavity mode were involved.

With the screw completely removed, true cavity modes may be found. These produce resonances at frequencies higher than those normally used for a given size cap, and probably set the upper frequency limit for a given size. For instance, a one-inch pipe cap nominal plumbing size (to fit over copper tubing with a one inch inner diameter) with no screw resonates at 7.923 GHz, measured for two different heights of pipe cap – the height has no effect on this resonance, only the diameter. Normal use for this size pipe-cap would be below 5 GHz.

The input and output probes couple to the open end of the quarter-wave resonator, the tuning screw, so they are providing predominantly capacitive coupling. Magnetic coupling could also be used, for instance, a loop at the shorted end of the quarter-wave, but it would be more difficult to assemble and adjust. Since the open end of the screw moves with frequency, the probe coupling also varies with frequency. Increased coupling loads the resonator, increasing the bandwidth. The equivalent circuit of a quarter-wave resonator is simply a parallel-tuned circuit, shown in Figure 4. Resonator losses are lumped into an equivalent resistance, **Ro**, in parallel with the tuned circuit.

The resonator has an unloaded ***Q***, $Q_U = R_o / X_{L_o}$ where X_{L_o} is the reactance of the inductor. For a high-***Q*** resonator, **Ro** is a very high resistance.

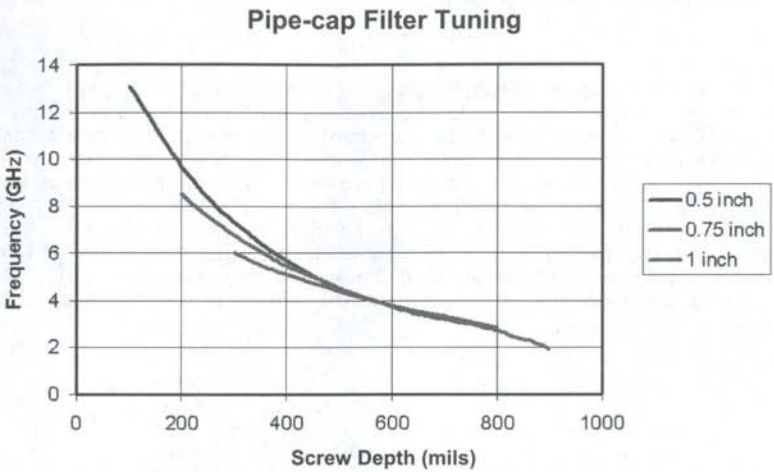

Fig. 3

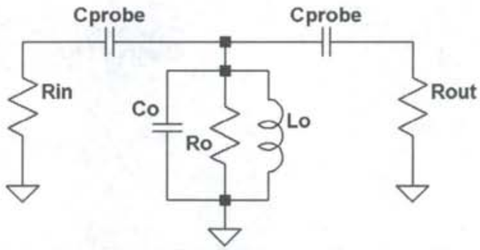

Fig. 4 Pipe-cap resonator equivalent circuit

In most RF circuits, R_{in} and R_{out} are 50 ohms. The coupling capacitors, the probes in this case, transform the effective resistance to a higher value in parallel with **Ro**, thus reducing the effective resistance across the resonator to a loaded value, R_L. This results in a loaded ***Q***, $Q_L = R_L / X_{L_o}$ that is lower than the unloaded Q_U. Coupling is proportional to capacitance – a larger capacitor produces more coupling and loads the resonator more. Next, the 3 dB bandwidth (half-power bandwidth) of the loaded resonator may be calculated[11]:

$$BW = \frac{\text{Frequency}}{Q_L}$$

Or we may measure the 3 dB bandwidth ***BW*** and then calculate Q_L. It is difficult to calculate the effective capacitance, inductance, and resistance of a quarter-wave resonator, but measurement of bandwidth is straightforward. From my measurements and those published by WA5VJB, I estimate the unloaded Q_U of the pipe-cap resonators as 600 to 1000. Pretty good!

Knowing the Q_U , we can make some estimates of loss. If a resonator is very lightly loaded, for very narrow bandwidth, so that **Ro** is not much larger than $\mathbf{R_L}$, then much of the power will be dissipated in **Ro** – resulting in high loss. With more loading, **Ro** becomes less significant and more of the power is transmitted. The loss of a resonator may then be calculated[12]:

$$\textbf{Insertion Loss} = 20\log\left(\frac{Q_U}{Q_U - Q_L}\right)\textbf{dB}$$

So for a Q_U around 1000, the bandwidth can be as narrow as perhaps 1% of the resonant frequency before loss becomes significant, since 1% bandwidth equates to $Q_L = 100$, which gives a resonator loss of just under 1 dB. Of course, this loss is in addition to circuit losses – a typical pipe-cap filter loss is 2 or 3 dB total for 1% bandwidth.

Probe Length

The difficulty with pipe-cap filters is finding the right probe length for a desired bandwidth. There is no simple way to estimate the length, and it appears to vary significantly with frequency and to be fairly critical. I realized this the hard way, while trying to make filters for 2304 and 3456 MHz. I thought that making them a little longer than ones I had used at 5760 MHz would be fine, but the results were not. Tuning was extremely sharp, and the circuit had so much loss that I wondered if the MIC amplifiers were defective and not amplifying. After spending far too much time troubleshooting, I began to suspect the pipe-cap probes.

Since my circuit was not conducive to controlled probe-length experiments, I turned instead to software, simulating the pipe caps using Ansoft **HFSS** software. Very short probes yielded sharp, lossy response curves, while long ones seemed rather broad. At each resonant frequency, or screw length, the best probe length was proportional to the screw length. Longer screw lengths, for lower frequencies, require much longer probes. I simulated enough data points to make a set of design curves for one-inch pipe caps so that I could predict my filter response. These curves have proven very useful and my circuits now work more predictably. For future work, both for myself and others, I made similar curves for other common sizes: ¾ - inch, useful at 5760 MHz, and ½ - inch, for 10 GHz.

1" Pipe-Cap Filters

Longer probes increase the coupling to the resonator, lowering the loaded ***Q***, ***QL***, thus increasing the resonator bandwidth, as shown in Figure 5. Some other results are apparent – not only does the bandwidth increase, but the out-of-band rejection decreases, particularly above the resonant frequency. This may be due to direct coupling between the probes. With shorter probes, the filter gets much sharper, but the loss also increases.

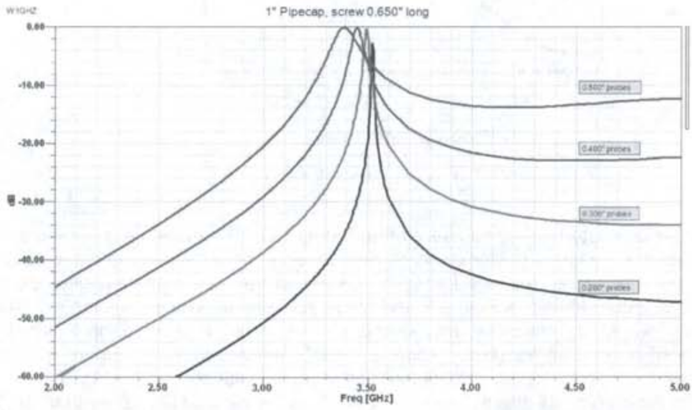

Fig. 5 Pipe-cap bandwidth as a function of probe length

The curves in Figure 5 are at one tuning screw setting – the probe length only affects the resonant frequency by a small amount. If the resonant frequency is varied, by tuning the screw, the bandwidth for a given probe length increases with frequency, as shown in Figure 6. However, I have trouble using this curve as a design guide for probe length. If we instead plot bandwidth curves vs probe length for each screw setting, in Figure 7, then it is easier to estimate a good probe length for a desired frequency – just refer back to Figure 3 to estimate the resonant frequency corresponding to each screw length.

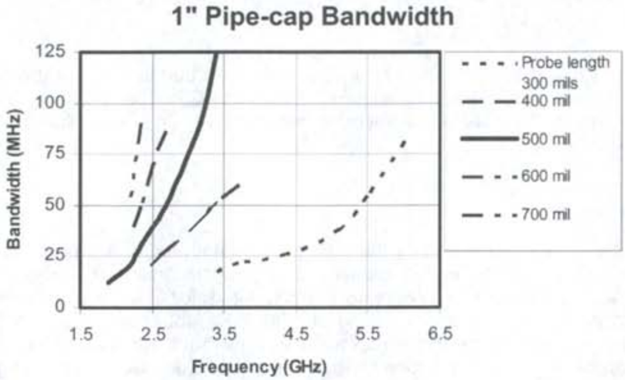

Fig. 6

Loss is much harder to simulate, since the losses are not in the materials, but in the details. A threaded screw is a rough surface for RF, and rough surfaces increase loss. Even worse is the screw contact to the pipe cap – this is at the maximum current point of the resonator, where even small resistances add loss.

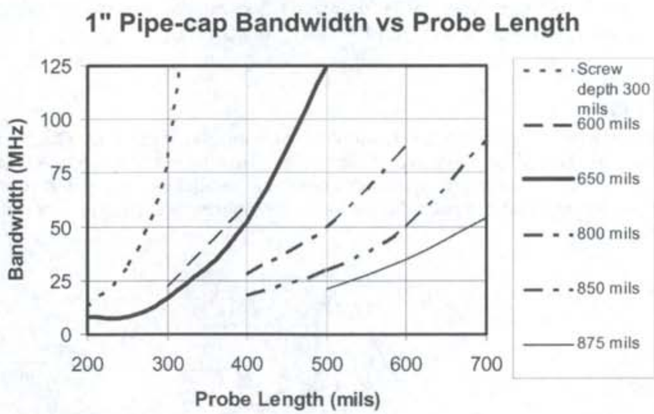

Fig. 7

So losses are better characterized by measurement. Didier, KO4BB, made a suggestion on the WA1MBA microwave reflector that a pipe-cap filter could be held together by a C-clamp to allow quick adjustments. Since the rim of the pipe cap is in a high-impedance, low current area, contact resistance is not critical. I put together the test fixture shown in Figure 8 and made some measurements using my ancient HP-8410 Network Analyzer. No fancy computer corrections are used, so these numbers aren't precise. The measured curves of bandwidth vs probe length for each screw setting, in Figure 9, show bandwidth increasing with probe length for longer probes, but flattening out with shorter probes. What is happening is that the equivalent resistance **R_o** due to losses is controlling the bandwidth, rather than the loading of the probes. Thus, the bandwidth remains constant but loss increases.

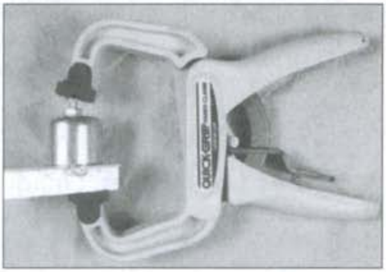

Fig. 8

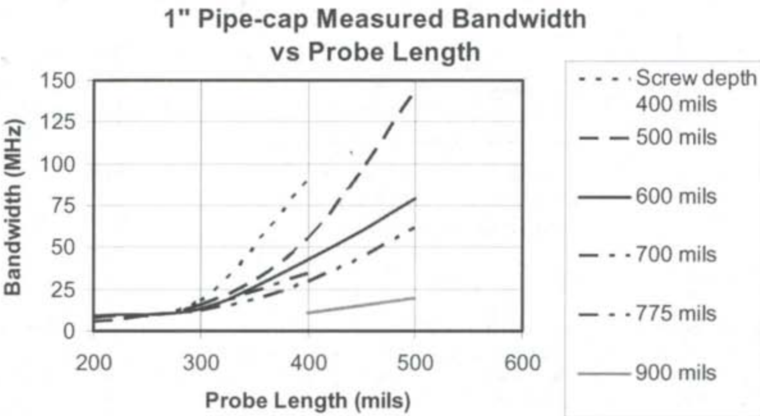

Fig. 9

The measured losses are plotted in Figure 10. The test fixture seems to add around 1 dB of loss, probably because it is built on ordinary epoxy-fiberglass PC board, rather than good Teflon microwave board. We can see that the loss gets high as we approach the flat area of the curves in Figure 9.

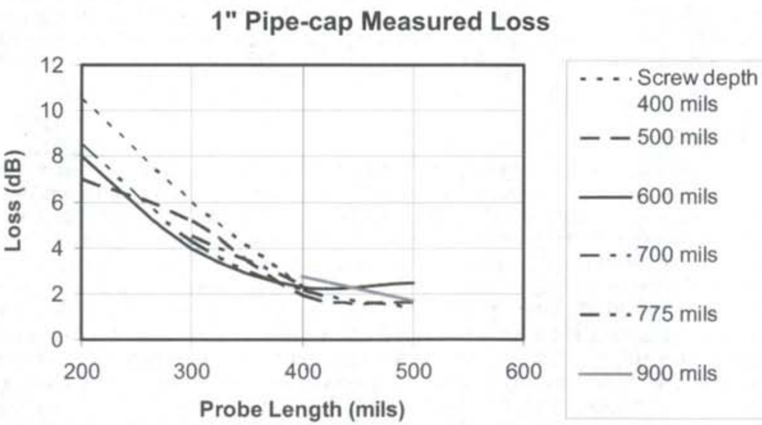

Fig. 10

Plotting the loss vs the relative bandwidth of the resonator is much more illuminating. In Figure 11, we see that the loss increases rapidly for bandwidths less than 1% of the resonant frequency. This fits with our estimate of the unloaded Q_U around 1000. I also found that taller pipe caps have lower loss, so the Q_U is apparently higher. The better version, marked "NIBCO", are about 1.015" high overall, while the shorter ones are about 0.925" high. Obviously, the taller ones will tune to a lower frequency since they can accommodate a longer tuning screw.

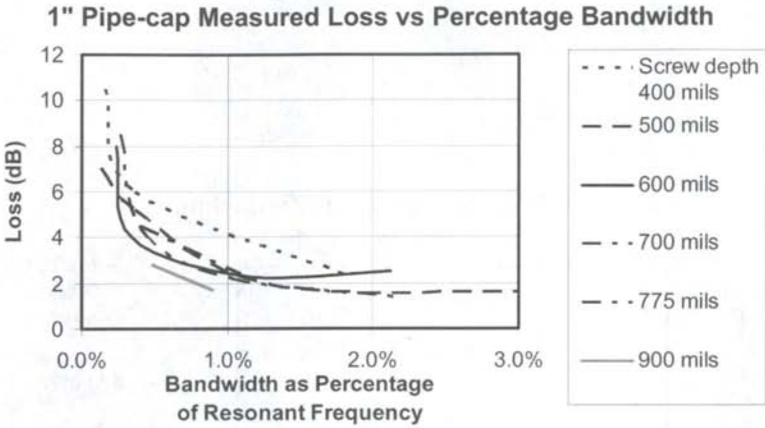

Fig. 11

Since amateur operation is usually within a narrow frequency range, we usually want narrow filters with low loss. With pipe caps, we can make reasonably low loss filters with 3-dB bandwidths in the range of 0.5% to 2% of the resonant frequency – for instance, 17 to 80 MHz bandwidth at 3456 MHz. While the 3-dB bandwidth is quite narrow, the skirts of a single resonator are not steep, so the out-of-band rejection, 20 or 30 dB down, can be much wider – see Figure 5. If a single resonator does not provide adequate rejection, multiple resonators may be cascaded. Direct connection will not work predictably, since the resonators will interact and the response will depend on the length of transmission line between them. However, we can isolate the resonators from each other and compensate for the loss at the same time by putting MMIC amplifiers between them. Then each resonator will see a reasonable termination at each end and behave predictably, and the total response will be the sum of the resonators and amplifiers.

One final note on probe length: all the curves above are for bare probes extending into the pipe cap from a PC board, like the "PCB input" in Figure 1. The results published by WA5VJB used semi-rigid cable connections, like the "Coax input" in Figure 1, with the center conductor extending into the pipe cap as a probe and the Teflon insulator extending the whole length of the probe. The Teflon appears to increase the capacitive coupling, so that the response of these probes is similar to a longer bare probe.

1/2" Pipe-Cap Filters

These small pipe caps work well at 10 GHz, and Figure 3 shows that they can be tuned down to about 5 GHz. Curves for the half-inch pipe caps are shown in Figure 12, as a function of resonant frequency, and in Figure 13, as a function of probe length for each tuning screw position. In the latter plot, we can again see the bandwidth leveling off for short probe lengths, an indication of increasing loss. Like the one-inch version, it appears that the loss will increase for 3-dB bandwidths less than 1% of the resonant frequency. I did not make any measurements for ½ inch pipe-caps, but did scan the measured curves from my 1993 paper3, in Figure 14. At 10.368 GHz, the compromise probe length is about 5/32"; shorter probes are lossy, and longer ones are not sharp enough. The difference between these three conditions is about 1/32 of an inch, which is about as close as I can control the length. For a 3 dB bandwidth around 1% of 10 GHz, a single resonator is not selective enough for good LO and image rejection, so multiple pipe-caps were needed. Since each pipe-cap resonator had more than 3 dB of loss at 10 GHz and good MMICs only have around 10 dB of gain, alternating pipe-cap resonators and MMIC amplifiers is a good combination.

1/2" Pipe-cap Bandwidth

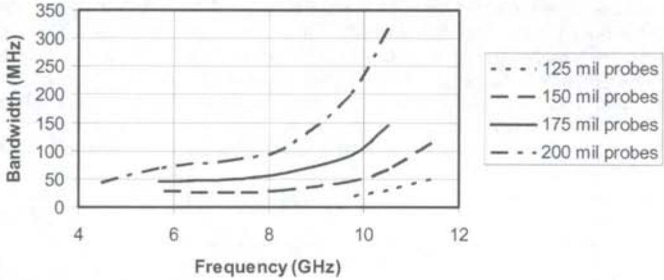

Fig. 12

1/2" Pipe-cap Bandwidth vs Probe Length

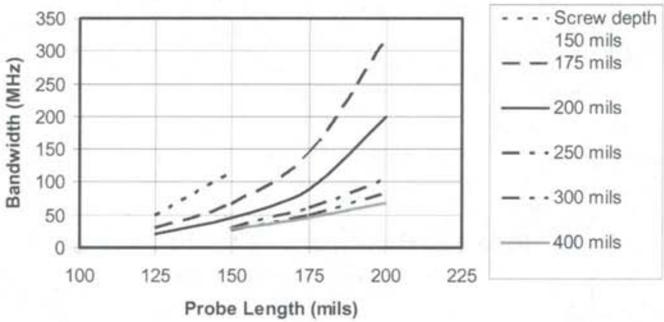

Fig. 13

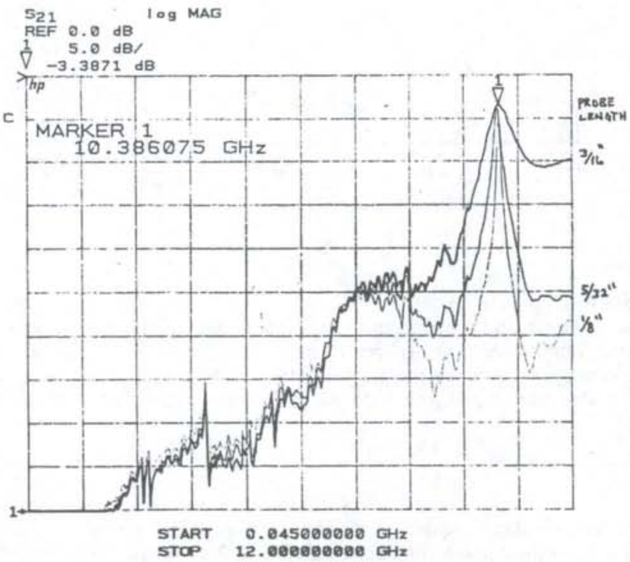

Fig. 14: Measured response of 1/2" pipe-cap filter

3/4" Pipe-Cap Filters

Three-quarter inch pipe caps are ideal for 5760 MHz. I also used them at 3.3 GHz in the multiplier chain of the 10 GHz single-board transverter7. Curves for the ¾ -inch pipe caps are shown in Figure 15, as a function of resonant frequency, and in Figure 16, as a function of probe length for each tuning screw position. In the latter plot, we can again see the bandwidth leveling off for short probe lengths, an indication of increasing loss. Like the one-inch version, it appears that the loss will increase for 3-dB bandwidths less than 1% of the resonant frequency. While I can't find records from measurements, I recall that the typical loss is lower than the ½ -inch version, probably similar to the one inch version.

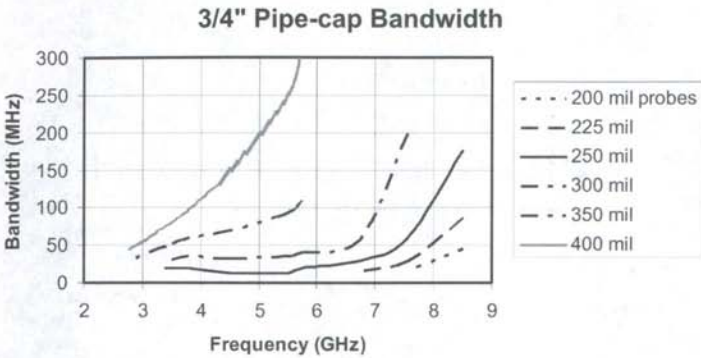

Fig. 15

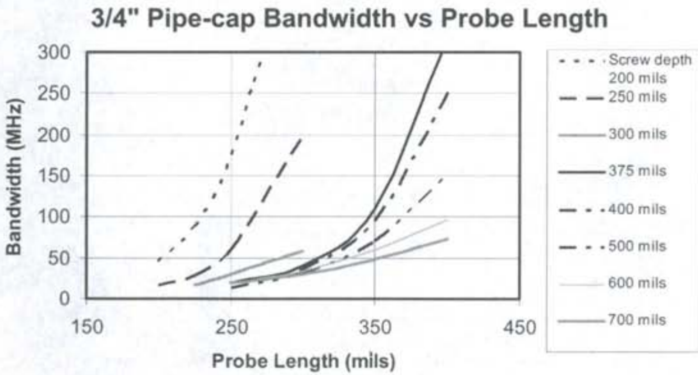

Fig. 16

Larger Pipe-caps

Pipe-caps for larger diameter pipe are not significantly taller than the one-inch variety. Thus, they cannot accommodate much longer screws, so will not operate much lower in frequency. On a printed-circuit board, one would occupy significantly more area, which is hardly an advantage. The only potential advantage might be that the probes could be spaced farther apart, which might improve stopband attenuation.

Summary

Pipe-cap filters are simple and inexpensive microwave filters. The design curves here should help understanding and enable their use in homebrew projects. The curves are useful not just in the ham bands but for other frequencies, such as in multiplier strings or just interesting projects like receiving deep-space probes.

Size Diameter	Inner Height	Inside Spacing	Probe
1/2"	0.625"	0.565"	0.375"
3/4"	0.875"	0.880"	0.5"
1"	1.125"	0.920"	0.7"

Table 1 - Nominal Pipe Cap Dimensions

References

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Note:
In Europe metric caps are available with 15, 18, 22 and 25 mm diameter. Table 1 in metrical dimensions see at the end of the German translation below.

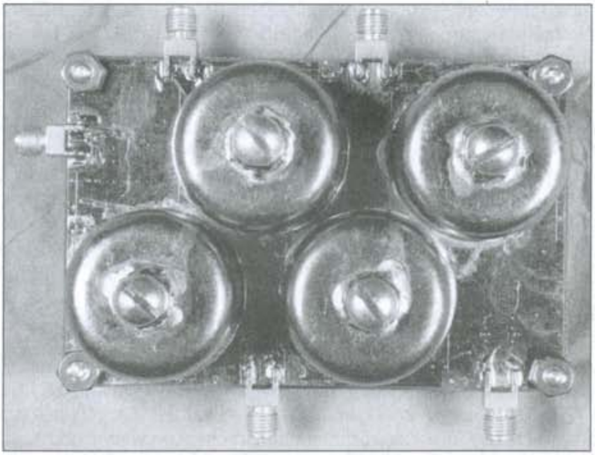

Fig. 17 Pipe cap filters in a Microwave transverter from W1GHZ

Kappen-Filter nochmal betrachtet

Paul Wade, W1GHZ ©2008 - w1ghz@arrl.net

Sogenannte (Kupferrohr-)Kappen-Filter werden in Geräten von Mikrowellen-Amateuren seit mindestens 20 Jahren verwendet. Dennoch wird ihre Arbeitsweise noch nicht richtig verstanden und Hinweise zum Design fehlen. WA5VJB[1] lieh sich die Idee von einem Transverter von DJ6EP und DC0DA[2] und publizierte einige gemessene Daten, was reichte, andere zum Nachbau zu motivieren.
I habe ½" Kappen-Filter in einem 10 GHz Mischer[3] und ¾" Kappen-Filter in einem 5760 MHz Mischer[4,5] verwendet, aber meine Umsetzung bestand in Bauen und Ausprobieren. Später habe ich diese Mischer zu Einplatinen-Transvertern erweitert: Einen[6] für 5760 mit fünf Kappen und dann einen[7] für 10.368 GHz mit sieben ½" Kappen-Filtern plus zwei ¾" Kappen in der LO-Kette. Diese Zahl von Filtern war nötig, um angemessene Selektivität ohne großen Filterverlust für TX und RX zu erhalten und, um etwas Spielraum für die Reproduzierbarkeit zu haben, da weder Selektivität noch Verluste gut quantifiziert waren. Beide Einplatinen-Transverter wurden von Down-East Microwave[8] weiter verbesstert und als Bausatz oder Fertiggerät angeboten. Der DB6NT[9] 10-GHz-Transverter verwendet eine ähnliche Art von Filter.

Kappen-Resonatoren

Die übliche Konfiguration eines Kappen-Filters ist in Abb. 1 gezeigt: Eine Metallplatte schließt das offene Ende ab, Sonden für Ein- und Auskoppelung, und eine mittige Abstimmschraube durch die Oberseite der Kappe. Zwei Arten von Sonden sind in der Abbildung gezeigt. Es hat einige Spekulationen über die verschiendenen Modes gegeben, die in diesen Filtern vorhanden sein könnten. Die Simulation mit Ansoft HFSS10 zeigt die Anordnung des elektrischen Feld mit einer Abstimmschraube, siehe Abb. 2.
Das Kappen-Filter ist ein einfacher koaxialer Viertelwellenresonator (was Amateure oft als „Cavity" bezeichnen). Die Abstimmschraube wirkt als zentraler koaxialer Leiter mit einem radialen elektrischen Feld um ihn herum. Die Feldintensität steigt zum offenen Ende der Schraube hin an. Die Resonanzfrequenz wird bestimmt durch die Länge der Schraube im Inneren des Filters. Abb. 3 zeigt, dass dieselbe Schraubenlänge dieselbe Resonanzfrequenz bei drei verschiedenen Größen von Kappen erzeugt. Die anderen Dimensionen beeinflussen die Freqzenz nicht, was der Fall wäre, wenn eine Wellenleiter-Ausbreitungsmodus beteiligt wäre. Wenn die Schraube komplett entfernt ist, könnten echte Cavity-Modes gefunden werden. Diese produzieren Resonanzen auf Frequenzen, die höher sind, als die, die normalerweise für eine gegebene Kappengröße verwendet werden, und wahrscheinlich die obere Frequenzgrenze für eine gegebene Größe festlegen. Zum Beispiel ist eine 1 Zoll-Kappe (die über ein Kupfer-Rohr mit 1 Zoll Innendurchmesser passt) ohne Schraube bei 7.923 GHz in Resoanz. Das wurde für zwei verschieden hohe Kappen gemessen, die Höhe hat keinen Einfluß auf die Resonanz, nur der Durchmesser der Kappe. Normale Anwendung für diese Kappengröße würde unterhalb 5 GHz sein.
Die Ein- und Auskoppelsonden koppeln mit dem offenen Ende des Viertelwellenresonators und der Abstimmschraube, es wird handelt sich also vorwiegend um kapazitive Koppelung. Magnetische Koppelung wäre auch möglich, z.B. eine Schleife am geschlossenen Ende der Viertelwelle, aber die Konstruktion und Justierung wäre schwieriger. Da das offene Ende der Schraube mit der Frequenz wandert, verändert sich auch die Koppelung der Sonden mit der Frequenz. Engere Koppelung belastet den Resonator und vergrößert die Bandbreite. Das Äquivalenzschaltbild eines Viertelwellenresonators, einfach ein parallel abgestimmter Kreis, ist in Abb. 4 gezeigt. Verluste des Resonators werden in einem Equivalent-Widerstand **Ro** zusammengefasst, parallel mit dem abgestimmten Kreis.
Der Resonator hat ohne Last ein ***Q***, $Q_U = R_o / X_{Lo}$ mit X_{Lo} der Reaktanz des Induktors. Für einen Resonator hoher Güte ("high-***Q***"), ist **Ro** ist ein sehr hoher Widerstand.
In den meisten HF-Schaltungen sind R_{in} und R_{out} 50 Ohm. Die Koppelkapazitäten, in diesem Fall die Sonden, transformieren den effektiven Widerstand auf einen höheren Wert parallel mit **Ro**; folglich wird der effektive Widerstand über dem Resonator reduziert zu einem Lastwert R_L. Das resultiert in einer Lastgüte ***Q***, $Q_L = R_L / X_{Lo}$, die niedriger ist als die Güte ohne Last Q_U. Die Koppelung ist proportional zum kapazitiven Widerstand, eine größere Kapazität erzeugt mehr Koppelung und belastet den Resonator mehr. Als nächstes wird die 3-dB-Bandbreite (Halbleistungsbandbreite) des Resonators unter Last berechnet[11]:

$$BW = \frac{\text{Frequenz}}{Q_L}$$

Oder wir messen die 3-dB-Bandbreite ***BW*** und berechnen dann Q_L. Es ist schwierig den effektiven kapazitiven Widerstand, effektiven induktiven Widerstand und Widerstand eines Viertelwellenresonators zu berechnen, aber die Messung der Bandbreite ist leicht. Aus meinen Messungen und denen, die von WA5VJB veröffentlicht wurden, schätze ich für Rorkappen-Resonatoren eine Güte ohne Last Q_U von 600 to 1000 ab. Ziemlich gut!
Mit Kenntnis von Q_U können wir einige Abschätzungen für den Verlust anstellen. Wenn ein Resonator sehr leicht belastet ist für eine geringe Bandbreite, so dass **Ro** nicht viel größer ist als R_L, dann wird viel der Leistung in **Ro** verbraucht, was in hohem Verlust resultiert. Mit mehr Last wird **Ro** weniger signifikant und mehr Leistung wird abgestrahlt. Der Verlust eines Resonators kann dann wie folgt berechnet werden[12]:

$$\textbf{Insertion Loss} = \textbf{20}\log\left(\frac{Q_U}{Q_U - Q_L}\right)\textbf{dB}$$

Für ein Q_U von etwa 1000 also, kann die Bandbreite so schmal wie vielleicht 1% der Resonanzfrequenz sein, bevor Verluste signifikant werden, da 1% Bandbreite gleichbedeutend mit Q_L = 100 ist, was einen Resonator-Verlust von gerade unter 1 dB ergibt. Natürlich ist dieser Verlust zusätzlich zu den Kreisverlusten vorhanden, ein typischer Gesamtverlust eines Kappenfilters ist 2 oder 3 dB für 1% Bandbreite.

Sondenlänge

Die Schwierigkeit bei Kappen-Filtern ist das Finden der richtigen Sonedenlängen für eine gewünschte Bandbreite. Es gibt keinen einfachen Weg die Länge abzuschätzen und es scheint, dass sie signifikant mit der Frequenz schwankt und ziemlich kiritisch ist. Ich habe das auf schmerzliche Weise erfahren, als ich versuchte Filter für 2304 und 3456 MHz zu bauen. Ich dachte, dass es gut wäre, sie etwas länger zu machen als die, die ich bei 5760 MHz verwendete, aber die Ergebnisse waren nicht gut. Die Abstimmung war extrem spitz und der Kreis hatte so viel Verlust, dass ich mich fragte, ob die MIC Verstärker defekt waren oder nicht verstärkten. Nachdem ich viel zu viel Zeit für die Fehlersuche verwedet hatte, begann ich an den Sonden der Kappe zu zweifeln.
Da meine Schaltung nicht geeignet war, kontrollierte Experimente mit Sonden-Längen durchzuführen, habe ich stattdessen Software zugewandt und Kappen mit Ansoft HFSS Software simuliert. Sehr kurze Sonden ergaben scharfe, verlustreiche Kurven, während lange Sonden ziemlich breit schienen. Bei jeder Resonanzfrequenz oder Schraubenlänge, war die die beste Sondenlänge proportional zur Schraubenlänge. Längere Schreubenlängen für niedrigere Frequenzen erfordern viel längere Sonden. Ich habe genug Datenpunkte simuliert, um einige Design-Kurven für 1-Zoll Kappen zu erhalten, so dass ich das Verhalten des Filters vorhersagen konnte. Diese Kurven haben sich als sehr nützlich bewiesen und meine Schaltungen arbeiten nun besser vorhersagbar. Für zukünftige Arbeiten, für mich und andere, habe ich ähnliche Kurvem für andere gebräuchliche Größen angefertigt: ¾ inch, brauchbar für 5760 MHz und ½ inch für 10 GHz.

1" Kappenfilter

Längere Sonden erhöhen die Koppelung mit dem Resonator und erniedrigen die Lastgüte ***QL*** und verbreitern folglich die Resonator-Bandbreite wie in Abb. 5 gezeigt. Einige andere Ergebnisse sind sichbar: Nicht nur die Bandbreite wächst, auch die Außerbandunterdrückung nimmt ab, besonders oberhalb der Resonanzfrequenz. Das kann durch die direkte Koppelung zwischen den Sonden verurackt sein. Mit kürzeren Sonden wird das Filter viel schärfer, aber auch die Verluste steigen an.

Die Kurven in Abb. 5 sind für eine Einstellung der Abstimmschraube – die Sondenlänge beeinflußt die Resonanzfrequenz nur in geringem Umfang. Wenn die Resonanzfrequenz durch Drehen der Schraube verändert wird, steigt die Bandbreite für eine gegebene Sondenlänge mit der Frequenz an, wie in Abb. 6 gezeigt. Aber ich habe Probleme diese Kurve als Design-Hilfe für die Sondenlänge zu verwenden. Wenn wir stattdessen Bandbreitenkurven gegen Sondenlänge für jede Schraubeneinstellung auftragen, siehe

Abb. 7, dann ist es leichter eine gute Sondenlänge für eine gewünschte Frequenz abzuschätzen. Man gehe zurück zu Abb. 3, um die Resonanzfrequenz für die korrespondierende Schraubenlänge abzuschätzen.
Die Verluste sind viel schwieriger zu simulieren, das die Verluste nicht von den Materialen kommen, sondern aus den Details. Eine Gewindeschraube ist eine rauhe Oberfläche für Hochfrequenz und rauhe Oberflächen vergrößern Verluste. Noch schlimmer ist der Kontakt zwischen der Schraube und der Kappe, hier ist der Punkt des maximalen Stromflusses des Resonators, wo selbst kleine Widerstände zu Verlusten führen.
Deshalb werden Verluste besser durch Messungen bestimmt. Didier, KO4BB, hat im WA1MBA-Mikrowellenreflektor vorgeschlagen, dass Rohkappenfilter mit einer C-Klemme zusammengehalten werden könnten, um schnelle Messungen zu ermöglichen (ohne zu verlöten). Da sich der Rand der Kappe in einem hochohmigen Bereich mit niedrigem Stromfluß befindet, ist der Übergangswiderstand hier nicht kritisch. Ich habe eine Test-Vorrichtung, wie in Abb. 8 gezeigt, aufgebaut und einige Mssungen mit meinem altertümlichen HP-8410 Netzwerkanalysator gemacht. Es wurden keine tollen Computer-Korrekturen verwendet, die Werte sind also nicht ganz genau. Die gemessenen Kurven von Bandbreite gegen Sondenlänge für jede Schraubeneinstellung, siehe Abb. 9, zeigen eine zunehmende Bandbreite mit der Sondenlänge für längere Sonden, aber abflachend für kürzere Sonden. Was passiert ist, ist, dass der äquivalente Widerstand **Ro** durch die Verluste eher die Bandbreite bestimmt, als die Last der Sonden. Folglich bleibt die Bandbreite konstant, aber der Verlust steigt an.

Die gemessenen Verluste sind in Abb. 10 aufgetragen. Die Testanordnung scheint etwa 1 dB an zusätzlichem Verlust zu bringen, wahrscheinlich, weil sie aus einer ordinären Epoxy-PC-Platine gebaut wurde und nicht aus gutem Teflon-Mikrowellensubsrat. Wir können sehen, dass der Verlust hoch wird, sobald wir den flachen Bereich der Kurven in Abb. 9 erreichen.

Mehr Erkenntnisse bringt das Auftragen des Verlustes gegen die relative Bandbreite des Resonators. In Abb. 11 sehen wir, dass der Verlust schnell bei Bandbreiten von unter 1% der Resonanzfrequenz ansteigt. Das passt zu unserer Abschätzung von etwa 1000 für die lastlose Güte Q_U.
Ich habe auch herausgefunden, dass höhere Kappen geringere Verluste haben, also ist offensichtlich Q_U größer. Die bessere Ausführung der US-Marke "NIBCO" ist etwa insgesamt 1.015" hoch, während die kleineren etwa 0.925" hoch sind. Offenbar werden sich die höheren Ausführungen auf eine niedriegere Frequenz abstimmen lassen, da sie eine längere Abstimmschraube aufnehmen können.

Da Amateurfunkbetrieb üblicherweise in einem engen Frequenzbereich stattfindet, wollen wir normalerweise schmale Filter mit wenig Verlust. Mit Kappen können wir annehmbare Filter mit niedrigem Verlust mit 3-dB-Bandbreiten im Bereich von 0.5% bis 2% der Resonanzfrequenz herstellen, z.B. 17 bis 80 MHz Bandbreite bei 3456 MHz. Während die 3-dB-Bandbreite ziemlich schmal ist, fällt die Umgebung eines einzelnen Resonators nicht steil ab, so dass die Außerbandunterdrückung, mit 20 oder 30 dB Absenkung, sehr viel breiter sein kann, siehe Abb. 5. Wenn ein einzelner Resonator nicht genügend Unterdrückung bringt, kann man mehrere kaskadieren. Eine direkte Verbindung wird nicht vorhersagbar funktionieren, da sich die Resonatoren beeinflussen und das Ergebnis von der Längr der Verbindungen zischen ihnen abhängt. Man kann die Resonatoren jedoch voneinander isolieren und den Verlust gleichzeitig ausgleichen, indem man MMIC-Verstärker zwischen sie schaltet. Dann sieht jeder Resonator einen angemessenen Abschluss an jeder Seite und verhält sich vorhersagbar und das Gesamtergebnis wird aus der Summe von Resonatoren und Verstärkern bestehen.
Eine abschließende Bemerkung zur Länge der Sonden: Alle oben gezeigten Kurven sind für die reine Sonde, die sich von der PCB in die Kappe erstreckt, wie die „PCB Input" in Abb. 1. Die von WA5VJB publizierten Ergebnisse beziehen sich auf Semirigid-Kabel-Verbindungen, wie „Coax Input" in Abb. 1, wobei sich der koaxiale Innenleiter als Sonde in die Kappe hinein erstreckt und die Teflon-Isolierung des Kabels sich in die Länge des Lochs der Sonde erstreckt. Das Teflon scheint die kapazitive Koppelung zu erhöhen, so dass die Charakteristik dieser Sonden ähnlich derer einer längeren reinen Sonde ist.

1/2" Kappen-Filter

Diese kleinen Rohrpkappen arbeiten gut bei 10 GHz und Abb. 3 zeigt, dass sie bis 5 GHz herunter abgestimmt werden können. Kurven für die Halbzoll-Kappen sind in Abb. 12 als Funktion der Resonanzfrequenz und in Abb. 13 als Funktion der Sondenlänge für jede Schraubenposition gezeigt. Im letzteren Plot können wir wieder die Bandbreitennivellierung für kurze Sondenlängen sehen, ein Indikator für steigende Verluste. Wie bei der Einzoll-Version ist ersichtlich, dass der Verlust ansteigt bei 3-dB-Bandbreiten, die geringer als 1% der Resonanzfrequenz sind.

Ich habe keine Messungen bei den Halbzoll-Kappen durchgeführt, aber habe die gemessenen Kurven aus meinen 1993er-Aufsatz[3] gescannt, siehe Abb. 14. Bei 10.368 GHz ist der Kompromiss für die Sondenlänge etwa 5/32"; kürzere Sonden sind verlustreich und längere nicht schmal genug. Der Unterschied zwischen diesen drei Bedingungen beträgt etwa 1/32 Inch, was etwa soviel ist, wie ich in der Länge noch kontrollieren kann. Für eine 3-dB-Bandbreite von etwa 1% von 10 GHz ist ein einzelner Resonator nicht mehr selektiv genug für gute LO und Spiegelfrequenzunterdrückung, so dass multiple Kappen benötigt werden. Da jeder Kappen-Resonator mehr als 3 dB Verlust bei 10 GHz hat, und gute MMICs nur etwa 10 dB Gewinn haben, ist die abwechselnde Reihenfolge von Kappenresonator und MMIC-Verstärker eine gute Kombination.

3/4" Kappen-Filter

Dreiviertelzoll-Kappen sind ideal für 5760 MHz. Ich benutze sie auch auf 3.3 GHz in der Multiplier-Kette des 10-GHz-Einplatinentransverters[7]. Kurven für die ¾-Zoll-Kappen sind als Funktion der Resonanzfrequenz in Abb. 15 und als Funktion der Sondenlänge in Abb. 16 für jede Schraubenlänge gezeigt.

Im letzteren Plot können wir wieder die Bandbreitennivellierung für kurze Sondenlängen sehen, ein Indikator für steigende Verluste. Wie bei der Einzoll-Version ist ersichtlich, dass der Verlust ansteigt bei 3-dB-Bandbreiten, die geringer als 1% der Resonanzfrequenz sind. Ich kann keine Aufzeichnungen über Verluste mehr finden, aber ich erinnere mich, dass der typische Verlust geringer als bei den ½-Zoll-Versionen ist, wahrscheinlich ähnlich denen der 1-Zoll-Version.

Größere Kappen

Kappen für großere Rohrdurchmesser sind nicht bedeutend höher als die Einzoll-Variante. Also können sie auch keine längeren Schrauben aufnehmen und nicht auf viel tieferen Frequenzen arbeiten. Auf einer PCB würde man auch viel mehr Fläche verbrauchen, was kaum ein Vorteil ist. Der einzige potentielle Vorteil könnte sein, dass die Sonden weiter voneinander entfernt angeordnet sein könnten, was die Außerbandunterdrückung verbessern könnte.

Zusammenfassung

Rohkappenfilter sind einfache und billige Mikrowellenfilter. Die hier gezeigten Designkurven sollten zum Verständnis beitragen und die Verwendung in Eigenbauprojekten ermöglichen. Die Kurven sind nicht nur für die Amateurbandfrequenzen nützlich, sondern auch für andere Frequenzen, wie sie in Vervielfacher-Ketten vorkommen oder interessanten Projekten, wie beim Empfang von Raumsonden.

Größe Durchmesser	Innere Höhe	Innerer Abstand	Sonde
1/2" (12,7mm)	0.625" (15,9mm)	0.565" (14,4mm)	0.375" (9,5mm)
3/4" (19mm)	0.875" (22,2mm)	0.880" (22,4mm)	0.5" (12,7mm)
1" (25,4mm)	1.125" (28,6mm)	0.920" (23,4mm)	0.7" (17,8mm)

Tabelle 1 - Nominale Kappen-Abmessungen

Anmerkung: 1 Inch (Zoll) = 2.54 cm; In Europa sind Kupferkappen von 15, 18, 22 und 28mm Durchmesser gebräuchlich und billig im Heizungssanitärhandel und Baumärkten erhältlich.

Referenzen

Siehe engl. Text oben.

A Decoder for Computer-generated CW and CWP

by Klaus von der Heide, DJ5HG

The goal of a decoder usually is to find the most probable messages for given signals. In this sense, the presented CW decoder is optimal, i.e. no other CW decoder can yield a lower message error rate than this. As a consequence it also is at least as good as a human operator. Nevertheless, other decoders might be better in computational performance, in insensitivity to non-Gaussian noise etc. This surely is true for the human operator who can adapt to situations not covered by Gaussian noise.
In a previous paper [1] the author proposed a digital CW-mode called CWP. A secod paper described a software-implementation of a CWP-receiver [2]. [2] did not discuss the decoder, because the basic methods of building a decoder are completely different from those to build a receiver with digital signal processing. It is the aim of this paper to give an overview on the principles of decoders in the first chapter, and to apply these to the decoding process of CW and CWP in the second chapter.

1. Error Correcting Codes

1.1. Binary Error Correcting Codes

A *binary code* is a set of mutually different words made of binary digits called bits. If all words have the same length (the same number of bits) then it is a *block code*. Alternatives are *variable length codes* and *convolutional codes*. We will discuss the principles of an error correcting binary block code now at a very simple example with only four different words of length 6. Each code word is associated with a specific message. This association must be known at both ends of the communication path. We simply associate the four code words with the messages "A", "B", "C", and "D". For a little bit more insight we define two such binary codes:

Message	Code 1	Code 2
A	000000	000111
B	010101	110001
C	101010	101010
D	111111	011100

The error correcting and error detecting capabilities of a code depend on the mutual difference of the words. The difference is called the Hamming-distance. It is the number of bits that are different. Since we only have four words, it is easy to evaluate the distance for all possible combinations:

Messages	Distances in Code 1	Distances in Code 2
A-B	3	4
A-C	3	4
A-D	6	4
B-C	6	4
B-D	3	4
C-D	3	4

All words of Code 2 exacty have three ones. Therefore it is called a constant-weight code. Also, all mutual distances are equal. Such a code is called a simplex code. Although the mean mutual distance of both codes is equal, the code with the greatest minimum distance is preferable, because this minimum distance (called the code distance) determines what the code can guarantee.

1.2. Additive White Gaussian Noise (AWGN)

The weak-signal channels on VHF and higher are AWGN-channels (if there are no birdies or other QRM). The properties are: (1) The noise is independent of the signal, (2) the noise values are mutually independent, (3) the noise values follow a Gaussian distribution. Fortunately, this is a mathematically clear case that allows deep insights and correct predictions by mathematical deduction. Also a channel simulation is easy done by adding random values with a Gaussian distribution.

As an example we transmit message B encoded by code 2 with BPSK. Usually binary zeros are sent as -1. Pure noise after demodulation has a mean value of zero. We add AWGN at SNR = 3 dB to the ideal transmitted word:

transmitted word:	**1**	**1**	**-1**	**-1**	**-1**	**1**
noise:	**-0.3062**	**-1.1791**	**0.0887**	**0.2036**	**-0.8116**	**0.8430**
received word:	**0.6938**	**-0.1791**	**-0.9113**	**-0.7964**	**-1.8116**	**1.8430**

In contrast to the transmitted word with it's integer values -1 and +1, the received word has real components. Therefore, the received word will not be identical to a member of the set of code words. The receiver only knows the statistical properties of the noise. Using this knowledge, the receiver can compute all probabilities by which the received word is generated out of all possible transmitted codewords. That codeword which has the largest probability to result in the received word is the best choice for the decoder. It follows from the AWGN that the received word with the smallest Euklidian distance has the largest probability. The decisions therefore are based on distances between received words from the code words.

The Euklidian distance is the n-dimensional form of what we in daily life call a distance: It is the squareroot of the sum of the squares of the differences of all components. Since the squareroot is a monotone function we can search for the minimum of sum of the squares of the differences of all components instead of the minimum of the squareroots of all these values.

There are two different ways to perform the most important task of a digital receiver: the final decision on what has been received. They will be discussed in the following chapters 1.3 and 1.4.

1.3. Hard-Decision Decoder

The simplest way to do the decision is at the received symbols, i.e. to restore directly the binary digits that where received. A negative received value would be replaced by -1 and a non-negative value by +1. The result from the received word from above the is:

received word:	**0.6938**	**-0.1791**	**-0.9113**	**-0.7964**	**-1.8116**	**1.8430**
restored word:	**1**	**-1**	**-1**	**-1**	**-1**	**1**
in binary notation:	**1**	**0**	**0**	**0**	**0**	**1**

Inspite of the correct elements -1 and +1, the restored word is not a code word. So we have to do what was described above. We compute the Euklidian distance of the received word to all code words. Since in this case the square of a difference of a component only can take the values 0 or 1, the Hamming distance is the square of the usual Euklidian distance. Therefore, we can directly search for the minimun Hamming distance to get the most probable code word:

word to compare	Hamming distance
A	3
B	1
C	3
D	5

We obviously should take message B as that which was probably sent. If the conversion from received real (or complex) values to a limited set of symbols is done before the decoder, then we speak of a hard-decision decoder. Since only the sign of the values is used in the decision, the decoder uses only very few information on the noise.

1.4. Soft-Decision Decoder

In a soft-decision decoder (or simply called a soft decoder, with both terms misleading) the final decision, which is the conversion of the received real noisy values into some symbols or a message, is done inside the decoder. Taking the example from above, the decoder computes the real Euklidian distances between the received word and all codewords (with zeros changed to -1):

word to compare	Euklidian distance
A	3.9234
B	1.7037
C	4.5222
D	4.4588

As in the case of the hard-decision decoder we decide to take the message B which has the smallest distance to the received word. Soft-decision is better than hard-decision. The gain depends on the code and on the noise level. At weak signals it is usually about 2 dB (for Hadamard, simplex, RS, and parity codes; about 1 dB for Hamming codes).

1.5. The Problem of Computational Complexity

The example in the chapters above was chosen to explain the general principle of a decoder for noisy signals. With four codewords there is no problem to compute all distances. Even if we use ten thousand code words, a modern computer could do that in less than a second. But usually we have such a huge number of possible code words that the brute-force mode to find the best fitting message is not realistic. The only way to solve the problem is to search for codes that offer a more direct decoding at acceptable properties of the code. It turns out that it is simple to find a code with optimal properties, but which is not decodable in practise, and it is also simple to find an easily decodable code with bad properties. Usable codes are somewhere between.

The CW decoder discussed in this paper finds the best fitting message of all possible messages without really trying all messages. This is possible because a Morse symbol has a very limited length, and it influences the received signal only locally.

2. Decoding CW

2.1. A Soft-Decision Decoder for CW

CW is not a code for Forward Error Correction (FEC). So the problem of computational complexity will not be an outstanding problem. Indeed, we will present a CW decoder which yields the same decoded output as a theoretical decoder that really tries all possible messages.

We assume a coherent detection of a classical CW signal as in figure 5c. of [2]. The advantage is that the noise will follow a Gaussian distribution while this would not be the case if the ASK of CW were demodulated using the absolute value of the signal. We further assume that the timing of the Morse symbols is derived from a precise binary clock with the clock rate known to the receiver.

Figure 1a shows a CW signal before modulation of the transmitter. 1b. shows the received noisy signal after demodulation, and 1c. is the output of the matched filter which in this case is simply the sum of all samples within the last bitlength. We assume that the rates of the binary clocks at both ends garantee that, within a message, the cumulative differential timeshift remains less than half a bit length. The length of usual CW messages is 1000 bits or less. So the necessary accuracy of the sample rates (which define the binary clock) must be of the order of 10^{-3} , which is satisfied by all sound cards. Therefore, the output of the matched filter, for the complete length of the message, can be segmented at a segment length of two bits (a nibble). At this stage the receiver does not know the boundaries of the bits. So the segmentation is done with an arbitrary starting point. The segments are indicated by vertical dashed lines in figure 1c. All segments are summed up giving the result shown in Figure 1d. The position of the minimum and the maximum in this figure yields the shift of the correct boundaries of the bits in figure 1c.

The values sampled at these retrieved binary clock cycles are marked by a dot. The sequence of the vertical positions of these dots are the values used to decode the received message.

The input to the decoder therefore is an array of real values, one for each basic clock cycle. We discuss the principles of the decoder at a simple example with the following properties:

(1) The receiver knows that the length of the transmission is 22 binary clock cycles (11 nibbles)
(2) The transmitter sends „AB" which in Morsecode is: .- -...
(3) The receiver of course does not know what was sent.

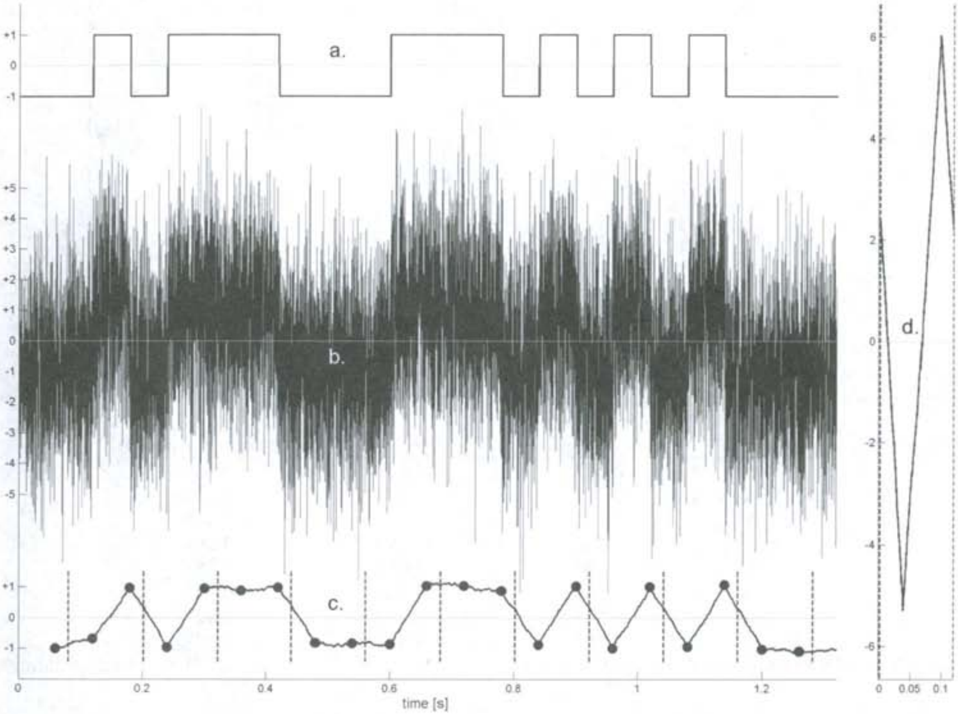

Figure 1. This figure demonstrates the reconstruction of the binary clock and the reduction of the input signal to a small set of real values representing the received bits. 1a is the Morse code before modulation in the transmitter. 1b is the received signal after demodulation. 1c shows the output of an integrator that sums up all samples of 1b within a bitlength (matched filter). This signal is segmented into segments of two bit lengths (vertical dashed lines). The segments are added (1d). The position of the minimum and maximum in 1d is taken as the position of the binary clock in all segments of 1c. The sampled values are marked by dots in 1c. They are the input of the decoder.

Because of their length we write the arrays down as columns for better readability in table 1:

Table 1. Example of a transmission of 22 binary symbols **0010111000111010101000** representing the Morsecode of "AB". The SNR is +3 dB. Please note that the binary 0 is sent as a -1. The noise in this example is considerable larger than in the example of figure 1. The hard decision only is given for comparison here. We do'nt further need it.

binary clock	binaries sent	noise	received signal	hard decision
1	-1	0.735	-0.265	-1
2	-1	-0.537	-1.537	-1
3	1	-0.180	0.820	1
4	-1	-0.960	-1.960	-1
5	1	-0.887	0.113	1
6	1	-0.626	0.374	1
7	1	0.412	1.412	1
8	-1	1.290	0.290	1
9	-1	0.944	-0.056	-1
10	-1	-0.344	-1.344	-1
11	1	-1.524	-0.524	-1
12	1	0.166	1.166	1
13	1	-0.515	0.485	1
14	-1	-1.246	-2.246	-1
15	1	0.314	1.314	1
16	-1	0.407	-0.593	-1
17	1	0.600	1.600	1
18	-1	-0.186	-1.186	-1
19	1	-0.292	0.708	1
20	-1	-0.144	-1.144	-1
21	-1	-0.122	-1.122	-1
22	-1	0.152	-0.848	-1

Table 2. This table demonstrates the computation of the square of the distance of the Morsecode for the character A starting at the binary clock 5 in the input signal.

binary clock	Morse A	received signal	difference	difference squared
5	1	0.113	0.887	0.787
6	-1	0.374	-1.374	1.888
7	1	1.412	-0.412	0.170
8	1	0.290	0.710	0.504
9	1	-0.056	1.056	1.115
10	-1	-1.344	0.344	0.118
11	-1	-0.524	-0.476	0.227
12	-1	1.166	-2.166	4.692
entry for table 3 in column A and row clock 5:				**9.501 squared distance**

Table 3. The squared distance of Morse codes from the received signals starting at all possible nibble clocks. Since this is for explanation, only the list from A to F and the blank is presented. A dash indicates that the given code would exceed the known length of 22 binary clock cycles in this example. This data array is called **symboldistance**.

Clock	A	B	C	D	E	F	blank
1	20.839	19.651	24.344	14.509	6.123	12.007	0.829
3	4.976	25.308	34.264	19.454	4.081	16.308	4.234
5	9.501	18.598	15.473	15.018	10.156	25.470	3.127
7	19.215	17.798	23.320	16.259	2.843	14.294	7.482
9	10.922	19.038	18.616	22.500	6.152	22.646	1.009
11	24.875	4.971	-	7.765	10.772	12.007	4.918
13	7.787	-	-	11.605	7.338	-	3.758
15	5.547	-	-	-	7.059	-	5.520
17	-	-	-	-	3.333	-	6.795
19	-	-	-	-	0.144	-	2.938

Table 4. The alphabet data are represented by the two arrays **symbol** and **nibbles**. **Symbol** defines the alphabet, while **nibbles** is the length of the corresponding Morse code in nibbles. As in table 3, only the alphabet from A to F plus the blank is shown here:

symbolindex	1	2	3	4	5	6	27
symbol	A	B	C	D	E	F	blank
nibbles	4	6	7	5	2	6	1

The decoder has two stages. As a first stage, the squared distances of all possible Morse codes starting at at all nibble clocks is computed. The result is shown in table 3. For explanation how these values are generated, we take one specific example: the entry of A at clock 5 in table 3, and demonstrate the computation of the distance using table 2.

Having generated table 3, the decoding process can start. To explain the algorithm we have to define a data structure named **workinglist:**

workinglist is an array with the nibble clock **nibbleclock** as it's index. Each element has the two fields **distance** and **decoded**. **Workinglist (nibbleclock).decoded** contains the actual best decoded text for the sequence of binary clock cycles from **1** until **nibbleclock-1**, and **workinglist(nibbleclock).distance** is the corresponding distance of the received pattern to that decoded Morse sequence.

workinglist(nibbleclock).decoded is initialized with the empty string for all possible **nibbleclock** indices, and **workinglist(nibbleclock).distance** is initialized with infinity.

The decoding algorithm uses a nested loop:

```
for nibbleclock:=1 to numberofreceivednibbles-1
        dist := workinglist(nibbleclock).distance
        for alphabetindex:=1 to lengthofalphabet
                actualdist := dist + symboldistance(nibbleclock,alphabetindex)
                entryclock := nibbleclock + nibbles(alphabetindex)
                if actualdist < workinglist(entryclock).distance
                        workinglist(entryclock).distance := actualdist
                        workinglist(entryclock).decoded := concatenate(
                                workinglist(nibbleclock).decoded, symbol(alphabetindex) )
                end
        end
end
```

The algorithm starts at **nibbleclock=1** with the Morse symbol for "A". The starting position (the **entryclock**) of a following symbol would be the actual position (1) plus the length of the "A" in nibbles. From table 4 we get **nibbles(1)=4**, so **entryclock** is set to 5. From table 3 we get the **symboldistance** of the actual **symbolindex (1)** at the actual **nibbleclock (1)** as 20.839. This value is stored in **workinglist(entryclock).distance** because the value is less than the previous value (the initial infinity). This is done for all symbols at **nibbleclock=1**. At each symbol a decision has to be made between two possible decodes ending at the same position. This decision is based on the total distance. If in the example **nibbleclock=1** and **symbolindex=6** then the length of the corresponding Morse symbol "F" is the same as with the symbol "B". The algorithm finds the previous entry for "B" and checks that the distance for an "F" is smaller than that of "B". So the entry of the "B" is overwritten in the **workinglist** by the better fitting "F".

After running through all symbols at **nibbleclock=1** the outer loop steps to **nibbleclock=2**, and so on. When the loop has finished **workinglist(numberofreceivednibbles+2).decoded** contains the message and **workinglist(numberofreceivednibbles+2).distance** is the total squared distance between the corresponding Morsecode and the received signal. In our example we find " AB" at a squared distance of 10.776. Since the message is 22 bits long this results in a mean square distance of sqrt(10.776/22) = 0.6999 . Indeed, 0.7 had been chosen as standard deviation of the generated noise in table 1 (which corresponds to SNR = 3 dB).

If the squared distances between the received signal and the Morse symbols (table 3) are computed on the fly then this algorithm allows simultaneous decoding. The crucial point is that synchronization of the binary clock must be achieved before the algorithm can start. 2.2. The Soft-Decision Decoder for CWP CWP is a computer-generated CW at a specified binary clock. The difference to CW is the phase change of 180° at every keydown. The demodulated signal simply is the real part of the received complex signal after phase synchronization. Figure 2 shows the same message " AB" as in figure 1 but for CWP. Although a human listener does not hear a difference to the CW signal, the CWP signal is very different. Nevertheless, the decoding algorithm remains the same. Only the table 3 is generated using the CWP-Morse code. For example, the column Morse code A of table 2 now must read: +1 0 -1 -1 -1 0 0 0 .

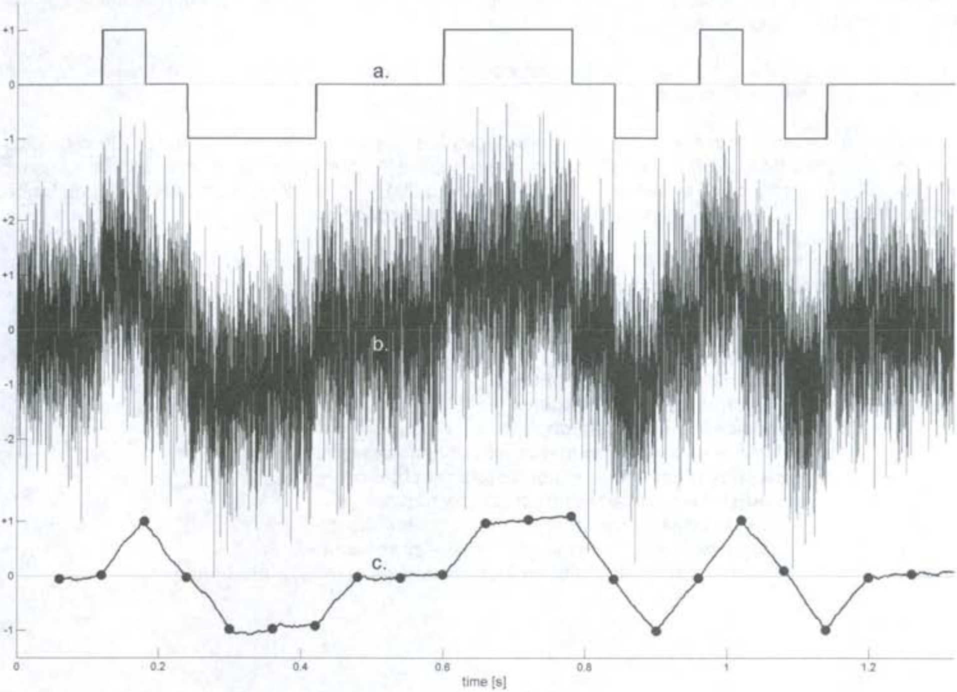

Figure 2. The message " AB" in CWP corresponding to the CW case of figure 1 at the same SNR. The recovery of the binary clock was discussed in [2] (figures 6 and 7 of that paper).

A problem arises if the channel generates Rayleigh-fading. The phase-tracking algorithm may locally fail because of vanishing signal. This problem is a general problem of phase modulation, not of the decoder. But it cannot be solved before demodulation. So the problem is propagated to the decoder. It complicates the simple generation of table 3 and even the decoding algorithm itself.

Figure 3 shows the noise-free signal of our Morse code example " AB" rotating in the complex plane before the demodulator. Instead of correcting for the phase rotation and taking the real part of the signal as the demodulation procedure, the actual CWP decoder generates table 3 directly from the complex signal. At each nibble clock the optimal rotation for every symbol is determined. The distance at this angle is the table entry. Additionally the angles are stored. The decoder works as described above, but a term proportional to the squared difference of the angles of adjacent symbols is added to the distance. This method also eliminates the general problem of the ambiguity of two starting phases of PSK.

3. The Computational Complexity of the Algorithm

If we use an alphabet of m symbols then there are mn different messages of length n. Thus the computational effort increases exponentially with the length of the message. It was A. Viterbi who found the basic principle of successive exclusion of sets of possible decoding results for convolutional codes. The application field of the Viterbi algorithm is very wide. Especially it is used in mobile phones, WLAN, and hard discs. The computational effort in the case of the CW decoder is given by the number of turns of the inner loop of the algorithm. It is the number of symbols of the alphabet times the number of received nibbles. Thus the complexity is proportional to the length of the received signal.

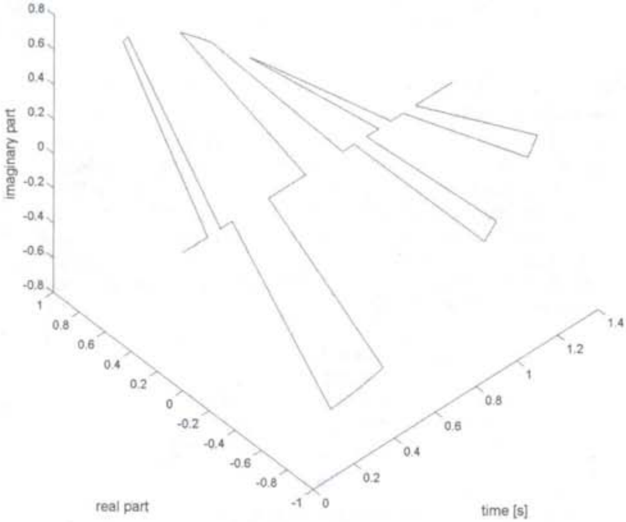

Figure 3. The CWP signal for the message " AB" rotating in the complex plane. See figure 5a of [2] for comparison.

Literature

[1] Klaus von der Heide, *CW for Weak Signal Applications*: CWP, DUBUS 3/2007, p.52
[2] Klaus von der Heide, *The CWP-Receiver*, DUBUS 1/2008, p.36
[3] AndrewViterbi: *Error bounds for convolutional codes and an asymptotically optimum decoding algorithm.* In: IEEE Transactions on Information Theory. 13, Nr. 2, 1967 See also: http://en.wikipedia.org/wiki/Viterbi_algorithm

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Ein Decodierer für Computer-generierte Telegraphie und CWP

von Klaus von der Heide, DJ5HG

Ziel eines Decodierers ist im Allgemeinen, für gegebene Signale die wahrscheinlichste Nachricht zu ermitteln. In diesem Sinne ist der hier präsentierte Decodierer optimal, kein anderer Decodierer kann also eine kleinere Fehlerrate für die Nachrichten liefern. Er ist deshalb auch wenigstens so gut wie ein menschlicher Operator. Dennoch können andere Decodierer in verschiedener Hinsicht besser sein, z.B.

in der erforderlichen Rechenleistung oder in der Unempfindlichkeit gegenüber nicht-Gausschen Störungen. Dies gilt sicher für den menschlichen Operator, der sich gut an alle Störsituationen anpassen kann.
In einer früheren Schrift [1] hat der Autor eine digitale CW-Betriebsart vorgeschlagen, die wegen der Phasenumtastung CWP genannt wird. In einer zweiten Schrift wurde die Software-Realisierung eines CWP-Empfängers beschrieben [2]. In letzterer wurde der Decodierer nicht diskutiert, weil sich Decodierer grundlegend von Empfängern unterscheiden, und zwar selbst dann, wenn sie per digitaler Signalverarbeitung als Software realisiert werden. Ziel dieser Schrift ist, im ersten Kapitel einen Überblick zu geben über die Prinzipien eines Decodierers und im zweiten Kapitel diese anzuwenden auf den Fall der Decodierung von CW und CWP.

1. Fehlerkorrigierende Codes

1.1. Fehlerkorrigierende Binärcodes

Ein *Binärcode* ist eine Menge von untereinander verschiedenen Wörtern aus Binärzeichen, die Bit genannt werden. Haben alle Wörter dieselbe Länge (dieselbe Anzahl von Bit), dann liegt ein *Blockcode* vor. Alternativen dazu sind Codes mit variabler Wortlänge und *Faltungscodes*. Hier werden wir an dem sehr einfachen Beispiel von nur vier Wörtern der Länge 6 die Prinzipien eines fehlerkorrigierenden binären Blockcodes behandeln. Jedes Codewort gehört zu einer festgelegten Nachricht. Diese Zuordnung muss an beiden Enden des Kommunikationskanals bekannt sein. Im Beispiel verknüpfen wir die vier Codewörter einfach mit den Nachrichten "A", "B", "C", und "D". Um etwas mehr Einsicht zu gewinnen, definieren wir gleich zwei verschiedene Codes:

Nachricht	**Code 1**	**Code 2**
A	**000000**	**000111**
B	**010101**	**110001**
C	**101010**	**101010**
D	**111111**	**011100**

Die Fähigkeiten eines Codes zur Fehlerkorrektur und zur Fehlererkennung hängen ab von der gegenseitigen Unterschiedlichkeit der Codewörter. Dieser Unterschied wird Hamming-Abstand genannt. Er ist die Anzahl der Bitstellen, an denen die jeweils zwei Codewörter verschieden sind. Da wir im Beispiel für jeden Code nur vier Codewörter haben, lassen sich die Hamming-Abstände sämtlicher möglichen Paare einfach bestimmen:

Nachrichten	**Abstände in Code 1**	**Abstände in Code 2**
A-B	**3**	**4**
A-C	**3**	**4**
A-D	**6**	**4**
B-C	**6**	**4**
B-D	**3**	**4**
C-D	**3**	**4**

Alle Wörter des Codes 2 haben genau drei Einsen. Deshalb wird er als Code mit konstantem Gewicht bezeichnet. Auch sind sämtliche gegenseitigen Abstände gleich. Solch ein Code wird Simplex-Code genannt. Obwohl die Mittelwerte der gegenseitigen Abstände bei beiden Codes gleich sind, ist der Code mit dem größten minimalen Abstand vorzuziehen, weil dieser minimale Abstand (genannt der Code-Abstand) festlegt, welche Fehlererkennung oder -korrektur der Code garantieren kann.

1.2. Additives weißes Gauss-Rauschen (AWGN)

Solange Birdies und anderes QRM in der benötigten Bandbreite nicht vorkommen, sind Funkkanäle im VHF-Bereich und höher mit guter Näherung AWGN-Kanäle (Additive White Gaussian Noise = additives weißes Gaussches Rauschen). Dessen Eigenschaften sind: (1) Das Rauschen ist unabhängig vom Signal, (2) die Rauschwerte sind statistisch unabhängig voneinander, (3) die Rauschwerte genügen einer Gauss-Verteilung. Dies is ein mathematisch einfach zu behandelnder Fall, der gut zu verstehen ist und korrekte Vorhersagen ermöglicht. Auch ist eine Kanalsimulation durch Addition von Gauss-verteilten Zufallszahlen zum Signal einfach zu realisieren. In folgendem Beispiel senden wir die Nachricht B codiert mit Code 2 in BPSK. Die binäre Null wird dabei wie üblich als -1 gesendet. Reines Rauschen hat nach der

Demodulation den Mittelwert Null, so dass die beiden Signalwerte +1 und -1 symmetisch zum Rauschen liegen. Wir addieren hier (als Simulation) weißes Gaussches Rauschen mit SNR = 3 dB zum gesendeten Wort:

gesendetes Wort:	**1**	**1**	**-1**	**-1**	**-1**	**1**
Rauchen:	**-0.3062**	**-1.1791**	**0.0887**	**0.2036**	**-0.8116**	**0.8430**
empfangenes Wort:	**0.6938**	**-0.1791**	**-0.9113**	**-0.7964**	**-1.8116**	**1.8430**

Im Gegensatz zum gesendeten Wort mit seinen ganzzahligen Signalwerten +1 und -1 hat das empfangene Wort reelle Werte als Komponenten. Deshalb ist das empfangene Wort praktisch nie identisch zu einem der Codewörter. Der Empfänger kennt aber die statistischen Eigenschaften des Rauschens. Damit kann der Empfänger die Wahrscheinlichkeiten berechnen, mit denen das empfangene Wort durch das Rauschen aus allen möglichen gesendeten Codewörtern entsteht. Dasjenige Codewort, welches nach dieser Berechnung mit der größten Wahrscheinlichkeit zum empfangenen Wort führt, wird als beste Wahl des Decodierers genommen. Aus den Eigenschaften des AWGN folgt, dass dieses gerade das Codewort ist, welches den kleinsten euklidischen Abstand zum empfangenen Wort hat. Die Entscheidungen basieren daher auf Abständen zwischen dem empfangenen Wort und allen Codewörtern, wobei natürlich die binäre Null immer durch -1 zu ersetzen ist.
Der euklidische Abstand ist die n-dimensionale Form dessen, was wir im täglichen Leben als Abstand bezeichnen: Die Quadratwurzel aus der Summe der Quadrate der Komponenten in einem rechtwinkligen Koordinatensystem. Da die Quadratwurzel eine monotone Funktion ist, können wir bei der Suche nach dem minimalen Abstand auf die Wurzel verzichten und nach dem Minimum der Summe der Quadrate der Differenzen aller Komponenten suchen. Es gibt zwei verschiedene Wege für die wichtigste Aufgabe eines digitalen Empfängers, nämlich die Entscheidung darüber, welche Nachricht empfangen wurde. Sie werden nacheinander in den folgenden Abschnitten 1.3 und 1.4 beschrieben.

1.3. Decodierer mit harter Entscheidung (Hard-Decision Decoder)

Der einfachste Weg, aus dem reellen empfangenen Wort ein digitales zu machen, ist der, jeden für ein Symbol empfangenen reellen Wert gleich in den nächstliegenden digitalen Wert zu wandeln. In unserem Fall wird also ein negativer Wert durch -1 ersetzt, ein nicht negativer durch +1. Für das oben genannte Beispiel ergibt sich dann:

empfangenes Wort:	**0.6938**	**-0.1791**	**-0.9113**	**-0.7964**	**-1.8116**	**1.8430**
restauriertes Wort:	**1**	**-1**	**-1**	**-1**	**-1**	**1**
in binärer Notation:	**1**	**0**	**0**	**0**	**0**	**1**

Trotz der korrekten Elemente -1 und +1 ist das restaurierte Wort kein Codewort. Wir müssen also noch das tun, was oben schon beschrieben wurde. Wir berechnen die euklidischen Abstände des restaurierten Wortes in binärer Notation von allen Codewörtern. Da in diesem Fall das Quadrat der Differenz einer Komponente nur die Werte 0 oder 1 annehmen kann, ist der Hamming-Abstand zugleich das Quadrat des üblichen euklidischen Abstandes. Deshalb können wir direkt nach dem Codewort mit dem kleinsten Hamming-Abstand zum restaurierten Wort in binärer Notation suchen:

Vergleichswort	Hamming-Abstand
A	3
B	1
C	3
D	5

Offensichtlich ist die Nachricht B diejenige, die mit größter Wahrscheinlichkeit gesendet wurde. Wenn die Symbole wie in diesem Abschnitt beschrieben vor dem Decodierer schon restauriert werden, dann spricht man von von einem Decodierer mit harter Entscheidung (hard-decision decoder). Der Decodierer nutzt in diesem Fall nur sehr wenig Information des Rauschens aus (nur das Vorzeichen).

1.4. Decodierer mit weicher Entscheidung (Soft-Decision Decoder)

Bei einem Decodierer mit weicher Entscheidung werden die Abstände zwischen empfangenem Wort und allen Codewörtern direkt bestimmt. Damit findet eine Entscheidung nur im Decodierer statt, nicht schon vor ihm. Aus obigem Beispiel ergibt sich (wieder mit 0 ersetzt durch -1):

Vergleichswort	euklidscher Abstand
A	3.9234
B	1.7037
C	4.5222
D	4.4588

Wie im Fall der harten Entscheidung ist die Nachricht B diejenige mit dem kleinsten Abstand zum empfangenen Wort. Weiche Entscheidung ist besser als harte Entscheidung. Der Gewinn hängt ab vom Code und vom SNR. Bei schwachen Signalen liegt er meist bei 2 dB (für Hadamard, Simplex, und RS-Codes; etwa 1 dB für Hamming-Codes).

1.5. Das Problem des Rechenaufwandes

Das in den vorangegangenen Abschnitten beschriebene Beispiel sollte das Prinzip eines Decodierers für verrauschte Signale erläutern. Mit nur vier Codewörtern gab es dabei kein Problem bei der Berechnung aller Abstände. Selbst bei tausend Codewörtern hat ein moderner Computer keine Mühe, das in weniger als einer Sekunde zu schaffen. ***Üblicherweise benutzt man aber so viele möglichen Codewörter, dass die Methode, sturheil sämtliche Abstände zu berechnen um das am besten passende Codewort zu finden, nicht praktikabel ist.***
Dann gibt es nur den Weg, nach solchen Codes zu suchen, die einen direkteren Weg der Decodierung bieten bei gleichzeitig akzeptablen Eigenschaften des Codes. Tatsächlich ist es einfach, optimale Codes zu finden, die praktisch nicht decodierbar sind, und ebenso einfach, leicht decodierbare Codes zu finden, deren Eigenschaften aber unzureichend sind. Praktisch brauchbare Codes liegen dazwischen. Der nachfolgend beschriebene CW-Decodierer findet die unter sämtlichen Möglichkeiten am besten passende, ohne wirklich alle Nachrichten durchzuprobieren. Das geht hier nur deshalb, weil ein Morsezeichen eine begrenzte Länge hat und deshalb das empfangene Signal nur lokal beeinflusst.

2. Decodierung von CW

2.1. Ein Decodierer mit weicher Entscheidung für CW

CW ist kein Code mit Fehlerkorrektur. Deshalb ist das Problem des Rechenaufwandes hier nicht gravierend. Tatsächlich liefert der beschriebene Decodierer dieselbe decodierte Nachricht wie ein theoretischer Decodierer, der sämtliche möglichen Nachrichten durchprobiert. Wir nehmen kohärente Demodulation eines klassischen CW-Signals an entsprechend Abbildung 5c. in [2]. Das Rauschen folgt dann einer Gauss-Verteilung. Das ist nicht der Fall bei inkohärenter Demodulation der ASK durch den Absolutbetrag des Signals. Weiterhin nehmen wir an, dass die Morsezeichen von einem präzisen Takt abgeleitet sind, dessen Taktrate auch dem Empfänger bekannt ist.
Abbildung 1a zeigt ein CW-Signal, bevor es den Sender moduliert. 1b zeigt das empfangene verrauschte Signal nach der Demodulation, und 1c zeigt den Ausgang des angepassten Filters, welches in diesem Fall einfach die Summe der letzten Abtastatungen über eine Bitlänge berechnet. Wir setzen voraus, dass die Generatoren für den Binärtakt an beiden Enden genügend übereinstimmen, dass der kumulative Gangunterschied innerhalb einer Nachricht kleiner als eine halbe Bitlänge bleibt. Die Länge üblicher CW-Nachrichten ist 1000 Bit oder weniger. Damit ist die notwendige Genauigkeit der Abtastraten (die den binären Takt bestimmen) in der Größenordnung von 10_{-3}, was von allen Soundkarten erfüllt wird. Deshalb kann die Ausgabe des angepassten Filters über die gesamte Länge der Nachricht segmentiert werden in Segmente der Länge zwei Bit (ein Nibble). An dieser Stelle weiß der Empfänger nicht, wo die Grenzen zwischen den Bit liegen. Die Segmentierung wird daher mit beliebigen Startpunkt vorgenommen. Diese Segmente sind in Abbildung 1c durch vertikale strichlierte Linien angedeutet. Nun werden alle Segmente aufsummiert (alle ersten Samples, alle zweiten Samples, usw.). Das Resultat zeigt Abbildung 1d. Die Positionen von Maximum und Minimum in diesem Bild geben die hieraus ermittelten geschätzten tatsächlichen Grenzen der Bit innerhalb aller Segmente an. Die an diesen Stellen abgetasteten Werte sind in 1c mit einem Punkt markiert. Die Sequenz dieser abgetasteten Werte wird als Input für den Decodierer verwendet. Der Decodierer-Input besteht also aus einem Feld von reellen Werten (ein Wert pro Binärtakt). Wir besprechen die Prinzipien des Decodierers an einem einfachen Beispiel mit folgenden Eigenschaften:

(1) Der Empfänger weiß, dass die Länge der Nachrichten 22 Binärtakte (11 Nibbles) beträgt.
(2) Der Sender sendet „ AB" , was in Morsecode ergibt: .- -...
(3) Der Empfänger weiß nicht, was gesendet wird.

Wegen ihrer Länge notieren wir die Datenfelder in Tabelle 1 als Spalten anstelle von Zeilen. (siehe Table 1 im englischen Text)

Tabelle 1. Beispiel einer Sendung von 22 binären Symbolen 0010111000111010101000, die den Morsecode für " AB" repräsentieren. Das SNR ist +3 dB. Zu beachten ist, das die binäre Null als -1 gesendet wird. Das Rauschen ist in diesem Beispiel deutlich stärker als in Abbildung 1. Die harte Entscheidung ist hier nur zum Vergleich angegeben. Sie wird nicht verwendet.

Abbildung 1. Dieses Bild demonstriert die Rekonstruktion des Binärtaktes und die Reduktion des empfangenen Signals auf ein kleines Datenfeld von reellen Werten, die die empfangenen Bit repräsentieren. 1a ist der Morse-Code vor der Modulation im Sender. 1b ist das empfangene Signal nach der Demodulation. 1c zeigt den Output eines Integrators, der jeweils die letzten Abtastatungen über eine Bitlänge aufsummiert (Matched Filter). Dieses Signal wird segmentiert in Segmente der Länge zwei Bit (vertikale gestrichelte Linien). Die Segmente werden addiert (1d). Die Positionen von Minimum und Maximum in 1d wird als Schätzung der Lage des tatsächlichen Binärtaktes in 1c genommen. Die an diesen Takten abgetasteten Werte sind in 1c als Punkte markiert. Diese Werte dienen als Input für den Decodierer.

Tabelle 2. Diese Tabelle demonstriert die Berechnung des Quadrates des Abstandes zwischen dem Morse-Code für den Buchstaben A und der gegebenen Sequenz abgetasteter Werte nach Abb. 1c beginnend bei Binärtakt 5.

Tabelle 3. Das Abstandsquadrat für alle Morsezeichen vom empfangenen Signal für alle Startpunkte. Da diese nur der Demonstration dient, ist hier der Übersichtlichkeit halber nur die Liste von A bis F und das Blank angegeben. Ein Strich deutet an, das der Code die in diesem Beispiel vorausgesetzte Länge von 22 Binärtakten überschreiten würde. Dieses Datenfeld hat die Bezeichnung **symboldistance** .

Tabelle 4. Die Eigenschaften des Alphabets werden repräsentiert durch die zwei Felder **symbol** und **nibbles** . **symbol** definiert das Alphabet, während **nibbles** die Länge des entsprechenden Morse-Codes in Nibbles angibt. Wie in Tabelle 3 wird auch hier nur das Alphabet von A bis F plus Blank angegeben.

Der Decodierer hat zwei Stufen. In der ersten Stufe werden die quadrierten Abstände für alle Morse-Zeichen an allen Startpunkten berechnet. Das Resultat ist beispielhaft in Tabelle 3 angegeben. Zur Erläuterung, wie diese Abstände berechnet werden, wird in Tabelle 2 das Beispiel des Morsezeichens für A beginnend beim Takt 5 behandelt.

Wenn Tabelle 3 generiert ist, kann der Decodierprozess starten. Zur Erläuterung des Algorithmus' wird die Datenstruktur **workinglist** definiert:
workinglist ist ein Array mit dem Nibbletakt **nibbleclock** als Index. Jedes Element des Arrays hat die zwei Felder **distance** und **decoded** . **workinglist(nibbleclock).decoded** enthält den jeweils aktuell besten decodierten Text für die Sequenz der Binärtakte von **1** bis **nibbleclock-1**, und **workinglist(nibbleclock).distance** ist das entsprechende Abstandsquadrat zwischen dem empfangenen Signal und dem Morse-Code des decodierten Textes. **workinglist(nibbleclock).decoded** wird initialisiert mit dem leeren Text für alle möglichen **nibbleclock** Indices, und **workinglist(nibbleclock).distance** wird initialisiert mit unendlich.
Der Decodieralgorithmus benutzt eine geschachtelte Schleife (siehe englischer Text). Der Algorithmus startet bei **nibbleclock=1** mit dem Morsezeichen für "A". Der Startpunkt (der **entryclock** Index) für ein nach dem A folgendes Zeichen wäre die aktuelle Position (1) plus die Länge des "A" in Nibbles. Aus Tabelle 4 erhalten wir **nibbles(1)=4**, also wird **entryclock** auf 5 gesetzt. Aus Tabelle 3 entnimmt man die **symboldistance** des aktuellen **symbolindex (1)** am aktuellen **nibbleclock (1)** zu 20.839 . Dieser Wert wird in **workinglist(entryclock).distance** gespeichert, weil dieser Wert kleiner ist als der hier bislang gespeicherte (noch das initialisierte unendlich). Entsprechend wird mit allen Zeichen bei **nibbleclock=1** verfahren. Bei jedem Zeichen muss entschieden werden zwischen zwei möglichen Decodierungen, die beide an derselben Stelle enden. Diese Entscheidung fällt aufgrund des gesamten Abstandes beider Morse-Codes. Ist im Bespiel **nibbleclock=1** und **symbolindex=6** dann ist die Länge des entsprechenden Morsezeichens "F" dieselbe wie die des Zeichens "B". Der Algorithmus findet also den früheren Eintrag für "B" und prüft, ob der Abstand für das "F" kleiner ist als der für das "B". Das ist hier der Fall und deshalb wird der Eintrag für das "B" in der **workinglist** durch das besser passende "F" überschrieben.

Wenn auf diese Weise alle Zeichen bei **nibbleclock=1** bearbeitet sind, schaltet die äußere Schleife zu **nibbleclock=2**, usw.. Wenn die Schleife zuende ist, enthält **workinglist(numberofreceivednibbles+2).decoded** die decodierte Nachricht, und **workinglist(numberofreceivednibbles+2).distance** ist das Quadrat des Gesamtabstandes zwischen dem Morse-Code des decodierten Textes und dem empfangenen Signal. In unserem Beispiel finden wir " AB" als decodierten Text mit einem Abstandsquadrat von 10.776. Da die Nachricht 22 Bit lang ist, ergibt sich ein mittleres Abstandsquadrat pro Bit von sqrt(10.776/22) = 0.6999 . Tatsächlich war 0.7 die Standardabweichung des simulierten Rauschens der Tabelle 1 (was SNR = 3 dB entspricht).
Wenn die Abstandsquadrate nach Tabelle 3 gleich während des Empfangs ermittelt werden, ist mit diesem Algorithmus auch simultanes Decodieren möglich (mit einer Verzögerung von weingen Zeichen). Kritisch ist dabei, dass die Synchronisation des Binärtaktes erreicht sein muss, bevor die Tabelle 3 überhaupt berechnet werden kann.

2.2. Der Decodierer mit weicher Entscheidung für CWP

CWP ist Computer-generierte Telegraphie mit spezifiziertem Binärtakt. Der Unterschied zu CW ist ein Phasensprung von 180° zu Beginn jedes Punktes und Striches. Das demodulierte Signal ist einfach der Realteil des empfangenen komplexen Signals nach der Phasensynchronisation. Abbildung 2 zeigt dieselbe Nachricht " AB" wie bei Abbildung 1, hier aber für CWP. Obwohl ein menschlicher Operator keinen Unterschied zu CW hört, ist das CWP-Signal sehr verschieden. Trotzdem bleibt der Decodieralgorithmus derselbe. Nur Tabelle 3 muss nach dem CWP-Morse-Code berechnet werden. Beispielsweise muss die Spalte in Tabelle 2 für den Morse-Code A nun lauten: +1 0 -1 -1 -1 0 0 0 .

Abbildung 2. Die Nachricht " AB" in CWP entsprechend dem CW-Fall in Abbildung 1 bei demselben SNR. Die Rekonstruktion des Binärtaktes wurde schon in [2] behandelt (dort Abbildungen 6 und 7).

Wenn der Funkkanal Rayleigh-Fading aufweist, gibt es folgendes Problem. Die Phasensynchronisation wird bei schwindendem Signal partiell versagen. Das ist ein grundsätzliches Problem der Phasenmodulation, nicht des Decodierers. Es kann aber nicht vor der Demodulation gelöst werden. Deshalb wird es auch für den Decodierer zum Problem. Die sehr einfache Berechnung der Tabelle 3 und auch der Decodieralgorithmus selbst werden dadurch wesentlich aufwändiger.

Abbildung 3 zeigt das rauschfreie, aber nicht phasen-synchronisierte Signal für unser Morse-Code Bespiel " AB" in der komplexen Ebene vor dem Demodulator. Anstatt die Phasenrotation zu korrigieren (was ja bei Fading schiefgeht) und bei der Demodulation den Realteil zu nehmen generiert der aktuelle CWP-Empfänger die Tabelle 3 ohne Demodulation direkt aus dem komplexen Signal. Bei jedem Nibbletakt wird für alle Morsezeichen die am besten passende Rotation bestimmt. Das Abstandsquadrat bei diesem Winkel ergibt den Tabelleneintrag. Zusätzlich werden die Winkel gespeichert. Der Decodierer arbeitet wie oben beschrieben, aber ein Term proportional zum Quadrat der Differenz der Winkel benachbarter Zeichen wird zum Abstandsquadrat addiert. Diese Methode beseitig zugleich das generelle Problem der Existenz zweier möglicher Startphasen bei der BPSK.

Abbildung 3. Das CWP-Signal für die Nachricht " AB" rotiert in der komplexen Ebene, wenn keine Phasensynchronisation vorgenommen wird (oder wenn diese mislingt). Siehe zum Vergleich Abb. 5a in [2].

3. Der Rechenaufwand für den Decodieralgorithmus

Wenn wir ein Alphabet mit m Symbolen benutzen, dann gibt es m_n verschiedene Nachrichten dern Länge n. Deshalb steigt der Rechenaufwand exponentiell mit n, wenn man sämtliche Nachrichten probieret um die am besten passende zu finden. Es war A. Viterbi, der das Prinzip des sukzessiven Ausschlusses ganzer Untermengen von möglichen Decodierresultaten für Faltungscodes fand. Der Anwendungsbereich des Viterbi-Algorithmus' ist sehr groß. Er wird z.B. benutzt in Mobiltelefonen, beim WLAN und in Festplatten. Der Rechenaufwand ist im Falle des CW-Decodierers gegeben durch die nötige Anzahl der Durchläufe der inneren Schleife des Algorithmus'. Es ist die Anzahl der Symbole des Alphabets multipliziert mit der Länge des empfangenen Signals (in Nibbles).

Design of a prime-focus feed with backward radiation

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Abstract. *This article describes the design of a highly effective parabolic dish antenna primary feed based on backward radiation. This assembly, comprising a dielectric lens and reflecting plate, supports both linear and circular polarization and may be directly attached to a circular waveguide. The current design is intended to work in the 10 GHz band with the specified parabolic dish antenna.*

Introduction

The objective of this article is to describe the design of a prime-focus feed for a 60cm diameter parabolic dish antenna with f/D ratio 0.285 (subtended angle 171°) for a frequency of 10.368 GHz. The main advantage of this feed configuration is improved dish antenna efficiency with a very simple mechanical setup. Design goals were:

- Linear / circular polarization capabilities
- Good axial ratio (with CP)
- Low cross-polarization losses
- -13 dB dish edge taper for low side lobes
- Suitable radiation pattern with suppression in the longitudinal direction to minimize blockage effects

Based on these considerations, a lens structure affixed to a circular waveguide was proposed (Fig. 1). This design comes from the so-called "hat-feed" [1], however; it has been substantially modified to match our electrical and system requirements.

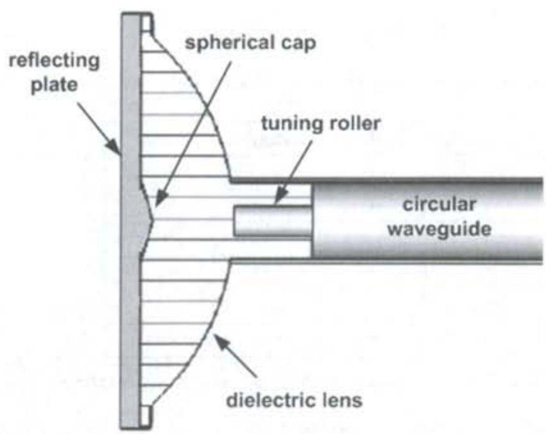


Fig. 1 Proposed design of the feed

1. Feed design

The feed consists of a relatively small number of parts (Fig. 1):

- dielectric lens with spherical cap made of TEFLON™
- Circular waveguide to provide transition with tuning roller and dielectric lens
- Metal reflecting plate

The circular waveguide has been designed to support propagation of fundamental TE_{11} mode only, at a center frequency f_0=10.368 GHz. This prompts one to specify a readily available cylinder with inner radius 10 mm for the waveguide.

2. Tuning the feed parameters

To investigate the performance effects of the designed feed parameters, parametric simulations were performed using full-wave EM simulator CST Microwave Studio [2]. The model of the assembly was fed by a waveguide port excited by pure circular polarization (two orthogonal TE_{11} modes shifted by 90° at center frequency).

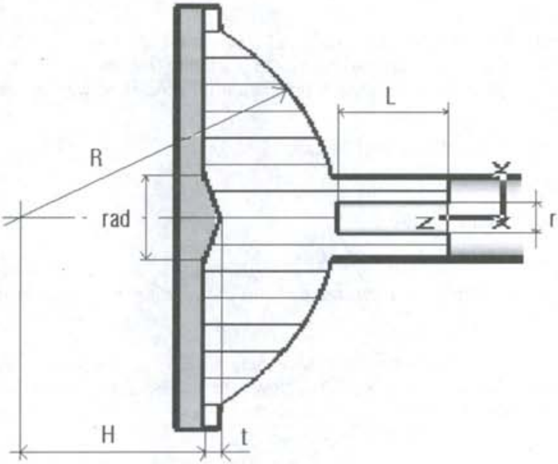


Fig. 2 Design parameters

The effect of tuning the feed's parameters is shown in Tab. 1, where AR denotes Axial Ratio.

Parameter	Pattern	Matching	AR
L	+	+++	N/A
r	+	+++	N/A
t	++	+++	++
H	+++	+++	+++
rad	+	++	+
R	+++	+++	+++

Tab. 1 Effect of tuning variables on feed performance

It was observed that the dielectric transition could be tuned (within TE_{11} band) by varying *L*, *r* and *t* parameters (see Fig. 2) while radiation parameters remain almost unchanged.
Illumination of the dish and Axial Ratio are controlled by selection of the *H* and *R* parameters.

3. Feed performance

After many parametric simulations, the feed was tuned at a frequency 10.368 GHz and its radiation properties were adjusted to properly illuminate the given dish. The radiation patterns of the feed excited with circularly polarized mode TE_{11} modeled in CST-MWS are shown in Fig. 3 and Fig. 4.

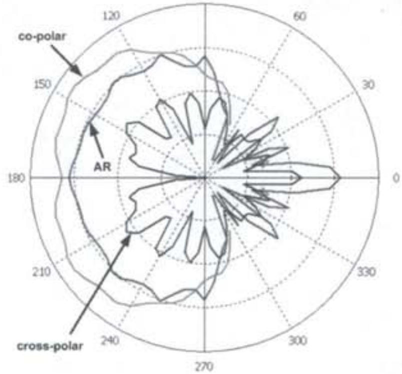


Fig. 3 Polar radiation pattern cut showing co- and cross- polarizations and AR

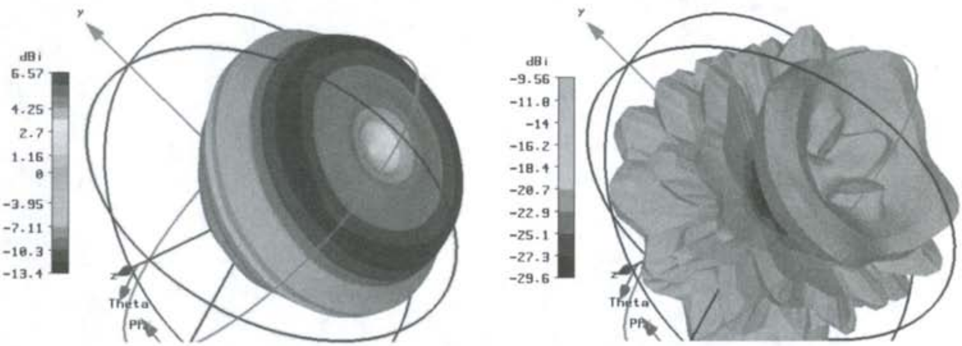


Fig. 4 Full 3D radiation patterns of co- (top) and cross- (bottom) polarizations.

Return Loss (S_{11} parameter) at the designed frequency is better than 25 dB. See Fig. 9.
Due to the lack of the time, actual operating feed measurements were made using linear polarization only. To operate this feed with circular polarization, a longer waveguide and polarizer (i.e. septum polarizer [3], [4]) must be added. CP measurements are planned in the near future.
For linear polarization measurements, a very simple coaxial-to-waveguide transition consisting of the inner pin of a SMA connector positioned within the circular waveguide was used. This transition was tuned for best impedance match at 10.368 GHz. The overall modified assembly is shown in Fig. 5.

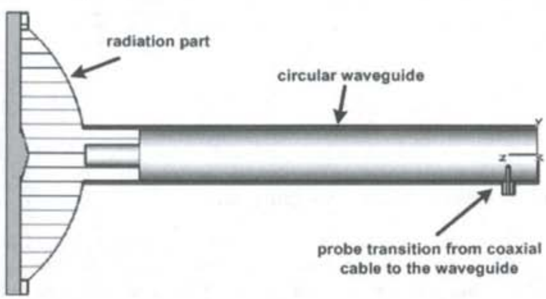


Fig. 5 Complete feed assembly with coaxial-to-waveguide transition

Relative bandwidth of the entire feed in free space is approximately 3% for S_{11} < -20dB. As discussed above, the feed assembly was measured in an anechoic chamber and E/H plane cuts were evaluated. See Fig. 6 and Fig. 7. Excellent agreement between modeled and measured parameters was observed.

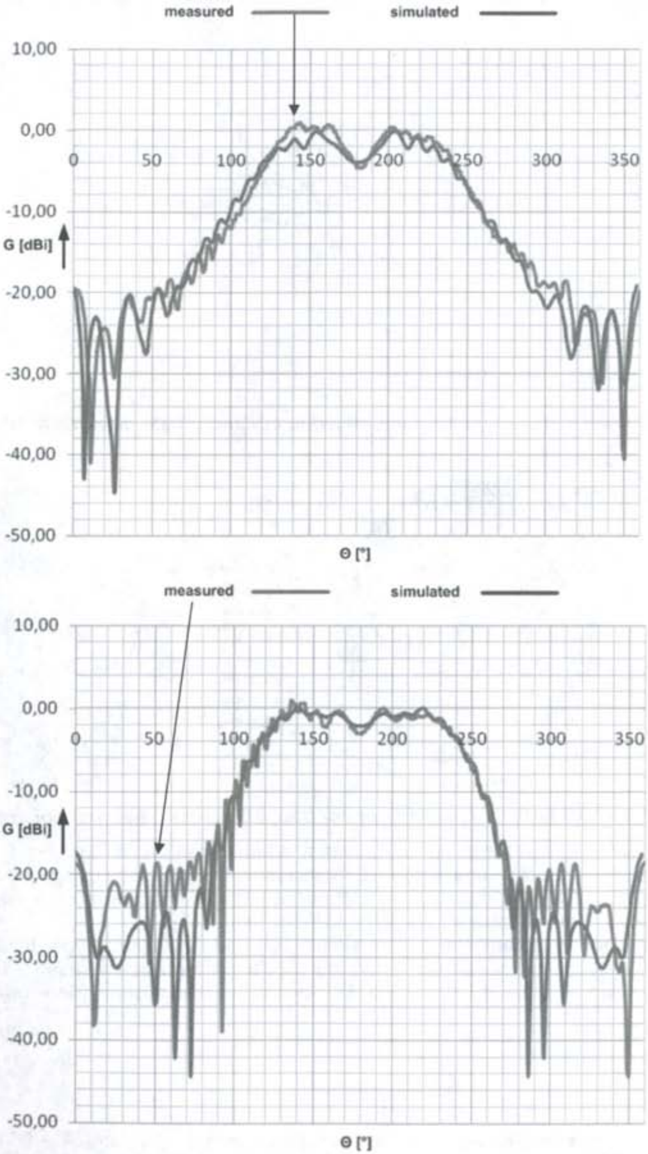


Fig. 6. E plane (top) and H plane (bottom) farfield co-polar cuts, comparison of measured and simulated data.

Finally, simulation of the entire system (feed+dish) has also been performed in CST-MWS. Despite the very large size of the modeled electrical system (dish diameter is 20λ), it was possible to run the simulation with good accuracy in T-solver. Because we used a full-wave simulation, it was possible to take into account all the negative factors that can downgrade the antenna performance . We calculated the entire system with the feed excited with both, linear and circular polarization. Measured radiation patterns for linear polarization and their comparison with calculated data are shown in Fig. 8

Very good separation of approximately 40 dB between co- and cross- polarization in the main lobe was achieved. See Fig 10. Simulated directivity D_{sim} was 33.87 dBi.

Theoretical maximum directivity of the entire system with constant illumination can be calculated from equation

$$D_{teor} = 20\log\frac{\pi D}{\lambda} = 36.278 \text{ dBi}, \qquad (1)$$

where D is dish diameter and λ is wavelength.
The calculated efficiency of the entire system is 57.4% while the measured result indicates actually efficiency about 15 % higher.

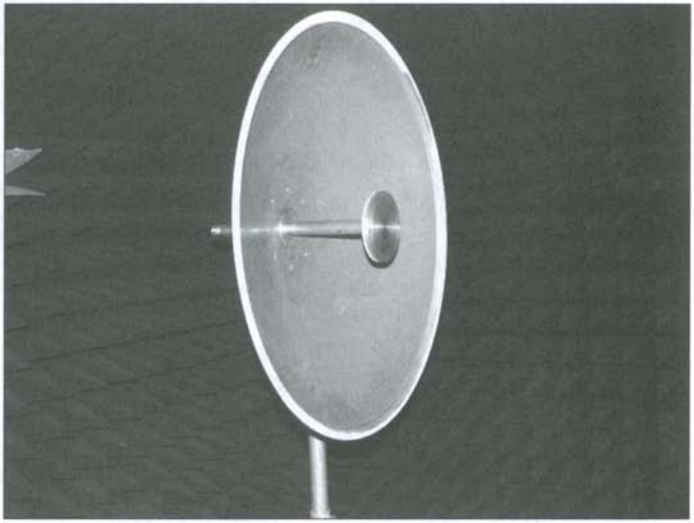


Fig. 7 Antenna assembly measured in anechoic chamber

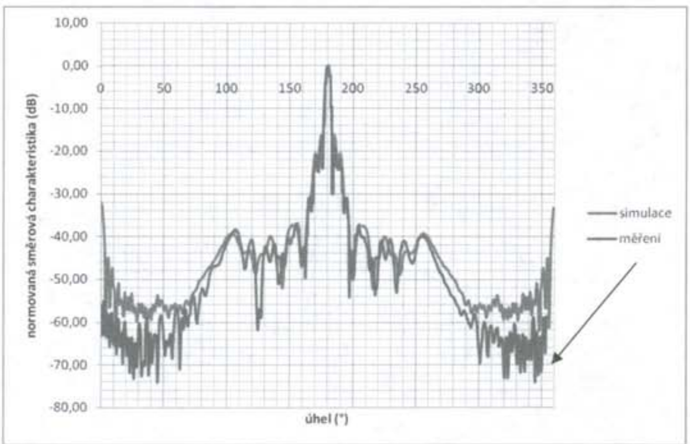
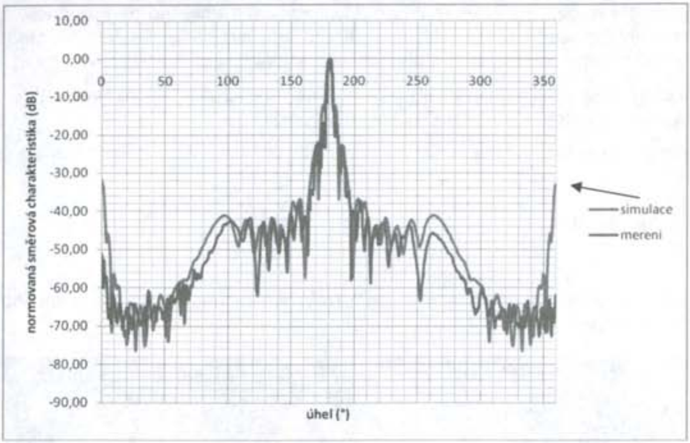


Fig. 8 Antenna radiation pattern. E plane (top) and H plane (next page)



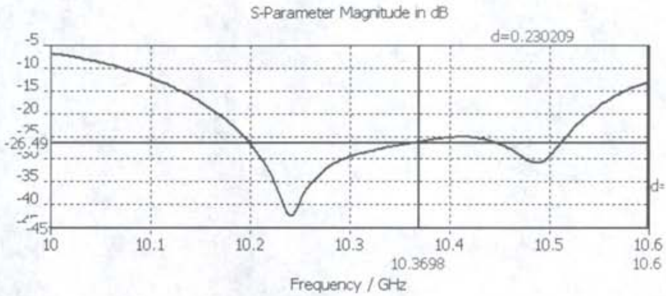


Fig. 9 Calculated S11 feed parameters

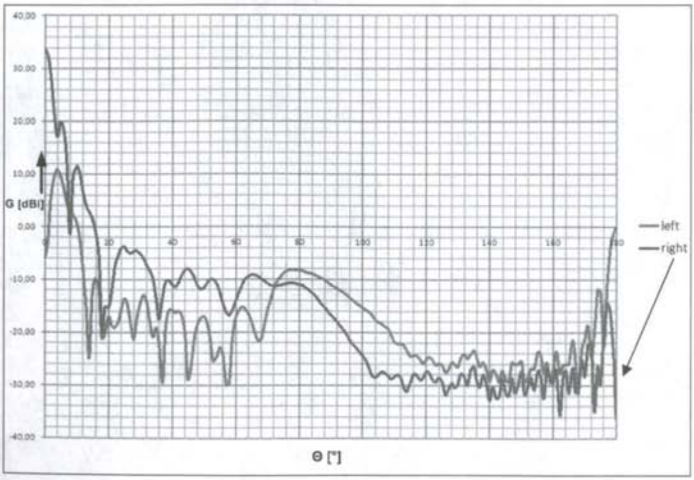


Fig. 10 Simulated co- and cross- polar radiation pattern of the feed + dish system

Conclusions

The designed feed exhibits very good performance parameters in all important areas for both linear and especially for circular polarization. The total efficiency achieved for this very deep dish parabolic antenna is excellent and the impedance match is also very good. The feed dimension are in Appendix 1.

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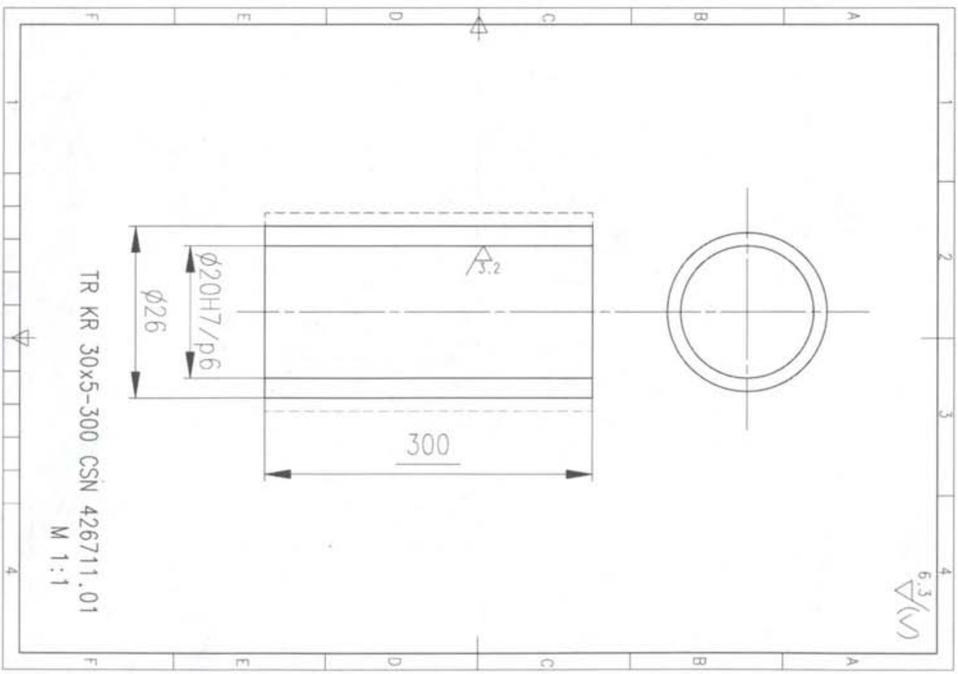
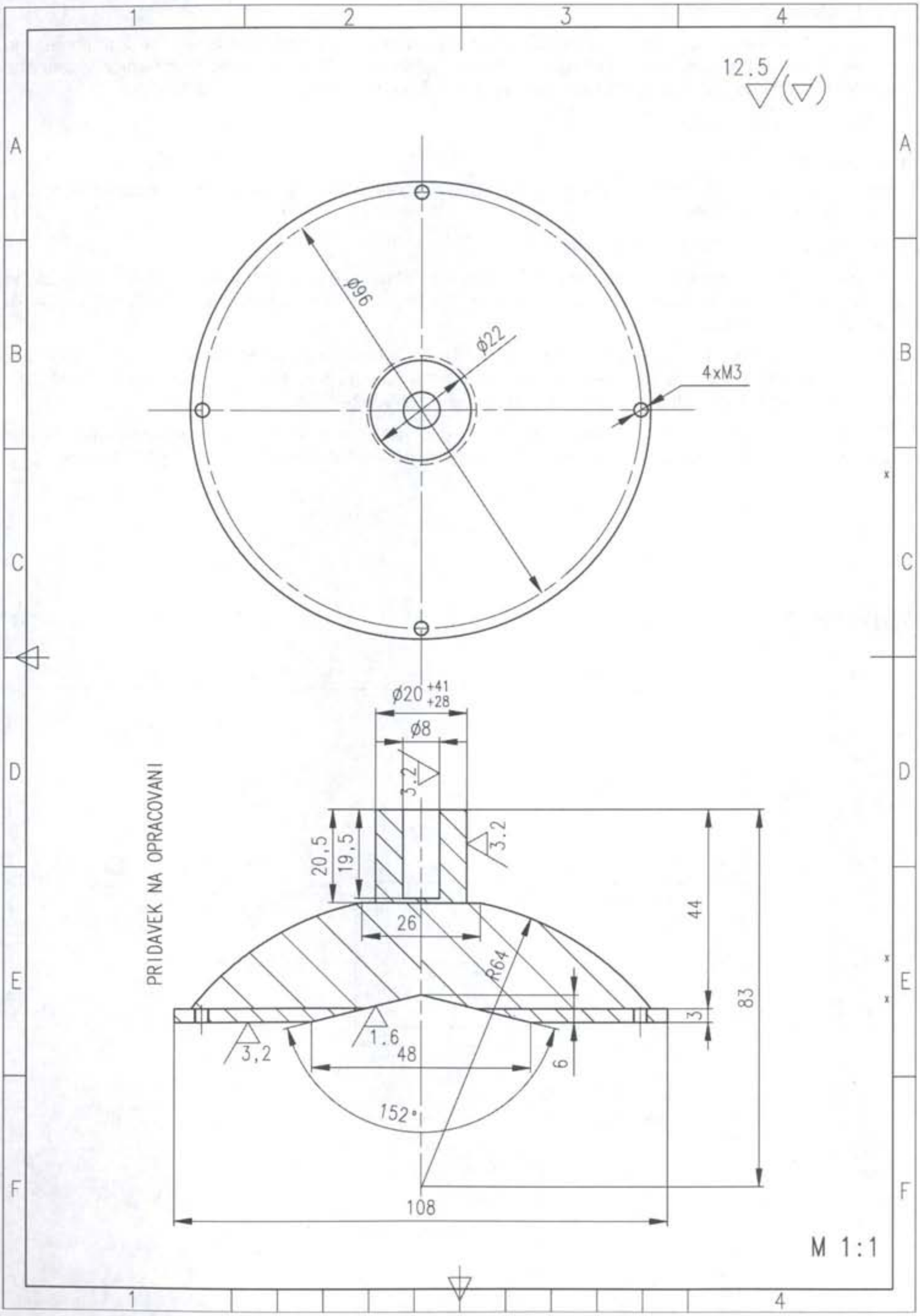
Appendix



Appendix A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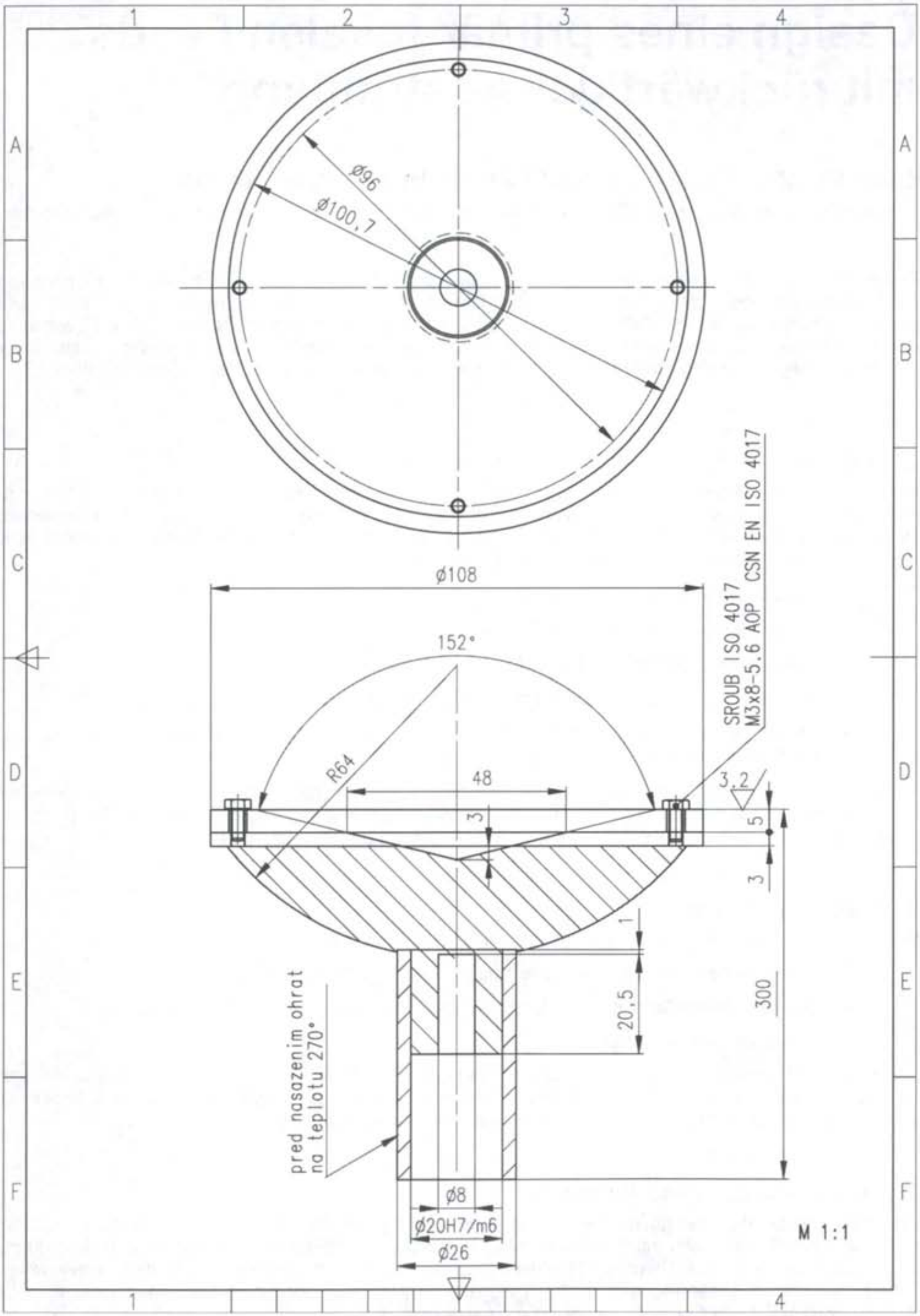
M 1:1

Appendix B


Ø96
Ø100,7
Ø108
152°
R64
48
3
5
3
1
20,5
300
SROUB ISO 4017
M3x8-5.6 AOP CSN EN ISO 4017
3,2
pred nasazenim ohrat
na teplotu 270°
Ø8
Ø20H7/m6
Ø26
M 1:1

Appendix C

Design eines primär-fokalen Feeds mit rückwärtiger Abstrahlung

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Zusammenfassung: *Dieser Artikel beschreibt das Design eines hocheffektiven primären Parabolspiegelerregers, der auf rückwärts gerichteter Abstrahlung basiert. Diese Anordnung, bestehend aus dielektrischer Linse und Reflektionsplatte, ermöglicht sowohl lineare als auch zirkulare Polarisation und kann direkt an einen zirkularen Wellenleiter angeschlossen werden. Das vorliegende Design ist für die Verwendung im 10-GHz-Band ausgelegt in Verbindung mit der hier spezifizierten Parabolantenne.*

Einleitung

Gegenstand dieses Artikels ist es, das Design eines primär-fokalen Feeds für eine Parabolspiegelantenne von 60cm Durchmesser mit f/D 0.285 (Winkel 171°) für eine Frequenz von 10.368 GHz zu beschreiben. Der Hauptvorteil dieser Feed-Konfiguration ist eine verbesserte Effektivität der Antenne mit einer sehr einfachen mechanischen Konstruktion. Design-Ziele waren:

- Möglichkeit für lineare / zirkulare Polarisation
- Gute Axial-Ratio (bei zirkularer Polarisation)
- Niedrige Kreuzpolarisationsverluste
- -13 dB Abfall am Spiegelrand für niedrige Nebenzipfel
- Passendes Strahlungsdiagramm mit Unterdrückung in der longitudinalen Richtung, um Blockierungseffekte zu minimieren.

Ausgehend von diesen Überlegungen wurde eine Linsen-Struktur, die an einem zirkularen Wellenleiter befestigt wird, vorgeschlagen (Abb. 1). Dieses Design kommt von dem sogenannten „Hut-Feed" [1]. Es wurde jedoch grundlegend modifiziert, um unsere elektrischen und Systemanforderungen zu erfüllen.

1. Design des Feeds

Das Feed besteht aus einer relativ geringen Anzahl von Teilen (Abb. 1):

- dielektrische Linse mit sphärischer Kappe aus TEFLON™
- zirkularer Wellenleiter für den Übergang mit Abstimmrolle und dielektrischer Linse
- Metallische Reflektorplatte

Der zirkulare Wellenleiter wurde so bemessen, dass er nur Ausbreitung im Basismodus TE_{11} unterstützt bei einer Mittenfrequenz von f_0=10.368 GHz. Das regt dazu an, einen fertig verfügbaren Zylinder mit einem inneren Radius von 10mm für den Wellenleiter zu spezifizieren.

2. Einstellung der Feed-Parameter

Um die Effekte der designten Feed-Parameter auf die Performance zu untersuchen, wurden parametrische Simulationen mit dem Ganzwellen-EM-Simulator CST Microwave Studio [2] durchgeführt. Das Modell der Anordnung wurde mit einem Welleiter durch rein zirlulare Polarisation erregt (zwei orthogonale bei der Mittenfrequenz um 90° versetzte TE_{11}-Modes). Der Effekt des Justierens der Feed-Parameter ist in Tabelle 1 gezeigt, wobei AR die Axial-Ratio ist.

Es wurde beobachtet, dass der dielektrische Übergang abgestimmt werden konnte (innerhalb des TE_{11}-

Bands) durch Veränderung der Parameter von *L*, *r* und *t* (siehe Abb. 2), wobei die Strahlungsparameter nahezu unverändert blieben. Ausleuchtung des Spiegels und Axial-Ratio werden bestimmt durch die Wahl der Parameter *H* und *R*.

3. Leistungsdaten des Feeds

Nach vielen parametrischen Simulationen wurde das Feed auf eine Frequenz von 10.368 GHz gestimmt und die Strahlungseigenschaften wurden so eingestellt, dass der gegebenen Spiegel vernünftig ausgeleuchtet wird. Die Strahlungsdiagramme des mit im zirkularer polarisiertem TE_{11}-Mode erregten mit CST-MWS simulierten Feeds sind in Abb. 3 und Abb. 4 gezeigt.

Der Returnloss (S_{11} Parameter) bei der Design-Frequenz ist besser als 25 dB. Siehe Abb. 9.
Aus Zeitmangel wurden reale Messungen am arbeitenden Feed nur mit linearer Polarisation durchgeführt. Um dieses Feed mit zirkularer Polarisation arbeiten zu lassen, muss ein längerer Wellenleiter und ein Polarisator (d.h. Septum-Polarisator [3]) hinzugefügt werden. Messungen für zirkulare Polarisation sind in naher Zukunft geplant.
Für Messungen linearer Polarisation wurde ein sehr einfacher Koaxial-Wellenleiter-Übergang verwendet, der aus dem inneren Pin eines SMA-Verbinders besteht, der im zirkularen Wellenleiter angeordnet wird. Dieser Übergang wurde auf beste Impedanzanpassung bei 10.368 GHz justiert. Die gesamte modifizierte Anordnung ist in Abb. 5 gezeigt.
Die relative Bandbreite des gesamten Feeds im Freiraum beträgt etwa 3% für $S_{11} < -20$dB. Wie oben diskutiert, wurde die Feed-Anordnung in einer reflektionsfreien Kammer gemessen und die Diagramme für E-und H-Ebene bestimmt. Siehe Abb. 6 und Abb. 7. Es wurde eine exzellente Übereinstimmung zwischen simulierten und gemessenen Parametern gefunden.
Schließlich wurde eine Simulation des kompletten Systems (Feed und Spiegel) mit CSR-MWS durchgeführt. Trotz der sehr großen Größe des simulierten elektrischen Systems (der Spiegeldurchmesser ist 20λ), war es möglich, die Simulation mit guter Genauigkeit laufen zu lassen.
Weil wir eine Ganzwellen-Simulation verwendeten, war es möglich, all die negativen Faktoren in Betracht zu ziehen, die die Leistung einer Antenne herabsetzen können. Wir haben das ganze System gerechnet, wobei das Feed sowohl mit linearer als auch mit zirkularer Polarisation erregt wurde. Die gemessenen Strahlungsdiagramme für lineare Polarisation und zum Vergleich die gerechneten Daten sind in Abb. 8 gezeigt.

Eine sehr gute Trennung von etwa 40 dB zwischen Ko- und Kreuzpolarisation in der Hauptstrahlrichtung wurde erreicht. Siehe Abb. 10. Die simulierte Directivity D_{sim} war 33.87 dBi.

Die theoretisch maximal mögliche Directivity des gesamten Systems mit konstanter Ausleuchtung kann berechnet werden aus der Gleichung

$$D_{teor} = 20\log\frac{\pi D}{\lambda} = 36.278 \text{ dBi}, \qquad (1)$$

mit *D* für den Durchmesser des Spiegels und λ der Wellenlänge.

Die berechnete Effektivität des gesamten Systems beträgt 57.4%, während das gemessene Ergebnis tatsächlich eine etwa 15 % höhere Effektivität anzeigt.

Schluß

Das Feed-Design weist sehr gute Leistungsparameter für alle wichtigen Bereiche für lineare und besonders zirkulare Polarisation auf. Die erreichte Gesamteffektivität für diesen sehr tiefen Parabolspiegel ist hervorragend und auch die Impedanzanpassung ist sehr gut. Die Abmessungen des Feeds sind im Anhang gezeigt. Siehe engl. Text oben.

Referenzen

Siehe engl. Text oben.

Anhang

Maßzeichnungen des Spiegels und Feeds. Siehe engl. Text oben.

More about Oblongs (IV) – a challenging antenna for 2m

by Slobodan Bukvic, YU7XL, yu7xl@nadlanu.com

It has recently become known that a 2 or 3-element quad has higher gain than the corresponding 2 or 3-element yagi. As the boom length and the number of elements are increased, the difference becomes more and more negligible. This is true according to my own experience, but only up to ae boom length of approximately 5 wl. You can see this by comparing my oblong models with yagis designed by YU7EF. With shorter booms, oblongs are much better than yagis. Then the difference between my 14-element oblong and the EF 14-element yagi with the same boom length is small. The oblong is still better, but not by much. Now here is a big surprise: When the boom length is increased to more than 5 wl, things change rapidly. It seems that the waveguide effect comes into play now, and the longer the oblong antenna the better it becomes. Every additional director is almost same in length as the previous one and gives more gain, with no significant influence on the front-to-back and front-to-side ratios.
It is a pity that a 5 or 10 wl (or even more) antenna is quite difficult to build on the 144 MHz band. One can try it! I know some EME operators who use a single antenna for EME operation which is 17 or 18 metres long. The antenna gain for such a length is 18 to 20 dBi, which can be easily achieved with 4 stacked shorter antennas. But, when stacked, you have to count on additional losses in splitters, connectors and phasing lines and finally, the antenna pattern becomes very poor. Using a single long antenna all performance parameters remain good. Anyway, this fact makes the oblong very useful on the 432 and 1296 MHz bands, where a boom length of 10 or even 20 wl is quite common. Therefore I can state that the quad (oblong) is a true UHF antenna, much better than a yagi.
An oblong usually has a bigger bandwidth than a yagi. When increasing the yagi boom length, its bandwidth becomes less and less. When increasing the oblong boom length, its bandwidth becomes bigger and bigger! The gain becomes higher and higher, and the temperature lower and lower!
Now I want to present my biggest challenge for a brave VHF enthusiast: the 25 element, almost 20 meters long oblong antenna for the 144 MHz band. Maybe there is a ham who can dare to build this antenna? If so, please, send me (and DUBUS!) details of how this antenna really works. Anyway, this article should be interesting to everyone, just to show what happens with extremly long oblongs.

25 Element OBLONG Antenna Q225D1XL

Performance Data (No loss condition)

TYPE	ELE	L (mm)	G (dBi)	F/B (dB)	F/Sh (dBi)	F/Sv (dBi)	Hor (°)	Ver (°)	Temp (K)	G/T (dB)	ΔF * (kHz)
Q225D1XL	25	19519	19.69	32.67	18.99	17.97	20.6	21.0	213.2	-3.62	2,600

*** ΔF given for SWR=1.5 (from 143.500 to 146.100 MHz)**

Performance Data (losses included)

Element material	G (dBi)	Temp (K)	G/T (dB)
Aluminum rods	19.56	215.3	-3.77

Dimensions:

	Ref	De	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11
Pos	0	275	480	862	1489	2189	2973	3805	4678	5597	6528	7455	8387
Length	786	734	708	691	673	659	645	633	625	611	609	605	597
	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23	
Pos	9318	10271	11205	12175	13135	14065	15065	15975	16895	17855	18745	19519	
Length	594	588	578	576	564	564	562	562	560	560	558	558	

Note: - All elements made of Al rods Ø 5 mm; height of all rectangles is 320 mm; All dimensions in mm

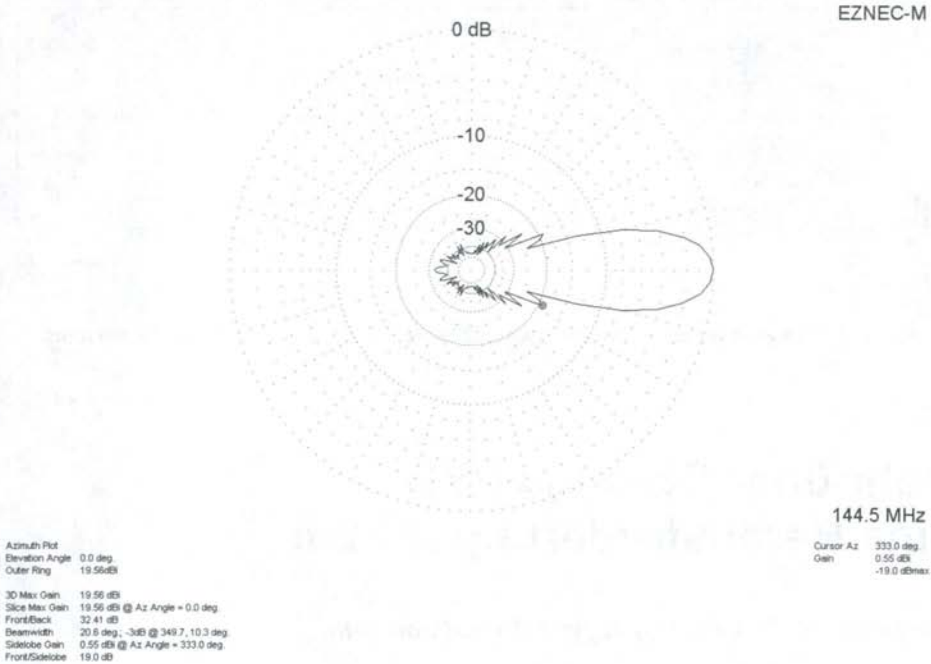
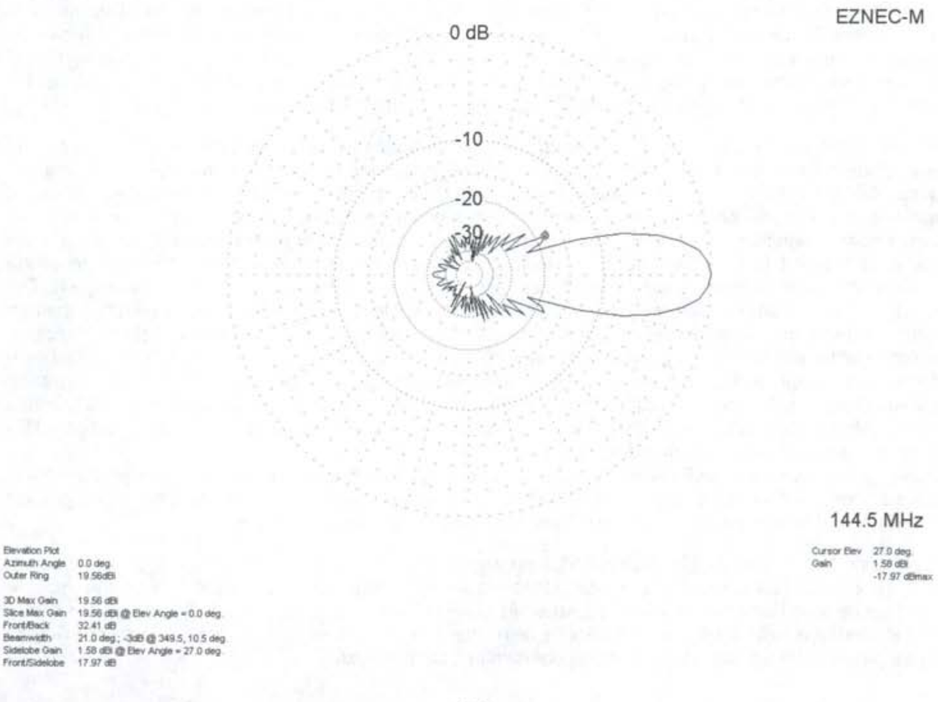


Fig. 1: 25 element Oblong for 2m – horizontal plane (top) and vertical plane (bottom)
(EZNEC simulation - losses not included)



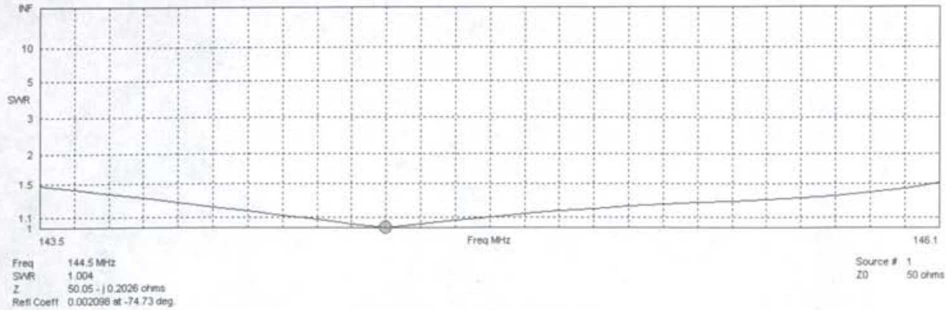


Fig. 2: SWR sweep for the 25 ele 2m oblong antenna (EZNEC simulation, losses included)

Mehr über Oblongs (IV) – Eine Herausforderung für 2m

von Slobodan Bukvic, YU7XL, yu7xl@nadlanu.com

Es ist bekannt, dass eine 2- oder 3-Element Quad mehr Gewinn als eine 2- oder 3-Element Yagi hat. Mit zunehmender Boomlänge und Zahl von Elementen wird der Unterschied immer geringer. Das hat sich auch in meiner Praxis bestätigt, aber nur bis zu einer Boomlänge von etwa 5 Lambda kann man dies im Vergleich zwischen meinen Oblongs und den Yagis von YU7EF sehen. Bei kürzeren Boomlängen sind die Oblongs viel besser als Yagis. Dann ist der Unterschied zwischen meiner 14-Ele-Oblong und der EF 14-Ele-Yagi mit gleicher Boomlänge gering. Die Oblong ist immer noch besser, aber nicht viel.

Nun kommt die große Überraschung: Wenn man die Boomlänge weiter vergrößert, über 5 Lambda hinaus, ändern sich die Dinge dramatisch. Es scheint, dass der Wellenleitereffekt hier wirkt und die längeren Oblong-Antennen werden besser und besser. Jeder zusätzliche Direktor hat nahezu dieselbe Länge wie der vorige und liefert mehr zusätzlichen Gewinn, ohne das Vor-Rückverhältnis und Vor-Seitenverhältnis signifikant zu beeinflussen. Schade, dass es ziemlich schwierig ist, auf 2m eine 5 oder 10 Lambda-Antenne (oder sogar mehr) zu realisieren. Man kann es aber versuchen! Ich kenne einige EME-OPs, die eine einzelne ganz lange Antenne für EME benutzen, die 17 oder 18m lang ist. Der Antennengewinn für solche Längen liegt bei 18 bis 20 dBi, was leicht mit 4 gestockten kürzeren Antennen erreicht werden kann. Aber, wenn man stockt, muss man zusätzliche Verluste in den Teilern, Steckern und Koppelleitungen berücksichtigen und letzlich wird das Diagramm auch schlechter. Wenn man eine einzelne ganz lange Antenne benutzt, bleiben alle Leistungseigenschaften erhalten. Diese Tatsache macht die Oblong sehr interessant für 70cm und 23cm, wo Boomlängen von 10, oder sogar 20 Lambda ziemlich gebräuchlich sind. Deshalb kann ich feststellen, dass die Quad (Oblong) eine wahre UHF-Antenne ist, die viel besser als eine Yagi ist.
Die Oblong hat stets eine größere Bandbreite als eine Yagi. Vergrößert man die Boomlänge einer Yagi, wird die Bandbreiter geringer. Wenn man die Oblong verlängert, wird die Bandbreite größer und größer! Der Gewinn wird höher und höher und die Rauschtemperatur kleine rund kleiner!

Hier stelle ich jetzt meine größte Herausforderung für den tapferen VHF-Enthusiaten vor: Die 25-Element Oblong für 2m, die fast 20m lang ist. Vielleicht gibt es einen Amateur, der sie nachbaut. Wenn ja, möchte ich (wir) gerne eine Rückmeldung, wie die Antenne wirklich funktioniert. Auf jeden Fall sollte dieser Artikel auch für alle allgemein interessant gewesen sein, nur um einmal zu zeigen, was bei extrem langen Oblongs passiert. Daten der Antenne, siehe oben im englischen Text.

5.5 Watt Power Amplifier for 24 GHz

by Philipp Prinz, DL2AM – prinz.DL2AM@t-online.de

In DUBUS issue 4/2007 I described a power amplifier for 24 GHz. TriQuint also offer another amplifier chip with the part number TGA4915EPU-CP. According to the data sheet it is rated from 25 to 31 GHz. This did not prevent me trying it on 24.048 GHz. This chip has a good price-performance ratio compared with 10 GHz power FETs. However ordering these high-tech devices in DL sometimes causes problems as they are also used for military applications.

The first tests were successful. Now I want to write about the necessary work to be done for constructing this PA. I want to refer again to the above mentioned article. The housing should be made from copper. One should use only new cutting tools and drills when working on this housing. When tapping the threads the tap should be reversed completely after each new turn.

The TGA chip (size 13.36 x 16.52mm) is placed crosswise, see the figure. For the voltage regulator a LT1084 (TO220) can be used or if there is enough space a LT1083CP is also ok. The RF and DC PCBs are the same as in the article mentioned above. For the DC supply see this article also. One has to undertake the same tests as described there. The RF PCB has to be glued with silver conductive glue. For the jacks only SMA microstrip types should be used.

Now the parts can be inserted and soldered to the RF PCB. The difficult work are the connections from the 50 Ohm input and output lines to the chip. Small strips are cut from a piece of silvered copper foil and carefully soldered with the help of a magnifying glass of at least 4 dioptres.

The RF input and output of the chip are high resistance. Thus it is easy to checkl if there is any short circuits after the work is finished. In addition, two wire links have to be inserted from pin 2 to pin 8 and from pins 3 – 4 to 6 – 7. Small ferrite beads have to be threaded over these two wires. The links from the RF PCB to the chip can be made with tin-solder if the gaps are small. Now the small SMD capacitors and the two resistors should be inserted.
Now follows the most interesting part for the GHz amateur. One should check again carefully with the magnifier that there are no blobs of solder and no unwanted bridges. When applying voltage there should be no idling current from 9 to 12 V. When there is about -0.7V at pin 2 of the chip, about 3.5 A idling current is drawn. The DC power supply should be adjusted to current limit at about 6 A. When driving with 10 mW input at 24.048 GHz, 2 W RF should be already measurable at the output.

I immediately discovered that this PA is more docile than the TGA4905 chip because adding tuning flags did not cause such large current jumps. This is because this chip has a higher placed input and output matching than the TGA4905. Just one small tuning flag at the 50 ohm input line is necessary here. Inserting more flags at other spots did not bring any further improvement. The amplifier is thermally very stable. The maximum output power was 5.5 Watt at 6.2 Amp. Changing the SMA jacks to WG may result in more output as the SMA jacks have already quite some loss on 24 GHz. I have discovered that the low drop regulator LT1084 (TO220) runs into current limiting at about 6.3 A. Thus, due to the falling voltage there is additional protection. On the inner side of the cover a piece of conductive foam is necessary. I have built three of these amplifiers now and there were no differences worth mentioning between them. The complete datasheet is on the web at www.triquint.com for download.

I want to thank Henry, KT1J and Werner, DK5TZ for their help.

Literature

Prinz, Philipp, DL2AM: 24 GHz PA with 3 Watt Output, DUBUS (Vol. 36) 4/2007, p. 66-70

Sources

Housing: Hubert Krause, www.micro-mechanik.de
PCB and parts: www.dl2am.de

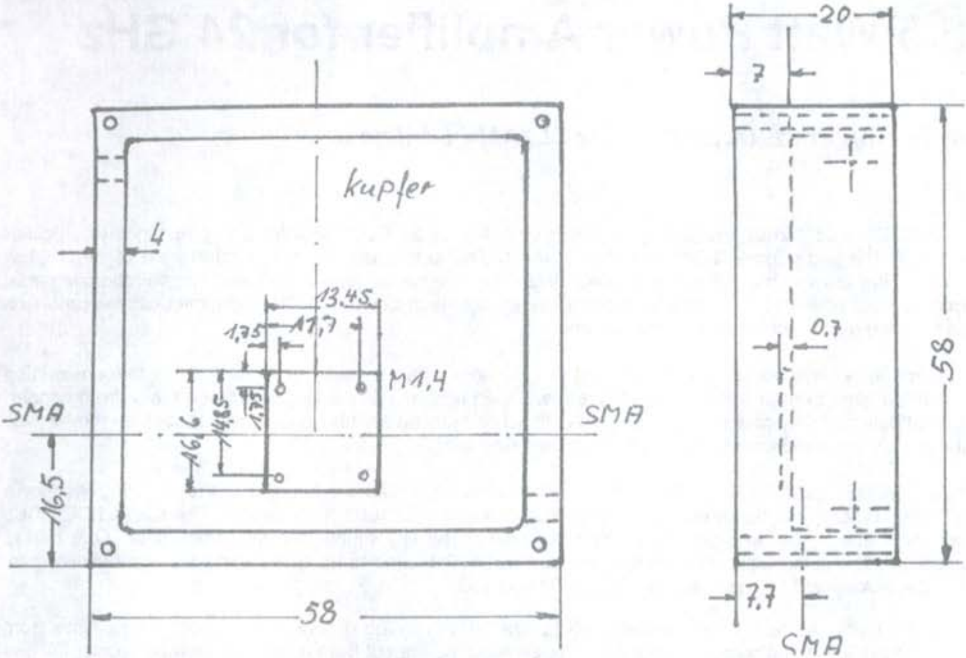


Fig. 1: Mechanical dimensions of the copper housing

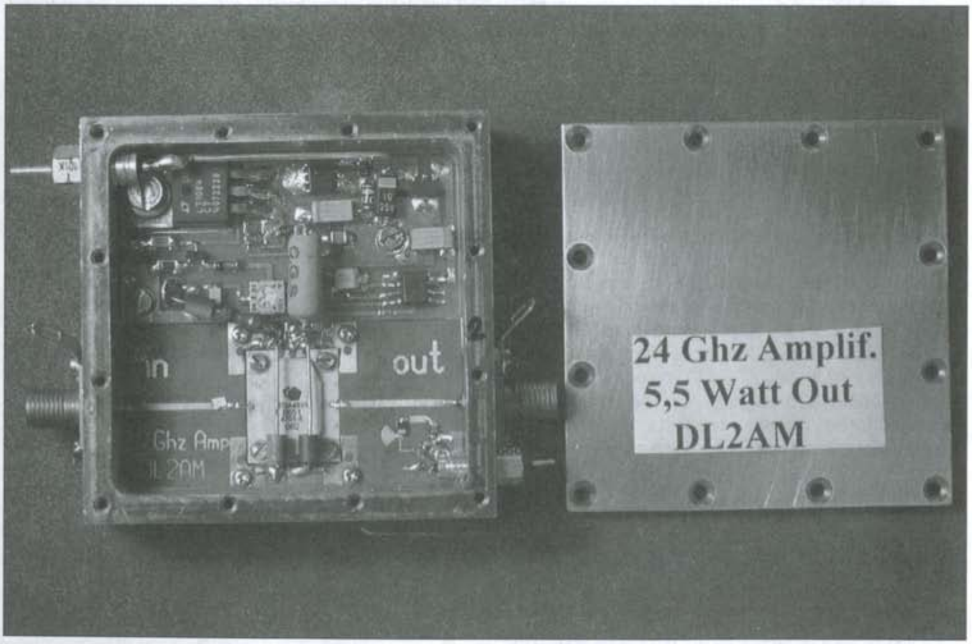


Fig. 2: Complete PA with cover

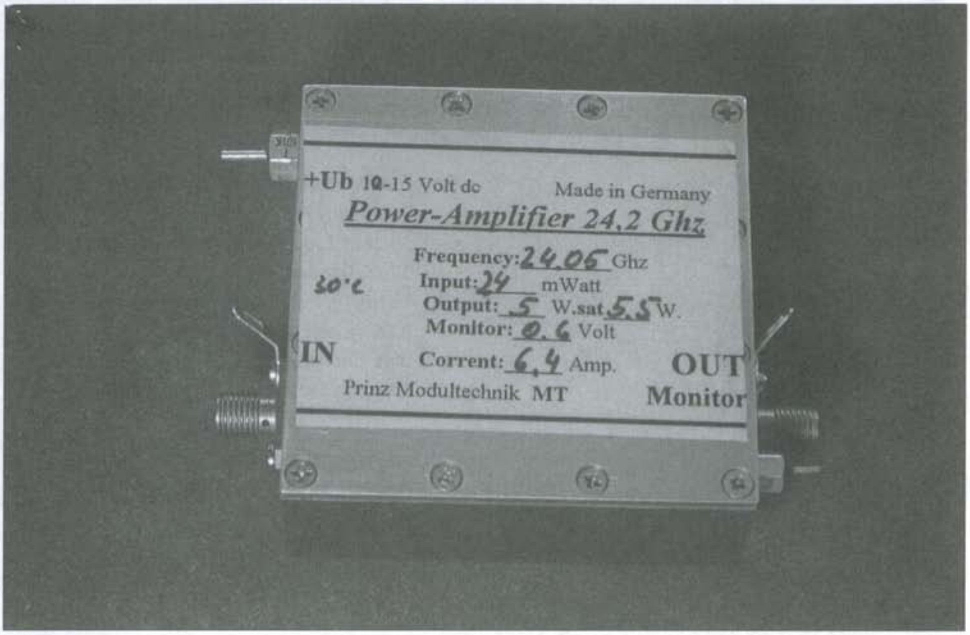


Fig. 3: 24 GHz 5 W PA

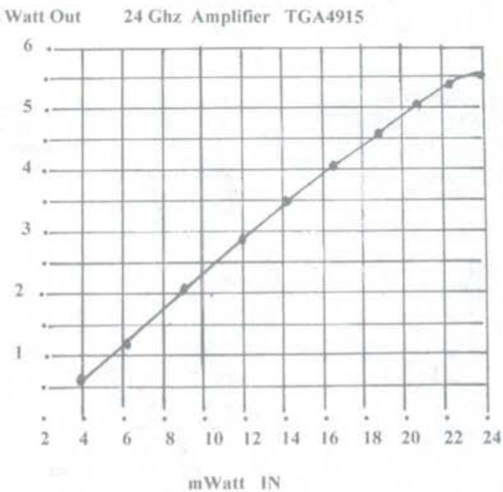


Fig. 4: Input vs output power

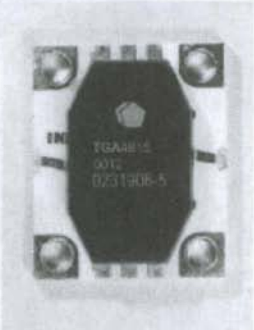
See cover picture of this issue for a full color close view into this PA!

TriQuint SEMICONDUCTOR®

Advance Product Information

June 30, 2004

7 W Ka Band Packaged Power Amplifier — TGA4915-EPU-CP



Key Features and Performance

- Frequency Range: 26 - 31 GHz
- 38 dBm Typical Psat @ Pin =21 dBm
- 22 dB Nominal Gain
- 15 dB Typical Return Loss
- 0.25µm pHEMT Technology
- Bias Conditions: Vd = 6V, Idq = 4.2 A
- Package Dimensions: 0.526 x 0.650 x 0.073 ir

Primary Applications

- Satellite Ground Terminals
- Point to Point

Product Description

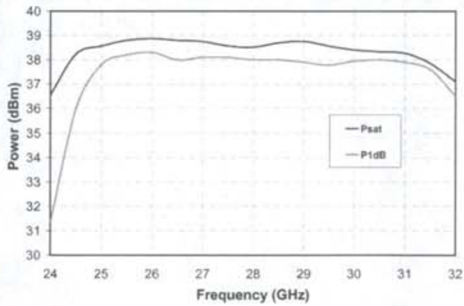
The TriQuint TGA4915-EPU-CP is a compact 7 Watt High Power Amplifier for Ka band applications. The part is designed using TriQuint's proven standard 0.25 um gate Power pHEMT production process.

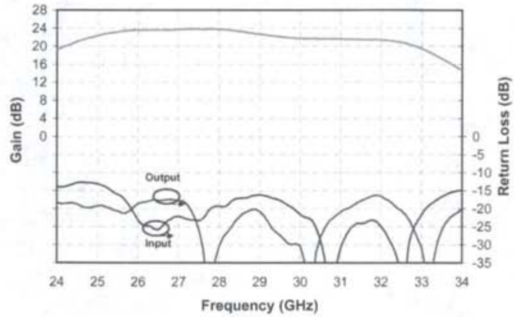
The TGA4915 provides a nominal 38 dBm of output power at an input power level of 21 dBm with a small signal gain of 22 dB.

The part is ideally suited for low cost emerging markets such as base station transmitters for satellite ground terminals and point to point radio.

Preliminary Measured Performance

Bias Conditions: Vd=6 V Idq=4.2 A





Note: Devices designated as EPU are typically early in their characterization process prior to finalizing all electrical and process specifications. Specifications are subject to change without notice.

Fig. 5: Datasheet TGA4915

5.5 Watt PA für 24 GHz

von Philipp Prinz, DL2AM - prinz.DL2AM@t-online.de

Im Dubus-Heft 4/07, Seite 66 bis 70, habe ich eine PA für 24 GHz beschrieben. Von TriQuint gibt es nun auch noch einen Verstärker mit der Bezeichnung TGA4915EPU-CP. Dieser hat laut Datenblatt einen Frequenzbereich von 25 bis 31 GHz. Dies hat mich nicht abgehalten, einen Versuch mit diesem auf 24,048 GHz zu machen. Dieser gehäuste Chip hat ein gutes Preis-Leistungsverhältnis im Vergleich zu 10 GHz Power-Fets. Wenn diese Hightech-Bauteile in DL bestellt werden gibt es aber immer wieder Probleme mit dem Beschaffen. Das Problem ist, dass diese auch für nichtfriedliche Zwecke verwendet werden können.

Die ersten Tests verliefen gleich erfolgreich. Nun nachstehend die notwendigen Arbeiten für diesen Verstärker. Ich möchte nochmals auf die zuerst genannte Veröffentlichung hinweisen. Das Gehäuse, denke ich, sollte aus Kupfer angefertigt werden. Zum Bearbeiten dieses Kupfer-Gehäuses sollten nur neue Schneid-Werkzeuge Verwendung finden. Wenn z.B. beim Gewindeschneiden der G-Bohrer eine Umdrehung reingedreht wird, sollte dieser komplett wieder zurückgedreht werden.

Der TGA ist quer platziert mit der Größe 13,36 x 16,51 mm, siehe Zeichnung. Als Spannungsregler kann der LT1084 – TO220 verwendet werden, wenn genügend Platz da ist, auch der LT1083CP. Die HF- und DC-PCB ist die gleiche wie in der vorherigen Veröffentlichung. Bei der DC-Versorgung weise ich auch auf die oben genannte Veröffentlichung hin. Es sind hier die gleichen Tests zu machen. Die HF-PCB ist mit Silberleitkleber einzukleben. Es sollten nur SMA-Microstrip Buchsen Verwendung finden.

Es kann jetzt die HF-Platine bestückt werden. Die schwierigere Arbeit ist die Verbindung herzustellen von den 50 Ohm Ein- und Ausgangsleitungen zum gehäusten Chip. Es werden kleine Streifen aus einer versilberten Kupfer-Folie geschnitten und sehr vorsichtig eingelötet unter Verwendung einer Kopf-Lupe mit minimal 4 Dioptrien.

Der HF-Aus- und Eingang des Chip ist hochohmig und somit ist es leicht zu kontrollieren, ob ein Kurzschluß durch diese Arbeiten entstanden ist. Es sind noch zwei Brücken zwischen 2 und 8 und 3 - 4 zu 6 - 7 zu machen und eine kleine Ferritperle ist auf diese zwei Drähte zu schieben. Die Brücken von der HF-PCB zum Chip können mit Zinn realisiert werden, wenn die Abstände klein sind. Es fehlen jetzt noch die kleinen SMD-Kondensatoren und die beiden Widerstände.

Jetzt kommt für den GHz-Amateur der interessantere Teil. Es ist nochmals genau mit der Lupe zu prüfen, ob keine Zinnreste oder Brücken vorhanden sind. Beim Spannunganlegen darf von 9 bis 12 Volt kein Ruhestrom fließen. Wenn ca. -0,7 Volt an Pin 2 vom Chip ansteht, werden ca. 3,5 Amp. (Idle) erreicht. Das DC-Netzteil ist mit einer Strombegrenzung von ca. 6 Amp. einzustellen. Wenn ich 10 mWatt Input bei 24,048 GHz einspeise, ist am Ausgang schon 2 Watt HF messbar.

Gleich habe ich festgestellt, dass dieser Verstärker sich gutmütiger verhält als der Chip TGA4905, da durch Anbringen der Fähnchen sich der Strom nicht so ruckartig verändert. Dies beruht darauf, dass bei diesem Chip die Ein- und Ausgangsanpassung doch wesentlich höher liegt, als beim TGA4905. Es ist nur ein kleines Fähnchen an der 50 Ohm-Leitung am Input notwendig. An anderen Stellen Fähnchen anzubringen hat nichts mehr gebracht. Thermisch ist der Verstärker sehr stabil. Ich nehme an, dass, wenn anstatt der SMA-Buchsen eine Hohlleiter Ein- und Auskopplung angewendet wird, mit einer Leistungserhöhung zu rechnen ist, da die SMA-Buchsen doch ganz schöne Verluste bringen bei dieser hohen Freqeuenz.

Die maximale Ausgangsleistung war nicht höher als 5,5 Watt bei einem Ausgangsstrom von 6,2 Amp. Ich habe dabei festgestellt, dass der Low-Drop-Regler LT1084 (TO220) bei ca. 6,3 Amp. Belastung in die Begrenzung geht. Somit ist durch die abfallende Spannung ein zusätzlicher Schutz vorhanden. An der Innenseite des Deckels vom Gehäuse ist ein kleines Stück Leitgummi notwendig. Von diesem Verstärker habe ich drei Stück aufgebaut und es waren nur unwesentliche Unterschiede feststellbar. Die Datenblätter von Triquent können unter www.Triquent.com heruntergeladen werden.

Bedanken möchte ich mich bei Henry, KT1J, und Werner, DK5TZ, für die Hilfe.

Literatur und Referenzen siehe englischer Text.

Conical Horn Antenna for 47 GHz

by Wolfgang Demmer, DD8BD - dd8bd@gmx.net

As I planned to build a simple 47 GHz converter for some experiments, I needed milled Aluminium housings and also one or two horn antennas. For experiments on 24 GHz I have previously successfully used dipoles made from UT-141 coaxial cable. But this would not be practical for 47 GHz. John, PA7JB recommended I ask Bert, PE1RKI about the mechanical construction of a horn antenna. Bert immediately agreed to build it and after some discussion we came to the dimensions of the horn presented here.See figure 1. This horn contains a circular waveguide with a circular flange. One can connect circular and rectangular waveguides to this flange. Also holes for the guide pins are supplied which are used with WG22/WR28/R320 (26.5 – 40GHz) and WG24/WR19/R500 (40 – 60GHz).

For the piece of waveguide in this horn I chose a diameter of 4.5 mm, but also 4.0mm and 4.8mm should be usable.

4mm	→ COF (Cut-Off-Frequencies)	= 43.85 – 57.25 GHz
4.5mm	→ COF	= 38.9 - 51 GHz
4.8mm	→ COF	= 36.5 - 47.7 GHz

For the exact mechanical dimensions see figure 2.

The calculated gain is of this horn is about 20.8 dBi. For the calculations the programs HDL-ANT and PCAAD were used.

In the meantime my 47 GHz converter (mixer head with external IF amplifier and DMC oscillator) was ready and I observed about 20 dB gain from the horn (by inserting attenuators). Ready-made horns are available from PE1RKI on request.

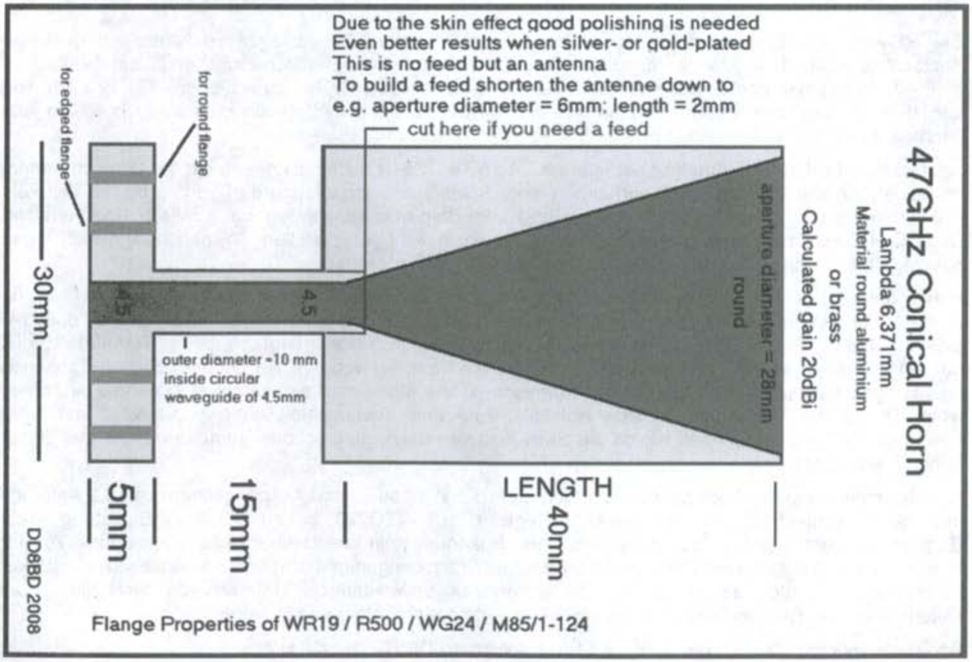


Fig. 1 47 GHz Horn Antenna

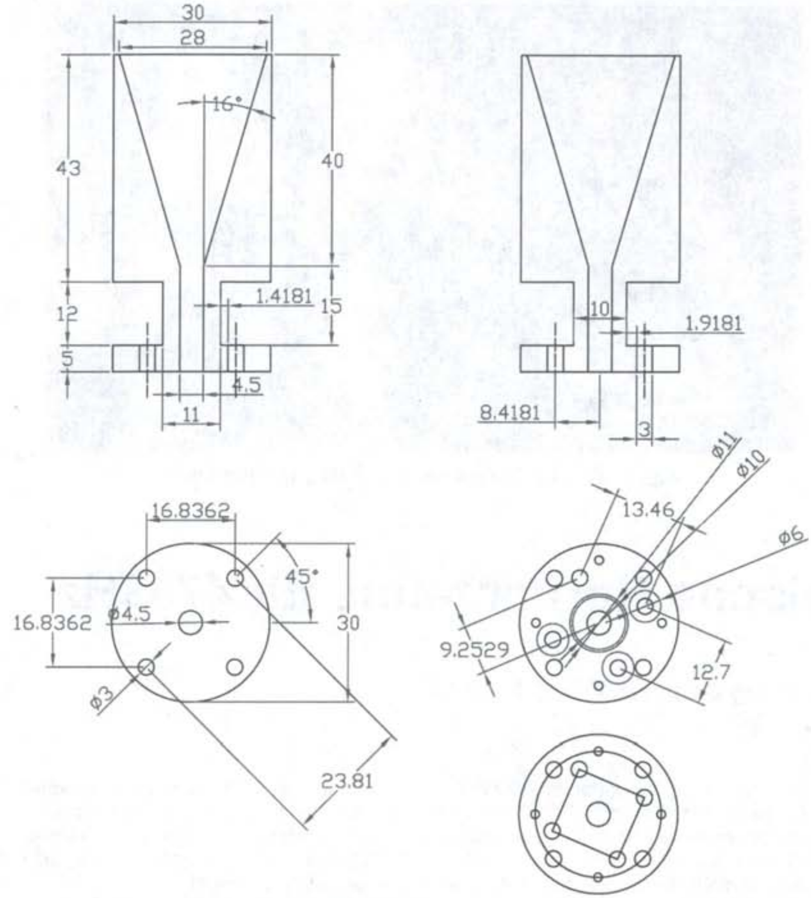


Fig. 2 47 GHz Horn Antenna - dimensions

Fig. 3 47 GHz Horn Antenna

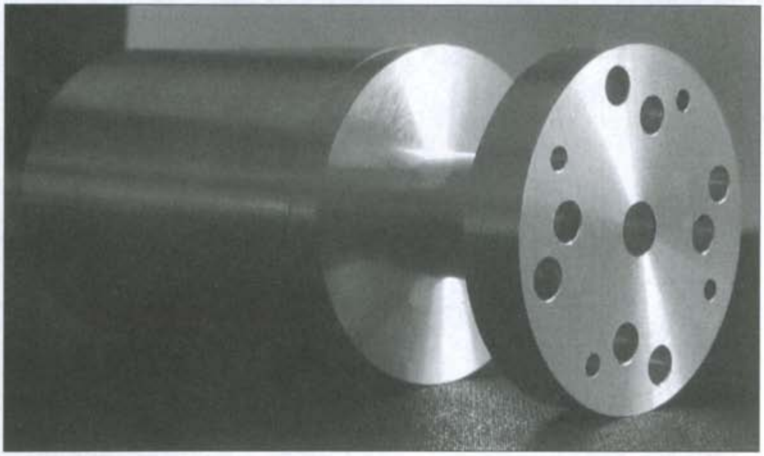


Fig. 4 47 GHz Horn Antenna – view to the flange

Konische Hornantenne für 47 GHz

von Wolfgang Demmer, DD8BD - dd8bd@gmx.net

Für mein Projekt, einen Konverter für 47,088GHz aufzubauen, sah ich neben der Beschaffung von gefrästen Alu-Gehäusen (Bert, PE1RKI fragen) die Notwendigkeit, auch ein oder zwei Horn-Antennen zu entwickeln, wobei es fraglich war, ob ich die mechanische Verwirklichung selbst schaffen könnte.
Für 24GHz hatte ich erfolgreich Testantennen für einen Konverter wie auch eine Testbake als Dipole an UT-141 Koax gebastelt, dies schien mir aber für 47GHz nicht mehr praktikabel.
Auf eine Anfrage hin bei John, PA7JB, erhielt ich den Tipp, einmal bei Bert Modderman, PE1RKI, anzufragen. Bert war sofort bereit, mir zu helfen und es entwickelte sich ein heftiger Mailverkehr zu technischen Details, die meine Bewunderung für Berts Präzision und auch Ausdauer mit mir hervorriefen.
So entstand ein Entwurf, der ein Conical Horn mit rundem Hohlleiter und rundem Flansch beschreibt , wobei an den Flansch sowohl runde wie auch eckige Hohlleiter angeschlossen werden können (auch Löcher für die sogenannten guide-pins sind vorhanden) , die zu den Hohlleitertypen WG22/WR28/R320 (26,5 - 40GHz) und WG24/WR19/R500 (40 – 60GHz) gehören.
Für das Stückchen Rundhohlleiter in dieser Hornantenne wählte ich einen Durchmesser von 4,5mm, aber auch Durchmesser von 4mm oder 4,8mm würden einen funktionstüchtigen Rundhohlleiter ergeben:

4mm	→ COF (Cut-Off-Frequencies)	= 43,85 – 57,25 GHz
4,5mm	→ COF	= 38,9 - 51 GHz
4,8mm	→ COF	= 36,5 - 47,7 GHz

Der mit HDL-ANT und PCAAD errechnete Antennengewinn könnte bei 20,8 dBi liegen.
Ich möchte mich an dieser Stelle ganz herzlich bei John und Bert für ihre Unterstützung bedanken!
Oben im engl. Text die hervorragende technische Zeichnung von Bert (Abb. 2) und mein Entwurf (Abb.1).

Nach endlich gelungener Fertigstellung eines 47GHz-Konverters (Mischkopf mit externer ZF-Verstärkung und DMC-Osczillator) konnte ich mit meinen amateurmäßigen Mitteln einen Antennengewinn des Horns von mehr als 20dB feststellen, indem ich das Horn vom Mischkopf entfernte und durch Dämpfungsglieder die Differenz im Signalpegel zwischen Horn und offener 4,5mm-Bohrung als Rundhohlleiter im Mischkopf ermittelte.
Das Horn kann von PE1RKI auf Anfrage fertig bezogen werden.

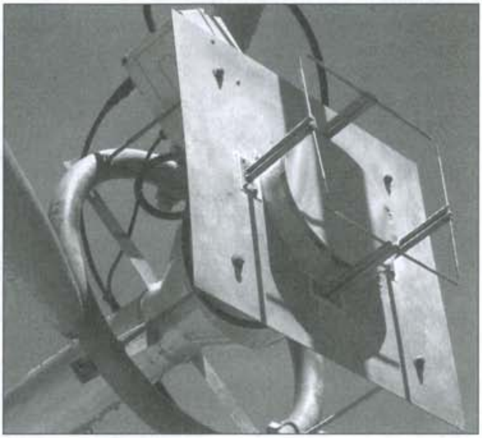
The Case of the extra Sky Noise

by Doug McArthur, VK3UM

I had not been down to the EME Shack for several weeks and thought it timely to check that the Wombats and other nasties had not taken over. At the same time checking out the operational status of the equipment was probably a good thing as well.

I turned things on and all looked normal but when I checked "Cold Sky" to termination on 23cm I observed the noise went down about 1 dB! I store the dish at the 90° "bird bath" position. It should have risen by ~6.5dB depending where the dish was pointing. We in the Southern Hemisphere see the Milky Way for prolong periods and at first I thought I may have been looking at Sagittarius. When I started to lower the dish the "Sky Noise" remained constant which immediately rang alarm bells!

Whilst tracking to the Sun (at ~ 35° elevation) I noticed at about 45 degrees the "Sky Noise" began to decrease and at about 40° I was seeing ~ 5.0dB Sky to termination. This was still about 1.5dB less that normal. I then checked the Sun noise (sfu of 61), I should see ~ 19.5dB on 23cm and 17.5 on 70cm. Well 70cm was spot on but 23cm was ~1.5dB low. (refer VK3UM EME Performance and Receiver Calculator)



The Moon was at about 20° at the time so the next step was to check Moon Noise and echo's. I was surprised to measure ~0.6 dB of Moon Noise and my echo's seemed pretty normal without actually measuring them . The Moon was on the edge of the Milky Way with about 15°K of background Noise (400 MHz) whilst the Sun was very close to Aquarius and that situation certainly did not account for the difference I was seeing. I had a quick QSO with SP6JLW with 56n/57n reports and all seemed normal in that regard.

I now had a situation of poor Sun Noise, increased 'Sky Noise' with elevations from 40° upwards independent of Azimuth, a Cold Sky to termination about 1.5db below normal at elevations below 40°, and seemingly normal Moon Noise and echo's. In addition when I stopped the dish at elevations above 45° I heard a strange varying white noise fluctuating rapidly (about 1.5dB) and then dying away after a few seconds. This "interference" seemed to occur each time I stopped the dish but was not evident from about 60° upwards. 70cm was totally normal.

So what was causing it Watson? I tipped the dish over where I have perfect access from the dish platform and began a close inspection. No water in the preamp enclosure, none visible inside the horn. (I can remove the rear end of the IMU due to its 'biscuit tin' type construction). The PTF shroud at the opening of the horn looked clean as best I could ascertain. then removed the SMA isolation relay and placed the LNA direct onto the probe. No change, the mystery noise still appeared from 40° upwards. I then changed the LNA. Still no change.

I then turned off every appliance at "Tikaluna" (and that extends the boundary of any possible interference to more than 2 kms!) apart from my 23cm receive system and elevation control. Still no change. Nothing was generating this "noise" in the EME Shack, House and sheds!Now the situation was getting a little eerie. Was I getting interference from an external source that I could not peak in azimuth ? .. not likely. And what was this strange noise that occurred when I stopped the dish? (elevation) It did not sound like Radar or anything else I could recall but it sort of reminded me of a weak signal subjected to Aircraft flutter fast at the beginning and then quickly decaying.

To summarize so far. It was not the isolation relay, the preamp, the feed probe, nor any water in the dish that I could see. It was not the speed controller in the azimuth drive (85A @ 24v!) nor the hydraulics and controllers. Neither was it the digital indicators, the computer control system, the 70cm preamp taking off or the solid state HPPA on the other IMU port. It certainly was not Stellar noise either.

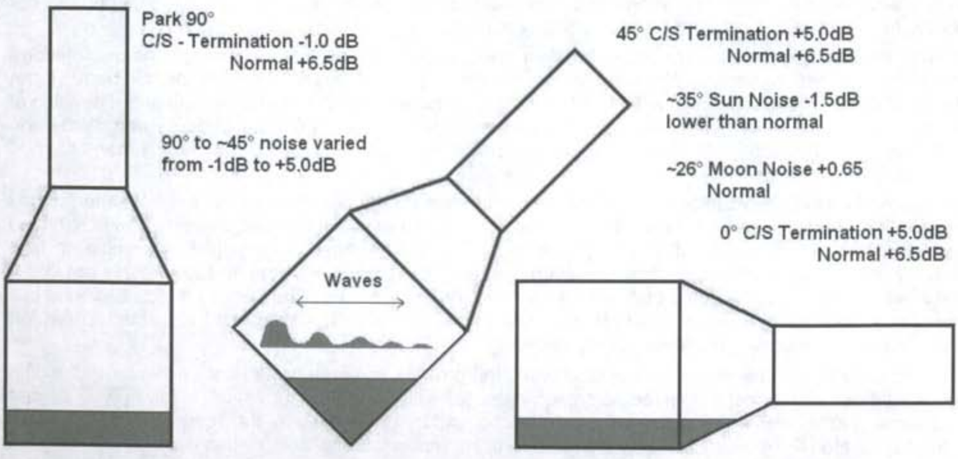
It simply had to be the shroud on the horn or water in the horn. But none was visible! I was reluctant to remove it at first as it is a 'devil' to get back on and I only replaced this PTFE cover when a flock of swallows were taking more than a passing interest by flying in and out of it last Spring. The bevy of little ladders (phasing stubs) must have looked most enticing as a condominium building site! nyway I positioned myself below the feed and undid the retaining hose clamp and slid the shroud off. Whoosh! I was drenched, by what seemed at the time, like a fire hose! Dam near came off the platform and dropped the battery drill in the process. "Golly Gosh Douglas" I was heard to say some 2kms distance, "that should not be"!

Obvious dear Watson! I could not see the water from the end of the IMU due to its taper. The seal was too good at the bottom of the shroud to see any moisture or drips when it was horizontal. The shroud extended some 35mm up the IMU and the rain, in the vertical storage position, had leaked into the IMU. I must have had > 20mm of water in the feed! The inside was coated with green "gunk" which also was not that evident from the other end of the IMU.

Now to conclude! Firstly I will skip all your thoughts that that was the "bleeding obvious" from the start, and resolve the technical issues. We all have a 20/20 vision on hind sight! A 8.6 meter dish with a f/d of 0.43, an edge taper of 15dB, with ~20cm of water in the end of an IMU horn, plus green "gunk", will degrade the system noise by ~7.5dB. Green "gunk" on its own appeared to degrade the system by ~0.5 dB. At half the aperture (45° elevation) half water plus green "gunk" was equivalent to ~5.0dB. And finally the slop in the water when stopping the dish (dead in my case with the hydraulics) will cause the system noise to vary ~1.5dB in an inverse time / elevation angle relationship lasting for a variable period depending on water depth and elevation angle and kinetic energy imparted to the water.

I am sure the mathematicians out there, who have time on their hands, can commit it to a formulae for Wn (Water noise)! It took me a day to prove it and surprise, surprise, all measurements then returned to normal without the water cooled IMU feature! n conclusion it does raise the old dilemma of weather proofing. It never works in practice and a small breathing hole is generally the only preferred option. I do use silica gel in the breathing holes of my Digital Indicator boxes. It's a pain to revitalize it in the microwave oven every month or so but has helped over the many years out in the weather.

You will notice in the photo above (that was actually taken during the original installation phase), that the PTFE shroud or cover was originally finished by cutting off the excess PTFE level with the hose clamp and then sealing over the join with Silicon sealant. When I replaced it, as it had a hole along the edge that could let the water in, I did not remove the excess PTFE above the hose clamp nor did I seal it with silicon. Although the seal was perfect around the bottom of the horn when horizontal, the flared PTFE above the clamp acted as a funnel and allowed water to enter where it was not sealed correctly. Hence it did not drip when horizontal nor could water could be seen by looking down the horn. Murphy at his fineness! If I had remained with the old version, with the hole, it would have been a far better solution given it was stored vertical and the water would run out and not in! Again 20/20 vision on hindsight. The answer is simple. Don't try and seal the mouth of the horn just "train" your birds to find a better nesting site? 73 Doug VK3UM



SILICON LABS

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- Industry-standard 5x7 mm package
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See page 24.

Applications

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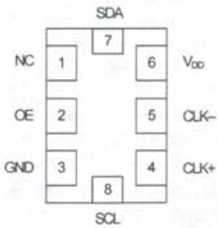
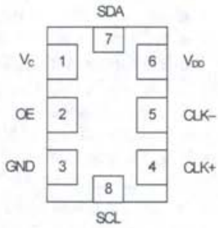
Pin Assignments:
See page 23.

(Top View)



Si570

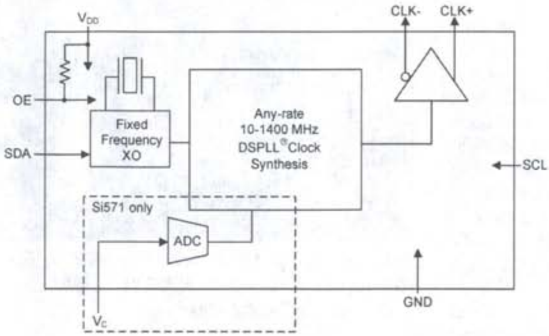


Si571

Description

The Si570 XO/Si571 VCXO utilizes Silicon Laboratories' advanced DSPLL® circuitry to provide a low-jitter clock at any frequency. The Si570/Si571 are user-programmable to any output frequency from 10 to 945 MHz and select frequencies to 1400 MHz with <1 ppb resolution. The device is programmed via an I²C serial interface. Unlike traditional XO/VCXOs where a different crystal is required for each output frequency, the Si57x uses one fixed-frequency crystal and a DSPLL clock synthesis IC to provide any-rate frequency operation. This IC-based approach allows the crystal resonator to provide exceptional frequency stability and reliability. In addition, DSPLL clock synthesis provides superior supply noise rejection, simplifying the task of generating low-jitter clocks in noisy environments typically found in communication systems.

Functional Block Diagram



ATV News

Bernd Beckmann, OE5BDO / DJ9PE
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„Grande Bleue" – Mittelmeertage 2008

Seit Jahren treffen sich im Monat Juni Funkamateure aus den Anliegerstaaten des westlichen Mittelmeeres zum sog. „Grande Bleue". Hier werden über das Meer Verbindungen in den Betriebsarten ATV, DATV und SSB auf Frequenzbereichen ab 1,2 GHz bis 24 GHz abgewickelt. Fast jedes Jahr werden dabei neue Rekorde bei Betriebsarten und Frequenzen aufgestellt. Der „Grande Bleue" 2008 fand dieses Jahr vom 20.-28.6.2008 mit Schwerpunkt am Wochenende 21.-22.6.2008 statt. Hier ein Bericht des Schweizer Teams:

Das Helvetische Team für den „Grande Bleue" 2008 setzte sich aus HB9ADJ/Charly, HB9AZN/Pierre-André und Paul/HB9RXV mit XYL Anouchka zusammen. Während einer knappen Woche (19. - 25. Juni 2008) wurde mit zwei Fahrzeugen von Sardinien aus rund um das westliche Mittelmeer Funkbetrieb gemacht. Die mitgeführten Ausrüstungen erlaubten uns ATV, DATV und teilweise auch SSB-Betrieb auf 23cm, 13cm, 6cm, 3cm und 24GHz. Die Anreise und die Überfahrt während der Nacht von Genua nach Porto Torres im Norden von Sardinien verlief ohne Zwischenfall, mit Ausnahme der endlosen Diskussionen mit den Angestellten der Schiffsgesellschaft im Hafen von Genua; dies wegen der Höhe der Antennen auf dem Dach der beiden Fahrzeuge. Nach unserer Ankunft am Freitag 20. Juni 2008 und nach Bezug der Unterkunft, waren wir bereits am Nachmittag auf einem Hügel an der Küste zirka 50 m über Meer qrv. Der Standort in der Nähe von Stintino an der Nord-West-Spitze der Insel hatte den Locator JN40CT. Von diesem Standort erreichten wir zahlreiche Stationen aus Spanien, Frankreich und Korsika in ATV, DATV und SSB.

Um Verbindung mit unseren Freunden aus Malta, Süd-Italien und Sizilien aufzunehmen, fuhren wir am Sonntagvormittag in Richtung Süden, Der Standort (JM49SD) befand sich in der Nähe von Villasimius auf einem Parkplatz etwa 100 Meter über Meer mit einem wunderschönen Blick auf die Strände (weisser Sand und türkisfarbenes Wasser). Gegen Mittag traf Sergio IS0AWZ aus Cagliari ein, der uns in überraschender Weise mit einem perfekten Französisch begrüsste (er war lange Zeit in Frankreich beruflich tätig). Nach einem ersten QSO mit IK0HWJ konnten wir das Team aus Malta auf 23cm (ATV/DATV), 13cm (ATV/DATV) und 3cm (SSB/ATV/DATV) erreichen. Die Ausbreitungsbedingungen auf 3cm waren hervorragend und erlaubten uns bis zum Abbruch am Abend dieses Band als Dienstkanal in SSB zu benutzen. Bereits im Jahr 2006 hatten wir die Ehre, das Team aus Malta in ATV und DATV kennen zu lernen (564 km in DATV). Dieses Mal war es wieder ein Erlebnis in SSB, ATV und DATV zu experimentieren. Das Team dort ist sehr motiviert und scheut keinen Aufwand, was die technische Ausstattung betrifft. Extra für uns wurde eine Art „Field Day" organisiert. Wir konnten unter anderem mit folgenden Stationen Kontakt aufnehmen: 9H1VW, 9H1EV, 9H1GB, 9H1FX, 9H1PI. Einen herzlichen Dank an Fortunato, 9H1ES und Joe, 9H1VW, welche auf Malta die Organisation übernommen haben. Als Abschluss unserer Expedition im Süden durften wir am Sonntagabend mit Sergio, IS0AWZ und seiner XYL die italienische Gastronomie und Gastfreundschaft bei einem gemütlichen Nachtessen geniessen. Da die italienische Fußballmannschaft bei der Europameisterschaft 2008 bereits ausgeschieden war, konnten wir auch eine ruhige Nacht in Villasimius verbringen. Am Montagmorgen ging es wieder in Richtung Norden zu unserem ursprünglichen Standort zurück. Am Dienstag, 24. Juni war der letzte Tag zum Funken. Es gelangen uns noch sehr interessante Verbindungen, wie ein ATV-QSO über 300 km mit F/HB9IIA auf 10 GHz (300 mW und „IKEA" Spiegel). Vor dem Abbau der Anlage erzielten wir noch einen **neuen Rekord mit F6DPH (Tour Batère/JN12HM) in ATV auf 5,7 GHz (508 km).**

Da wir mit zwei Fahrzeugen und doppelter Tx/Rx-Ausrüstung auf 23cm, 13cm, 6cm und drei 10 GHz Stationen vor Ort waren, konnten wir nicht nur die Wahrscheinlichkeit für ein QSO erhöhen, sondern auch noch sehr interessante Vergleiche betreffend Empfindlichkeit, Richtwirkung der Antennen, Sendeleistung, usw. machen. Diese Aufstellung und Zusammenarbeit hat sich bewährt und wir sind bereits daran die Schwachstellen für nächstes Jahr zu beseitigen.

Zusammenfassend blicken wir auf eine erfolgreiche Teilnahme am „Grande Bleue" 2008 zurück und bedanken uns bei allen die mitgemacht haben, insbesondere bei folgenden OMs: EA3XU, F6FPH mit F8BTP, F1HBV, F4CRT, F5AD, F5KUG, TK/F5BUU mit F1AAM, F/HB9IIA, F6HTJ, F1DMG, F5NVP, F5HBI, F6GUN und F3YX. Wir hoffen niemanden vergessen zu haben!

Möge diese kurze Berichterstattung andere OM motivieren, nächstes Jahr auch mitzumachen – das Mittelmeer bietet noch viele interessante Möglichkeiten für den Funkbetrieb. Packen wir es an! Mehr Einzelheiten und Photos befinden sich auf der SwissATV Webseite: www.swissatv.ch 73's qro von Charly, HB9ADJ, Pierre-André, HB9AZN und Paul, HB9RXV (Info via Bernd Beckmann, DJ9PE, tnx!)

Foto, von links nach rechts: HB9RXV, Paul und Anouchka, XYLv von HB9RXV, HB9AZN, Pierre André und HB9ADJ, Charly

VHF News
Australia & New Zealand

GippsTech Report

GippsTech, the Australian Annual VHF and above Technical Conference was held on 4 and 5 July with around 100 participants. There was an excellent program with the following presentations:

Roger Harrison VK2ZRH:
Solar Cycle 24: prognostications and prospects for VHF/UHF DX

Doug McArthur VK3UM:
Sun Noise and Measurements

Leigh Rainbird VK2KRR:
New features on the VK Logger

Dale Hughes VK1DSH:
DSP with the Atmel AVR processors

Andy Sayers VK2AES:
Versatile PLL Oscillator for microwave applications

David Smith VK3HZ, Peter McEwen VK3SO, Jim Forse VK3II, Rex Moncur VK7MO:
Locking our rigs to GPS references: TS-2000X, FT-847, FT-817, IC-706MkIIG, FT-736, IC-910H

Richard Gipps VK3ZCL:
Crystal IF filters and the practical issues involved with their use

Andy Sayers VK2AES:
Cavity backed feeds for 23, 13 & 9 cm

Bryan Ackerly VK3YNG:
A high performance 2 m downconverter

Barry Miller VK3BJM:
ADS-B virtual radar - an aid to AEP

Rex Moncur, VK7MO, Justin Giles-Clark, VK7TW and Ken Sulman, VK7XDY:
Non-line-of-Sight Optical Propagation

Neil Sandford VK2EI:
3.4 GHz Hardware

Leigh Rainbird VK2KRR:
AREPS - Advanced Refractive Effects Prediction System

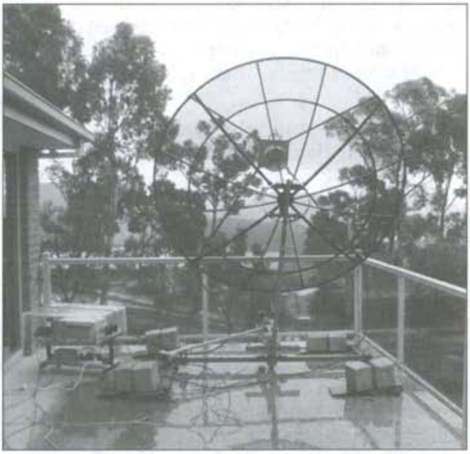
Roger Harrison VK2ZRH:
The Care and Feeding of RF Power Transistors

Details of the presentation on GPS locking of rigs are at: http://home.exetel.com.au/dwsmith/

Following the presentations on GPS locking of Rigs and the use of ADS-B to monitor aircraft positions Rhett VK3VHF has his 2 metre rig locked to GPS and with the use of the ADS-B system to identify aircraft enhancement has been able to copy JT65A on a 564 km path with just 25 milli-watts.

New 13 cm World EME Record

On 26 July 2008 Rex VK7MO assisted by Eric VK7TAS as the dish driver were successful in breaking the 13 cm, 2300 MHz, Earth Moon Earth World distance record twice. Rex was running 120 watts to a 2.3 metre dish. The existing World Record is held by Charlie VK3NX and Peter G3LTF at 16970 km. Eric's job was to keep the 2.3 metre dish antenna, directed at the moon to less than half a degree. A sked had been set up with Howard, G4CCH, and shortly after the moon cleared the trees at Howard's QTH weak digital signals were copied at 25 dB below the noise. At 13 cm or 2300 MHz frequency drift is a major issue and Howard's signals were difficult to copy due to drift of 60 to 80 Hz each transmission. Never-the-less after a few missed decodes a QSO was completed for a new 13 cm EME World record of 17385 km. As the moon cleared the trees in England signals improved to the point that they were audible and a CW QSO was also completed. Peter, G3LTF, at 17491 km then called on CW and the World record was extended a second time in less than half an hour by a further 106 km.



VK7MO 13cm EME station

Microwave Europe

Editor: Simon Lewis, DL4PLM
GM4PLM@hotmail.com

Hello and welcome to another Microwave Europe column. They say that the British have an obsession with talking about the weather and that it is the first subject we discuss when we meet someone, but seeing the weather over the past month or so... well it's not hard to understand why we talk about the weather so much! Indeed, many parts of Europe, particularly in the West, are discovering more about rainscatter this summer, than stable tropo systems! Certainly we seem have to having a run of storms just now here in Germany that shows little sign of changing. Not all parts of Europe are enjoying poor weather. Having just returned from a 4X4 driving and camping expedition in Iceland which, in some parts, is enjoying the hottest weather on record! Go figure! Summer is normally a quiet time for news on the radio front with everyone enjoying their holidays. This period is no exception. I would be grateful for news input from Europe, I am certain there is things happening ... please share them to the normal email address. Thanks. Simon DL4PLM

Satellites carrying microwave radio

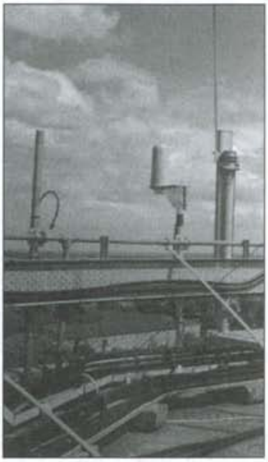
Satellites carrying microwave radio was on the topic of the recent annual AMSAT meeting at the University of Surrey, UK. Videos of the presentations given at this years AMSAT-UK International Space Colloquium are now available on the British Amateur Television Club (BATC) video site. To access the videos go to http://www.batc.tv/ and click on the 'Archive' icon on the left. Select which AMSAT-UK lecture you wish to watch then click the 'Play' (>) icon. Click on the icon between the 'Progress' bar and the 'Volume' bar to get full screen viewing. Lectures 4 and 5 are about the MoonLITE project which will be the first Lunar mission by the United Kingdom. Lectures 6, 7 and 8 are about the Delfi-C3 satellite Lecture 9 is the P3-E satellite presentation given by AMSAT-DL President Peter Guelzow DB2OS, see also "Get into Orbit with AMSAT-DL's P3E-Satellite" at www.p3e-satellite.org/index.pl?lang=en_EN
This satellite will use 2.4 GHz, 10 GHz and 47 GHz. Further lectures are also coming soon:
Lecture 10 will be the Amateur Radio Mars Orbiter P5-A given by Achim Vollhardt DH2VA, see also "GO-Mars with AMSAT-DL's P5A Mission" at http://ticket-to-mars.org/index.pl?lang=en_EN
P5-A will use the Amateur Satellite Service 2.4 GHz and 10 GHz allocations.
Lecture 11 will be the Delfi-n3Xt next generation satellite presentation.
Lecture 12 will be the presentation on the new GB4FUN vehicle given by Carlos Eavis G0AKI.
Lecture 13 will be the 2.3/3.4/5.6GHz Signal Generator for Satellite Applications by Grant Hodgson G8UBN.
Lectures 14/15 will be the Band planning for satellite operations on frequencies in the Amateur Service by Hans van de Groenendaal ZS6AKV, President AMSAT-SA followed by the IARU Satellite Forum.
The full lecture programme can be seen at: www.uk.amsat.org/content/view/640/213/
The PowerPoint presentation slides can be viewed at: www.uk.amsat.org/content/view/664/235/
Pictures from the event can be seen at: www.uk.amsat.org/gallery2
AMSAT-UK publish a newletter OSCAR News which is full of Amateur Satellite information. Join online at https://secure.amsat.org.uk/subscription/
For further details contact Jim Heck G3WGM. Tel: +44 (0)1258 453959 Email: g3wgm@amsat.org Web: www.uk.amsat.org/

Freddy ON6UG and the most well travelled dish in the universe!

Martlesham Microwave Round Table

John G3XDY writes: A reminder that preparations for the next Martlesham Microwave Round Table are well under way. The event will be held at Adastral Park, Martlesham Heath, Ipswich IP5 3RE, as usual, on Saturday and Sunday 8th/9th November 2008. The dinner on the Saturday evening will be held at the Holiday Inn Ipswich, London Road, Ipswich. Please note that this is not the hotel used last year (the Holiday Inn Ipswich Orwell). The dinner price will be £24 a head, full details of the menu choices and booking will be available shortly when the Round Table booking site opens. There will also be a block of rooms available at £65 per room per night including breakfast. Please note that you may be able to find lower intenet rates but these will not generally include breakfast, and availability may be limited.

Please look out for a further update when the round table booking site is up and running. 73 John G3XDY



GB3CAM/B

GB3CAM/B

John G4BAO writes: Bernie G4HJW and myself are just back from site after a successful install of the new 3cms beacon near RAF Wyton just north of St Ives in Cambridgeshire. The beacon is at 30m AGL at IO92wi and runs around 5W EIRP on exactly 10368.755MHz to a slotted waveguide. Beacon is locked to a 5 MHz precision source.

DFS by G4HUP

Dave G4HUP writes, just to let you know that I have updated the website, to provide details of:

- Issue 2 DFS PCBs - availability and features
- DFS30 - a new application which allows GPS locking of Icom IC706 series transceivers

30 MHz DFS for IC706 – DFS30

Whilst the prime cause of frequency error at microwaves is the local oscillator for the transverter, the driving rig itself also has a contribution to make. For many applications this contribution is small, and provided the rig is stable, the error will be constant. Where the rig suffers some drift, then this contribution can become sigificant,especially if digital modes such as WSJT are used.

The IC706 is known to suffer from a cyclic frequency shift problem related to the switching of the internal fan. The above modification reduces the frequency error considerably, but absolute stability can be readily achieved by using an external master oscillator, instead of the internal 30MHz source. A variant of the FC10-15, the DFS30 simply triples the GPS derived 10MHz, and gives a a nominal +5dBm output.

IC706 Modifications

GPS locking of the 706 requires that you make an internal connection to the PCB in place of the high stability oscillator option - the instructions given do not provide for any form of switching between the old oscillator (for stand alone operation) and locked operation. This is feasible, but you will need to sort that out for yourself, if you need that. Once modified, your IC706 will require an external 30MHz signal to operate - a high quality OCXO, or better still, a GPS derived 10MHz is needed to drive the DFS30.

DFS30 Specifications

- 74 x 55 x 30mm tin-plate box (3" x 2.25" x 1.2" approx)
- Connectors - SMA Female
- Construction - surface mount
- Supply Voltage - 10 - 15V DC
- Supply Current - 110mA when equipped with input buffer (50mA without)
- Input - 10MHz at +10dBm
- Output - 30MHz at +5dBm
- Spurii - <-65dBc
- Harmonics - <-45dBc

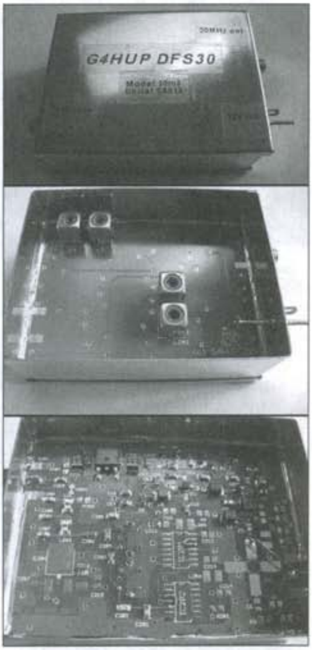
Events and Shows - 2008

During 2008 I expect to be attending the following events - I usually do 'show special' prices so catch me at one of these! UK Microwave Round Tables in Crawley UK and Martlesham UK.

In addition to this, small quantities of kits and any pre-ordered items will be available at the Weinheim VHF Meeting in DL.

Please E-mail me from the home page to confirm my attendance at any specific show, and to place any advance orders for collection!

73 G4HUP http://g4hup.com/



DFS30 internals and SPA print

New 710km World Distance Record for 24 GHz via RS!

24 June 2008. Congratulations to Marc F6DWG/P JN19AJ and Guy F2CT/P JN13IQ (1259m a.s.l.) on a remarkable 637km RS QSO on 24 GHz at 2001UTC. This exceeds the previous tropo record of 544km by some margin. The scatterpoint was determined to be over JN17LO. Also RS signals on 10GHz were extremely strong.

At 21:30 UTC F2CT/p completed a 24 GHz RS QSO with LX1DB (JN39CO) over 710km! 43S/52S were exchanged. This is a new WORD RECORD! Congratulations to both stations!

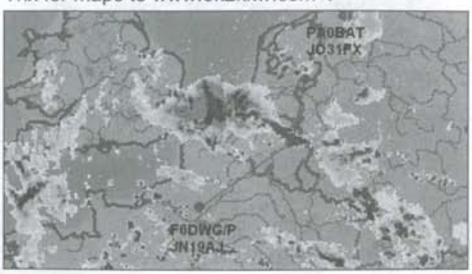
Station details: LX1DB is TX 4W at the feed, with RX NF 1.7db and 45cm dish. El 12° -

F2CT/P used an FT817ND as a 432MHz IF with a transverter from I3OPW. RX NF was 1.8dB and the TX output power was 7W! The dish was an 88cm Alcatel offset type. F6DWG/P was using 2.5W out with a 90cm Gregorian offset dish, and DB6NT preamp, 2.5db NF.

Another nice 462km RS QSO took place on July 28th 2008 between DB6NT (JO50TI) and HB9AMH/P (JN37OH) at 17:29. See map above.

And another 24 GHz RS QSO took place on June 2 2008 at 1744z between PA0BAT (JO31FX) and F6DWG (JN19AJ) over 423km. See map below.

Tnx for maps to www.ok2kkw.com !



Microwave USA

Editor: Kent Britain, WA5VJB
WA5VJB@flash.net

This years Central States VHF Society went well, with W5LUA (see picture below) and VE4MA both receiving the Chambers award for technical achievement. This is the second Chambers award for both of them since their 24 GHz and 47 GHz EME work was after their last technical achievement award.

I would also like to invite everyone to the **Microwave Update Conference this October 17 and 18th.** For the latest information see www.microwaveupdate.org MUD 2009 is supposed to take place in Dallas / Texas as well as the 2010 EME conference.

The higher gasoline prices have slowed rover contesters in many parts of North America. In the US, contesters who are moving from gird to grid cover much more area than their European cousins. For contestors to travel 2500 km during a VHF/UHF contest is not unusual, so the higher fuel prices are encouraging more contestors to operate from their home QTH. This change in activity can be seen in many VHF and Microwave contest logs.

On the VHF front, Brian, WA1ZMS had repaired his Yagis and his 1400 watt ERP beacon **WA1ZMS/B** is back on the air aimed 60 degs true from FM07fm on 144.285000 MHz. A new 1200 watt solid state amp is being build and should be QRV by October 2009. This will take be ERP of the Trans-Atlantic beacon to near 20,000 watts ERP for the 2009 summer openings. The extreme frequency accuracy makes many digital processing techniques for pulling out weak signals practical.

And after 8 months of English paper processing, I now have a UK call. 73 Kent WA5VJB / 2E0VAA

Al Ward, W5LUA

Microwave Japan

Seiji Fukushima, Ph.D, JH6RTO

Two-way digital television QSO, by JA6LXR, Kohei Nagaya

Our group succeeded in two-way digital television QSOs on the 24th of July, 2008. Three amateurs, JA6CAM, JA6CPU, and JA6LXR, moved to Oita City and two, JA6JNR and JA6SPI, moved to Hiji Town. The distance is 22km. A key component was a modulator/demodulator of the digital television and we used a DVB-S MOD/DEMOD fabricated by SR-SYSTEM. It outputs a lower frequency so a transverter was used for frequency conversion to 5745MHz. The transverters' output power was 500mW initially. At the first tiral, we made successful QSOs, receiving clearer images than conventional analog television. Then we decreased the output powers and found that the 22km-QSO was possible even at a few mW experimentally. The antennas we used were some dishes with diameters of 45cm to 1m.

Our next trial was lengthening a distance. Five amateurs in Kunisaki City and one in Iyo City tried 102km QSOs on the 27th of July and we succeeded again. We measured a reception margin as 13 dB, which means that we could make longer-distance QSO with the same equipment. Our challenges also include higher frequency bands such as 10 and 24GHz.

QSO details:

2008/07/24 0030Z (JA6CAM/6, JA6CPU/6, JA6LXR/6)-(JA6JNR/6, JA6SPI/6) digital television (DVB-S) 5745MHz 22km

2008/07/27 time unknown (JA6CAM/6, JA6LXR/6, JA6SPI/6, JA6MQT/6, JI6DRF/6)-(JA5GYU/5) digital television (DVB-S) 5745MHz 102km

JA EME Meeting, by JH1KRC, Michiaki

On the 14th and 15th of June, the 7th Japanese EME meeting was held at Tokyo Grand Hotel, Tokyo. The meeting is held every four year, synchronizing to Summer Olympic Game. Fifty-six amateurs gathered (see picture below!), who are serious moon bouncers or satellite amateurs.

The program included lectures, exhibitions, and banquet. Key lectures were as follows: Report of Project BIG-DISH 2007 by JM1GSH and JJ1NNJ, 2m and 70cm linear amplifiers by JA1NKV, Plans of Project KDES by JE1BNZ (*), Moon explorer KAGUYA by Akira Nakazawa of JAXA.

EME Project KDES

In 2007, the moon bounds experiment by the "Project Big Dish", 8N1EME with 32m Cassegrain antenna at KDDI Ibaraki satellite communication center, succeeded working on 144MHz to 5.6GHz by 500W output with carrier class big antenna at first time ever in Japan.

The Katsuura Tracking and Communication Station of the Japan Aerospace Exploration Agency (JAXA) has 18m Gregorian antenna which build in 1967 and it is not used now. It opens for experience operation for guest. It will scrap after two years. In the recent project was very short schedule and several experiments didn't complate. So, some peoples of the project proposed new experiment plans for EME and enlightening activity to the youth continuously with Katsuura's dish. And "Project Katsuura Dish Experimental Station 2008" (KDES 2008) was established.

JARL Chiba branch and Project KDES 2008 had discussions with JAXA to resolve problems for operation Amateur radio with 18m dish. We have a JARL Special station, 8J1AXA. More info on the web at: www.8j1axa.jp/index.html

This project goals are enlightening activity to the youth, skill up for HAMs and HAM population expansion. Project Duration: 1 Apr. 2008 to 31 Mar. 2010. Bands and Power: 500W on 144MHz, 432MHz, 1296MHz, 2424MHz, 5760MHz

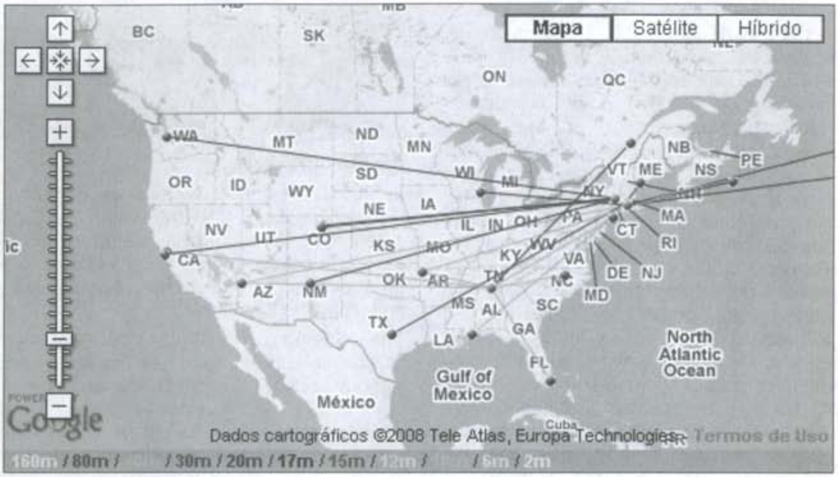
The EME station will start in this summer.

8J1AXA Location: Address: 1-14, Hanatateyama, Haga, Katsuura-shi, Chiba 299-5213. Loc: QM05df

VHF South America

by Flávio Archangelo PY2ZX

REVERSE BEACON PROJECT



Monitoring and monitored stations by Skimmers cluster.

The Reverse Beacon Project is a kind of a wide band automatic DX Cluster. The receiver and PC by itself identify the received stations with the use of CW Skimmer, a multichannel CW decoder software for all CW signals that are in the pass band of the used receiver. By one "aggregator", the identified CW CQs could be sent by a telnet connection as one spot to a DX Watch database that provides in the world wide web these information in a traditional DX Cluster table format or in maps as well.
The monitoring station can work with any receiver, but if an SDR is used (SoftRock, FlexRadio, RFSpace, SDRZero, etc), the reception will be in wide band so several stations can be identified simultaneously on different frequencies and these information will be sent at same time to the network, providing and collecting more data.

The map is designed according to the user, with spots lifetime screen between 15 seconds to 10 minutes. One can also change the location and study more deeply into selected areas of the world. Each trace that unites the monitoring and the spotted station is colored in a way to be related with the band where the station was heard. The system includes the VHF spectrum (6m, 2m) allthough currently the spots are mostly coming from HF from Europe and USA in this experimental phase of the project.

Felipe, PY1NB of the Reverse Beacon Project and Fabio, PS7HF of the Rio DX Group (L to R).

It would be fantastic if the VHF and upper bands could be covered by the project, or specific calling or beacons frequencies also be provided by narrow band receivers. For joining the network write to Felipe Ceglia, PY1NB, who with Pete Smith, N4ZR is working on this interesting project. Alex Shovkoplyas, VE3NEA, the same author of the famous DX Atlas and Faros software has developed CW Skimmer.

Reverse Beacons:
http://skimmer.dxwatch.com

CW Skimmer:
www.dxatlas.com/cwskimmer

PY1NB contact:
http://skimmer.dxwatch.com/contact

TROPO IN BRAZIL

PY1AR in action in GG87LL and the QSL card of the +1200 km QSO.

Amarildo, PY1AR, made one remarkable Tropo QSO considering the recent VHF DX history in Brazil: 1215 km with PT9PA and 850 km with PY5EW, both on 144 MHz. The most interesting are the conditions at PY1AR: portable at Morro do Açú, GG87LL, 2232 m a.s.l., Petrópolis, Rio de Janeiro. He used only FM mode and 5 W into HT antenna! PY1AR made about 30 QSOs with that extremely simple setup. Amarildo is one very active radio mountaineer and we can expect more interesting QSOs in the future.

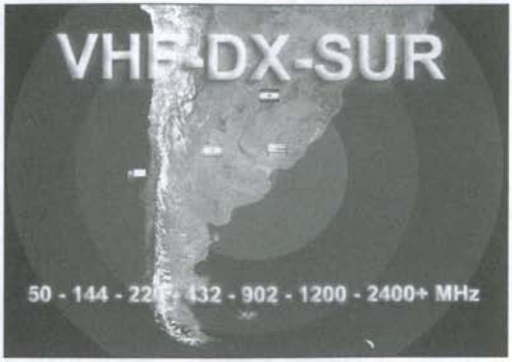
ARGENTINA ON 144 MHz


Horácio LU5BE (left) and Leonardo LU9JMG (right) operating from GG33er.

Argentina was active for the first time in the Concurso Brasileiro de 144 MHz (CB144-2008) with a portable station from the province of Corientes (LU#I) with the callsign LU5BE/I. The team formed by LU5BE, Horácio, LU9JMG, Leonardo and LU5JCL, Luciano drove several km to reach the border with Brazil in the extreme north of Argentina in GG33er. They worked 7 grid squares on 144 MHz and were heard from GG66. The longest QSO was over almost 500 km. They used an IC-706MKIIG, FT-736 and Swiss Quads. The same team is now planning future operations, including next contests.

Grids worked by LU5BE/I (dark grey) and Luciano LU5JCL in GG33er.

VHF-DX NETWORK



The VHF-DX mailing list was created 10 years ago for congregating the VHFers of Brazil, exchanging information and restoring VUSHF DX in the country that was, on that date, very quiet since the VHF boom in the 80´s. The success of VHF-DX was so great that it is still active today with about 700 members from different countries. Now the same goodwill is devoted to the South Cone of America where important radio countries like CE – LU – CX – ZP are located but the vast majority of the VHF activities are related to 50 MHz. So in July, 2008 the VHF-DX team also created the VHF-DX-SUR mailing list in partnership with Horácio LU5BE, and Leonardo, LU5JMG as coordinators. Within just a few days the list deployed huge Spanish language traffic and new local members making skeds and looking for DX on higher frequencies, too. So the VHF-DX Network is now formed with two forums, the traditional VHF-DX and the new VHF-DX-Sur. The addresses are:

VHF-DX:	**http://tinyurl.com/vhf-dx**
VHF-DX-Sur:	**http://tinyurl.com/vhf-dx-sur**

NEW AVHFC 2008

Araucária DX Group
Concurso 2009 de VHF

The Araucaria DX Group has announced the second edition of the **Araucaria VHF Contest 2008 for 18 and 19 October.** So the contest will have now two editions per year: one enjoying the spring conditions and the second for autumn conditions (both for Southern Hemisphere). Both are taking place close to the equinox. Stations abroad like in Caribbean and South America are welcome since TEP and Es could be active. The contest has the same rules as the CQWW VHF contest. More information at: **http://www.radioamador.com/avhfc**

TOP 5 CONTESTS RESULTS

AVHFC – 2008 - 174 Stations

Station – QSO – Grid Square – Points

Multi Op All Band

PU2VIR	*144*	*30*	*6810*
ZV2T	*112*	*31*	*5952*
ZV2ALT	*83*	*24*	*3268*
ZV2K	*77*	*24*	*3048*
PY5ARP	*76*	*16*	*2208*

Single Op All Band

PY2RJ	114	22	4488
PY2HL	108	25	4150
PY2VV	68	22	2552
PU2PJA	42	15	1108
PY2DA	42	13	975

PY2BJO receiving the trophy from PP5XX/PY5CC during the ceremony of AVHFC 2008 at FENARCOM Hamvention

Single Op 144 MHz

PY2HCD	58	13	1508
PY2PPZ	48	14	1344
PU2UDX	58	11	1232
PY2NET	49	12	1152
PY2EPC	42	11	902

50 MHz = PU2SHF, PY2IQ, PY2BJO.

PU2VIR = PU2VIR, PY2VM, PY2WC, PY2EL.
ZV2T = PY2ZX, PY2OC.
ZV2ALT = PY2EX, PY2FCL, PY2HT, PY2TZT, ZZ2SZV.
PY5ARP = PU5RAR, PY5DLT, PY5QW, PY5ZD.

CB144 –2008 – 236 Stations

Points – Station - QSOs – Cumulative Distance

Top Scores

13.971.504	PY2HL	232	60222
11.636.000	PY5ARP	200	58180
8.892.422	PY2PPZ	226	39347
7.903.272	PY2ZX	219	36088
7.361.919	PY2RJ	213	34563

Multi – Multi

13.971.504	PY2HL	232	60222
11.636.000	PY5ARP	200	58180
8.892.422	PY2PPZ	226	39347
7.903.272	PY2ZX	219	36088
6.969.809	PY2UE	193	36113

Single Op – Multi

7.361.919	PY2RJ	213	34563
5.685.320	PY2HCD	178	31940
4.350.510	PY4OG	123	35370
2.277.080	PU2THW	116	19630
2.180.412	PU2WOT	117	18636

Multi Op – FM

3.295.010	PY5AA	106	31085
2.360.900	PU2TMT	100	23609
1.984.416	PY2USA	96	20671
1.937.967	PU5PBC	83	23349
1.653.609	PU2PJA	87	19007

Single Op – FM

1.065.388	PU2KLM	83	12836
639.216	PU2MPM	72	8878
629.680	PY4ITA	40	15742
572.924	PY4GEL	58	9878
544.337	ZV2WAC	43	12659

PY2PPZ receiving the trophy from PP5JR during the ceremony of AVHFC 2008 at FENARCOM Hamvention

PY2RJ receiving the trophy from PY5EG during the ceremony of AVHFC 2008 at *FENARCOM Hamvention*

PY2ENO receiving the trophy from PY5EG during the ceremony of AVHFC 2008 at FENARCOM Hamvention

PY2ZX during his presentation about TEP at FENARCOM Hamvention

2-m-EME News

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

DUBUS EVENT RESULTS

SP7DCS (Chris): I was qrv most of time in Dubus event. I found good activity and great conditions most of time. Thanks for DF9CY for calling me - I knew you wanted to look for me, but I could not copy the call - please try next time. Before second leg I had technical problem with LNA switching so. I was late a bit. Nice surprise was cw initial 308 with W3TWX from Vermont. Log from 7 June 2008:
IK2DDR O/539 RO/539, JH0WJF 539 R/549, YO2AMU O RO, SM2CEW O/549 RO/549, SM7WSJ 539 R/529, PE1LWT O RO, YU1IO O RO, F0CXO O RO, OK1VVP O/539 RO, LZ1DP O RO, SV3AAF O RO, LA8YB O RO/559, W3TWX# RO O, W5UN 559 R/559, K1MS O RO, OZ1HNE R/539 O/539, IK1FJI RO O, PA3CWN O RO.

K6PF (Bob) I was only able to be QRV fm 1730 - 1830z during the DUBUS activity period. Worked 3 stations rather quickly with nice signals but lots of QSB & noise. All were vertical polarity for tx & rx. Here's my short list: 1740-1745z K9DX RO sent, O/R rcv'd, initial #217 (vy gud signal) 1758-1804z SP7DCS O/R sent, RO rcv'd (gud signal) 1806-1812z IK2DDR O/R sent, RO rcv'd (one of the best copies I've had fm Francesco). Tried a sked at 1830z with SV2KBS but had hi noise hr & Victoria only had 8-12 degrees EL so lot's of noise thr also. Nil on both sides. Enjoyed being active agn even for only a short while.

G3LTF (Peter): Weather prevented operation in the second period but in the first, using my 10m long yagi at about 18m, I worked IK3MAC with amazing signals from him, 539. I then worked LA8YB again with nice sgnals, which I think is an initial, not sure. I heard and called OZ1HNE. This was on the first ground lobe up to about 6 degrees, on the second lobe at about 12 degrees I heard OZ1HNE again,also F3VS and SP7DCS but too weak to call. Thanks for the QSOs and hope to be there next time with the dish which gives me elevation and polarity change.

SV2KBS (Victoria): Although this time condx seemed to be worse compared to the previous time I participated in the DUBUS Activity Event, I had the chance to copy partially many stations, although I did not have the chance to establish a QSO with them. Those were IK2DDR, LA8YB, SP7DCS and some others that I did not have sufficient time to acknowledge them and call them back. It was a great pleasure of mine to work Jorgen OZ1HNE and some minutes afterwards I wkd for the first time IK3MAC, who was very strong - it felt like working a european station on HF. During the 2nd leg, I wkd Jimmy SV1BTR after many calls since he seemed to have a big pileup so it took a while till I got through. I did enjoy this Activity Event A LOT and I am looking so much forward to the next one to meet you all ! Till then I wish you a great summer with lots of DX and fun !

K9DX (John): I am pleased to hear so many stations. At one point there must have been 10 stations calling SV1BTR at the same time. At one point signals were booming like the low bands, and then the last hour it just went away. Tnx to the following for the QSO. IK2DDR LA8YB F3VS DK3BU SP7DCS SV1BTR W3TWX I3EVK F0CXO IK1FJI K6PF W5UN.

IK3MAC (Graziano) I was qrv only in the first window (July), but the EME condx not very good. I worked 17 stations on CW random. Here is the QSO list :LA8YB, YO2AMU, G3LTF, OK2POI, SV2KBS, JH0WJF, SM2CEW, F9HS, SP7DCS, I3EVK, JR3REX, OZ1HNE, IK1FJI, PA3CWN, SP3XBO, F0CXO, IK2DDR.

OZ1HNE (Jorgen) I was only QRV in the second window of the June DUBUS CW EME activity event on 144MHz because of sea fishing activity in the beautifull and warm weather we had here in OZ. I found good condition and very nice to hear so good activity on the band. Thanks to all for the QSO's and two new initials with OK2POI (thanks for your patience) and YU7XL. It was all great fun as always. I worked the following stations on CW random: OK1MS OK1VVP, F0CXO PA3CWN LA8YB PE1LWT LZ1DP W5UN RN6MT OK2POI # 548 YU7XL # 549 SP7DCS SV3AAF. I was called by IT9CJC with good signal in last minute of the event, but Marcello had QRM problems.

AROUND 2-m-EME

DK3EE (Tom) sorry i was not able to be qrv in dubus cw activity due qrl. Here a short report of new stations worked this month (02.07.08 to 11.07.08): RW6HM SU1KM W3TWX WB2RVX YT1VP UA4LCF 9A2TK YO4FNG (init. 777)

OZ1HNE (Jorgen) I was QRV yesterday afternoon on 144 MHz for one hour calling CQ and found very good activity. I worked LA8YB 539/539, SM2CEW 539/539. PA3CWN called me with VERY good signal !!!!!! (new PA Oene ???) and I could send "O" report right away, but it took a few periods to complete due to deep QSB. Last QSO was IK1FJI with good signal, and very nice to hear and work you again Valter.

DK3WG here the result from R/U-stn and me May and June:

RA9YDL - JT65B with OH4LA, RX1AS, RU1AC, PE1LWT, W0HP, F8DO, F6BEG, PA2CHR, F6APE, F6BKI, WA2ODO, N6VMO, JW5E, IK7EZN.

RV9UV - JT65B added PE1LWT, PA3COB, DK5LA, OK1CU, F1NWZ and DL2LAH *RU1AA* - cw with RZ1AWO/p JW5E, RW6HM, RZ4HD, UA3DUY, SU1KM, UK/DL9LBH, W4RBO and CT2GUR.

RW3WR - JT65B this initials W5UWB, W7CE, PA2CHR, IW4ARD, DK5LA,OK1CU, ZS2GK, F1NWZ, PJ4NX.

RX1AS - JT65B with UA3DUY, LA8KV, DL0VV, JW5E, OK2POI, VA3TO, LY2SA.

RK3FG - JT65B new KI4TZ, DL9GS, PF7M, OZ4VV, ZS2GK, BX1AD (DXCC), RW3WR, YT3I, YU1IO, W7CE, HL4GHT (DXCC), ET3AA (DXCC), F4ERO, PA3DOL, OH2LHE,

AA4SC, YU2DX, EA/DL2NUD, W2DBL, N0YK, T61AA (DXCC #89), WA2ODO, GI4SNA, K5QE, W2TSL, DB8AT, EB3DYS.

RN6MT - JT65B give this: WB2RVX, UA3ME, JW5E, RW6HM, UA4LCF, EB3DYS, DC2MW, LA8YB and 9K2YM.

RV3IG - JT65B new W7CE, G8VYK, BX1AD, OZ4VV, UX5UL, RA3WDK, VE2JWH, KI4TZ and ET3AA.

RW3WR - JT65B added G8VYK, W2TSL, N6VMO, SP3VSC, F6APE, IK7EZN, WA2ODO, PA5KM, DJ7OF, TK5JJ, HA8CE and JH5FOQ.

UA4AQL - JT65B give this new stn: W7CE, OZ4VV, KI4TZ, N0YK and UA3DUY. JW5E, BX1AD, WB2RVX, RW5HM and SU1KM.

RV9UV - JT65B new PA3ECU, N4JH, W0GHZ, PE9DX, G8VYK, W5UWB, F5APE,OH4LA, F1TE, PA3DOL, LA8KV, WB9PNU, IK7EZN, OZ4VV, DK0VHFand EA3BB.

UA9FAD - JT65B wkd HL4GHT, BX1AD, VK7JG, ZS2GK, OZ4VV , HL4GHT, BX1AD, VK7JG, ZS2GK, OZ4VV.

UA9SL - JT65B new stn was I3EVK, JW5E, G4FUF, RW6HM, K5QE, UA4LCF and SP3VSC.

UA9YLU - JT65B give this stn: T61AA, K5QE, LA8KV, DJ6OL, EA8/G4RGK, EB3DYS, DL0VV, ZS2GK, SP3XBO, G8VYK, OY4TN, OZ4VV, SP2NJI, PI9CM, YU3LT, IT9CJC and PA0PVW.

UN6PD - JT65B wkd OK1UGA, PA1GYS, PE1L, DK3WG, RX1AS, PA0JMV, F1DUZ, CT1HZE, DL9MS, OH7PI, S52LM, SV8CS(?), YO9FRJ, F6BKI, DL8GP,AA7A, DL8EBW, DF7KF, H3YAK, DL2NUD, PA3CMC, DJ8MS, RA6AX,SM5CUI, DL8YHR, RA6DA and RW3AC.

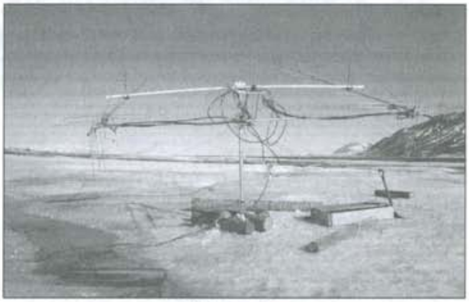
DK3WG - CW with W3TNX 539/529, - JT65B wkd EA/DL2NUD, W7CE, K5QE, WA2RVX, WA2VNV, UN6PD, OY4TN, BX1AD (DXCC #142), EA8/G4RGK #1163. RW6HM, IZ5ILX, RN6BL, JW5E, UA3DUY, T61AA (DXCC #143), UK/DL9LBH, SU1KM(DXCC #144), CT2GUR and W4RBO.

OZ1HNE (Jorgen) I was QRV for a short time both Saturday and Sunday (26/27 July) and found condition very good. First time I was calling CQ on Saturday I worked YU1EV # 552 with a very nice signal. On Sunday polarity was more unstabil but I worked RV3IG on sked in a few minuts (great to work you again Andrey). After the sked with RV3IG I was calling CQ and worked K1JT before I went QRT. Both RV3IG and K1JT was really "armchair" copy.

EXPEDITIONS

JW5E: 150 QSOs from Svalbard

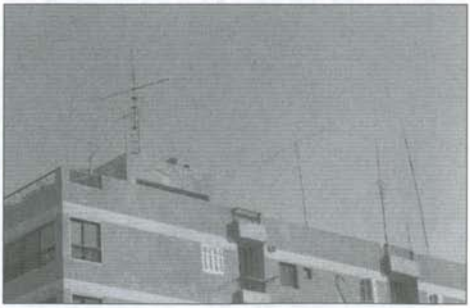
It is many years since the frosty island in the northernmost part of Europe was activated on EME: Back in 1994 Stefan LA0BY performed some very successful CW EME operations there in JQ88AD. Since the demand for JW had grown rather substantially the past 10 years or so it was high time somebody went there again. So Bouke PA0ZH and René PE1L did the job. Last year René was QRV as PJ4EME from the island of Bonaire where it was a thrill to make 273 QSOs via the moon in three weeks. However, only a few months after his return to PA land, René was thinking where to go next. There were a few options and JW was one of them. Soon he succeeded talking his neighbour Bouke PA0ZH into a expedition to JW. Bouke is a experienced dxpeditioner with several HF dxpeditions to the Caribbean. His favorite part of the hobby however is hardware - which should pay off during the dxpedition. Bouke and René had planned for the period 5 June until 9 June 2008, running with the callsign JW5E from JQ78TF. And the activity started even earlier: On 2 June JW5E showed up for the first time on the moon and 27 QSOs were logged in JT65 mode. Another 123 contacts followed until the end of operations on 8 June, with 35 DXCCs worked and 10 country firsts. Rig was a TS-2000, 2 x GI7B amplifier, GaAs-FET preamp and 2 x 20 xpol DJ9BV opt2. Only the TS-2000 troubled at one point not keying the amp anymore. Bouke luckily could fix it so there was nothing left on the way to the success of the activity. René reports that the experience from a location close to the North pole was very much different from working near the equator last year. The QSB was very strong and dynamic: one period one copied the caller with -18, the following period there was nothing at all. This happened not just once but often, on both sides of the QSO. Even the xpols could not always help.
QSLs with SASE via PA0ZH.



JW5E on ice

SU1KM... another Arab DXCC on Air

Frank DL8YHR is always good for a surprise when it comes to dxpeditions. After he had to cancel a planned activity from Tunesia scheduled for 21 to 28 June 2008, he went to Egypt a week later. Together with Jose EA7KW he visited Mohamed SU1KM in the capital Kairo and helped him to become QRV via 2m EME, with a single yagi and good power. However, the start was not easy because there was something wrong with



SU1KM QTH in Cairo (KL59)

the setup. SU1KM did not complete any QSO via moon the first days and also meteor scatter tries to Southern Europe were barely successful. So Frank dismantled and reassembled the antenna system again. After that it performed much better and so SU1KM successfully started working EME. At the end of the activity there were 100 completed contacts in SU1KM's log book. Mohammed now has a good understanding of "how to" do EME and maybe might start a permanent activity from Egypt. Frank however is already busy planning for another dxpedition from a rare spot. QSLs with SASE via DL8YHR.

DL8YHR, SU1KM and EA7KW

OZ1DJJ as OX3LX from Greenland

Bo OZ1DJJ needs to spend some days in Greenland on business nearly every year. Usually he brings some ham gear for the little time outside business obligations. That was the case also this July: From 10 to 22 July Bo was QRV from Qaqortoc in GP60LX, running some 400 watts into a 17 elements M2. The QTH was not very best with respect to moonrise and moonset directions. Moreover the low declination was the reason he had no moon at all for some days in the middle of his stay. However, Bo was successful giving the rare DXCC to some hams and wkd even the first ever OX to CT with CT1HZE. If conds would have been more supportive he sure would have completed more QSOs... maybe in 2009 then?

OX3LX - 17 ele M2 in GP60LX

OX3LX shack in GP60LX in July 2008

NEWS AND INFORMATION

SV8CS (Spiros): I received my 2m DXCC: - 2M DXCC (15 MAY 2008) # 28 - 103 countries. That is a big event for me, after many years of trying on VHF. My 2m DXCC, is the 1st 2m DXCC in Greece and I like to dedicate it to our SV VHF pioneer George SV1AB (sk).

F6HVK (André) last week i got my dxcc certifie 2 meters number 27. I am the first french station on the dxcc. Special tnx all the teams for nice expeditions in rare dxcc and many emotional dream first one qso .Also special tnx the 'make more mlles on vhf ' team web site. Great tnx to joe K1JT genial wsjt developpement software a eme new life for me I am not a big gun only middle rig station 4x17els h pol understacking array bay (first vertical side lobe -18db) in a noisy area without ground gain. Rig ft897 +gs35, 33 meters 7/8 cable, 800 watts on the splitter power divider, PA3BIY lna; all N coaxial connectors.

KB8RQ, (Gary) Yesterday I took a direct hit from lighting to my antenna system. So far I lost my SDR Flex Radio, power supply, controller box in radio room for Az and El. Also a computer and the control boards on the array for Az and El that are W5LBT design. Don't know if it got the absolute encoder yet. This is going to take a while to get everything fixed. I will be back.

W3TWX 2m EME from Vermont (FN33)

W3TWX (FN33UF): Wolfgang IN3TWX currently lives in the United States and has completed setup of a 4 x 18 ele M2 group since past December – and no wonder he is very happy with it. Wolfgang's rig are a IC275H (still the same as in the 1980s when he was QRV from Northern Italy), 8877 amp and a preamp with the MGF1302. Though his work leaves him little time for the hobby Wolfgang is quite busy on CW EME. For the future he will also become QRV in JT65 mode.

EME Antenna Data Base

With the help of Google Earth Jim F1EHN is busy creating an antenna data base of EME stations. Every EME operator will be able to visualize the antenna of the DX station he is contacting. How to do that? By downloading the database file (an example is available on F1EHN's website www.f1ehn.org) into Google Earth. This feature will also be available in the coming version of Jim's software "EME System". Of course, all is free (storage, database, update, use)....You only need to email a picture of your antenna to F1FHN (640*480 pxl or more), 1 per band, a comment/title of this photo (ex : "F6KSX 3cm – 3.3m dish"), precise latitude and longitude (exact location/position of the antenna), grid square locator and the nearest city to check the location of the photo. It is a very nice tool. Jim's email address is jj@f1ehn.org

WSJT 7.0

Joe K1JT has put a new version of WSJT ready for download: WSJT 7.0 Beta. The main change to earlier versions is the introduction of a new mode "WSPR", (pronounced "whisper"). It stands for "Weak Signal Propagation Reporter". WSPR generates and receives signals using structured messages, strong forward error correction, and narrow-band 4-FSK modulation. Its principal design goal is reliable copy at very low signal levels. Total bandwidth is about 6 Hz, so WSPR signals are about 1/60 the bandwidth of JT65B signals and ¼ the bandwidth of 20 wpm CW. In practice it works well at signal-to-noise ratios down to at least -27 dB in a reference bandwidth of 2500 Hz. However, it uses 2 minute tx/rx-sequences and is not exactly targeted as a replacement for the JT65 mode. It is much better suited for QRPP work on HF bands but can still deliver good results on 2m EME. WSPR has some 3-4 dB gain over JT65 KV decodes and is about 1 dB better than JT65 DS decodes. Joe is currently busy with another potential mode presently under study. That one retains one-minute T/R sequences and achieves nearly the same performance as WSPR is. WSJT 7 Beta with WSPR is ready for download at the WSJT Website http://physics.princeton.edu/pulsar/K1JT/index.htm where this information was copied from. Joe K1JT is grateful for feedback/suggestions to K1JT@arrl.net.

ONCE THERE WAS A CHAT ABOUT

(Chats of common interest in internet)

-ADDITIONAL CABLE LOSS (DL2FCN Bodo) Lunatics, my question: There are in antenna books and elsewhere tables showing the additional cable loss in respect to cable loss and SWR ratio. Lets take following case: My LNA is situated a few meters behind my perfectly (nearly) matched antenna. The SWR of the LNA is about 7:1 (return loss ca. 2-3dB) which is highly common with MGF1302 preamps. The loss of the cable between antenna and LNA is 0,6dB. According to a.m. table my additional cable loss would be ca. 1,3dB. Since any loss in front of the LNA must be added to the noise figure, the NF will be finally instead of lets say 0,5dB then 0,5dB plus 0,6dB cable loss and additional cable loss of 1,3dB = 2,4dB.. Is this right???

GW4DGU (Chris) No! This is a situation that's frequently misunderstood. Think of it this way...Your antenna produces a source impedance of close to 50ohms. Your preamp requires a source impedance of 50ohms for optimum noise figure. Connecting a lossless matched 50ohm cable to the antenna transfers the 50ohm source to the end of the cable remote from the antenna. Therefore with a perfect cable, the preamp will produce the same noise figure. If the cable has resistive losses, the impedance seen by the preamp will not change, so its noise figure won't change, but the resistive losses of the cable will add to the noise figure of the preamp. That's just the same as putting a matched attenuator between the antenna and preamp; something most of us do when making noise figure measurements! Mismatch losses occur when you are trying to transfer power along a transmission line. In the case of a preamp you're not trying to do that. Rather, you want the preamp to see the source impedance which gives best noise figure.

VK3NX (Charlie) Almost right........With LNA of 0.5dB and Cable loss of 0.6dB Ahead of preamp AND SWR 1:1 Then NF = 1.1dB (0.5 + 0.6) With SWR 7:1 and additional cable loss = 1.3dB (from table) than NF = 2.4dB (0.5 + 0.6 +1.3) Either way your Noise Floor has increased by 1.3dB!

SM5BSZ (Leif)I do not think it is so easy. First of all, signal loss and loss of S/N are two different things. Look at it this way: The wave front that arrives at the antenna will give a specific electromotoric force at the feedpoint. You will maximize the power extracted by putting a 50 ohm load there. Now, imagine a very long superconducting 50 ohm cable with a nominal loss of 0.6 dB. Also assume that the incoming signal has a very short duration. Just a pulse :-) In this case, the antenna will see the 50 ohm cable as a 50 ohm load and all the available power will start to travel along the cable. When it arrives at the preamplifier (which we for ease of understanding assume to have an infinite SWR) all the power is reflected and will start to travel backwards through the cable. When it reaches the antenna all of it will be re-radiated because the antenna is well matched. The voltage at the LNA will be twice the voltage one would have with a 50 ohm load - and that is the normal operating circumstances for this particular LNA. Actually the neutralized LNAs that I have been using in the past have an input impedance above 500 ohms so the infinite SWR is not unrealistic. It is not even uncommon with negative input impedances that cause the reflected wave to be even stronger than the incident wave. The signal loss due to the cable is just 0.6 dB. The infinite impedance LNA does not receive any power - it is just a device that amplifies the voltage. If you move the LNA up to the feed point your signals would grow by 0.6 dB. Another thing is that by moving the LNA to the feed point you could get a lower noise floor and therefore a better S/N. Whether this would happen depends on the antenna noise temperature. The noise floor will be proportional to the total system noise. 0.5 dB of your preamp is 35 degrees Kelvin. On 144 MHz your system temperature without cable losses would be something like 280 K. The cable with 0.6dB loss and 300K will not change the system temperature much. On 1296 your system temperature might be 50K and then a red hot cable (300K) would matter even though the attenuation is only 0.6 dB. With formulae you can see the situation as two cascaded amplifiers.

1) The cable. G1=0.871 (linear power gain) T1=300/0.871-300=44K

2) The LNA. T2=35K G2=100 (G2 does not matter) When series connected this formula applies: Tn= T1 + T2/G1. The result comes out as 44 + 40.2 = 84.2 K (NF=1.1dB) On 144 your S/N loss would be (280+35)/(280+84.2)=0.865=0.63dB On 1296 it could be (15+35)/(15+84.2)=0.504=3dB In other words, on 144 the signal would drop by 0.6 dB while the noise floor would not be affected. Under normal circumstances your sky temperature will be high above 200K and then the noise floor would also drop for an even more insignificant influence on the S/N due to the cable loss. On 1296, signals will drop by 0.6 dB due to the cable but the noise floor will increase by 2.4 dB for a total loss of 3dB. The VSWR of your LNA does not enter the picture. (Note that the LNA looks into 50 ohms in both cases.) It is quite another thing when we want to transfer power through the cable. Then the text-book formulae apply.

-Advise on bifilar choke for 8877 filament (Ed - KL7UW) I'm winding coils for my 2m-8877 PA (classic-W6PO design) and am wondering if I might use insulated #12 solid copper wire in place of enameled #12? I will have to buy a complete spool of the enameled wire mail-order if that is necessary. It appears to me that insulation in the bifilar choke is for dc voltage so insulation would likely only shift the inductance some. I can check that with a MFJ-269. So what's the opinion on this?

SM5BSZ (Leif). I do not know the original description, but generally, to feed the heater of a grounded grid amplifier I would use many enough of the enameled wires at hand in parallel and twist the bunch of 4, 8 or whatever strands with a drilling machine so they form a nice "cable" which can then be used to wind a coil with extremely high mutual inductance (and capacitance) between the two resulting inductances. Polyimide enamel is non-solderable and low loss.

WB2FCN (Jim) I have that amplifier (with modifications), been running it since 1978. It is also the same amplifier, manufactured by Scientific Radio Systems, for the NOAA Weather Radio broadcast systems, all over the U.S. during the '70s and '80s. The filament choke is an integral part of the design of the unit. The coil turns of enameled #12 are in fact very important. Same with the tuned line output section. Some folks tried funny things with the input circuit, ended up losing tubes in the process. My advise, get the #12 enamel wire and replace the choke. Of course YMMV, FWIW.

– CABLE LOSS QUESTION (PA3FPQ/PE1LWT) Just after finishing our new eme arrays we ran into a cable loss question we can't figure out properly. We nearly have the same setup; FPQ: 4x 9elxpol in +config, LWT 4x9el in X config FPQ is having a 4-port divider in the centre of the frame and uses 4x 5m length as phase line total use of cable =20m . LWT is having coax dividers and is combining the 2 left antennas with a T junction,the 2 right antennas with a T junction these 2 t junctions are connected together with n(odd)* 1/4λ lines tog et 50ohm again. Total use of cable = 15m (in fact this way the 4 port divider of coax is having longer legs). For both systems we have run from each antenna the same length of cable to the preamp. But the total amount of cable in the system is 5M less in LWT system. So our simple way of thinking will say LESS cable is LESS losses. Is this true ??

DF3KV (Peter) It will depend on the kind of cable used. 5m difference with 7/8" Cellflex is 0.0735db and 0.133 with 1/2" Cellflex, but would be 0.45db by using RG213. I guess the more important difference will be in the amount of interconnections. Probably I would go for a 4-port divider in the centre using a total of only 5 connectors and the feedline as large as mechanically as possible. With that layout, even by using 5 more meters of feedline, my total inter connection loss will be less then with the 9 connectors in the LWT system.

-Lightening protection guaranteed N4PZ (Steve) I lived in the thunderstorm capital of the america for years. I was hit often until I discovered a solution which is an expansion of the lightening rod idea. It consists on a shallow, round cone in the shape of an umbrella at the very top of all my towers. It hangs downward from the very top of the mast. I get a piece of 3 foot by three fot hardware cloth with 1/2 inch mesh. It's galvanized metal screening. I cut a 3 foot diameter disc out of it and then remove a pie shaped section so that it can be formed into a shallow cone later. THE TRICK THAT MAKES IT WORK IS THIS. WITH A PAIR OF WIRE CUTTERS, PLAN TO SPEND HOURS CUTTING AS MANY OF THE WIRes AS YOU CAN AND WITH LONG NOSED PLIERS, BEND THEM UPWARD. Leave enough intact so it won't fall apart.

YOU NOW HAVE A SHALLOW UMBRULLA OF SORTS HANGING FROM THE VERY TOP OF THE V= ERTICAL MAST WITH HUNDREDS OF SHARP WIRES POINTED UPWARD. I've seen them in commercial use on the interstate highways in the USA at the truck inspecion stops. They place them on lamp posts around the inspection stations. TRUST ME! IT WORKS. Slip it over the top of the mast and secure it with a hose clamp and use some sort of horizontal piece across the bottom, open end,of the cone to tie it to the mast with a "U" bolt. It dissapates the leader stroke which preceeds the main lightening strike. I've had them on all y towers for ten years and haven;t had a strike since. It's flimsy and not a work of art, but it works.

N6FD (Erich) If you don't want to go to all that trouble, you can get Nixalight phosphor bronze bird repellent strips. They consist of many thin, pointed spikes mounted on a strip. It is designed to prevent birds from landing on various surfaces. Should work in this situation as well. As an added benefit, you won't have birds sitting on your antenna there either.

–LMR 400 UF2 KD3UY (Bob)I just had a failure of a piece of LMR400 UF coax. It was only about 2 years old. It is clearly blown, SWR terrible, and you can see a small piece of the white dielectric sticking through the black outer insulator. I have a 2 yagi system, the other coax and antenna are working fine. Same coax, same age. swr perfect, looks almost new. At the time of failure I was running 1500W jt65 144mhz. Measured at the antenna, the swr was about 1.3 to 1.4. The most power I could have had in the failed coax was 700W and it is rated at 1500W for 150MHZ. But my SWR was not perfect in the antenna with the failed coax. Obviously I need to buy more coax. Has anyone had similar problems with LMR 400 UF? Was the cable defective or did I just push it a little too hard?

W1LE (Stan), Birds pecking at it, squirrels chewing it, other mechanical abrasion, water in the coax, too much flexing when rotating, az or el, Possibly tie wraps much too tight, compressing the inner dielectric and allowing a flash over from inner conductor to outer shields. I would replace it with another LMR-400UF piece and be sure to tune the antenna it feeds. Anyone in your circle of friends have a infra red thermal viewing camera? Look for hot spots after a WSJT run.

KD3UY (Lance) I had a similar problem with LMR-600 UltraFlex on 6m, and I understand there have been other similar situations. Apparently, the coax is very soft, and it will deform if taped too tightly to a tower, or kinked or left in a permanent tight loop. When it deforms from a true circular cross section or becomes pinched, the impedance changes and the loss goes up seriously. I don't know what to suggest except be aware that it is very delicate and do your best to relieve any strain on it and prevent it from any sharp bends or kinking.

SP2IQW (Michal) I think it was not a good idea about using cable at maximum power rating or overstressing it just as in your case. The LMR-400UF power handling is specified on 150MHz: for 1.22kW only (1.5kW is data for LMR-400).
http://www.timesmicrowave.com/wireless/
http://www.timesmicrowave.com/content/pdf/lmr/66-67.pdf
The power rating is mainly limited by seflheating of a cable at given freqency and temperature. SWR 1.3-1.4 derates power handling only by about 3% but SWR 2 - 12%, SWR 3 - 25% respectively. Note that with 1500W on 144MHz every meter of your cable is heated by 11.3W (3.5W/ft). Most often cable failure is caused by moister which penatrates into outer shield through gaps which could be even hard to see so corrosion may occur. Any mechanical failure of cable or connector assembly may be also critical when using cable at extreme power rating. Concluding, definitely larger cable starting from 1/2" and LMR-600UF would be a better choice for QRO. You will be also benefited from more watts passing into antenna. If you have longer cable it is worth to use solid 1/2" or 7/8" cable as a main feeder and only a short flexible jumper to moving system. Flexible cables always produce more loses than comparable ones with solid inner conductor.

-Pretunig of a 8877 (Ed - KL7UW)I recall hearing that one can use something like a 6K reisistor across the cathode-grid on a gg 8877 to resemble input impedance for pre-tuning the input ckts using a small signal from a MFJ-269 antenna analyzer. Can anyone confrim the input impedance for a 8877 (144-MHz)? Should I have the tube inserted to include inter-electrode capacitance? This is with HV off, of course.

W2DRZ (Tom) Use a 54 ohm for tube impedeance.input, output is 2,000 ohm.

–8877 filament inrush currant (KL7UW, Ed) How long a time delay needed for 8877 filament inrush current limitation? I can get maybe ten seconds using a RC time constant timing ckt. controlling relay with 100-ohm resistor to load inrush to filament transformer. That should lower filament to 3.0 volts at 11 amps. I'll be running 4.9 volts after startup.

Lance From what I have read, the most critical time for filament warmup is the first few AC CYCLES before the filament has time to warm up at all. I have used 4 or 5 seconds delay before going to full filament voltage only because I figured it would be better to be safe than sorry. After 4 or 5 seconds, you can see the voltage stabilize at the lower current, meaning the filament has definitely begun warming up.

F1HDI (Jean-marc) On my 8877 PA I have a resistor in serie which limits the inrush current (few 0.x ohms) which I left always in the heating circuit. You just need a tranformer which is designed to provide 6v+ac

TREASURY INTERNET

New version 4.5.0 of Eme Doppler.

It accepts the new computers that have no Com port RS 232 (!). http://F2TU.perso.orange.fr

Multi Beaming

www.ok2kkw.com/00003016/rx_switch/rx_switch_2m_en.htm

Photos of a 8877 project.

http://www.kl7uw.com/2m-8877.htm

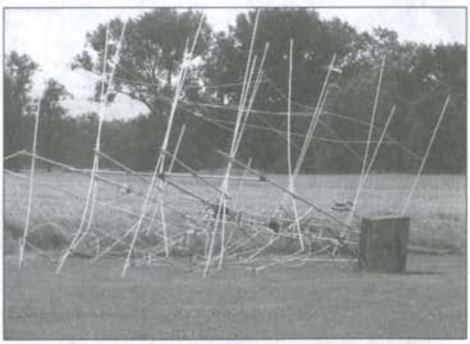
WSJT 7 BETA download at the WSJT Website
http://physics.princeton.edu/pulsar/K1JT/index.htm

LAST

REF/DUBUS EU EME Contest 2008 Result

A corrected PDF with the results of the DIGITAL section is now available on www.DUBUS.org

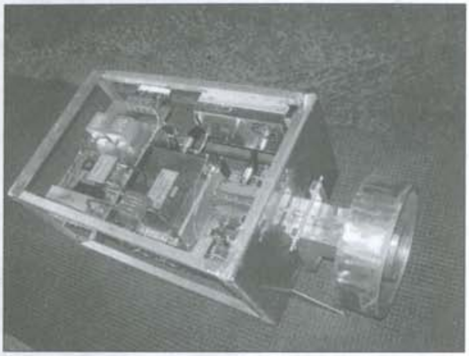
Next EME Conference will be DALLAS 2010



DL7APV's 70cm EME system after a tornado in July

UA3PTW`s new antenna: 24 x 15 Ele for 70cm

RW1AW new system for 3.4 GHz EME



RW1AW new system for 3.4 GHz EME

EME Conference Florence August 2008

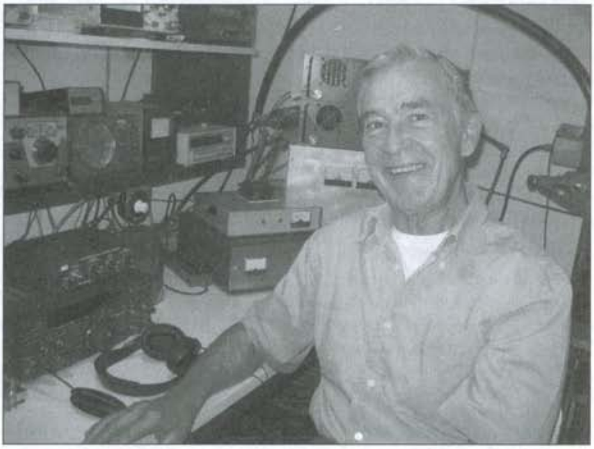
Yes, HE has really deserved it !!

EME Conference Florence August 2008

100 DXCCs on 70cm EME

by Jan Bruinier, DL9KR

During a 20m QSO when Ray VK3ATN and I discussed 160m DX matters , Ray transmitted a recording of K6MYC's 2m EME CW signals as received on his huge rhombic. Though having followed early EME developments (KH6UK, W4HHK, W3GKP, W1FZJ et al.) in "The World above 50 MHz"), this was my first impression of a treasure still hidden in my future. Then there was a cover foto of K2UYH's stressed dish in CQ magazine which gave me an idea that EME might be possible with "small" antennas. While still plugging along on 160, I was caught by the September 1976 QST cover story about K2UYH's first ever 70cm WAC. This was the "seed".



After the birth of our girl/boy twins we had started building a new home on a 1/3 acre lot in a semi-rural area. We moved to the new QTH in June 1976 and thanks to DJ3GL one of the first things was erecting a sturdy 6m high mast which hopefully would carry an EME array in the future. An underground cable run of 19m from the mast to the future shack in the basement was also installed. At that point I never thought of the encroachment by trees and shrub thus impairing my moon rise and set windows. Since then tons of "biomass" had to be removed, not always to my XYL's pleasure.

In 1972 I had begun to built transverters and small power amplifiers for 432 and 1296 tropo in connection with my Drake-4-line (bought at Harrison downtown NYC in '64). The 80w output TH316 now was planned as a driver.

As I was alone with my project, I resorted to QST and ARRL handbooks. W1HDQ had described open wire lines in feed harnesses and W1JR was using open wire in his collinear array. Having heard and read about so many "drowned" coaxial cables, open wire would be the choice. It also offered light weight and extremely low attenuation (when dry). An additional bonus was zero cost for cables, connectors and power dividers.

Antennas: K6YNB' s article on "quagis" in April 1977 QST offered a simple and light weight solution.

16 x 10 element quagis would be spaced in such a way that the transformation on the open wire lines resulted in the impedance of a single quagi appearing at the feed point of the array. Feedline and elements were made of #12 transformer wire thus keeping weight and wind resistance down. My (unsubstantiated) fear of problems with a metallic supporting structure made me rely upon fibre glass tubing for the large H frame. The wooden booms were soaked in a protective fluid. At first, a 2 over 2 (1,5 lambda high, 2 lambda wide) was constructed and measured. Since I needed 60 ohms to match the surplus 60 ohm Flexwell (approx. 7/8") feed line, quagi driven elements had to be shaped in an elliptic form until a perfect match was reached. Now the remaining 3 groups were fabricated. The construction took place on our porch in Summer 1977 and had to be protected from our very active toddlers.

Anyway, the little monster went up after a couple of weeks, being rotated by a KR500 in elevation and KR400 in azimuth.

At first a 6 ft length of flexible 60 ohm coax was used from feedline to feedpoint without a balun. Soon problems with moisture problems occurred and the RX/TX relay plus preamp were placed in an electrical junction box up on the mast. Now the moisture moved into the box, and drain holes, heating with a 10w resistor etc. were tried to no avail. The final solution was putting a small cotton bag filled with about a pound of recyclable sodiumstannate desiccant into the box. In 1979 I added 3 directors for about 1 dB more gain and replaced the loop reflectors by 0,6 lambda wide grids. The KR500 took the resulting mechanical unbalance but was frequently thrown out of elevation by gusts. In summer 1983 I set up sort of an antenna range aiming at a mod of the DL6WU yagi to obtain 240 ohms. Again, W1HDQ's description of a "delta folded dipole" was helpful. DL6WU had access to the German PTT's antenna range and we measured 15,6 dBd for a 19 element version of the "new" yagi with first sidelobes 17 dB down. A modified feed harness placed the 16 yagis at an equal spacing of 2,5 lambda. Now 2 ea. KR500s did the elvation but had soon to be discarded due to wind problems. However, they were left in place as bearings while an HD actuator took over. A KR2800 rotator was introduced for turning the array and is still in place. 5 years later, the weathered wooden booms were replaced by aluminum ones tapering down to 8 mm after adding 5 more directors. All directors were now of 2,5 mm transformer wire procured by DF3RU. This miraculous stuff still does not show any adverse effects due to UV irradiation. The directors are mounted thru the booms and glued in position by means of an acrylic cement (such as Loctite). The feed harness wire dia. was increased to 3 mm and all spacers (placed at the voltage nodes) and supports consist of PTFE. This filigrane and elastic structure (max. square boom dia. 15 mm) has since then withstood "century" storms with only minor damage. At the same time the transmit cable was changed to 1 5/8" Heliax, under nitrogen pressure for moisture protection. Total transmitting line loss was and still is 0,4 dB.

Receiving: In September 1977 I was happy to see 6,5 dB of sun noise with a BFT66 preamp in the shack. Soon the "state of the art" and ubiquitious NE645 took over while K2UYH was experimenting with MSC Hool 8800 GaAsFETs. JA1VDV published a V244 circuit. Eventually I obtained a V244 from a German source for about 200 bucks. Inadvertently, it was killed from the DC side soon after. I swore to myself I'd never experience such a disaster again and it remained that way. Soon the multitude of MGF types made the market and had my friend DJ8QL and me experimenting and measuring for countless hours. At that point we did not know about the pitfalls of noise measurements and had no explanation for even negative noise figures using an HP 346B source. During the 80s many other devices with ever lower NFs became available and made us breed over new input circuit designs. The late DJ9BV' articles in DUBUS provided a fantastic clarification of what was happening when measuring NFs. Rainer also described a relatively simple to build PANFI while DF7VX and DC3XY provided circuit boards and special items. My vintage G4COM device could now be replaced. Of course, aiming at ever lower NFs only makes sense when the losses ahead of the preamp are kept as low as possible. Here the low loss open wire came in as a winner. However, it could be improved by exchanging the 3mm copper wire with 10 mm aluminum tubing. (DJ9BV again!). Achieving a low system temperature had become an obsession. Silver plating, solderless joints whereever possible, input cavities etc. were and are on the agenda. My system temperature is in the 60K range and lets me see a 7dB noise increment when pointing from cold sky to ground (at minus 5 deg elevation). Ground in this context is shrub and lawn. Echoes are audible with 7 watts RF into the 28,4 dBd array thereby enabling QSOs with stations using a single LY & 100w. Naturally, I would have loved polarization switching to cope with Faraday effects but one can't have everything. The vintage and much modified R-4A (always using 400 Hz bandwidth) was replaced by a Kenwood TS870 in 1998. I listen to signals with the 200 Hz BW setting at a pitch of 200 to 300 Hz. Digging for weak signals on 160m since 1963 probably helped training my ears for signals in the noise.

Transmitting: Initially a German YD1332 was used in a stripline circuit but the tube didn't like me and flashed over ever so often while producing a puny 400 watts. After a long wait, an 8938 plus socket were obtained from Eimac. A new stripline amp now delivered a stable 750w output. Later, a TV xmttr stage was acquired and is run way below its CCS ratings at 1500 watts. I never used a sequencing circuit. Instead, an auxiliary DC contact on the antenna relay switches the DC supply to an early stage in the transverter. This aux contact is adjusted so that it closes only when the RF contact has already closed and vice versa, following the KISS principle.

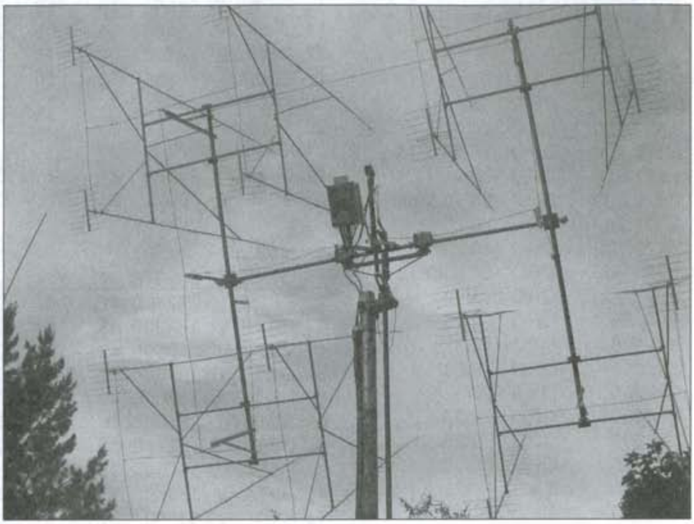
Where's the moon (and stellar sources)?: In the early days, Air Almanach and HO249 Height Reduction Tables (3 of the latter for Moon, Sun and stellar sources!) made Az/El calculations possible. Half hour intervals and intrapolation described the respective trajectory. A huge relief came with the arrival of VK3UM's planning tool. Its feature of real time tracking is still used with manual control.

Keeping in touch: When I entered the scene, 3 important backbones were in operation already. K2UYH's news letter existed in print, W1JR was running the EME net on 14345 kHz and VE7BBG was sked coordinator. Fortunately, K2UYH's NL (renamed 432 & above) persists, W4WD took over from VE7BBG in'79 and K1RQG is running the EME net since 1985. After W4WD's move to Utah DL4EBY and K1RQG coordinated the skeds. Without the existence of the Internet, direct personal correspondence played an important role. My moonbounce column in DUBUS 81 and '82 provided access to additional information. Of course, nowadays email is a major com factor but the importance of Al's NL and Joe' net control remain irreplacable. Another important item was the establishment of bi-annual EME conferences and the papers resulting from them.

QSOs: After hearing my own faint echoes early in Feb 1978 skeds were arranged and I5MSH was worked in a nerve-wrecking session. The YD1332 was cooled by air from the "back end" of a vacuum cleaner. Surely it arced over and pulverized 3 fuses configured in series. But the fuse holders were carbonized and still provided some anode current which resulted in big puffs of black smoke in the rhythm of the morse code. Hours later when K2UYH's window had opened, he was worked for #2. People were after the "new DL country" and WAC was completed in Nov 1978 due to the availability of YV5ZZ, ZE5JJ and KH6IHP.
Expeditioning had begun in the US (K2UYH, KL7WE, W0SD and others) and the completion of my WAS (#12, first outside the US) was done in 1987. At that point I had worked 50 DX entities and never imagined that a DXCC would be feasible in my lifetime though chasing new stations, some of them in new grids, kept things interesting. Big signals such as K3NSS, W3IWI/K8HUH, VE3ONT and KP4I appeared from big dishes. One of the first European Dxpeditions was G3YGF going to GM and GU. DF6NA presented OH0, HB0, EI and GI in a single-man show, the "Five Bells Group" went to GD, TF and OY, Russian travellers activated Belarus and Uzbekistan. NC1I plus group bounced signals off the moon from UN HQ in New York. Lonesome GM6TKS aired ZB2, later repeated by DF2ZC. DG1PJ and DF5JJ were on from C6 and EA6, respectively, while ON5FF activated EA8. Another lone expeditioner, DJ5MN, used the lunar path from OM, 3A and IS0. The "Yota Sawe Group" took care of C3, TK, T7 and CU, a Spanish group around EA3DXU, EA3UM and EA3EHQ put CN and EA9 on the moon, the F6KSX group aired GJ. Ex-WB6NMT, now KG6UH, activated DU, HL and eventually HP. SM0ERR made QSOs with 9M2 and 9M8 possible. SV1BTR was briefly on as SV9/SV1BTR. A Danish group put OX2K on the moon and SM2BYA produced a big signal from JW with a huge dish. DL8YHR was active from OJ0, 5A and D4. G4FRE and G0MRF joined the "Five Star Group" and were active as 3B9C. DL9MS made CU available again. DL1YMK & Monika activated TF, CT3 and CX. K2UYH activated P43L. Eventually, the two Zdeneks, OK1DFC and OK3RM gave me #99 and #100. All these expeditions "re-animated" the scene between the

sometimes 2 year long intervals of "nothing new DXCC-wise" and really deserve all our thanks!

What next?: As a "hunter/gatherer" I'm aiming at 1000 initials on 432 and 300 DXCC on 160m while enjoying any EME QSO with old friends. In CW, of course. And the fight for the last fraction of a dB goes on.



DL9KR 70cm EME

Here's my list of initial QSOs with the respective DXCC entity over the past 30 years. Short term residents or DXpeditions are also named if applicable.

1978: I5MSH, K2UYH, YV5ZZ, ZE5JJ, F9FT, LX1DB, SM5BFK, VE7BBG, KH6IHP, JA6CZD, DJ8QL.
1979: G3WDG, PA0SSB, GW3XYW, ON4DY, VK5MC, OK3CTP.
1980: XE1RY, ZL3AAD, HB9SV, OH3TH, GM3YGF/P, OZ9CR.
1981: ZS6NG, OE9XXI, KL7WE, YU1AW.
1982: GU3YGF/P, OY5NS, UA3LBO.
1983: LA1K, EA2BK, UB5GBY.
1984: CT1WW, Y23TI.
1985: LZ2KSQ, SO1MN, WP4G.
1986: DF6NA/OH0, RQ2GAG.
1987: EI4VBF by "Five Bells Group", UA9FAD.
1988: 4U1UN by NC1I & group, C30BVA by F6HKA & group, HG8VF.
1989: FO4NK, GI0/DF6NA, TK4EME by F6HKA & group, HB0/DF6NA, 4U1ITU by F6HYE, 4X1IF, DG1PJ/C6A.
1990: G4PIQ/TF by "Five Bells GROUP", GD4IOM by G4GCM, UI2/UZ3YWB by UA3YBT & group, YO2IS, SV0EC.
1991: VS6BI, GJ/F6KSX by F5HRY & group, UC2O/UB4LL, ES0SM by SM0ERR & group,
T70A by "Yota Save Group" (DJ9BV et al.).
1992: KG6UH/DU1 by exWB6NMT, , EA6/DF5JJ, YU3C (Slovenia), 9M2BV by SM0ERR, ZB0T by GM6TKS.
1993: FR5DN, LU7DZ, A22BW, HL9UH by exWB6NMT, 9M8WB by SM0ERR, OK1CA.
1994: PY5ZBU, 9A1EZA, OM1TL, EA8/ON5FF.
1995: 3A/DJ5MN, HP3/KG6UH by exWB6NMT, SV9/SV1BTR, ED9UHF by EA3DXU & group,
CN2EME by "Yota Sawe Group".
1998: LY2WR, 9H1BN.
2000: OX2K by Danish Group.
2002: IS0/DJ5MN.
2003: FY5DG, JW/SM2BYA.
2004: 3B9C by "Five Star Group" (G0MRF, G4FRE op), OJ0/DL8YHR.
2005: OA4O by HB9DRI and OAs.
2006: 4S7CCG by ZL1RS, CT3/DL1YMK, 5A7A by DL8YHR & group.
2007: CU2E by DL9MS, D44TD by DL8YHR, P43L by K2UYH.
2008: DL1YMK/CX, 4O/OK1DFC, Z3/OK1DFC.

REF / DUBUS EUROPEAN EME Contest 2008 - CW Results *by DL8HCZ*

MULTIBAND

Place	Call	Points	PWR	Bands
1	SV1BTR	2.452.800	QRO	2/70/23
2	OZ4MM	2.362.500	QRO	2/70/23/13
3	G3LTF	1.937.210	QRO	70/23/13/9
4	OK1KIR	1.329.000	QRP	23/13/9/6/3
5	OK1DFC	1.227.200	QRO	70/23
6	HB9Q	1.173.700	QRO	70/23/13
7	SD3F	1.050.200	QRO	2/70/23/13
8	F2TU	1.050.000	QRO	23/13
9	ES5PC	948.000	QRO	23/13/6/3
10	VK3UM	930.000	QRO	70/23
11	DF3RU	688.000	QRO	70/23/13
12	VE6TA	504.000	QRO	23/13/9
13	SP6JLW	421.600	QRO	70/23
14	WA6PY	399.600	QRO	70/23/13
15	SM2CEW	372.000	QRO	2/20/23
16	OZ6OL	365.400	QRO	70/23
17	DL4MEA	312.400	QRP	23/13/9
18	IW2FZR	310.200	QRP	23/13
19	IQ4DF	282.040	QRO	23/3
20	SV3AAF	269.500	QRO	2/70/23
21	JA6AHB	230.000	QRO	70/23
21	SP7DCS	230.000	QRO	2/70/23
23	KL6M	220.500	QRO	70/13
24	F5JWF	207.400	QRP	23/13/3
25	NA4N	132.000	QRO	23/13
26	W5LUA	119.600	-	13/9
27	VK3NX	92.000	QRO	13/9/6/3
28	RW3PX	84.000	QRP	70/23
29	JA8IAD	72.600	QRO	23/13
30	PA0BAT	53.200	QRP	23/13
31	WW2R	44.800	-	13/9
32.	G3LQR	34.500	QRP	23/13
33	SM3JQU	27.200	QRP	70/23
34	YO2IS	13.320	QRP	70/23
35	JA6CZD	8.400	-	13/6

144 MHz

Place	Call	Points	QSO (+Sked)	Multi	Pwr	OP
1	RU1AA	407100	69	59	QRO	SIN
2	SV1BTR	312000	60	52	QRO	SIN
3	SP7DCS	119000	35	34	QRO	SIN
4	LZ2US	92800	32	29	QRO	SIN
5	OZ1HNE	62100	27	23	QRO	SIN
6	IK2DDR	52800	24	22	QRO	SIN
7	SM2CEW	50600	23	22	QRO	SIN
8	YO2AMU	43800	23	21	QRO	SIN
9	F0CXO	32400	18	18	QRO	SIN
10	OZ4MM	32300	19	17	QRO	SIN
11	OK1MS	30600	18	17	QRO	SIN
12	DL5MAE	28900	17	17	QRP	SIN
13	OK1KKD	25600	16	16	QRO	SIN
14	I3EVK	24000	16	15	QRP	SIN
14	PA3CWN	24000	16	15	QRP	SIN
14	JH0WJF	24000	16	15	QRO	SIN
17	CT1HZE	14400	12	12	QRO	SIN
18	RA6DA	10000	10	10	QRO	SIN
19	9A9B	4900	7	7	QRP	SIN
20	SV3AAF	900	3	3	QRO	SIN
21	RV9UV	400	2	2	QRP	SIN
21	SV2KBS	400	2	2	QRP	SIN
21	SD3F	400	2	2	QRO	SIN

432 MHz

1	OZ4MM	206800	47	44	QRO	SIN
2	KL6M	202400	46	44	QRO	SIN
3	UA3PTW	172000	43	40	QRO	SIN
4	VK3UM	163800	42	39	QRO	SIN
5	OK1DFC	159900	41	39	QRO	SIN
6	I1NDP	156000	40	39	QRO	SIN
6	SV1BTR	156000	40	39	QRO	SIN
8	DF3RU	152100	39	39	QRO	SIN
9	G3LTF	140600	38	37	QRO	SIN
10	DL7APV	133200	37	36	QRO	SIN
11	SM2CEW	93000	31	30	QRO	SIN
12	VE6TA	78400	28	28	QRO	SIN
13	SP6JLW	75600	28	27	QRO	MULTI
14	OZ6OL	70200	27	26	QRO	SIN
15	DL1YMK	62500	25	25	QRP	SIN
15	G4RGK	62500	25	25	QRO	SIN
15	HB9Q	62500	25	25	QRO	SIN
18	SD3F	62400	26	24	QRO	SIN
19	RW3PX	52900	23	23	QRO	SIN
20	JA6AHB	48400	22	22	QRO	SIN
21	SM3BYA	44100	21	21	QRO	SIN
22	W8TXT	36100	19	19	QRP	SIN
23	DL5FN	16900	13	13	QRP	SIN
23	SV3AAF	16900	13	13	QRP	SIN
25	SM3JQU	10000	10	10	QRP	SIN
26	YO2IS	8100	9	9	QRP	SIN
27	WA6PY	6400	8	8	QRP	SIN
28	SP7DCS	900	3	3	QRP	MULTI

1296 MHz

1	OK1DFC	500500	77	65	QRO	SIN
2	F2TU	395300	67	59	QRO	SIN
3	SV1BTR	374000	68	55	QRO	SIN
4	OZ4MM	368500	67	55	QRO	SIN
5	G3LTF	359670	63+1	57	QRO	SIN
6	VK3UM	313200	58	54	QRO	SIN
7	OK1KIR	307400	58	53	QRO	MULTI
8	HB9Q	291200	56	52	QRO	SIN
9	HB9BBD	263200	56	47	QRO	SIN
10	SD3F	228800	52	44	QRO	SIN
11	VE6TA	206400	48	43	QRO	SIN
12	IQ4DF	190380	50+1	38	QRO	MULTI
13	ES5PC	188600	46	41	QRO	SIN

14	DF3RU	167700	43	39	QRO	SIN
15	IW2FZR	159600	42	38	QRP	SIN
16	SP6JLW	140000	40	35	QRO	MULTI
17	SV3AAF	128700	39	33	QRO	SIN
18	OZ6OL	115200	36	32	QRP	SIN
19	DL1YMK/CX	108500	35	31	QRP	SIN
20	WA6PY	105400	34	31	QRO	SIN
21	UT5JCW	95700	33	29	QRP	SIN
22	IK3COJ	92400	33	28	QRP	SIN
23	EV5M	83700	31	27	QRP	MULTI
24	ES6RQ	72800	28	26	QRO	SIN
25	DL4MEA	67500	27	25	QRP	SIN
26	JA6AHB	67200	28	24	QRO	SIN
27	HB0/DF1SR	60030	26+1	23	QRP	MULTI
28	RD3DA	50400	24	21	QRP	SIN
29	NA4N	44000	22	20	QRO	SIN
30	JA8IAD	39100	23	17	QRO	SIN
31	VA7MM	37800	21	18	QRO	MULTI
32	SM5LE	34000	20	17	QRP	SIN
33	DL4DTU	30400	19	16	QRP	SIN
33	PI9CAM	30400	19	16	PRO	MULTI
35	K7XQ	25500	17	15	QRP	SIN
36	K5SO	24000	16	15	QRO	SIN
36	W9IIX	24000	16	15	QRO	SIN
38	F5JWF	23800	17	14	QRP	SIN
39	EA2LU	16500	15	11	QRP	SIN
40	LA2Z	14300	13	11	QRP	MULTI
41	PA0BAT	13200	12	11	QRO	SIN
42	SP7DCS	10800	12	9	QRP	MULTI
43	SM2CEW	6400	8	8	QRO	SIN
44	PA3CSG	5680	7+1	8	QRO	SIN
45	G3LQR	5400	9	8	QRP	SIN
46	SM3JQU	4200	7	6	QRP	SIN
47	RW3PX	3500	7	5	QRP	SIN
48	YO2IS	630	2+1	3	QRP	SIN

2300 MHz

1	ES5PC	81000	30	27	SIN
2	F2TU	72500	29	25	SIN
3	G3LTF	52800	24	22	SIN
4	HB9Q	40000	20	20	SIN
5	OZ4MM	39900	21	19	SIN
5	OK1KIR	39900	21	19	MULTI
7	SD3F	36100	19	19	SIN
8	W5LUA	36000	20	18	SIN
9	VE6TA	24000	16	15	SIN
9	WA6PY	24000	16	15	SIN
11	DL4MEA	23800	17	14	SIN
12	WW2R	16800	14	12	SIN
13	F5JWF	13200	12	11	SIN
14	NA4N	11000	11	10	SIN
14	VK3NX	11000	11	10	SIN
16	IW2FZR	10800	12	9	SIN
17	JA4BLC	8100	9	9	SIN
18	PA0BAT	6400	8	8	SIN
19	G3LQR	4900	7	7	SIN
20	JA8IAD	2500	5	5	SIN
21	SP6GWN	2000	5	4	SIN
22	JA6CZD	1600	4	4	SIN
22	JA8ERE	1600	4	4	SIN
24	DF3RU	400	2	2	SIN
25	KL6M	100	1	1	SIN

3400 MHz

1	W5LUA	3000	6	5	SIN
2	G3LTF	2750	5+1	5	SIN
3	DL4MEA	2500	5	5	SIN
3	OK1KIR	2500	5	5	MULTI
5	VK3NX	1600	4	4	SIN
6	VE6TA	400	2	2	SIN
6	WW2R	400	2	2	SIN

5700 MHz

1	OK1KIR	1600	4	4	MUL
2	VK3NX	1200	4	3	SIN
3	JA6CZD	600	3	2	SIN
4	ES5PC	500	2+1	2	SIN

10 GHz

1	OK1KIR	13200	12	11	MULTI
2	F5JWF	9000	10	9	SIN
3	IQ4DF	4200	7	6	SIN
4	G4NNS	3000	6	5	SIN
5	ES5PC	1800	4+1	4	SIN
6	VK3NX	1200	4	3	SIN
7	LX1DB	900	3	3	SIN
8	SP7JSG	600	3	2	SIN

24 GHz

1	OK1KIR	50	0+1	1	MULTI

Note for Multiband:
If one or more of the bands of 2m / 70cm / 23cm was QRO category then on Multiband also QRO is listed. This is just for information. On 13cm and up there is no QRP/QRO indication.

Congratulations to all winners:
SV1BTR on Multiband, RU1AA on 2m, OZ4MM on 70cm, OK1DFC on 23cm, ES5PC on 13cm, W5LUA on 9cm, OK1KIR on 6cm and 3cm and 1.5cm. This is the first ever contest entry on 24 GHz! Good activity on 3.4 GHz this time! QRP winners are I3EVK and PA3CWN on 2m, DL1YMK on 70cm and IW2FZR on 23cm.
A special award for the best 23cm EME expedition of the contest goes to DL1YMK/CX!

Certificates will be sent out in September.
73 Joe, DL8HCZ/CT1HZE

Soapbox & Pictures

ES5PC: QRV first time ever on 10 GHz, low (6.5W) power only, but still 5 QSOs! On 2.3 GHz worked all I heard except JA8IAD. The station was remote controlled over the Internet. Worked 5 initials: VK4AFL, K7XQ, JA8ERE, ON5RR, SP6GWN.
During 1296 MHz weekend I operated being at my QTH, no remote this time. Was not qrv 100% of the time and missed several easy to work stations. CWNR: JA8IAD, JA6CZD, F5JWF, PA0SSB. Only one initial on 1296 this time: SV3AAF. Pleased to work DL1YMK/CX also in the contest. Many thanks to Michael and Monica for another excellent EME expedition!
Finally some statistics about my total number initials and DXCC-s worked on 1296 and above EME:
1296 MHz: 132 initials, 33 DXCC, 6 continents
2.3 GHz: 53 initials, 20 DXCC, 6 continents
5.7 GHz: 8 initials, 7 DXCC, 4 continents
10 GHz: 6 initials, 5 DXCC, 3 continents
73, de Viljo ES5PC

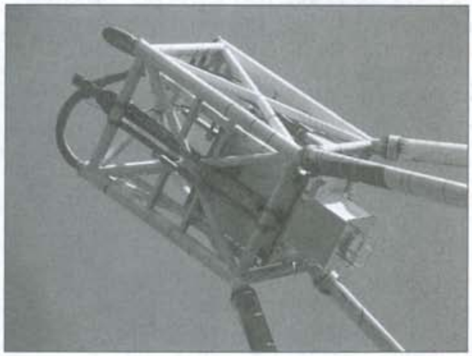
HB9BBD: Had only Saturday for contest. Rewarding 15 initials. 73 Dominique

F2TU: A very good contest. But for 23cm part, handicapped, with only my left arm valid, I left to do only a few qsos. But taken by the heat of action, it was a participation of 80%!
On 23cm: This gives 67 qsos with 16 initials. Missed SV1OE KP5PJR PA3FXB F5HRY RA3WND(?). Heard a brief moment K5GW. But not the other NA stations that were qrv. I have not always been active in the NA window and they had a bad wx. Thanks to Zdenek OK1DFC for its fairplay releasing its qrg left for me qso with Lexa OK1DST, very low. And also to those who have done the same to enable contact QRP stations. Tnx to dxpedition stations M&M DL1YMK/CX, EV5M group, HB0/DF1SR group. They contribute to have a strong EME activity this month. Band initials:
70CM 255 23CM 291 13CM 71 6CM 26 3CM 48
73, Philippe F2TU

F2TU handicapped 23cm operation

SV1BTR: Once more, a great EME WW Contest by DUBUS! I enjoyed myself very much working 164 cw eme random qso's and 160 stations in total, on 2m-70cm-23cm. This is the 1st time I participated on the 23cm section and had an amazing operating time working 68 stations with my 3.6m dish. This Contest is the benchmark of clear, distinct, fair rules which reward all those operators who like to advance their RF knowledge and operating skills bouncing signals off the moon exclusively via the Radio path. It brings out the best of EME RF developments in all fields and constantly paves the way for innovations and advancement on higher bands. Finally, I would like to congratulate the organizers for making a Contest entirely devoted to RADIO random operation and NOT a shameful Internet logger party (e.g. ARRL).'

PI9CAM on 23cm



PI9CAM: This was the first operation of PI9CAM. We use the 52 year old 25 meter Dwingeloo radio telescope, owned by ASTRON. See www.astron.nl Restoration of the historically important and monumental dish has been going on since early 2007. New motors and new cables have been mounted. A very motivated group of more than 30 people worked very hard to get everything going on May 10. On May 9 the new antennas were mounted and moontracking had to be calibrated. So it was a race against the clock to become QRV during the contest. But on Saturday afternoon we finally had automatic moontracking and the signals of HB9BBD nearly crushed our S-meter. We soon noticed that, although we made nice QSO's, we were not as strong as we expected. We hope to find the cause of this "shortage in dB's very soon. But the telescope moves again after more than 10 years of stand still. This makes us very happy! See www.camras.nl . A lot of work still has to be done to completely preserve this "old lady".

Eventually we hope to be regularly on the moon with this dish during contests. We will try to be QRV from 144 MHz to 10 GHz.
Details: Output power : 200 - 250W in the shack, cable loss 6 dB, so max. 60 W at the feed. Antenna: 25 m dish, so expected gain 48 dBi. Operators: Dick Harms (PA2DW), Eene de Weerd (PA3CEG), Jan Kappert (PA0PLY) and Jan van Muijlwijk (PA3FXB).
Locator of PI9CAM: JO32ET. 73 PA3FXB

OZ1HNE: Thanks very much to DUBUS for arranging this excellent CW EME contest with easy and clear rules. I was using: 8 x 8 elm. crossyagi's H/V and 8877. Best 73, OZ1HNE Jorgen.

EA2LU 23cm

EA2LU: After some time QRT, I enjoyed EME as never before find old friends on my favorite mode: CW. Wheater was terrible with heavy rain all time of operation, but I was able to heard my own echo for first time on this band. I want to express my thanks to EA2AGZ and EA2IE, without they great help operation could´nt be done. After long way and big effort to be QRV, I wish to give my little result to the EA3DXU memory....For you Josep M.!!! Thanks to DUBUS/REF to give us this great contest. 73 Jorge EA2LU

SP7DCS: Thanks for nice Contest and see you in next year!!! GL 73 de Chris SP7DCS & Maciek SP7MC

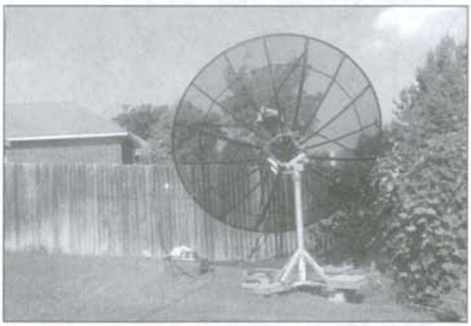
PA3CWN: Thanks for a wonderfull contest time and organizing this great event in memory of Josep EA3DXU !!! I found condx on both days marginal in the morning and 1st part of afternoon but getting very fine in the late afternoon on both days. Activity I found quite well and heard a total of 30 stations. I am very pleased to make a total of 16 qsoos with old friends. Excellent operating practice from all operators and looking forward to the next event !!! PA3CWN

SP7JSG 10 GHz

OZ4MM: Very good activity again this year and very nice to work new and old friends on the moon path. A pleasure to join the DUBUS contest in memory of our very good SK friend Jose, EA3DXU. 73 Stig

YO2IS: Was glad to run the contest again and to update my old fashion setup. Variable and some time strange conditions. See you in the next 23cm EME DUBUS 'heavyweight mode' contest, hi... Pity that so few EME'ers are nowdays interested to run skeds with 'little pistols'. As usual had many CWNRs! 73 & DX, Szigy YO2IS

SM2CEW: Weather prevented full time operation here. Still I had a very good time, this contest has a very nice format, and the rules suit my operating very well. I am now QRV also on 2320 MHz, however for this years contest I was not ready to transmit on that band. But next year I can hopefully add another band to my entry. Thank you Dubus/REF for the best annual EME contest, without competition! 73 de Peter



WW2R

WW2R: 13cm stations should be encouraged to spread out ...on more than one occasion I could see 4 stations operating within a 5 khz bandwidth 2304.1 to 2304.105!

EV5M info: Output power: 350 W, Transmit cable loss: 1.0 dB, Antenna type and gain: 3.6-m prime focus dish F/D = 0.4, gain = 32 dBi.
Contest participation time: 10 May 2008, 07:42 GMT - 11 May 2008, 14:10 GMT. Operators: Nick (UA3DJG), Oleg (UA3ATS).
Grid locator: KO54nj. Photo gallery on the web at:
www.vhfdx.ru/component/option,com_zoom/Itemid,99/PageNo,1/catid,509/

EV5M 23cm

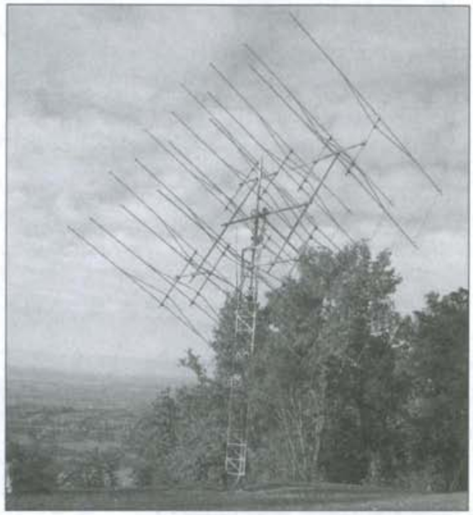
EV5M

EV5M

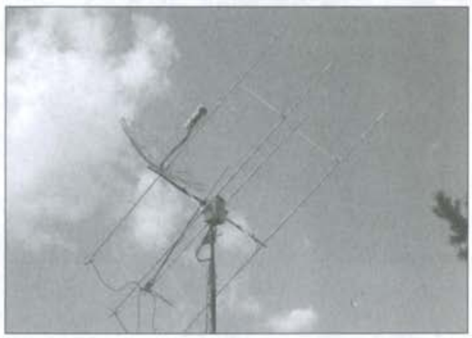
IW2FZR: This year big problem for 13 cm band. Poor qso in log! But big fun for working stations hi hi, this is a fine hobby! Next year hope to be on a new band 5.7 GHz. Tnx to all for fun. 73 Dario IW2FZR

W9IIX: 8 hours operation on 23cm on 1st contest day. High winds prevented operation on 2nd day. Excellent contest, had 4 initals. 73 Doug

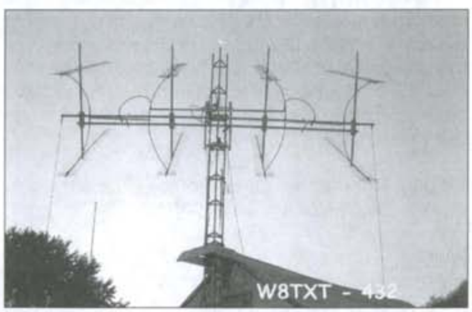
DL1YMK/CX: The DUBUS contest was a great deal of fun for us, the activity from our perspective was excellent. During the contest we made 37 contacts, 13 of these being new initials: OZ6OL, PA0SSB, HB9SV, SM3LBN, IZ1BPN, OH2DG, OE9ERC, VE6TA, F5HRY, PA0BAT, NY2Z, PI9CAM, SD3F (same as SM3AKW, no new#), IK2MMB.



I1NDP 70cm



SM3JQU



W8TXT 70cm with Moon and Venus

Tropo Reports

4m, 2m, 70cm and up

Editor: Wolfgang Schneider, DJ8ES

DJ8ES@gmx.de

4m

CT1HZE, IM57NH, wkd:

August 8th, 2008

1339 CU8AO HM49KL 53 55 1949 km

and again

2225 CU8AO HM49KL 51 51 1949km

CU8 was audible via Tropo continously for more than 18 hours from Aug 8th 13z to Aug 9th 06z. This is a new Tropo World Record on 4m. Several tries on 6m with CU8AO were not successfull, unfortunately. The duration of the opening and the negative result on 6m prove clearly that this was Tropo and not Es. The signals from CU8 on 2m and 70cms at that time were 599 to 599+40 dB.

CT1HZE (IM57NH) 4m 6 Ele. ZX Yagi by WiMo beaming west over the Atlantic

2m

CT1HZE, IM57NH, wkd:

June 10 2008

1944 CU3EQ 51 52 HM68KP 1604km

June 13 2008

2233 CT3MD 55 59 IM13TB new #

CT3MD is the only station on 2m from IM13. He has a yagi beaming southwest to a repeater on IM12. He states that he is NOT interested in working 2m DX ☹

June 27 2008

1355 CU7BC 55 51 HM58QS 1734km
1401 CU8AO 59 59 HM49KL 1949km
1821 CU3EQ 57 52 HM68KP
1832 CU2JX 59 57 HM77ES 1476km

July 17 2008

1213 CU2JX 55 57 HM77ES

July 21 2008

1324 CU3EQ 41 54 HM68KP
2007 CU2JX 52 52 HM77ES

August 3 2008

2106 D44TD 55 55 HK86NO 2681km

August 8 2008

1307 CU3EQ 52 52 HM68KP
1312 CU7BC 55 51 HM58QS
1329 CU8AO 59 59 HM49KL
1453 CU2JX 59 59 HM77ES

CU3EQ, HM68KP, wkd

July 21st

1425 G4LOH IO70JC 429 529
1945 CT1HZE IM57NH 53
1950 G4LOH IO70JC 529 559
1951 G4LOH IO70JC 52 55
2000 EA8AVI IL28FC

Nice tropo to UK. My first qso on 144 to UK.
Rig: 100W and 10 ele.

DL0RSH, JO43, wkd Mai ´08 >700km:

OM3KII (JN88UU, 902km); G4RRA (IO80BS, 881km); HB9TTY (JN46CX, 802km); OE2SCM (JN67OV, 793km); HB9RF59 (JN47GC, 790km); DK5LO/P (JN67DR, 782km); OE5D (JN68PC, 775km); OK5Z (JN89AK, 770km); DB1MUC (JN57WS, 767km); SP2NJI (JO92OS, 766km)
tnx for info Torsten (DG7TG)

EA8BPX, IL18SK, wkd:

June 21st 2008

UT1FG/MM HN22 (abt. 2300km).

EI2IP, IO61CX, wkd:

July 22nd 2008

21:06 EB8BRZ IL27HX
21:07 EA8BPX IL18SX
21:11 EA8AVI IL28FC
21:13 EA8CDX IL18NI
Rig: 50W + 10 ele.

F/LA0BY/p, JN02SV, wkd >700km:

2008-07-05

I3MEK (JN55SJ, 844km); 9A9SF (JN65UF, 1005km); IK5ZWU/6 (JN63GN, 893km); IQ5AE/5 (JN54JD, 758km); IK4WKU/6 (JN63ET, 881km); IK0WVO/6 (JN63IL, 906km)

2008-07-06

IZ6BTN/6 (JN63GN, 893km); S59BEM (JN75DS, 1062km); IK3UNA (JN55KK, 795km); DR5A JO30EM, 923km); S53D (JN76BD, 1060km); IW0HLE/5 (JN54MA, 776km); 9A9R (JN74LT, 1096km); DL0BLG (JN47GV, 779km); S53N (JN65WW, 1035km)
tnx for info Stefan

G4LOH, IO70JC, wkd:

June 27 2008

15:28 EA8TJ IL18RI 59 59 SSB 2600
15:30 EB8CDX IL18NI 53 57 SSB 2611

15:48 EA8BEX IL27GX 539 519 CW 2608
First tropo to EA8 this year

June 28, 2008

The Atlantic duct has also been open for about 36 hours now with EA8TX, EA8TJ, EB8CDX, EA8BPX and EA8BEX in the log too. I listened to them this morning working other G stations as an Es cloud over IN63 extended the tropo over the mountains in northern Spain. I heard CT1HZE briefly, the beacon in IM57 and had half a contact with CT1 on S20.

June 30, 2008

For the fourth day the duct has stayed open to EA8, today was by far the strongest. So strong that Joe, CT1HZE was easily workable by reflection from the Tiede Volcano that forms Tenerife island, amazing 3800km path, we confirmed the path several times over more than an hour, at 18:54 signals were S9! Also in the log: EA8TJ, EA8CCG, EA8BPX, EB8CDX, EB8BRZ.

July 17, 2008

Another strong duct from the Canary Islands to the UK today enabled easy contacts with EA8TX and EA8TJ on 144MHz.

Joe, CT1HZE was very strong reflected off the enormous Tenerife Volcano over a 3800km total path, so strong in fact, that his signal was almost fully quieting on FM!!! We made several QSO's between 10:30 and 13:00 UTC via this path.

I guess that due to the time of day there were no other stations on, it would be nice to work EA7 and CN by this reflection mode also someday.

July 21, 2008

I finally managed to make contact with CU3EQ today after many many attempts. Signals were not strong, I could not hear the CU8DUB beacon on tropo at all but had a few pings from it which is usually an indication that conditions are up.

14:25 CU3EQ 144.310MHz HM68KP 429 529 2144km. The duct did improve somewhat with EA8 signals reaching way over S9 and CU3EQ 55 on SSB. Aslo in the log is:

20:11 CU2JX 144.300MHz HM77ES 52 55 ssb 2121km for another new one along with EA8/DL6FAW and CT1ANO on cw/ssb and EA1QS via a repeater in IN52.

(tnx to G4LOH / www.G4LOH.com for info)

G4RRA, IO80BS, wkd:

June 30th 2008

18:01 EB8CDX IL18NI 53 51 2720km
18:22 EA8TJ IL18RI 55 51 2709km
18:45 EA8BEX IL27GX 519 519 2714km
21:15 EA8BPX IL18SK 55 55 2698km

After listening to Tim G4LOH working EA8s for 3 days and not hearing anything,they finally appeared on the 30th.

PA5DD, JO22IC, wkd May/Jul ´08 >500km:

SK7MW (JO65MJ, 660km); SK7CY (JO65RJ, 683km); OZ8ZS (JO55RT, 606km); OZ5BAL (JO65ER, 645km); OZ2PBS (JO55XJ, 602km); OZ3TT (JO66CA, 656km); SK7MW (JO65MJ, 660km); OZ5BAL (JO65ER, 645km); LB8IB (JO48KK, 753km); SK6W (JO78FM, 943km); OZ5DL (JO65FU, 657km). tnx for info Uffe

ZS2GK, KF47KT, 4 x 9 ele., hrd/wkd:

August 12th 2008

0845-1015 UT **FR5DN/B** LG78qs 529 2890km hrd

August 13th 2008

0139 FR5DN LG78qs 55 / 56 wkd! FIRST EVER 2m QSO from Africa to Reunion! Congrats!

FR5DN/B tx with 100w / 17 ele on 144.400 to ZS2.

70cm

CT1HZE, IM57NH, wkd:

June 27 2008				1604km
1837	CU3EQ	519	519	HM68KP new #
1840	CU2JX	55	55	HM77ES 1476km
CU2JX with 50w and RHCP yagi				
July 21 2008				
1923	CU3EQ	55	53	HM68KP 1604km
August 2 2008				
1723	EA2TA/1	559	559	IN83FE # 794km
1949	EA2VE/1	59	59	IN82FQ # 750km
August 8 2008				
1321	CU3EQ	51	51	HM68KP
1327	CU7BC	51	51	HM58QS new #
1322	CU8AO	59	59	HM49KL 1949km

EI2IP, IO61CX, wkd:

July 22nd 2008

21:47 EA8AVI IL28FC 55/56 2735km (ODX)

Rig: 50W + 19 ele. (EA8AVI using 20w)

PA5DD, JO22IC, wkd May/Jul ´08 >500km:

OZ3Z (JO45UM, 504km); OZ9KY (JO45VX, 545km); OZ6OL (JO65DJ, 620km); OZ6HY (JO45WA, 472km); G3CKR/P (IO93AD, 464km); G0LGS/P (IO81XV, 461km); G8VHI (IO92FM, 426km); G3NEO (IO93II, 426km); G0TVB/P (IO83WR, 492km); G8OHM (IO92AJ, 454km); SK7MW (JO65MJ, 660km); OZ6HY (JO45WA, 472km); OZ1DLD/P (JO45SK, 490km); OZ1MFP (JO55SK, 584km); SK7MW (JO65MJ, 660km); G0LGS/P (IO81XV, 461km)

tnx for info Uffe

SM7ECM, JO65NQ, wkd May/Jul ´08 >500km:

ES6P (KO37LS, 873km); ES0Q (KO07XW, 592km); ES8F/0 (KO18CC, 613km); UA2FL (KO04FQ, 478km); YL2OK (KO37AS, 820km); YL3AG/P (KO06WK, 550km); ES7FU (KO28SK, 809km); ES5PC (KO38HJ, 869km); ES8A (KO28FD, 739km); YL2IV/P (KO06OL, 509km); YL2GJW (KO06RM, 525km). tnx for info Anders

23cm + up

CT1HZE, IM57NH, wkd on 23cm:

August 2 2008

1544	EB8AYA	59	59	IL18RI	1226km

August 3 2008

1115	EA1FDI/p	59	59	IN52LW #	626km

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

05.03.08 21:20	G3XDY	JO02OB	523km
04.05.08 12:40	OK5Z	JN89AK	595km
04.05.08 13:14	OK2STV	JN89DO	600km
20.05.08 19:54	G3XDY	JO02OB	523km
20.05.08 20:04	SM6AFV	JO67GQ	642km
20.05.08 20:18	SM7GEP	JO77IP	700km
20.05.08 21:15	G0KPW	JO02RF	505km
07.06.08 22:42	OK5Z	JN89AK	595km
17.06.08 20:59	SM6AFV	JO67GQ	642km
05.07.08 15:35	G0VHF/P	JO01PU	520km
05.07.08 21:42	G3XDY	JO02OB	523km
06.07.08 07:55	OK1KJB	JN79IO	507km
06.07.08 13:04	OK5Z	JN89AK	595km
15.07.08 17:29	SM7GEP	JO77IP	700km
15.07.08 18:00	SM6AFV	JO67GQ	642km

rig: 65W, MGF1302, 44 ele yagi
tnx for info Eckhard

OE8PGQ, JN76AO, wkd 10GHz >300km:

30.05.08 17:07	9A2SB	JN95gm	367km
24.06.08 16:35	OM1GX	JN88lk	300km
24.06.08 16:50	IW4CJM	JN63hv	321km
24.06.08 16:51	I4XCC	JN63gv	323km
24.06.08 17:17	HA8MV/p	KN06ht	503km
25.06.08 18:10	DL6NCI	JO50vi	448km
25.06.08 18:14	DB6NT	JO50ti	453km
26.06.08 19:07	OK1TEH	JO70fd	395km

rig: Transverter DL1RQ 5w DB6NT, 60cm Dish
tnx for Info Günther

OZ1FF, JO45BO, worked:

1,3 GHz (>600km):

05/05/2008 19:42	GM4CXM	IO75TW	781km
05/05/2008 19:59	GM3SBC	IO85IX	714km
05/05/2008 20:18	G4EAT	JO01HR	655km
05/05/2008 20:38	GM4LBV	IO86RQ	671km
07/05/2008 22:13	G8KQW	IO91OC	774km
20/05/2008 17:26	DF9IC	JN48IW	742km
20/05/2008 18:15	DB6NT	JO50TI	629km
20/05/2008 18:29	DL6NAA	JO50VF	646km
20/05/2008 19:18	G3XDY	JO02OB	600km
20/05/2008 20:17	GM4LBV	IO86RQ	671km
17/06/2008 17:25	DF9IC	JN48IW	742km
17/06/2008 18:50	DL6NAA	JO50VF	646km
15/07/2008 17:50	DF9IC	JN48IW	742km
15/07/2008 19:01	G3XDY	JO02OB	600km
24/07/2008 06:16	SM1NJC	JO97DO	660km

2.3 GHz (>500km):

07/05/2008 20:56	GM3UAG	IO87XJ	654km
27/05/2008 17:48	DL3HRT	JO61AB	568km
27/05/2008 18:33	SA4Z	JO79OF	584km
27/05/2008 19:33	DF9IC	JN48IW	742km
24/06/2008 18:27	SA4Z	JO79OF	584km
24/06/2008 18:34	DF9IC	JN48IW	742km
24/06/2008 18:45	DL6NAA	JO50VF	646km
22/07/2008 17:50	SA4Z	JO79OF	584km
22/07/2008 18:32	DF9IC	JN48IW	742km
22/07/2008 20:20	DL6NAA	JO50VF	646km
24/07/2008 06:18	SM1NJC	JO97DO	660km

5.7 GHz (>400km):

05/05/2008 20:59	GM4LBV	IO86RQ	671km
08/05/2008 07:51	G8KQW	IO91OC	774km
03/06/2008 14:42	DL7QY	JN59BD	731km
22/07/2008 18:48	PA3AWJ	JO21GW	471km
22/07/2008 19:43	SM7GEP	JO77IP	462km
27/07/2008 19:55	G3XDY	JO02OB	600km

10 GHz (>300km):

05/05/2008 20:21	G4EAT	JO01HR	655km
05/05/2008 20:43	GM4LBV	IO86RQ	671km
07/05/2008 16:32	GM4LBV	IO86RQ	671km
08/05/2008 07:55	G8KQW	IO91OC	774km
08/05/2008 16:30	GM4LBV	IO86RQ	671km
08/05/2008 20:49	LA3EQ	JO28UX	402km
08/05/2008 21:04	G4EAT	JO01HR	655km
27/05/2008 17:36	PA3CEG	JO33FB	302km
27/05/2008 19:31	SM6EAN	JO57WQ	326km
27/05/2008 20:00	SM6AFV	JO67GQ	356km
27/05/2008 20:25	SM7ECM	JO65NQ	314km
12/06/2008 20:46	DL1ATI	JO50QU	570km
03/06/2008 14:32	DL7QY	JN59BD	731km
03/06/2008 14:49	DL7YC	JO62PK	487km
24/06/2008 17:58	SM6EAN	JO57WQ	326km
24/06/2008 19:37	SM7GEP	JO77IP	462km
24/06/2008 19:46	DJ8MS	JO63BR	331km
24/06/2008 19:53	SM6AFV	JO67GQ	356km
22/07/2008 17:18	SM6HYG	JO58RG	359km
22/07/2008 18:27	PA3CEG	JO33FB	302km
22/07/2008 19:45	SM7GEP	JO77IP	462km
22/07/2008 20:17	SM6AFV	JO67GQ	356km
22/07/2008 20:25	DL6NAA	JO50VF	646km
22/07/2008 20:34	SM7ECM	JO65NQ	314km
27/07/2008 19:58	G3XDY	O02OB	600km
29/07/2008 12:29	PA0BAT	JO31FX	418km
29/07/2008 12:55	DJ5BV	JO30KI	590km
29/07/2008 13:02	DJ8YE	JO32MH	373km

24 GHz (>100km):

06/07/2008 08:39	DK1ZD/P	JO43XX	111km
29/07/2008 08:24	DC6UW	JO44VJ	171km
29/07/2008 12:35	PA0BAT	JO31FX	418km

OZ1FF (Kjeld) writes:

Activity report from OZ1FF for 1.2 to 24 GHz: Several openings made DX contacts on all micro wave bands possible, many contacts were via rains scatter, a mode which appears as not being posted by DUBUS. In particular with a lot of RS on 24 GHz this year, inclusive a new world record with 637 km by F6DWG/P<RS>F2CT/P, it is hoped for that DUBUS will provide in future the corresponding posting to the DX community.
vy 73, Kjeld tnx for Info Kjeld

PA5DD, JO22IC, wkd May/Jul ´08 >400km:

23cm (>400km):
OZ9KY (JO45VX, 545km); OZ2LD (JO54TU, 552km); OZ6OL (JO65DJ, 620km); DF9IC (JN48IW, 451km); SM7ECM (JO65NQ, 681km); OZ1FF (JO45BO, 451km); SK7MW (JO65MJ, 660km); OZ2LD (JO54TU, 552km); OZ1BGZ (JO65AP, 623km)

13cm (>300km):
OZ1FF (JO45BO, 451km)

9cm (>300km):
DL7QY (JN59BD, 504km); DL7YC (JO62PK, 586km); DL6ABC (JO62OM, 581km); DL1SUZ (JO53UN, 499km)

6cm (>300km):
DL7QY (JN59BD, 504km); OE5VRL/5 (JN78DK, 793km); DL7YC (JO62PK, 586km); DL1SUZ (JO53UN, 499km); DC6UW (JO44VJ, 425km)

3cm (>300km):
F6DKW (JN18CS, 409km); F5HRY (JN18EQ, 413km); F6DWG (JN19AJ, 353km); F5PEJ/P (JN19BQ, 322km); DL6NAA (JO50VF, 537km); DL7QY (JN59BD, 504km); DB6NT (JO50TI, 520km); DC6UW (JO44VJ, 425km); DM2AFN (JO61WB, 645km); DL7QY (JN59BD, 504km); DL6NAA (JO50VF, 537km); DK5WMA (JO60KT, 584km); OE5VRL/5 (JN78DK, 793km); DK5AI (JO51GO, 406km); DL4DTU (JO60TR, 638km); DL3JAN (JO61VB, 639km); DL7YC (JO62PK, 586km); DL6ABC (JO62OM, 581km); DK2GR (JN59IE, 533km); DK1KR (JO53HW, 447km); OZ2LD (JO54TU, 552km); DL1SUZ (JO53UN, 499km); OZ2LD (JO54TU, 552km); DK1KR (JO53HW, 447km); F6DWG/P (JN19AJ, 353km)
tnx for info Uffe

SM7ECM, JO65NQ, worked:

1,3 GHz (>600km):
PA0S (JO21FW, 705km); PA3AWJ (JO21GW, 701km); SM0ERR (JO89WJ, 501km); PA3CEG (JO33FB, 521km); DL6NAA (JO50VF, 614km); DB6NT (JO50VF, 614km); DL9GK (JO50VF, 614km); SM3BEI (JP81NG, 663km); SM0EUI (JO99ES, 551km); SK4AO/P (JP70TN, 562km); SM4DXO (JP70VO, 569km); SM3BEI (JP81NG, 663km); PA0S (JO21FW, 705km); PA3BFK (JO22LI, 649km); PA3CEG (JO33FB, 521km); PA3AWJ (JO21GW, 701km); DF9IC (JN48IW, 809km); DH1NFL (O50VF, 614km); PA5DD (JO22IC, 680km); SK0CT (JO89XJ, 503km); SM0ERR (JO89WJ, 501km); OH0JFP (KP00AB, 635km); SM3BEI (JP81NG, 663km); SM4DXO (JP70VO, 569km); PA5DD (JO22IC, 680km); PA0S (JO21FW, 705km); PA3CEG (JO33FB, 521km); PA3AWJ (JO21GW, 701km); YL3AG/P (KO06WK, 550km); SM0ERR (JO89WJ, 501km); SM0EUI (JO99ES, 551km); SK4AO/P (JP70TN, 562km); DF2CK (JO71AD, 509km)

2.3 GHz (>500km):
SA4Z (JO79OF, 414km); PA3CEG (JO33FB, 521km); SA4Z (JO79OF, 414km)

5.7GHz (>300km):
DL7YC (JO62PK, 362km)

10GHz (>300km):
DL7YC (JO62PK, 362km); DL7QY (JN59BD, 755km); DL9GK (JO50TI, 601km); SM1NJC (JO97DO, 387km)

24GHz (>250km):
DC6UW (JO44VJ, 256km)
tnx for info Anders

Firsts on 24 / 47 / 76 GHz between OK / OM / SP

On August 3rd 2008 a group from OK, OM and SP were qrv from portable locations in JN99 and worked each other for 5 new first ever QSOs on 24, 47 and 76 GHz. Here the list:

12:00 SP6RYL 24 GHz OM3ID JN99KM
FIRST SP-OM

12:14 SP6BTV JN99KM 47 GHz OM6TX
FIRST SP-OM

13:41 OK1UFL JN99JM 47 GHz OM3ID JN99KM
FIRST OK-OM

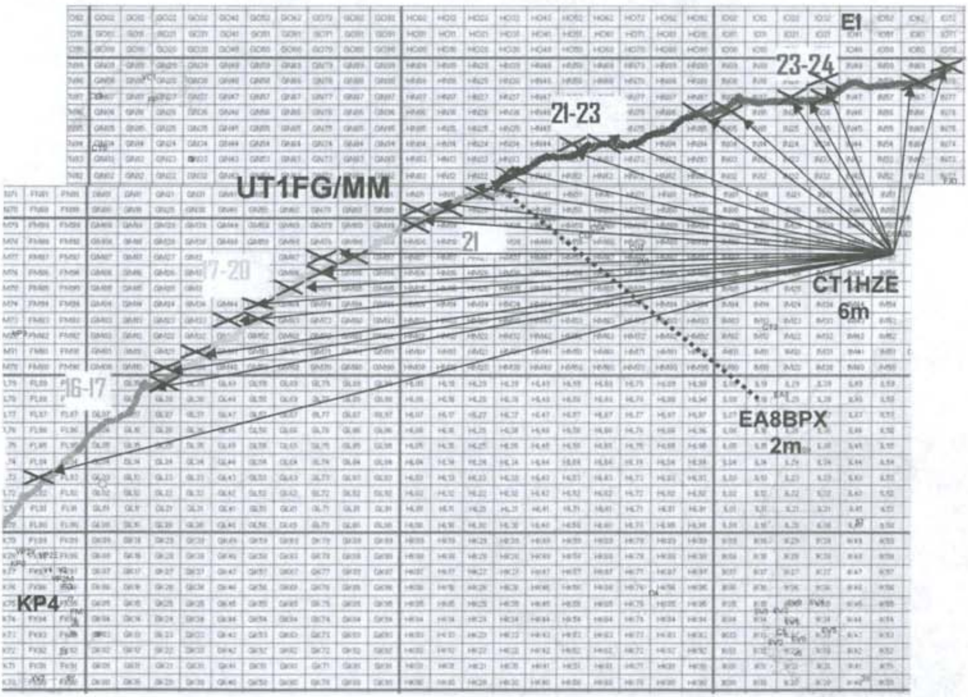
14:18 OK1UFL JN99JM 76 GHz OM3ID JN99KM
FIRST OK-OM

14:39 SP6BTV JN99KM 76 GHz OM3ID JN99KM
FIRST SP-OM

Participitiants from SP: SP6BTV Stan, SP6RYL Roma, SP6ARR Henryk, SQ6OXJ Janusz + SWL Maria.
Participitiants from OM: OM3ID Jan, OM6TX Peter, OM3TME Lenka, OM3WTE Jarmira and OM3CV Vilo.
And from OK: OK1UFL Milan.
More on the web at:
http://hamradio.pl/sp6kbl/klub/photogallery.php?album_id=21 and
http://hamradio.pl/sp6kbl/klub/news.php
73 de Míla OK1UFL

The UT1FG/MM 2008 Atlantic Cruise

Yuri Bodrov, UT1FG, from Odessa is the captain of the container vessel "Greenwing". See picture below. He was qrv on 6m and 2m already in the previous years and made a lot of QSOs from wet squares with happy customers. In 2008 the timetable of his ship was fortunate as a complete crossing of the Atlantic Ocean should take place from about mid to end of June. A perfect time for sporadic E! Yuri is working with about 100 w and a 2 element quad on 6m. His operating QRG is 50.110 MHz. During the first part of his trip from the FL, GL and GM grids he worked mostly stations from North America. VE1XY, K1SIX and K1TOL were the main hunters which were worked by Yuri from many squares. But also CT1HZE came into business early as the only station from EU when he wkd Yuri from FL83 grid northeast of Puerto Rico. In the following days Yuri made hundreds of QSOs with NA and EU from well over 30 very rare wet grid squares. UT1FG/MM was able to work CT1HZE (IM57NH) from 25 different grid squares. See map below. This was the record with a single station for Yuri. Yuri made two great 2m Tropo QSOs with EA8BPX (IL18SK) on June 22nd from HN22 over 2300km. On 2m Yuri wkd with a 4 ele and 50w. Yuri will be active again in 2009 but it could be from anywhere of the world.



Grids worked on 6m by CT1HZE (IM57NH) with UT1FG/MM from June 15 to 25, 2008: FL83 (5300km), GL29, GM20, GM31, GM43, GM44, GM54, GM65, GM76 (3200km), GM77, GM87, HM09, HN00, HN10, HN21, HN32, HN54, HN64, HN74, HN96, IN06 (1300km), IN27, IN37, IN38, IN68 and IN69. –

UT1FG/MM (HN22) wkd EA8BPX (IL18SK) on June 21st via Tropo over 2300km. See dotted line. When Yuri was close to Ireland (IN58, 68) he wkd a few EI/G on 6m/2m/70cm via Tropo.

CY0X – Sable Isl. Expedition Report

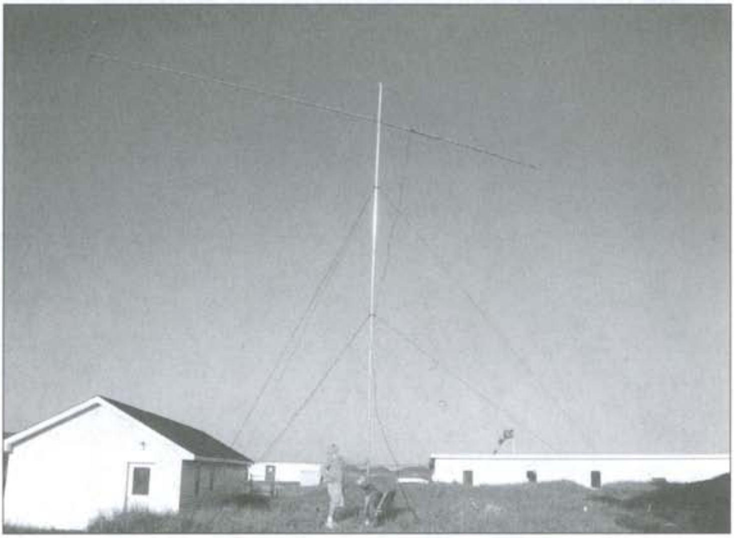
by Pete Csanky, VE3IKV

- Sable Island is approximately 20 miles long by 1 mile wide and is located on the eastern edge of the North American continental shelf, 150 miles southeast of Halifax, Nova Scotia (Canada)
- The island is home to 300 wild horses, and is a huge breeding ground for hundreds of thousands of Grey and Harbour seals, and Arctic terns
- Due to its remote location, any medical emergency requires evacuation to the mainland at the visitor's expense
- The flight to Sable Island is across 150 miles of open water of the North Atlantic ocean
- The aircraft is a Britten-Norman Islander, which is one of the few planes that is equipped to land on a beach, since there is NO airport or navigation aid on Sable Island
- Weight limit for the flight to Sable is only 1,400 pounds including operators, equipment, food, etc.!
- Cost of the charter for getting from Halifax to Sable and back again is VERY expensive - $10,000 total
- We are very fortunate to have a fog-free weather window for our scheduled June 25th flight to the island – fog delays in June & July can be over a week long, as we were to find out later.......
- As it was, we were still 130 pounds overweight and a lot of important gear had to go on a second flight, with no guarantee when it was going to arrive. We got VERY lucky that it made it later that same day, otherwise we could have been off HF entirely for the whole trip, since food flights to the island are usually only once every 2 weeks

Dick, K5AND and Chris, W3CMP on the way to Sable Island

- Under the capable direction of island staff, a safe runway area is marked out on the sandy beach and its orientation and dimensions are communicated directly to Debbie - our pilot in the air
- The island Officer-in-Charge, Gerry Forbes then parks the 4x4 truck at the beginning of the beach runway so that the pilot can locate the marked out area

Sable Island: Beach Airport



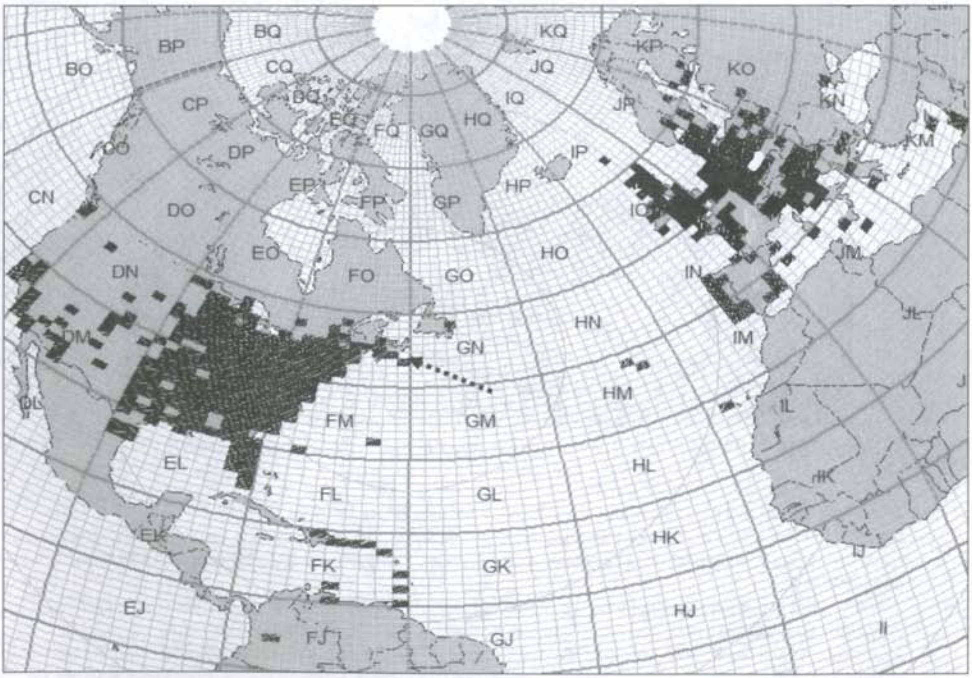
8-element M2 6m beam is up! CY0X, FN93XV

June 26th - CY0X is on the air on 6m and makes the first QSO with W1JJ!

- From June 26th to July 6th CY0X works 2632 QSOs on 6m with NA, EU and AS.
- Monday July 7th – Our original planned departure day dawns with a dense fog and causes a 3 day delay of our departure. Everything is packed but 6m operation continues with a backup 5 ele M2 yagi with armstrong rotator and just 100 W.
- July 8th – First major 6m opening to the US-Westcoast and all the W6s and W7s are shouting "We LOVE fog!"
- July 10th - Last QSO at 0141Z , the band finally closes with AJ9C on CW for 6m QSO # 3,941!
- Pete takes a look in the log and adds up our "fogged-in" QSOs with just 100W and the "temporary" 6M5X antenna – 1,309!
- July 12th: Departure – finally.....

- Final totals:
- 3,941 QSOs on 6 meters, in 60 DXCC entities and 45 USA states
- Best DX on 6m was 5B4 and 4X (about 7900 km), OH3 (5600km), LY (5800km), UR5 (6800km)
- 3,750 QSOs on HF (20m & 40m), in 80 DXCC entities
- Only 7 QSOs on 2 meters via tropo, meteor scatter & EME because of RFI from weather station computers, water in the antenna balun, RFI to island equipment when running over 50W, etc.
- 2m stations worked: VE9AA, VE1KG, VE1HD, WZ1V, WA1T, K1WHS, W5UN

(Ed.: THANKS to W3CMP, K5AND and VE3IKV for the BEST 6m expediton in 2008! Joe, CT1HZE)



449 grids worked on 6m by CY0X, FN93XV from June 26th to July 10th 2008

6m News
Reports, Expeditions, Infos
Editor: Joachim Kraft, DL8HCZ

Summer Transatlantic and Transpacific Es in 2008

The summer 2008 transatlantic Es season was one of the best ever from the Iberian peninsula. CT1HZE worked over 1900 QSOs with Northamerica within 10 weeks on 6m. This is the best score ever for him. On several days even California was worked over about 9000km.

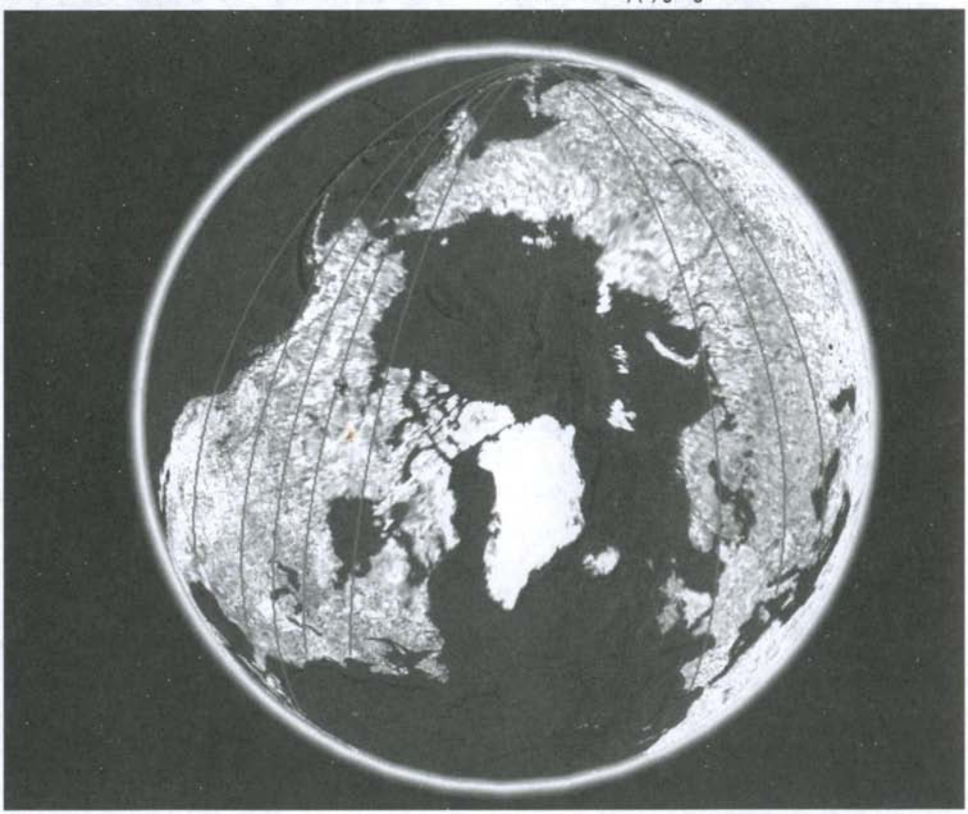
The same was true for the summer transpacific Es season from JA to NA. It was the best ever season and JE1BMJ worked more than 400 QSOs to W, VE, XE and even into HI. This QSO with HI3TEJ over 13.101km is a new Es world record on 6m! JE1BMJ wkd about 50 EU QSOs in 2008, the best distance was CT1HZE and EA3AKY.

JE1BMJ, QM05BR, 6m QSOs > 11.000km in 2008:

Date	Call	Grid	Distance	
0612	**HI3TEJ**	**FK49TL**	**13101 km**	**best WW**
0709	K4NNX	EL94QV	12030 km	
0608	W4SO	EL96VA	11949 km	
0613	KE4WBO	EL96VW	11864 km	
0608	K4MM	EL97TG	11824 km	
0608	W9DR	EL86XV	11736 km	
0708	K4UTE	EM90DH	11470 km	
0608	K4RX	EM70UE	11340 km	
0608	AC4TO	EM70VK	11322 km	
0622	**CT1HZE**	**IM57NH**	**11287 km**	**best DX to EU**
0710	N4JJ	FM04	11215 km	
0708	K4RV	EM93NQ	11199 km	
0710	K4MQG	EM94TG	11169 km	
0710	N4XD	FM05	11120 km	
0709	W2GFF	EM60BM	11105 km	
0709	KN4SM	FM16QT	11102 km	
0708	K4CIA	FM05PW	11092 km	
0708	K4QI	FM06JA	11060 km	
0710	W4BO	FM06gb	11057 km	
0710	K4WZ	EM73TO	11026 km	
0709	K4AU	FM06	11025 km	
0613	N5ORT	EM50KU	11002 km	

There are just 100 stations in the range of 10031 - 10996 km.

Fig.: Fan-shaped daylight paths from JA to NA (EM00, EL97, FK49, FM28 and FN44) and from JA to EU (IM57, JN61 and KM27) (c) google earth



Expeditions & OPs

6W Senegal: T98A is now qrv for about 2 years as 6W1SE from IK14.

9A Malta: TF3IT, Jonas, has moved to 9H and ist qrv permanently as 9H6BA from Gozo Isl., JM76BA, on 6m.

9Q Kongo: 9Q1EK is qrv fpr another 1 to 2 years on 6m. Loc. is JI75pq.

FY French Guayana: F5TND has moved to FY in July and will be there for 4 years. 6m with 2 x 5 ele + QRO. Loc: GJ34uw

IG9 Lampedusa: IG9/I2ADN will be qrv again for some weeks from the end of September on 6m + 4m from JM65HL.

T6 Afghanistan: VK1UN (ex EX1UN) is qrv as T61AA untill at least March 2009 on 6m with 8 ele and 600W. Loc. MN21.

TN Kongo: ex 5T5SN moved in August for 3 to 4 years to Brazzaville (JI75) and will be qrv on 6m.

VK9W Willis: The German VK9DWX Expedtion from October 8 to 27th will be also qrv on 6m.

ZD7 St. Helena: KC0W went QRT as ZD7X and will move to ZD9 where he will stay for 4 to 6 months. Also 6m operation was announced. QSL via WØMM.

Beacons

OH0SIX/B 50.0175 MHz, JP90XI, 3 W, dipole, N/S, qrv again since May 28th.

SK6QW/B 50.060 MHz, JO68WR, 2W, 5 ele Yagi, S, A1, qrv.

SK3SIX 50.070 MHz, JP73HC, 7W, X-dipole, Omni, is qrv.

SV5SIX/B 50.016 MHz, KM46CK, has now 3W instead of 0.1W and is a very good indicator even on 2xEs. Dipole and 65m a.s.l.

TF1SIX 50.057 MHz is ex TF3SIX, now from a new QTH in HP94SC. (TF3GW)

W6JKV Six Meter BBQ

The 6m BBQ will take place on September 26-27 in Austin, Texas at the QTH of W6JKV.

4m News

Reports, Expeditions, Infos

Editor: Joachim Kraft, DL8HCZ

IW4BET, writes:

Here is the report of the first two "real" opening on 4m for me in 2008!

23/05 from JN54ql

10.29 J49K 59-59 KM25ck

24/05 from /p JN54pg @700mt asl

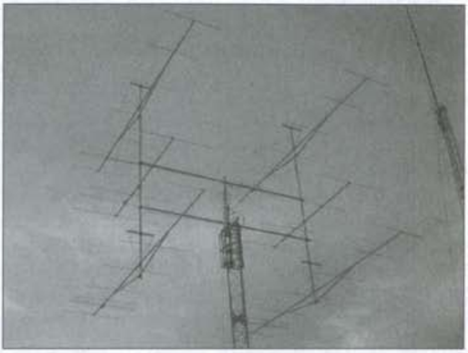
12.57 EI3IO 55-55 IO63wf
14.28 OZ1BNN 55-55 JO55rm
14.31 ES1II/8 55-55 KO18um

then, later, back home in JN54ql:

16.18 MW0CXH 59-59 IO71vq
16.23 G4MKF 59-59 IO91hj
16.24 GW4HBK 59-59 IO81kp
16.25 G7CNF 59-59 IO81re
16.26 GW6TEO 5 9-59 IO71lp
16.27 G0API 57-52 IO70xs
16.30 MW0HMV 59++-59++ IO71xt
16.31 GM4FAM 55-55 IO77um
16.35 G3ZGP 55-57 IO80sp
16.40 GM4WJA 59-57 IO87mn
16.44 ES5AM 55-59 KO38gr

The es lasted longer, but no new station for me. Not bad for this time! Rig: home made 50 to 70 mhz transverter oe9pmj/oz2m revised design, pwr is 10w from a surplus assembly pa ant: 5el (4el in /p qth) modified tv type yagi antennas.

73 de Carlo IW4BET



IZ4FUA, JN45WA with 4 x 8 ele YU7EF Yagis on 4m and 2 x 5 ele for 6m - probably currently the worlds largest 4m array

Portugal on 4m in 2008

The CT PTT ANACOM allowed alll previous 4m licence to operate again from the end of May 2008. Also new licences are issued now and they are valid for 1 year but will be renewed without any problem. The new allocated frequency range is 70.157 to 702125 and 70.3275 to 70.2875 MHz. The range 70.157 to 70.167 is reserved for beacons. Only class A licences from CT can get a 4m (same as with 6m) permit. CEPT operation is not legal in CT on 4m / 6m. The following beacon is qrv already:

CS5BFM, IM59RD, 70.166 MHz, dipole, omni,10w
CS3BFM, IM12, 70.162 is a proposal and
CS1BFM, HM49KL, 70.165 also a proposal.

CU3EQ (HM68KP) is qrv on 4m now with QRP and only HF / 6m antenna but has wkd some QSOs already.

CT1EAT, IM68, is also a new station and qrv.

Finland on 4m in 2009?

Allthough there did not take place any 4m operation during the Scandinavian VHF meeting in OH in June it was mentioned there that in 2009 there will be issued the first 4m licences in OH.

DL on 4m: DI2PM, DL3YEE + DI2AW

All current DL 4m licences are issued for the QRG

69.950 MHz and max. 9.9. WEIRP. Hans, DL8PM, continues to be qrv as DI2PM from JO30 untill October 31st. DL3YEE is qrv again since May 1st from JO42 untill Oct. 21st and DL4VCG, the UKW manager of the DARC district Saarland, is qrv on 4m as DI2AW untill Jan. 31st 2009. Also DL9USA (JO71) has got his 4m licence in the meantime ans is qrv as DI2LP.

SV5FOUR/B

Is qrv since May 29th. on 70.016 MHz from KM46CK with 3 Watt and dipole (a 3 ele. Yagi is proposed). It was hrd several times by CT1HZE over 3279km on double hop Es in summer 2008.

1st Crossband 6m/4m Transatlantic QSO from USA to Europe

After many attempts this and in the previous years on July 12, 2008 Emil, W3EP completed a 4m/6m crossband QSO with Joe, CT1HZE. The distance between FN31VP and IM57NH is 5334km. This is the longest known distance that was worked on the 4m amateur radio band. CT1HZE was transmitting CW on 70.200 MHz with a 6 element ZX-Yagi from WiMo and 100W and W3EP answered in SSB on 50.132 MHz. The 4m signal peaked 539 for just about 2 minutes in the USA. This is the first ever USA to Europe X-band contact on 6m/4m. The signal from W3EP on 6m was 59+20 and more for over an hour in CT and only continuous transmitting on 4m by CT1HZE and monitoring by W3EP made it possible to catch the short opening on 4m.

Several attempts between VE9AA (FN66NA) and CT1HZE were not successfull allthough signals on 6m were 59+++ for long periods. VE9AA wkd G7CNF on 4m/6m X-band already last year on June 26th over 4626km for the first ever Es 4m/6m X-band QSO from NA to EU.

N3DB, Dave, FM18SU, has announced that he will be active in summer 2009 with a good station for 4m X-band tests with Europe.

4 m General Release in EI

The 70 MHz band of 70.125 to 70.450 MHz has been released generally to experimenters in July 2008. This means that any licensed experimenter may now use the band without the need to make an individual application as was the position previously. The upper power limit is 50 W PEP and 25 W PEP for mobile operation.

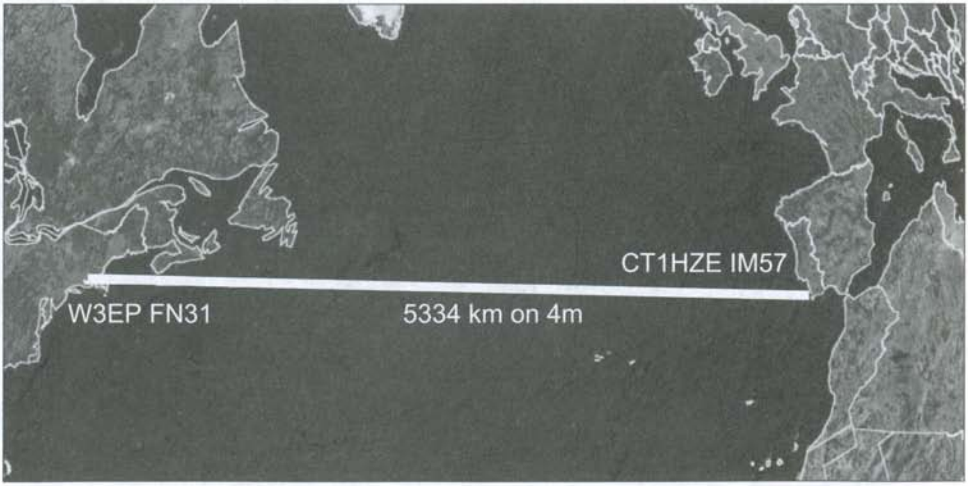
Danish allocation expanded

The Danish 4 m band allocation has been extended with the three following new segments:
69,9875 - 70,0000
70,2375 - 70,2875
70,4875 - 70,5125

New Firsts from CT in 2008

The following first ever 4m QSOs were made from CT in 2008:

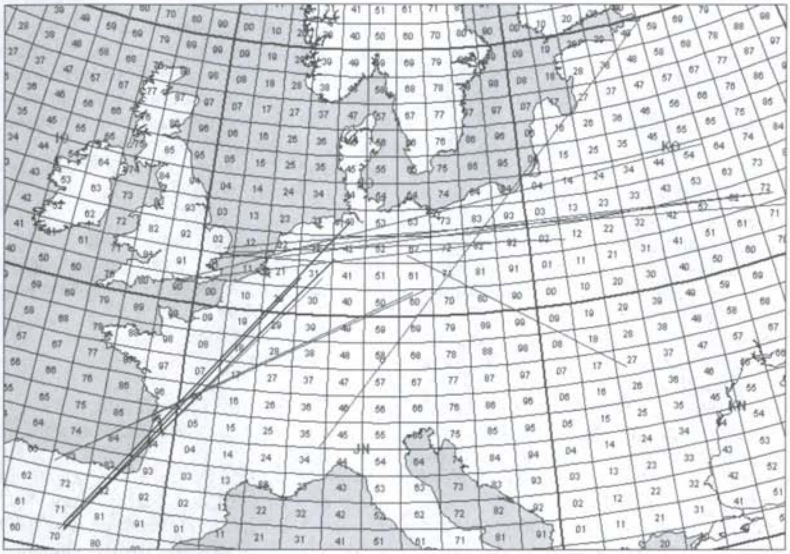
Crete	J49K to CT1HZE	May 28 0928	Es
Germany	DL3YEE to CT1HZE	June 1 0937	Es
Faroer:	OY3JE to CT1FFU	June 16 1620z	Es
Czech. R.	OK2POI to CT1HZE	June 22 0847	Es
Estonia:	ES3RF to CT1HZE	July 2 1034	Es



The path of the 4m/6m X-band QSO from W3EP to CT1HZ E across the Atlantic Ocean over 5334km

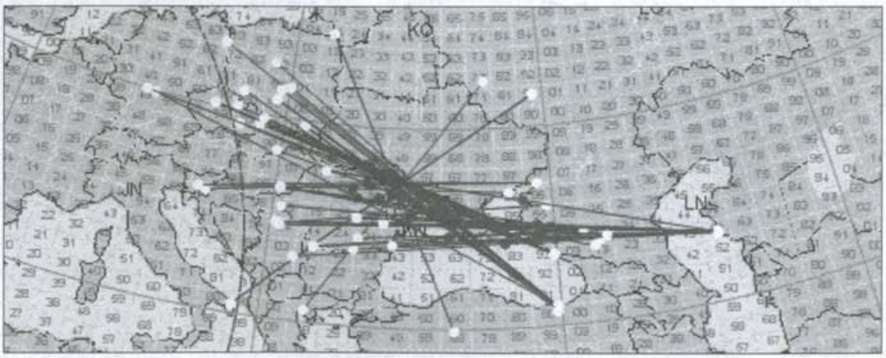
Sporadic-E Summary 2008 – 144 MHz

by DL8HCZ/CT1HZE



24. May – 1153-1203 and 1519-1544 UTC

At about 0752 YO8TK KN27 was hrd from JN58 and wkd from JO62. This was most probably Meteor Scatter. - The first real Es opening started at 1153 from EC1KR in IN70 who worked DG3XA JO43, DK4U JO42, DL5YEE JO42, DL3YEL JO41 and DF1VB JO31. In the afternoon a few QSOs took place from G and PA to SP5 and UA3 and 1 QSO from I1DMP (JN34) to RX1AX (KO59). This was a very late start of the 2008 season and not a too good sign already.

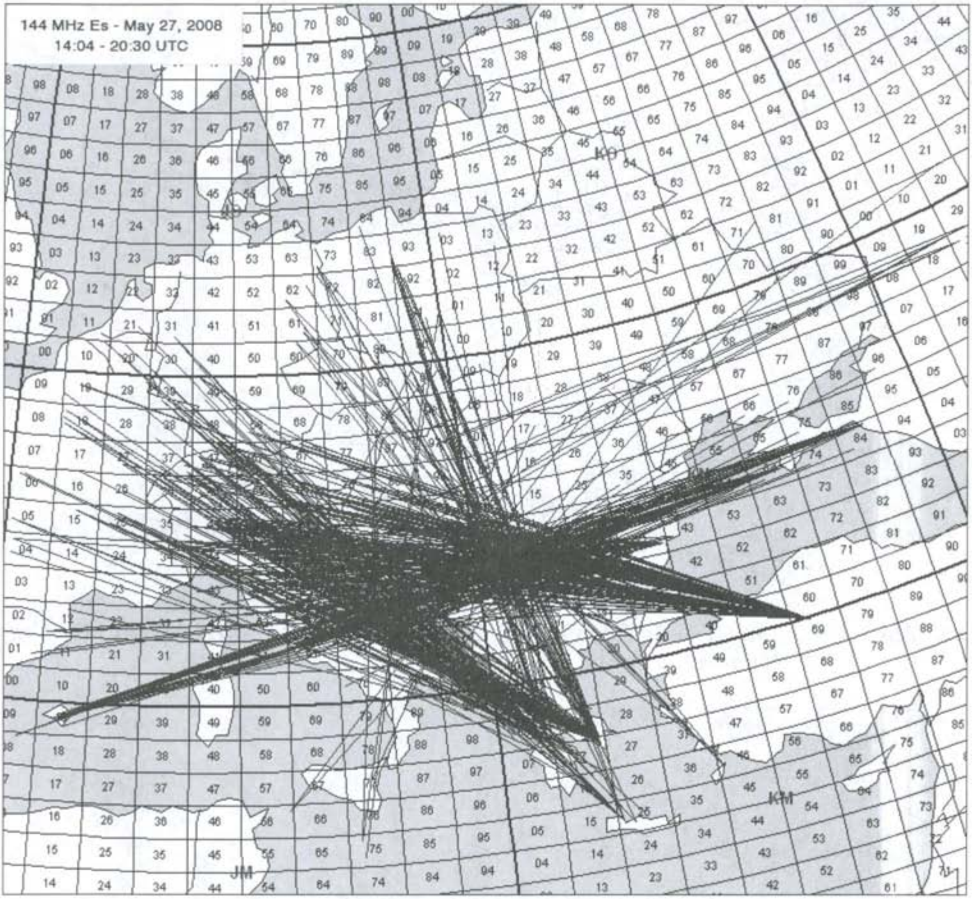


25. May - 0946-1127

UN7AX (JN53) wkd a few QSOs to YO and YU and RZ6BU (KN84) wkd some OK1, OK2 and OM.
TA7OM (KN90UX) wkd SP`s (JO80, 82, 91, KO01, KN09 and DH8BQA (JO73), also TB7MPB and TA7KA were active and made some QSOs. DK5YA hrd the UA6 and TA7 briefly. The other single QSOs on the map are from SV2JL (KN10) to UA3WM (KO72) and RX3QFM (KO91) to IK7XWJ (JN90) and from TA2ZAF (KM69) to LY2SA (KO14). An nice common reflection point over KN46.

26. May (no map)

1100-1109 S54O (JN75NT) wkd RK6LXN JN97, hrd: UA4ALU LN29, UA6MA KN97
1212 RA6AS (KN93VN) wkd IW4DHA JN64 (2209km)

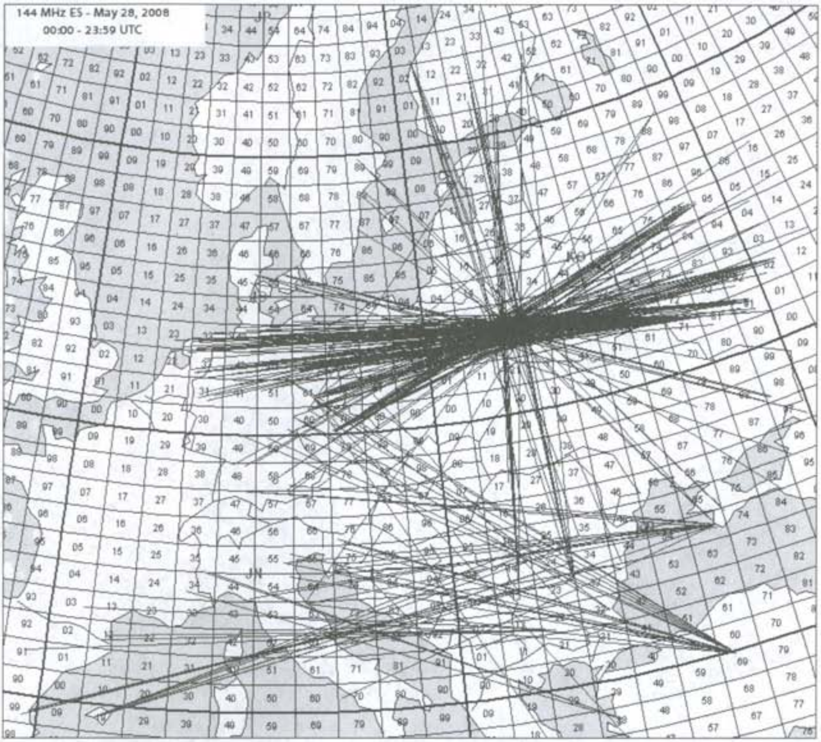


27. May 1404-2030 UTC

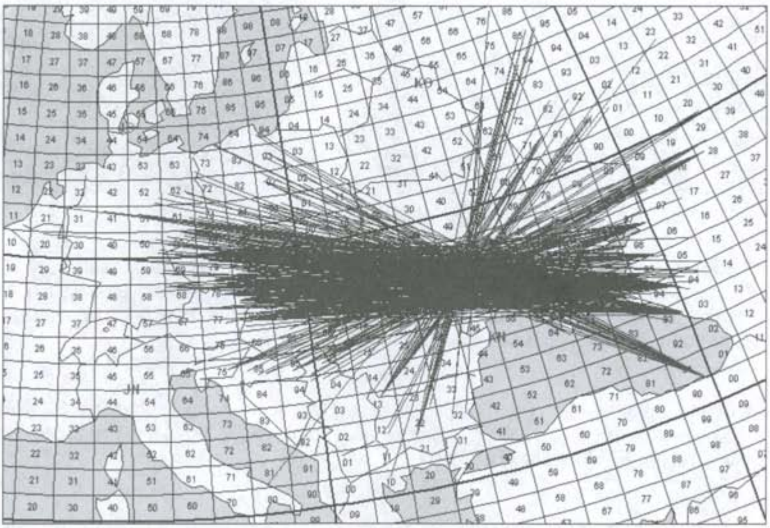
First "better" opening of the season with TA2ZAF (KM69) working 112 QSOs with only 10W and 11 ele. into F, DL, 9A, HB9, OE and I. SV1 and SV3 wkd into DL/F/SP and EA6 into LZ/UU5/UA6. TA1YB (KN41) the xyl from TA1D made some QSOs into S5. J49K (Op G3XUM, KM25) wkd into F/HB9 and DL and also SV5BYR made a few QSOs into eastern DL.

The best DX of the opening was from UT5JCW (KN64SN) to EA6VQ (JM19HN, 2596km), EA6SA (KM19KO, 2573km) and EA6FB (JM08PW, 2728km) and from RZ6BU (KN84PV) who wkd EA6VQ with 559 over 2855km and hrd EA6FB with 519 (3023km)

Earlier from 1103-1119 CT1HZE (IM57NH) wkd already (not shown on map above): G6HKS IO92, M5BFL IO91, G7RRD JO02, G4PBP IO82, 2E0NCG, M3NCG JO03. The first Es opening on 2m for CT1HZE in 2008, quite late for the season and it should remain the almost only one into the U.K.

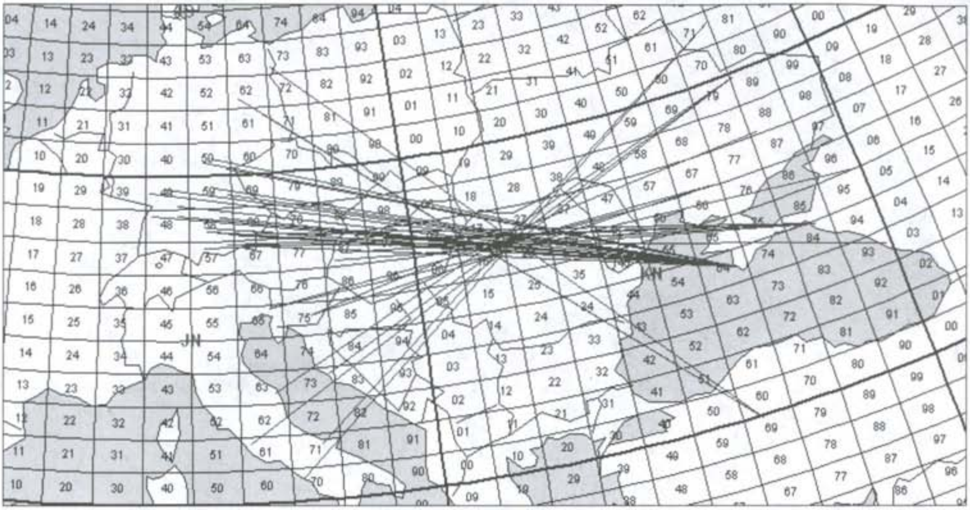


28. May - 1120-1303 TA2ZAF to DL, S5, I - 1625-1745 DL to UA3/4 and EA6 to YO and LA to UR and OH to YO/LZ and SM to UR



30. May 1422-1853 DL/HA/OE/OK/OM/SP to UA6, LZ to UA3, S5/YU to UA4

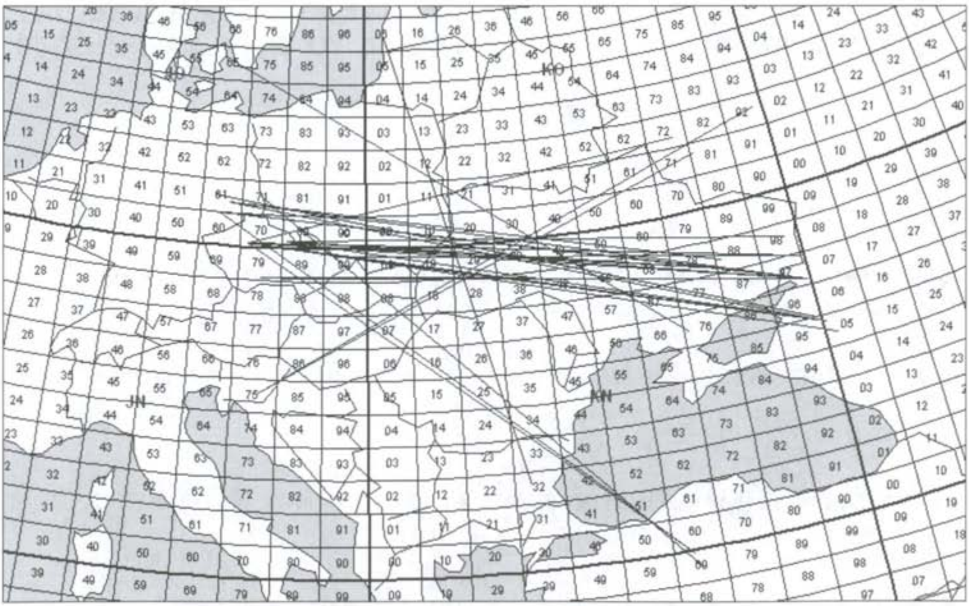
TA7OM (KN90UX) wkd some SPs and DL`s from JO62/73



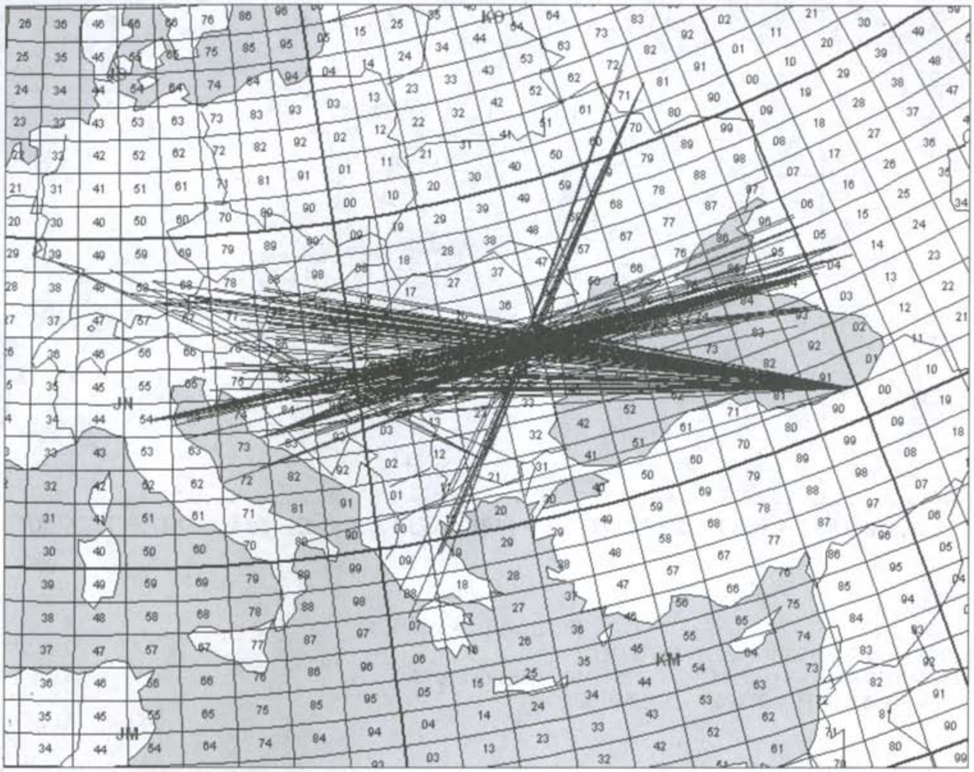
1 June 1332-1358 and 1725-1733 – I7/I8 to UA3 and DL to UU5/UA6/TA2ZAF

2 June (no map)

0946 SK2AT (KP03BU) wkd RW4HW (LO43QM)
1054-1058 RX3QFM (KO91OO) krd SK4MPI/B and OH5UW
1809 EA6SA (JM19LO) wkd LZ2PEP (KN22GM)



3 June 1318-1533 - DL/OK to UA3/6, TA2ZAF



7 June 0725-0728 LZ to DL and 1519-1620 YU/9A/I4 to UA6 and SV3 to UA3 and TA7KA (KN90UX) made 66 QSOs to DL, OE, YU, S5, 9A, HA, OM, E7, T9

8. June

1548-1553 9A/YU (JN95, KN05) to UR/UA4 (KN98, LN28) and 1615 UR (KN98) to SP6 (JO80)

11. June

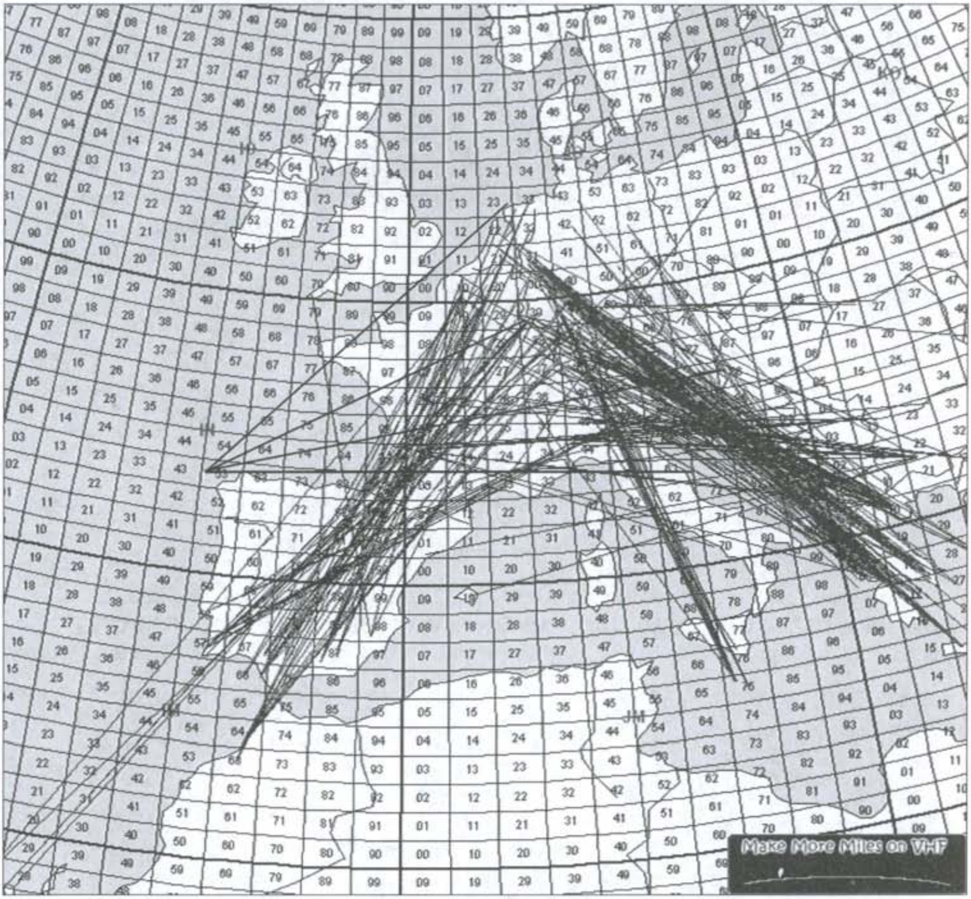
1302-1311 CT1HZE IM57NH wkd: F0FGC JN23, F1USF JN23, HB9BNI JN37, F5RRT JN25, HB9BRU JN37

17. June

Only 2 QSOs 1552 SV1BJY KM18 wkd I1DMP JN34 and 1801 LZ1ZP KN22 wkd 4X1UN KM72

21. June

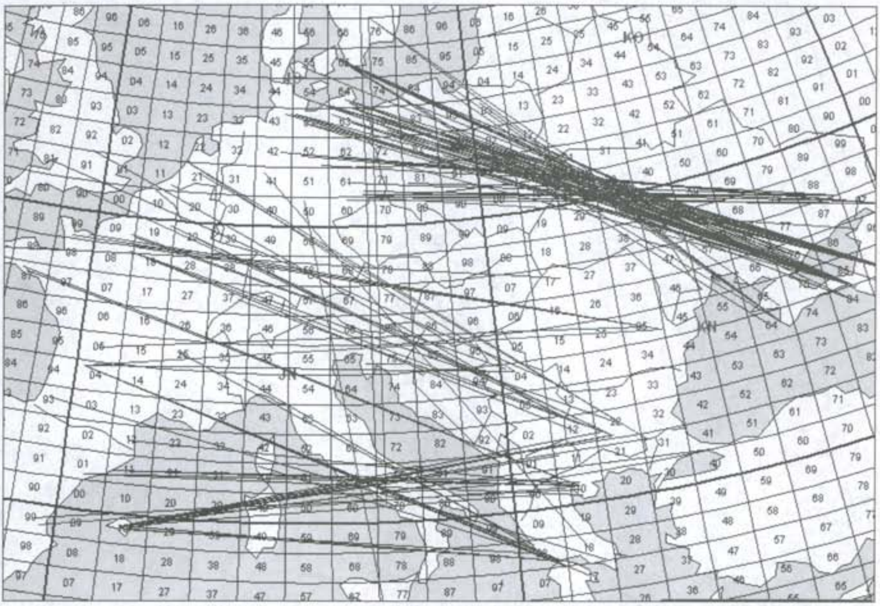
1612-1613 G4RRA IO80 wkd EA8BPX IL18SK 2698km and EA8BWY/p IL18UM 2683km
1612-1659 EA8BPX, IL18SK, wkd: G4RRA IO80, G6HIE IO90, G4FUF JO01, EA3BB/p



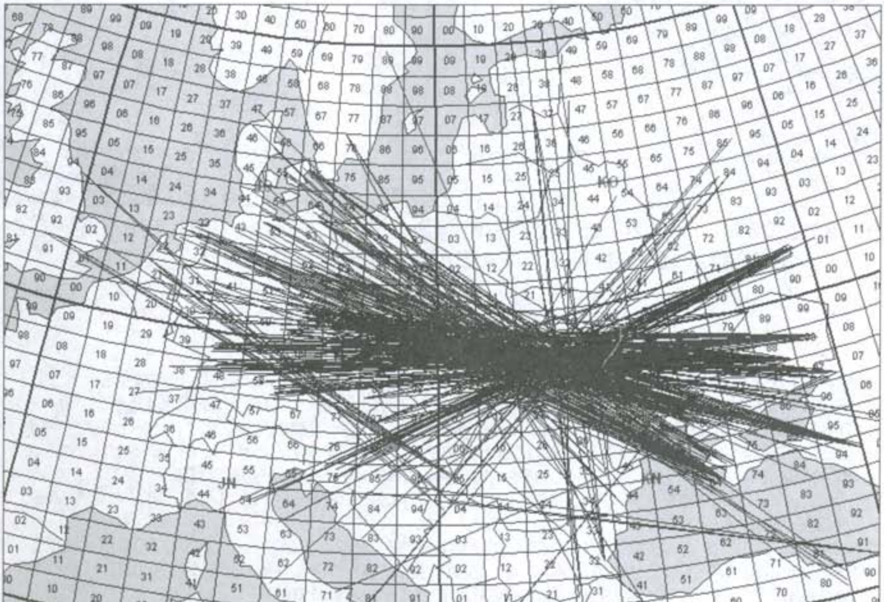
June 22, 0811-0912 DL to SV, SV9 - LZ to I1/I2/F and 1002-1004 DL to 9H and 1047-1107 DL to CT/EA/EA8 and 1230-1300 DL to CT/EA8

1047-1110 CT1HZE (IM57NH) wkd: F4EMN JN37, DO9BC JN48, DL2DN JN48, DD0NM JN59, DC5TD JN37, HB9DFG JN37, DK1CL JN48, DL6SDH JN48, DK5OX JN59, DL1GDS JN48, DL9SAI JN48, DQ3Q JN48, DL8SCQ JN48, DJ9EV JN49, DH8SBT JN48, DG2GEP JN48, DG2NBN JN59, DC1NNN JO50, DD0VF JO60, DF9IC JN48, DJ2NR JO50, I8MPO JN70 (Es to 84 deg. and FAI to 66 deg).
and 1148-1154 F6EGX JN23, I4GBZ JN54, IK3UNA JN55, I3MEK JN55, I1DMP JN34, 9A3NI JN65, F5CKP JN33, I3LDP JN65, I2FAK JN45, IW1DMC JN45, IK1YPD/1, EA3AVW JN11, 9A3AEB JN65, F4CTZ JN23, IW4AMK JN54
and 1209-1301 F4DSD JN23 (C?), F1HQM JN23, F6EGD JN24, F5DKK/p JN24, F0CXO JN26, F1DLT JN27, F4AGR JN07, F0FGC JN23, IW2DAL JN45, DL9SAI JN48, F4AB, F1FLA JN26, DF6IY JN48, F6EKJ JN27, DF2VJ JN39, DK8VS JN39, F4AZF JN39, DK1VW JN39
and 1352 IW9HII JM67

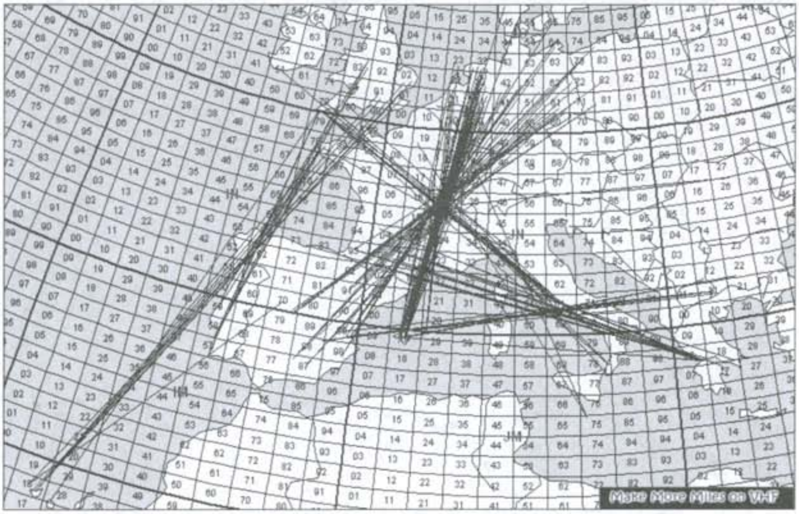
1250-1252 DF1VW (JN39HJ) wkd: EA8ACW/p (IL28EC, 3028km) and EB8BRZ (IL27HX, 3016km)
1255 F4AZF (JN39GG) wkd: EA8ACW/P (IL28EC, 3016km)



June 25 – 1629-1645 DL to UA6 and F to SV - 1738-1745 F/G to YU/YO/LZ
and 1318-1325 CU3EQ (HM68KP) wkd: F8DBF, F6KHM, F0EJW, F1AKK/M all IN78 (QRB abt 2100km)



June 26 0542-0752 DL/OE/OK to UR/UU/UA6/TA7 and I3/I4 to UA3 and G to HA/YU and LZ to YL/LY/SM5 and PA toYU1

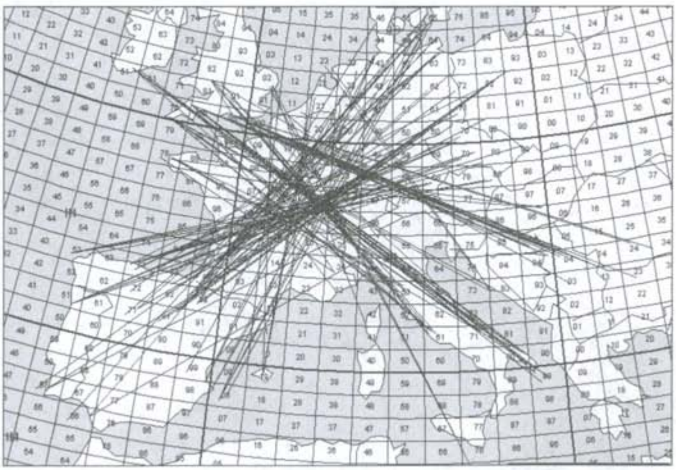


June 28 0849-0912 (F/EA6 to LZ/SV), 0958 (EA5 to I7/LZ), 1104-1129 (G to EA8, F to CT) + 1303-1357 DL, OZ, ON, PA to EA6/7)

<u>1107-1128 EA8BPX, IL18SK,</u> wkd: G0KLX IO91TM, G0KPW JO02RF, M0ITY JO02, G4EAT JO01HR, G4DCV IO91, G7RAU IO90IR, G4BWG IO91, G1YLE IO, G8IZY IO91VC, G3LTF IO91, G0JJE JO02, M3XED JO02, G3LQR JO02QF, G4ZFJ JO01HO, G4BAH/p JO02RF, EA1ASC IN70DX (Tropo?), CT2JHS IM58NW (Tropo), G4EAP IO91NJ, EA1GA IN52QR (Tropo), M5BPL IO91.
<u>1114-1120 EA8TX, IL18QI,</u> wkd: G0KPW JO02RF, G4EAT JO01HR, G8IZY IO91VC, G0JJG JO02LE, G7RAU IO90IR, G4ZFJ JO01HO, G1YLE JO02OB, G1KAW NC and Tropo: EA1GE IN51NW
1128-1129 CT1HZE (IM57NH) wkd: G4RRA IO80, F8DBF IN78

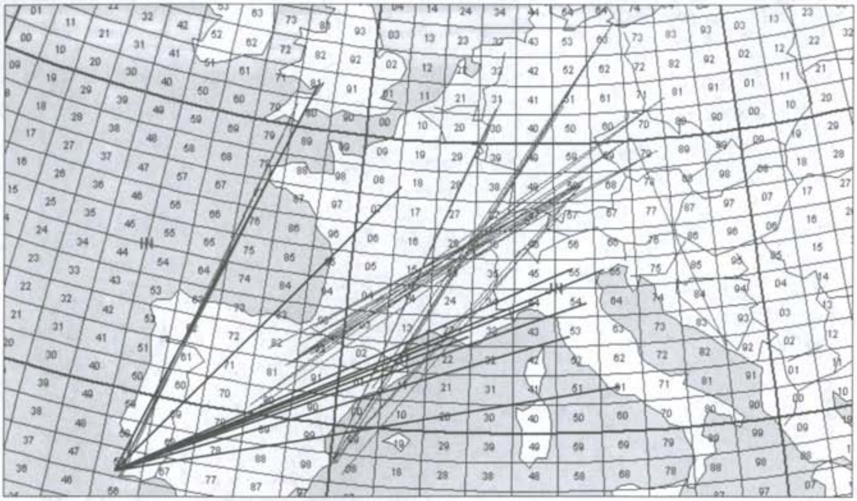
June 29 (no map)

1425 I4RHP/7 JM99DW to 4X1IF KM72PD - 1431-1433 I7CSB JN71QQ wkd 4X1IF and hrd 4X1GA



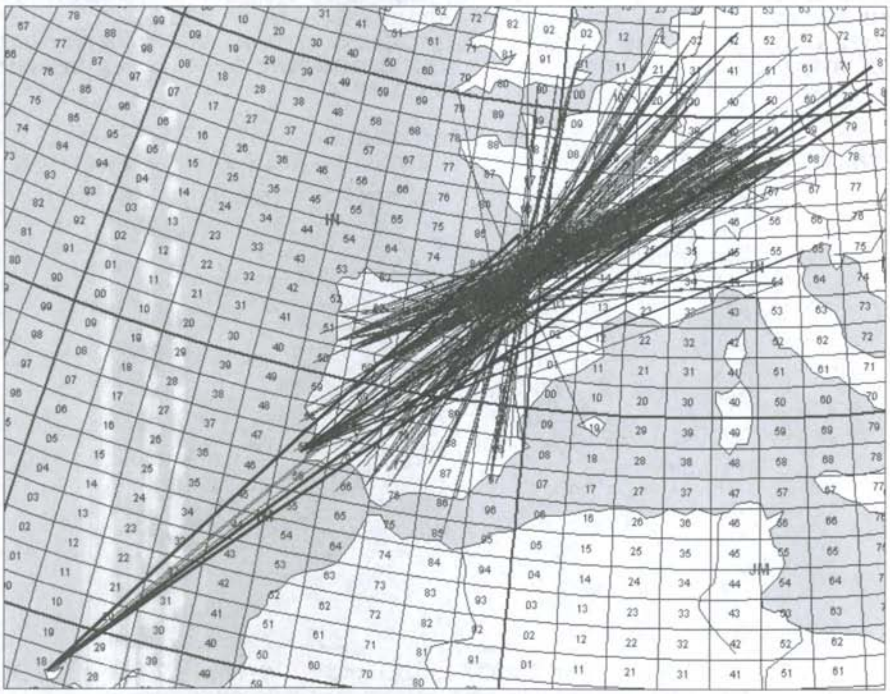
July 2 - 0712-0904 (G to I and EA/CT to DL) and 1714-1748 (G/F to YU/YO)

0734-0748 I4RHP/7 (JM99DW) wkd: EI5FK (IO51RT, 2445km), EI4DQ (IO51WU, 2420km)
0852-0905 CT1HZE (IM57NH) wkd: DK3WG JO72GI 2471km, DF1CF JN57, DF3RU JN59, DK2RY JN59, DF1SO JN48, DF5NK JN59, DD0NM JN59, DF9TF JN37, DJ9EV JN49.



July 9 - 0633-0700 DL to EA5, OK/SP to EA and
1023-1037 F/G to CT and 1510-1543 CT to I/9A/S5

1023-1034 CT1HZE (IM57NH) wkd: F8DBF IN78, G7CNF IO81, G4RRA IO80, F6KHM IN78, hrd F5DQK
1510-1543 CT1HZE (IM57NH) wkd: IZ4GRN JN54, IK5FTQ JN53, 9A9SF JN65, IK1JXY JN44, IW0AIJ JN61, 9A3AEB JN65, F5OWL JN33, IK1RAN JN44, IK1YKT JN44, 9A5CW JN65, I2PY JN55, S53N JN65



July 10 - 1613-1637 F to EA8 and 1926-2036
CT/EA1/4/7 to DL, SP, F, HB9, OE, LX, ON and G to EA5 and I2/4 to EA1

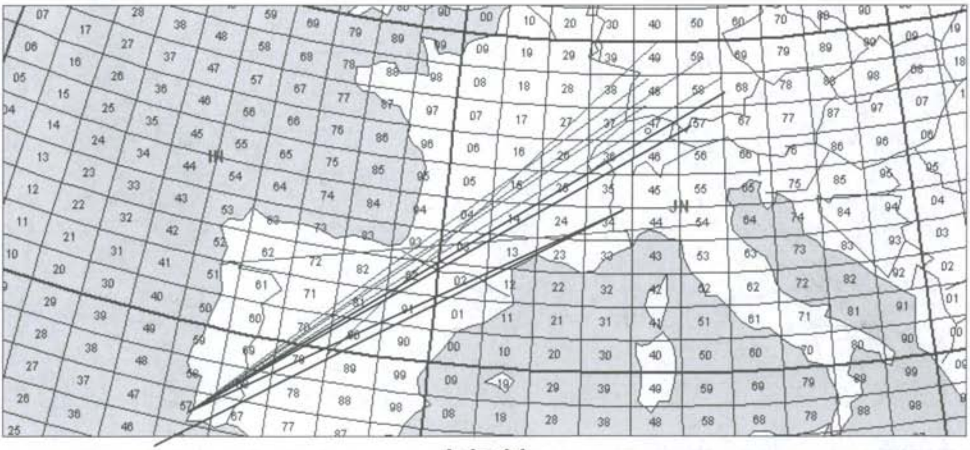
July 10th 1613-1640 EA8TX, IL18QI, wkd: F5VHX JN04FT, F6FHP IN94TR, F1MOZ IN93BS, F4BWJ IN93MP, F5HGO JN05AI, EA1MX IN73XK, F1VJQ IN95OL, F/G4FUF IN95OL and again 1930-1959 F4AZJ JN39GG, DF9IC JN48IW, DD9FJ JO40HF (new #), DL8GP JN39LH, DK8VS JN39NF, DH4IAJ JN49EX, and hrd SP6FUN JO81GH (3756km)

2006-2008 EA8BPX, IL18SK, wkd: F4AZF JN39GG, DK8VS JN39NF, DH4IAJ JN49EX and SP6NVN JO81CJ (best DX on 2m, 3722km)

1926-2036 CT1HZE (IM57NH) wkd: DK1MAX JN58, DJ7YP JO42, DF9TF JN37, DF9QT JO30, F4AZF JN39, DK5AL JO51, DK2EA JO50, DF1UF JN49, DK1MFI JN58, DJ9EV JN49, DJ9MG JO52, DL3JIN JO60, DH7OL JO41, DJ8RZ JN58, DF5NK JO50, DF8IK JO30, DH8IAT JN49, DF2AP JO50, DK5RQ JN58, HB9DFG JN37, DH4FAJ JN48, DL1PR JO30, DF6NA JN49, DG9NCL JO50, DL1RNW JO62GH 2357km, DL3LST JO61, DL9OBD JO42, DL5ME JO52, IW1BAI JN45, F8ZW JN38, DK7LZ JN38, DJ6JS JO31, DL6YBJ JO30, **SP6FUN JO81GH 2534km new DXCC!,** F6GIS, DH9GCD JN38, DD9FJ JO40, SP6GZZ JO80FX 2508km new #, DF9IC JN48, DK2DB JN48, DC2IP JN49, DK1VI JN49, DJ0QZ JN49, DF9FG JO52, LX1JX JO30, LX1DB JN39, DL8YAU JO41, DL9SDW JN48, DK7VW JO41, I3MEK JN55, I1DMP JN34, DL2AU JN58, IK2OFO JN45, F6IRS JN36, DC2GPS JN48, IK4GRD JN54, DL5GAC JN47, DL6YEH JO32, DL6FBS JO40, DF4WC JN49, DG1FBP JO40, HB9HLI JN37, OK1FD JO60, DF1SO JN48, DK1FG JN59, F1BRV JN16, F5ZV JN37, DD1OP JO42, DK0MD JO31, DL3YEE JO42, DJ6JJ JO32, DH3UN JO31, DF1VW JN39, DL1ATI JO50, DD1UN JN49, DF1CF JN57, F4EEI JN27, 9A5SF JN65, IW3HUL JN65, DL2RDT JN59, DH8WE JO50. 2037-2045 FAI: F4DSD JN23, I4RHP JN54, I3MEK JN55.

July 11 (no map)

1022 EA4 (IN80) to IT9 (JM76)
1037-1038 CT1HZE (IM57) wkd SV3CYM KM08 and SV3BSF KM08 **2688km,** open for >10 mins
1039 EA4 (IN80) to SV3 (KM08)
1509-1545 CT1HZE (IM57NH) hrd: CU8DUB/B HM49KL 599 and again 1845-1854
1831-1832 F (IN78) to OK2 (JN99) and OK1 (JN79), OM/OK1TEH JN99 hrd F8DBF IN78
1839 GW (IO81) to S5 (JN76)
1912 F (IN78) to OK1 (JN79) 1910 OM/OK1TEH JN99 hrd F0EJW IN78
So just 9 QSOs reported for all July 11



July 14

0939 EA8TK (IL18) wkd: I1DMP JN34
0945 CT1HZE (IM57NH) wkd: I1DMP JN34 and again 1028
1141-1221 CT1HZE (IM57NH) wkd: DF1CF JN57, F5DQK JN18, HB9BQU JN37, DK5EW JN47, DH3IAJ JN48, DK5RQ JN68, DJ7GK JN58, DF5NK JN59, F0CXO JN26, DQ5X JN48, DB6NT JO50, DL3WW JO60, OK1FD JO60, DJ9EV JN49, DF9TF JN37, DK5OX JN59, DL9GK JO50, DL0RWP JN48, DG1NPV JO50, DL8NSB JO50, DF9IC JN48.

July 17

1549-1552 CT1HZE (IM57NH) wkd: I1DMP JN34, IN3ZTI/3 JN55, DF1CF JN57 and EA8TX IL18 hrd DK5EW JN47

July 18

1804 DD0VF (JO60UX) wkd RZ6BU KN84PV (2 mins opening)

July 24

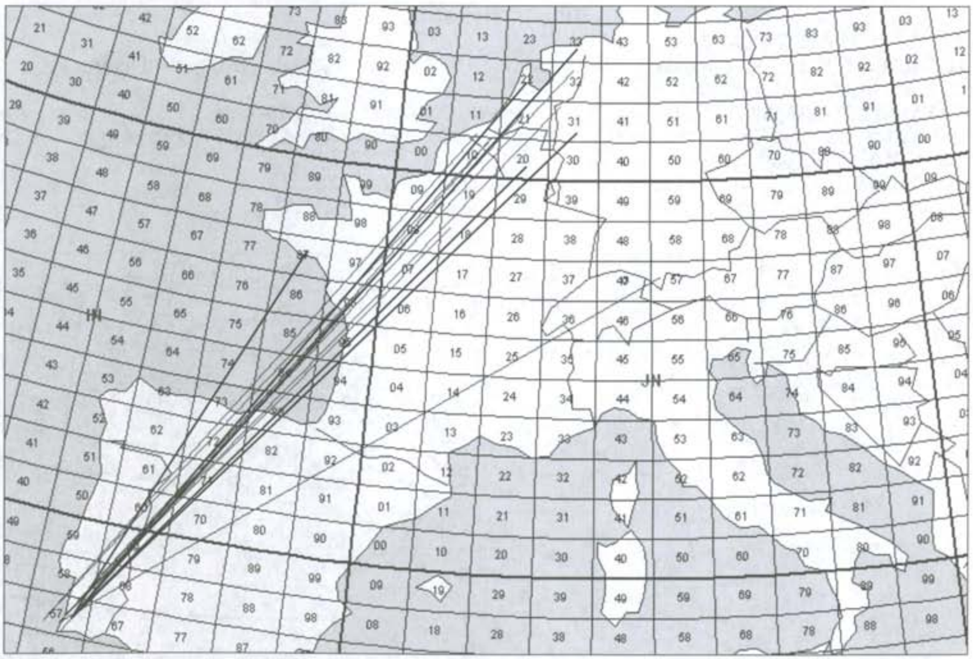
1136 EI4DQ (IO51WU) wkd I1DMP (JN34XU)

July 26

0729 IW0HLE/5 (JN54MA) wkd RA3QR (KO91OC)

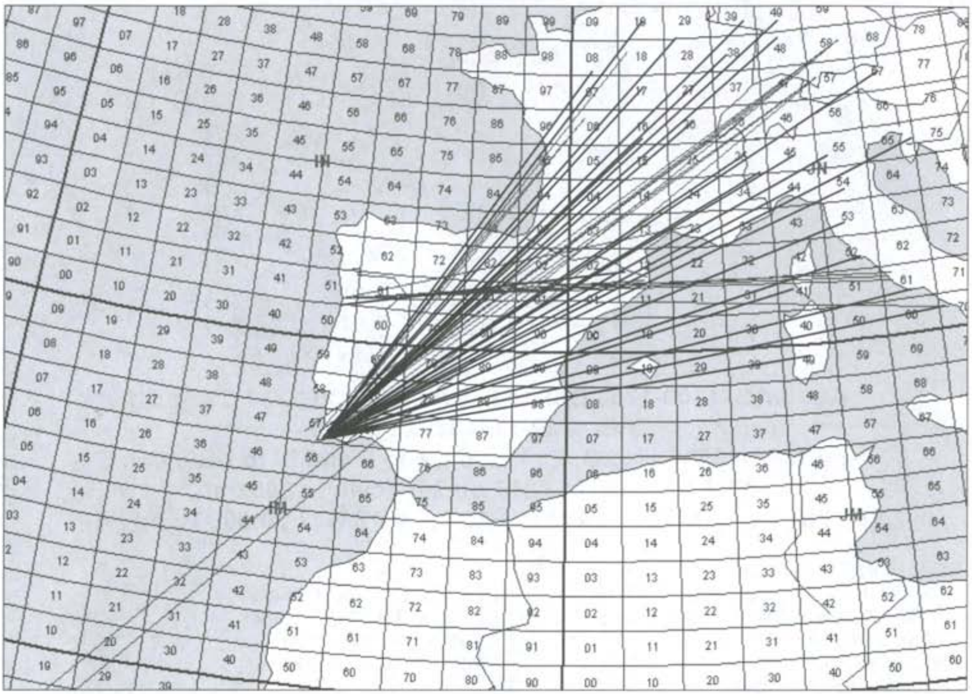
July 27

1425-1435 EA2TO/1 (IN83FE) wkd: EA8TX IL18QI, EB8AYA IL18RI, EA8TJ IL18RI, EB8BRZ IL27HX
1618-1710 CT1HZE (IM57NH) wkd: CU3EQ HM68, CU8AO HM49, CU2JX HM77, hrd CU8DUB/B (hrd agn for 2 mins at 1756)



July 28

1005-1031 CT1HZE (IM57NH) wkd: F5DQK JN18, F6CBH JN19, ON4ANH JO21, DD2JA JO31, F6AOJ JN08, F1CGN JN18, F1DRR JN18, ON7VA JO10, PA3FPQ JO22, ON4IMM JO11, DC9KC JO30, DG3YDG JO42, PE1L JO23, F8CIH/M, F1CKB IN97, F1AKO JN18, ON8BD, PD0EBF JO21, PD0HCV JO31, PE1GNP JO31, PA1LA JO32, DF1CF JN57, F2YT JO10, PA0TLC JO22, F5TTI JO10, DG5YIL JO32, PD2EZ JO32, PD9RDC JO11, F0FIG JO10, ON7EH JO20, PA3ECU JO32, ON7UC JO11, DL9EAJ JO31, DK4TG JO31, PA4AR JO22, PD7ES JO22, PA1TK JO22, PA2M JO21, F6DKW JN18, DG6JF/p JO33, PA3BRQ, F0FND, PE1LWT JO22, DL1EAP JO31, F5PCR JN19.



July 30

0849-0925 CT1ANO (IN51RE) wkd: I8MPO JN70, IZ9CBD JN61, IW0FFK JN61, IK0SMG JN61, F4DSD JN23 11266km, EA3DUY JN12 960km (MUF high!)
0741-0930 CT1HZE (IM57NH) wkd: IN3ZTI/3 JN55, S56HCE JN75, I1DMP JN34, IK1TXM JN45, I3MEK JN55, I8MPO JN70, IW0FFK JN61, IK5CQW JN53, IS0GQX JM49, IZ0CBD JN61, IK5QKG JN52, HB8SJV JN36, DL5GAC JN47, F6BEG JN25, IZ4FUA JN45, DK1MAX JN58, 9A9SF JN65, F6AOI JN33, 9A/I1JTQ JN65, F1EYB JN23, F1RFH JN23, IW4EHZ JN54, I1ANP JN44, F1DRN JN23, F1USF JN23, I2PY JN55, F4AZF JN39, I4AIR JN54, I2YKT JN44, IK2LDA JN45, IW1BCV JN44, DF1CF JN57, DL2KC JN67, F8NZQ JN35, HB9DSU JN36, F6BGC JN36, F6FGO JN25, F4UGF JN25, LX2RV JN39, F8EMH JN29, F0EUE JN29, IZ0CBD JN61, F1BRV JN16, F0ELY/p JN17, LX1DB JN39, F3CN JN06, F5DQK JN18, F8BUI JN18, F1BRR JN18, F6DKK, F6EBH JN19, F6CBH JN19, F5AOL JN18, F8OP JN26, DJ9CZ JO31, F1AFJ JN06, F0FCW JN38, F5CT JN08, DF9IC JN48, DK5YA JN49, F8CHM JN07, F6AOJ JN08, hrd: TK5ZMK/B JN41, IW0LTK/B JN61, IK4PNJ/B JN54, IQ5LU/B JN53
0852-0858 EB8AYA (IL18RI) wkd: DK1MAX JN58 3286km, DF1CF JN57 3161km.

August 1

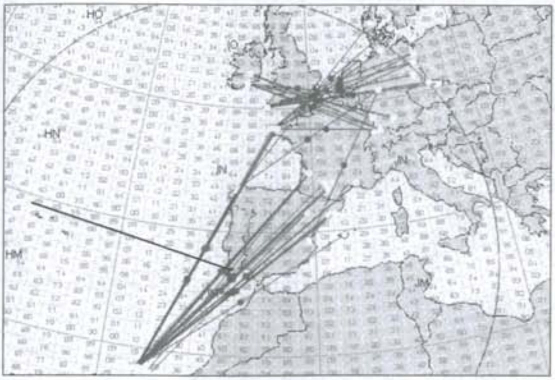
1533-1541 and 1543 and 1548-1550 and 1554-1620: CT1HZE hrd CU8DUB (HM49KL) 529 to 599+20

August 7

1130-1210: CT1HZE (IM57NH) hrd CU8DUB (HM49KL): 599

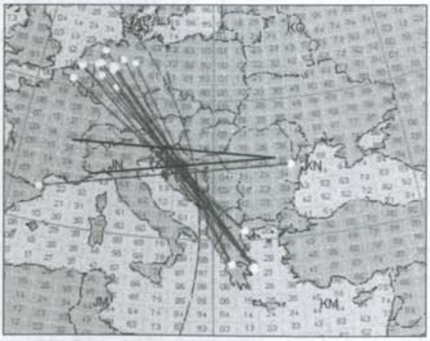
August 9

Aug. 9th was an exceptional day. At 1130 CT1HZE (IM57NH) hrd CN8MC/B (IM63NX) on 50.027 MHZ with 599 on Es over only 412km. This is very unusal even in this region. For about 1 hour from 1130 to 1230 CU8DUB/B was audible at times for minutes on Es then nil then 599 again and so on. There was a very widespread high MUF bubble over the Atlantic for a long time. CT1HZE wkd about 25 stations from Texas (W5) and one from California (W6) on 6m in the afternoon. Also loud pings from N7BHC/B FM15PA on 144.291 were heard at 18z from CT1HZE at the same time when N3DB (FM18SU) was 59+20 on 6m. Allthough a 100% sure identification of the N7BHC beacon callsign on 2m was not successfull, unfortunately. Thus this will not be claimed "officially" as a transatlantic 2m reception.



August 9 1109-1253 EA8 to F, EA and 1130-1230 CT to CU8 and 1439-1444 DL to EA1/5 and 1941-1959 DL to G, EI, F and OZ to F and EI to HB9, ON, F MUF > 215 MHz, QRB on 2m down to 880km! The line from DK7DR, JN47 to F8DBF, IN78 was 20:30UT and FAI!

EI2IP, IO61CX, wkd Aug. 9th: 1942-1947 UTC:
HB9DFG JN37SM, 1206km MUF 176 MHz
ON7CL 882km JO20JU MUF 215 MHz
DO9BC JN48QP 1272km
DK7DR JN47DP 1248km
OE2UKL JN68LA 1542km
DL6SBM JN58AK 1326km
DL3NCR JN48QX 1257km
DC2MW JN58IV 1351km
SP6FUN JO81GH 1674km



August 12 1603-1656 DL/ON/PA to SV, F to YO/LZ

August 14 1051-1123 and 1200-1249 UA3/4/6 + UB5 to S5/9A/HA/HBOE/I2/34/SP/DL/OK and UA1 to YO3

August 15 (no map)

1753-1755: IT9/I3EME (JM68MA) wkd: EA2BVD + AGZ IN91, EA4TF IM89, EA3DHR JN01.

Total count of days with 2m Es in summer 2008 for Europe is 37 so far (untill Aug. 15). The count for the corresponding year 1988 is 32 days. Quite a good match..... See also article "Midlatitude Sporadic E on VHF in correlation to the 22-year Magnetic Cycle of the Sun" in DUBUS 1/2008, p. 9.

TNX for maps to MMMonVHF and G7RAU!

FAI News
2008 QSO Summary

Editor: Dom Dehays, F6DRO
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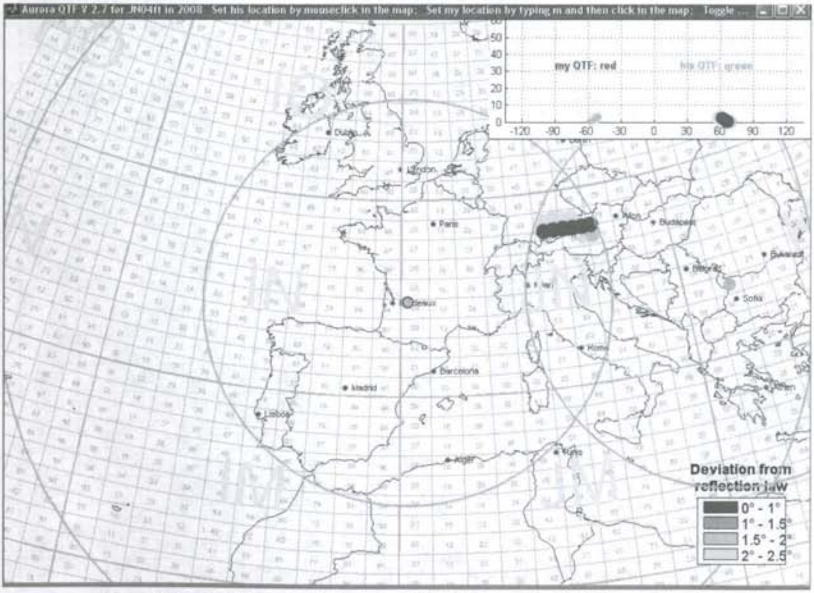
As this year has been a poor Es season, it is the same for FAI: very few QSOs reported.

Date	QTR	STN1	STN2	LOC1	LOC2	QRB	QTF/SCP	Rem
May 03	2105	9A1CRS	TK5EP/P	JN95AD	JN41IW	832		FAI?
May 24	1709	HA6NQ	F6DRO	JN98WA	JN03TJ	1503		
	2046	IK0BZY	G4LOH	JN61GW	IO70JC	1638		hrd
May 25	1100	YU2DX	RA6DA	KN04GS	KN96SA	1489		
	1102	YT3I	RA6DA	KN05HP	KN96SA	1463	60/??	
	1106	9A4EW	RA6DA	JN95KG	KN96SA	1604		
	1111	YU7MS	RA6DA	KN05FJ	KN96SA	1480		
May 26	1011	F6DRO	CT1HZE	JN03TJ	IM57NH	1116		hrd
May 27	1538	LZ1DP	I4XCC	KN22TK	JN63GV	1072		
	1725	F5VHX	9A1CHI	JN04FT	JN95KI	1444	60/??	
	1725	YU2DX	F6FHP	KN04GS	IN94TR	1647		
	1731	F5VHX	S54O	JN04FT	JN75NT	1154	60/??	
	1736	YU2DX	F5VHX	KN04GS	JN04FT	1581	??/60	
	1738	F5VHX	YU1IO	JN04FT	KN04IQ	1595	60/??	
	1746	F6FHP	9A1CHI	IN94TR	JN95KI	1511		
	1749	F6FHP	9A3RU	IN94TR	JN85LI	1361	50/??	
	1752	F5VHX	LZ2ZY	JN04FT	KN13OT	**1808**	55/??	
	1755	F5VHX	9A2LX	JN04FT	JN95LM	1449		
	2025	F5VHX	IC8FAX	JN04FT	JN70CN	1217		
	2030	F5VHX	S54O	JN04FT	JN75NT	1151		
	2034	F5VHX	IZ4BEH	JN04FT	JN54WL	903		
	2045	IC8FAX	F6FHP	JN70CN	IN94TR	1277		
May 28	1738	EA6VQ	LZ1ZP	JM19HN	KN22ID	**1874**		FAI?
May 30	1617	RZ6BU	YU7AA	KN84PV	JN95NS	1420		
	1635	OE3JPC	RA6DA	JN87EW	KN96SA	1764	80/??	
June 01	1555	IK2YXK	G4LOH	JN45OP	IO70JC	1182	JO20	
June 03	1538	RX3QFM	HA8EK	KO91OO	KN06BG	1524		
June 08	1626	RZ6BU	YU1EV	KN84PV	KN04CN	1348	Buda	
	1647	RV6YY	YU1EV	LN04AO	KN04CN	1567		
	1648	RV6YY	YU1IO	LN04AO	KN04IQ	1526		
	1654	RV6YY	YT3I	LN04AO	KN05HP	1524		
	1655	YT1VV	RA6HHT	JN94US	LN04WX	1741		
	1656	YT1VV	RV6YY	JN94US	LN04AO	1603		
	1705	YT3I	RA6HHT	KN05HP	LN04WX	1659		
	2000	RZ6BU	YU1EV	KN84PV	KN04CN	1348	Buda	hrd
June 16	0944	F6DRO	CT1HZE	JN03TJ	IM57NH	1116		hrd
June 17	1326	IV3GBO	DB0FAI	JN66OA	JN58IC	299		FAI?
June 22	1110	CT1HZE	I8MPO	IM57NH	JN70FO	**2044**	66/	
June 26	1768	UT5JCW	YU1IO	KN64SN	KN04IQ	1055		Hrd
July 1	2213	I8MPO	AO6VQ	JN70FP	JM19MP	976	290/	
	2213	IT9CJC	AO6SA	JM76IW	JM19LO	1067		hrd
	2214	I8MPO	AO6SA	JN70FP	JM19LO	984		
July 2	1740	F8DBF	I4RHP/7	IN78RI	JM99DW	2036	80/	

July 10	2027	F4DSD	CT1HZE	JN23JP	IM57NH	1351	/48	
	2032	CT1HZE	DF5NK	IM57NH	JN59PM	**1953**	/48	
	2033	I4RHP	CT1HZE	JN54QL	IM57NH	**1876**	267/	
	2034	CT1HZE	F4AZF	IM57NH	JN39GG	**1817**		
	2045	CT1HZE	I3MEK	IM57NH	JN55SJ	**1919**	57/	
July 11	1909	IZ4BEH	G4LOH	JN54WL	IO70JC	1428		
	1913	I8MPO	G4LOH	JN70FP	IO70JC	**1853**		SSB
	1914	G4LOH	YO2LEA	IO70JC	KN06WK	**2034**		
	1915	HA1FV	G4LOH	JN87JJ	IO70JC	1635		
	1916	HA1FV	G7RAU	JN87JJ	IO90IR	1365		
	1937	F6DRO	YU1EV	JN03TJ	KN04CN	1489		
	1945	F6DRO	LZ1ZP	JN03TJ	KN22ID	**1883**		
	1952	F6DRO	YU2DX	JN03TJ	KN04DS	1496		
	2018	F4DSD	YU1EV	JN23JP	KN04CN	1233		
	2019	F4DSD	YU1IO	JN23JP	KN04IQ	1273		
	2019	YU2DX	F6FHP	KN04DS	IN94TR	1628		Hrd
	2019	F6DRO	I1JTQ	JN03TJ	JN35UB	519	T/FAI mix	Hrd
	2040	F6DRO	IC8FAX	JN03TJ	JN70CN	1086		
July 12	1957	RZ6BU	IC8FAX	KN84PV	JN70CN	**1939**	Buda	Hrd
July 13	0823	F6DRO	CT1HZE	JN03TJ	IM57NH	1116	/35	
July 24	1934	F6DRO	YT3I	JN03TJ	KN05HP	1523		
	1956	F6DRO	YU1IO	JN03TJ	KN04IQ	1529		
	2021	F6DRO	YU2DX	JN03TJ	KN04DS	1496		
	2040	YU2DX	F6FHP	KN04DS	IN94TR	1628		Hrd
July 26	1734	I8MPO	G4LOH	JN70FP	IO70JC	**1853**		
	1740	HA1FV	G4LOH	JN87JJ	IO70JC	1635	51F	Hrd
July 30	0901	I8MPO	CT1HZE	JN70FP	IM57NH	**2044**		
Aug 3	1945	IV3GBO	IK7UXW/B	JN66OA	JN80XP	710	FAI?	Hrd



Possible scatterers between F5VHX and LZ2ZY on May 27

IFS – Iono Forward Scatter on 2m

by Joachim Kraft, CT1HZE

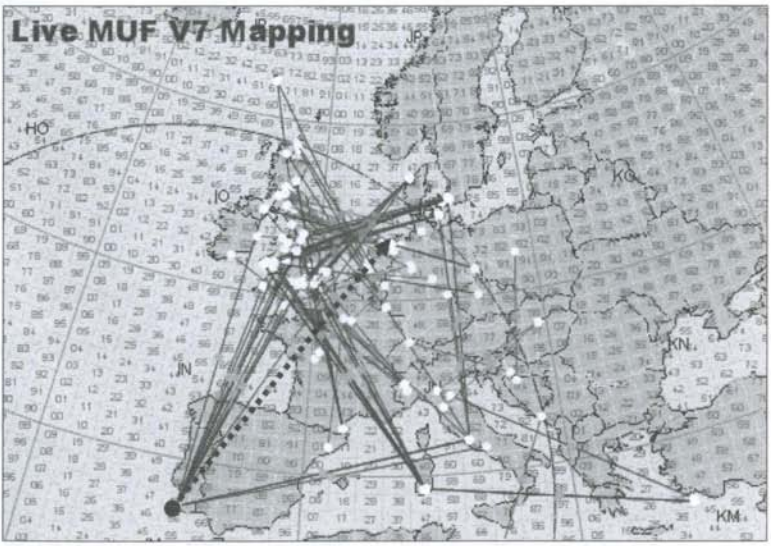
In the last years I have often made IONO QSOs on 2m with Tim, G4LOH. Also in summer 2008 we made some QSOs, e.g. on July 2nd at 13:12 with 529 / 559 on CW. The QRB is 1452 km. Finding stations with suitable ERP at larger distances is quite difficult and some tests were negative.
Looking at the current IARU Region 1 record table we see the following:

DF9PY/P	**JO30JF**	**SM2EKM**	**KP05UW**	**CW**	**1989-06-09**	**1947 km**
G4SWX	**JO02PB**	**SM2CEW**	**KP15CR**	**CW**	**1991-06-11**	**1923 km**
DK3BU	**JO33NO**	**RK3FG**	**KO86HP**	**CW**	**2003-07-03**	**1897 km**
PE1OGF	**JO21QJ**	**SM2CEW**	**KP15CR**	**CW**	**1998-06-07**	**1860 km**
SM2CEW	**KP15CR**	**PA0JMV**	**JO21PL**	**CW**	**1995-07-16**	**1854 km**

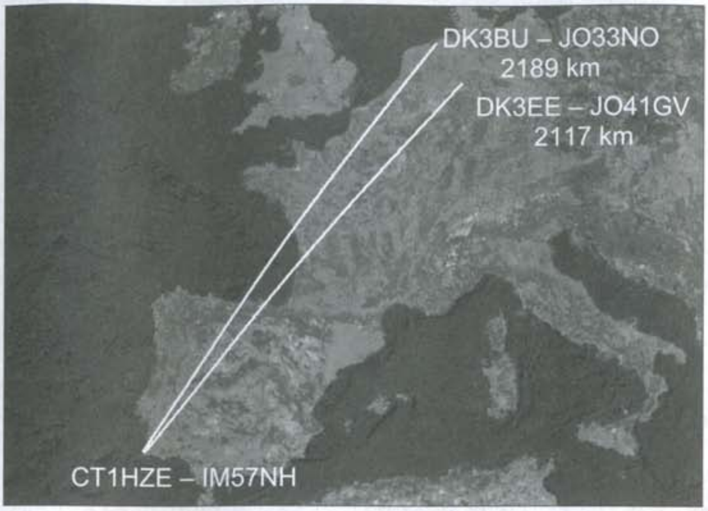
So there was no QSO beyond 2000km and the 1947km record stands since June 1989. As DK3BU (JO33NO) is still active I asked him if he would like to try some CW IONO tests with me and he agreed. The distance is a challenging 2189km. In June and July we run many tests on CW at different times. Sometimes DK3BU hrd me with 319 and sometimes I hrd him briefly in the noise beside the usual pings and bursts via meteor scatter. But it was never enough to make a QSO.

On July 20 I asked **DK3EE (JO41GV, 2117km)** spontaneously for a IONO test and he agreed. As the results on CW with DK3BU were poor, we chose JT65B. From 1443 to 1503z we completed a QSO in JT65B. Signal level of DK3EE was -28 and traces very visible well on the spectrum display.

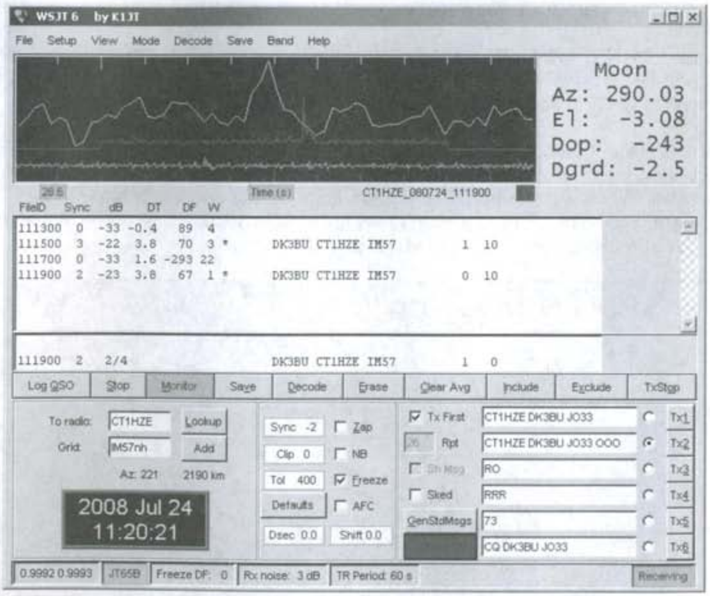
Encouraged by this result I tried again on July 24th with DK3BU as there was a lot of traffic on 70 MHz over western EU and the MUF looked promising. We also chose JT65 now as our previous CW tests were not successfull. When we started at 11:15z we immediately saw each other, I was -22 at DK3BU and he was -17 here. For some strange reason I was not able to decode this strong signal from Harm and we switched to CW and exchanged **419 / 419 at 11:20 UTC.**



Map with 4m (!) QSOs on July 24th 2008 – dotted line the 2m IONO path IM57 to JO33



New 2m IONO (IFS) IARU Region 1 Record – 2189km



2m IONO Signal from CT1HZE decoded by DK3BU (HZE`s clock was not set)

ARRL lists the following QSOs as IONO records:

IFS	**2856 km**	**K5JL (EM15dp) --**	**VE1ALQ (FN65vh)**	**08-Nov-1999**
IFS	**2587 km**	**K5JL (EM15dp) --**	**W1REZ (FN55ea)**	**08-Nov-1999**
IFS	**2552 km**	**K5JL (EM15dp) --**	**WA1JOF (FN44xw)**	**11-Nov-1999**
IFS	**1849 km**	**K0MQS (EN13uh) --**	**WA1JOF (FN44xw)**	**31-Aug-2000**

As the first three QSOs are totally out of the summer IONO season and there was strong Aurora on 2m on November 7, 8, 9 and 11, 1999 also over Europe these QSOs were most probably not IONO but Aurora-E. Thus may be only the 1849km QSO from August 2000 was IONO.

Aurora Reports

GM4VVX, IO78TA wkd on 144 MHz in CW:

26 March 08

18.18	PA3CWN	57a	55a	JO33AH	

23 April 08

17.00	OZ1BNN	33a	51a	JO55PM	
17.05	G7RAU	57a	57a	IO90IR	
17.07	PF7M	55a	56a	JO33BA	
17.16	PE1AHX	33a	31a	JO21OS	
17.28	G4DEZ	59a	57a	JO03AE	
17.39	PA2RU	33a	52a	JO32LT	
17.41	EI2IP	33a	51a	IO61CX	
17.49	GM6HGF	47a	55a	IO75QP	SSB
17.56	G4ZFJ	59a	33a	JO01HO	
18.00	G4YTL	57a	55a	IO92MB	
18.05	G4RRA	49a	55a	IO80BS	

tnx for info, Clive

LA/PA5DD, JP42WQ wkd on 144 MHz:

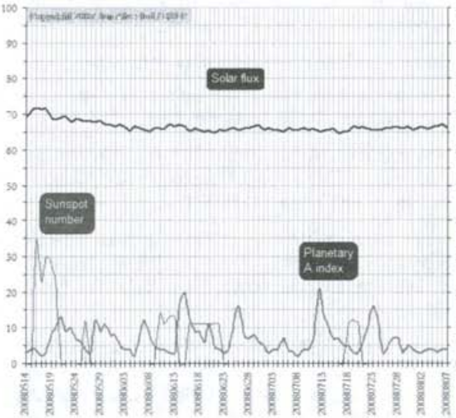
9 August 2008

1629	OH4LA	KP20LG	57A	57A	842km
1631	OH6PA	KP02PL	52A	55A	584
1633	OH6HFX	KP14RA	55A	57A	691
1634	OH1ND	KP00XL	57A	59A	683
1636	RA1WU	KO47ET	53A	57A	1149
1637	OH2BNH	KP20LG	59A	59A	842
1641	SM6HBI	JO57XQ	54A	55A	567
1643	RX1AS	KO59FX	59A	59A	1132
1644	RU1AC	KP50EJ	57A	59A	1110
1645	OZ1BNN	JO55PM	55A	55A	801
1647	SM7FMX	JO65KN	55A	53A	810
1649	YL2OK	KO37AS	55A	55A	1042
1650	SM6OPX	JO58RG	54A	56A	498
1652	OH6KTL	KP02OJ	59A	59A	581
1654	OH1TM	KP01VJ	57A	59A	636
1655	OZ1LPR	JO44UW	54A	57A	862
1700	SM0DXG	JO99CE	56A	59A	593
1707	SM0DFP	JP90JC	59A	59A	553
1710	OH1XT	KP01UK	56A	59A	630
1718	SM2CEW	KP15CR	53A	55A	684

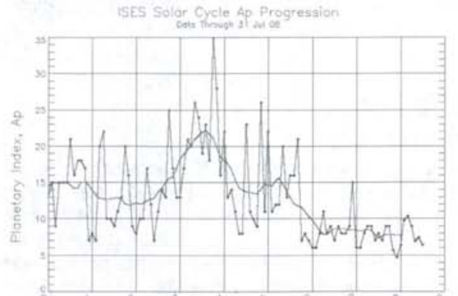
Beacon Reports via Aurora on 2m:

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

Date	UTC	Beacon heard from area / loc.
14.2.	2000	(Aurora on 6m)
18.2.	1405-1455	ES (KO28), YL (KO37)
28.2.	1630-1915	UA1 (KO59), OH6 (KP02), LA (JO59), OZ (JO65)
29.2.	1440-1630	OH6 (KP02), OZ (JO65), SM0 (JO89), DL (JO73,53), YL KO37
	2055	SM2 (KP15)
8.3.	1800-1810	OH6 (KP02), LA (JO59)
9.3.	0530	SM2 (KP15)
	2230	LA (JO59)
10.3.	1520	LA (JP33)
11.3.	1345-1425	LA (JP33), OH6 (KP02)
12.3.	2030	OH6 (KP02)
13.3.	1315-1405	LA (JP33), OH6 (KP02)
14.3.	1800-1925	OH6 (KP02)
15.3.	1113-1123	SM2 (KP15), UA1 (KP51)
19.3.	2120	SM2 (KP15)
26.3.	1520-1820	OH6 (KP02), LA (JO48), UA3
	2100-2145	OH6 (KP02), OH2 (KP20)
27.3.	1318-1505	+ 1848 OH6 (KP02)
	2150-2245	LA (JO59), OZ (JO65)
28.3.	0200	DL (JO43)
	1435-1805	OH6 (KP02), LA (JP33), SM0
4.4.	2004	OH2 (KP20)
	2224	SM0 (JO89)
5.4.	1655	SM2 (KP04)
7.4.	1629-1632	SM2 (KP15), OH6 (KP02)
8.4.	2107	SM2 (KP03)
10.4.	2000	(Aurora on 6m)
13.4.	2105	SM2 (KP03)
23.4.	1607-2100	SP2 (JO94), PA (JO32), SM2 (KP15), SM0 (JO89)
24.4.	1240	OH6 (KP02)
28.4.	1512	YL (KO37)
30.4.	1657	OH1 (KP01)
23.5.+*	1415	SM2 (KP15)
14.6.	2145-2157	LA (JO59), OH1 (KP01), DL (JO54)
12.7.	0530	SM2 (KP15)
22.7.	1655	OH6 (KP02)
23.7.	1608	UA1 (KO59)
*	1649	SM2 (KP15)
9.8.	1645	OH6 (KP02)



Extemely quiet sun from May to August 2008 with Flux 65 most of the time and very quiet Ap – source DXLC



Ap from 1. Jan. 2000 to 31. July 2008: 2006 to 2008 vy quiet Ap -> little Aurora, plenty Es

News & Comments

Editor: Joachim Kraft, DL8HCZ
Funk-Telegramm@t-online.de

Expeditions and DX

OM/OK1DFC - EME expedition to Slovakia, date: 21/22 September on 2,3 & 3,4 GHz - with 3.2m dish. Loc. JN87WV.

JP51 LA/PA5DD plans to be qrv in the Geminids from 11 to 14 December on 2m via FSK-MS. QRG: 144.393 MHz. On Dec. 15/16 Uffe plans to be qrv also as SM/PA5DD from grid **JO69** on his way back.

CT3 Madeira: CT3/DK2ZF will be qrv October 11 to 22 on 2m EME in JT65 with 4 x 11 ele and 500w. Loc.: IM12js

IQ50 Jan Mayen: LA9JKA ist qrv untill about October 10th as JX9JKA on 6m and also 2m and 70cm EME is planned with 2 yagis and 1 KW each. Loc. IQ50. Unfortunately this operation was a no show so far due to RFI problems.

A4 Oman: A 2m EME expedition is planned for November.

5R Madagascar: F1HDI (ex J79DI) etc plan to be qrv on 2m EME in JT65 from 20 to 25 September 2008.

HP Panama: HP3XUG (ex KG6UH/DU1, HL9UH) plans to be back soon on 2m EME with 4 x 17 ele Xpol + KW, 70cm EME with 4 x 28 ele + 8874 and also 6m EME. Loc. EJ88SK.

T6 Afghanistan: VK1UN is qrv as T61AA untill at least March 2009 on 6m. He is already qrv on 2m EME in JT65 with a single 9 ele and 750W and worked many QSOs. New location is MN21OE.

UK Usbekistan: UK/DL9LBH is on the air now with his 2m EME station with 2 x 11 ele and 750w and Hans has worked MANY stations and first ever QSOs. He has also 2 yagis and 50W for 70cm EME. Loc.: MN41OG.

JT Mongolia: PA4EME will be qrv in August 2009 as JT1EME on 2m EME (JT65). Rig: 1k + 2x16

GU Guernsey: MU/DH7FB & DF2ZC will be qrv from October 17 to 20 on 2m EME and MS. Loc.: IN89RK

Silent Keys

ZE5JJ / ZS6JT SK

Another grand old man left the EME community, and it was very sad to learn the news! ZE5JJ was my #5 in April '78 and I could hardly believe to have worked AFRICA off the moon. In those days, even in Europe, it was difficult to come by the needed special components for an EME station. But Peter had set up a true top notch station in Africa. As the situation in ZE deteriorated, Peter and family moved to ZS where in practically no time he rebuilt his superb station and activated ZS6JT. He was a wonderful and admirable person! My condolences to his large family! RIP Peter, you'll be remembered forever! Jan, DL9KR.

Beacons

CU2VHF 144.401 MHz, HM77DT, 30W, 2 x yagi, EU + USA, 835m a.s.l., proposal for September 2008.

CU7VHF 144.408 MHz, HM58QS, 10 W, Yagi to VE1, is a new transatlantic beacon project.

DB0SSB 24048.853 MHz, JO40EF, 15W EIRP, slot, omni 479m a.s.l., proposal. Volker, DL1ZB

N7BHC/B 144.291 MHz is operational as announced from FM15PA and beaming to Europe. Power is 100 W to a 17 ele Yagi. QTH is at the Atlantic Coast in North Carolina.

N7BHC 2m beacon rack

Another beacon enhusiast: N7BHC, Dave Pedersen

N7BHC/B - installation of the 17 ele beacon yagi

Dates

Microwave Update 2008

Microwave Update 2008 will be held **October 17-19** in Bloomington, Minnesota. The site is near the Minneapolis airport and next to "Mall of America" The largest shopping mall in North America. In 2009, MUD will be hosted by W5LUA and WA5VJB in the Dallas area. Watch www.microwaveupdate.org for additional information.

Martlesham Microwave Round Table

Preparations for the next Martlesham Microwave Round Table are well under way. As usual, the event will be held at Adastral Park, Martlesham Heath, Ipswich IP5 3RE, on Saturday and Sunday 8th/9th November 2008. The dinner on the Saturday evening will be held at the Holiday Inn Ipswich, London Road, Ipswich. Please note that this is not the hotel used last year (which was the Holiday Inn Ipswich Orwell).
The dinner price will be £24 a head, full details of the menu choices and booking will be available shortly when the Round Table booking site opens. There will also be a block of rooms available at £65 per room per night including breakfast. Please note that you may be able to find lower internet rates but these will not generally include breakfast, and availability may be limited. Please look out for a further update when the round table booking site is up and running. John, G3XDY

Roesrath Gigahertz Meeting

The Roesrath Gigahertz Meeting near Cologne is a gathering whose primarily purpose is to promote personal contacts and the exchange of experiences. This years meeting will take place on Saturday, 25th October 2008, starting at 14:00 o'clock. The location will be the pub "Dorfschaenke", Scharrenbroicher Strasse 75, D 51503 Roesrath.
Invited are all microwave freaks, who are engaged in GHz technology. Speeches are planned and a small selection of microwave parts might be available for sale. There will be no participation fee. An informal notification on participation would be appreciated. Please send further information and proposed titles of speeches to Mike DB5KN, db5kn@darc.de

European Microwave Week 2008

The European Mocrowave Week takes place from Oct. 27 to 31 in Amsterdam (NL). Info: http://www.eumweek.com/

News & New Products

IARU Region 1 Conference - Proposals

In November 2008 there will take place the next IARU Region 1 conference in Cavtat, Croatia. All proposals are available on the web at: http://www.oevsv.at/
opencms/modules/news/20080603_cavtat_iaru.html

Greek Microwave Group

We want to inform you about an initiative that has been started in the area of microwaves in Greece and that could help newcomers to enter this area, radio amateurs to improve their skills, but also engineers to improve their designs and considerations. The Greek Microwave Group has been established recently by a group of people who are interested in the area of microwaves. It is a public group and everyone can join it including interested people from every country in the world. In fact they encourage people from all over the world to join them and to share their experiences and research with each other. The experience of radio amateurs throughout the years has shown that this is a powerful way of learning. In the past, many amateurs have concluded results that often help the industry with new ideas to improve their products. Joining this microwave group is absolutely free for everyone and there are no economic benefits for its members. There are no economic benefits for the group itself, too. The purpose is learning and educational. The portal of the group is at **www.microwave.gr** Konstantinos Giannopoulos

Microwave Engineering Project (MEP)

The Microwave Engineering Project (MEP) aims to design and build a high-speed digital microwave-band system for amateur radio that supports high-definition video, point-to-point, and multiple-access communications.
We would like to invite anyone interested in microwave communications to participate in the project. We have just kicked off our exploratory phase.
This is the part of the project where (according to several engineers I've had the opportunity to spend time with) the sentence "Because it's COOL!" is plenty good justification for bringing up a function or an idea. I very much want to know what interested amateur radio operators would like to see us try and accomplish together as a design and development team. The only credential needed here is intellectual curiosity, a willingness to express yourself and the intent to learn along the way. We are a group of ordinary people talking about doing extraordinary things. My motivation is to enable a supportive and collaborative engineering process, learn new things, and produce something at the end of the day that we can all be proud of. Consider this phase to be open season, with the goal being as good a description (vision) of the project as we are able to write down. This means taking a fresh look at what we can offer amateur radio, and what we want to work on and experiment with.
There are many ways to approach this type of phase of a project. Being able to concisely summarize what problem is being solved by this project, or what need is being met, is very important because it provides a real foundation for producing a set of requirements, which will be the focus of the second phase of the project. That phase will be called requirements analysis. Here is a brief description of what we¢ve come up with so far as what we would like to produce.
We'd like to design and build a high-speed digital system for the relatively under-utilized microwave bands of 3.4 and 5.6 GHz. We want to support high-definition video. We would like to design something that could adapt from point-to-point use to multiple-access use without a lot of fiddling around. We¢d very much like to include a satellite simulator in order to explore the development of, for example, delay-tolerant protocols and techniques that might be useful for experimental and educational purposes. We¢d like for the system to be durable, and portable, and fun to use. We¢d like it to be affordable, highly integrated and high power.
I'd like for it to do a lot of things, but most importantly, I'd like to know what you all think it should do (or not do), and why.

The team has a website, a mailing list, and a podcast. If you subscribe to the podcast, all documents, videos, and audio recordings from the project will be delivered to the feed reader of your choice. The mailing list archives are open for public reading. The hardware will be designed using TAPR¢s open hardware license (OHL). The software will be open source according to the GNU General Public License (GPL).

Please feel free to sign up for the mailing list and RSS feed at the website: **http://www.delmarnorth.com/microwave/**

I serve the team as a coordinator. I have an MSEE in Information Theory from USC, worked at Qualcomm Incorporated for five years as an engineer in the Globalstar and Handset divisions, and am a life member of 10-10 International, ARRL, and AMSAT. I serve as newsletter editor for the Palomar Amateur Radio Club.

If you know of anyone that might be interested in this project, please forward this invitation. I'm happy to answer any and all questions. Michelle Thompson, W5NYV w5nyv@yahoo.com

PLL-stabilized Crystal Oscillator for 12 GHz

Now, an external 10 MHz reference frequency can be connected to achieve highest frequency accuracy. This is necessary for EME, WSJT and Tropo DX. The frequency of 10 MHz can be supplied by a highly stable OCXO, a reference oscillator of a frequency counter, a rubidium frequency standard or a GPS controlled frequency source. If a 10 MHz reference frequency is not available, the internal crystal oscillator of the unit can be used. This crystal oscillator is frequency stabilized by our 40°C precision crystalheater QH40A.

Features:

- Fixed frequency PLL-stabilized crystal oscillator
- Internal temperature stabilized crystal oscillator with QH40A
- Input for external 10 MHz reference frequency
- Automatic activation of PLL if ext. 10 MHz signal is supplied
- Lock Detect status: internal LED
- Over voltage and reverse polarity protection
- Helical filters and microstrip filters for high spurious and harmonic rejection
- Compact construction in a German Silver case

Specifications: Type MKU LO 12 PLL

Output frequency 11952 MHz (for 24 GHz), 12024 MHz (for 24 GHz USA), 11736 MHz (for 47 GHz)

Output power min. 35 mW

Frequency stability @ 0 ... 40 °C typ. 5 ppm (without 10 MHz reference frequency) - Ext. reference in 10 MHz / 2 ... 10 mW

Supply voltage +12 ... 14 V DC, Current consumption 260 mA

Input connector for 10 MHz SMA-female, 50 ohms

Output connector SMA-female, 50 ohms, Weight typ. 140 g

Dimensions (mm) 111 x 55 x 30, Case German silver

Accessories: • As a 10 MHz frequency source we recommend the GPS-stabilized oscillator by James Miller, G3RUH.

- GPS-stabilized 10 MHz oscillator (James Miller, G3RUH)

More information is available on our website **www.db6nt.de**

One Rover's Dream is Answered

Anyone roving with some of the reasonably priced surplus high power amplifiers in in the 25-200 watt class has noted often with chagrin the frequent need for 28 VDC at high current, i.e. to 17 amps or so. In my own case, a 40-60 watt amp for 2304 MHZ was powered in past by three 12.6 VDC batteries. I used one for the transverter and IF and two in series for 25.2 VDC. With the new device, built for WA3PTV and for myself, we have one 12 VDC to 28 VDC inverter sized as follows: Width 6.75 inch/170 mm, Height 4.5 in/115 mm, Front to back 4.75 in/120 mm, I estimate the weight at under 8 lbs/4kg. I plan to use one battery for the lower power stages at 2304 MHz and one for the 12-28 inverter. This will free-up one large 50 plus amp battery for my steadily increasing rover load I tested my unit with a brief 2304 MHz CW/SSB contest transmission less than 30 seconds long. The VDC under about a 15 amp load was 27.9 VDC and the output was 38 watts at an estimated 20 % efficiency for a total load of 190 watts. In the testing phase, Dan used a load of 300 watts at 28 VDC for 20 minutes.

Joe, WA3PTV, and I both checked for RFI on 6m, 2m, 222 MHz es 70 cm and found the two units surprisingly clean.

In writing about this unit, I am not attempting to sell the reader just informing microwavers of a device which will I believe will solve my needs for 28 VDC power as a rover. FYI, I have confirmed with Tim that the following info is correct.

The price should continue at $230.00 depending upon cable lengths. The shipping will be around $36.00 to Europe and up to $18.00 for US for delivery.

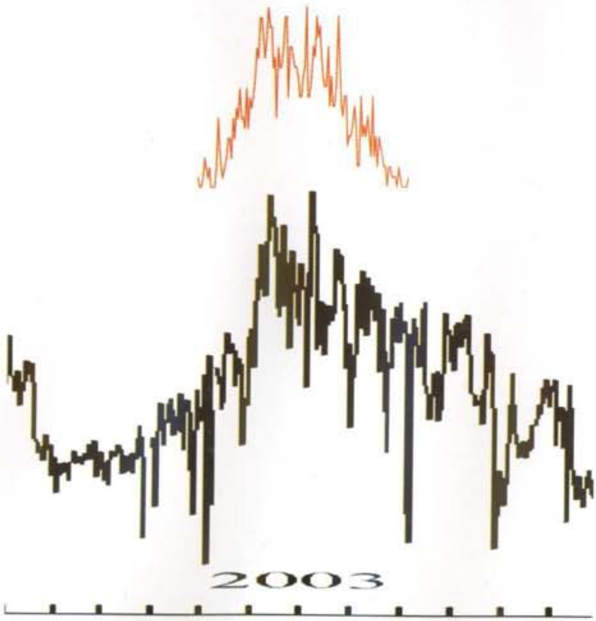
Appendix: I would like to report that the 12 to 28 volt booster worked flawlessly over the contest weekend, 14 to 15 June. I did not hear any interference on 6 m nor on 222, 2 m or 432 MHz. 73, John, W3HMS

Please direct any questions, comments or orders to:
Timothy Gerdeen, T.G. Electronics, 54677 Canal Rd., Houghton, MI 49931, Ph:906 487-9063, Cell: 906 370-5031
Website: http://www.tgelectronics.org

YU1AW Article

YU1AW has published a new article "Yagi Antenna Q factor".
URL: http://yu1aw.ba-karlsruhe.de/yagi_q_factor.pdf

Redaktionsschluss für Aktivitätsberichte und redaktionelle Beiträge für DUBUS 4/2008 ist der 1. November 2008. - Deadline for reports etc. for DUBUS 4/2008 is November 1st 2008.



Mid-latitude Sporadic E in Correlation to Meteor Mass Input

by DL8HCZ/CT1HZE

Mid-latitude Sporadic on 144 MHz, days from 34 years from 28. April to 2. September from 1974 to 2007 (top)

and a typical annual (Jan. to Dec.) Meteor Mass Input, measured in Norway in 2003 (bottom)

SV1BTR – new 24 x XPOL EME array for 70cm