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Nov. 20th 2003: Aurora in the South

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Entirely Devoted to VHF/UHF and Microwaves

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Redaktion / Editorial Staff

Technical Reports / Team of authors	Ian White, G3SEK, 52 Abingdon Rd, Drayton, Abingdon, Oxon, OX14 4HP email: G3SEK@ifwtech.co.uk Michael Kuhne, DB6NT, Scheibenacker 3, D-95180 Berg, Germany email: kuhne.db6nt@t-online.de Luis Cupido, CT1DMK, R. S. Joao, Lote 5, St. Joana, 3810 Aveiro, Portugal cupido@mail.ua.pt Leif Åsbrink, SM5BSZ, Jäders Prästgård, S-635 05 Eskilstuna, Sweden email: leif.asbrink@mbox300.tele2.se Werner Rahe, DC8NR, Conrad-Schulz-Weg 5, D-82211 Herrsching
Microwave Parts	Hennig Weddig, DK5LV, Konsul-Lieder-Allee 11, D-24226 Heikendorf email: Henning-Christof.Weddig@desy.de
EME-News, 70cm + up	Bernd Wilde, DL7APV, Nordhoferstr. 8, D-16833 Nordhof, Germany email: DL7APV@t-online.de
EME-News, 2m	DF2ZC, Bernd Mischlewski, Auf dem Scheid 36, D-53547 Burscheid Germany. Email: BerndDF2ZC@t-online.de
EME-Email-List 70cm + up	Klaus Tiedemann, DL4EBY, Halskestr. 35, D-12167 Berlin, Germany email: tklaus@snafu.de
Microwave Europe	Simon Lewis, GM4PLM, Creoch Farm, Ochiltree Ayrshire, KA18 2QH, Scotland, U.K. simon@creoch.freeserve.co.uk
Microwave Japan	JH6RTO (also 7L3TDU/M0RAA/AH0R), Seiji Fukushima, 1182-2505 Hase, Atsugi-city 243-0036 Japan. Email: jh6rto@m.ieice.org
Microwave USA	Kent Britain, WA5VJB, 1626 Vineyyard Rd., Grand Prairie, TX 75052, USA Email: wa5vjb@flash.net
Rain Scatter Reports	Jonathan Naylor, G4KLX/HB9DRD, 24 Castle View Drive, Cromford, Matlock, DE4 3RL, England, U.K. NaylorJS@yahoo.com
FAI Reports	Dom Dehays, F6DRO, Le Fourtou, F-31450 Montesquieu Lauragais France. email: f6dro@aol.com or dominique.dehays@enac.fr
Aurora Reports	Stefan Heck, LA0BY, Hildsvej 5, N-1349 Rykkinn, Norway email: la0by@qsl.net
Meteor-Scatter Reports Es-Reports, Top List	Norbert Goettsche, DL8LAQ, Tulpenweg 3, D-24568 Kaltenkirchen email: DL8LAQ@sh-home.de
Meteor Shower List	Guido Juenkersfled, DL8EBW, Gustav-Freitag-Str. 1, D-42327 Wuppertal, Germany. Email: DL8EBW@t-online.de
Tropo Reports	Wolfgang Schneider, DJ8ES, Lohweg 14, D-25591 Ottenbüttel email: DJ8ES@t-online.de
6m-News, Beacon List New Products News & Comments	Joachim Kraft, DL8HCZ, Gruetzmuehlenweg 23, D-22339 Hamburg email: funk-telegramm@t-online.de info@dubus.de

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DUBUS-Magazine, Verlag Joachim Kraft,
DL8HCZ, Grützmühlenweg 23,
D-22339 Hamburg, Germany
email: DUBUS@web.de info@dubus.de
Tel./FAX: ++49 40 538 31 86

Abo-Verwaltung / Circulation:
Norbert Goettsche, DL8LAQ, Tulpenweg 3,
D-24568 Kaltenkirchen, Germany.
Phone: ++49 4191 959913
email: DUBUS@web.de info@dubus.de

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DUBUS Distributoren
International DUBUS Representatives

Austria	Reinhilde Riml, OE9YTV, Marktstr. 35, A-6971 Hard, Austia. email: riml@aon.at
Australia	Doug McArthur, VK3UM, Tikaluna, 26 Old Murrindindi Rd., Glenburn, Victoria 3717. email: tikaluna@ycs.com.au
Belgium	InfoRad c/o Jan Galicia ON6JG, Oude Gendarmeriestratt 62, B-2220 Heist-op-den-Berg. email: inforad@pandora.be
Bulgaria	Christo Mintchev, LZ1DP, Ul Boruigrad 8 AP 10, 6004 Stara Zagora email: lz1dp@stz.orbitel.bg
Czech Republik	GES Electronics, OK1FM, Sady S. Kvetna, 30100 Plzen, Tel: +420 37 73 73 111 email: ges@ges.cz
Denmark	Gert Rahbek-Udengaard, OZ1FKZ, Virringvej 60, Virring, DK-8660 Skanderborg Tel.: 0045 8657 2660, email: oz1fkz@fritid.tele.dk
Eire	Albert E. Latham, EI6AS, 226 the Rise, Belgard Heights Tallaght Dublin 24 email: alby@esatclear.ie
France	Patrick Magnin, F6HYE, Marcorens, F-74140 Ballaison Tel: 0450941914, email: f6hye@ref-union.org
Finland	Jukka Hietaranta, OH1FF, Kuutie 25, FIN-36110 Ruutana Fax: 0424 9999 234, email: Jukka.Hietaranta@elektrobit.fi
Italy	Tony Fumagalli, I2FUM, Via Masia 34, I-22100 Como Tel: 031571537, email: elcosrl@tin.it
Japan	Ryuichiro Nagaoka, JA3MKS, 15-18-704, 2 chome, Higashi-izumioka, Toyonaka-shi, Osaka, 561-0864 Japan, Tel/Fax: +81-6-6850-1890, E-mail: mks@x.age.ne.jp
Netherlands	Veron Verkoop Bureau, P.O. Box 1166, NL-6801 BD Arnhem email: veroncb@worldonline.nl
Norway	Anders Thorrud, LA8LF, Jerpeveien 20, N-3030 Drammen email: LA8LF@tiscali.no
Portugal	Antonio Filipe S. Ferreira, CT1DDW, B S Eugenia 28-1 Post Viso, P-3500 Viseu, Portugal email: filipeferreira@net.sapo.pt
Poland	Andrezj Wlodarczyk, SP1JX, P.O. Box 67, 76-270 Ustka
Romania	Folea Ion, YO5TE, P.O.Box 168, RO-3400, Cluj 1 email: yo5te@yo5kai.codec.ro
Russia	Sergej Joutiaev, RW3BP, P.O. Box 462, 111555 Moscow, email: rw3bp@co.ru
R.S.A. + Namibia	Katti Venter, ZS6KVR, Postnet suite 534, Private bag X4, Menlo Park, 0102 email: zs6kvr@ananzi.co.za phone: +27 12 9934848
Spain	J.R. Daglio Accunzi, EA2LU, Manual Irribarren 2-5 D, E-31006 Pamplona email: ea2lu@telefonica.net
Serbia	Nemethy Istvan, YU7EW, Branka Radicevica 63, YU-23217 Aleksandrovo email: yu7ew@ptt.yu
Slovenia	Miha Habic, S51FB, Vodnikova 8, SI-1000 Lubljana email: Miha.Habic@pub.mo-rs.si
Sweden	Anders Pettersson, SM7ECM, Hökvägen 111, S-24562 Hjärup email: Anders.Pettersson@sonyericsson.com
Switzerland	Ferdinand Stämpfli, HB9MIO, Bachtelen 3, CH-3308 Grafenried stagra@bluewin.ch
Ukraine	Sergej Lysenko, UR5LX, Zolochev Reg., Iwaschki, Kharkov Obl, Ukr. 312211 email: ur5lx@sergej.kharkiv.com
United Kingdom	Roger Blackwell, G4PMK, 5 Tollgate Road, Culham, Nr. Abingdon, Oxon OX14 4NL email: dubus@marsport.demon.co.uk
USA	Kyle Britain, KB5UBE, 1626 Vineyard Road, Grand Prairie, TX 75052 email: dubususa@hotmail.com
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Editorial

Dear DUBUS Reader!

Here is the final issue for 2003. So it is time again to ask you to renew your subscription for 2004 with your national distributor as soon as possible. In the age of the Internet, it is not so easy anymore to keep a printed magazine alive, but many of you have said in our survey that you do want DUBUS to continue. So we would be happy to see all subscriptions renewed again for 2004. The good news is that the subscription rate remains unchanged. Many thanks!

We have some changes in the editorial staff now. Heinz, DM2BHG, is going QRT on 2m-EME due to the TVI situation in his neighbourhood. He suggested to give the 2m EME column to somebody who is really active on this band. Fortunately Bernd, DF2ZC, who is a really active DXer and EME-Op immediately agreed to edit the 2m EME column from now on. Thank you, Heinz, for many interesting pages - and welcome, Bernd!

We are also happy to introduce JH6RTO, Seiji, as our new editor for the Microwave Japan column. Seiji is a very active operator in Japan and has good contacts to the microwave groups in JA. For sure he will provide a lot of interesting information from Japan to the DUBUS readers. Welcome to the team, Seiji!

2003 is coming to its end and we can conclude that it was a really good year for Sporadic-E, Aurora, and Tropo. Also FAI was better than in 2002 but results may still be limited by a lack of participating stations. CW-Meteor-Scatter could be declared as dead, and SSB-MS is down as well, thanks to the WSJT program. Let`s see how things will develop after everybody has worked everybody again via Digital-MS... We just got a comment from Jürgen, DK3WG, who asks to exclude Digital-MS-QSOs from the toplist. Any comments?

Seasons`s Greetings to all readers and friends and all the best for 2004

from Joe, DL8HCZ / CT1HZE
and the DUBUS team!

Liebe DUBUS Leser!

Hier ist nun die letzte Ausgabe für das Jahr 2003 und es ist schon wieder Zeit, das Abo für 2004 zu verlängern. Wir bitten alle unsere Bezieher in DL zu unserer Arbeitserleichterung, das Abo für 2004 möglichst zwischen dem 1. Januar und dem 29. Februar 2004 zu verlängern. Der Abo-Preis bleibt übrigens unverändert bei 20 Euro für 2004. In der heutigen schnelllebigen Zeit des Internets ist es sehr schwierig geworden, eine gedruckte und nur vierteljährlich erscheinende Spezialzeitschrift am Leben zu erhalten. Wir würden uns deshalb sehr freuen, wenn uns möglichst alle Leser auch im Jahr 2004 treu bleiben würden. Vielen Dank!

Es gibt einige Änderungen im DUBUS Redaktionsteam: Heinz, DM2BHG, macht auf 2m EME QRT, weil der TVI-Probleme in der Nachbarschaft hat. Er hat deshalb vorgeschlagen, die Rubrik an einen wirklich aktiven 2m-EME-Mann zu übergeben. Glücklicherweise hat Bernd, DF2ZC, der auf diesem Band via EME sehr aktiv ist, sofort zugesagt, die Rubrik zukünftig zu betreuen. Dank an Heinz für viele interessante Seiten und willkommen im Team, Bernd!

Wir freuen uns auch, unseren neuen Redakteur Seiji, JH6RTO, für die Rubrik "Microwave Japan" hier vorstellen zu können. Seiji ist ein sehr aktiver Op in Japan und hat gute Kontakte zu den Mikrowellengruppen in Japan. Er wird uns sicherlich mit vielen interessanten Informationen aus JA versorgen. Willkommen in Team, Seiji!

2003 geht nun zu Ende und wir können bilanzieren, dass es ein sehr gutes Jahr für Sporadic-E, Aurora und Tropo war. Auch FAI war besser als 2002, aber es mangelt dort noch an Aktivität. CW-Meteor-Scatter ist praktisch tot und auch SSB-MS hört man kaum noch dank der Popularität von WSJT. Warten wir mal ab, wie sich das zukünftig entwickeln wird, nachdem jeder jeden auch via Digital-MS abgearbeitet hat. Gerade haben wir von Jürgen, DK3WG, einen Vorschlag erhalten, der besagt, Digital-MS-QSOs (WSJT) bei den Toplisten auszuschliessen. Wir bitten um Kommentare hierzu.

Wir wünschen allen Lesern und Freunden alles Gute für 2004!

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

Receiver Dynamic Range

Leif Åsbrink, SM5BSZ

http://antennspecialisten.se/~sm5bsz/index.htm
E-mail: leif.asbrink@mbox300.tele2.se

Receiver dynamic range is the ability of a receiver to receive a weak signal without loss of readability while a strong signal is present. The general concept is very easy to understand but sometimes the published measurements are based on non-valid assumptions. They may actually be measuring something else, which means that published dynamic range data can not be used as the basis for selecting the better of two transceivers. By use of a measurement method that actually mimics the critical situation, it is easy to get reproducible and well defined receiver dynamic range data.

This article will focus mainly on VHF receivers, but most of the comments are relevant at all frequencies.

1. INTRODUCTION

The traditional figures of merit for the dynamic range of a receiver are the third order intermodulation intercept point IP3 and the blocking dynamic range BDR. Actually there are many different receiver overload effects, and each one defines the upper end of a separate dynamic range; but the receiver's responses to third order intermodulation and blocking are generally assumed to be a good indication of its overall strong-signal handling capabilities.

Different authors define and measure BDR completely differently. But even though the definition of IP3 is always the same, the measurement procedures defined to measure IP3 may differ – and some measurements do not actually measure IP3.

Let us start from the beginning with these fundamental definitions:

0) *Noise floor power density* (NPD). Receiver noise power level in a 1Hz bandwidth (W/Hz or dBm/Hz), referred to the receiver input. This is the lower end of all the dynamic ranges defined below.

   On the air, noise floor power density is a property of the receiving *system*, because in addition to the receiver noise temperature T_{RX} it must include the effective noise temperature of the antenna system:

$$NPD = k(T_{RX} + T_{ANT}) \quad W/Hz \qquad (1)$$

   For dynamic range measurements, the receiver input is always connected to some kind of resistor (e.g. the output attenuator of a signal generator) which generates thermal noise. If this resistor is assumed to be at 290K, it can be shown that:

$$NPD = -174 + NF_{RX} \quad dBm/Hz \qquad (2)$$

   where NF_{RX} is the receiver noise figure (dB). Equation (2) is actually one way of formulating the definition of the noise figure.

1) *One-signal dynamic range*. Max undistorted level of a single desired signal in the receiver passband. Measured in dB above the noise floor power density.

2) *Two-signal dynamic range*. Max level of a single undesired signal that will degrade the S/N of a very weak desired signal by 3dB or less. Measured in dB above the noise floor power density. The two signal dynamic range is a function of the frequency separation.

3) *Three signal dynamic range*. Max level of two equally strong undesired signals that will not produce intermodulation products above the noise floor. Measured in dB above the noise floor power density.

Traditional definitions measure dynamic ranges in a specified bandwidth. Different product reviewers use actual CW or SSB bandwidth of the receiver, or some may recalculate the data to a standard 500Hz or 2.5kHz bandwidth. Defining the dynamic range in relation to the power *density* of the noise floor (dBm/Hz instead of just dBm) normalizes all measurements to a 1Hz bandwidth. This avoids ambiguity and is also very convenient for the measurement methods described below, where the output of a receiver is measured with an audio spectrum analyzer.

2. THE ONE-SIGNAL DYNAMIC RANGE

When you tune to a really strong SSB signal, the audio output may become severely distorted. This is not much of a problem for amateur SSB, but it is important for some data modes and may be essential in other services. The in-channel distortion caused by receiver overload can be avoided by use of better AGC circuits, ultimately an AGC-controlled RF attenuator at the antenna input as described by Ulrich Rohde in ref. [1]. There is no limit for how high one can make the one-signal dynamic range this way, but when AGC is used the signal/noise (S/N) ratio does not continue to improve. Since the one-signal dynamic range is not relevant to the main subject of this article, I see no reason in going deeper into measurement procedures.

The one-signal dynamic range is closely related to blocking, as explained later.

3. THE TWO-SIGNAL DYNAMIC RANGE

This is the most important quality of a VHF receiver. In principle, the measurement procedure is very simple: Set the signal level of a first signal generator to a suitable low level. Monitor the S/N of this signal with an audio spectrum analyzer at the audio output. Then increase the level of a second signal generator (P_{GEN}) until S/N is degraded by 3dB. The level of the second generator in relation to the noise floor power density is the two-signal dynamic range.

$$DR_2\ (dB_{Hz}) = P_{GEN}(dBm) - NPD(dBm/Hz) \qquad (3)$$

(The units of DR_2 are dB. The abbreviation dB_{Hz} should be read as "dB, referred to a 1Hz bandwidth".)

The degradation of the S/N can occur by several different mechanisms that either reduce the signal or increase the noise level. These mechanisms are discussed further at the end of this section, but the main two are identified here. Reduction of the signal level is called **blocking**, and is discussed below. A noise-free strong signal can cause an increase in the noise level due to **reciprocal mixing** between that signal and the noise sidebands of the receiver's local oscillator. The two signal dynamic range measurement, as defined here, does not question which of these two effects is happening, or what the causes are - it simply measures the practical total effect upon S/N. That is all a receiver reviewer needs to measure, because it shows readers what will happen on the air. Only the receiver *designer* needs to measure blocking and reciprocal mixing separately, because the ways to improve them lie in different parts of the receiver.

The two signal dynamic range varies with the frequency offset between the wanted and unwanted signal, in a way that depends on the receiver architecture. When the mechanism is reciprocal mixing, DR_2 follows the spectrum of the sideband noise on the local oscillator(s) but when the mechanism is blocking it depends on which stage of the receiver is the one that overloads, and how much effective selectivity there is before that stage when the mechanism is blocking.

The practical problem with DR_2 measurement is that the strong signal generator must not produce significant sideband noise at the frequency to which the receiver is tuned. This is where a crystal filter is needed. On HF bands it is possible to use the steep edge of a crystal bandpass filter to remove the sideband noise from the strong signal but on VHF this is not possible; a crystal notch filter must be used instead (see later). At VHF, normal crystals do not like the power levels needed to test good receivers. It is of course possible to make very low noise crystal oscillators for this test, but it is not so easy to be sure the test oscillator really is as good as one thinks.

The definition of DR_2 above is closely related to the conventional definition of blocking dynamic range, BDR [3-8]. The amount of degradation associated with the DR_2 value as I have defined it here is 3dB, rather than 1dB, which is often used in other definitions. The reason to use 3dB in the definition is twofold. First, the measurement is faster. This is important because the whole measurement must be repeated at several frequency offsets to see the complete picture. When the S/N degradation mechanism is reciprocal mixing and one wants to find the level of the strong signal within 1dB, one has to measure the noise floor very accurately if one wants to determine the level of the strong signal within ±1dB - as can be seen from **Table 1**. The 1dB degradation calls for a noise level measurement within ±0.1dB, which in narrow bandwidths takes a lot of time to achieve statistical accuracy. For the 3dB degradation, ±0.25dB is sufficient accuracy for each noise level, saving a factor of 6 in time.

Added noise signal relative to main signal (dB)	Signal level change (dB)
-30	0.00
-20	0.04
-15	0.13
-10	0.41
-9	0.51
-8	0.64
-7	0.79
-6	0.97
-5	1.19
-4	1.46
-3	1.76
-2	2.12
-1	2.54
0	3.01
+1	3.54

Table 1. *Adding a second noise source increases the noise level like this. For example, if both noise levels are equal (0dB), the sum is 3.01dB above a single signal and the sensitivity is about ±0.5dB for a ±1dB change of the added noise. If the added noise is 6dB below the original noise, the sum is 0.97dB above the original noise but the sensitivity is only about ±0.2dB for a ±1dB change of the added signal.*

The BDR (blocking dynamic range) values measured by ARRL lab and published in *QST* show when a receiver is blocked, and these BDR values can be taken to be one-signal dynamic range values if the measurement is not "noise limited". (Note that ARRL have their own definition for BDR through the 'ARRL Standard' BDR Test Conditions in ref. [2].) For example, the BDR value for the FT1000D published by ARRL lab is "larger than 154dB"; that refers to a bandwidth of 500Hz, so by the definitions above the one-signal dynamic range of the FT1000D is more than 181dB_{Hz}.

The second reason for using 3dB degradation rather than 1dB when measuring DR_2 is that for a receiver in which performance is limited by reciprocal mixing only, the numerical values become equal to the oscillator phase noise (dBc/Hz). Comparing the receiver DR_2 to the transmitter sideband noise may also show if there is a further problem caused by noise modulation in the transmitter amplifier stages (a common problem).

As noted above, the definition of DR_2 does not discriminate between the many different mechanisms that may be the reason for loss of S/N for the desired signal. This list of possible mechanisms is not complete, it just contains phenomena I have encountered in real life:

1) Blocking – the sensitivity of a saturated receiver is degraded.
2) Reciprocal mixing – due to phase noise from the local oscillator.
3) Amplitude modulation in RF amplifiers or LO buffer amplifiers.
4) Phase noise (time jitter) in CMOS switched mixers.
5) Phase noise in (time jitter) in frequency dividers.
6) Noise bursts caused by movement of small particles inside ceramic capacitors.

The list should also include wideband interference caused by strong signals. On top of that there are the discrete spurious responses. At some particular frequency separations there are false responses for the strong signal, and such spurs degrade DR_2 at those frequencies. As well as giving the wideband performance, preferably as a graph, the complete DR_2 performance should include a list of spurs, but presenting such a list is not as simple as it first seems. First order spurs like the mirror image frequency could be tabulated formally as DR_2 numbers for specific frequencies, because the DR_2 value equals the spur suppression in dB. However, receivers also have higher order spurs, things like (8*LO-5*RF) which may appear at very high RF signal levels whenever the result becomes equal to the IF frequency. Applying the DR_2 definition directly is impossible for these higher order spurs, because the result will depend on what signal level one has chosen for the weak signal. One way of describing higher order spurs is as a list stating: the frequency; what the level of the spur is for an input signal close to the wideband DR_2 level; and the order of the spur, which tells you by how many dB it decreases when the input level is reduced by 1dB.

4. THREE-SIGNAL DYNAMIC RANGE

The measurement is conceptually simple: Set the signal level of a first signal generator to a suitable low level. Then increase the levels of a second and a third signal generator until the level of the third order intermodulation product equals the level of the weak signal as measured with an audio spectrum analyzer at the audio output. The second and third signal generator should have equal amplitudes and their frequencies have to be set for the third order intermodulation product to be within the receiver passband.

When measured this way, the third order intermodulation product accurately follows the theoretical third order law, because the first signal is used as a pilot tone that makes the measurement unaffected by AGC circuits after the IF filter. If the receiver uses dual-loop AGC [4], the third order law will not hold at signal levels high enough to make the AGC reduce the RF gain.

With P_W for the power of the first generator in dBm and P_S for generators 2 and 3, the third order law is like this:

$$3P_S\,(\text{dBm}) = P_W\,(\text{dBm}) + 2k\,(\text{dBm}) \qquad (4)$$

where k is a constant, identified below.

If the power level of the generator 1 (P_W) is set to equal the NFPD, and the output powers of generators 2 and 3 (P_S) are increased together until the third order intermodulation product appears at the same level as P_W, then the third order dynamic range DR_3 is simply the difference in dB between P_S and P_W. The formula becomes:

$$DR_3\,(dB_{Hz}) = P_S\,(\text{dBm}) - NPD\,(\text{dBm/Hz}) - \{P_W\,(\text{dBm}) - NPD\,(\text{dBm/Hz})\}/3 \qquad (5)$$

The constant k in equation (4) is in fact the third order intercept point IP3 (dBm). This is the point where P_S and P_W would become equal if the third order law continued to be valid at such high levels. It follows that:

$$IP3\ (dBm) = P_S\ (dBm) + \{P_S\ (dBm) - P_W\ (dBm)\}/2 \quad \ldots\ldots\ldots \tag{6}$$

As a figure of merit for a receiver, IP3 is meaningless unless it is specified together with the associated noise floor. Just by adding a 10 dB attenuator, one would improve IP3 by 10 dB but the distance between IP3 and the noise floor would not improve since the noise floor would be raised by 10 dB also. One can specify IP3 in dB above the noise floor in 1 Hz like this:

$$IP3\ (dB_{Hz}) = P_S\ (dBm) + \{P_S\ (dBm) - P_W\ (dBm)\}/2 - NPD\ (dBm/Hz) \tag{7}$$

The IP3 number that comes out is typically about 10dB larger than the DR_2 value in the cases where DR_2 is determined by blocking. This is relevant to the *designer* who wants to separate blocking from reciprocal mixing. IP3(dB_{Hz}) and DR_3 convey the same information and for a receiver comparison one can use either one. They are related by:

$$DR_3\ (dB_{Hz}) = 2/3 * IP3\ (dB_{Hz}) \tag{8}$$

In a 500 Hz bandwidth the noise floor is 27dB higher, which gives:

$$DR_3\ (500Hz) = DR_3\ (dB_{Hz}) - 18 \tag{9}$$

The complete intermodulation dynamic range characteristics of a receiver should also include information about intermodulation of second order, and also of fourth and higher orders. Second order intermodulation can be very important for HF receivers, where a broadband front-end can allow second order intermodulation between say two 7MHz signals with the product causing interference at 14MHz, but it is normally of little interest on the VHF bands where we routinely use narrow filters at the RF frequency. Fourth and higher orders occur only near saturation when lower order IMD is already very strong, so these are of very little practical interest.

Note that intermodulation performance is a function of frequency separation of the two unwanted signals from the wanted frequency. This is for essentially the same reasons as blocking, namely the amount of effective selectivity ahead of the stage(s) that suffer intermodulation. It also means that a full intermodulation report will be quite an extensive table.

5. THE MEANING OF IP3

The third order intercept point, IP3, although a number that is obtained from an extrapolation, has a real physical meaning and it is well defined. The fact that different standardized procedures give different results may be because not all of these procedures measure IP3 correctly. They may be based on incorrect assumptions or some theoretical mistake. Another thing is that IP3 and the theory behind it is not applicable on all receivers. The most obvious case is a DSP radio containing an A/D converter in the signal path. However, analog receivers may also have side circuits such as noise blankers that contain amplifiers that produce intermodulation at signal levels where the main signal path is very linear. Such intermodulation may leak into the main signal path due to inadequate screening or buffering, causing irregular behaviour at low signal levels.

A single stage that causes intermodulation can be described by a transfer function that is very close to a straight line for voltages well below saturation. If the input is denoted X(t), a voltage that varies with time, the output Y(t+d) can be described with a power-series expansion in amplitudes only:

$$Y(t+d) = k_1X(t) + k_2\{X(t)\}^2 + k_3\{X(t)\}^3 + \ldots \tag{10}$$

where k_1, k_2, k_3 etc. are constant coefficients; and d is the time delay between input and output (not important here).

Such a description is valid if the input signal is small. At larger signal levels, there will also be a phase shift because semiconductors contain a capacitance that varies with the voltage in a non-linear fashion. Any reasonable analog circuitry (mixers, amplifiers, iron cores, whatever) will have $k_1 > k_2 > k_3 > \ldots$ so if the signal levels are really low, the transfer function is well described by the first 'linear' term only. By making $X(t)=A*\{\sin(2*\pi*f1) + \sin(2*\pi*f2)\}$ one can easily find what the output signal Y(t+d) becomes. Third order intermodulation is due to k_3, k_5, k_7... and k_3 alone is responsible for the third order intermodulation at very low levels. Cascading multiple stages will not change this analysis; the complete cascade of stages will still be characterized by equation (10), but with a new set of coefficients that can be computed from the individual stage coefficients.

IP3, the number we use to express k_3 of the transfer function, should have an exact relation to DR_3, which is another number we may use to express the same thing. If you find (for example in some *QST* reviews) that measured IP3 values do not have the correct relation to measured DR_3 values, this may indicate a measurement mistake or that the tested receiver has a leakage of intermodulation from some saturated stage that is not part of the signal chain. The ARRL lab measurements of TS-690S [9] show an extreme example, in which the third order intermodulation falls off by only 0.5 dB for an 1 dB reduction of the input level rather than the expected 3 dB. I have looked carefully at a TS-450S which was reported in [9] to have the same behaviour as the TS-690S, but found no sign of that peculiar behaviour. The serial number was much higher and maybe the signal leakage problem had been cured.

IP3 or DR_3 are both good figures of merit to describe the analog front-end of a receiver because they are both related to the fundamental transfer equation (10). However, A/D converters used in digital radios are not well described by (10). If multiple strong signals are allowed to enter the A/D converter, the relevant figure of merit is the A/D saturation limit. Below this limit, A/D converters are typically very linear – they produce practically no IM3 all the way up to the saturation limit where they fail completely. A digital receiver will have IP3 and DR_3 values that look very good, but in real life they can not be compared to "good old analog" receivers that will continue to function with input voltages high above the range indicated by DR_3. For example, an analog receiver that is subjected to 10 signals at the DR_3 level will produce IM3 for all combinations of these signals, but these spurious responses will be near the noise floor. A digital receiver will see the 10 signals sometimes add in amplitude to give a peak level that is 20 dB higher, so it may become heavily saturated and useless. At the present state of the art, digital receivers need roofing filters to limit the number of signals entering the A/D converter, but inside the roofing filter bandwidth they remain vulnerable to saturation effects when the band is crowded with very strong signals. Test procedures must take realistic account of this.

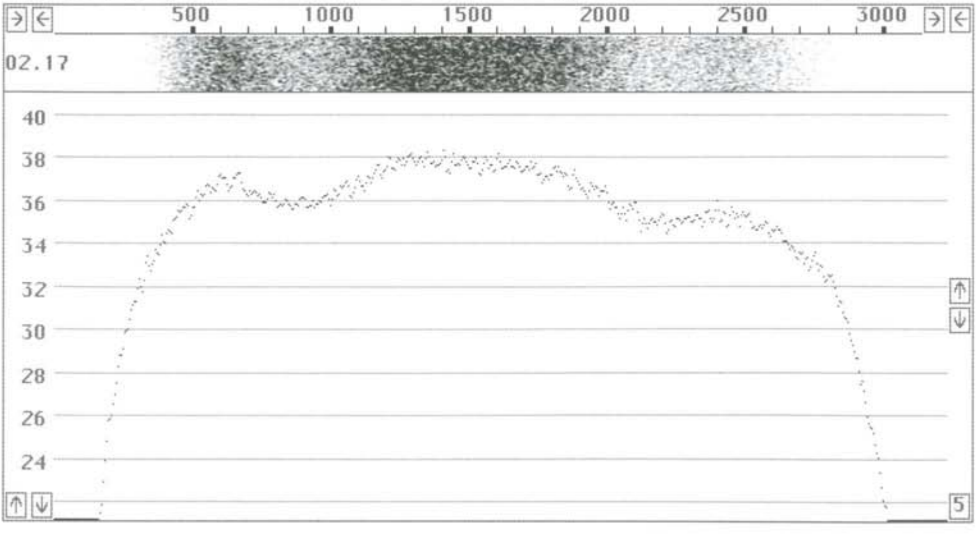
A receiver that has a signal leakage at low input levels is not well characterized by an IP3 number. There is no point at and below which the third order intermodulation follows a third-order law. IP3 and DR_2 should be presented *only* if the measurements show that they are valid figures of merit and any observed deviations occur at levels low enough to be insignificant; otherwise the entire curve of intermodulation versus input signal levels should be presented as in [9]. An EME operator looking for signals 20 dB below the SSB bandwidth noise floor might find the TS-690S receiver with the performance reported in [9] completely useless, while other operators not looking for signals below the noise floor might find the leakage insignificant. In real usage on the air, the noise floor is typically 10 to 20 dB higher than during the IM3 measurement, due to noise from the antenna on HF or due to the noise from the tower mounted preamplifier for in weak-signal VHF/UHF usage.

There is a detailed analysis and some accurate measurements at http://antennspecialisten.se/~sm5bsz/dynrange/intermod.htm. This Internet site illustrates the validity and limitations of IP3 and DR_3 for characterization of receiver intermodulation.

6. PRACTICAL MEASUREMENT OF NOISE FLOOR

First of all the noise floor has to be established. Methods that use a signal generator and an RMS voltmeter and rely on the known bandwidth of the receiver under test have accuracy problems because the audio frequency response is often not very flat – for example, **Fig. 1** shows the frequency response of an IC-706MKIIG.

***Fig. 1** Frequency response of an IC-706MKIIG. The passband ripple is in the order of ±2dB and would be invisible at a "normal" y scale.*



A typical (old) procedure would be to use a signal generator and a RMS voltmeter to locate the 6dB points which would be found at about 300Hz and 2800 Hz. One would then place the signal generator at the frequency of maximum and determine at what signal level the reading of the voltmeter has increased by 3dB. This is the point where the signal power equals the noise power, so one would then say that the noise power in 2500 Hz bandwidth equals the power level of the signal generator. The error in taking the 6dB bandwidth rather than the true noise bandwidth (equivalent 'rectangular' bandwidth giving the same noise power) will of course depend on the details of the frequency response. For the IC-706MKIIG in Fig.1 the actual noise bandwidth is only 1.6 kHz, so the error is 1.9 dB. All uncertainties add together, so by measuring the noise floor properly we can improve the accuracy of dynamic range measurements by several dB. Using a RMS voltmeter at the output may introduce errors if the AGC is not completely disabled. With a standard multimeter that is not a true RMS voltmeter other uncertainties are added as well.

To measure the sensitivity accurately, an audio spectrum analyzer should be used. These days such instruments are readily available in the form of computer programs for a standard PC computer. There are many alternatives but (since I wrote it myself) I prefer Linrad, which is free Linux software and can be downloaded from http://antennspecialisten.se/~sm5bsz/linuxdsp/linrad.htm

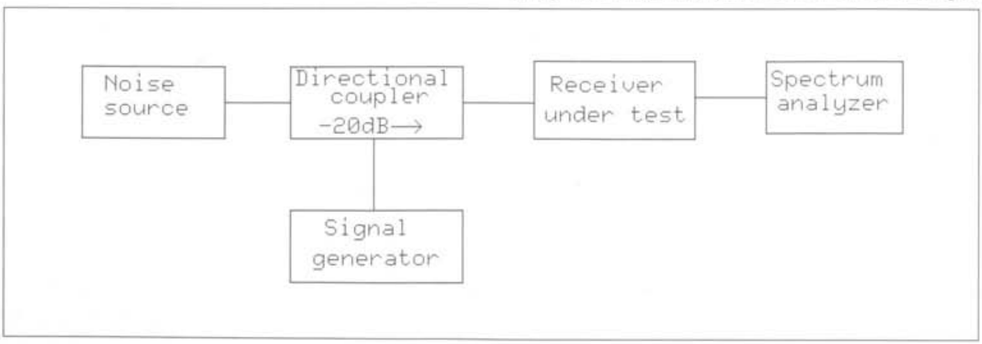
Besides the audio spectrum analyzer, a power reference is needed. It may be a calibrated noise source with a known noise temperature, but it may equally well be a signal generator with a well-known output level near the noise floor.

If you have a calibrated noise source, use the setup of **Fig. 2**.

***Fig. 2** Setup for NF measurement on a receiver.*

The noise source can be switched between two known noise temperatures, usually called 'hot' and 'cold'. If you have access to an old vacuum tube (diode) noise source, the hot noise temperature is known from the anode current by theory. Such noise sources are typically supplied with a plate current meter that is calibrated directly in noise figure and one is supposed to adjust the plate current for the noise level in the receiver to increase by 3dB when the current is switched on. The noise source may also be a semiconductor diode which presumably is calibrated so you know what the 'hot' noise temperature is when you give it the prescribed current. Without any current the noise source will have a 'cold' noise temperature that equals the room temperature or a little higher, the temperature of the resistor inside the noise source may be a little above room temperature. Noise figures are specified for a standardized temperature of 290K. If you make the measurement with the noise source at a different temperature there will be an error that you should correct if you look for an accurate noise figure.

When the current is switched on in the noise source, there is a side effect besides the increased noise temperature. The impedance will change slightly. In case the gain of the receiver under test is very sensitive to the source impedance, the noise floor will change because of the changed gain also and not only because of the changed noise temperature of the noise source. For the purpose of evaluating dynamic range, a modest accuracy of the NF is sufficient, but for measurements of low noise figures the accuracy has to be much higher. Rainer Bertelsmeier, DJ9BV, has written in detail about these problems [10]. One typically uses an attenuator to reduce this effect because it makes the impedance change smaller, but the noise source should preferably be calibrated with the attenuator permanently in place. With the setup of Fig.2, the purpose of the signal generator and the directional coupler is to supply a pilot signal with constant amplitude. By monitoring it on the audio spectrum analyzer one can compensate for modest changes



of the receiver gain that may be caused by AGC action or source impedance changes. Note that the losses in cables and in the directional coupler affect this measurement. These components can be treated just like attenuators near room temperature. It is not difficult to correct for, but keeping the losses small enough to be neglected is a better idea. The 20dB directional coupler shown in Fig. 2 is a good value because it avoids significant loss of noise power due to coupling into the branch line, and it also avoids coupling significant thermal noise from the branch line into the main line.

The measurement is straightforward. First set the signal generator so the pilot signal is well visible on the screen. Monitor the noise floor and make sure the signal level is low enough to not change the noise floor by more than a few tenths of a dB. The only concern here is signal leakage: make sure the signal really comes through the directional coupler and that it does not leak into the receiver some other way. There are four power levels to measure: the noise floor and the signal level, each for the 'hot' and 'cold' states of the noise source. Do not change the tuning between measurements. The only adjustments allowed are the on/off switch on the noise source and the controls on the spectrum analyzer. The four measurements are:

N_C = 'Cold' noise floor

N_H = 'Hot' noise floor

S_C = 'Cold' signal level

S_H= 'Hot' signal level

If you use Linrad the signal levels are obtained in dB from the S-meter. S_H and S_C should be measured with a bandwidth that makes the noise negligible. Make it 10 Hz for example. Check by switching off the signal generator. The reading should go down by at least 20dB. N should be measured with as much bandwidth as possible. Note that the statistical error in a noise power measurement is proportional to the square root of the measurement time and inversely proportional to the square root of the bandwidth. Just make sure the signal generator and any other spur that may be present is outside the passband selected. The difference between S_H and S_C is the gain change caused by switching on the noise source. It does not matter if the change is due to the AGC or due to an impedance change in the noise source as long as the gain change is modest.

The change in the noise floor due to the temperature change (N_{DIFF} measured in dB) is obtained from

$$N_{DIFF} = N_H - N_C + S_C - S_H \text{ dB} \qquad (11)$$

When converted from dB to a linear power scale, N_{DIFF} becomes the Y factor:

$$Y = 10 * \text{antilog}_{10}(N_{DIFF}) \qquad (12)$$

Because noise power is proportional to noise temperature, we can re-write equations (11) and (12) in terms of noise temperatures:

T_H = Hot temperature of the noise source

T_{CP} = Cold temperature of the noise source

R_X = Noise temperature of the receiver

Then we get the well-known equations:

$$Y = (T_H + T_{RX}) / (T_C + T_{RX}) \qquad (13)$$

$$T_{RX} = (T_H - Y * T_C) / (Y - 1) \qquad (14)$$

$$NF = 10 * \log_{10}(1 + T_{RX}/290) \qquad (15)$$

This is the good old warm/cold measurement method for noise figures. The equations suggest you can use ice water at 273K and the kitchen stove at 523K to get N_{DIFF} = 2.6dB if the noise figure is 0.5dB. At SSB bandwidth the uncertainty is large, maybe 0.3dB for N_{DIFF} but at higher bandwidths the absolute accuracy may be quite good. Liquid nitrogen for T_C improves accuracy dramatically at low NF values, but has extra technical problems of its own.

If there is no AGC and the receiver gain is insensitive to the source impedance, S_W and S_C will be equal and then there is no need for the directional coupler and the signal generator. Then you just connect the noise source to the receiver and use the audio spectrum analyzer as an RMS voltmeter. This also removes the uncertainty due to the insertion loss of the coupler.

To illustrate the above I made some measurements on an IC-706MKIIG. With a good preamplifier connected, the AGC enabled and the RF amplifier disabled, the IC-706MKIIG S-meter shows S0 for the noise floor when the signal generator and the noise source are off. The signal generator only lifts the S-meter to S1 and the noise source lifts the S-meter to S4. Signal and noise source together also gives a reading of S4.

Generator		S (in 10Hz BW)	N (in 300 Hz BW)
Signal	**Noise**		
off	off	25.8	40.1
off	on	28.5	42.8
on	off	48.8	39.9
on	on	46.3	41.8

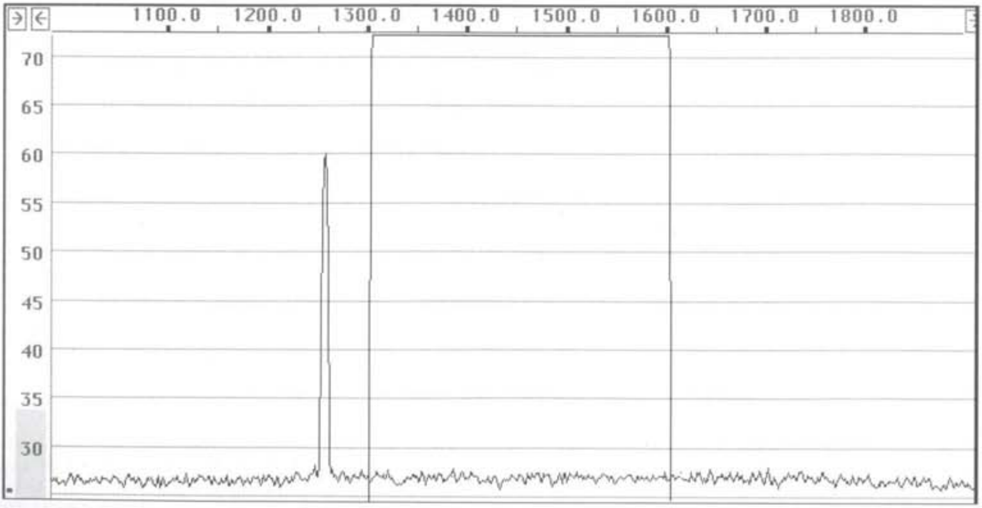
Table 2*. RMS power levels for the signal frequency and the noise floor with all four possible combinations of generators on/off.*

Table 2 shows the resulting signal levels in Linrad with the four combinations of on/off for the signal generator and the noise source.

In a conventional setup without the signal generator, one would get the Y factor (in dB) as 42.8 – 40.1 = 2.7dB. Using equation (11) above, however, we get N_{DIFF} = 41.8 – 39.9 + 48.8 – 46.3 = 4.4dB. The noise source was a temperature limited vacuum diode set for "3dB" which means that it would give a Y factor of 3dB if the noise figure were 3dB. T_H is then 870 K. On a linear power scale the Y factors are 1.86 and 2.75 respectively and with T_C=295K, the rx noise temperatures given by equation (15) become 373 and 34 K respectively. Converted to noise figures the results become 3.5 and 0.5dB respectively. In this case the error in NF caused by AGC action in a normal measurement would have been 3.0dB! With a signal generator to monitor gain changes, one obtains the correct result even when the AGC is fully activated. With my noise source (a Magnetic 123) and the AGC compensation applied, the noise figure of the barefoot IC-706MKIIG comes out as 4.4dB with the RF amplifier on and 8.7dB with the RF amplifier off.

The other way of measuring the noise figure is based on the use of a signal generator with a known signal level. One just connects the generator to the receiver under test and evaluates the audio S/N. It does not matter whether the AGC is on or off, the audio spectrum analyzer evaluates S and N in the audio passband and both of them are equally affected by the AGC. **Fig. 3** shows the Linrad screen when a –130.0dBm signal was sent into the IC-706MKIIG. The RF amplifier was enabled. The Linrad S-meter readings were S= 49.3dB and N=34.8dB. To get a very precise measurement for S the bandwidth was reduced to about 10 Hz. Since all the signal energy is still inside this narrower filter, the signal is completely unaffected. S/N is very good in 10Hz bandwidth so a very stable S-meter reading is obtained. Since the filter used to measure N is the precise rectangular filter of Linrad with 300 Hz bandwidth, these numbers give S/N 39.3dBHz which means that the noise floor is at -169.3dBm/Hz. From equation (2) the noise figure comes out as 4.7dB. With the RF amplifier off, the noise figure with the signal generator method is 9.1dB. These results compare quite closely with those obtained above using the noise source method. The somewhat higher results with the signal generator method are mainly because the passband of the IC-706MKIIG is not quite flat between 1300 and 1600 Hz. To improve the accuracy one can calibrate Linrad to make the noise floor flat within less than 0.1 dB but that would not help much because it is difficult to generate a weak signal with a precisely known power level. For the purpose of reporting the sensitivity of VHF receivers, especially if the noise figure is lower than about 4dB, the signal generator method is beyond the useful limits of its accuracy. Any authoritative product review should be based on noise-generator measurements. However, for the purpose of evaluating the dynamic range of a receiver an error in the order of 1 dB may be acceptable and that is within reach with normal signal generators.

Fig. 3 *The baseband spectrum of Linrad when doing NF measurements with a signal generator. The input signal is the audio from the same IC-706MKIIG as used in Fig. 2 when a –130dBm signal is applied to the input. Straight lines are drawn between the pixels to make the figure better visible in printing. The rectangular filter goes from 1300 to 1600 Hz.*



7. CRYSTAL NOTCH FILTERS

Both DR_2 and DR_3 measurements are easy if one has signal generators that are much better than the receiver under test. The big problem is: how do we know? Standard signal generators are surely not good enough for serious work. One has to build something better – but how do we know it really works as intended?

Crystal notch filters are the solution. Of course a crystal bandpass filter could also be used to improve the spectral purity of a signal generator, but that is practical for DR_2 measurements only. One would need one filter for each strong generator for DR_3 measurements, and one would then lose the essential flexibility to measure intermodulation at several frequency separations. **Fig. 4** shows a basic crystal notch filter.

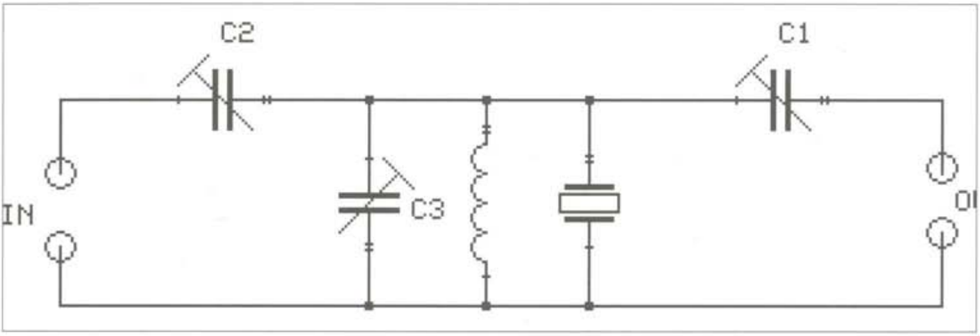


Fig. 4 The basic crystal notch filter. The coil and C3 form a parallel resonator which is selectively loaded by the crystal. C1 and C2 are equal. Smaller values for C1 and C2 gives deeper notches but the passband becomes narrower.

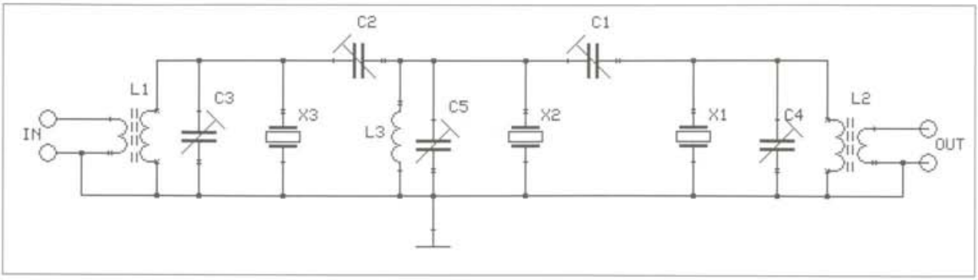
A parallel LC circuit is loaded by a crystal. The higher the impedance of the LC circuit is when not loaded by the crystal, the deeper is the notch. The LC circuit is a band pass filter. To get a high impedance at the same time as large bandwidth, one should use a large L/C ratio. This means keeping C3 small, so that the parallel capacitance of the crystal itself is the dominating capacitance. In practice it is also advantageous to do the impedance transformation inductively on the coil rather than using coupling capacitors as shown in Fig. 4 because that allows a larger L/C ratio and some more bandwidth.

If one wants to measure the dynamic range at close frequency separations, one does not only need a deep enough notch, one also needs it narrow - preferably 1dB or less attenuation at 5kHz away from the notch, with 30dB or more attenuation over a 1 kHz bandwidth at the notch center. This calls for more than one crystal.

Fig. 5 shows the schematic diagram of a practical notch filter for 14 MHz using three crystals. It is designed with very small tuning capacitors, to give the widest possible passband outside of the narrow notch.

The coils are wound on big toroids, Amidon T-80-6. This filter is intended for intermodulation measurements on 14 MHz and ideally the coils should be iron free. The 50 ohm windings are 13 turns and the tuned windings of the input and the output are 32 turns. The impedance that the crystals will load is thus 300 ohms. The toroids are heavily loaded by the input and the output, the loaded Q is low, and that is the reason the filter produces very low intermodulation despite the iron cores.

Fig. 5 (bottom) A 14 MHz notch filter. C3 and C4 are 20pF trimmers tuned near the minimum capacitance. C1 and C2 are 60pF trimmers tuned to about 20pF. The inductors are wound on Amidon T80-6 toroids.



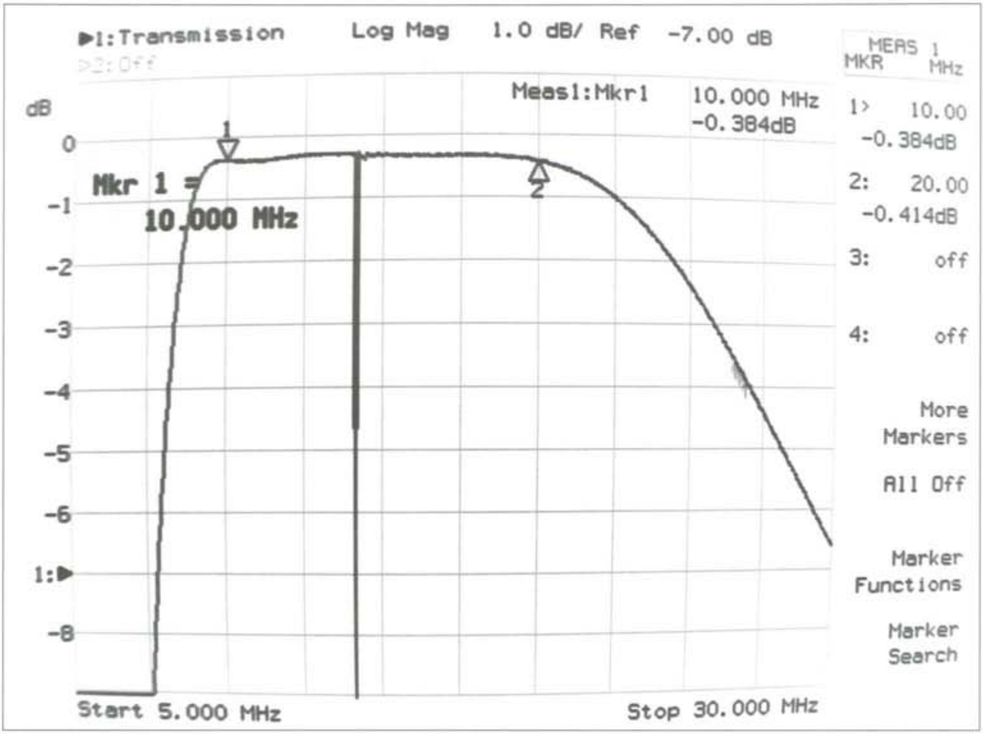


Fig. 6 Frequency response of filter in Fig 5 from 5 to 30 MHz. The filter attenuation is 0.3dB from 10 to 20 MHz.

The frequency response of this notch filter is shown in **Figs 6 and 7**.

The layout of a notch filter like this is uncritical. **Fig. 8** is a photograph how I made it. Tuning a filter like this is like tuning a bandpass filter with three LC resonators... not difficult at all if you have some kind of instrument to monitor the frequency response. Without any instruments at all it is possible to tune the filter for nearly zero attenuation 100kHz away from the notch. It will not be flat from 5 to 20 MHz automatically but it will certainly be flat enough to do dynamic range measurements.

It is possible to design a 144 MHz filter the same way. The passband will be narrower and the notch wider because the parallel capacitance of the crystal gives a smaller L/C ratio and the series impedance at 144 MHz is not very low. The computer grade 16 MHz crystals I have used have a series impedance of about 300 ohms on the 9^{th} overtone at 144.100 to 144.160 MHz. The overtone is not at the same place for different crystals, but buying 50 or 100 of these low cost devices makes it possible to get enough at the same frequency. Make sure that the crystals have a good 9^{th} overtone resonance before buying many (some modern crystals are much smaller than the can suggests, and therefore may be useless at 144 MHz).

Fig. 9 shows a 144 MHz filter using eight crystals. It is basically the same configuration as shown in Fig. 5. This 144 MHz notch filter gives a 60dB deep notch. The frequency response is shown in **Figs 10 and 11**. A 16MHz crystal has false resonances above the main 9^{th} overtone resonance. That gives rise to the spurious notches above the main notch in Fig. 11, so this kind of filter is not suitable to measure DR_2 and DR_3 with the undesired signals close to and above the desired signal.

Also a crystal notch filter will produce third order intermodulation in DR_3 measurements if the strong signals are close to the crystal resonance. At these frequencies the third order intermodulation products do not obey a third order law, even when the power level is far below the main signals, and amplifiers and mixers are behaving correctly. One has to go to very low power levels indeed to get true third order behaviour near the notch frequencies, and that is not so easy. To see it one has to use a very good receiver.

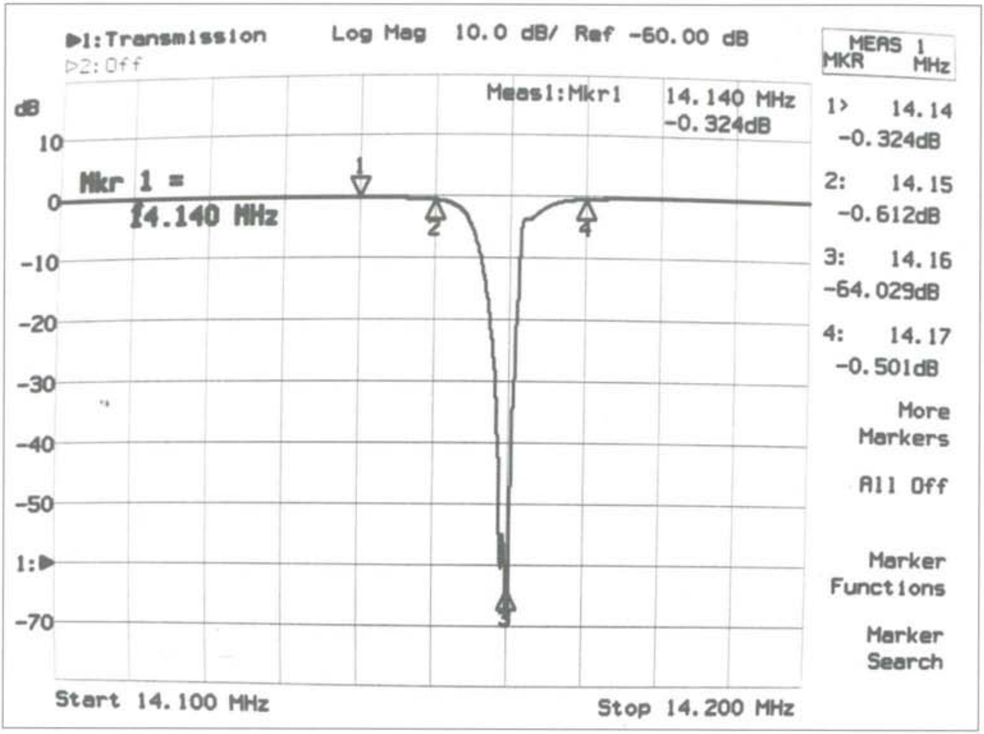
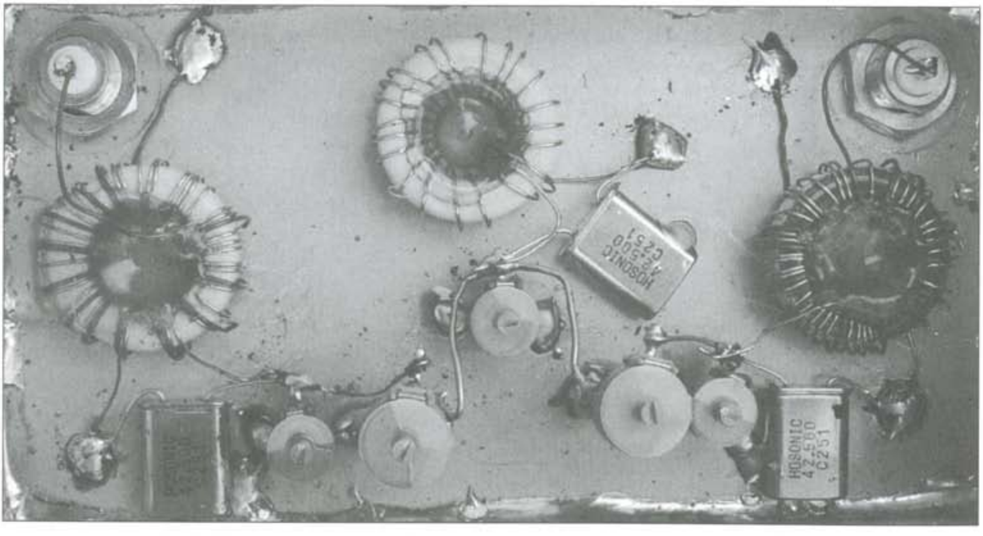


Fig. 7 (top) *Frequency response of filter in Fig 5 from 14.100 to 14.200 MHz. The filter attenuation is less than 0.5dB at 10kHz away from the notch, which is 50dB deep or more over 1.5 kHz.*

Fig. 8 (bottom) *The 14 MHz notch filter built in a box made from double sided PCB material. The components are soldered to ground and the toroids are glued.*



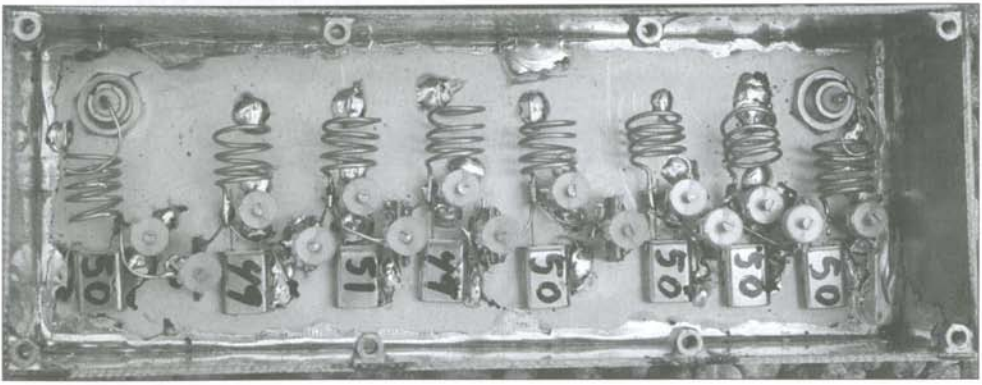
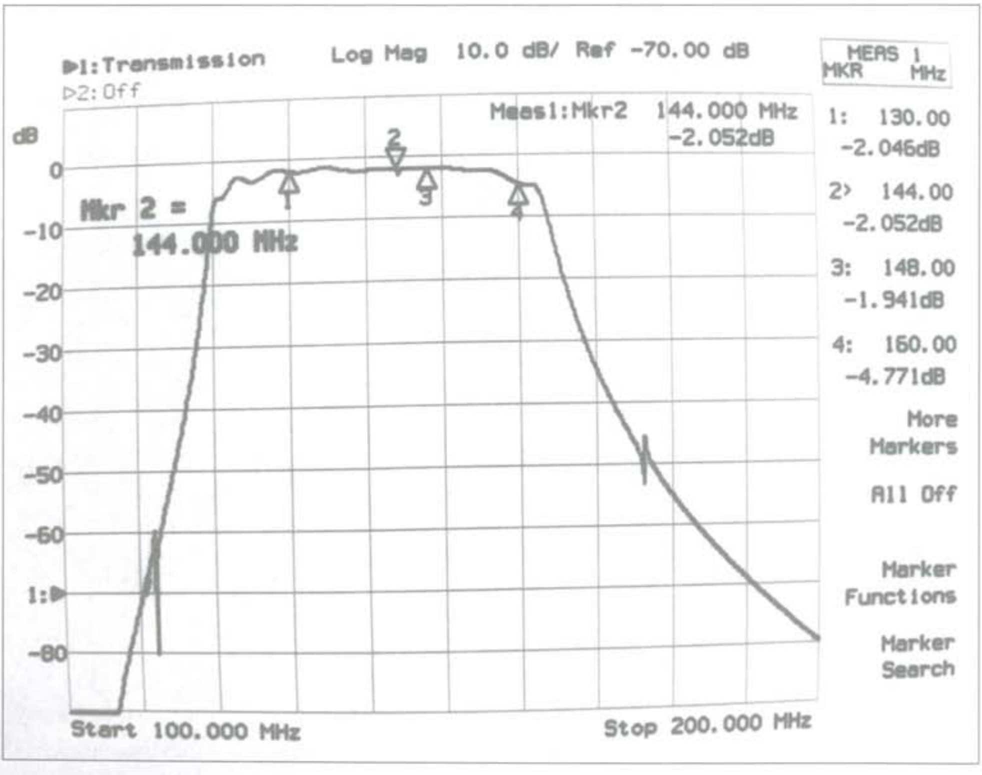


Fig. 9 (top) A notch filter for 144 MHz. There is no iron, the impedance is stepped up by connecting the input and the output 1.5 turns from ground on coils having 4.5 turns.

Fig. 10 (bottom) *Frequency response from 100 to 200 MHz of the notch filter shown in Fig. 9.*



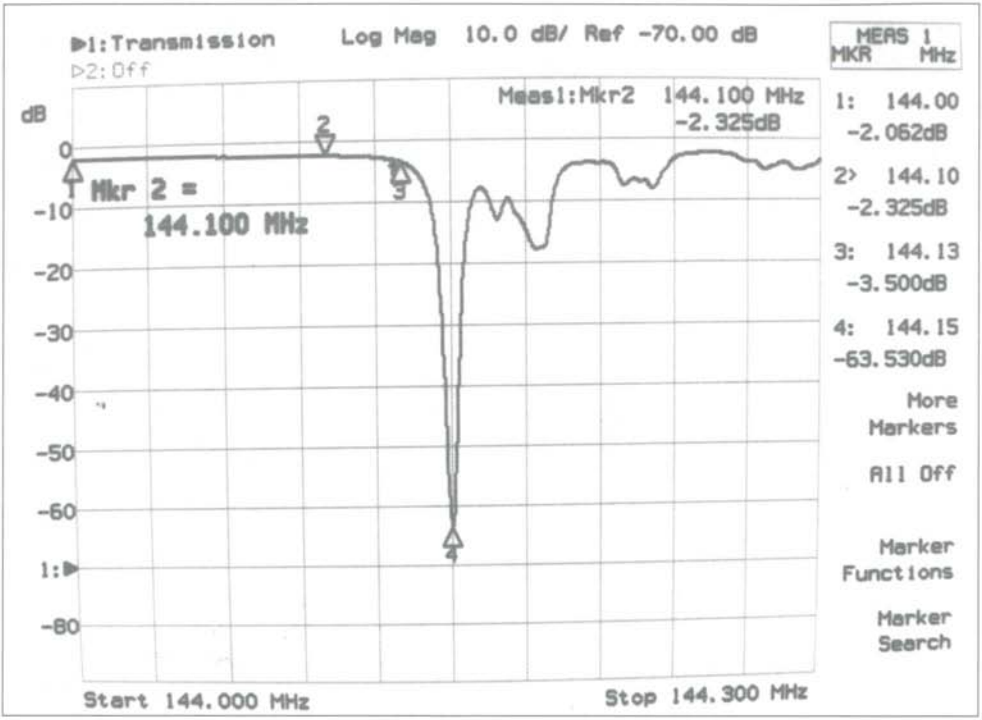


Fig. 11 *Frequency response from 144.000 to 144.300 MHz of the notch filter shown in Fig. 9.*

Fig. 12 shows the level of IM3 coming out from the 144 MHz notch filter at the notch frequency. The level of one of the two tones is also plotted for a 1:1 straight line. The two curves are measured at frequency separations of 20kHz and 100 kHz respectively. For this measurement 1W class A amplifiers followed by circulators were used in front of the combiner. The IM3 levels of the input signal to the notch filter are negligible. The notch filter was followed by an attenuator that was used to set the input to the RX144 converter well below the point where intermodulation is produced within the receive system. (The RX144 converter is the 144 MHz input of my high performance receiver hardware for Linrad. It is a quadruple frequency conversion radio with crystal oscillators only. The last conversion is from 2.5 MHz to DC, where a Delta44 soundcard converts wideband audio I and Q channels to digital form. For details see http://antennspecialisten.se/~sm5bsz/linuxdsp/optrx.htm) The bandwidth was set to 3Hz and the Delta44 was run at maximum gain to achieve good sensitivity for the intermodulation products. It is quite clear from Fig. 12 that a crystal notch filter does not have the behaviour we are used to see in amplifiers and mixers. The third order behaviour which must be obeyed at very low signal levels stops already when the IM3 product is about 100dB below the level of the signal pair. The third order behaviour is extrapolated from low levels in Fig. 12: the third order intercept point for the notch filter is +31.5dBm for two signals separated by 20kHz, and +49.5dBm for two signals separated by 100kHz.

With two test signals at +16dBm the notch filter gives IM3 73dB below the signals so for normal amplifiers and mixers, IP3 values up to +45dBm can be measured accurately at 20 kHz separation at this power level. Without the notch filter the IM3 levels are at –74dBm allowing measurement up to IP3 values of about +55dBm but if the circulators are removed the IM3 is at –52dBm. Since the notch filter is needed anyway for the DR_2 measurement it may be easier to use it than to make class A power amplifiers.

In summary, a crystal notch filter is a very practical piece of test equipment. It allows measurements to be done with standard laboratory signal generators which otherwise often are too noisy to allow evaluation of DR_2. Measuring IM3 at the noise floor is difficult; a notch filter is one of the possible tools one can use, but the unusual behaviour of IM3 products must be remembered - especially when working close to the notch frequency.

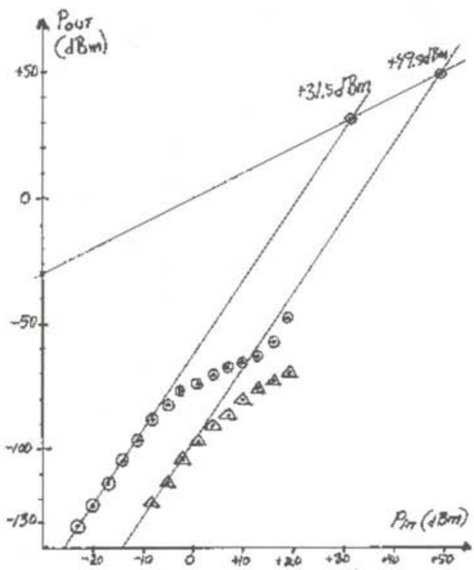


Fig 12 Signal levels at the output of a 144 MHz crystal notch filter in a two-tone test. Circles are for 20 kHz frequency separation, triangles for 100 kHz. The third order behaviour from very low levels is extrapolated towards the third order intercept points at +31.5 dBm for 20 kHz separation and at +49.5 dBm for 100 kHz separation. The intermodulation is created within the notch filter.

8. PRACTICAL DETAILS OF DR_2 MEASUREMENTS

For a conventional receiver, the level of the weak signal makes no difference as long as the dynamic range of the IF and audio sections of the receiver under test is adequate. It makes no difference at all if the AGC is enabled or not, if the spectrum analyzer at the loudspeaker output is being used to monitor the desired weak signal and the noise floor simultaneously.

To check the dynamic range of the IF and audio sections, increase the level of the desired signal and monitor S/N. At some point S/N will no longer increase in proportion to the input level. This is the level where IF or audio noise is no longer small compared to the noise floor at the antenna input which has been reduced by AGC action or it is the level where the signal does not increase any more because of clipping. If the receiver under test has a dual loop AGC, the level where an RF attenuator is inserted will be clearly visible in the plot of S/N vs input power. DR_2 measurements have to be made with the weak signal well below this level.

The way the two signal generators are combined is very uncritical for DR_2. The power level needed for the strong signal is below 0dBm and the weak signal may be somewhere around –130dBm. A simple resistive network will be fine – connect the strong generator through a 5 ohm resistor and add the weak signal through a 500 ohm resistor. A directional coupler or even a T-connector followed by a 6dB pad to restore 50 ohms impedance will be fine.

For the measurement, just select a frequency offset and adjust the strong signal for a 3dB loss of S/N. DR_2 is given by equation (3) above, where P_{GEN} is the level of the strong signal at the antenna connector of the test object. If the signal generator is calibrated, one only has to subtract the loss due to the cables and the signal-combining network. If the generator is not calibrated (it could be a homemade low noise crystal oscillator) it is still possible to determine the power level from the noise figure as described in conjunction with Fig. 3 above, although one would then need calibrated attenuators to bring the power down for the saturation level to somewhere around –130 dBm. Signal leakage is the critical point here.

To give an idea about the significance of using a notch filter, **Fig. 13** shows the screen of Linrad with the spectrum from 144.08 to 144.170 MHz when a HP8657A generator set to 144.0 MHz is connected through the notch filter. The data book says phase noise should be below –136dBc/Hz at a frequency separation of 20 kHz. The spectrum shown here shows that the sideband noise is –140dBc/Hz at a frequency separation of 100 kHz. State of the art commercial amateur transceivers are a little better than this, for example the TM255E tested at the Scandinavian VHF meeting in Gavelstad had a DR2 of 144.5dB at 100 kHz: http://antennspecialisten.se/~sm5bsz/dynrange/gavelstad/gav.htm

9. PRACTICAL DETAILS OF DR_3 MEASUREMENTS

Unlike the DR_2 measurements, which do not really have any difficulties associated with them, DR_3 measurements have all sorts of problems. It is very easy to come up with incorrect results, particularly if the measurements are made at low levels of the third order intermodulation products. On the other hand, measurements well above the noise floor may easily become incorrect if the S-meter or an RMS voltmeter at the loudspeaker output is used.

By measuring DR_3 with three signal generators as suggested here, it is possible to measure intermodulation correctly at high signal levels

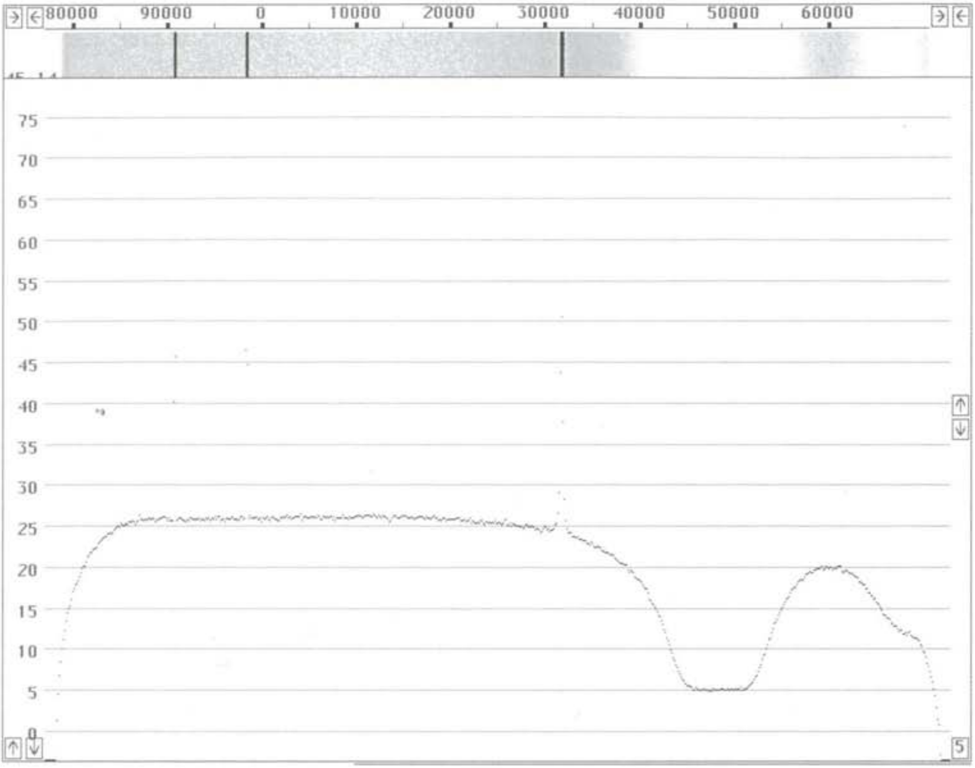


Fig 13 The Linrad spectrum of an HP8657A signal generator at 80 to 160 kHz offset. A practical illustration to the usefulness of a crystal notch filter for DR_2 measurements.

(but once again, if the unit under test has incorporated a dual-loop AGC, results will become incorrect at levels where RF gain is being reduced).

Problems with intermodulation measurement accuracy lie in the behaviour of the test receiver with strong intermodulating signals. One cannot trust the intermodulation to obey the third order law at high signal levels. For the more realistic situation with weak intermodulation products, below S6 or so, which we would typically notice when actually using the radio, the problems lie in intermodulation between the signal sources. These problems generally add some extra signal at the frequency where the third order intermodulation is expected. Typically one will therefore get results that underestimate the true performance of the tested unit, but the intermodulation signal could be in antiphase and then the error may go in the opposite direction.

Once a good source of two equally strong signals has been arranged (see more about that below), the rest of the DR_3 measurement is easy. Use the block diagram of Fig. 2, and replace the noise generator with the two-signal source. Set the weak signal generator (the one injected through the directional coupler) to a frequency close to the frequency where third order intermodulation is expected. Set the two high-level generators for equal levels and then set the weak signal to have the same level as the intermodulation product as seen on the spectrum analyzer. It does not matter if AGC is on or off – one will easily see when the signals have the same amplitude. It does not even matter if AF stages become saturated. Even IF stages may be saturated, provided that the two interfering signals are outside the IF passband. When intermodulation is measured this way, the third order law is confirmed over a much larger range of input signal levels than one typically observes with other methods.

Fig. 14 shows the levels of third order intermodulation in an IC-706MKIIG at input levels in the range –56 to –8dBm. As one can see from the measured data, third order intermodulation shows accurate third order behaviour up to a point when it is about 40dB below the two tones. To make this measurement a nearly perfect two-tone generator was used. With the aid of the RX144 and Linrad the source was verified to have IM3 far below the levels recorded for the IC-706MKIIG. It is of course essential that the source of the weak signal is very well screened. Any leakage will cause incorrect results at low levels of IM3.

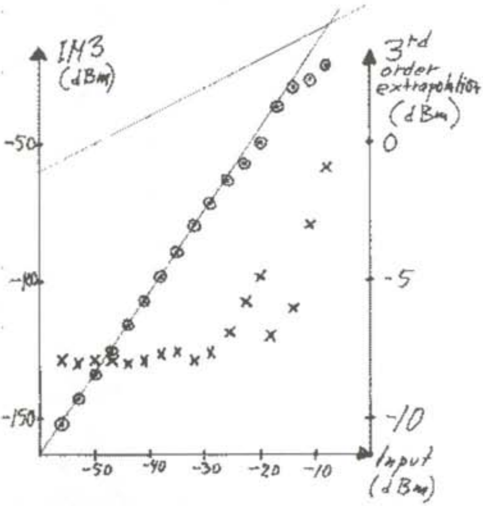


Fig 14 Measured levels of third order intermodulation (circles) for an IC-706MKIIG with RF amplifier off and with AGC enabled. The result of a third-order extrapolation (crosses) gives the correct result (IP3= –8 dBm) up to IM3 levels that are about 40dB below the main signals.

The following sub-sections identify problem areas that need attention when combining two high level signal generators to make a two-tone source for DR3 measurements.

Signal generator harmonics

First of all the two signal generators that are to be combined have to be free of harmonics. If for example two generators at 144.100 and 144.125 are used, the third order intermodulation products are expected at 144.075 and 144.150 MHz respectively. If both generators have some signal at the second harmonic, difference frequencies 288.250 -144.100 = 144.150 and 288.200 – 144.125 = 144.075 may be generated. The frequencies are exactly where the third order intermodulation products will appear. Even worse, these difference frequencies are second order so they do not fall off as rapidly as the third order products. Therefore the second order products related to generator overtones may dominate at low levels of intermodulation. To get an idea of what the consequences are, look at **Fig. 15**, which is a plot of the output from a wideband amplifier using BFR91A. Linrad with RX144 is used as a spectrum analyzer. The signal level and the levels at the two IM3 frequencies are measured directly with the Linrad S-meter. The input signal ranges from –29dBm to –59dBm. For these measurements the signal generators were followed by deliberately saturated amplifiers that produced second harmonics about 25dB below the main signals. At such a high harmonic content into a wideband amplifier, it is not surprising that the deviations from normal third order behaviour is rather large. For a comparison, Fig. 15 also shows data measured with a bandpass filter for 144 MHz inserted in the same setup to reduce the harmonics to about –75dBc.

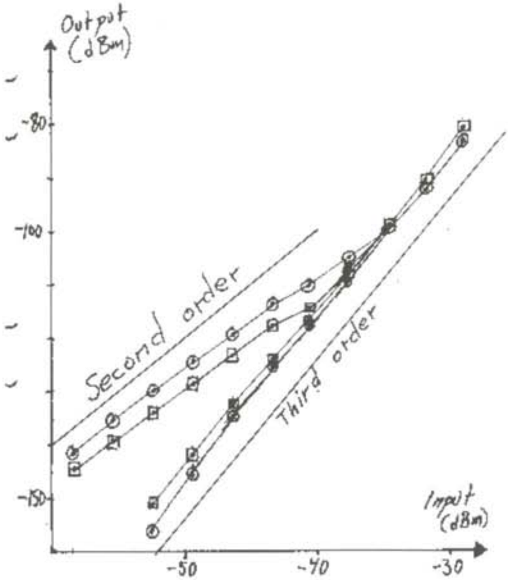


Fig 15. IM3 measurements on a BFR91A wideband amplifier The upper (circles) and the lower (boxes) intermodulation frequency signal level with and without a filter that removes the second harmonics from the test signal. Note that presence of harmonics causes a second order behaviour at low levels.

The wideband amplifier used to produce Fig. 15 has IP3 at about –4 dBm. It must be measured with input signals above –38 dBm when the harmonics are at –25dBc. The third order intermodulation products are then at about –107 dBm which is about 40 dB above the noise in 2 kHz bandwidth. Trying to measure the third order intermodulation free dynamic range at the noise floor would give incorrect results.

Second harmonics of the test signals will often be suppressed by the input filters of the test receiver, but it is still a good idea to make sure the test signals are not polluted with harmonics, particularly if external amplifiers are used to raise the power level. More power makes it easier to combine two signals without intermodulation, but simple saturated amplifiers need lowpass or bandpass filters at the output. If the144 MHz notch filter described above is being used to remove noise sidebands, it also provides very good harmonic suppression at 288MHz and above.

Mutual intermodulation between generators

The two strong signals required for a DR_3 measurement are usually obtained by the arrangement shown in Fig.16.

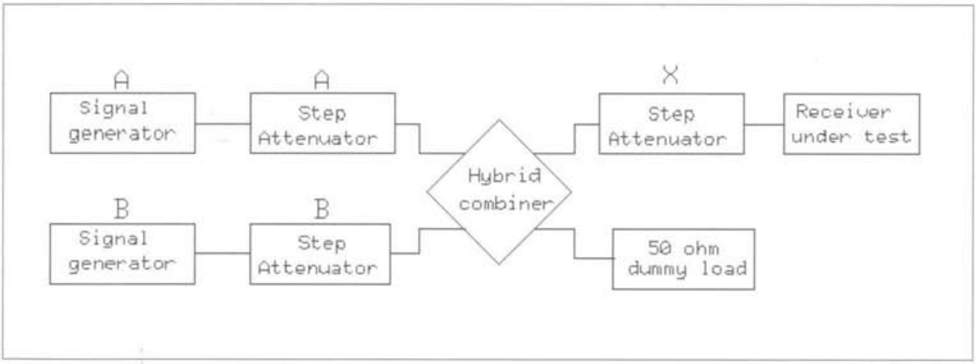


***Fig 16** Two signal generators are combined and isolated from each other with a hybrid combiner. See text.*

A suitable hybrid combiner can be made from coaxial cable. Avoid ferrite transformers – they may produce intermodulation. An iron-free hybrid combiner with built-in dummy load can also be made with coils, capacitors and a resistor. The hybrid will isolate the inputs from each other by something like 30 or 40dB if both outputs are terminated in 50 ohms. Note that the receiver under test is actually not likely to have an input impedance of 50 ohms – although it is designed for good noise figure and intermodulation characteristics when the source impedance is 50 ohms, this does not imply that the input impedance is 50 ohms. The input impedance of the IC-706MKIIG that I use as a reference for a typical modern rig has an input impedance at 145MHz of 55 ohms and 18pF. The input VSWR is 3.0 and the return loss is -6dB. If such a receiver is connected directly to the hybrid, even a perfect hybrid will degrade the isolation between the generators to only 12dB. For each dB of attenuation in front of the receiver under test, the isolation will improve by 2dB until the isolation reaches 25dB or so. The hybrid simply works as a VSWR bridge and it measures the reflected wave from the receiver under test. 50% of the power from generator A goes to the dummy load, 50% goes to the test port, comes back as a reflected wave and is then split equally into generator A and B that receive 25% each. Therefore the reflected wave minus 6dB is all the isolation one can get. For a given level of the test signal into the receiver it does not matter if attenuation is made in front of the hybrid or after the hybrid, as long as the isolation provided by the hybrid is far from the limit.

When the output attenuator is set high enough, small impedance errors may cause large changes of the near zero coupling between the generators.

By fine-tuning the impedance of the dummy load it is possible to cancel the coupling completely, but only from A to B or vice versa. The reason is that balancing is frequency dependent, but if the two generators are very close spaced balancing is a way of removing mutual intermodulation in the generators at high signal levels.

With good generators such as the HP8657A, worst case intermodulation levels for the configuration of Fig. 16 are shown in **Fig. 17**. The figure shows measured intermodulation levels at different power levels into the test object which is the same impedance as the IC-706MKIIG. The attenuator X is set to 3dB and the attenuators A and B are the attenuators built into the generators. To make accurate measurements of low intermodulation levels a directional coupler is inserted between generator A and the hybrid for the data in Fig. 17.

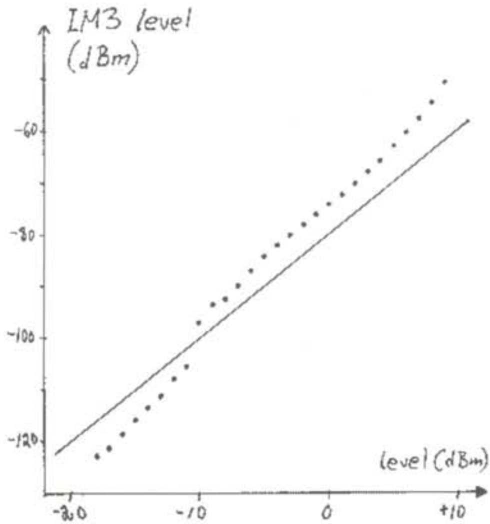


Fig. 17 The intermodulation produced in a HP8657A when used for a two-tone test. The discontinuity between −10 and −11dBm is between −3dBm and −4dBm power output from the signal generators. It is due to the internal architecture of the HP8657A generator.

To generate an IMD product at the noise floor in SSB bandwidth, the IM3 product will need to be at about −130dBm if a noise figure of about 10dB is assumed. This calls for IM3 levels from the generator of less than −140dBm. Extrapolating from Fig. 17, one finds that the maximum signal level one may use is then about −30dBm. This means that a pair of HP8657A generators can be used for IM3 measurements at the noise floor up to a third order intercept point of about +20dBm. An old vacuum tube free-running oscillator, the HP608D produces 12dB more intermodulation than the HP8657A if it is properly calibrated. However, by turning the output level control to maximum one can get +13dBm output power rather than the +4dBm that is the maximum when the control is "properly" set. This means that 9dB more attenuation can be used and then the HP608D becomes better than the HP8657A, with IM3 about 7dB lower.

It is a good idea to check what really comes out from the signal generators, by use of a directional coupler. If you do not have a good enough spectrum analyzer (RX144 + Linrad) you can use the receiver that will later become the test object. The signal extracted from a directional coupler will have the signal from the other generator suppressed by something like 20dB but the IM3 product will be present on the opposite side in frequency and its level below the generator signal is the same as will be presented to the test object in the real test. In this case the test object will produce at least 20dB less IM3 since it is not loaded by equal signal levels at the two frequencies due to the directional coupler. With a second directional coupler and a third generator one can measure the levels of signal and IM3 and make sure that the IM3 produced by the generator is well below the IM3 produced by the test object. Do not forget to allow the hybrid to see the same impedance as it will see later when the test object is connected to it. An open 3dB pad will correspond to VSWR=3 and may be used in the test port of the hybrid. Leave this 3dB pad in place and connect the test object after it to ensure the generator intermodulation will be smaller than the value you have checked.

It has been suggested that one can distribute the attenuation differently between attenuators in front of and after the hybrid to find out if there is a problem with IM3 produced in the generators. The idea is that the isolation provided by the hybrid will be constant and that therefore the attenuators in front of the hybrid will affect the intermodulation produced in the generators while the attenuator after the hybrid will not. This might be the case sometimes, but it will certainly not be true for a test object with an unmatched input, such as almost any low-noise VHF receiver.

To illustrate the effect of generator intermodulation, I have measured the IM3 levels of the IC-706MkIIG with two HP8657A generators set to +10dBm connected directly to the hybrid. The test port of the hybrid is connected to a step attenuator and also loaded by 18pF to make the hybrid see VSWR=3. The step attenuator is used to set the level of the test signal pair. The maximum available power level is +4dBm. **Fig. 18** shows the result. As expected, the intermodulation shows first order behaviour at low signal levels where the intermodulation produced in the generators dominates.

This measurement is intended to show a way of making an incorrect measurement, and what the result might look like. Fig. 18 is an extreme case of poor measurement engineering, where only the output attenuator is used to set the signal level. Obviously the mismatch at the hybrid output will be much smaller in a real measurement; the 18pF capacitance provokes a really bad VSWR. It is convenient to set the level of both generators simultaneously on the output attenuator X in Fig. 16; but as soon as one reaches the point where isolation does not improve by the full return loss improvement

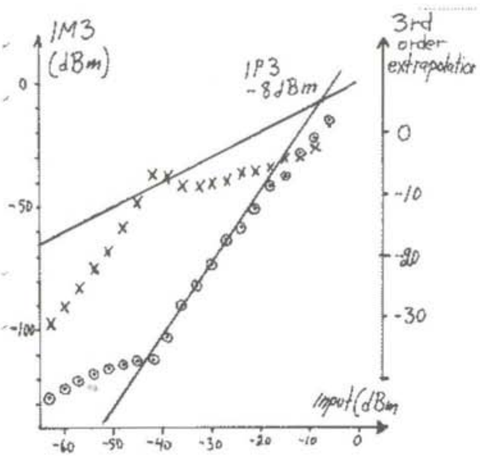


Fig 18 Measured level of third order intermodulation, (circles), for an IC-706MKIIG with RF amplifier off and with AGC enabled. This is the same measurement as in Fig.14 but with poor isolation between generators. The formula for evaluating IP3, result (crosses) gives the correct result (IP3 = –8dBm) in a narrow range only. At low levels the intermodulation in the generators dominates and at high levels the receiver under test does not have third order behaviour.

(typically at an attenuation in the order of 10dB or less), it is much better to use the attenuators at the generator side.

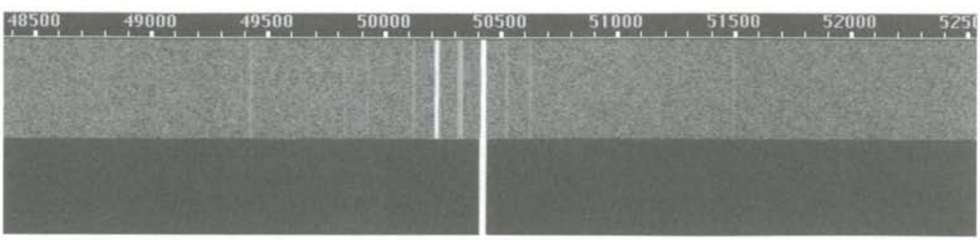
If measurements are done without the aid of an audio spectrum analyzer, all sorts of further errors are possible. If modern (synthesized) generators are used, they are likely to have spurs every 10kHz and/or every 100 kHz. **Fig. 19** shows the waterfall graph recorded from two HP8657A generators delivering –15dBm into the RX144. The lower part of the image shows IM3 only, but the upper part of the image shows all the noise and spurs that became visible without the notch filter which was used for the lower half. The loss of the filter was compensated for, so the level of the two strong signals was the same in both cases. Note the strong spurs 100 and 200 Hz below the intermodulation product. The generators, 100 kHz separated in frequency were offset by 100 and 200 Hz to move the spurs away from the IM3 frequency. One has to check for these spurs by running one generator only, because each strong spur belongs to one generator only. The notch filter removes spurs and lowers the noise floor so it makes IM3 stand out clearly even at low IM3 levels. Note that IP3 is not exceptional for the RX144; it is only about +25dBm, a level that is not difficult to reach taking the system noise figure of about 16dB into account. A narrowband receiver is easily much better than this; measuring IP3 near the noise floor may be really difficult on top performance receivers. If a third generator is not used, measuring IM3 well above the noise floor may be really difficult too.

When class A power amplifiers are used to allow measurement at the noise floor of very good receivers, one has to be extra careful with screening. Doubly shielded coaxial cables and good connectors are needed to make sure there is no leakage causing intermodulation in the amplifiers. One also has to make sure connectors are clean and of good quality, because intermodulation may be produced in poor connections, switches of stepped attenuators and elsewhere.

10. HOW MUCH DR DO WE NEED?

Based on surveys of actual signal levels at 7MHz, Peter Chadwick, G3RZP [11] arrived at the conclusion that PNDR (Phase Noise Limited Dynamic Range) should be at least 100dB and that ILDR (Intermodulation-limited dynamic range) should be at least 96dB.

Fig. 19 (bottom) *Two HP8657A generators at 143.9498 and 144.0499 produce IM3 at 144.1500 MHz (there is a calibration error of 430Hz). The lower half of this waterfall graph is with the composite test signal through a notch filter. Only IM3 is visible. The upper half is without notch filter: spurs and sideband noise are not much below the IM3 product at –82dBc. The HP8657A generators are not suitable to measure IM3 lower than about –70dBc without a spectrum analyzer and not lower than about –90dBc without a notch filter.*



These numbers refer to an SSB bandwidth, and in the terminology I have used in this article it means DR_2 should be at least $133dB_{Hz}$ and DR_3 should be at least $129dB_{Hz}$.

On the VHF bands, the basic principles remain exactly the same but the numbers are different. The needs will also vary much more at different locations. There are two kinds of problems: out-of-band interference and in-band interference. The out-of-band interference is typically at a large frequency separation, mainly FM and TV broadcast stations with very high ERP powers. This is a problem for a preamplifier and filters associated with it. In-band interference from our fellow amateurs can not easily be taken care of with filters, so here we need a good radio with high dynamic range.

On 144 MHz amateurs typically produce power levels of 3kW ERP with 100W RF into a 13dBd antenna, but ERPs of 100kW are also not uncommon – 1kW into 4 modest yagis with 18dBd array gain. The received powers at some different distances are given in **Table 3** under the assumption of free space propagation.

Distance (km)	Tx ERP (kW)	Rx Ant = 13dBd (dBm)	Rx Ant = 18dBd (dBm)
1	3	+2.4	+7.4
1	100	+17.4	+22.4
10	3	-17.6	-12.6
10	100	-2.6	+2.4

Table 3 *Received power levels with antennas pointing into each other on 144 MHz, at two different distances (assuming free space propagation).*

In reality we do not have free space conditions. Reflections from ground change the signal level in an unpredictable way because the ground is typically not flat at all. Nevertheless Table 3 indicates that a rig capable of dealing with –20dBm power from neighbouring amateurs would be useful at some locations. This translates to a DR_2 of 154dBHz, which is possible but nothing one can expect from standard transceivers today. Table 3 also shows that for two EME-grade stations at a distance of 1km to work undisturbed with antennas pointing into each other, they would need a DR_2 of about 200dB! That is impossible today and will most probably remain impossible.

Worst case in-band interference at VHF is typically dominated by a single signal. It happens when you have your main lobe pointing towards the nearest neighbour while he is pointing in your direction. Contrary to the situation on the HF bands, the DR_2 requirements on VHF may therefore be far more stringent than the DR_3 requirements.

When testing receivers, one has to collect and present a large amount of data. It is relevant to measure DR_2 at several frequency separations, and a reasonable choice is 5, 20, 100 and 500kHz. It would probably be enough to measure DR_3 at 5, 20 and 100 kHz separation, but still the amount of data is much larger than what is commonly published in product testing.

On the other hand, there is no reason to measure everything with and without preamplifier because the influence of a preamplifier should be easy to see – a preamp lowers IP3 by the amount of gain it has; and it reduces DR_3 by an amount given by the preamp gain minus the improvement in the noise figure. DR_2 should be affected only if it is limited by blocking, something that is uncommon in modern receivers. Within the limitations of available page space for reviews, it would be a good idea to focus product testing on the performance without the preamplifier, and simply specify the gain and noise figure improvement obtainable by switching in the preamplifier. Additional measurements can always be posted on the web (which is already ARRL's practice).

At VHF/UHF, an analysis of gain and dynamic range performance will show that it is always better to use a mast-mounted preamplifier, and to operate the main receiver with its built-in preamplifier switched off. A serious VHF/UHF weak signal enthusiast will always do this, so this is another reason for equipment reviews to focus mainly on the VHF/UHF performance data obtainable without the preamplifier. The noise from that preamplifier (including amplified antenna noise) should be the dominating contribution to the noise floor of the entire system. As a consequence signal levels are raised by something like 15 dB, and this is another reason why dynamic range requirements are much harder to meet at VHF/UHF, compared to HF bands where usually no preamplifier is needed.

References

[1] Ulrich L. Rohde, *Theory of Intermodulation and Reciprocal Mixing: Practise, Definitions and Measurements in Devices and Systems, Part 2. QEX* Jan/Feb 2003 p. 21-31.

[2] Ed Hare, W1RFI, *Swept Receiver Dynamic Range Testing in the ARRL Laboratory. QEX* June 1996 p. 3.

[3] http://www.w8ji.com/receivers.htm

[4] http://nlrs.dropboxone.net/Aurora-2002/W0ZQ/ReceiverDynamics.doc

[5] http://qrp.kd4ab.org/2001/010112/0049.html

[6] http://www.kachina-az.com/an108.htm

[7] http://www.natworld.com/ars/pages/lab_text/notes_bdr.html

[8] http://nlrs.dropboxone.net/Aurora-2002/W0ZQ/ReceiverDynamics.doc

[9] J. W. Healy, NJ2L, *Kenwood TS-450S and TS-690S Transceivers,.QST*, April 1992, p. 67-71.

[10] R Bertelsmeier, DJ9BV, *Myths and Facts about Preamp Tuning, DUBUS Technik V*, 1998, p. 150-158.

[11] Peter E Chadwick, G3RZP, *HF Receiver Dynamic Range: How Much Do We Need? QEX* May/June 2002, p 36-41.

Der Empfänger-Dynamik-Bereich

Leif Åsbrink, SM5BSZ

http://antennspecialisten.se/~sm5bsz/index.htm
E-mail: leif.asbrink@mbox300.tele2.se

Der Dynamikbereich eines Empfängers charakterisiert dessen Fähigkeit, ein leises Nutzsignal bei Vorhandensein eines starken zweiten Signals zu empfangen. Die grundsätzlichen Zusammenhänge sind einfach zu verstehen, jedoch basieren veröffentliche Messwerte oft auf falschen Annahmen. Diese falschen Meßdaten lassen einen Vergleich von Empfängern nicht zu. Bei Verwendung eines Meßverfahrens, welches die kritischen Fehlerquellen meidet, erhält man vergleichbare, sauber definierte Daten.

Dieser Artikel bezieht sich hauptsächlich auf VHF-Empfänger, die meisten Feststellungen sind jedoch generell gültig.

1. Einführung

Üblicherweise wird der Dynamikbereich eines Emfängers durch Angabe des Interceptpunktes dritter Ordnung IP3 und des blockingfreien Dynamikbereichs BDR angegeben. Es existieren bei Empfängern viele verschiedene Überlasteffekte und jeder definiert einen eigenen Dynamikbereich; die Reaktion auf IMD dritter Ordnung und Blocking (Zustopfen) stellen eine gute Beschreibung des Großsignalverhaltens dar.

Der BDR wird sehr unterschiedlich definiert und gemessen. Auch wenn die Definition des IP3 eindeutig ist, wird er mit unterschiedlichen Meßmethoden erfaßt, einige davon ergeben alles, nur nicht den wahren IP3.

Wir beginnen mit diesen fundamentalen Definitionen:

1. *Noise floor power density* (NPD) ->Rauschflur. Empfängerrauschleistung in 1 Hz Bandbreite (W/Hz oder dBm/Hz), bezogen auf den Eingang. Sie stellt die untere Schwelle aller weiter unten definierten Dynamikbereiche dar.

   Im Betrieb ist der Rauschflur eine Eigenschaft des gesamten Empfangssystems, weil neben der Rauschtemperatur des Empfängers noch die des Antennensystems zum tragen kommt:

   $$NPD = k(T_{RX} + T_{ANT}) \quad W/Hz \qquad (1)$$

   Zur Messung des Dynamikbereichs ist der Eingang des Empfängers immer wellenwiderstandsrichtig abgeschlossen (z.B. mit dem Dämpfungssteller eines Meßsenders). Es entsteht auch hier eine Rauschleistung. Bei Annahme von Zimmertemperatur (290K) ergibt sich:

   $$NPD = -174 + NF_{RX} \quad dBm/Hz \qquad (2)$$

   Wobei NF_{RX} die Empfängerrauschzahl in dB ist. Gleichung (2) ist eine Art, die Rauschzahl zu definieren.

2. *One-signal dynamic range* -> Eintondynamikbereich. Der maximale Pegel eines unverzerrt wiedergegebenen Signals im Durchlaßbereich des Rx, gemessen in dB über dem Rauschflur.

3. *Two-signal dynamic range* -> Zweitondynamikbereich. Der maximale Pegel eines unerwünschten Signals, welches das Signal/Rauschverhältnis eines sehr leisen Signals im Durchlaßbereich um nicht mehr als 3dB verschlechtert. Gemessen in dB über Rauschflur. Der Zweitondynamikbereich ist abhängig vom Frequenzabstand beider Signale.

4. *Three signal dynamic range* -> Dreitondynamikbereich. Der maximale Pegel zweier gleichstarker unerwünschter Signale, die keine IM-Produkte oberhalb des Rauschflurs erzeugen. Gemessen in dB über Rauschflur.

Üblicherweise werden Dynamikbereiche bei verschiedenen Bandbreiten gemessen. Verschiedene Tester verwenden CW- oder SSB-Bandbreite, einige rechnen Ihre Werte auf eine standardisierte 500Hz oder 2,5 kHz Bandbreite um. Wenn man den Dynamikbereich auf den Rauschflur (dBm/Hz statt auf dBm) bezieht, normalisiert man alle Messungen auf 1 Hz. So werden Mehrdeutigkeiten vermieden und es paßt zu den weiter unten beschriebenen Messungen mit einem Audiospektrumanalysator.

2. Der Eintondynamikbereich

Wenn man einen Empfänger auf ein sehr starkes SSB-Signal abstimmt, kann die NF erheblich verzerren. Für Amateurfunk ist dies meist kein Problem, jedoch sehr wohl für Datenübertragung und im kommerziellen Betrieb. Diese durch Übersteuerung hervorgerufenen Verzerrungen können durch ein besseres AGC-System, am besten durch ein AGC-gesteuertes Dämpfungsglied in der Antennenzuleitung, wie von Ulrich Rhode in [1] beschrieben, vermieden werden. Es gibt kein oberes Limit für den Eintondynamikbereich, eine AGC verhindert jedoch ein proportionales Anwachsen des Signal/Rauschverhältnisses. Weil für uns nicht relevant, verzichte ich auf die Beschreibung von Meßverfahren.

Der Eintondynamikbereich ist eng verknüpft mit dem Blocking, wie später zu sehen sein wird.

3. Der Zweitondynamikbereich

Die ist die wichtigste Eigenschaft eines VHF-Empfängers. Prinzipiell ist die Messung sehr einfach: Man erzeuge ein leises Signal mit einem Meßsender und beobachte das Signal/Rauschverhältnis am Rx-Ausgang mit einem Audiospektrumanalysator. Man erzeuge ein zweites Signal außerhalb des Empfangskanals und erhöhe den Pegel, bis sich das S/N um 3dB verschlechtert. Der Pegel des zweiten Signals bezogen auf den Rauschflur ist der Zweitondynamikbereich.

$$DR_2\ (dB_{Hz}) = P_{GEN}(dBm) - NPD(dBm/Hz) \qquad (3)$$

(Die Einheit von DR_2 ist dB. Die Abkürzung dB_{Hz} sollte als "dB, bezogen auf 1Hz Bandbreite" verstanden werden.)

Die Verschlechterung des S/N kann verschiedene Ursachen haben, die entweder das Signal reduzieren oder den Rauschpegel erhöhen. Die Reduzierung des Signals nennt man **Blocking**, dies wird später erläutert. Ein rauschfreies starkes Signal kann den Rauschpegel durch **reziprokes Mischen** mit den Rauschseitenbändern des Rx-Oszillators erhöhen. Die hier beschriebene Meßmethode berücksichtigt nicht, welcher Effekt die Ursache ist, es wird nur die Verschlechterung des S/N erfaßt. Ausschließlich das Empfangsverhalten ist interessant. Der Entwickler muß beide Effekte getrennt erfassen, um verschiedene Stufen seines Empfängers optimieren zu können.

Der Zweitondynamikbereich verändert sich mit dem Frequenzabstand beider Signale in Abhängigkeit der Konstruktion des Empfängers. Wenn reziprokes Mischen vorliegt, folgt DR_2 dem Seitenbandrauschspektrum des (der) Empfängeroszillators(en). Wenn Blocking vorliegt entscheidet, welche Stufe übersteuert wird und wieviel Selektion in welcher Stufe vorhanden ist.

Ein Problem bei der DR_2-Messung ist, daß der das unerwünschte Signal erzeugende Generator keine signifikantes Rauschen auf der Empfängerfrequenz produzieren darf. Hier benötigt man Quarzfilter. Auf KW kann man die steile Flanke eines Quarzbandpaßfilters verwenden um das Seitenbandrauschen zu minimieren, bei VHF geht das nicht mehr. Hier wird ein Quarznotchfilter benötigt (siehe weiter unten). Bei VHF mögen Quarze die zur Messung guter Empfänger benötigten Leistungen nicht sehr. Man kann versuchen, Lownoise-Quarzoszillatoren zu bauen, die erreichte Qualität des Signals ist jedoch schwer zu bestimmen.

Die Definition des DR_2 ist eng mit dem blockfreien Dynamikbereich BDR [3-8] verknüpft. Ich habe hier die Verschlechterung des S/N zu 3dB festgelegt, anderswo ist häufig 1 dB zu finden. Hierfür gibt es zwei Gründe. Einerseits ist die Messung einfacher. Dies ist wichtig, weil bei verschiedenen Frequenzabständen gemessen werden muß, um ein vollständiges Bild zu erhalten. Bei reziprokem Mischen muß man den Rauschflur sehr sorgfältig ermitteln, wenn man den Pegel des unerwünschten Signals auf ±1dB bestimmen will, siehe **Tabelle 1**. Die 1 dB-Verschlechterung erfordert eine Rauschmessung mit maximal ±0.1dB Fehler, für 3dB Verschlechterung reicht ±0.25dB. Man spart Faktor 6 an Zeit.

Added noise signal relative to main signal (dB)	Signal level change (dB)
-30	0.00
-20	0.04
-15	0.13
-10	0.41
-9	0.51
-8	0.64
-7	0.79
-6	0.97
-5	1.19
-4	1.46
-3	1.76
-2	2.12
-1	2.54
0	3.01
+1	3.54

Tabelle 1. *Die Addition einer zweiten Rauschquelle erhöht den Rauschpegel wie oben. Z.B., wenn beide Rauschleistungen gleich sind (0dB), ist die Summe 3.01dB über dem Einzelsignal und die Empfindlichkeit ist etwa ±0.5dB für ±1dB Änderung der addierten Rauschleistung. Wenn die addierte Rauschleistung 6dB unter dem Ursprungsrauschen ist, ist die Summe 0.97dB über dem Ursprungsrauschen aber die Empfindlichkeit ist nur ±0.2dB für eine ±1dB Änderung des addierten Signales.*

Die von der ARRL gemessenen und in der QST propagierten BDR-Werte (blocking dynamic range) zeigen, wann ein Rx zustopft. Diese BDR-Werte können als Eintondynamikbereich genommen werden, wenn die Messung nicht durch Seitenbandrauschen limitiert ist (Man beachte, daß im „ARRL Standard" eine BDR Testmethode [2] festgelegt wurde). Zum Beispiel wurde für den FT1000D ein BDR > 154 dB, bezogen auf 500 Hz Bandbreite angegeben. Nach meiner Definition ist der Eintondynamikbereich somit > 181dB_{Hz}.

Der zweite Grund , 3dB S/N-Verschlechterung anstatt 1dB zur Messung von DR_2 zu verwenden liegt darin, daß bei einer nur durch reziprokes Mischen begrenzten Messung die numerischen Werte gleich dem Phasenrauschen des Oszillators werden (dBc/Hz). Ein Vergleich des DR_2 mit dem Seitenbandrauschen des Senders (eines Transceivers) kann ein weiteres Problem, verursacht durch Rauschmodulation in einer Senderstufe (häufiges Problem) aufdecken.

Wie bereits bemerkt unterscheidet die Definition des DR_2 nicht zwischen den vielen möglichen Ursachen der S/N-Verschlechterung. Die nachfolgende Liste ist nicht komplett, enthält aber die meisten von mir beobachteten Phänomene:

1. Blocking – die Empfindlichkeit eines Rx in der Sättigung geht zurück.
2. Reziprokes Mischen – aus dem Phasenrauschen des Empfängeroszillators.
3. Amplitudenmodulation in HF-Stufen oder Oszillatortrennverstärkern.
4. Phasenrauschen (Jitter) in Mischern aus CMos-Gattern.
5. Phasenrauschen (Jitter) in Frequenzteilerstufen.
6. Rauschbursts hervorgerufen durch Bewegung kleinster Partikel in keramischen Kondensatoren.

Die Liste sollte auch durch starke Signale verursachte Breitbandstörungen enthalten. Vorwiegend sind dies Nebenempfangsstellen. Bei bestimmten Frequenzabständen verschlechtert sich DR_2 hierdurch. Eine vollständige Beschreibung des DR_2 sollte die Breitbandeigenschaften am besten als Graphen sowie eine Auflistung der Nebenempfangsstellen enthalten. Dies ist jedoch nicht so einfach. Einfache, wie die Spiegelfrequenz könnten tabellarisch dargestellt werden, weil DR_2 der Unterdrückung der entsprechenden Nebenempfangsstelle entspricht. Leider haben Empfänger auch Nebenempfangsstellen höherer Ordnung wie (8*LO-5*RF), die nur bei sehr hohen HF-Pegeln auftreten wann immer das Ergebnis der ZF-Frequenz entspricht. Hier ist die DR_2 -Definition nicht direkt anwendbar, weil das Ergebnis vom Pegel des Nutzsignals abhängt. Folgende Beschreibung als Liste ist möglich: die Frequenz; der Pegel der Nebenempfangsstelle für ein Eingangssignal in Höhe des Breitband-DR_2 -Pegels; die Ordnung der Nebenempfangsstelle, welche beschreibt, wie viel dB das Signal abnimmt, wenn der Eingangspegel um 1dB reduziert wird.

4. Dreitondynamikbereich

Die Messung ist grundsätzlich einfach: Ein leises Nutzsignal wird eingespeist. Zwei weitere Signale, deren Intermodulationsprodukte dritter Ordnung in den Empfangsbereich fallen, einspeisen und deren Pegel erhöhen, bis das IM-Produkt so stark wie das Nutzsignal mit einem Audiospektrumanalysator zu messen ist.

Mit dieser Methode folgt das IM-Produkt exakt der Theorie, weil das Nutzsignal quasi als Pilotton die Messung unabhängig von den nach dem ZF-Filter wirksamen AGC-Stufen macht. Hat der Rx eine doppelte AGC-Schleife [4], stimmt diese Annahme nicht mehr, wenn das Nutzsignal reicht, um durch AGC die HF-Verstärkung zu reduzieren.

Mit P_W als Leistung des Nutzsignals in dBm und P_S für Signal 2 und 3, wird die Gesetzmäßigkeit dritter Ordnung zu:

$$3P_S\,(\mathrm{dBm}) = P_W\,(\mathrm{dBm}) + 2k\,(\mathrm{dBm}) \tag{4}$$

wobei k eine Konstante ist, siehe weiter unten.

Wenn der Pegel des Nutzsignals (P_W) gleich dem Rauschflur ist und der Pegel der beiden unerwünschten Signale (P_S) erhöht werden, bis das IM-Produkt gleich P_W wird, ist der Dreitondynamikbereich gleich der Differenz von P_S and P_W in dB. Die Gleichung wird:

$$DR_3\,(\mathrm{dB_{Hz}}) = P_S\,(\mathrm{dBm}) - \mathrm{NPD}\,(\mathrm{dBm/Hz}) - \{ P_W\,(\mathrm{dBm}) - \mathrm{NPD}\,(\mathrm{dBm/Hz})\}/3 \tag{5}$$

Die Konstante k in Gleichung (4) ist der Interceptpunkt dritter Ordnung IP3 (dBm). Es ist der Punkt, an dem Nutzsignal und Intermodulationsprodukt gleich werden (fiktiv und nicht direkt meßbar).

$$\mathrm{IP3}\,(\mathrm{dBm}) = P_S\,(\mathrm{dBm}) + \{P_S\,(\mathrm{dBm}) - P_W\,(\mathrm{dBm})\}/2 \tag{6}$$

Als Qualitätsmerkmal eines Empfängers ist die Angabe des IP3 ohne zusätzliche Angabe des Rauschflurs bedeutungslos. Durch Einfügen eines 10 dB Dämpfungsgliedes erhöht man den IP3 um 10 dB, der Abstand zum Rauschflur bleibt jedoch gleich. Man kann den IP3 als Abstand zum Rauschflur (in 1Hz) in dB wie folgt beschreiben:

$$\mathrm{IP3}\,(\mathrm{dB_{Hz}}) = P_S\,(\mathrm{dBm}) + \{P_S\,(\mathrm{dBm}) - P_W\,(\mathrm{dBm})\}/2 - \mathrm{NPD}\,(\mathrm{dBm/Hz}) \tag{7}$$

Typische Werte für IP3 sind ca. 10 dB größer als DR_2 , wenn DR_2 durch Blocking bestimmt wird. Dies ist für den Entwickler relevant, um Blocking und reziprokes Mischen zu unterscheiden. IP3($\mathrm{dB_{Hz}}$) and DR_3 enthalten dieselbe Information und können beide für Empfängervergleiche herangezogen werden. Ihre Beziehung ist:

$$DR_3\,(\mathrm{dB_{Hz}}) = 2/3 * \mathrm{IP3}\,(\mathrm{dB_{Hz}}) \tag{8}$$

In 500 Hz Bandbreite ist der Rauschflur 27dB höher, daraus folgt:

$$DR_3\,(500\mathrm{Hz}) = DR_3\,(\mathrm{dB_{Hz}}) - 18 \tag{9}$$

Die Intermodulationscharakteristik eines Empfängers sollte auch Informationen über IM zweiter, vierter und höherer Ordnung enthalten. Intermodulation zweiter Ordnung kann für KW-Empfänger wichtig sein, wenn in breitbandigen Eingangsstufen vielleicht zwei 7 MHz-Signale Mischprodukte auf 14 MHz erzeugen. Selektive VHF-Empfänger sind davon kaum betroffen. IM höherer Ordnung tritt erst bei Signalpegeln nahe der Sättigung auf, wenn bereits sehr kräftige IM-Produkte niederer Ordnung vorhanden sind. Sie sind eher theoretischer Natur.

Man beachte, daß die Intermodulationsprodukte vom Frequenzabstand der beiden unerwünschten Signale zum Nutzsignal abhängig sind. Grund ist wie beim Zustopfen der Grad der Selektion vor den von IM betroffenen Stufen. Dies bedeutet ebenfalls, daß eine vollständige Beschreibung des Intermodulationsverhaltens eine umfangreiche Dokumentation wird.

5. Die Bedeutung des IP3

Der Interceptpunkt dritter Ordnung IP3 hat, obwohl nur rechnerisch ermittelbar, eine physikalische Bedeutung und ist sauber definiert. Die Tatsache, daß verschiedene standardisierte Meßverfahren unterschiedliche Werte ergeben, mag darin begründet sein, daß sie von falschen Annahmen ausgehen oder theoretische Fehler enthalten. Zum anderen kann die IP3-Betrachtung nicht auf alle Empfängerklassen angewandt werden. Dies trifft besonders auf DSP-Empfänger mit A/D-Wandler im Empfangspfad zu. In analogen Empfängern mit Noiseblanker können im Blankerpfad Intermodulationen entstehen, die durch ungenügende Abschirmung oder Pufferung in den Empfangspfad gelangen und schon bei kleinen Pegeln eigenartiges Verhalten erzeugen können, obwohl der Empfangspfad hochwertig ist.

Eine Einzelstufe, die Intermodulationen erzeugt, kann durch eine Übertragungsfunktion beschrieben werden, die für Spannungen weit unterhalb der Sättigung einer Gerade nahe kommt. Wenn das Eingangssignal X(t) (zeitveränderliche Spannung) ist, kann die Ausgangsspannung Y(t+d) als Reihe beschrieben werden:

$$Y(t+d) = k_1X(t) + k_2\{X(t)\}^2 + k_3\{X(t)\}^3 + \dots \qquad (10)$$

Wobei k_1, k_2, k_3 etc. konstante Koeffizienten sind; d ist die Laufzeit zwischen Ein- und Ausgang (hier unwichtig).

Diese Beschreibung ist für kleine Pegel gültig. Bei größeren Pegeln entsteht eine Phasenverschiebung, hervorgerufen durch eine sich mit der Aussteuerung nichtlinear ändernde Kapazität in den Halbleitern. Alle analogen Bauteile (Mischer, Verstärker, Eisenkerne etc) haben $k_1 > k_2 > k_3 > \dots$, sodaß bei kleinen Aussteuerungen die Übertragungsfunktion durch den ersten Term ausreichend beschrieben ist. Durch Annahme von $X(t)=A*\{\sin(2*\pi*f1) + \sin(2*\pi*f2)\}$ ist leicht zu erkennen, wie Y(t+d) wird. Intermodulation dritter Ordnung ist durch k_3, k_5, k_7... und k_3 allein bei kleinen Pegeln gekennzeichnet. Aneinanderreihung mehrerer Stufen ändert diesen Ansatz nicht; die gesamte Kette wird weiterhin durch Gleichung (10) beschrieben, nur mit anderen Koeffizienten, welche man aus denen der Einzelstufen errechnen kann.

Der IP3 , charakterisiert durch k_3 der Übertragungsfunktion, sollte eine exakte Beziehung zu DR_3 haben, welcher das Gleiche beschreibt. Wenn man (z. B. in QST-Publikationen) entdeckt, daß IP3 und DR_3 nicht die richtige Abhängigkeit zeigen, bedeutet dies einen Meßfehler oder das gemessene Gerät hat ein Übersprechen einer in der Sättigung befindlichen Stufe in den Signalzweig. Die Messung des TS-690S [9] durch die ARRL ist ein extremes Beispiel. Hier fallen die Produkte dritter Ordnung nur um 0,5 dB statt erwarteter 3 dB bei 1dB Pegelabsenkung. Ich habe einen TS-450S, der laut [9] ähnliches Verhalten zeigen sollte, sehr sorgfältig untersucht, jedoch nichts gefunden. Aufgrund der höheren Seriennummer war der Fehler wohl schon beseitigt.

IP3 sowie DR_3 sind beide gute Beschreibungen für ein Empfängereingangsteil, weil sie beide auf der fundamentalen Übertragungsfunktion (10) basieren. Für A/D-Konverter eines digitalen Empfängers trifft dies nicht zu. Wenn mehrere starke Signale am Eingang anliegen, ist die Sättigung limitierend. Unterhalb dieses Pegels sind A/D-Konverter üblicherweise sehr linear, man sieht praktisch keine IM-Verzerrungen, darüber versagen sie völlig. Ein digitaler Empfänger hat sehr gute IP3 und DR_3 –Werte, dem realen Vergleich mit einem „guten alten analogen" Empfänger, welcher auch noch weit oberhalb der durch DR_3 gekennzeichneten Pegel funktioniert, kann er nicht standhalten. Zum Beispiel wird ein analoger Empfänger, der 10 an der DR_3 –Grenze liegenden Signalen ausgesetzt ist, für alle möglichen Kombinationen Intermodulationen erzeugen, welche jedoch alle im Bereich des Rauschflures liegen. Ein digitaler Empfänger sieht die 10 Signale addiert als 20 dB höhere Spitzenleistung, wird weit übersteuert und unbrauchbar. Zur Zeit benötigen digitale Empfänger Vorfilter (Roofing-Filter) zur Einengung der Bandbreite. Innerhalb der Filterbandbreite reagieren sie wie oben beschrieben. Testroutinen müssen dieses Verhalten berücksichtigen.

Bei Empfängern mit Rückwirkungen bei kleinen Eingangspegeln (z.B. Noiseblanker, s.o.) ist die Angabe des IP3 nicht sinnvoll. Die IM-Produkte gehorchen nicht der Gesetzmäßigkeit. IP3 und DR_2 sollten nur angegeben werden, wenn sie sicher sind und evtl. Abweichungen bei so geringen Pegeln auftreten, daß sie insignifikant werden. Ansonsten sollte der gesamte Graph Intermodulation über Eingangspegel wie in [9] dargelegt werden. Im EME-Betrieb sucht man nach Signalen 20dB unterhalb des SSB-Rauschflurs, hier wäre ein TS-690S mit der in [9] beschriebenen Qualität unbrauchbar. Für jemanden, der nicht so leise hören möchte, kann das Rückwirkungsproblem u.U. bedeutungslos sein. Im realen Betrieb ist das Rauschen von der Antenne oder einem Vorverstärker kommend ohnehin 10 bis 20 dB höher als bei einer Messung.

Eine detaillierte Analyse und einige saubere Meßmethoden findet man bei http://antennspecialisten.se/~sm5bsz/ dynrange/intermod.htm. Diese Seite erläutert die Sicherheit und Grenzen der Beschreibung von Empfängerintermodulation mittels IP3 und DR_3 .

6. Praktische Messung des Rauschflurs

Als erstes muß der Rauschflur ermittelt werden. Methoden, welche mit Signalgenerator und Voltmeter unter Berücksichtigung der bekannten NF-Bandbreite arbeiten, sind ungenau, weil der NF-Frequenzgang selten sehr eben ist. Z.B. beachte man in Fig. 1 den Frequenzgang eines IC-706MKIIG.

Fig. 1 *Frequenzgang eines IC-706MKIIG. Die Welligkeit ist ±2dB und wäre auf einer ‚normalen' Y–Achse kaum sichtbar.*

Eine typische (alte) Methode würde mit Hilfe eines Meßsenders und NF-Voltmeters die 6dB-Punkte zu 300Hz und 2800Hz ermitteln. Dann würde der Meßsender auf den max. Peak eingestellt und der Pegel für eine NF-Spannungerhöhung von 3dB festgehalten. Hier sind Signal- und Rauschleistung gleich. Der Fehler durch Annahme der 6dB-Bandbreite im Gegensatz zur wahren Rauschbandbreite (äquivalente ‚rechteckige' Bandbreite gleicher Rauschleistung) ist abhängig von der Welligkeit des NF-Teils. Beim IC-

706MKIIG ist die Rauschbandbreite nur 1,6 kHz, der entstehende Fehler ist 1,9 dB. Da sich alle Unsicherheiten addieren, kann durch eine saubere Messung des Rauschflurs die Genauigkeit in der Bestimmung des Dynamikbereichs um einige dB erhöht werden. Ein Effektivwertvoltmeter am Ausgang kann Fehler durch nicht völlig abgeschaltete AGC hervorbringen. Ein Standardmultimeter ist noch ungenauer.

Einwandfreie Messungen erhält man mit einem Audiospektrumanalysator. Es gibt Computerprogramme hierfür, ich favorisiere meine Linrad-Software, sie ist frei erhältlich bei http://antennspecialisten.se/~sm5bsz/linuxdsp/linrad.htm
Zusätzlich benötigt man eine Signalquelle, wie z.B. eine kalibrierte Rauschquelle oder einen Meßsender, welcher bei Pegeln im Bereich des Rauschflurs genau ist. Mit einer kalibrierten Rauschquelle mißt man wie in Fig. 2 zu sehen.

Fig. 2 *Rauschzahlmessung eines Empfängers.*

Die Rauschquelle kann zwischen zwei bekannten Zuständen umgeschaltet werden, üblicherweise ‚Heiß' und ‚Kalt' genannt. Bei Rauschröhren kann die abgegebene Rauschleistung vom Anodenstrom abgeleitet werden. Das Anodenstrominstrument ist üblicherweise direkt in Rauschzahl geeicht. Die Rauschzahl des Empfängers ergibt sich durch 3dB Erhöhung der Rauschleistung am NF-Ausgang und ist dann direkt am Rauschgenerator ablesbar. Bei Halbleiterdioden ist die Rauschleistung ebenfalls eine Funktion des Stromes und üblicherweise bekannt. Ohne Betriebsstrom hat die Quelle eine ‚Kalt'- Rauschtemperatur, welche etwa Raumtemperatur beträgt, die Temperatur des Widerstandes in der Quelle liegt etwas oberhalb der Raumtemperatur. Rauschzahlen werden standardmäßig für 290K spezifiziert. Wenn eine Messung bei anderer Temperatur erfolgt, sollte man für optimale Genauigkeit eine Korrektur einrechnen.

Wenn die Rauschquelle eingeschaltet wird, gibt es neben der Erhöhung der Rauschtemperatur einen kleinen Impedanzsprung. Wenn ein Empfänger empfindlich auf Impedanzsprünge reagiert, ist die Änderung des Rauschflurs nicht nur von der Temperaturänderung der Quelle, sondern auch von der Verstärkungsänderung des Empfängers abhängig. Für die Bestimmung des Dynamikbereichs ist solch ein Fehler unbedeutend, zur Bestimmung einer sehr kleinen Rauschzahl essenziell. Rainer Bertelsmeier, DJ9BV, hat diese Problematik in [10] diskutiert.

Man kann einen zusätzlichen Abschwächer zur Minimierung dieses Fehlers verwenden, der in die Eichung der Rauschquelle einbezogen werden sollte. Bei dem Verfahren nach Fig. 2 stellt der Generator über den Richtkoppler ein Pilotsignal konstanter Amplitude zur Verfügung.

Durch Beobachten am Audiospektrumanalysator kann man durch AGC oder Impedanzsprünge verursachte kleine Schwankungen der Empfängerverstärkung kompensieren. Man beachte, daß Verluste in Kabeln und Richtkoppler die Messung verfälschen. Diese Komponenten kann man als Dämpfungsglieder nahe Raumtemperatur betrachten. Die Korrektur ist nicht schwierig, Minimierung ist jedoch besser.

Ein 20dB Richtkoppler wie in Fig. 2 ist wegen seiner geringen Durchlaßdämpfung gut und koppelt wegen seiner Auskoppeldämpfung wenig thermisches Rauschen in den Hauptzweig ein. Gemessen wird wie folgt. Am Generator wird ein am Audiospektrumanalysator gut sichtbares Pilotsignal eingestellt. Der Pegel sollte so klein sein, dass sich der Rauschflur um nicht mehr als ein paar Zehntel dB ändert. Entscheidend ist hier, daß das Signal wirklich durch den Richtkoppler und nicht durch Einstrahlung in den Empfänger gelangt. Vier Pegel sind zu bestimmen: Rauschflur und Signalpegel, jeder für ‚Heiß' - und ‚Kalt' - Zustand der Rauschquelle. Die Abstimmung darf während der Messung nicht verändert werden, erlaubt ist nur Ein/Ausschalten der Rauschquelle. Es ergibt sich:

N_C = ‚Kalt' Rauschflur

N_H = ‚Heiß' Rauschflur

S_C = ‚Kalt' Signalpegel

S_H= ‚Heiß' Signalpegel

Bei Linrad kann man diese Pegel in dB vom S-Meter ablesen. S_H und S_C sollten bei einer Bandbreite (z.B. 10Hz) gemessen werden, bei der das Rauschen vernachläßigbar wird. Prüfen durch Abschalten des Generators, die Anzeige sollte mindestens 20dB fallen. N sollte bei größtmöglicher Bandbreite bestimmt werden. Der statistische Fehler bei Rauschleistungsmessungen ist proportional zur Quadratwurzel der Meßzeit und umgekehrt proportional zur Quadratwurzel der Bandbreite. Man stelle sicher, daß keine Signale über Nebenempfangsstellen eingekoppelt werden. Der Unterschied zwischen S_H and S_C entspricht der Verstärkungsänderung des Empfängers durch den Impedanzsprung der Rauschquelle beim Umschaltvorgang. Es spielt hierbei keine Rolle, ob die Änderung durch den Impedanzsprung direkt oder durch die AGC hervorgerufen wird, solange sie gering bleibt. Die Korrektur des Rauschflurs über die Temperatur in dB erhält man aus:

$$N_{DIFF} = N_H - N_C + S_C - S_H \text{ dB} \qquad (11)$$

Nach Delogarithmierung wird N_{DIFF} zum Y Faktor:

$$Y = 10 * \text{antilog}_{10}(N_{DIFF}) \qquad (12)$$

Weil Rauschleistungen proportional zu Rauschtemperaturen sind, können Gleichung (11) und (12) transformiert werden in:

T_H = Heiß Temperatur der Rauschquelle

T_{CP} = Kalt Temperatur der Rauschquelle

R_X = Rauschtemperatur des Empfängers

Wir erhalten nun die bekannten Gleichungen:

$$Y = (T_H + T_{RX}) / (T_C + T_{RX}) \qquad (13)$$

$$T_{RX} = (T_H - Y * T_C) / (Y - 1) \qquad (14)$$

$$NF = 10 * \log_{10}(1 + T_{RX}/290) \qquad (15)$$

Die ist die gute alte Heiß/Kalt -Meßmethode für Rauschzahlen. Die Gleichungen ergeben, daß man Eiswasser bei 273K und den Küchenofen bei 523K hernehmen kann, um N_{DIFF} = 2,6dB zu erhalten, wenn die Rauschzahl 0,5dB ist. Bei SSB-Bandbreite ist die Unsicherheit groß, vielleicht 0,3dB, bei großen Bandbreiten wird die absolute Genauigkeit gut. Flüssiger Stickstoff erhöht die Genauigkeit für kleine Rauschzahlen dramatisch, ist im Gebrauch jedoch leicht problematisch.

Wenn keine AGC vorhanden ist und der Empfänger unkritisch auf Impedanzsprünge reagiert, sind S_W and S_C gleich und der Richtkoppler samt Meßsender sind überflüssig. Dann klemmt man die Rauschquelle direkt an den Eingang und nimmt den Audiospektrumanalysator als Effektivwertvoltmeter. Zusätzlich vermeidet man so die Unsicherheit der Einfügedämpfung des Richtkopplers.

Zu Anschauung habe ich einige Messungen an einem IC-706MKIIG vorgenommen. Mit einem guten Vorverstärker, eingeschalteter AGC und der internen HF-Verstärkerstufe ausgeschaltet zeigt der IC-706MKIIG S0, wenn Rauschquelle und Signalgenerator ausgeschaltet sind. Der Signalgenerator allein bringt das S-Meter auf S1, die Rauschquelle erzeugt S4 und beide Quellen erzeugen ebenfalls S4.

Tabelle 2 zeigt die Signalpegel in Linrad für die vier möglichen Kombinationen aus Signalgenerator und Rauschquelle.

Generator		S (in 10Hz BW)	N (in 300 Hz BW)
Signal	**Noise**		
off	off	25.8	40.1
off	on	28.5	42.8
on	off	48.8	39.9
on	on	46.3	41.8

***Tabelle 2**. Effektivwerte der Leistungspegel für Signalfrequenz und Rauschflur für alle vier möglichen Kombinationen.*

Bei einem konventionellen Aufbau ohne Signalgenerator würde der Y-Faktor (in dB) zu 42,8-40,1 = 2,7dB werden. Nach Gleichung (11) erhalten wir N_{DIFF} = 41,8 – 39,9 + 48,8 – 46,3 = 4,4dB. Die Rauschquelle war eine auf ‚3dB' eingestellte Röhrendiode, welche bei einer Rauschzahl von 3dB einen Y-Faktor von 3dB ergeben würde. T_H ist dann 870 K. Auf einer linearen Leistungsskala sind die Y-Faktoren 1,86 bzw. 2,75 und mit T_C=295K werden die Empfängerrauschtemperaturen nach Gleichung (15) 373 bzw. 34K. In Rauschzahlen umgerechnet wären das 3,5 und 0,5dB. Die AGC hat bei einer normalen Messung einen Fehler von 3dB erzeugt!

Mit einem Signalgenerator als Pilottonquelle erhalten wir ein korrektes Resultat, obwohl die AGC aktiv ist. Mit meiner Quelle (Magnetic 123) und AGC-Kompensation wird die Rauschzahl des IC-706MKIIG zu 4,4dB mit und 8,7dB ohne internen Vorverstärker.

Die zweite Methode basiert auf einem Meßsender mit bekanntem Pegel. Man mißt das S/N des NF-Signals mit angeschlossenem Meßsender. Die AGC spielt hierbei keine Rolle, der Audiospektrumanalysator ermittelt S und N richtig, beide sind abhängig von der AGC. **Fig.3** zeigt Linrad, wenn ein –130,0dBm Signal in den IC-706MKIIG mit eingeschaltetem Vorverstärker eingespeist wird. Das Linrad S-Meter zeigt S=49,3dB und N=34,8dB. Für eine präzise Messung von S wurde hier die Bandbreite auf 10Hz reduziert. Weil die gesamte Energie noch in diesem schmalen Filter ist, ist das Signal völlig unbeeinflußt. Das S/N in 10Hz ist sehr gut, die S-Meteranzeige ist stabil. Weil zur N-Messung das präzise rechteckige 300Hz-Filter aus Linrad herangezogen wurde, erhält man S/N = 39,3dB, d.h. der Rauschflur ist –169,3dBm/Hz. Aus Gleichung (2) wird die Rauschzahl zu 4,7dB. Bei ausgeschaltetem Vorverstärker erhält man hier 9,1dB. Diese Werte sind durchaus mit denen der Methode mit Rauschquelle vergleichbar. Die etwas höheren Werte resultieren in erster Linie aus dem welligen Frequenzgang des IC-706MKIIG zwischen 1300 und 1600Hz. Man könnte Linrad auf eine Welligkeit von 0,1dB des Rauschflurs kalibrieren, der Effekt wäre jedoch gering, da es schwierig ist, so kleine Signalpegel exakt zu erzeugen.

Zur Rauschzahlbestimmung eines VHF-Empfängers, speziell mit Rauschzahl <4dB, ist die Meßsendermethode ungeeignet. Eine Messung per Rauschquelle ist hier angezeigt. Zur alleinigen Bestimmung des Dynamikbereichs mag ein mit normalen Meßsendern erreichbarer Fehler von 1dB jedoch tragbar sein.

***Fig. 3** Das Basisbandspektrum von Linrad bei NF-Messung mit Signalgenerator. Das Eingangssignal entstammt dem gleichen IC-706MKIIG wie in Fig. 2 mit –130dBm Signal am HF-Eingang. Die Pixel sind mit geraden Linien verbunden, um bessere Ausdrucke zu erreichen. Das rechteckige Filter reicht von 1300 bis 1600Hz.*

7. Quarznotchfilter

DR2 and DR3 Messungen sind einfach, wenn die verwendeten Signalquellen erheblich besser als der zu prüfende Empfänger sind. Das große Problem ist: woher wissen wir das? Standard Meßsender sind mit Sicherheit zu schlecht für ernsthafte Arbeit. Man muß etwas besseres bauen. Nur, wie stellt man sicher, daß die Qualität ausreichend gut ist?

Quarznotchfilter sind die Lösung. Man könnte natürlich auch Quarzbandpaßfilter zur Verbesserung der Signalreinheit des Meßsenders einsetzen, die ist jedoch nur für DR2 Messungen sinnvoll. Man würde für jedes unerwünsche Signal ein Quarzfilter benötigen und hätte die Flexibilität, IM-Produkte bei verschiedenen Frequenzabständen zu messen, verloren. Fig. 4 zeigt ein einfaches Quarznotchfilter.

Fig. 4 Einfaches Quarznotchfilter. C3 ergibt mit der Spule einen durch den Quarz belasteten Parallelschwingkreis. C1 und C2 sind gleich. Kleinere Werte für C1 und C2 ergeben tiefere Kerben aber auch einen schmaleren Durchlaßbereich. Ein Parallelschwingkreis wird durch einen Quarz belastet. Je höher die Impedanz des Schwingkreises ist, umso tiefer wird die Kerbe. Die LC-Schaltung ist ein Bandpaßfilter. Für große Kerbtiefen bei gleichzeitig großer Bandbreite sollte man ein hohes L/C-Verhältnis anstreben. Dadurch wird C3 so klein, dass die Parallelkapazität des Quarzes dominant wird. Die Impedanztransformation sollte durch Spulenanzapfungen erzeugt werden, dies erhöht die Bandbreite durch größeres L/C-Verhältnis.

Wenn man den Dynamikbereich bei kleinen Frequenzabständen messen will, braucht man neben 30dB Kerbtiefe am besten < 1dB Dämpfung 5kHz neben der Kerbe. Hierfür benötigt man mehrere Quarze.

Fig. 5 zeigt den Aufbau eines 14 MHz Notchfilters mit drei Quarzen. Es ist mit sehr kleinen Abstimmkondensatoren aufgebaut, um neben der schmalen Kerbe einen optimal großen Durchlaßbereich zu gewährleisten.

Fig. 5 *Ein 14 MHz Notchfilter. C3 und C4 sind 20pF Trimmer, nahe der minimalen Kapazität abgestimmt. C1 und C2 sind 60pF Trimmer, bei ca. 20pF abgestimmt. Die Spulen sind auf Amidon T80-6 Kerne aufgebracht.*

Die Spulen sind auf große Amidon T-80-6 aufgebracht. Da dieses Filter für IM-Messungen bei 14 MHz gedacht ist, sollten die Spulen im Idealfall Luftspulen sein. Die 50Ohm Wicklungen haben 13 Wdg., die abgestimmten Wicklungen haben 32 Wdg.. Der Quarz sieht so ca. 300Ohm. Die Toroidkerne sind durch Ein- und Ausgang hoch belastet, das Q ist niedrig, deshalb produzieren die Filter trotz Eisenkernen wenig eigene Intermodulationen.

Der Frequenzgang des Filters ist in **Figs 6 und 7** dargestellt.

Fig. 6 *Frequenzgang des Filters aus Fig 5 von 5 bis 30 MHz. Die Filterdämpfung beträgt 0,3dB von 10 bis 20 MHz.*

Fig. 7 *Frequenzgang des Filters aus Fig 5 von 14,100 bis 14,200 MHz. Die Dämpfung beträgt weniger als 0,5dB 10kHz neben der Kerbe, welche über mehr als 1,5kHz Breite 50dB tief ist.*

Das Layout eines solchen Filters ist unkritisch. **Fig. 8** zeigt ein Photo. Die Abstimmung geschieht wie bei einem dreikreisigen Bandpaß. Mit einem Wobbler kein Problem. Ohne Meßmittel kann man das Filter auf minimale Durchgangsdämpfung 100kHz neben der Kerbe einstellen. Es ist dann nicht automatisch flach von 5 bis 20 MHz, für Messungen des Dynamikbereiches ist dies jedoch gut genug.

Fig. 8 *Das 14 MHz Notchfilter in einem Gehäuse aus doppelseitigem Platinenmaterial. Die Bauteile sind auf die Massefläche aufgelötet, die Kerne sind aufgeklebt.*

Ein 144MHz Filter kann auf gleiche Art gebaut werden. Der Durchlaßbereich wird kleiner und die Kerbe breiter sein, weil die Parallelkapazität der Quarze das L/C-Verhältnis verschlechtern und die Serienimpedanz der Quarze nicht sehr klein wird. Einfache 16MHz-Quarze zeigten bei meinen Versuchen ca. 300Ohm beim 9ten Oberton im Bereich 144,100 bis 144,160MHz. Für gleiche Obertonfrequenzen muß man aus etwa 50 bis 100 billigen Exemplaren selektieren. Vor dem Kauf einer größeren Menge sollte man sicherstellen, daß die 9te Obertonresonanz ausgeprägt ist. Einige moderne Quarze haben in großem Gehäuse kleine Quarzplättchen und können für 144 MHz unbrauchbar sein.

Fig. 9 zeigt ein 144 MHz Filter mit 8 Quarzen. Es hat prinzipiell denselben Aufbau wie Fig. 5. Dieses 144 MHz Notchfilter ergibt eine 60dB tiefe Kerbe. Der Frequenzgang ist aus **Figs 10 und 11** zu ersehen. Ein 16MHz Quarz hat falsche Resonanzstellen oberhalb des 9ten Obertones. Dies ergibt unerwünschte Kerben oberhalb der wahren Kerbe in Fig. 11, diese Art Filter ist nicht zur DR_2 and DR_3 Messung geeignet, wenn die unerwünschten Signale frequenzmäßig nahe am bzw. über dem Nutzsignal liegen.

Fig. 9 *Ein Notchfilter für 144MHz mit Luftspulen, die Impedanztransformation geschieht durch Anzapf bei 1,5 Wdg der 4,5 Wdg Ein- und Ausgangsspulen.*

Fig.10 *Frequenzgang des Notchfilters aus Fig. 9 von 100 bis 200 MHz.*

Fig. 11 *Frequenzgang des Notchfilters aus Fig. 9 von 144,000 bis144,300 MHz.*

Auch ein Quarznotchfilter produziert IM dritter Ordnung bei DR3 Messungen, wenn die unerwünschten Signale nahe der Quarzresonanzfrequenz sind.

Bei diesen Frequenzen gehorchen die IM-Produkte nicht der Gesetzmäßigkeit, nicht einmal wenn der Pegel weit unter dem Hauptsignal liegt und Verstärker und Mischer sich korrekt verhalten. In der Nähe der Notchfrequenz muß man sehr geringe Pegel einsetzen, um ein eindeutiges Verhalten nach der Gesetzmäßigkeit dritter Ordnung zu erzielen, das ist nicht einfach. Man benötigt einen sehr guten Empfänger dafür. Fig. 12 zeigt den Pegel der IM3 nach dem 144MHz Notchfilter bei der Notchfrequenz. Der Pegel eines Tones ist auch als 1:1 Gerade dargestellt. Beide Kurven sind bei 20kHz bzw. 100kHz Frequenzabstand gemessen. Hierfür wurden 1W Klasse A Verstärker mit Zirkulatoren vor dem Powercombiner eingesetzt. Zwischen dem Notchfilter und dem RX144 Konverter war ein Dämpfungsglied eingesetzt, um weit unterhalb des Einsetzens der IM-Verzerrungen im Empfangszweig zu bleiben. (Der RX144 Konverter ist Bestandteil meines High Performance Empfängers für Linrad. Es ist ein Empfänger mit vierfacher Frequenzumsetzung nur mit Quarzoszillatoren. Die letzte Umsetzung erfolgt von 2,5MHz nach DC, wo eine Delta44 Soundkarte breitbandig das Signal der I und Q Kanäle in einen Datenstrom konvertiert. Details findet man bei: http://antennspecialisten.se/~sm5bsz/linuxdsp/optrx.htm) Die Bandbreite wurde zu 3Hz gesetzt und die Delta44 wurde mit max. Verstärkung betrieben, um für die IM-Produkte eine gute Empfindlichkeit zu erzielen. Aus Fig. 12 wird klar, daß sich ein Notchfilter anders als ein Verstärker oder Mischer verhält. Das Verhalten dritter Ordnung ist nur bis zu Pegeln von ca. 100dB unter dem Signalpaar zu beobachten. Weiter muß extrapoliert werden: Der IP dritter Ordnung ist +31,5dBm für einen Frequenzabstand von 20kHz und +49,5dBm für 100kHz.

Mit zwei Testsignalen von +16dBm erzeugt das Notchfilter IM3 73dB unter dem Signalpegel. Für normale Verstärker und Mischer können saubere IP3-Messungen bei 20kHz Frequenzabstand bis zu +45dBm durchgeführt werden. Ohne Filter sind die IM3 Pegel bei -74dBm, hier wären IP3-Werte bis +55dBm sicher. Aber wenn man die Zirkulatoren entfernt, liegen die IM3-Produkte bei -52dBm. Da das Notchfilter ohnehin zur DR2 –Bestimmung benötigt wird, sollte man es verwenden, anstatt Klasse-A Verstärker zu bauen.

Fig 12 *Signalpegel am Ausgang eines 144MHz Quarznotchfilters im Zweitontest. Kreise gelten für 20 kHz, Dreiecke für 100kHz Frequenzabstand. Das Verhalten dritter Ordnung bei sehr kleinen Pegeln ist zum IP3 bei +31.5 dBm für 20 kHz Abstand und bei +49.5 dBm für 100 kHz Abstand extrapoliert. Die Intermodulation entsteht im Notchfilter.*

Zusammengefaßt ist ein Quarznotchfilter ein nützliches Utensil. Es erlaubt DR_2-Messungen mit Standard-meßsendern, welche häufig zu hohe Rauschspektren produzieren. IM3-Messungen am Rauschflur sind schwierig. Ein Notchfilter ist eines der brauchbaren Werkzeuge, aber das ungewöhnliche Verhalten der IM3-Produkte muß Beachtung finden, besonders bei Messungen nahe der Notchfrequenz.

8. Praktische Aspekte der DR_2 -Messung

Bei konventionellen Empfängern spielt der Pegel des leisen Signals keine Rolle, solange der Dynamikbereich der ZF- und NF-Stufen ausreichend ist. Es spielt ferner keine Rolle, ob die AGC anspricht oder nicht, solange der Spektrumanalysator am Lautsprecherausgang das gewünschte Signal und den Rauschflur simultan erfaßt.

Zur Prüfung des Dynamikbereiches der ZF- und NF-Stufen erhöhe man den Pegel des erwünschten Signals, bis sich der Signal/Rauschabstand nicht mehr verbessert. An diesem Punkt sind ZF- oder Audiorauschen nicht mehr klein gegenüber dem von der AGC heruntergeregelten Rauschflur am Antenneneingang, oder es ist der Pegel, bei dem das Signal aufgrund von Begrenzung nicht weiter ansteigen kann. Bei einem Empfänger mit zweifacher AGC-Schleife kann der Pegel, bei dem ein Dämpfungsglied aktiv wird, am S/N-Plot direkt erkannt werden. Bei DR_2-Messungen muß der Pegel des Nutzsignals deutlich unter dieser Schwelle gehalten werden.

Die Zusammenschaltung der beiden Meßsender ist bei DR_2-Messungen unkritisch. Der Pegel des Störsignals liegt unter 0dBm, der des Nutzsignals irgendwo bei –130dBm. Ein einfaches Widerstandsnetzwerk tut es, das Störsignal gelangt über 5Ohm, das Nutzsignal über 500Ohm auf einen Zusammenschaltpunkt. Ein Richtkoppler oder ein T-Stück mit nachfolgendem 6dB Dämpfungsglied zur Wiederherstellung der 50Ohm reicht.

Für eine Messung wähle man einen Frequenzabstand und stelle das unerwünschte Signal auf 3dB S/N-Verlust des Nutzsignals ein. DR_2 errechnet sich aus Gleichung (3) , wobei P_{GEN} der Pegel des unerwünschten Signals am Antenneneingang ist. Wenn der Generator kalibriert ist, muß noch die Dämpfung der Kabel und des Powercombiners subtrahiert werden. Bei unkalibrierter Quelle kann man den Pegel aus der Rauschzahl, wie in Zusammenhang mit Fig. 3 beschrieben bestimmen, man benötigt dann exakte Dämpfungsglieder, um in den Bereich um –130dBm zu kommen. Einstrahlung ist hier das Hauptproblem.

Um den Nutzen eines Notchfilters zu erläutern, zeigt **Fig. 13** Linrad mit dem Spektrum von 144,080 bis 144,170 MHz mit einem auf 144,000MHz eingestellten und über das Notchfilter angeschlossenen HP8657A Meßsender. Laut Spezifikation soll das Phasenrauschen <-136dBc/Hz bei 20kHz Frequenzabstand sein. Hier sieht man ein Seitenbandrauschen von –140dBc/Hz in 100kHz Abstand. Amateurfunkgeräte nach dem Stand der Technik sind kaum besser, z.B. wurde ein TM255E beim VHF-Treffen in Gavelstad mit DR2 von 144,5dB bei 100 kHz gemessen: http://antennspecialisten.se/~sm5bsz/dynrange/gavelstad/gav.htm

Fig 13 *Das Linrad Spektrum eines HP8657A Meßsenders bei 80 bis 160 kHz Abstand. Ein Beispiel zum Nutzen eines Quarznotchfilters zur* DR_2 *-Messung.*

9. Praktische Aspekte der DR_3 -Messung

Anders als bei der einfachen DR_2 –Messung hat man bei der DR_3 Messung einige Probleme. Man kann leicht falsche Ergebnisse erhalten, speziell wenn bei sehr kleinen Pegeln der IM-Produkte gemessen wird. Andererseits leiden Messungen bei Pegeln deutlich über dem Rauschflur an Ungenauigkeiten von S-Metern oder Effektivwertvoltmetern am Lautsprecherausgang. Bei Verwendung von drei Meßsendern, wie hier vorgeschlagen, kann man bei hohen Pegeln genaue DR_3 – Ergebnisse erhalten. (Nocheinmal: Bei Empfängern mit zweifacher AGC wird die Messung dort ungenau, wo die AGC die HF-Verstärkung reduziert).

Probleme der Intermodulationsmessung liegen in dem Verhalten des Testempfängers bei starken Intermodulationssignalen. Bei großen Signalstärken kann man dem gesetzmäßigen Verhalten der IM nicht trauen. Bei der realistischeren Situation mit kleinen IM-Signalen <S6 oder so, wie sie im Betrieb auftreten, liegen die Probleme in der Signalerzeugung (Die Generatoren erzeugen gegenseitig IM). Üblicherweise addiert sich die Generator-IM zur Empfänger-IM auf der Frequenz dritter Ordnung. Der Empfänger erscheint dann zu schlecht. Wenn sich die IM-Produkte der Meßsenders und des Empfängers in Gegenphase befinden, erscheint er zu gut.

Wenn man eine gute Quelle zweier gleichstarker Signale hat schaffen können, ist die DR_3 Messung kein Problem mehr. Man nehme das Blockschaltbild aus Fig. 2 , ersetze den Rauschgenerator durch die zweite Quelle. Die Frequenz des Pilottons (durch den Richtkoppler eingespeist) wird nahe neben die Frequenz des erwarteten IM-Produktes gestellt. Die unerwünschten Signale werden auf gleiche Pegel eingestellt und der Pilotton im Pegel dem IM-Produkt angepasst, wie auf dem Spektrumanalysator zu sehen. Die AGC spielt hier keine Rolle, man sieht leicht, wann die Signale gleiche Pegel haben. Sogar ZF-Stufen dürfen in die Begrenzung gehen, solange die unerwünschten Signale außerhalb der ZF-Bandbreite liegen. Mit dieser Methode erhält man über einen wesentlich größeren Pegelbereich sichere Ergebnisse als bei anderen Meßmethoden.

Fig. 14 zeigt die Pegel der IM-Produkte dritter Ordnung in einem IC-706MKIIG bei Eingangspegeln zwischen –56 und –8dBm. Man sieht das gesetzmäßige Verhalten der IM-Produkte bis ca. 40dB unterhalb der zwei Töne. Für diese Messung wurde ein fast perfekter Zweitongenerator benutzt. Mit Hilfe des RX144 und Linrad wurde sichergestellt, dass die

Quelle IM3-Produkte weit unterhalb derer des IC-706MKIIG hat. Es ist natürlich wichtig, die Pilottonquelle sehr gut zu entkoppeln. Jede Einstrahlung erzeugt Fehler bei niedrigen IM3-Pegeln.

Fig 14 *Gemessene IM3-Produkte (Kreise) eines IC-706MKIIG mit HF-Vorverstärker und AGC eingeschaltet. Das Ergebnis der Extrapolation der Produkte dritter Ordnung (Kreuze) ergibt den richtigen Wert (IP3=-8dBm) bis zu IM3-Pegeln von ca. 40dB unter den Einzelsignalen.*

Die folgenden Unterkapitel identifizieren Problembereiche, die bei der Zusammenschaltung zweier Signalquellen zu einer Zweitonquelle für die DR_3 Messung zu beachten sind.

Harmonische des Meßsenders

Erste Bedingung ist Oberwellenfreiheit der zu koppelnden Meßsender. Wenn z.B. zwei Quellen bei 144,100 und 144,125MHz benutzt werden, entstehen IM-Produkte dritter Ordnung bei 144,075 und 144,150MHz. Wenn beide Generatoren Energie auf der zweiten Oberwelle erzeugen, entstehen zusätzlich 288,250 - 144,100 = 144,150 und 288,200 – 144,125 = 144,075MHz. Exakt auf der Frequenz der IM-Produkte dritter Ordnung. Noch schlimmer: Da diese Produkte zweiter Ordnung sind, fallen sie nicht so schnell wie die Produkte dritter Ordnung. Daher werden sie dominant bei kleinen IM-Pegeln. Die Konsequenz erkennt man in **Fig. 15**, dem Plot des Ausgangssignals eines Breitbandverstärkers mit BFR91A. Linrad mit RX144 ist der Spektrumanalysator. Die Signalpegel und die Pegel der beiden IM3-Produkte werden direkt mit dem Linrad S-Meter erfaßt. Die Eingangssignale liegen zwischen –29dBm und –59dBm. Die Signalgeneratoren speisen hier übersteuerte Verstärker, die zweite Harmonische mit ca. 25dB unter Grundwelle erzeugen. Bei solch hohem Oberwellenanteil und einem Breitbandverstärker erstaunt es nicht, daß die Abweichung von normalem Verhalten dritter Ordnung groß ist. Zum Vergleich zeigt Fig. 15 auch die Werte mit zwischengeschaltetem 144MHz-Bandpaßfilter und auf –75dBc reduziertem Obenwellenanteil.

Fig 15*. IM3 Messung an einem BFR91A Breitbandverstärker. Die Pegel der höheren (Kreise) und niedrigen (Recktecke) IM3-Produkte mit und ohne Filter zu Reduzierung der zweiten Harmonischen des Testzweitons. Man beachte, dass Oberwellen ein Verhalten der IM3-Produkte zweiter Ordnung bei kleinen Pegeln hervorrufen.*

Der Breitbandverstärker aus Fig. 15 hat einen IP3 von ca. –4dBm. Er muß mit Pegeln > -38dBm gemessen werden, wenn die Harmonischen bei –25dBc sind. Die Produkte dritter Ordnung sind dann bei ca. –107dBm, also ca. 40dB über Rauschen in 2kHz Bandbreite. Der Versuch, den intermodulationsfreien Dynamikbereich dritter Ordnung am Rauschflur zu messen, ergibt falsche Werte.

Zweite Harmonische der Meßsender werden oft durch die Eingangsfilter der zu testenden Empfänger unterdrückt. Es ist jedoch gut, eine Belastung des Meßobjekts mit Harmonischen zu vermeiden, speziell wenn externe Verstärker zur Pegelerhöhung zum Einsatz kommen. Mehr Leistung erleichtert die Zusammenschaltung zweier Quellen, einfache gesättigte Verstärker benötigen Tief- oder Bandpassfilter am Ausgang. Das beschriebene Quarznotchfilter zur Beseitigung der Rauschseitenbänder bringt ebenfalls sehr gute Unterdrückung bei 288 MHz und höher.

Intermodulation aus Kopplung zweier Meßsender

Der zum Messen benötigte Zweiton wird üblicherweise mit einem Aufbau wie in Fig. 16 gewonnen.

Fig 16 *Zwei Generatoren werden mit einem Hybridcombiner gekoppelt und gleichzeitig voneinander isoliert. Siehe Text.*

Ein brauchbarer Hybridcombiner kann aus Koaxkabel hergestellt werden. Man meide Ferrit-Transformatoren, sie können IM erzeugen. Ein eisenloser Hybridcombiner mit integriertem Abschluß kann auch mit diskreten Bauteilen erstellt werden. Der Hybrid isoliert die beiden Eingänge um ca. 30 bis 40dB, wenn beide Ausgänge mit 50Ohm abgeschlossen sind. Man beachte, daß Empfänger selten 50Ohm Eingangsimpedanz haben, obwohl sie für gute Rausch- und IM3-Parameter bei 50Ohm entwickelt sind. Mein IC-706MKIIG, den ich als Referenz für moderne Geräte heranziehe, hat bei 145 MHz 55Ohm und 18pF Eingangsimpedanz. Das Eingangs-VSWR ist 3,0 und die Rückflußdämpfung 6dB. Direkt mit einem perfekten Hybrid verbunden, senkt ein solcher Empfänger aufgrund der Fehlanpassung die Isolation zwischen den Signalquellen auf 12dB. Jedes zusätzlich eingebrachte dB Dämpfung erhöht die Isolation um 2dB, bis auf max. 25dB. Der Hybrid stellt eine Reflektionsmeßbrücke dar. 50% der Leistung des Generators A verschwindet im Abschlußwiderstand, 50% sieht der Empfänger. Von dort wird ein Teil reflektiert, der dann zu gleichen Teilen an Generator A und B erscheint. Die reflektierte Leistung minus 6dB ist die max. zu erreichende Isolation. Bei einem gegebenen Pegel des Testsignals ist es egal, ob vor oder nach dem Hybrid Dämpfung eingefügt wird, solange die vom Hybrid erbrachte Isolation ausreichend gut ist.

Wenn der Ausgangsabschwächer groß genug ist, können kleine Impedanzfehler die hohe Isolation der beiden Generatoren stark beeinflußen. Durch Anpassen des Abschlußwiderstandes kann man die Verkopplung der Generatoren zum Verschwinden bringen, aber nur von A nach B und umgekehrt. Grund ist die Frequenzabhängigkeit dieser Kompensation. Wenn der Frequenzabstand der Generatoren klein ist, kann man so das Entstehen gegenseitiger Intermodulation der Generatoren bei hohen Pegeln verhindern.

Mit guten Generatoren wie z.B. HP8657A erhält man in der Konfiguration von Fig. 16 im ungünstigsten Fall IM-Produkte, wie in **Fig. 17** dargestellt. Man erkennt gemessene IM-Produkte bei verschiedenen Leistungspegeln, die Last hat dieselbe Impedanz wie der IC706MKIIG. Abschwächer X hat 3dB, die Abschwächer A und B sind die der Meßsender. Zur sauberen Messung der niedrigen IM-Pegel in Fig. 17 wird ein Richtkoppler zwischen Generator A und dem Hybrid eingesetzt.

Fig. 17 Die in einem HP8657A erzeugten Intermodulationen beim Zweitontest. Die Unstetigkeit zwischen −10 und −11dBm ist zwischen −3dBm und −4dBm Ausgangsleistung der Signalgeneratoren. Ursache ist die interne Struktur des HP8657A.

Um ein IMD-Produkt am Rauschflur in SSB-Bandbreite zu erzeugen, muß das IM3-Produkt bei einer angenommenen Rauschzahl von 10dB ca. −130dBm sein. Hierfür müssen die IM3-Pegel der Meßsender besser −140dBm sein. Aus Fig. 17 erkannt man, daß die maximalen Pegel dann −30dBm sind. Das bedeutet, ein paar HP8657A sind für IM3-Messungen am Rauschflur bis zu einem IP3 von +20dBm zu gebrauchen. Ein alter röhrenbestückter HP608D produziert 12dB mehr IM als der HP8657A, wenn sauber abgeglichen. Er kann jedoch durch Aufdrehen des Leistungsreglers zu +13dBm Ausgangsleistung gegenüber normalerweise +4dBm überredet werden. Man kann dann 9dB mehr Dämpfung einfügen und der HP608D wird mit 7dB kleineren IM3-Werten besser als der HP8675A.

Man sollte mit Hilfe eines Richtkopplers das Ausgangssignal der Generatoren überprüfen. Wenn kein guter Spektrumanalysator (Rx144+Linrad) verfügbar ist, genügt der später zu testende Empfänger. Am Ausgang der Richtkopplers ist das Signal des zweiten Meßsenders ca. 20dB unterdrückt, das IM3-Produkt ist jedoch in Kehrlage mit dem Pegel vorhanden, wie der zu testende Empfänger es sehen würde. In diesem Fall würde das Testobjekt mindestens 20dB weniger IM3 erzeugen, weil es aufgrund des Richtkopplers nicht mit zwei gleichstarken Signalen auf den zwei Frequenzen belastet wird. Mit einem weiteren Richtkoppler und einem dritten Generator kann man die Pegel von Signal und IM3 messen und sicherstellen, daß die von den Generatoren erzeugten IM3-Produkte deutlich kleiner sind als die vom Messobjekt im realen Test erzeugten. Der Hybrid muß hierbei die gleiche Abschlußimpedanz wie bei der späteren Messung sehen. Ein nicht abgeschlossenes 3dB Dämpfungsglied erzeugt VSWR=3 und kann zum Abschluß des Hybrides genommen werden. Man schließe das Testobjekt an das Dämpfungsglied an. Dann sind die von den Generatoren erzeugten IM3-Produkte sicher geringer als bei der vorherigen Abschätzung.

Es wurde empfohlen, die Dämpfung vor und nach dem Hybrid zu verteilen, um herauszufinden, wieviel IM3 die Generatoren produzieren. Hierbei wird davon ausgegangen, daß die Isolation des Hybrides konstant ist und die Dämpfung vor dem Hybrid die IM3-Produkte der Generatoren verringert. Die Dämpfung hinter dem Hybrid bewirkt dies nicht. Dies mag im Idealfall zutreffen, mit Sicherheit nicht für ein Testobjekt mit unangepaßtem Eingang, wie meist jeder rauscharme VHF-Empfänger.

Um den Effekt der Generatorintermodulation aufzuzeigen, habe ich die IM3-Pegel des IC706MKIIG mit Hilfe zweier HP8657A gemessen, die mit je +10dBm Ausgangsleistung direkt an den Hybrid angeschlossen sind. Der Testport des Hybrides ist über einen Stufenabschwächer und zusätzlich 18pF belastet, um VSWR=3 zu erzeugen. Mit dem Stufenabschwächer wird der Pegel des Meßzweitons eingestellt. Der maximal erreichbare Pegel ist +4dBm. **Fig. 18** zeigt das Ergebnis. Wie erwartet, zeigt die Intermodulation bei kleinen Pegeln lineares Verhalten, hier dominieren die IM-Produkte aus den Meßsendern.

Fig 18 *Messung der IM dritter Ordnung (Kreise) bei einem IC706MKIIG mit abgeschaltetem HF-Vorverstärker und aktivierter AGC. Dies ist die gleiche Messung wie in Fig. 14, nur mit schlechter Entkopplung der Meßsender. Die Formel zur Berechnung des IP3 ergibt (Kreuze) den korrekten Wert (IP3=-8dBm) nur ein einem engen Bereich. Bei kleinen Pegeln dominiert die Intermodulation der Generatoren, bei hohen Pegeln zeigt der Empfänger kein Verhalten dritter Ordnung mehr.*

Diese Messung zeigt, wie man zu falschen Meßergebnissen kommen kann und wie die Dokumentation aussieht. Fig. 18 ist ein extremes Beispiel schlechter Meßtechnik, wo der Zweitonpegel nur durch einen Pegelsteller am Ausgang eingestellt wird. Üblicherweise sieht der Hybrid eine wesentlich bessere Anpassung als hier, die 18pF erzeugen ein sehr schlechtes VSWR. Es ist bequem, den Zweitonpegel nur mit dem Dämpfungsglied X in Fig. 16 einzustellen. Wenn diese Dämpfung <10dB wird, verschlechtert sich die Isolation des Hybrides und man sollte mit dem Pegelsteller der Meßsender weiterarbeiten.

Wenn Messungen ohne Audiospektrumanalysator durchgeführt werden, sind viele weitere Fehler möglich. Moderne (Synthesizer) Meßsender erzeugen leicht Nebenwellen im 10kHz- oder 100kHz-Raster. **Fig. 19** zeigt das Wasserfalldiagramm zweier HP8657A Generatoren, welche −15dBm in einen RX144 speisen. Der untere Teil zeigt nur IM3, der obere Teil zeigt zusätzlich Rauschen und Nebenwellen. Hier wurde ohne Quarznotchfilter gemessen. Die Einfügedämpfung des Notchfilters wurde kompensiert, der Pegel des Zweitons ist in beiden Fällen gleich. Man beachte die starken Nebenwellen 100 und 200Hz unterhalb des Intermodulationsproduktes. Die 100kHz versetzten Generatoren wurden um 100 und 200Hz verstimmt, um die Nebenwellen von der IM3-Frequenz zu trennen. Man muß die Generatoren einzeln prüfen, jede Nebenwelle gehört hier zu einem Generator. Das Notchfilter entfernt Nebenwellen und Rauschen, das IM3-Produkt ist auch bei kleinen IM3-Pegeln sauber zu erkennen. Man beachte, das der IP3 des RX144 nicht extrem gut ist, nur ca. +25dBm. Ein Pegel, der leicht zu erreichen ist, speziell, wenn man die Rauschzahl von ca. 16dB berücksichtigt. Ein Schmalbandempfänger ist besser hinzukriegen. Eine IP3-Messung nahe dem Rauschflur ist bei sehr guten Empfängern schwierig. Wenn kein dritter Meßsender verwendet wird, kann auch die IM3-Messung bei großen Pegeln schwierig sein.

Fig 19. *Zwei HP8657A Meßsender bei 143,9498 und 144,0499MHz produzieren IM3 bei 144,1500 MHz (es existiert ein Eichfehler von 430Hz). Die zweite Hälfte des Wasserfall-diagramms zeigt das Zweitonsignal hinter dem Notchfilter. Nur IM3 ist sichtbar. Die obere Hälfte ist ohne Notchfilter entstanden: Nebenwellen und Rauschen sind nicht wesentlich schwächer als die IM3-Produkte bei −82dBc. Die*

HP8657A sind nicht geeignet, IM3-Pegel <-70dBc ohne Spektrumanalysator bzw. etwa <-90dBc ohne Notchfilter zu messen.

Wenn Klasse-A Leistungsverstärker für Messungen am Rauschflur bei sehr guten Empfängern benutzt werden, muß auf gute Schirmung geachtet werden. Doppelt geschirmte Kabel und gute Stecker sind zur Vermeidung von Leckagen und IM in den Verstärkern angezeigt. Zu beachten ist auch gute Kontaktgabe in Steckern und Schaltern, IM kann auch an schlechten Kontaktstellen irgentwo im Meßaufbau entstehen.

10. Wieviel Dynamikbereich ist notwendig?

Basierend auf den aktuellen Signalpegeln auf 7MHz kam Peter Chadwick, G3RZP [11] zum Schluß, daß ein PNDR (durch Phasenrauschen limitierter Dynamikbereich) von >100dB und ein ILDR(durch IM limitierter Dynamikbereich) von >96dB erreicht werden sollte. Diese Werte beziehen sich auf SSB-Bandbreite, bei der hier verwendeten Terminologie wird DR_2 >133dB_{Hz} und DR_3 >129dB_{Hz}.

Auf den VHF Bändern gelten die gleichen Zusammenhänge, nur bei anderen Zahlenwerten. Die Ansprüche sind ebenfalls von den örtlichen Gegebenheiten abhängig. Es gibt zwei Arten von Problemen: Außerbandstörungen und Inbandstörungen. Außerbandstörungen existieren meist in großen Frequenzabständen, z.B. hervorgerufen von Rundfunk- und Fernsehsendern mit hoher ERP. Hier sind Vorverstärker und ihre Filtermaßnahmen betroffen. Inbandstörungen werden von unseren lieben Amateurfunknachbarn erzeugt, hier hilft kein Filter, nur ein guter Empfänger mit großem Dynamikbereich bringt uns weiter.

Auf 144MHz haben Funkamateure meist 3kW ERP mit 100W HF in eine 13dBd Antenne, aber auch 100kW sind nicht unüblich, z.B. 1kW in 4 mittlere Yagis mit 18dBd. Die Empfangsfeldstärken bei zwei Abständen unter Freifeldausbreitung sind in **Tabelle 3** dargestellt.

Distanz (km)	Tx ERP (kW)	Rx Ant = 13dBd (dBm)	Rx Ant = 18dBd (dBm)
1	3	+2.4	+7.4
1	100	+17.4	+22.4
10	3	-17.6	-12.6
10	100	-2.6	+2.4

***Tabelle 3** Empfangsleistung bei aufeinander ausgerichteten Antennen auf 144 MHz unter Freifeldausbreitung für zwei verschiedene Abstände.*

Real existieren kaum Freifeldbedingungen. Erdbodenreflektionen ändern die Signalstärken unvorhersehbar. Trotzdem zeigt Tabelle 3, daß ein Empfänger, der mit –20dBm vom Funknachbar zurechtkommt, nicht unsinnig ist. Hierfür benötigt man einen DR_2 von 154dBHz. Dies ist möglich, sollte jedoch nicht von heutigen Standardtransceivern erwartet werden. Weiter erkennt man, daß zwei EME-Stationen in 1km Abstand zum ungestörten Funkbetrieb einen DR_2 von ca. 200dB benötigen! Dies ist heute und auch wohl in Zukunft nicht realisierbar.

Extreme Inbandstörungen entstehen meist durch ein einziges starkes Signal, wenn zwei Antennen aufeinander ausgerichtet sind. Im Gegensatz zur KW ist auf VHF gutes DR_2 Verhalten wichtiger als gutes DR_3 Verhalten.

Beim Testen von Empfängern müssen viele Daten gesammelt und präsentiert werden. Es ist wichtig, den DR_2 bei verschiedenen Frequenzabständen zu messen, sinnvoll sind 5, 20, 100 und 500kHz. Vielleicht reichen DR_3 –Messungen bei 5, 20 und 100kHz Frequenzabstand aus, die Datenmenge ist jedoch viel größer als bei üblichen Publikationen zu sehen.

Andererseits besteht kein Grund, alle Messungen mit oder ohne Vorverstärker durchzuführen, da sein Einfuß leicht zu erkennen ist. Ein Vorverstärker verringert den IP3 um den Betrag seiner Verstärkung und den DR_3 um seine Verstärkung minus der Verbesserung der Rauschzahl. Der DR_2 sollte nur dann schlechter werden, wenn seine Ursache Blocking ist, bei modernen Empfängern eher unüblich. Weil der für Publikationen zur Verfügung stehende Raum meist begrenzt ist, sollte man sich auf die Präsentation der Meßdaten ohne Vorverstärker beschränken und Verstärkung und Rauschzahlverbesserung durch Einschalten des Vorverstärkers hinzufügen. Weitere Messungen können dann im Web präsentiert werden (bereits Praxis bei der ARRL).

Eine Analyse ergibt, daß im VHF/UHF-Bereich eine Konfiguration mit Mastvorverstärker und ausgeschaltetem Gerätevorverstärker die beste Lösung ist. Jeder ernsthafte VHF-Funkamateur wird so handeln, ein weiterer Grund, Gerätemessungen ohne internen Vorverstärker durchzuführen. Der Rauschanteil des Mastvorverstärkers, inklusive Rauschen der Antenne, sollte den Rauschflur des Empfangssystems bestimmen. Daraus resultiert eine Anhebung der Empfangssignale um ca. 15dB, ein weiterer Grund, warum ein weiter Dynamikbereich bei VHF/UHF schwerer zu erreichen ist, als auf KW.

Referenzen

Siehe englischer Text auf Seite 28/29.

Abbildungen (Fig.): Siehe im engl. Text!

TNX

Vielen Dank an Harm, DK3BU, für die Übersetzung des Textes ins Deutsche!

Realisation of a 1-Watt amplifier for 24.2 GHz in microstrip technique (no bonding required)

Philipp Prinz, DL2AM

Most stations active on 24GHz are lacking of sufficient rf power especially for rainscatter operations and direct QSO's. This is more that likely the reason for low activity on this band. I hope the situation will improve with the following article.

In the past building 24GHz amplifiers with more than a couple of mWatts was rather a task for real experts. Modern semiconductors though, simplify the development drastically. Using the chip CHA-5093TCF, I belive the expense is within an acceptable range. I used an existing aluminium case of the size 54mm x 64mm x 20mm.

First I developed the film for the rf board (teflon 0.254mm) and the DC board (FR 4) (fig. 1 and 2).

Then I milled a heatabsorber out of electrolythic copper with the size of 56mm x 25mm x 3mm.

The bottom side needs to be completely flat and on the top side we need to mill an anvil of the size of 3.3mm x 2.29mm with a height of 0.25mm + SMD-solder 0.05mm equals 0.3mm out of the copper plate. Now with a sharp knive we need to cut the size of the avil out of the teflon pcb. In turning up the pcb over the copper plate the pcb needs to overlap the plate on all four sides.

On the each side of the copper block we need to drill 2 holes for the M1.4 screws. Now the pcb will be adjusted and mounted on the block. If everything fits, then we take the pcb back off the block. Now we aply a very thin layer of SMD soldering paste onto the copper plate on the anvil side. Be very careful and exact with this step. The melting point of the sloder should be between 150 and 160 degree Celsius. Now we mount the pcb again on the block and put everything under a presure unit (figure 3 and 4).The bottom part of the presure unit must be of copper with a thickness of 8 to 10mm. The top piece of the presure unit should be made out of silicon. Now you put the assembled unit onto a temperature controlled heating plate (fig. 5) with a temperature of 200 degree Celsius, After about 15 seconds the solder process should be finished and we remove the unit from the heater. Now we have a pcb with an attached cooling block. On the edge one can see if sufficient solder was used. We cut the pcb to the size of the cooling block, drill four holes for the mounting screws for the board and two holes to mount the block in the case.

Washers will be used with the four screws of the type M1.4 x 4. For stabilization purposes during construction we use screws in the 2.2mm-holes. Also we need to make sure that the cooling anvil and the pads on the pcb are levelled.

Now we need to mill the cavity for the copper plate out of the aluminium case. (figure 7). The 50-Ohm lines of the pcb need to match exact with the SMA connectors. The SMA's have a teflon isolation of 2.1mm in diameter and an inner conductor of 0.3mm (figure 8). Now comes the most difficult part, the mounting of the chip itself. I used a small aluminium bracket with 1mm thickness drilled a hole of 1.8mm into it and mounted that with a M1.4 x 6mm threaded screw onto the pcb (figure 9). For thermal isolation between the bracket and the pcb I used a piece of mica. Exact positioning of the chip is very important. Especially the 50-Ohm lines need to be exactly parallel. Using a stereomicroscope for this is of great help (figure 10, 11). Under the microscope we add SMD solder sparingly to the DC pads, the rf lines and the cooling anvil using a needle. The chip will be properly positioned using tweezers. Check the proper positioning before you do the next step, which is putting the copper block on the heating plate for about 15 seconds. Under the magnifier one can see a small drop of the chip. Let it cool down slowly.

Now we can start taking some measurements (table), (be aware of static discharge!). I was shocked when I read about 1.2 Ohms at the rf input despite the decoupling capacitors inside the chip's input and output stages. So I desoldered the chip again and started a critical survey of the board. Everything seemed to be normal. No bad solder joint or short was detected. A telephone call to the distributor unveiled the mystery: a ¼-stub is implemented at the input stage. So the author reassembled the chip. Unsoldering the chip had one good thing, it showed that all pads were properly soldered.

After this, I continued with soldering the rest of the components of the rf and the DC board. The blocking capacitors of the rf board are of the size of 0603 and need to bemounted to the chip as close as possible.

When testing the DC part, a maximum voltage of 6 Volts is allowed. The negative voltage should be adjustable beween –2 and 0 Volts. Now we install the SMA jacks and the resistors with the ferrites. The last check verifies that there is no short between the components. The supply current with now rf aplied should be approx. 300mA, with a voltage of –0.4 Volts on Pin 10.

We hook up a wattmeter to the output and apply power to the input port starting with 5 mWatts.

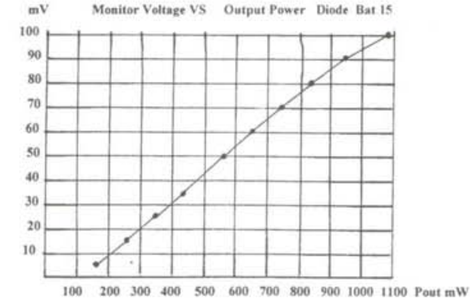
With no alignments made, I already had 250 mWatts at the output. After the alignment, using stubs, the power meter showed 1 Watt with an input of 14.5 mWatts. The maximum achievable power output is 1.1 Watts (diagram). This equals to 18 dB gain. The total supply current is approx. 600 mA. No oscillations were noticeable.
The amplifier is very stable. Measurements with the HP8350 and the HP8757C showed the broad bandwith of the design and a minimum return loss of 12 dB.
For construction and testing the author used the following equipment: a small milling machine, a small stationary drill (Flott), the HP437 power meter with 28GHz head, HP8350 spectrum analyzer with 28GHz plug-in, HP8757C network analyzer, Stereomicroscope from Zeiss and an attenuator switchable in 1-dB steps.
The layouts for amplifiers for two, four and eight Watts are already finished!

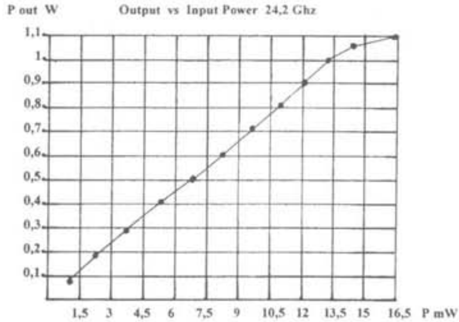
My thanks go to Dirk Fischer, DK2FD for making the boards and to Mr. Düllberg, Fa. Richardson, for the fast delivery of the chips. The cost per chip is 133 Euro's + VAT.

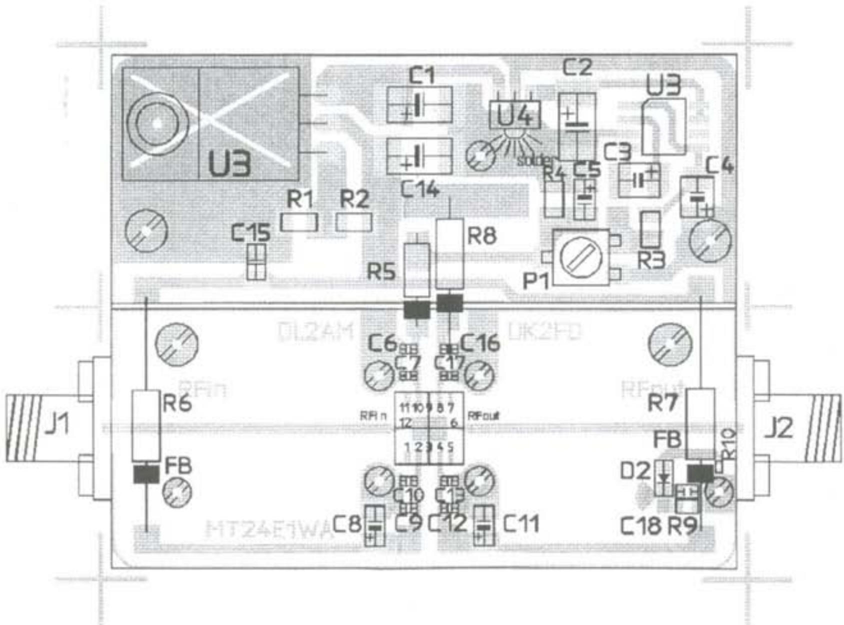
(Note: See back cover of this issue for a 4c picture of the complete PA)

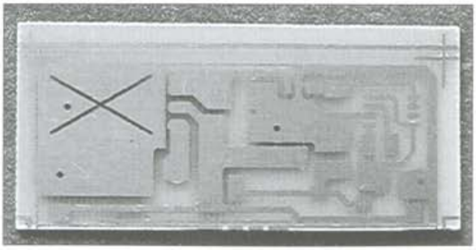
Data sheet in the web: www.ums-gaas.com

(TMX for the translation to Josef, DC9RK!)









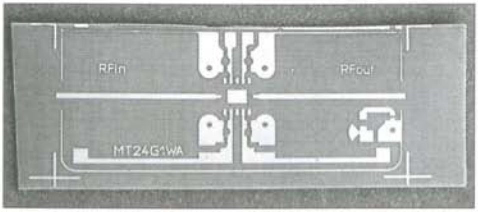


Fig. 1 and 2: PCB RF and DC

Fig. 3

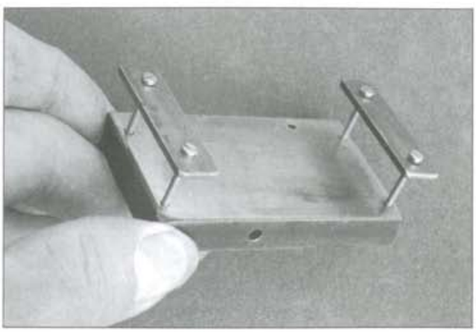


Fig. 4

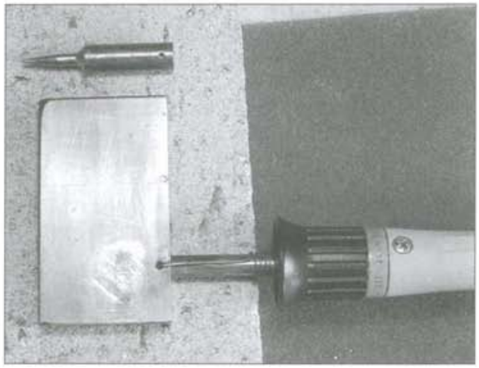


Fig. 5

Fig. 6

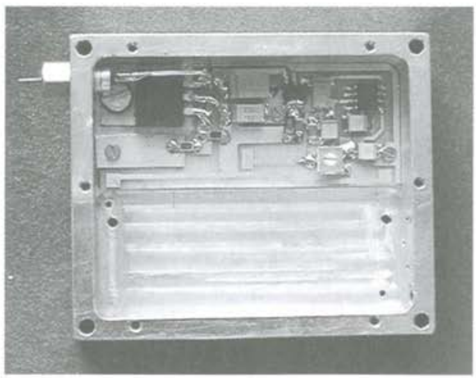


Fig. 7

Figures / Abbildungen:
1 DC PCB (RF4)
2 RF PCB (teflon)
3 Pressure Unit with PCB
4 Pressure Unit
5 Heating Plate
6 RF PCB with cooling block
7 Aluminium case with DC PCB

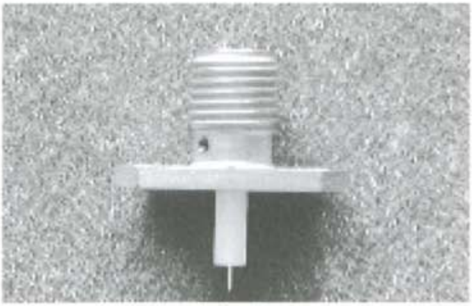
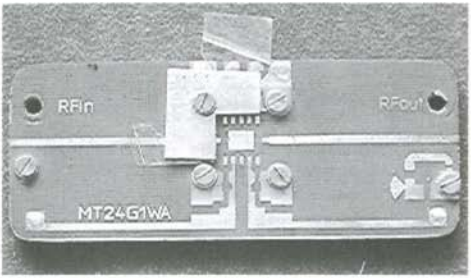


Fig. 8



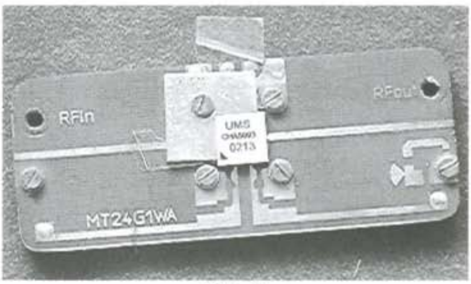


Fig. 9

Fig. 10

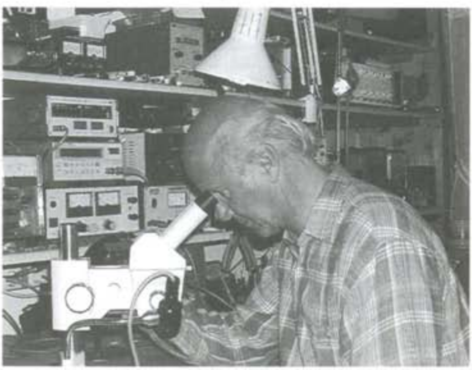


Fig. 11

Figures / Abbildungen:
8 SMA Connector
9 RF PCB with aluminium bracket
10 RF PCB with aluminium bracket and PA chip
11 The author at the stereomicroscope

Stückliste / parts list

for 24 GHZ 1 Watt PA with MT24G1WA

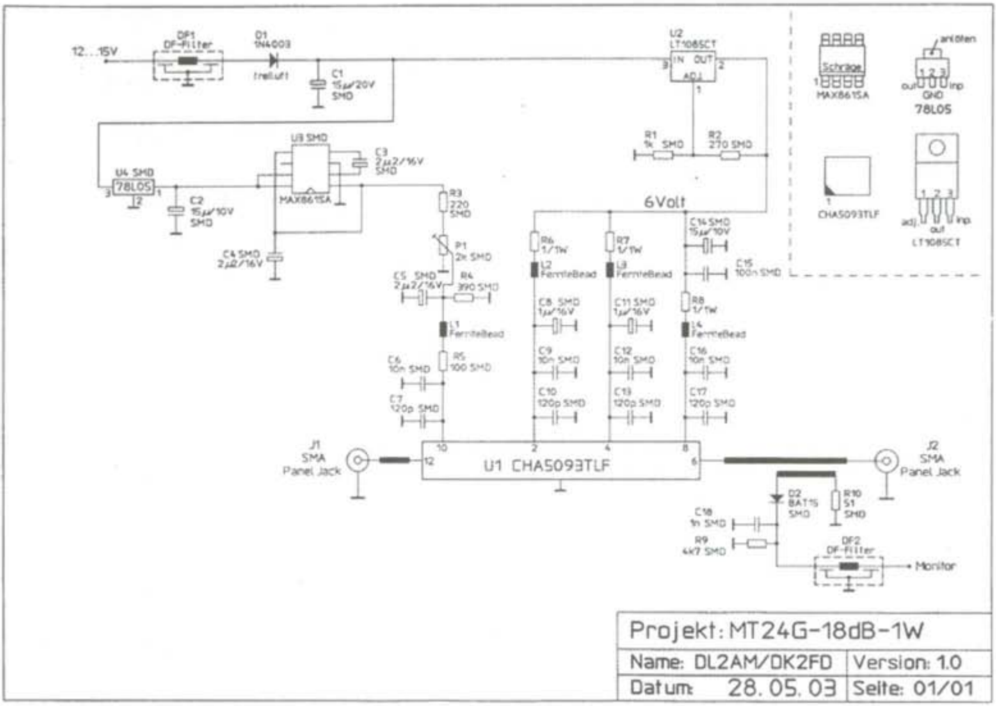
1	LT 1085 CT
1	MAX 861 SA
1	78L05
1	CHA 5093 TLF
1	Diode 1 N 4003
1	Diode BAT 15
1	Tantal 15 µ 20 V
2	Tantal 15 µ 10 V
3	Tantal 2,2 µ 16 V
2	Tantal 1 µ 16 V
1	100 nF
4	120 pf (0603)
4	10 nf (0603)
1	1 nf
1	1 k-Ohm
1	270 Ohm
1	220 Ohm
1	330 Ohm
1	100 Ohm (bedrahtet, wire)
3	1 Ohm (bedrahtet, wire)
1	4,7 k-Ohm
1	Poti 2,2 k-Ohm
3	Ferro-Perlen
2	SMA-Buchsen (high-Qualität)
2	Durchführungs-C`s, Feedthrough-C`s
1	Alugehäuse 64x54x20 mm
1	Kühlplatte (Kupfer) 56x25x3 mm
1	PCB 0,25, Teflon (hergestellt von Dirk Fischer, DK2FD.de)
1	PCB FR 4 (dc)
1	M 3 x 8 - Schraube
1	Isolier-Buchse
1	Glimmscheibe
9	M 1,4 x 4 Schrauben + U-Scheiben
10	M 2 x 6 - Schrauben + U-Scheiben
6	M 2x5 Senkschrauben für Gehausedeckel

Kits / Modules are available from Dirk Fischer, www.dk2fd.de

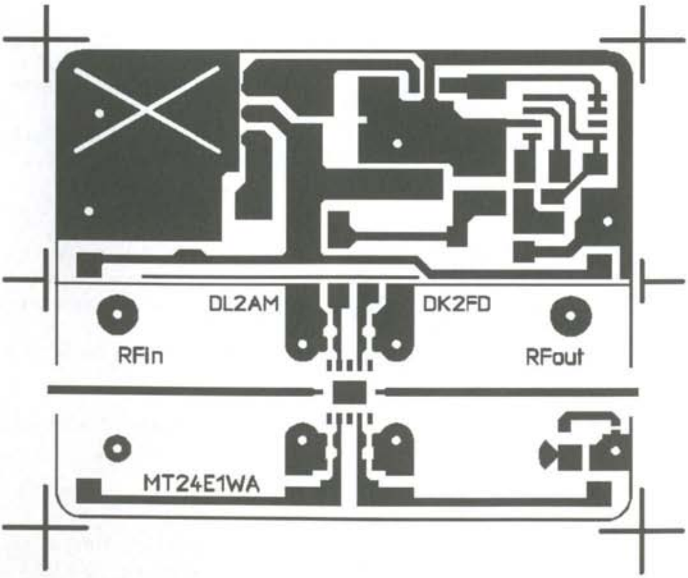
Technische Daten / Technical Data

Betriebsspannung:	6 Volt DC
Frequenz.	24.2 GHz
I ruhe	300 mA
I max	600 mA
Kleinleistungsverstärkung / Gain	19 dB
Eingangsanpassung (S 11)	12 dB

Der Artikel wurde in Deutsch in der cq-DL 8/03 veröffentlicht.



DL2AM`s 24 GHz PA - Circuit Diagramm / Schaltbild



DL2AM`s 24 GHz PA - Layout

DB6NT`s Mixer for 76 GHz:
New semiconductors for the doubler from 19 to 38 GHz

Jürgen Dahms, DCØDA

The semiconductors FLR16 and 26 which are used in the original circuit from DB6NT are not produced any more. Even in JA they are not available anymore. For keeping the mixers`s good concept and layout it was necessary to find an alternative. For the first stage of the doubler, that is amplifying the 20 mW of the first doubler (9,5 to 19 GHz), a NE32584C is used that is quite common for different purposes among microwave amateurs. An FHX 35 would be even better but also this type is not produced anymore. The semiconductor`s development goes more and more to chip versions with bond technique. "Normal" amateurs are not able to handle this. For the second doubler stage an MGF4953A was chosen. This one is better for higher frequencies than the NE32584C due to it`s dimensions. Both transistors are available at cheap prices on the market. For the feed-through-contacts of the PCB at the source pads very thin copper Folie should be used.

Before gluing the PCB into the aluminium box all parts have to be soldered on the PCB. This is necessary because of the specific dimensions of the MGF4953A, who has pad connectors on the bottom side. Hint: For better soldering of the transistor both source pads could be connected before by careful soldering with a cut gate or drain connector from an old MGF1302 which should have 2mm more length on both sides. With this the soldering of the transistor into the PCB is much more easy. The gate and drain pads of the transistor have a little nose that easily takes the solder (Lot) from the microstrip of the PCB.

For tuning this doubler you have to take your time. Anyway already before any tuning there is small power on 38 GHz detectable on the output of the high pass.

The coupling capacitor between both stages can be built from a small square from 0.125 RT / Duroid 5870 (doppelseitig kaschiert). This is available for a cheap price. In order not to destroy the transistors the given values from the DC plan should be kept.

OE2JOM obtained with this construction 6mW output on 38 GHz. But he used an FHX35 in the first stage.

I tried something else: There is also a new development with the mixer diodes. Now there are more and more so called Flip Chip Diodes. They don`t have the usual connectors like the so far used Beam Lead Diodes but two pads on the bottom side of the diode.

The Flip Chip Diode MA4E1318 from M/A-COM that I use is an anti-parallel GaAs-Schottky-Barrier-Diode that is equivalent to the HP diode HSCH9251 that was used before in the mixer. Having almost the same dimensions (ca. 630µm) this diode is suitable for all mixer and multiplier layouts from DB6NT. Of course this type of diode is also produced as a single diode.

This diode is rated with a maximal LO power of +20dBm (100mW !) and also a maximal RF power of +20dBm. So this diode will be very interesting also for other experiments in the microwave bands.

In a first experimental circuit a DSB noisefigure of 13dB was obtained on 76 GHz. Different from the HP diode, which has noise minimum at about 4mW LO level, the M/A COM diode could use much more LO level. At the moment I make tests on 47 GHz, because it is more easy to produce high LO power here than on 23,5 GHz.

I hope that these hints will inspire the Microwave amateurs!

Finally I want to thank DB6NT, DJ6BU, DF9LN, DG1KBF and OE2JOM for their help. 73 + 55 de DCØDA

Mischerbaustein von DB6NT für 76 GHz:
Neue Halbleiterbestückung für den Frequenzdoppler von 19 nach 38 GHz

Jürgen Dahms, DCØDA

Die in der Originalschaltung eingesetzten Halbleiter FLR 16 u. 26 werden nicht mehr hergestellt, Restbestände gibt es selbst in JA nicht mehr. Bei Beibehaltung des bewährten Mischerkonzeptes sowie des Platinenlayouts musste ein Alternative gefunden werden.

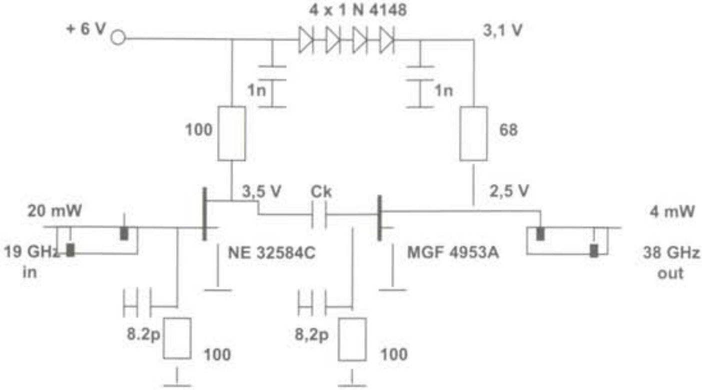
Für die erste Stufe im Doppler, die die ca. 20mW des 1. Dopplers (9,5 nach 19 GHz) verstärkt, wird der inzwischen für viele Anwendungsfälle von den Mikrowellenamateuren gebräuchliche NE 32584C eingesetzt. Vorteilhafter ist sicher der FHX 35, aber auch dieser Typ wird nicht mehr gefertigt. Die Entwicklung auf dem Halbleitersektor geht immer mehr zu Chipversionen für Bondtechnik über, dies ist für den normalen Funkamateur nicht handhabbar. Für die zweite eigentliche Dopplerstufe fiel die Wahl auf den MGF 4953A, er ist für hohe Frequenzen aufgrund seiner Gehäuseform besser geeignet als der NE 32584C. Beide Halbleiter sind zu günstigen Preisen auf dem Markt zu bekommen.

Beim Durchkontaktieren der Platine an den jeweiligen Sourceflächen sollte sehr dünne Kupferfolie verwendet werden. Die Bestückung der Platine ist vor dem Einkleben in das Alu-Gehäuse vorzunehmen, dies ist wegen der besonderen Bauform des MGF 4953A erforderlich. Seine Anschlüsse sind als Pads unter dem Gehäuse angeordnet. Tipp: Zur Einlöt- Erleichterung können die beiden Sourcepads vorher mit einem abgeschnittenen und über beide Pads gelegten Gate- oder Drainbeinchen eines alten z. B. MGF 1302, vorsichtig miteinander mit feiner Lötspitze verlötet werden, die Enden lässt man ca. 2mm auf jeder Seite überragen. Damit fällt das Einlöten in die Platine wesentlich leichter. Gate- u. Drainpads haben dagegen eine nach oben geführte kleine Nase und nehmen deshalb sehr leicht das Lötlot von der Steifenleiterbahn an.

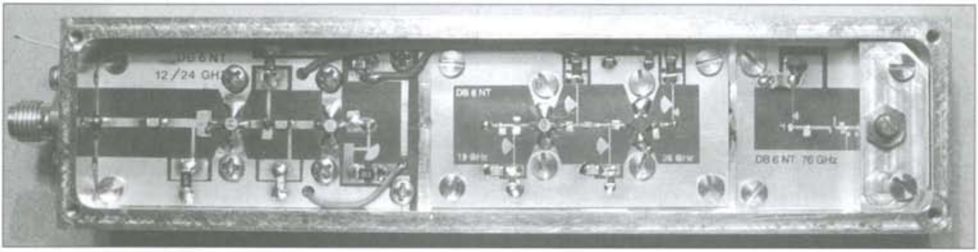
Beim Abgleich dieses Dopplers darf Zeit keine Rolle spielen, es ist aber schon vor dem Abgleich sofort eine kleine Leistung auf 38 GHz am Ausgang des Hochpasses messbar.

Das Koppel- C zwischen beiden Stufen kann mittels einem kleine Quadrat aus 0,125er doppelseitig kaschiertem RT / Duroid 5870 selbst hergestellt werden, zumal auch noch der

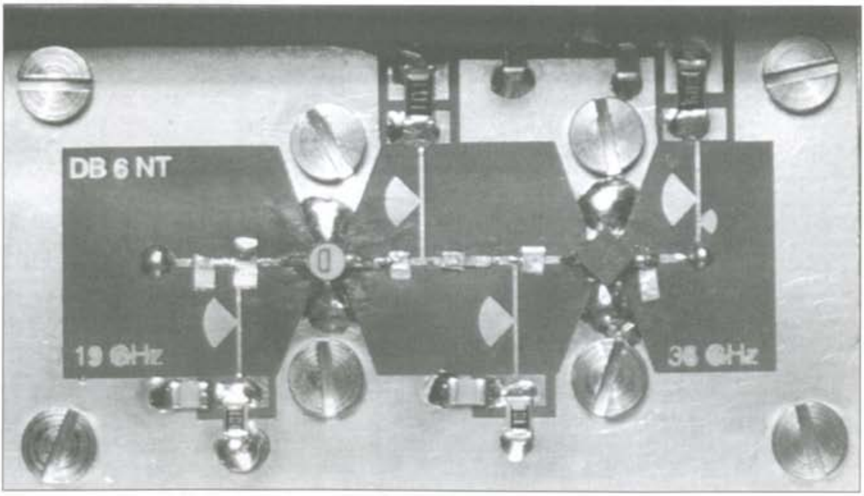
New semiconductors for DB6NT`s multiplier from 19 to 38 GHz
Neue Halbleiterbestückung für DB6NT-Frequenzdoppler 19 nach 38 GHz



Schematische Darstellung der DC- Beschaltung (Drainspannungen bei Ansteuerung / Musteraufbau). Lage der Bauteile aus Nahaufnahme des Dopplers ersichtlich. – Circuit diagram / DC plan



76 GHz- Mischerbaustein DB6NT mit neuer Halbleiterbestückung im 2. Doppler
76 GHz Mixer from DB6NT with new semiconductors in the second doubler



Detailansicht des neuen 2. Dopplers von 19 nach 38 GHz
The second doubler from 19 to 38 GHz in detail

Preis niedrig ist.
Um ein Zerstören der Transistoren zu vermeiden, sollten die angegebenen Werte im DC- Plan unbedingt eingehalten werden! OE2JOM erreichte mit diesem Aufbau eine Ausgangsleistung auf 38 GHz von 6mW, verwendete allerdings in der ersten Stufe einen FHX 35.
Ein weiterer Versuch wurde von mir durchgeführt: Auch bei den Mischdioden zeichnet sich eine Entwicklung
hin zu sogenannten Flip Chip Dioden ab, diese haben anstelle von Anschlussfahnen der bislang verwendeten Beam Lead Dioden zwei Anschlusspads auf der Unterseite des Diodenkörpers.
Die von mir eingesetzte Flip Chip Diode MA4E1318 von M/A-COM ist eine anti- parallel geschaltete GaAs Schottky Barrier Diode äquivalent der bislang im Mischer üblich eingesetzten HP- Diode HSCH 9251. Bei fast gleichen Gehäuseabmessungen (ca. 630µm) ist sie für alle Mischer- u. Vervielfacherlayouts von DB6NT geeignet. Natürlich wird dieser Diodentyp auch als Single Diode gefertigt. Bei einer zulässigen LO Power von +20dBm (100mW !), sowie einer ebenfalls zulässigen RF Power von +20dBm wird sie für viele Versuche im Mikrowellenbereich noch interessant werden.
Im ersten Versuchsaufbau wurde eine Doppelseitenband-Rauschzahl von 13dB auf 76 GHz erreicht. Anders als die HP- Diode, die bei ca. 4mW LO Pegel ihr Rauschminimum hat, kann die M/A COM Diode wesentlich mehr LO Pegel gebrauchen. Ein entsprechender Versuch wird z.Zt. von mir auf 47 GHz durchgeführt, da es hier sicherlich einfacher auf 23,5 GHz ist, große LO Leistungen zu erzeugen.
Die hier gemachten Hinweise sollen zur Anregung für die Mikrowellenamateure dienen!
Abschließend möchte ich mich bei DB6NT, DJ6BU, DF9LN, DG1KBF u. OE2JOM für ihre Unterstützung bei den vielen Vorversuchen bedanken. 73 + 55 de DCØDA

Update / Correction for the 23/13cm LNA (DUBUS 3/2003)

by Goran Popovic, AD6IW

Here is the values of the parts for 2,3 / 2,4 GHz LNA with ATF55143, 3V / 20 mA.
The measured gain is 15,4 dB, and noise is 0,7 dB, for single stage LNA.
C1, C6 = 2,2 pF
C2, C5 = 10 pF
R9 = 15 Ohm
Source strips are 0,9 mm long
L1 = 3,7 nH, wire 0,51 mm, 5mm long, hairpin (U shape)
L2 = 6 nH, wire 0,51 mm, 6mm long, hairpin

Errata:
In the Dubus magazine vol.32 3/2003, in the L&S band article on the schematics on the page 11, on the right side of the ATF 55143 transistor, it should be 3V / 20 mA, instead 3V / 30 mA.
The value of the parts is incorrect, L3 (L5) should be 22 nH for 1.3 GHz, 11 nH for 2.3 GHz, (Murata LQN21A22NJ04, LQN21A10NJ04) or air wounded inductor, installed through hole on the bottom side of the board.
Capacitor C11, (C14) should be 510 pf for 1.3 GHz or 270 pF for 2.3 GHz.

Thanks to Daniel Uppstrom SM6VFZ who notified that, and for his suggestion.

Goran Popovic, AD6IW, ad6iw@goran.us

Microwave Parts

Henning Weddig, DK5LV

From EIC there are new microwave amplifiers available. They were developed for use in base-stations and repeaters for commercial use e.g. GSM and UMTS. For sure they are interesting for use on amateur radio frequencies, too.
All devices are available in QFN16 and SOIC-8 packages and work with 5 V.
Here the list of new chips:

Von der US Firma EIC werden neue Verstärker-ICs für 2.4 GHz bzw. 100 bis 2300 MHz angeboten. Sie sind im QFN 16 und SOIC-8 Gehäuse erhältlich und arbeiten mit 5 Volt. Hier die Liste:

ECP053 0.5 Watt Power Amplifier
2.1 – 2.7 GHz, 28 dBm P1dB, 43 dBm OIP3
13 dB linear gain, Class A or AB

ECP103 1.0 Watt Power Amplifier
2.1 – 2.7 GHz, 30,5 dBm P1dB, 46 dBm OIP3
11 dB linear gain, Class A or AB

ECP203 2.0 Watt Power Amplifier
2.1 – 2.7 GHz, 32,5 dBm P1dB, 48 dBm OIP3
10 dB linear gain, Class A or AB

ECP100 1.0 Watt Power Amplifier
100 – 2300 MHz, 31 dBm P1dB, 47 dBm OIP3
12 dB linear gain @1.96 GHz, Class A or AB

ECP200 2.0 Watt Power Amplifier
100 – 2300 MHz, 33 dBm P1dB, 49 dBm OIP3
11 dB linear gain @1.96 GHz, Class A or AB
Address from the manufacturer:
EiC Corp. A Subsidiary of EiC Enterprises, Ltd.
45738 Northport Loop West, Fremont, CA 94538
Phone: (510) 979-8999 Fax: (510) 979-8902
www.eiccorp.com

Die Bauteile werden in DL durch laut Internet vertrieben von: Distributor for DL:
BFI Optilas (Avnet), Bosch Str. 12, D-82178 Puchheim.
PDF datasheets of all devices are available from EIC on the web.

Microwave Europe

Simon Lewis, GM4PLM / DL4PLM

Welcome to another column. This summer and autumn has seen some of the best tropo conditions for many years. A culmination of high summer temperatures and stable weather has allowed some excellent ducting to form and many tropo records have been broken this summer. As I write this another high pressure has formed over Europe and some excellent DX is being worked from between central and Northern Europe. I hope that many of you were able to take advantage of the conditions. A change of job for me has led to some new adventures this summer. GM4PLM is the proud owner of DL4PLM and I am working extensively in the beautiful city of Düsseldorf, Germany. I am working as a divisional IT Manager for Vodafone in the city and will be spending long periods of time here but still keeping my family and QTH in Scotland for the moment. My time in Europe has coincided with some of Europe's finest radio events and it was a great pleasure to make my first visit to Weinheim this year. I have also visited the huge fleamarket at Interradio in Hannover and will be paying visits to many of the big events in Europe across this coming year. I look forward to meeting many more of you as the year progresses, but a big thanks to all in DL who have made me so welcome. Vielen Dank! There is a lot of important information this issue and for me sad news regarding the RSGB and its Microwave Committee, however we have an English saying 'every cloud has a silver lining' and there is also good news where this is concerned so its not as depressing as we first thought! So enjoy this issue and keep sending in those reports, particularly of the activity over the past few months!

Weinheim 2003

I was lucky enough to make a pilgrimage to Weinheim this summer and was really pleased be the whole event. It really is a 'must see' date in the calendar. Unfortunately it was a flying visit as I had limited time that weekend but next year will be much better and I intend to camp at the radio club and enjoy the great socials that take place over the whole weekend. The whole weekend is packed with exhibitions, lectures, talks and practicals. The fleamarket is crammed round the edges of the school under the porch areas. Luckily as this years event suffered from some heavy rainscatter throughout the Saturday! The inside of the school was packed with amateurs from the early hours. I arrived with Stefan DG9BDI and his XYL Heike, at 0930 after a 3.5 hour drive and an early start from Osanbruck in JO42. The event was already well underway with plenty of activity on the 'flohmarkt' and trade stands. During the day I was lucky enough to meet up with Michael DB6NT and have a quick chat in between customers on his very busy stand. I also picked up a new 6cms transverter whilst talking to Michael, No I could not resist! The highlight of the day for me was the Scatter Meeting Dinner on the Saturday afternoon. This was held in the lounge of the local sports club across the road from the school where the event takes place. About 30 microwavers met, talked and generally made merry for a few hours over some good food and even better Bier. I met a great many of you and was pleased to make so many new friends during the visit. We travelled home to Osnabruck in the evening, through some huge thunderclouds and heavy rain again! The team at Weinheim should be justly proud of such a spectacular weekend, thanks team, you did a great job and I look forward to next year when I can spend some longer periods with you and the great Bier!

UK 24 GHz EME Recordings

Brian Coleman G4NNS sent me the following email 'Further to your article in RadCom re W5LUA and OK1UWA's QSO on 24GHz EME, you might be interested to hear the recording made of an earlier test where W5LUA is calling OK1UWA, as recorded at G4NNS. I was not able to listen in on their first QSO but I was able to hear both sides of a second one. Goto http://www.microwaves.dsl.pipex.com/moon/moon.htm.
for the explaination and recording on John G8ACE's web site.

Martlesham Microwave Roundtable

Martlesham is the UK's biggest regular annual microwave event and is held at the British Telecom laboratories at Martlesham near Ipswich. This year will probably remember as the best ever and certainly the most attendance from overseas for a long time. Overall the two day event on 8-9 November saw 100+ microwavers gather together at Ipswich for one of the best events in Europe. I persuaded Klaus DL3YEE and Stefan DG9BDI to make the trip across to the UK with me taking advantage of some cheap flights on Ryanair from Düsseldorf to London Stantead. The weekend started for us on the Friday night with Klaus and Stefan arriving for a radio hams sleepover at my QTH in Düsseldorf. An interesting evening watching the amazing DX on the ON4KST chat (the 2m band was open from the UK to Russia!). Stefan had bought me a present of a Waffle iron and soon we were tucking into a pile of waffles, cold Bier and DX! Klaus telephoned his XYL later and commented 'so there are 3 guys in a flat in Düsseldorf and your making Waffles!........ how much Bier have you been drinking!!!' We decided to get some sleep at a late hour (or was it early!!) before the flight. Next morning I had trouble getting Klaus awake!... it seemed that Stefan had been snoring most of the night and Klaus had to get up a number of times during the night and tell him he was '59S now shut up!! The fun never stopped the whole weekend! After an uneventful flight out we collected the hire car and drove to Ipswitch. This was Klaus's first visit to the UK and he couldn't get used to driving on the right side of the road, as opposed to the wrong side in Germany! The Saturday evening had a social dinner in the hotel we were stopping at and around 30 well known microwavers attended for an excellent meal and then retired to the bar after. Sunday morning saw an early start for breakfast and a short drive to the labs at BT just a few miles away from Ipswich. A small fleamarket was in progress when we arrived and after a short look round we went to see the first of the fine lectures that also took place. As always refreshments were available through the day, which is a good job given all the talking that goes on! It was a good opportunity for the overseas amateurs (9H1LO, DB6NT, DF6NA, DG9BDI, DL3YEE, DL4MUP, DL4PLM, EI2AK, WB5VJB, PA4ZP, ON6UG) that had travelled over to meet everyone and they enjoyed themselves so much they want to come back. I can see me bringing a bus next year! I also had the pleasure to meet some new friends as you can see in the picture, West met East when fellow DUBUS Columnist, Kent Britiain WB5VJB and I met up. Kent is a real 'larger than life' character and kept the whole event buzzing with his infectious Texan humour. Thanks Kent! We finally left around 15.30 and made our way back to Germany, tired but happy! Thanks to all at the BT labs radio society who organised the event and all the team that made the event such a success. See you all next year!

RSGB Microwave Committee goes QRT

As of the 31 Dec, the Radio Society of Great Britain's Microwave Committee will cease to exist. These changes were unexpected, and came as a complete shock to the committee members involved. The termination of the committee work also raises a number of questions about the commitment of the RSGB to the bands above 1 GHz. There are still many issues to be solved such as ongoing support of the many RSGB run microwave contests and activity periods. However, there is another solution! The UK Microwave Group was an alternative group in the UK that supported UK microwavers, although a much younger organisation. Support for this group was at a low last year with the group struggling to form a committee but at Martlesham this year the AGM was very different, mainly due to the situation with the termination of the RSGB Microwave Committee and many difficult decisions were discussed during the meeting. It was decided that the UKuG must support the UK microwavers if microwave radio is to continue the growth this area of the hobby has seen over the past 2 years in the UK. At the AGM a number of RSGB microwave committee members were elected as committee members of the UKuG and it was decided that the UKuG would accept the business activities that the committee was previously responsible for. The new committee is now in touch with the RSGB to discuss the handing over of key activities but it is almost certain that the Microwave Newsletter will get handed over to the UKuG to run, of course still edited by Peter Day G3PHO, who we are indebted to for his hard work. I am also a committee member of the new group, being a previous member of the RSGB Microwave Committee as editor of the Microwave Column in the RGSB RadCom magazine and will continue to be the link between the organisation and the many magazines and columns I write for. It is now essential that subscribers of the Microwave Newsletter support the new committee of the UK Microwave Group to ensure that we continue to have a voice in the UK. I will have more news next time round as the situation is very fluid even as I write this, but you can be assured that the new UKuG committee is 100% committed to the UK microwave fraternity. Latest info on www.microwavers.org More news next time.

Beacon News

GB3SCX on 10GHz and **GB3SCK** on 24GHz (new QRG 24048.905 MHz) are now operational again. Both have had their output power increased, raising them by at least 10dB over their previous nominal values.

GB3SCC on 5760.905MHz has had its keying duty cycle adjusted - it now transmits callsign and location details, followed by plain carrier for a total of 45 seconds, then stops transmitting for 15 seconds to assist thermal management. This keying sequence will be maintained over the winter period and will be reviewed when warmer weather returns in the spring. As an precautionary measure, the beacon complex will remain operating with its mast at reduced height for a while, until the continued reliable operation of the rebuilt units is assured. This reduced height should only affect propagation in a north west / south east direction due to slight shading from local trees. Reception reports should be sent to John Fell, G0API QTHR. Amateur microwaves are still going strong in spite of RSGB's attempt to stifle all representation of our use of frequencies above 1.3GHz , with their abolition of the Microwave Committee. Andy G4JNT

Activity Reports

10368MHz, DF5JJ, JO43XO, wkd:

From the lowest point of Hamburg (9m ASL plus 22m AGL) worked from April-Sept. 120 QSOs over 300km, from thats 35 QSOs over 500km. In Juli-Contest without any RS and normal tropo condx wkd 4800km and 270km/QSO. In June-contest with only 3 hours random-RS made 11000km with 320km/QSO. Several RS-QSOs in 400km range worked with only 250mW. Now in 2 years of activity worked 50 squares/ 11 WAEs. By extract of the Log:

8.5.03 RS: DL3MBG/JN67 (655), DD7MH/JN68 (634), OE5VRL/JN78 (648), OK2ZZ/JN89 (614)

2.6.03 RS: G3LQR/JO02 (594)

8.6.03 21 x RS (170-500km) and 16 x Tropo (55-450km)

16.7.03 RS: F1PYR/JN19 (737), F6DWG/JN19 (719), F6DKW/JN18 (761), G3LQR/JO02 (594), DF6IY/JN48 (538)

17.7.03 RS: SM0LCB/7 /JO86 (516km), SM7ECM/JO65 (308)

20.7.03 RS: G3XDY/JO02 (611)

21.7.03 RS: G4EAT/JO01 (662) 27.7.03 RS: OK1VAM/JN79 (517), OK1AIY/JO70 (500), SP3JBI/JO91 (588), SP4MPB/ KO03 (700)

9.8.03 TR: SM6HYG/JO58 (527), OZ1DOQ/P /JO55+56

23.8.03 TR: 8S7RS/P /JO75

www.df5jj.de has important weather-links (radars, airpressure, inversions, aurora etc.) also WWconvers/DXcluster-portals.Station: 55cm-Offset (AZ/EL), 20W at feed,1db NF Skeds via GSM 0049-172-4071061. CU de Peter, DF5JJ.

F6DKW JN18cs wkd on 10GHz > 800km

08/06/03 OE3WOG JN67rs 838km Rain-Scatter
10/06/03 OK1JKT JO60ok 812km Rain-Scatter
10/06/03 DM2AFN JO61wb 871km Rain-Scatter
10/06/03 DF2CK JO71ad 885km Rain-Scatter
10/06/03 DG0RG JO62jv 871km Rain-Scatter
16/07/03 DK1KR JO53hw 818km Rain-Scatter
08/08/03 OZ5BZ JO45ou 918km Tropo
08/08/03 LA6LCA JO59fe 1274km **1st F/LA on 3cm Tropo**
10/08/03 DK1KR JO53hw 818km Tropo

12/08/03 OZ1CTZ JO46oe 949km Tropo
06/11/03 SM6ESG JO67cc 1140km Tropo
06/11/03 SM4DHN JP60va 1452 km Tropo
10W/90cm Nf 0.7db. TNX for info!!

I4XCC (JN63GV) wkd on 10 GHz (yr 2003) > 500km
08/05 14.50 OK1JKT JO60OK 54s 54s CW RS 21 729
08/05 14.52 OE5VRL/5 JN78DK 57s 55s CW RS 21 522
08/05 20.50 DJ1KP JO40JJ 57s 59s CW RS 355 776
08/05 20.55 DK8ZP JO40JJ 57s 59s CW RS 355 776
08/05 21.28 DL6NCI/P JO50VA 57s 55s CW RS 355 683
09/05 13.12 OK1JKT JO60OK 57s 57s CW RS 5 729
09/05 13.58 DF9RJ JN68GS 54s 54s SSB RS 8 542
09/05 14.18 OE5KE JN78DF 55s 56s CW RS 8 500
09/05 14.18 OE5VRL/5 JN78DK 59s 59s CW RS 9 522
11/05 15.30 OK2DL JN89AO 579 579 CW RS 20 688
13/05 16.54 DC6AL JN68JJ 55s 55s SSB RS 350 501
25/05 20.03 OE5VRL/5 JN78DK 57 55 SSB RS 16 522
29/05 13.10 OK1JKT JO60OK 59s 59s CW RS 5 729
30/05 17.27 OK1JKT JO60OK 59s 59s CW RS 5 729
30/05 18.58 DL6NCI JO50VI 55s 55s CW RS 10 720
31/05 12.58 OK2ZZ JN89BO 59s 59s CW RS 25 691
31/05 13.46 OK1JKT JO60OK 53s 53s CW RS 10 729
02/06 14.58 OE5VRL/5 JN78DK 59s 59s SSB RS 12 522
06/06 17.39 OK2ZZ JN89BO 53s 55s CW RS 22 691
07/06 14.00 OM3LQ JN88OI 599 599 CW RS 30 612
07/06 14.01 OE5VRL/5 JN78DK 59 59 SSB RS 30 522
07/06 14.47 OE3WRA/4 JN87KT 59 59 SSB RS 5 549
07/06 16.21 OE5KE JN78DF 559 579 CW RS 5 500
07/06 17.20 OE5MKM JN78CJ 59 59 SSB RS 5 516
07/06 17.41 OM3ID JN88LE 559 599 CW RS 5 586
07/06 19.34 OL2R JN89BO 59 59 SSB RS 20 691
07/06 19.38 OK1JKT JO60OK 559 559 CW RS 20 729
07/06 19.47 OK1VHF JO70EB 599 599 CW RS 20 699
07/06 20.42 OK1VAM/P JO60LJ 579 579 CW RS 20 723
08/06 10.52 OM3TUC/P JN88LE 559 579 CW RS 20 586
08/06 10.56 S51VJ JN76JE 529 599 CW RS 20 310
08/06 13.24 OE8GMQ/8 JN66NS 59 59 SSB RS 20 323
11/06 15.51 OK1JKT JO60OK 57s 57s CW RS 5 729
11/06 15.55 DL6NCI JO50VI 59s 55s CW RS 5 720
11/06 15.57 DB6NI JO50VI 59s 55s CW RS 5 720
11/06 16.27 DB6NT JO50VJ 55s 55s SSB RS 5 725
11/06 16.56 DL1ATI JO50QU 55s 55s CW RS 5 778
11/06 17.06 DL6NCR JO50VI 59s 59s SSB RS 5 720
12/06 14.52 OK1JKT JO60OK 529 539 CW maybe real 729
13/06 16.40 OK1JKT JO60OK 59s 59s CW RS 25 729
13/06 17.20 OE5VRL/5 JN78DK 59s 59s SSB RS 25 522
14/06 15.38 DL1GGT JN58AO 53s 53s CW RS 350 557
14/06 16.16 OE5VRL/5 JN78DK 55s 52s CW RS 330 522
14/06 16.30 OK2ZZ JN89BO 55s 57s CW RS 0 691
14/06 17.00 F6BSJ JN26ES 52s 55s CW RS 31 713
14/06 17.25 HB9AMH JN37QD 59s 59s CW RS 31 541
14/06 18.24 OE5KE JN78DF 59s 59s SSB RS 20 500
14/06 18.30 OK1JKT JO60OK 59s 59s CW RS 10 729
17/06 18.16 OE5VRL/5 JN78DK 59s 59s SSB RS 16 522
17/06 19.23 OK1JKT JO60OK 55s 55s CW RS 22 729
23/06 14.22 OK1VHF JO70EB 57s 57s CW RS 18 699
23/06 15.12 DL3ALI/P JO50JP 59s 59s SSB RS 355 762
23/06 15.13 DL2ALI/P JO50JP 59s 59s SSB RS 355 762
23/06 16.35 DG1MFI JN58HW 59s 59s SSB RS 355 579
23/06 16.40 OK2ZZ JN89BO 59s 59s SSB RS 355 691
23/06 17.11 S57EA JN76HE 59s 59s CW RS 355 303
23/06 17.15 DL6NCO JN59MI 56s 56s CW RS 355 617
25/06 16.20 OK1JKT JO60OK 57s 58s SSB RS 7 729
25/06 17.27 HB9AMH JN37QD 57s 55s SSB RS 320 541
03/07 18.16 OE5VRL JN78DK 59s 59s SSB RS 19 522
05/07 18.00 OE5VRL/5 JN78DK 539 024 519 015 CW 522
09/07 17.02 DL6NCI JO50VI 53s 52s CW RS 8 720
16/07 14.45 OE5VRL/5 JN78DK 57s 55s CW RS 328 522
16/07 16.04 DL6NCI JO50VI 53s 53s CW RS 333 720
16/07 16.12 DF6IY JN48EU 52s 55s CW RS 340 637
16/07 17.51 OE8MI/8 JN66UO 59s 59s SSB RS 18 315
16/07 18.34 OK1VHF JO70EB 54s 54s CW RS 10 699
16/07 18.40 OK1AIY/P JO70SQ 55s 55s CW RS 10 788
21/07 15.31 OK1JKT JO60OK 55s 55s CW RS 10 729
21/07 16.45 OK1AIY/P JO70SQ 55s 55s SSB RS 12 788
22/07 19.10 OK1JKT JO60OK 55s 55s CW RS 9 d 729
23/07 16.06 OE5VRL/5 JN78DK 529 529 CW 522
26/07 13.27 OE5VRL/5 JN78DK 55 54 SSB pure tropo 522
28/07 14.20 OK1JKT JO60OK 57s 57s SSB RS 12 729
28/07 15.55 OK1AIY/P JO70SQ 55s 55s SSB RS 12 788
28/07 16.39 OE5VRL/5 JN78DK 59s 59s CW RS 32 522
04/08 18.38 OK1JKT JO60OK 55s 55s CW RS 15 729
06/08 16.53 OK1AIY/P JO70SQ 53s 53s CW RS 22 788
08/08 14.00 OK1JKT JO60OK 539 529 CW real tropo 729
15/08 15.59 OK1JKT JO60OK 56s 56s CW RS 12 729
16/08 17.50 OE5VRL/5 JN78DK 59s 59s SSB RS 20 522
16/08 17.59 OK1JKT JO60OK 57s 57s SSB RS 20 729
18/08 13.30 OE5VRL/5 JN78DK 59s 59s SSB RS 10 522
18/08 15.05 OE3LI JN88EC 58s 58s CW RS 30 553
23/08 18.30 OE5VRL/5 JN78DK 539 529 CW tropo 522
29/08 13.35 OE5VRL/5 JN78DK 59s 59s SSB RS 11 522
29/08 14.30 S51JN JN65WM 59s 59s CW RS 12 522
tnx for the Log, Claudio! QTF QRB

WA5VJB and GM4PLM at Martlesham 2003

Regards, Simon
New email: **SimonM.Lewis@vodafone.com**

A Review of the 2003 Rain Scatter Season

Jonathan Naylor, G4KLX

Introduction

After the record breaking of 2002, 2003 would have to be something special to match it. In many ways 2003 was an exceptional year, record temperatures throughout Europe, the largest solar flare for over ten years and some excellent tropo conditions. The 6cms tropo record was broken in November. However 2003 was in many ways also an exceptional year for rain scatter and the high temperatures did appear to make a difference to the results.

Records

An important rain scatter record was broken in 2003; the 24GHz record was extended to 404kms in a contact between PA0BAT and DB6NT on the 3 June. It has been hypothesised that considerably greater distances should be possible on 24 GHz than even on 10GHz by scattering from the ice crystals to be found at the top of the storm clouds. It may only be now with the increased availability of 500mW or more on 24GHz that this potential mode will be proved or disproved. Whether ice crystal scattering (IS?) or rain scatter is used, the increased activity on 24GHz surely means that records will continue to be broken on this band.

The third best rain scatter contact ever made was done on 10GHz in a contact between G4EAT and OK1JKT at 892kms on 30 May. This contact like the record breaking ones between DL6NCI/DB6NI and IW4CJM/4 last year; was a mixture of tropo and rain scatter; in this case there was definitely tropo at the English end across the North Sea towards Holland/Belgium. It is therefore not possible to give an authoritative maximum distance possible using purely rain scatter on 10GHz, but the figure of 800kms is still widely held to be true.

Finally again on the 3 June a couple of excellent rain scatter contacts were made on 3.4GHz between PA0WWM and PA5DD with DM2AFN at 664kms and 645kms respectively. Considering the increased loss on 3.4GHz relative to 10GHz, this shows that there must have been a very intense storm cell along the path. It is a little surprising that the 5.7GHz rain scatter record was not broken at the same time. The most recent region 1 DX records can be found at [1].

Logs

I had hoped to download all of the 10GHz DX spots that appeared on the DX Cluster during the course of the rain scatter season in order to build up a more complete picture of the overall season. I also made a request that people log the dish headings (QTF) of all of their contacts so that the positions of the best scatter points could be plotted. It is already known that the Black Forest and Munich attract storms and I wanted to prove this and to find other locations.

Unfortunately my circumstances changed considerably during the course of the year and coupled to a failure of my e-mail address, I missed a great deal of data. I had hoped to discover a place where archives of DX Cluster data are kept, but so far I have failed. It would appear that a valuable resource is being lost.

Therefore like the 2002 season, I have decided to use a selection of logs from individuals, and wherever possible I chose the same people as last year in order to allow for comparisons. The logs I used are from DF6NA [2], DG1VL [3], F6DRO [4], OK1JKT [5], OZ1FF [6], PA5DD [7], and SM7ECM. When collated and with duplicates removed they provide data for 523 unique rain scatter contacts containing 162 unique callsigns in 166 unique locators.

Analysis

A breakdown of the numbers of people active in various countries is interesting (see table 1 below). Note that the number of people here is less than the 162 stated above since I am counting individuals and so no distinction is made between F1PYR and F1PYR/P for example.

Country	Number
Austria	8
Belgium	1
Croatia	2
Czech Republic	15
Denmark	3
England	6
France	8
Germany	71
Hungary	1
Italy	5
Luxemburg	1
Netherlands	14
Poland	3
Slovakia	4
Slovenia	5
Sweden	3
Switzerland	1

Table 1: Countries and Numbers of 10GHz RS Operators

As in 2002 the country with the most active rain scatter operators is Germany. The Czech Republic is again represented strongly. What is most striking is that the activity from the east is increasing; Croatia is new in the list. It is also nice to see Belgium represented also. What is perhaps most striking is the reduction of activity in Switzerland, at least one rain scatter operator has left the country since the last rain scatter season, but a reduction from four active operators to only one is still shocking. However the eastwards spread of microwave activity is to be strongly welcomed, balanced with the fact that numbers appear to be static if not declining in Western Europe. The distribution of the stations active in this years rain scatter season can be seen in figure 1 below.

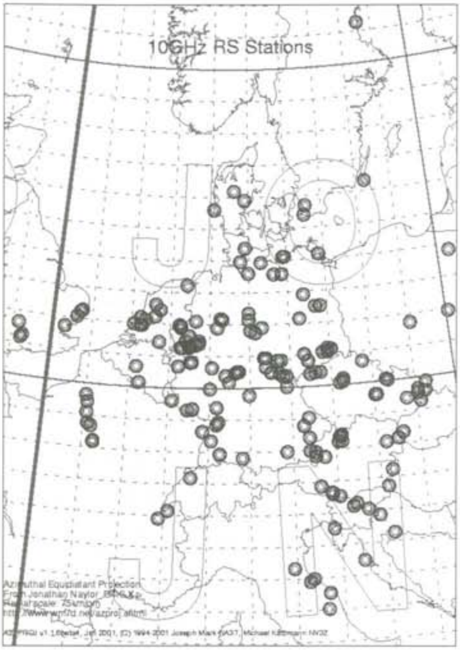


Figure 1: Rain Scatter Stations

The modes in use again favoured CW over SSB. The gap between SSB and CW wasn't as pronounced as it was last year; the figures are given in table 2 below:

Mode	Number
CW	331 (67%)
SSB	160 (32%)
FM	3 (< 1%)

Table 2: Mode and Number of Contacts made

Mode data was not available in all of the logs and so there is a difference in numbers between these figures and the total number of contacts analysed.

It will be interesting to see what the long-term effect of the abolition of the morse test has. Microwaves are one of the few areas of the hobby where a working knowledge of CW is still extremely important, although it is possible that some future data mode may eventually take over. This is likely to happen on microwave EME in the foreseeable future, and any mode able to withstand the frequency spreading of a 10GHz EME path is also likely to work on a rain scatter path also, not to mention for aurora on the VHF and UHF bands.

The start of the rain scatter season was at around the same time as last year, this is reasonable since the exceptional weather didn't start until later. A plot of the best DX by date (figure 2 above) shows some exceptional DX being worked early in the season much more so than in previous years.

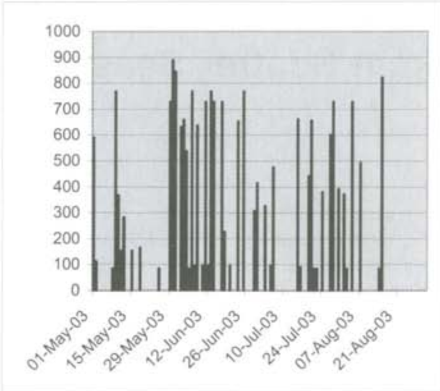


Figure 2: Maximum Distance by Date

In at least a few cases this was because of some tropo paths tying into rain scatter paths thereby extending the worked distances. Therefore the rain scatter itself may not have been exceptional for the time of year. It is difficult to tell.

The effect of the very hot weather was that the rain scatter season did not have the same shape as last year, where the maximum distance showed a trend towards a peak in late May and early June and fell away again towards the end of the season. The pattern in 2003 was that the peak did still appear at the same time, but there was no falling of the quality towards the end, instead after a dip in mid-July the maximum distances increased again.

A plot of maximum distances versus time is interesting (figure 3 below). Compared to the 2002 season, some exceptional distances was being worked earlier in the day. The traditional pattern of a summer's day was disrupted by the temperatures often not dropping below 30 deg C during the night in central Europe, and the difference in temperature between the night time lows against the day time highs was not so obvious. This meant that storms could occur at almost any time during the day and night, it is even possible that people going to bed missed some very good DX in the early morning. It would appear that rain scatter DX was available at least during the hours that most operators were awake; the idea that rain scatter was only a late afternoon/evening phenomenon was not true in 2003.

Analysis of rain scatter contacts by time has the same problem as it did last year in that people have to go to work and this necessarily affects the distribution of the contacts. This usually means that relatively few contacts were made before people returned from work from 1500 UTC onwards. At least one major rain scatter operator is retired and was able to make use of the conditions that were available during work hours. Considering the graph in figure 3 above, figure 4 below shows that the distribution of the numbers of contacts versus time was unexceptional.

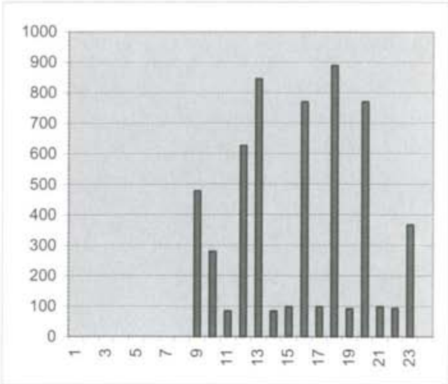


Figure 3: Maximum Distance by Time

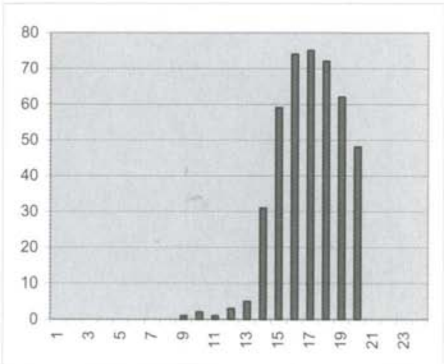


Figure 4: RS Contacts by Time

The final graph shows the number of contacts (fig. 5 below).

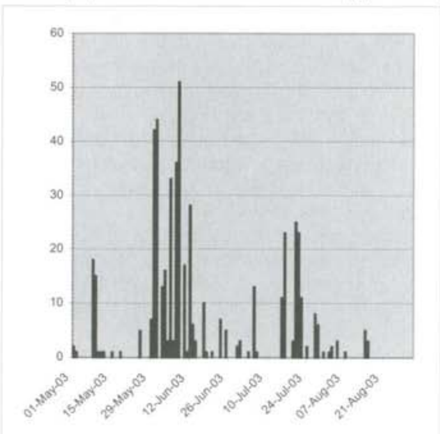


Figure 5: RS Contacts by Date

The obvious peak in activity in late May and early June coincided with the best conditions. Strangely the numbers of contacts made when conditions were still good later in the summer were well down on the peak. I am at a loss to explain this discrepancy. Maybe family holidays or sun bathing in the garden are the reason?

Conclusion

The exceptional nature of the weather in 2003 made the 2003 rain scatter season quite unlike the more conventional summer of 2002. Therefore it is not possible to spot overall trends apart from the numbers of operators and the times that they are operational.

So what will happen in 2004? With the steadily improving activity in the east and on the higher bands, we can look forward to another excellent year. Whether any records will be broken is another question, but I would not be surprised if the 24GHz record were not to be bettered. The logging of the bearings in rain scatter contacts on the DX Cluster is very important, and people should make an effort to record this data in their logbooks as well as it could provide a useful basis for scatter point analysis at some later date.

For those rain scatter operators who have web pages, please consider making copies of your rain scatter logbooks available on your web pages. This would allow for more detailed analysis by third parties at a later date as well as allowing others to see what can be done. With the increased pressure on our microwave spectrum it is important for us to be seen to using the bands.

The data collected and collated to generate the graphs and maps in this article are available from me, by sending an e-mail to jonathan@mechserv.demon.co.uk, the data from the 2002 article is also available.

I think now would be a good time for someone else to take over rain scatter reporting for next year. I no longer live in a country with good rain scatter and even then I am too far from the centre of activity to be able to report it accurately. I hope that someone in mainland Europe can take over the writing of this report and provide fresh insight into activity.

References

1. http://prime.d2g.com/~tommy/reg1/dxrec.htm
2. http://www.df6na.de
3. http://www.qsl.net/dg1vl
4. http://www.qsl.net/f6dro
5. http://www.qsl.net/ok1jkt
6. http://www.oz1ff.dk
7. http://www.hccnet.nl/uffe.noucha

Microwave Japan
Editor: Seiji Fukushima, JH6RTO

Hello. Microwave Japan is back here, edited by Seiji, JH6RTO also M0RAA, AH0R, 7L3TDU etc. I am QRV on 3.5-MHz to 10-GHz bands using the domestic call signs and love going dx vacations to sign M0RAA in the CEPT countries and AH0R in US. There are three topics in this issue; National Microwave Field Day, aircraft reflection QSO using JT44, and rain scatter communications.

National Microwave Field Day

Forth and fifth of October was National Microwave Field Day, which was scheduled to make a lot of microwave QSOs. The exact static is not reported but the number of teams and participants seems more than 50 and 80, respectively. Moreover, a 10-GHz amateur television group, DS0TV, also made portable operation in Korea and made some successful ATV QSOs with Japanese amateurs.
Neither domestic nor world distance record has not been reported unfortunately although all the participants enjoyed their own operations. Finally see the JA1ELV Nori's antennas below in Fig. 1, covering from 5.7 to 249 GHz. Nori's records were 151 km on 1.2 to 47 GHz. (JH6RTO)

Aircraft reflection on VHF

Every flying object could be a reflector for amateurs. Airplanes, which are the most popular objects in the air, have not been used eagerly. Let us see how powerful they are and how ineffective they are for communications.
The heights of typical objects are about 10, 100, and 1000 km for aircraft, meteor and a LEO, respectively, as shown in Fig. 2. The maximum coverage is only 700 km when the aircraft is used as the reflector. It is much smaller than the meteor scatter and LEO coverage. Furthermore, the signal reflected from the aircraft is extremely weak

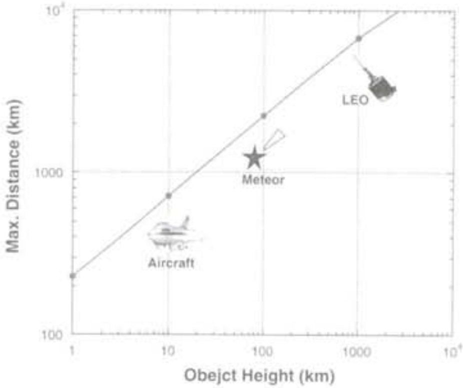


Fig. 2

and, then, the new digital mode JT44 should be employed.

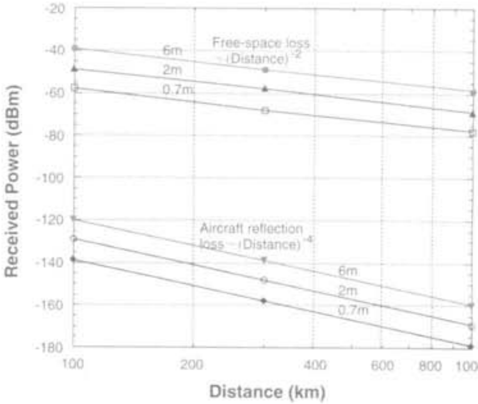


Fig. 3

Figure 3 is a received power vs. distance of two stations. The dependencies of the free-space and aircraft reflection (AR) communications are plotted under the assumptions P=50W and TX/RX antenna gain=10dBi. The free-space loss is proportional to the distance squared inversely, while the AR loss to the distance to the power -4. We have to note that the received power is about 80 dB lower than the free-space communication even at 100 km. It may be the audible levels or below them. In spite of the JT44's sensitivity, the maximum coverage is estimated to be a few hundred km. Our experiments were carried out successfully, as follows:

7L1RLL, Rick, in PM95so wkd:
08-15 1005 JA9BOH PM86fa 2m O O AR 282km

JA9BOH (PM86fa) wkd on 2 m:
8/15 2110 7L1RLL -16dB 282km PM95so AR

8/15 2205 JI1OQR -9dB 271km PM95ql AR
8/16 2004 JI4POR -12dB 308km PM65nk MT
8/17 1854 JH1OQW -13dB 343km QM06co AR
8/19 1932 JN1AYV -8dB 281km PM95ri AR
8/21 1958 7L3TDU -18dB 272km PM95qk AR
8/24 2216 JM1LQW -4dB 263km PM96qa AR
8/30 1918 JH0QBI -17dB 224km PM97ff AR
9/06 1910 JK1XDX -9dB 295km PM95ur AR
9/07 1907 7M2PDT -15dB 360km QM05ek AR
9/11 1942 7K1MFR -14dB 282km PM95sp AR

JH1OQW, (PM95ux) wkd:
08-17-1858J JA9BOH PM86fa 2m AR 293km

JH0QBI, Kame (PM97ff) wkd:
06-28 1326Z JO1QOR PM95ql 2m MT(?) 211km
08-30 1041Z JA9BOH PM86fa 2m AR 224km
09-20 1424Z JM1SZY PM95so 6m AR 205km

JM1SZY, Aki (PM95so) wkd;
08-30 1400Z JF3IPR PM74gs 6m 465km
08-30 1510Z JA3BXC PM74su 6m 373km
09-18 1616Z JK7IKU QM09ar 6m 460km
09-20 1424Z JH0QBI PM97ff 6m 205km
09-23 1517Z JM1KNQ/3 PM74lp 6m 431km
09-24 1536Z JH3VJV PM74lp 6m 431km

JA1JBF (PM96xq, 12el cross-yagi, 50 W) wkd:
10-11 1043Z JA9BOH PM86fa 2m MT 323km

JA7BJP, Satoru (QM07gn, GP, 30 W) wkd:
9-27 0804Z 7M2PDT QM05ek 70cm AR(?) 236km
9-27 0859Z 7K4VPV PM95sp 70cm AR 231km
9-28 0829Z 7L3TDU PM95qk 2m AR 258km
10-5 1307Z JM1LQW PM96qa 2m AR 200km
10-6 1220Z 7L3TDU PM95qk 2m AR 258km
10-18 1104Z JM1LQW PM96qa 2m AR 200km

JM1LQW, Mac (PM96qa, 9 or 10el-yagi, 50 W) :
8/24 22:05 JA9BOH PM86fa 2m 263km
9/20 18:39 JH9TJT PM86hk 2m 252km
10/5 22:05 JA7BJP QM07gn 2m 200km

7M2PDT, Shu (QM05ek) wkd:
9-7 1009Z JA9BOH PM86fa 2m AR 360km
9-27 0804Z JA7BJP QM07gn 70cm AR(?) 236km
10-25 0440Z JH3QYM PM74jw 70cm MT 511km

7L3TDU, Seiji (PM95qk) wkd:
08-21 1045Z JA9BOH PM86fa 2m AR 272km
08-29 1255Z JH0QBI PM87ff 2m AR 215km
10-06 1221Z JA7BJP QM07gn 2m AR 258km

AR: aircraft reflection, MT: mountain reflection and/or refraction.

Finally, I would suggest you to beam your antenna to the main paths of commercial aircraft, but not to your partner. (JH6RTO)

Rain scatter communications

Honshu Island (AS-007), the main island of Japan is divided into the Pacific plain and the Japan Sea plain by its backbone mountains with heights of a few thousand metres, as shown in Fig. 4. Unlike European weather, we have some rainy seasons. We see rain clouds from spring to autumn and snow clouds in winter above these mountains. Some amateurs learned that both plains can be reached on the microwave bands when they use the clouds as reflectors. We have been carried out beyond-line-of-sight experiments on 5.7- and 10-GHz bands between Tokyo and Nagano, although the paths were not identified.

Now the path is believed to be rain scatter (RS) since these communications are always possible when it is heavily raining over the mountains. In addition to the Tokyo-Nagano path, the 280-km Tokyo-Niigata path was experimentally confirmed on FM and SSB in summer last year. The style has changed like this. After the daytime work, the amateurs see the weather map or rain cloud map first. When the rain clouds are present, they make schedule using the internet chat system. The communication seems impossible without rain clouds.

This year a new path between Tokyo and Toyama was found. They are 270 km apart. When we perform these QSOs, both direct our antennas to the clouds, mostly to Niigata. It is quite interesting and this proves that the path is RS.

The communications are easier on 5.7 GHz than 10 GHz. Typical stations use 0.2 or 2 Watts into 70-cm to 5-m dishes on both bands. Now we learned that RS 5.7-GHz communications are possible up to 500 km using 60-cm dishes with 2-watt output power. We also succeeded in 10-GHz 300-km QSO using only a 38-cm dish and a 80-cm dish. JA1CUY, JA1CYC, JH1IGC, JI1CBS, JA7JJN, JH9CFT, and JA0RUZ are known as active RS microwavers. (JA0BQU, Itsuo)

Editor's address: S. Fukushima, 1182-2506 Hase, Atsugi 243-0036 Japan. Email jh6rto@m.ieice.org
URL http://www.geocities.com/ah0r/

Microwave USA

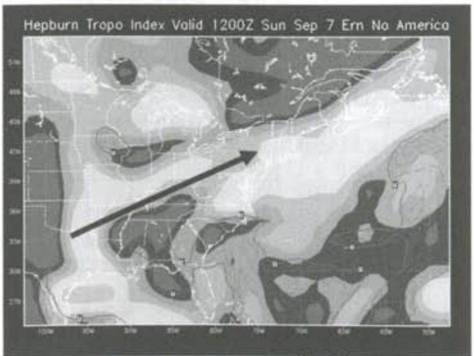
Editor: Kent Britain, WA5VJB

Microwave Update went very well in Seattle this year, N7UZ did a wonder job hosting the conference to 120 microwave enthusiasts. During the banquet WA1ZMS was presented the WAB or Worked All Bands award for completing QSO's on all 27 US Ham bands.

Fig.: WA1ZMS Receive the Worked All Bands award.

I would like to invite everyone to Dallas, Texas next year where W5LUA and I will be hosting Microwave Update next year. -

The big excitement this fall was the tropo opening of Sept 6th and 7th. With a cold front coming down from Canada stalled by Hurricane Fabian in the Atlantic, still air settled over the Eastern half of the US. This tropo opening was very unusual in that it mainly supported VHF QSOs. The **144 MHz Tropo record** changed hands 7 times that weekend with the QSO between KA5DWI (EM12) and K1WHS (FN53) at **2567 km** being the longest. On **222 MHz the Tropo record** changed hands 4 times when on Sunday morning WB5AFY (EM04, West Texas) worked K1ETO (FN42, Maine) on 222 MHz at **2421** km as the band faded. They tried on 432 MHz, but no signals were heard. This Lower VHF QSO, higher frequency nothing, pattern was typical though out the weekend. 432 MHz signals were typical weak and few 900+ MHz QSO's have been reported. There were no new records above 222 MHz. To give a better idea of the low frequency natures of this duct, there were several 1800+ km tropo QSO's on 50 MHz. I am personally in pain! I was in New York that weekend on business and missed all but a 1400 km QSO on 222 MHz in the last hours. But in flying back from New York, I got to actually see the duct for nearly 3 hours. A thick 'milky' layer at about 3000 m that just went on, and on, and on.



Tropo path on Sept. 6th/7th 2003

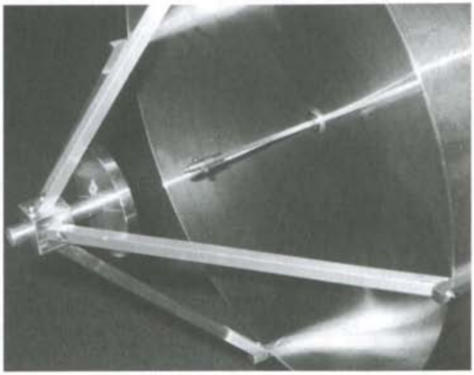


Fig.: WA1ZMS's new Machined Dish

There has also been a lot of activity on the US millimeter bands. WA1ZMS has had two new 300mm dish computer machined just for his millimeter stations and used his new 53 dBi antennas for 2 new records.

While for US Records 300 GHz and 400 GHz are considered the same band, on the 11th of November WA1ZMS/4 worked W4WWQ/4 on 403 GHz extending the world 400 GHz record from .05 to .521 km using his reworked 241 GHz stations. Humidity was 82% at the time of the QSO with a 14.4 dB/km atmospheric loss. Look for this record to be extended this winter.

Back on 241 GHz, on the 14th of November Brian extended the US and World DX record from 11.4 km to 34.9 km. Weather conditions varied across the length of the path, but the average atmospheric loss was about .75 dB/km. At times the signals peaked 13 dB above the noise, so we can certainly expect this record to be extended again during the low humidity of winter.

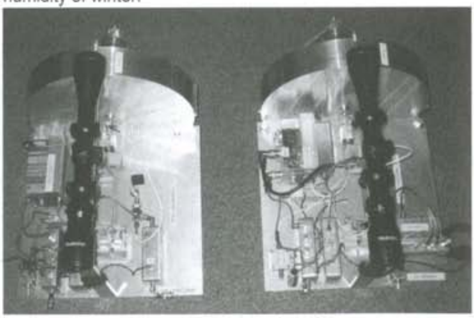


Fig.: 241 GHz Stations

Again I look forward to meeting you next year at Microwave Update here in Texas. WA5VJB

Dates

CSVHFS Conference 2004 will take place from July 22nd to 25th in Mississauga (Ontario, Canada)

The 30th Annual **Eastern VHF/UHF Conference** will be held next April 16th to the 18th, at the Radisson Hotel in Enfield, Connecticut.

Sporadic E
144 MHz - Reports

July 22nd, 2003

DK5YA`s comment for this day

I don't have no idea whats happening to the ionosphere this year .... Almost a copy of yesterday but much stronger and longer. MUF didn't drop that much during the night from July 21. to July 22. causing very high MUF in the early morning both above Italy and again in the east. First 144 MHz opening took place at 0722 UT from EA and F to LZ and SV while LZ was working into UA3 the same time!! MUF dropped at 0800 below 144 but was still extraordinary high. BC from almost everywhere in Europe all around in each and every country, 87-108 MHz was more HF than VHF -). At 1347 UT 144 was open again from DL to YO and a bit later also from OZ to LZ, YO and TA. Later G made UA6 on a QRB beyond 3.000 Km, G8VHI was the winner with 3032 Km, congrats Reg!! That's pretty rare across the continent. This opening was really huge and extremely widespread with very high MUF again reaching 250 MH59 from LY to DL!! Last sigs very late in the evening at 2021 UT. Take a look at the map, it says more than thousand words....

DD3DJ, JO31ol, wkd:

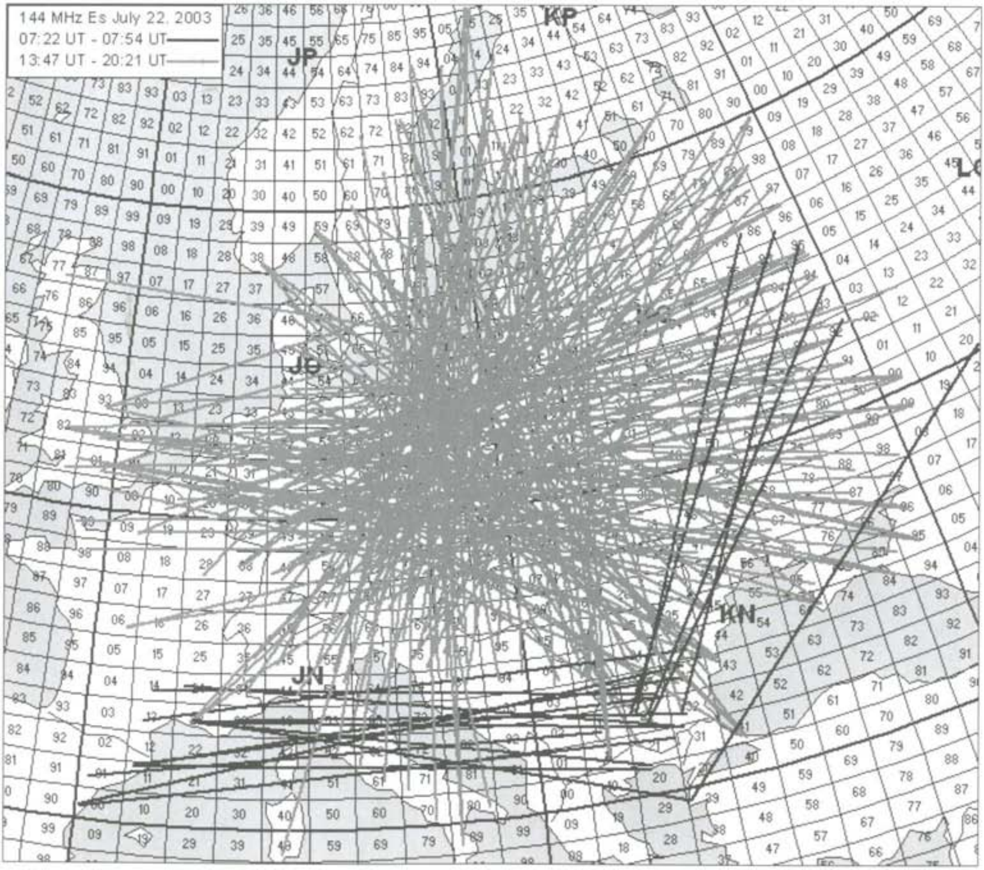
1412 YO4BZC KN45ak
1415 YO4RDK KN35wk
1455 YO3DMU KN34bj
hrd U5YM, YO4GJH KN34xg, YO7IV KN24, ER5AA KN45cw, YO3JW KN34 looking for UK only. YOs mostly spread off widely from .270 to .330 which makes life always a bit easier in the ES-business. Rig 100W + 7ele Flexa on gfk-portable mast.

DD1WKS, JN39kk, wkd:

1657 RW3PF KO93CD 2199 Km
1711 RU3FA KO84RU 2152 Km
1716 UA3WM KO72QI 2011 Km
1717 RK3WWF KO72QI 2011 K.

DD0VF, JO61wb, wkd:

1704 UU2JJ KN75AA 1635km
1715 UU1DX KN74BV 1648km
1718 UY5ON KN89CW 1578km
#510/546
1956 RX1AX KO59EW 1425km
1956 YL3AG KO26AW 930km
MUF 207MHz!
2001 RW1AW KP50EB 1434km
I calculated muf above 144 MHz to Georgia twice, but nothing hrd or seen in cluster. Nobody QRV there?



DF1CF, JN57fp, wkd:
1424 US5WU KO20
1448 ES5RY KO38
1631 LY2IC KO14
1633 LY2SA KO14
1635 UA3ARC KO85
1640 RA3AQ KO85
1644 RK3AF KO85
1649 RW3PF KO93
1652 RU3FA KO84
1653 RA3AH KO85
1654 RV3ANF KO85
1712 UA6IT hrd LN16
1950 RU1AA KP40
1954 RW1AW KP50
1958 ES6DO KO27
1959 RX1AX KO59
2001 ES5RY 59 57 KO38
1950 UA1NAN 599 hrd KP71

DF1NP, JN58ov, wkd:
1713 UR5GIM KN76CI
1721 UR5GP KN76CN
1727 RN6BN KN95LC

DF2ZC, JO30rn, wkd:
1519 YO8RNF KN37EW 1399 #
1628 RK3WWF KO72QI 1932 #
1637 UT2AM KO7ØKW 1918 km
1644 RW3ZO KO7ØWF 2002 k
1651 RW3WR KO71IM 1897 km
1703 UR5LX KO7ØWK 1997 km
1706 RW3PF KO93CD 2114 km
1707 UA3ARC KO85SO 2067 k
1716 UA3YOZ KO63QQ FM 1792 km #606
1717 UR5RJO KO61? FM 1690
1722 RA3EA KO82TX FM 2077
1728 UA3EIZ KO83GG FM 2002
1917 RK3AF KO85QR 2057 km
1917 UA3ARC KO85SO 2067 k
1917 RA3AQ KO85JE 2018 km
1927 RK3FG KO86HP 2021 km

DF5DE, JO40cx, wkd:
1443 YO4RDK KN35wk
1447 YO5TP KN16ss
1507 ER5AA KN45cw
1521 UT1FA KN56
1534 RK3WWF KO72qi
1645 UT2AM KO70kw
1701 UA3ARC KO85so
1713 UR5LX KO70wk
1721 RW3PF KO93cd
1947 RK3FG KO86hp
1951 RA3AQ KO85 CW
1953 UA3ARC KO85so
hrd stn's only for a short time.

DF6NA, JN49xs, wkd
1653 – 1725z RK3WWF JO72qi new#, RA3AH KO85up, UA3FA KO84ru new #, RA3AQ KO85sp, RU3FA KO84ru, RW3DW KO84fv, UA3DJG KO95cn new #
1947 hrd RK3FG KO86hf

DF7KF, JO30gu, wkd:
1428 ER5AA KN45
1430 YO8ROO KN36
1432 YO5BWD KN27
1436 YO4ATW KN35
1440 YO4RXX FM
1442 YO8BGX FM
1444 YO9GWW KN34 FM
1445 UT5JCW KN64
1447 YO4RDK 55 59 NC
1448 YO4BZC KN45
1449 YO5TP KN16
1455 YO5BEU KN27
1457 YO7IV KN34
1502 YO3DMU KN34
1504 YO5CRQ KN17
1520 YO8RNF KN37
1524 US2YW KN48 C?
1653 RW3WR KO71
1655 UR5LX KP70WK
1657 UT2AM KO70
1706 RW3PF KO93
1722 RK3WW/P KO72
1726 RU3EC KO82
1732 UY5UG KO50
1935 RA3AQ KO85
1945 RK3AF KO85
1946 RV3ANF KO85
1947 RK3FG KO86
1953 UA3ARC KO85
1955 RV3ANF KO85 dupe

DF8AE, JO41gx, wkd:
1646 UY5UG Ko50FI
1651 UT2AM KO70KW
1720 RK3WW/P KO72QI
1954 UA3ARC KO85SO
2005 RK3FG KO86HP
1649 UT2HN KN79OI

DF8IK, JO30jt, wkd:
1446 YO5BWD KN27GD
1448 YO5TP KN16SS
1448 YO4ATW KN35XG
1449 YO4BZC KN45AK
1450 YO4RFV KN45AK
1453 YO4GJH KN35XG
1454 YO5BEU KN27GD
1522 YO8RNF KN37EW big sigs hrd YO7IV, YO5CRQ, U5YM, YO3DMU, ER5AA

1629 RK3WWF KO72QI
1644 UT2AM KO70KW
1652 RW3WR KO71IM
1702 UR5LX KO70WK
1712 RW3PF KO93CD
1718 RW3ZO 55 55 KO70WT
hrd RU3EC, UT5ER cq G...
1922 RK3AF KO85QR
1929 UA3ARC KO85SO
1930 RA3AQ KO85JE
hrd RK3FG big pile-up
Rig 350w, 11el. yagi

DF9CY, JO54al, wkd:
1455 T94DU JN95
1457 OM5KU JN98
1459 HA8UG JN97
had to go away then;
1651 UT5JCW KN64

DG1IHH, JN49GJ, wkd:
1646 RW3WR KO71IM
1657 RA3AQ KO85SP
1716 RU3FA KO84RU

DG9MAQ, JN58lj, wkd:
1630 LY2IC KO14WW 1146 km
1652 UA3ARC KO85SO 1972 k
1655 RA3AQ KO85SP 1973 km
1712 UA1XP KO55JR 1573 km
1725 UR5GIM KN67CL 1584 km
2014 RU1AA KP40XD 1783 km

DG9NEO, JN49xr, wkd:
1644 RW3WR KO71IM 1748 #
1646 RW3PF KO93CD 1980 #
1652 UA3GLS KO90NJ 2069 #
1657 RK3WWF KO72KI 1756 #
1706 UA3FA KO84RU 1939 #
1708 RA3AH KO85UP 1966 #
1724 RW3DW KO84PV 1929

DH1HC, JO53gf, wkd:
1640 UX5UL KO50 1450km
1651 UY2QQ KN77OT 1839km
1718 UT5JCW KN64SN 1930km
1724 UR5LX KO70WK 1764km

DH2UAK, JO71fu, wkd:
1419 LZ2FO KN13 1126
1421 LZ2HM KN12QP 1223
1424 LZ1QI KN12PR 1212
1719 UU1DX KN74BV 1639
1722 UU2JJ KN75AA 1625
today 2-times only a short Es in JO71. Rig:100W, 13el-Yagi

DH0GHU, JN38vn, wkd:
1636 RA3AQ KO85

1642 RW3PF KO93CD
1643 UA3ARC KO85SO
1713 RK3AF KO85QR
1714 RA3AH KO85UP
1715 RW3DVO KO95BO

DJ3LE, JO44tn, wkd:
1635 UT5JCW KN64SN 2035km *ODX
1638 ER2NB KN46WT 1657km
1639 UT7GA KN66HP 1833km
1640 UT3BW KN29UA 1261km
1640 UT1FA KN53FF 1962km
1643 U5YM KN28XG 1326km
1647 UR8EK KN67RX 1800km
1711 UX5UL KO50 1509km
1720 UY2QQ KN77OT 1920km
1721 UY5UG KO50FI 1480km
1737 UT2AM KO70KW 1735km
1740 UR5LX KO70WK 1822km

DK1VI, JN49hh, wkd:
1639 RK3WWF KO72QI 1896 #
1642 UA3ARC KO85SO 2061km
1644 RW3WR KO71IM
1648 RW3PF KO93CD 2086k #
1659 RA3AQ KO85JE 2008km
1721 RU3FA KO86RU 2046km
1729 UR5LX KO70WK hrd only
Opening on Tuesday was much better for me, because of less QSB compared to Monday where stations sometimes were audible for few seconds only. Unfortunately I had to leave station after 17.50 so I probably missed some goodies. Rig: 100 W out, 16 El. F9FT

DK2CF, JO41gg, wkd:
1415 YO4BZC KN45
1417 YO4RDK KN35
1447 YO7IV KN24
1455 YO3JW KN34
1521 YO5BWD KN27
1717 RW3PF KO93

DK3XM, JO43xl, wkd:
1423 LZ2FO KN13KX 1414km
1424 YO7BUT KN15OA 1340km
1427 LZ2CC KN23JG 1571km
1428 LZ1KG KN31CS 1773km
1430 HA6ZB KN07BV 945km !!! MUF 206MHz!!!
1448 YU1BT KN03KN 1361km
1452 9A2CB JN95GM 1078km
1455 YZ1EW JN94XF 1259km
1646 UR8EK KN67RX 1753km
1651 UY2QQ KN77OT 1876km

1655 UY5UG KO50FI 1442km
1717 UY9VY KN68DG 1661km
1720 UR5LX KO70WK 1796km
1722 UT5JCW KN64SN 1970km
1838 UA3WM KO72QI 1699km

DK4TG, JO31, wkd:
1442 ER5AA KN45
1449 YO5TP KN16
1930 UA3ARC KO85
TX 5 watts! 11el.

DK5TX, JO41jw, wkd:
1402 UT5JCW KN64 1995km
1403 ER5AA KN45 1561km
1407 YO8CQQ KN36 1456km
1409 YO7HMH KN25 1401km
1413 YO6AWR KN25 1413km
1415 YO7IV KN24 1433km
1420 YO7AQF KN24 1452km
1422 YO3CCB KN34 1528km
1432 YO9CAD KN35 1466km
1635 RW3WR KO71 1776km
1642 UY5UG KO50 1516km
1648 UT2HN KN79 1874km
1715 UX5UL KO50 1512km
1728 UY2QQ KN77 1936km

DK7BY, JO33rj, wkd:
1412 LZ2PI KN23XU
1412 YO7IV KN24MT
1414 LZ3GM KN32RL
1415 YO7AQF KN24KU
1417 YO3CCB KN34CL
1427 YO6OE KN26JF
1436 YO5TP KN16SS
1444 YO5BWD KN27GD
1446 LZ2FO KN13
1447 YU7BCL KN05FW
1451 LZ2HM KN12
1453 HA5BSW JN97JD
1454 YU1IO KN04FT
1459 YU7MS KN05
1500 YU7VA KN05DJ
1701 RW3WR KO71IM
1707 UR5LX KO70WK
1726 UT5JCW KN64
1956 RW3WR KO71
Heard also UA3ARC, KO85

DK7LZ, JO30mr, wkd:
1405 YO4BZC KN45
1407 YO8CQQ KN37UF
1409 YO8DDP KN36UF
1412 UT5JCW KN64SN
1413 ER5AA KN45CW
1416 YO5BEU KN27GD
1431 YO5BWD KN27GD
1447 YO5BWD KN27GD

1454 YO5BEU KN27GD
1643 RW3ZO 55 55 KO70WT
1646 UT2AM KO70KW
1700 RA3AQ KO85JE
1715 RW3PF KO93CD

DK8ZJ, JO54ag, wkd:
1655 UT5JCW KN64sn
1708 UX5UL KO50
1721 UT5EZ 57/58 KN78ll
hrd UT5ER, U5YM

DL1EAP, JO31ik, wkd:
1924 UA3ARC KO85SO 2071
1945 RK3AF KO85QR 2060
1950 RA3AQ KO85JE 2024
1951 RK3FG KO86HP 2018 #
1953 RK3AF KO85QR 2060
2002 RA3AQ KO85JE 2024

DL1GGT, JN58ao, wkd:
1628 LY2MW KO24
1632 LY3OD KO24
1633 LY2SA KO14
1637 EW6GB KO45
1640 RW3PF KO93
1649 RA3AQ
1649 RK3AF
1650 UA3ARC KO85
1709 UR5GPT KN76
1716 UT2QA KN86
1718 UR5GP KN76
1725 UR5GIM KN76

DL1DUR, JO61vc, wkd:
1719 UY5ON KN89

DL1GNM, JN38wb, wkd:
1438 EW6FS KO35LB
1447 UY5UG 53/59 KO50FI
1450 LY2IC 55/59 KO14WW
1452 US5WU 57/59 KO20DI
1457 SP4MPB 51/55 KO03HT
1502 LY2SA 41/hrd KO14

DL2DN, JN48nx, wkd:
1646 RK3WWF KO72QI 1883k
1648 UA3ARC KO85SO 2056km
1649 RW3PF KO93CD 2075km
1657 RA3AQ KO87SO 2071km
1710 RK3AF KO85QR 2048km
1715 UA3ALA KO85ST 2060km
1717 RA3AH KO85UP 2067km
1726 RW3DVO KO95BO 2092k

DL2IAN, JN49bc, wkd:
1715 RU3FA KO84RK #431
1728 UR5LX KO70WK #432
100 W, 9 el under roof !!!

DL3HRT, JO61ab, wkd:
1423 YO7AQF KN24KU 1176k #
1425 YO3CCB KN34CL 1283km
1429 YO7IV KN24MT 1187km
100w + 2x9-ele. Yagi

DL5FDP, JN49lp, wkd:
1402 UT5JCW KN64
1411 UT1FA KN56FF
1417 UY5HF KN66HP
Rig: 80w + 9 ele Yagi

DL5GAC, JN47ut, wkd:
1438 LY2IC KO14WW
1439 LY3ED KO14UX
1450 ES6QB KO37MU
1500 YL3AG KO26AW
1631 LY2MW KO24PS
1637 LY3OD KO24OR
1638 EW6GB KO45CN
1641 UA3ARC KO85SO
1645 RW3PF KO93CD
1647 RA3AQ KO85JE
1658 RU3FA KO84RU
1709 UA1XP KO55JR
1729 RK3WWF KO72QI

DL5LBY, JO43RS, wkd:
1635 UT1CZ KN59PK 59 57 FM
1638 UT1VL KN68? 55 hrd FM
Nice Surprise! After eleven Years first Es-contact. Rig: IC24ET, 20W PA, little mobile whip indoor.

DL5NAV, JO33tf, wkd:
1415 YO7AQF KN24KU 1557 k
1419 YO7IV KN24MT 1570 km
1435 YO5BWD KN27GB 1381 k
1445 LZ1QI KN12PR 1642 km
1446 LZ2FO KN13KX 1515 km
1449 YU7BCL KN05FW 1226 k
1453 YU7MS KN05FJ 1270 km
1454 YU7AR KN05BW 1208 km
1706 UR5LX KO70WK 1951 km
1713 UT2AM KO70KW 1866 km
1715 UT4QU KN77MU 2012 km
1722 RW3WR KO71IM 1836 km
1833 RN6QR LO00BK not cfm
Heard UY2QQ, UR5GIM, UT5ER, RW3QTT...
Rig: 120 Watt + 9 ele Longyagi

DL5ROB, JN68hg, wkd:
1635 LY2IC KO14WW 59
1639 RA3AQ KO85JE 59
1641 LY3ED KO14UX 55
1643 RV3ANF KO85PO 57
1644 RA3AH KO85UP

1722 US5QGL KN86JS
hrd UR5GIM, RW3PF, UA6IK today short openings of 1 or 2 minutes then nothing agn.

DL5UP, JN49JE, wkd:
1717 RW3PF KO93CD
My first activity with sporadic E. I think this will become my additional favorite after the thrill of QRPP on HF -)
RIG TR751E, 20W, 8ele-Yagi

DL6BF, JO32qi, wkd:
1416 YO3CCB KN34CL
1417 YO7HMH KN25
1418 YO6AWR KN25TP
1421 YO7AQF KN24
1422 YO7IV KN24MT
1424 ER5AA KN45CW
1427 YO5BWD KN27GD
1431 YO4WZ KN44AI
1437 YO8RNF KN37EW
1444 LZ2CC KN23
1447 YO7BUT KN15OA
1452 LZ2FO KN13
1453 YO2LHD KN35
1454 HG7JAL JN97GA
1455 YO2BBT KN35WG
1520 YO6AWR KN25 - agn
1521 YO4IMP KN44AI
1636 UT2AM KO70KW
1642 UY5QQ KN77OT
1650 UY5UG KO50FI
1707 RW3WR KO71IM
1715 UT2AM KO70 QSO agn
1733 UY5QQ KN77 QSO agn

DL6YEH. JO32va, wkd:
1402 UT5JCW KN64SN 2063
1403 UT1FA KN56FT 1730
1405 YO3CBB KN34CL 1594
1406 YO7HMH KN25MG 1467
1411 YO4WZ KN44AI 1717
1422 YO6AWR KN25TP 1479
1428 YO5CFI KN16WJ 1321
1430 YO9CAD KN35AF 1533
1432 YO8RNF KN37EW 1399
1446 YO7IV KN24MT 1498
1447 YO4BUT KN15OA 1372
1448 YU7BCL KN05FW 1143
1449 YO7AQF KN24KU 1485
1452 YO3DMU KN34BJ 1594
1454 HA8DZ KN06CF 1107
1457 YO3JW KN34CK 1596
What can I say part two! After the ufb Es opening yesterday the cloud slept above the same position and woke up a bit more to the south/west, hi. QRB not as good as yesterday, but nevertheless 6 new squares! RIG here like every time Yaesu FT1000-MP, LT-2S TRV, PA 2x4CX250 pushpull, 2x2wl DJ9BV.

DL6WU, JN49ht, wkd:
1427 UT5JCW KN64sn
1640 RW3WR KO71im

DL8AAV, JO52dh, wkd:
1712 UT5JCW KN64SN
1716 UY5UG KO50FI
1722 RW3WR KO71IM
1729 UR5GIM KN76CL

DL8CMM, JO52vm, wkd:
1428 LZ1KG KN31CS
1430 LZ2CC KN23
1648 UY2QQ KN77OT #375
hrd 1650 UY5UG KO50; I was very busy today ...QRL

DL8EBW, JO31nf, wkd:
1529 ER5AA KN45 59+/
1532 YO8RNF KN37 55 hrd
1555 YO4BZC KN45 52 hrd
1626 RW3WR KO71 hrd
1627 SP5WCK KO12 hrd
1628 RK3WWF KO72
1634 UY5UG KO50 hrd
1638 UT2AM KO70 55 hrd
1642 RW3WR KO71
1652 UT2AM KO70
1653 UR5LX KO70 hrd
1659 RA3LW KO54
1711 RW3PF KO93
1714 UR5LX KO70
1717 RU3EC KO82 #626
1915 UA3ARC KO85
1917 RK3AF KO85
1928 RA3AQ KO85
1931 RW3DVO KO95
1939 RA3AQ KO85
1942 RK3FG KO86
1953 RV3ANF KO85
1959 RA3AH KO85 55 hrd

DL8LAQ, JO43xu, wkd:
1358 YO7HMH KN25MG
1402 YO7AQF KN24KU
1404 LZ2PI KN23XU
1405 YO3KKB KN34KI 57 hrd
1405 YO7IV KN34MT
1410 YO3HGQ hrd FM
1412 LZ2FO KN13KX
1413 LZ2CC KN23JG
1420 LZ2HM KN12QP
1421 UT5JCW KN46SN hrd
1423 YO7BUT KN15OA
1424 YO7LGI KN14VH
1425 HA8DZ KN06CF
1430 LZ1KG KN31CS
1439 UU2JJ KN75AA hrd
1445 T94DU JN95DA
1448 YU1BT KN03KN
1450 YZ1EW JN94XF hrd CW
1451 9A2SB JN95GM
1453 T94HJ
1454 YU1VV JN94 CW nc!
1457 HA6VV JN97WS 53 hrd
1457 HA5CW JN97PG
1500 HA6VV JN97WS 53/59 nc!
1515 RZ6BU KN84PV
1639 UR8EK KN67RX hrd
1640 UY5UG KO50FI hrd
1641 UT5JCW KN64SN 55 hrd
1647 UY2QQ KN77OT 55 hrd
1649 UR5GP KN76CN
1652 UR8EK KN67RX
1659 UR5LX KO70WK 57 hrd
1715 UT5ER KN78ER hrd
1716 UR5GIM KN76CL 55 hrd
1720 UR5LX KO70WK 53 hrd
1722 UT4AM KO70KW NC!
1726 UT5JCW KN64SN
1821 UR5LX KO70WK 53/59
1833 RN6QR LO00BK
1920 RW3WT? LO02? 41/- NC!
1949 RW3WR KO71IM 55 hrd
2002 EW6FS KO35LB 43 hrd

DO3VG, JN39gv, wkd:
1725 RW3WR KO71IM
1730 RW3PF KO93CD

F1AFJ, JN06ht, wkd:
1447 UY5UG KO50FI
1455 US5WU KO20DI

F1BKM, IN98MV, wkd:
1445 YO8RNF KN37EW 56 / 59

F1FIH, JN23gs, wkd:
0726 LZ1KG KN31CS
0732 SV7GX KN20EW
0739 TA1ZK/0 55 55 KM39AT
1441 SP4XYD KO12TR
1443 SP5XMU KO02LG
1446 SP5XMU KO02LG
1451 EW6FS KO35LB
1454 LY3AG KO26AW
1503 SP8NCJ KO12NA
hrd SP9UFH and LZ1BPN

M1MGD, IO91vc, wkd:
1441 US5WU KO20DI #DXCC
1444 ER5AA KN45CW #DXCC
1451 YO5BWD KN27GD

G4HGI, IO83pl, wkd:
1428 ER5AA KN45
1440 YO8RNF KN37
1452 ¥O7IV KN24
1453 YO3DMU KN34

G4SWX, JO02pb, wkd:
1631 UY5UG KO50FI 2033Km
1635 UX5UL KO50FL 2029Km
1648 UT2AM KO70KW 2315Km
1653 UR5LX KO70WK 2398Km
1659 UT5ER KN78ER 2360Km
1701 UA3WM KO72QI 2309Km
Again a mad panic getting home after seeing all of the spots on the DX cluster ~15.45 utc
As ever the PA and DL stations had the best of the opening but being one of the DX G stations helps -))

G8HGN, JO01fo, wkd:
1422 ER5AA KN45CW 2115
1437 YO4GJH KN35XG 2133
1438 YO4ATW KN35XG 2133
1439 YO5TP KN16SS 1754
1440 YO5CFI KN16WJ 1795
1442 YO6AWR KN25TP 1954
1445 YO5BEU KN27GD 1804
1450 US5WU KO20DI 1667
1502 YO4BZC KN45AK 2130
1505 YO5BWD KN27GD 1804
1508 YO5CRQ KN17SP 1713
1526 YO8RNF KN37EW 1895
Also heard:
1421 YO8CQQ KN46UF
1428 RN6BN KN95
1434 SQ8CMB ?
1448 HA0HO KN07SU
1455 YO7IL KN24MT
1500 YO4RVF KN45AK
1642 UX5UL KO50FI
1649 UT2AM KO70KW
Six new squares and 2 DXCC!!

G8IZY, IO91vc, wkd:
1425 SQ8CMB KN09QS #
1436 US5WU KO20DI #
1443 ER5AA KN45CW#+ DXCC
1444 YO4BZC KN45AK
1445 YO4KBJ KN54AK
1446 SP7EXY KN00QW #
1449 YO5BWD KN27GD
1453 HA0HO KN07SU

G8VHI, IO92fm, wkd:
1430 SQ8CMA KN09at
1432 YO7IV KN24
1442 RN6BN KN95LC 3032KM
NEW ODX!
1451 HA6VV JN97
1454 YO8RNF KN37
1459 YO4ATW KN35
1503 YO4DJH KN45DK
1504 YO5TP KN16SS
1505 YO4BZC KN45
1507 YO4GJH KN35XG
Hrd: ER5AA UB5's
What can I say I seem to be never in the real full es opening but the qso with RN6BN seems to eclipse all the other qso's. It is an all time new odx here and my first qso over the 3000kms mark! Rig Ts2000 pa 220w output ant 2x 14ele.

G0NNF, IO92al, wkd:
1435 SQ9HQ KN09FX 59/55
1501 YO4ATW KN35
15.03 YO4BZC KN45AK 55/55
very patchy with deep QSB, hrd RN6BN but impossible to break the pile-ups from here.

HA1FV, JN87jj, wkd:
1438 LA2AB JO59FV
1443 LA5KO JO59FH
1632 OH1FA KP10PL
1633 OH6MAZ KP31IG
1634 OH1JCS KP10AE
1634 OH1XT KP01
1638 OH1HSC KP10CM
1648 OH6FV KO19
1700 ES8JX KO28
1708 UY9QY KN77OL
1710 UT5MR KN58
1713 RU1AA KP40XD
1717 UA6MA KN97VE
1720 UR8EK KN67RX
1726 UA6IT LN16AD
1921 OH8UV KP34VJ
1922 OH6MAZ KP31IG
1923 OH1FA KP10PL
1926 OH2TP KP20AF
1929 OH7HD KP32RT
1931 OH4HXK KP21UG
1943 OH2LAK KP10XL
1945 OH3GR KP11OV
1946 OH1CO KP10EK
1949 OH1FA KP10PL FM
1951 OH2GP KP26VF
1953 OH1MDR KP12MA
1956 OH1AYQ KP01UK
1957 OH1NOR KP00XL
1957 OH1LT KP10OP

1958 OH1GO KP14OJ
2020 OH1ZAA KP01

HA5CW, JN97pm, wkd:
1457 DL8LAQ JO43XU
1633 SM4HFI JP70TO
1634 SK4BW JP70RM
1635 SM4JGG JP71TJ # 406
1638 SM5DIC JO89JT
1639 SM5KNV JO88MW
1641 OH1HSK KP10 sri NC
1643 OH1FA KP10PL
1644 OH6MAK KP21IG sri NC
1653 OH1XT KP01UK
1659 OH1MDR KP01VJ
1701 OH1?? sri NC
1702 OH1M?? sri NC
1703 OH1AYZ KP12JB
1709 OH1ZAA KP01RO
1714 OH6MAZ KP21IG #407
1716 OH4HX ?? sri NC
1618 OH7HD KP22RT
1721 OH5KE KP30NN
1722 OH7PI KP32XG
1728 OH7UE KP52EL
1923 OH6PA KP02PC #408
1925 OH1XT KP01UK
1930 OH1ZAA KP01RO
1931 SM2OKD KP03DR
1943 OH1MDR KP01VJ
19 47 SM2CEW KP15CR
1949 SM2DXH KP03CU
1952 OH3AWW KP01RS
1954 SM2ILF KP04 #409
1956 SM0KAK JO89XK
1957 SM3KJO JP93FX #410
2020 SM3VAE JP83VA #411

HA6NA, JN98vc, wkd:
1445 DJ9YE JO43HV
1654 SM4HFI 59 /55 JP70TO

HA8GY, JN96rk, wkd:
1651 OH1NOR KP10AK 1568
1654 OH1AYQ KP12MA 1750
1713 OH1ZAA KP01RO 1693
1717 OH6MAZ KP11VL 1697
1719 ES0MC KO18FL 1356
1723 OH7HD KP32KT 1882
1928 SM2OKD KP03DR 1926
1943 SM2ILF KP04NP 2030
1948 SM2DXH KP03CU 1939

HA8MV, KN06ht, wkd:
1634 SM6RME JO78DH
1638 SM5KNV JO88MW
1642 SM7EOI JO86FP
1651 SM3GSK JP82TM
1712 OH1ZAA 57 59 KP01RO

1715 OH1AYQ KP12JB
1716 OH1XT KP01UK
1718 OH6PA KP02PL NIL QSL!
1723 ES1II/8 KO18UK
1731 OH3BYZ 57 59 KP21UA
1939 SK3MF JP92FW
1946 SM3AFT JP82XP
1953 SM0KAK 59 42 JO89XK
1958 SM3KJO JP92FX
2001 SM3VAC JP83VA
Hrd: SM5LXA, SL0ZS, OH2TP, SM5WPW, OH1FA, OH6MAZ, ES2CM; Rig: 60w + 11 ele

HB9DFG, JN37sm, wkd:
1450 LY3ED KO14ux 1392km
1451 LY2IC KO14ww 1399km
1455 US5WU KO20di 1260km
1629 LY2MW KO24ps 1471km
1631 LY3OD KO24or 1464km
1635 LY2SA KO14ll 1323km
1641 UA3ARC KO85so 2238km SQR #316
1648 RA3AQ KO85sp 2239km

IZ1BPN, JN35vg, wkd:
1412 EW6FS KO35LB 1736
1413 US5WU KO20DI 1351
1414 EW6GB KO45CN 1832
1417 UY5UG KO50FI 1776
1439 YL3AG KO26AW 1714
1441 ES6QB KO37MU 1917
1446 ES6DO KO27WX 1873
1447 ES5RY KO38IJ 1940
1448 SP5XMU KO02LG 1236
1449 ES3BR KO28JS 1887
1450 ES6RQ KO38AJ 1911
1455 ES8JX KO28LM 1874
1456 YL3GAC KO27ES 1792
1457 ES5KJ KO38IJ 1940
1458 SP2JON JO94GJ 1271
1459 LY2SA KO14LL 1487
1459 SP2IQW JO93 1223+-
1500 SP4BY KO13 1429+-
1501 SP7NWM KO02BE 1184
1503 SP7JSG KO01BW 1168
1525 LY2MW KO24PQ 1623

I4RHP, JN54ql, wkd:
1631 ES5RJ KO38JI 1867
1633 YL3GAC KO27ES 1727
1635 YL2MK FM
1636 ES6PZ KO38KA 1843 FM
1637 ES6CO KO38KA 1843 FM
1638 YL2JZ FM
1638 LY2BBZ KO16 FM
1642 RU1AA KP40XD 2136
16,4 LY3OD KO24OR 1509
16,5 EW6GB KO45CN 1713

17,2 UR0EQ KN78WM 1919
19,8 OH7MA KP52BN 2342
19,2 RU1AA KP40XD 2136
19,3 ES2NJ KO29NK 1903
19,3 ES3BM KO29JA 1854

I4XCC, JN63gv, wkd:
1935 OH7MA KP52BN #518
1937 OH2LIY KP20MH
1939 RU1AA KP40XD
1943 ES3BR KO28JS
1943 OH7HD KP32RT
1943 ES2NJ KO29
1943 ES8JX KO28LM
1944 OH7PI KP42
1944 OH2LH KP20MG
1945 OH3BYZ KP21UA
1945 OH7RJ KP32
1946 OH2KKU KP20GB
1947 OH8UV KP34VJ #519 > 2400km !
1948 OH6NJ KP22
1948 OH2TP KP20AT
1949 OH2MFE KP20
1949 OH4LA KP20
1950 OH4GGW KP31PQ
1954 OH2BNH KP20LG
1956 OH4HXK KP21UM
2001 ES3BM KO29JA
2002 OH5IY KP31
2009 OH5LJL KP31HL
2017 UT5JCW 55 57 KN64SN FAI qso qtf 60

IK8ETN, JM89ch, wkd:
1410 SM0KAK JO89XK 2240Km
1411 SP2JXN JO94GJ 1685Km

ISØCAK, JM49mb, wkd:
1439 SP2JXN JO94GJ 1848
1440 SP2IQW JO94GM 1860

LA0BY, JO59fw, wkd:
1422 IK7XWJ JN90CK 2234 km
1451 S51MQ JN75NT 1601 km
1453 9A4VM JN85FS 1624 km
1454 9A6R JN83FM 1870 km
1456 S59DTB JN86AO 1527 km
1458 S51DI JN76VL 1537 km
1500 9A8A JN86EH 1564 km
1639 LZ2FO KN13KX 1960 km
1640 YO5BLA KN16SR 1699 km
1641 LZ2CC KN23JG 2091 km
1643 YO3DMU KN34BJ 2020 k
1643 YO7HMH KN25MG 1896 k
1643 YO7BKT KN25MG 1896 k
1644 YO7AQF KN24KU 1932 k
1644 YO7DAA KN24KU 1932 k
1645 LZ2PI KN23XU 2069 km

1647 YO5CRQ KN17SP 1608 k
1648 YO6AWR KN25TP 1878 k
1649 YO3IZI KN34BK 2016 km
1653 YO7HMH KN25MG 1896 k
1657 YO3CCB KN34CL 2015 k
1700 YO6KEA KN25TP 1878 km
1702 YO9CAD KN35AF 1934 k
1706 YO??W KN35XG 2001 km
1706 YO4GJH KN35XG 2001 k
1707 YO4BZC KN45AK 1988 km
1708 YO4BSM KN35XG 2001 k
1710 YO8RGJ KN36KN FM
1712 ER5AA KN45CW 1946 km
1717 YO8RNF KN37EW 1684 k
1718 YO8DDP KN36UF 1899 k
1718 UT3BW KN29UA 1556 km
1725 ER1DAB KN46KW FM
1725 ER1BAW KN46JX FM
1729 YO7IAA KN24KU 1932 km
1747 UU2JJ KN75AA 2278 km
1754 UT7GA KN66HP 2068 km
1911 YO4GJH KN35XG 2001 k
1915 UR5YDI KN28XG FM
1924 YO4BZC KN45AK 1988 km
1925 YO4FEI/p KN45NB 2066 k
1932 US7TM KN38IQ FM 1627 k
1939 UT7YM KN28XG 1636 km
1943 ER3AW KN37XS FM 1763
1946 YO8ROO KN36KN FM
1947 YO8ALA KN36KN FM
1949 UR5YEI KN28XG FM 1636
1951 UT3BW KN29UA 1556 km
1953 YO4RFV KN45AK 1988 km
1956 YO4GJH KN35XG FM
1958 ER1BAW KN46JX FM
1959 US7TM KN38IQ FM 1627
2001 YO8RGJ KN36KN FM
2004 US5WU KO20DI 1376 km

What a fantastic Es opening! In fact, there were 4 distinct periods with openings, almost in the same direction as yesterday. The last two days finally make the 2003 season a good one also for us in LA. Heard also 9A2TE, LZ1QI, T94DU and U5YM.

Nice to work so many stations on FM (145,450-145,575 MHz) and even vy rare squares. Not so much activity on SSB. Several times I thought the show was over, but when I made a final call on FM there was somebody who responded. Thanks to everybody who participated, and also to those who may have suffered some interference on their local FM channel.

LY2IC, KO14ww, wkd:
1417 IQ2LS JN45OO 1466
1418 IZ5EKV JN53OQ 1547
1420 IK0BZY JN61GW 1666
1421 IW0BET JN61FS 1685
1424 IW0GXY JN61CW 1678
1425 I0KNQ JN61UU 1634
1438 DL5GAC JN47UT 1259
1440 HB9DTE JN36OX 1459
1441 I1ANP JN44VC 1571
1447 DK8GA JN37VN 1383
1448 F4BIT JN37PR 1398
1450 DL1GNM JN38WB 1341
1455 F4AME JN33NP 1739
1457 F6AOI JN33NQ 1735
1630 I1DMP JN35UB 1587
1630 DG9MAQ JN58LJ 1148
1630 DL5MCG JN58KH 1158
1631 DK0EE JN58TG 1123
1631 DF1CF JN57FP 1233
1631 IK1EGC JN35UF 1573
1632 DH2UAK JO71FU? 712km MUF 250.2 MHz!!
1633 GM0HBK IO77BC 1850
1634 DG7MHR JN57DR 1235
1635 DL5ROB JN68HG 1072
1635 IW2HAJ JN45NO 1470
1636 I1CPN JN34VI 1644
1636 IK2GSO JN45GP 1496
1637 DK5TE JN58BG 1202
1641 DL8MEL JN58SD 1137
1641 S51KK JN76HB 1182
1645 9A6PAC JN74OD 1351
1651 IK3/PA2CHR/P JN65DD
1652 OE8TPK JN76AM 1162
1652 I4LCK JN54RK 1466
1653 IK4DRY JN64BL 1434

LZ1BB/M, KN12pq, wkd:
1410 DL9MS JO54WC
1415 OZ1LPR JO44UW
1416 LA2PHA 55/55 JO38
1419 OZ1BEF 59/52 JO46OE
1422 OZ2TF JO46PE
1424 DK7FF JO62TJ
1428 OZ1BUR 59/55 JO46HI
hrd and called mni times without success SM0KAK SM3BEI SM5KNV SM6RME DG2LG DL2NS OZ9PP OZ1BEF PA0OOM. RIG FT817 2Watts 5/8 Vertical working mobile. I was 1500m asl.

LZ2TU, KN13sf, wkd:
1415 DG8LG JO44up
1416 OZ1LPR JO44uw
1420 DL9MS JO54wo
1424 DK1KO JO53ct

1426 DL9AN JO62re
RIGFT290 -18W GP

LZ3GM, KN32rl, wkd:
1405 DH2OAA JO42TU 1756
1414 DK7BY JO33RJ 1910
1419 DL1BKK JO43NA 1794
1419 DJ9MG JO52TC 1597
1420 DL1AAH JO52EF 1675
1430 PA9KT JO33JF 1938
1551 SK6HD JO68SD 1993
1711 YL2HA KO26CV 1619
1712 YL3AG KO26AW 1625

LZ3NY, KN12qq, wkd:
1635 LA2AB JO59FV
1641 SM6RME 59/55 JO78DH
1645 SM4BDQ 59/57 JP80FG
1647 SM5DIC JO89JT
1648 SM7EOI JO86FP
1649 SK4BW JP70RM
1659 SM7NVF JO89NP
1714 SM5KNV JO88MW
1718 SM0KAK 59/52 JO89XK
Rig TS-770, 12W, 15el DJ9BV

OE1SOW, JN88ff, wkd:
1639 OH6MAZ KP21IG #
1944 OH2LAK KP10XL
1945 OH8UV KP34VJ #
1952 OH4HXK KP21UM
1953 OH1AYQ KP12MA
1953 OH1LT KP00XT
1957 OH7JEV KP10NJ
1958 OH6NJ KP22WG
2001 OH3BJL KP22TJ
2006 OH1FA KP10PL
2014 OH1HSC KP10CM
2x13 ele Yagi, 300W

OE3JHC, JN78we, wkd:
1944 OH4HXK KP21UM
1945 OH4HD KP32RT
1946 OH6NJ KP22WG
1948 OH8UV KP34VJ
1949 OH6MAZ KP21IG
1958 OH2LAK KP10XL
2009 ES2SM KO29..

OE3JPC, JN87ew, wkd:
1716 UT2QA KN86KS CW
1720 UA6IK LN16AD
1724 US5QGL KN86
1801 RZ6BU KN84PV CW

OH1JCS, KP10ae, wkd:
1406 I6BQI JN72BK 2045
1418 IWØGPN JN62FB 2118
1437 I4CIL JN64AH 1886
1441 IZ5EME JN52NS 2072

1632 9A2TE JN85KK 1675
1634 HA1FV JN87JJ 1462
1635 9A4VM JN85FS 1644
1636 S59GS JN57OO 1564
1640 S51RJ JN86DT 1533
1642 T94KU JN94JF 55 53 1787
1644 YT1VV JN94US 1721
1645 YZ1EW JN94XF 1779
1646 YT1VP JN94WG 1775
1650 YZ1KU KNØ4ET 1713
1652 HA8UG JN97SA 1473
1657 T94DU JN95DA 1704
1708 SP4CHY JO94GO 655
1708 9A2SB JN95GM 1647
1716 YU7EW KNØ5HP 1619
1724 HA8DZ KNØ6 1521+-
1950 HA5BSW JN97JD 1465
1953 OM5LD JN98AH 1345

OH1MDR, KP01vj, wkd:
1640 I6BQI JN72BK
1643 S51MQ JN75NT
1643 S51WX JN75OS
1647 YT1VV JN94US
1648 YZ1KU KN04ET
1649 YU4AR JN94AS
1649 YZ7MON KN04AX
1650 9A2SB JN95GM
1652 YU7KB JN94XX
1653 YZ7MON KN04AX
1654 HA8BI/7 JN97MI
1654 YT4D JN94BR
1655 YU7EW KN05HP
1655 YU7AR KN05BW
1655 YZ1PWJ KN04CP
1655 YU1LA KN04FR
1657 YZ1JA KN04FT
1657 YU1IO KN04FT
1657 T94DU JN95DA
1701 HA5CW JN97PM
1703 HG2SF JN87XC
1703 T94NK JN95DA
1703 YT4D JN94BR
1711 HA8CE KN06EN
1711 YZ1EW JN94XF
1714 HA7MB KN07BM
1714 YT1VP JN94WG
1715 YU7KG JN95WC
1715 YU1IO loc?
1716 YO2AMU KN06OC
1716 HG8QG KN06MT
1719 HA8BR KN06IP
1722 YO2IS KN05PS
1723 YU7ACO KN05QC
1723 YU1BT KN03BN
1925 T94DU JN95DA
1927 HA7UL JN97KK
1930 HA5KG JN97OK
1930 OM5LD JN98BI
1930 T94NK JN95DA
1930 9A5SG JN95IM
1932 HA5BSW JN97JD
1944 OM5KM JN98BG
1945 HA2ML JN97EO
1947 HG3KR JN86WU
1948 OM5AL JN97CX
1948 HA3IH loc?
1951 HA5AJC JN97NM
1952 9A2TE JN85KK
1952 HA1FV JN87JJ
1954 HG2SF JN87XC
1954 T94KU loc?
1954 9A3?? JN85EL
1957 SP9QMP JO90FB
1957 OM3RM JN88PA
1958 SP9OJQ JN99IW
1959 SP9DHQ JN99KR
2007 HA2RW loc?
2010 HA2ML JN97EO
My first Es QSOs on 144 MHz ever!; IC-706, 15 el yagi, 100W

OH1XT, KP01uk, wkd:
1417 I6BQI JN72BK
1438 I4CIL JN64AH
1441 IZ5EME JN52NS
1442 IK4DRY JN64BL
1442 IK4WMA JN54WG
1447 IA5/IK2OFO JN52BT
1455 I2PY JN55NB
1455 I3LGP JN55WJ
1456 IW4CVS JN54HQ
1458 I5JRR JN53DN
1500 IW4BET JN54QL
1630 IZ7EVZ/P JN71UR
1631 9A2TE JN85KK
1631 HG3KR JN86WU
1631 9A3GJ JN85QG
1633 OM5ZW
1634 HA1FV JN87JJ
1635 9A4VM JN85FS
1636 T94DU JN95DA
1637 HG1DLL JN87GF
1638 HA3RJ JN96CB
1639 S51MQ JN75NT
1640 9A3JN JN85EL
1641 S59GS JN75OO
1642 YT1VV JN94US
1643 YZ1EW JN94XF
1643 YT1VP JN94WG
1643 HA7MB KN07BM
1644 YT7AT KN04HV
1644 YZ1KU KN04ET
1645 YZ1PMT JN94WG
1645 YZ7MON KN04AX
1646 YU1IO KN04FT
1646 YU7AR KN05BW
1646 HA6ZB KN07BV
1646 HA2RD JN87WB
1648 IK7XWJ JN90CK
1649 HA8UG JN97SA
1649 9A2OM JN95IN
1649 YT7EK JN95RP
1650 HA6VV JN97WS
1651 YU7KB JN94XX
1651 HA8CE KN06EN
1651 T94KU JN94FW
1652 YZ1PWJ KN04CP
1653 9A2SB JN95GM
1653 HA5CW JN97PM
1654 YZ1JA KN04FT
1654 YU1BT KN03KN
1654 YU7ACO KN05QC
1655 HA8BR KN06IP
1655 YU1LA KN04FR
1656 YU7FU KN04HV
1657 YU1MD KN04GS
1700 HA5MO JN97QK
1702 YU7MS KN05
1703 T94NK JN95DA
1703 9A2VR JN95FQ
1705 OM3WBC JN98
1714 HA8MV KN06GU
1717 YO2IS KN05PS
1718 HG8QG KN06
1719 YU1MI KN03QW
1719 HA5ARR/P KN06NP
1721 HA0HO KN07SU
1722 YO2II KN06PE
1722 YU7RF
1725 YO5BYV KN07WB
1737 YO5CFI KN16WJ
1745 YO7AQF KN24KU
1833 YO6AWR KN25TP
1834 YO3IZI KN34BK
1922 OM5LD JN98AH
1923 HA5BSW JN97JD
1924 9A5SG JN95IM
1926 HA5AJC JN97NM
1927 HA5KG JN97OK
1927 YU7XL JN95NT
1927 HA3IH JN86WU
1931 SP9APC JN99QU
1943 HA2ML JN97EO
1943 OM5KM JN98BG
1944 SP9LCV JO90KF
1945 SP9OJQ JN99IW
1945 HA7UL JN97KK
1945 HA3GJ JN96AV
1947 SP9QMP JO90FB
1948 HA3LI JN96AV FM
1950 HA8BI/7 JN97MI
1951 OK2BRD JN99ET
1952 SP9EMF JN99PU
1954 9A7W JN85LN
1955 HG2SF JN87XC
1956 HA3PP JN87XC
1957 S51KV
1958 HA5KL

OH7HD, KP32rt, wkd:
1633 S53VV JN65UM 2109km
1636 S51DX JN75DW 2050km
1637 OE6IWG JN77PK 1868km
1638 S57TW JN75EX 2044km
1648 I6BQI JN72BK 2425km
1652 T94DU JN95DA 2061km
1700 9A2TE JN85KK 2044km
1705 9A4VM JN85FS 2017km
1705 HA2RD JN87WB 1849km
1706 9A3GJ JN85QG 2052km
1713 HA4WQ JN97IF 1815km
1715 HA5BSW JN97JD? 1823k
1717 9A3QB JN95EN 2001k C?
1717 HA5CW JN97PM 1773km
1720 HA8GY JN96RK 1888km
1722 9A2OM JN95IN 1995km
1929 HA1FW JN87JS 1797km
1930 S53O JN86AT 1916km
1931 S56IHX ??? ssb
1934 S51MQ JN75NT 2043km
1945 OE3JHC JN78WE 1775km
1950 I4XCC JN63CV 2319km
1952 S57TW JN75EX 2044km
1958 SP6CIZ JO81LB 1448km
1959 9A2RD JN65TF 2142km
2007 OK2ZAW JN97XN 1757km
2007 S51WX JN75OS 2045km
2008 OE3BCA JN87CX 1789km
2008 OE3GCU JN88EJ 1741km
2012 OK2KFK JN79XN 1629km
Heard 9A1CCB, 9A3JN and many others.Rig: 200W 2x17 ele

OM5LD, JN98ah, wkd:
1635 SL0ZS JO89XJ 1233 km
1721 RU1AA KP40XD 1523
1922 OH1XT KP01UK 1478
1923 OH1ZAA KO01RO 1494
1924 OH1HSC KP10CM 1384
1929 OH1MDR KP01VJ 1475
1932 OH1FA KP10PL 1395
1943 OH1AYQ KP12MA 1557
1943 OH1NOR KP00XL 1377
1944 OH1LT KP00XO 1390
1945 OH3AWW KP01RS 1513
1947 OH1SM
1950 OH6PA KP02PL 1589
1952 OH1JCS KP10AE 1346
1957 SM2CEW KP15CR 1953
2005 OH6LUX
2015 SM2ILF KP04
Rig: 100w + 7 ele Quad

OM7AQ, JN98ui, wkd:
1415 OZ1LPN hrd
1436 LA5KO JO59FH hrd qsb
1446 DJ9YE JO43HV hrd
1455 G1IZY IO91VC hrd
1533 PE1KLQ JO33JF hrd ??
1638 SM7EOI JO87FP
1640 SM7DFF JO88CN
1645 OH2TB KP20AF
1647 OH2HBR KP20
1652 SM7HFI JP80
1715 UA6IK LN16AD
1717 UR5GP KN76CN
1928 OH6PA KP02PL
1936 SM2DXH KP03CU
1957 SM3AFT JP82Xp hrd
Rig: 450W, 13 ele F9FT

ON4KHG, JO10xo, wkd:
1409 UT5JCW KN64SN 2303
1414 ER5AA KN45CW 1861
1415 YO8CQQ KN36UF 1812
1416 YO5BEU KN27GD 1550
1421 YO8DDP KN36UF 1812
1439 YO4GJH KN35XG 1876
1441 SP7EXY KO00QW 1224
1444 YO5BWD KN27GD 1550
1445 YO5TP KN16SS 1496
1447 YO8ROO KN36KN 1738 *
1447 YO8RGJ KN36KN 1738 *
1454 YO8BCF KN36KN 1738 *
1455 YO8BFC KN36KN 1738 *
1455 YO5CRQ KN17SP 1459 *
1457 HA0HO KN07SU 1311
1626 RW3WR KO71IM 2137
1628 SP5WCK KO12CJ 1277
1628 RK3WWF KO72QI 2169
1640 UT2AM KO70KW 2160
1702 UR5LX KO70WK 2241
1708 RW3PF KO93CD 2348
1930 RA3AQ KO85SP 2288
1939 RK3AF KO85QR 2277
1955 RK3FG KO86HP 2234 FM
Hrd or NC: YO4BZC, US5WU, YO5CES, YO8RNF (KN37EW), U5YM, UT3BW, RA3WJR (FM), EU4AI (FM), UY5UG (KO50FI), UT5ER (KN78ER), RA3ABZ, UA3ARC (KO85).

ON7CL, JO20JU, wkd:
1500 YO5BWD KN27GD 1494 K
1503 YO5CRQ KN17SP 1403 K
1505 YO8BDQ KN27QI 1543 K
1519 UT3BW KN29VA 1512 Km
1625 RW3WR KO71IM 2072 Km
1630 RK3WWF KO72QI 2103 K
1642 UT2AM KO70KW 2095 Km
1650 UR5LX KO70WK 2176 Km
1658 UY5UG KO50FI 1803 Km
1724 RW3PF KO93CD 2281 Km
UA3ARC KO85SO 1930 2221 K
RA3AH KO85UP 1941 2231 Km
RK3AF KO85HP 1945 2163 Km
RV3ANF KO85PO 1947 2205 K
RK3FG KO86HP 1952 2168 Km
Rig:12ele, 50W

OZ1IEP, JO55xu, wkd:
1627 LZ2CC KN32JG 1848
1629 YO4BZC KN45AK NC
1631 YO4ATW KN35XG 1624
1632 YO4BZC KN45AK 1613
1633 YO4GJH KN35XG 1624
1635 YO8BSE KN36EW 1403
1638 YO5BWD KN27GD 1298 #
1642 YO4GJH KN35XG 1624
1644 YO4RXX KN45AK 1613
1646 US2YW KN28XG 1271 #
1647 U5YM KN28XG 1271
1650 UT7YM KN28 1205+-
1654 UT5JCW KN64SN 1969
1658 UT3BW KN29UA 1198 #
1659 UT1FA KN56FF 1669 #
1700 US5WU KO20DI 1023
1737 UY5UG KO50FI 1372
1737 UT5ER KN78ER 1707
1741 UR0EQ NC
1758 UT2QA KN86QS 2017

OZ1LPR, JO44uw, wkd:
1405 YO2LEA KN06WK
1409 LZ1QI KN12PR
1409 LZ2FO KN13KX
1409 HA6NN JN97UC
1410 LZ2HM KN12QP
1413 LZ2TU KN13SF
1414 LZ1BB/M KN12PQ
1415 LZ3KP KN12PQ
1416 LZ1QI KN12DR
1417 YU7BCL KN05FW
1417 YU7EW KN05HP
1418 YU7RF KN05PC
1419 TA1ZK/0 KM39AT
1422 HA8DZ KN06CF
1423 YT7AT KN04HW
1424 YU1IO KN04FT
1425 YU7AR KN05BW
1425 YU1MD KN04GS
1425 YU1MZ KN05VF
1428 YU1MI KN03QW
1429 YZ7PEK KN05PC
1430 OM5KM JN98BG

MUF 205 MHz
1427 HA8UG JN97SE
1441 T94DU JN95DA
1441 US2YW KN28XG
1445 YU7MS KN05FJ
1446 9A2SB JN95GM
1446 9A4EW JN95KG

1447 9A3PZ JN95IN
1447 YZ1VAZ JN94WG
1451 T94DU JN95DA
1452 T94NK JN95DA
1453 9A3GR ???
1454 T94HJ JN94FV
1455 LZ2CC KN22GS
1457 9A3GJ JN85QG
1457 YZ' KU KN04RT
1458 YU AR JN94AS
1631 ER5AA KN45CW
1634 UT5JCW KN64SN
1637 ER2NB KN06WT
1642 UU2JJ KN75AA
1642 UT1FA KN56FF
1650 UY5UG KO50FI
1652 US5WU KO20DI
1729 U5YM KN28XG
1749 RW3WR KO71IM

That was 2 very good openings. It gave me 19 new # in total and 1 new DXCC. The qso's was worked on all frequencies from 250 to 340. Not all on 300 like always.

PA0JMV, JO21pm, wkd:
1425 ER5AA KN45 1819
1427 RN6BN KN95 **2569 km** new ES-ODX
1429 YO4RDK KN35 1779
1432 YO4BZC KN45 1801
1434 YO4GJH KN35 1805
1443 US5WU KO20 1336
1444 YO7HMH KN25 1610
1446 YO3JW KN34 1738
1453 YO5TP KN16 1425
1456 YO3DMU KN34 1735
1503 YO7IV KN24 1638
1521 YO8DDP KN36 1736
1529 YO8RNF KN37 1563
1638 RW3WR KO71 2026
1658 UT5ER KN78 2087
1701 UA3WM KO72 2054
1713 UR5LX KO70 2134
1948 RA3AQ KO85 2116
1951 RK3FG KO86 2106
1958 UA3ARC KO85 2162
2000 RA3AH KO85 2173
2003 RK3AF KO85 2152

First Russian language signals 1358 utc heard at work on a QRL-freq just above 147 MHz and I went home quickly.

PA3BIY, JO22eb, wkd:
1355 UT5JCW KN64SN
1400 ER5AA KN45
1405 ER2TX KN46 in FM!
1410 YO4BZC
1412 YO4RDK KN35WK
1418 YO4WZ KN44AI
1420 UR5BEU ? ??
1430 YO7HMH
1430 UY5HF KN66HP
1435 YO4GJH KN35
1444 YO7AQF KN24
1500 YO9GWW KN34 FM!
1523 YO5BWD KN27GD
1640 UR5HXR 55 59 ?? FM!
1654 UY2QQ KN77OT
1716 UY5UG KO50
1719 RW3WR KO71IM CW
1950 RA3AQ KO85 CW
1952 UA3ARC KO85SO
1954 RK3AF KO85
1957 RV3ANF KO85

PA5MS, JO21qj, wkd:
1440 ER5AA KN45OD 1885
1448 US5WU KO2ØDI 1328
1455 HA8DZ KNØ7BV 1128
1456 YO4ATW KN35XG 1793
1504 YO4BZC KN45AK 1790

PA9KT, JO33jf, wkd:
1409 YO7HMH KN25
1411 YO4RDK KN35wk
1412 ER5AA KN45
1412 YO7AQF KN24
1413 YO3CCB KN34cl
1415 YO7IV KN24mt
1418 LZ2PI KN23xu
1422 YO7AOF KN24ku
1426 YO5BWD kn27
1428 YO2LEA KN06wk
1429 YO5CRU KN17sp
1430 LZ3GM KN32lr
1433 YO6OEH KN26
1434 YO5TP KN16
1434 YO6AWR KN25tp
1439 YO4ATW KN35
1440 YO5CES KN17
1445 LZ2FO KN13
1446 YU7BCL KN05ew
1449 YU7VA KN05
1452 ER5AA KN45
1454 YU7AR KN05bw
1455 YU7MS KN05
1456 LZ2CC KN23
1523 YO3DMU KN34bj
1635 UY5UG KO50fi
1638 UX5UL KO50fl
1645 UR8EK KN67rx
1647 UY2QQ KN77ot
1650 UT5JCW KN64sn
1658 UR5GP KN76cn
1705 UR5LX KO70wk
1706 UT2AM KO70kw
1716 UT4QU KN77nu
1719 UT4EO KN78gp
1725 UT5JCW KN64sn
1843 RA3QTT LO01
1952 RW3WR CW KO71im
1959 RA3AQ KO85rp

PD2DB, JO22md, wkd:
1632 YO8RNF KN37EW 1587#
1638 YO7IV KN24MT 1676
1640 YO3CCB KN34CL 1773
1641 YO3DMU KN34BJ 1773
1643 YO2LEA KN06WK 1371#
1643 YO3JW KN34CK 1775
1645 HA8BR KN06IP 1284#
1652 YO4IMP KN34AI 1770
1657 YU7BCL KN05FW 1314#
1719 YO4BZC KN45KN 1880#
1723 ER5AA KN45CW 1814
1724 YO5BEU KN27GD 1504#
1728 YO5CRQ KN17SP 1411#
1908 RW3WR KO71IM 2025
1930 UR8EK KN67RX 2066
2151 RK3AF KO85QR 2133#
2154 UA3ARC KO85SO 2144
2156 RA3AQ KO85SP 2143
2159 RA3AH KO85 2113+-
2200 EW6FS KO35LB 1475#
2203 RV3ANF KO85PO 2128

Made 12 nw # and 3 nw dxcc. Eq 25w, 17ele. Times MESZ!

PE9DX, JO33md, wkd:
1400 YO4BZC KN45AK
1402 YO7IV KN25MT
1403 YO7HMH KN25MG
1404 YO7AQF KN24KA
1405 YO4RDK KN35WK
1405 YO4GJH KN35??
1407 YO4RQK KN45AK
1407 YO5BWK KN27GD
1408 YO8DDP KN36UF
1410 YO5BEU KN27GD
1412 ER5AA KN45CW
1416 LZ2PI KN23XU
1419 YO3CCB KN34CL
1422 YO5CRQ KN17SP
1427 YO4RDK KN35WK
1430 YO3GJZ KN34BK
1431 YO3HGQ KN34AK
1432 YO5OMT KN3???
1441 YU7RF KN05PC
1445 LZ2FO KN13??
1448 YU7VA KN05EJ
1450 YU5EW KN05HP
1452 YU7BCL KN05FW
1456 HA8DZ KN06CF
1523 YO3DMU KN34BJ
1630 UY5UG KO50FI
1632 UR8EK KN67RX
1636 UX5UL KO50FL
1641 UT1VL KN68NQ
1642 UR3QCW KN77OS
1643 UR5QGC KN77OV
1644 UR3RKA ?
1649 UY2QQ KN77OT
1658 UT5ER KN78ER
1701 RW3WR KO71IM
1704 UR5LX KO70WK
1706 UT2AM KO70KW
1715 UT4QU KN77MU
1731 RU3ZO KO80HN
1844 RA3QTT LO01GQ
1923 RA3QTT LO01GQ
1948 RU3EC KO82??
2003 EW6FS KO35LB

Rig: TS-711, 17 ele, 8877

RX1AX, KO59ew, wkd:
1942 OE5XBL JN68PL
1945 OK1CZ CW
1952 I4RHP JN54QL
1953 ES5RY KO38JI
1953 DL3RBH JN68IK
1955 DL5MCG JN58KH
1956 DD0VF JO61WB
1957 DL8MFL JN58OA
1959 DL2RDT JN59WK
1959 DF1CF JN57FP
2000 DG6RB JN59WK
2001 DJ3TF JN59WK
2002 DL3DXX JO61VC
2002 DL2DTJ SSB

RA3AQ, KO85sp, wkd:
1637 DH0GHU JN38VN 2158
1639 F5JNX JN37PV 2230
1639 DL5ROB JN68HG 1880
1640 DF6IY JN48 2083+-
1640 IK1EGC JN35UF 2382
1640 DF1CF JN57FP 2051
1641 OE2IGP JN67MT 1884
1641 DC6AL JN68JJ 1862
1642 DF5DL JO41GP 1946
1642 DL4CA JN68BL 1897
1644 DL6MFK JN67JX 1888
1645 I1DMP JN35UB 2394
1646 DL0NT JN48PO 2063
1646 DL8MEL JN67 1904+-
1646 DL1GGT JN58 1960+-
1647 DL5GAC JN49RU 1980
1647 DL5MAM JN58UB 1949
1648 HB9DFG JN37 2269+-
1648 DL2HQ JN49DA 2100
1649 DG7MHR JN57DR 2056
1649 DL1SP JN48QQ 2053
1651 DK1FG JN59OP 1883
1653 LX3DX JN39BM 2206
1656 DG9MAQ JN58LJ 1973
1656 DJ9EV JN49OS 2000
1656 DL2DN JN48MX 2056
1657 DF0BV JN58VF 1933
1657 DG1IHH
1659 DK1VI JN49HH 2062
1700 DJ5BV JO30KI 2115
1700 DK7LZ JO30 2096+-
1701 DF9QT JO30OR 2075
1703 DK6FX JO40OL 1962
1706 DL6KR JO30NQ 2082
1706 DK1NCF
1707 F5LGF JN38EB 2276
1713 DL0EK JN38VN 2158
1713 DK0BAT
1714 DL8NCG JO50UD 1824
1714 DG2NBN JN59OP 1883
1714 DF0HF JO50VF 1815
1714 DK1NCF
1715 DL4YY JO60HO 1743
1715 DL0EE JN49GK 2060
1716 DF6NA JN49 2025+-
1716 OK1FFD JO60LF 1742
1717 DC9MH
1717 OK1ZTZ JO60 1721+-
1724 DL5NEB JN59KV 1890
1921 DF2ZC JO30RN 2067
1928 DL8EBW JO31NF 2055
1930 DK5DQ JO31PG 2043
1930 DF8IK JO30JT 2096
1931 DH2DAM JO31PH 2041
1931 ON4KHG JO10XO 2285
1931 ON4LN JO20 2221+-
1934 DL8YET JO31MH 2056
1935 DF7KF JO30GU 2110
1939 DL8EBW JO31NF 2055
1939 DK5DQ JO31PG 9 2043
1944 DL1KDA JO30FQ 2124
1945 DL2OM JO30SN 2062
1946 DK9TF JO31NF 2055
1948 DF2JQ JO31HL 2074
1948 PA0JMV JO21PM 2156
1948 PA4ZP 599 599
1950 DF1EAP 599 599
1950 ON4GG JO20BU 2262
1950 PA3BIY JO22EB 2189
1951 PA3ECU JO32C 2067
1951 PA2TAB JO32G 2046
1951 PE1HWO JO21GV 2186
1952 DL6YEH JO32VA 1977
1952 DF5DE JO40 1970+-
1953 DH2OAA JO42TU 1827
1954 PA5DD JO22IC 2166
1954 DL3YEE JO42GE 1922
1956 DF7KF JO30GU 2110
1956 PD2DB JO22MD 2143
1957 PA0PVW JO21VA 2149
1957 DF8XR JO32MF 2014
1957 PD0ROS JO22XE 2084
1958 PA0WWM JO22FE 2178
1958 PB2DJ
1958 DF7VO JO32 2002+-
1958 DL6YDP JO32MF 2014
1959 PA9KT JO33JF 1989
2001 PE4AD JO21PS 2145
2001 DJ2NJ
2002 DL1EAP JO31IK 2071
2002 DL1TAP JO31 2046+-
2002 PE1IWT JO32KF 2025
2003 PE1RZJ JO22 2127+-
2004 PD0PVL JO22 2127+-
2004 PA5WT JO22HG 2164
2005 DC9YC JO31PI 2039

RK3AF, KO85qr, wkd:
1642 F5JNX JN37 +-2260
1644 DL5MAM JN58UB 1941
1644 DF1CF JN57FP 2044
1645 IK1EGC JN35 +-2394
1649 DL1GGT JN48WI 2034
1652 DL3RBH JN68IK 1856
1709 DL2DN JN48MX 2047
1711 DL1GST JN38VR 2139
1713 DH0GHU JN38VN 2149
1713 DL0EK JN38VN 2149
1714 DB3NV JN59MK 1897
1722 DG9GAX JN48NF 2088
1919 DF2ZC JO30RN 2057
1922 DF8IK JO30 +-2086
1927 DL8EBW JO31NF 2045
1928 DK5DQ JO31PG 2032
1929 DB2KA JO30JT 2086
1930 DG1KJG JO30NT 2065
1939 ON4KHG JO10VJ 2295
1943 DL0SE JO31PG 2032
1943 DF7KF JO30GU 2100
1945 DL1EAP JO31IK 2061
1945 DL6YEH JO32VA 1966
1945 DL8YET JO31MH 2046
1946 DJ6LV JO31JG 2064
1946 ON7CL JO20JU 2209
1947 DD9EN JN39LF 2162
1948 DL3YEE JO42GE 1912
1948 DJ2NJ JO31GK 2071
1951 PD2DB JO22MD 2133
1951 PD2JVE JO22 +-2116
1952 DG5YIL JO32 +-1991
1952 PE1IWT JO32KF 2014
1953 DL1EAP JO31IK 2061
1953 PA0PVW JO22VA 2091
1953 PA3BIY JO22EB 2178
1954 DF9KT JO30GU 2100
1954 PE1HWO JO21GV 2175
1958 DF8XR JO32MF 2004
1958 ON4GG JO20 +-2211
1959 DL6YDP JO22MF 2129
2000 PD0HCV JO31FW 2053

2001 PE1GNP JO31IX 2036
2002 PA3ECU JO32CF 2056
2003 PA3CCT JO21TX 2103
2003 PA0JMV JO21PM 2146
2003 DL2NS JO43LD 1846
2004 DL1SUN JO53 +-1702

RN6BN, KN95lc, wkd:
1426 PA0JMV JO21PM **2564**
1426 G4FUF JO01GN **2892**
1427 G3LTF IO91GG **3032**
1429 PE1HWO JO21GV **2617**
1434 DL3WJ
1434 SP6HED JO80IK 1757
1435 DO2CT JO50LT 2164
1441 DL4VS JN39LF 2442
1442 G8VHI IO92FM **3033**
1443 DF1VW JN39HJ 2466
1444 F6DWG JN19DL **2778**
1445 DL8GP JN39LH 2442
Very strong thunderstorm. QRT
1726 OE5KE JN78DF 1905
1726 DF1NP JN58OV 2133
1727 DJ9EV JN49OS 2280
1727 OK1AYK JO78GX 2249

RZ6BU, KN84pv, wkd:
1439 DL1YAW JO41DX
1455 G4LOH 57 hrd IO94
1510 DJ5HG JO53IM
1515 DL8LAQ JO43
1710 OK1MG JO70
1711 OK1FFD JO60CF
1715 OK1KKD JO70AD
1716 OK1DKZ JN69XP
1718 DL2ARD JO60AP
1718 OK1KDO JN69KL
1720 OK1WN JN69KL
1721 DF0HF JO50
1722 OK2BKV JN89KL
1724 OK2POI
1726 DL2RDT JN59WK
1800 OE5XBL JN68PC
1801 OE3JPC JN87EW
1415 to 1507 hrd mni PA and DL
stn, all 51 to 53, not copy me.

SM0BSO, JO99bg, wkd:
1424 IZ4AIK JN63
1428 9A2RD JN65TF
1429 S54G JN65TN
1431 IW0GPN JN62FB
1439 S57TW JN75EX
1439 IK0BZY JN61GW
1443 IK0NOJ JN61GV
1446 I6IQB JN72BK
1451 I0SPS JN61KU
1453 IZ5EME JN52NS
1456 IK4DRY JN64BL

1457 I4CIL JN64AH
1500 IK5YJY JN53PG
1500 IK3LGP JN55WJ
1500 IW4BVT JN54QL

SM2ILF, KP04np, wkd:
1938 YU7XL 57 57
1943 HA8GY JN96RK
1944 HA7UL JN97KK
1945 9A5SG JN95
1947 HA5BSW JN97JD
1951 SP5AMH SSS ??
1953 SP9NRQ JO90LC
1955 HA5CW JN97PM
1956 T94DU JN95DA
1959 SP9NRQ JO90LC
2000 HA8YG JN97
2001 YU1LR JN94
2008 9A2SA JN95
2009 SP9AMH JO90
2009 9A2OM JN95
2010 SP9LGV JO90
2010 SQ9PV JO90
2010 T94NK JN95DA

SM3RWZ, JP82mi, wkd:
1635 HA5BSW JN97
1640 9A2JB JN95
1703 YU1IO KN04
1705 YU7KB JN94
1708 YU2EW KN05
1710 LZ2FO KN13 2077Km
I also heard LZ1QI, HA6ZB, HA6VV, YO2AMU, LZ2PI, LZ2CC. This opening was a repeat of yesterday. Very strong signals in the same direction to eastern europe.The best signals on the band at my location was YO7AMU / LZ2FO 59+30db. Rig: 25 Watts to a 9 element yagi.

SM4HFI, JP70to, wkd:
1425 IC8FAX JN70CN 2231
1434 IW0BET JN61FS 2106
1439 I6BQI JN72BK 2023
1442 IC8CQF JN70CN 2231
1454 IV3HWT JN65ST 1651
1456 S53J JN75EV 1638
1457 S57UUD JN65XP 1667
1458 9A5AEI
1459 9A2RD JN65TF 1715
1613 YU7KB JN94XX 1761
1625 YT1VV N.C.
1630 YU7KG JN95WC 1747
1630 HA5RSW 59 NC
1632 YU7AR KN05BW 1658
1632 HA5CW JN97PM 1474
1633 HA7WJ JN97MP 1458

1633 YU1IO KN04FT 1785
1633 YZ1PWJ KN04CP 1801
1634 HA6NM JN98PB 1415
1635 YT7AT KN04HV 1778
1635 YZ9KU KN04ET 1784
1636 YZ1KU KN04EF 1849
1639 YU7EW KN05HP 1696
1641 YU1BT KN03KN 1928
1642 YO2AMU KN06OC 1653
1644 YU7KB JN94XX 1761
1645 LZ1QI KN12PR 2054
1647 YO2LEA KN06WK 1627
1648 LZ2FO KN13KX 1911
1649 LZ3CQ KN12PQ 2059
1651 HA0HO KN07SU 1468
1653 YU7ACO KN05QC 1765
1655 HA6NA 55 NC
1710 LZ2CC KN23JG 2023
1711 YO5BLA KN16SR 1626
1712 YO7AQF KN24EU 1845
1713 YO3CCB KN34
1714 YO5TP KN16SS 1622
1715 YO5CES JN17VV 1604
1716 YO3IZI KN34BK 1928
1717 YO3CCB KN34CL
1717 YO3DMU KN34BJ 1932
1718 YO5OKP KN17VV 1507
1719 YO5OKG 55 NC
1726 YO6FDS KN26VI
1734 YO4BJH NC
1958 SP8WJW KN09LL 1282
2000 SQ8CMB 44 55 NC
Rig 150W, TRX TS-700 and 2nd RX TR-7+conv; Antenna 15 el yagi 8m up. Today better than yesterday, and then the best since 1981 for me! The last SP really short distance.

SK4BX, JO79of, wkd:
1649 LZ1QI KN12PR 1917
1652 HA0HO KN07SK 1376
1654 YO7QF KN24KX 1713
1659 YO2LHD KN05WQ 1571
1703 YO7AQF KN24KU 1726
1704 YO3IZI KN34BK 1803
1705 YO7BUT KN15OA 1669
1706 LZ2PI KN23XU 1859
1707 YO3DMU KN24KU 1726
1708 YO5CES KN17
1709 YO3CCB ?
1709 YO6AWR KN25TP 1663
1713 YO5BEU KN14JO
1714 YO5BED KN27GD 1478
1715 YO6FDS KN26VI 1595
1715 YO6KEA KN25TP 1663
1716 YO9CAD KN35AF 1718
1727 UR5YM KN58XG 1634
1729 ER5AA KN45CW 1713

A huge thunderstorm passed, managed to work some ES in between the thunderstorms. Almost the same QTF as yesterday, around 140-160 degrees. Equipment Yaesu FT-736r with tweaked RX/TX frontend. Ants 2*17el at 35mAGL, 1kW

SM5DIC, JO89jt, wkd:
1420 9A2RD JN65tf
1426 IK7XWJ JN90ck
1428 I6BQI JN72bk
1432 IC8FDX JN70cn
1436 IC8CQF JN70cn
1449 IK8YOQ JN70gc
1454 IW0BET JN61fs
1455 IK0BZY JN61gw
1456 I4ERN JN64cb
1609 YU7KB JN94xx
1609 YZ7MON jn94
1613 YU7EW KN05hp
1631 YT1VV JN94vn
1635 HA4XG JN96lv
1636 HA7WJ JN97mp
1636 HA8BI/7 JN97mi
1637 HA8UG JN97sa
1638 HA5BSW JN97jd
1638 HA5CW JN97pm
1639 HA5KG JN97og
1642 HA5MO/7 JN97qk
1644 HA0MK KN08ta
1644 LZ3CQ KN12pq
1645 LZ3NY KN12qq
1650 YO2LEA KN06wk
1651 HA8QG KN06mt
1653 LZ2FO KN13kx
1654 YO2II kn06
1703 LZ1QI KN12pr
1705 LZ2CM KN13oj
1707 HA8CE KN06en
1707 YO2AMU KN06oc
1709 YU7RF KN05pc
1710 YO7LGI KN14vg
1711 YO5CFI
1713 YO5OMT KN16
1716 UX0DA KN18
1720 YO5BWD KN27gd
1923 YO2LEA KN06wk
1951 SQ8CMB KN09qs
1954 HA0MK KN08ta
1955 YO5BYV KN07wu
1958 OM8AQ KN08or.

SM5LXA, JO78si, wkd:
1443 I6BQI JN72BK
1445 IC8CQF JN70CN
1446 IC8FAX JN70CN
1449 IK8YOQ JN70GR

1450 I0KNQ JN61FU
1453 S53V JN76GB
1457 9A2RD JN65
1500 S54G JN65TM
1501 S53J JN75EV #
1631 HA8UG JN97SA
1632 EU7EW KN05HP
1633 YU7MS KN05FJ
1635 HA6VV JN97WS
1637 HA7MB KN07BM
1639 YU1MI KN03QW
1641 HA6ZB KN07BV #
1642 LZ1QI KN12PR
1645 LZ2CC KN23JG #
1650 LZ3CQ KN12PQ
1654 LZ2HM KN12
1700 YO2FO KN13KM
1709 YO3DMU KN34BJ
1711 YO3IZI KN34BK
1714 YO4ATW KN35XG #
1717 YO4IMP KN44AI
1721 YO4BJH KN35XG
1733 YO8DDP KN36DF #
1736 UT3BW KN29UA
1747 UT5JCW KN64SN
1951 YO5BWD KN27GD #

SK6HD, JO68sd, wkd:
1447 I6BQI JN72BK
1451 S51MQ JN75NT
1452 S51WX JN75OS
1453 S59GS JN75OO
1454 S51KK JN76HB
1454 S57MTA JN76EF
1455 S57TW JN75EX
1456 S51CAB JN7???
1457 S56IHX JN76JA
1458 S53V JN76GB
1458 S57EA JN76HE
1459 S53J JN75EV
A break because of heavy thunderstorm very close.
1610 YO2AMU KN06OC
1625 LZ3NY KN12QQ
1627 LZ2FO KN13KX
1628 LZ3CQ KN12PQ
1630 YO2LHD KN05WQ
1631 YO2CDX KN05WQ
1631 YO2LEA KN06WK
1632 HA0HO KN07SU
1635 YO2II KN06PE
1637 LZ2CC KN23JQ
1637 HA0MK KN08TA
1639 YO7BUT KN15OA
1640 YO7HMH KN25MG
1641 YO7BKT KN25MG
1641 YO7LGI KN14VH
1641 YO3DMU KN34BJ
1642 YO7IV KN24MT

1643 YO7AQF KN24KU
1643 YO3CCB KN34CL
1644 LZ2PI KN23XU
1644 YO3IZI KN34BK
1646 YO5PLA KN16SR
1646 YO5CRQ KN17SP
1647 YO6AWR KN25TP
1648 YO7AQF KN24KU
1649 YO5CES KN17VV
1649 YO9CAD KN35AF
1652 LZ3GM 55 59 KN32RL
1656 YO5BWD KN27GD
1658 YO9GWW KN34QN FM
1707 YO4BZC KN45AK
1707 YO4RXX 59 57 KN45AK
1710 YO4GJH KN35XG
1713 ER5AA KN45CW
1716 UT3BW KN29UA
1716 US5WU KO20DI
1720 YO8DDP KN36UF
1722 U5YM KN28XG
The best ES-openings, I have been QRV in for many years.

SM6OPX, JO58rg, wkd:
1404 YZ4KY KN04ET
1415 UT9FDJ KN97DA
1428 IK7XWJ JN90CN
1450 9A6R JN83FN
1455 S59DTB JN86AO
1640 YO5BYD KN27GD
1643 YO5CRQ KN07SP
1645 YO6AWF KN15SP
1649 YO3IZI KN34BK
1707 ER5AA KN45
1949 UT3BW KN29UN

SM7EOI, JO86fp, wkd:
1639 HA7MB KNØ7BM 1044
1639 HA6ZB KNØ7BV 1004
1640 LZ2FO KN13KX 1478
1641 HA8MV KNØ6GU 1124
1643 LZ2CC KN23JG 1599
1644 YU1BT KNØ3KN 1487
1645 LZ3NY KN12QQ 1627
1646 YO7AQF KN24KU 1436
1646 YO3DMU KN34BJ 1520
1654 YO3IZI KN34BK 1516
1655 YO5BWD KN27GD 1191
1715 ER5AA KN45CW 1439
1720 UT3BW KN29 976+-
1726 LZ1QI KN12PR 1621

SP2IQW, JO94gm, wkd:
1438 IK5YJY JN53PG 1356
1442 IS0CAK JM49MB 1859 #
1445 IZ5EME JN52NS 1412 #
1448 IA5/IK2OFO JN52BT 1438
1450 IK4WMM JN54 1234

1450 I4CIL JN64AH 1226 #
1451 IK4WMA JN54WG 1235
1459 IZ1BPN JN35VG 1281 #
1500 IK5QLO JN53FU 1320
Not bad, 21 sqrs in 2 days ! Seems cloud stopped later over SP-land for next many hours! Rig: 50W and vertical.

SP5XMU, KO02lg, wkd:
1444 F1FIH JN23GS 1538km
1448 IZ1BPN JN35VG 1236km
1452 IW2HAJ JN45NO 1136km
Hi, nice short opening just on the beginning. I spent almost 5 hour listening to 2m. But bigest Es was above my QTH - NIL here

SP7UDO, KO00qw, wkd:
1436 F1DBN JO00VT
hrd G8IZY from IO91VC

SP9OJQ, JN99iw, wkd:
1945 OH1XT KP01UK
1955 OH3AWW KP01RS
1956 OH1MDR KP01VJ
2007 SM2CEW KP15CR

S53VV, JN65um, wkd:
1404 ES8JX KO28LM
1407 ES5RY KO38IJ
1420 SM5DFF JO88CN
1428 SM0BSO JO99BG
1441 SM0LQB JO89XK
1448 SM0KAK JO89XK
1452 SM5KNV JO88MW
1454 SM1HOW JO97GV
1455 SM4EFW JP70WS
1457 SK3MF JP92FW
1501 SM7URQ JO77MJ
1502 OH1XT hrd weak
1630 ES2DF KO29
1632 YL3GAC KO27ES
1633 OH3BYZ KP21UA
1634 OH7HD KP32RT
1634 ES2NT KO29
1634 OH5IY KP31JK #460
1635 ES3BM KO29JA
1639 OH4LA KP20LG
1640 OH6NJ KP20WG
1641 RU1AA KP40XD
1656 RA3AQ KO85 FAI? 35 deg
1659 ES5RY KO38IJ dupe
1702 UT5EC/B KN78MM 59
1708 UT5EZ KN78LL
1710 UR0EQ KN78WM
1712 UT4EO KN78GP
1735 UR5LX KO70 FAI? 48 deg

UA1ALI, KP50dx, wkd:
1645 I6BQI JN72BK 2328
1720 9A3JN JN85EL 1947
RX/TX Kenwood TS-2000,Icom IC-820H, 10el Yagi

UA4AQL, LO20qb, wkd:
0744 TA1ZK/0 KM39

UR5LX, KO70wk, wkd:
1653 G4SWX
1654 PA3GKY
1655 DJ9CZ
1655 DF7KF
1656 PA3DZL
1656 OM4AMX
1657 DJ2NJ
1657 DK5DQ
1658 ON4GG
1658 DH2DAM
1659 ON4KRI
1700 PE2RMI
1700 G4LOH
1702 DB2KA
1702 DF8IK
1702 ON4KHG
1703 ON7CL
1703 DC6IA
1704 ON4IZ
1704 DF2ZC
1705 PE9D
1705 PA3GFY
1706 PA9KT
1706 PA0OOM
1706 DK7BY
1707 DL5NAV
1707 PE1MCD
1708 PD0NHM
1708 DH8BAC
1709 PE1OPK
1711 DK9TF
1712 PD0MNF
1712 ON6ZK
1713 DF5DE
1713 PA0JMV
1713 ON2ID
1714 PA4PS
1715 PD0PVL
1715 PA3BZL
1716 ON6ZK
1716 ON7EH
1717 DL8EBW
1717 DC9YC
1717 ON4IQ
1718 ON4LN
1718 DL5EBS
1719 ON1AEN
1719 PD0FFU
1720 DK3XM
1720 DJ5HG
1722 DL6BBR
1722 PE9GG
1723 PE1KLQ
1724 DH1HC
1724 PE1ODY
1724 PA0OOS
1725 PD0RKC
1726 DK5YA 55 55 FAI
1727 DG5BE
1727 DB1BHR
1728 PA3DII
1748 DF9IC
1729 DL0EE
1729 DL2IXN
1730 F6HVK
1732 DK9NCX
1736 S53VV 559 599 cw FAI
1739 S51DX 53 57 FAI
1741 DJ3LE
1807 DL9MS
1807 DF2LH
1807 DL5XV
1808 DG0KW
1808 DG3XA
1809 DL6NAA
1809 DL5WG
1810 DL3RBH
1810 DL2ARD
1812 DF0WD 539 59 FAI
1814 DK1KO
1819 DG2SRL
1821 DL8LAQ
1839 OZ1CLL
1945 DK1KO 55 529 cw FAI
1958 OZ1DLD FAI, MS?
1959 OZ1BUR FAI, MS?

US2YW, KN28xg, wkd:
1505 G4LOH 57 HRD
1523 DF7KF JO30JU 1408
1536 PA3DZL 59 HRD
1639 DL9MS 57 HRD
1641 OZ1LPR JO44UW 1341
1645 OZ1IEP JO55XU 1272
1648 OZ2TF JO46PE 1431
1649 DL3TW 59 HRD
Rig: GP + 10w.

UT5JCW, KN64sn, wkd:
1355 PA3BIY JO22EB 2293
1356 DF2JQ JO31HL 2129
1356 DG1FB
1401 LX1JX JO30AB 2147
1401 DJ9EV JN49OG 1911
1401 DL5FDP JN49LP 1934
1402 DK5TX JO41JW 1994
1402 DL6YEH JO32VA 2063
1403 PA3ECU JO32CF 2173
1404 PD3UX JO22LE 2256
1404 DL1YAW JO41DX 2029
1405 PA3CNX JO22MC 2249
1406 DG9FC JO40EA 1981
1407 ON4CHP JO21JD 2249
1409 ON4KHG JO10XO 2300
1409 DJ7OF JO51HQ 1865
1411 DK7LZ JO30MR 2086
1411 DK9TF JO31NF 2090
1412 DJ5BV JO30KI 2092
1414 PA4ZP JO21 2238+-
1414 ON4CHP JO21JD 2249
1415 G4SMX JO01 2512+-
1416 ON1VS JO21LH 2240
1417 DJ9MH JO50FA 1834
1417 ON4GG JO20AR 2296
1418 DB6LJ JO43 2029+-
1418 OK1FFD JO60CF 1717
1418 ON2VR JO11XA 2305
1420 DK5DQ JO31PG 2079
1422 DL8GP JN39LH 2074
1422 DB6LJ JO43 2029+-
1423 DC6IA JO30IV 2112
1423 DF1VW JN39HJ 2098
1424 DO1KTS JO30 2083+-
1424 DL5IAU JN49RO 1898
1425 DD2FJ JO40FI 1981
1426 DJ2JA JO40IM 1967
1426 ON4LN JO20IV 2251
1427 DL6WU JN49HT 1960
1428 DL4KMS JO30FO 2125
1429 DG4FDQ JO40HM 1972
1430 DJ8OG JO40MF 1938
1432 DK1KO JO53 1906+-
1434 ON2ID JO21GD 2266
1435 ON4AMY JO21MB 2230
1436 DJ9CZ JO31BC 2156
1439 DF7KF JO30GU 2123
1439 DK1ZD JO44WS 2031
1440 DK0KK JO30 2083+-
1442 ON1KLZ JO20GE 2255
1635 OZ1LPR JO44UW 2048
1635 DJ3LA JO44SJ 2034
1639 DJ9YE JO43HV 2069
1641 DJ5HG JO53IM 1926
1642 DG0KW JO64HM 1859
1642 DK1KO JO53 1906+-
1642 DL9MS JO54WC 1882
1643 DF2LH JO53AR 1976
1644 DJ8ES JO43SX 2016
1644 OZ3K JO45TL 2078
1646 DL5XV JO53AP 1972
1646 SP1FPG JO73GL 1695
1647 OZ1ANA JO55DK 2038
1647 SP1MVG JO73FJ 1695
1649 OZ2PBS JO55XJ 1943
1649 OZ1FKZ JO56AB 2084
1650 PA9KT JO33JF 2162
1650 PA0OOM JO33II 2171
1650 OZ1BNN JO55PM 1987
1651 SP9XUD/1 JO74 1725+-
1651 OZ1DLD JO45RL 2088
1653 OZ1BEF JO46OE 2136
1653 DL3TW JO44SK 2036
1654 DF9CY JO54AL 2008
1654 OZ1IEP JO55XU 1969
1654 DL4WK JO63SQ 1764
1655 DK8ZJ JO54AG 1999
1655 OZ1IIL JO47HC 2215
1656 DK3RA JO53LU 1925
1657 OZ2PJ JO65 1892+-
1658 SM7DTT JO65LJ 1889
1705 DL7FF JO62TJ 1698
1705 DL9USA JO71EN 1616
1705 DK6AS JO52GH 1891
1707 OZ8JYL JO47XA 2140
1707 DL1UU JO62 1740+-
1707 SP6RGB JO71SF 1527
1708 DL3HXS JO61CU 1767
1708 DG2HSF JO61LJ 1702
1709 SM7WT JO56QQ 2047
1709 DL1RTL JO62PH 1716
1709 DJ9FG JO52UD 1810
1710 DB7OB JO52IJ 1883
1711 DG0FE JO62UN 1700
1711 DL8AAV JO52DH 1907
1712 DL1AAH JO52EF 1899
1713 DC1GJF JO72GH 1637
1713 DL2BWH JO64XR 1796
1713 DG2SRL JO61HN 1729
1713 DL2ROM JO62RI 1707
1714 SQ9W/P JO90SK 1235
1714 SM6CMU JO57XK 2064
1715 SM6CEN JO66HU 1994
1716 SK6DK JO67EH 2035
1716 SP9KDA JO90EU 1329
1717 DM2DME JO62SQ 1716
1717 DO1TN JO62SG 1698
1717 DJ2IA JN58SC 1727
1718 DL2RWM JO62PF 1712
1718 DH1HC JO53GF 1925
1720 SP9UZ JO90WP 1224
1721 DL7ANR JO62PM 1724
1722 DK3XM JO43XL 1971
1724 LA5KO JO59FH 2256
1724 SP6RGB JO71SF 1527
1725 PA9RX JO32MT 2134
1725 PA0OOM JO33II 2171
1726 DL8LAQ JO43XU 1986
1726 PA9KT JO33JF 2162
1726 DK7BY JO43 2029+-
1727 DK1KO JO53 1906+-
1728 DH6KG JO52NU 1874
1728 PE1KLQ JO33JF 2162
1728 DL8MKG JO52 1866+-
1729 DO1LKG JO53DS 1962
1731 PA4PS JO33 2155+-
1737 SM6ONH JO68MN 2088
1747 SM5LXA JO78HH 1999
1839 OE5XBL JN68 1622km

UX5UL, KO50fl, wkd:
1635 G4SWX JO02PB 2022
1635 PE1HWO JO21GV 1803
1636 PE9DX JO33MD 1629
1638 PA9KT JO33JO 1647
1639 PE1KLQ JO33JF 1645
1639 DH1HC JO53GF 1396
1640 PA0WWM JO22FE 1806
1642 PE2RMI JO33GH 1662
1647 DK5DQ JO31PG 1621
1648 DD9EN JO31JG 1655
1649 DM1CG JO31IC 1663
1650 DJ2NJ JO31SL 1601
1652 DF6WE JO31GO 1669
1708 DK8ZJ JO54AG 1442
1711 DJ3LE JO44TN 1474
1715 DG0KW JO64MH 1252
1716 DK5TX JO41JW 1512
1717 DK1YAW JO41DX 1546
1717 DL4OL JO53BC 1423
1723 DL9MS JO54WC 1322
1936 OZ1BUR JO46HI 1578
1948 OZ1CLL JO65QQ 1275

9A6R, JN83fm, wkd:
1441 LA2AB JO59FV
1443 LA2JKA JO59CE
1446 OZ9NI JO65DJ
1450 LA5KO JO59FH
1452 SM6OPX JO58RG
1453 SM7FMX JO65KN
1454 OZ1CLL JO65GX
1455 LA0BY JO59
1455 DG0KW JO64MH
1456 OZ1JTE JO65ER
1456 SK6DK JO67EH
1456 OZ4AFR JO65ER
Rig: 100W, 12 ele.

YO2BBT, KN05wg, wkd:
1455 DL6BF JO32QI
1459 PA3CEG JO33FB

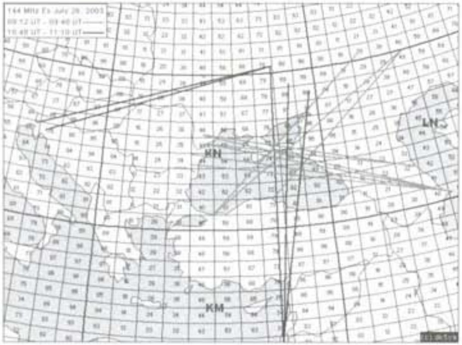
YT1VV, JN94us, wkd:
1455 DJ9YE JO43HV
1457 DL8LAQ JO43XU
1502 OZ1BUR JO46HI
1620 SM4HFI JP70EO
1630 SK3SEG JP70TJ
1632 SM5DIC JO89JT
1634 SM5XJX JO88GK
1638 OH1HSC KP10CM
1644 OH1XR KP10UK
1645 OH1JCS KP10AE
1645 OH1LT KP00XO
1646 OH1NOR KP00XL

1646 OH1MDR KP01VJ
1700 OH6LE ??
1702 OH6PA KP20DL
1706 OH1XT KP01UK
1709 OH3AQK ??
1710 OH1HSC KP10CM
1711 OH1AYQ KP12UJ
1713 OH1CO KP12OK
1717 OH1FA KP10PL
1718 OH6MAZ KP12IG
1719 OH6NKJ KP02WG
1729 OH4LA KP10LG
1728 OH3BYZ KP21UA
1731 ES3BR KO28IS
2008 SM2DXH KP03CU

'U1LA, KN04fr, wkd:
654 OH1ZAA KP01ro
654 OH1NOR KP00xl
655 OH1XT KP01uk
657 OH1MDR KP01vj
709 SM3VAC JP83va
714 OH6PA KP02pl
718 OH1AYQ KP12jb
719 OH1HSC KP10cm
720 ES0MC KO18fl
721 OH6MAZ KP21ig
724 OH1FA KP10

'U7EW, KN05hp, wkd:
413 LA2PHA JO38IB 1673 km
414 DL9MS JO54WC 1289 km
417 OZ1LPR JO44UW 1289 k
418 OZ2TF JO46PE 1413 km
419 OZ3LX JO55UM 1264 km
428 DL7ULM JO62SM 922 C?
433 OZ1BUR JO46TI 1453 km
440 PE3CEG JO33FB 1313 km
445 PE1LCH JO23WF 1356 k
445 PA7AL JO23VG 1363 km
448 PD0RFU JO32LS 1267 km
450 PE9DX JO32MD 1286 km
450 PE1KLQ JO32JF 1305 C?
610 SM0KAK JO89XK 1545 km
613 SM5DIC JO89JT 1597 km
631 SM5CNQ JO78TU 1508 k
632 SM5LXA JO78SI 1455 km
634 SM5KNY JO88MW 1498 k
635 SM5DRV JO77MW 1419 k
638 SM5NVF JO89NP 1575 km
640 SM4HFI JP70TO 1696 km
641 SM3GSK JP82TM 1887 k
642 SM1HOW JO96GL 1324 k
643 SM3AFT JP82XP 1899 km
643 OH1NOR KP00XI 1639 km
644 OH3AWW KP01RS 1795 k
650 SL0ZS JO89XJ 1540 km
652 OH1ZAA KP01RO 1776 k
654 OH1MDR KP01VJ 1754 k

1702 SK0CT JO89XI 1536 km
1707 SM3RWZ JO84MI 2093 #
1713 OH6PA KP02PL 1874 km
1713 OH1LT KP00XO 1667 km
1714 OH1HSC KP10CM 1658 k
1715 OH1JCS KP10AI 1639 km
1716 OH1CO KP10OK 1655 km
1723 ES1II/8 KO18UK 1438 km
1727 OH5MAZ KP21UG 1759 k
1842 OH7MA KP52BN 1977 km
#475
1921 SK3MF JO92FW 1929 km



1922 SM0KAK JO89XK 1545 km
1942 SM3AFT JP82XP 1899 km
1953 SM3DTR JP83HA 1950 km
1955 SM3KJO JP92FX 1934 km
1957 SM3GSK JP82TM 1887 k
1959 SM3VAC JP83VA 1942 km

Z32UC, KN11cr, wkd:
1410 SK7MW JO65MJ
1411 OZ1CDE JO65CO
1412 DG0KW JO64MO
1413 OZ9PP JO47VA
1414 OZ3LX JO55UM
1415 OZ1BNN JO55TM
1416 LA2PHA
1417 OZ2PJ JO65ER
1418 DG1BHA JO73DB
1419 OZ1JTE JO65ER
1420 DL3BUA JO73DB
1420 OZ4AFR JO65
1421 SP1FPG JO73GN
1422 OZ8LX JO65ER
1424 DK3WG
1425 OZ8ON
1427 OZ1CLL JO65GQ

1428 DJ4TC
1439 DJ9YE JO43HV
1643 SM5KNV JO88MW

July 26th, 2003

S57TW, JN75ex, wkd:
1051 UR5LX KO70WK

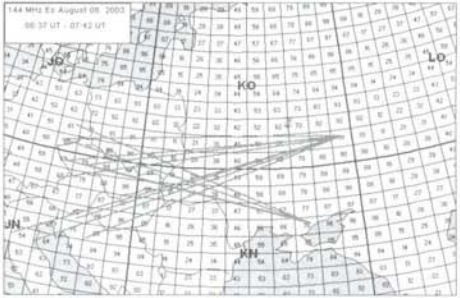
UR5LX, KO70wk, wkd:
1052 S57TW

1052 S58G
1055 4Z5AO 59 57
1105 4Z9GAI 59 58

August 8th, 2003

DL2ARD, JO60ar, wkd:
0632 heard UR5GIM for 1 min
0637 UR5GIM KN76, he was loud until 0715 (strong QSB)
0639 UR3GT KN76
0642 UR5GPT KN76
0730 RX3QFM KO91 (for 2 min.)
Rig: 350w + 4x5wl

OK1DFC, JN79gw, wkd:
0709 UR5GIM KN76CL #316
0740 RX3QFM KO91OH hrd



August 11th, 2003

RN6BN, KN95lc, wkd:
1557 DL5WG JO52VK 2135
1558 DL1RNW JO62GH 2082

RU3ACE, KO95kg, wkd:
1549 9A3JH JN75AD 2077
1551 9A4QV JN75BC 2076

UT5JCW, KN64, wkd:
1555 OZ1LPR JO44UW 2048
1558 DG0KW JO64MH 1825

August 15th, 2003

DF6NA, JN49xs, wkd:
1717 EA7RM IM87cs
nothing else heard

DL1RNW, JO62GH, wkd:
1710 EA5EHS IM99 HRD 55
1714 EA7RM IM87

EA5ZF, IM99vt, wkd:
1717 DL0EE JN49GK 1271 km
1717 F0DHF JN37AF 51 964 k
1718 DL8AKR JO52SW 1709

EA6VQ, JM19hn, wkd:
1703 PA3BIY JO22
This has been the fourth QSO with Peter by sporadic-E this year !! Also worked him on 16-June, 8-July and 9 July !

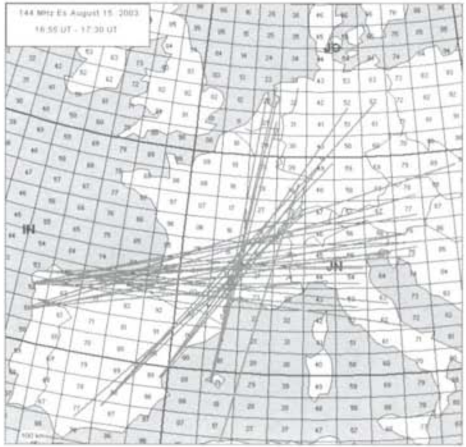
EB1EWE/P, IN53pc, wkd:
1730 9H1CAL JN73 hrd 59 with 5/8 vertical.

HB9DFG, JN37sm, wkd:
1715 EA7RM IM87cs 1423km

I4XCC, JN63gv, wkd:
1712 EA1RX IN52PF
1714 CT1DYX IN51QD
1718 EB1ENP IN62EU

PA3BIY, JO22eb, wkd:
1703 EA6VQ JM19
1711 EA6SA JM19

S51ZO, JN86dr, wkd:
1718 CT1FAK IN50QO 2105 km
1719 CT1DYX IN51QD 2079 km



9A3JH, JN75ad, wkd:
1659 EA1RX IN52PF
1711 CT1DYX IN51QN
1714 EA1YV IN52OC
Rig: 350W 12ele

Ed.: 2003 was an exceptional one regarding 2m Es openings. There were many days with openings and MUF higher than 200 MHz. This is the reason for the VERY big Es reports in this and in the last issue. Anyway we were not sure if you wished to see all these reports about 2m Es QSOs in DUBUS because you find QSO lists and maps also on the web.
We now got some feedback from several readers. 66% asked to print these (long) reports also in the future. So we will continue with this column.

TNX again for the maps to Udo, DK5YA!

DX Opportunities in 144 MHz Double Hop Sporadic E - Ground Reflection of Radiowaves by Lakes and Rivers

by Volker Grassmann, DF5AI

1. Introduction

The analysis of the May 20, 2003 DX opening between the Canary Islands and central Europe motivates the assumption of double hop sporadic E propagation supported by inland lakes and major rivers [2]. This assumption results from the geographical position of the corresponding path centers which appear to correlate to the location of inland water areas, see Fig. 1.

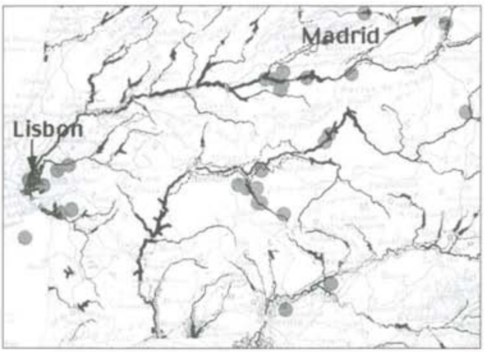


Fig. 1. In the May 20, 2003 dx opening, sixty percent of the radio paths between the Canary Isles and central Europe show midpoints which appear to correlate to the position of lakes and major rivers in Spain and Portugal [2].

The path midpoints are calculated geometrically and are considered the radiowaves' footprint on the Earth's surface resulting from the zigzag propagation path between ground and the E layer of the ionosphere. However, there remain many open questions and alternative interpretations need to be considered at this stage of investigation (see the detailed discussion in [2]):

- the findings in Fig. 1 may be considered accidental results, i.e. VHF double hop propagation supported by lakes and rivers does not exist at all
- the circles in Fig. 1 may be interpreted geographical footprints of ionospheric skip propagation, i.e. radiowaves in grazing incidence were reflected by the surface of inland water expanses which finally extended single hop sporadic E into double hop propagation ("radioglint" in inland lakes and major rivers)
- alternatively, the circles in Fig. 1 may be interpreted reflection points on the topside of tropospheric inversion layers, i.e. the radiowaves were actually not reflected at ground level but in a height of a few hundred meters above ground; those inversion layers are assumed local features above lakes, dams and major rivers enabled by high ground temperature, calm winds and by relatively low water surface temperature

Evidently, there is a need for further studies and investigations to clearify the possble importance of large inland water expanses in VHF double hop propagation. Using the BeamFinder analysis software [3], the author extrapolated the results in [2] to other European regions to identify potential dx opportunities in very long distance propagation and to encourage experimental studies by other radio amateurs [1]. In this paper, we present the findings which appear most important in the European sector.

In the following, we will discuss dx target maps centered to the position of a lake or a major river, respectively (see Fig. 2). The presentation allows radio amateurs identification of their individual dx opportunities in double hop sporadic E. First, the user iden-tifies his or her personal geographical position with respect to the shown circles and radials. In the next step, the user identifies the corresponding dx target on the same circle but in opposite direction. Note that the geographical position of the corresponding sporadic E clouds is not shown in this example but will appear in the following dx target maps.

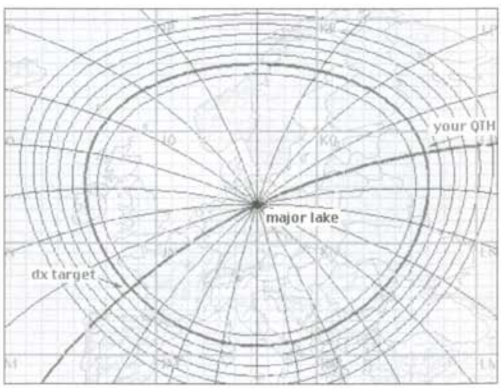


Fig. 2. Dx target map: the circles range from 1.300 to 1.900 kilometers in steps of 100 kilometers corresponding to dx QSOs of 2.600 to 3.800 kilometers with the lake at the path center. The radials denote multiples of 15° azimuth.

2. The Lake Balaton in Hungary

Providing a surface of 591 square-kilometers, the Lake Balaton is considered an interesting candidate for supporting watersur-face reflection in double hop propagation, see Fig. 3. Note, for example, possible dx QSOs between the southern tip of Norway and the island of Crete. The corresponding sporadic E clouds are found above east Germany and Macedonia (see the corresponding shading in the map center). Udo, DK5YA, reports this type of dx event in 144 MHz when attending a 144 MHz dxpedi-tion to Crete in 1998 [6]. Alternative dx opportunities are identified between south-west France and the Crimea Peninsula, north-west Spain and the eastern Ukraine, north-western Russia and Tunisia and even, corresponding to very long dx QSOs, from Northern Ireland and the Isle of Man to Cyprus.

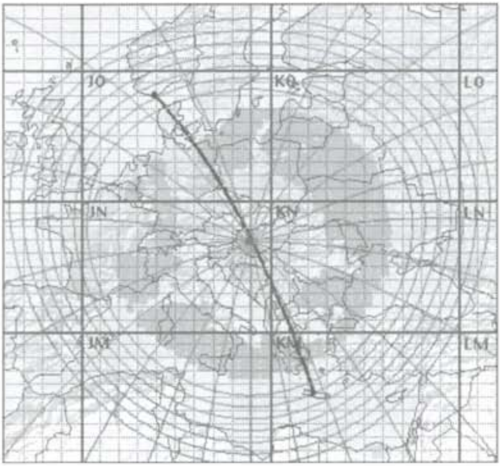


Fig. 3. Dx target map corresponding to the Lake Balaton, Hungary. The area in the center denotes the reflection points in the E layer of the ionosphere (105 km).

3. The river Dnieper in the Ukraine

About 200 kilometers south-east from Kiev, the river Dnieper extends into large water areas providing a very attractive scenario in double hop sporadic E, see Fig. 4. In fact, we may find dx opportunities, for example, from northern Germany and southern Denmark towards the Caspian Sea. Reinhard, DK1KO (JO53), reports this type of long distance sporadic E QSOs in 1989 (to UD6DE, LN40) and also in 1990 (to UD70DE, LN40) [4]. Joachim, DL8HCZ, mentions a quite large number of radio amateurs in northern Germany and southern Denmark having reported similar QSOs to the city of Baku at the west coast of the Caspian Sea [5]. It is perhaps also worth to mention that the river Dnieper provides even more dx opportunities because large water expanses exist in many places along its course from Kiev towards the river's mouth at the Black Sea.

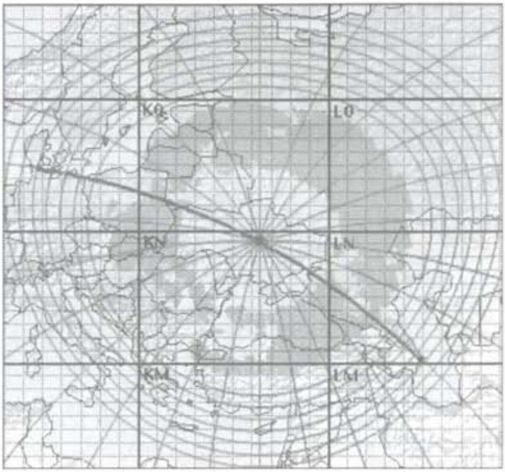


Fig. 4. Dx target map corresponding to the river Dnieper in the Ukraine.

4. Concluding comments

Dx target maps (more examples of similar maps are available in [1]) may be used in various applications, for example:

- analysing very long distance QSOs from recent years and decades
- modifying our strategy in sporadic E radio operation by keeping an eye on antenna directions which correspond to the azi-muth of large lakes, water reservoirs and major rivers
- finding attractive geographical positions when deploying radio beacons in remote areas
- planning dxpeditions in the high season of sporadic E

Reviewing the results in [2], sixty percent of the claimed double hop QSOs from May 20, 2003 appear to correlate to the position of inland lakes and large rivers, see Fig. 1. On June 22, at least two supporting examples are found from a total number of five QSOs (see fig. 9.2 and 9.3 in [2]). The QSO from July 8 provides little support to the hypothesis of radioglint in inland lakes but the July 9 dx opening strongly supports this model because two QSOs are almost perfectly aligned to the position of lakes (associated with dams), another one hits a major river and only one QSO provides no or little support to the hypothesis (see fig. 9.8 in [2]). In this paper, we finally identified three historical examples of double hop sporadic E with path centers corresponding to the position of the lake Balaton and to the river Dnieper, respectively.

All this results indeed provide indications but cannot provide reliable verification of the hypothesis. More very long distance QSOs beyond 3.000 kilometers need to be analysed in more detail. Surprisingly, nine percent of the radio amateurs listed in the Dubus 144 MHz Toplist report sporadic E QSOs exceeding 3.000 kilometers (see [2] and the references therein), i.e. observation data seems to be available but detailed information on this QSOs is not available to the author, unfortunately. Do we chase a phantom or is there an interesting phenomenon in 144 MHz very long distance propagation, we haven't identified in full detail? Perhaps, the sporadic E saison 2004 can provide some answers

5. References

[1] Very long distance propagation in the 144 MHz band, Part 2: Dx Opportunities in the European Sector, Grassmann, V., DF5AI, Langenohl, U., DK5YA, 2003, http://www.df5ai.net

[2] Very long distance propagation in the 144 MHz band, Discussion of the May 20, 2003 dx opening
Grassmann, V., DF5AI, Langenohl, U., DK5YA, 2003, http://www.df5ai.net

[3] BeamFinder Analysis Software, Grassmann, V., DF5AI, 2003, http://www.df5ai.net

[4] Personal communication
Koch, R., DK1KO, 2003

[5] Personal communication
Kraft, J., DL8HCZ, 2003

[6] Expeditionsbericht aus Kreta, 22.5.-7.6.98
Langenohl, U., DK5YA, Funktelegramm, 8, p. 35-36, 1998

Dx-Möglichkeiten bei 144 MHz „Double Hop" Sporadisch-E-Verbindungen - Reflexion von Radiowellen durch Binnenseen und Flüsse

von Volker Grassmann, DF5AI

1. Einleitung

Die Untersuchung der Dx Öffnung vom 20. Mai 2003 gibt Anlaß zu der Vermutung, dass Binnenseen und größere Flüsse die Ausbildung von double hop Sporadisch E Verbindungen unterstützen können [2] (Anm.: wir verwenden hier die auch im deutsch-sprachigen Amateurfunk gebräuchlichen Begriffe "double hop" und "single hop" zur Kennzeichnung von Doppel- und Einfach-Sprüngen über die E-Schicht). Diese Vermutung resultiert aus der geografischen Lage der Streckenmittelpunkte, welche mit der Position von Binnenseen und Flüssen übereinzustimmen scheinen , siehe Abb. 1 im englischsprachigen Teil dieses Aufsatzes.

Die geometrisch berechneten Mittelpunkte der Funkstrecken werden dabei als die Reflexionsgebiete auf der Erdoberfläche gedeutet, die aus dem zickzack-förmigen Verlauf der Funkwege zwischen dem Erdboden und der ionosphärischen E-Schicht hervorgehen. Jedoch bleiben viele Fragen derzeit noch unbeantwortet weshalb in diesem frühen Stadium der Untersuchungen auch abweichende Interpretationen zugelassen werden müssen (siehe die ausführliche Diskussion in [2]):

- es kann nicht grundsätzlich ausgeschlossen werden, dass die in Abb. 1 gezeigten Ergebnisse zufälliger Natur sind, d.h. der vermutete Zusammenhang zwischen double hop Sporadisch E und Binnenseen ist in Wirklichkeit gar nicht vorhanden
- die in Abb. 1 gezeigten Ergebnisse können als Reflexion von Radiowellen auf der Wasseroberfläche von Binnenseen und größeren Flüssen gedeutet werden, welche single-hop Sporadisch E Verbindungen zu double-hop Verbindungen erweitern
- die Ergebnisse werden alternativ als Reflexionsgebiete auf der Oberseite troposphärischer Inversionsschichten gedeutet, d.h. die Radiowellen werden nicht am Erdboden sondern in einigen hundert Metern Höhe über dem Erdboden gespiegelt; die Inversionsschichten werden als lokale Phänomene über Binnen- und Stauseen und Flüssen vermutet, hervorgerufen durch hohe Lufttemperatur bei vergleichweise niedrigen Wassertemperaturen und schwacher Luftbewegung

Offenbar besteht die Notwendigkeit weiterer Untersuchungen, um die Bedeutung von Binnengewässern bei double-hop Spora-disch E Verbindungen zutreffend bewerten zu können. Mit Hilfe der BeamFinder Software [3] hat der Autor die Ergebnisse aus [2] auf andere geografische Gebiete in Europa übertragen [1]. Es besteht die Hoffnung, auf diese Weise weitere Dx Möglichkeiten zu identifizieren und experimentelle Untersuchungen anderer Funkamateure anzuregen. In diesem Aufsatz werden die für den europäischen Sektor wichtigsten Ergebnisse vorgestellt.

Dabei werden sogenannte "Dx Target Maps" diskutiert, welche jeweils einen Binnensee bzw. einen Fluß als Ausgangspunkt besitzen (Abb. 2). Funkamateure können anhand der gewählten Darstellung ihre individuellen Dx Möglichkeiten auswerten. Da-bei identifiziert der Anwender zunächst seine geografische Position bezüglich der eingezeichneten Kreise und Richtungsstrahlen. Im nächsten Schritt ermittelt der Anwender die geografische Position potenzieller Dx Stationen, indem er auf dem gleichen Kreisboden, jedoch in gegensätzlicher Richtung, den entsprechenden Gegenpunkt feststellt. In Abb. 2 ist die geografische Lage der zugehörigen Sporadisch E Wolken nicht eingezeichnet, in den nachfolgenden Abbildungen sind diese Hinweise jedoch zu-sätzlich vorhanden.

2. Der Plattensee in Ungarn

Mit einer Oberfläche von 591 Quadratkilometern wird der Plattensee als ein wichtiger Kandidat zur Unterstützung von double hop Sporadisch E Verbindungen angesehen. Man beachte beispielsweise mögliche Dx Verbindungen zwischen der Südspitze Nor-wegens und Kreta, siehe Abb. 3. Die entsprechenden Sporadisch E Wolken befinden sich einerseits über Ostdeutschland und andererseits über Mazedonien (siehe die eingezeichnete Fläche im Zentrum der Abbildung). Tatsächlich berichtet Udo, DK5YA, von einer solchen 144 MHz Bandöffnung anläßlich seiner Teilnahme an einer Kreta-Dxpedition im Jahre 1998 [4]. Weitere Dx Möglichkeiten bestehen zwischen dem Südwesten Frankreichs und der Krim, Nordwest-Spanien und der östlichen Ukraine, dem Nordwesten Rußlands und Tunesien und sogar, was einer sehr langen Dx-Strecke entspräche, von Nordirland und der Isle of Man nach Zypern.

3. Der Dnjepr in der Ukraine

Etwa 200 Kilometer südöstlich von Kiew weitet sich der Dnjepr in ein ausgedehntes Staugebiet, welches für die hier diskutierten Untersuchungen sehr interessant erscheint, siehe Abb. 4. So finden wir Dx Möglichkeiten von Norddeutschland und dem Süden Dänemarks zum Kaspischen Meer. Reinhard, DK1KO (JO53) berichtet von entsprechenden Sporadisch E QSOs in 1989 (zu UD6DE, LN40) und in 1990 (zu UD70DE, LN40) [4]. Joachim, DL8HCZ, betont, dass eine größere Anzahl vergleichbarer QSOs von Norddeutschland und Süddänemark nach Baku an der Westküste des Kaspischen Meers verwirklicht worden sind [5]. Es sollte erwähnt werden, dass der Dnjepr noch weitere Dx Möglichkeiten bietet, denn entlang seines Verlaufs zwischen Kiew und seiner Mündung am Schwarzen Meer befinden sich weitere ausgedehnte Wassergebiete.

4. Schlußbemerkungen

Die Dx Target Maps (weitere Beispiele sind in [1] verfügbar) können auf vielfältige Weise angewendet werden, zum Beispiel:

- zur Analyse von Dx Verbindungen aus vergangenen Jahren
- im praktischen Funkbetrieb, beispielsweise indem man Antennenrichtungen im Auge behält, welche dem Azimut größerer Binnenseen, Staubecken oder Flußläufen entsprechen
- zur Auswahl attraktiver Standorte für zukünftige Funkbaken in entlegenen geografischen Regionen
- zur Planung von Dxpeditions in der Sporadisch E "Hochsaison"

Faßt man die Ergebnisse aus [2] zusammen, so stimmen sechzig Prozent der vermuteten double hop Verbindungen vom 20. Mai 2003 mit der Position von größeren Seen und Flüssen überein (siehe Abb. 1). Am 22. Juni findet man mindestens zwei QSO-Beispiele bei insgesamt fünf QSOs, welche die hier diskutierte Hypothese unterstützen (siehe Abb. 9.2 und 9.3 in [2]). Das QSO vom 8. Juli kann kaum als unterstützendes Beispiel gelten, hingegen bedeuten die QSOs vom 9. Juli eine erhebliche Unterstüt-zung des Modells: zwei QSOs entsprechen nahezu exakt der Position von Stauseen, ein anderes trifft präzise einen größeren Fluß und nur ein QSO liefert keine oder eine nur geringe Übereinstimmung mit Binnenseen oder Flüssen (siehe Abb. 9.8 in [2]). In diesem Aufastz wurden ferner drei „historische" Beispiele von double hop Sporadisch E QSOs erwähnt, welche mit der Positi-on des Plattensees bzw. mit dem Dnjepr korrespondieren.

Dies Ergebnisse liefern wichtige Hinweise, eine zweifelsfreie Bestätigung der Hypothese ist damit jedoch noch nicht erreicht. Es sollten wesentlich mehr 144 MHz Langstreckenverbindungen über 3000 km Entfernung untersucht werden. Erstaunlicherweise berichten neun Prozent der in der Dubus 144 MHz Toplist aufgeführten Funkamateure von 144 MHz Sporadisch E Verbindungen über 3000 km, d.h. entsprechendes Beobachtungsmaterial sollte bereits vorliegen, leider konnte der Autor die Einzelheiten die-ser QSOs jedoch nicht in Erfahrung bringen. Jagen wir gar ein Phantom oder liegt hier ein interessantes Ausbreitungsphänomen vor, welches wir noch nicht richtig erkannt haben? Vielleicht wird die kommende Sporadisch E Saison 2004 einige Antworten liefern können.

Die Literaturangaben sind im englischsprachigen Abschnitt aufgeführt.

FAI News

Reports, Info, Theory

Editor: Dom Dehays, F6DRO
f6dro@aol.com

There were many FAI QSOs during the 2003 season, but unfortunately very few reports received. First of all, tnx very much for those who reported. Most of the openings this year occured just after a big Es opening. Some scattering points were located in unusual places, giving FAI in northern EU, like it was predicted in this column previously. I am especially interested to get more reports from the 21 July event.

CT1FOH, IN50ra, June 5th 2003:
2200 Hrd several Italian stations QTF 50°

I4YNO, JN54kp, June 4th 2003:
2115 CT1FAK IN50 QTF 285°

IC8FAX, JN70, June 24th 2003:
2008 UT5JCW via KN16 scp
2008 RZ6BU send me via clx hrd report FAI 53F
2026 S53J (S57EA op) worked above Budapest he has 85Az, 5 elv, Me: 30/35 deg

PE1LWT, JO22va, wkd on ? :
2045 I2FAK JN45 52F 51F H/H QTF 75

S53VV, JN65um, July 22nd 2003:
1656 RA3AQ KO85SP QTF :35-40 deg
1735 UR5LX KO70WK QTF : 48 deg

S55AW, July 5th 2003:
1733 UU7J

UT5JCW, KN64sn, wkd:
21/07/2003

19:26	I2FAK	JN45OB	59F	57F	CW	QTF300	1912
19:29	S57TW	JN75EX	57F	57F	CW		1504
19:32	S53AC	JN76MC	55F	55F	CW		1452
19:34	IZ4BEH	JN54WL	55F	55F	CW		1712
19:36	S51MQ	JN75NT	55F	55F	CW		1446
19:40	I4YNO	JN54KP	55F	55F	CW		1788
19:47	S51WX	JN75OS	55F	55F	CW		1440
19:49	S57LM	JN76HD	55F	55F	CW		1485
19:50	IC8FAX	JN70CN	55F	55F	CW		1640
19:53	S57EA	JN76HE	55F	59F	CW		1485
19:57	S51DX	JN76CC	55F	57F	CW		1517
20:02	I4RHP	JN54QL	55F	57F	SSB		1751
20:07	YU1EV	KN04CN	55F	55F	CW		1055
20:16	IK4DRY	JN64BL	55F	43F	CW		1693
20:20	DL3RBH	JN68IK	55F	55F	CW		1646
20:24	IZ1BPN	JN35VG	55F	55F	CW		2020

YO3FFF, KN24nd, July 5th 2003:
? 7X2MA JM16 QTF300°

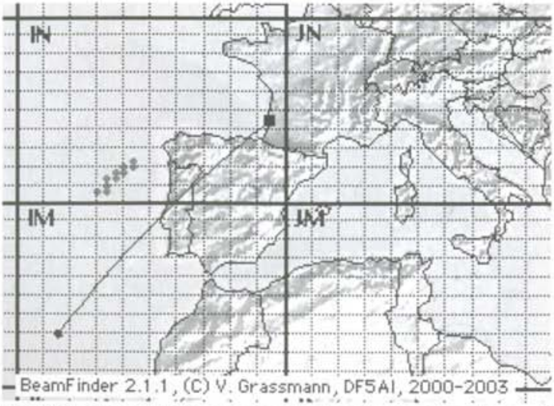
Hardcopy of cluster spots:
04/06/2003
2131 HB9JAW144290 CT1FAK 51 FAI in JN47 QTF :250
2121 I4YNO 144290 CT1FAK FAI JN54>IN50 QTF 280-290
2118 IZ4BEH 144290 CT1FAK 55 JN54WL FAI
2125 IK1SPR 144290 CT1FAK IN53QO 55 in JN34 QTF 280
2110 CT1FAK 144290 I4RHP FAI !

FAI on the Edge

Southern France to Madeira

Volker Grassmann, DF5AI

In this column, FAI opportunities are shown which might encourage radio amateurs to conduct unusual dx propagation tests.



FAI scatter volumes (dot marks) corresponding to the path F – CT3.

Please contact the author at feedback@df5ai.net or, alternatively, visit the www.df5ai.net webpage if a detailed analysis of antenna headings, target areas and scatter volumes is required in serious propagation tests.

2-m-EME News

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

- **ARRL-EME.-Contest 2003**
- **Around 2-m-EME**
- **News and information's**
- **Once there was a chat about...**
(Chats of common interest in INTERNET)
- **Treasury INTERNET**

ARRL-EME-Contest 2003
First Part

-AL7EB: I did hear a few stations last night even thru the aurora: Big guns W5UN, KB8RQ, I2FAK, station at .044, KJ9I, maybe CT1DMK at .033.... and of course KL7X (my neighbor 100km NE of me). After 0930 the Moon rose out of my beam so quit.

-N1BUG: On 2m I was hearing many stations, but having some difficulty getting their attention even though I am running good power and everything looks fine with the system. Probably just conditions. Worked only 3 sta-tions. By 0600z, operator starting to break down! Unit complaining about being extremely cold when going outside to move antenna. By 0700z, operator wrapped in multiple layers of clothing and shaking so hard it could barely generate CW. Tried increasing temperature in shack. Tried filling malfunc-tioning operator with hot liquid. No change in performance. Unit re-fused to go outside to turn an-tenna, then entered auto-shutdown mode. Unit seems functional after powering up this morning, but ?????? So much for the first pass.

-VE3AX: It's been a long time since I have made a 2m EME contact so had to sharpen up a bit at first! I've been down with a bad elevation jack for almost a year now, but managed to find one and get it installed last weekend in hopes of being around a bit this weekend. I was busy Saturday so did not get on for the 1st pass but I did manage most of the 2nd pass with a few hours out for sleep. The weather cooperated - drizzle early on but very light winds and eventually the sun came out later today. The moon was 6 degrees up when I got on and must have hit a sweet spot - the band was filled with loud signals. That waned somewhat as the night progressed but every once in a while a surprise came along. Not sure what LA9NEA is using these days but wonder if it's still one yagi. New ones included OH3AWW, OH3NJC, WW8M, and S53J. WW8M was equal strength off the moon as he was on tropo but fortunately the signals were a couple of hundred hertz apart. Finished with single yagi station VE1ZJ who was calling CQ on .035 and K6PF who I was looking for all contest and found him calling CQ with the moon at 10 degrees. Here's the list: 32 qso's/ 24 multipliers (I think) -2ND pass only: IK1FJI, RU1AA, I2FAK, HB9Q, F3VS, F1FLA, G3ZIG, OE5EYM, OK1MS, LZ1DP, PAOV, DL5MAE, LA9NEA, S53J, K5GW, OH3AWW, OH3NJC, WB9UWA, W3SZ, KB8RQ, PA2CHR, W5UN, N5BLZ, W7FG, W0PT, K9MRI, JA0BLU, WW8M, JH5FOQ, JN1CSO, VE1ZJ, K6PF

-VE1KG: For the time I spent on the moon I must say I had fun. Conditions were up & down they always are hi! Missed most of the second nite by sleeping in. Not good. Worked 17 stations not a big deal for sure but satisfied taking into account the time I spent.

I only wish I could have worked some of the stations calling KB8RQ. They were so many I could hear & could have worked!! Where do this folks go after they work Gary??? Probably looking for W5UN hi! Anyway had a good time & looking forward for the second leg hopping it is not at nite. I would like very much to work a VK station on the next leg. Or actually any time is ok.

-K2AXX: As a small station - I decided to try a few random QSOs. VERY pleased so far with the result of only a few hours effort. Worked:

F3VS (peaked 559), KB8RQ (very loud as well, neat hearing both the tropo signal and echoes +200hz apart!), I2FAK (peaked 549)

Comments: Found that CW is definately the way to go during an EME contest. Also spent time looking / decoding stations via JT44, and had good success finding people randomly - but NO success working anyone. Decoded a number of stations, none CQing - and waited until the QSO was complete before calling. No success whatsoever. I'm pleased with the result, and will be working to improve the station. Intend to construct a 4-yagi array initially, and hope to have my GS-35b amp online this spring. Currently, 450w out, 16-el yagi with no elevation.

-K0GU: Finally got a 2m array back up. Hoped to be ready for the start of the contest. But ended up working on the array all day Sat-urday and didn't get it going until dark. And then the preamp didn't work. Only one night, no preamp and no sleep before moonrise. Conditions were quite good to EU at times and very poor at other times. Was able to CQ and get a few callers. I was pretty much locked out to the US during all the EU window. Very little activity in the JA window. Stations worked: UA4AAV#, F3VS, HB9Q, DK3BU#, RU1AA, F1FLA, OZ1HNE, LZ1DP#, N5BLZ#, WB9UWA#, RN6BN#, I3EVK#, DL5MAE, DL6BAG/P#, OK1MS, W5UN, JN1CSO#.

Hrd: SM7WSJ, VE3AX, K6PF, I2FAK, I3DLI, PA3CWI

-S52LM: Poor EME conditions here, so it was very hard to work stations on CW. Luckily, I was able to work several on JT44. Worked stations in first Leg: IK2DDR, I1FJI, I2FAK, RU1AA, F3VS, F1FLA, HB9Q, JN1CSO, EA3DXU, RN6BN, K6MYC, PA2CHR all in CW. And in JT44: DLOUL, I2RV, JM1GSH, W3EME, PA3DZL, ES6RQ, SM7BAE, RK3FG, PA1GYS, DL7UAE, SP2OFW, VK2KRR, OK3DL, EA1FDI, UA9SL, JL1ZCG, K3IB, NJ0U, S53J, KJ6KO, EA1YV, ES6RQ, ON4ARF.

-SM7WSJ: I was active around 9,5 hours this weekend, worked 19 stations! I have heard much more and also missed a couple coming back to my CQ (some because I just could not get the callsign together and some because someone started to CQ right over the station calling me). Started saturday without the cable to the vertikal El mounted, but big problem making QSOs, I spent the afternoon making it finished. Sunday I worked with both V/H and it sure is nice to be able to listen in both polarisations. Interesting to see that it is possible to switch out the big ERP stations and not hearing anything from them in wrong polarisation. (not always! sometimes I hear them in both) (what I learned last week the polarisation can be slow in rotation in low sun activity times so i guess the coming years will show the value of V/H). Something i dont understand is how I can spend 1,5 hour to work a 539 signal station calling CQ and trying both polarisation without any success?? Something must be wrong! I am only running 1 KW into 4 yagis and sometimes I think it is more power needed to have success on random. I have worked a couple of station using 100 Watt so it seems the array is working, I have also very good echo from time to time.(S2 reading).

-I2FAK: This year Murphy did stay away and I was able to really test the performance of my new ar-ray 24 x 19LLY antenna system for the entire contest time. Results I did achieve confirm the quality of the new arry. Despite of moderate conditions I have closed the 1st leg with 138 qso's and 46 multipliers. 2 qso's were made in jt44.

-G3ZIG: I agree with most of you. Conditions were terrible. I went the longest periods I can remember without hearing my own echoes. I thought the coax had dropped off!! I finished up with 62 qso's and (I think) 35 multipliers.

-RU1AA: For some time I have been very busy building with my friends new antenna 16x5wl crossyagi. We have finished assembling it just before the contest. In the first night the conditions were good, but I lost the moon after first hour of operation, as the elevation angle tunned out to be too low. The result isthe loss of 5 hours. I altered the elevation by the afternoon, but the conditions became worse. Then drizzling rain made the elements wet and on sunday night the temperature dropped below the freezing point, we got some icing. The condition became so bad, that I could not remember any worse conditions. We could not receive our echo signal on any polarization through the Aurora. As a re-sult we could not receive many strong signals. Even I2FAK we made out after second call. Anyhow we got 128 QSO's, 42 mult.

-DF2ZC: Due to business I could only be QRV some 2-3 hours on Saturday. As with most of us conds have been very changing. For more than 60 minutes I couldn't even hear my own echos but then they gradually returned. And even the big guns were pretty low in strength at times.

09:05 F6HVK	JN27LH	
09:25 RU1AA	KP4ØXD	519
09:45 KL7X	BP51BG	529
09:56 LZ1DP	KN22TR	
10:08 RK3FG	KO86HP	
10:08 PA3CWI	JO11TK	
10:20 G3ZIG	JOØ2QQ	519
10:49 KB8RQ	EM79SV	539
10:58 I2FAK	JN45OB	539
11:05 DK3BU	JO33NO	529

-PA2CHR: During the first part of the ARRL contest I made: 54 QSO's with 28 multipliers on 2mtr. Conditions up and down, lots of polarisation chance, I was happy with Hor / Vert. switch on 2mtr!

Second part

-PA3CWI: The party is over and I had a lot of fun! Seems like my new antenna system is performing well. Saturday 15 October was windy here so I could only be on for about 3 hours, conditions seemed fair but the noise-level increased as the moon was setting. I worked SV1BTR (loud), OK1MS and WA8CLT. On Sunday 16 October I was active for about 6 hours. I worked DL8YHR#, LZ2US, S53J (took me about 30 minutes to get his call...sri and tnx for your persistance!) S52LM, SP7DCS#, PE1LWT#, YU1IO#, YO2AMU, DK3WG, DL7MAT#, RX1AS and K6PF (nice signal Bob, not much difference with the sigs of RN6BN!) I might have missed a few that I could not pull out of the noise.. Heard with fb sigs: SM3PWM, SM3MXR, KC4VI, DF7KF Unfortunately no Japanese stations. Total of 43 contacts with 7 initials

-YO3FFF: I made 4 QSOs in this leg (in the first one I was QRT). Worked: KB8RQ #initial/country, W5UN #initial, I2FAK, F3VS.

Heard: - RU1AA - loud an clear most of the time; trying to call him several times without success... - K5GW very weak - HB9Q very short - LZ2US on 15.11.03 - hearing him on TROPO and in the same time on the moon with delay and down to its TROPO freqency. It was the first time when I was hearing a station on TROPO and EME in the same time and I can say that is amazing! The signal was loud enough to be hear in the speaker and I've listening together with my family... The CONDX were good in my side for my little station. Never worked 4 stations in a EME Contest HI!

-K6PF: Completed 11 QSOs on 16 Nov. of which 2 were duplicates & picked up one new initial - K6MYC. I've worked Mike many times on SSB tropo but never on eme before. Also, I forgot to add K0GU as a new initial (#162) on 15 Nov. I saw Jay's posting & a # by my callsign. His call sounded so familiar I was sure I had worked him before but didn't. Guess it's time to implement a computer logging system to track these statistics. Here's a summary of stations I workedincluding report sent/rcv'd & polarity (tx/rx):

IK1FJI O/R RO H/H (Duplicate from 15 Nov)
W3EME RO O/R V/V
K6MYC RO O/R V/V (initial #163, my CQ)
PA2CHR O/R RO H/H (my CQ)
W0PT RO O/R H/H
OK1MS O/R RO H/H (my CQ, duplicate from 19 Oct)
RN6BN RO O/R H/H (valid QSO this time after my error yesterday calling RB6BN)
DF7KF O/R RO H/H (initial #164, my CQ)
PA3CWI RO O/R H/H (my CQ)
G3ZIG RO O/R V/V
K9MRI RO O/R H/H

Called OE5EYM a couple of times but no reply. DL7MAT called me & was extremely weak. When I finally got his callsign copied & sent O's, I lost him. Again, I apologize for all the QRZ's I sent to replies to my CQ's. It's a combination of condx & a learning process for me. All in all, I had a lot of fun. Tnx to everyone who I worked & I'm sri I couldn't com-plete with a lot more of you.

-9H1PA: I was active on Saturday for about 3hrs and worked 10 stations. Echoes were a bit down and alot of cross pole and polarity stuck on vertical. Last qso was with K5GW at moon set and conditions were still vertical here, not a wisper from him on horizontal , a typical polarity lock up. PA2CHR and RN6BN very stronge signals. I don't know why the ARRL still look for High Declination weekends and not best loss weekends. I would prefare to lose a hour of operation for lower loss, but that is how I think it.

-F9HS: 18th October - F3VS RN6BN I2FAK K6MYC K5GW RU1AA
19th October - I3DLI LZ1DP KB8RQ W5UN #DK3BU F1FLA
15th November - HB9Q IK2DDR IK1FJI OK1MS EA2LU PA2CHR KJ9I LZ2US SV1BTR G3ZIG
16th November - JN1CSO S52LM S53J K2TXB K9MRI OE5EYM LA9NEA
29 stn by 20 multi if not wrong

-DD0VF: After more than half a year of inactivity I really enjoyed in listening weak CW-sigs! The 1st part of contest I was in Italy (visited Giorgio IK1UWL twice - vy nice qth + rig), so there was a lot to do.

My old stuff - 4x7el 1.5wl, 550W and preamp in the shack is still working:

wkd Nov-15 0034: I2FAK on 1st call 14dB S/N only called 50min at all RU1AA - strange a easy job usualy called also I3DLI and KB8RQ headache + poor cond so i gave up after 4 hours....

wkd Nov-16 0454: KB8RQ 19dB S/N 0648: I3DLI 14dB S/N
0722: W5UN 21dB S/N easy (1h ago i lost Dave while waiting for RRR)
0735: K5GW 16dB S/N vy easy
0804: RN6BN 15dB S/N easy tnx #103
0856: HB9Q 15dB S/N easy
1020: DK3BU 15dB S/N easy tnx #104
1028: DK3WG 14dB S/N easy
I noticed fb euro cond 1000-1045
(rst copy SV1BTR and qso DK3BU, DK3WG)
called: RU1AA agn, just one qrz than cq cq
SV1BTR, F1FLA, IK1FJI, K6PF, LZ2US, KJ9I
hrd: I2FAK up to 20dB S/N, K9MRI, LZ1DP, OK1MS. I was looking for VE3AX and VE1KG, but nothing hrd :F3VS was nil (Birdy S7 on qrg)

-PE1LWT: Hereby a list of worked station during the contest: F3VS, I2FAK, I3DLI, KB8RQ, RU1AA, W5UN, RN6BN#, DK3BU#, F1FLA, HB9Q, G3ZIG, LZ1DP, IK1FJI, K5GW, KJ9I, K6MYC, N5BLZ#, K9MRI, SV1BTR, EA2LU, PA3CWI#, OK1MS#, LZ2US, HRD: K6PF, JL1ZCG, DF7KF, DK3WG, PA3DZL, SP2OFW. CWR:W3EME, JN1CSO, VE3KG

I found conditions ok this weekend, a lot of signals were received vertical. The activity was less than previous years, missed the swedish gang and no canadians in the log. Listened to some JT44 this evening, but (un)fortunate this mode doesn't excite me much. I am very happy with the new LINRAD RX, the total rx polarity is under control now. The only problem I have right now= I can SEE on my receiver the neighbours waking up, when they switch on all different kind of electronic devices, the noise level on my screen is going up.

-SM7WSJ: I REALLY ENJOY MY NEW TOY! 4 times X pol!! Very interesting to work with both polarisation and in a couple of qso when i was TX H and RX V i forgot to change back the polarisation and the other station transmitted same report again, When i switched to right polarisation! There it was!! The QSO complete! Very nice feeling! Feels like it was worth the big work to get it going.

I could not spend so much time on the contest (very young family) but worked 32 stations.

I heard many more stations and some where calling me on my CQ, when i was almost 100% on the call i lost a couple of them. (working EME is hard but fun! and i feel for every year i learn more and more about how it works.

with this setup i am sure to work 100 station in future ARRL if i could only spend full time and get more random experience and of course not using QRZ so much HI!!

-SV1BTR: I was qrv in the 2nd part of ARRL EME Contest weekend and was vy glad to test my new 2m array, new eme qth and work much better than the 1st pass!

In the 1st pass I was qrv only 1/4 of the time with my 4*15el. uwa low sidelobe yagis from home qth, had >2:1 swr due to some problems, my rx was way down and as a result worked only 20 stations.

In the 2nd pass after 1 year of hard work, i finally became qrv from my new eme qth, which is our weekend house 2 hrs drive from Athens. New array used there is 16*6el. 1wl xpol designed originally by VE7BQH as a 5el. And finalised by WB9UWA as a 6el. My thanks goes to both for their help & effort. Total array gain is around 22dbd. Pictures upon request. 2nd pass was qrv most of the time, except a 3 hour slot in US moonrise on Sunday where i had unexpected S9+ qrm. 2nd part worked 53 qsos, 52 stations. Also, in new qth i am losing at least 2.5 hrs of operating time at my moonrise, array seriously un-derperforms due to trees' blockage. So had a 2m total of 72 stations, 73 qsos, all in cw random. 9 initials for a cw 2m eme total of 290. No internet, no cluster spotting, or even pc used at all. Last year's contest worked 63 stations on 2m with my 4*15el. 4.4wl

Murphy?

-AL7EB: Temp QRT as lost the pulse signal from my elevation actuator arm. Wire must have pulled loose by the storm last spring. I did not test the elevation in my hurry to finish by sunset, or I would have detected it before raising the array. I will lower the array during daylight (after 1700) and see if it can be fixed (wx permitting)

-N1BUG: I detect the presence of Murphy. It must be a contest weekend! I started out the night on 70cm, worked DL9KR. Was calling F6KHM when the rotator completely failed! 70cm antenna now can not be moved at all. QRT 70cm. Made two trips up the tower to investigate dead rotator. The motor winding is burned out! On 2m I was hearing many stations, but having some difficulty getting their attention even though I am running good power and everything looks fine with the system. Probably just conditions. Worked only 3 stations. By 0600z, operator starting to break down! Unit complaining about being extremely cold when going outside to move antenna. By 0700z, operator wrapped in multiple layers of clothing and shaking so hard it could barely generate CW. Tried increasing temperature in shack. Tried illing malfunctioning operator with hot liquid. No change in performance. Unit refused to go outside to turn antenna, then entered auto-shutdown mode. Unit seems functional after powering up this morning, but ??????

N5BLZ: Power noise was killing my receive this weekend, in some directions it was so bad the only thing to do was to QRT for as much as two hours at a time. The noise source must be close to my QTH, with the antenna pointing up high it made no differance what the azimuth was. I phoned the light Co. this morning, they thanked me for calling and told me I was on their long list.

G3ZIG: Murphy made two visits, neither of which were too serious.Lost my Az indicator just before the start so was about 15mins late starting and alco lost drive from the transverter half way through the contest (a dirty switch wafer) so a little cleaning and was bag in business.

Around 2-m-EME

DL4KG: Yesterday I jumped off my chair when I worked V5UN with 100 W from my TS-2000, SSB preamplifier (abt. 0.8 dB NF) and a single 10ele-yagi in JT44 mode. Dave was at -16 dB and I could hear him in the speaker. The QSO started when the moon was about 11 degrees above the horizon and ended 35 minutes later at 4 degrees. I have no elevation on 2 m. Today I could monitor KB8RQ at -20 dB but also audible in the speaker. As he was very busy I didn't call. After many years of absence on 2 m I put up this small yagi to try meteor scatter with the WSJT program. It worked from the first moment and I worked up to 1600 km and made a 2600 km QSO with sporadic E. Now I was successful with QRP" on EME. Not too bad for a new start on 2 m.

IK2DDR: I made some activity, during this weekend (Sept.) and with surprise, i found a good activity. Maybe is the ARRL contest effect. I was very happy on working on random the followings stations: Saturday Sept. 20
7:57 DK3EE (LOUD)
8:33 OH3NJC he called me and i answered with my "OOO" report, but he disappeared (VERY NICE SIGNAL)
8:53 PA3CWI (LOUD)
9:01 F3VS (VERY STRONG AS USUAL 559/539)
2:21 W0PT (LOUD, NICE ON WORK HIM AFTER long time)
2:33 OH3NJC (LOUD) #452
SUNDAY 21
4:43 RH6BN (LOUD)
5:27 YU1IO (VERY NICE SIGNAL)
5:36 DK3EE (loud and strongerthan yesterday
:02 EA3DXU (HE IS THE REAL BIG GUN, HIS SIGNAL WAS SECOND ONLY AT F3VS.17db s/n IS NOT SO BAD FOR A 2 YAGI STATION) Nice to work you after so long time Josè. I wish to hear you much more active on CW, like in the past.
5:26 F1FLA (very loud)

DK3EE: this weekend i worked following stations on cw random: 29.09.
7.42 f6fhp on my cq
3.17 ik2ddr strong on cw , qsy ssb ... 33 and lost him - next time francesco !
3.34 f1fla on my cq
30.09. 09.17 df7kf fb sigs !
09.57 ua4aql on my cq
14.07 oz1hne fb

-EA3DXU: After long time without CW activity on 144Mhz, I am QRV again, my noise problem have practically disapeared and I can be QRV again on CW segment this weekend have experienced again CW sound. Hi.
20 / 9
05.52 RK3FG O /O JT44 random
06.27 DK8ZJ O /O " " BIG birdie + 27 db only 40 Hz dow synk QRG FB QSO
11.30 KB8RQ O /559 CW " FB sigs from Gary
12.08 WA4NJP O/ 559 " " 432 Mhz
13.05 OE9ERC 559/559 " "
Heard on 432 K2UYH and FY5DG
21 / 9
04.40 JA6AHB heard and called on JT44 432 Mhz , no report only QRZ
05.40 ? U1 ?? never get the call after many QRZ on my CQ
06.05 IK2DDR O / O FB sigs and eassy QSO after near 1 year Hi
06.12 F1FLA O / O FB sigs
07.58 OK2DL O / O Fb sigs on sked new initial # 488
08.36 DK3EE O / O week signal but finally we completed on random , Tks Tom
08.49 F3VS 549/449 FB as ussual
09.30 FY5DG - / - nil 432 Mhz sked

-RU3ACE:Only 2 qso in this moon window:
21/09/2003 12:15 ES6RQ KO38AJ RO O
23/09/2003 05:07 DF2ZC JO30RN o ro
1x5wl DK7ZB (in future 4x2,5wl) elev. max 50 deg, GI7B

-LU6KK (Sept): After my first test on 144 mhz this morning, I believe that I have that look very well my system of antennas. Only I listen to the big stations, like F3VS, KB8RQ, F1FLA ... I could not listen to my echoes on any opportunity and F3VS only say qrz??? after my call, tape-worm several stations calling it. I expect to be able to check well the details of array and to be qrv promptly.

-KL6M (Sept.):

UA4ALU	144.147	NIL, EL TOO LOW	
PA3CWI	144.107	O/O	#15
OH7PI	144.090	O/O	#16
PA0JMV	144.090	O/O	#17
RN6BN	144.090	O/O RANDOM	#18
RA4AOR	144.147	O COPY, lost sig after 1st seq	
RK3FG	144.143	O/O	#19
KJ9I	144.092	O/O	#20
W0PT	144.112	O/O	#21
WA4NJP	144.092	O/O	#22

ALSO HEARD O COPY: YO4FRJ, DK3BU

-SP7DCS (Sept.): After a lot of work I have just rebuild my system that was damaged last autumn (before being finished). It's 4 * (21 el. H + 21 el. V) SP7DCS CROSS-YAGI. Each YAGI has 13.5m long boom. What's more - It has even mechanical rotor - what is a very new situation for me hi! I worked this weekend and I think it is a big success - a can hear my own echo, what was impossible with single yagi. I managed to work on random: F1FLA , DF7KF #, JN1CSO #77, I2FAK (539/O). I find it difficult to get used to point antenna whitch needs such accuracy in pointing to the moon. It is new for me and it must probably take some time to get used to it.

-F8DO (Oct.): Poor activity here with bad degradation and no many time for EME. Nevertheless Friday and Saturday evenings echoes were good.
10th F1FLA loud as usual
F0CXO nice contact with Christian who just test his new 4X17 el array.New one on 144 # 109 here. Christian has good sigs and nice reception. Welcome Christian in EME gang. Sure you could make a lot of QSO's
11th IK2DDR 529 nice sigs with strong QSB
Heard YO2AMU 10 october with F1FLA

-VE1KG (Oct.): Just to let you know we survived Hurricane Juan. Here we live right on the coast. We have water frontage & our home is about 250 feet from the salt water. No protection from the Southwest to the East. Winds gusting to 95MH/155KM. Pretty scary stuff. The good news is my 4X17M2 array survived. So if you were worried about wind survival of M2 antennas DON'T. Thank you Mike (K6MYC). The H FRAME is fine. The Heavy duty 40LB hinge which Ray WA4NJP build for me years ago is probably the reason. Thank you Ray you are the MAN!!!.The bad news is i have dozens of tall spruce trees uprooted & leaning on each other all around the property. Also some damage to my roof which needs repairs. I want to thank Gary KB8RQ who called everyday. Just got the phone back 2 days ago & Power last nite. I have 256 emails to read.That is what i got in 8 days mostly junk of course.I do not own a boat but there is one sitting on my front lawn!!!!

News and information

-JT44 in EME by K2UYH

K2UYH has been presenting a Power Point presentation on JT44 in EME for smaller EME stations in particular. (at CSVHF and other meetings). Al has earned his scores and awards in EME. He has been active and promoting EME for decades and is a very credible player, technically as well as a radio amateur. It is highly significant, I believe, that someone with this record is promoting JT44 as a means to increase EME activity and to bring EME QSO's within a larger number of those interested in VHF/UHF weak signal work. As many of us experience it is harder and harder to run large stations in terms of ERP. JT44 and other DSP based techniques offer possibilities to negate some of these factors to a certain extent at least. The presentation shows even a few examples of EME in the field. JT44 is certainly not a method for the so-called dumb-down hams, often referred to, in certain circles. Of course we are all free to select methods and techniques according to our views and resources. The power point file is about 2MB large and requires MS Power Point software. I have also extracted the individual pages for viewing without power point. http://www.nitehawk.com/rasmit/jt44_50.html
At the bottom of he page are some links to detailed info on JT44.

-Ecoflex 15 (SM5IOT): The best ever coax i ever have used in stacking config... Low loss and low attenuation. It's like a rg 213 physic.. it's a perfect stacking cable for 144, 432 etc.. and not to mention the quick N7/16 con (solderless)!! I just love it !!Forgot to mentioned it's a 1/2"cable with foam (15 mm with)

-Local horizon (by W7GJ): Knowledge of the local horizon is especially important on VHF/UHF because:
1. For EME, it permits you to know when your moon really appears.
2. On 6m, take-off angle is critical for working DX on on F2, and for long distance VHF meteor scatter contacts.
3. For roving around on VHF/UHF, a clear horizon is essential for good tropo.

Roger Coude has been kind enough to include local visual horizon profiling in Version 4.4.5 of his very versatile (and FREE!) "Radio Mobile" program. The program has primarily been used for mapping and determining effective repeater coverage, but now is sure also to be a hit with VHF/UHF DXers. With it, you can evaluate potential remote/primary sites or portable contest locations right from the comfort of your own computer room! More information about Radio Mobile can be found at:
http://www.cplus.org/rmw/english1.html
In order to make the most of the program, you also will need to download high resolution Space Shuttle Radar Topography Mission (SRTM) data (a high speed internet connection is required) for your location: ftp://edcsgs9.cr.usgs.gov/pub/data/srtm//
An example of the type of information that is easily produced from version 4.4.5 can be viewed at:
http://www.bigskyspaces.com/w7gj/horizon.htm

-Nested Yagis (GW4DGU): Since posting my original query about nested yagis, I've run some reasonably thorough simulations of my proposed nested 144/432MHZ antenna.
I can only comment about the antenna system I've been evaluating, but my provisional findings are:
1. Without the support structure, the gain and pattern degradation of the two symetrically placed antennas was in the noise.
2. Adding the support structure caused the gain of the 144MHz antenna to fall by around 1.5dB, but the 432MHz array was essentially uneffected – just some minor pattern changes.
3. The gain degradation on 144MHz was mainly due to currents flowing in the booms of the 432MHz antennas.
4. Breaking-up the resonances in the 432MHz yagi booms restored the gain of the nested 144MHz antenna to within 0.3dB of its unnested free-space gain.

I used the Orion NEC4WINVM software, allowing me to circumvent the 500 segment limit inherent in EZENEC and most other PC-based implementations of NEC to carry-out these simulations, some of which took several hours to run.
I have still to complete the design of my new antenna, but I'm now able to conclude that it IS possible to make a nested array perform at least well enough for serious terrestrial work, and probably well enough for casual EME (if that's not an oxymoron!)

-Tracking initials (WB9UWA): A few years ago, I was having trouble keeping track of my EME initials, so I wrote a simple GWbasic program to track them. Recently, I modified it to track JT44 initials as well. I am not an advanced programmer and am sure that some pretty basic improvments are possible. Below is a breakdown of how the information can be summarized. If you wish to try it for yourself, it can be downloaded at this site: http://www.n1bug.net/

-SP7DCS: I want to inform you that due to changes on my WWW server my address has changed to: http://sp7dcs.webpark.pl

-SP2OFW: Hello pse look on my new www adr, my home page is now on new serwer http://free.of.pl/m/moonbounce/ later adr will be http://sp2ofw.of.pl

-ARGO (W8WN): Several have asked about Argo, the weak-signal detection program. It's the "little brother" of Spectran. Both run under Windows (but Spectran, with its filters and other things) may have trouble running under some audio boards. Both "should" run at the same time as WSJT, and Argo does quite well at the same time as WSJT (and with D4 and other programs also running). While FFTDSP is still probably the preferred weak-signal detection program, if you can't easily use it, try both of these. They should be available at http://www.weaksignals.com If that Web site is down, do a search on Google for Spectran Argo and you should find several other Web sites that have it. Other programs that may be helpful to you: All can be found on (or linked from) http://www.qsl.net/w8w8n/hscw/access.html

If you have to change your audio mixer settings for different programs, get QuickMix. After setting it once for each program, 3 mouse clicks brings back the proper setting. Besides Dimension 4, several other computer-clock-setting programs. Some, like D4, use the Internet. Some work without an Internet connection. (Some free, some shareware).

Z-Track - N1BUG's moon-tracking program. (DOS, but runs fine in a small window).

Irfanview - a screen-grab program to save the contents of a window on your computer as a JPG file.

I use most of them (tho use only 2 of the clock-setting programs), plus others. Most are freeware (I'm cheap).

Also check on some of the other links, services, & info available in the Quick Links at the top of the Hot News page at http://www.qsl.net/w8wn/hscw/papers/hot_news.html

-KB8RQ: To those my E-Mail has been bouncing? You can send to KB8RQ@yahoo.com it works all the time.

-W5UN: Gang, here is the latest information I know about upcoming DX on 2 meter EME:

VQ9, (2 X 6.3wl, 400 watts, CW, JT44) later this year.

YA, (2 X ??, 700-900 watts, CW, JT44?)

3Y (2 X ??, 100 watts, JT44, CW?) (Peter Isl), January 2005

VK0M, (unknown ant or power, JT44 only) tentative, date unknown.

I will release full details as soon as I know any. Do not email me asking anything about these, as this is all I know at this time.

-JT44 (IK1UWL): Hi friends, I sometimes monitor the 2m band for EME JT44 signals. Since everybody transmits on integer kHz frequencies, no decimals, I push the Tuning Speed Switch (TS) of my IC781 to select 1 kHz steps instead of 10 Hz steps, put the JT44 sw in Monitor, and wait approx 90 seconds on each frequency. Everything would be easier if the segment to be explored was small. Now, since in region 1 IARU has assigned to MGM (Machine Generated Modulation) modes (narrower than 500 Hz; and JT44 is 485 Hz wide) the segment 144.140 - 144.150 MHz, if the JT44 activity concentrates in this segment, random qsos would be possible spending not much more time than with CW.

-New cable (KJ9I): Andrew has new Heliax available. We all know the Low Density Foam LDF7-50A product (7 means 1 5/8 inch diameter) and - 50A is the later version LDF in 50 Ohm impedance. The new product has improved foam dielectric and is called Andrew Virtual Air AVA7-50. The new AVA7-50 can be seen at

http://www.andrew.com/search/docviewer.aspx?docid=6681

The loss is slightly improved at high frequencies. For 2m, however, there's little difference in loss (150 MHz is spec point): LDF7-50A is 0.254dB/100 feet while the new AVA7-50 is 0.243dB/100 feet at 150 MHz for an improvement of 0.011dB/100 feet. I thought you'd want to be current (and we moon-bouncers know the value of every dB or fraction thereof better than any crowd). (Andrew also has AVA5-50 in 7/8" available).

-GM4JJJ: Today I have updated the Macintosh Classic version of MoonSked:

What's new in this version:

- World Map Moon footprint rendering improved.
- Imported skeds now show up immediately again.
- Drag & Drop of callsign between callfinder and MoonTracking fixed.

Downloads from www.gm4jjj.co.uk/MoonSked/moonsked.htm

-New JAVA software: I have updated my JAVA software package (project_Auriga) which does some moon tracking, skymaps and logkeeping. For those of you who are interested, have a look on my homepage / software area.

I have the code under GPL license. Feel free and use it. The compiled classes are made with the latest JDK 1.4.1. So you need the JDK (Java Development Kit) or JRE (Java Runtime Environment). The oldest version which it should work with shall be JDK 1.2.2. There is still a bug in calculating the doppler shift (see src/astro.java). Perhaps I do not understand it correctly. Nevertheless that gives funny results. If one of you has any idea, let me know. Actual pA-version is x2.0.6

-EIMAC tubes (K6PF): In case you are not aware of it, there is a great section of Eimac's website called "Care & Feeding of Power Grid Tubes". It's at the link

below: http://www.cpii.com/eimac/index.html

I printed out an extra copy on my laser printer. It's 164 pages & 3 hole punched to fit into a binder. If anyone is interested & doesn't want to print it out, it's available for $10 + postage fm zip code 92708. That should cover the cost of paper & toner cartridge.

-JT65(K1JT): Exciting new JT65 beta test program is available now: http://pulsar.princeton.edu/~joe/K1JT/

If you are making use of the new JT65 mode in WSJT version 4.1.1, please read the page of FAQ and Operating Tips posted on the WSJT Home Page. The exact URL is http://pulsar.princeton.edu/~joe/K1JT/WSJT4Q.TXT

If you know of other things that would be helpfully explained there, please let me know.

Once there was a chat about... (Chats of common interest in INTERNET)

-Noise blanker (WB9UWA): In Leifs article in QEX, September/October 2003 issue, titled Linrad: New Possibilities for the Communications Experimenter,Part 4. I believe Leif is still talking about the noise blanker when he states: "I do not know how the IC-706MKIIG compares to other receivers, but I believe the results for the IC-706 are typical."

I have compared several VHF radios in actual use and can compare the built in noise blanker. I have used the Kenwood TS700A, Icom, IC202, Icom IC271A, Yeasu FT736R, Yeasu FT621B, Icom 706MKII and most recently a Yeasu FT100D. In short, the Icom 706MKII noise blanker is the worst one I have used by far. The 706 has a high threashold before any blanking will happen. It blanks very few line noise sources effectively. Even when it does a good job on ignition noise, nearby S-9 signals will completely turn it off. It also has an annoying clicking sound on S-9 signals. This is more evident on the AM mode. I made mine less annoying by reducing the value of the time constant capacitor on the noise blanker AGC loop. I was unable to make the noise blanker work properly on this rig and Icom was not interested in improving it. It acts like there is an unwanted feedback path in the noise blanker but I could not isolate it. Other then the poor noise blanker, the Icom 706 series is superior in every other way to comparibly priced radios.

-Why no circular polarization on 2m?

(WB9UWA): One thing I have not seen mentioned on Moon-net, so I don't know if it was mentioned to you are not, is that stations set up for tropo will always use horizontal polarization.

If we decide to work some of these tropo stations on EME, then we would have a 3db loss if we were all circular, as they are on 1296 Mhz EME. It is not generally practical for the 1296 gang to work tropo stations due to very high ground noise on the horizon and sliver sized elevation lobes.

Also most of the 2m EME stations will elect to use the simpler horizontal polarization. In that case there is a 3db penalty for using circular.

I use 0 and 90 degrees for TX, but my RX is set up for 0, 45, 90, and 135 degrees. This can give me up to a 2db advantage over 0/90 and worst case is 1db below optimum.

When the actual polarity is 45 degrees and 0 or 90 is selected, the loss is 3db. In practice this 3db loss condition is generally short lived since polarity will wander with time toward 0 or 90 degrees. The 45 degree polarity steps is not the cure all one would imagine. I am still subject to the mysterious " poor EME conditions".

In short, anything you can do to match the incoming polarity will help your RX to some degree. Linrad with Xpol is the best answer in that regard. The difference between a 45 degree setting and 90 or 0 degree is not startling as is the difference between 0 and 90 degree at times. In fact I must often find the wrong 45 degree setting to decide that the peak is 135 degrees.

-Trees in the path (KA6LAF): Jim (UWA) and myself were discussing trees in the signal path, and I was wondering how much effect trees have. I would imagine that trees would be a factor at microwave, but how about 144 and 432? In my case, my antennas would be about 100 feet from some medium sized trees that are about 50-60 feet tall. This represents trees being in front of a rising moon up to about 40 degrees above the horizon. Also, most of the trees are foilage rather than thick wood. Anyone have any real-world experience with the attenuation effects of trees at these frequencies? On a similar note, how close can the driven elements get to the ground when an array is elevated? Is 1 or 2 wavelengths sufficient to get away from any ground effects?

PA2DW: My experience on 144 MHz is that trees dont bother too much, untill they become wet by rain! Then I noticed significant effects of my "friend" the cherry-tree, which obstructs my very narrow window when using my 32JXX2.

That antenna is only about 2.5 meters above ground and that is fine, even at high elevation when the reflector almost hits the ground.

F5VHX: ...trees are not simply an attenuation issue, they are a double 'hit', as they can also be a major contributor to system receive capability especially at 432 and up.

...this means your 432 eme system receiver will be seeing quite close to ground noise upto 40 degrees of elevation in that direction.....the measured result from the trees will vary according to their reflectivity (season, dry, wet etc) and antenna aparture fill, on a decent 432 eme rx system this will possibly cause between 5 and 6.5 dB of rx system degredation "_+_" any attenuation.

If you search the web you will find good data for attenuation of trees, buildings and even street furniture prepared for the cellular industry, OK it's at 900 Mhz and x.xx GHz, but you can extrapolate 'something' from it.

-How to align antennas (IZ2EWV): I'm just near to the moment that the four antennas of my array will be placed on the masts, but I have no idea for ensuring a perfect alignment of their booms (the masts have circular section). Does anybody have the trick to suggest me?

WB9UWA: I use a simple method. I elevate the array to 90 degrees (straight up) and use a level on the H frame. It should be perfectly level to the ground. I then check the booms of each yagi to see that they are plumb with the H frame in all directions using the level. Done.

-HEMPT (F8DO): About preamp for 144 432 and 1296 is it possible to substitute ATF- 54143 with ATF-55143 or ATF-35143 ? I know Vds and 0IP3 are different but NF seem very close ?

F5VHX: yes.....but substitution is not really optimum....you will not achieve same NF, but still perhaps an acceptable NF. I have done a few of these recently.....simple designs of the 1302 and old atf1xxx series type etc, can be made to work with the 55xxx and 35xxx by ripping out the drain transformer and changing vcc and bias conditions...they will give acceptable (sub 0.6dB NF) results at 144 even with existing simple source bias configurations & cheap plastic low Q type input tuning caps....getting the device in physically represents more of a challenge, but can be done in most cases, you have to mount it diagonally and scapel and foil the board, or add fine wires for dead bug types....

I haven't tried the higher bands, but can foresee more problems there because the source inductance will go up and the ATF5xxxx series may not be happy with that stability wise... you absolutely NEED source inductance for the optimum 5xxxx designs, but too much and they can hoot at several GHz. (normally 5-6 GHz, you can see a dip in K in a simulation)

-JT44-CW (RU1AA): Dear friends,I will be QRV in ARRL contest from new QTH: KO48VR on 144044,144124 - JT44 . I hope that CW mode in EME contests will survive ...

WB9UWA:Actually, I wonder if JT44 can survive in a contest.With band full of carriers, JT44 is only useful when a roughly 1 khz passband is clean. On CW, I can operate 20 hz away from most of these carriers. Without the use of a logger to look for and agree on mutually clear frequencies and even QSY in the middle of a sked (the current accepted standard practice), I doubt that I would work many stations on random on JT44 that I would not work on CW. Certainly the numbers will be much lower then they could be. I will in all likelyhood find only the big guns calling CQ on JT44. I could post a frequency ahead of time that I might call CQ on in JT44, but with carriers and other traffic, I may well end up 10Khz or more off the posted frequency. Then people have wasted time looking for me.

I suspect that largely the only help provided by JT44 will be to the big guns that can easily be heard in speaker audio. Don't forget, if a signal can be heard in the speaker or easily seen using a DSP screen, it can generally be copied on CW. These big guns in a nice clean wide open quiet country side location can operate anywhere in the band and can predict with confidence (and post) a frequency for calling CQ.

These stations will be helped the most by JT44. The end result may well be a widening of the scores between the big and small stations. The large stations will, no doubt be repeatedly working stations on JT44 that are smaller then they normally work on CW. The majority of average stations will still be frustrated to find a way to call CQ and be found for themselves. You can detect a weak CW signal in a few seconds. A weak JT44 signal is copied after 30 seconds being fixed on a single frequency, but possibly not detected at all before 30 seconds. Try tuning the band with THAT kind of time lag! I suspect the average station will soon tire of calling CQ on random without help of a logger for spotting and go back to CW. What happens in a pile-up?

On JT44, it is likely that QRM will detract from the copy in an extreme manner, unlike CW where a good ear or a good filter will separate the callers. Of course CW activity MAY be hurt do to all the division of activity in favor of trying JT44. This MAY, no doubt, result in less of the smaller stations calling CQ on CW or even JT44, because of a small group of EMEers being further divided, as if a new EME band had been added. I hope I am wrong. If I am right, the likely result will be fewer medium sized stations QRV. Another imediate result will likely be that the smaller stations will not send in scores so they are not bound by contest rules so they can operate JT44 in a way that works well for that mode. That way they will work initials on JT44 using a logger. I see W3EME is already such an example. Were we too quick to jump in to a new digital mode that random operating problems have yet to be overcome?

There are possible things to try that can help, such as a specific range of frequencies and channelized operation, but no such things have been discussed. We could even take a solution from the 13cm gang and agree to be in specific modes at specific times (try to get agreement on anything from this 2M group). A frequency hopping method could help, but JT44 does not do that. A better solution (IMHO) is to keep the ARRL EME contest, CW/SSB only. A separate JT44 contest could be added that has rules suited to JT44 operation. For the above reasons, I will most likely continue to call CQ primarily on 144.057 CW as ususal during the European window and be on or near 144.028 in the JA window. I may go up frequency at times to pick off a few big guns that forgot to use the CW key from time to time.

I just hope this contest does not become less fun for many stations, resulting in many going QRT. Last year the poor conditions certainly did not help. I see fewer postings on Moon-net these days requesting skeds or suggesting activity. Where are the activity reports?

-Formula Zo for square outer tube (PE1ECM): I do know the formula for calculating Zo of round tube coaxial stripline (e.g. for power splitters). How does the formula change for square outer tube (with round inner conductor).

OZ5IQ: Have been making mni combiners prof as well, and the formula in the RSGB handbook is NOT correct when the Z splitter impedance is away of 50 ohm ! This is the correct formula: Z sp = 143 LOG D/d + 2 and this will give you:

at a SQR tupe, outer 30 x 30 mm and with an INNER size of 26mm x 26 mm. (2mm wall std in EU) for a 1/4 L combiner:

2 antennas	15 mm	round Ms (1 mm wall)
3 antennas	16 mm	round Ms (1 mm wall)
4 antennas	18 mm	ound Ms (1 mm wall)

and 1/2 L combiner :

4 antennas	12 mm	round Ms (1 mm wall)
6 antennas	14 mm	round Ms (1 mm wall)
8 antennas	16 mm	round Ms (1 mm wall)

Furthermore have been experimenting with a 0.5 mm wall of the innertube, works fine, but it makes the C less weight but the comb.-tube get rather fast losen/broken in the solder-point(s). I have been making the most kind of combiners , Z for 144 MHz and its my experience that you have to make the REAL calculated distance between the set of connectors in the ends 5 mm SHORTER than calculated. 10 mm for the 1/2 L version. I think this is caused by the lengh of connectors innerconductor before reaching the innertube.

-Noise filter for DC: this question is somehow related to EME, because my moon window is restricted due to this effect: My neighbour has a 2kw solar power station on his roof. The power converter produces a lot of noise, not birdies, it is wideband, I am getting S5 on 70cm and up to S9 on 2m. My neighbour is open to find a solution and also helpful, so I am really lucky, but due to the strength of the signal the solution must be very good.

Yesterday I was in his attic. The unit is about a shoe box size. The rear is a aluminium heat sink, but the cover is plastic, nothing screened. I had my AOR3000 wideband regeiver with me, and I was of course able to hear the noise even there. In my opinion the noise is so strong that radio reception in his house must be degraded. I found that the major outlet of the noise is on the DC input which works on around 180V and something like 10A in the maximum. The other components are radiating not that strong, but they do.

Our first idea is to put some ferrit cores around the DC cable, but I doubt that this is enougth. Can someone please give me some advise how to block that noise from the DC line as much as possible? How can I use a ferrit ring core for the best way? What core material should be used for frequencies above, say, 50MHz? How do I wind up the cable in it the best way? There is around 50cm of DC cable left to be wound somewere? Both cables the same way or both in opposite direction? Should I apply a kind of filter box, maybe a symmetrical low pass like they may be used for shortwave? The only problem not to use standard coax lowpass filters is that the DC lines are not ground free.

The other line is a single phase AC line. How can this be blocked? Should all three wires be wound on a ring core for itself or together on one common ring core?

What could be the best way?

SM5BSZ: OK. The box itself is a poor antenna below 200 MHz or so. On VHF the radiation is mainly from the wires. To start with it will be a good idea to prevent any voltage between the 5 wires. The three mains wires and the two DC wires make 5 wires in total. Imagine you could buy somewhere a lossy screened wire with a screen and 4 inner conductors. If you use the screen for the protective earth and two inner wires for DC and the remaining two inner wires for 220V AC. If the cable is long enough, and lossy, it does not matter what woltage you have between the wires and ground at the box side. At the other end there will be nothing due to the attenuation. If you then put the unit in a metal box and connect the screen of the lossy screened cable well to the wall you will have no interference at all. Now, the above was just to give an idea about mechanisms. Bring the cables as close to each other as possible.Put ferrite tubes on the individual wires if possible, otherwise on the individual cables. Place the ferrite tubes in groups so they work like multi-hole ferrite blocks. Ideally the structure should have a length of at least 0.25 wl at the lowest frequency and the ferrite blocks should be separated by 0.25 wl at the highest frequency. Finally wrap aluminium foil on top of the cable and ferrites, now you have a lossy cable! Do not connect the aluminium foil to any wire or to anything inside the box. If necessary, wrap aluminium foil around the plastic box and connect this outer screen well to the foil you placed around the cable.

The above is one way of doing it - and the mechanism is relatively easy to understand. You may try to exclude the ferrites as a first experiment, it might give some relief on 432 MHz but probably not so much on 50 MHz. Capacitors between the wires is very good for interference suppression - but you should think about safety regulations. For safety reasons it might be best to put all three 220V wires through a common ferrite tube in which case voltage differences between the three wires will not be suppressed.

BUT before doing anything at all. How old is the unit? Should it carry a CE mark? Maybe there is a CE mark on it already? Someone else may be responsible for doing something. That would not be enough for your EME work, but it would give a better starting point (most probably)

PA3FXB: I had this problem myself because I have a solar panel on my roof. At first I didn't realise that the QRM I had, once in a while, was generated by my own solar panel... There was noise on 21, 28 and 144 MHz. The maximum was on 28 MHz. The noise was so strong that it even effected a portable FM broadcast receiver. Then I contacted the manufactorer of the system. They already knew about the problem! It seemed to be the inverter which brings the 24V DC to 230V AC. The radiation level of those inverters was much more than expected but just within legal limits here in PA. Their policy was to replace inverters for better (quieter) ones only when problems arrised. So I sent my inverter to them and received a quiet one back in return. Problem solved. Of course I asked what I should have done when the solar panel was on the roof of my neighbour.

Locating the problem would have been not so easy in that case and the second problem could be convincing my neighbour...

The type of inverter I am talking about is the OK4. Maybe your neighbour is using the same type. Just replacing for quieter ones could then be the solution.

Good luck in fighting the noise!

Bernd J. Mischlewski, DF2ZC, is new 144 MHz EME Editor

Starting with the next issue of DUBUS magazine Bernd, DF2ZC, will take over the 144 MHz EME column from Heinz, DM2BHG. That means "back to the roots": Bernd was already a member of the DUBUS team in the late 70s and early 80s as well as in 1989/1990 when he edited the Meteorscatter column.

Since he was granted the ham radio licence at the age of only 14 in 1976 DF2ZC was always after the weak signals on 144 MHz. So the step from terrestrial propagation to EME was only logical but took some time (university, job, family): In 1999 DF2ZC finally started 2 m EME with four F9FT-17s and is now QRV with four 2M18s.

Bernd holds a Diplom-Ingenieur degree in telecommunications by Technische Universität Hamburg-Harburg. Businesswise he is a senior manager with Deutsche Telekom AG, one of the worlds largest telecommunications carrier.

E-Mail: BerndDF2ZC@t-online.de

EME News

Editor: Bernd Wilde, DL7APV

Intro

The major event was of course the ARRL contest with JW/SM2BYA on 432. This caused a huge activity, like in old times in Part 1 and less activity in Part 2. But a lot of new stations appeared, so many could add #.
23cm condx and activtiy were medium. The higher bands were partly quiet, what brought up the discussion if the ARRL contest rules should be changed to an extra microwave weekend. Many multiband single op stations cannot change quickly the feed during contest. The REF/DUBUS contest is different, but maybe could be better.

CU all in REF/DUBUS contest! 73, DL7APV

Last issue I mixed a foto with wrong text, the foto titled with FY5DG must be corrected in DL0AO 432 EME ant. Sri!!

432 MHz

ARRL contest news:

CT1DMK: It was fun to participate, but many external factors contributing to a very low performance this year. On 70cm it was bad but enough to work a few, but even so I got trouble with water in the TX cable. Second weekend, first pass, I found conditions very good and could work a few stations right at moon rise but less than two hours after I started to have electric power failures, more irritating was that it was coming and going repeated times with intervals of a few minutes. I had to give up. Second pass, I found conditions much worse then Saturday I also had the usual sensation that much less stations are active at the end of the contest then before. I've worked **14 x 13** on 432. Regards, Luis

DJ6MB: Wkd in contest 4 new stations : #365 jw/sm2bya, #366 uy5hf, #367 sm5iot, #368 ok2bdq. Due to a lot of qrm 6 birdies. Uwe had final **98 x 34**. 73 Uwe

DL4KG: Was vy disappointed his new 432 Mhz open tube feeder system was ready for the ARRL contest, but after some testing I found that I got several new noise sources in my neighbourhood. In some directions the noise is more than 20 dB above cold sky. At clear directions I found sun noise about 10 dB, so the system is working properly. As the noise is all around I only worked JW/SM2BYA and heard HB9Q and N2IQ. Due to the poor receiving capabilites I gave up and switched off. I think to gon qrt on EME; the last chance to keep some EME activity seems to move up to 23 cm.
73 de Gerald - DL4KG

DL4MEA: My quick & dirty 70cm setup worked much better than I ever would have expected. Worked were N2IQ, HB9Q, F6KHM, K1FO, UA3PTW, DL9KR. DL7APV, OH2PO and last but not least JW/SM2BYA. To be honest, JW/SM2BYA was the reason why I set-up this array. JL1ZCG was heard perfectly but I am wondering why he did not copy me over hours. Heard were also OZ4MM, DF3RU and HB9JAW. After this, the array might become disassembled quickly when a digger comes to finish our terrasse. 73, Guenter, DL4MEA, JN58ri.

DL7APV: Finished with 60x32. Not too good, but had lots of runaways. There is something to improve!

DL7UDA: Part1, I was qrv on Sunday only because my best friend Murphy visited me on Saturday. My PA fault! So I had only my IC475H barfoot! (70 W) into my 4x21 el yagi with 24 dBi on 432 MHz. But neverless I worked random HB9Q 549/429 !; JW/SM2BYA O/O; OH2PO O/O. From N2IQ came only qrz DL7UD? On my moonset (blocked by neighbours house). A JT44 sked with OE9ERC was not complete. I received Erich with -15 dB and sync 7. Heard on cw: F6KHM; DL7APV; DK3WG; DK9KR; SM2CEW; K1FO; K5GW; N9AB; JL1ZCG; OE9ERC and VE6TA. 73 Dietmar

DL9KR: Activity was revived by JW/SM2BYA, kudos and thanks a million to Gudmund & crew! Positive: Sometimes good conditions and 9 initials. Negative: Especially in the first part vertically stuck Faraday for long hours. Loss of abt 4 hours towards moonset due to encroachment by trees (no chance of killing them, XYL keeping sharp look-out).
Following random cw QSO's were made (dupes not shown):
Oct-18: JW/SM2BYA #785, S52CW, OE5EYM, DJ5MN, EA3DXU, UA3PTW, JH4JLV, JJ1NNJ, G4ALH, UT3LL, DJ3FI, SP6JLW, JS3SIM, JL1ZCG, DL1YMK, G4RGK, JA6AHB, RA3LE, JR9NWC, YO2IS, 7M2PDT, S53J, UA6LGH, UY5HF, HB9Q, DK3WG, SM3AKW, F6KHM, PA2CHR, DK3FB, OH2PO, OK2BDQ, HA1YA, DK5MV, K4EME, N1BUG, N9AB, DL7APV, CT1DMK, YO4FRJ #786, K9SLQ, KE2N/4, GW3XYW, SM2ILF, DJ6MB, OE3JPC, K2UYH, PA3DZL, K5GW, ON5OF, KU4F, WA4NJP, LU7DZ, W7MEM, VE6TA, KL7HFQ, SM2CEW, K6JEY, N2IQ, OZ4MM, K0RZ, KL6M, K1FO, OE9ERC, DL4MEA, F2TU, VK3UM, S51ZO, DL5LF, JA9BOH, VK4AFL,
Oct-19 (my 68th birthday): PA0PLY, YU1EV, JH0WJF, OH2DG, G3LTF, RW3PX #787, DF3RU, I5CTE, F6DRO #788, JJ3JHP, UA9FAD, DL8OBU, SM2LKW, DB6NT, DK8VS, SK0CC, G4YTL
Nov-15: JA6DZI, DL7UDA, SM5IOT, FY5DG, OH3AWW #789, IZ2FOB #790, PA3AEF, DF6NA, DL0AO, DJ7GK, G3HUL, DG1KJG #791, VK5MC, F6HZL #792
Nov-16: OE5JFL, PA5DD #793, G3LQR and JA2TY.
Score: 106 x 38 = 402.800 pts.
73 and thanks to all, Jan DL9KR.

F6DRO: First pass oct.: K1FO, DL9KR, JW/SM2BYA, HB9Q, DK3WG, OH2PO, DL7APV. 2nd pass: F6KHM, PA3CSG, N2IQ, K2UYH CWNR on the second part were N9AB, KU4F(back with QRZ), HB9JAW. Only 3 hours active because of windstorm on 1st pass , and the same during the 2nd pass: I need a radome!!! 73's Dom/F6DRO

IZ2FOB: I am glad to inform you that my antenna's elevation system is ready so now I am QRV via EME on 70cm. I made my first two QSOs with HB9Q and DL9KR on 15 November during ARRL contest and now I am available for any sked. My Rig: IC821h - pre mgf 1302 h.m. - PA GI7b (300W) h.m. - ant 4x21 F9FT full elevation. 73, Roberto

FY5DG 4x26el. 432MHz

EA3DXU: First leg: I was QRV both night pass, after 07 UTC local noise rose and made very difficult the 144 Mhz activity , on saturday I stoped at 08 UTC for job problems and on sunday after 07 UTC the 432 activity was very low and only worked some USA stations, 1 new DXCC # 40 on 432 Mhz JW/SM2BYA. In the second leg I was QRV only 7 hours on saturday morning, unfortunately I was indisposed and was imposible to be QRV more time on contest, I completed 7 more QSO for a total score of 52 x 38 (30 x 22 on 144) + (**22 x 16** on 432) all CW random.
432 Mhz: DL9KR, HB9Q, F6KHM, JW/SM2BYA # 154, N2IQ, DK3WG, OH2PO, SM2CEW, WA4NJP, SM3AKW, DL7APV, UA3PTW, OZ4MM, K1FO, G3LTF, N9AB, KU4F. Heard or called JL1ZCG, ON5OF, RA3LE, S52CW, G4RGK, K4EME, F2TU, K2UYH. 73 de Josep, EA3DXU, 2x38el. + GS23B

JA9BOH: I was alive on 432MHz in ARRL competition with 2 yagi and worked 9 stations in the contest. Oct-18 N2IQ (569/559), KL6M (O/O), JL1ZCG (559/439), DL9KR (O/O), Oct-19 HB9Q (O/O), OH2PO (O/O), JW/SM2BYA (529/519 #302, VK3UM (O/539), K5GW (559/559). Strongest was N2IQ and CWNR were HB9JQW, DK3WG, JH0WJF and DL7APV. On 26th I put on 4 yagi (2.81m boom) with Hor.-Pol. and copied (M-O) echoes on 31st Oct at 1kW output. I could detect marginal echoes at 250W output by ear. I think that JT44 QSO will be OK with less than 20dBd ANT and medium power. 73 Kimio JA9BOH

KL7HFQ: Anytime I can make a contact with this baby array (KL7WE's portable array) that I have, it's a good time for me. First night signals were LOUD here but couldn't work much, second night signals were down, but worked a couple stations after going to church: DL9KR, HB9Q (loudest station on first night from here), OZ4MM, N2IQ, OH2PO, K1FO, JW/SM2BYA, N9AB, K5GW. Heard: K6KHM, OE9ERC, JL1ZCG, SM3AKW, UA3PTW(?), VK3UM, HA1YA(?), OE5EYM, KU4F.
Nov. wkd: OZ4MM, N2IQ, OH2PO, K1FO. Heard F6KHM, DL0AO, N9AB, OE9ERC, JL1ZCG and others. I can't find my scratch pad. All stations were loud and HB9Q was the loudest station on the band. Funny, I heard K1FO loud last night and couldn't work him no matter where I polarized my ant, got up this morning and worked him at his moonset. Roger, KL7HFQ

K4EME: 1st Leg of the ARRL EME Contest on 70cm. This was my personal best contest weekend so far to date! I worked 24 X 19 stations on 70 cm. I worked a new initial, KE2N on Sunday. I also worked JW /SM2BYA. All in all, I had a great time in spite of no sleep. Everything appeared to continue to work and I heard my echoes well throughout the contest. Thanks to all that worked me or tried to work me!
73, Cowles, K4EME. 8 FO-33 & 1.5 KW on 70 cm.

K6JEY: First Weekend results. Things went pretty well. Suspect Aurora may have lessened some signals. Two signals of note: I consistently heard HB9Q on moonrise, through a huge magnolia tree! Even got a partial that way. At higher elevation he was consistently strong. DL9KR was like a local. Heard a few I couldn't work but this is the first weekend's line-up: HB9Q, N2IQ, DL9KR, JW/SM2BYA, K1FO, OH2PO, N9AB. Tnx to SM2BYA and crew for an exceptional effort. Still using 4x25el K1FO's, 1.5kw, <.4db preamp. 73, K6JEY

KJ7F: Oct. first pass worked: HB9Q - Loud as always, OH2PO, JW/SM2BYA, K1FO, SM2CEW, JL1ZCG - No problem working him, came right back to my call, UA3PTW down near the west horizon through a walnut tree and still nice signal, N2IQ, KU4F - without a doubt the loudest station I heard all weekend, KL6M, VK3UM, K5GW - weak until he rotated the polarity then 339. Heard but not worked: VK4AFL, K2UYH, N9AB - missed each other on random CW and random JT44, maybe next time. DL9KR, F5KHM, OE9ERC - Nice signal and then gone. I missed much of the EU window both days due to being asleep. The all night sessions are just too much for me. I need my beauty sleep, badly. Terry, KJ7F

KL7FH: Will try his first EME with 100W 16X12 ele and polarity rotation. I am loking forward to having my first EME QSO and the start of an adventure I have always wanted to begin. 73, Frank, KL7FH, BP51BB

LU7DZ: Eduardo reports his activity on 432 Mhz. He was active for 4 hours only due to a fault in the power supply of his amplifier with GS23b. He managed to receive very good signals and to contacts with: F6KHN, DL9KR, HB9Q and N2IQ. Also I listen to SM2CEW. Eduardo is QRV now again for Skeds on 144 or 432 Mhz. 73´s Fred LU6KK

N1BUG: First weekend. Brought some of the worst conditions I have ever seen on EME, but never mind... it was still a fun weekend. Thanks to those who worked me and many more who tried hard to pull my weak call out of the noise.
I am gaining some understanding of what it is like to operate two or more bands. It's tough to know what band to be on at what time. Since I had limited elevation capability on 70cm, I stayed mostly on that band until the moon got too high, then

moved to 2m. The highlight was working JW/SM2BYA on 70cm. **Only 4 QSO**'s on 70cm. 73, Paul, N1BUG

OA4CRK: My EME station probably is finished in a few months, then I have plans to move this station to OA (my original callsign is OA4CRK) and put OA on EME. Antenna: 4x21 AZ. I worked for years on this project. I started in Peru but with no material and now I am very close to finish. I appreciate any idea and collaboration. Thank you very much. Alex Artieda, HB9DRI/HK3TAS/OA4CRK, hb9dri@artieda.net

PA2CHR: First part. Thanks for all the QSOs. Highlight for me was working JW/SM2BYA; he had a nice signal all the time; a great job; hope he worked a lot of stations! It was fun and I worked **10 (8 multi)** on 70 cm. The 70 cm. stations: JW/SM2BYA # (DXCC 42), HB9Q, DL9KR, SM2CEW, OH2PO, OE5EYM, DL7APV, SM3AKW, JL1ZCG, N2IQ.
Best 73's, Chris, PA2CHR / JO22XA

S52CW: As the most of you, I also found that conditions were way down but at least they were the same for all of us, Hi. Managed to work **28** qso's : DL9KR, JW/SM2BYA, OH2PO, DK3WG, HB9Q, OE5EYM, DJ6MB, SM3AKW, F6KHM, OH2DG, DF3RU, RA3LE, PA3CSG, HA1YA, DL7APV, N2IQ, OZ4MM, SM2CEW, N9AB, F2TU, JW/SM2LTA, JL1ZCG, UA3PTW, K1FO, G3LTF, KU4F, K5GW, WA4NJP. 73 de Uros, S52CW
70cm eme with 8 x 7.7 dj9bv & gs35b from jn76ci

S53J: Wkd: HB9Q, DL9KR, JW/SM2BYA #, N2IQ, F6KHM, SM2CEW, K1FO, HA1YA, OH2PO, OZ4MM for a score of **10 X 10**. JN75EV. RIG: FT847 with Collins filters, RX: ATF 34143, TX : GS 23B, ANT : 4 X 9WL, 20m LDF 50, Any skeds are welcome, 144 & 432 MHz, CW, JT65. 73 Joze

SM5IOT: Worked second leg: DK3WG, OH2PO, UA3PTW, F6KHM, DJ6MB, DL9KR, HB9JAW, G4RGK, S52CW, F2TU ,DL7APV, K1FO, N9AB, K2UYH, JL1ZCG, VK3UM, DF3RU, SM3AKW, G3LTF, KL6M, OE5JFL, KU4F, K0RZ. Chased K4EME the hole morning, but nil!! Then I gave up (Sunday). Station heard during this time: K2UYH, K1FO, K0RZ, OE5EYM (K1FO steady signal all the time I listening for him, Hi) Around 11z. Was on for 10 hours only!! Chris, SM5IOT, 432 MHz, 8x26 el DJ9BV-Opt/II (GS23b)

SP2OFW: Hello guys I made up my new system on 70 cm 8x22 el by DJ9BV , maybe in the future I will work on 70 cm. Pse look on my page http://sp2ofw.of.pl for a few pictures of my new system. 73 de Wojtek

SV1BTR: Wkd from old eme qth with a single 13wl 70cm yagi + 100w and armstrong azimouth+elevation rotation JW/SM2BYA on 432MHz on October 17, prior to the contest. My plans, if i do not go for qrl abroad (9H) to stay for 1.5-2 years, involve a very decent 70cm system ready in spring. Again, thank you all, 73 Jimmy SV1BTR

VE6TA: I was active only on 70 cm for the first pass of the ARRL contest. The anticipation of JW/SM2BYA seemed to increase activity which is very refreshing. Managed to work the following stations this weekend: JW/SM2BYA #, OH2PO, HB9Q, UA3PTW, N9AB, RA3LE, DF3RU, DL9KR, F6KHM, HA1YA, N2IQ, KU4F, OZ4MM, K0RZ, K1FO, WA4NJP #, VK4AFL, JL1ZCG, KL6M, SM2CEW (moon in the trees!), K5GW, DL7APV, G3LTF, OE5EYM, K9SLQ, K2UYH, JA6AHB, VK3UM. Probably some of the best activity I have heard on 432 from this location. Our thanks to SM2BYA for the wonderful signals of JW/SM2BYA during the weekend. I am currently stuck at 99 initials on 432. 73's Grant, VE6TA

VK3UM: Only new station worked (apart from Gudmund at JW) was KJ7F. This is a summary and my log for both weekends. I ended up with a total of **48 QSO's X 27**multipliers.
This is some 10 fewer than last year with the multiplier count down by 3. My total operating time was only 7½ hours some 8 hours less than 2002.
18/10/03 UA3PTW, JW/SM2BYA, OH2PO, RA3LE, SM3AKW, DJ6MB, DF3RU, DL9KR, VK4AFL, JL1ZCG, HB9Q.
19/10/ JH4JLV, HB9JAW, JR9NWC, K5GW, JA6AHB N9AB, N2IQ, KL6M, K2UYH, KU4F, K4EME, JH0WJF, K1FO, K0RZ, VE6TA, JA9BOH, KJ7F.
15/11/03 OE3JPC, DL7APV, UA9FAD, SM2CEW, PA2CHR, SM5IOT, SP6JLW, ON5OF, OE5JFL, OK2BDQ, F2TU, G4RGK, OZ4MM, G3LTF, DJ3FI, DL1YMK.
16/11/03 YU1EV, G3LQR.
All contacts were completed without skeds, loggers, phone calls, spotting, digital modes etc. Just the good old fashion and most enjoyable 5 finger digit CW !!!!
Conditions were coming and going so quickly as to confuse many of us! Well that's over for another year with a (sadly) seemingly lower level of activity. I hope next year will see us "down under" getting a better choice of weekend! (Hi Ian, G3SEK!) If we pick a higher northern declination moon for Contests then, down here, I will be working with **permanent ground noise**?! Unfortunately it was not much of a first weekend for me as I had moon set *13 minutes* after the contest. 73, Doug (VK3UM)

Expeditons

EA8 (IL18) 12.-19.11. is shifted to next year. Sorry for this bad news. I had to shift the dxpedition to EA8 to the next year (European-DUBUS-Contest?!) By bad luck there was an error at the reservation of the houses and they were already blocked by otheres. vy 73 Oliver, DL1EJA

Dx-pedition to 3B9 (Rodriguez Isl.)

With the licence now authourised I can provide a few details: March / April 2004 will see a major Dx-pedition to Rodrigues in the Indian Ocean which will include a dedicated station set up for Satellite and basic EME operation on 70cms.
The dates for the trip are March 16th to April 15th with the satellite/EME operation scheduled for the final two weeks from March 31 to April 13th. Call will be **3B9C.**
The Satellite / EME station includes 4 x 19 ele F9FT yagis on 70cms and Az/Ele rotators. The radio will be an FT847 provided by Yaesu who are the principal sponsers of the Expedition. Unfortunately I have not managed to locate a 70cm amplifier and power will be 100 or 200 Watts. JT44 software downloaded and I'm gaining experience (slowly) with SMD preamps by the day. The path to the USA from 3B9 is limited and it will be important to find the right location. Those final few degrees down to the horizon will be very important.
A web site for the dx-pedition is available at:
http://www.fsdxa.com/3b9 Thanks to HB9Q for my first 'heard via EME' during last months contest. With just a single yagi and a pre-amp that checked out after the event at 1.3dB nf. A vy nice signal. 73, David, G0MRF G0MRF@aol.com

JW/SM2BYA

432 MHz EME operation, info de SM2BYA
1) The 32-m antenna did not perform quite as we had hoped for. Matching it was no problem, but the optics was another matter. At 432 MHz the noise temperature of the receiver itself was about 33 K and the sky another 35 K, but we got only 6.5 dB excess noise on Cyg-A and a little over 1 dB moon noise. Assuming a theoretical gain of 40.9 dBi for the 32-meter aperture, this corresponds to a system temperature of 177 Kelvin or 2.1 dB NF ! The explanation is probably that the feed does not perform terribly well down at 432. As a result the aperture efficiency suffers due to excessive spill-over while the ground noise pickup increases at the same time. Thus we had about 3 dB worse sensitivity on RX than we had hoped for, and probably about 1.5 dB less gain on TX. I'm afraid that we may have missed a number of 2-yagi, 50-watt class stations because of this. The smallest we worked were in the (2 yagi, 100 watt) or (1 very long yagi, 100 watt) class - which figures !
2) Once we had found that we were going to be sensitivity limited, we decided to back off on the TX power so as not to present an unbalanced link budget - no point in yelling louder than we had ears to hear.. Settled for running the K2RIW in borderline class C (the drive was marginal) which caused it to run very cool, producing 350 very stable watts of output. We actually did not have to climb the antenna to retune during the whole 60 hours !
3) The tracking ran so smoothly that after a while we forgot that we were actually following a celestial body. The antenna controller has a built-in tracking function, but there is no moon tracking function. To solve this, Assar -LTA installed an open source ephemeris software (from NASA) on our main Sun server. This produced updated values for RA and DE every six seconds, and the real-time system was then called on to poke the updated values into the antenna controller command stream - the whole thing essentially amounted to starting a new tracking every six seconds and worked like a charm.
4) As reported earlier, our grand total is 151 complete QSOs and probably about 140 initials (I still haven't had the time to a proper count...). Unfortunately one or two NCs. Many European stations were worked on the rising or setting moon; a number of these were callsigns unfamiliar to me and probably tropo stations. We snagged SK4BX in this manner at Sunday moonset - the moon must have been halfway below their horizon as we completed!
5) QSLs are already beginning to arrive - thanks to everyone ! Please bear with us if you don't get a card in return right away. Because of my travel schedule I won't have time to start writing them out until mid-November - but they will be coming! Please send QSLs to: Gudmund Wannberg SM2BYA, Duvvagen 22, SE-981 37 Kiruna, Sweden
BTW, our locator was JQ 88 AD.
6) Log. We will NOT submit a ARRL EME contest entry, but maybe a checklog. JW/SM2BYA and JW/SM2LTA worked a total of 151 QSOs. There were quite a few more dupes than we thought at first and so the actual number of initials is only 125. Most were worked by –BYA. -LTA worked two or three unique initials. QSO'd in alphabetical order were 7M2PDT, CT1DMK, DA0ED, DB6NT, DF3RU, DF6NA, DF9QX, DG1KJG, DG6SYL, DJ3FI, DJ5MN, DJ6MB, DJ7GK, DJ8MS, DK0WZ, DK3BU, DK3FB, DK3WG, DK5MV, DK7OM, DK8VS, DL0AO, DL0SWG, DL1SUN, DL1YMK, DL2OM, DL4KG, DL4MEA, DL4SUN, DL5LF, DL7APV, DL7UDA, DL8OBU, DL9KR, EA3DXU, F2TU, F6DRO, F6KHM, G3LQR, G3LTF, G4ALH, G4FUF, G4RGK, G4YTL, GM4ISM, GW3XYW, GW4DGU, HA1YA, HB9JAW, HB9Q, I5CTE, JA2TY, JA4LKB, JA6AHB, JA9BOH, JH0WJF, JH4JLV, JJ1NNJ, JJ3JPF, JL1ZCG, JR9NWC, K0RZ, K1FO, K2UYH, K4EME, K5GW, K6JEY, KE2N/4, KJ7F, KL6M, KL7HFQ, KU4F, LA9DL, N1BUG, N2IQ, N9AB, OE3JPC, OE9ERC, OH2DG, OH2PO, OH3AWW, OK1DFC, OK1KIR, OK1KZE, OK2BDQ, OM1TL, ON4KNG, ON5OF, ON7NH, OZ4MM, PA0PLY, PA2CHR, PA3CSG, PA3DZL, PA5DD, RA3LE, RW3PX, S51CL,S51ZO, S52CW, S53J, SK0CC, SK4BX, SK7MW, SM2CEW, SM2ILF, SM2LKW, SM3AKW, SM5IOT, SM5LE, SP6GWN, SP6JLW, SP6OPN, SV1BTR, UA3PTW, UA9FAD, UT3LL, WA4NJP, VE6TA, VK3UM, VK4AFL, YO2IS, YO4FRJ, YU1EV and YU1JB.
Thanks to all whom we worked and to all who tried for us for making this a great experience! If there is enough interest, we may consider repeating the exercise in one or two years' time - please let us know. SWL reports from all who copied us without getting through are particularly valuable.
73, Gudmund, SM2BYA

432 & up news

F2TU: My score in single operator:
432 MHz: 40 x 26 1296 MHz: 54 x 25
2300 MHz: 14 x 12 5670 MHz: 4 x 4
10368 MHz: 11 x 9
of which PA0EHG #28, IQ4DF #29
TOTAL: 123 x 76 = 934.800
Score of 75% better than the first contest in 2001 with the new parabole of 8m. But I was more active on 432 MHz. The proof that this contest penalizes the microwaves activity. Thank you with all and sorry for the QSOs which did not succeed. 73 Philippe Pierrat, F2TU

G3LTF activity report, 4 bands.
432 39*22 gotaways were g4rgk, yu1ev, ok2bdq, hb9jaw,

sk0cc and k4eme
1296 36*20 with gotaways ja8ere, k2uyh, oz9aar, again w7sz, w7bbm, dl8obu
2320 7*7 with gotaway ja4blc and dj7lc
432, crowded and condx were all over the place with lots of polarisation spread, 2320. The frustrations of 3 segments have to be worth double points at least!! 1296 normal and lovely. With 84 QSOs on 4 bands I am pleased but tired, and I have a "to do" list a yard long. CU all next time... wx permitting, Peter G3LTF.

HB9Q: 2003 first leg: We have been QRV on 144, 432 and 1296 CW all random. However participation was bellow average on 144. On 1296 we only spend 5 hours, therefore we are satisfied with the result. 432 was our major focus. We did work many new stations (23 initials), several of them were most probably QRP stations. Activity seemed to be quite high due to JW/SM2BYA activity. Score is 206 QSOs x 93
Our RIG did work with no technical problems (:-)), which is really unusual. We made some improvement before the contest on our 432 system. HB9BBD did help us with the preamp and the PA, we now do have full legal power on 432. 144 (full legal power) and 1296 (300W) is unchanged. For the detailed logs see the band pages on our home-page at www.hb9q.ch.
Second leg: We did enjoy very much to work many of you. Conditions seemed to be quite okay, however activity on 144 was lower then the last several years (due to JT44??). On 432 it definitely was up compared to the last many years (thanks again SM2BYA, Gudmund). 1296 (we spent only a few hours on 23cm) we belief to be on last years level. Here our results: Final results ARRL EME Contest 2003:

Band	No. QSO	Multipliers	
144	120	38	
432	119	40	
1296	61	28	
Total	300	106	= 3'180'000 points

All QSO's were **CW and random!** We added the detailed logs including comments on our band pages at www.hb9q.ch.
During the second leg of the contest we did work again several QRP stations on 432. If you do have a station running 4 yagis and 50W, 2 yagis and 100W, or 1 yagi and 200W, listen for us or contact us via e-mail.
To all stations calling us with no successful QSO: Please accept our apologize, we did hear many extremely week signals, but were not lucky enough to work them all. Do not give up, try again! Many thanks! Dan HB9Q

SM3AKW First part:Many thanks to you all who answered my calls. I found the activity to be pretty good and did enjoy myself on three bands.

144 x 6	2x17LB	
432 x 39	4x38 (9bv type)	
1296 x 40	5m dish	bcnu Carl/sm3akw

70cm-result from the R/U-stn Oct.:

RA3LE wkd JW/SM2BYA and G4YTL #181. contest 30 QSOs
RW3PX made first QSOs with JW/SM2BYA, UA3PTW, DL9KR, HB9Q and OH2PO.
UA3PTW had initials with JW/SM2BYA, RW3PX, SM2ILF, DL4MEA (new qth) and KE2N/4 #131 contest 55 QSOs
DK3WG very glad to work JW/SM2BYA (DXCC #79), DK5MV, OK2BDQ and F6DRO #402. contest 40 QSOs x 26 Multi
Info: RW3PX is qrv 70cm with 4x21el LY, GS35B. Yuri´s loc KO84TF

70cm & 23cm result from the R/U-stn Nov.:

RA3LE had withe frost this weekend ARRL Contest 29 QSOs
RW3PX wkd N2IQ and PA3CSG #7, hrd weak DK3WG.
UA3DJG hrd and called DL9KR, HB9Q, N2IQ
UA3PTW had initial with DJ7GK, KL7HFQ, G3LQR and JA2TY #135. ARRL 69 QSOs x 35 Multi
UA4ALU made first QSO with HB9Q.
UA9FAD wkd with VK3UM.
UR5LX wkd HB9BBD, F6KHM, OE9XXI, HB9Q, K5JL, K2UYH, K5GW, G4CCH, OE9ERC and OZ4MM **on 23cm**. Congrats fer first UR on 23cm-eme! He has a 3.20 m Dish and 150 W on 23cm.
DK3WG had initials with SM5IOT, YU1EV #404, contest **48 QSOs x 28** Multi
UA4ALU/RA4AOR (father/son) have 12x29el, 100W, hope more power in DUBUS contest.
UA3DJG, KO95CN had 2 LY (5m boom) and 200 W out. -
RA3LE and others do not have any contact to the UA-QSL-bureau, QSL only direct.
73 Jurgen, DK3WG

23cm

DL4MUP: First leg, 23cm results A very poor weekend compared to previous 2 years! In spite of the problems, 11 stations worked: HB9BBD, LA8LF (#), G4CCH, OZ4MM, OK1CA, OE9XXI, OE9ERC, F2TU, F6KHM, K5JL and K5GW. Signals overall were noticeably down on what was expected but some of that could have been the preamp.
My apologies to IK2MMB and HB9Q, whose calls I was able to copy, but then could not process the following overs due to the audio problems. Other 'gotaways' were few OZ6OL, WA6PY were the only ones I could confidently identify!
73 to All, and CU in Nov! Dave, DL4MUP

F5VHX: My new 144 array is well under way and I should be back on 144 for November. I'm targetting infinite return loss, a **negative noise** figure, zero sidelobes, 10 dB Y of ground noise, and installing a water feature in my shack for better **fung shui**...
F5VHX 23cm report was qrv for about 50% of moon at this qth. 200w (at feed) and 4 metre dish. My first experience in 3 years on this band of poor condx, normally this band is very stable/consistant, but this weekend it was very disturbed. This is actually not a serious problem because 95% on 1296 run with so many dB's of redundancy in their systems. So most people are/were still able to hear well enough, even the (us) smaller stations. Activity was down, less cq'ers.
I finished on **39 x 20** on 1296, 2 or 3 new inits. Heard about 30 more but never found them calling. I was mostly just tuning and calling not CQ'ing. I seem to have developed a poor return loss on tx so am somewhat off optimum TX just at the moment. 73 Graham F5VHX

G4CCH: First leg: Had a great time in the contest on 23cm. I did not have to wait too long before the next QSO. Staying awake was a problem on the second night... finally gave in and got a couple of hours before the start of the US window. So far, my score is **57 x 25**... here's who I managed to work:
F1ANH, OM6AA, HA5SHF, OZ6OL, IK2MMB, OE9XXI, HB9BBD, JH5LUZ, OZ4MM, LA8LF, OH2DG, F6CGJ, OE5EYM, JA6CZD, DF3RU, G3LTF, SM3AKW, OK1CA, HB9Q, DL4MUP, DJ5MN, F5VHX, N2UO, K5JL, DL3HRT #180, W2DRZ, W9IIX, PA3CSG, F2TU, OZ9AAR, W7SZ, PA0SSB, K2UYH, IOUGB, K7XQ, DL1YMK, WA6PY, WA4NJP, K5GW, JA6AHB, ON5RR, F6KHM, JH1KRC #181, OE9ERC, HB9SV, ZS6AXT, JR4ZZS #182, DK0ZAB, G3LQR, DL3HX #183 Good signal but, problems decoding callsign!!, IK3COJ, DL8OBU, G4DZU, W7BBM, W2UHI, W7GBI, VE7BBG. Many thanks to everyone who turned out...
I hope you had as much fun as I did. Also, a special welcome back to Jan PA0SSB... nice surprise, and especially hearing you work VE7BBG, K2UYH etc. 73's & GL Howard - G4CCH

HB9BBD: I definitely enjoy contesting! So much activity, concentrated in one or two weekends is just great. However, after a contest weekend I feel almost dead. Not only that day and night make me feel upside down, since during the night I almost fall off the chair in the shack. During the day I should sleep but my body recognizes, its day and its hard to get the sleep. What about reducing the contest to one full moon pass per weekend? It was in the days when an eme qso took 30 minutes to complete when one moon pass was just not good enough. These days it seems to me that the contest runs more like an ordinary 20m contest. I usually make around 60 qso in the saturday morning moon pass of the first weekend.
The whole second weekend then yields another 15 to 20 qso which is, relative to the pain, inefficient. My suggestion is to make things more efficient for all of us. Let's pull the activity into one full moon pass per weekend. Do we want fun in a contest or a painful survival weekend? Why are shortwave contests 24hrs events while eme contests need 48 hours?
73, Dominique, HB9BBD

OE9XXI EME Report: On 1296 I made my first steps during Summer using JT44 working ES8X (thanks to Tom and his crew) and DL3OCH's dxepedition on all his portable locations in TK and ISO (many thanks to Bodo). On October 18/19 during the ARRL EME Contest, I achieved a score of 60x25. Initial contacts were DL3HRT (439/559), JH1KRC (559/589) initial #300, JR4ZZS (559/579) and ON4QQ (439/559). My standings now are 302 initials and 50 DXCC on 1296 EME, on 2300 EME 63 initials and 23 DXCC.
For many EME'ers initial counting seems to be a problem because of the multiple callsign use of some stations especially during competitions. Also the callsign changes of the last years and anniversary activities does not make it easy. In many cases there are no informations available. I think something of an info-box / list available on the internet could be helpful to keep the rules of initial counting agreed several years ago (remember that we count stations, not any number of different callsigns). Myself I will try to update my long list of uncountables". 73's Peter OE9PMJ

DJ9YW: First contacts with TK and IS0: This years September DXpedition to Korsika and Sardinien Bodo, DL3OCH, took his single yagi EME System with him.
He made some JT44 qso with: PA3CSG, DJ9YW, OE9ERC, OE9XXI and K2UYH, which were all first ever QSOs between these countries on 23cms. Sreenshot´s see Bodo´s Homepage www.qsl.net/dl3och
Some problems by using the software (correct QRG) were solved before. DK5KK tried at his exp form arctic circle, but had RF in the laptop and WSJT didn´t run due to this.
At further tests between HB0/DL3OCH and OE9ERC and DJ9YW these problems appeared as well. After replacing the copper-PTT cable by a fiber-optical cable the problem disappeared. This problem will not be observed by the transmitting station, while receiving is ok. 73 de Heinrich, DJ9YW

LA8LF: Conditions on 23cm? Activity down?
Domenique experienced same back in the late 80's and early 90's as I experience now running a small dish and very high power. Small stations that know you have a small antenna (but not high power) think they are heard just as well as they hear me. I would have been OK on 7-8 stations I heard calling me if they had called 2.5 minute periodes as answer to my QRZ. Some of them called only for 30 seconds and never more than a minute. So this is a small station operator problem! OM6AA was a positive example of a vy good operator!.
Now to my human malfunction! 4 weeks ago I tried to lift a heavy load and one of the two major mucles in my right shoulder lost it's fixture and disappeared 6 cm down into the upper arm. Surgery at the University hospital in Oslo was fixed for Friday 14 Nov. When was next contest weekend???
Because of the pain, I was on only QRV 1 hour Saturday evening and 2 hrs next day (Sunday). Worked 42x20 and heard/called additional 9. Worked 11 new initials, now at total 146. The highlight was when K5JL, K5GW, K2UYH and PAØSSB all gave me 589 reports. Not bad for a 3.8M dish.
To those 144 and 432 MHz eme'ers that think of quitting EME due to problems encountered, try 23cm EME. It is a fantastic EME band (I have 4 band EME experience since 1987), but as Graham so correctly spelled out, you must get all links in the long chain done correctly. And that is why the band is so fasinating. Always something to correct in order to make it better. And it has a steeper learning curve!
73 de Anders, LA8LF

UR5LX: 1296 EME START from Ukraine for EME. 10 x 7.

Log: HB9BBD, F6KHM, OE9XXI, HB9Q, K5JL, K2UYH, K5GW, G4CCH, OE9ERC, OZ4MM. Ant. Dish 3,2 m, 150 w, FHX35. TNX for help for start UR5LX on 1296 EME to OE5JFL, OE9ERC, DF6NA, UY2QQ, DJ3FI + SM4IVE.
See You VIA MOON! 73! Sergej, UR5LX

W2DRZ / K2TXB: So I was the operator at W2DRZ this weekend for the 23 cm only contest effort. Conditions seemed good and lots of stations were heard both nights until the moon was South, at which time activity took a big drop! Since we have an Oak forest to the East, we cannot see moon for the first 2 hours or so each night.
As always there were a number of stations heard that were not worked, mostly because I never heard them calling CQ. The first night I got no answers to my own CQ's even though I got consistently good signal reports. Sunday I did get answers to some CQ's for 4 contacts. But I think the operators of smaller stations in this contest have to spend more time calling CQ and listening for weak CQ's or they will not make many possible contacts. Here is a partial list of stations heard but not worked due to never finding them on a clear frequency: N2UO (heard many times, good copy), OZ9AAR, F1ANH, WA4NJP, W7SZ, HB9Q, G3LQR, DL8GBU?
I think I could have worked all of the above if I had only found them calling CQ, or they found me when CQ'ing.
Stations worked Saturday: HB9BBD, K5JL, G4CCH, G3LTF, LA8LF, OK1CA, K2UYH, SM3AKW, OE9XXI, F6CGJ, OH2DG, DL1YMK, F2TU, OZ6OL, PA0SSB, K5GW, WA6PY, JA6AHB.
Sunday: F6KHM, ZS6AXT, PA3CSG, OE5EYM, HA5SHF, OZ4MM, DF3RU, OE9ERC, F5VHX, W2UHI, HB9SV, OZ6OL (dupe), IK2MMB, W7GBI, W9IIX, JH1KRC, W7BBM.
For a total of 34 contacts not counting the dupe.
It was lots of fun but now for some sleep. Drove 8 hours to get here from NJ and got about 6 hours between sessions. The station here is 16 foot dish and 200 watts with 2x7289. Rig TS-2000X.
73 all, Russ K2TXB - operator at W2DRZ (FN02LA).

10 GHz

DL0SHF in ARRL 1st leg on 10 GHz
We - DK7LJ and DF9CY - worked the following stations on 10 GHz:: PA0EHG; DL0EF; IQ4DF; OK1UWA; W5LUA; G4NNS; I5PPE and F2TU. We were also QRV on 13cm - heard very good echoes, but did not work anyone ?!? I went to the 23 cm station (which cannot transmit) too. Wow, that band sounded more like a portion of a crowded SW band ... Big sigs with the 7m dish ! I updated the website http://www.qsl.net/dl0shf
73 de Christoph Petermann, DF9CY

I4ZAU: We worked the following stations on 10 GHz, random: DL0EF; DL0SHF; IK2RTI; OK1UWA; W5LUA; I5PPE; PA0EHG; G4NNS; HRD F2TU (sked only?). 73 Vico, I4ZAU

IQ4DF (JN54VJ): Wkd WA7CJO, OK1UWA, F6KSX Sat. 15 Nov; Wkd Mr. Murphy until 7:30 Sun. 16 Nov, and besides DL0EF, F2TU, I5PPE. 73 Vico, I4ZAU

I5PPE: First Leg I5PPE - 10 GHz Toscana EME Team
During entire October 18th Saturday here we had a strong north wind. All day long, afternoon and the Saturday evening was breezy and very windy. For us it was impossible to move the parabolic dish to run due to a big risk to destroy the entire gear system. Sorry for that, we hoped for the next day.
On the 19th Sunday morning, there was low wind until to 7:00 GMT and we heard very good our own echoes, then we starting at 8:05 GMT the activity with some good contacts. After this, about at 10:30 GMT we had a break of the backspring of Rx-Tx Waveguide Relay....it's seemed just and correct as Murphy happening...since we haven't any spare spring to substitute the broken spring, therefore, for us, only about three hours of activity, the first ARRL Leg was stopped here.

10-GHz CONTEST ARRL Contest LOG Year 2003
Call Used = **I5PPE** Operator = **I5PPPE**

19 Oct. 2003			
IQ4DF	559	549	ITALY
OK1UWA	529	539	CZECH
DL0SHF	449	449	GERMANY
PA0EHG	O-R	O-R	NETHERLANDS
W5LUA	539	O-R	USA # 5
15 Nov. 2003			
WA7CJO	569	569	USA # 7
F6KSX	O-R	O-R	FRANCE
OK1KIR	O-R	O-R	
DL0EF	559	559	
F2TU	O-R	O-R	
IQ4DF	569	559	

QSO = 10 Multipliers = 7 Points = 1000
Claimed Score = 7 x 1000 = 7000
Best 73 de Alex IK5WJD & Pietro I5PPE

WA7CJO – DL0EF QSO on the web
You may be interested to hear a **recording** of DL0EF in **QSO** with WA7CJO on **10GHz SSB**. It can be found at my very embrionic web site at: http://myweb.tiscali.co.uk/g4nns
Unfortunately only half the recording plays on my system but as I am very new to web page production and adding links to sound files I may be able to fix this in the future.
73 Brian, G4NNS, IO91FF

24 GHz

OK1UWA and W5LUA 24 GHz EME QSO
On September 24 at 1400 UTC OK1UWA and W5LUA completed the first ever 24 GHz EME QSO between the 2 countries. This was Josef's first 24 GHz EME QSO and he was my third initial on 24 GHz. Signal report at W5LUA was "M" copy while I was "M" to "O" copy at OK1UWA. We had tried several times in August but no success. OK1UWA was able to hear me but I could not hear OK1UWA. This was our second sked this month which ended up with a success. Josef's station is a 3 meter prime focus dish with 35 watts at the feed, vertically polarized. My station is a 3 meter prime focus dish with 70 watts at the feed, horizontally polarized to account for the spatial offset between NA and Europe. Best 73 Al W5LUA

Software/Internet

How do solar terrestrial phenomena affect the ionosphere and many technical systems? You may find the answers and lots of stunning information (including breathtaking animations of scientific data) on the **"Space Weather CD ROM"**.
This mulitmedia project is published by the University of Greifswald and is supported by the "European Space and Technology Week (EU/ESTW 2002). The CD ROM is freely distributed and supports English, French and German language. See the details at http://www.df5ai.net

There is **a callbook for OH** hams in he web.
http://www.sral.fi/oh-callbook/?lang=EN It contains only members of SRAL (Finnish amateur radio league)
Both can be found on Buckmasters web site at:
http://hamcall.net/cgi-bin/do_hamcallexe
Information includes home address and email address.

I have updated my JAVA software package (project_Auriga) which does some **moon tracking**, **skymaps** and logkeeping. For those of you who are interested, have a look on my homepage / software area. I have the code under GPL license. Feel free and use it. The compiled classes are made with the latest JDK 1.4.1. So you need the JDK (Java Development Kit) or JRE (Java Runtime Environment). The oldest version which it should work with shall be JDK 1.2.2.
There is still a bug in calculating the doppler shift (see src/astro.java). Perhaps I do not understand it correctly. Nevertheless that gives funny results. If one of you has any idea, let me know. Actual pA - version should be x2.0.6
73 de Christoph, DF9CY

JT44 Checklist and Tips
In order to help new users learn more quickly, I have developed a "JT44 CHECKLIST", which is now posted on my website: http://www.bigskyspaces.com/w7gj/JT44checklist.htm
In case you are not aware of it, there is a great section of Eimac's website called "Care & Feeding of **Power Grid Tubes**". It's at the link www.cpii.com/eimac/index.html

A new **Beta Release of WSJT** is available for free download at the WSJT home page,
http://pulsar.princeton.edu/~joe/K1JT. Its principal attraction is a new mode called **JT65** that includes powerful FEC (forward error correction) and will be able to work with significantly weaker signals than JT44. A brief list of the features and technical specifications of JT65 is available at
http://pulsar.princeton.edu/~joe/K1JT/WSJT4.TXT
and a "Quick Start Guide for JT65" may be found at http://pulsar.princeton.edu/~joe/K1JT/UPD411.TXT.
If you are making use of the new JT65 mode in WSJT version 4.1.1, please read the page of FAQ and Operating Tips posted on the WSJT Home Page. The exact URL is
http://pulsar.princeton.edu/~joe/K1JT/WSJT4Q.TXT
If you know of other things that would be helpfully explained there, please let me know. 73, Joe, K1JT

X. Italian E.M.E. Contest 2003

Memorial Luigi Zorzino I2COR , is ended. Propagation up and down, low participation of USA stations. Italian stations present: I1ANP, IK1FJI, IK1UWL, I2FAK, I2RV, IK2DDR, IK2MMB, I3DLI, I3EVK, IK3COJ, I5WBE, IK7EZN, IK7UXY, I0UGB. Results: Foreign stations

Cat.	Call	QSO	St. Ita.	Points	Antenna
			432 MHz		
A)					
1	JA9BOH	4	-	40	2x2.8mt. 9BOH
B/C)					
1	EA3DXU	7	-	70	2x38 el. M2
2	K6JEY	6	-	60	4x25 K1FO
2	SK0CC	6	-	60	8x2.5mt.
4	UT3LL	2	-	20	6x27 el. DJ9BV
D)					
1	F2TU	17	-	170	8 mt dish.
2	JA6AHB	14	-	140	7 mt. dish
3	SP6JLW	8	-	80	8x32el. DJ9BV
4	JA4BLC	6	-	60	6 mt. dish
			1296 MHz		
1	F2TU 22	3	283	8 mt. dish	
2	G4CCH	24	2	282	5.4mt. dish
3	WA6PY	10	1	121	2.4 mt. dish
4	JA6AHB	2	-	20	7 mt. Dish
			2304 MHz		
1	JA4BLC	5	-	50	6 mt. dish
1	F2TU	5	-	50	8 mt. dish
			10 GHz		
1	F2TU	2	-	20	8 mt. dish
			Italian		
			1296 MHz		
1	IK2MMB	17	-	170	Dish
2	IK3COJ	12	-	120	3mt. dish

Winner: JA9BOH, EA3DXU, F2TU, JA4BLC, IK2MMB.
The prize and certificate will be delivered during next XIII. **Italian EME meeting on May 8th/9th 2004**, at the Joseph Hotel, in the same location like last year.
For stations who are not present there, the awards will be sent via mail after the meeting.
TNX to ALL! I1ANP, Mario, Italian EME Manager

XI. Italian E.M.E. Contest 2004

Will take place on September 11th and 12th 00-24z, with the same rules like in 2003.

Last:

I need some more pictures, let the stuff coming

73 Bernd DL7APV

Last Minute:

The 2004 HF-Expedition to **Aves Isl., YV0**, plans also some EME activity. Date: End of Jan. to Feb. 2004.

Lunar Weekend Calendar for 2004, by G3SEK

At 2400 Sat/ 0000 Sun	Declination (deg)	Signals (dB)	Sun offset (deg)	Sky temp (K,432MHz)	Comments
Jan-03/04	22.0	-0.9	+140	29	Night.Apogee.
Jan-10/11	**16.7**	**-0.1**	**-141**	**14**	**Night.**
Jan-17/18	-22.4	1.0	-53	66	Moon in south.
Jan-24/25	-9.9	-0.1	+41	19	Moon in south.
Feb-00/01	24.2	-0.9	+120	29	Day(PM).Apogee.
Feb-07/08	**12.8**	**0.0**	**-160**	**14**	**Night.**
Feb-14/15	-25.0	1.0	-71	66	Moon in south.
Feb-21/22	-6.4	-0.1	+21	19	Moon in south.
Feb-28/29	25.9	-0.9	+99	35	Day(PM).Apogee.
Mar-06/07	**8.9**	**0.1**	**-176**	**15**	**Night. REF/DUBUS I**
Mar-13/14	-26.9	1.0	-88	166	Moon in south.
Mar-20/21	-2.5	-0.2	+3	20	Moon in south.
Mar-27/28	27.1	-0.9	+79	35	Day(PM).Apogee. **REF/DUBUS II**
Apr-03/04	**5.2**	**0.2**	**+161**	**15**	**Night.**
Apr-10/11	-27.6	0.9	-105	149	Moon in south.
Apr-17/18	1.6	-0.3	-18	19	Sun noise.
Apr-24/25	27.6	-0.9	+60	29	Day(PM).Apogee.
May-01/02	**1.5**	**0.3**	**+141**	**21**	**Night.**
May-08/09	-27.2	0.9	-122	41	Moon in south.
May-15/16	5.9	-0.4	-36	20	Day(AM).
May-22/23	**27.4**	**-0.9**	**+42**	**20**	**Day(PM).Apogee.**
May-29/30	-2.3	0.4	+123	20	Moon in south.
Jun-05/06	-25.9	0.9	-140	41	Moon in south.
Jun-12/13	**10.2**	**-0.5**	**-53**	**20**	**Day(AM).**
Jun-19/20	26.4	-0.8	+24	20	Sun noise.
Jun-26/27	-6.5	0.5	+105	20	Moon in south.
Jul-03/04	-24.1	0.8	-158	24	Moon in south.
Jul-10/11	**14.2**	**-0.6**	**-71**	**24**	**Day(AM).Apogee.**
Jul-17/18	24.7	-0.8	+8	14	Sun noise.
Jul-24/25	-11.1	0.6	+88	21	Moon in south.
Aug-00/01	-21.8	0.7	-174	18	Moon in south.
Aug-07/08	**17.8**	**-0.6**	**-89**	**24**	**Day(AM).Apogee.**
Aug-14/15	22.4	-0.7	-13	14	Sun noise.
Aug-21/22	-15.7	0.6	+72	26	Moon in south.
Aug-28/29	-19.1	0.7	+164	20	Moon in south.
Sep-04/05	20.8	-0.7	-108	24	Day(AM).Apogee.
Sep-11/12	**19.9**	**-0.7**	**-31**	**13**	**Day(AM).Apogee. I-Cont**
Sep-18/19	-19.8	0.7	+55	29	Moon in south.
Sep-25/26	-15.6	0.6	+147	17	Moon in south.
Oct-02/03	23.3	-0.8	-127	24	Night.Apogee.
Oct-09/10	**17.1**	**-0.6**	**-50**	**14**	**Day(AM).Apogee. ARRL?**
Oct-16/17	-23.1	0.8	+38	35	Moon in south.
Oct-23/24	-11.4	0.5	+130	17	Moon in south.
Oct-30/31	25.3	-0.8	-147	29	Night.Apogee.
Nov-06/07	**13.9**	**-0.5**	**-70**	**14**	**Day(AM).Apogee. ARRL?**
Nov-13/14	-25.4	0.8	+19	66	Moon in south.
Nov-20/21	-6.6	0.4	+112	19	Moon in south.
Nov-27/28	26.8	-0.8	-167	35	Night.Apogee.
Dec-04/05	**10.4**	**-0.4**	**-90**	**14**	**Day(AM).**
Dec-11/12	-26.8	0.9	-4	166	Moon in south.
Dec-18/19	-1.8	0.3	+94	20	Moon in south.
Dec-25/26	27.7	-0.9	+172	35	Night.Apogee.

Sun Offset *vs* Time of Day for Visible Moon

-180° -120° -30° 0° +30° +120° +180°

-180° to -120°	-120° to -30°	-30° to +30°	+30° to +120°	+120° to +180°
Night	Day(AM)	Sun noise	Day(PM)	Night

EUROPEAN WORLD-WIDE EME CONTEST 2004

Sponsored by DUBUS and REF

The EU WW EME contest is intended to encourage world-wide activity on moonbounce. Multipliers are DXCC countries plus *** ALL W/VK/VE STATES ***. This gives equal chances for stations from North America, Europe and Oceania. The rules reward random QSOs, but do not penalize skeds on 2.3GHz or above. Winners (1^{st} places) receive free subscriptions to DUBUS magazine!

1. Contest Dates & Bands:

First weekend: 432 MHz, 2.3 GHz to 5.7 GHz 06-07 MARCH 2004, 00- - 24UTC
Second weekend: 144 MHz, 1.3 GHz and 10 GHz 27-28 MARCH 2004, 00 - - 24 UTC

2. Sections and Awards:

QRP 144MHz <100kW EIRP 432MHz <400kW EIRP 1296MHz <600kW EIRP
>= 2300MHz no separate QRP/QRO categories
QRO On 144, 432 and 1296MHz, stations with EIRP equal to or greater than stated above.
PRO Non-amateur equipment or antenna. PRO stations will have scores listed separately.
There are no separate multi-operator classes. Multi-operator and QRO stations will be highlighted in the general classifications. All QRP/QRO band winners and QRP/QRO multiband winners will receive a year's free subscription to DUBUS magazine. In each band/section, certificates will be sent to the top ten entries and to the highest-scoring station in the southern hemisphere.

4. Contest Exchange: For a valid QSO, both stations must transmit and receive both callsigns+ TMO/RST + R. During a QSO, on any band, liaison by any other means (eg DXcluster, Internet, telephone) is forbidden! There is no restriction on modes, but entrants must not cause inter-mode QRM.

5. Logs: Logs must be separate for each band, and should be in normal "logbook" format. Top line: Your callsign, Band Each QSO: Date/time, Callsign, Report sent, Report received, Points, Multiplier Bottom line: Total points, Total multipliers, Total claimed score.

5. QSO Points: 100 points for each random QSO completed.
10 (ten) points for each sked QSO completed on 144/432/1296MHz.
100 points for each random or sked QSO completed on 2.3GHz or higher bands.

6. Multipliers: Each DXCC country (except W/VE/VK), or EACH INDIVIDUAL STATE worked in W/VE/VK. Multipliers count only if worked by RANDOM (except on 2.3GHz or above). States and provinces can be determined after the contest using recent Newsletters, on the Web or in DUBUS.

7. Total Scores: Single band score = [Total of QSO points] * [Total of multipliers].
There will be one QRP winner and one QRO winner on each band.
Multiband score = [(Total sum of points on 144-1296MHz) +
(2 * total sum of points on 2.3GHz or above)] * [Total sum of multipliers on all bands]
There will be one QRP multiband winner and one QRO multiband winner. Multiband stations will also be listed as an entry on each separate band worked, and can also win single-band awards.

8. Contest Entries: Copy of the log for each band with details of points, multipliers and total points. The following information **MUST** also be included for each band: 1. Output power, transmit cable loss, antenna type and gain. 2. Category: QRO/QRP single/multi operator 3. Name(s) of all operators 4. Locator/State. Other info is welcome: Comments, conditions, locator, station details, photographs, etc.

9. Sending Your Entry: Contest entries **MUST** be sent no later than 30 days after the end of the second weekend (i.e. in the mail or e-mail by 30 APRIL 2004).
Mail address: Patrick Magnin, F6HYE, Marcorens, F-74140 BALLAISON, France
You can also e-mail your contest entry in ASCII format to: f6hye@ref-union.org
All email entries will be acknowledged within one week.

10. Referee: N.N. For rules and general questions contact: info@dubus.de

DO *NOT* SEND LOGS TO G3SEK, and DO *NOT* SEND LOGS TO ANY DUBUS POST OR E-MAIL ADDRESSES!

Good Luck in the Contest!

For REF: Patrick Magnin, F6HYE For DUBUS: Joachim Kraft, DL8HCZ

Tropo Reports

2m, 70cm and up

Editor: Wolfgang Schneider, DJ8ES
DJ8ES@t-online.de

Supplement: Great tropo opening in August ´03

In the beginning of August great tropo openings occurred on 4. – 10. August and also on Aug. 12th /13th to G, F and EA. In the first week a center of high-pressure area builds up over the North Sea, which later moved in northwestern direction.

Several logs received directly after that:

- LA0BY, Stefan, JO59IX and also /p in JO39PB
- LA6LCA, Leif, JO59FE
- DK3WG, Jürgen, JO72GI
- OZ1IEP, Carl, JO55XU
- DL8EBW, Guido, JO31NF
- G3XDY, John, JO02OB
- DB5KN, Mike, JO31NB
- DJ8ES, Wolfgang, JO43SX

QRV on all frequencies between 2m and 3cm was LA6LCA (Leif). From his qth in JO59FE he worked 23 stations on 144MHz, at over 1000km range; odx was G4RRA (IO80) with 1305km. On 432MHz Leif worked 12 stations >1000km. All qso´s were across the North Sea. Good results on 23cm and up could be logged, too: For example LA6LCA worked with G3XDY (JO02) on all this bands, and, on Aug., 8th, he worked F6DKW in JN18CS (1277km) on 10.368MHz. This is a first 3cm tropo-qso between LA and F!

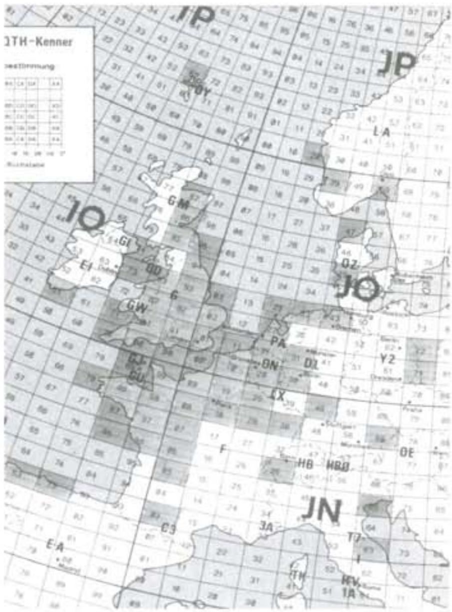
At the beginning of August OM Carl (OZ1IEP, JO55) worked several new squares on 2m and also 70cm. Contacts to UK, F, PA, ON and DL are logged. His odx on 144MHz (and also on 70cm!) was 1387km (F9IE, IN86WW).

Jürgen (DL3WG, JO72GI) reported qso´s up to 1100km and highlights with G4KWQ in IO92AQ at 1112km on 2m and G4RGK in IO91ON (1050km) on 70cm.

During the first two weeks of the August opening we found Guy (DL8EBW, JO31) on the 2m-Band. Between 5th. and 11th. he made contacts to GM and also listened a lot of beacons reports from the UK. But on Aug., 12th/13th, qso´s to LA, G, GW, GI, EI, F and EA were possible with good signals: His odx was EB1EHO (IN73) with 1288km.
Also from JO31-square, OM Mike (DB5KN) was active on 70, 23, 13, 9 and 6cm-band. On 432MHz he worked the Faroer-Islands with OY9JD (IP62OA, 1483km). Most of the other contacts were with the UK (incl. GI). Mike did have also a lot of qso´s on 23cm. Distances up to 1000km (GI0GDP, IO74CR) were possible for him. Stations like G3XDY (JO02), G4PBP (IO82) and G6DER (IO93) he worked on several bands.

John (G3XDY, JO02OB) concentrated specially on frequencies 23cm and up. Several contacts to SM, OZ, LA, F and DL were possible for him. Stations like F6APE (IN97), LA6LCA (JO59) and DG0RG (JO62) he worked on 23, 13, 9, 6 and of course 3cm.

For myself (DJ8ES, JO43) I worked stations from F, G, GW and GM with distances up to 1200km. My odx on 2m was F5GHP in IN96LE (1146km) and F9IE (IN86WW, 1135km) on 70cm. On 23cm there was not much activity, myself did only contacts to G and F in the range up to 800km. On 3cm the situation was a little bit better. Two new squares (IO93, JO01) were possible for me.



Squares wkd during the tropo opening in Aug ´03 (only qso´s >700km)

Actually:

A next great tropo opening occurred in November the 7th and 11th between Scandinavia and Russia (UA1/UA3). Details about that you will read here.

2m

ON4LDP, JO10UM, wkd (>900km):

06/11/03 20:22	SM6ONH	JO68MN	1075km
06/11/03 20:35	SM7XFD	JO77JO	1066km
06/11/03 21:36	SK4BX	JO79OF	1212km
06/11/03 21:49	SM6GXV	JO57XJ	934km
06/11/03 22:10	SK6DK	JO67EH	943km

rig: TS-790e, PA 150W, PreAmp, 13ele yagi
tnx for info Olivier

SK0UX, JO99BM, wkd (>1200km):

14/09/03 20:48	G4DEZ	JO03AE	1312km
14/09/03 22:13	G1XWD	JO03GI	1275km
14/09/03 22:19	G3KEQ	JO01BH	1450km
14/09/03 22:22	G4FUF	JO01GN	1410km
14/09/03 22:25	G4NQQ	JO01	????km
14/09/03 22:28	G4ZFJ	JO01HO	1402km
14/09/03 22:30	G8WXU	JO01EP	1411km

rig: 1kw, 4x5wl Yagi
tnx for info Hans (SM7MXO)

OZ1IEP, JO55XU, wkd (>1000km):

14/09/03 08:02	F5MSC	IN99EP	1142km
14/09/03 08:04	G8JLY	IO81JM	1105km
14/09/03 08:39	GW7SMV	IO81LN	1093km
14/09/03 19:15	G3JHM	IO91LC	1007km
14/09/03 19:37	F8LDX	IN99GK	1149km
14/09/03 19:42	G4RRA	IO80BS	1190km
14/09/03 19:48	EI3GE	IO63XD	1196km
14/09/03 19:52	F6FAI	IN88HM	1320km
15/09/03 19:40	G4RRA	IO80BS	1190km
07/11/03 21:29	RA1WL	KO47EV	1020km
07/11/03 22:03	RA3DRC/1	KO55JR	1173km
07/11/03 22:05	RA3LE	KO64AR	1273km
07/11/03 22:31	RA3LBK	KO65QA	1348km
07/11/03 22:45	EW6GB	KO45CN	1016km
11/11/03 17:24	RA1TT	KO68XJ	1351km

tnx for info Carl

DK3WG, JO72GI, wkd (>1000km):

22/09/03 07:53	OH1NOR	KP00XL	1014km
22/09/03 07:55	OH3BYZ	KP21UA	1181km
22/09/03 07:57	OH2LAK	KP10XL	1074km
22/09/03 08:16	OH3BYZ	KP21UA	1181km
22/09/03 08:19	OH7PI	KP42HF	1383km
06/11/03 09:33	SM3XRB	JP82UV	1190km
06/11/03 09:34	SM3HG	JP81DR	1050km
07/11/03 18:25	OH1NOR	KP00XL	1014km
08/11/03 16:34	OH1NOR	KP00XL	1014km
10/11/03 16:41	OH6KTL	KP02OJ	1187km
10/11/03 16:47	OH1NOR	KP00XL	1014km
10/11/03 16:48	OH6PA	KP02PL	1198km
10/11/03 17:22	OH6HFX	KP14RA	1399km
10/11/03 17:58	OH8NXE	KP25SB	1547km
10/11/03 18:04	OH1AYQ	KP12JB	1189km
11/11/03 16:18	RA3AQ	KO85S	1543km

tnx for info Jürgen

DL8EBW writes:

Hello dear VHF-friends,
thanks a lot for all the nice QSOs during the weekend in the MMC 2003. I was operating at the station/QTH from Dit, DF7KF, with his new antenna array (16x 18el M2). Really famous, if you met the partners direction, but very difficult sometime to read if you are only 10 degree away from it. So an qso to S5 was sometimes easier than the low distance qsos to JO31! Anyway, I did manage to work around 376 QSOs with 380km/QSO - here are the top ten:
S57O (JN86DT, 842km), S51ZO (JN86DR, 848km), OM3W (JN99BB, 851km), F6FHP IN94TR, 854km), HG1Z (JN86KU, 876km), OM3RM (JN87WV, 883km), 9A2L (JN86HF, 902km), OM0C (JN99PG, 926km), I5PVD/6 (JN63GN, 928km), HA5KDQ (JN97LN, 972km).
73 de guy (DL8EBW)

PA2CHR, JO22XA, wkd on Nov. 6th:

16:50	SM0KAK	JO89XK	1115km
16:54	OH1NOR	KP00XL	1127km
18:48	SK4BX	JO79OF	990km
19:30	SM6OHN	JO68MN	855km

Rig: TS850+LT2S, MGF1801, NF: 0.27dB, PA 3CX800, Ant 4 x 28 el. BVO/5wl
tnx for info Chris

RW3PF, KO93CD, wkd on Nov. 7th:

LA0BY (JO59IX), SM6ONH (JO68MN), OH0JFP (KP00AJ), ES1MM (KO29KK), SK0UX (JO99BM), SM6NET (JO68SD), SK6HD (JO68SD), SM7XFD (JO77JO), ES4EQ (KO39CE), YL3DW (KO26CW), LA6VBA (JO48MQ), SK6DK (JO67EH), LY2MW (KO24PQ), SK6EI (JO68VK), LA6LCA (JO59FI), SK6QW (JO68WR), SM1CXE (JO97FJ), LA3BO (JO59CD), SM5XJX (JO88GK), OZ1FDH (JO65CH), SM1TDE (JO97IS), YL8HSA (KO26CV), EW6GB (KO45CN), ES6DO (KO27WX), SM6CMU (JO57XK), SM4AXY (JO79LG), OZ9PP (JO47VA), SM6OPX (JO58RG), SM6ELY (JO68SE), OZ1HNE (JO57GG), LA6MV (JO59EJ), SM6TMR (JO67QO), SM7DVF (JO76JU), LA5UKA (JO59HJ), SM6FOV (JO78BR), OZ1SKY (JO56DG), SM6FBQ (JO67BQ), LA3TL (JO58SX), LA2PHA (JO38IB), SK6EI (JO68VK), LY2BUU (KO15XH), OZ2M (JO65FR), SM7EBI (JO77BT), SK6NP (JO68MB), SM6CTQ (JO78FM), SM6EAN (JO57WQ), LA7VH (JO59EK), OZ2PJ (JO65ER), SM7DLZ (JO86BS), OZ1CLL (JO65GZ), LY2IC (KO14WW), SM6ENG (JO67CQ). Rig: PA 4x10el BVO-3WL , PA GS35b
tnx for info Peter

LA0BY, JO59IX, wkd (>1200km):

07/11/03 16:01	UA3ARC	KO85SO	1650km
07/11/03 16:13	RW3PF	KO93CD	1831km

07/11/03 16:23	RW3LW	KO54MQ	1348km
07/11/03 16:33	RA3DCI	KO96CB	1664km
07/11/03 16:36	RA3AQ	KO85JE	1631km
07/11/03 16:38	RU3ACE	KO95KG	1742km
07/11/03 16:40	UA1WCF	KO55JR	1273km
07/11/03 16:45	RA3PG	KO84TD	1737km
07/11/03 16:53	RN3AP	KO85RQ	1642km
07/11/03 19:00	EW6PW	KO55CE	1273km
07/11/03 19:06	RU3FA	KO84RU	1687km
07/11/03 19:08	RX3PR	KO84TE	1735km
07/11/03 19:50	RA3DRC/1	KO55JR	1273km
07/11/03 20:32	EW1LN	KO33RW	1213km
07/11/03 21:12	RA3LBK	KO65QA	1454km
07/11/03 22:10	UA1XP	KO55JR	1273km
07/11/03 22:14	RU3EC	KO82TK	1847km
07/11/03 22:18	EU3AI	KO22CE	1201km
07/11/03 22:50	SP7EXY	KO00QW	1207km
07/11/03 23:07	US5WU	KO20DI	1370km
07/11/03 23:59	RA3LE	KO64AR	1399km
08/11/03 21:53	SP9SDR	JN99NN	1276km
08/11/03 21:56	SP9QMP	JO90FB	1207km
08/11/03 22:06	SP9KUP/9	JN99QU	1253km
08/11/03 22:18	SP9APC	JN99QU	1253km
08/11/03 22:23	SP9MCY	JO90OG	1206km
11/11/03 17:52	UA4UK	LO14MA	**2044km**
11/11/03 15:45	RW3TJ	LO16XG	**1974km**
11/11/03 16:18	RW3TI	LO16WG	**1969km**
11/11/03 17:30	RU3ACE	KO95KG	1742km
11/11/03 17:00	UA3ARC	KO85SO	1650km
11/11/03 16:01	RA3AQ	KO85SP	1648km
11/11/03 17:55	UA3AOG	KO85SR	1644km
11/11/03 16:11	RK3AF	KO85QR	1635km
11/11/03 17:05	RA3LBK	KO65QA	1454km
11/11/03 15:41	RA1TT	KO68XJ	1329km

tnx for info Stefan

I4XCC, JN63GV, wkd (>700km):

05/07 09.54	UT7DX	57/53	KN18JT	956km
14/07 18.25	SP6TTQ	55/59	JO90BK	840km
14/07 18.45	SP6OUL	58/ 59	JO90BF	821km
14/07 18.47	SP9JDP	57/ 51	JN99HW	814km
14/07 18.53	SP9LCV	56/55	JO90KF	851km
14/07 18.55	SP9JCS	55/59	JO90CA	805km
14/07 18.56	SQ9PV	53/56	JO90KF	851km
14/07 18.58	SP9SDF/9	55/59	JN99LN	797km
19/07 17.55	UT5DL/P	59/59	KN18JT	956km
26/07 10.00	DH2UAK	52/53	JO71FU	896km
03/08 07.23	DL1ANZ	559/559	JO51IJ	845km
03/08 08.37	4U1VIC	559/599	JN88FF	568km
03/08 10.30	DK3EE	559/519	JO41GU	933km
03/08 10.32	DL0MQ	559/539	JO41GV	938km
03/08 12.40	DL3DXX	559/599	JO61VC	807km

tnx fr info Claudio

RU3ACE, KO95KG, wkd (>1000km):

07/11/03 15:16	SM1HOW	JO97GL	1270km
07/11/03 15:28	OH0JFP	KP00FB	1212km
07/11/03 16:16	OZ2M	JO65FR	1654km
07/11/03 16:38	LA0BY	JO59FW	1754km
07/11/03 17:35	SM6NET	JO68SD	1569km
07/11/03 17:53	SM1TDE	JO97II	1260km
07/11/03 18:29	SK6EI	JO68VK	1555km
07/11/03 18:39	SK6HD	JO68SD	1569km
07/11/03 19:27	SM7XFD	JO77JO	1494km
11/11/03 13:44	OH7HXH	KP53HG	1003km
11/11/03 13:50	OH3XR	KP01UK	1208km
11/11/03 13:52	SM3AKW	JP92AO	1436km
11/11/03 14:54	OH1NOR	KP00XL	1151km
11/11/03 15:18	OH1XT	KP01UK	1208km
11/11/03 15:41	OH6KTL	KP02OJ	1281km
11/11/03 15:42	OH1HSC	KP10CM	1140km
11/11/03 15:43	OH1NOR	KP00XL	1151km
11/11/03 15:49	OH1XT	KP01U	1208km
11/11/03 15:54	OH1MDR	KP01VJ	1202km
11/11/03 15:55	OH1MA	KP10IL	1113km
11/11/03 16:04	OH2AUK	KO19TX	1044km
11/11/03 16:18	OH1MA	KP10IL	1113km
11/11/03 16:18	OH2AUK	KO19TX	1044km
11/11/03 16:21	OH6MRD	KP12EO	1243km
11/11/03 16:33	OH1MDR	KP01VJ	1202km
11/11/03 16:47	SK6EI	JO68VK	1555km
11/11/03 17:02	SM5KNV	JO88MJ	1366km
11/11/03 17:20	SP4MPB	KO03GS	1191km
11/11/03 17:31	LA0BY	JO59FW	1754km
11/11/03 18:13	SP2FAV	JO94MA	1279km
11/11/03 18:15	SP4JWD	KO03FR	1197km
11/11/03 18:55	SM0KAK	JO89XK	1330km
11/11/03 18:58	SM5CUI	JO89WW	1347km
11/11/03 19:04	SK3MF	JP92FW	1433km
11/11/03 19:06	SM0LCB	JO89XI	1328km
11/11/03 19:32	SM0AGP	JO89XF	1326km
11/11/03 20:33	SK6DK	JO67EH	1640km
11/11/03 20:48	SP2IQW	JO94GM	1298km
11/11/03 20:50	M5LXA	JO78HH	1506km
11/11/03 21:11	SK7HW	JO76JU	1497km
11/11/03 22:27	SM7EBI	JO77CS	1529km
11/11/03 22:36	SM6CTQ	JO78FM	1517km
11/11/03 23:53	SM0LQB	JO89XK	1330km
12/11/03 06:48	SM1HOW	JO97GL	1270km
12/11/03 07:37	YL2CQ	KO17EM	1043km

tnx for info Max

70cm

DJ8ES, JO43SX, wkd on 6./7. Nov (>600km):

SK4BX	JO79OF	59	59	678km
ES2RJ	KO29JM	57	59	1111km
ES2QH	KO29LL	55	55	1117km
ES2NA	KO29JL	55	55	1109km
ES2WX	KO29JN	57	57	1113km
SM5DFF	JO88CN	55	33	654km
YL3AG	KO26AW	55	55	969km

PA2CHR, JO22XA, wkd on Nov. 6th:

17:51	SM5DFF	JO88CCN	975km
18:13	ES2RJ	KO29JN	1439km
18:15	ES2WX	KO29JN	1439km

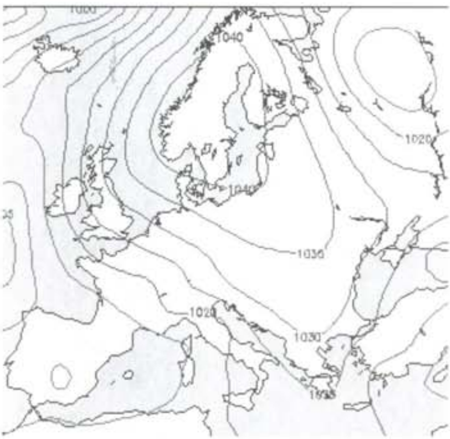
18:57	SM7XON	JO87FD	885km
19:00	ES2QH	KO29LL	1445km
19:02	ES2NA	KO29JL	1437km
19:14	SK4BX	JO79OF	990km
19:19	SM7HGY	JO86DR	850km
19:32	SM6ONH	JO68MN	855km
20:20	LA6MV	JO59EJ	866km
20:36	SM6CEN	JO57XO	731km

Rig: FT847, PreAmp MGF1302, nf: 0.32 dB, PA YL1050, Ant 4 x 35 el.BVO/11wl
tnx for info Chris

OZ1IEP, JO55XU, wkd (>700km):

14/09/03 09:26	GW3HWR	IO71XN	1152km
14/09/03 09:30	G0OGY	JO01GR	877km
14/09/03 09:39	G4DEZ	JO03AE	823km
14/09/03 20:02	G4KLX/P	IO93GB	919km
14/09/03 20:04	G8VHI	IO92FM	951km
14/09/03 20:09	G0VVE	IO91SG	963km
14/09/03 20:12	G8WXU	JO01EP	892km
15/09/03 06:08	YL3AG	KO26AW	752km
14/10/03 18:44	PA5KM	JO11WL	720km
07/11/03 21:09	RA3LE	KO64AR	1273km
07/11/03 21:18	YL2AJ	KO16OX	702km
07/11/03 21:41	ES2RJ	KO29JN	864km
07/11/03 22:29	EW6FS	KO35LB	948km
10/11/03 20:12	OH6QR	KP22BN	1014km
10/11/03 22:17	ES5PC	KO38HJ	927km
11/11/03 18:50	UA3ARC	KO85SO	1592km
11/11/03 18:57	ES2RJ	KO29JN	864km
11/11/03 19:11	ES5PC	KO38HJ	927km
11/11/03 19:18	RA3AQ	KO85JE	1556km

tnx for info Carl



Center of high pressure at 07.11.03 at 02.00 UT straight over scandinavia

OZ1FF, JO45BO, wkd (>600km):

04/10/03 15:43	DLØON	JO5ØVF	646km
05/10/03 05:46	DKØNA	JO5ØTI	629km
14/10/03 17:01	SMØFZH	JO99HI	752km
14/10/03 18:05	DLØEE	JN49GK	686km
14/10/03 19:23	SM1TDE	JO96BW	634km
14/10/03 19:39	G4BRK	IO91DP	782km
06/11/03 18:35	DB6NT	JO5ØTI	629km
11/11/03 18:00	SMØFZH	JO99HI	752km
11/11/03 19:38	SM1TDE	JO96BW	634km
11/11/03 20:31	G4BRK	IO91DP	782km

tnx for info Kjeld

HA8V, KN06HT, wkd on 4./5. Oct (>500km):
OK1MDK (JN79NU, 529km), IW1FQD/6 (JN63ET, 726km), DK0OG (JN68GI, 630km), OK1RF (JN79KM), 522km), OK2KKW (JO60JJ, 700km), DF0MTL (JO60LK, 692km), OK1KZE (JN79FX, 575km), DF0YY (JO62GD, 831km), OK1ES/P (JO70UR, 565km), OE5D (JN68PC, 570km), DK1KC/P (JN58QH, 713km), OK1OTS (JO70NJ, 567km), DL3TF (JO60RP, 676km), OK1KKD (JO60WD, 620km), OL4A (JO60RN, 671km)
Rig: 4x23el. K1FO, 35m agl, TR851E, 25w
tnx for info Gabi

DK3WG, JO72GI, wkd on 70cm (>500km):

06/11/03 09:43	SM6ONH	JO68MH	671km
06/11/03 11:32	SM3LBN	JP80IO	929km
07/11/03 12:51	SM7FWZ	JO77EQ	595km
07/11/03 13:33	OH0JFP	KP00AB	925km
08/11/03 08:11	LA2PHA	KO38IB	1000km
08/11/03 08:27	LA6MV	JO59FJ	824km
10/11/03 09:32	SP8NCJ	KO12NC	588km
10/11/03 17:38	OH6HFX	KP14RA	1399km#
10/11/03 17:40	SM3DBN	JP80IO	929km
10/11/03 18:17	SM7EOI	JO86FP	496km
11/11/03 17:36	RA3LE	KO64AR	1186km
11/11/03 18:05	OH0A	JP90XD	931km
11/11/03 18:30	SK1BL	JO97HK	626km

DB6NT, JO50TI, wkd Sep - Nov ´03:
SP3NEN (JO73), YL3AG (KO26), OZ9FW (JO65), OZ2ELA JO65), SP2MKO (JO93), OZ5KM (JO45), SM7SCJ (JO65), SM6ESG (JO67), SM6SKH (JO66), OZ1SKY (JO56), OZ1DLD (JO45), SM6CEN (JO57), ON4BBF (JO11), SM0LQB (JO89), SM4DHN (JP60), LA4BY (JO59), SM0LQB (JO89), OH6PA (KP02), OZ1MAX (JO57), OZ2ELA (JO65), OZ9ZZ (JO46), OZ3ZW (JO54), OZ1CTZ (JO46), OZ2OE (JO45), OZ5MZ (JO45), LA4YGA (JO48), LA6LCA (JO59), OZ1FF (JO45), OH6HFX (KP11), SM7NNJ (JO86), SM1NJC (JO97), SM0FMY (JO89), SM3LBN (JP80), SK6EI (JO68), SM5DFF (JO88), SM0LQB (JO89), SM5DIC (JO89)
tnx for info Michael

Tropo opening from 6.- 8. November by LA0BY:
The first day started with a lift to South, moving to Southwest and East during the evening. Condx

were quite good, but not extraordinary. When I called CQ beaming North for Aurora, G4SWX came in via Tropo on the backbeam. When I called CQ towards UK, but then OH1NOR called from the rear.

The event on November 7th was the best tropo opening I ever experienced - lots of stations and extremely strong signals over huge distances. I was obviously sitting at the western end of a duct extending into a very interesting direction! The result were new Tropo ODX on both 2 m (RU3EC KO92TK 1954km) and 70 cm (RW3PF KO93CD 1831km). The ducting to UA3 was very stable and lasted for more than 9 hours. 18 QSO with UA3 on 2 m and 5 on 70cm were really good from my location.
I also worked several stations in FM on the standard calling channels, even two new squares (KO47, KO33). My apologies for having annoyed some local stations with using their 'chat channel'. The opening appeared more like Sporadic E than Tropo. The beacons LY2WN on 2 m and ES0UHF on 70 cm came in with 599 (never heard before). Late at night the ducting extended more to South, with US5WU in KO20 and SP8RHL in KN19 being the furthest stations. In the morning UR5LX reported LA8VHF but I had to sleep sometime, sri.
An evening later I was QRV only for 1,5 hours. The duct was still open to SP5/7/9 and contacts with low-power stations over 1200 km were made, on both 2 m and 70 cm.

All in all I added 9 new squares on 2 m and 17 on 70 cm, plus 3 new DXCC on 70 cm. To those who monitor the DX-Cluster rather than the bands I can say that relatively few spots appear during openings to the East. 73, Stefan (LA0BY)

(Stefan added a new tropo ODX already 4 days later on Nov 11th with UA4AK, see his list above

LA0BY, JO59IX, wkd (>1000km):

06/11/03 15:28	DM2EUN	JO60JU	1024 km
06/11/03 16:34	DF0HF	JO50SF	1086 km
06/11/03 16:41	DB6NT	JO50TI	1072 km
06/11/03 21:51	DB1EPO	JO31HG	1002 km
07/11/03 16:08	LY2BAW	KO25KA	1008 km
07/11/03 16:14	RW3PF	KO93CD	1831 km
07/11/03 16:26	RA3LW	KO54MQ	1348 km
07/11/03 16:28	UA3ARC	KO85SO	1650 km
07/11/03 17:45	UA3PTW	KO93BS	1788 km
07/11/03 17:48	EW6FS	KO35LB	1110 km
07/11/03 18:00	RA3LE	KO64AR	1399 km
07/11/03 23:15	SP7EXY	KO00QW	1207 km
08/11/03 21:43	SP7TEE	JO91SS	1065 km
08/11/03 21:47	SP7CNL	JO91QQ	1068 km
08/11/03 22:00	SP7RFE	KO01CX	1066 km
08/11/03 22:01	SP7BCA	KO01CX	1066 km
08/11/03 22:20	SP9APC	JN99QU	1253 km
11/11/03 18:08	UA3ARC	KO85SO	1650 km
11/11/03 18:15	RA3AQ	KO85SP	1648 km
11/11/03 21:06	LY3OD	KO24OR	1045 km
11/11/03 20:53	LY2BAW	KO25KA	1008 km

tnx for info Stefan

RW3PF, KO93CD, wkd (>800km):

06/11/03 16:18	LA0BY	JO59IX	1830km
06/11/03 18:13	SK6EI	JO68SD	1632km
06/11/03 18:48	SM5DFF	JO88CN	1490km
06/11/03 18:55	SM6ESG	JO67CL	1701km
06/11/03 18:56	SM6NET	JO68SD	1632km
06/11/03 19:00	SM7EBI	JO77BT	1593km
06/11/03 19:45	LA6MV	JO59EJ	1835km
06/11/03 23:19	LY2IC	KO14WW	954km
06/11/03 23:21	SM1NJC	JO97DO	1345km
06/11/03 23:25	OZ1DLD	JO45RL	1868km
06/11/03 23:29	LY2BUU	KO15XH	955km
06/11/03 23:30	LY2PU	KO14XW	949km
11/11/03 13:42	OH1XT	KP01UK	1346km
11/11/03 17:13	SK1BL	JO96BW	1341km
11/11/03 17:15	ES2RJ	KO29JN	1088km
11/11/03 17:17	ES2QH	KO29LN	1080km
11/11/03 17:18	ES1OX	KO29HI	1082km
11/11/03 17:20	ES2NA	KO29JL	1082km
11/11/03 18:30	LY2SA	KO14LL	1009km
11/11/03 18:36	OH0AZ	JP90XI	1363km
11/11/03 18:38	SK6EI	JO68VK	1624km
11/11/03 18:40	SM3AKW	JP92AO	1577km
11/11/03 18:42	SK4BX	JO89OF	1455km
11/11/03 18:44	SK0CT	JO89XJ	1421km
11/11/03 18:45	LY2MW	KO24PS	862km
11/11/03 18:53	SM1TDE	JO96RW	1261km
11/11/03 19:46	OH2TI	KP20KE	1125km
11/11/03 21:05	OH0JFP	KP00FF	1332km
11/11/03 21:10	LY3OD	KO24OR	867km
11/11/03 21:16	SM5DFF	JO88CN	1490km
11/11/03 21:18	LY2IC	KO14WW	954km
11/11/03 21:47	SM0FZH	JO99HB	1373km
12/11/03 19:43	LY2BAW	KO25KA	892km
12/11/03 20:15	LY2PU	KO14XW	949km

rig: Ant 432-4x24el OPT-70, PA GS35b
tnx for info Peter

23cm + up

PA2CHR, (JO22XA), wkd on Nov. 6th:

17:25	F6DKW	JN18CS	449km
17:42	SM6DJH	JO58PI	782km
17:57	SM6CEN	JO57XO	731km
18:00	SM6OEW	JO67DA	691km
18:02	SM7ECM	JO65NQ	623km
18:08	SM4DHN	JP60VD	1026km

Rig: IC706+LT23, PreAmp FHX35, NF: 0.4 dB, PA 2x M-57762: 30 Watt, 44 el. SHF/13wl
tnx for info Chris

OZ1FF, JO45BO, wkd 23cm (>600km):

21/10/03 20:57 G3XDY	JO02OB	600km
06/11/03 18:37 DB6NT	JO50TI	629km
06/11/03 19:30 F6DKW	JN18CS	859km
06/11/03 19:32 F5HRY	JN18EQ	862km
06/11/03 20:54 SK0UX	JO99BM	737km
06/11/03 21:49 SM4DHN	JP60VD	605km

and on 10 GHz (>300km):

04/10/03 17:44 SK7MW	JO65MJ	310km
04/10/03 18:55 SM7ECM	JO65NQ	314km
04/10/03 19:13 PA6C	JO33FB	302km
28/10/03 18:01 SM6BTT	JO58PI	361km
28/10/03 18:29 PA3CEG	JO33FB	302km
06/11/03 18:19 SM5QA	JO89WG	711km
06/11/03 20:20 PA5DD	JO22IC	449km
06/11/03 20:59 SK0UX	JO99BM	737km
06/11/03 21:00 SM0DFP	JO89VL	719km
06/11/03 21:15 SM6BTT	JO67GQ	356km
06/11/03 21:53 SM4DHN	JP60VD	605km

tnx for info Kjeld

DB6NT, JO50TI, wkd Nov '03:
1296MHz:
SK0CT (JO89), OZ3ZW (JO54), OZ5MZ (JO45), LA6LCA (JO59), OZ1FF (JO45), SM3LBN (JP80), SK6EI (JO68), SM0LCB (JO89)

2320MHz

06/11/03	SM5QA	JO89	1081km
06/11/03	SK0CT	JO89	1083km
06/11/03	LA6LCA	JO59	984km
10/11/03	SM3LBN	JP80	1183km

3400MHz

06/11/03	OZ1CTZ	JO46	668km

5760MHz

06/11/03	SM5QA	JO89	1081km
06/11/03	SK0CT	JO89	1083km

10368MHz

06/11/03	SM5QA	JO89	1081 km

tnx for info Michael

HA8V, KN06HT, wkd on 4./5. Oct (23cm):

OE3XUA	JN77XX	374km
OK1KLL	JN79IW	558km
S57C	JN76PB	417km
S51ZO	JN86DR	330km
LZ9X	KN13IP	388km
HA1KYY	JN87FI	321km
OK5Z	JN89AK	448km
S59R	JN76OM	415km
OK1ES/P	JO70UR	565km
OK2KRT	JN99EJ	332km
S57WW	JN86CM	339km
OE3JPC	JN87EW	344km
OE1SOW	JN88FF	350km
OE3GWC	JN87AU	364km
OM3W	JN99BB	312km
OE3JTB	JN78QN	438km
DK0OG	JN68GI	630km

Rig: 4x19el. Loop-Yagi, 35m agl, MGF1202, 25w
tnx for info Gabi

SK0UX, JO99BM, wkd on 23cm (>1000km):

14/09/03 20:55	G4DEZ	JO03AE	1312km
14/09/03 21:40	G3XDY	JO02OB	1338km
14/09/03 21:43	G4EAT	JO01HR	1393km
14/09/03 22:30	G8WXU	JO01EP	1411km

tnx for info Hans (SM0MXO) and Viljo (ES5PC)

G3XDY, JO02OB, wkd Sep – Nov '03:
1296MHz:
F1BZG (JN07), SK7MW (JO65), SM6CEN (JO57), SK6EI (JO68), SK0UX (JO99), OZ2TG (JO65), SK6DK (JO67), YL3AG (KO26, OZ2LD (JO54), SM6ESG (JO67), OZ1FF (JO45), SM7ECM (JO65), OZ9KY (JO45), OZ6HY (JO45), DL1SUN (JO53), DJ8MS (JO63), DG6SYL (JO63), DK7OM (JO63), DL1SUZ (JO63), OZ1CTZ (JO46), DG0RG (JO62), DL0GTH (JO50), EI9E/P (IO62), GM4LBV (IO86), SM6DJH (JO58), SM6OEW (JO67), SM3LBN (JP80)

2320MHz
G4ALY (IO70), SK7MW (JO65), OZ2TG (JO65), SM7ECM (JO65), DL1SUN (JO53), DF0OL (JO40), DL3YEE (JO42), GM4LBV (IO86)

3400MHz
DF9QX (JO42), DG0RG (JO62)

5760MHz
SK7MW (JO65), OK2BFH (JN99), G3PHO/P (IO83)

10368MHz
OZ1CTZ (JO46), SK7MW (JO65), DK1ZD (JO44), DF5JJ (JO43), SM6ESG (JO67), SM7ECM (JO65), OK2BFH (JN99), G3PHO/P (IO83)
tnx for info John

Announcement:

Om Ivo Chladek (ZS6AXT) send a very interessting report about the situation of VHF-, UHF and specially microwave in ZS. You can read it in the next issue of Tropo-Reports in DUBUS 1/04.

(**Comment from DL8HCZ**: I checked the Hepburn Tropo maps in the internet for these openings. Surprisingly I found that several of these super openings e.g. the November duct from LA to EA/LY/UA3 were not predicted/indicated at an appropriate level. I asked Mr. Hepburn for any explanations or comments. But no answer so far.)

6m News

Reports, Expeditions, Infos

Editor: Joachim Kraft, DL8HCZ

6m-Logbook from DL (Day, Month, UTC): September to November 2003

18.8. 14-22 Strong Aurora/AE: PA0 heard VE4-beacons from EN09+EN19.

20.8. 2030 TEP+Es from PA/W-DL: ZD8VHF/B

28.9. 16-18 TEP+Es from W/M/S-DL: TR0A JJ40

2.10. 1540-1600 TEP+Es from W+S-DL: 3C0V JI28tn. First ever 3C0-DL (DC8TS + DL7QY wkd).

7.10. 0935-0945 Mulihop-Es from M-DL, PA, G: VU2ZAP MK82

29.-31.10. Aurora from all DL to many EU countries, also to the south: I, S5, HB9 etc.

5.11. 1810 Es from W-DL + PA: 5T5SN IK28

6.11. 1430 TEP+Es from HB9, F, SW-DL: RW1AY/MM JG67

29./30./31.10. Big Aurora from all DL to S5, I, YU..

20.11. Super Aurora from all DL to S5, I, YU, F, HB, OE, EH2KP in IN83

20.11.: Comment from SM7FJE, JO65: The best aurora ever for me on 6m. 29 DXCC worked. In the log: UT as far as KN88, 89. YO, 9A, S5, 4U1ITU, I2, I3, I4 and I5, (loads of) F from all corners including JN23 and IN93. Best dx EH2KP in IN83. First ever EA on aurora for me.

23.11. 20-22 Es von S+M-DL: TS7N JM54
2130-2230 TEP von S+M+W-DL: ZD8VHF
2235 TEP + E von DL7QY JN59: PY1RO

Expeditions and News:

/MM: G0KZG/MM, Andy has changed plans: His trip from CT to PY in October was cancelled. Now he plans to be qrv again on 6 + 2m in 2004 from a ship in the Mediterranean sea.

/MM RW1AY/MM is qrv on 6m from **JG67, 68, 77** with 100w and wire antenna until April 2004.

JP83 SM3XRJ is a new station on 6m

3C0 Annobon Isl.: DJ9ZB, EA5BYP, EA5FO + EA5YN were qrv on 6m as 3C0V. But only one day qrv with an opening to EU. Total 100 6m QSOs wkd. Many first. From DL only DC8TS and DL7QY wkd.

3B9 Rodriguez: From 16. March 2004 a big group will be qrv for 4 weeks also on 6m under 3B9C.

5U Niger: 5U7JB (US-Op) ist qrv on 6m for a longer period. Loc. JK13, QSL via ON5NT.

5V Togo: 5V7BR is qrv on 6m since Nov 17th.

7X Algeria: 7X0AD (JM16jr) says that there is good chance now to get a licence for 6m. He states that he will be qrv soon.

E3 Eritrea: A group from the U.K. will be qrv in mid February for 2 weeks on 6m. QSL via G3AB. QRGs: 50.107 CW and 50.150 SSB.

FT1Z Amsterdam Isl.:Starting in Januar 2004 new licenced Op Sebastien will be qrv for one year also on 6m. Loc.: MF81tx

HI Dom. Rep.: HI3TEJ is qrv with 100w + 5 ele on 6m. Loc. FK59. QSL via ON4ANT, now ON4IQ.

HK0: DL8YHR will be qrv 6m (incl. EME) in summer 2004. S0 was cancelled, no licence.

HZ: HZ1MD + 7Z1SJ are o.k. for DXCC now!

JW Svalbard: JW5RIA is qrv again from December 03 to June 04 on 6m from Bear-Isl., JQ94.

S9 Sao Tome: S9TX (ex S92TX) ist qrv on 6m now for about 1 year with 100w + 5 ele Yagi. Loc. JJ30. QSL via W7KNT

SV/A Mount Athos: SV2ASP/A has got a new IC706 and IC756PRO now. So let`s hope for some 6m activity. There is also a new QTH close to Thessaloniki belonging to "Mount Athos" Country.

TN Congo: CT3HK is qrv on 6m as TN3S for 1 year. QSL via Madeira Team, P.O. Box 19, P-9001-901 Funchal, Madeira Isl., Portugal

VQ9 Chagos: VK9LA is qrv on 6m for one year.

YA Afghanistan: G4KUX is qrv until spring 2004 on 6m as YA4F from Kabul, MM44ON. Also YA1D is very active on 6m now.

YI Irak: YI/OM2DX will be qrv also on 6m for the next 3 years from Baghdad (LM23).

YK Syria: YK1AO, Omar, has announced that he will erect a 6m antenna in December....

YV0 Aves Isl.: A 6m operation is planned in the end of Jan. and Feb. 2004.

VK9N & VK9L Norfolk + Lord Howe Isl.: DL7AFS + DJ7ZG will be active from Lord Howe Isl. between February 16 and 27 and from Norfolk Isl. from February 29 to March 13 2004 also on 6m.

XV Vietnam: XV9DT is qrv for some years from Hanoi also on 6m. OL20.

ZL New Zealand: GM3WOJ is moving permantly to ZL and will be qrv on 6m als ZL1CT. He hopes to work many EU´s in the peak of next cycle.

Beacons qrv

SK2CP, 50.052 MHz, KP07mu, 100W EIRP (should be 500WEIRP soon), 5 Ele. Yagi, QTF NW, 478 m a.s.l. A1A. A new beacon for transpolar propagation.

IK1PLD/B, 50.001,5 MHz, JN43CW, 0.1W, 1/4 Vertical, Omni, A1A, QRV since Mai 2003.

IQ4AD/B, 50.058 MHz, JN54DT, 8W, 1/2 GP, 50m a.s.l., A1A, qrv since the end of September 2003.

9Y4AT/B, 50.015 MHz, FK90, 25W, 3 Ele Yagi. QRV since September 2003.

Meteor-Scatter Reports

DJ8ES (JO43SX) wkd WSJT on 144 MHz:
2003/06/15
1445 IW1CCH/4 JN54HQ 27 26 c
1532 EA3AXV JN81TJ 27 27 c
2003/06/16
1910 LA/DL2NUD JP78FE 26 27 c
2003/06/20
1850 LA/DL2NUD JP65FW 26 27 c
2003/07/28
1755 I6BQI JN72BK 28 36 c
2003/07/30
2110 YU7AZX KN84AX 27 27 c
2003/08/11
1825 LZ2FO KN13KX 26 26 c
2120 OH9SCL KP46BI 26 27 c
2145 LA8G JP44XA 38 27 c
2205 RW3AZ/1 KO57AV 27 27 c
2003/08/12
1640 OM3KDX KN18DX 27 27 c
1830 OH6ZZ KP12BO 38 26 c
2003/08/13
0340 SK5CR/3 JP63XQ 38 37 c

LA/DK5KK and OH9/DK5KK wkd:
2003-06-09
1500 DL9MS KP38VM 27 26 CWMS
1815 DL9MS KP39MA 27 27 CWMS
1800 DL9MS KP29PO 26 26 CWMS
2003-06-10
1445 DL9MS KQ21HA 26 27 CWMS
1545 RX1AS KQ21HA 26 27 CWMS
1647 OH5LK KQ21HA 26 26 CWMS
2003-06-11
1350 DL9MS KP19RX 26 26 CWMS
2003-06-12
15:30 DL9MS JQ90NA 26 27 CWMS
2003-06-13
14:45 DL9MS JP99QH 26 26 CWMS
2003-06-14
1200 DL9MS JP88CN 26 26 CWMS
1715 DJ8MS JP88CN 26 26 CWMS
2003-06-15
1318 DL9MS JP89BD 27 27 CWMS
1405 DL5ME JP89BD 26 26 CWMS
1442 DL1UU JP89BD 26 26 CWMS
1515 DK3WG JP89BD 26 27 CWMS
1642 DL2ARD JP89BD 26 27 CWMS
1923 DJ8MS JP89BD 27 26 CWMS
2003-06-16
1330 LA0BY JP79XC 26 27 CWMS
2003-06-17
1300 OH5LK JP78EF 26 26 CWMS
1615 DK5DQ JP78EF 26 26 CWMS
2003-06-18
1300 DF7KF JP68VC 26 26 CWMS
2003-06-20
1500 DF7KF JP65FW 26 26 CWMS
1600 PA0JMV JP65FW 26 27 CWMS
2003-06-22
1920 DF8IK JP50JV 26 27 WSJT
1945 DL4DUA JP50JV 26 28 WSJT

G4LOH writes:
This log report for the 2003 Perseids period which will be memorable for me as a modest meteor shower combined with a great tropo. I have now dismantled the station in IO94ea to move to a new house in IO70 but I hope to be on again later this year or in 2004. Thanks to all, for many QSO's over the last 6 years operation from IO94.

G4LOH (IO94EA) wkd:
2003-08-08
1213 EA8BPX IL18SK 55 55 SSB 3089km tropo
2030 UA3ARC KO85SO 26 27 FSK MS 2481km
2059 RU3ACE KO95KG 26 26 FSK MS 2572km
2003-08-09
0635 OH9O KP48DA 36 26 FSK MS 2200km
1629 OM3KDX KN19DB 36 27 FSK MS
2200 RW3PF KO93CD 26 27 FSK MS **2595 km** (MS ODX)
2003-08-10
2047 RU3ACE KO95kg reports a strong burst from G4LOH received calling CQ in FSK, **2572**km.
2003-08-11
1659 EA8BPX IL18SK 52 52 3089km still Tropo!
1918 RW3AZ/1 KO57AV 37 27 FSK MS 2050km
1935 RU1AA KP40XD 37 27 FSK MS 1995km

The DX MS contacts to UA3 were helped by great tropo across the North Sea. Not listed here are several pages of 59/59 tropo qso's to SM6/7/ SP/ PA/ DL/OK/OE with some stations like SK6DK, PD2DB and DK5DQ at endstop, stronger than my local FM repeater for many hours.

At the time of the UA3ARC and RU3ACE qso's the DL0PR beacon (which is almost on the same QTF from IO94) was 59+40dB although when I worked RW3PF the following day it was down to only 559.

The most exciting time was at 22:06 from RW3PF when a huge burst started 15s into his 30s period, I heard him end the period and my tx started. I was able to quickly decode his signals and switch to sending him a report. In an e-mail from Peter aftethe QSO he reported that this burst continued to be received for about 20 seconds into the period at S8 in KO93!! Could have made it single burst SSB had we known :-)). I heard Peter a total of 7 times to complete the QSO in just over 1 hour. It was nice to end operations from IO94 with great tropo opening and nice Perseids. EA8BPX was hrd periodically for 4 days and a couple of times was strong whilst I was chatting with SK6DK, LB8SE and LA2PHA off the back of my antenna but despite lengthy attempts to enable EA8 - LA or SM I don't think he was heard at all the other side of the North Sea. Rig: 4x18xxx M2, 250m asl, 400W. 73 until IO70, Tim.

OZ1IEP (JO55XU) wkd FSK on 144 MHz:
2003-05-03 1552 OH8K KP13SX 26 26 c
2003-05-04 0929 T7-IW2BSQ JN63FW 26 26 c
1949 LA6K JP43BH 26 23 c
2003-05-06 0506 LA6K JP33 26 27 c
2003-05-17 1532 OH7AI KP33 26 26 c
2003-05-19 2033 F1EBK JN18BW 26 27 c
2003-05-20 2007 F5SDD JN23RF 55 55 c
2003-06-01 1551 RK3AFK O75WO 26 27 c
2003-06-05 1752 Z32UC/P KN00FN 37 26 c
2003-06-06 1649 OH8K KP53DX 26 26 c
2120 OH5LID KP51AT 26 26 c
2003-06-07 1928 OH6JW KP54DA 26 26 c
2003-06-10 1908 LA/DL2NUD KQ21HA 26 nc
2003-06-11 2018 LA/DL2NUD KP09GS 26 27 c
2003-06-12 1944 LA/DL2NUD JQ90NA 26 26 c
2003-06-14 1410 LA/DL2NUD JP88CN 26 26 c
2003-06-15 1614 LA/DL2NUD JP89BD 26 27 c
2003-06-16 1734 LA/DL2NUD JP78FE 26 27 c
2003-06-17 2212 TF/G4ODA IP34CT 26 nc
2003-06-18 0458 TF/G0ODA IP34CT 26 27 c
1542 LA/DL2NUD JP68VC 26 26 c
2003-06-20 0452 MM/DH7FB IO66 26 27 c
1917 LA/DL2NUD JP65 26 27 c
2125 OY/G4ODA IP61PL 26 27 c
2003-07-16 2105 SM6CMU/2 JP96 26 26 c
2003-07-17 2115 SM6CMU/2 JP95 26 26 c
2003-07-18 2103 SM6CMU/3 JP74 26 26 c
2003-07-19 0948 RA3QTT LO01GQ 26 nc
2110 SM6CMU/3 JP63LJ 26 27 c
2003-07-26 1931 LA/PA2DWH JP31 26 27 c
2003-07-28 1958 LA/PA2DWH JP42 26 27 c
2003-08-01 2102 IS0CAK JM49MB 26 nc
2003-08-07 1555 OH9O KP48DA 26 27 c
2003-08-08 2053 RW3PG KO84TF 26 27 c
2153 RW3AZ/1 KO57AV 26 27 c
2003-08-09 1835 OH9SCL KP46BI 26 26 c
2003-08-10 0710 OM3KDX KN19DB 26 26 c
1501 UA3DHC KO96CB 26 27 c
1837 OH9O KP37NA 26 27 c
1908 RA3QTT LO01GQ 26 27 c
2211 IS0CAK JM49MB 26 26 c
2003-08-11 1851 LA8G JP44 26 27 c
2105 UT8AL KO61WP 26 27 c
2203 IK0WGF JN52VC 26 27 c
2228 LZ1BB/P KN43AO 26 27 nc
2003-08-12 0457 EA3BB/2 IN91OQ 26 27 c
2331 YU1CF KN03QN 26 27 c
2003-08-13 0114 9A1CAL/P JN73 55 55 c
0512 LY2BAW KO25KA 26 26 c
0630 EA7AJ IM87CS 26 28 nc 2328
0824 CN8LI IM64NX 26 nc 2727km
1257 RK3PWJ KO83XC 26 27 c
1644 ES6DO KO27WX 26 26 c
2029 SM3PXO JP73GI 26 26 c

Rig: FT736, 600W on WSJT, 2*11 ele. 73, Carl

RW3PF (KO93CD) wkd:
2003-08-08
2058 OZ1IEP JO55XU 26 27 FSK
2003-08-09
0432 RN6BN KN95 27 27 FSK
1858 OZ1PIF 26 27 FSK
2256 G4LOH IO94EA 26 27 FSK new loc, SQR, DXCC QRB=**2605** km! The signal was very powerful and last about 25 seconds, but only one burst. Fowwowing bursts were much weaker.

RK3PWJ (KO83XC) wkd:
2003-08-12
0120 OZ2M 27 FSK 1918 ES6RQ 27 FSK
2003-08-13
1040 S57TW 27 FSK 1131 DJ9YE 27 FSK
1136 DJ3LE 27 FSK 1210 S55AW 27 FSK
1215 LY2SA 27 FSK 1245 DG0KW 27 FSK
1304 OZ1IEP 27 FSK 1310 DK3BU 27 FSK
1408 ES2RJ 27 FSK 1421 OZ1LPR 27 FSK
1856 DL5WG 27 FSK 1941 DJ7OF 27 FSK
2222 OK1DFC 27 FSK 2343 LZ1KWT 27 FSK

Most interesting has taken place then: EI5FK from IO51RT hrd RK3PWJ in QSO with DL5WG around 1859z on 144.370 in FSK. EI5FK could read several times callsigns and RRR. Fantastic! QRB 3108km! It is a pity that no QSO was possible!
Rig: PA GI7B, BVO-4WL.
Op.: Peter (RW3PF), Toly (RW3PN), Alex (UA3PNO) and Serge (RA3PD).
73, Peter - rw3pf@efremov.tula.net.

ZA1A, JN91, wkd 2m FSK-MS in Nov. 2003:
7.11. DK7BY, OZ1IEP, OZ1LPR, PA1GYS, S57TW, SP6IWQ, OE5KE, S52LM, DK5LA, OE5MPL, DL3YEL, DG6JF/p, PE1AHX, DL7FF, DJ5BV, PA1BVM
8.11. PA3BIY, S51AT, PA0C, DL4DWA, PA0JMV, PA2DW, F6FHP, S53VV, DF7KF, OE3MWS, DH0AAI, DL9MS, DG0KW, DL1RNW, ON4KHG, DL5ROB, S51MQ, ON7CL, DK3XM, DH8IAT, DJ3LE, DL5WG, OK2BRD,
9.11. F1FIH, DG2KBC, DH3YAK, DJ9CZ, DK0KK, ON7CL, OE3JTB, G4ZTR, DF9KT, DL3KBK, DL8DBU, IW1BCV, DL5GAC, DL5MCG, ON4KHG
10.11. DL1EAP, PA3ECU, DJ9FG, OZ2M, DJ5RE, SP2OFW, OE3MWS, OE6IWG, OZ1PIF, ON7EH, OE1SOW, DL6ZAU, OZ7Z
11.11. PA2CHR, OK1DFC, PE1HWO, IW1BCV, EA3AXV, DG9BEM, S53J (ending in Tropo), DL6LAU, DJ9MG, HA5OV (Tropo), PA1GYS, DL3LST, OK2WO, ON4IMM, OK1MZM, OK1XOD, DD3SP, HA6ZB.
OPs: DL6LAU and DL7AJA. QSL via OH2BH or DL6LAU.

Meteor Shower Calendar

by Guido Jünkersfeld, DL8EBW

January to March 2004

Name	Date	Max.	ZHR	RA	DEC	v (km/s)	Source
ɿuadrantids	01.01.-05.01.	04.01.	120	230	+49	41	IMO04 *1
:orvids	29.12.-25.01.	13.01.	10	185	-20		BMS50
ılpha-Craterids	27.12.-22.01.	13.01.	10	160	-14		BMS50
lelta-Cancrids	01.01.-24.01.	17.01.	4	130	+20	28	IMO04
appa-Cygnids	14.01.-20.01.	17.01.	10	295	+51		BMS50
ılpha-Leonids	28.12.-13.02.	29.01.	10	159	+06		BMS50
:ap./Sagittarids	13.01.-04.02.	02.02.	15	299	-15		IMO04
ılpha-Centaurids	28.01.-21.02.	08.02.	6	210	-59	56	IMO04
ılpha-Aurigids	15.01.-20.02.	5.-10.02.	12	074	+43		BMS50
hi-Capricornids	29.01.-28.02.	14.02.	10	315	-24		IMO04
lelta-Leonids	15.02.-10.03.	25.02.	2	168	+16	23	IMO04
ılp.-beta-Perseids	23.02.-12.03.	28.02.	10	047	+45		BMS50
eta-Bootids	10.03.-12.03.		10	218	+12		BMS50
ɪamma-Normids	25.02.-22.03.	14.03.	8	249	-51	56	IMO03
6-Draconids	14.03.-14.03.	14.03.	7	250	+54		BMS50
'irginids	25.01.-15.04.	25.03.	5	195	-04	30	IMO04
ɪeta-ursa-Majorids	23.03.-27.03.	25.03.	var.	161	+58		BMS50

egend / Erklärungen

lame: Name of the meteor shower / Name des Meteoritenschauers
ɪate: Days of activity / Zeitraum der Schaueraktivität
ɪax.: Day of the Maxiumum / Maximum des Schauereintritts
HR: Numer of meteors per hour during the maximum
ɴzahl der zu erwartenden eintretenden Metoriten im Maximum pro Std
:oordinates: RA/DEC: Rectascension / Declination of the shower's radiant /
limmelskoordinaten: RA/DEC: Rektaszenion/Deklination des Radianten
in [km/s]: speed of the meteors / Eintrittsgeschwindigkeit in die Erdatmosphäre in km/Sek.
ɪO04: Source Int. Meteor Organisation, list for 2004 / Datenquelle: IMO Aufstellung für 2004
MS50: Source: British Meteor Society, Meteorbook 1950 / Old data, but these showers are still active
nd the actual radiant can be calculated from RA and DEC.
tammdaten aus dem British-Meteorbook, Grundlage 1950! Zurecht könnte man sagen, die Daten ent-
prechen nicht dem akt. Stand (sp. Peak-Daten), aber die Schauer sind nach wie vor aktiv und der Radi-
nt kann durch die Himmelskoordinaten (RA/DEC) nach wie vor ausreichend genau berechnet werden!

ommentar: Liebe Funkfreunde, anbei der MS-Kalender für das erste Quartal 2004. Für diesen ersten eitraum gibt es kaum von größeren Schauern zu berichten. Die Quadrantiden (*1) gehören zu den vier rößten jahreswiederkehrenden Schauern und dürften dürften nochmal eine gewisse Aktivität hervorru-ɪn, bevor die große Frühjahrspause kommt.
as Maximum für 2004 wird für den 04.01.2004 in den frühen Morgenstunden (ca. 0430UT) erwartet.
a der Schauer nur ca. 6-8 Std breit ist, sollte dieses Event an einem Sonntag richtig gut nutzbar sein.
lle anderen Schauer in diesem Zeitraum gehen, zumindest für die MS-Gemeinde, in den spordaischen leteoriten anzahlmässig unter... Von hier aus ein frohes Weihnachtsfest und recht viel Erfolg für das eue Jahr 2004!!! Auf Wiederhören, 73 Guy DL8EBW
omment: In the first quarter of the year there are almost no bigger showers. Only the Quadrantids on ɪnuary 4th are one of the four biggest showers of the year. This year's maximun is expected on Jan 4th ɾound 0430z.
lerry Christmas and many success for 2004! 73, Guy, DL8EBW

Aurora Reports

Editor: Stefan Heck, LA0BY
LA0BY@darc.de

Hello Aurora fans!
The record breaking events of late October are still in my mind: A series of X-class flares occured within less than a week, among them an incredible X18 and another X11 flare. The blazes of the two latter reached the earth in less than a day and caused severe storming lasting for two days. The CME emitted from region 10486 was not only the second largest of the solar cycle 23, but also the second fastest measured since 1859. The solar wind speed was exceeding 2000 km/s. The instruments on the ACE and SOHO space-crafts went into saturation and became useless. I cannot remember having ever seen the Kiruna magnetometer reaching 3900 nT before! The mediterranean stations enjoyed hours of Aurora openings, but the show wasn't too good up in Oslo. See the reports! An even stronger flare, X28 for a new record, occured a few days later, but was not directed to earth. It triggered only minor Auroras.
On November 20th there was another strong Aurora with visible lights even in Italy, Slovenia and Croatia. QSOs were reported down to KN31 on 2m and IN82 on 6m. 70cm activity was great and several 1800km QSOs were logged on this band. More reports for this day follow in the next issue!

Good Auroras give many newcomers the opportunity to experience a new propagation mode. Besides the strange sound it is to be noted that the moving reflection area also causes Doppler shift. It may be as much as 2 kHz on 2 m and 6 kHz on 70 cm. Somebody may actually be calling you that far off your transmit frequency! A good practice is to use the RIT or SPLIT mode to search for responses.

There are also clouds on the Aurora horizon: NOAA's Space Environment Center (SEC) recently reported a cut of funding that may affect the future availability of observation tools like SOHO and ACE. SEC is providing extensive information on space weather (see their website http://sec.noaa.gov/), allowing for prediction of Aurora. You may try to protest to the SEC by writing an email to SEC.Webmaster@noaa.gov.

There were many reports received this time (over 2500 lines). In a few cases some short distance contacts were omitted from the list. Unless noted otherwise, all contacts listed were made in CW.

73, Stefan (LA0BY)

144 MHz reports

9A6WW in JN86EL wkd on 144 MHz:

2003-10-29

1558	DK2ZF	JO43VH	57A	hrd		
1616	OZ6OL	JO65DJ	53A	54A	10	1064 km
1619	SP6GVU	JO81LC	59A	59A	10	543 km
1658	SK7MW	JO65MJ	55A	57A	10	1051 km
1704	DK3BU	JO33NO	57A	57A	20	1065 km
1710	SP4JWD	KO03FR	53A	53A	15	878 km
1712	LY2CI	KO14WV	58A	59A	15	1091 km
1712	LY2IC	KO14WW	58A	59A	15	1095 km
1725	DK9OY	JO52CK	55A	55A	15	832 km
1741	PA0V	JO33II	57A	57A	15	1064 km
1750	OZ2M	JO65FR	55A	55A	10	1097 km
1754	PE9DX	JO33MD	57A	55A	SSB	1032 km
1808	DF0WD	JO42FD	55A	56A	SSB	886 km
1809	DK9OY	JO52CK	56A	55A	SSB	832 km
1822	PC5C	JO33GD	55A	55A	15	1056 km
1824	PA3CEE	JO33JI	57A	57A	15	1060 km
1826	OZ1LPR	JO44UW	59A	59A	10	1084 km
1840	DL1EJA	JO31DS	55A	55A	15	973 km
1843	DH2OAA	JO42TU	55A	57A	15	893 km
1845	DL5WG	JO52VK	55A	57A	20	774 km
1854	PA1T	JO33JF	59A	59A	15	1050 km
1856	DL8LAQ	JO43XU	53A	53A	15	972 km
1905	DF7KF	JO30GU	56A	55A	15	902 km
1908	PA2CHR	JO22XA	55A	55A	15	1008 km
1911	PA3BIY	JO22EB	53A	53A	15	1101 km
1920	DL6YEH	JO32VA	56A	59A	15	909 km
1935	DF2JQ	JO31HL	55A	57A	15	935 km
1938	DL7UDA	JO62TK	55A	54A	15	724 km
1941	PA0BAT	JO32JF	53A	53A	15	976 km
2012	G7RAU	IO90IR	55A	55A	340	1409 km
2053	G7RAU	IO90IR	57A	59A	340	1409 km
2057	GW4DGU	IO71SV	55A	55A	340	1654 km
2057	GW3LEW	IO71PS	55A	55A	340	1667 km
2059	G4KWQ	IO92AQ	55A	55A	345	1518 km
2101	PA3FOC	JO21FW	54A	53A	350	1088 km
2103	G3LTF	IO91GG	55A	55A	345	1435 km
2110	G3LQR	JO02GF	54A	55A	345	1342 km
2152	OZ1CLL	JO65GQ	55A	57A	10	1091 km
2156	OZ1LPR	JO44UW	59A	59A	10	1084 km
2200	OZ8FR	JO55SK	55A	56A	10	1085 km
2204	OZ5N	JO46SI	55A	55A	10	1229 km
2206	SM7ALC	JO65RL	59A	59A	10	1053 km
2208	OZ8ZS	JO55RT	56A	55A	10	1126 km
2211	DJ8MS	JO63CT	57A	57A	15	901 km
2215	DL1SUN	JO53PN	59A	59A	15	901 km
2220	DK7BY	JO33RJ	59A	57A	15	1033 km
2223	SP4MPB	KO03HT	53A	53A	20	891 km
2238	DJ9MG	JO52TC	58A	59A	20	784 km
2239	DL3DXX	JO61VC	59A	59A	15	581 km
2240	SP6A	JO81MC	55A	55A	15	618 km
2245	DJ1TO	JO51SL	53A	55A	15	692 km
2247	SP2FAV	JO94MA	59A	59A	20	884 km
2249	DH8BQA	JO73GF	55A	57A	20	793 km
2252	SP2RS	JO94FK	53A	55A	20	932 km
2254	DL1RTL	JO62PF	56A	59A	20	710 km
2256	LY2BIL	KO24PQ	55A	55A	25	1082 km
2257	DK2AR	JO42UC	55A	57A	20	824 km
2259	DL4KUG	JO64PB	55A	57A	20	903 km
2303	SM7BAE	JO65OP	57A	57A	10	1072 km
2304	OZ1LO	JO55VC	57A	57A	10	1044 km
2328	RA3LE	KO64AR	55A	55A	35	1439 km

2003-10-30
0002 SP4BY KO13OD 55A 57A 25 903 km
0006 SP3MGM JO73QE 55A 55A 25 780 km
0011 RW3WR KO71IM 59A 59A 40 1477 km
0013 DL2BWH JO62XR 59A 59A 30 749 km
0015 UR5LX KO70WK 59A 59A 50 1494 km
0013 DL3KVR JO64AC 55A 59A 30 935 km
0023 EU3AI KO22DE 56A 59A 35 865 km
0032 DL1JAW JO41DX 56A 59A 20 881 km
0033 SP2MKO JO93CB 57A 59A 30 769 km
0035 DL8YET JO31WH 58A 59A 20 859 km
0035 DL7VTX JO62TO 57A 55A 20 742 km
0038 SP5ZCC KO02PF 55A 57A 25 749 km
0047 G0CUZ IO82WM 57A 59A 340 1522 km
0048 G3XDY JO02OB 58A 59A 350 1293 km
0049 G4ERP IO81XW 57A 57A 340 1496 km
0050 G4RGK IO91ON 55A 55A 340 1401 km
0053 EI6GF IO62RG 55A 56A 330 1802 km
0053 PA0JMV JO21PM 56A 57A 350 1015 km
0055 PA3DOL JO22NM 55A 57A 350 1086 km
0057 PA5DD JO22IC 57A 57A 350 1084 km
0059 EI4BZ IO51UW 55A 55A 330 1912 km
0101 PE1HWO JO21GV 57A 57A 350 1081 km
0103 G4AEP IO91NJ 58A 59A 340 1401 km
0105 DK2CF JO41GG 55A 59A 350 819 km
0108 ON4KHG JO10XO 55A 56A 345 1053 km
0109 ON4LDP JO10UM 55A 56A 345 1143 km
0114 EI4DQ IO51WU 55A 55A 330 1899 km
0134 RW3PF KO93CD 57A 59A 40 1725 km
0142 G4ASR IO81MX 57A 57A 340 1401 km
tnx fer report, Zvonko!

DH0GHU in JN38VN wkd on 144 MHz:

2003-10-29
1855 DH2OAA JO52TU 55a 59a 30°
1901 DJ9YE JO43HV 55a 56a 30°
1927 G7RAU IO90IR 55a 55a 30°
1940 PA1T JO33JF 57a 59a 20°
2225 DL6YEH JO32VA 59a 59a 0°
2228 MM0CEZ IO85XU 53a 55a 0°
2256 OZ1LPR JO44UW 55a 55a 10°
2003-10-30
2124 DF8AE JO41GX 56a 59a 0°
2145 OK1DFZ JN79GW 59a 59a 45°
2149 DF7KF JO30GU 59a 59a 45°
2237 GM0CLN IO85HV 53a 52a 10°
2332 DL8LAQ JO43XU 53a 51a 20°
Hrd mni PA, G, GM, OZ, and RA3LE KO64 at 2245 UTC 55a
RIG: TS850S, LT2S-MKII, HLV300, 300W out, 11el. DL6WU
tnx fer report, Ulrich!

DJ8ES in JO43SX wkd on 144 MHz:

2003-09-29
1620 ES2DO KO28WK 59a 57a 1121 km
1658 SKØUX JO99BM 59a 55a 807 km
1722 G7RAU IO9ØIR 59a 59a 818 km
1727 LY2BAW KO25KA 59a 59a 994 km
1750 OH1NOL KPØØXL 55a 56a 1036 km

1837 GM1XOI IO85AT 57a 59a 885 km
1840 SM7ALC JO65RL 57a 59a 302 km
1853 MMØCEZ IO75XU 57a 55a 891 km
1858 G4RRA IO8ØBS 57a 57a 976 km
1913 OM3RM JN87WV 57a 57a 892 km
tnx for report, Wolfgang

DK3WG in JO72GI wkd on 144 MHz:

2003-10-29
1459 GM0TGE IO87TR 55A 59A
1511 SK6QW JO68WR 54A 59A
1516 SM0LQB JO89XK 57A 57A
1518 LA2EK JP50SP 55A 55A
1522 LA8PT JP50WQ 56A 56A
1525 SM4BGV JO69HP 59A 59A
1528 SM5FNU JO89CR 59A 57A
1531 SM6FOV JO78BR 57A 56A
1540 LA6BB JO59QC 56A 56A
1540 OH1MDR KO01VJ 54A 57A
1541 SM0DWF JO99CI 56A 56A
1544 SM6ENG JO67CQ 58A 57A
1547 SM0AGP JO89XF 57A 59A
1548 OH5KE KP30NN 55A 57A
1601 SM6CTQ JO78FM 57A 59A
1602 OH4LA KP20LG 59A 59A
1613 ES5PC KO38HJ 56A 57A
1618 ES1DF KO29IB 54A 59A
1618 SM0ASA JO89UP 55A 55A
1620 SM4GND JP70QR 57A 57A
1623 LA3IW JO29FS 59A 57A
1625 SM0BSB JO99IS 57A 59A
1629 SM3UFF JP80HR 57A 57A
1635 ES2NA KO29JL 57A 59A
1638 DK2ZF JO53 54A 52A
1643 SM0EPO JO89XM 57A 57A
1646 OH3AA KP21GA 57A 59A
1653 SM6DHU JO67IM 57A 55A
1655 SM5EFP JO79WJ 59A 59A
1705 RW3PF KO93CD 57A 59A
1707 EW6DX KO45JL 57A 57A
1708 RA3QTT LO01GQ 57A 59A 1774 km
1709 RA3FO KO86RI 55A 55A
1710 RK3FG KO86HP 55A 55A
1735 RW3WR KO71IM 55A 56A
1748 UR5LX KO70WK 55A 57A

DL1SUN in JO53PN wkd on 144 MHz:

2003-10-20
1547 SM4GJW JO69HP 57A 55A
1548 GM4ILS IO87IP 56A 55A
1557 LA3BO JO59CD 57A 55A
2003-10-21
1630 LA3BO JO59CD 57A 57a
1642 SK6DK JO67EH 56A 55a
2003-10-29
1718 LY2CI KO14MV 57A 57A
1718 PA3DXV JO21WA 55A 54A
1742 DL4WK JO63SQ 55A 59A

1747 SP4JWD KOØ3FE 55A 53A
1750 I4XCC JN63GV 55A 53A
1753 S53J JN75EV 55A 51A
1757 S54G JN65TM 55A 55A
1759 ON4LDP JO1ØUM 55A 56A
1805 IV3DXW JN65QQ 55A 55A
1808 OK2YT JN89JS 55A 55A
1810 HA5OV JN97NJ 59A 59A
1812 HA1BC JN87PU 57A 57A
1812 OM3RM JN87WV 59A 59A
1813 I4LCK JN54OI 55A 53A
1815 OM2LV JN87WV 59A 53A
1819 HA6ZB KNØ7BV 55A 55A
1823 HA7WJ JN97MP 55A 55A
1824 HA8V KNØ6HT 55A 52A
1827 OK1FPR JO7ØCE 55A 55A
1829 OK2VYG JN99CS 57A 55A
1840 YL3DW KO26CW 57A 58A
1846 OZ1HXL JO55EG 56A 57A
2214 OK1DFC JO79GW 59A 59A
2221 9A6WW JN86HF 59A 59A
2223 IZ4BEH JN54WL 55A 55A
2226 S54M JN86CL 57A 54A
2228 OM2TW JN88UG 55A 55A
2228 OK2WO JN89IH 55A 55A
2230 YL2LW KO26CW 55A 58A
2231 YL2HA KO26CV 57A 57A
2231 OM5AL JN97CX 55A 57A
2234 SP4BY KO13OI 55A 55A
2355 RW3PF KO93CD 59A 59A
2003-10-30
0024 RW3WR KO71IM 59A 59A
1752 OH1NOR KP1ØCN 57A 59A
1755 LA8WF JO59GW 59A 56A
1758 YL2LW KO26CW 55A 57A
1803 LY2BAW KO25KA 55A 55A
1806 ES6DO KO27WX 55A 55A
1809 ES2NA KO29JL 56A 57A
1832 SMØKAK JO89XK 59A 55A
1840 SM4BGV JO69HP 55A 55A
1849 SM5ACQ JO89HO 57A 57A
2032 SM4HFI JP7ØTO 55A 55A
2300 UT8AL KO61WP 59A 59a
2304 RA3WDK KO81BR 56A 59A
2311 ON6NL JO21UE 59A 59A
2312 ON4CLQ JO11SE 59A 59A
2320 RA3DRC/1 KO55JR 59A 57A
2003-10-31
0009 RW3WR KO71IM 59A 57A tnx fer report, Norbert

DL1SUZ in JO53UN wkd on 144 MHz:

2003-10-29
2218 RW3PF KO93CD 59a 59a tnx fer report, Uwe

DL6YEH in JO32VA wkd on 144 MHz:

2003-10-29
1522 SM6FOV JO78BR 55a 55a 845 km
1630 SM4IVE JO79SB 55a 53a 921 km

1634 ES5PC KO38HJ 53a 55a 1382 km
1638 MM0CEZ IO75XU 55a 55a 882 km
1746 G4RGK IO91ON 55a 55a 592 km
1749 F5LRL JN26MV 55a 53a 603 km
1805 ON4LDP JO10UM 55a 55a 329 km
1914 HA1BC JN87PU 55a 55a 821 km
1917 HA5OV JN97NO 57a 57a 948 km
1920 I4CVC JN54WH 53a 55a 908 km
1921 I4XCC JN63GV 53a 52a 969 km
1922 S57TW JN75EX 55a 55a 825 km
1925 9A6WW JN86HF 59a 59a 908 km
1926 IV3DXW JN65QQ 55a 55a 813 km
1928 OK2VWB JN99FS 55a 55a 788 km
1944 9A2RD JN65VG 55a 55a 869 km
1952 S54G JN65TM 57a 55a 839 km
2036 GM0TGE IO87TF 57a 59a 872 km
2042 SM7EOI JO86FP 52a 55a 760 km
2044 GM0FET IO87UB 52a 53a 857 km
2102 I4LCK JN54PD 53a 55a 913 km
2111 HB9BHU JN37XG 57a 55a 528 km
2126 OK1DFC JN79GL 52a 55a 552 km
2153 GM4AFF IO86ST 55a 55a 849 km
2157 SM7DLZ JO86BS 53a 57a 754 km
2216 OE5XBL JN68PC 57a 57a 586 km
2219 HB9QQ JN47KJ 59a 57a 520 km
2220 OK1ZHS JO70VA 53a 57a 602 km
2222 DL2IAN JN49BC 59a 59a 325 km
2224 OK1MHZ JO70VA 55a 55a 602 km
2226 DH0GHU JN38VN 59a 59a 384 km
2229 OK2YT JN88IW 53a 55a 717 km
2231 DL9MCC JN58UA 59a 57a 525 km
2247 IK1SPR JN34TQ 52a 55a 815 km
2250 IZ4BEH JN54WL 52a 55a 891 km
2253 IK1EGC JN35UF 52a 55a 755 km
2255 IZ4BEH JN54WL 55a 55a 891 km
2323 SM7EBI JO77BT 57a 57a 760 km
2335 ES6RQ KO28WA 53a 59a 1325 km
2003-10-30
1854 GW4FRX IO82MR 55a 55a 733 km
1905 DH7FB JO62SM 55a 55a 395 km
1908 PA7KY JO32LR 53a 55a 97 km
1910 DL8LAQ JO43XU 55a 55a 250 km
1924 DL1EJA JO31DS 55a 55a 107 km
2038 SM7EOI JO86FP 55a 59a 760 km
2047 SM7UYJ JO65OP 55a 55a 537 km
2134 GW3LEW IO71PS 55a 55a 857 km
2136 G4CAJ IO92HN 52a 55a 626 km
2141 S51MQ JN75NT 55a 55a 873 km
2143 IZ4BEH JN54WL 59a 59a 891 km
2145 IK1SPR JN34TQ 59a 59a 815 km
2146 YU7BCL KN05FW 57a 57a 1143 km
2148 HB9DFG JN37SM 57a 59a 501 km
2150 I1JTQ JN35UB 57a 55a 774 km
2152 I1DMP JN35UB 55a 55a 774 km
2156 HA1AD JN87RT 51a 55a 834 km
2159 HA5UK JN97OM 55a 57a 959 km
2206 HA6ZB KN07BV 55a 55a 992 km
2207 IK2YXK JN45OP 53a 55a 716 km

2209	F6BEG	JN25JS	53a	54a	728 km
2212	9A3JH	JN75AD	53a	55a	891 km
2213	S57TW	JN75EX	59a	59a	825 km
2215	OK1ZHS	JO70VA	55a	55a	602 km
2216	HA6NQ	JN98WA	55a	55a	969 km
2218	OE8HWQ	JN76KS	53a	55a	776 km
2221	OM5UM	JN98EO	55a	55a	841 km
2244	SP2MKO	JO93CB	55a	55a	713 km
2251	SP4JWD	KO03FR	53a	55a	870 km
2301	UT8AL	KO61WP	53a	57a	1783 km
2309	G3LTF	IO91GG	53a	55a	643 km
2314	G4IGO	IO80NW	53a	56a	748 km
2317	M5MUF	IO91JP	53a	55a	619 km
2322	RA3LE	KO64AR	57a	55a	1628 km
2326	SP2RS	JO94GK	52a	55a	763 km
2328	RW3WR	KO71IM	55a	57a	1842 km
2334	UR5LX	KO70WK	55a	55a	1950 km
2335	G0TPH	IO92IO	52a	57a	620 km

RIG: FT1000MP + TRV LT2-S + 2x4CX250B into 2x10ele DJ9BV. tnx fer report, Andreas!

DL8EBW in JO31NF wkd on 144 MHz:

2003-10-29						
1557	GM0TGE	IO87TF	57a	57a	10	907 km
1605	MM0CEZ	IO75XU	55a	55a	20	897 km
1622	EU6MS	KO45IN	55a	55a	35	1502 km
1701	DL0VV	JO64AD	59a	59a	40	463 km
2115	F5LRL	JN26MV	52a	55a	40	505 km
2003-10-30						
2135	SP2OFW	JO93AC	57a	59a	60	772 km
2144	I4LCK	JN54PD	57a	59a	90	847 km
2146	OE5XBL	JN68PC	59a	59a	90	563 km
2154	DL2RL	JN58PE	59a	59a	80	452 km
2155	OK1FRD	JO80DD	55a	55a	80	656 km
2156	DL5ROB	JN68HG	59a	59a	80	514 km
2157	I2FAK	JN45OB	59a	59a	80	703 km
2158	IK1SPR	JN34TQ	57a	59a	80	728 km
2201	OK2YT	JN88IW	55a	55a	80	729 km
2202	ON6AB	JO21EC	57a	55a	80	192 km
2208	DL3HWF	JO61AG	55a	55a	60	342 km
2214	F6CRP	IN96KE	57a	55a	20	824 km
2217	GM0NAI	IO75RU	59a	59a	20	925 km
2237	I5WBE	JN53JR	43a	55a	80	878 km
2302	G0MJW	IO91JO	55a	55a	30	579 km
2332	UT8AL	KO61WP	55a	53a	40	1844 km

Just before the 144MHz band opened with strong aurora backscatter signals, we had a visual bright red auroral borealis for more than 10min in direction 290°! It was the best I ever saw in JO31. tnx fer info, Guido!

DL9MCC in JN58UA wkd on 144 MHz:

2003-08-18						
1423	OZ2M	JO65FR	55A	55A		839 km
1603	SP2OFW	JO93AC	57A	59A		720 km
1630	GI6ATZ	IO74AJ	54A	56A		1414 km
1706	GW4DGU	IO71SV	55A	59A		1231 km
1726	G4SWX	JO02PB	55A	55A	35	868 km
1743	DL9MS	JO54WC	55A	55A		676 km

2003-10-29						
0655	G4KWQ	IO92AQ	57A	57A		1097 km
0705	G7RAU	IO90IR	57A	59A		986 km
1509	OZ6OL	JO65DJ	53A	55A	SSB	821 km
1832	DL1EJA	JO31DS	57A	59A		569 km
1841	PA5DD	JO22IC	55A	57A		674 km
1852	DL8LAQ	JO43XU	55A	55A		660 km
1913	GI6ATZ	IO74AJ	53A	55A	SSB	1414 km
1950	MIØAYR	IO64VQ	57A	57A		1442 km
2226	SP2MKO	JO93CB	55A	55A		724 km
2230	DL6YEH	JO32VA	57A	59A		525 km
2244	GMØNAI	IO75RU	55A	55A		1408 km
2250	MMØCEZ	IO75XU	55A	59A		1381 km
2256	OZ6TY	JO55XE	57A	59A		797 km
2302	OZ1LPR	JO44UW	55A	57A		781 km
2003-10-30						
2001	DK8ZJ	JO54AG	53A	55A	350°	704 km
2128	SP1FJZ	JO84CF	55A	56A	10°	758 km
2132	G4CBW	IO83UB	52A	55A	10°	1134 km
2200	DM2BHG	JO51MW	53A	53A	30°	438 km
2211	PA2DW	JO22GD	53A	57A	30°	686 km
2214	DK5DQ	JO31PG	57A	58A	30°	481 km
2223	PA5DD	JO22IC	57A	57A	30°	674 km
2225	OZ1CLL	JO65QQ	57A	57A	30°	860 km
2241	SM7SPG	JO66MD	55A	57A	15°	908 km
2252	DJ3LE	JO44TN	59A	57A	40°	741 km

tnx fer info, Hans

DM1CG in JO31IC wkd on 144 MHz:

2003-10-29					
1702	OZ1ZD	JO46HI	57a	59a	597 km
1707	OZØJD	JO47XA	57a	57a	691 km
1715	GM4ZNC	IO75JP	55a	57a	936 km
1718	SM6VKB	JO68BD	57a	58a	856 km
1718	DK7LH	JO43BB	57a	59a	238 km
1719	PAØGUS	JO23TA	57a	57a	226 km
1723	MØRDX	IO83WB	57a	57a	641 km
1725	OZ4VW	JO45VT	57a	57a	562 km
1727	DG4DT	JO31XK	55a	55a	94 km
1730	G8VYK	IO71FO	55a	55a	851 km
1732	DC7BQ	JO42JF	55a	59a	190 km
1808	DJ9OI	JO44OI	57a	57a	398 km
1815	ON4IMM	JO11UB	55a	53a	210 km
1826	GM4UPL	IO77XL	55a	57a	992 km
1827	GW7SMV	IO81LN	55a	55a	679 km
1832	DL1OKB	JO41WS	55a	55a	232 km
1834	G8GXP	IO93FQ	55a	57a	628 km
1836	GM4TOE	IO87HF	55a	57a	944 km
1838	GMØLVI	IO86JJ	57a	59a	876 km
1841	M5CSM/P	JO01FO	55a	53a	437 km
1847	PA3FXO	JO22FE	55a	55a	196 km
1849	DL7LAH	JO44XP	53a	55a	450 km
1852	HB9BHU	JN37XG	55a	55a	436 km
1853	DG2VC	JO62VM	53a	53a	511 km
1857	PDØMGX	JO22PE	53a	58a	155 km
1859	G8XVJ	IO83RJ	55a	55a	678 km
1906	DF1IAZ	JN49LD	57a	55a	270 km
1909	OE2SCM	JN67OV	55a	55a	589 km
1912	HB9RNL	JN37SN	55a	57a	398 km
1917	S53J	JN75EV	55a	54a	808 km
1921	HA1BC	JN87PU	55a	55a	844 km
1923	OE5OLL	JN68SI	55a	55a	578 km
1926	OE3FVU	JN78VE	55a	53a	729 km
1929	HB9BHU	JN37XG	55a	56a	436 km
1932	I4GBZ	JN54VV	55a	55a	786 km
1934	9A2RD	JN65TF	55a	55a	830 km
1935	IK3TPP	JN65EP	55a	55a	737 km
1937	OE6WIG	JN77PK	55a	55a	743 km
1945	DO1SMC	JN48SW	55a	59a	315 km
2145	DL5LF	JO54AF	55a	55a	414 km
2207	DL7UAE	JO62PH	55a	52a	473 km
2211	DL9AN	JO62RE	57a	58a	481 km
2217	SP7NWM	KOØ2BE	55a	55a	932 km
2220	SP2MSL	JO92NM	55a	55a	867 km
2222	ON4QZ	JO2ØGU	55a	55a	154 km
2223	ON4AVJ	JO11UB	55a	55a	210 km
2224	SP2IQW	JO94GM	55a	57a	880 km
2229	DL3HZM	JO51XL	55a	58a	367 km
2230	SP6HED	JO8ØIK	55a	57a	706 km
2233	OZ9ZZ	JO46QK	55a	56a	618 km
2239	OZ4AFS	JO55BI	55a	55a	524 km
2241	OZ2KLY	JO44XI	59a	59a	422 km
2242	MMØJMB	IO67IP	55a	57a	1158 km
2243	LA2PHA	JO38IB	57a	59a	773 km
2244	SM7SKI	JO65NS	55a	55a	670 km
2246	G1XWD	JOØ3CI	55a	55a	508 km
2249	OZ2PJ	JO65ER	55a	55a	636 km
2250	SQ2CO	JO84US	55a	54a	841 km
2255	M5TLA	IO93KS	55a	55a	608 km
2256	PE3MCO	JO22MA	55a	55a	154 km
2258	G8JVM	IO82SP	57a	59a	652 km
2300	PA3ENH	JO21OI	57a	57a	108 km
2303	DD6PE	JO62JL	55a	59a	445 km
2305	GI4SJQ	IO64SK	55a	55a	958 km
2312	G8IYG	IO82XT	55a	55a	628 km
2317	OZ8JYL	JO47WA	57a	57a	689 km
2320	EI3GE	IO63XD	57a	56a	898 km
2324	SP6HED	JO8ØIK	57a	57a	706 km
2333	SK6BA	JO67HM	57a	57a	809 km
2339	M3DFW	IO95FD	55a	57a	710 km
2340	OZ1SKY	JO56DG	57a	55a	621 km
2342	MM1RAH	IO88GL	55a	51a	1045 km
2350	OZ3OLJ	JO55IG	55a	55a	534 km
2357	GØXDI	IO91RP	57a	55a	506 km
2003-10-30					
0002	GM4VVX	IO78TA	57a	59a	1047 km
0006	LA6MV	JO59EJ	57a	55a	950 km
0013	GI6ATZ	IO74AJ	59a	59a	926 km
0019	GMØHTT	IO89JC	59a	58a	1088 km
2201	SP9APC	JN99QU	59a	57a	906 km
2203	I2PY	JN55NB	55a	58a	747 km
2205	F1PUX	JN16XL	55a	55a	552 km
2206	F1DUZ	IN97NJ	55a	56a	687 km
2207	OE6IWG	JN77PK	55a	57a	743 km
2209	F1CVU	JNØ9NJ	55a	54a	440 km
2210	F5MGD	JNØ7AW	55a	59a	596 km
2213	OK2WO	JN89IH	55a	59a	738 km
2218	HB9DFG	JN37SM	57a	59a	403 km
2219	OE5OLL	JN68SI	57a	57a	578 km
2221	HB9DKM	JN37SN	55a	57a	398 km
2222	DB4RU	JN69BE	55a	57a	441 km
2226	2W1RSS	IO83JG	55a	56a	717 km
2227	SP1FPG	JO73GN	55a	59a	598 km
2228	G4ILB	IO95GI	55a	53a	719 km
2232	DK9AT	JO43XO	57a	59a	355 km
2240	DB1HPH	JO43WO	55a	53a	351 km
2242	DB2SF	JO43WO	55a	55a	351 km
2244	GW7SMV	IO81LN	55a	53a	679 km
2245	GW8JLY	IO81JM	55a	55a	690 km
2248	G3YDY	JOØ1FQ	55a	55a	438 km
2306	G8GXP	IO93FQ	57a	57a	628 km
2308	MW1MFY	IO81FL	55a	55a	713 km
2314	G8HGN	JOØ1FO	55a	59a	437 km
2315	SP2BDR	JO83UA	55a	59a	780 km
2317	G8EFU	IO92BO	55a	54a	612 km
2319	G7DGH	IO83NN	55a	55a	705 km
2321	G7HIA	IO92IO	55a	55a	574 km
2325	GØETE	IO92XH	55a	55a	484 km
2326	GØXDI	IO91RP	57a	55a	506 km

All QSO were made in SSB, QTF mostly 75°.
RIG: TS 850 / LT2S 400W 12ele M². tnx fer report, Carsten!

F9OE/p in IN78QG hrd (!) on 144 MHz:

2003-10-29				
1713	GM3UCN	IO85FV	850 km	
1723	GM1XOI	IO85AT	840 km	
1724	GI4OWA	IO64		
1816	MM0CEZ	IO75XU	843 km	
2003-10-30				
2138	DL8YEH	JO32VA	976 km	
2142	PA5KM	JO11WL	705 kk	tnx fer report!

G3XDY in JO02OB wkd on 144 MHz:

2003-10-29			
2329	ES6RQ	KO28WA	1693 km
2003-10-30			
0048	9A6WW	JN86HF	1291 km
0100	YU7EW	KNØ5HP	1582 km
0112	IK1SPR	JN34TQ	946 km
0141	ES5PC	KO38HJ	1745 km
0152	LY2BJ	KO25ER	1563 km
0201	SM3BEI	JP81NG	1405 km
0239	LY3OD	KO24OR	1610 km
0242	LY2BIL	KO24PQ	1615 km
0247	LY2BJ	KO25ER	1563 km
2003-10-31			
0107	HA5PT	JN97MK	1376 km
0108	YO2IS	KNØ5PS	1618 km
0110	S51MQ	JN75NT	1228 km
0113	OK2PVF	JN99GU	1235 km
0116	9A2VR	JN95FQ	1441 km
0118	S57TW	JN75EX	1171 km
0120	SP6LB	JO7ØUU	1012 km

tnx fer report, John

G4ASR in IO81MX wkd on 144 MHz:

2003-10-29						
1458	PA2MB	JO21JP	55A	57A	050°	535km
1516	DJ9YE	JO43HW	53A	55A	060°	806km
1635	DK3BU	JO33NW	53A	N/C	060°	
1710	YL2LW	KO26CW	53A	57A	020°	1829km
1715	GM3WFJ	IO86FR	55A	56A	030°	531km
1718	LY2FRL	KO16HU	55A	59A	030°	1732km
1738	SK0UX	JO99BM	55A	57A	030°	1556km
1749	DF8AE	JO41GX	53A	55A	070°	788km
1755	DK7BY	JO33RJ	53A	55A	055°	720km
1757	DF7OG	JO52BN	54A	55A	055°	893km
1800	DJ9CS	JO54DG	52A	53A	055°	920km
1801	DL3AGB		41A	52A	055°	
1804	F5LRL	JN26MU	54A	55A	070°	812km
1807	DJ3XK	JO53AN	55A	55A	070°	892km
1808	ON6AB	JO21EC	57A	57A	070°	517km
1810	DL1DAX	JO31RM	53A	55A	070°	719km
1814	LX2DX	JN29WO	55A	57A	050°	675km
1822	F5MGD	JN07AW	53A	53A	055°	499km
1824	DL6WT	JN39VV	55A	57A	055°	788km
1825	DL6WU	JN49HT	55A	54A	055°	847km
1828	DK7FC	JN49HS	52A	53A	055°	849km
1830	OK1AR	JO60RF	55A	59A	065°	1161km
1835	F5VHX	JN04FT	55A	55A	065°	836km
1836	OZ6TY	JO55XE	53A	57A	050°	1046km
1837	HA0HO	KN07SU	54A	59A	065°	1805km
1842	HB9BHU	JN37XG	55A	55A	065°	836km
1844	HA8V	KN06HT	55A	57A	065°	1792km
1845	DM2BHG	JO51MW	53A	53A	065°	959km
1851	DL3HRT	JO61AB	54A	55A	065°	1042km
1853	DL2EVB	JO31LL	53A	53A	060°	686km
1855	HA2RD	JN87WB	52A	55A	055°	1515km
1858	OK1DXQ	JO70PO	55A	59A	055°	1276km
1903	OK2BLS	JN89NW	51A	55A	055°	1421km
1907	DL3DXX	JO61VC	55A	57A	055°	1161km
1909	OM5KV	JN97BS	53A	55A	055°	1576km
1917	DL1YA		53A	N/C	055°	
2225	DK2CF	JO42GG	53A	55A	060°	786km
2227	DL2IAN	JN49BC	55A	55A	060°	846km
2229	PA3JH	JO31	53A	53A	060°	690km
2230	DL5LBY	JO43RS	54A	59A	060°	857km
2233	F6CRP	IN96KE	59A	57A	060°	658km
2233	US5WU	KO20DI	53A	59A	055°	1900km
2237	DL6DAF	JO52BD	55A	57A	055°	895km
2242	EI2AJ	IO63TJ	55A	57A	055°	280km
2247	DK7HH	JO53CE	55A	55A	055°	900km
2250	DJ6OL	JO52AP	55A	55A	055°	887km
2251	DK5EQ	JO31QG	53A	53A	055°	718km
2253	DL1YMK	JO31QX	55A	55A	055°	708km
2259	DL8YET	JO31MF	53A	51A	055°	696km
2301	ON4IZ	JO11TA	55A	58A	055°	469km
2305	G3FYX	IO81RM	54A	57A	055°	59km!
2324	SP4MPB	KO03HT	57A	57A	040°	1590km
2003-10-30						
0055	OK1DFC	JN79GW	57A	59A	070°	1245km
0100	OK2PMO		53A	55A	070°	
0101	HA5CW	JN97PM	54A	55A	070°	1667km
0105	S51ZO	JN86DR	55A	55A	070°	1507km
0106	F6BEG	JN25JS	54A	55A	070°	893km
0108	HB9DFG	JN37SM	54A	55A	070°	902km
0114	HA5KG	JN97OK	51A	55A	070°	1666km
0136	SP2MKO	JO93CB	52A	55A	045°	1432km
0140	DL1YAW	JO41DX	53A	59A	045°	771km
0142	9A6WW	JN86HF	57A	55A	055°	1557km
0148	F5SE/P	JN19XH	57A	55A	060°	571km
0156	SM0KAK	JO89XK	55A	55A	005°	1543km
0218	SM3BEI	JP81NG	52A	56A	020°	1597km
0227	LY3OD	KO24OR	51A	N/C	040°	1883km
1425	GM4VVX	IO78TA	53A	55A	010°	679km
1554	GM3UCN	IO85FV	54A	55A	035°	438km
1556	GM0TGE	IO87TF	55A	57A	030°	586km
2003-10-31						
1115	GM4VVX	IO78TA	57A	59A	010°	679km
1323	GM1XOI	IO85AT	53A	52A	025°	431km

RIG: TS790 + PA + 4.2wl 18-el DL6WU Yagi
tnx fer report, David

G4KLX in IO93FB wkd on 144 MHz:

2003-07-29					
1855	GM4VVX	IO78TA	55A	54A	579 km
2003-08-03					
1654	GM0VHR	IO85RL	55A	55A	277 km
1717	OK2PMU	JN99AJ	55A	55A	1418 km
1738	F6AQI	IN96DW	55A	55A	681 km
1740	F9IE	IO86WW	55A	55A	682 km
1743	F6CBH	JN19BH	54A	54A	489 km

tnx fer info, Jonathan

G4ZTR in JO01KW wkd on 144 MHz:

2003-10-29		
1755	SM5DFF	JO88
1808	LA7XK	JP50
1840	HA5OV	JN97
1843	F5VHX	JN04
1909	HA0HO	KN07
2003-10-30		
2130	IK2GSO	JN45
2200	I2FAK	JN45
2204	IK1SPR	JN34
2206	I1JTQ	JN35
2215	YU7BCL	KN05
2219	9A2VR	JN95

This is only a selection of the most interesting contacts.
RIG: FT1000MP, LT2S, HLV-600, SP2000. 200w to 16JXX2
tnx fer report, John

GI6ATZ in IO74AJ wkd on 144 MHz:

2003-10-29					
1818	GW7SMV	IO81LN	57A	55A	371 km
1821	M5BXB	IO91XR	57A	57A	494 km
1822	F5APQ	JO00XU	57A	57A	663 km
1823	DL2NUD	JO63MF	59A	59A	1250 km
1824	ON7LAO	JO20CK	53A	55A	817 km
1826	PD4HDB	JO32HN	53A	55A	856 km
1828	DH9YX	JN68OL	57A	56A	1476 km
1831	EI2IV	IO51TU	57A	57A	325 km
1853	G8GTD	IO93GB	59A	59A	331 km
1854	G3JHM	IO91LC	59A	59A	493 km
1856	DG5CST		59A	59A	1287 km
1858	EI2JD	IO63VS	59A	59A	192 km
1858	F6AQI	IN96DW	57A	57A	881 km
1902	DL3DXX	JO61VC	55A	55A	1374 km
1903	F4DXX	IN97LH	53A	53A	859 km
1904	F5LJA	JO10IA	57A	59A	764 km
1905	DL8AAV	JO52DH	55A	55A	1100 km
1907	DL2ARD	JO60AR	59A	59A	1279 km
1908	DG1BCU	JO42LT	55A	57A	1019 km
1910	DF5NK	JN59PM	57A	55A	1296 km
1912	DL9MCC	JN58UA	59A	53A	1415 km
1913	DF5DE	JO40CX	55A	55A	1025 km
1915	DG5AAG	JO51CT	55A	55A	1114 km
1917	DL3RBH	JN68HJ	52A	53A	1446 km
1920	DL7UAE	JO62PH	55A	52A	1294 km
1923	G8FDJ	IO93FJ	52A	53A	310 km
1931	EI7BMB		57A	57A	192 km
1932	OH7TE	KP20IE	57A	57A	1931 km
1932	SM3UZS	JP92	59A	59A	1414 km
1934	DG9BDI	JO42EG	55A	55A	979 km
1935	DJ6XV	JO31QV	55A	57A	930 km
1936	OH6KTL	KP02OJ	59A	59A	1796 km
1936	G3UPS	IO80	53A	57A	478 km
1938	OH7PF	KP42VN	55A	55A	2231 km
1939	OH1AYQ	KP12MA	57A	59A	1877 km
1940	G1HHO	IO90	52A	55A	548 km
1941	SM3LIC	JP92FW	57A	59A	1685 km
1942	PE1CZG	JO22	53A	57A	753 km
1948	DL5EBS	JO31LH	53A	55A	931 km
1952	MI0RTX		59A	59A	60 km
2126	PE1BBI/A	JO33II	59A	59A	837 km
2128	G0XDI	IO91RP	59A	57A	474 km
2131	G1XWD	JO03CI	52A	55A	420 km
2132	PA3DTM	JO22IA	55A	57A	757 km
2136	PA3ATP	JO21BT	55A	55A	731 km
2144	G4KQH	IO92JD	52A	54A	403 km
2146	SM7FJE	JO65	59A	59A	1211 km
2147	OZ3ZW	JO54RS	59A	59A	1120 km
2148	SM7DTT	JO65LJ	59A	59A	1211 km
2149	ON6AA	JO11JD	52A	52A	690 km
2150	SP2CNW	JO93AD	57A	59A	1576 km
2152	2M0AVY	IO86GG	52A	53A	262 km
2155	GI4FUE		59A	59A	37 km
2157	DK8XK		53A	59A	1287 km
2159	SP5MXL	JO92UN	55A	57A	1798 km
2200	SP5ENA	KO02NF	57A	55A	1804 km
2201	DB8WJ	JO33TH	52A	52A	898 km
2202	PH7A	JO32NX	59A	59A	874 km
2203	DL7FF	JO62TJ	59A	59A	1313 km
2204	SP6NVN/3	JO82KL	59A	59A	1521 km
2204	GM3YTS	IO86AE	55A	55A	236 km
2205	SP9HMC/1	JO83FG	59A	59A	1470 km
2206	DH4AE	JO51DQ	52A	52A	1124 km
2207	DL8YHR	JO41GV	57A	57A	1004 km
2208	OK1AVQ	JO70OR	59A	59A	1481 km
2209	DL3WJ	JO60CV	55A	55A	1282 km
2222	DL5YEE	JO42GF	55A	53A	991 km
2223	PA1BVM	JO21RI	59A	59A	836 km
2224	DL2BDK	JO32XQ	53A	55A	937 km
2226	DG9BDV	JO33PE	59A	59A	879 km
2227	G4XGT	IO92XH	57A	59A	456 km
2228	PE1CZG	JO22PE	59A	59A	786 km
2230	DJ0KF		59A	59A	1287 km
2231	PA2JWN	JO22QD	59A	59A	793 km
2231	DL6KR	JO30NQ	59A	59A	974 km
2233	PA3ENH	JO21OI	59A	59A	821 km
2233	DL9OBD	JO42QN	59A	59A	1033 km
2234	PE3MCO	JO22MA	59A	59A	778 km
2235	PA0JUS	JO22OO	59A	59A	764 km
2236	DL1BKT	JO33EQ	57A	59A	808 km
2238	DL1YMK	JO31QX	59A	59A	926 km
2239	DL2YFT	JO31OR	59A	59A	927 km
2240	SP9XLC	JO90LJ	55A	58A	1738 km
2241	SP2MSL	JO92NM	55A	55A	1665 km
2242	SP7TEE	JO91SS	57A	59A	1718 km
2244	DG0DRF	JO71JJ	55A	55A	1426 km
2246	OK2BRD	JN99ET	57A	59A	1728 km
2249	OE3FVU	JN78VE	55A	55A	1654 km
2252	DL9YBZ	JO31KU	53A	53A	900 km
2336	G1ILB	IO95GE	57A	57A	302 km
2338	G8JVM	IO82SP	57A	58A	302 km
2340	GM8KMH	IO86DQ	55A	43A	291 km
2342	M5MUF	IO92JP	53A	55A	369 km
2345	ON4CHP	JO21JD	57A	59A	807 km
2347	GW4HBK	IO81KP	57A	59A	360 km
2348	PE1AHX	JO21OS	59A	59A	800 km
2349	SP9APC	JN99	55A	52A	1783 km
2353	DL1YAW	JO41DX	55A	59A	985 km
2355	SP2MKO	JO93CK	55A	52A	1578 km
2357	DJ5JD	JO33RM	59A	59A	882 km
2359	SP9APC	JN99QU	55A	59A	1791 km
2003-10-30					
0004	DL7OK	JO31KL	55A	57A	918 km
0006	DL1DAX	JO31RM	55A	57A	952 km
0008	DJ3FK	JO31KH	55A	55A	926 km
0009	PA4EME	JO20WX	59A	59A	882 km
0010	DB4BIN	JO42CO	59A	59A	956 km
0011	DD9EN	JO31JG	55A	57A	923 km
0011	DG4DW	JO31SO	57A	57A	953 km
0012	DM1CG	JO31IC	59A	59A	926 km
0014	DL6IY	JN49NI	55A	57A	1174 km
0016	DB8KJ	JO30CM	55A	59A	928 km
0017	DK5YA	JN49NX	59A	59A	1136 km
0019	G8TIC	IO82VF	59A	59A	346 km
0028	DO1FOX	JO31PU	53A	55A	927 km
0031	OK1COM	JN79GX	52A	55A	1669 km
0036	DF2VJ	JN39LI	55A	55A	1047 km
0037	G4LPD	IO92KW	59A	59A	357 km
0038	HB9DFG	JN37SM	57A	59A	1212 km
0040	DG5DWL		52A	57A	1287 km

RIG: IC251E + Mutek FE, PA 2 x 4CX250B, 13 ele Boomer
All contacts made in SSB. tnx fer report, Gordon

GM0TGE in IO87TF wkd on 144 MHz:

2003-10-29					
2338	OK2PM	JN99AO	55a	55a	1587 km
2339	SP2MKO	JO93CB	55a	55a	1381 km
2003-10-30					
0127	OK1MHZ	JO7ØVA	55a	52a	1434 km
0131	LY2BIL	KO24PQ	57a	57a	1732 km
0134	SP2MKO	JO93CB	57a	55a	1381 km
0141	OK1MZM	JO7ØSL	57a	55a	1387 km
0151	ES5PC	KO38HJ	57a	57a	1709 km
0209	RX1AS	KO59FX	57a	55a	1905 km
0221	LY3OD	KO24OR	59a	59a	1726 km

(Only short extract of DX QSOs) Rig: IC706, 100W, 17ele yagi 20m agl, 2dB feedline loss. tnx for report, Ian

HA6NY in JN98 wkd on 144 MHz:

2003-10-30					
1949	G7RAU	IO90IR	55a	55a	1553 km
2138	DK1KR	JO53HW	57a	59a	914 km
2140	PA1LA	JO32BM	55a	57a	1090 km
2142	SP7OGP	KO01AM	57a	55a	380 km
2143	SP2OFW	JO93AC	57a	59a	571 km
2149	RA3QTT	LO01GQ	55a	55a	1527 km
2154	OZ8ZS	JO55RT	55a	52a	1031 km
2156	DK5DQ	JO31PG	55a	55a	969 km
2204	SP2MKO	JO93CB	52a	55a	564 km
2207	DL7ANA	JO62PM	55a	55a	677 km
2210	ON7EH	JO20FV	55a	55a	1153 km
2212	ON4KHG	JO10XO	55a	56a	1183 km
2221	ON4LN	JO20IV	52a	55a	1136 km
2003-10-31					
0008	SM7DLZ	JO86BS	55a	57a	996 km
0013	RA3LE	KO64AR	55a	55a	1117 km
0026	LY2BIL	KO24PQ	55a	57a	822 km
0045	SM7WT	JO65QQ	57a	59a	953 km
0048	PA2DW	JO22GD	57a	55a	1179 km
0053	SP7ASQ	JO91RS	57a	55a	409 km
0112	G4KWQ	IO92AQ	57a	56a	1621 km
0121	DF8IK	JO30JT	55a	52a	991 km
0123	DL8LAQ	JO43XU	57a	53a	942 km
0128	UT8AL	KO61WP	55a	57a	1075 km
0133	RW3WR	KO71IM	55a	57a	1127 km
0144	DJ5HG	JO53IM	55a	54a	880 km

tnx fer report, Julius

HA8V in KN06HT wkd on 144 MHz:

2003-10-29						
1802	DK1KR	JO53HV	55A	51A		
1807	PA1T	JO33JF	57A	55A		
1816	SK7MW	JO65MJ	57A	55A		
1826	DL1SUN	JO53PN	53A	55A		
1828	OZ1LPR	JO44UW	57A	55A		
1831	DJ3LE	JO44TN	55A	55A		
1845	G4ASR	IO81MX	57A	55A	330	
1855	DK3BU	JO33NO	57A	59A	340	
1857	G3LTF	IO91GG	57A	56A	300	
1900	G7RAU	IO90IA	55A	55A	300	
1908	DF2JQ	JO31HL	56A	54A	330	
1915	G4ZTR	JO01KW	55A	55A	330	
1932	G4RRA		56A	55A		
1938	PA5DD	JO22IC	55A	53A	330	
1942	LY2BAW	KO25KA	59A	59A	5	
1945	OZ1CLL	JO65GQ	59A	57A		
1947	RA3LE	KO64AR	59A	55A	10	
2003-10-30						
2149	DF7KF	JO30GU	53A	51A	340	
2201	LY2CI	KO14WV	55A	55A	25	
2205	OZ8ZS	JO55RT	57A	55A		
2213	SP4JWD	KO03FR	56A	54A	25	
2216	SM7ALC	JO65RL	57A	57A	25	
2220	SP4MPB	KO03HT	55A	53A	25	
2224	DJ9YE	JO43HV	58A	56A	25	
2237	SM7DLZ	JO86BS	59A	59A	10	
2248	DJ4TC	JO63PN	57A	55A	0	
2252	OZ5N	JO46SI	56A	57A	30	
2254	SP4BY	KO13OD	56A	55A	30	
2256	OZ1LO	JO55VC	56A	56A	30	
2302	OZ8FR	JO55SK	56A	55A	30	
2313	OZ2M	JO65FR	55A	55A	20	
2003-10-31						
0008	DG6JF/P	JO33QN	57A	55A	30	SSB
0017	DL2BWH	JO62XR	56A	55A	30	
0017	DL3CAR	JO64AC	57A	57A	30	
0020	SP2MKO	JO93CB	59A	59A	30	
0024	DL8LAQ	JO43XU	59A	52A	30	
0034	SP2MKI	JO93AC	56A	57A	30	
0040	SP5ZCC	KO02PF	55A	55A	30	
0042	LY2BIL	KO24PQ	59A	59A	30	
0045	DH8BQA	JO73CF	54A	53A	30	
0051	LY3OD	KO24OR	59A	57A	30	
0058	SP3MGM	JO73QE	59A	59A	30	
0125	SK6DK	JO67EH	56A	55A	20	
0132	LY2BJ	KO25ER	57A	59A	30	
2120	LY2BAW	KO25KA	59A	59A	20	
2121	DK1KR	JO53HW	59A	59A	0	
2124	DJ5HG	JO53IM	59A	54A	330	
2127	G3WZT	IO90UX	57A	55A	330	
2128	GW4FRX	IO82MR	59A	59A	330	
2135	G4PBP	IO80WO	59A	56A	330	SSB
2141	PA5KM	JO11WL	59A	55A	340	
2142	SP4JWD	KO03FR	55A	54A	340	
2145	DL7ULM	JO62SN	57A	55A	330	
2149	DJ9MG	JO52TC	58A	56A	30	
2154	SP2OFW	JO93AC	59A	59A	0	
2158	OZ1LPR	JO44UW	55A	55A	0	
2159	SP3TYF	JO82FH	59A	59A	0	
2202	DL1YAW	JO31DX	55A	55A	0	
2205	PA5WT	JO22HG	59A	59A	330	
2206	PA2DW	JO22GD	59A	53A	330	
2209	PA0IJM	JO32GP	53A	55A	330	
2211	PA3CNX	JO22MC	57A	59A	330	
2212	SP9AI	JN99MT	55A	55A	330	
2212	PA3COB	JO32MF	59A	59A	330	
2215	DJ5BV	JO30KI	57A	55A	330	
2216	DL3LST	JO61FI	57A	57A	330	
2219	DK5DQ	JO31PG	55A	55A	330	
2220	PC5M	JO20QE	55A	53A	330	
2222	ON7EH	JO20FV	55A	55A	330	
2232	LY2BJ	KO25ER	59A	59A	10	
2251	SM7SPG	JO66MD	59A	59A	0	
2300	SM7DLZ	JO86BS	57A	57A	0	
2306	LY2BUU	KO15XH	55A	55A	25	
2312	OZ1LPR	JO44UW	59A+	59A	0	
2320	RA3DRC/1	KO55JR	56A	57A	30	
2003-11-01						
0017	PA0V	JO33II	57A	55A		
0024	RA3QTT	LO01GQ	57A	57A		
0029	SN70L	JO91RR	55A	57A		
0037	DL8LAQ	JO43XU	59A	55A		
0041	SP2IQW	JO94GM	59A+	59A		SSB
0045	DL5ME	JO52SD	55A	55A		
0048	PA3FOC	JO21FW	59A	55A		
0051	DL7ANR	JO62PM	59A	55A		
0054	DJ8MS	JO63CT	57A	57A		
0058	SM7WT	JO65QQ	59A+	59A		
0103	SP1FJZ	JO84EE	57A	56A		
0104	UT8AL	KO61WP	57A	59A		
0106	LY2BIL	KO24PQ	59A	59A		
0109	DJ9YE	JO43HV	59A	59A		
0111	PA5DD	JO22IC	55A	52A		
0114	RW3WR	KO71IM	59A	57A		
0118	PA0JMV	JO21PM	59A	55A		
0120	DK5DQ	JO31PG	57A	53A		SSB
0125	SQ2EEQ	JO94JC	59A	55A		
0128	PA2CHR	JO22XA	59A	55A		
0132	DL3DXX	JO61VC	57A	55A		
0147	DJ5HG	JO53IM	57A	55A		
0152	RW3PF	KO93CD	57A	55A		

hrd DH5FHC, PA3FOC, EU6MS, F5SE/P

RIG: 4x11 ele Yagi, 35m AGL, TM255E + GS35B 900W

tnx fer report, Gabi!

HB9BZA in JN36BE wkd on 144 MHz:

2003-10-29					
1923	PA5DD	JO22IC	53A	54A	25°
1941	G7RAU	IO90IR	53A	57A	20°
2224	PA3FOC	JO21FW	55A	57A	25°
2230	G4KWQ	IO92AQ	52A	55A	30°
2249	DK9OY	JO52CK	55A	55A	30°
2003-10-30					
2147	PA5KM	JO11WL	56A	56A	35°
2152	DJ3VI	JO43VI	55A	55A	
2155	DL4DWA	JO61QH	54A	55A	
2157	PA5WT	JO22HG	53A	55A	
2204	G4KWQ	IO92AQ	55A	54A	
2206	DF7KF	JO30GU	55A	55A	35°
2210	PC5M	JO22QE	56A	55A	
2215	ON4CDF	JO22EE	54A	55A	
2218	G4ZTR	JO01KW	52A	55A	
2222	PA2DW	JO22GD	53A	53A	30°
2229	DJ9YE	JO43HV	54A	57A	30°
2003-10-31					
0022	PA3FOC	JO21FW	53A	53A	
0028	PA0JMV	JO21PM	57A	59A	35°
0029	DJ2QV	JO31PF	56A	57A	
0055	G4IGO	IO80NW	55A	56A	15°
0059	EI4DQ	IO51WU	55A	55A	0°
0102	PA3BIY	JO22EB	59A	59A	25°
0104	DK3IK	JN39JF	56A	55A	40°
0105	DL8LAQ	JO43XU	55A	53A	30°/70°
0114	DF5DE	JO40CX	51A	52A	30°
0119	DK5DQ	JO31PG	55A	55A	35°
0125	DL1YAW	JO41DX	55A	55A	
0129	DH5FS	JO61UA	53A	55A	40°

tnx fer report, Robert!

I4YNO in JN54KP wkd on 144 MHz:

2003-10-29					
1835	PA1T	JO33JF	55A	59A	30
1842	DK9OY	JO52CK	55A	54A	30
1854	DL6BF	JO32QI	52A	54A	30
1854	PA0PVW	JO22VA	53A	56A	30
1906	PA0JMV	JO22PM	52A	52A	30
1909	PA2CHR	JO22XA	57A	55A	30
1913	PA3GYS	JO22WW	54A	55A	30
1915	PA3DZL	JO21HM	55A	55A	30
1945	DF7KF	JO30GU	55A	56A	30

Rig: FT-1000MP + S53WW xvtr, preamp MGF1302, 20 ele Shark. tnx fer report, Alex!

I4XCC in JN63GV wkd on 144 MHz:

2003-10-29					
1618	DK2ZF	JO43WJ	55a	55a	1074 km
1628	DJ9YE	JO43HV	55a	54a	1147 km
1645	PA0V	JO33II	55a	55a	1134 km
1651	DL1SUN	JO53PN	53a	55a	1078 km
1654	DK3BU	JO33NO	57a	55a	1149 km
1726	DK1KR	JO53HW	52a	52a	1125 km
1734	PA3CEE	JO33JI	55a	55a	1132 km
1739	DH2OAA	JO42TU	53a	53a	1019 km
1742	PA1T	JO33JF	59a	59a	1120 km
1744	DJ4TC	JO63PN	53a	53a	1076 km
1748	DK9OY	JO52CK	53a	52a	965 km
1754	DL8LAQ	JO43XU	55a	52a	1123 km
1759	PA5DD	JO22IC	52a	52a	1081 km
1807	PA2DW	JO22GD	53a	53a	1092 km
1812	PC5C	JO33GN	53a	52a	1160 km
1820	DL6YEH	JO32VA	53a	53a	969 km
1825	DF7KF	JO30GU	57a	55a	895 km
1826	DK5DQ	JO31PG	55a	55a	909 km
1831	ON4LN	JO20IV	55a	55a	975 km
1834	DL1EAP	JO31BC	55a	55a	934 km
1837	DF2JQ	JO31HL	55a	55a	951 km
1846	OK1VT	JN79IX	55a	55a	696 km
2114	PA4VHF	JO32	59a	59a	
2122	DL2BWH	JO62XR	55a	55a	987 km
2127	G4KWQ	IO92AQ	53a	54a	1446 km
2136	DL9ST	JO43UQ	55a	44a	1108 km
2143	DK7BY	JO33RJ	57a	56a	1119 km
2147	DJ8MS	JO63CT	57a	56a	1103 km

All QTF were abt 25 deg except some PA and G4KWQ to 350 deg.

2003-10-30
2225 DJ5HG JO53IM 57a 53a 1078 km
2248 DJ9YE JO43HV 57a 53a 1147 km
RIG: Rig 4x17 F9FT PA 3CX800 tnx fer report, Claudio!

I5WBE in JN53JR wkd on 144 MHz:
2003-10-29
1933 DF7KF JO30GU 53A 56A 10 853 km
Was active until 2230 UTC but heard only DF7KF. Was heard by DK5DQ. tnx fer report, Enrico

IK2YXK in JN45OP wkd on 144 MHz:
2003-10-29
1851 pa5dd jo22ic 55a 30°
1912 df7kf jo30gu 59a 50°
1931 pa0jmv jo21pm 59a 35°
2003-10-30
2153 df2jq jo31hl 55a 30°
2159 df7kf jo30gu 59a 20°
2204 g4pbp io82wo 59a 30° ssb
2207 dl6yeh jo32va 55a 20°
2216 g4kwq io92aq 55a 30°
2219 pa2dw jo22gd 55a 35°
2227 on4ln jo20iv 55a 60°
2003-10-31
0031 dl5me jo52sd 55a 50°
0034 pa3biy jo22eb 59a 50°
0038 pa3foc jo21fw 55a 50°
0049 df3oj jo41wu 55a 30° ssb
0053 g7rau io91ir 55a 30°
0051 dk5dq jo31pg 57a 30°
0101 dk5dq jo31pg 57a 30° ssb
0106 pe1ahx jo21os 59a 30° ssb
0107 dl6kr jo30nq 57a 15° ssb
0133 dk5ya jn49nx 55a 50°
Lost in qsb and heard: dl1sun, dk1kr, pe1hwo, dl8ebw, mw1mfy, pa3dzl, do1c??. Tnx to all... aurora was also visible reddish..but due city lights made a wrong view ... amazing anyway. Impressive the big qsb in almost every sigs...so really hard to complete qso... g4pbp was the most strong sigs! Rig: 400w, 12-ele, 220m asl tnx fer report, Mau!

IK4PMB in JN54LL wkd on 144 MHz:
2003-10-29
1912 PA2DW JO22
1940 G7RAU IO90
Hrd also DF7KF for a long time. tnx fer report, Anto

IZ4BEH in JN54VK wkd on 144 MHz:
2003-10-29
1710 DH2OAA JO42TU 55A 55A
1740 DK3BU JO33NO 55A 54A
1845 PA3CEE JO33JI 55A 55A
1852 PA5DD JO22IC 55A 55A
1910 DK9OY JO52CK 55A 54A
1914 PA2DW JO22GD 55A 52A
1914 DL1EAP JO31IK 54A 55A
1924 DF7KF JO30GU 55A 55A
1928 DL8YET JO31MH 51A 51A
2101 DL1YAW JO41DX 55A 55A
2111 DF2JQ JO31HL 54A 55A
2124 PA3BIY JO22EB 52A 55A
2129 PA3DZL JO21HM 55A 55A
2131 DK5DQ JO31PG 55A 55A
2225 DL1SUN JO53PN 55A 55A
2232 G4KWQ IO92AQ 51A 51A
2245 DJ4TC JO63PN 55A 55A
2255 DL6YEH JO32VA 55A 55A
2003-10-30
2135 DK1KR JO53HR 59A 59A
2140 G7RAU IO90IR 55A 55A
2145 DL6YEH JO32VA 59A 59A
2144 DL2RAG JN52TC 59A 59A
2150 DL7ANR JO62PM 55A 55A
2151 PA2DW JO22GD 55A 55A
2153 PA0JMV JO21PM 59A 57A
2200 DL7ULM JO62SN 59A 59A
2213 DL7UDA JO62TK 55A 55A
2215 DL5ME JO52ID 59A 59A
2216 DL3DXX JO61 55A 55A
2218 DK5YA JN49NX 59A 59A
2219 DL5WG JO53VK 59A 57A
2220 PA2CHR JO22GA 59A 59A
2227 DL7FF JO62TJ 55A 55A
2225 PA3CNX JO22MC 59A 59A
2232 PA5DD JO22IC 55A 55A
2237 DL8EBW JO31NF 55A 52A
RIG: 2x16ele-JXX, IC735 + trv home made, preamp MGF2407, PA 8877 tnx fer report, Rob!

LA0BY in JO59FW/IX wkd on 144 MHz:
2003-10-29
1510 LY2BJ KO25ER 52A 59A 40 945 km
1602 SP4JWD KO03FR 56A 57A 40 918 km
1610 DL8WF JO61CU 51A 51A 40 905 km
1612 SP6RGB JO71SF 53A 53A 40 1019 km
1615 YL2AJ KO16OX 59A 59A 40 810 km
1630 SP5AGT KO02MG 51A 55A 40 1073 km
1640 LY2IC KO14WW 56A 59A 40 974 km
1642 DL3DXX JO61VC 52A 55A 40 1004 km
1650 SP5GJH KO02RU 55A 55A 40 1036 km
1708 SP5ZCC KO02PF 55A 57A 40 1086 km
1709 DL1HWK JO61CU 52A 55A 40 905 km
1712 SP7EXY KO00QW 52A 59A 40 1211 km
1722 SP3JMZ JO82KJ 53A 55A 40 927 km
2116 SP6GVU JO81LC 55A 57A 30 1063 km
2117 DF7OG JO52BN 56A 55A 30 820 km
2121 DL5CF JO51SN 55A 55A 30 934 km
2134 ES4BW KO39PI 56A 59A 30 946 km
2154 SP7ASQ JO91RS 52A 55A 30 1066 km
2209 SP3DOQ JO81BU 52A 58A 30 965 km
2234 OK1CZ JO70EC 54A 56A 30 1121 km
2252 LY3OD KO24OR 54A 57A 30 1054 km
2313 RX1AS KO59FX 57A 59A 10 1109 km
2316 ES6RQ KO28WA 59A 59A 10 907 km
2320 RA3AQ KO85SP 57A 57A 30 1661 km
2326 DF8AE JO41GX 53A 55A 30 893 km
2342 LY2BIL KO24PQ 57A 59A 30 1061 km
2003-10-30
0015 SP4BY KO13OD 53A 53A 30 1083 km
2120 YL2HA KO26CV 56A 57A 30 867 km
2124 LY2BAW KO25KA 59A 59A 30 1017 km
2128 SP3QDM JO82EF 55A 55A 30 932 km
2130 DM2DXG JO51MV 54A 55A 30 895 km
2132 DM2BHG JO51MW 54A 55A 30 890 km
2134 OK2AF JN89AA 55A 55A 30 1265 km
2147 YL2GC KO26AW 55A 55A 30 856 km
2215 EU3AI KO22CE 55A 55A 30 1208 km
2220 DL1VDL JO61WB 53A 57A 30 1010 km
2318 ES5PC KO38HJ 52A 57A 30 935 km
2325 SP2OFW JO93AC 53A 57A 30 890 km
2351 DH5FS JO61UA 52A 55A 30 1012 km
After 2130 UTC when the geomagnetic disturbance was strongest, the Aurora was extremely weak here. All went south...
2003-11-04
1916 OH1MDR KP01VJ 52A 55A 30 623 km
1921 OH6HFX KP14RA 55A 57A 30 801 km
1924 SM2ILF KP04NP 55A 57A 30 746 km
1926 SK2AT KP03BU 52A 55A 30 654 km
1929 OH1NOR KP00XL 52A 59A 30 623 km
1932 OH3AA KP21GA 55A 55A 30 765 km
1933 SM3RIU JP93IG 53A 55A 30 558 km
2137 SM2DXH KP03CU 53A 55A 10 657 km
2146 LA4XGA JP33VC 55A 55A 10 380 km
2148 OH6QR KP22BN 53A 55A 10 771 km
2003-11-06
2015 OH6NVQ KP13IQ 55A 57A 20 715km
2003-11-15
1616 DK1KR JO53HW 59A 59A 20 667 km
1618 DL6NDK JO53AK 51A 55A 20 723 km
1619 DH7FB JO62SM 55A 55A 20 846 km
1620 DG2LAB JO54AK 53A 55A 20 612 km
1624 SQ2EEQ JO94JC 51A 55A 40 820 km
1630 DL0OS JO43AH 52A 55A SSB 751 km
1631 DC0NAC JO43VI 59A 59A SSB 733 km
1633 DG2BCP JO43DC 56A 55A SSB 771 km
1647 DL2NUD JO63MF 59A 59A SSB 762 km
1654 PA5DD JO22IC 55A 55A 310 941 km
1702 OZ/I4YNOJO65FR 55A 52A 20 483 km
1750 GW8IZR IO73TI 52A 53A 300 1161 km
RIG: IC-821H, 180 W, 9-ele yagi

LZ2FO in KN13KX wkd on 144 MHz:
2003-10-29
0658 PA3BIY JO22 55A 55A
2103 PA0V JO33 55A 55A
2112 PA2CHR JO21 52A 52A
2335 DF7KF JO30 52A 52A
hrd also DK1KR and G7RAU tnx fer info

M5MUF in IO92JP wkd on 144 MHz:
2003-10-29
1615 MM0CEZ IO75XU 59a 55a 401 km
1632 GM0TGE IO87TF 59a 59a 515 km
1710 PE1AHX JO21OS 59a 55a 448 km SSB
1745 G7RAU IO90 59a 55a 237 km
1806 PA4VHF JO32EH 59a 55a 515 km
2229 GW7SMV IO81LN 59a 59a 174 km SSB
2245 DK5DQ JO31PG 59a 55a 602 km
2247 PA4VHF JO32EH 59a 55a 515 km
2320 PA5DD JO22IC 59a 56a 406 km
2343 GI6ATZ IO74AJ 59a 59a 369 km SSB
2003-10-30
0025 EI4DQ IO51WU 56a 53a 479 km
0038 DK7FC JN49HS 55a 52a 755 km
0043 HA0HO KN07SU 42a 55a 60 1694 km
0049 DK5SO JN58AV 52a 52a 893 km
0057 F5LRL JN26 55a 55a 816 km
0108 F5SE/P JN19XH 55a 55a 517 km
0115 PA1BVM JO21RI 59a 59a 478 km
0120 GW3LEW IO71PS 57a 53a 257 km
0129 EI2JD IO63 55a 55a 396 km
0145 PD0RFU JO32LA 52a 55a 559 km
0205 MM0KSS IO87WB 59a 58a 494 km
0225 GM4BYF IO85JV 59a 55a 384 km
2137 PD4FDB JO32ON 56a 51a 568 km SSB
2144 PD1AIQ JO22RM 57a 55a 450 km SSB
2239 DJ5HG JO53IM 59a 55a 70 801 km
2246 DL1YAW JO41EX 55a 52a 70 655 km
2311 DF7KF JO30GU 59a 56a 70 569 km
2316 DL6YEH JO32VA 56a 53a 70 615 km
2328 PE1AHX JO21OS 59a 57a 448 km SSB
2339 PA5WT JO22IW 59a 57a 30 399 km
2342 PD1AIQ JO22RM 59a 57a 450 km SSB

2003-10-31
0012 PA1BVM JO21RI 59a 57a 478 km SSB
0022 DJ5JY JO42HA 55a 55a 90 671 km
0031 DF1CF JN57FP 59a 59a 90 998 km
0033 GM0CLN IO85 59a 53a 30 339 km
0043 DL6NDK JO53HV 52a 55a 90 798 km
0048 SP7ASQ JO91RS 52a 51a 90 1406 km
0056 DL1HWK JO61CU 55a 55a 90 916 km
0059 DL6KR JO30NQ 55a 55a 90 614 km
0233 G7RAU IO90 56a 55a 237 km
1324 GM4VVX IO78TA 58a 57a 630 km
Rig: IC202 + PA 20W, RX BF981, 10 ele. tnx fer report, Mike!

OE3FVU in JN78VE wkd on 144 MHz:
2003-10-29
0658 PD4R JN22VP 57A 59A 25 993 km
1725 PE9DX JO33MD 55A 53A 25 826 km
1943 PAOJMV JO21PM 59a 53a 25 838 km
1847 SP2MKO JO93CB 57a 55a 25 568 km
1915 PE1AHX JO21OS 55A 55A 25 854 km
1925 DC9YC JO31PJ 55A 55A 25 706 km
1926 DM1CN JO31IC 53A 59A 25 729 km
1926 PAOV JO33II 59a 59a 25 858 km
2159 DL9OBD JO42QN 58a 55a 25 665 km
2255 GI6ATZ IO74AJ 55a 55a 310 1653 km
All QSO in SSB. tnx fer report, Franz

OK2PM in JN99AO wkd on 144 MHz:

2003-10-29

1608	SM6ENG	JO67CQ	55A	55A		976 km
1618	OZ6OL	JO65DJ	55A	55A		751 km
1628	SK4BX	JO79OF	55A	55A		1085 km
1645	SM6YFF	JO68GO	55A	55A		1061 km
1655	SM6NET	JO68SD	55A	55A		993 km
1705	OZ1CLL	JO65GQ	55A	55A		770 km
1718	DJ3LE	JO44TC	55A	55A		763 km
1721	DK2ZF	JO43WJ	55A	55A		704 km
1759	PA1T	JO32JJ	55A	55A		845 km
1830	DJ4TC	JO63PN	55A	55A		548 km
1834	DK3BU	JO33NO	59A	56A		873 km
1840	SM1CXE	JO97FJ	57A	56A		866 km
1845	SK6HD	JO68SD	59A	58A		993 km
1848	SM7LZQ	JO77DS	55A	55A		940 km
1854	DJ9YE	JO43SV	55A	55A		754 km
1936	LA3BO	JO59CD	55A	55A		1173 km
1950	DL8BDU	JO43AA	51A	55A		791 km
2024	SK6DK	JO67EH	55A	55A		934 km
2105	SM5DFF	JO88CN	56A	56A		1002 km
2115	SM4IVE	JO79SD	57A	55A		1073 km
2125	LY2BAW	KO25KA	59A	59A		759 km
2159	YL2AJ	KO16OX	55A	55A		688 km
2210	DL9OBD	JO42QN	57A	57A	SSB	688 km
2224	DG6JF/P	JO33QN	55A	55A	SSB	857 km
2230	SK6BA	JO67HM	57A	57A	SSB	949 km
2233	OZ4VW	JO45UX	57A	57A	SSB	902 km
2246	SM7MRD	JO65NP	57A	57A	SSB	748 km
2254	SM7DLZ	JO86BG	57A	57A		752 km
2333	ES6RQ	KO28WA	59A	59A		1065 km
2338	GM0TGE	IO87TF	55A	55A		1586 km
2344	OZ8ZS	JO55RT	55A	55A		819 km
2359	RA3AQ	KO85SP	55A	57A		1470 km

2003-10-30

0004	DL8LAQ	JO43XU	51A	55A	729 km
0019	LY2BJ	KO25ER	58A	57A	803 km
0043	G7RAU	IO90IR	57A	57A	1378 km
0053	EI4DQ	IO51WU	52A	55A	1848 km
0101	G4ASR	IO81MX	53A	55A	1493 km
0120	GM0LVI	IO86JJ	52A	52A	1600 km
0128	GM4BYF	IO85JV	52A	55A	1583 km
0134	GM4VVX	IO78TA	54A	55A	1731 km
0232	ES5PC	KO38HJ	53A	55A	1124 km
0236	LY3OD	KO24OH	55A	55A	717 km

tnx fer info

ON4LN in JO20IV wkd on 144 MHz:

2003-10-29

1630	GM0TGE	IO87TF	55A	841 km
1712	GM1XOI	IO85AT	55A	793 km
1729	DJ9CS	JO54CG	55A	520 km
1732	DJ3XK	JO45XI	55A	607 km
1734	G4RGK	IO81ON	55A	527 km
1736	GW4MFC	IO81FL	55A	578 km
1742	DH2OOA	JO48TU	55A	939 km
1748	GW4LEW	IO71PS	55A	661 km
1754	DL7ULM	JO62RD	55A	621 km

1802	F5LRL	JN26MF	55A		520 km
1814	EI4DQ	IO51WU	55A		896 km
1819	OZ1LGW	JO44WK	55A		526 km
1828	DL0UU	JO64AD	55A		613 km
1901	HB9COC	JN26SM	55A		490 km
1903	DL2IAN	JN49BC	55A		315 km
1909	HA9CE	KN07KX	55A		1287 km
1912	S53J	JN75EV	55A		904 km
1914	HB9DKM	JN47SL	55A		517 km
1925	HB9BN	JN37	55A		414 km
1930	DL8MFL	JN58OA	55A		568 km
1932	I4XCC	JN63GV	55A		975 km
1936	I4LCK	JN45PD	55A		724 km
1939	DL3RBH	JN68IK	55A		637 km
1941	DK0OG	JN68GI	55A		631 km
2225	GW3HWR	IO71XN	59A		613 km
2247	I2FAK	JN45PB	55A		733 km
2258	DL1GGT	JN58AO	55A		520 km

2003-10-30

2128	IK1EGC	JN35UF	55a	55a	668 km
2138	OK2YT	JN88IW	55a	55a	885 km
2141	US5WU	KO20DI	55a	55a	1379 km
2144	DL3JDN	JO60HR	57a	57a	556 km
2148	S57TW	JN75EX	55a	55a	897 km
2153	I1JTQ	JN35FB	55a	55a	662 km
2155	DK0IG	JN58SE	55a	55a	577 km
2158	OK2BEW	JN79SJ	55a	55a	789 km
2205	HB9DFG	JN27SM	55a	57a	380 km
2206	OE5KE	JN78DF	55a	55a	751 km
2210	DB6NI	JO50VE	55a	55a	507 km
2212	YU7BCL	KN05FW	55a	52a	1283 km
2214	S51MQ	JN75NT	55a	55a	954 km
2217	DJ0TB	JN58OB	55a	55a	565 km
2220	HA6NC	JN97WC	55a	52a	1181 km
2227	IK2YXK	JN45OP	55a	55a	647 km
2237	IK1SPR	JN34TQ	55a	55a	724 km
2313	GW3LEW	IO71	55a	55a	582 km
2358	GM0CLN	IO85HV	55A	55A	771 km

Most of the qso's were made with a qtf from 60°

RIG: TS-711e, 17ele M2, MGF1302 and GS35b with abt 500W. tnx fer info, Eric

PA2CHR in JO22XA wkd on 144 MHz:

2003-10-29

1656	ES6RQ	KO28WA	55A	59A	30	1431 km.
1704	EU6MS	KO45IN	59A	57A	30	1543 km.
1714	ES5PC	KO38HJ	55A	55A	30	1486 km.
1724	EW6FS	KO35LB	55A	59A	40	1427 km.
1836	LX2DX	JN29WO	59A	59A	60	269 km.
1906	9A6WW	JN86HF	55A	55A	80	1009 km.
1911	I4YNO	JN54KP	55A	57A	80	896 km.
1931	OM3RM	JN87WF	55A	57A	70	1011 km.

2003-10-30

0035	OK2BDQ	JN99HQ	55A	55A	75	928 km.
0103	I4RHP	JN54QL	56A	58A	80	929 km.
0118	RA3LE	KO64AR	59A	59A	40	1751 km.
1841	GM0HTT	IO89JC	57A	59A	15	976 km.
2017	LA3BO	JO59CD	55A	57A	25	837 km.
2155	OE5OLL	JN68SI	59A	59A	70	677 km.
2204	I4LCK	JN54PD	55A	59A	80	961 km.
2218	IZ4BEH	JN54WL	59A	57A	90	946 km.
2248	PA3FOC	JO21FW	59A	59A	70	103 km.
2306	UT8AL	KO61WP	55A	55A	50	1913 km.

2003-10-31

0002	SP2MKO	JO93CB	55A	55A	60	838 km.
0006	RW3WR	KO71IM	55A	57A	60	1972 km.
0034	OE5XBL	JN68PC	59A	59A	80	682 km.
0038	RW3PF	KO93CD	53A	57A	60	2171 km.
0043	UR5LX	KO70WK	55A	59A	60	2082 km.
0117	I1JTQ	JN35UB	55A	55A	80	784 km.
0123	9A2VR	JN95SQ	59A	59A	80	1217 km.
0127	I1DMP	JN35UB	55A	59A	80	784 km.
0130	HA8V	KN06HT	55A	59A	80	1209 km.

RIG: TS850 + LT2S, MGF1801 pre-amp, 3CX800, 4 x 28 el.BVO/5wl. tnx fer info, Chris

RA3WDK in KO81BR wkd on 144 MHz:

2003-10-29

1502	RA3PG/3	59A	55A
1509	RW3PF	55A	57A
1513	RA1TT	59A	59A
1555	ES5RY	57A	57A
1602	RA3LE	59A	53A
1609	RX1AS	59A	59A
1612	ES5RY	57A	55A
1624	ES2RJ	55A	57A
1635	ES5RY	57A	43A
1644	RU1AA	59A	59A
1650	OH1FA	59A	54A
1653	OH2KW	59A	55A
1705	OH1FA	59A	59A
1707	ES1OX	59A	59A
1712	RA3FO	59A	55A
1714	RW3TJ	55A	55A
1717	UA3DHC	59A	59A
1722	UA3MAG	55A	55A
1906	RW1AW	59A	59A
1913	ES6RQ	59A	59A
1945	RZ1AP	57A	57A
1949	UA3MAG	59A	59A
2000	SK0UX	59A	57A
2004	RW1AW	59A	59A
2019	ES2DF	57A	57A
2030	RX1AX	59A	59A
2042	OH1NOR	55A	56A
2048	ES6DO	59A	59A
2109	LY2BJ	55A	55A
2123	YL3AG	59A	59A
2128	SM4IVE	57A	55A
2144	OH3XR	59A	55A
2148	RA1QFY	59A	59A
2157	UA9FAD	59A	55A
2201	RU3ACE	59A	59A
2209	ES1RF/3	59A	58A
2214	YL2HA	59A	57A
2219	LY2BAW	59A	59A
2224	LY3OD	59A	59A
2231	LY2BIL	59A	57A
2238	UA4AQL	59A	57A
2245	RW3APX/3	59A	59A
2246	UR5LX	59A	57A
2249	YL3DW	59A	59A
2254	RA4AOR	59A	58A
2259	ES5PC	59A	55A
2324	RA3AQ	59A	57A
2326	ES2NA	59A	57A
2353	DK3BU	59A	56A
2356	OZ1LO	59A	55A

2003-10-30

1939	RW1AW	57A	57A
1957	OH2NY	59A	56A
2006	RW3TI	59A	57A
2010	RA3IS	59A	59A
2040	ES6RQ	59A	59A
2252	LY2BAW	59A	55A
2301	RA3QTT	59A	55A
2307	DL1SUN	59A	55A
2313	UA3LBK	59A	59A
2323	OZ1LPR	59A	55A
2326	OZ2M	59A	54A
2332	DL8LAQ	59A	51A
2347	ES5PC	59A	57A
2355	RU3BB	55A	56A

2003-10-31

0012	DL7ANR	55A	51A
0019	YL2HA	59A	57A
0028	RN6BN	59A	59A
0033	UA3XAC	57A	57A
0044	SM7DLZ	59A	56A
0048	SM7WT	59A	57A
0059	RA4AOR	59A	59A
0108	RV3IG	55A	55A
0111	RW3TI	59A	57A

RIG: XVTR home made, 50 W into 11ele. tnx fer report, Ivan!

RK3AF in KO85QR wkd on 144 MHz:

2003-10-29

1453	OH6MAZ	KP21IG	57a	56a	957 km
1458	UT5ER	KN78ER	57a	52a	804 km
1509	RW3WR	KO71IM	57a	57a	500 km
1547	ES5RY	KO38JI	57a	56a	702 km
1612	RX1AS	KO59FX	59a	59a	624 km
1619	ES6RQ	KO28WA	57a	57a	742 km
1625	LY2BAW	KO25KA	57a	55a	792 km
1635	SK7MW	JO65MJ	57a	57a	1522 km
1700	EW6DX	KO45JL	57a	57a	539 km
1705	RA3FO	KO86TI	59a	59a	71 km
1854	OH2KW	KP20IJ	57a	55a	905 km
1906	ES6DO	KO27WX	59a	59a	741 km
1913	ES5PC	KO38HJ	55a	55a	713 km

tnx fer report, Dima!

RN6BN in KN95LC wkd on 144 MHz:

2003-10-30

2140 UR5LX KO70WK 59a 59a 636 km
2144 UA4AQL LO20JB 59a 59a 703 km
2200 UY5HF KN66SG 59a 59a 440 km
2207 SP2MKO JO93CB 55a 57a 1741 km
2209 SP2FAV JO94MA 57a 55a 1735 km
2214 SP2OFW JO93AC 59a 59a 1753 km
2218 SP4MPB KO03GS 57a 57a 1635 km
2219 RA4AOR LN29LA 59a 59a 629 km
2228 OK2BEJ JN79SJ 55a 55a 1822 km
2238 RZ6BU KN84PV 57a 57a 133 km
2313 LY2BIL KO24PQ 57a 57a 1442 km
2320 RA3YO KO73DG 57a 57a 969 km
2321 RW3WR KO71IM 59a 59a 779 km
2325 RW3PF KO93CD 57a 57a 896 km
2003-10-31
0027 RA3WDK KO81BR 59a 59a 765 km
0056 UT8AL KO61WP 55a 59a 818 km
0123 RN3QR LO00BK 52a 59a 599 km
0125 OK2MWR JN99HQ 59a 59a 1607 km
0141 DL3DXX JO61VC 57a 57a 1972 km
0144 DL2ARD JO51CH 55a 55a **2222 km**
tnx fer report, Sam!

RU3ACE in KO95KG wkd on 144 MHz:

2003-10-29
0650 RA3LBK KO65QA 59a 59a 350 km
0720 LY2BAW KO25KA 59a 57a 888 km
1332 RK3AF KO75TX 55a 57a 219 km
1350 RA3DRC/1 KO55JR 55a 59a 511 km
1403 LY2BJ KO25ER 55a 55a 913 km
1416 OH6MAZ KP21IG 59a 56a 1060 km
1427 UA3MAG KO97VP 59a 59a 270 km
1438 OH5KE KP30NN 59a 59a 907 km
1439 RW3WR KO71IM 59a 59a 500 km
1446 RZ1AP KO49VW 59a 59a 748 km
1453 SM3AKW JP92 59a 54a 1386 km
1456 OZ6OL JO65DJ 55a 54a 1671 km
1506 UT5ER KN78ER 55a 52a 789 km
1508 OH3KLJ KP21PI 59a 59a 1039 km
1510 RA3XR KO85HB 59a 59a 145 km
1511 SM4IVE JO79SD 59a 57a 1461 km
1520 SK4BX JO79OF 59a 57a 1481 km
1523 OH7UE KP52EL 59a 57a 937 km
1526 ES5RY KO38IJ 59a 56a 816 km
1545 SM7ALC JO65RL 55a 55a 1597 km
1549 ES5PC KO38HJ 59a 59a 820 km
1551 UA3RBO LO03NG 55a 55a 266 km
1602 RA3FO KO86TI 55a 59a 144 km
1606 EW6GB KO45CN 55a 55a 673 km
1608 UR5LX KO70WK 59a 55a 574 km
1609 RA1QA KO99XF 59a 59a 445 km
1611 RA4AOR LN29LA 59a 59a 809 km
1614 RW4WE LO66PU 55a 55a 910 km
1616 UA4NM LO48UP 59a 59a 755 km
1621 ES6RQ KO28WA 59a 55a 850 km
1625 ES1RF KO29IF 59a 57a 956 km
1635 RA1QFY KO89XC 59a 58a 430 km
1710 DL3DXX JO61VC 55a 55a 1723 km
1720 SP2FAV JO94MA 55a 55a 1279 km
1721 DL4WK JO63SQ 55a 55a 1636 km
1823 OH2KW KP20IJ 55a 57a 1010 km
1828 OH2TO KP20 55a 58a 1001 km
1839 LY2CI KO14WV 59a 57a 953 km
1902 ES6DO KO27WX 59a 57a 848 km
1918 ES2DF KO29GG 55a 55a 967 km
1919 RW3TI LO16WG 59a 59a 332 km
1920 RA3AQ KO85SP 59a 59a 94 km
1922 UA3BX KO95DT 55a 59a 71 km
1923 UA4AQL LO20QB 59a 59a 725 km
1928 UA9FAD LO88DA 59a 57a 1104 km
1947 UA3TCJ LO15OB 59a 59a 276 km
1956 OH3BY KP21VA 55a 55a 996 km
1957 OH3XR KP11 59a 59a 1150 km
1958 OH3BYZ KP21UA 59a 59a 999 km
2000 RX1AX KO59EW 59a 59a 724 km
2004 RK1NA KP71ET 59a 59a 772 km
2020 LY2FR KO15VR 59a 57a 949 km
2023 RU3DD KO84RT 59a 59a 104 km
2024 SK7MW JO65MJ 59a 59a 1624 km
2032 SM7DLZ JO86FI 59a 57a 1399 km
2039 RW3DW KO84OV 55a 55a 114 km
2042 UA1WCF KO55JR 55a 59a 511 km
2044 SK7HW JO76KV 57a 54a 1492 km
2053 LY2BIL KO24PQ 59a 59a 868 km
2110 SM5DFF JO88CN 59a 56a 1416 km
2113 SM0AGP JO89XF 55a 55a 1326 km
2114 ES4BW KO39PI 56a 59a 829 km
2122 DL4KUG JO64RB 53a 52a 1630 km
2123 SK6DK JO67EH 59a 57a 1640 km
2124 UT3BW KN29UA 53a 53a 1132 km
2127 SM4BDQ/7 JO65TJ 53a 55a 1588 km
2155 UR5LLW KN89EQ 59a 55a 643 km
2158 RN6MT KN97MS 59a 59a 834 km
2202 RA3WDK 59a 59a
2235 OZ2TF JO46PE 59a 55a 1840 km
2238 LA3BO JO59CD 55a 42a 1764 km
2247 UA4FOS LO13TN 59a 58a 361 km
2313 ES1OX KO29HI 59a 59a 966 km
2315 OH6NVQ KP13IP 59a 59a 1297 km
2328 OZ2M JO65FR 55a 52a 1654 km
2343 OZ6OL JO65DJ 59a 55a 1671 km
2349 LY3OD KO24OR 59a 59a 872 km
2003-10-30
1922 RA3PG/3 KO86EQ 53a 53a 221 km
1924 RU1AZ KO59HR 59a 59a 698 km
1925 UA1AP KO59FR 59a 59a 705 km
1927 RZ4HF LO43QM 59a 59a 706 km
1937 RA4AOR LN29LA 59a 59a 809 km
1939 UR5LX KO70WK 59a 59a 574 km
1954 OH2WC KP20MK 59a 59a 997 km
1958 OH1MDR KP01VJ 59a 59a 1202 km
2003 RK9AT LO93KK 59a 59a 1307 km
2005 RX9AN LO93LJ 59a 59a 1314 km
2009 ES1RF/3 KO29 59a 59a 951 km
2016 RW1AW KO49WN 59a 59a 719 km
2027 SM4IVE JO79SD 59a 55a 1461 km
2028 RW3TI LO16WG 55a 57a 332 km
2033 YL2HA KO26CV 59a 58a 926 km
2059 OH7PI KP32XG 59a 55a 998 km
2110 UX7LT KN89TR 55a 55a 622 km
2128 YL2GC KO26AW 55a 55a 936 km
2133 UR5TW KN39MK 59a 59a 1030 km
2135 EU3AI KO22DE 59a 59a 1016 km
2140 UT2IL KN88XB 55a 55a 804 km
2159 UT8AL KO61WP 55a 59a 521 km
2204 RN3QR LO00BK 55a 59a 544 km
2212 RA3EA KO82AW 59a 59a 318 km
2218 SM0KAK JO89XK 59a 54a 1330 km
2223 RN3AP KO85UG 59a 59a 74 km
2225 UY5UG KO50FI 59a 59a 785 km
2236 SP5GJH KO02RU 55a 55a 1164 km
2300 US5WU KO20DI 55a 55a 1119 km
2304 SP2MKO JO93CB 55a 55a 1362 km
2309 UR5SKB KN29 55a 55a 1132 km
2313 DD3SP JO72EN 55a 55a 1623 km
2315 DL1ARJ/P JO60AP 55a 55a 1856 km
2318 DL2ARD JO60AR 55a 59a 1852 km
2320 DL5ME JO52SD 55a 55a 1819 km
2321 DL7FF JO62TJ 59a 53a 1677 km
2331 DL7ANR JO62PM 59a 55a 1693 km
2335 SP6IWQ JO80HK 59a 55a 1579 km
2356 SP2OFW JO93AC 59a 59a 1371 km
2003-10-31
0052 SP5ZCC KO02PF 55a 55a 1200 km
0059 LY2BUU KO15XH 59A 55A 942 km
1133 RW3APX/3 KO94CX 53a 54a 53 km
tnx fer info, Maxim

RW3PF in KO93CD wkd on 144 MHz:

2003-10-29
1334 OH2TO KP20UT 55A 57A
1342 RA3ACE 59A 59A
1420 RA3PG/3 KO86EQ 55A 57A
1426 UA9FAD LO88DA 57A 59A
1430 RW4WE LO66PU 55A 55A
1438 OH6MAZ KP21IG 59A 59A
1451 OH5KE KP30NN 59A 59A
1501 UA4AQL LO20QB 55A 57A
1508 RA3WDK 55A 55A
1523 ES6RQ KO28WA 59A 59A
1534 RZ1AP KO49VW 59A 59A
1536 UA4NM LO48UP 57A 57A
1622 ES6DO KO27WX 59A 59A
1623 UR5LX KO70WK 59A 59A
1635 LY2BAW KO25KA 59A 59A
1658 OZ8FR JO55SK 55A 57A
1701 OK1AGE JO70ED 56A 57A
1702 UA1WCF KO55JR 59A 59A
1705 DK3WG JO72GI 57A 59A
1910 ES1OX KO29HI 44A 57A
1926 UA3TCJ LO16OD 55A 56A
2007 OH1MDR KP01VW 57A 59A
2147 LY2CI KO14WV 59A 59A
2148 RW3WR KO71IM 59A 57A
2149 DL4KUG JO64PB 55A 57A
2151 SK6DK JO67IH 57A 58A
2153 UT5ER KN78ER 59A 57A
2154 DJ9MG JO52TC 55A 55A
2155 OK1DFC JN89GW 55A 59A
2156 UR5LLW KN89EQ 59A 59A
2158 DK9OY JO52CK 55A 59A
2158 SP6IWQ JO80SK 55A 57A
2200 OK2MWR JN99HQ 55A 57A
2201 DL7UDA JO62TK 55A 59A
2203 DL2ARD JO60AR 59A 59A
2203 SP6A JO81MC 55A 59A
2205 DL7VTX JO62TM 57A 59A
2206 DL3DXX JO61VC 57A 59A
2207 OK1DTC JO60RN 59A 59A
2208 DL9DRA JO62TU 59A 59A
2209 DG5CST JO60DS 59A 59A
2210 OK1FID JO89CI 55A 55A
2212 DL2HTI JO61BB 55A 55A
2213 DL2ROM JO62RI 57A 57A
2216 DL1SUZ JO53 59A 59A
2219 DH8BQA JO83CF 55A 57A
2223 SP9DGS JO90MG 55A 55A
2224 DL2DTJ JO61UA 59A 59A
2225 UT3BW KN29UA 57A 57A
2226 SM7ASN JO66UD 59A 59A
2228 DH5FS JO61FA 57A 59A
2229 DF0WD JO42FD 59A 59A
2230 SP6LB JO70UU 59A 59A
2231 DL5WX JO51XF 55A 57A
2232 SP6LTC JO70VV 55A 55A
2233 DL3HWF JO61AG 59A 57A
2259 ES2DF KO29GG 57A 55A
2302 YL3AG KO26AW 55A 55A
2305 OK1CZ JO70 55A 55A
2307 SM5FNU JO89CR 55A 55A
2310 YL3DW 57A 57A
2314 OZ1CLL JO65GQ 55A 55A
2318 UY5UG KO50FI 57A 57A
2320 DL1RTL JO62PH 55A 55A
2322 DL7FF JO63TJ 57A 57A
2327 OH1NO KP00XL 56A 55A
2329 DL3YB JO42XK 57A 57A
2333 DK3BU JO33NO 54A 55A
2337 DJ9YE JO43HV 59A 59A
2350 DL1ARJ/P JO60AR 59A 59A
2354 DL1SUN JO53PN 59A 59A
2003-10-30
0024 OZ1LO JO55VC 59A 59A
0025 OZ8ZS JO55RT 55A 57A
0026 DL2BWH JO62XR 55A 57A
0028 RK1NA KP71ET 56A 59A
0040 RA4AOR LN29LA 59A 59A
0042 SK6DK JO67 55A 55A
0044 RX1AX KO59EW 59A 59A
0114 SQ2EEG JO94WC 59A 59A
0117 SP7ASQ JO91RH 57A 55A
0119 SM5DFF JO77CN 59A 59A

0122	DL5CF	JO51SN	59A	59A	
0123	HA1BC	JN87PU	55A	55A	
0125	RZ6BU	KN84PV	55A	55A	
0126	DM2DXG	JO51MV	59A	59A	
0128	EU3AI	KO22CE	57A	57A	
0130	DJ1TO	JO62SL	56A	59A	
0131	SM7DLZ	JO86BS	59A	59A	
0133	9A6WW	JN86HF	57A	59A	
0135	SP6GVU	JO81LC	57A	55A	
0138	LY3OD	KO24OR	57A	57A	
0141	S51ZO	JN86DR	55A	56A	
0144	SP2MKO	JO93CD	55A	55A	
0146	SM3BEI	JP81NG	55A	55A	
0151	DJ9FG	JO51UD	55A	53A	
0227	UA4FOS		59A	57A	
0228	RA3TZ	LO16VF	59A	59A	
0230	RK9AT	LO93KK	59A	59A	
0232	UA9SAN	LO91LI	59A	59A	
0236	UA9FU	LO87DX	55A	55A	
0238	RZ4HF	LO43QM	59A	59A	
0241	RW3APX/3	KO94TU59A		59A	
0243	RA3NM	LO07MS	59A	59A	
0245	UX7LT	KN89TR	57A	55A	
247	UA3XAC	KO85SC	59A	55A	
258	RX9AN	LO93LJ	59A	59A	
300	UA4RF	LO64DV	55A	57A	
301	RA3DRC/1	KO55JR	59A	59A	
307	ES1OX	KO29HI	55A	59A	
313	RA3LW	KO54MQ	59A	59A	
320	OH1LT	KP00XJ	55A	55A	
323	SP5GJH	KO02RU	57A	55A	
324	RN6BN	KN95LC	57A	57A	
325	DL5ME		59A	59A	
327	DB6NI	JO50VI	59A	59A	
329	DJ3XK	JO53AN	55A	55A	
330	DD3SP	JO72EN	57A	55A	
331	DL2RUG	JO62	55A	55A	
334	DK3XM	JO43XL	56A	59A	
335	LY2BUU	KO15XH	59A	59A	
337	SP2MKO	JO93CD	55A	55A	
339	DL2HWA	JO51WJ	51A	59A	
345	OE5XBL	JN68PC	55A	55A	
346	OK2BEJ		55A	55A	
003-10-31					
000	RX9FB	LO88EA	59A	57A	
004	SM5CUI	JO89WW	55A	55A	
014	DL7ULM	JO62SN	57A	57A	
019	DL5WG	JO52VK	59A	59A	
021	SP6GZZ	JO80FX	59A	59A	
024	DL8UAT	JO61TL	55A	55A	
026	HA5UK	JN97	55A	55A	
027	OK1ZHS	JO70	59A	59A	
029	OK1MZM	JN69	59A	59A	
030	OK2TT	JN89	59A	59A	
031	OK1AMI	JO70VA	59A	59A	
035	YU7EW	KN05SP	55A	55A	
037	PA2CHR	JO22XA	53A	57A	2171 km
042	EA3AK	IN82IT	53A	55A	pirate!

0043	DF1CF	JN57FP	59A	59A
0045	DL6MFK	JN67JX	55A	59A
0126	OE3JPC	JN87EW	57A	55A
0130	DK5RQ	JN68BV	55A	55A
0142	OZ1LPR	JO44UW	55A	55A
0143	SP3GCL	JO82FO	57A	55A
0146	OK2PWY	JN79KW	59A	55A
0149	HA6NQ	JN97WA	57A	59A
0151	HA8V	KN06HT	57A	55A
0155	RN3QR	LO00BK	55A	55A

RIG: 4x10el BVO-3WL, GS35b tnx fer report, Peter!

S51ZO in JN86DR wkd on 144 MHz:

2003-10-29					
2102	DF7KF	JO30GU	55a	55a	848 km
2146	OZ1LPR	JO44UW	55a	55a	1022 km
2151	OZ1CLL	JO53GQ	57a	57a	874 km
2200	SP4MPB	KO03HT	54a	54a	845 km
2207	OZ8ZS	JO55RT	55a	55a	1064 km
2219	DJ9YE	JO43HV	57a	59a	964 km
2221	SP2FAV	JO94MA	55a	57a	833 km
2231	DJ8MS	JO63CT	57a	57a	839 km
2235	DJ9YE	JO43HV	57a	57a	964 km
2240	DJ4TC	JO63PN	57a	57a	789 km
2256	DL8LAQ	JO43XU	52a	53a	910 km
2310	SM7ALC	JO65RL	52a	55a	992 km
2320	OZ2M	JO65FR	55a	53a	1035 km
2327	RW3PF	KO93CD	54a	54a	1714 km
2003-10-30					
0025	SP3MGM	JO73QE	55a	59a	721 km
0026	DL8LAQ	JO43XU	55a	52a	910 km
0028	DL1YAW	JO41DX	55a	59a	821 km
0038	G3LTF	IO91GG	59a	57a	1385 km
0047	G4AEP	IO91NJ	57a	57a	1350 km
0051	UR5LX	KO70WK	55a	55a	1493 km
0055	SP7ASQ	JO91RS	59a	59a	606 km
0057	DL7VTX	JO62TM	59a	59a	672 km
0105	G4ASR	IO81MX	55a	55a	1505 km
0110	EI4DQ	IO51WU	55a	53a	1849 km
0116	G7RAU	IO90IR	52a	57a	1360 km
0123	PA3COB	JO32MF	55a	54a	904 km
0142	RW3PF	KO93CD	55a	56a	1714 km
2311	SM7SPG	JO66OD	59a	59a	1068 km
2347	OZ8ZS	JO55RT	55a	55a	1064 km
2003-10-31					
0009	SM7SPG	JO66OD	55a	55a	1068 km
0014	OZ1CLL	JO53GQ	59a	59a	874 km
0020	LY2BIL	KO24PQ	57a	59a	1086 km
0023	SM7WT	JO65QQ	59a	59a	1016 km
0026	SP2OFW	JO93AC	59a	59a	720 km
0029	LY2BAW	KO25KA	59a	59a	1099 km
0134	SP1FPG	JO73GN	55a	59a	770 km
0136	DK2JP	JO73CB	53a	53a	720 km
0139	PA3CWN	JO33AH	53a	57a	1033 km
0144	PA3DOL	JO22MT	53a	55a	1051 km
0201	SQ2EEQ	JO94JC	53a	55a	839 km

tnx fer report!

SK0UX in JO99BM wkd on 144 MHz:

2003-10-29					
1540	DJ9YE	JO43HV	57A	58A	852 km
1541	SP5GJH	KO02RU	55A	55A	770 km
1543	ES4BW	KO39II	57A	59A	486 km
1544	DJ6TK	JO53FM	55A	55A	816 km
1544	DK5QW	JO42FA	55A	53A	1028 km
1545	DL3DXX	JO61VC	59A	59A	975 kṃ
1546	DK7BY	JO33RJ	59A	59A	944 km
1547	SP7CNL	JO91QQ	55A	59A	875 km
1548	SP4BY	KO13OD	55A	59A	775 km
1549	RW3WR	KO71IM	59A	59A	1365 km
1551	DL1RNW	JO62GH	55A	59A	874 km
1552	DL7PV	JO62NL	55A	57A	842 km
1553	DL2ARD	JO60AR	55A	55A	1051 km
1554	DL5CR	JO61UA	55A	55A	986 km
1556	DH7FB	JO62SM	59A	59A	829 km
1557	DJ8ES	JO43SX	55A	59A	808 km
1559	DJ3VI	JO43VI	55A	55A	855 km
1600	RA3QTT	LO01GQ	55A	59A	1644 km
1616	SP2FAV	JO94MA	55A	59A	615 km
1617	SP2AQB	JO93GA	55A	55A	724 km
1619	DK2JX	JO41OT	57A	55A	1022 km
1620	DK2AU	JO42GH	55A	55A	998 km
1627	OH7EME	KP42PP	55A	59A	693 km
1628	YL2HA	KO26CV	59A	57A	461 km
1629	EW6DX	KO45JL	55A	55A	779 km
1631	U1LP	KP40JS	55A	58A	606 km
1633	DL5EBS	JO31LH	55A	55A	1151 km
1635	G4RRA	IO80BS	55A	55A	1691 km
1637	G4IGO	IO80NW	53A	55A	1628 km
1638	G4ASR	IO81MX	57A	55A	1554 km
1640	RA1QFY	KO	55A	59A	QRM
1641	GW3LEW	IO71PS	55A	55A	1660 km
1644	GW3HWR	IO71XN	55A	55A	1640 km
1646	G4TYL	IO92MB	55A	57A	1445 km
1649	DH1NFL	JO50VF	55A	55A	1109 km
1651	PA7KY	JO32LR	55A	55A	1022 km
1653	PA1T	JO33JF	57A	59A	986 km
1654	DL3YB	JO42XK	59A	59A	936 km
1655	DL4DWA	JO61QH	55A	55A	961 km
1657	DK5EQ	JO31QG	57A	59A	1139 km
1658	PA3DTM	JO22IA	57A	59A	1180 km
1701	G4ZTR	JO01KW	57A	57A	1364 km
1712	DJ3XK	JO53AN	57A	59A	827 km
1713	DJ9CS	JO54DG	57A	59A	753 km
1716	DL7MB	JO62QK	57A	59A	841 km
1717	DL7ULM	JO62SN	57A	59A	825 km
1719	OZ1HXL	JO55EG	56A	59A	662 km
1721	DL2ROM	JO62RI	59A	59A	848 km
1723	DL2SWN	JO64FF	57A	59A	682 km
1725	DJ6OLJO52AP	57A	55A		913 km
1727	OZ5BD	JO65AN	59A	59A	571 km
1729	DL1HWK	JO61CU	57A	57A	929 km
1730	OZ1BMA	JO64AW	59A	59A	628 km
1748	SP4JWD	KO03FR	59A	56A	660 km
1803	RA3LW	KO54MQ	57A	59A	945 km
1805	RA3AQ	KO85SP	59A	59A	1230 km

1811	UA3WM	KO72QI	44A	55A	1332 km
1822	RA1QA	KO99WF	55A	57A	1228 km
1823	UA3MAG	KO97WP	55A	59A	1272 km
1831	RK1NA	KP71ET	55A	55A	919 km
1832	YL2LW	KO26CW	55A	59A	458 km
1833	OH6PX	KP22TI	59A	59A	513 km
1834	RX1AX	KO59EW	59A	59A	688 km
1837	RZ1AP	KO49VW	59A	59A	655 km
1839	UA1CCK	KO49XQ	55A	59A	666 km
1841	RU1AZ	KO59HR	55A	59A	703 km
1844	SM4BRD	JP70LW	59A	59A	236 km
1845	UA3ARN	KO85QP	55A	55A	1221 km
1847	SM2XHI	KP05EJ	59A	59A	664 km
1850	UA3XAC	KO85HC	55A	57A	1210 km
1852	RA3AH	KO85UP	57A	59A	1239 km
1853	RX3PR	KO84TE	55A	57A	1320 km
1854	UA3DHC	KO96CB	59A	59A	1246 km
1855	UA3AOG	KO85SR	57A	57A	1226 km
1857	EU3AI	KO22CE	57A	57A	899 km
1858	RA3WDK	KO84HA	57A	55A	1277 km
1902	OH5WR	KP41BB	57A	59A	577 km
1905	RW3APX/3	KO94TU55A		59A	1388 km
1908	RA1WF	KO47EU	57A	59A	620 km
1910	RA3DRC/1	KO55JR	57A	58A	863 km
1912	UA3ALA	KO85ST	55A	59A	1221 km
1914	UA1ALI	KP50DX	59A	59A	690 km
1915	UA1AP	KO59FR	59A	57A	693 km
1917	R3/LZ4AU	KO85TO	59A	59A	1237 km
1918	SP2MKI	JO93AC	55A	58A	714 km
1919	LY2CI	KO14WV	59A	59A	620 km
1920	EW1AA	KO33SU	55A	59A	852 km
1923	RK3WWF	KO72QI	59A	59A	1332 km
1924	SP1FJZ	JO84EE	57A	55A	603 km
1926	RW3DW	KO84OV	55A	59A	1254 km
1927	UR5LX	KO70WK	59A	59A	1510 km
1930	DF0WD	JO42FD	55A	55A	1017 km
1931	SP2AQB	JO93GA	55A	57A	
1934	OH2LH	KP20MG	55A	59A	395 km
1936	DL2BWH	JO62XR	55A	55A	798 km
1938	OH7SQ	KP33TO	55A	57A	677 km
1940	SP7NWM	KO02BE	57A	55A	825 km
1942	RZ3AM	KO85UP	55A	55A	1239 km
1944	OH7LRJ	KP42IB	59A	59A	640 km
1945	DK8ZJ	JO54AM	55A	55A	740 km
1950	RN3AP	KO85RQ	55A	55A	1223 km
1954	RA3YO	KO73DG	55A	59A	1209 km
1956	LY2NX	KO15VX	55A	57A	518 km
1959	UT5ER	KN78ER	57A	53A	1592 km
2003	US5WU	KO20DI	57A	59A	1092 km
2005	UT3BW	QSB	55A	55A	
2008	SP2RS	JO94GK	55A	55A	566 km
2011	SP5ZCC	KO02PF	55A	59A	835 km
2013	RV3ZR	KO80CL	55A	55A	1522 km
2015	SP3TYF	JO82FH	55A	58A	809 km
2017	UA3RBO	LO03NG	55A	57A	1567 km
2019	RA3EL	KO82AX	55A	59A	1319 km
2020	SP5AGT	KO02LG	55A	59A	826 km
2021	DL1DSN	JO51KC	55A	57A	1041 km

2023 OZ6EI JO45TT 59A 59A 652 km
2025 DL3CW JO52ST 57A 579 850 km
Rig: Tx 1kW in 4x17 ele and 2x16 ele. tnx fer info, Hans

SM2CEW, KP15CR, wkd 2m:

2003-10-29
1715 F8SE/p JN19XH 230 only hrd, 2100km
2116 UA9FAD LO88DA 090 1957km

SP6LB in JO70UU wkd on 144 MHz:

2003-08-18
1525 OZ2M JO65FR 55a 59a 584 km
1543 DK1KO JO53CT 57a 57a 499 km
1553 LY2BW? KO15XH 52a 55a 742 km
1555 LY2SA KO14LL 56a 56a 635 km
1621 SP2OFW JO93AC 55a 55a 297 km
1638 PA3BIY JO22EB 32a 32a 798 km
1655 ON4AMX JO20KV 55a 55a 762 km
1715 DK3EE JO42GU 55a 55a 541 km
2003-10-29
1705 SM6NET JO68sd 55a 55a 824 km
1724 OZ6TY JO55XE 53a 55a 544 km
1749 DK1KR JO53HW 55a 53a 487 km
1756 DK1ZF JO43JS 55a QRM 572 km
1854 DL1EJA JO31DH 55a 55a 661 km
1859 DF7KF JO30GU 55a 53a 645 km
1914 OZ2M JO65FR 55a 53a 584 km
1945 PA5DD JO22IC 55a 55a 776 km
1951 PA3CEE QRM 55a QRM
2018 DL1YAW JO40DX 55a 55a 522 km
2020 DK5DQ JO31PG 55a 55a 592 km
2149 OZ1CLL JO65GQ 55a 55a 578 km
2157 DJ9YE JO43SV 55a 57a 539 km
2200 OZ8ZS JO55RT 55a 55a 620 km
2204 SP4MPB KO02ST 55a 52a 457 km
2206 DK7ZJ JO54AG 55a 53a 540 km
2217 SP2MKO JO93CB 55a 55a 300 km
2224 LY2BAW KO25KA 55a 55a 770 km
2232 RW3PF KO93CD 59a 55a 1559 km
2302 DJ4TC JO63PN 55a 54a 344 km
2308 OZ1IEP JO55XU 55a 55a SSB 610 km
2319 LA3BO JO59CD 55a 56a 987 km
2343 SM7DLZ JO87BS 55a 55a 770 km
2359 DK9OY JO52CK 55a 52a 419 km
2003-10-30
2202 SP2MKO JO93CD 55a 55a 307 km
2220 SM1DVV JO93CD 55a 55a 307 km
2231 OZ8ZS JO55RT 55a 55a 620 km
2253 RA3QTT LO01GQ 55a 55a 1727 km
2300 LY2BJ KO25ER 55a 55a 792 km
2303 SM7DLZ JO86BS 55a 57a 659 km
2003-10-31
0001 LY2BIL KO24PQ 57a 59a 774 km
0013 LY2BAW KO25KW 57a 59a 831 km
0016 PA0V JO33II 57a 57a 676 km
0028 DL1RNW JO62GH 57a 59a 273 km
0031 PA3FOC JO21FW 52a 57a 791 km
0035 DL7ANR JO62PM 59a 59a 250 km

0044 DL3DXX JO61VC 55a 53a 137 km
0056 RW3WR KO71IM 59a 59a 1327 km
0102 DL8LAQ JO43XU 55a 54a 514 km
0104 PE1AHX JO21OS 55a 55a SSB 739 km
0121 G3XDY JO02OB 53a 53a 1015 km
0127 SP2OFW JO93AC 57a 55a 297 km
0136 DH5FS JO61UA 55a 55a 142 km
0139 UR5LX KO70WA 57a 57a 1430 km
0143 DJ8MS JO63CT 55a 53a 406 km
RIG: IC-910H, 9+9 ele yagi (horiz. + vert.), QTF 20-40 deg
All QSO made in horizontal pol., vertical gave much weaker signals. tnx fer report, Zdzislaw!

UR5LX in KO70WK wkd on 144 MHz:

2003-10-29
1544 ra3le ko64ar 57a 55a
1547 ra3pg/3 ko86eq 57a 57a
1550 es5ry ko38ij 56a 56a
1553 yl2ha ko26cv 56a 56a
1609 ru3ace 56a 55a
1614 ly2baw ko25ka 59a 59a
1630 rw3pf ko93cd 59a 59a
1656 rx1as 57a 57a
1703 es6do ko27wx 59a 59a
1712 r3/lz4au ko85to 59a 59a
1716 ly2bj ko25e r 59a 59a
1718 ua1wcf ko55jr 59a 59a
1720 dl1sun jo53pn 59a 59a
1724 sk7wmjo65mj 59a 59a
1728 dk2zf jo43wj 55a 55a
1749 dk3wg jo72gi 57a 56a
1943 dl2ard jo60ar 59a 55a
1945 dk0og jn68gi 59a 58a
1947 ok1pf ln69qv 55a 55a
2003 es6rq ko28wa 59a 59a
2024 ra3aq ko85sp 59a 59a
2029 sk0ux jo99bm 59a 59a
2048 rw3dw ko84ov 55a 55a
2056 ua3pb 55a 55a
2104 rx1as ko59fx 59a 59a
2114 es5pc ko38hj 59a 57a
2119 ly2baw ko25kb 59a 57a
2125 rw3apx/3 ko94tu 59a 59a
2127 ra3drc/1 ko55jr 59a 59a
2128 yl3ag ko26aw 59a 59a
2135 rw1aw kp50eb 57a 59a
2137 es2rj ko29jn 57a 57a
2140 ua4aql lo20qb 57a 57a
2141 ua3bx ko85ut 59a 59a
2145 ua3xac ko85vc 57a 59a
2148 rz3am ko85up 57a 57a
2259 us5wu ko20di 55a 59a
2300 om2vl jn87wv 57a 57a
2301 df0wd jo42fd 55a 55a
2302 dk2ar jo42?? 55a 55a
2305 ua3rbo lo03ng 59a 59a
2315 ua3tcj lo16ob 55a 58a
2323 ra3qtt 59a 59a

2326 ok1dfc 57a 57a
2344 oz2m jo65fr 57a 55a
2348 ua3dhc ko96cb 59a 59a
2354 ra3ah 55a 57a
2358 sk6dk jo67eh 59a 58a
2003-10-30
0002 oz1lpr jo67eh 59a 55a
0008 ua3aog ko85sr 57a 57a
0009 ra4aor ln29 59a 59a
0011 ly2bil ko24pq 57a 59a
0015 9a6ww jn86hf 59a 59a
0021 ok1zhs jo70va 55a 55a
0022 uy5ug ko50fi 59a 59a
0024 dh5fs jo61ua 55a 55a
0028 ha1bc jn87pu 57a 57a
0030 ok2pwy jn89kw 57a 59a
0042 ok2mwr jn99hq 59a 55a
0045 rw3wr ko71im 59a 59a
0046 ha5cw jn97pm 55a 55a
0052 s51zo jn86dr 55a 55a
0056 oe1sow jn88ff 57a 55a
0058 sp6gvu jo81lc 57a 55a
0103 pd0rfu jo32cm 55a 59a
0105 ok2bds jn79wf 57a 57a
0108 ok1aid jo80eo 57a 59a
0109 dk5ya jn49nx 57a 57a
0110 oe3jpc jn87ew 59a 59a
0112 ok1cz jo70ec 57a 56a
0114 ok1mhz jo70va 55a 55a
0123 dl8laq jo43xu 59a 54a
0124 m6mt kn97 59a 59a
0126 dj9ye jo43hv 59a 59a
1936 ra3pg/3 ko86eq 57a 57a
1938 ru3ace 59a 59a
2041 rw1aw kp50eb 57a 59a
2105 ru3bb ko84vx 57a 57a
2113 ra3ah 55a 59a
2127 dl7anr jo62pm 59a 59a
2132 oe5xbl jn68pc 59a 59a
2137 ua4aql lo20qb 59a 59a
2139 uy5hf kn66hp 59a 59a
2140 ha1ad jn87rt 55a 59a
2141 m6bn kn95lc 59a 59a
2142 ha5pt 59a 59a
2145 s57tw jn75ex 59a 59a
2155 ux7lt kn89th 57a 59a
2200 ra3xm ko84dm 59a 59a
2201 ra3ea 55a 59a
2202 uy5ug 55a 59a
2204 ra3el 59a 59a
2205 ua4caj lo32mb 57a 55a
2210 ra3yo ko73dg 59a 59a
2216 rk9at lo93kk 57a 59a
2218 ra3is 59a 59a
2219 rw3apx/3 ko94tu 59a 59a
2224 es2df ko29gg 55a 55a
2229 dl1arj/p jo60ar 59a 59a
2237 rw3ti lo16wg 59a 57a

2242 dl7ulm jo62sn 57a 57a
2244 dm2bhg 57a 55a
2246 dl7bu jo51ut 55a 55a
2250 dl4kug jo64pb 55a 55a
2251 dk7zh 55a 57a
2255 sp2mko jo90 55a 55a
2257 do3vi jo73vi 55a 55a
2258 dl2bwh jo62xr 55a 55a
2304 dj3vi jo43vu 55a 55a
2309 rx3pr ko74te 57a 57a
2310 pa0v jo33ii 59a 57a
2311 dl5me jo52sd 59a 55a
2314 dl3jin jo60lx 55a 56a
2333 dl6yeh jo32va 55a 55a
2337 oz8zs jo45rt 57a 55a
2341 rv3ig 59a 59a
2344 sm7dlz 55a 55a
2003-10-31
0001 ra3qtt lo01gq 59a 59a
0008 dl8laq 55a 51a
0011 dj9mg jo52tc 59a 58a
0013 oz1lpr jo44uw 59a 59a
0015 dj8ms jo63ct 59a 57a
0017 dk2jx jo41ot 59a 59a
0018 dl2hwa jo51we 57a 52a
0020 dk3xm jo43xl 59a 55a
0023 ok2pvf jn99gu 57a 57a
0026 ok2tt jn89ku 59a 55a
0027 dm2dxg jo51mv 57a 79a
0029 dl1ai
0031 dl2up jo31sr 57a 55a
0034 dl8yet jo31mh 59a 59a
0037 dj2qv jo31pf 55a 55a
0038 ok1dx jn69 59a 55a
0038 dl6mfk jn67 59a 55a
0039 pa0bat jo31fx 57a 57a
0040 dk5dq jo31pg 59a 57a
0042 dl1yaw jo41no 55a 57a
0043 pa2chr jo22xa 59a 55a
0044 dj6lv jo31jg 57a 57a
0045 dl6rj jo71ae 59a 59a
0048 do1yds jo42hj 59a 59a
0049 dl5cf jo51sn 59a 57a
0051 ok1wdr jo70nb 57a 59a
0053 ok1fpr jo80ce 57a 59a
0054 dk2jp jo73db 57a 57a
0055 dl2rom jo62ri 59a 59a
0057 df1cf jn57fp 57a 59a
0058 dl1ymk 55a 55a
0100 dl1yaw jo41dx 55a 59a
0103 dj9fg jo52ud 59a 59a
0119 ha7wj jn97mp 57a 57a
0128 m3qr lo00bk 59a 59a
0131 pa0v 59a 59a
0138 dh5fs jo61ua 59a 57a
0139 sp6lb jo70ua 57a 57a
0141 ra4aor 59a 59a
0147 ra3le 59a 59a

0149 dk5rq jn68bv 57a 55a
0154 ut8al 59a 59a
0158 rw3pf 59a 59a
tnx fer report Sergej!

UT5ER in KN78ER wkd on 144 MHz:

2003-10-29
1453 RA3FO KO86RI 52a 59a 873 km
1500 RK3AF KO85QR 52a 57a 804 km
1502 RU3ACE KO95KG 52a 59a 789 km
1530 RA3FO KO86RI 55a 57a 873 km
1555 YL2HA KO26CV 52a 57a 1134 km
1608 RA3LE KO64AR 55a 55a 686 km
1614 RA3PG/3 KO86EQ 52a 59a 895 km
1710 RW3TJ LO16XG 54a 59a 1058 km
1721 UA3ALA KO85ST 57a 59a 816 km
1722 UA3XAC KO85HC 55a 59a 725 km
1728 UA3DHC KO96CB 55a 59a 855 km
1729 RA3AH KO85UC 52a 59a 744 km
1733 SK7MW JO65MJ 59a 59a 1626 km
1744 RU3ACE KO95KG 59a 59a 789 km
1755 RA3AQ KO85JE 59a 59a 737 km
1823 OZ2M JO65FR 55a 52a 1673 km
2052 ES6DO KO27WX 55a 59a 1171 km
2103 SK0UX JO99BM 53a 57a 1591 km
2104 RA3IS KO76WT 59a 59a 904 km
2113 ES6RQ KO28WA 59a 55a 1175 km
2116 UA3AOG KO85SR 579 59a 807 km
2120 RW3TI LO16WG 57a 57a 1054 km
2127 SM5DFF JO88CN 53a 55a 1612 km
2133 ES5PC KO38HJ 57a 57a 1188 km
2153 LY2BAW KO25KA 59a 59a 955 km
2155 RW3PF KO93CD 59a 57a 559 km
2157 SK6DS JO67EH 59a 57a 1741 km
2207 RW3DW KO86OV 59a 59a 927 km
2210 RU3DD KO84RA 57a 59a 626 km
2225 UA3RBO LO03NG 59a 59a 691 km
2227 UA4AQL LO20QC 59a 59a 809 km
2235 SM4IVE JO79SD 59a 59a 1680 km
2239 YL3DW KO26CW 59a 59a 1137 km
2241 RA3XM 57a 59a
2243 SM7ASN JO66UD 55a 55a 1616 km
QRT at 2245 UTC but the band was still full of stations.
tnx fer info, Arkady!

YO2IS in KN05 wkd on 144 MHz:

2003-10-30
2132 SP2OFW JO93ac 59a 59a 0 848 km
2134 DJ9YE JO43hv 59a 57a 0 1277km
2003-10-31
0108 G7RAU IO90ir 57a 55a 340 1752 km
0109 G3XDY JO02ob 57a 53a 340 1618 km
0114 PA3FOC JO21fw 59a 55a 340 1404 km
0120 PA0JMV JO22pm 57a 52a 340 1379 km
RIG: 200W, 10 ele BV
Note: It seems many are running HPA's and small antennas, that's not enough to be able get out from the noise/QRM the REAL DX callers... tnx fer report, Szigy

YU7BCL in KN05FW wkd on 144 MHz:

2003-08-18
1551 DK1KO JO53CT 55A 53A 15° 1142 km
1600 SP2OFW JO93AC 59A 59A 0° 815 km
1636 DK3BU JO33NO 55A 52A 10° 1280 km
1647 ON4AMX JO20KV 52A 52A 330° 1275 km
1653 PA3FOC JO21FW 53A 53A 330° 1344 km
1656 G4RGK IO91ON 55A 55A 330° 1675 km
1700 G7RAU IO91IR 55A 55A 330° 1691 km
1706 G4SWX JO02PB 59A 55A 330° 1552 km
1710 G3LTF IO91GG 54A 54A 330° 1714 km
RIG: FT220 + XVTR, PA 2xGI7B, preamp MGF1302
ANT: 4 x 10 ele YU7EW (6m boom) tnx fer info, Nesha!

YU7EW in KN05HP wkd on 144 MHz:

2003-10-29
2121 OZ1LPR JO44UW 55A 55A 350 1288 km
2124 SP4JWD KO03FR 55A 53A 350 898 km
2139 SM7ALC JO65RL 55A 55A 350 1203 km
2149 SP4MPB KO03HT 55A 55A 350 907 km
2152 DJ9YE JO43HV 55A 55A 350 1255 km
2209 DL8LAQ JO43XU 55A 51A 350 1188 km
2218 SP4BY QRM 55A 53A
2234 SP2MKO JO93CB 55A 55A 350 842 km
2243 OZ6OL JO65DJ 55A 55A 350 1231 km
2247 SP3MGM JO73QE 55A 55A 340 919 km
2251 DH8BQA JO73CF 55A 55A 340 961 km
2258 G7RAU IO90IR 55A 55A 330 1711 km
2302 G7XDY JO02OB 55A 55A 330 1577 km
2303 G4RGK IO91ON 55A 55A 330 1698 km
2313 SP5ZCC KO02PF 55A 53A 0 733 km
2003-10-30
2042 DF2JQ JO31HL 55A 55A 330 1214 km
2053 SP2OFW JO93AC 57A 59A 350 849 km
2102 DJ3LE JO44TN 55A 52A 350 1260 km
2106 SP5HEJ KO02ME 55A 44A 350 728 km
2312 OZ2M JO65FR 55A 51A 0 1257 km
2322 OZ1CLL JO65GQ 55A 53A 0 1251 km
2333 SM7WT JO65GQ 57A 57A 0 1226 km
2336 RW3PF KO93CD 55A 55A 0 1514 km
2351 PA0V JO33II 55A 52A 0 1316 km
2003-10-31
0015 SQ2EEQ JO95JC 55A 55A 0 949 km
hrd mni DL, SM, OZ, PA, ON, G, SP, UR and RA4
Equipment: PA 250 W, ant only 10 ele 12 m high
QSL only direct to: Nemethy Istvan, Branka Radicevica 63, 23217 ALEKSANDROVO, Serbia tnx fer info, Pista!

432 MHz reports

DF5JJ in JO43XO wkd on 432 MHz:

2003-10-29
2240 G3XDY JO02 53A 59A 40
2358 RA3LE KO64 55A 57A 40 1437km
2003-10-30
2221 OZ1CTZ JO46 55A 54A 30
2233 G3LTF IO91 53A 55A 20
2003-10-31
0032 OK2SBL JN99 55A 59A 80 738km
0035 OK1DFC JN79 59A 59A 80
0114 OE3JPC JN87 55A 59A 80
0119 S51ZO JN86 51A 59A 80 885km
RIG: 500W/19el tnx for report, Peter

DH0GHU in JN38VN wkd on 432 MHz:

2003-10-30
2215 G3LQR JO02QF 53a 55a 20°
RIG: TS850S, LT70S, HLV120-3, 120W out, 19el, DL6WU
tnx fer report, Ulrich!

DK3WG in JO72GI wkd on 432 MHz:

2003-10-29
1718 UA3PTW KO93BS 57A 57A 1580 km
1720 RW3PF KO93CD 55A 55A 1591 km
tnx fer info, Jürgen!

DL1EJA in JO31DS wkd on 432 MHz:

2003-10-29
1806 G3LQR JO02QF 55A 55A 340 km
tnx fer report, Oliver

DL1SUN in JO53PN wkd on 432 MHz:

2003-10-29
1725 DK3BU JO33NO 59A 55A 40
1725 PA5DD JO22IC 55A 55A 40
1732 DJ4TC JO63PN 57A 57A 40
2214 OK1DFC JO79GW 59A 59A 70
2238 OK2BDS JN79WF 55A 55A 70
2258 OK2BDQ JN99HQ 59A 57A 70
2309 SQ2EEQ JO94JC 59A 55A 70
2345 RA3LE KO64AR 57A 57A 30
2003-10-30
0002 SM7EBI JO77BT 55A 55A 20
0005 S51ZO JN86DR 55A 52A 70
0013 OE3JPC JN87EW 56A 55A 70
2144 DL7QY JN59BD 55A 55A 70
2147 OK1TEH JO7ØFD 53A 55A 70
2148 OK2MWR JN99HQ 56A 58A 70
2151 DL9MCC JN58UA 59A 51A 70
2153 OE3JPC JN87EW 59A 56A 70
2220 G3XDY JOØ2OB 55A 55A 20
2244 PAØEZ JO22OF 59A 56A 30
2246 DJ9RX JO43LE 59A 59A 30
2339 DD3SP JO72EN 55A 55a 40
I tested also on 23 cm with OE3JPC but without success.
tnx fer report, Norbert

DL1SUZ in JO53UN wkd on 432 MHz:

2003-10-29
2223 DL7APV JO62JR 55a 55a
2233 UA3PTW KO93BS 59a 58a
2233 OK1DFC JN79GW 59a 59a
2242 PA5DD JO22IC 59a 56a 305
2352 RA3LE KO64AR 57a 55a 55
2352 OK2BDQ JN99HQ 55a 55a
2003-10-30
2138 OE3JPC JN87EW 55a 55a
2151 OK1TEH JO7ØFD 55a 55a
2158 OK2MWR JN99HQ 57a 57a
2219 OZ1CTZ JO46OE 57a 57a 55 tnx , Uwe

DL9MCC in JN58UA wkd on 432 MHz:

2003-10-30
2150 DL1SUN JO53PN 51A 55A 35° 617 km
tnx fer info, Hans

G3XDY in JO02OB wkd on 432 MHz:

2003-10-29
2350 DF5JJ JO43XO 612 km
2003-10-30
2135 DL8QS JO43KH 535 km
2220 DL1SUN JO53PN 697 km
2227 DJ9RX JO43LE 537 km
2236 DF9QX JO42HD 506 km
2328 DL8OBU JO42XI 597 km
2003-10-31
0001 OZ1CTZ JO46OE 693 km
0025 DJ4TC JO63PN 828 km
0029 OK1DFC JN79GW 961 km
0033 DM2DXG JO51MV 673 km
0040 HB9BZA JN36BE 744 km
0044 DK8VS JN39NF 522 km
tnx fer report, John

HB9BZA in JN36BE wkd on 432 MHz:

2003-10-31
0035 PA3DZL JO21HM 54A 57A 20°/65°
0042 G3XDY JO02OB 51A 54A 30°/70°
0047 PA2CHR JO22BA 54A 55A
0050 PA3DOL JO22MT 41A NC
This was my second aurora opening on 432 MHz, after the one on 13-14 March 1989, which was much better (21 QSO)
tnx fer report, Robert!

OZ1CTZ in JO46PE wkd on 432 MHz:

2003-10-30
2218 DL1SUZ JO53UN 53A 57A 60 333 km
2226 DF5JJ JO43XO 54A 55A 60 291 km
2229 DL2ALF JO50IW 41A 52A 60 592 km
2235 PA0EZ JO22OF 51A 55A 60 511 km
2246 OK2MWR JN99HQ 52A 55A 60 958 km
2251 OE3JPC JN87EW 54A 55A 60 1038 km
2321 OK1DFC JN79GW 54A 55A 60 780 km
2339 DL3JIN JO60LX 53A 55A 60 629 km
2341 S51ZO JN86DR 53A 53A 60 1159 km
2003-10-31
0003 PD0RFU JO32LS 51A 55A 60 407 km
0004 G3XDY JO02OB 54A 54A 60 693 km
0012 OK2SBL JN99HQ 52A 53A 60 958 km
0034 DJ5BV JO30KI 52A 57A 60 667 km
0036 OK2BDS JN79WF 51A 53A 60 893 km
0042 DF8IK JO30JT 54A 52A 60 618 km
0047 PA0BAT JO31FX 54A 53A 60 501 km
RIG: 75W to single 13 ele yagi tnx for report, Brian

PA2CHR in JO22XA wkd on 432 MHz:

2003-10-29
1816 G3LQR JO02QF 55A 58A 45 315 km.
2003-10-30
0126 RA3LE KO64AR 59A 59A 40 1751 km.
2224 G3XDY JO02MB 59A 59A 50 337 km.
2003-10-31
0048 HB9BZA JN36BE 55A 54A 60 648 km.
0101 G4RGK IO91ON 59A 57A 40 468 km.
RIG: FT847, MGF1302 pre-amp, YL1050, 4 x 35 el.BVO/11wl
tnx fer info, Chris

RW3PF in KO93CD wkd on 432 MHz:

2003-10-29
1610 UA9FAD LO88DA 33A 55A
1720 DK3WG JO72GI 55A 55A
1722 UA3PTW KO93BS 59A 59A
2244 OK1DFC JN89GW 55A 55A
2248 OK2BDQ JN99HQ 57A 59A
2337 ES2RJ KO29JN 57A 57A
2003-10-30
0005 YL3AG KO26AW 57A 59A
0008 RA3LE KO64AR 57A 59A
2003-10-31
0103 OK1DFC JN89GW 59A 55A
0110 S51ZO JN86DR 55A 55A 1719 km
0111 OE3JPC JN87EW 57A 59A
0113 OK2SBL JN99HQ 59A 59A
RIG: 4x24el OPT-70, GS35b tnx fer report, Peter!

S51ZO in JN86DR wkd on 432 MHz:

2003-10-30
0010 DL1SUN JO53 52a 55a 842 km
0133 UA3PTW KO93BS 57a 57a 1728 km
2339 OZ1CTZ JO46OE 53a 53a 1159 km
2003-10-31
0032 OZ7IS JO65DQ 57a 57a 1034 km
0045 RA3LE KO64AR 57a 57a 1415 km
0100 UA3PTW KO93BS 55a 57a 1728 km
0109 UA3PTW KO93BS 59a 59a 1728 km
0111 RW3PF KO93CD 55a 55a 1714 km
0118 DF5JJ JN43XO 59a 51a 606 km
tnx fer report!

UA3PTW in KO93BS wkd on 432 MHz:

2003-10-29
1718 DK3WG JO72GI 57A 57A
1724 RW3PF KO93CD 59A 59A
1725 DL7APV 55A 53A
2220 OK1DFC 59A 57A
2224 OK2BDQ JN99HQ 59A 59A
2228 OK1TEH JO70FD 53A 55A
2231 DL4WK JO63SQ 57A 59A
2233 DL1SUZ JO53UN 57A 59A 1729km
2238 DH8BQA JO83CF 55A 55A
2242 DD3SP JO71EN 55A 55A
2304 OK2SBL JN99HQ 55A 55A
2315 UA3DHC KO96CB 59A 59A
2328 ES2RJ KO29JN 59A 59A
2333 ES1RF/3 KO29IF 57A 57A
2342 YL3AG KO26AW 57A 57A
2347 ES2NA KO29JL 59A 57A
2351 ES2WX KO29 57A 59A
2003-10-30
0005 RX1AX KO59EW 59A 59A
0011 RA3LE KO64AR 59A 59A
0031 ES5PC KO38HJ 59A 57A
0125 OE3JPC JN87EW 57A 57A
0132 S51ZO JN86DR 57A 57A 290 1728 km
2129 OK2MWR JN99HQ 59A 59A
2250 OK2BDS 52A 55A
2003-10-31
0055 SP6IWQ JO80SK 53A 55A
RIG: 20x15 ele, MGF4319, GS35b. tnx fer report, Dmitrij!

20.11.03 Last Minute Special

Another big one that was visible even in Athens occurred on Nov 20th. Probably stations from SV, TA, IT9, IS0, EA etc. have missed this once (?) a lifetime chance to work AU-QSOs.

DF2ZC (JO30RN) wkd (all CW):

16:06 SP2RS JO94GK 55a 55a 864
16:09 OZ5BD JO65HR 55a 55a 669
16:11 DK2AU JO42OH 52a 57a 229
16:13 PAØJMV JO21PM 59a 59a 185
16:15 DL5LZ JO44WE 59a 59a 435
16:19 UR5SKB KN28VI 51a 53a 1460
16:25 DL5LBY JO43RS 55a 59a 382
16:28 DM3SWS JO62KL 51a 55a 431
16:33 HB9BZA JN36BE 57a 55a 496
16:35 I1DMP JN35UB 56a 56a 612
16:36 DL7GW JO62SL 57a 57a 471
16:38 SP3AGE JO83FG 55a 58a 686
16:42 OM3KZA JN99 55a 59a 834+-
16:43 DK2WV JN58TB 52a 59a 410
16:44 SP3BJK JO81HT 57a 59a 653
16:46 LZ2FO KN13KX 52a 52a 1370
16:48 S51AT JN75GW 55a 55a 734
16:50 SP2MKI JO93AC 59a 59a 779
16:51 SP9FUC JO9ØEA 57a 59a 777
16:53 F6AKU JN29KQ 59a 57a 208
16:54 IN3KLQ JN56RG 51a 59a 561
16:59 OK2SIA JN99CL 51a 59a 776
17:02 S51KK JN76HB 55a 59a 728
17:03 OK2BDS JN79WF 59a 59a 620
17:04 OM7AQ JN98UI 55a 57a 917
17:06 DL1AKP JO5ØSU 55a 55a 289
17:08 OM3QQ JN88VS 55a 55a 769
17:10 HA5KG JN97OK 55a 57a 923
17:11 IK4PMB JN54LL 55a 59a 725
17:12 F8OP JN26MM 59a 58a 483
17:13 UT5JCW KN64SN 59a 59a 2054
17:18 OM2RC JN88MK 55a 55a 730
17:20 LZ2ZY KN13OT 57a 57a 1402
17:23 HA5AB JN96MO 56a 56a 957
17:26 HA8BT/7 JN97MI 56a 57a 916
17:27 OK2POI JN99BL 57a 59a 771
17:28 OK2PTC JN89JM 59a 59a 676
17:30 HA5PT JN97MK 59a 59a 912
17:30 HA5CW JN97PM 55a 57a 925
17:31 OK2BFI JN89QH 57a 59a 722
17:33 HA7WJ JN97MP 57a 57a 902
17:34 HA2SU JN97AB 52a 55a 866
17:36 9A4EW JN95KG 55a 57a 1032
17:36 OE2LCM JN67NU 57a 55a 510
17:40 HA5KG 52a 55a ?
17:41 S57TW JN75EX 59a 59a 722
17:43 S51MQ JN75NT 57a 59a 775
17:45 IWØGPN JN62FB 51a 53a 1019
17:46 IK4DRY JN64BL 59a 59a 761
17:47 HA1YA JN87GF 59a 59a 085°/042° 759
17:50 S57LM JN76HD 55a 55a 721
17:53 IK1SPR JN34TQ 55a 59a 653
17:55 IK2YXK JN45OP 55a 59a 562
17:55 YU7EW KNØ5HP 55a 55a 1118
17:58 IK1EGC JN35UF 59a 59a 593
18:00 HA8V KNØ6HT 59a 59a 1050
18:02 OE6BMG JN77JE 57a 59a 654
18:03 IZ1AIK JN63HV 59a 55a 837
18:04 HA1FV JN87JJ 52a 55a 766
18:08 OM5LD JN98AH 52a 55a 804
18:10 LZ1ZX KN32IO 55a 55a 1709
18:11 YU7KB JN94XX 57a 58a 1119
18:13 LZ1QI KN12PR 55a 55a 1484
18:16 YO2IS KNØ5PS 52a 59a 1153
18:20 F6DQZ JN19NE 53a 55a 346
18:23 LZ2HM KN12QP 55a 55a 1496
18:24 HA7WJ JN97MP 55a 59a 902
18:27 HB9DFG JN37SM 52a 55a 338
18:29 S51IV JN76TN 55a 55a 747
18:32 S57Q JN76PA 56a 59a 768
18:35 S54G JN65TM 57a 57a 723
18:57 9A2RD JN65VG 55a 59a 754
18:59 I1JTQ JN35UB 59a 57a 612
19:01 YU7MS KNØ5FJ 55a 55a 1123
19:02 RW3WR KO71IM 55a 57a 1897
19:04 DL2SWB JO53SM 55a 55a 431
19:20 F6BEG JN25JS 57a 55a 568
19:21 U5YM KN28XG 55a 58a 1358
19:23 SP9FG JN99XG 55a 57a 905
19:26 OK2CFM JN89LX 55a 55a 678
19:35 UX1DC KN18DP 52a 55a 1088
19:36 HA5OV JN97NJ 59a 59a 920
19:38 U3UN 52a 55a ?
19:41 F6GNJ JNØ7TV 59a 59a 517
19:42 DL8ZAJ JO4ØKD 59a 59a 111
22:16 DK8ZJ JO54AG 55a 55a 448
22:41 I2FAK JN45OB 59a 59a 625
22:42 S55M JN65XM 56a 59a 739
22:43 DL9MCC JN58UA 53a 55a 418
22:44 I1DMP JN35UB 55a 55a 612
22:45 IK1EGC JN35UF 56a 55a 593
22:49 OM3TUC JN88DE 52a 55a 691
22:50 OK1MZM JN69PR 55a 59a 426
22:51 OE1SOW JN88FF 55a 55a 700
22:53 HA8V KNØ6HT 55a 57° 1050
22:55 OK2BEJ JN79SJ 56a 55° +1,5kHz dopp. 592
22:56 DL5GAC JN47UT 56a 58a 347
22:58 HAØHO KNØ7SU 55a 55a 1064
23:00 OM3TZZ JN88TI 56a 58a 774
23:03 OK1TEH JO7ØFD 51a 55a 498
23:05 OK1FRD JO8ØDD 53a 55a 628
23:06 DHØGHU JN38VN 57a 55a 224
23:07 OK1DVM JO7ØGA 53a 57a 506
23:09 S51ZO JN86DR 56a 56a 775
23:10 S57EA JN76HE 53a 57a 718
23:13 DL1MAJ JN68AH 55a 55a 415
23:13 DL1GGT JN58AJ 55a 55a 305
23:18 I5WBE JN53JR 55a 55a 800
23:25 DL2IAN JN49BC 53a 51a 169
23:27 OK1XN JO7ØDB 51a 55a 488
23:29 OK2MWR JN99CL 53a 52a 776
23:31 OK1PGS JN69RS 53a 59a 436

DF7KF, JO30GU, wkd 2m:

13:10 DL9MS 59a 59a JO54WC 10 to 20 Deg.
13:31 DL1SUN 59a 59a JO53PN
13:36 GM4BYF 59a 55a IO85JV
13:41 DK3WG 59a 59a JO72GI
13:42 DL2DXA 59a 59a JO61VC
15:34 OH5LK 59a 59a KP30ON
15:38 LY2IC 59a 59a KO14WW
15:40 SM1NJC 55a 57a JO97DO
15:45 9A2AE 56a 59a JN86HF 32 Deg
17:12 OM5AL 56a 59a JN97CX 52 Deg
17:13 DK1MAX 55a 59a JN58SP
17:14 OM5NZ 59a 55a JN97CX
17:18 9A3JH 59a 57a JN75AD
17:19 OK2BZQ 55a 57a JN99CO
17:20 HA5CW 59a 59a JN97PM
17:21 OK2VP 55a 55a JN89QH
17:22 OM5AL 55a 59a JN97CX dupe
17:24 OK2CPD 57a 57a JN89UF
17:27 OM3KZA 59a 59a JN99IF
17:31 HA1SO 55a 55a JN87HQ
17:33 LZ2FO 55a 55a KN13KX
17:35 S51KK 55a 58a JN76HB
17:37 S57TW 59a 59a JN75EX
17:38 HA5PT 59a 59a JN97MK
17:40 UT5DL 59a 59a KN18JP
17:41 UZ5DZ 59a 59a KN18DO
17:42 HA7WJ 59a 59a JN97MP
17:43 HA2SU 59a 59a JN97AB
17:44 IK2YXK 59a 59a JN45OP
17:45 IK4PMB 57a 55a JN54LL
17:47 HA8BI/7 53a 55a JN97
17:49 OE6BMG 59a 59a JN77JE
17:50 HA1YA 59a 59a JN87GF
17:52 S51KK 59a 59 JN76HB dupe
17:53 HA8V 59a 59a KN06HT
17:54 S51AT 59a 59a JN75GW

17:55 S51MQ 59a 59a JN75NT
17:56 IK4DRY 59a 59a JN64BL
17:58 YU7EWY 55a 55a KN05HP
18:00 LZ2ZY 53a 54a KN13OT
18:03 HA8AR 52a 55a KN06NQ
18:05 S57LM 55a 55a JN76HD
18:06 LZ2HM 57a 55a JN12QB 87 deg
18:08 LZ3GM 53a 56a KN32RL
18:11 YZ1JA 52a 55a KN04
18:12 LZ1ZX 59a 59a JN32IO
18:16 YU7KB 59a 59a JN94XX
18:19 YO3IZI 59a 339 KN34BK
18:22 F9OE 53a 55a IN78QG
18:25 LZ5UV 55a 55a KN12PR
18:27 LZ1JH 55a 55a KN22TM 93 deg!
18:34 LZ1KG 53a 51a KN31CS most southern stn
18:39 ON6MG 55a 56a JO10VK
18:51 SP3JBI 52a 59a JO91BR
18:55 F5VHX 55a 55a JN04FT
19:09 G4ERP 52a 57a IO81XW
19:14 F8OP 57a 57a JN26MM
19:21 F2FAK 57a 57a JN45OB
19:23 F5OAU 59a 59a JN27XG
19:29 LZ1QI 55a 55a KN12PR
19:32 HA5OV 59a 59a JN97NJ
19:33 LZ2FO 55a 55a KN13KX still good for LZ
18:35 YU7OP 53a 57a KN05AO
19:36 HB9BZA 55a 55a JN36BE
19:40 F5MGD 52a 55a JN07AW
20:41 RW3WR 55a 57a KO71IM 1946km 48 Grad
21:01 G3JRM 55a 55a JO02UL
21:02 DK8ZJ 55a 59a JO54AG
21:04 DL5LBY 53a 57a JO43RS
21:08 US5WU 55a 57a KO20DI
21:09 DL7AU 55a 55a JO62WD 56 Grad
21:14 OK1TEH 56a 59a JO70FD 67 Grad
21:16 DF6NA 57a 55a JN49XS
21:17 HB9DFG 53a 55a JN37SM
21:21 UR5SKB 53a 52a KN28IW

DK3WG in JO72GI wkd on 144 MHz:

1316 ES2JL KO29LL 57A 59A
1325 SM1CXE JO97FJ 55A 57A
1329 LY2BJ KO25ER 59A 59A
1335 DJ9CZ JO31BC 55A 55A
1337 PA1TK JO22IJ 55A 55A
1339 PA0JMV JO21PM 56A 57A
1342 DF7KF JO30GU 59A 59A
1344 SP9AGV JO91SO 55A 55A
1350 HA6NQ JN98WA 54A 53A
1354 HB9QQ JN47KJ 57A 58A
1356 DF1CF JN57FP 57A 57A
1402 YL85HA KO26WW 57A 57A
1404 EW6DX KO45JL 57A 57A
1413 OK1MHZ JO70VA 55A 55A
1416 S57TW JN75EX 55A 57A
1421 OK2POI JN99BL 54A 55A
1441 RW3PF KO93CD 57A 59A
1444 S54M JN86CL 57A 53A
1458 UT8AL KO61WP 57A 59A
1502 RA3DRC/1 KO55JL 55A 58A
1515 RW3RA LP02QW 54A 55A 1963km
1527 YL3CQ KO17EM 58A 59A
1529 UA4UK LO14MA 58A 59A
1531 ES6RQ KO28WA 59A 59A
1534 UA3XAC KO85HC 57A 59A
1537 UA3DHC KO95AW 59A 59A
1538 OK2PTC JN89JM 57A 59A
1540 RA3QTT LO01GQ 59A 59A 1774km
1541 RA3XR KO85GB 57A 57A
1543 RW3AC KO86SH 57A 57A
1548 OM5AL JN99CO 55A 55A
1554 SP3JBI JO91BR 57A 59A
1556 SP4BY KO13OD 59A 59A
1559 SP8AWL KO11GG 57A 59A
1601 UA3RBO LO03NG 55A 57A 1783 km
1603 DL7GW JO62SL 57A 59A
1605 SM5AQI JO88CN 55A 55A
1609 RA3DCI KO96CB 56A 59A
1611 RK3AF KO85QR 57A 59A
1612 RA3EL KO82AX 57A 59A
1615 GW3RME IO82TO 55A 55A
1651 RA3WDK KO81BR 59A 59A
1658 OK2DL JN89AO 55A 59A
1738 S54G JN65XM 59A 59A
1745 S51ZO JN86DR 59A 59A
1748 S51AT JN75GW 55A 55A
1750 DJ2GM JN58SC 57A 59A
1804 9A1CM JN86FM 55A 55A
1807 HB9BZA JN36BE 55A 55A
1809 S53VV JN65 56A 55A
1810 F6BEG JN25JS 55A 54A
1812 F5HB IN95OE 55A 56A 1369km
1814 HA3GR JN76VK 55A 59A
1816 DH0GHU JN38VN 56A 59A
1818 OK1DXW JO70HC 59A 59A
1819 HA5CW JN97PM 57A 59A
1820 OK1XN JO70 59A 59A
1821 S51MQ JN75NT 57A 59A
1824 S51IV JN76TN 55A 55A
1826 F6HGC JN27LI 55A 55A
1828 DL3RAH JN59RG 43A 57A
1830 SP9HVV KO00LA 55A 55A
1832 SP7OGP KO01AM 55A 55A
1835 OM3ID JN88ME 55A 59A
1836 DL8MFL JN58OA 55A 55A
1837 G3BNE JO01BJ 55A 57A
1840 DF5DL JN58TB 57A 57A
1842 G3YVR IO91WD 56A 57A
1843 DL4KG JN48OU 55A 57A
1845 IZ4AIK JN63HV 57A 59A
1848 F5VHX JN04FT 55A 55A
1850 S53J JN75EV 55A 55A
1851 F6FHP IN94TR 57A 57A 1379km
1852 IK2YXK JN45OP 57A 59A
1854 OE3JPC JN88 59A 59A
1855 F6HHR JO10AV 57A 57A
1858 IV3DXW JN65QQ 57A 59A
1900 HA2RD JN87WB 56A 57A
1902 S51DI JN76VL 57A 57A
1908 F6ETS JN15AU 56A 59A Tnx Jürgen !

F6DRO, JN03TJ, wkd in CW on 2m:

1648 G4FUF JO01GN
1650 G3JHM IO91LC
1654 G4RRA IO80BS
1658 PA3BIY JO22EB
1702 EI5FK IO51RT
1705 SP4MPB KO03HT
1713 GW3LEWIO71PS
1730 G4XBF IO91QD
1735 G3KEQ JO01BH
1741 G4IGO IO80NW
1804 PA3FOC JO21FW
1809 PA2DW JO21GD
1810 PA2M JO21JP
1821 PA3GDD JO21AI
1854 GW4FRX IO82MR
1858 PA3DZL JO21HM
1900 PG2M JO21FW
1904 DL2BWH JO62XR
1910 EI4BZ IO51UW
1914 EI2HI IO51PQ
1919 G0ORY IO90KP
1923 G4BRK IO91DP
1924 G4IGO IO80NW
1928 G7RAU IO90
1942 DL1RTL JO62PH
1943 ON4KHG JO10XO
HRD and called, but no QSO: G4KMF-PA5KM-PA1GYS-DK5DQ-F8DO-G4HGI-DF7KF-PA0JMV-F6DKW- AND MANY OTHERS! 73's Dom/F6DRO

F6HTJ, JN12KQ, wkd 2m CW:

17.23 DF8IK 59A JO30JT
17.28 PA3FOC 59A JO21FW
17.34 G3JHM 59A+ IO91LC
19.02 PA0GHB 55A JO11WH
19.20 PA3DZL 59A JO21HM
19.23 G3WZT 59A IO90UX
Heard also ON, GW stations. First time AU for me from Perpignan. Rig: 40w + 11 ele Yagi. Tnx for info Michel

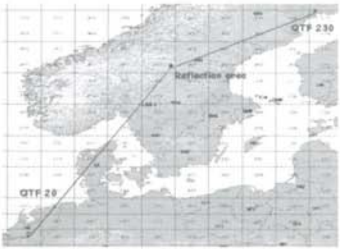
IK2YXK, JN45op, wkd 2m:

17.28 DF8IK 52a 55a JO30jt 30°
17.38 ON4LN 57a 59a JO20iv 40°
17.43 DF7KF 59a 59a JO30gu 35°
17.55 DF2ZC 55a 59a JO30m 20°
18.08 F6HPP/p 53a 55a JN19pg 0° ssb
18.20 DJ0SP 55a 55a JO32kb 0°
18.30 DF4UE 53a 55a JN48 355°
18.41 PA2DW 55a 55a JO22gd 0°
18.52 DK3WG 55a 59a JO72gi 330°!!!
also second scatterpoint 0° same rst
19.03 PA5AB 55a 55a JO22sa 350° ssb
19.11 DO1FOX 59a 59a JO31pu 350° ssb
19.12 DL5YET 59a 59a JO41ev 350° ssb
19.14 DK1FG 59a 59a JN59op 350° ssb
19.17 DK3EE 59a 59a JO41gu 0° ssb
19.34 DM1CG 59a 59a JO31ic 0° ssb
19.37 G7RAU 59a 59° IO90ir 355°
Heard EI2IV and EI stn in IO54 and IO63, G4DEZ I spent almost 1h for catch him... but my qrp cant break his pile-up.. sniff JN03 new for me...DK1KO, OK1DCF with 320° qtf!!!, ON7CL. For all qso's I have mp3..contact me if you want it at ik2yxk@libero.it and asap it will be on www.qsl.net/ik2yxk
I think this Au was the most strongest that I heard in my life and amazing range of qtf. 73, Mau

S51ZO, JN86DR, wkd CW on 2m:

17:44 DK3WG JO72GI 59A 59A 638
17:50 GW4DGU IO71SV 59A 58A 1603
17:52 DK7HH JO53CJ 55A 55A 858
17:53 PA3DOL JO22MT 57A 57A 1051
17:54 PA3ECU JO32CF 55A 55A 949
17:55 DL2UP JO31SR 57A 55A 843
17:57 DL6BF JO32QI 55A 57A 896
17:58 DK5AL JO51DS 55A 55A 709
18:04 DB3BW JO42AC 55A 55A 843
18:05 DL6CGC JO52MB 55A 55A 704
18:06 DF7VX JO41KP 56A 55a 767
18:08 GI4OWA IO64IX 55A 55A 1879
18:10 DF0WD JO42FD 59A 59A 826
18:11 OZ1CLL JO53GQ 59A 59a 874
18:12 DL3LST JO61FI 59A 59A 585
18:13 DJ3VI JO43VI 59A 59A 870
18:14 PA0WWM JO22FE 59A 59A 1046
18:26 G4MKF IO91HJ 55A 54A 1383
18:29 LY2CI KO14WV 55A 57A 1051
18:31 DL2SWD JO52SG 55A 58A 705
18:31 DL3LED JO53DP 57A 59A 879
18:31 LY2IC KO14WW 55A 57A 1055
18:34 DL7AU JO62WD 55A 55A 627
18:36 G3UTS IO94CU 55A 55A 1552
18:38 GW3LEW IO71PS 57A 57A 1617
18:39 DF8AE JO41GX 55A 55A 809
18:54 DK2CF JO41GG 55A 55A 757
18:55 G4YTL IO92MB 59A 59A 1377
18:55 G0PQF JO01BU 55A 55A 1299
18:57 DM2DXG JO51MV 57A 55A 689
18:59 DF5DE JO40CX 55A 55A 756
19:02 GW3LEW IO71PS 59A 59A 1617
19:02 PA1BVM JO21RI 53A 55A 941
19:03 DL6YEH JO32VA 57A 57A 850
19:24 DL6NAA JO50VF 59A 59A 511
19:25 F6CRP IN96KE 55A 55A 1332
19:25 G3XDY JO02OB 59A 59A 1239
19:30 G4KWQ IO92AQ 57A 57A 1464
19:33 DL2BWH JO62XR 56A 55A 688
19:33 DH4FAH JO40KC 56A 55A 663
19:36 DH7FB JO62AM 56A 55A 713
19:36 DK9VZ JO40FD 56A 57A 691

19:37	G0JJM	JO02LS	54A	55A	1286
19:37	PG2M	JO21FW	55A	55A	1032
19:40	DM2BUG		55A	55A	0
19:43	G3LQR	JO02QF	57A	57A	1235
19:44	G3RDC	IO82QC	54A	57A	1487
19:48	OK1DOL	JN69NX	55A	59A	430
19:59	DK1KO	JO53CT	57A	57A	897
20:08	DL9MS	JO54WC	57A	56A	877
21:14	RW3WR	KO71IM	57A	55A	1437
21:15	PA(VG	JO33II	55A	55A	1004
21:22	DK8ZJ	JO54AG	57A	59A	947
21:25	SP4JWD	KO03FR	57A	56A	832
21:27	DL8MKG	JO50NU	53A	55A	594
21:30	PD0RFU	JO32LS	53A	55A	947
21:31	DJ9YE	JO43HV	55A	55A	964
21:32	DJ9MG	JO52TC	55A	55A	686
21:35	DK5DQ	JO31PG	55A	54A	827
22:07	OZ6OL	JO65DJ	59A	57A	1003
22:12	OZ2M	JO65FR	59A	56A	1035
22:13	OZ1CLL	JO53GQ	57A	57A	874
22:23	SP4MPB	KO03HT	55A	56A	845
22:26	DL3YB	JO42XK	57A	57A	781
22:33	DH7FB	JO62AM	56A	55a	713
22:39	DL2ARD	JO60AR	55A	55A	543
22:42	DD0VF	JO61WB	57A	57A	513
22:45	DJ9CZ	JO31BC	57A	55A	887
22:49	DL2AOM	JO60	52A	52A	484+-
22:52	DF9QX	JO42HK	53A	53A	840
22:53	DF9QX	JO42HD	53A	53A	817
22:54	DL8YET	JO31MH	55A	55A	844
22:59	PA9RX	JO32MT	55A	59A	946
23:01	OK1VT	JN79IX	55A	59A	380
23:08	DL7FF	JO62TJ	55A	55A	658
23:09	DF2ZC	JO30RN	56A	56A	775
23:12	DF2JQ	JO31HL	57A	56A	878



Map for the QSO PA0JMV – SM2CEW (tnx PA0JMV)

SM2CEW, KP15CR, wkd 2m:

1450	DK3EE	JO41GV	230	
1452	PA0JMV	JO21	225	1851km
1459	G4FUF	JO01GN	230	1992km
1502	DG5CST	JO60DH	225	
1503	PA3FOC	JO21FW	225	
1504	PA3DZL	JO21HM	225	
1507	OZ2M	JO65FR	225	
1509	OZ1LPR	JO45UW	225	
1516	DL1YAW	JO41	225	

On 20 Nov I tried beaming +/- 10 deg and the signals were weaker. After a while, when stations started reporting aurora on 432 I also tried on that band with PA3DZL but nil. Unfortunately I think we were a bit to late to try 432 as signals had dissappeared from 144 also as the aurora moved further south. The funny thing in these openings is that the stations I worked were the only ones heard on the band, no other short skip aurora like OH6, OH2 or so was heard. TNX, Peter!!

70cm Aurora on November 20th 2003:

DK3WG in JO72GI wkd on 432 MHz:

1622	PA5AM	JO31GW	55A	53A	30
1626	G3LQR	JO02QF	57A	57A	18
1631	SM6HBI	JO57XQ	55A	55A	22
1647	PA3DZL	JO21HM	57A	57A	53
1705	9A2SB	JN95GM	57A	59A	85
1922	S51ZO	JN86DR	57A	59A	315

tnx fer info, Jürgen!

F6CRP, IN96KE, wkd on 432 MHz:

1715	PA5DD	57A	57A	JO22IC
1717	DF2JQ	51A	57A	JO31HL
1720	DF6NA	55A	54A	JN49XS
1729	DK8VS	55A	55A	JN39NF
1730	EI5FK	55A	55A	IO51RT
1741	G4RGK	55A	55A	IO91ON
1812	DJ4TC	55A	55A	JO63PN
1857	G4BRK	59A	56A	IO91DP
1858	G3XDY	59A	59A	JO02OB
1900	G0RRJ	51A	55A	IO91FE
1904	GW4DGU	55A	55A	IO71SV
1913	SP6IWQ	55A	55A	JO80HK
1918	DL1EJA	8 55A	55A	JO31DS

Rig: FT847 + 100 w amp + 2x 21 el - MGF1302

S51ZO, JN86DR, wkd on 70cm:

16:38	DL1SUN	JO53PN	57A	57A	838
16:39	DJ9RX	JO43LE	59A	59A	888
16:41	DL8OBU	JO42XI	59A	54A	774
16:43	DK6AS	JO52JJ	59A	59A	744
16:44	DL6BF	JO32QI	55A	56A	896
16:45	PA0EZ	JO22OF	59A	55A	1005
16:52	DL7FF	JO62TJ	59A	55A	658
16:52	PA5DD	JO22IC	59A	57A	1027
16:52	PA1TK	JO22IJ	59A	55A	1044
16:55	DF9QX	JO42HK	59a	55a	840
16:57	DJ6MB	JO30NR	59a	55a	805
16:59	PA2CHR	JO22XA	59a	55A	950
17:00	PA3COB	JO32MF	59a	59A	904
17:01	PA0BAT	JO31FX	59a	55A	919
17:02	DJ2QV	JO31PF	55a	56A	824
17:02	DL3JIN	JO60LX	55a	54A	531
17:05	DJ9DL	JO31NC	55a	55A	827
17:05	PA3DZL	JO21TN	59A	59A	942
17:07	PA5AO	JO31GW	55A	55A	912
17:08	DJ9MG	JO52TD	57A	59A	690
17:09	PA3ECU	JO32CF	57A	59A	949
17:10	G3LQR	JO02QF	53A	53A	1235
17:16	PA3CSG	JO21WD	55A	55A	904
17:21	PA3DOL	JO22MT	55A	57A	1051 QTF 30
17:26	G4RGK	IO91ON	57A	59A	1349
17:34	**EI5FK**	**IO51RT**	**53A**	**52A**	**1877km *)**
18:16	DF5JJ	JO43XO	59A	51A	887
18:17	DJ4TC	JO63PN	55A	55A	789
19:05	G4BRK	IO91DP	57A	56A	1413
19:10	G3XDY	JO02OB	57A	59A	1239
19:12	G0RRJ	IO91FE	55A	55A	1388
19:14	GW4DGU	IO71SV	55A	55A	1603
19:22	DK3WG	JO72GI	59A	57A	638

***) New IARU Region 1 Aurora record!!**

Tnx for info, Joze!

Editors final note:

I would very much appreciate if in future everybody could provide reports in a format similar to that used in this column. In order to make it easier for you, I have provided a standardized report form that can by downloaded from my website (http://www.qsl.net/la0by). However, if that seems too difficult, please send the reports anyway.

TNX + 73, Stefan (LA0BY)

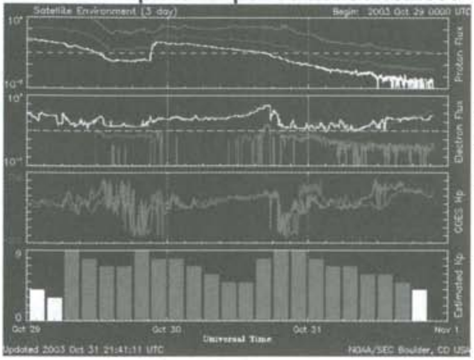
Reports of SK4MPI/B, JP70nj, via Aurora on 2m:

Date	Time	from area
20.8.	1615-1630	SM0 (JO89)
21.8.	0530	SM2 (KP15)
	1225-1800	LA (JP33), SM2 (KP15) UA1 (KP50), N-DL (JO32)
	2100	N-DL (JO53)
	2340	GW (IO73)
22.8.	1120-1700	LA (JP33), N-DL (JO53)
23.8.	1610-1635	N-DL (JO53)
24.8.	1220	OH6 (KP02)
26.8.	2240	SM2 (KP15)
27.8.	1350	SM2 (KP15)
29.8.	1335-1545	SM2 (KP15)
30.8.	1555	UA1 (KO59)
2.9.	1335-1505	SM2 (KP15), OH6 (KP02)
3.9.	1835	SM2 (KP15)
4.9.	1805	SM0 (JO89)
9.9.	1920-2100	SM2 (KP15)
11.9.	1935	SM2 (KP15)
16.9.	1430-1830	N-DL (JO53), PA (JO23)
17.9.	1315-1700	N-DL (JO33), PA (JO32)
	2100	SM0 (JO89)
18.9.	1320-1610	OH6 (KP02), SM3 (JP82)
19.9.	1325-1700	UA1 (KO49), N-DL (JO33)
20.9.	1300-1320	ES (KO27), OH6 (KP02)
	1700-1710	N-DL (JO54)
21.9.	1420-1630	OH1, N-DL (JO63), UA1
22.9.	1635	OH6 (KP02)
24.9.	1400-1730	N-DL (JO53), SP2 (JO93)
26.9.	1720	OH1 (KP11)
28.9.*	1540	SM3 (JP82)
3.10.	1805	LA (JP33)
7.10.	1645	LA (JO59)
15.10.	0605 + 1245	LA (JP33)
	1300-1600	N-DL (JO33)
	1915	SM2 (KP15)
16.10.	1345	LA (JP33)
	1710-1730	OH6 (KP02), LY (KO25)
17.10.	1150 + 1600	OH6 (KP02)
18.10.	1315-1545	OH6 (KP02)
19.10.	1335-1500	OH1 (KP11), SM3 (JP82)
20.10.	1530-1600	OH6 (KP02), N-DL (JO53)
22.10.	1115 + 1545-1700	OH6 (KP02), UA1 (KP50) N-DL (JO72), SP2 (JO93)
24.10.	1230-2200	LA (JP33), N-DL (JO53, 41), PA (JO21), LY (KO15)
25.10.	1335-1700	OH6 (KP02), UA1 (KP50) N-DL (JO53), SP2 (KP93)
29./30./31.10.	most time	SM, OH, UA1, N-DL, PA....
1.11.	2130-2200	LA (JO59), N-DL (JO33)
4.11.*	1745	LA (JO59)
4./5./6.11.	SK4MPI QRT	
8.11.	1800	OH6 (KP02)
9.11.	1320-1500	OH1, SP2 (JO93), DL (JO63)
10.11.	1800-2300	SM3, SM7, PA (JO32)
11.11.	1200-1700	DL (JO53), UA1, OH2, OZ
13.11.	1330-2300	DL (JO53), ON (JO10), SP
14.11.	1340	DL (JO44)
	2015	OH6 (KP21)
15.11.	1120-2000	SM2 (KP15), SP2 (JO94), DL (JO53), OZ (JO47)
16.11.	1400-1800	SM3 (JP82), DL (JO53)
17.11.	1530-1730	PA (JO32), DL (JO53), OH1
18.11.	0200	OH1 (KP21)
	1120	OH5 (KP30)
20.11.	0840-1030	SM2(KP15),OH1,UA3 (KO86)
	1220-2400	N-DL (JO53), OZ, PA, UA1
21.11.*	0425	OH6 (KP02)
21.11.	1700-1730	OH1 (KP10), UA3 (KO86)
22.11.	1500-2000	DL (JO42), UA3 (KO86), PA
23.11.	SK4MPI Beacon QRT again	
24.11.*	1410	OH5 (KP30)
	2020	OZ (JO46)

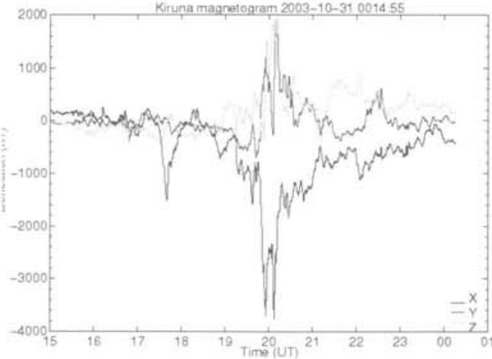
(* = report of LA2VHF JP53)

(We got several more reports, especially for the November 20th opening. Sorry, we can't print them all in this issue. But we will include them in issue 1/2004 unless there are coming too many of these strong openings in the next months.... Anyway keep sending your reports. Thank you!! 73, Joe, DL8HCZ)

NOAA/SEC plots of period 29.-31.10.2003

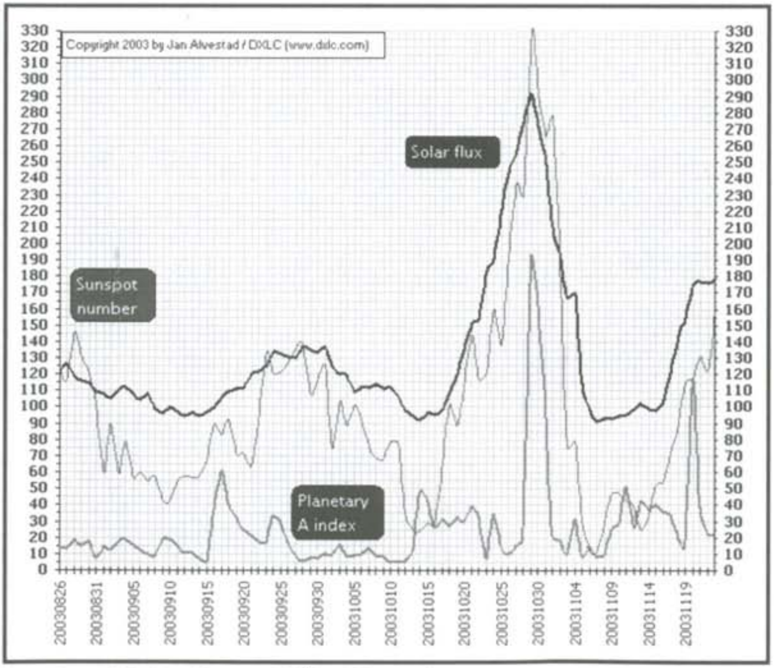


The diagrams show (from top to bottom) proton flux, electron flux, GOES Hp (magnetic field) and Kp index for Oct 29/30/31 A Kp index > 5 indicates storm levels. Here the maximum scale Kp = 9 is reached several times.



Kiruna magnetometer peaking at 3900 nT on 30th Oct. at 20:00 UT
On Nov. 20th the peak was around 1900 nT

Geomagnetic activity 26.8.-24.11.2003 (by DXLC)



Planetary A Index August 26th to November 24th with the big peaks from the openings on October 29th and November 20th.

Source: http://dxlc.com/solar

Ap on Oct 30th peaked 190 and on Nov 20th 115.

News & Comments

Editor: Joachim Kraft, DL8HCZ
info@DUBUS.de

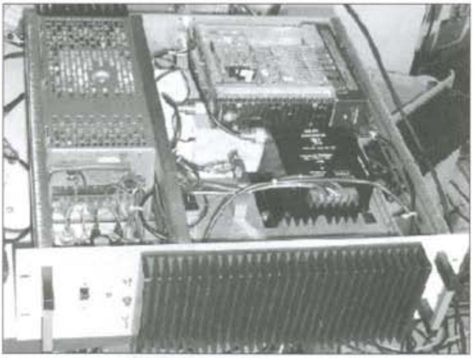
Beacons

Transatlantic Beacon Project VP9DUB beacon

The VP9DUB beacon antennas survived the hurricane "Fabian" on Sept. 5th 2003. This hurricane hit the tower with 270 km/h and the top section (10m) of the tower was lost! Fortunately the beacon antennas were at the lower part of the tower. The damage will be covered by an insurance and a new tower will be erected. This was a real check for the 6m loop antenna and the 4 element Flexa-yagi. So the VP9DUB 6m beacon was qrv continously since August 13th on 50.026 MHz.

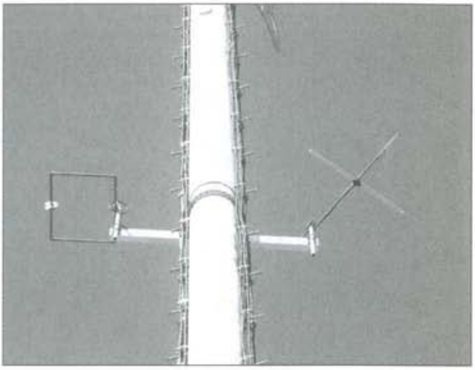
In mid October new boards for the 2m TX were shipped from DL to VP9. The 2m-TX produced a dirty signal and there were interference problems to a commercial FM repeater on 146 MHz that is located a few 100m away.

So we hope that the VP9DUB 2m part will be qrv soon. The new QRG is 144.290 MHz +/-. Loc. FM72oh.

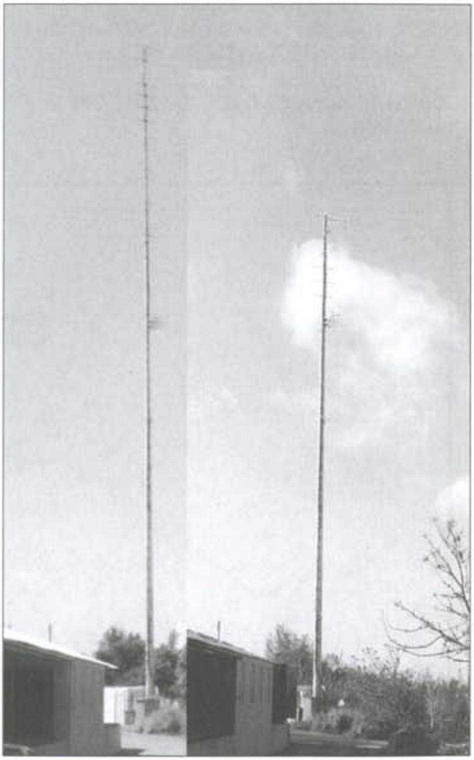


The VP9DUB beacon rack: A modified commercial BOSCH KF TX for 2m and a commercial Motorola TX for 6m. (Picture by DF7KF)

The VP9DUB beacon tower location



VP9DUB antennas
Left: Loop for 6m, right 4 ele. Flexa Yagi

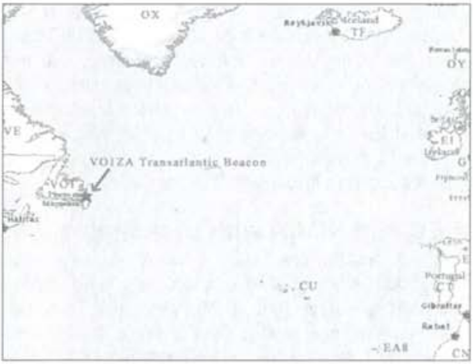


VP9DUB before and after Hurricane Fabian

VO1ZA, GN37js, qrv on 144.400 MHz

The Marconi Radio Club of Newfoundland and the Baccalieu Amateur Radio Club of Carbonear have been successful in placing a VHF Transatlantic beacon on the air. The beacon is transmitting on 144.400 MHz. The transmitter 250 W PA is the same one previously used by VE1SMU beacon. The VHF exciter board and the CW ID board have been built by Joe

Craig, VO1NA. The 11 element Cushcraft yagi, 1/2 inch hard-line feeder and 35 amp power supply to run the beacon have been donated by Frank, VO1HP. The yagi and feeder were installed by Boyd, VO1CBS, Roy VO1XP and Joe VO1NA on August 30, 2003. The repeater site is in the middle of a large field at a turkey farm!!....and it has a clear view of the North Atlantic ocean through the mouth of Conception Bay on the South East coast of VO1 land. It is in the town of Carbonear at coordinates N47 45'24" W53 12'59" (Loc. GN37JS) with the antenna at about 300' (90m) ASL. Transatlantic VHF beacon VO1ZA was placed on the air October 19, 2003 at 1330UTC on 144.400 Mhz by Frank, VO1HP, and Boyd, VO1CBS. The beacon is sponsored by the Marconi Radio Club of Newfoundland and the Baccaleiu Amateur Radio Klub. Any amateur station who claims to have heard this beacon is asked to send reports via e-mail to either vo1hp@rac.ca or vo1na@rac.ca. Please describe what you have heard and if possible the complete information being transmitted by the beacon." 73, Frank Davis, VO1HP - -



We are happy that this beacon is qrv now. This is also a result of the communication from DUBUS with the fomer VE1SMU keeper and the VO1-group some months ago.

VO1CBS and VO1NA installing the 2m yagi for VO1ZA

Stations, OPs and Expeditions

PC7CW/MM

Theo will be qrv again /MM next summer from the mediterre-anean see. Oliver, DL1EJA, plans to join him for some time and will work 2m-MS etc. from rare wet squares.

GØKZG/MM Info

Andy, G0KZG/MM, will be qrv from the fisheries research ship "CEFAS ENDEAVOUR", from the Mediterranean See in 2004. He hopes to be qrv again on 144 MHz Meteor-Scatter and Tropo, running the usual high power station.

RW1AY/MM qrv 6m

Vlad, RW1AY/MM, is qrv from a fishing trawler off the west-ern coast of Namiba (V5). On 6m he is working with a FT 100D, 100W and a matched longwire. The ship is cruising through the squares JG67, JG68 und JG77 through April 2004. On November 6th Vlad had a good opening into Europe and promised to be on 6m as often as his work permits

Info from Croatia

9A3FT (JN83) has changed his callsign to 9A6R. - The clubstation 9A1CAL (JN86) is temporary QRT because they lost the QTH. Chief OP Zvonko, 9A6WW, is qrv now with his own callsign from the QTH of 9A2AE in JN86hf.

New Transatlantic Attempt 2004

The group around Nico, DK5DQ, is planning a new 2m trans-atlantic attempt for August 2004. The group will be qrv from VO1 (GN37) and EA1 (IN53). The distance is around 300km more to VO1 from EA1 than from Ireland, where the group tried from as EI2TAA in 2002, but the path is more southern and the team is hoping for some Tropo or Es propagation.

HK0 2004

DL8YHR, Frank, plans to become qrv in June/July 2004 from HK0 on 2m and 6m via EME. No operation from S0 (Wester Sahara) due to licence problems.

SV/A Mount Athos

In October 2003 another rig was donated from the U.S. to SV2ASP/A. It is an IC756PRO. So Monk Apollo has now another rig with 6m capability available.

Comments

Help needed: TEP-program

Is there anyone who could try to write a simple simulation program for possible Transequatorial Propagation (TEP) paths with the data from previous 2m-TEP-QSOs and the magnetic equator? Please contact info@dubus.de

DATV: Noise on 23cm

The brandnew Digital Amateur Television (DATV) technology is getting more and more introduced also for repeater sta-tions. Recently the repeater DB0FS in Hamburg (JO43xo) was switched on in DATV mode on 1291 MHz. This caused a noise floor of 66 dB S/N on 1296 MHz to stations who were located in the area of Hamburg city. After some discussions with the keeper of the repeater we got information that the repeater was running with 3 channels. The licence was good only for 1 channel (+/- 3 MHz). So DB0FS was switched to 1 channel. Anyway there is still a noise floor of 26 db S/N on 1296 MHz left for stations in Hamburg. This is quite too much to work weak signal DX on 23cms. According to the DB0FS crew it is not possible to reduce this noise floor anymore with the actual DATV technology.

Communication in the 21st century?

In mid October 2003 I have asked a keeper from a well known beacon when the beacon will become qrv on the new 70cm QRG. Belief it or not: The keeper was not aware of the QRG change on 70cm! He has not been informed by anyone from the IARU. And this was a northwestern EU-country! The QRG change should be complete by Jan. 1st 2004... DL8HCZ

WSJT and beacons

DUBUS discussed with Joe, K1JT the future possibility of monitoring beacons with the WSJT program. Joe is supporting this idea and now we need to think about coordinated sequences for beacons. E.g. 30sec. periods of JT44(65), FSK441, JT6M and normal CW. So we need some input from you regarding which mode sequences for which bands should make most sence. So hopefully we will have some beacons using the modes from WSJT in the future. Please send your suggestions to: info@dubus.de (DL8HCZ)

Dates

GHz Meeting Dorsten 2004

The 27th GHz Meeting will take place on February 14th 2004 in Dorsten at the usual place: VHS Dorsten, Maria Lindenhof at the B224, 09:00h to 16:30h. Info: DL4BBU, Peter Hörig, Phone: 02362/41959, email: dl4bbu@darc.de

VHF-Meeting Weinheim 2004

The next Weinheim VHF Meeting (UKW-Tagung) will take place now on **September 11th/12th 2004**. Same location like in 2003 but new date.

VHF/UHF-Tagung München 2004

After a few years there will take place the VHF/UHF-Tagung again in Munich on March 13th/14th 2004.

News

24 GHz Changes

According to last years IARU decisions starting from January 1st 2004 only the range 24.048 to 24.050 GHz is recommended for narrow mode use. The calling QRG is 24.048,200 MHz. The beacons also change down 144 MHz. There is no beacon coordination by the IARU on this band. Please send any info about new QRGs to info@dubus.de especially if they are different from the minus 144 MHz scheme.

New U.K. Laser Record

The UK distance record for laser communications has been beaten. On Wednesday the 8th of October 2003, David, G0MRF, and Allan, G8LSD, completed a contact on a wavelength of 670 nanometres over a distance of 76.1 kilometres. Further details are on www.r-type.org/laser/

Live MUF (by G7RAU) V. 6!

Livemuf is a telnet cluster application by G7RAU & EA6VQ with additional ability to calculate muf / qrb / qtf etc for sporadic e from 50mhz + up. The version 6 is available since November 2003. More info: www.g7rau.co.uk/

WSJT Update – JT65

K1JT made a major update to his WSJT software in November 2003. The latest version 4.0 (beta) has got a new improved JT65 mode that should substitute the JT44 mode.

WiMax on 6 and 13cm!

Intel and the israelian company Alvarion have started to develop computer chips and products according to the new IEEE 802.16a standard. This standard is also called "Worldwide Interoperability for Microwave Access" or short "WiMax". This standard should enable broadband internet access on the last mile via microwave link. Also mobile users should be connected with this system. In January 2003 the standard was redefined and now microwave bands between 2 and 11 GHz were selected for this system. We can expect that the 13cm and 6cm amateur radio bands will be seriously affected when this system will be on the market.

SEC and NOAA with problems

The U.S. organisations SEC and NOAA that are providing many data regarding weather and spaceweather may get drastical financial cuts by the U.S. government in 2004. It was said that a "normal" work of these organisations will not be possible any more if these cuts will come true. Especially the data from the SEC are most important for the forcasts of Radio Aurora on VHF and Aurora research.

4m in OX

Following OY and OZ also Greenland (OX) has released the 4m-band for amateur radio lately.

Redaktionsschluss für Aktivitätsberichte und redaktionelle Beiträge für DUBUS 1/2004 ist der 5. März 2004.
Deadline for reports etc. for DUBUS 1/2004 is March 5th 2004

-> PSE send us any possible info for the next beacon list in DUBUS 1/2004!!

DUBUS Toplists

50 MHz Toplist

NR	Call	WW Loc	Wkd Sqr	DXCC	Tropo	Aurora	MS	Es	(ODX) F2
1	K1TOL	FN44	1162	167	0	0	0	0	0
2	ON4IQ	JO20	1151	212	1180	1952	1975	9007	16802
3	ON4GG	JO20	1100	213	813	1757	1695	8317	16727
4	DL7QY	JN59	1088	211	741	1665	2186	0	27926
5	VE1YX	FN74	1082	167	0	0	0	0	0
6	PA0HIP	JO21	1055	211	0	0	0	0	0
7	PY5CC	GG54	1052	219	0	0	0	0	0
8	IK0FTA	JN61	1043	217	0	0	0	0	0
9	G0JHC	IO83	1041	202	0	0	0	0	0
10	IK2GSO	JN45	1038	211	0	0	0	0	0
11	SM7FJE	JO65	1817	199	0	0	0	0	0
12	W3EP	FN31	1014	145	0	0	0	0	0
13	W5OZI	EM00	1011	149	0	0	0	0	0
14	SM7AED	JO65	1004	193	0	0	0	0	0
15	PA0RDY	JO22	1000	189	750	1617	1597	0	16320
16	G4IGO	IO80	974	197	578	1308	2528	7301	16188
17	EH8BPX	IL18	968	178	0	0	0	0	0
18	G4UPS	IO80	930	184	0	0	0	0	0
19	DL7AV	JN58	922	198	0	0	0	0	0
20	DL9USA	JO71	909	183	0	0	0	0	0
21	G3WOS	IO91	905	203	0	0	0	0	0
22	ON4AOI	JO21	894	193	0	0	0	0	0
24	SV1DH	KM17	892	225	0	0	0	0	0
25	F5JKK	IN87	878	184	0	0	0	0	0
26	PA7MH	JO22	872	182	0	0	0	0	0
27	TI5KD	EJ79	866	135	0	0	0	0	0
28	ON4KST	JO20	856	163	801	1415	1509	8374	16498
29	I0JX	JN61	846	209	0	0	0	0	0
30	GW3MFY	IO81	842	188	0	0	0	0	0
31	G3IMV	IO91	842	185	0	0	0	0	0
32	DL8PM	JO40	838	172	0	0	0	0	0
33	IZ5EME	JN52	836	176	583	0	1712	5216	15152
34	SP4MPB	KO03	831	181	710	1836	1507	8290	17521
35	ON4PS	JO20	823	162	752	1740	1902	6520	16358
36	SP6GWB/P	JO80	821	167	696	1774	1880	8583	17887
37	SP6MLK/P	JO80	821	125	1051	1610	1511	8557	27874
38	OZ8ABE	JO45	821	166	0	0	0	0	0
39	9H1BT	JM75	820	229	0	0	0	0	0
40	F8OP	JN26	820	167	631	1023	1369	5508	13547
41	DL6AMI	JO50	820	166	0	0	0	0	0
42	I0WTD	JN61	820	201	0	0	0	0	0
43	OZ3ZW	JO54	804	160	0	0	0	0	0
44	PA7FM	JO21	803	162	0	0	0	0	0
45	OK1DDO	JO60	802	161	620	1423	1340	6100	16266
46	SM6CMU	JO57	790	169	762	1452	1642	5922	0
47	DL8HCZ	JO53	776	115	365	1250	1356	3350	0
48	DL3AMA	JO51	764	155	519	1431	1600	4001	14810
49	PA2V	JO22	764	155	0	0	0	0	0
50	GJ4ICD	IN89	758	167	0	0	0	0	0
51	DJ6MB	JO30	754	162	0	1058	0	2685	16042
52	OZ1IEP	JO65	721	142	1986	1318	0	5832	0
53	G3ZYY	IO70	720	183	0	0	0	0	0
54	PA9KT	JO33	715	177	0	0	0	0	0
55	WA1ECF	FN41	714	108	0	0	0	0	0
56	EH3LL	JN01	709	169	0	0	0	0	0
57	DL1EJA	JO31	708	159	0	0	0	0	0
58	PE9DX	JO33	700	167	0	0	0	0	0
59	F9DI	JN23	695	179	284			2432	
60	YO7VS	KN14	689	164	0	0	0	0	0
61	OZ1DPR	JO45	686	145	0	0	0	0	0
62	S52SK	JN76	670	188	0	0	0	0	0
63	EH9IB	IM85	670	158	0	0	0	0	0
64	PE1HWO	JO21	660	144	835	2110	1674	6061	15177
65	PA2TAB	JO32	659	152	857	1370	1809	5797	15339
66	F5DE	JN05	658	149	860	704	1368	3638	15789
67	OK1FFD	JO60	654	148	580	1231	1380	7450	14773
68	IZ1EPM	JN35	647	176	0	0	0	0	0
69	DF7RG	JN68	639	136	652	1576	824	4864	14802
70	IW1AZJ	JN35	638	158	445	800	1341	3221	15261
71	I4XCC	JN63	630	140	707	0	1427	4456	18627
72	CT1EEB	IN50	624	183	0	0	0	0	0
73	OK2ZW	JN89	618	138	1681	0	0	0	15580
74	IK5JWQ	JN52	616	151	820	0	1485	5908	15237
75	PA3ECU	JO32	606	132	0	0	0	0	0
76	YL3AG	KO26	591	131	691	1817	0	8115	14305
77	DL2DR	JO31	577	115	1003	0	0	4769	12047
78	DL7HG	JO62	568	115	0	0	0	0	15600
79	OK1KT	JO70	561	121	0	1545	1486	4377	15999
80	7Q7RM	KH74	548	119	0	0	0	0	0
81	DJ6XV	JO31	535	109	512	1007	1130	4805	11502
82	SP6GZZ	JO81	529	0	515	1394	1826	8103	14443
83	PA5DD	JO22	516	130	0	0	0	0	0
84	OK1VBN	JN78	512	92	455	1496	897	8790	14645
85	ES1CW	KO29	503	104	959	1968	2116	6337	13090
86	DL6NCI	JO50	503	132	708	1294	505	7815	14239
87	HB9SJV	JN26	496	126	526	769	1475	5785	27696
88	YO2IS	KN05	465	109	412	1253	1404	7775	15931
89	ES2RJ	KO29	458	88	971	1923	2052	4642	13682
90	ON1IM	JO11	456	106	223	1278	1302	5607	16205
91	OK1FAV	JO60	444	96	0	579	1093	6250	12924
92	ES2WX	KO29	443	85	562	1924	1847	4651	13682
93	ES1AJ	KO29	439	94	415	1710	1850	3340	13694
94	ES2QN	KO29	437	81	848	2380	1963	5689	13098
95	DL4ALI	JO50	431	87	464	628	1850	3969	12195
96	DL9GU	JN49	402	0	721	450	0	8500	15625
97	PA2CHR	JO22	400	111	740	1403	0	5215	9322
98	DG1VL	JO61	396	81	430	1336	0	4697	10502
99	ES2NA	KO29	393	80	883	1870	1983	4647	11576
100	OK1MP	JO70	390	82	1125	1077	1753	3541	13452
101	ES2RW	KO29	382	55	410	1896	0	3827	9515
102	OK1IBL	JO60	377	77	530	1320	1717	6941	11816
103	SP2IQW	JO94	367	68	631	1537	1470	4034	10964
104	ES1II	KO29	367	81	335	1569	1410	3325	13978
105	DL8GAP	JN48	365	73	365	0	0	6924	13801
106	DL6BF	JO32	365	71	1193	1326	0	4955	11582
107	HB9AOF	JN36	350	82	500	0	0	5400	10663
108	F5PAU	IN88	345	90	0	0	0	0	0
109	ES1RF	KO29	340	63	340	1250	0	2800	11549
110	DL1SUZ	JO53	338	71	546	1434	865	5921	11859
111	DK9KX	JO30	337	186	0	0	0	0	0
112	SM3BIU	JP73	336	77	907	1704	1982	4414	0
113	LY2SA	KO14	336	74	374	960	904	4031	12947
114	ES4EQ	KO39	334	63	392	1869	0	4750	13005
115	PE1OGF	JO21	332	76	0	0	0	0	0
116	SM7JUQ	JO65	331	84	372	1349	1062	3900	14070
117	OZ7IS	JO65	324	84	410	1294	850	3100	0
118	F8CS	JN27	313	68	336	0	0	7454	9753
119	ES6QB	KO37	310	74	450	625	0	5145	13410
120	ES3BR	KO29	309	55	387	1900	1600	4536	11530
121	DC9YC	JO31	306	68	666	1154	0	5112	11921
122	I3ZVN	JN55	304	69	532	0	0	5742	8422
123	OE1SOW	JN88	302	68	0	0	0	0	11921
124	ES1MW	KO29	298	60	315	650	0	3972	9619
125	DF1EQ	JO31	295	0	279	0	0	2769	11510
126	ES5AM	KO38	289	53	452	1754	1981	4500	12923
127	DL3YEE	JO42	284	69	540	1056	1300	2700	13053
128	LZ1AG	KN22	559	148	375	0	1390	3941	10628
129	HB9STY	JN36	280	65	367	0	1431	4448	7810
130	ES2QH	KO29	279	60	372	1740	1710	2542	13682
131	DL7YS	JO62	275	64	342	461	1086	3547	8767
132	F1FIH	JN23	273	48	796	0	1637	2492	15613
133	ES2CM	KO29	270	56	353	1841	1228	4236	1153
134	CT1HZE	IM57	266	55	0	0	0	0	0
135	ES0HD	KO18	264	51	400	1111	0	2430	0

144 MHz Toplist (without EME)

NR	Call	WW Loc	Wkd Sqr	DXCC	Tropo	Aurora	MS	Es	(ODX) Iono
1	DK1KO	JO53	706	0	2124	2057	2210	3285	1484
2	DK3WG	JO72	681	72	2243	2034	2295	2782	1954
3	PA3BIY	JO22	630	64	1550	2026	2205	3143	0
4	DL8EBW	JO31	607	66	1454	1918	2123	2305	0
5	DF8LC	JO53	600	70	2105	2045	2226	3291	0
6	PA0RDY	JO22	568	67	1582	1979	2272	2819	0
7	DL8HCZ	JO53	566	60	1615	1976	2096	3527	1500
8	OH5LK	KP30	538	0	1962	2041	2235	2891	0
9	PA2CHR	JO22	535	67	1514	2171	2240	3212	1732
10	SM6CMU	JO57	534	0	1760	1928	2280	2540	0
11	I2FAK	JN45	529	0	1797	1508	2405	2995	1645
12	PA3FOC	JO21	522	59	1373	2010	2209	2326	0
13	SP6GZZ	JO81	520	0	1670	1794	2017	2717	0
14	I4XCC	JN63	520	77	1188	1826	2364	3248	1746
15	SP9EWU	JO90	517	63	1710	1927	2154	2871	0
16	DK6AS	JO52	516	0	1460	1885	2510	2260	0
17	HA1YA	JN87	513	72	1548	1876	2183	2885	0
18	DD0VF	JO61	510	62	1736	1701	2045	2617	0
19	DL3AMA	JO51	505	61	1785	1803	1925	2403	0
20	DK0OG	JN68	500	67	1708	1975	2172	3322	1543
21	DH3YAK	JO31	498	61	1424	1162	2105	2650	0
22	DJ7OF	JO51	489	63	1512	1518	2152	2156	0
23	PA3ECU	JO32	484	58	1721	2106	2018	3238	0
24	PA3DZL	JO21	484	59	1405	1851	2167	3107	0
25	LY2WR	KO24	483	57	2051	2075	2347	3007	0
26	SP4MPB	KO03	469	53	1886	1764	2090	2697	0
27	ON4IQ	JO20	469	67	1420	1965	2150	2725	0
28	DL8LAQ	JO43	465	0	1377	1858	2104	3304	0
29	ON4GG	JO20	464	68	1420	1965	2150	2124	0
30	YU7EW	KN05	463	67	1404	1868	2179	2430	2082
31	YU7MS	KN05	462	62	1319	1856	2160	2438	2130
32	IZ5EME	JN52	458	65	1590	0	2090	2893	2030
33	SK6HD	JO68	451	0	1911	1857	2172	2479	0
34	OH7PI	KP32	451	0	1902	1926	2151	2489	0
35	PE1HWO	JO21	448	64	1500	1403	2279	2618	0
36	OK2ZW	JN89	445	56	1417	1775	2113	2471	0
37	F8OP	JN26	432	63	1228	1196	2028	2720	0
38	OK2VMD	JN89	428	58	1662	1765	2031	3605	0
39	OK1KT	JO70	421	58	1411	1545	1900	2808	0
40	YO2IS	KN05	417	67	1360	1916	2130	2556	0
41	PA4VHF	JO32	416	0	1536	1337	2085	2086	0
42	ES2WX	KO29	415	40	1370	1950	2270	2071	0
43	IW1AZJ	JN35	411	62	1115	1188	2151	2780	0
44	OK1FM	JN69	403	56	1843	1438	2200	2150	0
45	ES6RQ	KO37	391	37	1500	1840	2172	1725	0
46	HB9Q	JN47	391	66	1404	1288	2060	2959	0
47	OK1JKT/P	JO60	389	52	1701	1764	2121	2269	0
48	F8CS	JN27	387	54	1161	1468	2124	3231	0
49	I4YNO	JN54	386	67	1357	1065	2242	2250	0
50	OE6IWG	JN77	384	61	1221	1110	2220	2126	1214
51	YL3AG	KO26	374	39	1552	1912	0	2452	0
52	UT5ER	KN78	370	0	1975	2014	2135	2525	1634
53	S50C	JN76	369	62	1463	1817	2233	3356	1608
54	DL1KDA	JO30	366	59	1388	1924	2101	2339	0
55	SM7JUQ	JO65	365	41	1902	1646	1921	2332	0
56	DL6BF	JO32	363	50	1542	1932	1814	2332	0
57	F6DKW	JN18	363	53	1519	1712	2051	2780	0
58	IK1PAG	JN35	361	57	1186	0	2254	2725	0
59	DL7YS	JO62	360	53	1512	1528	1826	2136	0
60	PA0WWM	JO22	359	56	1303	1839	1997	2394	0
51	ES2RJ	KO29	358	40	1190	1861	2000	2127	0
52	OE3OKS	JN87	356	59	1441	1273	1867	2788	0
63	SM3BIU	JP73	353	32	1460	1844	2260	2242	0
64	UR5BAE	KN29	351	53	1994	1924	1866	2492	0
65	PA5DD	JO22	351	51	1452	1829	2098	2307	0
66	YU7VA	KN05	350	60	1316	1399	1954	2446	0
67	F1FIH	JN23	350	58	1305	999	1926	2934	0
68	YU1WP	JN94	346	53	1422	1850	2236	2825	1953
69	PA2DWH	JO22	345	59	1230	1950	2150	2250	0
70	OK2BFH	JN99	340	46	2092	1929	1699	3790	0
71	YU7EF	KN05	340	58	1135	987	2248	2440	2373
72	OZ1IEP	JO65	339	52	1638	1542	2177	2328	0
73	PE1OGF	JO21	338	58	1391	1602	1959	2259	1856
74	G3LQR	JO02	337	0	1776	2031	0	2406	0
75	DK1KR	JO53	336	0	1481	2103	0	2375	0
76	OK1DKS	JO70	334	56	1230	1308	0	3530	0
77	ON4KHG	JO10	332	51	1507	1592	2094	2312	0
78	F5HRY	JN18	330	55	1276	1695	2038	2758	0
79	ON4PS	JO20	323	53	1449	1878	2082	2364	0
80	HB9DFG	JN37	323	56	1367	1360	1942	2987	1450
81	LY2SA	KO14	322	48	1906	1846	2220	2088	0
82	OK1FFD	JO60	322	54	1388	1808	1991	2197	0
83	DB6BX	JO32	321	55	1534	1541	1921	2126	0
84	ON1IM	JO11	320	42	1420	1310	1865	2306	0
85	OK1MG	JO70	319	50	1522	1685	1549	2631	0
86	ON4KST	JO20	314	54	1435	1612	1940	2383	0
87	DL1SUZ	JO53	313	47	1238	1661	1963	2309	0
88	PA2TAB	JO32	312	53	1302	1239	2103	2183	0
89	LA0BY/p	JO59	311	44	1405	1531	2196	2676	0
90	OK1DFC/P	JO60	310	52	1775	2453	2289	2453	0
91	ES2XM	KO29	308	37	1389	2198	0	2222	0
92	RW3PF	KO93	306	39	2039	2171	2243	2543	0
93	SP6GWB/P	JO80	306	47	1780	1581	1875	2437	0
94	G4LOH	IO94	304	46	3130	2143	2045	2480	1831
95	ES4EQ	KO39	302	39	1541	1840	2240	2245	0
96	OK1AXH	JO70	300	0	2142	1486	1366	1768	0
97	DF1IAZ	JN49	299	54	1038	1177	2069	1996	0
98	DG1VL	JO61	298	47	1373	1223	1817	2325	0
99	PA0BAT	JO31	292	49	1535	2041	2498	2366	0
100	SP2JXN	JO94	289	41	1650	1690	0	2634	0
101	DK2BJ	JO30	287	49	1476	1934	1593	2231	0
102	DH0GHU	JN38	284	49	1170	1170	2117	3067	0
103	OM7AQ	JN98	281	50	1484	1961	2085	2483	0
104	ES3GZ	KO28	281	35	1495	1720	2134	2101	0
105	HA8V	KN06	296	43	1062	1807	2062	2162	0
106	ES5WE	KO38	278	32	1406	1695	1934	2530	0
107	PA0ZM	JO32	268	45	1156	1771	2061	2246	0
108	YU7KB	JN94	268	42	1072	0	2137	2367	1532
109	DH8GV	JO33	267	42	1565	1018	1102	2450	0
110	OK1IBL	JO60	266	50	1438	1462	2003	3398	0
111	GM4JJJ	IO86	261	44	3253	1804	1868	2858	0
112	RK3AF	KO85	253	35	1244	1780	2202	2605	0
113	YU1GT	KN04	252	42	1650	1410	1310	2160	0
114	LZ1AG	KN22	252	43	915	0	1779	2534	0
115	ES1RF	KO29	252	30	1184	1820	1978	2084	0
116	DK1VI	JN49	251	50	1270	1215	1604	3165	0
117	DH9NBB	JN49	249	54	1363	1228	1846	2039	0
118	YU1VG	JN94	248	47	1407	826	1727	2294	1982
119	DC9YC	JO31	247	44	1548	1724	1849	1822	0
120	OK1VMS	JO70	246	51	1692	1423	0	2587	0
121	F5PAU	IN88	246	46	1630	0	0	2425	0
122	HA8MV	KN06	245	38	1062	1736	2026	2162	0
123	OK1PG	JO70	243	50	1773	1243	0	3488	0
124	G3XDY	JO02	243	41	1355	2049	1835	2135	0
125	DG3XA	JO43	240	42	1371	965	1832	2333	0
126	OK2QI	JO80	238	50	1475	1686	1380	2050	0
127	OK1KEI	JO70	236	36	1861	1259	1482	2067	0
128	F5HGO	JN05	235	44	1782	0	2024	2486	0
129	F5DE	JN05	232	42	1891	1671	1892	2399	0
130	OK1VBN	JN78	225	45	1578	1682	1915	2209	0
131	G3LTF	JO02	250	0	2842	1824	1876	3032	1876
132	ES5EJ	KO38	218	30	1422	1804	0	2070	0
133	OK1DDO	JO60	218	46	1329	1500	1720	2418	0
134	DJ8ES	JO43	217	37	1306	1432	2034	2177	0

135	ES0IW	KO19	216	32	1545	1687	0	1861	0
136	IK4PMB	JN54	213	46	1150	0	2015	2446	0
137	DL2DR	JO31	212	39	1158	980	0	2057	0
138	CT1DYX	IN51	211	0	0	0	0	0	0
139	OK1DIG	JO60	208	42	1420	1684	1840	2218	0
140	ES0NW	KO19	207	30	1060	1720	1797	1965	0
141	DL0UL/P	JN48	207	37	1026	0	1839	2019	0
142	OK1IAS	JO60	205	41	1392	1957	0	2466	0
143	OK1SC	JO70	204	0	1490	1673	0	1729	0
144	YU7ON	KN04	203	37	914	0	1897	2273	1485
145	OE5VRL/5	JN78	201	0	1665	1634	1990	2157	0
146	OH0NC	JP90	201	26	1544	1982	1647	2493	0
147	PA0JUS	JO22	200	38	1409	1050	0	2167	0
148	ES8RO	KO28	199	27	1802	1800	0	1780	0
149	UA4AQL	LO20	199	23	1124	1994	2158	2195	0
150	IT9VDQ	JM68	197	45	1676	0	2169	2491	0
151	ES0SM	KO08	196	31	1578	1767	1991	0	0
152	DK2DB	JN48	195	0	1239	1136	0	3106	0
153	F1HDF/P	JN18	194	0	1452	0	0	2425	0
154	ES1OX	KO29	194	18	1016	1449	1158	2121	0
155	ON4ZN*	JO21	193	35	1390	980	0	2194	0
156	PA3AOH	JO31	191	41	1457	1341	1722	2345	0
157	DL3YEE	JO42	191	40	1574	1450	1480	2106	0
158	ES7RDR	KO27	189	31	1200	1750	1000	2101	0
159	ES0HD	KO18	187	23	1550	1918	0	0	0
160	HB9MIO/P	JN37	185	0	1316	975	0	2183	0
161	DG3HS	JO53	184	35	1152	1091	0	2306	0
162	ES5RY	KO38	183	32	1198	1695	2002	1409	0
163	YZ7MON	JN95	180	37	1004	0	1837	2279	1536
164	DK5WO	JO30	177	35	1474	1219	0	1993	0
165	SP2IQW	JO94	174	28	1611	1611	997	1877	0
166	OK1KOK	JO80	173	27	1486	1062	0	1920	0
167	HB9AOF	JN36	173	45	1201	670	1675	2166	0
168	OK1VEI	JO70	170	32	1677	1197	1398	0	0
169	ES1AO	KO29	169	25	1162	1176	1792	2136	0
170	DL3IAS	JN49	167	43	988	1123	1829	2171	0
171	OK1KRY	JN69	166	40	1437	977	0	1830	0
172	SP9FG	JN99	164	31	1647	1283	0	1798	0
173	ES1JL	KO29	163	17	1379	1596	0	0	0
174	OK1CDJ	JO70	159	42	1580	0	2066	2655	0
175	DL9MCC	JN58	159	36	1248	1414	2063	2095	0
176	ES1AW	KO29	158	25	1230	1680	0	1924	0
177	OK1CA	JO70	156	0	1540	1065	950	2096	0
178	DJ6XV	JO31	156	34	1337	992	0	2007	0
179	ES0BI	KO18	154	21	1439	1823	1528	0	0
180	ES2QN	KO29	152	22	1175	1460	0	2116	0
181	OZ7IS	JO65	151	32	1128	1294	1901	1845	0
182	ES6PZ	KO38	151	20	1101	0	0	2532	0
183	CT1FAK	IN50	149	25	2129	0	2250	2488	968
184	DK0PX	JN48	147	0	1161	0	1815	1649	0
185	ES1CW	KO29	142	21	1192	1570	0	2143	0
186	DL0GTH	JO50	139	23	1124	0	0	0	0
187	OK2UFB	JN99	136	27	1526	0	0	1983	0
188	RW4AK (sk)	LO20	136	0	1126	1480	2158	2301	0
189	ES5QA	KO38	135	35	1665	1788	1555	2236	0
190	OK1DTG/P	JO70	127	27	1351	1352	0	0	0
191	YU7AZX	KN04	126	30	914	0	1389	2173	1484
192	OZ1FF	JO45	125	35	974	1239	1520	2357	0
193	F1PYW	JN38	124	30	936	888	1522	1958	0
194	HB9S/P	JN36	123	24	1135	0	0	0	0
195	S53J	JN75	123	27	1123	1036	983	1984	0
196	OK1VDA	JO70	123	30	938	641	0	2220	0
197	F1PYR	JN19	120	0	0	0	0	0	0
198	F6FGO	JN25	118	31	1390	0	0	2218	0
199	OL5Z	JN89	118	26	1061	1621	0	0	0
200	OK2KJU	JN89	115	32	1318	1766	0	1494	0
201	DL0SP/P	JO62	115	23	1315	785	0	1608	0
202	OK2KKW	JO60	115	24	1040	0	0	0	0
203	OE1SOW	JN88	112	32	0	1286	0	2250	0
204	DL5NEN	JN59	106	30	748	0	1767	1640	0
205	OK1TEH	JO70	103	30	1191	1474	0	2058	0
206	I3ZVN	JN55	98	32	1212	0	0	2237	0
207	OK2PHM	JN89	97	20	829	1265	0	2262	0
208	CT1DDW	IN60	95	20	2100	0	0	2500	0
209	YU1EBC	JN94	94	28	907	0	1427	2179	1766
210	LA/DL7YS/P	JO37	93	22	1207	0	1673	0	0
211	DK0FLT	JN59	93	18	975	0	0	0	0
212	CT1DIN	IN60	91	18	1218	0	0	2338	0
213	OK1UDX	JN79	91	19	537	0	0	0	2197
214	DK2MN	JO32	87	19	858	0	0	0	0
215	CT1CAD	IM67	85	18	1304	0	0	2249	0
216	YU1AAV	KN04	71	21	828	0	0	2031	0
217	OK1HRR	JO70	66	16	762	0	0	1890	0
218	G7LRQ	IO91	60	19	1088	0	0	0	0
219	OK2DTF	JN79	60	16	805	0	1607	1533	0
220	SP6MLK/P	JO80	58	16	853	756	0	1446	0
221	DG7SFL	JN49	57	11	759	0	0	1750	0
222	OK1VVW	JO70	55	15	913	0	1339	1096	0
223	F5OIH/P	JN08	49	8	666	0	0	0	0
224	IW3HTU	JN55	43	13	1180	0	0	0	0
225	F1JKY	JN25	41	10	798	0	400	991	0
226	IZ0BXT	JN63	37	12	804	0	0	1946	0
227	YZ1MGN	KN04	14	6	489	0	0	1653	0

432 MHz Toplist (without EME)

NR	Call	WW Loc	Wkd Sqr	DXCC	Tropo	Aurora	MS	Es	(ODX) Iono
1	DK3WG	JO72	217	43	1547	1591	0	0	0
2	PA0EZ	JO22	209	35	1787	1445	0	0	0
3	PA0RDY	JO22	207	38	1979	1807	1376	0	0
4	G3LQR	JO02	206	0	2031	1613	0	0	0
5	PA0WWM	JO22	200	38	1547	1836	0	0	0
6	HA1YA	JN87	190	43	1438	1221	0	0	0
7	DL8QS	JO43	189	35	1513	1513	0	0	0
8	OZ7IS	JO65	188	32	1499	1048	1294	0	0
9	OK1AXH	JO70	181	0	1861	1239	0	0	0
10	G3XDY	JO02	179	29	1589	1619	0	0	0
11	DB6BX	JO32	174	34	1550	662	0	0	0
12	DL7QY	JN59	173	0	1640	1848	1292	0	0
13	PA3DZL	JO21	172	32	1405	1851	1864	0	0
14	SM7ECM	JO65	171	27	1609	1073	0	0	0
15	DJ6MB	JO30	171	0	1278	1733	0	0	0
16	LY2WR	KO24	169	26	1995	1593	1935	0	0
17	F6DKW	JN18	168	23	1519	0	0	0	0
18	DK1KO	JO53	167	0	1643	694	0	0	0
19	DB6NT	JO50	166	32	1823	0	0	0	0
20	DK6AS	JO52	164	0	1569	775	0	0	0
21	SP6MLK/P	JO80	162	31	1780	0	0	0	0
22	DF8LC	JO53	161	0	1615	1361	0	0	0
23	PA4FP	JO33	156	32	2114	1010	0	0	0
24	SP6GWB/P	JO80	155	30	1780	759	0	0	0
25	DK1KR	JO53	154	0	1400	1827	0	0	0
26	OK2BFH	JN99	153	31	1914	0	0	0	0
27	PA2CHR	JO22	153	34	1445	1751	1099	0	0
28	OZ2OE	JO45	152	27	2216	1020	0	0	0
29	SM6ESG	JO67	152	26	1436	712	0	0	0
30	YL3AG	KO26	150	20	1571	1041	0	0	0
31	DH3NAN	JO50	147	0	1437	1008	0	0	0
32	OK1CA	JO70	146	0	1670	0	0	0	0
33	DL3YEE	JO42	144	29	1574	1728	0	0	0
34	PA3AOH	JO31	148	27	1530	573	0	0	0
35	ES2WX	KO29	140	17	1232	1415	0	0	0
36	OK1KEI	JO70	138	27	1682	1185	0	0	0
87	OZ1IEP	JO65	138	28	1470	0	0	0	0
38	SP9FG	JN99	137	26	1660	0	0	0	0
39	OH0NC	KP00	136	20	1598	920	0	0	0
40	OK1VEI	JO70	136	21	1532	811	0	0	0

41	SP9EWU	JO90	135	30	1589	1558	1664	0	0
42	OK1KIR/P	JO60	133	28	1773	0	0	0	0
43	PA0BAT	JO31	133	24	1535	413	0	0	0
44	PA0JUS	JO22	133	26	1340	0	0	0	0
45	OH5LK	KP30	132	0	1386	1196	0	0	0
46	OK1VMS	JO70	131	32	1434	972	0	0	0
47	PA3ECU	JO32	128	27	1385	808	0	0	0
48	ON4PS	JO20	127	23	1425	721	0	0	0
49	PA0ZM	JO32	122	25	1358	1693	0	0	0
50	OE5VRL/5	JN78	121	0	1524	1031	0	0	0
51	OK2KKW	JO60	120	26	1186	0	0	0	0
52	F5PAU	IN88	119	24	1630	0	0	0	0
53	DK0OG	JN68	119	30	1493	901	0	0	0
54	ON4ZN	JO21	119	22	1173	0	0	0	0
55	PA5DD	JO22	117	23	1462	1025	1808	0	0
56	OK2QI	JO80	114	25	1410	0	0	0	0
57	DL3AMA	JO51	114	22	1015	1219	0	0	0
58	DL0UL/P	JN48	113	22	1238	0	0	0	0
59	DL6BCT	JO43	113	0	1152	0	0	0	0
60	DJ6XV	JO31	113	19	1128	976	0	0	0
61	SP6GZZ	JO81	112	0	1549	870	0	0	0
62	PE1OGF	JO21	112	18	1288	0	0	0	0
63	G3LTF	JO01	111	0	2842	1602	0	0	0
64	DH9NBB	JN49	109	24	1363	0	0	0	0
65	DL2DR	JO31	109	21	1158	0	0	0	0
66	SM6CMU	JO57	108	0	1641	670	0	0	0
67	F1HDF/P	JN18	108	0	1204	0	0	0	0
68	DL0GTH	JO50	106	20	1113	0	0	0	0
69	DL4KG	JO31	105	21	1273	0	0	0	0
70	DG3XA	JO43	105	17	1131	0	0	0	0
71	OK1DFC/P	JO60	104	22	1179	0	0	0	0
72	DK5WO	JO30	104	20	1150	0	0	0	0
73	DC4XH	JO43	104	20	1133	808	0	0	0
74	ES6RQ	KO37	103	19	1452	1148	0	0	0
75	DJ8ES	JO43	103	16	1160	0	0	0	0
76	OK1AIY/P	JO70	102	0	1490	0	0	0	0
77	ON1IM	JO11	102	20	1410	0	0	0	0
78	DL1KDA	JO30	102	22	1286	999	1334	0	0
79	F5HRY	JN18	102	18	1222	583	0	0	0
80	OK1DKS/P	JO60	102	23	1118	0	0	0	0
81	PE1HWO	JO21	101	20	1315	369	0	0	0
82	DL1SUZ	JO53	101	18	1218	707	0	0	0
83	ON4GG	JO20	98	23	1407	0	0	0	0
84	LY2SA	KO14	97	20	1669	946	0	0	0
85	F5HGO	JN05	97	17	1237	0	0	0	0
86	ON4IQ	JO20	96	23	1407	0	0	0	0
87	DH8GV	JO33	95	19	1259	0	0	0	0
88	DL6BF	JO32	94	15	882	894	0	0	0
89	OK1KRY	JN69	93	23	1350	0	0	0	0
90	DK2DB	JN48	92	0	1331	0	0	0	0
81	ES2XM	KO29	92	11	1271	1259	0	0	0
92	S50C	JN76	91	18	977	0	0	0	0
93	OK1KPA	JN79	89	0	1176	0	0	0	0
94	DK0PX	JN48	89	0	1168	0	0	0	0
95	OK1OKL	JO60	88	0	1199	0	0	0	0
96	ES2RJ	KO29	87	17	1261	1123	0	0	0
97	DK1VI	JN49	87	21	1125	936	0	0	0
98	IZ5EME	JN52	86	20	1458	1670	374	0	0
99	DG1VL	JO61	86	16	1245	0	0	0	0
100	HB9MIO/P	JN37	84	0	1096	0	0	0	0
102	HB9AOF	JN36	84	15	926	0	0	0	0
102	ES0HD	KO18	83	19	1565	614	0	0	0
103	OK1KOK	JO80	81	22	1486	0	0	0	0
104	OK1MG	JO70	81	21	1329	691	0	0	0
105	DL7YS	JO62	81	18	1100	0	0	0	0
106	OZ1FF	JO45	81	18	1092	633	0	0	0
107	I4YNO/4	JO54	81	17	897	0	0	0	0
108	DL9MCC	JN58	80	20	1338	0	0	0	0
109	DF1EQ	JO31	80	0	1249	0	0	0	0
110	ES4EQ	KO39	80	16	1160	907	0	0	0
111	ES0IW	KO19	79	17	1342	906	0	0	0
112	DL5NEN/P	JN59	76	16	964	0	0	0	0
113	DH3YAK	JO31	75	13	1165	0	0	0	0
114	F1PYR	JN19	75	0	0	0	0	0	0
115	OK1FFD	JO60	74	23	1339	0	0	0	0
116	DG6GP	JN48	74	13	1024	0	0	0	0
117	OK1KRQ/P	JN69	73	16	1091	0	0	0	0
118	LA0BY/p	JO59	72	12	1261	790	0	0	0
119	OK1SC	JO70	71	0	1310	758	0	0	0
120	OM7AQ	JN98	71	14	922	0	0	0	0
121	OK2PWY	JN89	70	17	1135	0	0	0	0
122	OL5Z	JN89	70	15	761	0	0	0	0
123	DL0SP/P	JO62	69	13	1018	0	0	0	0
124	OK1DTG/P	JO70	68	14	1436	0	0	0	0
125	DK2MN	JO32	67	13	715	0	0	0	0
126	RW3PF	KO93	66	15	1875	1697	0	0	0
127	DD0VF	JO60	66	18	1106	0	0	0	0
128	SM7JUQ	JO65	65	15	1232	0	0	0	0
129	UR5BAE	KN29	64	18	1517	0	0	0	0
130	HB9CRQ	JN47	63	16	1010	0	0	0	0
131	DL3IAS	JN49	63	12	886	0	0	0	0
132	ES5WE	KO38	62	11	1406	0	0	0	0
133	SK6HD	JO68	62	0	811	0	0	0	0
134	DG7SFL	JN49	61	10	947	0	0	0	0
135	F6FGO	JN25	60	11	1016	0	0	0	0
136	ES0NW	KO29	59	17	1213	675	0	0	0
137	ES0SM	KO08	59	20	1202	925	0	0	0
138	DK2BJ	JO30	59	16	1053	0	0	0	0
139	OK2UFB	JN99	56	20	1232	0	0	0	0
140	DH0GHU	JN38	56	12	852	0	0	0	0
141	HA8MV	KN06	56	15	831	1500	0	0	0
142	OK1VBN	JN78	56	14	723	753	0	0	0
143	YO2IS	KN05	55	15	1020	1741	1030	0	0
144	LA/DB1DI/P	JO37	55	12	1013	0	0	0	0
145	OK1PG	JO70	54	18	1773	0	0	0	0
146	ES3GZ	KO28	52	10	1035	0	0	0	0
147	RB5EF	KN78	50	0	1805	0	0	0	0
148	F5DE	JN05	50	8	740	0	0	0	0
149	SP2JXN	JO94	49	15	1149	0	0	0	0
150	OK1TEH	JO70	49	15	912	0	0	0	0
151	S53J	JN75	49	9	688	0	0	0	0
152	ES1JL	KO29	48	11	1324	0	0	0	0
153	DK0FLT	JN49	48	14	695	0	0	0	0
154	ES1RF	KO29	47	10	875	682	0	0	0
155	F5OIH/P	JN08	46	5	651	0	0	0	0
156	DL5NEN	JN59	46	13	630	0	0	0	0
157	SM3BIU	JP73	45	3	917	763	0	0	0
158	GM4JJJ	IO86	44	15	1457	297	0	0	0
159	I3ZVN	JN55	43	13	1197	0	0	0	0
160	OE1PLW	JN88	42	12	1114	0	0	0	0
161	OK2KJU	JN89	42	13	731	0	0	0	0
162	OK1KT	JO70	40	7	1289	757	0	0	0
163	OK1HRR	JO70	40	13	765	0	0	0	0
164	OK2PHM	JN89	39	9	746	0	0	0	0
165	G7LRQ	IO91	37	15	1208	0	0	0	0
166	DF5JJ	JO43	37	9	662	0	0	0	0
167	OK2VMU/P	JN99	36	11	880	0	0	0	0
168	ES1AO	KO29	35	12	1131	0	0	0	0
169	DF0RU	JO62	35	9	682	0	0	0	0
170	ES0ZA	KO19	33	8	1077	0	0	0	0
171	ES1DF	KO29	32	7	511	0	0	0	0
172	ES1CW	KO19	32	7	500	688	0	0	0
173	F1FIH	JN23	30	16	796	0	0	0	0
174	ES0IC	KO18	30	7	673	0	0	0	0
175	OK1DIG	JO60	28	28	640	0	0	0	0
176	ES5MG	KO38	28	9	626	0	0	0	0
177	ER5MG	KO38	28	9	626	0	0	0	0
178	ES0B I	KO18	28	7	378	0	0	0	0
179	ES1CR	KO29	27	12	930	0	0	0	0
180	ES5QA	KO38	26	8	803	0	0	0	0

1296 MHz Toplist

NR	Call	WW	Wkd	DXCC	ODX
1	PA0EZ	JO22	141	24	1460
2	PA0WWM	JO22	135	24	1298
3	G3XDY	JO02	131	25	1561
4	PA0RDY	JO22	124	27	1286
5	DB6NT	JO50	123	24	1283
6	F6DKW	JN18	123	22	1273
7	OK1AXH	JO70	118	0	1444
8	G3LQR	JO02	118	0	1274
9	HB9AMH/P	JN37	114	0	1351
10	SM7ECM	JO65	111	18	1541
11	SP6GWB/P	JO80	101	24	1580
12	PA0BAT	JO31	101	22	1368
13	SM6ESG	JO67	99	19	1445
14	DB6BX	JO32	99	25	1125
15	SP6MLK/P	JO80	92	23	1580
16	OE5VRL/5	JN78	92	18	1524
17	OZ2OE	JO45	92	17	1425
18	OK1KIR/P	JO60	92	22	1208
19	OK2BFH	JN99	91	20	1713
20	F5PAU	IN88	89	19	1630
21	G6DER	IO93	89	20	1306
22	PA3DZL	JO21	89	19	1000
23	PA3AOH	JO31	88	21	1376
24	SM0DFP	JO89	87	16	1155
25	DL7QY	JN59	86	0	1261
26	OK1DFC/P	JO60	86	17	1177
27	DK1KR	JO53	86	0	1097
28	PA4FP	JO33	86	17	957
29	DL3YEE	JO42	85	16	1136
30	DK0OG	JN68	83	19	1161
31	OK1VEI	JO70	82	14	1313
32	OZ7IS	JO65	82	18	1205
33	F5HRY	JN18	82	13	1064
34	DK6AS	JO52	81	0	1421
35	OK1KEI	JO70	81	16	1316
36	F1HDF/P	JN18	80	9	886
37	PA5DD	JO22	79	18	1302
38	HB9AOF	JN36	77	15	975
39	DC9YC	JO31	74	16	1046
40	DL0UL/P	JN48	74	17	962
41	OK1AIY/P	JO70	73	0	1490
42	OK1VMS	JO70	73	19	1302
43	PA0JUS	JO22	72	16	1265
44	HB9MIO/P	JN37	72	0	1000
45	DH3NAN	JO50	71	0	1143
46	DH9NBB	JN49	71	13	1016
47	OK1CA	JO70	70	0	1421
48	PA0ZM (sk)	JO32	69	16	1329
49	DK5WO	JO30	69	16	1137
50	DL2DR	JO31	68	13	1158
51	DC4XH	JO43	67	14	1090
52	DL0GTH	JO50	67	16	1073
53	DF1EQ	JO31	67	0	908
54	OK2KKW	JO60	66	18	1128
55	ON4PS	JO20	65	14	1098
56	PA2CHR	JO22	64	18	1352
57	G3LTF	JO01	63	0	1417
58	OK1OKL	JO60	63	0	1177
59	SP9FG	JN99	62	17	1492
60	OK1DKS/P	JO60	62	13	1207
61	DL1SUZ	JO53	61	14	968
62	OK1FFD	JO60	60	14	1058
63	DJ8ES	JO43	60	10	1025
64	ON4GG	JO20	60	10	982
65	OH0NC	KP00	57	13	1592
66	ON4ANT	JO20	57	9	914
67	DJ6XV	JO31	56	11	946
68	DC8UG	JO30	56	10	900
69	DL3IAS	JN49	55	12	1079
70	DC0DA	JO31	55	1	1034
71	LY2WR	KO24	53	14	1026
72	F1PYR	JN19	53	0	0
73	PE1HWO	JO21	52	14	1315
74	DL3NQ	JN49	51	9	920
75	DK0FLT	JN59	51	12	684
76	DL1KDA	JO30	50	12	940
77	DJ1KP	JO40	50	0	698
78	OZ1FF	JO45	49	13	980
79	SP9EWU	JO90	48	12	946
80	5DK2MN	JO32	48	10	692
81	DK0PX	JN48	47	0	942
82	F6CGB	JN18	46	0	700
83	DF5JJ	JO43	43	11	815
84	S50C	JN76	43	12	626
85	IZ5EME	JN52	42	10	1036
86	DJ6MB	JO30	42	0	876
87	YL3AG	KO26	42	11	867
88	HA1YA	JN87	42	13	862
89	OK1KEI/P	JN79	41	10	740
90	ES2RJ	KO29	40	9	765
91	OK1KRQ/P	JN69	39	11	962
92	DK2DB	JN48	39	0	873
93	LA/DB1DI/P	JO37	38	9	1013
94	DK2BJ	JO30	38	10	886
95	DG1VL/P	JO61	37	7	723
96	ON4KHG	JO10	37	6	642
97	I0LVA/0	JN62	35	0	1152
98	G7LRQ	IO91	35	10	746
99	ES2WX	KO29	35	9	692
100	DG6GP	JN48	33	7	732
101	DH3YAK	JO31	33	5	715
102	ES4EQ	KO39	33	9	636
103	ES6RQ	KO37	33	9	600
104	F5HGO	JN05	32	4	796
105	HA8V	KN06	31	11	630
106	I4YNO/4	JN54	30	9	754
107	DK1VI	JN49	30	10	717
108	ES5WE	KO38	29	7	1249
109	DL7YS	JO62	29	7	535
110	I3ZVN	JN55	28	9	1197
111	IW3FZQ/4	JN54	27	7	732
112	ES0SM	KO08	26	8	873
113	F6FGO	JN25	26	4	839
114	OH5LK	KP30	25	0	1349
115	LA0BY/p	JO59	25	7	1098
116	OK1DTG/P	JO70	24	8	742
117	OK2QI	JO80	23	7	1275
118	F1FIH	JN23	23	6	605
119	OK1VBN	JN78	22	9	950
120	G4LDR	IO91	22	5	593
121	HA8MV	KN06	22	9	576
122	OK1PG	JO70	21	9	985
123	PE1OGF	JO21	21	6	588
124	OK2BFF/P	JO80	21	8	536
125	ON1IM	JO11	20	5	650
126	OK2VMU/P	JN99	20	7	570
127	DL0SP/P	JO62	20	5	430
128	OK1KRY	JN69	19	7	865
129	OK1KPA	JN79	19	0	783
130	OK2BBF	JN89	19	8	563
131	OL5Z	JN89	18	6	694
132	F5OIH/P	JN08	17	5	517
133	IW3HTU	JN55	16	4	838
134	S53J	JN75	16	6	410
135	DL5NEN	JN59	16	16	320
136	ES1RF	KO29	15	5	506
137	DG7SFL	JN49	15	3	358
138	OK1TEH	JO70	15	4	343
139	ES1AJ	KO29	14	5	531
140	ES2XM	KO29	14	5	478
141	DF0RU	JO62	14	3	373
142	ES2WR	KO29	13	5	694
143	ES0Z	KO18	13	5	453
144	F5DE	JN05	13	2	440
145	SM7JUQ	JO65	12	7	1061
146	ES1NJ	KO29	12	4	507
147	OM7AQ	JN98	12	5	426
148	ES1MW	KO29	11	4	507
149	ES0W	KO18	11	5	443
150	OK1SC	JO70	10	0	440
151	OK2PWY	JN89	10	6	357
152	OK2KJU	JN89	10	6	347
153	OK2PHM	JN89	10	0	341
154	IT9VDQ	JN68	9	1	899
155	ES1OX	KO29	9	5	772
156	ES1DW	KO29	9	5	330
157	DG3XA/P	JO43	8	4	664
158	YO2IS	KN05	8	5	472
159	OK1HRR	JO70	8	2	292
160	DL3AMA	JO51	8	3	162
161	ES1TCA	KO29	7	2	246
162	ES2NA	KO29	6	4	349
163	OK1ZVP	JO60	6	1	263
164	ES0NW	KO19	5	2	190

2320 MHz Toplist

1	PA0EZ	JO22	84	15	1028
2	PA0WWM	JO22	74	16	1155
3	DB6NT	JO50	73	15	1119
4	PA0RDY	JO22	65	15	1000
5	G3LQR	JO02	58	0	1006
6	G3XDY	JO02	55	13	1176
7	SM6ESG	JO67	53	8	1054
8	PA0BAT	JO31	52	14	923/682
9	OK1KIR/P	JO60	51	10	1115
10	OE5VRL/5	JN78	50	12	1291/495
11	SM7ECM	JO65	50	9	942
12	DL7QY	JN59	47	0	1018
13	G6DER	IO93	46	18	1265
14	OK1AIY/P	JO70	44	0	1296
15	PA4FP	JO33	44	12	727
16	DL0GTH	JO50	42	7	1052
17	F5HRY	JN18	42	6	877
18	PA5DD	JO22	40	10	1155
19	DJ1KP	JO40	36	0	698
20	DC8UG	JO30	35	8	900
21	PA3DZL	JO21	34	11	913
22	OK1OKL	JO60	34	0	830
23	DF1EQ	JO31	34	0	678
24	DL0UL/P	JN48	33	11	961
25	OZ2OE	JO45	33	8	914
26	DK0OG	JN68	33	8	675
27	HB9MIO/P	JN37	32	0	744
28	DC0DA	JO31	31	1	775
29	DC9YC	JO31	30	10	858
30	DL3NQ	JN49	29	8	890
31	OZ7IS	JO65	29	9	860
32	DL3YEE	JO42	29	10	520
33	DH9NBB	JN49	27	7	654
34	DK0PX	JN48	26	0	853
35	DL2DR	JO31	26	0	823
36	DK2MN	JO32	25	6	635
37	I0LVA/0	JN62	25	0	612
38	OK2BFH	JN99	24	9	1026
39	DL1SUZ	JO53	24	7	747
40	F1PYR	JN19	24	0	0
41	PA3AOH	JO31	23	7	785
42	OK1KEI/P	JN79	23	7	740
43	DL3IAS	JN49	23	6	604

44	DK2DB	JN48	22	0	873
45	OK1DKS/P	JO60	22	4	602
46	SP6GWB/P	JO80	21	5	650
47	F1HDF/P	JN18	20	3	621
48	OK1DFC/P	JO60	20	6	549
49	SM0DFP	JO89	20	4	520
50	I3ZVN	JN55	19	7	603
51	DJ8ES	JO43	19	7	1025
52	ON4PS	JO20	19	6	574
53	HB9AMH/P	JN37	18	0	933
54	G3LTF	JO01	18	1	902
55	LA/DB1DI/P	JO37	17	7	825
56	S51WI	JN75	17	5	533
57	HA1YA	JN87	15	5	476
58	OK1KRQ/P	JN69	15	4	350
59	DK6AS	JO52	14	0	620
60	DK1KR	JO53	14	0	792
61	PA0JUS	JO22	13	5	800
62	SP9FG	JN99	13	5	747
63	OK2BFF/P	JO80	13	6	418
64	DJ6XV	JO31	12	3	396
65	IZ5EME	JN52	10	3	552
66	G4LDR	IO91	10	2	444
67	IW3FZQ/4	JN54	10	3	403
68	OK1KEI	JO70	9	4	786
69	IW3HTU	JN55	9	2	542
70	OK2VMU/P	JN99	9	4	376
71	F6CGB	JN18	8	0	407
72	S50C	JN76	8	5	346
73	OK1CA	JO70	8	1	291
74	SP6MLK/P	JO80	8	3	272
75	F1FIH	JN23	8	1	239
76	OM7AQ	JN98	7	4	412
77	DG6GP	JN48	7	2	388
78	DG1VL/P	JO61	7	2	262
79	OK1PG	JO70	6	4	855
80	OK1KRY	JN69	5	3	189
81	OK2QI	JO80	4	2	305
82	F5PAU	IN88	4	0	260
83	OL5Z	JN89	4	3	158
84	OK1VBN	JN78	3	3	158
85	DL1KDA	JO30	3	2	98
86	G8BKE/P	IO80	1	1	114

3400 MHz Toplist

1	DB6NT	JO50	44	7	747
2	PA0EZ	JO22	31	8	835
3	PA0WWM	JO22	28	6	850/660
4	PA0BAT	JO31	26	5	729/729
5	G3LQR	JO02	23	0	924
6	PA5DD	JO22	19	5	867
7	PA0RDY	JO22	19	3	643
8	G3XDY	JO02	18	5	980/206
8	DC0DA	JO31	17	1	660
9	G6DER	IO93	16	7	859
10	PA4FP	JO33	16	5	733
11	DK2MN	JO32	16	3	422
12	DL3NQ	JN49	15	5	637
13	DL7QY	JN59	15	0	565
14	DC8UG	JO30	13	6	724
15	DF1EQ	JO31	13	0	532
16	DK0OG	JN68	13	3	476
17	DL2DR	JO31	13	0	470
18	DL6NCI	JO50	13	3	413
19	HB9MIO/P	JN37	12	0	463
20	DK2DB	JN48	11	0	331
21	DL3IAS	JN49	10	2	414
22	DK0PX	JN48	9	0	632
23	DL0UL/P	JN48	9	1	239
24	DL0GTH	JO50	7	2	466
25	DG1VL/P	JO61	7	2	320
26	OK1AIY/P	JO70	6	0	768
27	OK1KEI/P	JN79	6	2	306
28	OZ2OE	JO45	5	4	772
29	DJ8ES	JO43	5	3	578
30	DJ6XV	JO31	5	3	396
31	S51WI	JN75	3	1	98
32	OK1DFC	JO60	2	2	59
33	G8BKE/P	IO80	1	1	114
34	SP6GWB/P	JO80	1	1	2
35	SP6MLK/P	JO80	1	2	1

5760 MHz Toplist

1	DB6NT	JO50	51	16	1083
2	PA0EZ	JO22	49	9	1028
3	SM7ECM	JO65	48	9	960/647
4	F5HRY	JN18	48	8	686
5	OE5VRL/5	JN78	40	10	901/683
6	HB9AMH/P	JN37	38	9	929
7	PA0BAT	JO31	38	11	884/729
8	PA0WWM	JO22	34	9	863/589
9	HB9MIO/P	JN37	34	0	694
10	F1PYR/P	JN19	33	0	0
11	G3XDY	JO02	30	9	1240/540
12	SM6ESG	JO67	30	6	951
13	F1HDF/P	JN18	30	4	638
14	PA5DD	JO22	28	8	867/415
15	DL6NCI	JO50	25	9	600
16	G3LQR	JO02	23	0	949
17	F1GHB/P	IN88	22	4	779
18	I3ZVN	JN55	19	7	573
19	OK1KEI/P	JN79	18	7	466
20	SP6GWB/P	JO80	17	5	1024
21	DK0OG	JN68	17	4	476
22	OK1KIR/P	JO60	17	3	393
23	SM0DFP	JO89	16	6	1086
24	OK1UWA/P	JO70	16	1	998
25	S51JM/P	JN65	16	5	557
26	S51WI	JN75	15	4	586
27	DL3IAS	JN49	15	5	458
28	G6DER	IO93	14	8	947
29	OK1AIY/P	JO70	14	0	736
30	DL0UL/P	JN48	14	5	660
31	I0LVA/0	JN62	14	0	557
32	DK2MN	JO32	14	3	422
33	G4LDR	IO91	13	4	444
34	PA4FP	JO33	12	4	733
35	DC0DA	JO31	12	1	660
36	DL3NQ	JN49	12	4	318
37	OK2BFH	JN99	11	5	756
38	DC8UG	JO30	11	5	724
39	OZ7IS	JO65	11	4	593
40	DK2DB	JN48	11	0	315
41	DL7QY	JN59	10	0	565
42	DG1VL/P	JO61	10	4	525
43	OK1OKL	JO60	9	1	611
44	DK0PX	JN48	9	0	409
45	IW3FZQ/4	JN54	9	4	291
46	DL2DR	JO31	9	0	201
47	IW3HTU	JN55	8	3	542
48	LA/DB1DI/P	JO37	7	5	746
49	DL0GTH	JO50	7	2	674
50	F6CGB	JN18	7	0	407
51	HA1YA	JN87	6	5	461
52	SP6MLK/P	JO80	6	4	339
53	OK1DKS/P	JO60	6	1	318
54	DC8EC/P	JN57	6	1	278
55	OZ2OE	JO45	5	5	679
56	DJ8ES	JO43	5	5	578
57	DF1EQ	JO31	5	0	461
58	DJ6XV	JO31	5	2	176
59	OK2VMU/P	JN99	4	2	376
60	OK1KRY	JN69	3	2	175
61	S50C	JN76	3	1	126
62	F6CGB/P	JN24	2	0	375
63	G8BKE/P	IO80	2	1	242
64	OK2QI	JO80	2	1	108
65	ES2WX	KO29	2	2	89
66	OK1KRQ/P	JN69	1	1	96
67	OK1SC	JO70	1	1	10

10368 MHz Toplist

Nr	Call	Loc	Sqr	Dxcc	ODX Tropo/RS
1	F6DKW	JN18	94	14	1215
2	PA0EZ	JO22	82	14	1028
3	F5HRY	JN18	77	10	877
4	PA0WWM	JO22	72	14	850/811
5	DB6NT	JO50	71	19	1083
6	PA0BAT	JO31	69	13	884/729
7	OE5VRL/5	JN78	65	14	1135/786
8	DK1KR	JO53	65	12	168/725
9	SM7ECM	JO65	63	11	1110/711
10	DM2AFN	JO61	63	18	923
11	HB9AMH/P	JN37	62	12	998
12	OK1JKT/P	JO60	58	14	655/845
13	G3XDY	JO02	55	13	1240/881
14	G3WDG	IO92	55	0	1135
15	PA5DD	JO22	55	11	867
16	F1HDF/P	JN18	55	8	867
17	G4KGC	IO92	53	0	1135
18	G3LQR	JO02	52	0	1006
19	I6XCK/6	JN63	52	0	768
20	DF5JJ	JO43	51	11	611/761
21	OK1VAM/P	JO60	50	15	830
22	DL4EAU/P	JO51	48	9	826
23	PA3AOH	JO31	48	9	724
24	DL3YEE	JO42	48	12	625/700
25	DG1VL/P	JO61	46	10	807
26	DJ1KP	JO40	46	0	656
27	HB9MIN/P	JN37	45	0	939
28	DK0OG	JN68	45	12	563
29	I6CXB/6	JN63	52	0	751
30	SP6GWB/P	JO80	44	10	829
31	OK1DIG	JO60	44	12	551/689
32	DL3NQ	JN49	42	9	712
33	DL6NCI	JO50	42	11	567/960
34	DL3IAS	JN49	42	11	690
35	HB9MIO/P	JN37	40	0	744
36	OK1VAM	JN79	25	6	630
37	G4BRK	IO91	39	0	1115
38	DK0FLT	JN59	39	10	683
39	DC8EC	JN57	39	12	661
40	S51JM/P	JN65	39	13	637
41	SM6ESG	JO67	38	6	1275
42	IW6CVN	JN63	38	11	618/824
43	DL0UL/P	JN48	38	8	658
44	I0LVA/0	JN62	37	8	850
45	I4XCC	JN63	37	11	729/788
46	LX1DU	JN29	37	0	700
47	OK1KEI/P	JN79	37	10	639
48	DK8ZP	JO40	37	0	586
49	DH9NBB	JN49	36	9	654
50	G3GNR	IO70	34	0	1275
51	HB9RG	JN47	34	0	761
52	OK1AIY/P	JO70	34	0	736
53	OK2BFH	JN99	33	7	769/669
54	G4LDR	IO91	32	9	1118
55	DL6NAQ/P	JO40	32	8	656
56	DK2MN	JO32	32	8	633

57	DC9YC	JO31	32	9	599
58	G4DDK	JO02	31	0	901
59	SP6MLK/P	JO80	31	10	752/352
60	DL1BKK	JO43	30	0	842
61	OK1DFC/P	JO60	30	7	668
62	DL0GTH	JO50	30	7	240
63	EA6ADW/P	JM19	29	7	1090
64	IW6AEG/6	JN63	29	0	751
65	OZ1IPU	JO57	28	7	941
66	OK1KIR/P	JO60	28	6	658
67	OK1OKL	JO60	27	0	795
68	F6CGB	JN18	27	0	677
69	F1GHB/P	IN88	27	5	669
70	S50C	JN76	27	9	505
71	DL1SUZ	JO53	26	5	362/572
72	PA4FP	JO33	25	8	865
73	DK0PX	JN48	25	0	567
74	S51WI	JN75	24	6	586/343
75	DK4GD/P	JN48	24	0	566
76	ON4KHG	JO10	24	6	565/496
77	OZ2OE	JO45	23	6	789
78	ON7WR	JO20	23	9	756
79	DJ8ES	JO43	23	7	670
80	I3ZVN	JN55	23	8	573
81	OK1DST	JN79	23	7	402
82	DC0DA	JO31	22	1	816
83	DL2DR	JO31	22	4	603
84	DL1CF	JO42	22	6	0
85	G3LTF	JO01	21	0	902/435
86	SM0DFP	JO89	21	7	769
87	DJ5VW	JO31	21	5	474
88	DC8UG	JO30	20	6	753
89	DB1BX	JO32	20	7	705
90	DL4VCG	JN39	20	0	533
91	DF9QX	JO42	19	0	504
92	DK2DB	JN48	19	0	432
93	LA/DB1DI/P	JO37	18	6	825
94	DL5NEN/P	JN49	18	6	466
95	HA1YA	JN87	16	6	564
96	OK2PWY	JO80	16	5	558/594
97	IW3FZQ/4	JN54	16	5	557
98	ON7YK	JO20	16	0	494
99	F5PAU	IN88	16	2	430
100	OK1KRQ/P	JN69	16	3	325
101	HB9AMH	JN37	15	0	567
102	DL7QY	JN59	15	0	492
103	OK1UWA/P	JO70	15	0	434
104	F6CGB/P	JN12	14	0	1191
105	IW5ADB	JN53	14	0	1053
106	G4PMK	IO93	14	0	958
107	OZ1FF	JO45	14	7	740
108	SP9FG	JN99	13	5	611/518
109	OZ1DOQ	JO65	13	5	472
110	DF1IAZ	JN49	12	2	515
111	OH0NC	KP00	12	4	269
112	GW4LXO	IO81	12	0	309
113	G4KNZ	IO91	12	0	247
114	OK1DKS/P	JO60	11	2	616
115	DJ6XV	JO31	10	3	285
116	G4LRT	IO92	8	0	824
117	IW3HTU	JN55	8	2	542
118	IW3QCV	JN65	8	2	532
119	F5HRY/P	JN08	8	2	491
120	DL1KDA	JO30	8	4	477
121	DF1EQ	JO31	7	0	283
122	DF1EQ/P	JO31	7	0	283
123	ES0SM	KO08	5	2	384
124	DG0CAL	JO52	5	0	255
125	LA8AK	JO38	5	0	212
126	OK2QI	JO80	4	1	303
127	G8BKE/P	IO80	4	1	242
128	F5OIH/P	JN08	4	1	149
129	OK2VMU/P	JN99	3	2	376
130	PA0JUS	JO22	3	2	245
131	DH3NAN	JO50	3	0	134
132	DG5NEX	JN49	1	0	173
133	OK1KRY	JN69	1	1	78
134	GM0ICF	IO75	1	1	53
135	DL0SP/P	JO62	1	1	28
136	SM4SJY	JP70	1	1	160

24 GHz Toplist

1	DB6NT	JO50	13	6	403
2	OE5VRL/5	JN78	11	3	289/289
3	PA0BAT	JO31	10	3	403/403
4	PA0EZ	JO22	10	4	391
5	DC8EC/P	JN57	10	2	301
6	HB9AMH/P	JN37	10	0	286
7	HB9MIO/P	JN37	10	0	172
8	IW3EHQ/P	JN66	8	1	461
9	I0LVA/0	JN62	8	3	444
10	DJ1KP	JO40	8	0	273
11	DC0DA/P	JO41	8	1	131
12	OK1AIY/P	JO70	7	0	281
13	SM6ESG	JO67	7	3	242
14	EA6/DF5JJ	JM19	7	2	226
15	DK0OG	JN68	7	2	193
16	S51JM/P	JN65	6	3	293
17	DL3NQ	JN49	6	3	287
18	DL6NCI	JO50	6	3	280
19	IW3FZQ/4	JN54	6	3	250
20	PA0WWM	JO22	6	3	210/210
21	I3ZVN	JN55	6	2	210
22	PA3AOH	JO31	6	2	166
23	G3LQR	JO02	5	0	261
24	OK1KIR/P	JO60	5	2	227
25	OK1OKL	JO60	5	0	185
26	DL3YEE/P	JO42	5	1	151
27	DK2MN	JO32	5	2	132
28	F1PYR/P	JN19	5	0	0
29	PA5DD	JO22	4	2	204
30	OK1UWA/P	JO70	4	0	188
31	OK1DFC/P	JO60	4	2	185
32	DK8ZP	JO40	4	0	178
33	SM7ECM	JO65	4	2	168/168
34	DK0PX	JN48	4	0	168
35	F1GHB/P	IN88	4	0	158
36	G3GNR	IO70	4	0	154
37	DL2DR	JO31	4	1	98
38	F5HRY	JN18	4	1	96
39	F1HDF/P	JN18	3	1	230
40	OK1KEI/P	JN79	3	2	189
41	G4KNZ/P	JO02	3	0	173
42	IW3HTU	JN55	3	1	160
43	DG1VL/P	JO61	3	2	113
44	DL0GTH	JO50	3	1	108
45	GW8BKE/P	IO71	2	1	170
46	DF1EQ	JO31	2	0	133
47	F6CGB/P	JN12	2	1	91
48	DC9YC	JO31	2	2	87
49	DF5JJ	JO43	2	1	1/55
49	OZ2OE	JO45	2	1	52
50	DK2DB	JN48	2	0	48
51	SM0DFP	JO89	2	1	36
52	SP9FG	JN99	2	1	33
53	G8BKE/P	IO80	1	1	139
54	F5OIH/P	JN08	1	1	90
55	CT1FP	IN50	1	1	82
56	CT1DMK	IN50	1	1	82
57	DJ6XV	JO31	1	1	75
58	DJ5VW	JO31	1	1	61
59	OK1OGS/P	JN69	1	1	60
60	F6CGB	JN18	1	1	55
61	OK1JKT	JO60	1	1	18
62	DL7QY	JN59	1	0	13
63	SP6GWB/P	JO80	1	1	2
64	SP6MLK/P	JO80	1	1	1

47 GHz Toplist

1	DF1EQ/P	JO30	10	1	2
2	HB9MIO/P	JN37	8	1	166
3	DC0DA/P	JO41	7	1	131
4	IW3FZQ/4	JN54	6	1	188
5	I3ZVN	JN55	5	1	179
6	HB9AMH/P	JN37	5	1	166
7	OE5VRL/5	JN78	3	2	201
8	IW3EHQ/P	JN65	3	1	111
9	DL2DR	JO31	3	1	95
10	OK1OKL	JO60	2	2	96
11	OK1UWA/P	JO70	2	1	96
12	OK1AIY-P	JO60	2	1	96
13	DB6NT	JO50	2	2	95
14	DL6NCI	JO50	2	2	83
15	DK0OG	JN68	2	2	74
16	DK0PX	JN48	2	1	62
17	PA0BAT	JO31	2	2	51
18	DL3YEE/P	JO42	2	1	45
19	DK2MN	JO32	2	2	30
20	DC8EC/P	JN57	2	1	29
21	PA5DD	JO22	2	1	20
22	F1PYR/P	JN19	2	1	0
23	DL/HB9AMH/P	JN48	1	1	184
24	GW8BKE/P	IO71	1	1	93
25	IW3HTU	JN55	1	1	87
26	G8BKE/P	IO90	1	1	79
27	OK1KIR/P	JO60	1	1	5
28	OK1AIY/P	JO70	1	1	5
29	SP6MLK/P	JO70	1	1	1
30	CT1FP	IN50	1	1	1
31	CT1DMK	IN50	1	1	1

76 GHz Toplist

1	HB9MIO/P	JN37	4	1	114
2	DB6NT	JO50	2	1	77
3	DC0DA/P	JO50	2	1	48
4	G8BKE/p	IO80	1	1	79
5	G8BKE/P	IO91	1	1	33
6	OK1AIY/P	JO70	1	1	12
7	DC8EC/P	JN57	1	1	5
8	HB9AMH/P	JN37	1	1	1

145 GHz Toplist

1	DB6NT	JO50	1	1	3
2	IW3EHQ/P	JN65	1	1	2
3	DC0DA/P	JO41	1	1	1
4	G7FRE	JO01	1	1	1
5	G4FRE/P	JO01	1	1	1

241 GHz Toplist

1	DB6NT	JO50	1	1	2
2	HB9MIO/P	JN37	1	1	1

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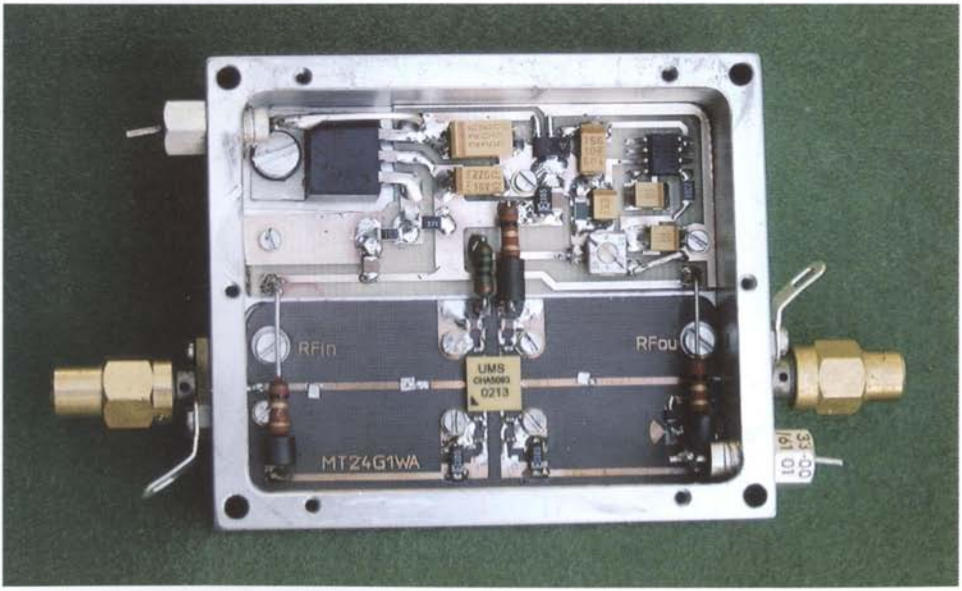

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