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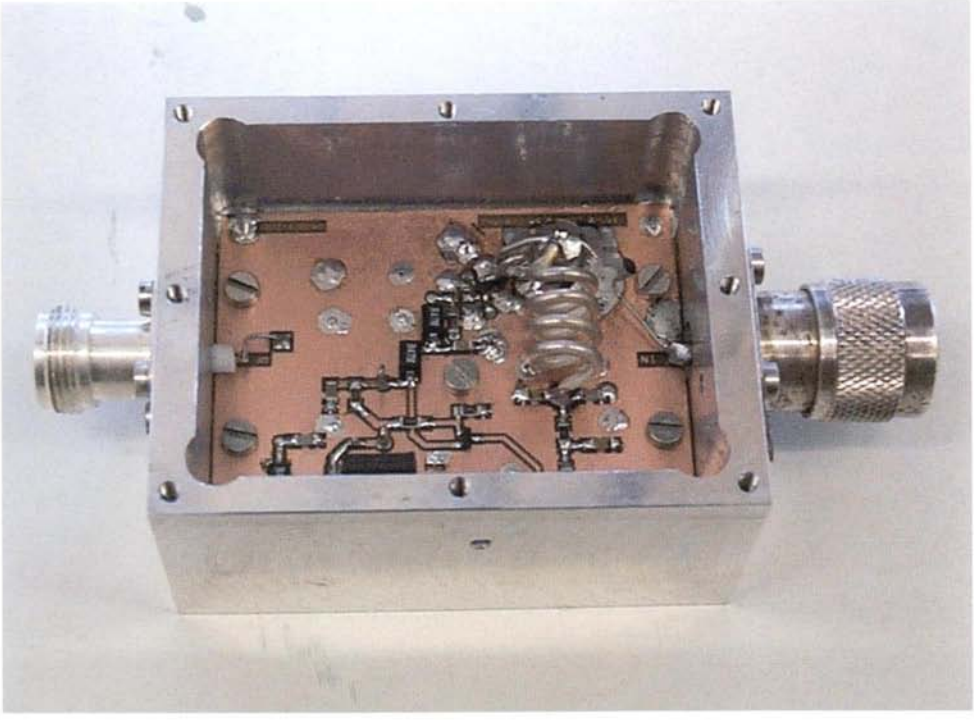

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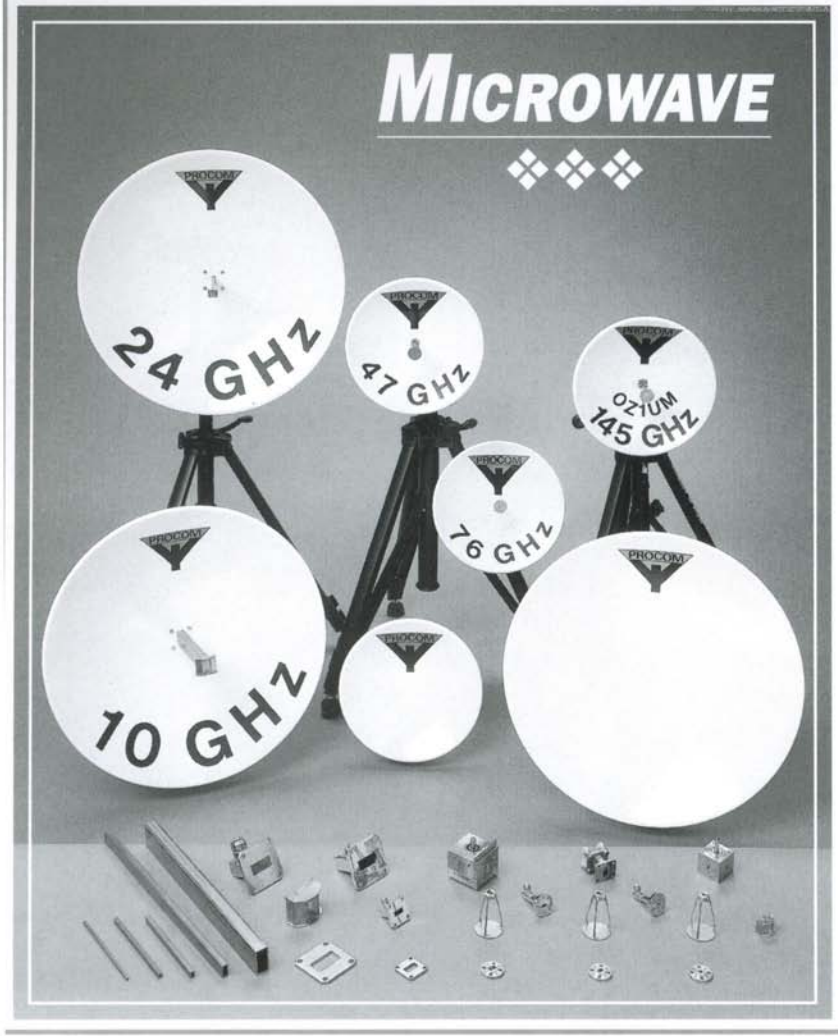

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Inhalt/Contents

Title: 144MHz LNA from PA3BIY

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Technical Reports

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A Very High Dynamic Range LNA for 144 MHz

Peter Hoefsloot, PA3BIY

Abstract: The pre-amplifier described here uses the latest technology of pHEMT devices. This technology enables the development a pre-amplifier with a noise figure less than 0.3 dB and an Input 3rd order Intercept Point (IIP3) of +2.5dBm. The combination of such a low noise figure and high IP3 is unique, and to my knowledge not met by any commercial pre-amplifier for the 2 metre band. The amplifier is unconditionally stable.

Introduction

Low noise amplifiers have always fascinated me. Though critical by design, they were my first steps in building an all mode 144 MHz transceiver in the early 80's. In fact, the first pre-amplifiers that I built (1978) did just one thing: oscillate! My fascination originated form the (wrong) concept, that a low noise amplifier improves the signal to noise ratio. As I will explain in this article, it does not! Nevertheless, a low noise amplifier is very important at VHF and higher, in order to be able to detect the often very weak signals. However, in order to obtain a low noise figure, amplifiers often had to be designed in such a manner, that strong signal handling suffered. The advent of new devices enables us to design amplifiers which are able to combine a low noise figure with strong signal handling capability.

The following topics will be addressed in this article:

- Theory on signal-to-noise ratio's (describing the relation between ambient noise, pre-amp noise figure and signal to noise ratio);
- The importance of (high) dynamic range of a pre-amplifier and the available design options (short overview of available techniques, and the introduction of some interesting recent developed devices);
- Designing the ideal Pre-Amplifier (issues are described which must be met, in order to obtain low noise figure and linearity;
- Circuit description and construction of the 144 MHz LNA; Putting it to operation).

- Stability
- Important qualities of a pre-amplifier and how to measure them (Noise figure, IP3 and return loss measurements are described); Measurement results (2-tone test results, return loss and gain sweeps are shown in plots. Also the result of the noise figure measurement is presented);
- Conclusions

Einführung

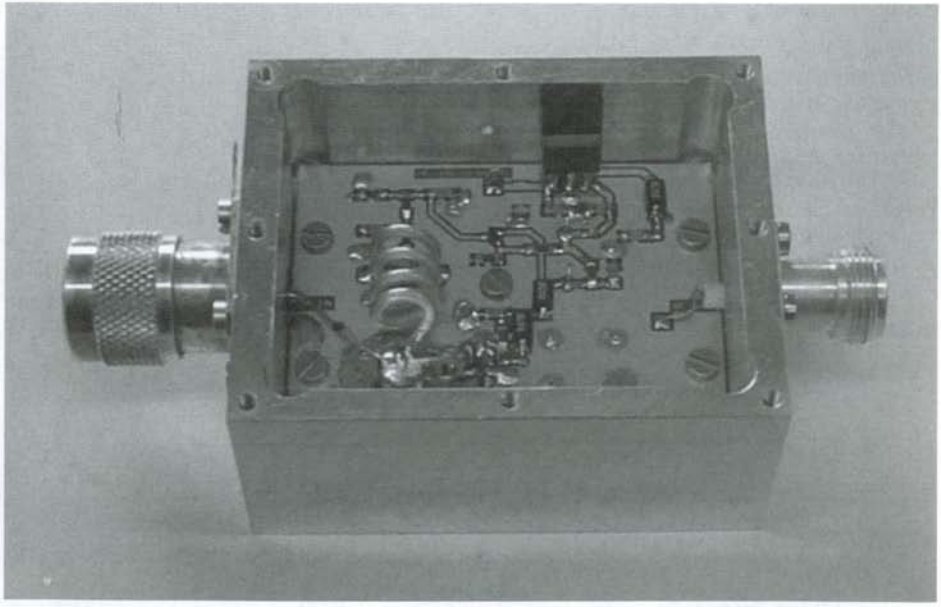
Rauscharme Verstärker haben mich immer fasziniert. Die Anziehungskraft kam von dem - mittlerweile als falsch erkanntem - Konzept daß diese Verstärker das Signal/Rausch-Verhältnis verbessern sollten. Ich werde im nachfolgenden Artikel erklären, daß dieses keineswegs der Fall ist. Trotzdem sind sie wichtig, um auf VHF und höheren Frequenzen schwache Signale zu verstärken. Oft wurde zugunsten der Rauschzahl das Großsignalverhalten geopfert. Nun ist es neue Transistoren, mit denen sowohl eine niedrige Rauschzahl als auch ein hoher IP3 erreichbar ist.

Folgende Themen werden behandelt:

- Details zum Signal/Rauschverhältnis
- Intermodulationsverhalten
- Design des idealen Preamp
- Stabilität
- Wichtige Kenngrößen und deren Messung (Rauschzahl, IP3, Rückflußdämpfung)
- Folgerungen

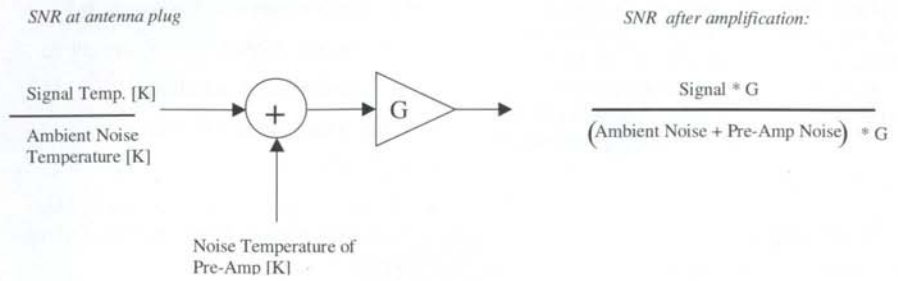
Signal-to-noise ratio

Low noise amplifiers are the logical choice of every first stage in VHF and up receivers. Their purpose: to minimise the deterioration of the signal-to-noise ratio as seen on the antenna connector. A pre-amplifier will never improve the signal-to-noise (SNR) ratio! The SNR at the antenna plug is the best we are ever able to obtain. Any noise added by an amplifier will deteriorate the SNR, so we want



144MHZ LNA

Bild/Figure 1: SNR degradation, due to pre-amplifier nois



to minimise that amount of noise. The ambient noise (man made, terrestrial or galactic noise) sets the limit to the SNR and can be expressed as dB above the thermal noise at T0 (T0=290 K) or as an equivalent temperature [K] at which the thermal noise would be of the same value. In order to calculate SNR and to perform calculations, it is often easier to describe noise and wanted signal as temperature [K] rather than in dB. The power produced by a noise source is related to the temperature of that source. An obvious example we can see every day in the sky: The Sun!

In table 1 I have set 3 ambient noise levels which may be found on 144 and 432 MHz. For calculation purposes I'll use a low level as seen in a quiet spot in the sky (EME), and a high level which is common in a city. Moreover, I'll use a very low value for ambient noise, as can be observed on 70 cm and higher frequencies when pointing into the sky. At these frequencies the Galactic noise is much lower than on 144 MHz.

In order to assess the SNR we need to transform it to an equivalent noise power and divide it by the ambient noise level. In figure 1 I have described the process between antenna and pre-amplifier in terms of noise power. The noise contribution of the pre-amplifier is transferred to the summing device (+). The amplification (G) is considered noise less, because the noise contribution is transformed to the input.

The bandwidth in the calculations is set to 2.4 kHz, being the most common used by amateurs.

The noise power is calculated as:

[1] $P_n = k \cdot T \cdot B$

Where:

P_n = Noise Power [W]

k = Boltzmann ($1.38 \cdot 10^{-23}$ [Ws/K])

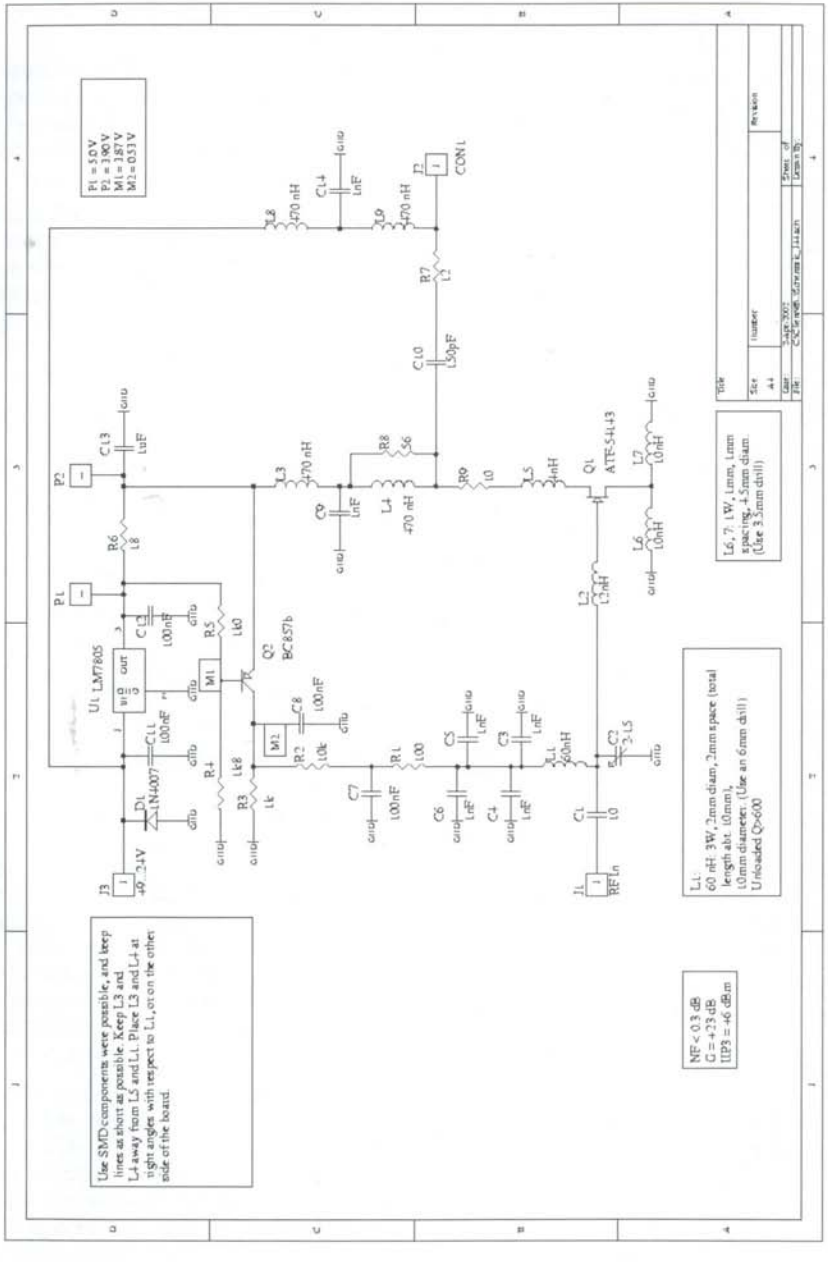
B = Bandwidth [Hz]

A signal of -130 dBm equals $1 \cdot 10^{-16}$ W. Using the above formula, T equals 3019 K (assuming the noise is evenly distributed over a 2.4 kHz bandwidth).

Table 1: Various noise powers

Ambient Noise	Noise (dB)	Noisepower (K)
Low (432MHz)	0.15	10
Low (144MHz)	2.28	200
High (144MHz Urban)	8.97	2000

Bild/Figure 2: Circuit Diagram



Furthermore, for calculation purposes, let's assume a decent pre-amplifier, with a noise figure of 0.8 dB. The noise temperature of such a pre-amp is 59 K.

Using the ambient noise levels from table 1, the following SNR's at the antenna plug and after amplification can be calculated. For the SNR the amplification figure does not matter, as both noise and signal are equally amplified. We only need gain in order to amplify the nanovolt signals to levels were headphones can be exited, but this figure is not important when assessing the influence of pre-amplifier noise to the final SNR.

Table 2: Signal-to-noise-ratio when a wanted signal of 3019 K signal power is received. SNR is shown before and after amplification, applying various ambient noise levels. The Noise figure of the pre-amp was set to 0.8 dB.

As we can see from table 2, the importance of low noise temperatures increases as ambient noise levels drop. At 432 MHz EME it becomes obvious that a small decrease in noise temperature of the pre-amplifier has a great effect on the SNR after amplification. Even on 144 MHz EME it is worth while to strive for a low noise figure.

Lowering the noise figure further, will improve the SNR even more (I ought to say: "A lower noise figure gives less deterioration of the SNR"). Table 3 gives the SNR when a pre-amplifier with a noise figure of just 0.3 dB (21 K) is used.

Table 3: Signal-to-noise-ratio when a wanted signal of 3019 K signal power is received. SNR is shown before and after amplification, applying various ambient noise levels. The Noise figure of the pre-amp was set to 0.3 dB.

Comparing the SNR's after amplification, it is evident that 70 cm EME gains the most of low noise figures. A drop of noise figure from 0.8 to 0.3 dB gives 3.5 dB improvement in SNR (mind you, a drop in noise figure from, for example, 3.5 to 3.0 dB will not give such an improvement!).

Signal/Rauschverhältnis

Jeder Verstärker verschlechtert das von der Antenne angebotene Signal/Rauschverhältnis. Die Verschlechterung wird genau durch seine Rauschzahl definiert.

Um nun das bestmögliche Signal/Rauschverhältnis in einem Empfänger zu erhalten, müssen die ersten Stufen eine Empfänger sorgfältig auf niedriges Eigenrauschen ausgelegt werden.

Um einen Überblick zu bekommen, was überhaupt erreichbar ist, habe ich in Tabelle 1 die Rauschleistung, welche die Antenne aus der Umgebung empfängt, in Abhängigkeit von der Frequenz und der Umgebung aufgetragen. Diese Rauschleistung definiert das minimale Signal, was empfangen werden kann.

Abb1. zeigt den Zusammenhang zwischen der Rauschzahl eines Verstärkers und dem Signal/Rauschverhältnis. Ich nehme ein Signal von -130dBm an, was nach Formel [1] einer Temperatur von 3019K entspricht. Tabelle 2 zeigt die Verhältnisse bei einer Rauschzahl von 0,8dB (= 59K) auf.

Erniedrigt man die Rauschzahl auf 0,3dB (=21K) ergeben sich drastische Verbesserungen auf 70cm EME (+ 3,5dB SNR), immerhin noch 0,7dB auf 2m EME (ruhiges Land), aber nicht in der Stadtumgebung.

Dynamic range and available design options

An important feature of an amplifier, is its ability to cope with strong signals. Even though a pre-amplifier will have the lowest signal levels in the chain of amplification, any distortion it creates can never be deleted by subsequent components. Moreover, strict bandwidth limitation is not possible yet, due to the involved loss which influence the noise figure. Hence, the pre-amplifier needs to cope with strong out of band signals as well.

Let's have a look at some devices. Probably the most widely used device in low noise pre-amplifiers, is the MGF1302. If properly designed, a noise figure of 0.35 dB can be achieved at 144 MHz. However, its large signal properties are poor: the IIP3 is -7...-13

Table 2: S/N of a 3019K Signal w/ NF=0.8dB

Ambient Noise	Noise (dB)	Noisepower (K)	S/N @ Antenna (dB)	S/N @ RX-Output (dB)
Low (432MHz)	0.15	10	24.8	16.4
Low (144MHz)	2.28	200	11.8	10.7
High (144MHz Urban)	8.97	2000	1.8	1.7

dBm. Some "old fashioned" transistors do pretty good too, for example the BFT66, which can deliver IIP3 better than +10 dBm using loss less feedback technology [1, 2]. However, the noise figure that is obtained is relatively poor: about 1.5 dB. Some have experimented using high power GaAs FET's like the MGF1801. Though low noise figures were acquired (0.2...0.4 dB), the IIP3 figures remained relatively poor, given the type of device used: +1.5 dBm [3].

The advent of today's modern communication technology has seen the development of some interesting FET devices. Although specifically designed for PCS. (Personal Communication Systems like DECT at 1900 MHz) and GSM (900 and 1800 MHz), some of these devices work pretty good into VHF frequencies as well. One specific company that has created such kind of devices is Agilent (formerly Hewlett-Packard semiconductor division). A series of wide gatewidth PHEMT devices have been introduced that show remarkable features. Noise figures below 0.5 dB are obtained at 1 GHz, combined with exceptional large signal properties. IIP3's of +7 dBm are easily achieved at UHF and SHF frequencies. So what's the trade off? A rather high drain current of 40 to 80 mA! However, for desktop transceivers, power consumption is rarely a limitation....

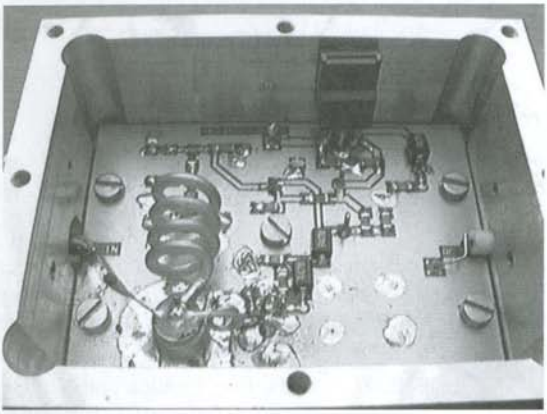
PHEMT stands for "Pseudomorphic High Electron Mobility Transistor". The HEMT structure can be visualised (simplified) being a 2-dimensional sheet, in which the electrons can move from source to drain. The properties of the layer are such that very high electron mobility and saturation velocity is achieved, giving rise to high fT, and few collisions with other electrons and atoms, hence low noise.

The structure of these pHEMT's differs from MESFET's, like the MGF1302, such that the gate structures are very wide. The ATF33143, for example, has a gate width of 800 m, as opposed to the MGF1302 which has a different structure, utilising relatively narrow gate widths. As a result of the wide (pHEMT) gate, the current consumption has increased, but without sacrificing noise figure. The ATF33143 (introduced 2 years ago) needed negative biasing on the gate. More recent devices have a slightly altered structure and

Table 3: S/N of a 3019K Signal w/ NF=0.3dB

Ambient Noise	Noise (dB)	Noisepower (K)	S/N @ Antenna (dB)	S/N @ RX-Output (dB)
Low (432MHz)	0.15	10	24.8	19.9
Low (144MHz)	2.28	200	11.8	11.4
High (144MHz Urban)	8.97	2000	1.8	1.74

Bild/Figure 3: Top view of the Prototype



are called E-pHEMTs. The "E" stands for "Enhanced" and designates the need for positive gate biasing. The ATF54143 needs +0.6V gate biasing, and draws a low (leakage) gate current (a few µA). For VHF applications, the positive biasing has complicated the circuit design somewhat, as we'll see further on.

Devices designed for PCS and GSM (0.9 to 2 GHz), have very high gains at low frequencies like 144 MHz. Gains in excess of 30 dB can be achieved, but are too much to be useful. Gain is fine, as long as it serves the purpose of overcoming the noise figures of subsequent stages. Anything more will only result in overloading mixer and IF stages, decreasing the dynamic range of the receiver. 30 dB of extra gain will decrease the usable dynamic range by nearly 30 dB as well!

So how can we decrease the gain of SHF devices without sacrificing the noise parameters?

1. Using an attenuator behind the amplifier;
2. Inserting loss less feedback across the device;
3. Use non-optimal loss less matching of the device.

An attenuator will decrease the gain, and diminish the load on the subsequent receiver stages. However, by putting an attenuator behind the pre-amplifier, the OIP3 is diminished by the same amount as well. Although the subsequent stages have some protection from overloading, the maximum attainable dynamic range is limited too. Limiting the gain of the pre-amplifier without sacrificing the OIP3 (using some form of feedback or non-optimal matching) will conserve the dynamic range.

Distortion is nearly always the effect of voltage or current limitations that appear in the output circuit of an active device. Limiting the voltage and/or current level in the output circuitry, using loss less feed-back for example, will decrease the gain, hence a higher IIP3 will be obtained. Loss less feedback can be created by inserting a small amount of inductance in the source leads of the pHEMT. Using simulations [4] a value of about 6 nH turned out to give enough feedback to decrease the gain to about 23 dB in stead of 30 dB. However, this form of feedback may also affect stability.

The linearity of a device depends on its ability to handle currents and voltage across the output terminals. Devices that either run at high voltages, or are biased at high currents, will usually perform well. The E-pHEMT devices used here, are biased at currents of about 70 mA (remember the MGF1302 running at 10 mA!). The addition of loss-less feedback in the source, gives some reduced gain, hence a higher IIP3.

Dynamischer Bereich

Sehr wichtig für die Auslegung des Vorverstärkers ist die Optimierung des Intermodulationsverhaltens. Intermodulation maskiert schwache Signale und wird durch starke Signale im Band und außerhalb des Bandes erzeugt. Naturgemäß ist die Bandbreite von Vorverstärkern recht groß.

In der Vergangenheit wurde oft der MGF1302 eingesetzt. Bei einer minimalen Rauschzahl

von 0,35dB ist sein Eingangs-Interzeptpunkt ca. -13...-7 dBm.

Eine andere Option ist die Verwendung von bipolaren Transistoren wie z.B. dem BFT66 in einer Gegenkopplungsschaltung [1,2]. Dort wird ein IIP3 von +10dBm bei einer Rauschzahl von ca. 1,5dB erreicht.

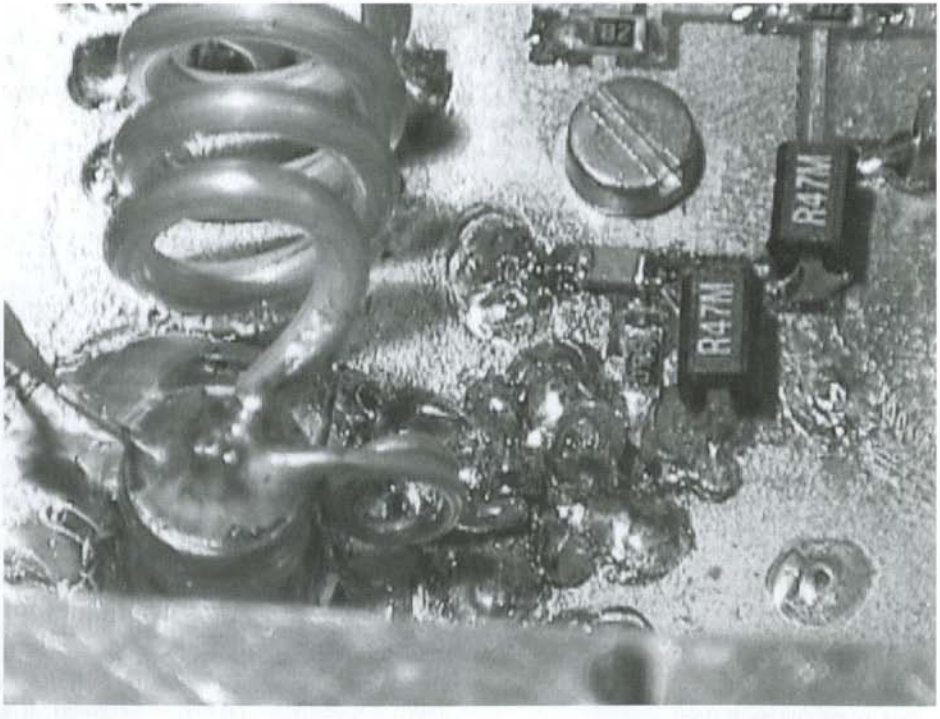
Auch Leistungs-GaAs-Fet wie der MGF1801 werden benutzt. Bei Rauschzahlen von 0,2...0,4dB ist der IIP3 ca. +1,5dBm [3]. Trotz hoher DC-Leistung ist das weniger als erwartet.

Inzwischen wurden moderne Leistung-HEMT's für die Anwendung in GSM-Basisstationen entwickelt. Speziell Agilent (früher als HP bekannt) vermarktet PHEMT's, die eine Rauschzahl von 0,5dB bei 1GHz und einen IIP3 von +7dBm bei dieser Frequenz erreichen.

Diese PHEMT's haben sehr große Breiten in der Gate-Struktur. Ein MGF1302 hat 250µm, ein ATF33143 hat 1600µm (=1,6mm!) und ein ATF51443 hat 800µm. Dadurch werden kleine Rauschzahlen bei großem Strömen möglich. Große Ströme implizieren niedrige Intermodulation. Typische Ströme für minimales rauschen liegen bei 60...80mA. Der ATF54143 ist ein E-PHEMT. Er braucht wie ein normaler Leistungs-MOSFET eine positive Spannung auf dem Gate.

Die Transistoren sind für den Bereich von 0,9...2,5GHz vorgesehen. Auf 144MHz zeigen sie einen exorbitante Verstärkung von mehr als 30dB. Das ist viel zu viel und ernied-

Bild/Figure 4: Close-up view of the E-pHEMT



rigt nur den Dynamikbereich des Empfängers.

Es gibt Methoden, um die Verstärkung zu erniedrigen:

1. Abschwächer nach dem Verstärker
2. Künstliche Verstimmung
3. Anwendung von "Lossless Feedback"

Ein Abschwächer erniedrigt die Verstärkung. Gleichzeitig wird aber auch der Ausgangs-Interzeptpunkt erniedrigt. Damit wird der Dynamikbereich erniedrigt. Also keine gute Idee.

Mit bewußter Fehlanpassung kann die Verstärkung auch erniedrigen. Z.B. kann man als Drainlast einfach einen 50Ω Widerstand nehmen.

Am besten ist Anpassung auf die optimale Last, die Spannungs- und Strombegrenzung gleichzeitig erfolgen läßt und die Anwendung von Induktivitäten in der Source. Mittels PUF [4] läßt sich zeigen, daß eine Induktivität von 6nH die Verstärkung auf 23dB sinken läßt. Allerdings können durch Sourceinduktivität leicht Instabilitäten oberhalb von 3GHz entstehen.

Stability issues

When I started this design, I thought that stability would be the least to worry about. It turned out to be close to a nightmare!

The device I used has a cut-off frequency well over 15 GHz. Hence, the maximum device gain at VHF is very high (30 dB). One would expect that the circuit might oscillate at VHF frequencies, but it did not. It oscillated like hell at 2...5 GHz.

The initial circuit I build was stable, but was put on a piece of board, without any "cutting edge" tweaking of the PCB. As soon as I changed to "nice circuits" (nicely designed board and a shiny aluminium case), things turned sour. Murphy had spotted me!

I made 3 new PCB designs with various results, except one: They all oscillated as soon as I put the lid on the box. However, in the last design I had incorporated some features to the circuit that did improve stability somewhat. But it still oscillated...

The part that had blotted my sight turned out to be the tuning capacitor! I had used a tuning capacitor which had an effective capacitor length of some 9mm (total length head to tail was 13mm). The series and parallel series resonances across the tuning capacitor was (one of) the causes of input impedance values which turned the circuit into an oscillator. Having substituted the tuning capacitor for a low inductance type, the oscillations ceased. Moreover, measuring the S-parameters of the pre-amp (130 to 10000 MHz), calcullations showed that the pre-amplifier is now unconditionally stable. Even with the lid on, which is the most difficult task to achieve! This is familiar to every microwave experimenter.

Stabilität

Als ich mit diesem Projekt anfing, dachte ich nicht, daß die Stabilität ein Problem werden könnte. Tatsächlich wurde es das Hauptproblem. Der FET, die ich benutze, er hat eine Grenzfrequenz von über 15GHz. Auf VHF ist die Verstärkung mehr als 30dB.

Die Oszillationen waren zwischen 2 und 5GHz, sobald ich den Deckel aufsetzte. Auf 144MHz selbst war der Verstärker stabil. Die induktive Gegenkopplung in der Source zusammen mit einem ungeeigneten Abstimmkondensator im Eingangsschwingkreis erzeugten einen Oszillator.

Durch Wahl eines geeigneten Trimmers und Serieninduktivitäten im Gate und im Drain wurde Stabilität erreicht. Das wurde durch Messungen der S-Parameter von 130MHz bis 10000MHz bei geschlossenen Deckel bestätigt.

Designing the ideal Pre-Amplifier

Let's get this straight: the ideal pre-amplifier can not be constructed using amateur equipment, but we can get very close to it these days! Some modern high frequency FET's have NFmin which are equal or less than 0.1 dB! (NFmin is the minimum noise figure which theoretically can be obtained with such a device using loss less matching to the optimum impedance). NFmin is acquired at a

specific impedance. The transformation from the antenna impedance (usually 50Ω) to the impedance of NFmin introduces loss, which will add up to NFmin. If the impedance match to NFmin fails (i.e.: the transformation ends up with an impedance that differs from the optimum noise impedance), the noise figure of the device will also be higher than NFmin. The sensitivity for impedance mismatches is often expressed with noise circles. Any point on this circle will give a specific NF of the device at the specified impedance. The larger the distance between the successive circles, the less critical the requirements of the matching network will be.

To match to the optimum noise impedance, we need to design a circuit that will do the trick with the least amount of loss. The matching loss is a function of loaded- and unloaded-Q values of the matching network (Q is the ratio between the centre frequency and the 3 dB bandwidth of a resonant LC-network).

The unloaded Q (Q_u) is the bandwidth of a circuit without any loading by active or passive circuitry: just an LCR network. The loaded Q (Q_l) is the same network, but coupled to an active or passive system, which lowers the total bandwidth. The ratio between these 2 figures, determines the loss, according to the following formula:

[2] $$IL = 20 \cdot \log\left(\frac{Q_u}{Q_u - Q_l}\right)$$

As can easily be derived from the formula, a high value for Q_u and a low value for Q_l, minimises the losses. However, the selectivity of the LC network, is determined by the loaded Q (bandwidth!). A high value for the loaded Q, means small bandwidth (= high selectivity), but increases the network loss. If the active device has good strong signal parameters, we can tolerate poor selectivity, because the device is able to cope with strong out of band signals, hence design a matching network with low loaded Q.

Well designed lumped coils can obtain fairly high Q values of 300 to 600. Using a 3 dB bandwidth of 20 MHz, the insertion loss will amount 0.1...0.2 dB, giving an acceptable selectivity of -10 dB at 100 MHz, compared to 144 MHz.

Summarising the characteristics of the input matching network:

- matching antenna impedance to NFmin (NFmin is a device specific, frequency dependent, impedance);
- keeping matching losses as low as possible, given the practical constraints of available Q of the network.

Design

Es gibt heute Transistoren, die selbst nur eine Rauschzahl von 0,1dB auf VHF haben. Der Transistor will eine bestimmte Impedanz für die minimale Rauschzahl "sehen". Das wird durch Kreise konstanter Rauschzahl im Smith-Diagramm beschrieben.

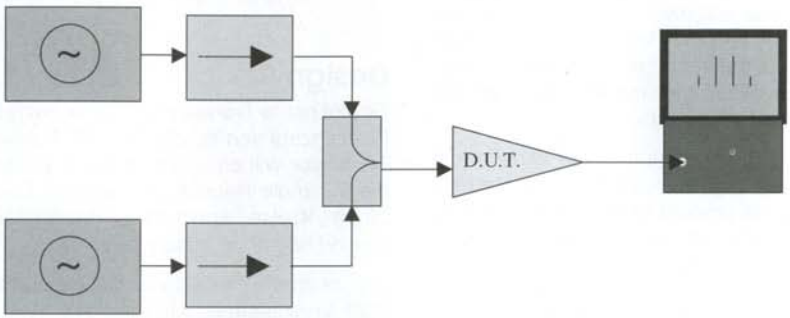
Die optimale Impedanz ist meistuns von 50Ω verschieden. Man braucht also eine Transformationsschaltung, welche diese Impedanz aus der Nennimpedanz von 50Ω herstellt. Die Verluste einer solchen Transformation werden durch Gleichung [2] beschrieben.

Es kommt also darauf an, ein möglich größes Verhältnis zwischen der Leerlaufgüte Q_u und der Lastgüte Q_l, zu erreichen. Spulen haben auf 2m Güten zwischen 300 und 600. Setzt eine 3dB Bandbreite von 20MHz an, ist die Lastgüte 144/20=7. Damit ist der Eingangsverlust 0,1...0,2dB.

Circuit Description

The LNA is designed straight forward (figure 2), however L2 and L5 need some special attention. The input matching network consists of C1, C2 and L1. L1 is a lumped air coil, made of 2 mm diameter silver plated copper wire. Using wire spacing of 2mm, the theoretical Q is estimated to be above 500. The inductance is 65 nH. The bandwidth (-3 dB) is set to about 20 MHz, a compromise between selectivity and loss. At 100 MHz the gain is reduced by 12 dB compared to 144 MHz. The calculated insertion loss amounts to 0.1....0.15 dB.

Bild/Figure 5: Intermodulation Measurement set-up



L2 and L5 are part of the stabilising measures I have taken, in order to obtain an unconditionally stable amplifier. L2 is 13/4 turn of 1 mm wire (use 3.5 mm drill), which bridges the space between the gate and the top of the tuning capacitor. L5 is a very small inductance in series with the drain (about 4 nH). A thin piece of wire, folded into a hairpin 4mm tall, will do.

Opposed to conventional "low signal" FET's, this E-pHEMT needs positive bias at the gate. Two approaches are possible: a passive or an active circuit. The former is simple, the latter provides a constant current over temperature, hence the choice for the active circuit. Q2 measures the voltage across R6 and provides DC feedback to the gate of Q1, which in turn provides feedback to the FET to keep the voltage across R6 constant. Using the values as depicted in the schematic, a current between 60 and 70 mA will flow through R6 (= drain current). Changing R6 will change the current through the FET.

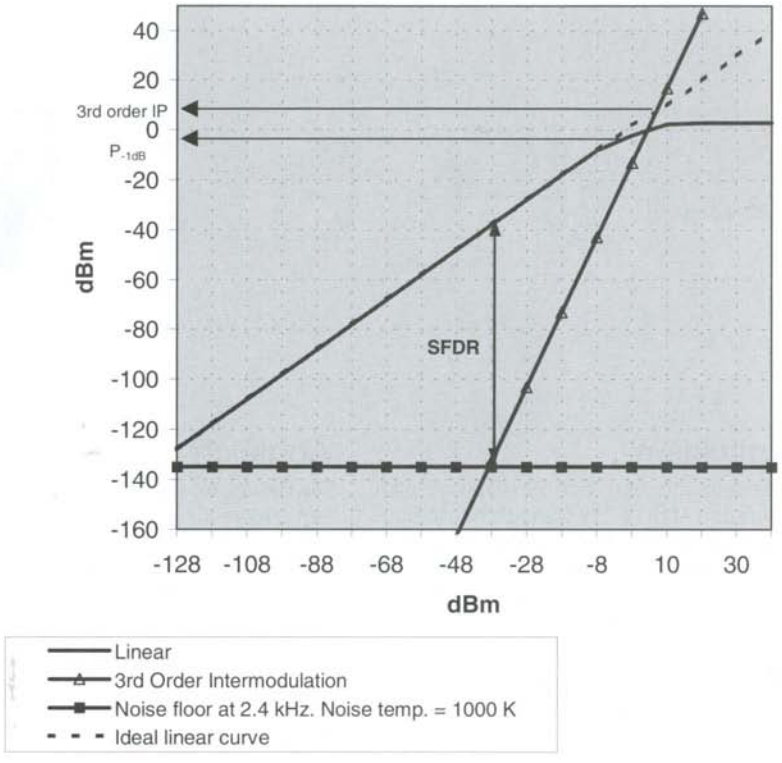
Schaltung

Die Schaltung in Abb. 2 hat wenig Geheimnisse. Die Eingangsschaltung besteht aus C1, C2 und L1. L1 wird aus 2mm CuAg gewickelt. Mit einem Windungsabstand von 2mm wird eine Güte von ca. 500 erreicht. Die Induktivität ist 65nH. Bei einer 3dB bandbreite von 20MHz ist der Abfall bei 100MHz 12dB.

L2 und L5 wurden experimentell gefunden, um den K-faktor größer als 1 werden zu lassen.L2 besteht aus 1 ¾ Windungen 1mm CuAg auf einem 3,5 dickem Dorn. L5 ist ein dünner Draht als 4mm "Hairpin" gebogen.

Der ATF54143 ist "Enhance Mode" FET. Er braucht also eine positive Spannung am Gate, um zu leiten. Es wird eine aktive Biasschaltung verwendet. Q2 mißt die Spannung

Bild/Figure 6: IIP3, P-1 dB and Spurious Free Dynamic Ra



an R6 und sorgt durch Rückführung auf das Gate dafür, ein ein konstanter Strom durch Q1 fließt. Mit den Werten im Schaltbild beträgt der Strom 60...70mA.

Construction

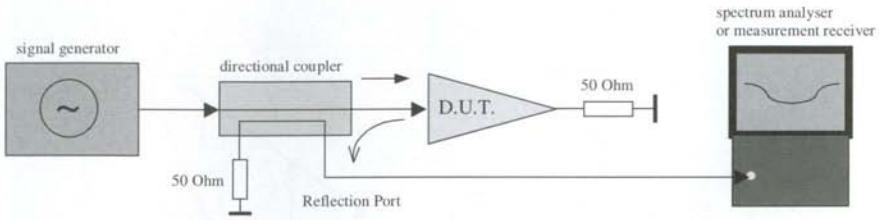
The circuit can be build on a piece of copper clad or tin sheet, using "spider structures". The E-pHEMT is a very tiny device (SOT-343 shape), so I've made a PCB design, which is printed in this article.

PCB layout and components placement are shown at the end of this article (figures 14 through 17).

Building the pre-amp is quite straight forward. Use very fine tin core (1 mm), and a clean solder tip. Position all the parts on the PCB, except for the pHEMT (ATF-54143). Solder the components (make sure the parts are in the right position, capacitors and resistors look quite alike at SMD shape level!). Figure 3 shows the components at the Top side of the prototype (!) PCB.

Inductors L6 and L7 must be placed on the Bottom side of the PCB in order to prevent coupling with the input inductor L1. The last part to solder is the ATF-54143 (designated 4Px). Now the pre-amp is ready for testing.

Bild/Figure 7: Input return loss measurement set-up



Konstruktion

Die Leiterplatte und der Bestückungsplan sind aus den Abb.14...17 ersichtlich. Alle Bauelement werden montiert und verlötet. Zuletzt wird der sehr FET ATF54143 (4p) eingelötet. L6 und L7 sitzen auf der Masseseite der Platine. Die Abb. 3 und 4 zeigen den Aufbau.

Adjustment

Although the pre-amplifier is stable, make sure to connect an antenna, or 50Ω dummy loads to in- and output. Connect a clean power supply to the circuit (9 to 24V DC) and measure the current at the power supply or the voltage across R6. The current should read between 65 and 70 mA, the voltage measured across R6 should read about 1.14V.

Next, insert the pre-amp in the RX chain and tune to a beacon. Adjust the input coil tune capacitor to maximum signal strength. I found that the minimum noise figure is a very broad minimum. Tuning for maximum signal strength equals the minimum noise figure within a few hundreds of a dB. The only way to squeeze the last hundreds of noise figure out of the pre-amp, is by using a calibrated set-up.

Abgleich

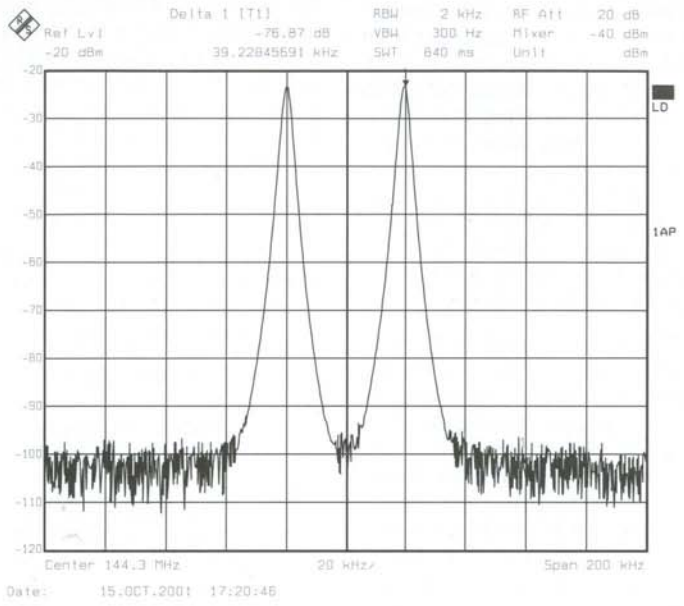
Die Betriebsspannung von 9...24V wird angelegt und verifiziert, daß der Strom 60...70mA beträgt. Die Spannung über R6 beträgt 1,14V.

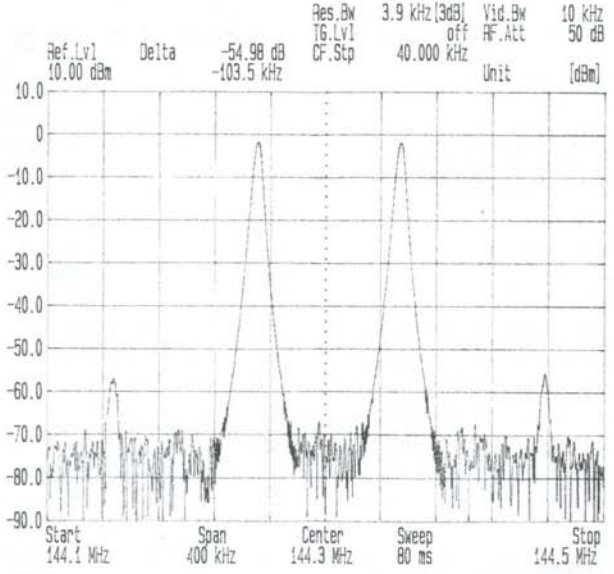
Der Eingangskreis wird an einer schwachen Bake einfach auf Maximum gedreht. Die Rauschzahl ist dann bis ein paar Hundertels dB im Minimum.

Measurements

In this chapter some considerations and pitfalls of measurement set-ups will be described. Obviously, the noise figure of a pre-amplifier is one of the most important quantities, however, some errors easily made, may lead to erroneous conclusions. The linearity of a pre-amplifier may seem unimportant, but, like the strength of a chain, the weakest part of a receiver chain determines the total strength. The in- and output impedance is an indication of how stable an amplifier is. Moreover, high output return loss values will keep subsequent amplifier stages quiet.

Bild/Figure 8: Input 2-tone signals





Bild/Figure 9: Output Intermodulation Products

Noise figure measurements and inherent errors

Fortunately, I am in the position to use professional noise measurement equipment from HP (HP8970A and HP346B noise source). Nevertheless, one should be careful not to make measurement errors. Measurement errors may be not obvious when starting a measurement. An example is the effective value of a periodic signal. If this is not a perfect sinewave, most voltage meters will give the wrong effective voltage. They are designed using the assumption that an alternating voltage will be a sinewave!

The input SWR of a low noise amplifier is often everything but 50Ω. Most designs will use a tuned circuit in order to transform the input impedance to optimal noise impedance of the active device. As a consequence, the optimal source impedance of an active device rarely matches the optimal power impedance. Hence, it is rare to find low noise pre-amps that exhibit a 50Ω input impedance. A poor input SWR of a pre-amplifier may influence the measurements dramatically (not the noise figure itself!!).

The nature of noise measurement equipment is to switch a known noise source ON and OFF. The ratio between the ON and OFF situation is the basis on which the noise figure calculations are performed. The noise source is followed by a fixed amount of attenuation. However, the impedance of the noise source itself may not be exactly 50Ω, due to the fact that a switch is involved (ON and OFF). As long as the impedance of the DUT is 50Ω the noise source mismatch is of no concern, because the equipment is calibrated using 50Ω impedance. However, a DUT with an input impedance other than 50Ω, will result in an error in attenuation factor between the 2 alternating noise states. This difference is usually ignored, but becomes crucial when the impedance deviates much from 50Ω or when the noise figures we want to measure are very small.

One example I recall, is a design from YU1AW [5]. This pre-amplifier had an excellent noise figure (it utilised a MGF1302), but had an input SWR of 1:100 or so. Such a SWR will not deteriorate the amplifier's performance, but measuring its noise figure, was quite a challenge! In fact, I was able to tune the input circuit to negative noise figures!! The only way to resolve this was by inserting a fixed (calibrated) attenuator between the noise source and amplifier. After subtracting the attenuator value of the measured value, I was able to obtain the real noise figure (0.35 dB for the YU1AW pre-amp).

If you are interested to get to the bottom of noise figure measurements and pit falls, it is worth reading an article by Rainer Bertelsmeier, DJ9BV [6].

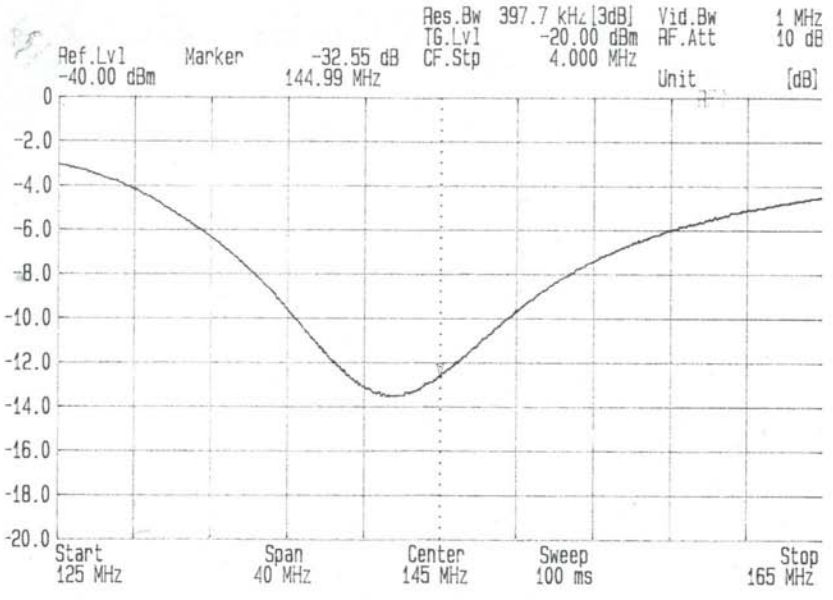
Inserting extra attenuation reduces the measurement error considerably and should be standard practice in low noise pre-amp measurements. Using a standard noise source (even a professional one), may lead to misleading (low) noise figures! Some noise figure measurement set-ups automatically measure the S-parameters of both noise source and DUT, and compensate. This may be the ultimate method, but requires a very expensive set-up.

Measuring IP3

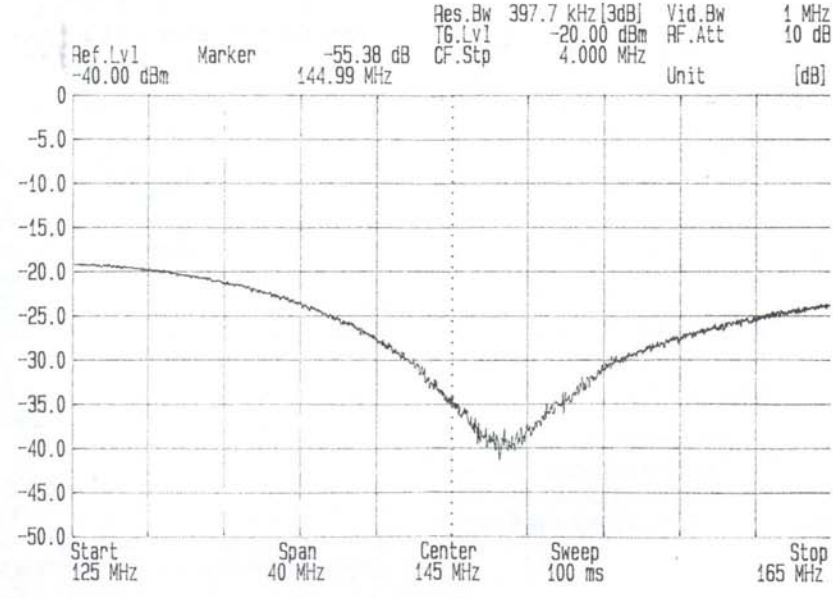
Linearity can be measured using 2 independent signal sources, isolated from each other by circulators and a combiner. The circulators are added in order to increase the isolation between the 2 signal sources and prevent intermodulation to emanate from the signal sources themselves (figure 5). In this set-up I used the FSEA spectrum analyser from Rohde & Schwarz (but any spectrum analyser having adequate dynamic range, may be used). Care must be taken not to overload the analyser, which will lead to the generation of IM products in the analyser itself.

The isolators are from Philips (surplus 154 MHz pagers systems, tuned to 145 MHz), which provide more than 40 dB isolation. Added to the isolation provided by the hybrid combiner (about 20 dB), both signal generators are isolated by more than 60 dB, which was sufficient to obtain more than 80 dB suppression of any 3rd order products.

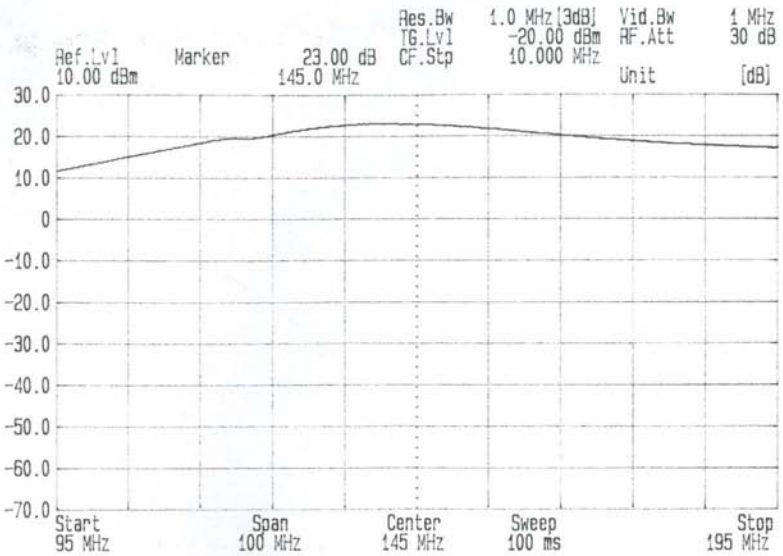
Bild/Figure 10: Input Return Loss



Bild/Figure 11: Output Return Loss



Bild/Figure 12: Gain plot from 95 to 195 MHz



In figure 6, the relation between IM, the fundamental signal and IP3 is shown. As can be seen the actual 3rd order IP point will never be reached by an amplifier, because saturation will have occurred long before. Instead, we need to measure the intermodulation products some 10 to 20 dB below the saturation point of the amplifier, and calculate the IP3. The Spurious Free Dynamic Range (SFDR) can also be calculated if the IIP3 and noise floor are known.

The equation for IP_3 is:

$$[3] \quad IP_3 = \frac{3 \cdot P_O - IMD_3}{2}$$

where

P_O	Single tone output level in dBm
IMD_3	Two Tone 3rd order distortion level in dBm

From the intermodulation products as they appear at the output of the Device Under Test, the IIP3 can be calculated (as a tool I use a freeware program from Agilent: AppCad [7]).

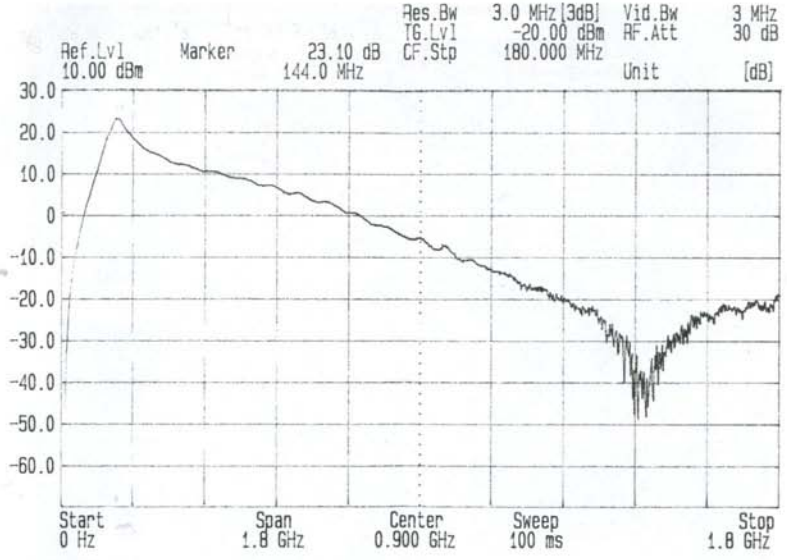
Measuring the return loss of amplifier ports

The input and output return loss are a measure of how well an amplifier matches to 50Ω impedance. The smaller the reflection (i.e. a high return loss level in dB), the better it matches to 50Ω. Is it an important value? Not for the actual noise figure. However, upon employing the LNA good matching guarantees that 50Ω interconnection lines can be used without having to take their length into account. The return loss can be measured using a directional coupler which is fed by a signal generator and terminated by the Device Under Test (DUT). The reflection port will show the amount of energy that is not absorbed by the DUT and reflected back into the directional coupler (Figure 7).

In stead of a spectrum analyser, a sensitive power meter (< -10 dBm) or a calibrated receiver can be used as well.

The set-up can be easily calibrated: Step 1: Let the output port open (i.e.: no DUT attached to the directional coupler) and read the strength of the signal at the reflection port of

Bild/Figure 13: Gain plot from 0 to 1800 MHz



the directional coupler (a value should be found equivalent to the specified coupling loss of the directional coupler. For example, if the coupling loss is 20 dB, and the signal generator is set to -20 dBm, a value of about -40 dBm should be found).

Step 2: Attach a 50Ω dummy load or 50Ω SMD resistor to the output of the directional coupler, and the reading should be at least 20 dB less than before because all energy should be absorbed in the 50Ω load and no reflections should appear at the reflection port (apart of the directivity of the coupler in use, usually 30 dB).

Messungen

Die Messungen beziehen sich auf folgende Eigenschaften:

- Rauschzahl
- Linearität (IP3)
- Eingangs- und Ausgangsanpassung

Rauschzahl

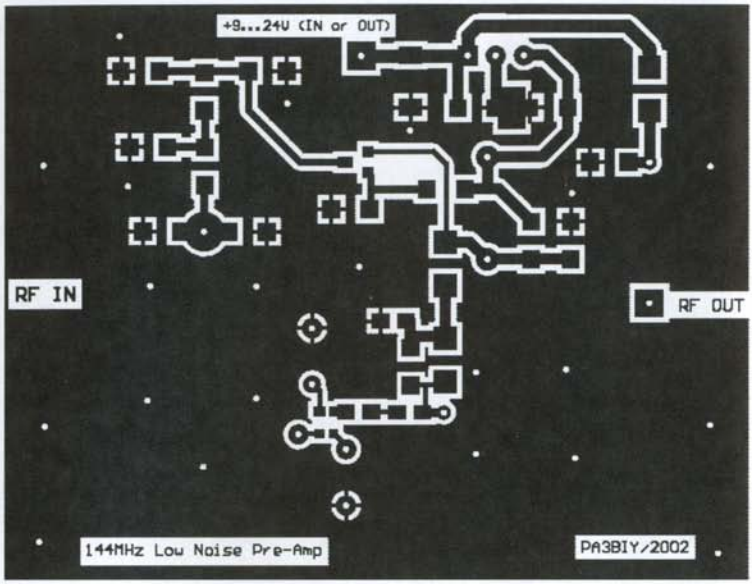
Normalerweise hat ein Vorverstärker ein schlechtes Eingangs-VSWR. Das geht den Meßwert eine Rauschzahlmessung sehr stark beeinflussen.

Die Rauschquelle schaltet periodisch zwischen Ein- und Auszustand hin- und her. Dabei ändert ihre Impedanz ganz wenig. Selbst Sie ihre Anpassung zeigt (> 30db Rückflußdämpfung) reicht eine kleine Änderung der Impedanz, um bei Meßobjekten mit hohem VSWR eine Änderung der Verstärkung herbeizuführen. Damit kann je nach Phasenlage ein größerer oder kleiner Y-faktor vorgetäuscht werden, was dann zu einem falschen Meßwert für die Rauschzahl führt. Speziell 15dB ENR Rauschquellen wie die HP346B oder die AILTECH 7615 sind dafür anfällig. Da hilft dann nur ein zusätzlicher 10dB Abschwächer.

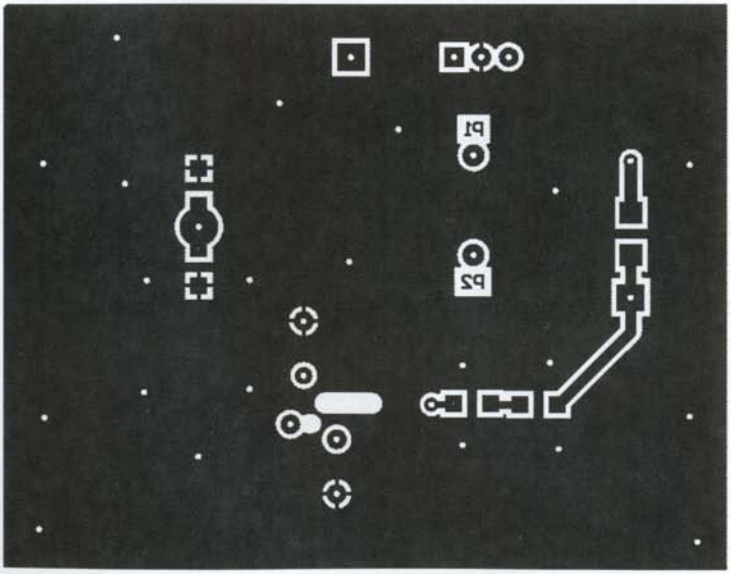
Das war vor Jahren die einzige Methode, um einen Vorverstärker nach YU1AW [5], der ein Eingangs-VSWR von 1:100 hatte, zu messen.

Wer sich da eingehender informieren möchte, sei auf den Artikel von Rainer Bertelsmeier, DJ9BV [6], verwiesen.

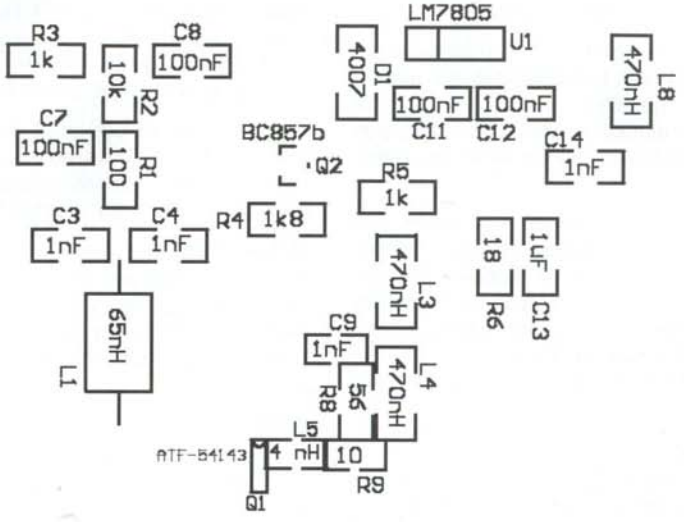
Bild/Figure 15: PCB Top View



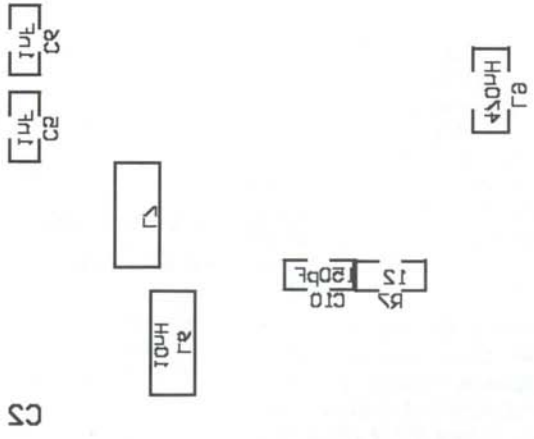
Bild/Figure 14: PCB Bottom View



Bild/Figure 16: Silk Screen Top



Bild/Figure 17: Silk Screen Bottom



Linearität (IPI)

Wie in BA,. 5 gezeigt wird die Intermodulation mit zwei entkoppelten Signalquellen und einem Spektrumanalysator gemessen.

Die Entkopplung wird mit zwei Isolatoren von Philips und einem Hybridkoppler auf mindestens 60dB gehalten. Das reicht aus, um keine Intermodulation im Dynamikbereich (> 77dB) des Spektrumanalysators zu sehen (Abb. 8).

Abb. 6 zeigt den Zusammen zwischen den Intermodulationsprodukten und dem Eintonsignalen. Die Produkte wachsen im linearen Bereich mit der 3-fachen Geschwindikeit wie die Einzeltöne, bis schließlich Sättigung eintritt. Aus einer solchen Kurve kann den IP3 und den intermodulationsfreien Bereich bestimmen.

Anpassung

Die Anpassung im Ein- und Ausgang macht den Einsatz des Verstärkers problemlos z.B. vor Filtern und ist außerdem ein Kriterium für Stabilität.

Die Rückflußdämpfung kann nach dem Aufbau im Abb. 7 bestimmt werden. Die Kalibration wird durch Anlegen einer Last von 50Ω und einer offenen Last bewerkstelligt.

Measurement Results

Intermodulation

From the intermodulation products as they appear at the output of the Device Under Test, the OIP3 can be calculated (I used a freeware program from Agilent: AppCad [7]). The IIP3 then follows by subtracting the gain (AppCad will perform this equation as well). The 2-tone test signal as applied to the pre-amplifier is shown in figure 8a. All IM products are 80 dB down. In figure 8b, the measured IM spectrum is shown as produced by the amplifier.

The measurements performed on the 144 MHz pre-amplifier shows 3rd order Intermodulation Products of -55 dBm, compared to the fundamental signals of -2 dBm. These values result in an Output IP3 of +25.5 dBm. At an amplifier gain of 23 dB, the IIP3 is +2.5 dBm (IIP3 = OIP3 - Gain).

Input and output return loss

The input and output return losses were measured using a professional S-parameter measurement set-up by HP. The input return loss shows a fairly wide dip, and peaks at -13.5 dB around 142 MHz. However, the return loss is still -12 dB at 144 MHz.

The output return loss has a more or less flat characteristic, which is the result of the heavy loading by R8 in the drain circuit. At 144 MHz the output return loss is better than 25 dB.

Noise figure

In order to prevent the gain error, a fixed (carefully measured!) attenuator of 10 dB was inserted between the noise source and the LNA. The noise LNA figure was measured to be 0.25 dB.

Gain

The gain is measured in a traditional manner (if you are lucky to have a spectrum analyser at your disposal!). Figure 11 and 12 show plots of different frequency spans. A slight rise in gain can be noticed for frequencies higher than about 1500 MHz. This is due to the series inductance of the tuning capacitor and the series inductance in the source. As can be seen from the plot, the gain is 23 dB around 145 MHz.

Summarising

Gain:	23 dB
NF:	0.25 dB
Input return loss:	12 dB
Output return loss:	>25 dB
3rd order input intercept point:	2.5 dBm
Supply voltage:	+9...+24V
D.C. supply current:	68 mA

Ergebnisse

Intermodulation

Abb. 9 zeigt die Intermodulationsprodukte eines intermodulationfreien Eingangssignal nach Abb. 8. Aus den Pegeln errechnet sich ein OIP3 von IP3=-2dBm+55/2=25,5dBm. Bei einer Verstärkung von 2,5dBm entspricht das einem IIP3 von +2,5dBm.

Anpassung

Abb. 10 zeigt die Eingangsanpassung. Sie ist auf 144MHZ 12dB, ein erstaunlich hoher Wert für die Rückflußdämpfung.

Abb. 12 zeigt, daß auf 145MHZ die Rückflußdämpfung besser als 30dB ist.

Rauschzahl

Die Rauschzahl des Prototypen wurde mittels HP8970B und einer HP346B+10dB Abschwächer mit 0,25dB gemessen.

Verstärkung

Die Verstärkung betragt auf 145MHz 23dB (Abb. 12). Der Breitbandplot ist in Abb. 13.

Conclusions

The merit of this pre-amplifier is in the combination of a high dynamic range with a very low noise figure. Optimal utilisation of both aspects can only be realised when the subsequent stages have a high dynamic range as well, otherwise only the noise figure will drop, sacrificing dynamic range. Modern E-pHEMT FET's enable us to construct pre-amplifiers with low noise figures and high IIP3, without the need for compromises on either aspect. Moreover, the Input- and Output impedance's can be matched very closely to 50Ω as well, without sacrificing performance. Some care must be taken in order to prevent oscillation in the SHF frequency range, given the high f_T of these devices, but carefully designed these amplifiers are unconditionally stable.

Schlußbemerkungen

Der Vorteil dieses Vorverstärkers besteht in der niedrigen Rauschzahl, des hohem IP3, der guten Ein- und Ausgangsanpassung und nicht zuletzt der absoluten Stabilität von 100 bis 10000MHz. Das wurde ermöglicht durch den Einsatz eines modernen E-PHEMT.

Acknowledgement

I'd like to thank Frank van Vliet (PA3FAQ) for reviewing this article and for his technical support considering E-pHEMTdevice issues. I'd also like to thank Jos van de List (PA0JOZ) and Rainer Bertelsmeier (DJ9BV) for their constructive comments.

[As an option, I can supply complete "do it yourself" kits, including the PCB, 2 x N connector, a milled aluminium box and all electronic parts (ATF-54143 pHEMT, Hi Q tuning capacitor, SMD parts, etc). I need at least 100 interested Hams before I'll order PCB's. If you are seriously interested, please send an email to: pa3biy@wanadoo.nl]

Danksagung

Ich möchte Frank van Vliet (PA3FAQ) dafür danken, daß diesen Artikel Korrektur gelesen hat. Jos van de List (PA0JOZ) und rainer Bertelsmeier (DJ9BV) danke für Ihre konstruktiven Beiträge.

Als Option biete ich die Bereitstellung von Teilesätzen an, die alle Teile einschließlich PCB und Gehäuse enthalten. Ich brauche mindestens 100 Interessenten, um eine PCB kommerziell fertigen zu lassen. Nur ernsthaft Interessierte melden sich bitte unter pa3biy@wanadoo.nl

Literature

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[3]Domenico Marini, I8CVS, Piero Moroni, I5TDJ, "Improvements For The 144 MHz Cavity Preamplifier", DUBUS, page 25-32

[4]Puff version 2.1

[5]D.Dobricic, YU1AW, "Absolut Stabile, Rauscharme GaAs-FET Vorverstärker", UKW- Berichte 2/1990, page 118-126 and 3/1990, page 138-146

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47 GHz Verstärkertechnik

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Birkenweg 15, D-95119 Naila, Germany

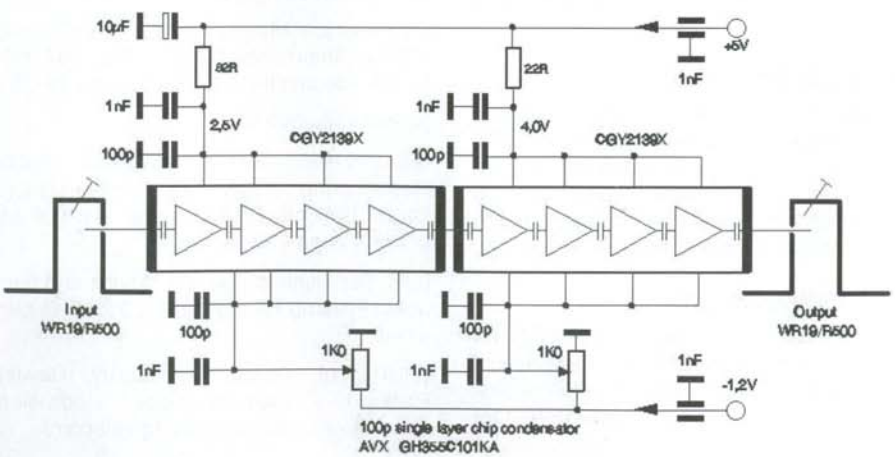
Einführung

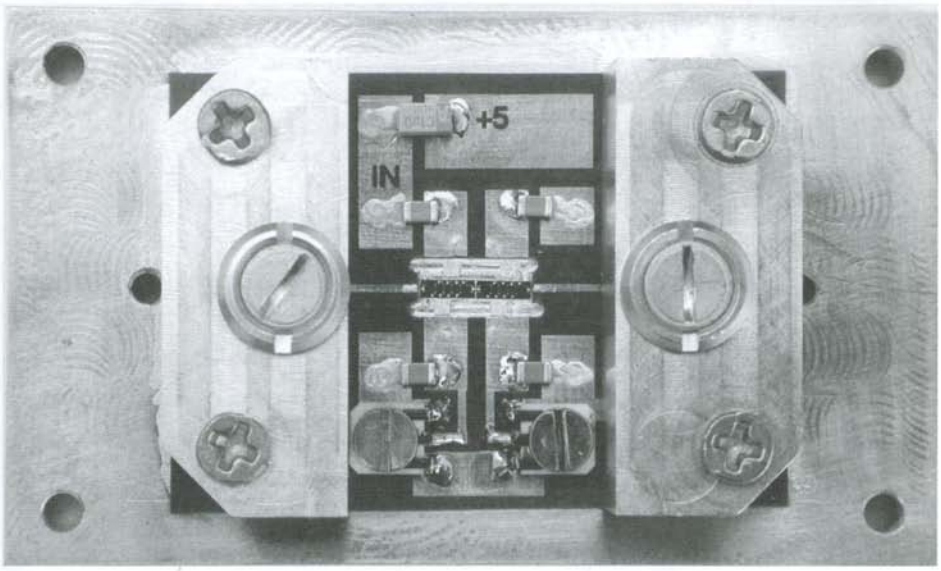
Die Realisierung eines rauscharmen Vorverstärkers mit brauchbaren technischen Daten für das 47 GHz Amateurband war bisher nicht möglich. Lediglich wurden hochkommerzielle Verstärker für die Militärtechnik oder Radioastronomie zu entsprechenden Preisen angeboten. Seit einiger Zeit sind jedoch Verstärkerchips von verschiedenen Halbleiterherstellern erhältlich, die gute Verstärkerdaten liefern. Leider sind dies reine Halbleiterchips, die zur Kontaktierung der Anschlüsse gebondet werden müssen. Dies setzt den Zugriff auf eine entsprechende Bondanlage voraus. Versuche mit gehäusten GaAs FET's wurden schon in den Neunziger Jahren unternommen, die jedoch keinerlei Verstärkung aufwiesen. Dies ist hauptsächlich auf die Gehäuse und deren parasitären Eigenschaften (Induktivitäten) zurückzuführen. Selbst CFY77 mit abgefeilten Gehäuseboden und direkter Montage auf der Leiterplatte blieben ohne jeglichen Erfolg. Alle Anstrengungen, die Bondtechnologie zu umgehen, scheiterten.

Introduction

Until now there existed no amplifiers for the 47GHz amateur band. There were only commercial amplifiers on similar frequencies for military or radio astronomy use. Their prices made them prohibitive for use by amateurs.

Bild/Figure 1: Amplifier w/ 2xCGY2139X





Photograph of the CGY2139X amplifier

Nevertheless there are some chips on the market. But they can only be used if there is access to a bonding equipment.

Since 1990 we made experiment to use normal FET's in a package on 47 GHz. Even some CFY77, where the bottom of the package had been removed and mounted directly on the PCB, were completely ineffective. So all attempts to avoid the use of bonding equipment were fruitless.

Hersteller von Chips

Chips werden von Firmen wie z.B. UMS, TRW, Philips, HP, ALPHA, SIEMENS, NEC, FUJITSU, MITSUBISHI oder anderen hergestellt. Die meisten Halbleiter werden jedoch für kommerzielle Frequenzbereiche gefertigt. Das ist z.B. der Bereich von 38...44 GHz oder 55...60 GHz. Für das Amateurband um 47,088 GHz wird leider kein Chip produziert, so dass Standardhalbleiter verwendet werden müssen, die außerhalb ihres normalen Frequenzbereiches betrieben werden und somit nur eingeschränkt die technischen Daten der Hersteller erreichen.

Verwendet wurden zum einen der von PHILIPS hergestellte Chip CGY2139X (30...44 GHz) mit dem zwei Verstärker aufgebaut wurden. Zum anderen wurden weitere Verstärker mit UMS Chips vom Typ. CHA2157 (55-60 GHz) und CHA2194 (36-44) aufgebaut.

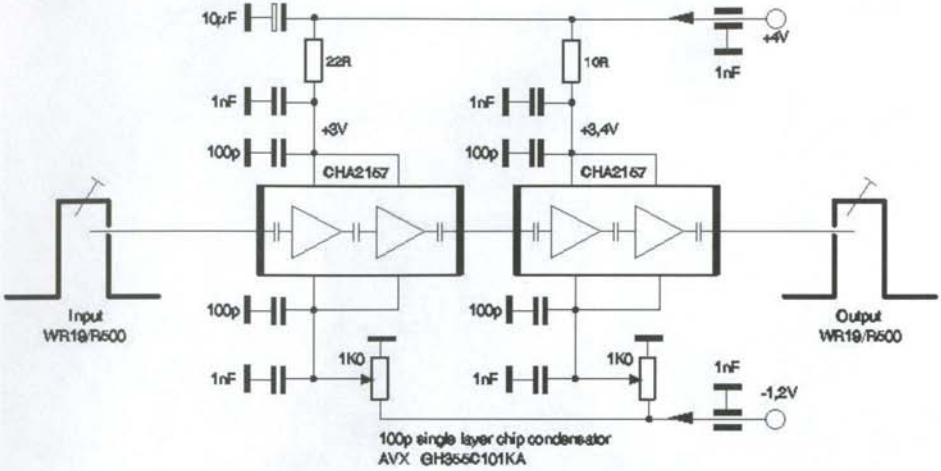
Zur Anwendung kamen jeweils zwei Verstärker Chips in Serienschaltung, um eine hohe Durchgangsverstärkung zu erzielen. Dies ist nötig um die relativ schlechte Eingangsrauschzahl des nachgeschalteten Subharmonikmischers mit Spiegelfrequenzfilter zu verbessern.

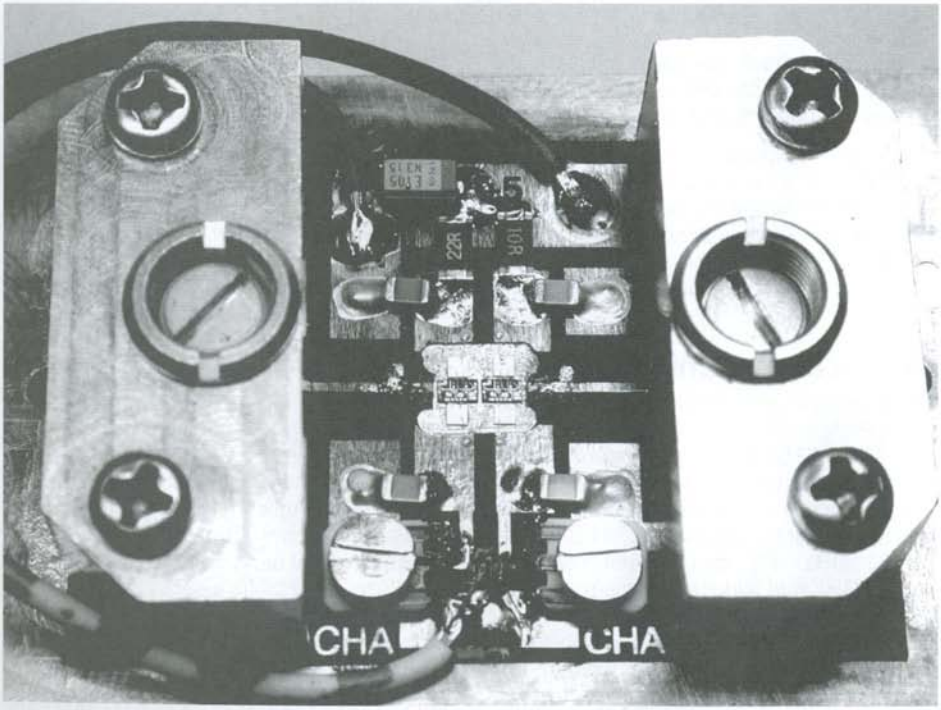
Chip Manufacturers

Usable chips are manufactured by UMS, TRW, Philips, Agilent, Alpha, Siemens, NEC, Fujitsu, Mitsubishi. There are produced for the commercial band from 38 to 44GHz and for 55 to 60GHz. To use them on 47GHz means to accept compromises in respect to their published performance.

Positive results were achieved by the Philips chip CGY2139X (33...44GHz) and the CHA2194 (36...44GHz) and CHA2157

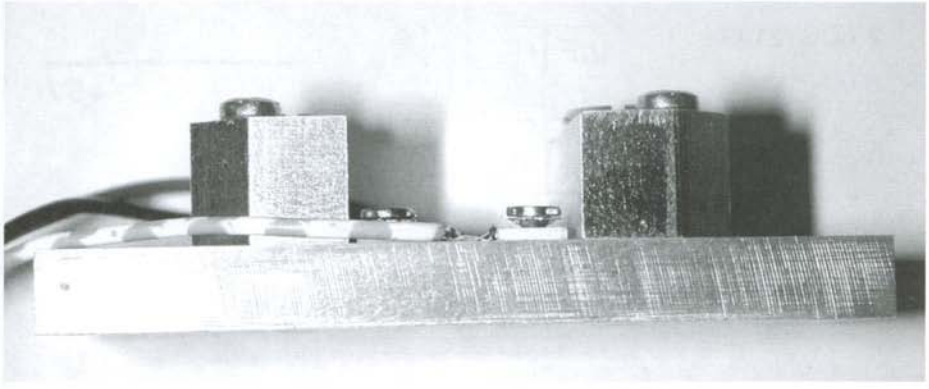
Bild/Figure 2: Amplifier w/ 2xCHA2157





Photograph of the CHA2157 amplifier

Bild/Figure 3: Side view of amplifier



(55...60GHz) from UMS. To get a reasonable gain two chips were staggered. This resulted in a gain of more than 30dB and was enough to mask the extremely noise of the subharmonic mixers in the case of an RX preamp.

Aufbau

Der Aufbau erfolgt auf einer 5 mm starken und 30 x 50 mm großen Messingplatte mit entsprechenden Ausfräsungen für Hohlleiter und Bohrungen für die verstellbaren Abstimmschieber. Die Montage der 0,12mm starken RT/duroid 5880 ROGERS Leiterplatte erfolgt durch Auflöten. Hierzu ist die Messingplatte vorher zu verzinnen. Durch diese Anordnung ergibt sich eine direkte Einkopplung von der Leiterplatte in den Hohlleiter. Ferner lässt sich der Verstärker axial drehen und somit als "Wendeverstärker" für Senden und Empfang nutzen.

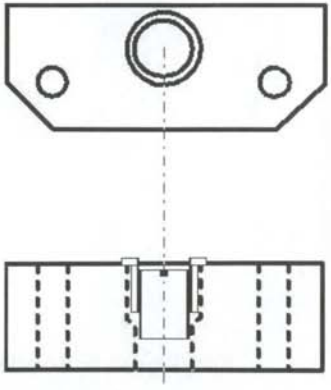
Construction

The construction was on a 5mm thick brass plate with the dimension 30x50mm (Fig. 16). The substrate is a 0.12mm (5mil) thick PTFE RT/Duroid material 5880 from Rogers. This PCB is directly soldered to the brass plate. The coupling to the waveguide is directly from the PCB. (Fig. 4).

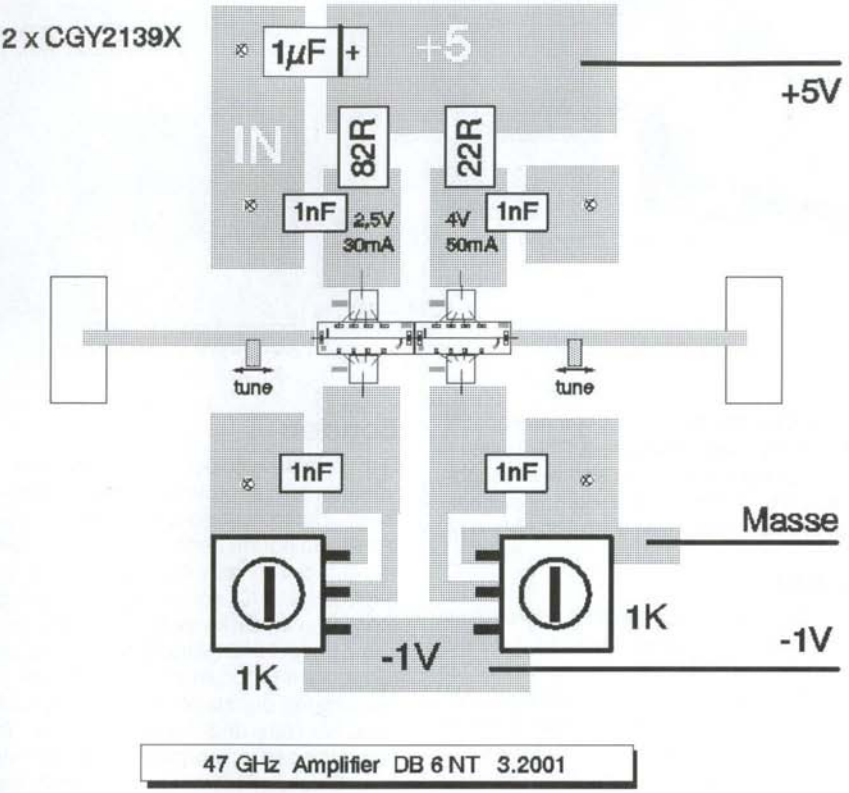
Bonden

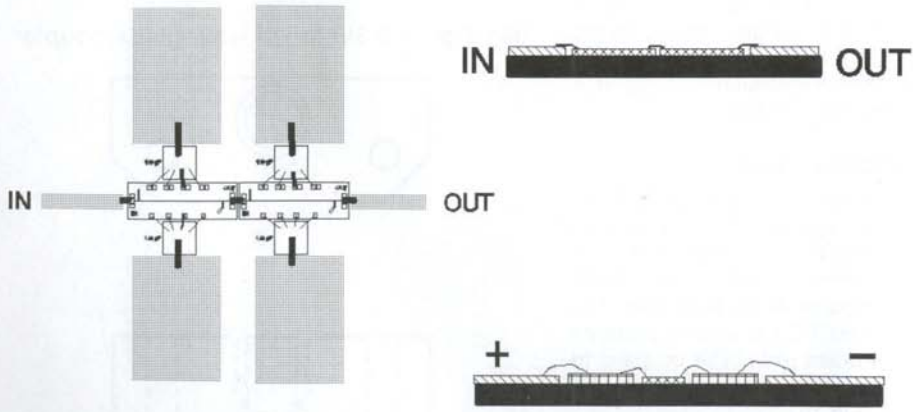
Die Verstärkerchips werden in eine Ausfräsung der Leiterplatte eingeklebt (die-bonding) und im "wedge-wedge" Bondverfahren mit 25 Golddraht ohne Bondloop mit der Leiterplatte verbunden. Der Spalt zwischen Leiterplatte und IC sollte dabei so gering wie möglich sein, um kurze Bonddrahtlängen und somit gute HF-Eigenschaften zu erreichen (Bonddraht = Induktivität = Tiefpass!). Die Versorgung der Halbleiter mit Betriebsspannung für Gate und Drain erfolgt über Bondverbindungen mit normaler "loop" auf "single-layer Chipkondensatoren" die unmittelbar neben den Verstärkern eingeklebt sind und

Bild/Figure 4: Sketch of waveguide coupler



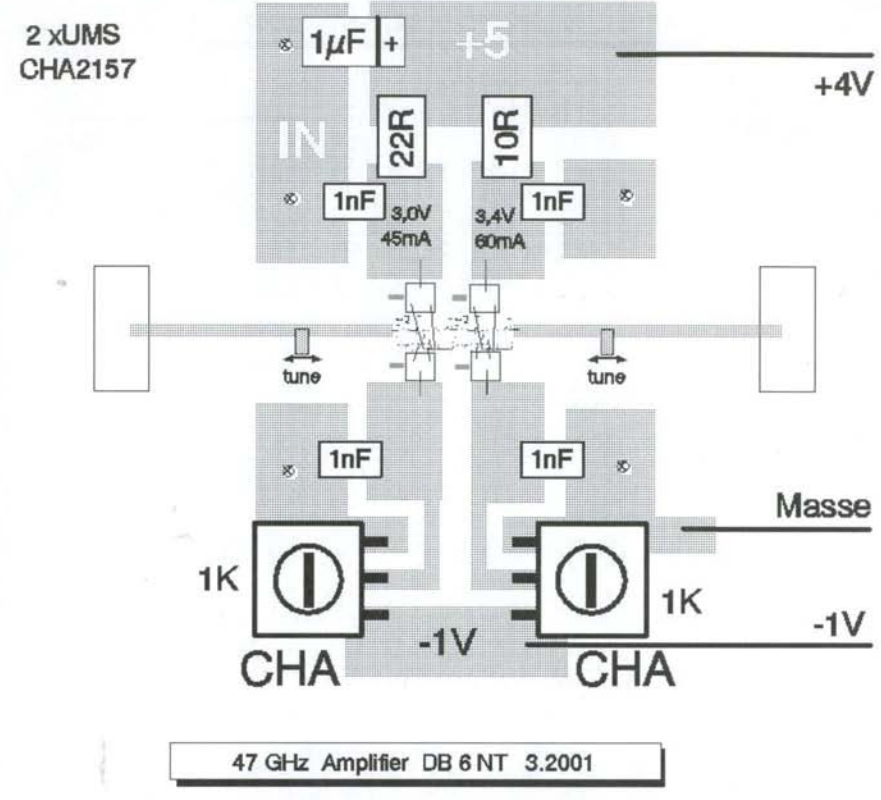
Bild/Figure 6: Parts Layout for CGY2139X

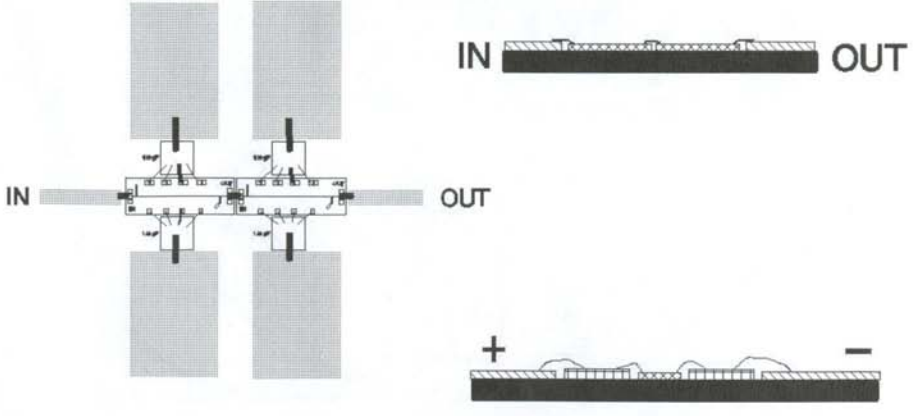




Bild/Figure 5: Bonding sketch for CGY2139X

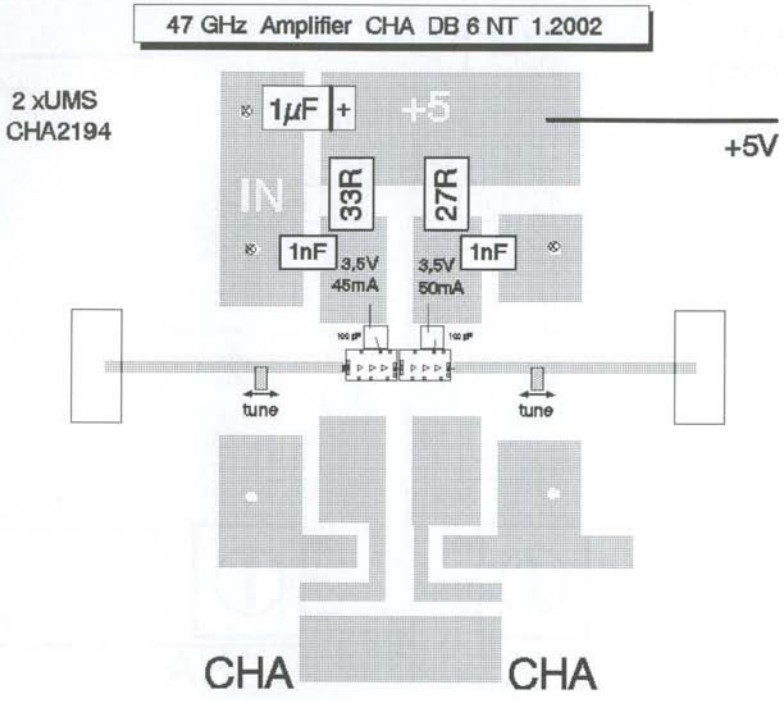
Bild/Figure 7: Parts Layout for CHA2157

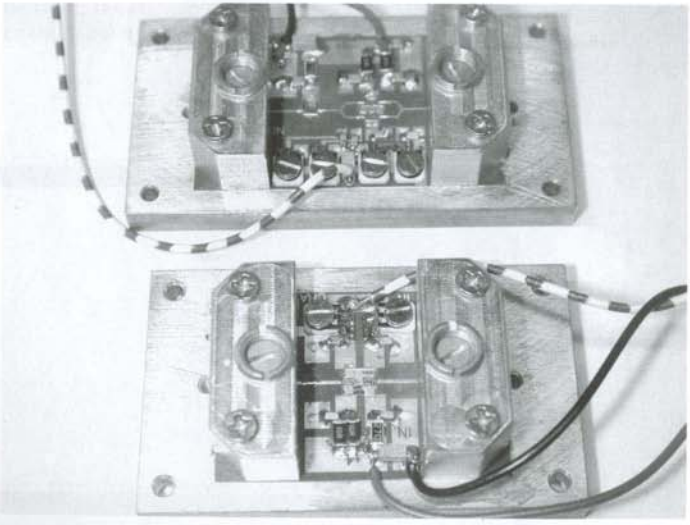




Bild/Figure 8: Bonding sketch for CHA2157

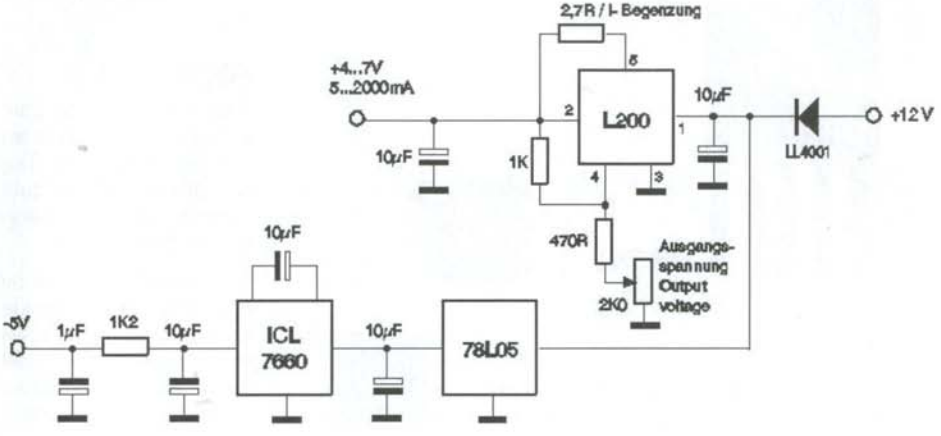
Bild/Figure 9: Parts Layout for 2xCHA2194 parallel





Bild/Figure 10: 2xCHA2194 (top) and CHA3093C (bottom)

Bild/Figure 11: Circuit Diagram for power supply



dann weiter auf die Leiterplatte. Die Chipkondensatoren sind notwendig, um Schwingneigungen durch zu lange Bonddrähte zu minimieren und somit eine gute HF Abblockung zu erreichen. Das Bonden auf weichen Substraten (6) wie TEFLON erfordert höhere Ultraschall -Leistung als auf dem Halbleiter. Um eine optimale Haftung der Drähte auf der Kupferleiterbahn zu erreichen wurde zusätzlich etwas Leitkleber aufgetragen.

Bonding

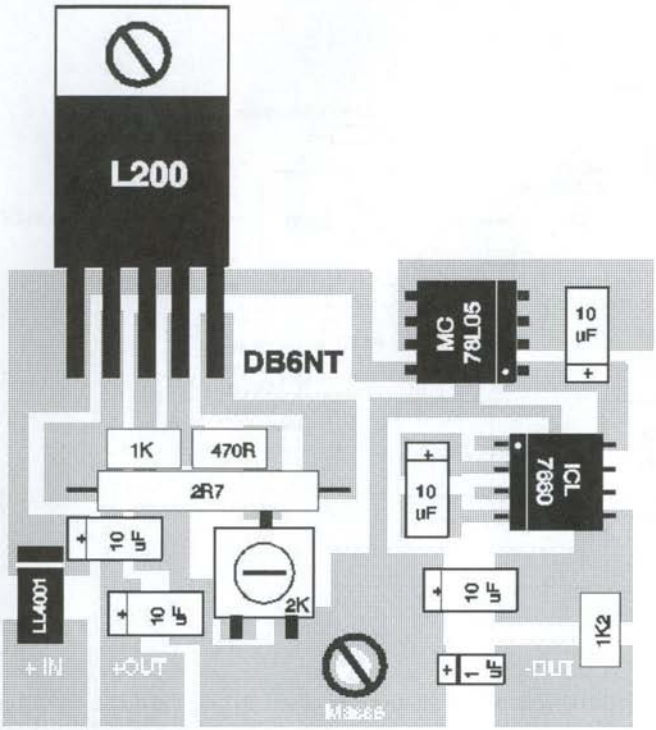
The chips have to glued into a slit of the PCB (Die-Bonding). The connection pads are bonded to the PCB by means of 25um) gold wire (wedge-wedge procedure).

The connections to the bias pads (gate and drain) are first routed to chip capacitors which are glued near the chip and then to the PCB. Bonding to a soft substrate as PTFE is not without difficulties. To help the durability of the bonding some silver epoxy glue had been attached to the copper traces.

Stromversorgung

Für den Betrieb ist eine negative Versorgungsspannung sowie eine positive Drainspannung erforderlich. Dazu wurde eine entsprechende Schaltung mit SMD -Leiterplatte entwickelt, die universal für verschiedene Verstärker verwendet werden kann. Die mit handelsüblichen Bauteilen bestückte Leiterplatte erzeugt eine strombegrenzte Drainspannung mit regelbarer Ausgangsspannung von 4...7V und je nach Widerstandsbestückung einer Strombegrenzung von 10...2000mA. Die negative Gatespannung beträgt 5V über einen Vorwiderstand. Arbeitswiderstände für die einzelnen Stufen sowie Gatespannungsregler befinden sich auf den HF-Leiterplatten.

Bild/Figure 12: Powersupply Parts Layout



Power Supply

To operate the chips a positive supply as well as a negative gate supply is necessary.

Fig. 11 to 14 show an universal power supply, which delivers a current of 5...2000mA at an output voltage of 4...7V and a negative gate voltage of -5V.

Abgleich

Zunächst werden die Gatespannungen auf den entsprechenden Wert der ICs, ca. -0,3V, voreingestellt. Danach wird die Drainspannung angelegt und der dem Datenblatt entnommene Drainstromwert eingestellt. Die Arbeitswiderstände sind vorher dafür entsprechend zu dimensionieren. Nun kann der HF-Abgleich durch Verstellen der Hohlleiterkurzschlüsse (Abstimmschrauben der Firma TE-KELEC-TEMEX) und durch Anbringen von "Stubs" an den HF-Leiterbahnen erfolgen. Danach erfolgt der Feinabgleich mit den Ruheströmen der ICs.

Alignment

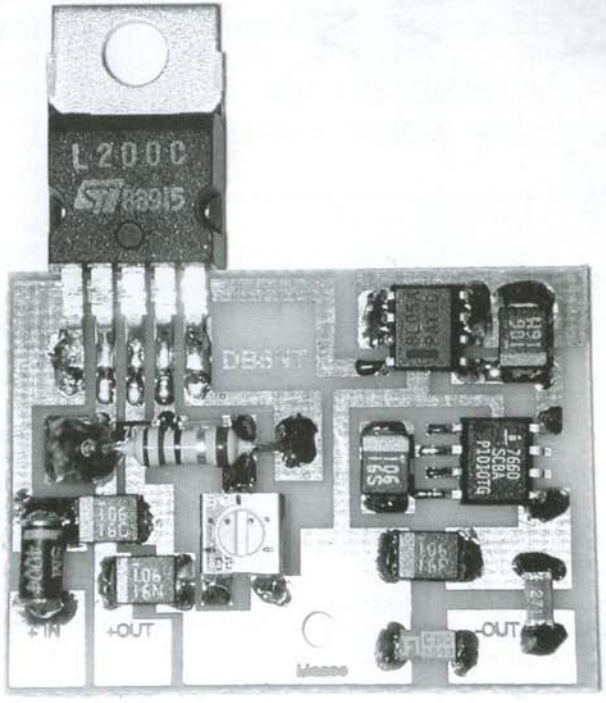
After presetting the gate voltage to -0.3V the drain voltage is applied. The typical value of the data sheet is to be set by varying the gate voltage.

The gain is optimised by adjusting the waveguide shorts (Tuning screws from Temex). Additional tuning can be performed by stubs and adjusting the current.

Meßwerte

Daten Prototypen mit je 2 Chips in Serie. Mit den PHILIPS IC's (Original Frequenzbereich 38...44 GHz) konnte bei zwei Prototypen eine Verstärkung von 31 dB bei einer Sättigungsleistung von 20 mW erreicht werden. Das ergibt bei einer Steuerleistung von 25Watt eine Ausgangsleistung von 14 mW. Einseitenbandrauschzahl NF betrug bei einem Exemplar 5,7 dB bei dem anderen 4,9 dB. Durch die hohe Leerlaufverstärkung bei 40 GHz ergab sich eine leichte Schwingneigung, die mit Absorbermaterial zu unterdrücken war.

Mit den ICs der Firma UMS (Original Frequenzbereich 55...60 GHz) konnte bei einer Verstärkung von 27 dB eine Rauschzahl NF von 4,1 dB gemessen werden. Bei einer Steuerleistung von 25W wird eine Ausgangsleistung von 8 mW erreicht. Die Sättigungsleistung liegt bei 37 mW! Output. Der Abgleich im Eingang des Verstärkers war kritisch und



Bild/Figure 13: Powersupply

stellt einen Kompromiß zwischen Rauschanpassung und Verstärkung dar. Dieses ist auf die schlechte Eingangsanpassung des IC's bei 47 GHz zurückzuführen (siehe Datenblatt -2-). Die angegebene Rauschzahl von 3,5 dB bei 55...60 GHz konnte bei 47 GHz dadurch nicht erreicht werden.

Mit 2 Chips CHA 2194 (Original Frequenzbereich 36...44 GHz) in Serienschaltung wurde bei einer Rauschzahl von 4,4dB NF eine Verstärkung von 32 dB gemessen. Die Sättigungsleistung lag bei 42 mW. Ein mit zwei parallel geschalteten Chips CHA 2194 aufgebauter Verstärker erreichte 65 mW Ausgangsleistung.

Ein weiterer Verstärker mit dem UMS Chip CHA 3093c ergab noch keine zufriedenstellenden Ergebnisse.

Rauschzahl und Verstärkung wurden über einem 47 GHz DB6NT Transverter mit 2 Kreis Hohlleiterfilter nach OE9PMJ gemessen. Dazu wurde ein Noise Gain Analysator von EATON 2075B mit einer Hohlleiterrauschquelle HP Q 347B benutzt. Die Leistungsmessung erfolgte durch ein HP435B mit Powersensor Q8486A.

Measurements

2 chip prototypes

The chips from Philips CGY2139X could be tuned to 31dB gain and a saturation power of 20mW. The noise figure measured between 4.9dB and 5.7dB for the second prototype

The chips from UMS CHA2157 (Original range from 55 to 60GHz) could be tuned to 27dB gain and a saturation power of 37mW. The tuning was quite difficult. The input return

Bild/Figure 15: Amplifier for 47GHz

loss at 47 GHz is quite low. Anyway the noise figure measured 4.1dB.

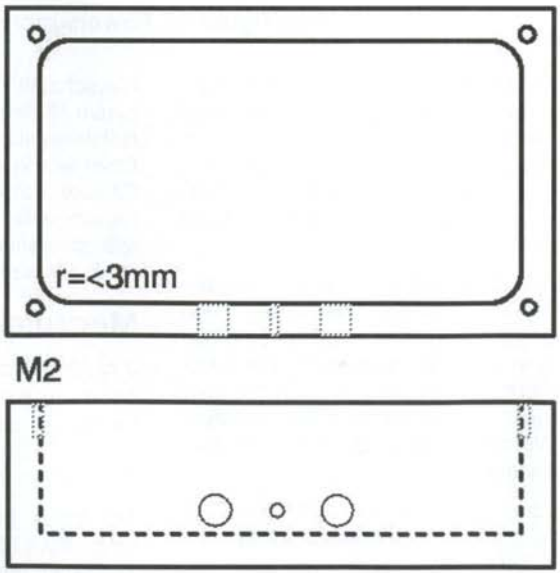
The chips from UMS CHA2194 (Original range from 36 to 44GHz) could be tuned to 32dB gain and a saturation power of 42mW. The noise figure measured with 4.4dB.

Two chips CHA2194 in parallel measured with a saturation power of 65mW.

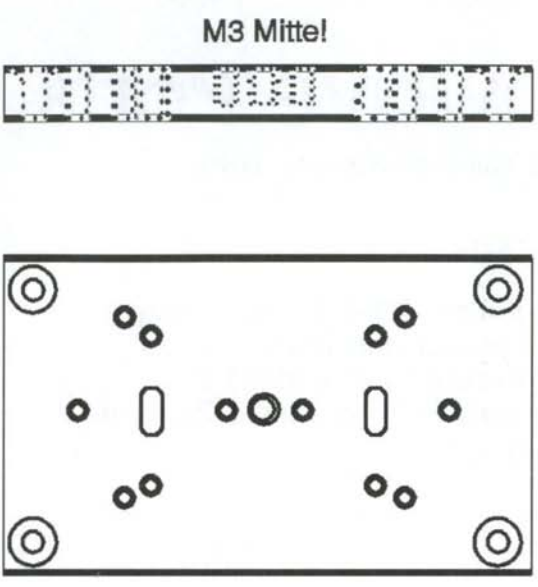
Noise figure and gain were measured in front of a DB6NT transverter which had a waveguide filter after OE9PMJ in front. The noise figure was determined by an EATON 2075B without a waveguide noise source HP Q347B. Power was measured by a Q8486A sensor with a HP435A powermeter.

Zusammenfassung

Ich denke, das die erreichten Werte einen deutlichen Fortschritt für die Amateurfunktechnik im 47 GHz Band darstellen. Sicherlich wird es in Zukunft weitere interessante Verstärker IC's geben, die noch bessere Ergebnisse bringen, doch gegenüber den bisher verwendeten Transvertern mit Subharmonicmischer (Einseitenband Rauschzahl um die 11 dB) stellt der derzeitige Stand bereits eine Rauschzahlverbesserung von über 6 dB (eine S -Stufe) dar. Die SSB Sendeleistung erhöht sich auch um mehr als 20 dB. Als einzige Hürde für den



Bild/Figure 14: Machined Box



Bild/Figure 16: Base Plate

Nachbau ist die Bondtechnologie zu sehen, die leider nicht zu umgehen ist.

Summary

For the first time active devices could be utilised in 47GHz amplifiers. This gives a large step in performance for the power level and in term of noise figure. In front of a typical subharmonic mixer which measures with a SSB noise figure of 11dB more than 6dB can be gained. The power level is improved by 20dB.

Danksagung

Bedanken möchte ich mich bei den Firmen PHILIPS Tunerwerk in Krefeld und bei der Firma RICHARDSON ELECTRONIC GMBH für die Bereitstellung der Musterchips. Ferner bedanke ich mich bei Herrn Gerold Henning für die Inbetriebnahme unserer Bondanlage und die Verarbeitung der Prototypen. Der optimale Aufbau wurde unter anderem durch Gert DG8EB und Hubert DG1KBF realisiert.

Acknowledgement

Richardson Electronic Gmbh did help with the UMS chips and Philips Tunerwerk Krefeld with the Philips chips. Mr. Gerold Henning did the bonding. Gert, DG8EB and Hubert, DG1KBF did the construction work.

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(2) Datenblatt, UMS CHA2157 und CHA2194

(3) 47 GHz Transverter, DB6NT DUBUS 1.94/Technik Buch IV

(4) 47 GHz Hohlleiterfilter, OE9PMJ GHz Tagungsheft Dorsten 1992 oder VHF - UHF Tagungsheft München 1992

(5) 47 GHz Waveguide Switch, I4OPW & IW3EHO DUBUS 1.2000

(6) Wire bonding to Soft Substrates, DENIS BOULANGER Micowave Journal Feb.1990

Microwave Parts

Editor: Rainer Bertelsmeier, DJ9BV

Enhancement PHEMT ATF 54143

Agilent ATF-54143 Low Noise Enhancement Mode Pseudomorphic HEMT in a Surface Mount Plastic Package

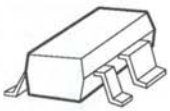
Data Sheet

Description

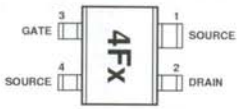
Agilent Technologies's ATF-54143 is a high dynamic range, low noise, E-PHEMT housed in a 4-lead SC-70 (SOT-343) surface mount plastic package.

The combination of high gain, high linearity and low noise makes the ATF-54143 ideal for cellular/PCS base stations, MMDS, and other systems in the 450 MHz to 6 GHz frequency range.

Surface Mount Package SOT-343



Pin Connections and Package Marking



Note:
Top View. Package marking provides orientation and identification

"4F" = Device Code
"x" = Date code character identifies month of manufacture.

Features

- High linearity performance
- Enhancement Mode Technology[1]
- Low noise figure
- Excellent uniformity in product specifications
- 800 micron gate width
- Low cost surface mount small plastic package SOT-343 (4 lead SC-70)
- Tape-and-Reel packaging option available

Specifications
2 GHz; 3 V, 60 mA (Typ.)

- 36.2 dBm output 3rd order intercept
- 20.4 dBm output power at 1 dB gain compression
- 0.5 dB noise figure
- 16.6 dB associated gain

Applications

- Low noise amplifier for cellular/PCS base stations
- LNA for WLAN, WLL/RLL and MMDS applications
- General purpose discrete E-PHEMT for other ultra low noise applications

Note:

1. Enhancement mode technology requires positive Vgs, thereby eliminating the need for the negative gate voltage associated with conventional depletion mode devices.

ATF-54143 Electrical Specifications

T_A = 25°C, RF parameters measured in a test circuit for a typical device

Symbol	Parameter and Test Condition			Units	Min.	Typ.	Max.
Vgs	Operational Gate Voltage		Vds = 3V, Ids = 60 mA	V	0.4	0.59	0.75
Vth	Threshold Voltage		Vds = 3V, Ids = 4 mA	V	0.18	0.38	0.52
Idss	Saturated Drain Current		Vds = 3V, Vgs = 0V	µA	—	1	5
Gm	Transconductance		Vds = 3V, gm = ΔIdss/ΔVgs; ΔVgs = 0.75 - 0.7 = 0.05V	mmho	230	410	560
Igss	Gate Leakage Current		Vgd = Vgs = -3V	µA	—	—	200
NF	Noise Figure[1]	f = 2 GHz	Vds = 3V, Ids = 60 mA	dB	—	0.5	0.9
		f = 900 MHz	Vds = 3V, Ids = 60 mA	dB	—	0.3	—
Ga	Associated Gain[1]	f = 2 GHz	Vds = 3V, Ids = 60 mA	dB	15	16.6	18.5
		f = 900 MHz	Vds = 3V, Ids = 60 mA	dB	—	23.4	—
OIP3	Output 3rd Order Intercept Point[1]	f = 2 GHz	Vds = 3V, Ids = 60 mA	dBm	33	36.2	—
		f = 900 MHz	Vds = 3V, Ids = 60 mA	dBm	—	35.5	—
P1dB	1dB Compressed Output Power[1]	f = 2 GHz	Vds = 3V, Ids = 60 mA	dBm	—	20.4	—
		f = 900 MHz	Vds = 3V, Ids = 60 mA	dBm	—	18.4	—

Notes:

1. Measurements obtained using production test board described in Figure 5.

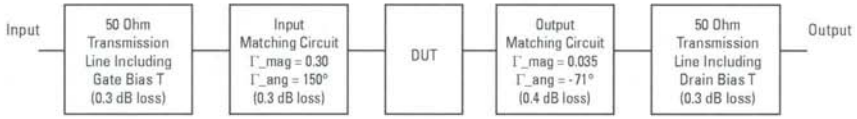


Figure 5. Block diagram of 2 GHz production test board used for Noise Figure, Associated Gain, P1dB, and OIP3 measurements. This circuit represents a trade-off between an optimal noise match and associated impedance matching circuit losses. Circuit losses have been de-embedded from actual measurements.

ATF-54143 Typical Performance Curves

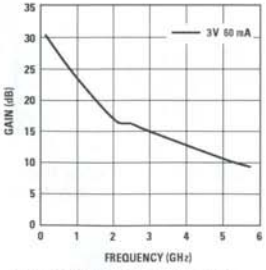


Figure 6. Gain vs. Frequency and Bias Tuned for Max OIP3 and Fmin.

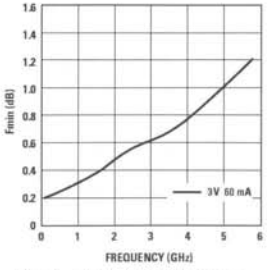


Figure 7. Fmin vs. Frequency and Bias Tuned for Max OIP3 and Fmin.

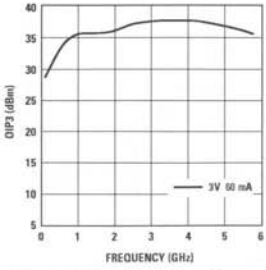


Figure 8. OIP3 vs. Frequency and Bias Tuned for Max OIP3 and Fmin.

ATF-54143 Typical Performance Curves, continued

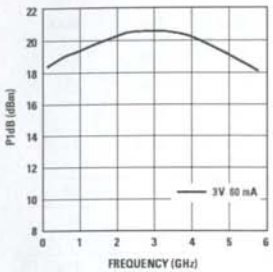


Figure 9. P1dB vs. Frequency and Bias Tuned for Max OIP3 and Fmin at 2 GHz.

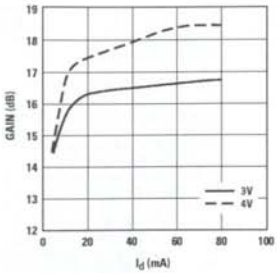


Figure 10. Gain vs. I_{ds} and V_{ds} Tuned for Max OIP3 and Fmin at 2 GHz.

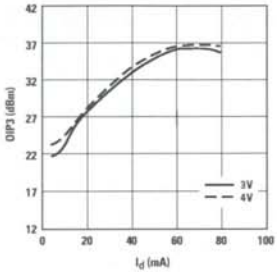


Figure 11. OIP3 vs. I_{ds} and V_{ds} Tuned for Max OIP3 and Fmin at 2 GHz.

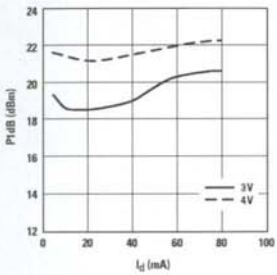


Figure 12. P1dB vs. I_{ds} and V_{ds} Tuned for Max OIP3 and Fmin at 2 GHz.

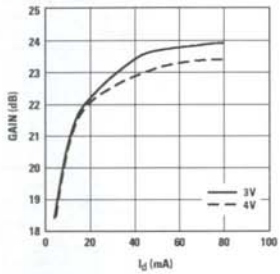


Figure 13. Gain vs. I_{ds} and V_{ds} Tuned for Max OIP3 and Fmin at 900 MHz.

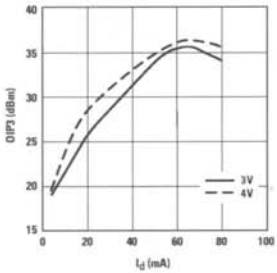


Figure 14. OIP3 vs. I_{ds} and V_{ds} Tuned for Max OIP3 and Fmin at 900 MHz.

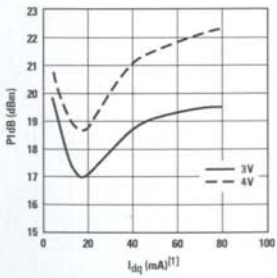


Figure 15. P1dB vs. I_{ds} and V_{ds} Tuned for Max OIP3 and Fmin at 900 MHz.

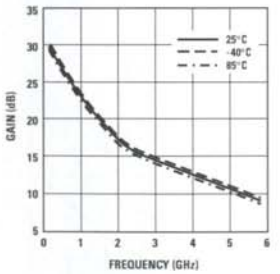


Figure 16. Gain vs. Frequency and Temp Tuned for Max OIP3 and Fmin at 3V, 60 mA.

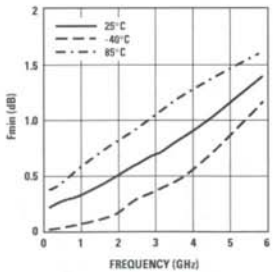


Figure 17. Fmin vs. Frequency and Temp Tuned for Max OIP3 and Fmin at 3V, 60 mA.

Note:

1. I_{dq} represents the quiescent drain current without RF drive applied. Under low values of I_{dq}, the application of RF drive will cause I_d to increase substantially as P1dB is approached.

ATF-54143 Typical Performance Curves, continued

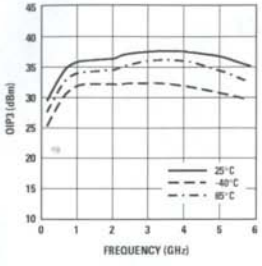


Figure 18. OIP3 vs. Frequency and Temp Tuned for Max OIP3 and Fmin at 3V, 60 mA.

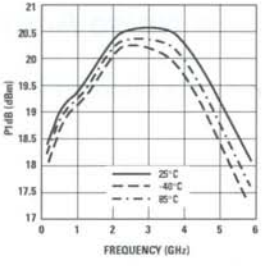


Figure 19. P1dB vs. Frequency and Temp Tuned for Max OIP3 and Fmin at 3V, 60 mA.

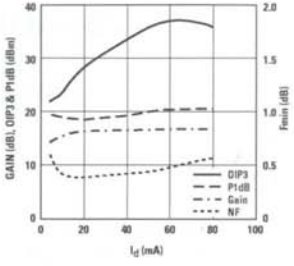


Figure 20. OIP3, P1dB, Gain and Fmin vs. I_{ds} at 3V @ 2 GHz.

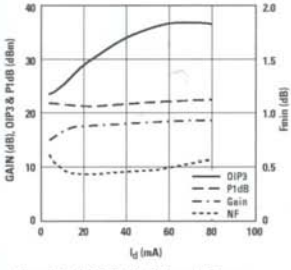


Figure 21. OIP3, P1dB, Gain and Fmin vs. I_{ds} at 4V @ 2 GHz.

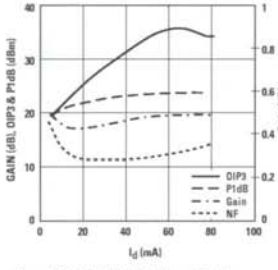


Figure 22. OIP3, P1dB, Gain and Fmin vs. I_{ds} at 3V @ 900 MHz.

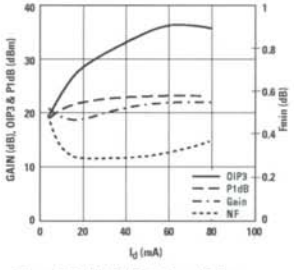


Figure 23. OIP3, P1dB, Gain and Fmin vs. I_{ds} at 4V @ 900 MHz.

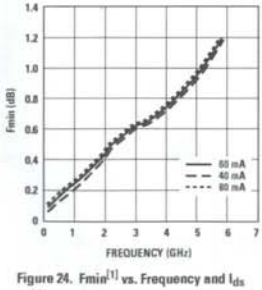


Figure 24. Fmin[1] vs. Frequency and I_{ds} at 3V.

ATF-54143 Reflection Coefficient Parameters tuned for Maximum Output IP3, V_{DS} = 3V, I_{DS} = 60 mA

Freq (GHz)	Γ Out_Mag.[1] (Mag)	Γ Out_Ang.[1] (Degrees)	OIP3 (dBm)	P1dB (dBm)
0.9	0.017	115	35.54	18.4
2.0	0.026	-85	36.23	20.38
3.9	0.013	173	37.54	20.28
5.8	0.025	102	35.75	18.09

Note:
1. Gamma out is the reflection coefficient of the matching circuit presented to the output of the device.

united monolithic semiconductors

CHA2194

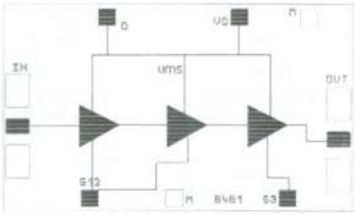
36-44GHz Low Noise Amplifier

GaAs Monolithic Microwave IC

Description

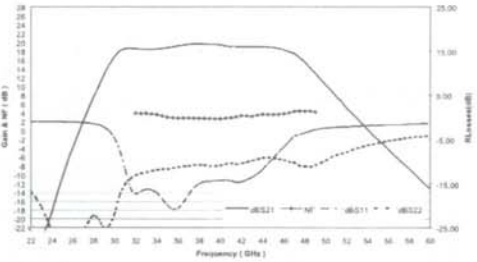
The circuit is a three-stage self biased wide band monolithic low noise amplifier, designed for 38 GHz to 44 GHz point to point and point to multipoints communication .

The circuit is manufactured with a standard HEMT process : 0.25µm gate length, via holes through the substrate, air bridges and electron beam gate lithography.
It is supplied in chip form.



Main Feature

- Broad band performance 36-44GHz
- 3dB noise figure
- 19dB gain, ± 0,5dB gain flatness
- Low DC power consumption, 45mA
- 20dBm 3rd order intercept point
- Chip size : 1,670 x 0,970x 0,1mm



On wafer typical measurement

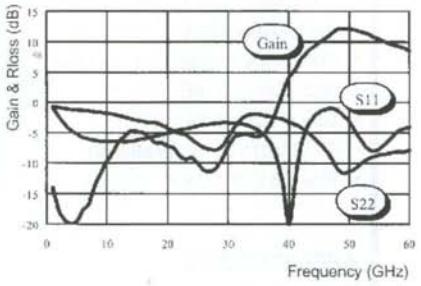
Main Characteristics

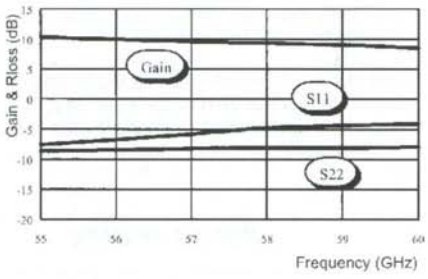
Tamb = +25°C

Symbol	Parameter	Min	Typ	Max	Unit
NF	Noise figure at freq : 40GHz		3	4	dB
G	Gain	17	19		dB
ΔG	Gain flatness		± 0,5	± 1	dB

Typical on Wafer Measurements

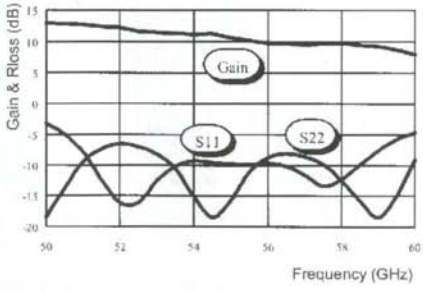
Bias conditions: Tamb = +25°C, Vd = 3.3V, Vg1 = Vg2 to have Id = 80mA

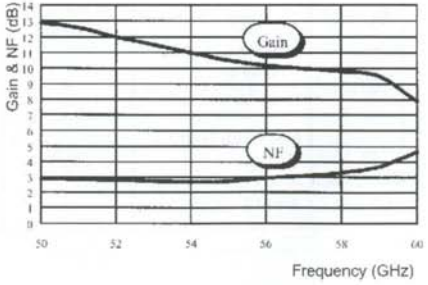




Typical packaged Measurements

Bias conditions: Tamb = +25°C, Vd = 3.3V, Vg1 = Vg2 to have Id = 80mA





CGY2139X
Ka/Q Band Low Noise Amplifier

Advance Information.

DESCRIPTION

The CGY2139X is a four stage low noise amplifier in chip form designed for communication receivers that operate from 30 GHz to 44 GHz.

This device is fabricated using the Philips Microwave Limeil standard D02AH pHEMT process. This circuit is one of PML's standard components and is part of our range of millimetre wave circuits.

FEATURES

- High Gain - Low Noise Amplifier
- Via holes grounding
- Frequency Range : 30 - 44 GHz
- High Gain : 25 dB
- Low Noise : 4 dB
- 50 Ω Input/Output Matching
- Bias : 3 V @ 30 mA

APPLICATIONS

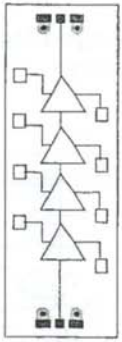
- Radio Links, Low noise receiver
- MVDS

SUMMARY DATA

	Min	Max	Unit
Frequency Band	30	44	GHz
Noise Figure		5	dB
Gain	20		dB
Supply current	20	50	mA

MAXIMUM RATINGS

Symbol	Description	Maximum Ratings	Unit
V_{dd}	Positive Supply Voltage	4	V
V_{gg}	Negative Supply Voltage	-1.5	V
RF_{in}	Input Power	0	dBm



(3 mm x 1 mm x 100 µm)

Last Revised May, 1996
Version 0.01

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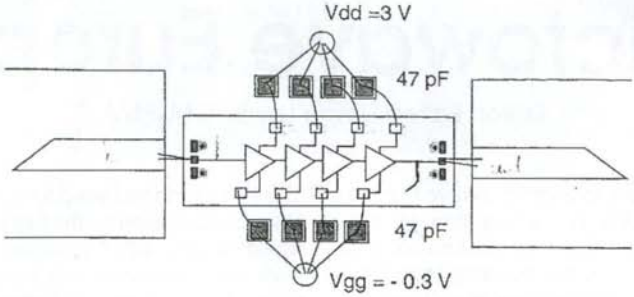
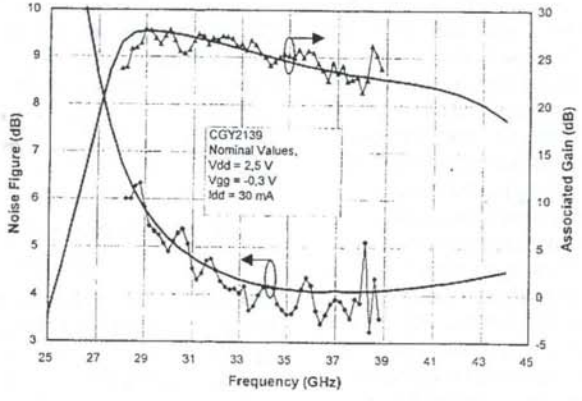
MICROWAVE
LIMEIL

PHILIPS

Assembly Diagram:



Measured Noise Figure and Associated Gain using an in-house metallic package:



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2

Microwave Europe

Editor: Editor: Simon Lewis, GM4PLM

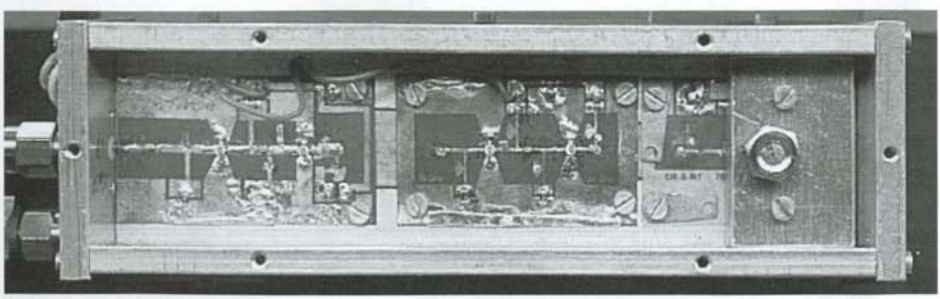
Hello and welcome to another uWave Europe Column. Sunshine is beating through the shack window here as I write this and with the promise of spring on the doorstep, thoughts are turning to the warmer days ahead and the chance of some hilltop operation. With the Foot and Mouth crisis over in the UK, this summer should see more activity although UK operators should be sensitive to that fact that some landowner's may still be touchy about site access. Please check your permissions before you venture back to your old site. Of course spring is always a time to get out and operate portable on the microwave bands. This year I have added a new FT817 to the shack. I was surprised to see little feedback from microwave operators on the 817 as an IF transceiver. A quick email to the microwave reflectors brought back a flurry of replies, some of which where reported to the RSGB's Microwave Newsletter. The general consensus is that it is an excellent little radio for microwave use. I certainly have found it to be a great little radio. I have done a few words on using it as a microwave transverter driver for this column.

This last period has seen a number of UK and US records broken on the higher bands. Who would have thought 5 years ago that we could work the distances being completed on the millimetre bands we are seeing. With technical advances in both RF components and amateur construction techniques that we have seen over the past few years who knows what will be happening in the next 5 years! Congratulations all concerned, you are all record breakers and the advances you are making are worthy of note.

Space is always tight so on with the news of those last few months of record-breaking contacts!

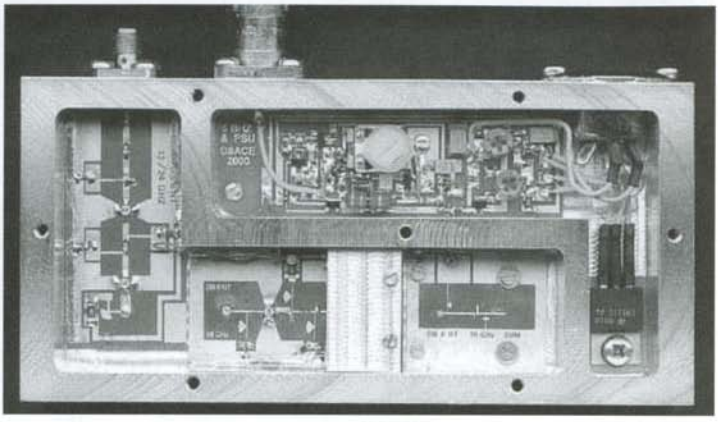
UK 76GHz Record Extended To 58km

The year 2001 ended on a high note for a group of Northern England millimeter wave operators. On 31 December 2001, Paul Widger, G0HNW/P, located at Winter Hill, IO93RO94 and Martin Farmer, G7MRF/P on Mow Cop, IO83VC47, made a two contact over the 57.8km path, for a new UK record. This comes only two months after the same group set up a new UK 47GHz record! The



G8KBE on 76GHz

previous 76GHz record stood at 52km. This contact was the result of many months of painstaking construction and equipment alignment. G0HNW/P sent a report of RS42 on SSB and received a RS43 report from G7MRF/P. Equipment at both ends were DB6NT mixer transverters and 15cm diameter dishes. After the SSB contact was established, Paul decided to try to feed the 3-foot diameter dish, used on 24/47GHz, with the 76GHz RF. For this he poked a short length of tubing inside the 47GHz feed tube and a useful improvement in 76GHz signals was obtained. Reports of RS54 were then exchanged using narrowband FM. Paul expects a further improvement to be obtained when he can feed the 3-foot dish with a purpose-made 76GHz feed tube (circular waveguide) and a dual mode (W2IMU) feedhorn. Dave, G0IVA/P, using an offset fed dish, was also present at the Mow Cop end of the path but could not find G0HNW/P's signal. Unfortunately, another member of this millimetre group, David Hall, M0VZT, was unable to take part in the tests as he was held up by snow around his home area of Telford. (Congratulations to all on another fine achievement - Ed)



G8ACE on 76GHz

JA1ELV on 76GHz

America 76 GHz Record Response.

On 1 March 2002 at 1230pm PST W0EOM completed a QSO from Mt.St.Helena, California (CM88QQ) to KF6KVG on Mt. Umunhum (CM97AE) on 47.040GHz. Signal levels were 20+dB out of the noise. Several minutes later, W0EOM and AD6FP both completed QSOs from Mt.St.Helena to KF6KVG on Mt. Umunhum on 75.600 GHz. Once again signal levels were 20+dB out of the noise. The distance from CM88QQ to CM97AE is calculated as 175.3km.

For a more detailed report on these activities please visit Peter Day G3PHO's site at www.qsl.net/g3pho

Japan Millimetre Operators Break World Record.

Although not strictly EU news, with this period's record breaking contacts in EU, it would be unfair not to mention the amazing achievements in Japan on this band - Ed

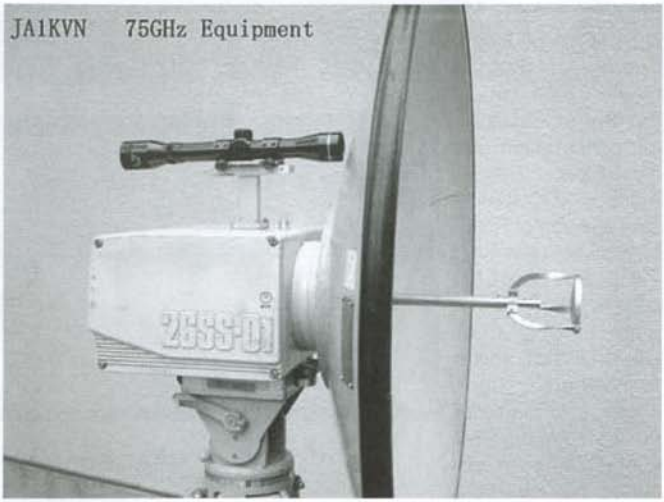
On 16 November 2001, at 1310 Japanese standard time, JA1ELV/2, located in PM95JI, worked JA1KVN/1 in QM06BF, on 75GHz SSB for a new world record of 151 kilometres, just 6km more than that set up earlier this year by Will, W0EOM and Bob,KF6KVG.

JA1ELV/P was heard at RS45 while he copied JA1KVN/1 at RS43. JA1ELV/1 had 3mW output to a 50cm dish and was located at just under 2000 metres asl on the side of Mt. Fuji. JA1KVN/1 had 1mW output to an 80cm dish and was located 296 metres asl on the the slopes of Mt. Tukuba. The low relative humidity (around 42%) and fine weather obviously helped a lot!

Microwave Beacon News

After more than 12 months of planning and 6 months of weekend site preparation work during the winter months, five new microwave beacons covering the bands 2.3 to 24GHz came into service on Saturday 23 March 2002. The beacons are on a communal mast 15 m above ground level and 275m ASL on top of Cranborne Chase in Dorset, UK, IO80UU59

Callsigns and frequencies: GB3SCS - 2320.905MHZ GB3SCF - 3400.905MHz GB3SCC - 5760.905MHz GB3SCX - 10368.905MHz GB3SCK - 24192.905MHz



JA1KVN on 76GHz

A full description of equipment and erp's will be published shortly. This complex of beacons is the largest single site concentration in the UK at this time and GB3SCC is the first operational 6cm beacon. It is hoped that this new source of microwave band signals will encourage ongoing multi-frequency propagation studies and stimulate operation and construction throughout the upper parts of the Amateur bands. This project has been undertaken by the South Coast Repeater and Beacon Group and supported by local Amateur Societies and individual members of the local vhf and microwave fraternity. Construction was undertaken by G8BKE, G0JMI, G4LDR, G0API, G4JNT and G3YGF. Reception reports would be welcomed via e-mail by the beacon keeper at g0api@tesco.net or g4jnt@thersgb.net

Using the FT817 as a Microwave IF.

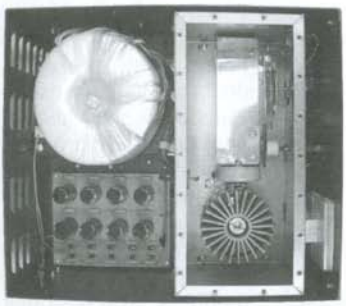
I was recently looking for a new transceiver to act as a microwave IF and decided that the FT817 looked an interesting option especially as it is capable of operating on HF, 6m, 2m and 70cms all in a very small compact unit. I had not heard a great deal of feedback from users in the microwave world so posted some queries on the Internet and was pleasantly

WiMo

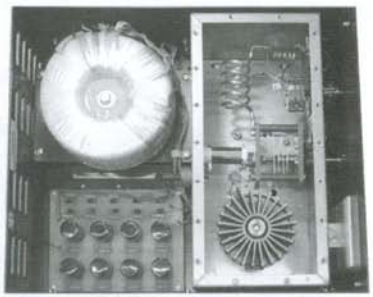
Tube amplifiers for 6m and 2m

LINEAR AMP UK

The new versions of the 2m and 6m DISCOVERY use a Russian GS31 ceramic triode valve. This is a very rugged valve which will operate for long periods at an output of 1200W. The RF compartment is made from aluminium which has been aluchrome finished to give excellent conductivity. A heavy duty toroidial transformer and voltage doubler board produce 2800V. Cooling the valve is forced air from a very quiet Papst flatpack blower located under the transformer.



2m Version: 1/4wave stripline and flapper tuning is all made from silver-plated brass.



6m Version: the output stage is a Pi-L network with a tuned input circuit.

Soft-start is fitted as standard and there is a 2 minute startup timer so the amplifier cannot operate until the the valve has properly warmed up. Grid protection circuits are incorporated with a trip mechanism in case of bad SWR, antenna malfunction or any other cause of high grid current.
The 2m Discovery covers 144-146MHz, the 6m Discovery covers 50-54MHz. These Amplifiers are the ideal amplifier for contesting, EME and Meteor scatter operations.....**2190.- EUR**

WiMo Antenna Ltd.,
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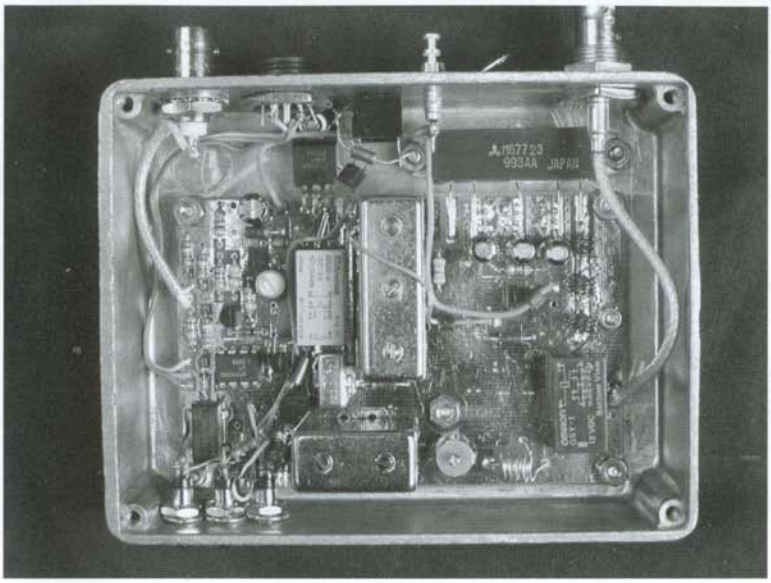
surprised to receive a large amount of feedback from users pleased with this choice. Some of this feedback was recently published in the RSGB's regular Microwave Newsletter but I thought that some might like to hear a little more about this amazing little radio. The unit has a lot of interesting features that make it useful as a microwave IF. It is very small, in real terms about two-thirds the size of the old Yaesu FT290. Its lightweight but looks robust as it's built on a diecast chassis. It has two antenna sockets. The front panel carries a BNC, the other a rear mounted SO239 UHF type. You can switch between the two using the radio's extensive menu entries. The radio has variable power levels from 5 to 0.5W so can be switched down for transverter driving. The radio is very sensitive but also carries a very good receiver; time will tell how good but even on the crowded HF bands it managed quite well on my Carolina Windom. The radio is easy to drive and plenty of nice features, there is even an inbuilt keyer you can drive from the microphone up/down scan buttons - leaving the keyer on the shack bench shouldn't be a worry anymore - although it might take sometime to get used to - my hilltop DXped to try the radio out did not result any sensible Morse being sent when using that option - definitely more practise needed! There are only a couple of things that it didn't do that would have been nice. It does not have the option to put a voltage on the antenna socket like the old IC202/FT290's used to and it's a little thirsty on batteries, so you will need an extra 12V power supply for a day's hilltopping. The radio uses a set of 8 x AA cells unlike older radios that used C size. Mind you, battery technology has also moved on a lot too! Modern NiMH cells are now rated at 1800ma - nearly twice what the old C size could manage! I am very impressed with the radio and really liked it a lot. During a recent 6M opening I worked South Africa with it barefoot on my 7 element 6M beam. There are some good deals around now especially in Europe so shop about for the best buys - I did notice some competition starting in the UK with the main dealers dropping prices quickly to match the better prices in EU. So far I am very impressed and can recommend that you consider it if your looking for a microwave IF transceiver or just in the market for something new. It will definitely replace the old FT290/IC202 and give you loads more besides. Now who needs more of an excuse than that to buy one!

W2GHZ/2 on 222MHz

Stop Press!

Paul Wade W1GHZ has been playing with his FT817 and built a 222 MHz add on transverter for it. It's not microwaves but it may give someone some ideas for new designs. More information can be found on his website:



W2GHZ/2 on 222MHz

- http://www.w1ghz.cx/new/222short.zip
- http://www.w1ghz.cx/new/222.zip

The short ZIP contains fewer pictures. (for slower Internet connections)

I have included some photos as well as it looks really interesting!

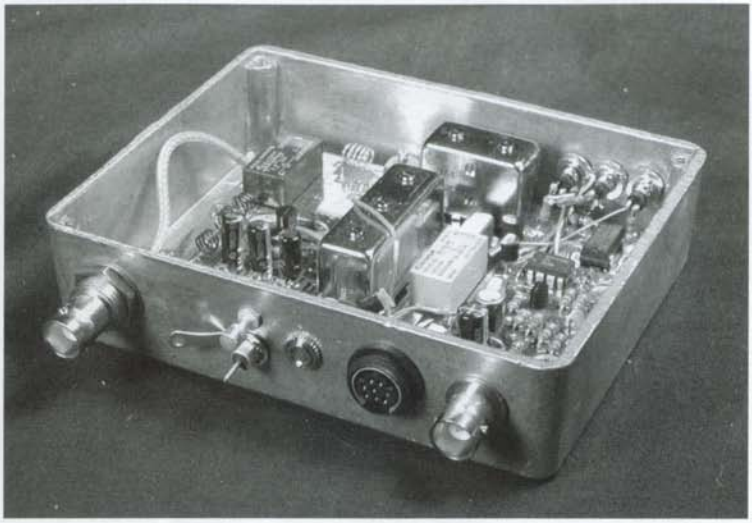
The K1EL K10+ CW Keyer Kit - Simon Lewis GM4PLM

'The K1EL is a useful microwave accessory as it has a number of beacon functions that would help when out portable microwaving. I have included it in this column, as it is a useful addition to the microwavers kit and very reasonably priced'

As a firm lover of the CW mode, one of the most useful items in my DX armoury is my memory keyer. This highly useful tool makes general CW operating effortless, contests a joy and has without a doubt increased my QSO rates over the years. Recently I was looking to replace my aging TTL logic driven keyer with a modern microprocessor driven unit. After searching the Internet looking for a suitable replacement I was quite horrified at the price that some kit suppliers were asking for such items. Surely a simple PCB and programmed processor should not cost in excess of £50? So I was pleasantly surprised when I came across an interesting web site run by Steven Elliot, K1EL. Steven runs a small business producing a range of kits based on PIC technology. For those of you unfamiliar with the PIC processors, they are a range of quite powerful tiny microcomputers and are contained on small integrated circuits (IC's). Very few additional components are required for most projects and the devices use very little power making them perfect for battery operation. They are very interesting devices and there have been plenty of books and articles written on their use. A search of the Internet for amateur radio applications for the PIC will lead you to some exciting ideas for them. One kit that K1EL markets caught my eye was the K10+ electronic keyer unit. The specification is packed with features and the kit very cheap at $15 so I arranged for a kit to be sent across from the US.

So what do you get for your money?

Well not a lot of components that's for sure! But don't let that fool you for a minute. That little 1.5 inch square PCB is a packed little power house of technology that really flies! You can buy a programmed chip and PCB or you can buy a complete kit containing PCB, programmed chip and all board mounted components (this includes the onboard



W2GHZ/2 on 222MHz

speaker and 5 volt regulator. You supply a case, pushbutton switches and hardware for mounting the board. There are 4 or 5 push-button switches required dependent on whether you choose to use a panel-mounted pot to set and load the keyer speed or simply use a CW keyed entry to set it. The other buttons are used for entering the command mode and to replay the programmable memories. A small PCB mounted piezo speaker is supplied with the full kit or audio can be fed to an additional AF amplifier or the rig audio input line.

I won't describe building the unit - it should not take more than an hour to build up the unit and could be built by anyone who can handle a soldering iron competently. Comprehensive instructions are supplied with the kit or can be downloaded from the K1EL website. There are a number of construction and powering options for the unit and these are detailed in the instructions supplied. No power switch is required as the unit will go to 'sleep' when not being used and will consume less than 1uA so no on/off switch is needed. Good thinking especially if you have ever tried to find a spare set of batteries for the flat ones in the keyer, after stumbling out of bed at 4am for that early morning sked or on a windy hilltop miles from anywhere!

Features galore!

So let's take a look at some of the features the K10+ offers. Ok so it's a CW keyer, so your expecting that it will do the normal functions of a CW keyer right? The K10+ will do speeds of 5 - 59 WPM using lambic A and B modes. The dot/dash ratio is adjustable; you can swap side of the paddle, reduce letter spacings and select an automatic letterspace mode. The keyer also supports Farnsworth modes. Sidetone frequency can be altered and the speed either altered from the key or from an external pot. So the keyer has all the basic functions you would expect of a good electronic keyer and believe me it does them well but the K10+ offers a lot more than that.

The keyer also has four memory slots, which can hold a maximum of 96 characters in total, and this is where the fun starts. The K10+ has a range of predefined embedded commands that can be inserted into these memory strings. These commands cover standard texts like 'NAME IS', 'QTH IS', UR RST IS'. Embedded commands look like the slash character (DN) followed by a letter. The keyer interprets this as an embedded command and sends the preloaded command's text. The keyer is also very useful for DXpeditions or microwave work as it has a built in beacon mode which can be programmed for 1 - 59 seconds delay. Memory slot 1 and 2 can be alternatively sent by using more embedded commands, and the transmitter can be keyed to give key down tone. I have already used

this for beaconing on 10 GHz and it's a very useful function.

Entering commands into the unit is very simple. One of the pushbuttons is marked as a command entry and this is pressed and held for two seconds. The unit will respond with 'R' in inbuilt sidetone only. The K10+ can then be commanded by entering the command letter in Morse. An extended entry is required on some functions and the K10+ will prompt you by adding an 'E' to tell you so. There are 24 commands in total and these are detailed in Table 1.

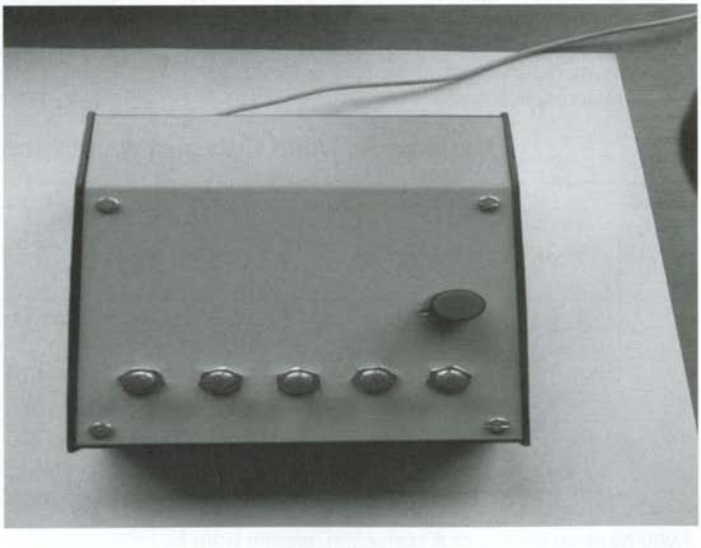
The K10+ firmware also includes a CW send and receive practise mode. Entering 'P' in the command mode puts the keyer into the practise mode. A difficulty level will then be requested by the keyer. A letter from A to D is then entered, A being the easiest and D the hardest level. Random letters are then sent in groups of 5 with a space between them. In the transmit practise mode the keyer will send a letter and you are required to enter the corresponding letter back. The keyer then sends two letters and the same is required from the operator. This continues to three letters and then reverts back to one letter. The mode is designed to build head copy and letter recognition skills.

One feature worthy of note is the high-speed CW mode (HSCW) used for meteor scatter operations. The K10+ can be loaded to run MS routines and will send character strings at speeds of 1000 and 6000 letters per minute (LPM). Again I won't go into the details of MS operations but the unit will supply an audio line to a Mic socket for audio keying of a transceiver for MS use. You can program the K10+ to loop your MS message and it will play it for 1 or 2.5 minutes depending on whether you are in US or European mode.

In Operation

I built and boxed the keyer in an evening and then spent a few nights practising how to drive the unit before connecting it to my transceiver. Connecting it to my FT847 was easy and I disabled the internal keyer and then connected the K10+ to the key line. I have found the unit to be excellent in use and simple to drive and program. I made myself a small command table, which I stuck to the top panel of the keyer case and this reminds me of all the commands available. Loading memories is easy and I tend to leave them loaded with strings like CQ DX CQ DX de GM4PLM GM4PLM GM4PLM K or CQ A DE... Adding a memory is easy and can be done live on air very quickly. The keyer is easy to program and a joy to use. The price is excellent with its nearest rival at near 4 times the cost. Dislikes? None really, I'd like to see a contest mode that increases the serial numbers incrementally but there is very little I could say it didn't have.

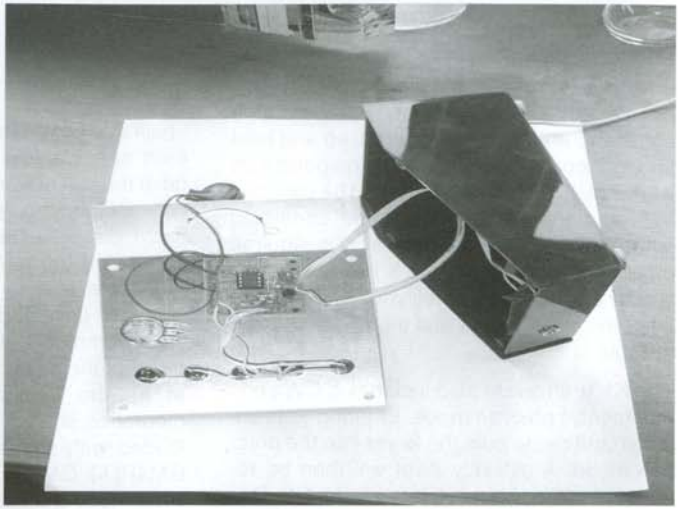
Overall it's a great little kit and has the pride of place on my desktop and more importantly



K1EL Keyer

is in almost daily use. Sort of speaks for itself really!

The K10+ kit is available for $15 from Steven Elliott K1EL, 43 Meadowcrest Drive, Bedford, NH 03110 USA. He is also regularly updating the firmware so keep an eye on the K1EL website at http://www.k1el.com Steve can also be reached by email at K1EL@aol.com



K1EL K10+ Keyer Command Set

A Sidetone on/off
O Select Tone or keyed HSCW oscillator
B Start CW Beacon
P Start receive practise session
C Set command speed in CW
Q Query current WPM speeds
D Set fast/slow AFK tail delay
R review message without transmitting
F Set Farnsworth letterspace
S Set CW transmit speed in WPM
G Select AF/normal keying
T Key transmitter for tuning
H HSCW mode enabled
U Select autospace on/off

K1EL Keyer

I Select Iambic mode A/B
V Start transmit practise session
J Select 3:1 or 4:1 Dah:Dit ratio
W Set keying compensation in msec.
K Select straight/iambic mode
X Exchange paddles
L Load message memory slot online
Y Analog input diagnostic
M Load message memory slot offline
Z Select sidetone frequency

Microwave: World Firsts and World Records

Band (GHz)	World First QSO			World Record		
	Date	Calls	QRB (km)	Date	Calls	QRB (km)
10	1946-05-06	W2JRM-W2JN	3.3	2000-06-25	4X/DJ4AM-I/DJ3KM	2079
24	1975-10-14	G3BNL/P-G3EEZ/p	150	2000-06-18	I0LVA-IW3EHQ/3	461
47	1984-10-03	HB9AMH-HB9MIN	1	1998-12-26	F6BVA/p-F5CAU/p	286
76	1985-12-30	HB9MIN-HB9AGE	0.5	2002-03-01	W0EOM/6-KF6KVG/6	175
145	1992-12-12	DB6NT/p-DL1JIN/p	1	2001-01-01	W2SZ/4-WA4RTS/4	62
241	1993-05-23	DB6NT/p-DL1JIN/p	0.1	2002-03-11	WA1ZMS/4-W4WWQ	11.4
411	1998-01-06	DB6NT/p-DL1IN/p	0.05	1998-01-06	DB6NT/p-DL1IN/p	0.05

If you have an update or a correction, please write to:
Simon Lewis, GM4PLM, Creoch Farm, Ochiltree, Ayrshire, KA18 2QH, UK

Microwave USA

Editor: Kent Britain, WA5VJB

This has certainly been a period of Millimeter records.

First on 47 GHz:

On March 1st W0EOM and KF6KVG thought they had a new world record on 47 GHz. Signals were 20 dB out of the noise, but later calculations showed they were about 1 km short of the 174 km record. But the day was not wasted.

76 GHz Record

A few moments after their 47 GHz QSO, KF6KVG worked both W0EOM and AD6FP on 76 GHz over a 175.3 km path. The 75 GHz signal peaked 23 dB out of the noise with 6-8 dB fades. Equipment W0EOM 8 milliwatts xmit, 18 inch cassegrain dish 15 dB NF AD6FP 4 milliwatts xmit, 3 foot cassegrain dish, 15 dB NF KF6KVG 10 milliwatts xmit, 12 inch prime focus dish, 15 dB NF All radios used LO's that were locked to either a precision OCXO's or Rubidium standards. Weather 18% to 26% humidity along the path Temperature varied from 4 to 18 deg C along the path. They have spotted a 250+ km path so expect the 47 and 76 GHz records to be extended.

It is difficult to think of 47 and 76 GHz as the low bands, but WA1ZMS/4 and W4WWQ and been working on their 241 and 322 GHz stations.

241 GHz

On February 23rd Brian and Peter worked each other over 3.8km, 6.1km and finally 7.3 km where they simply ran out of signal margin for the weather. Weather conditions were 8.3 C and 46% Humidity. Calculated loss 1.70 dB/km

On March 11th in what were much better conditions for the radios, Brian and Peter competed a QSO for a new World Record of 11.4 km. The old US record was 1 km by W2SZ/4 and the old world record was 2 km by DB6NT. Temperature 5.6C 21% Humidity Calculated loss .65 dB/km The stations were the same ones used in the December 2001 QSO's but this time the 81.6 GHz Gunn sources were phased locked to the 2220th harmonic of homebrew ovenized crystal oscillators. The stations were able to maintain better than 2 KHz stability over several minutes. The IF frequency was 439.7 MHz, an Icom R-7000 and a Yaesu FT-817 were used as the IF rigs.

322 GHz

The US amateur frequency assignments list 300+ GHz as the amateur assignment. Using the 4th harmonic rather than the 3rd harmonic of their stations put them on 322 GHz. On the evening of March 1st, WA1ZMS/4 worked W4WWQ over a distance of .5 km. This may not sound like real DX, but it is 10 times farther than they were able to go without the Gunns being Phase Locked. Weather was -.5C and 31% humidity. Calculated loss 4.56 dB/km. This is pretty much the limits of their current equipment, but I can assure you Brian will be searching the Dayton fleamarket for a bigger dish and a new mixer is planned.

I would like to again invite everyone to the Microwave Update 2002 Conference held this year in Enfield, Connecticut October 24th thru the 27th. For the latest updates, registration forms, and hotel information see www.microwaveupdate.org

EME News

Editors: Bernd Wilde, DL7APV & Heinz Borde DM2BHG

THE **PRAHA conference** in aug. will be open to **all Bands**, not only 432&up like we reported in last issue

intro :
Last issue was drastically cut by 9bv. So we had to move some stuff to this issue.

European activity jan. to March was limited by many heavy storm events. Cental europe was hit by 7 stroms with winds >100km/h.

ARRL contest date votes:
There were 93 replies.

1. **Oct 26/27, Nov23/24**	51 votes
2. Sept 28/29, Oct 26/27	22 votes
3. Sept 28/29, Nov 23/24	11 votes
4. Nov 23/24, Dec 21/22	1 vote
5. Oct 19/20, Nov 16/17	1 vote
6. Nov.3+28th	1 vote
7. July 13/14, Sept 7/8	1 vote

There were 5 replies that expressed broad opinions but did not state specific dates.

General Feedback:

There was virtually total support for two separate weekends. There were 4 responses stating a preference for two weekends but different bands on each weekend like DUBUS. The majority of feedback supported keeping the contest in the same format it is now. 73, Lionel, VE7BQH

144 MHz

Topics:

- Otto and Paul
- Around 2-m-EME
- Highlights of 2-m-EME
- Awards
- W5LUU's Moon Calendar 2002
- Expeditions
- News and information's
- Once there was a chat about...(Chats of common interest in INTERNET)
- Treasury INTERNET
- Remarks

Otto and Paul

Part 2. Otto needs a better array

DB6NT 70cm EME Antenna 4x11wl 9BV

EME-TOPLIST

144MHz

Call	small	SQR	DX CC	US States	WAS	WAC	#
I2FAK	484	60	112	50	1988	1993	1060
HB9Q	460	64	120	50	1986	1994	913
PA2CHR	431	48	79	50	1993	2001	491
RW1AW	186	43	47	33	1999	--	224
GM4JJJ	184	40	59	35	1986	--	271
PA3DZL	182	33	49	28	1991	--	240
CT1DMK	141	0	41	0	--	--	146
UA3PTW	129	25	33	20	--	--	165
DM2BHG	122	26	36	27	--	--	192
OK1DIG	114	27	36	24	--	--	138
YO2AMU	110	18	36	20	2001	--	110
9A9B	86	18	27	16	--	--	119
RW3PF	75	21	22	10	--	--	81
DD0VF	73	19	31	16	--	--	78
YO2IS	65	20	24	14	--	--	66
SP7DCS	65	18	24	12	--	--	71
EA1ABZ	61	55	23	9	--	--	61
WA6PY	40	18	22	13	--	--	62
SP2JXN	15	8	9	0	--	--	15
DL1SUZ	3	0	3	0	--	--	3
OK1MS	0	52	100	50	1982	1992	745

432MHz

Call	small	SQR	DX CC	US States	WAS	WAC	#
DL9KR	391	53	83	50	1978	1987	768
DJ6MB	291	42	62	44	1984	--	348
OK1KIR	251	45	63	44	1982	--	351
DL7APV	165	31	38	41	1984	--	215
G4ERG	137	28	34	30	2000	--	166
HB9Q	132	27	38	22	--	--	174
YO2IS	124	26	38	23	2001	--	156
ON4KNG	119	25	43	18	1996	--	146
PA3DZL	112	26	38	31	1991	--	124
UA3PTW	83	23	28	20	--	--	89
RW1AW	81	27	25	21	--	--	89
S52CW	80	24	20	20	--	--	91
OK1CA	71	24	26	22	1996	--	121
EA6ADW	66	19	24	19	--	--	69
CT1DMK	60	0	19	0	--	--	63
PA2CHR	45	15	19	9	--	--	45
UT3LL	41	23	17	13	--	--	45
OK1DFC	39	17	19	11	--	--	42
RW3PF	9	5	8	0	--	--	9

1296MHz

Call	small	SQR	DX CC	US States	WAS	WAC	#
OK1KIR	147	32	39	28	1989	--	188
G4CCH	126	27	32	24	2000	--	164
DJ9YW	123	29	38	22	1998	--	140
F5PAU	108	25	31	21	--	--	134
EA6ADW	108	24	31	24	1994	--	148
HB9Q	94	27	26	17	2001	--	109
CT1DMK	87	0	24	0	--	--	93
OK1DFC	78	23	32	15	1999	--	98
HA5SHF	58	18	25	12	--	--	68
PA3DZL/P	55	16	20	12	--	--	64
OK1CA	47	20	24	9	--	--	71
WA6PY	42	13	15	13	--	--	50
F1PYR	25	0	0	0	--	--	0
PA3DZL	13	10	10	4	--	--	13
OK1UWA	12	10	11	5	--	--	22
F1ANH	0	0	15	0	--	--	40

2300MHz

Call	small	SQR	DX CC	US States	WAS	WAC	#
OK1KIR	39	13	19	10	--	--	41
OK1CA	14	9	13	1	--	--	15
OK1UWA	11	7	10	1	--	--	12
WA6PY	9	6	7	2	--	--	10
EA6ADW	8	4	8	1	--	--	9

5760MHz

Call	small	SQR	DX CC	US States	WAS	WAC	#
OK1KIR	16	10	12	3	--	--	17
CT1DMK	13	0	4	0	--	--	13
F1ANH	1	1	1	0	--	--	1

10368MHz

Call	small	SQR	DX CC	US States	WAS	WAC	#
OK1UWA	20	9	11	1	--	--	21
OK1KIR	17	8	13	2	--	--	18
IK5WJD	13	7	10	3	--	--	13
CT1DMK	13	0	8	0	--	--	14
OK1CA	6	4	4	1	--	--	7
I5PPE	4	4	8	2	--	--	10
WA6PY	1	1	1	1	--	--	1

After his first QSO, made by accident, Otto was qrv during the ARRL-EME-Contest.

He worked KB8RQ again and SM5FRH and heard several other stations. He came to the solution: he needs a better antenna. He phoned his friend Paul and they made an appointment, to discus the matter.

How to make elevation. Otto had his own thoughts. That is only a mechanical question. But what about antennas? Paul gave him the following suggestions.

Result of 8th Italian EME contest

Memorial I5TDJ Piero Moroni
Were present: I1ANP, I1PIK, IK1FJI, IZ1BPN, I2FAK, I2RV, IK2DDR, IK2MMB, IZ2DAY, I3DLI, I3EVK, IK3COJ, IN3AGI, I4XCC, I5PPE, I5WBE, I5YDI, I6PNN, IK6MLI, IK7EZN, I0UGB.
Classification stranger stations

144 MHz

Pos. Call	n.qso	It.stns	points	antennas
Category B)				
1) SM5BSZ	17	3	233	(1 x 2SA13X cross-y)
2) JA9BOH	14	2	182	(2 x 3 wl bvo)
3) N2WK	11	2	152	(4 x CC214b)
4) DD0VF	6	2	102	(4 x 7 el.)
4) SP7DCS	6	2	102	(1 x 12.87 mt.y)
Category C)				
1) JH2COZ	19	4	274	(4 x 14el. 3.6WL)
2) LZ2US	17	3	233	(4 x KLM17LBX,)
3) EA3DXU	16	3	223	(2 x 17 M2)
4) YU7BCL	17	2	212	(4 x 10el.BVO,)
5) YO2AMU	12	4	204	(4 x 16el. F9FT)
6) SM5CFS	15	2	192	(4 x 16LBX,)
7) 9A9B	11	2	152	(4 x 16el. F9FT)
8) PA3DZL	9	2	132	(4 x 17el. 3.6WL)
9) N2VR	2	0	20	(4 x 13B2CC)
Category D)				
1) G3ZIG	56	8	728	(8 x 15el. 3,99WL)
2) G0RUZ	34	4	424	(4 x 5WL BVOPT,.)
3) S52LM	26	7	407	(4 x 17M2 5WL)
4) S53J	10	4	184	(4 x 17M2 5WL)
5) JH0WJF	10	3	161	(4 x 17M2)
6) SM7WSJ	10	2	142	(4 x 18M2)
7) K6PF	7	2	112	(4 x 2MXP20.)
Category E)				
1) RU1AA	73	9	919	(4 x 5.4WL cross-yagi)
2) DL5MAE	33	5	435	(8 x 17M2)
3) LZ1DP	23	4	314	(4 x 5WL BV cross yagi)
4) DL7MAT	12	1	141	(8 x 17M2)
Category F)				
1) F3VS	100	11	1231	(24x20bvH.+ 8x20Bvv)
Category SWL				
1) JF4TGO/8	3	1	51	(2x20MXP20 3WL)

Not received any log for A) category.

432 MHz Category A)

1) DL5LF	2	0	20	(2 x 9BV 8.5WL)
Category B)				
1) EA3DXU	6	0	60	(2 x 38el. M2)
Category C,D)				
1) UA3PTW	16	0	160	(16 x 15el.BV. 16x2.8mt)
2) UT3LL	11	0	110	(6 x 27el.BV. tot. 36mt.)
3) JA6AHB	10	0	100	(7 mt. dish)
4) JH4JLV	5	0	50	(4x34el.H+4x 32el.V)

Categories C,D, for rule, are togheter.

1296 MHz

1) G4CCH	19	3	253	5.4 mt. Dish.
2) DK0ZAB	10	0	100	10 mt. Dish.
3) JA6AHB	3	1	51	7 mt. Dish.
4) JH5LUZ	1	0	10	5 mt. Dish.

2.3 GHz

1) JA4BLC	1	0	10	40 dB Dish.

Not received log for frequency UP.

Italian stations results

144 MHz

Category C)				
1) I3EVK	25	3	250	(4 x 19LLY)
2) IK2DDR	24	4	240	(4 x 4218cc mod.)
3) I2RV	22	3	220	(4 x 16KLM)
4) I1ANP	15	3	150	(4 x 16BV)
5) I5YDI	7	0	70	(4 x 15BV)
5) IK7EZN	7	2	70	(4 x 16 JXX)
7) IZ1BPN	2		20	(4 x F9FT)
Category D)				
1) I3DLI	80	10	800	(6 x 19LLY)
Category F)				
1) I2FAK	100	6	1000	(24 x 19LLY)
Category SWL				
1) IZ2DAY	14	0	140	(24 x 19LLY)
2) IK6MLI	12	5	120	(2 x 11 KLM)

432 MHz

Category D)				
1) IN3AGI	2	0	20	(8 x 33el. tot. 92mt.)

1296 MHz

1) I0UGB	5	1	50	5 mt. Dish.
2) IK3COJ	2	0	20	3 mt. Dish.

10 GHz

1) I5PPE	1	0	10	dish.

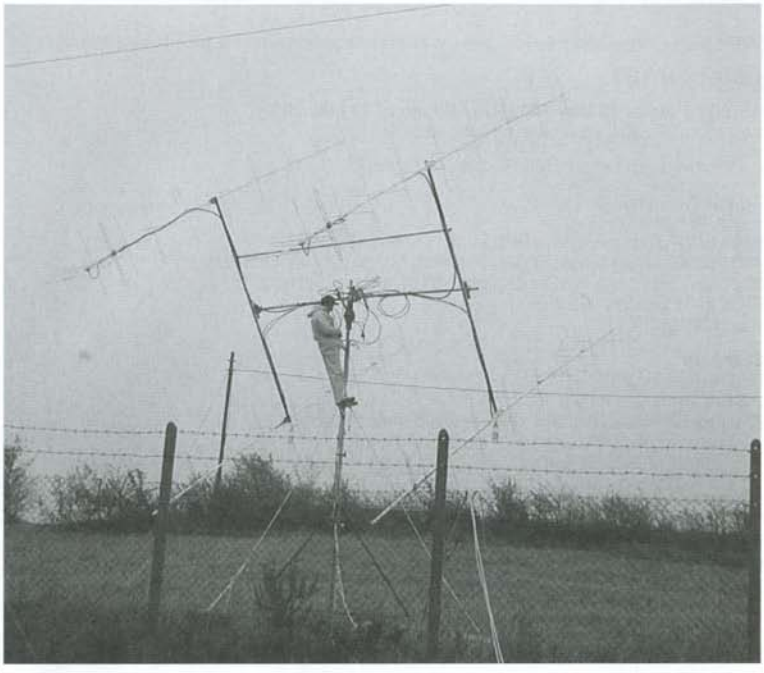
The **Winners** are;
SM5BSZ, I3EVK, JH2COZ, I3DLI, G3ZIG, I2FAK, RU1AA, IZ2DAY, F3VS, IN3AGI, JF4TGO/8, I0UGB, DL5LF, I5PPE, EA3DXU, UA3PTW, G4CCH, JA4BLC

A best compliment at winners, others were present, but not sended log, to all my thanks for participation, i remember to all, pse send the log for survival of the contest, much stations send log with poor qso, my particular thanks for your Ham spirit.
Price distribution, of this contest, on XI Italian EME meeting, on 27/28 April 2002, at usual place, Hotel Joseph, Marina di Pietrasanta, Lucca.
For stranger people not present on meeting, after, it will be sended, via mail directly, or to Prague on August de-visu.

Changed part of the rule, especially for cross-yagi stns.

Italian EME Manager
I1ANP Mario Alberti, via Priv. Maralunga,12
19126 La Spezia Italy.

e-mail i1anp@lunigiana.it or
mario.alberti8@tin.it



T7-Expedition

Otto's two F9FT are a solution. But when to do something new, why not 4 antennas?

OK. 4 antennas would be fine for Otto, but there are so many on the marked and some more to be build. Paul told him about gain and G/T (see http://qsl.net/dk7zb/ve7bqh.htm). He brought up the topic of stacking gain. Otto learned that each antenna has a certain gain over a dipole (dBd). One of his actual F9FT has a gain of about 12 dBd. That means it is more then 10 times more effective then a ordinary dipole in its main direction. But where does the antenna get this efficiency from? Does it produce power? No said Paul. A dipole is bi-directional. A Yagi brigs his radiation together in a main lope. Here its efficiency comes from. As better an antenna can concentrate its radiation in its main lope, as more effective it is, as more gain it has. When you

double your antennas you will have an increased gain of theoretical 3dB. Only theoretically because for several reasons you will never have this result. But 2.6 dB would be a good solution for simple calculations. Otto calculated his actual antenna gain and came up to about 14.6 dBd. That means, his antennas radiate about 40 times more power in their main direction then a simple dipole would do.

Due to his possibilities it was Otto's final decision, to build up a new array with 4 antennas by full elevation. And, because Paul advised him so, he ordered 4 cross yagis.

Around 2-m-EME

K6PF worked KC4VI, OH3AAW, HB9Q, 7J6CCU for now initial 125

OK1MS reports under strange (poor and unstable) conditions: HB9Q, RX1AS, JN1CSO, I2RV, SM5CFS, ES6RQ#, VE3AX, RU1AA, F3VS, RA1ZC#, S53J and W7FG

EA3DXU reports: Quite good conditions this week end, unfortunately bad weather in the north part of Europe limited the activity. Joseph worked:RK3FG,RX1AS,I2ANP,RV3IG vor now 430# on 144.

EA2AGZ added to his log W7QX, JN1CSO, RU1AA and RX1AS

WB9UWA: Before it all came crashing down (see :News and information's), I did reach

rule of 9th italian EME contest, **changed rule** for single to multi polarization antenna for 144 and 432 MHz.

A. R. I.IX ITALIAN EME CONTEST

Date and Time : from **00.00 utc of 18 May 2002 to 24.00 utc of 19 May 2002**
Frequency : 50,144,432,1296,2304,5760 MHz,10 GHz and UP.

Mode : CW , SSB . Only bilateral contact EME.Report : M, O, RST.

Band 144 MHz ; Category
A) antenna max length 10 meters
B) ant. between 10,01 to 20 meters length or dish up to 7 meters diameter
C) ant. between 20,01 to 40 meters length or dish between 7,01 to 10 meters diameter
D) ant. between 40,01 to 80 meters length or dish over 10.01 meters diameter
E) ant. between 80,01 to 160 meters length
F) ant. over 160 meters length

Band 432 MHz ; Category
A) antenna max 12,5 meters length
B) ant.between 12,51 to 25 meters length
C) ant. between 25,01 to 50 meters length or dish up to 4,5 meters diameter
D) ant. over 50,01 meters length or dish over 4,51 meters diameter
As for other frequencies (50,1296 MHz and up), categories are one for each band.

To **define** length of antenna : length on meters, between last reflector to far director.
EX. 1 antenna length 10 meters is A category, also with a plant from 4 to 2,50 meters length or 2 by five meters A category as well (referred to 144 MHz). Also same for 432 MHz. The stations that use cross antenna, have a separate categories from the single polarization, referred 144 and 432 MHz.

OM and SWL can partecipate. In the SWL section, also OM are accepted, but just as SWL and they can't make EME transmissions during the contest.

SWL category are one for each band.
Score : 10 points a bilateral contact
31 points a bilateral contact with an Italian stations
10 points a bilateral contact between Italian stations
Remarks on the 144 and 432 MHz bands categories:

If the score of the first station classified in each category does not exceed the first of the preceding category, the category itself is cancelled and stations will be listed in the lower section.

EX. : The first in E category scores 1000 points, the first in F category scores 990 points, then F category is declassed into E category and its partecipants compete in E cat. too. In the same way, if the first in C cat. scores 300 p.ts , first in D cat. scores 290 p.ts, first in E cat. 280 p.ts and first in F cat. scores 310 p.ts, we will have a single classification for F category and another for C,D,E all together.
Winners : are those who get the maximum score in each category.

Every **single station** can partecipate in more than one band.

PRIZES : Only the first in each category gets a prize ; all the others get a certificate.

A winner in more than one category, will receive an award in one category only and in the others (even if the is the winner in other categories), the award will go the second placed. The first will receive a diploma certifying him as the winner, the second a plaque certifying his second place.

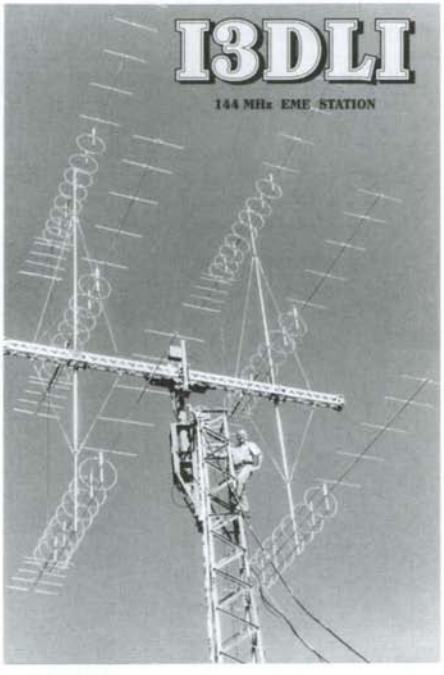
For the **contest score**, QSO's among Italian stations are valid. These and foreign stations in Italy, will compete in a separate classification from the rest of the world.

Logs contain; date, time, calls, rprt send, rprt rcvd, points, category, summary and total points end of log and all informations of station, particular type of antenna used and length, are welcome; suggestions, comments, photo (for photo on e-mail, please a definition 300 DPI or better).

Sending log to: e-mail address : i1anp@lunigiana.it or mario.alberti8@tin.it

mail: I1ANP Mario Alberti, via privata Maralunga,12 19126 La Spezia, Italy.For all, send also your e-mail, telephone, for sort time confirm that i received log, normally i cfm on same way that i received.

End time for acceptation log, is August 2002. I1ANP Mario Italian EME Manager



I3DLI

another high point by working W7FG on SSB in fairly short order (yes by EME). Here is my activity for this perigee: VE3AX, W7MEM, W7FG, RX1AS, after rebuilding his array he worked: SM5TSP , RA1ZC, ES6RQ, 9Y4/DL5MAE, YO2IS, PA3CMC , K8EME, W7FG, WA8CLT, F5LRL, W5UN, F1FLA for now #205)

JH2COZ wkd RK3FG, ES6RQ, F9HS, KC4VI and W9JN for now #259

OE6IWG could log: OK1MS, JA9BOH, S53J, K2GAL, LA9NEA, OH3AAW, PA2CHR, WB9UWA, K6PF, RK3FG, KB8RQ, DL1EJA, DL2RSX, W7FG, JH5FOQ, JR3REX, DL8GP, DL8GP, UR5LX, K9MRI, WA8CLT, W7MEM, 7J6CCU, W7QX, N5BLZ, N1BUG, UA9FAD, JA0BLU, RA4AOR, 9Y4/DL5MAE, SM2CEW, DF2ZC, I2FAK, UT5ER, UA4API, W5UN for now #53. Fine job Walter.

LA9NEA Viggo reports JA0BLU, WA8CLT, UR5LX and W7MEM

DF2ZD put the following in his log: IK2DDR, F1FLA, OK1MS, JN1CSO, 9Y4/DL5MAE (DXCC 70), NQ2O, JH5FOQ, JH0BLU, RK3FG, UY9YLU, OE6IWG, I2FAK, W9JN(**single yagi**)

F9HS worked F3VS,SM2CEW and new #:W5UN,UA9YLU,ES6RQ (new DXCC),RA1ZC

JH5FOQ reports : JR7JPM, GM4JJJ, OK1MS, W9JN, DL9MS, JN1CSO, DF2ZC , RN6MT, G4LOH for now #220

F8DO got UA9FAD, DK8ZJ. Not easy this year with only 2x2.5wl

N1BUG could work new# DK8ZJ, KC4VI, OE6IWG, 9Y4/DL5MAE, RK3FG, SM2BYA, OK1VVP, UA4API for now #602

RK3FG has 3REX, VE2JWH, N1BUG, WB0GGM, YU7BCL, PA0JMV, OK1VVP, SM5CFS for #86 now

RX1AS worked F9HS, EA2AGZ, OK1VVP, S53J, W7FG, SM5TSP, RN6MT, KC4VI

RV3IG had initials with EA3DXU, K6AAW, RN6MT, F9HS, UY7BCL

I3DLI

W5LUU's Moon Calendar 2002

Date 2002	Dec. deg	RA hrs	144MHz Temp. K	Range Factor dB	DGRD, dB 144 MHz	GRD, dB 432 Mhz	MoonPhase	Conditions
Apr. 07	-20.7	21.1	336	2.14	4.4	2.7		Poor
14	10.7	2.4	350	2.14	4.6	2.7	NM+2d	
21	22.3	8.7	182	0.87	1.2	0.9		**Very Good**
28	-15.2	15.2	431	0.41	3.6	1.2	FM+1d	Moderate
May 5	-18.6	21.7	316	2.10	4.2	2.6		Poor
12	14.0	3.0	365	1.98	4.6	2.6	NM-11h	
19	20.0	9.4	179	0.89	1.1	0.9		**Very Good**
26	-18.0	15.7	485	0.61	4.2	1.6	FM-1d	Poor
June 02	-16.1	22.3	259	2.08	3.5	2.5		Moderate
09	16.9	3.5	357	1.81	4.3	2.4	NM-2d	Poor
16	16.8	10.1	190	0.79	1.2	0.8		**Very Good**
23	-20.5	16.4	646	0.88	5.6	2.1	FM-1d	Very Poor
30	-13.3	22.8	244	2.1	3.3	2.4		Moderate
July 07	19.3	4.1	370	1.68	4.3	2.4	NM-3d	Poor
14	13.1	10.8	206	0.59	1.2	0.7		**Very Good**
21	-22.1	17.1	994	1.15	7.6	3.0	FM-2d	very Poor
28	-10.1	23.3	244	2.16	3.4	2.5		Moderate
Aug 04	21.5	4.6	421	1.62	4.7	2.5		very poor
11	9.2	11.4	231	0.34	1.4	0.5	NM+3d	**Very Good**
18	-24.4	17.8	2692	1.34	11.9	5.4		very Poor

RA4AOR wkd WB0GGM, N2WK, VE7BQH, VE1KG, PA0JMV, SM4IVE, DD0VF, S57TW, OK1VVP, K1CA

UA4API had QSO with I2RV, RA1ZC, N1BUG, OE6IWG, W5UN

UA4AQL cfm QSO with W7FG and F9HS,S52LM for now #60

UA9FAD added WA8CLT, OE6IWG, F8DO, 7J6CUU, YU7BCL, 9Y4/DL5MAE

RN6MT wkd initials JH5FOQ, EA3DXU, RV3IG, DL2RSX, UA9YLU, RX1AS, DJ6FU, DL8GP, EA2AGZ, EA2LU, F1FLA, F3VS, F9HS, G3ZIG, GM4JJJ, 7K3LGC, JA0BLU, JL1ZCG, JH2COZ, WB9UWA, LZ1DP,

LZ2US, S52LM, SM3MXR, SM5IOT (hard job for Jürgen)

UR5LX wkd new PA3CMI, DD0VF, SM2BYA, UA3MBJ, YU7BCL, OK1VVP, K7XQ, OE6IWG, UA3TCF, I2RV, WA4NJP, DM2BHG, VE2JWH, VE2SGM, GM4JJJ, SV1BTR, S57TW, W5UN, WA8CLT, NQ2O, YO2AMU, OK1DIG for now #189

UT5ER had YU7BCL, RA1ZC, OK1VVP, DF2ZC, OE6IWG

Higlights of 2m EME

Today: I3DLI (by PA3DZL)

Last summer I was with my wife and my children on holiday in Italy and was very lucky to get persuasion from my XYL Rian to pay a visit to a radio amateur, hi!

Because I had worked Paolo, I3DLI via EME and had contact with him via E-mail the choice was not very difficult.
Paolo is a radio amateur who is mainly active on two meter via EME. Results are very good with his home made and designed LOG LOOP YAGI.

His wife Wilma is also a radio amateur. Her call sign is IK3UHA and is active on HF 40 and 80m, CW only. Since 1 year she is QRX. She is very occupied with painting. Wilma is an artist. Her artist name is Fara.

They live in the nice village Dolo close to Venecia. I had been able to talk a lot with Paolo about this very special LOG LOOP YAGI.What he showed me was very impressive. I will tell you more about this antenna.

The LOG LOOP YAGI is a 19 el. LLY with a boomlength of 7.75 m.
The LLY has: 1 reflector, 4-way log-periodic-dipole and 14 directors, 7 of them are made in a LOOP.

In 1990 he started to design this antenna. His first EME QSO was made on random on the 26th of October 1990 with 1x19 LLY and 300 Watt with W5UN.

Also worked with this single 1x19 LLY were: SM5FRH, OE3UP, K2GAL, F1FLA, DL8DAT, K5GW, DL5MAE and KB8RQ. After this he started again to optimize the LLY.

During many years of testing and calculating he reached the optimum in 1995. This 19 el. LLY gives 0.5dB more Gain then similar yagis on the same boomlength as published by DJ9BV, DL6WU and others. The gain of this LLY is 14.7dBd. It is not only the forward gain but also the F/B ratio is very good >30dB and a very good side lob attenuation: 1st is -19dB, 2nd is -26dB and the other lobes are all >-30dB. This is for one 19 LLY.

Paolo is using an array of 6 times 19LLY. He made very good QSOs with this system even with QRP stations like: XE1/SM0KAK, 1x17B2 + 420W on sked. Random worked were: RA3QQT, 4x13el + 100W, OH7PI/4, 1x19el + 150W,BY1QH, 180W and a QSO with SM2CEW who was using a single yagi, 1 m above the ground at that time.

Own echoes were received with as little as 30 Watt output (+3dB S/N). With wideband AF9Y FFTDSP he measured own echo's up to +26dB (at full power). A nice example of good ham spirit is the way he tested the 6 yagis for equal radiation. He mounted a NEON lamp on the first director of every antenna. This was a nice test because he saw the same amount of light of every antenna. So power divider and dipole were working very good. During the evening when it is dark the show is great in the rhythm of a CW transmission. Many UFO's have been seen in DOLO, hi...

Also in several EME contests results were very good.

It was very nice to meet Paolo and Wilma and I enjoyed the very good cooking of her very much.

Awards

Sea of Peace Pennon (SOP)

As far as I know nobody has applied in the mode EME for this award until now. Here are the rules:

The SOP is awarded for contacts with different countries/areas bordering the Baltic Sea

9Y4expedition

and Norway in one year from 1st to 31st of July. On frequencies above 30 MHz exclusively applicants need only 5 points. DL is here not compulsory 1 QSO with Mecklenburg-Vorpommern district (DOK:V.., Z87,Z89, MVP, SOP9 = 3 points or 3 different other stations of DL = 3 points (DL max. 3 points). The following 25 countries/areas count 1 point each for the SOP:

ES, LA, LY, OH1, OH2, OH5, OH6, OH8, OH9, OH0, OJ0, OZ

R1/MVI, RA1, RA2, SM1, SM2, SM3, SM5, SM6, SM7, SM0, SP1, SP2, YL

No QSL's are needed. Log only. So, if you can get DL0SOP you will need only two more contacts with areas mentioned above.

For more information's and application see at: www.amateur-funk_mvp.de/sop-antrag/index.htm

Expeditions

9Y4/DL5MAE: Wolfgang gave the following statement:

Since 13th of March 9Y4/DL5MAE is history. I arrived safely back home.

I want to apologize to all stations I have missed due to RIG problems. I was not able to repair the broken PA because of missing spare parts in Tobago. This PA survived my activities from 5B4(9o EME QSOs),TA4(65QSOs) and HV4NAC(25QSOs) without any problems. Unfortunately now at 9Y4 the big crash happened after 52 QSOs. There was a minor problem a day before this big flash over, but this was just some contact problem in the PTT line.

So the most lucky station was Dan, HB9Q, which was the last contact I made. Most unlucky was Jac, PA3DZL. I called him for 2 periods with O-report and lights went off...

I was able to get the PA running again after 1,5 hours and my last CQs where send out from exactly 00.00 - 00.14 utc until another capacitor was melted in the plate line.

Many tnx to all who gave me some advice to fix the PA. I took out the tube but could not find a short at the tube or any capacitor. Maybe it's not a direct short but I'm quite sure the problem is in the RF cabinet. Anyway, I did not have any more C and any spare tube either.....

Anyway, I had a great time in Tobago. I like to congratulate those who made a QSO with me via the moon. I enjoyed my vacation very much and one day I would like to return to this Island and the nice people.....

GJ

Conrad ,G0RUZ will go with Martin, G4XUM to activate GJ. They will be on eme from 14.00 on the 23rd until 02.00 or so on 24th of March.

LY

Oliver, DL1EJA, is going to visit LY between 4th to 11th of June. He is planing to be qrv with 2x4wl and 700-800W.

News and information's

-WB9UWA lost his array on Jan. 31 in an ice storm. The antennas have been covered with •" ice.

-DK3WG is manager for RU1A/RZ1AWT, RU1AA, RW1AW, RX1AS, RK3FG, RV3IG, RW3PF, UA3MBJ, UA3TCF, RA4AOR, UA4AAV, UA4API, UA4AQL, UA4NM, RK9CC, UA9FAD, UA9YLU, UR5LX and UT5ER. Please send your QSL and SAE to: J.Fiedler, P.O.Box 1531, D-15205 Frankfurt, GERMANY

-N1BUG has a manager: KS4YT

-W5LBT Bob deleted his log book. If somebody has to get a qsl card from him, should tell him.

-SV1BTR is back on 2 m with 4x12el, H pol., full elevation and 1.5kW

-ARRL Contest: a list of logs received for the 2001 ARRL EME contest has been posted at http://www.arrl.org/contests/claimed

-W5UN is back on 2-m-EME. Dave moved to a new location and counts as a new #

-VK3FIG: My name is Geoff, my location is Stawell, Australia. I had my first listen to eme signals this morning on 2 meters. This has prompted me to update my system for 2 m EME.

-JR7JPM is a new 2m EME stn with 4x12FO and 1,2kW in QM09XM

-EME Conference 2002 in Prague: The organizing committee declares, that the 10th International EME Conference in Prague is open to all. There is no band, mode or any other restriction. In other words: You'll come, now!

-9Y4/DL5MAE Wolfgang asks for some patience concerning the QSLs. He needs to print the cards first. QSL address is: Wolfgang Schlaffer, Am Rosengarten 3, D-85467 Luess-Neuching, Germany

Once there was a chat about.....

-What material to use in a RF field?

Derwin, W5LUU, proposed KEL-F which is chemically and RF wise somewhat similar to Teflon. Its advantages are that it is rigid, machines well and has the high temperature and low RF loss properties of Teflon. It is of a light green translucent color, and does not cold flow like Teflon.

Then there was the proposal of using Delrin, but AG6K stated: Delrin has a considerably higher RF Dissipation factor then polyethylene, but the D factor is not an bad as Nylon. When a "3kW" antenna tuner with a Delrin roller coil was tested at the ARRL Lab, it reportedly caught fire at 900W.

A good proposal came from S57UU: Find a few different materials that are mechanically suitable for you. Put a piece of each into a microwave oven. Whatever is cool after a minute is ok.

Treasury INTERNET

-http://news.bbc.co.uk/hi/english/sci/tech/newsid_1761000/1761407.stm
Earth/Moon distance measurement

-http://aa.usno.navy.mil/software/novas/novas_info.html
Tracking formula for sun and moon

-http://n1bug.net : **Collection of pre amps**

-http://www.arrl.org/contests/claimed
Logs of ARRL 2001

-http://www.emeconference2002.cz
10th Intern. EME conf. in Prague

activty Status of the GUS - EME - stations on 70cm 3/2002 by dk3wg

DXCC	CALL	QTH	ANT/el.	Pwr/KW	Rem.	QSL-Mgr.
ES	ES6RQ	KO28WA	12x14	1.5	built	
EU	no stn				Exp.-1991, UC2O/UB4LL	(qsp)
RA1	RW1AW	KP50EB	12x15	1.5	qrt	DK3WG
	RW1AW	KO49WN		1.5	built	DK3WG
	UA1ZCL	KP78TX	5,7m-D	1.5	qrt	(qsp)
	RA3DRC/1	KO55JR	4x29	0.3	qrv ?	qsp
	RA3LE	KO64AR	8x7wl	1.5		qsp
	RA3YCR	KO73DH	8x26	1	silent key	(qsp)
	RW3PF	KO93CD	4x24	0.8	50-170°AZ, El <30°	DK3WG
	RW3RW	LO02RW	4x21	1	not active	
	RZ3BA/1	KO56BC	1x38	1	not winter time	RW3BP
	UA3PTW	KO93BS	8x15 BV	1		qsp
	UA3TCF	LO26IU	8x	0.5	qrt	DK3WG
	RV4AQ	LN28FG	4x18 BV	0.5	not active	
	UA4API	LO20QC	4x19	1	not active	DK3WG
	UA4NM	LO48UP	4x25	0.8	only 05-13 utc	DK3WG
	RA6AAB	KN94WR	4x30	1	silent key	
	UA6LGH	KN97LF	16x25KR	1		qsp
RA9	UA9FAD	LO88DA	8x16	1.5		DK3WG
	UA9XEA	LP63UN	4x		qrt	(qsp)
UK	no stn	Exp.-1990, UI2U/UZ3YWB				
UR	UR5LX	KO70WK	4x	1.5	built Ant agn	DK3WG
	UT1PA	KO21FC	4x10wl	1	el <45deg	qsp
	UT3LL	KO80AC	4x27	0.4		qsp
	UT5DL	KN18EP	8x25	1	not active	(qsp)
	UT5EC	KN78MM	8x27	1	random only	qsp
	UT5UAS	KO50GK	6m-D	0.2	qrt	
	UT7VF	KN68MQ	4x17 KR	1	silent key	

432 MHZ

WA6PY wkd first jan weekend : So far I QSOd on 432 DL9KR and K1FO using **2.4 m** dish and full size dual dipole - dual polarization feed. He added SM2CEW, DJ5NV; now # 5 on 70cm KL6M complete. VY 73 Paul WA6PY

432 & up (net) news

ZL1KA and ZL2MQ may be become active on 70cm.

DL9KR: worked WA6PY with excellent signal now to init #768,

TA4SAT ??? worked by SM2CEW & DJ5NV ??? who could this have been on 70cm ?

DL1YMK has sold his 432 array to DL7UDA, Dietmar will be qrv sson with this array.

Dave - **KB0PE**/EM48ts reports : I will take down the 6 & 2 and put up 432 and 1296.

result from the R/U-stn end of Dec/begin March:
RA3LE wkd new VE6TA and WB0GGM.
RA3LE had bad wx in Feb, wind,rain...sri no sked complete, heard only I5CTE-weak, G3HUL going down. Heard Random K4EME 539/- and wkd new K5WXN #162.

in feb RA3LE wkd K9SLQ, UA9FAD(#165) sri not complete with JA6DZI, JJ1NNJ and JR9NWC, other skeds nil...

UA9FAD - finish with RA3LE and S52CW.

DK3WG : 2m only 4-Yagis now, only in sked qrv. 70cm nothing on skeds....hrd Random K1FO, UT3LL, K9SLQ.
73, gl via moon Jurgen, DK3WG

DL5LF : I want to inform the community that my antennas did not survive the heavy storm in DL at the last weekend (26/27th Jan). I am thinking what to do next, but that will not be before summertime. Thanks to all so far, it was always big fun. Frank

JA Status by JA4BLC

JS3SIM (js3sim@ma5.seikyou.ne.jp): he hopes weekend skeds on 432.070 to avoid local QRM. He would not QRV at 0730z on Feb 22 (= 1630 local time on Friday, he needs to work).

JJ1NNJ(BYD01531@nifty.ne.jp): he can QRV on weekend. Pse contact to confirm the skeds via e-mail.

JR9NWC(jr9nwc@po.ttn.ne.jp): he has been very busy by business trip to overseas. Pse contact to confirm the skeds via e-mail.

7M2PDT(7m2pdt@pop01.odn.ne.jp):he will accept the sked list. Pse contact to confirm the skeds via e-mail.

JA6AHB(ja6ahb@nifty.ne.jp):he can QRV on 432 and 1296 and wish to ake a sked by personal mail. Pse contact him via e-mail.

Other stations:

JA2KRW will not QRV till next notice by the radio interference.

JH1XUJ, JA6DZI and JR1RCH can be reached via e-mail but have not sent any reply concerning the subject.

I have no way to contact **JH7PAV.**

JA4BLC(ja4blc@web-sanin.co.jp): will accept the sked on 13cm, not 432 nor 1296 at the moment.

note: All stations except JA6AHB and JA4BLC is on 432.

JO3RNL he has small antenna yet.

JR1EUX do not active now.

JH3EAO takao is active

JS3ISM JS3SIM he is active

JR1RCH he is bussy in bussiness. he is my local station. 30km NNW from me

JH7PAV he does not join ja-eme mailing list

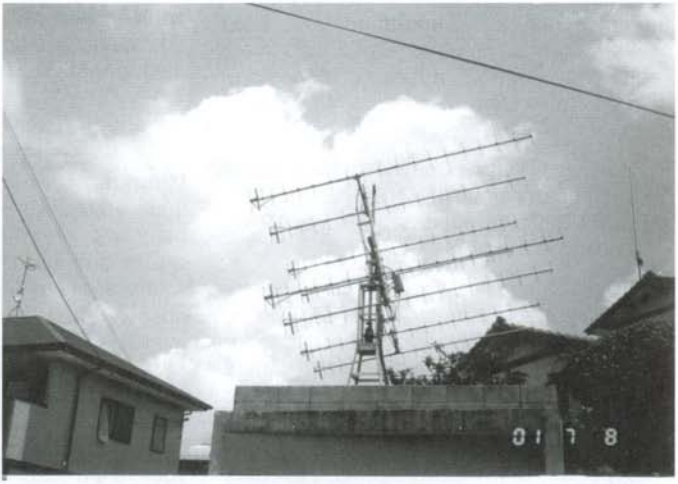
JH1XUJ his antenna is broken yet

JA2KRW he can not QRV now

1296 MHz

SSB contest :

As reported yesterday, we had very heavy winds and were unable to be QRV during the SSB contest.



JA6DZI 8x20el. 432MHz

The next day on 23 cm, I had a great time at the beginning of SSB contest. Signals and conditions seemed excellent. The SSB copy of many of the bigger stations was perfect -- better than 20 m! We had good WX here, but apparently this was not the case in Eur. Many regular Eur stations were missing. I did QSO on CW N7AM. After the moon set in Eur things got very quiet and I took a break. I came back on for the JA/VK window, but heard nothing except my own echoes. After an hour of CQs with nil results, I discovered that my 726 had jumped a MHz and that I was on 1297 not 1296! By this time the moon was at 16 degs and blockage a real problem. I went down to 1296, and called for another 15 minutes with similar nil results. This was very disappointing. I wonder how others made out? 73, Al - K2UYH

SETI

The SETI League, Inc. received two Technology Achievement **Awards** from the Central PA Chambers of Commerce, for its two current engineering projects. The nonprofit organization's **Lunar Reflective Calibration Beacon** (we reported earlier about) for Radio Astronomy was awarded Second Place in the category "Best Application of Technology," and Array2k: Phasing Multiple Antennas for a Next-Generation Radio Telescope received Second Place for "New Technology Project," at today's Technology Awards Showcase luncheon in Williamsport.

SETI League Director Completes **New Book**: Tune In The Universe! (ISBN 0-87259-854-3), copyright 2001, is published by the ARRL, <<http://www.arrl.org/>>.

SETICon02 Technical Program Takes Shape Little Ferry, NJ.., February 2002 - SETICon is the premier international technical forum for amateur and professional radio astronomers to exchange ideas in the scientific Search for Extra-Terrestrial Intelligence. The 2002 conference will be held at The College of New Jersey (Trenton, NJ, USA), April 26-28. Some topics:

Magic SETI Frequencies: One Amateur's Search, by Stephen Carver, Esq., **K5PT**, USA

Stressed Parabolic Antennas for SETI, by Prof. Allen Katz, **K2UYH**, USA

Removal of Heat by Hydraulic Means, by C. Lee Kitchens, **KB9PIP,** USA

2001: A Moonbounce Odyssey, by Dr. H. Paul Shuch, **N6TX,** USA

Applying Descriptive Statistical Analysis to SETI, by Russell Tillman, **K5NRK**, USA

Upgrading your Argus Station, by Marko Cebokli, **S57UUU**, Slovenia

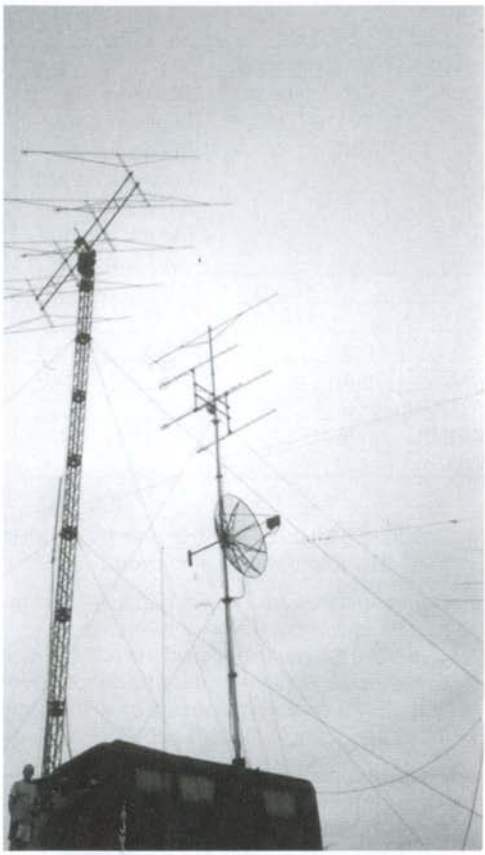
The Little Bitty Telescope, Version 2, by Charles Forster, **WA9ACI**, USA

Details of the annual SETICon02 Technical Symposium, Awards Banquet, and Membership Meeting may be found online at <http://www.setileague.org/seticon >.
email to join@setileague.org,

Moonbounce Beacon Returned to Service, Stronger than Ever. The SETI League's "moonbounce" beacon **W2ETI on 1296.000** has been returned to service, ten times more powerful than before.
It operated for four and a half months at a modest 15-watt transmit level, before being temporarily shut down in late July for the addition of a 150-watt amplifier assembly. The next Arecibo tests have been scheduled for March 21 - 22, 2002.

Galactical news

Moon temperature: One relevant reference that you might find interesting is at http://www.monstein.de/astronomypublications/MoonEnglishHtml/Moon2001V2.htm where a monthly cycle from 192k to 236k is observed at 10 GHz with simple equipment available to any amateur interested in Radio Astronomy. The moon is a thermal radiator at cm-meter wavelengths. The apparent RF temperature reflects the physical temperature of the "dirt" about one wavelength deep, so your 13 cm observations reflect a depth in the lunar material about 4 times deeper than the 3 cm measurements in this paper.



SP6OPN&SP6JLW 8x32el. 432MHz

Therefore the mean value is about the same, but the range will be reduced because the lunar "dirt" will provide additional insulation. Therefore I would predict that lunar brightness at 13 cm should be about 214 +/- 10 K.
73 de Tom, W3IWI

Internet bookmarks

For those interested in the **DSP-aided** modes, there is new information on an EME contact between W7LHL and W7SZ at 10 GHz:
http://www.proaxis.com/~boblark/dsp10.htm
(follow the link to the 'weak signal page' under the title '10 GHz PUA-43 Mode EME QSO').

They were running 5 and 15 Watts to 10 foot antennas. The mode was PUA43 using DSP-10's. The signals were quite "sub-audible!" 73, Bob Larkin W7PUA

Linear actuators:
http://www.thomsonindustries.com/default.htm

See this site for the lastest on high accuracy **lunar distance** measurements
http://news.bbc.co.uk/hi/english/sci/tech/newsid_1761000/1761407.stm

Interesting article on **double echos** complete with strip chart recording on my web site in the NOTEBOOK section titled: LDE (Long Delayed Echoes on EME circuit) thought you might be interested. John - K3PGP
http://www.k3pgp.org
http://www.weaksignal.org
http://www.deucearmy.com
http://www.wpponline.org

Stumbled onto an interesting web site providing information on spectrum allocations world wide from **31 to 81 GHz** - very interesting to learn what's there around the world.
http://www.superfreq.com/itu30_81ghz.html
Owen, K6LEW, FM18lx
http://www.c3iusa.com http://www.k8gp.net

changes

OK1DFC has a new e-mail address ok1dfc@tesmail.cz.

EME conference 2002

EME Conference 2002 - N/F Contest

N/F Contest consists of the noise figure N/F [dB] and the associated gain G [dB] measurement on preamplifiers (LNA) and on RX part of transverters 144, 432, 1296 MHz directly and on 2,3 + 3,4 +GHz, 5,7 +GHz a 10 GHz via auxiliary transverters.

On each frequency band (category) the LNAs and/or transverters will be settled in an order by the best measured N/F.

Frequency	Connectors (WG) available:			
	Connector:	WG:	Other types:	Remarks:
A 144MHz	N / SMA (male and/or female)	n.a.	7-/116, TNC, BNC, ... ?	In other cases the device must be provided with a transition (adaptor) to the available type
B 432 MHz		n.a.		
C 1296 MHz		n.a.		
D 2,3 GHz		n.a	n.a	
E 3,4 GHz		R40 (WR229) ?	n.a.	
F 5,7 GHz		R70 (WR137)	n.a.	
G 10 GHz		R100 (WR90), R120 (WR75)	n.a.	

The overall N/F Contest results will be officially announced during the Sunday conference program.

The three best units in each category will acquire the Kepler diploma. The best preamplifier in each category will be appreciated by special prize from the EME Conference committee.

The measurement will be realized in Czech Academy of Sciences in the professional laboratory provided with HP8970B N/F measuring set and HP346B noise sources.
The measurement of N/F and associated gain will cover the input frequency bands (categories) and the coaxial connector interfaces defined in the Table 1.

N/F Contest Terms

Only the equipment (LNA/Transvertor) corresponding to the data presented in Table 1 will be allowed to enter the contest. In the case of transvertor the output (intermediate) frequency must fall into the frequency range 10 to 1600 MHz.

Individual LNAs from od 2,3 GHz up to 10 GHz will be measured via transvertors (convertors), preceding the NF measuring instrument. DB6NT and DownEast Microwave transvertors with frequency inputs on a DownEast Microwave 2304/2320/2424 MHz, 3400/3456 MHz, 5760 MHz and 10368 MHz 144 MHz output will be employed..

Common terms for contest handover and return of equipment (LNA/transvertor):
To assure the participation in the N/F Contest the particular equipment must be handed over at the EME conference reception in the hotel latest on Friday, August 16, 2002.

Each unit posed to competition will be assigned with an ordinal number label and the owner (contestant) will be given the receipt document confirming the equipment handover.

Due to the fact that N/F Contest is strictly anonymous, each contestant is asked to support the objectivity by removing all the respective identity identifiers (like the call sign, etc.) from the units under test.

Tested equipments will be returned to the respective contestants at the official announcement of the N/F Contest results.
If an equipment will not be handed back during the official program it will be available in the EME Conference reception up to Sunday, August 18, 2002 and will be handed back to the contestant against to the respective receipt document.

Any individual requirements as regards the handover and return of equipment under the

Startup EME 432 MHz

This time we want discuss antennas. There are many different types to choose from but the first decision is:

To buy or to homebrew?

Next: Dish or Yagi?

A dish will allow you to use different UHF bands by simply exchanging the feed system. Moreover, polarization switching or gradual rotation will not be a problem. But homebrewing a dish plus its rotation mechanism is a demanding task. Buying a new dish >4m diameter is practically out of the question.

Yagi arrays have advantages such as: Ease of construction and rotation, lower weight and windload, suitability for limited space, less conspicuous to neighbours. However, polarization rotation is not easy (and often too slow), polarization switching requires cross-yagis.

But for some reasons a yagi array has some other advantages. The following table should give an overview.

Gain /dBD	Dish Diam. /m	Yagi array (dimemsions)
30,5	13	16xBV 13wl opt. (9,2x7x7m)
29,8	12	16x9BV 13wl (9,2x6x6m)
28,2	10	16x9BV 11wl (7,5x6x5,9m)
26,3	8	8x9BV11wl (7,5x6x2m)
23,8	6	4x9BV 13wl (9,2x2x2m)
20,3	4	4x21el. FT (4,2x1,7x1,7m)

Obviously, something like a 4 yagi array will be a newcomer's preference.

Polarization:
As on 2m, linear polarization is used on 70cm. Due to Faraday rotation (ionospheric influence) and geographical situations moon-reflected signals rarely coincide with the polarization plane at the receiving end. a 45 degree offset results in 3 dB loss, 90 degrees in approx. 20 dB loss, depending on the polarity "sharpness" of the moon signal.

There are several approaches to overcome the above problem:

1. Use of **cross-yagis**. Disadvantages: Extra weight and extra losses due to switching relays. Interaction may reduce gain. Difficulties with the use of open wire feeders. Only one station (EA8FF) is known to have solved the problems involved in a multi-cross-yagi system.

2.**Turning the whole array** around an additional (polarization) axis.

Disadvantages: Need for extra rotor and bearings. Slow rate of turn when fast changes between transmit and receive periods are desirable. Limited boom lengths and thus limited single yagi gain. Need of counterweight. Yet several stations such as G3SEK, G4ERG, K1FO, VK4AFL and a number of JA's have demonstrated the feasability.

3.**Live with** the problem.

Disadvantage: Time and patience required. Sometimes, unsuccessful skeds have to be repeated. Problem may be mitigated by building a "huge" array.

Yagi antennas.

There is a variety of **commercia**l antennas with proven performance, such as Tonna and M2. Steel elements are undesirable due to additional losses which impair receive capability. Still the cheapest way is to homebrew yagis.

For everyone who has not two left hands and a good drilling mashine **homebrew** Yagis are the best solution.
Built 8 yagis or buy a single yagi.

There are several designs made over the last 15 years. The most public design is the DL6WU yagi. Günter made in the early days some fundamental work on yagi dimensions.

All news designs were compared to his gain versus length curve. The designs from K1FO, DL9KR, W1JR are all above these gain curve. One of the best known designs is the DJ9BV opt. design. This design has the highest gain at a normalized length. The 9BV opt. design has only one disadvantage, these antennas are very sensitive against missing or bent elements or drilling errors or cutting the elements wrong. BUT they have **+0.85dB** more gain at 13wl compared to a normal 6WU design! Thats 1,7dB more echoes!

A good compromise should be the 9BV normal design (like I use). These antenna has no problems with wet wheather, loosing elements and mismeasured holes. They can be build in a short version like 7,7wl and can be made longer later on, which is not possible with the 9BV opt. system.

At a length of **>8wl** a tapered boom is a must. I have not done this and the result is a heavy antenna which is very sensitive against wind, because of the high swinging load at the end of the boom.

4 long antennas are always better than 8 short ones. The feeding system is more simpler and the leverage is smaller, what the rotator will answer with a longer life. Every doubling of the number of antennas will produce a 4 times more effort on the mechanical construction.
See DJ5NVs (ex DL9NDD) success with 4x16wl 9BV Antennas!
Of course 8 or 16 long antennas are much better!

It is always better to have the **EME antenna as low** as possible. To see the horizont is not bad, but the windload should be take into consideration. We had some destroyed EME antennas by high winds lately. For repair and improved it also helpful to have the antenna close to the ground. A good idea is a lift-tower, where the system can be moved to ground quickly for repair, storm. will be continued..

DL7APV, tnx for help to DL9KR
ref:

Other EME info sources

432&up:

EME **Newsletter**, Skeds, photos, and more: http://www.nitehawk.com/rasmit/

Al, "a.katz@ieee.org" K2UYH, editor of the 432 & Above News Letter, reminds all that the NL is available via e-mail and the internet. You can get the NL in .pdf or .doc format from cscott@surfsouth.com
KD4LT and also it is on the http://www.nitehawk.com/rasmit/em70cm.html
PA0ZN web site. Find back issues of the NL there also.

Latest 432&up skeds will always be on DL4EBY web page. You can find links at the http://www.nitehawk.com/rasmit/em70cm.html page through the 432 & Above

432&up **EMAIL-List**
CORD/NL DISTRIBUTION: SCOTT, KD4LT <cscott@surfsouth.com>

432 **EME NETS**: 14.345, 10 AM ET SATURDAY AND SUNDAY (AFTER VARO NET ENDS ON SUNDAY)
NET CONTROL AND SKEDS CORDINATOR: JOE, K1RQG, TEL (207-469-3492), E-MAIL k1rqg@aol.com

2m

The **2m Net** runs after the 432&up Net, same freq. VE7BQH net control

all bands

Online **EME TOPLIST** (based on initials) by HB9Q
http://www.hb9q.ch/database/search.htm

All about he coming **EME conference** in Praha (incl. booking)
http://www.emeconference2002.cz/

ONLINE **EME-Logger**
http://dxworld.com/emelog.html

Moon-Net posting and subscription instructions are at http://www.nlsa.com/help/moon-net-help.html

N/F contest shall be agreed in advance at the EME Conference reception, or with the N/F Contest measurement providers respectively.

Technical rules for admission :
The following rules will be applied at the equipment handover to enter the N/F Contest: Input frequency band (to assign category), and the output frequency data in the case of a frequency conversion (transverter).
Type and specification of the equipment (e.g. LNA or TRX, NF<0.5dB at 15 dB gain, etc.), eventually (wanted !) type of transistor used on the input (e.g. MGF1302, ATF36077) and the producer information a (e.g. HB LNA - , LNA design W5LUA, TRX DB6NT,).
Fully understandable equipment specifications and four-square definition of power requirements and respective connections (e.g. the red color wire to +12 V, power consumption <100 mA, -12 V connect to the body of equipment under test, etc.).
Each contestant takes full responsibility for the respective provisions to allow the equipment to be easily and unambiguously connected to the power supply to enable its contest measurement (e.g. flexible colored and/or labeled wires with free ends, etc.)
Info from Franty, OK1CA

LAST

- deadline every first of Feb./May/August/Nov. were late this issue!
- email DL7APV@t-online.de
- DM2BHG : Heinz.Borde@t-online.de
- our deadline, was March 22nd
- All EMEers describing their Station, pse use ONLY power at feedpoint. It is much easier to compare.

73
Bernd DL7APV &
Heinz DM2BHG

6m News

Editor: Joachim Kraft, DL8HCZ - info@DUBUS.de

6m-Logbook from DL (Day, Month, UTC):

January to March 2002

1.1. 0900-0900 F2 from M+S-DL: JY9NX, UK9AA 1110-1130 from all DL: FY5KE

1300-1500 F2 from all DL: W1,2,3,4,5, VE1, VO1. Laut: W4 aus EL95,96. N4MM FM09, N4AVV FM04

2.1. 1200-1600 F2 from N/M/W-DL: YY5OIG FK81, YV1DIG, YV4DDK, 9Y4AT, VP5VAC, VP2VI, WP4U, VP5JM, C6AIE, CO8DM, HH7PV FK28, N4HGZ FM14, KB4FQ FM04, KF4VKU EM77, WB4CTW EM76, N5ZEN EM82, N4JQQ EM55, K8MN EM99, K9VV EM79, NX4E EM70, N4DA EM74 and many W+VE

3.1. 0815 F2 from S-DL: UN1SIX 1315-1530 F2 from N/W-DL (weak): W1,W2,W3W4 VE1, VO2AC FO73

4.1. 0810 F2 from S-DL: A45XR LL93 12-15 F2 from all DL: OX2SA GP60, OX3OX GP36, VE8BY/B, VE2HOG FN07, K9HMB EN52, KV4T EM53, VO2AC FO73, W1,2,3,4 VE1,2,3

5.1. 1410-1450 F2 from all DL: VE8BY/B FP53. 15-16 KF4T EM53, K0AZ EM37, K5CM EM25, WB8XX EM79, K0ETC EM27, W0VD, N9NJY EM58 u.a.

6.1. 0920-1000 F2 from M+S-DL: DU1EV, YB5QZ 14-15 from all DL: AA4S EM95, K4QI FM06, W4MW EM96, K6EID EM73, NN4X EL95, KD5HPT EM32, K4PI u.a.

7.1. 13-15 F2 from all DL: VE1, W1,2,3,4 from FN84,74,86,42,41,54,23,24,41,10, EL95 etc. C6AIE FL16

8.1. 1010-40 F2 from N/M/E-DL: XV3AA 1300 VO1ZA, 1400 C6AIE 1630 K5CM, W5EU EM12, W5UN

10.1. 0955-1030 F2 from N-DL: EX8QB MN82, UN6P, UN1SIX 1400-1530 F2 from N/W-DL: VE1, W3

12.1. 1015-1300 F2 from N/W + S-DL: LA7THA/MM JJ14 hrd, UN7QX, PY8MD, YV1DIG, PJ2MI, FM5WD, 9Z4BM, 9Z4AT, YV4DDK, P43JB, P49MR

13.1. 0930-1430 F2 from all DL: LA7THA/MM JJ14, XV3AA, 9M2/JI1ETU, 6W4RK, D44TD, FY5KE/p, YV4DDK, TT8DX, 8P9HW GK03, FM5WD, FG5FR+BG, PJ2MI, P43JB, P49MR, VP2VI, KP2BH, W1, VE1

14.1. 08-09 F2 from all DL: UK9AA 0950 LA7THA/MM JJ14 13-14 VE1, VO1, W1,3

15.1. 1100 F2 from all DL: UN6P 14-15 W1, VE1

16.1. 0915 F2 from N-DL. UN9P 1215-1530 9Y4TL, VO1BC, P43JB, P49MR, K3KYR, K2RTH

17.1. 1220-1600 F2 from N/M/W/E-DL: OX3VHF, OX3SIX, OX3OX, OX3SA, WP4KJJ, P43JB, P49MR, YV4GLD + FJK + YV1DIG + YY4GMG alle FK60, NP3GG, WP4Q, TG9NX, 6Y5RV, KG4DX FK49, W1,2,3,4,5,8,9,0, VE1,3,VO1 u.a. W9DU EN41, KM0A EM48, WB4WEN EM86, K3UL FN11, N5OKC EM40, KE8FD EM84, N4HGZ FM14, WR4K EM90, K5CM, ZF1DC, CO8DM, CO8LY

18.1. 0745-1000 F2 from N/W/E-DL: UK9AA, JY9NX, JY4NE, SU1SK, 4X6XQ, S92JHF JJ30, LA7THA/MM JJ14 1200-1600 F2 from all DL: HP2CWB, HP1AC, KG4DX, CO8DM, CO8LY, OX3HX GP44, OX3OX, OX3SA, ZF1DC, VP5VAC, W1,2,3,4,8 VE1,2,3, VO1 VE8BY/B FP53

19.1. 1230-1330 F2 from N+W+E-DL: VE1YX+TRB, FP5BU, OX3SIX 1600 PA2VST hrd NL7Z (Alaska)! 1730 v W-DL: W8

20.1. 0830-0900 F2 from N-DL: 4X1IF, JY4NE, OD5SIX/B

21.1. 08-09 F2 from East+South-DL: JA, UN6P from OZ: JT1CO! 14-15 from E/M/S-DL: VE8BY/B, OX3VHF, VE1

22.1. 0715-1030 F2 from all DL: EX8MLE+MLT, UN6P, JA1 1330-1500 VE8BY/B, OX3VHF+SIX, OX3SA GP60

23.1. 0822-0824 F2 **JT1CO, ON38** wkd S-DL: DJ4PI **(First DL-JT!)**, DJ5JK, DF9TF. 1200-1430 F2 from E+S-DL DU1/GM4COK, DU1EV, JW7SIX from N-DL: W1,2,3,4,8 VE1, VE8BY/B

24.1. 0700-1000 F2 from E-DL: A45XR from all DL: UK9AA, UN7QX 1130 v S-DL: JW7SIX 1330-1430 W

25.1. 0700-1200 F2 from all DL: EY8CQ, EX8MLE+MLT, UN6P 1020 v S-DL: JW7SIX/B. 0800-1000 F2 JT1CO ON38 wkd: OZ, SP, ES, EA, I etc. - 14-15 from all DL: W1,2,3,4 1700 Aurora

26.1. 1230-1630 F2 from all DL: W1,2,3,4,8,9,0 P43JB+P49MR, OX3HI,OX,SA, FP5BU, K0GU,PJ, VE8BY

27.1. 0700-1130 F2 from all DL: EY8MM, UK9AA 11-13 PZ5RA, YV4DDK+YC, P43JB+49MR, 1300 FP5BU, 1430 VE8BY, VE2FK FN68 1530-1630 from S-DL: KR5V EM13, W7CI DM13, N6ZZ DM73

28.1. 0630-1000 F2 from all DL: EY8MM, UK9AA, EX8MLE+MLT, UN9P 1330-1430 VE1, W1,W4

1520-1700 F2 from all DL: K5CM EM25, WZ8D, K5AM v S-DL: W5OZI, W0BJ DN91, W7CI, K0EU M79

29.1. 0710-1000 F2 from all DL: HZ1MD, EX8MLT, EY8MM, UN9P, UN7GM

1515-1630 F2 from all DL: K5CM, WZ8D, N0VSB u.a. 1730 W7XU/0 EN13

30.1. 0655-1100 F2 from all DL: EY8MM, UN7GM, EX8MLE, HZ1MD, 7Z1SJ, UK9AA

1250-1600 F2 from all DL: VE1YX, W1,2,3,4 W8GF EN82, OX3OX, VE8BY/B

31.1. 0700-0900 F2 from all DL: EX8MLE, UN7GM, EX2A MN72 11-12 v S-DL: JW7SIX 11-13 from all DL: OX3SA, OX3OX, VO1TJM,BC,GO 13-16 v N+W-DL : VY2SS, VE1,3 W1,2,8, VE8BY

1.2. 0715-0900 F2 from E+N-DL: EX8MLE, A45XR, 7Z1SJ 1015-1100 v all DL: 9M6LSC OJ85 via JN1WTK

2.2. 0910 F2 from S-DL: EX8MLE

3.2. 0800-1000 F2 from all DL: VK3SIX, **YI9OM** (QSL OM6TX), EY8MM v. M+S-DL hrd: ZL3JT + NW RE66

1300 F2 from N+M-DL: TT8DX 1330-1600 from all DL: W1, VE1

4.2. 0830-1100 F2 from all DL: VR2LC, DU1EV from OZ: V73AT 13-17 v N+M-DL: W1,3 VE1, 1500 K5CM

5.2. 07-09 F2 from S+M-DL: UN7GM, UN3G 9-10 HZ1MD, HZ1MZ (LL34)

1500 F2 from N-DL: VE1, W1 1550 TI5KD EK70, W5UWB EL17

16-17 F2 from N-DL: AA5XE EM00, K6LHD, W6JKV, W5OZI 1650 F2 v. S-DL: K5AM DM62

8.2. 1000 TEP from S-DL: TR0A

9.2. 0830-1000 F2 from S/M-DL: DU1/GM4COK PK04

10.2. 0830-1000 F2 from all DL: DU1/GM4COK PK04, DU1BP PK03, UN1SIX; JA1,7,9,0, VK6JQ 1100 TR0A

1215 TEP from E-DL: ZS6NK KG46, 1300 from S-DL: TR0A/B

11.2. 1345-1530 F2 from all DL: VE1, VO1, FP5BU GN16, W1,2,3,4

12.2. 0845- F2 from E-DL: A45XR 10-12 F2 from all DL: 5U6W JK13, PY8EA, CU3AN, CU3ED, CU2CE

1215 F2 from M+S-DL: PY0FF/B, 9Y4TL 1230 VO1ZA, +BC, TR0A/B

13.2. 0845-0900 F2 from S-DL: 8Q7JE MJ64 1045-1200 TEP from N,M,E,S-DL: TR0A/B

14.2. 0730-1100 F2 from N+E-DL: EY8CQ, EX8QB, VR2LC, JA1 from all DL: DU1/GM4COK, 5U6W, 1100 TR0A

15.2. 0830-1030 F2 from N-DL: UN5PR, UN7GM, TR0A/B

16.2. 0720-1100 F2 from all DL: UN7GM, EX8MLE, EY8MM, EX8QB

17.2. 0830-1130 F2 from all DL: UN1SIX, UN3G, EX8MLE+MLT, EX2F MN72, EX8QB, UK9AA, VK6RSX/B

18.2. 0700-1000 F2 from all DL: EY8CQ, EX8QB, EX8MLE+MLT, VK6JQ, JA3,6

10-12 F2 from M+N-DL: **V73AT + V73UX RJ38** 1300-1330 TEP from all DL: ZS6

19.2. 0730-1200 F2 from all DL: EX8MLE+MLT, XV3AA OK45, JA's, VK6RSX/B, VK6HK + JQ, DU1/GM4COK

11 UT: hrd from E-DL and OZ: HL1LTC

20.2. 11-13 F2 from N-DL: VK6RSX/B, from S+E-DL: DU1/GM4COK

21.2. 0750-1000 F2 from S+E-DL: UN3G, UK9AA, 10-12 from all DL: VK6RSX/B, VK6JQ, JA's 1530 v S-DL: ZS6

22.2. 0730-1000 F2 from S+E-DL: EY7AF MN40, VK6RSX, VK4BLK QG56, VK4CXQ, UN7QX

11-12 TEP from all DL: **9U5D, KI46**

23.2. 0800-1100 F2 from all DL: VK6JQ, from S+O-DL: 9M2TO/B, VK4ABW QH30, EY7AF 11-13 TR8CA, PY8EA 13-16 TEP from all DL: V51/SP6IXF JG97, ZS6, V51E JG89

24.2. 0745-1100 F2 from S-DL: VK4ABW, CXQ, FNQ, JH, JA's 1130-1230 TR0A/B, ZS 0900-1130 F2 from all DL: YB5QZ, VK6RSX, VK6JQ, JA's, DU1BP PK06, XW0X 1320 from N-DL: KP4EIT

25.2. 0800 F2 from all DL: VK6RSX/B

26.2. 0715-1200 F2 from all DL: EX8MLE+MLT, EY7AF, EY8MM, HZ1MZ, 7Z1SJ, A71MA LL55, VK4ABW from N-DL: S07V IL56, QSL: DK2WV

27.2. 0730-1200 F2 from all DL: 7Z1SJ, VU2RM NK16, EY7AF, A71MA, 12- TEP: TR8CA, ZS6WB, D44TD 1315 F2 from S-DL: KP4EIT

28.2. 0745-1200 F2 from all DL: XV3AA OK45, VK6RSX/B, UN7GM, VK4APE, ABW, FNQ, CXQ, JH, VK6JQ

1200-1300 TEP from all DL: ZS6, TR8CA

1.3. 0650-1300 F2 from all DL: A45XR, EX8MLE, VK6RSX/B, 7Z1SJ, D44TA HK85, VK6JQ, 1100 J21EX LK11

0930-1700 TEP from all DL: ZS6, V51/SP6IXF JG97 2130 DL5RBW JN68 hrd PW0T HG59

2.3. 0730-1200F2 from S+M-DL: VU2LO ML88, VK6RSX, VR2LC, UK9AA, XW0X OK18, VK6JQ

1000-1300 TEP from all DL: 5N6NDP JJ57, TT8DX JJ88, ZS6, V51/SP6IXF 12-14 F2: D44TA + TD, 9Y4TL

3.3. 0800-1200 F2 from all DL: DU1/GM4COK, DU1EV, VK6RSX, VK6JQ, EY8MM, VK4FNX, VK8RAS/B, JA's, DU3NXE, DU1BP, VU2ZAP, VU2PAI MK72. 1230-1430 TEP: ZS6, TT8DX

4.3. 0830-1100 F2 from all DL: VK6RSX, VU2ZAP, D44TA (QSL OE5XVL) 0930- TEP: 7Q7SIX, Z22JE

5.3. 1030-1330 TEP from all DL: ZD8VHF/B, F2: D44TA HK85

6.3. 1115-1500 TEP from all DL: TR0A/B, ZS6, V51/SP6IXF JG97

7.3. 10-12 F2 from all DL: D44TA v. S-DL: TR0A/B

8.3. 1045 TEP from S-DL: TR0A/B

9.3. 1030-1700 TEP from all DL: ZS6, TR0A/B, ZS4NS, ZS4TX, V51KC

10.3. 0800 F2 from S-DL: EY8MM 1030-1300 TEP from all DL: TR0A/B, ZS6, V51C JG77

11.3. 0830-1100 F2 from all DL: VK6JQ PH12, VK6RSX/B

1000-1600 TEP from all DL: ZS6, ZR5ADQ KG50, V51LK JH90 QSL via DJ4LK, TR8CA, TU2MA IJ85

12.3. 1100 TEP from S-DL: ZS61230 from all DL: TT8DX JJ88

13.3. 1015-1700 TEP + F2 from all DL: TR0A/B, ZS6, J28FF LK11, J28EX

14.3. 1000-1730 TEP + F2 from all DL: ZS6, TR0A/B, J28EX + FF, ZS3C KG21, ZR3CDK KG10, Z22JE KH52

19-20 TEP from S-DL: V51LK JH90, 7Q7SIX/B

15.3. 10-13 F2 Longpath from S-DL: 10UT KH6SX (Hawaii!), TEP from all DL: ZS6, TR, V51LK, TT8DX

16.3. 0900-1000 F2 from S-DL: VK6JQ 12-16 TEP from all DL: 7P8Z KG30SR QSL via ZS4TX; V51E, ZS6,

17.3. 0800-1000 F2 from DL: VR2LC, MY, XMT, IL, PX, VK4FNQ 0940-1040 LP from DL: **KH6SX BK29, WH6O BL11**

20.3. 0940 F2 from E-SL: VK6JQ 12-13 TEP from all DL: ZS6

Expeditions and News

/MM M0HEN / PA3HEN/MM is qrv on 50.140 MHz and on 2m. He tours mostly from OH to EA and EA to TA.

/MM GU4AJE/MM is qrv on 6m now untill mid July. He is on a Greenpeace-ship and the exact destination is always secret.

/MM G0KZG/MM is qrv again from May 9th starting in VK (Fremantle) cruising to S7(Seychelles) unterwegs, from S7 direction Mauritius (3B8) untill July 15th. Andy is on 50.110 and qsys to 50115.

IM57/56: DL8HCZ is qrv again on 6m as CT1HZE several times from IM57 and IM56 during summer 2002. QSL direct to DL8HCZ.

IM6:3 HB9HLM is qrv from 1.-22.6. as CN2DX on 2m+6m from IM63. This year NO mobile operations from other squares!

IN89: GJ/F5JOT, F5LGQ, F6CKH, F8CRH, F8CUR + CUY are qrv 6m and 2m from 17.-21.5.

JO13: From 15.-16.6. PA3HEN, PA2DWH + DL1EJA/MM are qrv 6m, 2m, 70cm + 3cm. Inkl. CW-MS on 2m.

KM73: OD5/OK1MU is qrv for another year on 6m+2m (100w, 9 Ele). Also OD5/IW0GXY is qrv now on 6m. His QRG is 50.155 Mc.

KP45: The OH8K-Group is qrv on May 3 to 5 on 6m and 2m CW-MS. Skeds: oh6jw@sral.fi

3V Tunesia: The TS7N-Group (DJ7IK etc) plans another expedition with 6m in Mai 2002.

8Q Maledives: A british group plans to become qrv on 6m in the end of July as 8Q7ZZ. Locator is MJ65. QRGs 50105 +50145 Mc.

9M9 East-Malaysia: 9M6/7M2VPR is qrv on 6m from June 11.-19.

9Q Dem. Rep. Kongo: 9Q1A is qrv on 6m untill September and again from October.

9U Burundi: 9U5D went QRT on March 2nd but has plans to be qrv again this year.

FJ St. Martin: FJ5DX, is new on 6m from Loc. FK87ou. The only FJ on 6m.

FP Miquelon, GN17: FP/N1RZ + K1TOL plan a 6m-only-Expedition (QRO) from June 14.-24.

J3 Dominica: J37CAJ, Conrad, is a resident, and new on 6m SSB with 100W and dipole.

JT Mongolia: JT1CO, Chak, is qrv on 6m with 100 Watt and 5 Ele. from Ulan-Bator, ON38FA.

KH1 Baker Island: From 29.4.-10.5. there will be an int. expedition qrv also on 6m. Locator: AJ10.

OX Greenland: OX3LG is qrv also on 6m from 1.8.-1.10. from Kook-Island (GP34). QSL via OZ1ACB.

OY Faroer Isl.: OY/DL2VFR + DL2RTC are qrv 6m from May 20.-22.

TF Island: TF/DL2VFR and DL2RTK are qrv 6m from May 23.-30. from several squares.

TN Congo: EA3BT + WL are qrv from May 16.-27. as TN3B + TN3W also on 6m.

TR Gabon: Well known 6m-DXer TR8XX became a silent-key on February 12th.

VK0M Maquarie Isl.: VK0MQI is qrv also 6m untill December.

XY Myanmar: DL4KQ etc will be qrv also on 6m in July/August.

YA Afghanistan: YA5T, YAØUSA + YA/G4KUX are all expected to show up on 6m anytime. Also N7BHC (who was active from ZA before) is in YA now for almost 2 years and plans to make 6m and 2m EME.

ZD7 St. Helena: ZD7VC, Bruce, and ZD7WT, Tom, are very qrv on 6m now.

The Italian 6m group "SIXITALIA" promotes a yearly 6m-QSO-of-the-year-contest. From the result here we publish the top ten QSOs of the year 2001:

Nr. / Call1/ Locator1 / Date / UTC / Call2 / Mode / Locator2 / Distance (Km)

1. EH7KW IM67XI 03/04/01 20.02 ZL3VTV/1 SSB RF73KD 19915

2. PY5CC GG54RE 18/02/01 1.32 7J6CCU SSB PL36VI 19659

3. EH7CD IM86RQ 04/04/01 4.48 ZL4AAA SSB RF65SA 19620

4. VR2XMT OL72BM 24/04/01 13.31 LU2NI SSB FG72UF 19403

5. VR2ZXP OL72DH 15/09/01 4.44 LU2NI SSB FG72UF 19384

6. HP2CWB FJ09BI 13/04/01 2.23 YC1MH SSB OI33JH 19241

7. F5LNU JN04JV 08/11/01 9.46 ZL2TPY SSB RF70BW 19161

8. VR2DXA OL72BM 05/11/01 2.10 OA6/N6XQ SSB FH43FO 19115

9.CE0Y/W7XU DG52GU 05/04/01 14.13 A45XR CW LL93EN 18742

10. ZL3TY RE57OM 13/11/01 8.44 I2YSB CW JN45IF 18583

73s see you on 6m! Joe, DL8HCZ/CT1HZE

Tropo News

Editor: Tom Doelle, DG3FK - DG3FK@darc.de

Dear readers, tnx for some tropo reports, hpe to cuagn on VHF/UHF/SHF. 73, Tom

Tropo 2m:

DB5KN, JO31NB wkd:

02.11.2001: GW7SMV io81ln 708; F1LEA in78bi 981; G4CQM io70st 811; GW8JLY io81jm 720; G4HGI io83pl 720; GW8ASA io81em 749; EI3GE io63xd 927; GU4IAN in89rk 710

09.12.2001: GM3POI io88ow 1078 ODX

10.12.2001: M0DAD io95fc 732; GM0EFT io86pl 869

05.012002: LA0BY/P jo59ix 1016; LA6LCA jo59fb 914km. Rig: 100W + 9Ele F9FT. tnx for info Mike

DF0TEC/P, JO73CF, wkd:

02.03.2002: DK0ALK 55 53 JN38TD 731; ON4NOB 57 59 JO20KV 689; DL0HEU 54 59 JN47NX 685; 03.03.2002: ON1DNF/P 59 59 JO20MV 678; DF1CF 52 52 JN57FP 676; PE1HWO 55 55 JO21GV 670; ON6LY 51 55 JO21LH 664; PA3DYS 51 55 JO21JP 662; LX/PA1TK/P 57 59 JO30BB 660; DJ1SR 59 59 JN48VF 637km. Rig: FT-847 + PA, 300 W, antenna : 2 x 7 ele DL6WU, 8 mAGL, 88 mASL, tnx for info Oli

DG3FK, JN59OP, wkd :

02.03.2002: G4Z 55 55 JO03AH 873; G5B 55 58 JO03CE 858; F1FIH 55 59 JN23GS 828; 9A4EW 55 59 JN95KG 754

03.03.2002: G7RAU 51 54 IO90IR 897; G0XDI 55 59 IO91RP 857; T90O 59 59 JN94IR 787; HA8MV/P 59 59 KN06HT 765; HA8CE 57 59 KN06EN 762; F8BCU/P 57 59 JN24JW 713

Rig: TS850 + TV + PA 600W, antenna: 8*15 ele 50m above Gound + 550m asl

DG5CST, JO6ØDS wkd:

06.01.2002: LA0BY/P JO59IX 55 52 1028. tnx for info Sebastian

DG6NEL/P, JN59SV wkd:

02.03.2002: F5CUA 57 59 JN19KR 622; OZ/DL0IZ/P 59 59 JO45GD 618; PI4WFL 55 57 JO23MP 611; SK7JM 57 59 JO65TM 641; HA6W 59 59 KN08FB 681;

03.03.2002: 9A2VR 55 59 JN95FQ 697; 9A2KD 59 59 JN85EG 629; ON1YW 55 59 JO11LC 621; HA0MK/P9 55 59 KN08QC 744; HG6Z 55 59 JN97WV 648; F6DWG/P 59 59 JN19AJ 686; T90O 55 59 JN94IR 788. tnx for info Markus

DJ8ES, JO43SX, wkd:

04.01.2002: LA5JX JO59CB 53 57 567; LA6OJ JO28VR 57 59 576

05.01.2002: SM4BDQ JP80FG 53 34 813; SL0ZS JO89XJ 59 59 790 ; SM1LPU JO97CK 57 54 664; SM4WGB JO78LS 59 57 628; SM3LBN JP80IO 57 57 852; SM4ATA JO79BH 53 53 655

tnx for info Wolfgang

DL5UH/P, JO74AA wkd:

2.3.01: DL0HEU JN47NX 53 59 755, DJ7SR JN48VF 53 59 709

3.3.01: ON1DNF/P JO20MV 55 55 702, DJ8VH JN39PM 53 59 683, DK0ES JN48TN 539 529 680. Rig: R2, 750W, MGF1302, 10 ele 24 m asl. tnx for info Moritz

DL8EBW, JO31NF, wkd:

05.01.02: SM7WT JO65 (645km); SM7URQ JO77 (855km); SL0ZS JO89 (1134km) SK6HD JO68 (875km); SM1FMT JO97 (1028km), hrd only: OH0JN KP00 (1271km); SM4BDQ JP80 (1159km); SM3LBN JP80 (1180km); SM4WGB JO78 (974km). Rig: FT726R MOD CF300 , 11 el DL6WU, PA: GU74b, tnx for info guy

LA0BY/P, JO59IX wkd:

05.01.2002: DL0UMK JO31IC, LX2DX JN29WO (1194 km), ON1LPA JO20XO, DL0BIT JN39EX, DK7LZ JO30MR, DB5KN JO31NB, DO3VG JN39GV (1152 km), ON1BQI JO20MU, DF1BN JO31GD, DM1HD JO31GD, ON4AJJ JO20SV, DO1KHB JO30EK, DB2KA JO30JT, DL2KEB JO31CA, DO2KA JO31DD, DF7KF JO30GU, DO1KWS JO31CC, ON4YZ JO20GG, DC6IA

JO30IV, DF2ZC JO30RN, DO1KDL JO30NU, DL8GP JN39LH (1210 km), DG5CST JO60DS, DJ0VZ JO30FQ, DG5VO JO71DD, ON4KRI JO20VQ. My equipment was 180 W and a single 9-ele-yagi. Nice to work LX as a new country and many novice stations (DO) that run only small power. Promised the bill for a broken S-meter to DF7KF... tnx for info Stefan

ON4ZN, JO21, wkd:

20.11.2001 DH9YX JN68OL 688

4.12.2001 OZ9KY JO45VX 648; OZ1BEF JO46OE 647; DL3TW JO44SK 505; OZ1ALS JO45WA 567; OZ2TF JO46PE 650; OZ8ZS JO55RT 699.

5.12.2001 wkd agn DH9YX

9.12.2001 opening to the North: DG2LBF JO54BH 523; DL2SWI JO53RV 566; GM3POI Orkney Isl. IO88OW 989 + mni shorter contacts IO81, JO44

10.12.2001 Much better condx: GM0HTT IO89JC 1017; GM3POI see above now S9 +20dB! (I do have a Scottish S-meter, calibrated with prof.signal generator per recommendations of IARU Region I) GM4WJA IO87MN 867; GM4ZUK /P IO86RW 797.

16.12.2001 OL5MS JN69JJ 618; SK7MW JO65MJ 744; DK1FG JN59OP 502 etc...

3.1.2002 GM4ODA /P IO88IH 946

5.1.2002 OZ1BEF JO46OE 647; LA2JKA JO59CE 972; OZ4CQ JO45XG 591, SK7WT JO65QE 780; SK7CY JO65NS 773; SK7MW JO65MJ 744.

20.1.2002: Contest d'activité en F some 20 qso ...ODX: F5HGO JN05AI 716km.

10.2.2002 F6CRP IN96KE 682; F1CKB IN97SL 537; F6BAH/P IN96NI 656; MW1MFY IO81FL 561 17.2.2002 OK1KNF JN68MK 680.

5.3.2002 OZ/DL0IZ/P JO45GD 529; OZ2TF, OZ1BEF, OZ9KY, OZ1DLD /P + mni DL JO43, 44, 52.

10.3.2002 F6BAH/P IN96NI 656; F4CKV JN16NM 516km. tnx for info Walter

Tropo 70cm

DB5KN, JO31NB wkd:

01.11.2001 G7IGC io92bm 639

02.11.2001 G8VHI io92fm 617

03.11.2001 G4NPH jo02bi 503

09.12.2001 GM4ZUK/P io86rw 907; G7TAS jo03dg 526;GW4VEQ io73sg 826; GW8AWM io81nr 697; G3TA io81xs 640

10.12.2001: GM0EFT io86pl 869

05.01.2002: LA0BY/P jo59ix 1016 ODX; LA6MV jo59ej 949 ; LA6LCA jo59fb 914

08.12.2002 OZ9KY jo45vx 574

03.02.2002 G4SIV io92ws 532

12.02.2002 OZ2LD jo54tu 518; G3MEH io91qs 543; OZ9KY jo45vx 574; M0GHZ io81vk 650

Rig: 125W + 19Ele. F9FT, Tnx for info Mike

DF0TEC/P, JO73CF, wkd:

02.03.2002: DL1EAP/P 55 519 JO31BC 600; PA6C 59 59 JO33FB 517

03.03.2002: PA6NL 57 539 JO21BX 695; DJ8SP 52 519 JO30EM 616; DJ8EN 55 55 JO31BP 576; DJ6JJ 529 519 JO31LG 540; DL0VR 52 55 JO31MI 530; DK0HN 52 53 JO31PP 501; PI4GN 59 54 JO33II 499; DK2MN 55 52 JO32PC 483km.

Rig: FT-726R + PA, 80 W, Antenna: 23 ele DJ9BV, 6 mAGL, 86 mASL, tnx for info Oli

DG5CST, JO6ØDS wkd:

06.01.2002 LA6MV JO59EJ 57 57 966; SM3BEI JP81NG 529 549 1204; SM7FMX JO65KN 55 55 534; SK7MW JO65MJ 59 55 517. Tnx for info Sebastian

DJ8ES, JO43SX, wkd:

04.01.2002: GM4ODA/P IO88IH 57 54 927; LA6OJ JO28VR 57 59 576. tnx for info Wolfgang

LA0BY/P, JO59IX, wkd:

05.01.2002: DK1KO JO53CT, DG3XA JO43WJ, DK1ZD JO44WE, DD3SP JO72EN, DF0LBO JO53CT, DK5KK JO63EX, DL8LDN JO43XQ, DK5HX JO43WN, DL1SUZ JO53UN, DK5WO JO30AS, DB8WK, JO33XN, DG1EBD JO73AR, DG1DPA JO73AR, DK9TF JO31NF, DB5KN JO31NB, DL6YEH JO32VA, DF8IK JO30JT, DJ9MG JO52TC, DG2LAB JO54AK, DL8OBU JO42XI, DL7APV JO62PM, DL4HG JO53CM, DL1JRN JO60LT, DK3XM JO43XL, DB7LN JO44VL, DK5XX JO53AK, DC7TS JO62PO, DF3AR JO52GG, DD2LRF JO53EK (3W + HB9CV under roof!). My equipment was 120 W and a single 13-ele-yagi. tnx for info Stefan

ON4ZN, JO21, wkd:

9.12.2001 G3TA IO81XJ 460

10.12.2001 GM0EFT IO86PL 764; GM4VHU IO87VM 838 plus mni at medium range

14.12.2001 F6ETI IN97DF 621 (also wkd on 16..12.)

3.1.2002 GM4ODA/P IO88IH 946; square # 115

5.1.2002 SK7WT JO65QE 780

8.1.2002 only OZ9KY JO45VX 648 ...some PA0's Regio contest + G-activity (70 cm) ODX: M0GHZ IO81VK 468km.

12.2.2002 OZ9KY JO45VX 648.

12.3.2002 only OZ9KY es M0GHZ.

OZ1FF, JO45BO, wkd:

11.12.2001: SMØDFP JO89VL 419 519 719km; G8GJO JOØ1AL 59 59 703; MØGHZ IO81VK 59 59 824; G3JHM IO91LC 59 59 786; GØXDI IO91RP 59 59 720; G4BRK IO91DP 59 59 782; G8OHM IO92AJ 59 59 748; MØCLH IO91HO 52 55 767; GØGCI JOØ1ED 59 59 713; G3TA IO81XS 56 57 792; SMØFZH JO99HI 419 419 752; G4AJC IO91VJ 59 59 722; G4YTL IO92MB 59 59 713; F6DKW JN18CS 52 52 859; G7IGC IO92BM 57 59 736; G3KBS IO91OJ 59 59 752; G4MKF IO91HJ 59 59 782; G1WYC IO92AT59 59 724; G3JJZ JOØ1AJ 54 59 709; G7EUA JOØØET 55 55 741; GØRRJ IO91FE 54 59 806

26.12.2001 SMØDFP JO89VL 529 559 719

08.01.2002 SMØDFP JO89VL 529 539 719

08.01.2002 SMØFZH JO99HI 319 319 752; G8OHM IO92AJ 55 57 748; G3MEH IO91QF 53 549 756; G8VHI IO92FM 52 56 717

12.02.2002 SMØFZH JO99HI 519 519 752

Rig: 2x23 el., 25 m ASL, 250 W. tnx for info Kjeld

Tropo 23cm

DB5KN, JO31NB, wkd:

09.12.2001: GM4ZUK/P io86rw 907; G3XDY jo02ob 424; G4VSQ io91ll 571; G8AIM io92fh 613; G4EAT jo01hr 457; G8ADM io91ro 536; G8AGY io91gq 599; G8VHI io92fm 617; G8TIC io82vf 656

10.12.2001: G4PBP io82wo 658; G8PNN io95ef 744; G6IQL io92aj 642; G3YKI io92bd 633; G4BYV jo02lq 460; G8AGY io91gq 599

05.01.2002: OZ6HY jo45wa 477; LA6LCA jo59fb 914 ODX

15.01.2002: G3XDY jo02ob 424

Rig: 15W + 48Ele. DL6WU design, Tnx for info Mike

DF0TEC/P, JO73CF, wkd: 02.03.2002: DL4MEA 57 55 JN58RI 576; OE5VRL/5 59 59 JN78DK 533;

03.03.2002: PA6NL 55 55 JO21BX 695; PI4TUE 559 539 JO21RK 627; PA0BAT 519 529 JO31FX 542; DK1VC 52 52 JO31RG 509; DK2MN 53 55 JO32PC 483

Rig: IC-706 + DB6NT + PA, 130 W, Antenna 180 cm dish, 5 mAGL, 85 mASL. tnx for info Oli

OZ1FF, JO45BO, wkd:

11.12.2001: G7UWA JOØ2UK 55 59 547; G4ZPL IO92PJ 58 57 678; G6JHR JOØ1FK 59 59 686; G4DEZ JOØ3AE 59 59 588; G8GJO JOØ1AL 59 59 703; GØRRJ IO91FE 54 57 806km.

05.01.2002: SMØDFP JO89VL 57 56 719.

Rig: 44 el, 26 m ASL, 40 W. tnx for info Kjeld

Tropo 13cm:

DB5KN; JO31NB wkd:

09.12.2001: G3XDY jo02ob 424

10.12.2001: G4PBP io82wo 530 ODX; G4BYV jo02lq 460. Rig: 6W + 1m dish. Tnx for info Mike

DF0TEC/P, JO73CF, wkd:

02.03.2002: OE5VRL/5 519 419 JN78DK 533; DK0NA 59 58 JO50TI 366; DL6NCI 529 529 JO50VI 361; DL3JMM 57 53 JO50XL 343km.

Rig: IC-706 + DB6NT + PA, 5 W, Antenna : 180 cm dish, 5 mAGL, 85 mASL. tnx for info Oli

OZ1FF, JO45BO, wkd:

05.01.2002: LA6LCA JO59ED 55 55 416km. 19.02.2002: DJ6JJ JO31LG 519 519 488km. tnx for info Kjeld

Tropo 5,6 Ghz:

DB5KN; JO31NB wkd:

10.12.2001: G4BYV jo02lq 460km. Rig: 300mW + 1m dish

Tropo 10 Ghz

OZ1FF, JO45BO, wkd:

20.11.2001: PA3CEG JO33FB 519 519 302; SK7MW JO65MJ 53 53 310; SM7ECM JO65NQ 529 529 314km.

11.12.2001: DJ6JJ JO31LG 51 559 488; G4EAT JOØ1HR 55 57 655; G4BRK IO91DP 54 59++ 782; G4LDR IO91EC 54 56 816; G3XDY JOØ2OB 59++ 59++ 600

18.12.2001: PA3CEG JO33FB 55 56 302; SK7MW JO65MJ 519 519 310

05.01.2002: SMØDFP JO89VL 549 569 719; DL1SUN JO53PN 55 55 305

15.01.2002: PA3CEG JO33FB 549 559 302; SK7MW JO65MJ 519 529 310; SM6ESG JO67CC 529 529 302

19.02.2002: PA3CEG JO33FB 54 54 302; SM6ESG JO67CC 539 559 302; SM7ECM JO65NQ 529 539 314

03.03.2002: PA6C JO33FB 55 51 302

Rig: 65 cm Dish, 23m ASL, 5W. tnx for info Kjeld

Tropo 24 Ghz:

DB5KN; JO31NB wkd:

10.12.2001: PA5DD jo22ic 203km

Rig: 60mW + 30cm dish. Tnx for info Mike

Aurora News

Editor: Stefan Heck, LA0BY

Dear readers,

starting from 2002 the Aurora column will have a new editor. Norbert, DL8LAQ, has done a great job with having run this column for many years. Please continue to send your reports and let others know what is to be worked.

After moving to the Oslo area some years ago, many of my contacts were via Aurora. For us living in the North the Aurora is the most common type of DX propagation on VHF. It can be boring sometimes when only the usual stations are on. While the distances are not as long as at mid-latitudes, there are still lots of interesting contacts to be made. We hope to see a continuing rise of the VHF activity in Eastern Europe, namely in Russia and the Baltic countries, and the Aurora will offer good opportunities for contacts that way. Nowadays the tools for predicting Aurora are readily available on the the internet. Go ahead and use them if you can, and monitor the bands more carefully when the Sun sends us her blasts.

Aurora is one of the propagation modes where the use of CW is most advantageous. With the licensing authorities reducing or even waiving the requirements for CW, we should be aware that an increasing number of amateurs will have inferior knowledge of CW. This may reduce the number of stations being active via Aurora. Please help others to get on with CW, but also make some effort to try SSB - at least during major Aurora openings.

73 es CU, Stefan (LA0BY)

DL8EBW in JO31NF wkd via Aurora on 144 MHz:

2002-02-05

1836	LA2Z	JO59	51A	hrd	30 CW
1845	OZ6ABA	JO57	55A	hrd	20 SSB

Tnx fer report, Guido.

F4AZF in JN38IW wkd via Aurora on 144 MHz:

2002-10-21

2312	G8VHI	IO92FM	53A	54A	10 SSB
2256	G4HGI	IO83PL	53A	53A	10

Tnx fer report, Damien!

LA0BY/p in JO59IX wkd via Aurora on 144 MHz:

2002-03-05

1800	SM1PYO	JO97GI	53A	55A	340
2147	OH6QR	KP22BN	54A	55A	30
2148	SM2DXH	KP03CU	54A	55A	30

ES News

Editor: Norbert Göttsche, DL8LAQ

Dear Readers, please send your reports via email to dl8laq@gmx.de or packet radio to DL8LAQ @ DB0HB.#HH.DEU.EU. 73, Norbert.

Sporadic-E 2001 Supplements

DK6AS (JO52JJ) wkd on 144 MHz:

2001-06-23: 1655 RA6CT KN95, 1711 SV8DTD KM39.

2001-07-27: 1736 RA4AOR LN29, 1751 RN3QR LO00.

Thanks for your report, Andreas.

LZ1KG (KN31CS) wkd on 144 MHz:

2001-06-23: 1708 PA2CHR JO32XA, 1710 DG5YIL JO32KG, 1710 PE1GNP JO31, 1710 DF8XR JO32MF, 1711 PA0PVW JO22VH, 1711 DJ2JS JO31SL, 1711 DD1JN JO50DJ, 1712 DL5ARM JO52JR, 1713 PA3ECU JO32, 1714 DL8NCG JO50UD, 1714 DF2ZC

JO30RN, 1715 DL8AKI/p JO55, 1715 DL5YET JO41EV, 1715 DL4YDR JO32RG, 1715 DF0CI JO51, 1716 PE1DX, 1717 DF0WD JO42FD, 1718 DJ5REJN59, 1719 DL9GS JO31, 1720 PA9RX JO32, 1721 DK3EE JO41GV, 1721 DL5MAE JN58, 1723 DL1KDA JO30FJ, 1723 DF9KX JO30, 1727 DO1USA JO62.

2001-07-22: 1710 EA3CSV JN01NA, 1711 EA3ADW JN11CQ, 1713 EA6VQ JM19HA, 1714 EA6QB JM08QV, 1735 EA5EZJ IM98VI, 1737 EB6ADS JM29DV, 1744 EA5AZW IM98XU, 1753 EA5YB JN01XG.

2001-07-29: 0912 EA3ADW JN11CQ, 0915 EA3TI JN11, 0919 EA3BTZ JN11, 0929 EB3GND.

2001-08-04: 1220 F5LRL JN26MV.

2001-08-09: 1757 EA3ADW JN11CQ, 1832 DF0HF JO50.

Thanks for your report, Mitko.

LZ1KJ (KN31CS) wkd on 144MHz:

2001-07-22: 1705 EA6VQ, 1706 EA3CSV, 1707 EA3DBJ, 1710 EA3ADW, 1711 EA5EZJ, 1713 EA6QB, 1723 IW1AZJ, 1725 IK1YWB, 1739 EB8ADS, 1744 EA6FB, 1745 EB6ADS, 1753 EA5YB.

2001-07-27: 0735 LY3ED, 0925 DL8SCL, 0934 DL1UU.

2001-08-04: 1220 F5LRL.

2001-08-09: 1759 EA3ADW, 1810 EA3TI, 1726 DF0HF.

Thanks for your report, Ivan.

OE6IWG (JN77PK) wkd on 144MHz:

2001-07-02: 1400 EA1BFZ IN81SS, 1435 EA3CSV JN01ND, 1459 F1RHS JN03PV, 1502 F6ITV JN03OO, 1505 F6DRO JN03SM, 1507 F5SJP JN13VQ, 1518 EV1CTV IN73FM, 1520 F1DVI JN05UD, 1603 EW6FS KO35LB, 1608 EW6GB KO45ON, 1610 RW1AY/1 KO68OK hrd.

Equipment: GS35b, 4*10el homemade, MGF1302. Thanks for report, Walter.

PA3BIY (JO22EB) wkd on 144 MHz:

2001-05-23: 2028 I7OXH JN90EB.

2001-07-02: 1250 EB6ALB JM19NL, 1255 EB6AOS JM19, 1434 IT9NGN JM78PE, 1436 I8YGZ JN70HR, 1443 I8MPO JN70FP, 1445 I8TWK JN70GR, 1454 IK8YOQ JN70, 1505 IZ4AIK JN63HV, 1508 IK8XSY JN70VB (cw), 1510 IK4WMA JN54, 1517 I4XCC JN63GV, 1528 IK8TOY JM89CH, 1536 I7CSB JN71QQ, 1546 IK7IWI JN80OO.

2001-07-05: 0715 YO4GJH KN35XG, 0716 YO5BWD KN27GD, 0725 YO6OBK KN26TR, 0728 YO2LEA KN06WK, 0744 HA8CE KN06EN.

2001-07-07: 1550 EA4AMX IM89AT, 1552 EB4AFK IN80EK, 1622 I7CSB JN71QQ, 1643 Z32UC KN11CR, 1655 LZ5QD KN12GD, 1725 LZ1KCO KN22 (cw), 1733 LZ1KWT KN32AS, 1847 CT1FOH IM59, 1858 EA2CAR IN82PK, 1904 EA1BFZ/P IN81TX.

2001-07-14: 1637 U5YM KN28XG, 1715 UR5BAE KN29SM, 1813 I7FML JN80PW.

2001-07-26: 1845 YO3CCB KN34CL, 1846 YO3DMU KN34BJ, 1846 YZ1BUL KN04.

2001-07-27: 0933 TA1ZK/0 KM39AT 2144km New DXCC and new Sqr. Tnx Andeas! 1850 RX3QFM KO91FM.

2001-07-28: 1836 LZ2FO KN13KX, 1845 LZ1QI KN12PR.

Thanks for your report, Peter.

PE1HWO (JO21GV) wkd on 144 MHz:

2001-06-15: 1107 EA7IT IM87XI, 1122 EA7GTF IM87CS.

2001-07-02: 1436 IT9NGN JM78PE, 1437 I8YGZ JN70HR, 1442 I8MPO JN70FP, 1444 I8TWK JN70GR, 1454 IK8YOQ JN70GR, 1501 IK4HDO JN54TF, 1505 IW9GBU JM78NC, 1507 IK4WMA JN54WG, 1509 IZ4AIK JN63HV, 1512 I4XCC JN63GV, 1518 IK8XSY JN70VB (cw), 1525 IK7BFD JN71QQ, 1536 I7CSB JN71QQ, 1619 RX3QFM KO91FM.

2001-07-04: 0716 YO5BWD KN27GD, 0745 HA0MK KN08TA.

2001-07-06: 1852 EA7BIU IM77HL, 1907 CN2DX IM63DM.

2001-07-07: 1553 EA4AMX IM89AT, 1559 EA4EEK IN80AP, 1602 EA4EJR IM68KQ, 1624 I7CSB JN71QQ, 1637 Z32UC KN11CR, 1648 SV2DFA KN10LO, 1727 LZ1KCO KN21SK (cw), 1733 LZ1KWT KN32AS.

2001-07-14: 1714 UR5BAE KN29SM.

2001-07-27: 0928 TA1ZK/0 KM39AT, 1827 RX3QFM KO91FM, 1858 RX3QFM KO91FM.

2001-07-28: 1547 ES2QH/P KO18XC, 1845 LZ1QI KN12PR.

2001-08-04: 1159 SV1BTR KM17VU.

73, André. pe1hwo@amsat.org www.qsl.net/pe1hwo. Thanks for your report, Andr.

Meteor Scatter

Editor: Norbert Göttsche, DL8LAQ

DL1GNM (JN38WB) wkd on 144 MHz in SSB:

2001-11-18

0648	EA4BAS	IN80HL	59	59	c
0656	9A2PT	JN86	49	38	c
0720	EA3DXU	JN11CM	59		59 c
0722	EA7GTF	IM87CS	49		37 c
0734	GI6ATZ	IO74AJ	39	59	c
0737	I8MPO	JN70FP	59		59 c
0952	GM3POI	IO88MI	59	59	c
0957	F5FLN	IN94SR	59	59	c
1011	LA2AB	JO59FV	59		59 c

Heard: 9A1EZA, YO3PF?, EA6FB, 0742 G4ASR IO81, DL9MS JO54, HA5ON?, G7RAU, 0753 IV3HWT, 0759 SM1A, 1001 GM4?JZ, 1001 G4ZTR, 1006 OK2PVK, SM7TK?, 1011 S50C, 1012 HA8UG, 1015 YO3FFF/P, 1015 LZ2FC?, 1018 SM5FRH 59!, 1100 G4LOH. Thanks for your report, Michael.

DL8EBW (JO31NF) wkd on 144 MHz:

2001-12-13

2255	2305	RZ1AWT	KO48	28	38	m	m 7	cr*1
2310	2320	YT7WA	KN05	28	28	m	m 5	cr*1*4
2320	2330	LY2CI	KO14	28	hrd	5	m 5	ncr*1
2330	2345	EU6MS	KO45	39	29	m	m 10	cr*1
2345	0001	OL2O	JN79	28	28	7	m 5	cr*1*4

2001-12-14

0005	0035	RA3LE	KO64	27	hrd	9	5 3	ncr*3
0045	0100	UT8AL	KO61	27	hrd	5	m 3	ncr*2

2001-12-27

2030	2115	S52LM	JN65	26		3	1	0,2nc*5

2002-03-10

2030	2110	SM2CEW	KP15	28	hrd	6	m	1.5only listen

Remarks: *1 BCC-test QSY 1 letter (D); *2 BCC-test QSY 2 letter(DD); *3 BCC contest without letter system; *4 Sidescatter-QSO (my antenna beaming to radiant - QTF 70); *5 Test with digital ms mode WSJT.

Equipment: FT726R (mod. CF300), 144MHz 11el DL6WU, GU74b, DTR, ETM9C (RX/TX max 3500lpm).

Infos are welcome via VHFnet, or PR (BBS DB0NDK), or GSM: +491745430884. Thanks for your report, Guido.

YT7WA (KN05EF) wkd during BCC MS contest 2001:

2001-12-11

2035	2052	OH1XT	27	37	10	7	2	c
2105	2117	DL5WG	27	26	11	15	2	c
2150	2217	PA2TAB	27	27	13	m	1	c
2230	2247	DJ9YE	27	27	m	m	2	c
2320	2335	SM3MXR	27	37	8	m	2	c

2001-12-12

0000	0017	F6CRP	28	27	9	m	2	c
0020	0037	DK5DQ	28	27	8	10	1	c
0050	0102	PA2CHR	37	28	8	m	3	c
0145	0212	DL1MAJ	28	27	6	15	1	c
0220	0242	PA3ECU	29	37	7	m	3	c
0305	0317	PE1HWO	29	37	10	m	2	c
0330	0345	DG3GAG	27	28	8	15	1	c
0350	0417	DL3UL	29	27	12	m	1	c
0830	0855	TM1E	27	27	m	m	24	c
0905	0930	DL3BUE	27	27	6	m	3	c
1020	1035	F8DO	26	27	4	m	2	c
1750	1802	DL5MAE	27	27	m	m	2	c
1830	1852	PA2DWH	37	28	m	m	3	c
2040	2052	S51AT	27	27	3	5	1	c
2140	2157	I5TWK/8	27	27	6	12	1	c
2200	2212	DJ9FG	28	27	6	7	7	c
2320	2335	DL1SUZ	28	27	9	m	6	c
2355	0017	I5WBE	29	27	12	11	4	c

2001-12-13

0200	0227	F1DUZ	27	27	m	m	4	c
0230	0242	G0RUZ	28	27	m	m	15	c
0245	0252	S57TW	27	27	m	m	2	c
0340	0355	RW3PF	27	27	8	12	2	c
0425	0437	LA0BY	39	37	m	m	5	c
0620	0632	RZ1AWT	28	27	m	m	6	c
0802	0820	DL3YEL	37	37	8	m	3	c
1145	1200	DL1EJA	26	26	m	m	5	c
1720	1747	RK2AF	26	27	m	m	3	c
1910	2007	RA3DQ	26	27	m	m	2	c
2025	2047	RK1B	26	27	m	m	2	c
2112	2125	PA3BIY	27	37	8	m	2	c
2125	2145	DD0VF	37	27	m	m	6	c
2145	2200	DD3SP	27	27	9	7	3	c
2220	2240	SM1HPV	37	27	m	m	5	c
2310	2322	DL8EBW	28	27	m	m	3	c
2322	2340	SM5TSP	38	28	11	7	8	c

2001-12-14

0000	0027	DL1EAP	28	26	m	m	4	c
0040	0052	DF8IK	29	28	m	m	3	c
0100	0122	ON1ALJ	28	27	m	m	20	c
0125	0140	PA3DOL	28	28	4	3	1	c
0145	0200	DH0GHU	28	28	7	m	2	c
0205	0222	DL3HRT	27	27	4	3	1	c
0235	0255	UT8AL	27	28	4	m	1	c
0717	0730	DJ2QV	28	28	5	3	7	c
1222	1240	DK3BU	28	27	13	m	36	c
1632	1657	DK8EL	27	27	6	9	3	c
1855	1932	OH5LK	28	28	8	m	3	c
2035	2055	DJ8MS	27	27	10	m	6	c
2105	2125	PA5DD	28	37	8	12	10	c
2210	2252	PI4AJS	28	28	2	m	1	c

2001-12-15

0100	0122	DJ3HW	26	27	6	m	1	c

Equipment: 4x4 loop, 11el WU, C5400E, MGF1302, GS35B.

OP's: YT7WA, YU7KB, YU7MS, YU7ON, YU7PS and YZ7MON.

This is our twelfth competition in the BBC MS contest. It is obvious that there have been fewer contacts than the previous years. Is WSJT the reason or something else? We think that lack of publicity of this contest in the past few years might also be the reason of weak activity.

We worked from the "old portable location" outside the town. The activity, which was good starting the first day, seems to have weakened the last night. There were reflections during the whole day even when the shower was behind the horizon so we did most of the contacts during the day.

There were some interruptions due to some preamplifier, output amplifier and tape recorder problems. There were more technical problems than usually but we managed to handle them. Fortunately, we had no power problems as in the last few years.

Many reflections we had form G0RUZ, TM1E, DL0UL and some interesting side scatter reflections even from YZ7UN who was 80km away from us.

Thanks to all old and new friends we contacted or were called from.

Congratulations to the winners! See you next year. 73, Gigi YT7WA. Thanks for report, Gigi.

News & Comments

Editor: Klaus Tiedemann, DL4EBY

GHz-Tagung Dorsten 2002

Am 17. Februar nahmen ca 200 Teilnehmer an der 25. GHz-Tagung in Dorsten teil. Nach der Kontestpokalverleihung durch DL9GS folgten 6 Vorträge aus dem Bereich der Mikrowellen und zwar von DC0DA ber das 47 GHz-Band, von DJ4AM über optimierte Antennensysteme fr 10 GHz und 13 cm portabel Antennen ohne Relaisumschaltung. DF9IC berichtete ber D-ATV, digitale Videoübertragung im Mikrowellenbereich, DL2SAX gab einen Rückblick über 25 Jahre Kontestgeschehen und DJ4OW berichtete über die Auswirkungen der Sonne auf die Funkausbreitung.

Alle Vorträge sind im Tagungsband enthalten der bei DJ6XV erhltlich ist. Die Tagung wurde vom DARC OV N38 Herrlichkeit Lembeck durchgefhrt. Die Tagungsleitung hatte DL4BBU und DJ6XV. Sollten Sie einen Beitrag oder Vortrag technischer oder betriebstechnischer Art aus dem Bereich der Mikrowellen haben, wenden Sie sich bitte an die Organisatoren. Die Planung der 26. Tagung im Februar 2003 hat schon begonnen Peter, DJ6XV

GHz-Convention in Dorsten 2002

February 17th about 200 participants attended the 25th GHz Convention in Dorsten this year. After DL9GS awarded contest results there followed 6 lectures around microwaves: DC0DA about the 47 GHz band, DJ4AM on optimized antenna systems for 10 GHz and 13 cm portable antennas without relais switching. DF9IC reported on digital ATV on microwaves, DL2SAX gave a retrospect over 25 years of contesting and DJ4OW reported about the effect of the sun to the radio propagation.

The convention was held by the OV N38 Herrlichkeit Lembeck, under direction of DL4BBU and DJ6XV. In case you want to provide a technical or operational lecture please contact above organizers. The planning for Dorsten 2003 (February) already has begun. Thanks to Peter, DJ6XV

WSJT on 2m across the Atlantic

Alex, N2PIG writes:

In the beginning of March I went to eastern Newfoundland, CANADA, to establish a high power 2M & 70Cm Station , with the intent of working my XYL, Debra, VA3PIG, in Europe.

The next week, my XYL and I traveled to western IRELAND, where we established a similar station, mindful of the 26dBW-at-Antenna limit. Last week I returned to my Newfoundland portable, leaving my XYL, in IRELAND, at IO41vs.

On Saturday night, 16 March, 2002, I "flipped the switches" on, at the Canadian Station. In the following five days, Debra & I have been communicating across the Atlantic Ocean, at an approximate Great Circle Distance of 1890 miles/ 3000 kilometers, on 2 Meters, using WSJT!!!

St. Patrick's Day, Sunday, we managed an exchange of Call Signs. On Tuesday, yesterday, we completed an full exchange, in less than four hours!

Today, in the early morning, we exchanged the salutations: "God Bless America", from Newfoundland, and a partial "Greetings from Ireland". Full details of the event will be available in a Web-Site, we are soon to construct...It was a few years in dreaming, planinng, and training for this DXPedition, and still Mr. Murphy accompanied us. However, we

were well prepared for him, and he was most co-operative, in the end.

Debra has now dis-assembled her station and has begun her journey back to Canada, where I shall rendezvous with her, in Toronto, late Thursday. Therefore, this is your only "window of opportunity" to work me at Old Perlican, Avalon Peninsula, Newfoundland, CANADA.

Best Luck & Great DX!!! Alex, P/VO1/N2PIG

WSJT auf 2m über den Atlantik

Alex, N2PIG writes:

Anfang Mrz reiste ich nach Ost-Neufundland in Kanada, um eine Highpower-Station fr 2m/70cm aufzubauen, mit dem Ziel, meine Frau Debra, VA3PIG in Europa zu arbeiten.

Die folgende Woche reisten meine Frau und ich nach West-Irland, um dort eine hnliche Station aufzubauen, wohl wissend der Begrenzung auf 26 dBW an der Antenne. Letzte Woche ging ich zurck zu meiner Neufundland Portabel-Station, meine Frau in Irland, IO41VS zurcklassend.

Samstag Nacht, 16. Mrz 2002, schaltete ich die Station in Canada ein. An den folgenden 5 Tagen konnten Debra und ich ber den Atlantik funken, ber eine Grokreisentfernung von ca. 3000 km auf 144 MHz, mit Hilfe von WSJT!!

Am Sonntag schafften wir es, unsere Rufzeichen auszutauschen. Am Dienstag, dann, legten wir eine komplette Verbindung in weniger als 4 Stunden hin!

Heute frh tauschten wir den Gru "God Bless America" von Neufundland, und teilweise "Greetings from Ireland" aus. Die kompletten Details der Verbindungen werden bald im Internet zu finden sein. Diese Expedition bedeutete jahrelanges Trumen, Planen und Trainieren, und doch was Mr. Murphy mit uns. Aber wir waren gut auf ihn vorbereitet, und er war letzten Endes sehr kooperativ.

Debra hat nun ihre Station wieder zusammengepackt und ist auf dem Heimweg nach Kanada, wo ich sie Donnerstag in Toronto treffen werde. Deshalb gibt's nur ein kurzes Fenster mich in Old Perlican, Avalon Peninsula, Neufundland zu arbeiten. Viel Glck - Alex, VO1/N2PIG/P

Announcements

ON0SIX beacon QRV

Since the 3rd of March, ON0SIX in JO20EP, 50.041 MHz is active. Power 5W, A1, Ant. crossed dipoles. It's a construction of the ON7WR club. Reports are welcome to on4ldz@pandora.be - 73, Roger, ON4TX

Die Bake ON0SIX ist seit 3. Mrz in JO20EP auf 50.041 aktiv: 5W in A1 an Kreuzdipol. Die Konstruktion stammt aus dem ON7WR-Club, Berichte willkommen an on4ldz@pandora.be - Roger, ON4TX

10GHz Beacon DB0HO qrv

DB0HO is qrv since Feb. 2002: Frequency: 10368.930 MHz Locator: JN47QT 850m ASL Power: 8W ERP Antenna: OMNI (SL WG)

Please send reports with your working conditions to/Berichte mit Stationsbeschreibung an: DF6TK@t-online.de, Packet Radio DF6TK @ OE8XPI, TNX - Vy 73 Werner, DF6TK

10GHZ Beacon DB0UL qrv

DB0UL is qrv since Feb. 2002: Frequency: 10368.8025MHz Locator: JN48XK (Uni Ulm) 650m ASL Power: 4W ERP Antenna: OMNI (SL WG) Pictures/Bilder: http://www.qsl.net/dl0ul/beacon.htm

Please send reports with your working conditions to/Berichte mit Stationsbeschreibung bitte an: Tom DL1GGT or Ingo DL5EBT, dl1ggt@yahoo.com or dl5ebt@yahoo.com, Packet Radio: DL1GGT@db0gpp or DL5EBT@DB0GPP, Vy 73, Ingo, DL5EBT

More New Beacons: ON0SIX, CN8MC, ZS1SIX, CT1ART

Since March 3 2002 the beacon ON0SIX is qrv on 50.041 from JO22EO with 5W and X-dipole. Since Feb. 3rd the beacon CN8MC is qrv from IM64 on 50.027 MHz (8W, J-pole, omni) and 144.465 MHz with 30 watts and 5 ele yagi (QTF N). Since Feb 17th the beacon ZS1SIX is qrv on 50.080 MHz from JF96FB with 10w and Inverted V. VK3SIX, from QF12 is QRT on 6m. CT1ART, 144.406 MHz, is qrv from IM67AH with 5w, halo, omni since January 2002.

DB0UL auf 10 GHz

Seit 28.02.02, DB0UL, 10368.8025 GHz, JN48XK (Uni Ulm), 650m NN, 4W ERP, Omni Antenne.

Bitte Empfangsberichte an Thomas (dl1ggt@yahoo.com), mich (dl5ebt@yahoo.com). Bilder unter: http://www.qsl.net/dl0ul/beacon.htm, 73s de Ingo, DL5EBT

Activities, Dates

The 24. Nordic VHF-UHF-SHF meeting 14-16 June 2002 in Sletten

The 24th Nordic VHF-UHF-SHF meeting will take place at the "Sletten" conference center at the foot of Himmelbjerget at lake Juls, in the center of Jutland. The Danish VHF committee is the organizer of the meeting with the OZ9KY Contestgroup as the pratical contractor of the arrangement. The meeting will be held in the spirit of previous arrangements, and will of course consist of lectures, fleemarket, Hamdinner and informal gathering. Sletten is a very large area, which before has hosted more than 20.000 scouts in tents, so if you are for camping, we have the space. If you prefer indoor accomodation it will be possible in 4-bunk rooms.

To register, contact OZ1GWD, Joergen Pedersen, Viadukten 9, 9900 Frederikshavn, Denmark. Phone +45-40-35 82 60, jpe7@def.dk

More info: www.qsl.net/oz7d

CN2DX

is again QRV from 1 June to 15 June, QTH IM63DM, 144MHZ 2x9el 200w and 50MHz 2el 100w, no sked only random. 73 Andr HB9HLM Andre Breguet Beau-site 16 CH-2014 Ble/NE, hb9hlm@net2000.ch, http://radioamateurs.eicn.ch/cn2dx

CN2DX ist wieder QRV vom 1. - 15. Juni 2002, in IM63DM, 144 MHz 2x9el 200w und 50 MHz 2el 100w, nur random. 73 Andr HB9HLM Andr Breguet, Beau-site 16, CH-2014 Ble/NE - hb9hlm@net2000.ch

JO13

June 15 th - June 16 th, 2002 DXpedition plans by PA3HEN/mm, PA2DWH/mm, DL1EJA/mm on board ship "Isle Fogo"; 144/50/432MHz MSCW, Tropo, Es also (weather/swell depending) activity on 3cm by PA2DWH/mm

PA3HEN/mm, PA2DWH/mm, DL1EJA/mm planen am 15./16. Juni an Bord der "Isle Fogo" mit 144 MHz MSCW, Tropo, Es QRV zu sein, je nach Wetter auch auf 10 GHz (PA2DWH/mm).

JM67/68/76/77/78

From June 22 nd - July 3 rd IK0BZY will be QRV 144MHz MS WSJT, rig: 130 Watts, 4ele.

Please sked requests no later than May 31st, 2002 to fa00416@mbox.flashnet.it, Enrico, IK0BZY

IK0BZY wird vom 22. Juni - 3. Juli auf 144 MHz in MS WSJT, mit 130 und einer 4ele QRV sein. Sked-Wnsche bis sptestens 31. Mai 2002 an Enrico, IKBZY, fa00416@mbox.flashnet.it

Beacon List

Editor: Joachim Kraft, DL8HCZ

Beacons sorted to Frequency (f ≥ 1296MHz)

CALL	QRG	WW	POWER	ANTENNA	QTF	ASL	MODE
KH6HME	**1296,000**	BK29GO	2500ERP	4XLY	TO CA	2501	
WA2IKL	**1296,000**	FN21TA	200WPEP	24DBI QUADHELIX	TO MOON!		EME BCN
YO2U	**1296,000**	KN05PS	0,025W	10 ELE YAGI	360		A1A
DF6VB	**1296,004**	JO31QP	0.15W ERP		S	85	F1A
DF0RB	**1296,020**	JO51GO	1,3	HORN	270	672	TEST
DF5EO/A	**1296,025**	JO31DV	0.8W	DBL.HELICAL	OMNI	170	F1A
HB9BBD/P	**1296,050**	JN47GA	8W	3 X DIPOLE	0	1662	F1A
S55ZNG	**1296,063**	JN65UU	0,1W	HORIZ		643	
K3SIW/B	**1296,070**	EN52	20W	CORNER	90		
S55ZSE	**1296,075**	JN65WP					
S55ZMS	**1296,090**	JN86CR	0,3W	SLOT	OMNI	350	
UT5EC	**1296,170**	KN78MM		4 X YAGI	OMNI	180	A1A
S55ZRS	**1296,380**	JN76MC	1W	DIPOLE		1219	
PI6ASD	**1296,642**	JO22JH	1W	QRT NOW!	OMNI	30	F1A
FX6UHY	**1296,739**	JN38PJ	4W ERP	BIG WHEEL	OMNI	1070	F1A
DB0GD	**1296,800**	JO50AL	1,5W ERP	VERTICAL STACKED		926	A1A
DB0JS	**1296,800**	JN59GB	5W ERP	SLOT	OMNI	700	A1A
OE3XMB	**1296,800**	JN77TX	0,1W			1154	
SK6MHI	**1296,800**	JO66LJ	50W ERP	CLOVER LEAF	OMNI	230	A1A
DB0GP	**1296,805**	JN48WQ	4W ERP	4*5EL. YAGI	OMNI	760	0RIG
DB0HEG	**1296,805**	JN59GB					
DB0ZW	**1296,810**	JN69EQ	1W	SLOT	OMNI	825	
GB3NWK	**1296,810**	JO01BI	100W	2*8EL. YAGI	NNW	180	F1A
PI7DIJ	**1296,810**	JO33AI	1W	9 ELE YAGI	200	20	F1A
SK7MHF	**1296,810**	JO77IP	50WERP	SLOT	OMNI		
F1XBI	**1296,812**	JN37NX	1W ERP	4ELE	SE	1278	F1A
DB0VI	**1296,815**	JN39NK	1W	13EL. YAGI		400	F1A
SK7UHI	**1296,815**	JO76	20W ERP	HORIZONTAL	OMNI	120	QRT
DB0OT	**1296,820**	JO32QR	1W	BIG WHEEL	OMNI	80	F1A
HB9G	**1296,820**	JN36BE	10WERP	VERTIKAL	OMNI	455	
LA8UHG	**1296,820**	JO59JW	10W ERP	14 ELE	160	364	A1A
DB0ABG	**1296,825**	JN59WI	0,5W	SLOT	OMNI	522	
DB0HF	**1296,825**	JO53BO	0.3W	BIG WHEEL	OMNI	65	F1A
DB0OP	**1296,825**	JN59WI	0.5W	4EL. YAGI	N	522	F1A
OE1XTB	**1296,825**	JN88EE	8W	4 X DIPOLE		190	
GB3MHL	**1296,830**	JO02PB	500W ERP	2*32ELSLOT.WAVEG	W/E	85	F1A
DB0AJ	**1296,835**	JN57VX	10W	6EL. GROUP	N/W	720	A1A
DB0ISM	**1296,835**	JN58UF		QRV			
SK0UHG	**1296,835**	JO89WI	10W ERP	DOUBLE HELICAL	OMNI	55	A1A
DB0FGB	**1296,840**	JO50WB			OMNI	1100	
DB0KI	**1296,840**	JO50WC	15WERP	SLOT	OMNI	980	A1A
OH6SHF	**1296,840**	KP13GM	8WERP	DIPOL	OMNI	55	
DB0LBV	**1296,845**	JO61EH	2W	2X4ELE SLOT	OMNI	234	A1A
SR3SHF	**1296,845**	JO91CQ	2W	2X HELIX	OMNI	180	F1A
F5XBK	**1296,847**	JN18IR	10 W	SLOT	OMNI	160	F1A
CT0MBC	**1296,850**	IM59SK					
DB0JH	**1296,850**	JO31JK	1W	MALTESER	OMNI	85	
DL0UB	**1296,850**	JO62KK	10W	4XKASTEN (QRT)	OMNI	120	A1A
GB3FRS	**1296,850**	IO91PH	3W	DISC	OMNI	120	F1A

CALL	QRG	WW	POWER	ANTENNA	QTF		ASL
DB0JO	**1296,854**	JO31SL	350W ERP	4*15 YAGI	W	312	F1A
OZ3UHF	**1296,855**	JO56CE	6W	5ELE	180	150	F1B
SK3UHG	**1296,855**	JP81KQ	20W ERP	HORIZONTAL	OMNI	30	
GB3MCB	**1296,860**	IO70OJ	3W HF	2*15ELE	ENE	300	
LA8SHF	**1296,860**	JO59FB	60WERP	13DB HORN	180	30	
F1XAK	**1296,862**	JN23MM	158W	PROPOSAL!	OMNI	114	F1A
DB0JK	**1296,865**	JO30LX	40W ERP	4 X 8 ELE	OMNI	257	F1A
HB9WW/P	**1296,865**	JN37LA	1,5W	15 ELE	120	1145	
SK7MHG	**1296,865**	JO65SO	50W ERP	SLOT	OMNI	200	
DB0IBB	**1296,870**	JO32VG	170WERP	DQUAD	S/W	200	A1A
GB3AND	**1296,870**	IO91GF	50W ERP	STACK. SLOTS	QRT NOW!	85	F1A
LA2SHF	**1296,870**	JP53		PROPOSAL			
F1ZMT	**1296,872**	JN07CX	20W	PROPOSAL	180		
DB0FAI	**1296,875**	JN58IC		PROPOSAL			
FX3UHX	**1296,875**	IN78UK	1W ERP	QUAD	E	121	F1A
GB3USK	**1296,875**	IO81QJ	250W ERP	2 X 15 ELE YAGI	90	235	
DB0FRE	**1296,880**	JN37WX		QRV?			
LA3SHF	**1296,880**	JO38XB	10WERP	2*15EL. YAGI	180	5	QRT NOW
ON5SHF	**1296,880**	JO10UN	10W ERP	SLOT	OMNI	180	F1A
DB0INN	**1296,883**	JN68GI	1W	SLOT	OMNI	504	
DB0TUD	**1296,885**	JO61UA	1W	SLOT 8DB H	OMNI	250	
OE3XEA	**1296,885**	JN78SB		QRV?		725	
F1XBC	**1296,886**	JN06BX	25W ERP	SLOT	OMNI	140	F1A
OM0MSA	**1296,888**	JN88NE	0,1W	DIPOLE	E/W	570	
GB3DUN	**1296,890**	IO91RV	2W ERP	HB9CV	N	263	F1A
HG6BUB	**1296,890**	KN07AU	1W	SLOT	OMNI	1050	A1A
LA4SHF	**1296,890**	JO28UO	40WERP	COLLINEAR	180	175	
OM0MUT/B	**1296,892**	JN88					
DB0JC	**1296,895**	JO40RV	1.5W	4EL.SLOT WAVEG	OMNI	620	F1A
DB0AN	**1296,900**	JO31SX	1W	BIG WHEEL	OMNI	100	F2A
GB3IOW	**1296,900**	IO90IO	100W ERP	ALFORD SLOT	OMNI	250	F1A
HG9BUA	**1296,900**	KN08FB	0,5W	SLOT	OMNI	890	
LX0SHF	**1296,902**	JN39BP	3W	2 X BIG WHEEL V	OMNI		
DB0AD	**1296,905**	JO40AQ	1W	V DIPOLE	OMNI	693	
DB0INB	**1296,905**	JO50FU		QRV?			
IT9S	**1296,905**	JM77NO	1W	2XMINI WHEEL	OMNI	250	A1A
OH4SHF	**1296,905**	KP31OX	15WERP	7DBD	OMNI	200	
OK0EA	**1296,905**	JO70UP	0.2W	4*10ELE YAGI	NW/W/SW/	1355	F1A
SK4UHI	**1296,905**	JO79LK	10W ERP	HORIZONTAL	OMNI	270	
F5XAJ	**1296,907**	JN12LL	100W	SLOT	OMNI	1100	F1A
DB0UX	**1296,910**	JN48FX	1W ERP	BIG WHEEL	OMNI	275	F1A
GB3CLE	**1296,910**	IO82RL	10W ERP	2*15+15EL. YAGI	N/SE	573	F1A
DB0UBI	**1296,915**	JO42GE	2,5WERP	8 ELE COLL	35	120	F1A
ES0SHF	**1296,915**	KO18DN	60/60	2XDIAMOND	90/270		
9A0BLB	**1296,920**	JN83HG	1W	DIPOLE		778	
DB0VC	**1296,920**	JO54IF	12WERP	2 X BIGWHEEL	OMNI	300	
GB3COA	**1296,920**	IO75SU	10W	2XQUAGI	0/90	52	
PI7QHN	**1296,923**	JO22KH	4W	GAIN 6DB	OMNI	20	F1A
DB0AAT	**1296,925**	JN67HU					
DB0JF	**1296,925**	JO50CA	10W ERP	4*12 EL. SLOT	OMNI	300	F1A
DB0KME	**1296,925**	JN67HT	1W	VERTIKAL	OMNI	800	
SK6UHG	**1296,925**	JO57TQ	10W ERP	4*BIG WHEEL	OMNI	40	A1A
GB3MLE	**1296,930**	IO93EO	50W ERP	CORNERREFLECTOR	SSE	600	F1A
OK0EL	**1296,930**	JO70SQ	0,2W	HORN	SW/NW	1030	F1A
OZ7IGY	**1296,930**	JO55VO	30WERP	BIG WHEEL	OMNI	95	F1A
DB0YI	**1296,935**	JO42XC	4W	BIG WHEEL	OMNI	480	A1A
OH5SHF	**1296,935**	KP30HV	25W	SLOT	OMNI	145	
DL0UH	**1296,940**	JO41RD	1W ERP	TEMP. QRT	OMNI	385	A1A
HG3BUB	**1296,940**	JN96CC	1W	SLOT	OMNI	585	
PI7IVA	**1296,940**	JO22TA	1W	8 DB GAIN	OMNI	30	F1A
SK7MHH	**1296,940**	JO86GP	10W	SLOT	OMNI	45	
DB0OS	**1296,945**	JO40CW	1W ERP	6 EL. ARRAY	W	745	F1A
HB9F	**1296,945**	JN36SW	15W	CORNER	360	1015	
OH9SHF	**1296,945**	KP36OI	30W ERP	10DBD	200	236	A1A

CALL	QRG	WW	POWER	ANTENNA	QTF	ASL	MODE
F5XBF	**1296,948**	IN94UW	50W ERP	2*BIG WHEEL	OMNI	88	F1A
DB0HG	**1296,950**	JO40HG	3WERP	BIRWHEEL	OMNI	300	
OZ5UHF	**1296,950**	JO65GQ	1W	COLLINEAR	OMNI	35	A1A
OZ1UHF	**1296,955**	JO57FJ	10W	BIG WHEEL	OMNI	150	A1A
HG7BUB	**1296,960**	JN97KR	1W	SLOT PROPOSAL	OMNI	700	
SK4UHG	**1296,960**	JP60VA	20W ERP	2*15EL. YAGI	180	440	A1A
OK0EJ	**1296,961**	JN99FN				1324	F1A
DF0ANN	**1296,965**	JN59PL	0,5W	4 X DQ	OMNI	630	
GB3ANG	**1296,965**	IO86MN	40W	SLOTYAGI	170	319	
OK0EO	**1296,965**	JN89QQ	.05/.12W	2ELEYAG PROPOSAL	SW	602	
GB3ESB	**1296,970**	JO00GP		SLOT	OMNI	120	
SK7MHL	**1296,970**	JO65OR	15WERP	ALFORD SLOT	OMNI	100	A1A
DB0SGA	**1296,975**	JN69KA	5W	4X2 ELE	NWSE	1124	A1A
HG1BUB	**1296,975**	JN87FI	2,5	SLOT	OMNI	725	
OH3RSE	**1296,975**	KP11UM	10WERP	BIG WHEEL	OMNI	247	
ON4AZA	**1296,975**	JO21EE	1W	CLOVER	OMNI	60	
DB0JU	**1296,980**	JO31CV	2W	HELICAL	OMNI	295	A1A
SK2UHG	**1296,980**	JP95HB	80	HORIZ		500	
OZ2ALS	**1296,983**	JO45UB	8WERP	2XSLOT	OMNI	28	A1A
DB0AS	**1296,985**	JN67CR	0,5W	DIPOLS	10	1565	F2A
DB0FB	**1296,990**	JN47AU	4W	DIPOLE	N/S	1200	F1A
DB0JN	**1296,990**	JO31WP	0.1W	MINI WHEEL	OMNI	80	F1A
GB3EDN	**1296,990**	IO85HW	25W ERP	2*CORNER REFLCT.	NW/SE	117	F1A
DB0WOS	**1296,995**	JN68ST	5W ERP	4*DQ	OMNI	850	F2A
GB3NO	**1297,000**	JO02PP	25W ERP	SLOT	OMNI	55	F1A
DB0JW	**1297,010**	JO30DU	50W ERP	4 X 11 ELE	NE	225	F1A
DB0LB	**1297,040**	JN48NV	0.3 W ERP	BIG WHEEL	OMNI	367	F1A
K3SIW/B	**2304,020**	EN52	10W	15Y	270		
S55ZNG	**2304,040**	JN65UU	0,1W	SLOT	OMNI	643	
W6IFE	**2304,085**	DM14KF	2.5W ERP	6C		1958	
I7D	**2304,870**	JN80PU	1,2WERP	2X25 YAGI	305/135	368	
HB9BBD/P	**2308,178**	JN47GA	6W	3 X DIPOLE	0	1662	F1A
S55ZMS	**2320,090**	JN86CR	O,5W	D-SLOT	OMNI	350	
SK6MHI	**2320,800**	JO57XQ	10W ERP	SLOT WG	OMNI	135	
SK6UHJ	**2320,800**	JO58RG	1W	2*??EL. YAGI	S/SW	80	A1A
DB0ZW	**2320,810**	JN69EQ	1WERP	6XSLOT	OMNI	505	
SK7MHF	**2320,810**	JO77IP	0,1W	2XBIGWHEEL	OMNI	505	
SK0UHH	**2320,812**	JO99BM	25W ERP	H	OMNI	90	
DB0IH	**2320,815**	JN39ML	5WERP	BIGWEHEEL	OMNI	630	F1A
DB0OT	**2320,820**	JO32QR	1W ERP	BIG WHEEL	OMNI	80	F1A
4U1VIC/B	**2320,825**	JN88FF	2W	4*2 ELE.	OMNI	290	
OE1XTB	**2320,825**	JN88EE	1WERP	4XDIPOLE	OMNI	170	QRT NOW
DB0JX	**2320,830**	JO31FF	0.1W	2X HELIX	OMNI	115	A1A
GB3MHS	**2320,830**	JO02PB	25WERP	SLOT WG	OMNI	85	
DB0FGB	**2320,833**	JO50WB	15W ERP	SLOT WG	OMNI	1100	F1A
F5XAC	**2320,838**	JN12LL	20W ERP	SLOT WG	OMNI	1100	F1A
DB0KI	**2320,840**	JO50WC	15WERP	SLOT	OMNI	980	A1A
DB0LBV	**2320,845**	JO61EH	1,5W	DQ	135/225	234	A1A
SR3SHF	**2320,845**	JO91CQ	1W	2X HELIX	OMNI	180	F1A
DB0GW	**2320,850**	JO31JK	8W ERP	2X HELIX	OMNI	80	A1A
DL0UB	**2320,850**	JO62KK	10W	5 X DIPOLE	OMNI	120	A1A
GB3NWK	**2320,850**	JO01BI	5W ERP	ALFORD SLOT	OMNI	180	F1A
DB0SHF	**2320,855**	JN48XS	0,2W	6XDIPOLE	260	800	
OZ3UHF	**2320,855**	JO56AJ	0.1W	14ELE 12DBD	180	150	F1A
PI7GHG	**2320,857**	JO21CV	30WERP	10ELE YAGI	270	30	F1A
HG7BUC	**2320,860**	JN97KR	1W	SLOT	OMNI	700	
LA8SHF	**2320,860**	JO59FB	50W ERP	13DB HORN	180	30	A1A
F1XAH	**2320,862**	JN23MM	15W	SLOT WG	PROPOSAL	114	F1A
DB0GKB	**2320,865**	JN48JC	1W	DIPOLE-HELIX	OMNI	1000	
PI7TGA	**2320,865**	JO21VT	50WERP	10 DB	NW/SE	75	.880
DB0IBB	**2320,870**	JO32VG	4WERP	10 X SLOT	OMNI	200	A1A
DB0GO	**2320,880**	JO41ED	50WERP	SLOT WG	OMNI	738	F1A
DB0YI	**2320,880**	JO42XC	3W ERP	BIG WHEEL	OMNI	480	A1A
LA3SHF	**2320,880**	JO38XB	1WERP	2X6DB HORN	90/180	5	

CALL	QRG	WW	POWER	ANTENNA	QTF	ASL	MODE
DB0INN	2320,883	JN68GI	1W	SLOT	OMNI	504	
DB0TUD	2320,885	JO61UA	1W	SLOT 8DB H	OMNI	250	
PI7RMD	2320,885	JO31AE	10WERP	DQUAD	180	100	
F5ZMF	2320,886	JN06JG	25WERP	4XHORN	45/315	230	
OM0MTA	2320,888	JN88NE	0,06W	DIPOLE	E/W	570	
GB3ANT	2320,890	JO02PP	5W ERP	SLOT	OMNI	75	F1A
HG9BUB	2320,890	KN08FB	0,5W	SLOT PROPOSAL	OMNI	890	
HG3BUC	2320,895	JN96CC	1W	OMNI	SLOT	612	
DB0JW	2320,900	JO30DU	25W ERP	6 ELE ARRAY	NE	238	F1A
DB0UX	2320,900	JN48FX	1W ERP	BIG WHEEL	OMNI	275	F1A
GB3WWH	2320,900			QRV???			
LX0THF	2320,902	JN39BP	0,5W	D-QUAD HORIZ	OMNI	420	
DB0INB	2320,905	JO50FU		PROPOSAL	OMNI	910	
GB3SCS	2320,905	IO80UU	1.3WERP	SLOT	OMNI	275	A1A
DL0UH	2320,912	JO41RD	2W ERP	TEMP. QRT	360	385	A1A
DB0UBI	2320,915	JO42GE	0,5WERP	COLLINEAR	45	165	F1A
DB0VC	2320,920	JO54IF	3WERP	BIGWHEEL	OMNI	300	
PI7QHN	2320,920	JO22KH	0.2W	GAIN 6DB	OMNI	20	QRT NOW
GB3PYS	2320,925	IO82HL	10WERP	SLOT	270	436	
OK0EL	2320,930	JO70SQ	0,2W	HORN	SW/NW	1030	F1A
OZ7IGY	2320,930	JO55VO	20W	SLOT	OMNI	91	F1A
PI7PLA	2320,930	JO33IC	0,15W	SLOT	OMNI	90	.935?
DB0GQ	2320,935	JO40GP	3WERP	DIPOLE HELIX	OMNI	549	
DB0JO	2320,935	JO31SL	0.2W	HORN	N	312	F1A
DB0DON	2320,940	JN58KR	1WERP	SLOT	OMNI	532	
DB0GB	2320,940	JO30OQ		QRV?			
GB3WYE	2320,940	IO81KO	100WERP	DIPOLEPANEL	90	369	PROPOSL
SK7MHH	2320,940	JO86GP	50WERP	30CM DISH	360	45	
DB0OS	2320,945	JO40CW	2W ERP	8 EL. ARRAY	270	730	F1A
DB0KP	2320,950	JN47TS	0,1W	SLOT	OMNI	435	
OZ9UHF	2320,950	JO65HP	5W	SLOT	OMNI	30	F1A
GB3LES	2320,955	IO92IQ	30WERP	ALFORDSLOT	160	220	.945
OZ1UHF	2320,955	JO57FJ	8WERP	SLOT	OMNI	150	A1A
HG6BUC	2320,963	KN07AU	1W	SLOT	OMNI	1050	
DB0AJA	2320,965	JN59AS	1W	SLOT WG	OMNI	360	A1A
DF0ANN	2320,965	JN59PL	5W	4 X DQ	OMNI	630	QRT
DB0AS	2320,967	JN67CR	0.5W	28EL. YAGI	337	1560	A1A
SK7MHL	2320,970	JO65OR	25WERP	WG SLOT	OMNI	100	A1A
DB0JL	2320,975	JO31MC	2W ERP	SLOT	OMNI	195	
HG1BUC	2320,975	JN87FI	1W	SLOT	OMNI	700	
DB0JU	2320,980	JO31CV	1W	HELICAL	OMNI	150	A1A
PI7EHG	2320,999	JO22JH	10WERP	SLOT 8 ELE	OMNI	92	.008
DC8EC/A	2321,050	JN58TB	4W	6 ELE ARRAY	NW	580	
DB0HF	2322,825	JO53BO	0.3W	BIG WHEEL	OMNI	65	F1A
DB0TUD	3400,000	JO61UA		SLOT	OMNI	260	QRT NOW
DL0UB	3400,005	JO62KK	10W	12 X SLOT	OMNI	120	A1A
PI7SHF	3400,018	JO22JH	1,2W	8B SLOT	OMNI	90	
DB0AS	3400,020	JN67CR	0,5WERP	2X8	10	1565	
DB0HF	3400,025	JO53BO			202	65	
DB0KI	3400,040	JO50WC	15WERP	SLOT	OMNI	980	A1A
DB0EZ	3400,050	JO31BS	0.1W ERP	SLOT	115	110	F1A
DB0JL	3400,050	JO31MC	1W ERP	HELICAL	OMNI	195	F1A
S55ZMS	3400,090	JN86CR	0,5W	D-SLOT	OMNI	350	
PI7CKK	3400,165	JO33GE	5W	SLOT 10DB	OMNI	55	
DF6VB	3400,170	JO31QP	0.02W			85	F1A
OK0EL	3400,400	JO70SQ	0,1W	HORN	SW/NW	1030	F1A
DB1BX/P	3400,810	JO32SV	1,2WERP	HELIX	OMNI	90	F1A
DB0GW	3400,850	JO31JK	8WERP	D-HELIX	OMNI	80	A1A
GB3SCF	3400,905	IO80UU	2.5WERP	SLOT	OMNI	275	F1A
GB3ZME	3400,910	IO82SQ	100WERP	SLOT WG	OMNI	215	PROPOSL
DB0JO	3456,155	JO31SL				312	F1A
DB0KHT	3456,800	JO40FE	10WERP	HORN	OMNI	247	
DB0MST	3456,800	JN67IR	1W	COLLINEAR	OMNI	1800	
DB0JX	3456,830	JO31FF	0,1W	HELICAL	OMNI	115	

CALL	QRG	WW	POWER	ANTENNA	QTF	ASL	MODE
DB0SHF	**3456,855**	JN48XS	0,5W	HORN 12 DB	260	800	
DB0INN	**3456,883**	JN68GI	1W	SLOT	OMNI	504	
GB3OHM	**3456,900**	IO92AJ	8WERP	SLOT	OMNI	171	
OK0EL	**5760,030**	JO70SQ	0,05W	HORN	SW/NW SE	1030	A1A
PI7EHG	**5760,035**	JO22JH	6W	16DBI	OMNI	90	
DF0WP	**5760,050**	JO31QP	0,1W ERP		S	85	F1A
OK0EA	**5760,050**	JO70UP	0,05W	8 ELE SLOT	W/E	1355	F1A
F1XAO	**5760,060**	IN88HL	10W	SLOT WG	OMNI	326	F1A
OK0EX	**5760,060**	JN79OW	0,06WERP	SLOT	115/315	500	
DB0JL	**5760,070**	JO31MC	0.8W ERP	SLOT	OMNI	195	F1A
DB0EZ	**5760,080**	JO31BS	1W ERP	SLOT	OMNI	110	F1A
S55ZMS	**5760,090**	JN86CR	0,5W	D-SLOT	OMNI	350	
DB0AS	**5760,100**	JN67CR	0,5WERP	2X8	10	1565	
HB9EI	**5760,500**	JN45MW	0,1W	10DB HORN	180	1628	A1A
DB0KHT	**5760,800**	JO40FE	0,5W	HORN	OMNI	247	
SK6MHI	**5760,800**	JO57XQ	5W ERP	HORN	270	135	A1A
DB0RIG	**5760,805**	JN48WQ	15WERP	DB0GP PROPOSAL	OMNI	780	
DB1BX/P	**5760,810**	JO32SV	1,2WERP	HELIX	OMNI	90	F1A
DB0JX	**5760,830**	JO31FF	0,08W	SLOT	OMNI	115	
F5XBE	**5760,830**	JN18JS	2WERP	SLOT	OMNI	160	
DB0FGB	**5760,833**	JO50WB	15 WERP	SLOT	OMNI	1100	
DB0KI	**5760,840**	JO50WC	15W ERP	SLOT	OMNI	980	A1A
F1XBB	**5760,845**	JN07WV	2WERP	SLOT	OMNI	170	
DL0UB	**5760,850**	JO62KK	0,2W	12 X SLOT	OMNI	120	A1A
I3E	**5760,850**	JN55WV	1WERP	SLOT 10DB	170	1400	
SK7SHF	**5760,850**	JO65OR	7W ERP	HORIZONTAL	OMNI	115	
DB0SHF	**5760,855**	JN48XS	0.4W	DIPOLE-PATCH(6DB	260	800	
DB0ARB	**5760,860**	JN69NC	3W ERP	SLOT	OMNI	1456	A1A
LA8SHF	**5760,860**	JO59FB	25W ERP	13DB HORN	180	30	A1A
OE1XVB	**5760,865**	JN88EF	4WERP	10DB SLOT		191	QRT NOW
GB3RBY	**5760,875**	IO92JJ	1WERP	SLOT WG	OMNI	165	PROPOSL
DB0INN	**5760,883**	JN68GI	1W	SLOT	OMNI	504	
DB0TUD	**5760,885**	JO61UA	1W	SLOT	OMNI	250	
OM0MXA	**5760,888**	JN88NE		PROPOSAL		570	
HG3BSA	**5760,890**	JN96CC	0,1W	SLOT	OMNI	585	
HB9G	**5760,895**	JN36BK	6.8W ERP	SLOT	OMNI	1577	
DB0CU	**5760,900**	JN48BI	5W ERP	SLOT	OMNI	970	F1A
HG6BSB	**5760,900**	KN07AU	0,2W	SLOT	OMNI	1050	
DB0INB	**5760,905**	JO50FU		QRV?			
GB3SCC	**5760,905**	IO80UU	5WERP	SLOT WG	OMNI	275	A1A
SK0UX/B	**5760,905**	JO99BM		HORIZ.			
GB3ZME	**5760,910**	IO82SQ	100WERP	SLOT WG	OMNI	215	PROPOSA
OZ7IGY	**5760,930**	JO55VO	15W	WG SLOT	E/W	91	F1A
DB0AJA	**5760,945**	JN59AS	1W	SLOT WG	OMNI	360	A1A
HG9BSA	**5760,950**	KN08FB	0,1W	SLOT PROPOSAL	OMNI	890	
OZ9UHF	**5760,950**	JO65HP	50WERP	WG SLOT	OMNI	30	F1B
OZ1UHF	**5760,955**	JO57FJ	8WERP	WG SLOT	OMNI	150	A1A
OZ8SHF	**5760,955**	JO57FJ	8W	WG SLOT	OMNI	150	A1A
DB0MFI	**5760,960**	JN58KR		PROPOSAL			
OE2XRO	**5760,963**	JN67LA	3,5W	SLOT WG	OMNI	3105	F1A
DF0ANN	**5760,965**	JN59PL					QRT
ON4C	**5760,970**	JO20IV		PROPOSAL			
SK7MHL	**5760,970**	JO65OR	10WERP	WG SLOT	OMNI	100	A1A
HG1BSA	**5760,975**	JN87FI	0,2W	SLOT	OMNI	700	
GB3IOW	**10100,000**	IO90IO	1W ERP	SLOT WAVEGUIDE	OMNI	250	F2A
GB3ALD	**10120,000**	IN89VR	1W ERP	SECT. HORN	30	90	F2A
DB0JA	**10357,875**	JN58TE		QRV??			
PE1BLE	**10368,020**	JO22JH		QRT NOW!			
DK0UU/B	**10368,027**	JN48XK					
DB0EZ	**10368,035**	JO31BS	1W ERP	SLOT	115	110	F1A
PI7SHY	**10368,038**	JO21RK	1W	16DBI	315	80	F1A
F1XBD	**10368,040**	JN18JS	4WERP	SLOT WG	OMNI		
DB1BX/P	**10368,045**	JO32SV	1,2WERP	HELIX	OMNI	90	F1A
HB9MPU/B	**10368,045**	JN47HD					

CALL	QRG	WW	POWER	ANTENNA	QTF	ASL	MODE
DF0WB	**10368,050**	JO31QP	1W ERP		S	85	F1A
F5XAY	**10368,050**	JN24BW	3/10WERP	SLOT/HORN	OMNI/0	1691	
I5X	**10368,050**	JN44XH	0,05W	ALFORD SLOT	OMNI	1260	A1A
LX0DU	**10368,050**	JN29XM	20KWERP	1,3M DISH 40DBD	63	280	
OK0EL	**10368,050**	JO70SQ	0,4W	12 ELE SLOT	W/E	1030	A1A
S55ZKP	**10368,050**	JN65XM	0,1W	SLOT	OMNI	1028	
DK4GD/B	**10368,059**	JN47FW					
F1XAI	**10368,060**	JN07WT	10W	SLOT	OMNI	160	F1A
GM4ISM	**10368,070**	IO85BU	1WERP	SLOT	OMNI	300	
OK0EA	**10368,075**	JO70UP	0,5	SLOT 12ELE	W/E	1355	F1A
PI7GOE	**10368,075**	JO11XL	0,1WERP	SLOT WG	OMNI		QRT NOW
S55ZRS	**10368,083**	JN76MC	0,15W	SLOT	OMNI	1219	
PA0TGA	**10368,090**	JO21VT	4WERP	16DB GAIN	W	75	A1A
PI7TGA	**10368,090**	JO21VT	4WERP	16DB	270	75	QRT NOW
S55ZMS	**10368,090**	JN86CR	0,25W	D-SLOT	OMNI	350	
KH6HME	**10368,100**	BK29GO	30KW ERP	1.22M DISH	60	2501	
F1XAP	**10368,110**	IN88HL	5W	SLOT WG	OMNI	326	F1A
DB0JL	**10368,120**	JO31MC	0.15W ERP	SLOT	OMNI	195	F1A
IT9F	**10368,132**	JM67LX	0,15W	SLOT 10DB	360	400	
ON4TNR	**10368,140**	JO20KJ	7WERP	17DB HORN	292	250	A1A
I3F	**10368,150**	JN55WV	1,5WERP	SLOT 10DB	170	1400	
OE8XXQ	**10368,150**	JN66UO	1WERP	10DB HORN	45	2166	
DB0AS	**10368,180**	JN67CR	0,5WERP	HORN	10	1565	
PI7EHG	**10368,185**	JO22JH	0,1W	SLOT 12DB	OMNI	90	
GB3SWH	**10368,240**	IO91TP	1WERP	SLOT WG	45/225	187	
DL0WY	**10368,270**	JN67AQ	0.1W	SLOT/HORN	45/270	1838	.286
DB0ZDF	**10368,282**	JN49CX					
PI7GHG	**10368,285**	JO21GW	0.25W	16 DB GAIN	NE	50	F1A
N6CA	**10368,300**	DM03TS	140W ERP		OMNI	427	
OK0EX	**10368,365**	JN79OW	0,04WERP	SLOT	115/315	500	
F1XAE	**10368,755**	JN24PE	5W	HORN	270	1910	F1A
SK6MHI	**10368,800**	JO57XQ	5W ERP	SLOT WG	OMNI	135	A1A
DB0UL	**10368,802**	JN48XK	4WERP		OMNI	650	
DB0XL	**10368,805**	JO53HU	.16W	2X8 SLOT HOR.	OMNI	49	A1A
DB0GHZ	**10368,810**	JO43UP	2,5WERP	SLOT	OMNI	40	
DB0MAX	**10368,815**	JN58SP		PROPOSAL		420	
DB0VI	**10368,815**	JN39NK		PROPOSAL			
ON4KUL	**10368,818**	JO20IV	0,1W	10DB SLOT	+-20KC!		
DB0KHT	**10368,820**	JO40FE	3WERP	HORN	OMNI	247	
DB0HRO	**10368,825**	JO64AD	0,2W	SLOT 10DB	OMNI	185	
DB0JX	**10368,830**	JO31FF	90MW	SLOT	OMNI	115	A1A
GB3MHX	**10368,830**	JO02PB	1 ERP	SLOT WG	OMNI	80	F1A
DB0FGB	**10368,833**	JO50WB	13WERP	SLOT WG	OMNI	1100	F1A
SK0SHG	**10368,835**	JO89XJ	0.5W ERP	SLOTTED WAVEGUID	OMNI	60	A1A
DB0JO	**10368,840**	JO31SL	1WERP	6 X SLOT	OMNI	312	.850
SK0SHI	**10368,840**	JO89XL	1WERP	SLOT	OMNI		
DB0SZB	**10368,845**	JO60JM	15WERP	SLOT	OMNI	767	.835
DL0UB	**10368,850**	JO62KK	0,1W	12 X SLOT	OMNI	120	A1A
GB3SEE	**10368,850**	IO91VG	3WERP	SLOT WG	OMNI	250	F1A
SK7SHG	**10368,850**	JO65OR	3W ERP	10 DB OMNI	OMNI	115	F1A
SR0CWK	**10368,850**	JO90NS	8W	SLOT	OMNI	280	
DB0SHF	**10368,855**	JN48XS	0,1W	HORN 13DB	260	800	
DB0GG	**10368,858**	JN48NS	0,05W	SLOT	OMNI	400	
DB0ARB	**10368,860**	JN69NC	3W ERP	SLOT	OMNI	1456	A1A
DB0UX	**10368,860**	JN48FX	1WERP	SLOT	OMNI	275	
F1BDB	**10368,860**	JN33OQ	1W	SLOT	OMNI		
F5XAD	**10368,860**	JN12LL	3W	SLOT WG	360	1100	F1A
LA8SHF	**10368,860**	JO59FB	10W ERP	13DB HORN	180	30	A1A
DB0JK	**10368,865**	JO30LX	200WERP	SLOT	OMNI	260	F1A
DB0IBB	**10368,870**	JO32VG	2WERP	SLOT	OMNI	245	
GB3KBQ	**10368,870**	IO80LW	1W ERP	SLOT WG	OMNI	167	
OE8XGQ	**10368,870**	JN66WQ	1,5WERP	SLOT	OMNI	1909	
DB0HW	**10368,875**	JO51GT					
DB0IS	**10368,875**	JO51GR	40MW	SLOT	N/W	1020	A1A

CALL	QRG	WW	POWER	ANTENNA	QTF	ASL	MODE
OE5XBM	**10368,875**	JN78DJ	10WERP	SLOT WG	OMNI	985	
ON4AZB	**10368,875**	JO21EE				95	
GB3CEM	**10368,880**	IO82WO	30WERP	SLOT WG	OMNI	165	
OE1XVB	**10368,880**	JN88EF	10WERP	SLOT WG	OMNI	185	.884
DB0INN	**10368,883**	JN68GI	1W	SLOT	OMNI	504	
DB0TUD	**10368,885**	JO61UA	0.5W	SLOT 10DB H	OMNI	250	
HB9G	**10368,885**	JN36BK	2WERP	SLOT WG	OMNI	1600	
DB0KLX	**10368,890**	JN39VK	1W	SLOT	OMNI	350	
HG9BSB	**10368,890**	KN08FB	0,1W	SLOT PROPOSAL	OMNI	890	
ON4RUG	**10368,890**	JO11UB	0,75W	SLOT 11DBI	OMNI	95	F1A
DB0ECA	**10368,895**	JN57UU	10WERPP	SLOT	OMNI	705	
DB0CU	**10368,900**	JN48BI	5W ERP	SLOT	OMNI	970	F1A
GB3AZA	**10368,900**	IO94TF	50WERP	DISH		75	
OZ5SHF	**10368,900**	JO45WX	4WERP	WG SLOT	OMNI	170	A1A
LX0CD	**10368,902**	JN39BO	1/10W	SLOT			
SR6NCI	**10368,904**	JO80JG	1WERP	SLOT WG	OMNI	1150	F1A
GB3SCX	**10368,905**	IO80UU	0,8WERP	SLOT WG	OMNI	275	A1A
DB0HEX	**10368,910**	JO51HT	8WERP	SLOT	OMNI	1250	
GB3RPE	**10368,910**	IO81AO	4WERP	SLOT WG	OMNI	60	
HG3BSB	**10368,915**	JN96CC	0,2W	SLOT	OMNI	612	
OZ4SHF	**10368,915**	JO65BV	10WERP	WG SLOT	OMNI	22	F1B
OZ9PRO	**10368,915**	JO65BV	10W	WG SLOT	OMNI	22	F1A
DB0VC	**10368,920**	JO54IF	1WERP	SLOT	OMNI	291	
SK7MHF	**10368,920**	JO77IP	4WERP	SLOT WG	OMNI	505	
F1XAU	**10368,925**	JN27IH	1,5 W	SLOT WG	OMNI	516	F1A
OE3XMB	**10368,925**	JN77TX	10WERP	SLOT WG	OMNI	1154	
DB0HO	**10368,930**	JN47QT	8WERP	SLOT WG	OMNI	850	F1A
GB3MLE	**10368,930**	IO93EO	1WERP	HORN	N/S	600	
OZ7IGY	**10368,930**	JO55VO	5WERP	WG SLOT	OMNI	92	F1B
OE2XBO	**10368,932**	JN67MW	10WERP	SLOT WG	OMNI	740	.925
SK0SHH	**10368,935**	JO89WF	0,05W ERP	HORIZONTAL	OMNI	90	QRT
DB0DON	**10368,940**	JN58KR	1WERP	SLOT	OMNI	532	
GB3CCX	**10368,940**	IO81XW	3WERP	SLOT	OMNI	342	
SK7MHH	**10368,940**	JO86GP				45	
DB0OS	**10368,945**	JO40CW					QRV
HG7BSA	**10368,945**	JN97KR	0,2W	SLOT	OMNI	700	
DB0AJA	**10368,950**	JN59AS	1W	SLOT WG	OMNI	360	A1A
DB0FHR	**10368,950**	JN67BU	1WERP	SLOT	OMNI	474	.953
OZ9UHF	**10368,950**	JO65HP	3WERP	WG SLOT	OMNI	30	F1B
SK1SHF	**10368,953**	JO97CJ		HORIZ.		52	
OZ1UHF	**10368,955**	JO57FJ	0,8W	WG SLOT	OMNI	150	A1A
OZ9SHF	**10368,955**	JO57FJ	0,8WERP	WAVEGUIDE SLOT	OMNI	150	A1A
GB3CMS	**10368,960**	JO01GR	3WERP	4XSLOTWG	OMNI	107	F1A
OE2XRO	**10368,960**	JN67LA	10WERP	SLOT WG	OMNI	3105	.963
SK4SHI	**10368,960**	JO79LH	8W ERP	HORIZ	OMNI	270	
DF0ANN	**10368,965**	JN59PL	0,2W	12 X SLOT	OMNI	630	QRT
HG5FMV	**10368,970**	JN97KR	0,1W	SLOT		690	
SK7MHL	**10368,970**	JO65OR	10WERP	WG SLOT	OMNI	100	A1A
HG1BSB	**10368,975**	JN87FI	0,2W	SLOT	OMNI	725	F1A
ON4LVN	**10368,975**	JO20IV	5WERP	SLOT	OMNI	100	
OZ3SHF	**10368,975**	JO45NL	2WERP	WG SLOT	OMNI	58	F2B
HG6BSB	**10368,977**	KN07AU	0,2W	SLOT	OMNI	1050	
HB9AK	**10368,985**	JN47LI	0,23W	10DB SLOT	OMNI	1133	
F5XBG	**10368,994**	JN26KT	5WERP	SLOT WG	OMNI		
DB0KI	**10368,995**	JO50WC	13W ERP	SLOT WG	OMNI	980	.999
F1XAN	**10369,000**	JN09TD	1,5W	SLOT WG	OMNI	300	F1A
GB3LEX	**10400,000**	IO92IQ	1W ERP	SLOT QRV????	SE	220	F2A
GB3XGH	**10400,000**	IO83QF	1W ERP	SLOT QRV????	OMNI	100	F2A
LA8SHF	**24000,860**	JO59FB		13DB HORN	180	30	
GB3IOW	**24025,000**	IO90IO	8WERP	SECT HORN		250	
GB3ALD	**24100,000**	IN89VR	8WERP	SECT HORN	30	90	PROPOSL
GB3SCK	**24192,000**	IO80UU	0.6WERP	SLOT WG	OMNI	275	A1A
DB0KHT	**24192,050**	JO40FE	0,02W	HORN	OMNI		
I3G	**24192,050**	JN55WV	0,25W	SLOT 10DB	170	1400	A1A

CALL	QRG	WW	POWER	ANTENNA	QTF	ASL	MODE
OK0EX	**24192,070**	JN79OW	0,02WERP	SLOT	115/315	500	
PI7EHG/1	**24192,076**	JO22JH	0,1W	DISH	267	90	
DB0JO	**24192,080**	JO31SL	0,6WERP	6 X SLOT	OMNI	312	
LX0DUF	**24192,100**	JN29XN	1,2KW ERP	DISH 0,4M	63	280	
OK0EL	**24192,114**	JO70SQ	0,01 W	12 ELE SLOT	W/E	1030	A1A
DB0JL	**24192,120**	JO31MC	0,01WERP	SLOT	OMNI	195	
I6G	**24192,160**	JN63RO	0,155W	DISH	335		
PI7EHG/2	**24192,164**	JO22JH	0,02W	SLOT 13DB	OMNI	90	.175
F6DWG/B	**24192,170**	JN09WI	4WERP				
DB0ISM	**24192,200**	JN58UF		QRV?			
F1XAQ	**24192,252**	IN88HL	0.1W	SLOT WG	OMNI	326	F1A
DB0AS	**24192,405**	JN67CR	0,5WERP	HORN	10	1565	.408
DB0AJ	**24192,408**	JN57VX	0,1WERP	SLOT	N	620	
SK6MHI	**24192,800**	JO57XQ	1W ERP	2XHORN	225/315	135	
DB0XL	**24192,805**	JO53HU	1WERP	2X16 SLOT	OMNI	49	A1A
DB0VI	**24192,815**	JN39NK		PROPOSAL			
F5XAF	**24192,830**	JN18DU	0,1W	DISH	090		F1A
GB3MHK	**24192,830**	JO02PB	25WERP	SLOT WG	OMNI	85	PROPOSL
DB0FGB	**24192,833**	JO50WB	1WERP	SLOT	OMNI	1100	F1A
DB0KI	**24192,840**	JO50WC	0.5W ERP	SLOT	0	980	
DL0WY	**24192,850**	JN67AQ	10WERP	HORN	360	1880	.848
DB0ARB	**24192,860**	JN69NC	0,03W	DISH	225	1456	
DB0JK	**24192,865**	JO30LX	1W	2 X H-HORN	OMNI	260	
DB0HW	**24192,875**	JO51GT	1WERP	SLOT	OMNI	1016	
GB3RBY	**24192,875**	IO92JJ	0,1WERO	SLOT WG	OMNI	165	PROPOSL
OE5XBM	**24192,875**	JN78DJ	0,5WERP	SLOT WG	OMNI	985	
ON4AZC	**24192,875**	JO21EE	1WERP	SLOT WG	OMNI	60	
DB0TUD	**24192,885**	JO61UA	0.01W	SLOT 10DB H	OMNI	250	
GB3DUN	**24192,890**	IO92RV	1WERP	SLOT	OMNI	260	
DB0ECA	**24192,895**	JN57UU		SLOT	360	705	QRT?
DB0CU	**24192,900**	JN48BI	5W ERP	20 DB HORN	180	970	F1A
SK0UX/B	**24192,900**	JO99BM		HORIZ.			
DB0NCO	**24192,905**	JN59MI	0,4W	HORN 13DBI	150	400	
DB0HEX	**24192,910**	JO51HT	8WERP	SLOT	OMNI	1000	
GB3NUL	**24192,910**	IO83		PROPOSAL			
GB3ZME	**24192,910**	IO82SQ	10WERP	SLOT WG	OMNI	215	PROPOSL
OZ4SHF	**24192,915**	JO65BV	10WERP	WG SLOT	OMNI	22	F1B
OE2XBO	**24192,920**	JN67MW		SLOT	OMNI	740	
GB3AMU	**24192,940**	IO81JN	1WERP	HORN 11 DBI	135	266	
OE2XRO	**24192,945**	JN67LA	5WERP	SLOT WG	OMNI	3105	.958
OZ1UHF	**24192,955**	JO57FJ	0,5W	WG SLOT	OMNI	150	A1A
DB0MFI	**24192,960**	JN58KR		PROPOSAL			
DF0ANN	**24192,965**	JN59PL		TEMPORARY	QRT	630	
SK7MHL	**24192,970**	JO65OR	1WERP	WG SLOT	OMNI	100	A1A
ON4KUL	**24192,975**	JO20IV	0,5WERP	SLOT WG	OMNI	120	
ON4LVN	**24192,975**	JO20IV	0,05W	10DB SLOT			
DB0AS	**47088,100**	JN67CR	0,5WERP	HORN	10	1565	
I3H	**47088,240**	JN66EB	1,2WERP	HORN 25DB	180	1570	A1A
DL0WY	**47088,300**	JN67AQ	0,1W	HORN	0,90,270	1838	.853
DB0FGB	**47088,833**	JO50WB	0,2W ERP	HORN	N/E	1150	
DB0JK	**47088,865**	JO30LX	0,4WERP	2XHORN	OMNI	257	
OE5XBM	**47088,875**	JN78DJ	0,025W	20DB HORN	230	855	
DB0ECA	**47088,895**	JN57UU		HORN	360	705	
OK0EL	**47088,930**	JO70SQ	0,001W	PROPOSAL		1030	A1A
DB0MFI	**47088,960**	JN58KR		PROPOSAL			
DB0AS	**76032,100**	JN67CR	0,1WERP	HORN	360	1565	
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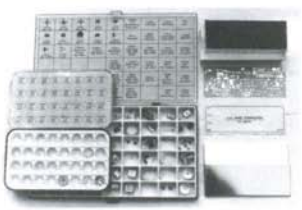

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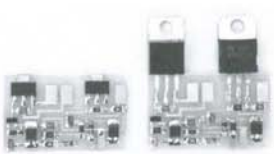

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