Vol. 23

DUBUS

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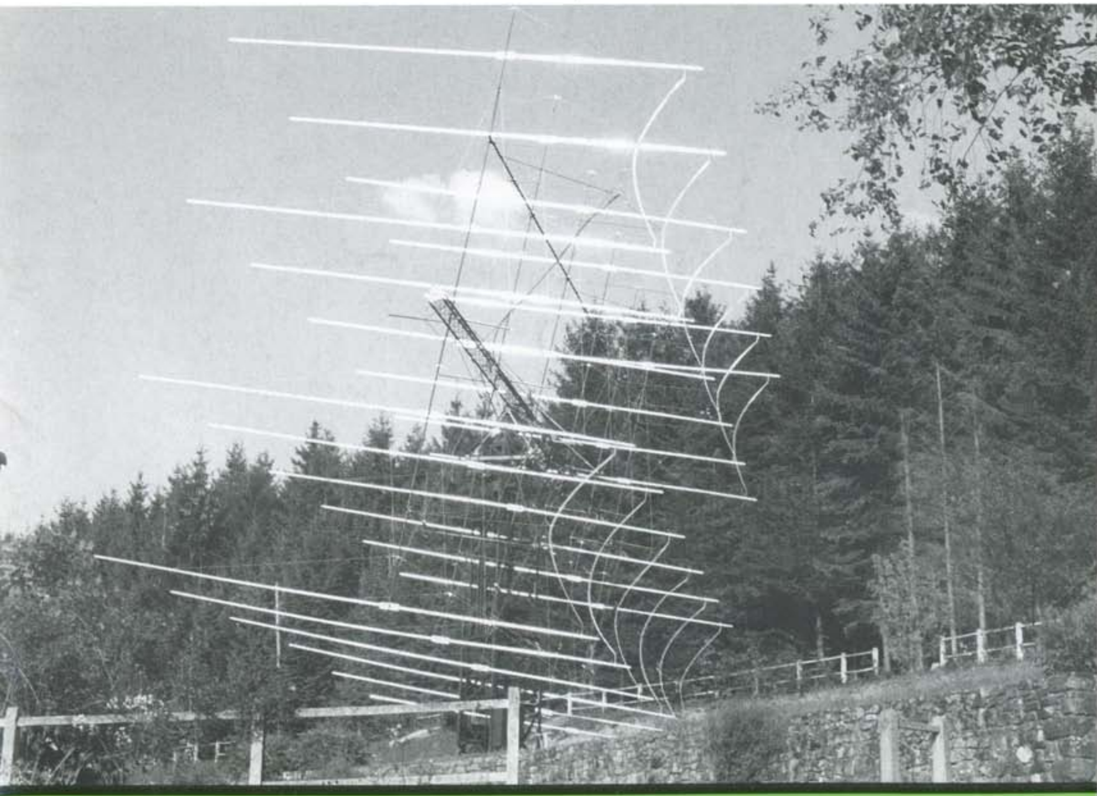
F3VS: 144MHZ EME



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Das **DUBUS-Magazin** erscheint vierteljährlich im März, Juni, September und Dezember. Der Abonnementspreis beträgt in der BRD DM 29,- Durch Überweisung des Abonnementspreises auf unser Postgiro-Konto werden Sie für ein Jahr Bezieher der DUBUS.

The DUBUS-Magazin is published quartely in March, June, September and December. For subscription please contact your national representative or transfer the appropriate annual rate, which can be seen below, by international postal money order to DUBUS Postgiro account. Also EURO-Cheques are acceptable alternatively, if they are issued in DM.

Abo-Verwaltung/Circulation:

Norbert Goettsche, DL8LAQ, Tulpenweg 3, D-24568 Kaltenkirchen, Tel.: 04191/88138

Abo-Konto/Subscr.-Account:

Postgiro Hamburg, Kto.-Nr. 266292202, BLZ 20010020

Herausgeber/Publisher:

DUBUS Verlag GbR, Postfach 500368, D-22703 Hamburg 50, FRG. Fax: (++49)40-8508972

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Other Countries:	Contact DUBUS Verlag. Subscription Rates: **Europe DM 29,-; Overseas Air Mail DM 40,- (US$ 25.00)**

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Technical Reports

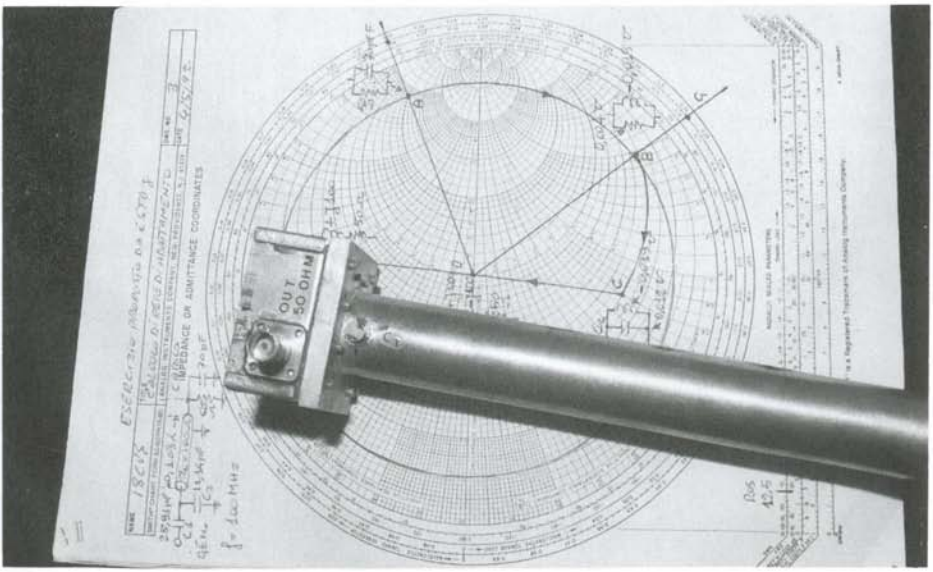
Editor: Rainer Bertelsmeier, DJ9BV

Cavity Preamplifier for 144MHz using a Power GaAs-FET

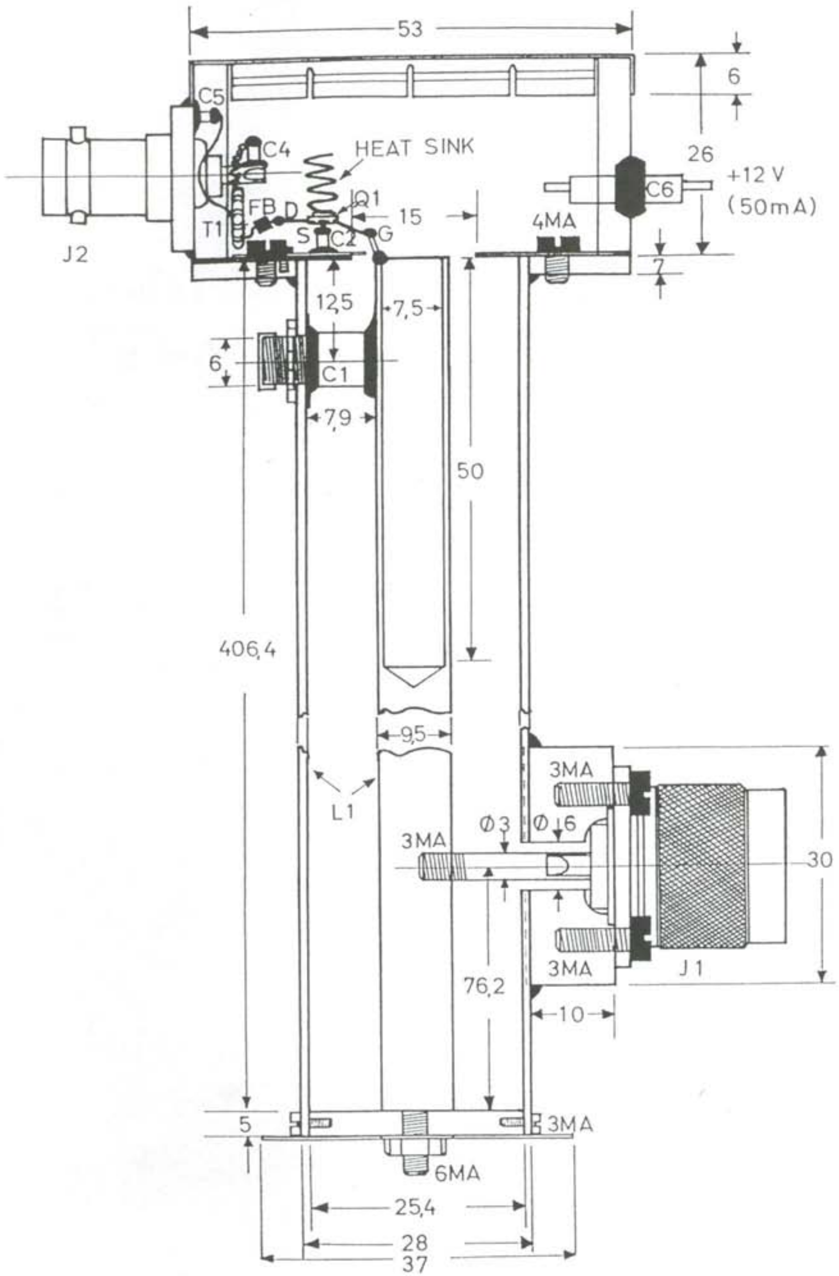
Domenico Marini, I8CVS

Piero Moroni, I5TDJ

Abstract: Extremely low NF, very high gain and good level IP can all be obtained at 144 MHz using GaAsFET designed for 10 GHz power amplifiers. This unexpected effect was discovered, when WB5KGL needed a high dynamic range preamp, hoping that power FET would be able to handle the strong local signals. The same results were obtained by WA5VJB and WD5AGO and respectively described in (1) and (2).



Cavity Preamp


53
6
26
+12 V
(50mA)
C5
C4
HEAT SINK
C6
FB
D
Q1
15
4MA
T1
S
C2
G
J2
7
12,5
7,5
6
C1
7,9
50
406,4
9,5
3MA
L1
Ø3
Ø16
3MA
30
76,2
3MA
J1
10
5
3MA
6MA
25,4
28
37

Figure/Abb. 1

This prototype was designed by the authors following the WD5AGO idea and it exhibited a NF of 0,22 dB with an associated gain of 25 dB during the official NF measurements at the Eighth Technical Symposium in Orvieto (Italy). All the measured parameters are listed in Table 1.

Kurzfassung: Ein sehr niedrige Rauschzahl, hohe Verstärkung und ein hoher Interzept-Punkt können bei einem Vorverstärker auf 144MHZ erreicht werden, wenn als aktives Element einen Leistungs-GaAs FET benutzt wird. Dieser Effekt wurde von WB5KGL beim Experimentieren entdeckt. In der Folge haben WA5VJB ([1]) und WD5AGO ([2]) entsprechende Schaltungen beschrieben.

Introduction

This cavity preamplifier uses a MGF-1801, a device designed to develop 150 mW at 10 GHz; but a MGF-2116 can be used with similar results. The measured NF for those devices was below 0,25 dB with 28 dB gain and -5,5 dBm input IP_3, a worthwhile improvement over the measured -11dBm input IP_3 of the smaller 10 mA drain MGF-1302 (0,35 dB NF and 25 dB gain).

Einführung

Der Vorverstärker mit einem Viertelwellenresonator im Eingang benutzt einen MGF-1801 oder MGF-2116 Leistungs GaAs-FET. Die Rauschzahl ist ca. 0,25dB bei einer Verstärkung von 28dB und einem Eingangs-IP von -5,5dBm. Bestückt man den gleichen Verstärker mit einem MGF-1302, kann man eine Verstärkung von 25dB, eine Rauschzahl von 0,35dB und einen Eingangs-IP von -11dBm erreichen.

Circuit Description

The resonant circuit L1 in Fig. 1, is a quarter wave cavity tunable to 144 MHz by C1. The ratio between the outside and inside diameters of the copper tubes making the coaxial cavity, gives a $Zo=138\log_{10}(25,4/9,5)=59$ ohm.

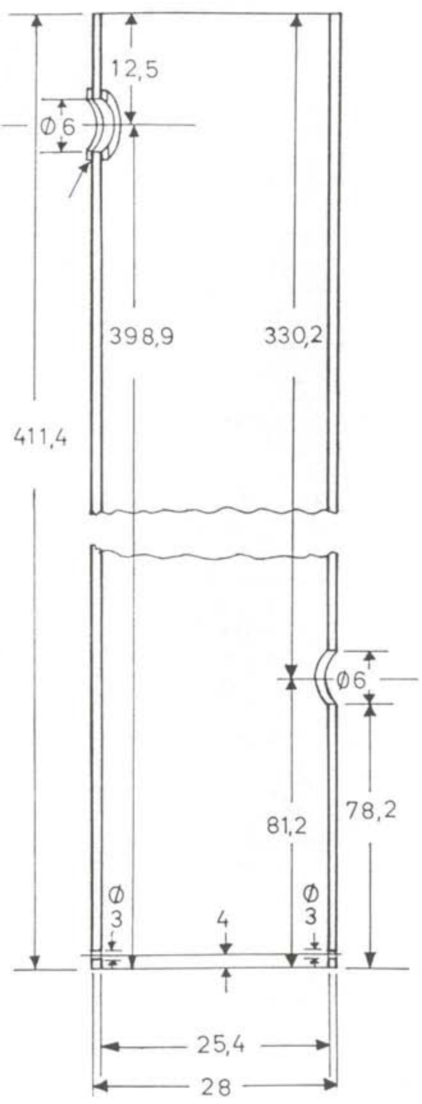
The antenna input is connected to a low impedance point of the cavity inner line to transform 50 ohm to that required by Q1 to give the lowest NF. This point has been experimentally found since manufacturers don't provide S-parameters at 144 MHz for 10 GHz devices.

The cavity bottom is a short circuit and so the current is maximum at this point. To prevent losses here, the electrical contact all around between the inner and outer copper tubes must be made with the lowest possible resistance. For this reason, all the cavity parts are made of copper, lathe-machined with high accuracy, silver plated and then bolted together. Mechanical contacts like these, have less resistance than tin soldered connections.

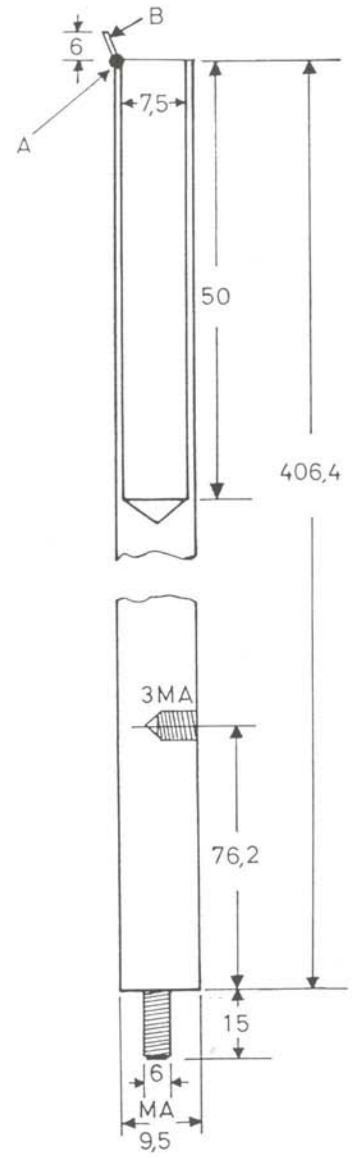
At the open end of the cavity the voltage is maximum and C1 must be a low loss (high Q) 10 pF Airtronic capacitor; those of the 5750 series are recommended. C1 is soldered to L1 using Alpha type 2% silver tin. To easily solder C1 to L1, the upper part of L1 inner rod is internally drilled to a 7,5 mm diameter (Fig. 3), thus reducing its mass to prevent the heat to sink through the copper. When soldering C1 to L1, avoid to excessively heat C1, otherwise it will fall apart. Piston capacitors are rather delicate and tend to do that.

Fig. 3 shows a very small, 6 mm long,copper strip. It is hard soldered with silver alloy to L1 in (A). Q1 gate must be soldered to this strip, using standard tin alloy. Fig. 2 shows the outer cavity tube to house both C1 and the flange of the N-male input connector. Fig. 4 shows the drilling layout of the bottom of a Teko 53x48x26 metal box which contains the amplifier components; holes are corresponding to those of the upper cavity flange (Fig. 5), where it is to be placed.

C2, C3, R1, L_S and Q1 must be mounted on a small piece of flat, 0,5 mm thick, silver plated copper strip (D in Fig. 4),cut to 25x15 mm. Drill the two holes as shown, tap two 3 mm holes on the cavity upper flange (Fig. 5) and then bolt it there. This plate allows to easily mount those components without overheating them. Fig 5 shows the upper copper flange which is hard soldered with silver alloy to the outside tube of the cavity. A copper bushing to house the input N connector is detailed in Fig. 6. It must be hard soldered with silver alloy to the external wall of the outer cavity tube. Dimensions E and F (Fig. 6) change with the type of the available connector and they must be determined accordingly. A 3 mm diameter copper rod to join the N connector central pin to L1 inner line is shown in Fig. 8. It is 3MA threaded at the L1 side and the other end is soldered to the N connector central pin using 2% silver tin.

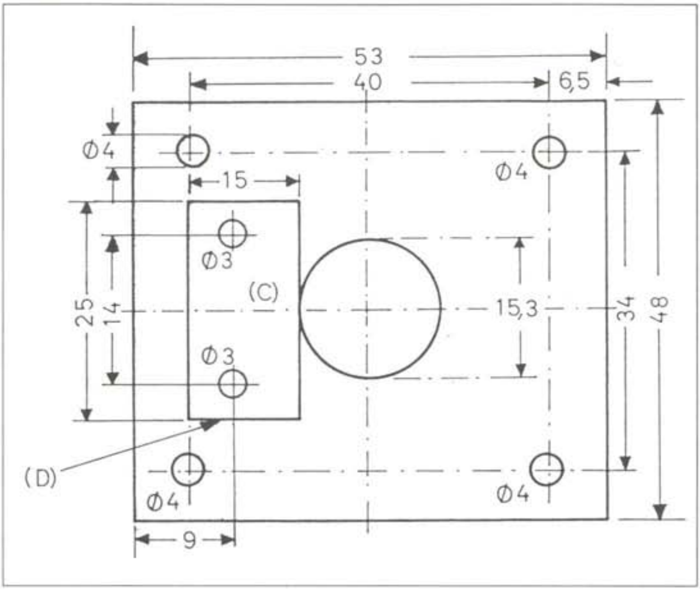


Figure/Abb. 2



Figure/Abb. 3

Fig. 9 shows the general layout of the most important components on the bottom side of the Teko metal box bolted on the cavity top. In place of chip capacitors, it is better to use trapezoidal capacitors since the former break easily if a minimum bending force is applied. This layout is for a MGF-1801.



Figure/Abb. 4

Schaltung

Der Eingangskreis (Abb. 1) besteht aus einem Viertelwellen-Koaxialkreis, der mittels C1 abgestimmt wird. Die Impedanz der Leitung beträgt 59Ω.

Die Antenne wird an eine Anzapfung angeschlossen. Diese wurde experimentell bestimmt, um die niedrigste Rauschzahl zu erreichen.

Das kalte Ende der Koaxialleitung wird kurzgeschlossen. Um Verluste zu minimieren, ist dieser Kurzschluß als Verschraubung ausgelegt.

Am 'heißen' Ende der Leitung dient C1 zur Abstimmung. Um die Leerlaufgüte zu maximieren, wird an dieser Stelle der Typ 5750 von Airtronic mit einer Leerlaufgüte von ca. 5000 verwendet. C1 wird mit silberhaltigem Lötzinn (2% Ag) auf L1 gelötet. Der obere Teil von L1 ist auf 7,5mm aufgebohrt. Diese Trimmer sind sehr hitzeempfindlich. Darum muß er mit größter Sorgfalt eingelötet werden.

Abb. 3 zeigt die Gate-Anschlußfahne, die an L1 mit Hartlot angelötet wird. Die Gate-Fahne kann dan mit Weichlot daran angelötet werden.. Abb.2 zeigt die 'Cavity'. Abb. 4 zeigt das Bohrschema für das Teko-Gehäuse (53x48xy26mm), das auf die 'Cavity' aufgeschraubt wird.

C2, C3, R1, Ls und Q1 werden auf einen kleinen, versilberten Kupferstreifen mit 0,5mm Dicke aufgelötet (Teil D in Abb. 4). Die Abmessungen betragen 25x15mm. Diese Montageplatte wird an die 'Cavity' angeschraubt (Abb. 5). Die Montageplatte dient gleichzeitig zur Wärmeableitung. Abb. 5 zeigt den oberen Flansch aus Kupfer, der an das Außenrohr hart verlötet wird. Die Befestigung der N-Eingangsbuchse geht aus Abb. 6 hervor. Wenn man andere Buchsen verwenden will, ändern sich die Maße E und F. Abb. 8 zeigt die 3mm Verbindungsleitung. Sie hat ein M3-Gewinde für L1 und wird an der anderen Seite auf den Mittelleiter der N-Buchse festgelötet.

Abb. 9 zeigt das Layout der Teile für den Ausgangskreis für den MGF-1801. Trapezkondensatoren eignen sich besser als Chip-Kondensatoren, da sie eine höhere mechanische Beanspruchung aushalten.

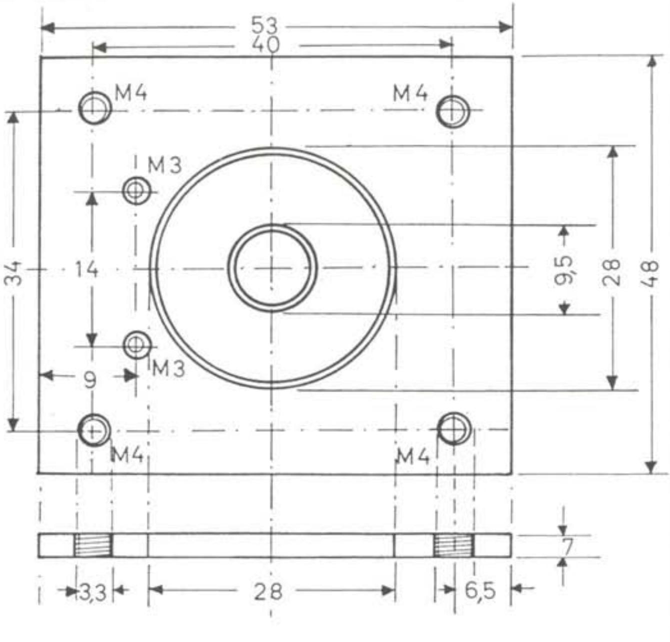
TESTING THE CAVITY

After C1 has been soldered (Fig, 1), make a small, about 1 pF, capacitor twisting together two small pieces of insulated wire. Connect one terminal of this capacitor to a grid-dip-meter and the other one to L1,point (B) of Fig. 3. Q1 must be disconnected: perform this test before connecting it. Set the g-d-m frequency to 144 MHz;rotating C1, a sharp dip must be noticed on the g-d-m. If not, C1 has been damaged during soldering and must be replaced.

Test des Eingangskreises

Nachdem man C1 eingelötet hat, testet man den Eingangskreis mit einem Dip-Meter. Dazu macht man einen kleinen Testkondensator aus verdrilltem, isoliertem Draht, der an Punkt B und an das Dip-Meter angeschlossen wird. Q1 ist nicht angeschlossen. Es muß ein sehr scharfer Dip auf 144Mhz zu erzielen sein. Andernfalls ist C1 defekt.

Figure/Abb. 5



IMPEDANCE MATCHING AND STABILITY

Using power GaAsFETs of the MGF-1801 family, we got a low NF and a fairly good IP. The 4:1 transformer on the drain gives a too high load impedance for MGF-1801 and MGF-2116 working at high current. Due to this high impedance drain load, the MGF-1801 goes very early into voltage and current limiting giving an IP_3 of - 10 dBm. Following DJ9BV suggestions[1], the 4:1 transformer leads were simply reversed to get a 12.5 ohm load for the drain. This modification gave an IP_3=-9 dBm, K>1, S_{22}>30 dB; the drain FB was no longer necessary. Thinking that the drain transformer core could produce some intermodulation due to the high current in its windings, it was replaced by a low ohmic resistance 0.56 µH Delevan choke. The drain load is now 50 ohm and the IP3 improved to -5.5 dBm (Fig. 10).

In order to get a K factor > 1, as per DJ9BV suggestion, an output diplexer was added. The preamplifier is stable and does not oscillate with the input open. Moreover, checking its response from 144 through 1300 MHz by a spectrum analyzer and tracking generator, we observed (photo 6) several frequencies with a 10 dB gain without the diplexer (due to the input cavity multiple modes). With the diplexer (photo 7), the maximum level of the extra responses went down to -10 dB or 35 dB below the wanted 144 MHz signal.

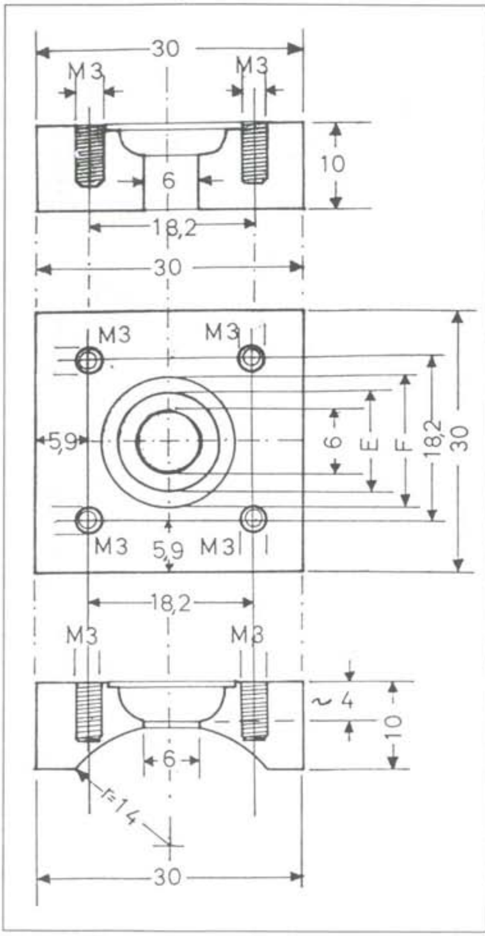
Replacing the MGF-1801 with a MGF-2116 ,an IP3 of -7 dBm with an associated 0,25 dB noise figure and 28 dB gain is obtainable.

The lowest NF of 0.25 dB at 144 MHz, for this 10 GHz power GaAs FET device occurs at an I_{DS} ranging from 95 to 100 mA. Fig. 1 shows both the noise figure NF and the associated gain G_A versus I_{DS}.

Since the device is biased at 5.6 V and 100 mA, the optimum drain load is around 40Ω; therefore

1 *Borrowed from John Regnault, G4SWX*

Figure/Abb. 6

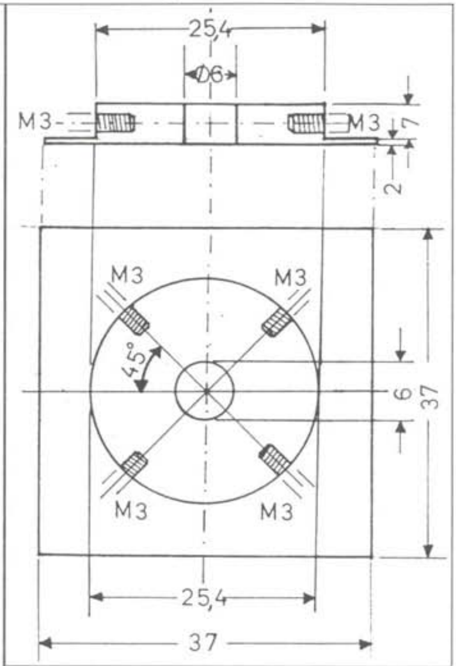


an output transformer is not necessary to match the drain to 50Ω. The drain is powered by a 0.56 μH choke.

Since the device drains 400 mW, an I_{DS} in excess of 100 mA is not recommended for the device safety. Heat sinking has been provided in the same way as for the MGF-1801 circuit.

The MGF-2116 source is electrically connected to the case flange and must be insulated from ground; it is fastened, using two 1 mm screws, to a U shaped 3.5 mm wide silver plated copper supporting strip (Photo 3).

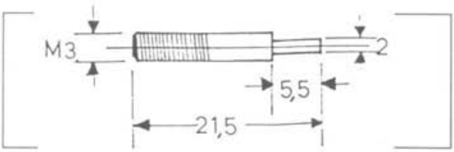
Figure/Abb. 7



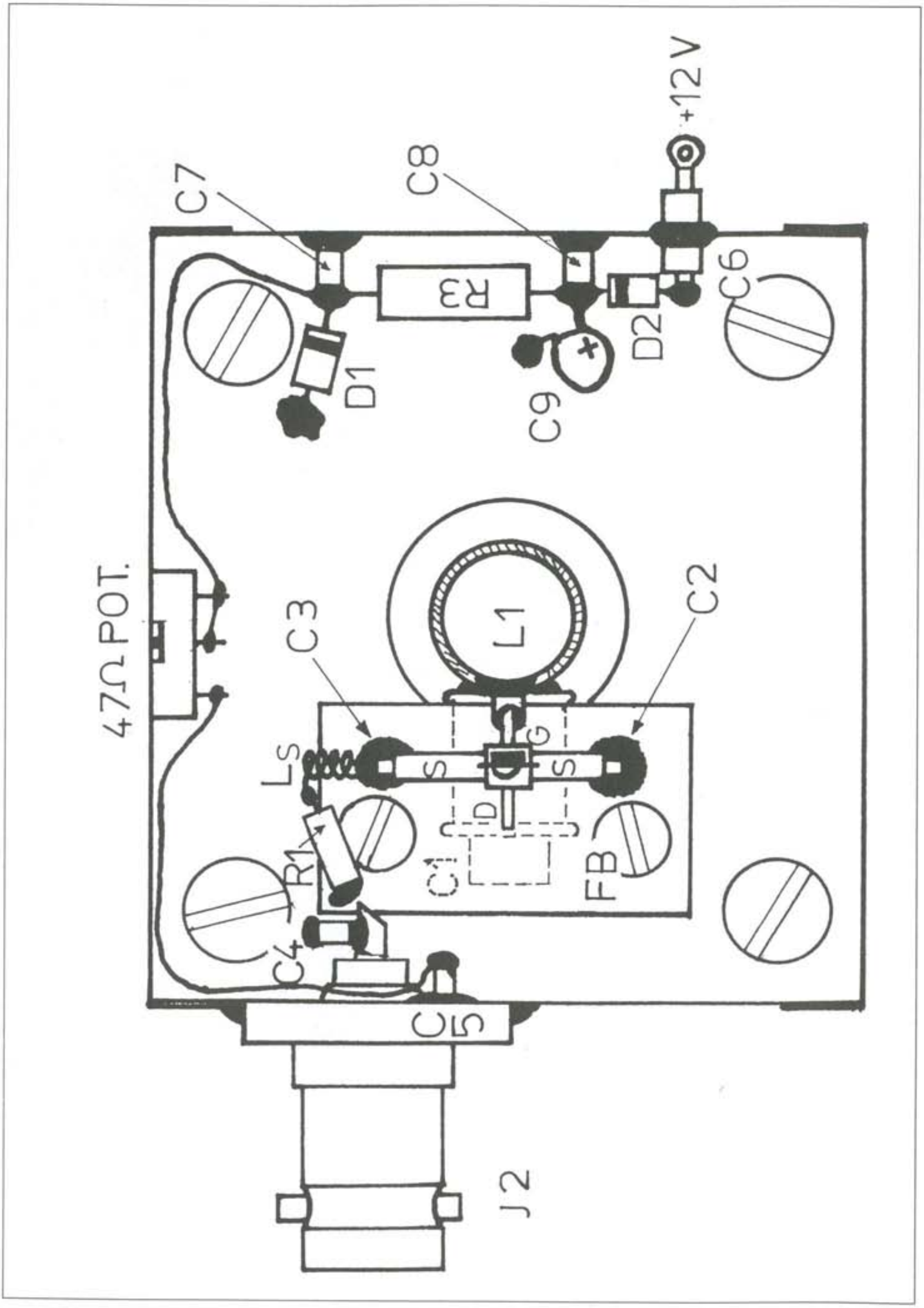
This strip, which adds a small source inductance L_S, is soldered to the two trapezoidal source bypass capacitors C2 and C3.See fig. 2.

R1 is a 22Ω resistor, but a combination of a 10Ω resistor in series with a 50Ω potentiometer could be used in order to adjust I_{DS} for the lowest NF, while trimming R2 as well.

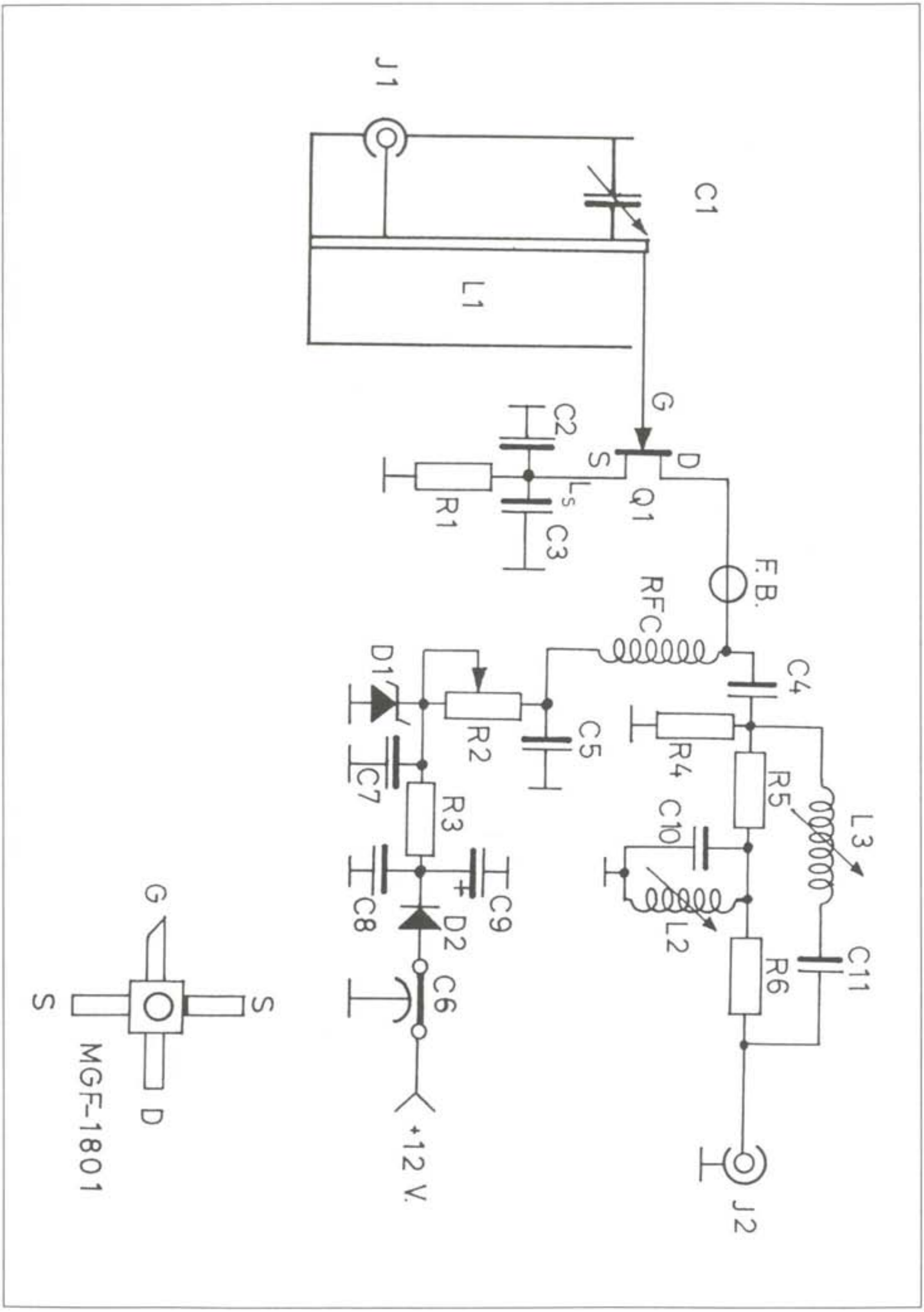
D1 must be changed to a 10W/5,6V zener diode; three 2W resistors, one of 150Ω and two of 330Ω respectively, have been added in parallel to the original R3 to supply the extra needed current. The circuit draws a steady 140 mA current even rotating R2 through its range since D1 sinks the current which does not go into the drain. To measure I_{DS} it is necessary to disconnect R2 from T1.



Figure/Abb. 8



Figure/Abb. 9



Figure/Abb. 10

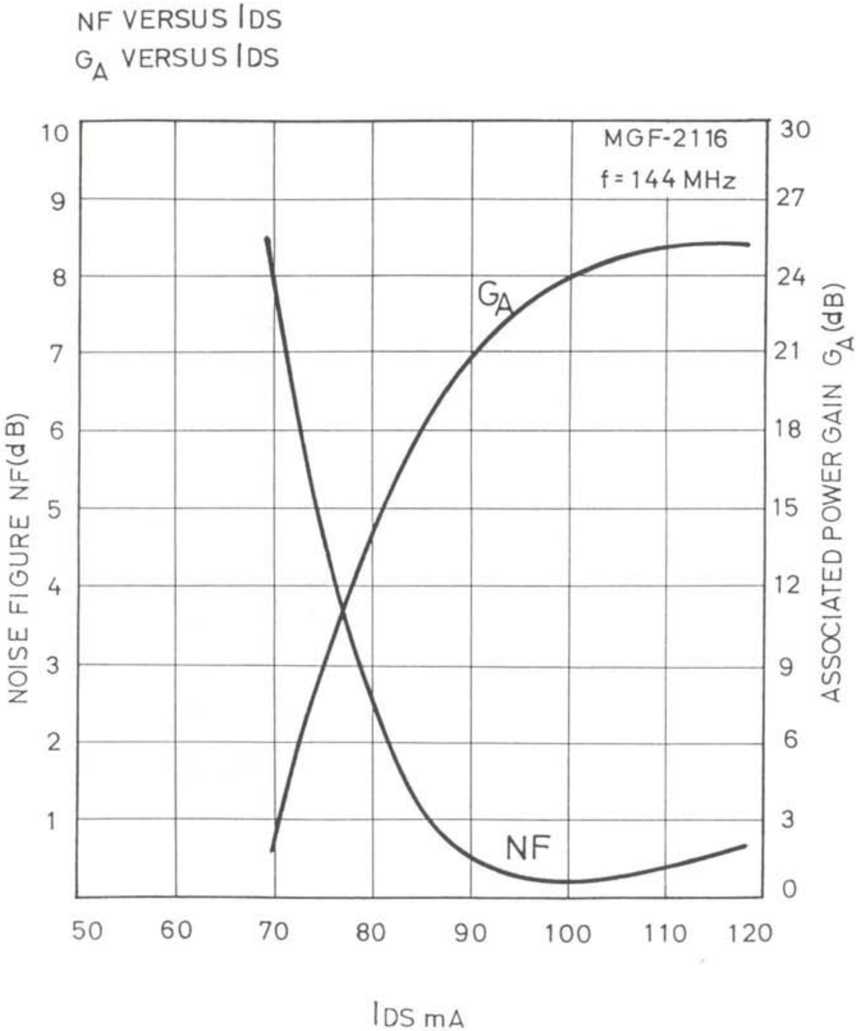

NF VERSUS IDS
GA VERSUS IDS
MGF-2116
f = 144 MHz
NOISE FIGURE NF(dB)
ASSOCIATED POWER GAIN GA (dB)
GA
NF
10
9
8
7
6
5
4
3
2
1
30
27
24
21
18
15
12
9
6
3
0
50
60
70
80
90
100
110
120
IDS mA

Fig. 11

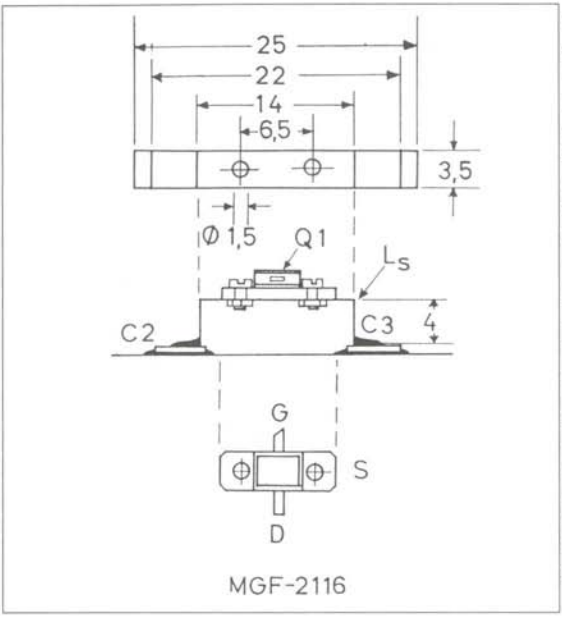


Fig. 12

The outside diameter of the cavity inner conductor can be reduced to 8 mm to bring the impedance to 70Ω in the hope to further reduce its losses. The output diplexer has also been added.

Stabilität und Ausgangskreis

Das Hauptproblem, um mit Power Gas-FET's hohen IP und Stabilität zu erreichen, ist eine geeignete Dimensionierung des Ausgangskreises. Ursprünglich wurde ein 4:1 Transformator im Ausgang verwendet. Mit diesem ergab sich eine gute Rauschzahl und ein brauchbarer Eingangs-IP. Allerdings gehen die FET's MGF-1801 und MGF-2216 wegen ihres hohen Stroms und der hohen Lastimpedanz von nominell 200Ω in Sättigung. Der IP war nur -10dBm. Nach Vorschlägen von DJ9BV wurde zunächst ein 1:4 Transformator eingesetzt, um den IP zu verbessern. Mit dieser Lastimpedanz von 12,5Ω ergab sich ein IP von *-9dBm.* Dann wurde nach seinem Vorschlag ein Diplexer direkt am Drain angeschlossen. Die Gleichspannungszuführung wird über eine 0,56µH Drossel vorgenommen. Damit ergibt sich ein Eingangs-IP von -5,5dBm bei einer Lastimpedanz von 50Ω. Außerdem ist der Ausgangs-Rückflußdämpfung nun besser als 30dB und K ist größer als 1. Selbst bei offenem Eingang ist im Unterschied zu den anderen Schaltungsvarianten keine Schwingneigung festzustellen. Im Frequenzgang sind alle Spitzen (Foto 6) verschwunden und sind mit Diplexer mehr als 35dB unterdrückt (Foto 7).

Benutzt man an stelle des MGF-1801 einen MGF-2116 ergibt sich ein IP von -7dBm bei 28dB Verstärkung und 0,25dB Rauschzahl. Abb. 11 zeigt den Zusammenhang zwischen Drainstrom und Rauschzahl. Für den Arbeitspunkt Uds=4V und Id=100mA ist die optimale Lastimpedanz für maximale Ausgangsleistung ca. 40Ω. Der Lastwiderstand von 50Ω wird ohne Transformation auf den Drainanschluß geführt. Der Diplexer sorgt für alle Frequenzen außerhalb der Betriebsfrequenz für einen sauberen Abschluß. Damit können keine Resonanzen entstehen. Um die Verlustleistung nicht zu überschreiten, soll der Strom auf 100mA begrenzt bleiben.

Die Source des MGF-2116 ist mit dem Gehäuse verbunden. Dieses muß von Masse isoliert werden. Daher wird es mit zwei 1mm Schrauben auf ein 3,5mm breites Kupferband befestigt (Photo 3). Dieses Blech wird dann auf die beiden Chip-C's gelötet (Abb. 2).

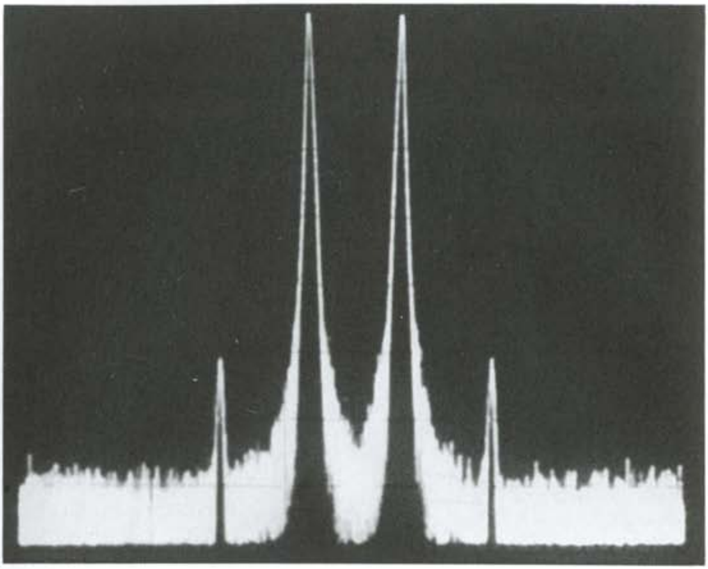
R1 ist ein 22Ω Widerstand. Er kann durch einen 10Ω Widerstand in Serie mit einem 50Ω Potentiometer ersetzt werden, um den Drainstrom auf 100mA einregeln zu können. D1 ist eine 5,6V Znerdiode. Der gesamte Strom ist 140mA.

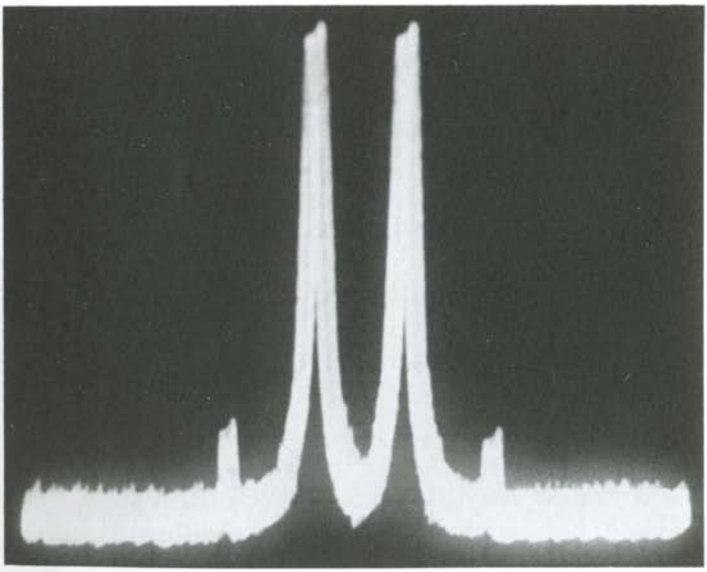
Der Durchmesser des Innenleiters der koaxialen leitung kann auf 8mm verringert werden, um die Impedanz auf 70Ω zu bringen. Das kann die Eingangsverluste noch weiter verringern.

POWER SUPPLY

The dropping resistor R3 and zener diode arrangement has just worked fine. With a fine adjustment of the drain voltage by R2, or of the source bias resistor R1 value, it is usually possible to improve the NF by quite few tenths of dB. Please do not use

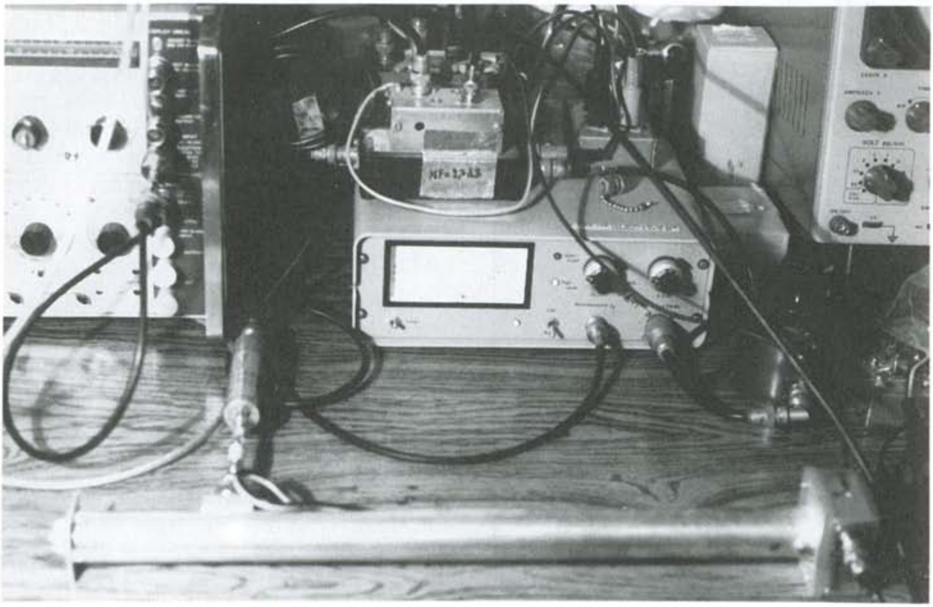
IMD Performance of MGF-1302 Amp (50dB down @ -37dBm input)

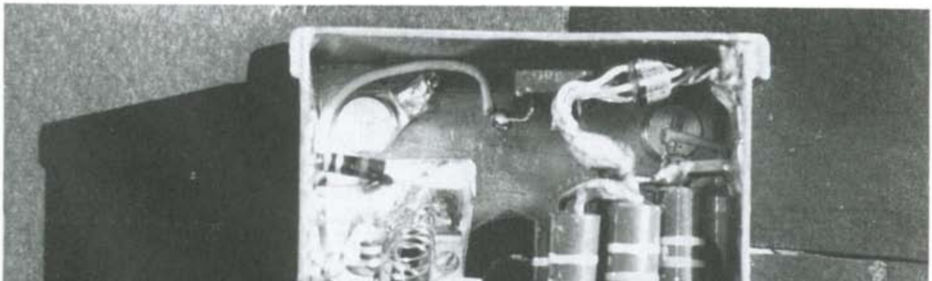




IMD-Performance of MGF-2116 Amp (60dB down @ -37dBm input)

Cavity Preamp (Close View)





Noise Figure Measurement Setup

Table 1: Parts List

No.	C	Value
C1	1	1...10pF Tekelc Airtronic 5750
C2,3	2	Chip or Trapez 470p
C4,5	2	Chip or Trapez 1000p
C6	1	1n F.T.
C7,8	2	100n Chip
C9	1	100uF/35V Tant
C10	1	NP0 47p
C11	1	NP0 12p
R1	1	18 or 22Ω
R2	1	47Ω Cermet Pot
R3	1	71Ω/6W or 35Ω/10W
R4	1	56Ω
R5,6	2	47Ω
RFC	1	0.56µH Delevan
Ls	2	4.5mm source line
Q1	1	MGF-1801/2116
J1	1	N-Male
J2	1	UG-290 BNC
D1	1	5.1V/1W or 5.6V/10W
D2	1	1N4148
L2	1	3t, 3mm ID, 0.3mm Cu, 2mm long (27nH)
L3	1	7t, 4mm ID, 0.3mm Cu, 6mm long (108nh)
Box	1	53x48x26mm TEKO

All parts must be silver plated

Mechanical Parts can be obtained from Luigi Ciaravolo, Tel.: (++39)818474135

a voltage regulator in place of the zener diode. If the preamplifier should oscillate, the device is a 2 watt transmitter; the zener dropping resistor R3 limits Q1 current to a safe value.

Stromversorgung

Es wird nicht empfohlen, statt der Zenerdiode einen Spannungsregler zu benutzen. Dann kann der FET maximal 2W Ausgangsleistung liefern. Der Widerstand R3 begrenzt daher den maximalen Strom auf einen sicheren Wert.

TUNING FOR THE LOWEST NF

Connect the preamplifier to a noise figure meter (like the DJ9BV set of photos 4 and 5) in the usual manner and adjust C1 and R2 for the lowest NF. It should be around 0.24 dB with G=25 dB for the MGF-1801 at I_d=50 mA. The measured input return loss is better than 3 dB. This is not a problem since the preamplifier is antenna mounted.

Abgleich

Der Vorverstärker wird an ein rauschzahlmeßgerät angeschlossen und C1 und R2 werden auf minimale Rauschzahl abgestimmt. Die Eimgangs-Rückflußdämpfung ist besser als 3dB.

IP MEASUREMENTS

A HP 8554-B spectrum analyzer and two oscillators tuned 25 kHz apart were used. Before any measurement the output signal of the oscillators coupler was checked to be sure their IMD should be well down, using a directional coupler. The measurements results for three cavity peamplifiers with 4:1, 1:4 transformer and drain chocke are are listed in Table 1 (see also photo 1 and 2).

IP Messungen

Zwei durch einen Richtkoppler entkoppelte Oszillatoren mit 25KHz Frequenzabstand und ein HP 8554B Spektrumanalysator wurden benutzt, um den IP zu bestimmen. Die Resultate sind in Tabelle 1 zufinden (siehe auch Photo 1 und 2).

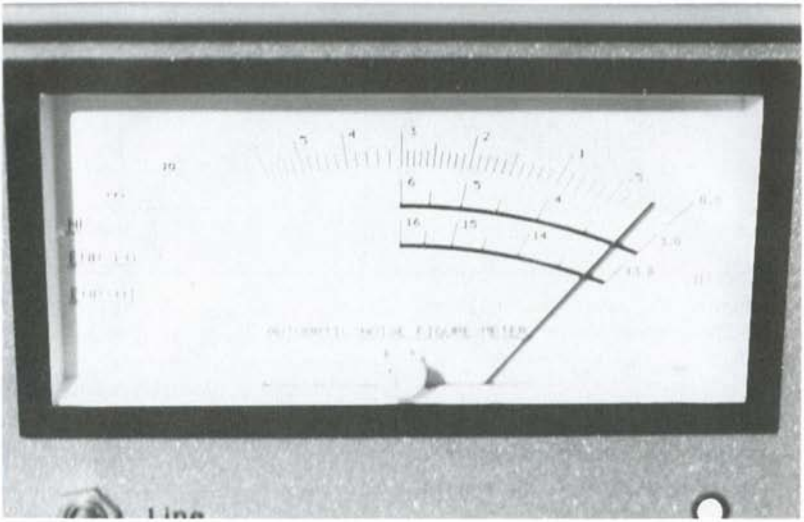
RESULTS ON THE AIR

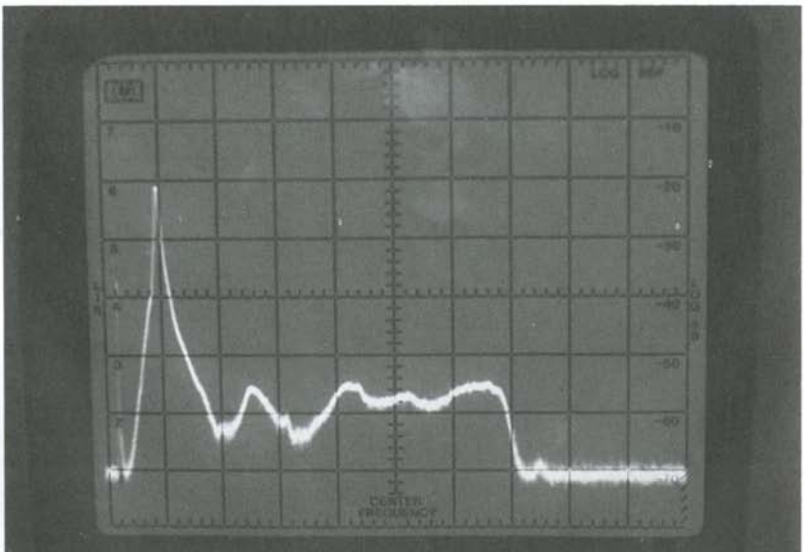
The MGF-1801 equipped design with its high Q input circuit, has provided excellent rejection of out of band signals with a low NF and a high IP3 as well (Photos 8 and 9). Gain compression and blocking from nearby two meter FM stations have been strongly reduced. Such results cannot be obtained with a small signal GaAsFET device and using lumped constant circuits at the input.

Praktische Erfahrungen

Der MGF-1801 zusammen mit dem verlustarmen Eingangskreis sorgt für eine exzellente Selektion und niedrige Rauschzahl sowie einen hohen Inter-

PANFI measuring 0.25dB NF





Frequency response of MGF-2116 Version with diplexer: Up to 1.3GHz no spurious responses or resonances as in the version without diplexer.

Summary of Inrercept Point Measurements

						Output 4:1 Trf			Output 1:4 Trf			Output 1:1 Diplexer		
Device MGF-	Vd [V]	Id [mA]	R1 [Ω]	Ropt [Ω]	NF [dB]	Pin [dBm]	IP [dBm]	G [dB]	Pin [dBm]	IP [dBm]	G [dB]	Pin [dBm]	IP [dBm]	G [dB]
1801	3.9	50	25	48	0.25	-37	-12	23						
1801 (Dipl)	5.1	56	18	64	0.35	-37	-10	22.5	-37	-9	20.5	-37	-5.5	21
2116 (Dipl)	5.6	100	22	41	0.25				-37	-10.5	27	-37	-7	28

zept-Punkt (Fotos 8, 9). Kompression und Blocking durch 2m FM-Stationen sind erheblich geringer als mit Kleinsignal-FET's.

CONCLUSION

Since the input IP of small commercial preamplifiers with MGF-1302 at 10 mA was measured to be only -11 dBm (photo 1), a power GaAsFET preamplifier gives about 5 dB of IP improvement. A preamplifier with MGF-2116, with a NF=0.25 dB, gain=28 dB and IP_3=-7 dBm is nearly the maximum we can obtain from such devices (Photo 2).

Using power GaAs FETs it is rather hard to get better IP than those measured, because even if using an optimum output match, their very high transconductance forces them quickly into current limiting due to the high input voltage step-up required for a low noise figure. FETs are inherently high impedance devices especially on low freqencies.

Power GaAs FETs show a very low NF at 144 MHz; why? Probably, the larger gate of power FET devices for 10 GHZ just works better at VHF since the power FET's have 3000 times as much gate area than the small signal FET's and so a very, very low internally generated noise; but what's really happening has still to be carefully investigated to clarify why power FET's have poor NF at 432 MHz. It seems that the actual 10 GHz Power FET devices are useful only for 144 and 220 MHz.

Schlußbemerkungen

MGF-1302 FET's können nur einen Eingangs-IP von -11dBm erzeugen. Die Leistungs GaAs-FET's ergeben eine Verbesserung von 5dB im IP. Der Absolutwert des IP ist nicht so hoch, wie wir erwartet hatten. Die Ursache liegt in der hohen Ein gangsimepdanz, die eine beträchtliche Transformation des Antennen-Innenwiderstandes erfordert. Die hohe Steilheit bewirkt dann eine frühe Sättigung der in der Stromaussteuerung.

Die niedrige Rauschzahl kann durch die große Gate-Peripherie erklärt werden. Damit wird die Feldstärke im Kristall kleiner und folglich auch der Rauschstrom. Dieser Effekt, der noch nicht genau geklärt ist, wirkt aber nur auf 144 und 220MHz, nicht dagegen auf 432MHz, wo diese Leistungs-FET's schlechter als Kleinleistungs-FET's sind.

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1) Kent Britain, WA5VJB — GaAsFET preamps, Proceedings of the 24^{th} Conference of the Central States VHF Society, ARRL Catalog N° 3266, page 6.

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3) Domenico Marini, I8CVS — Preamplificatore per 144 MHz a GaAsFET di potenza, Radio Rivista, ARI via Scarlatti 31, I-201424 Milano, page 20.

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An Antenna For All Meteors?

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P.O. Box 611, Shrewsbury, MA 01545-8611 U.S.A.

Meteor burst signals are reflected by meteor trails (ionization columns) that are continuously formed in the atmosphere at about 100 km altitude. Because MB is an inherently weak-signal mode, similar to EME, MB links require good antennas. The conventional wisdom is that a good antenna for long links is one or more Yagis several wavelengths above the ground. This technical note describes an alternative antenna that should work well for any distance between the transmitter (TX) and receiver (RX). It should also be useful for EME work.

Maximum gain at low take-off-angles is crucial for good link performance at long ranges. A typical antenna system might consist of two vertically oriented 3 to 3.5-wavelength Yagis stacked horizontally (side-by-side) at a height of 4 wavelengths above ground. Such an elaborate system is required to offset the "ground tuck" that occurs in the radiation pattern of any antenna over real earth. Ground tuck is a sharp drop in gain at shallow take-off angles (typically 10-30 dB). All antennas exhibit this effect, but it is less pronounced for vertical radiators.

Near-horizon gain can be maximized by using a vertically polarized antenna on a ground screen. If the screen, which acts as a reflector, is long enough in the direction of maximum radiation, it can all but eliminate ground tuck. This observation suggests the possibility of a single antenna designed for maximum near-horizon gain that is also suitable for intermediate MB ranges.

Fig. 1 is a schematic representation (not to scale) of the type of antenna being suggested - a passive array of vertical monopoles. The monopole array is essentially half a Yagi mounted on the ground screen. It consists of a single reflector (REF), a single driven element (DE), and N directors (D_i). All elements except DE are connected to the screen. DE is mounted on a base insulator and excited by the RF source (TX) which is connected between the base of the element and the screen. In practice, the feed is a coaxial cable with its shield is connected to the screen and the center conductor to an impedance matching device such as a transmission-line transformer (Unun) or a gamma match.

Fig. 2 shows the radiation pattern for a well-designed 18-element monopole array on an infinite ground plane. Maximum gain for this design is 18.6 dBi, which is consistent with MB at the longest ranges. On a finite plane, the gain falls off very close to the horizon, but the ground tuck is substantially reduced by the presence of the ground screen. Two opposing effects occur as the take-off angle increases:

1. the antenna gain drops rapidly because of the highly directive main lobe
2. the MB propagation loss decreases rapidly because the TX-RX range is reduced.

Lower antenna gain reduces available RX power, while lower path loss increases it.

Comparing MB link performance with varying TX-RX range to the performance at maximum range provides a simple measure of how well a particular antenna works. If the link performance is acceptable at the maximum range, then all the antenna has to do at any other range is meet or exceed that performance to provide a solid MB link at the shorter TX-RX range. Fig. 3 is a typical comparison. It plots the ratio of available RX power vs. range to the RX power at maximum range (zero take-off angle). This curve applies to mid-point reflections along the TX-RX great circle path (GCP), and it assumes a spherical earth of radius 6371 km with a 100 km trail height.

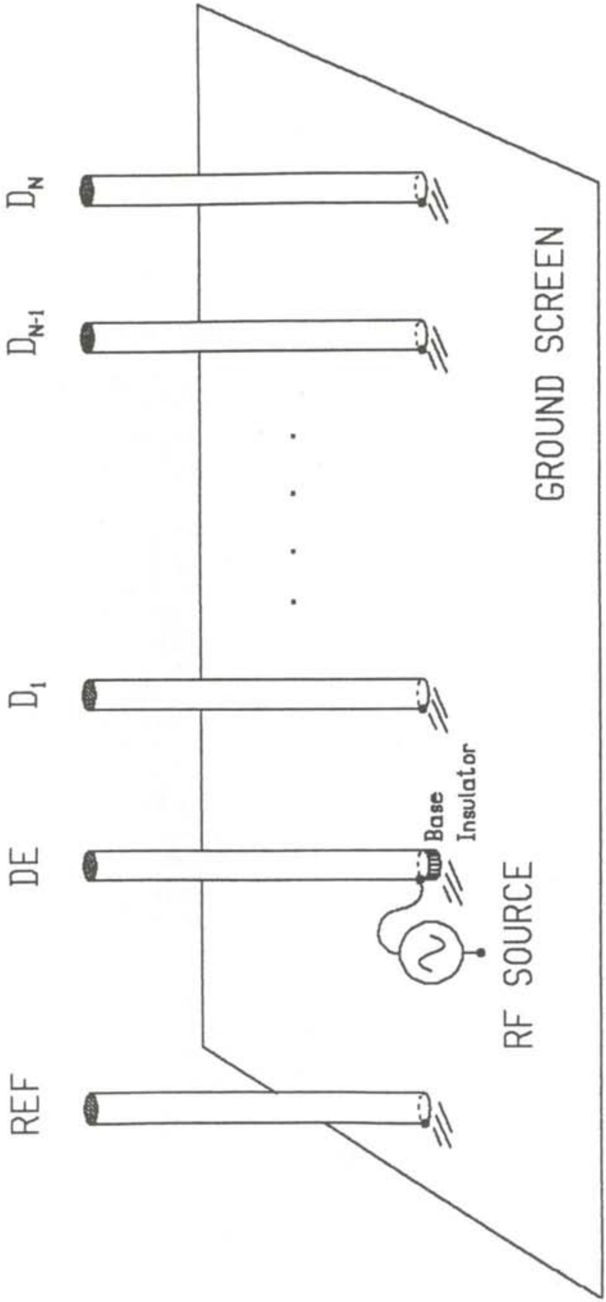


Fig. 1 Monopole Array on Ground Screen

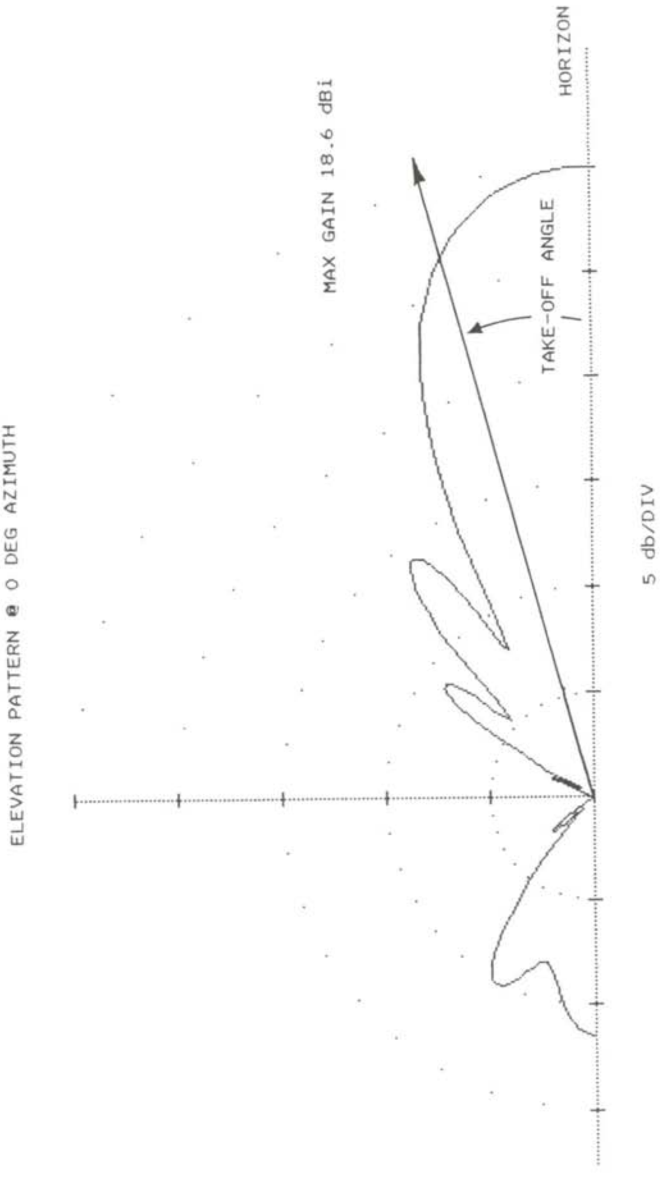

ELEVATION PATTERN @ 0 DEG AZIMUTH
MAX GAIN 18.6 dBi
HORIZON
TAKE-OFF ANGLE
5 db/DIV

Fig. 2

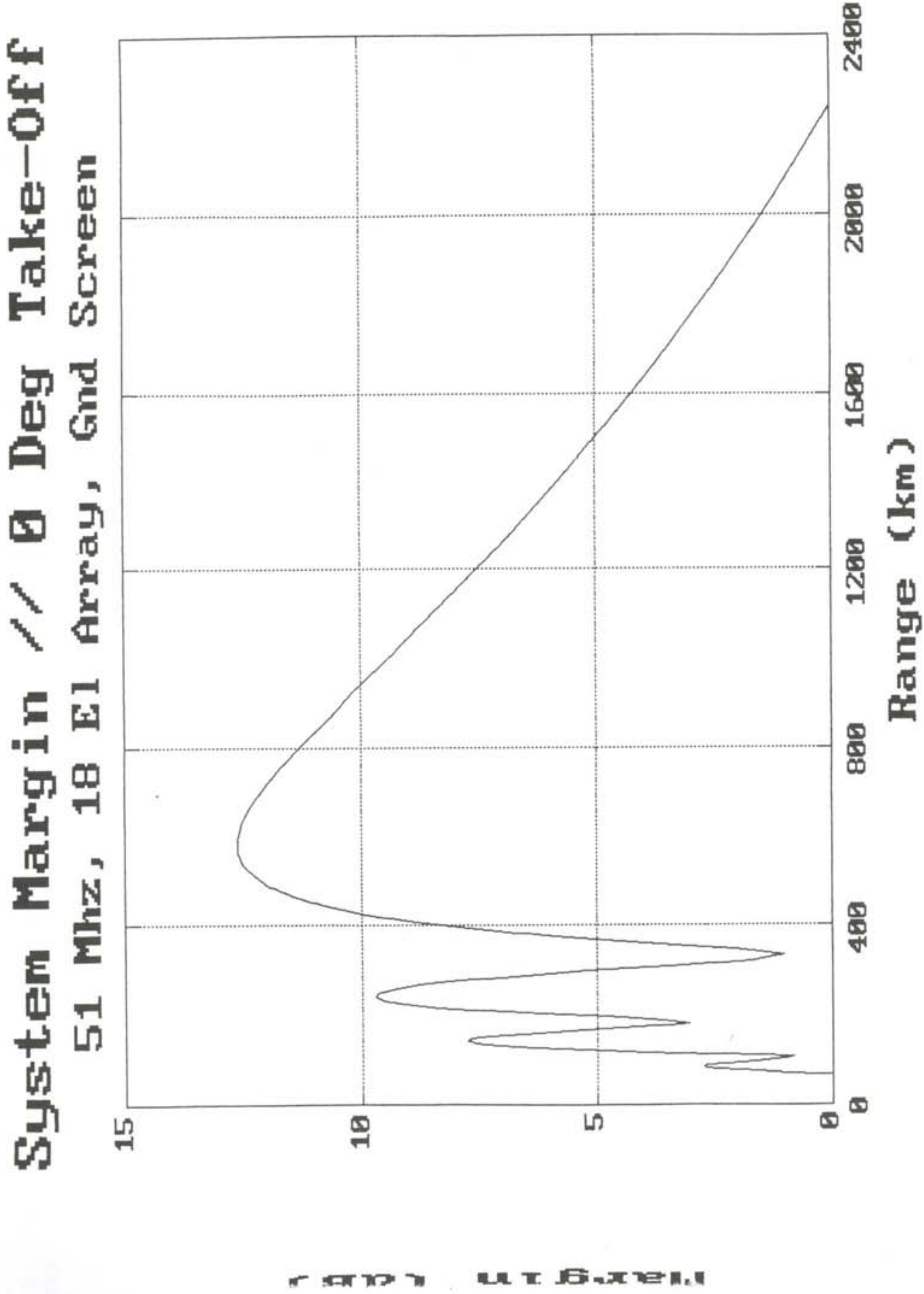

System Margin // 0 Deg Take-Off
51 Mhz, 18 El Array, Gnd Screen
15
10
5
0
0
400
800
1200
1600
2000
2400
Range (km)

Fig. 3

Fig. 3 shows that the 18-element monopole array on a ground screen, which is designed to provide maximum gain near the horizon for the best possible maximum-range performance, also provides a positive system margin at almost all intermediate ranges. Near 600 km the margin is about 13 dB! The effects of the 3 secondary lobes in the pattern are clearly evident between approximately 70 and 350 km range, where the margin varies considerably but is always positive. Only at the shortest ranges does it fall below zero.

Even though the monopole array is designed with the single objective of maximizing near-horizon gain, it works well at all TX-RX ranges except the very shortest. This behavior is explained heuristically as follows. For mid-path MB reflections, the received power varies as the cube of the distance from TX to the meteor trail. As the range decreases (increasing take-off angle), the RX power increases very quickly because of this cubic behavior. By comparison, the antenna gain, which falls off as the range decreases, drops much more slowly than a cubic variation. The decrease in antenna gain at shorter link ranges is more than offset by the increase in received power on the shorter propagation path.

Of course, MB reflections do not occur only at mid-path. Trails on either side of the GCP, trails at different heights, and even trails behind the TX or RX can support a link. Nevertheless, the behavior for GCP mid-point reflections appears to illustrate a generally valid effect: when highly directive antennas are used to maximize near-horizon gain, the lower MB path loss at shorter ranges offsets reduced antenna gain and results in positive MB link margins (more RX power compared to maximum range) at all ranges except possibly the very shortest. The monopole array on a ground screen is a typical antenna system. Other configurations should exhibit similar behavior.

On the practical side, the monopole array on a ground screen is mechanically simpler, almost certainly less expensive, and easier to install and maintain than Yagis on a tall tower. In addition, it eliminates unnecessary, but potentially substantial, feed system losses associated with long cable runs, power dividers, and coax connectors. Of course, the monopole array suffers the disadvantages of not being rotatable and requiring a large ground screen.

Unfortunately, there is no simple way to specify just how big the screen should be. In theory, it should extend hundreds of wavelengths or more in the direction of the main lobe to essentially eliminate all ground tuck. But, in practice, a few wavelengths should work quite well. The screen should extend several wavelengths beyond the last director (the more the better), and as far as possible to the side and behind the array. Because FB for a long "half-Yagi" is high (in the example, about 18.5 dB), the screen size behind the reflector is probably the least critical.

As an indication of what should be achievable, computer simulations of MB performance at maximum range using a screen extending 10-wavelengths beyond the last director show a 6-fold improvement in average throughput, with nearly a factor of 10 improvement at certain times of day. The comparison antenna was essentially the stacked array system described above.

Deutsche Version

Meteor Scatter erfordert wegen der geringen Feldstärken gute Antennen wie bei EME. Normalerweise werden gestockte Yagis verwendet. Dieser Artikel beschreibt eine Alternative, die gut für jede mögliche Entfernung funktioniert.

Für hohe Reichweiten ist maximale Verstärkung bei niedrigen Erhebungswinkeln der Antenne nötig. Eine typische Antenne kann z.B. auf 3-3,5 wl langen Yagis bestehen, die horizontal gestockt sind und in vertikaler Polarisation 4 Wellenlängen über der Erde sind. Solch ein System ist sinnvoll, um die 'Einschnürung' im Richtdiagramm zu umgehen, die bei jeder Antenne, die über realer Erde abstrahlt, auftritt. Für vertikal polarisierte Antennen ist dieser Effekt weniger ausgeprägt.

Den Gewinn bei niedrigen Erhebungswinkeln kann man maximieren durch Verwendung von vertikal polarisierten Antennen über einen Reflektor am Boden. Wenn dieser groß genug ist, kann man diese Antenne sowohl für DX als auch für mittlere Entfernungen bei MS gebrauchen.

Abb 1. zeigt einen Anordnung von vertikalen Monopolen. Diese Antenne ist eigentlich eine halbe Yagi, die vertikal über einer leitenden Fläche montiert ist, Sie besteht aus einem Reflektor, einem Speiseelement und n Direktoren. Alle Elemente mit Ausnahme des Speiseelementes sind direkt mit der leitenden Grundfläche verbunden. Das Speiselement wird isoliert aufgebracht und über eine Anpaßschaltung mit dem Koaxkabel verbunden.

Abb2. zeigt das Diagramm für einen 18-Element Array über einer unendlich großen leitenden Fläche. Der Gewinn ist 18,6dBi. Auf einer endlichen Fläche fällt der Gewinn etwas, aber die Aufspaltung der Hauptkeule ist wegen des Erdreflektors gering. Wenn der Erhebungswinkel steigt, gibt es zwei gegenläufige Effekte:

1. Der Antennegewinn fällt
2. Der Verlust für MS-Ausbreitung fällt, weil die Entfernung abnimmt.

Wenn man die Leistung für MS-Ausbreitung für verschieden Entfernungen untersucht, kann man ein Maß für die Güte der Anlage bezogen auf die maximale Entfernung definieren. Wenn die Leistung für die maximale Entfernung ausreicht, muß die Antenne nur genug Gewinn für alle kleineren Entfernungen aufweisen. Abb. 3 zeigt ein typisches Ergebnis. Sie zeigt die verfügbare RX-Leistung in Verhältnis zur RX-Leistung bei maximaler Entfernung. Die Voraussetzung für den Graph sind Reflektionen auf dem Mittelpunkt des verbindenen Großkreises zwischen den Stationen und eine Höhe des Rfelexionszentrums von 100km bei einem Erdradius von 6371km.

Abb. 3 zeigt auch, daß die 18 Element Monopol Antenne einen positiven Systemgewinn für nahezu alle Zwischenentfernungen liefert. Bei 600km Enbtfernung ist der Systemgewinn fast 13dB. Den Effekt der drei Nebenzipfel kann man auf den Entfernungen zwischen 70 und 350km sehen.

Obwohl der Monopol-Array für maximalen Gewinn bei null Grad Erhebungswinkel dimensioniert ist, arbeitet er auch bei allen kleineren Entfernungen. Die Erklärung liegt darin, daß im Fall von Vorwärts-Scatter auf der Mitte des Übertragungsweges, die Empfangsleistung mit der dritten Potenz der Entfernung abnimmt. Bei kleineren Entfernungen nimmt daher die Empfangsleistung sehr schnell zu, aber der Antenngewinn nicht so schnell ab, da die Abhängkeit vom Erhebungswinkel nicht kubisch ist.

Es gibt naturlich auch andere Ausbreitungswege. MS-Rfelektione können durch Seitenscatter, selbst durch Rückwärts-Scatter auftreten. Die direkte reflektion ist aber eher typisch. Daher sind Antennen mit hohem Gewinn und niedrigem Erhebungswinkel besonders geeignet, um alle Entfernungsbereiche abzudecken.

Von der praktischen Seite gesehen, ist eine Vertikal-Antenne sehr viel einfacher aufzubauen als horizontale Yagis-Arrays, die auf Masten montiert werden müssen. Als Nachteil sind die feste Azimuth-Richtung und der große Bodenreflektor zu betrachten. Unglücklicherweise kann man die erforderliche Größe nur schwer angeben. Theorethisch muß die Länge in Richtung der Hauptkeule einige hundert Wellenlängen betragen, um jede Erhöhung des Erhebungswinkel zu eliminieren. In der Praxis reichen auch wenige Wellenlängen. Der Bodenreflektor sollte hauptsächlich in Strahlrichtung ausgelegt werden.

Rechnersimulationen zeigen an, daß ein Bodenreflektor mit 10 Wellenlängen vor dem letzten Direktor ungefähr eine 6-fache Leistung erbringen als ohne Reflektor.

Noise Figure Meter MKII

Rainer Bertelsmeier, DJ9BV

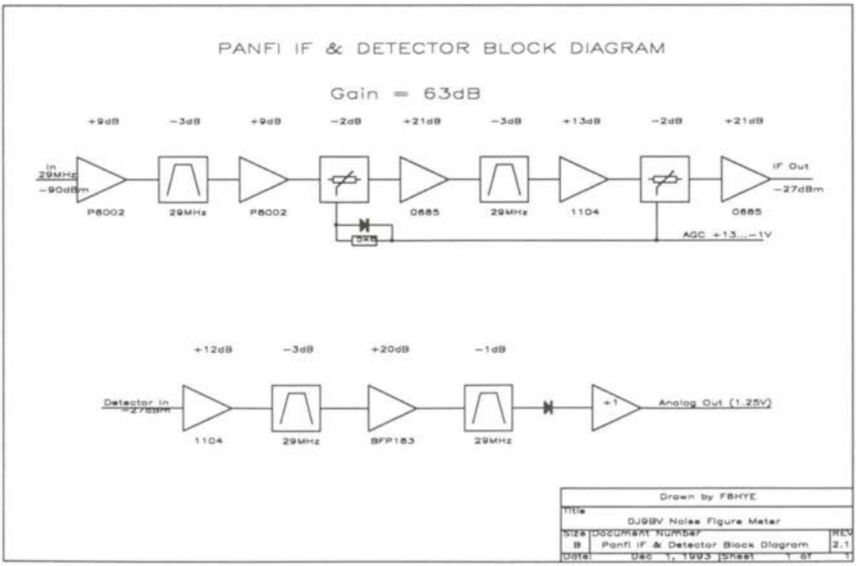
Kurzfassung: Aufgrund der Erfahrungen beim Nachbau der Rauschzahlmeßgeräte ergeben sich Forderungen nach Verbesserung des Dynamikbereichs und nach neuen Betriebsarten, um Mond- bzw. Sonnenrauschen in EME-Anlagen zu messen. Mit den hier vorgestellten Verbesserungen kann man nicht nur exakt Rauschzahlen messen, sondern dieses Gerät auch zum Messen von Mondrauschen auf 2,3...10GHz EME einsetzen.

Abstract: The experiences which have been gained with the replication and use of my noise figure meter suggested a redesign for better dynamic range, linearity and new modes for measurement of sun- and moonnoise in EME applications. The instrument of the following article not only provides very accurate noise figure measurements of LNAs but also the versatility for measuring moon noise in EME applications.

Einführung

Seit der Beschreibung des Rauschzahlmeßgeräts in [1] und [2] haben sich Erfahrungen ergeben, die eine Überarbeitung nahelegten:

1. Eine ENR-Kalibration für 15dB ENR erscheint überflüssig.
2. Eine Benutzung im manuellen ON/OFF-Mode ist wünschenswert.
3. Der ZF-Verstärker mit den TV-IC's bewirkte einen Meßfehler aufgrund von Breitbandrauschen. Das reduzierte den dynamischen Bereich auf ca. 20dB.
4. Die Verstärkung der ZF ist unzureichend.
5. Die Platine des Analog-Prozessors war von unzureichender Qualität.
6. Die 15V-Regler auf der Analog-Platine waren unzureichend gekühlt.



Figure/Abb. 1: Block Diagram IF & Detector

Der ZF-Verstärker und der Detektor sind aufgrund dieser Erkenntnisse vollkommen neu in SMD-Technik konstruiert. Die Schaltung des Analog-Prozessors wurde entsprechend angepaßt. Das ergibt folgende Eigenschaften:

- Selektivität verteilt auf 7 Kreise verhindert Meßfehler durch Breitbandrauschen.
- Höhere Verstärkung ergibt eine um 15dB höhere Empfindlichkeit von -90dBm für AGC-Lock.
- Durch zwei PIN-Dioden Abschwächer und verteilte Selektivität Dynamikbereich von 60dB ab AGC-Lock bei maximal 0,1dB Abweichung vom Meßwert.
- Der neue Detektor ist hochlinear (±0,025dB) über einen Bereich von 7dB und damit optimiert für ein kleines ENR (<6dB) der Rauschquelle.
- Die Bandbreite von 2MHz und eine Zeitkonstante von 330ms ergeben eine Unruhe der Anzeige von < 0,03dB ($\Delta I = 1/\sqrt{B\tau}$)
- Neue Betriebsarten: Manuelle Messung ON/OFF mit manueller Einstellung der Verstärkung.

Die bisherige Auswerteschaltung kann mit einer geringen Modifikation weiterverwendet werden.

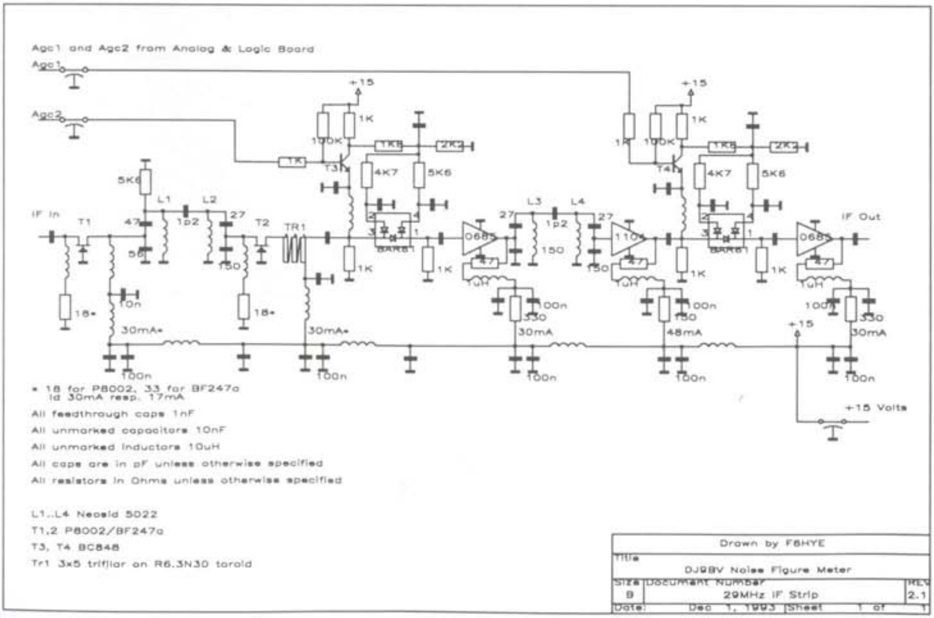
Eine verbesserte Version wurde dennoch erstellt, weil die bisherige Qualität der Platine unzureichend war und neue Betriebsarten vorgesehen wurden.

Die neue Version des Rauschzahlmeßgeräts ist bei einigen Amateuren und beim Verfasser bereits seit 1992 im Einsatz und hat sich sehr bewährt. Vor allen Dingen ist die extrem hohe Zeitstabilität der ENR-Eichung bemerkenswert.

Introduction

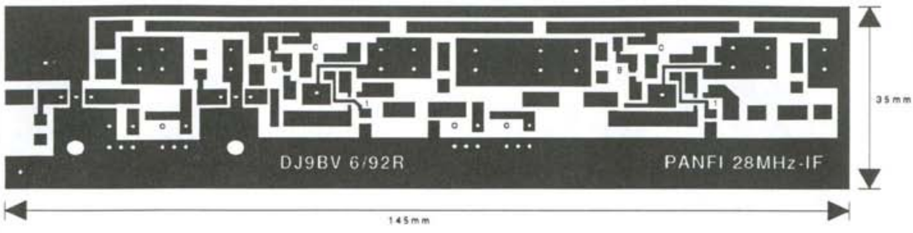
Since the description of a noise figure meter in [1], [2] and [3] some experiencies suggested a redesign of my original circuit:

1. There seems to be no need for a 15dB ENR facility because of the low measurement accuracy when measuring non-impedenance matched DUTs with this type of noise source.
2. A manual ON/OFF mode is needed.
3. Gain of the original IF-cicuit is to low.
4. The measured noise power is masked by broadband noise from the TV-ICs used. This reduces the dynamic range of the system to about 20dB.



Figure/Abb. 2: Circuit Diagram IF

Figure/Abb. 3: PCB IF



5. The quality of the analog processor PCB was not acceptable.
6. The 15V-Regulators on the PCB got to hot.

For these reasons the IF-circuit and the detector are new designs with superiour leariny, gain and dynamic range. The analog processor has been changed to accomodate the new modes and the new IF-circuits:

- The influence of spurious broadband noise is inhibited by 7-pole selectivity distributed over the IF-chain.
- 15dB more gain provides a sensivity of -90 dBm for AGC-Lock.
- Because of distributed selectivity and two PIN-diode attenuators dynamic range of 60dB above AGC-Lock at maximum 0.1dB unlinearity.
- Highly linear detector (+-0.025dB) provides excellent accuracy for low ENR noise sources.
- Bandwidth of 2MHz and integration time of 330ms result in a fluctuation of indication of less than 0.03dB ($\Delta I = 1/\sqrt{B\tau}$)
- New modes Manual ON/OFF and manual gain provide new measurement facilities

The new version is in operation since 1992 at the author and at several amateurs, who got the updated circuits.

Schaltung

Das Blockdiagramm in Bild 1 zeigt, daß 7 Kreise auf der ZF-Seite für Selektion sorgen. Die Abregelung wird mittels zweier PIN-Diodenabschwächer durchgeführt. Die Verstärkung erfolgt mittels MMIC's oder Leistungs-FET's. Durch die Verteilung der Selektion und die Verwendung hochlinearer Verstärker ist die Kompression kleiner als 0,1dB bei 60dB Abregelung. Die Bandbreite beträgt nominell 2MHz bei 3dB Abfall. Die Empfindlichkeit des Systems beträgt typisch -90dBm, so daß nur noch ca. 20 dB externe Verstärkung nötig sind, um für ein Meßobjekt mit 1dB Rauschzahl "AGC-Lock" zu erreichen.

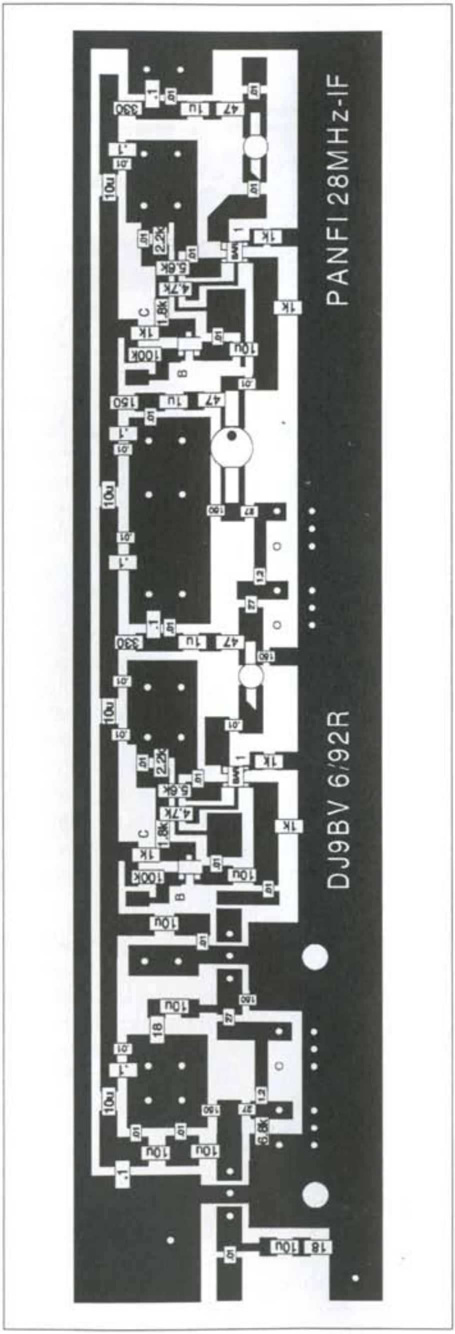
ZF-Verstärker

Die Schaltung ist in Bild 2 zu sehen. Nach zwei hochlinearen Stufen mit dem Leistungs-FET P8002, die das erste Filter entkoppeln, folgt der erste PIN-Dioden Abschwächer mit ca. 50dB Regelbereich. Dann folgen ein MSA-0685, das nächste Bandfilter, ein MSA-1104, der zweite PIN-Dioden Abschwächer mit ca. 50dB Regelbereich, und ein MSA-0685. Alle Verstärker werden mit einer maximalen Ausgangsleistung betrieben, die mindestens 25dB unter ihrem 1dB Kompressionspunkt liegt.

Alle Bandfilter sind unterkritisch gekoppelt, so daß man sie ohne Wobbler abgleichen kann. Das Maximun auf 29MHz ist eindeutig. Der Aufbau ist in SMD-Technik (Abb. 4). Die Verstärkung des ZF-Teils beträgt ca. 63dB. Die gemessene Gesamtbandbreite ist in Abb. 17, 18 zu sehen. Die Eingangsrückflußdämpfung ist besser als 20dB von 10 bis 100MHz (Abb. 19).

Detektor

Die Schaltung zeigt Abb. 5. Der Aufbau ist in SMD-Technik (Abb. 7). Die Eingangsempfindlichkeit für 1,25V Ausgangs-Gleichspannung (AGC-Lock) beträgt ca. -27dBm. Der Detektor ist wegen einer Regelschaltung selbstkompensierend und temperaturstabil. Diode D1b erhält einen Vorstrom von ca. 7µA durch die beiden 1M Widerstän-



Figure/Abb. 4: Parts Layout IF

de. Der Gleichstrompfad des HF-Gleichrichters D1a ist an der Temperaturreferenz D1b exakt nachgebildet, so daß mittels IC2b der gleiche Strom durch D1a erzwungen wird (die Idee wurde vom HP8970A entliehen [3]). D1a und D1b sind auf einem Chip. Durch Subtraktion der Flußspannung von D1b, die von IC2a an den Subtrahierer IC3 geführt wird, ist die Ausgangspannung des Gleichrichters 0±100µV über einen weiten Temperatur- und Vorstrombereich. Die Linearität des Detektors zeigen die Abb. 15 und 16. Im Bereich eines Y-Faktors von 0...7dB ist die Abweichung kleiner als ±0,025dB. Dieser Detektor ist für ein ENR der Rauschquelle von 0 bis 6dB optimal.

Analog-Prozessor

Die Auswerteschaltung (Abb. 8, 9, 10) wurde vereinfacht, durch die Umschaltung für manuell ON/OFF ergänzt und hat eine negativ gehende AGC. Durch die ON/OFF Möglichkeit, kann man das Meßgerät auch als hochpräzisen Detektor for Mond-/Erd- oder Sonnenrauschen einsetzen. Das dürfte für viele EME-Stationen von Vorteil sein.

Circuit Description

The block diagram in Fig. 1 shows the principal design. Seven poles provide the selectivity on 29MHz. Gain stages are either power-FETs or MMICs from Avantek. Therefore compression is less than 0.1dB for 60dB gain reduction. Bandwidth is 2MHz at minus 3dB (Fig. 17/18).

IF-Amplifier

Two linear amplifiers with the P8002 power-FETs isolate the first filter and provide a broadband 50Ω input impedance (Fig. 19). A subsequent PIN-attenuator with BAR-61 provides 50dB attenuation range. A MSA-0685 follows and drives the second filter. A further MSA-1104 drives the second PIN-attenuator. All bandfilters are coupled sub-critical. The alignment can be done by peaking the whole circuit on 29MHz. Gain is 63dB for the IF. All stages provide output compression powers in excess of 15dBm and are operated at least 25dB below this level. Therefore any compression is negligible. Four poles of selectivity are decoupled from the attenuators. Therefore bandwidth is not affected by the AGC-level. Construction is on a double sided epoxy PCB in SMD technique (Fig. 4).

Detector

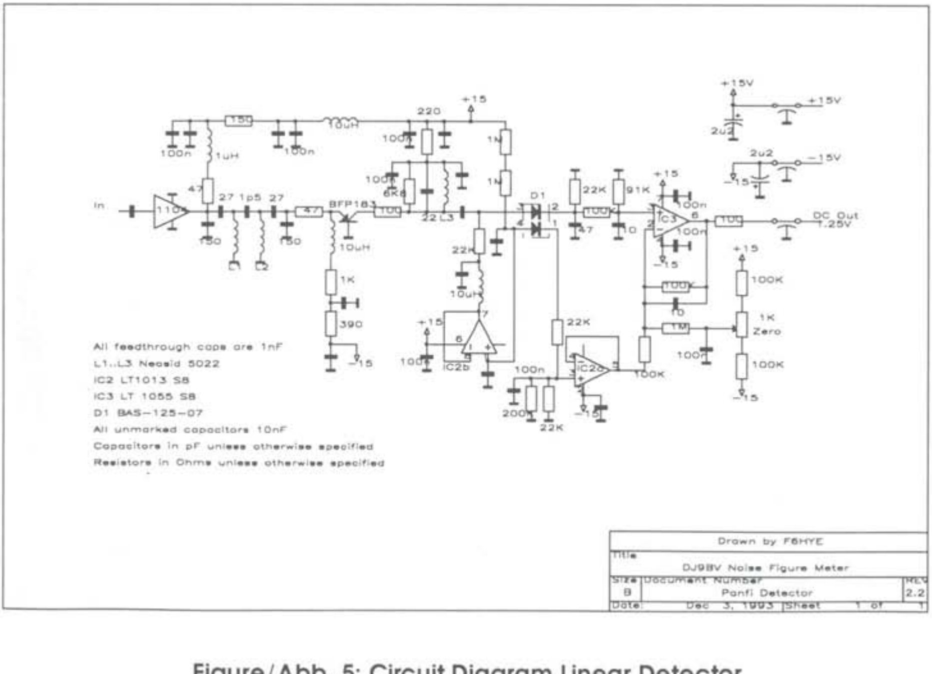
A further amplifier with a MSA-1104 drives the third bandfilter (Fig. 5). A detector driver stage with a BFP183 transistor follows. The driver is operated at 10mA current in a grounded base circuit with high isolation. The highly linear detector uses a BAS125-07 Schottky diode pair in an offset compensating feedback loop (the idea was borrowed from [3]). D1a rectifies the RF-voltage, which is injected by the high impedance collector circuit of the BFP183. D1b is on the same chip and tracks the temperature of D1a. Bias is set by the two 1M resistors to about 7µA. IC2b samples the voltage across D1b and forces the same bias current through D1a. Difference amplifier IC2b subtracts the DC-voltage of D1b to achieve zero output voltage. Because of tight temperature tracking of D1a and D1b offset compensation is effective over a wide temperature range with an error voltage of less than 100µV. Over a range of 7dB the differential linearity is better than ±0,025dB (Figs. 15/16). Input sensivity for the detector is -27dBm for 1.25V DC output. No high power stages are necessary. This reduces spurious level considerably and lowers the thermal load. Construction is on a 72x35mm epoxy double sided PCB in SMD-technique (Fig. 7).

Analog Processor

The analog processor (Fig. 8, 9, 10) has been simplified and a new switching facility for ON/OFF measurements and manual gain control has been added:

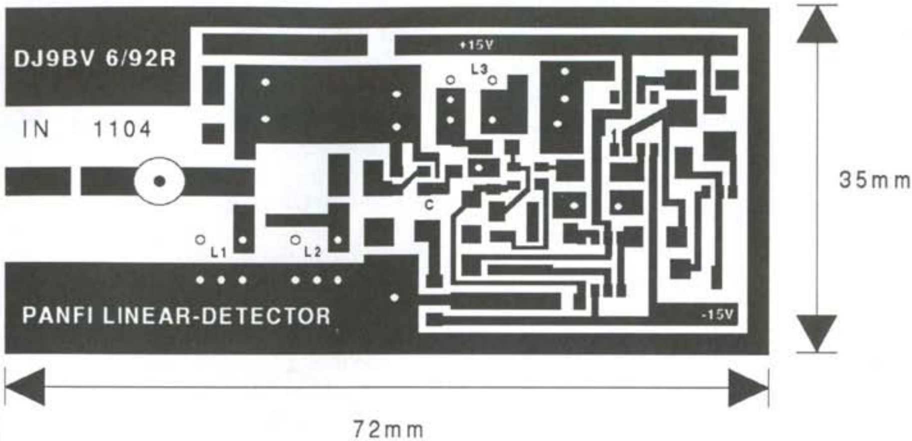
1. CAL: ENR-Calibration sets instrument to ENR of noise source. ENR-range is 3...6dB.
2. AUTO: Instrument measures noise figure. Range 0...10dB.
3. OFF: Manual measurement. Noise source is off. Set manual gain control for convenient indication.
4. ON: Manual measurement. Noise source is on. Indicates Y-Factor.

This provides new measurement capabilities like moon noise monitoring. The OFF/ON modes provide a precision power detector ($U_{DC} = k \cdot U_N^2$) on 29MHz with manual gain control.



Figure/Abb. 5: Circuit Diagram Linear Detector

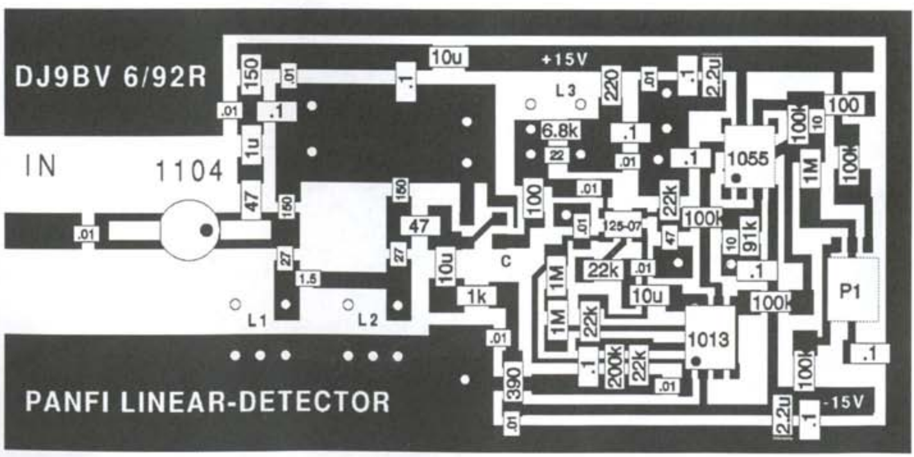
Figure/Abb. 6: PCB Detector



Abgleich

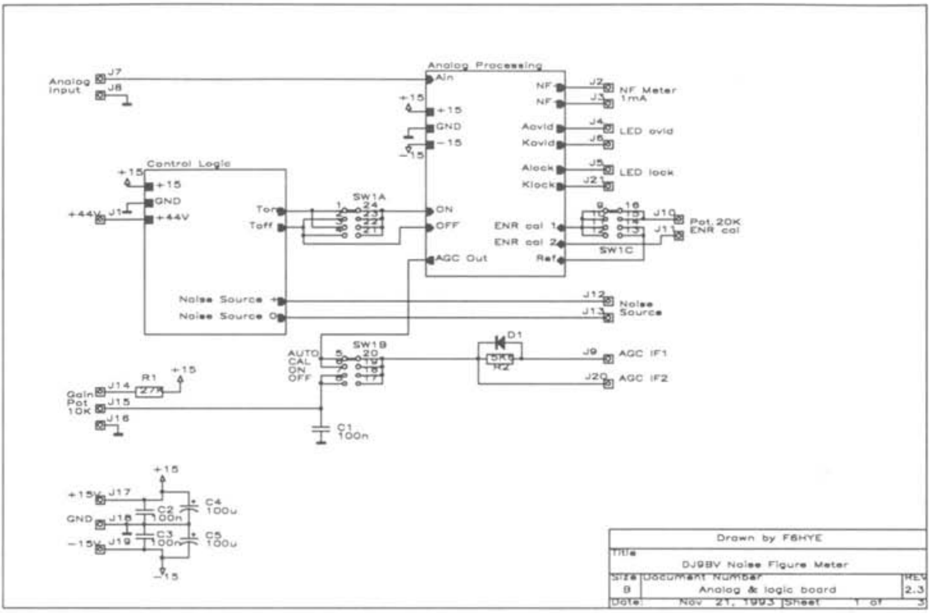
Nach dem Zusammenbau werden alle Spannungen an den MMIC's und aktiven Bauelementen geprüft. Folgende Schritte sind erforderlich:

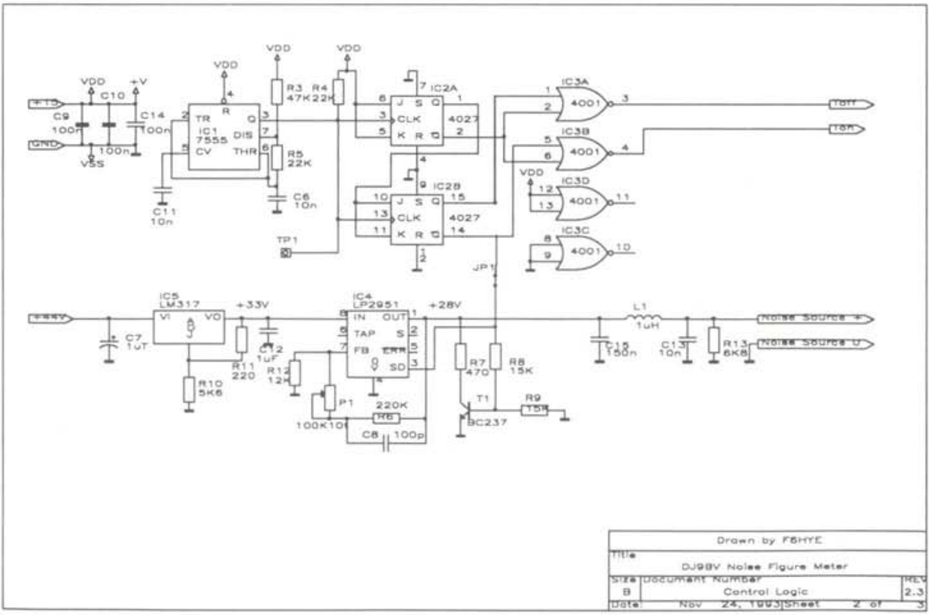
1. PANFI in OFF-Mode schalten
2. Gain Poti auf Maximum
3. Voltmeter an Analog-Out des Detektors anschließen.
4. Eingang des Detektors mit 50Ω abschließen.
5. Zero-Poti auf 0V Gleichspannung einstellen
6. 29MHz Generator mit -27dBm am Eingang des Detektors anschließen.



Figure/Abb. 7: Parts Layout Linear Detector

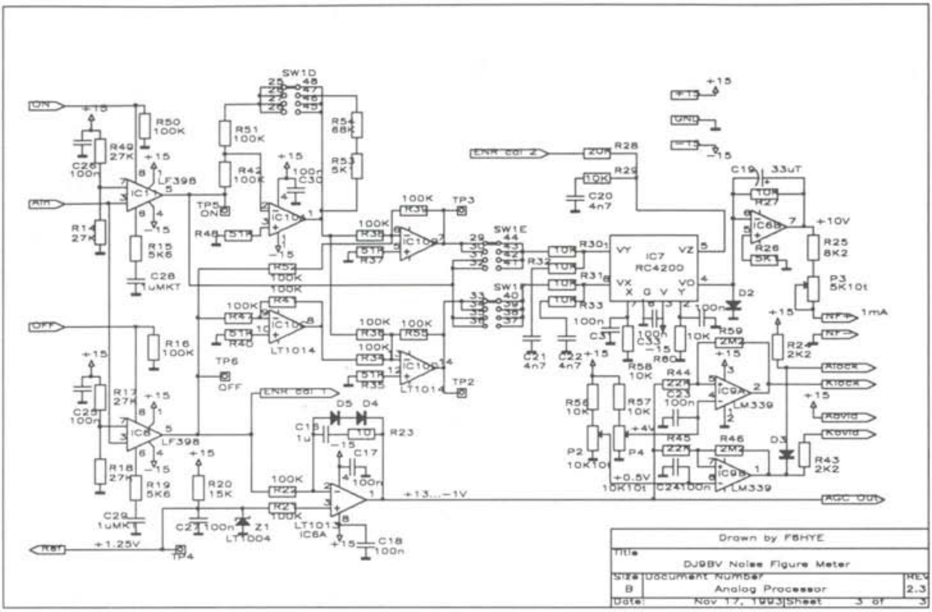
Figure/Abb. 8: Block Diagram Analog Board

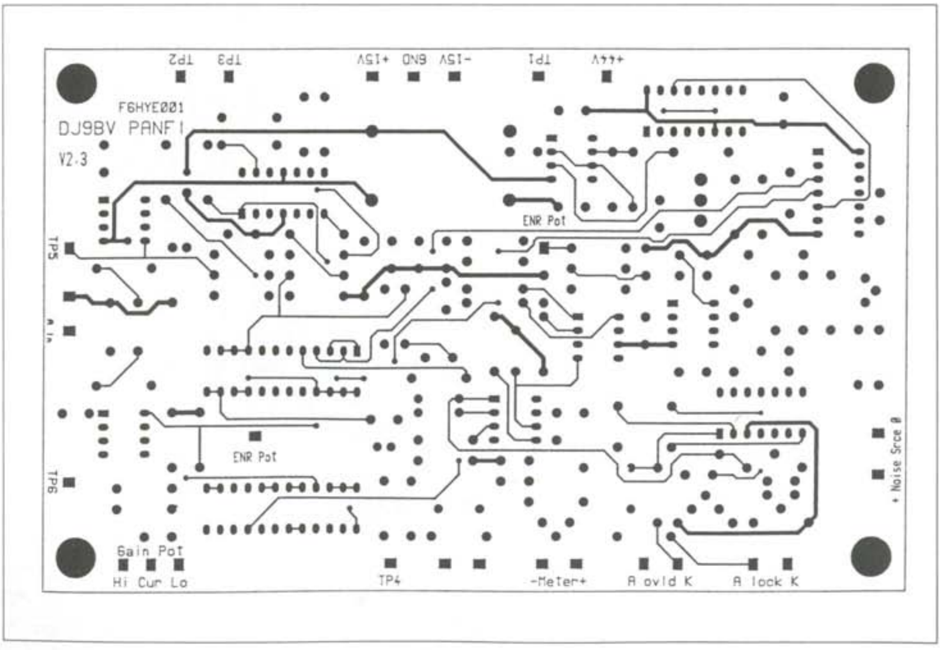




Figure/Abb. 9: Circuit Analog Board Clock Generator

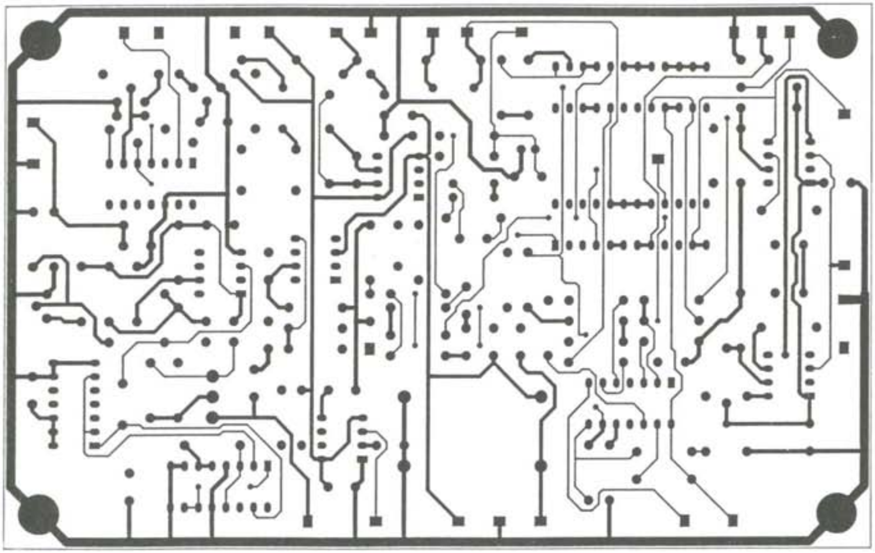
Figure/Abb. 10: Analog Processor

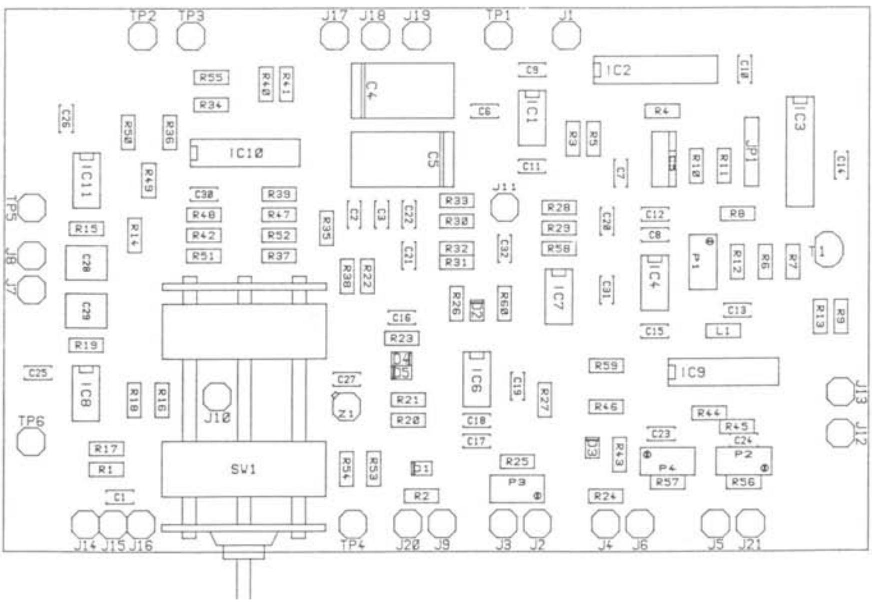




Figure/Abb. 11: PCB Analog Processor (Top Side)

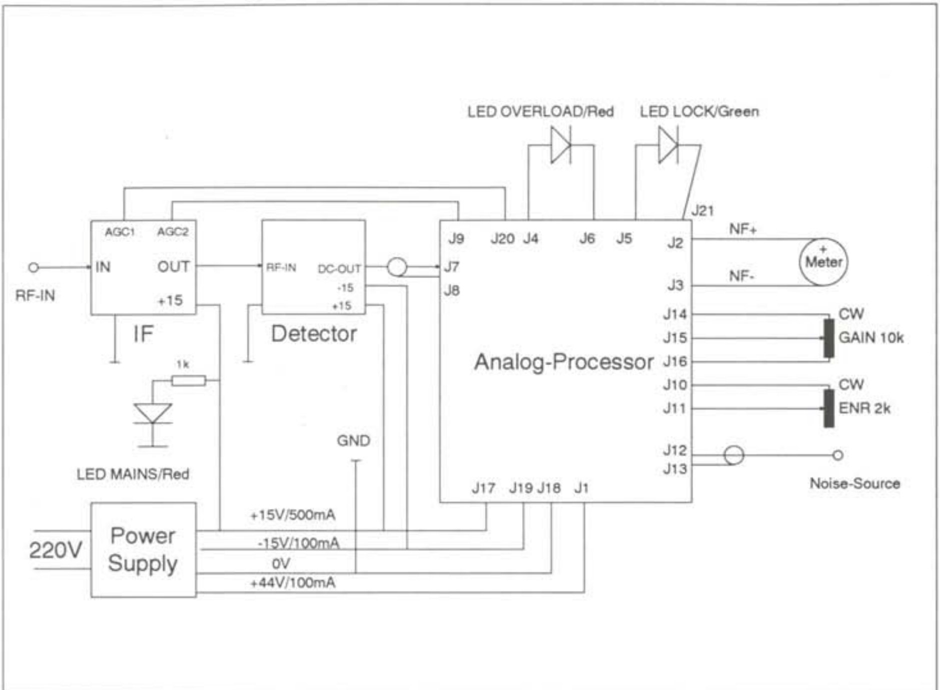
Figure/Abb. 12: PCB Analog Processor (Bottom Side)

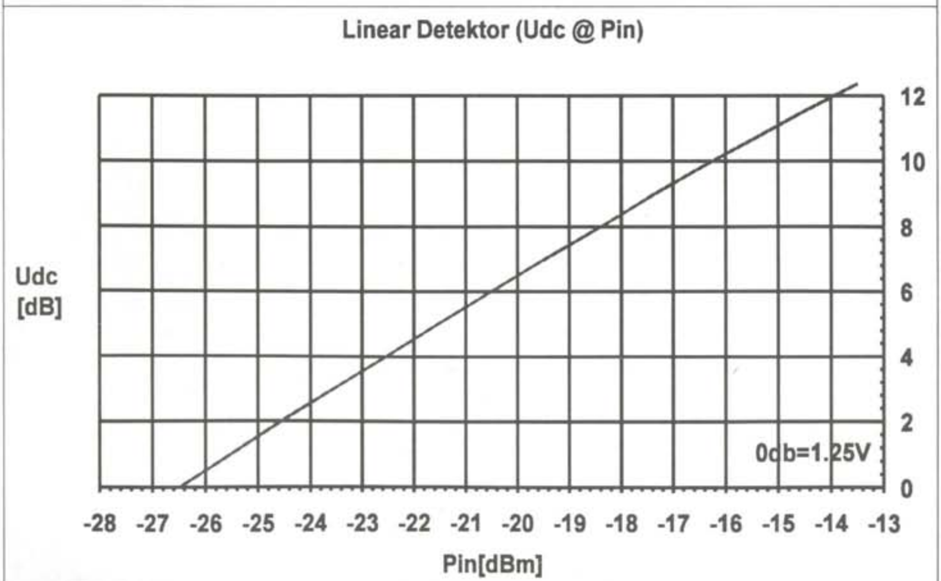




Figure/Abb. 13: Parts Layout Analog Board

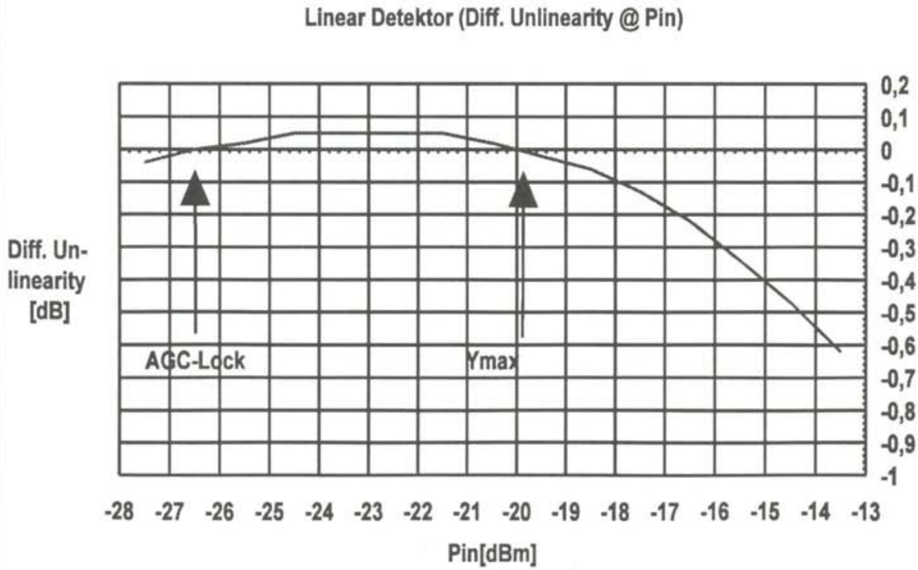
Figure/Abb. 14: Interconnection Diagram





Figure/Abb. 15: Measured Detector Linearity

Figure/Abb. 17: 3dB Bandwidth of IF

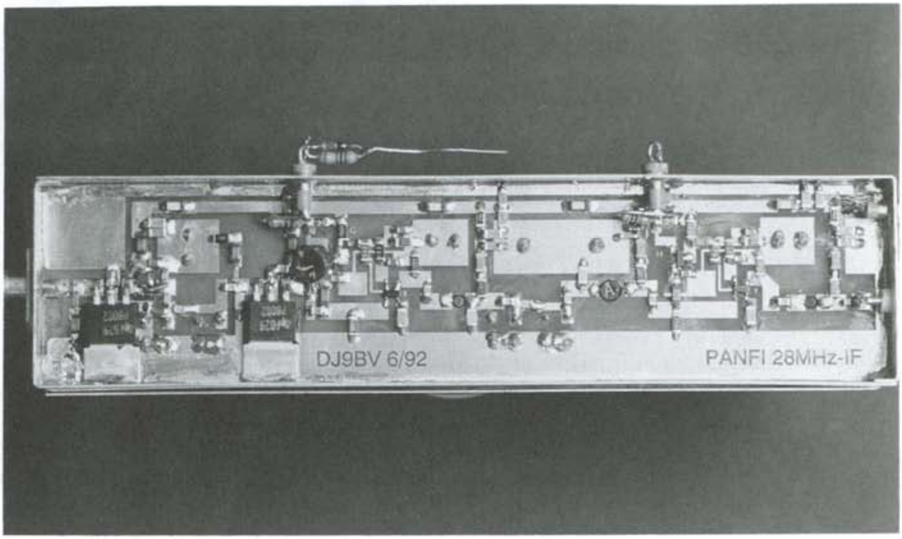


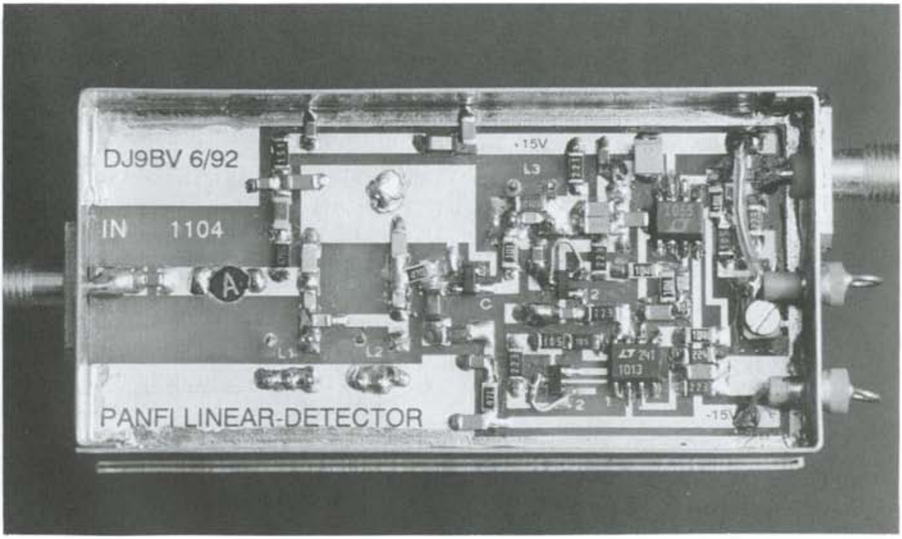
Figure/Abb. 16: Measured Differential Linearity

Figure/Abb. 18: Overall Bandwidth of IF

Figure/Abb. 19: Input Return Loss of PANFI

IF Module (Top View)

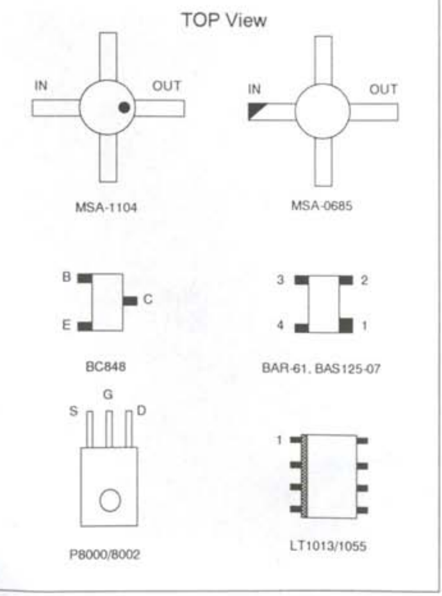




Detector Module (Top View)

Table 4: Misc. Parts

No.	Count	Value
1	2	LED red, 5mm
2	1	LED green, 5mm
3	1	Helipot 2k, 10t
4	1	Helipot 10k, 10t
5	1	BNC-Socket
6	1	N-Socket
7	1	Mains-Switch 1A
8	1	Scale (Photo DJ9BV)
9	1	Instrument 100uA or 1mA, Neuberger RuR 100, Gossen JD069
10	1	Mainsfilter with Socket, 220V,1A + Fuse 0.4A
11	1	Powersupply: 15V reg. /0.5A;-15V reg. /0.1A;44V/0.1A unreg.
12	1	Box Knürr 2.400.001.3
13	1	Front Plate 2.400.120.9



Figure/Abb. 20: Semiconductors

7. Kerne in L1, L2 und L3 auf Maximum drehen. Spannung soll ca. 1,25V betragen.
8. ZF und Detektor verbinden und Generator am Eingang anschließen. Pegel so einstellen, daß ca. 1,25V am Ausgang des Detektors anliegen. Alle Kerne in der ZF (L1...L4) auf Maximum drehen. Pegel soweit reduzieren, daß nicht mehr als 1,25V am Ausgang anliegen.
9. Ausgang des Detektors mit Analog-Prozessor verbinden.
10. PANFI auf CAL schalten
11. Regelspannung messen. Generator von -100dBm in 1dB Stufen auf höhere Leistung schalten. Wenn die Regelspannung von +13V nach unten schwingt, bei einer AGC-Spannung von 3,5V den Pegel festhalten und AGC-Lock Einstellung P4 auf Anzeige justieren.
12. Pegel um 55dB erhöhen und P2 auf Overload-Anzeige einstellen.
13. Rauschquelle anschließen. JP1 ziehen und P1 am 2951 auf 28±0,1V einstellen. JP1 wieder stecken.
14. Konverter, Vorverstärker mit Rauschquelle anschließen. AGC-Lock Lampe muß aufleuchten. ENR-Einstellung auf Rechtsanschlag drehen und P3 auf 100% (3dB) einstellen. Dann aktuelle ENR einstellen und durch Schalten auf Auto die Rauschzahl messen.

Alignment

After finishing construction connect power supply with ±15V and check all active devices for correct voltages and the overall circuit for signs of 'smoke'. The following steps have to be performed for alignment:

1. Switch PANFI to OFF.
2. Set gain to max (CW).
3. Measure DC-voltage at output of detector.
4. Connect 50Ω load to input of detector.
5. Adjust ZERO-pot to 0V reading (±1mV).
6. Connect 29MHz source with -27dBM at input of detector.
7. Adjust cores in L1, L2 and L3 to maximum voltage at output of detector.
8. Connect IF and detector. Adjust level for 1.25V DC on output of detector. Adjust cores in L1...L4 to maximum reading. During the alignment reduce generator output level to stay at about 1.25V DC voltage at detector output.

Table 1: Parts Analog Processor

Item	Count	Referenz	Value	Manufact.
1	17	C1,2,3,9,10,14,17,18,23,24,25,26,27,30, 31,32,33	100n	Div.
2	2	C4,5	100µ	Div.
3	3	C6,11,13	10n	Div.
4	2	C7,12	1µ T/50V	Div.
5	1	C8	100p	Div.
6	1	C15	150n	Div.
7	1	C16	1µ	Div.
8	1	C19	33µ T	Div.
9	3	C20,21,22	4n7	Div.
10	2	C28,29	1µ MKT	Div.
11	1	D1	1N4148	Div.
12	4	D2,3,4,5	1N4148	Div.
13	1	IC1	7555	NS
14	1	IC2	4027	Div.
15	1	IC3	4001	Div.
16	1	IC4	LP2951C	NS
17	1	IC5	LM317T	NS
18	1	IC6	LT1013DN	LT
19	1	IC7	RC4200ANB	Ray
20	2	IC8,11	LF398N	NS
21	1	IC9	LM339N	NS
22	1	IC10	LT1014DN	LT
23		J1,TP1,J2,TP2,J3,TP3,J4,TP4,J5,TP5,J6,TP 6,J7,J8,J10,J11,J12,J13,J14,J15.J16, J17,J18,J19,J20,J21	Veropin	Div.
24	1	JP1	Jumper	
25	1	L1	1µH	
26	1	P1	100k, 10t	
27	2	P2,4	10k, 10t	
28	1	P3	5k (50k*), 10t	
29	10	R27,29,30,31,32,33,56,57,58,60	10k, 1%	
30	2	R3	47k, 2%	
31	4	R4,5,44,45	22k, 2%	
32	1	R6	220k, 2%	

Table 1: Parts Analog Processor

Item	Count	Referenz	Value	Manufact.
33	1	R7	470, 2%	
34	3	R8,9,20	15k, 2%	
35	4	R2,10,R15,R19	5k6, 2%	
36	1	R11	220, 2%	Div.
37	1	R12	12k, 2%	Div.
38	1	R13	6k8, 2%	Div.
39	5	R1,14,17,18,49	27k, 2%	Div.
40	14	R16,21,22,34,36,38,39,41,42,47,50,51, 52,55	100k, 1%	Div.
41	1	R23	10, 2%	Div.
42	2	R24,43	2k2, 2%	Div.
43	1	R25	8k2 (82k*), 2%	Div.
44	2	R26,53	5k1, 1%	Div.
45	1	R28	20k, 2%	Div.
46	4	R35,37,40,48	51k, 2%	Div.
47	2	R46,59	2M2, 2%	Div.
48	1	R54	68k, 1%	Div.
49	1	SW1 (4x6)	SBL11/SBL15	ITT-Alcatel
50	1	T1	BC237 (BC547)	Div.
51	1	Z1	LT1004-1.2CZ, LM385Z-1.2	LT, NS

* For 100µA Instrument!

9. Connect output of detector to analog processor.
10. Switch to CAL.
11. Measure AGC voltage at analog processor. Adjust generator to -100dBm and increase level in 1dB steps. When approaching AGC-Lock the AGC voltage swings down from 13V. Hold level at about 3.5V AGC voltage and adjust indicator AGC-Lock for light on. (P4).
12. Increase input level for 55dB. Adjust Overload indicator to lit (P2).
13. Connect noise source. Remove jumper JP1 and adjust P1 at 2951 regulator to 28V±0.1V at noise source BNC-connector. Reconnect JP1.
14. Connect preamp, converter, and noise source. Mode switch to CAL. AGC-Lock LED must switch ON. This indicates that there is enough gain in the system. Adjust ENR-pot to fully CW. Adjust P3 to F.S. reading (3dB). Then adjust ENR-pot to actual ENR of noise source, switch to AUTO and measure NF.

References

[1] R. Bertelsmeier, DJ9BV, "Novel Approach to Noise Figure Measurement", DUBUS 2/1990, pp.2-11

[2] R. Bertelsmeier, DJ9BV, H. Fischer, DF7VX, "Construction of a Precision Noise Figure Measurement System", DUBUS 2/1990, pp.12-22 & DUBUS 3/1990, pp.13-31, & DUBUS 4/1990, pp.37-40

Table 2: Parts IF

No.	Count	Value
1	8	SMD 100n
2	26	SMD 10n
3	3	SMD 150p
4	3	SMD 27p
5	1	SMD 47p
6	1	SMD 56p
7	2	SMD 1.2p
8	1	FT 1000pf
9	2	SMD 18Ω
10	3	SMD 47Ω
11	1	SMD 150Ω
12	2	SMD 330Ω
13	6	SMD 1k
14	2	1k axial lead RM7.5
15	2	SMD 1.8k
16	2	SMD 2.2k
17	2	SMD 4.7k
18	3	SMD 5.6k
19	2	SMD 100k
20	1	SI R6.3N30 Toroid, 3x5t
21	3	SMD 1uH
22	9	SMD 10uH
23	4	Neosid 5022, 1.1μH
24	2	TI P8000/8002 (BF246A)
25	2	HP MSA-0685
26	1	HP MSA-1104
27	2	SI BAR-61
28	2	SI BC848 SMD-NPN
29	2	SMC Socket
30	1	PCB IF
21	1	Tinplate Box 35x30x145

[3] H. Swain, H.M. Cox, "Noise Figure Meter Sets Record for Accuracy, Repeatability, and Convenience", Hewlett Packard J., April 1980, pp. 23-32

Table 3: Parts Detector

No.	Count	Value
1	8	SMD 100n
2	11	SMD 10n
3	2	SMD 150p
4	2	SMD 27p
5	1	SMD 22p
6	1	SMD 47p
7	1	SMD 1.5p
8	2	SMD 10p
9	2	SMD 47Ω
10	2	SMD 100Ω
11	1	SMD 220Ω
12	2	SMD 390Ω
13	1	SMD 1k
14	4	SMD 22k
15	1	SMD 91k
16	5	SMD 100k
17	2	SMD 1M
18	2	SMD 2.2μF
19	2	FT 1000pF
20	1	SMD Pot 1k
21	1	SMD 1uH
22	3	SMD 10uH
23	3	Neosid 5022, 1.1μH
24	1	LT1013S8
25	1	LT1055S8
26	1	HP MSA-1104
27	1	SI BAS125-07
28	1	SI BFP183 SMD-NPN
29	2	SMC Socket
30	1	Tinplate Box 35x30x74

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Parts

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Acknowledgements

I have to thank Axel Bünning, **DF1XB** for producing the layouts from my PS-output and Rainer Jäger, **DC3XY** for providing kits for the PANFI. I'm especially indebted to my friend Patrick, **F6HYE,** for doing the layout of the analog processing PCB and the circuit drawings. Without their help this work would not have been possible.

Danksagung

Ich danke Rainer Jäger, **DC3XY**, für die Zusammenstellung der Kits, und Axel Bünning, **DF1XB**, für die Erstellung der Layouts. Besonderen Dank gebührt Patrick, **F6HYE,** für die Erstellung des Layouts der Analog-Platine und die Zeichnung der Schaltungen.

Appendix A: ENR Calibration Range

The normal version is designed for 3dB minimum ENR. The scale for ENR calibration runs parallel to the NF scale. Therefore the useful range for ENR calibration is +5dB up from minimum with 0.1dB scale ticks. For low ENR sources the range can be adjusted by changing R54 and R53.

ENR-Calibration Range			
ENR_{min} [dB]	R_{cal} [k]	R53	R54
0	141.42	2k4	39k
1	150.30	3k3	47k
2	160.78	4k7	56k
3	173.07	5k1	68k

Appendix B: Instrument

To accomodate an instrument with 100µA F.S. the resistor R25 has to be changed to 82k and the pot P3 to 50k.

TECHNIK III

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San Diego Intl. Microwave Convention

W. Pittelkow, DL6TN

Sängerstr. 18, D-88069 Tettnang

Introduction

During the week of May 22 to 29 about 7000 attendees listened to 4000 presentations, discussed 120 papers in 17 workshops and over 60 poster sessions or strolled around in the exhibition hall with 400 exhibits. The predominating topic was the 'dual use', the application of new hardware for military and commercial use as well. This is a must after the end of the 'cold' war and subsequent reduced spending for defense. Therefore also amateurs can exploit the tremendous progress in microwave technology. Even if the freqency bands of commercially applicable and components differ from amateur freqency allocations the hardware is often so wideband that amateurs can use it in their portions of the spectrum.

Outstanding examples of increasing integration level in microwave monolithics is a single chip 2.4GHz transceiver. HBTs are coming up because of lower cost, low operating voltage, better efficiency for a -30dBc IMD spec and their good linearity. The GaAs-Silicon war has just started.

Microwave Components

A 0.15µm T-shaped AlInAs/InGaAs HEMT with NF=0.9dB, 7dB gain at 60GHz has been developed by Mitsubishi (1). At the same frequency a basic building block power module with 0.8W output power has been described by TRW (2). To improve IC performance further shortening of gate length is necessary. NTT LSI labs announced a 0.1µm gate-length GaAs MESFET for both ultra-high speed digital and analog ICs showing a 48GHz divide-by-four dynamic freqency divider (3). HBT (Heterojunction-Bipolar-Transistor) technology stands for high gain at low power consumption. TRW presented a 4 stage 12GHz amplifier with a gain/power consumption ratio figure of merit of 2.5dB/mW which is presently the highest figure for a self-biased amplifier benchmarked on this frequency (4) fig.1.

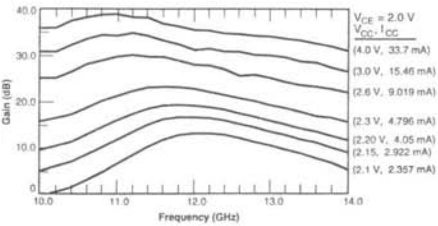


Fig. 1: X-Band Gain

Receiver

A MMIC single chip with 1.4x2.79mm die size packed in a QSOP-24 plastic package containing a 2.4GHz transceiver with a 4.7dB noise figure comes from M/A-Com (5). A transmitter power amplifier in the same size deliver 21dBm, fig. 2. A very interesting design of a downconverter shows Fujitsu (6). At 60GHz a four stage amplifier with 0.15µm HEMTs has a noise figure of 6.8dB. The image rejection active

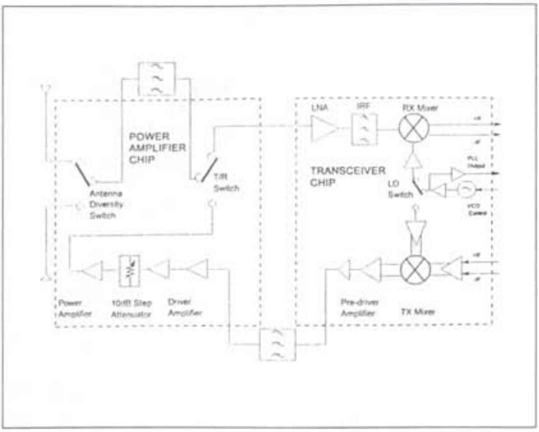


Fig. 2: Chip Set Block Diagram

HEMT mixer has a conversion gain of 15.5dB and transverts the 60GHz RF directly to an IF of 140MHz with an image rejection of 20dB and is driven by a 8dBm LO source, fig.3.

An increasing number of microwave amateurs not only wants to rebuild some already proven equipment design but are also interested to have some insight into the secrets of microwave circuit design. Furthermore they want to measure their homebrew circuits. A wideband, 2...52GHz amplifier one a single chip from Alcatel may be helpful (7). This amp is a matrix distributed amplifier, fig. 4, combining the advantages of additive and multiplicative amplification. Distributed amplifiers are already available (8), fig. 5, at a cost level of DM3000,- and up.

Transmitter

TRW reports on a W-band (94GHz) source module MMIC with a 4GHz tuning bandwidth consisting of a 23.5GHz HBT VCO, a 23.5 to 47GHz HEMT doubler, a 47GHz two stage buffer amplifier and a 47 to 94GHz HEMT doubler. Then a three -stage amplifier delivers 3dBm at 94GHz with a phase noise of -90dBc/Hz at 1MHz offset (9), fig. 6.The complete module with three chips has an area of 10...12mm^2. Raytheon has developed a high efficiency 40 Watt PsHEMT S-band (2.5GHz) MIC power amplifier with a gain of 13dB, 57% PAE, which is biased at 8V (10), fig. 7. An 8mW coplanar monolithic integrated 75GHz oscillator using GaAs HFET is from Fraunhofer in Freiburg (11) with an outer dimension of 5x6cm.

For the purpose to replace TWT amplifiers by solid state devices Mitsubishi developed a noval constant-resistance network and a parallel resonant circuit as input and output matching circuits with a low impedance interstage network to achieve ultra-broad bandwidth of 4 to 25GHz and a o.5W output power (12), fig8. Another approach to achieve high output power on high freqencies was selected by Martin Marietta (13). A 16-way combination of 31.3GHz MMIC amplifiers and 16 step recovery diode triplers deliver 1.6 Watt at 94GHz to a combining W-band waveguide network producing 1 Watt output power over a 500MHz bandwidth, fig. 9. Direct applicable to the amateur 43GHz band is TRWs 1 Watt Q-band class A PsHEMT MMIC amplifier (14). The two satge amplifier is broadband from 40 to 46GHz and has a gain of 12dB with a chip size of 3x5mm.

Others

Cyrogenic Amplifiers:

Low noise hunters may improve their front end amplifiers by cooling them. For example a GaAs-FET wideband amplifier has a noise figure of 2dB on 24GHz at room temperature. Cooled down to -55°C it provides a noise figure of 1.3dB and at

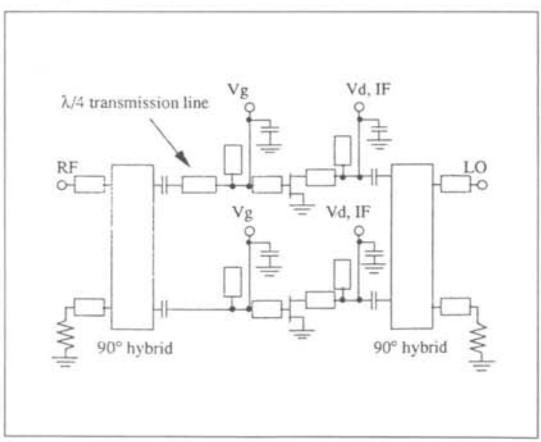


Fig. 3: Image Rejection Active Mixer

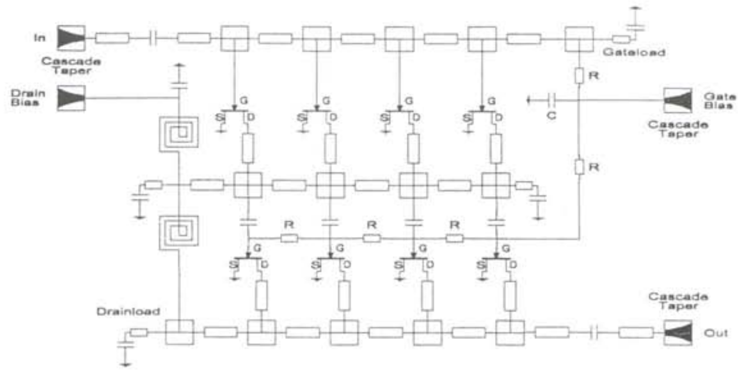


Fig. 4: Distributed Matrix Amplifier

-210°C (liquid nitrogen) it's possible to get a noise figure of 0.7dB. The table below shows noise figures of cooled commercial amplifiers (Miteq). The main problem is to handle the mechanical stress at cyrogenic temperatures.

Superconducting Circuits:

For most conductors and semiconductors the resistance decreases with decreasing temperature. Superconductors like Niobium exhibit a virtually zero resistance when cooled to below 9K. In 1986 new materials were found which 'jump' to zero resistance at 70K (HTS=High Temperature Superconductors). This discovery promised a new line of HTS-microwave components with extremely low loss. Until today this hope has not really matured, but some filter circuits with high Q elements have been developed. These are quite expensive and somewhat esoteric for amateurs. Nev-

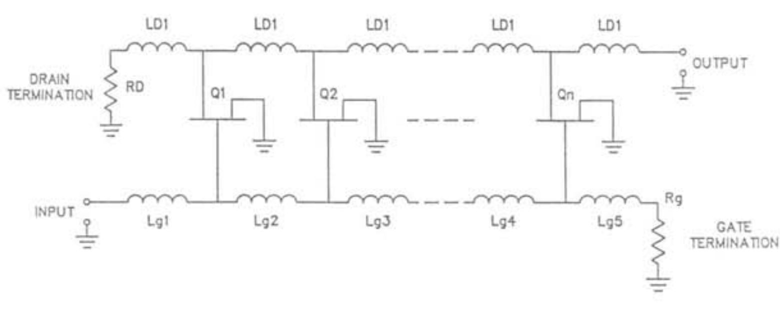


Fig. 5: Cascaded Amplifier

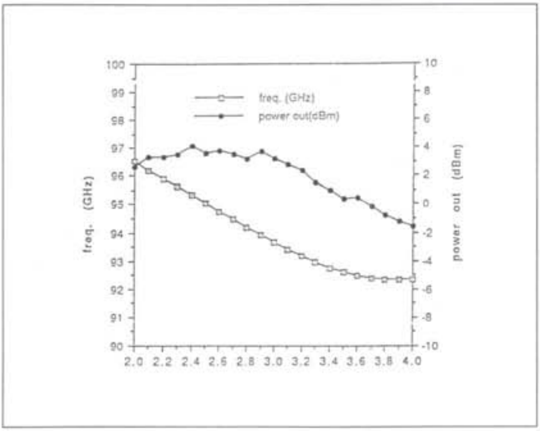


Fig. 6: W- Band Source Module

ertheless some 100 experts attended the two workshops on CAD design os Superconducting Microwave Components and High Power Superconducting Microwave Technology.

Conclusion

Most of the hardware described is presently in the state of R&D and not available at reasonable cost. Only if market demands raise the need for high volume microwave products - like the high volume DBS-Receiver front ends influenced amateur X-band front ends some years ago - microwave amateurs will have a chance to participate in the progress of microwave technology. Experts in San Diego forecast a future market demand on Automotive Microwave Equipment (Anti-Collision systems for example) and on new household communications systems. MMIC technologies will play a major role in these developments.

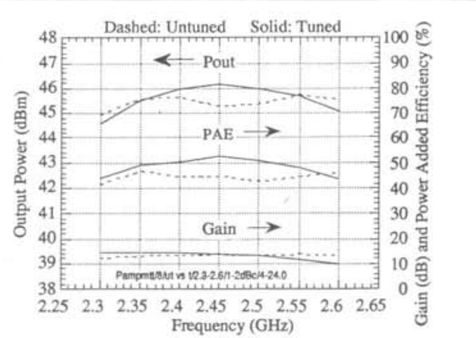
Deutsche Version

Einführung

Vom 22.bis 29. Mai besuchten etwa 7000 Teilnehmer 400 Vorträge, 17 Workshops mit 120 Diskussionsbeiträgen und ca. 60 Postersessions, oder sie streiften durch die Ausstellungshalle mit 400 Ständen. Generalthema war die "dual use", die Nutzung neuer Hardware für zivilen und militärischen Einsatz nach Ende des kalten Krieges und Reduzierung der Verteidigungsausgaben. Damit werden auch die Amateure mehr von dem rasanten Fortschritt profitieren. Die Hardware ist oft so breitbandig, daß sie auch von Amateuren benutzt werden kann. Hervorragendes Beispiel fortschreitender Komponentenintegration ist ein 2.4GHz-Transceiver auf einem Chip. HBTs sind auf dem Vormarsch wegen niedrigerer Kosten, geringerer Betriebsspannung, höherem Wirkungsgrad und guter Linearität. Der GaAs-Siliziumkrieg hat bereits begonnen.

Mikrowellen-Komponenten

Einen 0.15μ HEMT mit F=0.9 dB und G=7 dB bei 60 GHz stellt Mitsubishi vor (1). Bei gleicher Frequenz hat TRW einen Leistungsmodul mit 0.8 Watt HF- Leistung entwickelt (2). An der Verkürzung der Gate-Länge wird intensiv gearbeitet. NTT LSI berichtet über einen 0.1μ MESFET für Höchstfrequenz-ICs, z.B. zur Verwendung als 4-zu-1-Teiler bei 48 GHz (3). HBT-(Heterojunction-Bipolar-Transistor) Technologie bedeutet auch hohe Verstärkung bei niedrigem Stromverbrauch. TRW erreichte einen neuen Rekord mit einem 4-stufigen 12 GHz-Verstärker, der 2.5 dB pro mW macht (4), Fig.1.



Measured Frequency Response of the 40 W Power Amplifier Utilizing 24 mm Devices Over a 2.3-2.6 GHz Band. Vds = 8V, Vgs = -0.45V.

Fig. 7: 2.3GHz 40W Amplifier

Empfänger

Von M/A-Com (5) kommt ein 2.4 GHz Transceiver mit einer SSB- Rauschzahl von 4.7 dB, plaziert auf einem 4 Quadratmillimeter-Chip und verpackt in einem QSOP-24- Plastikgehäuse! Gleich groß ist die Senderendstufe mit 21 dBm, Fig.2. Einen 4-stufigen Verstärker mit Rauschzahl 6.8 dB bei 60 GHz hat Fujitsu (6) entwickelt. Besonders interessant macht ihn der nachfolgende Abwärtsmischer, der jeweils an Ein- und Ausgang einen 90° Hybrid hat und damit extrem hohe Spiegelselektion ermöglicht. Der aktive HEMT-Mischer verstärkt das Signal mit 15.5 dB und setzt es bei 8 dBm LO- Leistung auf die ZF von 140 MHz um. Die Spiegelunterdrückung beträgt dann immer noch 20 dB, Fig.3.

Eine wachsende Zahl von Amateuren scheint nicht nur erprobte Schaltungen nachbauen zu wollen, sondern auch auf dem Mikrowellengebiet anspruchsvolle Messungen selbst zu machen. Sie müssen daher ihre meist schon älteren Geräte zu höheren Frequenzen erweitern. Dabei wäre z.B. ein Breitbandverstärker von Alcatel (7) hilfreich, so er einst bezahlbar sein wird. Er deckt den Bereich von 2 bis 52 GHz ab und ist mit acht Transistoren als addierender und multiplizierender Matrixverstärker aufgebaut, Fig.4. Kaskadierte rauscharme Breitbandverstärker, Fig.5, sind bis etwa 20 GHz auf dem Markt verfügbar (8), allerdings für 3000 DM und aufwärts!

Sender

TRW hat einen Oszillator mit Vervielfacher und Endverstärker für das W-Band (94 GHz) entwickelt. Ein MMIC enthält den 23.5 GHz HBT VCO, der um 1 GHz verstimmt werden kann. Das zweite MMIC enthält einen HEMT-Verdoppler, einen zweistufigen 47 GHz-Verstärker und einen weiteren HEMT- Verdoppler, der 94GHz liefert. Ein drittes Chip enthält einen dreistufigen Verstärker, der eine HF-Leistung von 3 dBm bei 94 GHz liefert mit einem Phasenrauschen von -90 dBc/Hz in 1 MHz Abstand. Verpackt nehmen die drei Chips etwa 10mm x 12mm ein (9), Fig.6. Raytheon hat einen 40 Watt Leistungsverstärker im 2.5 GHz- Band mit PsHEMTs entwickelt. Der MIC hat bei 8 Volt Versorgungsspannung 13 dB Verstärkung und einen besonders hohen Wirkungsgrad von 57% (10) Fig.7 Fraunhofer in Freiburg hat mit GaAs HFETs einen koplanaren monolitisch integrierten 75 GHz Oszillator vorgestellt. Gehäuseabmessungen 5 x 6 cm (11). Um TWT-Verstärker durch Halbleiter zu ersetzen entwickelte Mitsubishi einen Ultra- Breitbandverstärker mit 0.5 Watt zwischen 4 und 25 GHz und verwendet dabei neuartige Widerstands- und Parallelresonanz- Netzwerke (12) Fig.8. Einen anderen Weg zu Mikrowellen-Leistungsverstärkern wählte Martin Marietta (13): 16 MMIC-Verstärker werden bei 31.3GHz parallel angesteuert, 16 nachfolgende Step-Recovery- Dioden verdreifachen auf 94 GHz und die Einzelleistungen werden anschließend duch ein Hohlleiternetzwerk addiert, Fig.9. Unmittelbar im 43 GHz-Amateurband anwendbar sein, dürfte ein von TRW kommender 1 Watt PsHEMT MMIC-Verstärker (14). Der zweistufige Verstärker ist breitbandig von 40 bis 46 GHz, hat 14 dB Verstärkung und ist auf einem Chip von 3mm x 5mm untergebracht.

Sonstiges

Kryogene Verstärker:

Rauschzahl-Rekordjäger können ihre Empfänger-Vorverstärker durch Kühlung verbessern. Ein Breitband-GaAsFET-Verstärker habe z.B. bei 24 GHz und 25°C eine Rauschzahl von 2 dB. Bei -55°C geht die Rauschzahl dann auf 1.3 dB runter und bei -210°C erreicht sie 0.7 dB. Tabelle 1 zeigt die Rauschzahlen und die Verstärkung eines marktgängigen (Miteq) Verstärkers zwischen 4

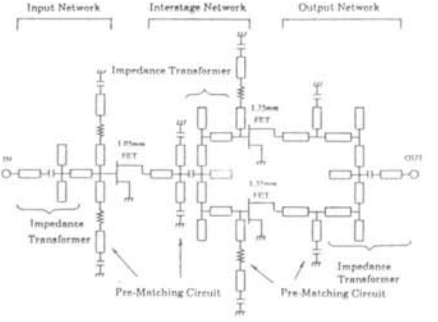


Fig. 8: Lossy Match Power Amplifier

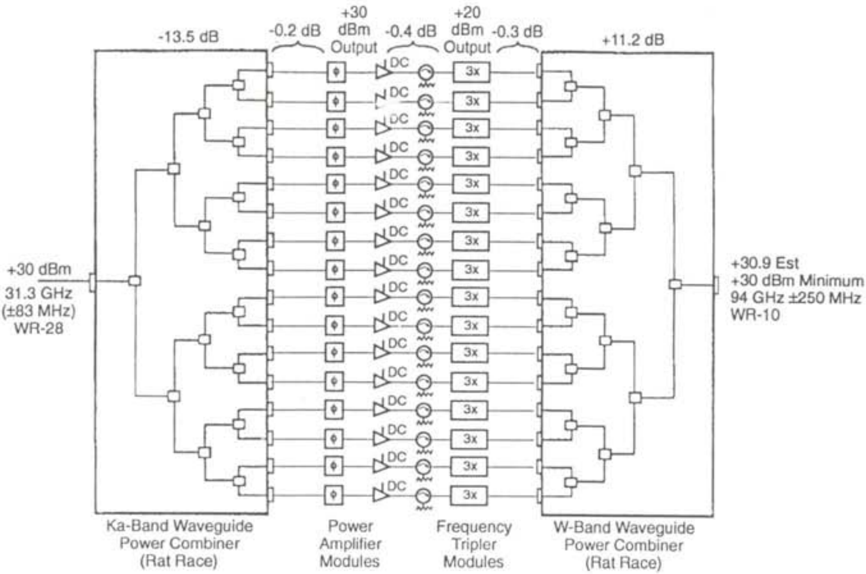


Fig. 9: 94GHz Transmitter Diagram

und 8 GHz bei verschiedenen Temperaturen. Allerdings reicht Kühlung nicht allein. Schon bei der Konstruktion von Platine und Gehäuse muß gegen mechanische Temperaturspannungen vorgesorgt werden.

Supraleiter:

Kontinuierliche Abkühlung wird bei veschiedenen Leitern und Halbleitern von einer kontinuierlichen Verringerung ihres Widerstandes begleitet. Supraleiter wie Niobium zeigen einen abrupten Rück-

AFS3-04000800-CR S/N 273212

FREQ (GHz.)	Noise Figure at 77° K (amp. immersed in liq. N_2)	Noise Figure at 20° K (amp. in liq. Helium)	Gain (dB) at 20° K
4,0 - 8,0	(0,8 at 25°C)		(30 at 25°C)
4.0	0.27	0.21	33.30
4.5	0.24	0.17	32.56
5.0	0.29	0.18	32.10
5.5	0.24	0.15	32.93
6.0	0.16	0.12	32.30
6.5	0.17	0.13	32.32
7.0	0.16	0.12	32.15
7.5	0.21	0.16	32.45
8.0	0.23	0.16	32.06

Table 1: Noise Figures at cyrogenic Temperatures

gang ihres Widerstandes auf nahe Null bei 9 Grad Kelvin. Als 1986 neue Supraleiter entdeckt wurden, die ihre Sprungtemperatur bei 70 Grad K haben (HTS High Temperature Superconductor), war die Hoffnung groß, neue HTS Mikrowellenbausteine entwickeln zu können. Das ist jedoch bis heute nicht der Fall. Lediglich einige Filter und Resonanzkreise mit extrem hohen Güten wurden gebaut, jedoch ohne Kostenattraktion für Amateure (15). Immerhin trafen sich etwa 100 Experten bei zwei Workshops zu den Themen CAD von supraleitenden Mikrowellen-Komponenten und Hochleistungs-Mikrowellentechnologie mit Supraleitern.

Resümee

Die meiste der vorgestellten Hardware befindet sich im Status der Vorentwicklung und ist nicht zu akzeptablen Preisen zu haben. Nur wenn sich für neue Mikrowellen- Systeme eine grosse Nachfrage entwickelt, wie vor einigen Jahren für Fernseh-Satellitenempfänger im X-Band, kann der Amateur hoffen, mit preiswerten Komponenten am Fortschritt der Mikrowellentechnologie teilzunehmen. Experten in San Diego sagten eine neue Marktnachfrage voraus bei Mikrowellensystemen für das Auto und für die Haus- und Büro- Kommunikation. MMIC-Technologie wird dabei wohl die Hauptrolle spielen.

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(3) " p.1629
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(5) 1994 IEEE MMWMC Digest p.11
(6) " p.77
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(10) " p.667
(11) " p.135
(12) " p.257
(13) " p.305
(14) " p.805
(15) " p.101

IEEE Institut of Electrical and Electronical Engineers

MTT-S Microwave Theory and Techniqüs Society

MMWMC Microwave and Millimeter-Wave Monolithic Circuits

DJ9BV Powermeter PCB Available

Because of many requests a second production of the PCB of the DJ9BV power meter published in DUBUS Technik III, pp. 80-95, is available now in limited quantities. The professional PCB, double-sided with plated through holes is drilled and measures 95x170mm. Price is DM 40,- prepaid by EURO-cheque or cash inside Europe. Outside Europe please send US$30.00.

Special Parts Kits and a full size photo scale are available from DC3XY, Rainer Jäger, Breslauer Str. 4, D-25479 Ellerau (Tel.: (++49)4106-73430)

DJ9BV Wattmeter Platine

Wegen vieler Nachfragen gibt es nun eine zweite, begrenzte Auflage der Platine des DJ9BV Wattmeters aus DUBUS Technik III, S. 80-95. Die professionelle Platine ist doppelseitig, mit galvanisierten Durchkontaktierungen, gebohrt bzw. gefräst und verzinnt. Die Abmessungen sind 95x170mm. Bestellung nur per Vorkasse von DM 40,- auf das DUBUS Postscheckkonto (Siehe S. 3) oder per Euro-Scheck an den Verlag. Bitte Ihre Adresse genau angeben.

Teile-Bausätze und Original Fotoskalen sind von Rainer Jäger, DC3XY, Breslauer Str.4, D-25479 Ellerau (Tel.: 04106-73430) erhältlich.

HEMT Preamplifier for 10GHz

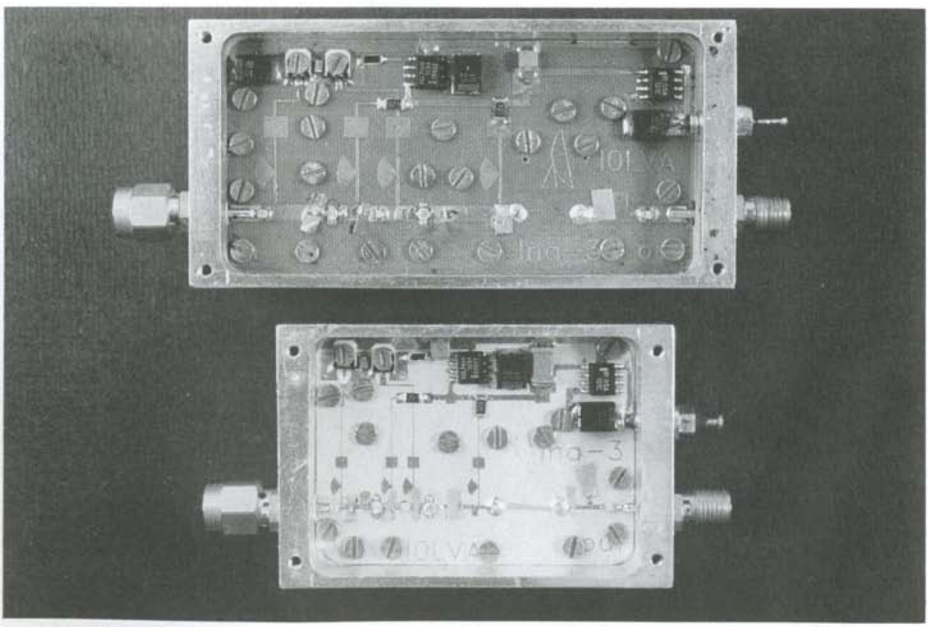
Silvano Ricci, I0LVA

Abstract: After developing a 10 GHz/2.5 W amplifier (A forthcoming DUBUS publication), the need was felt to improve the reception capability. The result (after two solutions, one on micro-stripline and the other in the air by means of a reference block) is the two-stage preamplifier, which is shown in the photograph. The devices which have been used are HEMT MGF4317D in the first stage and the GaAs-Fet MGF1303B in the second stage. Gain is about 18 dB and the noise figure is about 1 dB.

Kurzfassung: Nach der Entwicklung eines 10 GHz/2,5 W Endverstärkers (Wird in der DUBUS veröffentlicht), wurde ein zweistufiger LNA entwickelt, der in der ersten Stufe mit einem MGF-4317D HEMT und in der zweiten Stufe mit einem MGF-1303 GaAs-FET bestückt ist. Die Verstärkung ist 18 dB und die Rauschzahl beträgt ca. 1 dB.

Description

Fig. 1 shows the classic grounded source circuit. A printed circuit board (fig. 2) has been used. Costruction follows micro -stripline techniques. It is made of alumina, it has a 0.79 mm thickness with Er=10 and 50x36 mm standard size, fitting into the classic tinplate boxes or into a milled brass silver-plated box, as in my case. The latter solution offers very good results, also under the mechanical sta-



I0LVA HEMT Preamps for 10GHz

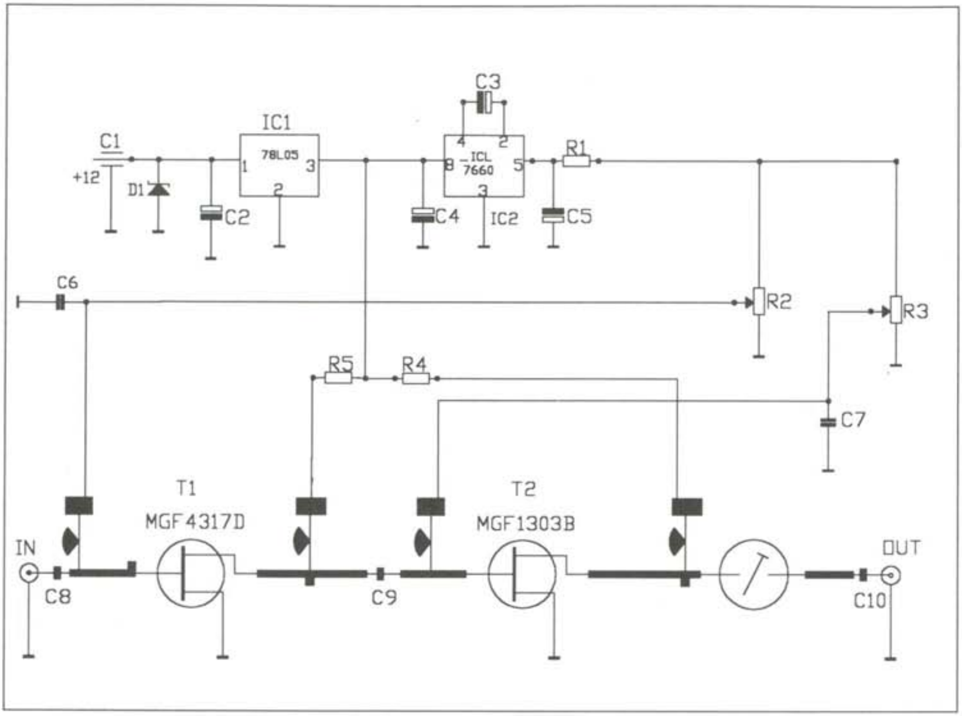


Fig. 1: Circuit Diagram

bility aspect, althoug both solutions have given equally good results.

The power supply has been integrated in the same printed circuit board, with a 78L05 for 5 volts of drain voltage and with a bias circuit composed by ICL 7660 for the negative gate voltage. SMD components have been used.

Fig. 4 shows the drawing with the components' layout.

ATC 1 pF input, output and interstage chip capacitors have been used.

A band pass filter has been inserted after the two stages to obtain clearer reception signal. The following results have been obtained:

- bandwidth 40 MHz at - 3.0 dB
- bandwidth 100 MHz at - 10.0 dB
- loss 1.5 dB

If the brass silver-plated box is used, the resonant cavity can be directly made on the bottom of the box following the size shown in the picture.

Construction

Cut the PCB to fit it into the box. Fasten it with with M2 screws on the silver-plated box bottom.

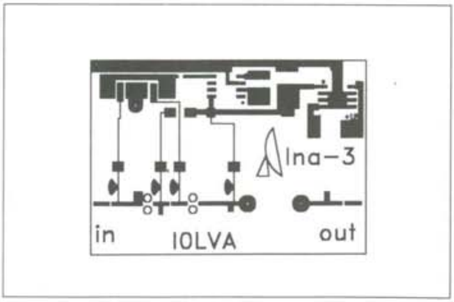
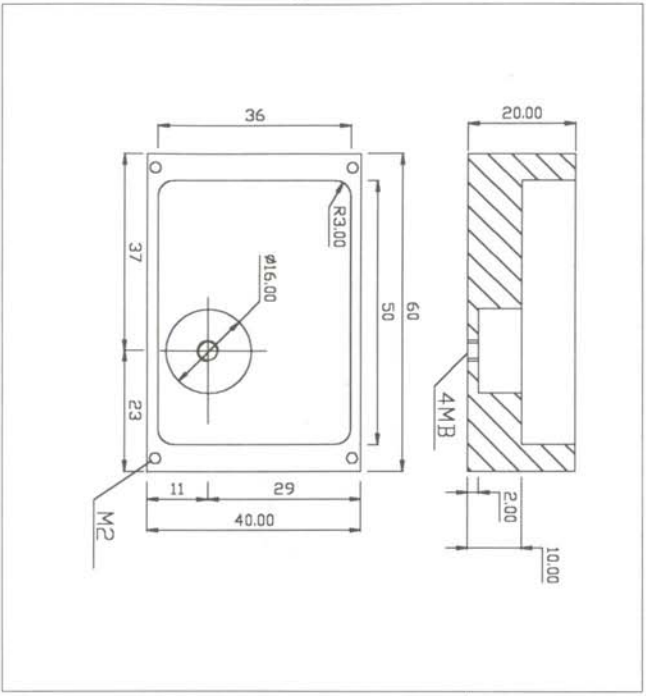


Fig. 2: PCB

Bild/Figure 3: Filter



Solder the rivets for the grounded source circuits connection. Solder the two 1 mm thick silver-plated copper wire cavity launchers. Once holes have been cropped, launchers must protrude by 2 mm from the grounded side.

Fix the PCB on the bottom of the box by means of M2 screws. Assemble the SMA connectors, the feed-through capacitor and all the power supply components.

If the tinplate box is used, solder the PCB along the edges at a 15 mm height from the grounded side. Solder the two input and output SMA connectors, the power supply feed-through capacitor and the rivets. Make slots for the grounded source circuits connection, solder the two cavity launchers. Place the cavity after outlining the circumference and keep it still in position by means of an amateurial vice, so that it does not move. Then solder it, making sure that no tin gets inside and finally assemble the power supply components.

If the tinplate box is used instead, the PCB must be soldered around the box walls.

Make the holes for the input and output SMA connectors, choosing the best solution to suit your needs. I have chosen male SMA connector for input, so that the input is directly connected to the antenna relay, and a female SMA connector for output.

Make a hole for the Erie 1000 pF feed-trough capacitor.

Two systems are available for the grounded source circuits connection, as described here below:

a) Make two 1.2x0.5 mm parallel cuts with a 2 mm center distance by means of a small screwdriver, which shall be used as a chisel, according to the drawing shown in fig. 5a.

b) Make two 1.5 mm dia. holes with a 2 mm center distance. 2 copper or brass rivets with a 1 mm dia. internal hole shall be soldered on the grounded side, as shown by the drawing in fig. 5b.

Before soldering the HEMT and the GaAs -Fet, perform the first test, to see whether power supply is correct. If everything is OK you can assemble devices.

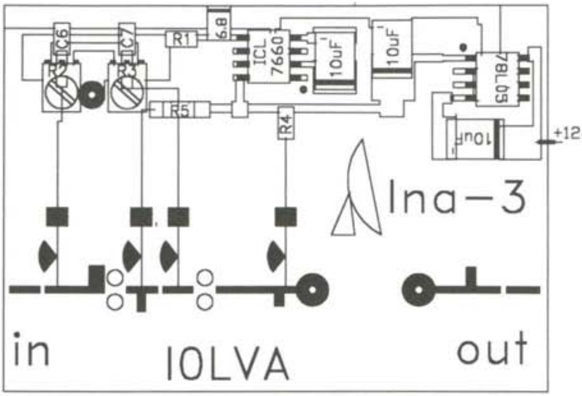
Connect the welder to the box ground by means of a wire. Cut 2 mm long GaAs-Fet ends. Position the GaAs-Fet on tracks and then solder the ends. This operation must be performed very quickly with a small quantity of tin. At this point the preamplifier is finished and the tuning phase can thus be started.

Beschreibung

Abb. 1 zeigt die Schaltung. Die gedruckte Schaltung zeigt Abb. 2. Sie besteht aus einem AlO_2 Substrat mit 0,79 mm Dicke und einer Größe von 50x36mm, so daß sie in Standard-Gehäuse paßt. Die Stromversorgung ist auf der Platine integriert und benutzt die üblichen Regler und Inverter

(78L05/ICL7660). Abb. 4 zeigt die Anordnung der Teile. Als Trennkondensatoren werden 1pF ATC Chips benutzt.

Bild/Figure 4: Parts Layout



Ein Filter (Abb. 3) sorgt für zusätzliche Selektion. Es erreicht bei 1,5 dB Grunddämpfung eine Selektion von 40 MHz bei 3 dB und von 100 MHz bei 10 dB Abfall. Bei Benutzung eines gefrästen Messinggehäuses kann das Filter ebenfalls ins Gehäuse integriert werden.

Konstruktion

Die Platine passend für das Gehäuse zuschneiden. In das Gehäuse Gewindelöcher M2 zur Platinebefestigung drehen. Löcher für die SMA-Buchsen und für den Durchführungskondensator bohren.

Um die Sourcen zu erden, hat man zwei Alternativen:

a) Zwei 1,2x0,5 mm Schlitze mit 2 mm Abstand in die Platine schneiden (Abb. 5a)

b) zwei 1,5 mm Löcher in 2 mm Abstand bohren (Abb 5b). Dort hinein zwei Nieten mit 1mm Innendurchmesser von unten einlöten.

Alle Nieten für Durchkontaktierungen einlöten. Zwei 1mm dicke Silberdrähte als Sonden für das Filter einlöten. Sie müssen 2mm von der Masseseite abstehen.

Platine ins Gehäuse einbauen, SMA-Buchsen und Durchführungs-C einbauen. Dann alle Komponenten der Stromversorgung einbauen.

Falls ein Weißblechgehäuse benutzt wird, die Platine mit 15 mm Abstand einlöten.

Bevor die FET's eingebaut werden, sollte die Stromversorgung getestet werden. FET Anschlüsse auf 2 mm kürzen und dann die FET's einbauen.

Tuning

Before connecting the power, check if everything is OK and that nothing has been forgotten. Prepare 4 or 5 small sheet-brass or copper 3/10 mm thick rectangular pieces (having different sizes: 3 x 2, 3 x 1.5, 3 x 1 mm). Connect the power . Adjust the two gate negatives so that the two stage current is about 23 mA. Because not everyone may have a Noise Figure Meter, adjust the preamplifier and receive a signal wich can come from a noise source, a signal generator or a beacon. If none of those is available, a tx can be used for 432 MHz in the CW mode and the harmonic 24 can be used.

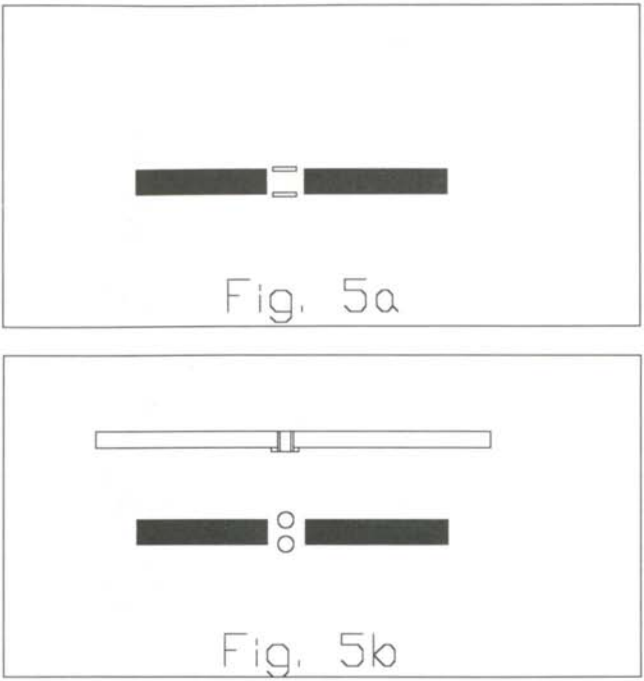
Adjust the 4 MB screw of the resonant cavity and insert it for 4 mm. depth. Anyway adjust it to obtain the maximum gain or the best signal on the S-meter of the receive. Once the proper adjustment is found, tighten the screw by meansof the lock nut.

Put the tags along the 50 ohm lines starting from the input until the NF reduction is detected on the Noise Figure Meter. For fine tuning, a Noise Figure Meter should undoubtedly be used, because the NF minimun can never be obtained by means of the maximun gain method. As the NF minimun is gradually reached, solder the tag in the correct position, if everything has been properly done one will read NF = 1.0 dB and G = 18 dB.

The following instruments have been used:

1. DJ9BV Noise Figure Meter
2. Noise Source with BAT-31 home made
3. Noise Figure Meter EATON 2075-2
4. Noise Source EATON 7618
5. Sweep generator HP 8620 C with plug-in HP 86290 B
6. Network Analyzer HP-3570A with converter 144/12 MHz

Bild/Figure 5: HEMT Mounting Details



7. Spectrum Analyzer HP 141T + HP 8552B + HP 8555
8. Network Analyzer HP 8755 C - HP 11664A

The following results have been obtained by means of two prototypes:

Parameter	Unit	No. 1	No. 2
NF	dB	1.0	1.2
Gain	dB	18.0	19.0
I_D	mA	23	25

I am at your full disposal for any clarification, comments or criticism.

Abgleich

Einige Abstimmfahnen aus 0,3 mm dickem Kupferblech vorbereiten. Spannung anschließen. Die negative Gatevorspannung so einstellen, daß ein Gesamtstrom von 23 mA fließt. Hat man kein Rauschzahlmeßgerät, kann man den Vorverstärker auf eine Bake oder eine Harmonische eines Signalgenerators abgleichen. Die Abstimmschraube wird 4mm eingedreht und von dieser Position aus das Maximum der Verstärkung eingestellt. Danach die Schraube sichern.

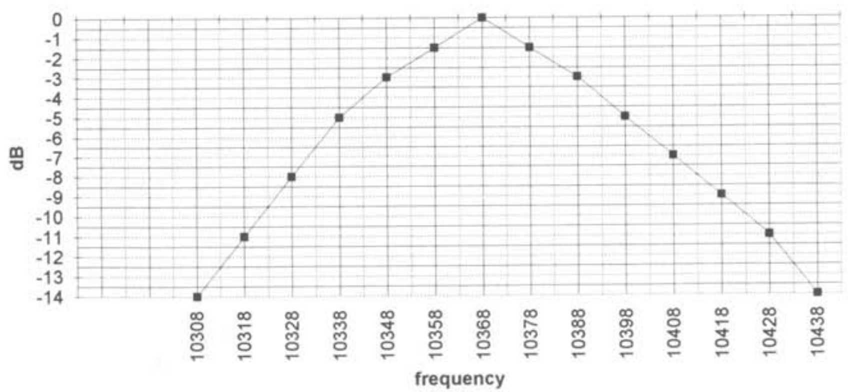
Mit einem Rauschzahlmeßgerät bringt man Abstimmfahnen beginnend vom Eingang an und verschiebt sie, bis die Rauschzahl ein Minimum ist. Hat man eine gute Abstimmung gefunden, können die Fahnen angelötet werden.

Folgende Meßgeräte wurden zum Abgleich benutzt:

1. DJ9BV Noise Figure Meter
2. Noise Source with BAT-31 home made
3. Noise Figure Meter EATON 2075-2
4. Noise Source EATON 7618
5. Sweep generator HP 8620 C with plug-in HP 86290 B
6. Network Analyzer HP-3570A with converter 144/12 MHz
7. Spectrum Analyzer HP 141T + HP 8552B + HP 8555

Table 1: Parts

Pos	Qty	Reference	Part
1	1	C1	1nF F.T.
2	3	C2,3,4	10µF/25V SMD
3	1	C5	6.8µF/25V SMD
4	2	C6,7	1nF SMD
5	3	C8,9,10	1pF ATC
6	1	D1	Zener 15V
7	1	J1	SMA Socket
8	1	J2	SMA Socket
9	1	R1	2k7 SMD
10	2	R2,3	10k SMD
11	1	R4	100 SMD
12	1	R5	270 SMD
13	1	T1	MGF4317D
14	1	T2	MGF1302B
15	1	IC1	78L05 SMD
16	1	IC2	ICL7660 SMD
17	1	AlO_2 PCB	50x35mm, 0.79mm AlO_2 ($\varepsilon_r = 10$)
18	1	Box 51x37x30	Brass, Silver Plated



Bild/Figure 6: Filter Passband

8. Network Analyzer HP 8755 C - HP 11664A Damit wurden die Resultate in der Tabelle auf der vorigen Seite erzielt.

Für Frage und Kritik stehe ich jederzeit zur Verfügung.

Hints & Kinks

Editor: Gerold Bächle, DF5GX

"LOWCOST AUTOTRACKING" for SAT und EME with ROTORSYS

Raimund Eisenstecken, IN3HER, Oberdorf 99, I-39040 VAHRN, Italien

Kurzbeschreibung

Dieses Programm ist in der Lage, bewegliche Ziele (z.B. Mond, Satelliten, kosmische Rauschquellen) zu berechnen und zu verfolgen. Das Besondere dabei ist, daß zum Lesen der Azimut- und Elevationswinkel die mechanischen Teile einer Computermaus und als Interface die Mauselektronik an der seriellen Schnittstelle verwendet werden.
Die Steuerung der Rotoren erfolgt über die parallele Druckerschnittstelle, als Interface sind lediglich einige Bauteile notwendig. Das heißt: Um den Preis einer Computermaus, zwei ICs und 4 Relais kann ein rechnergesteuertes Verfolgungssystem realisiert werden.

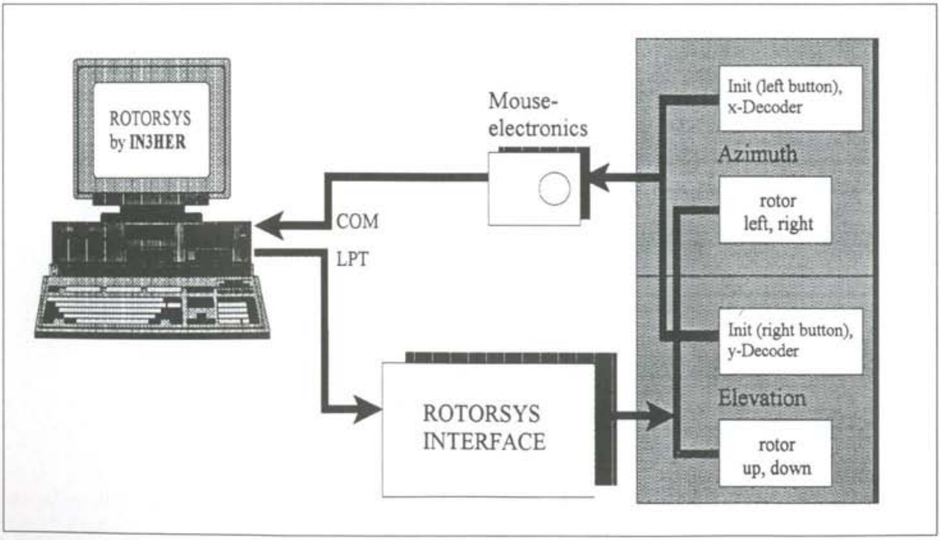


Abb./Fig.1

Systemanforderungen

Das Programm ist in Turbo Pascal geschrieben und auf einem IBM-kompatiblen PC mit EGA- oder VGA-Grafik lauffähig. Vor dem Programmaufruf muß der Maustreiber geladen werden.

Übersicht

Gestartet wird mit ROTORSYS für die deutsche Version, die Englische kann mit dem Parameter /E aufgerufen werden. /H zeigt einen kurzen Hilfetext. Der Parameter /BW ist bei Verwendung eines monochromen Monitor anzuhängen. Der Bildschirm präsentiert sich in zwei Felder. Das äußere Feld zeigt die effektiven Rotorpositionen. (Istsituation). Das innere Feld zeigt die Berechnungsgrundlagen und die Sollpositionen.

Menüleiste

- F1 = Startet oder beendet die automatische Verfolgung.
- F2 = Zielobjekt auswählen mit Bild auf / Bild ab.
- F3 = Verfolgungsintervall auswählen von 1 bis 15 Minuten mit Bild auf / ab.
- F4 = Offset-Winkel Azimut -9.9 bis +9.9 wählbar mit Bild auf / ab.
- F5 = Offset-Winkel Elevation -9.9 bis +9.9 wählbar mit Bild auf / ab.
- Ist die Verfolgungsautomatik nicht aktiviert, können die Rotoren per Cursortasten bewegt werden.

Funktionen

Nach dem Programmaufruf meldet der Rechner, daß die Referenzpunkte manuell gesucht werden müssen, erst dann ist das System kalibriert. Es ist zweckmäßig die Referenzpunkte in die Nähe der Antennenparkposition zu legen, damit diese schnell gefunden werden.

Der Referenzpunkt wird hinter der Gradanzeige als Doppelpfeil dargestellt. Als Referenzpunkte dienen die 2 Maustasten. Links für Azimut und rechts für die Elevation.
Nach Auswahl des zu verfolgenden Objekts (F2) und Festlegung des Zeitintervalles (F3), kann die Verfolgung mit F1 aktiviert werden. Ein eventueller Offset-Winkel kann mit F4 = Azimut oder F5 = Elevation angewählt werden. Ist der errechnete Elevationswinkel negativ, so werden die Rotoren nicht nachgesteuert. Die Verfolgung kann jeder-

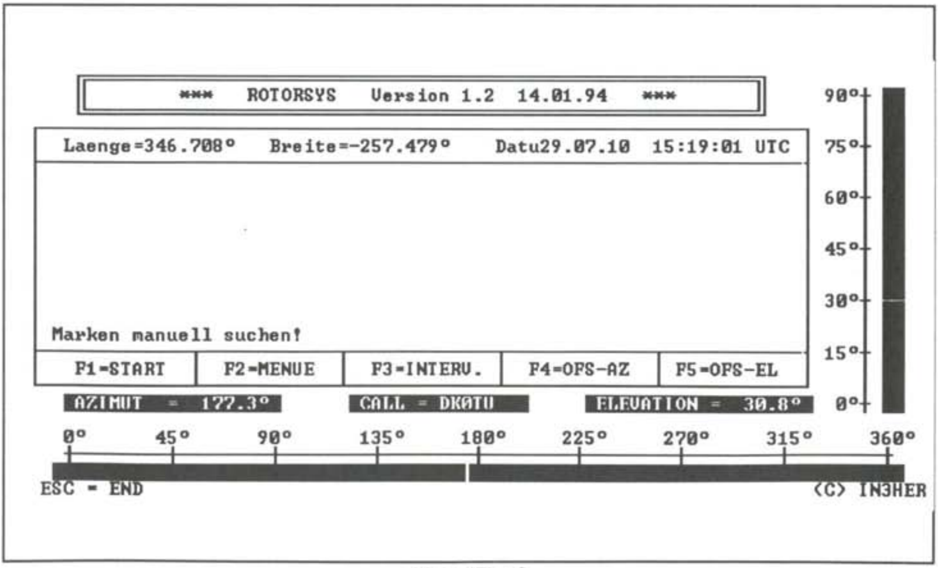


Abb./Fig.2

zeit mit F1 wieder abgebrochen werden. Ein Programmausstieg kann mit ESC erreicht werden.

Parameter

Eine Anzahl von Parametern können in der Konfigurationsdatei ROTORSYS.CFI definiert werden. Es ist zu beachten, daß die Bezeichner Schlüsselwörter sind, werden diese verändert, so kann der nachstehende numerische Wert nicht richtig oder überhaupt nicht interpretiert werden. Eine Übersicht der gültigen Bezeichner zeigt Tabelle1.

Rotorensteuerung

Die Rotoren werden über die Druckerschnittstelle gesteuert (alle H-Pegel):

Pin 2	= AZ-Rotor dreht im Uhrzeigersinn.
Pin 3	= AZ-Rotor dreht im Gegenuhrzeigersinn.
Pin 4	= EL-Rotor dreht nach oben.
Pin 5	= EL-Rotor dreht nach unten.
Pin 6	= AZ-Rotor dreht schnell (Delta 10 Grad)
Pin 7	= EL-Rotor dreht schnell (Delta 10 Grad)
Pin 25	= 0 V

Parameter	Description	Beschreibung	Default
MYCALL=	own callsign	Eigenes Rufzeichen	
MY-LOC=	own locator	Eigener Locator	
MY-LAT=	(or instead of locator the geogr. latitude i.e. +46.729)	anstelle des Locators die geogr. Breite z.B. +46.729	
MY-LON=	(or instead of locator the geogr. longitude i.e. -11.625)	anstelle des Locators die geogr. Länge z.B. -11.625	
LPT-NR=	used printerinterface LPT1 or LPT2	verwendete Druckerschnittstelle LPT1 or LPT2	1
AZ-REF=	AZ-angle, on which the sensor is active (left mouse-button)	AZ-Winkel, an dem der Referenzsensor aktiv ist (linke Maustaste)	180
AZ-P/G=	number of azimuth-pulses over 360 degrees	Azimuth-Impulszahl, die über 360 Grad gelesen werden	360
EL-REF=	EL-angle, on which the sensor is active (right mouse-button)	EL-Winkel, an dem der Referenzsensor aktiv ist (rechte Maustaste)	0
EL-P/G=	number of elevation-pulses over 360 degrees	Elevation-Impulszahl, die über 360 Grad gelesen werden	360
MY-QTR=	timedifference UTC - localtime	Zeitdifferenz UTC - Lokalzeit	0
AZ-ERR=	tolerance of the azimuth-tracking (depends on the play in drive and the speed of rotation)	Einstelltoleranz für Azimuth (hängt vom Getriebespiel und der Drehgeschwindigkeit ab)	0.5
EL-ERR=	tolerance of the elevation-tracking (depends on the play in drive and the speed of rotation)	Einstelltoleranz für Elevation (hängt vom Getriebespiel und der Drehgeschwindigkeit ab)	0.5

Tab.1:Konfigurationsdatei/configfile ROTORSYS.CFI

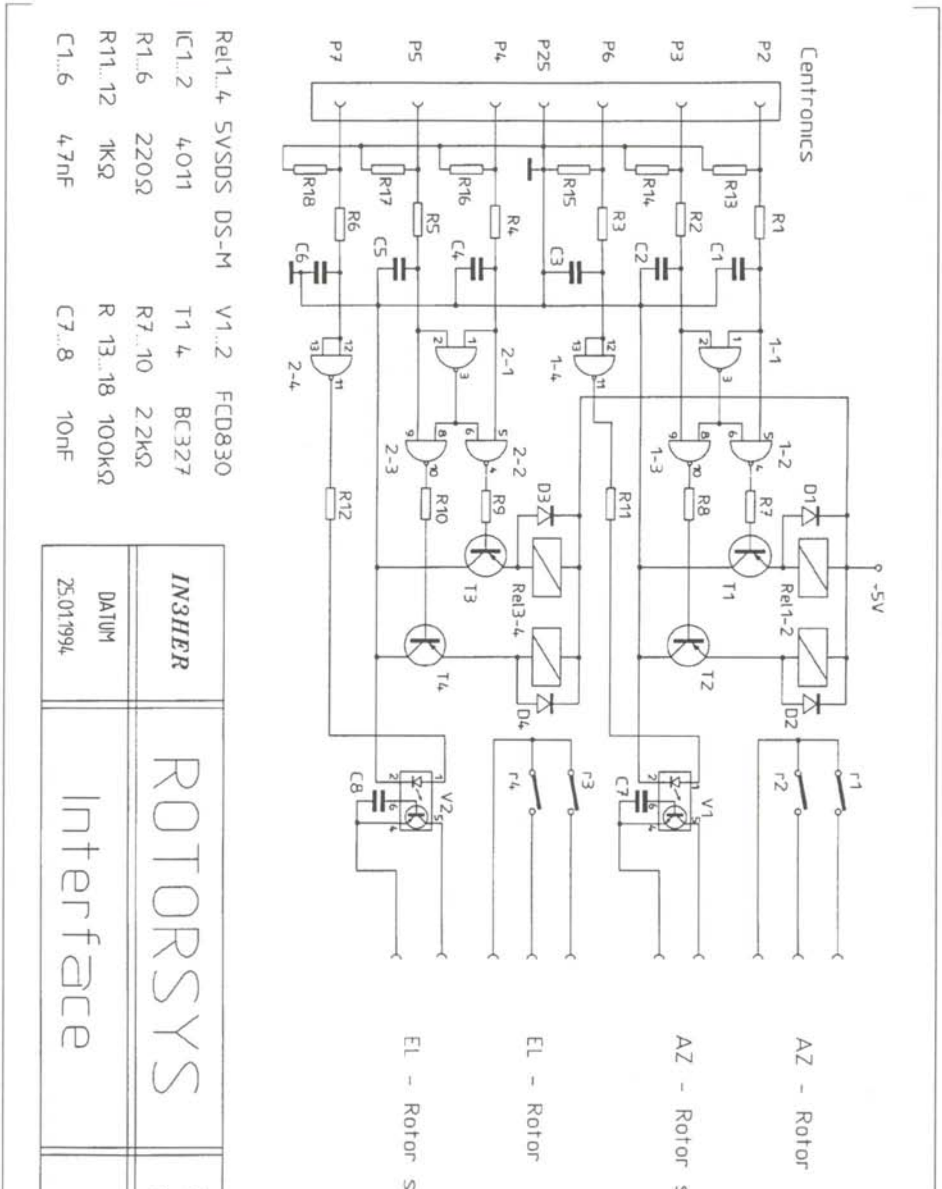


Abb./Fig.3:Rotorsys-Interface

Abbildung 3 zeigt einen Schaltungsvorschlag.

Keplerelemente

ROTORSYS kann bis zu 50 SAT-Dateien (.DAT) verwalten. Sie können mit einen Texteditor (zB. EDIT von DOS) erstellt werden. Eingeleitet werden die Elemente mit der 1.Zeile OBJEKT: SAT. Zu beachten ist auch hier, daß die Bezeichner (z.B. EP-DAY) Schlüsselwörter sind. Der numerische Wert muß mit einem Komma enden. Bei Radiosternen muss in der 1.Zeile OBJEKT: STERN stehen, gefolgt von Rektaszension und Deklination.

Mausencoder-Anpassung

Diese Arbeit erfordert etwas Fingerspitzengefühl, da es verschiedene Encodermechaniken gibt. Besonders geeignet sind solche, bei denen die 2 Encoder gesondert aufgebaut sind. Prinzipiell müssen diese von der Mausleiterplatte abgetrennt und am Rotor an die Motorachse angebracht werden. Dasselbe gilt auch für die zwei Referenzsensoren. Dieses Problem muß natürlich individuell gelöst werden. Auch fehlt derzeit noch die notwendige Erfahrung um dafür ein Patentrezept zu verschreiben. Die Tests wurden mit einer Geniusmaus durchgeführt, in der Encoderräder mit 45 Schlitzen montiert sind. Mit diesen Rädchen wird eine Auflösung von 2° erreicht (360/(45*4)= 2).

Die Mauselektronik wertet die von den Optokopplern kommenden Signale aus, und kann auch ein Viertel einer Periode erkennen da die Optokoppler um 90° zueinander versetzt angebracht sind. Getestet wurde auch ein professioneller Encoder (1250 Impulse / 360°), welcher an die Mauselektronik gekoppelt wurde. (Auflösung = 0.072°) Dies ist natürlich die beste Lösung, aber auch dementsprechend teurer. Zu beachten ist, daß bei steigender Impulszahl die Rotorgeschwindigkeit reduziert werden muß.

Schlußbemerkung

Mit diesem Programm hat der Autor versucht, eine billige Lösung für das Problem "Autotracking" zu finden. Natürlich kann dieses System noch verbessert werden. Dies sollte ein Anreiz sein, das vielleicht vorhandene analoge System durch ein rechnergesteuertes zu ersetzen. Hinweise auf vorhandene Fehler oder Anregungen sind willkommen.

Danksagung: Dank gebührt Walter IW3AZJ, für die Bereitstellung einiger "Mäuse".

Abstract

This program is able to calculate the position of moving targets (i. e. moon, satellites, cosmic noise sources) and to follow them. To read the azimuth and elevation angle, the mechanical parts of a computer mouse and its interface are used. The steering of the rotors will be done via the parallel interface, you only need a few components. That is with a mouse, two ICs and 4 relays you can realize a lowcost autotracking system.

System requirements

The program is written in Turbo Pascal and is running on an IBM-compatible PC with EGA or VGA graphics. A mousedriver must be loaded before invoking the ROTORSYS program.

Overview

With the parameter /E you can start the english version. /H shows a short help info. /BW choses the monochrome monitor. The screen is devided in two sections. The outer one shows the actual positions of the rotary, the inner area the basic calculations.

The menu

- F1 = starts or stops the automatic tracking
- F2 = select the desired object with pageup/pagedown
- F3 = tracking time interval between 1 and 15 minutes pageup/pagedown
- F4 = azimuth offset azimuth -9.9° to +9.9° with pageup/pagedown
- F5 = elevation offset -9.9° to +9.9° with pageup/pagedown

If you didn't activate the autotracking mode, you can move the rotaries with the cursor keys.

Function

After loading ROTORSYS, the program needs to be calibrated at the reference positions, which should be set close to the parking headings, in order to shorten the calibration procedure. The reference position is marked with a double arrow behind the display of the angle. The azimuth reference is reported by the left mouse key, the elevation reference by the right one. After selecting the object to follow and the time interval, the tracking may be started by F1. An existing offset in azimuth or elevation may be corrected using F4 or F5, respectively. If the calculated elevation is negative, the rotaries won't be activated. The tracking may be stopped using F1 at any time. The ESC key will terminate the program.

Configuration

A number of parameters may be defined in the file ROTORSYS.CFI using keywords. It should be noted, that the keywords may not be changed; otherwise, the numerical value cannot be evaluated correctly. An overview about the valid keywords is shown in table 1.

Interface

The rotaries are controlled via the data lines of a parallel port (active high).

Pin 2 = AZ rotary moves clockwise
Pin 3 = AZ rotary moves counter clockwise
Pin 4 = EL rotary moves up
Pin 5 = EL rotary moves down
Pin 6 = AZ rotary moves fast
Pin 7 = EL rotary moves fast
Pin25= ground

Figure 3 proposes a circuit.

Keplarian elements

ROTORSYS supports up to 50 object files (.DAT). They are created with an ASCII editor. The element sets are introduced with the line OBJEKT:SAT. The keywords have to be used unchanged (e.g. EP-DAY), and the numerical value must be followed by a komma. With radio stars, the first line must be OBJEKT:STERN followed by right ascension and declination.

Adaption of the encoders

This part of the work needs a bit of subtle intuition, since there are different ways of encoder mechanics used in a mouse. Of special interest are those with two physically separated encoders. In principle, they must be demounted from the circuit board of the mouse and attached to the axis of the rotary. The same applies to the two reference sensors. This task has to be solved individually, of course. Additionally, so far the necessary experience is missing to provide a patented recipe. The tests were carried out using a Genius mouse, in which encoder wheels with 45 slits are mounted. With this wheels, a resolution of $360°/(45*4) = 2°$ is achieved.

The mouse electronics evaluates the signals coming from the opto couplers. It can recognize even a quarter of a period, since the opto couplers are mounted at 90° to each other. Also a professional incremental encoder (1250 pulses per 360°) was tested after connecting it to the mouse electronics (resolution = 0.072°). This, of course, is the best solution, but also a bit more expensive. It should be noted, that rotary speed must be decreased with rising pulse rate.

Final note

With this program the author tried to find an inexpensive solution for the problem "autotracking". Of course, this system can be improved. This should be a stimulus for further experiments to replace the perhaps existing analog system with a digital one. Any hint about mistakes or new ideas are welcome.

Thanks to Walter, IW3AZJ, for supplying several mouses.

Literatur/References

Noise measurements of cosmic objects (DUBUS TECHNIK 2 Jan Bruinier DL9KR)

Radioastronomische Methoden (Antennen Band 3: Messtechnik Edmund Stirner)

Locating the moon (THE RADIO AMATEUR'S HANDBOOK 1982)

Ephemeriden - Programm Mond (CQDL 1/86 Manfred Belter)

MINI CALC (AMSAT JORNAL 5/6/85 Dr. Karl Meinzer DJ4ZC)

Software is available on DUBUS Information System (+49 30 455 76 25)

Folded Dipole Construction for Yagis

K.H. Bollmeyer, DC6GB, Gustavstr. 28-30, D-32312 Lübbecke

For all Yagis, which have an input impedance near 50Ω a folded dipole is the perfect driven element. It's broadband, low loss and has no surplus electrical joints except for the cable and balun connection. This type of driven element is especially suitable for all type of Yagis described by DL6WU or DJ9BV.

Low inductance connection to balun.

This is essential for low VSWR. Most problems reported concerning high VSWR stem from an undesirable way of the balun connection. Bracket BR1 (Fig. 6) provides a very low inductance path to connect balun and input connector. Second it provides a frame to be fastened to the boom and to secure the position of the plastic enclosure.

Integrated PTFE balun

It's made from doubly shielded RG-142B/U. Single shielded cables like RG-58 are not desirable because of spurious radiation and low power capability.

Low Cost, water proof enclosure.

The box selected is a low cost alternative to those expensive MACRALON boxes.

Alternative Models

There are two versions: one for a N-connector (Figs. 4,5,6), the other for direct cable connection (Ask Author for details). For EME arrays the builder can select the cable version and fit the phasing cables in appropriate length directly to the driven element. This saves money and is more simple.

Measurements on 432MHz

VSWR Measurements taken on BV70-8.5λ:

430	431	432	433	434	435	436	437	438	439	440
1.2	1.1	1.08	1.05	1.05	1.1	1.15	1.2	1.3	1.4	1.6

Models for 144 and 432MHz

The construction described in the drawings above is equally well suited to operation on both 144 and 432MHz. The only differences are different sizes of the folded dipole and of the PTFE balun. For 432 the RG-142B/U balun fits into the connection box, but for 144 the lengthy balun has to be put outside.

Low Cost Kits available:

Karl Heinz Bollmeyer, DC6GB, see address above. Tel.: (++49)05741-9475/Fax:(++49)0574190265. Prices: 70cm N: DM27,-; 70cm Cable: DM31,-; 2m N: DM42,-; 2m Cable: DM46,- plus transport charge.

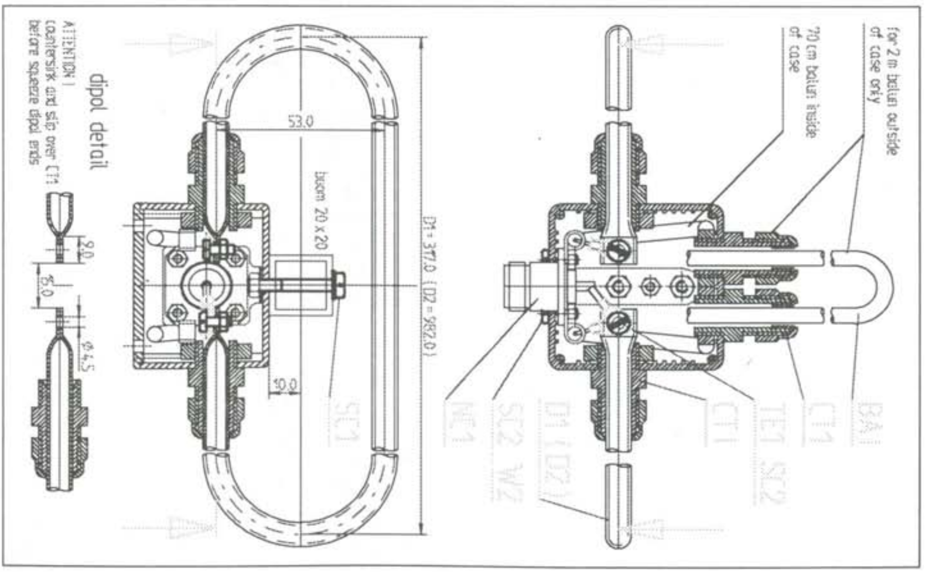
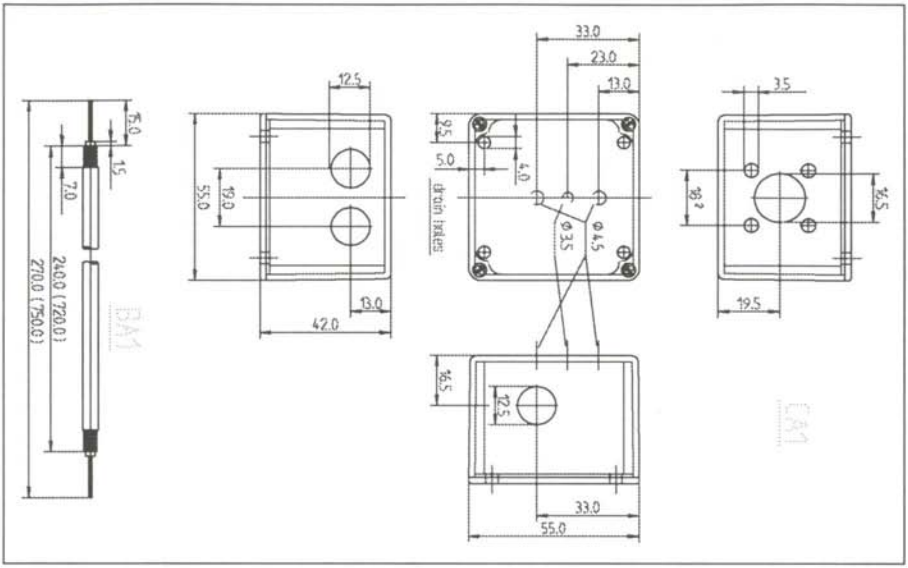
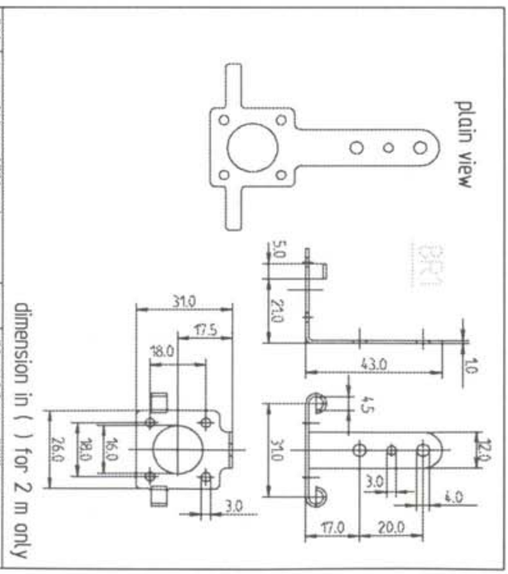


Abb. / Fig. 4: Dipole for N-Connector

Abb. / Fig. 5: Dipole for N-Connector





item	name	pcs.	material
BA1	balun 240 mm (720 mm)	1	RG - 142 B / U PTFE coax
D1(D2)	dipol tube 8 x 1 690 mm (2020 mm)	1	aluminium
N1	self locking nut M3	2	DIN 985
TE1	ring terminal Φ 3.3	3	
CT1	cable feed throught	2 (4)	PG 7 with plastic nut
W2	washer 3.2	4	DIN 125
SC2	screw slotted head M3 x 8	6	DIN 84
NC1	N connector	1	UG 58 / U
W1	washer 4.3	2	DIN 125
SC1	screw slottet head M4 x 30	2	DIN 84
BR1	bracket	1	brass 1 mm
CA1	case 55 x 55 x 42	1	ABS

1994	date	name
drn. by	23.03	Dan.
appr. by		
rev. by	25.05	Dan.

designed with: PC-DRAFT professional

(C) K.H.Bollmeyer Gustavstraße 28 - 30 D - 32312 Lübbecke DC6GB

dipol connecting case
70 cm and 2 m with N connector

DOS name \DC6GB\DIP_CC4N
drawing no.
sheet 1 of 3
scale 1:1

Abb. / Fig. 6: Dipole for N-Connector

Microwave Europe

Editor: John Sørensen, OZ1IPU

1296 MHz:

SM7ECM JO65NQ wkd: 27.10.93 G3XDY JO02, 28.10.93 OK1IBL JO60, OK1FFD/p JO60,DG0CR/p JO50, DB6NT JO50, 29.10.93 OK2BLE JN99, 01.11.93 SM4EFW JP70, F6CTW JN18, F6GCT JN18, F1BJD JN08, ON4YZ JO20, F6HPP/p JN19, F5HRY JN18, F6DKW JN18, F6BCH JN19, F6DWG JN19, G3UVR IO83, 02,07,94 PA3BLS/p JO22, PA3ETM JO22, PA0RDY JO22, GM6MGS/p IO86, PA3FPS JO22,03.07.94 PA0EZ JO22,12.07.94 G3XDY JO02, G0JDL JO02, G4BYV JO02, 22.07.94 PE1ODY JO23, 23.07.94 PA0SQE JO21, PA3AWJ JO21, PA0HEJ JO22, PA0JUS JO22, 25.07.94 SP2DDV JO93, 26.07.26 SP3RBF JO71, 28.07.94 ES5WE/0 KO07, Tks fer info Anders.

OK1KIR/p JO65LJ wkd: 02.07.94 OK2KQQ/p JN99, OK2KIS/p JN99, PA3C JO33, SP9FG JN99, SP9EWU JO90, OK2KAT/p JN89, 03.07.94 OK3KME/p JN99, SM7ECM JO65, OZ9EDR JO64, 9A5Y JN85, DL0HU/p JO44, PI4GN JO33, G4JAR/p JO01, 9A2SB JN95, S51ZO JN86, Rig PA.150W. RX MGF1412. 1,7m.dish. Tks fer info Tonda.

DG5NEX in JN49WS

DJ1LP JO64CC wkd: 04.04.94 DL5KVA JO64, 14.05.94 DG0CAL/p JO64 17.05.94 OZ1DOQ JO65, 29.05.94 DL0HRO/p JO74, DL1LB JO54, 30.05.94 DL1SUN JO53, 11.06.94 DL0AUB/p JO53,21.06.94 OZ1DOQ JO65, 28.06.94 SO1NVC/p JO73, 02.07.94 hrd.SK6UHI JO66, wkd. OZ8ERA/p JO55, OZ9EDR/p JO64, DK1KR JO53, DL0HU/p JO44, SP1JVG/p JO84, SP1UJU/p JO84, 03.07.94 hrd. LA1UHG JO59, SK6UHI JO66, OZ7IGY JO55, OZ1UHF JO57, SK6UHG JO57, wkd. SM6FHZ JO57, OZ/ WB2PSD JO55, LA8AV JO48, OZ7ALB/p JO65, DK4LP/p JO44, OZ2OE JO45, PI4GN JO33, DL8BDU JO43, Tks fer info Detlev.

DG9NBT JN49WS wkd: 04.06.94 DL0SHF JO54, DL8BDU JO43, 05.06.94 HB9BI JN36, DK1KR JO53, 18.06.94 OK1OEA JO80, Tks fer info Martin.

DG5NEX JN49WS wkd: 03.05.94 SO1NVC/p JO73, 04.05.94 DL0SHF JO54, 05.06.94 DK1KR JO53, 18.06.94 OK1OEA JO80, DG5NEX wkd in contest 200km. : 07.05.94 PA0EZ JO22, HB9BA/p JN37, DK0PX JN48, HB9BI JN36, ON4CP/a JO20, DD4JN JO31, PA0WWM JO22, PA0RDY JO22, DK3FB JO31, DF0HZ/p JO31, DJ3FI JO31, PI4GN JO33, DB6BX JO32, DL8BDU JO43, DJ5BV JO30, DF7JS JO31, ON6ZT/p JO10, HB9FX/p JN37, HB9MIN/p JN37, PA3FPQ JO21, DL0LN/p JO31, DB1BX JO32, DL0NOT JN57, DL2JDX JO60, DL9OE/p JO52, DF0RI JO42, OE5VRL/5 JN78, PA0BAT JO31, DL5YEE JO42, PA6C JO33, PE0MAR/p JO21, PA0WMX JO21, PA3BAS JO21, 08.05.94 DG2MIM/p JN57, DG1KJG JO30, DL6NVC/p JO73, DC9KK JO30, DF0YY JO62, DK0OG JN68, DF0RB JO51, DG7YBN/p JO42, DG0CAL JO52, PA3AWJ

JO21, DF1EQ JO31, DD2EE JO31, PA0PLY JO22, DK2MN/p JO32, DL2DAO JO31, DL2EAA JO31, HB9EAH/p JN37, DB5KN JO31, ON5DG JO20, DD7MH JN68, DL1EKM J031, DC8AG JO31,Tks fer info Uli.

PA0WWM in CM63g: 13-06-94 SP3RBFHL08G, 01-07-94 OK1DKS/P GK45D, 02-07-94 HB9MIN/P DH67G, 03-07-94 G3UAX/P ZL43B 03-07-94 G6SFR/P YK30E, 03-07-94 G3ULT/P ZL54J, 03-07-94 DF0CI FL52G, 03-07-94 DF0RB FL33B 03-07-94 G4BRA/P YK18C, 03-07-94 G3OHM/P YM50D, 03-07-94 G3CKR/P ZN61F, 03-07-94 G4WGE/P ZN71H

2320 MHz

SM7ECM JO65NQ wkd: 28.10.93 DG0CR/p JO50, DB6NT/a JO50, 02.07.94 PI4GN JO33, PA6C JO33, PA0RDY JO22, PA3FPS JO22, 03.07.94 PA0EZ JO22, 12.07.94 SO1NVC/p JO73, 19.07.94 LA2D JO49, LA3DV JO59, 23.07.94 PA3AWJ JO21, PA0SQE JO21, DL3YEE JO42. Tks fer info Anders.

DG9NBT JN49WS wkd: 25.04.94 DL4VCG JN39, 10.05.94 DK4GD JN47, 04.06.94 DF0RB JO51, 05.06.94 DC8VJ/p JO31, DK0MU JO31 Tks fer info Martin.

OK1KIR/p JO60LJ wkd: 02/03.07.94 DB2QL JO44, DL0DR JN48, DK2DB JN48, DL1BKK JO43, Tks fer info Tonda.

PA0WWM in CM63g: 03-07-94 F6CBH BJ51J

3456 MHz

PA0WWM in CM63g: 03-07-94 G3LQR AM67B

5760 MHz

OK1KIR JO60LJ wkd: 02.07.94 OK1AIY JO70, OK5VHF/p JO70, DG1VL/p JO61, DL1VFL /p JO61, OK1UFL/p JO70, OK1KRY/p JN69, DC9BU/a JO40, 03.07.94 DF0CI JO51, Tks fer info Tonda.

DG1VL/p JO61XE wkd: 12.07.94 OK1KIR/p JO60, DL0PL/p JO50, Tks fer info Henry.

SM7ECM JO65NQ wkd: 17.08.93 LA2D JO48, 02.07.94 PA3FPS JO22, 03.07.94 DL1BKK JO43, 09.07.94 LA6LCA JO59, 19.07.94 SM6EAN/7 JO86, LA2D JO49, LA3DV JO59, Tks fer info Anders

PA0WWM in CM63g: 03-07-94 PA0WMXCL38D, 03-07-94 PA0BAT DL03H, 03-07-94 G3LQR AM67B

10368 MHz

SM7ECM JO65NQ wkd: 17.08.93 SM6FHZ JO57.19.10.94 DL5KVD JO64,15.03.94 OZ2OE JO45, 19.04.94 SK6YH JO57, 02.07.94 DK1KR JO53, DJ3KM/p JO64, DL5KVD JO64, DL2NUD JO63, PA6C JO33, PA3FPS JO22, PE1CQQ JO33, 03.07.94 PA0EZ JO22, DL1BKK JO43, DL5KVA/p JO54, 04.07.94 DK3UC JO42, 09.07.94 LA6LCA JO59, SM6EAN/7 JO86, LA8AV JO48, 14.07,94 DL3YEE JO42, 19.07.94 SM6EAN/7 JO86, LA2D JO49, LA3DV JO59, DJ3KM/p JO62, SK6YH JO57, 23.07.94 PA3AWJ JO21, PA0SQE JO21, 28.07.94 wkd via Rainscatter: DJ5BV JO30, PA0EZ JO22, DL3YEE JO42, DF9QX JO42, Tks fer info Anders.

DG9NBT JN49WS wkd: 04.06.94 via RS: DF0CI JO51, hrd. DK3UC JO42, 05.06.94 DK2DB JN48, Tks fer info Martin.

DG1VL/p JO61WC wkd: 10.05.94 DL1VFL/p JO61, 19.05.94 DL4DTU/p JO61, DL1VFL/p JO61, 29.05.94 OK1AIY/p JO60, 05.06.94 OK1KTL/p JO60, 07.06.94 DB6NT/a JO50, Tks fer info Henry.

OK1KIR JO60LJ wkd: 02.07.94 DC9BU/a JO40, OE5VRL/5 JN78, DK0OG JN68, 03.07.94 DF0CI JO51, DL1BKK JO43, DK3UC JO42, Tks fer info Tonda

F5HRY/p ZJ57a wkd: 26.06.94 F6DKW BI12f, G4KGC IO92, G3WDG IO92, G4ZXO/p JO00, G4JNT/p IO90, G4FCD IO91, G4FUF JO01, G4EZP JO01, G4BCH/p IO90, G4LSD/p IO90, G3JMB/p IO90, G3RQZ/p JO00, G4KNZ IO91, G0FDZ/p JO01, G8BJG/p JO00, Tks fer info Herve.

HB9MIN JN37OE wkd: 13.02.93 G4DDK JO02, ZE1AVS JO02, G0BPU JO02, G4BYV JO02, G3ZFP IO91, G3JVL IO90, 14,02,93 G4CBW IO83 939km. G3ZFP IO91, 03.03.93 DF0OG JO41, 01.05.94 IW4BTJ JN54, I4BER JN54, DF0OG JO41, 04.06.93 DK3UC JO42, PE0MAR JO21, 29.10.93 G4LDR IO91, 30.10.94 G4FCD IO91, F6DKW BI12, OE5VRL JN78, 31.10.93 G3FYX IO91, Tks fer info Erich.

PA0WWM in CM63g: 27-06-94 G4BRK ZL22E, 27-06-94 G4FCD ZL05A, 27-06-94 G4LDR ZL72B 27-06-94 G4BCH/P ZK25D, 27-06-94 G3FYX YL38F, 27-06-94 G3JMY YL32D 02-07-94 ON4CP/ACK04E, 04-07-94 DJ5BV DK26H RS, 04-07-94 DL3YEE EM63J RS 04-07-94 DL3NQ EJ34J RS, 04-07-94 HRD DK3UC-DK1PZ-LX1DU-G3LQR PA0EZ-PE1JBK RS

24192 MHz

HB9MIN JN37OE wkd: 03.02.93 DF6FAE/p JO40 396km. 01.05.93 DJ7FJ/p JN37, HB9TBT/p JN37, 04.06.93 DF9IC/p JN48, 03.10.93 HB9MIO/p JN37 27.02.94 DL1AS/p JN57, Tks fer info Erich.

DB6NT Duobandtransceiver 10/24 and 47/76GHz

New world record on 76GHz

DB6NT/a in JO50TI (Mountain top 'Schwedenwache') and DL1JIN/p in JO60IK (Mountain top 'Auersberg') made a **new distance record over 77km** on 76GHz at July, 13th, 1994. To establish the optimum alignment of the antennas and for propagation tests first QSOs on 10, 24 and 47GHz with 59 reports were established. The following QSO on 76GHz was run at signal levels of S3 in CW and S1 in SSB. Output power of transverters were 0.1mW in SSB and 2mW in CW. Noise figures of the RX front end were about 13dB. Antennas used were 30 resp. 40cm dishes.

The record QSO is the result of several trials starting with a 38km QSO in 1992, a 48km QSO at May, 23rd, 1994 and a 54km QSO during the summer-BBT between mountain tops 'Schöneck'/JO60DJ and 'Ochsenkopf'/ JO50VA. An iterative improvement in antenna gain finally gave the results mentioned above.

New world record on 145GHz

On July, 2nd, 1994, Danish stations OZ9ZI/p and OZ1UM/p achieved the new world record on 145GHz over a **distance of 11 km**. QTH was at a small lake in JO65. Signals were **56/57 in SSB**. Equipment were DB6NT transverters for 145 GHz. A full report follows in the next issue.

73, John OZ1IPU

Microwave: World Firsts and World Records

Band [GHz]	World First QSO			World Record		
	Date	Calls	QRB [km]	Date	Calls	QRB [km]
10	6.V.1946	W2JRM-W2JN	3.3	18.7.1983	EA9/I0SNY-I0YLI/IE9	1666
24	14.IX.1975	G3BNL/P-G3EEZ/p	150	3.II.1993	HB9MIN/p-DH6FAE/p	396
47	3.X.1984	HB9AMH-HB9MIN	1	15.IX.1992	HB9MIN/p-HB9MIO/p	166
76	30.12.1985	HB9MIN-HB9AGE	0.5	13.VII.1994	DB6NT/a-DL1JIN/p	77
145	12.VII.1992	DB6NT/p-DL1JIN/p	1	2.VII.1994	OZ1UM/p-OZ9ZI/p	11
241	23.V.1993	DB6NT/p-DL1JIN/p	0.1	30.VI.1993	OZ/DB6NT-OZ/DF9LN	0.5

If you have an update or a correction, please write to:
John Sørensen, OZ1IPU, Rosenvej 49, DK-9300 Sæby, Denmark.Tel.: (++45)9846-3311

Microwave USA

Editor: Kent Britain, WA5VJB

10GHZ EME

April 16th was a big day for 10 GHz EME. At least 7 stations were on for the REF contest.

I was able to work ON6JZ , DJ7FJ, VE7CLD, and a "Random" with WA7CJO.

(I gave Jim a 599, he gave me a 594) I also had a sked with WA6EXV, but Chuck's Mojave Desert QTH was blocked by rain clouds. That doesn't happen very often!

Charlie, G3WDG was in the Dallas area on business and came out for the fun. Charlie enjoyed all the activity and did much of the moon tracking.

A 3 Meter dish and 20 watts is certainly capable of working several stations on cm EME.....if you can keep it on the moon. G3WDG was able to note the moon tracking problems of ON6JZ and VE7CLD. Working CLD was much like meteor scatter. Out of his 17 min of transmitting, we only heard about 30 to 40 seconds, rising and fading as he swept around. Gunther had lost his noise meter and was valiantly carrying on without it. Proper equipment for Moon Noise tracking is just as important as 20+ watts and a 1dB NF LNA.

The next week G3WDG and I again set up the 3 cm EME station this time working G4KGC on the 23rd of April. Charlie really enjoyed working his wife Petra and hearing his own EME station. An hour later we worked WA6EXV in a 12 min QSO. SWL'ing during the QSO was W6HCC using his trailer mounted 2.5 meter dish. With a HEMT LNA and 30 watts of parallel TWT's, he is hoping to operate from several western US states and grid squares. W6HCC was able to copy both sides of our QSO but doesn't have all the station set up as yet.

Polarisation on 10GHz EME

All these 3 cm QSO's used linear polarization. Standard procedure has been for the European stations to run vertical polarization and the North American stations to use horizontal polarization. With Europe and North America about 90 degrees apart in longitude, spatial polarization is the same.

G3WDG/W5 in QSO with his XYL G4KGC on 10GHz EME

10GHZ EME Stn: WA6EXV, 10' Dish, Scalar

WA7CJO has studied X-Band RADAR returns from the moon. A Circular Polarization signal is returned circular, but if the signal is monitored in another part of the world, the signal is elliptical polarized. Forward scatter off a rough sphere will distort circular polarization. WA7CJO has carefully matched a pair of CP feedhorns and is sending one to G3WDG for on the air tests. At this time CP is not recommended for 3 cm EME.

Digital processing

High quality recordings were made of the QSO's and have been forwarded to Mr. Frank Perkins, WB5IPM at RF Monolithics. Mr. Perkins is heavily into Digital Signal Processing and will be running the tapes though a main-frame computer. 3 cm EME signals have several hundred Hz dispersion and are not recognized by current DSP filters as a coherent signal. Proper DSP alogarithiums could improve signals several db.

North America had a busy summer with three records broken the 11th and 12th of July.

First QSO on 120GHz

July 11th, WA1MBA and WB2BYW made the first amateur QSO on our 120 GHz band. Because our 120 GHz band is only 40 MHz wide, the transverters used 28 MHz I.F.'s. The CW signals were 529 both ways at 1.15 km. Path loss is very high next to the 118 GHz Oxygen absorption line. And July in Boston is a very poor time to avoid humidity. The record should be greatly extended this winter. Tom also has an excellent way of greatly lowering LO phase noise in the receiver we hope to cover soon.

First QSO on 13cm W6/KH6

On this same day, there was a tropo opening between California and Hawaii. After 13 years of attempts, KH6HME and N6CA traded 559's on 2304.1 MHz CW over a 3973 km path. There was a quick attempt at an SSB QSO, but quick quit so they could QSY to 3cm. Both stations used a 1.3m dish, 12 watts out, and 1.5 dB NF.

The next day N6XQ was able to work KH6HME over a 4054 km path on 902.1 MHz. During the 4 days the opening lasted, KH6HME made 148 QSO's on 144 MHz, 6 on 222 MHz, 39 on 432 MHz, 1 on 902 MHz, 3 on 1296 MHz and 1 on 2304 MHz. Historically signals on 6cm and 9cm are stronger than on 23 cm, but no signals were heard despite hours of attempts with a dozen stations on 3cm and 6cm. This leaves 3cm as the only band left to be worked over the California to Hawaii path.

June 4th WA7CJO worked K9KFR for a new 3 cm EME initial. K9KFR uses a 3.7 Meter dish and 100 watts output. The QSO took awhile because of a high Noise Figure at K9KFR and his moon tracking problems from not being able to see moon noise. These problems have been fixed. WB0TEM also has 70 watts out, HEMT, and a 3.7 Meter dish almost ready for 3 cm EME.

K2TXB is now looking for 3 cm EME schedules with a 2.2 meter dish and 100 watts. Last year he had near miss QSO's with WA7CJO and WA5VJB when using 30 watts.

At least 4 North American amateurs are building 6cm EME stations and hoping to complete the first 6 cm EME QSO since the WA5TNY and W7CNK QSO in 1987.

Ref. : EME News, Bernd Wilde, DL7APV

Comments from WA5VJB about VE3ONT

In September 1987, W3IWI activated a 43 Meter dish on several bands for the ARRL EME contest. The EME station included a 3 cm transverter with 100 watt TWT built by KY7B and WA7CJO. WA7CJO operated the 3 cm equipment and attempted QSO's with at least 6 stations. Switching problems with the TWT prevented reception, but one way signals were copied by myself and KY7B. KY7B was able to detect W3IWI with a 1 Meter dish and 3 dB NF.

At the Dayton HamFest I spoke at length with VE3ONT and W9IP about the feasibility of using 3 cm at Algonquin Park. I suggested using a 18 to 20 dBi feedhorn and horribly under illuninating the dish. An edge illumination of -20 dB assures virtually all the energy of the feed is directed at the moon. The 60+ dB antenna gain insures virtually all the energy from the dish strikes the moon.

As an EME antenna approaches 48 to 50 dB of gain, increasing the antenna gain 1 dB increases received signals 1 dB and echoes 2 dB. But beyond 50 dB, the equation for EME path loss flattens out if one station is smaller. Most of the energy is already striking the moon, increasing TX antenna gain only slightly increases energy returned to the earth. (The center of the moon does reflect better, the smaller illumination area reduces Doppler smearing and libration effects.)

Practical Result:

As the gain of a large dish goes beyond 50 dB, the dish illuminates smaller areas of the moon, the dish looks at smaller areas of the moon, and echoes continue to increase approximately 2 dB for every 1 dB increase in antenna gain.

10GHZ EME Stn: VE7CLD

If a small dish is trying to QSO with a larger dish, the result is different. As the gain of the large dish increases beyond 50 dB, the effect is only a slight increase in received signal for the small dish. Most of the energy form the large dish is already striking the moon, so most of the improvement is less Doppler smear and liberation.

When the large dish is listening and the small dish is transmitting again the results are lower. The small dish is illuminating the entire surface of the moon. The large dish is looking at only a portion of the illuminated moon. As gain of the large dish is increased, the microvolts/Meter within the vision of the dish is unchanged!!!

Conclusion:
20 watts, 1 dB NF

	50 dBi to 50 dBi	Easy QSO
"	40 dBi to 60 dBi	Marginal QSO
"	30 dBi to 70 dBi	NO WAY!

Microwave Japan

Editor: Toshihiko Takamizawa, JE1AAH

New 5.7GHz Record

It was made this August, 7th, by JA8BGS and JA9TYK over 640km. JA8BGS was running only around 100mW. They made second contact after 2 hours from first contact to comply with new Japanese regulations for DX-records. The propagation was duct. At the same time 1.2GHz mobile signals were heard at both ends with S9++. 10GHz was not tried because of missing equipment at JA8BGS end.

75GHz/47GHz Activity

CQ Ham radio magazine reports Japanes first (Official) 75GHz and 47GHz contact in No.8(1994 issue. JA8CMY and his friend JA8ZGN made first contact on22.5.1994. See

Photographs. The 76GHz contact was a follow up for 47GHz contact in last November. As beam pattern on 75GHz is very sharp, 47GHz contact on F3 was made first. Signal level was S9++. Colour television signals were exchanged at M5C like commercial TV quality. Then they tried 75GHz but without success. The first trial was on 5.5km. Then they reduced distance to 1.2km and after several antenna direction adjustments signal were S5 in F3. The they tried F5 but without success. On 4th of June in 1994 they tried again at 800m distance. F3 was ok but F5 was only monochrome picture. JA8CMY noted that signal levels were 20dB then estimated. This was caused by antenna problems. He will modify his antenna to achieve better results.

JE1AAH trying to tell his daughter about Microwaves

Asia Pacific Microwave Conference 94

It will be held from 6.12. to 9.12.94 in Tokyo. It's a conference for Microwave engineers covering topics like new devices, power devices, low noise devices, MMICs, EMC/EMI, propagation, antennas, satellite and mobile communication, remote sensing etc. It#s sponsored by IEICE and by IEEE MTT-S. A special session covers microwave activity in amateur radio. The following amateurs contribute with lectures:

JE1AAH	Challenge to Millimeter Wave Communications
JG1IIK	Microwave Antenna in Amateur Communication
JS1UKR	Earth-Moon-Earth Commuication
JA1KAB	Amateur satellite Communication
JA1XF	EMC Issues in Amateur radio

New devices for 2.4GHz

There is an engineering sample available from Motorola for 2.4GHz transceiver chip set. There are LNA/Down converter, driver amp, power amp, Up converter and antenna switch. The chip set is designed for spread spectrum systems on 2.4GHz ISM band. Some chips work from 1.5...2.5Ghz.

Package is SOIC-8 or SOIC-16, which is very small and it would be possible to realize pocket size 2.4GHz transverter with some appropriate LO-module.

I got sample of LNA/downconverter, driver and power amplifier and will report something using this chips.

XRFIC2401 2.4-2.5GHz Downconverter

RF Frequency:	2400...2500MHz
LO Frequency:	2050...2400MHz
IF Output Freq.:	100...350MHz
LO Input Pow.:	-5dBm
LNA Gain:	16dB
LNA NF:	2dB
Mixer NF:	12dB
Supply:	5V/9.5mA

PRFIC2401 2.4-2.5GHz Up Converter

RF Frequency:	2400...2500MHz
LO Frequency:	2000...2250MHz
IF Input Freq.:	240...400MHz
LO Input Pow.: -	5dBm
Conversion Gain:	6dB
Supply:	3V/15mA

XRFIC2404 2.4-2.5GHz Driver Amplifier

RF Frequency:	2400...2500MHz
Small Signal gain:	17dB
Power Output:	5dBm
Supply:	3V/15mA

XRFIC2404 2.4-2.5GHz Power Amplifier

RF Frequency:	2400...2500MHz
Small Signal Gain :	22.5dB
Gain Control Range:	20dB
Power Output (1dB Comp.):	22dBm
Power Output (4dBm Pin):	23dBm
Supply:	5V/95mA and -1...-2V/Gate

73 de JE1AAH

EME News

Editor: Bernd Wilde, DL7APV

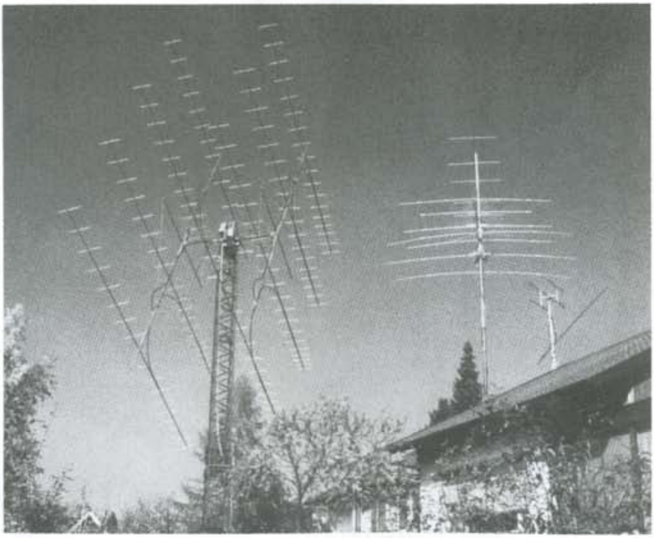
Intro: May sw were terrible condx on 432, very bad faraday and caused low activity. June sked-weekend condx were reported to be fair. July sw was splitted and caused low activity on 70 as well.The beginning holliday season will drop activity down as well in august. The **ARRL** contest is still in progress, but don't forget the **conference** in SM. Let photos&infos come. Last info, the five bells group will be qrv from **OY** see news.

144MHz

CT1WW wkd: 16.05. W0HP, 17.05. W7HAH, W5UN, W9QXP, 20.05. PA0JMV. rig 4x17el FT, 800w and MGF1302 hb preamp. tnx fer info Tiago

DK9ZY (JO40be) wkd only initials: 06.11.93 JA4BLC, DL7AKA, 07.11. F1PUX, KU8Y, WA2GSK, ON7RB, 04.12. KA5AIH, WB0GGM, 05.12. IK5UBM, W9QXP, 02.01.94 SM6CMU, K8BHZ, K6AAW, 29.01. VP2MGW/p, K2RTH, 30.01. WB2OYC, RA3YCR, S51ZO, 26.02. UT5ER, N6OC, 27.02. N0XX, W7VXW, 27.03. SV1BTR, UR3EE, UA3GGE, EI4DQ, VP3MR, 28.03. G4PIQ, 23.04. PA3EPD, OZ9AAR, DK9OY, 24.04. DL0WAC, F3VS, 21.05. OH2BAC, WB4BKC, W8ORS #174. rig 4x10el 9bv MGF1302 YL1052. tnx fer info Wolf-Dietmar

EA6VQ: is back on 144EME & wkd following initials in April EI4DQ, UT5ER, S51ZO, ON4ANT, IK1FJI, UT5EC, UR3EE, G4PIQ, PA3EPD, I4XCC, F3VS, SM5BSZ, SM0FFS, SM6CMU, IW5CNS, K2RTH, K6HXW #116. rig 8x17 2M5wl, 1KW. He is qrv on weekends from Friday evening to Sunday afternoon and can be reached via: EME NET, VHF NET, EMAIL 71404.3365@compuserve.com or packet @EA6URP.EAPM.ESP.EU and Tel : 34-71-756163. tnx fer info Gabriel



HB9CRQ

HB9CRQ wkd new stns: DL0WAE, SV5/DL5MAE (DXCC97), WB5IGF #613. Dan had not much time for EME due to much work bad wx and condx. Dan uses the EME-BBS (US) regulary. tnx fer info Dan

JA9BOH wkd: 11/12.06. hrd JL1ZCG, W0HP with good sigs. On 12.06. W5UN O/O Eu sked arranged, DL3BWW nil, SM2CEW O/O good sigs only take 10 min to complete, IW5AVM nil DL4?? clg EI4DQ also, On 15.06. He had a nice ECHO with 4-13el and 400Watts. 11.06. W5UN O/O, SM2CEW O/O #23, 18.06 W5UN

EME-TOPLIST

144MHz

Call	small	SQR	DXCC	States	WAS	WAC
I2FAK	380	50	78	50	1993	1988
HB9CRQ	346	51	81	49	--	1987
DL3BWW	333	46	72	50	1992	1983
UA9FAD	320	37	53	35	--	Yes
PA0JMV	251	44	64	50	1993	1988
F6IRF	171	29	41	32	--	Yes
UA3TCF	145	0	30	0	--	--
UZ3FWA	114	0	28	0	--	--
RA3YCR	109	0	33	24	--	--
RA3LE	94	0	0	0	--	--
DK9ZY	89	23	24	16	--	yes
EA6VQ	84	22	26	0		
LA0BY	83	27	29	20	--	--
SM0PYP	76	19	28	15	--	--
SP5EFO	74	21	28	13		
UV1AS	52	0	21	0	--	--
UA9XEA	49	0	20	0	--	--
SP5CJT	44	14	17	11	--	--
DL7AKA	32	14	12	10	--	--
DL7UTS	29	10	13	10	--	--
IK5OIY	19	13	9	5	--	--
DL5DTA	18	9	8	4	--	--
F5HRY	14	0	6	7		
UA3MAS	11	0	5	0	--	--
DL3YEE	4	2	4	0	--	--
HB9DFG	3	3	2	2	--	--
UA6LGH	2	0	1	0	--	--
DL8EBW	1	1	1	0		

432MHz

Call	small	SQR	DXCC	States	WAS	WAC
DL9KR	325	47	73	50	1987	1978
SM0PYP	290	40	50	42	--	1989
OK1KIR	222	39	57	43	--	1982
DJ6MB	214	33	54	37	--	1984
DL3BWW	196	36	51	38	--	1991
RA3YCR	187	0	46	33	--	
UA6LGH	163	0	38	0	--	
UA9FAD	120	24	34	26	--	--
YO2IS	99	19	31	21		
SP5CJT	94	24	28	26	--	--
OE9XXI	93	27	29	23	--	1983
RA3LE	92	0	0	0	--	
DL3YEE	86	22	31	15	--	--
EA6/DF5JJ	37	15	14	0		
UA3TCF	30	0	11	0	--	
UA9XEA	23	0	11	0	--	
HB9CRQ	20	13	12	9	--	--

1296MHz

Call	small	SQR	DXCC	States	WAS	WAC
OE9XXI	152	28	33	24	--	1989
SM0PYP	100	21	26	15	--	1989
OK1KIR	93	24	28	18	--	1989
EA6/DF5JJ	50	15	18	9		
OE9FKI	42	8	17	9	--	--
HB9BBD	24	12	11	3		
DF5JJ	13	6	7	2		
DL3YEE	9	6	6	1	--	--

2300MHz

Call	small	SQR	DXCC	States	WAS	WAC
OE9XXI	35	13	15	9	--	--
OK1KIR	25	9	11	8	--	--
SM0PYP	21	9	11	7	--	--
OE9FKI	3	3	3	1	--	--

10368MHz

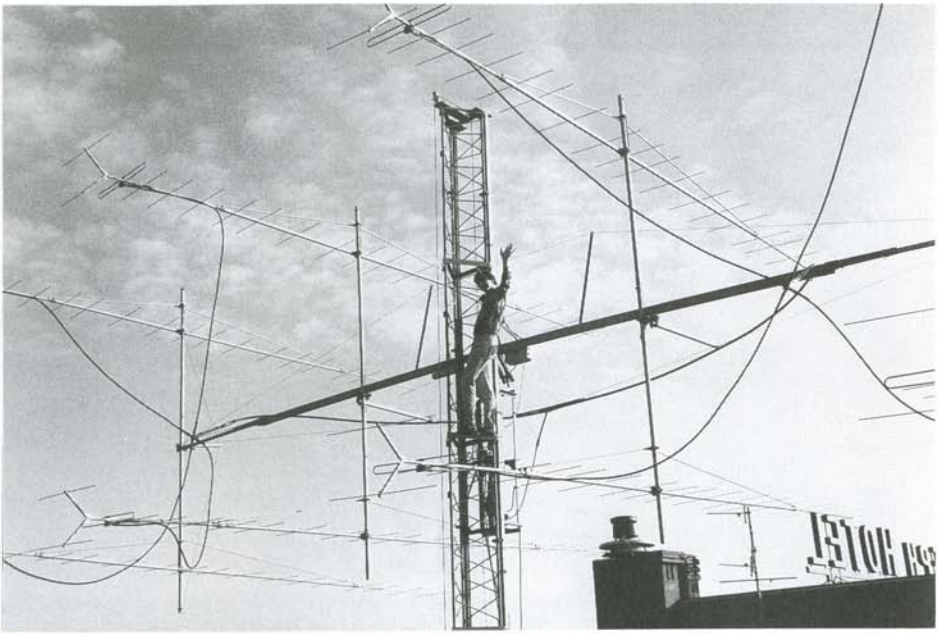
Call	small	SQR	DXCC	States	WAS	WAC
DJ7FJ	8	0	7	2		
OK1KIR	5	5	5	1	--	--

VE3ONT will back on EME with the 46m dish form Algonquin Park (FN05xw).
They plan operation in ARRL contest part I&II.

UTC DATE	VE3ONT Tx Freq	Listening Range	Approx. Times (UTC)
29.10.	432.050	432.050-432.060	6:45-18:15
30.10.	1296.050	1296.050-1296.060	7:54-18:44
26.11	144.100	144.100-144.110	5:38-16:45
27.11	144.100	144.100-144.110	6:46-1713

They will operate split, so do not call on their tx qrg. They have circular switcheable polarization. Please do not call for a secound qso after a cw qso for ssb agn, or reverse. They will run NO SKEDS and no sequencing. Please be patient, the qrm on their end was intense in '93. Low power stations are encouraged to make an EME contact. 100w delivered to a single long yagi should be sufficient on 144 & 432, 2m dish and 10w on 1296. QSLs with an SAE to Dennis Mungham VA3SO, RR 3, Mountain Ontario, Canada KOE 1SO. Be sure and send an EME contest entry to the ARRL.

I5JUX: 8x20Y for 144 with DL5MAE testing



559/ 339, # were DL5MAE, JA2JRJ, JL1ZCG, VE7BQH. Now he is playing with KW AMP using 6F62R Japanese TV translator tube. tnx fer info Kimio

UT8AL (KO61wp) wkd all random 22.01.94 W5UN, 23.01. I2FAK, 19.02. VE7BQH, 20.02. W5UN, 26.02. SM5BSZ, 27.02. KB8RQ 529/559, HB9CRQ, 19.03. SM5FRH, 20.03. W5UN, 25.03. KB8RQ 529/549, 26.03 I2FAK, W5UN, WB5LBT, LA8YB, 27.03. K5GW, LA8YB, 23.04. SM5MIX, LA8YB, DL3BWW, W5UN, SM5BSZ, 24.04. I2FAK, KB8RQ 529/559, K5GW, F3VS #117, SM5BSZ, hrd IK3MAC, DJ5QX, HB9CRQ, LZ2US, K2GAL, KA5AIH, AF9Y; DL5MAE, DK1KO, I5JUX, S57TW, 21.05. KB8RQ, K2GAL, hrd S57TW, IK1MTZ, LA8KV, W4ZD. rig:1x20elKLM&700w. tnx fer info

144 MHz news

EA4LY wkd 29.05. DL3BWW. JA2JRJH wkd only JL1ZCG in June.

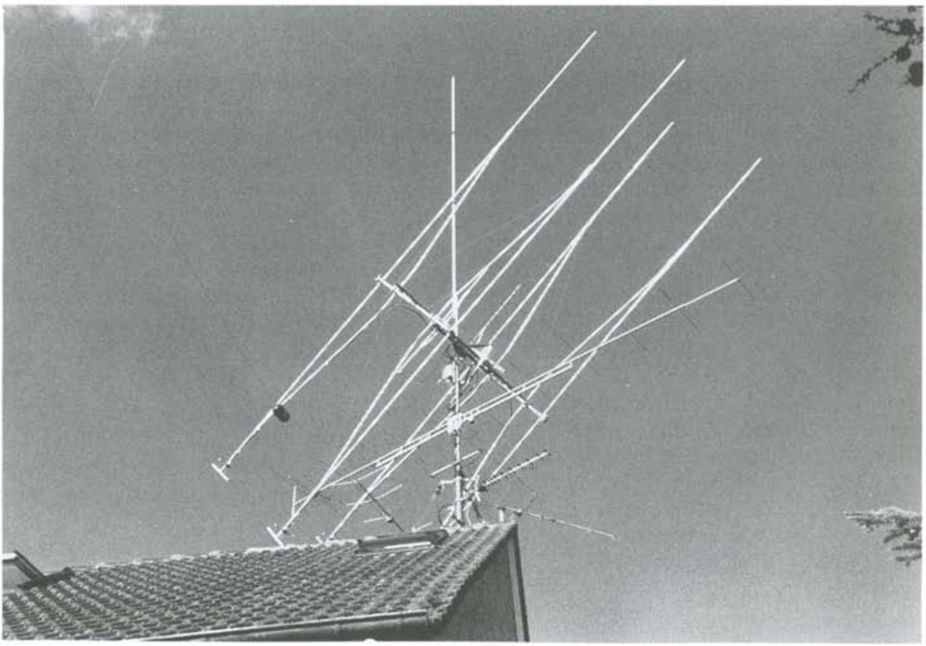
432 MHz

DF6NA (JN49xs) wkd : 01.01.94 UT5EC #, 02.01.94 PA3CSG, SM0PYP, K2UYH 26.02. DF3RU 27.02. hrd W2UHI/W2PGC 19.03. 9M2BV #, VE1ALQ # (tnx QSL), K0RZ, W7FN # (tnx QSL) 26.03. EA3UM #, SM2CEW (tnx QSL) hrd JA5OVU 27.03. KD4LT, F1FO, JA2KRW # (tnx QSL), UR5LX hrd G4RGK 16.04. F1JZG #, N4GJV, K0RZ hrd G4ALH, SM0PYP, SM2CEW, I5MPK, G4RGK 17.04. JL1ZCG, EA5CJ #, VK5MC #, JA2JRJ #, DL9KR, K1FO, W2UHI #, hrd JA2KRW, JA9BOH, HL9UH, DL6WU. He still need following QSL's : JL1ZCG, OH2PO, N2IQU, SM4IVE, F1FEN, UT5DL, 9M8WB, UT5EC. tnx fer info Rainer

DK0NHF (JO62JR) wkd : 14.05. KD4LT O/M, N4GJV O/O, K1FO O/339, DL9KR O/O; cwnr K0RZ, 15.05. DL9KR, I5MPK cwnr, 21.05. DL3BWW O/O, 22.05. SM2CEW. rig reactivated 8year old apv stn: 4x21el ft, 0.35db 9bv preamp and .5kw at feed point. This is the new clubstation at our new qth 50km NW of Berlin. After 3 years of absence my first EME qso's. The crew : DF5GX, DL7PL and me. tnx fer info Bernd hi.

G3SEK wkd : 21.05. were Faraday and Murphy related? This must be about the 5th month that we've had 45-90 deg of Faraday and lots of ionospheric absorption too. I did a lot of listening this month, as part of a review of 5 commercial DSP audio filters - more details next month. Does anyone have practical experience of DSP filters with poorly correlated signals such as Ar or back-scatter signals, or with high-speed CW for Eu-style meteor-scatter? 14.05. G3HUL (339/339), K1FO (449/449), EA3DXU (M/QRZ), SM4IVE (559/429), DF3RU (439/439), JA2KRW nil on sked. 15 May: JA5OVU (O/O)#, EA3DXU (M/O), SM2CEW (449/559), KD4LT (559/449), W2CRS sri not QRV. 17&18 May: PY5ZBU nil on skeds. News by telephone from PY5ZBU is that Don's new Henry PA has arrived in Paraguay, so he is expecting it shortly. It should make a big improvement over his present 100W, but Don feels he isn't hearing as well as he should. Also he needs information about the finer points of sked and QSO procedures. As a comment, the 432.020-.030 QRP segment is not really working. Maybe it needs more publicity, especially ahead of the ARRL and REF contests.Proposal for the REF contest: multipliers should be the same as for ARRL, ie all DXCC plus all W/VE call areas. Reason: during the periods outside of the Eu/NA window, Eu stations have access to 15-20 possible DXCC multipliers (maybe more) but W/VE stations have access to only 5-6. Changing the rules will encourage more W/VE activity for everybody to enjoy. In June he worked only I5CTE (O/M). In July I worked OM9AME (O/O) at the 4th attempt, on 27 July, and also SM2CEW. CU in Sweden! tnx fer info Ian

G4FRE (JO02OB) wkd : 14.05. K2UYH O/Os #5, SM4IVE 559/429r #6, K0RZ O/Or #7, KD4LT 449/449r #8, SM2CEW O/Or #9, N4GJV O/O 549r #10, DL9KR 449/449r, cwnr:K1FO, UR5LX, PA3CSG, IK3MAC, W2UHI. The gear is now dismantled (so no point in anyone asking for skeds!), by the time you print this the equipment should be on the Atlantic ready to be activated again as WG3I in the fall. Equipment is also in transit (everything except the dish) for 10GHz



DL3YEE's 432 MHz antenna

eme. rig: 4x21 el y, open wire fed, K2RIW PA, 0.55dB NF. tnx fer info Dave

JA9BOH wkd May'94. He was at shack this month and got 8 QSO and added 2 initials. Farady was not good for his vertical sense (only N4GJV, DL9KR was copied). Other JA's seemed to be quite productive, but Murphy is always present. 14.05 started NA window with no echo condition. W2UHI T copy one slot, JA2KRW told him that UHI sent M. JA2KRW O/O, K5WXN sked nil, VK3UM 549/339, hrd were KD4LT and K1FO, good echo around meridian. OK1CA O/O #234, G0RRJ nil, 4X1IF nil, EA3UM O/O (439) #235, IN3HER M/R, G0BPU nil. Moon was half shadowed by his house El gt 15 deg at az 280 deg. 15.05. KD4LT 559/549, he was the strongest this SW, N4GJV O/O, OK1CA sked No QRV, UR5LX 449/449, new call but no initial, heard were ZL3AAD(439), DL9KR(439), IN3HER(339) and JA2KRW, and in June 11.06. PA3CSG 549/549, JA2KRW O/O, hrd 12.06. HL9UH. He needs another 7213 like Tube 4651 and 8791 ,8792 and needs Data sheet. tnx fer info Kimio

JA2KRW : reports about May SW as follows; he is using new K1FO 4-25el instead of Araki 4-21el from this month which gave him 50 initials in 15 month operation. 14.05 NA window JA9BOH O/O, KD4LT 549/559, N2IQU 539/439, K1FO 549/539, EU sked gave him EA3UM O/O #51 , IN3HER O/O #52 in random. 15.05. K0RZ 549/449, W2UHI respond to his CQ 539/539 #53, also N4GJV 549/539. They had strong wind almost in all JA area, but quite bad at EU sked time for him. It caused slip more than 90 deg. and wrong reading of AZ rotator. During weak wind time worked DL9KR 579/569, DL3BWW 539/439. After he cured the rotator I5TDJ O/O #54, I5MPK 559/559. CWNR were ZL3AAD, VK3UM. he ask to set sked again with G3SEK, I5CTE and others whom he missed in high wind condition. 11.06. JA9BOH, DF3RU, JA4BLC, 12.06. K1FO, K0RZ, PA3CSG, IN3HER, SM2CEW, DL6WU(#55), 19.06. W7HAH (#56) arranged a sked by telephone. Tokuichi has 4m dish and is looking for High-Power Tube like TH328 . His Fax +81-561-84-8014. tnx fer info Tokuichi

JA5OVU had 8 QSO including 4 initials and he claims his standings as # 41, country 14, states 10, 14.05. N2IQU O/O #38, KD4LT 559/549, K1FO 559/439, 15.05. VK3UM O/339 #39, DL9KR 579/559, G3SEK O/O #40, IN3HER O/O #41, DL3BWW O/O he copied W2UHI, K0RZ, JA9BOH, JA2KRW, N4GJV, YO2IS, I5CTE, ZS6AXT, I5MPK and CWNR was ZL3AAD, 12.05. UR5LX 539/449, DL3BWW 559/539, DF6NA 439/439, hrd JA4BLC, ZS6AXT, IK3MAC, UT1PA, 11.06. K1FO 559/439, K0RZ 449/439, hrd were KD4LT, W7HAH, DL9KR, DL6WU, SM2CEW, PA3CSG, VK3UM, IK5WJD who was calling JA2KRW many times. tnx fer info Tom

ON4KNG worked since the 19 of march: SM2CEW, K0RZ, VE1ALQ, KD4LT, G3SEK, F1JZG, DL9KR, K1FO, PA3CSG, EA2LU, I5MPK. He has now open tube (6mm.alu) 200 Ohm feed lines. He has not received yet qsl from: SM0ERR, F1ELL, DK3BU, UT5DL, ON5OF, K4QIF, F5MZN, UA6LGH All his qsl were send direct but also ok via buro. tnx fer info Peter

ON5FF wkd in REF EME CONTEST 16/17.04.94 (single Op, QRP): G3SEK, F1JZG, ON4KNG, SM2CEW, hrd I2COR, N4GJV 559/559, DL9KR 599/569, K1FO 559/449 JA2JRJ 559/549, DL3BWW , hrd I5MPK, SM0PYP, ZS6AXT, hrd sked 9M2BV with EA5CJ hrd both on 432.025, hrd I5MPK agn, nearly qso with F2TU O/? he was taking him for ON4KNG!!! he had good echoes +6dB over noise at that time, and I seem to have -3dB less power than F2TU qrm? N4GJV 559/549, DL3YEE O/O, S51ZO ?? called him very weak, 11x100x8 = 8.800 pts total & F1JZG for #73. At Italian EME contest 23/24.04. Class 432 D: 24.04. N4GJV 579/569, W2UHI O/O #, W7CI 559/559 #, K0RZ 589/569, SM4IVE 599/O, UA6LGH O/O# fer 6x10 = 60 pts! rig 16x23el flexa, 0,5dB and 500w. Dirk is always available for test and skeds +32.3.271.08.35 Tel+Fax Packet messages read in BBS @ ON6AR to: ON5OF @ ON6AR. #AN.BEL.EU tnx fer info Dirk

YO2IS wkd : 21.05 DF6NA O/O #, 18.06 DK3FB O/O # in skeds & ran. 11.06. SM0PYP 559/439, K1FO 559/439, 12.06. SM2CEW 559/439. He reports most vertical pol. in June. tnx fer info Szigy

netnews 432&up

HL9UH is back stateside. **OM9EME** (KN08ai) is an expedition from July 23-27th. They will operate skeds on 432.085 random .019. They will use

WORLD WIDE EME MARATHON 1994

Sponsored by the Italian Radio Amateur Association A.R.I. SECTIONS: OM and SWL, portable or fixed station.
DATE/TIME: from 0000z January 1st, 1994 to 2400z December 31st, 1994.

Frequency	Category
VHF 144 MHz	1A QRO (ERP >= 100KW)
VHF 144 MHz	1A QRP (ERP < 100KW or 1-4 ant.)
UHF 432 MHz	2A QRO (> 50dBW ERP)
UHF 432 MHz	2B QRP (< 50dBW ERP)
SHF 1296 MHz	1C QRO (> 60dBW ERP)
SHF 1296 MHz	2C QRP (< 60dBW ERP)
SHF 2304 MHz	
SHF 5760 MHz	
SHF 10450 MHz	

(if you don't specify the category you will be assigned to the QRO category)

- -VALID QSOs: 2way EME CW/SSB.
- -SWL: in this category are admitted also OM stations (licensed radio amateurs) but only SWL and not transmitting.
- -EXCHANGE: callsignes and RST or TMO.
- -SCORING: 100 points per QSO multiplied by the total number of DXCC countries plus 1 (your country is valid for the computation)
- -EXAMPLE: 20 QSOs and 5 DXCC countries means 12000 points. (20 * 100) * (5 + 1) = 12000
- -PRIZE: first 2 OM and SWL of each band. If a station will win in more than one band, he/she can choose only one prize after known the position tables.
- ENTRIES: postmarked no later than January 31st, 1995 to: IW0BET, GIOVANNI ZANGARA , P.O. BOX 36, 00100 ROMA CENTRO, ITALIA, BBS IW0BET@IW0CFV.ILAZ.ITA.EU, EME MARATHON MANAGER, 73 de IW0BET

EME MARATHON 1993 FINAL RESULTS WORLD WIDE

144 MHz QRO							
CALL	N.QSO	Countries	F. Score	JA9BOH	41	21	86.100
I2FAK *	492	46	2.263.200	JH4JLV	15	10	15.000
IK1MTZ *	264	32	844.800	IW5AVM	13	9	11.700
JA4BLC	133	27	359.100	I7FNW	1	2 ??????	200
144 MHz QRP				1296 MHz QRO			
IK2DDR *	201	29	582.900	I2COR	25	15	37.500 #
IW5AVM*	98	28	274.400	1296 MHz QRP			
I1JTQ	79	16	126.400	IK3COJ *	84	17	142.800
I1ANP	49	20	98.00	JA4BLC	16	9	14.400
JA4KLX/1	45	21	94.500	2304 MHz			
IK5UBM	65	11	71.500	I6PNN *	12	6	7.200
IN3TWX	24	11	26.400	JA4BLC	5	3	1.500
JA9BOH	13	8	10.400				
I4GBZ	4	5	2.000				
432 MHz QRO							
I2COR*	93	23	213.900				
JA4BLC	87	23	200.100#				
ON4KNG*	65	17	110.500				

= (Prized on other band), * = PRIZED STATIONS, many thanks to all stations for participation. special thanks to japanese stations. hoping to increase participants number on 1994. best dx
73s de IW0BET Giovanni.

DUBUS BBS:

DUBUS mailbox service information:

- **Tel.: (++ 49 30 455 76 25)**
- **Speed: up to 16800/ARQ/V42bis. Speed of calling modem will be recognized automatically.**
- **Services:**
  - **Bulletin Board/Mail**
  - **DUBUS News**
  - **Technical Software**
  - **EME Skeds Database for 144&432&up**
  - **EME Sked Utilities (Programs)**
  - **EME Contest Results (REF & ARRL)**
  - **European Contest Schedules**
  - **10GHz Active Station List**
  - **European Beacon List**
  - **432&up EME adress list**
- **Access for all who use their call sign.**
- **Box-Operator: DL7APV or DL4EBY**
- **Software Maintainance: DL4EBY**
- **PE1DAB sends the sked database 2m&up from the K4PKV mailbox al-**

OM/DJ5MN or OM/DG1MHY or OM9AME or OM9MHY. QSL adress is Bernhard Dobler, DJ5MN, Breslauer Str.7, D-85435 Erding, or Ingo Raibold, Merowingerstr.21, D-85435 Erding., last info they wkd :JR2JRJ, SM4IVE, PA3CSG, OE5JFL, IW5AVM, SM2CEW, UR5LX, DF3RU, S51ZO, K1FO, SM0PYP, & DL9KR. **CX9BT** has trouble to communicate on EME-net and packet radio. He continues to make progress on 23&70, but not qrv yet. He has 60w on 2304 but it will be delayed to '95 . **DJ7FJ** has a 4.5m dish for 10G now but still amstrong controlled. **CT1WW** plans to put down his 8x21el ft and replace it by a hb antenna. **EA3DXU** wkd I5TDJ (!), IK3MAC, DF6NA, IK1MTZ, ZS6AXT. **JA2JRJ** was not on 432 both 11/12.06. He is working with 8877 * 2 AMP on 144 Mhz. Initial check with lower power level seems to be promising. He is looking for Sked with South American station. he can see the Moon without blockage to any direction. He worked on 432 K1FO in his moonset. The five bells group will be qrv 9-16.08. with 8x21el &3CX800 form **OY** (**IP61**). They are to tx on 432.028 during the 2nd period and will take skeds via 20m. **W4RDI** has lost his array in a storm. **VE3BQN** is back on 1296.

1296 MHz

EA6/DF5JJ wkd : 18.03. OZ4MM, HB9BBD, 19.03. F1ANH, OZ4MM, HB9BHU, OE9XXI, I2COR, ZS6AXT, F5AQC, F6CGJ, F5PL, SM0PYP, SM4DHN, 20.03. IN3HER, F2TU, EA3UM, HB9SV, OH2AXH, N2IQU, AA6WI, 23.04. I6QGA, OE9XXI, ZS6AXT, IK3COJ, LA8LF, HB9BHU, F5PL, 24.04. WA4NJP, HB9BBD, KB2AH, OE9XXI, 14.05. ZS6AXT, LA8LF, HB9BBD, I6QGA, GW3XYW, AA4TJ, HB9BHU, 15.05. OZ4MM, KB2AH, AA6WI, N2IQU, 02.07. ZS6AXT, I6PNN #52, AA6WI, 03.07.I6PNN, F5PL, KB2AH. Peter is looking for skeds until 15.11. TEL/Fax +34 71 53 14 26. rig 500w, 3.7m dish G/T 14dB. He is also looking for TH6885 on 13cm. tnx fer info Peter

HB9BHU wkd : Jan '94 LA8LF M/O #, OZ4MM 549/449 #, K4QIF 439/439 #, OE9XXI 549/549, N2IQU 449/549 #, ZS6AXT 339/449 #, G3LTF 439/449 #, K5JL 539/539 #, Feb. F1ANH 439/439 #, OZ4MM 439/449, IK3COJ hrd, IN3HER 449/559#, OK1KIR 339/449 #, F5PL 449/449 #, OE9ERC 559/549&44/44, SM0PYP 559/569 #, ZS6AXT 339/449, March EA6/DF5JJ O/O #, OZ4MM 449/449, HB9SV 559/559 #, F1ANH 439/439, OE9XXI 569/549&44/44, F6CGJ 449/449, #, F2TU 449/449 #, SM4DHN 559/539 #, HB9SV 549/449, I3COR 439/559 #, SM0PYP 559/559, ZS6AXT 339/449, AA6WI 339/439 #, K2UYH & LX1DB & SV1OE hrd, VE4MA 329/549 #, N2IQU 439/549, F5PL 339/439, OE9XXI 55/44, April KB2AH 549/449 #, AA6WI 439/439, VE4MA 339/339, HB9BBD M/439 #, LA8LF 439/439, IK3COJ 329/O #, I6QGA 559/449 #, OE9XXI 569/559, EA6/DF5JJ 449/O, SV1OE hrd, F5PL 559/339, OE9XXI 44/55, May EA6/DF5JJ 339/339, AA6WI 439/339, OE9XXI 55/54, I6QGA 549/449, ZS6AXT 449/449, OE5JFL 569/559, GW3XYW 449/449 #, KB2AH 559/559, OZ4MM 559/549, HB9BBD 439/429, G3LQR M/O #30. rig 3.7m dish f/d 0.33 VE4MA feed&W2IMU polarizer, YD1270+TH308 300w at feed, FHX35+ATF10136 preamp 9BV design+VK3UM autotrack. tnx fer info Fredi

OE9XXI wkd : 03.04. F6HYE 439/449 #162 (4y 400w), SV1OE 559/559+5/4 5/4 ssb, 17.04. WA8WZG O/O no final Rs, SM5CFS 449/569, 22.04. IK3COJ 449/559, nil sked HL5QO, 23/24.04. AA6WI 54/55, K9KFR 55/58, KB2AH 54/57, N8DJB 32/53, I6QGA 54/57, IW6ARH 54/57 = I6QGA, ZS6AXT 44/55, SV1OE 44/54, IK3COJ 43/44, I0UGB 33/53, HB9BHU 44/53, EA6/DF5JJ 44/45, VK1VP O/O, LA8LF 559/579, WA8WZG O/O O/O #163 (2-loop-y 100w), N2IQU 559/579, HB9BBD 559/599, EA3UM 559/579, WA4NJP 559/599 and KA1OTP M/O no final Rs (8y 80w), 01.05. DK2GR O/O #164 (2y-500w), 14/15.05. ZS6AXT 559/569, I6QGA 559/559, I6PNN 549/559, G3LQR 449/569, HB9BBD 44/53, WA4NJP 43/54, F2TU 54/55, HB9BHU 54/54, KB2AH 54/56, OZ4MM 44/56, I6PNN 44/54, 20/22.05. HB9BBD 559/559, WA4NJP 559/599, KA1OTP O/O #165, ZS6AXT 549/579, 12.06. GW3XYW 55/55, KB2AH 55/57, DL0SHF 55/57 #166, AA6WI 55/55, AA4TJ 43/56, OZ4MM 55/57, KN6DD 559/589, 18.06. K9ZZH O/O #167, 04.07. TK/DF2VJ/p nil 16.07. DL3IAS M/O #168 (1m dish 180w), 23/24.07. I6PNN 43/54, I0UGB 42/51, G4DZU M/O #169, OZ4MM 579/579 & 55/56, G0LBK T/O nc. tnx fer info Peter

2304/2320MHz

OE9XXI wkd *:* 16/17.04. F1ANH 549/439, IN3HER 549/449, OE9ERC 559/559, JA4BLC O/O, SM0PYP 549/559 and nil sked W3KWH, 26.04. VE1BVL O/O #37. tnx fer info Peter

10 GHz

DF7FJ monitored *:* 05.06. a 10GHz EME test between WA7CJO and W3CCX. His receiving system consisted of a 1.2m dish! with HEMT preamp+conv..WA7CJO copied "O". tnx fer info Joe

DL2GSG/p wkd *:* during the annual Kochelsberg SHF meeting on 11 June DF7FJ gave a talk about their 10 GHz EME activity. As a highlight they brought along a portable EME rig, 2m dish mounted on a trailer and the proven receiving system along with 2 TWT's in parallel with 25w out. DL2GCG/p wkd : SM4DHN M/M and WA7CJO O/O under the stress of about 100 spectators watching them. tnx fer info Greg.

OK1KIR wkd: 16.04.94 DJ7FJ O/O #3, hrd I4CHY M, WA7CJO 439 and ON6JZ M, 14.05. I4CHY O/M no final r, 17.06. G3WDG O/O #4, G4KGC O/O, 19.06. I4CHY O/M #5, 09.07 VE7CLD M/-, 16.07. K9KFR O/-. They have a new linear rotatable feed.tnx fer info Tonda OK1DAI

Gossip column

As **Charlie**, G3WDG was in the US visiting WA5VJB he worked from Kent's station his wife Petra, G4KGC on 10GHz; was an international telefone call too expensive?? **Ivo**'s (ZS6AXT) time in May was limited due his wife's away in OK-land and he had to do all the cooking washing etc (during moon-window?). **Doug**, VK3UM reports that he will build a new house; what about bigger antennas? **F5FLN** is the proud papa of a baby girl. He expects to be back next spring with 8y. When you have problems changing babies napkins ask PA3CSG or OE5JFL for advice (these are the professionals!). **Al**, K2UYH published in June the sked's for May and caused some confusion; we like Al's secret weapon to motivate those sked guys for random operation!

Last :

An overview from Klaus DL4EBY about 432&up presents, that around 120-130 Stations are qrv every sked weekend on 432&up. I have splitted it into a statistic see later. Our EME mast is brocken down so that DK0NHF is qrt now. No time to put up a new one, hopefully we will be back in autumn. **Please let your reports come, but in time please.** I had only 3 pages at deadline and 10p three days (&3 working nights!) later.

73 Bernd DL7APV

Activity statistics

April - June based on reported QSO in EME NL and DUBUS (might not be complete!)

432 Call	April	May	June
9A2EA	X		
9M2BV	X	X	
DF3RU	X	X	X
DF6NA	X	X	X
DJ5MN		X	
DK0NHF		X	X
DK0VS		X	
DK0TU		X	
DK1PZ	X		
DK3FB			X
DK8VS			X
DL3BWW	X	X	X
DL3YEE	X		
DL6WU	X		X
DL9KR	X	X	X
DL9NDD	X		X
EA2LU	X	X	
EA3DXU	X	X	X
EA3UM	X	X	
EA5CJ	X		
EA8/ON5FF	X		
F1ANH	X		
F1JCG	X		
F2TU	X		
F5MZN	X		
F6CGJ	X		
G0BPU	X	X	
G3HUL	X	X	X
G3SEK	X	X	
G4ALH	X		
G4ERG		X	
G4FRE		X	
G4RGK	X	X	X
G4VIX			X
HB9HLM	X		
HB9JAW	X		
HL9UH	X		X
I2COR	X		X
I5CTE	X		X
I5MPK	X	X	
I5TDJ		X	X
IK1HWG	X		
IK1MTZ		X	X
IK3MAC		X	
IK6JWK	X		
IK5WJD		X	X
IK6EIW	X		X
IN3HER	X	X	X
IW5AVM	X	X	
JA2JRJ	X		
JA2KRW	X	X	X
JA2ODV		X	
JA4BLC	X	X	X
JA5OVU	X	X	X
JA6CZD	X		
JA9BOH	X	X	X
JH2CFD	X	X	
JH4JLV			X
JL1ZCG	X		
JO3RNL		X	
K0RZ	X	X	X
K1FO	X	X	X
K2UYH	X	X	
K3LFO	X		
K5JL	X	X	
K5WXN		X	
K6HXW	X		
K8WW	X		
KB2AYU		X	
KB4WM			X
KB8ZW	X	X	
KD4LT		X	X
N2IQU	X		X
N4GJV	X	X	
OE5JFL	X		
OK1CA	X	X	
ON4KNG	X	X	X
PA3CSG	X	X	X
PY5ZBU		X	
S51ZO	X	X	
SM0PYP	X		X
SM2CEW	X	X	X
SM4IVE	X	X	
UA6LGH	X		
UA9FAD		X	
UR5LX	X	X	X
UT1PA	X	X	
UT5DL	X		
UT5EC	X		
UT7VF	X	X	X
VE1ALQ	X		
VE1BVL	X	X	
VK2DND	X	X	
VK3UM		X	X
VK5MC	X		
W0KJY	X		X
W1ZX/3	X		
W2CRS/0	X		
W2UHI	X	X	X
W7CI	X		
W7HAH			X
W8TN	X	X	
WA3FFC		X	
WA4NJP			X
YO2IS	X		X
ZL3AAD		X	
ZS6AXT	X	X	X
= 104	= 80	= 59	= 44

1296 Call	April	May	June
AA4TJ			X
AA6WI	X	X	X
DL0SHF			X
EA3UM	X		
EA6/DF5JJ	X	X	
F1ANH	X		X
F2TU	X	X	
F5PL	X	X	
F6HYE	X		
G3LQR	X	X	
GW3XYW		X	X
HB9BBD	X	X	X
HB9BHU	X	X	X
I6PNN	X	X	X
I6QGA	X	X	
IK3COJ	X		X
IW6ARH		X	
JA4BLC			X
JH3EAO	X	X	
KB2AH	X	X	X
KA1OTP	X	X	
K9KFR	X		
K9ZZH			X
KN6DD			X
LA8LF	X	X	X
N2IQU	X		X
N8DJB	X	X	
OE5JFL	X	X	
OE9ERC			X
OE9XXI	X	X	X
OH2AXH		X	X
OZ4MM		X	X
PA3CSG	X		
SM0PYP			X
SM2CEW	X		
SM3AKW	X		
SM4DHN		X	
SM5CFS	X	X	
SV1OE	X	X	
VE4MA	X	X	
W0KJY	X		
W0RAP	X		
WA4NJP	X	X	
WA8WZG	X	X	
VK1VP		X	
ZS6AXT	X	X	X
= 46	= 33	= 28	= 20

2304 Call	April	May	June
F2TU	X		
F1ANH	X	X	
GW3XYW		X	
IN3HER	X		
OE9ERC	X	X	
OE9XXI	X		
VE1BVL	X		
VE4MA	X	X	
W4HHK	X	X	X
WB5LUA	X		X
JA4BLC	X		X
W7GBI			X
G3LQR		X	
I6PNN		X	
W3KWH	X		
= 15	= 11	= 7	= 4

10G Call	April	May	June
DF7FJ	X		X
I4CHY	X	X	X
SM4DHN			X
VE7CLD	X		X
WA5VJB	X		X
WA7CJO	X		X
G3WDG/ G4KGC	X		X
OK1KIR		X	X
ON6JZ	X		X
G4RFR			X
K9KFR			X
= 11	= 7	= 2	= 11

Tropo News

Editor: Joachim Kraft, DL8HCZ

2m > 700 km

DD0BI, JO33RL, wkd on 2m: 13.06.94 LA8OW JP50. 2.7.94 F6KBI/P IN97. tks fr info

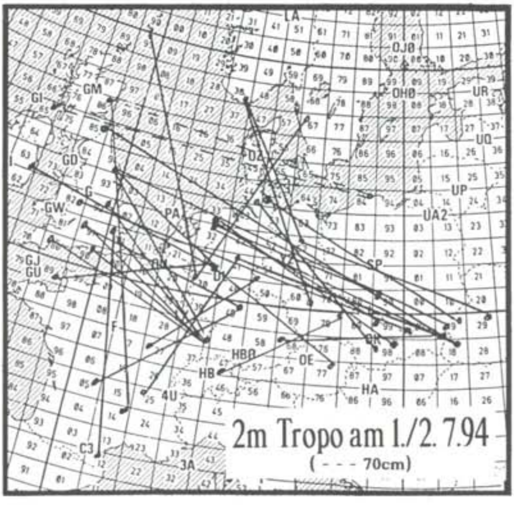
DD4OT, JO42XT, wkd 2m: 1.7.94 2205 UT5DL/P 59 59 KN18KS, 2220 OM3MB/P 59 59 JN98TW, 2310 OK2VYG/P JO70JT, 2317 SP9EIJ JO90FB, 2318 SP9QZT JO90FB, 2324 OK1UYR/P JN79IO, 2331 UR5DDX/P 55 55 KN18KS. RIG TR-9000 + PA 50WATT, 2X 10 ELE.YAGI. tks fr info, Hans

DG9NBT, JN49WS, wkd 2m: 2.5.94 LA9YN JO48OR 997. 21.5.94 G4APA/P IO94RJ 877, G4DSP/P JO03CE 769. 15.6.94 GJ4AFF/P IN89WG 867. Rig 4 x 11 ele Yagi. Skeds for 2m, 70cm, 23cm, 13cm + 3cm welcome via PR DG9NBT DB0GV or Phone 09306/906949 or FAX /1069 tks fr info, Martin

DH6JT, JO31JO / DL34B, wkd 2m: 03.04.94 OK1DHC/P JN69, OK1KNG/P JN69, OK1KJB/P JN79. 17.04.94 F6HPP/P JN19, F5MGD JN19, F6DQZ JN19. 27.04.94 A LOT OF G'S FROM JO00-JO03, IO90-94, IO80, 81. 03.05.94 OZ9EDR JO55, OZ1DOQ/P JO64, F6HVK JN27, HB9JAW JN47. 07.05.94 DL2VAA/P JO71, HB9LU/P JN46, HB9CNY/P JN36, OE1XTU/3 JN77, DL0SG/P JN69, HB9RDE JN37. 21.05.91 G8FBG/P IO91, GW0RDI/P IO82, G3PIA/P IO91, G4APA/P IO94, DL0HRO/P JO74. 07.06.94 F8KLW/P JN17, F6KBF/P JN08, F6CTT/P IN97, F6EAM JN19, F5MXP IN87, F5POJ JN19, DL9USA JO71. 11.06.94 OZ9VUS JO56, OZ1DOQ/P JO56. 13.06.94 F1AFC JN28, OZ6ABA JO57, LA1ZE JO28, LA9DM JO59, LA2PHA JO38, LA8SJ JO59, LA3BO JO59. 17.06.94 GJ4AFF/P IN89. 27.06.94 I2FAK JN45, G6LEU IO70, G0BLB IO81, G0ODI IO90, G4RUW IO91, G4KIT IO90, GW3KJW IO72, G3JMY IO81, G4RRA IO91, G0GXT IO81, GB3LER JP90 BAKE 599++++. RIG 144MHZ TS-700MOD, 4CX250B, 17EL LY, MGF1302

DK8LV wkd on 2m: 11.7.94 F5ADT IN94 1291km. 23.7.94 F1FPL/P IN99, F2LQ/P IN88, F6CKZ JN09, G0BLB IO81, G0CUZ IO82, G0EMG IO94, G0GAG IO93, G0OFE IO90, G1BFK IO93, G3CKR/P IO93, G3KEQ JO01, G4LCQ/P IO92, G7RAU IO90, G8LNC/P IO90, GM4RWE IO86, GU3EJL IN89, GW4UDE/P IO82. 30.7.93 ES2RL/3 KO18, ES5WE/0 KO07. 31.7.94 ES8JX KO28, UA2FL KO04, YL2GDA KO06, YL3AG KO26. tks fr info, Stephan

DK0PX, Op DH3IAJ, JN48JC wkd 2m: 18.6.94 1645 HA3UU JN96JO, 1648 HG7B/P JN97KW, 1650 HG1W JN87GF, 1653 HA2KSD JN87VE, 1655 S57O JN86DT, 1657 HG1Z JN86KU, 1900 9A1CCY JN85OO, 1924 HG6Z JN97WV, 1931 OK1OEA JO80FG. 5.7.94 1854 OZ1DOQ/P JO64GX, 1858 OZ1SDB/P JO44XX, 1925 OZ9EDR JO55UL, 1948 TK/DC3VW/P



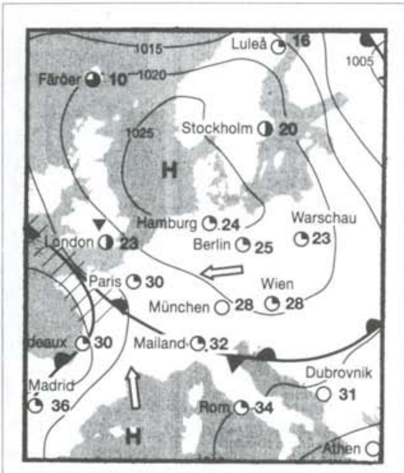
2m Tropo am 1./2. 7.94
(- - - 70cm)

JN42MM. 20.7.94 1052 DB8WK JO33XN, 1100 DK0OF JO33TD. DK0PX is qrv during contests up to 24 Gc. Skeds welcome via PR DH3IAJ OE9XPI.AUT.EU TEL ++741/21982 tks fr info, Ralf

DL0FTG, JO53AP, wkd 2m: 31.7.94 ES5WE/0 KO07.

DL1GNM, JN38WB wkd 2m: Rig 2X10EL. XY RECHTSZIRKULAR, 200W, BF981 2.7.94 2150 G3SDC/P IO92NP 802, 2159 G6LX/P IO91XH 674, 2202 G3ZMS/P IO90WV 657, 2206 G3WOI/P IO91GI 763, 2214 G0PPO/P JO01DH 654, 2219 G6CTU/P IO91XG 671, 2253 G3WSC/P JO01OC 587, 2312 G4BRA/P IO80ST 806, 2328 G3WMR/P JO01BH 664, 3.7.94 0009 G0MSJ/P hrd JO00EW, 0021 G7IJB/P HRD, 0806 G4JAR/P JO01PU 631, 0808 G6SRC/P JO01JG 621, 0810 G4ERG/P HRD IO94, 0828 G4MRS/P JO02PA 643, AND HRD G4AHT/P. tks fr info, Michael

DL8EBW, DL66A/JO31NF wkd on 2m: 12.05.94 1940 TP6CE JN38VO. 04.06.94 1526 F6CTT IN97HV, 1854 F5EAN JN06CP, and a lot of stns from JN08, 09, 19, 18, 17, 29, 28, 27. 07.06.94 1950 GU/DC9KZ IN89RK. 13.06.94 2157 LA8SJ JO59HQ, 2202 LA3BO JO59CD, 2204 OZ6ABA JO57DJ, 2209 LA3BAA JO38PB, 2230 SM6KJX JO67CK, 2243 LA2PHA JO38IB, 2246 LA6MV JO59FJ, 2322 LA8OW JP50NC. 14.06.94 0458 OZ5AGJ JO56DF. 15.06.94 1810 GJ4AFF/P IN89WG. 17.06.94 1550 GJ4AFF/P IN89WG. 18.06.94 0835 F5MSL/P JN26CS, 0619 DC1RT/P JN68AK. 19.06.94 0830 OK1PGS/P JN69RR. tks fr info, Guido



High Pressure Area at 1st of July, 1994

DL8EBW/p,JN57LN, 1780m a.s.l. wkd 2m: 23.5.94 1130 IW5BML JN53PD 492 KM, 1135 DF7KF JO30GU 486 KM, 1138 DG3KCE/P JO30FQ 477 KM, 1140 DL1KDA JO30FQ 477 KM, 1145 DB8KJ JO30CM 477 KM, 1150 DC9KZ JO30IX 489 KM, 1153 PA0PVW JO21VX 615 KM ODX!, 1200 DG6PY/P JO30JF 425 KM, 1228 DK0KK/P JO30GU 486 KM, 1354 DK9OY JO52CK 544 KM. DL8EBW RIG IC202, 3 EL, 3 W !!

EA7DBH, IM76GD wkd 1300km on 2m: 6.6.94 EB8BTV IL18QI. 8.6.94 5T5JC 1105UT IL30LM SSB-CW 1886 km! EA8AEA IL18RI, EB8ALZ IL18RI. 22.7.94 EA8AHH/M IL18VN, EB8BHN/M IL18VN, EA8AOM IL18TK. 24.7.94 EB8AYT IL28AG, EA8CAB IL28AG, EA8ACM IL28AG. Rig 100 w + 12 ele yagi. tks fr info, Miguel

EA9AI (XV04e) wkd via Tropo on 144MHz (700 km): 5.6.94 0934 EB8BTV RO57b 1355 km, 0949 EB8ALZ RO58h 1349 km. 8.6.94 1058 5T5JC TG35d 1869 km ssb+cw. 10.6.94 1940 EB8BTV RO57b 1355 km. 10.7.94 0611 EB8ALZ RO58h 1349 km, 0808 EB8BTV RO57b 1355 km. 12.7.94 2323 EA6SA BZ35a 827 km. tnx fr info, Francisco

I4XCC, JN63 wkd 2m: 09.01.94 1035 F1CYB JN17XT, 1040 F1DUO JN26MB, 1151 DH0YAZ JO41GV, 1227 IK8TOY/8 JM89AG. 06.03.94 0342 DL0EKO JO72HC, 0344 DL6UDX JO72HD, 0535 DL0WAE JO42FB. 30.04.94 0841 DK9OY JO52CK, 1300 DL1KDA JO30FQ, 1311 DF9KX JO30FQ, 1355 DH0YAZ JO41GV. 08.05.94 0051 DF0RI JO42NC, 0052 DK3DM/P JO42NC, 0349 DL0WX JO30FQ, 0530 DF0YY JO62MD, 1050 F6HPP/P JN19PG, 1127 DL0HOY/P JO71DB. 29.05.94 1015 DL9YEY JO41GV. 04.06.94 1010 SP9AGV JO90JH, 1345 F6KQL/P JN37JK, 1430 F5OKD/P JN15VQ, 1559 F6KDF/P JN25GQ, 1657 F5JNX/P JN37NV, 1659 T94BK JN93EU, 1837 YU1IO KN04IQ. 05.06.94 1537 I8TUS JM89CG. 10.06.94 0605 DL9YEY JO41GV. 18.06.94 1439 SP0VHF JO81WI, 1457 DL4DWA JO61QH. 27.06.94 1328 DL9YEY JO41GV. 02.07.94 1740 F1OOM/P 55148 55049 JN28WQ. 03.07.94 0025 SP9UUV/P JO90RM, 0320 F6KSL/P JN28QJ, 0504 OM3KDX/P KN19DB, 0559 YO2IU/P KN06ID, 0603 YO2II/P KN06UG. tks fr info, Claudio

OK1MAC, JN79 wkd 2m: 3.7.94 TK/DC3VW/p JN42NN. tks fr info, Jan

PE1LAU, JO33 wkd 2m: 1.7.94 21.38 UT5DL/P KN18, 21.59 OM3KDX/P KN19, 22.11 OM3MB/P JN98, 22.45 UR5DDX/P KN18, 23.08 OK2VYG JN99 ALSO OK2BVE, OK2UYG, 23.19 SP9EWQ/P JN99, 23.20 SP9QZT/P + SP9EIJ/P JO90. tks fr info

YO5TE wkd on 2m YO5TE/P, KN16TQ: 19.6.94 OK1AJY/P JO70PO 750 KM. YO5TE/P, KN16JS: 2.7.94 OK1OXX/P JN69SA 733 KM. tks fr info, Nelu

70cm > 500km

DF0CB wkd on 70cm: 7.5.94 1404-1824UT DL0UL/P JN48UO 533, HB9DLO/P JN37MD 723, F6KIM JN38AJ 617, DL5MHB/P JN58KI 565, DJ3ST/P JN48EV 511, DF8GQ/P JN48CO 545, DG2GFR/P JN47RU 616, DL0DR JN48FX 501, HB9FX/P JN37RN 670, ON6ZT JO10UU 507, DJ3JJ JN48VF 574. RIG 4*17ELE + 100W, 160M A.S.L. tks fr info, Mathias

DF9UV/P, JN48JE, wkd 70cm: Rig 10w 21 ele yagi, 980m a.s.l. 2.7.94 1431 PA3FPS JO22IJ 549(km) 1528 PA0PLY JO22MH 529, 1551 DL0HU/P JO44OJ 689, 1641 S5/IV3DVB JN65WW 459, 1735 OE3EFS/3 JN78SB 503, 1841 PA3BPC/P JO21BX 536, 1943 G0FRR/P IO80WP 837, 2129 G6FRS/P IO91OF 768, 2150 PA6C JO33GB 563, 2206 G4MRS/P JO02PA 684, 2238 G3ZPB/P IO91XH 724, 2244 G4WJS IO91NP 792, 2253 G0NTP/P JO01DH 703, 2304 G8MNY/P IO91XG 722, 2338 G1RDX/P IO91OS 793, 0019 G1ZMS/P IO90WV 711, 0039 G4JAR/P JO01PU 673, 0046 PI4GN JO33KK 597, 0600 DL8BDU JO43AA 538, 0625 G4CLA/P JO03BF 828, 0714 G4FAM/P JO01LD 653, 0923 DK5HQ JO53CO 608, 0936 G6APZ/P IO94WC 904, 0950 G0JRB/P IO94SB 917 ODX, 1059 DF0CB JO43VI 577, 1206 DL0OU/P JO54DG 682 1225 S53M JN86BS 574, 1232 S57C JN76OM 518. tks fr info, Peter

DG9NBT, JN49WS, wkd on 70cm: 3.5.94 SO1NVC/P JO73FU. 7.5.94 DL0HU/P JO44OJ, DL3LAB JO44XS, G4CRA/P JO01IT, G4DSP/P JO03AE, G4GCM/P JO01QX, G4HRY/P JO01KJ, G4PIQ JO01MU, G4PUB/P JO01OU, G8FBG/P JO02QD, IK4DCX JN64GA. 8.5.94 DL6NVC/P JO73AL, S5/IV3DVB JN65WW, S51S JN76B, S53M JN86BS, S51ZO JN86DR. 10.5.94 OZ9EDR JO55UL. 12.6.94 S51ZO JN86DR. 18.6.94 I4GBZ JN54VV. 19.6.94 DL6NVC/P JO73AL, HG1W JN87GF, S53N JN65WW. tks fr info, Martin

DH6JT, JO31 wkd 70cm: 02.07.94 G4MRS/P JO02, G4JAR/P JO01, DF0CI/P JO51. RIG 70CM IC-402 (3 W), 21EL. LY tks fr info Thorsten

DJ8ES, JO43 wkd 70cm: 16.05.94 19.23 G8GXP IO93FQ 727km, 20.14 G4IVN JO02UP 540km. tks fr info, Wolfgang

DL1GNM, JN38WB wkd 70cm: Rig 2X18EL XY, RECHTSZIRKULAR, 20W, CF300 2.7.94 2240 G3ZPB/P HRD IO91XH. 3.7.94 0816 PA3BPC/P 53 HRD, 0820 G4CLA/P hrd JO03BF, 0924 G4JAR/P JO01PU 631, 0934 G4MRS/P 5JO02PA 643. tks fr info, Guido

PA0WWM in CM53: 13-06-94 DL6NVC/P HN41H, 13-06-94 DL7ALPGM38F, 28-06-94 EI5FK VL18H, 01-07-94 OK1DKS/P GK45D02-07-94 G7AIC/P YK05D 03-07-94 OZ9EDR/P GO03B, 03-07-94 G4BRA/P YK18C, 03-07-94 G8IUB/P YM75C, 03-07-94 F5GYA/P BF29C. Tnx fer info Wim

SP1JVG, JO84OP, 150m a.s.l., wkd 2./3.7.94 on 70cm: 19.00 GM6VIU/P IO65RU 51 51 1503 KM, 20.50 DF0CB JO43VI 505, 21.12 DG7LAZ JO43UG 513, 21.40 PA3BLS/P JO22NT 819, 21.55 PJ4GN JO33KK 687, 23.09 DB8WK JO33XN 614, 23.31 GM3ZBE/P IO86RW 1255km, 05.07 OK1KQW/P JO80NB 509, 05.12 OK2KDS/P JN99DL 579, 05.44 OK2KQQ/P JN99FN 571, 05.46 OK2KHF/P JO90NE 512, 05.57 OK2KDJ/P JN99BM 573, 06.07 OK2KIS/P JN99CL 578. and on 23cm: 19.25 DL0HU/P JO44OJ 516 KM, 19.30 OZ9EDR/P JO64GX 301, 19.32 DJ1LP JO64CC 329, 19.38 OZ8ERA/P JO55XF 341, 19.53 DL5KVD JO64AD 339, 21.28 PA6C JO33FB 725, 22.35 PA3GCV JO42LU 577, 22.37 PA3GUS JO22OK 828, 22.59 PI4GN JO33KK 59 59 687, 23.40 GM3ZBE/P IO86RW 51 51 1255km!!, 05.20 SP6GWB/P JO80JG 559 559 487. Rig 70CM 25 W HB9/SP1CLY (COMBINATION HB9CV + 25 EL) 23CM 10 W ANT. DL6WU (DUBUS 2/94). tks fr info, Mirek

YO5TE wkd on 70cm: YO5TE/P, KN16TQ: 19.6.94 SP9EWU JO90NH 521 KM, S57O JN86DT 558 KM. YO5TE/P, KN16JS: 2.7.94 S5/IV3DVB JN65WW 690 KM. 3.7.94 9A1CBE JN86BE 514 KM, OE6XLD/6 JN77WM 529 KM, S57C JN76OM 579 KM. The group from yo5kai club is always qrv during big contests from very good places (example,kn16js 1836 m asl and excellent take off in all directions).I suppose that other dx qsos in 2m,70cm & 23cm are also possible at higher distance but the first step is that you turn the antenna system in our direction (hi!). Tropo skeeds during contests are welcome at bbs yo5teyo5dmb.clj.rom.eu. - tks fr info, Nelu

6m News

Editor: Joachim Kraft, DL8HCZ

DJ2XS, JO53 wkd 6m: 15.5.94 1345 YU1NW KN04OO, 1350 9A1CRJ JN95HN, 1355 YU7AS KN05DJ, 1400 9A2OB JN95IM, 1405 YZ1SM KN04RR. 17.5.94 I5XDL JN52, RA3TES LO15, R3VHF LO16, RA3YO KO73. 1.6.94 I2TUG JN45. 2.6.94 R3VHF LO16, EU1AA KO33, EW1AA KO33. 9.6.94 IK7UXY JN90, I8IGS JM78, JY7SIX KM71. 16.6.94 9A3FT JN83, Z32BU KN01, YU1NW KN04, OH3MF KP20, OH5NR KP30, IT0EIK JN80. tks fr info, Mathias

DJ3TF, JN59 WKD: 15.5.94 0816 RA3YO KO73, 1702 EA8/DJ3OS IL18. 16.5.94 1525 SV9ANK KM25, YO4BZC KN45, SP7DCS/7 JO91, 1710 TK/F5HRY JN41 DXCC #106, 1814 SV8RV KM07. 17.5.94 0632 ES6PZ KO38, 0715 YU7FU KN04, 0900 5T5JC IL30 DXCC #107, 1417 Z32BU KN01 DXCC #108. 21.5.94 1053 ES1CW KO29. 22.5.94 1848 CT1DVV IN50. 11.6.94 1008 5T5JC IL30. 14.6.94 1835 JY7SIX KM71. 18.6.94 0839 F/G7EQM IN86. 19.6.94 0908 EH6IF JN20, 2008 FP5EK CW-599 GN16, 2009 K1TR, 2107 K8MF EN90. USA was wide open, but i did not call stations, which i worked within the last years... tks fr info, Wolfgang

DJ6TK, JO53 wkd 17.5.94 R3VHF LO16, RA3TES KO15, SP8MMZ KO11,EU6MS KO25, OM3PC JN98,OH3MF KP20, OH4OB KP32, EU1AA KO33 EX UC2AA, RA3YO KO73. 12.6.94 0800 EU1AA, 0853 SM3BIU JP73, 1328 EH3ADW, EH3CUU, 1430 EH3EHQ. 14.6.94 IC8SDL JN70. 17.6.94 EH6VQ JM19, 1426 5T5JC IL30, 1550 G4HBA IO80, 1746 9K2ZR 1803 LA5SAA JO29, 1817 EH8ACW IL28, 1913 OH3MF KP20. 18.6.94 IS0OMH JN40, 0835 RA3YO KO73, 0853 EW7IM KO53, 0935 EU1AA KO33, 1232 EH6IF JN20, EU1AA KO33, 1232 EH6IF JN20, 1240 YO7VS KN14, 1312 SV4AAQ KM19, 1339 9A1CCY JN85, 1457 SV7CO KN20, 1504 SV8CS KM07. 19.6.94 0824 OH9NDD KP26, 1009 EH6FB JM08. 22.6.94 1454 EH7DJW IM76, 1603 9H5DV JM75, 2057 LA5FTA JP99. 23.6.94 0916 OH1VR KP11, 0957 CT1DHM IN61, 1047 R3VHF LO16. 29.6.94 0751 9H3IE JM75, 0811 9H3QD JM75. 30.6.94 0940 RA3YO KO73. tks fr info, Wilf

DL1GNM, JN38 wkd 6m: 14.06.94 18:29 CT1DIZ IM58, 20:11 EH6SA JM19. 15.06.94 19:05 GM0EWX IO67UL. 17.06.94 11:06 CT1DIZ IM58. 18:49 EH3/DJ3MY JN01ME. 18:52 EH1YV IN52. 18.06.94 09:11 F/G7EQM/P IN86, 09:27 EH1TA/P IN63BF, 10:38 C31HK JN02, 11:18 EH6VQ JM19MP, 12:48 ER5OK KN46, 12:55 YO9IE KN34. 19.06.94 09:58 EH1DDU IN73FM, 12:21 ZB2BL 31/HRD IM76HD, 12:46 5T5JC 31/HRD IL30, 13:17 CN8ST 59/HRD IM64NA, 15:42 ZB2VHF 559/HRD IM76HE. 20.06.94 17:35 GM0ILB IP90, 18:19 EI7GL IO51TU, 18:27 ZB2VHF 529/BCN. 22.06.94 15:30 GB3MCB 599/BCN IO70OJ, 15:48 F2LQ IN98EB, 15:51 F1SAH IN88KU, 15:55 GU1DWO IN89, 15:59 GU2XML 55 hrd IN89QK, 16:27 EH4CAV/P IM89HH. 02.07.94 13:00 SP5MXL JO92UN, 13:01 SP5NZE JO92UN, 16:52 ES2RW/2 KO19XI, 17:05 LA/F5SJP/P JP28RW, 19:27 SP6BTI JO81HI, 19:29 SP7VCD JO91RT, 19:30 SP6CPH JO81IG. 04.07.94 16:33 SP5NZE JO92UN, 16:34 SP7BCA KO01BW, 16:35 SP7RFE KO01BW, 16:38 SP7VCD JO91RT, 16:39 SP5NHF KO02MD. tks fr info, Michael

DL7ARM, JO62 wkd: 16.5.94 19-20UT CT1DHM, IN61, I, EA2,3,5,6(JM19). 17.5.94 1100-2050 R3VHF LO16, RA3TES LO15, I, IT9, EA2,3,5, TK/F5HRY JN41. 25.6.94 1700-1900 CT1DVV (IN50), GB2RAF. 26.6.94 1800-2030 G. 02.7.94 1100-2100 S5, 9H, RU1A KO48, GJ, ES2RW/2 KO19, 9A5Y JN85, T97V JN84, 9A70Z JN75, 9A2OB JN95, G, I. 03.7.94 0830 EA8/DJ3OS 59++. 12.7.94 1540 SV8CS KM07. tks fr info, Christian

DL7QY, JN59 wkd: 15.6.94 2208-2240: VE1PZ FN85, VE1AA FN65, VE1RAA FN84, VE1ZZ

FN84 VE1YX, K0SN/CY9 FN97 (59!!), XL1YX FN74. 19.6.94 1837-2011: W2CAP FN41, VE1RAA FN84, FP5EK GN16 (599!!), K1TOL FN44 WA3TBG FN42, VE3KKL FN25, W1AIM FN34, K8MFO EN90, WB2ELB FN03. 25.6.94 14:50-22:30 : N4EJV EL97, K4SC EL98, KJ4E EL98, W4WHK EM90, K2UO EL87, NT4B EL89, WA4CHA EL88, K3QKP EL98, N4UYO EL88, WB4NFS/VP9 FM72 (DXCC#119) WA4UAS EL87, WB2CUS/4 EL98, WZ1V FN31, WD4MGB EL87. Hrd: N5JHV + mni others. tks fr info, Claus

DL8EBW, JO31, wkd 6m: 09.05.94 1750 CT0WW IN61. 15.05.94 1734 SP8MMZ KO11. 17.05.94 0715 YU7FU KN04, 1353 Z32BU KN01, 1554 EU1AA KO33.

DL8HCZ, JO53AP, wkd: 2.6.94 ER5OK KN46. 9.6.94 JY7SIX KM71. 16.6.94 F/G7EQM IN86. 17.6.94 5T5JC IL30. 20.6.94 F1AUX IN98, F1YJ JN17, UX0FF KN45. 22.6.94 EH4CYV/P IM89. 2.7.94 US7CQ KN59, T97V JN84. 5.7.94 OH9NDD KP26. 6.8.94 DL9USA JO71.

I4XCC, JN63 wkd 50 MHZ: 15.05.94 0949 OD5SK KM74WK. 21.05.94 0850 SP8MMZ KO11JI, 0859 OM3ID JN88ME, 0905 SP7BCA KO01BW, 0910 OH6LGM KP22TJ, 1150 RA3TES LO15JW, 1158 R3VHF LO16XG, 1506 IT9IPQ/9 JM78SG. 02.06.94 1337 EU1AA KO33, 1342 EU6MS KO45IN, 04.06.94 0839 LZ2CI/P KN32DQ, 0845 LZ1ZX/P KN32FR, 0944 5T5JC IL30LM, 1315 HV4NAC JN61FV, 1323 I2ADN/8 JM87. 09.06.94 1259 LZ3BD KN12, 1303 Z32BU KN01RX, 1652 SP9MRK JO90NI. 10.06.94 0728 JY7SIX KM71. 15.06.94 0820 ER5OK KN46, 0944 EW1AA KO33, 1101 9K2ZR 559 599 LL39. 18.06.94 1258 OM3OM KN08QX, 1410 EW7IM KO53, 1630 F1YJ JN17ET. 21.06.94 1730 JY7SIX KM71. 24.06.94 1857 CU1CB 59 59 HM76KX. 25.06.94 1542 UX0FF KN45NI, 1628 N4EJV 559 559 EL97, 1640 ER5OK 599 599 KN46 ES VIA I8YGZ -- 1655 KJ4E 559 449 EL98, 1659 K4SC 559 449 EL98, 1739 YL2MB KO27PI, 1900 YU1NW KN04, 2017 NT4B 559 559 EL89, 2024 K8MFO 559 579 EN90, 2030 KM1H 579 559 FN42NH, 2035 WA1OUB 59 59 FN43, 2038 W4WHK 559 559 EM90, 2040 W2CAP 59 57, 2044 K1JRW 57 55 FN32, 2045 W3EP 559 539 FN31, 2047 W1DU 57 55 FN42, 2103 N2LT 579 579 FN20, 2104 N2CG 549 549 FN20, 2112 W5HUQ/4 559 559 EM90, 2120 K2QE 559 559 FN32. 26.06.94 1737 UX0FF KN45. 30.06.94 1214 5B4/G3DSL KM65FA, 1219 US7CQ KN59, 1233 ES2RW/2 KO19XI. 04.07.94 1715 UU8JJ KN74CK. tks fr info, Claudio

OK1DDO, JO60JD wkd 6m: 16.5.94 16.28 YO4BZC KN45, 17.23 TK/F5HRY JN41, 17.39 YU7AS KN05, 17.42 YU7RK KN05, 17.5.94 14.22 Z32BU KN01, 14.23 9A2OB, 16.58 SP6GZZ IO81 TROPO, 21.5.94 10.25 OH6LGM KP22, 10.31 ES1CW KO29. 22.5.94 15.57 SV9ANJ KM25, 16.33 SV9ANK KM25, 18.01 CT1DVV IN50. 02.6.94 17.02 RA3TES LO15, 17.20 EU1AA KO33, 17.40 EW1AA. 04.6.94 07.22 I2ADN/8 JM87. 12.6.94 12-14.40 MNI EH, F, G. 16.6.94 18.44 JY7SIX KM71. 17.6.94 15.49 SV8QG KM39, 19.12 UU8JJ KN74. 18.6.94 10.04 EW7IM KO53. 12.6.94 ER5OK KN46. 20.6.94 20.03 UX0FF KN45. tks fr info, Jirka

OK1MAC, JN79, wkd: 14.5.94 5T5JC. 15.5.94 RA3YO, R3VHF, EA8/DJ3OS. 17.5.94 TK/F5HRY. 22.5.94 EA6/DF5JJ, IS0MVE, SV9ANJ, SV9ANK, CT1DVV, 5T5JC hrd 59+20. 31.5.94 SV8QG. 2.6.94 EU6MS, EU1AA. 14.6.94 JY7SIX. 18.6.94 US7CQ, CU1EZ, EW7IM. 19.6.94 5T5JC, UU/AH0M. 20.6. SV5TS, UX0FF, EH8ACW. 25.6.94 CT1DIZ, CN8NS. 9.7.94 5T5JC, CT1DK/P. 10.7.94 Z32BU. 21.7.94 SV5TS. tks fr info, Jan

ON7UC, JO11ND, wkd 50MC: 31.5.94 I2ADN/8 JM87, YU1BT KN03, YU7FU KN04, I8TWK JN70 , YU7AS KN05DJ, S51ZO JN86DR, S57AC JN76, YO7VJ KN14 RA3YO KO73. Rig: 1 W OUT + 5 EL. Tks fr info, Johan

SM6CMU, JO57XH (RIG 50 W + 6 EL.) wkd: 19.6.94 20.01 VE1RAA FN84, 20.09 K1TOL FN44, 20.12 XL1YX FN74. ALSO HEARD (19.51-20.18 UT): WA1OUB, WA1AYS, KA1YQ, K1JRW, WA3TBG. AGAIN VE1RAA HEARD AT 21.08 WKG SM6EHY JO67. 25.6.94 20.31 WB4NFS/VP9 FM72 DXCC NO 119, 20.43 N4EJV EL97, 21.06 W4OWJ EL97, 21.12 KJ4E EL98, 20.19 W4OO EL96 (579/579), 20.33 W3EP FN31. ALSO HEARD (20.26-21.52 UT): AD4PS, K4SC, K4FA, W2CAP, W1VAB. tks fr info, Ingo

Meteor Scatter

Editor: Norbert Göttsche, DL8LAQ

Results of the CT Meteorscatter Expedition in May 1994

(CT/DF7KF - CT/DC9KZ - CT/DF7KG)

02.5.94 IM69HH (1000m asl, 17ele F9FT, PA 3CX800)

0400	0445	DL8EBW	JO31NF	-	-	1	17	-	NC
0445	0550	DL1KDA	JO30GU	26	27	8	mni	-	C tailend
0600	0700	DF8LC	JO53GX	26	26	25	23	-	NC
0800	0815	G0CUZ	IO82WM	27	27	26	mni	-	C

NIL: DL3IAE, DL2IAN (tailend), DK9OY, S51AT, HB9JAW

03.05.94 IM69HH

0300	0400	PA3FOC	JO21FW	26	26	23	19	-	C
0400	0430	DL3YEL	JO41EV	26	26	13	5	-	C
0430	0455	DK2PH	JO41EV	26	26	9	13	-	C tailend
0500	0530	DL1EAP	JO31IK	26	26	mni	mni	-	C
0530	0600	DH6JT	JO31JO	26	27	16	15	-	C tailend
0700	0800	IK0BZY	JN61GW	26	27	23	25	-	C?
0800	0830	DH0YAZ	JN41GV	-	-	-	-	-	NC faulty keyer
0830	0900	IW1AZJ	JN35UB	28	27	6	12	-	NC tailend
0900	1000	DJ3MY	JN58QD	27	26	16	12	-	C
1000	1100	DG7SF	JN48RR	26	26	12	16	-	C SSB
1100	1200	DC6DY	JO31IK	27	26	5	11	-	C SSB

NIL: PA2TAB (tailend), S57EA, S51AT (tailend)

04.05.94 IM69HH

0300	0400	DH6JL	JO31MI	26	26	15	11	1.5	C
0400	0442	DF9KX	JO30FQ	26	27	27	25	2	C
0442	0505	DL8EBW	JO31NF	26	27	13	11	24	C *1
0505		DK9OY	JO52CK	37	26	21	6	10	C *1
		DF8LC	JO53CT	26	26	15	10	17	C 2115km ODX! (69)
0700		DC7UT	JO42QN	26	26	6	9	5	NC slow speed
0900		ON4ANT	JO20AR	37	37	mni	mni	8	C
	1000	ON4GG	JO20AR	37	37	mni	mni	37	C tailend
1000	1100	IN3KLQ	JN56RG	26	27	10	10	1	NC TX +1.5kHz?
1100	1200	DJ6WD	JO40AT	26	27	10	8	1	C
1200	1300	I4XCC	JN63GV	26	27	25	18	4	C

NIL: DL2EAA (tailend), OK1FM, DL3MGL (tailend), HA7UL, IK1LGV Remarks: *1 QRM from DL2EAA (pse only call expeditions, if they call CQ!!!)

05.05.94 IM69HH

0400	0500	G0FIG	IO90UU	26	26	12	15	1	NC
0500	0540	IW1AZJ	JN35UB	26	27	21	9	1	C
0540	0610	DL2IAN	JN49BC	27	-	14	5	1.5	NC

0610	0700	DL7AKA	JO62QO	26	-	3	4	4	NC
0700	0805	DL4DTU	JO60TS	26	27	2	4	7	C?
0855	0955	DL3MGL	JN58QD	27	27	25	8	3	C
1055	1140	DK8ZJ	JO30IX	26	-	4	3	0.5	NC

NIL: HA7PL, DF1SO (tailend), IN3KLQ

7.5.94 IM68DH (395m asl, 2x17ele, 3CX800)

0255	0225	G0CUZ	IO82WM	26	28	18	11	1	C
0330	0350	PA2TAB	JO32GB	-	-	-	4	-	NC tailend
0250	0315	DL5MAE	JN58VF	27	27	mni	mni	2.5	C
0315	0345	PA3BIY	JO22FA	26	27	21	23	1.5	C
0350	0421	DL1EAP	JO31IK	27	49	23	18	2	C
0530	0550	F5HRY	JN18DT	26	38	mni	mni	5.5	C tailend
0550	0602	F9HS	JN03GL	38	26	5	6	15	C random
0602	0616	DL8EBW	JO31NF	27	49	mni	mni	5	C
0616	0659	DL2EAA	JO31JO	27	26	13	6	1.5	C tailend
0700	0716	PA3FOC	JO21FW	26	27	12	5	3	C
0750	0855	IK0BZY	JN61GW	27	27	24	21	4	C
0900	0927	DF5BN	JN49GU	27	27	38	14	1	C
0927	0947	DH6JT	JO31JO	26	26	6	2	5	C tailend
1050	1150	IW1AZJ	JN35UB	27	26	32	14	2	C
1226	1302	PA0JMV	JO21PM	26	26	11	10	1	C random
1302	1400	DJ3MY	JN58QD	26	26	3	3	1	C?
1400	1435	EA6VQ	JM19QK	28	26	11	15	2	C

NIL: PA3BZL, DL3BWW (2300km), DL7UME (tailend), DK8ZJ (only QRM frm ON4ANT!)

08.05.94 IM68DH (sri Antenna faulty in the morning)

0641	0705	DK1KO	JO53CT	27	26	17	2	1.5	C 2195km
1400	1505	F6CTW	JN18CS	26	-	29	21	1	NC
1505	1559	DK2PH	JO41EV	26	-	1	-	-	NC Random
1655	1720	PA0RDY	JO22KJ	28	26	4	2	2	C Random

NIL: DL3BWW (2300km), DF8LC (tailend), I5YDI, DL1GI, DL9NDD

09.05.94 IM68DH

0255	0350	DK9OY	JO52CK	26	26	15	21	2	C
0349	0500	DF8LC	JO53GX	26	26	18	13	1	C 2224km ODX! (68)
0500	0545	DK2PH	JO41EV	26	26	19	16	15	C
0545	0610	DL3YEL	JO41EV	37	27	8	4	15	NC tailend
0610	0631	DL1KDA	JO30FQ	38	27	23	mni	3	C
0631	0655	DF9KX	JO30FQ	27	28	18	mni	2	C tailend
0655	0702	DJ9CZ	JO30	27	27	9	mni	2	C
0755	0815	DL9YEY	JO41GV	27	27	5	9	4	C
0820	0855	PA2DWH	JO22	26	27	16	23	1	C tailend
0855	0959	DJ7OF	JO51EP	26	26	14	12	2	C?
1000	1025	DL9NDD	JN59KN	27	27	9	4	1	C
1055	1140	DF1SO	JN48PO	26	26	3	1	0.5	NC

10.05.94 IM68DH

0300	0400	DF6NA	JN49WS	26	27	9	6	2	C
0600	0700	DL3YEL	JO41EV	26	27	14	10	114	C
0700	0800	DK8ZJ	JO30IX	26	37	13	15	4	C
1000	1100	DJ6WD	JO40AT	26	27	9	7	5	C
1050	1105	ON4GG	JO20AR	27	27	mni	mni	2	C

1105	1115	ON4ANT	JO20AR	27	27	mni	mni	2	C
1200	1300	DK0OG	JN68GI	27	27	25	8	1.5	NC

NIL: G0FIG, OE6IWG, PA2TAA, S53VV

Special thanks to Serafin, CT4KQ. Without his help, this expedition was never possible. He gave us his Jeep with mobile-phone, his camping-car and a big generator. Also he organized everything we need for this trip in CT. And at least he gave us for 4 days a home in his house. Also mni thanks to DL8EBW and DL1KDA for the sked-organize and the daily informations from home. *73s Dithmar, Angelo es Horst*

DL8EBW (DL66a/JO31NF) wkd on 144MHz:

040394	0500 0540	LA4XGA	JP33VC	27	R27	12	23	1	C *1
110394	0500 0530	LA4XGA	JP33VC	26	-	3	6	0.5	NC *1/QRN
180394	0500 0538	LA4XGA	JP33VC	R27	27	12	20	1.5	C *1
020494	0500 0557	LA4XGA	JP33VC	R26	26	16	mni	0.5	C *1
080494	0400 0437	LA4XGA	JP33VC	R27	26	6	21	1.5	C *1
100494	0600 0657	SM2CEW	KP15CR	R26	R27	8	19	35(!)	C *2
100494	0700 0800	SM2LKW	KP15BO	-	-	-	5	-	NC
150494	0400 0431	LA4XGA	JP33VC	R26	26	7	21	0.8	C*1
220494	0400 0442	LA4XGA	JP33VC	27	R26	16	25	0.6	C *1
020594	0400 0445	CT/DF7KF	IM69HH	26	-	14	17	1	NC
040594	0442 0506	CT/DF7KF	IM69HH	R27	R26	12	M	6	C #445
070594	0100 0136	HA7UL	JN97KK	27	R26	9	20	1	C
070594	0400 0421	LA4XGA	JP33VC	28	R39	11	22	2	C *1
070594	0600 0611	CT/DF7KF	IM68DH	R49	27	mni	mni	43	C #446
130594	0400 0446	LA4XGA	JP33VC	R26	R26	17	35	1	C *1
200594	0400 0430	LA4XGA	JP33VC	R26	R26	14	26	2	C *1
030694	0400 0416	LA4XGA	JP33VC	27	R27	10	15	1	C *1
100694	0400 0431	LA4XGA	JP33VC	37	R28	15	44	5	C *1
110694	0400 0405	EA3TI	JN11CQ	R28	27	8	mni	8	C SSB
110694	0615 0643	EA4LY	IN80CJ	38	R27	mni	mni	5	C random
120694	0720 0740	EA3KU	JN00JV	R28	27	15	mni	3	C
160694	0400 0427	EA/DL3MGL	JN01ME	27	R27	10	16	2	C
160694	0430 0502	EADJ3MY	JN01ME	26	R37	17	16	1	C
170694	0400 0422	LA4XGA	JP33VC	R27	27	13	47	2	C *1
190694	0500 0600	Z32UC	KN11CR	-	-	1	1	0.5	NC

Remarks: *1 Regular sked with Geir (1320km); *2 Exchanged Rogers in slow speed after BK (1823km!). NIL: 21.04. Z32UC KN11, 07.05. YL2MB/A KO36, 14.05. 9A1CHI JN95, 11.06. GU/DC9KZ IN89, 12.06. Z32UC KN11. *Thanks for info, Guido.*

QRV from the Island of Vanna

LA5TFA and LA0BY (10.-12.6.1994)

LA5TFA/p worked from KQ00BC on 50 MHz random MS: SM7AEL and SM7FJE. SM3EQY was not complete. We could have worked more if we had announced a frequency and a sequence.

LA0BY/p worked from KQ00BC on 144 MHz MS: OH5IY, OH2BAP, OH2BNH, RX1AS, DL9GJW, DL7AKA and DK9OY (ODX 2028 km). The skeds with DC7UT and DJ1JD were not complete. We heard nothing from DF7KF, DL4DTU, SM0KAK/0, PA2TAB, DJ9CZ, and PA3FOC. Unfortunately we had to leave the site early on Sunday morning (05 UT). The weather became very nasty, with the wind picking up and heavy rain showers. Since the Arietids have a velocity of 37 km/s and the Zeta Perseids only 29 km/s, we were happy to exceed 2000 km. The conditions on HF were rather poor. We were not able to get through on the VHF-Net. Therefore I will try to arrange as many skeds as possible for the Perseid-trip in advance by E-mail or telephone.

For the Perseids in 1990 and 1991 I compared the shower peak prediction of OH5IY's MS-Soft v 4.2c with my own observations. The correlation was very good indeed! My compliments to OH5IY! It seems as if this is a very useful piece of software.

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Holidays in Norway

LA/DL5DTA (JP22TJ - Isle of Runde) wkd on 144MHz:

940710	0200	0325	G4MKF	IO91	26	27	46	103	5	C
	0400	0435	DF6NA	JN49	26	26	11	9	2	C
	1100	1133	DK2PH	JO41	26	27	11	36	23	C
	1133	1205	DL9YEY	JO41	26	26	17	44	2	C
940711	0200	0300	G0FIG	IO90	26	-6	8	8	1	NC
	0300	0325	DL9GJW	JO54	27	27	9	20	4	C
	0345	0500	DL2DXA	JO61	26	26	16	35	4	C
	0500	0548	DL3YEL	JO41	27	26	24	67	3	C
	1030	1125	OH7PI/4	KP42	26	27	20	32	2	C
	1900	1925	ON4GG	JO20	26	26	18	38	3	C
	1925	1950	ON4ANT	JO20	27	27	13	35	4	C
940712	0200	0300	OH9NDD	KP26	26	-	1	19	0.5	NC
	0300	0400	DD0VF	JO61	26	-	15	13	1	NC *1
	0400	0433	DF5BN	JN49	27	27	25	76	44	C *2
	0500	0530	PA3FOC	JO21	28	26	14	52	2	C
	0900	1000	G0FIG	IO90	26	26	12	39	1	NC
	1100	1143	DL1KDA	JO30	27	26	29	82	3	C
	1200	1223	SM2CEW	KP15	26	27	9	16	3	C
	1900	2000	G4YTL	IO92	26	26	28	43	2	NC
	2000	2050	SP2OFW	JO93	26	26	11	22	3	C
940713	0300	0335	DK8LV	JO44	26	26	16	49	1.5	C
	0400	0425	DJ7OF	JO51	27	26	18	37	5	C
	0430	0510	DL3LBK	JO54	26	26	11	41	1	NC *3

Remarks: *1 ssb-sked, *2 best burst on my '94-Norway-expedition; *3 random-qso but DL3LBK stopped at 0500?

LA/DL5DTA (JP21NV - Steinvik, near Maly) wkd on 144MHz:

940716	0000	0035	DL9GJW	JO54	26	26	14	19	1	C *1
	0100	0203	PA2TAB	JO32	26	26	18	39	20	C
	0203	0230	DK2PH	JO41	27	26	17	27	2	C
	0258	0338	DL9YEY	JO41	28	26	30	92	2	C
	0400	0420	PA3BIY	JO22	27	26	11	17	1	C
	0420	0450	PA3FOC	JO21	47	27	23	52	27	C *random
	0500	0600	EI4DQ	IO51	26	26	9	17	5	NC *2
940717	0000	0030	DK9ZY	JO40	26	26	21	63	1	C
	0030	0100	DH2OAA	JO52	26	27	6	25	0.5	NC
	0100	0140	DJ9CZ	JO40	26	26	21	43	1	C
	0140	0205	DK9OY	JO52	28	27	16	40	2	C
	0205	0300	DL2IAN	JN49	26	26	6	16	1	NC
	0300	0350	DL3YEL	JO41	27	26	26	43	2	C
	0400	0443	DL1EAP	JO31	26	27	22	59	2	C
	0443	0505	DL8EBW	JO31	27	26	14	22	2	C

	0505 0530	DL9NDD	JN59	-	-	-	-	-	NIL *3
	0530 0545	ON4ANT	JO20	28	27	10	16	3	C
	0545 0603	ON4GG	JO20	29	27	21	32	2	C
	0800 0858	EI4DQ	IO51	26	26	21	19	3	C
	1030 1125	G4FUF	JO01	28	27	25	46	1	C
940718	0000 0055	G4EZP	JO01	26	26	27	63	1	C
	0100 0205	ON4KHG	JO10	28	26	26	35	2	C *4
	0200 0230	DL8GP	JN39	26	27	17	26	5	C
	0300 0330	DK4TG	JO31	-	-	-	-	-	NIL
	0330 0350	DF6NA	JN49	26	26	13	26	14	C *random
	0400 0425	DL1KDA	JO30	28	26	25	61	3	C
	0425 0445	DF7KF	JO30	29	26	19	34	5	C *5
	0500 0600	DL2DXA	JO61	-	-	-	-	-	NIL
940719	0000 0055	OH7MA	KP52	26	26	11	22	0.5	C
	0100 0148	DK8LV	JO44	27	26	22	60	1	C
	0200 0255	DF8LC	JO53	27	26	34	79	3	C *6
	0300 0355	SP2OFW	JO93	26	26	17	34	1	C
	0400 0435	DJ7OF	JO51	28	-	13	41	3	NC *7
	0500 0548	DL8LAQ	JO43	27	26	23	56	2	C
	0600 0653	G4YTL	IO92	26	26	30	77	2	C

Remarks: *1 rcvd his final-R's via MS and via Aurora; *2 nothing rcvd after 0515; *3 rcvd bursts but identified callsign later as EI4DQ; *4 rcvd his final-R-burst in the first rx-period of next qso; *5 bursts were modulated with strong 50Hz-rest-ripple - use more capacitors in your pwr supply, hi; *6 very slow speed (500 instead of 1000); *7 he didn't send rpt until 0435, rx-problems? Rig used: TR-751E; PA 200Wout; 9ele F9FT; GaAsFET-Preamp; 6m RG213; Laptop with OH5IY MS-pgm (ufb programm - tnx to OH5IY). I know that more stations are interested in a sked with JP21-square but I had to split my time there into time for my family and time for amateur radio. I hope to work these stations next year when I will be again in JP21. 73's to all, Arnfried. *Thanks for info.*

OE3JPC (JN88EB/II72c) wkd via MS on 144MHz:

121293	2210 2225	RV3ZR		27	27	8	3	5	C random
	2247 2255	RB5AL		39	38	-	-	-	C random
	2355 0015	UA1C	KO58BR	27	27	-	-	-	C random
131293	2307 2315	UC2SMM		29	29	-	-	-	C random
030194	0100 0140	LA7DFA	JP33VC	26	27	-	-	-	C
	2355 0015	IW0REX		27	28	-	-	-	C? random
070594	0300 0405	OH9NMS	KP36GA	26	27	11	5	3	C 2083km

Thanks for info, Johannes.

MS-Address-List (changes)

F9HS	JO03GL	AD43a	Claude Dagonneau, F-32300 Moncassin, ++62668145, VHF-NET
DJ5RE	JN59WI	FJ60a	Thomas Höppe, Bodelschwingstr. 3, 92224 Amberg, ++9621-84535, CW only, max. 1000lpm
DL9BDM	JO33RL	DN48a	Eilert Menke, ex DG4BE, Leerer Landstr. 58, 26603 Aurich, SSB

ES News

Editor: Edmund Ramm, DK3UZ

940521

DL1GNM (DI80j) wkd: 1213 EA7?G? hrd in QRB, hrd HB9 wkg EA7,1248 EA1AEN VC77c terrible QRM on .300, crowds of local 'cq sporadic' callers as ususal. Vln dk fr info, Mike

EA9AI (XV04e) wkd: 1220 F6HRP YI, 1227 GW8CMU YL44f, 1233 G4MKF ZL44f, 1233 G3IMV ZL07h, 1234 G1YTV, 1234 G4XEN ZM57j, 1235 G4RUW ZL44e, 1236 G3MQY YK, 1236 G7RAU ZK34h, 1236 G0EAT ZN17g, 1237 GW0ACH YL43g, 1238 GW0PZT XM17j, 1238 GW3KJW XM17j, 1239 G4XNS YN, 1239 G1SWH YN37b, 1240 G0NPG, 1242 GW3ZTH YL33f, 1242 G4VPD ZM41e, 1245 G4HBA YK, 1245 G4IGO YK06j, 1248 GW4UWR YL25d, 1250 G7NER YN27d, 1251 GW4ZQV YL25c, 1252 G0FYD YN15d, 1252 G0PES YN, 1258 G0FYD YN15d. Gracias por info Javi

940618

DL8EBW (DL66a) wkd: 1638 UR7GN QG. Vln dk fr info, Guido

940619

EA9AI (XV04e) wkd: 1332 ON4GG CK11a, 1333 ON4ANT CK11a, 1334 F6HMO BI, 1334 F6 DKW BI12f, 1334 F5DQK BI23b, 1341 G4EZP AL33c, 1343 G4FUF AL33j, 1344 G4DHG/m gracias por info Javi

940622

DL8EBW (DL66a) wkd: 1543 CT4KQ WA21e, 1809 CT1DIN WA34e, 1817 CT4KQ WA21e, 1827 EA4EHI WY16h, 1913 CT1WW WB63b, 1931 EA1BLA VD39e. Vln dk fr info, Guido

EA9AI (XV04e) wkd: 0843 DJ9KV GI47g, 0845 IK2UIX EF34c, 1536 IW8PPJ HY69h, 1547 DL9YEY, 1548 DK2PH EL03d, 1554 IW9BJU HX53d, 1557 IW9DCN, 1559 IT9BLB/9 GY76a, 1620 IW9DRW GX05b, 1932 GW8JLY YL35d, 1933 GW4EAI YL24d, 1933 G4ASR YL06h, 1934 G7NPG YN27f, 1934 G4BBY ZP, 1935 GW4UWR YL25d, 1936 G1KHX YL56h.
gracias por info Javi

940624

DL8EBW (DL66a) wkd: 1803 **7X2DS** BW28d, 1852 EA6QB AY03d, 1919 EA7TL XW
vln dk fr info, Guido

EA9AI (XV04e) wkd: 1624 F6FLV BI11g, 1624 F6IXI BJ37j, 1625 F1DXH AI30b, 1627 F1JGN, 1630 ON1AEN BK09e, 1630 ON7EF BL, 1633 ON1ALJ BK09d, 1634 OE3OBC II52b, 1647 DK1 XFJ/p HJ14j, 1648 DL5MAE FI69b, 1649 OK1VSO GJ60e, 1649 OK1UMA/p HJ34a, 1650 DJ7GK/a GJ, 1651 PA0RDY CM45e, 1653 DL5MAM FI79j, 1653 PA3DVG DN, 1656 PA3EHH CN62c, 1656 PE1LCH CN70a, 1705 PA3FPQ CL09b, 1705 PA3FBP DN73c, 1706 PA3CEG DN73 g, 1707 PA0JMV CL37e, 1712 DJ9KV GI47g, 1724 DG5MFX FH20b, 1725 DF9RJ GI13d, 1726 DL1MBV FH09a, 1729 OE5MKN HI72d, 1732 OK2BEV HI11h, 1736 OK2UAF/p, 1737 F5NJY, 1737 F1DBN AK19c, 1739 F5MZX, 1739 OK1UDX, 1740 G4PIQ AL16h, 1741 ON1ARQ BK09b, 1741 PA3FOC CL03g, 1742 G4SWX AM77j, 1742 ON1IM BL79c, 1743 PA3CNX CM76h, 1744 G4RKV AL57h, 1747 OK2BEV HI11h, 1748 HG1W HI63b, 1749 HA1WD IH63b, 1751 DG3FK EL58h, 1755 PA3EZA, 1759 OM3LQ II46g, 1802 DJ7ZO EJ02b, 1803 OE5VRL/5 HI42j, 1804 I2FAK EF77g, 1804 IW2BNA EF37h, 1807 IW2BSQ EF49e, 1814 DL2RMC, 1814 DK0OG GI53 b, 1828 OK1MAC HJ27f, 1834 DL4DWA GL57c, 1835 DG0OFH/p, 1835 DG0WD FK, 1835 DL1APW FK28d, 1836 DL2DXA, 1836 DK2EA FK, 1836 DL8NBI FK69b, 1837 DL5IND FK70b, 1838 DL3JPN, 1839 G4FCD ZL04d, 1842 DK3SR EJ78g, 1843 DL3JSW GK22b, 1845 DL0HEL FK69a, 1847 DJ9EV EJ77g, 1848 OK1UIR HH11j, 1849 DG0VL, 1915 PA3FVE CL60e, 1916 ON6NL CL69j, 1918 ON5LL, 1918 F6HEO BH77h, 1919 DK4TG DL63h. Gracias Javi

94Ø7Ø2

DL8EBW (DL66a) wkd: 1539 UT3LK SJ45j, 154Ø UT5EU/a SJ, 1557 UE3PFW SN45e, 1758 RW3WR RL38f, 16Ø2 UT8AL QL3Øe, 16Ø4 UT5ER RI22a, 16Ø7 RW3WR RL38f, 16Ø8 UR3EE SI, 16Ø9 UR3GS SJ, 1612 RV3ZR SK42h, 1613 UA3DHC TQ72g, 162Ø UT7EF QI26g, 1622 UA3 QR TM75e, 1626 RB5FYZ, 164Ø UR5LX RK5Øj.
The best opening in dir UA/UB I ever had in my QTH! Sporadic-E during a contest is a shame! If there are such propagations it would be nice to work only CW!
vln dk fr info, Guido

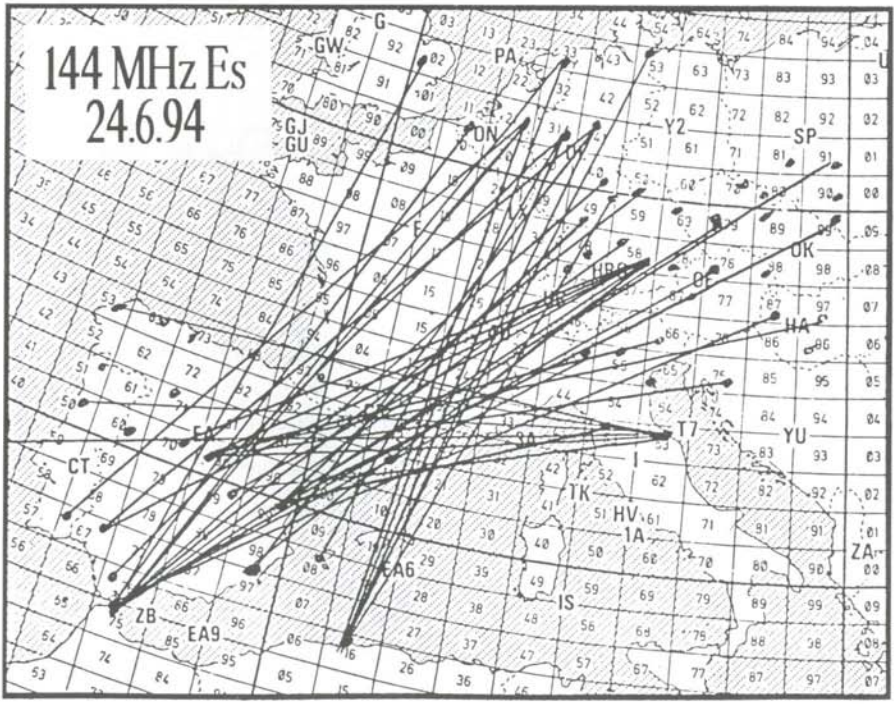
Please submit your Es reports preferably in machine-readable form. You may do so using the following **magnetic media:**

5 1/4" or 8" FM/MFM CP/M disk (please specify logical format).
5 1/4" 36ØK MS-DOS, 3 1/2" 72ØK TOS or MS-DOS (please no HD coating).

Further you can report to me by **Email:** dk3uz@iSYS-hh.hanse.de

or via **Packet Radio**: DK3UZ @ DBØHHT.#HH.GER.EU

vy 73 Eddi



Aurora News

Editor: Edmund Ramm, DK3UZ

DL8EBW (DL66a) wkd via Aurora on 144MHz in CW:

940307
1711 GM4CXM XP09g 55a 55a 10
1855 OZ6OL GP42e 57a 55a 30

940402
1623 GM4YXI YR60a 57a hrd 350
1630 GM4UFD ZR32f 52a hrd 350
1702 GM0GMD YQ69j 55a hrd 0

940403
1634 GM4ILS YR24e 53a hrd 0
2350 GM0GMD YQ61g 59a 58a 0

940404
0000 OZ1FTU FP10j 59a 53a 20
0016 OZ1CLL GP23c 53a 55a 20
0035 OZ9ZI GP52g 53a hrd 30

940417
0647 LA2PHA DS74j 52a 53a 0
0738 DL/UA2FM EO20d 52a 55a 20
hrd also: OZ1BEF, OZ3GW, SM6KWJ, SM7PER, GM4OGX, LA1KHA, F6HPP/p ...
Dopplershift up to 4 kHz, strange !

940501
2350 SM5BSZ IT44e 55a 55a 0
vln dk fr info, Guido

UA3MHJ (SR08b) wkd via Aurora on 144MHz in CW:

940111
1601 OH5KAY OV73b 57a 55a
1624 SM5BSZ IT44e 59a 59a
1625 SM5AQJ JT62g 59a 57a
1637 RZ1AWR PT02a 57a 57a
1643 SM6LPG GS59b 57a 55a
1652 OH3BY MV79d 55a 52a
1654 SM5EFP HT50e 59a 58a
1700 UA1CSE OT71a 53a 55a
1718 OH2KKP MU56g 55a 55a

940206
1300 OH5NZO NU05j 57a 57a
1302 OH3TZ LV39f 53a 55a
1304 OH3MF MU23h 58a 55a
1317 OH7SQ NX39h 57a 57a
1323 SM0ELV IT49a 55a 55a
1325 OH1NHX KV49a 59a 59a
1329 OH5EK OV72g 59a 55a
1335 OH6VR MW10j 55a 55a
1344 OH5NM OV64j 59a 57a
1346 SM0FMT IT50j 57a 54a
1353 YL2MB/a KR10b 55a 52a
1356 OH6LWW MW59e 58a 59a
1402 SM0CCM IT59d 55a 55a
1406 UA1TFU QS40e 57a 59a
1407 OH5LW NU36j 57a 59a
1441 SK5AA IT23c 56a 56a
1445 SM5MIX HS54d 57a 54a
1504 OZ1FTU FP10j 55a 52a
1507 OH1KH KV39g 54a 53a
1509 OH3KCB MV41g 55a 54a
1511 OH4LJL NV31f 55a 57a
1516 UA3TIE VQ60e 59a 59a
1517 LA9BM EU32f 55a 55a
1524 OH8MSM OY76a 53a 56a
1527 UW3LZ TM33b 55a 55a
1532 OH2VZ MU64f 53a 55a
1537 UT5AG QK18f 57a 57a
1539 UA3T VQ20e 57a 59a
1543 UA3GCE TM46e 59a 59a
1548 OH5BM OV47a 57a 59a
1550 SM0EPO IT50b 55a 55a

UA3MHJ (SR08b) contd.:

1410	OH2KKP	MU56g	57a	59a	1600	UA4PNS	AP12e	57a	57a
1412	RZ1AWR	PT02a	59a	59a	1602	RZ3QS	TL18d	59a	59a
1420	UC2SMM	PN22a	57a	57a	1605	ES1AO	MT54h	57a	57a
1431	SM4POB	HU43g	57a	57a	1611	RA4FDT	WN66g	57a	57a
1433	OH6MAZ	MW60e	59a	59a	1618	OH2BUQ	MU44e	57a	57a

940206

1626	UA1WCF	PP20d	57a	59a
1631	R3AZ	SQ16e	55a	57a
1634	UA3PC	SO69h	55a	59a
1635	UA3BB	SP41g	53a	57a
1642	OH7MA	PW31j	54a	55a
1651	OH5KAY	OV73b	59a	57a
1652	ES2RJ	MT34d	59a	59a
1656	OH2LNM	MU65a	55a	55a
1700	OH5KRM	OV61e	57a	59a
1702	OH5MW	OV72g	57a	57a
1706	OH2TI	MU65j	59a	59a
1724	OZ1AZZ	FR43b	53a	53a
1726	SM4HFI	HU39h	53a	53a

940207

1317	UA4NM	YS79j	58a	59a
1328	RA3TES	VP04c	56a	56a
1416	OH6PA	KW27a	55a	55a
1420	OH6AAO	KX79h	56a	55a
1434	OH1LWZ	KV18b	53a	54a
1436	OH2BAD	MU53f	57a	57a
1439	OH1MVO	LU66j	59a	59a
1440	UA1WAM	PQ53b	59a	58a
1443	OH3NXW	LV59b	55a	59a
1447	RW3DA	SO07f	57a	57a
1450	OH2MJY	MU09e	58a	55a
1452	UA3XEH	RN13h	57a	57a
1508	UA1AS	PT03a	59a	59a
1510	OH2AV	MU64b	57a	55a
1519	OH2NHP	MU64a	59a	57a
1522	OH2BNH	MU55d	59a	59a

спасибо за инфо

UA3TCF (WQ14a) wkd via Aurora on 144MHz in CW:

940501

1405	OH2LNM	MU65a	55a	55a	350
1415	UA9FAD	CS72e	59a	59a	0
1419	UA4WCA	AQ16e	57a	59a	0
1433	ES2RJ	MT34d	56a	57a	350
1445	SM0FMT	IT50j	55a	55a	330
1457	OH2BNH	MU55d	59a	59a	0
1500	SM5BSZ	IT44e	58a	57a	330
1520	YL2MB/a	NQ71f	55a	55a	320
1526	UA3VB		44a	55a	330
1538	UA1CSE	OT71a	54a	55a	0
1615	UA4NX/a	YT44d	54a	B	30
1641	EW7IM	PN22a	57a	59a	310

спасибо за инфо Алекс!

Please submit your Aurora reports preferably in machine-readable form. You may do so using the following **magnetic media:**

5 1/4" or 8" FM/MFM CP/M disk (please specify logical format).
5 1/4" 360K MS-DOS, 3 1/2" 720K TOS or MS-DOS (please no HD coating).

Further you can report to me by **Email:** dk3uz@iSYS-hh.hanse.de

or via **Packet Radio**: DK3UZ @ DB0HHT.#HH.GER.EU

vy 73 Eddi

News & Comments

Editor: Klaus Tiedemann, DL4EBY

Bandplanning on the 5.6 and 24 GHz bands

by Arie Dogterom, PA0EZ

The IARU Region I conference 1993 in Belgium has again discussed the choice of the narrowband segments in the 5.6 and 24 GHz bands. At an earlier conference a decision was made to recommend 5668-5670MHz and 24048-24050MHz.In practice, however, almost none of the microwave amateurs followed the recommendation and everybody continued using only 5760-5762MHz and 24192-24194MHz. After much discussion the conference decided that not only 5668/70MHz should be recommended as narrowband DX segment, but in addition the "old" and much used 5760/62MHz segment. But it was strongly recommended that all 5.6 GHz stations should construct their stations in such a way that both NB segments could be used. For the 24 GHz band the existing recommendation was reconfirmed.

It seems, however, that several microwave amateurs are not aware of the necessity to change to the "new" DX-segments and all VHF/Microwave managers are requested to discuss the matter with the microwave amateurs in their country.Why is this matter important ? In case the amateur allocations in a country allow amateurs to use either segment, it is natural that amateurs do not like to change their working frequencies, requiring much effort in many stations. They need to understand the reason for a change. Why then does IARU recommend a change from the traditional band segments?

The 24 GHz band

The ITU Frequency Table shows an ***exclusive*** amateur / amateur satellite allocation from 24.00-24.05 GHz. In addition, a ***secondary*** allocation to the amateur service exists from 24.05-24.25 GHz where ISM interference has to be accepted as well. In several Region I countries this secondary segment has not been allocated to amateurs or has been allocated with restrictions (e.g. UK, Italy...).

The IARU Region I conference, therefore, had to come to the conclusion that recommending the use of the 24192/94 segment for international amateur activities not only would be rather silly as the segment was not available to amateurs in several countries, but would be silly as well as amateurs would not use the segment ***exclusively*** allocated to them but a segment shared with other services instead. Moreover the possibility exists that in the future the 24.05-24.25 GHz segment would be lost in more countries and, although currently the 24 GHz amateur activity is growing fast, a later change (the recommendation has been made in 1990!) would be more difficult as a very large number of stations would be involved. Amateur societies can be very active in promoting the recommended narrowband segment, in particular by only supporting beacon licenses in the 24048MHz band.

The 5.7 GHz band

Here the situation is rather complex. The ITU allocation to the amateurs is on a secondary basis, the primary user being radar below 5725MHz and satellite downlinks above that frequency. In fact, there is no common segment available to all amateurs in Region I. In Italy, in practice, only the segment 5760-5770MHz is available, in Poland, Lithuania and probably other Central European countries only the 5650-5670MHz segment is allocated to amateurs. In some countries it is very difficult to obtain beacon licenses in the 5760/62MHz segment; not so many difficulties are expected for the establishment of beacons in the 5668/70MHz band. A recommendation from the CEPT ERO to the CEPT frequency management groups exists which asks the administrations to allocate to their amateurs at least the 5660-5670MHz segment (where amateur satellites can operate, too). The only segment common to the majority of the countries, with the exception of Italy, is this CEPT ERO recommended band. In practice administrations appear to keep the segments allocated to the amateur satellite service (such as the 5660-5670MHz segment) free from other services, even services with a primary status. In the future we can expect that CEPT will recommend that member administrations make at least the 5660/70MHz segment available to their amateurs and that may in some countries imply the loss of the band above 5725MHz. In this situation IARU Region I continues to recommend the 5668/70MHz segment for DX work, but in order to take care of the problems in Italy ***in addition*** the segment 5760/62MHz is recommended.

All microwave amateurs are requested to design their stations in such a way that both segments can be covered. That will avoid problems in case we will be forced to leave the 5760/62MHz segment completely. In practice, as most stations currently QRV on the band use heterodyne/SSB stations, the first design consideration would be not to use 145MHz as the first i.f., but to choose a higher frequency. Then filters can be used with a passband 5668-5762MHz and a simple switching of the crystal oscillator will give access to both band segments. Well designed amplifiers will easily cover a relative bandwidth of less than 2%.

All VHF and Microwave managers are requested to distribute this text to the microwave amateurs in their countries. Following IARU Region I recommendations sometimes requires more effort from the national society than simply publishing a note!

CEPT Discussions on microwave frequency allocations

The recommendations of the CEPT/ERO published in the DSI report are currently under discussion in the CEPT Frequency Management group. Conclusions will probably be drawn at the meeting of this group in February 1994. As the ERO recommendations also deal with common amateur radio segments in the shared allocations above 3.4 GHz, you (and your national society!) are urgently requested to ensure that the representatives of your administration to the CEPT Frequency Management group support the recommendations! The CEPT Frequency management group also will deal with the the harmonisation of allocations between 1 and 3 GHz. Here our 1.3 GHz band and 2.3 GHz band are involved. SP3FM is very active in promoting the IARU Region I viewpoints with CEPT. In particular the 2300-2450MHz band is under much pressure. IARU wants to improve the status of the amateur and amateur satellite service in the 2390-2410MHz segment. It is of utmost importance that the IARU Region I national societies make clear to their administrations the importance of harmonized amateur allocations in the 2.4 GHz band!

Do not hesitate to call SP3FM (+48 22 580161) or PA0EZ (+31 35 241408 [home]) if you want any guidance or advice on actions you contemplate to undertake in your country!

FM Channels, Truth and Tales

by Arie Dogterom, PA0EZ

One of the first technical standards recommended by IARU Region I dealt with frequency modulation. The standard was really necessary as with FM optimum communication only is possible when TX and RX are designed for the same channel bandwidth.

IARU Region I opted for a 12 kHz signal bandwidth, a compromise between minimum bandwidth and good audio S/N ratio. Soon after some xtal filter manufacturers made 12 kHz wide filters available and excellent QSO's could be made using FM without (at that time very important) audio break through in nearby HiFi-equipment. The 12F3 standard has never been changed and is (should be) the basis for all technical discussions in IARU Region I.

Not much later a decision had to be made on the recommended channelling for fixed channel systems, in particular FM-repeaters. I have not been able to find a report of the discussions, but it appears that the choice for a 25 kHz system was made without much discussion and probably based upon commercial mobile radio systems. The number of "channels" appeared to be enormous.

After a while two developments occurred. The first was that almost no FM-repeater used a 12 kHz wide RX filter nor limited the TX deviation to 3 kHz. The second was the appearance on the European market of commercial FM rigs using 15 or 20 kHz wide IF-filters. Amateurs using those bad receivers asked the transmitting stations to increase their deviation and slowly the effective standard in Region I changed from the recommended 12F3 to 16F3.

Before any discussion on the channel separation between FM channels is started, we first will have to make a decision on the fundamental parameters: do we want to keep 12F3 or do we want to change for a much larger bandwidth ?? Do we need a change in order to accommodate all receivers in use which do not follow the IARU Recommendation and accept that we are going to recommend to use at least 50% more spectrum for FM communications than necessary? Or are we - that is, the national societies!! - starting a common activity trying to convince users and manufacturers of FM receivers to make receivers with 12 kHz wide filters?

Only then we can really discuss the choice of a channel separation. Some relation exists between the channel separation and the modulation standard. But this relation is not so easy to determine. The basic issue is the minimum geographical distance between transmitters and receivers using neighbouring channels.

In professional mobile radio systems, where often different organisations have been allocated neighbouring channels, the requirement is that reception shall be possible while a nearby transmitter uses the next channel. This requires very good filters and an excellent dynamic range in the receiver as well as an excellent bandwidth limitation in the transmitter.

A completely different approach is followed by FM broadcasters, having the advantage of the non-mobility of the TX's. Here the receiver bandwidth is 300 kHz and the selectivity is in general rather poor. The choice of a 100 kHz channel separation is fully based upon a large (600 kHz) channel separation between colocated transmitters.

The two extreme examples indicate that the choice of the channel distance depends on the application. For amateur radio we will have to define the requirements seriously.

Basic questions to be answered for the amateur service are :

1. Which will be the minimum channel separation between a transmitter and a nearby (co-located ?) receiver ?
2. What shall be the the minimum geographical distance between a transmitter and a receiver on neighbouring channels ?

Those requirements will have to be combined with the question

3. What is the minimum quality of the RX filter in an amateur receiver as in particular the skirt selectivity of the RX will determine interference by a transmitter on a neighbouring channel on a QSO.

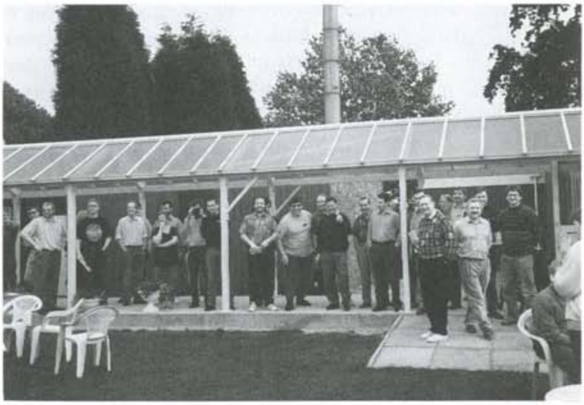
Minor, but also important, will be the practical tolerances on the nominal TX centre frequency.

Before the matters indicated above have been studied seriously, it will not be possible to decide upon IARU Region I recommendations.

From the discussions at the 1993 Conference I have learned that (groups in) member societies have quite different starting points. Some want to use professional mobile telephony design rules, others want to base the planning on relative wide filters with bad selectivity in amateur receivers, et cetera.

We must accept that the number of amateurs wish-ing to construct or modify their receivers is becoming rather low. We also will have to accept that most users of FM channels in the amateur bands are not so much interested in the challenge of making amateur to amateur contacts under difficult conditions but want in stead a reliable link comparable with commercial mobile radio systems.

Well it really is necessary that a group of amateurs in IARU Region I prepares a set of draft guidelines on the starting points for the design of FM channel systems in IARU Region I. Once the VHF Committee agrees upon such a set of guidelines the technical consequences can be easily written down. One practical matter has to be taken into account: It will be very impractical to recommend a new channelling regime which is incompatible with the existing 25 (12.5) kHz system, for the change from one to the other system might result in several years of incompatible systems in neighbouring areas. 73s, Arie



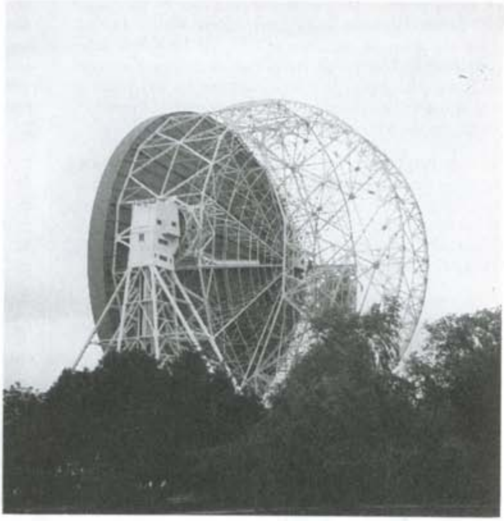
VHF DXers from G, GD, GM and GW at Jodrell

Northern Lights VHF DX Convention 1994

The Northern Lights contest group organized a highly succsessful VHF DX Convention on 9/10 July. They have a wonderful conference centre near Nantwich, Cheshire (JO83): a farming / gardening college set in an old manor estate with beautiful gardens, good food and comfortable overnight accommodation. It's good for the family too, with a farm and plenty of interesting places to visit nearby.

There were talks from G3WOS (50MHz), G3SEK (Yagis), G4DDK (10GHz), G3YLA (Es) and G4PIQ (Working DX) and the organizers also invited a few VHF DX-related traders. Best of all was the social side, with plenty of time to talk radio and swap DX stories, and a late, late bar with low-price beer!

On Sunday morning (rather late) we drove away for a technical tour of the Jodrell Bank radio observatory. This is a place where **the biggest dish is 76m** and even a *small* one is 10m diameter. Jodrell Bank is also a coordinating centre for even larger *virtual dish* systems, combining signals from other parts of England and also from across Europe. In the equipment room we were happy to see many small boxes hanging between coaxial leads (everbody does it), but we didn't see the **HEMT preamps cooled at 15K** - it's a very long way up to the focus of that big dish! The convention ended with a late lunch at the Visitor Centre.



The 76m dish at Jodrell Bank. Two large wheels stabilize the rear of the dish and provide elevation control, and the whole enourmous thing rotates in atimuth on a railway track.

Many thanks to Northern Lights for organizing such a FB convention - the first time they had ever done it - and we hope there will be many more. If you didn't make it this year, be there in 1995!

DUBUS DXer Meeting in Weinheim

During the annual Weinheim VHF/UHF meeting DUBUS invites all VHF/UHF/SHF DXers to attend our get-together in the private brewery 'Zehntscheuer' in Hemsbach, 3km north of Weinheim. It will begin at Saturday, September 17th, 1900 loacal and can last to 2400. There is food, lots of beer, and fun. ***Address: Restaurant Zehntscheuer, Hildastr. 3, D-69502 Hemsbach. Tel. 06201-7711.*** You will find Hemsbach by driving the B3 north in direction towards Heppenheim. When getting into Hemsbach after 3km you should seek the parking place of the mayors house. Hildastraße is quite nearby. Hope to see you all!

Während der Weinheim UKW-Tagung veranstaltet der DUBUS Verlag das jährliche DXer Treffen in der Privatbrauerei 'Zehntscheuer' in der Hildastr. 3, D-69502 Hemsbach, Tel.: 06201-7711. Es beginnt am Samstag, den 17.9.94, abends ab 1900 Uhr. Hemsbach liegt 3 km nördlich von Weinheim an der B3 Richtung Heppenheim. Die Hildastraße ist in der Nähe des Parkplatzes am Rathaus. Bier, Essen und Spaß sind angesagt. Auf Wiedersehen im 'Zehntscheuer'!

You are welcome to send the text of your reports, especially EME News, Hints & Kinks and News & Comments via electronic mail or Packet radio or disk, in order to minimize our typing errors...

- EMail (Internet): klaus@netmbx@netmbx.de or klaus@afutub.extern.tu-berlin.de
- Packet Radio: DL4EBY@DB0GR.DEU.EU 73s, Klaus.

DUBUS Toplist

Editor: Norbert Goettsche, DL8LAQ

DUBUS 50 MHz Top List

NR	CALL	WW	EU	WK	TR	AU	MS	ES	F2
1	PA0RDY	JO22	CM	593	725	1617	1597	****	16320
2	G4IGO	IO80	YK	583	577	1308	2528	6970	16188
3	ON4KST	JO20	CK	565	652	1415	1509	7920	16498
4	ON4ANT	JO20	CK	547	710	1757	1695	7243	16547
5	ON4GG	JO20	CK	530	710	1757	1695	7243	16547
6	DL7QY	JN59	FJ	512	741	1665	2186	6900	16353
7	G6HKM	JO01	AL	456	347	1883	780	5674	16112
8	SM6CMU	JO57	FR	424	762	1452	1642	5922	0
9	F1GTU	JN05	AF	418	699	815	1421	3268	16400
10	PA3FYM	JO22	CM	375	1238	2019	0	****	16373
11	PA2TAB	JO32	DM	354	610	1370	1809	5797	15339
12	I4XCC	JN63	GD	352	492	0	1427	3349	18627
13	OK1MAC	JN79	HJ	335	0	0	0	0	0
14	DL9GU	JN49	EJ	327	721	450	0	8500	15625
15	DL7ARM	JO62	GM	315	909	1189	1245	8324	15817
16	F8OP	JN26	CG	314	631	1023	1369	5508	13547
17	DL3YEE	JO42	EM	244	540	1056	1300	2700	13053
18	G6LEU	IO70	XK	214	700	750	0	0	0
19	9A2EY	JN85	IF	182	438	0	0	0	0
20	DL8EBW	JO31	DL	179	247	1050	1150	5800	13300
21	DL7YS	JO62	GM	166	342	461	0	3547	8767
22	SP6GWB	JO80	IK	150	696	0	0	4250	0
23	OK1VBN	JN78	HI	146	455	0	0	3468	0
24	SP6GZZ	JO81	IL	131	0	0	0	0	0
25	DL5IO	JN49	EJ	119	113	340	900	3100	12995
26	DL3AMA	JO51	FL	96	326	0	0	4001	0
27	IN3TWX	JN56	FG	95	396	0	0	1890	8100
28	I2FUM	JN45	EF	90	137	0	0	2023	0
29	DJ6MB	JO30	DK	64	0	661	0	5968	0
30	DJ8ES	JO43	EN	44	1105	0	0	2100	0
31	OK1DKS	JO70	HK	28	1012	0	0	1710	5102
32	HB9MIO/P	JN37	DH	6	463	0	0	1101	0

DUBUS 144 MHz Top List

NR	CALL	WW	EU	WK	TR	AU	MS	ES
1	DL3BWW	JO72	HM	619	2243	2034	2295	2782
2	PA0RDY	JO22	CM	545	1582	1979	2272	2819
3	SM6CMU	JO57	FR	534	1760	1928	2280	2540
4	SM6AFH	JO66	GQ	531	1730	1554	2010	2330
5	PA3BIY	JO22	CM	520	1550	2026	2205	3143
6	OH5LK	KP30	NU	517	1962	2041	2235	2891
7	DF8LC	JO53	FN	514	2105	2045	2202	3291
8	SP6GZZ	JO81	IL	502	1670	1794	2017	2717
9	DK9OY	JO52	FM	500	1651	1943	2208	2434
10	SP9EWU	JO90	JK	488	1710	1927	2154	2531
11	OE3JPC	JN88	II	472	1584	1821	2128	2769
12	I2FAK	JN45	EF	464	1750	1508	2405	2995
13	DL8EBW	JO31	DL	452	1454	1918	2029	2214
14	DL8LAQ	JO43	EN	438	1376	1806	1934	3302
15	DL5BCU	JO43	EN	421	1479	1928	2010	2538
16	I4XCC	JN63	GD	402	1177	1803	2275	3084
17	PA3FOC	JO21	CL	400	1373	2010	2142	2179
18	DL5DTA	JO61	GL	399	1344	1578	1907	2057
19	DL7AKA	JO62	GM	396	1747	1916	2065	3620
20	OK1MAC	JN79	HJ	389	1536	1681	1940	2511
21	F8OP	JN26	CG	389	1228	1196	2028	2720
22	UA3MBJ	KO88	SS	373	1560	2006	2573	2392
23	ON4ANT	JO20	CJ	352	1420	1965	2124	2725
24	DL3AMA	JO51	FL	349	1785	1803	1925	2075
25	OE3OKS	JN87	IH	349	1441	1273	1867	2788
26	ON4GG	JO20	CK	342	1420	1965	2124	2124
27	G3LQR	JO02	AM	329	1776	2031	0	2406
28	DL7YS	JO62	GM	328	1512	1528	1826	2136
29	DJ1LP	JO64	GO	324	1347	1071	2058	2301
30	F6DKW	JN18	BI	320	1519	1602	2051	2755
31	S53CAB	JN76	HG	319	1463	1530	2233	3356
32	OK1DKS	JO70	HK	319	1230	1308	0	3530
33	DK0OG	JN68	GI	310	1708	1722	2125	3320
34	DK1KR	JO53	FN	310	1481	2103	0	2026
35	SP3MFI	JO91	JL	307	1697	1632	1802	2617
36	DL8OBU	JO42	EM	297	1483	1866	1733	2159
37	IW1AZJ	JN35	DF	291	1105	1188	1904	2780
38	SP6GWB	JO80	IK	290	1780	1581	1875	2437
39	F1FIH	JN23	CD	289	1305	999	1723	2934
40	IN3TWX	JN56	FG	283	1100	0	1609	1750
41	G4IGO	IO80	YK	274	2761	1917	1903	2833
42	SP2JXN	JO94	JO	274	1650	1690	0	2634
43	DB6BX	JO32	DM	266	1534	1541	1921	2059
44	PA0WWM	JO22	CM	266	1303	1839	1997	2212
45	OZ1IPU	JO57	FR	261	1387	1187	1566	2452
46	OK1HAG	JN79	HJ	260	1441	1749	1909	3463
47	DK2BJ	JO30	DK	258	1476	1924	0	2205
48	DD0BI	JO33	DN	252	1565	1018	1102	2362
49	F6CKZ	JN09	AJ	250	1552	1330	1725	3407
50	DJ6LV	JO31	DL	250	1268	1880	1822	3130
51	F5HRY	JN18	BI	248	1239	1695	2038	2758
52	G6HKM	JO01	AL	241	1304	1555	1660	2269
53	ON4KST	JO20	CK	239	1435	1612	0	2383
54	F5JRX	JN25	CF	237	1598	1187	1616	2301
55	DG1BA	JO43	EN	232	1674	1280	1588	2239

56	F1GTU	JN05	AF	225	1650	967	1934	2400
57	RB5GU	KN66	QG	222	1877	1446	1930	2617
58	OK1VBN	JN78	HI	217	1578	1682	1915	2209
59	UB2GA	KN66	QG	205	1830	0	2010	1940
60	UY5HF	KN66	QG	200	1750	0	1820	2032
61	DL9BDM	JO33	DN	197	1538	1248	1659	2321
62	DF9QX	JO42	EM	197	1446	1070	1455	3320
63	HB9DFG	JN37	DH	196	1284	1299	0	2302
64	DC6DY	JO31	DL	194	1416	1045	1914	2292
65	F5PAU	IN88	YI	192	1630	0	0	2425
66	DK2DB	JN48	EI	192	1239	1136	0	3106
67	S59AM	JN65	GF	184	1377	0	1945	1788
68	DK9RL	JN69	GJ	177	1311	1513	1286	3316
69	HB9MIO/P	JN37	DH	176	1316	975	0	2183
70	OE5VRL/5	JN78	HI	175	1665	1573	1990	1949
71	G6LEU	IO70	XK	173	2620	750	0	2403
72	DL3YEE	JO42	EM	172	1574	1450	1480	2106
73	PA2TAB	JO32	DM	170	1302	1094	1875	2183
74	DG0CR/P	JO50	FK	169	1279	1530	0	2010
75	IK1LGV	JN44	EE	163	1466	0	1613	1890
76	SP9FG	JN99	JJ	157	1647	1283	0	1698
77	UA3MHJ	KO87	SR	156	539	1943	2405	1948
78	DG5NEX	JN49	EJ	133	1234	0	1333	1941
79	DG9NBT	JN49	EJ	131	1363	0	1333	1832
80	DL3NAW	JN59	FJ	120	1019	0	1961	1237
81	DL0SP/P	JO62	GM	108	1315	785	0	1608
82	DK0PX	JN48	EI	98	847	0	1815	1649
83	DJ8ES	JO43	EN	94	1306	0	0	1856
84	DL3IAS	JN49	EJ	88	988	1123	0	1209
85	DB8NU	JN49	EJ	71	867	0	0	0
86	9A2EY	JN75	HF	64	707	0	0	0

DUBUS 432 MHz Top List

NR	CALL	WW	EU	WK	TR	AU	MS	ES
1	DJ9BV	JO43	EN	219	2154	1863	1440	0
2	PA0RDY	JO22	CM	202	1979	1807	1376	0
3	G3LQR	JO02	AM	198	2031	1613	0	0
4	DL3BWW	JO72	HM	191	1547	1494	0	0
5	PA0EZ	JO22	CM	188	1787	1445	0	0
6	PA0WWM	JO22	CM	185	1547	1836	0	0
7	DL8QS	JO43	EN	180	1513	1513	0	0
8	DL7QY	JN59	FJ	173	1640	1848	1292	0
9	DJ6MB	JO30	DK	171	1278	1733	0	0
10	F6DKW	JN18	BI	160	1519	0	0	0
11	DB6BX	JO32	DM	155	1550	662	0	0
12	DB6NT/A	JO50	FK	153	1823	0	0	0
13	PA3DIJ	JO33	DN	148	2116	1010	0	0
14	DK1KR	JO53	FN	147	1400	1827	0	0
15	DF8LC	JO53	FN	143	1615	1361	0	0
16	DH3NAN	JO50	FK	142	1437	1008	0	0
17	SP6GWB	JO80	IK	141	1780	759	0	0
18	SP6MLK	JO80	IK	141	1780	0	0	0
19	OK1KIR/P	JO60	GK	130	1773	0	0	0
20	DL3YEE	JO42	EM	130	1574	1728	0	0
21	SP9FG	JN99	JJ	129	1660	0	0	0
22	SM7ECM	JO65	GP	129	1344	1068	0	0
23	OH5LK	KP30	NU	124	1386	1196	0	0
24	G6HKM	JO01	AL	118	1289	281	0	0
25	SP9EWU	JO90	JK	117	1544	1558	1664	0
26	OE5VRL/5	JN78	HI	116	1522	948	0	0
27	G6RAF	IO92	ZM	113	1730	0	0	0
28	OZ1IPU	JO57	FR	113	1387	0	0	0
29	UA3MBJ	KO88	SS	110	1306	1541	0	0
30	SP6GZZ	JO81	IL	109	1549	870	0	0
31	HB9MIN/P	JN37	DH	109	1300	0	0	0
32	SM6CMU	JO57	FR	108	1641	670	0	0
33	SM6AFH	JO66	GQ	108	1315	1200	0	0
34	DL6BCT	JO43	EN	107	1152	0	0	0
35	DF9QX	JO42	EM	105	1136	721	0	0
36	DC4XH	JO43	EN	103	1133	808	0	0
37	F5PAU	IN88	YI	101	1630	0	0	0
38	PA0BAT	JO31	DL	101	1301	0	0	0
39	OK1DKS/P	JO60	GK	98	1118	0	0	0
40	RB5GU	KN66	QG	94	1877	0	0	0
41	DG9NBT	JN49	EJ	93	1187	0	0	0
42	DJ1LP	JO64	GO	91	1414	0	0	0
43	DG5NEX	JN49	EJ	91	1187	0	0	0
44	G4LRT	IO92	ZM	90	1394	410	0	0
45	DL3AMA	JO51	FL	89	1015	1219	0	0
46	DK0OG	JN68	GI	88	1351	745	0	0
47	ON4GG	JO20	CK	87	1258	0	0	0
48	DK9RL	JN69	GJ	87	1185	0	0	0
49	DD0BI	JO33	DN	85	1259	0	0	0
50	ON4ANT	JO20	CK	85	1099	0	0	0
51	UY5HF	KN66	QG	84	1670	0	0	0
52	DL5BCU	JO43	EN	83	1188	766	0	0
53	F5HRY	JN18	BI	82	1222	583	0	0
54	DG0CR/P	JO50	FK	82	1048	759	0	0
55	DC6DY	JO31	DL	82	888	0	0	0
56	DK2DB	JN48	EI	81	1331	0	0	0
57	F1GTU	JN05	AF	75	1114	0	0	0
58	HB9MIO/P	JN37	DH	75	1096	0	0	0
59	F6CKZ	JN09	AJ	72	1038	0	0	0
60	UB2GA	KN66	QG	70	1790	0	0	0
61	OE3JPC	JN88	II	69	1000	1450	0	0
62	DJ8ES	JO43	EN	67	1025	0	0	0
63	S53CAB	JN76	HG	67	817	0	0	0
64	DL0SP/P	JO62	GM	64	909	0	0	0
65	G6LEU	IO70	XK	63	1400	0	0	0
66	F5JRX	JN25	CF	62	1070	0	0	0
67	DB8NU	JN49	EJ	55	691	0	0	0
68	OK1VBN	JN78	HI	53	737	753	0	0
69	DK0PX	JN48	EI	51	1168	0	0	0
70	DL9BDM	JO33	DN	50	1278	0	0	0
71	I2FUM/2	JN44	EE	47	875	0	0	0
72	9A2EY	JN75	HF	41	588	0	0	0
73	F1FIH	JN23	CD	30	796	0	0	0
74	OK1HAG	JN79	HJ	30	584	682	0	0
75	SP2JXN	JO94	JO	27	1149	0	0	0

DUBUS 1296 MHz Top List

NR	CALL	WW	EUWKODX
1	PA0RDY	JO22 CM	119 1286
2	PA0EZ	JO22 CM	116 1261
3	F6DKW	JN18 BI	115 1215
4	PA0WWM	JO22 CM	111 1298
5	DB6NT/A	JO50 FK	107 1243
6	G3LQR	JO02 AM	106 1274
7	SP6GWB	JO80 IK	89 1580
8	OK1KIR/P	JO60 GK	89 1208
9	G6DER	IO93 ZN	86 1306
10	DL7QY	JN59 FJ	86 1261
11	SP6MLK	JO80 IK	85 1580
12	F5PAU	IN88 YI	83 1630
13	OE5VRL/5	JN78 HI	83 1522
14	DB6BX	JO32 DM	82 1052
15	DK1KR	JO53 FN	79 1097
16	SM7ECM	JO65 GP	78 1322
17	PA3DIJ	JO33 DN	78 939
18	G6LEU	IO70 XK	74 2620
19	PA0BAT	JO31 DL	73 1014
20	DL3YEE	JO42 EM	71 1136
21	OZ1IPU	JO57 FR	70 1096
22	OK1AIY/P	JO70 HK	66 1490
23	G4PMK	IO93 ZN	65 1302
24	DC4XH	JO43 EN	63 1090
25	G4LRT	IO92 ZM	62 1152
26	DG5NEX	JN49 EJ	61 1060
27	DG9NBT	JN49 EJ	60 1016
28	HB9MIO/P	JN37 DH	60 945
29	G6HKM	JO01 AL	58 1193
30	DF9QX	JO42 EM	57 1066
31	DH3NAN	JO50 FK	56 1143
32	DG0CR/P	JO50 FK	55 1048
33	DC0DA	JO31 DL	55 1034
34	DL9GU	JN49 EJ	54 900
35	DC8UG	JO30 DK	54 900
36	DL3NQ	JN49 EJ	51 920
37	SP9FG	JN99 JJ	49 1492
38	DB8NU	JN49 EJ	49 1016
39	DK0OG	JN68 GI	47 901
40	OK1DKS/P	JO60 GK	46 1207
41	DJ6MB	JO30 DK	42 876
42	DB1BX	JO32 DM	41 895
43	F5HRY	JN18 BI	41 664
44	DC6DY	JO31 DL	39 865
45	F6CGB	JN18 BI	38 700
46	F1GTU	JN05 AF	36 896
47	DK2DB	JN48 EI	36 873
48	OE3JPC	JN88 II	36 702
49	ON4GG	JO20 CK	35 934
50	DL3IAS	JN49 EJ	33 769
51	ON4ANT	JO20 CK	32 914
52	I0LVA	JN62 GC	31 1152
53	DF6VB	JO31 DL	31 722
54	UB2GA	KN66 QG	30 820
55	I2FUM/2	JN44 EE	30 779
56	DK9RL	JN69 GJ	27 891
57	DK0PX	JN48 EI	27 725
58	S53CAB	JN76 HG	27 626
59	DJ8ES	JO43 EN	26 727
60	RB5GU	KN66 QG	25 680
61	OZ8VO	JO56 FQ	24 951
62	SP9EWU	JO90 JK	23 639
63	UA3MBJ	KO88 SS	20 301
64	OH5LK	KP30 NU	17 1349
65	DJ1LP	JO64 GO	15 558
66	9A2EY	JN75 HF	14 395
67	F1FIH	JN23 CD	13 475
68	OK1VBN	JN78 HI	12 307
69	DL0SP/P	JO62 GM	9 347
70	UY5HF	KN66 QG	6 520

DUBUS 2320 MHz Top List

NR	CALL	WW	EUWKODX
1	PA0EZ	JO22 CM	70 962
2	PA0RDY	JO22 CM	59 831
3	DB6NT/A	JO50 FK	55 1119
4	PA0WWM	JO22 CM	53 851
5	G3LQR	JO02 AM	52 1006
6	OK1KIR/P	JO60 GK	48 1115
7	DL7QY	JN59 FJ	47 1018
8	G6DER	IO93 ZN	42 1265
9	PA3DIJ	JO33 DN	42 727
10	OK1AIY/P	JO70 HK	39 1296
11	PA0BAT	JO31 DL	36 923
12	DC8UG	JO30 DK	35 900
13	OE5VRL/5	JN78 HI	32 1289
14	DC0DA	JO31 DL	31 775
15	SM7ECM	JO65 GP	30 877
16	OZ1IPU	JO57 FR	29 1028
17	DL9GU	JN49 EJ	29 877
18	DL3NQ	JN49 EJ	28 890
19	G4LRT	IO92 ZM	27 1022
20	DG0CR/P	JO50 FK	26 962
21	DF9QX	JO42 EM	26 915
22	I0LVA	JN62 GC	23 612
23	G4PMK	IO93 ZN	22 1249
24	DL3YEE	JO42 EM	21 911
25	HB9MIO/P	JN37 DH	21 694
26	DK2DB	JN48 EI	20 873
27	DB1BX	JO32 DM	18 525
28	DK0PX	JN48 EI	17 566
29	DB8NU	JN49 EJ	17 428
30	DG5NEX	JN49 EJ	16 465
31	DK0OG	JN68 GI	16 412
32	DG9NBT	JN49 EJ	15 465
33	DF6VB	JO31 DL	15 414
34	OK1DKS/P	JO60 GK	13 504
35	DL3IAS	JN49 EJ	12 445
36	I2FUM/2	JN44 EE	10 354
37	DK1KR	JO53 FN	9 792
38	DJ8ES	JO43 EN	7 682
39	F1GTU	JN05 AF	7 313
40	F5HRY	JN18 BI	5 539
41	S53CAB	JN76 HG	5 346
42	SP9FG	JN99 JJ	3 217
43	DF2CA/P	JN57 FH	3 206
44	9A2EY	JN75 HF	2 96
45	SP9EWU	JO90 JK	1 134
46	OK1VBN	JN78 HI	1 6

DUBUS 3400 MHz Top List

NR	CALL	WW	EUWKODX
1	DB6NT/A	JO50 FK	27 738
2	PA0EZ	JO22 CM	23 636
3	DC0DA	JO31 DL	17 660
4	G3LQR	JO02 AM	16 924
5	PA0WWM	JO22 CM	16 435
6	DL3NQ	JN49 EJ	15 637
7	DL7QY	JN59 FJ	15 565
8	G6DER	IO93 ZN	13 718
9	PA0BAT	JO31 DL	13 469
10	DC8UG	JO30 DK	12 724
11	PA0RDY	JO22 CM	12 445
12	DB1BX	JO32 DM	9 425
13	DK2DB	JN48 EI	9 331
14	G4PMK	IO93 ZN	7 704
15	DK0PX	JN48 EI	6 528
16	G4LRT	IO92 ZM	5 421
17	DJ8ES	JO43 EN	4 578
18	DF9QX	JO42 EM	2 143
19	DK0OG	JN68 GI	2 78
20	DF2CA/P	JN57 FH	2 24

DUBUS 5760 MHz Top List

NR	CALL	WW	EUWKODX
1	DB6NT/A	JO50 FK	26 880
2	SM7ECM	JO65 GP	24 857
3	PA0EZ	JO22 CM	24 835
4	HB9MIO/P	JN37 DH	21 694
5	G3LQR	JO02 AM	20 949
6	OZ1IPU	JO57 FR	15 805
7	OK1KIR/P	JO60 GK	14 362
8	PA0BAT	JO31 DL	12 601
9	DL3NQ	JN49 EJ	12 318
10	DC0DA	JO31 DL	11 451
11	DC8UG	JO30 DK	10 724
12	DL7QY	JN59 FJ	10 565
13	G6DER	IO93 ZN	8 947
14	HB9MIN/P	JN37 DH	8 286
15	S51WI	JN75 HF	7 532
16	PA0WWM	JO22 CM	7 422
17	OK1AIY/P	JO70 HK	6 693
18	DK2DB	JN48 EI	6 315
19	I2FUM/2	JN45 EE	6 201
20	DK0PX	JN48 EI	5 324
21	DB1BX	JO32 DM	5 150
22	DG0CR/P	JO50 FK	4 304
23	G4PMK	IO93 ZN	3 479
24	F6CGB	JN18 BI	2 407
25	F6CGB/P	JN24 CE	2 375
26	DK0OG	JN68 GI	2 78

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DUBUS 10 GHz Top List

NR	CALL	WW	EU	WK	ODX
1	PA0EZ	JO22	CM	45	835
2	HB9MIN/P	JN37	DH	37	939
3	SM7ECM	JO65	GP	33	857
4	DB6NT/A	JO50	FK	31	692
5	G3LQR	JO02	AM	30	924
6	G3WDG	IO92	ZM	29	1008
7	DL3YEE	JO42	EM	29	695
8	I0LVA	JN62	GC	24	850
9	DL3NQ	JN49	EJ	24	712
10	F6DKW	JN18	BI	23	695
11	G4KGC	IO92	ZM	22	769
12	HB9MIO/P	JN37	DH	22	694
13	OE5VRL/5	JN78	HI	22	549
14	OK1KIR/P	JO60	GK	21	419
15	PA0BAT	JO31	DL	19	601
16	DF9QX	JO42	EM	19	504
17	OZ1IPU	JO57	FR	18	941
18	PA0WWM	JO22	CM	18	589
19	DK0PX	JN48	EI	17	419
20	DK4GD/P	JN48	EI	17	411
21	S51WI	JN75	HF	15	532
22	DL7QY	JN59	FJ	15	492
23	DC0DA	JO31	DL	14	639
24	DK2DB	JN48	EI	14	432
25	DK0OG	JN68	GI	13	476
26	G4KNZ	IO91	ZL	12	247
27	DB1BX	JO32	DM	11	465
28	G4PMK	IO93	ZN	10	737
29	OK1AIY/P	JO70	HK	10	736
30	DC8UG	JO30	DK	9	492
31	I4XCC	JN63	GD	8	426
32	F6CGB	JN18	BI	6	677
33	DK1KR	JO53	FN	6	232
34	DJ8ES	JO43	EN	5	210
35	DF6VB	JO31	DL	5	162
36	F6CGB/P	JN12	BC	4	823
37	9A2EY	JN75	HF	4	374
38	DG0CR/P	JO50	FK	4	283
39	PA3DIJ	JO33	DN	4	195
40	S53CAB	JN76	HG	4	176
41	DL3IAS	JN49	EJ	4	93
42	G4LRT	IO92	ZM	3	103
43	F5HRY	JN18	BI	2	410
44	DG9NBT	JN49	EJ	2	173
45	DG5NEX	JN49	EJ	1	173

DUBUS 24 GHz Top List

NR	CALL	WW	EU	WK	ODX
1	HB9MIN/P	JN37	DH	9	396
2	HB9MIO/P	JN37	DH	8	172
3	DB6NT/A	JO50	FK	5	178
4	DF2CA/P	JN58	FI	5	142
5	DK4GD/P	JN48	EI	4	184
6	DF6VB/P	JO31	DL	4	104
7	DL3YEE/P	JO42	EM	3	151
8	G4KNZ/P	IO83	YN	3	120
9	DL3NQ	JN49	EJ	3	112
10	DK0PX	JN48	EI	3	99
11	OK1AIY/P	JO70	HK	2	95
12	DG0CR/P	JO50	FK	2	52
13	DK2DB	JN48	EI	2	48
14	DC0DA/P	JO32	DM	1	104
15	F6CGB/P	JN37	DH	1	74
16	OZ1IPU	JO57	FR	1	55
17	DB1BX	JO32	DM	1	37
18	G3LQR	JO02	AM	1	2

DUBUS 47 GHz Top List

NR	CALL	WW	EU	WK	ODX
1	HB9MIO/P	JN37	DH	4	166
2	HB9MIN/P	JN37	DH	4	166
3	DF2CA/P	JN58	FI	4	15
4	DB6NT/A	JO50	FK	2	95
5	DK4GD/P	JN47	EH	2	80
6	DF6VB/P	JO31	DL	2	69
7	DC0DA/P	JO31	DL	2	69
8	DF2CA/P	JO60	GK	2	59

DUBUS 76 GHz Top List

NR	CALL	WW	EU	WK	ODX
1	DF2CA/P	JO50	FK	4	4
2	DB6NT/A	JO50	FK	2	77
3	DC0DA/P	JO50	FK	2	48
4	DF6VB/P	JO50	FK	1	18
5	OE9FKI	JN47	EH	1	2
6	HB9MIN/P	JN37	DH	1	1

DUBUS 145 GHz Top List

NR	CALL	WW	EU	WK	ODX
1	DB6NT/A	JO50	FK	1	1

DUBUS 241 GHz Top List

NR	CALL	WW	EU	WK	ODX
1	DB6NT/A	JO50	FK	1	1