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Iceland Expedition

TF/G4DHF

Private Communications

SUPER-AMP Mastvorverstärker für 2 m, 70 cm, 23 cm und 13 cm

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	SP - 2	SP - 70	SP - 23	SP - 13	
Frequenzbereich	144 - 146	430 - 440	1250 - 1300	2300 - 2400	MHz
Rauschzahl, typ.	0,8	0,9	0,9	1,2	dB
Verstärkung, typ.	20	20	20	25	dB
Schaltleistung, HF - VOX	200	100	10	10	Watt
Schaltleistung mit DCW 15	750	500	100	50	Watt
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Editorial

by Rainer Bertelsmeier, DJ9BV

Liebe Leser!

Diese Ausgabe der DUBUS erscheint verspätet. Leider hat mich ein Unfall, dessen Folgen inzwischen behoben sind, dazu gezwungen, die Endredaktion dieser Ausgabe zu verschieben.

Diese Ausgabe ist wieder voll mit technischen Artikeln. Daher mußten einige Rubriken wie z.B. die Bakenliste auf die nächste Ausgabe verschoben werden. Wir hoffen auf Ihr Verständnis, daß regelmäßige Rubriken aktuellen Artikeln Platz machen müssen. Damit wird letztlich die international bekannte, hohe Qualität unserer Zeitschrift gewährleistet.

Nun noch einige Änderungen: Der Bezugspreis für das Inland ist auf DM 29,- angehoben worden. Weiterhin wird für säumige Zahler das Heft 1 des Folgejahrgangs nicht mehr wie bisher gratis geliefert. Achten Sie daher bitte auf eine pünktliche Überweisung.

Die Auflage ist im letzten Jahr wieder um ca. 10% gestiegen, was wir als ein positives Zeichen für die weltweite Geltung der DUBUS ansehen.

Viel Glück für 1994 und 73

Rainer, DJ9BV

Dear Reader

This issue of DUBUS appears about 1 month late. We apologise for this inconvenience. An accident three months ago and a subsequent surgical operation forced me to postpone the final editing of this issue. We will be back in the normal time schedule for the next issue.

Because of the large amount of technical articles in this issue some periodicals like the beacon list have to be delayed for the next issue. We hope for your understanding, because advanced technical articles about VHF and microwave amateur radio are the backbone of our internationally respected and world-wide distributed magazine.

Some changes: From next year on we are not longer able to deliver a gratis issue No.1 for those who don't renew their subscription. Therefore don't forget to renew at your distributor.

Last year the circulation of DUBUS has increased by about 10 percent especially in countries outside of Germany. We take this as a positive feedback for the quality of our work and the ever increasing world-wide reputation of DUBUS which is dedicated to the publication of advanced techniques for narrow band DX-operation in VHF and microwave amateur radio.

Happy new Year 1994 and 73

Rainer, DJ9BV

Technical Reports

Editor: Rainer Bertelsmeier, DJ9BV

HEMT Preamp for 24GHz

Toshihiko Takamizawa, JE1AAH

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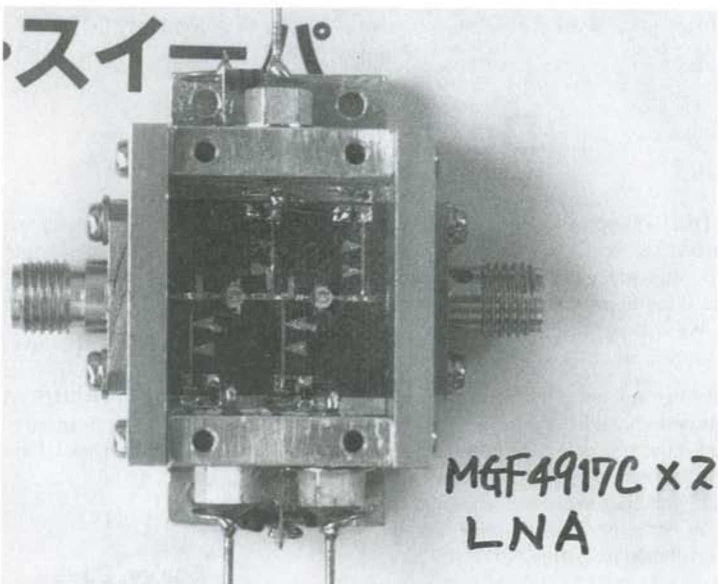
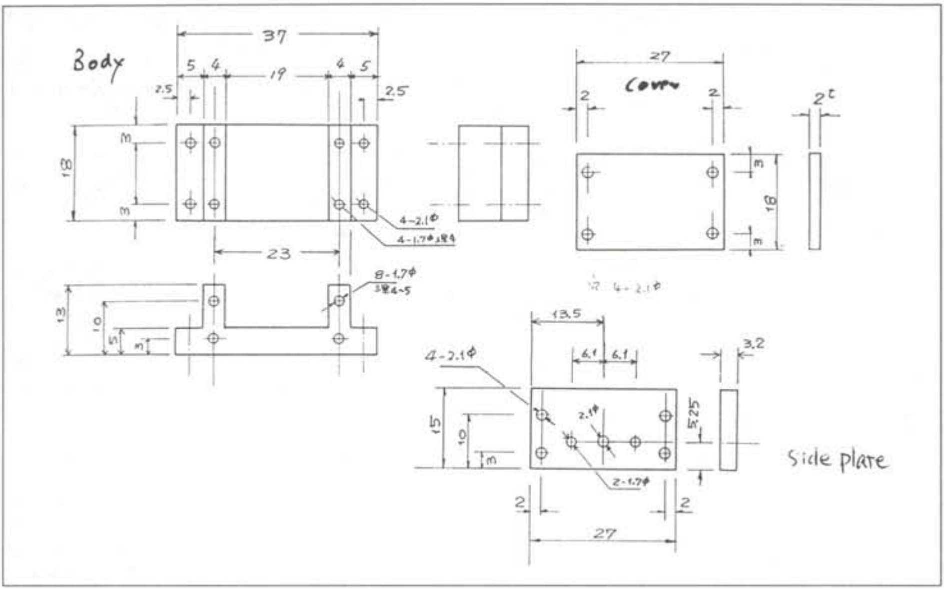
Abstract: A two stage preamp with MGF4917C HEMTs achieves more than 17dB gain and less than 2.5dB noise figure on 24GHz. It uses SMA-connectors for input and output. The problems of the selection of suitable connectors and of suitable monolayer chip capacitors for DC-separation are discussed with comparative measurements.

Kurzfassung: Der 2-stufige Vorverstärker ist mit MGF4917C HEMT's bestückt und erreicht eine Rauschzahl von weniger als 2,5dB bei mehr als



Bild/Figure 1: Overall View on 24GHz LNA



Bild/Figure 2: Case

17dB Verstärkung. Eingang und Ausgang sind mit SMA-Buchsen ausgerüstet. Die Probleme eines möglichst verlustarmen Übergangs von SMA auf Microstrip und der verlustarmen Kopplung über einschichtige Chip-Kondensatoren werden im Zusammenhang mit Meßwerten diskutiert.

1. Introduction

I have developed an LNA on 24GHz using a MGF4917C. The project was inspired by one professional article on a conference held in Finland several months ago. This March when I visited UK, I met G4KNZ and he passed me this article titled '22GHz Band downconverters for DBS' by Thomson Consumer Electronics R&D France. HB9MIN also has this article and asked Thomson what device has been used. Thomson people used the MGF4317C (another package of MGF4917C) and it is a 2-stage configuration. The original work used 0.4mm thickness PTFE board and K connector. Designed frequency is 22GHz band, which is new DBS frequency. This experimental 22GHz LNA is claimed to perform with 22dB of gain and 1.7 to 1.8dB of NF. I was very encouraged by the article and started the project last April.

1. Einführung

Das hier vorgestellte Projekt eines LNA's für 24GHz in koaxialer Technik wurde durch einen Artikel von dem Forschungslabor von Thomson CSF inspiriert. G4KNZ hat mich dankenswerterweise darauf aufmerksam gemacht. Erich, HB9MIN, hat bei Thomson recherchiert und erfahren, daß in diesem LNA MGF4317C HEMT's von Mitsubishi verwendet wurden. Die MGF4917C sind 4317C mit kurzen Anschlüssen. Der Thomson LNA arbeitet auf 22GHz und hat eine angegebene Rauschzahl von 1,7 bis 1,8dB bei 22dB Verstärkung.

2. Design

The board used is 0.25mm thickness Cu-clad 250GT with 18um copper clad from Arlon. Size of the PCB (Figure 3) is 19mm x 18mm (WxL) which is just the same length of the 22GHz LNA. I used a radial stub for bias feed line to decouple RF energy. An interstage coupling capacitor used is a mono layer micro chip capacitor from Johanson dielectric capacitor type 101UDDQ0R5C94 0.5x 0.5mm size. This capacitor improves VSWR and insertion loss of mainline tremendously (Figure 2). When using usual 1005 or 1608 size multi layer ceramic chip capacitor, an internal parasitic reactance should be taken in account when tune the matching circuit.

2. Design

Das Material der Platine ist 0,25mm dickes PTFE-Substrat 250GT von ARLON. Die Größe der Platine ist 19x18mm (Bild 3). Die Koppelkondensatoren sind Einschicht-Kondensatoren von JOHANSON, Typ 101UDDQ0R5C94 mit einer Größe von 0,5x0,5mm. Diese Kondensatoren haben niedrige Einfügungsdämpfung und niedriges VSWR auf 24GHz. Normale Kondensatoren sind nicht geeignet.

3. Box

From this project on, I have changed the housing case for the amplifier. It is machine milled aluminum block construction case. See fig. 2 for the detail. This type of case is easy to build when mounting the PCB inside of the case. Two side plates where an input and output SMA connectors are mounted can be separated from main body. It is very convenient to change the connector if needed.

3. Gehäuse

Bild 2 zeigt die Gehäusezeichnung. Es ist einfach, die Buchsen auszuwechseln, da das Gehäuse getrennte Seitenwände hat.

4. Construction

1. First, cut PCB to fit appropriate case.

2. Make ground contact for source using very thin(0.03 to 0.05mm) copper foil.

3. Make 'U shape' of 1mm leg + 1mm bottom + 1mm leg by 1.5mm width ribbon.

4. Cut two 1.5mm slits in parallel of 1mm space at source area of the board. Production version of PCB has via hole at source pad. You do not need this work.

5. Make 'U shape' ribbon upside-down and feed the legs through the board.

6. Bend the legs right angle and make sure the legs are completely flat on the surface of the board.

7. Solder the legs with very small amount of solder. If too much, remove solder by desoldering tool or 'solderwick' (TM).

8. Solder chip parts.

9. Mount the PCB with silver paste or bonding glue.

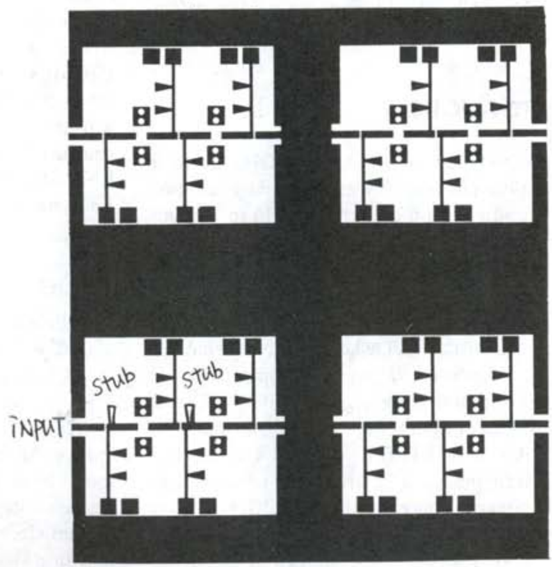
10. Make gate and drain wiring by very thin wire. I used one piece of peeled usual wire. It is about 0.1mm diameter.

11. Ground gate and drain terminals to case.

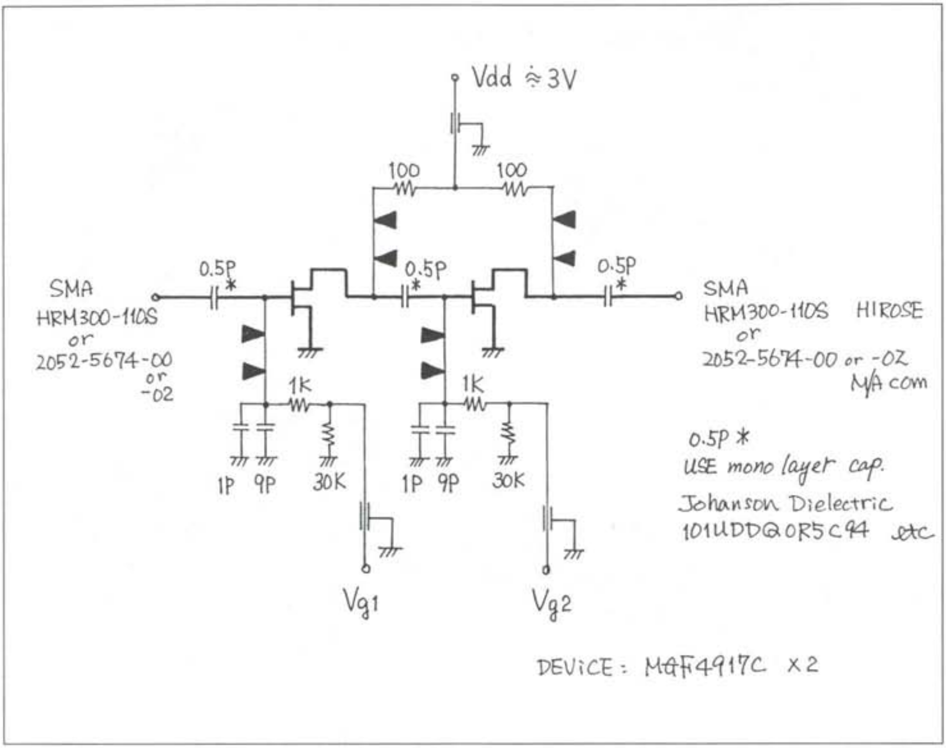
12. Cut and shorten HEMT's gate, drain and source legs to 0.3mm length. No leg for source is okay because around the package, you can see a gold metalization area for source which can be soldered.

13. Solder HEMT and after that remove ground wire on gate and drain terminals

14. Attach both side plates with appropriate SMA connector. I strongly recommend to use Hirose HRM300-110S or equivalent which has thin(2.2mm) PTFE extension with 3.2mm of ex-



Bild/Figure 3: PCB



Bild/Figure 4: Circuit Diagram/Schaltung

tension length. Usual 4.17mm extension SMA connector never work well above 20GHz according to experimental work. M/A com type 2052-5674-00 or -02 works well with tenth of dB degradation from Hirose. Cut and shorten a center conductor of SMA to 0.5 to 0.7mm. DO NOT SOLDER CENTER CONDUCTOR OF THE SMA. It is quite enough electrical connection to fit the center conductor to the stripline track by light pressure when attaching the side plate to main body.

15. Tune the LNA. My experience indicates there will be 13 to 14dB of gain on 23 to 24GHz band without tuning stubs. 2 to 2.5mm away from gate is stub position and stub length is about 2mm. It can be applied to both stage. No drain tuning is required. I am using 0.05mm thickness 0.6mm width copper ribbon or gate leg of FET for stub.

16. Additional small foil on the bias line will boost the gain about 0.5 to 1.0dB.

17. There is no decoupling chip capacitor at the drain bias pad area. Before I did it, but the amplifier did work as an oscillator. Be careful for decoupling work.

4. Konstruktion

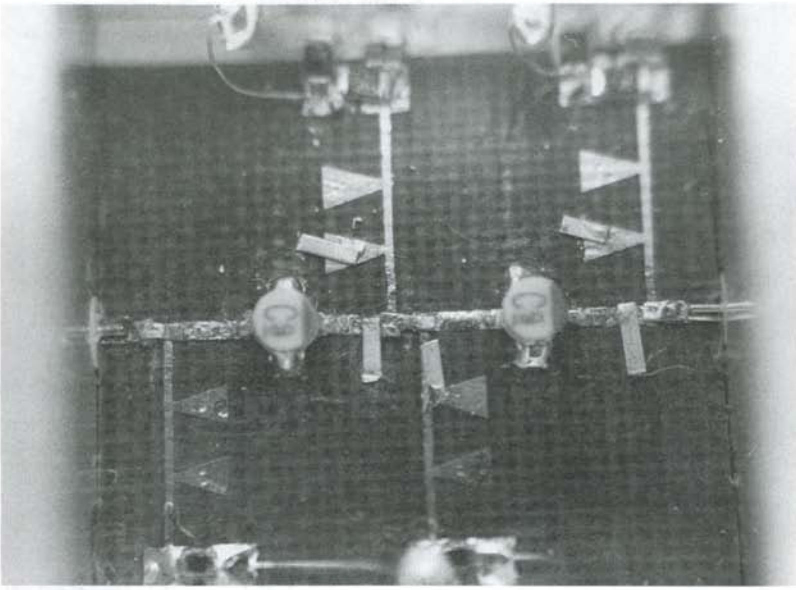
1. Die Platine wird auf Maß geschnitten.

2. Die Durchkontaktierung an der Source mit 0,05mm dicker Kupferfolie ausgeführt.

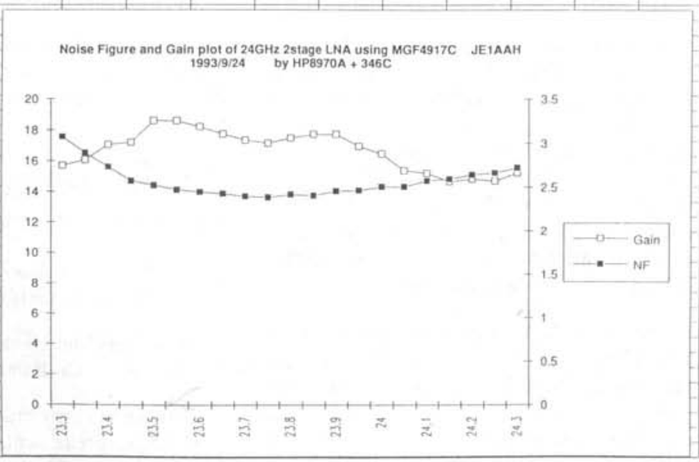
3. Fertige ein U mit 1mm Schenkellänge aus einem 1,5mm breitem Cu-Band.

4.- 7. In die Platine werden dort, wo der FET sitzt, zwei 1,5mm breite Schlitze in 1mm Abstand geschnitten. Das U-Blech wird mit den Beinen nach unten durchgesteckt, flach auf die Platine gebogen und mit wenig Lötzinn verlötet. (In der Produktions-Version der Platine gibt es dort Durchkontaktierungen und diese Arbeit entfällt).

Bild/Figure 5: Close View on 24GHz LNA



	Gain	NF
23.3	15.7	3.07
	16.05	2.89
23.4	17.04	2.73
	17.19	2.57
23.5	18.59	2.52
	18.58	2.47
23.6	18.18	2.44
	17.73	2.42
23.7	17.31	2.39
	17.13	2.38
23.8	17.46	2.41
	17.69	2.4
23.9	17.69	2.45
	16.93	2.46
24	16.43	2.5
	15.36	2.5
24.1	15.19	2.57
	14.62	2.59
24.2	14.8	2.64
	14.67	2.66
24.3	15.2	2.72



Bild/Figure 6: NF Measurement of LNA

8. Alle SMD-Teile werden aufgelötet.

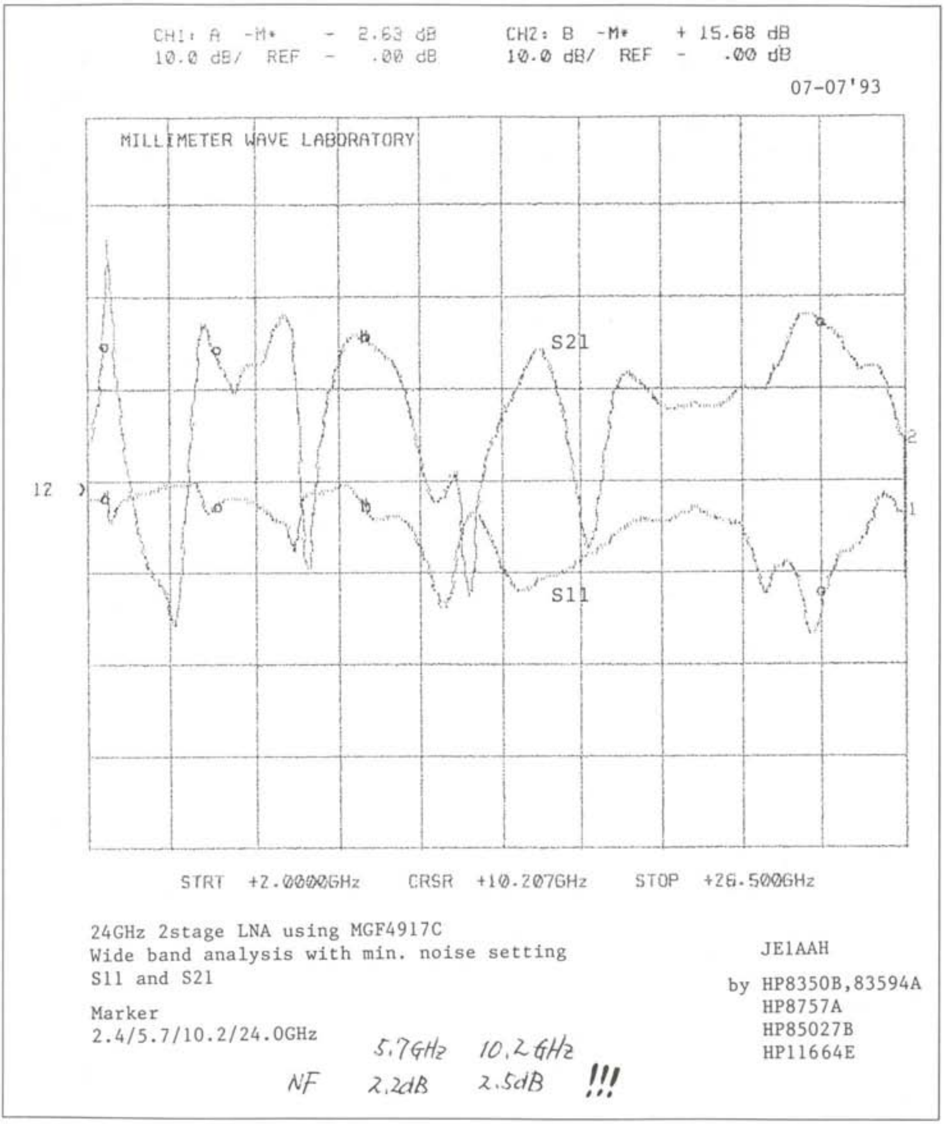
9. Die Platine wird mit Silberpaste eingebaut.

10.-11. Die Gate- und Drain-Anschlüsse der HEMT's werden mit dünnem Draht mit den Sourcen verbunden.

12. Alle Beinchen der HEMT's werden auf 0,3mm gekürzt.

13. HEMT's einlöten und nachher die Kurzschlußdräht von Gate und Drain entfernen.

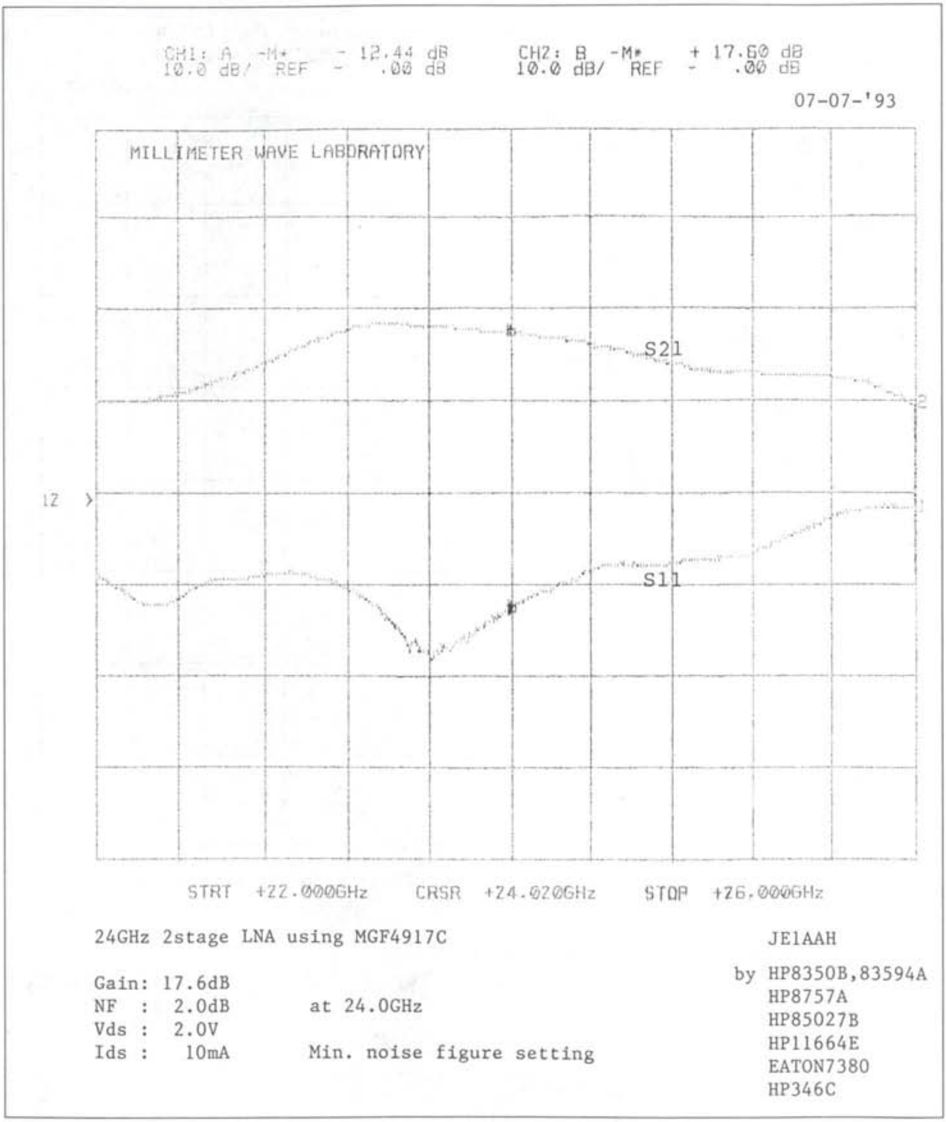
14. Beide Seitenplatten des Gehäuses werden mit den SMA-Buchsen versehen. Empfehlenswert ist



Bild/Figure 7: S11 and S21 (Broadband)

der Typ HRM300-101S von Hirose, der eine 3,2mm lange und 2,2mm dicke PTFE-Muffe hat. Als Ersatz kann man auch die M/A-COM type 2052-5674-00 nehmen. Normale SMA-Buchsen mit 4,7mm dicker PTFE-Muffe funktionieren nicht als Koax-Microstrip Übergang. Den Innenleiter der Buchsen auf 0,5 bis 0,7mm kürzen. Die Innenleiter werden ***nicht*** aufgelötet, sondern haben nur Kontakt durch Pressung! Darauf ist bei der Montage der Seitenplatten zu achten.

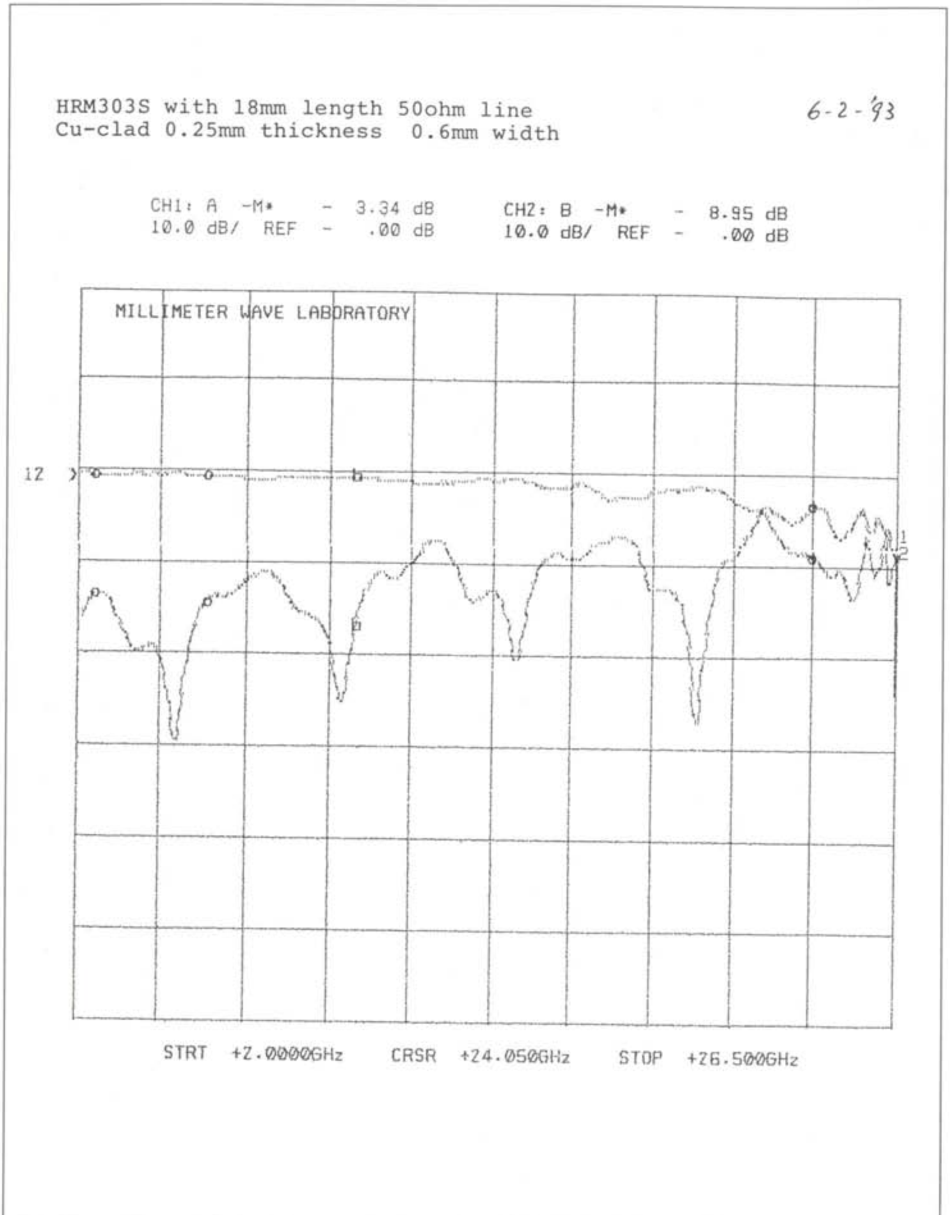
15. Ohne Abstimmfähnchen werden 13 bis 14dB Verstärkung erzielt. Durch Anbringen von 2mm langen und 0,6mm breiten Abstimmfähnchen ca.



Bild/Figure 8: S11 and S21 from 22 to 26GHz

2,5mm vom Gate entfernt kann die Verstärkung auf über 17dB und die Rauschzahl auf unter 2,5dB gebracht werden.

16. Kleine Zusatzfähnchen auf der Bias-Leitung können die Verstärkung nochmals um 0,5 bis 1dB anheben.



Bild/Figure 9: Insertion Loss of HRM303S SMA

17. Die Bias-Leitung wird nicht über Kondensatoren 'abgeklatscht'. Das führte zu Oszillationen.

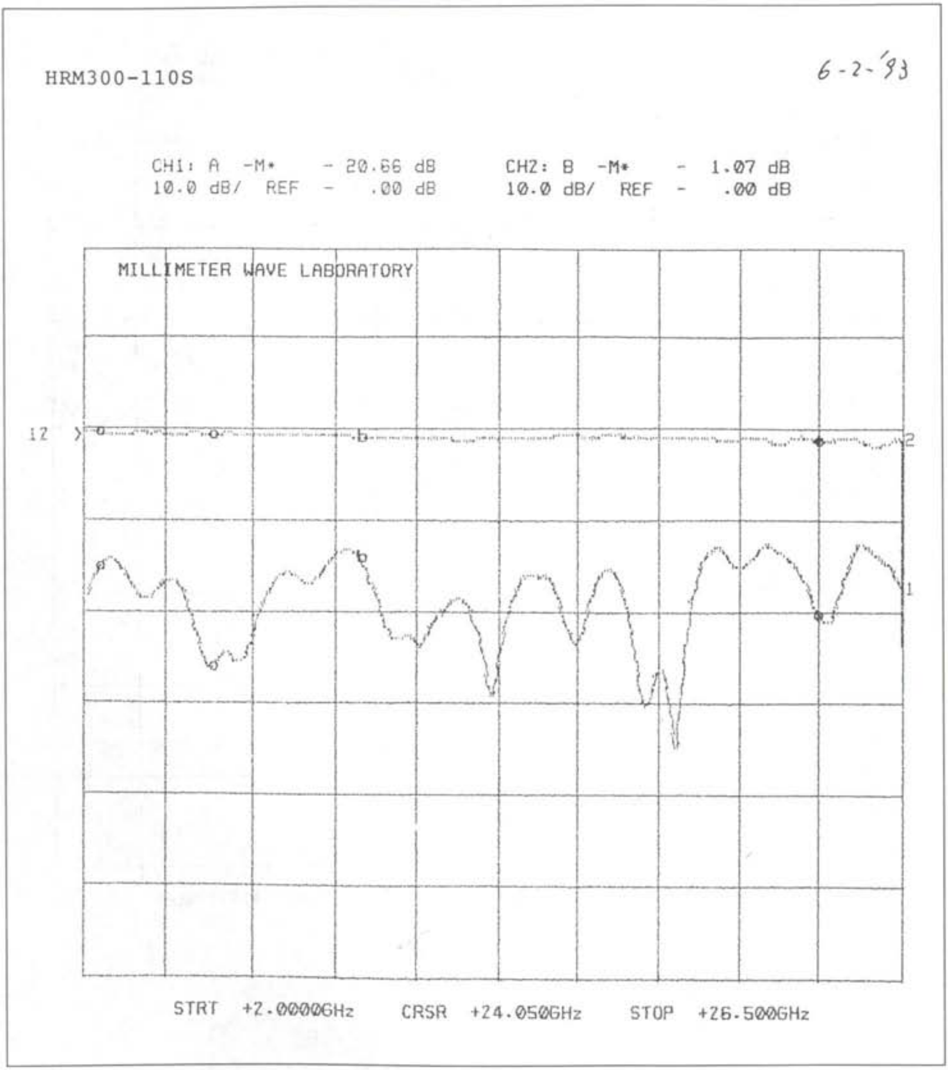
5. Results

I have measured the LNA on my bench using the following instruments:

- HP8350B+83594A,8757A,85027B,11664E for S11,S21,S12,S22 measurement
- HP346C, EATON7380 for NF measurment
- HP346C,8970B for NF plot

A typical LNA performs as follows:

- NF: 2.2dB
- Gain: 17.5dB
- V_{DS}: 2V
- I_{DS}: 10mA



Bild/Figure 10: Insertion Loss of HRM300-110S SMA

5. Ergebnisse

Die Prototypen wurden mit folgender Ausrüstung gemessen:

- HP8350B+83594A,8757A,85027B,11664E für die Messung von S11,S21,S12,S22
- HP346C,EATON7380 für Rauschzahlmessung
- HP346C, HP8970B für Plot der Rauschzahl

Ein typischer LNA hat folgende Werte:

- NF: 2.2dB
- Verstärkung: 17.5dB
- U_{DS}: 2V
- I_{DS}: 10mA

6. Conclusion

This project was very successful indeed. Even though comparing Thomson's work, difference of NF is about 0.5dB and it is well catching up the work. They used K connector and my LNA is using SMA. 0.5dB change is well acceptable.

I strongly wish to thank to G4KNZ and G8KMH for their introduction of the Thomson article.

6. Schluß

Ich glaube, daß das Projekt ein Erfolg war. Wenn man die Ergebnisse von Thomson vergleicht, sind die auf 24GHz erreichten Werte für die Rauschzahl nur 0,5dB schlechter, was auch an den bei Thomson verwendeten besseren K-Konnektoren liegen kann.

Ich möchte G4KNZ und G8KMH herzlich für die Information über den Thomson Artikel danken.

Power Amplifier for 24GHz

Toshihiko Takamizawa, JE1AAH

1. Introduction

I have developed a real HPA on 24GHz using Fujitsu FLR devices. With great success of LNA, next step to overcome was a real HPA. The HPA employs exactly the same construction of LNA. Difference is only drain bias circuitry using a ferrite bead instead of a 100ohm chip resistor. First I have developed a 2 stage HPA using FLR016FH and FLR026FH, then a single stage HPA using FLR056FH was developed. I have tried FLR026 + FLR056 combination at first. However it allowed only 8-9dB of gain and about +18dBm of Po driven by +10dBm input. I wonder if there is more driving power needed for FLR056. Then I have decided to develop those two HPAs.

1. Einführung

Um einen Leistungsverstärker für 24GHz (HPA) zu konstruieren, habe ich exakt die gleiche Platine und das gleiche Gehäuse verwendet. Die Transistoren sind allerdings Leistungs-GaAs-FET's Fujitsu FLR016FH und FLR026FH. Nur die Stromversorgung wurde geändert, indem man statt des 100 Ohm Widerstandes eine Ferritperle einsetzt.

Versuche mit einem einstufigen Verstärker bestückt mit dem FLR056FH und einem zweistufigen Verstärker mit FLR026/056 blieben ohne Erfolg. Es wurde nur eine Ausgangsleistung von 18dBm bei schlechter Verstärkung erreicht.

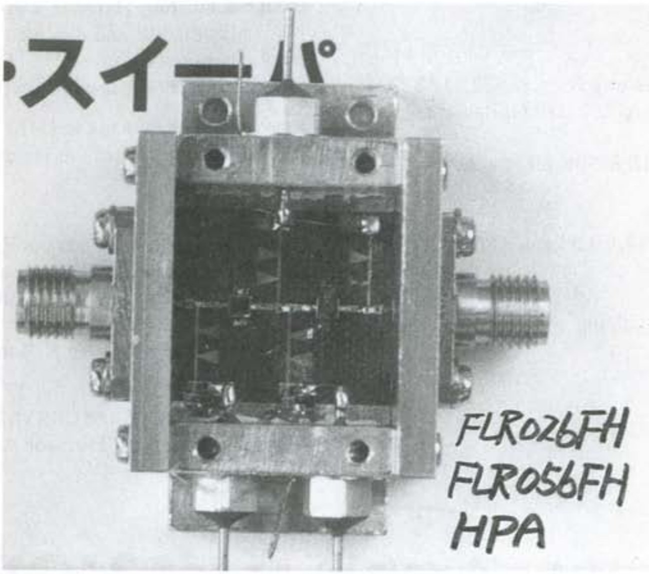
2. Design, Case, Construction

As mentioned above, Please refer LNA part for these items.

2. Design, Gehäuse, Aufbau

Wie gesagt, kann man alle Details dem vorigen Artikel über den LNA entnehmen.

Bild/Figure 1: Overall View on 24GHz HPA



3. Construction Hints

Only one thing what has to be concerned about this 2-stage amplifier is to ensure drain bias decoupling. At first, I do not use a ferrite bead for each drain bias line. Each FET's drain seems almost directly connected as DC view point which allows only few decoupling value at lower microwave frequency region. It resulted self oscillation!!! I have put a ferrite bead at drain bias line instead of a jumper wire. About a single stage amplifier, there is no coupling capacitor used for gate and drain DC-cut purpose. It provides better VSWR(because straight 50ohm line only) and easy construction. If it is critical depends on your application, put a mono layer microwave capacitor at usual position. I am using a floating type Coax-WG transition for operation, it is possible to use. If you use HP K281C type grounded center conductor transition, you need a drain DC-cut capacitor at least.

3. Aufbauhinweise

Wichtig für die Stabilität ist eine gute Entkopplung der Drain-Zuführungen. Eine Ferritperle auf den Drain-Leitungen löste das Problem. Man kann auf die Koppelkondensatoren im Ein- und Ausgang verzichten, wenn man erdfreie SMA-Hohlleiter Übergänge benutzt. Der HP K281C hat allerdings einen geerdeten Stift. Also Vorsicht!

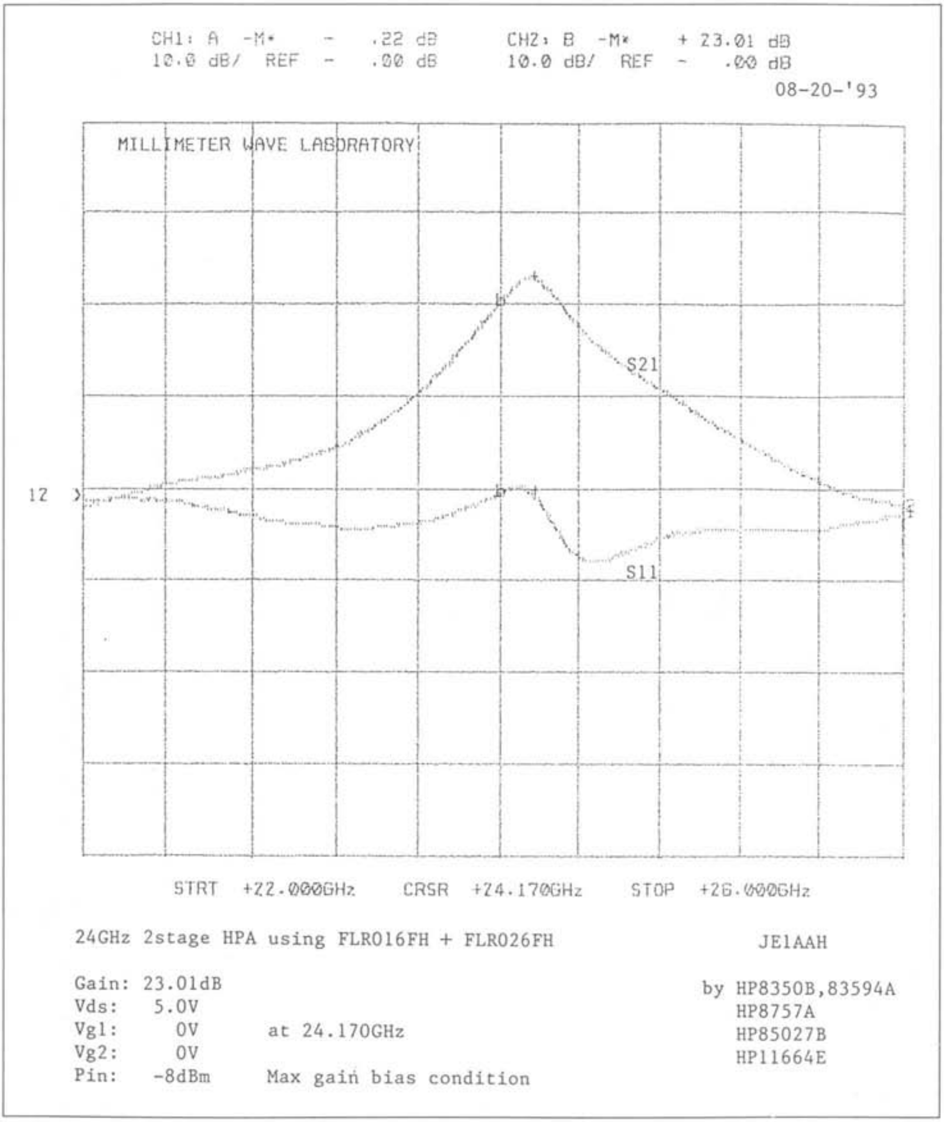
4. Results

Using a lot of diagrams, I can show the extremely good performance of the 2 stage HPA. When I was measuring an HPA, some characteristics depends on DC biasing condition were realized which are:

- For maximum gain, V_{DS} is about 5V for each device and V_{DS} is almost 0V for each device. Since there is one V_{DS} terminal for two devices used, two separate V_{DS} supplies would provide better result.
- For maximum saturated power output(Psat), V_{DS} is 6.8V. V_{G_1} does not affect a lot on P_{Sat} but affects total amplifier gain at lower input level and power added efficiency. Total gain goes up with lower V_{G_1} at lower input level and it causes more drain current for FLR016FH(efficiency goes worse). At higher output level(+20dBm), as gain is already com-

pressed at this output level, varying V_{G_1} does not change a lot on total amplifier gain. V_{G_2} does not affect a lot on both total gain(liner gain) and P_{Sat} at this V_{DS} setting of 6.8V. This is trade off of biasing what you request to this amplifier. (Setting1)

- For higher gain: Lower V_{DS} and higher current. Setting1 For higher P_{Sat} and good efficiency: High V_{DS} and lower current but lower liner gain. (Setting2)
- For everything: High V_{DS} and high current but lower power added efficiency. (Setting3)



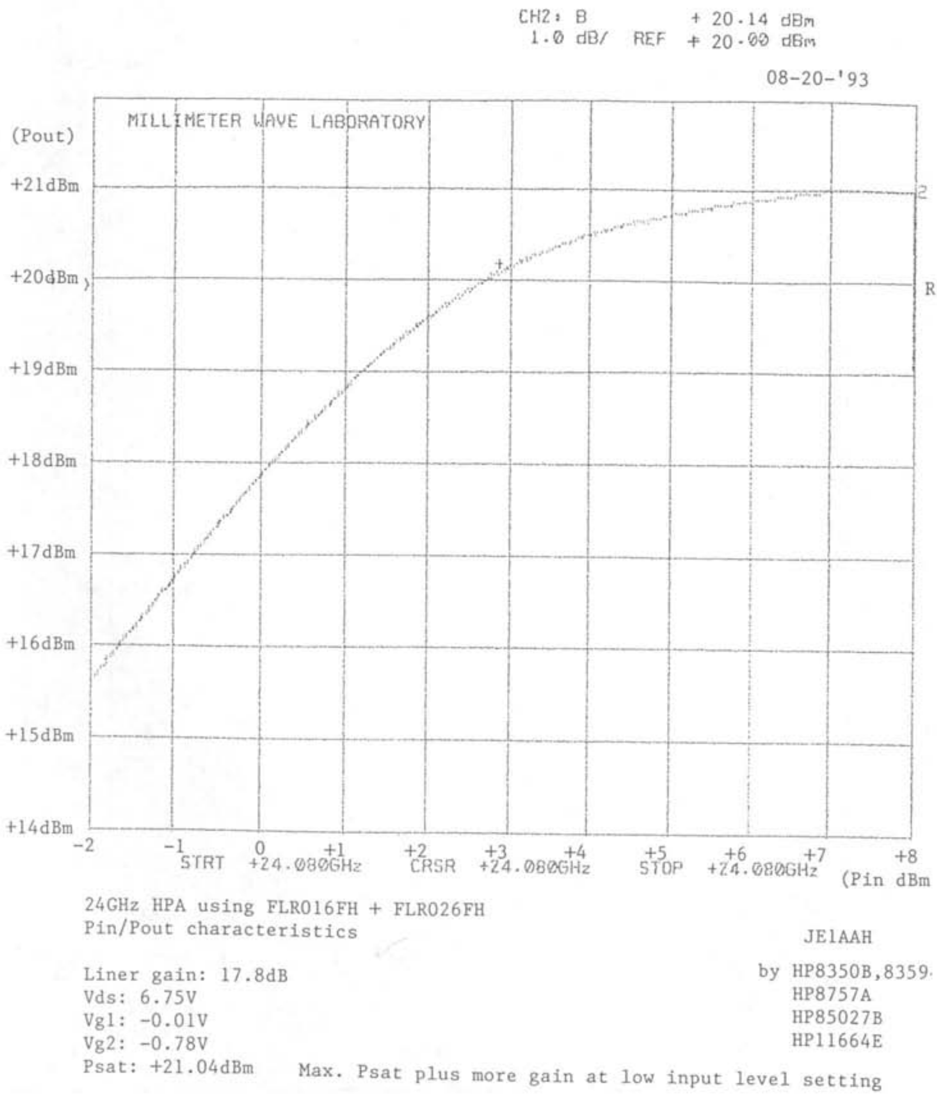
Bild/Figure 2: HPA: S11 and S21 from 22 to 26GHz

I have measured the HPA on my bench using following instruments:

- HP8350B+83594A,8757A,85027B,11664E for S11,S21,S12,S22 measurement
- Wiltron 43KC-20 (40GHz 20dB attenuator)

The 2 stage HPA performs as follows:

- Setting1
  - V_{DS}: 5V
  - V_{G_1} and $V_{G_2} = 0V$
  - Linear gain 23dB at an input level of $-8dBm$
  - Compressed gain 19.3dB at input level of 0dBm with V_{DS}=5.5V,V_{G_1}=0V and



Bild/Figure 3: HPA: Pout versus Pin

V_{G_2}=-0.26V. This means at 1mW P_{IN} 85mW P_{OUT}. However P_{Sat} never exceed +20dBm.

- Setting2
  - V_{DS} 6.8V
  - V_{G_1} -0.29V
  - V_{G_2} -0.80V
  - Linear gain:16.4dB (x 44)
  - P_{Sat} +21.06dBm (128mW) +21.30dBm was observed later
  - 1mW P_{IN} --> 46mW P_{OUT}
  - 2mW P_{IN} --> 91mW P_{OUT}
- Setting3
  - V_{DS} 6.75V
  - V_{G_1} -0.01V
  - V_{G_2} -0.78V
  - Linear gain: 17.8dB (x 60)
  - P_{Sat} +21.04dBm (127mW)
  - 1mW P_{IN} --> 60mW P_{OUT}
  - 2mW P_{IN} --> 103mW P_{OUT}

Fujitsu specifies V_{DS} of 8V for FLR series. However my experience shows it can not be applied for over specification use on far above 18GHz, especially on 24GHz like this. V_{DS} of 8V should work well but with no improvement on Psat and Gain. Bad efficiency is the only result. You need to select what bias condition you use.

4. Ergebnisse

Bei den Messungen ergaben sich folgende Abhängigkeiten von den Arbeitspunkten der FET's:

Für maximale Verstärkung soll die Drainspannung bei ca. 5V liegen und die Gatevorspannung ist nahe 0V. Für maximalen Output ist eine Drainspannung von 6,8V günstiger. Bei hohem Output (20dBm) ändern Variation von U_{G_1} und U_{G_2} nicht viel bei der Verstärkung. Folgende Bias-Einstellungen haben sich als günstig erwiesen:

- Einstellung 1
  - U_{DS} 5V
  - U_{G_1} and U_{G_2} 0V
  - Verstärkung 23dB bei einem Eingangspegel von -8dBm
  - Verstärkung 19.3dB bei einem Eingangspegel von 0dBm und U_{DS}=5.5V, U_{G_1}=0V und U_{G_2}=-0.26V. Das bedeutet 85mW Ausgangsleistungt bei 1mW Steuerleistung. P_{Sat} erreichte nur 100mW
- Einstellung 2
  - U_{DS} 6.8V
  - U_{G_1} -0.29V
  - U_{G_2} -0.80V
  - Verstärkung 16.4dB (x 44)
  - P_{Sat} +21dBm (128mW)
  - 1mW P_{IN} --> 46mW P_{OUT}
  - 2mW P_{IN} --> 91mW P_{OUT}
- Einstellung 3
  - U_{DS} 6.75V
  - U_{G_1} -0.01V
  - U_{G_2} -0.78V
  - Verstärkung 17.8dB (x 60)
  - P_{Sat} +21dBm (128mW)
  - 1mW P_{IN} --> 60mW P_{OUT}
  - 2mW P_{IN} --> 103mW P_{OUT}

Die Meßwerte wurden mit folgender Ausrüstung gemessen:

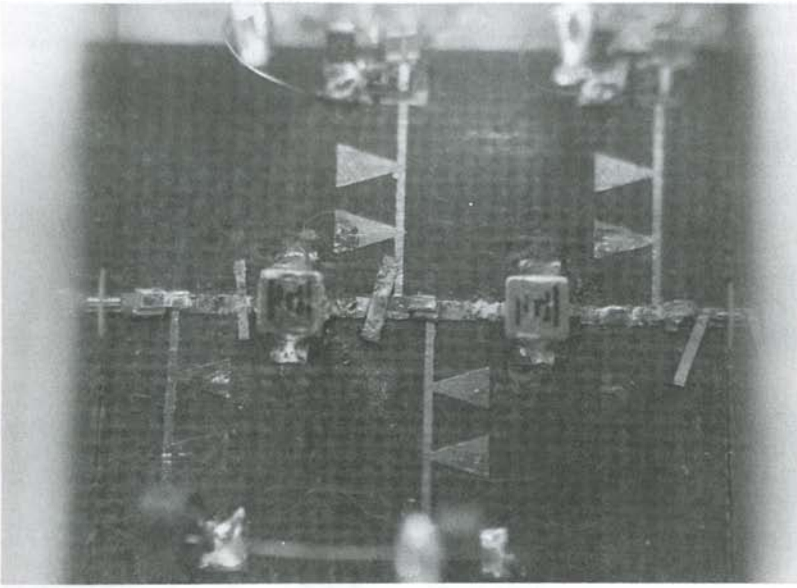
- HP8350B+83594A,8757A,85027B,11664E für S11,S21,S12,S22 Messung
- Wiltron 43KC-20 (40GHz , 20dB Abschwächer)

Fujitsu erlaubt 8V Drainspannung für die FET's. Die Anwendung dieser Spannung ergibt keine Verbesserung in Leistung und Verstärkung, sondern erniedrigt nur den Wirkungsgrad und ist thermisch problematisch.

5. Trial: A single stage FLR056FH amplifier

I can not report a good result on FLR056FH. I have tried two chips on my test jig. They performed about 3dB of gain and 15 to 17dBm of Po. I have three chips but it can be estimated that FH package is not suitable for FLR056. I need further investigation on the device and the application. I will ask Fujitsu to mount TLR056 in an another package. WG or WF is nice for higher power chips. As Idss is exceeding 220mA, I believe the chip inside is FLR056 but performance is ...

Bild/Figure 4: Close View on 24GHz HPA



5. Ein Versuch: Einstufiger Verstärker mit FLR056

Einstufige Verstärker mit dem FLR056FH funktionieren nicht gut. Testwerte waren 3dB Verstärkung bei max. 17dBm Ausgangsleistung. Das FH-Gehäuse ist offensichtlich nicht geeignet. Ich werde meine Freunde bei Fujitsu fragen, ob sie mir den TLR056 Chip in ein WG oder WF Gehäuse einbauen können. Dann werde ich das nochmal untersuchen.

6. Conclusion

This HPA project was very successful except FLR056. As a result of these projects, PCB size should be as small as possible and using mono-layer microwave chip capacitor is a key to success if you want to catch up with state-of-the-art performance. I could get previously reported 3 stage HPA performance by 2 stage HPA. I hope this article will be helpful for 24GHzers in the world and be much appreciated to hear from you regarding obtaining devices and PCBs, QAs and so on. Please feel free to call me, Fax to me or write to me. I hope to hear from 24GHzers.

Special Thanks

I strongly wish to thank to Fujitsu for their special offering of FLR056FH in stead of usual chip form supply, but not succeeded hi!

6. Schluß

Das HPA-Projekt war ebenfals erfolgreich. Kleine Platinen und Mono-Schicht-Kondensatoren sind der Schlüssel zum Erfolg. So konnt e die Leistung des alten dreistufigen Verstärkers mit einem zweistufigen ([2]) erreicht werden. Falls Teile beschafft werden müssen, können 24GHz DXer mich anrufwen oder ein Fax schicken. Das würde mich freuen.

Besonderen Dank gebührt der Fa. Fujitsu, die mir die FLR056 Chips in ein FH Gehäuse montiert hat. Leider funktionierte dann der Verstärker doch nicht

References

[1] **T. Takamizawa, JE1AAH,** '24GHz Transverter with HEMTs', DUBUS 2/1991, pp.37-48

[2] **T. Takamizawa, JE1AAH**, '24GHz Transverter with HEMTs', DUBUS 3/1991, pp.24-32

Modern 10GHz Transverter System (Part II)

(Modernes 10GHz-Transverter System - Teil II)

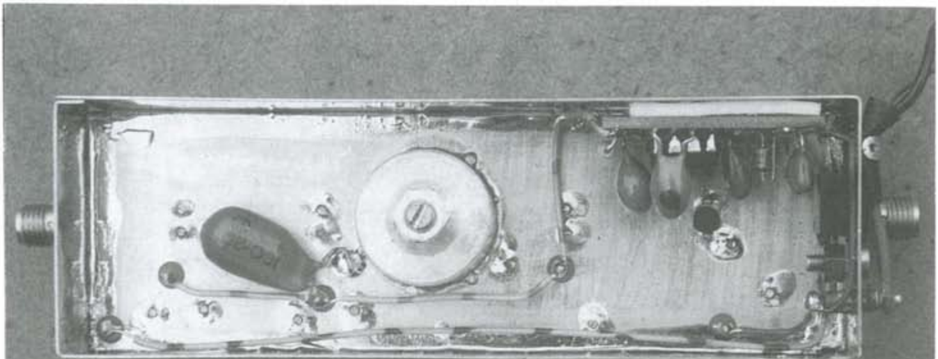
Charles Suckling, G3WDG & Petra Suckling, G4KGC

Introduction: The second part of this series covers the description and alignment procedures for the various modules which make up the G3WDG 10GHz transverter. These are:

- G3WDG001 Signal Source (Multiplier/Amplifier)
- G3WDG002 10GHz - 144MHz Receive Converter
- G3WDG003 144MHz - 10GHz Transmit Converter
- G3WDG004 10GHz HEMT Preamplifier

Part III in DUBUS 1/1994 will describe

- G3WDG005 2-stage Amplifier
- G3WDG006 1-stage, 250mW TX-Amplifier (MGF1801)
- G3WDG007 1-stage, 1W TX-Amplifier (MGF2430A)
- G4FRE Power Supply
- G4NJT001 Transverter Interface Unit



Bild/Figure 1: G3WDG001 (Top View)

For an operational 10GHz station with 50mW output you need a G4DDK001 LO, a 002 RX-converter, a 003 TX-converter, and the G4FRE power supply with the G4NJT TIU. To achieve 250mW output power you have to add a 006 PA, for 1W output another 007 PA. To lower the standard noise figure of the RX from 2.5dB downto 1.0dB you have to add a 004 HEMT-preamp. The 10GHz transverter system is a fully modular 50Ω system.

Einführung: Der zweite Teil der Artikelserie beschreibt die verschieden Module des G3WDG Transvertersystems. Es sind im einzelnen:

- G3WDG001 Signalquelle (Vervielfacher/Verstärker)
- G3WDG002 10GHz - 144MHz RX-Konverter
- G3WDG003 144MHz - 10GHz TX-Konverter
- G3WDG004 10GHz HEMT Vorverstärker

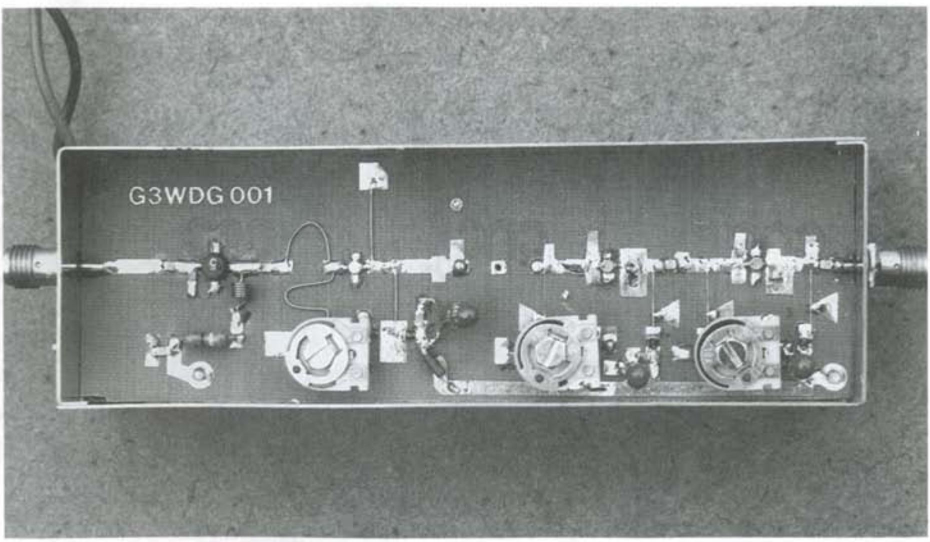
Teil III in DUBUS 1/1994 wird folgende Module bringen

- G3WDG005 2-stufiger Verstärker
- G3WDG006 1-stufiger 250mW Leistungsverstärker (MGF1801)
- G3WDG007 1-stufiger 1000mW Leistungsverstärker (MGF2430A)
- G4FRE Stromversorgung
- G4NJT001 Transverter Interface Einheit

Für eine funktionierende 10GHz Station braucht man einen G4DDK001 LO, einen 002 RX-Konverter, einen 003 TX-Konverter, eine G4FRE Stromversorgung und eine G4NJT Kontrolleinheit. Will man die Empfängerrauschzahl auf ca. 1dB erniedrigen, kann man noch einen 004 HEMT-Vorverstärker wahlweise in Koax- oder Hohlleitertechnik einfügen. Zur Leistungserhöhung sind einmal der 006 Leistungsverstärker mit 250mW Leistung und der 007 Leistungsverstärker mit 1000mW Leistung geeignet. Das ganze System ist modular in 50Ω-Technik realisiert.

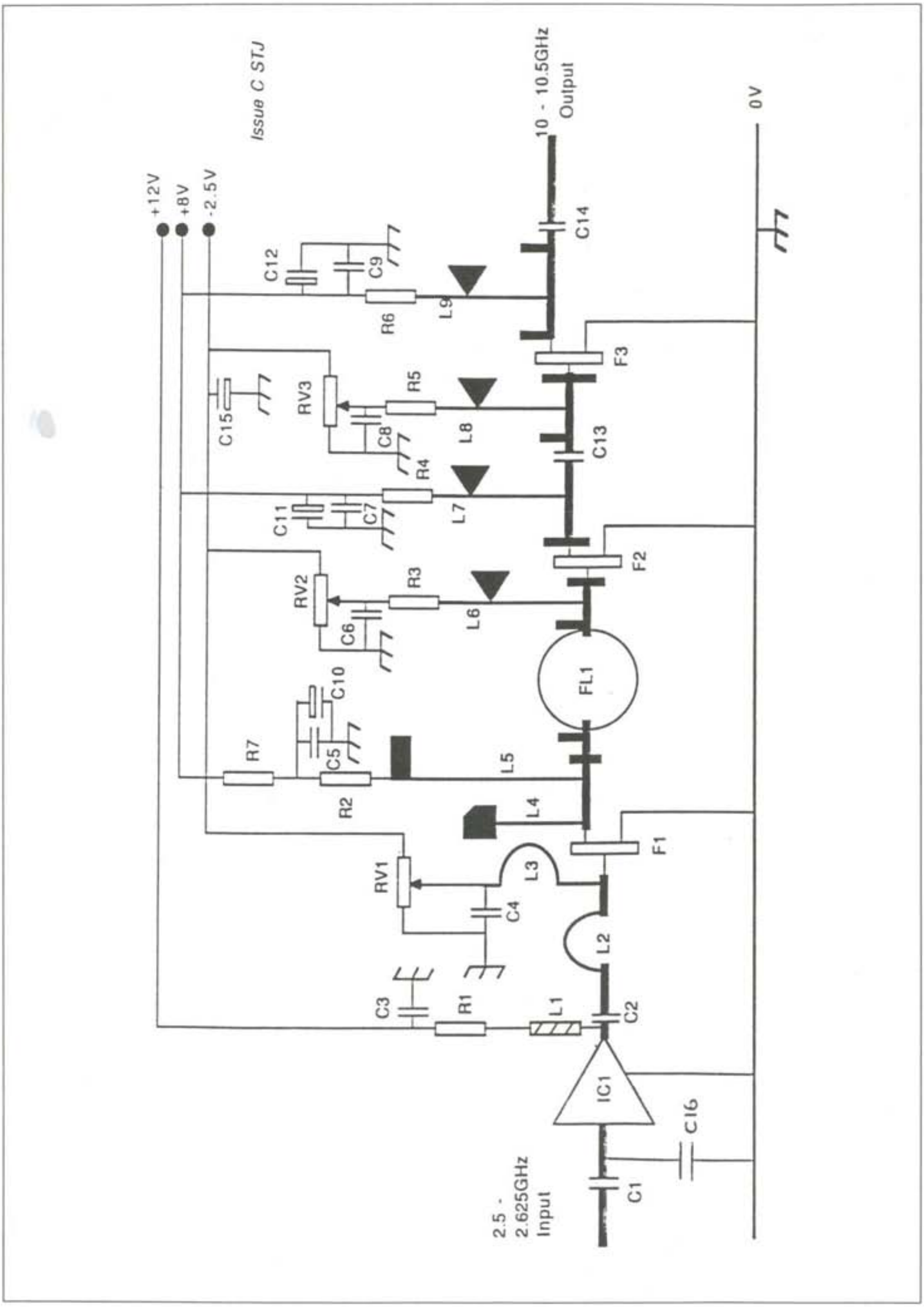
1. The G3WDG001 multiplier/amplifier

The G3WDG001 was the first module in the series to be developed and proved that GaAs FET multipliers and amplifiers could be constructed reproducibly in microstrip form by amateurs with no access to specialist facilities or test equipment.



Bild/Figure 2: G3WDG001 (Bottom View)

Bild/Figure 3: Circuit Diagram of G3WDG001



While not part of the transverter system, it is a very useful module in its own right. It represents a very simple way of generating a narrow-band signal on 10GHz, when used with the G4DDK004 local oscillator. The main application for this design has been for beacons, but it could also be used for ATV and as a packet link transmitter.

The module is capable of operating anywhere in the 10 - 10.5GHz band. Usually it is used to generate 10,368MHz, when a drive frequency of 2592MHz is required (at a power level of about 10mW). A suitable oscillator design in the G4DDK004, described in DUBUS 3/93.

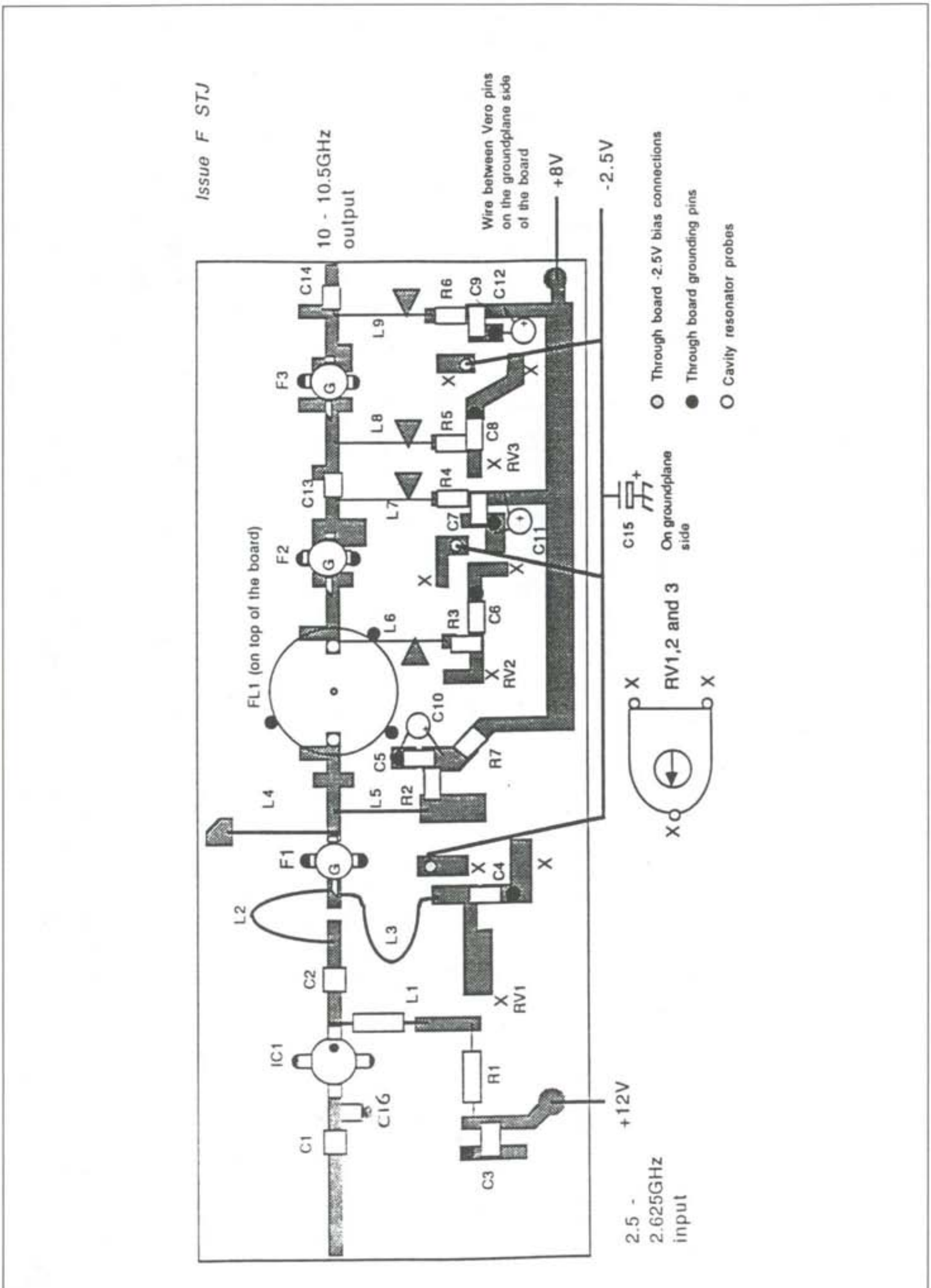
The circuit diagram of the G3WDG001 is shown in Fig. 3, and the component layout in Fig. 4. The input stage is an MAV11 MMIC amplifier with a shunt capacitor C16 on its input to improve in the input VSWR. The output from the MAV11 drives the FET multiplier via a lumped element matching circuit L2/L3. This circuit has sufficient bandwidth to accommodate the required range of drive frequencies. The FET is normally biased close to pinch-off with the drive signal driving the drain current up to 10-15mA. This has been found to produce the best conversion loss as a multiplier. A series tuned circuit on the drain of the FET (L4/printed capacitor) forms a short circuit at the drive frequency, which improves conversion loss by a few dB. Drain bias is fed via L5 and decoupled with a short circuit stub. The output multiplier is fed via some matching stubs to the filter FL1. The idea for this filter was borrowed from previous designs [1]. Small probes made from circuit pins (the same type that are used for grounding the chip components) couple in and out of the filter. The output of the filter is fed to a 2 stage amplifier, which typically produces some 50mW output power. The amplifier was designed to cover the full 10-10.5GHz band and has a gain of 19-20dB. Special attention was paid to the grounding of the FET sources to guarantee reproducible performance. Experiments with passing the source leads through the board or using copper foil showed that these methods are not reproducible. The method which was adopted uses small circuit pins ("veropins") to ground the sources, which behave very similarly to plated through holes. Good quality coupling capacitors (ATC series A type) were chosen because of their guaranteed performance. They are a little more expensive than conventional chip capacitors but have extremely low loss and behave the same every time. These factors allow the design to be built with the expectation that it should work first time with no need for tuning! The bias feeds for the amplifier use quarter wave high impedance lines made from silver plated wire-wrap wire and radial stub low impedance decoupling elements. Low frequency decoupling is taken care of by series resistors and decoupling capacitors.

Alignment

Alignment of the unit is straightforward if the following sequence is adopted:

1. Connect a current meter between the +8V supply and the +8V rail on the board.
2. Set RV1, 2 and 3 so that full negative bias will be applied to the FET gates.
3. Attach a suitable load/power indicator to the output socket. This might consist of an SMA to WG16 transition, attenuator and diode detector, or an SMA attenuator and coaxial power meter.
4. Apply DC power, and with no oscillator drive applied, the current shown on the meter should be no more than a few microamps. If the current shown is higher than this look for mis-connected or damaged components.
5. Adjust RV1 so that the current rises to about 2mA.
6. Apply 2.5GHz drive and the current should rise (typically by 10mA).
7. Set RV2 to increase the current drawn by 20mA (total now about 30mA).
8. Set RV3 to increase the current drawn by a further 20mA (total now about 50mA).
9. A small amount of RF output may now be seen on the power meter. If not, do not worry at this stage. The filter is now tuned for maximum output. Assemble the locknut on to the screw so that approximately 7.5mm of screw thread protrudes from the nut. Without moving the nut, insert the screw into the cavity until the nut touches the cavity. Slightly tighten the nut with a spanner. Keeping the nut slightly tight with a spanner, turn the screw a few turns either side of the initial position looking for a peak in output power. Once the peak has been found tighten the locknut and if necessary readjust the screw for maximum power. For those who like to do their own car maintenance, this operation is very similar to adjust-

Bild/Figure 4: Parts Layout of G3WDG001



ing tappets! With the screw supplied, it should not be possible to find any other resonances, but of course a check should be made with a wave meter or spectrum analyser before putting the unit on the air!! It should be noted that, with the screws supplied, the heads may prevent the bottom lid of the box from fitting correctly. If this is a problem then after alignment the screw should be removed and the head sawn off. A screwdriver slot is then cut in the end of the screw with a small hacksaw to permit the screw the be adjusted. The screw is refitted to the cavity and the alignment procedure repeated.

Parts List G3WDG001

Part-No.	Item
IC1	**MAV11***
F1-F3	Birkett 'Black Dot'
C1-C9	**180pF 0805**
C10-C12	**2.2pF ATC100**
C15	100uF Tantalum
C16	**1pF 0805**
R1	100R Wire Ended 0.5W
R2-R5	**47R 0805**
R6	**47R or 10R 0805**
R7	220R Wire Ended 0.5W
RV1-3	10k horizontal skeleton carbon preset (Philips OCP10H)
L1	6t **0.3mm enamelled copper wire** (ecw) close wound, 2mm dia., 2mm lead length, mounted 1mm above board
L2	16mm length ecw, tinned 1mm ends, mounted flat on board
L3	19.5mm length as L2
L4,5	Straight length 0.3mm ecw, tinned 1mm ends, mounted flat on board

Parts List G3WDG001

Part-No.	Item
L6-9	Straight length **0.2mm silver plated wire (CuAg)**, tinned 1mm ends, mounted flat on board
FL1	**Silver plated cavity resonator, M4 screw and nut**, probe length 4.7mm
Veropins	**1mm single ended (25 required)**
Sockets	SMA 2-hole or 4-hole, gold plated (2 required)
Tinplate Box	37x111x30mm (Schuberth Size 3)
Feedthrough	100pF not critical
Bias Parts	**G4FRE023PCB** and parts
PCB	**G3WDG001 Issue B**

*** Items in kit are in bold face!**

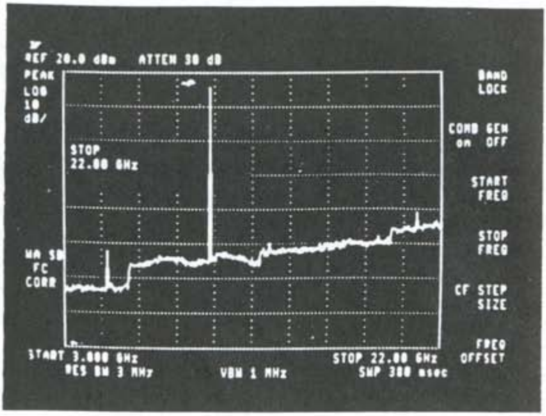
10. Adjust the gate bias settings (RV1, 2 and 3) to optimise power output.
11. This completes the alignment of the unit. The power output should be between 50 and 100mW. If a well matched load can be guaranteed, it is possible to increase power output by a small amount by changing R6 to 10R. However, this is pushing the transistor ratings a little and is not recommended where the unit is intended to be operated continuously, for example as a beacon. If power output is below 50mW, it may be possible to increase this by adding small tuning tabs to the microstrip circuitry. This is done by cutting a small piece of copper foil (2x2mm to start with) and sliding this around with a wooden cocktail stick while monitoring power output. The tab is then soldered in position (with the power off!). As many tabs as are needed may be added.

The output spectrum of a typical unit is shown in Fig. 5

1. G3WDG001 Vervielfacher/ Verstärker

Der G3WDG001 wurde als erstes Modul entwickelt und kann als Bake, ATV-Sender oder als Packet Radio Sender dienen. Er ist im Bereich von

Bild/Figure 5: Output Spectrum G3WDG001



10 bis 10,5GHz abstimmbar. Als Oszillator dient zweckmäßig der G4DDK001 (DUBUS 3/93).

Bild 3 zeigt das Schaltbild und Bild 4 zeigt die Teileanordnung. Die Eingangstufe besteht aus einem MAV11 MMIC. Der Ausgang treibt einen FET Vervierfacher. Dieser wird mit geringen Ruhestrom ('Pinch-Off') betrieben und zieht bei Ansteuerung 10...15mA. Ein Serienkreis (L4/Gedr. Kap.) am Ausgang auf der Eingangsfrequenz verbessert den Wirkungsgrad. Über ein Anpassungsglied und das Filter FL1 wird das Signal ausgekoppelt. Die Ein- und Auskopplung des Filters geschieht über Veropins. Nach Verstärkung durch zwei weitere Stufen liegt ein Pegel von 50mW vor. Der Verstärker ist breitbandig und hat ca. 20dB Verstärkung. Die Methode, die Sourcen der FET's mit Veropins zu erden, hat sich sehr bewährt und ist beinahe equivalent zu professionellen 'Through Holes'. Die ansonsten gebräuchliche Methode , die Source-Beine durchzustecken oder Kupferfolien zu verwenden, hat sich als nicht so reproduzierbar erwiesen. Die Koppel-C's sind ATC-Chips. Sie sind zwar teurer, aber sind völlig reproduzierbar und verlustarm und damit ihr Geld wert, da sie nicht zu unvorhergesehen Schwierigkeiten beim Betrieb führen. Die Spannungszuführungen an Gate und Drain werden durch versilberte, dünne Drähte ('Wire-Wrap') mit hoher Impedanz realisiert. Radiale 'Stubs' blocken für die Betriebsfrequenz ab. Für niedrige Frequenzen sind Serien-Widerstände und Chip-Kondensatoren vorgesehen.

Abgleich

Die Abstimmung ist einfach, wenn man die folgende Reihenfolge beachtet:

1. Das Modul wird über einen Strommeßgerät an das ausgeschaltete Netzgerät mit 8V angeschlossen.
2. RV1,2 und 3 werden auf volle negative Spannung an den Gates eingestellt.
3. An den Ausgang Leistungsmeßgerät anschließen.
4. Gleichspannung anlegen und verifizieren, daß der Strom nur einige µA beträgt. Wenn der Strom höher ist,nach defekten Bauteilen suchen oder nach Fehlbestückungen.
5. RV1 so einstellen, daß der Strom ca. 2mA beträgt.
6. Ein Signal auf 2,5GHz anlegen und Stromanstieg auf 10mA beobachten.
7. RV2 so einstellen , daß der Strom auf ca. 30mA ansteigt.
8. RV3 so einstellen, daß der Strom auf ca. 50mA ansteigt.
9. Schraube am Filter ca. 7,5mm eindrehen, die Kontermutter leicht anspannen und für ein Maximum an Leistung suchen- Schraube hin- und herdrehen!. Die Abstimmposition ist eindeutig.
10. RV1,2 und 3 können nun auf maximale Leistung nachgestellt werden.
11. Die Leistung sollte ca. 50...100mW betragen.

Das Ausgangsspektrum ist in Bild 5 zu sehen.

2. G3WDG002 10GHz - 144MHz Receive Converter

The circuit diagram of the G3WDG002 receive converter is shown in Fig. 8, and an artist's impression of the board layout is given in Fig. 9. Fig. 10

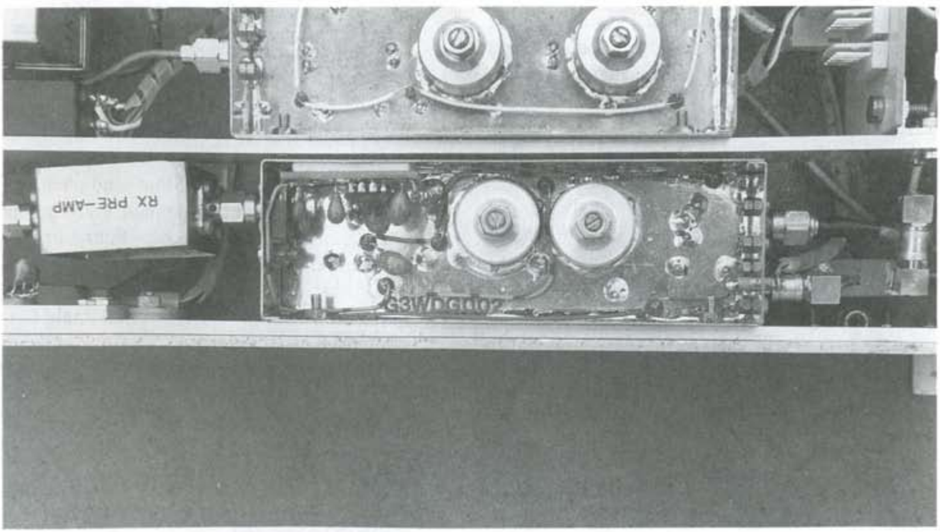
shows the connections to the reverse side of the pcb. Referring to Fig. 8, the 2556MHz LO input signal is fed to F1 which acts a quadrupler to 10224MHz. The multiplier is exactly the same design as used in the G3WDG001. The output from FL1 at 10224MHz is fed to the LO port of the diode mixer via a microstrip impedance matching network. The mixer uses a series diode pair, D1, connected between the ends of a folded three-quarter wavelength line. This configuration gives good rejection of the LO signal at the RF port, and vice-versa. L9 is a shorted quarter-wave line to provide the required low impedance IF return path, while having no effect at the LO frequency. The conversion loss of the mixer including its matching networks has been measured as 6-7dB.

A two-stage low noise amplifier is provided to reduce the noise figure of the unit to a more acceptable level. The amplifier design is very similar to the amplifier used in the G3WDG001, except that a low noise FET can be used in the input stage as an option. F2 can be either a "red dot" or "black dot" FET according to the level of performance required. Noise figures of 2.5dB with a red dot FET and 3.2dB with a black dot FET are typical. Normally the amplifier is perfectly stable, but occasionally some red dot FETs have shown signs of instability, and this has been cured by substituting a black dot FET. The input circuit of F2 has an optional stub which in some cases has been found to lower the noise figure. It is normally not required. The overall gain of the LNA section is about 20dB with a noise figure of around 2dB.

The output of the LNA passes to the mixer via a bandpass filter FL2 and a high-pass filter (C11). The image rejection with a 144MHz IF is typically better than 25dB. Note that it is possible to tune FL2 to the image frequency, so care needs to be taken when tuning up (see below). The IF output from the mixer is fed to a low noise amplifier at 144MHz via a low pass filter consisting of L10, a quarter-wave line and L11, to prevent any 10GHz signals reaching the IF amplifier.

Alignment

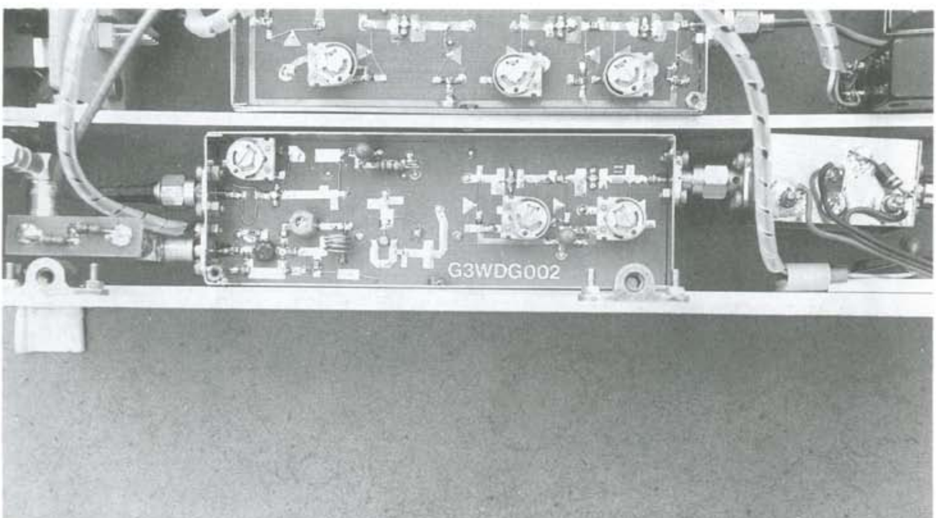
1. Temporarily bridge out the image filter FL2 as shown in Fig. 11. The wires are 0.3mm diameter spaced one wire diameter apart and overlap by 5mm. They are mounted flat on the board. The wires form a crude side-coupled wideband filter section with the properties of DC



Bild/Figure 6: G3WDG002 (Top View)

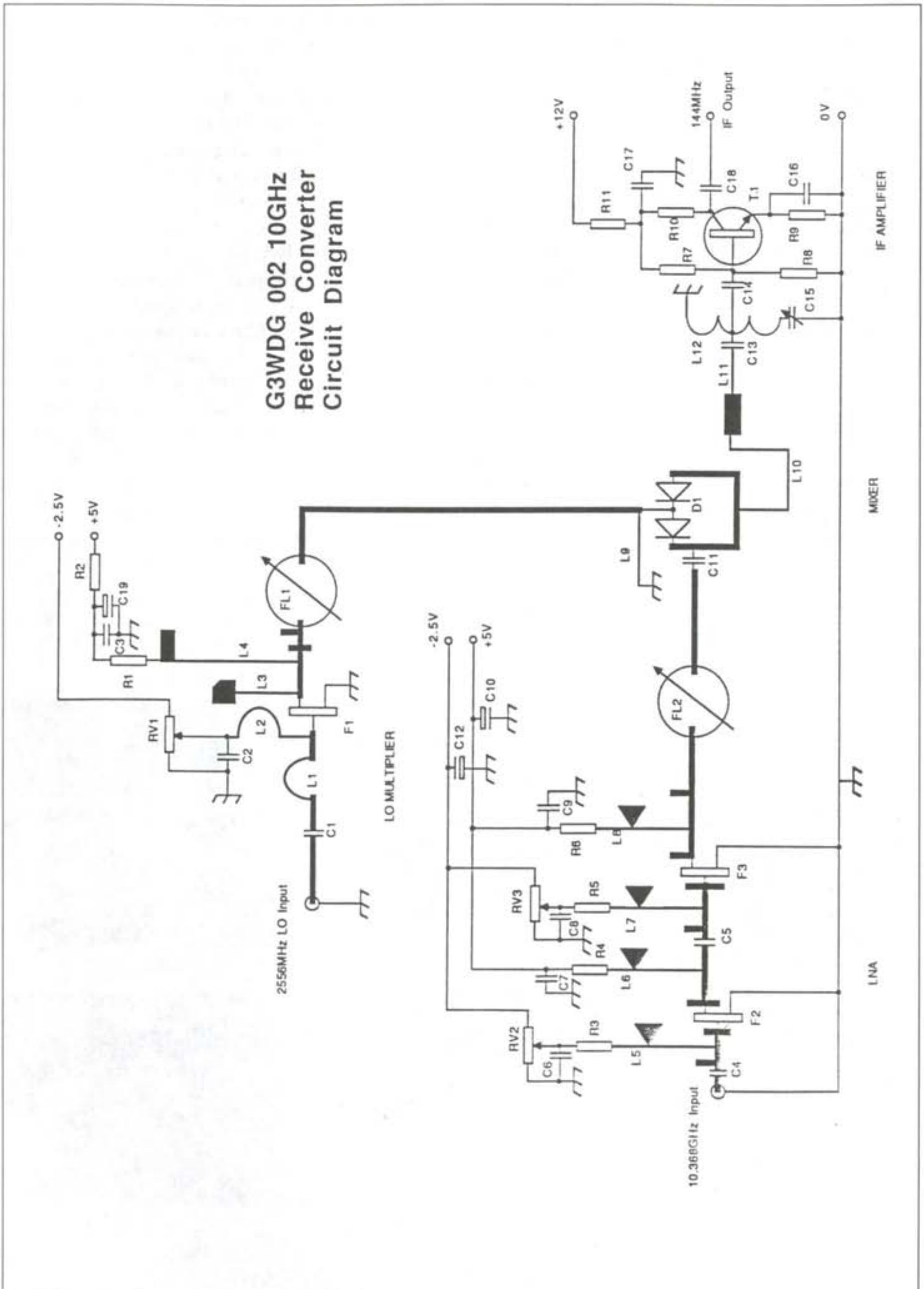
isolation and low RF loss at 10GHz. Preset FL1 and FL2 as described above for the G3WDG001, with 7.5mm of screw thread protruding from the nuts, and the nuts lightly tightened on the cavity.

2. Turn RV1, 2 and 3 so that full negative gate bias will be applied to the gates of the FETs on power up.
3. Insert a multimeter in series with the +5V supply and the +5V rail on the board.
4. Connect a load to the 10GHz input socket, such as an SMA termination, attenuator or an SMA - waveguide transition feeding a horn antenna or other well-matched load.
5. Apply DC power, and the indicated current on the multimeter should be a few microamps only. If not, look for shorted or damaged components.
6. Adjust RV1 to give an indicated current of about 1mA on the meter.
7. Apply 2556MHz drive (5mW min) and the current should rise (to 5-15mA). The absolute level is not critical.
8. Connect a 144MHz ssb receiver to the IF output socket and tune C15 for a noise peak. This should be a fairly significant peak if the IF amplifier is working properly.
9. Set RV2, 3 to give 0V gate bias to F2 and F3.
10. Adjust FL1 and when complete, RV1 for maximum noise. Use the procedure described in step #9 in the alignment procedure of the G3WDG001 to adjust the filter tuning screw.
11. Power off and remove the wires "bridging" FL2. Power on again and adjust FL2 for maximum noise. Two noise peaks should be found, about 0.4 turn apart. The correct peak is with the screw furthest out, ie smaller penetration.
12. Reset RV2, 3 to give full negative bias to F2 and 3. Adjust RV2 to cause the indicated current to rise by approximately 12mA and RV3 to cause a further increase of 15mA. The total indicated current should be in the region of 35-40mA.
13. If a signal source is available, check this can be heard satisfactorily. It is worth reconfirming that FL2 is tuned to the correct frequency, and not the image! If no such signal is avail-



Bild/Figure 7: G3WDG002 (Bottom View)

Bild/Figure 8: Circuit Diagram of G3WDG002



able, try listening for local signals on the band, or perhaps harmonics from lower frequency equipment (eg 1152MHz x 9 =10368).

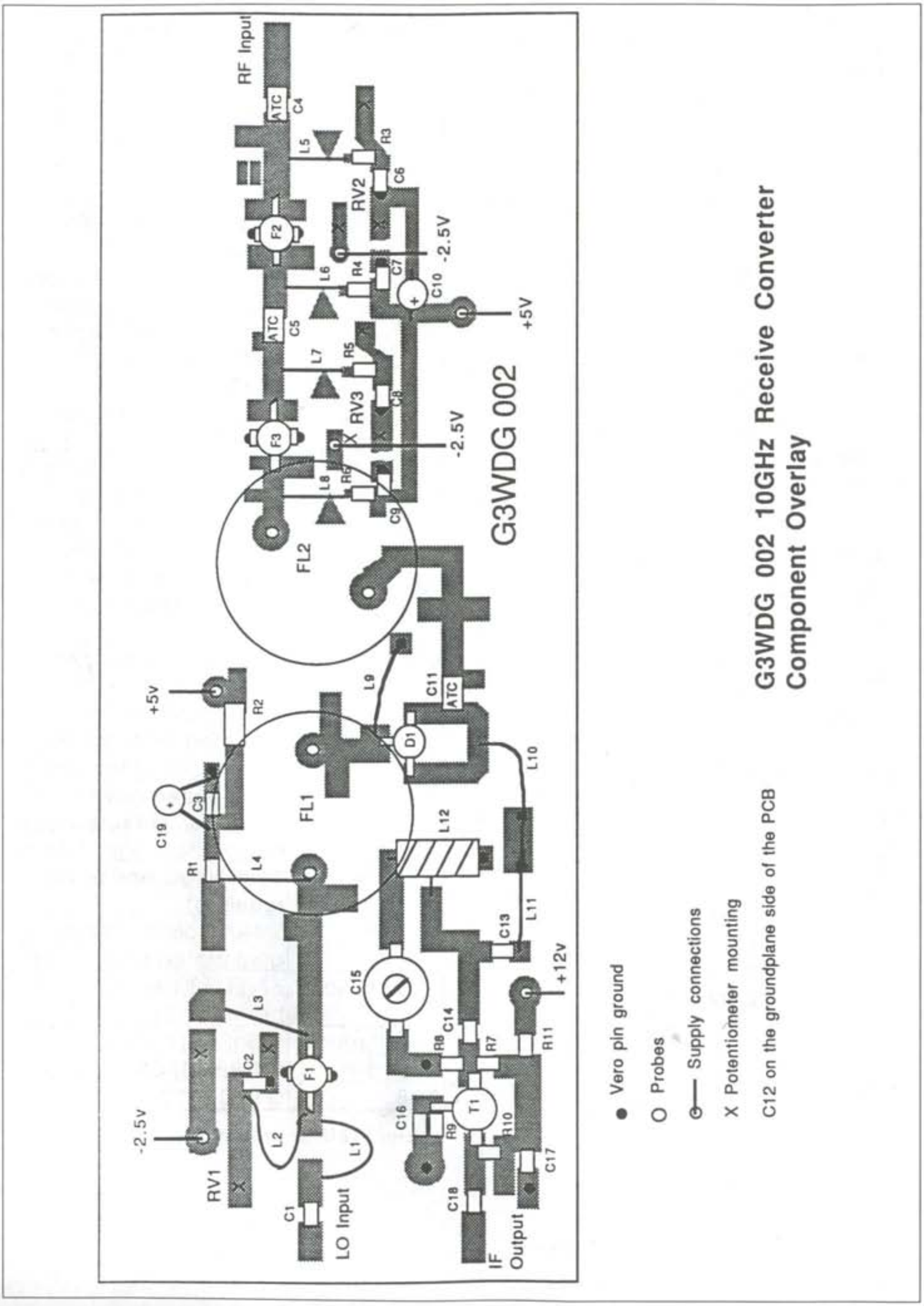
14. Remove the test meter and make good the connection.
15. Final alignment can be done with a noise figure meter if available, or a weak signal. Adjust RV1, 2 and 3, FL1 and 2, and C15 for best results. After alignment the converter should have a noise figure of 2.5 to 3.5dB and a conversion gain of 27-30dB.
16. Check that the performance is not degraded when the RF lid is in position. If signs of instability are present, the piece of lossy rubber supplied with the kit should be glued to the inside of the RF lid, above the low noise amplifier section. This material is very effective at curing box-induced oscillations, and is the kind of material fitted to LNBs for the same purpose!

Parts List G3WDG002

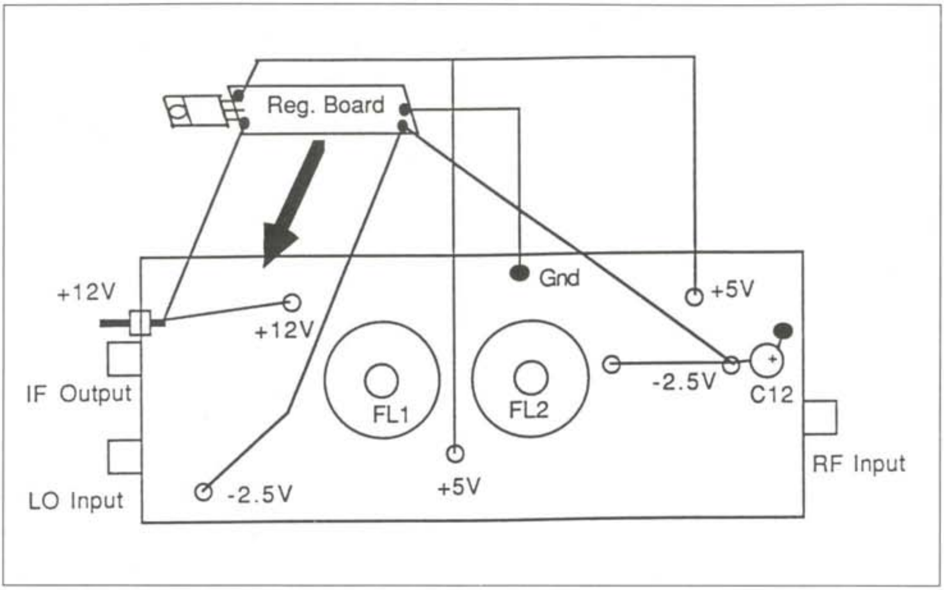
Part-No.	Item
F1, F3	Birkett 'Black Spot'
F2	Birkett 'Red Spot'
D1	**DMF3909-99 Series Diode Pair**
T1	BFR90/91
C1-3,C6-9	**180pF 0805**
C13,14,16-19	**10nF 0805**
C4,5,11	100uF Tantalum
C12	22-47uF Tantalum
C10,19	2.2-10uF Tantalum
C15	30pF Trimmer
R1,3,4,5,6	**47R 0805**
R2	220R Wire Ended 0.5W
R7	**15k 0805**
R8	**4k7 0805**
R9	**220R 0805**
R10	**100R 0805**
R11	**470R 0805**
RV1-3	2k2 horizontal skeleton carbon preset (Philips OCP10H)
L1	16mm length 0.3mm ecw, tinned 1mm ends, formed into loop, mounted flat on board
L2	19.5mm length as L2
L3	Straight length 0.3mm ecw, tinned 1mm ends, mounted flat on board. The wire should be soldered to the edge of the stub and as close as possible to the drain of F1
L4	Straight length 0.3mm ecw, tinned 1mm ends, mounted flat on board
L5-9	Straight length **0.2mm silver plated wire (CuAg)**, tinned 1mm ends, mounted flat on board
L10,11	Combinded total length of 0.2mm silver plated wire mounted flat omn board as shown in figure. Solder at both ends of central stub section
L12	4turns 0.6mm copper wire, 5mm I.D., turns spaced 0.3mm, mounted 1mm above board, center tapped
FL1,2	**Silver plated cavity resonator, M4 screw and nut**, probe length 4.7mm
Veropins	**1mm single ended (33 required)**
Sockets	SMA 2-hole or 4-hole, gold plated (3 required)
Tinplate Box	37x111x30mm (Schuberth Size 3)
Feedthrough	100pF not critical
Bias Parts	**G4FRE023PCB** and parts
PCB	**G3WDG002 Issue B**

*** Items in kit are in bold face!**

Bild/Figure 9: Parts Layout of G3WDG002



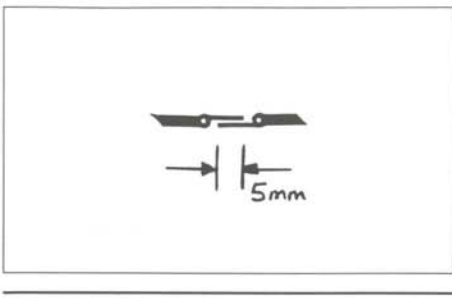
Bild/Figure 10: Wiring Arrangement for G3WDG002



2. G3WDG002 10GHz - 144MHz Empfangs-Konverter

Das Schaltbild des G3WDG002 Empfangskonverters ist in Bild 8 zu sehen. Die Teileanordnung folgt aus Bild 9 und die Verdrahtung auf der Platinenrückseite aus Bild 10. Das Eingangssignal auf 2556MHz wird vom Vervierfacher F1 auf das Filter FL1 geführt. Das ausgesiebte Signal auf 10224MHz steuert den Mixer mit dem Diodenpaar D1. Die Seriendioden sind mit einer gefalteten $^3/_4\lambda$-Leitung verbunden, die für eine gute Isolation zwischen LO- und HF-Port sorgt. L9 ist eine kurzgeschlossenen $\lambda/_4$-Leitung, die als eine niederohmige ZF-Rückführung wirkt und auf der Betriebsfrequenz als Parallelkreis wirkt. Der Mischverlust dieser Anordnung beträgt nur 6...7dB inklusive der Anpaßnetzwerke.

Bild/Figure 11: DC Block



Ein zweistufiger Vorverstärker mit ca. 20dB Verstärkung und 2dB Rauschzahl ergibt eine Gesamtrauschzahl des Konverters von ca. 2,5dB, wenn in der Eingangsstufe ein 'Red Dot' FET verwendet wird. Der Ausgang des Vorverstärkers gelangt über das Spiegelfrequenzfilter FL2 und den Hochpass C11 auf den Mischer. Die Spiegelfrequenzunterdrückung ist bei 144MHz ZF ca. 25dB. Der ZF-Ausgang des Mischers gelangt über einen Tiefpaß (L10, Viertelwellenleitung und L11) an den rauscharmen ZF-Verstärker mit einem BFR90.

Abgleich

1. Man überbrückt zwecks Abstimmung das Filter FL2 mit Hilfe der Anordnung in Bild 11. Die beiden Parallel-Leitungen werden durch 0,3mm dicke Leitungen gebildet, die einen Drahtdurchmeser voneinander entfernt liegen. FL1 und FL2 werden vorabgestimmt, indem man die Schrauben soweit eindreht, daß ca. 7,5mm Länge des Gewindes außen zu sehen ist.

2. RV1-3 werden auf maximale negative Spannung eingestellt.
3. Strommeßgerät zwischen +Anschluß und 5V Netzgerät schalten.
4. 50Ω-Abschluß am Eingang aufstecken.
5. Gleichspannung anlegen. Dann darf nur ein Strom von wenigen µA fließen. Andernfalls gibt es Kurzschlüsse oder Fehlbestückungen.
6. RV1 auf Gesamtstrom von 1mA einstellen.
7. Nach Anlegen des 2556MHz LO-Signals (mindestens 5mW) muß der Strom auf ca. 5...15mA steigen
8. Nach Anschluß eines 144MHz SSB-Empfängers wird C15 auf maximales Rauschen abgeglichen.
9. RV2 und RV3 werden auf 0V Gate-Vorspannung eingestellt.
10. Fl 1 wird auf maximales Rauschen abgeglichen und dann RV1 ebenfalls optimiert.
11. Netzgerät ausschalten, den HF-Kurzschluß von FL2 (Bild 11) entfernen und FL2 auf Rauschmaximum abgleichen. Es gibt zwei Maxima ca. 0,4 Drehungen der Abstimmschraube entfernt. Die korrekte Abstimmung liegt vor, wenn die Schraube weiter herausgedreht ist.
12. RV2 und 3 werden wieder auf volle negative Vorspannung zurückgedreht und dann RV2 soweit auf, bis der Gesamtstrom um ca. 12mA steigt und RV3 soweit auf, bis der Gesamtstrom um weitere 15mA ansteigt.
13. Steht eine Signalquelle zur Verfügung, kann verifiziert werden, ob man diese im RX hört. Andernfalls ist FL2 auf der Spiegelfrequenz abgestimmt.
14. Das Meßgerät wird entfernt und die Verbindung zu +5V hergestellt.
15. Ein Feinabgleich kann mit Hilfe eines Rauschzahlmeßgeräts oder einer Bake erfolgen. RV1 und 3, FL1 und FL2, sowie C15 werden auf bestes Signal abgeglichen. Man kann eine Rauschzahl von 2,5...3,5dB und eine Verstärkung von 27...30dB erwarten.
16. Nach Aufsetzen des Deckels dürfen sich keine Änderung der Leistung oder Instabilitäten ergeben.. Andernfalls wird **verlustbehaftes Gummi (Mikrowellenabsorber)**, das mit dem Kit mitgeliefert wird, in den Deckel eingeklebt. Das gleiche Material wird auch für kommerzielle LNB's verwendet und ist weit besser, als das bei Amateuren sonst gebräuchliche, antistatische Schaummaterial.

3. G3WDG003 144MHz - 10GHz Transmit converter

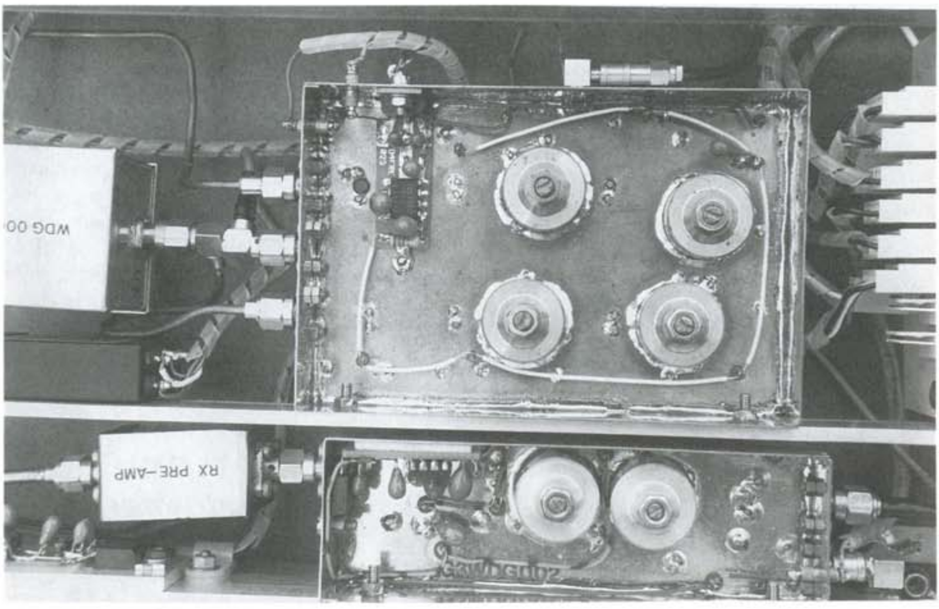
The circuit diagram of the G3WDG003 transmit converter is shown in Fig. 14. Referring to Fig. 14, the 2556MHz LO signal is fed to a MMIC amplifier IC1, which provides about 5.5dB gain. The output of this goes into a printed Wilkinson divider, which splits the signal into two well - isolated paths. One output is connected to J2, which is intended to provide the LO signal for a G3WDG 002 receive converter. The gain from J1 to J2 is about 2.0dB, allowing proper operation of the unit with LO powers in the range 5-10mW. The good input VSWR of the MMIC amplifier guarantees a good load for the G4DDK004 local oscillator, and removes any "resonant cable" effects. The other output from the Wilkinson is fed to the x4 multiplier stage, identical in design to that used in the G3WDG001 and 002 units. The filtered 10224 MHz from FL1 is fed to the gate of F2 together with the 144MHz signal from J3 (about 1mW level). F2 acts as an upconverter, and is provided with both variable gate bias (VR2) and drain bias (VR3) to optimise conversion efficiency. The output from F2 contains three main signals, the LO at 10224MHz, the wanted signal at 10368MHz and the image product at 10080MHz. FL2 selects the wanted output. The remaining circuitry is a four stage amplifier containing further bandpass filtering (FL3, 4) to clean up the output signal. The value of the drain bias resistor is optional (47R or 10R). The use of 10R here may increase the power output by a small amount, but should only be used if a well-matched load can be guaranteed.

An artists impression of the board layout is given in Fig. 15. Note that C12 is not shown, as it is mounted on the reverse side of the board, as shown in Fig. 16.

Alignment

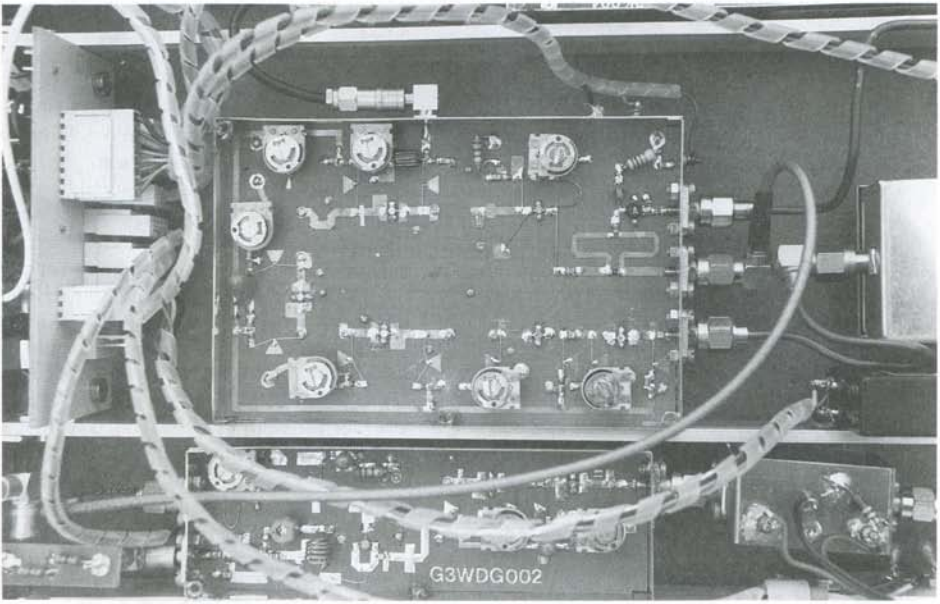
The unit is capable of being aligned without laboratory test equipment if the following sequence is adopted. The basic method is to align the multiplier using the drain current of the mixer FET F2 as a tuning indicator. Filters F3 and 4 are then RF short circuited by home-made single section coupled line sections allowing the mixer bias and FL2 to be tuned up. The RF shorting sections are then in turn removed from FL3 and then FL4 allowing each filter to be tuned up separately.

1. Connect a 50 ohm load to J2 and a 10GHz power indicator to J4 (eg. SMA - waveguide transition and diode detector). Set all gate bias preset resistors to give full negative gate bias to all stages when power is applied.
2. Temporarily connect a voltmeter across R4 and set VR1 so that 1mA drain current flows (0.22V across R4). Apply 2.5GHz drive to J1 (at least 5mW) and drain current should increase to approximately 10mA (2.2V across R4). Remove DC power and RF drive.
3. Transfer voltmeter to be across R6, and preset VR3 to minimum resistance (fully clockwise). Reconnect DC but not RF power and set RV2 to give 1mA drain current through F2 (.05V across R6). Reconnect RF drive to J1 and adjust FL1 for maximum volts across R6. Refer to aligment stage #9 for G3WDG001 above for correct method of adjusting the filter. Follow this by adjusting VR1 for maximum volts across R6. Remove RF and DC power and remove meter connections to R6. Set VR3 to about 0.75 maximum resistance (a quarter turn clockwise from fully anticlockwise position). Do not touch the setting of VR2.
4. Connect bridges across FL3 and 4 as shown in Fig. 002/4 and described in the alignment of this module. Reconnect DC power and RF drive to J1 and apply about 1mW of drive at 144MHz to J3. Next, by monitoring the DC current drawn from the 12V supply by the whole unit, adjust VR4-7 so that each causes the current to rise by about 5mA (this sets up approximately 5mA drain current in each of the four amplifier FETs). Monitor the RF output from J4 in the 10GHz power indicator and carefully adjust FL2. Three peaks should be found, with about 0.2 turns between each. The centre peak will be the strongest (10224MHz). The correct peak (10368MHz) is with the screw furthest out (smaller penetration).
5. Next optimise VR2 and 3 for maximum 10368MHz. The adjustments interact to some extent, so it is necessary to iterate until the best position for both is found. VR3 should be somewhere fairly close to where it was set in



Bild/Figure 12: G3WDG003 (Top View)

Bild/Figure 13: G3WDG003 (Bottom View)



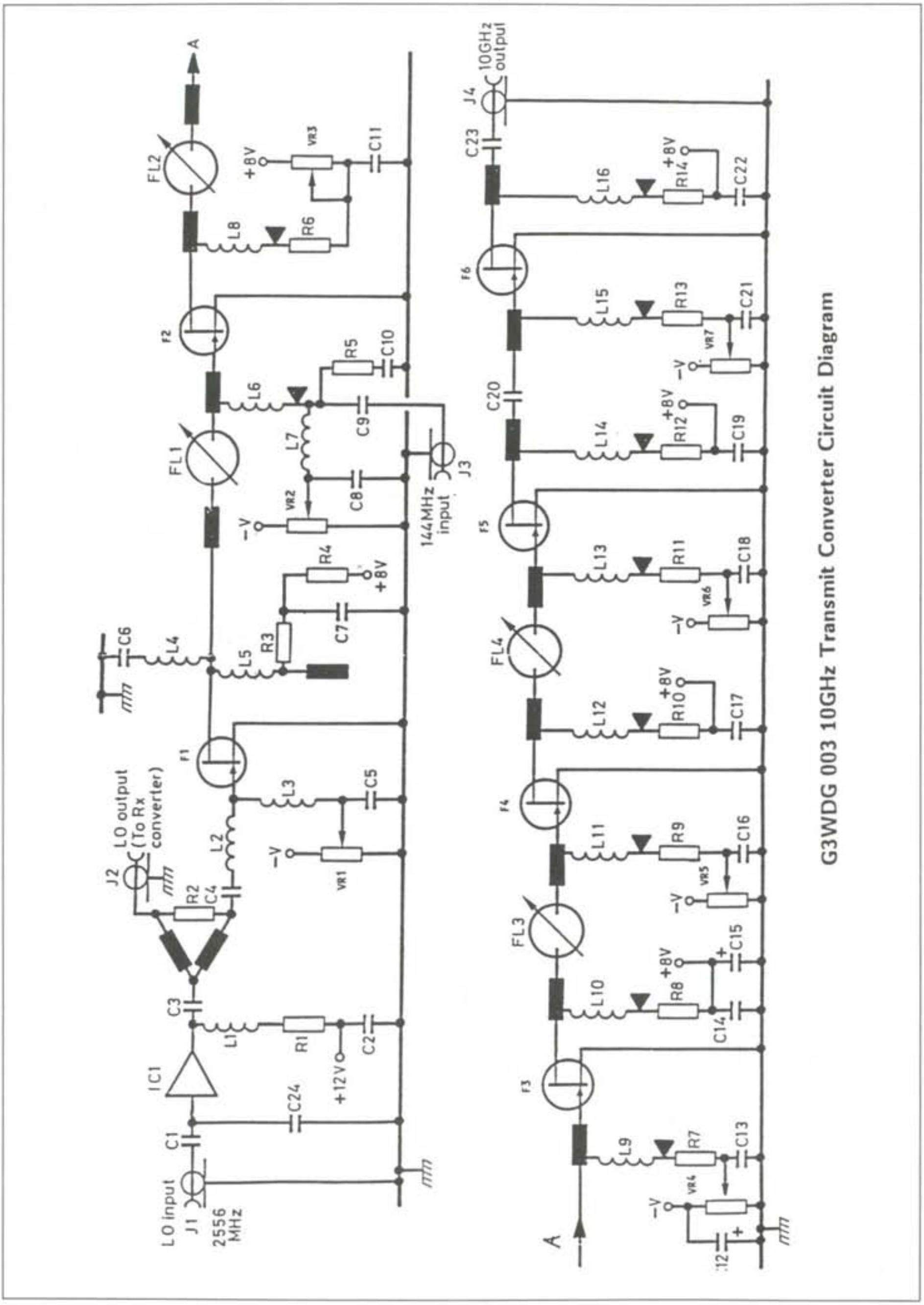
step 3 above. If is too far clockwise, it is possible for the mixer to oscillate.

6. Remove DC power and unsolder the bridging wires across FL3. Power on again and tune FL3 for maximum power.
7. Repeat last step for FL4.
8. Reset bias on F3-6 to about 20mA each.
9. Go around all adjustments again for maximum power at 10368MHz at J4. It is possible that the unit will be driven into compression with 1mW of 144MHz, and adjustments may be easier witrh a lower drive power. Finally experiment with bias settings with VR4-7 for best power output. Do not be concerned if some stages are run with close to zero gate bias. This is quite safe for the devices specified! Most units produce over 50mW after correct alignment. Typical performance is shown in Figs. 17 and 18. In case power output is low, it is permissible to try tuning the microstrip lines as described above for the G3WDG001. Areas to try first are the lines around F6 and between F2 and 3.
10. Check the power output from J2. Typically this is 1.5 to 2dB higher that the level applied to J1 (up to 10mW input to J1).
11. The performance of the unit should be checked with the top lid in position. Rarely will this cause any instability, the only effect being a small increase in the levels of the 10080 and 10224MHz signals. A typical output spectrum is shown in Fig. 18. In case of instability, reducing the gain of the amplfier section may help (try adjusting VR5 first). A very effective cure for instability should it occur is a piece of lossy rubber glued to the centre of the box lid. Suitable material is available from the Microwave Committee Components Service at the address shown at the beginning of this article. It should be noted that the black foam used to package ICs is far less effective in curing box mode oscillation (contrary to what you may have read elsewhere!).

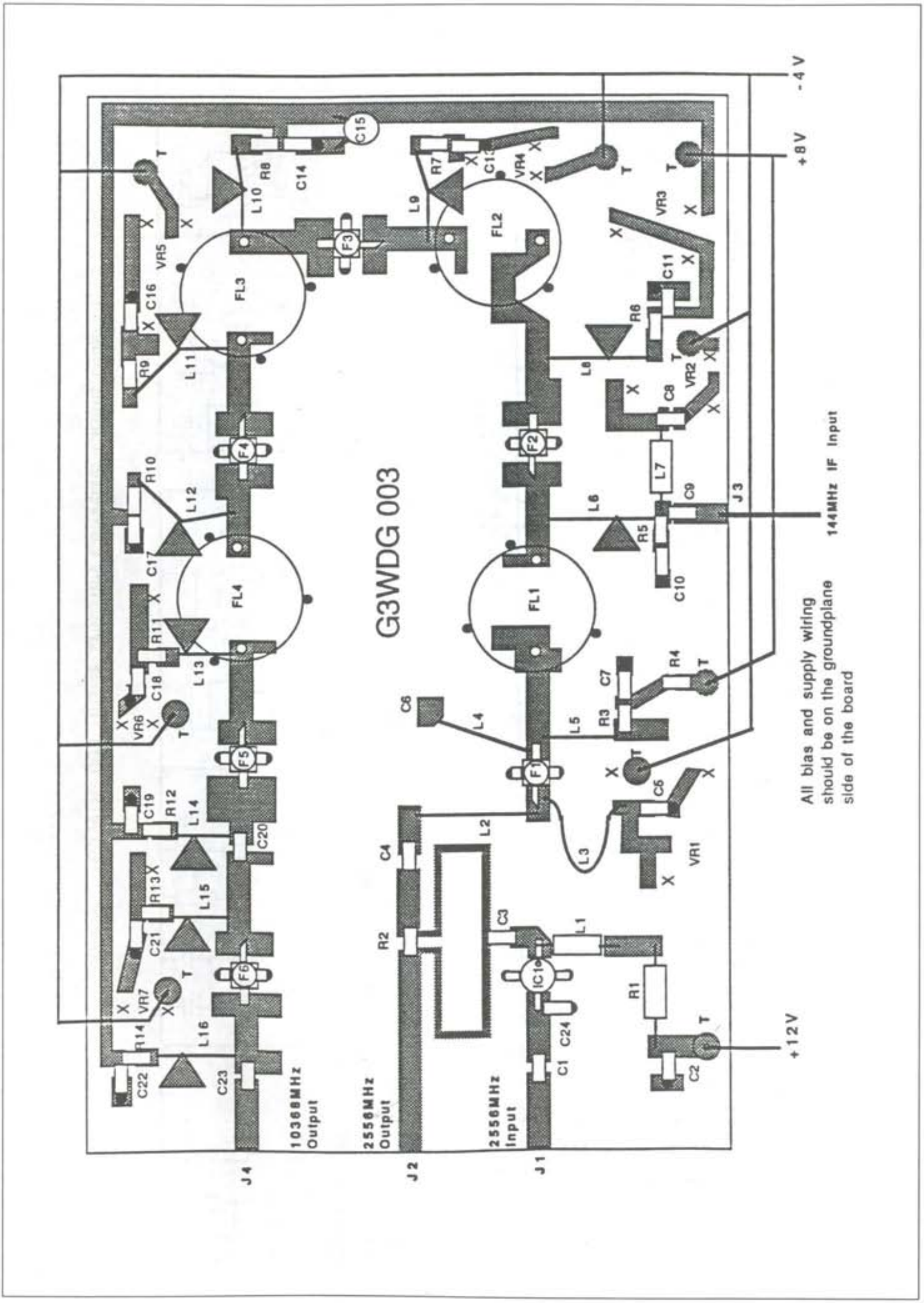
3. G3WDG003 144MHz - 10GHz Sendeumsetzer

Das Schaltbild des G3WDG003 Sendeumsetzters ist in Bild 14 zu sehen. Die Teileanordnung folgt aus Bild 15 und die Verdrahtung auf der Platinenrückseite aus Bild 16. Das Eingangssignal auf 2556MHz wird von IC1 um ca. 6dB verstärkt und

Bild/Figure 14: Circuit Diagram of G3WDG003



Bild/Figure 15: Parts Layout of G3WDG003



Parts List G3WDG003

Part-No.	Item
IC1	MAV11 (MSA1104)
F1-F6	Birkett "Black spot"
C1-5, 7, 11, 13, 14, 16-19	**180pF 0805 chip**
C6	**printed on PCB**
C8,9	**10nF 0805 chip**
C10	**22pF 0805 chip**
C12,15	10uF Tantalum bead
C20,23	**2.2pF ATC 100 type**
C24	**1pF 0805 chip**
R1	100R wire ended 0.5W
R2	**100R 0805 chip**
R3, 5-13	**47R 0805 chip**
R4	220R 1206 chip or wire ended
R14	**47R or 10R 0805 chip** (see text)
VR1,2, 4-7	10k horizontal skeleton carbon preset (Philips OCP10H)
VR3	2k2, type as above
L1	6t **0.3mm enamelled copper wire (ecw)** close wound 2mm internal diameter, lead length 2mm mounted 1mm above board
L2	16mm length 0.3mm ecw tinned 1mm each end formed into loop and mounted flat on board
L3	19.5mm length as L2
L4,5	Straight length of 0.3mm ecw tinned 1mm each end, mounted flat on board
L6,8-16	Straight length **0.2mm silver plated wire** mounted flat on board
L7	4.5 turns of 0.3mm ecw on FX1115 ferrite bead, or 10uH wire ended choke

Parts List G3WDG003

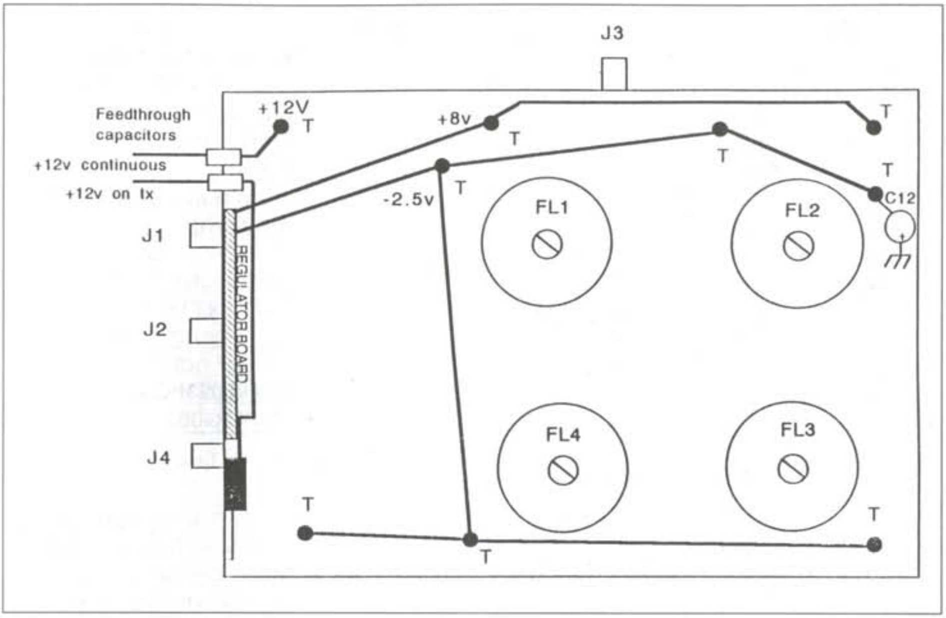
Part-No.	Item
FI1-FI4	**Silver plated cavity resonator, M4 screw and nut (probe length 4.7mm for FL1 and 3.4mm for FL2-4)**
Veropins	**1mm single ended (25 required)**
Sockets	SMA 2-hole or 4-hole, gold plated (4 required)
Tinplate Box	74x111x30mm (Schuberth Size 6)
Feedthrough	1000pF not critical
Bias Parts	**G4FRE023PCB** and parts
PCB	**G3WDG003**

*** Items in kit are in bold face!**

auf einen Wilkinson 3dB-Teiler geführt. C24 sorgt für gutes Eingangs-VSWR an J1. Damit sind resonante Effekte, wie sie im Zusammenhang mit Zusammenschaltkabeln auftreten, nicht zu erwarten und der G4DDK001 LO sieht eine 'gute' Last. Ein Ausgang des Wilkinson 3dB-Teilers geht an J2, wo die LO-Leistung für den Empfangskonverter 002 entnommen wird. Der andere Ausgang steuert über L1 den Vervierfacher F1 an. Der Ausgang von F1 geht auf das Filter FL1. Das ausgesiebte Signal auf 10224MHz steuert den Mixer mit dem FET F2, dem am Gate zusätzlich das 144MHz zugeführt wird. VR2 und VR3 gestatten die Optimierung der Mischverstärkung. Das Nutzsignal von 10368 MHz am Ausgang von F2 wird durch FL1 ausgesiebt und gelangt auf einen vierstufugen, selektiven Verstärker mit F3, 4, 5 und F6 sowie den Filtern FL3 und FL4. Drei Filter im Signalweg sorgen für ein nebenwellenarmes Ausgangssignal Bild 17). Außerdem ist genug Verstärkung vorhanden, um eine Ausgangsleistung von mehr als 50mW bei 1dB Kompression (Bild 18) ohne 'Quälen' des Mischers zu erreichen.

Will man die mögliche Ausgangsleistung 'auskitzeln', kann man die Drainwiderstände von 47Ω auf 10Ω erniedrigen. Das ist aber nur bei gutem Last-VSWR empfehlenswert. Das Layout der Teile ist in Bild 15 zu erkennen. C12 ist auf der Rückseite montiert (Siehe Bild 16).

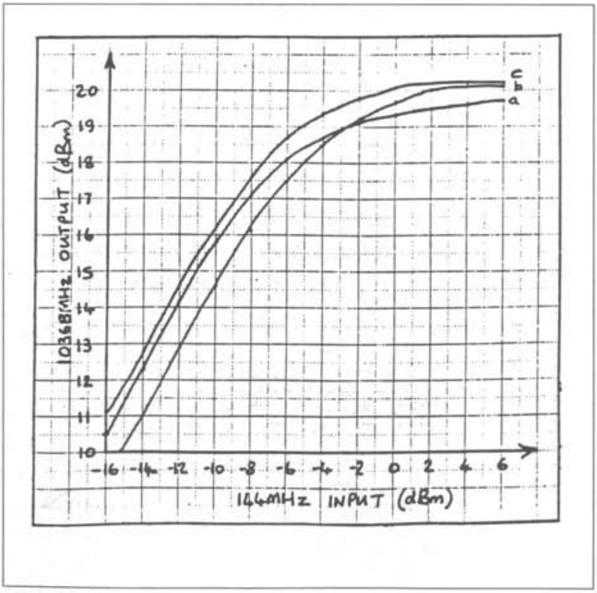
Bild/Figure 16: Wiring Arrangement for G3WDG003



Abgleich:

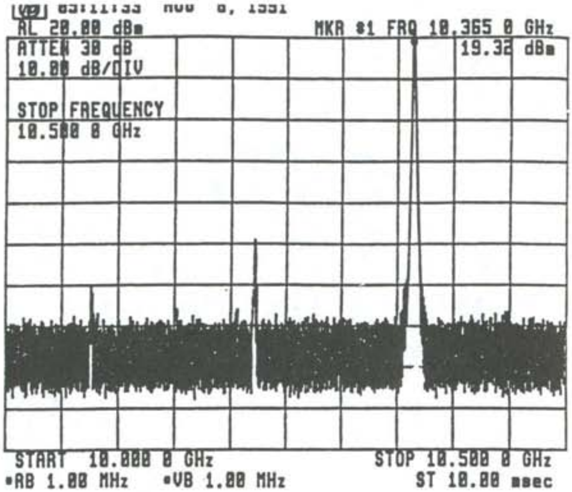
Man kann den Sendeumsetzer ohne professionelle Meßgeräte abgleichen. Der Vervierfacher wird mit dem Mischerstrom als Indikator abgeglichen. Man überbrückt die Filter FL3 und FL4, damit man FL2 abgleichen kann. Dann wird sukkzessive der Kurzschluß von FL3 und FL4 entfernt und nacheinander abgeglichen.

1. An J2 ein 50Ω-Abschluß anschließen und an J4 einen 10GHZ Leistungsmesser. Alle Bias-Potis werden auf maximale negative Vorspannung eingestellt.
2. Ein Voltmeter über R4 anschließen und mit VR1 einen Drainstrom von 1mA einstellen. 5mW LO-Leistung auf J1 geben. Der Strom in F1 muß auf ca. 10mA steigen (2.2V an R4). Dann Betriebsspannung und LO-Signal entfernen.
3. Voltmeter über R6 anlegen, und VR3 auf Minimalwiderstand

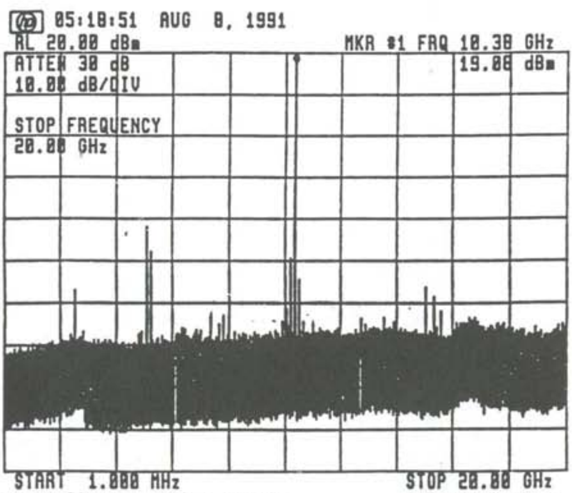


Bild/Figure 17: Output Power @ Input Power (G3WDG003)

Bild/Figure 18: Output Spectra of G3WDG003

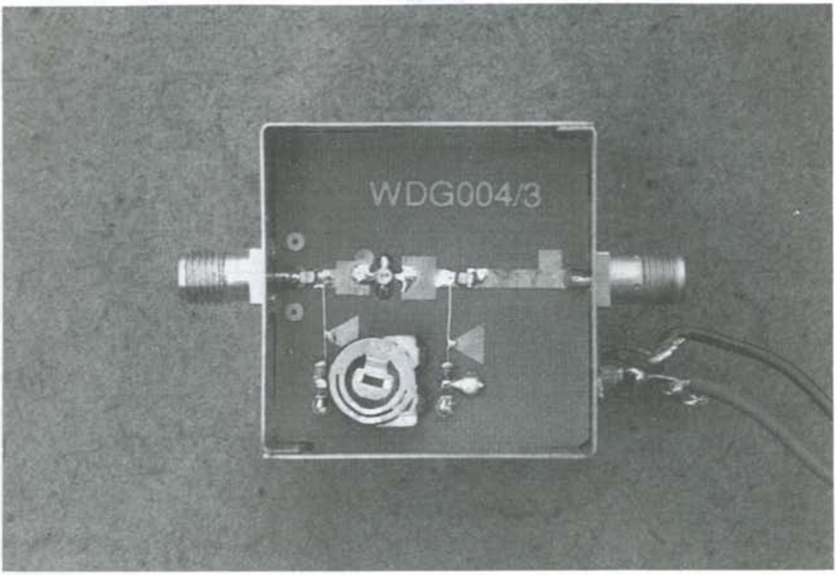


Output spectrum of G3WDG003 from 10-10.5GHz showing wanted signal at 10368MHz, LO at 10224MHz and image at 10080MHz



(b) wideband output spectrum of G3WDG003 from 1MHz to 20GHz

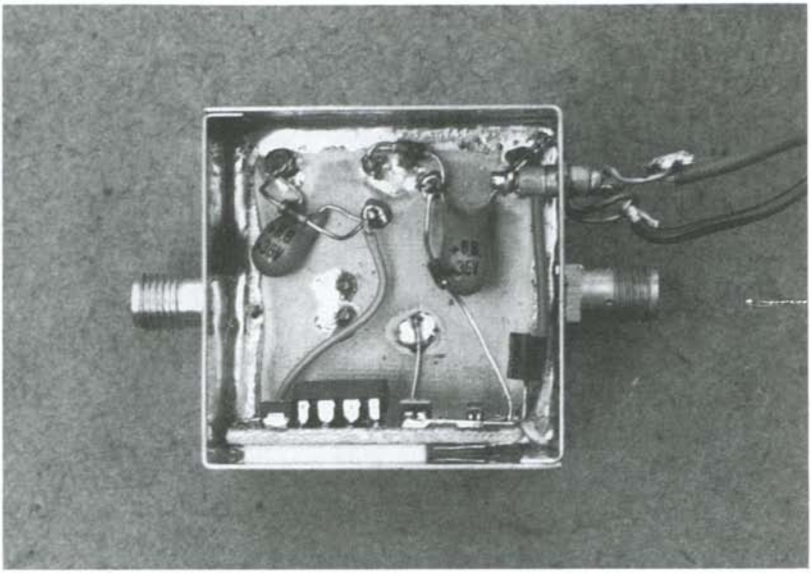
Bild/Figure 19: G3WDG004 (Bottom View)



(CW=im Uhrzeigersinn) eindrehen. Betriebsspannung anlegen und RV2 auf 1mA Drainstrom von F2 einstellen (50mV an R6). Dannn LO wider an J1 anschließen und FL1 für maximalen Spannungsabfall an R6 abgleichen. Dann VR1 auf maximalen Spannungsabfall an R6 abgleichen. Dann Betriebsspannung und LO-Signal entfernen und VR3 auf 75% (1/4 Rechtsdrehung von der CCW-Position=Gegen-Uhrzeigersinn) einstellen.

4. HF-Brücken wie in Bild 11 gezeigt über FL3 und FL4 legen. Betriebsspannung und LO wieder anschließen und an J3 ein 144MHZ Signal mit 1mW Leistung anlegen. Dann stellt man die Stöme in F3, F4, F5 und F6 mittels VR4-7 so ein, daß unter Beachtung der Gesamtstromaufnahme jedes Poti sukkzessive auf einen Stromanstieg von 5mA eingestellt wird. Leistung an J4 messen und FL2 abgleichen. Man kann drei Abstimmstellungen finden, die sich jeweils um ca. 0,2 Drehungen der Abstimmschraube unterscheiden. Die zentrale ergibt die amximale Leistung und entspricht der Abstimmung auf den LO von 10224MHz. Die richtige (10368MHz) wird bei der kleineren Eindringtiefe der Abstimmschraube erreicht.
5. VR2 und VR3 werden nun wechselseitig auf maximale Ausgangsleistung optimiert. VR3 sollte ungefähr auf dem Anfangswert liegen, andernfalls kann der Mischer schwingen.
6. Betriebsspannung und HF-Brücke über FL3 entfernen. Betriebsspannung wieder anschließen und FL3 auf maximale Ausgangsleistung optimieren.
7. Schritt 6. für FL4 wiederholen.
8. Strom in F3-F6 auf nunmehr 20mA statt 5mA einstellen.
9. Alle Einstellungen für maximale Ausgangsleistung optimieren. Die Leistung am 144MHz gegebenfalls verringern, da schon Kompression vorliegen kann. Es ist normal, wenn einige Stufen nahezu mit 0V Gatevorspannung laufen. Es sollten mindesten 50mW Ausgangsleistung erreicht werden.
10. Ausgangsleistung an J2 prüfen. Sie sollte ca. 1,5 bis 2dB höher als an J1 sein.
11. Deckel aufsetzen und Leistung überprüfen. Ein typisches Ausgangsspektrum ist in Bild 18 und die Kompressionskurve ist in Bild 17 zu sehen. Falls Instabilität auftritt, Verstärkung

Bild/Figure 20: G3WDG004 (Top View)



mittels VR5 reduzieren oder **verlustbehaftes Gummi** (**Mikrowellenabsorber**), das mit dem Kit mitgeliefert wird, in den Deckel einkleben. Das gleiche Material wird auch für kommerzielle LNB's verwendet und ist weit besser, als das bei Amateuren sonst gebräuchliche, antistatische Schaummaterial.

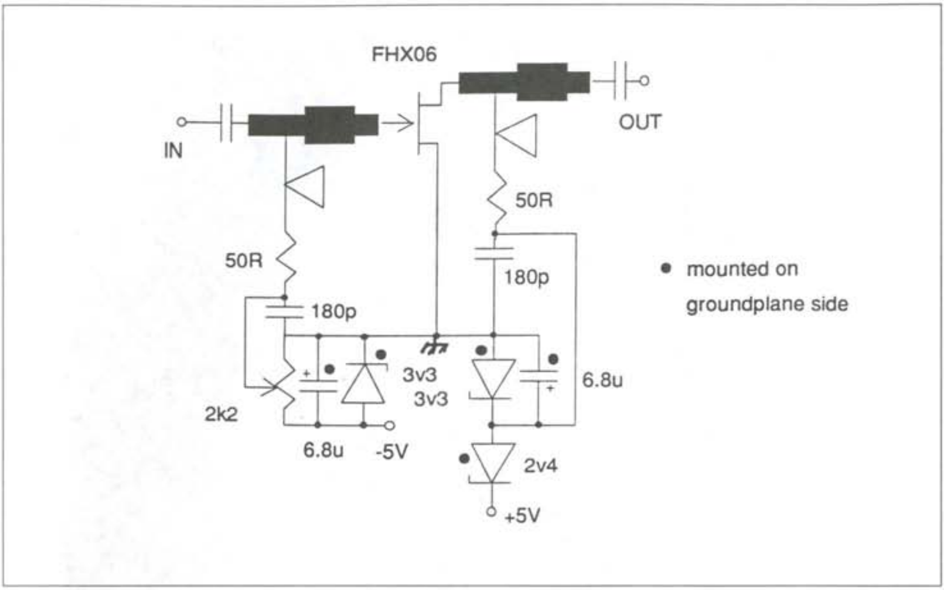
4. G3WDG004 10GHz HEMT Preamplifier

The G3WDG004 preamplifier is a state-of-the-art ultra low noise preamplifier intended for high-performance applications. At the time of writing (Oct 1993) versions of this preamp are in use by a number of 10GHz EME stations (G3WDG/G4KGC, WA7CJO, WA5VJB and G0API) as well as many stations for tropo use. It uses a well-proven, reliable, FHX06LG HEMT device from Fujitsu to achieve a very low noise figure and high associated gain. The FHX06 is a low cost selection of the FHX04/05/06 series of HEMTs. When fittimg a FHX04 the noise figure can be lowered by another 0.2dB without any change in circuitry. This may be an interesting feature for EME-applications.

The preamplifier is normally built with SMA input and output, as with all the other G3WDG 10GHz modules, but has been constructed with WG16 (WR90) input. The waveguide version has not been beta tested and is therefore considered experimental, but may be of interest to experienced constructors with plenty of time looking for perhaps a 0.1dB lower noise figure in waveguide systems where the loss of one transition is eliminated. The kit of components is applicable to either version.

The circuit diagram of the G3WDG004 is given in Fig. 21. The device is operated in grounded source, and the pcb supplied in the kit already has the source grounding pins fitted. These are recessed into the pcb to ensure minimum reproducible source inductance. Microstrip circuits provide the correct noise match on the input and a low VSWR on the output. A considerable amount on development work was necessary to get the lowest possible noise figure. The usual ATC capacitors are used as low-loss DC blocks, even on the wave-guide input version. If building this version, do not be tempted

Bild/Figure 21: Circuit Diagram for G3WDG004



to replace the input ATC with a bridge, as the capacitor's impedance transformation characteristics are built into the design!

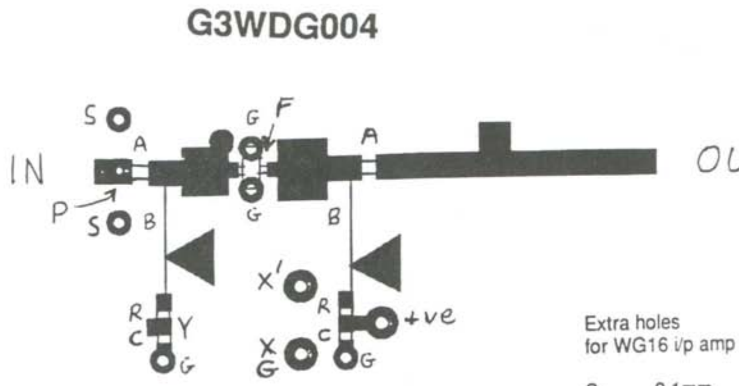
The layout of the board is shown in Fig 22. Note that some of the components are mounted on the groundplane side, together with the dc inverter/regulator pcb. In the kit for this module, all the regulator components are supplied.

Alignment

Tuning up the amplifier is straightforward, the only adjustment required is to set the drain current to 10mA with VR1. This can be done by monitoring the supply current to the complete amplifier, and first setting VR1 for minimum current (about 1-2mA) and then setting it for a 10mA increase. This method is recommended instead of trying to measure current in-situ to avoid possible damage to the HEMT from static or soldering iron leakage. Special precautions will be outlined in Part 3 of this series (Construction) to avoid damaging the device during construction. The Microwave Committee Components Service cannot undertake to replace damaged devices free of charge! It should be said that out of some 50 kits sold to date, no problems with device damage have been reported (other than blowing them up with 300W of RF!). If noise figure measuring equipment is available, try optimising VR1 for lowest noise figure. The performance of the amplfier as-built should be NF 1dB and gain 12dB. For the waveguide input version, try adjusting the matching screws for lower noise figure (unlikely, if the transition has been built carefully as specified). The last point concerns the need for lossy rubber in the lid. A small piece of lossy rubber is supplied with the kit. This is intended to be glued centrally on the inside of the RF lid of the box. Some amplifiers do not need it, whereas others have shown some benefit from having it fitted. If no test equipment is available to see if the lid has any adverse affect on performance, it is recommended that the rubber should be fitted.

HEMTs are perhaps more sensitive than "normal" GaAs FETs to damage from high RF input levels (this is a matter of debate). The FHX06 device should be quite happy with at least 1-10mW RF input, but watts of power would probably damage the device. Antenna changeover relays with poor leakage could cause trouble if high power is used, and if the relay or switch has built-in indicators to show when it has changed over, these should be built-in to the T/R switching circuitry as interlocks to prevent the transmitter coming on until the relay

Bild/Figure 22: Parts Layout for G3WDG004



Layout of G3WDG004 preamp

Key to components

A	2.2pF ATC (mounted with lettering on top)
B	bias wire, mounted flat to the board, soldered to tip of triangular element
C	180pF chip cap
F	HEMT (cut lead is gate)
G	grounding veropin
R	47R chip res
X,Y	position of connections to bias pot (X' is -ve input)

is ready. Users of high power TWTs take special care, please! It should be noted that many of the small SMA relays available on the surplus market can be damaged with more than a few watts of power, which might also put the HEMT at risk.

4. G3WDG004 10GHz HEMT Vorverstärker

Der G3WDG004 Vorverstärker repräsentiert den Stand der Technik. Zur Zeit sind Verstärker diesen Typs bei einigen 10GHz EME-Stationen (G3WDG/ G4KGC, WA7CJO, WA5VJB und G0API) sowie bei vielen Tropo-Stationen im Einsatz. Er benutzt den bewährten HEMT FHX06LG von Fujitsu und wird normalerweise in Koax-Technik gebaut (SMA-Buchsen). Es gibt aber auch eine experimentelle Hohlleiter-Version mit WR90 Eingang. Die Platine ist dafür vorgesehen. Man kann dann vielleicht eine nochmals 0,1dB niedrigere Rauschzahl erreichen.

Das Schaltbild ist in Bild 21 zu sehen. Der FET arbeitet in Source-Schaltung. Die Platine im Kit ist bereits mit den Erdungsstiften an den Sorcen ausgerüstet. Einige Entwicklungsarbeit war nötig, um die Anpaßnetzwerke für die kleinste Rauschzahl zu optimieren. Deswegen werden auch nur ATC-Chips als Koppelkondensatoren eingesetzt. Diese sind mit ihrer Serieninduktivität Bestandteil der Anpaßnetzwerke und dürfen auch bei der Hohlleiter-Version nicht entfernt werden.

Das Layout der Teile ist in Bild 22 zu sehen. Beachten Sie, daß einige Teile wie z.B. die Spannungsversorgung auf der Masseseite der Platine montiert werden.

Abgleich:

Man braucht nur VR1 auf 10mA Strom einstellen. Das war's dan. Beim Einlöten des HEMT's ist äußerste Vorsicht angebracht, da sie gegen Statik erheblich empfindlicher als normale FET's sind. Beim Messen nicht mit den Tastspitzen auf die Platine gehen.

Hat man einen Rauschmeßplatz, kann man VR1 für geringste Rauschzahl optimieren. Die Rauschzahl beträgt typisch 1dB bei 12dB Verstärkung. Der HEMT FHX06 kommt aus der Serie FHX04/05/06, die identische mechanische und elektrische Daten haben. Der FHX06 ist innerhalb dieser Serie die Selektion mit der schlechtesten Rauschzahl und natürlich dem niedrigsten Preis. In die gleiche Platine ist daher auch ohne Änderung der FHX04LG, der die beste Rauschzahl hat, einsetzbar. Dann sinkt die Rauschzahl auf unter 0,8dB, was allerdings nur Sinn für EME-Stationen macht.

Mit dem Kit wird ein Stück verlustbehaftes Gummi (Mikrowellenabsorber) mitgeliefert. Das kann man in die Mitte des Deckels kleben. Einige Exemplare brauchen es, andere wieder nicht. Das sollte man ausprobieren. Im Zweifel sollte man es einkleben.

HEMT's sind empfindlicher gegen hohe HF-Leistung als normale FET's. Der FHX06/04 kann etwa 1...10mW aushalten. Daher muß man gute Koax-Relais oder Hohlleiterschalter verwenden. Speziell beim Einsatz von Hochleistungs-TWT's gilt Vorsicht, denn die meisten SMA-Relais halten nur wenige W aus. In jedem Fall muß man für geeignete Verzögerungsschaltungen sorgen, die nicht nur den HEMT schützen sondern auch das TWT.

Parts List G3WD004

Item	Qty
G3WDG004 pcb	1
G4FRE023A psu pcb	1
ATC 2.2pF chip	2
Veropins	6
HEMT device FHX06LG	1
2k2 preset	1
2k2 1206 chip	1
47R chip	2
180pF chip	2
1uF chip	2
10uF chip	1
22uF chip	2
7660	1
78L05	1
0.2mm wire for bias lines silver loaded solder	1
6.8uF wire ended tantalum	2
3.3V zener	2
2.4V zener	1
Lossy rubber	1
SMA connectors (gold plated)	2
1000pF feedthru cap	1
35 x 35 x 30mm tinplate box (Size 1)	1

*** Items in kit are in bold face!**

Parts

Kits of components for all these modules are available from:

Microwave Committee Components Service,
Petra Suckling G4KGC,
314A Newton Road, Rushden,
Northants, NN10 0SY, U.K.
Tel +44 933 411446

Prices for kits can be seen in DUBUS 3/93, p.33. Please note that cheques and Eurocheques should be **payable to Mrs. P. Suckling.**

***Standard tinplate boxes** (Remark from Editor): They are manufactured by Schuberth/Germany and distributed by several companies all over Europe. They have standard sizes for width (37, 55 and 74mm), for length (37, 55, 74, 111 and 148mm), for height (30 and 50mm) and are low cost. In this project **size 1** (37x37x30mm), **size 3** (37x111x30mm) and **size 6** (74x111x30mm) are used. Distributor in the UK is Piper Communications for example. In Germany Eisch Electronic, Abt-Ulrich Str. 16, D-89079 Ulm, Tel.: (++49)730523208 may be contacted.*

Teile

Teilesätze für alle Module gibt es bei der obigen Adresse. Frau Petra Suckling spricht Deutsch!

Bitte beachten: Auf allen Schecks muß **Mrs. P. Suckling** explizit als Empfänger eingetragen sein!

HEMT LNAs for 23cm

Rainer Bertelsmeier, DJ9BV

Abstract: The two versions described, one with an integrated highpass filter for tropo work and one without input filter dedicated for EME work, use low cost FHX35 HEMT-FETs. Both have unconditional stability (K> 1.4), are broadband and have a very low noise figure (0.45 or 0.35dB typical), high gain (16dB typical), good output return loss (>20dB) and moderate input return loss (> 3dB). An active bias circuit is integrated into the RF-board. The preamps are lightweight, constructed in microstrip technique without any special machined parts and have a small size (35x74x30mm).

Kurzfassung: Mit preiswerten FHX35 HEMT's wurden zwei Vorverstärker für 23cm entwickelt: eine Version hat ein integriertes Hochpaß-Filter für terrestrischen Einsatz (Tropo), die zweite Version hat kein Eingangsfilter und eignet sich nur für EME. Beide sind unbedingt stabil (K>1,4), sind breitbandig und haben eine typische Rauschzahl von 0,45 bzw. 0,35dB, haben hohe Verstärkung (16dB) und eine gute Ausgangsanpassung (>20dB RL). Die aktive Stromversorgung ist in die HF-Platine integriert. Die Verstärker sind leicht, in Microstrip-Technik ohne spezielle Mechanik konstruiert und sind relativ klein (35x74x30mm).

1. Introduction

Both versions of the preamp use the Fujitsu HEMT FHX35LG in a grounded source circuit. They have been developed from the successful LNA which has been described in [1]. That preamp uses a ATF10136 GaAs FET and has a noise figure of

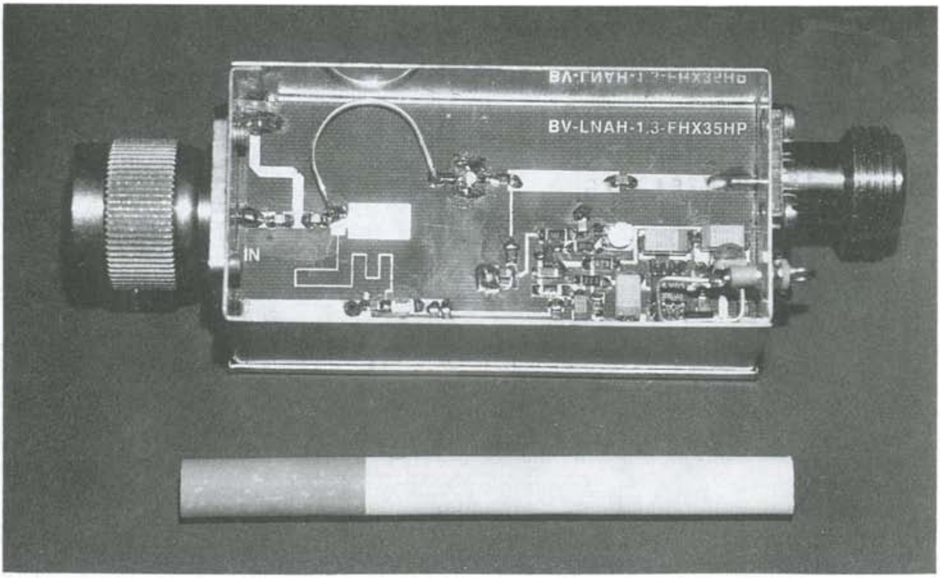
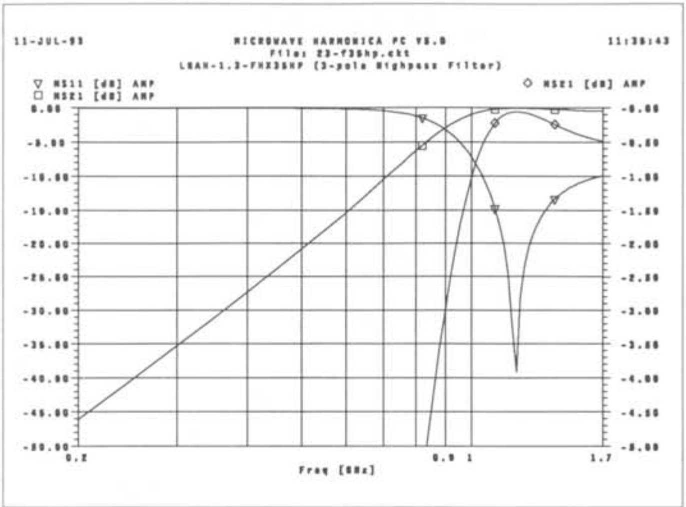


Figure 1: LNAH-1.3-FHX35HP

Figure 2: Selectivity of Highpass-Filter



ATF10136 GaAs FET and has a noise figure of typically 0.55dB with a spread from 0.45 to 0.65dB at 14dB gain. The new preamp has a substantially lower noise figure and a higher gain of 16dB. Stability is excellent because of the grounded source. The well proven highpass filter (Fig. 2) protects the preamp from overload by TV or 70cm amateur stations. It has less than 0.1dB attenuation on 1.3 GHz and more than 25dB attenuation on 432MHz. The EME version relies on a waveguide feedhorn for a similar highpass characteristic. Preamps which don't provide input selectivity are prone to overload by out-of-band signals.

The FETs grounded source requires a bias circuit to provide the negative voltage for the gate. A special active bias circuit (Fig. 3) is integrated into the RF board which provides regulation of voltage and current for the FET. PNP transistor T1 operates in a feedback loop with the FET and forces a constant current through the FET. T1 maintains a constant voltage across R14/P1 by regulating the negative gate voltage on the FET. The drain voltage is set by R12 und R13 (Fig. 3). P1 serves for current adjustment (7... 25mA). IC1 is a 5V standard regulator. IC2 generates the negative voltage. C13 provides a time delay of 10ms and suppresses the 1kHz ripple frequency from IC2.

1. Einführung

Beide Versionen des Vorverstärkers arbeiten mit galvanisch geerdeter Source. Das hat sich als beste Lösung erwiesen. Sie sind mit dem HEMT Fujitsu FHX35LG bestückt. Die Schaltung wurde aus dem LNA, der in [1] beschrieben wurde und mit dem ATF10136 bestückt ist, weiterentwickelt. Dieser hatte eine Rauschzahl von 0,55dB typisch mit einer Streubreite von ca. 0,45 bis 0,65dB. Der neue Vorverstärker hat nicht nur eine deutlich niedrigere Rauschzahl, sondern auch mehr Verstärkung. Die Stabilität ist wegen der geerdeten Source ausgezeichnet. Das bewährte Hochpaß-Filter wurde übernommen (Bild 2). Es hat weniger als 0,1dB Dämpfung auf 1,3GHz und mehr als 25dB Dämpfung

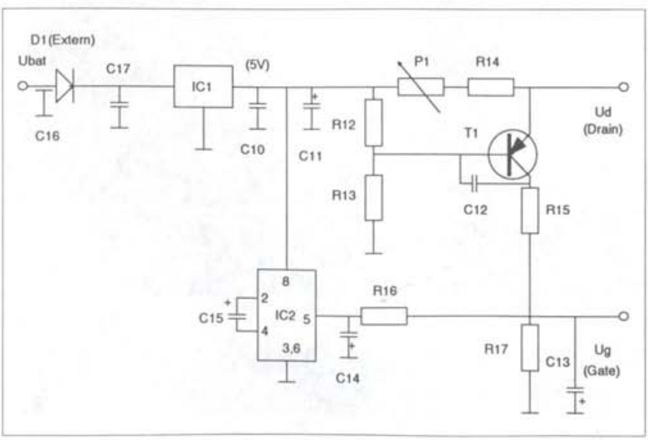
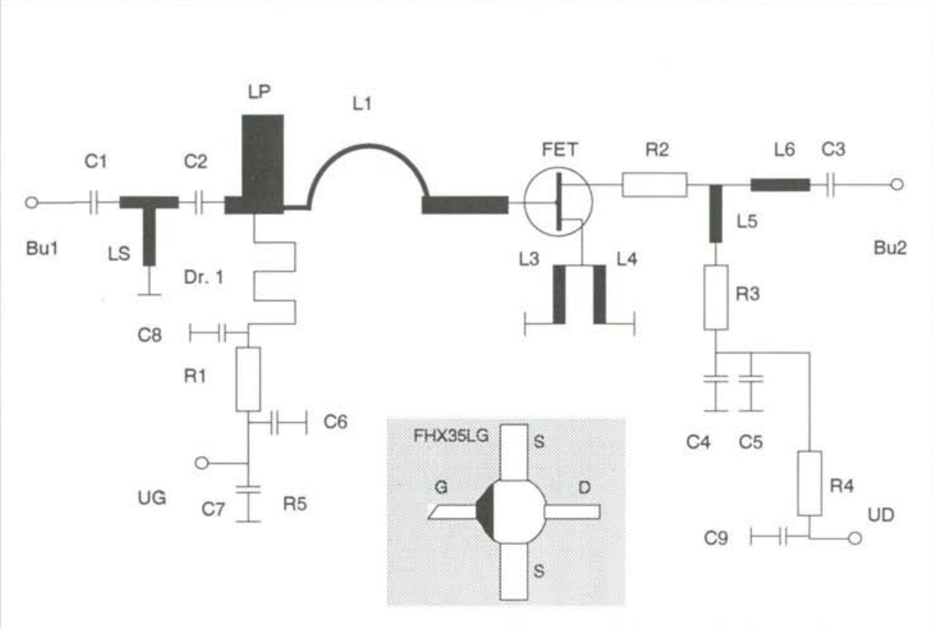


Figure 3: On Board Bias Circuit

Figure 4: Circuit Diagram for LNAH-1.3-FHX35HP



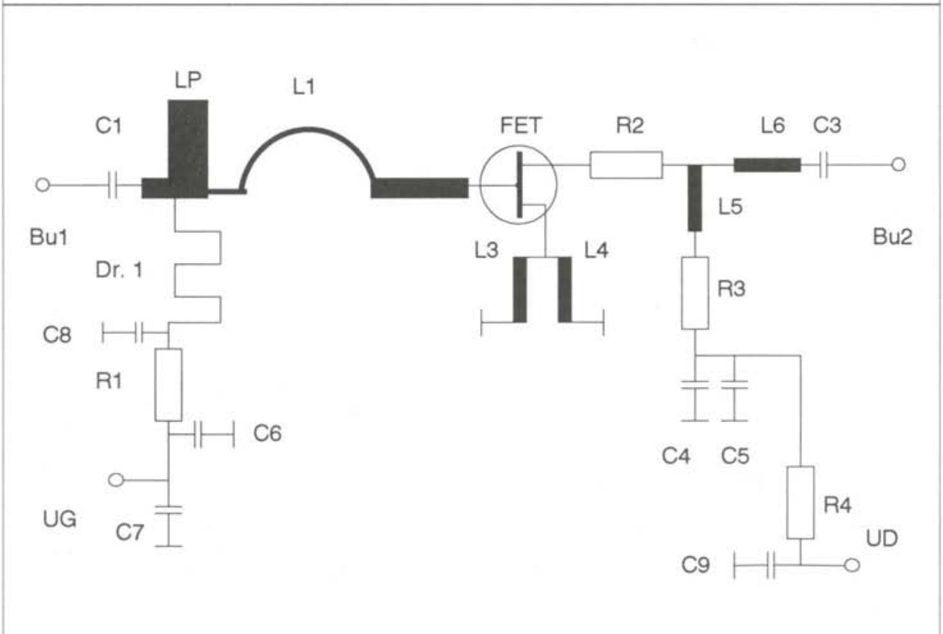


Figure 5: Circuit Diagram for LNAH-1.3-FHX35E

ken Signalen im TV-Band oder dem 70cm Amateurband geschützt. Leider haben die meisten publizierten Verstärker, die in der Serien-L Schaltung konfiguriert sind, keinerlei Eingangs-Selektivität, so daß sie sehr empfindlich gegen Signale unterhalb des 23cm Bandes sind.

Die geerdete Source erfordert eine negative Spannung auf dem Gate. Eine spezielle Vorspannungsschaltung (Bild 3) regelt Strom und Spannung im FET unabhängig von den Exemplarstreuungen und der Temperatur. Dazu dient der PNP-Transistor T1, der mit dem FET in einer Gegenkopplungsschaltung arbeitet. Er erzwingt einen konstanten Strom durch den FET, indem er den Spannungsabfall an R14/P1 durch Regeln der negativen Gatespannung konstant hält. R12 und R13 setzen die Drain-Versorgungsspannung. IC2 erzeugt die negative Spannung. C12 und C13 sorgen für eine Regelzeitkonstante von 10msec und unterdrücken die 1kHz Schaltfrequenc von IC2. Der Drain-Strom läßt sich mittels P1 von 7...25mA einstellen.

2. Circuit description

LNAH-1.3-FHX35HP

Fig. 4 shows the circuit of the LNAH-1.3-FHX35HP. This is the version with a highpass filter. The 3-pole highpass filter consists of C1, C2 and a printed inductive stub LS. The corner frequency is about 1GHz. Gain rolls off with 18dB per octave below 1GHz. Stub LP and inductance L1 provide optimum noise impedance matching. L1 functions as a dielectric transmissionline above a PTFE board and has somewhat lower loss than a coil. L3 and L4 provide inductive feedback to increase the stability factor and input return loss. R2, L5, R3 increase stability factor. L6/C3 match the output of the FET to 50Ω. Dr.1 is a printed $\lambda/4$-choke to decouple the gate bias supply.

LNAH-1.3-FHX35E

Fig. 5 shows the circuit of the version LNAH-1.3-FHX35E. The only difference to the HP-version is the missing highpass filter. This version is intended for use in EME only and relies on a waveguide feedhorn for a similar highpass characteristic as the version HP.

2. Schaltung

LNAH-1.3-FHX35HP

Bild 4 zeigt die Schaltung der Variante LNAH-1.3-FHX35HP. Diese Variante ist mit einem Hochpaß-Filter am Eingang bestückt und sorgt für eine hohe Unterdrückung des FS-Frequenzbereichs und von 432MHz. C1, LS und C2 bilden das 3-polige Hochpassfilter mit einer Eckfrequenz von 1GHz. Dadurch wird der Bereich unterhalb von 1GHz mit 18dB pro Oktave abgesenkt. Parallelstub LP und die Induktivität L1 bilden die Eingangsanpassung

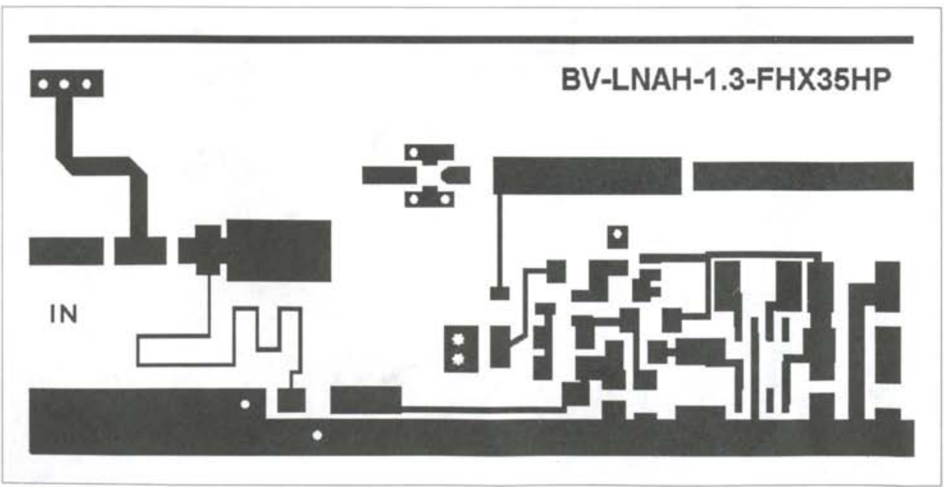


Figure 6: PTFE-PCB of LNAH-1.3-FHX35HP

für minimale Rauschzahl. L1 wirkt wie eine Draht-Leitung über einem Dielektrikum (Teflon-Platine) und hat weniger Verluste als eine Spule. L3 und L4 erzeugen eine Gegenkopplung in der Source, um den K-Faktor und die Eingangsrückflußdämpfung zu vergrößern. R2/L5/R3 sorgen für absolute Stabilität. L6 und C3 passen den Ausgang des Transistors auf 50Ω an. Dr.1 ist eine gedruckte λ/4-Drossel und dient zur Zuführung der negativen Gate-Spannung.

LNAH-1.3-FHX35E

Bild 5 zeigt die Schaltung des LNAH-1.3-FHX35E, die nur für EME-Betrieb geeignet ist. Der einzige Unterschied zur vorigen Version besteht im Fehlen des Hochpaß-Filters. Die EME-Version sollte nur an einem Horn betrieben werden, welches selbst wegen der Hohlleiter-Grenzfrequenz eine Hochpaß-Charakteristik besitzt.

3. Construction

Warning: If you want to use this amplifier on terrestrical links I recommend to build the HP version with the highpass filter. This filter is **essential** for troublefree operation. A possible 0.1db improvement in noise figure when building the E version cannot be utilized on terrestrical links because of the high antenna noise temperature. Second the coaxial T/R-relay must have an excellent isolation (>50dB at 100W power). HEMTs are more sensitive to RF-power than normal GaAs FETs. **Never switch off** the supply voltage of the preamp when switching from receive to transmit. In a **biased** condition maximum input RF-power to the HEMT should be limited to 10mW. In a no-bias condition not more than 1mW should be applied.

Construction follows micro-stripline techniques on a PTFE board (Fig. 6/7) of 35x72mm size made to fit into a standard tinplate box . The parts list can be seen in Table 1. Look for the parts layout in Figs. 8 and 9.

Step by Step Procedure:

1. Prepare tinned box (solder side walls).
2. Prepare PCB to fit into box.
3. Prepare holes for N-connectors into box. Attention: Input and output connector are asymmetrical. Use PCB to do the markings.
4. Drill holes for through contacts (0.9 mm dia.) into the PCB and connect through with 0.8 mm CuAg at indicated positions.
5. Solder all resistors onto PCB.
6. Solder all caps onto PCB.
7. Cut a 36mm length of CuAg, 0.8mm diameter wire. Bend down ends at 1mm length to 45°. Form wire into a half circle loop according to Figs. 8,9 and 10. Solder into the circuit with

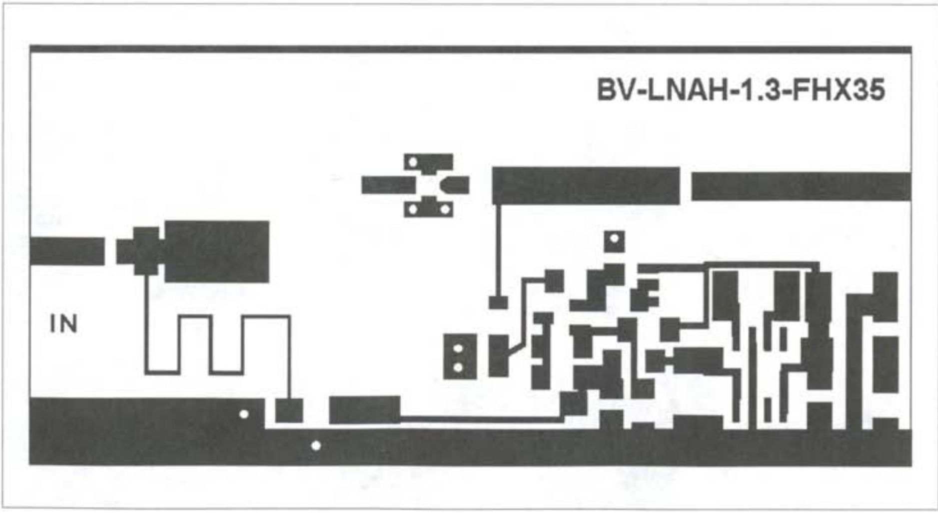
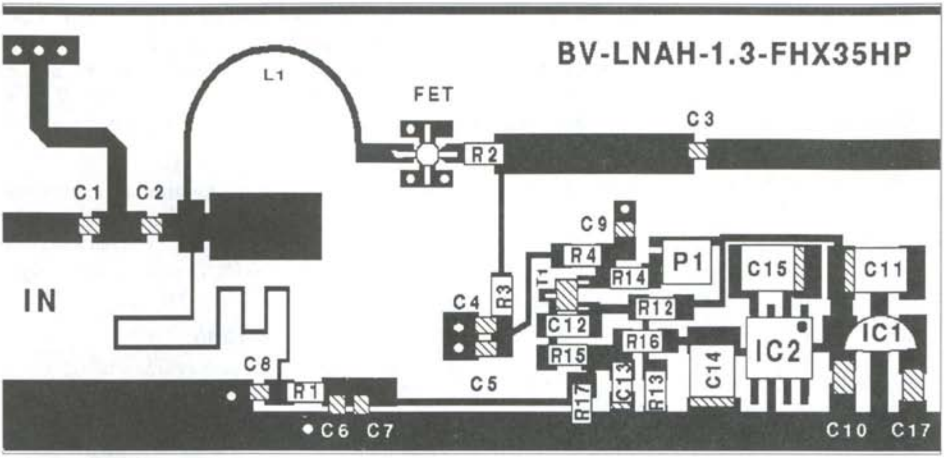


Figure 7: PTFE-PCB of LNAH-1.3-FHX35E

Figure 8: LNAH-1.3-FHX35 - Parts Layout



1.5mm clearance from the PCB. The wire loop has to flush with the end of the gate stripline and should be soldered in a right angle to it. The wire loop has to be oriented flat and is **parallel** to the PCB.

8. Verify open loop function of bias-circuit. Adjust P1 to 20Ω resistance. Solder 100Ω test resistor from drain terminal on PCB to ground. Apply +12V to IC1 and measure +5V at output of IC1, -5V at IC2/Pin5, $-2.5V$ at collector of T1, +3.9V at emitter of T1, +3.4V at base of T1, $-2.5V$ at R17 and +2.0V across the 100Ω. If O.K. remove 100Ω test resistor.
9. Solder HEMT FHX35 onto PCB. Use only an insulated soldering tool (Weller), ground the PCB, your body and the power supply of the soldering tool. Never touch the HEMT at the gate - only at the sources or the drain - when applying it to the PCB and solder fast (<5sec).
10. Solder N-Connectors into side walls of the box.
11. Solder finished PCB into box - solder from both sides at the side walls and solder center pins of the connectors to the microstriplines.
12. Solder feedthroug cap into box.

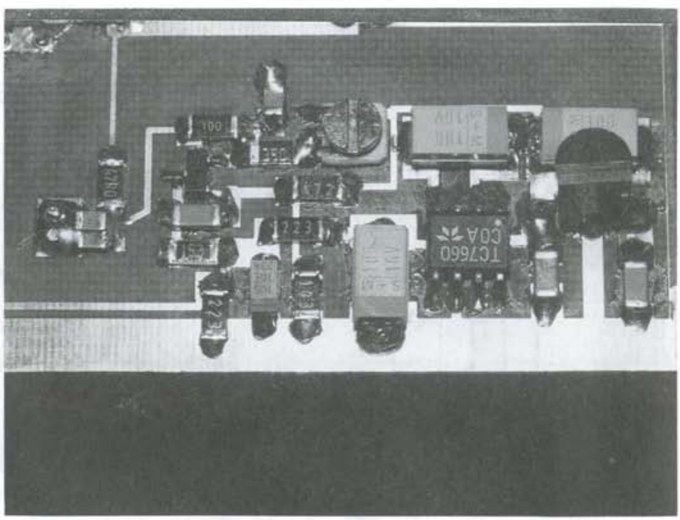
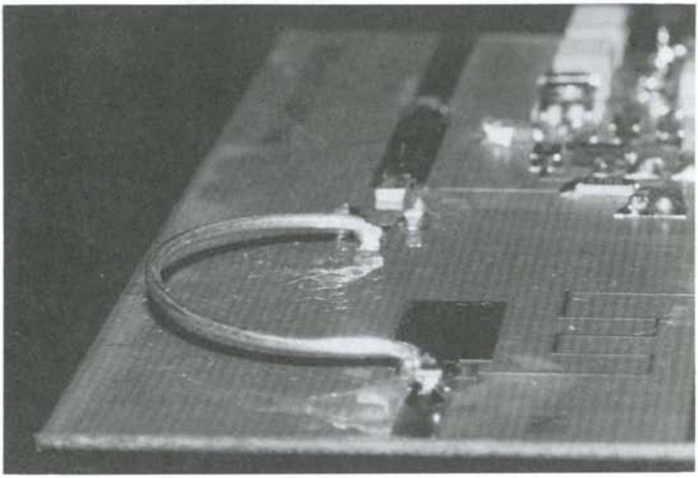


Figure 9: LNAH-1.3-FHX35HP (Close View)

Figure 10: Close View onto Input Wire Loop



13. Connect D1 between feedthroug cap and PCB.
14. Connect 12V B+ and adjust P1 for 20 mA drain current (measure 200mV across R4 on RF-Board). Voltages should be around +2.0V at the drain terminal, -0.2V at the gate, +4V at emitter of T1.
15. Connect LNA to PANFI - if you have one - and adjust input wire loop - change clearance to PCB - as well as drain current by adjusting P1 for minimum noise figure. Even without tuning the noise figure should be within 0.1dB of minimum because of the limited tuning range of the wire loop.
16. Glue conducting foam into inside of top cover and ans slip to the top of the box.
17. Your small wonder is finished now.

3. Konstruktion

Warnung: Wenn der Vorverstärker für terrestrischen Einsatz benutzt wird, sollte man nur die HP-Version mit eingebautem Hochpass-Filter bauen. Andernfalls wird der RX von Signalen unterhalb von 1GHz zugestopft. Eine maximal mögliche Verbesserung von 0,1dB in der Rauschzahl ist nicht nutzbar, da die Antenne bei terrestrischen Einsatz eine wesentlich höhere Rauschtemperatur als der Vorverstärker hat. Zweitens muß das koaxiale Relais, das zur Umschaltung benutzt wird, eine hohe Übersprechdämpfung haben (>50dB bei 100W HF). HEMT's sind wesentlich empfindlicher gegen HF-Leistung am Gate als normale GaAs FET's (Faktor von 10!). Die maximale Eingangsleistung im eingeschalteten Zustand - der HEMT zieht Strom - darf höchstens 10mW betragen (100mW für einen MGF1302!). Beim Umschalten von Empfang auf Senden darf die Betriebsspannung eines GaAs-FET Vorverstärkers unter **keinen Umständen abgeschaltet** werden. Andernfalls ist die Belastbarkeit im Eingang nochmal 10-mal kleiner, weil die Gate-Elektrode wegen der fehlenden Sperrspannung eher durchbricht. Das Abschalten der Betriebsspannung von GaAs-FET Verstärkern beim Wechsel von Empfang auf Senden ist ein leider sehr häufig begangener Fehler und die Ursache für viele zerstörte GaAs-FET's.

Die Konstruktion besteht aus einer TEFLON-Platinen (Bild 6/7), die mit SMD-Teilen bestückt ist. Nur D1, IC1 und C16 sind keine SMD-Teile. Die Größe ist 32x74mm. Die notwendigen Teile sind im Tabelle 1 aufgeführt. Die Plazierung der Teile ist in den Bildern 8 und 9 zu sehen.

Aufbau-Prozedur:

1. Gehäuse zusammenlöten.
2. Platine zufeilen, damit sie ins Gehäuse paßt.
3. Löcher für die N-Buchsen in die Seitenwände schneiden. Achtung: Die N-Buchsen sitzen unsymmetrisch. Platine zum Anreißen als Maß nehmen.
4. Löcher für die Durchkontaktierungen in die Platine bohren (0,9mm Ø) und mit 0,8mm CuAg durchkontaktieren.
5. Alle Widerstände auf die Platine löten.
6. Alle Kondensatoren auf die Platine löten.
7. Einen CuAg Draht, 0,8mm Durchmesser, auf 36mm Länge abschneiden. Enden auf 1mm Länge auf 45° abbiegen und das Ganze zu

einer halbkreisförmigen Drahtschleife (siehe Bilder 8, 9, 10) biegen. In die Platine so einlöten, daß die Drahtschleife parallel zur Platine liegt und 1.5mm Luft zwischen Drahtschleife und Platine bleibt. Die Drahtschleife muß mit dem Ende der Gate-Stripline fluchten und mit 90° Winkel davon abgehen.

8. **Funktion der Vorspannungsschaltung verifizieren:** P1 auf 20Ω einregeln und einen 100Ω Testwiderstand auf der Platine vom Drainanschluß auf der Platine nach Masse löten. 12V anlegen (IC1). Am Ausgang von IC1 müssen 5V anliegen, am Gate-Anschluß (R17) müssen -2,5V anliegen. Am Kollektor von T1 -2,5V, am Emitter 3,9V, an der Basis von T1 +3,4V. Am Testwiderstand 2,0V. An IC2/Pin5 ca. -5V. Falls alles O.K. ist (+-200*mV*), wird der Testwiderstand wieder entfernt.
9. HEMT FHX35 auf die Platine löten: Weller-Lötkolben verwenden, Netzgerät-Erdbuchse mit der Massefläche und dem eigenen Körper verbinden. FET **nicht** mit der Pinzette am Gate anfassen, sondern an der Source oder dem Drain. Schnell löten (<5sec).
10. N-Buchsen ins Gehäuse einlöten.
11. Platine auf die Innenleiter der N-Buchsen legen, justieren und ringsrum mit dem Gehäuse verlöten (Von beiden Seiten). Zuletzt die Innenleiter der N-Buchsen auf die Striplines löten.
12. Durchführungs-C einlöten.
13. D1 an das Durchführungs-C anlöten.
14. Spannung anlegen, und mit P1 den Strom auf 20mA einstellen (An R4 fallen dann 200mV ab). Spannungen sollen am Drain-Anschluß ca. 2V, am Gate ca. -0,2V und am Emitter von T1 ca. 4V betragen.
15. LNA am Rauschzahlmeßgerät anschließen, die Drahtschleife durch Änderung des Abstandes (nominell 1.5mm) von der Platine sowie den Strom mittels P1 auf minimale Rauschzahl abgleichen. Selbst ohne Abgleich ist die Rauschzahl höchstens 0,1dB schlechter als das mögliche Minimum, da der Abstimmbereich der Drahtschleife im Gegensatz zu einer Spule sehr begrenzt ist.

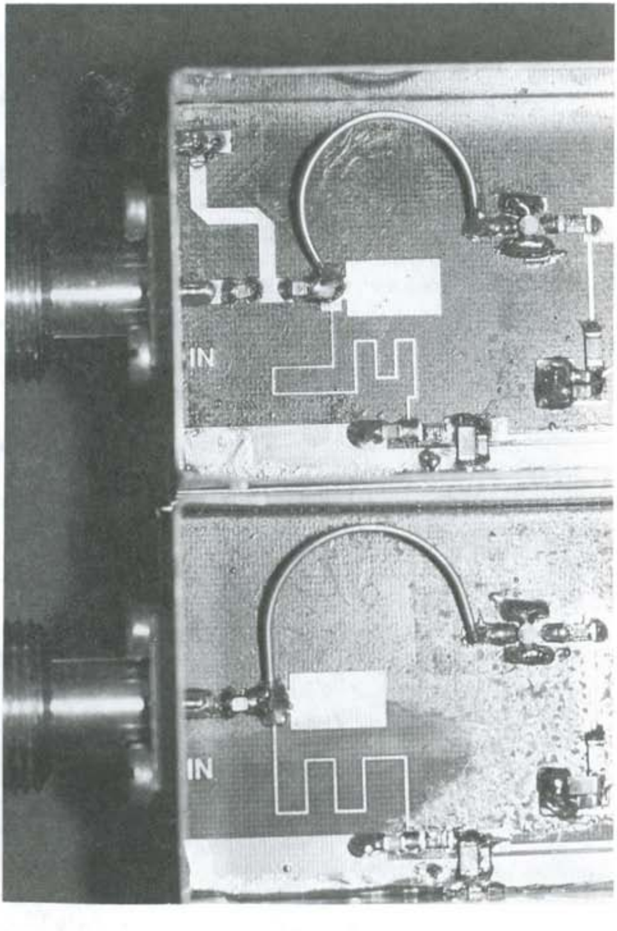
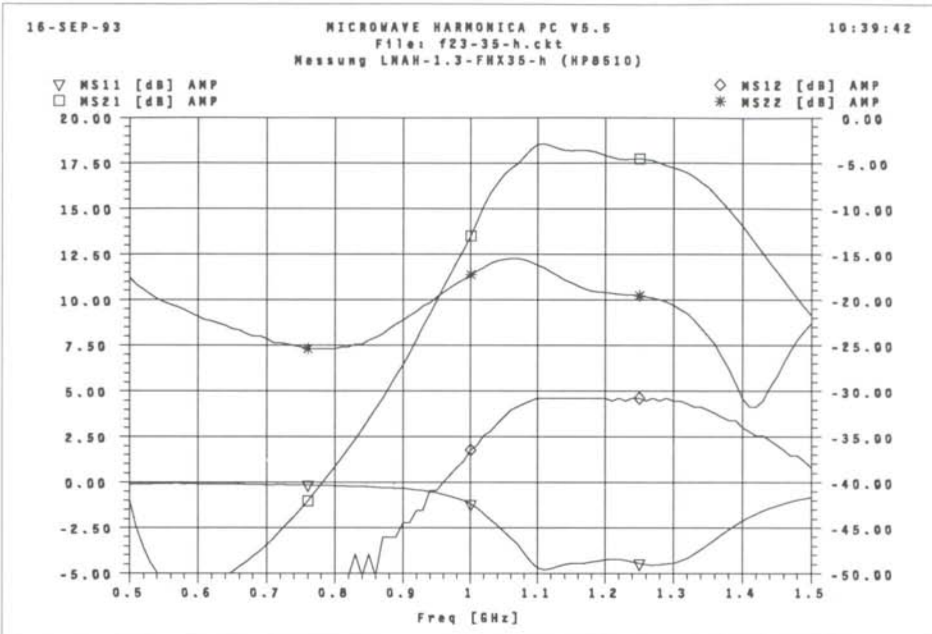


Figure 11: LNAH-1.3-FHX35HP & E (Top Views)

Figure 12: Measured S-Parameters of LNAH-1.3-FHX35HP



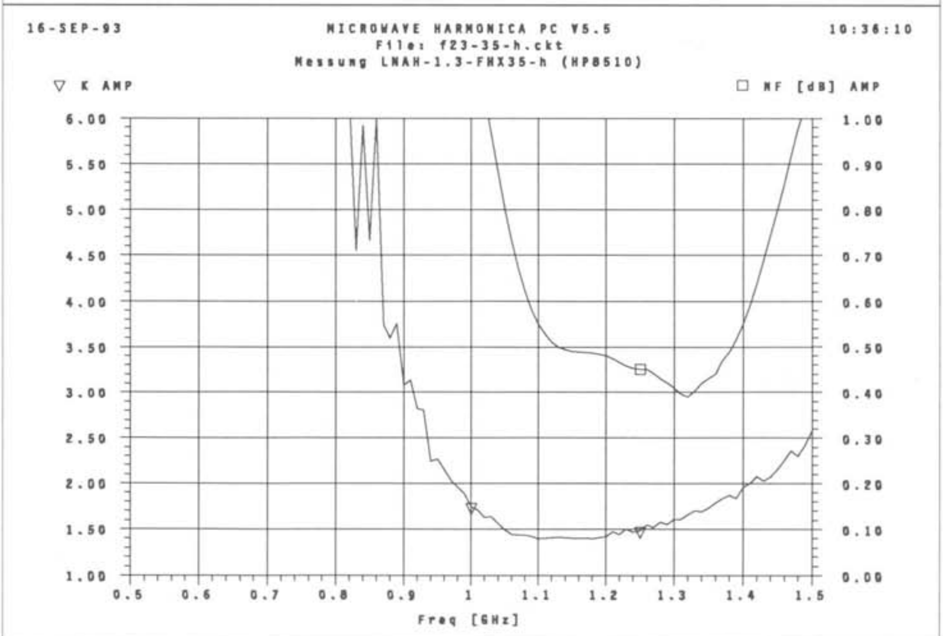
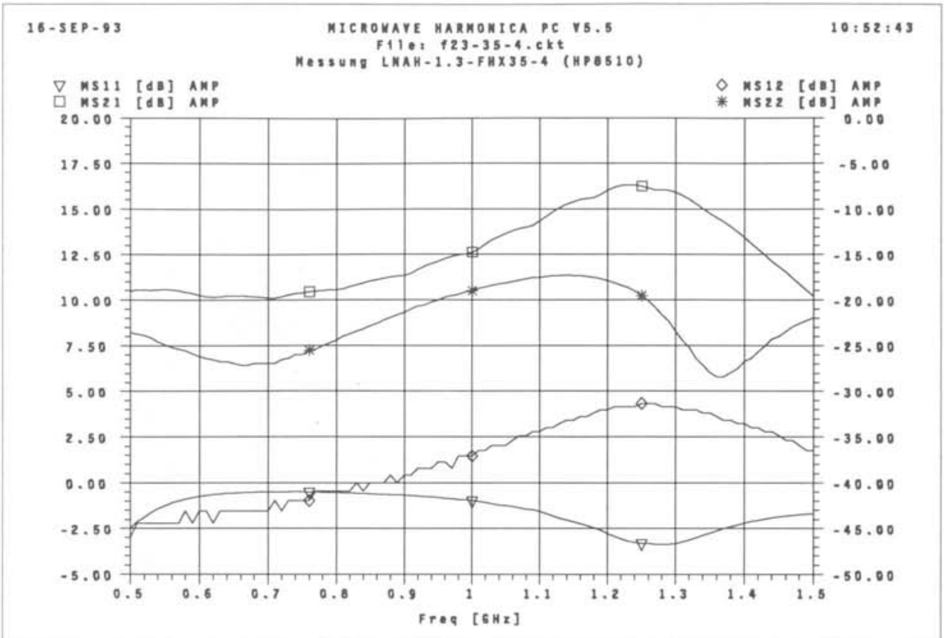


Figure 13: Measured NF & K-Factor of LNAH-1.3-FHX35HP

Figure 14: Measured S-Parameters of LNAH-1.3-FHX35E



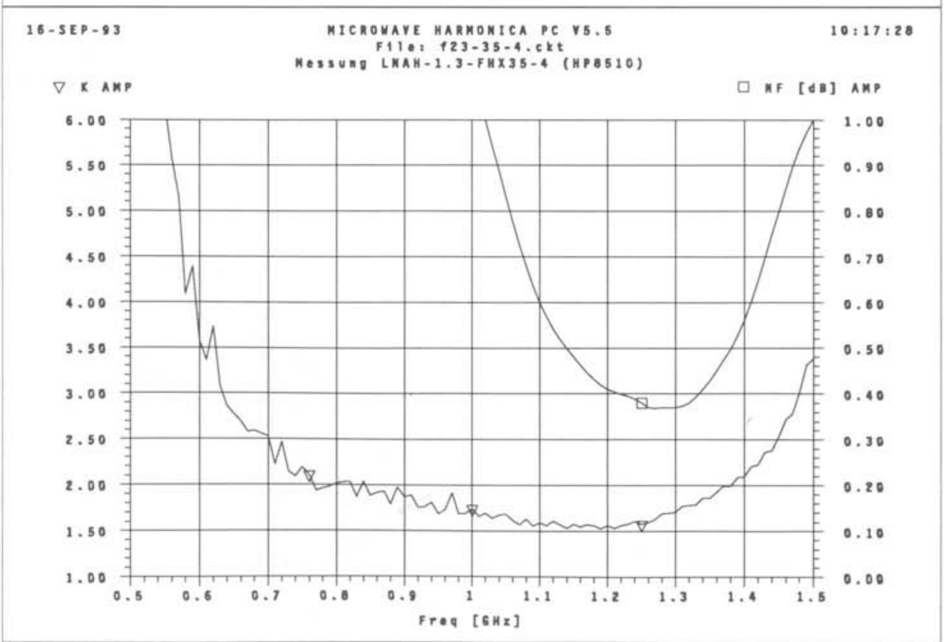
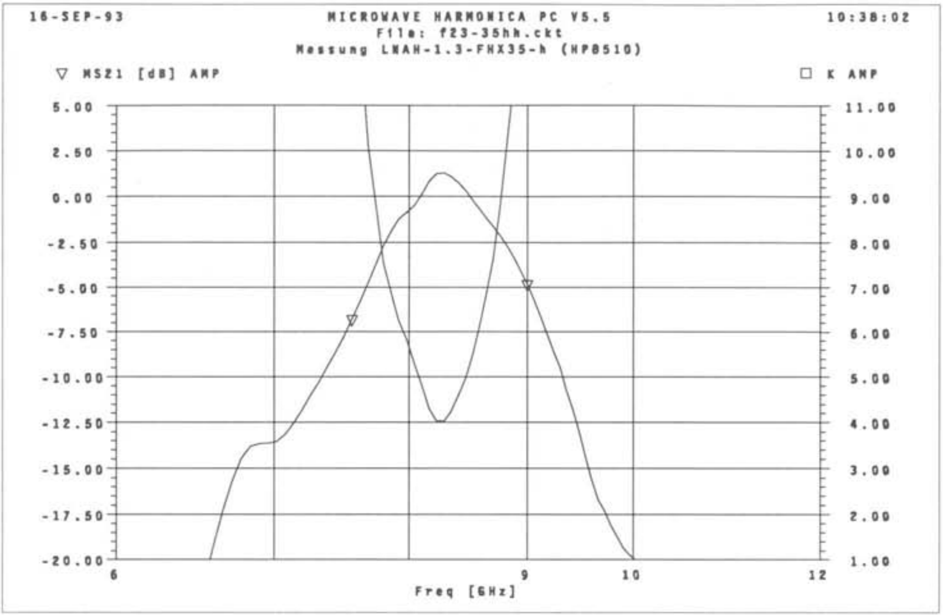


Figure 15: Measured NF & K-Factor of LNAH-1.3-FHX35E

Figure 16: Measured K-Factor of LNAH-1.3-FHX35HP @ 8GHz



16. Innenseite des oberen Deckels mit leitendem Schaumstoff bekleben.
17. Deckel zu und fertig ist die Laube.

4. Measurement Results

Measurements were taken by a HP8510 network analyzer and HP8970B/HP346A noise figure analyzer, transferred to a PC, imported to MICROWAVE HARMONICA PC and plotted subsequently.

Version LNAH-1.3-FHX35HP

Figures 12 to 13 show some typical results measured on the LNAH-1.3-FHX35HP version. Figure 12 shows the magnitude of the S-parameters versus frequency. Gain is 17dB at 1.3GHz and rolls off with 24dB per octave below 1.1GHz. Response is already 16dB down at 800MHz. Input return loss is 4dB and output return loss is 20dB. Figure 13 shows the stability factor which is greater than 1.4 from 0.5 to 1.5GHz. Fig. 16 shows the stability factor from 6 to 12GHz. At about 8GHz it shows a dip with a magnitude of not less than 4. Therefore the critical issue of broadband stability which is caused by the inductive source feedback has been solved by this design. The noise figure is less than 0.5dB (<35K) on 1.3GHz with a broad minimum less than 0.5dB from 1150 to 1380MHz.

Version LNAH-1.3-FHX35E

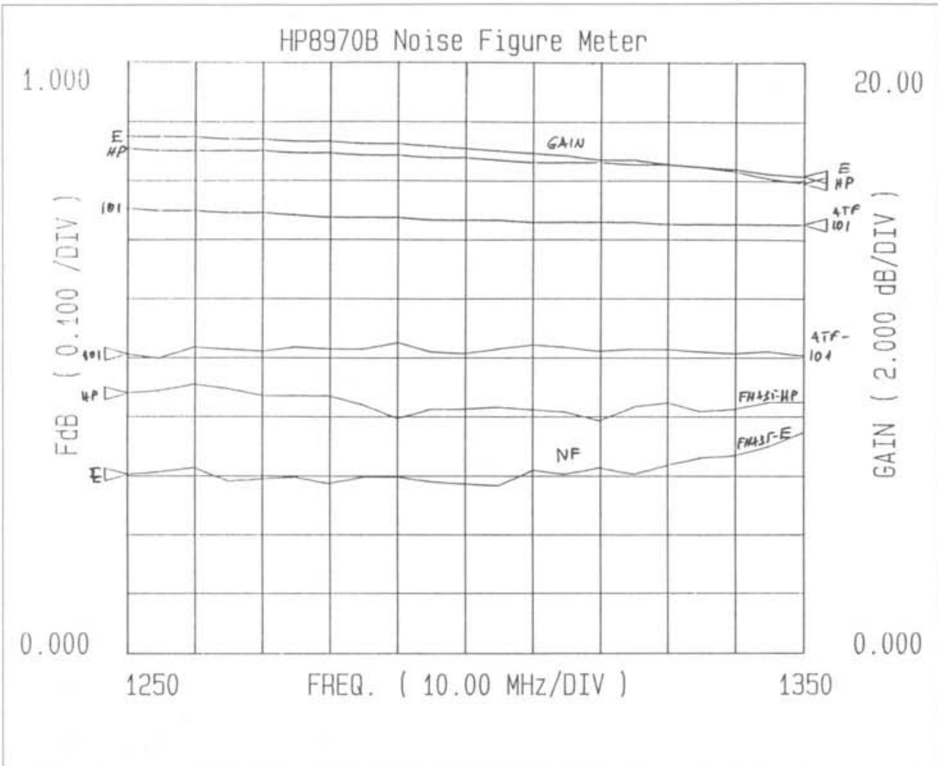
Figures 14 to 15 show some typical results measured on the LNAH-1.3-FHX35E version. Figure 14 shows the magnitude of the S-parameters versus frequency. Gain is 16.0dB at 1.3GHz and about 10dB on 0.5GHz. At 1.3GHz input return loss is 3dB and output return loss is 23dB. Figure 15 shows the stability factor which is greater than 1.6 from 0.5 to 1.5GHz. The noise figure is less than 0.4dB (<28K) on 1.3GHz and exhibits a broad minimum from 1220 to 1340MHz.

Selection of Best Transistor

HEMT	NF Simulated [dB]	NF Measured [dB]
FHX35LG	0.52	0.30...0.37 (6)
ATF35076	0.23	0.40...0.43 (3)
CFY66	0.46	0.43 (1)
FHX06LG	0.44	0.41 (1)
NE32484	0.43	0.42 (1)

Several different HEMTs were tried in a prototype board to find the most suitable transistor. The table

Figure 17: Comparison of Measured Noise Figures



above shows the test results achieved. Even if the results are in the same range some choices are more favourable.

Simulated noise figures were calculated by MICROWAVE HARMONICA PC-V5.5 based on the figures given in the datasheets. The cheapest and most surprising choice turned out to be the FHX35.

4. Meßwerte

Die Meßwerte wurden durch einen HP8510 Netzwerk-Analysator bzw. durch ein HP8970B/ HP346A Rauschzahlmeßgerät bestimmt. Diese waren über ein IEEE-488 Interface an einen PC gekoppelt. Die Meßwerte wurden in MICROWAVE HARMONICA PC importiert und auch mittels dieser Software geplottet.

Version LNAH-1.3-FHX35HP

Die Bilder 12 und 13 zeigen die Meßwerte des LNAH-1.3-FHX35HP für Tropo. Die Verstärkung beträgt 17.0dB bei 1,3GHz, die Eingangs-Rückflußdämpfung ist ca. 4dB. Die Ausgangs-Rückflußdämpfung ist 20dB (VSWR<1,25) und der Stabilitätsfaktor K ist größer als 1,4 im Frequenzbereich von 0,5GHz bis 1,5Ghz. Auch im Bereich von 6 bis 12GHz ist der K-Faktor größer als 1 mit einem Minimum von K=4 bei der Resonanz auf 8GHz. Damit ist das Problem der Breitbandstabilität, das durch die induktive Gegenkopplung entsteht, mit diesem Design gelöst. Die gemessene Rauschzahl ist kleiner als 0,5dB bei 1300MHz.

Version LNAH-1.3-FHX35E

Die Bilder 14-15 zeigen die Meßwerte der Version LNAH-1.3-FHX35 für EME. Die Verstärkung beträgt 16.0dB bei 1,3GHz, die Eingangs-Rückflußdämpfung ist ca. 3dB. Die Ausgangs-Rückfluß-

Table 1: Parts List for FHX35HP & FHX35E

Teile-Nummer/Part-No.	Art/Sort	Wert/Value	Hersteller/Manufacturer	Herst.-Bez./Manuf.-No.
C1	Chip-C 50mil	10pf (2.2pF in HP-Version)	Tekelec Airtronic/ATC	CHA/ 100A
C2	Chip-C 50mil	2.2pF (Only in HP-Version)	"	"
C3	SMD-C	100pF	Sie	0805
C4,6,9	SMD-C	1000pF	Sie	0805
C5,7	SMD-C	0.01uF	Sie	0805
C8	SMD-C	10pF	Sie	0805
C10,12,17	SMD-C	0.1uF	Sie	1206
C13	SMD-Elco	1uF	Sie	1206
C11,14,15	SMD-Elco	10uF	Sie	1210
C16	Feed-Thr.	1000pF	Sie	
R1	SMD-R	270Ohm	Sie	1206
R2,14	SMD-R	39	Sie	1206
R3	SMD-R	47Ohm	Sie	1206
R4	SMD-R	10Ohm	Sie	1206
R12	SMD-R	4.7kOhm	Sie	1206
R13	SMD-R	10kOhm	Sie	1206
R15	SMD-R	15kOhm	Sie	1206
R16,17	SMD-R	22kOhm	Sie	1206
P1	SMD-Pot	100Ohm	Murata	4310
Dr.1	Printed	$\lambda/4$		
L1	Wire Loop	0.8mmCuAg, 36mm long, 1.5mm above PCB	Homemade	
D1	Diode	1N4007	Mot	
FET	GaAs-FET	FHX35	Fujitsu	FHX35
T1	PNP	BC807	Sie	
IC1	Regulator	uA7805A	Mot	
IC2	Inverter	LTC1044SN8 (ICL7660SN8)	LT (Intersil)	
Bu1,2	Coaxial	N-Small Flange		
PCB	Teflon PCB, Taconix TLX	35 x 72 mm, 0.79 mm, Er=2.55, LNAH-1.3-FHX35HP or LNAH-1.3-FHX35E	DC3XY, Rainer Jäger, Tel. (++49)4106-73430	
G	Box, Weißblech (Tinplate)	35x74x30 mm	Schuberth	Size 2

Parts and Kits are available from Rainer Jäger, DC3XY, Breslauer Str.4, D-25479 Ellerau. **Ready made and calibrated preamps** are available from Frank Schreyer, DD1XF, Maimoorweg 32, D-22179 Hamburg, Tel. (++49)406428253.

dämpfung ist 23dB (VSWR<1,1) und der Stabilitätsfaktor K ist größer als 1,6 im Frequenzbereich von 0,5GHz bis 1,5Ghz. Die gemessene Rauschzahl ist kleiner als 0,4dB bei 1300MHz.

5. Conclusions

It has been shown that unconditionally stable, easy to build LNAs with HEMTs can be constructed for 23cm. They provide a very low noise figure. These LNAs can be cascaded in any number and provide ultimate performance for tropo or EME.

These preamps have a noise figure, which are 0.1 to 0.2dB better than of those preamps equipped with a ATF10136 described in [1]. Figure 17 indicates that a typical LNAH-1.3-FHX35HP will be around 0.1dB better than a typical LNA-1.3-101. The best one out of 5 prototypes of the LNAH-1.3-FHX35E type achieved a noise figure of 0.3dB, but a typical exemplar would measure more likely around 0.35dB noise figure. Stability factor K is excellent with a minimum of 1.4 at 1.3GHz. Perfect broadband stability is achieved from 6 to 12GHz. This range usually denotes a critical range for all source inductive feedback type circuits.

To make the results fully comparable to the 1992 Thorn EME conference measurements, the noise figure measurements for these preamps have been normalized by means of two reference amplifiers, which have been measured at the 1992 Thorn EME conference. In fact that HP346A noise source at DF9CY's QRL indicated an even 0.06dB lower noise figure when calibrated to its stated ENR. But these numbers were judged to be not feasible and instead the normalization to the THORN values was preferred as more realistic.

5. Zusammenfassung

Es wurde gezeigt, daß auf 23cm unbedingt stabile LNA's mit HEMT-FET's gebaut werden können, die eine extrem niedrige Rauschzahl mit absoluter Stabilität vereinen. Diese Vorverstärker sind im Mittel ungefähr 0,15db besser in der Rauschzahl als der in [1] beschriebene Vorverstärker mit dem ATF10136. Außerdem wurde eine Breitbandstabilität auch im kritischen Breich von 6 bis 12GHz erreicht.

Bild 17 zeigt einen Vergleich der verschiedenen Modelle. Ein typischer LNAH-1.3-FHX35HP ist ungefähr 0,1dB besser als ein typischer LNA-1.3-101. Der beste von 6 Prototypen eines LNAH-1.3-FHX35E erreichte eine Rauschzahl von nur 0,3dB, obwohl der typische Wert eher bei 0,35dB liegen dürfte. Um solide Vergleiche mit den Messungen auf der EME Konferenz in Thorn 1992 zu erlauben, wurde die eingestellte ENR am HP8970B mit Hilfe von zwei in Thorn gemessenen Referenzverstärkern auf die ENR der Quelle, die in Thorn verwendet wurde, normalisiert. Damit sind die obigen Messungen mit den Messungen in Thorn voll vergleichbar. Hätte man dagegen die im Kalibrationsprotokoll der jetzt verwendeten HP346A angegebene ENR eingestellt, wären die Meßwerte nochmal 0,06dB kleiner gewesen. Das hätte einen relativ unwahrscheinlichen Wert von 0,24dB für das beste Exemplar bedeutet. Daher wurde entschieden, daß die vorliegende Quelle zu 'gut' mißt und stattdessen die in Thorn benutzte Quelle als Normal genommen. Solche Abweichungen von 0,06dB sind innerhalb der Meßgenauigkeit, da die ENR-Eichung solcher Quellen nur auf typ. 0,15dB (Maximaler Fehler 0,23dB) genau sind.

6. References

[1] **R. Bertelsmeier, DJ9BV**, "Low Noise Preamp for 1.3GHz", DUBUS 4/1991, pp. 37-50

7. Acknowledgements

I have to thank Klaus Eichel, **DL6SES**, from TSS for lending the SUPERCOMPACT-PC-Software; Axel Bünning, **DF1XB** for producing the layouts from my PS-output; Rainer Jäger, **DC3XY** for providing kits for these preamps; Christoph Petermann, **DF9CY** for measuring the noise figures; Toshihiko Takamizawa, **JE1AAH** for delivering some valuable parts; and last but not least Dieter Briggmann, **DC6GC** for measuring the S-parameters. Without their help this work would not have been possible.

7. Danksagung

Ich danke K. Eichel, **DL6SES**, von TSS für die Überlassung von SUPERCOMPACT, Rainer Jäger, **DC3XY**, für die Zusammenstellung der Kits, Dieter Briggmann, **DC6GC**, für die Messungen an den Prototypen, Christoph Petermann, **DF9CY**, für die Rauschzahlmessungen, Toshihiko Takamizawa, **JE1AAH**, für die Bereitstellung spezieller Teile, und Axel Bünning, **DF1XB**, für die Erstellung der Layouts.

Baugruppen für 24GHz

(Modules for 24GHz)

Michael Kuhne, DB6NT

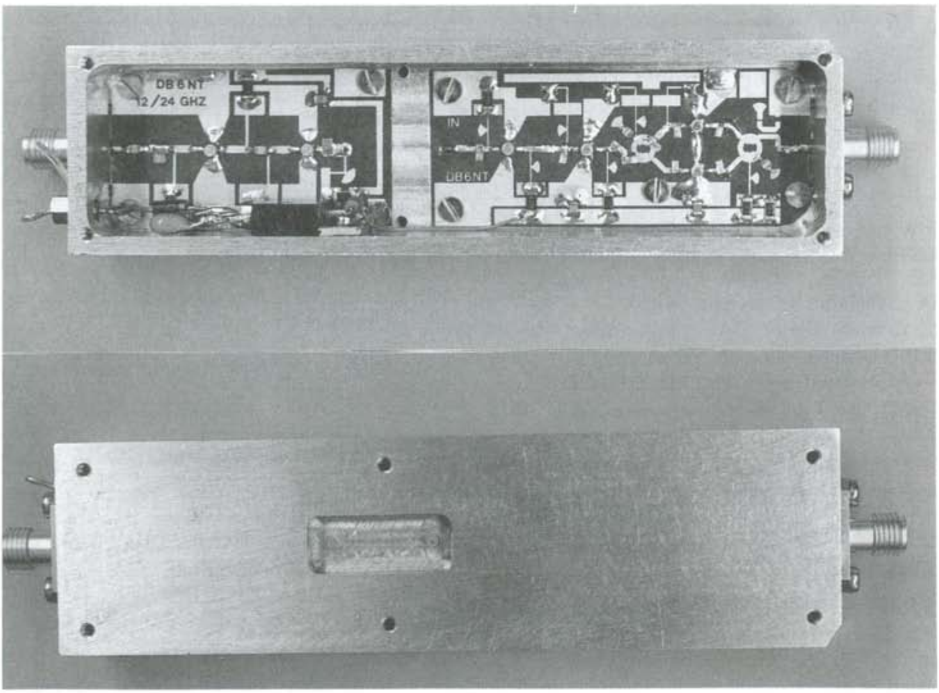
Kurzfassung: Es werden einige 24GHz Module vorgestellt, die für 24GHz Transverter oder Baken benutzt werden können. Dazu gehören ein 24GHz-LO, ein 24GHz Leistungsverstärker, ein dreistufiger 24GHz HEMT-Verstärker sowie ein Verdoppler von 23 auf 46GHz.

Abstract: Some modules which may be useful for 24GHz stations are introduced. These are a 24GHZ LO with 100mW output power useful for beacons, a 24GHz power amplifier with 65mW output, a three stage HEMT amplifier and a doubler from 23 to 46GHz.

1. 24 GHz Bake - LO für Millimeterwellentransverter

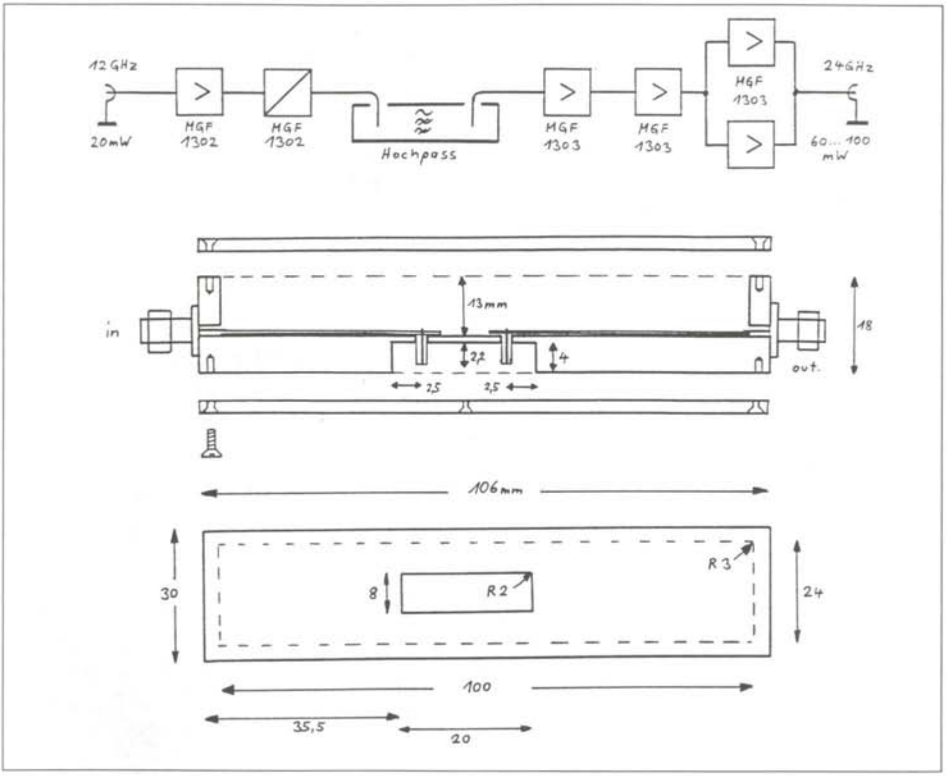
Bilder 1, 2.

Die hier beschriebene Baugruppe liefert ein 24 GHz Signal mit einem Ausgangspegel von ca. 100



Bild/Figure 1: 24GHz LO

Bild/Figure 2: 24GHz LO - Diagram



mW. Sie kann als 24 GHz Bake oder LO für Millimeterwellentransverter eingesetzt werden.

Die Schaltung läßt sich im Bereich 22...25.5 GHz abstimmen. Um eine Ausgangsleistung von 100 mW zu erreichen, ist die Verwendung von vorher stromselektierten MGF 1303 erforderlich. Der I_{DSS} sollte über 45 mA liegen - siehe DUBUS 1/88-. Die Verstärkerschaltung wird über einen 7808 Spannungsregler mit 8 V versorgt. Der Verdoppler wird über einen Vorwiderstand betrieben (6V).

Abgleich

Nach dem Einbau der voll bestückten Verdopplerleiterplatte wird diese mit 12 GHz/20mW angesteuert. Der Drainstrom geht dabei etwas zurück. Am Ausgang des Hohlleiterhochpasses wird über ein SEMI-RIGID-Kabel die 24 GHz Leistung gemessen und mit kleinen Abstimmfähnchen optimiert. Es werden zwischen 10 und 20 mW erreicht. Siehe DUBUS 1/92.

Jetzt kann die Verstärkerleiterplatte eingebaut und abgeglichen werden.

Siehe Abgleich und Aufbauanleitung 24 GHz PA mit MGF 1303.

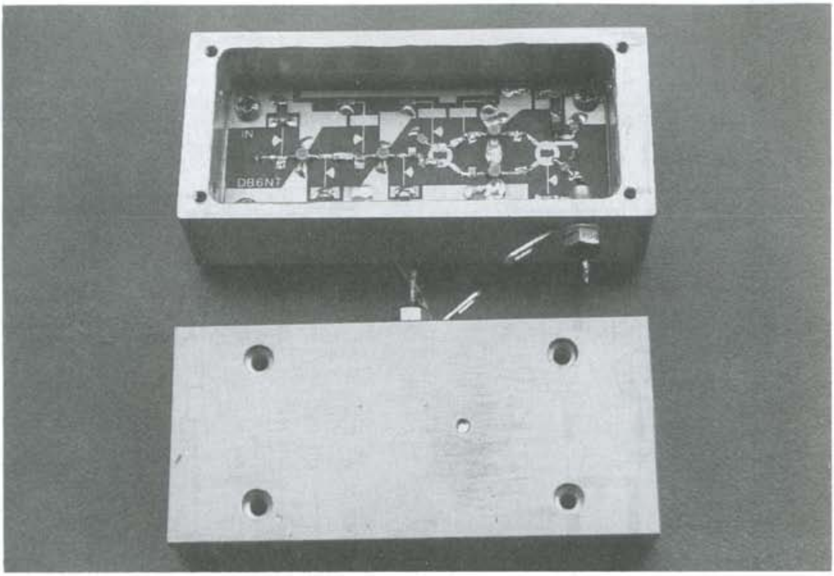
1. 24 GHz LO for Beacons

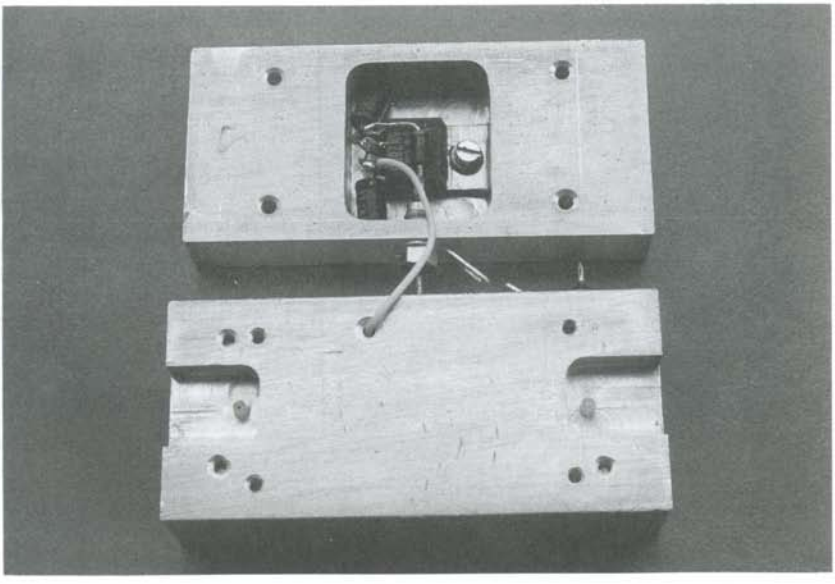
Figures 1 and 2.

The LO-module generates a 24GHz signal with a power of 100mW. It's useful as an LO for 24GHz transverter or as a beacon transmitter.

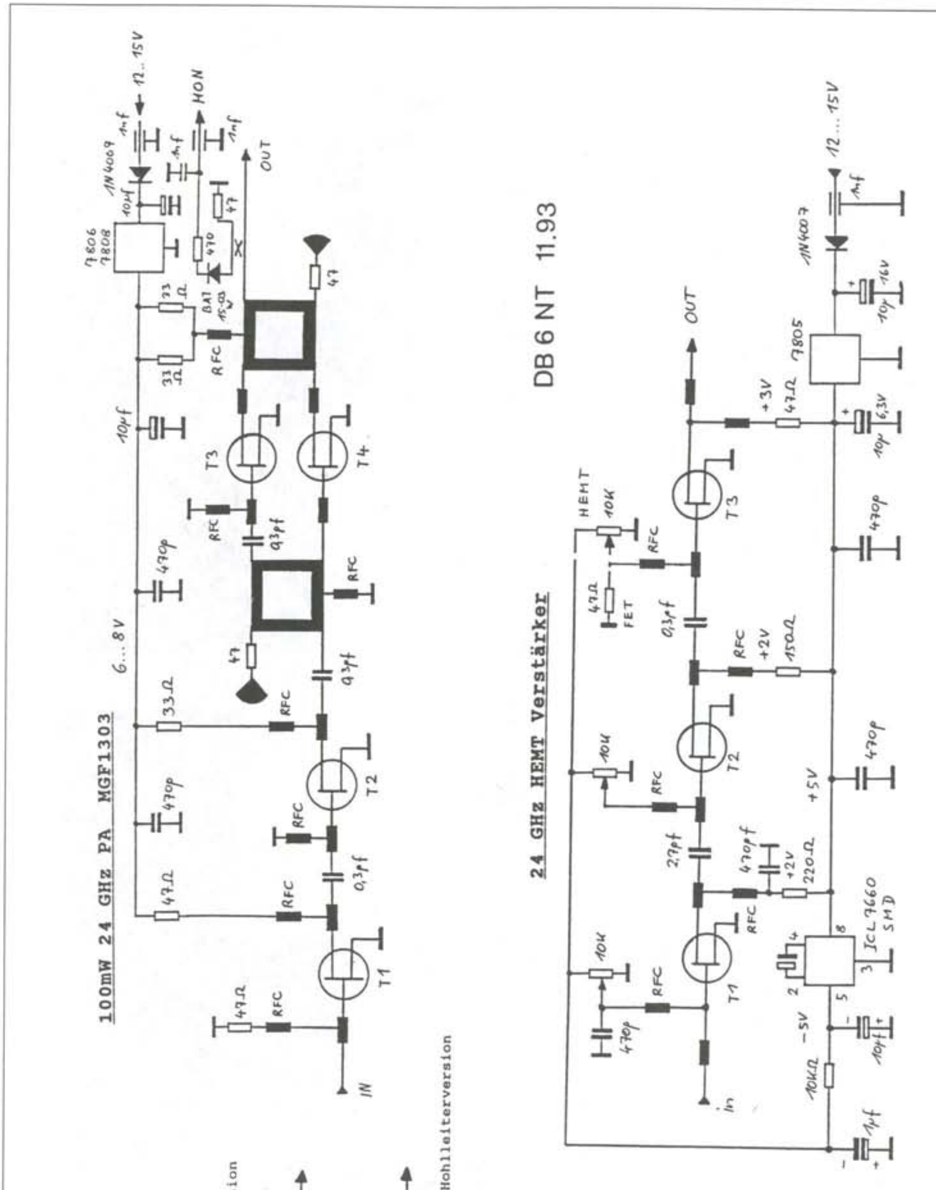
This module is tunable from 22 to 25.5GHz. To achieve 100mW output power a selection has to be made for the MGF-1303 FETs. An I_{DSS} is appropriate. The power amplifier has a 8V supply. The doubler gets 6V by menas of a dropping resistor.

Bild/Figure 3: 24GHz PA mit MGF1303 in Hohlleiter



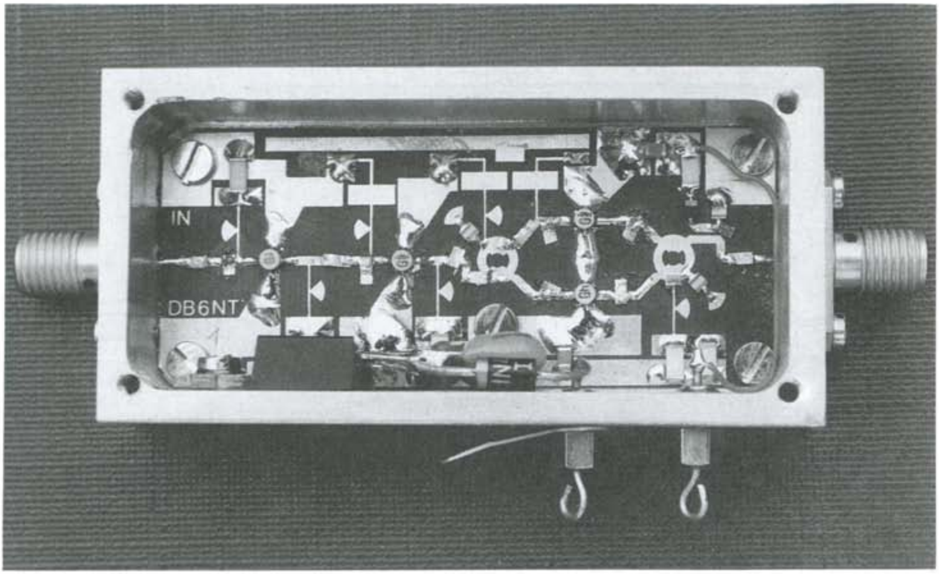


Bild/Figure 4: 24GHz PA mit MGF1303 in Hohlleiter



Bild/Figure 5: Circuit Diagram/Schaltung für 24GHz Amps

Bild/Figure 6: 24GHz PA mit MGF1303 in Koax



Adjustment

After mounting the doubler PCB the doubler circuit is driven by a 20mW 12 GHz source. The output signal is measured after the waveguide highpass. Small tuning tabs are used for optimisation. A power of 10...20mW is practical.

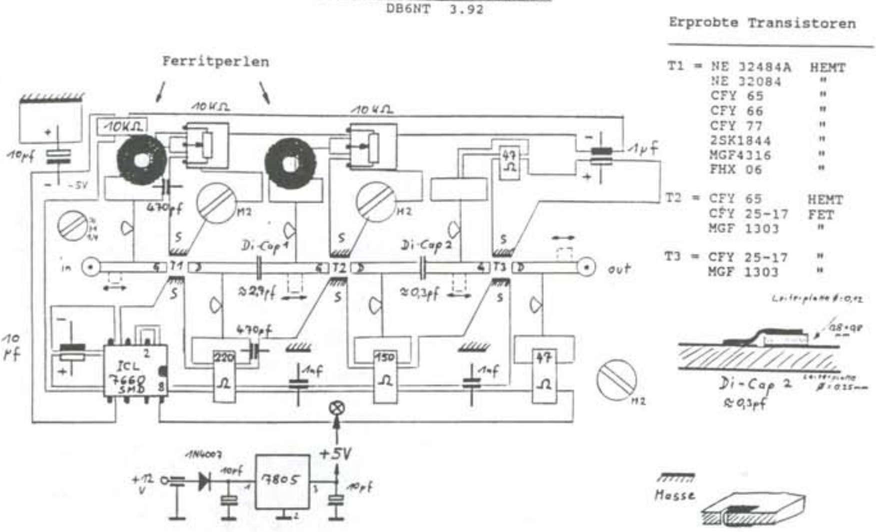
Now the amplifier board is mounted and can be tuned - see chapter in description of the PA-module.

2. 24 GHz PA mit MGF1303

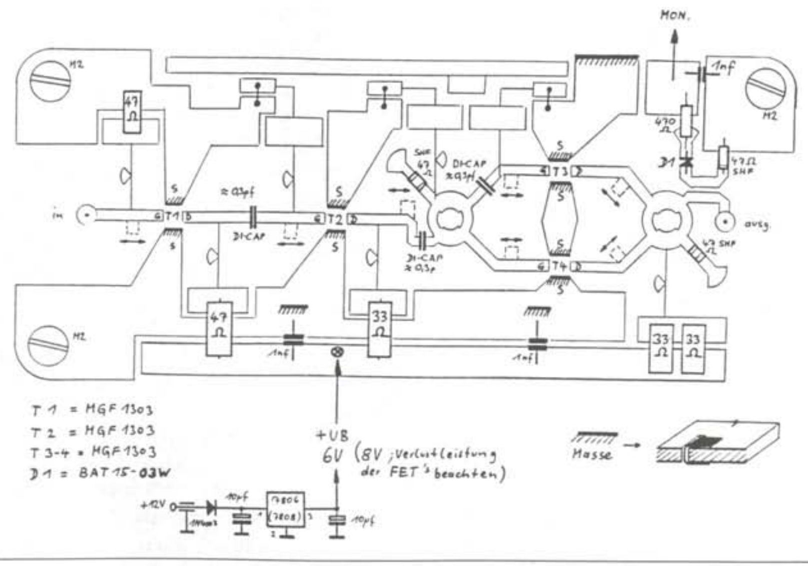
Bilder 3, 4, 5, 6, 7 und 8.

1. Als Koppelkondensatoren zwischen den Stufen werden "di-cap" C's eingesetzt. C = 0.2-0.5 pF. Hersteller: DLI, USA. Oder Eigenbau aus 0.12 Teflonleiterplattenstücken.
2. Die vollbestückte Leiterplatte sollte vor dem Einbau in das Gehäuse mit Spiritus abgewaschen werden.
3. Die Montage erfolgt durch 5 Stück M2-Schrauben.
4. Vor dem Anschrauben der Leiterplatte sollte diese gerade ausgerichtet werden, um eine plane Montage zu gewährleisten. Auf der Unterseite der Platine wird der Mittelteil mit Wärmeleitpaste (Wärmeableitung), die Ein- und Auskoppelseiten mit Sekundenkleber bestrichen. Dieser Arbeitsgang muß sehr schnell erfolgen, da der Kleber schnell trocknet. Durch zusätzliches Andrücken der Leiterplatte nach dem Festschrauben wird ein optimaler Sitz erreicht. Die Hohlleitereinkopplung wird mit UT 085 (abgemanteltes SEMI-REGID Kabel) 1,7mm ∅ realisiert. Einkoppeltiefe ca. 2,2 mm. Der Abstand zur Rückwand ergibt sich aus den Abmessungen der Leiterplatte sowie den Ausfräsungen im Gehäuse. Bei Verwendung der Leiterplatte mit Koaxanschlüssen sind zusätzlich Koppelkondensatoren zu bestücken. Es sollten MICROSTRIP-Buchsen verwendet werden.
5. Es ist eine Verstärkung von über 16 dB und eine Sättigungsleistung von 60 mW zu erwarten. Bei einer Betriebsspannung von 8V können 100 mW erreicht werden. Verlustleistung der FET's beachten! In der Endstufe sind MGF 1303 mit großem Drainstrom 45 mA zu verwenden. Ausmessen! - siehe DUBUS Heft 1/88, Seite 8, Fig. 11.
6. Der Richtkoppler am Ausgang der Schaltung wird mit einer SMD-Diode BAT 15-03W (Sie-

24 GHz - HEMT - Verstärker
DB6NT 3.92



24 GHz - PA - Verstärker - MGF 1303
DB6NT 3.92

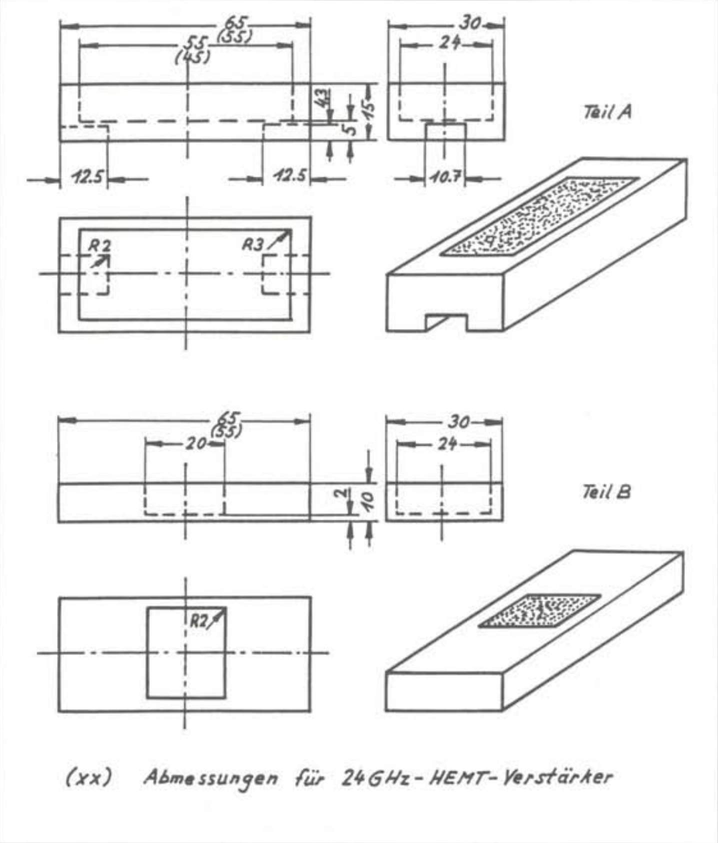


Bild/Figure 7: Parts Layout für 24GHz Verstärker

mens) bestückt. Die Diode wird "Überkopf" eingelötet, um keine Gehäuseinduktivitäten zu erhalten. Ausgangsspannung ca. 250 mV - Evtl. Verstärker.

7. Die 47-50 OHM Widerstände an den Kopplern sind kleine SHF-Typen von Firma Rohrer GmbH München Tel. 089/2016960
8. Der Aufbau von 24 GHz Verstärkern erfordert viel SHF-Erfahrung und Geduld. Jedes "dB" muß sich durch "Fähnchen schieben" und Einbringen von MOS-Schaumstoff sowie Kupferstreifen geholt werden!
9. Es gelten die Baubeschreibungen in DUBUS Heft 1/88 sowie Dorsten 1988, Weinheim 1992, Dorsten 1993, DC0DA.

Bild/Figure 8: 24GHz PA, Gehäuse



2. 24GHz Power-Amplifier

Figures 3 , 4, 5, 6, 7 and 8.

1. Coupling caps between stages are dicap (0.2...0.5pf) from DLI, USA. Probably home-made caps made from small pieces of substrate material wikll work also.
2. Clean finished PCB before mounting with alcohol.
3. Use 5 pcs of M2 screws for fastening.
4. Flatten PCB before mounting. Use thermal compound for the middle part and cyanacrylate glue for the ends. Mount PCB fast enough and press tight before screwing. Waveguide coupler is made from UT-085 semirigid. Depth of probe is about 2.2mm. The distance to the back is defined by the PCB and the machined nuts in the box. If you use connectors you have to mount additional coupling caps and to take special microstrip SMS-connectors.
5. You can expect about 16dB of gain and 60mW output power. With a supply voltage of 8V 100mW output power can be achieved, but FETs are running at their dissipation limit. Select only FETs with an I_{DSS} > 45mA - see DUBUS 1/88, p.8, Fig. 11.
6. The directional coupler at the output feeds a power detector with an Siemens BAT15-03W SMD-diode. Mount the diode 'overhead' to

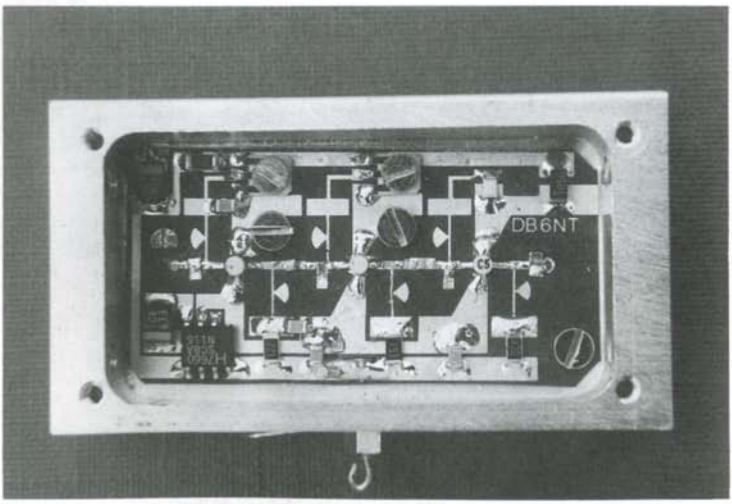
minimize parasitics. Output voltage is about 250mV.

7. 50Ω resistors at the couplers are small SHF-types from Rohrer, Munich, Tel.089/ 2016960.
8. The construction of 24GHz amplifiers requires patience and some experience. Each 'dB' or mW has to be 'squeezed' by positioning tuning tabs or absorber material!
9. For further details look at the descriptions in DUBUS 1/88 or DUBUS TECHNIKIII, p. 343-359.

3. 24GHz HEMT-Verstärker

Bilder 5, 7, 9 und 11.

1. Die Leiterplatte ist mit einem Spannungsinverter ICL7660 in SMD ausgerüstet, um die HEMT-Transistoren mit einer negativen Gatevorspannung zu versorgen. Für alle Stufen sind SMD-Potis vorgesehen. Die Platine ist mit FLR 016/026 FUJITSU Power-Transistoren auch als Leistungsverstärker einsetzbar.
2. Als Koppelkondensatoren zwischen den Stufen werden "di-cap" C's eingesetzt. C2= 0.2-0.5 pF C1=2,7pF Hersteller: DLI, USA. Oder Eigenbau aus 0.12 Teflonleiterplattenstücken. (Evtl. 2,7pF Bauform 0603)
3. Die vollbestückte Leiterplatte sollte vor dem Einbau in das Gehäuse mit Spiritus abgewaschen werden.
4. Die Montage erfolgt durch 3 Stck M2-Schrauben und eine M1,4 Schraube am Einkoppelpunkt der Leiterplatte.
5. Vor dem Anschrauben der Leiterplatte sollte diese gerade ausgerichtet werden, um eine plane Montage zu gewährleisten. Auf der Unterseite der Platine wird der Mittelteil mit Wärmeleitpaste, die Ein- und Auskoppelseiten mit Sekundenkleber bestreichen. Dieser Arbeitsgang muß sehr schnell erfolgen, da der Kleber schnell trocknet. Durch zusätzliches Andrücken der Leiterplatte nach dem Festschrauben wird ein optimaler Sitz erreicht. Die Hohlleitereinkopplung wird mit UT 085 (abgemanteltes SEMI-RIGID Kabel) mit 1,7mmØ realisiert. Einkoppeltiefe ca. 2,2 mm. Der Abstand zur Rückwand ergibt sich aus den Abmessungen der Leiterplatte sowie den Ausfräsungen im Gehäuse. Bei Verwendung der Leiterplatte mit Koaxanschlüssen sind zusätzlich Koppelkondensatoren zu bestücken. Es sollten MICROSTRIP-Buchsen verwendet werden.
6. Durch die hohe Verstärkung der HEMT's ist eine Schwingneigung zu erwarten. Diese kann



Bild/Figure 9: 24GHz HEMT Verstärker in Hohlleiter

durch Einkleben von Ferritperlen und anderen Dämpfungsstoffen beseitigt werden.

7. Der Aufbau von 24 GHz Verstärkern erfordert viel SHF Erfahrung und Geduld. Jedes "dB" muß sich durch "Fähnchen schieben" und Einbringen von MOS-Schaumstoff sowie Kupferstreifen geholt werden!
8. Es ist eine Verstärkung von über 20 dB und eine Rauschzahl kleiner 5dB zu erwarten. Mit NE326/324 wurden Rauschzahlen von <3dB erreicht.
9. Es gelten die Baubeschreibungen in DUBUS Heft 1.88 sowie Dorsten 1988 --- Weinheim 1992 ---Dorsten 1993 DC 0 DA.

3. 24 GHz HEMT-Amplifier

Figures 5, 7, 9 and 10.

1. An ICL7660 voltage inverter supplies the negative gate voltage for the HEMTs. You can use FLR016/026 in this PCB for application as a power amplifier.
2. Coupling caps between stages are dicap (0.2...0.5pf) from DLI, USA. Probably home-made caps made from small pieces of substrate material wikll work also.
3. Clean finished PCB before mounting with alcohol.
4. Use 3 pieces M3 screw and one M1.4 at the input for mounting the PCB into the box.
5. Flatten PCB before mounting. Use thermal compound for the middle part and cyanacrylate glue for the ends. Mount PCB fast enough and press tight before screwing. Waveguide coupler is made from UT-085 semirigid. Depth of probe is about 2.2mm. The distance to the back is defined by the PCB and the machined nuts in the box. If you use connectors you have to mount additional coupling caps and to take special microstrip SMS-connectors.
6. There is some tendancy for oscillation because of the high gain of the HEMTs. Use ferrite beads and absorber material to dampen these oscillations.
7. The construction of 24GHz amplifiers requires patience and some experience. Each 'dB' or mW has to be 'squeezed' by positioning tuning tabs or absorber material!
8. A gain of 20dB and a noise figure of less than 5dB can be achieved. With NE326/324 noise figures of <3dB were achieved.

4. 23,5 auf 47GHz Verdoppler

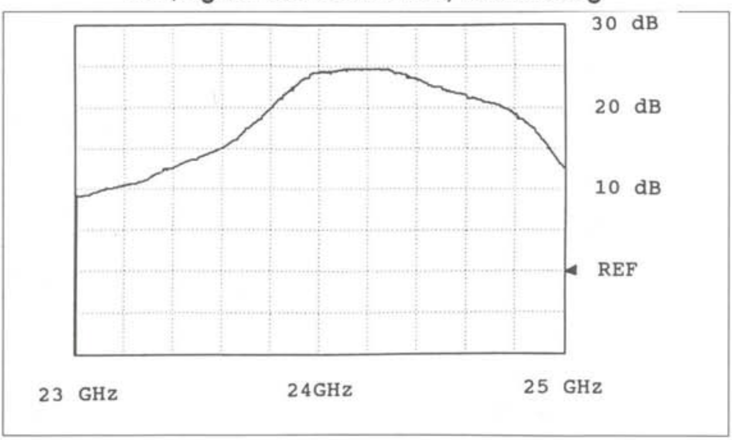
Bilder 11, 12 und 13.

Der Diodenverdoppler (Bild 11) arbeitet mit Schottky- oder Varaktordioden im Beamlead-Gehäuse. Die Schaltung ist in einem Alugehäuse (Bild 12) eingebaut und besteht im wesentlichen aus einer Leiterplatte (RT/duroid 5870 mit 0.125mm Stärke) sowie einer im Gehäuse eingebrachten 4mm Bohrung, die einen Rundhohlleiter bildet.

Bei einer Ansteuerung von 100mW auf 23,5GHz konnte unter Verwendung von zwei parallel geschalteten HP Dioden HSCH-5312 (Bild 13) eine Ausgangsleistung von mehr als 5mW gemessen werden (R_A ~ 100Ω).

Mit der Varaktordiode A92220-5 (GaAs) der russischen Firma ELECS Ltd. konnten mehr als 12mW erreicht werden (R_A ~ 5k).

Bild/Figure 10: 24GHz HEMT, Verstärkung



Anmerkungen:

1. Die Leiterplatte sollte mit Silberleitkleber und vier M2 Schrauben in das Gehäuse montiert werden.
2. Aufbauhinweise in DUBUS 2/92, S. 2 bis 14 beachten

Abgleich

Mit angeschlossenem Leistungsmesser wird nach Anlegen der Steuerleistung auf 23,5GHz die Ausgangsleistung durch Veränderung von R_A sowie durch Anbringen von Abstimmfähnchen optimiert. Mit dem Kurzschlußschieber (M5 Schraube) kann die Anpassung auf den Hohlleiter eingestellt werden.

4. Doubler 23,5->47GHz

Figures 11, 12 and 13.

The doubler (Fig. 8) uses beamlead-diodes. The circuit on a PCB is mounted into a aluminum box (Fig. 9).

With 100mW drive power on 23.5GHz you can get more than 5mW on 47GHz with two times HSCH-5312 (Fig. 10) diodes in parallel (R_A ~ 100Ω).

With a Russian varactor A92220-5 from ELECS Ltd. more than 12mW can be achieved (R_A ~ 5k).

Remarks:

1. Mount PCB with silver adhesive and four M2 screws into box
2. Look for hints in DUBUS 2/92

Adjustment:

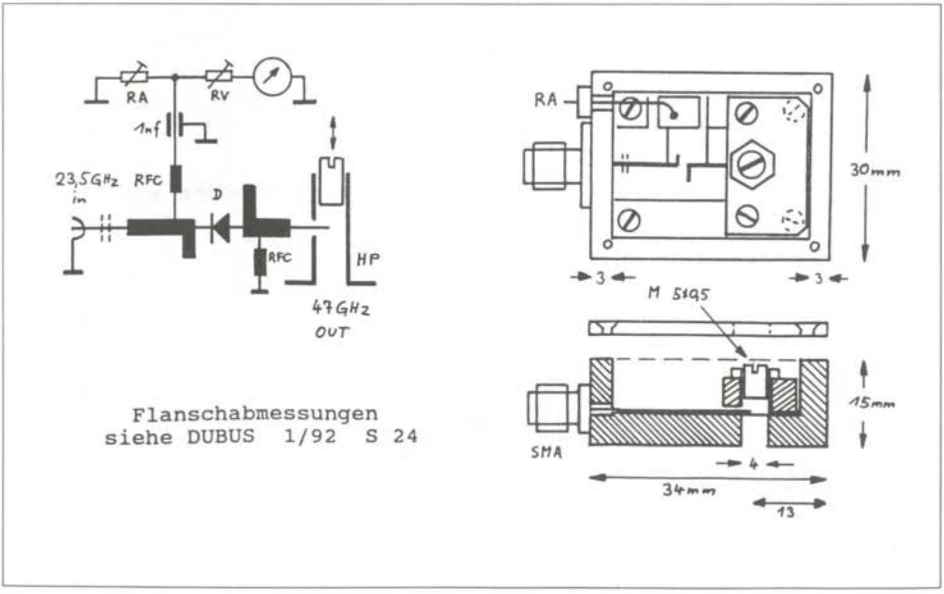
Connect powermeter to 47GHz output and tune for maximum power by adjusting R_A and by means of tuning stubs. The shorting glider can be adjusted for best match.

5. Teile:

Leiterplatten für Koax- oder Hohlleiteraufbau sind bei DB6NT Michael Kuhne, Birkenweg 15, D-95119 NAILA erhältlich. Alugehäuse sowie Hohlleiterkomponenten sind bei DG1KBF, Hubert Krause, Berghagen 60, D-53773 HENNEF erhältlich.

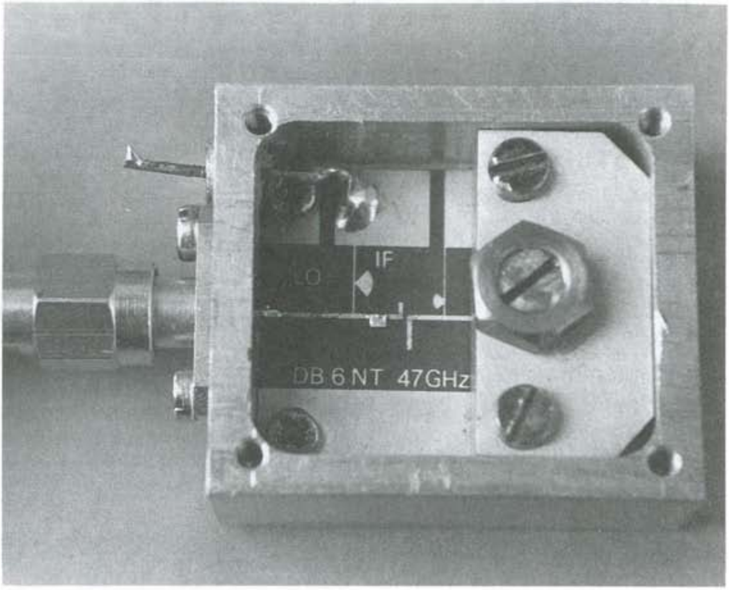
5. Parts:

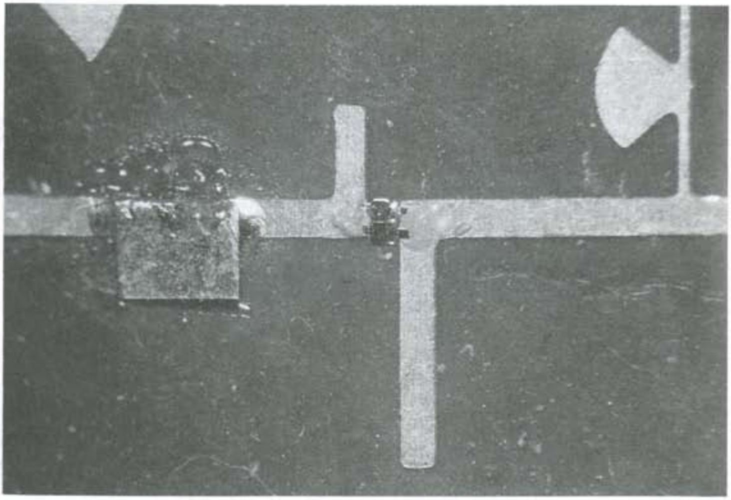
You can get PCBs at DB 6 NT Michael Kuhne, Birkenweg 15, D-95119 NAILA. Machined boxes and waveguide components you can get at DG1KBF, Hubert Krause, Berghagen 60, D-53773 HENNEF.



Bild/Figure 11: Frequenzverdoppler 23,5 -> 47GHz - Diagram

Bild/Figure 12: Frequenzverdoppler 23,5 -> 47GHz





Bild/Figure 13: Einbau der HSCH-5312 Dioden

Microwave News

Editor: John Sørensen, OZ1IPU

1296 MHz:

DG6LAE JO44MO wkd: 05.06.93 DB6BX JO32OK, ON5OF/P JO30AM, G3LQR JO02QF, G4DEZ JO01IN, PA3FXV JO23VE, PE1ODY JO23JB, PI4ZOD/P JO32LT, G0JBA JO01II, PI4DHV/P JO33GB, GOJDL JO02UL, PA3API/P JO32BW, PA3FHY JO21WW, DB1BX JO32OT, PI4ZI/P JO32EG, PA0BAT JO31FX, PA0JUS JO22OO, PE1AIL JO22EE, G3ZEZ JO01NT, G3XDY JO02OB, PE1JWV JO33JF. 06.06.93 G1HWY IO90UW, DJ3FI JO31DI, DG1KDA JO30FQ, DL0WX JO30FQ, DK2FT JO42KC, DK3RV JO31DI. TX: 75W, RX: O.5dB, ANT. 35elm. Tnx fer info Erhard.

PA0BAT JO31FX wkd: 04.02.93 F1HRY BI, FD1NXU IN97, F6APE IN97, FC1BJD JN08, F1FHI IN97, FC1HNF IN97, F1EAN JN06, F6CCH IN96. 05.02.93 FC1FYE/P JN08. Tnx fer info Gerard.

DC8UG DK59j wkd. from 30.10. to 01.11.93 F6APE IN97QI, F1EZQ JN27LS, F6ACA JN18JR, F6DKW BI12f, F6CTW BI12f, F1FYE/P JN08NK, F6HMQ JN18GP, F6GCT JN18NT, F1NWZ JN07WT, F1DBE JN07WE, F5FHI IN97GD, F6HPP/P JN19PG, F5DED/P JN18CS, F5DQK JN18CS, G3XDY JO02OB, F6CGB JN18FW, G3LQR JO02QF, G4BYV AM25c, G0BPU JO02OB, G6HKM JO01FT, G8LHT IN93JM, G6UWO IO92IV, G4NBR IO92VU, G4LOJ JO02QN, G4KIY IO92WN, G8EBM IO92FX, G3APY IO93JD, G8ZQB IO92JN, G8GXP IO93FQ. Tnx fer info Harald.

DB6NT/A - DK0NA JO50TI wkd: 26.10.93 OK1AIY/P JO70, OK2BFH JN99, HB9AMH/P JN37, PA3AWJ JO21, PA0BAT JO31, DG2NUD JO63, SP3RBF JO71. 28.10.93 GM4LBV IO75, OZ7IS JO65, SM6EAN JO57, OE3EFS/3 JN78, OE3JPC JN88, 9A2SB JN95, OK2BFH JN99, SM7ECM JO65, SM6MUY JO67, OZ2TG JO65, OZ1IPU JO57, LA6VBA JO48, OZ1DOQ JO65. 29.10.93 OZ9ZI JO65. 31.10.93 HB9SNR JN36, HA2RD, F5DED JN18, F6CGB JN18, F6APE IN97, F5GCT JN18, F6ACA JN18, F5NWZ JN07, F2AI JN18, F6HPP JN19, F1JGP JN17. 01.11.93 F1EZQ JN27, F6CTW DI12f, F6FLV JN18, F1DPX IN97, F6CBH JN19, PAOEZ JO22. Tnx fer info Michael.

DG0CR JO50XL wkd: 26.10.93 OK2BFH JN99. 27.10.93 OK1AIY/P JO70, HB9AMH/P JN37, HB9MIO/P JN37, DK1KR JO53, DL5KVD JO64, OK2BLE JN99. 28.10.93 OZ7IS JO65, OZ2TG JO65, SM6EAN JO57, SM6ESG JO67, SM6FHZ JO57, OZ1IPU JO57, OZ2OE JO45, SM7ECM JO65, OZ1DOQ JO65, SM6MUY JO67, DL5KVA JO64. 29.10.93 OZ9ZI JO65, OZ1HDA JO47, SM6FHZ JO57, SM7SCJ JO65, SP2NJI JO92, DC5UW JO44, SM6EAN JO57. 31.10.93 F5FHI IN97, F5DQK JN18, F5DED JN18, F6GCT JN18, F6ACA JN18, F1DBE JN09. TX: 60W, ANT. 1,5m Dish. Tnx fer info Bernd.

DL3YEE JO42GE wkd: 17.05.92 GJ4ICD IN89. 31.05.92 F8ZW/P JN38, F6HPP/P JN19. 17.06.92 G4ZFJ JO01. 29.06.92 DK9MN JN58. 03.07.92 LA1T. 19.07.92 HB9AMH/P JN37. 20.07.92 DD7MH JN68. 27.07.92 DK9MN JN68. 16.09.92 HB9AMH/P JN37, HB9ASP JN36. 17.09.92 DK7NT JN57, DK0OG JN69. 03.10.92 HB9AMH/P. 08.10.92 SP2DDV JO93, OK1VEI JO70, SP6GWB/P JO80, OK1AIY/P JO70. 06.11.92 FC1EZQ JN27. 25.12.92 SM7ECM JO65. 26.12.92 FC1DBE JN09, F6APE IN97, F6CCH IN96, F6ETZ IN97, GJ4ICD IN89.

DG0CR/p in JO50

PA0BAT

30.12.92 OZ1IPU JO57. 02.01.93 OZ1UM JO65. O3.01.93 DK9MN JN58. 02.02.93 OE5VHL JN68. 04.02.93 F1FHI IN97, F1DPX IN97, F6APE IN97, FE1DQK JN18, F1HRY JN18, F1EAN JN06. 16.05.93 F8ZW JN38. 05.06.93 DL0HRO/P JO74. 03.07.93 G4MRS/P JO02, G4JAR/P JO01. 04.07.93 G4IEV JO01, DL0UL/P JN48, G4HWA/P JO03, DK0PX JN48, DL1AS/P JN47. 17.07.93 F1DLJ/P JO10. 27.10.93 HB9AMH/P JN37. 31.10.93 F1EZQ JN27. 1.11.93 F6CGB JN18, F6DKW JN18, F6CBH JN19, G4RGK IO91, G3MEH IO91, G8NEY IO81, G4KGC IO92, G3UVR IO83. Tnx fer info Claus.

DG1VL JO61WC wkd: 27.10.93 DJ9HO JO50, OK1AIY JO70. 29.10.93 DK6AS JO52, OZ6HY JO45, DL0LH JO43, PE1JWV JO33, DL4EAU/P JO51, SK7QJ JO76, OZ1DOQ JO65, hrd. OZ8ZS JO55, OE3XUA JN77, OK1VEI JO70, DB6NT/A JO50, SP3RBF JO71, DK0OG JN68. Tnx fer info Henry.

G3XDY JO02OB wkd: 27.04.93 DC6LN JO43, DG4BR JO33, OZ6HY JO45, DC9XG JO43, DK4LP JO44, OZ6AQ JO44, DL8BDU JO43. 01.05.93 DF0RB JO51, DF0CI JO51, DC8VJ/P JO31, PI4GN JO33, DL0MI JO42, DL0UL/P JN48, PA6C JO33. 25.05.93 DL5BKK JO43, DC9XG JO43, DK1AQ JO43, DC4XH JO43. 04.06.93 OZ2OE JO45, LA8OJ JO28, OZ1IPU JO57, DL8BDU JO43. 05.06.93 DC4LZ JO44, DJ7JG JO43, DB1BX JO32, DG5LAE JO44, OZ6HY JO45. 06.06.93 DG4BR JO33. 30.06.93 LA8OJ JO28, LA8AK JO38, SM6EAN JO57. 02.10.93 DJ6JJ JO31, DL8KP JO31, DK1VC JO31, GJ7DNI/P IN89, DK2NH JO53, DF0OJ JO41, DL0UL/P JN48, DK0MU JO31. 03.10.93 DF0CI JO51. 20.10.93 GD4GNH IO74. 27.10.93 SM7ECM JO65, OK1AIY/P JO70 1005km. 28.10.93 DD8JN JO31. 29.10.93 HB9MIN/P JN37. 31.10.92 DC8UG JO30. 01.11.93 DL4EAU/P JO51, DK1PZ JO41. 02.11.93 DL1BKK JO43. 04.11.93 GD4GNH IO74. 05.11.93 DF1EQ JO31, DG4YFK JO31. 18.11.93 GD4GNH IO74, DJ6JJ JO31. Rig: FT736, PA 300W, MGF1400, 0,9dB NF, 4x23elm (8x23elm from 02.10.93). Tnx fer info John.

OK1AIY/P JO70SQ wkd: 27.10.93 DG0CR/P, DG0AU, DJ9HO, OE3EFS/3, DB6BX, DG1VL, DL1KDA, HB9MIO/P, OE5VRL/5, DF1OI, PA0RDY, G3XDY, G3LQR. 30.10.93 DL4EAU, DL1VAA. 31.10.93 HB9MIO/P, DJ9PC, DL6NAQ, DG0AU, DK3NAN, OK1DFC. TX: 20W, RX: 3SK97, 4x25elm loop yagi. Tnx fer info Pavel.

PA0WWM CM63g wkd: 30.06.93 LA8OJ CS09d. 03.07.93 G3ULT/P ZL34a. 04.07.93 DF0RB FL33b, DF0CI FL52g, GU4XUM/P YJ29b, G4JNT/P YK30e, HB9BA/P DH58d, HB9FX/P DH68h. 02.10.93 DF0CI FL52g. 01.11.93 DG9NBT EJ20e, DF6NA EJ20d, DG5NEX EJ20e, DJ9UN EJ19d, DL4EAU/P FL33b, DK0OG GI53b, OE5VRL/5 HI42j, G8XVJ YN48f, EI4AEB WN42b. Tnx fer info Wim.

OZ1IPU JO57GH wkd: 21.09.93 SM7THS/7 JO86, OZ1HTB JO75. 28.10.93 DG0CR/P JO50, DL2JDX JO60, DG0AU JO50, DG0CN JO60, OK1FFD/P JO60, OK1IBL JO60, DK2FT JO42, DL6NCI JO50, DB6NT/A JO50. 29.10.93 OK2BFH JN99, OK2AGE/P JO70, DG2NUD JO63, OK2BLE JN99, DL1KDA JO30.

2320 MHz:

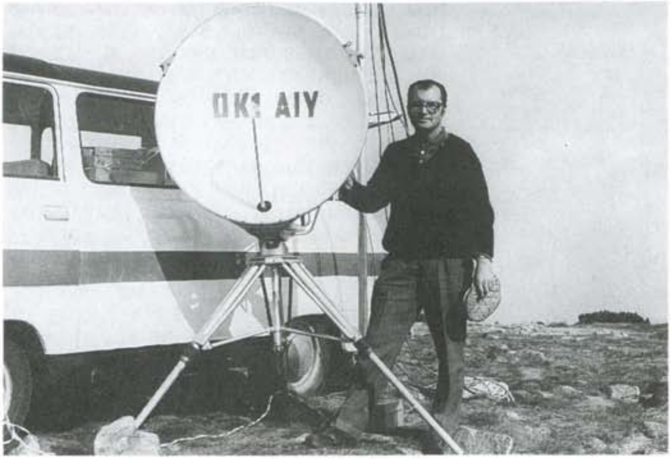
PA0BAT JO31FX wkd: 04.02.93 F6APE IN97, FC1BJD JN08, F1FHI IN97, FC1HNF IN97, F1EAN JN06. Tnx fer info Gerard.

DC8UG DK59j wkd. from 30.10. to 01.11.93 F6APE IN97, F5FHI IN97, F6CGB JN18, G0BPU JO02. TX: 40w, 1,5m Dish. Tnx fer info Harald.

DB6NT/A - DK0NA JO50TI wkd: 27.08.93 PA3AWJ JO21. 28.10.93 SM6ESG JO67, OE3EFS/3 JN78, SM7ECM JO65, OZ1IPU JO57, OZ1DOQ JO65. 31.10.93 F6APE IN97, F1FHI IN97, F1JGP JN17. 01.11.93 F1DPX IN97. Tnx fer info Michael.

DG0CR JO50XL wkd: 27.10.93 OK1AIY/P JO70, HB9MIO/P JN37, DK1KR JN53, DK2FT JO42, DL1SUN JO53. 28.10.93 OZ7IS JO65, SM6ESG JO67, DG2NUD JO63, OZ1IPU JO57, OZ2OE JO45, SM7ECM JO65, OZ1DOQ JO65. TX: 30W, 1,5m Dish. Tnx fer info Bernd.

DL3YEE JO42GE wkd: 08.10.92 DK0TU JO62. 29.11.92 PA0WMX JO21. 30.11.92 PA0WMX JO21. 04.12.92 F1FHI IN97, F6APE IN97. 12.05.93 DG5NEX JN49, DG9NBT



OK1AIY/p in JO70

JN49. 06.06.93 DG9NBT JN49. 03.07.93 PE0MAR/P JO21, PA0WMX JO21, OK1KIR/P JO60, ON7WR/P JO20. 04.07.93 DB8NU JO49, PA0EZ JO22. 07.07.93 DJ1KP JO40. Tnx fer info Claus.

OK1AIY/P JO70SQ wkd: 26.10.93 DK0NA. 27.10.93 DG0CR, DJ9HO, OE5VRL/5, DF1OI, PA0RDY. 30.10.93 DL4EAU. TX: 20W, RX: MGF 1400, 4x25elm loop yagi. Tnx fer info Pavel.

PA0WWM CM63g wkd: 04.07.93 DF0RB FL33b. 01.11.93 DG9NBT EJ20e, DG5NEX EJ20e, DL4EAU/P FL33b. Tnx fer info Wim.

OZ1IPU JO57GH wkd: 28.10.93 DG0CR/P JO50, DG0CN JO60, DL6NCI JO50, DB6NT/A JO50.

3400 MHz:

PA0BAT JO31FX wkd: 02.05.93 DF0SSB/P JO40. 04.07.93 DF0CI JO51, DL1BKK JO43. Tnx fer info Gerard.

DC8UG DK59j wkd. from 30.10 to 01.11.93 G3LQR JO02QF. TX: 10W, 1,5m Dish.

PA0WWM CM63g wkd: 04.07.93 PA0BAT DL03h. 01.11.93 DL4EAU/P FL33b. Tnx fer info Wim.

5760 MHz:

PA0BAT JO31FX wkd: 07.03.93 DL0OW JO41. 04.07.93 DF0CI JO51, DL1BKK JO43. Tnx fer info Gerard.

DB6NT/A - DK0NA JO50TI wkd: 27.10.93 HB9MIO/P JN37, PA0BAT JO31, OZ1IPU JO57. 31.10.93 OK1UWA/P JO70, OE3EFS/3 JN78. Tnx fer info Michael.

OK1AIY JO70SQ wkd: 31.10.93 HB9MIO/P. TX: 1W, RX: MGF1402, 75cm Dish. Tnx fer info Pavel.

PA0WWM CM63g wkd: 04.07.93 PA0WMX CL38d, PA0BAT DL03h. Tnx fer info Wim.

OZ1IPU JO57GH wkd: 17.08.93 LA2D JO48XX. 28.10.93 DB6NT/A JO50TI. 29.10.93 OK1UWA/P JO70UR odx. 805km, first OK-OZ.

10368 MHz:

PA0BAT JO31FX wkd: 07.03.93 DL0OW JO41. 02.05.93 DF0SSB/P JO40. 20.04.93 DL3YEE JO42. 06.06.93 ON5OF/P JO30. 04.07.93 ON7WR/A JO20, ON4CP/A JO20. Tnx fer info Gerard.

DC8UG DK59j wkd from 30.10. to 01.11.93 F6CGB JN18FW, F6DKW JN18CS, G3LQR JO02QF. Rig: 12W, 60cm Dish. Tnx fer info Harald.

DL5KVD JO64AD wkd: 02.10.93 OZ7UHF/P JO64. 19.10.93 SM7ECM JO65, OZ1DOQ JO65, OZ2TG JO65, DG2NUD JO63. Rig: 1W, 1m. Dish. Tnx fer info Manfred.

DB6NT/A - DK0NA JO50TI wkd: 25.10.93 DJ1KP JO44. 27.10.93 HB9MIO JN37, DF1OI JO42, OK1AIY/P JO70, HB9AMH JN37, PA0BAT JO31, DG2NUD JO63. 28.10.93 OE5VRL/5 JN79, DK9MN JN58, DH1SPJ JN48, F6CGB JN18, DC8EC/A JN57. Tnx fer info Michael.

F1GHB/P JN16LE wkd: 01.05.93 F1JGP/P JN15LS.

F1GHB/P JN17GL wkd: 06.06.93 F1JGP JN17CX.

F1GHB/P JN17FG wkd: 03.07.93 F1JGP JN17CX, 04.07.93 F1JGP JN17CX, F6DKW JN18CS.

F1GHB/P JN17HN wkd: 08.08.93 F1JGP JN17CX.

F1GHB/P JN15JO wkd: 21.08.93 F1EIT/P JN02XR, F1JPB/P IN93IH.

F1GHB/P JN15LE wkd: 22.08.93 F1JGP/P JN15JO. Rig: DB6NT TV, 1W OUT, RX: FHX35LG, 90cm Dish. Tnx fer info Eric.

PA0WWM CM63g wkd: 04.07.93 PA0BAT DL03h. Tnx fer info Wim.

OK1AIY/P JO70SQ wkd: 27.10.93 DK0NA, DL6NCI, OE5VRL/5, DK3UC. 31.10.93 HB9MIO/P JN37WA, first HB9-OK. TX: 160mW, RX: CFY18 and 75cm Dish. Tnx fer info Pavel.

DL3YEE JO42GE wkd: 24.03.93 DK1UV JO41CT. 17.04.93 DF9QX JO42HD. 18.04.93 DK3UC JO42WK.

DL3NQ's Rain Scatter QSOs*

22.07.93 DH1SBJ JN48, 155°/4,5°el. 81km, FS.
26.07.93 DK0NA JO50, 281°/6,5°el. 232km, BS.
30.07.93 DL3YEE JO42, 347°/18°el. 292km, SS.
08.08.93 DJ1RV JO40, 160°/8°el. 71km, BS.
16.08.93 DK4GD JN48, 182°/3,5°el. 177km, SS.
03.09.93 HB9RG JN47, 195°/0,4°el. 260km, FS.
09.09.93 DJ1RV JO40, 289°/1°el. 71km, SS.
10.09.93 DK1UV JO41, 125°/17°el. 252km, SS.
11.09.93 DH9FAH JO40, 125°/17°el. 65km, SS.
30.09.93 DC8UG JO30, 271°/0,7°el. 110km, SS.
30.09.93 PA0BAT JO31, 286°/0,7°el. 310km, SS.
02.10.93 DJ5HN/P JO40, 180°/4°el. 65km, BS.
02.10.93 DJ5BV JO30, 125°/10°el. 175km, BS.
02.10,93 DJ1KP JO40, 214°/2°el. 93km, BS.
02.10.93 DF0OG JO41, 220°/7°el. 269km, BS.
02.10.93 DL6NAQ/P JO40, 220°/7°el. 127km, BS.
03.10.93 DH1SBJ JN48, 176°/4°el. 81km, SS.
30.10.93 DK0PX JN48, 175°/4°el. 163km, FS.
03.10.93 DL/OE2BM/P JN48 159°/3,5°el. 98km, SS.
03.10.93 HB9RG JN47, 203°/0,3°el. 260km, SS.
09.10.93 LX1DU JN29, 289°/0,3°el. 196km, SS.
14.10.93 DC8UG JO30, 276°/0,3°el. 110km, SS.
*Date,Call,QTH,Azimuth,Elevation,QRB,Mode**
**Mode:

FS:	forwardscatter	Az:+-3° from QTF	El:<3°
SS:	sidescatter:	Az:+-90° from QTF	El:<40°
BS:	backscatter:	Az:>90° from QTF	El:<20°

19.04.93 DJ5BV JO30MR. 20.04.93 PA0BAT JO31FX, PA0EZ JO22OF. 21.04.93 DK0TU JO62PM. 01.05.93 DF0OG JO41PU, PE0MAR/P JO21BX, PA0PLY JO22GF, G4EZP JO01PU, PA0BAT JO22OF, DJ5BV JO30MR, PA0SQE JO21FW, PA0EHG JO22HB, PA0WWM JO22FE. 09.05.93 DK9MN JN58TC, DC3UC JO42WK, PA0BAT JO22OF, DC8VJ JO31TO, ON5UI JO11VB. 16.05.93 DK3UC JO42WK. 20.05.93 HB9RG JN47GF odx. 551km. DJ5BV JO30MR, DK3UC JO42WK. 21.05.93 DK3UC JO42WK. 22.05.93 DJ5BV JO30MR. 26.05.93 DJ9VS JN49GO. 05.06.93 DK1UV JO41CT, DC9KK JO30NT. 16.06.93 DC4BK JO43LA. 03.07.93 PE0MAR/P JO21BX. 04.07.93 PA0BAT JO31FX. 18.07.93 DG2YT/P JO42GH, DC1QH/P JO42GH. 25.07.93 DF0CI JO51CH, DK3UC JO42WK. 09.08.93 DK0NA JO50TI. 09.09.93 DC8VJ JO31UI. 04.10.93 DF6VB JO31QP, DK2UO JO33OR, DJ7FJ/P JN48CO. 02.11.93 ON5UI JO11VA. Tnx fer info Claus.

DL3NQ JN49IN: The sensitivity for the chances of rain-scatter on 10368 MHz is still underdeveloped at the majority of 3cm operators. In order to promote their feeling of that frequent useable phenomen, I add the following listing of RS-contacts during the last 3 month's (See box on the left). Tnx fer info Vollhardt.

OZ1IPU JO57GH wkd: 29.10.93 DL5KVD JO64AD.

24192 MHz:

OK1AIY/P JO70SQ wkd: OK1UFL 6km. TX: 5mW, RX: MGF1303 AND 75cm Dish. Tnx fer info Pavel.

145GHZ

Kent, WA5VJB, writes that the world record on 145GHz has been achieved by two stations from USA recently. As reported in Microwave Update 93, T.D. Williams, WA1MBA, and J:B. Mead, WB2BYW, achieved a QSO over a path of 3.75km at May 2nd, 1993, 22:30UTC. Reports have been 46S/43S. S stands for unstable tone. The rig consisted of commercial G-Band harmonic mixers from Hughes, driven by the 13th harmonic of a 11GHz LO. The estimated system parameters are:

Freq.:	145GHz
TX-Power:	1µW
Antenna:	18"(450mm) Dish/53dBi gain
RX-Noise Figure:	45dB
IF BW:	1.5 and 0.5kHz

Tnx for info, Kent.

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	29.V.1989	OE9PMJ/9-OE9YTV/9	0.3	30.IV.1992	DB6NT/p-Y24IN/p	38
145	12.VII.1992	DB6NT/p-DL1JIN/p	1	2.V.1993	WA1MBA-WB2BYW	3.6
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 correction, please write to:
John Sørensen, OZ1IPU, Rosenvej 49, DK-9300 Sæby, Denmark.

EME News

Editor: Bernd Wilde, DL7APV

Intro: 50 MHz EME from Italy, high scores at the ARRL contest, and full success from VE3ONT. The sked weekend calendar is included. The power limit of 100W in DL discussed by the telecom seems to be canceled. Because of qrl the address-list updates will be published next issue but earlier in the mailbox. Lot's of infos let no room for photos, next issue more will come.

50MHz

I5MXX: made his first 50MHz EME qso's from italy, he worked 14.08.93 W6JKV and K6QXY. Later he worked K6MYC, W5FF and K5FF. Frequency was 50.161 MHz with 1 minute period. rig : 4x9el 2λ K6MYC design homebrew stacked 8x7m with el and az control, about 18dBD. Marzio Moncini, Via del Melo 31, 51018 Pieve A Nievole, Italy. tnx fer info Marzio

VK3OT: wants EME skeds 50 MHz. He has a good window to Europe commencing November 20th at 1300z: I have skeds with OH2BC on 20 & 21 at1300z and 1330z. He is available for skeds or next few days 22/23/24/25 Nov from half an hour later each day until moonset. Dec 3/4/5/6 is good for me for US skeds. Note these details please: frequency Only 50.0535 the VK3SIX beacon channel which is shut down for skeds. Power 1KW only. Single 2.5 wl yagi 15dbi. soon to be upgraded. rx NF 0.6 db. rx sens -130dbm. Coax loss 0.25 db. Grid square QF12ag. fax +6155 712222 all hours. t/f +6155 723333 not in the middle of the night please 9like 3am). Packet at VK3SSS. AUS. OC. Please call with details asap. many tnx fer info Steve

IK8MKK (JN71dc): is looking for skeds starting from 01.01.94 he will be ready for EME. purposals pse via IK8MKK @ IW8DGA or IK8MKK @ IK8VRH. rig: single 2,5 λ yagi 15 dBi, rx : 1 dB, tx good power. VISCA Michele, V.LE LIBERTA 81 022 CASAGIOVE (CE) ITALY tnx fer info Mike

144 MHz

DK9ZY wkd new initials : 04.06.93 DL1KS r, DJ7OE r, 01.05. W9OEH r, 26.05. DJ5MN r, 28.05. DG1MHY r, 29.05. IK1FJI r, 30.05. SM0FFS r, 24.06. ZL1PE s, 26.06.IK1MTZ r, 24.07. IK2DDR r, 21.08. LA2AB r, 12.09. G4XBF r, OO4GG r, 09.10. S51WV r, SM5BSZ r, N5JHV r, JL1ZCG r, 10.10.PA3CEG r, VE3ONT r, DL1HYZ r, 11.10. DL2RSK s #134. mny tnx fer info Wolf Dietmar

DL2IAN wkd : 06.06.92 2200 - 2215 W5UN O/O, 3.10.93 1130 - 1150 KB8RQ O/O & 519/429. eu-loc EJ71a. rig: FT-726 R, 100 Watts, Ant: 2x17 Elem. F9FT full elevation. for further EME Skeds to DL2IAN@DB0GE.SAR.GER.EU, or to DL2IAN, Thomas Schenk, Hintergasse 9, D-76865 Rohrbach/Pfalzviele. tnx fer info Tom

DL3YEE wkd : at the ARRL 4x4. rig Yaesu FT221 400 Watt 2x17 ele F9FT. tnx fer info Klaus

DL7AKA reports that the qso with ON7EH last time published was not correct. Maybe next time. Hajo wkd since 10.03.93 OZ4MM, DK1KO, F6IRF, IW5AVM, LZ2US, OH7PI, HB9JAW, IK3MAC, UZ2FWA, AF9Y, SM4RNA, S57TW, W4ZD, DK9ZY, I4XCC, EA3DXU, IK1FJI, S51WV, JL1ZCG, SM5IOT, SM5BSZ, G3IMV, G4SWX, K1MNS; IK1MTZ, N5JHV, FR5DN #61. He wkd 25x16 (+ 8 compared to '92) at ARRL and found condition changeable and not much acvtivity from the states. tnx fer info Hajo

DL8DAT wkd : at ARRL 234x54 incl following initials S51WV, F5JTA, HL9UH, G4XBF, UN7TQ, UB5EQA, DL9MHG, N0XX, NT0V, JE1BMJ, JA9RNR, JA2JRJ, F5UM, VE1HD, DL6WT, W2HPF, G4HWA, SK7CA, LA3EQ, W1XR, DF6LO, KB2AH, ON4GG, RB5EZ, WE7P, UA1IMY, OE3XMS, DL3YEE; DL1YEL, G4WKN, S51ZO, VE3KDH, K2QE, EA8/ON5FF, WA4CHA, VE7BEE, NC7K, WA6YDI, N2IQU, G6CW/p, IK6MMJ, W8IDF, N0AKC, KA2KQM, HB9DLU, W9HLY, W2CRS, I3DLI, VE7KPE, UC2OEU, and after contest K2RTH/4, IK0RNL, 7K3LGC ?, WA9KRT, DL5DAT, UB5EQA, W9QXP, UT5ER fer # 952!!. Some highlights of the past '91 CN2JP, CX9BT, PJ7/W6JKV, FM5CS, CU3/N6AMG, '92 HK0/W6JKV, C53GS, FR5DN, FG/W6JKV, KP2A, '93 VP2MBM, J37AV, HL9UH, EA8/ON5FF; most of them first!. Many thanks fer info Manfred.

G0JLF/TF/p (IP42nk) wkd : 02.08. I2FAK, DL1MAJ, 04.08. DJ9CZ, PA0JMV, 06.08. G4SWX. tnx fer info G4DHF

HB9CRQ wkd : following initials in oct. DL6WT, G4XBF, PA3EPD, EA4ED, DK0JG, EA3BXA, K8BHZ, DL0UMK, IK2DDR, N0XX, EA2AGZ, G4RWA, DL2RMC, HL9UH, JA9BOH, DK5PD, VE3ONT, ON4GG, LA3EQ, SV3AAF/3, OM3KNY, KB5XW and in nov. DL9MHG, GD4IOM, EA8/ON5FF, UZ9CXM, VE7BEE, NC7K, DL4DTU, ON4ANT, WA4CHA, UB5EQS, UN2IQ, G6CW/p, HB9DLU, OH2BNH, W9QXP, DK6JU and DK3BU and last 08.11. VP5/ WA3HMK DXCC #93 and #587. He found condition unstable but better than in Oct. and lot of qrm from the marconi contest in europe. Dan had a score 165x48 for the ARRL.tnx fer info Dan

I2FAK wkd new initials so far : IK1SPR, EA2AGZ, DL4XX, VP2MBM, NC7K, KU8Y, DJ7OF, JK1HIX, JA8IAD, F6NAD, EA3EHQ, KA3WSZ, WE7P, WA2FUZ, G4HUP, OZ5IQ, KA2DRH (WAS), 9M2MK, VP2MR, UA3GCE, 9A1CCY, F1PUX,WA6EIW, DL2HWA, WB4BKC, OZ2GZ, DK5PD, IK5UBM, J37AV, DL6WT, K1FJM, DF6LO, WA8WZG, DL8OBU, UA3MAS, G4WKN, W9XA, HB9QQ,

REF EME CONTEST

- **1. Contest Dates&Periods**
  - The contest happens during two legs. Dates correspond to activity weekends* of March and April. Each leg begins at 00:00 UTC on saturday and ends at 24:00 UTC on sunday.
    *In 1994, these weekends will be **19/20 March** (1st Leg) and **16/17 April** (2nd Leg).
- **2. Bands**
  - First leg: 144MHz, 1296MHz. (19/20.III.1994)
  - Second leg: 432MHz, 2300MHz and above. (16/17.IV.1994)
- **3. Categories**
  - QRP 144MHz <100kW EIRP
    432MHz <300kW EIRP
    1296MHz <500kW EIRP
    2300MHz <900kW EIRP
    > 2300MHz no specific class
  - QRO EIRP greater or equal than stated above.
  - PRO Non amateur equipment or antenna
- **4. Exchange** TMO or RST
- **5. Scoring** 100 points for each **random** QSO completed
  10 points for each **sked** QSO completed
- **6. Multipliers** Each DXCC country per band worked by **RANDOM** .
- **7. Total per band** Sum of points multiplied by sum of multipliers.
- **8. Final score** Total sum of points multiplied by total sum of multipliers.
- **9. Classifying** Top score defines one winner total per band and one for multiband** class.
  ** Multiband stations will also be classified on each separate band worked.
  Multi operators and QRO stations will be highlighted in the general classification.
- **10. Reporting** Copy of the log for each band with details on points, multipliers and total points.
  The following information **must** be included: Output power, transmit cable loss, antenna type and gain. Working category: QRO/QRP, mono/multi operator, name(s) of operators. Other information is **welcome**: Comments, conditions, grid locator, station details, photographs, etc...
- **11. Awards** A certificate will be sent to each entry.
- **12. Posting** Entries must be postmarked no later than 30 days after the end of the second leg to the following address:

  RESEAU DES EMETTEURS FRANCAIS,
  (REF EME CONTEST), BP 2129
  F-37021 TOURS CEDEX

OH5LK, DL1KS, DK4XI, ON4ANT, G4XBF, K8BHZ, DJ5MN, AJ6T, DL2NWK, DJ5RE, DJ9YW, OZ6OL, LA3EQ, DK5MV, DL6YDH, DH0OAH, OZ9AAR, G4DHF/TF7/p and DF8LC #628. mny thanks fer info Franco

PA0JMV wkd : ARRL-EME contest results from a small 2-yagi station (2x16 el 4.2WL hb). 54x 29. Some 30 more (mostly small) stations have been heard but not worked. Conditions seemed very moderate to him, especially in the first weekend, after an Aurora. The second weekend showed lots of qrm from the Marconi-contest.The contest skedule with VP5/WA3HMK was not complete, but on Nov 8, I had a backupand in 12 minutes made a solid qso with him, including final "73", for DXCC #85 and initial station # 389. tnx fer info Joop,

VE3ONT EME Test : 1993 SummaryDuring the two weekends of the 1993 A.R.R.L. International EME Competition,the

EME-TOPLIST

Call	Small	SQ	DXCC	States	WASWAC
144MHz					
I2FAK	355	47	71	50	1993
HB9CRQ	333	48	78	49	--
DL3BWW	318	46	72	50	1992
UA9FAD	291	0	49	35	--
PA0JMV	251	44	64	50	1993
UA3TCF	145	0	30	0	--
IW5AVM	144	29	37	28	--
F6IRF	144	27	35	27	--
UZ3FWA	114	0	28	0	--
RA3YCR	109	0	33	24	--
F9HS	95	24	30	16	--
RA3LE	94	0	0	0	--
DK9ZY	89	23	24	16	--
PA2CHR	83	35	38	37	--
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	--
DJ4UF	40	12	20	2	--
DL7AKA	32	14	12	10	--
EA6VQ	30	12	13	0	--
DL7UTS	29	10	13	10	--
SP9EWU	23	12	12	8	--
IK5OIY	19	13	9	5	--
OK1KIR	14	9	8	5	--
UA3MAS	11	0	5	0	--
SP4DSC	5	2	3	10	--
DL7YW	4	4	3	2	--
DL3YEE	4	2	4	0	--
UA6LGH	2	0	1	0	--
DL8EBW	1	1	1	0	
432MHz					
DL9KR	321	46	72	50	1987
SM0PYP	290	40	50	42	--
SM3AKW	247	21	41	11	--
OK1KIR	214	38	55	43	--
DJ6MB	203	33	53	36	--
F1FHI	197	30	48	44	--
RA3YCR	187	0	46	33	--
DL3BWW	184	36	51	38	--
UA6LGH	163	0	38	0	--
UA9FAD	113	0	32	26	--
SP5CJT	94	24	28	26	--
OE9XXI	93	27	29	23	--
RA3LE	92	0	0	0	--
DL3YEE	86	22	31	15	--
T70A	85	20	20	--	--
DK0TU	81	25	32	18	--
CS1EME	73	18	21	--	--
PA3DZL	70	25	27	22	--
IW5AVM	57	17	22	9	--
EA6/DF5JJ	37	15	14	0	--
UA3TCF	30	0	11	0	--
UA9XEA	23	0	11	0	--
HB9CRQ	20	13	12	9	--
Y21TC	6	5	6	1	--
LA9BM	2	0	2	0	--
SP9EWU	1	1	1	0	--
1296MHz					
OE9XXI	121	24	31	20	--
SM0PYP	100	21	26	15	--
OK1KIR	90	24	28	17	--
OE9FKI	42	8	17	9	--
EA6/DF5JJ	14	0	10	0	
DF5JJ	13	0	7	0	
DL3YEE	9	6	6	1	--
F1FHI	1	1	1	0	--
2300MHz					
OE9XXI	32	11	14	8	--
OK1KIR	24	9	11	8	--
SM0PYP	21	9	11	7	--
OE9FKI	3	3	3	1	--
10368MHz					
OK1KIR	2	2	2	1	--

Toronto VHF Society used the **46-m (150') dish** at the Algonquin Radio Observatory. Here is a summary of their results:

- **Band QSOs Multipliers**
- **144 235 46**
- **432 246 41**
- **1296 79 29**
- **TOTAL 560 x 116= 6,496,000 points**

As a non-amateur antenna, VE3ONT's score should not be compared against that of other stations. The above listing represents one day each on 144 and 1296 MHz and 2 days on 432. The 432 score may be broken down to: (first day) 167 x 37 + (second day) 79 x 4 new ones. Equipment: 144 & 432 MHz 1KW, RHCP helix feeds; 1296 100 W, coffee-can feed with L/R switching. Power amps and transverters were mounted at the feed. Feeds were built by Bob Morton (VE3BFM) of Sinclabs Amateur Products Division. Preamps on 432 and 1296 were made by WD5AGO. Operators: VE2DFO, VE3ASO, VE3BFM, VE3CRU, VE3DSS, VE3EMS, VE3KDH, VE3VD, and W9IP. Conditions the first weekend were fair, deteriorating after 1700 UTC on Sunday. The second weekend, aurora-induced absorption was very bad. QSB made copying weak 432 MHz stations difficult. 23 cm echos were extremely loud; we could hear our own echos with < 1 watt output. However, activity declined to nearly zero after European moonset. They also listened extensively for the Mars Observer with no result, even using AF9Y's extraordinary DSP software. Equipment worked flawlessly the first weekend. During the second week-end, we had some equipment troubles at about 0900-1100 UTC on 432; at 0400 local time Saturday morning, VE3CRU and had W9IP the pleasure of going upin the 90' cherry-picker in wind and snow to fix the 432 MHz amplifier. A large number of EME stations insisted on duplicate QSOs, sometimes 3 or 4 dupes (!). Needless to say, this cut into our ability to work other stations even once. Please QSL to VE3ONT (1993 callbook address ONLY) or to VE3ASO, Dennis Mungham, R.R. 3, Mountain, Ontario K0E 1S0. Color photo-QSLs are being printed; expect a few weeks delay. Michael Owen W9IP (tired but happy) tnx fer info

ON7UC reports: after the loss of the complete antenne 2x10 el.cue dee and the tower in jan.1990 on7uc (ex on4aai ex on4aur) is back on 144 mhz eme qrp, beginning 06/03/1993 the new system: 2 x 16 elements klm lbx(jmv) full elevation, 4CX250R. wkd random 06.03.1993 DL8DAT O/O, HB9CRQ O/O, SM5FRH O/O, 30.05. K5GW O/539, 19.08. W5UN O/O and on sked: 15.08. PA0JMV O/O (2 YAGI-2 YAGI). hrd: LA8YB, IK3MAC, ON4GG, HB9JAW, I2FAK, SM5MIX, I5JUX, EA2LU, OK1MS, IK2EAD. tnx fer info JOHN

SM5FRH wkd at ARRL (*looks like 20m ed.*) 09./10.10 SM4NRA, SM2CEW, VK3AMZ, GM4JJJ, SM0FFS, SM5IOT, PA3CEG, OZ9AAR #, OH5IY, JA4KLX/1, OH9NMS, JA9EYI, F51JTA, F5UM #, IK1MTZ, UZ2FWA, S57TW, UN7TQ, SK7CA #, VE1BVL, SP5EFO, DK5PD, DL9MHG #, DLK9ZY, IW5AVM, DJ3WA, DJ7OF, LZ2US, S51WV, PA0JMV, IK1FJI, DL7MAT, DK0OG, DL2RMC, F6IRF, DL3SAS, SM2CKR, N1BUG, DL0UMK #, WA2GSX, N1GDP, PA2CHR, N8AM, FR5DN, K1GVM, K2TXB, DL5BCU, PA3EPD, KA5AIH, OE5JFL, IK0BZY, N3AJX, W0HP, K5GW, G3IMV, AA4FQ, K8BHZ, K9BCT, RB5AL, DF9YF, UT5EC #, G4SWX, EA4ED, SM6CMU, I1JTQ, LA9NEA, DL6WT, K2QE #, LA3EQ, WA8WZG, WA3HMK, DL3IAE, N5JHV, UB3EE, WA6PEV, UB5EQA #, PA3BUT #, ON7RB, G4XBF #, I1ANP, DL5RDO #, N0XX, DJ5RE, UC2OEU, LA1K, KU8Y, SM5BSZ, W7FN, DL3BWW, EA3EHQ, YU1IO #, IK2DDR, EA6VQ, 9A1CCY, ON4ANT, VE6TA, PE1DAB, EA2AGZ #, DJ9YW #, HA0HO, DJ5QX #, SM4HFI #,DH0OAH #, VE7BQH, WB4WTC, KB2AH #, I4XCC, W7HAH, LA8YB, JA4BLC, HA2RG, OE3JPC, ZL1PE, PA0CIS, OK2VMD, DL7AKA, PE1AGJ, DL6BCT #, DL6WH, VK2FLR, DG3BCU #, IK5UBM #, DF6LO, I5JUX, G0LBK, JA8IAD, I2FAK, OE5EYM, HB9CRQ, SV1AAF/3, DL2RSX, DL2HWA, JA9RNR, LZ2AR, EA3DXU, RB5AO, IK3MAC, UA9FAD, JE1BMJ #, DL8DAT, DL8OBU, OM3KMY #, EA8/ON5FF #, IV3VFP #, F1PUX, EA3KE, DL5DTA, VE1KG, ON4GG, IK0FEC, VE3ONT #, HA1YA, UA3GCE, SM7BAE, AF9Y, G4HWA #, DL6YDH #, W9-G4FDX, DK2FT #, YU7EW, AA7A, DJ9CZ, 9A2MK, LA8KV, K6AAW, W1XE, DL4DTU, K0RRY, W5UN, UA4AQL, W4ZD, K2GAL, K1MNS, G4WKN, LA1T#, WA6MGZ, WA7TDU, N7BNJ, WE7P, WA6EIW, W0RWH, I5YDI, OH6NVQ, EA2LU, K6HXW, ON5JBT #, 06./07.11 F5HRY, G3ZIG, GD4IOM, 9A1KCY #, IN3TWX, EA3ADW, JA9BOH, PA2GER, S51ZO #, RA9FMT, G3LTF, IK0RNL, HB9JAW, W9OEH, K0IFL, UZ9CXM #, W9HLY #, OH5LK, VE3KDH #, W2PGC, WA4CHA #, RA4YA, UA3DHC, DL6NAA, OE3UP, N6OC, VE7BEE #, WD5AGO, W8WVM, W7VXW, K1FJM #, N6OI #, NC7K #, WB0GGM, 9H1PA #, K9MRI, SM5MIX, KL7FB #, JL1ZCG, SM0PYP, OZ1HNE, GM4YXI, HL9UH #, OH2BNH, LZ1DP, IK6MMJ, RA3YCR, W8IDU #, DL1HYZ, RB5PA, PA3BZO, WB4BKC #, KA2KQM #, WB2OYC, W2CRS #, WA7KYM, DK5MV #, I3YXQ, VE7KPB #, HB9DLU #, KL7X, KE7CX, UT5ER #, WA6YDI #, KB8RQ, WA1JXN/7, WB5LBT. for 253x53x100=1340900p rig 24x18el, rx 0.35dB, tx QBL5/3500. tnx fer info Torbjörn

Lunar Weekend Calendar 1994

Date	Declination	Signals (dB)	Sun offset	Sky Temp [K] 144/432MHz	Comments
1/2. Jan *	+5	-0.3	-130	217/15	night
8/9. Jan	-21	-0.4	-40	700/60	moon in south
15/16. Jan	-6	-1.6	+30	280/24	moon in south
22/23. Jan	+21	-1.6	+130	442/32	night apogee
29/30. Jan *	-3	-0.1	-180	228/19	night
5/6. Febr	-21	-0.5	-60	1500/100	moon in south
12/13. Feb	+1	-1.8	+20	278/22	sun noise
19/20. Feb*	+21	-1.5	+115	477/35	day PM apogee
26/27. Feb	0	-0.2	-180	238/18	moon in south
5/6. March	-20	-0.5	-75	2800/140	moon in south
12/13. March	+5	-1.9	+16	SUN/24	sun noise
19/20. March*	+21	-1.5	+100	575/44	day PM
26/27. March	-4	-0.1	-180	265/21	moon in south
2/3. April	-19	-0.6	-100	1965/100	moon in south

The marked wekends are the sked weekends!

Lunar Weekend Calendar 1994

Date	Declination	Signals (dB)	Sun offset	Sky Temp [K] 144/432MHz	Comments
09/10. April	+7	-1.8	-11	SUN	sun noise
16/17. April*	+20	-1.4	+60	560/44	day PM
23/24. April	-7	-0.1	+160	322/24	moon in south
30/1.April/May	-17	-0.7	-120	835/50	moon in south
7/8. May	+10	-1.9	-23	310/25	sun noise
14/15. May *	+19	-1.3	+70	459/35	day PM
21/22. May	-9	0.0	-140	360/25	moon in south
28/29. May	-15	-0.9	-120	425/30	moon in south
4/5. June	+12	-1.9	-40	335/25	day AM apogee
11/12. June	+17	-1.2	+40	391/28	day PM
18/19. June	-12	0	-135	351/28	moon in south
25/26. June	-13	-1	-147	375/28	moon in south
2/3. July*	+14	-1.9	-60	355/27	day AM apogee
09/10. July	+15	-1.1	+20	230/19	sun noise
16/17. July	-15	-0	-120	385/28	moon in south
23/24. July	-11	-1	-180	375/27	moon in south
30/31 July *	+17	-1.9	-90	380/29	day AM apogee
06/07. Aug.	+13	-1	-5	SUN	sun noise
13/14. Aug.	-17	0	-85	440/31	moon in south
20/21. Aug.	-9	-1.1	+180	369/26	moon in south
27/28. Aug.	+18	-1.9	-115	410/29	day AM apogee
03/04. Sept. *	+10	-0.9	-24	210/15	sun noise
10/11. Sept.	-19	-0	-85	500/35	moon in south
17/18. Sept.	-6	-1.2	+160	325/25	moon in south
24/25. Sept.	+19	-1.9	-130	410/28	night apogee
01/02. Oct. *	+8	-0.8	-40	210/15	day AM
08/09. Oct.	-19	-0.03	+55	621/41	moon in south
15/16. Oct.	-2	-1.3	+130	280/22	moon in south
22/23. Oct.	+19	-1.8	-150	430/33	night apogee
29/30. Oct. *	+5	-0.7	-60	220/16	day AM
05/06.Nov.	-19	-0.01	+20	1100/39	moon in south
12/13. Nov.	+1	-1.4	+120	277/22	night
19/20. Nov.	+20	-1.8	-150	500/38	night apogee
26/27. Nov. *	+1	-0.6	-80	230/17	day AM
03/04. Dec.	-20	-0.1	+23	SUN	moon in south
10/11. Dec.	+3	-1.4	+100	275/23	day PM
17/18. Dec. *	+20	-1.8	-180	575/43	night apogee
24/25.Dec.	0	-0.5	-100	240/18	moon in south
31.Dec/01.Jan. 94	-19	-0.2	+7	SUN	moon in south

Sked weekends are marked with an asterisk. The September and October SWs will produce a conflict with the main European **VHF/UHF IARU** region 1 contests of the year. This conflict would be even harder, if the ARRL and/or their advisors in their infinite wisdom would chose 01/02 Oct. as the first leg of the ARRL EME contest. The choices should be **29/30 Oct. and 26/27 Nov.** as dates for the **ARRL EME** competition. Otherwise some European EMEers may argue that ARRL intentionally puts a bias to European stations by ignoring possible conflicts with the main IARU region1 contest dates.

UA3TCF wkd ARRL 10.10.93 on VE3ONT 559/529 #146, K5GW O/O. 73! de Alex

S59CAB (JN76jg) wkd: 15.08.93 K5GW O/O, 21.08. N5JHV O/O; hrd were AF9Y, UZ2FWA, K2GAL, IK3MAC, DL5MAE, W5UN, HA2RD, I3DLI and their own echoes. rig 4x15el Cue Dee, 2x4CX250B. tnx fer info

144 MHz News

NC7K (DM09ep) is a new station now QRV on 144Mhz EME, NC7K from N. NV. Station is 4 X 13 ELE DJ9BV design with full elevation. Single 4CX250B driven to 350W output by Kenwood TS-770 144/432 allmode. 4 NF Preamp. He is especially interested in skeds from Asia and the Pacific. requests send to him or to the EME net on 20 Meters and the EME BBS. Tnx fer info Tim

432 MHz

DJ6MB wkd: part 1 ARRL 78x31 including 8 initials : VE3ONT # 244, K0RZ # 245, 9M8WB # 246, DL7MAT # 247, S57QM # 248, F5MZN # 249, EA5CJ # 250, and KB2AH # 251.He found partly heavy faraday and could not copy his own echoes's. tnx fer info Uwe

DL3YEE wkd : at ARRL 4x4. rig IC475e 700 Watt 4x35 ele DJ9BV. tnx fer info Klaus

G0JLF/TF/p (IP42nk) wkd : 31.07. DL9KR, SM0PYP, OE5JFL, SM2CEW, 03.08. DL9KR, PA3CSG, 05.08. DL3BWW, 06.08. K1FO, N2IQU, 080.08. EA3UM, DL9NDD, UT5DL, G3LTF, AA4TJ, KD4LT, VE1ALQ, KB4WM, K5JL, N4GJV, K2UYH, W1ZX, DF3RU. tnx fer info G4DHF

IW5ABE (JN53ps) is a new station on 432 since jan '93.He worked 1/93 F1FHI, hrd SM4IVE, 3/93 SM0PYP, JA4BLC, K1FO, DL9KR, 5/93 KB4WM, AA4TJ, N4GJV, DL9NDD, PA3CSG, VK5MC nc, bad callsign, he mistakes IW5AVM, hrd JA2JRJ, 6/93 SM2CEW, UT5DL, G3LQR, hrd 7/93 OK1KIR, 8/93 KD4LT, IK6EIW, JA4BLC, 9/93 DL3BWW hrd VK3UM. Since some days Alex got his new callsign **IK5WJD** (see photo). rig 4x26el DJ9BV/i5tdj hb antennas, 8877 abt. 1KW hb -1,5dB cable, MGF1302 0,4dB. His adress Alessandro Giusti (Alex), Via Romanelli 54, 50011 Antella, Firenze-Italy. tel 0039.55.62.12.60. He likes to sked with VK stations. Many thanks for info ALEX

OH2DG reports : is QRT on 70cm EME because he had bad luck about 3 weeks ago. His 24m high tower with 16x21ele for 70cm, 4x36ele for 23cm and 1x15ele for 2m is smashed, now. Why ? Because the stay wide broke and the whole system came down! Nominal strength of the steel stay wide is 3000 kg, and static loading tension only about 50 kg. The problem was in the middle of the wide, so far away that local rust was invisible. It happened in the early morning - all the people were sleeping and nobody was hurt. The houses, trees and other things didn't get damaged, this was very good luck. tnx fer info Eino

OK1KIR wkd : initials EA3DXU, KB2AH, VE1BVL, DL6LAU, JA2KRW, and VE3ONT #286. tnx fer info Tonda

ON4KNG wkd ARRL 1 : DL3BWW, DL9KR, SM4IVE, F5FHI, OH2PO, SM0PYP, F1FEN, I2COR, DL9NDD, OE5JFL, SM2CEW, K1FO, VE3ONT, N2IQU, N4GJV, PA3CSG, K4QIF, KD4LT, F6CGJ, K0RZ, W7GBI; hrd: EA2LU, OZ1HNE, WA3FFC, KB4WM, W7HAH, DJ6MB. part2 : DJ6MB, F5MZN, G4RGK, G3SEK, KB4WM, K2UYH, ON5OF, EA3UM, UA6LGH, UT5DL for a total score of 31x14. rig : 4x11 λ OPT 9BV+ 150w from JO20du. tnx fer info Peter

UA3TCF wkd : DL9KR, DF3RU, SM4IVE, DK3BU, G3LQR, G3RRS, K2UYH, N4GJV, NC1I, YU1AW, OE5JFL, W3IWI, PA3CSG, W0RAP, K1FO, K5JL, FD1FHI, K4PKV, N7ART, KU4F, W7HAH, F1ELL, F1FEN, WA3FFC, SM3AKW, K4QIF, UA1ZCL, RB5LGX, OK1KIR???, SM0ERR and at ARRL 06.11.93 VE3ONT O/O #31, SM4IVE 529/529. Hrd: DL9KR, F5FHI, DJ6MB, OE5JFL, N4GJV. This is vy low result, because he had problems with preamp. 3 GaAs-FETs was break-down due to bad second coax relay. tnx fer info Alex

Netnews 432&up

IK6EIW will be qrv under IK6DZH/IS0 from Sardinia at ARRL contest. **DL6LAU** is a new station on 432, C. Esch; Postfach 2; 24233 Laboe; Germany. **SV0EC** is not QRV because of moving. His new adress : HARDY STEIN, VAS.GEORGIOU 58, 58300 KRIA-VRISSI/GIANNITSA, GREECE tnx fer info Hardy

1296MHz

AA6WI wkd: 09.10.OE9ERC, SM6CKU, SM4DHN, ZS6AXT, LA8LF, IN3HER, EA6/DF5JJ, G4CCH, F1ANH, K2UYH, SM2CEW, OE9XXI, KB2AH (#55), DL3YEE (#56), N2IQU, and VK5MC, 10.10. SM0PYP, K4QIF, F2TU, G3LTF, DL9EBL, WD5AGO, VE6TA, GW3XYW, IK3COJ, OE5JFL, VE4MA, WB5LUA, W0KJY, KN6DD, and WA4OFS. 06.11. I6QGA, F5PL (#57), EA3UM, LX1DB (#58), WB0TEM, GW3XYW (Dupe), F6CGJ, I2COR, W0RAP, and JH3EAO. CWNR were HB9BBD and HB9BM. 07.11. VE3ONT (#59), K9KFR, F5ELL, AA4TJ (#60), G3LQR, HB9BBD (#61), W7GBI, WA4NJP (#62), and JA4BLC (#63). The only "getaways" were HB9BM and SM3AKW. Contest totals are 49 X 25 on 23cm with 7 new initials. He needs QSL info for HB9BBD and F5PL. He had lots of fun this year since his previous tree blockage is a thing of the past! Highlights of the contest was finally working LX1DB (after three years of looking) and working HB9BBD on random after chasing him for two months!! Conditions seemed excellent the 2nd night of both contest weekends. tnx fer info Hoppy

DL3YEE wkd: in ARRL 4x4. rig FT290r 200 Watt 3,5 mtr Dish and test with 4x48 ele Yagi. tnx fer info Klaus

F5PL wkd : at ARRL 09/10.10.93 G3LTF O/O, SM6CKU 339/339, F1ANH O/O, SM4DHN O/O, LA8LF O/O, OE9XXI 54/55, ZS6AXT O/259, OE9ERC 56/55, I2COR 559/549, 06/07.11. I6QGA 549/449, ZS6AXT 459/O, DL9EBL 579/569, F1ANH 549/449, OE9ERC 569/559, SM4DHN 569/55, EA3UM 449/439, LA8LF 339/449, EA6/DF5JJ 439/O, AA6WI 45/449, OE9XXI 569/559, F2TU 459/549, SM0PYP 549/559, G4CCH 339/349, F5ELL 579/559, OE5JFL 579/569, SM0PYP 569/569, OZ7UHF 339/539, F6CGJ 559/549, VE3ONT 579/579, VE3ONT 56/55, K4QIF O/O, WD5AGO 549/449, N2IQU O/O, K9KFR 559/579, WB0TEM 559/559. He improved his station between part and two; now 270w at the feed and true circular polarisation. He changed his old RG214 to 28mm heliax, the sum of this improvements is ARRL part 2 and 6dB echoes now. tnx fer info Bertrand

LA8LF wkd: 11.12.92 F1ANH, OE9ERC, ZS6AXT, IN3HER, OE5JFL, OE9XXI, 12.12. SM2CEW, WB5LUA, SM6CKU, F1ANH, 14.08.93 AA6WI, 12.09. ZS6AXT, EA6/DF5JJ, AA6WI, WD5AGO, G3LTF, K2UYH, 09.10. F1ANH, SM4DHN, ZS6AXT, SM6CKU, F2TU, G3LTF, OE9XXI, OE9ERC, DL9EBL, EA6/DF5JJ, EA3UM, AA6WI; SM2CEW, K2UYH, N2IQU, 10.10. SM0PYP, IN3HER, OE5JFL, OK1KIR, I2COR, WD5AGO, GW3XYW, K4QIF, 30.10. OZ7UHF, 06.11. I6QGA, F5PL, OZ7UHF, WB0TEM, LX1DB, F6CGJ, 07.11. HB9SV, JH3EAO, F5ELL, OH2AXH, SM3AKW, VE3ONT; a total of 36 #, 53 qso incl. 49 random!!.He worked now on three bands OE5JFL, SM2CEW, G3LTF, HB9SV, SM3AKW and WB0TEM. rig 3.6m dish 0.38 f/D, TH388 300w VE4MA feed, 0.42dB preamp DJ9BV and fully computer controlled el/az rotors by EMEtrak from VK3UM. tnx fer info Anders

OE9XXI wkd: 14/15.08.93 AA6WI 44/55, OE9ERC 56/57, ZS6AXT, 44/55, F2TU 54/54, HB9BBD 449/579, SM0PYP 579/599, G3LTF 549/569, KN6DD 559/589, 18.08. HB9BHU 439/559 #126 (4m dish 80w lin pol.), 10.09. DJ7FJ 439/549 #127 (3m 100w lin. pol.),11./12.09. AA6WI 44/54, F1ANH 55/56, IK3COJ 43/53, OE9ERC 57/57, EA3UM 43/57, EA6/DF5JJ 44/45, IN3HER 54/54, ZS6AXT 44/55, OE5JFL 56/57, K2UYH 44/56, OH2AXH 43/57, KB2AH 549/599 43/58 #128, WD5AGO 54/56, 19.09. OE9HHV M/M #129 (1.4m dish 450w lin.pol.), at ARRL 37x22 new stations were VE6TA O/O #130, JA4BLC 449/579 33/55 #131, 16./18.10. OE3JPC M/O #132 (2-yagi 100w), OZ1IPU O/O #133 (2.2m dish 250w lin.pol.), and SM5QA O/O #134 (2 loop yagi 120w) tnx fer info Peter

OK1KIR wkd: in ARRL SM4DHN, OE9ERC, F2TU, LA8LF #98, ZS6AXT, DL9EBL, F1ANH, OE5JFL, EA6/DF5JJ, EA3UM, G3LTF, OE9XXI, G4CCH, SM2CEW, SM0PYP and IK3COJ, hrd were HB9BBD, IN3HER and JA4BLC. tnx fer info Tonda

DUBUS BBS:

DUBUS mailbox service information:

- **Tel.: (++ 49304557625)**
- **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**
- **Access as guest or registered user. You become a registered user after a few days when answering the questions for new users.**
- **Box-Operator: DL7APV or DL4EBY**
- **Software Maintainance: DL4EBY**

PE1DAB sends the sked database 2m&up from the K4PKV mailbox always in time (Every Monday) from stateside. mny tnx !!!

At the moment we have more than 50 users from DL, F, G, I, OE, ON, OZ, PA0, SM, and SP.

Last: A new 386-40 machine is operating the box and provides the high speed demanded by the 16800 Baud modem on the RS232 port.

2304/2320MHz

OE9XXI wkd : (2300) 14.08 EA3UM 549/339 #34 DXCC #14, OE9ERC 559/559, 09./10.10. 4x4 tnx fer info Peter

10 GHz

OK1KIR now is qrv on this band. The station consists of a 4m aluminium Rafena dish with f/D 0,35. The beam is 0.6° for -3dB. Circular feed from IEEE AP May 1973 designed and adjusted by Jarda OK1AHH. They have the LNA with waveguide input using an ATF35376 on first stage and NE67383 on secound stage. The LNA incl waveguide switch is mounted at the feedpoint of the dish. Sun noise is abt. 13.2dB, moon noise 1.5dB and CS/G 4.1dB. The power is 16W from a TWTA and they can copy their own echoes with "M". They worked 10.10. SM4DHN O/O #1, WA7CJO O/449 #2, hrd SM4DHN, G3WDG "M"and WA5VJB, G3WDG M/T. Many thanks to Vico I6ZAU, Charlie W7GBI, Kent WA5VJB, Jarda OK1AHH and Peter OE9PMJ for their help. tnx fer nice report Tonda

LAST: The station list wkd in ARRL from SM5FRH may not be interesting for everybody but will give an overview about who was qrv in the contest. What do you think about it? Not too much criticism is welcome! The new KD0GT EME address list for 432&up is on the Dubus BBS (an update has to be made as soon as possible by myself), as well as the SW calendar and a active station list of 10GHz amateurs in eu and more. Many stations reporting qrm at ARRL 2 because Marconi contest in europe. Because next year two sked weekends will be at the same time as the most popular VHF/UHF contests in europe, conflicts are already programmed. Is that a good choice?

73 Bernd DL7APV

Tropo News

Editor: Joachim Kraft, DL8HCZ

2m 2m 2m 2m 2m 2m 2m 2m 2m 2m 2m 2m 2m > 700 km

DH6JT, JO31JO / DL34b wkd:
28.10.93 GW4FRX IO82MR, GW0PZT IO72PT, G3HMJ JO01GR, GW3KJW IO72PT, G4RGK IO91ON, GD4XTT IO74TF, EI9HW IO63MP, G3NBQ IO83MW, G4ASR IO81MX, G4APA IO83TD.
29.10.93 GW8JLY/p IO81LS, GW3ZTH/p IO81FP, G6HKM JO01FT.
tks fr info, Thorsten

DJ8ES, JO43SX, wkd >700km:
05.09.93 HB9SUL/p JN47PH 741 km, F1AHO/P JN37NV 701 km, G8LNC/p IO90JO 820 km.
29.10.93 OK 2 BFH 59 59 JN99FN 784 km. 01.11.93 F6TNB JN18CS 770km.
tks fr info, Wolfgang

DK0ALK, JN48AB wkd:
04.09.1993 HA2KRD JN87WD 743, HG7B/P JN97KW 805, G8LNC/P IO90JO 726, G4VIX/P JO01PU 640, G0RDI/P JO01KJ 634, G4PIQ JO01MU 654, G7PBI JO02PD 661, G3WRS/P IO94MJ 941.
05.09.1993 HA1KYY JN87FI 634, OM3KRF JN88MK 667, S59DBC JN86DT 635, OK1FMJ JO80IB 669, GU4APA/P IN89VR 771, F6KBI/P IN88GN 851, G2XV/P JO02EC 707, TM7C/P IN99JP 698, G6WVG/P IO84VB 977, G5RS/P JO00EW 639, G4DSP/P JO03AD 798, DF0CB JO43VI 601.
heard: GW4BVY/P IO81NV 888, HG5FMV JN97KR 807, G4ERG/P, 9A1CCY, G6BRA/P, OM3RAL/P.
RIG: 80W, 2x7el. WX: was bad, foggy, electrostatic rain and +3 deg temperature. tks fr info, Mike

EA3KU, (OPs EA3TI, EA3AIR, EA3DJL, EA3KU, EA3CQQ) JN12IK, wkd:
04./05.09.93 HB9WNA JN37OB, F6APE IN97QI, F6BDJ/P JN16FI, F1CYB JN17XT, F6AUH IN97RL, IK2VOV JN45OL, IW2CEG JN45OM, F1DPX IN97DX, 9A1CCY JN85OO 1210KM, YU7AL JN95NS 1359KM, S57CC JN75FO 1002KM, I5SOI/5 JN53HH, DK0PX JN48JC 789KM, G8LNC IO90JO 956KM, F8KLW JO00TN 907KM, F6KBI IN88GN 833KM, GU4APA/P IN89VR 895KM, F6KFH JN39OC 819KM, F1MCQ/P JN19BC 743KM, F1RMK IN98OJ 716KM, IW3GML JN65BK 824KM, S65AW JN75DS 995KM, I3WWK JN55VR 812KM, IK3TPP JN65EP 850KM, IN3AYO/3 JN55NQ 763KM, I3EGD JN55OE 747KM, G4DSP/P JO03AD 1207KM, G4ERG/P IO94PH 1344KM, G5RS/P JO00ES 943KM, G4PIQ JO01MU 1055KM, GW4BVY IO81NV 1132KM, GW1VDF IO82JG 1180KM, G0RDI/P JO01KJ 1006KM, GI8TSI/P IO74AP 1497KM, GJ1TJP IN89XT 898KM, F1CVU JN09BN 817KM, F6CWV IN99SA 772KM, TM6C JO10BF 867KM, F5JDS JO10DB 848KM, G4SWX JO02PB 1075KM, G4XGT IO80HP 1024KM, GD4GNH IO74QD 1409KM, G8IWD IO80SQ 998KM, G4MRS JO02PB 1075KM, G7FDC IO80FI 1001KM, G8NSA IO80FP 1029KM, F1OOQ IN99EP 868KM, G0GMS IO91UB 986KM, GD8EXI IO74PC 1407KM, G4VIX/P JO01PU 1052KM, GW4LXO IO81JM 1104KM, GW4ZTH IO81FP 1127KM, G6MXL IO80XR 990KM, GW4HDF IO80JO 1014KM, GU3EJL IN89VR 985KM, G4ASR IO81MX 1143KM. (Total points: 107.695) tks fr info!

IK5FTQ/5 (FE64d) (50W, 13 Ele) 1800 m asl wkd >700km:
20.06.93 EA6SA BZ65j.
18.07.93 EB3DYS BB42g, EA3ARZ BB21e, EA3AND BB42g, EA3BBD BB32d, EB5IFI ZZ20a, EA5IC ZY09b, EA6MQ CZ02e, EA5YB ZZ79c, EA3FSD BB41e, EA3GAW BB51a.

IK5FTQ/5 (FE75c) 1300 m asl wkd:
09.07.93 EA3DXU BB32f.
07.08.93 EA3CBH/6 BZ26f, EA5YB ZZ79c, ED6SA BZ17d, EA5GIN ZY29d.
19.08.93 EA5YB ZZ79c, EA7GNO YW19e.

IK5FTQ/5 (FE76f) 1100 m asl wkd:
EA3AEG BB41e, EA3AND BB42g, EA5YB ZZ79c. grazie per info Roberto

IW5ACP (FD05c) wkd via Tropo on 144MHz >700km:
08.07.93 F3ANK ZE56a, FC1HSU BF41f. grazie per info Mauro

IW5AQC (FD25c) wkd via Tropo on 144MHz >700km:
17.05.93 EA3FLN BB76j.
22.05.93 EA6VQ BZ26f.
24.05.93 EA3AND BB42g. 17.07.93 EA6MR CZ02e, EA3ESD BB41e.
07.08.93 ED6SA BZ17d.
18.08.93 EB3ENW BB41j, EB3DYS BB22h, EA3BBD BB32c. grazie per info Luciano

IW5BVP (FD34j) wkd via Tropo on 144MHz:
27.6.93 EA3FSD BB41e, EA3ARR AA23c.
03.07.93 EA6VQ BZ26f.
08.07.93 F5MMF AE06j, F6ANQ ZE18g, FC1HSU BF41f.
15.07.93 EA5YB ZZ79c.
16.07.93 EA5IC ZY09b.
18.07.93 EA3FSD BB41e.
24.7.93 ED3IM BC77g.
30.07.93 EB5IFI ZZ20a.
04.09.93 9H1CBE HV61j. grazie per info Stefano

IW9CER, JM78QF, wkd:
22.05.93 EB6YO JM19NI.
23.05.93 FC1EBP/P JN13GK.
24.05.93 FD1SMZ JN23XB, EA6QB JM08QV.
26.05.93 FC1BAV JN33OQ.
01.06.93 EA6QB JM08, FC1SJP JN13VQ. 16.06.93 EA6VHF JM08 599 HRD.
17.06.93 9A2QS JN74OC. 27.06.93 9A1CCB JN74OC.
01.07.93 S53UAN JN65WW.
03.07.93 9A1HST JN75BA.
16.07.93 EA5/DB8JU/P IM98VX, EA5YB IM99VB, EA5IC IM98VX.
17.07.93 EA6FB JM08PV, EA5YBM EA5/DB8JU/P.
18.07.93 EA5DIT IM99CD, EA5YB, EA5GET IM97EK, EA5GRB IM98RJ, EA5IC IM98VX. tks fr info, Tony
19.07.93 EA5/DB8JU/P IM98, I1JTQ JN35UB, IK1TVR JN34QM, IK1ODO JN35SA, EA5YB IM99VB, EA5DVI IM98VX, F6BNX JN33KP.
25.07.93 EA5GET IM97EK, EA5HHF IM97EK. 18.09.93 IW1BCV JN44FS, IW1AZJ JN35UB.
Address for QSLs (not in CB): Tony Tringali, Via Siracusano 106, I-98040 Venetico Marina (Me), Italy

LA1T/P, (OPs: LA8KV, LA6VBA, LA5TIA, LA8AK, LA8AV, LA8ZQ, LA9UX, LA6LCA) JO37SX, wkd:
4./5.9.93 (CALL, LOC, KM)
DF2ZC JO30MK 840, DL3ALI/P JO50KO 849, PA3BZO JO21RS 704, G0RDI/P JO01KJ 848, PA3BPC/P JO21BX 702, DL2ARD/P JO50VQ 857, DK0VKG/P JO31HC 767, DL4NVC/p JO73CK 655, DL6ZBN/P JO40QO 829, DL7AKL JO62PM 708, DL0LN JO31RS 691, PA0LMD/P JO31BS 697, DL4OL/P JO52CK 640, DF0YY JO62GD 723, DK5OZ JO42WH 648, DL6FBL JO40XL 849, DF0RI JO42NC 662, OK1KIM JO60RN 910, DL0GC/P JO31BQ 706, G4DSP/P JO03AD 715, G2XV/P JO02EC 797, OK1KPU/P JO60VR 902, DL7UEK/P JO63IH 612, DK0MU JO31QX 668, DK2MN/P JO32OH 631, DK0YA/P JO31WM 719, DF0OL/P JO41GD 763, DK5DQ/P JO31PG 747, DK0SM/P JO42QH 641, DL8EBW JO31NF 752, DL5YBZ JO31OW 673, DF0OG JO41PU 691, G4PIQ JO01MU 798, PI4ZLD JO11WM 756, OO4CP/A JO20GT 821, G6CTU/P IO91XG 891, PA0JED JO22WA 672, DF0CI JO51CH 761, F6KBF/P JN09IT 1012, DL0WX JO30FQ 815, DK0BN/P JN39VX 891, F5RAB/ IN98VD 1209, DG0CAL JO52WO 658, DL8AAV JO52DH 654, G4ERG/P IO94PH 654, DL0JS/P JO62OK 714, DJ9MS JO42VI 642, DF0BT JO62QN 707, DG9BDS JO52JT 610, OT3E JO20AR 838, LX/PA3FPS JO30BB 886, DL0XS/P JO42QG 646, DL0ANT JO52GE 672, DL6ATI/P JO51EK 750, OK1KVK/P JO60JJ 910, DL0HBS/P JO51KW 705, DL0CQ JO30GX 782.
tks fr info, Jan-Martin

OE3XUA, JN77XX wkd 144 MHz > 700 km:
13.8.1992 UZ2FWA KO04 14.8.1992 IW5BML JN51JW
30.8.1992 DL6YEH JO31, PA3FMZ JO32
6.11.1992 ON1KVL JO20, PA0PVW JO21, ON1BG JO20, ON7BU JO20, ON2KPJ JO10, G3JMB IO91
7.11.1992 DK9HN + DF5LS JO43, LZ1ZP KN13, DL2EBX/p JO30, IW1AXE JN34, PA3FJY JO32, DF0WD JO42
15.12.1992 OZ6PK JO65, SK7VHF bcn JO65 hrd 569, OZ7IGY bcn hrd 579, SM7SHY JO86, OZ7JT JO65, SM7SCJ JO65, OZ1BNN JO55, DG0KW JO64, SM7JUQ JO65PO, DC3XE JO53, OZ1HNE, OZ1IPU JO57, OZ8VO JO56, OZ8ZS JO55, SM7NNJ JO86, OZ1JPT JO86, OZ4VV JO46
2.2.1993 SP4CHY KO03, SP4LVG KO13, SP4SKA KO14, SP4CPB, SP4WRB KO13
12.2.1993 DK1KR JO53
26.6.1993 DL1DUN, DF8LC JO53, DF2ZC JO30
3.7.1993 PE1AGJ JO30
27.7.1993 YO3JW KN34 tks fr info, Michael und Johannes

PA3BIY, CM72c, JO22EB wkd:
13.02.93 F6KCM BG.
17.03.93 F6DBB IN96NS, F6HRL JN06FP.
25.05.93 GM3JFG IO77XR, GM4CXM IO76BR, GM0ILOB IP90HJ, GM3XOQ IO99IX.
03.06.93 LA9YN JO48OR, LA6HL CS, LA1ZE JO28TP. tks fr info

PA3FJY, JO32EH, DM53g wkd:
03.02.93 FC1PZA JN06, F6HRL JN06, FD1OQJ IN96.
04.02.93 FE1DCO IN96, FD1PIG JN06, FC1JVW JN06, F6ANW JN06, F6BQX JN06, GW4ZWV IO81, EI3EUB IO63, G6NEJ IO81, EI5FK IO51, EI8GQ IO51, EI4DQ IO51, GW8JLY IO81.
06.02.93 FF1OFL JN06.
14.02.93 GW6NLP IO83
15.05.93 GW0RDI/P IO82, GW4BVY/P IO81.
16.05.93 GD4IOM IO74.
25.05.93 G8ZRE 83, EI3GE 63, G7OGV 82, GW7JML/P 83, GI4KSO 64, G4IJD 83, G3NBQ 83, G7LPW 83, G0TOU 83, G4NCI 83, G0MRL 83, G3RZA 83, G3IVQ 82, GM3XOQ IO99, GM1TDU IO87, GM0ILB IP90 and mni Gs from IO92, 93 and 94.
07.06.93 GW0PZT IO72. 12.6.93 F6CTT IN97. 19.06.93 GM4YXI IO87. 27.06.93 GW1VDF/P IO81.
01.07.93 GW1MCD 81, G8VYT 81, G0KON 80. 02.07.93 F6CTT IN97.
03.07.93 GU4APA IN89, G4RFR/P 80, OK1KOB/P JO70, TP2CE JN38. tks fr info,Dick.

PA3FOC, JO21FW, CL03j, wkd:
13.02.93 FC1BQM JN06UT, FC1CUY IN96UM, F6HRL JN06PT, F1OYC IN99EP, FC1RJM IN99FN, FC1BVA IN98MB.
24.05.93 GD4XTT IO74.
25.05.93 GM1TDU IO87WE, GM4CXM/P IO76XA, OY9JD IP62OA, GM0HUO IO86OI, GM4NHI IO87TE, GM0HTT IO89JA.
03.06.93 GM7FYB IO97CM, GM1MBZ IO87VJ, LA9VFA JO28TP. tks fro info, Rene

SM4SJY/4, JP70OE, wkd in SSB:
10.08.93 OH6AAG KP12CJ, SM7BEU/6 JO66LJ, OZ7UHF JO65ER, OH6KTL KP03RJ.
Rig: 60 w, 22 ele Yagi, 350 m a.s.l. tks fr info, Mats

S79CAB, JN76JG, wkd:
03.07.93 F6EPE JN23, SP2OFW JO93, SP5EFO KO02, DL9WL JO42.
04.07.93 LZ5N/P KN12TF, DK0FFO JO72, DF0OL JO41, IT9IPQ/P JM78, IT9OWA/P JM68, SP3SFN 82.
05.07.93 F1FIH JN23. 17.07.93 IT9TVF JM68
01.08.93 DL8OBU JO52, DK9OY JO52, DF9YF JO42, IW9DRI JM76MW 1037km, DK1KO JO53.
08.08.93 DL8CMM JO52, IS0/IK6DZH JN40WM.
14.08.93 YO5BEU/P + CBX/P KN27GD, YO5CBX/P JN27EC.
15.08.93 LZ6Z KN13PK, YO3AID/P KN23NU, YO5QCF/P KN17VU, YO5BIN/P KN17VV, LZ1ZP KN22, LZ1AG KN22, YO7KAJ/P KN13.
22.08.93 IT9VDQ/9 JM68, EA6SA JM19KO 1218km.

70cm 70cm 70cm 70cm 70cm 70cm 70cm 70cm
> 500 km

DJ8ES, JO43, wkd on 432MHz:
02.10.93 **DG3FK JN59OP** 495km, **DK8VR/A JN39NR** 500km, **G4JAR/p JO01PU** 600km.
28.10.93 **SP 9 FG JN99XF** 890 km. 29.10.93 **OK2BLE JN99FN** 784 km, **LA 8 SJ JO59HQ** 638 km.
31.10.93 **G 6 RAF IO92QP** 690 km, **G1WYC JO01AT** 680 km, **F1CYB JN17XT** 788 km, **G4SEU IO92FM** 753 km, **G8PNN IO95EF** 731 km, **G8DQK IO83RK** 796 km, **2M0ABX/p IO76XA** 893 km, **GM4JJJ IO86GB** 858 km, **GM4LBV IO75TW** 912 km, **GI8FLQ IO74DO** 989 km. tks fr info, Wolfgang.

IW5AQC (FD25c) wkd via Tropo on 432MHz >500km:
18.08.93 **EB3ENW BB41j.** grazie per info Luciano

IW9CER, JM78QF, wkd:
20.06.93 **IK1HXM/1 JN44IL, IW1PPZ JN44HJ.**
21.06.93 **IW1QGJ JN33VT, I2ZFJ/1 JN44FF.**
03.07.93 **F/IW1QBJ JN34UB.**
16.07.93 **EA5/DB8JU/P IM98** (ALSO 17.07. + 19.07.), **EA5YB IM99VB.**
18.07.93 **IW1QBJ/1 JN44GK.**
25.07.93 **EA5YB IM99VB.** tks fr info, Tony

OZ1IPU, JO57GH, wkd:
28.10.93 **DG0CN JO60EM, DL6NCI JO50VI, DB6NT/A JN50TI.**
29.10.93 **OK2SUP/P JN99FN, SP9FG JN99XF, OK1UWA JO70UR, OKBLE JN99FN, DL5JIN/P JO60PP, DL5KVD JO64AD, SP6MLK/P JO80JG, DD6HZ JO62QN, OK1AGE/P JO70UR, DG5VG JO71AG, DK9TF JO31NF, DL1KDA JO30FQ.**
30.10.93 **DF5LQ JO44, DL3BWW JO72GI.**
Rig: **FT780R** + 25 watts, 4 x 30 ele **DJ9BV.** tks fr info, John

PA0WWM, CM63g, wkd >500km:
03.07.93 **G4BRA/P YK18C.**
04.07.93 **G8YEO/P YK28C, GU4GCM/P YJ29B, DK0PX EI74B, DL0UL/P EI39A, HB9WW/P DG13B, HB9BA/P DH58D, HB9FX/P DH68H, HB9RG/P EH79H.**
25.07.93 **GW8AWM/P YL15D, G4BRA/P YK18C.**
03.10.93 **DK0PX EI74B.**
25.10.93 **GI0GDP XO22H.**
27.10.93 **OK2SUP/P JJ33G.**
28.10.93 **GM4JJJ YQ73C, 2M0ABX/P XQ80B.**
01.11.93 **GI8FLQ XO32A, GI0GDP XO22H, E14AEB WN42B .** tks fr info, Wim

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PLEASE SENT ANY INFO ABOUT VHF / UHF - BEACONS FOR THE NEXT DUBUS-BEACON-LIST TO:

JOACHIM KRAFT, DL8HCZ, GRÜTZMÜHLENWEG 23 D-22339 HAMBURG OR ☎ +40 538 3186

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Meteor Scatter

Editor: Norbert Göttsche, DL8LAQ

DD0VF (JO61VB) wkd via SSB MS on 144MHz:

930531	1334		EB4TT		36		1		10	hrd	1800km .300
930620	2149		YU1EV		39		1		20	hrd	NC! .300
930605	0400	0457	IW1AZJ	JN35	27	26	11	11	6	C	
930606	0500	0600	YO2IS	KN05	27		2		1	NC	
930626	0800	0900	EV5N							NIL	
930714	0400	0500	FC1NSR	JN33	36		16	26	8	NC	
930717	0400	0500	FC1NSR	JN33	28		28	51	1	NC	
930727	1800	1900	OM9AAW	KN18	26		1	4	1	NC	600km ×1
930728	1800	1900	OM9AAW	KN18	26		3		1	NC	
930729	1800	1900	OM9AAW	KN18				2		NC	
930730	2000	2100	OM9AAW	KN18			2	3	0.5	NC	
930731	1800	1900	OM9AAW	KN18	26	26	2	1	1	NC	
930801	0700	0800	OM9AAW	KN18	36		1	2	10	NC	sidescatter
930811	0600	0700	F1NSR	JN33	26		3	5	4	NC	
	1900	1945	SM2ILF	KP04						NIL	
	2000	2026	SM2CKR	KP03	27	27	10	16	25	C	
	2300	2310	G1AWP	IO95	37	37	1		20	C	
	2341	2350	LZ1KWT	KN32	27	27	mni		10	C	.200
930812	0005		TF/G4DHF		37					6	hrd 2200km
	0006		G4XBF/p	IN79	29	29	1		15	C	.200
	0029		GM4YXI	IO87	29	27	1		10	C	.199
	0100	0103	GM0BQM	IO85	27	27	mni		7	C	.397
	0115		F5JRX	JN25	27	27	1		12	C	.203
	0128		S57TW	JN75	29	38	1		10	C	600km 230deg .206
	0154		G0CUZ	IO82	27	27	1		10	C	.399
	0204		OH5LK	KP30	29	37	1		20	C	.204
	0300	0345	ES3GZ	KO28	26	27	4		5	NC	×2
	0333		ES2RJ	KO29	27	29	1		30	C	.199
	0600	0655	YO2IS	KN05	27	27	2	16	17	C	
	0744		EA3DUY	JN12	27	26	1		10	C	.200
	0845		F1NSR	JN32	27	27	1		12	C	.405
	0943		G8XVJ	IO83	37	29	1		60	C	.202
	2217		LZ1KWT	KN32	27	27	1		10	C	.200
	2300	2343	GM3POI	IO88	28	27	30	77	17	C	

Remarks: ×1 Tropo impossible, used elevation 20deg. ×2 ES3GZ problems with PA (only 15W). tks fer info, Stefen.

Attention
Please send your correction or update to the MS-Address-List

Achtung
Bitte senden Sie Ihren Neueintrag oder die Berichtigung für die MS-Adreßliste

DH6JT (JO31JO/DL34b) wkd via MS on 144 MHz:

930605	0600	0710	OH3AWW	R28	26	KP11TL	7	15	4	C	×1
930606	1100	1120	YU7EF	27	R26	KN04HV	8	11	1	C	×2
930609	2000	2040	SM2CEW	27	R27	KP15CR	12	7	1.5	C	
930612	0600	0640	OH3AWW	R27	27	KP21QF	12	42	1	C	×1
930613	0500	0545	I1JTQ	27	R27	JN35UB	10	38	1	C	×3
930625	0235	0300	EV5N	R27	R27	KO42RX	6	15	1.5	C	×4
930710	2200	2245	S51AT	R26	26	JN75GW	5	6	1	C	
930716	0400	0420	EA4LY	28	R26	IN80CJ	9	13	1.5	C	
930717	0400	0445	EB4TT	27	R27	IN70XJ	4	9	1	C	
930717	1200	1305	EI4DQ	R26	26	IO51WU	7	40	1	C	
930718	0500	0520	HA8CE	27	R26	KN06EN	6	22	2	C	
930719	0400	0435	EA3KU	26	R26	JN00JV	5	12	7	C	
930721	0400	0420	HA7PL	47	R26	JN97WO	4	8	37!	C	×5
930723	1000	1115	9A1EZA	28	R27	JN86HG	8	7	4	C	
930725	0400	0420	9A1CCY	37	R27	JN85OO	4	30	15	C	
930725	1425	1440	LA2AB	28	R27	JO59FV	12	14	2	C	random
930802	0300	0350	LA8OW	R27	26	JP50NC	5	6	4	C	
930802	0020	0040	EADL5YET	27	R27	IN61US	10	9	2	C	×6
930806	1600	1640	GM4ZAP/p	27	R27	IO89	4	11	1.5	C	SSB
930807	0400	0430	EA3BTZ	27	R26	JN01XI	9	10	30!	C	
930808	1205	1235	HA3UU	26	R27	JN96JO	9	9	5	C	
030809	1535	1630	UZ2FWA	27	R27	KO04FT	12	31	7	C	
930810	0200	0250	HA5CW/0	R26	R26	KN07SU	13	33	90!	C	×7
930810	2300	2400	LA8KV	27	R27	JP52QQ	6	26	5	C	
930812	0045	0110	LA7DFA	28	R37	JP33VC	5	31	30!	C	random
930812	0040	0440	ED5TOR	26	R28	IN90XP	11	9	1	C	
930812	2110	2135	GM0EWX	26	R37	IO67UU	7	9	5	C	
931018	0017	0040	RB5WU	37	R27	KO20DI	5	4	2.5	C	
930818	0100	0135	YL2MB	R26	26	KO27PH	7	5	2	C	new WAE
931024	1140	1240	HA7UL	26	R26	JN97KK	5	11	1	C	

Remarks: 1× tnx for your activity from 2 sqr's for me ×2 ufb refl. at that time ×3 short qrb, but ufb qso ×4 tail-end qso dk3xt ×5 vy long refl., ufb ×6 tail-end qso dl1eap ×7 longest burst i ever heard (90sec.) For sked write to: Thorsten Scherf, Luchsstrasse 6, 46535 Dinslaken, ☎ 206457874 or via PR: DH6JT at bbs DB0IZ, infos abt west german square dancers dx group also via my adrress.
73 es gd dx Thorsten, DH6JT

DG1BA (EN75c) wkd in SSB via MS on 144MHz:

260693	0655	0722	EV5N	KO42	R27	27	4	mni	8	C	.170
120893	0449		S59CAB	JN76	37	R37	1		×20	C	.212
120893	0500		S53VV	JN65	36	36	1		×10 s	C	random

Hrd via random at 12.Aug 1993: 0230-0330 RB5GZ .200; UB4EWA .200; LZ1KWT .200; LA1K .200; HA5OV/7 .200; 9A2DI .200; YU7VA .200; ES2RJ .220. tks fer info, Dieter.

DL2IAN (JN49) wkd via MS on 144MHz:

280493	0430	0452	GM4IPK	IO99	26	R37	16	40	4	C	
050593	0400	0500	RB5WU	KO20	37	3	1		5	NC	
060593	0300	0400	UB3EE	KN88						NIL	
140593	0330	0430	EA3FLN	JN12	26	26	4	8	2	NC	
050693	0837	0912	9H3ZZ	JM76	26	R26	10	12	3	C	
060693	0655	0717	OH2BAP	KP20	26	R37	9	20	6	C	
070693	0500	0600	RB5WU	KO20	27	R26	4	9	2	NC	
280693	0300	0400	SM2CEW	KP15						NIL	
280793	0317	0347	EA/DL5YET	IN72	26	R26	21	21	4	C	
280793	1800	1900	OH7PI	KP42						NIL	
310793	0500	0545	RB5WU	KO20	26	R26	5	9	4	C	
	0700	0727	EA/DL3YEL	IN62	26	R26	12	18	15	C	
	0820	0902	YO3JW	KN34	26	R26	8	13	2	C	
010893	2000	2100	IK0RNL	JN61	27	26	3	10	1	NC	
020893	2250	2302	EA/DL5YET	IN61	R37	27	7	7	7	C	vy fast
040893	0400	0500	9A2SB	JN95						NIL	

DL2IAN (JN49) continued:

050893	0320	0337	EA/DL3YEL	IN71	R27	27	7	11	5	C	
070893	0500	0600	LY/DF1ZE	KO05	R26	26	15	28	20	C	
090893	2200	2300	RU1A	KO48						NIL	
110893	0300	0400	SM5TSP	JP90						NIL	SSB
110893	1600	1700	CT4KQ	IN60	27		2	5	2	NC	
	2300	2350	HG6NQ	JN98	27	R37	8	5	9	C	
120893	0052		GM4ZAP/p	IP90	26	R37	1		20	C	SSB Random
	0116		GM4AFF	IO87	37	R27	1		10	C	SSB Random
	0203		LA5KO	JO48	27	R27	1		9	C	SSB
	0252		IC8FAX	JN70	27	R37	1		7	C	SSB Random
	0319		GM0CLN/p	IO85	37	R37	1		25	C	SSB Random
	2000		LZ1KWT	KN32	37	R37	1		80	C	SSB Random

Equipment: FT-726R, 17 Element, 100 Watt. tka fer info, Thomas.

DL8EBW (DL66a) wkd via MS on 144MHz:

260693	0300	0316	ES0SM/6	KO37RI	R28	26	5	18	1	C	■432
260693	0400	0436	RU1A	KP40HK	27	R27	4	8	3	C	■433 ×2
280693	0350	0358	EV5N	KO43KB	38	R27	8	mni	6	C	Rnd ■434
020793	0400	0421	LA4XGA	JP33VC	27	R27	8	28	2	C	×1
050793	0400	0500	OH9AB	KP46BI	26		2	1	0,3	NC	2049km
080793	0400	0451	OH6NDD	KP23UH	R28	26	13	mni	26(!)	C	■435
090793	0400	0420	LA4XGA	JP33VC	R27	27	12	mni	1	C	×1
100793	0300	0325	YO3KWJ	KN24	37	R26	6	6	6	C	■436
160793	0400	0416	LA4XGA	JP33VC	28	R29	10	31	2	C	×1
200793	0400	0417	HA7PL	JN97OG	R26	26	10	28	1	C	
200793	0420	0451	HG7B/p	JN97OG	R27	28	7	15	1,5	C	Rnd
230793	0400	0441	LA4XGA	JP33VC	R26	R26	17	42	34(!)	C	×1
230793	2200	2231	RU1A	KO48VR	26	R27	6	12	1	C	■437
240793	0500	0600	OH9NYW/p	KP35	26		1	6	1	NC	
290793	2335	2400	EA/DL5YET	IN72MB	27		8	mni	1,5	NC	×3
310793	0020	0036	EA/DL3YEL	IN62	28	R27	10	26	2	C	
050893	0200	0248	G0JLF/TF	IP24Nk	R26	27	13	24	1,5	C	■438
070893	0400	0417	LA4XGA	JP33VC	R37	R49	10	18	7	C	×1
070893	0500	0521	HA9RC	KN08NB	27	R27	9	26	1,5	C	
110893	0400	0420	ED5TOR	IN90XP	27	R26	15	35	10	C	
120893	0043		YU1BT	KN03KN	27	R37	1		30	C	Rnd SSB
120893	0153		GM4ZAP/p	IP90	R37	26	mni	mni	20	C	Rnd SSB
120893	0203		G4DHF/TF	IP34	27	R37	mni	mni	20	C	Rnd SSB 439
120893	0231		LZ1KWT	KN32	37	R37	mni	mni	40	NC	no RRR
120893	0247	0248	IK5QLO	JN53	37	R37	1		50	C	Rnd SSB
120893	0248	0304	IW6AEG	JN63RO	37	R27	mni		10	C	Rnd SSB
120893	0306		9A2DI	JN95	R29	37	1		10	NC	no RRR
120893	0312	0313	S51WV	JN76	37	R27	1		20	C	Rnd SSB
120893	0314	0319	YU1WP	JN94OM	27	R38	mni	mni	10	C	Rnd SSB
120893	0320		YU1VG	JN94BR	R27	R27	1		20	C	Rnd SSB
120893	0337		LZ1KWT	KN32	37	R37	mni	mni	30	C	Rnd SSB
120893	2339		LZ1KWT	KN32	27	R37	1		15	NC	no RRR
130893	0055		LZ1KWT	KN32	27	R28	1		25	C	Rnd SSB
130893	0118		YU1EXY	KN04	27	R27	1		90	C	Rnd SSB
130893	0118		IK1LGV	JN44JK	37	R27	1		×	C	Rnd SSB
130893	0119		I8MPO	JN70	37	R27	1		×	C	Rnd SSB
130893	0130		IK1LGV	JN44JK	39	R29	1		30	C	Rnd SSB
130893	0130		IK1MTZ	JN35UB	49	R39	1		45	C	Rnd SSB
130893	0400	0426	LA4XGA	JP33VC	37	R29	11	23	13	C	× 1

Remarks: ×1 regular sked with Geir (1320 KM), to test MS-condx; ×2 Nice Expedition 1675 Km - only 300 lpm - 150W - 9el; ×3 What happend ? Only calls and after 3 periods qrt ???
NIL: 040793 ED1GSR IM79, 280793 LA6HL/TF IP34 1925km, 110893 OM3AU KN08, LY/DF1ZE KO05, 120893 YO8BSE KN36, 120893 UA3MHJ KO87 2075km, RV3ZR KO80 2029km, UB3EEKN88 2110km, 130893 Z32UC KN11.

DL8EBW (DL66a) continued:

Perseids: hrd also with long bursts: (×10sec) SM3BEI, HA5CW, HA3UU, YU7VA, OM3LQ, UZ2FWA, GM4YXI, G4XBF/p, IK2DDR, S57TW, S59AM, EA3DXU and many more longest bursts abt. 90sec - 130893 0118 3 QSOs. I saw a strong maximum at the 12th August at around 01-03 UTC. The second maximum was 24 hours later 13th August around 01 UTC. Otherwise the reflections outside the maxima were not so very well. I was unlucky in the skeds - most NIL (?) . Before the shower it went better, hi...never mind next good shower will come soon, hi.

140893	0000	0037	OH6NVQ/p	KP14RC	R26	27	17	17	6	C	≡ 440
140893	0150	0226	YU7FU	KN04HU	27	R27	12	mni	3	C	Rnd
200893	0400	0435	LA4XGA	JP33VC	26	R27	11	33	22	C	×1
270893	0400	0426	LA4XGA	JP33VC	R26	26	9	27	0,7	C	×1
030993	0400	0431	LA4XGA	JP33VC	R26	R26	15	33	1	C	×1
100993	0400	0426	LA4XGA	JP33VC	R27	R29	14	32	1	C	×1
011093	0400	0500	Z32UC	KN11CR				2		NC	
011093	0500	0530	LA4XGA	JP33VC	26	R26	10	27	0,7	C	×1
081093	0500	0548	LA4XGA	JP33VC	R27	27	15	43	2	C	×1
151093	0500	0525	LA4XGA	JP33VC	26	R39	9	31	1,5	C	×1
221093	0500	0522	LA4XGA	JP33VC	R27	26	10	32	2	C	×1
291093	0500	0531	LA4XGA	JP33VC	R26	27	12	21	1,5	C	×1
051193	0500	0532	LA4XGA	JP33VC	R26	26	7	35	1	C	×1

Remarks: ×1 regular sked with Geir (1320 KM), to test MS-condx. NIL: 221093 Z32UC KN11.
Equipment: FT726R mod. with CF300, 11ele DL6WU, MGF1302, 350W. Skeds are very welcome via VHFNET, or PR (BBS DK0MWX), or , ++202-781170. tks fer info, Guido.

F5HRY (BI22c, ex F1HRY) wkd via MS on 144MHz:

930808	1200	1240	ES5RY	NS44e	R28	26	2	4	4	C	
	1300	1325	CT4KQ	WA21e	R28	26	2	14	3	C	≡DXCC
930809	0600	0625	HA9RC	KI76j	37	R27	11	25	12	C	
930810	0500	0600	EA3BTZ	AB		26	11	mni	1	NC	QRM ATV
930811	2030	2100	ED5TOR	ZA	27	R46	4	4	5	C	hrd Tropo
	2308		SM7TUG	HQ	R27	27	1		7	C	SSB
930812	0000	0040	OH5IY	NU03d	38	R36	6	1	25	C	×2000km
	0159		G4DHF/TF/p	TY	37	R37	1		10	C?	QRM...
	0200	0215	SM7FWZ	HR	R47	37	4	10	25	C	SSB
	0240		GM4ZAP/p	ZU	R37	26	1		15	C	SSB random
	0300	0311	LA5KO	ES	R26	36	1		4	C	SSB
	0400	0428	LY/DF1ZE	KP	R46	37	5	15	50	C	
	0458		HA3UU	JG	37	R37	1		30	C	SSB random
	1100	1200	SM2CEW	LZ		26	6	3	2	NC	×2200km
	1400	1450	OH3EX	MU	R37	36	5	4	8	C	

Rig: 4×11ele, 1kW, 0.5dB NF. Comment: Perseids 1993? Good, of course, even a little better then usual... But what about the thousands of meteors predicted??? A bit disapointing and, as usual, great deal of QRM...Pse use the letter system on CW!!! tks fer info, Herve.

F5JRX (?) wkd via MS on 144MHz (complete QSOs only):

921212	0600	0700	HG7UL/p	JN97	R26	R26	
921213	2000	2100	DL5DTA	JO61	R26	R26	
	2100	2200	GM0HBK	IO77	R36	R36	
930103	1000	1100	SP2NJI	JO92	R26	R26	
930801	1000	1100	OM3LQ	JN88	R26	R27	
930808	0300	0400	OZ1FTU	JO55	R27	R27	
	2000	2100	DL3BWW	JO72	R26	R37	
930810	0700	0800	HA3UU	JN96	R26	R27	
	1200	1300	DL7AKA	JO62	R26	R26	
	1400	1500	SM6EAN	JO57	R26	R26	
930811	0800	0900	SM6CMU	JO57	R26	R26	
	1430	1500	GM4ZAP/p	IP90	R26	R26	
	2230	2245	UZ2FWA	KO04	R26	R26	random
930812	0000	0030	LA5IH	JP20	R26	R37	

F5JRX (?) continued:

930812	0100	0115	SP2OFW	JO93	R26	R26	
	0140	0200	SM7FWZ	JO77	R27	R36	random
	0345	0400	SP2NJI	JO92	R27	R27	random

Equipment: 300W + 4 × 16ele Yagi. tks fer info, Bruno.

I2FAK (JN45OB) wkd via MS on 144MHz:

930807	2000	2100	RU1A	KO48VR						NIL	
	2100	2153	LY/DF1ZE	KO05	26	26	16	10	5	C	
930808	0600	0740	RB5GU	KO20DI	26	28	7	6	4	C	
930809	0900	1000	UA1W/RW3AZ	KO55	26	28	8	5	9	C	
930810	0900	1000	UA3MHJ	KO87SX						NIL	
	2000	2100	RU1A	KO48VR	26	27	5	7	3	C	
930811	0500	0600	YL2MB/a	KO07	Not QRV, no PA					NIL	
	0800	0900	UA3MHJ	KO87SX	26	26	4	3	3	C	ODX 2405km
	1100	1125	YL2MB	KO27PI	36	27	6	5	20	C	
	1450	1520	GM4ZAP/p	IP90	26	26	4	6	2	C	
	2044		OH1AF	KP10TM	28	27	1		10	C	
	2152		SM4EPR		39	39	1		20	C	
	2334		GM4EWX		29	29	1		10	C	
	2353		GM4AFF		29	27	1		15	C	
930812	0000	0100	LA4XGA	JP33						NIL	
	0130		OH2AV	KP20	27	27	1		5	C	
	0130		LA8KV	JP52	38	28	1		15	C	
	0130		SK5QJ		38	28	1		20	C	
	0223		G4ERG		27	39	1		5	C	
	0249		PA3CEG		27	27	1		5	C	
	0310		GM4ZAP/p	IP90	39	39	1		15	C	
	0312		GM0CLN/p		38	38	1		20	C	
	0313		SM7FWZ		38	39	1		15	C	
	0342		GM4YXI	IO87	29	39	1		10	C	
	0342		GM4IPK	IO99	39	39	1		10	C	
	0342		OY9JD	IP62	28	28	1		10	C	
930812	2100	2200	RV6ALA	KN95		NIL					
	2200	2204	LA2PHA	JO38	37	37	2	1	15	C	LA2PHA QRP 10W!
930812	1100	1200	RV6ALA	KN95						NIL	
930812	2000	2100	PE1MVJ	JO21	26	27	1	10	2	NC	

tks fer info, Franco.

IK1SLI (JN35UI) wkd via MS on 144MHz:

930725	2200	2232	PA3FJY	DM	27	27	9	22	3	C	
930727	2100	2145	SP2OFW	JN	26	26	6	16	3	C	
930731	2200	2252	DL7YS	GM	26	26	5	19	4	C	
930804	2000	2035	HA9RC	KI	27	27	4	18	3	C	
930808	0500	0527	G0CUZ	YM	37	37	7	28	16	C	
	2100	2157	SP6GZZ	IL	26	26	3	32	2.5	C	
930809	2000	2052	ON4GG	CK	26	26	3	13	4	C	
	2200	2242	GD4IOM	XO	48	27	3	21	21	C	
930810	1400	1425	DL5XV	FN	27	27	2	8	2.5	C	SSB
930811	2100	2147	DL9GKA	GN	27	27	7	39	3	C	
	2321		G0LBK	ZN	27	27				C	SSB random
930812	0143		G4EAP	ZL	37	37				C	SSB random
	0700		SP3MFI	JL	27	27	4	9	4	C	SSB
	1130	1212	PA3EPD	CL	37	26	8	37	11	C	
	2100	2152	G0GMB	ZM	27	27	5	20	3	C	

Equipment: IC-275A, PA 200W, MGF1302, 14ele DL6WU. tks fer info, Gianni.

LZ MS-Expedtition 1993

This year we decided to operate from NC23h. Firstly, because it is a very good place on the top of a mountain, 1016 m asl, and also that all of us expected more reflections caused by comet Swift Tuttle during the Perseids this year.
We made more than 200 MS QSOs, including 15 skeds. Our opinion is that the influence of Swift Tuttle was considerable and we have got a few very long bursts of more than 200 seconds.
Participants of the expedition: Rumen - LZ1JH, Mitko - LZ1ZX, Savi - LZ1UK, Slav - LZ1MC, Christo - LZ1DP and Dora, a 15 year young girl with big interest in MS and Packet Radio.

Equipment: FT-736R, PA 1kW out, 2 x 16ele F9FT and a Mutek GaAs-Fet-preamp on the mast.

QSL via LZ1DP, P.O.Box 143, 6000 Stara Zagora, BULGARIA.

Best 73's and see you soon again. Christo - LZ1DP

LZ1KWT (KN32FR) - List of skedules:

930809	1900	2000	OE5KS	JN78	26		2	mni	1.5	NC	
	2000	2100	DF1SO	JN48	26		1	6	2	NC	
	2100	2200	DF1IAZ	JN49	26		2	8	2.5	NC	
930810	0600	0700	I4XCC	JN63	Sri, no electricity						
	1230	1305	DK0OG	JN68	37	27	8	mni	40	C	
	1305	1320	DL6RDR	JN68	27	27	6	mni	12	C	
	2100	2200	F5SE/TK	JN41	26	26		mni		NC	SSB no RRR
	2300	2330	OK2PTC	JN89	26	26	5	12	7	C	
930811	0100	0210	DF1SO	JN48	26	37	6	mni	3	C	
	0300	0400	F6CRP	IN96				only pings		NC	
	1100	1140	DL8OBU	JO42	38	38	7	mni	24	C	
	1200	1235	RW3RW	LO02	26	37	6	mni	12	C	
	1400	1500	DL1GJO	JN38	26		8	2	3	NC	
	1500	1545	DK3XT	JN45	26	26	6	16	4	C	
	1600	1700	UZ3TXB	LO16	Not QRV, very strong wind, sri.						
	1900	2000	SM5CBN	JO78	26	37	7	mni	5	C	
	2000	2100	PA3FJY	JO32	37	27	6	12	4	C	
	2100	2200	F5SE/TK	JN41	27	27	5	mni	6	C	SSB
	2200	2250	PA3TAB	JO32	27	27	6	14	12	C	
930812	0600	0620	S53VV	JN65	38	38	10	mni	28	C	
	0645	0657	S53CAB	JN76	27	27	5	mni	12	C	SSB
	0700	0800	F6CRP	IN96				only pings		NC	
	1000	1030	UW4AK	LO20	37	26	9	mni	20	C	
	1100	1125	UW3ZD	KO81	37	27	8	mni	16	C	
	1330	1400	UA3MHJ		26	27	4	mni	3	NC	SSB
	1415	1500	UZ3TXB	LO16	26	38	5	mni	8	C	
	1800	1900	OZ1HNE	JO57	26		2	6	3	NC	SSB
	2000	2040	RA3DDK		26	26	7	8	7	C	
	2100	2200	G4ASR	IO81	Sri, strong QRM from SM6KJX + OH9NMS						

LZ1KWT (KN32FR) - List of Random QSOs:

930811	2047	DC9YC	27		NC	.200
	2249	DL7UTS	27	27	C	
	2249	ON4AEG	27	37	C	
	2249	DL2OM	27	37	C	
	2256	DC3VW	38	26	C	
	2300	OZ4VV	38	38	C	
	2307	SM7FIF	27	27	C	
	2314	YU7BW	27	37	C	
	2316	YO2LEA	27	27	C	
	2329	OZ9FW	27	27	C	.200
	2329	DL8HCZ	27	27	C	
	2329	DF8LC	49	49	C	
	2332	SP2NJK	27	27	C	
	2332	G4AIS	28	28	C	
	2334	PA3??T		27	NC	
	2336	PE1UN	27	27	NC	
	2341	DD0VF	27	27	C	
	2344	SP2NJK	27	27	C	

LZ1KWT (KN32FR) continued:

930811	2317	DK1KU	27	27	C	
	2319	SM7WT	59	59	C	
	2321	ES2RJ	27	27	C	
	2322	SM0ELV	37	37	C	
	2322	SK6HD	27	27	C	
	2326	DB6L?		37	NC	
930812	0000	DF9USA	29		NC	.200
	0000	DF2ZC	27	27	C	
	0000	PA0JMV	29	29	C	
	0000	???BCT		28	NC	
	0004	DL9USA	29	39	C	
	0005	DL1BCT	28	28	C	
	0006	PE1NAU	27	27	C	
	0009	SM6KJX	27	27	C	
	0016	DG0KW	37	37	C	
	0017	DL8DAT	37	37	C	
	0017	DL0WAE	26	37	C	
	0018	DH0YAZ	37	37	C	
	0018	SP2JYR	37	37	C	
	0018	DG9VL	37	37	C	
	0020	DG6J?F		37	NC	
	0028	PA3CAR	37	37	C	
	0030	SM5MIX	37	37	C	
	0030	OZ5QF	37	37	C	
	0030	OZ1BVW	27	27	C	
	0032	SP8?FX		28	NC	
	0032	DL8LBK	37	37	C	
	0043	DL4XX	37	37	C	.400
	0043	DA3FBN	37	37	C	
	0043	ON4CTW	37	26	C	
	0044	DG0CAL	37	37	C	
	0045	OZ1CLL	37		NC	
	0049	DA2UU	27		NC	
	0052	??5CW		29	NC	
	0053	OZ1CLL	37	37	C	
	0053	DL6UAL	26		NC	
	0100	SP6FUN	37	37	C	
	0104	DK3XM	37	26	C	
	0106	DK0AK	27	27	C	
	0107	OK1FEM	27	27	C	
	0110	OH2AT	26	26	C	
	0119	DL3RGH	37		NC	
	0123	OZ8ZS	38	38	C	
	0123	ON4ANT	27	27	NC	
	0126	??1EBG		27	NC	
	0130	ON4ANT	27	27	C	
	0132	SP3MFI	27	27	C	
	0136	SM4LMV	27		NC	
	0136	DL6IAL	27	26	C	
	0137	SM7LML	27	27	C	
	0142	DL5GAC	29	29	C	
	0142	OZ1BEF	37	37	C	
	0142	ON4ANT	27	27	C	
	0143	SP2JYR	37	37	C	
	0144	SP3MGI	39	39	C	
	0157	SP3NNH	36	37	C	
	0200	SM4LMV	37	37	C	
	0201	OH4AV	39	27	C	
	2349	DK9OY	27	27	C	
	2349	DL7AKA	27	28	C	
	2349	DH8NAA	27	27	C	
	2354	DF2ZG	27		NC	
	2356	OZ1BNN	27	27	C	
	2358	SM0ERV	27		C	
	0304	G3RKV	37	37	C	.200
	0304	DK0PX	37	37	C	
	0306	SM6AFH	27	27	C	
	0306	SM6CMU	37	37	C	
	0308	SP3NNH	27	27	C	
	0310	OZ1DLD	27	27	C	
	0312	DF9YF	27	27	C	
	0312	OH2EX	38	38	C	
	0316	SP6TRQ	27	27	C	
	0318	OZ1FTU	37	37	C	
	0318	DH0YAE	38	38	C	
	0318	PA3BGM	37	37	C	
	0321	SP2MSO	37	37	C	
	0322	ON4GG	39	39	C	
	0322	DC?BV	38	28	NC	
	0324	DL8OBU	39	39	C	
	0325	DL3IAA	39	39	C	
	0326	PA3FUH	27	27	C	
	0326	DF6NA	37	37	C	
	0326	DL1BAA	27		NC	
	0328	PA2CHR	39	39	C	
	0330	DL7UM	39	39	C	
	0333	HB9JAW	39	27	C	
	0335	YU1EXY	37	37	C	
	0336	DL8EBW	37	37	C	
	0336	PB0AMW	37	37	C	
	0336	PA0LMI	38	38	C	
	0338	DL3YEL	37	37	C	
	0342	DF8LC	39	39	C	
	0344	RB5AO	39	39	C	
	0344	SM7BVU	27	27	C	
	0344	OH2TI	39	39	C	
	0411	PA3FOI	37	37	C	
	0418	SM7SJR	39	27	C	
	0418	DL3YEL	37	27	C	
	0427	DJ5RE	27	27	C	
	0427	DL8RO	37	37	C	
	0440	SM7TUG	27	27	C	
	0442	DC9YC	27	38	C	
	0448	DL8RC	37	37	NC	
	0453	DL8HCZ	59	59	C	
	0458	PA2JOK	37	37	C	
	0500	SM6EAN	37	37	C	
	0500	DL0PX	37	37	C	
	0500	DL2HWA	39	39	C	
	0521	OZ1CLL	37	37	C	
	0541	DF0CI	27	27	C	
	0541	DK1UAK	27	27	C	
	0817	IW3KTG	27	27	C	
	0857	F8OP	57	57	C	
	1157	DJ9EV	27	39	C	
	1231	DL5BCU	29	29	C	

LZ1KWT (KN32FR) continued:

930812	0214	SP2OFW	39	39	C	.200
	0214	SP2NJI	27	37	C	
	0214	DG1VL	27	27	C	
	0214	OH1AU	36	39	C	
	0217	SP2OFW	27	27	C	
	0220	OK2SBL	39	37	C	
	0228	DF9EC	39	27	C	
	0228	DL2HWD	27	37	C	
	0230	DL7AKA	27	27	C	
	0230	DL8LAQ	27	27	C	
	0231	???FEA		37	NC	
	0233	DJ9EV	39	39	C	
	0233	DL9GKA	37	27	C	
	0235	OZ3MW	26	27	C	
	0235	DF6NA	37	37	C	
	0237	DB5ML	39	39	C	
	0237	DJ1OJ	39	39	C	
	0238	DL1FAP	27	27	C	
	0242	DJ9YE	37	37	C	
	0242	OZ1FTU	37	37	C	
	0243	DF6NA	27	27	C	
	0248	DF7KF	38	38	C	
	0250	DL0DET	39	39	C	
	0250	PA3BIY	37	37	C	
	0252	PA3DOC	39	39	C	
	0255	DG3FK	28	28	C	
	0301	PA3AQN	37	37	NC	
	0302	PA3AQN	37	37	C	
	0302	DB6BX	37	37	C	
	0302	DL3AKW	37	37	C	
	1231	DK9TF	59	59	C	
	1232	F6EAM	37	37	C	
	1233	ON6NL	37	37	C	
	1242	DK6J?		38	NC	
	1251	OM3CYP	39	39	C	
	1251	DL8VHF	39	39	C	
	1251	SP9MRT	37	37	C	
	1252	DL1JSF	39	39	C	
	1252	DL2BUM	39	39	C	
	1253	OK1DUG	39	39	C	
	1301	DL9USA	27		NC	
	1303	SP2SGZ	27		NC	
	2000	ON4AMX	27	27	C	
	2000	DL2IAN	37	37	C	
	2000	LX1DB	59	59	C	
	2001	OO4AOI	27	37	C	
	2132	OZ8ZS	36	36	C	
	2138	PA3CEG	26	36	NC	
	2152	DK1IAZ	27	27	NC	
	2158	DC7OH	27	27	C	
	2158	OZ6OL	26	26	C	
	2213	PA3FUH	37		NC	
	2217	DD0VF	27	27	C	
	2235	DG5FM	28	28	C	
	2310	DL7ALP	27		NC	
	2324	DL2ARD	27	27	C	
	2324	DL5A?		27	NC	
	2336	S59AM	37	37	C	
	2338	DL8EBW	27	27	C	
	2340	OZ6OL	37	37	C	
930813	0000	DF0DX	27	27	C	
	0001	PE1LAU	27	27	C	
	0001	PA3CEG	27	27	C	
	0002	DL3IAE	26	26	NC	
	0003	HA3UU	39	39	C	
	0003	I1KTC	39	39	C	
	0005	OZ8ZS	27	27	C	
	0008	SP2NJI	27	27	C	
	0008	OM3LQ	27	27	C	
	0009	ON4PV	47	47	C	
	0010	DL1ARJ	27		NC	
	0035	DL7AKP	27	27	C	
	0035	DL5XV	27	27	C	
	0057	DL8DAT	28	28	C	
	0057	DL1EAP	27	37	C	
	0058	ON4GG	27	27	C	
	0059	DL6FRS	27	27	C	
	0059	DF8AE	27	27	C	
	0100	DF8XC	27	27	C	
	0122	OK1FFD	36	36	C	
	0141	PA1BVM	37	37	C	
	0141	PA3EFC	37		NC	
	0155	OK1XTJ	27		NC	
	0156	???FFU		39	NC	
	0208	S59AMR	27	27	C	
	0245	OK1XTJ	27	39	C	CW
	0418 0442	DL9GKA	37	37	C	CW
	0328 0359	OK2VZE	37	36	C	CW
	0501	IW5AVM	37	37	C	
	0513	DC6AYR	26	27	C	

PA3BIY (CM72c / JO22EB) wkd via MS on 144MHz:

930508	0500	0527	YU7EF	KE	27	27	21	9	40	C
930514	2100	2120	SM5MIX	HS	27	27	mni	mni		C
930516	1335	1400	IK0BZY	GB	27					NC ×1
930516	2030	2110	IK0BZY	GB	26	27	20	22	3	C
930522	0827	0847	LA6K	EX	27	27	30	35	1.5	C random
930604	0400	0450	9H3ZZ	HW	26	27	32	32	2	C
930605	0700	0800	OH9NYW	NZ	26		1	4		NC
930606	0512	0552	OE6XHF		27	27	mni	mni	2	C random
930613	0400	0418	HA9RC	KI	37	27	mni	mni	7	C
930624	0225	0238	EV5N	OM	27	27	13	20	7	C

PA3BIY (CM72c / JO22EB) continue d:

930625	0700	0718	ES0SM/6	NR	28	27	14	19		C
930628	0047	0104	EV5N	ON	27	28	19	7	1.5	C random
930704	0300	0400	ED1GSR	XZ	27	27	6	16		NC ×2
930704	0400	0550	OH9AB	OA	26	26	15	21	1	C 2066km
930711	0500	0600	LA0BY/p	JE	26	2?	3	2		NC ×3
930712	2347	0045	LA6HL/TF	PX	26	26	15	21	1.5	C
930720	1230	1245	SM5MIX	HS	27	27	mni	mni	3	C
930722	1900	2000	RU1A	OS	26		2	5		NC
930724	0400	0510	OH9NYW/P	NZ	26	27	6	9	15	C
930724	0800	0847	RU1A	OS	26	26	26	14	5	C
930725	2332	0100	LA6HL/TF	RX	26	26	12	19		NC ×4
930727	0000	0040	LA6HL/TF	RY	26	26	7	14	10	NC
930728	0000	0033	LA6HL/TF	TY	26	27	15	22	5	C
930801	0400	0427	IK1PAG	DF	26					NC ×5
930803	2008	2122	G0JLF/TF/P	SY	27	26	14	31	10	NC random
930810	0000	0100	RB5GU	PG	26		3	9		NC
930811	0133	0142	HA5CW		39	28			10	C SSB random
930811	0920	1000	UV1AS	PT	37	26	6	6	12	C
930811	1320	1340	HA3UU		27	27	mni	mni	24	C
930811	1900	1920	OM3AU	KI	37	26	8	5	17	C
930811	2100	2200	UA3MHJ	SR	26	2?	3	10		NC ×6
930811	2300	2400	UB3EE	SI	26		3	5		NC ×6
930812	0025		G4DHF/TF/P		38	38	1		×10	C SSB random
930812	0059		IW6AEG		37	27	1		×30	C SSB random
930812	0052		SP2JYR	JM	59	59	1		×60	C SSB random
930812	0118		SM2CEW	LZ	27	38	1		×60	C SSB random
930812	0137		YO3JW/P	NH	27	27	1		×20	C SSB random
930812	0148		UZ2FWA	KO	37	37	1		×20	C SSB random
930812	0153		YU7BW		27	27	1		×20	C SSB random
930812	0200	0245	3ADJ5MN	DD	26	26	7	10	12	C ×7
930812	0250		LZ2KWT	NC	37	37	1		×10	C SSB random
930812	0304		YU7VA		39	37	1		×10	C SSB random
930812	0309		IV3HWT		39	39	1		×20	C SSB random
930812	0313		9A1IBE		37	37	1		×20	C SSB random
930812	0315		YU7EF	KE	39	37	1		×20	C SSB random
930812	0321		HA3UU		39	39	1		×20	C SSB random
930812	0345		HG1DRD		37	37	1		×30	C SSB random
930812	0349		SM3JAW	JX	39	37	1		×30	C SSB random
930812	0349		SM4HFI	HU	37	37	1		×30	C SSB random
930812	0353		LA1K	FX	37	37	1		×30	C SSB random
930812	0420		YO2LEA		27	38	1		×20	C SSB random
930812	2224	2255	RB5EC	RI	47	27	4		20	C random MSODX 2205km
930812	2345	0017	HA1VQ/p		27	28	mni		5	C random
930812	0055	0130	S51WV		37	37			18	C random

Remarks: ×1 IK0BZY had to go QRT because of a thunderstorm. ×2 First 30 minutes nil, then he called PA3FOC for 2 periods. (FOC was tail-ender after BIY) and then NIL again!!?? ×3 2130 km, weak reflections. ×4 Vy, vy short reflections. ×5 I found IK1PAG 10 KHz (!) lower than the sked frequency calling EA1YV!! ×6 Long distance (~ 2150 km), weak and short reflections. ×7 They had to elevate 70 degrees (!).

Heard on cw random during Perseids: RB5GU, YU7EXY, 9A1CCY, LA4XGA, UC2SMM, UB3EE (2300 km), YU7FU. On ssb random: OH8UV, S57TW, UB5BDC, IT9TVF, LZ1KDP.

Perseids were not bad this year, although the forecast storm did not occur. The peak between 00.45 and 04.00 GMT on Aug. 12th was very good though. Many bursts longer than 20 Seconds and good activity on ssb random. I did not hear any unussual long distance stations during this period. Next night (12/13 Aug.) seemed better. Although there were less reflections than the previous night, I heard some very long distance stations (UB3EE) and could work RB5EC (2205 km) for a new ODX on random.

Good reflections and hope to meet you on 2 metre via ms.

Best 73's Peter, PA3BIY (PacketRadio via PE1JCG at PI8VNW). tks fer info, Peter.

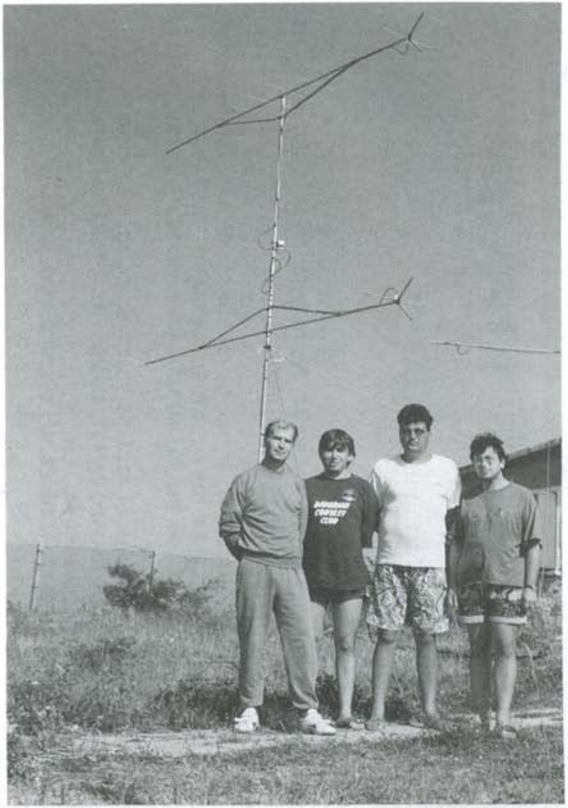
S59CAB (JN76JG) wkd via MS on 144MHz:

930807	1540	RW3AZ	KO55OO	26	37	9	24	7	C 1541km
	1750	OH2AV	KP20JF	26	26	5	14	7	C 1683km
	2122	ES5RY	KO38IJ	27	27	3	12	8	C 1566km
	2255	PA3DUU	JO21IU	37	27	2	26	20	C 960km
930808	2130	GD4IOM	IO74QD	49	27	7	43	24	C 1627km
	2253	SM7TUG	JO76TG	26	26	3	14	2	C SSB 1113km
930809	1647	UV1AS	KO59FX	26	26	2	22	1	C 1837km
	2157	RB5GU	KN56XP	26	27	4	46	18	C 1479km
	2257	OZ1IPU	JO57GH	26	26	5	19	3	C SSB 1261km
930810	1557	G0FIG	IO90UU	27	27	3	10	2	C 1218km
	1952	LA1K	JP53EK	26	26	3	13	50	C 1927km
	2145	SM5DIC	JO88ST	26	27	3	26	14	C 1406km
930811	0337	DG1JL	JO31MI	26	27	3	37	2	C 800km
	0647	PA3FJY	JO32EH	27	27	4	15	15	C 906km
	1732	UZ2FWA	KO04FT	26	26	6	30	2	C 1029km
	1950	RV3ZR	KO80CL	26	27	5	10	5	C 1642km
	2057	HB9BZA	JN36BE	26	27	6	30	3	C 666km
	2036	GM4AFF	IO87VA	37	37				C SSB random 1665km
	2037	GM4ZAP/p	IP90HA	37	37				C SSB random 1859km
	2039	SM7WT	JO65QQ	59	59				C SSB random 1051km
930812	0040	LA6VBA	JO48	37	37				C SSB random
	0053	SM6CMU	JO57XK	37	37				C SSB random 1256km
	0053	SM5DHT		37	47				C SSB random
	0136	OH2TI	KP20KE	37	39				C SSB random 1681km
	0148	SM5DIC	JO89JT	37	37				C SSB random 1510km
	0150	OH1AU	KP10DL	37	37				C SSB random 1653km
	0151	SM5CR		37	37				C SSB random
	0216	SK7GJ		27	27				C SSB random
	0217	LA8KV	JP52QQ	37	37				C SSB random 1837km
	0238	SM7FWZ	JO77	37	37				C SSB random
	0238	GM7LVJ		26	26				C SSB random
	0251	G0JUR	IO92WS	27	27				C SSB random 1292km
	0320	OZ1FTU	JO55WW	59	28				C SSB random 1093km
	0321	PA3EPN		27	27				C SSB random
	0324	GD4IOM	IO74QD	37	39				C SSB random 1627km
	0326	DF9YF	JO42GE	27	27				C SSB random 798km
	0337	DC7UT	JO42GC	47	47				C SSB random 791km
	0346	OO4AOI		37	37				C SSB random
	0346	OH7NQ	KP42	37	37				C SSB random
	0417	RB5WU	KO20DI	37	26	4	1	5	C 835km
	0444	DG1BA	JO43LB	37	37				C SSB random 863km
	0449	DG1OOA		37	37				C SSB random
	0512	UB4EWA	KN68RA	37	37	8	10	35	C 1420km
	0530	F/G0RDI	JN14DM	27	27				C SSB random 993km
	0553	EI4DQ	IO51WU	37	27				C SSB random 1771km
	0658	LZ1KWT	KN32FR	37	27				C SSB random 1004km
	2317	GM4YXI	IO87WI	27	37				C SSB random 1684km
930813	0023	LA5KO	JO48TU	27	26				C SSB random 1440km

NC QSOs during the shower: SM7TUG, PA3FJY, ON4QQ, G4XBF/p, UA3MAS, LA5KO, PA3EFC, OO6NL, LA8KV, OH8UV, G1DNY, G4HGT, GB2XS, G0GMB, G8XVJ, LA4XGA, G0LBK, G4VPD,...

NIL QSOs: Z32UC, UA3MAS, GB2XS, OO1ALJ, LA5KO, OO4KHG, OZ8ZS, UZ3TXB, UW4AK, YL2MB, UA4AQL, OH9NMS, UA4API, UW3ZD, UA3MHJ, YO3JW.

We heard also a lot other stations on random frequency like OY9JD, but we weren't able to complete QSO! Equipment: TS-711E, BF981, PA 2×4CX250B, 4×15ele CueDee. Location: Mt. Menina, 1508m asl tks fer info. S53CAB. tks fer info.



LZ1KWT, KN32FR, Perseids 1993

l to r: LZ1DP, Christo; LZ1JH, Rumen; LZ1UK, Slavi; LZ1KQ, Krasi

6m News News

Editor: Joachim Kraft, DL8HCZ

DL1GNM, JN38 wkd/hrd:
14.08.1993: 10:18- 9H; LA; SM; OH; OZ; G, GW; 13:01-13:18 EA1
16:08-19:02 IO70, 73, 82, 83, 90, 91 JO45, 49, 57, 59, 67, 77, 78 JP50, 81; KP11, 20; JM75; IN52
15.08.1993: 16:26 GM, GM (sh) 18:07-18:15 IO77; IP90
21.08.1993 10:35-12:40 OZ; SM; OY; GM, GM (sh);
19:30-19:52 IT9; 9H, EA7; CT; SV9 from JO54, 55, 57, 65, 66 IO77; IP62, 90 JM68, 75; IN61; IM87;
22.08.1993: 09:55-12:05 CT; 9H; IT9; LA; ES; SM; OZ; OY; GI, GM, GM (sh); DL; EA5, 7; from:
KO38, JO43, 44, 45, 46, 49, 55, JO57, 65 , 86, 96, 99, JM75, 78, IO65, 68, 75, 77, 87, 99, IM59, 87, 97; IN61; IP62, 90;
25.08.1993: 18:24-18:55 G, GI, GM, GM (sh)from IO64, 65, 75, 77, 83, 84, IO86, 87; IP90
26.08.1993 1618-1630 ES6SIX 529/BCN, SM3RPQ JP74BT, SM3BIU HRD JP73ST, SM3GHW HRD.
29.08.1993: 13:32-13:42 SV9; KM25; RU1A; KO48;
15:54-20:?? 9H; YU1; I8, IT9; SM3; GM (sh); OH; ES; SP; SV1; SV9; RU1A from:
JM75, 76, 78, 89; JN71, JO57, 58, 59, 65, 68, 78, 99, KN04; KO02, 37, 38, 48, JP73, 81; KP01, 11, 12, 20, 30; IP90, KM18, 25.
IQSOs: 13:39 SV9ANJ KM25, 17:50 RU1A KO48VR, 18:07 SM5PRE JO78, 19:54 SO5ASL KO02LF.
30.08.1993 16:30/18:35 SV9; KM25; CT; IN61
10.10.1993 16:58-17:40 SM3, 9H from JP81; JM75;
17:10 5T5/F5JKK 55 /56 IL30AM !!!!! (FIRST 5T - DL ? ?)
15.10.1993 16:49-18:08 CT, 9H, EA1 from JM76; IN51, 61, 82; IM58, 87
24.10.1993 11:19-12:06 9H; EA7, 9 from JM75; IM85, 87 tnx fr info, Michael

LY/DF1ZE, KO14 wkd:
26.7.93 1203-1849 I2WSG JN45, IK5JWQ JN52, I3VWK JN55, I3LDS JN55, IK2QDX JN45, F6FEF JN05, ON4PS JO20, ON1ANK, F8OP JN26, ON4KST JO20, F1MXE JN05, ON9CFB JO20, PA0FM JO20, LX1SI, DL8PM, ON4ANT JO20, PA0AMX JO20, ON4CC JO20, LZ2UU, LZ1KDP, KN12.
28.7.93 MS: DJ9YE JO43.
29.7.93 1128-1313 F6GNP IN97, GU7DHI IN89, Gs from IO90, 91, 70, 81 JO01, SV1DH 30.7.93 OZ3VV
2.8.93 MS: PA0RDY 3.8. 1126-1355 F9DI JN33, YU2QC KN04, YU1MW KN04, YU1AD KN04, IK1EGC.
6.8.93 MS: IK8MKK, YU1EU 11.8.93 MS: DK5UG, SM7AED, PA3BGM, G3FHG JO01.
12.8.93 SP5CCC 13.8.93 SM7BAE 14.8.93 YU1EU tks fr info, Michael

PA0LPM, JO22IA wkd:
4.6.93 RU1A KP40HK. 10.6.93 F/PA0RDY/M JN14YC, ZBOT IM76, 2003 EA8/DJ3OS IL18 12.6.93 C31HK JN02TK 13.6.93 G4DSP/P JN03EF. 28.6.93 EH8ACW IL28, EV5M KO42 22.8.93 OY3JE IP62 25.8.93 EH5BZS/P JM09AX. Rig: 10w, HB9CV. tks fr info, Luit

SM7CMV, JO75AM wkd:
17.7.93 OH7TE/9 KP36CP, SV7CO KN20WU, T70A JN63, F6ECS JN12LO.
19.7.93 EH1EH IN82, EH1TA/P IN63BF, 2130: VO1ZZ HRD G/F1PEJ IN79
26.7.93 YO4BZC KN46AK
03.08.93 RA3YO, YO/DF2IAX/P KN44 09.08.93 RU1A KO48VR
16.08.93 21-23 AURORA: SM, LA, OH, G, GM3XOQ IO99, GM6ABU/P IP90HA.
22.8. 09-11 Es to all EU: I, OE, DL, HB9, IT9 23.08.93 12-14 EH1, CT
26.08.93 16-1930 I, OH3MF/9 KP36, OH9SIX, OY9JD, GB3LER. G, GW, GM, GI, EI8GQ IO51.
30.08.93 12-1330 OH3MF/9 KP36, OY3JE IP62, LA7SIX, OH9SIX
13.09.93 16-18 AURORA: OY9JD, PA, DL, ES1CW KO29, GB3LER tks fr info, Ken.

ES News

Editor: Edmund Ramm, DK3UZ

930512

DG1BA (EN75c) wkd:
1744 IT9IPQ HY58d
1750 IW9CER HY67b
1759 IT9NAN HX36a
vln dk fr info, Dieter

DL1GNM (DI80j) wkd:
1605 SV9ANJ MV56j
1624 SV1RK LX09j
1625 SV1VS LY79d
1631 SV1WE LY79d
1638 SV3KH KX28g
1703 SV8JE KY61e
1744 I7IWN JA62j
1750 IK7UXY JA72a
1758 I7UGO IA60e
1758 I7FFE IB53f
vln dk fr info, Mike

DL8EBW (DL66a) wkd:
1613 SV8JE KY61e
1615 SV3KH KX28g
1620 I7IWN JA62j
1750 IK7OKE IB03f
1800 IK8FGM IZ52h
1816 IK8ETN IZ52g
vln dk fr info, Guido

F1FIH (CD13e) wkd:
1543 LZ1UH LB18b
1614 4N5UC LB22h
1619 SV7APS MB77b
1625 SV7CO MA20a
1628 LZ1TD MB08c
1637 LZ1KDP LC27d
1640 LZ/OK1ZDM LC27b
1642 LZ3BD LC18f
mci bcp pr info Michel

IK5FTQ (FD05c) wkd:
1642 YZ5XRJ LB44g
1645 LZ1UH LB18b
1649 SV7APQ MB77b
grazie per info Roberto

IW5ACP (FD05c) wkd:
1913 DL1DV EK46f
1915 FC1DVI AF69e
2000 EB4DCI YZ11g
grazie per info Mauro

PA3BIY (CM72c) wkd:
1737 I7UGO IA60e
1755 I7FFE IB53f
1806 IW7CGF IB74c
1808 IK8FGM IZ52h
bedankt voor info Peter

PA3FOC (CL03j) wkd:
1735 I7IWN JA62j
1743 I7UGO IA60e
1800 I7FFE IA53f
1809 IK8ETN IZ52g
1810 IK7HIN IB75a
1812 IW7CGF IB74c
bedankt voor info Rene

930601

IW5AQC (FD25c) wkd:
1707 UB2GA QG24f
grazie per info Luciano

930608

DG1BA (EN75c) wkd:
1021 IK8ETN IZ52g
1025 IW9CER HY67b
1036 I8MPO HA
1039 IT9SAS HY68d
1040 9H3ZZ HW72g
1043 I8TWK HA
1045 IK8UDV HA
1048 IW8AOK HA12h
1055 IT9LCY HX36b
vln dk fr info, Dieter

DL1GNM (DI80j) wkd:
1038 4N5VB KB37j
1039 sv4/DC2BI/p LA68f
1045 4N5KF
1047 SV2JL LA35b
vln dk fr info, Mike

F1FIH (CD13e) wkd:
0905 SM5IME IT75b
0906 SM5KQS IS26j
0908 OZ6OL GP42e
0909 OZ1HDF GP23c
0910 SM0FFS JT51f
0912 SM7KNK HP32c
0918 OZ1CLL GP23c
0925 OZ3GW FQ21a
1013 YO5QAQ LG59e
1015 YO6AXM NG
1018 YO5TE LG19f
1019 YO2LIA KG
1020 YO2LIM LG
1021 YO5BXK LG29h

930608

F1FIH (CD13e) contd.:

1021	YO5ODA	LG	1037	HA8KAX	KG16g	1048	HA7UL	JH45j
1025	YO2LIN	LG11j	1042	HG7NA	KH64b	1050	HG2SF	IH80b
1030	HA8CL	KG63b	1044	YO2AVM	LF61f	1053	HA0ML	LH03b
1032	HA8ET	KG22j	1046	HA4GBG	JG	1112	OM3AU	KI27h
1035	HA5AOP	JH	1047	HA5DE	JH36g	mci bcp pr info Michel		

PA3BIY (CM72c) wkd:

1111	IK7MCJ	IA47d	1112	SV8JE	KY61e	bedankt voor info Peter

PA3FOC (CL03j) wkd:

1111	SV8JE	KY61e	1113	IK7MCJ	IA	bedankt voor info Rene

930610

DL1GNM (DI80j) wkd:

			1702	EI5FK	VL08f	1804	GM0NUL	YQ46a
1553	YO3JW	NE41h	1704	EI4GL	VL19h	1809	GM7GUC/p	YQ56e
1600	G0CUH	WJ09e	1705	EI8GQ	VL19g	2054	GW8ELR	XL26g
1604	G1SDX	XK	1724	EI4HG/m	VN34a	2058	EI3EBB	VL08f
1624	G4IGO	YK07f	1737	EI7HP	WM65a	2102	EI2DNB	WN58h
1646	EI3GE	WN60d	1748	GM4CXP	YP37c			
1651	EI9HW	WN26f	1802	GM3JFG	XR30b	vln dk fr info, Mike		

DL2IAN (EJ71a) wkd:

			1716	EI8GQ	VL19g	1811	GM0LXB	XP20d
1559	G0CUH	WJ09e	1717	EI7GL	VL12b	1818	EI2GT	VM27j
1602	G6LEU	XK66g	1735	EI7HP	WM65a	1823	EI4HG/m	VN
1630	G0BWE	YK62b	1809	GM0HBK	XR71a			
1714	EI5FK	VL08f	1810	GM0GMD	YQ61g	vln dk fr info, Thomas		

DL8EBW (DL66a) wkd:

1612	YU1EV	KE13d	1617	YU7EF	KE14h	1709	UT5JCW	QE38c
1613	YU7EW	KF24f	1622	YU7AL	JF16e	1710	RT5JG	QE28g
1616	YU1EM	KE13g	1623	HA8MV	KG13b	1804	GI1JLA	WO40c
1616	YO3JW	NE41h	1633	HA3UU	JG	vln dk fr info, Guido		

F1FIH (CD13e) wkd:

			1558	G0JSB	YN	1649	GI1JLA	WO40c
1528	SP5EFO	KM66f	1559	GM4CXM	XP09g	1651	GW4VEQ	XN58d
1529	SP5TAT	KM67h	1605	G8GXP	ZN23g	1652	GM3JFG	XR30b
1530	SP5ATS	KM35a	1616	GM3LVI	YQ	1656	GI7CMC	XO
1530	SP7JTQ	KL01j	1618	GM0HUO	YQ57h	1701	GI4OWA	WO04a
1530	SP5CCC	KM66a	1627	G0KTQ	YN	1707	G7HUD	YN
1531	SP7CNF	KL	1635	OZ1CLL	GP23c			
1557	GM0HBK	XR71a	1644	GI4KSO	WO50c	mci bcp pr info Michel		

IK5FTQ (FD05c) wkd:

1642	G7NRO		1719	GW0PZT	XM17j	grazie per info Roberto

IW5ACP (FD05c) wkd:

1630	SK4EA	HT	1645	GM3JFG	XR30b	2046	FC1DIW	ZF
1641	G0CQD	ZO	1752	EI7BFB	WN	grazie per info Mauro		

IK7UXY (JA72a) wkd:

			1710	9H1ET	HV13b	1727	PA3FJY	DM52c
1703	F1EAN	AG22f	1711	F1JRX	CF02j			
1706	IK1LLD	EE52f	1725	SV1BRL/8	KY64e	grazie per info Gianni		

PA3BIY (CM72c) wkd:

			1606	EB5MS	ZZ	1622	HG8UJ	JG09j
1533	YO9CBZ		1611	YU7EF	KE14h	1624	YU1WP	JE34b
1548	EA1TA	VD58a	1615	LZ2CM	LD47f	1625	YO2IS	KF17e
1605	YU1UO	KE	1618	YO2BBT	KF60e	1626	LZ2WY	MD44d

930610

PA3BIY (CM72c) contd.:

			1910	OK2SBL	JJ24g	1914	OK2BTI	JJ13h
1634	YZ7MJU	KF11j	1911	OK2BMU	JJ11a			
1740	CT1WW	WB63b	1912	OK2BTL	JJ12g	bedankt voor info Peter		

PA3FOC (CL03j) wkd:

			1618	HA8ET	KG22j	1635	HA3GJ	JG
1533	YO3JW	NE41h	1620	YU7AL	JF16e	1639	EA1MO	XB27e
1552	EA1TA	VD58b	1621	YU1IO	KE13g	1710	UT5JCW	QE38c
1552	EA1NQ	XD32d	1623	YU1WP	JE34b	1717	CT1WW	WB63b
1556	YU1EV	KE13d	1623	YO2IS	KF17e	1740	CT4KQ	WA21e
1613	YU7ON	KE	1626	LZ2WY	MD44d	1743	EA7WM	WX64j
1614	YU7EF	KE14h	1627	YU7EW	KF24f			
1616	YU1GT	KE25d	1630	YO2BBT	KF60e	bedankt voor info Rene		

930611

DG1BA (EN75c) wkd:

			0808	IC8FAX	HA	0825	9H3ZZ	HW72g
0802	IW9CER	HY67b	0823	9H1GB	HV13a			
0807	IT9LCY	HX36b	0824	9H5DM	HV03f	vln dk fr info, Dieter		

DL2IAN (EJ71a) wkd:

0803	SV8AQY	KY64e	1004	LZ2WY	MD44d	vln dk fr info, Thomas		

DL8EBW (DL66a) wkd:

						1016	LZ3BD	LC68f
1011	LZ3UF	LC27c	1012	LZ/OK1ZDM	LC27b	vln dk fr info, Guido		

PA3BIY (CM72c) wkd:

0704	IC8FAX	HA	0829	9H1GB	HV13a	1008	LZ3BD	LC68f
0808	SV8AQY	KY64e	0831	9H5DM	HV03f	1009	LZ/OK1ZDM	LC27b
0824	IK8ETN	IZ52g	0833	9H1PA	HV	1010	LZ3UF	LC27c
0828	9H1JP	HV13b	0836	9H1CD	HV03e	1011	LZ3RX	LC27j
0828	9H3ZZ	HW72g	0842	9H1ET	HV13b	bedankt voor info Peter		

PA3FOC (CL03j) wkd:

0805	SV8AQY	KY64e	0829	9H1GB	HV13a	0833	9H1PA	HV
0825	IK8ETN	IZ52g	0830	9H5DM	HV03f	0843	9H1CD	HV03e
0828	9H3ZZ	HW72g	0832	9H1JP	HV13b	bedankt voor info Rene		

930612

PA3BIY (CM72c) wkd:

			1736	UZ3AF	SP27b	bedankt voor info Peter		

930613

PA3FOC (CL03j) wkd:

						1022	YZ7MJU	JF
1014	HA8CE	KG32c	1020	HG7JAL	JH45j	bedankt voor info Rene		

930615

IK5FTQ (FD05c) wkd:

1412	LZ1YP	NC41h	1414	LZ1ZX	NC12b	grazie per info Roberto		

930620

DL2IAN (EJ71a) wkd:

0655	SV8AQY	KY64e	0726	IK7CMY	IB75j	0759	LZ1ZP	MC64e
0703	IK7UXY	JA72a	0752	SV8JE	KY61e	vln dk fr info, Thomas		

DL8EBW (DL66a) wkd:

0724	IK7OKE	IB03f	0725	SV8JE	KY61e	0725	SV1BRL/8	KY61e

930620

DL8EBW (DL66a) contd:

0726 IK7UXY	JA72a	0739 I7CCF	IB53f	0757 IW2FEA/p	IA48d
0727 IK7CMY	IB75j	0745 I7IWN	JA62j	0810 YU6AA	JC47g
0734 IK7HIN	IB75a	0755 IK7LMX	IA30d	vln dk fr info, Guido	

F1FIH (CD13e) wkd:

0621 LZ2ZF	LD	0659 YO5BLA	LG29g	0718 HA8ET	KG22j
0622 LZ2HB	ND	0700 YO5PK	LG28c	0721 YO5TP/p	LG28c
0624 LZ2CM	LD39a	0701 YO3JW	NE41h	0722 YO5OCS	
0625 LZ1UK	LD	0702 YU1WX	KE02d	0724 HA8MV	KG13b
0627 YO7VJ	LE	0702 YU1VG	JE19e	0725 YO5OBR	KH80c
0634 I3VIP	FF	0704 YU1AD	KE53f	0726 HA8KAX	KG16g
0639 YU7EW	KF24f	0704 YO5TE	LG19f	0730 YO5CBX/p	MH
0640 YU1ES	KE13c	0706 YO7NE	OF52b	0732 I3VYK	FF46j
0641 IK4JPN	FE15e	0707 YO5OB	NF02g	0734 YO8BSE	NG
0642 HA8DK	KG63b	0708 YO5CSO/p	LG25j	0742 HA5DE	JH36g
0645 HA8PO		0710 YZ7MJU	KF11j	0744 UB5BDC	MJ35j
0649 YO2BBT/p	KF	0712 HA8CE	KG32c	0746 HG6IAS	KH
0651 YO2AMU	KG67e	0713 HA8EK	KG51e	0748 HG6VP	KH01f
0652 9A1CRJ	JF34g	0714 YO5BWD	MH63d	0749 HG6IBS	KH22a
0653 YO2LGO	KG67j	0715 HA8AH	KG26h	0819 YU7XU	KF
0655 YO5CFI	LG50e	0716 YO5LH	LG19f		
		0717 YO5DGE	MH63f	mci bcp pr info Michel	

IK7UXY (JA72a) wkd:

		0729 DL1KDA	DK23g	0749 DL1EAP	DL44j
0702 ON4KST	CK22d	0730 PE1OGF	CL47d	0750 DG1JL	DL56h
0703 DG9KQ	DK24e	0730 DC8TS	DK24d	0751 DD5HI	DK
0703 DL2IAN	EJ71a	0730 DJ9CZ	DL71a	0752 DC6KI	DK44a
0719 DL8GP	DJ55c	0730 PA3FYF	CM73c	0753 PA3EHW	CM36f
0720 ON4QQ	CK	0731 DL3IAE	EJ62j	0754 PA3FJY	DM52c
0720 ON5CN	BL79d	0731 DK6UG	EJ32f	0754 DB4ES	DL74h
0720 DL4VS	DJ65b	0731 DJ5BV	DK26h	0755 DH4JZ	DL35e
0721 DF2VJ	DJ55b	0732 PA0JMV	CL37e	0755 PA0RDY	CM45e
0721 G4PIQ	AL16h	0733 DG1KBZ	CL75j	0756 PA0RLS	CM53d
0721 DB8KJ	DK32f	0735 PB0AFZ	CK10a	0756 PA3FOC	CL03g
0722 DG6PY	DK64b	0736 DC9KZ	DK04j	0757 G4SWX	AM77j
0722 DK2BJ	DK41e	0737 DF9KT	DK13b	0757 DK6OR	DL64j
0723 DC6DY	DL47g	0738 DK2AR	EM79a	0757 PA3FFS	CM57h
0724 DG6PS	DK59b	0739 DL3SBA	DL67e	0759 PA3BZO	CL18e
0724 DF7KF	DK13b	0740 PA3EPD	CL02c	0759 DL8KBJ	DK04c
0725 DK4VW	EK14j	0741 DF2JQ	DL44h	0801 DL4XX	EN50c
0725 PE1LCL	CL34f	0742 PA2CHR	CM80d	0802 PE1LAU	DN66f
0726 DL8EBW	DL66a	0744 DC3VW	DJ45e	0803 9H1EE	HV03f
0726 DG4KBV	DK23g	0745 PA3BIY	CM72c	0811 DL3IEL	EL
0727 DK5WO	DK11f	0746 DJ6XV	DL25c	0833 9H1GB	HV03f
0728 PE1AIL	CM62c	0747 PA3EKK	DM	0853 SV8JE	KY61e
0728 PE1DNO	CL48h	0748 DK9TF	DL66a		
0728 PE1OPF	CL34f	0748 DJ4UF	DK21a	grazie per info Gianni	

PA3BIY (CM72c) wkd:

				0755 I7IWN	JA62j
0745 IK7UXY	JA72a	0753 SV8JE	KY61e	bedankt voor info Peter	

PA3FOC (CL03j) wkd:

		0759 SV8JE	KY61e	0810 YU1BT	KD
0754 IK7UXY	JA72a	0808 YU6AA	JC47g	bedankt voor info Rene	

930627

F1FIH (CD13e) wkd:

				1628 CN8HB	WT24h
0847 CN8HB	WT24h	0853 EA7WM	WX66g	mci bcp pr info Michel	

930627

IW5ACP (FD05c) wkd:

		1700 CN8HB	WT24h	grazie per info Mauro

IW5BVP (FD34j) wkd:

1650 EA9IB	YV	1710 CN8HB	WT24h	grazie per info Stefano

930708

DL8EBW (DL66a) wkd:

1020 9H5CL	HV03f	1215 IK8ETN	IZ52g	vln dk fr info, Guido

F/DL1GNM/p (YI37h) wkd:

				1934 9H1AL HV
1928 9H1A	HV	1929 9H5CL	HV03f	vln dk fr info, Mike

PA3BIY (CM72c) wkd:

				1028 9H1ET HV13b
1020 IT9DEC	HX	1027 9H5CL	HV03f	bedankt voor info Peter

930717

IW5ACP (FD05c) wkd:

		1118 UB3EE	SI72a	grazie per info Mauro

IW5BVP (FD34j) wkd:

1115 UB3EE	SI72a	1119 RB5EEZ	SI61h	grazie per info Stefano

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" 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 @ DB0HBS.#HH.GER.EU

vy 73 Eddi

Aurora News

Editor: Edmund Ramm, DK3UZ

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

930804
1720 GM4ZAP/p YT75j 52a hrd 360

930913
1555 GM4IPK ZT04j 52a hrd 330
1612 UZ2FWA KO13g 57a 57a 340
1625 SM5DFF IS32g 52a 43a 350
1629 SM5BSZ IT44e 55a 55a 330
1654 GM4JJJ YQ73c 55a 55a 360

hrd also:
DF8LC FN03a, GM4UFD ZR32f, OZ1BEF EQ67f, G4ASR YL06h

vln dk fr info, Guido

LA1T/p (DR08a) wkd via Aurora on 144MHz in CW:

930904

1527	SM4POB	HU43g	59a	57a
1530	SM0FFS	JT71f	53a	55a
1532	LA2EGA	FT11j	55a	55a
1535	DJ9YE	EN04f	59a	59a
1540	SM5PPS	IT26f	55a	55a
1543	OH2TI	MU65j	59a	59a
1545	ES2RJ	MT34d	52a	55a
1547	ES1DF/2	MT53d	53a	55a
1549	YL2MB	MR57a	53a	57a
1551	SM5EOS	IT23d	53a	55a
1554	LA2RZ	CU47b	55a	55a
1556	LA5TGA	FT53f	59a	59a
1558	SM5BSZ	IT44e	55a	55a
1613	LA7DFA	DX79b	59a	59a
1618	GM4ZUK/p	YQ08g	55a	55a
1621	GM4YXI	YR60a	55a	55a
1626	SM4HFI	HU39h	59a	55a

takk for info Jan-Martin

ON7UC (BL66d) wkd via Aurora on 144MHz in CW:

930804
1742 GM4ZAP/p YT75j 55a 55a 350
1800 GM4ILS YR24e 55a 54a 350

bedankt voor info, John

SM4SJY (HU77h) wkd via Aurora on 144MHz in SSB:

930913

1433	LA2PHA	DS74j	51a	41a
1603	DB6QS	EO48g	51a	51a
1606	DL9GKA	GN08b	53a	55a
1615	SP2OFW	JN71h	41a	52a
1642	SP2SGZ	IM19a	52a	59a
1645	DJ3LE	EO18d	51a	55a

hrd bcns: LA2VHF FX52d, LA1VHF ET13c, DL0PR EO54c, SK7VHF GP38c, OZ7IGY FP39b, SK1VHF JR42f

tack for info

Please submit your Aurora reports preferably in machine-readable form. You may do so on disc, by E-Mail or by Packet Radio:

dk3uz@iSYS-hh.hanse.de

DK3UZ @ DB0HBS.#HH.GER.EU

vy 73 Eddi

News & Comments

Editor: Klaus Tiedemann, DL4EBY

The Five Bells Group 2nd DXpedition to Iceland, 1993 Summary of results

Dates : 31st July to 11th August 1993.

Team and operators : Organisation and logistics by Keith (G4ODA). Also, David (G4DHF), Tim (G4VXE) and John (G0JLF). Thanks to Chris (G8IJC) for all the cooking and "good house keeping" which allowed the operators time to make the contacts!

Route(s) : (G4ODA, G4DHF, G0JLF) V8 Landrover with a fully laiden full size safari-type roof rack from Lincolnshire to Aberdeen - Lerwick (Shetland

G0JLF/TF/p in IP24NK, listening to 144 MHz Meteor Scatter

Islands) - Torshavn (Faroes) - Seydisfjordur (Iceland). Overland via "road" (!) to Stafafell, approximately 50km NE Höfn.

(G4VXE, G8IJC) Air freight, Heathrow - Reykjavik - overland by bus to Höfn.

Locations :

- Holiday accomodation, Stafafell, IP24NK
- portable location August 11, IP34FV

Equipment : A 500w permit was granted for 144 MHz and 432 MHz at the fixed accomodation. Antennas - 80ele collinear group for 144 MHz and 8x21ele yagis for 432 MHz. TS850S & transverters, FT736, H/B preamps (0.35dB NF).

A low power permit of 25w (with an operating curfew) was granted for 50 MHz. Antenna - 5ele yagi. FT736.

The HF station ran 100w from a TS850S into a "Butternut" vertical antenna. Over 4500 contacts were made on all HF frequencies, including 1.8 MHz and the WARC bands - *A little light entertainment for the redundant VHF operators!* All callsigns had to sign /TF/p... try sending that on CW!

Acknowledgements : We ran real time computer logging almost continually. Our thanks to G3WGV for "TurboLog" which ran superbly. Also to K1EA for "CT" and to VK3UM for the real time Moon Tracking program.

Thanks to Jon, OY9JD and his family for their generous hospitality on our return to Torshavn. Thanks to Andy, GM4IPK.

432 MHz EME.

Originally, we had not intended to take 70cm due to the lack of operators, but a plea for assistance in the "VHF-UHF DXer" magazine brought a response from Tim, G4VXE who really committed himself. We were therefore able to request a 500w license from the Authorities along with Tim's personal license. We're really pleased we made space for the extra equipment because 70cm proved to be the highlight of our operations via moon-bounce.

70cm operation was both highly exciting and frustrating in the extreme! With the Moon almost at apogee during our arrival and with a high level of ionosperic activity, conditions were less than favourable to say the least. Adverse Faraday rotation for hours and days on end was the major factor in preventing the completion of more QSOs than we actually made. Even so, our 8x21ele, H/B preamp (0.35dB NF) and 3CX800 PA worked very well in the circumstances. When conditions were good, they were excellent, but...oh dear!...all those frustrating hours we spent with no returning signals! Even Jan, DL9KR commented on the pitiful state of the band! Stations with cross-polarisation facilities regularly informed us (via 14.345 MHz) that our signals were returning vertically polarised.

What was particularly interesting to note was that on at least two occasions we were able to hear stations calling us and to work DL9KR approximately 20 minutes before our moonrise, and always at good signal strength. It has been suggested that this is caused by enhanced refraction over a sea path. Anyhow, the phenomenon does exist and does appear to enhance signals under the right conditions. We frequently noticed a marked deterioration in signal strengths as the returning signals became increasingly cross-polarised as the moon increased in elevation. by 10° or so of elevation,

G8IJC, Chris, the cook with many tasks..

signals had frequently all but faded only to return again some hours later when the moon was around 40° in elevation.

50 MHz operation

In his report, Keith mentions that he was somewhat disappointed that there were no major Es openings to Europe like those we had experienced during our first visit in 1990. Even so, we were regularly able to work into parts of LA and SM most evenings around 1700z via some form of **scatter** propagation. Some G's were also worked via this mode. The Auroral contacts on the 4th August were particularly interesting and we wonder if these were the first via this mode from TF ? Later the same evening there was propagation into G via **Auroral E** when all the beacons were well audible, but there was little in the way of activity. The main form of station operation used by Tim and Keith was by running a daily beacon on 50.110 which proved to be the most effective way of yielding contacts on an apparently *dead* band. This method provided a significant number of QSOs (nearly 200) as weak and minor openings were more readily detected.

During the peak of the Persids, the six meter station ran at very low power to avoid break through on the two meter station. It was interesting listening to reflections on both bands simultaneously as the reflections were markedly stronger and more consistent on 144 MHz! Even so, again, a good number of stations were worked. When we went QRT on two meters at around 0400z, the band was well open into G via sporadic E. Again, all the beacons were well audible but the level of activity was generally quite low. Perhaps everyone was on 144 MHz ?

144 MHz operation from IP24NK

Two meters was to be the main stay of our operations and we had carefully prepared our equipment accordingly. Originally, we had planned to transport a trailer mounted tower, but this was not possible due to a lack of towing clearance above the havily laiden Landrover.

We selected to operate with collinear antennas because,

a) we knew from previous experience that they performed well. Tests had shown the 80ele array gave slightly more gain than 4x16ele yagis.

b) logistically, they were far easier to erect because having a boom length of under two feet per antenna, the whole array could be 'knitted' together at ground level. Longer yagis would have necessitated an operating height of around 11' or so above ground level.

Although we had the means to elevate the system with a fair degree of engineering, we chose to erect the antenna as quickly as possible without it in order to be QRV for the weekend's operation. Remember, the moon was becoming more distant with every passing day. In the event, we were QRV and working stations within one day of having arrived at our site.

Reflections via MS generally proved to be weak and relatively short lived in the period prior to the peak of the Persids. Even so, we completed with a good number of well-equipped European stations. With the absence of all form of man-made noise and a good pre-amplifier we were regularly receiving all the necessary information before our sked partners. John, G0JLF had a *baptism of fire*. Never having operated MS before, he quickly and efficiently learnt the procedure and within a matter of hours was operating like an old hand! I think that we will hear a lot more of him via this mode in the near future. Our take-off from East through South-East was perfect with an uninterrupted nearby sea path to the horizon. As with 70cms, Faraday rotation prevented the completion of more contacts than we actually made via 2m EME. Unfortunately, our US window was screened by the huge mountain range which extended around and behind our QTH. This was a great disappointment to us, but we had worked around 40 stations via the mode when we last visited TF in 1990. Also, the limited mains supply to the wooden holiday 'shack' could not cope with two QRO amplifiers operating simultaneously and would 'trip' the electric fuse box! We therefore decided to concentrate on 70cms EME because the elevation system way already in place.

In the late afternoon of the 4th, Keith detected auroral signals on six meters. We quickly fired up two meters and carefully turned our array between North West and South East in the hope of hearing signals, but just where do you beam when you are so far North ? We had observed a visual aurora during during our previous visit but had failed to detect any signals at that time. Then, it happened! Beaming at a QTF of some 20° I heard GM4ZAP/p (IO89) pulsing the noise on 144.055. I called and received a "QRZ..G4..HF". I called again, this time signals were stronger. Our keying became increas-

G4DHF/TF/p in IP34FV, running 144 MHz Meteor Scatter

ingly more excited as we exchanged callsigns, 55a/59a reports and locators. I looked out of the window and observed that we were beaming into 2000 ft of solid rock less than a mile from our QTH! A few minutes later I heard and completed with Ron, GM4ILS (IO87). I could tell by his keying that he was also somewhat surprised to be called by us. Signals quickly faded into the noise and I heard no more new stations. A second contact with GM4ZAP/p took place nearly two hours later, but the event failed to increase in intensity and no other signals were detected. When we met with Richard, G4WKN (GM4ZAP/p), on the Shetland Islands some two weeks later, he confessed that we nearly did not make the contact because he thought that "..it was only some weak G station calling him"! In reality, I knew that Richard was the kind of operator who seek out the weakest of signals. To our knowledge, we do not know of any other auroral contacts having ever taken place from TF and we would therefore welcome any further information.

Portable operation from IP34FV during the Persids

By the late afternoon of the 11th we had loaded the Landrover and were heading back to Seydisfjordur to catch the 'Norona' the following morning. On the way back we made a detour along the coast in IP34 and established a portable station by the side of the road above a 300 ft precipice directly overlooking the sea. Stations for two and six meters were established inside the vehicle and we became operational by 2030z. On two meters we used a much modified IC202S (including internal digital display), a home brew 4CX250B linear and a 20 ele collinear antenna. Listening on 144.200 we noted only a few bursts in excess of 2s or so. And then it all happened!

We started operating at 2150z and worked a few stations on 144.200. When we QSY'd to our previously announced operating QRG of 144.215, there were a number of stations already there waiting to work us. We were quite literally greeted by a wall of returning QRM from most of Western Europe as we interrupted our transmit sequence. This confirmed that we were indeed radiating an excellent signal. Reflections became more frequent and longer lived, so much so that between 0030z-0200z on the 12th it was almost like operating in sporadic E conditions. Some bursts favoured only DL while others F, ON, PA and G. Many were audible to all which give rise to excitable walls of frantic QRM. What a delight! Even the medium and low power stations were calling and being worked with increasing success. No time to stop for anything. My logbook, which was no more than a spiral bound notepad, contained frantic hieroglyphic scribbles as station after station exchanged calls and reports in a single burst. Computer logging would have been too slow. A later contact with a DL station on the VHF-Net informed us that we had been audible in Western Germany for 4 minutes on a single burst. Although I was too busy working stations to note the full duration of bursts, looking back through my notes I can confirm that **in one exceptional burst at 0050z I completed with 15 different stations**, and that included repeated *QRZs* because I couldn't identify individual prefixes or letters in the wall of QRM!

By 0330z reflections were noticeable less frequent and by 0400z there appeared to be no further point in calling. It was as though someone had switched the shower off! In the five hours of continuous operation we had completed with around 127 stations....quite remarkable. Who would have wanted to sleep on a night like this ? In a state of sheer elation we dismantled the stations and by 0830z were continuing on our journey to catch the boat. I don't mind betting that there were quite a few people in Europe who felt just as pleased as we did that morning!

Conclusion

I believe that it is fair to say that we have now taken TF off *the most rare VHF Countries list*. Many of our contacts were between 1800km-2200km which shows what can be achieved with good equipment and a keen team of operators. But what next? Things are really becoming quite difficult now because our group has activated most of the rare locators and remote Islands off the west coast of Scotland over the past ten years. This also includes two trips to TF and OY. If we can gain assistance, both financially and logistically, Jan Mayen is possible. So too is Greenland, but this is rather beyond the range normally associated with MS operation and we would have to rely on EME or some other form of scatter propagation. All it takes is two well equipped stations and the determination to penetrate the white noise. And to think that only a matter of two decades ago VHF/UHF propagation was considered to be limited to around a few tens of kilometers line of sight! 73s, de David, G4DHF

(For QSO reports, have a look at the appropriate sections of DUBUS in this and the next issue.. Klaus)

F6FLV, Jean-Pierre, writes about his VHF experience in Lebanon 1993:

I had a contact with Samir (OD5SK, an official ham in Tripoli) three years ago on the 10m band. He told me it isn't possible to bring a transceiver in your luggage. Recently, he said this has changed.

I took a 2m 25w multi mode transceiver and a 9ele yagi on the plane. F1TFF, (Marie-Therese, my wife) and I arrived at Beirut Airport on 31st July. The customs asked about the antenna, but not about the radio equipment.

On 1st August I mounted my 9ele yagi on the roof of the house we were living in in Beit Chabab, 750m asl at the Mediterranean coast, pointing towards Cyprus. The TRX can work with a 110V mains, but as we had electricity only twice three hours per day (public and private, respectively), I obtained a car battery plus charger to be QRV as long as possible.

We informed the Lebanese Ministry of Telecommunications of our stay and applied for a license. Unfortunately, they said in order to qualify for a license, we would have to stay in the country for a minimum of 5 month. They advised us to use our call signs together with the Lebanese QTH, without an official paper. Anyone needing a license for Lebanon should contact the RAL (*Lebanese Radio Amateur League*), POBox 8888, Beirut, Lebanon, tel.: 09-911 223 or 01-581912.

Every day I had an SSB QSO with Nicolas, 5B4AAI, (25w, 11ele), on 144.300, with 59+ signals. Nicolas is a very friendly ham, and he likes VHF very much. He would like to become QRV on MS and EME. Since August he is QRV on 6m. The first day I heard 4X4IF (RS, 250w SSB), but as it is absolutely forbidden to contact Israel from OD5, there was no QSO.

We met Samir, OD5SK, a friendly and dynamic ham. He has good equipment, but is not QRV on 2m SSB. He plans to erect a 2m yagi soon, so hopefully we can work him next year. OD5SK is probably the only Lebanese station QRV on 6m. On 3rd August, 1400z, he heard YU an SV stations calling Es on 2m. Unfortunately I had no electricity at that time .

But on 7th August, from 1730z on I worked Es with strong signals from Northern Italy and ex-Yugoslavia, ODX 2430km. After getting no reply from any local station, the pile up on 144.300MHz was a good surprise for us. We got reports from 55 to 59+, and I felt as if we were the only DX station QRV in this part of MDLE. I gave my location as **RU**, but later I calculated it to be **RT09g**. I worked I3LTT, S51SLO, IW3GGU, IV3GBO, S53AC, S57MJM, S53VV, S57HUK, IK3MAC, I4XCC, 9A3JH, 9A1HST and 9A3NC.

Apart from this opening I worked no further DX. 2m SSB activity is poor in that part of the world. The only other two SSB QSOs were with Andy, 5B4XA, and Panicos, 5B4AET. I did not work TA5C, who is QRV on 2m and 70cms SSB.

During the Perseids' maximum I was QRV all night on 144.200 MHz. I heard many stations, especially YU, I, LZ and UB5. But not very long and strong bursts. So I had no complete QSO. From 0220 to 0330z I heard LZ1KWT continuously with 41 to 53 signals, peaking 55 in bursts. He didn't hear me because of my QRP power. I also had the feeling, that a lot of stations at good MS distance were beaming in the opposite direction.

It is very difficult to use 2m in Lebanon. Near Beirut, at 750m asl, I received hundreds of pirate stations in the 2m band, industrial repeaters, commercials, 2m CB, phone patch, music broadcasts, cordless telephones, ... It took about one week to almost clear 144.300MHz. At the beginning it was impossible to hear amateurs on this frequency, too many strong FM pirate stations. All of 2m is like this in Lebanon. Except at nighttimes I couldn't hear the SSB MS net during the Perseids shower. It is so easy to buy and use an amateur frequencies transceiver in Lebanon.

The situations seems to be the same with TV, 22 stations for a population of 2 million, and FM broadcast, sometimes three stations per channel.

As of now telecommunications are completely disorganized. But the situation may change soon, because the government has problems with pirates also on maritime, aircraft and police frequencies.

After 15 years of war, the second amateur radio exam was planned for October 1993. Unfortunately some people I spoke to want to pass this exam only to have a permanent license in order to use amateur frequencies tax free for their business purposes!

Lebanon is a beautiful country with very good summer weather and many monuments to visit. The weather is hot and charged near the sea, but dry and pleasant in higher places. Apart from e.g. the center of Beirut and a few villages (I didn't visit southern Lebanon), the majority of houses have been rebuilt, war marks are disappearing. At the moment electricity and telephones aren't working normally, but this will change soon.

VHF wise Lebanon is exceptional because of the good Es distance from Europe, and it is a new country for most amateurs. The northern Lebanon Mediterranean coast is near hills and mountains up to 3088m high, many of them suitable for DX-peditions. You'll need a TRX which can be run from 110 and 220v ac and 12v dc, a car battery, and possibly a generator. At this time thousands of generators are in use throughout the country to make up for only three hours/day with mains supply. So generators are in good supply, and petrol is cheap, only $5 for 20ltrs. If you need an antenna rotator, you'll be delighted to hear that every house uses one.

There are not many radio amateurs in Lebanon, about 120, of which only one is QRV on 6m, and none is QRV on 2m SSB. OD5s use 144.600MHz as an FM net frequency and DTMF code to keep out pirates. So, were you to call there during an Es opening, they wouldn't probably hear you. Amateurs in OD5 are mostly QRV on HF. We met OD5CN, OD5KB, OD5KU, OD5MU, OD5JU and OD5KI. Apparently they don't know about 2m DX by means of Es. I hope some of them will give it a try next year.

For those, who are planning a VHF DXpedition to OD5:

Good sites for VHF operation are:

Bzommar, RT09a, 900m asl, Hotel Bzommar, tel.: 09 902469/2731/2953. The manager allows (for free) antennas on the hotel roof if you stay for a few weeks. This is a good hotel ($50/day), 20km N/E Beirut, 180° of clear take-off towards the sea. There are a few cavity antennas for commercial repeaters on the roof.

Laqlouq, RU, 1800m, many hotels, 40km NE Beirut.

Jabal Sannine (Faraiya Mzar), RT/RU, 30km NE Beirut. Village from 1500 to 2000m asl. Telecoms tower with two big dishes in direction Cyprus. Technicians can permit amateur radio, no interference detectable with my handy TRX. With a jeep you can go up to 2500m, where there is a TV repeater.

Choueir, RT, 1000m, 20km NE Beirut. Nice area, but lots of damaged houses and hotels.

Qornet es Saouda, Jabal el Mekmel, SU51j, 3088m asl, 60km NE Beirut, 30km SE Tripoli. The top of the Middle East, at the Mediterranean sea. The mountain top can be reached by jeep. There is nothing on the top, you'll need to bring a generator. Some savage animals.

You need an international driving license to drive in Lebanon. The traffic is dangerous, therefore renting a car is expensive. There are many holes in the roads and no roadsigns. 73s, Jean-Pierre.

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