United Kingdom
Microwave Group

Scatter Point - Pilot Issue

November 1999

Contents

Editorial

Welcome to this first issue of the UK Microwave Group's newsletter. I have been asked by Lehane and Martyn to write this editorial as an introduction to the new group, which I am very pleased to do.

Some of you will have seen the initial information about the UKuG on my web page so I won't take up space by repeating it here. The URL for my web page is
www.btinternet.com/~jewell.

We have been asked by a number of prospective members why we feel it is necessary to form a microwave group when we already have the RSGB Microwave Committee that organises Roundtables, has introduced so many new technology designs, and produces a first class microwave newsletter. Well, the idea for this microwave group was first mentioned some years ago at one of the UK microwave Roundtables. I don't remember the exact reason the subject came up but it had something to do with the popular misconception at the time that the RSGB Microwave Committee was the governing committee of a microwave group. It seemed then that a microwave club to look after the interests of UK amateur microwavers, in much the same way as BATC and AMSAT does for TV and satellite, would be a popular idea.

Due credit for the idea of a UK-based microwave club must be given to Glenn Ross, G8MWR, who ran the very successful Microwave Society many years ago, and who helped to popularise amateur microwaves in the UK. Although the new group is not the same as the Glenn's microwave society, it has many of the same aims.

It is hoped that active microwavers will join the UKuG and some of you will form the new committee to run the group. For the present, Lehane, Martyn and myself will act as a steering committee to get the UKuG off the ground. As soon as possible we will hold an open meeting of as many members as we can get together and vote a full committee to run the UKuG. In the meantime we are funding this first newsletter ourselves. We hope it will become as influential as the RSGB Microwave Newsletter or even DUBUS. The newsletter doesn't yet have an official name. That will be one of the first things the new committee will need to do.

The steering committee has decided to set the annual subscription for membership of the UKuG at £12 per year. This may, of course, be changed by the elected committee, but we feel should be sufficient to ensure 6 high quality newsletters each year. We have already recruited several well-known microwavers to produce regular columns in the newsletter and there are plans to recruit several more. Even so, we would like your input as well. In particular, technical articles are sought and will be given high space priority in the newsletter. Several interesting equipment designs are already planned for inclusion in subsequent issues.

It is to be hoped that the UKuG will once again bring UK amateur microwaves to the fore where the late Dain Evans, G3RPE, firmly placed it so many years ago.

73 de Sam, G4DDK

The DC Bands - 1.3 and 2.3GHz News

© John Quarmby G3XDY

I will be covering the goings on for the low microwave bands in this column. To do this justice I need your news and views from around the UK and beyond. My contact details are at the end of this piece, I look forward to hearing from you.

My own activity is focussed on DX and contests, but there is much more going on, such as packet node links, FM and AM ATV repeaters, voice repeaters, satellite operation, EME, beacons and more, and I hope to cover as wide a range of topics as possible. One aim of this column is to highlight the level of activity of all types, as part of the “use not lose” campaign to ensure we maintain access to this valuable spectrum.

DX Report

The week between 28th July and 3rd August produced an extended period of excellent tropo conditions across the whole of the North Sea area. UK Stations near the East Coast from Kent to Scotland saw the best of the conditions, but it certainly penetrated inland as far as the Pennines and the Cotswolds.

One notable aspect was the amount of backscatter. Stations in GM and Northern England worked Southern stations with both ends of the QSO beaming east. With a good quality duct, the radar reflection from the continental coastline provides enough signal to make this possible. This makes possible QSOs that would otherwise be very difficult due to obstruction on the direct path. I heard Peter G3PHO from his home QTH in Sheffield with a good backscatter signal, turned the antenna to the direct path and lost him completely. Bob, G0KPW, also noted the same when working GM.

Simon, G3LQR, made very good use of this effect to work OY9JD (IP62 square) on 1.3GHz. The OY had an excellent signal into Holland, and Simon was able to work him by beaming east. This path should also be possible for other stations with a clear take off to Holland even if their takeoff to the North is poor, and is certainly worth bearing in mind for the future. By the way, if you think that this needs high power to make it work, I understand that OY9JD was running just 3W output to an indoor 23element Yagi! At my QTH OY9JD was the same strength (539) on both the direct and backscatter paths.

Other highlights from the week included LA6LCA in JO59, worked by several UK stations on 1.3GHz and also making it into the East coast on 2.3GHz and higher bands, plus several SM6, SM7, OZ and Northern DL stations, often very strong on 1.3GHz but signals on 2.3GHz were generally weak. Many beacons were reported on both bands that are rarely heard in the UK, but will be worth looking for in future openings, such as LA1UHG in JO59, heard at S9 for extended periods on 1.3GHz, and its 2.3GHz counterpart which peaked 569 here, and SK6UHI in JO67,also a good signal on 2.3GHz.

Neil, G4BRK, reported a good QSO with OZ5BZ on 1.3GHz with signals so strong that his receiver overloaded this over a path of more than 850km!

1.3GHz & 2.3GHz Fixed Contest

Conditions for this event were back to normal after periods of tropo enhancement during the previous few days. G7LRQ (IO91) appeared to be doing very well on 1.3GHz, with 30 QSOs at the three hour mark including DG1KJG in JO30. I spent a lot of time running tests on 2.3GHz, with moderate success. I exchanged signals with David G8NEY in IO81, but not enough for a full 2 way contact. Neil G4BRK was getting out well with his new set up, working G4DDK amongst others. John G8ZQB was active from IO92. Roger G3MEH (IO91) was trying a new system out on 2.3GHz, whilst Brian G8DKK has receive only capability at present. A test I tried with Dave G4RGK was unsuccessful, however signals on 1.3GHz were not particularly strong at the time. A couple of PAs were active, with Wim PA0WWM at 54 here in East Anglia.

This is a welcome influx of stations getting going on 2.3GHz, and I look forward to reporting more activity during the autumn contest season.

Regular Activity

A frequent complaint is that there is little or no activity on 1.3GHz outside contests and good openings. A number of stations have started a “Mass Trespass” on 1.3GHz on some Sunday mornings in the past two or three months, starting at 10.00am for an hour or so. A number of contacts were made during these activity periods, and it seems to be a time when many people can get on for a look round. Having a defined time and day for activity certainly makes sense. Many years ago Monday evenings at 8pm used to be the preferred activity period. I welcome your views on whether Sunday mornings are the best time for this and will let you know the outcome in the next column.

Using the DXCluster for Microwave DX

The UK has a well-developed Packet DX Cluster network that link nodes throughout the UK and to Europe to pass on DX spots and other DX information such as WWV sunspot and magnetic disturbance data. This network is very useful for alerting users to activity and openings, and is being used increasingly for microwave DX as well as HF and VHF spots.

The original cluster software was written with 432MHz as highest fully supported frequency. Spots can however be input with any frequency, and will be broadcast through the network, but the cluster will not remember the history for spots above 432MHz. This is why many microwave spots are broadcast showing frequencies of 144000.0 or 432000.0MHz with the actual frequency involved included in the comments field.

A work around has been put in place on many of the UK nodes, by re-using the 220MHz band which the cluster supports but which is not allocated in Europe. Typing sh/dx 220 will then list the last 5 spots on 1296MHz and above.

To use the DX cluster you will need a PC, TNC, and a suitable radio for the local access in your area. Many of the UK DXCluster use 70MHz for local access, others have 432MHz access, or you may need to work through an intermediate network node to get to the cluster.

An alternative for those of you with Internet access is the excellent OH2AQ internet version of the cluster (http://www.oh2aq.columbus.fi), which gives world-wide visibility of spots, although it does not pick up all the spots that appear on the UK cluster network.

A good example of the benefits of the cluster are the regular 1.3GHz QSOs between Erik, G8XVJ (IO83) and John, GM4LBV (IO86), which are frequently “spotted” by Erik. This gives a good indicator of conditions and activity in the North of the UK, and an opportunity for stations further away to listen for a DX contact.

The Cluster network is also an important user of 1.3GHz in its own right for some of the “trunk” links between the cluster nodes. This has the advantage of little QRM and plenty of bandwidth for high speed modulation schemes. The Martlesham DX cluster (GB7DXM) is linked to the Kent cluster (GB7DXK) this way, for example.

Sign off

Please let me have your news and views, criticism (constructive I hope!), and tell me what you would like to see in future columns. I can be contacted as below. By the time the next newsletter appears we will have had the October UHF Contest and be into the UK 1.3/2.3GHz Cumulatives, so please let me know how you got on. Information for this column has come from G4DDK’s “A View from East Anglia” web site, from the DX Cluster network, and also QSOs made by the writer.

73 John, G3XDY

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Why do I have to change my transverter crystal? - yet again!

Mike Dixon G3PFR

Background

It is October 1999 and the next World Radio Conference (WRC) is maybe less than a year away. Meanwhile the commercial pressures on the amateur microwave bands, from "auctioning of radio spectrum", continues unabated. By international definition, both the Amateur Services are in the unfortunate position of being unable to compete financially in bidding for spectrum. Our case is not strengthened by under-use of the bands currently available. The "Use or Lose" principle has been stated so many times that amateurs tend to disregard the warning signs and forget that it is a reality which has to be faced, sooner or later. Perhaps the message should be modified to "Use and Protect"? Make no mistake, the crunch is coming in the early years of the next Millennium, unless we take a realistic, pragmatic stance in negotiations prior to the next WRC!

Within all ITU Regions (and, of course, IARU Regions), each country has its own radio administration. In the case of the UK, it is the Radiocommunications Agency (RA). In Region 1, the majority of countries are also members of CEPT and therefore have an additional "layer" of administration in the form of the European Radiocommunications Committee (ERC) and its executive office, the European Radiocommunications Office (ERO). The deliberations and recommendations of the ERC (and its sub-committees and working groups) are published in printed format, but are also (usually) available on the Internet at the Web-site http://www.ero.dk

Over the past five or six years the ERC has conducted a number of Detailed Spectrum Investigations (DSIs), and published corresponding Responses and Consultative documents, covering CEPT usage of various parts of the spectrum. For example, DSI Phase I covering 3400MHz to 105GHz, Phase II covering 29.7 to 960MHz and Phase III covering 862 – 3400MHz (I fail to see the logic in the numbering of the phases!). Our own RA has carried out similar exercises in the UK.

A bit of microwave history

Many of the present-day microwave bands were allocated to the Amateur Service just before, or immediately following, the first post-World War 2 Telecommunications Conference in Atlantic City (1945). Needless to say, the Amateur Satellite Service didn't then exist (the first "sputnik" was launched 12 years later, in September 1957). Traditionally, amateurs world-wide have used sub-bands harmonically related to an initial drive frequency of 1152MHz, for instance 2304, 3456, 5760 and so-on, as decided at the 1945 conference.

More than 50 years later, amateurs use transverters instead of multipliers, and the need for these harmonic relationships has disappeared, although there has been a tendency to stay with them in determining the weak-signal narrowband segments still in use today. None of the DSIs, so far, has recognised the need for protection of these "traditional" amateur weak-signal sub-bands, other than by recommending that national administrations "*consider the needs of the Amateur Services"* by carefully allocating frequencies and sub-bands to the Primary Services. The ERC has, so far, not felt able to raise the status of any of the weak-signal sub-bands from shared Secondary to Amateur Primary.

Amateur policy

Thus, the policy of the various national Amateur Radio Societies, comprising IARU Region 1, has been to seek a minimum of 10MHz-wide Primary sub-bands, not necessarily maintaining the traditional harmonic relationships, whilst retaining as much of the present Secondary allocations as possible.

At the present time

In the space available here it will only be possible to review a few of the proposals which have, so far, come from negotiations. We would like you to study as many of the ERC/ERO publications as you can, so that we can hope for some feedback from you!

The 1.3GHz band (1)

Amateur Services operate on Secondary basis, alongside Radiolocation, Earth Exploration (active) satellites, Space Research (active), Radionavigation, Radionavigation-Satellite (Space to Earth) and future Wind-Profiler Radars (in the band 1270 – 1295MHz).

A recent proposal from DARC requests three points to be taken into consideration:

(1) upgrading the Amateur Service to Primary status in the sub-band 1260 – 1270MHz, “even at the expense of more difficult sharing in the remaining parts of the band”,
(2) to extend the right of the Amateur Satellite Service to operate Space–to- Earth in this same sub-band and
(3) to encourage administrations to study compatibility criteria and implement existing amateur allocations for a trial period to show that there is no interference risk to protected services.

The 2.3GHz Band (1)

In Regions 2 and 3, the Amateur services are allocated the whole of the band 2300 – 2450MHz. In Region 1 the Amateur Service is allocated the whole of the band 2310 – 2450MHz and the Amateur Satellite Service is allocated the 2400 – 2450 sub-band. Both are secondary to Fixed and Mobile Services and co-secondary with the Radiolocation Service.

The ERC propose to establish a “semi-protected” sub-band harmonised with Canada and the US (Region 2), with the Amateur Services elevated to Primary status in the sub-band 2390 – 2417MHz, “even at the expense of more difficult sharing in the remaining parts of the 2300 – 2450MHz band”. In making assignments to other user’s systems/stations sharing this sub-band, the national authorities must take into account the Amateur Services’ weak signal communication needs. In support of this approach, it is stated that “The Amateur community is however aware of heavy demand of spectrum in this frequency range and is willing to accept reality, provided that some steps were undertaken to safeguard the Amateur Services. *Such steps have already been taken by the US and Canadian administrations who transferred the spectrum 2390 – 2400MHz and 2402 – 2417MHz from governmental use to the private sector and upgraded the Amateur Service in these frequency segments to*

Primary status. Simultaneously the Amateur services were requested to accept sharing with the secondary PC-S users". Now that's what I call pragmatic (the Italics are mine)!

The 3.4GHz band.

In theory, most of IARU Region 1 has no allocation in the 3300 – 3600MHz band. Despite this, Germany, Israel, Nigeria and the UK all have 3400 – 3475MHz. Very recently Dutch amateurs gained a 200kHz-wide band and, as a consequence, Region 1 is recommending the adoption of 3400 – 3402MHz as the preferred weak-signal sub-band. It may be possible that other CEPT countries may also get a narrow Primary allocation. In the UK, some frequencies above 3410MHz were allocated to the 'phone operator Ionica which has since "gone bust". In theory, this leaves us free to carry on as before. However, it makes a great deal of (that word again!) pragmatic sense to press for elevation of the 3400 – 3410MHz sub-band to Amateur Primary and ignore the "traditional" 3456MHz.

The 5.6GHz band.

Not a lot happening here at the moment, although there is increasing pressure from broadcasting auxiliary services (eg OB links and the like) to use part of this already (in the UK) fragmented band. Once again we would be well advised to consider using the amateur Primary allocations instead of the traditional 5760MHz – again the "traditional" harmonic relationship! I really cannot understand why, when in some of the bands we already have Amateur Primary allocations, we don't use them. Inconvenience caused by needing to fit a new crystal and realign the LO? Most "front-ends" are sufficiently broadband not to need serious realignment, so why not do it and take advantage of something for which we don't have to fight quite so hard to maintain? This is one of the intermediate bands where we stand a risk of loosing all because of under-use.

The 10GHz band.

All UK amateurs should be well aware of what has happened in the most widely used and popular microwave band! With effect from 1 February 1999, the UK Radiocommunications Agency (RA) made further changes in the 10GHz amateur band. These have made it necessary for amateur band usage to be re-planned for the second time in approximately three years.

Prior to these changes, UK amateurs could not use the segment 10,150 to 10,300MHz. Following the changes, the segment 10,120 to 10,225MHz cannot be used. This is a gross gain of 45MHz for Terrestrial usage only. The provision of 2.5MHz "guard" bands reduces this to a net gain of 40MHz

Also, prior to the most recent changes, the segment 10,450 to 10,500MHz was available for combined Terrestrial and Space use. However, following the changes the segment 10,475 to 10,500MHz is no longer available for Terrestrial use, only for Space use.

It should be noted that the RSGB Microwave Committee has taken the opportunity to adopt a wideband transponder numbering system based on (centre) input/output frequencies, rather than Channel Numbers. Although "normal" frequency pairings are shown on the current bandplan, these may be varied, as required by local needs.

The new UK 10GHz bandplan still conforms to the more general IARU Plan, but it should also be noted that, at present, the RA will not approve formal, unattended, narrowband beacons in the 10,368 to 10370MHz segment. Thus it would seem, in the longer term, that the pragmatic approach would be to use 10,450 – 10452MHz as the preferred weak-signal sub-band instead of 10,368 – 10370MHz currently used.

The 24GHz band.

This, the first of the mm bands, is shared with ISM and amateurs “must accept interference from other ISM users”. This being said, the nature of band propagation is such that mutual interference between terrestrial stations is unlikely, except on a local basis, because of atmospheric water and oxygen absorption. Space to earth or earth to space may be more prone to interference particularly if the path is near-vertical, thus minimising the effective of atmospheric absorption.

The band segment 24.00 to 24.05GHz is allocated on a Primary basis to both the Amateur Services in all three ITU Regions, whereas the rest of the band, up to 24.250GHz is Secondary, with the segment 24.05. to 24.15GHz unavailable in the UK.

German amateurs (and UK operators) still use the harmonically related 24192MHz (1152x21) in the Secondary part of the band. Common sense tells us that we should be using the Primary part of the band, although this is unlikely until we *have* to do so! I believe that the time is rapidly approaching where we must, seriously, take up this option, even though it means a crystal change and LO realignment!

Bands above 71GHz (2)

Of the bands allocated at WARC '79, only the Amateur Primary (Exclusive) bands 75.5 - 76GHz, 142 - 144GHz and 248 -250GHz were implemented by the UK Radiocommunications Agency. In many other IARU R1 countries, the Amateur Secondary bands are also available. This has led to the situation where (notably) German amateurs use parts of the bands - for example in the 76GHz band - unavailable in the UK. This hinders and restricts amateur operation because harmonisation of use is not possible.

Frequency band and band status changes to the mm-bands above 71GHz are proposed in (2). These will have considerable implications for the future of Amateur and Amateur Satellite experiments. The proposed allocations, which are co-allocated to Radio Astronomy and the Amateur Services, are:

76 - 79GHz Amateur Secondary. Radio Astronomy (RA) Primary
79 -80.5GHz Amateur Secondary. Radio Astronomy Primary
80.5 - 81GHz Amateur Primary. Radio Astronomy Secondary

136 - 141GHz Amateur Secondary. Radio Astronomy Primary
134 - 136GHz Amateur Primary. Radio Astronomy Secondary

241 - 248GHz Amateur Secondary. Radio Astronomy Primary
248 -250GHz Co-Primary

The paper states that "Co-allocation of the RA and terrestrial services (may be) possible provided there is the necessary co-ordination around the Radio Astronomy station(s)". It may be argued that the Radio Astronomy sites will generally be in remote, unpopulated locations, so there should be little trouble. However, much of the amateur operation in the mm-bands will almost certainly be from hilltop sites and cannot, therefore, guarantee to be clear of Radio Astronomy sites, even though the Radio Astronomy sites using the mm-bnads are well scattered and at very high altitude to minimise the atmospheric absorption effects of which we are all well aware.

Furthermore, many of the mm-bands currently allocated to the Amateur Services are proposed to be shared Primary with the Radio Astronomy Services. The loss of Primary Exclusive status is likely to complicate and restrict unattended operation (eg. Beacons) in these bands. Future satellite-borne stations in the Amateur Satellite Service may cause serious interference, as they will over-fly many Radio Astronomy sites.

Note S5.YYZ states that "the Radio Astronomy Service in the bands 80.5 - 81.0GHz, 134 - 136GHz and 248 - 250GHz is Secondary to the Amateur Satellite Service". This statement is ambiguous, in that it appears to exclude the Amateur Service. These CEPT proposals, unless modified, will be finalised at WRC 2002.

The RSGB Microwave Committee considers that band sharing with Radio Astronomy (a passive service) and loss of Primary Exclusive status will restrict the use of the mm-bands by the Amateur and Amateur Satellite Services. As far as we are aware, these proposed changes have only been discussed in ITU Region 1, although they will affect all three ITU Regions.

Summary

The amateur microwave bands, almost without exception are under extreme pressure from commercial and professional users and each MHz of spectrum has monetary value. Amateurs were once given all the “wavelengths below 200m” because they were considered useless for commercial purposes. As soon a amateurs proved this to be untrue (in the 1920’s and ‘30’s), they were reallocated to commercial (SW broadcasting and other) services. Unless we come up with some pretty cogent and pragmatic reasons for retaining them, in the early 2000’s the microwave bands will go exactly the same way! Use and Defend is today’s message!

Source Documents

(1) “Overview of contributions to the 1st round of the DSI Phase III consultation process” – ERO

(2) ERC Document PT 33(99)02r2.

Rain scatter – Where, When, How ?

© PA5DD, Uffe Lindhardt

This paper forms the basis of a talk on rain scatter given at the Adastral Park Microwave Roundtable on 14 November 1999. It deals with the practical aspects of using rain clouds as a mean of reflection on frequencies around 10 GHz. It also includes a look back on the rain scatter season 1999 as seen from the Netherlands.

Frequencies

For radio amateurs the main frequency band of interest for rain scatter contacts is 10 GHz. Rain clouds offer very good reflectivity at this frequency, and atmospheric losses are low. At the same time the availability of high performance components and circuits for this band has increased the last few years.

On lower bands the reflectivity decreases drastically due to the size of raindrops compared to the wavelength. According to WA1MBA (see Internet resources below) this amounts to –12dB at 5.7 GHz and –19dB at 3.4 GHz in relation to 10GHz. These figures seem to match the practical experience of many amateurs. DX-contacts (over 400 km) are quite difficult on 5.7 GHz. Also the number of stations QRV on this band is much smaller.

Rain scatter on higher bands than 10 GHz is an area where very little experience has been gathered. Due to the still very merger activity and the small output powers on 24 GHz, very few contacts has been made. Certainly atmospheric losses start to play a role on this band. It seems though, that shorter contacts of up to 200 km can be made when strong forward scatter is present on 10 GHz. For these contacts elevation is essential.

Equipment

Which kind of equipment is needed to make rain scatter contacts ?

Basically any equipment used to make tropospheric contacts will do, but to make full advantage of this propagation mode a narrowband mast mounted home station is essential. The weather patterns that rain scatter are linked to, do not invite for hill top portable operation. It is also very difficult to predict when good rain scatter openings will occur, and it is therefore essential, to monitor the conditions over longer periods.

QTH

It is not essential to have a high-elevated QTH for working rain scatter, as it is often the case with tropospheric contacts. High altitude will give only little enhancement in the achievable ODXs. What is important is a clear horizon because even a few degrees of horizon elevation are going to block for DX contacts. The rain clouds resides only up to a maximum height of 10 – 12 km, and it is essential to have a clear view of the reflection areas on the horizon if you want to achieve contacts of 600 – 800 km.

TX

A reasonable ERP output power is important. Output powers of up to 1W are available at low cost (e.g. QUALCOMM surplus modules), and with that power and a parabolic dish of 50cm, you have a good rain scatter station. In fact most of then QSOs reported at the end of this paper was worked with 1 W and a 45cm dish, including several QSOs of 600 – 700 km.

Since the station should preferably be mast mounted - because of the high feed losses at 10 GHz - solid-state amplifiers are easier to install. On the other hand the cost of solid-state transistors at a power outputs above 1 W are still very expensive. Installing a TWT amplifier in your mast can be quite cumbersome. Nevertheless many stations using 10 W or more are QRV via rain scatter, so be prepared for some frustration if you go on the air with 200 mW.

RX

Since low cost HEMTs like the NE325 are now available, the receiver should have a noise figure of 1 – 2 dB. On the other hand since many high power stations are QRV any receiver will do.

Antenna

For maximum size/gain performance a parabolic dish of at least 40cm should be used. Using a relative small dish gives some advantages in finding the optimum reflection point and also removes the need to elevate the antenna at medium distance contacts.

A larger antenna gives the advantage of a larger ERP output power, which can prove essential for DX contacts. Exact pointing gets difficult from a dish size of 70cms onwards using the normal commercially available azimuth rotators. My advice is to use a 40 - 50cm dish if you are looking for many QSOs (like in a contest), and a larger (70 – 90cm) if you are a DXer.

Elevation can be very useful in rain scatter openings. For medium distances (300-500 km) it can mean a difference of 10 – 20 dB in signals. It is however my experience, that you will work these stations also without elevation, but probably AFTER that the stations with elevation are done rag chewing. For 24 GHz elevation is essential for rain scatter.

Modes

All though rain scatter is possible using broadband equipment real DX requires the better system performance of narrowband modes like CW, SSB & narrowband FM. CW (telegraphy) is by far the most efficient mode. Due to the fast random orientation wind speeds in rain clouds, reflected signals are subject to Doppler distortion, which makes the signal sound like white noise. The size of the Doppler effect is on 10 GHz very similar to the one known from 144 MHz Aurora reflection. This distortion makes it difficult to understand SSB signals, especially when using side scatter (i.e. the reflection point being offset from the direct line between the two stations). On the other hand SSB is normally quite useful for making DX QSOs, which are always forward scatter.

For local or medium distance contacts - where signals can be very strong – narrowband FM is also an option. In FM the Doppler distortion disappears all together, due to the low deviation of the Doppler effect as compared with the modulation. For making fast comfortable QSOs or for rag chewing FM is the perfect mode, it is however recommended to QSY from the narrowband part of the band to prevent disturbance to other stations.

Finding rain scatter

Finding rain scatter openings are quite a challenge because of the sparse distribution of stations and beacons, and because of the narrow beam angles associated with 10 GHz antennas. The rain scatter season – at our latitudes - extends from approximately begin of May to the end of September, with a peak in the month of June. Certainly rain scatter contacts can be made outside this season, but they rarely produce any DX contacts.

At present most of the rain scatter QSOs made are made along the 50º latitude. From my experience rain scatter is less frequent at higher latitudes like 55º. It is however difficult to separate the effect of the generally low 10 GHz activity level there and possibilities for rain scatter. There seems however to exist a belt of high thunder activity going from the Biscay bay and North- East towards central Europe. In any case there will certainly be some variation in rain scatter activity from region to region.

At present the main warning channel for rain scatter openings is the Packet Cluster network. This network links most of Europe together for fast real-time spotting of rain scatter observation. The ideal rain scatter spot contains information of the QTH of the two stations, and the azimuth angle QTF of the reporting station. Unfortunately only the newer DX cluster software has a good support for reporting 10 GHz contacts, and this software is not yet installed throughout Europe (e.g. not in the UK). For example CLX provides excellent features like dedicated 10 GHz spotting and reflection point calculation.

WW-converse is also available via the Packet network. It is a “chat mode”, and allows real-time communications between rain scatter stations on channel. 10368. Unfortunately WW-converse is also not available everywhere, and normally less than 10 stations van be found here during openings.

The Packet cluster & WW-converse can also be reached via various “back doors” on the Internet. So can some of the professional weather radar’s. These radar’s typically work at around 9 GHz, and they can therefore provide very useful information on current rain scatter conditions. The main problems in using these sources are the cost of real-time information, which is sold at commercial terms. The information that is publicly available is normally some hours old, and does for example not include elevation scans, which are essential for the evaluation of DX possibilities. A few exemptions are mentioned under the Internet resources below.

Beacons are another essential tool in finding good rain scatter reflection points. It is however essential with high power beacons (1W or more), since the beacons are required to have an Omni-directional antenna pattern, and hence have relative low ERP. It is also important that beacons are placed between places, where actual activity can be expected. A good example of such a beacon is DB0JK in JO30LX, which serves the three main areas of activity at present, namely the Randstad NL (JO22), Ruhr D (JO31) & Rhein/Main D (JN49). Unfortunately the lesser-activated areas (like the UK at present) suffer from the mutual concentration of activity between these centres. One answer to solve this problem is the deployment of beacons to attract attention.

A final means of locating rain scatter reflection points is the use of another local station as “sounder”. In my experience the backscatter signal of a station close to you gives the best indication of the beam angle towards the DX stations. Beacons which are often received via side scatter will give a beam angle slightly offset to the forward scatter beam angle. A very good teamwork can evolve between two close-by stations alternately giving CQ, while the other station are optimising his beam angle. Combined with some kind of backbone communication, this can be a powerful tool to find the reflection in directions, where no beacons are present.

It can however be difficult to determine the distance to the scatter point using this technique. Maybe in the future amateurs will be able to do their own “sounding”, using fast RX/TX switching and precise time mapping of the return signal.

Finally it cannot be stressed enough, that activity brings on more activity in quite a surprising way. It is my estimate that at present, there are close to a doubling of rain scatter activity every year on the continent, at least if measured by the number of contacts made. For an indication of the present activity, you can check the list of stations compiled by DG1VL and referenced below under Internet resources. This list is only the top of the iceberg !

Operating

The rain scatter activity is concentrated around 10368.100 MHz. During openings the activity can extend well beyond the band 10368.080 – 10368.150 MHz. It is apparent, that more spectrum will be needed if activity continue to increase at the present level. It is not unheard of to hear 10 stations giving CQ at the same time in this band segment during an opening.

Most contacts are made randomly following a CQ without any prior arrangement. This makes rain scatter contacts an extra treat, since most other contacts on 10 GHz are made after contacts made on lower bands. The normal operation style is to have an automatic keyer make a CQ in the direction, where the rain scatter reflection point is assumed to be. These CQ calls can be quite long, but in order to find the rain scatter it is important, that the on-air time is kept high. Unfortunately this leads some operators to call CQ for more than 10 min, without checking for stations coming back to their call. If this happen to be the rare DX station you are looking for, be sure to have some tranquillisers at hand. Calls in SSB are also made, but usually even stations that cannot read CW uses an automatic keyer to make the CQ.

A main activity during a rain scatter opening is to keep track of the reflection area. The reflection point is often moving (though not fast), and DX stations will have slight variations in the optimal azimuth angle, depending on the angle they have towards the reflection area. In some big openings there are 2 or 3 different reflection areas, which can be challenging to the operator. A good working Packet cluster can help to focus on the best direction.

On the IARU conference in Lillehammer 1999 it was decided to replace the last character of the RST report with an S (e.g. 59S) in rain scatter contacts. This reporting is used on CW as well as phone.

Log analysis 1999

To round off this paper I have made some simple analysis on the rain scatter contacts that I have made during 1999. All of the contacts were made from my home QTH that is situated at –2m ASL, but with 360º of free horizon take-off. Most of the contacts were made with 1 W output and a 45cm parabolic dish (actually a lampshade). Towards the end of the period I have upgraded to 10 W output and a 70cm dish. These improvements were made as an effect of the good results made with the original set-up.

The first figure in appendix 1 shows the distribution of contacts and distances over the season. Of course the number of contacts are highly dependent on when I was actually QRV, but still the figure are rather interesting. It should be noted that many stations have been worked more than once. For a detailed analysis I refer to the complete log in appendix 2.

The first figure shows 5 – 6 real DX openings concentrated in the period May, June and July. The DX openings are characterised in that contacts over 450 km are possible. These contacts are much rarer than contacts of 200 – 400 km.

This is shown more clearly in the second figure, where the same contacts has been sorted after distance. DX contacts are more difficult to achieve due to the fact that openings are shorter, and DX openings can rarely be detected using beacons. The signal strengths of DX stations can be quite impressive though.

Conclusion

It is my hope that this paper shows that rain scatter reflection on 10 GHz is a mode that everybody can enjoy, and that we can continue the rising trend of rain scatter activity in Europe in the coming years. Today the achievable DX results on 10 GHz far succeed those of the lower microwave bands like 2.3 GHz. This is a surprising development, from which we have only seen the beginning yet.

Internet resources

WA1MBA, on the basics of rain scatter:
http://www.wa1mba.org/10grain.htm

DG1VLs list of rain scatter stations:
http://www.qsl.net/dg1vl/RS_05_02_99.txt

Weather radar for the Netherlands:
http://weerkamer.nl/radar/

Weather radar for Bonn, Germany with elevation scans:
http://www.meteo.uni-bonn.de/Deutsch/Forschung/Gruppen/radar/radar_en.html

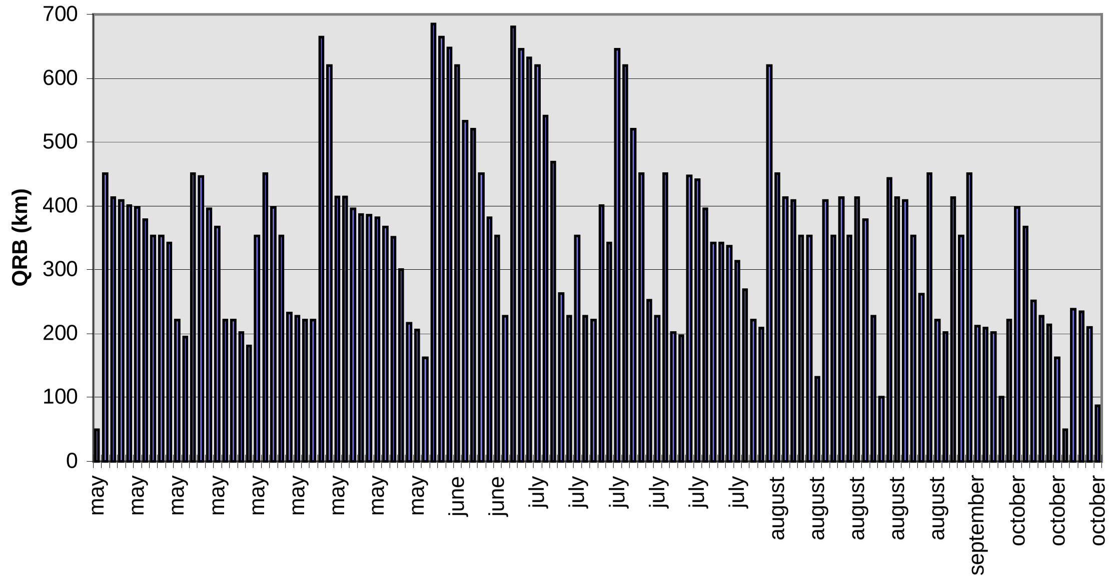
PA5DD, Authors homepage:
http://home.worldonline.nl/~nouchavw/

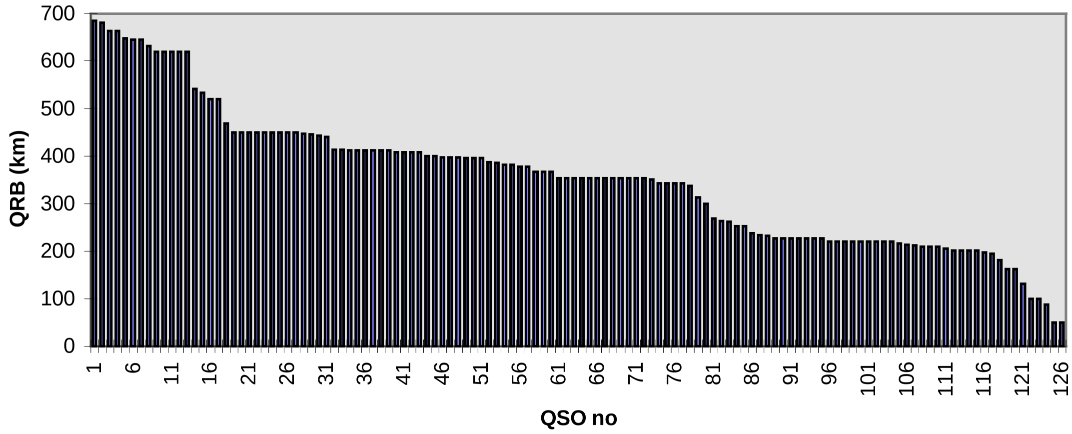
G4DDK, Activity reports:

http://www.btinternet.com/~jewell/

DF6NA, Sound recordings of rain scatter contacts:
http://df6na.mayn.de/~df6na/audio.htm

Appendix 1





Appendix 2

Rain scatter LOG for PA5DD (JO22IC) 1999

Date	UTC	Call	Loc	QRG	2*	RSTs	RSTr	QRB(km)
19990505	1154	PA3DYS	JO21JP	10368	CW	59RS	57RS	50
19990507	1657	F6DWG/P	JN19AJ	10368	CW	59RS	55RS	353
19990507	1702	F5HRY	JN18EQ	10368	CW	57RS	55RS	413
19990507	1722	F6DKW	JN18CS	10368	SSB	58RS	54RS	409
19990507	1726	F6DWG/P	JN19AJ	5760	CW	55RS	57RS	353
19990507	1746	F1PYR/P	JN19BC	10368	SSB	55RS	55RS	378
19990507	1754	DG1KJG	JO30NT	10368	SSB	57RS	55RS	221
19990507	1902	DL3NQ	JN49IN	10368	CW	57RS	42RS	398
19990507	1912	DC9YC	JO31PJ	10368	SSB	57RS	52RS	195
19990507	1921	DC6RW	JN49HL	10368	SSB	56RS	41RS	401
19990507	1931	DF6NA	JN49XS	10368	CW	55RS	52RS	450
19990507	1945	DJ1KP	JO40JJ	10368	CW	55RS	55RS	342
19990510	1541	DG1KJG	JO30NT	10368	SSB	59RS	59RS	221
19990510	1544	DG1KJG	JO30NT	5760	SSB	42RS	52RS	221
19990510	1549	DJ6JJ	JO31LG	10368	SSB	59RS	59RS	181
19990510	1559	DH8AG	JO31RL	10368	SSB	59RS	55RS	202
19990510	1724	DH9NBB	JN49WS	10368	SSB	56RS	51RS	446
19990510	1731	DF6NA	JN49XS	10368	CW	56RS	53RS	450
19990510	1746	DH6FAE/P	JO40PL	10368	SSB	59RS	59RS	367
19990510	1856	DL3IAS	JN49EJ	10368	CW	55RS	55RS	396
19990519	1539	F6DWG	JN19AJ	10368	CW	54RS	51RS	353
19990529	1758	F6DWG	JN19AJ	10368	CW	57RS	55RS	353
19990529	1812	DG1KJG	JO30NT	10368	SSB	59RS	56RS	221
19990529	1822	G3LQR	JO02QF	10368	CW	59RS	57RS	227
19990529	1850	G4DDK	JO02PA	10368	CW	57RS	55RS	232
19990529	2004	DG1KJG	JO30NT	5760	SSB	55RS	53RS	221
19990529	2119	DL3NQ	JN49IN	10368	SSB	59RS	58RS	398
19990529	2124	DF6NA	JN49XS	10368	CW	57RS	54RS	450
19990530	1046	ON7WR	JO20EP	10368	CW	59RS	55RS	162
19990530	1153	OK1JKT/P	JO60OK	10368	CW	56RS	57RS	620
19990530	1159	DL2ABO	JO51CR	10368	SSB	59RS	59RS	381
19990530	1205	DH4AE/P	JO51DQ	10368	CW	55RS	55RS	387
19990530	1212	DH6FAE/P	JO40PL	10368	SSB	59RS	59RS	367
19990530	1217	DK3FF	JO30MT	10368	SSB	58RS	58RS	216
19990530	1230	DJ5VW	JO31RJ	10368	CW	59RS	56RS	206
19990530	1243	F6DPH/P	JN28QJ	10368	SSB	57RS	55RS	414
19990530	1328	DL4EAU/P	JO51DR	10368	CW	58RS	58RS	386
19990530	1342	DK1PZ	JO41TH	10368	CW	54RS	55RS	351
19990530	1404	DL3IAS	JN49EJ	10368	CW	55RS	55RS	396
19990530	1528	LX1DU	JN29XM	10368	CW	59RS	55RS	300
19990530	1534	F6DPH/P	JN28QJ	5760	SSB	59RS	59RS	414
19990530	1701	DK9MN	JN58TC	10368	CW	55RS	41RS	664
19990602	1451	DF6NA	JN49XS	10368	CW	59RS	55RS	450
19990602	1500	DK2GR	JN59IE	10368	CW	52RS	52RS	533
19990602	1508	OK1JKT/P	JO60OK	10368	CW	55RS	55RS	620
19990602	1520	DF3CK/B	JN57UV	10368	CW	55RS	HRD	685
19990602	1520	DK9MN	JN58TC	10368	CW	58RS	52RS	664
19990602	1658	DB6NT	JO50TI	10368	SSB	59RS	54RS	520
19990602	1741	DL2ABO	JO51CR	10368	CW	55RS	53RS	381
19990602	1754	DG1VL/P	JO61XE	10368	SSB	52RS	52RS	647
19990603	1546	F6DWG	JN19AJ	10368	CW	54RS	41RS	353
19990627	1808	G3LQR	JO02QF	10368	CW	57RS	55RS	227
19990703	0745	G3LQR	JO02QF	10368	CW	59RS	59RS	227
19990703	1620	OK1JKT/P	JO60OK	10368	CW	59RS	59RS	620
19990703	1635	DK0FLT	JN59FW	10368	CW	59RS	55RS	469
19990703	1649	DL3YEE	JO42GE	10368	CW	57RS	59RS	263
19990703	1711	DM2AFN	JO61WB	10368	SSB	55RS	55RS	645
19990703	1735	OK1KIM	JO60RN	10368	CW	559	559	632
19990703	1948	SM7ECM/B	JO65NQ	10368	CW	54RS	HRD	681
19990703	1951	DL5CC	JO64AD	10368	CW	55RS	55RS	541
19990707	1453	G3LQR	JO02QF	10368	CW	59RS	55RS	227
19990707	1521	DG1KJG	JO30NT	10368	SSB	59RS	59RS	221
19990707	1627	F6DWG	JN19AJ	10368	CW	59RS	57RS	353
19990712	1459	DJ1KP	JO40JJ	10368	CW	58RS	58RS	342
19990712	1509	DC6RW	JN49HL	10368	SSB	56RS	51RS	401
19990713	1522	DL3YEL	JO41EV	10368	CW	52RS	54RS	253

19990713	1708	DF6NA	JN49XS	10368	CW	56RS	52RS	450
19990713	1855	DM2AFN	JO61WB	10368	CW	55RS	57RS	645
19990713	1901	OK1JKT/P	JO60OK	10368	CW	54RS	55RS	620
19990713	1908	DB6NT	JO50TI	10368	SSB	57RS	53RS	520
19990714	1942	G3LQR	JO02QF	10368	CW	58RS	57RS	227
19990718	1801	DH8AG	JO31RL	10368	SSB	53RS	52RS	202
19990718	1814	DF6NA	JN49XS	10368	CW	57RS	55RS	450
19990718	1830	DC9YC	JO31PI	10368	SSB	53RS	53RS	197
19990719	1424	DK4VW	JO40IT	10368	CW	53RS	53RS	313
19990719	1430	DL3IAS	JN49EJ	10368	CW	55RS	55RS	396
19990719	1452	DG1KJG	JO30NT	10368	CW	59RS	59RS	221
19990719	1520	DJ1KP	JO40JJ	10368	CW	54RS	55RS	342
19990719	1528	DK8ZP	JO40JJ	10368	CW	55RS	57RS	342
19990719	1611	DF9QX	JO42HD	10368	CW	59RS	59RS	269
19990719	1631	DK1KR	JO53HW	10368	CW	55RS	59RS	447
19990719	1711	DF1OI	JO42TF	10368	SSB	55RS	52RS	337
19990719	1927	DL3ALI	JO50JW	10368	CW	56RS	59RS	441
19990719	1943	DL2DR	JO31TO	10368	CW	53RS	55RS	209
19990808	1524	F6DWG	JN19AJ	10368	CW	53RS	52RS	353
19990808	1526	DL3EAG	JO31DK	10368	CW	56RS	55RS	132
19990808	1531	DF6NA	JN49XS	10368	CW	53RS	54RS	450
19990808	1540	F6DKW	JN18CS	10368	CW	52RS	51RS	409
19990808	1547	F6DWG	JN19AJ	10368	CW	59RS	59RS	353
19990808	1619	F5HRY	JN18EQ	10368	CW	57RS	57RS	413
19990808	1907	OK1JKT/P	JO60OK	10368	CW	56RS	59RS	620
19990814	1926	F6DWG	JN19AJ	10368	CW	59RS	59RS	353
19990814	2006	F6DKW	JN18CS	10368	SSB	59RS	59RS	409
19990816	1850	F6DWG	JN19AJ	10368	CW	57RS	57RS	353
19990816	1853	F5HRY	JN18EQ	10368	CW	55RS	529	413
19990818	1522	G3LQR	JO02QF	10368	CW	57RS	55RS	227
19990818	1719	F5HRY	JN18EQ	10368	CW	58RS	57RS	413
19990818	1800	F1PYR/P	JN19BC	10368	CW	55RS	55RS	378
19990819	1624	PE9GHZ	JO11TL	10368	CW	54RS	52RS	100
19990825	1812	F5HRY	JN18EQ	10368	SSB	59RS	59RS	413
19990825	1815	F6DKW	JN18CS	10368	SSB	59RS	59RS	409
19990825	1824	F6DWG	JN19AJ	10368	CW	59RS	59RS	353
19990825	1906	G4BYV	JO02LQ	10368	SSB	58RS	58RS	262
19990825	1946	F5JTA	JN08VN	10368	CW	57RS	55RS	443
19990826	1627	DH8AG	JO31RL	10368	SSB	59RS	59RS	202
19990826	1631	DG1KJG	JO30NT	10368	SSB	59RS	59RS	221
19990826	1641	DF6NA	JN49XS	10368	CW	58RS	59RS	450
19990905	1714	F5HRY	JN18EQ	10368	CW	55RS	55RS	413
19990905	2028	F6DWG	JN19AJ	10368	CW	56RS	55RS	353
19990906	1729	DF6NA	JN49XS	10368	CW	56RS	55RS	450
19990906	1851	DL2DR	JO31TO	10368	SSB	55RS	57RS	209
19990906	1853	DH8AG	JO31RL	10368	SSB	59RS	59RS	202
19990906	1914	DB7QE	JO32VF	10368	SSB	56RS	57RS	212
19990906	2006	PE1CQQ	JO22VQ	10368	SSB	54RS	57RS	100
19990913	1535	DG1KJG	JO30NT	10368	SSB	57RS	57RS	221
19991002	1446	G8P	JO01QD	10368	CW	55S	53S	252
19991002	1727	DL3NQ	JN49IN	10368	CW	54S	54S	398
19991002	1800	ON7WR	JO20EP	10368	CW	569	569	162
19991002	1807	DH6FAE/P	JO40PL	10368	SSB	55	55	367
19991002	1810	DF0BG	JO30OX	10368	SSB	56	59	214
19991002	1911	PA3DYS	JO21JP	10368	CW	59S	59S	50
19991002	2315	G3LQR	JO02QF	10368	CW	599	599	227
19991003	0725	G0EMG/P	JO02OD	10368	SSB	59	59	238
19991003	1130	M1CRO/P	JO01PU	10368	CW	539	55S	234
19991003	1348	PI4GN	JO33KK	10368	SSB	59	55	210
19991003	1350	PA0WSO	JO22XD	10368	SSB	59	59	87

Testing Times

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Introduction

This is the first article in a continuing series which will cover a range of test equipment from simple diode detectors through to spectrum and network analysers, how to build them – diode detectors not network analysers! Where to buy, how much, etc. Most importantly I aim to cover their usage in a typical home workshop – not in some esoteric research lab.

This issue I'll cover two areas. One for beginners with setting up test facilities and the other more advanced on second-hand scalar network analysers.

Your first test lab

Let's admit it, part of the fun in microwaves is spending the time on the bench with a piece of equipment, trying to get that last extra bit of performance from it. I hate to think how many hours are spent getting half a dB more from amplifiers but to be able to do this you need a certain amount of test equipment. Building an LO chain for your 10G transverter needs a different set. Let's look at some of the things you'll find really useful in say, building a 10G system. You probably have many of them already so you're half way there.

Tools

It may seem very basic but you will need some good quality hand tools. Don't buy junk which wears out or won't close properly. Personally I like Lindstrom but CK aren't too bad. Next you'll need a good soldering iron, preferably two. Try and get a temperature controlled one like the Weller TCP series. The second one can be a bigger one for soldering tinplate, etc. Get some 22swg solder and some SMD solder paste (RS/Electromail). A good 6" stainless steel rule comes in handy as does a magnifier. A good hand drill and a variety of twist drills are needed, from 0.4mm through to 10mm.

Meters

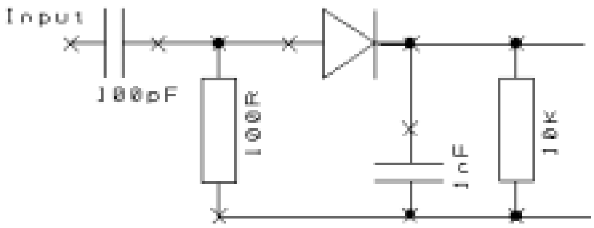
Seen those £9.99 DVM's you can get? Keep walking! Most of these aren't designed to give much in the way of accuracy and you really have to spend a little more to get a decent one (Having said that, a $4.99 one obtained in the States is to 0.1% - just luck). You don't need all the bells and whistles, just decent accuracy. Next you need an analogue meter, you just can't see the changes fast enough on a DVM to be able to align things. Old AVO's and other good meters go for £4 up at rallies.

RF

You may be thinking that you need stacks of expensive HP test gear to build your first 1.3/2.3GHz transverter or ATV transmitter? It can be done with two things – a homebrew RF detector and a homebrew wavemeter to 2.6GHz. I'll describe how to make them in a second. A few more can make things easier and I'd suggest a signal source, a surplus detector and some co-axial attenuators.

I'm actually going to cheat and tell you how to make two detectors since you really can't describe the first one as requiring any effort.

To make a great RF probe, good enough to align your LO sources first off, you'll need a glass Schottky diode (HP HSCH2800 etc), two capacitors, one about 1-100pF (lower is better for microwave work) and the other 1nF, one 10K resistor, one 100R resistor and two bits of wires. The circuit below shows how it works but the photo tells the real story. Just twist all the bits together and cut off the leads, if you want you can use some solder! Costs about £2. If you are worried about cosmetics you can package it in a pen, cigar tube, whatever!



The second detector is more accurate and can be used up to several GHz. You'll need either to make the PCB or get it (and the rest of the parts) from the UKuG components service – more on this in the next issue. This is basically the same circuit but using surface mount devices (SMD) – it'll be good practice since you'll be mounting lots of SMD's over time. Without all the stray reactance's from those leads it will have a fairly uniform response and the published graphs show a plot of power vs. output volts for different diode types.

The second item is a cavity wavemeter, very accurate and useful for checking the LO strip, typically a DDK004, is on the right frequency (typically within a few kHz). To build it you'll need to do some metalwork with either brass sheet(preferred) or tinplate. The device consists of a 3 sided long box with a 4 or 5mm brass/copper tube/rod in the middle. You can either mount it up on a piece of wood and calibrate it using a ruler or measure the depth the rod is in the cavity each time. Full constructional details of one based on a tube are in the RSGB Microwave Manual, Volume 2. Of course, surplus commercial units are better and can be had for as little as £20.

The other optional items you can't make. That's the bad news, the good news is that commercial detectors and attenuators are about at rallies and round tables. Commercial detectors typically come in SMA or N type connectors and cover a range up to 12.4 or 18GHz. Get attenuator(s) that match your detector, either N or SMA, and one or more adapters from N to SMA. If you can, get 3dB, 6dB and 10dB ones. Look for names like Weinschel, Narda, MidWest Microwave or, if you are lucky, Hewlett Packard (HP). A very useful one would be a 12.4GHz 10dB 2W. A good detector is from £5-15 and attenuators from £1-5 although the 10dB 2W one could be up to £25 – unless you are extremely careless it'll last a lifetime.

Well, what haven't I mentioned? There are lots of things you can add to your 'lab' and I'll cover many of them over the months. Next time though I'll describe how to add to these to be able to build your 10GHz system.

Scalar Network Analysers

Impressive sounding name! Many of you will have used something similar without really thinking about it. At its simplest it is an RF source which can be varied over a range of frequencies (‘swept’), a detector with a logarithmic amplifier and an oscilloscope. Add a second detector and a directional coupler and you have a versatile tool.

Before you start thinking about how to build one, let me tell you that these units, without the RF source, come on to the surplus market for £25-60 without the detector head. In fact because they have no detector heads! Detectors, when available, tend to be about £75-300 each. Of course you may ask what use one is without the detectors? Well, mostly they can be used with homebrew detectors or with commercial N/SMA detectors and a few resistors or an op-amp. Except the HP network analysers which, in order to get a better dynamic range, use an AC coupled amplifier and AM modulate the RF source at 27.8KHz. Look for the Wiltron 560/560A and the Marconi 6500, unless you can get one with detectors in which case the HP 8755 with an 182T is a nice unit. Later units, like the 8756/7, are probably outside most amateurs budgets at £800 up.

Typically the units require two interconnections between the sweep oscillator and the network analyser. One will be the sweep control voltage, a sawtooth/ramp waveform, from the oscillator to the analyser and this varies from 0 to –10V, 0 to –8V and +/-5V depending on model. Another is the blanking output which blanks the CRT display when the sweep ramp is decaying (retrace). On the HP units there will be the AM modulation input as well and some Wiltrons have a marker output.

The source can be from a simple one transistor VCO up to a full blown HP sweep oscillator. HP and other sweepers are regularly available surplus and I’ll cover sweepers next time. Don’t forget your old Gunn oscillator can be readily made into a sweep oscillator with the addition of an op-amp sawtooth generator and an op-amp level shifter. You can get by without blanking to start with, it looks messy but does the job.

Having got one, what can you do with it? Well, all those filter alignments become easy with one of these – you can *see* the filter response. Think your 10G antenna isn’t behaving? Sweep it with a Gunn and either a circulator or a directional coupler and see whether the reflected power is better higher or lower than 10368. Building a 23cm amplifier? Sweep it with a one transistor VCO and see how flat it is and whether it covers just 1296 or 1268 (satellite) as well.

We take it all too seriously……

SQUALKS

Squalks are problems noted by US Air Force Pilots and left for maintenance crews to fix before the next flight. Here are some genuine maintenance complaints and their respective responses……

(P) = Problem, (S) = Solution

(P) - Left inside tyre almost needs replacing
(S) – Almost replaced left inside tyre

(P) – Test flight OK except Auto Land very rough
(S) – Auto Land not installed on this aircraft

(P) – Number 2 propeller seeping prop fluid
(S) – Number 2 propeller seepage normal , propellers 1,3,4 lacking normal seepage

(P) - Something loose in cockpit.
(S) - Something tightened in cockpit.

(P) – Evidence of leak on right main landing gear
(S) – Evidence removed

(P) – DME volume unbelievably loud
(S) - Volume set to more believable level

(P) – Dead bugs on windscreen
(S) – Live bugs on order

(P) – Auto Pilot in "attitude hold" causes a 200 ft/sec descent.
(S) – Unable to reproduce problem on ground

(P) – IFF inoperative
(S) – IFF always inoperative in OFF mode

(P) – Friction Lock causes throttles to stick
(S) – That's what they are there for

(P) – Number 3 engine missing
(S) – Number 3 engine found on right wing after brief search

(P) – Aircraft handles funny
(S) – Aircraft told to straighten up, fly right and be serious

(P) – Target RADAR hums
(S) – Target RADAR reprogrammed with the words

Lifted from Talkthrough – Newsletter of UKFM Group (Western) – Thanks!

That's it! Many thanks to the contributors

Comments articles etc. Please!
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