OFFICIAL NEWSLETTER OF THE

BORDER RADIO CLUB

EAST LONDON

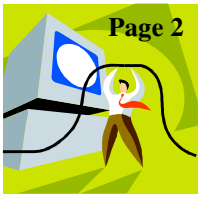
CQ LIGHTHOUSE

SEPT 2009

LIGHTHOUSE WEEKEND
&
REPEATER REPAIR

Affiliated to the SARL

FEEDBACK



INTRODUCTION TO PACKET RADIO - PART 8 - by Larry Kenney, WB9LOZ

This part of the series discusses the various parts of the packet message.
The following is an example of what you see when listing messages on a BBS.
On some systems the information is displayed in a different order, but the same information is given.

```
 MSG# STAT SIZE TO     FROM   @ BBS  DATE/TIME SUBJECT
14723 PN   1084 WD5TLQ WA6XYZ N5SLE  0604/1240 Software working great!
14721 B$    771 PACKET WB9LOZ WUSA   0604/1154 INTRO TO PACKET-Part 7 of 20
14717 BF   2387 EXAMS  W6NLG  NCA    0603/1020 FCC Exams: March - June
14715 TN    275 94114  W1AAR        0604/0959 San Francisco 415-821
14714 BF   1663 DEBATE N2DEQ  WW     0602/2314 CW REALLY NEEDED?
14712 BF    918 INFO   N6ZYX  NCA    0603/1845 9600 BAUD DEMONSTRATION
```

The MESSAGE NUMBER is assigned by the BBS program when the message is received and it cannot be changed. The numbers are assigned sequentially.
The STATUS of the message includes several different bits of information. The first letter of the STATUS indicates the TYPE of message: B for Bulletin, P for Personal, or T for Traffic for the National Traffic System. Bulletins are messages of general interest to all users, and they can be read by everyone using the system. Personal messages are listed only for the sender, the addressee and the sysop, and they're the only ones who can read them. The list above would have to have been requested by WD5TLQ, WA6XYZ or a sysop. Can you see why? It lists an outgoing personal message.
(NOTE: Although personal messages can't be read by everyone using the BBS, anyone in monitor mode can see a personal message as it's being sent over the air, of course.) Traffic messages, type T, are listed for everyone and can be read by anyone. In fact, all users are encouraged to participate in the delivery of NTS messages addressed to your area.
(Refer to part 12 of this series for information on NTS messages.)

STATUS also shows whether or not the message has been read, has already been forwarded to all designated stations, or has not been forwarded. You might see one of these letters: N - no, it hasn't been read, Y - yes, it has been read, F - it has been forwarded, $ - it has not been forwarded, I - it's in the process of being forwarded right now.

The SIZE indicates the combined total of characters, including punctuation, in the message text. The forwarding headers (explained below) are considered to be part of the text and are included in the size. What starts out as a short message can grow in size as it's forwarded from BBS to BBS.

TO is the callsign of the addressee for personal messages, the category or interest group for bulletins and the zip code of the addressee for NTS messages. While you might find bulletins addressed TO AMSAT, TO PACKET or TO SALE, they're actually messages about AMSAT, about PACKET or about equipment for SALE. You're apt to see anything in the TO column: ALL, USERS, EXAMS, CODE, SALE, WANTED, DEBATE, SAT, PACKET, etc.
FROM shows the callsign of the station originating the message.
@ BBS is used for forwarding a personal message to someone at another BBS, for forwarding NTS messages and for general distribution of a bulletin using a forwarding designator. In the list shown above, the personal message would automatically be forwarded to WD5TLQ at the N5SLE BBS. By entering a special designator, such as NCA, in the "@ BBS" column a bulletin may be forwarded to specific areas. (See Parts 6 and 7 of this series for details on the addressing of personal messages and bulletins and on using the forwarding designators. Addressing of NTS messages is discussed in Part 12.)

Next is the DATE and TIME showing when the message was received at the BBS you're using, or when the message was written. (This varies depending on the type of software being used at the BBS.) If the message originated at another BBS, the date and time when the message was originally entered will be shown in the forwarding headers, as explained below, and at the top of the message when you read it. The date and time indicated can be either local time or GMT (Zulu time) depending on the time used by the BBS.

The SUBJECT (or TITLE) is a short description of the message content. For bulletins, this is the information that determines whether or not someone is going to read your message when he sees it in the message list. It should be brief, but it also should be informative. You need to tell the other users what the message is about as clearly and concisely as you can with just 30 characters.

The parts of the message mentioned so far are all seen when you ask for a message list using the L (LIST) command. On some systems, entering a semicolon after the list command (Example: LL 35 ;) will give you more information about the message, such as the message ID, the full hierarchical address, the number of times the message has been read, etc.
If a message has been forwarded from another BBS, forwarding headers are added at the top of the actual message TEXT. This information is added by each BBS that is used to get the message from its origination point to the destination. Each BBS adds one line showing the time the message was received by that particular BBS, its callsign and address, and possibly the QTH, zip code, message number and other information. If you use the RH or V command (depending on your software), rather than just R, when reading a message, you'll receive complete headers. With just the R, headers are

reduced to a list of the BBS callsigns. The complete headers are useful if you want details on the path a message took to reach you or how long it took to be forwarded from system to system from the source to destination.

The TEXT of the message contains the information you want to convey to the reader. It can be of any length. However, if the message will be going to a distant BBS and will most likely be forwarded on the HF network, there is a 2.5K size limit. This limit has been set by the HF gateway sysops to keep traffic moving smoothly despite poor conditions and QRM. Extremely long messages can tie up the forwarding system unnecessarily, so users are advised to break up long messages into parts. As mentioned in part 6, when entering a message into a BBS, use carriage returns at the ends of your lines, as if you were using a typewriter. The normal screen width is 80 characters, so you should enter a carriage return prior to the 80th character on each line. A message entered without the carriage returns can be very difficult to read as words are cut at improper points, lines vary drastically in length, and blank lines are often inserted. On some terminal programs and printers, any line exceeding 80 characters without a carriage return inserted will not be seen or printed past the 80th character.

You should include your name, call and packet address at the end of the text so that the person reading your message will be able to send a return message to you if he or she wishes to do so. You end your message with a control-Z or a /ex at the beginning of a new line. This will tell the BBS to save the message. Don't disconnect until you receive the prompt back

Be like him, tidy up your Shack, but give me the monitor's !

Chairman's Chirp

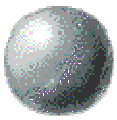
Here it is, the beginning of Spring and I certainly hope with it the rains which we so desperately need. We welcome Peter back from his UK jaunt and certainly hope he took across a good impression of the BRC to the Sheffield Radio Club.

The past few weeks has been a busy one for some Club members, firstly with the repairs to the Hospital repeater, then Lighthouse weekend and not to forget getting our BRC website up and running once again after a long absence. Much work still needs to be done in updating the website, but Ivan and yours truly are doing the best we can.

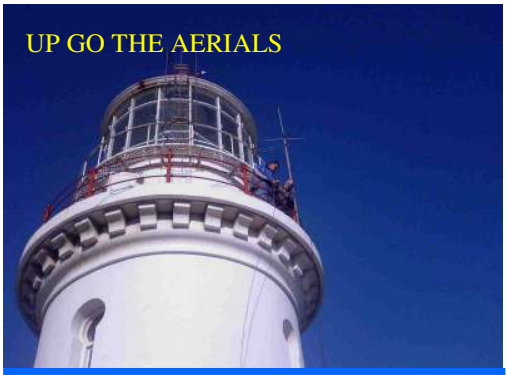
Until the next issue of FEEDBACK, here's wishing you all good health and happy DX'ing (what's that!).

Anthony – ZS2BQ

Recognition for SumbandilaSat Design and Development



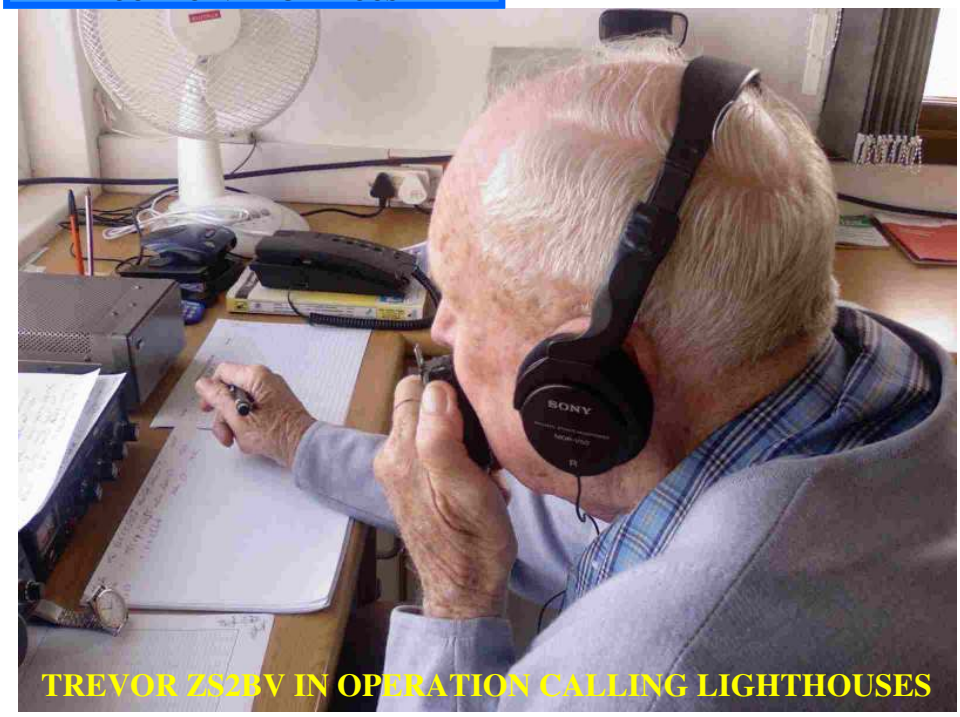
In recognition of their design and development of the Amateur Payload on South Africa's SumbandilaSat
Andrew Roos, ZS6AA, and Hannes Coetzee, ZS6BPZ jointly received the Garth Milne Technology Award.
SumbandilaSat is currently planned to be launched on 21 August but has been moved to 15th September on a Soyuz Rocket from Baikonur.



HOOD POINT LIGHTHOUSE

LIGHTHOUSES ON THE AIR

The Border Radio Club once again supported the Lighthouse weekend by setting up a station at HOOD POINT lighthouse. Several members assisted with erecting the aerials and getting the station on the air.
A great day was had by all and the weather was fine. Some of our oldest members were active on the bands.



TREVOR ZS2BV IN OPERATION CALLING LIGHTHOUSES

TREVOR ZS2BV & KEN ZS2KW
RELAX AND SUPERVISE

PHIL ZS2NP

WITH A SMILE LIKE THAT
HE KNOWS SOMETHING WE DON'T KNOW !

Amateur Moon Bounce

Moonbounce, also called Earth-Moon-Earth (EME), is a form of wireless communication in which the moon is used as a passive satellite. To the uninitiated, this sounds a little like science fiction, but it has been done and continues to be done by experimentally-inclined amateur radio operators.

There are several challenges and difficulties inherent in moon bounce operation. One of the most troublesome for two-way communication is the fact that the moon's distance introduces lag time. The moon is approximately 250,000 miles away from the earth, and radio waves travel at 186,282 miles per second. A signal sent to the moon does not return until 2.7 seconds have elapsed. If two people are engaged in a conversation and one person asks a question, that person cannot expect a reply until at least 5.4 seconds later (the answer must travel to the moon and back, as must the question).

Besides propagation delay, the path loss to and from the moon is considerable. The moon is a relatively poor reflector of electromagnetic rays at any wavelength, including radio waves. Its surface is irregular, and it scatters, rather than focusing, reflected energy. Because of this, sophisticated equipment is necessary to successfully bounce a signal off the moon and hear it return.

Another problem with moon bounce communication is libration fading and Doppler shifting. The moon does not always present exactly the same face; it "wobbles" a few degrees back and forth. This "wobbling," called libration, produces a constant change in every component of any signal reflected from the moon. The returned signal consists of the sum total of countless rays that have bounced off mountains, boulders, crater walls, and other lunar features. The relative phase of these components rapidly fluctuates because of libration, so any signal returning from the moon is "fluttery" and distorted.

Amateur-radio moon bounce generally requires the following:

- A sensitive receiver with a narrowband filter
- A transmitter capable of operating on at least one amateur band above 144 MHz, and capable of producing 1500 watts of continuous radio-frequency output
- An antenna with high directivity and gain, capable of being rotated in both the azimuth and elevation planes
- A location in which the moon can be seen without obstruction for extended periods
- A location in which human made radio noise is minimal
- Neighbours who will tolerate the presence of a large antenna and the proximity of a high-power radio transmitter
- A neighbourhood without ordinances or covenants prohibiting large antennas and/or high-power radio transmitters
- Operating skill and patience.

EME Operation News

For those of you just getting interested in EME – Moon bounce operation, there is a net operation every weekend where you can obtain additional information or make schedules. The net starts aprox 1500 GMT on 14.345 Mhz with 432 and above EME. It is followed by the 2 mtr EME net at aprox 1600/1700 GMT. EME scheduling from the nets is done with the SKD program. SKD is freeware developed by W9HLY, N1BUG and AF9Y. : skd87a.zip (181K Bytes)

The data files for SKD87a are updated every Monday Evening by Brian Manns, W3EME. You can contact him at w3eme@mtwirefree.net for automatic emailing each week or you can download it here: Station data files for SKD87a are typically updated monthly.

There is also a database of EME stations information (mailing adr, telephone, etc.) in a PCF Database. EME PCF Database File - emedir.zip (aprox 130K Bytes) For those of you using the FFTDSP program, here is the latest eme.ws file which is used in the "FIND" mode: EME WS File for FFTDSP- eme.ws (aprox 9K Bytes)

AF9Y EME Station From 1990 to 1994 the AF9Y 2 Mtr EME station consisted of:

- **Antenna** - 6 x 22 element, 42' Boom Yagis
- **Amp** - 4CX1500, 1500 Watts Out
- **Preamp** - MGF 1302, 0.25 dB NF
- **Tx Coax** - 300 foot run of 1 5/8 Hardline
- * **Radio** - Microwave Module & ICOM 781

1988 - 90

1990 - 94

1994 - 95

Only about 1,000 ham radio buffs worldwide have the equipment to bounce A signal off the moon.

PALO ALTO, Calif. — Dogs bay at it. Lovers swoon under it. And some people like to bounce their voices off it.

Michael Cousins, an engineer at SRI International, a non-profit that operates the dish, centre, in the control room, with Ham operators Lance Ginner, left, and Jim Klassen.

A radio dish at Stanford is powerful enough to bounce signals off the moon, a tricky endeavour.

The first two are easy, but sending a voice signal 239,200 miles to the moon and back is not quite as simple.
On Saturday, amateur radio buffs or "hams," as they call themselves, will hold a global bounce-fest, using as many giant parabolic antenna radio telescopes as they can borrow around the world. Not that one needs an excuse to hold a moon-bounce, but this one is being held as a kind of advance
celebration of the 40th anniversary next month of the Apollo 11 mission.

Moon-bouncing, also known as Earth-Moon-Earth communications, or E.M.E. requires a higher grade of ham-radio technology than that used for traditional earth-bound communication across parts of the radio spectrum approved by governments for amateur use. Only about 1,000 hams worldwide have stations capable of moon-bouncing. **I don't mean JT65 signals, but real phone conversations.**

Skill and luck also help. As the hams say, the moon is a poor sounding board, since it is spinning and has a rough surface that can disrupt signals. The hams' voices must survive atmospheric interference over the long round-trip journey in a discernible form. "It's the equivalent of climbing Mount Everest in amateur radio.
Large dishes like those owned by the government and communications companies can solve many of these problems by making it easier to send and receive signals. That's why the hobbyists have searched out retired or rarely used dishes.
So far, operators of about 20 large dishes in the United States, Australia and Europe have agreed to participate in the event. One of them is located on a hill overlooking Stanford University campus, and will serve as the command centre for the weekend's event. Known simply as the Dish, the 150-foot-wide antenna, owned by the federal government, will be outfitted with special equipment and a computerized tracking system to keep a powerful, focused signal on the moon.

A handful of radio enthusiasts have been working on the structure over the last few weeks, huddling inside a central command centre below the towering, rusting web of metal. They gathered around whirring communications gear as if it were a campfire and chortled with satisfaction when their "hellos" bounced back from the moon 2.5 seconds later. There is a point beyond the "because it's there" challenge.
The hams also hope to inspire young technology buffs. "People think of ham radio as something Grandpa did down in the basement while he smoked and talked to people around the world," said Pat Barthelow, who has organized the worldwide moon-bounce, called Echoes of Apollo. "I think moon-bounce retains an exoticness and difficulty that can hook some people and bring ham radio into the modern era."Creating a homemade radio capable of hitting the moon can require years of tweaking custom components. The setups cost $200 to $2,000.

The United States military began bouncing radio signals off the moon in the 1950s to communicate over long distances when other transmission methods were hampered by atmospheric disruptions. By the mid-1960s, operators at large dishes started building amateur systems capable of moon-bouncing. In 1964, Michael Staal accomplished the feat, linking a setup at Stanford to another one in Australia.
"I got famous very quickly," said Mr. Staal, who sells antennas to ham radio operators. Moon-bouncers often hold contests where they must hunt around different frequencies and both send and receive a signal with another station, logging their activities for review. They're forbidden from communicating with each other via non-lunar means during the contests, and often win a certificate for making contact with as many others hams as they can.

"It is the thrill of pulling a weak signal out from a long distance that excites the amateur radio folks."

Blind operator

ZS2ABF is a counselor who helps coordinate support groups for visually impaired Ham XYL's. Many participants have a condition known as macular degeneration, which makes it very difficult for them to distinguish facial features. I had just been assigned to a new group of Blind Hams and was introducing myself. Knowing that many in the group would not be able to see me well, I said, "I look like a cross between Paul Newman and Robert Redford."
Immediately, one XYL called out, "We're not THAT blind!"

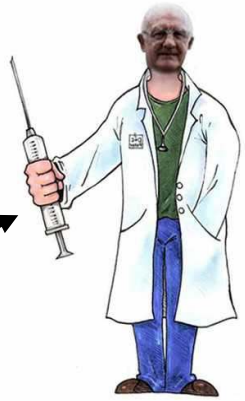
Doctor's Advice

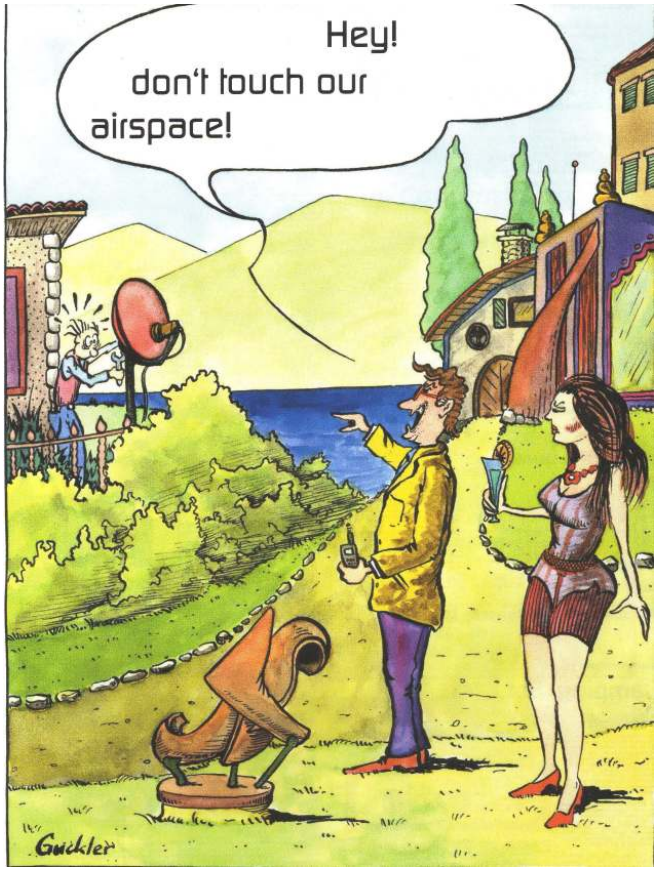
Doctor: I see you're over a month late for your appointment. Don't you know that nervous disorders require prompt and regular attention? What's your excuse?

Patient: I was just following your orders, Doc.

Doctor: Following my orders? What are you talking about? I gave you
no such order.

Patient: You told me to avoid people who irritate me.





Terminating Guy Wires

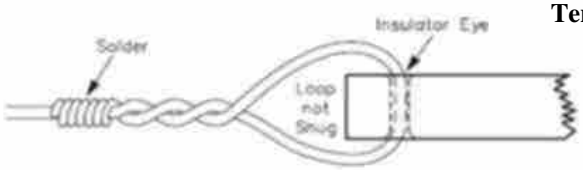


Fig 1 –When fastening antenna wire to an insulator, do not make the wire loop too snug. After the connection is complete, flow solder into the turns. Then when the joint has cooled completely, spray it with acrylic.

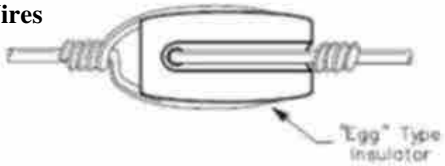


Fig 2 –Conventional manner of fastening wire to a strain insulator. This method decreases the leakage path and increases capacitance

BRC REPEATER MONKEY BUSINESS

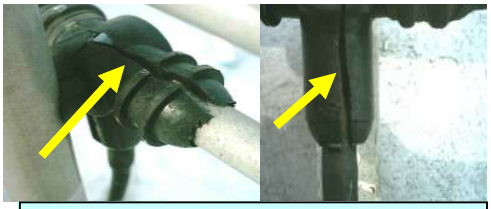
VIEW FROM THE SITE

On Saturday 7th of August a working party of BRC members, climbed like Monkeys on to the top of the Frere Hospital, to repair one of our repeater installations. The 145.775 MHz section that feeds into the East Cape link had been hit by Gale force winds last month and prior to that had not been up to scratch.

An inspection found that the mounting pole was bent and required serious repair. When the Aerials were down, close inspection showed that both had suffered deterioration of components due to, height and proximity to the sea etc.
The Helix coax had broken inside the building (may be it was the Monkeys swinging on it, hi). U bolts and nuts were rusted.
After a full days work exposed to Sun and wind, the repeater was restored to, "better than" it's former glory.
Signals of S9++ were heard around the city. Unfortunately there still is some clipping of the received signal coming back down the link, this was out of the control of the working group. Further work needs to be done in the Grahamstown direction by our P.E. friends.
Thanks go to members of the team which was made up of: ZS2CDC, ZR2ACJ, ZS2NB, ZS2ILN, ZS2BQ and ZS2ABF.

145.775 Mhz BEFORE

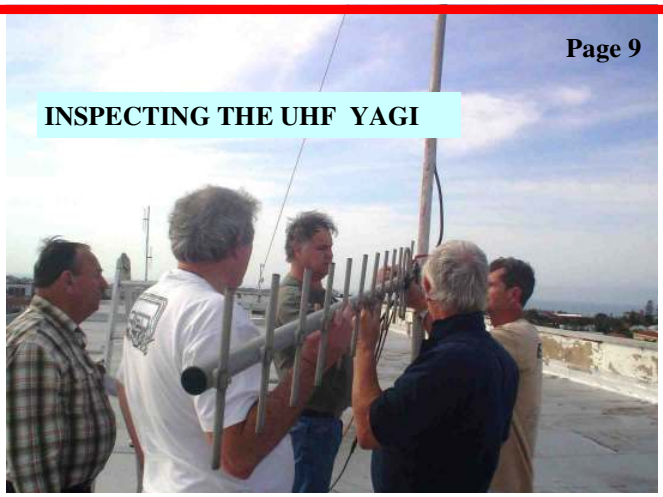
REPAIR TEAM + ANDY (BEHIND CAMERA)



DRIVEN ELEMENT REPAIRS

TAKING THE MAST DOWN


CHECKING THE SWR


INSPECTING THE UHF YAGI


BEWARE
NICK WITH HIS-
TOOL IN HAND

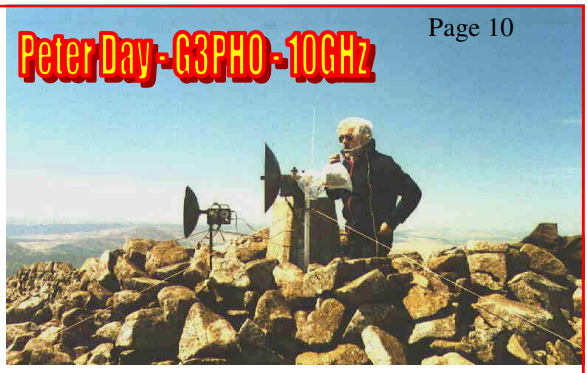

NEW CABLE & PLUG FITTED
(WHAT NO SPECS ?)


COAX BREAK
FOUND HERE

HELLOOO,
I DON'T THINK IT'S
FUNNY. NOW PUT
THE LADDER BACK


NEW INSTALLATION
BACKUP AND WORKING
ON TOP OF THE
HOSPITAL

AFTER



SHEFFIELD AMATEUR RADIO CLUB

A BRIEF HISTORY OF 10GHz AMATEUR MICROWAVES

The UK story....In the beginning.... put together by G3PHO

10GHz is probably, in the UK at least, the most popular of the amateur microwave bands. It has seen some sixty years of development since the first experimental contacts made by W2RJM and W2JN in the USA during 1946. These two "pioneers" could not have known what was to follow their 2 mile (3km+) contact! A year later, in 1947 the world 3cm record was extended to 7.65 miles after a contact between W6IFE/3 and W4HPJ/3. W6IFE is now the callsign of the San Bernardino Microwave Society, the oldest amateur microwave group in the world and one with a fascinating history of its own. Even before that epic QSO, the Radio Society of Great Britain had published a series of articles in its journal, "The RGSB Bulletin" or the "Bull" as it was known to UK amateurs) during 1943, a period when amateurs were not allowed to transmit signals as we had a thing going on with a man called Adolf at the time! These articles, entitled "Communication on centimeter waves" were followed up in 1947 with a booklet about microwaves, "Microwave Technique".

By that time there were a few UK amateurs taking an interest in microwaves. Two of them, Des Clift, G3BAK and G3LZ, began experimenting in 1949 and, in January 1950, were rewarded with the first UK two-way contact on the 10GHz band. Des eventually migrated to Australia where he carried on his microwave activities, mainly on the 5.6GHz band, until his death in early 2005. He was VK2AHC in New South Wales at first but then relocated to South Australia as VK5ZO.

His 10GHz equipment for that 1950 contact with G3LZ consisted of a mains powered klystron transmitter/receiver and the path was just a "few miles" (actually about 1.75 miles) across the Manchester Ship Canal in North West England. Of just as much interest was his use of 70cm for talkback. At that time even the 432MHz band was for radio pioneers!

Another 3cm pioneer was Jim Spragg, G3APY. Sadly Jim became a Silent Key in 1997 but his contribution to amateur microwave radio will be remembered for a long time to come. On September 23rd, 1950, he made contact with G8UZ over a new world record distance of 12 miles. The R.S.G.B Bulletin for January, 1951, records Jim's next world 10GHz record contact, this time with G3ENS/P over a distance of 27 miles. This took place on 22 October 1950, just a month after his contact with G8UZ. Jim's gear was a dual band affair, 23cm plus 3cm and was mounted on the top of his saloon car. Separate, 5 element Yagi antennas were employed on the 23cm transmitter/receiver system while an 18 inch diameter dish with dipole/reflector feed (waveguide fed) radiated the 3cm RF. On 23cm, CV90 oscillators were used with a klystron on 3cm for wideband FM . A common IF/AF unit was employed on both bands. Simple crystal diode receive mixers were employed on both 23 and 3cm. Most interestingly for this writer, Jim used the Alport Height location at IO93FB, near the town of Matlock in Derbyshire for much of his UHF and microwave work. The UK record on 70cm was only 161 miles at that time...dead easy now of course, but a milestone in 1950!

Klystrons...10GHz wideband FM.

In the UK, the 10GHz band was exploited by a small group of dedicated enthusiasts who built simple klystron transceivers, using wideband FM modulation. The most popular klystron during the 1960's and 70's was the 723A/B. (This was identical in appearance to the 3GHz klystron type 726A, shown below). These were really designed to work best at around 9.5GHz but amateurs found ways of "bending" them up to the lower 100MHz of the 10GHz band (the UK had 10.0 to 10.5GHz available at that time). Power outputs were in the region of a few mill watts. The klystron was used as an oscillator on both transmit and receive, the wideband FM modulation being applied to its repeller. Unfortunately, fairly high voltages (by modern standards) were needed, up to 300 volts or so, and portable power supplies were usually of the 12v dc input/300v dc output inverter variety. As a result, they often produced a distinctive whine on the modulation! Many amateurs used directional couplers in their equipment so that the klystron oscillator could be used as a receiver local oscillator as well as a transmitter. Waveguide switches and other items of waveguide 16 "plumbing" made these rigs bulky and off-putting to non-microwaver's! Frequently, a duplex arrangement was used with a common IF of 30MHz or 100MHz (with bandwidths around 200kHz). One station in a contact would transmit, say, a signal on 10.100GHz and the station at the other end would set his local oscillator on 10.070GHz (10.130GHz)to hear the signal in a 30MHz receiver. The first station, also equipped with a 30MHz receive IF would hear the second station at the same time. For initial signal finding, each station would modulate the transmitter with a 1kHz tone. When the two stations found each other the two tones would beat with each other in an unmistakable manner! The 10GHz receive front end was, in most cases, a simple diode (for example a 1N23E or similar).

In 1959, Bob G3GNR and Don G3JHM, had their very first 10GHz QSO, over a 4km path(later extended to 30km) between Worthing and Newhaven, in Sussex They were using the "evergreen" modified 723A/B on 10050 MHz at about 10mW o/p and their PSUs were two small rotary converters running from 12V batteries. The receivers were single-ended mixers with LOs fed by a 10dB directional coupler and NF measured at 11dB! Both these operators were still very active on 10GHz up to the late 1990s and are probably two of the longest serving 10GHz ops, at least in the UK. It was equipment of this type that enabled the 150km "barrier" to be broken for the first time in the UK, when G3RPE and G3ZGO made contact between Dartmoor (SW England) and the Prescelly Mountains SW Wales). This distance became the yardstick by which the rest of us measured our 10GHz performance. The RSGB Microwave Distance Awards still recognize that level of achievement. Easy now with modern narrowband gear but quite difficult for simple wideband equipment of those days. Dain Evans, G3RPE, who wrote the first microwave column in the RSGB's RadCom magazine, became chairman of the RSGB Microwave Committee and then RSGB Microwave Spectrum Manager. Until his untimely death, he worked unstintingly for the good of UK microwaver's. He is remembered to us all in the UK by the G3RPE Trophy, awarded to the leading station in the annual 10GHz Cumulative Contests, formerly run by RSGB and now by the UK Microwave Group

continued

The Americans put on the pressure..

In 1960, W7JIP/7 and W7LHL/7 achieved a two-way contact on 3cm of 427km. This was a remarkable contact for that time and it stood as the 10GHz world record until 1976.

During the mid 1970's the Gunn diode appeared on the amateur market and revolutionized the wideband scene. Power supplies shrank, the Gunns requiring a low current supply of around 7 volts or so. Since the diodes were also very small (a few millimetres long), 10GHz equipment became highly portable and the UK saw what many Old Timers still regard as the "Golden Age" of 3cm! Almost all active 10GHz amateurs in the UK would operate from portable locations. The summer cumulative contests, organised by the RSGB Microwave Committee became very popular and the hilltops of North Wales, the Pennines, the North and South Downs, as well as many other areas, "grew" tripods, dishes and 2 metre talkback stations on a regular basis. Here at G3PHO I developed a compact 3cm transceiver based on a Gunn diode oscillator, a 1N23E RX mixer diode and a small solid state 30MHz IF (with a 1.5dB NF post-mixer amplifier). This, together with an 18 inch dish and short portable mast, an IC202S 2 metre ssb handheld with a quarter wave whip antenna and a small 12 volt "dryfit" battery, was frequently backpacked up some of the country's highest mountains in the search of longer and longer line of sight paths. Duplex operation was still very much the norm, as in klystron days, but 10.7MHz IFs replaced the 30MHz ones in many cases. The limitations of the line-of-sight path became a challenge to10GHz operators.

Propagation studies open up the potential for real 10GHz DX. Some excellent DX was worked with simple Gunn equipment of this type. Operators such as GM3OXX/P, GW3PPF/P, GW4BRS/P, G3RPE, GM8BKE (now G8BKE) and many others made long distance contacts, during the 1970s, that would still give pleasure to some narrowband operators today. The longest line-of-sight path worked at that time was that between the summit of Mt. Snowdon (North Wales) and the Cairnsmore of Carsphairn (South West Scotland). At 245km it represented the best you could do in the UK without enhanced propagation. (G3PHO repeated the path in 1987). Longer paths than this were worked, however, due to the inquisitiveness of amateurs such as GW3PPF, who saw the potential of the moist air ducts that often form over the sea. He, and others, spent a considerable amount of time and money travelling around the UK to establish the existence of these "super refraction" paths, often hundreds of kilometers in length. In fact, the longest path covered by this propagation mode during the 1970's was a new world DX record (on the 14th August 1976) between Pendeen Sands, Cornwall and Portpatrick in South West Scotland, a distance 521km, thus exceeding the W7's record of the 1960 period by a handsome margin of almost 100km. For this remarkable contact G4BRS/P (The Barry Radio Society) and GM3OXX/P used simple 10 mill watt Gunn transceivers to small dishes (60 to 75cm diameter). The signals were exchanged directly on 10GHz, without recourse to prior talkback on 144MHz. The signals peaked 45dB above noise. Very loud ones! A super-refractive sea duct was the means by which the two stations were able to work well beyond line-of-sight with such low power and wide bandwidth receivers. They had made eight previous, separate attempts for this world record by the way! World 10GHz records made since, either on wideband (by Italians) or narrowband (by Australians) have made use of this "super-refraction" propagation mode to exceed even 1000km! (Present world record is now over 2000k!) Halcyon Days!

The 1970's produced many "firsts" for UK 10GHz operators. The first GW to GM contact took place in 1972 when GW3CKT/P worked GM8AZU/P (now G4NNS). The QSO was a world record at the time, only to be exceeded a few months later by GM3OXX/P. A photograph of the GM team of operators, carrying the gear (including an 80cm dish) up the Cairnsmore of Fleet, appeared on the front cover of Short Wave Magazine a few months later and is worth seeing if only for a look at G8DKK's multi-coloured trousers! The first G to PA contact was made on the 3rd August 1975 by G8APP/P and PA0KKZ. The former used a 20mW klystron while the latter ran just 3 mill watts to cover the 240km path. Both stations were again located at or very near sea-level. This contact had immediately followed a one way attempt by G4ALN, who used 10 mW to a DUST BIN LID as an antenna!! G8APP/P was located at Walton-on-the Naze, a site that has become famous in the annals of 10GHz in the UK and one that is still used by the UHF/Microwave contest group G0VHF. It is arguably the finest /P location in the UK for working into the European Continent. By the November of 1976 some 12 countries had been worked by G stations. The first GI to GM contact was made in August 1976. Germany, Denmark, Norway and Sweden were still awaiting contact.

Narrowband developments...

Throughout the wideband period described above, there existed a small group of British amateurs who were developing crystal-controlled, narrowband systems for 10GHz. Such systems usually consisted of a vhf crystal oscillator, with watts of output in some cases, driving a chain of varactor diode multipliers. The multiplier chains provided both narrowband transmitter RF (CW and nbFM) as well as local oscillator drive for simple diode mixer receivers. At this time there were no transistor devices available that would work as amplifiers or mixers at 10GHz.

Perhaps the most well-known team of operators at that time was the G3BNL - G3EEZ partnership. Les and Alan both built remarkable (for that period) narrowband systems that were used to establish UK records on all microwave bands at the time. Unfortunately G3BNL is now a Silent Key and he is greatly missed by the UK microwave fraternity. His name lives on in the form of the G3BNL Trophy, awarded annually to a microwave amateur for expertise and innovation in home construction.

Another narrowband pioneer in the UK was Mike Walters, G3JVL. During the period when Gunn diode wideband equipment was very popular, Mike was experimenting with image recovery, narrowband filter systems leading to the development of what has become known as the "JVL RIG". This consisted of a step-recovery diode multiplier (mounted in waveguide 16) driven by a lower frequency crystal oscillator source..typically 384MHz at around 500mW. The multiplier produced a low power (5 to 10mW) at 10224MHz which passed through a narrow bandwidth, waveguide filter. This filter was the secret of the JVL rig's success, for its three cavities were iris coupled and reduced the image signal to negligible proportions. The filtered 10224MHz then drove a waveguide in-line diode mixer to which a few Milli watts of 144MHz was applied and the desired 10368MHz ssb/cw signal was then passed through another three-stage, iris-coupled filter to produce around 1 mW at the antenna port. The JVL RIG was therefore a complete transceiver. As a receiver, it could certainly hold its own ,since, as a result of the excellent image rejection, noise figures of 6 to 7dB were possible with the "bare" diode mixer and this without a GaAsFET preamp in sight!

continued

GaAsFET's, G4DDK and G3WDG.. During the mid to late 1980's, a number of German designs for solid-state, GaAsFET-based systems appeared in the UK.
A commercial transceiver made by SSB Products retailed at over £400 sterling and many amateurs thought the dreaded "black box" had finally arrived on microwaves! However the microwave bands do not attract amateurs with little or no interest in home construction. The reverse is true, for the microwave regions are a "magnet" for amateurs who have grown tired of the commercial equipment approach to our hobby. A few SSB Product systems were sold but the home constructor was spared the headache of making up his or her mind whether or not to purchase one. Sam Jewell, G4DDK was, at this time, developing a series of compact local oscillator printed circuit designs for the 1 GHz region. In March 1987, the RSGB Microwave Newsletter published the DDK001 design....."A local Oscillator Source for 1152MHz". This was closely followed by a companion1 watt amplifier, the DDK002. These two pcb's, once built up into working modules, offered a reliable narrowband route through to the 23cm band and provided the basis of transverter's for the higher microwave frequencies. It wasn't long before Sam, G4DDK, introduced the DDK004 board giving 10 to 12 mill watts out at around 2.5GHz. This little gem was to have a profound effect on the way 10GHz narrowband was to go in the UK for, at the same time as Sam was doing his development work, Charlie Suckling, G3WDG, was working on a 10GHz transverter system that was to bring ssb/cw to all UK 10GHz operators. In fact he virtually "killed off" wideband FM as the preferred mode of operation! Charlie's designs use the G4DDK driver modules to feed a transmit multiplier/ amplifier module and a receiver, each using cheap and readily available GaAsFET devices . They included RF amplifiers to provide what was, in 1990, HIGH power (50 to 100 Milli watts) and low noise receivers (around 2 to 3dB NF). The WDG 10GHz kits soon became the most popular and widespread 3cm equipment in the UK. As if by fate, a large quantity of cheap (approx. £2 sterling each!) 10GHz GaAsFET's became available on the surplus market, just as Charlie was developing his system. The supplier, J.Birkett of Lincoln, and the devices' code names "Red Spot" and "Black Spot" became by-words in the UK microwaver's vocabulary! This unit is built on Teflon pcb and mounted in a tinplate box 11cm x 3.5cm x 3cm.
A basic WDG transverter for 10GHz uses a WDG001 x4 multiplier/amp, a WDG002 receive converter and a WDG003 transmit down converter. The DKK004 source at 2.5GHz drives both local oscillators. All that is needed for full transceiver operation is a low power 144MHz transceiver such as the IC202 or FT290, microwave coaxial relay and a +12 volt DC power supply. The modules are constructed in small tinplate boxes and are fully connectorised in SMA. The use of tinplate boxes allows very efficient shielding and pcb mounting. Charlie later added several other modules to the WDG system, including a 1 watt PA and a sub 2dB HEMT receive preamp.
These kits and many others (including designs for the 23cm and 13cm bands) are available from the Microwave Components Service, operated by Petra Suckling, G4KGC, the wife of G3WDG. Charlie proved how good his equipment was by making the very first UK to Australia EME (Earth-Moon-Earth) contact when in 1995 he worked VK2ALU, Lyle Patison of Wollongong, New South Wales, Australia. This historic contact saw WDG equipment in use at both ends of the contact.

In the early 1990's ...
A number of surplus M/A-COMM 10.5GHz data link transceivers arrived on the UK surplus market. Nicknamed the "White Box", it sold for around £100 sterling, quite cheap for a 200mW transceiver! Dozens have been modified by UK amateurs and they often form the heart of a home or portable station and microwave beacons. Modification details were already available from the USA, where the "White Boxes" appeared in their hundreds, particular on the West Coast. Modifications were also developed in the UK. G3WDG's WDG 005 receive preamp fits nicely into the Box for example, and improved the "barefoot" ring mixer's 11dB NF to around 2 to 3dB. The WDG HEMT preamp can be added to get down towards 1dB NF.
The "White Box" was the basis of the writer's 10GHz system in those days and is still occasionally used for both home and portable operation.

The late 1990's to early 21st century ...
The G3WDG/G4DDK systems led to more and more HOME STATION operating in the UK. A number of cheap (sometimes free!) 4 to 5 watt Travelling Wave Tube amplifiers (TWTs) became available during the '90s. These were easily driven by a couple of Milli watts. Higher powers were also around with quite a few UK amateurs running power outputs in excess of 10 watts and one or two around 60 watts. In the latter half of the 1990s, a series of excellent amateur microwave kitsets, including complete transverter's, oscillator/multipliers and power amplifiers, came onto the European market. These are produced in Germany by three main companies: Eisch Electronics, Kuhne Electronic (DB6NT) and Philip Prinz (DL2AM). They are all still going strong in 2005. There's no doubt, however, that Michael, DB6NT and Kuhne Electronics has changed the face of amateur microwaves, certainly in Europe, if not the world, as he now supplies both kits and ready made equipment available from 1.2GHz right up into the submillimetre bands and all at an affordable price and of excellent quality. Nowadays there must be few active microwaver's in Europe who have not at least one item from the DB6NT "stable" in their shack! Indeed, The writer's own equipment is based largely around DB6NT transverter kits. In the USA, the Down East Microwave company has grown into **that continent's major supplier of amateur microwave equipment with many original US designs.**
Where to next?

In 2005, in addition to the excellent German, UK and USA kitsets, there is a wide variety of SOLID STATE power amplifier (SSPAs) easily obtainable and indeed produced for the amateur microwave market. Power levels of over 50 watts are available (at a price!) on 10GHz while bands lower than 10GHz have seen the
widespread availability of surplus SSPAs from commercial radio links and abandoned defense contracts. These power levels and home station operating have seen the exploitation of unusual propagation modes such as rain scatter and aircraft reflection, as well as tropocatter and ducting, being used to work some very long paths in the UK and over the sea to Europe. "Entry level" 10GHz narrowband power levels of 1 watt are now "de riguer". In the UK at least, the 60 to 90cm, offset fed dish antenna (often ex- satellite TV)is now the most popular 10GHz antenna
and contacts up to 400km are the norm. Some home stations work daily skeds over this sort of distance and have **continued**

800 to 1000km+ contacts when tropo conditions are good. During the monthly contest weekends, when activity is at its highest, portable stations often work long distances on 10GHz narrowband, sometimes beyond 600km under apparently flat band conditions! This is usually due to the exploitation of aircraft and rain scatter.

In spite of the growth of home stations, portable operation is still popular, as any Cumulative Contest weekend will show. E.M.E (Earth-Moon-Earth) propagation is now quite common on 10GHz and there are now a number of UK operators equipped to make overseas contacts via the Moon. The contacts have been a little "easier"(!) by the introduction of computer software that not only keeps the large dish on target but also sends the contact exchange details by data mode, often at a level at the limit of, or even below, the human ear.

Today, the 24GHz band is now going through a similar sort of "revolution" that 10GHz had a decade ago. Narrowband and "high" power (3 watts) has arrived at 24GHz.....kits and surplus "boxes" are changing that band too! But that's another story .... 10GHz may have become "old hat" for some people but there is still plenty to do there and room for more converts to microwaves.....

SO WHY DON'T YOU TRY 1OGHz?

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