Pat Hawker's Technical Topics

SATELLITE TV - A SOURCE OF REVERSE TVI

DR BRIAN AUSTIN, G0GSF, recently mentioned that he has been suffering from interference to HF reception and had found the source to be the 'outdoor' 11GHz LNB converter unit of a satellite TV receiver. I had not previously come across this problem but G0GSF has sent me a copy of an article 'In the workshop with the Optoelectronics Handi-Counter 2300' by Rob Mannion, G3XFD, the Editor of *Practical Wireless* in his August 1992 issue.

It describes the use of this hand-held frequency counter as a means of tracking down sources of interference. In particular, one such source affecting the 14MHz band was traced to the UHF modulator used in an early computer in his daughter's bedroom. This was radiating spurious signals on HF, VHF and UHF but the problem was cured by replacing the modulator by one purchased for £1 at a rally. He continues:

"I then recalled a problem I had helped solve for another radio amateur during 1991. This to cut a long and sad story short, involved a satellite TV low noise block (LNB). The amateur concerned could not operate on the higher HF bands at all because of very bad interference. He had tried everything except changing the LNB which fortunately (or unfortunately!) had been installed for the benefit of his disabled and housebound wife. After I suggested that someone with a portable spectrum analyser should be brought in, the culprit was found and changed.

"Remembering the 1991 incident, I walked along the road where I live, taking the Handi-Counter with me. I soon found other LNBs radiating signals on HF strong enough to be locked onto by the Optoelectronics 2300. After some research, I have discovered that the problems are probably caused by the high level of local oscillator injections on satellite LNBs.

"I had also come across the problem in the USA while attending the Dayton HamVention, where the hotel dish feeding the 'piped' TV was just below my bedroom window. With spurious signals making the HF bands virtually useless, even trying to hear the BBC World Service was a painful process!"

It thus seems that this problem is universal and likely to become of increasing importance as the number of satellite-TV installations increases. At present, despite the EC EMC Directive, there appears to be no legal requirements that LNBs (or other similar sources of reverse-TVI) should not interfere with reception on the amateur bands, although G0GSF does point out that his local RA inspector is watching the situation.

ROOF-SPACE DUAL BAND MAGNETIC LOOP

SOME MONTHS AGO, FOLLOWING the publication of a number of items on magnetic loop antennas (both in *TT* and as full-length *RadCom* articles), I began to feel that the subject deserved a rest. What more could be written - it had been shown that such antennas were capable of achieving good results, particularly on the lower frequency HF bands, for amateurs without sufficient space or high enough supports to allow the erection of an antenna providing the higher radiation resistance that makes for good efficiency at low cost. It did seem, at least to me, that the models that had appeared on the market were costly compared with a simple wire dipole, while home-constructed models called for good quality tuning capacitors welded to an extremely low-resistance loop, with the complication of accurate remotely controlled motor tuning. Nevertheless, well made compact transmitting loops do work surprisingly well and represent a valid approach for those without space. From a number of contacts made with stations using small loops, it does appear that they compare well with, for example, trapped verticals mounted on the ground.

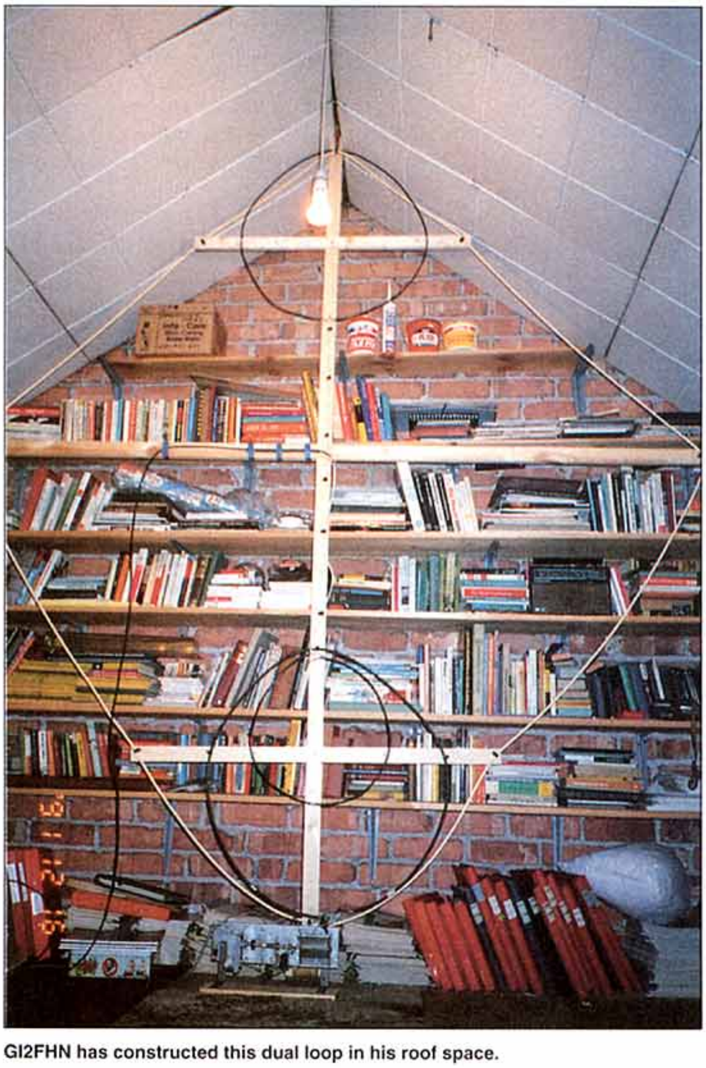
Roberto Craighero, I1ARZ, with much personal experience of using loops, writes: "I confirm once more that the radiation efficiency of a short loop antenna having a circumference slightly less than 0.25-wave approaches the efficiency of a half-wave dipole a half-wave above ground. It is clear that having sufficient space to erect a dipole at such a height provides a more convenient antenna than a compact loop. However, it is clear that most amateurs wishing to work the lower frequency bands find it difficult to erect long dipoles at the required height. In such cases the compact loop is certainly better than a dipole at a very low height in terms of wavelength.

"But I wish to stress once again that to obtain good results with a compact loop, the materials employed must be of good quality. An excellent split-stator capacitor must be used to tune the loop. Welding must be accurate to keep ohmic losses to a minimum.

"In my experience a ground plane improves the overall efficiency of a compact loop even if not directly connected to the antenna. An 80cm loop mounted over the roof of my car, but not connected to the car body, showed a significant improvement due to the ground plane provided by the roof of the car. With my large square loop for the lower frequency bands, I could notice an improvement when the surface of the flat roof is wet following rain. [But is rain water electrically conductive? *G3VA*].

"I can confirm DK5CZ's remarks (*Eurotek*, Oct 1991, p39) that the high loop currents tend to heat and thereby distort the thin metal in vacuum capacitors and consequently detune the loop. With my large low-frequency loop which has a vacuum capacitor, I find that on SSB (about 60W PEP) with its low power factor there is no need to retune the antenna. But when I use CW with its greater power factor, there is a need to retune the loop from time to time.

I1ARZ also drew attention to a loop described by Sergio Clauser, IV3RLL, in *Radio Rivista*, 7/91, using a length of low-loss UHF Heliax cable. This has an external diameter of 41mm after removing the internal nylon spiral and inner conductor to provide a very light but solid copper conductor of large diameter that can be bent into a circle by hand. Such bending is possible since this type of cable has copper tubing with a special knurling that permits bending and increases the electrical surface of the antenna by about



GI2FHN has constructed this dual loop in his roof space.

20%. Such cable is very expensive but it is sometimes possible to acquire short end-of-reel lengths at much reduced cost since short lengths have low commercial value. I1ARZ also mentions the use of 3in elliptical waveguide.

Eric Sandys, GI2FHN, has been making good use of a multiband form of magnetic loop that borrows a dual tuning technique from the Z-match tuner: **Figs 1 and 2**. He writes:

"On 14, 18, 21, 24 and 28MHz, L1 is tuned by C1A and C1B in series. As L3 is high impedance at these frequencies, it can be ignored. On 3.5 and 7MHz, L3 is tuned by C1A placed in parallel with C1B through L1. The coupling links L2 and L4 are connected in parallel and RF is fed in through a 1:1 choke balun. The sizes of the coupling links were

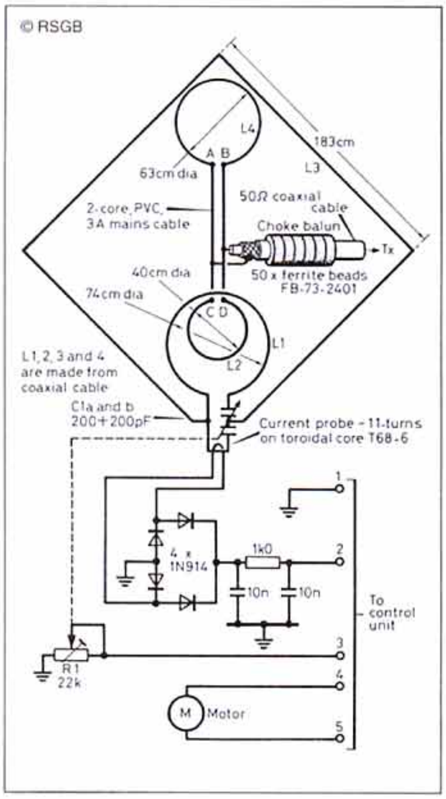


Fig 1: GI2FHN's dual magnetic loop antenna covering 3.5 to 28MHz erected in the roof-space.

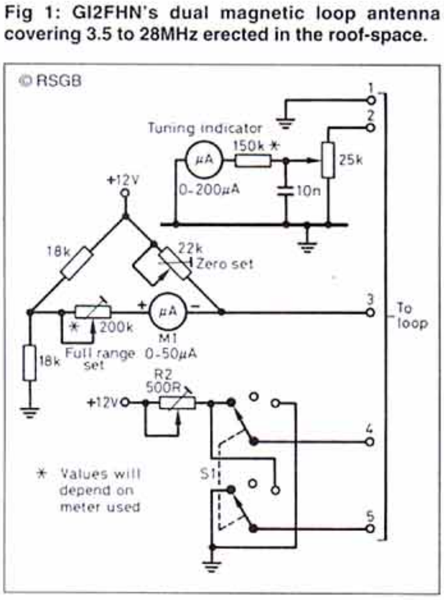
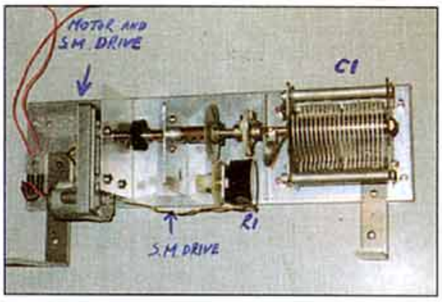


Fig 2: Control unit for tuning the loop antenna.



The loop's tuning unit with slow-motion drives.

selected to give the lowest SWR which is better than 1.5:1 on all bands. If coverage of the 10MHz band is required, L4 needs to be reduced slightly in size.

"The same diameter coaxial cable is used for the loops and coupling links. Note that the connections between the two coupling links should not be transposed. A should go to C and B to D. Failure to observe these points can result in degradation of the SWR.

"The loop is housed in the roof space using a timber framework to provide the necessary support. All functions are carried out from a control box (Fig 9) at the operating position. Changing bands is made easy by using a Wheatstone bridge to give a visual indication on M1 of the travel of C1. The variable arm R1 is gear driven from the shaft connecting the motor and reduction gearing to C1.

"Direction of rotation is controlled by S1, a DPDT switch (centre-off). Fine tuning is provided by a speed control R2. A current probe enables exact resonance to be established at the operating frequency.

"Results have exceeded all expectations and the arrangement can be recommended for anyone who does not have space for a fullsize outside antenna."

MORE ON THE G5RV/ZS6BKW ANTENNAS

THE JANUARY *TT* drew attention to the growing interest overseas in the ZS6BKW/G0GSF antenna developed from the G5RV but offering a reasonable match (without ATU) on five bands: 7, 14, 18, 24 and 28MHz. It is interesting to note that Bill Orr, W6SAI, in his *Radio FUNdamentals* column in *CQ* (November 1992) also presents information on both versions under the heading 'The G5RV antenna revisited - again'.

In addition, he traces some early history, writing: "To go back a bit, the G5RV antenna is an offspring of a 3-band antenna (80-40-20 metres) designed by Art Collins (ex-W9CXX) and L M Croft and described in detail by Croft in the December 1935 issue of *Signal* magazine, the house publication of the old Collins Radio Company . . . . The idea behind the antenna was sound, but the execution was a failure because the antenna used a 300Ω section made of two 82.5ft lengths of aluminium tubing hanging from the centre of the 103ft flat top. The weight of the installation made it heavy and impractical. Signal gain of this antenna was about 1dBd.

"In the early 1950s the antenna reappeared in modified form in England, redesigned and popularized by Louis Varney, G5RV. The Varney antenna functions as a 1.5-wave antenna on 14MHz with a feedpoint impedance slightly over 100Ω. The matching section of heavy tubing is replaced by a 450Ω open-wire half-wave line. This light-weight (Matching section) transformer closely matched the antenna feedpoint impedance to an 80Ω transmission line on 20 metres . . . . it was quickly found that the G5RV would function quite well on other bands if an antenna tuning unit was used at the transmitter. No one worried much about SWR in those days . . . ."

Curiously enough, the highly-respected Walt Maxwell, W2DU, in his book *Reflections - Transmission lines and antennas* (ARRL, 1990) commits one of his very few errors in dismissing as "one of the myths and confusion concerning the G5RV" that it can yield a low SWR [admittedly not 1:1 but below 2:1 - *G3VA*] on bands other than 14MHz. He states categorically that "there is no length of open-wire line of any characteristic impedance Zc that will transform the antenna impedance Za to an impedance that is even close to presenting a match to 50 or 75Ω coax, except on 20 metres". May I humbly suggest to W2DU that before the next edition is published, he should carefully read the various papers by G0GSF mentioned in the January *TT*.

ADVANCES IN HF RECEIVERS

IN THE ERA OF BLACK BOX transceivers, there is a danger that most of us, unless professional design engineers, will gradually lose touch with the finer points of modern HF receivers. There is a pertinent cartoon in the December 1992 issue of the Australian 'Amateur Radio'. It is a drawing of an amateur speaking into the microphone of his transceiver with a 'Black Box Operator certificate' hanging on the wall. He is saying "Yes, I got the certificate. Now I'm going for the fifty knob endorsement!"

It seems that the trick nowadays is to learn how to use the knobs rather than to have any clear idea of what they do and why they actually work - not to mention whether they are really necessary, and whether the facility they provide may be at the cost of more desirable performance characteristics. It has to be admitted ruefully that in many respects, at least for CW operation, the HF receiver of today is unlikely to be significantly better and may be significantly worse than the best designs of over 30 years ago.

On the other hand it has also to be admitted that if a manufacturer were rash enough to attempt to market a replica of receivers such as the Collins 75A4 or 51J4, the Hammarlund SP600 Super Pro or even the 1940s RCA AR88, the price tag would be way up in the stratosphere! Recent articles have shown that in 'real terms' the cost of 'economy-class' amateur HF transceivers has continued to fall although top-of-the-range models with ever more built-in facilities (and even more knobs) have risen significantly. **Fig 3** shows representative block diagrams of modern receivers.

Currently, in the professional and to some extent in the amateur receiver world, the main talking point is the increasing use of digital signal processing as part of the trend towards the true digital-radio. Digitization is still confined to post-detection baseband (audio-frequency) signals as in **Fig 4** or to IF signals at relatively low-frequency by using sub-Nyquist sampling.