TV Reception via the F2 Layer

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AS the current sunspot cycle heads toward its peak, so propagation of signals in the lower part of the v.h.f. spectrum via the F2 layer is becoming more frequent. The greater the number of sunspots, the higher the electron density in the F2 layer. As a result, higher frequency signals are reflected. The sunspot peak, likely to be in early 1980, is expected to be very high this time. We can hope therefore for the propagation of many v.h.f. TV signals over very long distances – similar maybe to the 1957/58 peak, when Crystal Palace BBC-TV on ch. B1 was received in Australia. The last peak, ten years ago, was not so pronounced. Frequencies to note are ch. E2 vision (48·25MHz) and sound (53·75MHz) and ch. E3 vision (55·25MHz).

Earlier this year I received several signals from Africa via this mode of propagation. With the hope of better things still to come, this article has been written to help others interested in receiving and identifying these exotic signals.

F2 Propagation

The F2 layer is the highest one in the ionosphere, being on average some 200 miles high. Thus a signal reflected from this height above earth will have a skip distance of some 2,000-2,500 miles. During a sunspot peak the maximum usable frequency (m.u.f.) can rise to 60MHz or so, giving reception of such signals over great distances. The m.u.f. is higher in winter than in summer, since the ionised gas layer is denser due to decreased heat from the sun. This is why most really long-distance TV reception in the past has been during the winter.

The shallower the incident angle of a signal, the easier its reflection by the F2 layer will be – if the angle is too steep and the ionisation too weak, the signal will pass through the ionised layer into space.

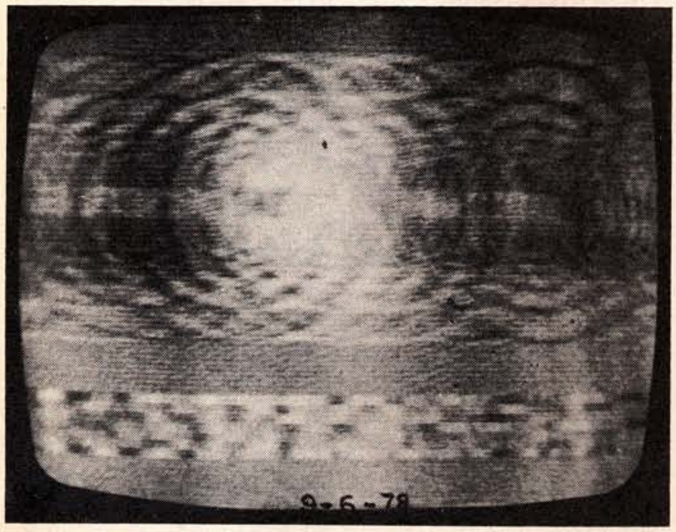
A point to bear in mind is that optimum reception occurs at the m.u.f. So when a relatively clear signal on ch. E2 begins to become stronger and more blurry, it will pay to check on ch. E3.

Unfortunately, the UK is a "fringe area" so far as F2 propagation of v.h.f. signals is concerned. The equatorial belt receives the greatest radiation from the sun, so the F2 layer above this belt is densest. In consequence, higher m.u.f.s more commonly occur for transequatorial propagation. The higher one is above say latitude 40°, so reception falls off. It often happens that transequatorial (F2/TE) signals just make it into the southern UK, but are not seen farther north. Don't be discouraged if you live in the north however – Gwelo Rhodesia ch. E2 was received in the very north of England in May 1973. Use a very high aerial wherever possible, because the F2 signal may be only just scraping over the horizon. Note that due to the sun's 27-day period of rotation, exceptional reception may be repeated approximately 27 days later.

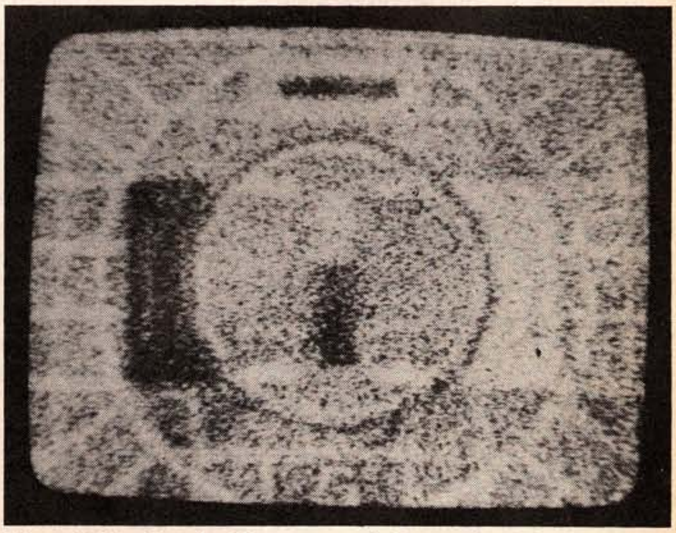
Certain signals, particularly Rhodesia ch. E2, have been received during southerly Sp.E openings. Double- or even triple-hop Sp.E signals would not reach the UK over such a distance however, so it's possible that the signal arrives in north Africa via F2 reflection and then continues its long journey to the UK via Sp.E. Reception of certain mid-African countries via Sp.E in the UK (notably Nigeria) is virtually ghost free and probably via double- or triple-hop. Some tropospheric enhancement at either end of the F2 path may also help the signal to travel marginally farther. For more detailed information on F2 reception, see Roger Bunney's *Long-Distance Television* book (a new edition has just been published by Bernard Babani (Publishing) Ltd., The Grampians, Shepherd's Bush Road, London W6 7NF at £1.45 (plus 20p via post).

TE Skip Reception

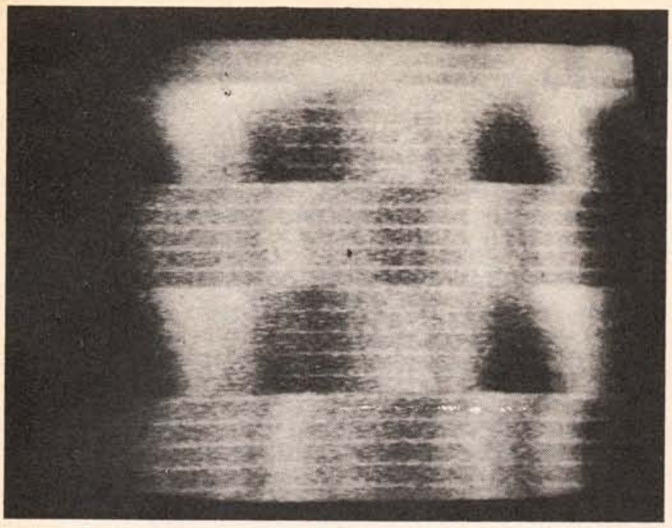
As we've seen, the most common form of F2 propagation is transequatorial skip reception. From dusk onwards, the two F layers break up and a single night-time F2 layer forms. While dispersal is taking place, the m.u.f. can rise to a higher level than during the day – radio amateurs in north/south America have noted reception at up to 420MHz! Most signals propagated in this way remain



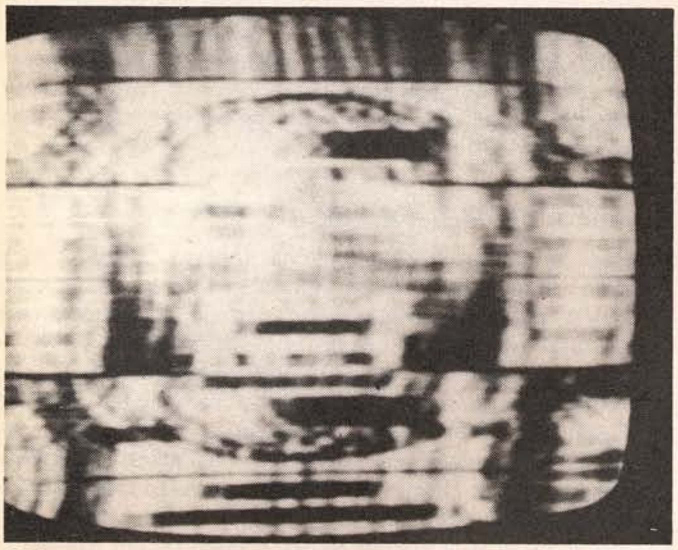
Rhodesian TV, ch. E2, received by Ryn Muntjewerff in Holland in June this year. Note the multiple images.



West Malaysia ch. E2 test card G received in Southern Australia in November 1977.



The Rhodesian checkerboard pattern, received on ch. E2 in May this year in Norfolk.



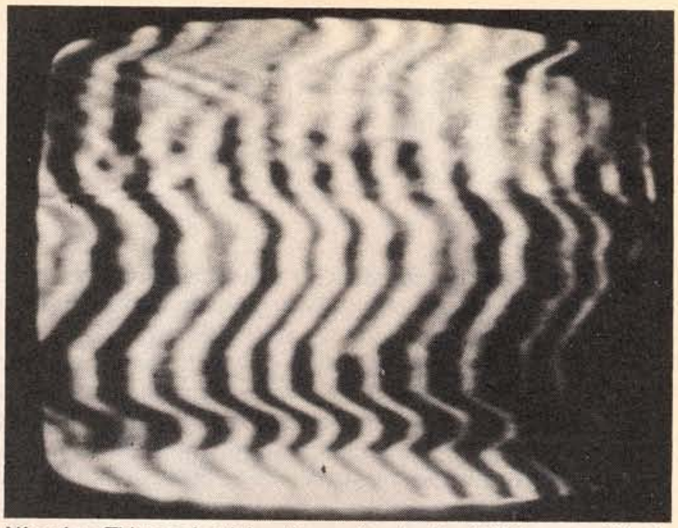
Chinese test card received in Australia on ch. R1 (49·75MHz vision carrier). This test card is no longer in use.

within the equatorial belt, but on the odd occasion one finds its way into the UK – in April 1978 a very strong Nigerian signal was received over the period 1730-1830 GMT on ch. E3 (there was little on ch. E2 at the time, so always check on ch. E3 even if there are only very weak signals on ch. E2).

Obtaining Reception

In the UK, F2 reception from Africa is easiest. This is because for low v.h.f. F2 reception the mid-point between the transmitter and the receiver should be at noon. Since noon in Europe and Africa are at approximately the same time, this means that north-south reception is far less critical.

The best period for reception from Africa is from 1200 GMT onwards. If, like the writer, you don't have facilities for monitoring the 30-40MHz band, check whether the receiver is displaying the following signs of a rising m.u.f. (1) After 1200 GMT, check for weak morse code over the ch. B1 vision buzz – obviously a fairly weak B1 signal is needed. (2) Check whether by 1300 GMT the ch. E2 vision frequency (48·25MHz) is forming lines – audible as a low whistling note. (3) Tune the TV set to below ch. E2 – the lower sideband usually appears first. It's best to switch to positive modulation, as the negative-going sync pulses are more easily seen (as a thin, jumbly white line running down the screen). A short time after all this, the main carrier



Nigerian TV received by the writer in April this year. Weak programme material was present before this stronger, more smeary signal appeared. This time the channel was E3.

should appear. The time varies, but the main signal has never appeared before 1315 GMT and never later than 1445 GMT. It's usually quite strong, with several ghosts. The ch. E3 sound channel has never been heard so far, but on one occasion a weak ch. E3 vision carrier was noted. The duration of reception varies – from just five minutes to well over an hour.

If African reception occurs regularly, east/west reception may occur later in the year. As noon must be at approximately the mid-path, reception from the far east should occur from 0700 GMT onwards, middle eastern reception from 1000 GMT on and reception from north/south America from about 1400 GMT. Reception from the Americas is more difficult, due to the high frequency of ch. A2 (approximately 55MHz). If the m.u.f. is rising in that direction however, the 50MHz amateur band used in the Americas will become active, giving a good clue.

Identifying Signals

As reception tends to occur at the same time each day, the same material will tend to be received. Several African countries, notably Nigeria, now transmit in colour, and a vertical interval test signal should thus be present. The country I received on several occasions on ch. E2 last March appeared to use frequency grating charts. Rhodesia uses the checkerboard pattern (similar to Spain) till 1500, when it goes on to programmes. VITS are not used, and the line frequency is more or less 15,625kHz (some monochrome networks are not). There's generally a distinctive star symbol between advertisements on Rhodesian TV, and this may help with signal identification, though it's not always used. Gwelo ch. E2 produces a very distinct pattern of several diagonal bars when beating with the local (North Hessary Tor) ch. B2 sound signal here – in other parts of the country the B2 offset frequencies are different so this won't help.

Incidentally, last June I received an African station which used a symbol similar to the old Rediffusion star. I'd like to hear from anyone who can throw any light on this.

If conditions allow, listening to the sound channel will often yield more clues than trying to identify the messy vision signal (it also avoids eyestrain!). Once you've seen your first African signal, recognising further ones will become much easier since you will be aware of the signal's characteristics and be watching at the right time.

Finally, thanks to Roger Bunney and others who have sent photographs, and good viewing this winter! ■