Working 10m FM

Here is the lowdown on using this fast growing mode, complete with repeater and propagation information, from its best known exponent, John Petters, G3YPZ.

With the legalization of CB a couple of years ago, and the ready availability of cheap FM rigs easily shifted up a MHz or so, radio amateurs in the UK have discovered the new and exciting operational pastime of 29 MHz FM.

Although the ten metre band has been used for many years and has provided many excellent DX contacts, it has not been generally considered suitable for local traffic. In fact, the band displays many VHF characteristics, and, if approached with VHF techniques with regard to aerials and receiver sensitivity, ten metres can outperform the two metre band, particularly for mobile use. The added possibility of intercontinental DX, even with very modest power and simple aerials, gives the band an edge that 2m definitely lacks!

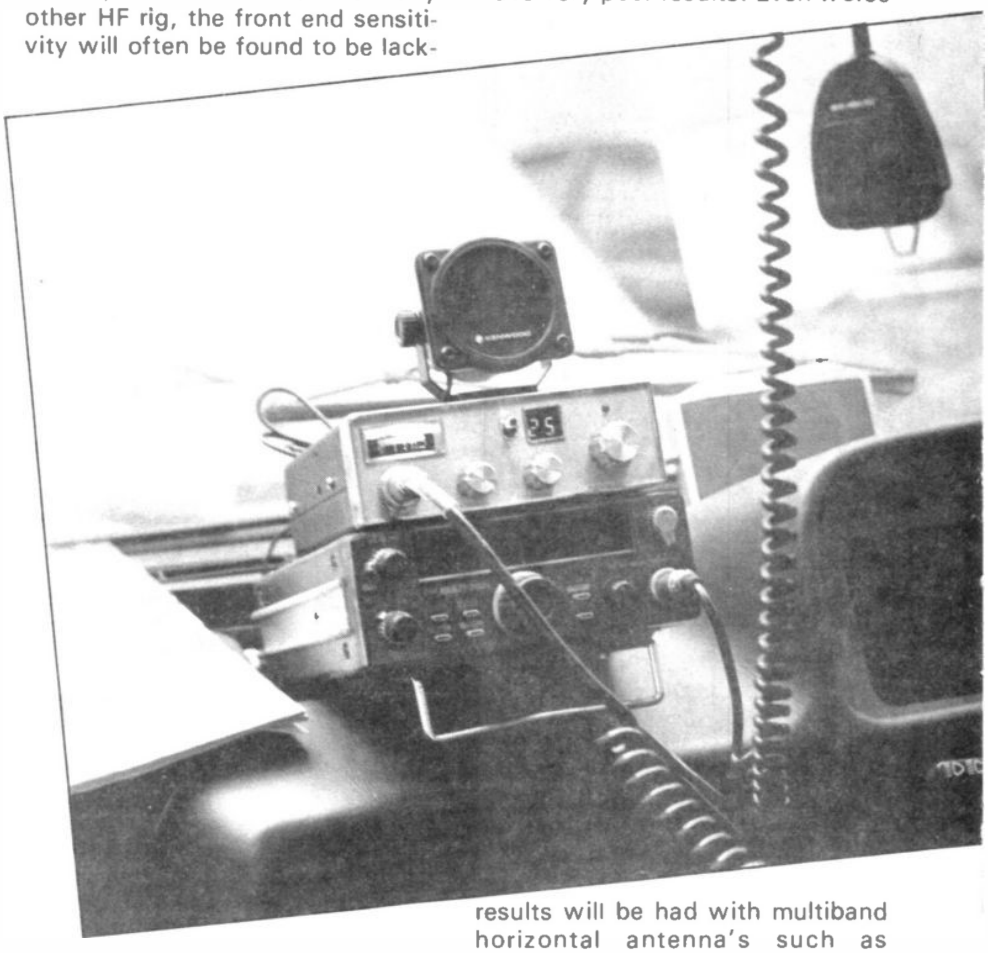
The first steps towards using 29MHz FM for local traffic occurred during the mid 70's in the USA when groups of amateurs started to modify ex-commercial radios for the band. Activity in other parts of the world was slow to follow, with G3ZEV, G3LWM and the writer among the first on the mode in the UK during the Autumn of 1978.

Getting On The Band

A variety of different CB rigs can be modified for 10FM and can be obtained at a very low cost if you are prepared to shop around and carry out the modifications yourself. The most commonly heard 'boxes' on the band are the Icom 1050, the DNT M40 and the LCL and Oscar rigs. These are all modifiable by a simple crystal change and 'tweak up'. Other rigs such as the Midland, Fidelity, Maxcomm etc, which all use a so-called unshiftable PLL chip, require the insertion of a mixer and a divider circuit to get them on the correct frequencies.

Having got the rig, it is worth looking into improving the sensitivity of the receiver. Many radios have a MOSFET front end which can generally be improved by inserting a 3SK88, BF900,961 or 981 instead of the original device. For those using FT101s, TS430a, FT77s, FT757s or almost any other HF rig, the front end sensitivity will often be found to be lacking on 10m. A solution is to use a good MOSFET pre-amp, providing you live outside a highly populated CB area. If you are surrounded by CBers this can lead to an unprecedented amount of cross modulation. Many of the all band multimodes can suffer badly enough from this problem without increasing the front end sensitivity.

The aim of the 10m operator should be to have a station of equal sensitivity to that which is accepted on 2m. The antenna is of co-equal importance to the receiver performance on 10FM. The use of a vertical antenna, cut for the band, with a good ground plane and in the clear is the only way to radiate an effective signal with good omnidirectional coverage. The use of trapped verticals such as HF5's, 18AVT's, 12AVQ's etc will produce very poor results. Even worse results will be had with multiband horizontal antenna's such as G5RVs, trapped dipoles, minibeams and long wires. As with VHF, the polarization of the aerial is critical, with up to 20dBs typical loss between cross-polarized systems.



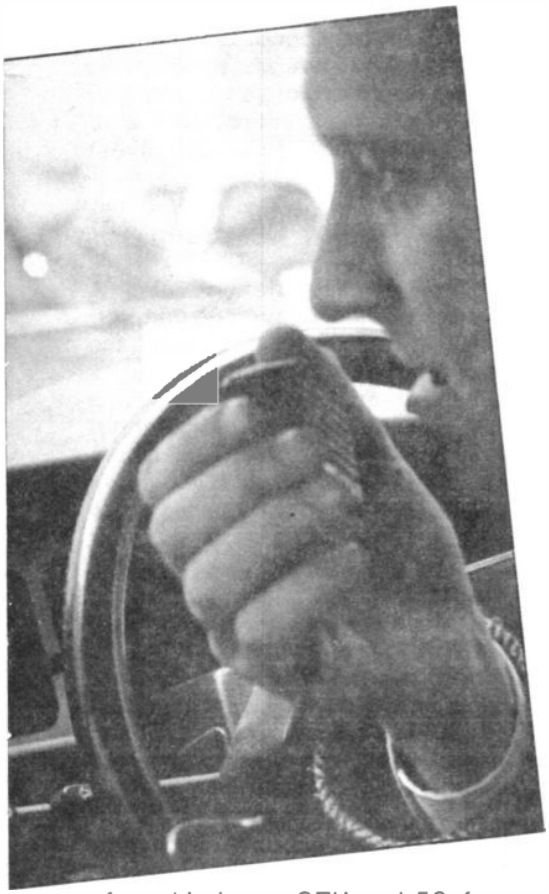
Propagation

There are many different modes of propagation apparent on the ten metre band, ranging from F2 layer ionospheric, which is the main DX mode, through to direct 'space wave' (often miscalled 'ground wave') which provides the reliable local contacts.

With the average 4 watt FM rig and a 1/2 wave vertical at, say, 20 feet above the ground, it is possible under good sunspot conditions to have good contacts with stations all over the world. Higher power and a 5/8 wave ground plane would improve the results.

What Can Be Worked

Since October 1978, G3YPZ has worked 84 country prefixes



from his home QTH and 59 from mobile, including all the American and Canadian call areas, Japan and Australia from fixed *and* mobile. All of the contacts from home were made using either 1/2 or 5/8 wave verticals, with heights ranging from 30ft to 150ft (the latter height is *not* essential!) above ground. The mobile antennae were either centre loaded or base loaded 1/4 waves, a full length 1/4 wave or helically loaded 5/8 CB – whips retuned for 20m, the latter giving the best results. Power levels varied from only 1W up to about 100W.

Many stations QSO'd were giving fully quieting signals, (ie practically noise free) and, apart from QSB and phase distortion, which is a problem on FM, they sounded as good as the local two metre repeater. More than any other HF band, 10m is affected by both seasonal changes and the eleven year sunspot cycle. The best F2 conditions on the East-West path are to be had in the Autumn and Spring months, particularly October and March, while the short daylight hours of mid-winter find signals coming in just around dawn, and disappearing soon after dark. From April-September, F2 only takes place on a North-South path, which enable good contacts with ZS and PY and occasional openings to VK.

Conditions so far during 1984 have not been too good, although QSOs with YB3AP, VK6RO, VK6IV, ZS5BK and strings of Stateside stations were made in March. Contacts with K6QE, K0HRX, FY7AU, via the Virgin Island repeater, and simplex with ZS2FP, ZS1LI, PY3ECO and CN8EO were made during late April. July and August produced the odd opening to PY and a QSO with 9J2LG.

As the sunspot cycle continues to descend towards its minimum, the F2 openings will become fewer, and less reliable, until eventually there will be no propagation via that mode. This will leave the VHF type propagation available on the band, which includes sporadic E and 'tropo' working.

Using American Repeaters

The excellent openings during the last five years have enabled many UK Amateurs to work stations via the American repeaters. These machines differ from the VHF/UHF repeaters we are used to in this country in several ways; they can be co-sited but sometimes the Tx is as far as 10 miles from the Rx. The two sites are UHF linked, and also offer the possibility of access from 2m or even UHF. It is not uncommon to be working a station through a 'stateside' 10m repeater who is transmitting on a two meter handheld!

Most repeaters require only a carrier to access them, and the input and output are spaced 100kHz apart, with the input being the lower frequency. Some difficulty can be experienced in working co-sited repeaters due to selective skip. This problem occurs when for example the Tx site is within the skip range but the Rx site, say, five miles away, is just outside. Repeater Tx/Rx separations of as little as a couple of miles can be affected in this way.

The problem of 'phase distortion' rears its ugly head twice-fold in the repeater situation. Firstly, there will be distortion on the path between the UK and the repeater Rx, which upsets the quality of the signals: secondly, if a UK station is trying to work another European via a stateside repeater, the double dose of distortion can at times render a QSO impossible. When conditions are good, however, it can be quite a novelty to work local G stations in this fashion! High power is again not an essential. When working the 10m repeaters, as many contacts are often made through these machines by mobile stations running just 4W.

Sporadic 'E'

Sporadic 'E' occurs with regularity during the summer months and occasionally and quite unexpectedly at other times on 10m. Unlike F2 propagation, sporadic 'E' is not affected by the sunspot cycle, so even during the minimum years it will be possible to work Euro DX on 10FM. Skip distances can vary between as little as 300 and up to a couple of thousand miles.

Such places as Israel and the Canary Islands are audible throughout all seasons from time to time, and certainly appear on 'E' during the summer, but seem to be heard via F2 in the winter – it is therefore sometimes impossible to be quite sure what mode of propagation is in evidence.

The nature of 'E' signals on 10m is certainly sporadic, as the

name suggests with signals many dBs over S9 fading down into the noise in a matter of seconds. The propagation can be limited to isolated areas at any one time or can stretch across the whole of Europe. 'E' can also take place at any time of the day or night. Signals from DL0IGI have frequently been heard as late as 4am during the summer of 1984. Because sporadic E is Ionospheric (ie signals being bounced off the ionosphere), the polarization of the antenna is not critical, which means that the '5 RV brigade can be deceived into thinking that an S9 report from SM or HB9 means their antenna will also work well for local contacts on 10m.

Results obtained over a number of years by G3YPZ indicate that the vertical systems outlined earlier will still out-perform the trapped type of aerial, and can only really be bettered by using a good beam. The 1984 sporadic E season got under way in late April and was in full fling during August. Countries worked on sporadic E by G3YPZ during 1984 include Cyprus, Liberia and Greece.

Tropospheric Ducting

'Tropo', like sporadic E can occur at anytime of the year and is not affected by sunspot activity. As the name suggest, this type of propagation is due to signals apparently travelling along ducts in the troposphere. It would appear that there is some degree of tropospheric lift present most of the time on 10m as signals over a 30 mile path tend to vary with slow fading. During the summer months with high pressure and temperature inversions, particularly on foggy or misty days, the enhancement of 10m signals can be quite great.

Tropo' signals display a very deep fading characteristic with no phase distortion and no polarization shift. It is therefore very important that proper aerials are used when attempting to work this mode.

As with the selective skip experienced on F2 and 'E', tropo' paths can be critical within a couple of miles, although the speed at which the ducting distance changes is much slower. Phase distortion is pleasantly absent from signals on this mode. As the level of activity increases on the band more knowledge will be learned about this fascinating propagation characteristic. During 1984 G3YPZ has had tropo' contacts over distances varying from 40-240 miles.

Many operators on 10m FM use CB antennas cut down to size, as these are cheap and plentiful. The above pic shows (just) G4NXV's 'modified' centre loaded ¼ wave CB antenna.

Notable contacts using tropospheric propagation have been made between G3MY, Sheffield, and G3IAG, Newmarket, Suffolk, using FM and about 80 watts over the 120 mile path with greatly varying signal strengths. Meteor 'pings' can often be experienced when signals on the direct path are weak or even non existent. The study of this phenomena and auroral propagation on 10m should prove to be most interesting.

Space Wave Propagation

Space Wave Propagation, often incorrectly assumed to be ground wave, is the mode used for local contacts on 10m, as indeed it is on other VHF bands. Although this is often thought of as 'line of sight' propagation, range is not restricted to the horizon, because signals are refracted or bent slightly to follow the curvature of the earth for a distance. At the higher VHF and UHF frequencies, the refraction is very slight, and eventually 'line of sight' becomes literally 'line of sight'. At 29MHz the refraction of space wave signals is considerable, giving a much greater range with less attenuation of signals over built up or hilly terrain. Contacts between two valleys with rising ground between are usually possible on 10m where as they are not on 2m.

Obstacles such as buildings, trees and lamp posts etc cause less mobile 'flutter' on 2m which is very fast is reduced to slow fades on 10m. Interruptions in the direct path can be found with signals reflected from aircraft, these giving a fast flutter effect as the phase of the two signals varies, adding to and subtracting from the direct path.

Day-to-day Operating

For a base station using 4 watts to a 1/2 wave end fed vertical at, say, 20 ft above the ground, in an average location, a range of at least 30 miles to a similar installation should be about normal. Higher power and a 5/8 wave will of course greatly improve this. The base to mobile range should be in the region of about 20-25 miles depending on the mobile antenna.

Mobile-to-mobile should produce anything from 15 to 30 miles range, depending on terrain. Contacts between mobiles in the region of 40-50 miles apart have been noted when high power and good locations are used.

Present levels of activity on 10FM in the London and Home Counties are quite high, with the band having a similarity in both operating manners and procedure to that of 2m in the pre-repeater days. The use of 29.600 as a working frequency must now be frowned upon during the busy times, a QSY to another channel being the correct procedure. Operators should remember to avoid frequencies between 29.350

and 29.550 which are satellite channels.

It is very easy to get discouraged when no one replies to a CQ call, but patience and perseverance will pay off. Remember, if everyone gave up and went back to the local 2m repeater there would never be any activity on any other band. When that JA gives you a call it will all seem worthwhile. . .

Table 1 — List of 10M Repeaters

Input	Output	Callsign	QTH
29.51	29.61	DB0 RU	Duisber West Germany
29.52	29.62	KE4 IO	Atlanta, Georgia
		K3 SP	Freeland, Maryland
		WB7 CAG	Glendale, Arizona
		WD0ALH	Newton, Kansas
		W1 BHD	Malden, Mass
		WD8 CIY	Brady, Texas
		W0 JZY	Hillsboro, Miss
		W4 ZJM	Memphis, Tenn
		WA2 TMZ	Toms River, N.J.
29.53	29.63	N6 AHW	Montery, Calif
29.54	29.64	WB3FKQ	NE Penn
		W3 DID	Baltimore, Maryland
		WD8 DPA	Ann Arbor, Mich
		KE4 QC	Mobile, Alabama
		WA6 ZOI	Mt Wilson, Calif
		K0 LKH	Boone, Iowa
		K0 GBZ	Quinter, Kansas
		WA0 YUA	Bridgeton, Miss
		WB7 DRU	Sioux Falls, S.Dak
		WB5 ITT	Port Neches, Texas
		K5 TYV	San Antonio, Texas
		W7 ZFX	Sedro Wooley, Wash
29.54	(29.640) (145.45) (433.95)	K2 KLN	Manhattan, NY
29.55	29.65	K3 SLG	Pine Grove, Penn
		KB2 DQ	Buffalo, NY
29.56	29.66	WP2 IPJ	St. Thomas, Virgin Is
		WR2 ABA	Huntingdon, NY
		AE0 N	Bloomington, Minn
		W0 IA	Boulder, Col
		N9 PL	Palomar, Mt Calif
		N3 AUY	Silver Spring, Mld
		W0 TQ	Concordia, Kansas
		K8 YPW	Hastings, Mich
		WR5 ARS	Houston, Texas
29.57	29.67	DB0 QK	Mainz, West Germany
29.58	29.68	W4 MM	Albany, Georgia
		WB6 IGH	Palos Verdes, Calif
		WB9 STA	Pendleton, Indiana
		KD4 DN	Sterling, Maryland
		W2 SEX	Buffalo, NY
29.51	29.69	W3 EDU	York, Penn
26.60	145.15	N4 AHN	Bessemer, Alabama
29.60	224.74	WA2 NCB	Cambria Heights, NY
29.60	144.94	K2 TKE	Setauket, NY

Note. Both of the German repeaters require a 1750 KHz tone to access them.