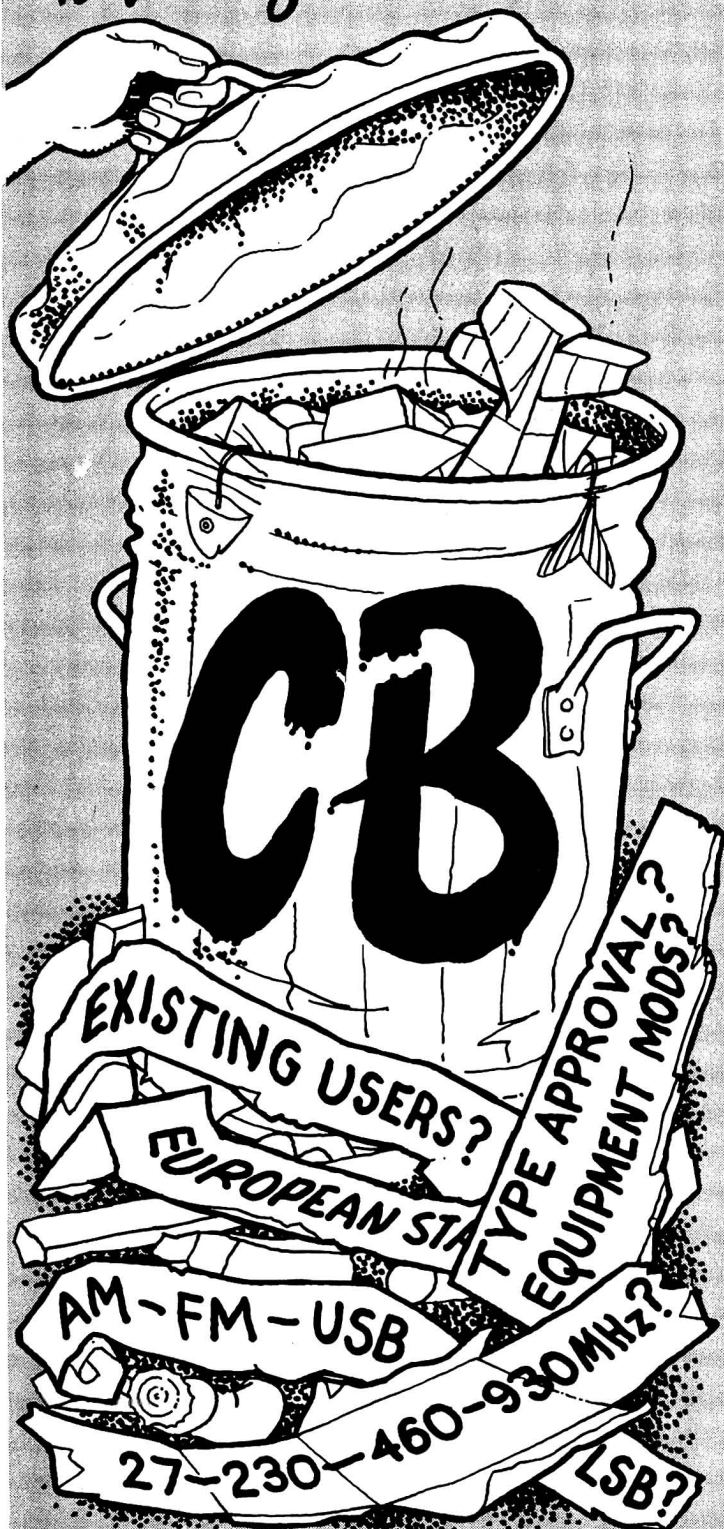


Taking the lid off



UNANSWERED QUESTIONS

Geoff ARNOLD G3GSR

First of all, let me come straight out with it: I'm in favour of CB. I think that everyone has the right to a personal, short-range, mobile telephone system, which is what CB is all about.

What it's used for is up to the individual. You can keep in touch with home or other members of your family; you can get directions or news about traffic hold-ups when you're on the road; you can call for help in an emergency; you can use it to chat to friends or even to make new friends. Anything, so long as it doesn't spoil other people's enjoyment of their hobbies or pastimes, or interfere with essential radio services.

There are things, though, that to my mind should very definitely not be encouraged on CB, and in fact some countries go so far as to ban them. The first is DX (long distance) working. Sometimes, when atmospheric conditions allow, the DX comes roaring in on 27MHz, and even wipes out your local stations, or at least cuts down the range at which you can work them. With the sunspot cycle as it is now, this applies in the UK for most of the daylight period. It isn't necessary to have high power to work DX, but DX-hunting encourages the use of high-power linear amplifiers. With a limited number of channels available, the same channel must be used over and over again, in different areas, and anything that is done to increase range **unnecessarily** will stop that happening. Imagine sharing just 40 channels with 4 million other people, all within range!

The second use of CB to be discouraged is for radio experimentation. By all means get the rig installed properly, and the antenna fitted and adjusted for maximum efficiency, but any experimentation should be done on the bands set aside for the purpose—the amateur bands. Any CBer who becomes interested in the techniques of radio communication should not find it too difficult to pass the exam to get a Class B Amateur Licence. No ability in Morse code is required, though if you can achieve 12 w.p.m., then a Class A Licence and several extra frequency bands can be yours.

CB UK

As I write this article, the draft specifications for the UK 27MHz and 934MHz services have just been issued. By the time this issue of *PW* is on the bookstalls, no doubt the final specifications will be ready. The important parts of the draft for the 27MHz service may be summarised as follows:

Frequency range: 27.60125–27.99125MHz in 40 channels at 10kHz spacing. Maximum frequency error ± 1.5 kHz.

Maximum r.f. output: 4W. This is stated as giving an effective radiated power (e.r.p.) of 2W with the "specified antenna" but details of the antenna do not appear in the draft specification.

Modulation: Frequency- or phase-modulation with max-

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imum deviation of ± 2.5 kHz. Audio bandwidth 300Hz–3kHz.

Power output in the adjacent channels: At least –60dB, but need not be less than 2μ W.

Transmitter spurious emission: Less than 0.25μ W over the range 100kHz–1000MHz, but within certain p.m.r. and aircraft bands, and broadcast bands II, III, IV and V, a far tighter figure of less than 50nW is called for.

Receiver spurious radiation: Must not exceed 20nW at any frequency.

When used with antennas erected at a height above ground exceeding 10m, the transmitter power output must be reduced by 10dB (i.e. 0.4W max.), and the equipment manufacturer must offer a suitable attenuator as an optional extra.

The transceiver must not operate on any modes or frequencies other than those specified, although there does appear to be an option of having a combined 27MHz/934MHz rig.

An equipment's compliance with the specification rests with the manufacturer, assembler or importer. He must test samples himself, or get an independent test house to do it for him. So far as we can make out, the Home Office will not type-test equipment in advance themselves, but each approved set must carry a prescribed mark, stamped or engraved on the front panel.

The use of linear amplifiers with an r.f. output power exceeding 4W is prohibited.

Transceivers originally built to other specifications will be acceptable providing they are modified to comply with the UK specification.

For the 934MHz service, the main features are as follows:
Frequency range: 934.025–934.975MHz in 20 channels at 50kHz spacing. Maximum frequency error ± 9.0 kHz. (There is a rumour that eventually 25kHz channel spacing may be introduced.)

Maximum r.f. output: 8W for sets with separate antennas, giving a maximum e.r.p. of 25W with the "specified antenna". Again, no details included. For sets with integral antennas (i.e. hand-helds), the maximum e.r.p. is given as 3W in one part of the draft specification and 5W in another.

Modulation: Frequency- or phase-modulation with maximum deviation ± 5 kHz. Audio bandwidth 300Hz–3kHz.

The transmitter adjacent channel power and spurious emission limits are as for 27MHz equipment, except that the 0.25μ W limit is extended to the range 100kHz–3GHz.

I must stress that these details are taken from the draft specifications, and are subject to possible amendment in the final version. However, I don't anticipate any major changes.

Observations

The frequencies chosen for the 27MHz f.m. service mean that it will be clear of the model radio control band, and that harmonics will fall at less sensitive places in aircraft navigation system bands. The limitation on e.r.p. precludes the use of "gain" antennas such as colinears or beams, or of phased whips.

The tight specification for transmitter spurious radiation should help considerably in reducing interference to domestic radio and TV reception.

Unanswered Questions

Although the draft specifications have cleared the air quite a bit, there remain many questions still to be answered.

Some will quite possibly be dealt with in the CB Licence, but I can foresee others causing some head-scratching:

1. Will a licence be required for each transceiver, or for each "household" group of sets?
2. Will business use be allowed?
3. Will emergency or calling channels be laid down?
4. Will operation on buses, trains, aircraft, boats or ships be permitted?
5. Will there be any restrictions, or warnings given, on operating near quarries, airfields, petrol filling stations, etc?
6. Will there be a range limit set, and will international contacts be banned, as in just about every other country with a CB service?
7. Will the licence itself include a summary of any such operating regulations, or will a separate book be issued—a sort of *CB Highway Code*?
8. Will speech processors or special microphones be allowed? There is no mention of the microphone in the draft specification.
9. Will a home constructor be permitted to assemble a CB rig from component parts or from an approved kit? Will he be allowed to modify an existing rig to the new specification? Presumably the answer will be no, on the grounds that he cannot certify compliance with the specification on things like spurious emissions.
10. Who will be permitted to service or repair CB rigs? The draft specification says that a transceiver must be maintained in a state to meet all the technical requirements, but doesn't say exactly who is responsible.
11. The draft specification says that rigs modified to meet all its requirements will be acceptable. What will happen about illegally imported rigs? Will it be possible to pay the Duty and VAT in some way so that they could become "legal"? Licensed amateurs could well be interested in adapting redundant 27MHz sideband rigs for use on the 10m band.
12. Will transverters be permitted, between 27MHz and 934MHz (problems with channel spacing here) or between amateur bands and CB bands?

New Legislation

The Government is said to be planning changes in the legislation affecting radio transmitting equipment. Certainly the present collection of Acts of Parliament and Customs and Excise Orders is an ineffective, unworkable mess, full of loopholes and in urgent need of overhaul. There is a growing lobby for making the simple fact of possession of radio transmitting equipment without a relevant licence illegal, though I can foresee some cases of hardship under such a law.

Having been personally involved in radio communications, both as a profession and a hobby, for over thirty years, my feeling is that it is vital to have regulation of radio services. The fact that the vast majority of people in the UK have for many years enjoyed their daily dose of TV with little or no interference, has been largely due to the effects of the Wireless Telegraphy Acts in limiting the number of radio transmitters around. The recent explosion of interest in CB has caused many interference problems for users of TV, hi-fi, p.a. systems, and electronic organs, aggravated by the fact that, due to the generally "quiet" radio environment created in the UK by the Wireless Telegraphy Acts, r.f.i. suppression components normally fitted in such equipment built for other countries are omitted from UK models.

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The American specification for CB transceivers was drawn up at a fairly relaxed level, largely because the authorities there never foresaw the scale of interest. When I first became involved with CB, back in the mid-1960s, I had to investigate the use of CB transceivers for on-board communication on UK-registered ships. There had been several successful prosecutions of people using 27MHz hand-helds in ports such as Southampton and Falmouth, and there was obviously no way we were going to get official approval for their use in UK territorial waters. However, the Post Office did say that we could use them on board British ships in international waters, providing that they met the limits for frequency stability and spurious emissions laid down for that band in the *International Radio Regulations*. We scoured the world for sets, but at that time could not find a single one that came anywhere near complying. It was not until about 1970 that the first hand-helds produced in Japan for their 27MHz small business user service did meet these requirements.

I think that this stresses the point I made earlier, that CB is essentially a national service, not intended to be used outside one country, which can therefore set its own rules. Having said that, the argument for some measure of international agreement in a continent like Europe, with many thousands of miles of land borders, and considerable cross-border road traffic, is overwhelming. What a pity that all the European authorities could not have got together two or three years ago, and agreed a common specification at least on the salient technical points, instead of each devising their own different system.

The Future

The announcement that the UK CB service would be on 27MHz f.m. provoked a pretty widespread reaction, with coverage on TV and in national and local press including statements which ranged from misleading to totally wrong!

There is no doubt that some of the present illegal CB users will go on using their a.m./s.s.b. equipment, linear amplifiers, etc., and it remains to be seen what may be done by the authorities to stop them. Some newspapers made much of the "universal anger" of CB users at the realisation that their a.m. sets would be outlawed. My own impression is that this anger is by no means universal. The attitude of many CBers seems more along the lines of: "We took a gamble, we spent more money, we had some fun. If we have to junk our present sets and buy new to talk to the rest of the people then so be it."

The heart-rending tales of hard-up CBers who can't afford to scrap their a.m. transceivers don't seem to tally very well

with people who buy an £85 rig, and trade it in a fortnight later for an all-singing, all-dancing £185 one. Or those who spend £500 on an amateur rig for conversion to 27MHz—one of our locals was recently saving up for a £700+ rig! I think that much of this anger actually comes from importers with warehouses full of a.m. rigs, who stand to lose very large sums of money indeed because they backed the wrong horse.

With a few exceptions, the reaction of licensed amateurs towards CBers has been remarkably tolerant. Even one West Country amateur who'd been stopped 17 times by the police was pretty philosophical about the whole thing. Certainly many amateurs will become CBers as well, when it's legal—they need a mobile telephone as much as anyone else, and not all their family and friends are sufficiently interested to study for the RAE. The number of licensed amateurs has certainly grown because of the interest aroused by CB, and many new G8s and G6s openly admit to being frustrated ex-CBers.

Hopefully, along with changes in legislation will come some way of helping the licensed amateur to prove his bona fides to the police. Having an identifying mark stamped on the front panel of the new approved CB sets isn't going to help mobile amateurs prove that they're not operating illegal CB rigs. A new form of Amateur Licence, looking rather more like an official document than the present photo-copied sheets, would help here.

In the course of time, new CBers will outnumber the present illegal users, and the whole character of CB will change. Those illegal users who are there simply because it is illegal will find something else to amuse themselves with, some will go on using the illegal system, the rest will lose interest or settle down to becoming regular users of the new, legal, system. Some will move on to become licensed radio amateurs.

Happily, the CB fraternity is at last becoming more aware of the potential problems of causing interference to TV, hi-fi, p.a. systems, organs and the like, all of which have been experienced by *PW* editorial staff in the Bournemouth/Poole area. At a local motor-cycle scramble last week-end, CBers among the spectators were requested not to transmit during the races, because it interfered with the p.a. system.

Argument over whether the massive illegal use of CB in the UK was a blow for democracy or a symptom of our moral decay will no doubt continue for many years to come. I think there are points on both sides, and though I do go along with the need for a reasonable level of regulation and control of radio services, I think that the right of the general public to a personal, short-range, mobile telephone service is undeniable. Would the Government have introduced CB without that massive illegal use—who knows? ●

27 MHz FM ~ WHAT TO EXPECT

When it was announced that the UK CB service was to use frequency modulation, even on the 27MHz band, one of the main arguments put forward by opponents was that the range would be inferior to an amplitude modulated service. Since CB is a local service, with DX contacts illegal

in pretty well every country having CB, it is the local, ground-wave range that matters. Admittedly, "capture effect", which causes an f.m. receiver to respond only to the strongest signal, could actually be a disadvantage if a DX signal arriving by ionospheric skip is stronger than the

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local wanted signal, but this seems to be an argument for stronger action against the use of illegal linear amplifiers, rather than for adopting an inferior type of modulation. After all, if you've got an urgent message to get through, it's better to pass it quickly and clearly, and then leave the channel free for someone else, than to fight against the interference of several stations coming in at once. That is basically the difference between an f.m. and an a.m. service.

There seems to be little or no practical data on the sort of ground-wave ranges likely to be achieved at 27MHz, or in the neighbouring 10m amateur band, standing as they do at the frontier between h.f. and v.h.f. There seemed no reason why ranges achieved using f.m. should be less than those with a.m., providing a similar r.f. bandwidth is used, but to prove things one way or the other we decided to carry out some tests of our own, using the 10m amateur band, the exact frequency chosen being 29.300MHz.

Equipment Used

We were fortunate enough to get the loan of a couple of Azden PCS-2800 10m f.m. mobile transceivers from the UK importers, Waters and Stanton Electronics, to whom our thanks are due.

These rigs were fitted into cars belonging to *PW* editorial staff. The antennas used were 10m "G-Whips", which are similar in construction to many 27MHz CB antennas, comprising a 635mm helically-loaded base section, with a telescopic top section which was 1100mm long when tuned to resonance at the test frequency. Because of the temporary nature of the installation, we gutter-mounted the antennas, not an ideal arrangement from a directional coverage point of view, as this brought them towards the rear corner of the car roof, and the best v.s.w.r. obtainable was 1.3:1.

The PCS-2800 has a nominal r.f. output power of 10W, with a low-power position of 1W. We found that they actually produced 12-15W, depending on the supply voltage, with the low-power output over the nominal level by about the same proportion. Spurious outputs are specified as better than -60dB. On the receive side, a double superhet with i.f.s of 16.9MHz and 455kHz is used. Sensitivity is quoted as better than 0.28µV for 20dB quieting, with 6/60dB bandwidths of ±6 and 15kHz. The loudspeaker is downward-facing, and this rig would undoubtedly benefit (like most mobiles) from the use of an external loudspeaker.

The Tests

We were blessed with dry, overcast weather with occasional sunny periods on April 22 for the tests, which lasted from 1007 to 1436GMT. The temperature was 18°C and the pressure 1026mb. The 10m band was completely dead from a DX point of view that day, and no other amateur stations were heard.

Having discussed at some length the form that the tests should take, we felt it would be difficult to be very scientific in our approach, whilst gaining a useful amount of practical information within a reasonable space of time. The tests may therefore appear rather haphazard, but seemed to offer conditions nearest to a real-life situation.

One car, with G8VFH driving and G4LFM operating, left Poole in a westerly sweep through Wareham, Wool, Dorchester and Sherborne, thence east to Shaftesbury, returning cross-country to Bournemouth and Poole. Meanwhile, the second car, with G3GSR at the wheel and G8MCP on the microphone, operated first as pseudo-base station, on the first-floor, roof-top car park of our editorial offices which are virtually at sea level. It then moved off to a vantage point in Poole, about 50m above sea level and with a good take-off to the west, eventually leaving there for G3GSR's home QTH and a brief check using an HF5V trapped vertical antenna with radial kit in a true base-station situation.

Up to this point, it had been arranged that only one car moved at a time, the other remaining stationary as a reference point. Now, however, the two stations travelled cross-country to converge at a point some 24km north of Wimborne, before heading back to Bournemouth and Poole via differing routes, separated by distances of up to about 13km.

The Results

Across reasonably open country, good quality communication was obtained at ranges up to 16km, with noisy but perfectly readable signals out to 32km. When operating in more hilly country, these ranges were approximately halved. In gently rolling countryside, it made little or no difference whether the cars were on top of a rise or in a dip, but where the hills were steeper and taller, there were noticeable "shadows" where signals dropped out. Apparently, at these frequencies, the ground-wave will follow gradual undulations but not the more sudden ones.

The tests with the HF5V showed a slight increase in signal strength over that obtained from the car parked in the drive at a site 60m a.s.l. in a shallow valley. The HF5V is mounted about 8m above ground level and is peaked up at around 28.3 MHz. It is in a less than ideal position, and gives a v.s.w.r. of 1.9:1 at the frequency of the tests.

The tests carried out in built-up areas provided good-quality communication up to 6.5km, with readable copy out to 13km, providing the roads were fairly open. These ranges were approximately halved for operation in more closed-in areas, such as a shopping centre with two- and three-storey buildings, plus delivery vans, double-decker buses, etc., crowding around.

As was to be expected, it made virtually no difference whether the transmitters were set to low or high power, except when the signals were just on the point of dropping out at extreme range.

As mentioned earlier, no interference was experienced from other amateur stations, but there was mutual interference between our rigs and the 27MHz a.m. rigs of passing "good buddies", especially when one came and parked with his antenna about a metre away from ours!

The ranges which we obtained equalled or bettered those which we understand CBers to get on their illegal 27MHz a.m. rigs around this area. They consider 11km good and 24km fantastic DX in the same open country where our tests were carried out.

All in all, it would seem that users of 27MHz f.m. rigs should be able to get satisfactory range for the sort of purposes that CB is intended to serve.

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934 MHz FM ~ WHAT TO EXPECT

So far the sole published information on the potential range of equipment in the 930MHz region has been aimed at informing the CB public that it will be useless. Most of this opinion seems to be based on some sort of hysteria probably put about by those with vested interests in 27MHz a.m. gear.

The nearest amateur bands to the proposed CB band at 934MHz are 430MHz and 1296MHz and to arrive at some range results for 934MHz which have some claim to authority we have drawn on our own experiences at 430MHz and the results of some very comprehensive tests conducted by the RSGB in and around London at 1296MHz.

When taken into perspective and put alongside the results of our own tests at 29MHz and the claimed ranges obtained by CB operators in the Bournemouth and Poole areas 934MHz looks as if it could be the answer for city use.

1296MHz Tests

The RSGB tests were carried out using horizontal polarisation on both f.m. and s.s.b. under a wide variety of road conditions and both mobile to mobile and mobile to base station. Tests were performed in London, out in the northern London suburbs and in the country around North Buckinghamshire, Oxfordshire and Bedfordshire.

The equipment used comprised a transceiver and antenna system capable of giving 2.5W e.r.p. with the antenna mounted on the vehicle at a height above ground of 2m. The vehicles were driven around the various areas chosen and the quality of the received signals noted. Both f.m. and s.s.b. were used but it is interesting to note that although s.s.b. appeared to give marginally greater range its readability was very doubtful mainly as a result of multipath distortion in built-up areas making it of little or no use for CB purposes.

In London the useful f.m. range varied from as little as 1km up to as much as 4km depending on the terrain and intervening buildings. The best results were obtained when both cars were travelling along the same main road while the worst results came when one car turned off the main

route and proceeded down a side street. It should be noted that the tests used horizontal polarisation with an e.r.p. of 2.5W. The proposed specification for 934MHz f.m. CB service allows 25W e.r.p. and this will most probably be vertically polarised which should improve the range capabilities in heavily built-up areas.

In open countryside the range obtained varied from 1km to 8km on undulating and wooded roads.

For base station to mobile use the fixed station had an e.r.p. of 10W—still well below the maximum to be allowed. Ranges of up to 12km were obtained in the most favourable direction while in the least favourable direction the range fell to 1km.

430MHz

This is a popular band with amateurs especially for mobile f.m. use and the UK has a very useful repeater network to enhance mobile use of this band.

Vertical polarisation together with e.r.p.s of around 30W is common and ranges of around 5km are normal in heavily built-up areas and 15km in open country. Base station to mobile ranges are usually of the order of 25km.

934MHz Predictions

Using the test results obtained with the lower power 1296MHz gear together with the results obtained regularly on 430MHz the ranges to be expected on 934MHz f.m. CB should be around 5km in cities mobile to mobile and 10km in open country with a useful range of possibly 20km base station to mobile.

These ranges would make 934MHz a very useful band for in-town use, offering a useful range with a large number of available channels, especially when compared with the congested 27MHz band with usable ranges not that much different if current users are to be believed.

We are grateful to the Radio Society of Great Britain for permission to publish details of their tests.

LET'S BE RATIONAL ABOUT CB

Angus MACKENZIE G3OSS

This article was written shortly before publication of the draft specifications for CB in the UK. Some of the queries raised have now been answered, but all of the comments made remain valid.

Now that the Government has at last announced its intention of allocating narrow-band frequency modulation on both 27 and 930MHz bands, it seems an opportune moment for a rational look at why they have ignored pleas for a.m. or s.s.b. on 27MHz, and why many other frequency bands have been discounted.

It has been said that the Government, including the Socialists and Conservatives, has taken an inordinately long time in coming out with the recent statement. It has certainly not been ignoring the matter, but has been watching developments in the USA, and more important, in European

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countries such as Italy. In this article I shall be giving the pros and cons that would almost certainly have been discussed at Home Office committees dealing with the problem.

Interference to Other Users

There is relatively little difference between the amount of interference caused by a.m. or s.s.b. transmitters at a particular frequency. However, an a.m. signal picked up by a hi-fi system is usually intelligible, whereas s.s.b. is not, thus earning the nickname "Donald Duck". Both are equally annoying, but with a.m. you are more likely to be able to trace the cause and do something about it if it is illegal.

What actually happens is that the r.f. energy is picked up within the electronic equipment, and rectified by any non-linearity such as a semiconductor base/emitter junction. The actual carrier strength can dramatically change the d.c. conditions of the electronic circuit, whether it is a burglar alarm, a digital clock, a hi-fi system or the random access memory circuits of a computer. If the carrier is then amplitude modulated, this can cause a further disturbance, and in the case of audio circuits the modulation becomes audible to a greater or lesser extent, causing annoyance. I have encountered some amplifiers so badly affected by r.f.i. as to give their full output to the loudspeakers until they could be turned off. In some cases, I have no doubt that high power output stages would have blown up under the strain, apart from the fact that loudspeakers might also have been damaged.

I published lengthy details of radio frequency interference tests on about sixty hi-fi receivers in *Hi-Fi Choice* issued in 1976, the worst offender being a Pioneer receiver which nearly blew up my Spondor BC3s! This happened when I was transmitting with only around 10W s.s.b. on 1.9MHz into a half-wave antenna, the end of which was some 9m away from the equipment. It is difficult to understand how some CBers have got away with using up to 100W of output power illegally for more than a day or two, unless they were mobile. Even if one ignores the interference problem of potentially hundreds of thousands of fixed stations using 27MHz a.m., the thought of an even greater number of mobiles using high power is horrifying.

It is possible to modify hi-fi equipment, etc., to reject transmissions received from a neighbour, and the Post Office have been very helpful in assisting my neighbours to reject my transmissions from 1.8 to 1296MHz from their equipment. There are probably only a few thousand transmitting stations, though, running high power on the amateur bands in the UK, and the Post Office can only just cope with the interference problems. Also, there are probably only a few hundred mobiles transmitting more than 10W on the amateur radio bands in the short wave region below 30MHz. Thus the chances of receiving interference from short wave mobile licensed radio amateurs is minimal, but there would certainly be a problem if the Home Office allocated a high effective power on 27MHz, and the interference problems would be impossible to deal with.

It is easy to suggest that hi-fi equipment, etc., has been badly designed in the first place, but the fact is that there are perhaps ten million pieces of hi-fi equipment with poor electromagnetic compatibility in use in the UK. Many manufacturers have had to go to considerable expense to cure

problem equipment, and are now tending to pay more attention to electromagnetic compatibility, but there still remain the odd TV manufacturers who omit interference suppression components for the UK market, whereas these are included in sets for most European countries.

When Timothy Raison, MP, told a Radio Industries Club lunch last year that 27MHz would not be allocated, and when the Open Channel Green Paper inferred that the Government favoured the much higher frequency of 930MHz, there were sighs of relief from a large part of British industry and commerce. The problem of interference was largely in the Government's mind when absolutely rejecting 27MHz a.m. and s.s.b. The use of f.m. on this band will certainly produce much less interference, but there will undoubtedly still be a problem, for the transmitter r.f. carriers will themselves cause blocking effects, etc., in electronic circuits. To minimise this, there will probably be a severe restriction on power to, at the most, 5W mobile and perhaps even less for a fixed station.

Other bands have been rejected because they are either much too close to domestic radio or TV services, or their harmonics occur within the bands allocated for domestic or commercial and p.m.r. (private mobile radio) services. Although I have tested many low-power transmitters, I have rarely found harmonic output greater than -60dB, but this is certainly not the case with higher-power rigs or linears. One high-power linear checked recently gave a 2nd harmonic distortion of -20dB, whilst another piece of equipment produced a harmonic within the video colour subcarrier of London ITV which, whilst measuring -58dB, was enough to wipe out reception in a house 45 metres away, where ITV was a weak signal. The Home Office will thus probably insist on strict type approval.

The 41MHz band has also been suggested, but this has already been allocated for other purposes by the recent World Administrative Radio Conference. There seems to be no other possible hole for CB until we reach the frequency of 230MHz, but this is uncomfortably close to Band III, and there are plans for this band to be used for additional domestic services, when it is freed from 405-line TV.

A band at 460MHz has been suggested, but this is another frequency region that is becoming well used by p.m.r. and public utility services, and there is simply not enough room for CB. In any case, it is again rather close to the bottom of Band IV for comfort.

Interference to CB

There are some interesting facts concerning interference in the other direction. During the day, 27MHz is virtually useless for other than very local contacts, since American and Italian interference is so loud as to blot out CB stations only 5-6km away, because of the excessive powers used abroad and the properties of 27MHz ionospheric skip. At the present time, it is only after dark that it is possible to have longer distance contacts on illegal CB in the UK. It has been reported to me recently, and especially since the Government's announcement, that many stations have already changed to f.m., and have commented that this mode is much better for readability, giving less interference and a more pleasant sound quality.

It must be said, though, that day-time interference will reduce within two years as the 11-year sunspot cycle

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progresses to its minimum. Conditions on 930MHz, on the other hand, will be relatively stable, although occasional long-distance contacts of up to 150km or so will be possible in tropospheric ducts which occur with atmospheric temperature inversions. This ducting quite often occurs when the barometer begins to fall back from a pressure greater than 1030mb, during times of considerable temperature differences from day to night time. The occurrence is unpredictable, and can be caused by various other atmospheric conditions. Use of 930MHz is unlikely to produce serious interference problems, although there may be occasional annoying exceptions.

Social and Economic Considerations

The lower the frequency chosen for CB, the longer the antenna will need to be. A whip 2.75 metres tall ($\frac{1}{4}$ wave) is rather unwieldy on a vehicle, and vertical colinears, which have gain over a dipole, might be considered unattractive on a house. I had to have planning permission for my mammoth roof-top antenna installation, but how would the planning departments cope if every house wanted a colinear vertical 5.5m tall at the top of a scaffold pole on the roof? Surely a tiny 930MHz beam with a 10dB gain on top of a very small rotator would be far less unsightly. A colinear vertical on the car, perhaps less than 460mm tall, but with considerable gain, is going to be quite acceptable. With 930MHz f.m. and possibly 27MHz f.m. low power, there is going to be far less aggro with neighbours, and so possibly the Government's scheme is more socially fair and viable.

The cost of illegal a.m. rigs has up to now been unrealistic, for in the main they are rigs which have been over-produced for the US market and off-loaded at US export prices of not more than £25 or so, and possibly far less. I am told by many friends from the US that the use of CB is declining fast there, and sales of rigs have virtually collapsed, so that wholesalers have been forced to dump sets in Europe. But these sets will not be available at the cheap prices for very long, and I have heard of £180 paid for sets selling in the States for under £50.

In Holland, 22-channel f.m. sets with only $\frac{1}{2}$ W output are selling at between £40 and £100. The potential of the Dutch market, though, is far smaller than ours, and many of their sets are dreadful in performance. In recent tests, I only found four that were reasonable. It seems to me that many must be regarded as a rip-off on the Dutch market, and I do not think that we should stand for such quality when sets come out in the UK to our Government's specifications. It should be possible to get a 27MHz f.m. set, perhaps within a year, with 22 channels and with 5W output (if this is allowed), to better specifications than those produced in Europe, selling at under £100.

But what about 930MHz? Many false estimates of great expense have been made for transceivers for this band, but they should not cost more than £200, although inflation must be taken into account. The most useful way, if it will be allowed, to get onto 930MHz will be by using a transverter from 27MHz to 930MHz, and perhaps some enterprising British manufacturer, such as Microwave Modules, will enter this market. The only basic difference between a transmitter section for v.h.f. and one on 930MHz is the requirement for one or two more transistors to raise the frequency to the higher one, and a slightly more expensive output transistor.

Output transistors for higher and higher powers at ever increasing frequencies are costing less and less as the years go by, and 5W output at 930MHz should not, in the end, cost significantly more than the same power output at 433MHz. As far as the receiver is concerned, a slightly better front-end transistor would be required, together with an extra transistor in the local oscillator circuit, and so the receiver part should not cost more than an additional £5 or so on the factory price. I understand that a 2W microwave walkie/talkie was recently shown in Japan at only £75, and so we may get a few surprises within a year or so.

Medical Problems

There has been considerable discussion about the danger of radiation from mobile antennas into the human body. I feel that much of the scare has been overstated, but there does remain the possibility that the use of such a short wavelength as 32cm combined with high power could cause problems such as cataracts. The truth of the matter is that not enough is known about the harmful effects of exposure at these particular frequencies, but sensible use of equipment and antennas should sufficiently minimise the likelihood of any problem.

If you wish to use the maximum allocated power on 930MHz, then to be safe, it would be wise to place the antenna in the centre of the roof or cab, rather than at the edge, to avoid anyone getting too close during transmission. Lower powered rigs into small whips on the wings, however, will probably be completely safe. I am slightly concerned, though, about the use of more than 2W output from walkie-talkies, for there is always the chance that someone might transmit with the instrument very close to the mouth, and thus the antenna close to the eyes. It may be advisable for 930MHz walkie-talkies to be fitted with external microphones to discourage this.

Transmission Ranges

Ranges on 27MHz are already well established, and well known, so need not be covered here, but do remember that during the day, under skip conditions, the ranges are greatly reduced because of foreign interference. The 41MHz band might have been slightly better than 27MHz, for it would have almost completely eliminated skip break through, whilst antennas would have been shorter, and the local range virtually identical. On 230MHz the propagation, power for power, would probably have been slightly inferior to that of the existing 144-146MHz radio amateur band, and terrain difficulties would be more marked. At 460MHz, mobile-to-mobile is fairly limited, but fixed-to-mobile distances are quite useful with 10W into a simple whip giving good contacts of between 10 and 20km average radius, assuming good installations and a fixed station antenna height of around 12m.

At 930MHz many new factors come into play, which are fascinating. I first tried fixed-to-mobile on 1296MHz when G8ADM had affixed to his Jaguar a small "V"-shaped dipole antenna, feeding it with about 4W of f.m. I managed to track him at not less than 5/9 over a very large area of North London, and noticed strong signals even when he was going down underpasses. He was also strong when completely obscured, for at this frequency there are so many long reflec-

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tion paths that one or other always seemed to reach me. This was some years ago, when my system was rather crude, with no pre-amplifier at all, but I was very surprised at the good signals throughout the tests.

More recently, Radio Society of Great Britain members, including myself, have carried out prolonged trials, again on 1296MHz, of f.m. from mobile to mobile and mobile to fixed station. The mobile stations used only 1W power output into a vertical antenna, including a slot feed, which thus made it horizontal polarisation, the antenna having some effective gain. The absolute minimum mobile-to-mobile distance at this very low power level was about 1km, there being a large steel-framed building and a high railway embankment in the way, whilst average distances varied from a normal minimum of 2km to a maximum of 15km, or so, 5km being generally quite reasonable. I was able to work the mobiles from my fixed station at up to 30km, and I also tracked one of the low-power mobiles all the way from the City of London through Euston and Paddington and via West London up to Amersham, only very rarely losing the signal for a few hundred metres. My antenna system was faulty at the time, and it was quite obvious that if the mobile had been running the full 25W e.r.p. suggested by the Green Paper, the signals would have been firm throughout.

It thus seems reasonable to suggest that a good transceiver on 930MHz in a well-installed system should be able to work any mobile over ranges between 5 and 10km, with mobile-to-fixed contacts of up to 20km being envisaged if the fixed station is using a beam with a pre-amp, or possibly even a transverter actually installed at the antenna end. I can see r.f.-sensed pre-amps for installation at the antenna being commonplace, and perhaps transverters giving 2.5W into an antenna with a gain of 10dB being provided for mast-head use, the base-station rig itself being on 27MHz. If beams are used, the antenna gain must be taken into account, if the Government specifies the maximum effective radiated power. On average a 10W transmitter would be necessary at the bottom of a very long cable if 25W e.r.p. is required from a beam antenna.

Conclusions

I for one hope that CB will give very much pleasure to hundreds of thousands of UK citizens. I sincerely hope that the illegal operators will abandon a.m. and s.s.b. on 27MHz for the sake of being both legal and unselfish. I would like to see a means found for retailers to take in old rigs and modify them for f.m. to Government specifications for a minimum cost. I also hope that 930MHz rigs will become available as soon as possible, and I would very much like to see the rather silly slang associated with American CB discouraged on 930MHz.

We may find those who just want fun out of a hobby remaining on 27MHz, together with "10/4", "Hey buddy" and "What is your rough twenny?" and 930MHz used by those who want to contact relatives out shopping, or business colleagues, using the band in a more serious way.

CB will of course be of tremendous benefit in emergency situations. However, when conditions in the ionosphere favour skip propagation, as at present, ranges with the low power likely to be permitted on 27MHz by the Home Office will be limited during daylight hours. Unless there happen to

be other people listening on the right channel within a few kilometres, this band may not be so effective in an emergency situation in a rural area.

Things may not be that much better on 930MHz in the middle of a somewhat desolate Welsh or Scottish valley. The chances are, though, that by the time there are perhaps over a million users, at least one mobile or fixed station may hear a call for help. I feel sure that once an emergency channel has been allocated, there will be CBers normally monitoring it, particularly in bad weather conditions. What would be a great help, though, would be for the Home Office to allow rural district councils to provide emergency repeaters, which should not cost more than about £100 a year to run, and which could be immediately justified by the saving of a life.

I can see walkie-talkies being an essential part of climbers' or hikers' kit, for how often have we heard of people lost for days in the wilds. A simple call through a repeater could save a lot of people a lot of time. Licensed radio amateurs have already proved the success of efficient repeaters, and have installed these on v.h.f. and u.h.f. all over the UK. For the repeaters to be useful, though, there will have to be self-discipline amongst CB users, for if one of the repeaters is jammed by an interfering input signal, someone who desperately needs help may not be able to get it.

Whilst fully appreciating that the prime purpose of CB is to have fun, there are so many obvious benefits that will only come to be fully appreciated many months after the bands are opened up. It is easy for the Home Office to say that those who wish to communicate reliably should have p.m.r. systems (and pay handsomely for them), but what about the motorist who gets stuck in a blizzard, and ends up unable to move on the road with drifts 2m deep? Whilst CB may be fun in urban areas, it will eventually become a necessity in rural ones, and I can envisage police stations all over the country equipped with monitoring units and always at the ready to deal with an emergency, let alone monitoring by keen CBers.

We all have the right to CB, and to be able to use it for whatever purpose we want, in the knowledge that we are not likely to be selfishly disturbing those who want to enjoy their own hobbies of hi-fi or TV. I sincerely trust that a small minority will not wreck a marvellous new service for the majority, and that those who are now transmitting illegally will see the point of view of the Home Office which has tried to steer a difficult route through a prickly forest, which is probably why the announcement has taken such a long time. How much better it is for the majority of the public that the Home Office was not forced into allocating 27MHz a.m., and yet still recognised the need for CB. ●

Watch future issues of *Practical Wireless* for CB rig reviews, installation hints, and how to lick interference problems