The World Above 50 MHz

Conducted By Bill Tynan, W3XO
Send reports to PO Box 117, Burtonsville, MD 20866,
or call 301-384-6736 to record late-breaking information.

Why Not a 6-Meter DX Window?

The January column presented the case for a 6-meter DX window in which a portion of the band, such as 50.1 to 50.125, would be set aside for working, or trying to work, DX only. As promised, the points most frequently voiced against the idea, along with a few observations concerning them, will be covered this month.

One argument that this conductor has yet to encounter is the one that might be expected to be offered most frequently. It can be paraphrased as: "Taking away 30 kHz of the prime portion of the band for DX-only operation to benefit the few who want to work DX is depriving the average 6-meter operator of too much space." The fact that this contention does not come up indicates that few believe it to have merit. Besides, with the amount of spectrum we have available on 6 meters, such a claim would be hard to justify. What then are those not favorably disposed to establishing a DX window saying against it? Their comments seem to fall into two general categories. First, they insist that "It won't work because not everyone will abide by it." The second can be summarized as; "Why not solve the problem some other way."

Those espousing the first objection contend that "since few will comply, there is no point in even bringing the matter up." They advise sticking with the status quo and "if DX contacts are lost, that's the way the cookie crumbles." This conductor happens to believe that we can bring about improvements as to how we use our bands by voluntary agreements. It is true that such methods seldom result in 100 percent observance. However, with the right degree of peer pressure, we should be able to significantly improve the present situation. It seems to me that opposing something simply because it won't work perfectly displays a defeatist attitude.

The second group suggests all sorts of measures in place of the one being offered. One of the most often heard of these alternate approaches is: "Move DX operation to some other part of the band not currently heavily used, such as 50.2." The rationale for this point of view seems to be based on the premise that foreign 6-meter operators are fewer in number than are those in the US and Canada, so it should be easier to change the operating habits of the rest of the world than it would be ours. Those fostering this approach fail to specify how they would implement a worldwide education campaign to convince people in many far-flung countries that 6-meter DXing would henceforth take place somewhere other than around 50.110, where it has been for the past 20 years. One wonders also, if we US and Canadian amateurs can't be convinced to change our ways, how can we expect the rest of the world's 6-meter operators to so materially alter theirs? In addition, the premise is undoubtedly wrong. It is quite likely that Japan alone has more 6-meter operators than we do.

A corollary suggestion to "Move DX operation" is "Use CW." Apparently, the rationale for this is that CW operation takes place below 50.1 and that this part of the band is free of QRM. The fact is that, although US regulations prohibit voice operation below 50.1, there are probably more CW contacts made above 50.1 than below it. Most people who take 6-meter DXing seriously are already aware of CW's superiority when the going is tough, and use it extensively. I haven't counted them, but I am sure that at least half of the countries I have worked on 50 MHz were via CW. Very few of them were below 50.1, however. Despite its advantage under conditions involving weak signals and heavy QRM, even CW does not fare well in the presence of 40 dB over S9 sideband splatter. In the light of these considerations, one is hard pressed to see how "using CW" will solve the problem at hand. There is also the problem that many foreign operators, such as UK Class B licensees, either don't know the code or are not equipped for CW operation on 6 meters.

A related comment is "Why not use split frequency?" Here again, the problem is one of communicating to the rest of the world what we expect them to do. In addition, many 6-meter DX stations have old equipment, much of which does not have split-frequency capability. Even if it were decided that this is a practical idea, what frequency would the DX call on, and would many of us monitor it? No matter where above 50.1 we answer, probably without listening first, we would run the distinct risk of clobbering someone's QSO. This is one of the problems with split-frequency operation. I firmly believe that the HF bands are better places to be now than they were in the days of AM when essentially all phone DX operation employed split frequency.

A frequently heard claim is that if we move most of our routine operations to 50.130 and above, all of the action would be there and the DX stations, not being able to attract attention at 50.110, would have to go where we are to work us. This would put them back in the middle of the QRM. This is probably the best argument against the DX window concept that I have encountered so far. However, I do not believe it valid because even if no one is listening between 50.1 and 50.125 and thus does not hear a DX station call, the DX station ought to be able to get someone's attention by calling in the midst of the activity. Once the word is out that DX is coming in, all of those interested in pursuing it will be able to QSY into the DX window. Those wishing to continue domestic contacts can do so without being bothered by QRM from DXers. A related argument is that two calling frequencies will be established with the institution of a DX window: 50.110 for DX and some other, such as 50.130 or 50.2 for domestic use. Many are quite vehement in saying that they want one frequency to monitor. I acknowledge that more than one calling frequency might lead to some confusion and possibly even result in a few openings being missed. However, I contend that the advantage of providing a relatively QRM-free part of the band in which to pursue DX outweighs this disadvantage. Besides, many of us now have radios that can scan programmable segments of the band or sequentially monitor preselected frequencies stored in memory. Thus, I feel that more than one calling frequency does not represent as great a burden as it might have a few years ago.

These are the arguments that I have heard raised against the concept of a 6-meter DX window. There may be others. If so, I would be very interested in hearing them. As usual, this column will attempt to air all sides. So please drop me a note expressing your opinion one way or the other. The time is getting short. If the active 6-meter operators can reach a consensus favoring a DX window, it would be worthwhile to be able to begin it in time for next summer's E_s season, not to mention the onset of F2, which will probably produce some DX openings beginning about October.

ON THE BANDS

6 Meters—Most of us must be content to read about how much DX is being worked on 50 MHz in other parts of the world. Not so NE8Z, who most will more readily recognize as HC1MD and HC8VHF. Rick found an SB-110 at a hamfest for $75 and picked it up. Getting the most out of his new purchase was the next order of business. A late October trip with the rig and a "Galapagos Quad" to the

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A 6-Meter DX Window

Regular readers of this column are aware that the subject of ways we can use our 6-meter band to better advantage has been discussed several times over the years. One approach has been to urge those who aim primarily, to make domestic, US and Canadian contacts to concentrate their operations around 50.2. In fact, 50.2 is designated as the "domestic SSB calling frequency" in the ARRL 6-Meter Band Plan. While recent years have produced some improvement in how stations spread out, particularly during widespread openings, few consistently operate around 50.2. Most activity can still be found in the vicinity of 50.110. In the meantime, an increasing amount of criticism has been erupting, particularly surrounding the League's June VHF QSO Party. The complaint is that stations not trying to work DX make it a general practice to operate in the low end of the band, preventing those who do wish to work DX from doing so.

Various suggestions have been offered to alleviate this problem. The May 1987 column dealt with this situation particularly as it applies to the June Contest. In it, the argument was made that it would be utterly impractical to mandate that contest operation take place higher in the band as contesters will be where most of the activity is. Despite the suggestion presented in that column that we move our routine domestic operations to the vicinity of 50.200 and thus bring the contesters up with us, no perceptible shift in operating habits was apparent during the 1987 running of the June Contest. While a few, including this conductor, were fortunate to work some quite rare DX, including CT4KQ, a number of other interesting contacts were missed because of contest QRM. Most notable of these was GJ4ICD, who heard New Mexico station N5JHV and several other 4s and 5s for over two hours, but could not attract anyone's attention through the contest QRM.

Treatment of the subject in the May column, plus a number of incidents which took place during last June's contest, led to rather spirited discussions at two VHF conferences held since that time. One of these was the Central States VHF Society's meeting held in Arlington, Texas in late July and the other was the Mid-Atlantic Conference sponsored by the Pack Rats which took place in the Philadelphia area in October. One concept which predominated these discussions was the setting aside of a specific portion of the 6-meter band for use only in working, or attempting to work, DX stations. In other words, a "DX window."

First, let's define what a DX window would be and how it might be used. Then, some of the arguments for it will be presented. Next month, space will be devoted to some of the arguments raised against the idea as well as various alternatives suggested.

The concept for a DX window on 6 meters originated several years ago with a group of South Florida 6-meter DX enthusiasts including WB4OSN and W5DZF/4, the latter since deceased. The concept they offered was to set aside 25 kHz from 50.1 to 50.125 exclusively for working, or attempting to work, DX stations. Following the custom established on HF, DX would be defined more in terms of rarity rather than the distance involved. Thus, US stations located in the 48 contiguous states and Canadians in the VE1 through VE7 call areas would be considered "domestic." All others, including VE8, VY1, VO1 and VO2, although they do not count as separate countries from Canada, might be treated as DX. Of course, KL7, KH6 and 4U1 (the UN Building in New York City), as well as all others, would qualify as DX. Institution of the DX window would mean that we would never operate within its limits, unless calling or working a DX station, or calling CQ DX. To prevent us from forgetting to move out when the band opens, the DX window, if we decide to have one, should apply at all times, even when a band opening is a remote possibility.

The argument for a DX window seems clear. It would provide a section of the band in which the probability of hearing the usually weak signals from DX stations is improved due to the absence of strong signals from stations often engaging in rather long-winded QSOs. On the other hand, most contacts with DX stations are usually quite short, sometimes lasting considerably less than one minute. It seems apparent that those who would benefit most from a DX window are those who run low to moderate power and have modest antenna installations. The "big" stations can usually make enough noise to be heard by the DX as well as chase ragchewers away. Also benefiting would be those who, due to geographical location, have less opportunity to work a particular part of the world than more favorably located stations.

How would DX-only operation in the DX window be enforced? This is the most-asked question and the one which seems to raise the most controversy. The only answer that I can offer is peer pressure. If enough of us agree that a DX window should be created and begin using it only in pursuing DX, those not adhering to it will simply have fewer people to talk to. Certainly compliance will not be 100 percent. It seldom is. But, even if it's only 75 or 80 percent, significantly less QRM will be present than exists now.

How would the DX window work during contests, when it appears anything goes? Once we have a generally accepted operating custom in place, it seems reasonable that those establishing rules governing contests might be persuaded to institute a rule to the effect that "all contest operation must abide by established customary practices on the various bands." This precedent has already been established to some extent by the prohibition, in the ARRL-sponsored VHF contests, of the use of 146.52, the single most popular simplex FM calling and working frequency. Heavy contest operation on that channel was widely accused of disrupting noncontest QSOs and, in few instances, even hampering emergency communications. The hue and cry heard regarding 146.52 was similar to that being voiced today with respect to contest operation blocking DX work by those not wishing to participate in the contest. It seems reasonable that any rule, such as the one outlined above, prohibiting contest participants from operating in a DX window should permit them to operate there, if pursuing DX at the time. However, they should not be allowed to use that as an excuse to work a string of non-DX stations in the process.

A DX window from 50.100 to 50.125 would imply that most calling for domestic contacts would begin at 50.130. It would not appear that the loss of 30 kHz represents a serious loss for those not particularly interested in DX. After all, the 6-meter band is 4 MHz wide, and narrowband modes such as SSB, CW and AM are generally considered to occupy the first 500 kHz of it.

Next month, I'll present some of the arguments raised against the DX window, as well as some of the alternative suggestions that have been offered. In the meantime, please think about the matter and drop me a note expressing your opinions.

If we can reach a consensus on the desirability of establishing a DX window, we should be able to have it in place in time for next summer's E season and the F2 contacts that are quite likely next fall.

ON THE BANDS

6 Meters—Although most of us are not yet participating, 6 meters is already beginning to show signs that Solar Cycle 22 is well on its way. Last month's column carried reports of a number of stations from Florida to New Mexico working into Peru, Ecuador and the Galapagos Islands as well as contacts between Japan and Australia. Now, the other side of the world chimes in with DX tales of its own. From several sources, including overseas telephone calls from some of the participants, as well as the South African publication *VHF*

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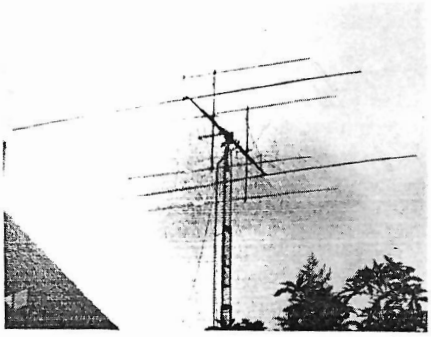
Another 6-meter Propagation Mode

Although the promise of F2 DX is definitely in the air, there are those who are not willing to wait for it. A rising group are equipping themselves to span great distances on 50 MHz at any time without depending on the ionosphere at all. They are using the technique that proved so viable on 2 meters and 70 cm and is increasingly finding converts on the higher bands as well. As I'm sure everyone has guessed, I am talking about moonbounce, or EME as it is popularly known.

The first 6-meter EME contact dates back to 1972 and the work of two groups, one working in the Tulsa, OK area and the other near Houston, TX. The group in Tulsa was comprised of W5WAX, now K5SW, and K5WVX, now K5CM. On the Houston end were WA5HNK and W5SXD. Both used what seemed then to be gigantic fixed arrays of eight 6-element Yagis and their sheds were run when the moon was within an hour or so of rising or setting, thus taking advantage of horizon gain. That work sparked some further interest, but not the swelling of EME activity that has taken place on 2 meters and 70 cm. Nevertheless, a few 6-meter moonbounce contacts were made over the years, with WB6NMT, W7FN and K6MYC being some of those most consistently involved.

The reasons for the failure of 6 meters to catch on as a moonbounce band are several. Most obvious is the size of the arrays needed. Also, exploitation of the mode on this band has always been assumed just "too hard." Contributing to this difficulty is the fact that cosmic noise is considerably higher at 50 MHz than at the higher frequencies. In addition, ionospheric propagation modes have been serving 6-meter aficionados quite well, so there is less impetus for most to go to the considerable effort required for successful EME. But thank goodness, ham spirit does not give up just because something is "too hard." There are a few in our ranks, and that number has been growing over the past year or so, who have accepted the challenge of 6-meter moonbounce with the same determination that drove the early climbers of Mount Everest—"because it is there!"

One of those who has been preparing for 6-meter EME for several years, and waiting for others to join him, is WA4NJP in Georgia. Ray has assembled an array of four 8-element Yagis and runs the legal limit. Most of the rest of the current crop of 6-meter moonbounce experimenters are Californians. Presently actively trying, with varying degrees of success, are K6MYC, K6HCP, W6JKV and K6QXY. Using only a single 11-element M Squared Yagi, albeit 50 feet long, K6MYC has been able to hear his own echoes on several occasions. To accomplish this, Mike, like the pioneers who demonstrated 6-meter moonbounce 16 years ago, takes advantage of horizon gain by working near moonset. K6QXY's attempts have been with four 10-element Yagis on 30-foot booms but a problem with phasing has blocked success so far. However, Bob is in the process of improving his system, replacing the present Yagis with the longer M Squared variety and correcting the phasing difficulty.



The 6- and 2-meter-EME-capable arrays at W6JKV. For 6 meters Jim uses two 11-element 50-foot-long M Squared Yagis mounted side by side. On 2 meters it's a quad array of 4 M Squared Yagis (33-foot boom). *(photo by W3XO)*

Meanwhile, W6JKV has caught the 6-meter EME bug in a big way. Interest in this phase of 6-meter DXing is not exactly new with Jim. Most will recall that he has made attempts at moonbounce during some of his DXpeditions. But this is his first try from his own QTH. For the effort, he has put up an array of two M Squared Yagis mounted side by side (see accompanying photo). A nonmetallic horizontal member prevents the undesirable disruption of the pattern one would normally expect from such an arrangement. In any case, the system works. Using only 600 W output he has already succeeded in working WA4NJP. This conductor had the pleasure of being present on Jim's first EME QSO. As is usually the case with moonbounce, signals were not what could be termed "loud," but they were audible all over the shack and were distinct enough to be recorded on the audio track of a videotape I made of the contact. Since that time, Jim has worked Ray on several more occasions. It's interesting to note that their contacts have come with both of their antenna arrays elevated above the horizon—so ground gain is not a necessity for successful 6-meter moonbounce.

Despite the fact that K6MYC has helped Jim with much of his installation, he wasn't about to let him get too far ahead. Mike managed to use a recent Hawaii vacation to extend the terrestrial distance covered via 6-meter moonbounce. Using a pair of 50-foot M Squared Yagis at his QTH on the Kona Coast of the Big Island, K6MYC has exchanged reports with WA4NJP. Again arrays at both ends of the path were aimed considerably above the horizon, so it's becoming clear that horizon gain is not a necessity.

The work done to date by these few pioneers has been just enough to demonstrate to the rest of us that 6-meter EME is doable. Hopefully, it will serve to pique the interest of many more who seek a new challenge. W6JKV is particularly intrigued by the prospect of being able to work distant stations on 6 meters without waiting for F2 or E_s propagation to favor the intended path. To further this desire, Jim promises something new and bigger in the way of an array. Keep tuned.

Are there other potential 6-meter EMErs out there? I would be especially interested in hearing any reports of activity or serious intention so that information can be passed along to the current active practitioners.

ON THE BANDS

6 Meters—Sporadic-E is the big story this month. Although we are accustomed to a spurt of E_s around the winter solstice, this year's mini-season seemed to be better than most. It even featured a number of excellent 2-meter openings. But more on that in the section to follow.

Propagation on 6 meters was outstanding, particularly during the week preceding Christmas. This conductor was alerted to the conditions at 2345Z Dec 18 by a phone call from W5NZS Oklahoma City who informed me that Central America stations, including YS1ECB and TI2HL, were in at his location. Usually tips like this from more southerly located stations do not lead to anything in this part of the country, but this time was different. A little listening revealed a Florida station on CW and a weak SSB signal with a familiar voice. This turned out to be XE1GE, who was finally worked at 0100Z Dec 19. It was nice to be able to say hello to Goeff again after several years. Many will recall that he was very active during the last solar peak. The next morning, W5FF near Albuquerque telephoned to report that he had experienced a great opening to Central America and the Caribbean that evening, including KP4s, a KP2 and a contact with HH7PV.

The band was open for the next few evenings before Christmas, seemingly better

50MHz—A GREAT RESOURCE

Ray Cracknell, G2AHU, co-ordinator, The 50MHz Reporting Club

The impression that 50MHz was a band that was usable for perhaps a few days at the peak of each solar cycle was widely held until very recently, but this idea has now been proved to be entirely false. The realisation of this has spread rapidly with a large upsurge of interest worldwide. It seems it is no mere coincidence that this upsurge coincides with the progressive release of the 50–52MHz band to British amateurs during the period since February 1983, at first to a chosen few outside tv hours, for what we refer to as the "trial period", then in February 1986 to all Class A licence holders and, since June 1987 to all licensed British amateurs.

Considerable credit must be given to RSGB for the way in which the successful return of the band was negotiated, from the first establishment of the beacon GB3SIX in Anglesea in order to investigate transatlantic propagation at 50MHz, through the acceptance of propagation experiments as justification of the early permits, to partial general release and, finally, to the present situation where the band is poised for exploitation by channelised fm and packet radio in addition to ssb and cw, which are the modes used on the band at present.

During the "trial period" from February 1983 to February 1986, permit holders were obliged to submit reports to RSGB and these were analysed and published [1]. After the first general release this obligation fell away, and in its place the 50MHz Reporting Club was established by the RSGB VHF Committee. There are 36 British and 14 overseas members of the club and they send in reports every six months to a co-ordinator whose job it is to analyse them and to produce a consolidated report which is circulated to members by RSGB HQ. Although membership was initially restricted to 50, room will now be made for several newcomers to join should they wish to do so, and information on the progress of the new modes will be most welcome.

On the first day of the partial general release on 1 February 1986, just over 200 stations were logged on 50MHz, and the number rose steadily so that, before the end of the year, over 600 were worked by club members, and 77 stations elsewhere in Europe were worked either two-way or crossband. Also on the band were the beacons, GB2SIX, GB3NHQ, and GB3RMK, as well as ZB2VHF, 5B4CY, OX3VHF and FY7THF which were monitored regularly, while LA3EQ and W2CAP were heard occasionally, and expeditions to the Azores, Iceland and Greenland provided interesting QSOs during the summer of 1986.

1987 is a year of special interest in that solar activity is near minimum. In 1986 50MHz opened to North America on the 9, 12, 17, 19 and 21 July, but there was an earlier opening in 1987 with W4s being worked from the Midlands and W1s from southern England on 7 June. The FY7THF beacon was heard in 1986 on 30, 31 May; 2, 4, 5, 6, 7 June and 4, 9 July, and this year it was first heard on 28 May, while exotic calls such as OH1ZAA/OF0, N4HSM/V2A and W6JKV/V2A as well as ZC4VHF 5B4 on the top of Mt Troodos are providing great interest. Openings to Europe also commenced earlier this year, with Spain and Portugal appearing 14 days earlier in what appears to be a wonderful sporadic-E season with a large increase in European stations and a high level of activity from Britain, including a considerable number with Class B callsigns. The OX3VHF beacon was also heard on 28 May 1987. JA1VOK reports the "best Es season he has ever heard" and SV1DH reports early sporadic-E openings to Spain and Portugal on both 50 and 144MHz. Reports from these two stations also showed that transequatorial propagation from Japan to Australia and New Zealand and Greece to Zimbabwe and Zambia had held up well at 50MHz through the solar minimum.

The summer sporadic-E season in 1986 opened on 50MHz on 28 April and lasted until 2 December. European stations were worked from Britain on at least 59 days during that period and the band was frequently open from before 0600 until after midnight. Strong signals were propagated; for instance, two stations worked into Germany using only 200mW to four-element Yagis. Fortunately, when 50MHz is open for sporadic-E to any area, 28MHz is also open, so that for most crossband working European stations used the 28,885kHz calling frequency. In 1986 this worked well except on a few occasions when two or three stations were on the same frequency, but already by early June 1987, the frequency is remarkably crowded at weekends so that after calling, stations need to be encouraged to spread out away from the calling frequency. Certainly the old idea that such conditions were merely a product of high solar activity has been well and truly exploded and it has been clearly demonstrated that conditions for sporadic-E propagation are at their best during years of the quiet sun when magnetic disturbances are at a minimum.

Nevertheless in 1986, just a week after the partial general release, from 7 to 9 February, a fine aurora occurred and stations by beaming north were able to work all parts of the British Isles, Norway and Sweden. K1JRW reported that he had "good copy on the GB3SIX beacon" and SM6PU heard K1TOL on 50MHz. The aurora yielded excellent communications on cw and ssb, and gave many newcomers a fine introduction to dx working. Opportunities for auroral Es undoubtedly existed, as shown in the American and Scandinavian reports. SM6PU reported 201 aurora openings on 50MHz during 1986, while only 19 of them produced propagation up to 144MHz. The OX3VHF beacon was heard by OH1ZAA on 3 August and on 14, 15, 29 and 30 November, of which the November openings were by auroral Es.

Apart from being an excellent band for aurora, 50MHz is undoubtedly also the finest band for exploiting meteor scatter propagation. During showers, stations at distances up to 1,700km can be worked with ease, and bursts of more than a minute were frequently reported, so that during the better showers almost normal ssb QSOs were possible. Several stations have started to make increasing use of sporadic meteors, and tests between Britain and Norway and between Scotland and England have shown that QSOs could be completed in 5–15min in the morning by this means. Opportunities exist for exploitation of crossband ms working into Europe, since the mode works almost equally well on 28MHz as it does on 50MHz, and it is hoped that some of the many stations now working crossband sporadic-E will turn to ms during the winter.

Winter is the season when 50MHz operators also concentrate upon working as many of their fellow operators as they can. The number of squares worked and country totals will this year qualify for vhf certificates. It became apparent in 1986 that, with the power allowed, distances of 200km could be worked with ease, and under favourable high pressure weather conditions this range could be extended up to at least 1,000km. Thus it is possible to work the whole of Britain from any reasonably good location within the British Isles, even without resorting to using sporadic-E, ms, aurora and back-scatter, which will enable it to be done even on fm. In general, with comparable power and antennas, 50MHz has proved to be more reliable than 144MHz over difficult paths, and although 144MHz will produce stronger signals when conditions are favourable, over hilly ground 50MHz is to be preferred for the rest of the time.

It is remarkable that 50MHz provides almost every type of propagation observable at hf and vhf. Of course these are not workable all the time, and real dx is never as easy as it is on 14MHz, for example, but, as with hunting and fishing, the more difficult and challenging it is, the greater the pleasure and satisfaction there is in working it. It is also true that F-layer work at higher latitudes is confined to years of high solar activity, but from southern Europe transequatorial paths are likely to open throughout the solar cycle, and even farther north tep plus Es is always a possibility, as was illustrated by 50MHz contacts between Japan and New Zealand in October 1986.

The outlook is encouraging. Earlier this year the RSGB requested [2] that the band be extended up to 52MHz, that the band be made available to Class B licence holders, that power restrictions should be eased, polarization restrictions be removed, and that mobile and portable operation should be permitted. Not all these were granted in the latest dispensation, but a further review has been promised in the not-too-distant future and, once the fears of our European neighbours have been placated, those still outstanding are likely to be granted. The VHF Committee has applied to put a 50MHz sub-standard frequency and time beacon locked to the MSF standard time and frequency signal from Rugby at the site of GB3BUX, mid-way between Sheffield and Manchester (1O93BF). This will be aimed at providing a frequency reference against which any amateur frequency can be checked as well as providing facilities for cracking some of the teasing problems associated with 50MHz propagation.

Activity in Britain is continuing to rise, and as more equipment becomes available, particularly gear suitable for Class B operators, use of the band will undoubtedly accelerate. More and more European countries are becoming interested and are granting facilities to at least some of their amateurs, and we sincerely hope that the interest will grow with a steady relaxation of present restrictions as the lower frequency tv transmitters are gradually

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closed down. Meanwhile, crossband working into Europe from Britain and other countries able to use 50MHz is much to be encouraged as more and more amateurs, particularly those who are experimentally oriented, appreciate what a wonderful resource this part of the spectrum really is.

References

[1] "How about trying 50MHz?" Ray Cracknell, G2AHU. *Rad Com* September 1986, pp641–644.

[2] "50MHz survey analysed—Society puts its view to DTI". *Rad Com* April 1987, p261. □

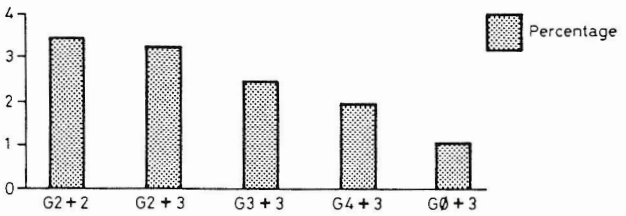
ANALYSIS OF 50MHz ACTIVITY DURING 1986

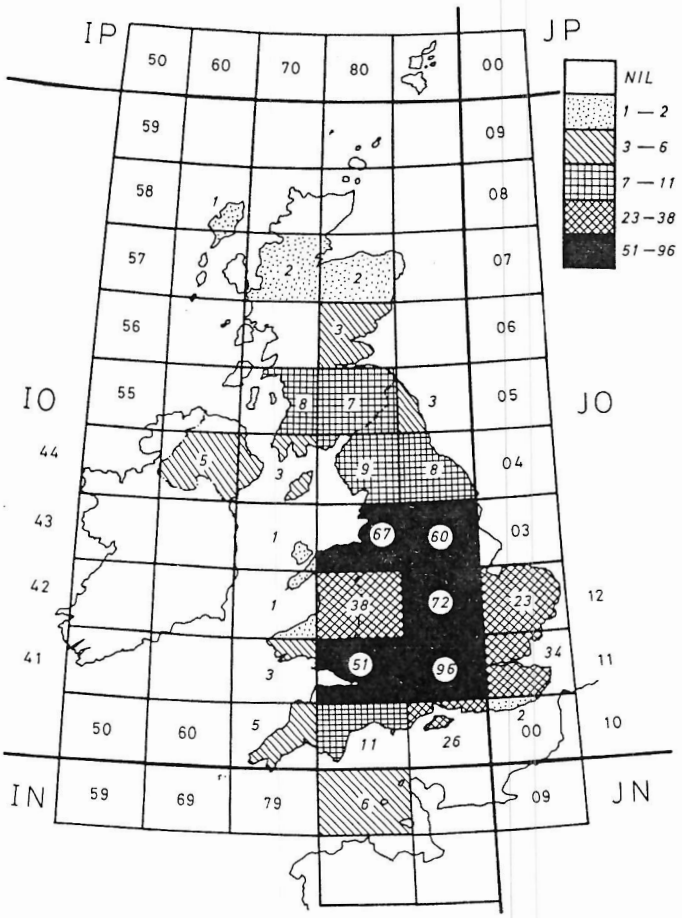
Clive Smith, G4FZH

THE STATISTICS in the bar chart and on the map of the British Isles are taken from the list of stations worked by members of the 50MHz Reporting Club between February 1986 and February 1987.

The bar chart shows 614 stations classified according to their callsigns into groups commencing G2AA, G2AAA, G3AAA, G4AAA and G0AAA. The totals are then expressed as percentages of the total numbers in each class listed in the 1987 *RSGB Amateur Radio Call Book*. These groups reflect the length of time callsigns have been held, with only a few exceptions. The G2AA–G8ZZ group being pre-September 1939 full licences and the G0AAA series the most recent licences issued.

On the map the number of stations is reduced to 547 due to *Call Book* particulars being withheld and a few doubtful calls which became apparent when stations were listed into QTH locator squares. Nevertheless a very reliable sample is used and, although activity has increased very considerably, the distributions are unlikely to change significantly.





THE INTERNATIONAL BEACON PROJECT

*Alan Taylor, G3DME, International co-ordinator**

Historical background and introduction

The 28MHz International Amateur Radio Beacon Project was started by the IARU Region 1 Division as a result of a suggestion by DJ7AA. Before then, there had been from time to time a few 28MHz beacons, used mainly for propagation studies. The more important of these were ZC4WR (1963–4), GB3LER during IQSY (1964–5), ZD7WR (1968) and DL0AR. These beacon transmitters used frequencies around 29MHz. The last-named station was used by the Max Planck Institute specifically for studying auroral propagation.

At the beginning of 1968, the DARC stated the essential features of an organised network of transmitters to be run by amateurs on the 21, 28 and 50 MHz bands, together with a companion organisation of receiving stations—the Worldwide Observation Programme (WOP). The proposal for this Worldwide Amateur Radio Beacon Transmitters (WAB)† called for stations to be established on each continent. They were to operate with a time-sharing arrangement on a common (main) frequency, of 28,200kHz in the case of 28MHz, for periods of 5min in each hour, reverting to an individual (secondary) frequency for the remainder of the time. In practice, only the 28MHz band was taken up in an organised way. There are now many beacons on the 50MHz band, brought into being by the cycle 21 sunspot activity.

As might be expected, the DARC installed the first 28MHz beacon of this new programme on Mt Predigtstuhl in Southern Germany, followed fairly soon by the RSGB with one at Crowborough in SE England. Then came VE3TEN on the North American continent, ZL2MHF in Region 3, and so the network started to grow. It is not within the scope of this description to detail the ups and downs of the endeavours made by a relatively small number of amateurs to put the stations on the air. Suffice to say that the beacons were established by the dedicated co-operation of individual amateurs and their friends to whom the amateur fraternity should be most grateful.

It should perhaps be mentioned here that originally the beacons were placed on frequencies between 28,150 and 28,200kHz. This was reviewed when the USA Federal Communication Commission (FCC) opened that portion of the band to Novice licensee cw operation—despite informed protests from Europe—and the segment 28,200—28,250kHz was recommended for beacons by Region 1 Division at the Warsaw Conference. At Miskolc-Tapolca the segment was extended to 28,300kHz to cater for expansion that was foreseen. In case any reader should wonder why a portion much higher up the band, say 29+MHz, was not used, it is pointed out that

†Changed to International Amateur Radio Beacon Project (IBP) to avoid confusion with Worked All Britain (WAB) Award.

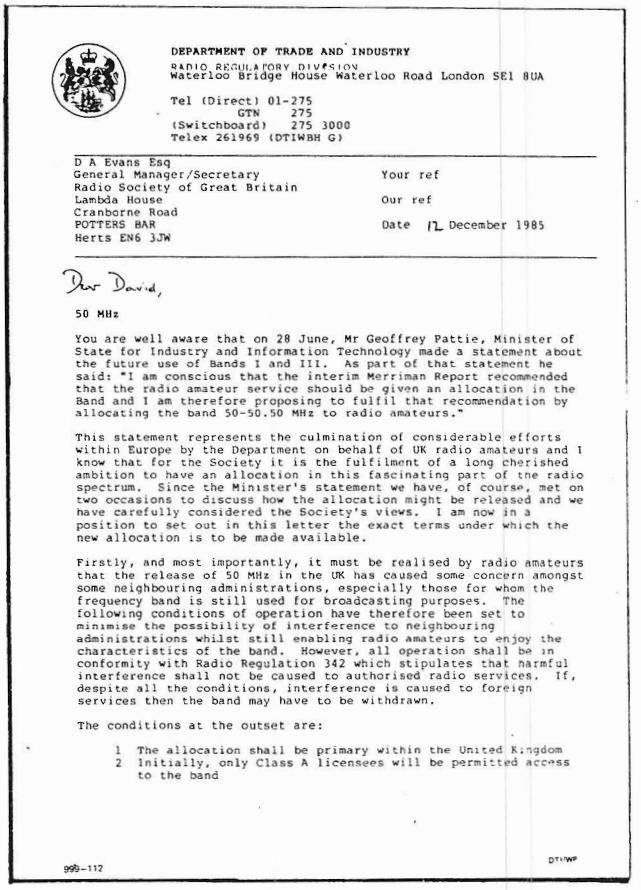
*"Altadena", South View Road, Crowborough, Sussex TN6 1HF.

50MHz

LONG-AWAITED BAND AVAILABLE 1 FEBRUARY

In this special six-page feature we mark further progress of the 50MHz experiment with two articles written by DTI staff. On this page can be seen the actual letter received at RSGB Headquarters in December 1985 from the Radio Regulatory Division of the Department of Trade and Industry. On the facing page is an article written by the Department giving some technical and political insight into the way in which a 50MHz allocation was obtained for UK amateurs. Also in this feature is the text of the DTI's Information Sheet relating to the 50MHz band. This is particularly valuable insofar as it gives the answers to questions which will be asked about the new allocation; the Information Sheet itself is expected to be available from the Department later this month.

On the following pages: Recent history of the 50MHz band; Radio regulatory factors; Possible interference scenarios; European attitudes to the UK proposals; Technical factors; Class A amateurs; Repeaters; The future; References. Plus: Questions about 50MHz answered by the DTI, with comments by the RSGB.



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Your ref
Our ref
Date 17 December 1985

Dear David,

50 MHz

You are well aware that on 28 June, Mr Geoffrey Pattie, Minister of State for Industry and Information Technology made a statement about the future use of Bands I and III. As part of that statement he said: "I am conscious that the interim Merriman Report recommended that the radio amateur service should be given an allocation in the Band and I am therefore proposing to fulfil that recommendation by allocating the band 50-50.50 MHz to radio amateurs."

This statement represents the culmination of considerable efforts within Europe by the Department on behalf of UK radio amateurs and I know that for the Society it is the fulfilment of a long cherished ambition to have an allocation in this fascinating part of the radio spectrum. Since the Minister's statement we have, of course, met on two occasions to discuss how the allocation might be released and we have carefully considered the Society's views. I am now in a position to set out in this letter the exact terms under which the new allocation is to be made available.

Firstly, and most importantly, it must be realised by radio amateurs that the release of 50 MHz in the UK has caused some concern amongst some neighbouring administrations, especially those for whom the frequency band is still used for broadcasting purposes. The following conditions of operation have therefore been set to minimise the possibility of interference to neighbouring administrations whilst still enabling radio amateurs to enjoy the characteristics of the band. However, all operation shall be in conformity with Radio Regulation 342 which stipulates that harmful interference shall not be caused to authorised radio services. If, despite all the conditions, interference is caused to foreign services then the band may have to be withdrawn.

The conditions at the outset are:

1 The allocation shall be primary within the United Kingdom
2 Initially, only Class A licensees will be permitted access to the band

999-112 DTI/WP

3 The maximum power at all times shall be

Carrier	PEP
14 dBW erp	20 dBW erp

4 Maximum transmitting antenna height to be 20 metres above ground .evel
5 Antennas shall be horizontally polarised
6 No mobile, portable or 'temporary premises' operation will be allowed
7 There will be no restriction on modes of operation
8 No repeaters will be allowed in the band
9 Existing permits will be withdrawn.

Whilst the Department realises that the release of the band has been widely welcomed by radio amateurs we are conscious that these conditions may perhaps be seen by some as restrictive. In particular, we are mindful that the Society has put forward a strong case for Class B licensees to also have access to the band. We have very carefully considered this point but we have concluded that with the views expressed by some neighbouring administrations there is every reason to take a cautious approach at first and we feel that it is right, at least initially, to limit the numbers using the band. I can tell you now though, that the Department is prepared to keep under review the operation at 50 MHz and provided that no difficulties are experienced with neighbouring administrations in the light of the above conditions then we would be willing to reconsider the position of Class B access to the band in a positive way. I suggest that the Department and the Society re-open this issue again after an operational period of 12 months and that we start to review together then such experience as is available in using the band. It would be helpful in working towards this position if the Society could set in hand procedures for gathering details of operational experience from its membership. At the end of the review period, given operation free from interference, there might also be the prospect of additional spectrum at 50 MHz being made available for amateur operation.

I hope that the Society and radio amateurs throughout the UK will now understand the Department's position on 50 MHz. Given evidence of successful operation under the above conditions then there is every chance that further relaxations can take place within a reasonable time scale. It is up to amateurs themselves to abide by these conditions and make a success of the new band.

A Gazette Notice implementing the above conditions and varying the terms of licences will be published on 20 December 1985 with the conditions coming into force on 1st February 1986.

Yours sincerely,

B A MAXWELL
Head of Licensing Section

By the time this article appears in print, many readers may be aware of the various terms and conditions that will apply in the use of the 50MHz band by amateurs in the United Kingdom.

Many of the restrictions will be questioned by licensees and indeed some have already been widely discussed in the amateur press. The purpose of this article is to provide further insight into the Department of Trade and Industry's thinking and to explain why some of the restrictions have been introduced. It probably goes without saying that the more onerous limitations, from the amateurs' viewpoint, have been strongly debated and contested by the RSGB. However, the Department views the introduction of 50MHz as a continuing experiment which must be carefully nurtured to a hopefully successful conclusion.

RECENT HISTORY

A study of Radio Communication magazine from 1978 to the present day provides an accurate picture of the 50MHz story, including the unsuccessful debates on an amateur allocation in ITU Region 1 - particularly in Europe - at the 1979 World Administrative Radio Conference; the interim and final recommendations of the Independent Review of the Radio Spectrum by Dr Merriman; the decision by the Government to cease television broadcasting in the bands 47 - 68MHz and 174 - 216MHz (TV Bands I and III); the protracted discussions leading to the out of television hours 50MHz amateur experiment; and finally the release of 500kHz at 50MHz to UK Class A amateurs on a primary and exclusive basis in terms of other UK radiocommunications services.

This story reads relatively well in UK terms but what is probably not widely known is the various discussions conducted with neighbouring administrations on the introduction of the land mobile service in the United Kingdom in TV Bands I and III in the presence of the continuing television broadcasting networks in neighbouring countries. These negotiations and discussions figured strongly in the various decisions made with respect to the amateur service at 50MHz.

RADIO REGULATORY FACTORS

The Amateur Information Sheet addressing 50MHz published by the Department and printed elsewhere in the issue of Radio Communication mentions that Article 8 of the Radio Regulations (the international table of frequency allocations) does not provide for an amateur allocation in ITU Region 1, with the exception of certain African countries.

The Department considers that Article 8 is one of the most important constituent parts of the Radio Regulations which together with the International Telecommunications Convention have international treaty status. It was therefore with some unease that a policy was developed which ran counter to Article 8 of the Radio Regulations, ie a 50MHz allocation for UK radio amateurs. Because of this it was decided to strictly enforce the terms of Radio Regulation 342 which states that Administrations introducing services which are not in accordance with the Frequency Table shall not cause interference to other countries' services operating in accordance with provisions of the Radio Regulations. It was factors such as these which decided the Department not to be influenced by Article 32 of the Radio Regulations and in particular RR 2735 which indicates that for bands above 30MHz allocated to the amateur service, the requirement for a proficiency test in manual morse code telegraphy may be waived at the discretion of concerned administrations. The rationale being that 50MHz and indeed 70MHz are not allocated internationally to the amateur service in Europe. Two other factors influenced our decision on the question of Class B licensees, but more of this later.

POSSIBLE INTERFERENCE SCENARIOS

In respect of 50MHz the service most likely to be affected in neighbouring countries is television broadcasting; although

"....and I am therefore proposing to fulfill that recommendation by allocating the band 50 to 50.5 MHz to radio amateurs."

in a number of those countries this part of the spectrum is additionally allocated to the land mobile service on a permitted basis which means that the broadcasting service has the prior choice of frequencies in planning, any use thereafter by the land mobile service would be of a primary nature. It follows therefore that both broadcasting and land mobile services of neighbouring countries shall always be protected against interference from the UK amateur service and that if interference was found to be occurring then the use of the band by the UK amateurs would have to be reconsidered.

EUROPEAN ATTITUDES TO THE UK PROPOSALS

Because of the regulatory factors outlined above it was felt necessary at an early stage to consult with neighbouring administrations on the use of 50MHz by UK amateurs, and to provide details of how protection was to be afforded to their services. It would not be an exaggeration to say that several administrations expressed concern at the UK's proposed use of the band, especially as detailed and sometimes difficult negotiations had already taken place on the UK's use of Band III by the land mobile service.

TECHNICAL FACTORS

It has been asked: "How can a relatively low power amateur signal, or indeed in the case of Band III a land mobile station, cause interference to a high power broadcasting station?" Taken individually, it would seem unlikely for such interference to occur.

The problem can at least partially be explained by means of an example. In the case of 50MHz the broadcasting station currently most likely to be affected is the Antwerp station in Belgium using Channel E2. The B/PAL television system is based on a 7 MHz channel arrangement and for Channel E2 the vision carrier frequency is 48.25MHz and the sound carrier frequency is 53.75MHz. Thus the TV receiver is tuned to approximately 47-54MHz and all emissions found in this band would have a cumulative interference effect on the programme information received. Readers will realise that the amateur allocation at 50MHz is about 7% of the E2 television channel.

The currently accepted method for determining interference to television arising from multiple interference sources emanating from widely separated locations is the simplified multiplication method which uses the statistical (in locations) nature of propagation and the various differing path lengths to determine an overall nuisance field. The television services' protection ratio characteristics are also taken in account, the overall intent being to protect a median wanted field strength for Band I which should never be lower than +48dB (uV/m), for perhaps 99% of time and at 50% of locations.

The Department's experience in the case of land mobile services in Band III has indicated that the addition of multiple interfering sources has a significant effect on the number of systems that can effectively use the spectrum contained within a television channel.

The pertinent question is therefore how the Antwerp service area can be protected, taking account of the factors indicated above, together with the intended use of spectrum outside the 50MHz amateur allocation but within Channel E2 (47-50MHz and 50.5-54MHz), and since the answer is currently unclear it is necessary to adopt fairly conservative parameters for UK amateur stations. This is because the location and number of amateur stations that will be operating is unknown and the overall planning of Band I is not yet completed. To determine the initial technical parameters for UK amateurs a simple model was developed which was then sent to neighbouring administrations for approval. The essential elements are contained in the Department's Information Sheet, but it may be worthwhile considering again some of the points in the light of preceding paragraphs.

"...strongly debated ...by the Radio Society"

CLASS A AMATEURS

Apart from the regulatory considerations and in the absence of statistical information on the possible utilisation of the band by UK amateurs, it has been necessary for the time being to restrict the number of amateurs licensed to use the band, thus the absence of Class B licensees effectively reduces the number of potential interferors by about 50%. A further factor in this regard is that the proposed European amateur licence intended to provide for easier movement across international frontiers gives two classes of licence for which national administrations must indicate an equivalence. Class 1 is for those amateurs who have proved their competence in morse code and authorises the use of all frequency bands available to the amateur service in the country where the station is established and Class 2 which limits utilisation of stations to frequency allocations above 144MHz authorised for the amateur service in the country where the station is to be installed. The Department is currently considering the adoption of the European licence but the difficulty in respect of 50 and 70MHz will be readily appreciated.

REPEATERS

The decision not to authorise repeater stations at 50MHz derives from a specific request from a number of administrations for the UK not to introduce such stations since they are normally located on high unobstructed sites and operate in many cases continuously for long periods, especially during peak television broadcasting hours, thus they pose a significant interference threat.

THE FUTURE

The introduction to this article indicated the Department's view that the use of the 50MHz band on a general basis is still regarded as an ongoing experiment. The Amateur Information Sheet indicates that there will be a review of the initial conditions once the Department has gathered information on operations after a reasonable period of time. For this reason it is essential that the Department is provided with statistical information on how the band has been utilised, especially during periods of anomalous propagation. It is hoped that all users of the 50MHz band will respond positively to any request for information in the future as this will be the only means by which the Department will be able to construct a suitably accurate model to assess the likelihood of interference to services operating in neighbouring countries.

Finally, as stated earlier the worst interference scenario currently is the Antwerp television service area. However should a television transmitter be introduced in the future which requires more protection, the conditions of amateur utilisation would have to be reviewed. Also users of the band should be mindful of the location of all E2 transmitters in operation and where possible avoid beaming towards them, especially during anomalous propagation events which occur during television hours.

In addition to Antwerp there are a number of transmitters operational in Norway whose service areas could be affected by amateur operations from North East Scotland.

The Radio Regulatory Division of the Department of Trade and Industry hopes that all licensees using the 50MHz band are successful in their operations and the Department looks forward to reading in future issues of Radio Communication magazine of information that will improve the knowledge of propagation phenomena in this interesting part of the radio spectrum.

" ...50 MHz... ...is still regarded as an ongoing experiment... "

" ...this interesting part of the radio spectrum".

REFERENCES

(1) Independent Review of the Radio Spectrum (30-960MHz) - Interim Report - The Future Use of Television Bands I and III (Cmnd 8666).

(2) Report of the Independent Review of the Radio Spectrum (30-960MHz) (Cmnd 9000).

(3) Bands I and III - A Consultative Document (Cmnd 9241).

(4) Amateur Information Sheet No 2: Amateur Service Allocation in the 50MHz band (6 metres).

(5) CCIR Report 306-4, Ratio of wanted-to-unwanted signal for AM vestigial sideband colour television systems.

(6) CCIR Report 239, Propagation statistics required for broadcasting services using the frequency range 30 to 1000MHz.

(7) CCIR Report 945, Methods for the assessment of multiple interference.

(8) CCIR Recommendation 418-3, Ratio of the wanted-to-unwanted signal in monochrome television.

(9) CCIR Recommendation 370-4, VHF and UHF propagation curves for the frequency range from 30 to 1000MHz.

(10) CCIR Recommendation 419, Directivity of antennas in the reception of broadcast sound and television.

(11) ITU Radio Regulations, Edition of 1982, revised in 1985.

(12) Draft CEPT Recommendation, Criteria to be used to assist the efficient and effective utilisation of shared frequency bands which are allocated to the broadcasting service (television) and the land mobile service, using assignments which overlap a television channel (television Bands I and III only).

(13) CEPT Recommendation T/R 61-01 (Nice, 1985) Concerning the CEPT Amateur Radio Licence.

The 50 MHz band

- some questions answered by the DTI

The Department of Trade and Industry has allocated the band 50-50.50MHz to radio amateurs. Mr Geoffrey Pattie, Minister of State for Industry and Information Technology, gave the news on 28 June 1985. He said he was accepting the recommendation of the Merriman Report on the future use of TV Bands I and III that the radio amateur service should be given space on Band I.

The initial conditions of the release of the band are:

* The allocation shall be primary within the United Kingdom

* Initially, only Class A licensees will be permitted access to the band.

* The maximum power at all times shall be: carrier 14dBW erp, pep 20dBW erp.

* Maximum transmitting antenna height to be 20 metres above ground level.

* Antennas shall be horizontally polarised.

* No mobile or portable or "temporary premises" operation will be allowed.

* There will be no restriction on modes or times of operation.

* No repeaters will be allowed in the band.

* Existing permits will be withdrawn.

Here we try to answer some of the questions you may have.

"There is no Region 1 allocation to the amateur service, so how has this new amateur allocation been possible?"

For the purposes of the International Radio Regulations, the world is divided into three Regions. The UK, the rest of Europe, Africa and the USSR are all in Region 1. Within Regions 2 and 3 (but not Region 1 except for certain African countries) the band 50-54MHz is allocated to the amateur service on a primary basis. However, within Region 1 the whole of the band 47-68MHz is allocated to the broadcasting service on a primary basis. There are thus no international rights for UK radio amateurs to have access to 50MHz. However, with the closure of 405-line tv broadcasting in the UK the frequencies at 47-68MHz have become available for re-allocation. Ministers have decided that, in the main, the frequencies should be used for land mobile services. However, the Merriman Report on the future use of the frequencies said that radio amateurs should be given a suitable allocation.

"Why the restrictions on the usage?"

Other European administrations are still using the band for its primary purpose of broadcasting. The UK allocation for radio amateurs has been introduced under the International Radio Regulation No 342 which says that harmful interference shall not be caused to authorised radio services. The initial conditions have been set to minimise the possibility of interference to neighbouring administrations while still enabling radio amateurs to enjoy the characteristics of the band.

The conditions must be followed by everyone. It is in the long-term interests of the hobby that no interference is caused to primary services using the band in countries in Region 1. Interference could result in the complete withdrawal of the hard-won privilege of access to the band.

"Will the restrictions remain?"

Not necessarily. The Department has had to negotiate with other European administrations to prepare the way for this allocation and we are therefore moving cautiously into this new band. Providing no problems are caused to the authorised services using the band in Europe, changes to the initial terms and conditions of use may prove possible.

The Radio Society of Great Britain (RSGB) wanted Class B licensees to have access to the band and this point was fully considered. However, there is a need to minimise potential interference to the services of other administrations. At the outset, therefore, the Department has decided to limit the numbers of radio amateurs using the new band.

"Will there be a review of the 50MHz allocation?"

Yes. We have said to the RSGB that after the first year we will start a review with them and we have asked the Society to gather details of operational experience from its membership. If no difficulties have been caused to

neighbouring administrations, we can reconsider the initial conditions. In particular, we have told the Society that after this initial period we would be willing to reconsider the position of Class B access to the band.

"What use will the band be with the restrictions?"

Restrictions on band usage are common all over the world. They are normally set to give some protection to other spectrum users while still allowing successful operation. At 50MHz on an experimental basis, 100 permits were issued to interested amateurs while the final allocation was being decided. Those experiments have shown some very interesting characteristics relating to sunspot activity, E and F layer reflections, temperature inversions and meteor scatter work. These phenomena all act either to enhance or inhibit radio station communications and beacon signals. By removing the previous restriction to night-time operation (by permit holders) this band should hold yet more interest to amateurs.

"Why have the 50MHz permits been withdrawn?"

The permit holders were the "pioneers" in the band and now all Class A licensees have access. The permits allowed greater powers and more spectrum to be used outside broadcasting hours but the Department's discussions with other European countries, which resulted in the new conditions, tried to minimise the interference possibilities on a 24-hour basis. The time for the permits has therefore come to an end; there can be no exceptions to the restrictions set out earlier.

"Why can't I operate whilst mobile or portable?"

The antenna becomes more effective as height is increased above ground level. Because we must avoid potential interference to the services of other administrations it is necessary to prevent operation from elevated positions such as hills or mountain tops. This also explains the restriction of antenna height to 20 metres above ground level.

"Why is the maximum power 14dBW carrier, 20dBW erp?"

Internationally accepted methods have been used to evaluate the probability of interference to the European primary and permitted services from UK amateur transmissions in the band. Calculations have shown that the permitted powers should give the required protection in order to comply with Radio Regulation 342.

"Why must the antenna be horizontally polarised?"

The band's existing and proposed primary and permitted services have a large majority of vertically polarised systems. If amateur transmissions are restricted to horizontal polarisation an antenna discrimination factor may be used in the interference calculations. This permits a higher effective radiated power.

"Will I be able to operate on 50MHz with a reciprocal licence while I am on holiday abroad?"

Not in Region 1. While this allocation is valid in the United Kingdom, the band is still used in Europe on a primary basis by other users - in particular by television services. With the band not being an internationally recognised amateur allocation in Region 1, UK amateurs are in a privileged position.

RSGB comments...

This "Information Sheet" should be read in conjunction with the DTI's article giving the background to the negotiations leading up to the 50MHz allocation, which is also featured in this issue. A great deal of discussion, negotiation and debate between the Society and the Department of Trade and Industry took place between the initial statement by Geoffrey Pattie in June 1985 and the ultimate release of the band, and it is obviously disappointing that some of the Society's requests were not able to be met initially - in particular, that Class B licensees should have access to the band, for which a very strong case was made out. However, in the light of the fact that European countries continue to use Band I for television broadcasting, the need to avoid interference to broadcast stations and also to stations in the land mobile service is obvious and the Society accepts the technical case for restrictions. We very much hope that in the light of the results of the first year of operation, the promised review will result in the removal of some or all of the restrictions.

Some points arise from the Information Sheet itself which are worth amplifying. With regard to the restriction relating to antenna height above ground, the Society did make the point to the DTI that an amateur living in a high-rise flat who has his antenna on the roof could not comply with the "20 metres agl" condition. The Department has indicated its willingness to treat cases of this nature on an individual basis.

The Information Sheet also mentions the interim report of the Merriman Committee concerning the future of Bands I and III and that it recommended that UK radio amateurs be given access to the band. It should be mentioned that the Society's input to the Committee was very considerable.

Finally, we must stress the importance of abiding by the restrictions. The Department of Trade and Industry faced considerable opposition from other European administrations in its proposal to make a 50MHz allocation to UK radio amateurs. Any interference with the services of other administrations is very likely to lead to immediate withdrawal of 50MHz operating privileges, and this would obviously be nothing short of disastrous. In particular, please be careful to observe the restriction on effective radiated power as meticulously as you can. Always use the minimum power necessary to maintain contact with a particular station, especially if you are beaming towards Europe or Scandinavia, and do make sure that you have realistic figures for antenna gain and feeder loss available. Obviously, effective radiated power levels need to be derived from these two parameters plus the output power of your transmitter - they cannot be measured directly - and it is important to get your arithmetic right!