

John K. Andrews, W1TAG
August 13, 2015

Re: FCC ET Docket 15-99
Responses to: FCC 15-50, VI: NPRM (WRC-12 Notice)

The undersigned has been a licensed Amateur operator since 1961, and a low-frequency enthusiast since the mid 1990's. I worked for 26 years in radio broadcast engineering prior to becoming an engineer at a broadcast equipment manufacturer for 18 years. I have held an Experimental license (WD2XES) since 2004 for operation in the 2200 meter band, and have been part of the WE2XGR license since 2007 for operation in the 630 meter band.

The comments below refer to paragraphs in FCC 15-50, VI (WRC-12 Notice), A (Issues below 490 kHz), 3 (Amateur 2200 meter (135.7-137.8 kHz) and 630 meter (472-479 kHz) Bands. The paragraph numbers from that document are used.

(165)

Briefly, Experimental operation in the 630 meter band has shown propagation, noise and fading characteristics different than the 2200 meter or 160 meter bands. Weak signal techniques not available to earlier users have proven to be very effective even with the very limited EIRP we have been permitted to use. Much work remains to be done, especially with limited antenna systems, and I endorse the creation of an Amateur allocation in this band.

(166)

Given the limited amount of publicly-available information on actual PLC operations, what follows is based on experience and conjecture. In the LF spectrum, including the 2200 meter band, PLC signals are typically observed on integral 100 Hz frequencies, and we have long counseled operators doing narrow-band work under Part 15 in the 160-190 kHz band to avoid exact 100 Hz multiples. When PLC signals are audible (or visible with DSP techniques), one typically finds multiple close-spaced carriers, possibly from different sources, within a few Hz of the center frequency. For example, such a grouping is barely audible (but clearly visible with DSP) in southern Maine on 136.0 kHz, the only such signal in that band. No similar signals have been observed in the proposed 630 Meter band at the same location. Note that most of the ever-increasing interference in those bands is not frequency-stable, and can be attributed to switching power supplies, etc. Observed PLC carriers are very stable, even with the milliHertz resolution typically used in weak-signal work.

It would seem that the basic common-sense rule that governs most Amateur communications applies here: If you can hear (see) an interfering signal, move to another frequency. That approach has already gotten us through many tens of thousands of hours of Experimental operation in the 2200 and 630 meter bands.

(168)

Without unnecessary complication, perhaps some clearer definition of “fixed locations” could be given. For example, I have two residential locations, only one of which appears in FCC records. Would I be limited to that one alone? Would a group of Amateurs giving a demonstration of communications activities be able to pick a suitable site without some notification? If the Commission’s goal is simply to prohibit mobile operation, perhaps that could be clarified.

(169)

In a hobby situation like Amateur Radio, one generally adapts to local conditions. High power distribution lines that might be used for PLC transmission generally produce noisy RF environments due to corona discharges, leaky insulators, and so on. Amateur operation in the currently-available lower frequency bands (1.8 and 3.5 MHz) can be very difficult in close proximity to such lines. If moving to another residential location was not possible, most would limit their activities to higher frequencies where the noise would not be so troublesome. I doubt that Amateurs living in close visual proximity to high power transmission lines would choose to operate in the proposed 2200 and 630 Meter bands. Were I being shown a house for potential purchase that had steel tower power transmission lines within a few hundred meters, I would be asking the real estate agent for other options, and not because of PLC signals.

The ARRL-suggested separation of 1 km between a transmitting antenna and a power transmission line using PLC’s may be reasonable. See my comments under paragraph 176.

At the location for which my Experimental licenses were granted, I have a loop antenna in the vertical plane, supported by trees. The original dimensions were roughly rectangular, 23 meters high and 51 meters long. An intervening ice storm reduced the height somewhat, but the perimeter is still about the same. The loop axis is in the 70°/250° direction. For the authorized 1 watt ERP (not EIRP) on 2200 meters, field strength measurements in those directions have shown a transmitter output power of 500 watts to be appropriate. Obviously, the efficiency is poor! In that band, field measurements should be made no closer than 3 km from the antenna, otherwise the various fields with $1/r^2$ and $1/r^3$ attenuations would have to be considered. At 630 meters, calculations show that 250 watts would produce about 5 watts ERP with the present antenna. I will make actual field strength measurements on that this winter.

(171)

As previously stated, receptions of possible PLC signals at my two locations on either the 2200 or 630 meter band have not caused any interference.

In my case, I have two residential locations. The one that has been used in Experimental operation over the last 11 years is 1.8 km from the nearest lines that might possibly carry PLC signals. Other lines on large wooden poles are nearer, but they are evidently used to move power between substations. The other location is more rural, and is 3.2 km from the nearest possible candidate for PLC’s. Again, a closer distribution line between substations exists. In the first case, no interference to or from PLC signals has evidently happened in more than 11,000 hours of operation in the 2200 meter band. The second location is used only for receiving.

(175)

Absent a clear showing from the power industry, I believe that the 1 watt EIRP at 2200 meters and 5 watts EIRP at 630 meters with a guard distance of 1 km is sufficient protection. Should any Amateur wish to operate closer than 1 km from a power transmission line using PLC's, he should be required to coordinate the use as described in my response to paragraph 176, below.

(176)

In comments filed in an earlier proceeding, I recommended that an Amateur organization, perhaps under the wing of the American Radio Relay League, be established to provide a contact point with the power industry's UTC. Without weakening the industry's security, Amateur operators could check on the viability of transmitting locations. This would seem a much better approach than requiring us to guess whether a given local power transmission line uses PLC's, or navigating through the phone tree of regional power system operators who really don't want to give out such information. If the ARRL is willing to sponsor such a service, it could be done with a volunteer group at minimal administrative expense.

The European situation provides a useful reality check. As each of these two bands were opened for Amateur Radio access in the various EU countries, there were brief bursts of activity in the next year or two. Gradually things settled down. Operators in many cases found that noise and antenna limitations made continued operation less interesting. On a given evening, there may be only a dozen Amateur operators using those bands in Europe. A recent "activity day" in the U.K. woke things up for a weekend, but in reality, only perhaps a few dozen stations did any transmitting.

Potential Amateur operation in these bands in the U.S. will probably produce similar results. Commercial equipment is not widely available, and considerable technical skills may be required to assemble a good station. Many licensees lack the antenna space or noise-free environment to provide satisfactory operation. The latter is not a small issue: noise levels have increased dramatically in recent years. Predictions of inductive charging of electric vehicles suggest that whole neighborhoods would be affected, particularly at 2200 meters.

In all, given the modest number of Amateur Radio operators likely to operate on these bands, a volunteer coordinating organization appears to be entirely practical.

(178)

I concur with the 200 foot limitation.

(179)

Given the variety of antennas beyond a simple vertical conductor that may be employed at these frequencies, I suggest that no transmitter power limit be specified. This has been the approach in other countries, and simple tutorials have arisen within their Amateur communities to assist in calculations or measurements. There is a major difference between commercial and Amateur practice in these bands. Environmental losses due to trees, vegetation and buildings can be controlled in large commercial

installations by installing large ground systems, removing trees, and mowing acres of land as needed. The back yard of one's residence is subject to different rules. Calculation of expected field strength or ERP (EIRP) will generally overstate the actual results. Such optimism will always favor the utilities employing PLC's. I advise the Commission to keep this regulation simple, and set limits only on radiated power. Perhaps an overall transmitter output power of 1500 watts PEP would be appropriate.

(180)

I do not believe that the 2200 meter or 630 meter bands should be subdivided either by license class or operating mode. I am not aware that other countries have taken those approaches.

ARRL's suggestion that the bands be accessible to General Class and above licensees seems sound. While there are substantial technical problems in constructing equipment and antennas for these frequency ranges, passing tests for the higher class licenses would not seem to be an asset. In a practical sense, those attracted to MF/LF operation tend to already have considerable technical skills.

Dividing such narrow bands on the basis of license class would seem pointless. It also would be counter-productive in the PLC interference arena, if stations routinely listened on frequencies other than the one on which they were transmitting. If the bands are open to all with General Class or higher licenses, then ad hoc groupings based on modes will be much more effective.

The use of modes with 300 Hz or less of occupied bandwidth should be encouraged, if not mandated. This would rule out conventional voice transmissions, but it is now possible to transmit voice signals in narrow bandwidths through digital compression. Much work has been done in the last 15 years on narrow-band communication techniques, and that should be allowed to continue. Of the growing number of digital modes available to Amateurs, all are specified in terms of bandwidth. If the Commission wants to specifically authorize CW and RTTY, that's fine, but they should all fit within a 300 Hz mask. I strongly believe that the Commission should not divide these bands by modes. Divisions will naturally be made by users, in many cases in conformity with practices in other countries.

(181/182)

The only issue in this regard during Experimental operation on 2200 meters has been with CFH, a Canadian military station, which occasionally operated on 137.0 kHz. We tried to give them a +/- 400 Hz window when they were on the air, and received no complaints. It appeared at the time that they were "burning the cobwebs" on seldom-used equipment. Since the Canadian government authorized the 630 meter Amateur band after WRC-12, I cannot recall having heard CFH on 137.0 kHz.

The usual general cautions to accept interference from, and not cause interference to other users of these bands would seem to be appropriate.

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