

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of:

**Inquiry Regarding Carrier Current)
Systems, including Broadband over) ET Docket 03-104
Power Line Systems)**

To: The Commission

COMMENTS OF THE RADIO AMATEUR SATELLITE CORPORATION

The Radio Amateur Satellite Corporation (AMSAT[®]) hereby respectfully submits its comments in response to the *Notice of Inquiry*, FCC 03-100, 68 Fed. Reg. 28182, released April 28, 2003 and corrected May 23, 2003 at 68 Fed. Reg. 32720. In response to some of the questions contained in the Notice, AMSAT states as follows:

1. AMSAT is a scientific and educational corporation chartered in the District of Columbia in 1969 and certified by the Internal Revenue Service as a charitable corporation under §501(c)(3) of its Rules. FCC licensed amateur radio operators make up the vast majority of our membership.

2. We design, construct, test and operate amateur radio satellites, often in cooperation with radio amateurs in many other countries. We also make available a variety of publications, computer programs, and Internet services promoting space science education among radio amateurs and students worldwide.

3. AMSAT-OSCAR 40, the latest of our free-flying spacecraft, was lifted to orbit by an Ariane-5 launcher in November 2000. Radio amateurs from more than a dozen countries cooperated in its design and construction. Similarly, together with ARRL, NASA and cooperating radio amateurs from other nations, we are maintaining and expanding an amateur

space station aboard the International Space Station (ISS) for use by astronauts and cosmonauts and for a variety of experiments.

4. A recent analysis by Ed Hare, W1RFI, of ARRL, available on ARRL's Web site <http://www.arrl.org/>, shows that amateur stations are likely to experience severe interference from the introduction of Broadband over Power Line (BPL) systems, if the Commission's current rules regarding maximum permitted emissions from such systems are maintained¹. Studies conducted in other countries have produced similar findings. Some of these made use of actual in-the-field measurements².

5. Hare's analysis, and others we have seen, assumed terrestrial amateur operation only. However, downlink signals from amateur radio satellites are often considerably weaker than typical terrestrial signals, and would be correspondingly more vulnerable to interference from BPL systems. Currently, there are two amateur radio satellites operating with downlinks in the 28-29.7 MHz (10-meter) band: our own AMSAT-OSCAR 7 and the Russian satellite RS-15. Both employ linear communication transponders capable of relaying many amateur signals simultaneously over thousands of miles. Including these, a total of twelve amateur radio satellites have carried 10-meter downlinks into low or medium earth orbit.

6. A typical example of how weak such signals are is as follows: The 10-meter downlink of AMSAT-OSCAR 7 currently transmits with a power output of approximately 0.5 W, shared among the stations transmitting through it at any one time, including the satellite's own telemetry beacon. If one such station consumes one-tenth of the total power (a typical case), its power output from the satellite's dipole transmitting antenna would be 50 mW (82 mW

¹ Ed Hare, W1RFI, *Calculated Impact of PLC on Stations Operating in the Amateur Radio Service*, ARRL, November 15, 2002.

² For example, see David Lauder, G0SNO, *EMC*, in the June 2003 issue of RadCom, the monthly journal of the Radio Society of Great Britain.

eirp). At a distance (slant range) of 3,000 km, again a typical value and far from the maximum range of about 4,000 km dictated by the satellite's orbit, the signal strength into a half-wave dipole receiving antenna would be approximately -110 dBm, or 0.7 microvolts across an input impedance of 50 ohms.

7. At the present emissions limit of 30 microvolts per meter at 30 meters, the same half-wave dipole would see an interfering signal from a BPL system of approximately -75 dBm in a receiving bandwidth of 9 kHz, or approximately -80 dBm in the 3 kHz bandwidth more likely to be employed to receive amateur SSB signals from AMSAT-OSCAR 7. The BPL interference, then, would be approximately 30 dB stronger than the desired signal from the satellite's downlink.

8. In practice, the interference problem is likely to be even more serious. The foregoing analysis assumed that the satellite's transmitting dipole and the receiving dipole on the ground are optimally positioned with respect to each other, that there is no mismatch in polarization, and that there is no ionospheric absorption. In reality, these favorable conditions rarely occur, so on average, the satellite's downlink signal will be on the order of 5 to 6 dB weaker than the -110 dBm calculated here.

9. Two Russian amateur radio satellites, RS-10/11 and RS-12/13, have also carried communication uplinks in the 21 MHz band. Since their footprints in orbit were roughly circular areas more than 2,000 miles in radius from the sub-satellite point, the cumulative impact of millions of BPL devices would have produced very harmful interference to these uplinks, similar to the ionospheric-propagation case described by Hare. As in that case, this interference would have extended far beyond U.S. national boundaries. No such uplinks are currently functioning in orbit, but RS-10/11 and RS-12/13 produced valuable research into ionospheric propagation

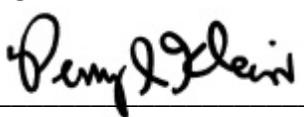
through polar regions³ and additional 21 MHz uplinks are under active consideration by several prospective amateur satellite-building groups.

10. The potential effect of harmonics of BPL emissions in amateur bands above 144 MHz could be serious as well. The experience of our members with satellite communication at 144 MHz shows how extremely vulnerable such operations are to ordinary neighborhood interference sources such as incidental radiation from personal computers, leakage from power lines, etc.

11. The BPL industry maintains that no significant interference to licensed services, including amateur, is likely. In view of the facts presented in these comments, we urge the Commission to require full theoretical and field-testing studies of potential interference to the amateur and amateur-satellite services, and possible corrective and preventative measures, and to take these studies into account in determining how BPL is to be regulated. As a licensed service, amateur radio is entitled under the Commission's Rules to protection from any and all harmful interference from Part 15 devices such as these.

RESPECTFULLY SUBMITTED,

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³ John Branegan, GM4IHJ, Space Radio Handbook, Radio Society of Great Britain, 1991.