October 8, 2004

Via Courier and Email
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RE: Interference Complaint, Ambient Corporation Broadband Over Power Line System at Briarcliff Manor, New York; Request for Immediate Cessation of Operation Pursuant to Experimental Authorization WD2XEQ, File No. 0050-EX-ML-2003.

Gentlemen:

This office represents ARRL, the National Association for Amateur Radio, also known as the American Radio Relay League, Incorporated (ARRL). The purpose of this correspondence and the attached engineering exhibit is to complain of unlawful operation of a Broadband over Power Line (BPL) trial system located in Briarcliff Manor, Westchester County, New York, on power lines owned and operated by Consolidated Edison. The result of tests conducted by ARRL laboratory manager Ed Hare, the author of the Test Reports attached hereto as ***Exhibits A and B***, is that this facility, which has been the subject of numerous interference complaints in the recent past, is still causing harmful interference to Amateur Radio stations and must be required to cease operation immediately. The operator of the system has attempted what it referred to as "adjustments" in this system in order to reduce the severe interference potential to licensed radio services such as the Amateur Service. These "adjustments" have come to be inaccurately referred to as "notching" of certain bands, and as a solution to interference to Amateur Service stations, they are incomplete and inadequate. The Briarcliff Manor system currently causes harmful interference and it is not compliant with applicable FCC part 15 regulations, including Section 15.5 thereof, or with the terms of the experimental authorization granted by the Commission and currently outstanding.[1]

ARRL therefore requests that the BPL facility at Briarcliff Manor, New York be instructed to shut down immediately; and that it not resume operation unless the facility is shown to be in full compliance with Commission rules regarding radiated emissions and with the non-interference requirement of both Section 15.5 of the Commission's Rules and the terms of the experimental authorization. As support for these requests, ARRL states as follows:

According to Exhibit A, certain "adjustments" made by the holder of the experimental authorization, Ambient Corporation, following the receipt of multiple interference complaints from licensed radio amateurs, involved shifts in frequency bands used. This did not, however, result in a reduction of interference on a substantial portion of the High Frequency (HF) amateur allocations. "Notching" has not been done on all parts of the system. Despite these efforts to resolve instances of harmful interference, the system continues to cause such, and radiates at levels, in some instances, not compliant with FCC Part 15 radiated emission limits.

According to the ARRL study, Ambient has attempted for more than a year to mitigate interference at this site by notching, but to no avail. The ineffectiveness of the notching techniques, which have been employed with similar results in other cases elsewhere, is shown with a great degree of precision in the Attached Exhibit A study. For example, measurements taken at 14.3 MHz, in one of the most heavily used Amateur HF allocations along Chappaqua Road in Briarcliff Manor, revealed 30 to 40 dB of degradation to Amateur Radio operations along a stretch of road over a kilometer in length. Furthermore, a sweep of the Amateur band 21.0-21.45 MHz shows that the BPL signal at the location of Chappaqua Road and North State Road in Briarcliff Manor

[1] Special Condition #1 states: "Licensee should be aware that other stations may be licensed on these frequencies and if any interference occurs, the licensee of this authorization will be subject to immediate shut down." As a separate matter, it is noted that this experimental authorization, which replaced prior experimental authorizations under the call letters WB9XQT, is shown with a station class "FX" or fixed, but the license itself is for mobile nationwide. It is unclear why the Commission would grant a nationwide license for these systems, unless the intention of the applicant is to obscure the location of experimental BPL systems, which is antithetical to any good-faith effort at interference resolution.

occupies the entire band, and at distances of more than 500 meters from the BPL injector. These measurements and tests occurred on October 3, 2004, and are therefore representative of current conditions at the test site.

Exhibit B offers baseline measurements which were taken in Burlington, Connecticut, an area removed from the Briarcliff Manor site and from any other BPL site, and which is typical of ambient HF conditions under which Amateur HF mobile stations might operate. Contrasting these baseline tests with those in Exhibit A reveals the substantial interference-causing noise across several of the most important and heavily-used HF allocations of the Amateur Service. The levels of interfering BPL signals are sufficient to obscure virtually all Amateur Radio received signals and preclude Amateur Radio communications in the areas and on the bands identified in the report.

The attached test results are sufficient to demonstrate that this BPL test site should be shut down immediately, pending compliance determinations, and a demonstration that the system can operate without causing harmful interference. ARRL does not believe that such can be demonstrated. ARRL requests that this station be shut down immediately and that appropriate monetary forfeitures be imposed against Ambient Corporation.

Kindly address all communications on this subject to the undersigned counsel.

Yours very truly,

Christopher D. Imlay

cc: Dr. Yehuda Cern, Ambient Corporation
79 Chapel Street, Newton, MA 02458
(via U.S. Mail)

EXHIBIT A

Testing of the Broadband Over Power Line System in Briarcliff Manor, NY to Assess the Effectiveness of Frequency-Notching Techniques to Mitigate Interference

Author: Ed Hare, ARRL Laboratory Manager, W1RFI@arrl.org
Revision Date: October 4, 2004

Summary:

The Broadband Over Power Line (BPL) system in Briarcliff Manor, NY is operated by the local electric utility, Con Ed. The Ambient Corporation is the manufacturer of the BPL system. This system uses Orthogonal Frequency-Division Multiplexing (OFDM), with using multiple carriers in groups of three spaced approximately 1.1 kHz. It occupies multiple segments of HF and low VHF. It is being operated under an Experimental license, WD2XEQ, formerly WB9XQT.

One of the conditions of this license is that the system must not cause harmful interference. Under this condition, if interference is caused, the license authorization states that the system will be subject to immediate shutdown.

Several interference complaints have resulted from the operation of this system. In several instances, the BPL manufacturer, the Ambient Corporation, attempted what it characterized as "adjustments" to the system to mitigate interference[2]. Testing performed on October 3, 2004 by ARRL Laboratory Manager Ed hare shows that although these adjustments have changed the frequencies the system uses, to date, they have not resulted in this system being able to operate without causing interference. The notching has not been done in all parts of the system, and this system continues to intentionally use spectrum allocated to the Amateur Radio Service at full-strength Part 15 levels[3], with no attempt made to protect amateur spectrum locally in those areas.

Contrary to the claims that notching has been effective in mitigating interference to the Amateur Radio Service from the Briarcliff Manor, NY BPL system, strong interference is still found in most of this system, and this best-effort attempt by Ambient and Con Ed has not corrected the reported interference.

[2] These "adjustments" have come to be called "notching" by the BPL industry, although in general, these techniques do not create notches in their spectrum use, but either move blocks of spectrum around or attempt to turn of blocks of carriers.

[3] The graphs shown in this report show the field strength measured at the antenna used for testing. It has been corrected for antenna factor, but not adjusted for slant-range distance. The test antennas used were mounted on the vehicle roof, either using a magnetic mount or a tripod affixed to the vehicle roof rack, at a height of approximately 2.5 meters above ground to the antenna center.

ARRL and several area amateurs have reported interference to the operators of this system as early as June 2003[4]. These interference reports are also included among those at http://www.arrl.org/~ehare/bpl/NPRM_hyperlinks.html#reports. Subsequent to that time, attempts to mitigate interference by notching have been tried, to one degree or another. One amateur, Alan Croswell, has kept a detailed log of his interference reports and the general lack of success in correcting them by notching[5].

Present Status of This System:

The results of this recent testing demonstrate that despite investing over a year's time attempting notching as a mitigation technique, strong interference levels continue in several amateur bands in various parts of this system. The lack of overall success shown in these test results demonstrate that it is not possible to effectively apply notching to a complex system with multiple BPL segments[6]. Any insufficient degree of mitigation will result in systems that create strong interference to mobile and fixed operation in the Amateur Radio Service in most areas of that installation, as seen in Briarcliff Manor.

General Discussion and Note About the Testing:

Although there are a relatively small number of users on this system, it is complex, with multiple "legs" and repeaters used to extend the BPL signal across the entire geographical range of the system. Some portions operate with continuous carriers, while in other locations, these carriers are modulated and are present only when customers are using the system. For this reason, it is possible that additional segments and spectrum use may not have been discovered during this single day of testing. For example, late in the day, it was discovered that the portion of the system near the Con Ed substation uses spectrum in the 60-meter band amateur and federal allocation. This use is not documented in this report

Test Conditions:

The testing for this report was done with the ESH2 in peak-detect mode with a 2400 Hz measurement bandwidth. This was chosen instead of a CISPR quasi-peak detection to be able to show individual signals within the band, rather than a composite of multiple signals within the 9-kHz CISPR/C63.4 bandwidth. The peak-detector mode also has more dynamic range on the ESH2 metering indication. With the test method used, this shows the entire range of received signals on a single graph. The use of a peak detector

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[4] At that time, ARRL Laboratory Manager Ed Hare demonstrated strong interference to Ambient Corporation's engineering staff. This was seen on ARRL's ESH2 EMC receiver and on a communications transceiver. This transceiver, a Kenwood Model TS-850, was subsequently loaned to Ambient to permit their staff to easily assess the effectiveness of any changes they planned to make to the system to mitigate interference. The interference that is documented in this report would have been readily apparent when heard on that equipment's receiver.

[5] The history of this complaint is documented thoroughly on Croswell's web log at http://www.columbia.edu/~alan/bpl/.

[6] The FCC has had similar complaints about similar ineffective interference mitigation in other BPL systems and areas. Several of these tests have been terminated.

typically adds several dB to the measurement result, while the use of smaller bandwidth will decrease the measured signal level. For the types of signal and noise typically encountered on this spectrum, ARRL has consistently seen 3-dB or better correlation between the actual CISPR detector in the ESH2 and the results using a peak detector and 2400 Hz bandwidth. The use of a peak detector and 2400 Hz bandwidth typically slightly underestimates impulse noise such as spark-plug or fuel-injector pulses. The test vehicle was turned off for all of this testing.

Test Equipment Used:

Manufacturer	Model	Description	Date Calibrated	Notes
Rohde & Schwarz	ESH2	EMC Receiver, 3-30 MHz	5 Feb 2004	Peak, quasi-peak or average power measurements
ICOM	IC-R3	General coverage receiver	Not calibrated	Used for monitoring only
AH Systems	SAS-563B	Active loop antenna	11 Mar 2004	
	Various	Loaded mobile whip antennas	ARRL calibrated against SAS-563B on 1 Sep 2004	
LabJack	U12	USB Data acquisition card	Purchased new 1 Sep 2004	8-channel, 12-bit ADC

Test-Fixture Configuration:

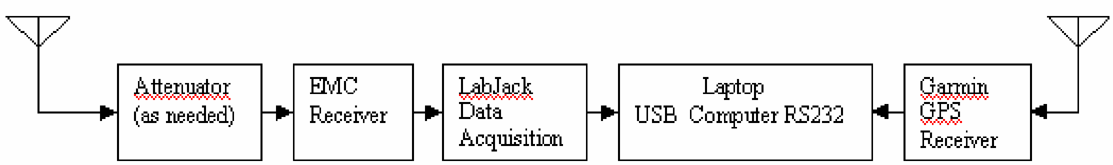

Figure 1: A laptop computer is used to read a data acquisition device connected to an EMC receiver meter-output voltage and GPS receiver to obtain calibrated field-strength measurement vs distance and position.

The ESH2 was used to analyze the use of spectrum by the BPL system. It was also used to measure the BPL signal levels on a single frequency within that occupied spectrum along several kilometers of the power lines in Briarcliff Manor.

All equipment was powered from 12 volts from an automotive battery installed in the back-seat area of the test vehicle. The battery can be charged from the vehicle electrical system, but it is generally operated independently of the vehicle to minimize noise. The laptop operates from its internal battery, which is periodically recharged with a DC-to-

AC converter available in the vehicle. This converter is powered off during all testing. There are few "birdies" from the computer and these are easily avoided during testing.

Test Results:

3.5-4 MHz:

This graph shows the typical signal levels encountered outside the BPL test area on the 3.5-4 MHz band in the Amateur Radio Service.

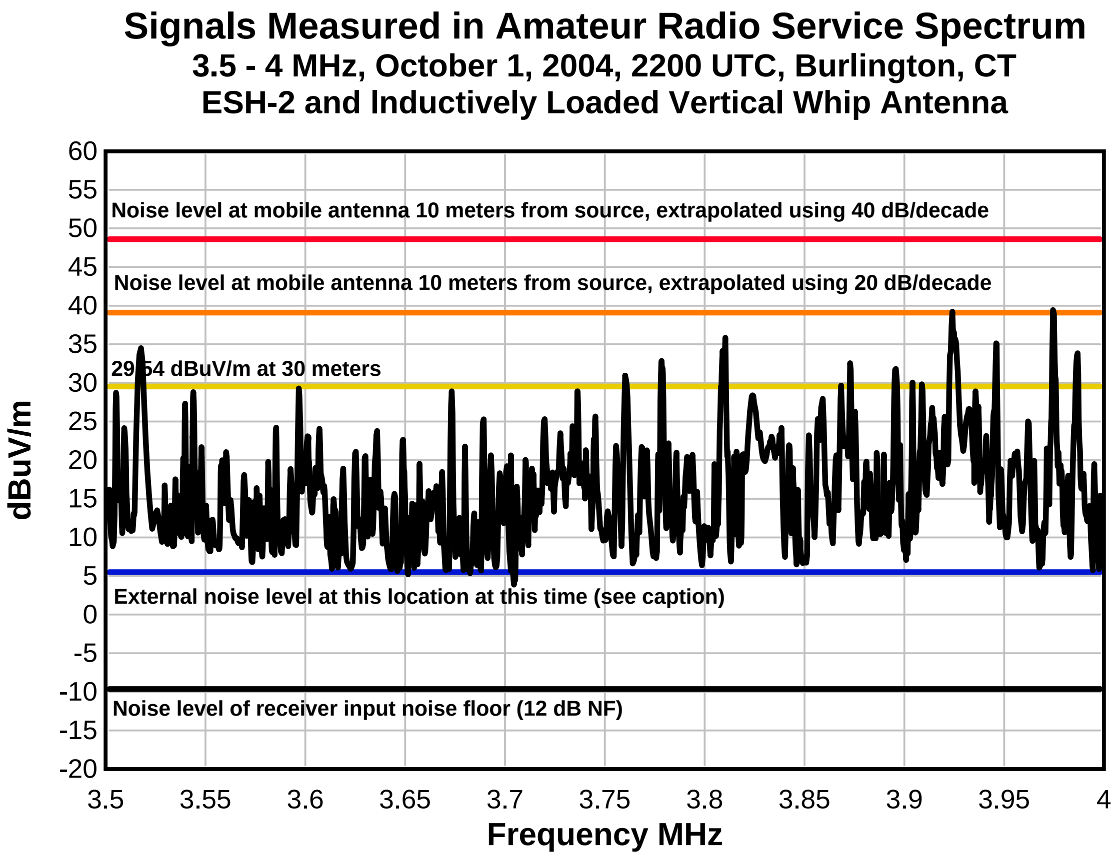

Figure 2 – These are the signals that were present on the 3.5-4 MHz Amateur band in Burlington, CT on   October 1, 2004 at 2200 UTC. The lower line shows the sensitivity that would result from the use of a typical communications receiver with a 12 dB noise figure.

The following graph shows the use of the 3.5-4 MHz amateur band by the BPL system in Briarcliff Manor, NY:

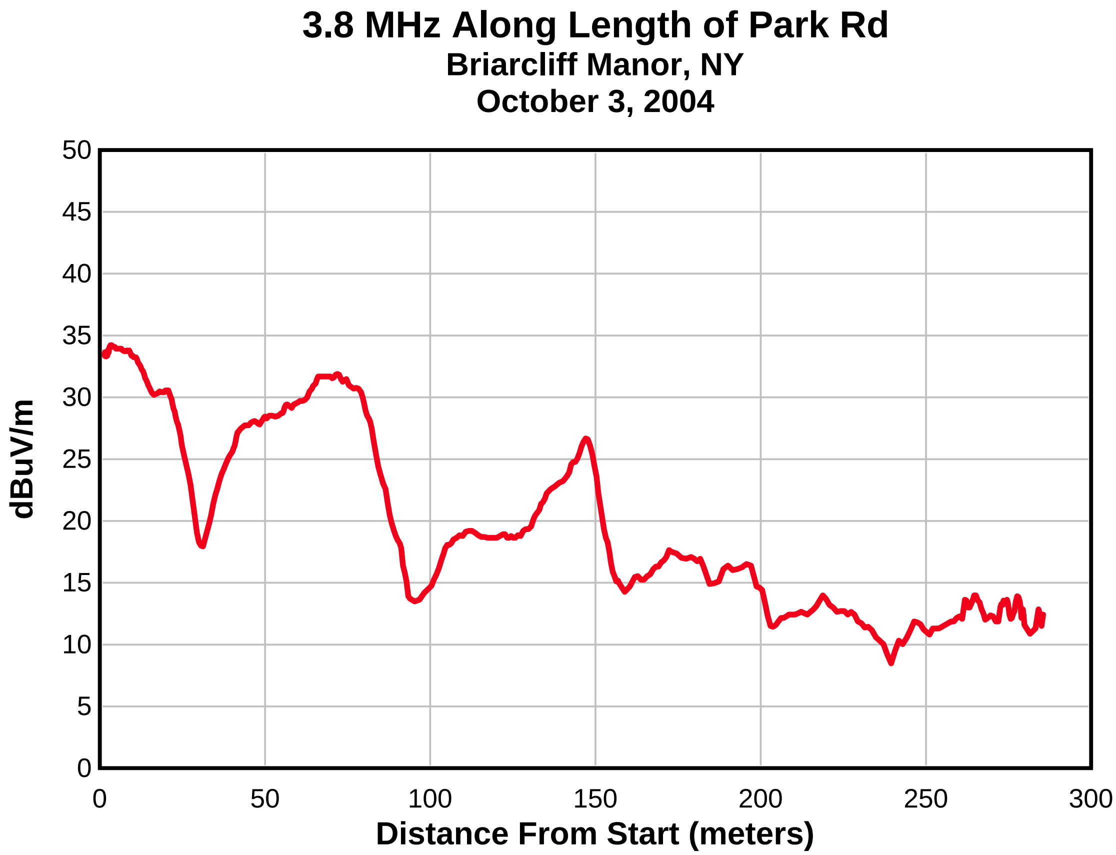

Figure 3 – This shows the BPL signal on 3.8 MHz along the length of Park Road. These data were taken using the 3.5-4.0 MHz mobile whip, with an antenna factor of 14.9 dB. These signal levels are greater than the signal levels typically seen on the 3.5-4 MHz amateur band.

14-14.35 MHz:

This graph shows the typical signal levels encountered outside the BPL test area on the 3.5-4 MHz band in the Amateur Radio Service.

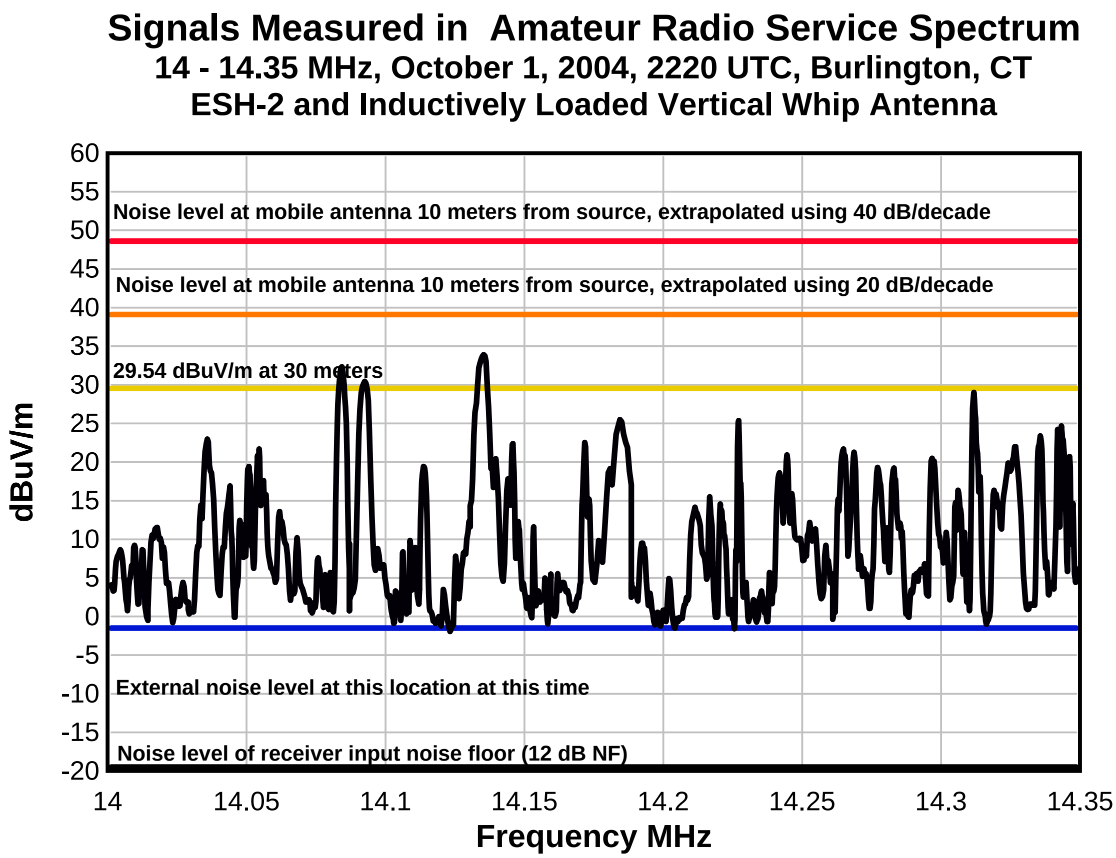

Figure 4 – These are the signals that were present on the 14-14.35 MHz Amateur band on October 1, 2004 at 2220 UTC. The lower line shows the sensitivity that would result from the use of a typical communications receiver with a 12 dB noise figure.

The following graphs show the use of the 14-14.35 MHz amateur band by the BPL system in Briarcliff Manor, NY:

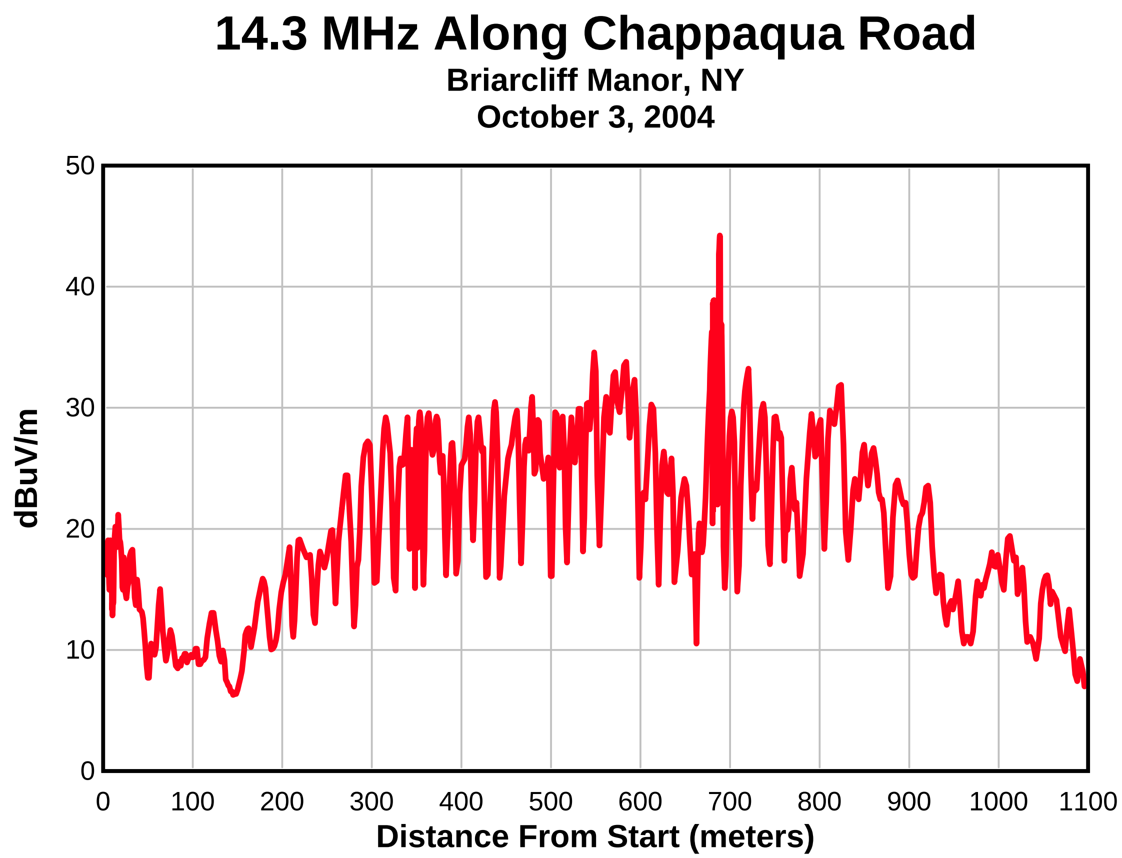

Figure 5 – This graph shows the BPL signal measured along Chappaqua Road. The peak seen at 700 meters is where Chappaqua Road crosses North State Road. The test vehicle was stopped for approximately 1 minute at a stoplight before crossing the road. The peaks and valleys seen were caused by the BPL signal turning off and on.

When the above two plots are combined in the graph that follows, the level of BPL interference in Briarcliff Manor, NY becomes more apparent:

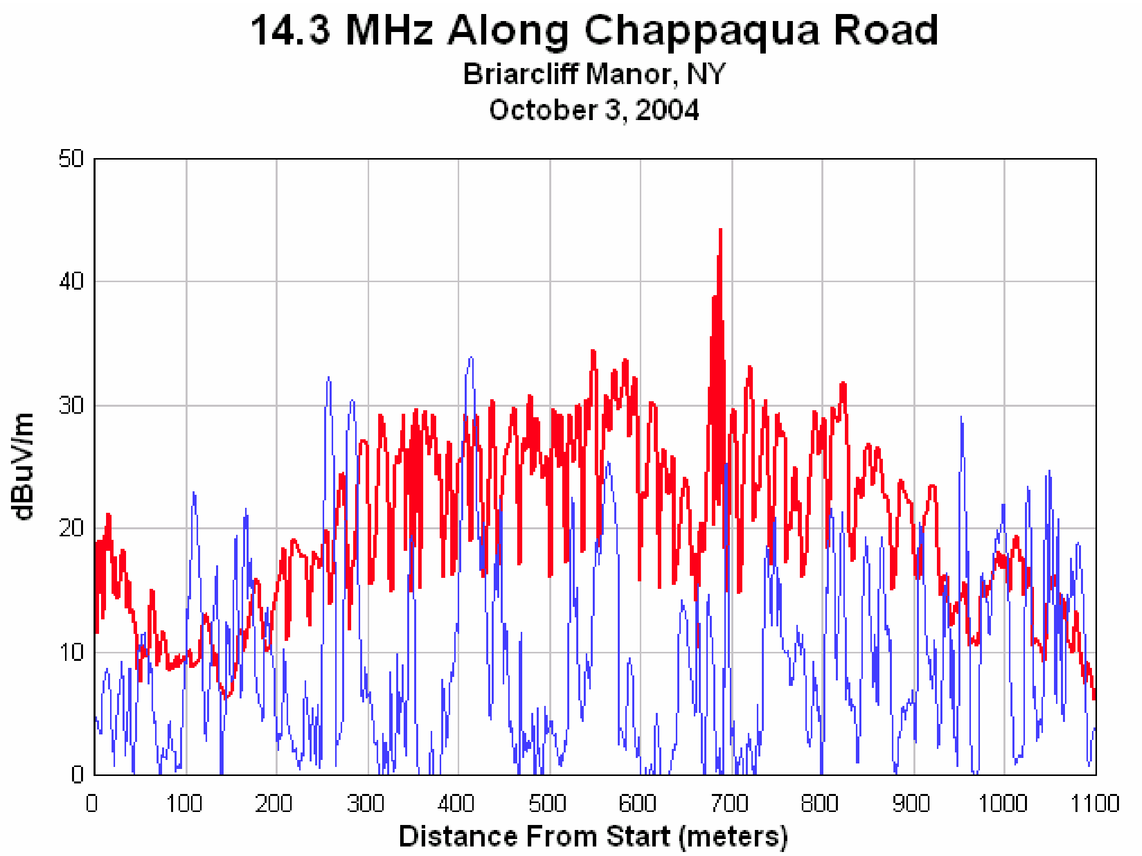

Figure 6 – This chart displays the graph of the measurement of the 14.3 MHz BPL noise along Chappaqua Road overlaid over measurements of the signals on the 14-14.35 MHz amateur band taken outside of the BPL area. At this location, BPL on this band would completely cover all but the strongest of signals, and those would still be quite noisy. Note that the X-axis scale for the measurement is in meters distance from the starting point, while the X-axis scale for the measured ambient signals is 14 to 14.35 MHz. The latter is included only for reference, to show 30 to greater than 40 dB of degradation to licensed use of this spectrum along more than a kilometer of road. This will occur again and again in a BPL area, on different amateur bands in turn, in a fully deployed system.

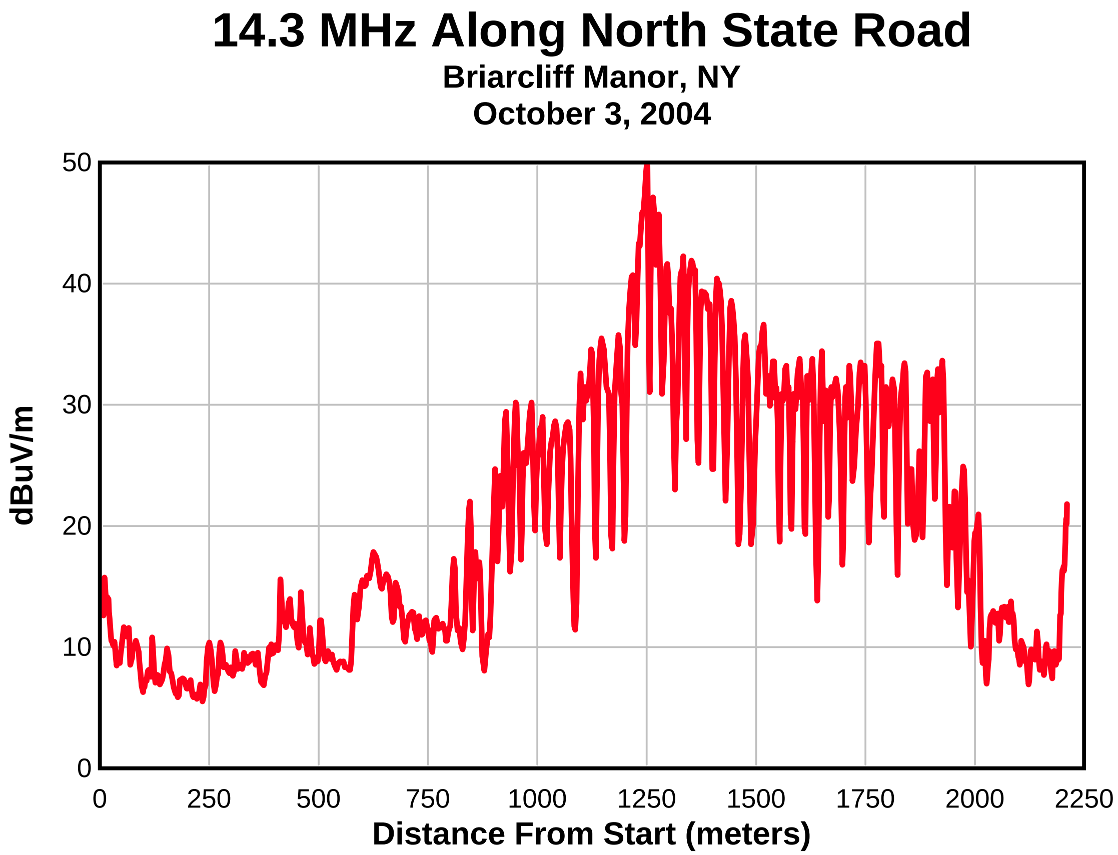

Figure 7 – Interference in the 14-14.35 MHz amateur band was not limited to a single area. This shows the BPL signal over 1 kilometer of North State Road. The peak here is where North State crosses Chappaqua, correlating with the graph shown in the figure above. Just as seen on the signal along Chappaqua Road, this interference persisted at a strong level along over 1 kilometer of the line, and even past the edges shown on this graph, the interference level was still about 10 dB greater than some over-the-air signals.

21-21.45 MHz:

The following graphs show the use of the 21-21.45 MHz amateur band by the BPL system in Briarcliff Manor, NY:

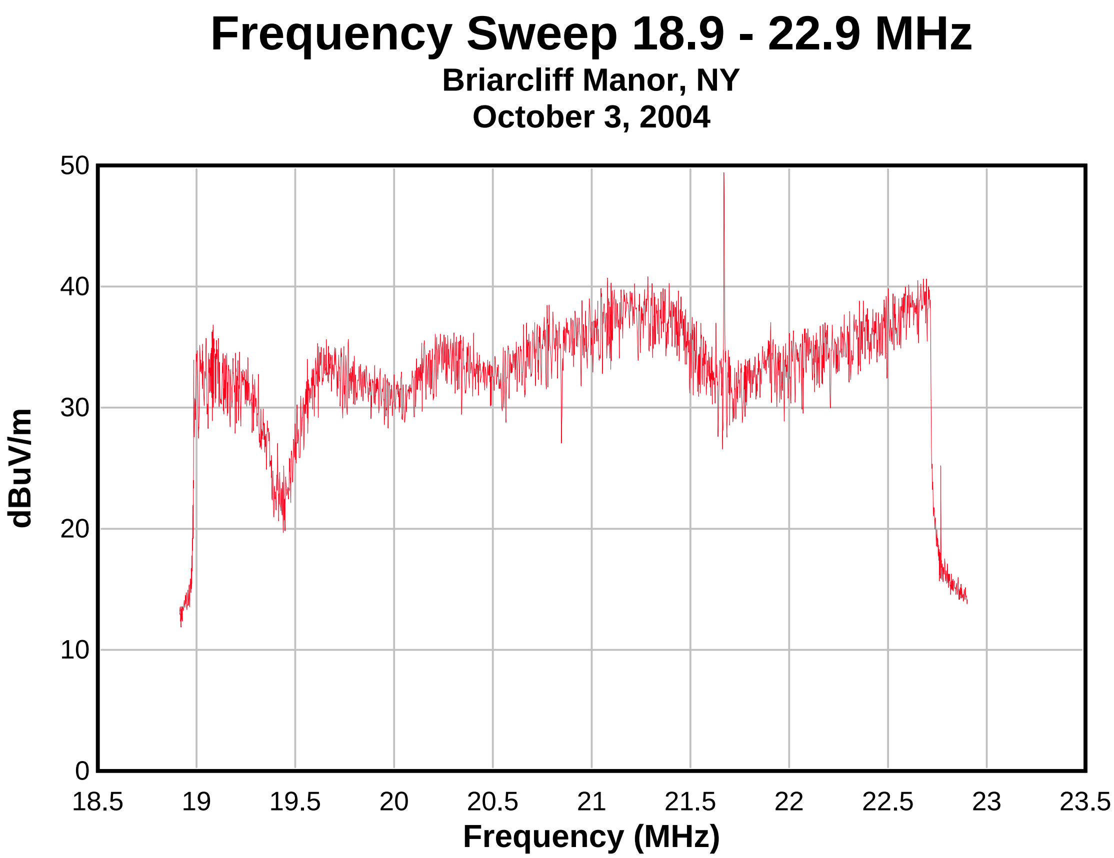

Figure 8 – These data from 18.5 to 23 MHz were taken were taken near the intersection of Chappaqua Road and North State Road, using the AH Systems calibrated loop antenna. This point was 16 meters horizontally from the power line. The BPL signal occupies the entire 21-21.45 MHz amateur band and significant adjacent spectrum.

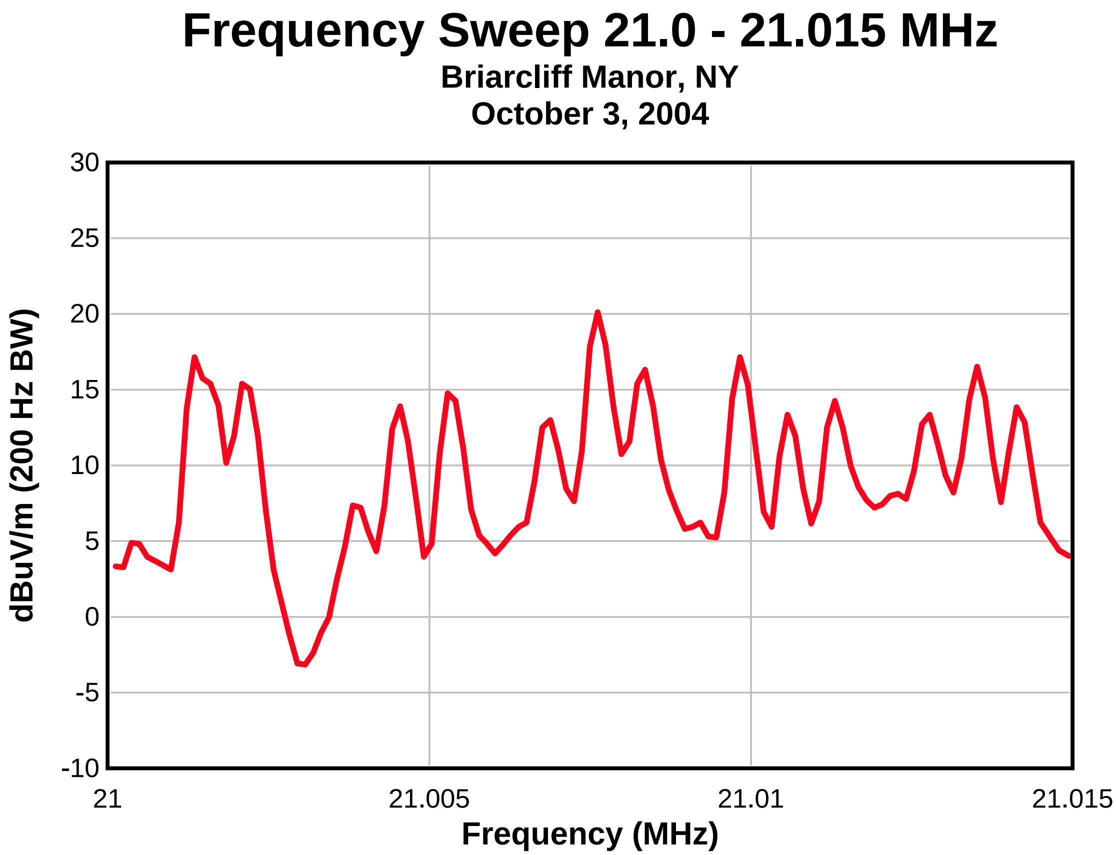

Figure 9 – This “close-in” view of the BPL signal shows individual carriers that are spread out across the entire occupied frequency range. The bandwidth for this test was narrowed to 200 Hz, so this is no longer an accurate measurement of field strength. It is useful, however, to show how a BPL signal fully occupies the spectrum it uses. This plot was made near the intersection of Chappaqua Road and North State Road.

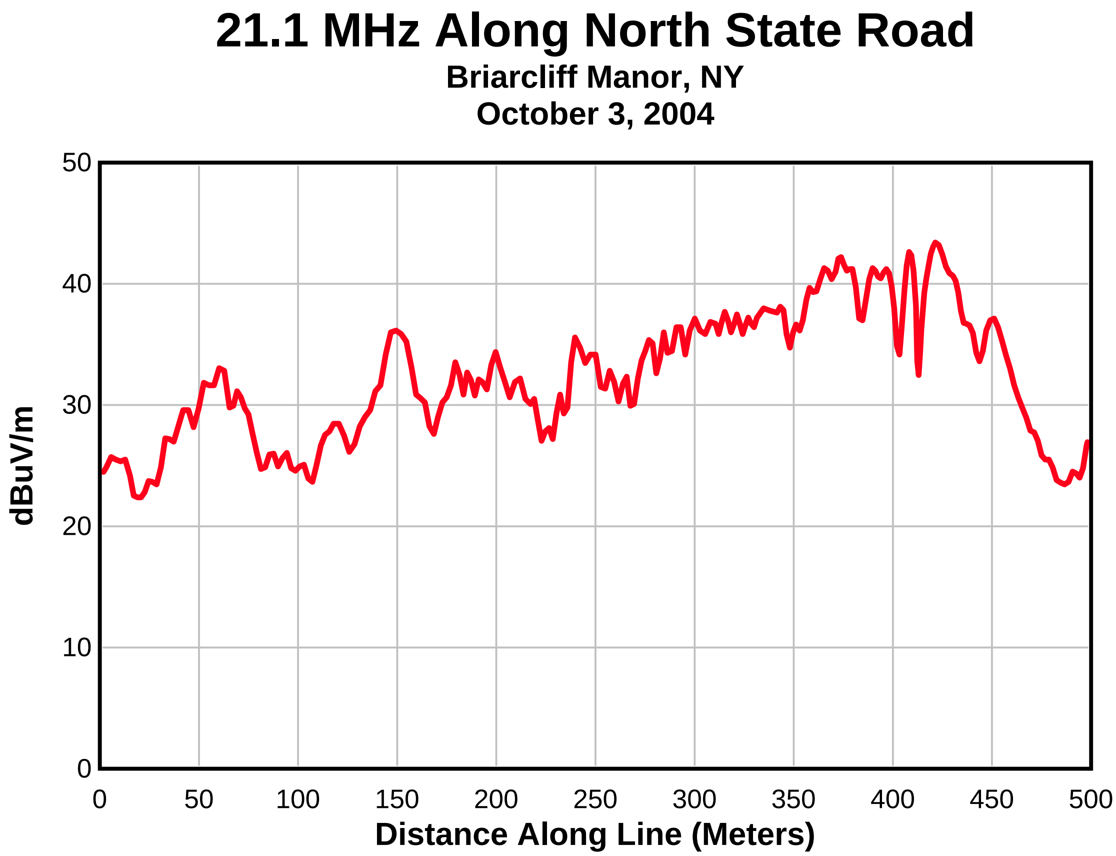

Figure 10 – As seen in the entire BPL area, strong signal levels are not limited to the immediate vicinity of BPL injectors. If test equipment and antennas of sufficient sensitivity are used, BPL can be heard and measured for significant distances along lines carrying their signals. As can be seen in graph after graph in this report, it is not practical for HF mobile stations to simply drive away from a BPL area. This could often require a search of a few kilometers from the source, and it is just as likely that interference on different spectrum will be encountered in that area should it become necessary to change bands to accommodate different propagation conditions to different parts of the country or world.

28-29.7 MHz:

The following graphs show the use of the 28-29.7 MHz amateur band by the BPL system in Briarcliff Manor, NY:

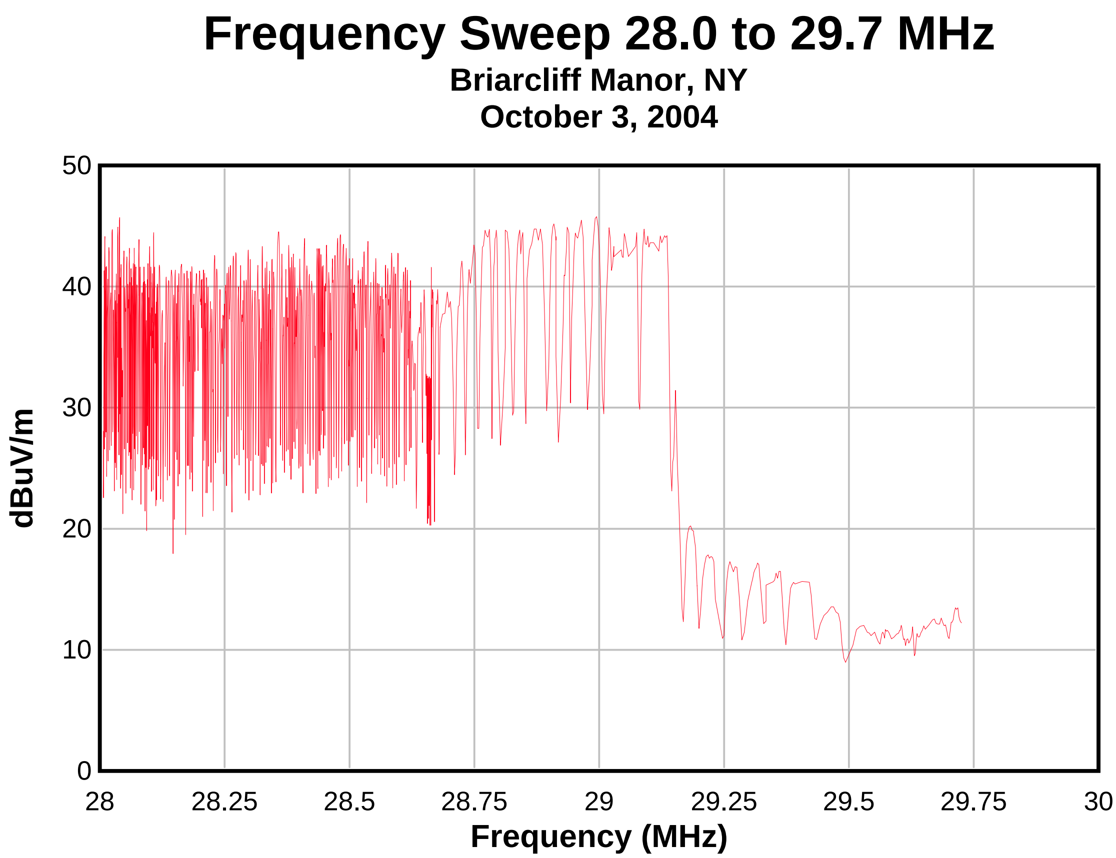

Figure 11 – This data was taken on Fuller Road. The test was done from a fixed location, so the periodicity seen is as a result of the BPL signal cycling on and off with time period of about 1 second. There was a failure of the receiver tuning motor drive midway through the test, so the change in the graph occurred when the receiver tuning was continued by hand[7]. The BPL signal shown at the right of the graph right of the graph was still audible at a level several dB stronger than an estimated ambient noise level of approximately 8 dBuV/m at this location with the vehicle in motion. It would normally not be possible to hear any ambient amateur signals on this band with this level of noise.

[7] Apparently at a faster tuning rate.

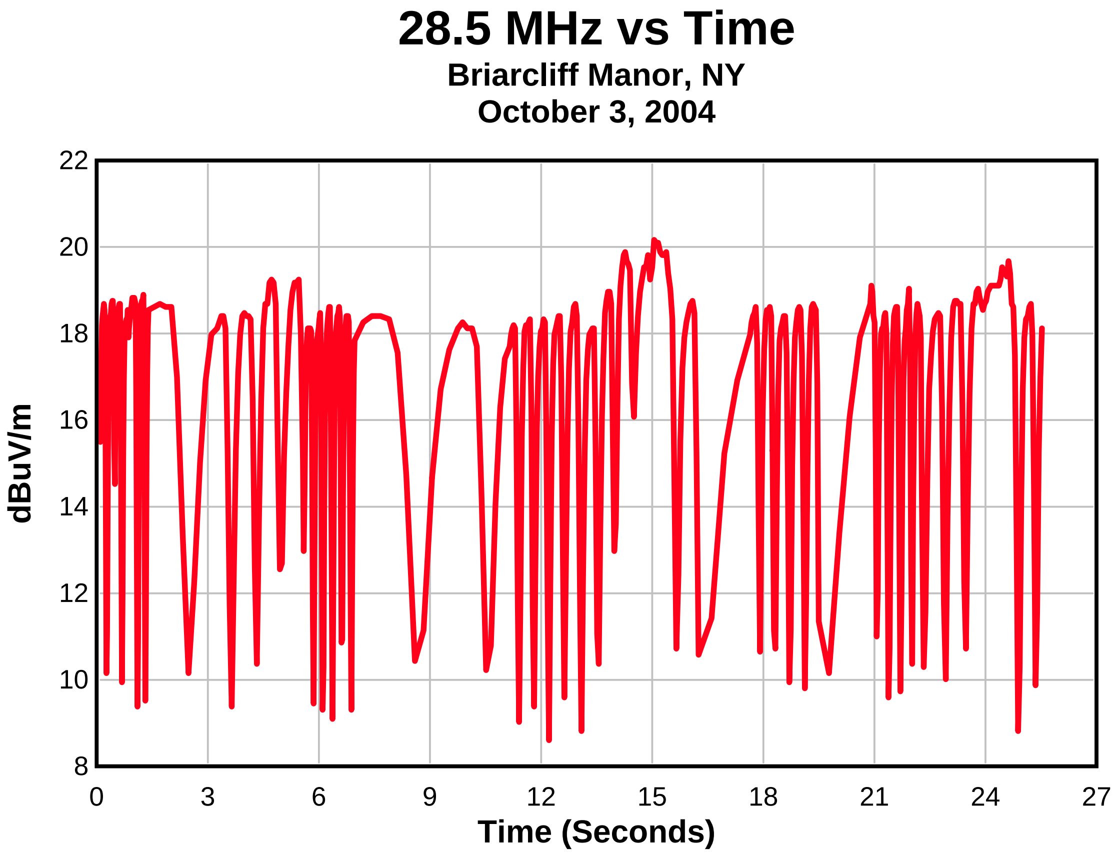

Figure 12 – This shows the way that the BPL signal varies with time. During any "transmission," the BPL signal was present virtually all of the time, with periodicity as typically shown above. In some instances, a signal could disappear for several minutes, only to return. In other areas, BPL signals were heard virtually all of the time during this testing period. This graph was not taken at the location of maximum emissions, although it can be seen that it is well above the level in the very brief intervals between the cycled BPL signals. This BPL system occupies spectrum for a considerable percentage of time.

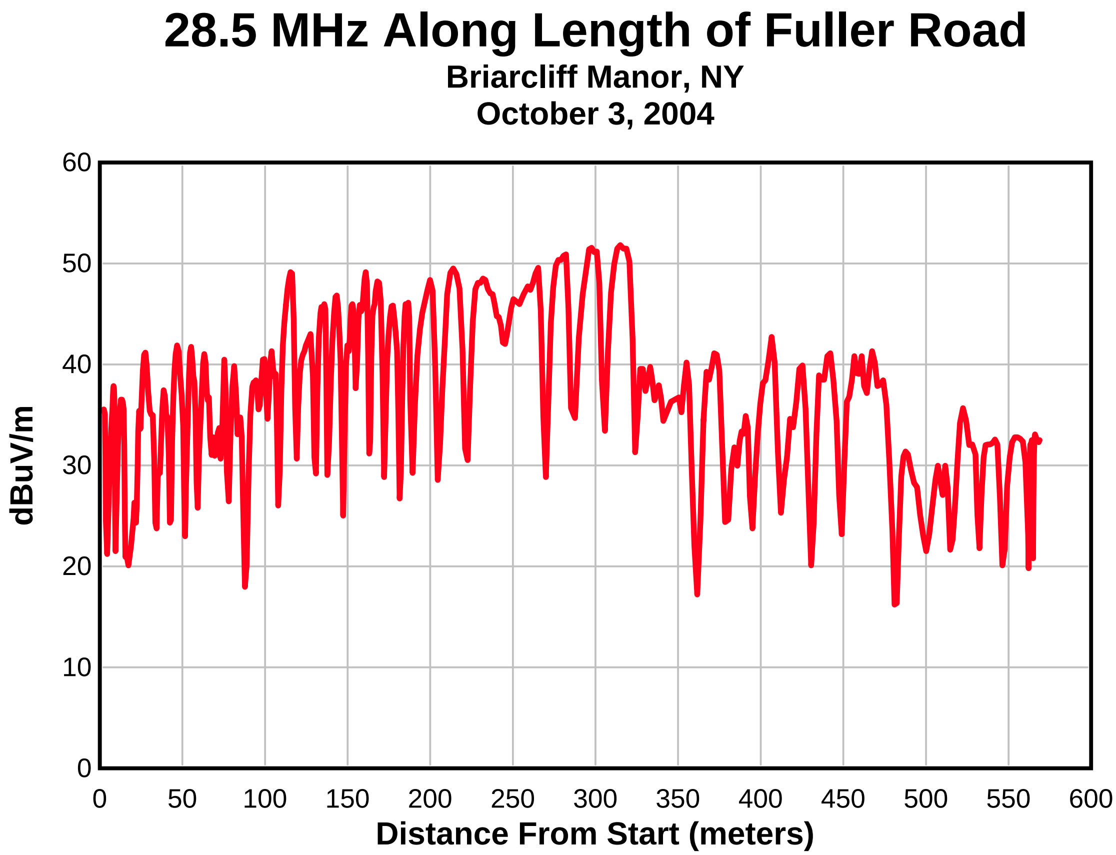

Figure 13 – This graph shows the signal that was present along the entire length of Fuller Road as measured on 28.5 MHz. The start of this run was at the corner of Fuller Road and it ended at the turnaround at the end of the road. On this band, the BPL signal occupied the entire amateur allocation over a considerable geographical area. The signal was audible at a level strong enough to cover all signals along Fuller Road and weak signals about 1.6 kilometers from this source. The apparent steps in the signal strength probably indicate that there were multiple BPL signals being measured at the time. In several instances, it was possible to tell by ear that different BPL signals were present at different levels, although this is not always apparent from the graphs.

EXHIBIT B

Measurements of the Field Strength of Signals Found on the 3.5-4 MHz, 7-7.3 MHz and 14-14.35 MHz Bands in the Amateur Radio Service

Author: Ed Hare, ARRL Laboratory Manager, W1RFI@arrl.org
Revision Date: October 5, 2004

Test Description:

On the evening of October 1, 2004, measurements were made in Burlington, CT of the strength of signals found on the 3.5-4 MHz, 7-7.3 MHz and 14-14.35 MHz amateur bands. These measurements were made with a mobile measurement test system, using mobile loaded vertical whip antennas installed on a 1989 Subaru station wagon. The antenna factors of these antennas have been determined by comparing these antennas against a calibrated AH Systems amplified loop antenna. These antennas are typical of those that would be used for HF mobile operation by many radio services.

Test Equipment Used:

Manufacturer	Model	Description	Date Calibrated	Notes
Rohde & Schwarz	ESH2	EMC Receiver, 3-30 MHz	5 Feb 2004	Peak, quasi-peak or average power measurements
AH Systems Mobile HF whip antennas	SAS-563B Iron Horse brand, various models Various	Active loop antenna Inductively loaded vertical whip antennas Loaded mobile whip antennas	11 Mar 2004 Self-calibrated against AH Systems SAS-563B 10/2004-11/2004 ARRL calibrated against SAS-563B on 1 Sep 2004	
LabJack	U12	USB Data acquisition card	Purchased new 1 Sep 2004	8-channel, 12-bit ADC

Test-Fixture Configuration:

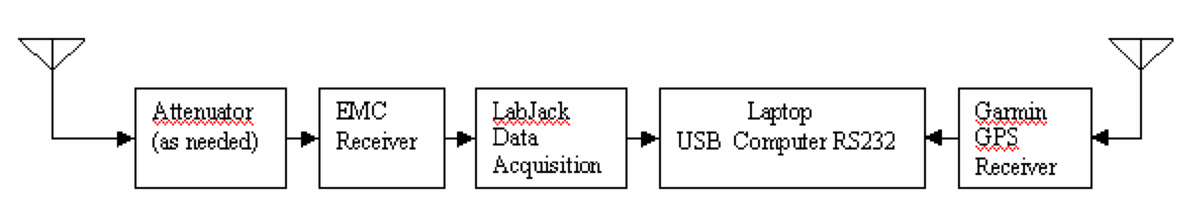

Figure 1: A laptop computer is used to read a data acquisition device connected to an EMC receiver meter-output voltage and GPS receiver to obtain calibrated field-strength measurement vs distance and position.

All equipment was powered from 12 volts from an automotive battery installed in the back-seat area of the test vehicle. The battery can be charged from the vehicle electrical system, but it is generally operated independently of the vehicle to minimize noise. The laptop operates from its internal battery, which is periodically recharged with a DC-to-AC converter available in the vehicle. This converter is powered off during all testing. There are few "birdies" from the computer and these are easily avoided during testing.

Test Conditions:

The testing for this report was done with the ESH2 in peak-detect mode with a 2400 Hz measurement bandwidth. This was chosen instead of a CISPR quasi-peak detection to be able to show individual signals within the band, rather than a composite of multiple signals within the 9-kHz CISPR/C63.4 bandwidth. The peak-detector mode also has more dynamic range on the metering indication. With the test method used, this shows the entire range of received signals on a single graph. The use of a peak detector typically adds several dB to the measurement result, while the use of smaller bandwidth will decrease the measured signal level. For the types of signal and noise typically encountered, ARRL has consistently seen 3 dB correlation between the actual CISPR detector in the ESH2 and the results using a peak detector and 2400 Hz bandwidth. The use of a peak detector and 2400 Hz bandwidth typically slightly underestimates impulse noise such as spark-plug or fuel-injector pulses. The test vehicle was turned off for all of this testing.

Antenna Factors:

The antenna factors for the antennas used in this test are:

Table 1: Antenna factors for whip antennas

Frequency (MHz)	Antenna Factor (dB/m)	Gain (dBi)
3.5	14.9	-33.8
3.6	11.5	-32.3
3.7	6.6	-25.3
3.8	5.1	-23.7
3.9	11.1	-29.1
4	11.4	-29.1
7.0	0.8	-13.7
7.05	0.75	-13.6
7.1	0.1	-12.9
7.3	0	-12.5
14	-4.1	-2.8
14.1	-4.0	-2.8
14.35	-3.9	-2.8

Ionospheric Conditions:

On the evening these tests were done, the solar activity was very low. No flares were observed. A more complete description of solar and ionospheric conditions is included in this report as Attachment A.

Weather:

The weather was cloudy, with nearby sporadic rain and an approaching cold front. The temperature was approximately 60 degrees. Early in the testing, occasional static crashes from distant lightning were observed. As the evening progressed, these became somewhat more frequent and the level of these lightning discharged increased somewhat. The level and frequency of occurrence of lightning noise were seasonably typical.

Local Conditions:

The testing was done at a private residence in a suburban neighborhood. The population density of the neighborhood is best described as low, with houses separated by approximately 75 meters. There is a home on either side of this residence and one across the street. The area is served by overhead power lines, in an RF environment that is moderately low. The test vehicle was parked on a dirt driveway, approximately 25 meters from the property's residence, and approximately 50 meters from the nearest other residence. Devices such as computers, televisions and fluorescent lights were turned off in the subject residence, but all other appliances were not controlled. No attempt was made to control other residences in the neighborhood. The test vehicle engine was shut off for all testing.

Test Results:

The following graphs show the signal levels measured on 3.5-4.0 MHz, 7-7.3 MHz and 14-14.35 MHz at approximately 1800 UTC, 2000 UTC, 2200 UTC and 2400 UTC. These data are derived from the received signal level in dBuV (50 ohms) and the antenna factor of the antenna used for this testing. Actual mobile antennas were used instead of the calibrated loop antenna to obtain sensitivity down to the local ambient noise floor.

Weather:

The weather was cloudy, with nearby sporadic rain and an approaching cold front. The temperature was approximately 60 degrees. Early in the testing, occasional static crashes from distant lightning were observed. As the evening progressed, these became somewhat more frequent and the level of these lightning discharged increased somewhat. The level and frequency of occurrence of lightning noise were seasonably typical.

For graphs with multiple lines, starting at the bottom of the graph, the lines show:

- The black line show the calculated noise level that combines the receiver input noise and the antenna factor to show the lower limit of the sensitivity of typical communications receivers. The gain of the mobile whip antennas used for these tests is low compared to the higher gain antennas typically used by stations operating in the Amateur Radio Service. These stations would have a lower threshold of their ability to receive external signals and noise.
- The blue line shows the external noise level at this location at this time. This represents the minimum signal level that can be received at this location. Some external noise was somewhat higher, caused by emissions from nearby devices, but the majority of the communications channels in these bands were at the level shown, unless occupied by an on-the-air signal. These on the air signals were present and audible down to the external noise level shown. Those signals that were a few dB higher than this level can be easily copied by an operator with reasonable skills.
- The yellow line shows 30 uV/m (29.64 dBuV/m).
- The orange line shows the level that would be present at an antenna located at a slant-range distance of 10 meters from a source that is radiating at a level of 29.54 dBuV/m if that signal is extrapolated to 10 meters using a 20 dB/distance decade extrapolation ratio.
- The red line shows the level that would be present at an antenna located at a slant-range distance of 10 meters from a source that is radiating at a level of 29.54 dBuV/m if that signal is extrapolated to 10 meters using a 20 dB/distance decade extrapolation ratio.
- The test data are shown in black.

Almost all of the measured amateur and most of the international shortwave broadcast signals present on these bands were well below a field-strength level of 29.54 dBuV/m. All but the strongest of signals were below the extrapolated levels that would be present at antennas located 10 meters or less from radiating power-line conductors (overhead or building electrical wiring). These antennas would include those used in HF mobile stations, general-coverage shortwave receiving stations using indoor antennas or modest outdoor antennas located close to buildings and many stations operating in the Amateur Radio Service whose antennas are not located at great distance from power lines or building electrical wiring.

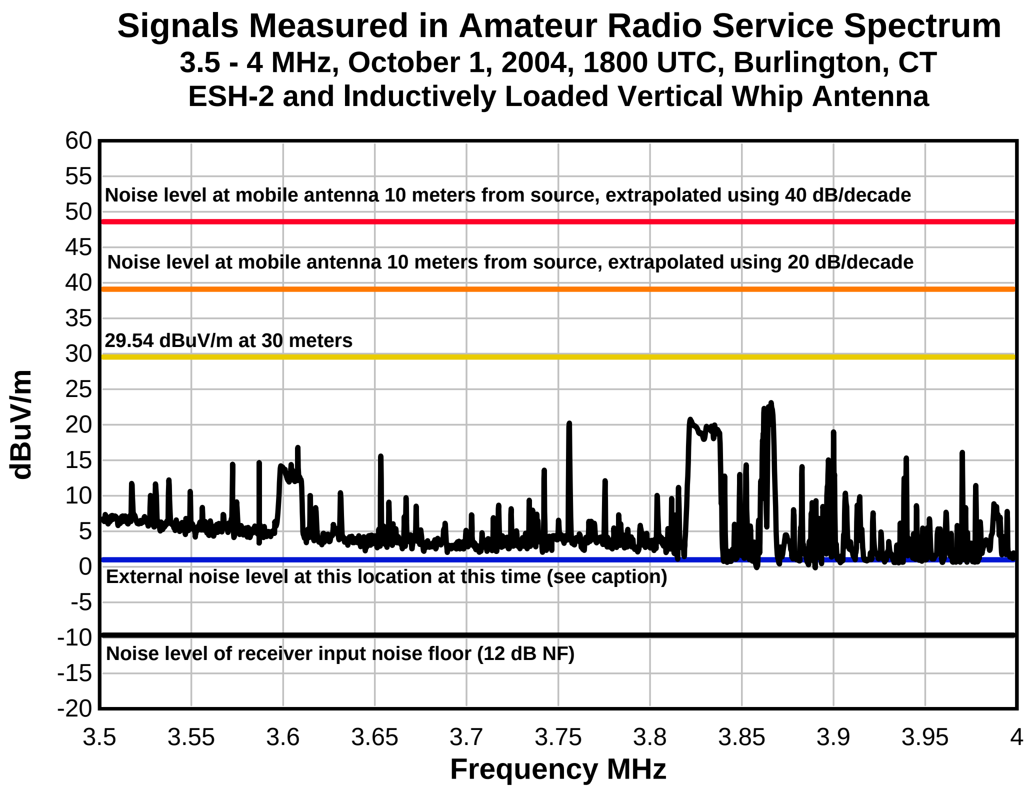

Figure 2 – These are the signals that were present on the 3.5-4 MHz amateur band on October 1, 2004 at 1800 UTC. The lower line shows the sensitivity that would result from the use of a typical communications receiver with a 12 dB noise figure. The noise figure of the Rohde and Schwarz EMC receiver is somewhat higher, so the noise levels shown above 0 dBuV/m are limited by the sensitivity of the test receiver, after being adjusted for antenna factor. The mobile antenna was adjusted to be resonant at 3.85 MHz, so the measured external noise starting at 3.8 MHz represents the actual external ambient noise level.

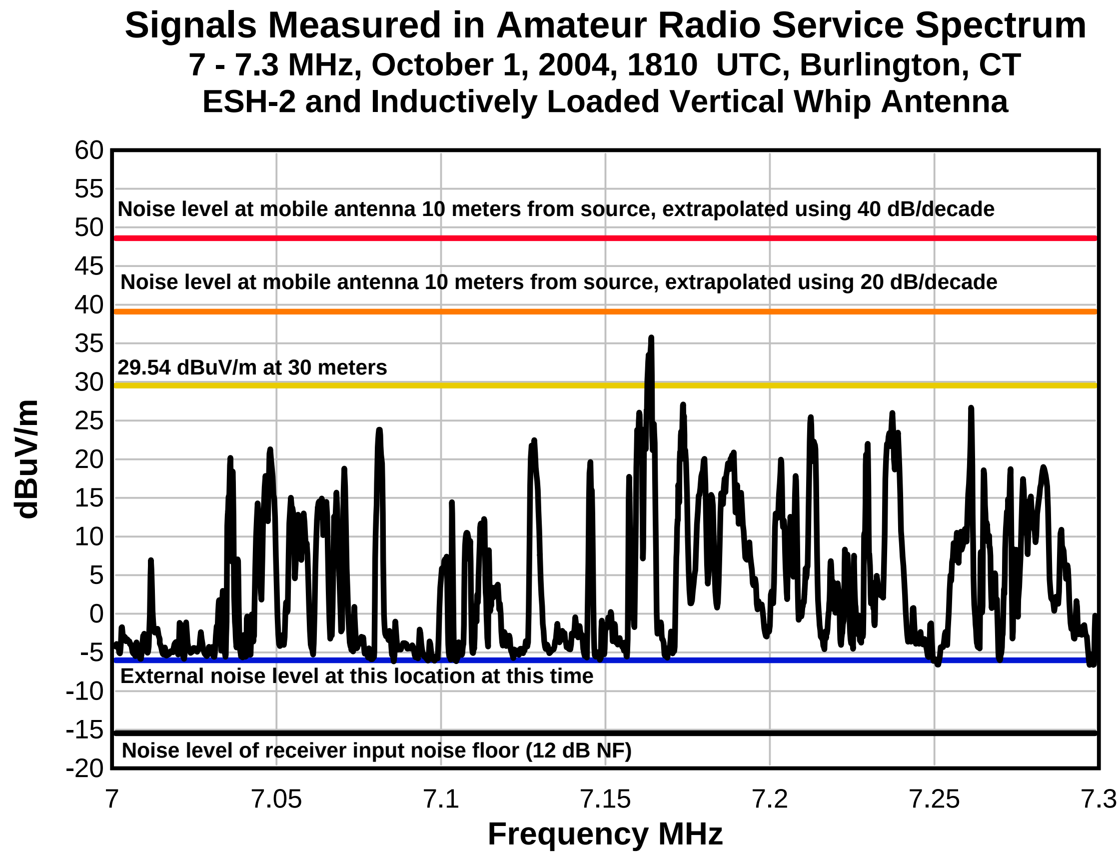

Figure 3 – These are the signals that were present on the 7-7.3 MHz amateur band on October 1, 2004 at 1810 UTC. The lower line shows the sensitivity that would result from the use of a typical communications receiver with a 12 dB noise figure. Some of the signals appearing above 7.1 MHZ are international shortwave broadcast stations.

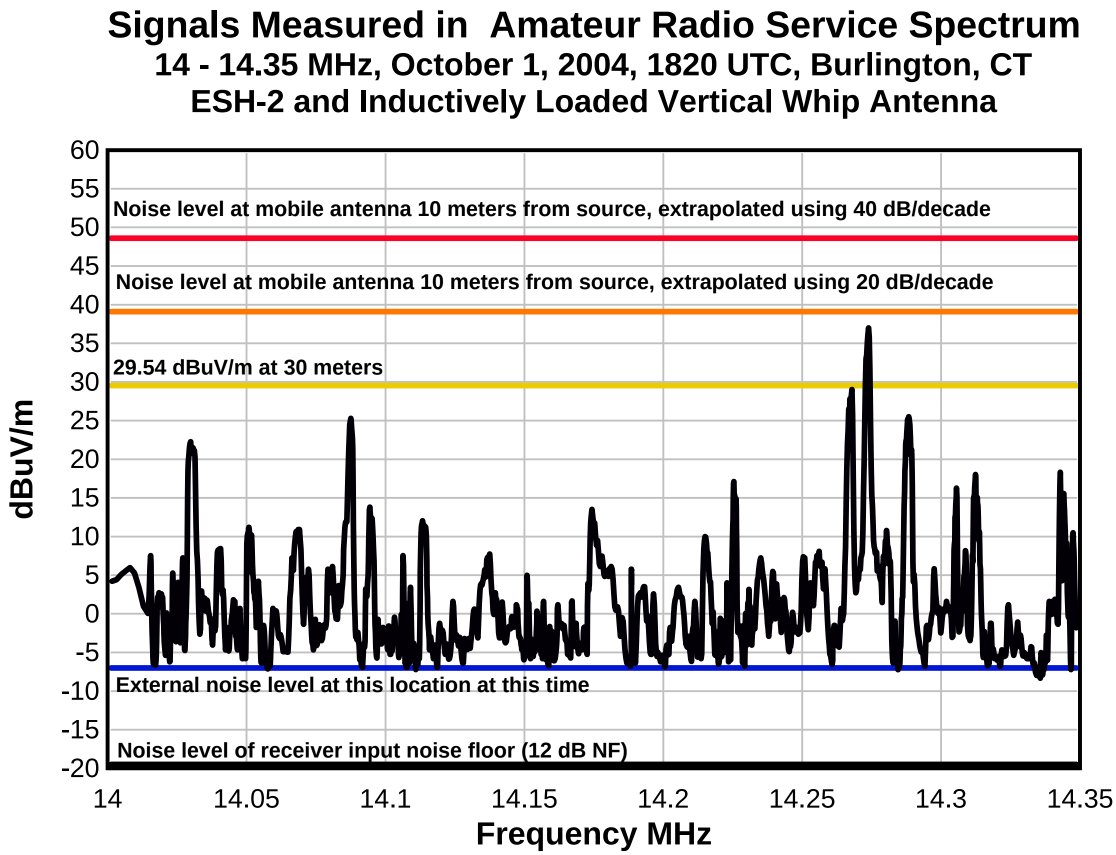

Figure 4 – These are the signals that were present on the 14-14.35 MHz amateur band on October 1, 2004 at 1820 UTC. The lower line shows the sensitivity that would result from the use of a typical communications receiver with a 12 dB noise figure.

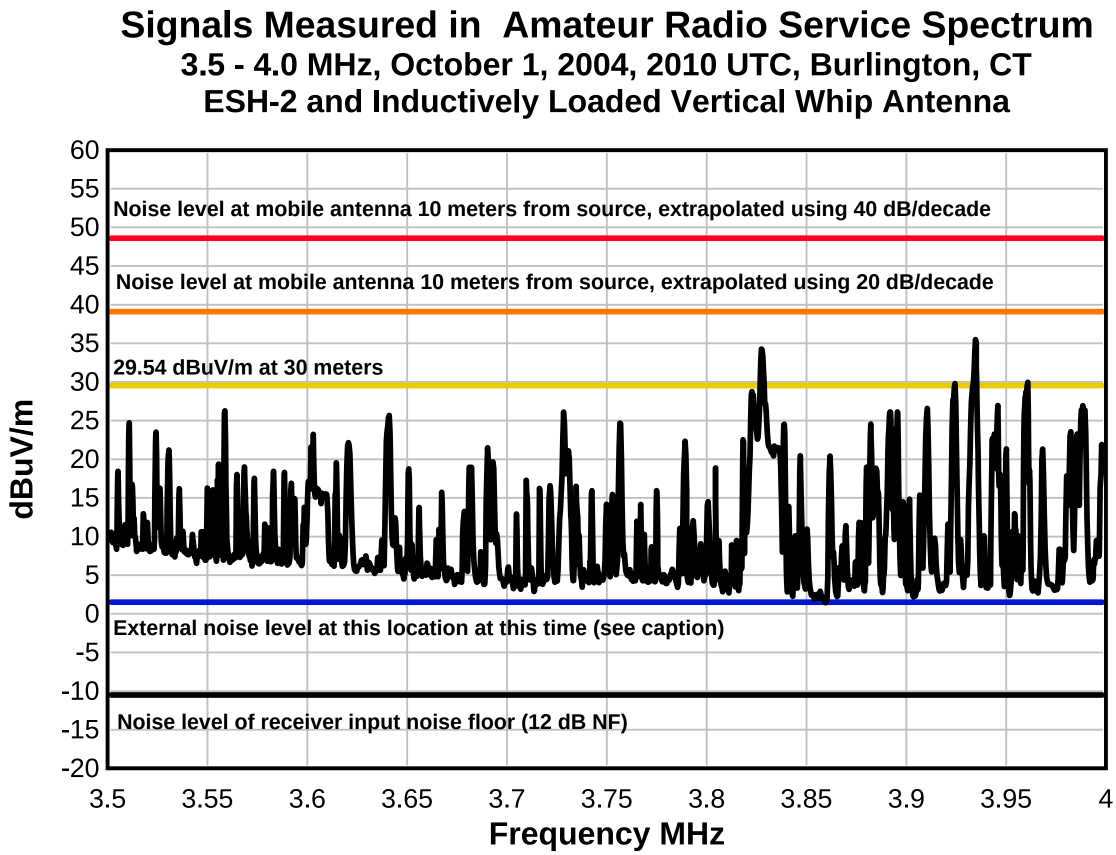

Figure 5 – These are the signals that were present on the 3.5-4 MHz amateur band on October 1, 2004 at 2010 UTC. The lower line shows the sensitivity that would result from the use of a typical communications receiver with a 12 dB noise figure. The noise figure of the Rohde and Schwarz EMC receiver is somewhat higher, so the noise levels shown above 0 dBuV/m are limited by the sensitivity of the test receiver, after being adjusted for antenna factor. The mobile antenna was adjusted to be resonant at 3.85 MHz, so the measured external noise starting at 3.8 MHz represents the actual external ambient noise level.

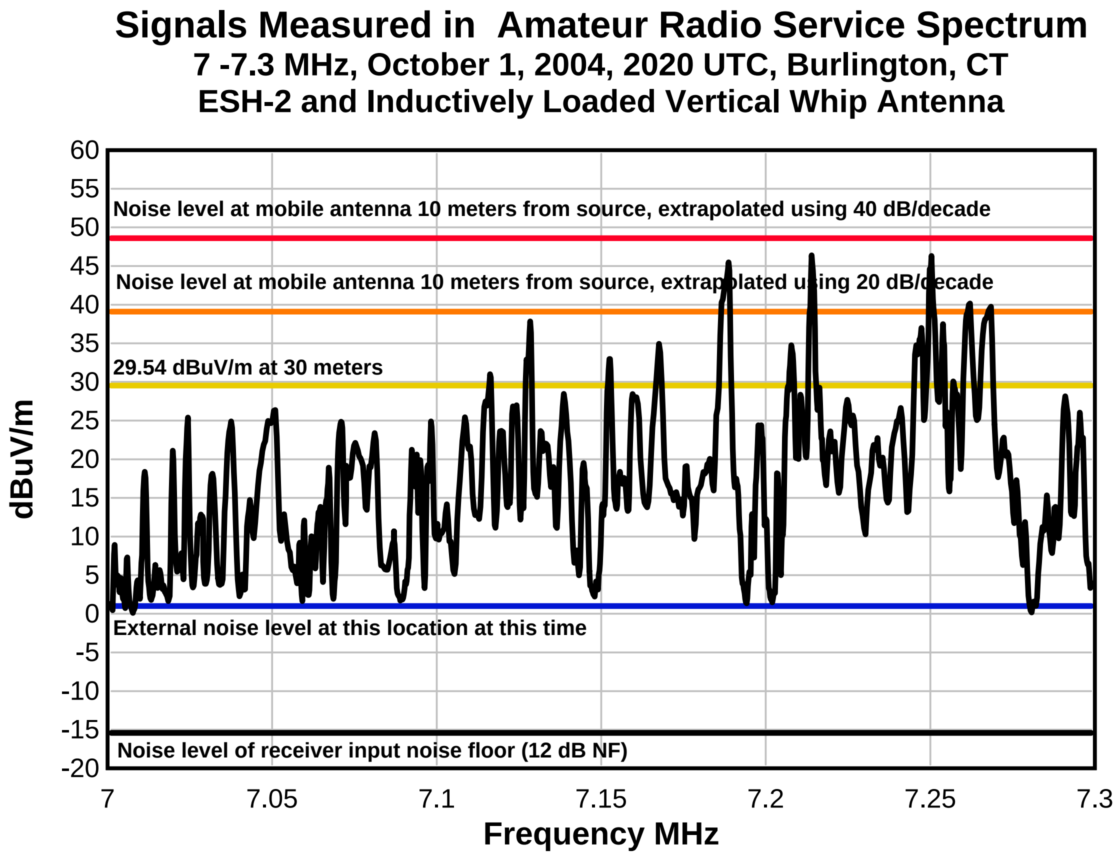

Figure 6 – These are the signals that were present on the 7-7.3 MHz amateur band on October 1, 2004 at 2020 UTC. The lower line shows the sensitivity that would result from the use of a typical communications receiver with a 12 dB noise figure. Some of the signals appearing above 7.1 MHZ are international shortwave broadcast stations.

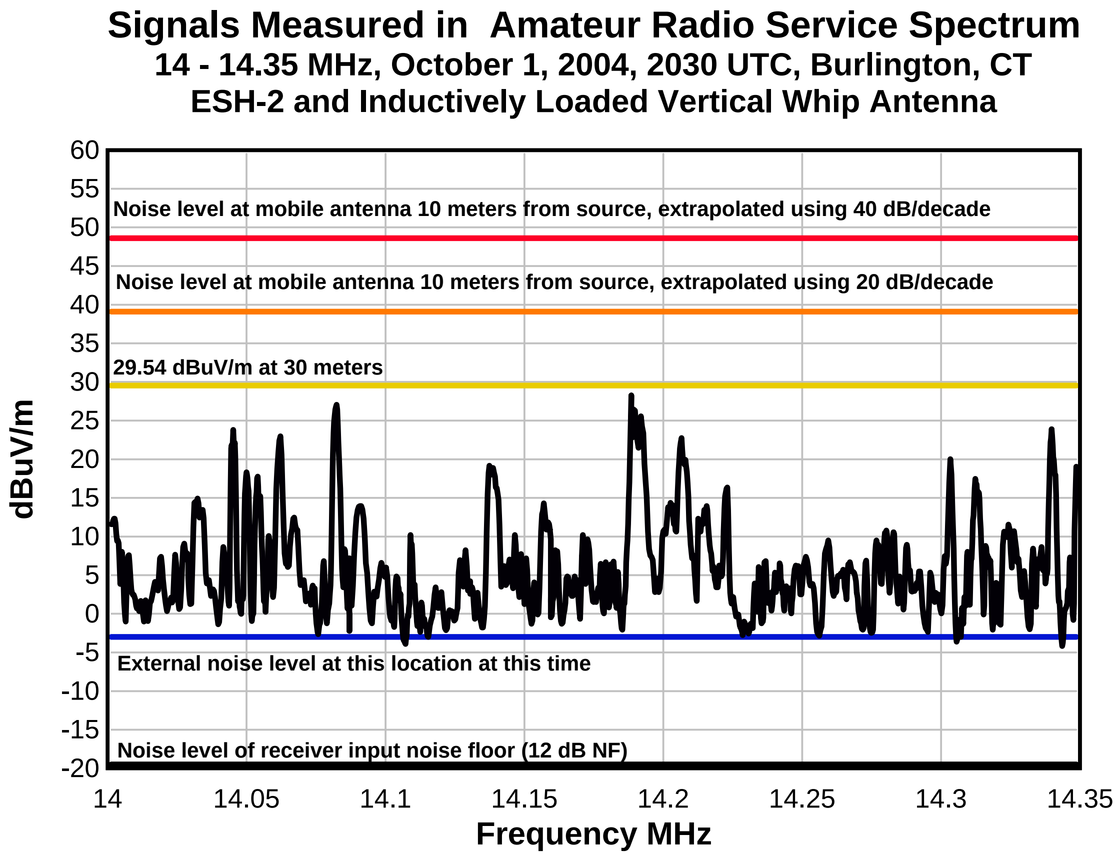

Figure 7 – These are the signals that were present on the 14-14.35 MHz amateur band on October 1, 2004 at 2030 UTC. The lower line shows the sensitivity that would result from the use of a typical communications receiver with a 12 dB noise figure.

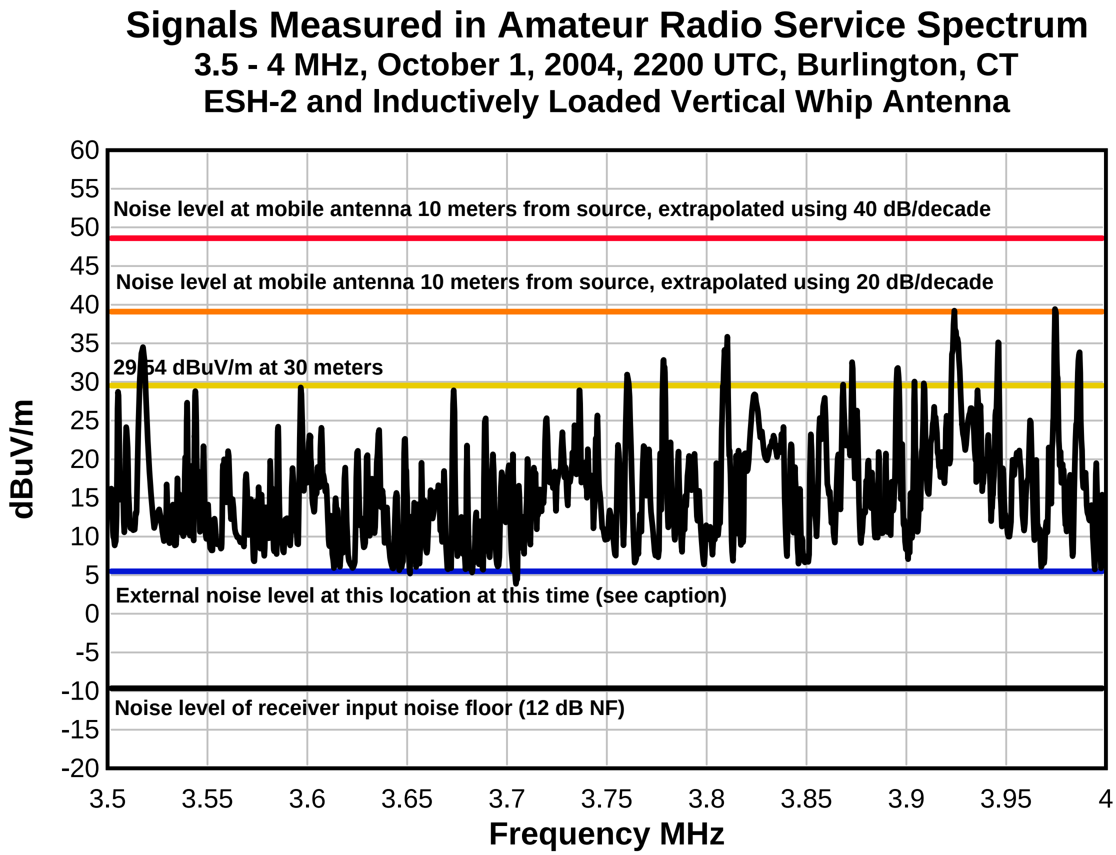

Figure 8 – These are the signals that were present on the 3.5-4 MHz amateur band on October 1, 2004 at 2200 UTC. The lower line shows the sensitivity that would result from the use of a typical communications receiver with a 12 dB noise figure. The measured signal and ambient noise level are greater than the sensitivity of the ESH2 receiver, so at this level, the ambient noise level is not limited by the receiver sensitivity.

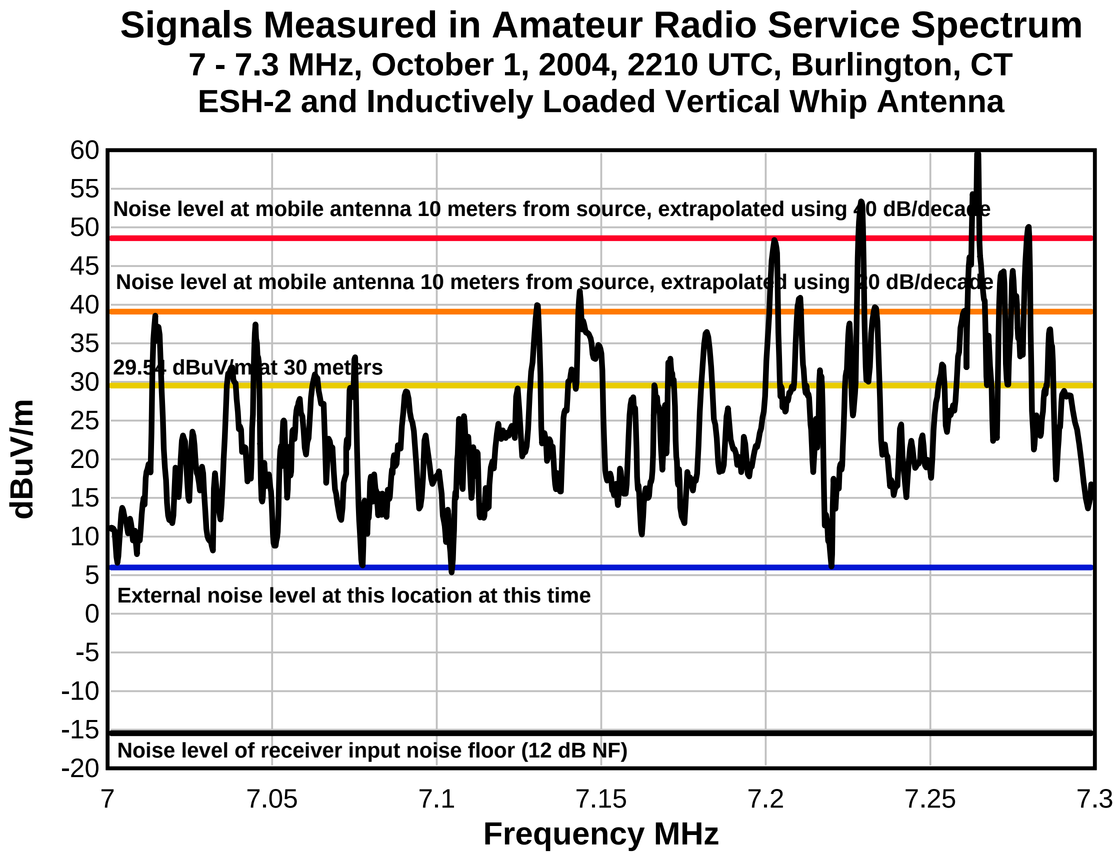

Figure 9 – These are the signals that were present on the 7-7.3 MHz amateur band on October 1, 2004 at 2210 UTC. The lower line shows the sensitivity that would result from the use of a typical communications receiver with a 12 dB noise figure. Virtually all of the signals appearing above 7.1 MHZ are international shortwave broadcast stations.

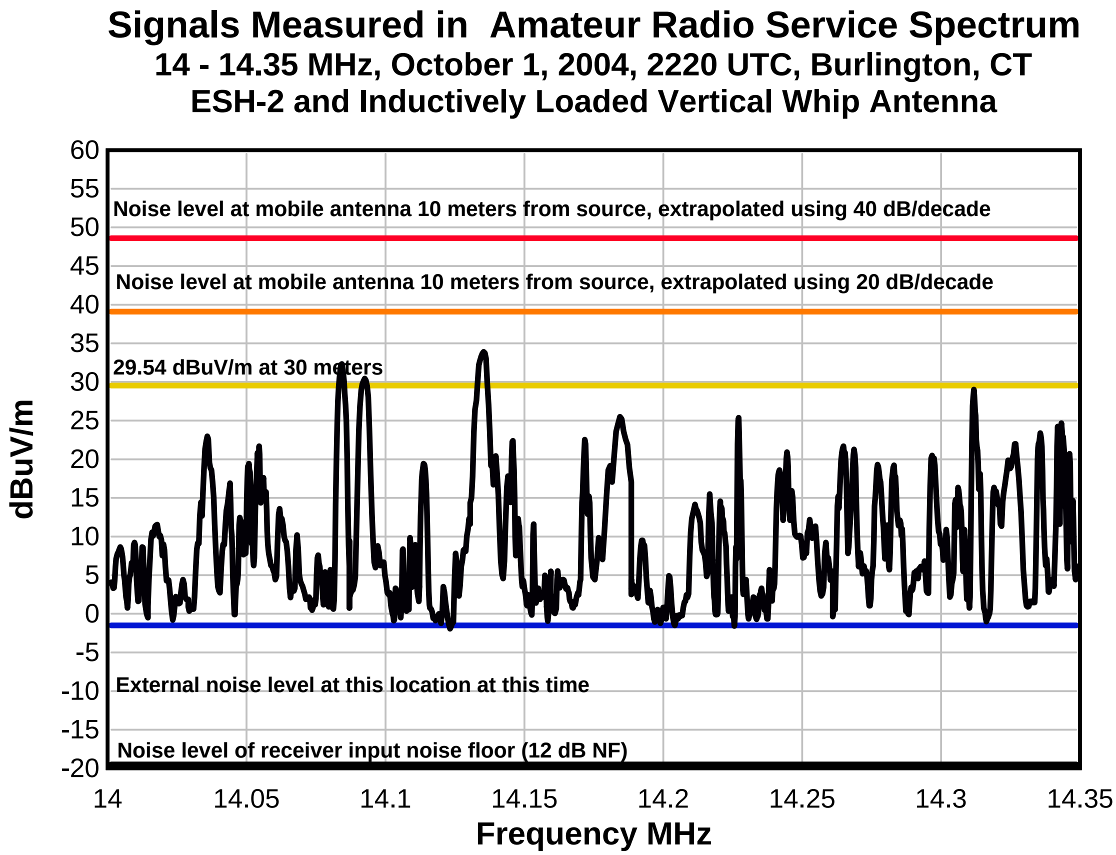

Figure 10 – These are the signals that were present on the 14-14.35 MHz amateur band on October 1, 2004 at 2220 UTC. The lower line shows the sensitivity that would result from the use of a typical communications receiver with a 12 dB noise figure.

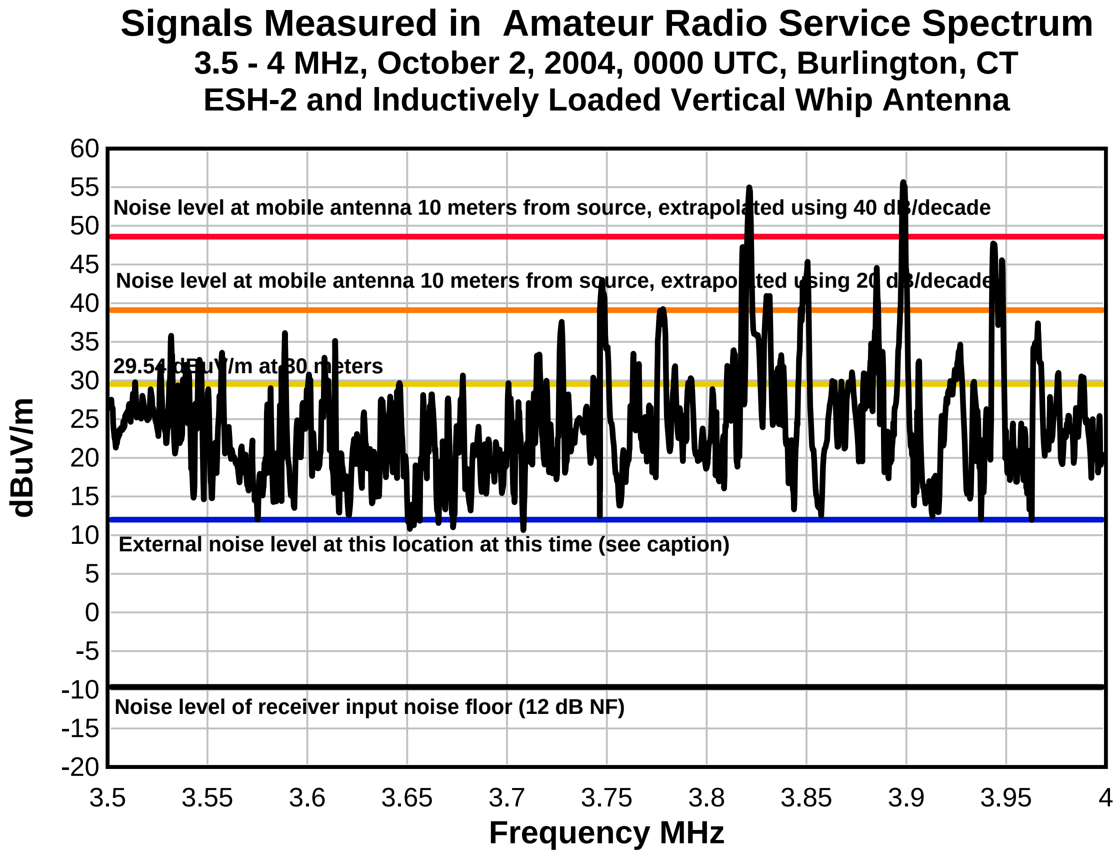

Figure 11 – These are the signals that were present on the 3.5-4 MHz amateur band on October 2, 2004 at 0000 UTC. The lower line shows the sensitivity that would result from the use of a typical communications receiver with a 12 dB noise figure. The measured signal and ambient noise level are greater than the sensitivity of the ESH2 receiver, so at this level, the ambient noise level is not limited by the receiver sensitivity.

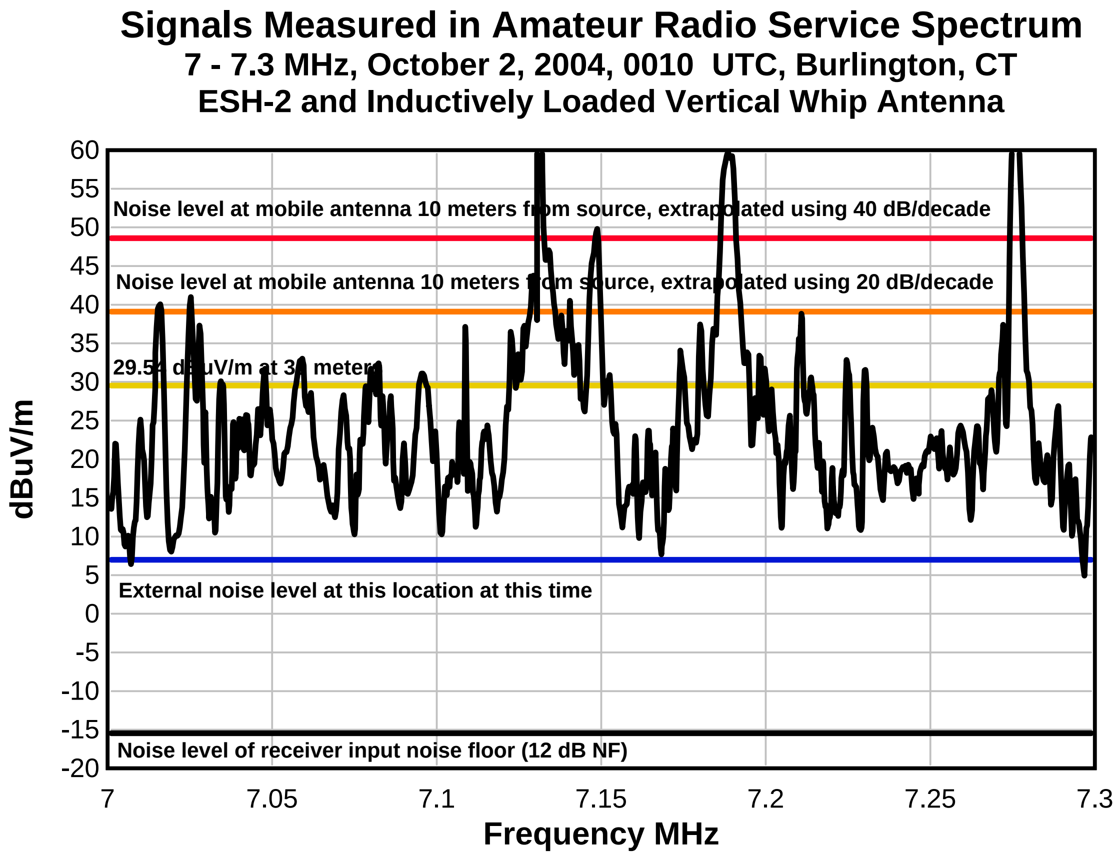

Figure 12 – These are the signals that were present on the 7-7.3 MHz amateur band on October 1, 2004 at 1810 UTC. The lower line shows the sensitivity that would result from the use of a typical communications receiver with a 12 dB noise figure. Some of the signals appearing above 7.1 MHZ are international shortwave broadcast stations.

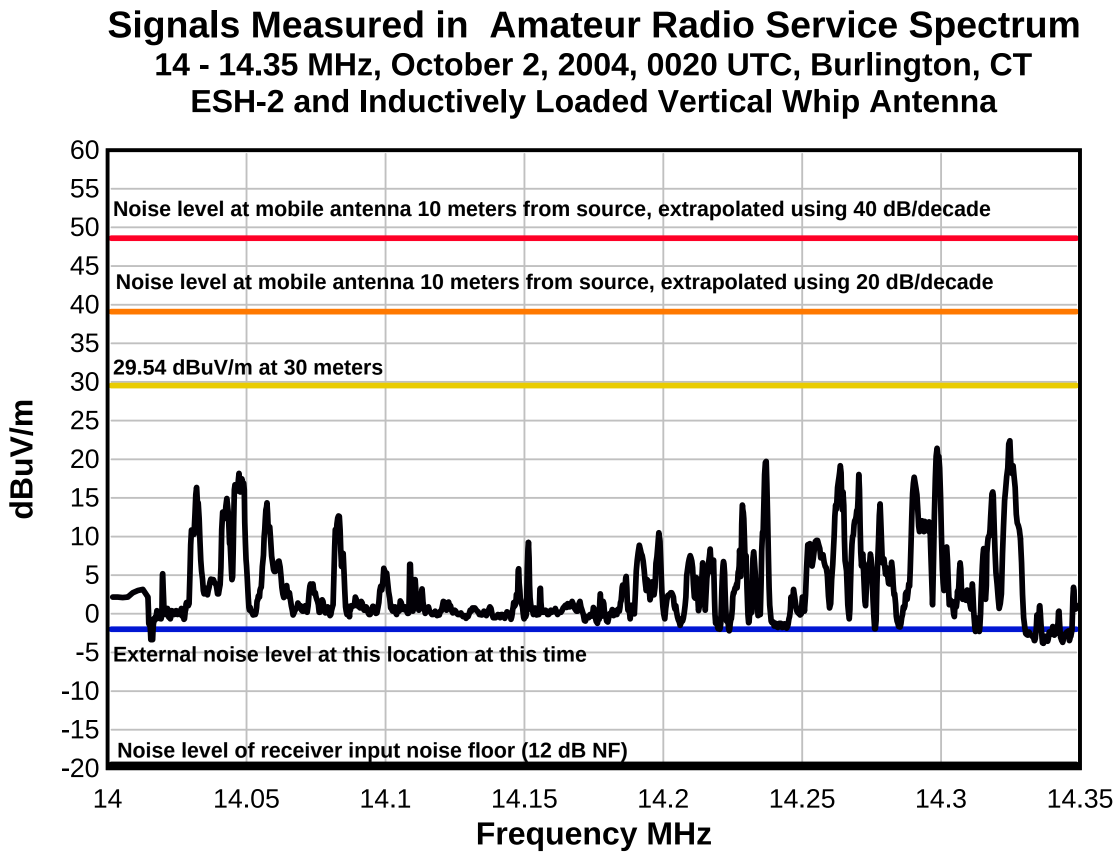

Figure 13 – These are the signals that were present on the 14-14.35 MHz amateur band on October 1, 2004 at 1820 UTC. The lower line shows the sensitivity that would result from the use of a typical communications receiver with a 12 dB noise figure.

Attachment A:

Solar Conditions for 2 October, 2004 through 3 October, 2004

http://www.sec.noaa.gov/ftpdir/forecasts/RSGA/1001RSGA.txt

Product: 1001RSGA.txt
Issued: 2004 Oct 01 2210 UTC
Prepared jointly by the U.S. Dept. of Commerce, NOAA,
#Space Environment Center and the U.S. Air Force.
#
Joint USAF/NOAA Report of Solar and Geophysical Activity
SDF Number 275 Issued at 2200Z on 01 Oct 2004
IA. Analysis of Solar Active Regions and Activity from 30/2100Z
to 01/2100Z: Solar activity was very low. No flares were observed.
IB. Solar Activity Forecast: Solar activity is expected to be very low.
IIA. Geophysical Activity Summary 30/2100Z to 01/2100Z:
The geomagnetic field was quiet.
IIB. Geophysical Activity Forecast: The geomagnetic field is
expected to be quiet to unsettled.
III. Event Probabilities 02 Oct-04 Oct
Class M 01/01/01
Class X 01/01/01
Proton 01/01/01
PCAF green
IV. Penticton 10.7 cm Flux
Observed 01 Oct 088
Predicted 02 Oct-04 Oct 090/095/095
90 Day Mean 01 Oct 111
V. Geomagnetic A Indices
Observed Afr/Ap 30 Sep 002/004
Estimated Afr/Ap 01 Oct 003/005
Predicted Afr/Ap 02 Oct-04 Oct 005/008-008/012-008/012
VI. Geomagnetic Activity Probabilities 02 Oct-04 Oct
A. Middle Latitudes
Active 15/15/15
Minor storm 05/05/05
Major-severe storm 01/01/01
B. High Latitudes
Active 25/25/25
Minor storm 15/15/15
Major-severe storm 05/05/05

http://www.sec.noaa.gov/ftpdir/forecasts/RSGA/1002RSGA.txt

Product: 1002RSGA.txt
:Issued: 2004 Oct 02 2210 UTC
Prepared jointly by the U.S. Dept. of Commerce, NOAA,
#Space Environment Center and the U.S. Air Force.
#
Joint USAF/NOAA Report of Solar and Geophysical Activity
SDF Number 276 Issued at 2200Z on 02 Oct 2004
IA. Analysis of Solar Active Regions and Activity from 01/2100Z to 02/2100Z: Solar activity was very low. Region 675 (S09W19), a small H-type sunspot group, produced a few B-class x-ray flares.
IB. Solar Activity Forecast: Solar activity is expected to be very low.
IIA. Geophysical Activity Summary 01/2100Z to 02/2100Z:
The geomagnetic field ranged from quiet to active.
IIB. Geophysical Activity Forecast: The geomagnetic field is expected to be quiet to unsettled with the chance of isolated active periods.
III. Event Probabilities 03 Oct-05 Oct
Class M 01/01/01
Class X 01/01/01
Proton 01/01/01
PCAF green
IV. Penticton 10.7 cm Flux
Observed 02 Oct 088
Predicted 03 Oct-05 Oct 090/095/095
90 Day Mean 02 Oct 111
V. Geomagnetic A Indices
Observed Afr/Ap 01 Oct 002/004
Estimated Afr/Ap 02 Oct 008/015
Predicted Afr/Ap 03 Oct-05 Oct 008/012-008/012-005/008
VI. Geomagnetic Activity Probabilities 03 Oct-05 Oct
A. Middle Latitudes
Active 15/15/15
Minor storm 05/05/05
Major-severe storm 01/01/01
B. High Latitudes
Active 20/20/20
Minor storm 10/10/10
Major-severe storm 05/05/05