EXHIBIT B

Inadequacies in the Reporting of Test Results from the BPL System Measurements Made in Brazil

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Abstract

An undated report on testing of a BPL system in Brazil was cited with approval by the FCC in the ET-04-37 proceeding regarding Broadband over Power Line (BPL) systems. FCC suggests that this study demonstrates a 40 dB/decade signal decay rate with distance from power line. Although this is the conclusion of the report, the report does not contain any reasonable description of the equipment used, the test methodology, the equipment tested or the test location. These are all items that are routinely included in measurement reports.

Test Conditions

Although the test report does contain some information on the test conditions, there are a number of important things omitted from the report. The report, for example, does not cite the test equipment used, model number and serial number, nor does it state that the equipment was in current calibration.

The report also omits any information about the BPL system being tested. The BPL manufacturer, model number(s), serial number(s) and type of BPL system are all omitted. It is not clear whether this system is being fed with a single coupler on the line, or differentially between two couplers. NTIA concluded in its Phase II report that there was a considerable difference in measurements and the nature of emissions between systems fed with one coupler and systems in which two phases were fed differentially.

The report does not indicate how the BPL signal was coupled onto the power lines. It does not say whether the BPL coupler was capacitive or inductive. These omissions are poor test-engineering practice, but more seriously, the omission makes it difficult to evaluate the accuracy of the report. As one example, the report indicates that measurements were made in the peak mode, and that a correlation of 4 dB between peak and quasi-peak was established. In most cases reported in other studies, however, the ratio between peak and quasi-peak is more than 4 dB, although it is possible that for some BPL systems, the signal could be such that a 4 dB ratio is possible. Without any information about the nature of the BPL system included in the report, it is not possible to reach complete conclusions about the measurement techniques.

There is no information about the height of the power lines, or the spacing of the conductors. The location is not specified. Municipality, date and time of day of the tests are not described.

The location chosen for this testing is atypical of most BPL systems. If one looks at the photograph in the report showing the test antenna *in-situ*, it is readily observed that the ground slopes upward from the radiating power line, serving to some degree as a scatterer, confounding any results. The measurements of emissions levels and extrapolation measurements, if made at the point shown in that picture, are suspect. If the purpose of the testing was to show typical performance of a BPL system, the test engineers should have selected a typical site.

The report did not explicitly state the height of the measurement antenna. This can be inferred from the photo shown as being approximately 1 meter in height, but a well-documented, reliable report would have explicitly stated all of the test conditions.

As seen in the discussion of the atypical finding that the BPL system radiated emissions measured decreased significantly in level along the line, the probable atypical nature of the test site is significant and readily apparent.

Emissions levels

There is a section in the document that discusses the emission levels results in Figure 3. It states: "*Figure 3 shows that when the equipment is set at maximum injected power, the electric field is far above the FCC quasi-peak and ITU-T K60 peak limits. Distance correction was applied to the FCC limit value according to the extrapolation factor adopted in FCC rules. When scanning the spectrum with and without the presence of PLT, it can be noted that the PLT signal interferes in the existing services. However, there is a considerable reduction in the radiated power when moving down the line from the injection point."*

There are three points of significance in this single paragraph. First, it notes that at its maximum levels, the system was "far above" FCC quasi-peak limits. That alone makes the system suspect. At these strong levels, without a good description of the test equipment used and how it was used (i.e., what settings were used for internal and external attenuation), there is no way to know that the test equipment was being used within its capabilities and not subject to overload. If the measurement instrument were a spectrum analyzer, for example, CISPR and other standards caution against the possibility of easily overloading spectrum analyzers in making measurements, especially in open-field test site and in-situ situations.

The most telling statement in this paragraph, however, is the conclusion that "there is a considerable reduction in the radiated power when moving down the line from the injection point." This is in stark contrast to the FCC's own findings of overhead-line BPL systems, where the FCC has concluded that BPL systems radiated for considerable distance along a power line. If the study's finding is that the line does not radiate along its length, that, too, strongly points to the possibility that this system is not typical, as it is clearly yielding atypical results.

In looking at Figure 3 in the report, it is not a correct conclusion that there is a "considerable reduction" in the radiated power down the line. The data show that on most of the spectrum in question, there is not a large difference between the signal levels at 0, 1/4, 1/2 and 1 wavelength along the line. On the upper part of the frequency range, the reduction from 0 wavelengths to 1 wavelength along the line is approximately 10 dB, but it would be hard to justify 10 dB as "considerable reduction," especially when the results are evaluated over the entire frequency range.

Distance extrapolation

The section of the report on "distance extrapolation" is also not well-documented. Although Figure 5 in the report shows the measured data, the report doesn't indicate whether these data are the result of a single measurement point, or of multiple measurements points at each of the distances along the line specified earlier in the document. It does not indicate what the orientation of the loop antenna was, nor does it indicate how the extrapolation measurement dealt with the three-axis measurement the report indicates was used for some of the testing. There is no indication that this measurement was taken at the point of maximum emission.

All of these significant omissions notwithstanding, in looking at the complexity of the EMC environment in an overhead power line environment, a single measurement of a single system is simply not adequate to draw any conclusions about extrapolation, except as one more data point to be used to compare this system against the ones measured by, for example, OFCOM in Creiff and Winchester, Scotland.

Three-Axis Measurement

In measuring emission levels, the test engineers did measure all three axes by rotating the test loop horizontally and vertically. The test method as described does not explain, however, how the resultant data were used and reported. The report doesn't say whether they reported the greatest of the three axes or whether they more correctly took the square root of the sum of the squares (root sum square, or RSS) of the measurements. The section on extrapolation does not state whether single-axis or three-axis measurements were made and used.

The results were also poorly reported. Although the graph shows a calculated 11.7 dB difference between 3 meters and 10 meters distance, the text describes that this equates well to 40 dB/decade. By working the numbers for the estimated FCC 40 dB/decade extrapolation backwards, one can determine that the height of the line must be 12.9 meters, if the measurement point were 1 meter off the ground. Although this is possible, the height, 42.3 feet, is somewhat higher than most overhead power lines. It is not possible to determine the actual height of the line from Figure 1 in the report. What is clear, however, is that if the lines are 12.9 meters off the ground, they are higher than typical for most United States installations.

With the complexity of the EMC environment near power lines, it is inappropriate to determine extrapolation from a single measurement point on a single measurement system. These extrapolation data need to be compared to other measurements and modeled results.

Notching

The section on notching does show that notching can reduce the noise level from BPL systems. The results of the notch-depth testing, however, shown in Figure 4, are suspect. The level reported as the minimum noise levels in the Figure 4 graph appears to be approximately 30 dBuV/m. The most common reason for measured levels this high is that the test instrumentation sensitivity is insufficient to measure down to the actual ambient noise level. The presence of stronger over-the-air radio signals can also make it appear as if the noise level is higher than it is if the resolution of the spectrum analyzer is insufficient to measure the quieter noise levels in between the stronger intentional signals. The level of 30 dBuV/m shown is tens of dB higher than the median level for man-made noise in a residential environment, as described in ITU-R P.372-8, "Radio Noise." Although the presence of notching is clearly shown in these test data, the effectiveness of the notch is not well established with respect to the median values of man-made noise.

Power Reduction

Although the study does show that the power from BPL systems can be reduced, it does not demonstrate whether the power reductions demonstrated had any negative impact on the BPL system performance. Reports reviewed by ARRL in the United States reveal generally that BPL systems that operate at less than robust power do not maintain reliability under conditions sometimes encountered on power lines. It is not possible to conclude that power-reduction is a viable technique without the concurrent testing of system reliability and performance.