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April 12, 2006

VIA ECFS
Ms. Marlene H. Dortch
Federal Communications Commission
Office of the Secretary
445 12th Street, SW
Washington, D.C. 20554

Re: *Ex Parte* Communications in ET Docket 04-186

Dear Ms. Dortch:

CEA is pleased to provide the attached report on field data that was collected to further the engineering analysis of issues related to the above-captioned docket. The study provides some insight into building attenuation, which is a critical factor in both interference potential and the ability of an unlicensed device to autonomously detect vacant TV channels. Higher building attenuation reduces the chance that an unlicensed device in one home interferes with a neighbor's home, but higher attenuation makes it more difficult for an unlicensed device inside a home to detect vacant channels.

The study also provides data on the difference in signal strength between a rooftop antenna that would typically be used for TV reception and an unlicensed device trying to detect that same signal inside a home. The data indicates that approximately 10-percent of test samples have a signal strength difference in the range 39 dB to 43 dB. Autonomous sensing will need to overcome this difference to reliably detect vacant channels.

The study is a relatively small sample considering the large installed base of TVs, geography, and home construction. CEA is hopeful that the experts working on techniques to avoid interference from unlicensed device operation in TV bands can use the study. We will make the raw data available for download by the public in two weeks.

This letter is being provided to your office in accordance with Section 1.1206 of the Federal Communications Commission rules.

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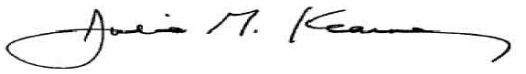
Respectfully submitted,



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A Report To

Consumer Electronics Association

Analysis of Field Test Data For Unlicensed Device Operation In the Television Bands

March 17, 2006

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Introduction:

The Federal Communications Commission (FCC) has issued a Notice of Proposed Rulemaking (NPRM) that proposes to allow the operation of unlicensed wireless devices within the frequency bands now utilized for television broadcasting. This has been proposed via an NPRM from the FCC in Docket ET 04-186.

Several concerns exist about this proposed operation. The possible *interference* to existing analog NTSC and digital ATSC receivers is a potential problem. Further, the permissible *power levels* for the unlicensed devices may cause tuner overload and other impairments to the existing and future base of receivers. And, the potential schemes of *selecting "vacant" television channels* are problematic, as they may not detect stations that are, in fact, occupying those channels. These are just a few of the many potential problems with the proposed operations.

The Consumer Electronics Association (CEA) contracted with the firm of Meintel, Sgrignoli, & Wallace to conduct some field tests related to the proposed operation of unlicensed device operation in the TV bands. This testing was conducted during December, 2004. In order to complete its investigation into specific areas of concern, CEA requested additional data analysis work and reports utilizing this data. This report provides that further analysis to make it easier for the industry to use the field data that is being made available.

Ten field locations were visited between December 1, 2004 and December 17, 2004. All of these were in the greater Washington DC metropolitan area (including sites in both Virginia and Maryland). The structures were one- or two-story buildings that were either frame or brick construction. Both new and old buildings were part of this field test. The tests involved using an Agilent 89600 Series Vector Signal Analyzer (VSA) to make spectrum measurements in various areas for each test location. The spectrum measurements were conducted to determine the received signal levels for a pair of DTV channels, as well as for spectral emissions from various devices in the homes tested. The setup involved using a calibrated dipole antenna connected to the VSA via a low-loss coaxial cable to make the prescribed measurements.

Using the VSA, field strength data was gathered on two different adjacent RF channels (CH 39 and CH 40). The pair of adjacent channels was chosen for the test because the channel 39 station was within close proximity to the measurement locations, but the channel 40 station was located some distance away, but still within the 41dBµV/m contour of the the station. This allows a scenario where a strong adjacent channel exists, but does not preclude reception of the weaker channel 40 signal using an outdoor antenna. Sensing the presence of the weaker channel 40 signal is critical and difficult in this scenario due to the strong channel 39 signal. Measurements of the signal level (field strength) were made outside the structure at 30' Above Ground Level (AGL) and 6' AGL, as well as inside the structure at 6' AGL. In all but one of the homes, the indoor

data was collected in four (4) different rooms on the first floor (about 6' AGL) within the house, as well as just outside these particular rooms (also at 6' AGL). The purpose of doing this was threefold. **First**, the measured field strength at 30' AGL determines normal *rooftop antenna* reception (as predicted by the FCC curves). **Secondly**, the outdoor 6'AGL level just outside each of the tested rooms determines variation in signal strength due to the height difference (compared to 30'AGL). **Finally**, indoor measurement in each of the tested rooms determines not only the received signal strength that an "omni-directional" antenna on an unlicensed wireless device might provide, but also determines the building penetration loss.

For an unlicensed wireless device to determine the presence of an existing broadcast DTV channel, it must receive the DTV signal by whatever means it has available to it. That is, it must receive the signal in the location that the user has placed it, with whatever self-contained small omni-directional antenna it has, and in whatever interference condition that exists at that location. Of course, when the unlicensed wireless device transmits its own signal, there is the possibility of interference into a co-channel DTV signal should it not be able to *properly* detect the presence of a co-channel DTV signal or with an adjacent channel DTV signal (tuner overload or desensitization). Making matters worse, successful DTV reception of a weak (but still adequate) ATSC signal using an outdoor antenna at 30'AGL in the same or a nearby house may be possible, but sensing the presence of a DTV signal inside the house on the first floor with an omni-directional indoor antenna may not be feasible. In this case, the unlicensed device would then incorrectly select this particular channel on which to transmit its data and possibly interfere with DTV receivers.

Data Analysis:

Upon analyzing the 10 test site locations, the statistics for the field strengths at the various locations and heights were determined. The calculated results are shown in **Table 1** and **Table 2** for both CH 39 and CH 40. Since the two RF channels tested are adjacent, similar results might be expected, although differences can certainly exist since signals were transmitted from different transmitter locations. Nevertheless, data from the 10 visited homes provided data from a total of 76 "mini-sites" (38 measurements times 2 channels).

Channel	CH 39			CH 40			
Parameter	**Outdoor 30' AGL**	**Outdoor 6' AGL**	**Indoor 6' AGL**	**Outdoor 30' AGL**	**Outdoor 6' AGL**	**Indoor 6' AGL**	**Units**
Minimum Field Strength	59.3	53.2	34.8	43.9	41.3	25.7	dBuV/m
Maximum Field Strength	93.9	99.0	94.4	79.7	73.2	68.6	dBuV/m
Average Field Strength	74.1	70.2	59.1	63.4	58.1	47.7	dBuV/m
Median Field Strength	76.7	68.1	58.5	66.8	58.9	51.3	dBuV/m
Standard Deviation	9.7	12.5	13.6	11.5	9.4	12.7	dBuV/m

Table 1 Summary of field strength statistics for 10 sites (38 locations).

Channel	CH 39			CH 40			
Parameter	**30' to 6' Height Attenuation**	**Building Penetration Attenuation**	**Total Attenuation**	**30' to 6' Height Attenuation**	**Building Penetration Attenuation**	**Total Attenuation**	**Units**
Minimum	-17.0	-4.2	-3.2	-12.7	-4.0	-1.9	dB
Maximum	21.8	51.2	42.3	22.4	46.2	41.1	dB
Average	3.9	11.0	14.9	5.3	10.3	15.7	dB
Median	6.6	6.6	14.9	5.5	7.3	14.8	dB
STD Deviation	10.8	14.6	11.4	8.4	12.7	10.8	dB

Table 2 Summary of attenuation statistics for 10 sites (38 locations).

Note the large possible range in field strengths, as well as total attenuation values describing outdoor field strengths at 30' AGL and first-floor indoor field strengths at about 6' AGL. The maximum values for total attenuation can be very large over 40 dB (18 out of 76, i.e., almost 25% of the mini-sites, had > 20 dB of *total* attenuation). The median values for CH 39 and CH 40 were 14.9 dB and 14.8 dB, respectively. This means that the unlicensed wireless device could often have a *substantially* lower DTV signal at its antenna to detect than an outdoor roof-mounted antenna.

Also, the unlicensed wireless device will typically have a low-gain, omni-directional antenna while an outdoor antenna (especially farther away from the transmitter site) will have a high-gain, directional antenna, and perhaps even a low-noise preamplifier at its output. This means that the DTV receiver connected to the outdoor antenna will have a much better chance of getting an adequate signal for DTV reception.

Also, the fact that the room propagation dynamics can easily change with specific location in the room, placement of furniture, people walking around, etc. makes it more challenging for DTV identification by the unlicensed wireless device.

Interference from nearby adjacent DTV channels can also provide a challenge for proper detection of an existing DTV channel. With the rooftop outdoor antenna, there is an opportunity for some discrimination of non-co-located interfering DTV signals due to the directionality of the rooftop antenna but none with an omni-directional antenna that would be likely used in an unlicensed wireless device. While the specific geometry of the house, the placement of its windows, and the type of construction material used can help the situation (i.e., block interfering signals more than any DTV existing on the channel in question, the opposite can happen just as often making the situation worse. The unlicensed device would have no means of knowing when this situation would occur.

Worst-Case Site Analysis:

An analysis of the 10 worst test locations was undertaken to determine the attenuation factors that would need to be considered in order to protect the reception of DTV in the majority of circumstances. This analysis looked at those locations with the highest attenuation factor from the 30-foot outdoor field strength to the indoor 6-foot field strength. The chart below indicates those locations.

Channel #	Site #	Site Name	Attenuation
39	4	C-1	42.3
39	3	C-1	41.3
40	3	C-1	41.1
40	1	C-1	39.8
39	2	C-1	39.6
40	4	C-1	39.5
40	2	C-1	39.2
39	1	C-1	36.8
39	22	C-6	25.4
40	19	C-6	24.2

Attenuation Factors for worst-case locations

As can be seen by reviewing the above data, an attenuation factor of over 40dB in several cases would need to be taken into account. Even the lower attenuation of 24-36dB would be substantial.