Peer Review Panel Report

On

OET Report FCC/OET 07-TR-1005

Direct-Pickup Interference Tests of Three Consumer Digital Cable Television Receivers Available in 2005

Peer Reviewers:

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Background:

This report contains the peer review of OET Report FCC/OET 07-TR-1005, entitled "Direct-Pickup Interference Tests of Three Consumer Digital Cable Television Receivers Available in 2005." This study presents the results of *in situ* measurements of the interference susceptibility of three Digital Cable Ready (DCR) TV receivers to direct pickup interference when receiving digital cable service. The purpose of the study was to assess the vulnerability of a very small sample of digital cable ready TV receivers to direct pickup of undesired emissions within the channel width of a digital cable signal to which the TV was tuned. The study was undertaken to obtain some understanding of direct pickup interference susceptibility of such receivers within the limited time frame of the Commission's proceeding on unlicensed operation in the TV broadcast bands, ET Docket NO. 04-186.

Peer review of the report was performed as required under the OMD Information Improvement Act for influential scientific and engineering studies. The review panel was made up of five engineers, three from the Enforcement Bureau and two from the Wireless Telecommunications Bureau. The review panel analyzed and discussed various subject areas in the OET report, both independently and jointly. Specifically, as requested in the OET memo, the review panel addressed the following:

1. Whether the type of receivers chosen for the study was appropriate, given the limited scope of this test, and provides useful information in conjunction with other data submitted into the record to better understand the potential impact of direct-pickup interference to digital cable ready receivers available to consumers for reception of digital cable television signals;
2. Whether the scope of testing in terms of the direct pickup interference conditions examined with respect to digital cable signals was appropriate; and,
3. Whether the measurement methodologies used to examine the receivers' susceptibility to direct pickup of interference on digital cable channels were appropriate and the tests were properly conducted consistent with those methodologies.

The response of the review panel is presented below for each question shown above:

1) Whether the type of receivers chosen for the study was appropriate, given the limited scope of this test, and provides useful information in conjunction with other data submitted into the record to better understand the potential impact of direct-pickup interference to digital cable ready receivers available to consumers for reception of digital cable television signals.

The report, in the Executive Summary, acknowledges the limited scope of the test. The review panel generally feels that the sample of TVs chosen for the study, which included recent models from different manufacturers, was appropriate, given the test's limited scope. The TV samples tested were selected from among the DTV receivers that were used in a 2005 study by the Commission's laboratory of DTV reception performance. It would have been useful for the report to have given some indication of where the three models tested ranked in those tests (ideally, they would have represented the median range of tuner performance). The three TVs were 2005-model flat-panel LCD digital TVs of different brand names. All had the DCR logo,

indicating that they were "Digital Cable Ready." As such, all could accept a CableCARD™ to allow premium digital cable channels to be decrypted.

In the opinion of the review panel the televisions tested are representative of a limited study and cross-section of the digital televisions currently in use by consumers. The TVs are "Digital Cable Ready" and have the capability of accepting a CableCARD™ as would many TVs in use by consumers today. Thus, given that the tests were performed on newer models in a real-world environment, the panel feels that the tests was able to provide some indication of the interfering power levels at which current digital TV owners might detect direct pickup interference.

The review panel recognizes that there were time constraints, which prevented the acquisition and testing of newer TVs, but the panel believes that if there had been more time to conduct the test, it would have been beneficial to have tested newer TVs (i.e., 2006 and 2007 models could have contained improvements that might have made them less vulnerable to interference). The review panel also thinks that if more TVs could have been acquired, then it would have been beneficial if at least one or two of the TVs were plasmas (instead of only LCD TVs).

2) Whether the scope of testing in terms of the direct pickup interference conditions examined with respect to digital cable signals was appropriate.

Given the study's time limitations, the review panel believes that the scope of the testing was appropriate and yielded measurements of direct pickup interference levels that could interfere with cable signals in a real-world environment. The review panel also feels that the study can provide some insight into the mitigating factors that might affect direct pickup interference in that environment.

The tests were conducted on a single 256-quatdrature amplitude modulation (256-QAM) digital cable TV signal. The review panel generally agrees that testing a single unencrypted "clear QAM" channel provides interference measurements that can cause a cable customer to experience direct pick-up interference in some instances. However, the review panel feels if there had been more time to conduct the study, then a more complete picture of the affects of direct pickup interference on cable viewing could have been made by, for example, testing on multiple cable channels, on encrypted channels, and on high definition cable TV signals.

For these tests, the cable TV signal was adjusted to a signal level near the minimum level specified by the "Digital Cable Network Interface Standard" for the "input terminals of the first device located on the subscriber's premises." If there had been additional time for testing, the review panel thinks that conducting the tests at one or more higher signal levels would have provided a more complete picture of the susceptibility of DCR TVs to direct pick-up interference (e.g., TVs could have been tested at the median level prescribed by the standard, which might have provided a more typical measure of the direct pickup interference vulnerability of DCR TV receivers).

Measurements were performed at three test sites. One test site was outdoors, with no objects between the antenna and the TV. Two test sites included a wall between the antenna and the TV: in one case, an exterior wall of a single-family home, and in the other, the wall separating two adjacent townhouses. The review panel thinks that, given the limited time available for this study, the test sites were appropriate to represent a reasonable sample of the actual interference

situations that cable customers might experience. The tests were performed in complex multipath propagation environments that mirror actual environments where direct pickup interference would be experienced. However, the panel believes that if additional time is available in the future, measurements should be taken in an apartment/condo building – whose units (adjacent, above, and below) are likely to be separated by building materials different than those found in a townhouse or a single family house.

Although the sites were realistic, the review panel feels that more thorough information on the interference environment would be helpful in determining all of the mitigating factors that could affect the measurements. For example, at test site 2, the report could include information on the position of the large metallic garage door (up or down) and note the location of metal tools and a garage door opener since all of these items could affect the measurements. Also, because the report acknowledges that the presence of electrical wiring and the location of metal items in the walls can affect propagation, the review panel feels that it's important to provide a clear basis for the make-up of the walls. For example, the review panel thinks that verifying the location of items within the wall by use of a stud sensor that can detect metal or electrical wiring or some other method would be beneficial.

The report states that one element missing from the garage wall relative to the exterior residence wall was insulation. The reports maintains that *"Because the insulation in the residence walls was fiberglass with a clear plastic vapor barrier, it is not expected to contribute significantly to wall attenuation; consequently, the absence of insulation is not expected to influence the test results."* The review panel agrees that one would not normally expect insulation to be a factor, but insulation can be foil-backed rather than kraft-backed (paper). And so, in the opinion of the review panel, a better description of the wall construction, including insulation, sheathing, wiring, etc. would be useful, as well as a citation, if available, confirming that such materials will not attenuate signals. Ideally, in a larger study, actual testing of an insulated outside wall would be conducted to provide certainty regarding the affect of insulation on interference measurements.

In these tests, most measurements were performed with the interfering device located behind the TV receiver, but some measurements were performed with the interfering device located in front of the TV, and a few measurements were performed at other aspect angles and at various offsets with respect to the TV. The report indicates that the number of measurements was limited to keep the study at a manageable level. Considering the limited time that was available for this test, the review panel feels that the number aspect angles and offsets tested were sufficient, but in a larger study, the review panel thinks that it would be useful to measure at least eight different angles around the television to examine a greater number of possible spatial relationships, which might exist between an interfering source and a TV. Although the panel recognized the need to employ a plastic TV cart so as not to introduce extraneous RF reflections into the TV, the panel believes that in a larger study, tests could be done with the TV situated on carts made of different materials (carts are available to consumers today, which are made of various, different materials, including metal).

In general, the review panel feels that, given the limitations of this study, the scope of the study was appropriate to provide a basic understanding of the vulnerability of DCR TV receivers to direct pick-up interference and to determine if there are grounds for further study. To obtain a more complete picture of DCR TV receiver susceptibility to such interference, the panel believes that a larger study would be needed. Ideally, the scope of a larger test would include a larger number of measurements, with a larger number of TVs, at more aspect angles, distances and

antenna heights, and in various different types of buildings, with rooms containing different types of furnishings. The review panel thinks that by taking additional measurements on more TVs and in more environments, the variety of conditions that exist in the real world could be better explored. We suggest that if further testing and measurements take place, that the initial measurements be made on a test range or anechoic chamber, where multiple interference source angles and distances can be more fully explored.

3) Whether the measurement methodologies used to examine the receivers' susceptibility to direct pickup of interference on digital cable channels were appropriate and the tests were properly conducted consistent with those methodologies.

The review panel believes that the measurement methodologies used in the test were appropriate and that the tests were properly conducted consistent with those methodologies. However, the panel believes that in a more expansive test, where more time would be available to gather and analyze results, certain improvements could be made in the way that measurements were made and analyzed.

During the tests, sound from the TV receiver under test was monitored as a basis for identifying interference. The tests were performed by a single engineer who directly monitored the sound at sites 0 and 1. At site 2, the sound was monitored through a 2.4 GHz wireless phone operating in intercom mode. The interfering transmit signal level was increased in one-dB steps while monitoring the sound from the TV. If an audio dropout was observed, the sound was monitored for an additional period. If dropouts were found to last less than about 50 percent of the observation period, the interference level was increased another 1 dB until a sound dropout exceeding 50 percent was observed. At that point, the transmit level was measured.

The review panel has no reason to believe that the sound of an audio dropout will not be the same for all observers, and any concerns about a single observer's ability to distinguish a dropout are mitigated by the fact that apparently sound was present continuously during the monitoring period for one interfering signal step, but then dropped out completely on the next step. However, the review panel thinks that in a more extensive study, it would be beneficial to have multiple observers, with the results averaged.

Ideally, the test would also be structured to eliminate the need for observers to rely on a 2.4 GHz phone to hear the sound coming from the TV. In the opinion of the review panel, this secondary sound source could have potentially introduced audio noise, which could have affected the listener's ability to distinguish or determine a dropout.

The test employed a 4.8 MHz OFDM signal centered at the mid-point of Cable Channel 70, at 501 MHz, and measurements were made on the effect of this signal on TV channel 19, which extends from 500 to 506 MHz. The panel believes that in a more extensive study, interfering signals of both smaller and wider bandwidths could be employed to determine the effects of different-sized and partially and fully overlapping interfering signals.

The report indicates that a limited number of measurements were taken to keep testing to a manageable level so the study could be completed in a timely manner. However, because unexpected results can sometimes occur when measuring radio transmissions, the panel believes that in a more exhaustive study, more than one measurement should be taken for each condition

at each location. Finally, the reported interfering signal levels in the Executive Summary were the lowest interfering signal levels from among all those measured at 2 meters and 10 meters (i.e., 6.3 dBm for 2 meters and 15.3 dBm for 10 meters). In the opinion of the review panel, it might have more informative to indicate the median interfering signal level measured (perhaps along with standard deviation) in addition to the lowest measured, interfering signal level at each distance.