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FCC's Office of Engineering and Technology Releases Laboratory Report on Technical Testing of DTV Converter Boxes for Certification under NTIA's Coupon Program

The Federal Communications Commission's Office of Engineering and Technology has released a report on tests of digital-to-analog TV (DTV) converter boxes. The report, OET Report FCC/OET 09-TR-1003, entitled "DTV Converter Box Test Program -- Results and Lessons Learned" (DTV Converter Box Test Report), describes methodologies, results and lessons learned in over 50,000 individual engineering tests that were performed on 136 DTV converter boxes that were submitted for certification as "coupon eligible" by various manufacturers in the period August 2007 to January 2009 and on 17 converter box samples that were purchased from retail outlets through February 2009. The tests were completed in March 2009. Most of the tests were performed for the Department of Commerce's National Telecommunications and Information Administration (NTIA) and served as one step in the NTIA's approval process of converter boxes under the Government's TV Converter Box Coupon Program and were intended to ensure that all of the boxes certified as coupon eligible passed NTIA's conservative performance specifications before going on the market.

The DTV Converter Box Test Report, which follows in the tradition of previous reports on tests of television receiver performance by the FCC's Laboratory, is intended to inform engineers involved in designing DTV receivers, TV broadcasters, measurement technicians, standards developers and the technical community of engineering data on the performance of the converter boxes and of functional and performance issues that might apply to other DTV receiver products as well. Because information for this purpose is best described as statistical measures of performance, the results are presented without identifying brands or models of converter boxes. Consequently, the report does not provide information that would be meaningful to consumers for selecting a converter box. The testing evaluated a sample of each converter box submitted for certification to check for compliance with NTIA's technical standards for such devices. These standards address numerous aspects of radiofrequency performance and other functionalities. To provide additional information on certain other features that are of interest to the technical community, the testing also examined some attributes of the converter boxes that extend beyond the NTIA requirements.

The report indicates that 116 of the 136 converter box models tested by the FCC Laboratory eventually passed all tests to satisfy the NTIA requirements and were offered to the public as coupon-eligible converter boxes, though many required upgrades to software - and in some cases modifications to the hardware - before passing. (The NTIA's list of 191 approved

converter boxes includes minor variants of the 116 models that passed all required tests.) The report also identifies the initial failures of converter boxes to satisfy NTIA requirements and presents statistics on the RF performance of those that were ultimately approved. It further identifies potential issues for further consideration by DTV standards committees. Those issues include the potential need for add-on channel scan capability and more detailed specification of the requirements for handling future changes to the parental control system through a downloadable rating system.

The report shows that the approved converter boxes exhibited significant RF performance improvements in ability to receive weak signals on VHF channels, ability to reject interference from strong signals on other channels, and ability to process signals received in the presence of severe multipath (of particular importance in indoor reception locations) as compared to DTV receivers that were on the market in 2005 and 2006 (as tested by the FCC Laboratory and reported in 2005 and 2007). The areas in which initial failures to meet the NTIA standards occurred included parental controls (especially downloadable ratings capability), closed captioning, video modes, daylight savings time implementation and ability to reject potentially interfering signals on certain neighboring channels. In most cases, these failures were corrected by the manufacturer and the box was then re-tested for compliance.

Of the approved converter box models, 72 included an RF pass-through capability to allow reception of analog TV broadcasts on the connected television. The report indicates that those boxes exhibited no significant degradation in DTV reception sensitivity or interference rejection performance relative to non-pass-through boxes. The testing also found that the approved converter boxes consumed an average of 6.6 watts when operating and 0.8 watts in sleep mode. Because the tested units were supplied by the manufacturers as “production samples,” some of the tests were repeated on 17 “audit samples” that were purchased from store shelves. No statistically significant performance differences were found between the purchased samples and the corresponding samples the manufacturers provided to the certification program.

Finally, the FCC Laboratory’s test experience in previous programs and in the lead-up to and performance of the converter-box program yielded a number of lessons that are documented in the report and that may be of value to others performing such tests. The report states that those lessons include the need to use video containing motion in tests of video modes, the need for daylight savings time tests that extend beyond those of current test software, the impact of automatic-gain-control loops with memory in some receivers, and a methodology to assess the impact of unintended phase noise from DTV signal generators.

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