

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, DC 20554**

In the Matter of	)	
	)	
Unlicensed Operation in the TV Broadcast Bands	)	ET Docket No. 04-186
	)	
Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band	)	ET Docket No. 02-380
	)	

**REPLY COMMENTS OF MSTV AND NAB  
TO THE OET MEASUREMENT REPORT ON  
DTV RECEIVER INTERFERENCE REJECTION CAPABILITIES**

May 15, 2007

## SUMMARY

The Commission's recent interference testing, and the comments submitted in response to the OET Report on interference rejection thresholds, confirm that adequate protections must be put into place before *any* TV band device is allowed to operate in the television spectrum. The Report demonstrates the need for the Commission to exercise caution and establish baseline protections in order to prevent interference to television services.

The record also confirms that the Commission must account for the fact that:

(1) DTV receivers are at their most vulnerable to interference when operating at low desired signal levels and that *84 percent* of the coverage area of a broadcast station may experience such signal levels; (2) interfering signals from multiple devices can be significantly more severe than a single interfering signal; and (3) there is wide variance of DTV interference rejection performance among DTV receivers.

In fact, the data from the FCC Report clearly shows that a 100 mW transmitter operating on the first adjacent channel could cause interference to DTV viewers in 80 to 87% of a TV station's service area depending on which of the Commission's tested DTV receivers is used. The situation actually worsens if one includes DTV receivers tested by CRC and the University of Kansas, as these studies found that interference could be caused to viewers in more than 95% of a TV station's area. This data, demonstrating that TV band devices would create interference to DTV viewers in *at least* 80% of the service area, clearly does not corroborate the feasibility of personal/portable devices.

Therefore, in order to address the concerns discussed in the Report, at a minimum, the Commission must: (1) prohibit TV band devices from operating on a co- or adjacent channel; (2) establish proper D/U ratios; and (3) prohibit all personal/portable devices from operating

within the spectrum. Without these protections, television viewers will experience harmful interference which will severely and unacceptably disrupt DTV services.

While the Device Coalition attempts to use the Commission's Report to support its position that harmful interference will not occur, it fails to cite to any data or findings within the Report. At no point throughout this process has the Device Coalition presented the Commission with any research to counter the studies submitted by MSTV and NAB, and now the Commission, proving that harmful interference will occur. Further, while the Device Coalition claims to have submitted prototype devices for testing, these devices are not representative of the TV band devices which would be introduced into the market. Consequently, these devices cannot form a basis upon which to craft rules capable of protecting the public's television service from the *actual* devices intended for the TV band.

The stakes in this proceeding are particularly high as the country is undergoing an expensive and important transition to DTV technology. It is integral that the Commission protect the billions of dollars invested in this transition.

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The comments submitted in response to the Commission’s Office of Engineering and Technology (“OET”) and its Laboratory Division’s testing<sup>1</sup> clearly demonstrate the need for the Commission to exercise caution and establish baseline protections in order to prevent interference to television services. The record confirms that the Commission must account for: the fact that (1) “weak” DTV signals are more vulnerable to interference and such weak DTV signal conditions can occur throughout the vast majority of a television station’s service area; (2) interfering signals from multiple devices can be significantly more severe than a single interfering signal; and (3) there is wide variance of DTV interference rejection performance among DTV receivers. As a result of these findings, the Association for Maximum Service Television, Inc. (“MSTV”)<sup>2</sup>, the National Association of Broadcasters (“NAB”)<sup>3</sup>, and others

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<sup>1</sup> See *Office of Engineering and Technology Report: Interference Rejection Thresholds of Consumer Digital Television Receivers Available in 2005 and 2006*, OET Report, FCC/OET 07-TR-1003 (March 30, 2007) (“FCC Report”).

<sup>2</sup> MSTV is a non-profit trade association of local broadcast television stations committed to achieving and maintaining the highest technical quality for the local broadcast system.

have explained that the Commission must develop appropriate D/U ratios and prohibit co- and adjacent channel TV band devices from operating within a station's protected contour through implementation of a geolocation method. Further, because of increased interference concerns, personal/portable devices must not be allowed to operate within the spectrum.

While Dell, Google, et al. ("the Device Coalition"), attempt to ignore the Commission's findings and assert that interference will not occur, the Device Coalition fails to examine the actual evidence and data from the Report. The Commission must continue to conduct testing and ensure that all TV band devices it authorizes to operate in the band comport with rules established to provide adequate protection to digital television ("DTV") services.

**I. THE RECORD SUPPORTS MSTV & NAB'S POSITION THAT BASELINE PROTECTIONS MUST BE ADOPTED BEFORE TV BAND DEVICES ARE ALLOWED TO OPERATE.**

As MSTV and NAB have long maintained, the Commission must adopt a series of protections to guard against interference to existing television operations in the band; the Report, as well as the comments submitted in response, demonstrate the high susceptibility of TV receivers to interference from TV band devices and the need for measures to protect against such interference. While the potential for interference to television services has been a prime concern throughout this proceeding, the Commission's recent finding that "DTV receivers are at their most vulnerable [to interference] when operating at low desired signal levels" and that "fully 84 percent of the coverage area of a broadcast station" may experience such signal levels,<sup>4</sup> underscores the absolute necessity of adopting appropriate interference avoidance protections. For example, as Shure notes in its comments, the Report results "clearly lead to the conclusion

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<sup>3</sup> NAB is a nonprofit trade association that advocates on behalf of more than 8,300 free, local radio and television stations and also broadcast networks before Congress, the Federal Communications Commission and other federal agencies, and the Courts.

<sup>4</sup> See FCC Report at xi (emphasis added).

that effective interference protections must be developed, tested and securely in place *before* unlicensed devices are allowed to be introduced into the TV frequencies.”<sup>5</sup> Similarly, the National Cable and Telecommunications Association (“NCTA”) explains that the Report’s finding that there is a “high probability of both near-field interference to television receivers and fringe-area headend reception interference,” compels the Commission to adopt “appropriate technical and operational rules.”<sup>6</sup>

As the Report makes clear, in developing rules to protect television services, the Commission must not only account for the presence of “weak” signals throughout a large portion of the service area, but it must also create rules that address the effects of multiple interfering signals from TV band devices and the high degree of variability in interference performance among consumers’ television sets. Consequently, the Commission must ensure that TV band devices operate outside the protected contour of both co- and adjacent channels and at D/U ratios which factor in “weak” television signals and multiple interfering devices. As spectrum sensing is ineffective to determine the location of a TV band device, geolocation will be necessary in order to ensure that devices are in fact outside of the contour.

Furthermore, because of the increased interference potential posed by personal/portable devices, the Commission must not allow them to operate. As Shure summarized in its comments, “introduction of new unlicensed devices in the TV frequencies, especially mobile (personal/portable) devices, is potentially very problematic.”<sup>7</sup> NCTA noted that the Report “documented that TV receivers are highly susceptible to interference from signals

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<sup>5</sup> Comments of Shure Incorporated, ET Docket No. 04-186 (filed Apr. 30, 2007) (Shure Comments) at 5.

<sup>6</sup> Comments of National Cable and Telecommunications Association, ET Docket No. 04-186 (filed Apr. 30, 2007) (NCTA Comments) at 3.

<sup>7</sup> Shure Comments at 2.

emanating from devices in close proximity” to television receivers.<sup>8</sup> As personal/portable devices would be able to operate at any location, and likely locations very near TV receivers, it will be impossible to avoid potential interference. In addition, allowing personal/portable devices will increase the detrimental effects of multiple signals seen in the Report. For these reasons, personal/portable devices must be prohibited.

It is important to note that the Commission’s testing likely underestimated the actual effects of interference as it did not factor in the effects of out-of-band emissions. MSTV and NAB have encouraged the Commission to factor in such emissions into its analysis. Shure also urged the Commission to “evaluate the potential interference from out-of-band emissions in its planned testing of proposed interference protection measures of unlicensed TV band devices.”<sup>9</sup> This testing is necessary to fully appreciate the effects of TV band devices on existing services in the television spectrum and create effective interference avoidance mechanisms.

**II. THE DEVICE COALITION, WHILE STRONGLY ADVOCATING FOR THE USE OF TV BAND DEVICES, HAS FAILED TO CITE TO ANY EVIDENCE THAT THESE DEVICES WILL NOT CAUSE HARMFUL INTERFERENCE TO DTV SERVICES.**

**A. The Device Coalition Ignores The Report’s Findings Demonstrating The Need For Interference Avoidance Mechanisms.**

Though the Device Coalition attempts to use the Report to support its view that TV band devices will not be problematic, it fails to discuss important findings from the Report demonstrating the harmful interference to DTV service that will occur without proper protections. The Coalition states that the “Report speaks for itself,” and argues it confirms the “feasibility of low power portable unlicensed devices,” proves that geolocation is ineffective, and

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<sup>8</sup> NCTA Comments at 2.

<sup>9</sup> Shure Comments at 3.

overestimates interference because DTV receiver performance will have improved by the DTV transition.<sup>10</sup> While MSTV and NAB agree that the Report does “speak for itself,” the findings do not support any of the Device Coalition’s assertions. In fact, as discussed above, the data from the Report shows that personal/portable devices will cause interference and should NOT be allowed, and further that sensing alone will be ineffective at preventing interference.

Rather than providing any analysis, the Coalition merely states that the Report generally corroborates its previous position concerning the feasibility of the Coalition’s low power portable unlicensed devices that would transmit at 100 mW.<sup>11</sup> However, the data from the Report clearly shows that a 100 mW transmitter operating on the first adjacent channel could cause interference to DTV viewers in 80 to 87% of a TV station’s service area depending on which of the Commission’s tested DTV receivers is used.<sup>12</sup> The situation actually worsens if one includes DTV receivers tested by CRC and the University of Kansas, as these studies found that interference could be caused to viewers in more than 95% of a TV station’s area.<sup>13</sup> This data, demonstrating that TV band devices would create interference to DTV viewers in *at least* 80% of the service area, clearly does not corroborate the feasibility of personal/portable devices.

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<sup>10</sup> Comments of Dell Inc., Google, Inc., The Hewlett-Packard Company, Intel Corp., Microsoft Corp., and Philips Electronics North America Corp., ET Docket No. 04-186 (filed Apr. 30 , 2007) (Device Coalition Comments) at 1.

<sup>11</sup> See Device Coalition Comments at 1-3.

<sup>12</sup> A complete listing of all DTV receivers tested and their interference areas based on measured D/U ratios is shown in Appendix 1.

<sup>13</sup> It is important to note that the Report confirms that personal/portable and adjacent channel operation must be prohibited even though only the eight “best” DTV sets were used in the study and that the tests were conducted with the undesired signals purposely “filtered” significantly beyond what has been proposed by the Coalition. Consequently, if the Commission were to conduct testing using a more practical and realistic filter for the undesired signal, this would yield results closer to the University of Kansas and CRC values suggesting even a more significant interference problem.

Rather, it confirms the comments submitted by MSTV, NAB and others explaining that personal/portable devices should not be permitted.<sup>14</sup>

The Device Coalition, in a further attempt to support the introduction of personal/portable devices, argues that “(i)n the vast majority of cases, if a DTV receiver is capable of rejecting interference from other DTV broadcasts, it will not suffer interference from personal/portable white spaces devices.” While it attributes this finding to the Commission, this is neither an accurate statement from the Report nor is it a correct statement about interference rejection capabilities generally. In fact, interference from DTV stations and unlicensed personal/portable devices are fundamentally different. For example, adjacent channel operation is easily permitted for co-located DTV stations because the adjacent channel DTV signals originate from the same location, and therefore, any obstacle will affect both signals equally.<sup>15</sup> A personal/portable TV band device, however, will not be co-located with the desired TV station. Instead, it can be located anywhere including in close proximity to a DTV receiver. Therefore a TV band device may transmit a signal that violates the D/U ratio required to protect

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<sup>14</sup> Joint Reply Comments of MSTV and NAB, ET Docket No. 04-186 (filed Mar. 2, 2007) (MSTV/NAB Reply Comments); Comments of IEEE 802, ET Docket No. 04-186 (filed Jan. 31, 2007) (IEEE Comments); Joint Comments of Broadcasters, ET Docket No. 04-186 (filed Jan. 31, 2007); Comments of Microphone Interests Coalition, ET Docket No. 04-186 (filed Jan. 31, 2007); Comments of Professional Audio Manufacturers Alliance, ET Docket No. 04-186 (filed Jan. 31, 2007); Comments of Qualcomm, ET Docket No. 04-186 (filed Jan. 31, 2007); Comments of Shure Incorporated, ET Docket No. 04-186 (filed Jan. 31, 2007); Comments of Wireless Internet Service Providers Association, ET Docket No. 04-186 (filed Jan. 31, 2007); Comments of Cox Broadcasting, ET Docket No. 04-186 (filed Jan. 31, 2007); Comments of Medial General, ET Docket No. 04-186 (filed Jan. 31, 2007).

<sup>15</sup> The maximum allowed power of a DTV station is 1 MW and the minimum power is 50 kW – a difference of only 13 dB, which will be maintained at all DTV receiving locations. This 13 dB difference in power is well within the adjacent channel performance of even the “worst DTV receiver” measured by the University of Kansas that exhibited a “D/U” adjacent channel performance value of - 21 dB. *See* Comments of New America Foundation- University of Kansas Interference Study, ET Docket No. 04-186 (filed Jan. 31, 2007) (NAF Kansas Study) at A.11.

television services.<sup>16</sup> In other words, while DTV broadcasts do not cause interference, transmissions from personal/portable TV band devices have the potential to cause harmful interference to DTV. Thus, the Device Coalition's assertion that these situations are comparable interference scenarios is without merit.

In addition to its claims regarding personal/portable devices, the Device Coalition also argues that the Report does not support MSTV and NAB's contention that spectrum sensing alone will be ineffective to prevent interference. In its comments, the Device Coalition states that "the Report explains that even if a white spaces device had access to complete, accurate information regarding its location, there would still be no way for it to know the desired and undesired signal field strengths at a victim DTV receiver without knowing the gain, height, and placement of its antenna as well as the placement of a white space device relative to the DTV receiver."<sup>17</sup> This argument is another attempt by the Device Coalition to ignore findings from the Report in order to claim that TV band devices will not cause interference. The explanation in the Report cited by the Device Coalition summarizes precisely why geolocation is necessary to prevent interference; only through geolocation can it be ensured that a TV band device is the appropriate distance beyond the contour.<sup>18</sup> Spectrum sensing will not provide such a guarantee.<sup>19</sup>

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<sup>16</sup> For example, a DTV signal of -84 dBm will produce a perfect picture. A 100 mW device will produce an interfering signal of -28 dBm at 10 meters. The difference in signal levels between these signals is -56 dB. No DTV set measured by the Commission, University of Kansas, or CRC provided this level of first adjacent channel performance.

<sup>17</sup> Device Coalition Comments at 2.

<sup>18</sup> See FCC Report at 2-7.

<sup>19</sup> The Device Coalition once again cites to its inadequate detection threshold of 30 dB below a DTV receiver's threshold of visibility for interference protection without geolocation capability. Measurements provided by MSTV have already shown that very low signal levels, below the detection threshold proposed by the Coalition, can occur well within the contour of a TV station.

As discussed, the Report confirms MSTV and NAB's longstanding position that co- and adjacent channel TV band devices must be prevented from operating within the protected contour. As, it is not possible to determine the actual desired signal at the victim receiver (e.g., the DTV receiver may be using an outdoor or indoor antenna), it is essential that D/U ratios are met for all signal levels, including weak signal conditions. For co-channel operation, this means that the TV band device must be located some considerable distance beyond the co-channel protected contour of a TV station in order not to cause interference. Intel, in previous filings, suggested this distance must be 5 kilometers or more.<sup>20</sup> IEEE, MSTV and NAB have suggested even greater distances were needed.<sup>21</sup> Further, the DTV receiver performance measured by the Report shows that adjacent channel operation must also be confined to beyond the protected contour of a DTV station in order to protect reception of weak DTV signals and to meet the required D/U ratios. Thus, geolocation is necessary to ensure that TV band devices are operating outside of the protected contour.

Finally, in an argument unsupported by any data, the Device Coalition argues that there is reason to believe that the performance of DTV receivers will be "even better by the time that white spaces devices would first be allowed to operate."<sup>22</sup> While there is no evidence that

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Measurements provided by CEA and NAF have shown that "indoor" DTV signals can be attenuated by 30 dB or more. Sensing at the levels proposed by the Coalition simply do not work and will not protect DTV viewers. A spectrum sensing device receiving a very low DTV signal level may on occasion be the appropriate distance outside the contour or may be well inside the contour but located behind a building or indoors where it will cause interference to DTV viewers. The only way to accurately tell the location and position of a device is through geolocation and not spectrum sensing.

<sup>20</sup> See Comments of Intel Corp, ET Docket No. 04-186 (filed Nov. 30, 2004) at App. A.

<sup>21</sup> See Joint Comments of MSTV and NAB, ET Docket No. 04-186 (filed Jan. 31, 2007) at 10-13; MSTV/NAB Reply Comments at 11-16; IEEE Comments at 8.

<sup>22</sup> Device Coalition Comments at 2-3.

the new DTV receivers being produced will more effectively reject interference,<sup>23</sup> even if this is a possibility, the Commission cannot base its rules on potential future improvements.

Furthermore, the Device Coalition does not explain what is to become of the tens of millions of consumers that have purchased current state-of-the-art DTV receivers which will still be present in the market in 2009. In fact, the Device Coalition does not even advocate for the Commission's rules to protect any receivers that fall short of the Grand Alliance prototype.<sup>24</sup> As the Grand Alliance prototype is more demanding than the ATSC guidelines and the Device Coalition acknowledges the Commission's finding that all receivers tested failed to meet ATSC guidelines, the Device Coalition advocates that the Commission not ensure interference protection for any DTV receiver or viewer. This position is clearly untenable.

**B. Neither The Device Coalition, Nor Any Other Party, Has Submitted A Prototype Device That Allows The Commission To Conduct Adequate Testing.**

While the Commission has sought out real-world devices in order to conduct interference testing, currently no party has submitted such a device. In response to OET's Public Notice inviting the submittal of prototype TV Band devices for testing,<sup>25</sup> the Device Coalition

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<sup>23</sup> While the Device Coalition asserts that the FCC tested receivers one to two generations behind the current receivers and that receivers can be expected to improve in the two years leading up to the DTV transition deadline, the CRC tests included a relatively expensive LCD receiver manufactured in 2006 and purchased one week prior to testing. Despite the use of the 2006 receiver, the performance did not differ significantly from the much less expensive DTV receiver manufactured in 2003.

<sup>24</sup> See Device Coalition Comments at 3-4.

<sup>25</sup> See *Office of Engineering and Technology Invites Submittal of Prototype TV Band Devices For Testing*, DA 06-2571 (rel. Dec. 21, 2006) (OET Prototype Notice). The Commission stated that it plans to conduct testing to assess the potential interference from low power devices operating in the TV bands. Such an assessment can not be made if devices are not representative of actual devices that may be deployed.

submitted an *ex parte* comment in February very briefly describing a device.<sup>26</sup> More recently, it also submitted another *ex parte* discussing two other devices with an attached “device manual.”<sup>27</sup> The Device Coalition’s description of its devices, however, as well as its newly submitted manual, suggest that the alleged “prototypes” will not be at all representative of typical TV band devices. Simply put, the Device Coalition’s “development platforms” to “explore, develop and evaluate technologies ... to create a commercially viable ... product,”<sup>28</sup> fail to satisfy the Commission’s request for “prototype TV band devices” which would allow the Commission the opportunity “to assess the potential interference from low power devices operating in the TV bands.”<sup>29</sup> Consequently, these devices cannot form a basis upon which to craft rules capable of protecting the public’s television service from the *actual* devices intended for the TV band.

Further, as MSTV and NAB have previously explained, the Device Coalition’s devices even fail to comport with its own proposals with regard to the technical rules and regulations for devices in the TV band.<sup>30</sup> As Shure noted, the Device Coalition’s testing device “falls short of a meaningful opportunity to evaluate a prototype device whose interference

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<sup>26</sup> See *Ex Parte* of Dell Inc., Google, Inc., The Hewlett-Packard Company, Intel Corp., Microsoft Corp., and Philips Electronics North America Corp., ET Docket No. 04-186 (filed Feb. 5, 2007) (Feb. Device Coalition *Ex Parte*).

<sup>27</sup> See *Ex Parte* of Dell Inc., Google, Inc., The Hewlett-Packard Company, Intel Corp., Microsoft Corp., and Philips Electronics North America Corp., ET Docket No. 04-186 (filed May 3, 2007) (May Device Coalition *Ex Parte*).

<sup>28</sup> May Device Coalition *Ex Parte* at 1.

<sup>29</sup> OET Prototype Notice.

<sup>30</sup> See MSTV/NAB Reply Comments at 27-29 (“for example, in response to FCC questions, the Device Coalition states that the device will operate with a bandwidth of 4.5 MHz, thus providing a 1.5 MHz (0.75 MHz +0.75 MHz ) “guard band” between adjacent channels. Yet the Device Coalition’s own comments provide no recommendation for such a guard band”).

protection capabilities can be counted on to protect incumbent services from interference.”<sup>31</sup>

The Commission must ensure that any rules it adopts are as restrictive as the parameters determined necessary to operate any “prototype” in a non-interfering manner. In order to ensure this occurs, MSTV and NAB continue to urge the Commission to publicize the testing protocol for any “prototype” devices and give parties an opportunity to comment.

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<sup>31</sup> Shure Comments at 6, note 13.

## CONCLUSION

The stakes in this proceeding are particularly high as the country is undergoing an expensive and important transition to DTV technology. It is integral that the Commission protect the billions of dollars invested in this transition. MSTV and NAB accordingly commend the Commission for its testing and reporting, and urge the Commission to adopt appropriate protections to ensure that any TV band devices allowed to operate in the spectrum do not cause harmful interference to DTV service.

Respectfully submitted,

/s/ Marsha J. MacBride

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### Appendix 1: DTV Receiver Test Results

	D/U for N-1 at -68 dBm	DTV FS where IX begins <sup>i</sup>	N-1 Interference Area (% of TV Service Area) <sup>ii</sup>	D/U for N+1 at -68 dBm	DTV FS where IX begins <sup>i</sup>	N+1 Interference Area (% of TV Service Area) <sup>ii</sup>	Free Space Interference Distance at Edge of DTV Contour <sup>iii</sup>
FCC Best Receiver	-40.1	-68.1	84%	-42.1	-70.1	80%	56 meters
FCC Worst Receiver	-37.9	-65.9	87%	-37.9	-65.9	87%	112 meters
FCC 2 <sup>nd</sup> Worse	-38.0	-66	87%	-38.3	-66.3	87%	100 meters
FCC Median	-39.3	-67.3	85%	-39.7	-67.7	84%	80 meters
UK Receiver #1	-24	-52	97%	-31	-59	94%	562 meters
UK Receiver #2	-31	-59	94%	-39	-67	85%	178 meters
UK Receiver #3	-30	-58	95%	-29	-57	96%	223 meters
CRC Receiver #1	-29.7	-57.7	95%	-27.5	-55.5	96%	282 meters
CRC Receiver #2	-34.2	-62.2	92%	-37	-65	88%	126 meters
CRC Receiver #3	-36.7	-64.7	89%	-36.5	-64.5	89%	100 meters
CRC Receiver #4	-37.2	-65.2	88%	-39.0	-67	85%	89 meters
CRC Receiver #5	-37.7	-65.7	88%	-37.0	-65	88%	100 meters

<sup>i</sup> DTV field strength (FS) at which the measured D/U ratio for each tested DTV receiver would be violated and interference could be caused by a 100 mW device at 10 meters (-28 dBm).

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ii Percentage of DTV station's service that has a field strength equal to or less than required to meet the measured D/U ratio for each tested DTV receiver that would be therefore be subject to potential interference from a 100 mW device at 10 meters.

iii The distance a 100 mW device could potentially cause interference to each tested DTV receiver at the edge of a DTV station's service area using the free space propagation model. For the purpose of these calculations, the DTV signal level was generally assumed to be -84 dBm, unless another specific value was identified in the test report.