Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37, and	)	ET Docket No. 14-165
	)	
Amendment of Part 74 of the Commission's Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap	)	
	)	
Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions	)	GN Docket No. 12-268
	)	

To: The Commission

PETITION FOR RECONSIDERATION OF THE WMTS COALITION

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Executive Summary

While the WMTS Coalition appreciates the attempt to protect WMTS systems from harmful interference from unlicensed TV white space devices, the codified rules simply will not provide the level of protection contemplated nor the level needed to ensure that remote monitoring of hospital patients will not suffer interference from TVWS devices operating on Channel 37 or adjacent and near adjacent channels. Unfortunately, in many of the assumptions that were made in calculating the separation distances at which unlicensed devices must operate, the Report and Order favored the avoidance of overprotection of hospitals in some directions at the expense of under-protection where WMTS systems are likely to be vulnerable to harmful interference.

The continued use of the TM-91-1 propagation model is insufficient to provide separation distances that will protect many WMTS systems from interference. And even in modeling the environment using TM-91-1, the Report and Order fails to account, or inadequately accounts, for a number of factors that impact interference protection. Appropriately calculated, the separation distances should be on the magnitude of three times those adopted in the Report and Order – ironically the same magnitude that the Report and Order finds presumptively reasonable if requested by a WMTS licensee in a waiver filing.

The Report and Order also inappropriately places burdens on the incumbent WMTS licensees to obtain protection from interference from unlicensed devices that by policy and practice should fall on unlicensed operators that desire to use Channel 37. To the extent that information about the hospital environment must be accumulated and filed in order to allow an

unlicensed device to deviate from appropriately calculated separation distances, the burden should fall on new entrant unlicensed device operators, not the WMTS licensee.

The Coalition appreciates the difficulties inherent in developing rules for the use of this band by unlicensed devices, and applauds the decision to defer widespread use of Channel 37 until test bed markets demonstrate the adequacy of these rules. However, significantly more detail is needed in order to assure that any "test bed" is adequate in scope and length to demonstrate that interference will not occur to WMTS systems as the market for TVWS devices actually matures. Nor should operation of unlicensed devices in this band be permitted until a well-developed process has been adopted for the prompt resolution of any interference to WMTS systems that does occur.

Finally, the Coalition urges the Commission to reconsider the decision to include personal/portable devices in the group of TVWS devices that may operate on Channel 37. A number of technical questions remain unresolved, and until the rules have proven adequate to protect WMTS systems from fixed devices, the risk of interference from personal/portable TVWS devices is simply too great.

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The WMTS Coalition (the "Coalition"),[1] pursuant to 47 C.F.R. § 1.429 of the Commission's rules, hereby requests reconsideration of the Commission's *Report and Order* in the above-captioned proceeding.[2] For the reasons stated in detail below, the Coalition believes

[1] The WMTS Coalition is a coalition consisting of the American Society for Healthcare Engineering of the American Hospital Association ("ASHE") (a personal membership group of the American Hospital Association ("AHA")) representing hospitals and other users of WMTS in the delivery of healthcare services; the Association for the Advancement of Medical Instrumentation ("AAMI"), representing manufacturers and others interested in the development of medical devices, generally; and several of the principal manufacturers of wireless medical telemetry devices.

[2] *Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37*, "Report and Order," 30 FCC Rcd 9551 (the "*R&O*"). This petition represents the general consensus positions of the Coalition membership; however, individual members of the Coalition may file their own petitions raising other issues, or even differing with the Coalition's view on a particular issue addressed in this petition.

that the Commission has adopted rules that will not adequately protect Wireless Medical Telemetry Service ("WMTS") licensees from harmful interference from unlicensed white space devices that will be allowed to operate for the first time in Channel 37, and now in nearby channels with greatly relaxed out of band emission limits.

This is the result of the Commission's use of less-than-conservative assumptions about the most vulnerable environments in which many, if not most, WMTS systems will be operated. The potential for even a few interference incidents relatively early in the use of the band by unlicensed devices may well harm its long-term potential, even in areas where interference is not likely. On reconsideration, the Commission should review and reconsider the calculations on which the *R&O* based the adopted separation distances and power limits for unlicensed use of Channel 37 and make other changes to the rules to assure that over the long term, interference should not occur to any hospitals employing WMTS systems on Channel 37.

The *R&O* has also erred by imposing obligations on the WMTS licensee to obtain interference protection from unlicensed devices, rather than requiring the unlicensed operators to take the measures needed to protect WMTS licensees from harmful interference. On reconsideration of the *R&O*, the Commission should establish appropriately conservative default protection distances but allow unlicensed devices operators to seek permission to operate in closer proximity than the appropriately conservative rules permit.

Finally, given the *R&O*'s recognition that the adopted rules carry the risk of being insufficient to protect WMTS systems from interference, it is imperative that more thought be given to how the rules will be rolled out – both to assure that the separation distances finally adopted are sufficient and that the technology needed to implement them safely in unlicensed devices is mature and reliable.

I. Introduction

The Commission is well aware of the importance of wireless medical telemetry systems in the healthcare ecosystems, as well as the critical importance of interference-free operation of such systems for fetal monitoring and monitoring the vital signs of critically ill patients and other patients who are ambulating.[3] WMTS systems operate primarily in two spectrum bands, the 608-614 MHz band (Channel 37) and the 1.4 GHz band. Over 3800 WMTS systems are currently registered with the ASHE database to operate on Channel 37.

From its inception in 2001 through the initial authorization of TV White Space Devices in 2007,[4] the Commission had consistently rejected unlicensed use of Channel 37 in order to protect WMTS systems from interference. Nevertheless, in the Commission's *Incentive Auction R&O*, the Commission determined that unlicensed devices would be authorized to operate on TV Channel 37 (608-614 MHz).[5] However, while the decision to permit unlicensed operations in channel 37 was announced in the *Incentive Auction R&O*, such operations were expressly made

[3] See e.g., *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 12-268, Report and Order, 29 FCC Rcd 6567 (2014) (*Incentive Auction R&O*) at paragraph 281: "WMTS is used for remote monitoring of patients' vital signs and other important health parameters (e.g., pulse and respiration rates) inside medical facilities. In addition, WMTS includes devices that transport the data via a radio link to a remote location, such as a nurses' station, which is equipped with a specialized radio receiver."

[4] *See, e.g.*, *Unlicensed Operation in the TV Broadcast Bands*, Notice of Proposed Rulemaking, 19 FCC Rcd 10018, 10034 ¶ 34 (2004) (proposing not to allow unlicensed devices in Channel 37 due to "special interference concerns associated with … the critical safety function of [WMTS]"); *Unlicensed Operation in the TV Broadcast Bands*, First Report and Order and Further Notice of Proposed Rulemaking, 21 FCC Rcd 12266, 12267 ¶ 2 (2006) (deciding not to permit TV bands devices in Channel 37 to minimize the risk of interference to WMTS); *Unlicensed Operation in the TV Broadcast Bands*, Second Report and Order and Memorandum Opinion and Order, 23 FCC Rcd 16807, 16859 ¶ 148, 16861 ¶ 155 (2008) (affirming decision not to allow TV bands devices in Channel 37 in order to protect WMTS operations).

[5] As the Commission is also aware, the Coalition has consistently urged that a decision should not be made as to the availability of Channel 37 for unlicensed operations until a full record has been developed in which it had been demonstrated that they could do so without creating interference to licensed WMTS systems. *See, e.g.,* Coalition "Petition for Reconsideration" of the *Incentive Auction R&O*, filed on September 15, 2014.

subject to the development of appropriate technical parameters for such operations in order to protect the WMTS and RAS from harmful interference[6]:

> "[U]nlicensed operations on channel 37 will be authorized in locations that are sufficiently removed from WMTS users and RAS sites to protect those incumbent users from harmful interference."[7]

This assurance of protection from harmful interference was consistently emphasized as the Commission discussed the anticipated Part 15 rulemaking. For example, in a speech to the ASHE membership in August, 2014, Chairman Wheeler stated that "[m]ake no mistake, we will make sure that these new services do not come at the expense of WMTS."[8] And in the *Notice of Proposed Rulemaking* in this proceeding[9], the Commission again emphasized the importance to the public interest of a viable, interference free WMTS and the need for protecting these licensees from harmful interference:

> We recognize the importance of WMTS to patient care, and will remain mindful of this critical function when developing these technical parameters. In this Notice, we propose technical parameters below to protect the WMTS and RAS from harmful interference and will develop a full record on the issues raised in this proceeding before adopting final rules.[10]

Yet despite this commitment to protecting licensed WMTS services operating in Channel 37 from harmful interference, the Commission has made numerous technical assumptions that undermine that commitment. And these choices have been made even where the *R&O* tacitly

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[6] *Incentive Auction R&O*, 29 FCC Rcd at 6686.
[7] Id.
[8] Taped remarks of FCC Chairman Tom Wheeler to ASHE Annual Conference, August 2014.
[9] *Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37*, Notice of Proposed Rulemaking, 29 FCC Rcd12248 (2014)(the "*NPRM*").
[10] Id. at 12279; see also *Incentive Auction R&O* 29 FCC Rcd at 6686-87: "We recognize the importance of WMTS to patient care, and will remain mindful of this critical function when developing these technical parameters. We also recognize the concerns of WMTS equipment manufacturers and users about the potential for unlicensed operations on channel 37 to cause harmful interference to the WMTS."

acknowledges that in doing so many WMTS licensees will not be fully protected from harmful interference. Indeed, apparently driven by concerns that some proposed approaches would "overprotect" some, even many, hospitals, the ***R&O*** adopted separation distances that will fail to protect many hospitals from the threat of interference.

II. The approach to sharing in Channel 37 in the ***R&O*** will not assure that interference will not occur to critical patient care devices.

As the Coalition has consistently emphasized, in its written comments and *ex parte* meetings with the Commission, a conservative tolerance approach to interference should be adopted where patient safety is at stake. Unlike television reception, or even reception for wireless devices, where interference may be a nuisance or distraction, for a WMTS system even a small level of interference could result in the failure of the WMTS system to monitor critical care patients for some period of time, placing those patients at significant health risk. And if interference occurs on a relatively regular basis, or if it cannot be resolved relatively quickly, confidence in the WMTS system erodes, significantly burdening the health care infrastructure in terms of the hospital's ability to remotely monitor patients.

With this in mind, the Coalition urged the Commission to recognize that the most vulnerable parts of the WMTS system must be considered in determining appropriate separation distances at which TWVS devices may operate. The Coalition acknowledged that this approach may overprotect some parts of the WMTS system that are less vulnerable to interfering signals. But that should not result in separation distances that are insufficient to avoid interference to WMTS systems. Rather, where less separation is needed in certain directions, this "overprotection" can be mitigated through an appropriate waiver process available to those

unlicensed device operators who can demonstrate that operation at particular locations closer to the WMTS system will not create interference.

While acknowledging the critical functionality of WMTS systems in providing quality and safe health care to patients,[11] the *R&O* reflects a less-than-adequate approach for protecting all WMTS systems from interference. Indeed, a concern that using more conservative factors will "overstate" protection in some (indeed, possibly even many) situations permeates the *R&O* discussion and has led to rules that underestimate the separation needed to protect a significant number of WMTS systems from interference.

Examples of this "inverted" approach are easily identified. For example, in rejecting the proposal of the Coalition and GE Healthcare to use "worst case" assumptions in calculating the separation distances, the Commission stated that "the worst possible scenario presented by GE Healthcare [is not] likely in actual deployments, [and] could vastly over protect *a large number of facilities* to the detriment of efficient spectrum usage."[12] Similarly, the Commission refused to recognize the substantial number of WMTS installations in which the antennas are located well above 10 meters (three floors) because "[t]o assume a greater height in our analysis would be unreasonable because it would produce greater separation distances than are needed to protect WMTS devices *in many cases*."[13] Perhaps most symptomatic of this recognition that the rules are not, in fact, designed to protect all WMTS systems from interference, the *R&O* rejected the only real-world testing submitted into the record stating that "comparing the separation distances we are adopting to the WMTS test results for the Wheaton and Froedtert hospitals show that in

[11] *R&O*, 30 FCC Rcd at 9631 n.486.
[12] Id at 9637 (emphasis added).
[13] Id. at 9637 (emphasis added); see also id. at 9643 ("We note that the distances we are setting to protect WMTS systems will generally protect against harmful interference.")(emphasis added).

all but one case tested, WMTS receivers would be protected from interference from white space devices,"[14] – dismissing the proof that interference did, indeed, occur in that one case (and in fact there was at least one instance of harmful interference at each of the hospitals tested). That statement highlights the fundamental flaw in the Commission's analysis. The Commission essentially acknowledges that to avoid "overprotecting" hospitals where they are least susceptible to interference, the separation distances it has adopted may not fully protect most WMTS systems from interference where they are most vulnerable to it.

As the Coalition consistently urged, by using more realistic assumptions about the hospital environment and the WMTS systems' likely susceptibility to interference in at least some directions, the rules should impose much larger separation distances. While it is almost certainly true that such larger separation circles may "overprotect" some parts of a hospital, it is imperative that the default distance be based on more than a "median" approach. These areas of overprotection can and should be dealt with by allowing TVWS device operators an appropriate waiver process to operate in closer proximity than the designated larger separation distances where they can demonstrate that doing so will not increase the threat of interference to the WMTS system.

[14] Id, at 9639.

III. The Commission's calculation of separation distances for TWVS devices to operate on Channel 37 is flawed, leading to distances that are too small to assure that interference will not occur to many hospitals

A. The application of TM 91-1 in this case was inappropriate to protect many WMTS systems.

The *R&O* adopts the use of TM 91-1 propagation model for calculating separation distances between TVWS devices and WMTS licensed systems, although the Coalition has demonstrated that TM 91-1 will not reflect a realistic assessment of propagation for the environment surrounding a hospital's most vulnerable areas, thus failing to prevent interference as TVWS devices proliferate throughout the areas around the hospitals.

The *R&O* essentially acknowledges that use of the TM 91-1 model will result in separation distances that will not fully protect most hospitals. For example, in rejecting models that might be more complex, but more effective, the *R&O* acknowledged that its rules "are crafted to protect the vast majority of health care facilities."[15] Similarly, the *R&O* ignored the evidence placed in the record by GE Healthcare and the Coalition that in some directions, hospitals in urban areas would not experience significant losses by reason of ground clutter, multipath effects and building penetration losses.[16] The *R&O* also failed to refute the fact that TM 91-1 calculates results based on a median signal level, thus failing to protect WMTS systems from signal variations that exceed the median level, which by definition occurs 50% of the time.[17] Here again, the *R&O*'s rationale highlights the shortcomings of its analysis: the *R&O*

[15] *Id.* at 9635.
[16] *Id.* at 9635-36.
[17] At footnote 524, the *R&O* justifies this median approach by reference to work done by the Commerce Spectrum Management Advisory Committee (CSMAC). While the FCC is correct in noting that the CSMAC was, "…comprised of spectrum policy experts from the government and the wireless industry…", it is important to realize that this work was based ultimately based on several unpublished Department of Defense studies where sharing analyses had already been completed using median-based

emphasizes the fact that "a comparison between predicted free space path loss and actual measured path loss for several test sites at two hospitals submitted by the WMTS coalition shows that *in many cases* the actual path loss is substantially more than the prediction and compares favorably with the predictions of the TM 91-1 model."[18] What is missing is the ***R&O***'s acknowledgment that in at least some cases, the TM 91-1 model compares quite unfavorably with measured data, in which case the impacted hospitals will remain susceptible to harmful interference at the adopted separation distances.[19]

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approaches. The specific reference in FN 524 of the Order refers to the efforts of Working Group 5, which addressed airborne operations, where the nature of the airborne and commercial systems are mobile and may be comprised of multiple propagation paths. It is also worth noting that of the four systems addressed by WG5 (PGM, ACT, SUAS, and AMT), the CSMAC work concluded that sharing was not feasible with PGM and SUAS. Contrary to the FCC's characterization of Air Combat Training Systems as a safety-of-life service, DoD did not characterize ACTS as a safety-of-life operation. Moreover, there was disagreement between commercial and DoD participants regarding the appropriate application of the propagation models (specifically regarding the clutter and terrain effects), interference protection criteria, and a more representative LTE model which has not been resolved; indeed, the DoD is still working on how best to model propagation between ground-based commercial systems and airborne systems. This work is being conducted under the DISA 5: Spectrum Sharing Test & Demonstration effort as outlined in the DoD DISA DSO AWS-3 transition plan. Finally, in order for the use of median path loss predictions to be valid, it is necessary to somehow account for the intrinsic variability of the real-world propagation about the median. In fact, the CSMAC analysis cited by the Commission appears to have incorporated additional margin within the protection criteria itself to mitigate against the expected propagation variability about the predicted median. By contrast however, the Commission's TVWS/WMTS calculations fail to account for any expected interference propagation variability about the predicted median -- neither by incorporating an explicit term in the minimum coupling loss equation, nor by employing a protection criteria for WMTS that "builds in" any additional margin.

[18] *Id*. at 9636. This can be explained in a number of ways: (1) Path loss measurements were taken from the inside (sometimes from the hallway because the room with the window was occupied), so the measured values include building losses; (2) The more modern hospital, Wheaton, appeared to use passive low-E glass windows which created more losses than the windows at Froedtert, which appeared to be clear glass. Despite taking measurements from the inside, two test locations at Froedtert measured within 2 dB of calculated free space loss. TM 91-1 calculated 14 and 19 dB more path loss than measured at these two locations.

[19] *Id*, at 9636-37 note 523. As the Coalition and GE Healthcare noted in filing their test reports in this docket, despite taking measurements from the inside, two test locations at Froedtert measured within 2 dB of calculated free space loss. TM 91-1 calculated 14 and 19 dB more path loss than measured at these two locations.

In short, TM 91-1 does not adequately predict interference to WMTS systems for a significant percentage of environments in which they will be operating – with the likelihood that as TVWS device use of Channel 37 increases over time, a large number of WMTS systems could suffer seriously adverse consequences. Simply stated, where safety of life is at risk, a propagation model more appropriate to the actual environment in which WMTS systems will operate should be used.

B. The Commission failed to account accurately for a number of factors in determining the final separation distances.

Regardless of the propagation model chosen, the Commission must reconsider some of the assumptions and factors it has relied on in using this approach. By implementing the model incorrectly by using inappropriate assumptions, the *R&O* adopted separation distances that are inadequate to protect many WMTS systems from objectionable interference. On reconsideration, the Commission should recalculate these distances using appropriate assumptions in order to satisfy its stated objective that "unlicensed operations on Channel 37 will be authorized in locations that are sufficiently removed from WMTS users and RAS sites to protect those incumbent users from harmful interference."[20]

In order to assure that interference will not occur to a WMTS licensee from an outside source, the Commission must consider both the WMTS receiver's sensitivity (*i.e.*, the lowest signal at which the receiver can reliably receive a signal) and the required signal to noise ratio (SNR) necessary to receive a signal. Together, these two parameters correspond to the level of the intrinsic "noise floor" of the WMTS system required for WMTS operation. An interfering signal that is 6 dB below this noise floor will cause a 1 dB noise rise of desensitization. In the

[20] *Incentive Auction R&O*, 29 FCC Rcd at 6686.

R&O, the Commission appropriately used an interference-to-noise ratio ("I/N") of -6 dB[21], but incorrectly applied this value to the receiver sensitivity rather than to the receiver noise floor. In doing so, the Commission's analysis failed to consider the minimum required SNR for WMTS systems of approximately 10 dB which translates directly to 10 dB of additional path loss required.

Similarly, the Commission must consider several factors that account for the likely existence of multiple interferers. As TVWS devices flourish,[22] a WMTS system is likely, at its most vulnerable points, to have line-of-sight to the signals being radiated by several different TVWS devices. By the same token, those devices are likely to be capable of radiating a signal into more than one of a WMTS system's distributed antennas. The *R&O*, however, only allowed a gain of 3 dB to account for these factors while the Coalition believes that at least an additional 3 dB gain must be added to account for both potential circumstances, *i.e.*, at least 6 dB to account for the likelihood that those antennas will also be aggregating signals received from multiple sources and the potential that an interfering signal may radiate into more than one WMTS antenna.

Another incorrect assumption was the *R&O*'s use of a 10 meter height above ground level (AGL) for the WMTS antenna. The Coalition presented evidence that a substantial number of hospitals – almost 45% of the registered hospitals – deploy WMTS antenna systems above 10

[21] Although the Coalition continues to believe that the FCC erred in using -6 dB rather than the suggested -8.4 dB for the I/N, the failure to consider the SNR in determining the appropriate level of interference in the equation is a far more serious flaw in the calculations.

[22] The proponents for the use of Channel 37 by unlicensed devices base the need for access to this spectrum on their expectation that millions, if not tens of millions, of unlicensed devices will be using the 600 MHz band.

meters (the third floor of a building); indeed many WMTS antennas are deployed above the 10th floor of the hospital (*i.e.*, more than 30 meters AGL).[23]

The *R&O* dismisses this evidence with very little justification, claiming that it is unreasonable to assume that every WMTS device at every facility is located on the top floor (thus dismissing the impact of the analysis on the many hospitals in which WMTS devices are operated on floors well above 10 meters). The data provided by the Coalition, however, demonstrated the highest floor on which a WMTS system actually was being operated, not merely the highest floor of the hospital. On reconsideration, this factor alone warrants recalculation of the separation distances to account for a significant number of hospitals in which the WMTS antenna will be located well above 10 meters.

To further bolster use of the 10 meter assumed height, the *R&O* makes the unsupported assumption that "the taller facilities are more likely to be located in urban areas where losses due to shadowing and multipath will be greater and thus protected from harmful interference."[24] To the contrary, however, the record in this proceeding contains letters from over 200 hospitals describing their use of WMTS systems with systems deployed well above the third or fourth story. Moreover, the Coalition filed pictures of 100 hospitals, many well taller than 3 floors, located in urban areas in which there are virtually no surrounding buildings that would provide the shadowing and multipath losses that the *R&O* assumes would protect WMTS systems from interference. By comparison, there is nothing in the record to justify the assumption of a 10 meter antenna height used by the Commission in calculating the *R&O*'s separation distances.

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[23] Exhibit A is a chart showing the distribution of the highest floor on which a WMTS system antenna is located within the hospital.

[24] *R&O*, 30 FCC Rcd at 9638.

Absent any evidence in the record to support this assumption, the Commission has no basis for continuing to use a 10 meter height in calculating separation distances.

The evidence in the record of the AGL of the highest WMTS antenna indicates that almost half of the hospitals in the ASHE database will be under-protected from surrounding fixed or personal portable unlicensed devices based on the use of a 10 meter WMTS deployment assumption in calculating the required separation distances.[25] Factoring in the 13 dB of additional path loss required because of the omission of the required SNR (10 dB) and the failure to account for multi-interferer aggregation factor (of *at least* 3 dB), the number of under-protected hospitals with significant risk of experiencing harmful interference to WMTS is even greater. Reconsideration is clearly warranted as the *R&O*'s analysis will not protect the vast majority of WMTS licensees from the potential of interference from co-channel TVWS devices.

C. It was inappropriate for the *R&O* to use HAAT in determining the height of the TVWS device.

The *R&O* used the height above average terrain (HAAT) of a fixed TVWS device, rather than height above ground level (HAGL) in calculating the required separation distances relative to a WMTS licensed location. As GE Healthcare noted in its comments in the record, this approach may lead to very significant interference potential in circumstances where the HAAT and the HAGL vary significantly. As GE Healthcare noted, HAAT was used primarily for broadcast television signals and as such only considers terrain variations from 3 to 16 kilometers, while TVWS devices cover areas that are relatively much smaller. Moreover, since WMTS hospitals may be located near rivers, lakes, or other bodies of water (as demonstrated in the

[25] At the very least, the *R&O* should have assumed a WMTS antenna height factor of no less than 20 meters (which would represent a more conservative 85% of the hospitals registered in the ASHE database).

pictures submitted by the Coalition), the average terrain in the range of 3 to 16 kilometers around these hospitals will typically be at a higher elevation than the land in much closer proximity to the hospital where the fixed TVWS device is likely to be operating. As a result, the HAAT at locations near the hospital where fixed TVWS devices could be deployed could be negative at ground level.

As currently developed in the rules, if a TVWS device is deployed where the HAAT at ground level is negative, its antenna could meet the standard for a HAAT of less than three meters even though it is mounted on a tower that is up to 30 meters AGL. Because the rules allow TV white space devices with less than three meters HAAT to be closest to WMTS facilities at the allowable power levels, WMTS systems would be at significantly greater risk of experiencing interference than would a hospital where the HAAT at ground level is, in fact, positive.

Although the *R&O* suggests that at these distances HAAT and AGL are the same, the Coalition strongly disagrees; and there are numerous examples in the current white space device database that confirm our dissent and demonstrate that this problem is not merely a theoretical one.[26] Nevertheless, the problem can be easily fixed by amending the rules to limit the height of fixed TVWS a device to a numerical value that results in the *shorter* distance *above ground level* of either the antenna's HAAT or the antenna's AGL.[27]

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[26] A review of the TVWS databases as of December 10, 2015, indicates that of the 616 registered fixed white space devices, 416 devices, or approximately 68 percent of the devices, are located in areas where the HAAT at ground level is negative.

[27] For example, when the geographic location of a tower has a HAAT at ground level that is negative, then HAAT will no longer apply and the height values in the table of separation distances will be considered to be AGL. This will ensure that an antenna's height above ground level will never be more than its HAAT, and thus will maintain more reasonable height, power and distance combinations for unlicensed devices near WMTS operations.

D. The TWVS/WMTS separation distances are significantly shorter than those imposed on the use of TVWS devices near DTV and uplink receivers, although the impact of interference is much greater on WMTS.

Demonstrating that the Commission applied the wrong approach in developing separation distances applicable to unlicensed operation in Channel 37, a comparison of the separation distances for unlicensed operation in bands used by DTV receivers and mobile uplink receiver base stations shows much larger separation distances than those required for operation near a WMTS system.[28] It seems illogical that the separation distances from life-critical WMTS systems are significantly smaller than the *R&O* allows from over the air television reception. Yet the R&O provides no clear explanation for these significant differences.

To the extent the *R&O* has used more conservative assumptions in protecting DTV or wireless services from interference than for WMTS, the basis for these differences should be explained. And absent reasonable justification for providing greater protection against interference to over-the-air television reception than for patient critical wireless monitoring, the more conservative assumptions should be applied as well in determining separation distances between TVWS devices and WMTS systems.

In addition, and despite concerns raised by the Coalition and GE Healthcare for the potential increase in interference from adjacent channel use on Channels 36 and 38, the *R&O* opened up these channels to use by TWVS devices along-side their use by wireless microphones. The *R&O* also removes the previously imposed emission mask that has been very effective in protecting WMTS systems from adjacent channel interference. The Coalition has acknowledged that the emission mask might not be necessary if appropriate separation distances are imposed on

[28] Exhibit B is a table comparing the adopted separation distances.

the use of TVWS devices in adjacent and near-adjacent channels, but it is not apparent that adequate separation between a potentially interfering TWVS device and the receiving WMTS antenna has, in fact, been achieved. To the contrary, the rules do not impose any separation requirement on unlicensed devices operating in near adjacent channels, e.g., Channels 35 and 39, and as a result, such a TVWS device could be operating directly next to a WMTS antenna. To the extent that the increase in out-of-band emissions limits are far from insignificant, if TVWS device operation is to be allowed in the adjacent and near adjacent channels at the adopted power levels, then the separation distances finally adopted for Channel 37 must be reviewed and applied to TVWS devices without regard to the specific channel being used to assure that interference will not occur from adjacent and near adjacent channel unlicensed operations.

E. Appropriately calculated separation distances are essential to assuring that all WMTS licensees are protected from interference from the anticipated proliferation of TVWS devices.

Had the Commission employed appropriate factors in its calculations using the TM 91-1 propagation model and appropriately applied these factors in calculating both co-channel and adjacent channel restrictions, the Coalition believes that the resulting separation distances would be approximately as set forth in Exhibit C attached hereto, with distances ranging from 1.4 km for a fixed device (with antenna height less than 3 meters) or a personal portable communicating with a Mode II or Fixed device (doubled if it is communicating with a Mode I device) and operating at 40mW of power, up to 32.88 km for a fixed device with an antenna height of 200-250 meters operating at 4W power. Ironically, calculating separation distances using appropriate additional factors as a baseline provides results that are not, in many cases, significantly different

from the 3x multiple that the Commission endorses as "presumptively reasonable" for any hospital seeking a larger separation distance than those provided in the rules.[29]

Given the acknowledgement that 3x separation distances are appropriate in an individual case, and the similar results determined by using TM 91-1 with appropriate additional factors included in the calculation, the Coalition urges the Commission, on reconsideration of the ***R&O***, simply to employ these additional factors in developing the "default" separation distances for all hospitals for newly authorized operation of TVWS devices on Channel 37. Supplemented by the Commission's general approach to allow "parties [who] believe a distance other than that provided in the rules . . . over . . . protects WMTS systems, [to] file waiver requests with the Commission to modify the distance for a particular facility or group of similarly situated facilities,"[30] adopting these larger separation distances will assure that WMTS licensees are generally protected from interference, while TVWS device operators may still operate in closer proximity where they can demonstrate that the factors used in calculating the "default" distances do not exist at particular locations around a specific hospital.[31]

IV. The *R&O* inappropriately places burdens on WMTS licensees to obtain protection from interference that appropriately lie on TVWS device operators who must assure it.

In its effort to provide WMTS licensees with protection from interference, the Commission made two significant decisions in the ***R&O***. First, the ***R&O*** requires that separation distances be measured from the perimeter of each health care facility containing a WMTS

[29] ***R&O***, 30 FCC Rcd at 9642-43 n.554.
[30] *Id.* at 9642.
[31] For example, if a TVWS device operator desires to locate a fixed device with a 10 meter HAAT with 100 mW power (i.e., an EIRP of 20 dBm/6 MHz) closer than 2.94 km, and can show (a) the hospital is only three stories (i.e., 10 meters tall), and that the area between its device and the hospital is characterized by much taller buildings, providing significant path loss between the hospital and the device, it may be able to demonstrate that the factors used in calculating the default distance (i.e., 20m WMTS antenna height and line-of-sight propagation) are inappropriate.

system.[32] Second, where the adopted separation distances are considered inadequate, the *R&O* provides WMTS licensees (and apparently TVWS devices operators, as well) the opportunity to seek a modification of the separation distances for a particular facility or group of similarly situated facilities through a waiver request.[33]

The Coalition applauds the Commission for recognizing both the impact of location inaccuracies in the current database, and the potential that creating a circular "separation zone" around any hospital will almost certainly be more or less protective depending upon the direction from a hospital at which a TVWS device is operating. However, both in determining the hospital's perimeter and in providing a mechanism for improving protection from interference, the Commission has imposed new burdens on the WMTS licensee – in one case by requiring the WMTS licensee to determine the perimeter of the hospital and then newly register it with a TWVS database administrator, and in another by adopting smaller separation distances and then imposing on many hospitals the obligation to justify a waiver to extend the separation distances to those actually needed to assure against interference. As discussed below, both decisions should be reconsidered.

A. The *R&O* erroneously placed the burden of defining a hospital's (or hospital's campus) perimeter on the WMTS licensee, who will typically have limited or no ready ability to do so.

The *R&O* recognized that "[t]o implement the necessary protection, several parties are involved – the health care facility, the white space device operator, and the white space database administrator."[34] The *R&O* hoped to achieve this protection through a procedure that is

[32] *R&O*, 30 FCC Rcd at 9641-42.
[33] *Id*. at 9642.
[34] *Id.* at 9643.

"simple, straightforward, and easy to implement for all parties."[35] The result however, does not achieve that goal. To the contrary, the *R&O* requires *the WMTS licensee* to determine the perimeter of its facility and then newly register that information with a whitespace device administrator in order to obtain protection based on the required separation distances. [36] This approach fails on numerous levels.

First, there is no hard evidence in the record to support the conclusion that "defining the perimeter of a facility will be a simple, straightforward process."[37] Indeed, while Microsoft and Google aver in their comments that this can be easily done, they provide no record evidence as to the level of expertise needed or costs that would be associated (with or without the level of expertise available in-house) with defining the perimeter of even a small health care facility, much less a WMTS licensee that maintains numerous systems throughout a large healthcare campus environment. The FCC can look at its own experience where numerous errors were identified in the location information of "professionally installed" devices provided to the TVWS databases. [38]

The Coalition is convinced that the *R&O*'s approach will not work. For one thing, it inappropriately places the burden on WMTS *licensees* to take steps to obtain protection from

[35] *Id.*
[36] *Id*. at 9654.
[37] *Id*. at 2642.
[38] In fact, as the National Association of Broadcasters noted in various filings at the agency, a significant percentage of registered TVWS devices had significantly incorrect information. *See* Press Release, National Association of Broadcasters, NAB Files Petition to Correct Television White Space Database Design Flaws (March 19, 2015) available at http://www.nab.org/documents/newsroom/pressRelease.asp?id=3618; Emergency Motion for Suspension of Operations and Petition for Rulemaking of National Association of Broadcasters, RM-11745, March 19, 2015; Reply of the National Association of Broadcasters to Oppositions to Its Petition for Rulemaking, RM-11745, May 18, 2015; and More TVWS Database and Device Problems, National Association of Broadcasters Presentation to OET, June 9, 2015, available at http://www.nab.org/documents/newsRoom/pdfs/061215_TVWS_Database_Review.pdf.

interference from an *unlicensed* device, even though the *R&O* emphasizes that the burden of avoiding interference lies exclusively with the unlicensed device operator.[39] And this burden is imposed retroactively on WMTS licensees who have already registered their location in the separate FCC-authorized WMTS database in order to be licensed.

The R&O errs in believing that hospitals will have ready access to the resources, or readily available personnel, needed to research the required information or make the perimeter calculations and then to file the necessary registration information.[40] As the record in the *Incentive Auction Rulemaking* already demonstrated, and the Commission has earlier recognized, ASHE has consistently encountered significant difficulties in obtaining accurate WMTS location information from all users of WMTS systems; indeed it is suspected that many hospitals still have yet to register any of their equipment in the WMTS database.[41] While the *R&O* is not entirely clear on this point, it appears that a WMTS-licensed hospital that fails to re-register in the TVWS database or fails to enter accurate data will not be protected by the separation distances in the rules (notwithstanding registration in the ASHE database) so that nothing would prevent TVWS devices from operating anywhere on the hospital campus and causing harmful interference. The *R&O* provides no fail-safe plan.

Moreover, asking hospitals to develop detailed descriptions of their perimeters, register first with the FCC-designated WMTS frequency coordinator as a condition of licensing (and coordinate use with other hospital licensees in the WMTS), and then with *another* non-WMTS

[39] *R&O*, 30 FCC Rcd at 9643: "We take this opportunity to underscore for white space device operators that in all cases, they always have the obligation to protect WMTS systems from harmful interference and eliminate such interference if it should occur."

[40] As discussed in detail below, many hospitals are very small businesses that simply have no resources to complete this effort – a fact the *R&O* fails to consider generally in its PRA analysis, and certainly as to this requirement.

[41] *Incentive Auction R&O*, 29 FCC Rcd at 6687 n.832.

database administrator (of which there are several, which will itself be confusing) in order to obtain protection from an unlicensed source, is unnecessarily complicated and burdensome on hospital resources.[42] This approach will also impose burdens on the ASHE database and the several TVWS data base administrators at the very least to confirm that a hospital entity wishing to register perimeter information is, in fact, a WMTS licensee, and then coordinating the location information among themselves and the ASHE database.

While the Coalition applauds the desire to use the most accurate reflection of a hospital's location for purposes of calculating separation distances, the Coalition continues to believe that the better approach for purposes of the rules is to include a "location inaccuracy" factor into the calculation of separation distances, as a starting point. To that end, the Coalition continues to urge that on reconsideration of the ***R&O***, separation distances be increased by 300 meters to account for registration inaccuracy in the identification of a WMTS system location. Moreover, as a complement to this approach, the FCC may allow TVWS device operators who believe that the location as thus "adjusted" provides too much protection in any given direction from a hospital to identify the actual perimeter of the WMTS system hospital, confirm its determination of the perimeter calculation with the hospital (through the ASHE database contact point), and then seek recalculation of the relevant separation distances as reflected in the TVWS device database.

If the Commission insists on utilizing a hospital's actual perimeter in measuring the separation distances, then the onus must be placed on the unlicensed community to make that

[42] Ironically, the Commission decided to adopt the relatively simpler "licensing by rule" approach for WMTS licensees in part because it would "minimize regulatory procedures and thus facilitate deployment." *Amendment of Parts 2 and 95 of the Commission's Rules to Create a Wireless Medical Telemetry Service*, Report and Order, 15 FCC Rcd 11206, 11216 ¶ 27 (2000).

determination. The proponents of TWVS device use in Channel 37, Microsoft and Google, have the technical resources to make these calculations. As the two commenting parties who believe that the calculation of a hospital's perimeter is a relatively simple task, it does not seem unfair to seek their assistance in completing this process for the approximately 5500 hospitals that may deploy WMTS systems in this spectrum band.

It is also not unfair to impose on a TVWS device operator who desires to operate in closer proximity to a hospital to determine and then register with the TVWS database the closest point of the hospital's perimeter to its desired operating location (based on GPS or other available information) in order to use Channel 37 closer than the designated separation distance. Whether the perimeter of a particular hospital is determined by the unlicensed community or individual TVWS device operators, over time the appropriate databases should develop reasonably accurate perimeter measurements from many, if not most, hospitals on file, mooting the need for any further "location inaccuracy" factor based on the potential inaccuracy of the information in the ASHE database.[43]

B. WMTS Licenses should not have to seek waivers in order to assure that interference to patient-safety services will not occur.

Unfortunately, the *R&O*'s approach to interference protection for WMTS is the adoption of separation distances that will not fully protect most WMTS licensees from interference, mitigated only by an apparently complex waiver process imposed on hospitals to obtain the necessary protection in the form of sufficient separation distances in their specific

[43] Of course, a mechanism must also be adopted for regular review of these perimeter measurements to assure that they appropriately reflect changes in the location of the WMTS system within a hospital campus.

circumstances.[44] The Commission should not be satisfied merely to protect *many* hospitals from interference to their WMTS systems. Rather, the appropriate approach should be to adopt more conservative separation distances, even when doing so creates larger zones than may be needed to protect a particular WMTS licensee from interference. With this approach, it is entirely appropriate for the Commission to allow TVWS device operators (or the so-called "unlicensed community") to establish through the waiver process that the unique characteristics of any given WMTS system operation or external environment will allow operation of TWVS devices in certain locations in closer proximity to the hospital without likely causing for harmful interference to the WMTS system.

The overwhelming majority of hospitals are not, and will not become, positioned to understand the implications of these rules (and the possibility of unlicensed operation on their WMTS spectrum in very close proximity) before an incident of interference occurs – and by that point, the damage to patient care will have been suffered and the realistic opportunity to engage in the waiver process will have passed. Nor are most hospitals positioned with personnel and resources to prepare the materials necessary to justify the waiver, much less engage counsel or other resources to file it. Hospitals are in the business of providing high quality health care and should not be obligated to make filings in order to protect the facilities they use to complete their primary mission. It is one thing for the Commission to place the burden of licensing on the hospitals in order to obtain protection for their WMTS systems; it is a far greater and unjustified

[44] The *R&O* stated "We note that the distances we are setting to protect WMTS systems will *generally* protect against harmful interference, but recognize that adjustments may be necessary based on the unique characteristics of the health care facility and path loss relative to the potential locations of the white space deployment." *R&O*, 30 FCC Rcd at 9643 (emphasis added).

burden to require that they make further filings in order to obtain protection from interference for those life-critical facilities from *unlicensed* TVWS devices.

The Coalition recognizes, of course, that for many hospitals the "circular" separation distances created by the correctly applied TM 91-1 calculation may not be reflective of the surrounding environment, terrain and actual operating characteristics of every licensed WMTS systems in use. The Coalition also recognizes that there may be other policy reasons to allow some unlicensed devices to operate in closer proximity where local factors will provide the level of protection necessary to assure that interference should not occur from the closer operation of a TVWS device. But the burden to characterize a particular hospital's environment must fall on those parties who want to operate in closer proximity closer, and not on the hospitals to protect themselves from the greater likelihood of interference.[45]

Ironically, rather than acknowledge the oddity of imposing on a *licensed service* the obligation to make a filing to obtain protection from interference from an *unlicensed use*, the *R&O* seems to discourage any hospital that would even try to seek such relief. First, the hospital must show that the "good-faith steps taken to engage the unlicensed community and reach a consensus as to an appropriate and tailored approach to sharing"[46] – as if any particular hospital would even know who and where to engage such a "community" (to the extent one exists). And then the *R&O* threatens to dismiss any request for expanded separation distances "in the absence

[45] As noted above, the waiver process must also establish a mechanism for reviewing the environment for which the waiver was granted on some regular basis. Particularly where the waiver is based on the existence of intervening buildings or other "clutter," or even on the nature of the hospital building construction, the possibility that over time those factors may change – as buildings are torn down, or hospitals upgrade their exterior to add more glass – must be considered in assuring that the factors that warranted a waiver in one year may not exist several years later.

[46] *Id*. at 9642-43 n.554.

of a substantiated showing"[47] – as if to discourage hospitals from seeking relief without a costly, time consuming study of their environment or other factors that would warrant larger separation distances.[48] There is no need for such a burden,[49] and it is inconsistent with the *R&O*'s general acknowledgement that the burden of interference avoidance falls on the unlicensed user, and not on the licensee.[50] The burden of seeking waivers should be placed principally on the newcomer unlicensed operator/user community that seeks operation closer than appropriately conservative calculated protection distances.

If the adopted separation distances remain insufficient to protect a significant number of hospitals from interference, and the Commission continues to place the burden of obtaining necessary relief on WMTS licensees, the Commission should adopt a very liberal waiver standard that can be easily implemented by hospitals. The Coalition believes that simply demonstrating that the hospital's environment or operating factors do not fit into the assumptions used by the Commission in calculating the "default" separation distances (i.e., showing factors such as the appropriate SNR, the WMTS antenna height above 10 meters, or the existence of line-of-sight to distances much farther than those in the rules in a particular direction from the hospital) should be sufficient to justify relief in the form of significantly larger separation distances in the direction in which the hospital is most vulnerable to TWVS signals. And such filings should be expeditiously reviewed and approved.

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[47] *Id.*

[48] One could make an argument today that merely showing that the hospital operates a WMTS system with antennas located at heights above 10 meters should warrant a significant increase in the currently adopted separation distances. The *R&O* is unclear whether more is expected.

[49] It is noteworthy that there is no similar statement imposing this obligation on a TVWS device operator who desired to reduce the size of the default separation distances.

[50] "We take this opportunity to underscore for white space device operators that in all cases, they always have the obligation to protect WMTS systems from harmful interference and eliminate such interference if it should occur." *R&O*, 30 FCC Rcd at 9643

V. The proposal to "limit initial deployment of white spaces devices" as a means of ensuring that the separation distances will protect WMTS licensees from interference, while laudable, requires significantly greater detail.

The Coalition applauds the recognition in the *R&O* that a "trial run" limited to authorization of unlicensed operation on Channel 37 in a few areas is needed "to validate and, if needed, adjust our approach so that critical WMTS systems do not experience harmful interference."[51] However, the Coalition believes that significantly more consideration must be given to the implementation of these trials, both as to the scope and length, before TVWS devices can be ubiquitously authorized to operate in Channel 37. While opponents may be unhappy with the resulting delays in being able to go to full scale production of TVWS devices capable of using Channel 37, the need to assure that the Commission's adopted separation distances will not result in widespread instances of interference more than justifies any such delays. The Coalition stands ready to work with the Commission to develop appropriate plans for these test beds, but urges the Commission on reconsideration of the *R&O* to clarify its expectations for a valid test.

A. The choice of area of testing and hospitals under test should consider a variety of operating systems and operating environments to assure that the "most vulnerable" areas of each site tested are determined and tested.

As the Coalition fully acknowledged in submitting test results, and the *R&O* consistently notes,[52] operation of unlicensed devices on Channel 37 at different locations around a WMTS hospital will not necessarily result in interference from any particular device; but it only takes operation in one direction to cause interference. As the test results submitted by GE Healthcare

[51] *Id.* at 9643.
[52] *Id*. at 9636 and 9637.

and the Coalition[53] demonstrated, *signals from at least one unlicensed device location created interference into the test receivers at each of the three hospitals tested.* Moreover, as the Coalition has consistently noted, given the regular use of distributed antennas in many WMTS systems, interference received at one antenna in a system is likely to impact the use of the system along the entire facility.

For this reason, the Coalition believes that any "limited area validation testing" must take into account numerous locations around several hospitals in order to find the area of each hospital that is likely to be most vulnerable to interference. It is not enough to pick a few test points in locations that are well shielded and conclude that interference won't occur to that WMTS system. To the contrary, the better testing will seek to determine the most vulnerable locations in the hospital in order to confirm that, even where there is the least amount of natural shielding, operation of an unlicensed device at the designated distance and power levels will not create interference.

Moreover, testing must consider the almost certain aggregation of signals that will exist if unlicensed devices proliferate as expected by the "unlicensed community." So it will not be enough simply to test individual locations; rather testing should consider multiple simultaneous transmissions from different locations around the hospital in order to simulate the likelihood that many devices will be transmitting simultaneously.

[53] See, e.g., ex parte letters from Lawrence J. Movshin & Timothy J. Cooney, Counsel to WMTS Coalition, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 14-165 and GN Docket No. 12-165 (July 20, 2015) (one letter contains Wheaton test results and the second letter contains Froedtert test results); Comments of GE Healthcare, ET Docket No. 14-165 and GN Docket No. 12-165, at Apps. A and B (Feb. 4, 2015) (Inova Alexandria test results).

Given the likelihood that over time there will be scores of manufacturers of unlicensed products, it is also important that these tests include devices manufactured by several different manufacturers. In this manner, testing can better demonstrate the vulnerability of WMTS systems to interference from a variety of unlicensed devices that may be operating over time in a real world environment.

Finally, but by no means, least important, the testing to validate the adopted rules must be carefully coordinated with any hospitals in the testing market to assure that real time patient monitoring is not compromised. As the Coalition and GE Healthcare determined in conducting the three tests accomplished prior to the release of the ***R&O***, this is no small issue and one that cannot be taken lightly; because any interference to a working system has the potential for placing critical care patients at risk, cooperation of *all* hospitals within a market – even those not obviously within close proximity to the tests but still potentially affected by the offending signals – must be obtained.

In the same vein, before engaging in any testing, the Commission should coordinate with the Food and Drug Administration. (FDA) While the FCC is responsible for regulating the electromagnetic environment to prevent harmful interference to WMTS, the FDA has jurisdiction over the review, approval and supervision of WMTS systems and, as such, has significant interest in any changes that might occur in the environment in which incumbent WMTS systems operate. For some WMTS systems, the use of Channel 37 as a "quiet space" free from potentially interfering uses may have been of some decisional significance to the FDA; allowing unlicensed operations in Channel 37 is a matter that may impact FDA approvals of some of the equipment under test. And clearly, any testing that could put patient safety at risk will be of some concern to the FDA.

In addition to coordinating with the FDA, the Coalition urges that the Commission, pursuant to 45 CFR 46.101(d) and as a matter of public policy, establish an Institutional Review Board to guide the design and conducting of testing. Given that harmful interference to WMTS systems would create life-threatening situations for patients, it is appropriate for the Commission to impose a high level of rigor and independent review to assure the safety and validity of testing and that the interests of the patients potentially impacted are protected.

VI. The Commission should not allow any TVWS devices to operate in Channel 37 until a well-designed and proven plan for enjoining an interfering device has been adopted.

A. The current approach to interference mitigation will not be sufficient for protecting patient safety if an unlicensed device does create interference into a WMTS system.

No matter what separation distances are adopted, given the tens of millions of unlicensed consumer-grade devices that the unlicensed community projects, if unlicensed TVWS devices are allowed to operate in Channel 37, it is likely that some interference at some time to some WMTS systems will occur. Manufacturing failures, quality control, software design flaws, or failures relating to TVWS database management (in addition to the inevitable existence of "bad actors" who simply ignore the certification requirements) are all possible and could result in some amount of interference to WMTS systems.

Given this real possibility, the Coalition sought detailed procedures for assuring that interference would be promptly resolved. As the Commission acknowledged in the *R&O*, under current rules, database administrators may not take action to shut down a device or a channel without Commission authorization,[54] a relatively cumbersome process that could leave a WMTS system out of commission for some time. Unfortunately, the *R&O* leaves this important element

[54] *Id*. at 9654.

of its regulatory regimen to a further proceeding for the FCC Staff and other interested parties to propose a more efficient and effective system.

On reconsideration, the Commission should develop and adopt a method by which any interference that occurs into a WMTS system will be promptly resolved without burdening healthcare practitioners with the obligation to hunt down the interferer and make filings with the Commission. In the Coalition's view, if interference into a WMTS system is detected, the rules must allow the impacted WMTS hospital to contact either a TVWS database administrator or the ASHE database administrator to have all potentially offending devices within a pre-designated radius of the affected hospital promptly redirected off Channel 37. This may be accomplished by the immediate expansion of the adopted separation distances by some multiple, and redirection of any devices then operating on Channel 37 within the expanded zone to a different channel[55] until the interference can be resolved (with the additional opportunity to further expand the separation zone if the initial expansion does not work to resolve the problem). Or it may be accomplished by extending the same type of "push" notification process that the *R&O* now requires for TVWS devices when they are operating in proximity to wireless microphones to incidents of interference to WMTS systems, [56]with similarly short processing time for TVWS database administrators to send the "push" notification to change channels.

In addition, a regulatory process should be adopted by which the specific offending device may be identified before any devices are allowed to use Channel 37 at the previously

[55] In addition, if the interference continues after moving all devices off Channel 37, the rules should allow the TVWS database managers also to move any devices operating within a pre-designated distance (for example, within 3x meters of the required separation distance) on adjacent and near adjacent channels (i.e., any channel within the range of Channels 33-41) to other channels outside this range, in order to establish the interfering source and eliminate it.

[56] *See id.* at 9662-64

authorized separation distances. For example, some process may be imposed that requires the TVWS database administrator to authorize the use of Channel 37 only on a device by device basis at the designated separation distance until the offending device has been identified. The Commission should not move forward in allowing Channel 37 to be used by unlicensed devices without an interference-resolution plan in place and codified in the rules.

VII. The Commission Erred in Authorizing Operation of Personal Portable Devices on Channel 37

In the *Notice*, the Commission sought comment on several approaches for allowing unlicensed white space devices to access channel 37, including allowing fixed white space devices only, fixed and Mode II personal/portable devices, or also permitting Mode I personal/portable devices.[57] The Coalition consistently urged that the Commission initially allow only fixed devices to operate in Channel 37, as they would be most easily controlled and least likely to violate the required separation distances. Relying on erroneous factual premises however, the *R&O* authorized both fixed and mobile devices, giving short shrift to the Coalition's proposal to permit only fixed operations initially.

Specifically, the *R&O* claims that "[t]he white space databases are well equipped to protect WMTS and RAS users from interference from fixed devices as well as Mode I and Mode II personal/portable white space devices."[58] The *R&O*, however, provides no support for this claim. The envisioned geolocation database scheme entails a massive and complex, autonomous real-time distributed system that simply has not been tested for the large number of personal/portable TVWS devices that are envisioned by the unlicensed community. As the

[57] *See NPRM*, 29 FCC Rcd at 12279-12280, ¶¶ 101-103.
[58] *R&O*, 30 FCC Rcd at 9633.

WMTS Coalition and GEHC have pointed out, the Commission has only limited experience with unlicensed fixed white space devices and *no experience whatsoever* using the white space databases to control personal/portable devices. Health care institutions should not be the test bed for experimentation with untried technologies.

The *R&O* also failed to respond to the serious questions regarding the *dependability* (including *reliability* and *security*) of the proposed white space geolocation database scheme. The *R&O*'s suggests that "the white space rules require devices to have security features built in and for the databases to have the ability to shut down a device or class of devices if they are found to be causing harmful interference or otherwise in violation of the rules."[59] This statement would be true, however, only if all components of the system – including the white space databases and the potentially millions of disparate consumer-grade devices - can be depended upon to consistently function correctly i.e. are both secure *and* reliable. These issues warrant further reconsideration.

Besides its cursory treatment of unlicensed device security, the *R&O* fails to address the question of reliability, a factor that is critical to assuring that the adopted separation distances and power levels are respected in all cases and that the interference redress mechanism can be relied upon.[60] In particular as the Coalition previously pointed out, decades of experience from other industries show that type testing and attestation alone are insufficient to assure software-based consumer devices will all operate reliably. These issues may not be particularly important

[59] *Id.* at 9632 n.495.

[60] "Dependability" refers to system properties like reliability and security that allow a system to be relied on to function as required. "Reliability" is the probability of failure-free software operation for a specified period of time in a specified environment. Reply Comments of GE Healthcare, ET Docket No. 14-165, GN Docket No. 12-268, February 25, 2015, at 2, 9; Comments of GE Healthcare, ET Docket No. 14-165, GN Docket No. 12-268, February 4, 2015, at 28.

for devices operating in most TV white space channels, but they are critical for safety-of-life WMTS systems. That the *R&O* fails to address these issues is a matter that also warrants reconsideration.

As the Coalition and its members have consistently emphasized, authorizing personal/portable operations in adjacent and the same frequency bands presents a significant threat to the viability of WMTS systems. Any interference may be severely damaging but yet too intermittent to identify and remedy. In fact, the source of the problem in the health care facility may not be immediately understood because hospitals rarely have an RF engineer on staff; and the itinerant nature of portable operations makes identification and isolation of the source and cause of interference extremely difficult. These risks may be deemed acceptable for television service but not when patient safety is in the balance.

Ironically, in allowing personal/portable devices to operate on Channel 37, the R&O assumed that such devices would be operating at heights of 3 meters or less, but there is no specific limitation at which personal/portable devices may operate, thus increasing the risk posed by such devices to WMTS systems when they are, in fact, located at heights higher than 3 meters. For example, nothing in the current regulations would restrict the use of a personal/portable TVWS device from operating on a very high floor of a building in close proximity to a hospital, potentially even on a balcony or other outdoor living spaces where the TM 91-1 model assumption of a 3 meter antenna height is entirely inadequate to protect the WMTS system from interference.[61]

[61] While the Coalition does not support the use of personal portable devices in Channel 37 at this time, if the Commission does not reconsider this decision, at the very least the Commission should take into account the height of personal/portable devices in determining the separation distance needed to protect

Finally, the ***R&O*** erred in adopting a wide range of available power levels at which mobile/portable devices might be authorized to operate, but then assuming that as a result of the incentive auction channel plan, only the lowest power levels will be permitted in Channel 37.[62] This assumption is premature. Until the channel plan is defined, the Commission should not have even considered allowing higher-powered devices to operate in Channel 37. On reconsideration, this error should be remedied.

VIII. The Commission has not complied with the Regulatory Flexibility Act

As the Commission is well aware, when an agency promulgates a final substantive rule that is subject to the notice and comment requirements of Section 553 of the Administrative Procedure Act ("APA"), Section 604 of the Regulatory Flexibility Act ("RFA") requires that the agency prepare a final regulatory flexibility analysis regarding the effect of the rule on small businesses.[63] The analysis must contain, *inter alia*, a succinct statement of the need for, and objectives of, the rule; a description of and an estimate of the number of small entities affected; and an explanation for the rejection of alternatives designed to minimize the significant economic impact of the rule on small entities.[64]

In the ***R&O***, the Commission decided to allow unlicensed white space devices to operate on Channel 37, which for over a decade has been used exclusively for WMTS and the Radio Astronomy Service ("RAS"). The FCC decided that its rules need not protect hospitals subject

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WMTS systems from interference. Because Mode II personal/portable devices are required to have geolocation capability, their height should already be known so that the rules can specify protection distances at different operating heights and powers, much like they do for fixed white space devices.

[62] *R&O*, at 9633.

[63] 5 U.S.C. § 604. *See USTA, Inc. et al. v. FCC*, 400 F.3d 29, 40-41(D.C. Cir. 2005) (noting that legislative rules are subject to the notice and comment requirements prescribed by Section 553 of the APA and thus the regulatory flexibility analysis requirement contained in Section 604 of the RFA).

[64] *See* 5 U.S.C. § 604(a)(1)-(6).

to a "worst possible scenario" where WMTS transmitters receive antennas in a hospital are placed near windows facing the direction of a white space transmitter.[65] Thus, hospitals that seek protection from Channel 37 white space operations may need to re-design their systems to move WMTS receive antennas transmitters away from windows that possibly could face a white space transmitter.

The FCC also required Channel 37 WMTS licensees that seek protection from co-channel unlicensed operations to register with a white space database and provide information on the perimeter of the buildings employing WMTS transmitters operating on Channel 37 to a TVWS database administrator.[66] Additionally, the FCC adopted a procedure by which any hospital or white space operator that needs to remediate inadequate default protection zones must file a request for waiver to modify the protection distance for a particular facility or group of facilities.[67] Health care facilities seeking to provide appropriate protection for their WMTS facilities will need to either prepare such waiver requests or respond to waiver requests from white space operators.

Notwithstanding that these new requirements will place a significant burden on hospitals generally, but even more on smaller hospitals, the Commission's final Regulatory Flexibility Analysis does not address in any fashion the burdens that these new obligations will impose on health care facilities, many of which qualify as small entities within the meaning of the RFA. Indeed, the FCC's final Regulatory Flexibility Analysis does not even mention hospitals or health care facilities; they are completely ignored. The Regulatory Flexibility Analysis does not

[65] *R&O*, 30 FCC Rcd at 9637.
[66] *Id.* at 9643.
[67] *Id.* at 9642.

include a succinct statement of the need for, and objectives of, the rules affecting WMTS licensees; a description of and an estimate of the number of small entities affected; or an explanation for the rejection of alternatives designed to minimize the significant economic impact of the rule on such small entities. In the absence of the ***R&O*** complying with the RFA, the Commission may not require small entity health care facilities to register with a white space database and, thus, may not permit white space operators to begin operations on Channel 37.

Additionally, pursuant to the Paperwork Reduction Act of 1995 ("PRA"), the Commission may not require the collection of information such as the determination and registration of perimeter measurements, other information that WMTS licensees are to provide the white space database administrator, or to collect for purposes of filing a waiver request without first conducting a review and obtaining OMB's approval for the proposed collection.[68] Prior to seeking OMB approval, the Commission must review the proposed collection of information and seek comment on: (i) whether the proposed collection is necessary for the proper performance of the functions of the agency; (ii) the accuracy of the agency's estimate of the burden of the proposed collection; (iii) ways to enhance the quality, utility, and clarity of the information collected; and (iv) ways to minimize the burden of the collection.[69] Only after the Commission's review is complete and the public comments received have been evaluated, may the FCC seek OMB approval.[70] If OMB finds that the collection "is unnecessary for any reason, the agency may not engage in the collection of information."[71] As discussed above, all of these obligations are extremely burdensome on health care facilities, and yet the FCC has not yet

[68] Paperwork Reduction Act of 1995, Public Law 104-13; 44 U.S.C. § 3507.
[69] 44 U.S.C. § 3506(c)(1)-(2).
[70] *Id*.
[71] 44 U.S.C. § 3508.

initiated that process with respect to WMTS licensees. This is a significant failing that must be remedied on reconsideration.

IX. Conclusion

The Coalition has stated its concerns that the Commission might not adequately protect most hospitals from interference in determining the technical limitations on unlicensed use of Channel 37, and many of the decisions made in the *R&O* have validated those concerns. The public interest, and protection of patient safety (and of licensed services from interference) warrant reconsideration of the approach underlying the adopted separation distances. For the reasons discussed above, the Coalition urges reconsideration of the *R&O* consistent with the changes requested herein.

Respectfully submitted,

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EXHIBIT A

Highest Floor of WMTS Deployments

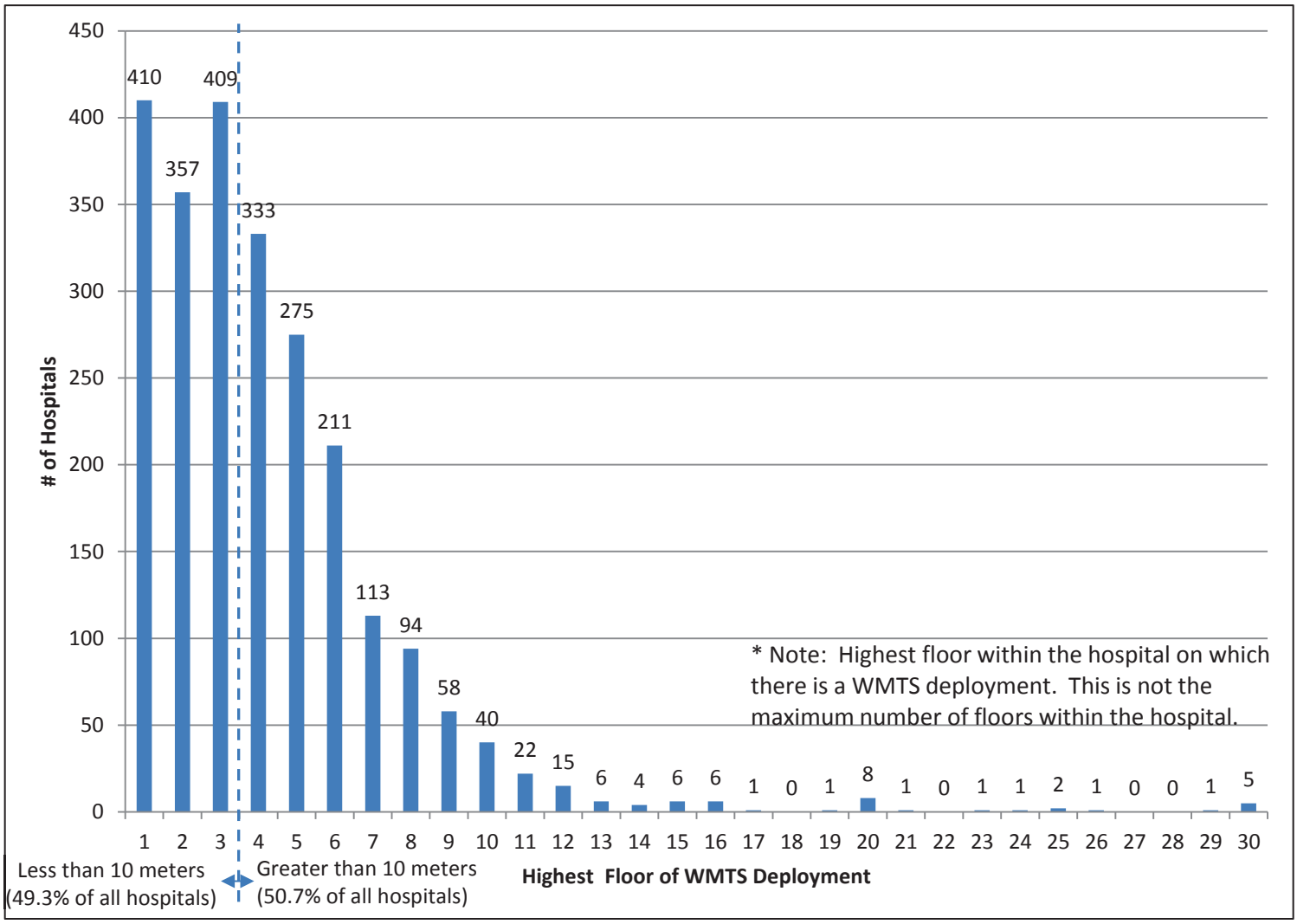

EXHIBIT B

Adopted Separation Distances between TVWS devices
and
Licensed WMTS, DTV and 600 MHz Stations

Height Above Average Terrain of Unlicensed Device (m)		Tx EIRP (dBm/6 MHz)						
		16	20	24	28	32	36	40
Communicating with Mode II or Fixed Device	Unlicensed to WMTS	0.38	0.48	N/A	N/A	N/A	N/A	N/A
	Unlicensed to DTV	1.3	1.7	N/A	N/A	N/A	N/A	N/A
	Unlicensed to 600 MHz	5	6	N/A	N/A	N/A	N/A	N/A
Communicating with Mode I Device	Unlicensed to WMTS	0.76	0.96	N/A	N/A	N/A	N/A	N/A
	Unlicensed to DTV	2.6	3.4	N/A	N/A	N/A	N/A	N/A
	Unlicensed to 600 MHz	10	12	N/A	N/A	N/A	N/A	N/A
Less than 3 meters	Unlicensed to WMTS	0.38	0.48	0.60	0.76	0.96	1.20	N/A
	Unlicensed to DTV	1.3	1.7	2.1	2.7	3.3	4.0	4.5
	Unlicensed to 600 MHz	5	6	7	9	12	15	19
3-Less than 10 meters	Unlicensed to WMTS	0.70	0.88	1.10	1.38	1.74	2.20	N/A
	Unlicensed to DTV	2.4	3.1	3.8	4.8	6.1	7.3	8.5
	Unlicensed to 600 MHz	9	11	14	17	22	27	34
10-Less than 30 meters	Unlicensed to WMTS	1.20	1.55	1.95	2.45	3.05	3.80	N/A
	Unlicensed to DTV	4.2	5.1	6.0	7.1	8.9	11.1	13.9
	Unlicensed to 600 MHz	15	19	24	30	38	47	60
30-Less than 50 meters	Unlicensed to WMTS	1.55	2.00	2.50	3.15	3.95	4.95	N/A
	Unlicensed to DTV	5.4	6.5	7.7	9.2	11.5	14.3	19.1
	Unlicensed to 600 MHz	20	24	31	38	49	60	60
50-Less than 75 meters	Unlicensed to WMTS	1.90	2.45	3.05	3.85	4.85	6.10	N/A
	Unlicensed to DTV	6.6	7.9	9.4	11.1	13.9	18.0	23.8
	Unlicensed to 600 MHz	24	30	37	47	60	60	60
75-Less than 100 meters	Unlicensed to WMTS	2.20	2.80	3.55	4.45	5.60	7.05	N/A
	Unlicensed to DTV	7.7	9.2	10.9	12.8	17.2	21.1	27.2
	Unlicensed to 600 MHz	27	34	43	54	60	60	60
100-Less than 150 meters	Unlicensed to WMTS	2.70	3.45	4.35	5.45	6.85	8.65	N/A
	Unlicensed to DTV	9.4	11.1	13.2	16.5	21.4	25.3	32.3
	Unlicensed to 600 MHz	33	42	53	60	60	60	60
150-Less than 200 meters	Unlicensed to WMTS	3.15	3.95	5.00	6.30	7.90	9.95	N/A
	Unlicensed to DTV	10.9	12.7	15.8	19.5	24.7	28.5	36.4
	Unlicensed to 600 MHz	39	49	60	60	60	60	60
200-250 meters	Unlicensed to WMTS	3.50	4.40	5.60	7.00	8.80	11.00	N/A
	Unlicensed to DTV	12.1	14.3	18.2	22.0	27.3	31.2	39.5
	Unlicensed to 600 MHz	43	54	60	60	60	60	60

EXHIBIT C

Proposed Separation Distances for TVWS Devices operating on Channel 37

Rx Sensitivity	-100	dBm/10 kHz
I/N	-6	dB
SNR	10	dB
Aggregation factor	6	dB
Antenna mismatch, polarization	2	dB
Assumed Tx Frequency	611	MHz
Rx Antenna Height	20	m

	Required Path Loss (dB)					
	16 dBm (40 mW)	20 dBm (100 mW)	24 dBm (250 mW)	28 dBm (625 mW)	32 dBm (1600 mW)	36 dBm (4 watts)
Required Path Loss (dB)	108.22	112.22	116.22	120.22	124.22	128.22

*Fomula to calculate req'd path loss==> (Tx EIRP + 10*log(12.5/6000)) - (Rx Sens + 10*log(12.5/10)) + SNR - I/N + Agg Factor - Ant Mismatch*

Fixed and Mode II White Space Devices

Antenna height above average terrain of unlicensed device	Required co-channel separation distances from WMTS sites when communicating with Fixed or Mode II devices (km)						Additional distance when communicating with Mode I	
	16 dBm (40 mW)	20 dBm (100 mW)	24 dBm (250 mW)	28 dBm (625 mW)	32 dBm (1600 mW)	36 dBm (4 watts)	16 dBm (40 mW)	20 dBm (100 mW)
Less than 3 meters	1.14	1.43	1.81	2.27	2.86	3.60	**	**
3 - Less than 10 meters	2.08	2.62	3.30	4.15	5.22	6.58	**	**
10 - Less than 30 meters	3.60	4.53	5.71	7.19	9.05	11.39	**	**
30 - Less than 50 meters	4.65	5.85	7.37	9.28	11.68	14.70	**	**
50 - Less than 75 meters	5.69	7.17	9.03	11.36	14.30	18.01	**	**
75 - Less than 100 meters	6.58	8.28	10.42	13.12	16.52	20.79	**	**
100 - Less than 150 meters	8.05	10.14	12.76	16.07	20.23	25.47	**	**
150 - Less than 200 meters	9.30	11.71	14.74	18.56	23.36	29.41	**	**
200 - 250 meters	10.40	13.09	16.48	20.75	26.12	32.88	**	**

** As noted in Footnote 41, if the Commission does not reconsider the decision to permit use of Mode I devices in Channel 37, the Commission should develop separation distances that take into account not only the height of the Mode II device but also the height of the Mode I device in determining the separation distance needed to protect WMTS systems, recognizing that in the absence of a method for determining accurately the height of the Mode I device more conservative distances must be imposed