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Before the
Federal Communications Commission
Washington, D.C. 20554

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In the Matter of	)	
	)	
Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems	)	ET Docket No. 98-153
	)	
Petition for Waiver of the Part 15 UWB Regulations Filed by the Multi-band OFDM Alliance Special Interest Group	)	ET Docket No. 04-352

THIRD MEMORANDUM OPINION AND ORDER
AND
MEMORANDUM OPINION AND ORDER

Adopted: August 10, 2010 **Released: August 11, 2010**

By the Commission:

I. INTRODUCTION

1. By this action, we are reaffirming certain rules and procedures for ultra-wideband ("UWB") devices that operate on an unlicensed basis under Part 15 of the Commission's rules. This action terminates the above-captioned proceedings and thus provides certainty for the continued development of UWB equipment, including ground penetrating radars for underground imaging, through wall imaging systems, short-range high capacity data links, and other applications.

2. Because of their wide operating bandwidths, UWB devices operate in frequency bands that are allocated to many different types of Federal and to non-Federal licensed operations.[1] In this Third Memorandum Opinion and Order, we are dismissing as procedurally defective a Petition for Reconsideration filed by the Satellite Industry Association ("SIA") in response to the *Second Report and Order and Second Memorandum Opinion and Order* ("*Second R&O*" and "*Second MO&O*") in ET Docket No. 98-153 that argues that the power level adopted for UWB devices is too high to protect C-band (3.7-4.2 GHz) fixed satellite service ("FSS") earth stations from interference.[2] In this Memorandum Opinion and Order, we are dismissing in part and denying in part a Petition for Reconsideration filed by SIA and denying a Petition for Reconsideration filed by Cingular Wireless LLC ("Cingular") (now AT&T) in response to the *Order* ("*Order*") in ET Docket No. 04-352.[3] Both petitions argue that the

[1] The operation of Federal Government radio stations is regulated by the National Telecommunications and Information Administration (NTIA), while the operation of stations by private industry, by state and local governments and by the public is regulated by the Commission.

[2] *See Second Report and Order and Second Memorandum Opinion and Order* in ET Docket No. 98-153, 19 FCC Rcd 24558 (2004).

[3] *See Order* in ET Docket No. 04-352, 20 FCC Rcd 5528 (2005). This waiver was granted in response to a petition filed by the Multi-band OFDM Alliance Special Interest Group ("MBOA-SIG").

waiver granted by the *Order* of the measurement procedures for UWB devices operating in the 3.1-5.03 GHz and 5.65-10.6 GHz bands would significantly increase the potential for interference to C-band fixed satellite and cellular operations.

II. BACKGROUND

3. On February 14, 2002, the Commission adopted the *First Report and Order* ("*First R&O*") in ET Docket No. 98-153, amending Part 15 of its rules to permit the marketing and the unlicensed operation of products incorporating UWB technology.[4] UWB devices operate in frequency bands that are allocated both to Federal and to non-Federal operations, including certain frequency bands where unlicensed devices generally are restricted from transmitting, *i.e.*, the restricted frequency bands, due to the extremely wide bandwidths UWB devices use.[5] Consequently, before the Commission adopted its technical and operational rules for UWB devices, it evaluated several measured and simulated analyses regarding the potential for UWB devices to cause harmful interference to the authorized services.[6]

4. Two additional orders were adopted in response to several Petitions for Reconsideration. On February 13, 2003, the Commission adopted a *Memorandum Opinion and Order and Further Notice of Proposed Rule Making* ("*MO&O*" and "*FNRPM*") in ET Docket No. 98-153,[7] addressing fourteen Petitions for Reconsideration of the *First R&O*[8] and proposing changes to the UWB regulations. On

[4] *See First Report and Order* in ET Docket No. 98-153, 17 FCC Rcd 7435 (2002), and *Erratum* in ET Docket No. 98-153, 17 FCC Rcd 10505 (2002). *See also* 47 C.F.R. §§ 15.501-15.525.

[5] The restricted bands are frequency bands employed by radio services that are used for safety-related purposes or that must function, as a nature of their operation, using extremely low received signal levels. These latter systems may be passive, such as radio astronomy, or active, such as satellite down links and wildlife tracking systems. *See* 47 C.F.R. § 15.205. There is sufficient spectrum between restricted bands to allow for the operation of non-UWB devices without incursion into the restricted frequency bands. *See First R&O* at paras. 30-32 for additional discussion on this issue.

[6] These analyses and tests are filed in the record for the UWB proceeding in ET Docket No. 98-153. *See, e.g.*, NTIA Special Publication 01-43, *Assessment of Compatibility between Ultrawideband Devices and Selected Federal Systems*, January 2001; NTIA Special Publication 01-45, *Assessment of Compatibility between Ultrawideband (UWB) Systems and Global Positioning System (GPS) Receivers*, February 2001; NTIA Special Publication 01-47, *Assessment of Compatibility between Ultrawideband (UWB) Systems and Global Positioning System (GPS) Receivers (Report Adendum)*, November 2001; NTIA Report 01-383, *The Temporal and Special Characteristics of Ultrawideband Signals*, January 2001; NTIA Report 01-384, *Measurements to Determine Potential Interference to GPS Receivers from Ultrawideband Transmission Systems*, February 2001; NTIA Report 01-389, *Addendum to NTIA Report 01-384: Measurements to Determine Potential Interference to GPS Receivers from Ultrawideband Transmission Systems*, September 2001; *Final Report UWB-GPS Compatibility Analysis Project*, 8 March 2001, Strategic Systems Department, The Johns Hopkins University/Applied Physics Laboratory; the study submitted by NTIA on March 21, 2001, on behalf of the Department of Transportation regarding tests performed at Stanford University; *A Model for Calculating the Effect of UWB Interference on a CDMA PCS System*, September 12, 2000, Dr. Jay Padgett, Senior Research Scientist, Telcordia Technologies attached to the Sprint comments of September 12, 2000; measurements and analysis submitted by Qualcomm in its comments of March 5, 2001; the analyses submitted by the Satellite Industry Association in several of its comments; and multiple others.

[7] *See Memorandum Opinion and Order and Further Notice of Proposed Rule Making* in ET Docket No. 98-153, 18 FCC Rcd 3857 (2003).

[8] Petitions for reconsideration were submitted by Aeronautical Radio, Inc. and Air Transport Association of America, Inc. ("ARINC and ATA"), by American Gas Association and American Public Gas Association ("AGA and APGA"), by Cingular Wireless LLC ("Cingular"), by GPR Service Providers Coalition ("GPR Providers"), by Ground Penetrating Radar Industry Coalition ("GPRIC"), by Kohler Co. ("Kohler"), by Multispectral Solutions, Inc. ("MSSI"), by National Utilities Contractors Association ("NUCA"), by QUALCOMM Inc. ("Qualcomm"), by Satellite Industry Association ("SIA"), by Siemens VDO Automotive AG ("Siemens VDO"), by Sirius Satellite

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December 15, 2004, the Commission adopted the *Second R&O* and *Second MO&O*,[9] addressing the proposals in the *FNPRM* in addition to denying the Petitions for Reconsideration of the *MO&O* filed by Cingular and by SIA. In the *Second MO&O*, the Commission also addressed the interference analysis submitted by the Coalition of C-Band Constituents ("Coalition").[10] The Coalition had contracted with Alion Science and Technology ("Alion") to determine what, if any, interference potential exists to Fixed Satellite Service ("FSS") reception from UWB operation.[11] The Commission found that the test report on this matter ("Alion Report") was based on multiple worst-case and unrealistic assumptions and provided no justification to warrant reducing the allowed UWB emission levels in the FSS frequency band.

5. On March 10, 2005, the Commission adopted an *Order* granting a waiver of the measurement procedures to permit emissions from UWB transmitters operating in the 3.1-5.03 GHz and 5.65-10.6 GHz bands that employ frequency hopping or stepped frequency modulation techniques, or that gate the transmitted signal, to be measured with the transmitter operating in its normal transmission mode.[12] This action waived the UWB measurement requirements not only for Multi-band OFDM Alliance Special Interest Group ("MBOA-SIG") but also for any UWB device using hopped, stepped or sequenced modulation techniques or that gates the transmittal signal.

III. SIA PETITION FOR RECONSIDERATION OF THE *SECOND MO&O*

6. SIA asserts, as it has on previous occasions in this rulemaking proceeding, that the power limit adopted for UWB devices[13] is not sufficient to protect C-band FSS earth stations from interference because, in devising this power limit, the Commission's analysis relied on a 0 dB interference-to-noise ratio ("I/N") for earth station receivers, which is too high. SIA also disagrees with the Commission's conclusion in the *Second MO&O* that the Alion interference study was based on multiple worst-case assumptions that were not realistic and thus did not support modifying the UWB power limits. SIA further asserts that the Commission's reliance on complaint procedures to protect FSS stations from interference from UWB devices, as discussed in the *Second MO&O*, is ineffective. Opposing comments were filed by Freescale Semiconductor, Inc. ("Freescale"), and joint supporting comments were filed by Fox Broadcasting Company, Fox Cable Networks and Home Box Office, Inc. ("Fox *et al.*").

7. *I/N level.* As indicated above, over the course of this rulemaking proceeding, SIA has raised numerous arguments against the UWB power limits. SIA filed a Petition for Reconsideration ("First Reconsideration Petition") of the *First R&O*, arguing that the emission limits the Commission adopted for UWB devices in the 3.7-4.2 GHz band do not protect FSS receivers from interference. The Commission denied SIA's First Reconsideration Petition in its *MO&O*. Subsequently, SIA filed a Petition for Reconsideration ("Second Reconsideration Petition") of the *MO&O*, arguing, among other

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Radio Inc. and XM Radio Inc. ("Sirius and XM"), by Sprint Corp. ("Sprint"), and by Time Domain Corporation ("Time Domain").

[9] *See Second R&O* and *Second MO&O*, *supra*.

[10] Coalition members include A&E, CBS, C-SPAN, Discovery, E!, Fox Networks, Fox Cable, HBO, iNDemand, Lifetime, MTV, PanAmSat, Scripps Networks, SES Americom, Showtime, Starz!, USA and Warner Bros.

[11] *See, Evaluation of UWB and Lower Adjacent Band Interference to C-Band Earth Station Receivers*, Alion Science and Technology, February 11, 2004.

[12] Gating refers to the use of burst transmissions where a transmitter is turned on and off for selected time intervals. The transmitter generally is turned off to listen for a response or to permit other transmitters to operate, such as through time division multiple access operations.

[13] UWB devices operating in the FSS C-band must comply with an emission limit of -41.3 dBm/MHz EIRP. *See, e.g.*, 47 C.F.R. §§ 15.517 and 15.519.

issues, that an I/N of -10 dB should be employed for the interference analysis of FSS receivers instead of the 0 dB I/N specified by the Commission in the *First R&O*, and objecting to the Commission's characterization of SIA's interference analysis as overly conservative. The Commission denied SIA's Second Reconsideration Petition in its *Second MO&O*, characterizing SIA's petition as repetitious, and stating that SIA had provided no new information to substantiate its claims. The Commission concluded that SIA was disputing, for the first time, the issue of the 0 dB I/N ratio that was cited in the *First R&O* and that the time was long past for filing a petition for reconsideration of that decision.[14] Finally, SIA filed the instant Petition for Reconsideration ("Third Reconsideration Petition") of the *Second MO&O*.[15] In its Third Reconsideration Petition, SIA now argues that the Commission should use an I/N of -20 dB in its analysis of the UWB interference potential to FSS C-band reception and for establishing UWB emission levels in the FSS band, citing what it claims as new evidence as to the appropriateness of a -20 dB I/N.[16]

8. While SIA states that its petition is a Petition for Reconsideration of the *Second R&O* and *Second MO&O*, it does not address any changes to the regulations that were adopted in the *Second R&O* portion of that document. As stated in 47 C.F.R. § 1.429(i), "[a]ny order disposing of a petition for reconsideration which modifies rules adopted by the original order is, to the extent of such modification, subject to reconsideration in the same manner as the original order. Except in such circumstances, a second petition for reconsideration may be dismissed by the staff as repetitious." In this case, SIA is not seeking reconsideration of any change to the regulations that was adopted in the *Second R&O* and *Second MO&O*. Rather, we find that SIA's Third Reconsideration Petition to effect a change to the UWB emission limits through a change to the I/N level employed in the analysis is a request to reconsider the standards adopted in the *First R&O* and does not address any decision made in the *Second R&O* and *Second MO&O*.

9. We do not agree with SIA that its petition to establish a new interference analysis based on an I/N of -20 dB provides new information relating to UWB interference.[17] There is no technical analysis or other justification supporting the application of a -20 dB I/N as representative of harmful interference. In any event, the time is long past for filing a petition for reconsideration of the decisions reached in the *First R&O*.[18] SIA cannot continue to file petitions for reconsideration of the same issue simply by raising new arguments or asking for different new standards each time. Similarly, SIA cannot petition for reconsideration of an action responding to an earlier petition for reconsideration unless SIA's petition addresses changes to the rules adopted in that Order. Accordingly, as stipulated under 47 C.F.R. § 1.429(i), the portion of SIA's Third Reconsideration Petition that seeks the use of -20 dB I/N for

[14] *See Second MO&O, supra*, at para. 94.

[15] On May 25, 2005, the Commission released a public notice inviting comments on the SIA Petition for Reconsideration. *See Petition for Reconsideration of Action in Rulemaking Proceeding*, Report No. 2712, May 25, 2005. Notice of the petition was filed in the Federal Register on June 15, 2005. *See* 70 FR 34766, June 15, 2005. Comments were due on or before June 30, 2005, and reply comments were due on or before July 11, 2005. At the request of SIA, an Order was issued extending the reply comment period until July 20, 2005. *See Order Granting an Extension of Time to File Reply Comments*, adopted July 11, 2005, DA 05-1990.

[16] All of the papers referenced by SIA are based on International Telecommunication Union Recommendation ITU-R S.1432 (2000). This document apportions the total noise allowance from all non-primary emissions to one percent, *i.e.*, to an I/N of -20 dB. However, ITU-R S.1432 is a recommendation that is not binding on the U.S. or on any other party. Further, this recommendation is intended to enable the establishment of FSS system design parameters instead of calculating potential interference. This recommendation has since been replaced with ITU-R S.1432-1 (2000-2006).

[17] *See* SIA's Third Petition for Reconsideration at p. 21 and reply comments at p. 6.

[18] A Petition for Reconsideration must be filed within 30 days from the date upon which public notice is given of the order. 47 U.S.C. § 405(a) and 47 C.F.R. § 1.429(d).

establishing UWB emission limits in the FSS band is dismissed as repetitious.

10. *Alion Report.* In the *MO&O*, the Commission stated that it would take appropriate action to protect the authorized services if tests or other sources provide any indication that the UWB technical requirements are not adequate to protect against harmful interference.[19] The Coalition contended that the Alion Report provided this indication. However, the Commission, in its *Second MO&O*, concluded that the Alion Report did not demonstrate a need to modify the UWB technical requirements and essentially affirmed the Commission's earlier decisions. In so concluding, the Commission characterized the following assumptions in the Alion Report as worst-case and unrealistic: 1) that there would be a large concentration of UWB devices operating near the FSS receiver; 2) that UWB devices would be operated as close as 30 meters to the ingress-controlled FSS receiver installation site; 3) that UWB will replace all existing Part 15 cordless telephones, wireless security applications and wireless data transmissions; 4) that all UWB devices will operate with a 100 percent activity factor (as opposed to duty cycle);[20] 5) that all UWB devices will operate with their emissions centered at 4 GHz and all UWB devices will produce spectral lines that appear in the passband of an FSS receiver; 6) that the majority of UWB devices will operate outdoors; and 7) that many UWB transmitters will operate with their signals directed toward the FSS site. In its Third Reconsideration Petition, SIA argues that the Commission should have accepted these assumptions and objects to the Commission's characterization of these assumptions as being worst-case, unrealistic and therefore very unlikely to occur. SIA argues that the Alion Report demonstrates the need to modify the UWB interference criteria and emission levels. Fox *et al.* in its reply comments concurs with SIA's assertions. Freescale submits that while SIA disagrees with the Commission's characterization of the Alion interference study's underlying assumptions, it does not lay out a reasonable set of assumptions.[21]

11. SIA is essentially making the same arguments here that it made in its Petition for Reconsideration of the *Order*, as discussed below, asserting that the Alion Report supports the need to modify the UWB technical requirements. The Commission explained in the *Second MO&O* that its reasons for recalculating the analysis in the Alion study were based on its rejection of the application of a signal aggregation factor for UWB devices and its rejection of the assumption that most UWB devices would operate outdoors in proximity to FSS earth stations.[22] As the Commission indicated in the *Second MO&O*, the inclusion of either of these factors was sufficient to demonstrate that there was no need to modify the UWB emission limits to protect FSS earth stations.[23] SIA presents no new arguments or information in its Third Reconsideration Petition—it merely disagrees with the Commission's analysis and conclusion. Further, SIA is essentially requesting reconsideration of an Order denying a petition for reconsideration. In that action, however, the Commission did not make any changes to the UWB regulations. Accordingly, pursuant to 47 C.F.R. § 1.429(i), we are dismissing this portion of SIA's Third Reconsideration Petition as repetitious.

12. *Reliance on Complaint Procedure to Protect FSS.* SIA protests that the Commission's complaint procedures would not be effective for addressing claims of interference from UWB devices to FSS earth stations, and thus requests that the Commission modify the UWB power limits to reduce the likelihood of interference. SIA's concern is based on the Commission's statement in the *Second MO&O* that it will monitor the situation and will take whatever appropriate action is necessary to ensure that

[19] *See MO&O, supra*, at para. 131.

[20] SIA appears to have confused the Commission's statement regarding a 100 percent transmitter activity factor with the 20 percent duty cycle used by Alion. *See* Alion interference study at p. 3-12.

[21] Freescale comments to the SIA Petition for Reconsideration at p. 5.

[22] *See Second MO&O, supra*, at paras. 95-99.

[23] *Id.* at para. 99.

UWB operation does not result in harmful interference to FSS receivers.[24] This statement was made in conjunction with the Commission's conclusion that the Alion Report did not justify a reduction in the UWB emission levels in the FSS frequency band, *i.e.*, that UWB devices were not a potential threat of harmful interference to FSS operations. The Commission's acknowledgement that it will continue to monitor this situation and investigate any interference complaints from unlicensed UWB devices to authorized services is consistent with Commission regulations and policies and is not by itself a basis for reconsidering the UWB emission limits that were adopted in the *First R&O*.[25] Further, SIA's Third Reconsideration Petition is requesting reconsideration of an action that responded to a petition for reconsideration, but does not address any changes that were made to the UWB regulations. Accordingly, consistent with 47 C.F.R. § 1.429(i), we are dismissing this portion of SIA's Third Reconsideration Petition.

IV. SIA AND CINGULAR PETITIONS FOR RECONSIDERATION OF THE *ORDER*

13. When the Commission adopted its UWB regulations in 2002, it established standards that were technically neutral, permitting the use of any type of technology or modulation technique that resulted in the transmitter's compliance with the minimum bandwidth specification[26] and the limits on radiated emissions. The Commission recognized in the *First R&O* that measurement procedures had not been established to address transmitters, UWB or otherwise, employing stepped frequency, frequency hopping, or swept frequency transmissions, and that their interference aspects had not been evaluated based on the different measurement results that would be obtained from measurements taken with the system operating in its normal operating mode.[27] At the time the Commission adopted the UWB rules, its rules already required that frequency swept devices be measured with the frequency sweep stopped at the frequency chosen for the measurements reported.[28] With respect to the *First R&O*, the Commission adopted a rule specifying measurement procedures for UWB devices using pulsed gated modulation schemes, which were under development at that time, requiring measurements to be made with the pulse train gated on if the transmitter is quiescent for intervals that are long compared to the nominal pulse repetition. The Commission, consistent with its existing regulations, also adopted a rule stating that it may consider alternative measurement procedures.[29] The Commission stated, but did not codify in the rules, that UWB transmitters employing stepped frequency, frequency hopping, or swept frequency transmissions need to be measured with the step, hopping, or sweep function disabled and with the transmitter operating continuously at a fundamental transmission frequency.[30]

14. Subsequent to the adoption of the UWB standards, on August 26, 2004, the MBOA-SIG filed a petition for waiver of the UWB measurement procedures as applied to UWB systems employing multiband orthogonal frequency division multiplexing ("MB-OFDM") modulation, which is a stepped or

[24] *See Second MO&O, supra*, at para. 99.

[25] *See* 47 C.F.R. § 15.5(c).

[26] *See* 47 C.F.R. § 15.503(d). *See also First R&O, supra*, at para. 32.

[27] *See First R&O, supra*, at para. 32.

[28] *See* 47 C.F.R. § 15.31(c).

[29] *See* 47 C.F.R. §§ 2.947(a)(3) and 15.521(d).

[30] While the Commission indicated in the *First R&O* that it would be unlikely that devices using stepped frequency, frequency hopping or swept frequency modulation formats would comply with the fractional bandwidth or minimum bandwidth requirements for UWB devices, such systems were eventually developed. *See First R&O, supra*, at para. 32. The rules also permit UWB vehicular radar systems employing gated transmissions to be measured in their normal operating modes. *See* 47 C.F.R. § 15.515(g).

sequenced modulation scheme, operating in the 3.1-5.03 GHz and 5.65-10.6 GHz bands.[31] MBOA-SIG requested a waiver of the measurement procedures for such systems, as discussed in para. 32 of the *First R&O*. MBOA-SIG also requested a waiver of the measurement procedure in 47 C.F.R. § 15.521(d), as adopted in the *First R&O*, for pulse gated systems to the extent that this rule applied to MB-OFDM systems. Freescale Semiconductor, Inc. ("Freescale"), which produces a UWB device based on a direct-sequence spreading of binary-phase-shift-keyed pulses ("DS-UWB") employing pulse gating techniques, requested that the Commission extend any waiver of the measurement rules and procedures to permit any UWB device to be measured in its normal operating mode so as to retain technical neutrality in the Commission's UWB regulations.[32]

15. In support of its request, MBOA-SIG submitted simulated and actual test data demonstrating that the interference potential of frequency hopped or stepped systems, measured in their normal operating modes, is less than that of a UWB transmitter employing impulse modulation.[33] In addition, NTIA and the Commission developed detailed measurement procedures for frequency hopping and stepped frequency systems. In reaching its decision, the Commission recognized that the interference aspects of a transmitter employing frequency hopping, stepped frequency modulation, or gating are quite similar, as viewed by a receiver, in that transmitters using these burst formats appear to the receiver to emit for a short period of time followed by a quiet period.[34] The Commission thus concluded that any requirement to stop the frequency hop, band sequencing, or system gating serves only to add another unnecessary level of conservatism to already stringent UWB standards.[35] Accordingly, the Commission granted a waiver of the measurement procedures, permitting the emissions from UWB transmitters that employ frequency hopping or stepped frequency modulation techniques, or that gate the transmitted signal, to be measured with the transmitter operating in its normal transmission mode.[36] This allows the measurements to account for the time averaging during which the UWB emitter is not transmitting.

16. The waiver does not apply to UWB transmitters operating in the 5.03-5.65 GHz band. NTIA had expressed concern regarding two Federal systems operating in this band, the Microwave Landing System and Terminal Doppler Radar. NTIA requested that UWB operation within this band under the waiver be delayed until such time that its Institute for Telecommunication Sciences ("ITS") completed a measurement program testing the relative interference potential of various UWB waveforms to FSS receivers.[37] The Commission observed that the system proposed by the MBOA-SIG petition was

[31] MB-OFDM systems hop between several operating channels. The hopping to different frequency channels of operation also can be described as a step or sequenced modulation.

[32] *See Order*, *supra*, at para. 17. The request from Freescale was contained in its comments. Freescale comments to MBOA-SIG's petition at p. 11; Freescale reply comments to MBOA-SIG's petition at p. 7.

[33] The MB-OFDM modulation employed by the MBOA-SIG equipment can be described interchangeably as hopped, stepped or sequenced.

[34] *See Order*, *supra*, at para. 17.

[35] *See Order*, *supra*, at para. 13.

[36] At the request of NTIA, the Commission did not waive the measurement procedure in 47 C.F.R. § 15.31(c) that applies to UWB devices employing swept frequency modulation.

[37] The ITS study addressed the relative interference differences between different UWB modulation types to a digital television FSS C-band receiver operating within the 3.7-4.2 GHz band and did not address systems operating within the 5.03-5.65 GHz band. *See* NTIA Report 05-419, *Interference Potential of Ultrawideband Signals; Part 1: Procedures to Characterize Ultrawideband Emissions and Measure Interference Susceptibility of C-Band Satellite Digital Television Receivers*, Michael Cotton, Robert Achatz, Jeffery Wepman and Brent Bedford, February, 2005 (http://www.its.bldrdoc.gov/pub/ntia-rpt/05-419/index.html); NTIA Report 05-429, *Interference Potential of Ultrawideband Signals; Part 2: Measurement of Gated-Noise Interference to C-Band Satellite Digital Television Receivers*, Michael Cotton, Robert Achatz, Jeffery Wepman and Paul Runkle, August, 2005 (http://www.its.bldrdoc.gov/pub/ntia-rpt/05-429/index.html); and NTIA Report TR-06-437, *Interference Potential of*

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capable of avoiding operation in the 5.03-5.65 GHz band and granted NTIA's request.[38]

17. On April 11, 2005, Cingular and SIA filed Petitions for Reconsideration of the *Order* requesting that it be vacated.[39] SIA also requests that operation of UWB devices under the terms of the *Order* not be allowed in the 3650-4200 MHz band used for satellite downlinks, pending the outcome of NTIA studies of interference from UWB devices to satellite digital television receivers in this band. Supporting comments were filed by Sprint Corporation ("Sprint") and supporting reply comments were filed by Cingular and by SIA. Opposing comments were filed by the WiMedia Alliance ("WiMedia-MBOA").

Discussion

18. Cingular and SIA raise various objections to support their central argument that the waiver of the UWB measurement procedures will effectively and significantly increase the potential for harmful interference from UWB devices. SIA also argues that multiple studies demonstrate that the existing UWB power limits expose FSS receivers to unacceptable interference, and it continues to request the application of a -20 dB I/N as a protection requirement for FSS operation.[40] This portion of SIA's petition is merely a request to reconsider the standards adopted in the *First R&O*. In the discussion above, we reject SIA's petition on this same issue. Because SIA's petition for reconsideration raises the same arguments as its earlier petition and does not address any decision made in the *Order*, we dismiss this portion of its petition. We discuss below the other arguments raised by Cingular and SIA in their petitions for reconsideration of the *Order* and conclude that the petitions offer no new evidence that would support vacating or changing the *Order*. Accordingly, these petitions are being denied.

19. *Argument that the waiver violated the Administration Procedure Act ("APA") and other statutes and eviscerates the rules.* Cingular claims that the waiver, because it supplants the specific provisions of existing rules and is intended to be binding prospectively on all parties, constitutes a rule according to the APA.[41] Cingular argues that a rule cannot be waived for all parties, but that a rule making proceeding is required under the APA since a general waiver effectively repeals the subject regulation. Cingular further argues that because the *Order* adopted rules, this action also violates the Congressional Review Act and the Regulatory Flexibility Act since the Commission did not comply with

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Ultrawideband Signals; Part 3: Measurement of Ultrawideband Interference to C-Band Satellite Digital Television Receivers, Michael Cotton, Robert Achatz, Jeffery Wepman, and Roger Dalke, February, 2006 (http://www.its.bldrdoc.gov/pub/ntia-rpt/06-437/index.html).

[38] *See Order, supra,* at para. 16.

[39] Cingular's petition was placed on Public Notice on May 25, 2005, with comments due on or before June 30, 2005, and reply comments due on or before July 11, 2005. *See Petition for Reconsideration of Action in Rulemaking Proceeding*, Report No. 2712, May 25, 2005. Notice of the petition was filed in the Federal Register on June 15, 2005. *See* 70 FR 34766, June 15, 2005. The SIA petition was placed on Public Notice on August 4, 2005, with comments due on or before September 1, 2005, and reply comments due on or before September 12, 2005. *See Petition for Reconsideration of Action in Rulemaking Proceeding*, Report No. 2724, August 4, 2005. Notice of the petition was filed in the Federal Register on August 17, 2005. *See* 70 FR 48421, August 17, 2005. The SIA petition originally was announced in the same publications as the Cingular petition but was reannounced, and the comment period was extended, to correct a clerical error. At the request of SIA, the Commission issued an Order extending the reply comment period until September 23, 2005. *See Order Granting an Extension of Time to File Comments*, adopted September 9, 2005, DA 05-2434.

[40] SIA references its Petition for Reconsideration of the *Second MO&O* (SIA's Third Reconsideration Petition) and the studies cited therein.

[41] *See* 5 U.S.C. § 551(4).

the requirements of those laws. Cingular adds that a waiver exempts only certain parties based on a determination that application of the rule is unwarranted due to special circumstances in particular, individualized cases.[42] Cingular further states that although waivers are an appropriate method for the Commission to handle unusual situations where enforcement of the rule would cause hardship or disserve the public interest, the obligation to consider waivers does not contemplate that an agency must or should tolerate evisceration of a rule by waiver.[43] According to Cingular, the *Order* "eviscerates" the rules by removing all UWB devices from coverage of plainly applicable rules governing power measurement and substituting a different standard.

20. SIA and Sprint concur with Cingular. Sprint notes that the Commission previously relied on its rulemaking processes to amend, in the *Second R&O*, the UWB rules to permit frequency hopping vehicular radar systems to be measured in their normal operating mode but it declined to provide the same relief to other UWB devices because the interference aspects had not been thoroughly evaluated. Sprint argues that, in contrast, the waiver effectively repeals 47 C.F.R. § 15.521(d) by allowing any UWB device to be measured under normal operating conditions.[44] Sprint also argues that MBOA-SIG justified its waiver request on the ground that the requested relief would pose no greater threat of harmful interference than pulsed UWB systems but never alleged any special circumstances necessary for granting a waiver.

21. WiMedia-MBOA opposes these requests for reconsideration, arguing that the waiver was supported by detailed data derived from a theoretical interference model based on simulation testing, actual interference measurements taken in the vicinity of a C-band satellite receiver, and an evaluation of amplitude probability distribution comparing MB-OFDM to pulsed UWB. WiMedia-MBOA also states that the MBOA-SIG showed that testing under normal operating conditions was critical for MB-OFDM devices to be competitive with impulse and DS-UWB devices in terms of their signal range and data throughput.

22. We conclude that the waiver of the measurement procedures for certain UWB devices does not constitute a rule in violation of the APA and that the waiver does not "eviscerate" the rules. Indeed, the Commission's action is entirely consistent with its rules. The Commission permits the use of alternative measurement procedures, provided the applicant can demonstrate that the requested procedure is reasonable. For example, the Commission's rules provide that the Commission will accept measurement data that meets various standards or procedures established and published by the Commission or recognized bodies as well as "any measurement procedure acceptable to the Commission ... demonstrating compliance with [its] requirements...."[45] As discussed above, the Commission's rule specifying measurement procedures for pulsed gated UWB devices, 47 C.F.R. § 15.521(d),[46] also states that alternative measurement procedures may be considered by the Commission. Even if one considers the Commission's statements in the *First R&O* regarding measurement procedures for gated, stepped frequency, frequency hopping or swept frequency transmissions to be tantamount to a "published" measurement procedure, the Commission's rules clearly allow it to consider alternative measurement procedures for UWB devices without conducting a rulemaking proceeding.

23. While the Commission could have addressed the measurement procedure requested by

[42] *See WAIT Radio v. FCC*, 418 F.2d 1153, 1157 (D.C. Cir. 1969).

[43] Cingular cites *WAIT Radio v. FCC*, 418 F.2d 1153, 1159 (D.C. Cir. 1969).

[44] The portion of 47 C.F.R. § 15.521(d) referenced by Sprint states that emissions from a UWB transmitter employing pulse gating shall be measured with the system gated on if the transmitter is quiescent for intervals that are long compared to the nominal pulse repetition interval.

[45] *See* 47 C.F.R. § 2.947. *See also* 47 C.F.R. § 15.31(b) and (p).

[46] This provision does not apply to UWB vehicular radar systems. *See* 47 C.F.R. § 15.515(g).

MB-OFDM without a notice and comment proceeding, it believed that the prudent course of action was to analyze MBOA-SIG's request within the context of its waiver standard.[47] It issued a Public Notice and entertained comments from interested parties. It is important to note that no changes were made to the emission standards on which the non-interference probability of UWB devices is based. Rather, the Commission relaxed an overly conservative measurement procedure that artificially constrained the emissions from UWB devices employing certain modulation types to levels that were effectively below the levels permitted under the regulations. Further, only the portion of 47 C.F.R. § 15.521(d) applicable to pulsed gated UWB devices was waived; the measurement procedure for swept frequency transmissions was not waived. Thus, the Commission's determination does not constitute "evisceration" of the rules.

24. It is a well-established principle that the Commission will waive its rules in specific cases only if it determines, after careful consideration of all pertinent factors, that such a grant would serve the public interest without undermining the policy which the rule in question is intended to serve.[48] In the *Order* the Commission determined that permitting use of the new measurement procedures was in the public interest because it enabled a new technology to be introduced to the market to the benefit of businesses and consumers. In addition, the Commission demonstrated how granting the waiver would not undermine the policy which the rule is intended to serve, *i.e.*, the prevention of harmful interference to the authorized radio services. Test information evaluating the interference potential of these emission types, based on measurements performed with the equipment in its normal operating mode was submitted by MBOA-SIG. Through testing and interference analysis, MBOA-SIG provided convincing information that the application of these test procedures to systems employing MB-OFDM modulation would not result in an increased risk of harmful interference. In the *Order*, the Commission supplied a reasonable explanation as to why a similar application to DS-UWB systems also would not result in an increased risk of interference but would retain the technical neutrality of the UWB regulations.[49] Thus, we conclude that the waiver granted in the *Order* permitting UWB transmitters employing frequency hopping, stepped frequency or gated modulation techniques to be measured in their normal operating mode does not constitute a violation of the APA. Further, as the Commission has not amended its rules, the issuance of the subject waiver did not violate the Congressional Review Act or the Regulatory Flexibility Act. Accordingly, this portion of Cingular's petition is denied.

25. *Argument that the waiver increases the threat of harmful interference by 6 dB or more.* Cingular claims that the change in measurement procedures allowed by the waiver effectively will increase the power levels of UWB devices by 6 dB or more and will introduce additional interference that cannot be mitigated through error correction coding or other means.[50] Cingular argues that the OFDM waveform addressed under the waiver was not envisioned during the original rulemaking, that there were no measurements or tests with this technology, and that the waiver deviates from the Commission's policy of proceeding cautiously with regulations.[51] Cingular continues to contend that additional testing is needed to address the impact on wideband receivers.[52] It argues that measurements or tests were not performed for the MB-OFDM system nor was there an analysis of interference potential.[53] SIA states that because the Commission believed that the UWB emission limits were conservative, a view SIA does not

[47] *See Order*, *supra*, at para. 9.

[48] *See WAIT Radio v. FCC*, 418 F.2d 1153 (D.C. Cir. 1969); *Northeast Cellular Telephone Co. V. FCC*, 897 F.2d 1164 (D.C. Cir. 1990).

[49] *See Order*, *supra*, at para. 17.

[50] Cingular petition at 10.

[51] Cingular petition at 9.

[52] Cingular petition at 12.

[53] Cingular petition at 9.

share, it thought that additional interference could be permitted by granting the waiver.[54]

26. The petitioners' arguments are based on a mistaken assertion that the UWB emission limits were somehow relaxed as a result of the waiver. The Commission did not change the emission levels for UWB devices in the *Order*. Instead, the Commission merely allowed the use of different measurement procedures that demonstrate, consistent with our rules as discussed above, that the devices comply with the power limits for UWB devices.

27. The UWB limits on radiated emissions were based on extensive and extremely conservative analyses in the *First R&O* and on the supposition that a transmitter would operate continuously within a single frequency band. However, the MB-OFDM transmitter envisioned by MBOA-SIG hops to three different channel frequencies. The transmission duty cycle on a specific channel is 26 percent (5.9 dB). By requiring the emissions to be measured with the MB-OFDM transmitter operating continuously on the same operating frequency, the duty cycle per channel is artificially increased to 100 percent and an emission level is measured that is 5.9 dB higher than what would be obtained with the transmitter functioning in its normal operating mode. Thus, Cingular is not correct that the waiver permits the UWB emission levels to increase by 6 dB or more. Rather, the measurement procedures described in the *First R&O* for this type of transmission scheme would require testing in an artificial operating mode that results in the actual emissions from the MB-OFDM transmitter being restricted to 5.9 dB below the limits specified in the rules. The effect of the waiver is to provide a more realistic representation of the signal level actually produced by the UWB device, permitting the UWB transmitters to function at the emission levels permitted by the regulations.

28. As stated in the *Order*, contrary to Cingular's claims, the MBOA-SIG members conducted simulated and actual testing of devices employing the MB-OFDM modulation format to demonstrate that, under normal operating conditions, there is no greater interference potential from an MB-OFDM UWB waveform than from an impulse-generated UWB waveform even when compliance with the emission limits is demonstrated with the frequency hop or step function active.[55] The Commission stated that these results are consistent with the theory, as expressed by NTIA, that RMS measured emission levels are proportional to the measured bandwidth and the spectral power density, irrespective of pulse rate or modulation.[56] Indeed, an integrated RMS measurement provides true average power readings, even for non-continuous signals such as frequency hopped UWB waveforms. Thus, the 6 dB potential increase claimed by Cingular will not be seen by a victim receiver and is irrelevant with regard to interference potential.[57] Instead, the victim receiver will see the RMS average of that signal.

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[54] SIA petition at 4.

[55] MBOA-SIG petition for waiver at p. 3 and 8-9. Actual testing was performed using an FSS C-band earth station receiver. Interference testing indicated that the MB-OFDM emitter had to be located within 20 feet of the C-band earth station antenna to cause interference. *See, e.g.*, MBOA-SIG petition for waiver at p. 8-9, Philips comments to the MBOA-SIG petition at p. 13-14, and MBOA-SIG reply comments to its petition at p. 4-5 and 9-10 and at Attachments A and C.

[56] *See* NTIA Report 01-383, *The Temporal and Special Characteristics of Ultrawideband Signals*, January 2001, at p. 8-44. In addition, Agilent states that an RMS detector reports the true average power for each part of the measurement span which is particularly useful when measuring non-continuous waveforms such as those produced by frequency switching or packet based transmissions. Agilent adds that the RMS average detector also is well behaved when measuring noise-like signals. *See* Agilent APP Note 1488, *Ultra-Wideband Communication RF Measurements*, at p. 43.

[57] Cingular's arguments that other modulation formats, when measured for compliance in their normal operating modes, may be more interfering by more than 6 dB is technically misleading. As the Commission noted in the *Order* at n. 40, the MB-OFDM system could demonstrate a 5.9 dB difference between measurements made in the static and active modes. However, the Commission also stated that the actual impact on the interference potential is

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This is the reason that the Commission adopted RMS average limits for UWB devices.

29. The Commission took a cautious approach throughout this proceeding, limiting the applications for UWB and adopting knowingly conservative emission limits. This approach was not contravened by the waiver since no changes were made to the emission masks. Cingular and SIA have provided no new information to support their claims of increased interference potential and no arguments which undermine our rationale in granting the waiver. Accordingly, these portions of Cingular's and SIA's Petitions for Reconsideration are denied.

30. *Argument that the Commission did not meaningfully respond to Cingular's comments.* In response to MBOA-SIG's waiver request, Cingular argued that the waiver could not be granted without tests comparing the measurements of transmissions from MBOA-SIG's proposed system that would result with and without the frequency hopping stopped.[58] In the *Order*, the Commission concluded that the tests submitted by MBOA-SIG demonstrated that, under normal operating conditions, MBOA-SIG's proposed system does not increase the potential for interference relative to a UWB transmitter using impulse modulation.[59] Based on that conclusion, the Commission concluded that there was no need for the additional testing recommended by Cingular.[60]

31. In its Petition for Reconsideration, Cingular argues that the Commission failed to address its comments adequately because it did not conduct the tests that Cingular recommended.[61] We disagree. The Commission considered the record fully, including Cingular's arguments, in determining whether additional testing was needed. The Commission also explained fully why it concluded that MBOA-SIG's proposed system did not increase the potential for interference relative to a UWB transmitter using impulse modulation, and that, therefore, the additional tests recommended by Cingular were unnecessary.[62] Accordingly, we find that the Commission did consider Cingular's comments in this proceeding, and we are denying this portion of Cingular's petition.

32. Furthermore, we continue to conclude that there was no justification to delay the outcome of this proceeding by requiring MBOA-SIG to perform the additional testing requested by Cingular in its comments responding to the MBOA-SIG Petition for Waiver. By proposing testing of MBOA-SIG's proposed system with the frequency hopping stopped, Cingular in effect advocated testing that system while artificially forced to operate at a 100 percent per channel duty cycle. MBOA-SIG's proposed system is designed to operate at a 26 percent per channel duty cycle. Testing such a system at a 100 percent duty cycle will show an emission level that is 5.9 dB higher than it would be at a 26 percent duty cycle. However, such a test would be irrelevant, as it would not reflect the actual operation of the equipment and would not be indicative of the interference potential of the UWB emissions

33. *Argument that the Commission gave no weight to Freescale's comments that contradicted the MBOA-SIG test results and the waiver was overbroad.* SIA states that the central dispute in this proceeding was which of two kinds of UWB waveforms has a greater interference potential, but the Commission did not explain why it based its waiver decision on the MBOA-SIG test

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much less than the difference between the instantaneous emission level and the emission level averaged over a one millisecond period during normal operation.

[58] *See Order, supra*, at para. 11.

[59] *Order, supra*, at para. 12.

[60] *Order, supra*, at para. 12.

[61] Cingular Petition at 11-12.

[62] *See Order, supra*, at paras. 12-14.

data and not on Freescale's conflicting data.[63] SIA states that the MBOA-SIG technical analysis was limited to one specific MB-OFDM modulation format,[64] that Freescale demonstrated that other MB-OFDM modulation formats would be more interfering by up to 5 dB, and that Freescale found that impulse-generated UWB is significantly less interfering than MB-OFDM.[65] Because the record contained no test measurements for other types of MB-OFDM modulation formats or for direct sequence (DS) modulation schemes, SIA argues that application of the waiver to all MB-OFDM devices and to DS-UWB devices was overbroad and not supported by the record.[66] SIA also argues that impulse-generated waveforms affect only a small number of symbols, whereas a frequency hopping waveform affects a limited but significant number of symbols and thus has a greater interference potential.[67] Cingular also argues that the Commission did not explain how the waiver petition addressed the various objections concerning increased interference, offering only the conclusion that the concerns were addressed without explaining how it resolves the issues raised by the comments.[68]

34. WiMedia-MBOA states that the only claim SIA raises in relation to the waiver is that the Commission erred by giving no satisfactory explanation for rejecting the interference analysis presented by Freescale in its opposition to the waiver request. WiMedia-MBOA adds that the Commission adequately explained its rejection of the Freescale analysis in footnote 40 of the *Order*, where the Commission explained that Freescale evaluated the interference potential of MB-OFDM devices using an improbable theoretical basis that did not represent actual operating conditions, and rejected the Freescale analysis in favor of the analysis submitted by MBOA-SIG.

35. As stated in the *Order*, several of the comments contained technical discussions on whether or not the MB-OFDM modulation format resulted in greater or lesser interference than the DS-UWB format.[69] However, the Commission added that this issue is not relevant to the request for waiver. What is important with regard to the waiver request is whether or not the MB-OFDM modulation format, when measured in the normal operating mode, has a sufficiently greater interference potential than a UWB transmitter employing impulse modulation so as to increase the risk of harmful interference.[70] While the comments argued this issue based on different criteria, the Commission rejected as improbable the theoretical analyses that were performed assuming a zero background noise level, a zero bit error rate and a victim receiver with a bandwidth that is greater than the UWB band switching rate.[71] Instead, it favored the analysis from MBOA-SIG as being representative of an actual operating system where the background noise level will mask a low level undesired signal and bit error rates are greater than zero.[72]

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[63] SIA petition at 6-7. The two waveforms are Freescale's DS-UWB and MBOA-SIG's MB-OFDM.

[64] SIA claims that the MBOA-SIG test data only pertains to the "MB-OFDM F1F2F3" format.

[65] SIA petition at 8. SIA references Freescale's comments of 9/29/04 at Section 3.1 and Figure 4.

[66] SIA petition at 8.

[67] SIA petition at 7.

[68] Cingular petition at 12.

[69] *See Order*, *supra*, at para. 12-14. *Id.* at n. 39 (acknowledging comments filed by decaWave, Freescale, Philips, and TimeDerivative and the reply comments of decaWave, Freescale, Motorola, and MBOA-SIG).

[70] We recognize that different modulation types will have different interference potentials. While the Commission compared the interference potential of FS-UWB and MB-OFDM devices to impulse-modulated UWB transmitters, the UWB regulations that were adopted permit any type of modulation to be used. This is one reason that conservative emission limits, based on multiple worst case conditions, were adopted.

[71] *See Order*, *supra*, at n. 40.

[72] While SIA argues that background noise is irrelevant to the issue, stating that the UWB interference potential remains constant across different levels of background noise, this is incorrect. Thermal and other noise sources are a reality and will mask some of the effects of low level unwanted UWB emissions. Freescale's results were based on

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Based on this real-world analysis and actual measured test data submitted by MBOA-SIG, the Commission stated that it was clear that the interference potential of the MB-OFDM format, based on compliance with the rules being demonstrated with the frequency hop active, is no greater than that of an impulse UWB emission. Thus, contrary to the claims of the petitioners, the Commission did explain why it favored the MBOA-SIG analysis over that of the conflicting analysis from Freescale and did address the objections to the petition.

36. We also disagree with SIA's statement that any increase to the number of FSS symbols that potentially could be affected by interference due to the use of frequency hopping waveforms will also result in harmful interference. In adopting rules for UWB devices, the Commission chose to rely on emission limits as the tool for preventing harmful interference irrespective of the duty cycle of the UWB device or its specific modulation type. Because the waiver does not change the emission limits, we conclude that the potential for harmful interference will not be increased.[73] Neither SIA nor Cingular provide any new information demonstrating that the Commission erred in its decision.

37. We also disagree with SIA's argument that application of the waiver to all MB-OFDM devices and to DS-UWB devices was overbroad. NTIA's technical analyses clearly demonstrated that the average power of the transmitted signal, not its instantaneous power such as would be measured in a static mode, was the appropriate basis for determining interference potential.[74] Further, this reasoned analysis by the Commission allowed for continued technology-neutral treatment of various UWB design formats without undermining the policy which the rule is intended to serve, *i.e.*, the prevention of harmful interference to the authorized radio services. Based on the above, we therefore find that these portions of SIA's and Cingular's Petitions for Reconsideration are without merit and are denied.

38. *Argument that Multiple devices operating in an area will synchronize and fill up the spectrum.* Cingular states that multiple MB-OFDM devices transmitting within a small area will choose different hopping patterns and effectively fill up the time periods, effectively removing the effect of time averaging gained through the new measurement procedure and resulting in increased interference.[75] SIA states that Freescale had demonstrated in its comments that it was possible to interleave in time the transmissions from multiple frequency hopping MB-OFDM devices in the same general vicinity, adding that such interleaving also can be used in DS-UWB devices.[76] Because of this, SIA argues that the test procedures adopted by the Commission in the *Order* are inaccurate, since the multiple interleaved UWB devices collectively will produce a continuous transmission with an aggregate interference that is nearly 6 dB higher than what is measured by testing a single device.[77] SIA adds that this interleaving can result in

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a mathematical simulation of a laboratory condition, *e.g.*, a noise free environment, whereas MBOA provided analyses and test results based on real world conditions. *See* MBOA-SIG reply comments at p. 6-10 and at Appendix A.

[73] Cingular's statement that frequency hopping waveforms affect the reception of a significant number of FSS symbols is unsupported and does not constitute a technical showing that MB-OFDM systems have greater interference potential than impulse systems.

[74] *See First R&O, supra*, at para. 122, 237, and 242; *Second R&O, supra*, at n. 65; and *Order, supra*, at para. 3 and 12.

[75] Cingular petition at 10.

[76] SIA petition at 9.

[77] SIA petition at 9. If four co-located MB-OFDM transmitters were to interleave their emissions and these emissions were cohered such that the emissions added linearly at a victim receiver, the interference could appear to be 6 dB greater than what would be produced by a single transmitter. SIA claims that the interference caused by these four transmitters would be 3.6-5.2 dB greater than the effect from an impulse-modulated UWB transmitter. SIA bases this claim on a computation using the calculated 6 dB maximum increase from four emitters added to
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interference levels well above what the Commission determined to be acceptable.[78]

39. In its comments, WiMedia-MBOA explains that Cingular and SIA are incorrect in this concern since its MB-OFDM devices operate independently of each other and are not designed to be interleaved or synchronized.[79] SIA responds that UWB devices that are designed to monitor the spectrum before transmitting will synchronize with other nearby UWB transmitters.[80] SIA further argues that UWB devices that do not monitor the spectrum before transmitting will cause cumulative interference by transmitting simultaneously and will have increased activity factors exposing C-band receivers to additional interference.[81] Finally, SIA states that there is nothing in the Commission's rules to prohibit UWB devices from synchronizing their operations.[82]

40. There is no evidence or valid analysis to support Cingular's claims that multiple, co-located UWB devices will synchronize their transmissions. Freescale did make such claims in its comments to MBOA-SIG's Petition for Waiver. However, this issue was specifically addressed by MBOA-SIG in its reply comments and by Texas Instruments in its *ex parte* comments.[83] As they show in these findings, such synchronization would require nanosecond time-scale synchronization between devices – an improbable task, particularly if the devices were attempting to monitor the spectrum to determine open operating windows. These transmitters are thus uncoordinated and will employ different on-off starting times, and possibly different timing intervals, which will be further degraded by timing drifts between the devices. Further, the Commission has already demonstrated that SIA's claims of cumulative interference are misplaced.[84] Even if synchronization were possible, the emissions from co-located transmitters with synchronized operations still would not be expected to add linearly at a victim receiver as slight differences in path lengths due to multipath and other factors would skew any synchronization as well as the levels of the received signals. If we assume the unlikely condition where an FSS receiver will receive signals from multiple UWB devices and that these UWB signals are synchronized with respect to reception by the FSS receiver and not by the UWB receiver, three devices operating simultaneously on the three channels would result in a maximum increase in the received level of approximately 4.8 dB. This is exactly the same increase that would be caused by three impulse devices operating under the same conditions. Therefore, waiving of the measurement rule would not increase the likelihood of aggregation.

41. Based on the above, we find that there is no evidence from the petitioners that UWB devices will synchronize or interleave their transmissions or that there will be any aggregate or cumulative effects from multiple UWB transmitters operating in the same area. Thus, no rule prohibiting such operation is necessary. Accordingly, these portions of Cingular's and SIA's Petitions for Reconsideration are denied.

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MBOA-SIG's test results demonstrating that the interference potential from an individual MB-OFDM F1F2F3 waveform is 0.8 to 2.4 dB less than that of an impulse emission operating at a 3 MHz pulse repetition frequency.

[78] SIA petition at 10.

[79] WiMedia-MBOA opposition at 5.

[80] SIA reply at 4.

[81] *Id.*

[82] SIA reply at 5.

[83] *See* reply comments from Freescale at p. 13-14 and Appendix A at p. 44-45 and *ex parte* comments from Texas Instruments filed on November 3, 2004.

[84] *See R&O, supra*, at para. 233-234, *MO&O, supra*, at para. 120, and *Second MO&O, supra*, at para. 99.

42. *Argument that the Commission needs to exclude operation in the 3.65-4.2 GHz band under the waiver, just as it did in the 5.03-5.65 GHz band, pending completion of ITS testing.* SIA notes that the Commission granted NTIA's request to exclude UWB operation in the 5.03-5.65 GHz band under the waiver based on a request from NTIA pending completion of the ITS testing. SIA believes that similar considerations should apply to FSS C-band downlink frequencies because NTIA also is conducting a measurement program to assess the interference threat posed by various UWB formats to C-band digital television receivers.[85] SIA reasons that if the pendency of NTIA's test warranted delaying action on the 5.03-5.65 GHz band, it also warrants delaying action on the 3.65-4.2 GHz FSS band pending the outcome of NTIA's measurement program.

43. In its comments, WiMedia-MBOA states that the 5.03-5.5 GHz band is heavily used by the Federal Government for radiolocation and air navigation purposes and so it is reasonable, as an act of comity pursuant to a specific interest from NTIA, that the Commission defer from extending the scope of the waiver to that band pending conclusion of the Government's own study. SIA responds that commercial customers have as much right to protection against excess levels of interference as Federal Government users, reiterating that the waiver should not apply to the 3.65-4.2 GHz band pending completion of NTIA's measurement program.

44. The Commission delayed implementation of its waiver provisions on the 5.03-5.65 GHz band, pending completion of the ITS study, solely as a matter of deference to NTIA and not because of any demonstrated potential for harmful interference to these systems.[86] Such action is within the Commission's discretion. When spectrum, such as the 5.03-5.65 GHz band, is allocated for use by Federal Government agencies, the Commission consults with NTIA on any proposed non-Federal use of that spectrum. However, when spectrum is allocated exclusively for non-Federal operations, the Commission has exclusive jurisdiction to interpret and apply interference analyses and studies in determining emission limits and operating parameters. Because the Commission had already determined in its rulemaking proceeding that there was no potential for harmful interference to FSS reception, there was no need to delay implementing the waiver in the 3.65-4.2 GHz FSS band.

45. In addition, we note that Microwave Landing Systems operate in the 5.03-5.65 GHz band, which are used for precision approach and landing of civilian and military aircraft.[87] We find that it was a reasonable exercise of its discretion for the Commission to be more cautious with respect to MLS because of the public safety function that those systems serve. On the other hand, while we agree with SIA that commercial FSS merits protection from interference in the 3.65-4.2 GHz band, FSS generally does not serve the same public safety function as MLS. Accordingly, we find that it was a reasonable exercise of the Commission's discretion for it to conclude based on the record in the *Order* that granting MBOA-SIG's waiver request with respect to 3.65-4.2 GHz band would not create an unreasonable increase in the potential for interference to FSS in that band.

46. We continue to maintain that FSS C-band receivers are more than adequately protected from UWB emissions, as shown in the various interference analyses when rational operating conditions are employed. This conclusion has been verified through the Alion interference study submitted by the

[85] Only one interference study was performed by NTIA, as referenced in footnote 40 above. This study was an analysis by ITS to determine the relative interference differences between different UWB modulation types including noise, gated noise, DS-UWB, and MB-OFDM using FSS C-band digital television receivers as a test bed. The ITS tests do not deal with the various additional parameters necessary to determine the emission levels necessary to prevent harmful interference to radio operations. These emission levels were determined by the Commission in the *First R&O*.

[86] The Commission previously addressed the potential for harmful interference to Federal Government systems operating in the 5.03-5.65 GHz band. *See First R&O* at para. 143-144.

[87] *See First R&O* at para. 142.

C-band Coalition[88] and through the analysis and real world tests performed by MBOA-SIG. Further, the completed ITS study, which analyzed whether there were discernible differences between different modulation formats that could be used in UWB devices, does not alter our conclusion that FSS C-band receivers are unlikely to suffer harmful interference from UWB emissions. Accordingly, this portion of SIA's Petition for Reconsideration is denied.

V. ORDERING CLAUSES

47. Pursuant to Sections 4(i), 302, 303(f), 303(r), and 405 of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 302, 303(f), 303(r), and 405, IT IS ORDERED that the Petition for Reconsideration from the Satellite Industry Association in response to the Commission's *Second Report and Order and Second Memorandum Opinion and Order* in ET Docket No. 98-153 IS DISMISSED.

48. IT IS FURTHER ORDERED that the Petition for Reconsideration from the Satellite Industry Association in response to the Commission's *Order* in ET Docket No. 04-352 IS DISMISSED in part and DENIED in part. IT IS FURTHER ORDERED that the Petition for Reconsideration from Cingular Wireless LLC in response to the Commission's *Order* in ET Docket No. 04-352 IS DENIED.

49. IT IS FURTHER ORDERED that ET Docket No. 98-153 and ET Docket No. 04-352 ARE TERMINATED.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch

Marlene H. Dortch
Secretary

[88] This analyses effectively demonstrated that emissions from UWB devices operating at the current limits are at least 9-10 dB lower than the level that is necessary to prevent interference to FSS reception even under extremely improbable operating conditions using the most sensitive FSS receiver with the FSS antenna in its most vulnerable operating position, *i.e.*, at a 5° antenna elevation, and operating at only 3 dB above the lowest possible received signal level, and assuming some linear UWB signal aggregation at the FSS receiver.