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

In the matter of	)	
	)	
Petition for Waiver of the Part 15 UWB	)	
Regulations Filed by the Multi-band OFDM	)	ET Docket No. 04-352
Alliance Special Interest Group	)	

ORDER

Adopted: March 10, 2005 **Released: March 11, 2005**

By the Commission:

I. INTRODUCTION

1. By this action, we are granting a waiver of the certain emission measurement procedures applicable to ultra-wideband ("UWB") transmitters that operate under Part 15 of our rules.[1] Specifically, we are permitting the 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,[2] to be measured with the transmitter operating in its normal transmission mode. This waiver applies to the measurement procedure applicable to UWB devices, permitting products to be tested based on the manner in which they are operated. This action is taken in response to a Petition for Waiver that was filed by the Multi-band OFDM Alliance Special Interest Group ("MBOA-SIG")[3] on August 26, 2004.

II. BACKGROUND

2. On February 14, 2002, the Commission adopted regulations to permit the operation of UWB transmitters.[4] Several categories of UWB devices are permitted to be operated under the Part 15 regulations without a requirement for an individual license: imaging systems,[5] vehicular radars and indoor and outdoor communication systems. UWB transmitters operate using spectrum that is allocated to various radio services, including frequency bands that are allocated both to U.S. Government and to

---

1 *See* 47 C.F.R. §§ 15.501 *et seq*.

2 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.

3 The MBOA-SIG represents approximately 160 domestic and foreign companies seeking adoption by the IEEE 802.15 Task Group 3a of a UWB standard specifying the use of its MB-OFDM modulation. Similarly, the UWB Forum, also consisting of several domestic and foreign companies, is seeking adoption by the IEEE 802.15 Task Group 3a of a UWB standard specifying the use of its DS-UWB modulation

4 *See First Report and Order* ("*1st R&O*") in ET Docket No. 98-153, 17 FCC Rcd 7435 (2002); *Erratum* in ET Docket No. 98-153, 17 FCC Rcd 10505 (2002); *Memorandum Opinion and Order and Further Notice of Proposed Rule Making* in ET Docket No. 98-153, 18 FCC Rcd 3857 (2003); and *Second Report and Order and Second Memorandum Opinion and Order* ("*2nd R&O*") in ET Docket No. 98-153, 19 FCC Rcd 24525 (2004). *See*, also, 47 C.F.R. §§ 15.501-15.525.

5 Imaging systems consist of GPRs, wall imaging systems, through-wall imaging systems, surveillance systems, and medical imaging systems.

non-government operations.[6] UWB transmitters also operate in several restricted frequency bands within which the operation of other types of Part 15 transmitters are prohibited.[7] UWB devices are not allocated spectrum but share these frequency bands with the authorized radio services on a sufferance basis.[8] Consequently, before the Commission implemented its standards for UWB operation, it evaluated several measured and simulated analyses regarding the potential for UWB devices to cause harmful interference to the authorized services.[9] As stated in the *1st R&O*, this was an unusually controversial proceeding involving a variety of UWB advocates and opponents that were unable to agree on the emission levels necessary to protect Federal Government-operated, safety-of-life and commercial radio systems from harmful interference.[10] Because of this, the Commission implemented standards that it categorized as extremely conservative, in addition to applying additional restrictions on operating parameters,[11] to ensure that UWB devices can coexist with the authorized radio services without the risk of harmful interference while it gains additional experience with this technology.

3. The emission standards applied to UWB operations are more stringent than those applied to non-UWB devices. Non-UWB transmitters operating under the Part 15 regulations are subject to emission limits above 1000 MHz that are based on the use of a linear average detector. In no case, are emissions from non-UWB devices required to be reduced below the Part 15 general emission limits.[12] Transmitters employing swept frequency modulation techniques are required to demonstrate compliance with the average emission limits with the frequency sweep function disabled.[13] However, pulsed

---

6 The operation of Federal Government radio stations is regulated by the National Telecommunications and Information Administration ("NTIA"), while operation of stations by commercial entities, state and local governments, and the general public is regulated by the Commission.

7 47 C.F.R. § 15.205.

8 47 C.F.R. § 15.5.

9 These analyses and tests are filed in the record for the UWB proceeding in ET Docket No. 98-153. *See*, for example, 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.

10 *1st R&O*, *supra*, at para. 2.

11 For example, UWB communications systems that are designed to operate outdoors are restricted to hand-held devices and fixed outdoor infrastructures are prohibited.

12 47 C.F.R. § 15.209.

13 47 C.F.R. § 15.31(c). This rule paragraph references only swept frequency devices. In addition, the Commission normally would apply a similar requirement to average emission measurements for transmitters employing step function or frequency hopping modulation techniques due to the lack of appropriate test procedures and the lack of interference studies regarding these modulation types. However, the Commission, in the *2nd R&O*, recently amended its regulations to permit non-UWB frequency hopping and stepped frequency systems operating in the 6 GHz, 17 GHz and 24 GHz bands to be measured in their normal operating modes.

emissions may be averaged over a 100 millisecond period and this period may include any effects from gating the signal. On the other hand, emissions from UWB transmitters, at the request of the National Telecommunications and Information Administration ("NTIA"), are subject to emission limits above 960 MHz that are based on the use of a root-mean-squared ("RMS") detector and a one millisecond averaging period.[14] NTIA employed RMS levels in its interference analyses,[15] indicating that measurements made using instruments having a linear average detector but using logarithm amplifiers are largely insensitive to energy contained in low duty cycle, high amplitude signals. NTIA added that no single average detector function adequately describes the interference effects of UWB signals but believes that this is better quantified by use of an RMS detector. Further, NTIA indicated that RMS levels are proportional to the measured bandwidth and the spectral power density, irrespective of pulse rate or modulation.[16]

4. In addition to differences in the measurement procedures, the emission limits adopted for UWB devices generally are considerably lower than those applied to other Part 15 applications. Unwanted emissions from UWB devices are required to be reduced below the Part 15 general emission limits by as much as 34 dB.[17] Further, the average emission levels[18] must be measured with the transmitter operating continuously at a set fundamental frequency with any frequency hop, frequency sweep, or frequency step disabled.[19] Similarly, emissions from gated UWB transmitters must be measured with the gating disabled.[20] These measurement procedures can result in the measurement of higher average emission levels in a one millisecond period than what are actually emitted by a UWB transmitter under its normal operating conditions.

5. Since the adoption of the UWB regulations, two primary formats for communications systems have been developed. Freescale Semiconductor, Inc. ("Freescale") has obtained certification for a UWB transmitter based on the direct sequence UWB ("DS-UWB") modulation system that was pioneered by XtremeSpectrum.[21] DS-UWB employs direct-sequence spreading of binary-phase-shift-keyed pulses and supports operation in two different bands. The lower band occupies the spectrum from 3.1 GHz to 4.85 GHz, and the upper band is from 6.2 GHz to 9.7 GHz. Within each band there is support for up to six piconets (*i.e.*, overlapping wireless networks). Each piconet channel has a designated operating frequency and direct sequence code word of length 1, 2, 3, 6, 12, or 24. Data is used to

---

[14] Depending on the modulation type, emissions measured using an RMS detector may be higher than those measured using a linear average detector.

[15] *See* NTIA Report 01-383, *supra*, at pg. 6-18 through 6-25 and A-1 through A-21. *See*, *also*, NTIA Special Publication 01-43, *supra*, at pg. 2-1 through 2-2.

[16] *See* NTIA Report 01-383, *supra*, at pg. 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 pg. 43.

[17] This 34 dB reduction does not include any differences that may result from the UWB measurement procedures.

[18] The reference to average emission levels for UWB intentional radiators refers to emissions measured using an RMS detector with a 1 MHz resolution bandwidth and a one millisecond or less averaging time. *See* 47 C.F.R. § 15.521(d).

[19] *See*, *1st R&O*, *supra*, at para. 32.

[20] 47 C.F.R. §15.521(d).

[21] Freescale, through Motorola, acquired substantially all of the assets and intellectual property of XtremeSpectrum, Inc. A grant of certification, FCC ID RUN-XSUWBWDK, was issued by the Commission to Freescale on August 5, 2004, for a UWB transmitter operating under 47 C.F.R. § 15.517.

modulate the direct sequence code. These modulated code words, in turn, modulate a carrier whose frequency is three times the chipping rate. The resulting signal is band-limited by a root-raised-cosine filter. DS-UWB also employs error correction, interleaving, multiplexing, and synchronization techniques.

6. Another type of UWB system has been developed by the several members of the Multi-band OFDM Alliance Special Interest Group ("MBOA-SIG"). The MBOA-SIG transmitter employs multiband orthogonal frequency division multiplexing ("MB-OFDM") modulation. This modulation format consists of QPSK-modulated OFDM signals occupying a 528 MHz bandwidth.[22] These signals are shifted to different frequency bands (or channels) within the 3168-10560 MHz band. At least three separate transmission frequencies are employed. For a transmission employing three channels of operation, the transmission on a single channel lasts for 242.4 nanoseconds followed by an "off" period of 695.1 nanoseconds, resulting in a complete transmission cycle of 937.5 nanoseconds.

7. On August 26, 2004, the MBOA-SIG filed a Petition for Waiver requesting that the Commission permit the average radiated emission levels for its MB-OFDM waveform to be measured under normal operating conditions, *i.e.*, with the frequency hop or step function active and not disabled as required in the measurement procedure established in the *1st R&O*.[23] MBOA-SIG states that it is not clear if the UWB test procedures, which it claims were designed for pulse-based systems, apply to MB-OFDM systems. Consequently, it seeks a waiver of the measurement procedures, including the pulse gating procedures in 47 C.F.R. § 15.521(d), to the extent that they apply to MB-OFDM systems. The MBOA-SIG requests that this waiver apply only to a specific MB-OFDM architecture consisting of three non-overlapping operating bands.[24] Transmitters using this MB-OFDM format would operate under the provisions for indoor and handheld UWB devices.[25]

8. On August 30, 2004, the Commission released a public notice inviting comments on the MBOA-SIG petition for waiver. In response, 17 parties filed comments and 4 filed reply comments.[26] A list of the commenting parties, along with the abbreviations used to identify them, is attached as an Appendix to this Order.

III. DISCUSSION

9. Although MBOA-SIG questions whether the UWB measurement procedures established in the *1st R&O* apply to MB-OFDM systems, we believe that the prudent course of action here is to analyze the requested relief under a waiver standard. We note, in particular, that the Commission was quite clear in its discussion in the *1st R&O* that the requirement to perform measurements with the frequency sweep, hop or step function inactive was because no measurement procedures had been proposed or established nor had the interference effects of these modulation types been evaluated based on the results that would be obtained should measurements be performed with the system functioning normally.[27] Further, the change in operating frequency in the MB-OFDM system, which the petitioner refers to as "band sequencing," is equivalent to a frequency hopping or a stepped frequency modulation

---

22 MBOA-SIG petition for waiver at pg. 1-2. A detailed explanation of the modulation format is contained in Attachment B of the MBOA-SIG reply comments.

23 *1st R&O*, *supra*, at para. 32.

24 MBOA-SIG petition for waiver at pg. 10. Various methods of sequencing these three bands are shown in Attachment A to the MBOA-SIG petition.

25 47 C.F.R. §§ 15.517 and 15.519.

26 Freescale, MBOA-SIG, and Motorola also filed *ex parte* comments.

27 *1st R&O*, *supra*, at para. 32.

technique. 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.[28] We agree with the petitioner that a waiver of the measurement procedures will ensure that MB-OFDM systems are not unfairly burdened in the marketplace. The question is whether such a waiver would undermine Commission policy by causing an increase in the interference potential of UWB operations, and thus not serve the public interest.

10. In the *1st R&O*, the Commission specified a measurement procedure that required the average radiated emissions from UWB systems employing frequency hop, frequency sweep or stepped frequency modulation techniques to be measured with the hop, sweep or step function disabled.[29] The Commission indicated that this method of measurement was necessary since pertinent measurement procedures had not been proposed or established for these modulation types and because their interference aspects had not been evaluated. Furthermore, the various interference analyses regarding UWB operation were performed without consideration of the additional time averaging that would occur if the emission measurements were performed with the sweep, hop, step or gating active.[30] In addition, NTIA expressed concern that the emissions might not be maximized during the measurement, *i.e.*, that a swept frequency analyzer might not completely synchronize with a frequency hopped waveform, resulting in a measurement that is less than the maximum emission level. However, since the adoption of the *1st R&O*, NTIA provided comments that the measurements of systems with the frequency hopping, sweeping, stepping or gating function turned on provides a more meaningful representation of the emissions generated by a device.[31] NTIA also has suggested measurement procedures that should be applied to frequency hopping and stepped frequency systems.[32] NTIA recommended that the measurement procedure be modified to require that the measurement be performed over multiple sweeps with the maximum hold function enabled until the observed amplitude stabilizes. This measurement procedure ensures that the maximum radiated emissions are detected.[33]

11. In its comments, Cingular Wireless LLC opposes the petition, arguing that such a waiver can not be justified without tests comparing the measurements that would result with and without the frequency hopping stopped.[34] The Coalition of C-Band Constituents opposes the waiver claiming that it would permit an almost four-fold increase in the UWB power levels with materially greater interference.[35] The Satellite Industry Association argues that appropriate measurement procedures and emission masks must be developed to control interference potential and that a waiver to the current measurement

---

[28] *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).

[29] *1st R&O*, *supra*, at para. 32. This procedure was not codified in the rules.

[30] Average emission measurements performed on a system that employs a frequency hopping, frequency sweep or stepped frequency modulation format will be reduced proportional to the time period that the transmitter is active on the frequency being measured divided either by the length of time that it takes for a complete cycle through the operating frequency bands or the averaging time period of the measurement instrument, whichever is shorter.

[31] NTIA comments of 12/10/04 in ET Docket No. 98-153 at pg. 3-4.

[32] NTIA comments of 12/10/04 in ET Docket No. 98-153 at Enclosure B and NTIA comments of 1/15/04 in ET Docket No. 98-153 at pg. 13-19 and at Appendices C and D.

[33] The Commission recently amended its rules to permit wideband systems operating in the 5925-7250 MHz, 16.2-17.7 GHz and 23.12-29.0 GHz bands to be measured, using NTIA's suggested procedures, with any frequency hopping, stepped frequency or signal gating active. *See 2nd R&O*, *supra*.

[34] Cingular comments at pg. 5.

[35] Coalition of C-Band Constituents comments at pg. 1 and A4.

procedures will not accomplish this objective.[36] Freescale and decaWave also oppose the requested waiver, claiming that MB-OFDM causes more interference than would a pulsed modulation or direct sequence modulated system.[37]

12. The MBOA-SIG members conducted simulated and actual testing of devices employing the MB-OFDM 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.[38] These simulations and tests address the interference concerns expressed by Cingular Wireless, the Coalition of C-Band Constituents and other commenting parties. 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.[39] While the comments argue this issue based on different criteria, it is clear from the measurement and analyses results 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, if not less, than that of an impulse UWB emission.[40] These results are consistent with the theory, as stated by NTIA, that RMS measured emission levels are proportional to the measured bandwidth and the spectral power density, irrespective of pulse rate or modulation. Indeed, an integrated RMS measurement provides true average power readings, even for non-continuous signals such as frequency hopped UWB waveforms.

13. The UWB emission limits were established to prevent harmful interference to the authorized radio services from UWB transmitters employing impulse modulation. As previously noted, the Commission observed that these UWB emission standards were extremely conservative.[41] The MBOA-SIG demonstrated that the interference potential of frequency hopped, stepped or sequenced systems, measured in their normal operating modes, is less than that of a UWB transmitter employing

---

[36] Satellite Industry Association comments at pg. 3-4.

[37] Freescale comments at pg. 6-7; decaWave comments at pg. 1-3.

[38] MBOA-SIG petition for waiver at pg. 3 and 8-9. Actual testing was performed using a C-band earth station receiver for the Fixed Satellite Service ("FSS"). Interference testing indicated that the MB-OFDM emitter had to be located within 20 feet of the C-band earth station antenna. *See*, *e.g.*, MBOA-SIG petition for waiver at pg. 8-9, Philips comments at pg. 13-14, and MBOA-SIG reply comments at pg. 4-5 and 9-10 and at Attachments A and C.

[39] *See*, *e.g.*, the comments filed by decaWave, Freescale, Philips, and TimeDerivative and the reply comments of decaWave, Freescale, Motorola, and MBOA-SIG. This issue is not relative to the request for waiver. What is important is whether or not the MB-OFDM modulation format, when measured in the normal operating mode, has a greater interference potential than a UWB transmitter employing impulse modulation.

[40] If interference potential is evaluated using an improbable theoretical basis where no background noise level exists, a zero bit error rate is desired, and the bandwidth of the victim receiver is greater than the band switching rate of the MB-OFDM emission, it can be shown that the increase in interference potential is directly related to the additional time averaging that would occur if measurements were made with the MB-OFDM system functioning normally. The MB-OFDM system transmits only for 242.2 nanoseconds during every transmission cycle of 937.5 nanoseconds. Thus, the additional time averaging for this modulation format is 10 log (242.2/937.5) = -5.9 dB. During a one millisecond averaging period, *i.e.*, 1066.67 hopping sequences, the maximum differences in any averaging period will be 10 log [(1066 x 242.2) ns/1000000 ns) = -5.9 dB. However, this situation will not occur under actual operating conditions. The background noise level will mask a low level undesired signal and bit error rates are actual values. Further, while the instantaneous signal level of a hopped or stepped emission may be higher, it is higher only for a very short period of time, *i.e.,* less than one millisecond. The actual impact on the interference potential is much less than the difference between the instantaneous emission level and the emission level averaged over a one millisecond period during normal operation.

[41] In general, the UWB emission standards were based on modulation and operational characteristics that produced worst case interference results.

impulse modulation. Thus, any requirement to stop the frequency hop or band sequencing or system gating serves only to add another unnecessary level of conservatism.

14. We thus conclude that concerns regarding potential increased interference levels and proper detection of the radiated emissions have been addressed. Frequency hopping, stepped frequency, and sequenced UWB operations may be employed, with a minor change to the existing measurement procedures, without an increase in the potential for harmful interference to the authorized services. Accordingly, the request from MBOA-SIG for a waiver of the UWB measurement procedures for hopped frequency UWB systems has been shown to satisfy the criteria in *WAIT Radio v. FCC* and that a waiver is appropriate. However, while we agree with MBOA-SIG that its requested waiver should be granted, we also recognize, as the Commission has expressed throughout the UWB rule making proceeding, that we should continue to follow a conservative approach until such time as we have gained additional experience with UWB operations. For this reason, we believe that some conditions need to be applied to this waiver of the measurement procedures to further ensure that there is no increase in interference potential.

15. First, we are requiring that the transmitter continue to comply with all applicable UWB standards, as measured with the transmitter functioning normally. Second, we are concerned about the possible impact should an MB-OFDM system encounter interference on one of its channels and decrease the number of hopping or sequenced channels, *e.g.*, from the proposed three channel system to two channels or to a single channel.[42] Such a change could result in a higher signal level that exceeds the emission limits, as measured with the system actively hopping or sequencing between channels.[43] Thus, if provisions are made to operate using a different number of hopped or sequenced channels, the system must be designed to ensure that it complies with the emission levels under all possible operating conditions. Further, we see no technical reason to limit operation of the MB-OFDM system to only three channels. As long as the system complies with the standards set forth under this waiver, harmful interference should not occur.

16. NTIA expressed concern regarding two Federal systems that operate in the 3.1-10.6 GHz frequency range. The Microwave Landing System ("MLS") operates in the 5030-5091 MHz frequency band and is used for the precision approach and landing of aircraft. The Terminal Doppler Weather Radar ("TDWR") operates in the 5600-5650 MHz band to provide quantitative measurements of gust fronts, wind shears, microbursts, and other weather hazards for major airports. Because of these Federal operations, NTIA requests that we not permit UWB devices to operate under this waiver in the 5030-5650 MHz band until such time that the Institute for Telecommunication Sciences ("ITS"), a branch of NTIA, completes its measurement program.[44] At this time, we are implementing NTIA's request, limiting this waiver to UWB systems that operate in the 3.1-5.03 GHz and/or 5.65-10.6 GHz bands. We note that the three-hop system described in the MB-OFDM petition is capable of avoiding operation in the

[42] While MBOA-SIG requested a waiver for a three channel MB-OFDM system, the ability to eliminate operation on one or more channels because of interference could result in the MB-OFDM system operating with less than three channels.

[43] If the system is found to comply with the emission limits while actively hopping or sequencing between three channels, the instantaneous emission level produced on each channel may be as high as (-41.3 dBm + 5.9 dB) = -35.4 dBm/MHz. Under this circumstance, the average emission level that is measured with the transmitter operating normally would be -41.3 dBm/MHz, the level specified in 47 C.F.R. §§ 15.517 and 15.519. However, if that same transmitter switches to a hopping or sequenced system using only two channels, *e.g.*, to avoid interference on one operating channel, the instantaneous emission level produced on each channel will remain at -35.4 dBm/MHz but the average emission level measured with the transmitter operating normally will increase to (-35.4 dBm/MHz – 3 dB) = -38.4 dBm/MHz, a level 2.9 dB above the limit.

[44] Motorola is funding a study being performed by the ITS to characterize different UWB signals, test the relative interference potential of various UWB waveforms, and examine compliance measurement techniques.

5030-5650 MHz band and would not be adversely impacted by NTIA's request.

17. Freescale states that granting the requested waiver to MBOA-SIG will result in an unfair competitive advantage by permitting MB-OFDM systems to effectively operate at a power level 6 dB greater than what is permitted for other UWB devices.[45] Freescale notes that its systems employ gated transmissions. Since all devices in close proximity must share a single channel, data is sent in bursts, one packet at a time, with the system listening for acknowledgement of reception and making room for other transmissions during these blanking intervals. Freescale states that the duty cycle for each device rarely exceeds 25%, *i.e.*, -6 dB. The requirement to perform emission measurements with the gating disabled results in the power during actual use being at least 6 dB below what is determined during the compliance measurements.[46] Thus, Freescale, while opposing the petition from MBOA-SIG, states that should the Commission grant a waiver to MBOA-SIG it must do so in a technology-neutral manner, allowing any UWB device, not just MB-OFDM, to be measured under normal operating conditions.[47] We agree. The interference aspects of a transmitter employing frequency hopping, stepped frequency modulation or gating are quite similar, as viewed by a receiver, in that both appear to the receiver to emit for a short period of time followed by a quiet period. We recognize that a waiver of the measurement procedures in 47 C.F.R. § 15.521(d) that require gated systems to be measured with the system gated on, permitting them to operate under the same measurement procedures being applied to MB-OFDM systems, will ensure that gated DS-UWB systems are not unfairly burdened in the marketplace. Further, granting such a waiver will not undermine the Commission's policy as it also would not result in any increase to the interference potential of UWB operations for the same reasons attributed to the MB-OFDM modulation format, and thus would serve the public interest. Accordingly, we are also granting a waiver of the requirement to disable the gating, as specified in 47 C.F.R. § 15.521(d), subject to the operating conditions applied to the MBOA-SIG waiver.[48] In addition, we see no technical justification to restrict these waivers only to gated DS-UWB devices or to MB-OFDM systems. Frequency hopped, frequency stepped, band sequenced and gated emissions all appear similar to a receiver and should be treated equally under the conditions of this waiver.

18. In summary, we are waiving the UWB measurement procedure that requires the emissions from UWB devices employing hopped, stepped or sequenced operation to be measured with the hop, step or sequenced function stopped. In addition, we are waiving that portion of 47 C.F.R. § 15.521(d) that requires the emissions from UWB devices that employ gating to be measured with the emission gated on. The emissions from such systems shall be measured in their normal operating mode. These waivers do not apply to systems that employ swept frequency modulation.[49] Further, UWB transmitters certified under these waiver provisions also shall comply with the following provisions:

- Operation under the provisions of this waiver shall apply only to indoor or handheld UWB devices under 47 C.F.R. §§ 15.517 or 15.519 that operate in the 3.1-5.03 GHz and/or 5.65-10.6 GHz frequency bands. The fundamental emission of the UWB device shall not be located within the 5030-5650 MHz band. All other provisions of the UWB regulations shall continue to apply to these devices.

---

[45] Freescale reply comments at pg. 6-7.

[46] As with hopping and other similar systems, gated UWB devices are required to be tested with the gating turned off. 47 C.F.R. § 15.521(d).

[47] Freescale comments at pg. 11; Freescale reply comments at pg. 7.

[48] Our action here applies only to new products and does not any previously approved devices.

[49] As stated in 47 C.F.R. § 15.31(c), the emissions from transmitters employing swept frequency modulation are required to be measured with the frequency sweep stopped. Swept frequency systems were not addressed in this waiver and are outside of its scope.

- The measurement of the average and peak emission levels for hopped, stepped, sequenced or gated systems shall be performed with the equipment operating in its normal mode and shall be repeated over multiple sweeps with the analyzer set for maximum hold until the amplitude stabilizes.

- If provisions are made to operate using a different number of hopped, stepped or sequenced channels, the system shall be designed to ensure that it complies with the emission levels under all possible operating conditions.

- This waiver shall not apply to the determination of the UWB bandwidth or the classification of a device as an ultra-wideband transmitter. The requirements in 47 C.F.R. § 15.503(a) and (d) continue to apply based on measurements performed with any frequency hop, step or band sequencing function stopped.

- These waivers are effective until such time as the Commission finalizes a rule making proceeding dealing with these issues.

19. We are confident at this juncture that there is no significant risk of interference under the terms of this waiver. We believe the public interest is served by granting a waiver at this time to enable this new technology to be introduced to the market to the benefit of businesses and consumers. We also believe this is vitally important so that we can gain more experience with UWB technology. As the Commission has stated previously, we plan to closely monitor the introduction of UWB technology and may make appropriate modifications to our rules in the future if necessary to correct any harmful interference that occur. Upon completion of the ITS study and advisement by NTIA that it has no objections, we intend to modify the conditions of this waiver to permit operation within the 5.03-5.65 GHz band. We therefore delegate authority to the Office of Engineering and Technology to modify this waiver for the 5.03-5.65 GHz band accordingly. In addition, we plan at an appropriate time in the future to initiate a rule making to codify the provisions of this waiver for UWB communications devices.

IV. ORDERING CLAUSES

20. IT IS ORDERED that the Petition for Waiver from the Multi-band OFDM Alliance Special Interest Group IS GRANTED, to the extent described above.[50] IT IS FURTHER ORDERED that, on our own motion, a waiver of that portion of 47 C.F.R. § 15.521(d) which requires gated UWB transmitters to be measured with the system gated on IS GRANTED, to the extent described above. These actions are taken pursuant to Sections 4(i), 301, 302, 303(e), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 301, 302, 303(e), and 303(r).

21. IT IS FURTHER ORDERED that these waivers are effective upon release of this Order. IT IS FURTHER ORDERED that delegated authority is extended to the Office of Engineering and Technology to modify this waiver to permit operation within the 5.03-5.65 GHz band.

[50] The Commission will not send a copy of this Order to Congress or to the Government Accountability Office pursuant to the Congressional Review Act, *see* 5 U.S.C. 801(a)(1)(A), because no rules are being adopted.

22. For further information regarding this Order, contact John A. Reed, Office of Engineering and Technology, (202) 418-2455, john.reed@fcc.gov.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

Comments and Reply Comments Filed in Response to the MBOA-SIG Petition for Waiver

Comments:

1. Alereon, Inc. (Alereon)
2. Centro de Techologia de las Comunicaciones, S.A. (CETECOM)
3. Cingular Wíreles LLC (Cingular)
4. Coalition of C-Band Constituents (Coalition)
5. decaWave
6. FOCUS Enhancements, Inc. (FOCUS)
7. Freescale Semiconductor, Inc. (Freescale)
8. Harris Corporation (Harris)
9. Hewlett-Packard Company
10. Philips Electronics North America Corporation (Philips)
11. Pulse-LINK
12. Renesas Technology American, Inc.
13. Satellite Industry Association (SIA)
14. TimeDerivative Inc.
15. Time Domain Corporation (TDC)
16. WiLinx Corporation
17. WiMedia Alliance

Reply Comments:

1. decaWave
2. Freescale Semiconductor, Inc.
3. Motorola, Inc.
4. Multi-band OFDM Alliance Special Interest Group (MBOA-SIG)