Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Wireless Communications Association Int'l	)	
Petition to Amend Section 27.53(m) of the	)	RM-_____
Commission's Rules	)	

FILED/ACCEPTED

OCT 2 2 2010

Federal Communications Commission
Office of the Secretary

PETITION FOR RULEMAKING

wcainternational

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October 22, 2010

No. of Copies rec'd 0+4
List ABCDE

WTB 10-124

Pursuant to Section 1.401 of the Commission's Rules, The Wireless Communications Association International (WCAI), the trade association of the wireless broadband industry, submits this request to amend Sections 27.53(m)(4)[1] and 27.53(m)(6)[2] of the Commission's rules as described below.

I. Discussion

WCAI asks that the Commission amend its rules governing out-of-band-emission (OOBE) limits for mobile digital stations in the 2.5 GHz band to accommodate the use of the wider channel bandwidths. Specifically, WCAI asks that the Commission relax slightly the OOBE limits for mobile digital stations in section 27.53(m)(4) from 43 + 10 log (P) dB to 40 + 10 log (P) dB at the channel edges, and impose a 43 + 10 log (P) dB attenuation factor beyond 5MHz from the channel edges, and a 55 + 10 log (P) dB attenuation factor at "X" MHz from the channel edges where "X" is the greater of 6 MHz and the actual channel bandwidth. WCAI also requests that the Commission allow a resolution bandwidth of 2 percent for mobile digital stations in section 27.53(m)(6).

Amending the OOBE limits in the 2.5 GHz band as requested is necessary to realize the full benefits of 4G technologies and better align the Commission's rules with the approach of the global 3rd Generation Partnership Project[3] (3GPP) and future WiMAX standards applicable to the 2.5 GHz band.[4] Providing for operation of wider channel bandwidths will promote efficient use of the spectrum and help

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[1] See 47 C.F.R. § 27.53(m)(4).

[2] See 47 C.F.R. § 27.53(m)(6).

[3] The 3rd Generation Partnership Project is a consensus-driven international partnership of telecommunications standards bodies.

[4] See 3GPP TS 36.101 V8.7.0 (2009-09).

achieve the goals of the National Broadband Plan for mobile broadband. And harmonizing the Commission's rules with the applicable 3GPP standard and future WiMAX standards will enable manufacturers and network operators to realize enormous economies of scope and scale in 2.5 GHz mobile devices, which would otherwise need to be customized for use in the United States.

a. Current OOBE Limits in the 2.5 GHz Band Do Not Allow Wider Channel Bandwidths

Although current deployments in the 2.5 GHz band typically use 10 MHz channels, operators must begin deploying channel bandwidths of 20 MHz or more to realize the full benefits of 4G technologies. Today's 2.5 GHz band subscribers are already using an average of 7 GB of data monthly,[5] and overall network demand is expected to soar in the next several years.[6] To meet this projected demand, operators in the 2.5 GHz band must begin to make even more efficient use of their spectrum. Following Shannon's law, as channel bandwidth is increased, channel throughput generally increases linearly. In contrast, increasing carrier to interference-plus-noise ratio through frequency reuse generally yields only a logarithmic increase in capacity. Deploying wider channel bandwidths thus enables more efficient use of spectrum and has become fundamental to the deployment of 4G technologies.[7]

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[5] *See* Broadband Performance, OBI Technical Paper No. 4, page 20.

[6] National Broadband Plan, page 76, Exhibit 5-A.

[7] Twenty MHz channels using WiMAX or TDD LTE 4G technologies are expected to provide 20-50% average throughput gains relative to existing 10 MHz WiMAX systems and double the peak throughput.

Unfortunately, the current OOBE limits for mobile devices are preventing deployment of wider channel bandwidths in the 2.5 GHz band in the United States. Operators are poised to deploy wider channel bandwidths *today* – making more efficient use of existing spectrum allocations and increasing broadband throughput to consumers – but operators are unable to do so efficiently or economically until the OOBE limits are modified in accordance with this Petition. However well-intended when they were initially adopted, the current OOBE limits applicable to mobile devices have become outdated, and threaten to impede the Nation's goal (as articulated in the National Broadband Plan) of "lead[ing] the world in mobile innovation, with the fastest and most extensive wireless networks of any nation." To realize this goal, the Commission should commence a rulemaking to amend the uplink OOBE limits in the 2.5 GHz band as quickly as possible.

b. The Commission Should Amend Its OOBE Limits to Accommodate Wider Channel Bandwidths in the 2.5 GHz Band

Twenty MHz or wider channels were never envisioned during the BRS/EBS rulemaking in 2004. At that time, 4G technology standards were incomplete, and operators lacked experience in deploying channels wider than 5 MHz. The current OOBE limits in the 2.5 GHz band were thus based on the limits applicable to other Part 27 services (i.e., 43 + 10 log P dB at the channel edge measured in 1% of designated bandwidth in the first 1 MHz), which were designed to accommodate the 5 MHz channel widths more typical in 3G deployments.

Operators in the 2.5 GHz band now have substantial experience deploying 4G networks using 10 MHz channels and are prepared to deploy even wider channel bandwidths. But these operators have discovered that even mobile devices using

only 10 MHz channels have difficulty meeting the current OOBE limits, let alone 20 MHz or wider channels. Power amplifier efficiency for mobile devices operating in 10 MHz channels is already at the limits of current technology and is just barely manageable now – when most current mobile products in the 2.5 GHz band are in relatively large form factors, such as fixed CPE or embedded laptop devices.

The next generation of 4G devices (WiMAX and LTE) will be focused on 20 MHz or wider channels and smaller, highly mobile form factors (e.g., smartphones) in which filtering complexity and economic tradeoffs are key concerns. Designing a smartphone with a small form factor using 20 MHz or wider channels that meets current OOBE limits would be very difficult at best (and, at worst, impossible) . Such a device would likely have an artificially low battery life and could not easily dissipate the extra heat that would be generated by the additional filtering. Base-station scheduling algorithms that restrict the use of certain resource blocks at lower power levels (in the case of LTE) would also need to be implemented. Implementing these controls would result in coverage and capacity loss on the uplink. Given these difficulties, the only practical option for meeting current uplink OOBE limits using 20 MHz channels in the 2.5 GHz band would be to reduce device bandwidth or lower device transmit power, either of which would artificially limit the benefits operators and consumers hope to achieve with 4G technologies.

To achieve a reasonable balance between smartphone design issues (e.g., size and battery life) and the spectral efficient of wider channel bandwidths, and thus fulfill the promise of 4G technologies, the Commission should amend its OOBE rules as described in detail in Appendix A. Specifically, the Commission should relax

slightly the OOBE limits for mobile digital stations in section 27.53(4) from 43 + 10 log (P) dB to 40 + 10 log (P) dB (-10 dBm) at the channel edge measured using a resolution bandwidth of 2 percent.

The Commission should also eliminate the assumption that BRS/EBS channels are 5.5 MHz wide. Section 27.53(m)(4) of the Commission's rules currently requires that licensees meet an attenuation factor of 55 + 10 log (P) dB at 5.5 MHz from the channel edges. The 5.5 MHz distance was based on the channel widths proposed in the industry's initial white paper asking that the band be reconfigured to accommodate 4G services. This 5.5 MHz distance does not scale with actual channel bandwidth, and thus does not accommodate 20 MHz or wider channels. To remedy this defect, WCAI asks that 2.5 GHz licensees be required to meet an attenuation factor of 43 + 10 log (P) dB beyond 5MHz from the channel edges, and the 55 + 10 log (P) dB attenuation factor at a distance of "X" from the channel edges where "X" is the greater of 6 MHz or the actual emission bandwidth as defined in section 27.53(m)(6) of the Commission's rules.[8]

These changes to the OOBE limits would allow operators to provide the full uplink capacity available in 20 MHz or wider channels, which would greatly enhance spectrum efficiency and broadband throughput. As described more fully below, any increase in the risk of interference from such a relaxation of the existing rule could not be defined as "harmful" because it would be far outweighed by the benefits of accommodating 20 MHz or wider channels.

[8] See 47 C.F.R. § 27.53(m)(6). Section 27.53(m)(6) defines "emission bandwidth" as "the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power."

In assessing the impact of the proposed rule change on potential interference, it is worth noting that the scenario where an increased risk of potential interference is most likely is also atypical. Mobile 4G devices using orthogonal frequency-division multiple access (OFDMA) technology will typically not be allocated all of the uplink bandwidth while at the same time operating at full transmit power. This is due to the fact that the OFDMA multiple access scheme shares the uplink channel among multiple users in the manner of both frequency-division multiplexing (FDM) and time-division multiplexing (TDM). Therefore the transmission bandwidth allocated for each mobile device is much narrower than the full channel bandwidth, and occurs for a duration that is a fraction of the total frame duty cycle of the communication protocol. To preserve battery life and minimize intra-system interference, particularly in reuse 1 systems, mobile devices operate under very stringent power control rules, which are explicitly designed to minimize transmission power at all times. Typically, mobile devices only operate at full power when they are in cell edge regions of the coverage area. In these situations the composite energy of the device is typically also confined to the narrowest bandwidth possible in order to maximize the range of the system, while preserving battery life. This limits the instantaneous bandwidth that is typically used at full power, and hence the out of band emissions.

As a result, the spectral emissions mask (SEM) being proposed is not the same as the instantaneous emissions expected from any one device. Instead the SEM is the composite mask of all different forms of instantaneous emissions that may occur; the actual emissions being a function of the power allocated and the number

and location of the allocated frequency resources to any one user of the OFDMA based system. This fact is why the adjacent channel leakage ratio (ACLR) of 4G systems based on OFDMA is typically much less than represented by the SEM. ACLR is a measure of the amount of power actually transmitted outside of the channel and is a baseline transmitter performance metric that is included in mobile device specifications from international standards organizations such as IEEE, WiMAX Forum, 3GPP,[9] and the ITU. Therefore, for 4G systems, a relaxation of the SEM cannot be inferred as resulting in an equivalent increase in the potential risk of interference because the 4G systems are designed to avoid the combination of factors that would most likely lead to greater risk.

c. Current OOBE Limits in the 2.5 GHz Band Are Not Aligned with 3GPP Standards Applicable to the 2.5 GHz Band

In addition to the benefits noted above, amending the OOBE limits as proposed in Appendix A would align the Commission's rules with the applicable 3GPP standard for mobile devices as well as future WiMAX standards addressing 20 MHz or wider channel bandwidths.[10] Harmonizing the OOBE limits for mobile devices with international standards is critical to economic deployment of the 2.5 GHz band in the United Statutes, because it allows manufacturers and operators to take advantage of enormous economies of scope and scale in 2.5 GHz mobile devices. Without such harmonization, 2.5 GHz mobile devices would need to be

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[9] For an example of ACLR performance specifications for 4G mobile devices, see 3GPP TS 36.101 V8.7.0 (2009-09), section 6.6.2.3; ACLR remains the same value for all channel bandwidths, from 1.4 to 20 MHz.

[10] To date, the WiMAX Forum has not completed its specifications for the next generation of the WiMAX standard; however, WCAI expects that this approach would also be consistent with future WiMAX standards addressing 20 MHz or wider bandwidths.

customized for use in the United States at a significant cost to operators and, ultimately, consumers. International standards also provide strong evidence that the OOBE limits sought in this Petition would not cause harmful interference.

The 3GPP standards[11] define three bands for the 2500-2690 MHz band (bands 7, 38, and 41).[12] Unlike the Commission's current OOBE limits in the 2.5 GHz band, the OOBE limits applicable to these 3GPP bands expressly provide for up to 20 MHz channel bandwidths.[13] The 3GPP standard's OOBE limits for mobile devices in the 2.5 GHz band are illustrated in the table below.[14]

[illegible] (MHz)	[illegible] MHz	[illegible] MHz	[illegible] MHz	10 MHz	15 MHz	20 MHz	[illegible]
± 0-1	-10	-13	-15	-18	-20	-21	30 kHz
± 1-2.5	-10	-10	-10	-10	-10	-10	1 MHz
± 2.5-2.8	-25	-10	-10	-10	-10	-10	1 MHz
± 2.8-5		-10	-10	-10	-10	-10	1 MHz
± 5-6		-25	-13	-13	-13	-13	1 MHz
± 6-10			-25	-13	-13	-13	1 MHz
± 10-15				-25	-13	-13	1 MHz
± 15-20					-25	-13	1 MHz
± 20-25						-25	1 MHz

[11] WCAI relies solely on 3GPP standards in this Petition only because next generation WiMAX standards have not yet been finalized.

[12] Band 7 is a FDD paired spectrum allocation from 2500-2570 MHz for uplink and 2620-2690 MHz for downlink with channel bandwidths of 1.4, 3.0, 5.0, 10.0, 15.0, and 20 MHz. Band 38 is a TDD unpaired spectrum allocation from 2570-2620 MHz (located in the Band 7 FDD duplex gap) with channel bandwidths of 1.4, 3.0, 5.0, 10.0, 15.0, and 20 MHz. Band 41 is a TDD unpaired spectrum allocation from 2496-2690 with channel bandwidths of 5.0, 10.0, 15.0, and 20 MHz. Any of these three 3GPP-defined bands could be deployed in the United States pursuant to the Commission's current rules, which are completely flexible regarding duplex mode.

[13] The 3GPP standard for LTE mobile devices applies across multiple bands, including the 2.5 GHz band.

[14] See 3GPP TS 36.101 V8.7.0 (2009-09), page 32, Table 6.6.2.1.1-1.

Adoption of rules consistent with the approach used in this 3GPP standard should provide the Commission with assurance that the OOBE limits requested in this Petition are both necessary and will not cause harmful interference. The 3GPP is a consensus-governed organization, bringing together a wide range of industry experts to develop globally applicable standards. All 3GPP participants are invited to participate in this process,[15] and the 3GPP endeavors to adopt standards based on the consensus of all participants. This process ensures that 3GPP standards are broadly-accepted by industry experts from around the world. As part of 3GPP Release 8,[16] adopted in 2009, the 3GPP OOBE requirements for mobile devices described above thus represent a widely approved and implemented standard that is *already* in place internationally and provides strong evidence that such OOBE limits do not cause harmful interference. Aligning the Commission's OOBE limits with these industry-approved practices is thus both appropriate and necessary to ensure that U.S. deployments do not fall behind global standards.

II. Conclusion

Granting this Petition is necessary to facilitate the rapid deployment of 4G mobile broadband services in the 2.5 GHz band nationwide. WCAI asks that the Commission immediately issue a notice of proposed rulemaking seeking comment on the amendments sought in this Petition, and looks forward to helping the Commission develop a complete record on the issue.

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[15] 3GPP Working Procedures are available at http://www.3gpp.org/ftp/Information/Working_Procedures/3GPP_WP.pdf.

[16] See 3GPP TS 36.101 V8.7.0 (2009-09).

Respectfully submitted,

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October 22, 2010

Appendix A

Revise Sections 27.53(m)(4) and (m)(6) as follows:

(4) For mobile digital stations, the attenuation factor shall be not less than 40~~3~~ + 10 log (P) dB at the channel edge, 43 + 10 log (P) dB beyond 5MHz from the channel edges, and 55 + 10 log (P) dB at X~~5.5~~MHz from the channel edges where X is the greater of 6 MHz or the actual emission bandwidth as defined in 27.53(m)(6). Mobile Service Satellite licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

(6) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent (or two percent for mobile digital stations) of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified, or 1MHz or 2 percent for mobile digital stations). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. With respect to television operations, measurements must be made of the separate visual and aural operating powers at sufficiently frequent intervals to ensure compliance with the rules.