

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the matter of

Amendment of Part 27 of the
Commission's Rules to Govern the
Operation of Wireless Communications
Services in the 2.3 GHz Band

Establishment of Rules and Policies for the
Digital Audio Radio Satellite Service in the
2310-2360 MHz Frequency Band

WT Docket No. 07-293

IB Docket No. 95-91
GEN Docket No. 90-357
RM No. 8610

COMMENTS OF MOTOROLA, INC.

Motorola, Inc. ("Motorola") respectfully submits these comments on the Notice of Proposed Rulemaking and Second Further Notice of Proposed Rulemaking ("NPRM/FNPRM") in the above-captioned proceedings.¹

I. MOTOROLA INTEREST IN THIS PROCEEDING

Motorola is a global manufacturer of a wide range of wireless and wireline communications products, including mobile telephones, broadband wireless access equipment, public safety communications equipment and cable modems. As such, Motorola has extensive experience in developing and implementing new radio technologies for a wide variety of services, applications and environments and is uniquely situated in developing reliable and commercially viable radio-based solutions. In particular, Motorola has experience with the

¹ Amendment of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band, *Notice of Proposed Rulemaking and Second Further Notice of Proposed Rulemaking*, WT Docket No. 07-293, IB Docket No. 95-91, GEN Docket No. 90-357, RM No. 8610, FCC 07-215, (rel. December 18, 2007) ("NPRM/FNPRM").

issues facing equipment in the 2.3 GHz band, through seven WiMAX trials and one commercial WiMAX contract spanning Asia and Europe.

II. INTRODUCTION

The technical and regulatory uncertainty surrounding the 2310-2360 MHz band has proved difficult for both Wireless Communication Service (“WCS”) and Satellite Digital Audio Radio Service (“SDARS”) licensees. Without rules for SDARS repeaters, the SDARS licensees have had to pursue licensing of repeaters through the Commission’s special temporary authority process (“STA”) with unclear regulatory requirements. The lack of technical rules for SDARS repeaters, as well as the stringent nature of some of the rules for WCS, has resulted in uncertainty about the interference environment WCS operations will ultimately face and stymied large-scale deployments of WCS systems. Noting these difficulties facing the services in the 2310-2360 MHz band, Motorola applauds the Commission for initiating a rulemaking to determine final rules for SDARS repeaters, and for concurrently considering revisions to important technical rules applicable to WCS.

From a terrestrial standpoint, momentum is growing around the world for use of the 2300-2400 MHz band (“2.3 GHz band”) for WiMAX and other broadband wireless access technologies. The WiMAX Forum has a system profile which includes the 2.3 GHz band and the WCS license blocks in the United States.² In 2007, this frequency band was identified for use by International Mobile Telecommunication (“IMT”) technologies, including WiMAX, on a globally harmonized basis in the international Radio Regulations.³ In addition, many countries

² See WiMAX Forum™ Mobile System Profile Release 1.0 Approved Specification (Revision 1.2.2: 2006-11-170, http://www.wimaxforum.org/technology/documents/WiMAX_Forum_Mobile_System_Profile_v1_2_2.pdf

³ International Telecommunication Union World Radiocommunication Conference 2007 (“WRC-07”) identified 2300-2400 MHz for IMT globally. See WRC-07 Provisional Final Acts, Footnote 5.384A and Resolution 223 (rev. WRC-07) at <http://www.itu.int/md/R07-WRC07-R-0001/en/>.

around the world are proceeding with licensing of the 2.3 GHz band for broadband wireless access, and systems are being implemented.⁴ These developments underscore the benefits consumers and service providers in the United States could accrue from economies of scale for WCS equipment in the band, if the technical requirements imposed are sufficiently similar to those applicable elsewhere in the world.

In the following sections, Motorola respectfully submits its comments on various technical issues on which the Commission sought comment in its NPRM/FNPRM.

III. SDARS/WCS POWER LIMITS

A. Power limits for WCS base stations and SDARS repeaters

The Commission seeks comment on proposals from Sirius Satellite Radio Inc.⁵ (“Sirius”) and the WCS Coalition⁶ on power limits for WCS base stations and SDARS repeaters. Sirius proposes that WCS base stations and SDARS repeaters be subject to an average power limit of -44 dBm measured at 2 m above the ground; this is equivalent to a Power Flux Density (“PFD”) limit of -45.3 dBW/m².⁷ Sirius does not propose an accompanying transmitter power or equivalent isotropically radiated power (“EIRP”) limit. Sirius would allow an exclusion zone, where the -44 dBm could be exceeded, up to a level of -32 dBm (or a PFD of -33.3 dBW/m²).⁸

⁴ For example, Hong Kong, Singapore, Korea, Malaysia, Philippines, Vietnam, Bangladesh, Australia and New Zealand are all in varying stages of allocating and/or licensing the 2.3 GHz band for broadband wireless access use

⁵ Sirius Satellite Radio Inc., Petition for Rulemaking and Comments, filed Oct. 17, 2006 (“Sirius Petition for Rulemaking”).

⁶ The WCS Coalition is comprised of AT&T Inc., Comcast Corporation, NextWave Broadband Inc., and Sprint Nextel Corporation, who collectively hold licenses covering virtually all of the 2.3 GHz WCS spectrum within the fifty United States, and the Wireless Communications Association International, Inc. The WCS Coalition’s proposals for rule changes to Parts 25 and 27 of the Commission’s rules are found in their July 9, 2007 ex parte letter to Ms. Marlene H. Dortch in IB Docket 95-91, GEN Docket No. 90-357, RM-8610. (“July 2007 WCS Letter”)

⁷ NPRM/FNPRM at ¶15-20. The PFD limit is computed assuming a 0 dBi measurement antenna.

⁸ See Sirius Petition for Rulemaking at Page A-1, proposed new Section 25.214(d)(2)(A)(i).

With respect to the Sirius proposal, the Commission asks a number of questions, including how the limit should be specified (e.g., as a PFD limit instead of power limit), the impact of the limit on SDARS and WCS operations, and if another value would be better (in which case, supporting technical analysis is requested).

The WCS Coalition proposes a 2 kW average EIRP limit for SDARS repeaters and WCS base stations.⁹ The WCS Coalition proposes that this EIRP limit be measured in a 5 MHz bandwidth using the definition of average power in Section 2.1 of the FCC's rules. The WCS Coalition also proposes specification of the EIRP limit as a power spectral density, i.e., an additional average EIRP limit of 400 W/MHz. The Commission asks a number of questions about the WCS Coalition proposal, such as whether average vs. peak specification of power will increase the risk of interference to services operating outside of 2305-2360 MHz and whether a 13 dB PAR as used in the 700 MHz band is appropriate. The Commission also seeks comment on a hybrid approach where a general average EIRP limit would be applied, but higher EIRP would be allowed if a certain emission level on the ground is met, as is applied in the Lower 700 MHz band.

Motorola supports the WCS Coalition proposal for a 2 kW average EIRP limit for base stations/repeaters in both services. Specifying an average EIRP limit is consistent with the limits that exist or have been proposed for other similar services in the FCC's rules, including the 700 MHz band.¹⁰ The measurement of average values with non-constant envelope technologies

⁹ NPRM/FNPRM at ¶21-23. The Commission indicates that the WCS Coalition proposed a 6 dB peak-to-average ratio ("PAR") limit to accompany its EIRP limit. *See* NPRM/FNPRM at ¶23. However, this appears to be a misinterpretation of the WCS Coalition proposal, where the WCS Coalition mentioned a 6 dB PAR ratio in its July 2007 letter as representative of current DARS repeater technology. *See* July 2007 WCS letter at footnote 9 and Exhibit A (proposed text for §27.50(a)).

¹⁰ *See* Service Rules for the 698-746, 747-762 and 777-792 MHz Bands, *Report and Order and Further Notice of Proposed Rulemaking*, 22 FCC Rcd 8064, 8103-04 (2007) ¶105-106. In addition, various entities have

avoids the possibility that impulse-like transient surges of extremely short durations will unnecessarily govern the operating power of such stations. This average output power approach is consistent with most standards specifications¹¹, which would bring the rules in-line with industry practices. Motorola also supports the proposal to additionally specify the power as a power spectral density (dBW/MHz), consistent with proposals by Motorola and others for power spectral density limits for Part 24 broadband PCS and Part 27 AWS services.¹²

With respect to the possible specification of a PAR to accompany the average EIRP limit, Motorola notes that the WCS Coalition did not propose a PAR, presumably in a willingness to provide some flexibility to both DARS and WCS licensees. As recognized by the Commission previously,¹³ different technologies have different values of PAR, with current OFDM technologies having a PAR around 10 dB. If the Commission decides to include a PAR requirement, Motorola urges the adoption of 13 dB, in order to allow licensees technological flexibility as was afforded in the 700 MHz proceeding.

(Continued . . .)

proposed the application of average power limits for broadband PCS and AWS in another proceeding. *See* Biennial Regulatory Review – Amendment of Parts 1, 22, 24, 27, and 90 to Streamline and Harmonize Various Rules Effecting Wireless Radio Services, *Report And Order And Further Notice Of Proposed Rulemaking*, WT Docket No. 03-264, (rel. August 9, 2005) (“Biennial Review”). *See, e.g.*, Comments of CTIA in WT Docket No. 03-264 at Pgs. 9-10 and Comments of Motorola in WT Docket 03-264 at Pgs. 2-4.

¹¹ *See e.g.*, 3GPP TS 05.05 V8.20, “3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Radio transmission and reception (Release 1999)”, November 2005. 3GPP2 C.S0010-C V1.0 “Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Base Stations”, 14 January 2005.

¹² *See, e.g.*, Comments of CTIA in WT Docket No. 03-264 at 6-9 and Comments of Motorola in WT Docket 03-264 at Pgs. 2-4.

¹³ *See* Service Rules for the 698-746, 747-762 and 777-792 MHz Bands, *Report and Order and Further Notice of Proposed Rulemaking*, WT Docket No. 06-150, 22 FCC Rcd 8064, 8103-04 (2007) ¶¶105-106.

B. Power limits for WCS subscriber stations

The Commission seeks comment on proposals from Sirius and the WCS Coalition on power limits for WCS subscriber stations.¹⁴ Sirius proposes an average power limit of -44 dBm at 1 m from any WCS subscriber station antenna. This is equivalent to a WCS subscriber station EIRP of 0.4 mW, assuming a 0 dBi antenna, and is some 5,000,000 times lower than the current Commission rules for fixed user stations.¹⁵ The WCS Coalition proposes a 20 W average EIRP limit on all user stations. In addition, stations which limit their power to 2 W output power for non-mobile stations or 2 W EIRP for mobile stations may operate under relaxed out-of-band emission limits.

In determining the appropriate technical rules for WCS/DARS, Motorola believes that the Commission must take into account the particulars of the situation, where two arguably incompatible services must find a way to co-exist. In contrast to a scenario where the Commission is establishing rules for new services, the WCS and DARS bands were auctioned and licensed over ten years ago. The current rules (or lack thereof in the case of SDARS repeaters) have proved problematic for both WCS and DARS licensees, and the Commission seeks to find a middle ground where both services can operate commercially viable systems, albeit not in an interference-free environment.¹⁶

¹⁴ NPRM/FNPRM at ¶15-18.

¹⁵ See Sections 27.50(a)(1) and (2) of the Commission's rules, which permit 20 W peak EIRP for mobile stations and 2000 W peak EIRP for fixed stations

¹⁶ In the initial Report and Order in General Docket No. 96-228, the Commission noted "However, a desire for an interference-free radio service must be balanced with the need to provide reasonable operating parameters for adjacent services. Accordingly, our intention in determining out-of-band emission limits for WCS into the spectrum used by DARS has been to limit the potential for interference to a reasonable level—not to provide a pure, interference-free environment." See Amendment of the Commission's Rules to Establish Part 27, the Wireless Communications Service ("WCS"), *Memorandum Opinion and Order*, GEN Docket No. 96-228, 12 FCC Rcd 3991 (1997).

Motorola notes that the WCS proposal would result in WCS user stations operating at much reduced power levels than the current rules. Under the WCS proposal, mobile stations would generally operate at 10 dB lower EIRP (10 times lower), and non-mobile stations (fixed) would operate at more than approximately 20 dB lower EIRP (100 times lower). These reductions would considerably reduce the potential for blocking interference to SDARS receivers. Motorola also agrees with the WCS Coalition that there are additional mitigating factors that could be considered in determining the potential for interference between WCS and SDARS receivers.¹⁷

Motorola recommends that the Commission follow its typical policy of specifying transmitter output power or EIRP limits for subscriber stations, as proposed by the WCS Coalition.¹⁸ Motorola does not support the type of power limit on subscriber stations proposed by Sirius. Such an approach would unduly constrain the power levels of WCS terminal to a level that would make the WCS service not viable. Sirius' proposed limits (effectively 0.4 mW) on subscriber station power are much more restrictive than those applied for similar services in the Commission's rules.¹⁹

¹⁷ See July 2007 WCS Letter at Pgs. 12-15. For example, non-mobile WCS stations would often be desktop CPEs, where the assumed separation with SDARS receivers would be greater than typically assumed between two handheld devices and attenuation by walls could also be considered. In the case of handheld WCS and SDARS receivers, attenuation by the body of the person holding the devices should also be considered.

¹⁸ Motorola recommends this power level also be specified on an average basis as discussed for the base station/repeater case and has similar comments with respect to specifying a PAR for user station power limits. The Commission should be careful not to limit the technologies that can be used in the band. Further, Motorola notes that the typical PAR for user stations may be different for user stations, as compared to that for base stations, even for a given technology.

¹⁹ For example, for the Broadband Radio Service, EIRPs of 2 Watts are allowed for mobile stations and output powers of 2 W for other user stations. See Section 27.50(h)(2) of the Commission's rules. For the Upper and Lower 700 MHz bands, ERPs of 3 Watts are allowed for portable devices, and control and mobile stations are allowed 30 Watts ERP. See Sections 27.50(b)(2) and(3) and 27.50(c)(2) and (3) of the Commission's rules.

C. Assumed out-of-band signal rejection for WCS receivers

The Commission seeks comment on a proposal from Sirius to assume, in assessing any WCS claims of harmful interference through measurements or calculations, that the WCS receivers (base and subscriber) have a front-end band-pass filter providing 16 dB attenuation of out-of-band emissions.²⁰ The Commission seeks comment on this proposal, including whether it is feasible from an economic or technical standpoint and if a similar obligation should be placed on SDARS receivers.

Instead of specifying receiver performance requirements in the Commission's rules, Motorola suggests that the specification of such parameters should be left to the standards bodies. For example, Motorola notes that it is typical for standards bodies to define receiver adjacent channel rejection or adjacent channel selectivity requirements.²¹ The Commission typically specifies the level of interference that a system must accept (i.e., through out-of-band emission limits or power limits on neighboring services), but does not specify receiver performance.

D. Out-of-band emission limits

The Commission seeks comment on proposals from the WCS Coalition to revise the out-of-band emission limits for WCS stations.²² Specifically, they propose to apply an out-of-band emission attenuation limit of $75+10 \log P$ for DARS repeaters and WCS base stations. The WCS Coalition proposes out-of-band limits of $55+10 \log P$ for 2320-2324 MHz and 2341-2345 MHz;

²⁰ NPRM/FNPRM at ¶20.

²¹ See, e.g., 3GPP TS 25.102 V7.9.0 (2007-12), "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; User Equipment (UE) radio transmission and reception (TDD) (Release 7)", 20 December 2007. In this standard, adjacent channel selectivity is defined as "a measure of a receiver's ability to receive a wanted signal at its assigned channel frequency in the presence of adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel. ACS is the ratio of the receive filter attenuation on the assigned channel frequency to the receiver filter attenuation on the adjacent channel(s)."

²² NPRM/FNPRM at ¶24-25.

61+10 log P for 2324-2328 MHz and 2337-2341 MHz; and 67+10 log P for 2328-2337 MHz, for WCS subscriber stations operating at less than 2 W average power (fixed/non-mobile stations) and less than 2 W average EIRP (mobile stations) and incorporating transmitter power control mechanisms.²³ Compliance would be based on a 1 MHz resolution bandwidth, except for within the first 1 MHz outside the operational band, where 1% of the emission bandwidth may be used. Other subscriber stations (operating up to 20 W EIRP) would be subject to the 75 + 10 Log P limit. In addition, the WCS Coalition does not propose changes to the limits applicable outside of the SDARS band.²⁴

It is critical that the current out-of-band emission limits on WCS stations be relaxed in order to make the service feasible. The strict current out-of-band emission requirements on WCS equipment have been a significant impediment to development of WCS equipment.²⁵ The Commission recognized the difficulties associated with the current out-of-band limits in granting an extension of the construction requirement for the WCS licensees, finding “...that relatively restrictive OOB [out-of-band emission] limits may have impeded the development of WCS equipment and have contributed to the unique circumstances of the band.”²⁶ The costs of filtering for consumer premise equipment (fixed or mobile) to meet the current out-of-band emission levels leads to prohibitively expensive equipment. Further, the size of the required filter exceeds the form factor for consumer premise equipment (“CPE”). Depending on the

²³ The current out-of-band limits for WCS subscriber stations are 110 + 10 log P for mobile stations and 80 + 10 log P for fixed stations. The current limit for WCS base stations is 80 + 10 log P. *See* Section 27.53(a) of the Commission’s rules.

²⁴ *See* Section 27.53(a) of the Commission’s rules. The current out-of-band levels are 70 + 10 log P below 2300 MHz and above 2370 MHz, and 43+10 log P for 2300-2320 MHz and 2345-2370 MHz

²⁵ *See* Comments of Motorola in WT Docket 06-102 at Pg. 8 and Comments of Intel in WT Docket 06-102 at Pg. 2.

²⁶ Consolidated Request of the WCS Coalition for Limited Waiver of Construction Deadline for 132 WCS Licenses, *Order*, WT Docket 06-102, DA 06-2641, 21 FCC Rcd 14134 (WTB, 2006) at ¶10.

design tradeoffs chosen between power, throughput and filtering, the required filter could result in more than doubling the overall size of the CPE. Similarly, smaller, access-point style base station designs would not be feasible because they can only accommodate a limited filter size.

IV. CONCLUSION

Motorola urges the Commission to expeditiously move forward and finalize the rules applicable to SDARS repeaters and WCS, in accordance with the proposals outlined above.

Respectfully submitted,

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