the Commission staff's *WCS/SDARS Technical Rules Public Notice*, Sirius XM reiterated its position on ground-based emission limits as a means of limiting interference to SDARS. It also added that the Commission should require that the WCS network be deployed with a cell density such that a power level greater that -44 dBm would not be present for greater than 100 meters of continuous road surface.[277]

117. In the *2007 Notice*, the Commission requested that interested parties discuss whether a ground-level emission limit – of the kind proposed by Sirius – would facilitate the deployment of both SDARS and WCS services to the public. Specifically, parties were requested to discuss the interference potential of a -44 dBm limit on WCS and SDARS operations, and to balance that potential with the economic and business impact of such a limit on WCS and SDARS operations. In addition, the Commission sought comment on how easily it could verify compliance with and resolve disputes arising under a ground-level emission limit requirement.[278]

118. The Commission also encouraged parties to propose alternative ground-level emission limits, and to provide technical studies demonstrating the effect such alternative limits would have on the ability of SDARS and WCS licensees to serve the public. Further, the Commission stated that it would consider an equivalent power flux density (PFD) limit expressed in dBW/m^2, or a field strength limit expressed in $dB\mu V/m$, because such a limit would eliminate the need to make an assumption about receiver antenna gain. The Commission asked parties to recommend the bandwidth to be used in calculation of a PFD limit if it were to adopt such a limit.[279]

119. As an alternative to Sirius' ground-level emission limit proposal, WCS licensees proposed allowing both WCS base stations and SDARS repeaters to operate with an EIRP up to 2 kW, based on average rather than peak power, per 5 megahertz, with a 6 dB PAPR.[280] The WCS licensees further proposed a power spectral density limit such that only 400 W average EIRP could be emitted per 1 megahertz, to ensure the transmitted energy is spread across the band.[281]

120. In the *2007 Notice*, the Commission asked several questions regarding the WCS Coalition's proposal and the methodology on which it is based. For example, the Commission asked whether the adoption of a 2-kW EIRP average power limit would permit the deployment of WCS services to the public. The Commission also asked whether the adoption of an average rather than a peak power limit for WCS stations would have any effect on the ability of the licensees to deploy their services. The Commission also requested comment on whether to adopt the 6-dB PAPR suggested by the WCS Coalition, or whether a different ratio may be more appropriate, such as a PAPR of 13 dB, which was adopted for wireless services in the 700 MHz band. Finally, the Commission requested parties to discuss whether an average, rather than a peak, power limit would increase the risk of interference with adjacent channel licensees, whether they are WCS or SDARS licensees, or licensees outside of the 2305-2360 MHz range.[282]

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[277] *See* Comments of Sirius XM Radio Inc., filed April 23, 2010, at 32.

[278] *2007 Notice*, 22 FCC Rcd at 22130 ¶ 18.

[279] *2007 Notice*, 22 FCC Rcd at 22130 ¶ 18.

[280] WCS Coalition July 9, 2007, *Ex Parte* at 3-4, *cited in 2007 Notice*, 22 FCC Rcd at 22131 ¶ 21. As proposed by the WCS Coalition, average EIRP would be calculated using the average power of the transmitter measured in accordance with the definition of "mean power" in Section 2.1 of the Commission's rules.

[281] WCS Coalition July 9, 2007, *Ex Parte* at 3, Appendix A, proposed Sections 27.50(a)(1) and 25.XX(a), *cited in 2007 Notice*, 22 FCC Rcd at 22131 ¶ 21.

[282] *2007 Notice*, 22 FCC Rcd at 22131 ¶ 22.

121. Finally, the Commission invited interested parties to discuss whether a hybrid power approach might be appropriate. The Commission explained that such an approach would give SDARS licensees flexibility to place their repeaters on high towers and operate them with more power if they meet a certain emission limit on the ground, while WCS would have the flexibility to meet an average EIRP limit using towers lower to the ground.[283] The Commission observed that it adopted a similar approach for the lower 700 MHz band, where commercial base stations must meet an effective radiated power (ERP) limit of 1 or 2 kW, depending on whether they are deployed in rural areas, but such stations could also transmit at 50 kW ERP if they do not produce signals exceeding a PFD of 3 mW/m^2 on the ground within 1 kilometer (km) of the station.[284] Further, the Commission invited commenters to suggest specific power limits to be used in a hybrid approach if such an approach is adopted.[285]

122. The WCS Coalition states that allowing WCS base stations to operate with an average rather than peak power limit of 2 kW EIRP will enable WCS licensees to match the power level of SDARS terrestrial repeaters if necessary to avoid interference to WCS mobile stations.[286] Motorola supports the WCS Coalition's proposal to apply average power,[287] arguing that an average EIRP limit would be consistent with the power limits that the Commission adopted for the 700 MHz band.[288] Motorola asserts that applying a non-constant envelope to WCS would better accommodate transient power surges of short duration.[289]

123. Sirius XM argues that the need to increase power limits for WCS base stations to a maximum of 2 kW EIRP average power is not well documented, and appears to only function as a means to achieve parity with SDARS technical standards.[290] Moreover, it argues that increasing the base station power limit to 2 kW EIRP average power would quadruple the amount of harmful interference to SDARS receivers.[291] Sirius also submits that the average power should be measured at the 0.01 percent probability level.[292] In response, the WCS Coalition argues that its proposal for use of average measurements, coupled with a proposed power spectral density limit of 400-W average EIRP per megahertz, will substantially reduce overload interference from WCS licensees.[293] The WCS Coalition asserts that under current Part 27 rules, a WCS licensee is free to transmit multiple narrow band (including 200-kilohertz wide) carriers at 2-kW peak EIRP each; accordingly, its proposal results in less potential for overload interference, not more.[294] Sirius XM proposes to keep the technical rules as they currently exist in Part 27 for WCS Blocks C and D, allow more flexibility to enable mobile operations in

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[283] *2007 Notice*, 22 FCC Rcd at 22131-32 ¶ 23.

[284] *2007 Notice*, 22 FCC Rcd at 22131-32 ¶ 23, *citing* 47 C.F.R. §§27.50(c), 27.55(b).

[285] *2007 Notice*, 22 FCC Rcd at 22131-32 ¶ 23.

[286] WCS Coalition Comments at 25-26.

[287] Motorola Comments at 3-4.

[288] Motorola Comments at 4. *See also* WCS Coalition Reply Comments at 44.

[289] Motorola Comments at 4-5.

[290] Sirius XM Sept. 8, 2008, *Ex Parte* at 18.

[291] Sirius Comments at 19-20, Sirius Reply Comments at 30-32, XM Comments at 32-33.

[292] *See* Sirius' Reply Comments Technical Appendix in Support of Reply Comments IB Docket No. 95-91 and ET Docket No. 07-293, Exhibit D at 5.

[293] WCS Coalition Reply Comments at 42-43.

[294] WCS Coalition Reply Comments at 43.

WCS Blocks A and B provided that Blocks C and D serve as appropriate guard bands to satellite radio, and that there are appropriate restrictions on WCS devices' maximum power and OOBE limits.[295]

124. Finally, in the *2007 Notice*, the Commission requested comment on the WCS Coalition's proposal to relax the base station OOBE attenuation requirement of 80 + 10 log (P) dB.[296] Specifically, the Commission sought comment on the WCS Coalition's proposal to require WCS and SDARS licensees to attenuate emissions into each other's band by a factor of 75 + 10 log (P) dB.[297] In response to the *2007 Notice*, the WCS Coalition reiterated its support for a relaxed OOBE attenuation requirement of 75 + 10 log (P) dB.[298] Sirius XM also supports relaxing the emission mask for WCS base stations. XM proposed that we adopt an OOBE attenuation of 75 + 10 log (P) dB, measured in a 1-megahertz bandwidth, with ground-level emission limits of 100 dBμV/m (-44 dBm isotropic equivalent power) for WCS Blocks A and B and 90 dBμV/m (-55 dBm isotropic equivalent power) for WCS Blocks C and D.[299] Sirius likewise urges us to relax the WCS base station's OOBE attenuation factor to 75 + 10 log (P) dB, measured over a 1-megahertz bandwidth, subject to ground-level emission limits.[300]

125. In its comments on the Commission staff's proposed rules, Sirius XM contends that the proposed rules will not prevent interference from WCS base stations. Sirius XM submits that this is why, in 2006, it urged the Commission to impose ground-based emissions levels limits on all 2.3 GHZ licensees to avoid the creation of "hot spots" that would result in overload interference to adjacent-band receivers. Sirius XM claims its study of 2.5 GHz-band WiMAX devices currently operating in Philadelphia showed large areas surrounding base stations where the base station power level would mute satellite radio receivers. Further, Sirius XM argues that the proposed rules only obligate WCS licensees to select base station sites and frequencies that will minimize the potential for harmful interference to SDARS receivers, but do not provide any meaningful opportunity for Sirius XM to work with WCS licensees to mitigate interference from WCS base stations.[301] To limit the potential for harmful interference from WCS base stations, Sirius XM requests that the Commission set ground-level emissions limits near WCS base stations. Furthermore, Sirius XM believes that the Commission should require that the WCS network be deployed with a cell density such that a power level greater than -44 dBm would not be present for greater than 100 meters of continuous road surface on major and secondary roads.[302] Sirius XM also urges the Commission to require WCS and SDARS licensees to negotiate and enter into a written coordination agreement governing base station deployment, defining harmful interference to SDARS to mean muting of SDARS receivers, obligating WCS licensees to resolve harmful interference if it occurs, establishing an expedited procedure for Commission adjudication in the event of disputes, and imposing significant penalties on WCS licensees who cause interference to SDARS receivers.[303] In addition, Sirius XM asserts that more specific processes are needed to define and assess interference, to

[295] Sirius XM Nov. 6, 2008, *Ex Parte* at 8.

[296] *See 2007 Notice*, 22 FCC Rcd at 22142 ¶ 24.

[297] *See id.*

[298] WCS Coalition Comments at 21.

[299] XM Comments at 34-35, Exhibit A at 7.

[300] Sirius Comments at 25, Exhibit A at A12. Although SDARS licensees initially supported the same OOBE limit for both WCS base stations and terrestrial repeaters (*see, e.g.*, Sirius Comments at 25, Exhibit A at A12; XM Comments at 34-35, Exhibit A at 7), Sirius XM recently recommended the more stringent OOBE attenuation of 90 + 10 log (P) dB for SDARS terrestrial repeaters. *See e.g.* Sirius XM September 8, 2008, *Ex Parte* at 18.

[301] *See* Comments of Sirius XM Radio Inc., filed April 23, 2010, at 21-22.

[302] *Id.* at 32.

[303] *Id.* at 32-33.

respond to interference claims, and to resolve interference complaints that the parties cannot resolve themselves.[304] In particular, it calls for at least 180-days notice prior to any WCS base station offering service to the public.[305]

126. For WCS CPE, Sirius XM recommends that the OOBE on all frequencies in the 2320-2345 MHz SDARS band be maintained at the existing 80 + 10 log (P) dB limit. In support of this recommendation, Sirius submits that WCS licensees have not submitted any data or analysis into the record, such as the propagation losses associated with WCS CPE located within a home or apartment, as opposed to a vehicular environment, that would warrant modification of CPE devices' OOBE as proposed by the Commission. Sirius XM also believes that the Commission should apply the proposed 2.5-megahertz WCS mobile and portable device guard band to include WCS fixed CPE. Finally, because it contends that its technical study show a greater interference potential from wider bandwidth WCS signals, Sirius XM believes that the Commission should establish a maximum occupied bandwidth of five megahertz, which it contends is consistent with every technical submission filed by WCS licensees to support their recommended rule changes.[306]

127. In its comments on the Commission staff's proposed rules, the WCS Coalition submits that because no party to this proceeding has suggested precluding point-to-point FDD links from operating in the 2305-2320 MHz portion of the WCS band, the Commission should not restrict WCS FDD fixed stations from transmitting in the 2305-2320 MHz WCS band. Thus, the WCS Coalition suggests that the proposed rule be modified to reflect the Commission's presumed intent to require FDD systems to use the lower WCS bands for mobile-to-base station transmissions and use the upper WCS bands for base station-to-mobile transmissions. If the Commission decides to prohibit fixed FDD transmissions in the 2305-2320 MHz band, however, to avoid customer dislocation and stranded investment, the WCS Coalition believes it should consider grandfathering existing FDD point-to-point deployments constructed prior to adoption of the new technical rules.[307]

128. Stratos Offshore Services Company (Stratos) operates 200 WCS fixed point-to-point transmitters on its WCS spectrum within the Gulf of Mexico service area that provide vital services to the oil and gas industry.[308] Because these station pair channels in the 2305-2320 MHz band for communications in one direction with channels in the 2345-2360 MHz band for communications in the reverse direction, Stratos submits that the Commission should not adopt a rule that precludes point-to-point FDD fixed links in the lower WCS bands.[309] However, if the Commission is disposed to adopting such a requirement for mobile FDD systems, Stratos suggests that it should clarify in the rule that mobile systems using FDD technology are restricted to utilizing the 2305-2320 MHz band for mobile-to-base station transmissions and the 2345-2360 MHz band for base station-to-mobile transmissions. Stratos contends that such a clarification would remove any risk of ambiguity as to whether the Commission has eliminated the present ability of WCS licensees to deploy FDD point-to-point systems utilizing both segments of the WCS band and provide Stratos with the regulatory

[304] *See* Comments of Sirius XM Radio Inc. at 2 (filed May 13, 2010).

[305] *Id.*, Attachment at 1.

[306] *Id.* at 34-35

[307] *See* Comments of the WCS Coalition, filed April 23, 2010, Appendix A at ix.

[308] *See* Comments of Stratos Offshore Services Company, filed April 23, 2010, at 2

[309] *Id.* at 3-4.

certainty it needs to continue operating and expanding its FDD point-to-point network to meet the needs of the oil and gas industry in the Gulf of Mexico.[310]

129. Based on our analysis of the record before us and a balancing of the Commission's objectives in this proceeding, we adopt, in part, WCS Coalition's proposal regarding base station power limits in WCS Blocks A and B, and we adopt, in part, Sirius XM's proposal regarding base station power limits in WCS Blocks C and D. We conclude that the relative placement of the WCS spectrum blocks in relation to SDARS operations requires that we establish different power level parameters for the A and B blocks than for the C and D blocks. However, as we discuss below, the differing parameters we have developed will provide WCS licensees with operational flexibility as well as safeguard SDARS operations from harmful interference. We also clarify that fixed FDD transmitters are not prohibited from transmitting in the 2305-2320 MHz WCS band.

1. WCS Base and Fixed Station Power Limits (WCS Blocks C and D)

130. Our analysis of the record leads us to conclude that, in order to appropriately balance the interests of both SDARS and WCS licensees, we cannot revise the base station power limits for the WCS C and D blocks as requested by the WCS Coalition. As noted above, WCS Blocks C and D effectively sandwich the 2320-2345 MHz SDARS band. Accordingly, base station operations in WCS Blocks C and D inherently pose more risk of potential interference to satellite radio users than would base station operations in WCS Blocks A and B, which are separated from the SDARS spectrum by at least 5 megahertz. We agree with Sirius XM that a 2-kW average EIRP limit over 5 megahertz should not be adopted for WCS Blocks C and D given the proximity of the C and D blocks to SDARS spectrum.[311] A review of the technical analyses submitted by the commenters leads us to conclude that, in light of the sensitive nature of the SDARS receivers, applying base station power limits on an average versus peak power basis in spectrum immediately adjacent to the SDARS band would unacceptably increase the potential for harmful interference to satellite radio operations.[312] Accordingly, we make no changes to the 2-kW peak power limit and OOBE limit for WCS base station operations in WCS Blocks C and D. However, as noted by the WCS Coalition, Section 27.50(a)(1), as it exists currently, does not expressly preclude WCS licensees from meeting the 2-kW EIRP peak power limit on a per emissions basis, which could cause overload interference to SDARS receivers.[313] Thus, in order to protect SDARS receivers from overload interference, we are amending Section 27.50(a)(1) to clarify that WCS base stations in WCS Blocks C and D are limited to 2-kW peak EIRP over 5 megahertz (*i.e.*, 400 W/MHz).

2. WCS Base and Fixed Station Power Limits (WCS Blocks A and B)

131. Because WCS blocks A and B are separated from SDARS spectrum by at least 5 megahertz, we believe that the application of average power limits to these blocks of spectrum does not raise the same interference concerns with regard to SDARS. The use of an average power limit, however, will allow an increase in power levels for WCS operations, particularly those using non-constant envelope

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[310] *Id.* at 5-6.

[311] Letter from Robert L. Pettit, Counsel to Sirius XM Radio, Inc, to Marlene H. Dortch, Secretary, FCC (dated Oct. 2, 2008), at 9 (Sirius XM Oct. 2, 2008, *Ex Parte*).

[312] Even if the current "peak" EIRP limit of 2 kW was used on a per emission basis by four 1.25-megahertz-wide emissions (*i.e.*, the smallest bandwidth emissions that can be used for WiMAX, which is the projected use of the WCS bands) over 5 megahertz, the horizontal separation needed to avoid harmful interference to SDARS operations will be less than the separation needed if an "average" EIRP limit of 2 kW over 5 megahertz with a PAPR of 13 dB were used in WCS Blocks C and D.

[313] *See* WCS Coalition May 5, 2008, *Ex Parte* presentation at 16.

modulation technologies.[314] Given the sensitivity of SDARS receivers, we conclude that it is appropriate to account for any resulting increased risk of overload interference to SDARS operations by limiting the base station average power level in WCS Blocks A and B.[315] Specifically, we find that it is appropriate to modify the WCS Block A and B base station limit to 2-kW average EIRP over 5 megahertz (400 W/MHz) with a PAPR of 13 dB when measured at the 0.1-percent probability level.[316] This approach should provide the technical flexibility for WCS licensees in these blocks to feasibly deploy mobile broadband services to the public with minimal impact on SDARS users.

132. We agree with commenters who state that applying an average power approach would be beneficial in situations where wideband non-constant envelope technologies are used. The Commission permits licensees in other wireless services flexibility to meet radiated power limits on an average basis.[317] In other proceedings, the Commission noted that a number of the newer non-constant envelope technologies, such as OFDM-based technologies, can produce an emission with transient power spikes.[318] The Commission concluded that limiting power on an average basis would more accurately predict the interference potential for such technologies, and that using peak power measurements for non-constant envelope technologies inaccurately suggests a much higher overall operational power, compared to actual power levels, due to the power spikes.[319] Because average power is a more accurate measure of interference potential with respect to technologies that are likely to be deployed in the WCS spectrum, we conclude that we should adopt this mode of operation for the WCS A and B blocks.

133. In addition, we conclude that the use of a PAPR of 13 dB will provide an additional flexibility to WCS licensees without causing greater risk of interference to SDARS operations. The Commission found in other proceedings that limiting that PAPR to 13 dB strikes the right balance "between enabling licenses to use modulation schemes with high PAPRs (such as OFDM) and protecting other licensees from high PAPR transmissions."[320] Further, commenters agree that the use of a

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[314] Non-constant envelope modulation, as used in wideband Code Division Multiple Access (W-CDMA) networks, is characterized by high PAPRs and requires both the phase and the amplitude of the signal to be modulated, as opposed to constant envelope modulation, as used in GSM networks, which only involves the phase.

[315] Based on the mobile receiver overload parameters (-44 dBm in the WCS A and B blocks, and -55 dBm in the WCS C and D blocks) submitted by Sirius (Sirius Comments, Exhibit C.) and the WCS Coalition (WCS Coalition Comments at 15), we establish, for reference purposes only, a horizontal separation needed to protect a SDARS receiver from overload interference from a WCS base station. Based on a WCS base station height of 30 meters (approximate height for cellular-type architectures), with peak EIRP of 8 kW (2 kW per 1.25 megahertz-wide emissions, with 4 carriers in a 5 megahertz block), an SDARS receiver overload level of -55dBm, an SDARS receiver height of 1.5 meters, flat terrain, and an empirical path loss model suitable for an urban area under these conditions, namely COST-231 Hata Model, the separation distance for the WCS C or D block would be 347 meters. Because the SDARS licensees support retention of the current peak power limit for the WCS C and D blocks, we conclude that they are prepared to tolerate the equivalent of a 347-meter separation distance in the WCS A and B blocks as well. Using the -44 dBm overload threshold agreed upon by the parties for the A and B blocks, we find that permitting an average EIRP of 2 kW over a 5-megahertz bandwidth (or 400 W/MHz) in the WCS A and B blocks will result in a separation distance of less than 347 meters.

[316] In radio networks, the PAPR is measured at a particular probability level to restrict how often the peak power is above the specified average power level.

[317] *See Streamlining Third Report and Order*, 23 FCC Rcd 5336-5337 ¶¶ 40-42; *700 MHz Report and Order*, 22 FCC Rcd at 15417-18.

[318] *See Streamlining Third Report and Order*, 23 FCC Rcd at 5334 ¶ 34.

[319] *See id.* at 5337 ¶ 40.

[320] *See 700 MHz Report and Order*, 22 FCC Rcd at 8104 ¶ 39; *Streamlining Third Report and Order*, 23 FCC Rcd at 5337 ¶ 42.

13-dB PAPR will provide technical flexibility, and maintain consistency with other services.[321] We believe that the application of a 13-dB PAPR limit in this matter furthers the Commission's goal of facilitating the deployment of advanced technologies, while limiting the potential for interference that might result from high PAPR transmissions.

134. We believe that, in light of the sensitivity of SDARS receivers to overload interference, it is in the public interest to apply a power spectral density formulation as proposed by the WCS Coalition.[322] We conclude that in WCS Blocks A and B, specifying the bandwidth over which power is to be limited is appropriate because it could otherwise be assumed that the power limit applies on a "per emission" basis. For example, a licensee employing one variation of WiMAX might only transmit one emission within its five-megahertz bandwidth, while another variation of WiMAX or other technologies with narrower emissions might employ multiple emissions over that bandwidth, each at the maximum power level allowed. Such a result would increase the likelihood of interference to SDARS receivers. Accordingly, the power limit for WCS base stations operations in Blocks A and B will be expressed as average EIRP of 2,000 W (2 kW) over a 5-megahertz bandwidth (400 W/MHz), with a 13-dB PAPR.[323] To further limit the potential for interference to SDARS receivers, WCS base stations supporting FDD mobile and portable operations are restricted to transmitting in the 2345-2360 MHz band.

3. WCS Base and Fixed Station Out-of-Band Emissions Limit

135. We also find that the public interest would be served by adopting an OOBE attenuation factor for WCS base and fixed stations below the transmitter power P, as measured over a 1-megahertz resolution bandwidth, of not less than 43 + 10 log (P) dB on all frequencies between 2305-2320 MHz and between 2345-2360 MHz that are outside the licensed band of operation, not less than 75 + 10 log (P) dB in the 2320-2345 MHz band, not less than 43 + 10 log (P) dB in the 2300-2305 and 2360-2362.5 MHz bands, not less than 55 + 10 log (P) dB in the 2362.5-2365 MHz band, not less than 70 + 10 log (P) dB in the 2287.5-2300 MHz and 2365-2367.5 MHz bands, not less than 72 + 10 log (P) dB in the 2285-2287.5 and 2367.5-2370 MHz bands, and not less than 75 + 10 log (P) dB below 2285 MHz and above 2370 MHz.

136. As noted above, both WCS and SDARS licensees urge us to lower the current 80 + 10 log (P) dB OOBE attenuation factor by 5 dB to 75 + 10 log (P) dB. Although the SDARS licensees also request that we establish ground-level emission limits, we decline to adopt ground-level emission limits for WCS base stations as proposed by Sirius XM because of the difficulties associated with charaeterizing and quantifying the case-specific propagation environment's effects on an RF signal's field strength that could influence the interference potential at each fixed site. The rules that would result from an attempt to deal with the anomalies associated with field strength levels, moreover, would be overly complex and difficult for licensees to comply with and would be difficult, at best, for the Commission to enforce. Furthermore, we believe that the revised power limits that we are establishing, together with a 75 + 10 log (P) dB OOBE attenuation factor, will provide SDARS operations reasonable interference protection while affording WCS licensees additional flexibility to offer mobile services to the public. We therefore are revising Section 27.53 of our rules to reflect the relaxed OOBE attenuation requirements outlined above. Below in Section F, we will discuss the impact of these emission limits on the sharing environment relative to AMT and DSN operations.

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[321] Motorola Comments at 5; WCS Coalition Reply Comments at 54-55.

[322] *See, e.g.*, WCS Coalition Reply Comments at 41-44; WCS Coalition July 22, 2008, *Ex Parte* Exhibit A.

[323] The peak-to-average power ratio (PAPR) measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that the PAPR will not exceed 13 dB for more than 0.1 percent of the time or another Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

4. WCS Customer Premises Equipment

137. *Background*. The WCS Coalition proposes that WCS fixed CPE devices be limited to an average EIRP of 20 W, with the average EIRP calculated by using the average power of the transmitter measured in accordance with the definition of mean power in Section 2.1 of the Commission's Rules.[324] The WCS Coalition also proposes attenuating the OOBE for such CPE devices by a factor not less than 75 + 10 log (P) dB below the transmitter output power P on all frequencies in the 2320-2345 MHz band. Alternatively, for WCS fixed CPE devices transmitting at no greater than 2 W average transmitter output power, the WCS Coalition proposes that the OOBE be attenuated by a factor of 55 + 10 log (P) dB on all frequencies in the 2320-2324 and 2341-2345 MHz bands, by a factor of 61 + 10 log (P) dB for frequencies in the 2324-2328 and 2337-2341 MHz bands, and by a factor of 67 + 10 log (P) dB for frequencies in the2328-2337 MHz band. In other words, the WCS Coalition believes that the stepped OOBE mask of 55/61/67 + 10 log (P) dB that it proposes for WCS mobile and portable devices should also apply to WCS CPE transmitting at 2 W or less.

138. Regarding the frequencies above and below the WCS band, originally, the WCS Coalition proposed that WCS fixed CPE devices' OOBE be attenuated by a factor of 70 + 10 log (P) dB for all frequencies below 2300 MHz and above 2370 MHz. For all frequencies in the 2300-2320 and 2345-2370 MHz bands that are outside the licensed bands of operation, the WCS Coalition proposed that WCS fixed CPE devices OOBE be attenuated by 43 + 10 log (P) dB. In addition, the WCS Coalition proposes that in complying with its proposed OOBE limits, WCS fixed CPE devices that use opposite sense circular polarization from that used by SDARS systems in the 2320-2345 MHz band shall be permitted an OOBE allowance of 10 dB.[325] However, on March 15, 2010, the WCS Coalition submitted an *ex parte* presentation amending their proposal for CPE OOBE limits. Specifically, they now propose that WCS fixed stations be attenuated by 43 + 10 log (P) dB on all frequencies between 2305-2320 MHz and on all frequencies between 2345-2360 MHz that are outside the licensed band of operation, not less than 55 + 10 log (P) dB at 2362.5 MHz, not less than 70 + 10 log (P) dB at 2300 and 2365 MHz, not less than 72 + 10 log (P) dB at 2367.5 MHz, and not less than 75 + 10 log (P) dB at 2370 MHz.[326]

139. Sirius XM, on the other hand, proposes that all WCS fixed CPE devices' OOBE outside the 2305-2320 and 2345-2360 MHz bands be attenuated by 75 + 10 log (P) dB over a 1-megahertz resolution bandwidth, regardless of the device's operating power.[327] Sirius XM also proposes that WCS fixed CPE devices operating with an EIRP greater than 2 W be subject to ground level-based emission limits of 100 dBμV/m (-44 dBm isotropic equivalent power) for the WCS A and B blocks (2305-2315 and 2350-2360 MHz) and 90 dBμV/m (-55 dBm isotropic equivalent power) for the WCS C and D blocks (2315-2320 and 2345-2350 MHz).[328] In addition, Sirius XM proposes that WCS fixed CPE devices operating at 2 W EIRP or less be exempt from the ground level-based emission limits requirements, so long as they also meet the 75 + 10 log (P) dB OOBE attenuation requirement.[329] In its comments on the Commission staff's proposed interference rules, Sirius XM reiterated its position on CPE devices. It added however, that, at a minimum, the required OOBE attenuation for fixed CPE devices should be

[324] In the Commission's Rules, mean power (of a radio transmitter) is defined as the average power supplied to the antenna transmission line by a transmitter during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation taken under normal operating conditions. *See* 47 C.F.R. § 2.1.

[325] WCS Coalition July 22, 2008, *Ex Parte*, Exhibit A at 1-2.

[326] *See* WCS Coalition March 15, 2010, *Ex Parte*, at 8.

[327] Sirius Comments, Exhibit A at 4.

[328] Sirius Comments, Exhibit A at 13.

[329] *Id. See also* Sirius Comments at 31-32.

maintained at the existing 80 + 10 log P dB level on all frequencies between 2320-2345 MHz.[330] Sirius XM also expressed concern about there not being any prohibition on the use of external antennas with WCS CPE or on outdoor CPE installations. In addition, Sirius XM stated that the Commission should apply the proposed WCS 2.5-megahertz mobile and portable device guard band to CPE devices by prohibiting the operation of WCS CPE in the 2.5 megahertz closest to the SDARS band.[331]

140. *Discussion.* Although we are establishing guard bands for the 2.5-megahertz portions of the WCS C and D Blocks immediately adjacent to the SDARS band because this portion of spectrum is currently not viable for full power mobile and portable device operations in close proximity to an SDARS receiver,[332] we believe that this spectrum can still play an important role in providing broadband service to the public. Because of the likely physical separation of a fixed WCS transmitter from an SDARS receiver, we expect WCS licensees will be able to use these portions of the WCS C and D Blocks to provide fixed operations, including CPE and backhaul operations, with little impact on SDARS reception. Thus, we decide that we should adopt the current mobile transmitter power limit of 20 watts peak EIRP for WCS fixed CPE devices.[333] WCS CPE devices should also employ ATPC, so the transmitted power is limited to the maximum necessary for successful communications. For fixed customer premises equipment (CPE) transmitting with more than 2-W average EIRP, we also decide to adopt the OOBE attenuation factor that we are adopting for WCS base stations of not less than 43 + 10 log (P) dB on all frequencies between 2305-2320 MHz and on all frequencies between 2345-2360 MHz that are outside the licensed band of operation, and not less than 75 + 10 log (P) dB on all frequencies between 2320 and 2345 MHz. These WCS CPE's OOBE must also be attenuated by a factor of not less than 43 + 10 log (P) dB in the 2300-2305 and 2360-2362.5 MHz bands, not less than 55 + 10 log (P) dB in the 2362.5-2365 MHz band, not less than 70 + 10 log (P) dB in the 2287.5-2300 MHz and 2365-2367.5 MHz bands, not less than 72 + 10 log (P) dB in the 2285-2287.5 and 2367.5-2370 MHz bands, and not less than 75 + 10 log (P) dB below 2285 MHz and above 2370 MHz.

141. An examination of the Commission's Equipment Authorization Database shows that although most 2.3 GHz WCS fixed CPE devices are authorized to use significantly lower EIRP levels (*e.g.*, in the 1 to 2 W range), some WCS fixed CPE devices are authorized to operate up to the 20-W EIRP currently allowed for WCS mobile devices.[334] Authorized WCS fixed CPE devices have been operating at EIRPs up to 20 W for some time in the 2.3 GHz band, but SDARS licensees have not reported any instances of interference. We expect that if we were to continue to allow WCS fixed CPE devices to use up to 20 W peak EIRP, SDARS operations would not experience any appreciable increase in interference from these WCS operations. Moreover, continuing to allow WCS fixed CPE devices to use up to 20 W EIRP will enhance the provision and quality of service in rural areas, where subscribers are often located significant distances from WCS licensees' serving base stations. Furthermore, as discussed in paragraph 136, *supra*, we decline to adopt the ground level-emission limits proposal of Sirius because of the difficulties associated with characterizing and quantifying the case-specific propagation environment's effects on an RF signal's field strength that could influence the interference potential at each fixed site.

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[330] *See* Comments of Sirius XM, filed April 23, 2010, at 34-35.

[331] *Id.*

[332] Based on the results of the Ashburn, VA tests, to prevent SDARS receivers from receiving harmful interference, WCS mobile and portable devices are prohibited from operating in the 2.5-megahertz portions of the WCS C and D blocks closest to the SDARS band (*i.e.*, 2317.5-2320 and 2345-2347.5 MHz).

[333] *See* 47 C.F.R. § 27.50(a)(2).

[334] *See, e.g.*, FCC Identifier AEZCPE-310-230.

142. In a fixed scenario, there exists an increased separation distance between WCS CPE and SDARS receivers than would exist in a vehicle-to-vehicle scenario. Furthermore, structural blockages are more likely to exist between fixed WCS CPE devices and SDARS receivers. The increased propagation losses that result from these factors allow for greater flexibility in establishing technical limits for WCS fixed CPE devices operating at or below 2-W average EIRP. We therefore adopt the stepped OOBE attenuation factors proposed by the WCS Coalition for mobile and portable devices' OOBE into the SDARS band. Specifically, for fixed CPE transmitting with 2-W average EIRP or less, OOBE emissions must be attenuated by a factor of 43 + 10 log (P) dB on all frequencies between 2305-2320 MHz and on all frequencies between 2345-2360 MHz that are outside the licensed band of operation, not less than 55 + 10 log (P) dB in the 2320-2324/2341-2345 MHz bands, not less than 61 + 10 log (P) dB in the 2324-2328/2337-2341 MHz bands, not less than 67 + 10 log (P) dB in the 2328-2337 MHz band, where P is the transmitter output power in Watts. To protect DSN operations at 2290-2300 MHz and AMT operations at 2360-2395 MHz, OOBE of CPE transmitting at 2 W average EIRP or less must be attenuated by a factor of not less than 43 + 10 log (P) dB in the 2300-2305 and 2360-2365 MHz bands, not less than 55 + 10 log (P) dB in the 2296-2300 MHz band, not less than 61 + 10 log (P) dB in the 2292-2296 MHz band, not less than 67 + 10 log (P) dB in the 2288-2292 MHz band, and not less than 70 + 10 log (P) dB below 2288 MHz and above 2365 MHz.

143. We agree with the WCS Coalition that these emission limits – which we also adopt today for WCS mobile and portable devices – will provide reasonable protection to SDARS licensees, while affording much needed operational flexibility to WCS licensees.[335] Although SDARS licensees oppose the stepped OOBE limits and instead[336] advocate a reduced OOBE attenuation requirement of 75 + 10 log (P) dB, the SDARS licensees note that current fixed WCS deployments pose no or little interference concerns to SDARS operations.[337] In addition, the SDARS licensees recognize that WCS fixed CPE devices operating at or below 2 W average EIRP do not require the same safeguards against interference to SDARS operations as fixed stations transmitting at higher power levels.[338] As we have concluded *supra* that the stepped OOBE attenuation factors for WCS mobile and portable devices will provide sufficient protection to SDARS operations, we conclude that WCS CPE operating at 2 W average EIRP or less with these same attenuation factors will provide SDARS operations sufficient protection from harmful interference. Thus, we find that it is appropriate to adopt the stepped OOBE attenuation factors for WCS fixed CPE operating at 2-W average EIRP or less that we are adopting for WCS mobile and portable devices. To further limit the potential for harmful interference from WCS CPE to SDARS receivers, however, we restrict WCS CPE devices to the use of indoor antennas and indoor installations. We also require WCS CPE to employ ATPC to limit their transmitted power to that which is necessary for successful communications. Because we believe the increased propagation losses associated with the increased distances between WCS CPE and SDARS receivers and structural blockages will be sufficient to limit the potential for harmful interference from WCS CPE, we will not, however, apply a 2.5-megahertz guard band to WCS CPE and prohibit their operation in the 2.5-megahertz portions of the WCS band closest to the SDARS band. For WCS CPE using TDD technology, we set the maximum duty cycle to 38 percent; for WCS CPE using FDD technology, we set the maximum duty cycle to 12.5 percent in the WCS C block (*i.e.*, 2315-2320 MHz) and to 25 percent in the lower WCS A and B blocks (*i.e.*, 2305-2315 MHz).

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[335] *See* WCS Coalition Comments at 11-12.

[336] Sirius Comments at 31-32, XM Comments at 35, Exhibit A at 15.

[337] XM Comments at 33, Exhibit A at 14.

[338] Although the SDARS licensees argue that WCS fixed terminals/stations operating above 2 W should be subject to the 75 + 10 log (P) dB OOBE attenuation level as well as a ground-based power limit to protect SDARS operations, the SDARS licensees support exempting WCS fixed CPE devices operating at a lower power from a ground-based power limit. Sirius Comments at 31-32 (supporting an exemption so long as the WCS fixed CPE devices employ power control and a guard band for the C and D blocks), XM Comments at 35, Exhibit A at 15.

5. Notification Requirement

144. *Background.* In the *2001 Public Notice*, the Commission sought comment on whether to require WCS licensees to exchange information with SDARS licensees regarding WCS station deployments.[339] This information would include the number of base stations, their locations and technical characteristics, and the estimated reasonable cost to resolve interference to any WCS station receiving blanketing interference from a specified SDARS repeater.[340]

145. In its *2006 Petition for Rulemaking*, Sirius proposed that we require both SDARS and WCS licensees to maintain certain information regarding their transmitter deployments, and to require that it be made available to other licensees via a secure Internet website.[341] Specifically, Sirius urged the Commission to require sharing of the following information: (1) a list of all operating transmitters and their technical parameters; (2) telephone and email address of emergency contacts to investigate complaints of harmful interference; and (3) the radiation patterns for all transmitting antenna types, including manufacturer name and model number.[342] Sirius also recommended that we require licensees to post a predictive analysis on the website, showing that a transmitter will meet the applicable power limits, no later than 90 days before it begins commercial operations.[343]

146. *In the 2007 Notice,* we invited comment regarding the extent to which WCS licensees should be required to notify SDARS licensees of the deployments of base stations.[344] We solicited comment on the proposals discussed above, and asked parties to discuss which proposal would provide the most effective and efficient means for parties to exchange information necessary to avoid interference and co-exist in adjacent spectrum.[345] We specifically asked whether the Sirius website proposal is necessary to provide notice to all licensed radio stations potentially affected by WCS base station deployments, and whether the proposal should be considered only if we adopt Sirius' ground-level emission limits proposal.[346]

147. In response to the *2007 Notice,* Sirius reiterated its proposal to require all SDARS and WCS licensees to maintain an Internet-accessible database of all their deployed and planned repeater and base station operations, respectively, noting that such information could enable licensees to mitigate any out-of-band interference that they might experience.[347] XM asserted that SDARS operators and WCS licensees can resolve interference issues between themselves in coordination.[348] XM supported notification and record-keeping requirements to facilitate coordination, provided that the requirements are

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[339] *2001 Public Notice*, 16 FCC Rcd at 19441-42, *cited in 2007 Notice*, 22 FCC Rcd at 22134 ¶ 30.

[340] *Id.*

[341] *2006 Petition for Rulemaking* at 6, *cited in 2007 Notice*, 22 FCC Rcd at 22134-35 ¶ 31.

[342] *2006 Petition for Rulemaking*, Appendix A, proposed Section 25.214(d)(6), and Appendix B, proposed Section 27.50(l), *cited in 2007 Notice*, 22 FCC Rcd at 22134-35 ¶ 31.

[343] *Id.* Sirius proposed that we exempt SDARS licensees from these requirements for repeaters operating with an EIRP of 10 W or less, and repeaters deployed before the date the rule would become effective. *See 2006 Petition for Rulemaking*, Appendix A, proposed Section 25.214(d)(6), *cited in 2007 Notice*, 22 FCC Rcd at 22134-35 ¶ 31.

[344] *2007 Notice*, 22 FCC Rcd at 22135 ¶ 32.

[345] *Id.*

[346] *Id.*

[347] Sirius Comments at 9-10.

[348] XM Comments at 38-39.

narrowly tailored to minimize administrative burdens.[349] XM also suggested that this information be maintained by a third-party frequency coordinator.[350] In its comments on the Commission staff's proposed interference rules, Sirius XM argues that the revised WCS rules should also require WCS and satellite radio licensees to negotiate a coordination agreement governing WCS base station deployment, define harmful interference to satellite radio to mean "muting" of satellite radios, obligate WCS licensees to resolve harmful interference to satellite radio by immediately ceasing operations, establish an expedited procedure for FCC adjudication in the event of disputes, and, in any event, should impose significant penalties on WCS licensees who cause interference to satellite radio. Sirius XM contends that including such requirements in the WCS rules would ensure that future WCS licensees are fully aware of their obligations to satellite radio.[351]

148. While the WCS Coalition generally supported measures that encourage SDARS and WCS licensees to share certain technical information, it argued that requiring the provision of such information 90 days before operating a new facility would be unduly burdensome. According to the WCS Coalition, WCS licensees will need to adjust their base stations frequently to provide optimal coverage to the public, and a 90-day notice requirement would severely impede that process.[352] The WCS Coalition argues further that there is no reason to require such reporting unless the Commission assumes that there will be a problem with complying with the rules.[353] Sirius responds that both SDARS and WCS licensees would be subject to its proposed 90-day notice requirement, and questioned why the WCS Coalition would oppose the proposal while advocating coordination of repeaters exceeding 2-kW average EIRP limit.[354]

149. In its comments on the Commission staff's proposed interference rules, the WCS Coalition states that although it supports the 10-day notification period for new WCS base stations, it believes the requirement to give 5 days notice before modifications are made to existing WCS base stations is problematic, given the manner in which ubiquitous cellular networks are constantly being adjusted to assure consumers the best quality of service. As an alternative, the WCS Coalition proposes that notice of any modification to a WCS base station, other than a change in location, be given within 24 hours of the modification being made. The WCS Coalition contends that this approach would assure that SDARS licensees have current data regarding the configuration of WCS facilities and would facilitate future cooperation between WCS and SDARS licensees, but would allow modifications not related to locations to be made within the timeframes dictated by marketplace realities.[355] Sirius XM, on the other hand, states that the 10-day and 5-day notice periods in the *WCS/SDARS Technical Rules Public Notice* are insufficient.[356] It claims that 10 days is too short to review and process information about a potentially large number of new base station sites and to raise concerns about potential interference.[357] Sirius XM also asserts that more specific processes are needed to define and assess interference, to respond to interference claims, and to resolve interference complaints that the parties cannot resolve

[349] *Id.* at 39.

[350] *Id.*

[351] *See* Comments of Sirius XM, filed April 23, 2010, at 32-34.

[352] WCS Coalition Comments at 38-40.

[353] *Id.* at 40.

[354] Sirius Reply at 34-35.

[355] *Id.* at 14-16.

[356] Comments of Sirius XM Radio Inc. at 2 (filed May 13, 2010).

[357] *Id.*

themselves.[358] In particular, it calls for at least 180-days notice prior to any WCS base station offering service to the public.[359] In response to this proposal, the WCS Coalition argues that if WCS licensees are required to give 180 days advance notice prior to deploying new base stations, they will be incapable of responding within the time frames demanded by the marketplace, particularly as dead zones within existing markets are identified.[360] In addition, the WCS Coalition contends that such a requirement for WCS licensees would hardly be fair and balanced given that Sirius XM has proposed that it be exempt from providing any advance notification of the location of its terrestrial repeaters. [361]

150. *Discussion.* Based on the record before us, we find that the public interest will be served by requiring WCS licensees to notify SDARS licensees prior to deploying new or modified base stations. We note that all parties addressing this issue support requiring coordination in some form. The notification requirements that we adopt below are intended to enable SDARS licensees to minimize the potential for harmful interference to their services without imposing undue administrative burden, while ensuring that the public continues to enjoy those services without disruption. We decline, however, to adopt Sirius' 2006 proposal that would require 90-day prior coordination. We agree with the WCS Coalition that a 90-day notice requirement is unnecessary, and with XM's assertion that any notification requirements should be designed to minimize administrative burdens for licensees.

151. Our review of the record indicates that the potential for interference between WCS and SDARS can be mitigated by a streamlined notification process, whereby WCS licensees share information regarding new or modified WCS base station operations. Specifically, we will require WCS licensees to provide informational notifications as specified in those rules, as set forth in new Section 27.72 in Appendix B.[362] The rules we adopt today will require WCS licensees to share with SDARS licensees certain technical information at least 10 business days before operating a new base station, and at least 5 business days before operating a modified base station. We also will require all WCS licensees and WCS spectrum lessees to provide Sirius XM an inventory of their deployed infrastructure in accordance with and within 30 days of the effective date of new Section 27.72 in Appendix B to this Order. Although we do not require this information to be provided to the Commission when it is provided to SDARS licensees, a WCS licensee must maintain an accurate and up-to-date inventory of its base stations, including the information set forth in Section 27.72(c)(2), which shall be made available upon request by the Commission.[363]

152. We also find that the public interest will be served by requiring parties to cooperate in good faith in the selection and use of station sites and frequencies to reduce interference and make the most effective use of the authorized facilities. Licensees of stations suffering or causing harmful interference must cooperate in good faith and resolve such problems by mutually satisfactory arrangements. If the licensees are unable to do so, the Wireless Telecommunications Bureau, in consultation with the Office of Engineering and Technology and the International Bureau, may impose restrictions on WCS licensees, including specifying the transmitter power, antenna height, or area or hours of operation of the stations. Similarly, the International Bureau, in consultation with the Wireless

[358] *Id.*

[359] *Id.*, Attachment at 1.

[360] *See* WCS Coalition *Ex Parte* presentation, filed May 13, 2010, at 3.

[361] *Id.*

[362] We note that if a WCS licensee is party to a *de facto* transfer spectrum leasing arrangement under Part 1, Subpart X of the Commission's rules, its lessee will be required to comply with new Section 27.72, in Appendix B to this Order.

[363] *See infra*, Appendix B, at § 27.72(c)(3).

Telecommunications Bureau and the Office of Engineering and Technology, may impose such restrictions on SDARS licensees. We note that Sirius XM proposed specific metrics for defining harmful interference and crafted a comprehensive process for exchanging information among the licenses, analyzing the potential for harmful interference and specific steps for remedying harmful interference.[364] Although we do not adopt these specific proposals in Part 25 or Part 27 of our Rules, we refer Commission staff to the comments for consideration in resolving interference issues as they arrive.

153. We note that in today's companion *Second Report and Order* in IB Docket 95-91, we are requiring SDARS licensees to provide WCS licensees an inventory of their already-deployed terrestrial-repeater infrastructure.[365] Provision of this information will provide WCS licensees a baseline from which to plan their network deployments. In the companion order, we also are adopting streamlined notification procedures that are designed to help ensure that new or modified SDARS terrestrial repeaters will not cause harmful interference to existing WCS base stations, and to facilitate future WCS network deployments. Specifically, the new rules will require SDARS licensees to provide WCS licensees certain technical information prior to deploying new or modifying existing repeaters.[366]

6. Legal Issues Raised by Sirius XM

154. Sirius XM alleges that adoption of WCS rules as proposed in the WCS/SDARS Technical Rules Public Notice and the resulting interference will improperly modify its licenses, and limit Sirius XM's utilization of its licensed spectrum in violation of its statutory, constitutional, and contractual rights. At the outset, we continue to reject Sirius XM's assertion that the changes to the WCS technical rules will necessarily result in harmful interference to SDARS operations. The rule changes that we are adopting to enable the provision of mobile broadband services in the 2.3 GHz band are tailored to avoid harmful interference to SDARS operations, and, as a result, will not hamper Sirius XM's ability to utilize its spectrum. Moreover, as explained below, we find that Sirius XM's legal arguments laek merit.

155. *Section 316 Modification.* Sirius XM asserts that any Commission action allowing additional interference to a licensee constitutes a modification of license under Section 316 of the Communications Act.[367] Sirius XM states that, because the proposed rules "reverse" the Commission's current OOBE protections and will cause significant interference to Sirius XM's operations, the proposed rules constitute a modification of Sirius XM's licenses under Section 316, and thus Sirius XM is entitled to that section's procedural protections, including an adjudicatory hearing.[368]

156. Section 316 of the Act provides for an adjudication process before the Commission may modify a particular license.[369] That provision, however, does not deprive the Commission of its authority to establish rules of general applicability to an industry through its notice-and-comment rulemaking authority.[370] Sirius XM acknowledges that the Commission may adopt rules of general applicability that

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[364] *See* Sirius XM *Ex Parte* Communication, filed May 13, 2010, Attachment at 1-2.

[365] *See infra* ¶ 278.

[366] *See* § 25.263 in Appendix B to this Order.

[367] Sirius 4.23 Comments at 49.

[368] *Id.* at 50-51.

[369] 47 U.S.C. § 316.

[370] *See Committee for Effective Cellular Rules v. FCC,* 53 F.3d 1309 (D.C.Cir. 1995); *Upjohn Co. v. FDA*, 811 F.d 1583 (D.C. Cir. 1987); *WBEN, Inc. v. FCC*, 396 F.2d 601, 618 (2d Cir.), cert. denied, 393 U.S. 914 (1968) (stating that "[a]djudicatory hearings serve an important function when the agency bases its decision on the peculiar situation of individual parties who know more than anyone else. But when, as here, a new policy is based upon the general characteristics of an industry, rational decision is not furthered by requiring the agency to lose itself in an

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affect a class of licensees, but states that the Commission must conduct a Section 316 adjudication when an individual licensee's interests are at stake.[371] Sirius XM argues that the proposed rules do not directly apply to a broad class of licensees, but affect only Sirius XM.[372] While Sirius XM is eorrect that it is the only entity holding SDARS lieenses involved in this proceeding, it neglects to note that it constitutes the entire elass of SDARS licensees. To the extent that the revised WCS technical rules have any effect on SDARS rights, such effect is applicable to all current or future SDARS licensees. We therefore reject as unfounded Sirius XM's argument that our actions are directed solely to the licenses of an individual licensee. As explained above, the purpose of the Commission's actions here is to establish revised technical rules that will foster the provision of new services without causing harmful interference among a number of adjacent services, including SDARS, WCS, and AMT. Thus, our new rules are based on the general characteristics of a number of services, and adjudicatory hearings concerning the impact on Sirius XM would be inappropriate.

157. *Retroactivity.* Sirius XM also asserts that the proposed rules would improperly result in both primary and secondary retroactive changes to satellite radio licenses Sirius and XM acquired at auction.[373] Sirius XM argues that the proposed rules would have primary retroactive effect because they "significantly impair" the rights provided by Sirius XM's licenses.[374] It is unclear, however, how adoption of the proposed technical rules would constitute primary retroactivity. Primary or direct retroactive application of a rule is limited to situations in which an agency "alter[s] the *past* legal consequences of past actions."[375] Application of a rule is impermissibly retroactive when it "would impair rights a party possessed when he acted, increase a party's liability for past conduct, or impose new duties with respect to transactions already completed."[376] In contrast, application of the revised WCS technical rules would have a prospective effect only. Even if the revised technical rules somehow affects Sirius XM's operations or planned use of its spectrum going forward, Commission action that upsets expectations held by Sirius XM based on existing rules is not impermissibly retroactive.[377] Moreover,

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excursion into detail that too often obscures fundamental issues rather than clarifies them"); Revision of Part 22 and Part 90 of the Commission's Rules to Facilitate Future Development of Paging Systems, WT Docket No. 96-18, Implementation of Section 309(J) of the Communications Act -- Competitive Bidding, PR Docket No. 93-253, *Memorandum Opinion and Order on Reconsideration and Third Report and Order*, 14 FCC Rcd 10030, 10096 ¶ 123 (1999) (*Paging MO&O on Reconsideration and Third R&O*); Amendment of Part 22 of the Commission's Rules to Provide for Filing and Processing of Applications for Unserved Areas in the Cellular Service and to Modify Other Cellular Rules, *Further Memorandum and Opinion on Reconsideration*, 12 FCC Rcd 2109, 2127-28, ¶ 37 (1997); and Revision of Rules and Policies for the Direct Broadcast Satellite Service, *Report and Order*, 11 FCC Rcd 9712, 9766, ¶ 139 (1995) (stating that "the Commission may modify any station license or construction permit if in its judgment such action will promote the public interest, convenience, and necessity, and, ... such modification may appropriately be accomplished through notice and comment rulemaking").

[371] Sirius 4.23 Comments at 50-51.

[372] *Id.* at 52.

[373] Sirius 4.23 Comments at 53-54.

[374] *Id.* at 54.

[375] *See Celotronix Telemetry, Inc. v. FCC*, 272 F.3d 585, 588 (D.C. Cir. 2001) (citing *Bowen v. Georgetown University Hospital*, 488 U.S. 204, 219 (Scalia, J., concurring)).

[376] *Celotronix Telemetry, Inc.*, 272 F.3d at 588 (citing *Landgraf v. USI Film Products*, 511 U.S. 244, 280 (1994)).

[377] *See National Cable & Telecommunications Assn. v. FCC*, 567 F.3d 659, 670 (D.C. Cir. 2009) (citing *Mobile Relay Assocs. v. FCC*, 457 F.3d 1, 11 (D.C. Cir. 2006)); *Chemical Manufacturers Ass'n v. EPA*, 869 F.2d 1526, 1536 (D.C. Cir. 1989) (stating that "[i]t is often the case that a business will undertake a certain course of conduct based on the current law, and will then find its expectations frustrated when the law changes. This has never been thought to constitute retroactive rulemaking, and indeed most economic regulation would be unworkable if all laws disrupting prior expectations were deemed suspect").

Sirius XM could not have had any reasonable expectation that the Commission would refrain from exercising its regulatory power to change the operational requirements of a service in cases where the public interest is best served by such change, given that the Communications Act prohibits the grant of any license without a waiver by the licensee in the use of the spectrum "as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise."[378] Similarly, Sirius XM's argument conflicts with an underlying policy of the Act, discussed below, that no person is to have anything in the nature of a property right as a result of the granting of a license.

158. We also reject Sirius XM's claim that the revision of the WCS technical rules will have harmful, secondarily retroactive effects. Sirius XM argues that the proposed rules may result in secondary retroactivity because bidders relied on Commission rules protecting SDARS spectrum from interference from mobile WCS operations, and spent billions of dollars to deploy satellite networks and equipment based on rules in existence when they purchased their licenses.[379] An agency must balance harmful "secondary retroactivity" of an action that upsets prior expectations or existing investments against the benefits of applying rules to those preexisting interests.[380] Secondary retroactivity will be upheld if it is reasonable.[381] As discussed above, we reject Sirius XM's premise that changes to the WCS technical rules will result in harmful interference, so the effect on Sirius XM's investment or Sirius XM's use of its licensed spectrum does not rise to the level of harmful secondary retroactivity. In any event, even if there is harmful secondary retroactivity, we find that the rules we adopt here reasonably balance the public interest in establishing revised technical limits to facilitate the provision of mobile broadband services and Sirius XM's interest in maintenance of the status quo.

159. *Fifth Amendment Taking.* Sirius XM further argues that interference resulting from the relaxation of OOBE limits likely constitutes a taking in violation of the Fifth Amendment.[382] It asserts that government regulation that burdens property in a manner that unfairly interferes with the owner's investment backed expectations constitutes a regulatory taking.[383] For it to prevail on this takings claim, however, Sirius XM must show that it has a protected property interest in the spectrum licensed to it. However, the Communications Act is clear that there can be no ownership interest in the spectrum licensed to Sirius XM.[384] The courts have long held that "[t]he policy of the Act is clear that no person is to have anything in the nature of a property right as a result of the granting of a license,"[385] and that "[n]o licensee obtains any vested interest in any frequency."[386] The Commission has previously upheld this

[378] 47 U.S.C. § 304.

[379] Sirius 4.23 Comments at 54.

[380] *See National Cable & Telecommunications Assn.*, 567 F.3d at 670 (citing *Bergerco Canada v. U.S. Treasury Dep't*, 129 F.3d 189, 192-93 (D.C.Cir.1997)); *Mobile Relay Assocs.*, 457 F.3d at 11.

[381] *Mobile Relay Assocs.*, 457 F.3d at 11.

[382] Sirius 4.23 Comments at 56-57.

[383] *Id.* at 57.

[384] *See*, *e.g.*, 47 U.S.C. § 301 (providing that it is the purpose of the Communications Act "to provide for the use of . . . channels [of radio transmission], but not the ownership thereof, by persons for limited periods of time, under licenses granted by Federal authority, and no such license shall be construed to create any right, beyond the terms, conditions, and periods of the license"); 47 U.S.C. § 304 (indicating that "[n]o station license shall be granted by the Commission until the applicant therefore shall have waived any claim to the use of any particular frequency or of the electromagnetic spectrum as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise").

[385] *FCC v. Sanders Bros. Radio Station*, 309 U.S. 470, 475, 60 S. Ct. 693, 697, 84 L. Ed. 869 (1940).

[386] *Ashbacker Radio Corp. v. FCC*, 326 U.S. 327, 331, 66 S. Ct. 148, 150, 90 L. Ed. 108 (1945). *See also Mobile Relay Associates v. FCC*, 457 F.3d at 12 (holding that licenses confer only "the right to use the spectrum for a

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principle,[387] as well as rejected the argument that a post-auction rulemaking change that may affect the value of an auctioned license should be considered a taking under the Fifth Amendment.[388] Accordingly, Sirius XM does not have a property interest in the spectrum covered by its SDARS licenses such that any rule change that might affect the licenses could be considered a Fifth Amendment taking of Sirius XM's property.

160. *Contractual Rights.* Finally, Sirius XM argues that adopting the proposed rules may breach the "existing contractual relationship" established when the Commission granted satellite radio licenses to Sirius and XM. Sirius XM argues that spectrum auctions create binding contracts between the Government and the winning bidder.[389] Sirius XM argues that revising the WCS rules to allow harmful interference and thereby reducing the value of Sirius XM's licenses would breach the contract established at the spectrum auction.[390] However, the Commission has previously rejected the notion that rule changes affecting a licensee constitutes a breach of the license contract.[391] It is well established that the Commission retains the power to alter the terms and conditions of existing licenses by rule making.[392] Further, the Communications Act makes clear that the auction mechanism for assigning licenses was not intended to change the Commission's basic regulatory role or otherwise provide additional rights to auction-winning licensees.[393] Thus, no auction bidder, including Sirius or XM, could have assumed that it was buying a license containing terms that the Commission could not revise.

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duration expressly limited by statute subject to the Commission's considerable regulatory power and authority" and "[t]his right does not constitute a property interest protected by the Fifth Amendment."

[387] *See e.g.* Amendment of Parts 73 and 74 of the Commission's Rules to Establish Rules for Digital Low Power Television, Television Translator, and Television Booster Stations and to Amend Rules for Digital Class A Stations, MB Docket No. 03-185, *Report and Order*, 19 FCC Rcd 19331, 19359 n.166 (2004); Allocations and Service Rules for the 71-76 GHz, 81-86 GHz and 92-95 GHz Bands, WT Docket No. 02-146, *Report and Order,* 18 FCC Rcd 23318, 23346 n.184 (2003); *Paging MO&O on Reconsideration and Third R&O*, 14 FCC Rcd at 10095-96 (1999).

[388] *See* Amendment of the Commission's Rules Regarding Maritime Automatic Identification Systems, WT Docket No. 04-344, Petition for Rule Making Filed by National Telecommunications and Information Administration, RM-10821, Emergency Petition for Declaratory Ruling Filed by MariTEL, Amendment of the Commission's Rules Concerning Maritime Communications, PR Docket No. 92-257, *Report and Order and Further Notice of Proposed Rule Making and Fourth Memorandum Opinion and Order*, 21 FCC Rcd 8892, 8926-27 ¶ 46 (2006); Facilitating the Provision of Spectrum-Based Services to Rural Areas and Promoting Opportunities for Rural Telephone Companies to Provide Spectrum-Based Services, *Report and Order and Further Notice of Proposed Rule Making*, WT Docket No. 02-281, 19 FCC Rcd 19078, 19126 ¶ 84 (2004) (*Rural Report and Order*).

[389] Sirius 4.23 Comments at 54-56.

[390] *Id.* at 55-56.

[391] *Rural Report and Order*, 19 FCC Rcd at 19126 ¶ 84.

[392] *See, e.g., United States v. Storer Broadcasting*, 351 U.S. 192, 205 (1956); *Committee for Effective Cellular Rules v. FCC*, 53 F.3d at 1319-20.

[393] See 47 U.S.C. §§ 309(j)(6)(C) (stating that nothing in the auction statute or use of auctions shall "diminish the authority of the Commission under the other provisions of [the Communications] Act to regulate or reclaim spectrum licenses"); *cf.* 47 U.S.C. § 309(j)6)(D) (stating that nothing in the auction statute or in the use of auctions shall "be construed to convey any rights, including any expectation of renewal of a license, that differ from the rights that apply to other licenses within the same service that were not issued pursuant to this subsection").

F. Deep Space Network, Aeronautical Mobile Telemetry Service, and Amateur Service Operations

161. *Overview.* The 2360-2395 MHz band is allocated on a primary basis for Federal and non-Federal AMT use.[394] The 2360-2390 MHz band is the part of the 2310-2390 MHz band that remained allocated for AMT after the 1992 World Administrative Radio Conference allocated spectrum to satellite audio broadcasting. The Commission allocated the spectrum 2320-2345 MHz on a primary basis to the SDARS and the 2305-2320 MHz and 2345-2360 MHz bands to the WCS thereby reducing the available spectrum for AMT in the United States in this band from 80 megahertz to 30 megahertz.[395] In 2004, as a partial replacement for the spectrum that was allocated for the WCS and SDARS, the Commission allocated the 2390-2395 MHz band for AMT use, thereby increasing to 35 megahertz the amount of spectrum available for AMT.[396]

162. In allowing WCS licensees additional technical flexibility to facilitate the operation of mobile services, we must consider potential effects on other spectrum users above and below the WCS bands. Five megahertz below the 2305 MHz lower WCS band edge, in the 2290-2300 MHz band, NASA operates its Deep Space Network (DSN), which is vital for communications supporting space exploration. Additionally, above the 2360 MHz upper WCS band edge, AMT operations are conducted by Federal and non-Federal aviation entities in numerous areas throughout the country, collecting real-time data for the purposes of aircraft and missile flight testing. Also, in the 2300-2305 MHz band, immediately below the lower WCS band edge, radio amateurs conduct technical investigations using weak-signal operations. The Commission has also asked whether Medical Body Area Networks (MBANs) should be permitted to operate in the 2300-2305 MHz band.[397]

163. All of these services operate with highly sensitive receivers and high gain antennas in order to receive very weak signals. Although the weak signals and highly directional antennas could increase instances of interference, these services are also operated by persons with specialized technical expertise, and have different types of geographical deployments, so the interference considerations are somewhat different for these services, compared to those for the much more ubiquitous SDARS, which is used by consumers. The DSN is located at Goldstone in California's Mojave Desert. AMT receiving antennas are deployed in many areas that often have controlled boundaries, such as Federal and non-Federal facilities and airports. The number of amateur stations conducting weak signal operations in this band is relatively small, and they are often located in low-noise areas that provide favorable conditions for experimentation. As outlined below, we believe that reasonable rules can be devised to allow WCS mobile operations to commence without causing harmful interference to DSN, AMT, or amateur operations.

164. *Amateur and Deep Space Network (DSN) operations below the WCS bands.* Amateur station weak-signal operations in the 2300-2305 MHz band are clustered around 2304 MHz.[398] Amateurs

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[394] 47 C.F.R. § 2.106, US276.

[395] *See* Amendment of the Commission's Rules to Establish Part 27, the Wireless Communication Service, *Report and Order*, GN Docket No. 96-228, 12 FCC Rcd 3977 (1997).

[396] *See* Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems, ET Docket No. 00-258, *Seventh Report and Order*, 19 FCC Rcd 21350, 21351 ¶ 3 (2004) (*AWS 7th R&O*).

[397] *See* Amendment of the Commission's Rules to Provide Spectrum for the Operation of Medical Body Area Networks, ET Docket No. 08-59, *Notice of Proposed Rulemaking*, 24 FCC Rcd 9589 (2009).

[398] The 2300-2305 MHz band is allocated to the amateur radio service on a secondary basis. There is no non-government primary allocation for this band.

use this frequency to experiment with home-built and adapted commercial microwave equipment and they employ special techniques to communicate across large distances. Some amateur stations operating in this band are designed to transmit signals that reflect off the surface of the moon and back to a receiving station on Earth. DSN operations are conducted in the 2290-2300 MHz band. The NASA DSN is an international network of antennas that support interplanetary spacecraft missions and radio and radar astronomy observations for exploration of the solar system and the universe. The DSN consists of three communications facilities spaced approximately 120 degrees of longitude apart around the world: at Goldstone, CA; near Madrid, Spain; and near Canberra, Australia. This strategic placement permits constant observation of spacecraft as the Earth rotates, and makes the DSN the largest and most sensitive scientific telecommunications system in the world.[399]

165. The comments are mostly silent on protection of the DSN and amateur operations below 2305 MHz. However, on May 4, 2010, the National Telecommunications and Information Administration (NTIA) submitted a letter to the record expressing concern that the DSN be protected from interference from WCS operations.[400] NTIA proposes a relaxation of the WCS mobile/portable stations' OOBE limits and a tightening of the WCS base stations' OOBE limits (to account for equipment that is currently available) combined with an increase in the coordination distance for WCS base stations. Specifically, NTIA suggests that WCS base stations' OOBE should be attenuated by a factor of not less than: 43 + 10 log (P) dB in the 2300-2305 MHz band segment, 70 + 10 log (P) dB in the 2287.5-2300 MHz band segment, 72 + 10 log (P) dB in the 2285-2287.5 MHz band segment, and 75 + 10 log (P) dB below 2285 MHz.[401] NTIA also suggests that WCS mobile/portable devices' OOBE should be attenuated by a factor of not less than: 43 + 10 log (P) dB in the 2300-2305 MHz band segment, 55 + 10 log (P) dB in the 2296-2300 MHz band segment, 61 + 10 log (P) dB in the 2292-2296 MHz band segment, 67 + 10 log (P) dB in the 2288-2292 MHz band segment, and 70 + 10 log (P) dB below 2288 MHz. Further, NTIA requests that the coordination distance for WCS base stations be increased to 145 kilometers (km) around the DSN site located in Goldstone, CA, from the existing 50-km coordination distance.[402] The current rules require a WCS OOBE attenuation of 43 + 10 log (P) dB in the 2300-2305 MHz amateur band and 70 + 10 log (P) dB below 2300 MHz where the DSN operates, combined with a 50-km coordination distance around the Goldstone, CA DSN Facility.[403]

166. We believe it is important to ensure that the lower WCS spectrum is usable for broadband mobile deployment, while also protecting the DSN facility at Goldstone, CA. We find that the best way to achieve this is through the adoption of reasonable OOBE limits combined with an adequate coordination distance for WCS base stations located near the Goldstone Facility. Therefore, we will adopt the OOBE limits suggested by NTIA for WCS base, mobile, and fixed operations into the lower adjacent band to protect adjacent-band services operating below 2305 MHz, which also appear to be achievable with existing equipment designs and are not opposed by the WCS Coalition.[404] We will also

[399] The NASA Deep Space Network (DSN) is an international network that supports interplanetary spacecraft missions and radio and radar astronomy observations for the exploration of the solar system and the universe. See http://deepspace.jpl.nasa.gov/dsn/ (last visited October 27, 2009).

[400] *See* May 4, 2010, letter to Julius Knapp, Chief, Office of Engineering and Technology, from Karl B. Nebbia, Associate Administrator, Office of Spectrum Management, National Telecommunications and Information Adminstration, at 4 (NTIA May 4, 2010 Letter).

[401] *Id.*

[402] *Id.*

[403] 47 C.F.R. §§ 2.106 fn US338, 27.53(a)(3).

[404] *See* WCS Coalition April 30, 2010 *Ex Parte* Letter.

adopt NTIA's proposed coordination distance of 145 km for WCS base stations.[405] We note that this coordination distance is based upon a line of sight calculation assuming a WCS antenna with a height of 300 meters, which could occur particularly in mountainous terrain but is not likely for the type of mobile applications that are being considered by WCS licensees. We also acknowledge that a coordination distance of 145 km is a significant increase from the requirements in footnote US338 of the U.S. Table of Frequency Allocations, which requires WCS licensees within 50 km of the Goldstone Facility to coordinate their facilities to minimize interference with DSN.[406]

167. Nevertheless, because there is only one DSN location within the United States, we believe this increased coordination distance is an additional precautionary measure that will ensure that the work at the Goldstone Facility is not interrupted. We also fully anticipate WCS base stations can be deployed well within the coordination distance once WCS licensees demonstrate that adequate shielding and engineering practices are being implemented to protect the DSN. The coordination for the DSN facility at Goldstone, CA, will be between NASA and the WCS licensees. Given that there is only one location in a relatively remote area, we do not anticipate that the 145-km coordination distance will impact the deployment of WCS. Additionally, if WCS equipment is manufactured with better OOBE attenuation in the lower adjacent band, then WCS licensees will likely be able to coordinate base-station locations that are closer to the Goldstone Facility.

168. *Aeronautical Mobile Telemetry Service operations above the WCS bands.* The AMT Service's 2360-2390 MHz band is immediately adjacent to the upper 2360 MHz WCS band edge. AMT is used by the aerospace industry to collect critical data generated during flight testing of aircraft and missiles, such as stresses on control surfaces, engine temperatures, fluid pressures, and many other measurement points.[407] WCS mobile and base stations are currently subject to an OOBE attenuation requirement of 43 + 10 log (P) dB in the 2360-2370 MHz band and 70 + 10 log (P) dB above 2370 MHz.[408]

169. In response to the *2007 Notice*, AFTRCC filed comments requesting that the currently required OOBE attenuation factor of 110 + 10 log (P) dB into the SDARS band not only be retained, but formally extended to protect the AMT band as well.[409] AFTRCC admits that it has benefited from the current 110 + 10 log (P) dB OOBE attenuation factor afforded to SDARS, which have effectively precluded mobile use of the WCS spectrum.[410] It claims that, under more relaxed rules that would facilitate the deployment of mobile and portable WCS stations and associated base stations, the signals from these WCS operations would raise the noise floor of AMT systems and cause data dropouts.[411] AFTRCC contends that AMT receivers are sensitive and use highly directional eight-foot or larger antennas because AMT telemetry signals are frequently very weak and fluctuate due to the distance of the

[405] We note that some amateur stations operating around 2304 MHz may experience an increased antenna noise temperature caused by the implementation of mobile WCS operations, and will have to tolerate this change in the RF environment. Due to the technical flexibility allowed to amateur stations in Part 97 of our rules, however, we believe that operators of these stations may be able to offset or mitigate the effects of this change by relocating or redirecting their antennas, or by making other permitted technical adjustments.

[406] 47 C.F.R. §§ 2.106 footnote US338, 27.53(a)(1).

[407] AFTRCC Comments at 2.

[408] 47 C.F.R. § 27.53(a)(3).

[409] AFTRCC Comments at 5.

[410] *See* Letter from William K. Keane, Counsel for Aerospace and Flight Test Radio Coordinating Council, to Marlene H. Dortch, Secretary, FCC (dated November 17, 2008) at 2 ("AFTRCC Nov. 17, 2008 *Ex Parte*").

[411] *Id.* at 7.

aircraft from the receiving antenna, the low power of the aircraft transmitter, and the extreme maneuvers of the aircraft being tested, and therefore, these signals are vulnerable to increases in the noise floor.[412] AFTRCC contends that WCS interference will have a direct impact on the ability of AMT operators to fly out to distances of up to 200 miles in order to comply with air traffic control requirements or to find acceptable test conditions.[413]

170. To mitigate the risk of interference to AMT operations, AFTRCC suggests that if we relax the OOBE attenuation requirements for WCS into the SDARS band, then we should increase the OOBE attenuation to 70 + 10 log (P) dB between 2360-2370 MHz and 90 + 10 log (P) dB between 2370 2390 MHz for WCS mobile and portable stations and to 75 + 10 log (P) dB between 2360-2370 MHz and 95 + 10 log (P) dB between 2370-2390 MHz for WCS base stations.[414] AFTRCC also states that the WCS Coalition's proposed attenuation of 75 + 10 log (P) dB for base station OOBE into the SDARS band is designed to achieve this roll-off on the SDARS side of the band and OOBE should achieve the same roll-off on the AMT side of the band. AFTRCC states that it would not object to allowing a reasonable grandfathering period – one year, for example – for a limited deployment of WCS equipment not meeting the OOBE attenuation levels that it suggests.[415] AFTRCC later urged that WCS licensees be limited to transmitting only from base stations using the upper WCS bands and that WCS base stations be required to meet an OOBE attenuation of 70 + 10 log (P) dB at 2360 MHz band edge and above.[416] As an alternative to the limitation of base station-only transmissions in the upper WCS band, AFTRCC urges the creation of a 2.5-megahertz-wide guard band at 2357.5-2360 MHz in addition to the other technical limits it proposed on mobile WCS operations.[417]

171. Additionally AFTRCC requests that power and OOBE limits be measured on an EIRP basis (*i.e.*, after transmit antenna) rather than transmitter output power. Further, although AFTRCC originally stated that if average power is allowed, then peaks should be limited to 6-8 dB for no more than 0.1 percent of the time, it later stated that all powers should be expressed as peak power as currently outlined in Section 27.50(a).[418] AFTRCC contends that allowing average power measurement instead of peak power measurement would exacerbate WCS interference to AMT and, for 99 percent of the time, would allow WCS OOBE levels into the AMT band corresponding to an attenuation of only 32 + 10 log (P) dB.[419] In a subsequent *ex parte* filing, AFTRCC argues that allowing WCS to use average power measurements with a peak to average ratio of 13 dB rather than specifying peak power measurements will lead to a reduction of 13 dB in the level of OOBE interference protection afforded to

[412] AFTRCC May 7, 2008, *Ex Parte* at 3.

[413] AFTRCC April 23, 2010 Comments at 3.

[414] AFTRCC *Ex Parte* of November 17, 2008 at 5-6. AFTRCC arrives at these mobile and portable OOBE attenuation levels accounting for 16 dB to reduce the maximum single device interference to the noise floor of the AMT receiver using free space propagation at a 1.5-mile (2.4 km) separation distance; 8 dB to account for aggregate interference from multiple devices; and 3 dB to account for multipath and other non-line-of-sight enhancements to interference signal strength. For base stations, AFTRCC includes an additional 5 dB to account for improved line of sight from a tower-mounted antenna to the AMT receiver site.

[415] *See* Letter from William K. Keane, Counsel for Aerospace and Flight Test Radio Coordinating Council, to The Honorable Kevin J. Martin, Chairman, FCC (dated December 1, 2008) at 3 ("AFTRCC Dec. 1, 2008, *Ex Parte*").

[416] AFTRCC *ex parte* of March 19, 2010 at 15.

[417] *Id.*

[418] AFTRCC Comments at 6. In their *Ex Parte* filing dated September 15, 2009, at 15, AFTRCC suggests to retain peak power measurement consistent with existing rules.

[419] AFTRCC April 23, 2010 Comments at 3.

AMT telemetry operations.[420] In addition, AFTRCC submits that allowing average measurements would result in a degradation of 8 dB from the current interference protection above 2370 MHz contained in the Commission's Rules.[421] AFTRCC also suggests that we require ATPC be employed for WCS base, mobile, and portable stations.[422] AFTRCC claims that these additional protections are necessary to avoid potential harmful interference to AMT operations.[423]

172. To further protect AMT receivers from harmful interference, AFTRCC suggests that the 75 + 10 log (P) dB OOBE attenuation for base stations should also be backed up by a coordination regime for WCS base stations that would be located within line of sight of an AMT receiver.[424] AFTRCC claims that although the 43 + 10 log (P) dB OOBE attenuation level satisfies the ITU-R M.1459 power flux density protection level of -180 $dBW/m^2/4kHz$ at distances over 100 km for an AMT ground receiving antenna pointing at a WCS mobile transmitter,[425] a single WCS device at a distance of 18.67 km from an AMT receiver could cause interference to the receiver.[426] Additionally, AFTRCC states that the WCS Coalition's proposed OOBE attenuation of 55 + 10 log (P) dB produces a separation distance of 32 km from AMT receivers in order to avoid causing interference to the receivers, while an OOBE attenuation of 67 + 10 log (P) dB produces a separation of 8 km to avoid causing interference.[427]

173. In its April 30, 2010, comments, AFTRCC reiterates its opposition allowing WCS mobile applications in the upper WCS band and support for its proposed technical constraints on WCS operations. AFTRCC also states that if the WCS technical rules are established as indicated in the *WCS/SDARS Technical Rules Public Notice*, then stringent coordination requirements would be needed, coupled with an unconditional and immediate obligation for WCS licensees to shut down any upper WCS-band base stations within line of sight of an AMT receiver upon receipt of a complaint of interference to AMT operations.[428] AFTRCC contends that even an expedited Commission procedure for eliminating interference would be no substitute for such a procedure given the aviation safety issues at stake. Boeing also requests that the WCS transmitters be shut down if they cause interference and seeks more stringent coordination requirements; including the protection of mobile AMT receive operations and the protection of future AMT deployments, even if it requires modifications to or relocation of WCS operations.[429] Boeing contends that the flexible use of mobile AMT sites is essential to effective and efficient flight testing. Boeing also requests that WCS licensees be required to provide a list of WCS base stations and their technical characteristics upon request by an AMT site operator.[430]

174. In its early comments in this proceeding, the WCS Coalition argued that its proposal to relax the OOBE attenuation requirement in the 2320-2345 MHz band would not affect AMT

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[420] *See Ex Parte* Letter from William K. Keane, Counsel for Aerospace and Flight Test Radio Coordinating Council, filed May 13, 2010, at 2.

[421] *Id.*, Attachment at 3.

[422] AFTRCC Nov. 17, 2008, *Ex Parte* at 5.

[423] AFTRCC Comments at 2-3.

[424] AFTRCC Comments at 6.

[425] AFTRCC Comments at 5.

[426] AFTRCC August 14, 2009, *Ex Parte* detailing its conclusion to the tests conducted by WCS and SDARS.

[427] AFTRCC Comments at 5.

[428] AFTRCC April 23, 2010 Comments at 6.

[429] Boeing April 23, 2010 Comments at iii, 2, 4.

[430] *Id.* at 5.

operations.[431] Also, NextWave Wireless (NextWave) contends that the OOBE attenuation factors of 43 + 10 log (P) dB in the 2360-2370 MHz band and 70 + 10 log (P) dB above 2370 MHz were established in 1997 and, although AFTRCC participated in the proceeding establishing the WCS rules, it did not petition for reconsideration of the adoption of those OOBE attenuation requirements.[432] NextWave continues that there has been no interference to AMT operations from existing fixed WCS operations.[433] Further, the WCS Coalition suggests that AFTRCC has failed to install appropriate filters and take other steps to protect against WCS operations.[434] AFTRCC dismisses these arguments, stating that the only reason the aerospace companies have registered their concerns is because WCS licensees are contemplating a radical change in their use of the band that was not practical under the rules adopted in 1997.[435] AFTRCC also states that for filters to be effective against WCS OOBE, they would have to be added to the WCS transmitter, not the telemetry receiver.[436]

175. In response to AFTRCC's proposals, the WCS Coalition offered a more stringent attenuation of OOBE into the AMT band in its March 15, 2010 *Ex Parte* filing.[437] However, as a result of negotiations with NTIA, on April 30, 2010, the WCS Coalition updated its proposal for even more stringent OOBE attenuation into the AMT band if the OOBE attenuation into the lower adjacent band could be relaxed for WCS mobile devices.[438] Specifically, the WCS Coalition and NTIA now agree that WCS base stations' OOBE, as measured over a 1-megahertz resolution bandwidth, must be attenuated below the transmitter power P by a factor not less than 43 + 10 log (P) dB in the 2360-2362.5 MHz band segment, 55 + 10 log (P) dB in the 2362.5-2365 MHz band segment, 70 + 10 log (P) dB in the 2365-2367.5 MHz band segment, 72 + 10 log (P) dB in the 2367.5-2370 MHz band segment, and 75 + 10 log (P) dB above 2370 MHz. Additionally, they agree that WCS mobile/portable devices' OOBE, as measured over a 1-megahertz resolution bandwidth, must be attenuated below the transmitter power P by a factor not less than 43 + 10 log (P) dB in the 2360-2365 MHz band segment, and 70 + 10 log (P) dB above 2365 MHz.[439] The WCS Coalition argues that adoption of AFTRCC's proposed OOBE limits at 2305 MHz and 2360 MHz could have a material adverse impact on the utility of the lower A and upper B block channels for broadband and would effectively force WCS licensees to waste 2.5 megahertz of the lower A block and the upper B block closest to the band edges as guard band

[431] WCS Coalition Reply Comments at 52-53.

[432] *See* Letter from Jennifer M. McCarthy, Vice President, Regulatory Affairs, NextWave Wireless Inc., to Marlene Dortch, Secretary, FCC (dated November 23, 2008) at 1 ("NextWave Nov. 23, 2008, *Ex Parte*").

[433] *Id.* at 2.

[434] WCS Coalition Reply Comments at 52.

[435] AFTRCC Dec. 1, 2008, *Ex Parte* at 2.

[436] AFTRCC May 7, 2008, *Ex Parte* at 3.

[437] In its March 15, 2010 *ex parte* filing, the WCS Coalition updated its position regarding emissions above 2360 MHz, stating that, given the state of filter technology, it would be able to meet base station OOBE limits of 43 + 10 log (P) dB 2360 MHz, 55 + 10 log (P) dB at 2362.5 MHz, 70 + 10 log (P) dB at 2300 MHz and at 2365 MHz, 72 + 10 log (P) dB at 2367.5 MHz, and 75 + 10 log (P) dB at 2370 MHz. In addition, the WCS Coalition submits that it would be able to meet mobile and portable OOBE limits of 43 + 10 log (P) dB at 2360 MHz, 45 + 10 log (P) dB at 2362.5, 55 + 10 log (P) dB at 2365 MHz, 65 + 10 log (P) dB at 2367.5 MHz, and 70 + 10 log (P) dB at 2370 MHz. WCS Coalition March 15, 2010 *Ex Parte* presentation at 8-9.

[438] *See* WCS Coalition April 30, 2010 Ex *Parte* letter at 2, 5.

[439] WCS Coalition April 30, 2010 Ex *Parte* letter at 2, 5; and NTIA May 4, 2010 Letter at 2.

spectrum because practical filters could not achieve sufficient roll-off to meet the proposed mask absent a guard band.[440]

176. The WCS Coalition also states that the single greatest impediment in the staff's proposal to achieving the objectives in the National Broadband Plan is the coordination proposal to protect AMT facilities.[441] The WCS Coalition contends that the proposed 45-km coordination distance could delay if not preclude service to 25 percent of the population in the United States. Instead, they argue that even under worst case conditions for the upper B block, a 10-km coordination distance would provide adequate protection to AMT operations. The WCS Coalition states that it is difficult to square the proposed tighter OOBE limits with a 45-km coordination distance, when the Commission required neither type of protections for AMT operations when it reallocated the 2385-2390 MHz band in WT Docket 02-8.[442] The WCS Coalition adds that coordination works best when both services have to coordinate with each other and there is an incentive to be reasonable. However, the WCS Coalition contends that even though the Commission staff has rejected AFTRCC's technical restrictions on WCS, the coordination requirement will allow AMT interests to hold WCS deployment hostage absent compliance with the rejected limits.[443] The WCS Coalition also states that the 45-km coordination distance ignores attenuation characteristics that would minimize interference to AMT facilities and provides its own technical analysis supporting a 10-km coordination distance.[444]

177. GE Healthcare (GEHC) also asserts that the 45-km coordination distance is unnecessarily large and could stifle the deployment of WCS and broadband services. GEHC contends that AFTRCC's reliance on ITU-R M.1459 for protection levels for AMT and the use of free-space propagation assumptions are inappropriate and result in overly conservative assumptions that should not be applied to the WCS interference analysis.[445] GEHC contends that even if one uses the inappropriate -180 dBW/m^2/4kHz protection level, a more realistic path-loss calculation would only result in a coordination distance of 17.8 km for a WCS base station meeting 43 + 10 log (P) dB at 2360 MHz.[446] GEHC suggests that a 10-km coordination distance would be more than adequate between these 2 services. GEHC also submits that AMT receivers close to populated areas are already subject to OOBE from numerous uncoordinated radio sources, including unlicensed devices, which far exceed the -180 dBW/m^2/4kHz protection level on a regular basis. Therefore, it would be inconsistent to hold WCS base stations to a higher standard than existing and ubiquitous unlicensed Part 15 and Part 18 devices currently meet in the AMT band.[447] GEHC also points out that AFTRCC regularly coordinates and approves wireless video links in the AMT band to televise major sporting events and that these devices transmit at 250 mW and 1.5 W from airborne transmitters at locations throughout the country on a frequent basis. Finally, GEHC argues that the Commission staff's proposed coordination requirement lacks clarity with respect to the responsibility of both parties and urges that a deadline for resolution of coordination be established.

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[440] *Id.*

[441] WCS Coalition April 23, 2010 Comments at iii, 6-7.

[442] *Id.* at 8. The WCS Coalition acknowledges that the referenced allocation was later rescinded, but the principle of the finding remains valid.

[443] *Id.* at 9.

[444] *Id.* at 10 and Appendix B.

[445] GEHC April 23, 2010 Comments at 2-3.

[446] *Id.* at 4.

[447] *Id.* at 5-6.

178. In its April 30, 2010 Reply Comments, AFTRCC continues to support the protection levels in ITU-R M.1459 as being appropriate to address potential interference between WCS and AMT operations. AFTRCC also disputes the technical analysis of GEHC and the WCS Coalition supporting a 10-km coordination distance and contends that the 45-km or line-of-sight coordination distance, whichever distance is greater, is reasonable.[448] AFTRCC also argues that it is not reasonable to compare the emissions into the AMT band from Part 15 devices that are 10 megahertz above the upper edge of the AMT band at 2390 MHz to the WCS emissions that are adjacent to the lower band edge at 2360 MHz.[449]

179. As indicated above, on May 4, 2010, NTIA submitted a letter to the record recommending emission limits and a coordination requirement to allow broadband mobile applications for WCS, while also ensuring interference protection for Federal and non-Federal AMT operations.[450] NTIA contends that the existing WCS OOBE limits into the AMT band would not adequately protect AMT operations unless there was 10 megahertz of guard band between the services, which would result in a large amount of WCS spectrum being rendered unusable. Therefore, NTIA proposed emission limits that should be achievable with existing technology combined with a requirement that WCS base stations be coordinated when they are within 45 km or line of sight of an AMT receiver site, whichever distance is greater.[451] NTIA also contends there may be instances in which WCS facilities could be located on towers higher than the 30-meters above ground that was assumed in setting the coordination distance, or could be located on a mountain overlooking an AMT facility, and therefore interference to AMT receivers beyond the 45-km coordination distance, but within line of sight, could occur unless coordinated beforehand. Thus, NTIA expects that the WCS licensee will be immediately responsible for eliminating any interference situations, even if they occur beyond the 45-km coordination distance, and requests that WCS licensees be required to take all practical steps necessary to eliminate such interference.[452] Also, although the WCS Coalition and NTIA agree on the OOBE limits in the AMT band, they disagree on the appropriate coordination distance.[453]

180. NTIA also recommends consideration of the following factors to reduce interference to AMT receivers: using the channels in the lower portion of the WCS band (2305-2320 MHz) for base stations that are located in areas with lower population densities; using lower antenna heights to minimize base station coverage; using down-tilt antennas for base stations to minimize the signal level in the direction of AMT sites; employing sector blanking to eliminate base-station coverage in the direction of AMT sites; reducing the transmitter power to minimize the base-station coverage areas; and employing terrain shielding where practical to reduce signal levels in the direction of AMT sites.[454] NTIA also states that if line of sight is involved, the coordination process should also take into consideration other parameters of the AMT receiver (*e.g.*, antenna height and gain, minimum elevation angle, and terrain shielding). The operational area used for flight testing (*e.g.*, test ranges located away from populated areas or over the ocean) should also be considered in the coordination process. NTIA suggests that future technology advances, including better filtering for WCS base stations, should also be considered to facilitate coordination. NTIA also suggests that to minimize the need for coordination, WCS lieensees operating in the 2345-2360 MHz band should avoid locating base stations within radio line of sight of

[448] *See* AFTRCC April 30, 2010 Reply Comments at 4-6.

[449] *Id* at 9.

[450] *See* NTIA May 4, 2010 letter at 1-3.

[451] A listing of current and planned Federal and non-Federal AMT receiver sites can be obtained from the Aerospace and Flight Test Radio Coordinating Council (AFTRCC).

[452] *See* NTIA May 4, 2010 letter at 3.

[453] *See* WCS Coalition April 30, 2010 Ex *Parte* letter at 2, 5.

[454] *Id.* at 4.

AMT receive sites, and if during the coordination process a mutual agreement as to the protection of AMT receivers cannot be reached, the FCC and NTIA should be notified to resolve any conflict. This includes interference that could occur to AMT receivers from WCS bas stations operating outside of the 45-km coordination distance.

181. *Discussion.* We believe it is possible to establish reasonable WCS limits that will allow mobile broadband operations, while also preventing harmful interference from occurring to AMT operations in the adjacent spectrum. First, we find the OOBE attenuation factors suggested by AFTRCC are overly stringent and would likely render a meaningful portion of the upper WCS blocks unusable for effective mobile broadband applications. Therefore, we find that the best approach to address the spectrum boundary at 2360 MHz is to adopt reasonable OOBE attenuation for WCS transmissions, coupled with a coordination requirement for WCS base stations, so that effective engineering practices can be applied in the design of WCS deployments around AMT installations. We agree with NTIA that the coordination process will allow for the application of technical and operational techniques that take into account the local surroundings of specific AMT sites, and will enable the protection of AMT receivers while also allowing WCS deployments in those areas around AMT receivers to the greatest extent possible.

182. Specifically, as outlined previously, we will tighten the OOBE attenuation approach for WCS mobile and portable devices above 2360 MHz as follows: 43 + 10 log (P) dB in the 2360-2365 MHz, and 70 + 10 log (P) dB above 2365 MHz. Additionally, WCS base and fixed stations will still be required to meet the OOBE attenuation of 43 +10 log (P) dB in the 2360-2362.5 MHz band, 55 + 10 log (P) dB at 2362.5-2365 MHz band, 70 + 10 log (P) dB at 2365-2367.5 MHz band, 72 + 10 log (P) dB at 2367.5-2370 MHz band, and 75 + 10 log (P) dB above 2370 MHz. These limits are consistent with the agreement between NTIA and the WCS Coalition on how best to address possible interference into the AMT band.[455] In our independent judgment, we find that these limits strike an appropriate balance between our competing goals of protecting AMT operations and promoting provision of broadband mobile services by WCS licensees. Although these limits are more stringent than we typically require for mobile services, they appear to be achievable with currently available equipment technology. These limits will also be accompanied by conservative coordination distances that will allow the parties to engineer solutions to co-exist depending on the particular deployment scenarios for each facility.

183. Regarding our decision to establish a coordination process between WCS base stations and AMT receivers, we acknowledge that coordination between adjacent spectrum allocations is not the norm.[456] In this instance, however, the limited number of AMT installations nationwide and AFTRCC's experience as a frequency coordinator lead us to believe that coordination between WCS licensees and AFTRCC could be effective in reducing interference between these services, without overly burdening either service. While AMT interests make some effective arguments demonstrating that interference could occur over longer distances (*e.g.*, in situations where the main beam of the AMT receiver is pointed at the horizon, directly at a WCS base station transmitter, when the aircraft is operating at the outer fringes of its communications range), the WCS interests have equally demonstrated that WCS operations can be deployed well within our adopted coordination distance when real world deployment factors are considered (*e.g.*, typical terrain obstructions, down-tilt antennas by WCS base stations, and side-lobe suppression of AMT antennas will greatly reduce the interference potential). Therefore, although we are adopting the 45-km coordination distance and/or line of sight (whichever is greater) approach supported

[455] *See* WCS Coalition April 30, 2010 Ex *Parte* letter at 2, 5.

[456] However, in some limited instances, we have required inter-service coordination or other interference avoidance requirements to address possible interference scenarios between different services in adjacent spectrum. *See, e.g.*, 47 C.F.R. §§ 25.213, 25.254, 27.1131, and 95.861.