Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington D.C. 20554

In the Matter or	)	
	)	
Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band	)	WT Docket No. 07-195
	)	

COMMENTS OF MOTOROLA, INC.

Motorola, Inc. ("Motorola") hereby submits these comments to the *Notice of Proposed Rulemaking* in the above-captioned proceeding.[1] Motorola appreciates the Commission's commitment to ensuring that sufficient spectrum is made available for advanced wireless services ("AWS") and therefore supports the release and licensing of the 2155-2175 MHz band (*i.e.*, AWS-3). Motorola supports flexible use of this spectrum, but notes that its use for Time Division Duplex ("TDD") two-way transmissions versus downlink-only operations presents different challenges for ensuring a compatible environment with adjacent services. In these comments, Motorola provides technical information to assist the Commission in developing appropriate rules for permitting both forms of implementations. Motorola recommends that the Commission continue work on crafting appropriate technical rules to ensure that the use of this band does not create unacceptable risks of interference to adjacent services.

I. BACKGROUND.

The subject *Notice* seeks comment on service rules for the 2155-2175 MHz band "in a manner that will permit it to be fully and promptly utilized to bring advanced wireless services to American consumers."[2] Noting that the AWS-3 spectrum is a single 20-megahertz segment as opposed to two symmetrically paired blocks, the *Notice* seeks comment on three different

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1 Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band, WT Docket No. 07-195, *Notice of Proposed Rulemaking*, FCC 07-164 (Sept. 19, 2007) ("*Notice*").

2 *Id* at ¶ 1.

technological approaches: (1) permitting both base station transmissions and mobile handset transmissions in the band based on the needs of the licensee(s) ("uplink/downlink approach"); (2) permitting both base station transmissions and mobile handset transmissions in the band, but only in particular parts of the band designated by the Commission ("structured uplink/downlink approach"); or (3) allowing only base station transmissions in the band ("downlink approach").[3] The *Notice* seeks comment on the interference potential of each of these deployment options and requests recommendations for service rules that best accommodate the preferred approach.

Use of the 2155-2175 MHz band was discussed previously in the proceeding that established services rules for the 1710-1755/2110-2155 MHz band (AWS-1).[4] In that proceeding, Motorola recommended that the 2155-2180 MHz band be used for asymmetrical AWS downlink applications in conjunction with AWS mobile devices operating in other frequency bands, notably, the 1710-1755 MHz AWS-1 mobile transmit band.[5] Motorola argued that using the 2155-2175 MHz spectrum for downlink applications would be most compatible with the adjacent 2110-2155 MHz band and would avoid the need for guard bands to prevent interference between the two services.[6]

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[3] *Id.* at ¶ 2.

[4] 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, *Third Report and Order, Third Notice of Proposed Rulemaking and Second Memorandum Opinion and Order*, 18 FCC Rcd 2223.

[5] Comments of Motorola, Inc., ET Docket No. 00-258, April 14, 2003 at 14. Previously, the 2175-2180 MHz band was considered along with the 2155-2175 MHz block. However, that upper 5 MHz block is now is now treated as "AWS-2" spectrum along with the 1915-1920 MHz, 1995-2000 MHz, and 2020-2025 MHz bands. *See*, Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands; Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands, WT Docket No. 04-356; WT Docket No. 02-353, *Notice of Proposed Rulemaking*, 19 FCC Rcd 19263 (2004).

[6] Reply Comments of Motorola, Inc., ET Docket No. 00-258, April 28, 2003 at 5.

The interference risk to AWS-1 mobile receivers that are tuned to receive base transmissions from the 2110-2155 MHz band remains a concern with allowing AWS-3 spectrum to be used by mobile transmitters. Based on recent tests performed by Motorola, allowing mobile use in the 2155-2175 MHz band may require power and out-of-band emissions restrictions on AWS-3 operations that are more restrictive than those applied to other mobile bands. The results of these tests are described below and detailed in the attached Appendix.

II. IMPACT OF MOBILE TRANSMISSIONS IN THE 2155-2175 MHZ BAND.

Allowing mobile transmissions in the AWS-3, in either a structured band plan or not, will require AWS-1 mobile receivers to discriminate between desired base transmissions originating in the 2110-2155 MHz band from undesired mobile transmissions originating in the adjacent 2155-2175 MHz AWS-3 band. The close proximity that mobile devices can operate within is a key factor in determining the environment where interference may occur.

In the attached Appendix, Motorola provides the results of measurements performed on current AWS-1 handset receivers to determine the ability of those devices to reject signals originating from potential AWS-3 mobile transmitters. Motorola's tests confirm that mobile use of the 2155-2175 MHz band would present interference scenarios similar to those predicted to occur between the AWS H-block spectrum (1915-1920/1995-2000) and Broadband PCS handsets.[7]

As in the H-Block case, the interference potential of an AWS-3 mobile transmitter to an AWS-1 mobile receiver is dependant upon three factors: 1) the blocking level of the AWS-1 receiver, 2) the transmitted power of the AWS-3 mobile transmitter and 3) the separation

[7] Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands, *Notice of Proposed Rulemaking*, 19 FCC Rcd 19263 (2004).

distance between the two devices.[8] The blocking performance of a handset is a measure of a receiver's ability to receive a desired signal in the presence of a strong interfering signal and minimum performance requirements are established by standards development groups (*i.e*. TIA, 3GPP or 3GPP2).[9] Real-world performance of handsets typically exceeds the minimum specifications.

Using test procedures established by CTIA to measure the impact of H-block mobile devices on Broadband PCS handsets[10], Motorola measured the AWS-3 interfering signal level that would result in a dropped call by a nearby AWS-1 receiver.[11] Measuring the signal level that results in a dropped call is a deviation from the CTIA test procedures, which instead defined the point of harmful interference as the level of interference that increases the Frame Error Rate ("FER") by 1 to 2 percent of the baseline reference.[12] Using the results of measurements and assuming free space path loss between the two devices in close proximity (with each device having an additional loss of 3 dB to account for antenna and other internal losses), the interfering signal level can allow one to calculate the transmitter output level of the AWS-3 device necessary to cause interference at certain specified separation distances.

As in the H-Block proceeding, the tests include a "worst case wanted signal condition" where the AWS-1 receiver is operating in a very low signal level environment (-105 dBm

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8 *See, e.g.*, Comments of Motorola, Inc., WT Docket No. 04-356, December 8, 2004 at 4.

9 As further discussed below, one of the factors that impact receiver blocking performance is the amount of isolation provided by duplexers.

10 Comments of CTIA – The Wireless Association, WT Docket No. 04-356, December 8, 2004.

11 The AWS-1 receiver used for these test used a CDMA modulation and had a 1.23 MHz channel bandwidth.

12 More interfering power is required to cause a victim receiver to drop a call than is needed to increase FER by 1 to 2 percent. Other measures on the impact to the victim handset such as an increase in the FER or Bit Error Rate would result in lower power levels than those measured by Motorola.

desired receive signal level) as well as the condition where the AWS-1 receiver operates with an additional 5 dB of margin (-100 dBm). The effects of unmodulated and CDMA modulated interfering signals were measured.

Motorola's tests and calculations show that when the two devices are separated by only 1 meter, the AWS-3 device would need to operate with only 11 dBm of transmit power to cause a call drop to an AWS-1 receiver operating in a low signal level environment (*i.e.*, -105 dBm desired receive level).[13] If the AWS-1 receiver were operating with a higher desired signal level (-100 dBm), the interfering AWS-3 mobile transmitter would cause at call drop at 17 dBm transmit power. Typical 2 GHz AWS mobile transmit power levels are approximately 24 dBm (250 milliwatts) with the FCC's rules allowing up to 1 watt EIRP.[14]

Requiring commercial wireless devices from adjacent band services to co-exist at a distance of 1 meter is a metric that has been supported by a majority of the wireless industry including Motorola.[15] Applying this requirement to AWS-1 and AWS-3 mobile services, Motorola's test results indicate that a 250 milliwatt power limit for AWS-3 mobile units as discussed in the *Notice* would result in interference severe enough to cause dropped calls at distances beyond 1 meter.[16] Motorola's results would suggest that more restrictive power levels would be necessary to ensure a compatible environment between AWS-3 mobile units and

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[13] The result cited here are for the CDMA modulated interfering signal case.

[14] *See* 47 C.F.R. § 27.50(d)(2).

[15] Comments of Motorola, Inc., WT Docket No. 04-356, December 8, 2004 at 5; Comments of CTIA – The Wireless Association, WT Docket No. 04-356, December 8, 2004 at n. 42.

[16] Motorola notes that mobile receivers operating above 2175 MHz would be subject to the same type of interference risks described above for the AWS-1 band. Thus, the FCC must consider the impact of mobile use of the AWS-3 band on the J-Block. spectrum at 2175-2180 MHz and mobile devices operating in Mobile Satellite mobiles (both "ATC" terrestrial units and non-ATC units) operating in 2180-2200 MHz band.

AWS-1 receivers.[17] AWS-3 mobile use at higher powers would require filters for AWS-1 receivers or would require the AWS-1 operators to accept interference at separation distances greater than 1 meter.[18]

Filtering plays a key role in limiting the effects of these types of interference. In the case of receiver blocking, the duplexers currently used in AWS-1 handsets do not provide much attenuation from transmissions originating in the 2155-2175 MHz band. As shown in Figure 3 of the attached Appendix, current performance shows only 1-2 dB of roll-off is achieved over the 2155-2175 MHz band. This provides AWS-1 handsets with only limited isolation from AWS-3 mobile transmissions.[19] Motorola notes that in the PCS bands extensive work has been done on duplexer filters to protect PCS mobiles from interfering with PCS receivers and that the characteristics of the filters considered for PCS represent current state of the art and are tuned for operation in the PCS band.[20] Use of such filters in the AWS-1 handsets would require further work to understand the applicability and extensibility of those filters to the AWS-1 band.[21] A fundamental difference, however, between PCS and AWS-1 and AWS-3 is the existence of a 15 MHz guardband between the mobile receive band and mobile transmit bands in PCS. No such

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[17] For reference, Motorola notes that CTIA recommended maximum power levels for H-block mobile units of 5 dBm or approximately 3 milliwatts. *See* Comments of CTIA – The Wireless Association, WT Docket No. 04-356, December 8, 2004 at 13.

[18] Motorola is continuing to review the feasibility and impact of additional filtering for AWS-1 mobile devices in order to provide additional options for AWS-3.

[19] Standards bodies such as 3GPP or 3GPP2 typically specify the performance of devices when in the presence of potential interferers in the adjacent channels.

[20] *See, e.g.*, Letter from Steve B. Sharkey to Marlene H. Dortch, Secretary, Federal Communications Commission, ET Docket No. 00-258, July 20, 2004. The appendix attached to that letter shows that PCS receiver filters provide 50 dB of isolation at 5 MHz offset. Further evaluation is needed to determine if such performance can be achieved for AWS-1 receivers.

[21] Impacts of using such filters include evaluation of the size and performance impacts to the AWS-1 handset including the ability to provide commercial design margins which can operate over the required temperature ranges.

guardband exists between AWS-1 and AWS-3. Accordingly, even state of the art filtering will likely have limited potential to improve coexistence.

Motorola also measured the impact of AWS-3 mobile out-of-band emissions and spurious emissions on AWS-1 receivers. Following the CTIA testing protocols, Motorola measured the out-of-band signal levels that resulted in an AWS-1 receiver to drop a call at -159.7 dBm/Hz (-100 dBm desired signal strength for the AWS-1 receiver) and -163.5 dBm/Hz for the worst case situation (-105 dBm desired signal level for the AWS-1 receiver). At a 1 m separation this would result in out-of-band emissions levels of AWS-3 devices of -64.6 dBm/100 kHz and -68.4 dBm/100 kHz, respectively.

In short, mobile use in the AWS-3 band would require out-of-band emission restrictions greater than existing FCC requirements expressed as 43+10log(P) based on a requirement for 1 meter separation.[22] In the H-Block proceeding, Motorola recommended that emission levels into the adjacent PCS mobile receive bands be reduced to levels of at least -71 dBm/100 kHz, which reflected current state of the art performance for GSM 1.9 GHz devices.[23] Motorola's data summarized above would suggest similar levels of attenuation for wideband emissions.

Motorola notes that use of the band as a downlink band, which could be used in conjunction with any other commercial wireless band licensed under Parts 22, 24, 27, 90 or for mobile broadcast operations, is a viable option. The "downlink only" option for the AWS-3 band does not raise the same mobile-to-mobile interference issues and interference considerations with adjacent operations would be similar to those for the PCS or AWS base stations transmit bands. The uplink/downlink option to allow the placement of Time Division

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22 47 CFR 27.53(m)(3)

23 *See*, Reply Comments of Motorola, Inc., WT Docket No. 04-356, February 8, 2005 at 6.

Duplex (TDD) or Half Duplex Frequency Division Duplex (HFDD) operations in the AWS-3 band would require limitations on transmit power and out-of-band emissions levels to reduce the potential interference from AWS-3 mobiles to AWS-1 mobile, J-Block and MSS mobile receivers as described above. Similarly, the structured uplink/downlink option will still have the same potential for interference as the TDD mobile transmitters would be only 5 MHz away from the AWS-1 band edge.

III. SPECIFIC RULE RECOMMENDATIONS.

Motorola supports subjecting the AWS-3 band to the Part 27 rules, which provide licensees the flexibility to provide any service that comports with the technical rules specified for that frequency band.[24] As indicated above, to the extent that the Commission decides to deploy base stations in the AWS-3 Band Motorola supports using rules that are compatible with the adjacent spectrum environment. To accommodate such use, Motorola recommends the following technical requirements:

***Power and OOBE Limits*:** Motorola recommends that the FCC adopt power and emission limits for fixed and base stations that are consistent with those established for AWS-1. Section 27.50(d)(1) specifies a peak EIRP of 3280 Watts in rural areas and 1640 Watts in all other areas. Section 27.53(h) specifies the out of band emission limits for AWS-1 fixed transmitters at 43+10log(P). Motorola believes that there are no unique interference issues associated with the AWS-3 band that would preclude adoption of these standard reference levels for fixed transmitters.

[24] *See* 47 CFR 27.2.

Boundary limit: Again, Motorola see no limit to deviate from the standard practice of limiting AWS and PCS emissions at the boundary of the authorized service area to 47 dBuV/m.[25] This value has proven to be a workable solution for co-channel protection and the rule provides opportunities for licensees to negotiate variances where necessary. This policy should be adopted for AWS-3.

HAAT**:** Motorola recommends that the FCC not impose any restrictions on the height above average terrain for antennas. This is consistent with the Commission's actions in AWS-1 where it determined that boundary limits and power restrictions were sufficient to protect adjacent area licensees so that it is not necessary to place a limit on the coverage area produced by individual base stations.[26] The Commission's arguments apply equally to AWS-3 and, therefore, there should be restriction on HAAT.

Under any scheme which deploys mobile stations in the AWS-3 band, the use should be done in a compatible manner with adjacent band operations.

IV. CONCLUSION.

The AWS-3 band provides additional spectrum needed to help provide the wireless broadband services demanded by consumers. Motorola supports opening the AWS-3 band in a flexible manner to provide any service that comports with the technical rules specified for that frequency band. While Motorola supports providing flexibility in how the band is used, Motorola's test results indicate that use of mobile transmitters in the band creates unique challenges in ensuring a compatible environment with adjacent operations and will likely require rules that are more restrictive than for mobile operations in other bands. The Commission should

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[25] *See* 47 C.F.R. § 27.55 of the Commission's rules.

[26] Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands, WT Docket No. 02-353, Report and Order, 18 FCC Rcd 25162 (2003) at ¶ 103.

carefully study the interference potential and adopt rules that take into account the need for AWS-3 operations to be compatible with adjacent operations. Motorola urges the Commission to continue to evaluate future technologies that will help bring this band to the market place.

Respectfully submitted,

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APPENDIX – AWS-1 IMPACT FROM AWS-3 OPERATIONS

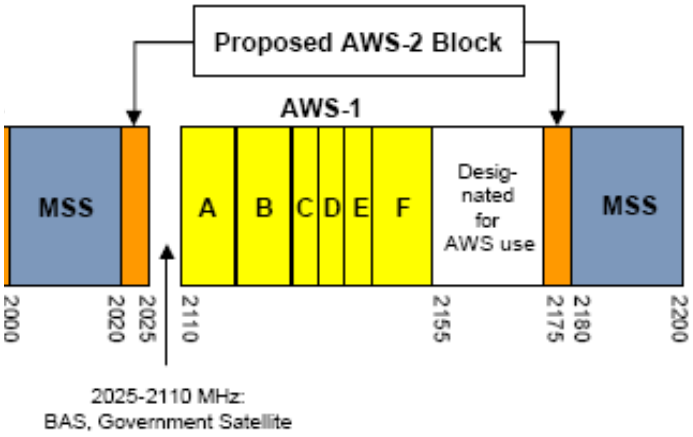

Figure 1 – AWS Bands.

Shown in Figure 1 are the AWS bands that may be impacted by operations in the 2155-2175 MHz AWS-3 band.[1] The use of AWS-1 block from 2110-2155 MHz is for base stations transmissions / mobile stations receivers, the impact would be to AWS-3 mobile receivers. AWS-2 Block, termed J-block, is proposed to be base station transmit/mobile receive in 2175-2180 MHz, impact would be to mobile station receivers. MSS operation from 2180-2200 MHz is mobile satellite service downlinks, if ancillary terrestrial component is used in the forward direction then this band would have base station transmit / mobile receive and the impact would be to mobile stations receivers. This appendix is focusing on the impact to mobile station receivers in the AWS-1 block.

Operations in the 2155-2175 MHz band could be either base stations or mobile stations. If base stations are deployed in AWS-3 then for compatible operations with AWS-1 receivers, the characteristics should be such that they are similar to base stations deployed with the AWS-1 base stations. Under this deployment scenario the impact to adjacent AWS-1 operations is no more than would be experienced between to AWS-1 blocks.

If mobile stations are operated in 2155-2175 MHz then there are two primary paths that need to be considered when evaluating the interference environment, the impact of the out-of-band emissions (both from spurious emissions and transmit noise power of the AWS-3 mobile transmitter) and the transmit power directly overloading the adjacent mobile receiver. Similar types of interference cases have previously been considered by the Commission in the AWS H-block proceeding.[2]

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[1] *See Notice* at ¶ 8

[2] Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands, *Notice of Proposed Rulemaking*, 19 FCC Rcd 19263 (2004).

The transmit power of an AWS-3 mobile device directly overloading the AWS-1 mobile can be characterized by the blocking performance of the AWS-1 mobile, this is a measure of the ability of the receiver to receive a desired signal in the presence of a strong interfering signal on any frequency and is described by its blocking specification agreed in the standards development groups (i.e. TIA, 3GPP or 3GPP2). This becomes an important specification when operating in an environment where strong signals could be encountered, such as the case in a mobile-to-mobile environment in a crowded public gathering where little isolation (path loss) is available. The interfering transmitter may be on a different frequency from that of the receiver and may even be modulated in a different way than the victim receiver is designed to demodulate. The blocking specification is a special case of the more general spurious response characteristic of a receiver. In general, handsets perform better than the blocking specifications developed by the standards organizations.

The out-of-band emissions from an AWS-3 transmitter will fall directly into the operating channel of an AWS-1 receiver. Since this power occupies the operating channel there is no ability for the AWS-1 receiver to overcome this interfering emission. In the standards bodies for 3GPP / 3GPP2 the minimum performance characteristics typically specify the level two forms if out-of-band emission, a wideband noise level (similar to an AWGN signal) or transmit spurious emissions.

Blocking performance and evaluation of AWS-3 mobile transmit power

The impact of an AWS-3 mobile transmitter on an AWS-1 receiver is dependant upon the blocking level of the AWS-1 receiver, the transmitted power of the AWS-3 mobile transmitter and the separation distance between the two mobiles. The minimum separation distance between the two handsets for which receiver blocking is not a problem can be found by:[3]

$$Loss = 27.6 - 20 * \log(d) - 20 * \log(f) = Rx_{BL} - P_{TX} + 6$$

or

$$\log(d) = \left(21.6 - 20 * \log(f) + P_{TX} - Rx_{BL}\right) / 20$$

Where:

- $Loss$ - Free space loss (dB)
- d - Distance between two mobiles (m)
- f - Frequency (MHz)
- P_{TX} - Transmit power of AWS-3 Block mobile device (dBm)
- Rx_{BL} - Blocker level of AWS-1 receiver (dBm)

[3] Assuming free space loss between the two handsets with each handset having an additional 3 dB of blockage of its signal. This is consistent with analysis methods used in the 3GPP standards organization where free space loss is used with each handset having 2 dB of loss from cable connectors and 1 dB from body loss, *see* 3GPP standard TS 25.942 on Radio Frequency (RF) system scenarios at table 4.1, http://www.3gpp.org/ftp/Specs/archive/25_series/25.942/25942-630.zip

Shown in Figure 2 is the relationship between the transmit power, separation distance and blocking specification. For example if a AWS-3 mobile is transmitting at a power of 200 mW and is separated from a AWS-1 receiver by 1 meter then no receiver overload would occur if the AWS-1 mobile receiver has a blocking level of -21 dBm or larger.

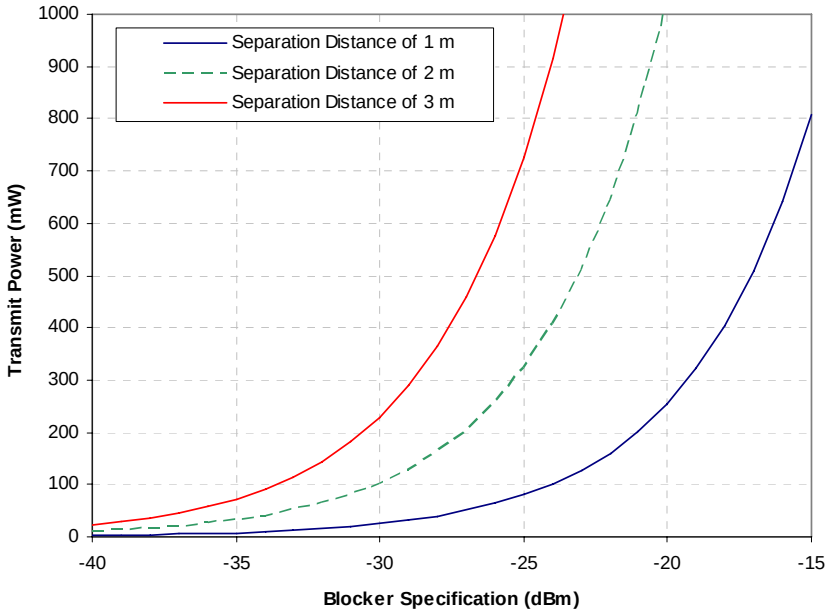

Figure 2 - Relationship between transmit power, separation distance and blocking specification.

One of the factors that impact the receiver blocking is the amount of isolation provided by duplexers, current AWS-1 duplexers do not provide much attenuation from operations in 2155-2175 MHz. Shown in Figure 3 is a measurement of the duplexer from a representative AWS-1 receiver, as shown there is only 1-2 dB of roll-off achieved from 2155-2175 MHz.

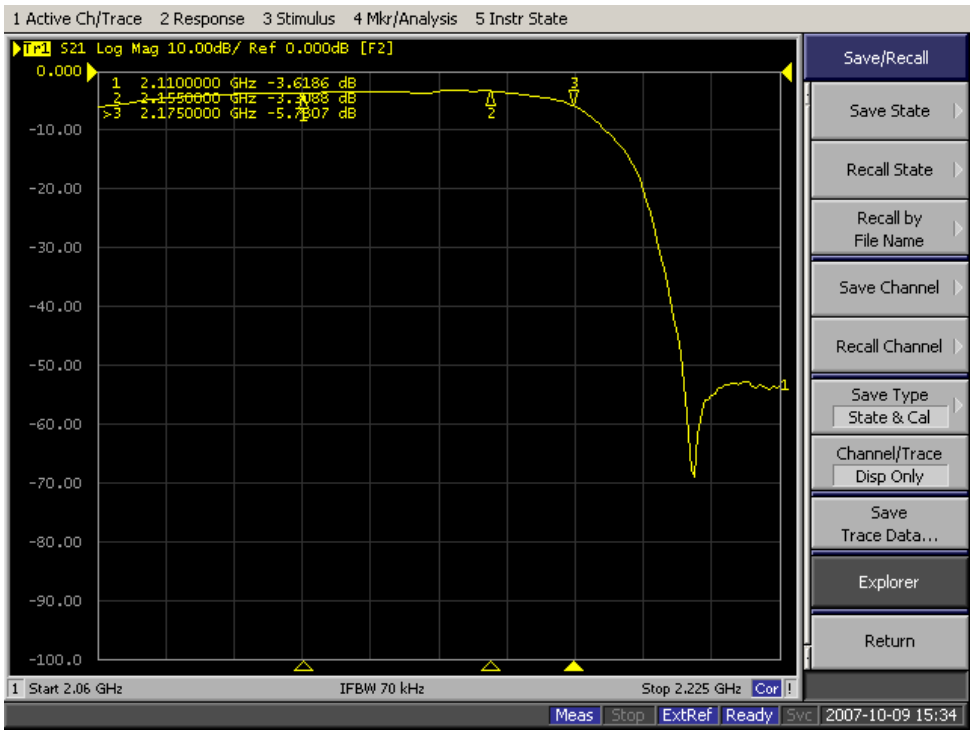

Figure 3 – AWS-1 Duplex attenuation in 2060-2225 MHz.

In order to evaluate the impact of blocking of AWS-1 operations from AWS-3 mobile transmitters we evaluated two test cases using the same approach outlined by CTIA in their H-Block test plan.[4] These test cases parameters are shown in Table 1, Ior is the received power level of the wanted AWS-1 signal and the Frame Error Rate (FER) was set by adding Additive White Gaussian Noise (AWGN). For each test case a call using a CDMA carrier was setup with the prescribed power and FER levels for AWS-1 channel 875 (center frequency of 2153.75 MHz).

Table 1 – Test Case Parameters

Test Case	Ior	FER rate
1	-100 dBm	0.75-1%
2	-105 dBm	4.5-5%

For each test case two types of interfering signals were considered, one an unmodulated signal and the other a CDMA modulated signal, each signal was located at three different center frequencies in 2155-2175 MHz. In the tables below the power level indicated for the interfering signal is that which caused the call on the AWS-1 channel to be dropped. If other measures of impact to the wanted signal are utilized, such as a percent increase in FER as was done with the CTIA measurements, the power levels would be reduced from that found in tables 2 and 3.[5]

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[4] Comments of CTIA – The Wireless Association, WT Docket No. 04-356, December 8, 2004..

[5] 3GPP Standard TS 25.101 v7.6.0 (2006-12), "User Equipment (UE) radio transmission and reception (FDD) (Release 7)" for band class IV (1710-1755 / 2110-2155 MHz) at table 7.6 has blocking requirements of -56 dBm at ±10 MHz offset and -44 dBm at ≤ 15 MHz offset for the condition where Bit Error Rate does not exceed 0.001. While CDMA Standards (C.S0011-C v2.0 – "Recommended Minimum

Table 2 – Unmodulated Interfering Signal

AWS-3 Center Frequency	Test Case 1 Ior = -100 dBm AWGN = -98.7 dBm	Test Case 2 Ior = -105 dBm AWGN = -107.3 dBm
2156.25 MHz	-22.4 dBm	-28.6 dBm
2157.5 MHz	-21.5 dBm	-29.3 dBm
2162.5 MHz	-19.9 dBm	-28.3 dBm

Table 3 – CDMA Modulated Interfering Signal

AWS-3 Center Frequency	Test Case 1 Ior = -100 dBm AWGN = -98.7 dBm	Test Case 2 Ior = -105 dBm AWGN = -107.3 dBm
2156.25 MHz	-29.0 dBm	-34.1 dBm
2157.5 MHz	-27.7 dBm	-34.2 dBm
2162.5 MHz	-27.0 dBm	-34.0 dBm

As expected from observing the duplexer parameters in Figure 3, there is only a few dB difference in the level required to drop a call if the AWS-3 transmitter is located either at the lower or higher part of the band. Based on these blocking levels for the CDMA modulated signal at 2157.5 MHz the transmit power level to cause a dropped call under worst case wanted signal conditions (test case 2) would be around 11 dBm for a 1 m separation and 25 dBm for a 5 m separation. For higher wanted signal levels (test case 1) the power level would be around 17 dBm for a 1 m separation and 31 dBm for a 5 m separation.

Out-of-Band emissions

Out-of-band emission from AWS-3 transmitters will fall with-in the operating channel of an AWS-1 receiver and may be present in two forms, wideband noise (similar to an AWGN signal) or transmit spurious emissions.

To determine the level of out-of-band emissions that a receiver is capable of tolerating and continue operation the same procedure described above is used but without an interfering carrier signal in the AWS-3 band. In this case the AWGN signal is increased for the two tests cases until the call drops, that level is noted. The out-of-band signal level shown below is this level minus the AWGN level that results in the prescribed FER rate required for each test case.

Performance Standard for cdma2000 Spread Spectrum Mobile Stations") do not specify receiver blocking characteristics for the AWS band class, the blocking requirement for the PCS band class has blocking requirements of -56 dBm at ±5 MHz offset and -44 dBm at ±7.5 MHz offset for the condition where FER does not exceed 10% with 90% confidence.

Table 4 – Out-of-band emissions performance

	Test Case 1 Ior = -100 dBm AWGN = -98.7 dBm	Test Case 2 Ior = -105 dBm AWGN = -107.3 dBm
Power Spectral Density	-159.7 dBm/Hz	-163.5 dBm/Hz
Power in 1.23 MHz Bandwidth	-98.8 dBm	-102.6 dBm

At a 1 m separation these measurements indicate the call would be dropped for out-of-band emissions levels from AWS-3 devices of -64.6 dBm/100 kHz and -68.4 dBm/100 kHz, respectively for test case 1 or 2.

For wideband noise comparison purposes a representative CDMA phone in the PCS band has wideband noise of approximately -122.5 dBm/Hz, for this device 37.2 dB of attenuation would be required under test case 1 and 41 dB of attenuation for test case 2.[6] Under the same propagation conditions indicated above[7], a separation distance of 62 cm would provide 41 dB of isolation.

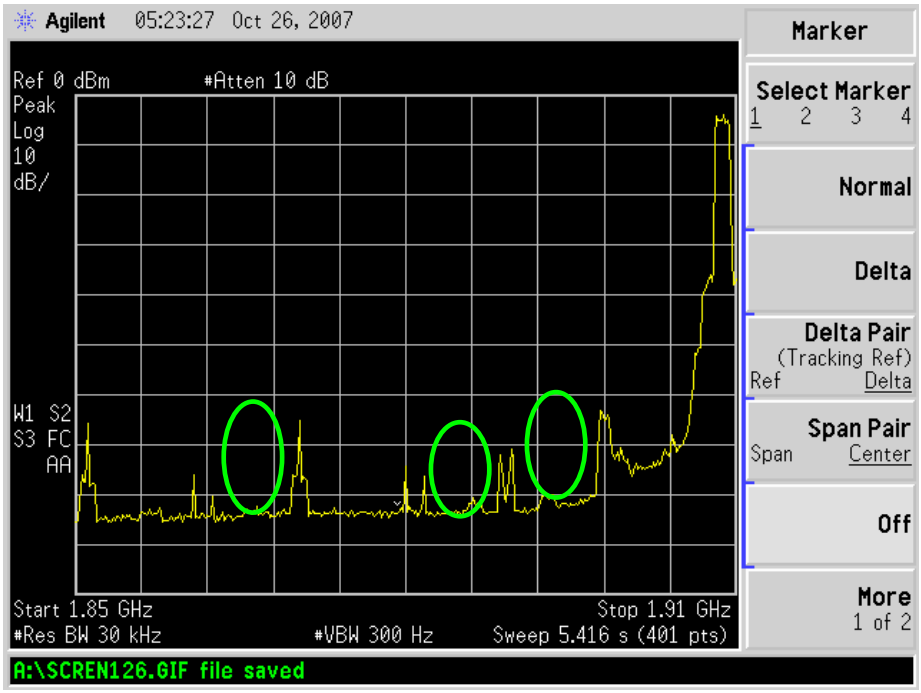

Figure 4 – Spurious emissions from CDMA PCS handset.

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[6] The offset frequency at which a device reaches the wideband noise floor will depend on the technology utilized in the device; generally narrowband equipment will reach the noise floor at smaller offset frequencies than wideband technologies.

[7] *See* n. 3 *supra.*

Table 5 – Spurious Power at antenna port

Offset for Spurious emission	Power level in 1.23 MHz Bandwidth
10.75 MHz	-37.8 dBm
21.625 MHz	-46 dBm
38.35 MHz	-48 dBm

For transmit spurious emissions comparison purposes Figure 4 indicates the spurs generated from a representative CDMA phone in the PCS Band. Three of the strongest spurs are indicated and fall at an offset from the center frequency of 10.75 MHz, 21.625 MHz and 38.35 MHz. Shown in Table 5 is the power level in a 1.23 MHz receiver bandwidth from each of the spurs. For the strongest spur of -37.8 dBm, 61 dB of attenuation would be required under test case 1 and 64.8 dB of attenuation would be required under test case 2 to avoid a call drop. Under the same propagation conditions indicated above,[8] a separation distance of just over 9.6 m would provide 64.8 dB of isolation.

It should be noted that for out-of-band emissions that FCC rules are typically in the -13 dBm/MHz range, the emissions shown above for both the spurious emissions and wideband emissions are well below that level.

[8] *Id.*