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November 17, 2008

VIA ELECTRONIC FILING

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, D.C. 20554

Re: *Ex Parte* Notice

AWS-3 Broadband Maximization Plan

Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band
WT Docket Nos. 07-195 and 04-356

Dear Ms. Dortch:

T-Mobile USA, Inc. ("T-Mobile") submits this ex parte to elaborate further on the benefits of adopting a bandplan that combines the 20 MHz AWS-3 band with the 10 MHz J Block (both uplink and downlink).[1/] This broadband maximization plan utilizing asymmetric pairing is far superior to the Commission's current bandplan proposal because it—

[1/] T-Mobile has proposed this approach in previous filings, and the proposal has drawn support from other parties. T-Mobile Further Notice Comments at 7-8; T-Mobile Further Notice Reply Comments at 12; Letter from Lynn R. Charytan, Counsel to T-Mobile, to Marlene H. Dortch, Secretary, FCC, WT Docket Nos. 07-195 and 04-356, at 2 (filed October 9, 2008); Letter from Kathleen O'Brien Ham, T-Mobile, to Marlene H. Dortch, Secretary, FCC, WT Docket Nos. 07-195 and 04-356, Exhibit - AWS-3 Interference, at 19 (filed September 18, 2008); Letter from Howard J. Symons, Counsel to T-Mobile, to Marlene H. Dortch, Secretary, FCC, WT Docket Nos. 07-195 and 04-356, Exhibit - AWS-3, at 8 (filed September 17, 2008); Letter from Kathleen O'Brien Ham, T-Mobile, to Marlene H. Dortch, Secretary, FCC, WT Docket Nos. 07-195 and 04-356, Exhibit - AWS-3 Lab Testing, at 10 (filed September 3, 2008); *see also* AT&T Further Notice Comments at 5-7; Ericsson Comments at 10-12; SpectrumCo Comments at 6-7; Terrestar Comments at 3; Letter from Mark Racek, Ericsson, to Marlene H. Dortch, Secretary, FCC, WT Docket Nos. 07-195 and 04-356, at 1-3 (filed October 31, 2008); Letter from Jeanine Poltronieri, AT&T, to Marlene H. Dortch, Secretary, FCC, WT Docket Nos. 07-195 and 04-356, Exhibit - AWS-3 & H-Block Interference Issues, at 4 (filed October 8, 2008); Letter from Patricia Paoletta, Counsel to 3G Americas, to Marlene H. Dortch, Secretary, FCC, WT Docket Nos. 07-195 and 04-356, at 6 (filed October 6, 2008); Letter from Mark Racek, Ericsson, to Marlene H. Dortch, Secretary, FCC, WT Docket Nos. 07-195 and 04-356, at 2 (filed September 26, 2008); Letter from Michael Lazurus, Counsel

- Enables faster and more robust broadband service than under any other proposal in the record;

- Allows new entrants (including but not limited to M2Z Networks, Inc. ("M2Z")) to provide wireless broadband services using a variety of technologies, including WiMAX;

- Increases spectral efficiency by as much as 40 percent by eliminating the need for guard bands or strict technical limitations;

- Does not preclude the Commission from imposing conditions on the AWS-3 license, including requiring the provision of free service; and

- Cures the significant interference problems identified by T-Mobile and other licensees in the adjacent AWS-1 and MSS spectrum, allowing broadband services to continue to develop fully in those spectrum bands as well.

The technical issue at the center of the debate over the 20 MHz of unpaired spectrum in the AWS-3 band has been how best to achieve efficient use of the band without causing harmful interference to AWS-1 licensees. The Commission's proposal to allow uplink operations in the AWS-3 band creates a risk of interference and has triggered a debate between those who argue vigorously that the Commission's proposed technical rules are too strict, and those on the other side who argue that they are not strict enough.

T-Mobile believes there is a better way to deploy services in the AWS-3 band: combine the AWS-3 band with both the uplink *and* downlink bands of the J Block. This approach will make possible faster speeds, maximize the efficient use of spectrum, permit new entry, and resolve the impasse over interference without risking harm to the customers of AWS-1 services. Under this broadband maximization plan, a provider would have 25 MHz of downlink bandwidth that would support bit rates of about 35 Mbps per sector. The 5 MHz uplink would support bit rates of about 4 Mbps per sector, sufficient for uploading videos and other bandwidth-intensive content. The proposed band plan is illustrated below.

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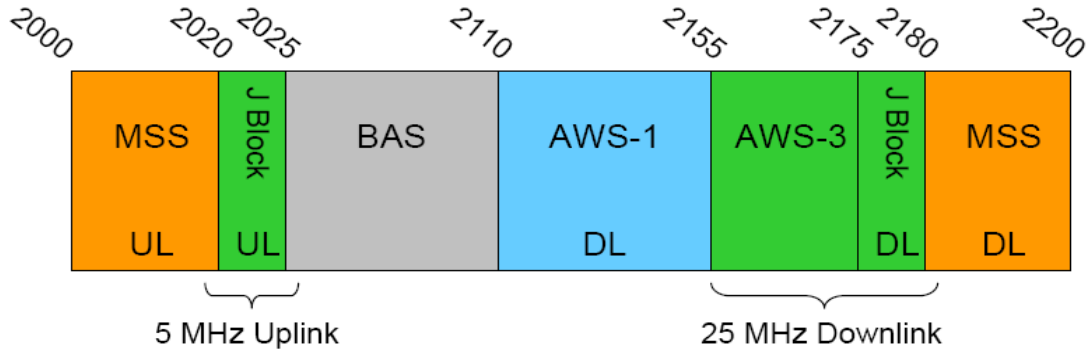
to MetroPCS, to Marlene H. Dortch, Secretary, FCC, WT Docket Nos. 07-195 and 04-356, Presentation, at 2 (filed July 15, 2008). The FCC itself contemplated that the AWS-3 spectrum could be paired asymmetrically with the J Block uplink. *Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band*, Notice of Proposed Rulemaking, 22 FCC Rcd 17035, 17046-47, 17050 ¶¶ 21, 29 (2007) ("*Initial Notice*").



Considerable effort has been expended in this proceeding to determine the best way to address AWS-1 interference concerns while not unnecessarily hamstringing AWS-3 operations. What many participants in the debate have overlooked, however, is whether the Commission's fundamental approach to the AWS-3 band should be to leave this 20 MHz of spectrum unpaired or to combine it with another band to create paired spectrum. T-Mobile believes that combining the AWS-3 band with the J Block would maximize the efficient use of unassigned spectrum, facilitate the deployment of two-way wireless broadband services, and eliminate the AWS-1 interference concerns entirely.

The benefits of asymmetrically pairing the AWS-3 band with both the uplink and downlink bands of the J Block are considerable. *First*, creating a 5 MHz band for uplink (2020-2025 MHz) and a separate 25 MHz band for downlink (2155-2180 MHz) make possible a far more efficient use of spectrum than allowing uplink and downlink operations in the AWS-3 band. Efficient use of spectrum has long been a fundamental goal of this agency[2/] and has been specifically mentioned by the Commission as a primary objective of this rulemaking proceeding.[3/] As described below, combining AWS-3 with the J Block would increase the *useable* spectrum to 30 MHz and provide an increase in overall spectral efficiency (bps/Hz) by as much as 40 percent.

The Commission has proposed in the *Further Notice* to combine the AWS-3 band with only the J Block *downlink* to create a 25 MHz unpaired block.[4/] As demonstrated by numerous

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[2/] 47 U.S.C. § 309(j)(3)(D); *see also, e.g.*, Federal Communications Commission, Strategic Plan 2009-2014, at 9 (rel. September 30, 2008) (identifying efficient use of spectrum as a strategic goal of the agency); *Spectrum IVDS*, Order, 23 FCC Rcd 8800, 8806 ¶ 18 (2008); *Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets*, Notice of Proposed Rulemaking, 15 FCC Rcd 24203, 24204 ¶ 2 (2000); *EFL Realty Trust*, File No. 0001852833, Order, FCC 08-245 ¶ 11 (rel. October 15, 2008).

[3/] *Initial Notice*, 22 FCC Rcd at 17036 ¶ 2.

[4/] *See Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band*, Further Notice of Proposed Rulemaking, 23 FCC Rcd 9859, 9860 ¶ 3 (2008) ("*Further Notice*").

commenters, the *Further Notice* plan would require significant limitations on transmission power in the AWS-3 frequencies,[5/] as well as the use of guard bands,[6/] to prevent harmful interference to AWS-1 devices. It would also inefficiently orphan the 5 MHz uplink band of the J Block.

The following table compares the capacity and efficiency of the *Further Notice*'s Time Division Duplexing ("TDD") approach with the asymmetric pairing approach described herein. In comparing these approaches, it is important to note that *asymmetric pairing would allow the licensee to choose among several variations of WiMAX technology, as well as Frequency Division Duplexing ("FDD") technologies.*[7/] In the table we compare the TDD and FDD

[5/] AT&T Further Notice Comments at 12-14, 27-28; CTIA Further Notice Comments at 35-37, 40; Ericsson Comments at 5; Motorola Further Notice Comments at 6-7, Appendix; Nokia Further Notice Comments at 34; SpectrumCo Comments at 4-5; T-Mobile Comments at 10-19; U.S. Cellular Corp Comments at 3-6; Verizon Wireless Initial Comments at 8-13.

[6/] In addition to T-Mobile, many other commenters have expressed the need for guard bands. *See, e.g.,* AT&T Further Notice Comments at 16, 27-28; Motorola Further Notice Comments at 6-7, Appendix; Nokia Further Notice Comments at 3-4; SpectrumCo Further Notice Comments at 4-5; U.S. Cellular Corp Further Notice Comments at 6; Verizon Wireless Initial Comments at 8-13. Both the European Conference of Postal and Telecommunications Administrations ("CEPT") and the United Kingdom's Office of Communications ("Ofcom") support the use of guard bands between time division duplex ("TDD") and frequency division duplex ("FDD") spectrum. CEPT Report 19, Report from CEPT to the European Commission in Response to the Mandate to Develop Least Restrictive Technical Conditions for Frequency Bands Addressed in the Context of WAPECS, Appendix IV: Block Edge Masks for 2.6 GHz Band, at 69-77 (December 21, 2007); Office of Communications of the United Kingdom, On the Impact of Interference from TDD Terminal Stations to FDD Terminal Stations in the 2.6 GHz Band, at 15 ¶ 4.21 (April 21, 2008). Further, the Korean allocation in the 2.3 GHz band for WiBro, the 802.16e (*i.e.*, mobile WiMAX) compatible broadband wireless system, requires 4.5 MHz guard bands to separate the three WiBro bands and a 10 MHz guard band at the edge of the WiBro band. *See* Case Study of Mobile Broadband Wireless Access: WiBro Service, Technologies and Market, Samsung Electronics and KT, The Republic of Korea, The Asia-Pacific Telecommunity (APT) Wireless Forum Interim Meeting 2006 (February 17, 2006). In its Reply Comments, M2Z analyzes the efficiency of TDD use in the AWS-3 band but only estimated use of a 2 MHz guard band. *See* M2Z Reply Comments, Technical Appendices at 29. However, consistent with the comments of Intel and the out-of-band emissions ("OOBE") limit of 60 + 10 log (P) dB proposed by the Commission, T-Mobile believes the more appropriate assumption is a 5 MHz guard band for TDD operations in the AWS-3 band.

[7/] The WiMAX standard includes an FDD version and a hybrid version half-frequency division duplex (H-FDD) in addition to TDD. TDD transmits uplink and downlink data using the same channel but at different times and can be implemented in a single unpaired spectrum block whereas FDD uses two distinct channels and paired spectrum. H-FDD has attributes of both TDD and FDD in that uplink and downlink data are transmitted at different times but on different frequencies using paired spectrum. *See* IEEE Std. 802.16^{TM}-2004, IEEE Standard for Local and Metropolitan Area Networks, Part 16: Air Interface for Fixed Broadband Wireless Access Systems, 1 October 2004 and IEEE Std. 802.16e^{TM}-2005, IEEE Standard for Local and Metropolitan Area Networks, Part 16: Air Interface for Fixed and Mobile

versions of WiMAX. To provide a conservative comparison, TDD was assumed to have the maximum channel asymmetry ("DL/UL") of 3:1[8/] and to use multi-antenna signal processing ("MAS") techniques such as spatial division multiple access ("SDMA") to increase efficiency in the downlink and uplink.[9/] A total guard band of 10 MHz (5 MHz per band edge) was assumed, although greater separation in frequency may be required depending upon the emission limits.[10/] Although FDD can also employ MAS,[11/] the use of MAS was not assumed for FDD giving further advantage in this analysis to TDD.

Broadband Wireless Access Systems, 28 February 2006. The WiMAX Forum has created system profiles for the 3.3 GHz, 2.5 GHz and 3.5 GHz bands that include TDD and FDD implementations.

8/ TDD channel asymmetry can be varied over a limited range. WiMAX, for example, supports downlink/uplink ratios of between 1:1 to 3:1 *See* Mobile WiMAX – Part II: A Comparative Analysis, WiMAX Forum, May 2006 at 7; *see also* Letter from Douglas A. Hyslop, Wireless Strategy, to Marlene H. Dortch, WT Docket Nos. 07-195 and 04-356, at 2 n.6 (filed August 25, 2008) ("Wireless Strategy Ex Parte") ("Further, the reverse link budget and latency depend on the amount of time allocated for the uplink, defining a minimum uplink timing split of 30-35%.").

9/ Although MAS technologies such as SDMA are not supported in the current WiMAX profiles, they have been proposed for future implementations of WiMAX. For the purpose of this analysis, we use an MAS gain of 1.3 X, based on the use of a four-antenna array per sector, consistent with the analysis by Wireless Strategy. We also use an *average* spectral efficiency per sector of 1.4 bps/Hz for the downlink and 0.8 bps/Hz for the uplink. *See* Wireless Strategy Ex Parte at 1-6.

10/ Intel, a major manufacturer of WiMAX chipsets, has recommended a 5 MHz guard band adjacent to the AWS-1 band, consistent with the recent EU policy for the 2500-2690 MHz band. *See* Letter from Mike Chartier, Director, Spectrum Policy, Intel Corporation, to Marlene H. Dortch, Secretary, FCC, WT Docket Nos. 07-195 and 04-356, at 1 (filed October 14, 2008).

11/ MAS technology also can be applied to FDD systems, but usually with reduced accuracy since the downlink and uplink channels are not symmetric due to the separation in frequency. Nevertheless, MAS has been successfully applied to current FDD technologies like GSM and WCDMA, including high-speed packet access (HSPA), to increase capacity and spectral efficiency. Similarly, it can be applied to the FDD and H-FDD versions of WiMAX. *See* Arraycomm, MAS in Practice, *available at* http://www.arraycomm.com/docs/20080902_A-MAS-3i_for_Enhanced_HSDPA_Data_Rates.pdf.

	FNPRM Approach	Alternate Approach
Band	AWS-3 + J block DL	AWS-3 + J block
Duplex Approach	TDD	FDD
Total Spectrum-MHz	25.0	30.0
Guard Band-MHz	10.0	0.0
Useable Spectrum-MHz	15.0	30.0
Time Asymmetry	3.0	
DL Bandwidth-MHz	9.5	25.0
DL Spectral Efficiency-bps/Hz	1.4	1.4
AAS Gain	1.3	1.0
DL Capacity-Mbps	17.2	35.0
UL Bandwidth-MHz	5.5	5.0
UL Spectral Efficiency-bps/Hz	0.8	0.8
AAS Gain	1.3	1.0
UL Capacity-Mbps	5.7	4.0
Total Capacity-Mbps	23.0	39.0
Channel Asymmetry	3.0	8.8
Overall Efficiency-bps/Hz	0.92	1.30
Capacity Advantage		**41.4%**

As shown in the table, the asymmetric paired FDD plan increases the *usable* spectrum to 30 MHz—15 MHz more than provided by TDD as proposed in the *Further Notice* by eliminating the need for guard bands to avoid interference to neighboring licensees. It also provides significantly greater capacity per sector—despite assuming that MAS technology is applied only to TDD—with an increase of over 40 percent in overall spectral efficiency (bps/Hz).[12/]

Second, combining the AWS-3 band with the J Block facilitates the deployment of robust, two-way wireless broadband services. Asymmetric pairing[13/] matches well with the demand for broadband capability, which is overwhelmingly focused on downloads. With 25 MHz of downlink spectrum, a provider could offer average download bit rates of about 35 Mbps per sector. A 5 MHz uplink would provide users with an average upload bit rate of about 4 Mbps per sector, sufficient for uploading videos and other bandwidth intensive content.[14/] The

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[12/] A service provider could choose to implement the H-FDD version of WiMAX instead of an FDD technology. H-FDD allows full FDD operations while retaining some of the characteristics of TDD, *e.g.*, the user terminals are simpler and less expensive since they cannot simultaneously transmit and receive. However this factor, coupled with the limited channel asymmetry (a maximum of 3:1) of TDD terminals results in less effective use of asymmetrically paired spectrum than the FDD approach.

[13/] Asymmetric pairing typically involves pairing larger-sized downlink (base station transmission) spectrum blocks with smaller uplink (mobile transmission) spectrum blocks.

[14/] Note that these are average speeds per sector. In a typical deployment, an average downlink capacity of 35 Mbps per sector can support considerably greater peak download data rates. Similarly, an average uplink capacity of 4 Mbps per sector can support considerably greater peak upload data rates. Thus, a

Commission itself has acknowledged that "[s]uch an approach may be well-suited for high data rate Internet applications, such as video-streaming" and that providing additional spectrum for download transmissions could offer great potential for meeting the spectral demands of the data-centric applications being deployed for the next generation of wireless broadband services.[15/]

The fact that most Internet traffic is asymmetric, with greater traffic in the downstream direction, makes asymmetric pairing a highly efficient spectrum arrangement for broadband services.[16/] The WiMAX Forum projects *average* wireless traffic asymmetry (DL/UL) of about 5:1 in the near term—increasing to over 6:1 in the future.[17/] In fact, traffic asymmetry can be even greater due to local and temporal variations.[18/] As shown in the above table, the maximum channel asymmetry of the TDD band plan in the *Further Notice* is 3:1. By contrast, pairing the AWS-3 band with the J Block increases channel asymmetry to 8.8:1 and allows the licensee to deal with projected lopsided traffic ratios.

Third, not only does asymmetric pairing allow an AWS-3 licensee to operate without strict technical rules, it also retains the possibility that a new entrant could win the license and offer two-way wireless broadband services. When it earlier considered restricting the unpaired AWS-3 band to downlink-only use, the Commission expressed reservations that "a downlink-only approach would inhibit new entry into this band by potential providers that may not be licensed to use spectrum in other bands."[19/] Pairing AWS-3 with the J Block makes it possible to limit the 2155-2180 MHz band to downlink-only use, yet still afford an opportunity for a new entrant. Further, asymmetric pairing does not prevent the Commission from imposing social conditions on an AWS-3 licensee—including free broadband—to the extent it finds those conditions to be in the public interest.

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typical deployment could provide enough bandwidth capacity to support simultaneous uploading and downloading of videos and other bandwidth intensive content.

[15/] *Initial Notice*, 22 FCC Rcd at 17046-47 ¶ 21. In addition, asymmetric pairing also is contemplated by standards bodies. *See, e.g.*, 3GPP TS 25.101 v.7.5.0.

[16/] Traffic asymmetry is measured by the ratio of downlink traffic (DL) to uplink traffic (UL).

[17/] Traffic asymmetry is usually greater for consumer data than for business data. For example, the WiMAX Forum studies project traffic asymmetry in 2015 of about 8:1 for consumer data but only 6:1 for business data. *See* WiMAX Forum, A Review of Spectrum Requirements for Mobile WiMAX™ Equipment to Support Wireless Personal Broadband Services, at 27, 31 (September 2007); *see also* UMTS Forum, Report No. 33, 3G Offered Traffic Characteristics Final Report (November 2003).

[18/] The traffic generated by individual users can be highly asymmetric in either direction. Some kinds of applications (*e.g.*, web browsing) would lead to significant asymmetry, with more downlink traffic than uplink traffic in a mobile network. Others are typically symmetric (*e.g.*, voice and video telephony). Others may be asymmetric in the opposite direction (*e.g.*, uploading photographs). The general trend for aggregated traffic, however, is increasingly asymmetric in the downlink.

[19/] *Initial Notice*, 22 FCC Rcd at 11047 ¶ 21.

Finally, combining the bands would eliminate the concerns that AWS-3 operations would cause harmful interference to adjacent AWS-1 licensees.[20/] In its *Further Notice*, the Commission proposed a 23 dBm/MHz power limit and a 60 + 10 log (P) dB OOBE limit on AWS-3 mobile devices to protect adjacent AWS-1 operations.[21/] By using the J Block uplink (2020-2025 MHz), these interference concerns go away,[22/] and with them the need for strict power and OOBE limits. Indeed, with separate uplink and downlink bands, AWS-3 devices could operate at the more relaxed 33 dBm/MHz power limit and 43 + 10 log (P) dB OOBE limit that M2Z proposes.[23/]

In the end, the benefits of asymmetrically pairing AWS-3 with the J Block far outweigh the risks and encumbrances that would necessarily attend any effort to permit uplink operations in the AWS-3 band. Indeed, this broadband maximization plan offers faster speeds and higher efficiencies while permitting the use of higher power mobile devices without raising the concern of harmful interference that has dominated this proceeding.

We respectfully ask the Commission to consider this option fully. The Commission is obliged to carefully consider this "responsible alternative" submitted by T-Mobile.[24/] When it does, we believe that the Commission will conclude that this alternative achieves all of the objectives of this proceeding more fully than the proposal put forward in the *Further Notice*.

Sincerely,

/s/

Thomas J. Sugrue
Vice President, Government Affairs

[20/] *See, e.g.*, Letter from David Shively, AT&T, David Urban, Comcast, Charles Jackson, CTIA, Jonas Naslund, Ericsson, Bill Alberth, Motorola, Randy Leenerts, Nokia, Vish Nandall, Nortel, Roberto Padovini & Jamshid Khun-Jsuh, QUALCOMM, Cole Brodman & Neville Ray, T-Mobile, Jeff Baenke, U.S. Cellular, to Chairman Martin and Commissioners, Copps, Adelstein, Tate and McDowell, FCC, WT Docket Nos. 07-195 and 04-356 (filed October 20, 2008).

[21/] *Further Notice*, 23 FCC Rcd at 9860 ¶ 3.

[22/] By setting the duplexing direction of the 2155-2180 MHz band for downlink-only use—as was done in the AWS-1 band—the Commission would bring the AWS-3 band into harmony with adjoining AWS-1 and Mobile Satellite Service ("MSS") licensees and group all downlink bands together. *See* T-Mobile Further Notice Comments at 23-24. In addition, M2Z's concerns that AWS-1 base stations would interfere with AWS-3 base stations would be eliminated.

[23/] M2Z Networks Further Notice Comments at 2.

[24/] *See American Radio Relay League, Inc. v. FCC*, 525 F.3d 227 (D.C. Cir. 2008) (agency has a "duty to consider responsible alternatives to its chosen policy and to give a reasoned explanation for its rejection of such alternatives"); *Yakima Valley Cablevision, Inc. v. FCC*, 794 F.2d 737, 746 n.36 (D.C. Cir. 1986).