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December 2, 2008

VIA ELECTRONIC FILING

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

Re: *Ex Parte* Notice
WT Docket Nos. 07-195 and 04-356
Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band

Dear Ms. Dortch:

T-Mobile USA, Inc. ("T-Mobile") submits this letter to provide more details about its proposed AWS-3 Broadband Maximization Plan[1/] and to respond to M2Z Networks, Inc.'s ("M2Z's") unfounded criticism of the plan.

T-Mobile's Broadband Maximization Plan would combine the 20 MHz AWS-3 band with the 10 MHz J Block (both uplink and downlink) in an asymmetric pairing that would support downstream bit rates of about 35 Mbps per sector and upstream bit rates of about 4 Mbps per sector. This truly high-speed offering stands in contrast to the 17 Mbps downstream bit rates that would be available under the plan proposed in the *Further Notice* and is orders of magnitude faster than the 768 kbps that would be available under the mandated "free broadband" offering.[2/]

[1/] *See* Letter from Thomas J. Sugrue, T-Mobile, to Marlene H. Dortch, Secretary, FCC, WT Docket Nos. 07-195 and 04-356 (filed November 17, 2008) ("Broadband Maximization Plan Letter"). Contrary to M2Z's unfounded assertion that the asymmetric pairing proposal is "being brought up to further delay a decision on AWS-3," Letter from Uzoma Onyeije, M2Z Networks, to Marlene H. Dortch, Secretary, FCC, WT Docket Nos. 07-195 and 04-356, at 2 (filed November 24, 2008) ("M2Z November 24 Letter"), the FCC itself contemplated that the AWS-3 spectrum could be paired asymmetrically with the J Block uplink and the proposal has been the subject of comments for months. Broadband Maximization Plan Letter at 1 n.1.

[2/] *See Service Rules for Advanced Wireless Services*, Further Notice of Proposed Rulemaking, 23 FCC Rcd. 9859, 9860 (2008) ("*Further Notice*"). As one prominent public interest group recently noted, the proposed 768 kpbs is "already *below* the lowest available speed offered by commercial cable modem providers." Free Press Comments, WC Docket No. 05-337, at 23 (filed November 26, 2008) (emphasis in original).

While M2Z raises a hodge-podge of complaints about the plan,[3/] none of them can refute T-Mobile's showing that asymmetric pairing will enable the use of AWS-3 for broadband without any possibility of harmful interference.[4/] And M2Z's primary claim—that asymmetric pairing forecloses the use of Time Division Duplexing ("TDD") and requires the use of allegedly less spectrally efficient Frequency Division Duplexing ("FDD")—elevates form over substance, ignoring the practical limitations on the use of TDD in the AWS-3 band that would in fact render it a less efficient choice than FDD. For instance, TDD operations in the AWS-3 band would require strict limitations on transmission power and out-of-band emissions ("OOBE") as well as the use of guard bands, reducing the net amount of usable spectrum. By contrast, more relaxed limits and no guard bands would be possible under the Broadband Maximization Plan, rendering it more spectrally efficient overall than the use of TDD in only a portion of the band. TDD is also not inherently a more efficient technology for broadband precisely *because* it has a limited capability to handle the highly asymmetric data typical of consumer Internet traffic.

Even if TDD is not an option in an asymmetric pairing arrangement, the Broadband Maximization Plan is hardly "technologically biased," as M2Z asserts. To the contrary, M2Z or any other company has a choice of several different technologies to implement in asymmetric pairing, including several variations of WiMAX technology.[5/] WiMAX includes two variations that work in paired spectrum and a variety of 3G and 3.5G technologies as well as LTE that can be used in an asymmetrically paired configuration.[6/]

In the final analysis, M2Z's comparison of TDD and FDD, even if it were accurate, is irrelevant to the overarching considerations in this proceeding: which plan maximizes the use of all available spectrum most efficiently to deliver the highest speeds to consumers with the least risk of interference to other providers and their customers. On these crucial points, T-Mobile's Broadband Maximization Plan is clearly superior.[7/]

[3/] Letter from Uzoma Onyeije, M2Z Networks, to Marlene H. Dortch, Secretary, FCC, WT Docket Nos. 07-195 and 04-356 (filed November 20, 2008) ("M2Z November 20 Letter").

[4/] Notwithstanding M2Z's claims to the contrary, substantial concerns remain about the harmful interference that would be created by M2Z's proposed use of the AWS-3 band. *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).

[5/] Broadband Maximization Plan Letter at 4.

[6/] *Id.* at 4 n.7.

[7/] The Broadband Maximization Plan will (1) enable faster and more robust broadband service than any other proposal in the record; (2) allow new entrants (including but not limited to M2Z) to provide wireless broadband services using a variety of technologies, including WiMAX; (3) increase spectral efficiency by

TDD Use in the AWS-3 Band Would Require Guard Bands, Reducing Capacity

Whatever the virtues of TDD, a proper analysis of its relative spectral efficiency depends in no small measure on the amount of spectrum that would be available for a TDD system. In this crucial regard, the *Further Notice* plan falls short of the Broadband Maximization Plan because of the substantial amount of AWS-3 spectrum that would have to be devoted to guard bands under the former. While M2Z argues that T-Mobile's assumption of 10 MHz for guard bands is flawed,[8/] in fact every entity that has studied the issue has concluded that at least a 5 MHz guard band is required wherever TDD and FDD operations are located in adjacent bands.[9/] Even M2Z has conceded it will need to use at least 4 MHz for guard bands on the AWS-3 band edges.[10/]

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approximately 40 percent by eliminating the need for guard bands or strict technical limitations; (4) permit the Commission to impose conditions on the AWS-3 license, including requiring the provision of free service; and (5) cure the significant interference problems identified by T-Mobile and other licensees in the adjacent AWS-1 and Mobile Satellite Service ("MSS") spectrum, allowing broadband services to continue to develop fully in those spectrum bands as well. Broadband Maximization Plan Letter at 2.

8/ M2Z November 20 Letter at 3.

9/ The technical rules for the European 2500-2690 MHz band require a separation of 5 MHz between the edge of the TDD spectrum block and the FDD spectrum block. Commission Decision of 13 June 2008 on the harmonization of the 2500-2690 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community (2008/477/EC) ("Commission Decision of 13 June 2008"). 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 TDD and FDD spectrum. Ofcom specifically found that for macrocell deployment, *e.g.*, 1 km cells, a 5 MHz guard band is required. Ofcom further specified that the 5 MHz can be left unused as a guard band or be used for "restricted" operations with TDD picocell deployments (cell range of 100 meters). 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) ("Ofcom Report"). 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). Many commenters in this proceeding have noted the need for guard bands if mobile TDD operations are authorized on the AWS-3 band. *See, e.g.*, AT&T Further Notice Comments at 16, 27-28; Motorola Further Notice Comments at 6-7, Appendix; New ICO Satellite Services Further Notice Comments at 3-4; 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; 3G Americas Further Notice Reply Comments at 9; 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).

10/ *See* M2Z Further Notice Reply Comments, Technical Appendices at 29.

Although 4 MHz would be inadequate to avoid harmful interference, asymmetric pairing would still be more spectrally efficient when guard band sizes are 4 MHz or greater.[11/]

While M2Z now suggests it could utilize low power picocells at the edges of the AWS-3 band,[12/] that assertion is inconsistent with its prior statements that its network would be engineered to have fewer wireless towers and base stations than conventional cellular telephone networks.[13/] Such an architecture implies large macrocells and essentially rules out picocells. Even if M2Z did decide to change course and deploy picocells, however, they would not be an alternative to a macrocell deployment. Although picocells could be deployed in "hot spots" like train stations and airport lounges, with their small coverage area (*e.g.*, 100 meter cell radius) they would not be practical or economical, as part of the primary deployment of M2Z's network. And the use of picocells could be problematic, since, according to Ofcom, TDD terminals operating in a restricted 5 MHz guard band would be subject to interference.[14/]

M2Z's claim that TDD is more efficient than FDD relies on *everything else being equal*. In fact, everything else is *not* equal. The need for guard bands reduces the net amount of spectrum that TDD can use. The Broadband Maximization Plan will need no guard bands, making the asymmetric pairing approach more efficient.

[11/] This can be easily derived from the table in the Broadband Maximization Plan Letter. Minimizing the use of guard bands maximizes spectrum efficiency because guard bands are effectively vacant lots in the spectrum band, denying full potential use of spectrum up to the band edge. *See Service Rules for the 698-746, 747-762 and 777-792 MHz Bands*, Second Report and Order, 20 FCC Rcd. 15289, 15325 ¶ 78 (2007) (limiting a band plan to two, rather than four, internal guard bands "allows increases in network capacity and higher data throughput rates even with existing technologies" because there would be no "loss of usable spectrum" from the additional guard bands); *Reallocation of the 216-220 MHz, 1390-1395 MHz, 1427-1429 MHz, 1429-1432 MHz, 1432-1435 MHz, 1670-1675 MHz, and 2385-2390 MHz Government Transfer Bands*, Report and Order and Memorandum Opinion and Order, 17 FCC Rcd. 368, 393 ¶ 57 (2002) (noting that the ability to operate without a guard band makes "spectrum use more efficient").

[12/] M2Z November 20 Letter at 3.

[13/] Leslie Cauley, *Start-Up Wants to Provide Free Broadband*, USA TODAY (September 3, 2008), *available at* http://www.usatoday.com/tech/products/services/2008-09-02-m2z-free-broadband_N.htm.

[14/] According to Ofcom, the 5 MHz block immediately adjacent to an FDD downlink will be subject to restrictions on the base station power levels in order to mitigate intrasystem base-station to base-station interference. Ofcom notes, however, that there is a risk of significant interference to TDD terminal stations operating in the restricted 5 MHz block. *See* Ofcom Report at 15, 18.

TDD Has Limited Advantages in the Provision of Broadband Service

TDD is not inherently more suited than FDD for the delivery of broadband services, and in fact may be *less* suited to this task. This is because TDD is limited to a *maximum* channel asymmetry (downlink/uplink ("DL/UL") ratio) of 3:1,[15/] and may not be as efficient as asymmetrically paired FDD in dealing with the highly asymmetric traffic that characterizes consumer broadband Internet use. Internet Service Providers typically offer asymmetries of 5:1 to over 10:1 to match the increasingly asymmetric nature of data traffic.[16/] Asymmetric pairing can better match these data asymmetries. In contrast with TDD's limitations in this regard, the Broadband Maximization Plan provides asymmetry of 8.8:1.[17/]

M2Z suggests TDD can be implemented to respond to the time-varying nature of data asymmetry.[18/] While this might be true for an isolated system, TDD base stations generally must be synchronized to prevent intra-system interference that occurs when a base station is transmitting when another is receiving.[19/] The number of TDD base stations that would need to

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[15/] 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, Secretary, FCC, 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%.").

[16/] *Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band*, Notice of Proposed Rulemaking, 22 FCC Rcd. 17035, 17046-47 ¶ 21 (2007) ("*Initial Notice*"). Also WiMAX Forum studies project traffic asymmetry in 2015 of about 8:1 for consumer data and 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).

[17/] Broadband Maximization Plan Letter at 7.

[18/] M2Z November 20 Letter at 2.

[19/] *See* Wireless Strategy Ex Parte at 2 n.6. ("While the time dedicated to downlink versus uplink may be adjusted in TDD systems, the same setting must be defined for all sites in a city to prevent intra-system interference; otherwise, a TDD base station may be transmitting at the same instant that a nearby base station may be receiving."), *see also* WiMAX Forum, Mobile WiMAX – Part I: A Technical Overview and Performance Evaluation, at 16 (August 2006); WiMAX Forum, Mobile WiMAX – Part II: A Comparative Analysis, at 32 (April 2006); Hughes Network Systems, Airlink Management in Point-to-Point Systems: An Examination of FDMA, FDD, and TDD, at 10 (2002), *available at* http://www.hughes.com/HUGHES/Doc/0/7QT8MAJUREKKB67P9DN841TF9C/Airlink_management.pdf ("To mitigate these situations, TDD systems synchronize transmit and receive system wide as best they can in an attempt to restrict any remote unit or hub from transmitting when another is receiving on the same frequency.…This transmit/receive synchronization locking carries a significant penalty in limiting the flexibility of TDMA and dynamic bandwidth reassignment — in fact, defeating its whole purpose.").

be synchronized in a nationwide deployment would make it virtually impossible to vary dynamically the number of time slots allocated to the uplink and downlink. As a result, a fixed allocation along the lines of 1:1 or 3:1 is established at the start and would be changed only on an occasional and predetermined basis. While M2Z argues that the efficiency of FDD will be reduced when the volumes of upstream and downstream data traffic differ from the design assumptions, this is equally true for TDD: with a DL/UL ratio of only 3:1, TDD will always operate inefficiently assuming a data asymmetry of 8:1.

M2Z's Claims About Relative Efficiency Are Unfounded

Without any support, M2Z claims that TDD is "50% more efficient" than FDD when the combined effects of Adaptive Antenna Systems ("AAS") are taken into account.[20/] As demonstrated above, however, TDD is not a more efficient technology for delivering broadband service in the AWS-3 band. In any event, M2Z's claim is simply inaccurate. T-Mobile's analysis is an apples-to-apples comparison of WiMAX TDD with WiMAX FDD in asymmetric pairing. It assumed TDD use of AAS and multi-antenna signal process ("MAS") techniques such as Spatial Diversity Multiple Access ("SDMA").[21/] T-Mobile even assumed the FDD system would not employ MAS, even though FDD systems can and do employ these techniques, giving an artificial advantage to TDD in its analysis.[22/] Many techniques, such as higher order modulations apply to both TDD and FDD systems and "improvements" in spectrum efficiency from these techniques would also apply to both FDD and TDD.

Even assuming arguendo, as M2Z asserts,[23/] that TDD in the AWS-3 band offers 50 percent more capacity, then the overall capacity would be 34.5 Mbps. That is still less than the 39 Mbps capacity offered in the asymmetric FDD approach.[24/] Even with that capacity, TDD only provides 3:1 channel asymmetry – which as noted above is inadequate for real world data traffic.

Asymmetric Pairing Avoids Orphaning the Lower J Block

Contrary to M2Z's claim, our inclusion of the lower J Block (2020-2025 MHz) does not "skew[] the capacity comparison in favor of [our] proposal."[25/] We used the same metric—bits per second/MHz—to compare the spectrum efficiency of both proposals. That metric takes the additional spectrum into account and provides the "apples to applies comparison" that M2Z

[20/] M2Z November 20 Letter at 3.

[21/] Broadband Maximization Plan Letter at 5

[22/] *Id.*

[23/] M2Z November 20 Letter at 3.

[24/] Broadband Maximization Plan Letter at 5.

[25/] M2Z November 20 Letter at 3.

purports to demand, and demonstrates clearly that the Broadband Maximization Plan produces more capacity per unit of spectrum.[26/] Moreover, utilizing this band for the uplink portion avoids orphaning the lower J Block spectrum, which would leave it with little value.[27/] Although other uses have been proposed, none would provide the capacity and efficiency achievable through pairing this band with the combined AWS-3 band. As T-Mobile has demonstrated, the highest and best use of the orphaned J Block uplink is to combine it in an asymmetric pairing for the provision of wireless broadband services.[28/] A combined, simultaneous auction of the AWS-3 band and the J Block with multiple geographic licenses will allow multiple new entrants to provide wireless broadband services.[29/]

[26/] Broadband Maximization Plan Letter 6.

[27/] The FCC itself has found that the lower J Block is "best suited" for AWS use as an uplink. *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*, Sixth Report and Order, Third Memorandum Opinion and Order, and Fifth Memorandum Opinion and Order, 19 FCC Rcd. 20720, 20742-43 ¶¶ 46-47 (2004).

[28/] M2Z has proposed, for example, that the uplink could be used for essentially narrowband unlicensed local area network operations that are short distance and low power such as home monitoring, cordless telephones, personal monitoring networks and wireless microphones. *See* M2Z November 24 Letter at 2-3. These functions are all supported in a number of unlicensed bands, *e.g.*, 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz among others, and by ultra wide broadband ("UWB"). The Commission also has made the millimeter wave band (57-64 GHz) available for use by unlicensed devices, noting that this spectrum would be suitable for short-range, high data rate applications. M2Z also proposes that the uplink could be used for telemetry and data services, citing AirCell comments in this proceeding that the AWS-3 band be made viable for use by air-to-ground ("ATG") broadband providers. AirCell's request, however, was for a 5 MHz band to be used for downlink only base station operations, which would be compatible with adjacent band AWS-1 downlink. M2Z's proposal, however, would put a downlink band adjacent to an MSS uplink band. (The MSS band is also adjacent to the H-block downlink band). As a result, base stations transmitting adjacent to the MSS band may cause interference to the sensitive satellite receivers through overload and out-of-band emissions. *See* Letter from David Cavossa, Satellite Industry Association, to Ms. Marlene H. Dortch, Secretary, FCC, ET Docket No. 00-258 and IB Docket No. 99-81, at 2 (filed August 31, 2004).

[29/] M2Z has suggested that, since a licensee could pair the AWS-3 band with any suitable spectrum block, the Commission should move forward with service and technical rules for a nationwide license for the unpaired AWS-3 band, while examining asymmetric pairing of the J-block uplink in a Further Notice. M2Z November 24 Letter at 3. This essentially would preclude any new entrant that does not have spectrum suitable for the uplink from employing the more efficient asymmetrical pairing approach. With a sequential auction, a new entrant would have to bid first for the AWS-3 band, with the risk that the J-block uplink might not be available within a reasonable amount of time if at all.

Single National License

M2Z points to the Commission's rationale for granting a single nationwide license for the 1670-1675 MHz band to support its request for a similar licensing scheme in the AWS-3 band.[30/] That example is indeed relevant to this proceeding but for a very different reason: it provides a stark reminder of what can happen when the Commission tailors an auction to the desires of a single company. The Commission created a single, nationwide license in the 1670-1675 MHz band to meet the needs of ArrayComm's particular business plan. Despite obtaining an additional six months to attract financing, ArrayComm was unable to find sufficient funding and failed to participate in the auction.[31/] As a result, the auction had only two qualified bidders and garnered only a single bid at the minimum opening amount.[32/] To date, no commercial service has been initiated in the band.

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As demonstrated herein and in our November 17 letter, T-Mobile's Broadband Maximization Plan offers faster speeds and greater efficiencies while permitting the use of higher power mobile devices without raising the concern of harmful interference that has dominated this proceeding. The Commission is under no obligation to open the AWS-3 band to TDD uplink operations simply because FDD operations are prevalent in other bands—especially when those operations are not in the public interest or a superior alternative exists. Simply put, asymmetrically pairing the AWS-3 band with the J Block accrues all of the claimed benefits of permitting uplink operations in the AWS-3 without any of the risks. We respectfully urge the Commission to adopt it.

Sincerely,

/s/

Thomas J. Sugrue
Vice President, Government Affairs

30/ *See* M2Z November 24 Letter at 3.

31/ *See* Public Notice, 1670-1675 MHz Band Auction (Auction No. 46) Postponed Until April 30, 2003, DA 02-2395 (rel. September 25, 2002) (announcing a six month delay in the 1670-1675 MHz auction); *see also* Public Notice, Auction of License for 1670-1675 MHz Band, DA 03-1166, (rel. April 17, 2003) (listing only two eligible bidders, neither of which was ArrayComm).

32/ *See* Public Notice, 1670-1675 MHz Band Auction Closes, DA 03-1472 (rel. May 2, 2003) (listing the single winning bidder at the open minimum bid amount of $12,628,000).