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

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

DECLARATION OF NEVILLE R. RAY

Declarant hereby states as follows, under penalty of perjury:

1. My name is Neville R. Ray. I am the Senior Vice President, Engineering and Operations for T-Mobile USA, Inc. My business address is 12920 SE 38th Street, Bellevue, WA 98006.

2. I have been involved in mobile radio technology for more than 20 years. I joined T-Mobile USA in 2000, and am presently responsible for managing the company's wireless network, including approximately 40,000 cell sites. I oversee the continued growth of the current network along with the rollout and launch of future networks. My experience includes all aspects of wireless network design and deployment including radio planning & optimization; wireless switching; base station equipment design, operation and maintenance; data transmission; cell site design and construction; transport facilities planning and management.

3. Prior to joining T-Mobile, I was Vice President of Engineering and Operations for Pacific Bell Wireless, a GSM wireless operator in California. I have also

served as the Principal Consultant for PA Consulting, a UK/US management consulting firm. I earned a BSc Honors Degree in Engineering, in London, UK.

4. The purpose of this declaration is to provide technical substantiation of the significant potential for harmful interference to T-Mobile's nascent Universal Mobile Telecommunications System ("UMTS") operations in the AWS-1 band (1710-1755 MHz and 2110-2155 MHz) posed by the Commission's Further Notice of Proposed Rulemaking (FNPRM) released June 20, 2008 in this proceeding. T-Mobile has participated actively in this rulemaking, filing comments in December 2007 and reply comments in January 2008, as well as numerous ex partes in June and July 2008, in support of the adoption of downlink-only operations in the newly proposed AWS-3 band (2155-2180 MHz).

5. On June 5, 2008, I submitted a technical declaration in the above-referenced docket in which I concluded that AWS-3 spectrum could not be used for mobile (uplink) operations without stringent power and out-of-band emission ("OOBE") protections for adjacent operations in the AWS-1 band. Since then, T-Mobile has conducted further tests at the Boeing EMC laboratory facilities in Seattle, WA. I am familiar with the results of these tests, including the AWS-3 to AWS-1 Interference Laboratory Test Report, prepared on T-Mobile's behalf in these filings with the Commission. In sum, these tests confirm the conclusions in my previous declaration and demonstrate the FNPRM's proposed power and OOBE limits will not adequately protect T-Mobile's UMTS operations in the AWS-1 band.

Summary of Findings

6. As can be seen from the accompanying test report, based on the service rules proposed in the FCC's June 2008 FNPRM, the results demonstrate the following:

(a) Operation of mobiles in the AWS-3 band would cause harmful interference to UMTS mobile units in the AWS-1 band in the form of OOBE interference and receiver overload.

(b) The use of band pass filters that reject transmissions above 2155 MHz would not mitigate receiver overload in a meaningful fashion and would have absolutely no effect on preventing OOBE interference.

(c) Harmful interference is likely and would not be limited to marginal or extreme situations.

(d) The impact of interference would not be limited to the mobile handset or handsets receiving the harmful interference. Rather, because a UMTS base station responds to interference to one handset by raising the downlink power level to *all* handsets in a particular cell, AWS-1 capacity and quality would be reduced throughout the cell's coverage area.

(e) The guard bands and AWS-1 handset filters that have been proposed by parties in this proceeding are insufficient to prevent harmful interference. Even a 15 MHz guard band between AWS-1 and AWS-3 would be insufficient to adequately protect AWS-1 mobiles from AWS-3 mobiles operating at the OOBE and power limits proposed by the FCC.

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Description of Test Plan

7. Between June & July 2008, T-Mobile conducted tests of the impact of AWS-3 mobile operations on its AWS-1 UMTS mobile handsets, using independent facilities at Boeing EMC Laboratory. The objectives of those tests were: (a) to determine if the FCC's proposed service rules for AWS-3 would result in harmful interference to AWS-1 mobiles; (b) to quantify the OOBE and transmit power service rules necessary for AWS-3 to avoid harmful interference to AWS-1; and (c) to provide an open test bed for the FCC and other interested parties to observe or participate in the

testing. Third parties, including Commission staff, were invited to attend. To date, the Commission has not accepted this invitation. The detailed test plan and report is attached to this declaration.

8. Three different T-Mobile UMTS mobile devices were tested. Two of these devices are currently part of T-Mobile's commercial handset lineup; the third is a pre-commercial version. All of these handsets have been designed in accordance with the international technical specifications of the Third Generation Partnership Project ("3GPP") for UMTS operation, and were tested under typical service conditions.

9. In particular, base station emulators were employed to generate serving and interfering signals, and an additional signal generator was used to mimic real-world conditions via the introduction of background (Additive White Gaussian) noise to the serving signal. The tests were performed in conducted (i.e., cabled) mode. Prior to introducing serving and receiving signals, path loss was independently measured and recorded for each mobile device.

10. The technical assumptions employed for the interfering signal were consistent with those proposed by the Commission in its June 2008 FNPRM. Specifically, AWS-3 mobile simulations adhered to the proposed 60 + 10log(P) dB limitation for attenuating out-of-band emissions, and to a mobile transmit power limit of 23 dBm/MHz effective isotropic radiated power (EIRP). Further, the testing used both UMTS (with a 5 MHz bandwidth) and a WiMAX source (with different channel bandwidths, OFDMA subchannel configurations and activity factors) for interfering signals.

Test Results

11. The results from the Boeing Lab tests confirm that AWS-1 operations will suffer harmful interference if mobile transmitter operations are allowed in the AWS-3 band under the currently proposed rules. Indeed, these tests showed that with the FCC's currently proposed OOBE and transmit power limits, T-Mobile's AWS-1 UMTS customers would be unable to communicate within a large radius around an AWS-3 device transmitting at even moderate power levels.

12. The test results demonstrate that mobile transmitters in the AWS-3 band cause two types of interference to AWS-1 operations: OOBE interference and receiver overload/blocking. I refer to the combined impact of this interference generally as "AWS-3 Interference" in this declaration.

13. The primary cause of AWS-3 interference is OOBE interference, which appears co-channel in the AWS-1 band and presents itself as unwanted energy in AWS-1 mobile device receivers. It is referred to generally in the test report as "AWS-3 OOBE interference." Testing has shown that strict OOBE limits must be imposed on AWS-3 transmitters to mitigate harmful interference, if the Commission allows mobile transmitters in the AWS-3 band.

14. The second cause of AWS-3 interference is receiver overload/blocking and occurs because of the presence of AWS-3 transmissions spectrally adjacent to an AWS-1 receiver that is tuned to receive a low-power signal. In this case, the interfering AWS-3 signal overpowers the AWS-1 receiver and degrades the performance of the

AWS-1 receiver. This is referred to in the test report as "AWS-3 Adjacent Channel Interference ("ACI").

Typology of Harms to AWS-1 Operations

15. As described above, the Boeing lab tests illustrate that AWS-3 mobile transmissions can create harmful interference to the operation of individual AWS-1 mobile devices. The debilitating impacts that are likely to occur from AWS-3 interference include one or more of the following conditions: call set-up failures, degraded speech quality, degraded data throughput, or dropped calls. In other words, the harmful interference would cause serious degradation to consumers' service quality and reliability.

16. The Boeing lab tests also show the impact of AWS-3 mobile transmissions on the overall operation of a UMTS network. Based on T-Mobile's testing, analysis, and experience with UMTS technology, I believe AWS-3 mobile transmissions—in addition to impacting individual AWS-1 mobile devices—would have deleterious impacts on cell system capacity, as well as the reliability of UMTS coverage and service.

17. AWS-1 mobile devices subjected to AWS-3 interference would request increased downlink transmit power from the serving base station. If downlink power is available, the base station would power the link up to improve downlink reliability for the mobile and attempt to overcome the interference. Base station power is finite, however, and once allocated would no longer be available to serve other AWS-1 mobile devices operating in the cell, which would have several negative consequences including

reduction in overall cell capacity and harmful impacts to other AWS-1 handsets in close geographic proximity to the victimized AWS-1 receiver.

High Probability of Harmful AWS-3 Interference

18. Some parties have suggested that harmful interference to AWS-1 mobile devices from AWS-3 mobile operation would be a "low probability" event. Based on testing, analysis, and experience from operating mobile voice and data services, I am led to conclude just the opposite. Under the proposed AWS-3 rules, harmful interference would occur in a number of common situations whenever AWS-3 mobile devices come within tens of meters of AWS-1 mobile devices, even when operating at moderate transmit powers. Such a scenario is unlikely to be a rare occurrence if the devices are operating rich, multimedia applications, as is planned by WiMAX operators.

19. These interference-induced outages can be expected to occur between AWS-1 and AWS-3 devices in a variety of common situations, including:

- Pedestrian interactions between AWS-1 and AWS-3 mobile devices.
- Public transportation facilities including airports, trains, ferry boats, and buses.
- Private residences or office buildings where consumers have chosen to purchase service from both AWS-1 and AWS-3 operators.

- Vehicular use where the manufacturer has pre-installed broadband wireless internet devices, and consumers have chosen to subscribe to data service from the AWS-3 operator for their in-vehicle service at the same time as they subscribe to AWS-1 voice and data services.

- Public meeting places including businesses, restaurants, and cafes.

Evaluation of Guard Bands and AWS-1 Handset Filters

20. Some parties have also argued that a guard band between AWS-1 and AWS-3 or AWS-1 handset filters optimized to the 2110-2155 MHz band would mitigate AWS-3 interference. Based on the Boeing Lab tests that evaluated these options, I conclude that they would not adequately protect T-Mobile's AWS-1 operations.

21. T-Mobile tested guard bands of 5 MHz, 10 MHz, and 15 MHz of separation between AWS-1 and AWS-3 operations. Based on these tests, I conclude that none of these guard bands is sufficient to mitigate fully AWS-3 interference. Although AWS-3 interference would be somewhat reduced by a guard band, adequate protection can be achieved only when combined with corresponding limitations on AWS-3 transmit power levels and limitations on AWS-3 OOBE.

22. AWS-1 handset filters optimized to the 2110-2155 MHz band would also not mitigate AWS-3 interference. As discussed above, AWS-3 interference is primarily caused by OOBE "leaking" from AWS-3 transmitters directly into the AWS-1 receive band. There is simply no way to filter out this unwanted co-channel signal, because the interference is manifested precisely in the same frequencies that the mobile was designed

to use. As such, optimized AWS-1 filters would have no remedial effect on this dominant interference source.

23. The tests using UMTS as a interfering signal source demonstrated that with the FCC NPRM's proposed OOBE of 60 + 10log(P), the AWS-3 mobile transmit power levels had to be limited to between -11 dBm/MHz (adjacent channel with no guard band) and -4 dBm/MHz (with 15 MHz guard band). Tests using a WiMAX signal source also at OOBE of 60 + 10log(P) indicated that if AWS-3 used WiMAX the transmitter powers would have to be limited to -9 dBm/MHz for 20 MHz WiMAX channel bandwidth with no guard band.

24. Notwithstanding the above, should the Commission decide to permit mobile operation in the AWS-3 band, stringent OOBE restrictions and power limitations would be required. Based on analysis of the Boeing lab tests, AWS-3 transmit filters would need to provide attenuation of 96 + 10 log (P) dB in order to avoid harmful OOBE emissions to AWS-1 receivers at a 1 meter separation distance. Further, even with this tighter OOBE limit, tests with a 5 MHz UMTS interferer signal shows that AWS-3 mobile transmit power would need to be restricted to between 2 dBm/MHz (adjacent channel with no guard band) and 10 dBm/MHz (with a 15 MHz guard band).

Further Testing Would be Advantageous

25. While I believe the testing T-Mobile has conducted provides compelling evidence of interference, T-Mobile also supports further empirical testing of the impact of AWS-3 mobile transmissions on AWS-1 receivers conducted under FCC aegis. One of T-Mobile's objectives in undertaking tests at the Boeing Lab was to jump-start the

establishment of a neutral test bed to advance our common understanding of the technical issues presented in this rulemaking. T-Mobile has invited the Commission and other parties to participate in the Boeing tests.

26. Building on this invitation, I believe it would be in the public interest for the FCC to defer any further action in this docket in order to conduct additional testing. These could be overseen directly by Commission staff, or by a third party. T-Mobile continues to stand at the ready to support additional testing.

Conclusion

27. I hereby declare under penalty of perjury that, to the best of my knowledge and belief, the foregoing is true and correct.

Neville R. Ray
Senior Vice President, Engineering and Operations
T-Mobile USA, Inc.

Dated: July 25, 2008