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August 22, 2017

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

Re: RM-11793: WiMAX Petition for Rulemaking Regarding AeroMACS
Reply Comments of Raytheon Company

Dear Ms. Dortch:

Raytheon Company ("Raytheon") files this letter in response to the Wireless Telecommunications Bureau's (the "Bureau's") Public Notice in the above-referenced matter.¹ Raytheon supports the position advocated by the Aerospace and Flight Test Coordinating Council, Inc. ("AFTRCC"), of which Raytheon is a member, in its comments on the Petition for Rulemaking filed by The WiMAX Forum asking the Commission to adopt Aeronautical Mobile Airport Communications System ("AeroMACS") service rules in the 5000-5030 and 5091-5150 MHz bands (the "WiMAX Petition").² As explained herein, Raytheon agrees with AFTRCC (and several other AFTRCC member companies that filed comments) that that it would be premature for the Commission to proceed to a rulemaking proceeding concerning the 5091-5150 MHz band before field tests to confirm methods for compatibility between AeroMACS surface-communications systems and aeronautical mobile telemetry ("AMT") has occurred and the results can be fully taken into account to adopt rules that maximize the efficient use of the band by AMT and AeroMACS users.

Raytheon Company is a leading member of this nation's aerospace industry and is a partner with the Department of Defense ("DOD") in the conduct of many missile flight tests

¹ Wireless Telecommunications Bureau Seeks Comment on WiMAX Forum Petition Proposing Rules for the Aeronautical Mobile Airport Communications System, Public Notice, RM-11793, DA 17-696, released July 19, 2017 ("Public Notice").

² See AFTRCC Statement of Position on Position for Rulemaking, RM-11793 (filed Aug. 18, 2017).

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occurring in AMT spectrum. Several Raytheon business units, including Raytheon Missile Systems (“RMS”) headquartered in Tucson, Arizona, and Integrated Defense Systems (“IDS”), headquartered in Tewkesbury, Massachusetts, are responsible for the design, development, and production of missiles for the United States armed forces and our allies, including air-to-air, strike, naval weapon systems, land combat missiles, guided projectiles, and directed energy weapons. Some of the best known RMS programs are the Standard, Tomahawk, Maverick, Sparrow, and Paveway missile systems. IDS programs include support for several missile defense programs, such as the Patriot Advanced Capability-3 missile, which destroys threats by slamming into them, and the National Advanced, Surface-to-Air Missile System (“NASAMS”), which can fire three different Raytheon missiles: the Evolved Sea Sparrow Missile, the AMRAAM and the AIM-9X.

A critical stage of all missiles’ design and operation is the ability to transmit continuously large volumes of telemetry data. Clean spectrum for telemetry is absolutely critical for the effective testing of these systems during their development and design (or redesign), including flight tests, as well as for their successful operation, in the event they are ever used. During flight test telemetry is conducted all the while and data transmitted to distant ground stations. Raytheon relies not only upon critical-path S-band and L-band AMT spectrum for missile flight tests, but as the amount of data used during the tests has grown and video is used more extensively during flight test evaluations, Raytheon and the aerospace industry had long sought access to more spectrum resources to supplement the existing spectrum. Accordingly, Raytheon welcomed the Commission’s implementation, in 2015, of the 5091-5150 MHz band for AMT which had been designated for AMT in Region 2, at the United States’ urging, at the 2007 World Radiocommunication Conference.³ The *2015 Report and Order* also allocated the 5091-5150 MHz band for AM(R)S, i.e. AeroMACS, on a primary basis, but did not adopt service rules.

The tests of Raytheon-designed and -built missile systems are performed in conjunction with Raytheon’s customers within the DOD. The tests are very costly to conduct and typically involve hundreds of company and government personnel. During these tests, the missiles are pushed to their operational limits. Raytheon is responsible for the nearly instantaneous processing of the telemetry data sent to radio facilities on the ground, data which play a vital role in real-time decisions made concerning the continuation and conduct of the test. The significant amounts of telemetry data, and increasingly video, is generated not only by the missiles, but also from the several “chase planes” (high performance Navy or Air Force jets) involved in any missile test. The missile data is sent directly or is relayed through range support

³ See *In the Matter of Amendment of Parts 1, 2, 15, 25, 27, 74, 78, 80, 87, 90, 97, and 101 of the Commission’s Rules Regarding Implementation of the Final Acts of the World Radiocommunication Conference (Geneva, 2007) (WRC-07), Other Allocation Issues, and Related Rule Updates*, Report and Order, FCC 15-50, 30 FCC Rcd 4183 (2015)(hereinafter, “*2015 Report and Order*”).

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aircraft, whereas the chase planes send their own telemetry data directly. Tens of thousands of telemetry data points are continuously obtained by on-board systems and transmitted to sensitive ground stations as much as two hundred miles away from the missiles or range support aircraft *many times per second*, all the while monitoring position, attitude, speed, voltages, temperatures, g-forces, vibrations, currents and other vital information. Video feeds are also increasingly used with today's missile systems tests, and this information, too, is relayed and processed in real time throughout the tests.

The telemetry data must be relayed and processed to be of use. The data is used in real time to make, for example, critical adjustments during the test to maximize the benefit and success of the test. Significant to the need for a suitable radio frequency environment, all data and video from missile tests would otherwise be lost if not received when first transmitted because missiles do not survive flight tests. Stated differently, the data cannot be stored on board, although stored data would not, in any event, be of use to make real-time decisions during the flight test. Moreover, the continuous streaming of the data and video from the missile and aircraft is also necessary to ensure the safety of chase planes and other range support aircraft as well as persons on the ground, both ground crews and civilians, during the test.

In the *2015 Report and Order*, the Commission noted that there could be issues of compatibility within the 5091-5150 MHz near airports where significant AMT operations take place and AeroMACS is being implemented. The Commission urged AMT and AM(R)S operators to "cooperate with each other and exchange information about planned deployments of their respective systems," so as to "enhance the prospects for compatible sharing of the band."⁴ While the Commission identified in the *2015 Report and Order* six specific airports near which AMT has requirements in the 5091-5150 MHz band as locations where such compatibility concerns likely would be present,⁵ the Commission acknowledged that other locations might merit accommodation on a "case-by-case basis."⁶

Raytheon is particularly concerned about compatibility issues arising between AeroMACS and AMT in the 5091-5150 MHz at and around the Tucson International Airport, which is adjacent to the major research, design, development, and manufacturing facilities of RMS. RMS has had a long and constructive relationship with the Federal Aviation Administration ("FAA"), as well as many other entities, working on spectrum coordination matters in the Tucson area, reflecting Raytheon's experience and commitment to electromagnetic compatibility as a whole nationwide. Raytheon understands that the Commission, in the *2015 Report and Order*, accorded AeroMACS priority over AMT in the 5091-5150 MHz. At the same time, based on expert technical analysis and advice that AFTRCC has received and shared with

⁴ *2015 Report and Order*, ¶ 60.

⁵ *Id.*

⁶ *Id.*

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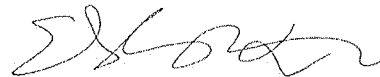
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its members, Raytheon believes that compatibility can be achieved at and near the Tucson International Airport provided that all sides exercise reasonable flexibility as good stewards of the spectrum resources of the band. To bear out these prospects for successful compatibility, Raytheon supports AFTRCC's call for field tests. There is no need for the conduct of tests to inject any significant delay action on The WiMAX Forum's petition for rulemaking, but the tests results will inform the Commission, the AMT community, and parties interested in AeroMACS deployment how the band can be efficiently and effectively managed and AeroMACS and AMT channels assigned. As such, field test results would help fill a large hole in the petition for rulemaking, which is totally devoid of specifics regarding criteria for coordination and assignment of AMT channels as well as about AeroMACS usage in general.⁷ Understanding better how and the extent to which AMT and AeroMACS can use the band compatibly will help the Commission, with input from the FAA as appropriate, to be well informed when crafting proposed rules that would maximize use of the spectrum and achieve the objectives of the Commission in making the 5091-5150 MHz band available to AMT on a shared basis with AeroMACS. Spending the time to conduct well-designed tests now at this early stage is likely to temper the prospects for a contentious proceeding down the road and facilitate an earlier and more successful, as well as spectrally efficient, introduction of AeroMACS later.

For the reasons stated above, Raytheon submits that it is premature for the FCC to proceed to a notice of proposed rulemaking until field tests assessing the compatibility between AeroMACS and AMT are conducted and factored into any decision how to move forward. Raytheon appreciates the Commission's consideration of this letter in its deliberations.

Respectfully submitted,



Edward A. Yorkgitis, Jr.

Attorney for Raytheon Company

⁷ The WiMAX Forum concedes that "[i]t is not yet clear how AeroMACS usage by Federal and non-Federal entities will unfold over time, how much spectrum various AeroMACS applications will require, and who will be the primary users. Rather than trying to predict these factors without sufficient real-world experience, the Commission should adopt rules that allow the Channel Manager to react flexibly to marketplace and technological developments." WiMAX Petition at 22.