**BEFORE THE**

# Federal Communications Commission

**WASHINGTON, DC 20554**

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| In the Matter of | ) | |
| | ) | |
| Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands | ) | WT Docket No. 12-70 |
| | ) | |
| Fixed and Mobile Services in the Mobile Satellite Service Bands at 1525-1559 MHz and 1626.5-1660.5 MHz, 1610-1626.5 MHz and 2483.5-2500 MHz, and 2000-2020 MHz and 2180-2200 MHz | ) | ET Docket No. 10-142 |
| | ) | |
| Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands | ) | WT Docket No. 04-356 |

To: The Commission

## COMMENTS OF DEERE & COMPANY

Deere & Company ("Deere"), by its undersigned counsel, hereby submits these limited comments to address certain out-of-band emission ("OOBE") limits raised in the above-captioned Notice of Proposed Rulemaking and Notice of Inquiry ("*AWS-4 NPRM/NOI*").[1] At the outset, Deere strongly supports the Commission's goal of expanding wireless broadband services, particularly in rural areas where greater access to broadband services is sorely needed to fuel and maintain economic growth. Deere also applauds the Commission's decision to launch a comprehensive rulemaking proceeding to consider service, technical and licensing rules for prospective terrestrial wireless broadband and other flexible uses of the 2 GHz band. As a leading global manufacturer of agricultural, construction and other equipment that employs

[1] *See Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands et al.*, WT Docket No. 12-70 (rel. March 21, 2012) ("*AWS4-NPRM/NOI*"). *See* FCC Public Notice, "Wireless

sophisticated navigation technology using the 1559-1610 MHz band allocated on a primary basis to the Radionavigation-Satellite Service ("RNSS") and including particularly "high precision" Global Positioning System ("GPS") service extensively used in agricultural and construction operations, Deere is interested in the evolution of spectrum uses that may affect GPS-based navigation services. GPS navigation is a proven innovative, efficient and highly beneficial technology already in widespread embedded use in commercial, government, consumer and public safety applications. Accordingly, Deere strongly supports Commission rules that will allow for the introduction of expanded terrestrial wireless broadband services while safeguarding the current and future growth and reliability of RNSS services and ensuring the successful coexistence and development of these two important spectrum uses.

To that end, Deere has consistently endeavored to provide the Commission with substantive engineering-based analysis and policy recommendations on the proposed flexible use of Mobile Satellite Service ("MSS") spectrum.[2] While the proposed repurposing of MSS spectrum for terrestrial use has raised difficult and complex issues, Deere believes that the public interest is best served by facilitating a timely, complete and thoughtful evaluation of the technical and policy issues raised by such proposals. Deere believes that this approach is consistent with the Commission's broad request in this proceeding for input regarding interference issues of concern to GPS.[3]

In response, Deere generally supports the comments being concurrently filed by the U.S. GPS Industry Council ("USGIC"). In addition, and consistent with Deere's previous discussions

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Telecommunications Bureau Announces Pleading Cycle for Comments and Reply Comments on Advanced Wireless Services in the 2 GHz Band," DA 12-603 (rel. April 17, 2012).

[2] Deere contributed extensive technical input to the Commission regarding terrestrial operations in L-band spectrum throughout 2011 and 2012 in IB Docket No. 11-109, chaired the high-precision sub-team of the joint USGIC/LightSquared Technical Working Group, and participated in multiple rounds of government-led testing concerning terrestrial use of L-band spectrum.

[3] See *AWS4-NPRM/NOI*, ¶ 55 ("We request comment on whether any special interference rules protecting

regarding this topic,[4] Deere submits these limited comments to provide additional preliminary analysis and perspective on the existing OOBE limit and the need to further study and update the appropriate levels for OOBE from other spectrum uses in the RNSS band.

## I. THE COMMISSION SHOULD UPDATE AND INCORPORATE INTERFERENCE PROTECTIONS ALREADY ADOPTED BY INDIVIDUAL MSS ATC SYSTEM AUTHORIZATIONS INTO PART 27 2 GHZ AWS SERVICE RULES

Deere generally supports the Commission's approach to adopt for the new AWS-4 2 GHz band the technical rules and license conditions applicable today for the provision of ancillary terrestrial component "ATC" services in the 2 GHz bands.[5] However, these rules were developed to accommodate MSS ancillary terrestrial service ("ATC") which is a specific, and more limited, service that differs from the ubiquitous, high density, mobile terrestrial broadband service that is envisioned by the new AWS-4 2 GHz service. The proposed change of use of 2 GHz spectrum will inevitably lead to the operation of many 2 GHz terrestrial handsets in close proximity to RNSS receivers -- a scenario not contemplated by the operation of a conventional MSS/ATC network.[6] Effective management of OOBE levels will be essential to ensure the successful *en masse* operation of terrestrial 2 GHz handsets and RNSS receivers in close proximity. Accordingly, it is appropriate for the Commission to assess whether the rules provide adequate protection in the context of these significantly changed circumstances.

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GPS are warranted for the 2 GHz band if we implement the AWS-4 proposals.")

[4] *See, e.g.*, Reply Comments of Deere & Co. IB Docket 11-109, at Exhibit 1 (filed March 31, 2012) ("*Deere 2012 Reply*") (explaining how -95 dBW/MHz of OOBE into the RNSS band will create harmful interference; attached as Exhibit I to the instant comments).

[5] *AWS-4 NPRM NOI* at ¶ 28.

[6] For example, MSS handsets are unlikely to be operated inside moving vehicles in close proximity to general location and navigation RNSS receivers because they could not communicate effectively with the relevant overhead satellite due to attenuation created by the body of the vehicle. However, because terrestrial service handsets need only transmit a signal to the nearest base station, they can be expected to be used in and around vehicles much as other CMRS handsets are used today.

The *AWS-4 NPRM/NOI* acknowledges that the currently-licensed 2 GHz MSS systems have been authorized for several years to operate ATC networks associated with their authorized satellite operations.[7] These authorizations incorporate explicit license conditions regarding the limitation of OOBE into the 1559-1610 MHz band allocated for RNSS.[8] Specifically, the licenses held by New DBSD and TerreStar limit equivalent isotropically radiated power ("EIRP") density for wideband emissions to -95 dBW/MHz; while narrowband emissions are subject to a limit of -105 dBW/kHz.[9] In addition, fixed or mobile base stations must adhere to a wideband EIRP density emission limit of -100 dBW/MHz; and a narrowband emission limit of -110 dBW/kHz.[10] These limits appear in the individual system authorizations and are not reflected in the Commission's Part 25 Rules.[11]

In its initial 2 GHz NPRM, the Commission referenced these OOBE limits and stated its intention to impose them on any new Fixed or Mobile service in the MSS bands, proposing to require these service providers to operate "according to the technical and operational conditions *specified in the ATC authorizations*."[12] However, the current *AWS-4 NPRM/NOI* does not specifically propose to carry forward these established operating parameters as currently specified in the 2 GHz MSS ATC authorizations. Instead, the Commission asks "whether any special interference rules protecting GPS are warranted for the 2 GHz band if we implement the AWS-4 proposals."[13]

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7 *AWS-4 NPRM NOI* at ¶ 70.

8 *See New ICO Satellite Services G.P.*, 24 FCC Rcd 171, ¶ 65 & ¶69 (2009) ("*ICO MSS ATC Waiver Order*"); *TerreStar Networks, Inc.*, 25 FCC Rcd 228, ¶ 28 & ¶ 34 (2010) ("*TerreStar MSS ATC Waiver Order*").

9 *See ICO MSS ATC Waiver Order*, 24 FCC Rcd at ¶ 65 & ¶69; *TerreStar MSS ATC Waiver Order*, 25 FCC Rcd at ¶ 28 & ¶ 34 ("The limits in this table are material terms of the authorization").

10 *Id.*

11 Section 25.252 of the Commission's Rules provide that EIRP density may be no greater than -70 dBW/MHz in the 1559-1610 MHz band. 47 C.F.R. § 25.252(b)(3) (2011)

12 *See Fixed and Mobile Services in the Mobile Satellite Service Bands at 1525-1559 MHz and 1626.5-1660.5 MHz, 1610-1626.5 MHz and 2483.5-2500 MHz and 2000-2020 MHz and 21180-2200 MHz*, 25 FCC Rcd 9481, 9487 n.51 (2010) ("*2 GHz NPRM*") (emphasis added); *see also id.* at ¶13, ¶18 & n.56.

13 *AWS-4 NPRM NOI* at ¶ 55. *See also Id.* at ¶ 136 (Commission proposes to modify ATC authorization to

## II. THE COMMISSION SHOULD FORMALLY RETIRE OBSOLETE OOBE LEVELS VOLUNTARILY SUPERSEDED YEARS AGO BY THE 2 GHZ LICENSEES

First and foremost, Deere strongly urges the Commission to formally retire the -70 dBW/MHz OOBE limit for MSS ATC handsets that has effectively been superseded in practice by both existing 2 GHz licensees. -70 dBW/MHz offers inadequate OOBE interference protection for RNSS receivers and is a full 25 dB above the voluntary levels adopted by TerreStar and New DBSD. The -70 dBW/MHz OOBE level for the RNSS bands at 1559-1610 MHz specified in Section 25.252 of the Commission's Rules was based on the expectation that no more than one mobile ATC terminal would transmit in close proximity to affected GPS receivers. This limited scenario did not take into account the potential impact of large numbers of terrestrial handsets and base stations operating simultaneously in close proximity to the much broader range of RNSS devices fielded today.[14]

In part for these reasons, the inadequate -70 dBW/MHz OOBE level limit was first superseded *a decade ago* (for MSV) and more recently when the S-band licensees sought ATC authority by the specific provisions that are contained in the 2 GHz MSS ATC authorizations issued to New ICO (now New DBSD) and TerreStar.[15] Today, the -70 dBW/MHz OOBE limit for MSS/ATC exists only as a remnant of the earlier proceeding and does not serve the purpose for which it was originally intended. No new facts have been introduced to date in any of these proceedings that would justify a *relaxation* of the existing OOBE limits that protect RNSS. (In

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assign rights under Part 27, but does not specify the proposed disposition of the OOBE conditions in the current ATC licenses).

[14] The ITU has already acknowledged that -70 dBW/MHz offers inadequate OOBE interference protection for contemporary RNSS applications from Big LEO MSS services. *See* Recommendation ITU-R M.1903, "Characteristics and protection criteria for receiving earth stations in the radionavigation-satellite service (space-to-Earth) and receivers in the aeronautical radionavigation service operating in the band 1559-1610 MHz," at 2, Recommends 1-3 and Note 1 (2012).

[15] These limits were originally agreed to as a result of discussions between the Council and the L-band MSS ATC licensee. See *Ex Parte* Letter from Bruce D. Jacobs, Counsel to Mobile Satellite Ventures L.P., and Raul R.

fact, the introduction of ubiquitous terrestrial service in the place of limited ATC authority makes it important that OOBE limits be carefully re-evaluated and updated as necessary.) Given the very real interference threat presented if a new class of handset following the defunct -70 dBW/MHz OOBE limit were to be extensively deployed, and the fact that more appropriate limits have been voluntarily applied by the 2 GHz licensees, there is no sound policy or technical justification for carrying forward this OOBE level from Part 25 to Part 27.

## III. UPDATED OOBE LEVELS SHOULD BE CONSIDERED

Deere has advised the Commission in the past that the prospect of large scale deployments of handsets warrants a re-evaluation of the OOBE limits that should apply in this new environment.[16] While Deere continues to examine what OOBE levels are appropriate in the 1559-1610 MHz band as the 2 GHz band is repurposed for high-density terrestrial broadband use, it is clear that there is a need to study and update the OOBE measurement.

The proposed changes in the spectral environment and use model will create a dramatic increase in the aggregate OOBE from S-Band handsets into the 1559-1610 MHz band and present a greater risk of OOBE interference to RNSS. In particular, since RNSS signals are direct sequence spread spectrum, they are especially susceptible to interference from wideband signals. The GPS signal that requires the greatest protection (due to its low signal-to-noise ratio and 10 MHz clock rate) is the precision-code (P-Code), which has a clock rate of 10 MHz. Given the low signal-to-noise ratio of the P-Code and its 10 MHz code rate, it is necessary to further study appropriate OOBE limits for 2 GHz terrestrial-only handsets, and to ensure that Commission rules adequately protect the RNSS band from wideband OOBE emissions.[17]

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Rodriguez, Counsel to the U.S. GPS Industry Council, IB Docket No. 01-185, filed July 17, 2002. The OOBE limits were subsequently extended to licenses issued in other bands.

[16] *See, e.g., Deere 2012 Reply*, Exhibit I.

[17] For example, Deere suggests a broader study of whether a -95 dBW/10 MHz OOBE limit would appropriately reflect and offset the significant increased risk of interference harm.

Applying an updated OOBE measurement may be necessary to reflect and offset the significant increased risk of interference harm. Given that spurious emissions are often narrowband in nature, it should be possible to develop handsets that meet an updated limit and any appropriate revision to OOBE levels will not pose a significant burden for existing or future devices.

Consistent with the Commission's goals in this proceeding, Deere urges the Commission to further study this issue and consider an update to the OOBE limit with the purpose of facilitating the successful introduction and co-existence of new terrestrial uses in the MSS bands with the widespread use of RNSS equipment and RNSS applications. Deere believes that the proposed update will not delay the Commission's action in this proceeding or the near term introduction of AWS-4 terrestrial service and, in fact, will facilitate the successful introduction and consumer acceptance of AWS-4 services.

Respectfully submitted,

/s/

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## Out-of-Band Emission Noise Floor Degradation

There is significant concern over the potential for the aggregate OOBE levels from multiple LightSquared handsets to significantly degrade the noise floor and hence performance of a GNSS receiver. The current requirement sets OOBE at -90 dBW/MHz and after five years decreases OOBE for newly manufactured devices to -95 dBW/MHz. Table 1 shows that a single LightSquared handset would degrade the noise floor of a GNSS receiver if it were 1 meter away with an OOBE of -90 dBW/MHz by 16 dB.[1]

**Table 1. Noise Floor Degradation with One Handset 1 Meter Separation**

| | | | |
|---|---|---|---|
| 1 | OOBE Specification | -60 | dBm/MHz |
| 2 | OOBE power density | -120 | dBm/Hz |
| 3 | OOBE power density / handset @ 1 meter | -156.5 | dBm/Hz |
| 4 | Thermal Noise power density | -174 | dBm/Hz |
| 5 | Noise Figure (example) | 1.5 | dB |
| 6 | Equivalent Thermal Noise power density | -172.5 | dBm/Hz |
| 7 | Total power density (3 + 6) | -156.4 | dBm/Hz |
| 8 | Noise Floor Degradation (6 – 7) | 16.1 | dB |

Alternatively, with 10 handsets within 10 meters of a GNSS receiver, the GNSS noise floor would be degraded by at least 7 dB as shown in Table 2. In a large scale deployment, such as that proposed by LightSquared, this latter scenario is easily envisioned well before the OOBE limit is decreased to -95dBw/MHz.

**Table 2. Noise Floor Degradation 10 Handset within 10 Meters**

| | | | |
|---|---|---|---|
| 1 | OOBE Specification | -60 | dBm/MHz |
| 2 | OOBE power density | -120 | dBm/Hz |
| 3 | OOBE power density / handset @ 10 meters | -176.5 | dBm/Hz |
| 4 | 10 handsets | 10 | dB |
| 5 | Total OOBE power density @ 10 meters (3+4) | -166.5 | dBm/Hz |
| 6 | Thermal Noise power density | -174 | dBm/Hz |
| 7 | Noise Figure (example) | 1.5 | dB |
| 8 | Equivalent Thermal Noise power density | -172.5 | dBm/Hz |
| 9 | Total power density (5 + 8) | -165.6 | dBm/Hz |
| 10 | Noise Floor Degradation (8 – 9) | 7 | dB |

The above analysis and prior discussions regarding LightSquared handset emissions demonstrate that LightSquared's predecessors did not envision the large scale

[1] Simultaneous operation of a LightSquared handset and GPS receiver within one (1) meter of proximity would occur in routine scenarios (*e.g.*, driving a car enabled with GPS navigation while a passenger operates a handset).

terrestrial broadband network that LightSquared now proposes to deploy. The 5 year transition between the -90 dBW/MHz and the -95 dBW/MHz OOBE specification suggests that the anticipated uptake of the ATC service would be slow to develop and spatially sparse. Moreover, analysis associated with the 2002 commitment by LightSquared's predecessor, Mobile Satellite Ventures, to reduce OOBE emissions to -95 dBW/MHz reflects degradation of approximately 2 dB in the noise floor of a GPS receiver at a range of 4.5 meters from a single handset but does not further evaluate aggregate OOBE from multiple handsets.[2] Given that at 5 years post-deployment of ATC network infrastructure interference analysis evaluated OOBE levels from a single handset at 4.5 meters, the interference envisioned when long-term OOBE levels were established was from an occasional satellite handset operating at considerable distance from GPS receivers, not from a large scale terrestrial-only broadband network.[3]

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[2] *See* Letter to FCC from Mobile Satellite Ventures L.P. and the U.S. GPS Industry Council, IB Docket No. 01-185, at 4-5 (July 17, 2002).

[3] Operation of a handset at 4.5 meters from a GPS receiver is consistent with traditional MSS operations, which generally require the receiver to have clean line-of-sight to the overhead satellite. Traditional MSS handsets are less likely to be operated at sub 1-meter distances from many types of GPS devices. For example, an MSS handset will generally not work in an in-motion automobile due to the attenuation created by the vehicle's chassis, thus making it unlikely for a traditional MSS handset and Personal/General Navigation device to be operated in close proximity while a vehicle remains in-motion.