

**BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
Washington D.C. 20554**

In the Matter of)	
)	
LightSquared Subsidiary LLC)	
)	SAT-MOD-20101118-00239
Request for Modification of its)	
Authority for an Ancillary Terrestrial)	
Component)	
)	

PETITION FOR RECONSIDERATION OF
DEERE & COMPANY

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SUMMARY

Deere appreciates the Commission's desire to foster wireless broadband services in any available spectrum, including MSS spectrum, but it is critical that the Commission carefully evaluate and address potential interference posed by new service proposals. In this case, Deere seeks reconsideration of the Bureau order granting LightSquared a waiver enabling it to operate powerful terrestrial only cellular base stations using its L- Band MSS/ATC spectrum for terrestrial wireless broadband. In that Order, the Bureau failed to fully consider the devastating interference that LightSquared's proposed service will likely cause to high-precision location systems using GPS receivers operating in neighboring spectrum as well as co-channel interference caused to transmissions in the L-band that are critical to precision location services such as Deere's StarFire service in widespread use by major agricultural, construction and survey customers nationwide. The Bureau's order is more akin to a spectrum reallocation than a waiver of a non-conforming spectrum use permitted generally only on a non-interference "do no harm" basis. In the Bureau's rush to introduce a new service into the L-band, the extensive technical evaluation and engineering essential to introducing a new spectrum user into a band already populated with incumbent services without creating harmful interference has been inappropriately abandoned. Incumbent users in and around the L-band, an intentionally quiet spectrum environment with low ambient electromagnetic energy and sensitive devices prone to overload and desensitization, are now at risk for massive interference from LightSquared base stations that will blanket the country and operate with output power levels vastly disproportionate to incumbent devices operating co-channel and on adjacent channels. In particular, high precision GPS systems and GPS augmentation systems, including Deere's

StarFire system, which are essential for widely used agriculture, construction, land and aerial survey applications, will suffer devastating interference.

Deere urges reconsideration of the order granting LightSquared conditional authority to proceed with the construction of a terrestrial-only network that is fundamentally incompatible with incumbent spectrum uses as presently proposed. On reconsideration the Commission should (1) adequately consider and give proper weight to incumbent spectrum user concerns that LightSquared's proposed use will create devastating interference to GPS receivers and licensed MSS-based augmentation signals, (2) appropriately treat LightSquared's request to operate a nationwide network of powerful cellular base stations in the L-band under vastly different technical and operational rules as a reallocation of spectrum that merits public comment and participation in an open and transparent rulemaking, and (3) establish an effective process to scientifically evaluate the interference impact of LightSquared's proposed operations on GPS services, as opposed to the present "working group" procedure that inappropriately empowers LightSquared to set the agenda and direct the testing process, and fails to adequately address many other requirements necessary to fairly and impartially evaluate proposed terrestrial operations in the L-band. This process should be open, impartial, deliberate, and encourage public participation from the existing user community and other technical experts. The Commission should assume a more direct role in this process and contribute its institutional knowledge, engineering prowess and laboratory facilities. Direct Commission oversight is critical to the credibility and validity of this technical evaluation. Adequate time should be allocated to this process, and the public comment should be sought on test plans and results, and at other critical junctures during the process of testing and evaluating new technology for the L-band.

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Deere & Company (“Deere”), by its undersigned attorneys, and pursuant to Section 1.106¹ of the Commission’s Rules, files this Petition for Reconsideration (“Petition”) of the International Bureau’s Order and Authorization, dated January 26, 2011 (“Order”),² granting LightSquared Subsidiary LLC (“LightSquared”) a “conditional waiver” of the Ancillary Terrestrial Component (“ATC”) rules to use its Mobile Satellite Service (“MSS”)/ATC spectrum for an extensive network of high-powered base stations to provide terrestrial-only broadband services.

As further explained below, Deere seeks reconsideration of the grant of a waiver because the Bureau (1) did not adequately consider the devastating interference harm that transmissions from LightSquared’s terrestrial network in the 1525-1559 MHz band will cause to Global Positioning Satellite System (“GPS”) receivers operating in nearby spectrum and the equally devastating co-channel receiver interference that LightSquared’s transmissions will have to

¹ 47 C.F.R. § 1.106.

² *In the Matter of LightSquared Subsidiary LLC Request for Modification of its Authority for an Ancillary Terrestrial Component*, Order and Authorization, SAT-MOD-20101118-00239 (Released Jan. 26, 2011) (“Order”).

augmentation receivers that make up high-precision systems causing material, operational and economic damage to major agricultural, construction and survey operations nationwide, (2) inappropriately treated the LightSquared proposal to use MSS/ATC spectrum for new purposes under a vastly different operational and technical plan, inconsistent with the Commission's pre-existing rules and policies and having widespread ramifications, as a simple license modification and waiver rather than a reallocation decision that should be considered pursuant to open and transparent rulemaking procedures with a full opportunity for public participation, (3) established a "working group" procedure in the Order to examine and resolve issues relating to GPS interference that (a) does not provide adequate time to ensure that the technical and operational issues of GPS interference will be fully addressed, (b) inappropriately empowers LightSquared to set the agenda and direct such proceedings and therefore does not ensure that the process will be comprehensive, fair and impartial, (c) does not ensure that interested segments of the public -- government and nongovernment -- will have the opportunity to participate through open and transparent proceedings, (d) fails to articulate the standard by which the "Commission, after consultation with the NTIA" may determine that GPS interference issues have been resolved to its satisfaction thus meeting the Order's condition and permitting LightSquared to commence commercial service, and (e) fails to ensure that the Commission's decision on this matter, the record evidence considered, and its analysis of the issues will be made public in a comprehensive report upon which the affected public will have adequate time to comment.

Given the very significant risk to important existing services, the very real potential threat to major agricultural and other operations nationwide, and the complex technical issues that need to be analyzed to understand the potential to establish meaningful interference solutions, even if

the Bureau does not reconsider the grant of a waiver, Deere urges the Commission to reconsider the procedures for technical evaluation of interference to GPS and MSS receivers and the interference mitigation measures that could be put in place to protect incumbent operations and to modify those procedures as specified herein.

I. DEERE & COMPANY

Deere & Company (NYSE: DE) is a world leader in providing advanced products and services and is committed to the success of customers whose work is linked to the land - those who cultivate, harvest, transform, enrich and build upon the land to meet the world's dramatically increasing need for food, fuel, shelter and infrastructure. Today, Deere employs over 50,000 people. Since 1837, John Deere has delivered innovative products of superior quality built on a tradition of integrity. Deere is a pioneer and leading provider of state-of-the-art data and information solutions designed to greatly enhance productivity and environmental safety. In the agricultural sector, Deere's precision farming services enable growers to manage land, water, seed, fertilizer and labor resources to minimize costs and waste, greatly increase efficiency and crop yield, and responsibly manage important environmental concerns.

For nearly two decades, Deere has been equipping agricultural equipment with high precision farming systems including the StarFire™ system provided by its wholly owned subsidiary NavCom Technology, Inc. ("NavCom"). Deere and competitor high-precision Global Navigation Satellite Systems ("GNSS") receivers are used for agriculture, construction, land and aerial survey, and other applications that require 0.01 to 0.1 meter precision, 24 hours a day, 365 day per year, anywhere on earth.

The StarFire system employs receive-only vehicle mounted mobile earth stations that receive L-band signals from the Inmarsat 4F3 and 2F1 satellites covering the United States and provide correctional data that greatly enhance the information the StarFire system receives simultaneously from GPS. This system enables the operators of agricultural equipment to pinpoint their location to within 10 centimeters. To achieve this high level of accuracy the receivers employ design characteristics that are significantly impacted by the proposed high-powered Long Term Evolution (“LTE”) 4G signals in the 1525 MHz to 1559 MHz band.

This precise positioning capability, developed originally to assist farmers in comparing the crop yields from various fields to determine, among other things, the amount of fertilizer and seed appropriate for a particular field and crop, is now an essential feature to all modern growing enterprises as it improves growing efficiency and enables farmers to greatly reduce crop and soil damage.³ These systems are used in countries around the world and play an increasingly important role in averting global food shortages.

The StarFire system uses GPS signals to compute correction information that enables Deere’s platform (tractors, combines, sprayers, construction machines, etc.) to navigate with very high accuracy (a few inches) while performing their functions. GPS-stand-alone positioning is insufficiently accurate for many of these functions. This correctional information is distributed to Deere customers via L-band satellites with downlink signals in the MSS band. The high navigational accuracy enabled by StarFire permits the collection and use of field and

³ The precision farming system allows a farmer to boost crop yields and reduce over-fertilization which can harm the environment through real-time collection by tractor-based mobile units of pinpointed data about crop yield, as well as of pinpointed data about amounts of fertilizer added to each spot within a field. Growers can track variances in yield between different parts of a field from year to year, providing data that can be analyzed to determine how fields should be sowed and fertilized the following year and for future years. Deere’s StarFire system enables growers to automatically record crop yield and moisture data as the farmer harvests the crop, and at the same time, uses the GPS to determine the location where data is collected.

construction information that greatly increases productivity. For example, seeds can be planted with precision, fertilizers can be applied in varying amounts and, where needed, pesticide use can be minimized, cultivation done only where required, and harvesting can avoid damaging crops. With this superior, precise, site-specific data, a farmer can analyze and carefully adjust his or her farming methods to be the most efficient, most economical, and most environmentally-friendly possible.

Deere is an interested party in this proceeding because LightSquared's proposed terrestrial service is likely to cause severe disruption to the StarFire system used nationwide which relies on GPS signals as well as transmissions in the MSS band pursuant to Deere's FCC license.⁴ The Bureau's Order granting a waiver *sua sponte* to LightSquared, without prior analysis, testing and resolution of what, if any, interference mitigation solutions could be employed adversely affects Deere, its nationwide agricultural and other industrial customers, as well as ultimate consumers. Deere did not comment on the "modification" request in the expedited timeframe announced by the Bureau for responses because Deere recently became aware of the significant potential risk that the LightSquared terrestrial services poses to its operations. In the few short months since LightSquared filed its "modification" and the one month since the Bureau granted a waiver authorizing this new spectrum use, Deere's technical team has been analyzing what little detail LightSquared has put forth to describe its plan to use its MSS/ATC spectrum for a dense network of high-power terrestrial base stations. It was not until recently that the Deere team was able to complete its analysis, albeit preliminary, of the likely interference impact of the LightSquared network operations. That preliminary analysis is attached at Exhibit B.

⁴ As required by Section 1.106(e) of the Commission's Rules, attached at Exhibit A is an affidavit of a qualified radio engineer regarding the electrical interference discussed in this Petition.

II. HIGH-PRECISION SYSTEMS WILL SUFFER SERIOUS HARM

In the agricultural, construction and survey industries served by Deere's advanced StarFire system, the impact is expected to be severe. The impact on high-precision GNSS receivers (essentially all Deere receivers are high-precision receivers) will generally be worse than that on personal and commercial GPS receivers. This is not because they use additional frequencies, but because high-precision receivers typically have filters that are open to a wider band around each GNSS frequency. This is done to capture additional GNSS signal energy that helps in forming precision measurements, and hence more accurate navigation results. However, if there are high powered LightSquared signals in the adjacent MSS band, more of the unwanted LightSquared energy will also be captured. See Figure 1.

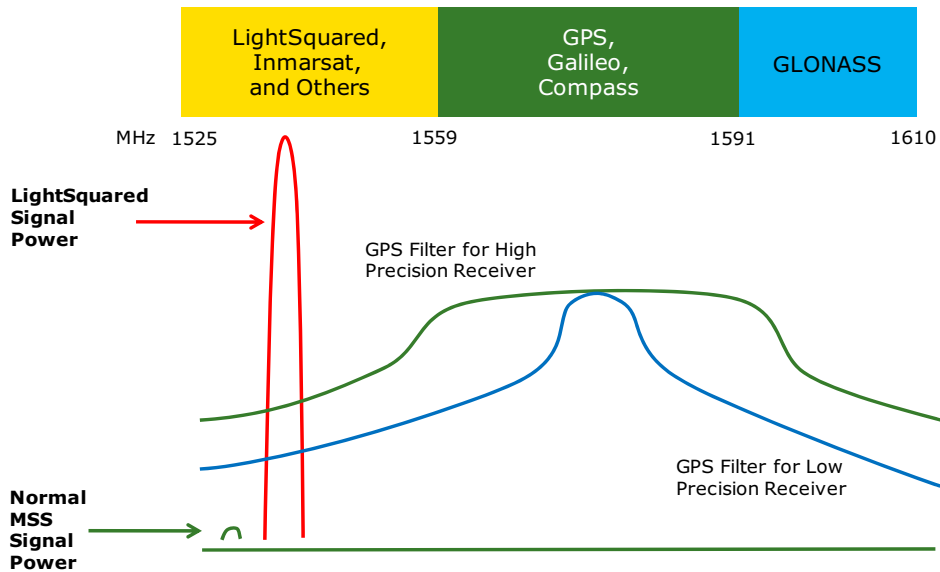


Figure 1 Filter Bandwidths

High-precision GNSS receivers are extremely sensitive instruments that attempt to derive very accurate measurements of the ranges to the satellites. These are the basis for the computation of

position and velocity by the receiver. The LightSquared energy will first degrade these precision measurements, and as the range to a LightSquared base station decreases, the measurement quality will decrease until the measurements become unusable for precision navigation. Deere cannot at this time accurately determine the range at which measurements become invalid for precision navigation, but for Deere high-precision receivers, it expects disruptions to navigation equipment tens of miles from LightSquared base stations.⁵

The result of this will be that many Deere customers who depend on high precision navigation will lose it. In some cases, this will mean reduced productivity and lower crop yields, but in some significant cases, it will not be possible to conduct reasonable farming operations. For example, a significant portion of Deere planters in recent years are purchased without marker arms and depend on precision guidance, without which they cannot properly operate. Without knowing the locations and technical characteristics of the LightSquared base stations, Deere cannot pinpoint the areas in which precision agriculture will no longer effectively operate, but it is clear that a single LightSquared base station in a rural town might impact precision agricultural operations over 1,000 square miles.

The StarFire Augmentation System

The accuracy of a high-precision GNSS receiver operating only with the signals available from GPS and/or another GNSS can be significantly improved by providing it with differential GNSS correction signals from an augmentation system such as StarFire. Many agricultural,

⁵ Deere's preliminary analysis indicates that LightSquared's base station transmissions will cause co-channel interference, effectively disabling the StarFire systems within a radius of 21 miles and severely degrading performance within a radius of 37 miles to an operating LightSquared base station. LightSquared's network -- consisting of 40,000 high-powered base stations -- will not be subject to any geographic limitations and therefore can be expected to span urban, suburban and rural, coastal and inland areas. Therefore, the planned systems poses a serious interference threat to high-precision systems in agricultural, construction and other environments nationwide.

construction, and survey applications (as well as many other applications) require the increased accuracy provided by such an augmentation system. The U.S. Government operates WAAS (Wide Area Augmentation System) for commercial and general aviation use throughout the United States for this reason, and Deere operates StarFire to offer its customers accuracy of a few inches in their applications.

StarFire consists of:

- 80 Reference Sites around the world
- Two Processing Centers
- Six Satellite Uplink Sites
- Access to Six Inmarsat Satellites (for redundant global coverage)

Each Reference Site has multiple GNSS receivers that send real-time data every second to the Processing Centers, where it is processed and corrections are developed. The Processing Centers send their corrections to the Uplink Sites, from which they are sent to the satellites and broadcast to Deere customers globally. With these real-time corrections, Deere customers can operate at accuracies of a few inches. This is extremely important in terms of productivity.

The LightSquared system will create several types of problems for StarFire that will largely disable it in the United State and damage it globally:

- The StarFire correction signals are all in the 1525 MHz – 1559 MHz MSS band that would be used by the LightSquared base stations. The LightSquared signals are in-band for the StarFire portion of Deere receivers and cannot be filtered out, and as a result, correction signals will experience interference from LightSquared base stations

many miles away. Deere customers who depend on the accuracy of StarFire will be severely affected.

- The degradation of the GNSS receivers at the Reference Sites that are near LightSquared base stations will cause their measurements to be unavailable or degraded, so accuracy of the global corrections will decrease, particularly over the United States. Deere customers globally will be affected to an extent that Deere cannot accurately predict without detailed knowledge of the LightSquared system. So even Deere customers who are not near LightSquared base stations will be adversely affected.

III. NEITHER LIGHTSQUARED’S REQUEST NOR THE ORDER ADEQUATELY ADDRESSES THE LIKELY DEVASTATING INTERFERENCE TO HIGH-PRECISION SYSTEMS USING GPS RECEIVERS

In its November 18, 2010 filing, styled by LightSquared simply as an “update” or “minor modification,” LightSquared blithely reported that its business plans had evolved and that it is poised to use its ATC authority to establish a “nationwide 4G LTE network” made up of “40,000 terrestrial base stations.”⁶ In its request and subsequent filings,⁷ LightSquared devoted most of its energy to defending the highly unorthodox expedited procedures used to review the request⁸

⁶ *LightSquared Subsidiary LLC Request for Modification of its Authority for an Ancillary Terrestrial Component*, Application Attachment - Letter Narrative, SAT-MOD-20101118-00239 at p. 3 (Filed Nov. 18, 2010) (“Modification Application Narrative”).

⁷ *See* Modification Application Narrative; Opposition to Extension of Filing Deadline, LightSquared Subsidiary LLC, SAT-MOD-20101118-00239 (Filed Nov. 24, 2010) (“Opposition to Extension”); Consolidated Reply, LightSquared Subsidiary LLC, SAT-MOD-20101118-00239 (Filed Dec. 9, 2010) (“Consolidated Reply”); *Ex Parte* Notification, LightSquared Subsidiary LLC, SAT-MOD-20101118-00239 (Filed Dec. 15, 2010); *Ex Parte* Notification, LightSquared Subsidiary LLC, SAT-MOD-20101118-00239 (Filed Dec. 20, 2010) (discussion with Satellite Division); *Ex Parte* Notification, LightSquared Subsidiary LLC, SAT-MOD-20101118-00239 (Filed Dec. 20, 2010) (discussion with Office of Engineering and Technology) (“OET *Ex Parte*”).

⁸ *See* Opposition to Extension at pp. 1-3; Consolidated Reply at pp. 5-21; OET *Ex Parte* at p. 1.

and to espousing increasingly tortured arguments that its plan to use its ATC authority for a stand-alone nationwide terrestrial wireless network, in fact, meets the spirit and letter of the Commission’s rules designed to ensure that terrestrial operations under ATC authority remain truly ancillary to the MSS satellite service.⁹ The record supporting LightSquared’s request is virtually devoid of any technical detail of the planned network. The application is silent with respect to the likely impact on other MSS licensees and nearby services operating in adjacent spectrum. In particular, LightSquared did not address interference to GPS or other MSS licenses in its “modification” filing. In subsequent filings after various GPS stakeholders raised concerns regarding the significant potential interference that LightSquared’s terrestrial network could cause to GPS receivers, LightSquared argued only that it meets all applicable rules and requirements.¹⁰

In granting a waiver, the Bureau’s Order failed to address adequately the very significant concerns regarding the risk of serious interference by LightSquared’s proposed new terrestrial network to GPS receivers, including high-precision systems, used by numerous industries and government agencies. GPS interference concerns over LightSquared’s dramatically revamped network proposal were raised in response to the Commission’s Public Notice, which was issued just one day after the LightSquared application was filed and announced a meager 10-day window of opportunity (a period that spanned a major federal holiday) for affected parties to react to the filing. Grave concerns were expressed by multiple parties about widespread adverse impacts on GPS receivers – including parties who pointed out that interference would adversely

⁹ See Modification Application Narrative at pp. 3-7; Consolidated Reply at pp. 21-29.

¹⁰ See Consolidated Reply at pp. 4, 19.

affect GPS-reliant services important to health, public safety, and homeland security.¹¹ This diverse community of GPS stakeholders advised that the technical operational issues are complex and varied and that there has been insufficient time to study the broad implications of LightSquared's proposed operation with respect to widespread embedded GPS receivers in many commercial and government sectors especially given the fact LightSquared failed to provide any technical detail of its planned extensive nationwide network of high-power base stations.¹²

Despite requests *not* to grant the LightSquared application before such important issues can be fully addressed, the Bureau granted the conditional waiver to LightSquared. The Order provides no analysis whatsoever of the multiple GPS interference concerns raised. The Order includes no discussion of the technical analysis of interference to GPS receivers submitted by Garmin,¹³ or to information provided by others, such as the US GPS Council¹⁴ and Motorola Solutions.¹⁵ Instead, the Order only outlines an informal working group process, *to be led by LightSquared*, and an extraordinarily expedited process to consider this issue.

Deere submits that the Bureau erred in granting any authority to LightSquared -- even conditional authority -- given the magnitude and impact of the likely interference to many GPS receivers. Further, as discussed below, the working group procedures are inadequate to address

¹¹ See, e.g., *Ex Parte* Notification, U.S. GPS Industry Council, SAT-MOD-20101118-00239 (Filed Jan. 19, 2011); Comments, Cessna Aircraft Company, SAT-MOD-20101118-00239 (Filed Jan. 18, 2011); Letter, National Telecommunications and Information Administration, Department of Commerce, SAT-MOD-20101118-00239 (Filed Jan. 12, 2011).

¹² The docket for SAT-MOD-20101118-00239 contains approximately 76 submissions concerning the potential negative impact of a LightSquared license modification or waiver on GPS performance dated prior to the International Bureau's grant of waiver. Submitting parties include industry groups, research associations, government agencies, aircraft manufacturers, pilots, GPS equipment manufacturers, GPS equipment owners, and running enthusiasts, amongst others.

¹³ See *Ex Parte* Notification, U.S. GPS Industry Council, SAT-MOD-20101118-00239 (Filed Jan. 20, 2011).

¹⁴ See, e.g., Comment, U.S. GPS Industry Council, SAT-MOD-20101118-00239 (Filed Dec. 2, 2010).

¹⁵ See *Ex Parte* Notification, Motorola, Inc., SAT-MOD-20101118-00239 (Filed Dec. 22, 2010).

the GPS interference issues and do not provide for meaningful resolution of these interference issues.

IV. GRANT OF LIGHTSQUARED'S WAIVER WAS INAPPROPRIATE AND CONFLICTS WITH ESTABLISHED COMMISSION PRECEDENT AND POLICY

A. The Order Inappropriately "Waived" Policies And Rules Leading To Direct Interference With Other Licensees

In considering waiver requests,¹⁶ the Bureau is obligated to follow long-established Commission precedent regarding the limited circumstances in which it is appropriate to depart from rules established in notice and comment rulemaking procedures that are mandated by the Administrative Procedures Act¹⁷ and Communications Act.¹⁸ The seminal *WAIT Radio* case provides clear guidance: A waiver may be granted in a particular case only where the particular facts make strict compliance inconsistent with the public interest, and the relief requested would not undermine the policy objective of the rule in question and would otherwise serve the public interest.¹⁹ The waiver process is to be used sparingly and is not appropriate in situations where actions have widespread ramifications²⁰ or effect a change in general policy.²¹ The Commission has specifically recognized that it is inappropriate to proceed through a narrow waiver process

¹⁶ While LightSquared sought a modification of its license, the International Bureau instead chose to grant LightSquared a waiver.

¹⁷ 5 U.S.C. §§ 551 *et seq.* (2011).

¹⁸ 47 U.S.C. §§ 151 *et seq.* (2011).

¹⁹ *See WAIT Radio v. FCC*, 418 F.2d 1153, 1157 (1969).

²⁰ *See In re Applications of Capital Cities/ABC, Inc. (Transferor) and The Walt Disney Company (Transferee) for Consent to the Transfer of Control Licenses*, Memorandum Opinion and Order, 11 FCC Rcd 5841 at ¶ 87 (1996) (refusing to amend the Commission's permanent waiver rules due to the "broad application" of the rules and the restricted nature of a waiver proceeding).

²¹ *See In re Office of Cable Television, State of New Jersey*, Memorandum Opinion and Order, 68 F.C.C.2d 1431 at ¶ 38 (1978) (finding a waiver proceeding the improper forum for a change to the Commission's "general policy" of preserving local television service).

where a grant would be tantamount to a *de facto* reallocation of spectrum raising policy questions regarding the best use of particular spectrum -- matters that are best addressed in a rulemaking proceeding.²² New interpretations of agency rules in conflict with prior definitive interpretations require notice and comment.²³

The Order does little to explain how the waiver is justified under this specific standard. In this case, the waiver authorizes a dramatic departure from the intended ancillary use of spectrum to fill in areas in support of mobile satellite services. The projected terrestrial services will inflict damaging interference to GPS receivers across the country risking, in the agricultural application, serious disruption of agricultural GPS-based services over 1,000 square miles surrounding each base station.

B. The “Waiver” Inappropriately Authorizes A Harmful Non-Conforming Network That Should Be Operated Under Commission Rules Only On A Non-Interference Basis

A demonstration that incumbent services will not suffer harmful interference is a longstanding Commission prerequisite for granting a waiver involving non-conforming spectrum use. Without meaningful explanation or justification, the Commission has flipped this established precedent on its head and granted LightSquared waiver authority to operate a network that will create massive interference with absolute certainty for Deere’s licensed

²² See *In the Matters of Rulemaking to Amend Part 1 and Part 21 of the Commission’s Rules to Redesignate the 27.5-29.5 GHz Frequency Band and to Establish Rules and Policies for Local Multipoint Distribution Service; Applications for Waiver of the Commission’s Common Carrier Point-to-Point Microwave Radio Service Rules; Suite 12 Group Petition for Pioneer’s Preference; University of Texas-Pan American Petition for Reconsideration of Pioneer’s Preference Request Denial*, Notice of Proposed Rulemaking, Order, Tentative Decision and Order on Reconsideration, 8 FCC Rcd 557 at ¶ 53 (1993) (denying applications for waiver on ground that grant would “amount to a *de facto* reallocation of the 28 GHz band”), *aff’d*, *Melcher v. FCC*, 134 F.3d 1143, 1164 (1998) (“the waivers raised common policy questions, involving both the best use of the 28 GHz band and the additional rules that would be needed to govern new uses of that band, questions that would best be addressed in a rulemaking proceeding”).

²³ See *In re: Calvary Chapel of Costa Mesa, Inc.*, 23 FCC Rcd 9971 at p. 3 (2008) (citing *Syncor Int’l Corp. v. Shalala*, 127 F.3d 90, 94 (D.C. Cir. 1997) for proposition that “new interpretation of an agency rule in conflict with prior definitive interpretation requires notice and comment”).

MSS/L-band high-precision GPS receivers, as well as numerous other incumbent spectrum users.²⁴

The Commission standard for granting a waiver authorizing an intentionally radiating communication is well-established. The Commission may grant a waiver of the application of its rules only where “good cause is shown,”²⁵ and only where the waiver of the rule serves the public interest.²⁶ When evaluating a request to operate a non-conforming intentional RF radiator that cannot be routinely authorized, a demonstration that harmful interference will not affect existing, authorized incumbent spectrum users is a key requirement in demonstrating that the waiver benefits the public interest.²⁷ Commission precedent shows that for requests for non-conforming spectrum uses, a grant is warranted only “when there is little potential for interference into any service authorized under the Table of Frequency Allocations and when the nonconforming operator accepts any interference from authorized services.”²⁸ With regard to evaluating proposed non-conforming uses of MSS frequencies, the Commission has set the bar much higher, and firmly stated that “non-conforming service may only be provided on a no-

²⁴ Deere is an MSS earth station licensee in good standing with the Commission. See File No. SES-LIC-20010112-00051.

²⁵ 47 C.F.R. § 1.3.

²⁶ See *Ne. Cellular Tel. Co. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990).

²⁷ See *In the Matter of AfriSpace, Inc. Application for Authority to Launch and Operate a Replacement Satellite, AfriStar-2, at 21° E.L. and to Co-locate It with AfriStar-1*, SAT-LOA-20050311-00061 at ¶¶ 21-22 (2006) (granting waiver after deeming it unlikely that harmful interference between satellites would occur); see also *In re State of Alaska*, Memorandum Opinion and Order, 18 FCC Rcd 16315, ¶ 15 (2003) (explaining that a waiver grant for non-conforming spectrum use is appropriate when the proposed operations “will not result in harmful interference to other licensees”).

²⁸ *In the Matter of PanAmSat Licensee Corp. Application for Authority to Use Extended Ku-Band Frequencies for Domestic Service*, Order and Authorization, 20 FCC Rcd 14642 at ¶ 6 (2005) (citation omitted); *In the Matter of The Boeing Company Application for Blanket Authority to Operate Up to Eight Hundred Technically Identical Transmit and Receive Mobile Earth Stations Aboard Aircraft in the 14.0-14.5 GHz and 11.7-12.2 GHz Frequency Bands*, Order and Authorization, 16 FCC Rcd 22645 at ¶ 12 (2001) (citation omitted).

harmful-interference basis vis-a-vis any licensed service provided in conformance with the Table of Allocations.”²⁹

Commission precedent and policy prohibit a non-conforming spectrum use authorized by waiver from being elevated to super-priority status over a licensed service. Given that significant scientific data in the record as in well as the attached Exhibit B demonstrate that licensed co-channel MSS operators, including Deere’s StarFire network, will experience massive harmful interference if LightSquared is permitted to deploy 40,000 high-powered terrestrial base stations in the same frequencies presently used to receive very faint signals from satellites thousands of miles overhead. The Order cannot be reconciled with Commission precedent. To maintain its policy of limiting non-conforming use to a “no-harmful-interference“ basis, the Commission must do more than merely agree to study the impact of LightSquared’s network on existing licensed spectrum uses.³⁰ Instead, as described in greater detail below, the Commission needs to undertake a deliberate evaluation of how to introduce powerful new radiators into L-band MSS frequencies without disrupting existing licensed spectrum users, and assume a leadership role in thoroughly evaluating the interference protection needs of incumbents.

C. The Order Enables LightSquared To Pollute An RF Environment That Has Been Carefully Cultivated For Sensitive Uses

MSS services as originally envisioned required a quiet spectrum environment to support space-to-earth signals. To ensure that the L-band remained a viable home for delicate space-to-earth communications, the Commission has cautiously introduced new uses in neighboring frequencies, and avoided the introduction of higher powered services that might generate strong

²⁹ See *Motorola Satellite Communications, Inc.*, Order and Authorization, 11 FCC Rcd 13952 at ¶ 11 (1996); see also *Mobile Satellite Ventures Subsidiary LLC*, Order and Authorization, 19 FCC Rcd 22144, ¶ 14 (2004) (confirming that non-conforming use of MSS bands is in the public interest where the Commission is “certain that relaxation of the rule restriction will not significantly increase interference”).

³⁰ See Order at ¶¶ 41-43.

interfering signals, raise the noise floor, or emit unacceptable out-of-band emissions. This approach cultivated the L-band and neighboring frequencies into a low-noise environment that supports sensitive applications well, but remains susceptible to interference from higher powered services.

Receivers that support MSS and GPS applications in L-band and neighboring frequencies are sensitive by design. They need to be in order to successfully receive signals as weak as -152 dBm, or -182 dBW from space based transmitters in orbit. As already extensively discussed in this record, however, the heightened sensitivity necessary to receive faint signals from space-based transmitters also makes the receivers in the L-band subject to overload and desensitization in the presence of strong interfering and adjacent channel signals. Given their heightened sensitivity and susceptibility to overload, the 32 dBW base station proposed by LightSquared will render many existing devices, including Deere's high-precision MSS/GPS receivers unusable within a large radius around the LightSquared base station.³¹

The pollution introduced into the L-band and neighboring bands would have been problematic but likely manageable if an ATC network was deployed that only served to fill gaps in densely populated and well shielded urban areas, as originally intended by the Commission. But 40,000 base stations operating with 32 dBW of output and covering 92% of the population in the conterminous U.S. threatens massive interference to legacy spectrum users, and require a meaningful evaluation of the impact on incumbents and possible interference mitigation techniques that has not yet happened. Given the sensitive nature of the L-band and neighboring bands, and the lack of Commission-led testing to evaluate the interference mitigation techniques, grant of the Order presents a significant risk that the Bureau should rethink.

³¹ See discussion at Exhibit B. Deere has assumed that LightSquared's base stations will operate at 32 dBW. However, there appears to be no prohibition preventing LightSquared's base stations from operating up to 42 dBW.

V. THE WORKING GROUP PROCEDURE ESTABLISHED IN THE ORDER IS INADEQUATE

Deere appreciates the Commission's expressed concern regarding GPS interference.³² However, the working group procedures established in the Order to address GPS interference issues fall far short of an open, transparent, impartial and deliberate technical process that will produce a meaningful examination of GPS interference and assessment of potential interference mitigation solutions, if any. The Order states that Commission staff will work with NTIA, LightSquared and the GPS community including appropriate Federal agencies to establish a working group to fully study the potential for overload interference to GPS devices and to identify any measures necessary to prevent interference to GPS.³³ The Order directs *LightSquared* to help organize and fully participate in this working group and sets an aggressive timetable of interim reports with LightSquared to submit a final report by June 15, 2011, including the working group's analysis of the potential for overload interference to GPS devices and technical and operational steps to avoid such interference, and specific recommendations going forward to mitigate potential interference to GPS devices.³⁴ The process will be complete once the "Commission, after consultation with NTIA, concludes that the interference concerns have been resolved and sends a letter to LightSquared stating that the process is complete."³⁵

The process outlined in the Order is inconsistent with prior Commission precedent and wholly inadequate to address the significant GPS interference concerns raised. The process is compromised at the outset as it leaves the proverbial fox in charge of henhouse security. The

³² See Order at ¶ 41.

³³ *Id.*

³⁴ *Id.* ¶¶ 41-43.

³⁵ *Id.* at ¶ 43.

Order authorizes LightSquared to act as the principal architect of the tests that will evaluate its own interference risk to incumbents, which casts doubt on the validity and objectivity of the tests.³⁶ The Order also instructs LightSquared to lead the interference test effort, which casts additional doubt on the integrity of the test process and results.³⁷ Allowing the new entrant to play the principal role in both the design and administration of the tests that evaluate its own interference potential is patently inconsistent with good engineering practices, and presents significant opportunity for LightSquared to steer the tests toward its desired outcome -- a favorable finding regarding incumbent interference protection with LightSquared's preferred network configuration and desired power levels.

Moreover, the process outlined in the Order does not provide adequate time to ensure that the technical and operational issues of GPS interference will be fully addressed. In addition, there is little assurance that all interested segments of the public -- government and nongovernment -- will have the opportunity to participate in an open and transparent proceeding. Indeed, in the February 25, 2011 letter, the Commission states that "LightSquared is not required to obtain participation of any particular organization or individual."³⁸ LightSquared is "responsible for selecting appropriate participants."³⁹ Affected parties that have legitimate objections to the methods or process appear to have no recourse. The Order fails to articulate the standard by which the "Commission, after consulting with the NTIA," has decided that the

³⁶ *Id.* The letter issued by the International Bureau and the Office of Engineering and Technology today regarding the application of the Federal Advisory Committee Act to the working group procedures states that LightSquared "is to set the agenda." Letter, International Bureau and Office of Engineering and Technology of Federal Communications Commission, SAT-MOD-20101118-00239 at p. 2 (Filed Feb. 25, 2011) ("February 25, 2011 Letter").

³⁷ Order at ¶ 42.

³⁸ Letter, International Bureau and Office of Engineering and Technology of Federal Communications Commission, SAT-MOD-20101118-00239 at p. 1 (Filed Feb. 25, 2011).

³⁹ *Id.*

concerns are resolved thus meeting the Order's condition and permitting LightSquared to commence commercial service. Finally, the outlined process fails to ensure that the Commission's decision on this matter, the record evidence considered, and its analysis of the issues will be made public in a comprehensive report upon which the public will have adequate opportunity to comment.⁴⁰

VI. A MORE OPEN, IMPARTIAL, AND DELIBERATE PROCESS IS NECESSARY TO PREVENT LIGHTSQUARED'S PROPOSED SERVICE FROM CREATING HARMFUL INTERFERENCE TO LONGSTANDING INCUMBENTS

A. The Commission Must Assume More Direct Oversight Of Technical Analysis And Interference Mitigation

The introduction of terrestrial-only handsets in the L-band is akin to spectrum reallocation or the introduction of a completely new service in a band already heavily populated with incumbent spectrum users. The proposed CMRS base stations and end user devices are not complementary of MSS systems, as originally contemplated when ATC service was authorized.⁴¹ Instead, LightSquared's proposed terrestrial network will actually be a competing, co-channel user of frequencies whose introduction will dramatically reshape the L-band and potentially affect many critical spectrum users in adjacent bands as well. When new entrants have proposed co-channel operations in bands heavily used by incumbent services in recent years, the FCC has acted only after conducting extensive tests led by OET to evaluate

⁴⁰ The February 25, 2011 Letter indicates that LightSquared is to file its progress reports and final report in the public record and that the public may submit comment on them.

⁴¹ See, e.g., *Establishment of Policies and Service Rules for the Mobile Satellite Service in the 2 GHz Band*, Memorandum Opinion and Order, 16 FCC Rcd 16043, ¶ 19 (2001) (noting that ATC service was authorized to the "extend MSS availability to indoor and urban areas that would otherwise go unserved by a satellite-only service").

interference concerns and develop effective mitigation steps.⁴² Deere urges the Bureau to modify its process for examining the GPS interference issues so that OET will have direct oversight and active involvement in the technical review, testing and analysis.

OET and the FCC Columbia laboratory have the dedicated engineering expertise, resources and experience necessary to evaluate compatibility issues and interference risks associated with introducing new spectrum users into already occupied frequencies, and must be involved in the present evaluation of the L-band as a suitable environment for the proposed Commercial Mobile Radio Service (“CMRS”) network. Direct FCC oversight of technical analysis and testing in connection with the introduction of extremely low-powered transmitters across overlapping allocations below 10 MHz, has repeatedly helped the agency to avoid hasty implementation of regulations that inadvertently create harmful interference versus rules based on sound engineering principles that enable more efficient and innovative use of spectrum while also protecting incumbent spectrum users:

- FCC tests and scientific analyses conducted at the Columbia laboratory determined that the initial proposed interference protection scheme for incumbents in the “white spaces” was technically unsound and required a comprehensive overhaul which led to successful implementation of alternative interference avoidance mechanisms.⁴³
- The FCC, working with NTIA and other government agencies, conducted tests that helped enable the development of rules that permit unlicensed devices in the 5 GHz band.⁴⁴

⁴² See, e.g., *Unlicensed Operation in the TV Broadcast Bands*, First Report and Order and Further Notice of Proposed Rulemaking, 21 FCC Rcd 12266 (2006) (establishing the need for laboratory and field tests to evaluate incumbent interference tolerance prior to the introduction of unlicensed devices in TV broadcast spectrum) (“*White Space Order*”).

⁴³ See *Unlicensed Operation in the TV Broadcast Bands*, Second Report and Order, 23 FCC Rcd 16807, ¶ 73(2008) (discussing how OET testing demonstrated that spectrum sensing by itself was inadequate interference protection for incumbent services).

⁴⁴ *Revision of Parts 2 and 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, Order, 20 FCC Rcd 4883, ¶ 8 (2005) (while implementing dynamic frequency sharing devices in the 5 GHz band proved “more complex than originally envisioned” the Commission lab was able to work with “all parties” to develop measurement procedures for the certification of new entrant devices that ensure comprehensive interference protection for all incumbents.)

- FCC/NTIA tests and scientific analyses were used to determine the levels of ambient RF energy that incumbent services were able to tolerate from ultra-wideband emissions without experiencing harmful interference.⁴⁵

FCC engineers, and in particular OET engineers, have a comprehensive understanding of the L-band RF environment and adjacent frequencies, and are best positioned to evaluate the impact of new entrants and to ensure meaningful, real-world interference protections for incumbents. OET has also acquired a comprehensive understanding of how Part 15 GNSS receivers react to interfering signals, and how spurious emissions may degrade or disrupt the performance of GNSS networks.

As has been the case in other contemporary proceedings where a new entrant is allowed to operate co-channel with an existing incumbent, OET should be tasked with leading a structured test effort that establishes clear objectives and a public process. Based on the scale and scope of the effort necessary to evaluate the effect of introducing new technology in the MSS L-band, Deere urges the Commission to implement the following steps in OET's test program.

- **Test Plan:** Publication of a test plan that evaluates the impact of LightSquared's proposed terrestrial network on in-band MSS receivers and adjacent band GPS receivers, including hybrid receivers such as Deere's high-precision StarFire units that are licensed MSS terminals but also receive GPS signals. Interested parties should be given a reasonable comment period (at least 15 days) to provide input on the proposed test parameters and protocols.⁴⁶
- **FCC Laboratory Testing:** The FCC Columbia laboratory should conduct tests on the susceptibility of MSS receivers, GPS receivers, and hybrid receivers to interfering signals using equipment available to the installed MSS/GPS user base. As in prior OET-led test initiatives, all tests should be readily accessible to interested parties.

⁴⁵ See, e.g., *In the Matter of Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems*, First Report and Order, 17 FCC Rcd 7435 at ¶¶ 70-146, 170-71 (2002).

⁴⁶ Deere has attached test protocols for the evaluation of high precision GPS receiver interference tolerance to base station and LTE transmissions as Exhibit C.

- **Publication of Test Results:** Test results should be published by FCC laboratory engineers and comments should be solicited by the Commission on the test results.

Further tests would be appropriate to the extent that interference issues arising during the initial round of tests require the implementation of mitigation techniques that require validation. Deere urges the Commission to ensure that public comment and participation in subsequent tests is solicited.

B The Process Should Allow Adequate Time To Ensure That Interference Tests Are Meaningful

In prior rulemakings where new entrants are introduced into frequencies already occupied by sensitive incumbents, even when a reallocation is not required, the Commission has undertaken a thoughtful technical analysis and ensured that test procedures and protocols used to serve as the underlying basis for rules governing new entrant operations are impartial and open to public comment.⁴⁷

Public participation in Commission tests evaluating new technology has proven invaluable in recent proceedings and helped shape the ultimate rules in other bands where new entrants have been introduced. The expedited treatment of LightSquared's request and the unrealistic milestones for interference testing do ***not*** provide FCC engineers and private industry with adequate time to fully evaluate the impact of the proposed services on incumbents and further undermine the test process. Nor does the Commission's expedited process provide sufficient time for LightSquared and interested incumbent spectrum users to work on engineering solutions for any interference problems that might be discovered during testing. Requiring the conclusion of testing and resolution of all interference issues within a five (5) month window as

⁴⁷ See, e.g., *White Spaces Order* at ¶ 48 (noting the Commission commitment to “conduct extensive testing as part of the process to develop technical rules” for new devices proposed for the TV bands).

specified by the Order is patently unrealistic, in particular given that the Commission itself has not yet taken a more direct role in ensuring the integrity of the tests and test data, as it has in other proceedings introducing new entrants in bands already heavily used by important incumbents. Absent modification, such procedures will enable a rush to judgment that will adversely affect the public interest.

Respectfully submitted,

/s/

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Deere & Company
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Moline IL 61265

Dated: February 25, 2011

Exhibit A

Affidavit of Qualified Radio Engineer

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

In the Matter of)	
)	
LightSquared Subsidiary LLC)	
)	SAT-MOD-20101118-00239
Request for Modification of its)	
Authority for an Ancillary Terrestrial)	
Component)	
)	

AFFIDAVIT OF PAUL H. GALYEAN

1. My name is Paul H. Galyean. My business address is 20780 Madrona Avenue, Torrance, CA 90503. I am currently employed as manager, System Engineering and IME/Robotics by NavCom Technology, Inc. (“NavCom”), a wholly owned operating subsidiary of Deere & Company (“Deere”). I have personal knowledge of the contents of this filing and am authorized on behalf of Deere and NavCom to provide this affidavit.

2. This affidavit was prepared in support of the above-captioned Petition for Reconsideration (the “Petition”) of Deere concerning the International Bureau’s Order and Authorization, dated January 26, 2011 (“Order”),¹ granting LightSquared Subsidiary LLC (“LightSquared”) a “conditional waiver” of the Commission’s Ancillary Terrestrial Component (“ATC”) rules.

3. Based on my engineering analyses, LightSquared’s proposed use of radiofrequencies as contemplated in the Order will create harmful electrical interference to

¹ *In the Matter of LightSquared Subsidiary LLC Request for Modification of its Authority for an Ancillary Terrestrial Component, Order and Authorization, SAT-MOD-20101118-00239 (Released Jan. 26, 2011) (“Order”).*

incumbent spectrum users in the 1525 – 1610 MHz frequency range, including licensed mobile satellite service terminals operated by Deere. Specifically, the introduction of 32+ dBW emissions in the 1525-1559 MHz band will disrupt or heavily degrade the operation of Deere MSS terminals within a 35 kilometer radius of the transmitting base station.

4. Based on my engineering analyses, the specific impact of the harmful electrical interference generated by LightSquared's contemplated operations is accurately reflected in the Petition and complementary exhibits.

I affirm under penalty of perjury that the foregoing is true and correct.

Paul H. Galyean

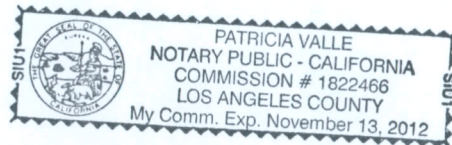
STATE OF CALIFORNIA
COUNTY OF LOS ANGELES

SWORN TO AND SUBSCRIBED before me on the 25 day of Feb., 2011.

Patricia Valle
Notary Public

by PAUL H. GALYEAN

proved to me on the basis of
satisfactory evidence to be the person(s) who appeared before me



My commission expires: 11-13-2012

Exhibit B

Engineering Analysis of Base Station Interference to Deere Receivers

Technical Background Information for LTE Interference with Deere receivers.

Deere and competitor high-precision GNSS receivers are used for agriculture, construction, survey, and other applications that require 0.01 to 0.1 meter precision, 24 hours a day, 365 day per year, anywhere on Earth. To achieve this high level of accuracy the receivers employ design characteristics that are significantly impacted by high-powered LTE signals in the 1525 MHz to 1559 MHz band.

Typically, the front-end signal processing sections of high-precision receivers use an antenna and first-stage LNA system that is designed to receive the 1 MHz GPS C/A code, the 10 MHz GPS P(Y) code, both at 1575.42 MHz and the GLONASS G1 signals with center frequencies between 1597 MHz and 1605 MHz. Most high-precision receivers are also designed to receive StarFire, Omnistar or equivalent augmentation signals in the 1525 MHz to 1559 MHz MSS band.

Support of all these signals requires the antenna and first-stage amplifier/filters of high-precision receivers to be responsive to frequencies between 1525 MHz and 1610 MHz. In addition, at least 10% (9 MHz) additional margin must be provided at each of end of the pass band to accommodate manufacturing process variability. A portion of the pass band spectrum for a high-precision antenna is shown in **Figure 1** (Not shown: the antenna is also responsive to GPS L5, L2, GLONASS G2 signals at lower L-band frequencies.) For the depicted antenna, the -1dB response corners are located at 1515 MHz and 1620 MHz. All LTE signal power between 1515 MHz and 1620 MHz will impinge upon the antenna's first stage filters and amplifiers.

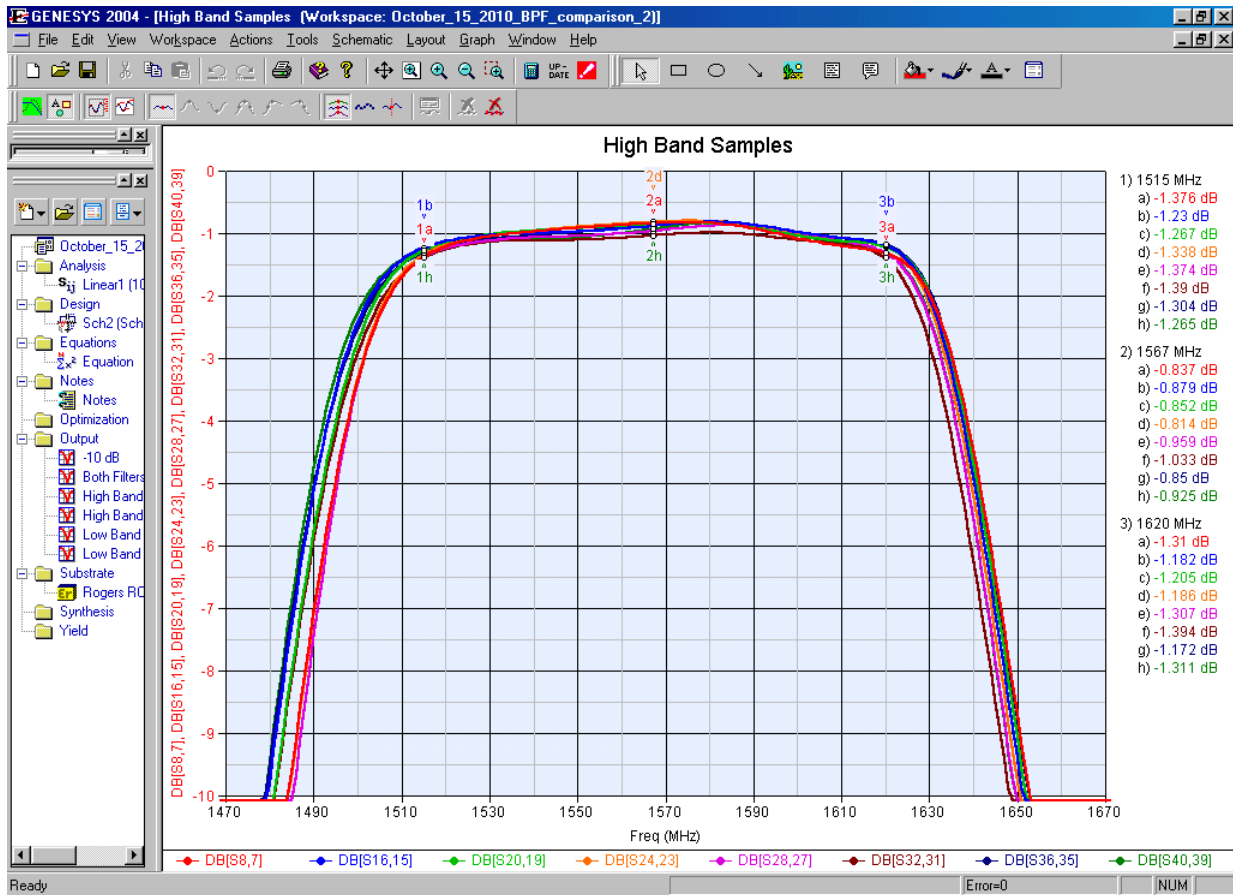


Figure 1 Measured Antenna/First Stage Amplifier Pass Band for High Precision Receiver

A generic block diagram of the front end of a typical commercial high-precision GNSS receiver with MSS band augmentation is shown in **Figure 2**. The antenna and first stage amplification and filter sections (Circled "A" in the figure) receive signals of all frequencies, filter out frequencies outside the range of 1515 MHz to 1620 MHz, amplify the signals, and pass them to the GNSS receiver via a cable.

The measured 1dB compression point for filters and amplifiers for this antenna is -40 dBm. Stronger signals cause significant degradation in the sensitivity and accuracy of the receiver. The proposed +32 dBW EIRP of the LTE signals will obviously adversely affect receivers for considerable distances from the broadcast tower.

The antenna cable is connected to the RF section of the receiver, which splits the signal and processes it in several signal processing chains. The details of the signal splitting and processing are unique to each receiver, but all are similar in general plan. **Figure 2** is a representative receiver. The 1515 MHz to 1620 MHz bands are split into several sub-bands including, GPS (Circled B in figure), StarFire (Circled C) and GLONASS (not shown).

TYPICAL GNSS RECEIVER WITH MSS-BAND AUGMENTATION

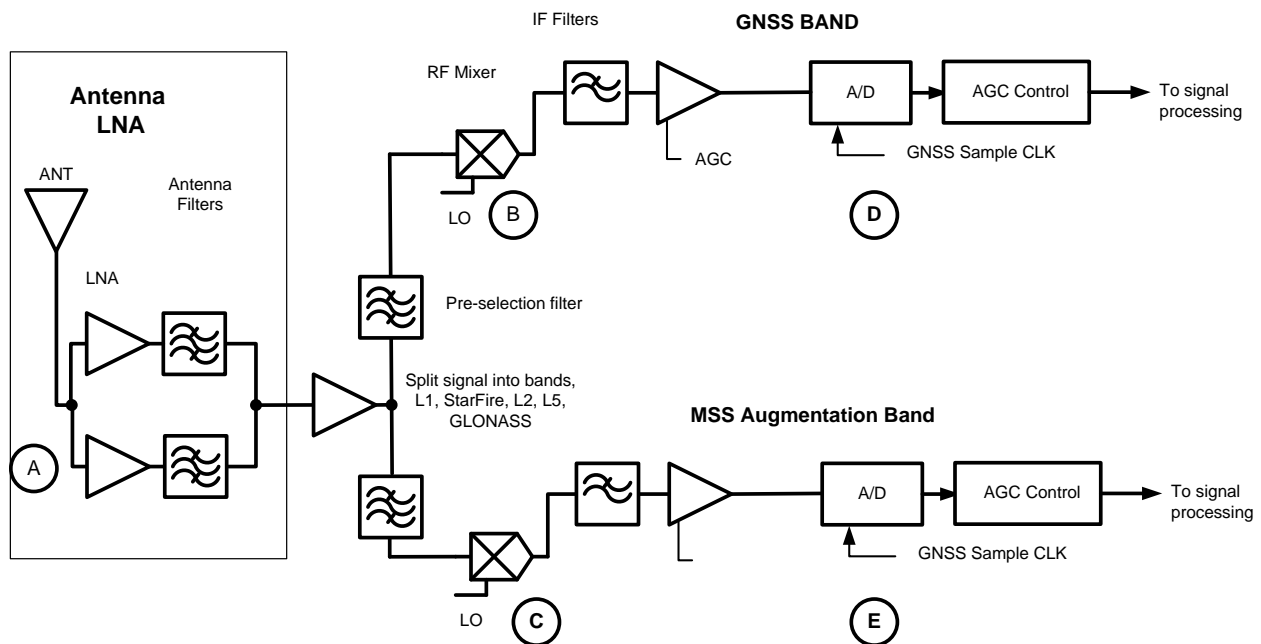


Figure 2 Typical High Precision GNSS Receiver with MSS Augmentation

GPS SIGNAL PROCESSING

The GPS portion of the split signal (Circled B) is filtered again to remove non-GPS signals, down-converted to an Intermediate Frequency (IF) by mixing with a Local Oscillator (LO) and amplified with a Variable Gain Amplifier. In the depicted receiver, the 1 dB compression point of the filter/mixer combination is -28 dBm which corresponds to -65 dBm at the LNA. Received power from the LTE signals in the frequency range 1515 MHz to 1559 MHz with power greater than the 1 dB compression point of the filter/mixer will adversely affect the sensitivity and precision of the receiver.

The first-stage filter/mixer (Circled B) has -1 dB frequency corners at 1559.42 MHz and 1591.42 MHz, which are coincident with the edges of the GPS L1 band. Many high precision receivers use a very high-performance Surface Acoustic Wave (SAW) filter to reject non-GPS signals. The measured frequency response of the SAW filter from a typical high precision receiver is shown in **Figure 3**. Here, the 1575.42 MHz GPS frequency has been down converted to an IF of 140 MHz. The edges of the pass band are very sharp and the filter and mixer provide a net total of almost 45 dB of out of GPS band interference rejection. Portions of the LTE signals that are stronger than the SAW filter rejection will degrade the sensitivity and precision of the GPS measurements.

Theoretically, the width of the SAW filter pass band could be narrowed with respect to the width of the GPS band. This is often done for lower-performance receivers that don't track the GPS P(Y) code. However, receivers that use the 10 MHz P(Y) must provide have at least +/- 10 MHz of pass band in order to avoid compromising the code's signal bandwidth and adversely affecting measurement precision. Experiments have demonstrated that narrowing the width of the SAW filters from 32 MHz to 24 MHz (+/- 12 MHz from 1575.42 MHz center) reduces measurement precision.

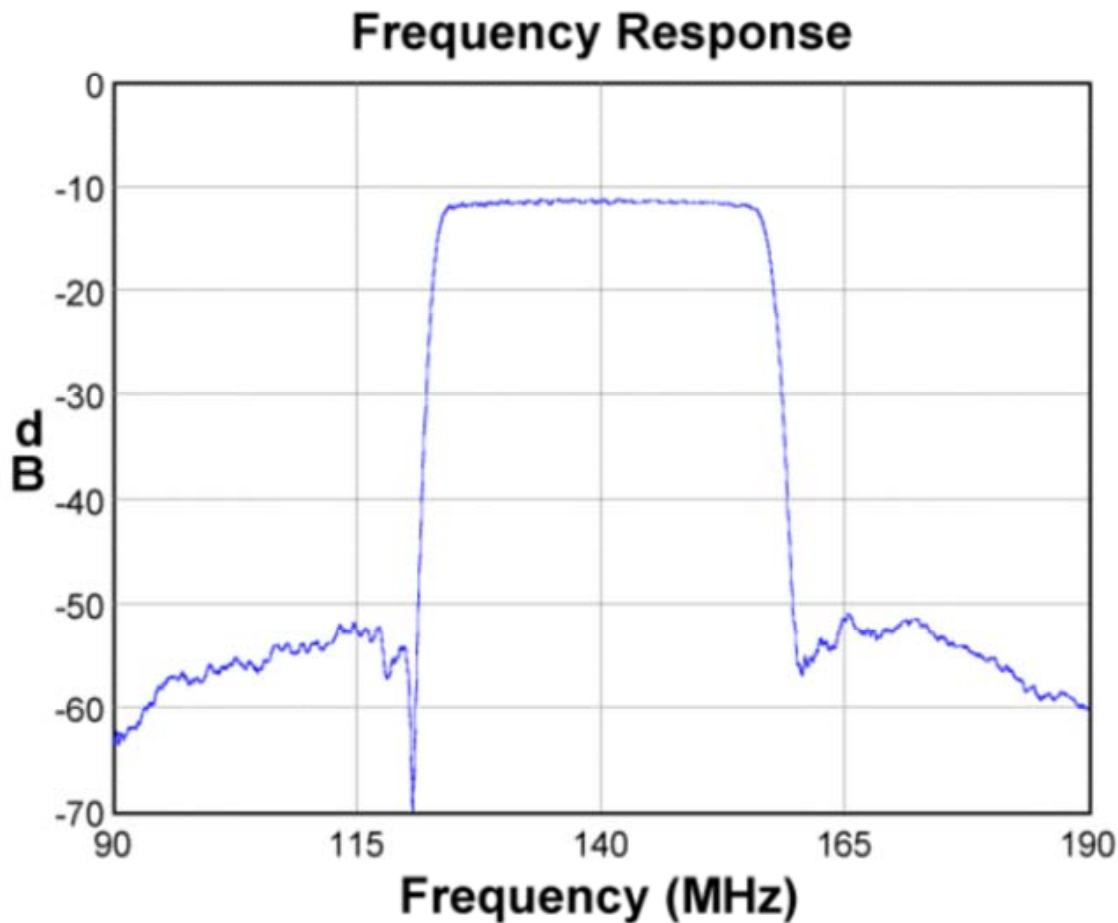


Figure 3 Frequency Response for High Performance GPS SAW Filter

The receiver's GPS filters do not significantly remove jamming signals with frequencies that fall within the 1559 MHz to 1610 MHz GPS band. However, some protection is provided by the GPS spread spectrum signal and the receiver's anti-jamming signal processing. (Circled D in **Figure 2**).

STARFIRE AUGMENTATION

The StarFire MSS-band augmentation portion of the antenna signal (Circled C in **Figure 2**) is filtered again to remove non-MSS band signals, down-converted to an Intermediate Frequency (IF) by mixing with a Local Oscillator (LO) and amplified with a Variable Gain Amplifier. In the depicted

receiver, the 1 dB compression point of the filter/mixer is -28 dBm and is -65 dBm for the LNA. Received power from the LTE signals in the frequency range of 1515 MHz to 1620 MHz with power greater than the 1 dB compression point of the filter/mixer will adversely affect the sensitivity and precision of the receiver.

The first-stage filter/mixer (Circled C) has -1 dB frequency corners that allow passage of an INMARSAT-distributed augmentation signal such as StarFire or Omnistar. Many receivers use a very high-performance Surface Acoustic Wave (SAW) filter to reject signals at unwanted frequencies. The measured frequency response of the SAW filter from a typical receiver is shown in **Figure 4**. Here, the carrier frequency of the StarFire signal has been down converted to an IF of 225 MHz, and the pass band of the filter is 160 KHz.

The down conversion LO for the augmentation signals is tunable to match the carrier frequency of one of over 50,000 INMARSAT channels between 1525 MHz and 1559 MHz. The exact frequency of the channel of interest varies over the Earth and is subject to change at the discretion of INMARSAT. Deere receivers have been specifically designed to be equally responsive to all signals within 1525 MHz to 1559 MHz to accommodate channel reassignments as directed by INMARSAT.

The edges of the SAW filter pass band are very sharp and the filter and mixer provide a net total of almost 45 dB of out of channel interference rejection. Portions of the LTE signals that are stronger than the SAW filter rejection will degrade the sensitivity of the augmentation signal.

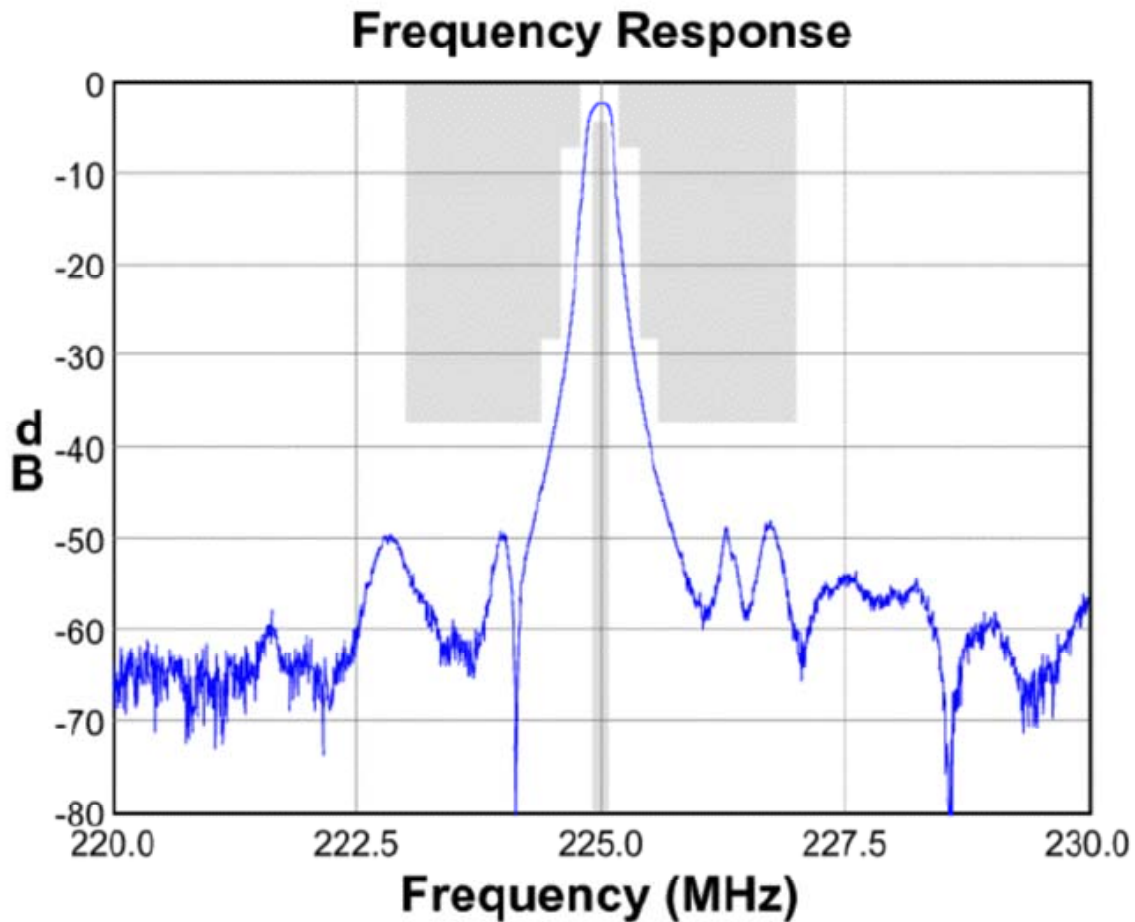


Figure 4 Frequency Response for High Performance StarFire SAW Filter

The receiver's augmentation signal filters do not significantly remove jamming signals with frequencies that are less than 80 KHz away from the augmentation signal's nominal frequency. However, some protection is provided by the message structure of the augmentation signals and by the receiver's anti-jamming signal processing. (Circled E in **Figure 2**).

Range of LTE Interference

The following analysis is based on theoretical estimation of the received LTE signals at various ranges from the base station. The estimation of received signal strength (P_{rx}) is based on a spherical wavefront model. Terrestrial obstructions, particularly those in urban regions, will usually cause the signal level to drop off faster with increasing distance. No adjustments have been made for horizon masking.

It is assumed the broadcast of the signal is +32 dBW EIRP and the antenna pattern gain in the GNSS receiver is 0 dB (typical), and it is assumed that there is no leakage of the LTE signal power into the 1559 MHz to 1591

MHz GPS band. The computed effective signal strength (dBm) as a function of distance from the base station (km) is plotted in **Figure 5**.

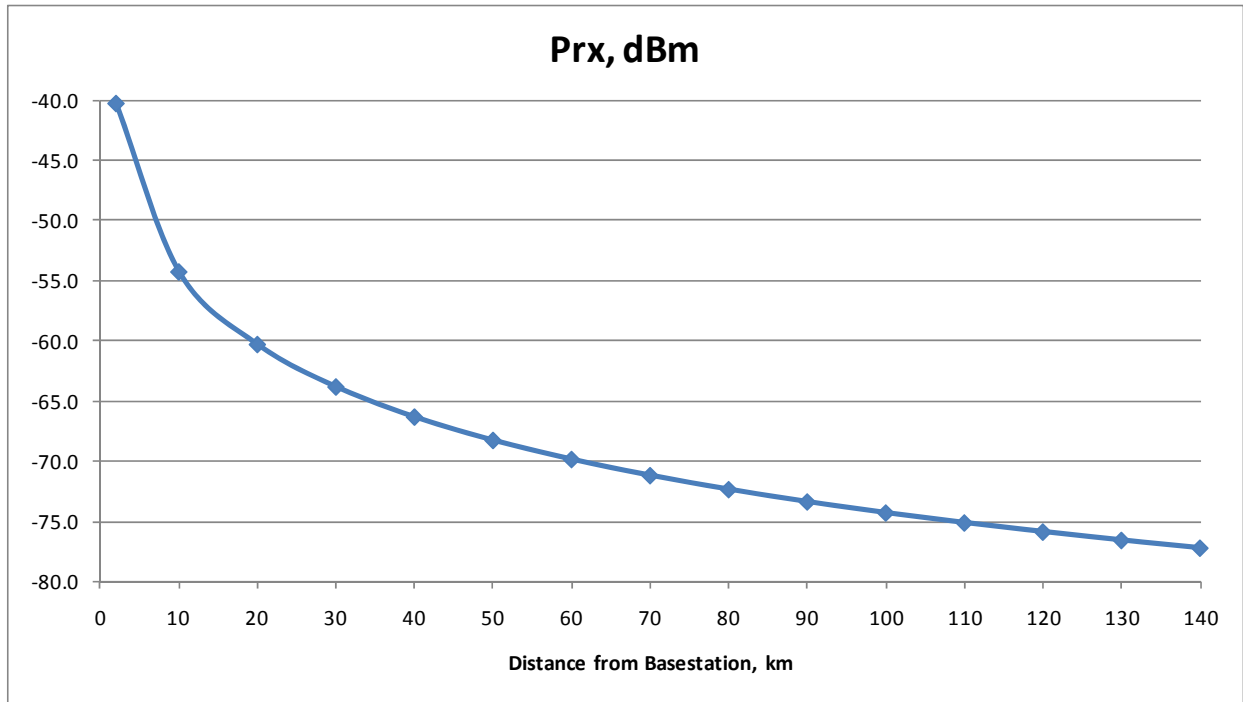


Figure 5 Received Signal Strength LTE Signal

GNSS Interference

In this analysis, all overload conditions, even those deep in the receiver, are referenced back to the LNA input power that causes them. The computed distance from the base station at which a particular degradation ceases to occur is shown in Table 1.

Table 1 Ranges for Degradation of GPS Signals

GPS L1 Signals Processing	dBm	Effect	Range of Effect
Saturation of Antenna LNA (1dB LNA)	-40.0	Inoperative	2 Km
Saturation of Mixer/Filter	-65.0	Heavily degraded sensitivity	35km
GPS degradation	-80.0	No Degradation	>140 Km

Antenna LNA compression is the first overload condition. It requires the greatest power and occurs nearest to the base station. The receiver will not be able to track any GPS or augmentation signals when antenna LNA compression occurs. At greater distances, while the down conversion mixer and filter experience compression, the precision and sensitivity of the receiver are severely degraded. This effect is caused by the presence of the LTE signal within the MSS band, even if no LTE power leaks into the GPS

band. At greater distance, the LTE signals no longer causes mixer compression. At this point the performance and accuracy of the receiver will gradually improve until the range indicated in the bottom row of the table is reached.

We note that the range at which LTE does not interfere with the receiver measurement quality is larger than the usable operational range of the LTE signals in the LTE network.

Augmentation System Interference

A similar analysis of the range of LTE signal interference with StarFire augmentation signals is summarized in Table 2.

Table 2 Ranges for Degradation of StarFire Signals

Augmentation Signal Processing	dBm	Effect	Range of Effect
Saturation of Antenna LNA (1dB LNA)	-40.0	Inoperative	2 Km
Saturation of Mixer Filter	-65.0	Degraded sensitivity	35Km
Adjacent Channel Interference	-70.0	No Degradation	60 Km

Mitigation of Interference

Deere does not believe it is possible to mitigate the interference of the proposed LightSquared LTE system with the operation of our receivers short of redesigning and replacing all of our receivers.

We believe that LightSquared can engineer their broadcast signal so that it does not leak degrading amounts of signal power into the GPS signal band. In general terms, , the presence of these new high-powered LTE signals in the MSS band will cause all Deere receivers to fail to work as designed whenever and wherever the LTE network is operational. The deleterious effects of the LTE signals in the MSS band extend beyond the effective coverage of the LTE network.

Exhibit C

Test Plan Proposal

Testing Effects of LightSquared LTE Signals on Deere GNSS/StarFire Receivers

Deere suggests two series of tests to determine the effects of the LTE signals on the sensitivity and precision of Deere GNSS/StarFire Receivers.

The first series of tests measure the time-to-first-fix, displayed C/No, number of tracked satellites and standard deviation of computed position fixes for a simulated GPS signal constellation in the presence of various power levels of simulated LightSquared LTE signal.

The second series of tests will measure the acquisition time, displayed signal strength and bit-error-rate (BER) for various strengths of simulated StarFire signals in the presence of various power levels of simulated LightSquared LTE signals.

LTE Interference of GPS Receiver

A prototype setup designed to test the effects of LTE signals on GNSS receivers is shown in Figure 1. The GPS signals are created by a GNSS simulator such as those built by Spirent or other manufacturers. The LTE signals are generated by an Agilent E4438C, or other equivalent signal generator as indicated by LightSquared, and should be followed by blocking filters that match the characteristics of the LightSquared LTE base station in the 1559 to 1610 MHz range. The signal strengths of both simulated signals should be attenuated with step attenuators to achieve the signal to noise levels required for the test. The two signals are then combined with a simple mixer/combiner and fed into the GNSS receiver.

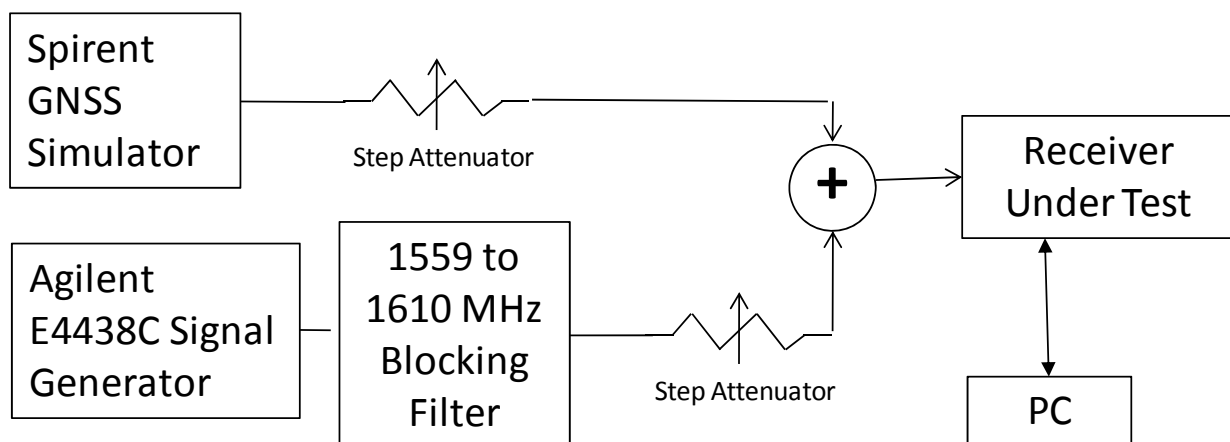


Figure 1 Setup to Test LTE Interference with GNSS Measurements

It is assumed the signal powers of the two simulated signals are significantly stronger than thermal noise so that the overall system thermal noise floor is set by the step attenuators and mixer/combiner.

The method used for inputting the signal into the receiver must be tailored to the requirements of the receiver under test. If the simulated signal is used as a replacement for the receiver's antenna, additional amplification and filtering must be added to match the specifications of the receiver's antenna.

We envision a series of test sets, with several test runs in each set. Each run in a test set must repeat the identical truth location, GPS satellite constellation, signal power, etc., with different powers of the simulated LTE signal between runs. Between test series, the truth location, GPS satellite constellation and satellite power should be varied. Enough series should be run to characterize scenarios that will be faced in practice by GPS receivers.

Data from the receiver should be recorded regularly during each test including, computed position, time-to-first-fix, number of satellites tracked, signal strength (such as estimated C/N0). If available, other quality indicators such as phase noise indicator, cycle slip indicator, etc. should also be recorded.

At the completion of the tests the performance of the receiver as a function of the received LTE signal strength should be analyzed and statistically characterized.

LTE Interference of StarFire Signals

A prototype setup designed to test the effects of LTE signals on a StarFire receivers is shown in Figure 2. This test setup is more difficult to achieve because it requires a custom-built StarFire signal generator. Deere will loan this simulator for the tests.

The StarFire signals are created by using the StarFire simulator to modulate StarFire message data onto a carrier tone generated by a signal generator such as an Agilent ESG. The LTE signals are generated by an Agilent E4438C, or other equivalent signal generator as indicated by LightSquared. The signal strengths of both simulated signals should be attenuated with step attenuators to achieve the signal to noise levels required for the test. The two signals are then combined with a simple mixer/combiner and fed into the StarFire capable receiver.

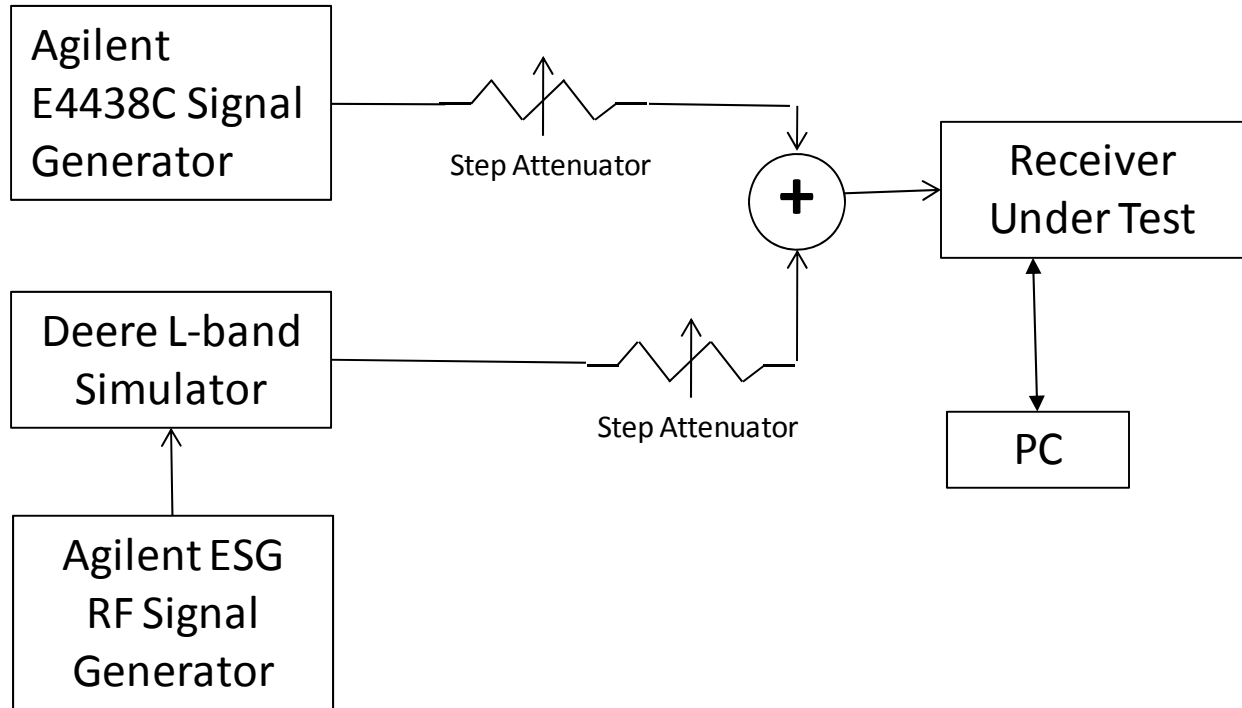


Figure 2 Setup to Test LTE Interference with StarFire Measurements

The method used for inputting the signal into the receiver must be tailored to the requirements of the receiver under test. For receivers without an internal LNA, additional amplification and filtering must be added to match the gain and noise figure characteristics of the receiver's antenna.

We envision a series of test sets, with several test runs in each set. Each run in a test set must repeat identical StarFire data with a different LTE power level. Between test series, signal power of the StarFire data should be varied. Enough series should be run to characterize scenarios that will be faced in practice by receivers.

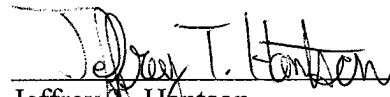
Data from the receiver should be recorded regularly during each test including, data bits and symbols, signal acquisition time, number of acquisition, signal strength (C/No indicator) and number of data message errors.

At the completion of the tests the performance of the receiver, including bit error rate, as a function of the received LTE signal strength should be analyzed and statistically characterized.

CERTIFICATE OF SERVICE

I, Jeffrey T. Hantson, hereby certify that on February 25, 2011, I have caused a copy of the Petition for Reconsideration of Deere & Company to be served via U.S. Mail and electronic mail on the following:

Mr. Jeffrey J. Carlisle
Executive Vice President, Regulatory Affairs
LightSquared Subsidiary LLC
10802 Parkridge Blvd.
Reston, VA 20191
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Jeffrey T. Hantson