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May 27, 2011

VIA ELECTRONIC FILING

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Re: **Notice of *Ex Parte* Presentation in LightSquared Subsidiary LLC Request for Modification of its Authority for an Ancillary Terrestrial Component, IBFS File No. SAT-MOD-20101118-00239**

Dear Ms. Dortch:

On May 26th, 2011, Deere & Company ("Deere") met with Angela Giancarlo, Chief of Staff & Senior Legal Advisor, Wireless & International, to Commissioner Robert McDowell, to discuss the above-referenced application. Attending this meeting on behalf of Deere were Patricia Harris, Assistant General Counsel, Paul Galyean, Director, System Engineering and IME/Robotics, and Rich Keegan, Senior Engineer, along with Catherine Wang and Tim Bransford of Bingham McCutchen LLP, outside counsel to Deere.

During this meeting Deere provided an update on recent tests conducted at government facilities in Holloman and White Sands, New Mexico regarding the interference impact of proposed LightSquared transmissions on GPS receivers.[1] Deere informed Ms. Giancarlo that these tests, which simulated various cellular base station transmission schemes proposed by LightSquared in L-band frequencies between 1525-1559 MHz, including configurations where the simulated emission was reduced in bandwidth and/or assigned to frequencies in the lower part of the L-band, without exception demonstrated severe interference to Deere's licensed StarFire Mobile Satellite Service ("MSS") and Global Positioning System ("GPS") receivers.

Deere explained that, in the course of its careful technical analysis undertaken in the time available, Deere's engineers have determined that there is currently no practicable technical solution, or solutions in combination, available to avoid or substantially mitigate interference from the LightSquared's base stations to Deere's

[1] The tests conducted in Holloman and White Sands are separate from LightSquared working group tests presently underway at a various test sites across the country.

Boston
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existing precision GPS system and to similar systems operated by others particularly in the agriculture and construction industries. Deere also confirmed that while there are important *potential* mitigation strategies that may be worth exploring with respect to *future generations* of GPS receivers, no single interference mechanism -- such as repositioning LightSquared's operating frequencies, modestly reducing transmitter power, etc. -- and no combination thereof, has been examined such that it can be deemed to provide meaningful protection for precision farming operations essential to today's U.S. agricultural sector. Similarly, no potentially effective mitigation solution, alone or in combination, has been examined such that it can be deemed to protect *other* precision GPS users in the construction sector or GPS in other applications.

Deere emphasized that, based on the above data and analysis, permitting LightSquared to operate its network as proposed or any variant of its currently proposed network will create massive interference into Deere's StarFire system and other similar systems risking serious harm to the U.S. agriculture industry.

Deere expressed its support for expanding wireless broadband services, particularly in rural areas, so long as initiatives to provide new wireless service do not compromise critical and irreplaceable GPS and/or space-to-earth MSS services essential to the nation's agricultural community. Deere appreciates the Commission's efforts to explore potential solutions to the challenging and complex interference issues raised by the prospect of establishing a new high-power nationwide wireless system in MSS spectrum. Deere suggested that, in the absence of short-term solutions, should the Commission decide to pursue a new use of L-Band spectrum as a long-term option, the Commission should do so in Commission rulemaking proceedings allowing for full public input, technical examination, product and development time and appropriate testing. Given the critical importance of the L-Band interference to Deere's agricultural (and other customers), Deere would expect to participate in such proceedings.

The attached presentation was circulated. If you have any questions regarding this meeting, please do not hesitate to contact the undersigned.

Very truly yours,

/s/

Catherine Wang
Tim Bransford

CC: Angela Giancarlo

LightSquared Interference to GPS and StarFire

26 May 2011

Agenda

- Executive Summary
- Major Issues
- New Mexico Testing
- Potential Mitigations
- Additional Concerns
- Plans

Executive Summary

All existing Deere GPS receivers and the StarFire service will be very adversely affected in and near areas served by LightSquared

- Degradation starts at 22 miles, severe at 4-22 miles*

Deere customers in agriculture, construction, and other applications will lose high accuracy navigation in and near areas served by LightSquared

There are major economic consequences (not just for Deere)

We do not know any feasible mitigations for existing Deere receivers or for the StarFire service

* Assumes 100m tower; degradation starts at longer ranges with higher towers; severity estimate depends on propagation model used (4 miles = WILOS, 22 miles = free space)

Major Issues Identified in March

There are three issues:

- LightSquared Out of Band Emissions
  - OOBE is not a problem in the GPS band if LightSquared filters their signals as they have committed
- GPS receiver overload
- LightSquared MSS co-channel interference with Deere StarFire network

Out of Band Emissions – Issue 1

LightSquared base stations will operate in the MSS band (1525 MHz–1559 MHz) just below the GPS band (1559 MHz-1591 MHz)

OOBE is not a problem in the GPS band if LightSquared filters their signals as they have committed

- -100 dBW/MHz is below the thermal noise floor

- no GPS impact

GPS Receiver Overload – Issue 2

Very serious problem affecting all GPS receivers near a LightSquared base station, not just Deere receivers

- All GPS receivers assume MSS contains low powered signals
- All GPS receivers use filters that overlap in the MSS band
- GPS filters are overwhelmed by LightSquared base station power
- No solution known for current receivers

Overload will also be a problem for GPS receivers near LightSquared handsets

MSS Co-Channel Interference – Issue 3

StarFire (and Omnistar, other major augmentation provider) signals are broadcast from satellites in the MSS band to be used by LightSquared

- Many agriculture, machine control, survey, and high precision GPS receivers receive these augmentation signals

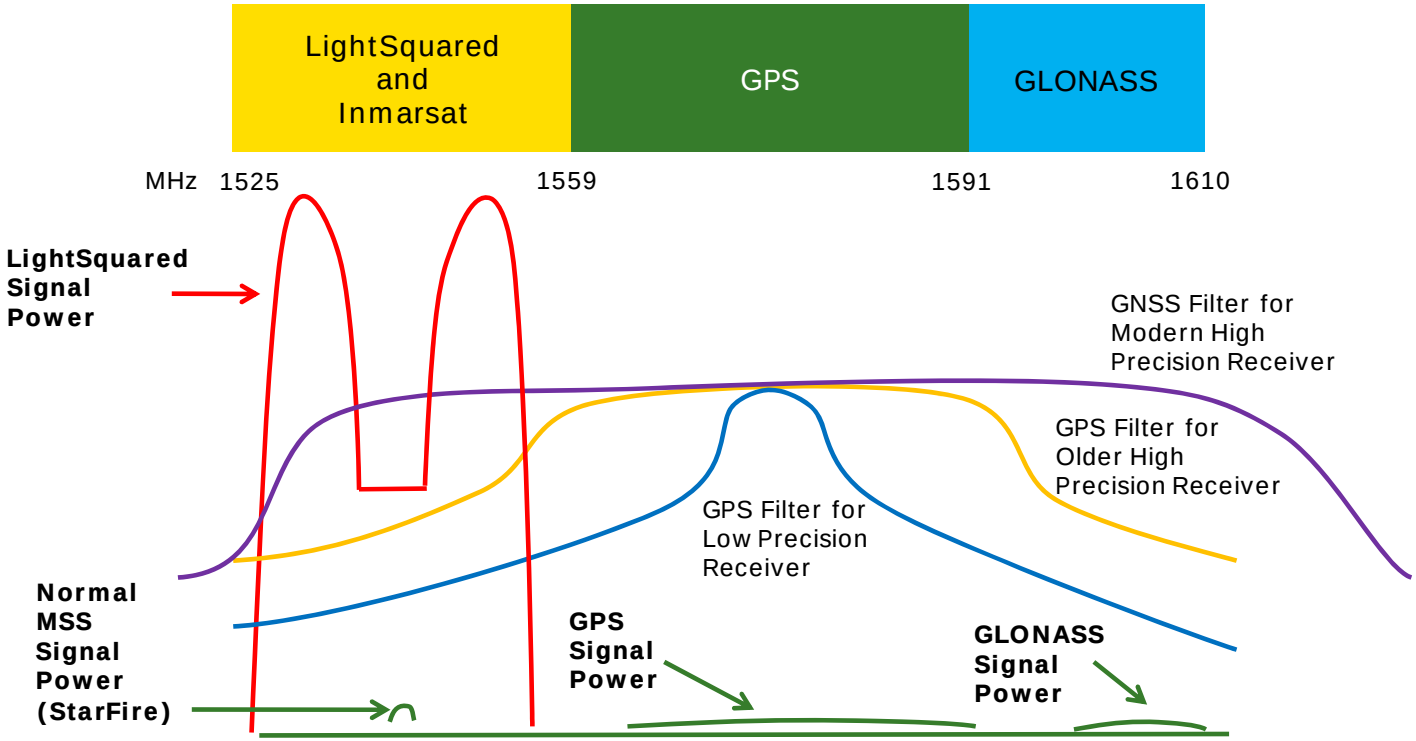
LightSquared signal is >90 dB stronger than StarFire signal near base stations

- Exceeds the capability of the filters to reject LightSquared power at considerable distances from the base stations
- Augmentation signal cannot be received when near a base station
- No solution known for current receivers

High Precision Receivers are More Affected

High precision receivers are more affected than are consumer grade receivers

- Modern high precision receivers use filters that cover MSS, GPS, and GLONASS bands
- Wideband filters are required for higher rate, precision codes



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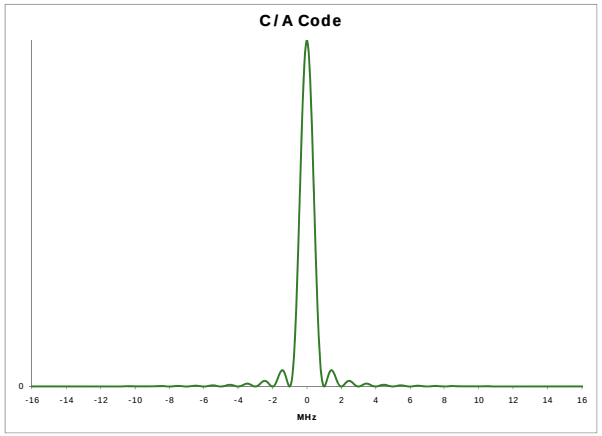
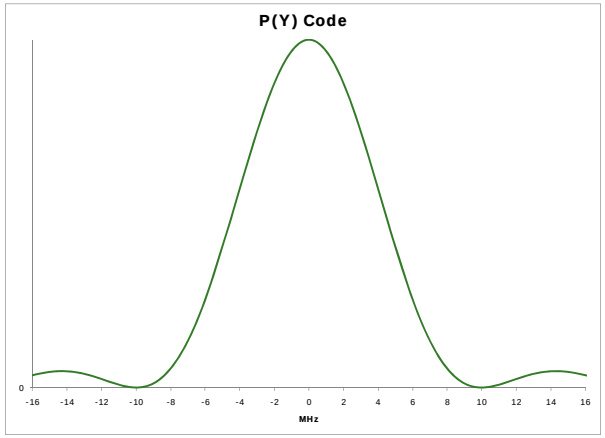
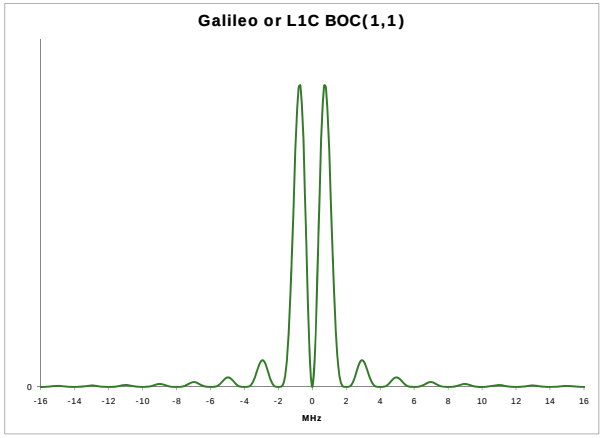
GNSS Code Structures

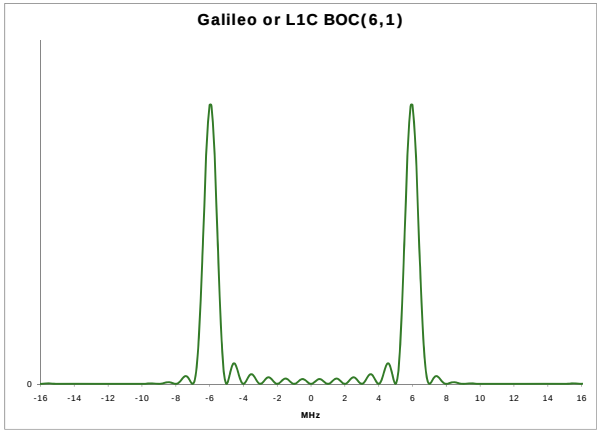
2+ MHz is sufficient for consumer receivers using C/A Code

High precision GPS receivers need 20+ MHz for GPS P(Y) code









- Legacy GPS satellite signals are 24 MHz bandwidth
- GPS is being modernized with new signals and satellites
- Future GPS satellite signals will be 32 MHz bandwidth
- Other GNSS signals are also wideband
- <u>In the future, many more GNSS receivers will be wideband</u>

Receiver Effects & Range Modeling

GPS L1 Signals Processing	dBm	Effect	Range 1/D² Model (miles)*	Affected Area (sq miles)	Range WILOS Model (miles)	Affected Area (sq miles)
Saturation of Antenna LNA	-40	Inoperative	1.2	4.5	0.7	1.5
Saturation of Mixer	-65	Heavily degraded sensitivity, not GPS usable	22	1520	3.6	43
Degraded A/D and Baseband	-80	Reduced accuracy, weak satellites lost	22	1520	14	614

StarFire Signals Processing	dBm	Effect	Range 1/D² Model (miles)*	Affected Area (sq miles)	Range WILOS Model (miles)	Affected Area (sq miles)
Saturation of Antenna LNA	-40	Inoperative	1.2	4.5	0.7	1.5
Saturation of Mixer	-65	Strongly degraded tracking, very high BER	22	1520	3.6	43
LTE OOBE power equals StarFire power	-70	3 dB degraded tracking, minor to significant BER	22	1520	6	113
Degraded A/D and Baseband	-80	Degraded tracking, minor to significant BER (depending on channel)	22	1520	14	614

* Assumes 100m tower; horizon is at 22 miles.

Conclusions From New Mexico Open Air Testing

Open air testing clearly showed interference

- LightSquared power was varied rather than moving receivers

- Very significant multipath was present
  - Many large vehicles present in test area, and locations were different each day
  - Large variations in LightSquared power were measured in the test area (±10 dB)

Power testing started at -51 dBm at LNA input

- Immediate GPS tracking loss: unable to find threshold

New Mexico Testing

The US Military conducted anechoic chamber tests at White Sands NM and open air tests at Holloman NM in April 2011

Deere and many other private companies participated, including LightSquared

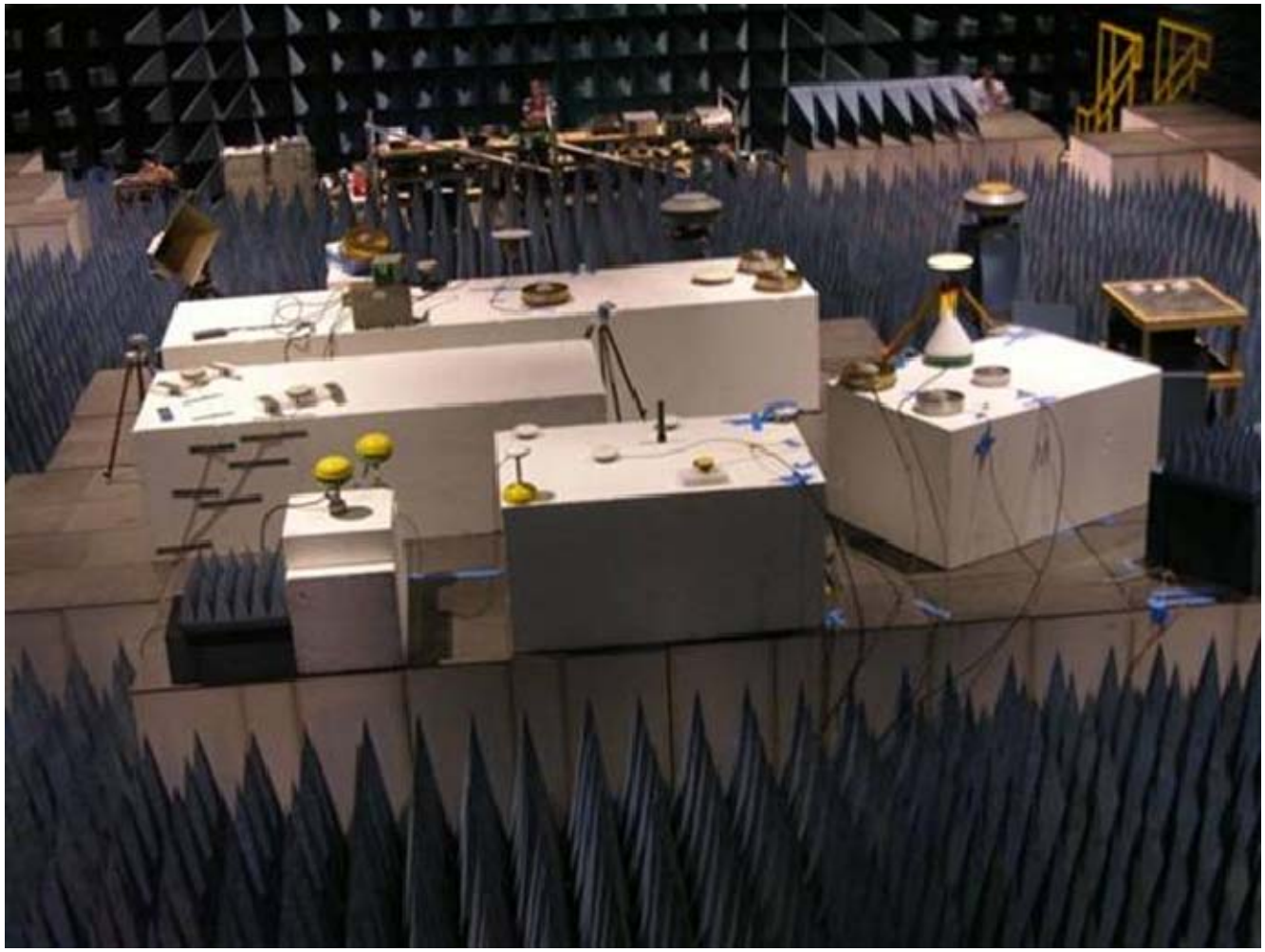
- Anechoic chamber tests and open air tests both showed GPS interference effects
- Deere results consistent with prior laboratory analysis

Dual 10 MHz, Dual 5 MHz, and High 5 MHz testing all caused loss of all satellites

Low 5 MHz caused significant interference, but no loss of satellites

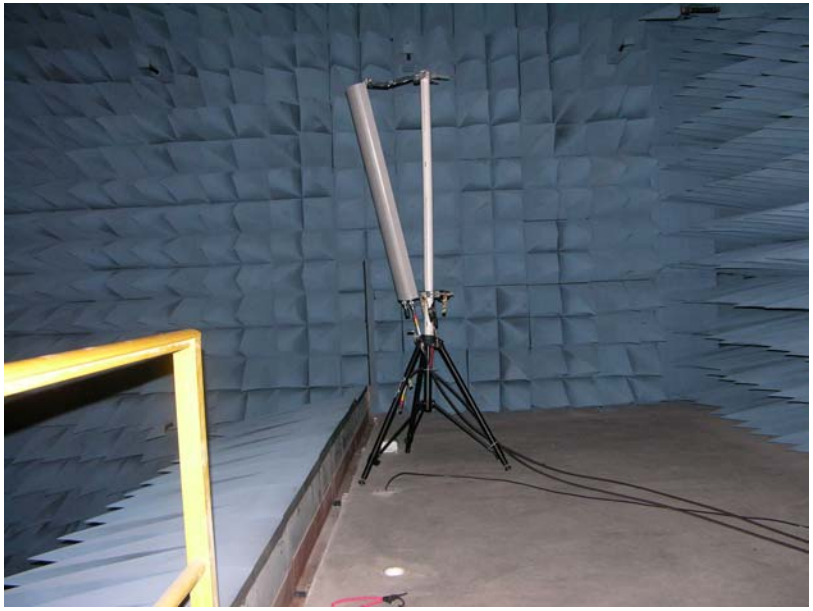
New Mexico Anechoic Chamber Testing

Commercial anechoic test area



New Mexico Anechoic Chamber Testing

LTE Signal Source



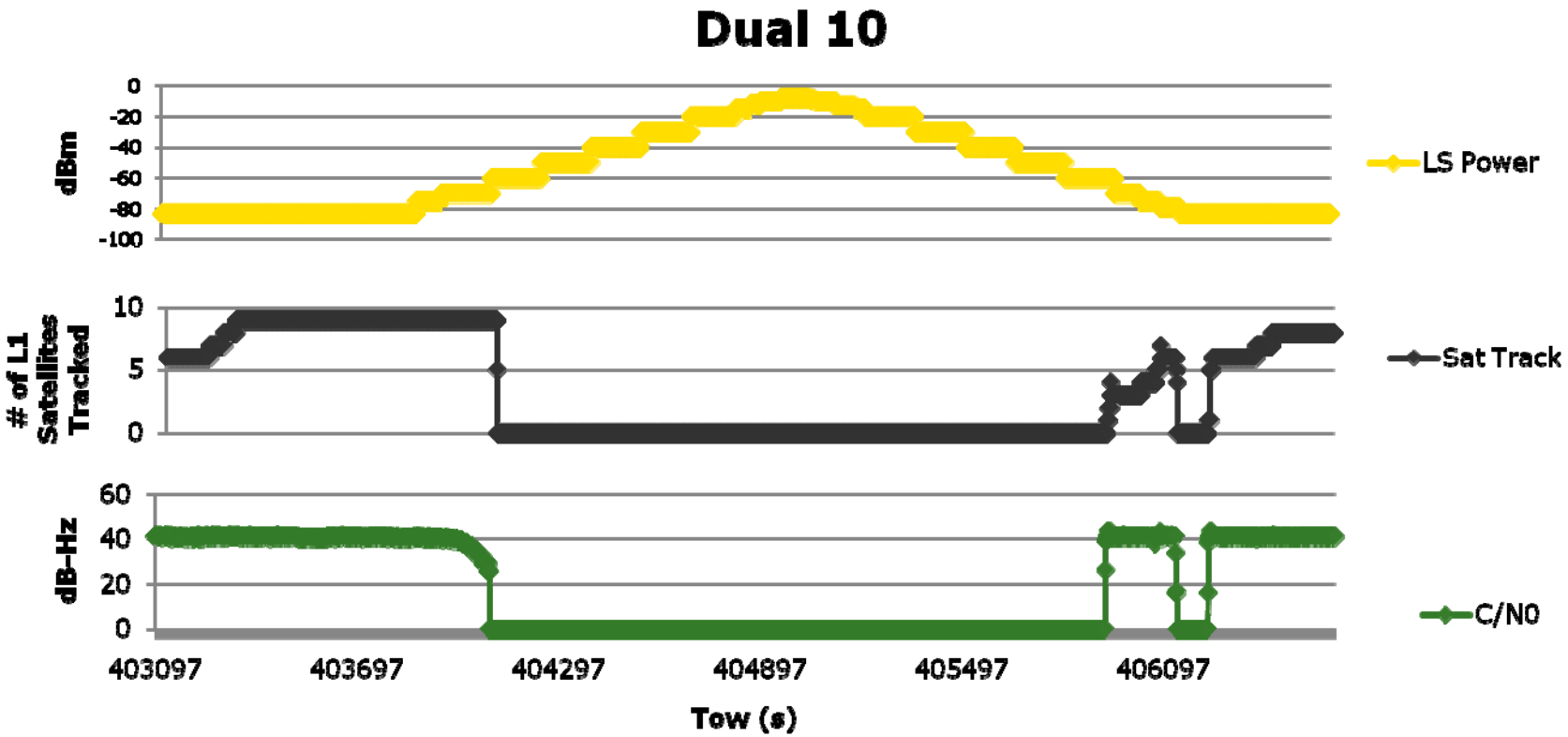
LTE Base Station Antenna

New Mexico Anechoic Chamber Testing

Dual 10 MHz LightSquared bands

Power referenced to input of receiver LNA

Tracking OK at -80 dBm, degraded at -70 dBm, all sats lost at -60 dBm



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New Mexico Anechoic Chamber Testing

Dual 5 MHz LightSquared bands

Power referenced to input of receiver LNA

Tracking OK at -80 dBm, degraded at -70 dBm, all sats lost at -60 dBm

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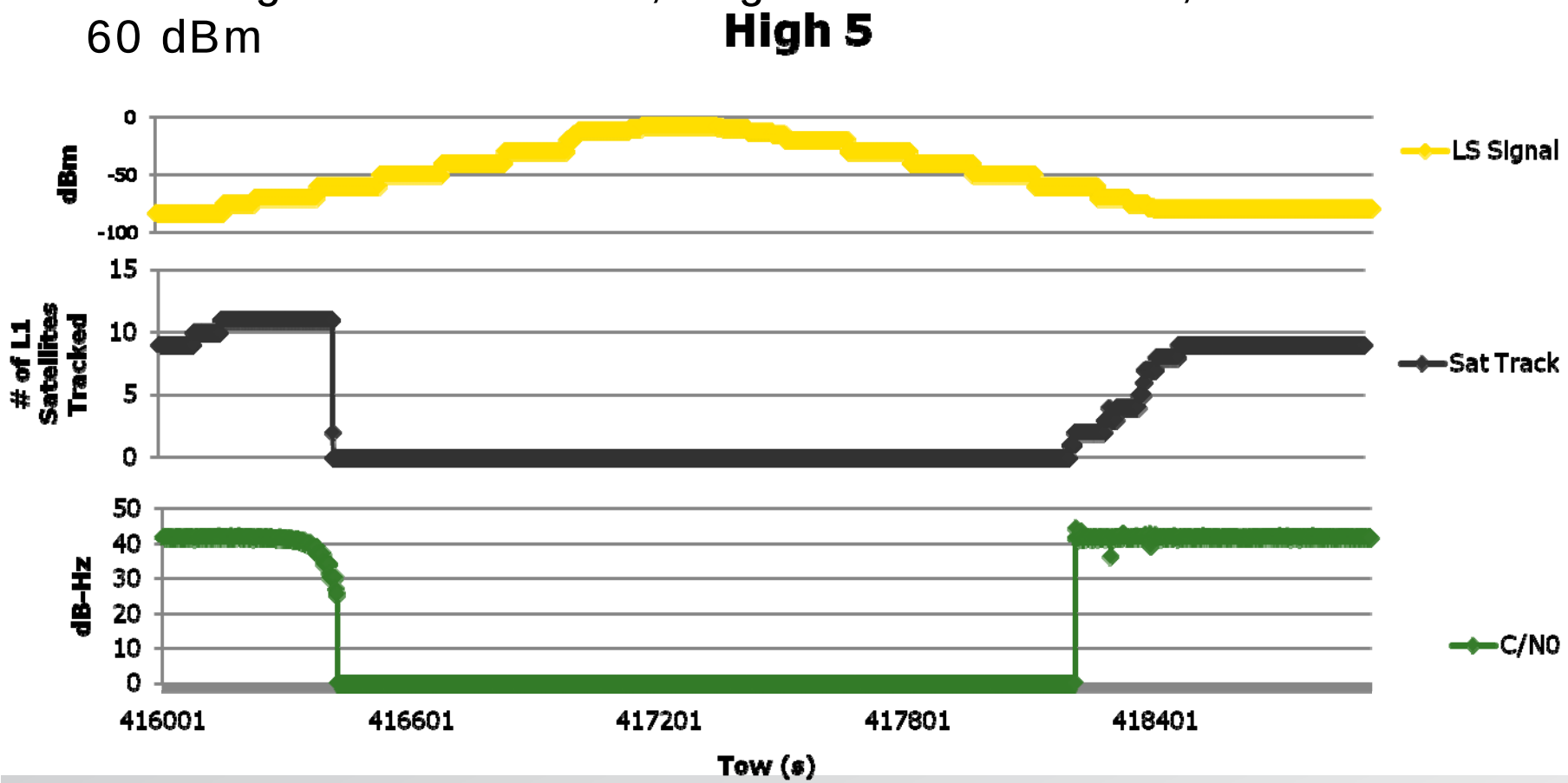
New Mexico Anechoic Chamber Testing

High 5 MHz LightSquared bands

Power referenced to input of receiver LNA

Tracking OK at -75 dBm, degraded at -70 dBm, all sats lost at -60 dBm



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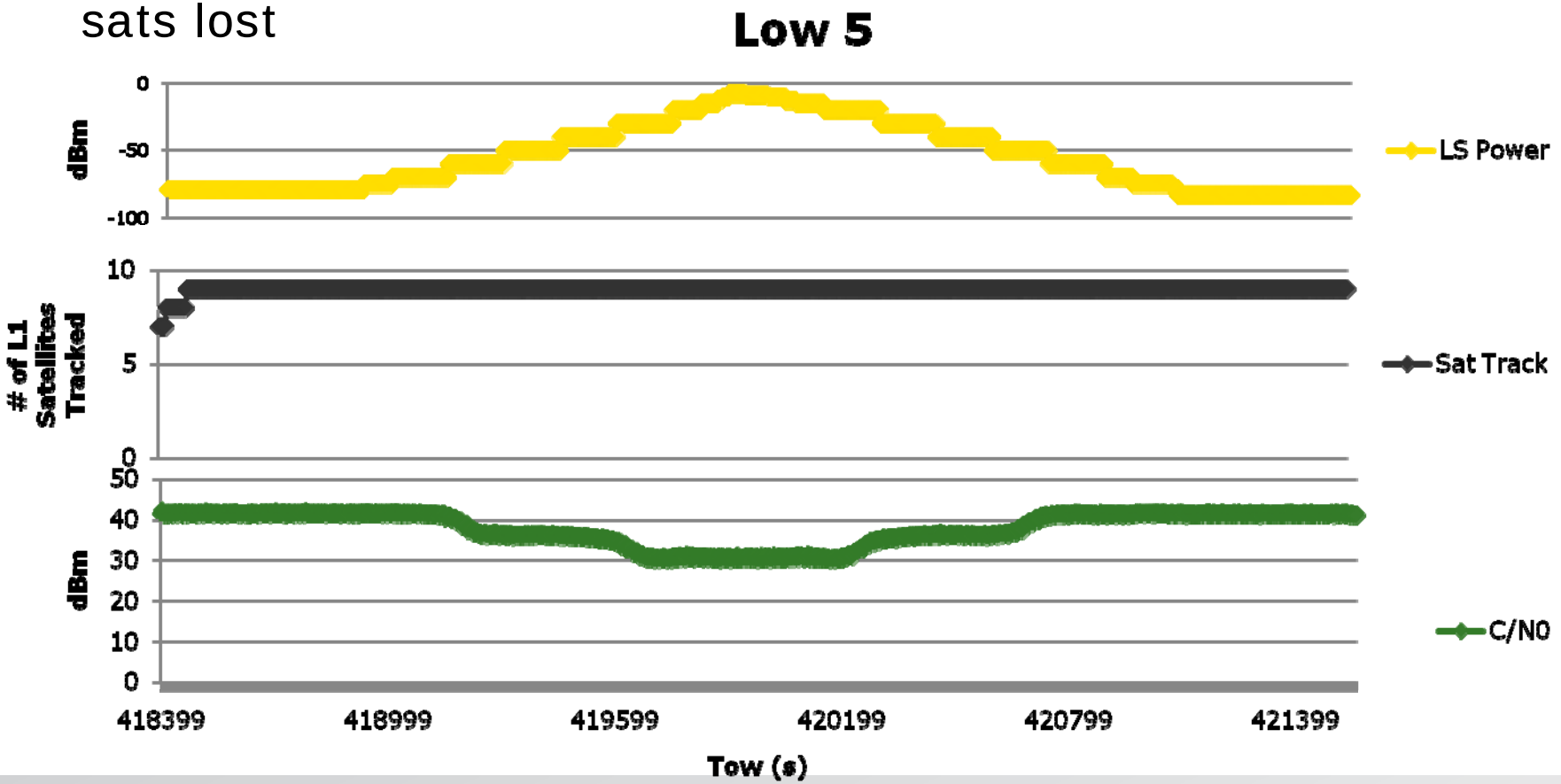
New Mexico Anechoic Chamber Testing

Low 5 MHz LightSquared band

Power referenced to input of receiver LNA

C/N_0 starts to degrade at -60 dBm, down 9 dB at -10 dBm, no sats lost



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Potential Mitigations

Solution for existing receivers/StarFire

- None currently identified

Potential mitigation areas to explore for future receivers

- Reduce LightSquared transmit power
- Increased filtering in GPS receivers
  - Extremely difficult problem
  - Will likely degrade GPS performance
- Place StarFire frequencies very close to GPS band
  - Helps StarFire greatly if strong GPS filtering is necessary
- Reduce noise between LightSquared bands to level in GPS band
  - Might permit StarFire to operate in this band
  - Strong filtering still required
- Examine repositioning LightSquared frequencies

Additional Concerns

Not possible to receive StarFire signal in MSS band with remaining Inmarsat bandwidth (1535 MHz – 1545 MHz) and LightSquared OOBE power level in this band (-40 dBW/MHz)

While LightSquared intends to operate at 32 dBW, they are licensed to 42 dBW

- Higher powered operations would increase the range of degradation

LightSquared operations closer to GPS than 1555 MHz could be done with reduced power

- Even more difficult to address the interference

Handsets will be a problem when operated close to GPS receivers

Plans

Deere is participating in the LightSquared – USGIC Technical Working Group – High Precision Sub-Team

- Anechoic chamber testing completed - processing data now
- Currently participating in Las Vegas Live Sky testing

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