

DCS & LRIT LTE In-Band Interference Study

Microcom Design, Inc.

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Study Goal

- **Determine the susceptibility of DCS and LRIT reception to interference from in-band LTE transmitters**
 - **The study focused on hand held transmitters because of the power limitations of the signal generator**

Setup

➤ Transmit

- Agilent N5182B signal generator
- $\frac{1}{4}$ wavelength dipole antenna
- 5 MHz wide band with 100% utilization
- Center frequency of band was set to 1693 MHz to impact both DSC and LRIT simultaneously
- Power adjusted from -23 dBm to +20 dBm in 1 dBm steps

➤ Location

- One transmission location was used
- Site was chosen because it provided a consistent line of site to the front of the antenna while being 250 feet away

Setup

➤ Receive

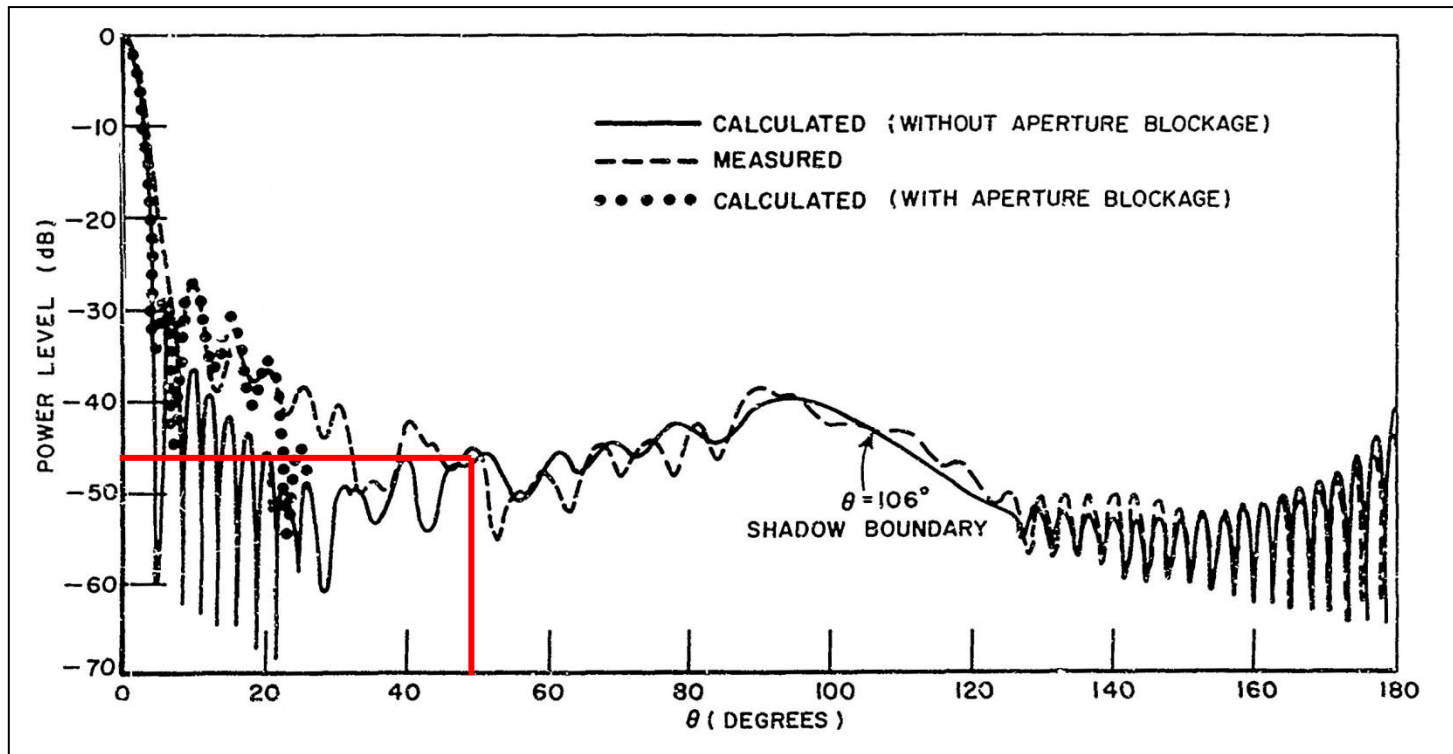
- DCS 3.6 meter dish
- LRIT 1.2 meter dish
- Limited study to GOES East reception / Interference

➤ Link

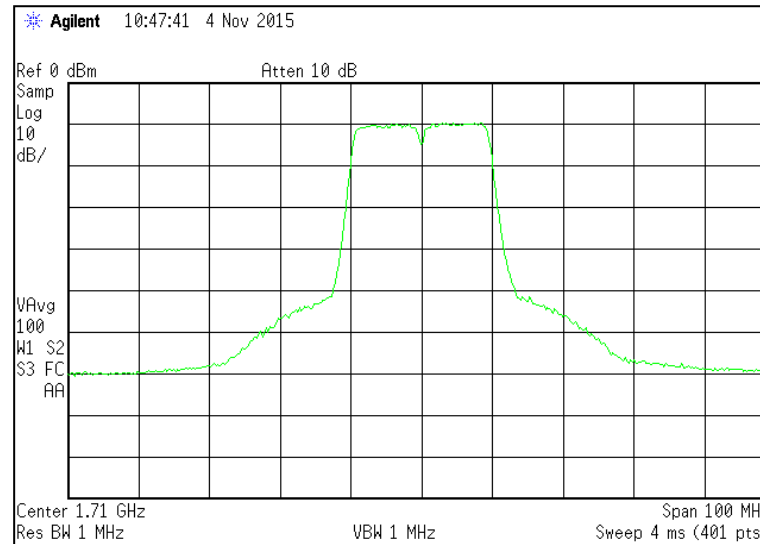
- 250 foot separation between transmitter and receive dishes
- DCS and LRIT dishes pointed 49° off axis from LTE transmitter

Antenna

- Estimated Location within example parabolic dish gain pattern
 - Transmitter located 49° off center, about -47 dB down



Example Interference Waveform

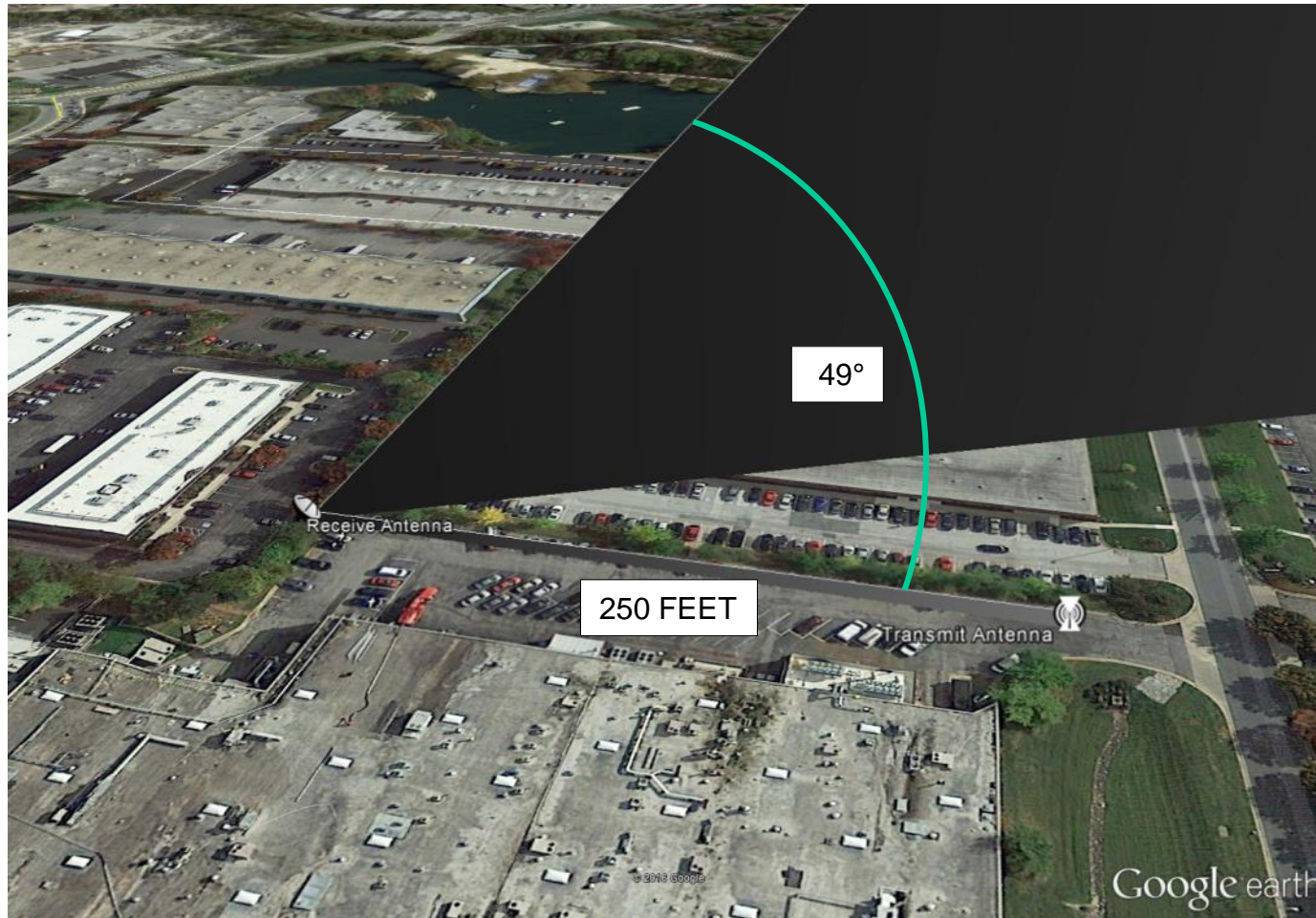


- **Example LTE signal from signal generator demonstrating ability meet the LTE requirement of -25 dB down within 10 MHz and -47 dB down outside 10 MHz**
- **LTE bandwidth is adjustable between 6 options (1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz). The above picture shows the 10MHz option**

Data Source

- **DPCM phase noise measurements were recorded from the Microcom Design DAMS-NT Client software DPCM Pilot Level / Noise Floor Graph**
- **LRIT Reed-Solomon success percentages were recorded from the Microcom Design DAMS-NT DigiRIT DIGITAL LRIT/HRIT RECEIVER front panel display**
- **70 MHz tap from the DCS antenna front end was fed into an Agilent E4402B spectrum analyzer**
- **Screen shots were taken from the spectrum analyzer**

Site Arial View



Testing Results

- **Transmit power at : -11 dBm**
 - **LRIT Reed Solomon Success percentage dropped to 98**

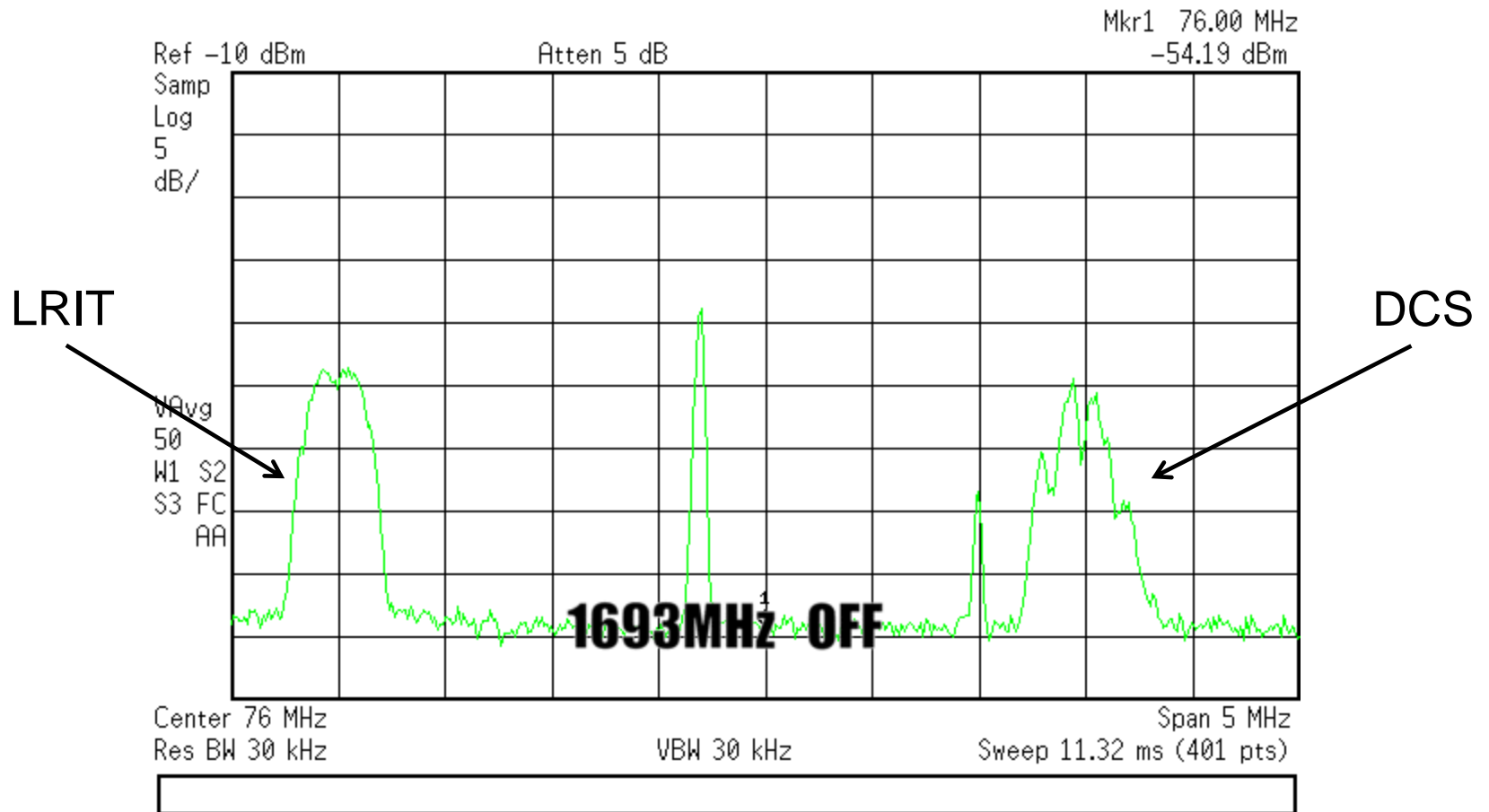
- **Transmit power at : -8 dBm**
 - **LRIT lost frame sync**

- **Transmit power at : +1 dBm**
 - **DRGS phase noise rose from 2.2 ° to 3.0 °**

- **Transmit power at : +19 dBm**
 - **DRGS lost carrier lock**

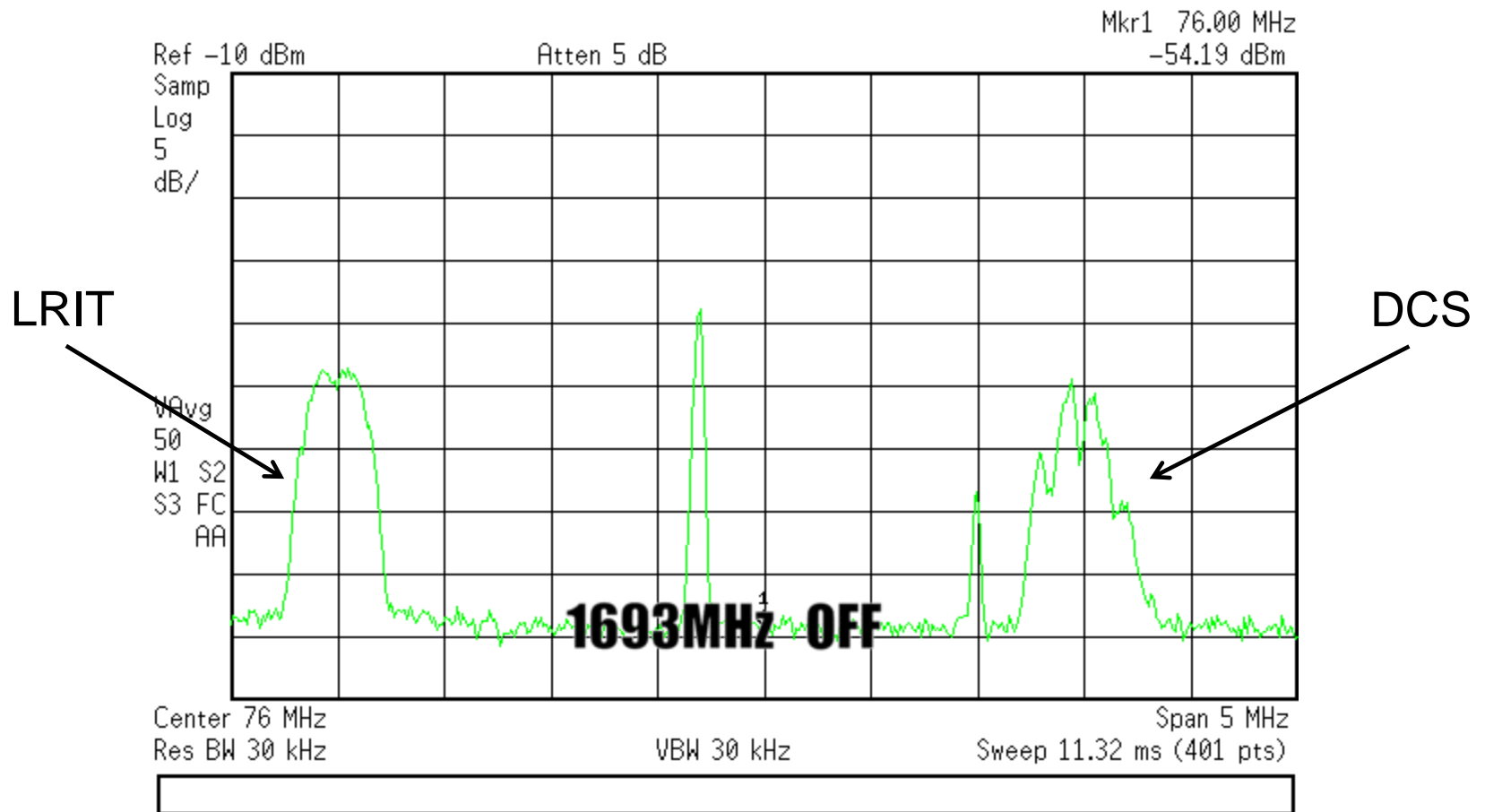
LTE In Band Interference Animation

Agilent 15:38:12 17 Feb 2016



LTE In Band Interference Animation

Agilent 15:38:12 17 Feb 2016



LTE In Band Interference Animation

Agilent 15:46:29 17 Feb 2016

Mkr1 76.00 MHz
-32.96 dBm

Ref -10 dBm

Atten 5 dB

Samp
Log
5
dB/

Average
50

LRIT

DCS

VBW
50
W1 S2
S3 FC
AR

1693MHz 0dBm

Center 76 MHz

Res BW 30 kHz

VBW 30 kHz

Span 5 MHz

Sweep 11.32 ms (401 pts)

Cause of interference

- **LTE signal swamped DCS and LRIT signals**
- **The LRIT receiver was more susceptible than the DCS most likely due to the smaller 1.2 meter dish vs the 3.6 meter DCS dish**
- **The 1.2 meter LRIT dish has a lower gain and lower SNR than the 3.6 meter DCS dish**
- **The interfering signal was coupling in significant energy even though the radiating element was far off in a side lobe**

Summary

- **Receive sites are highly susceptible to in band interference**
 - **Testing showed that complete data loss can be caused by an LTE handset transmitting near a receive site antenna even with relatively low transmit power**
- **Handset transmitting 250 feet away from and 49° off axis from receive dish can cause interference with as little as -11 dBm of power**

Recommendation

- **All efforts should be made to not allow band sharing**
- **If band sharing is allowed then a large quiet zone around receive antenna must be created**
- **Under no circumstances should towers be allowed to transmit in band**