



**FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8**

CERTIFICATION TEST REPORT

FOR

WALL SWITCH

MODEL NUMBER: CWD-CWC-WH, CWS-CWC-WH

**FCC ID: 2ACQ6-CWC
IC: 11481A-CWC**

REPORT NUMBER: R10015049-RF

ISSUE DATE: 2014-08-18

Prepared for
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NVLAP LAB CODE 200246-0

Revision History

| Rev. | Issue Date | Revisions | Revised By |
|------|------------|---|------------|
| -- | 2013-11-07 | Initial Issue | Jeff Moser |
| 1 | 2014-07-15 | Grantee Code Revised (previous one issued in error) | Jeff Moser |
| 2 | 2018-08-18 | Revised references to KDB 558074 | Jeff Moser |

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: CREE INC.
4600 SILICON DR.
DURHAM, NC 27709 USA

EUT DESCRIPTION: Wall Switch with Transceiver

MODEL: Wall Switch, p/n CWD-CWC-WH and CWS-CWC-WH

SERIAL NUMBER: None

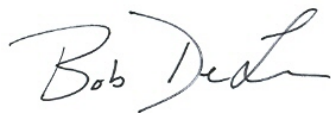
DATE TESTED: 2013-06-20, 2013-06-29, 2013-08-13, 2013-09-11, 2013-09-16
2013-10-24

| APPLICABLE STANDARDS | |
|---|--------------|
| STANDARD | TEST RESULTS |
| CFR 47 Part 15 Subpart C | Pass |
| INDUSTRY CANADA RSS-210 Issue 8 Annex 8 | Pass |
| INDUSTRY CANADA RSS-GEN Issue 3 | Pass |

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL LLC based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released
For UL LLC By:



Bob DeLisi
EMC Principle Engineer

Prepared By:



Jeff Moser
EMC Program Manager

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Dr., Research Triangle Park, NC 27709, USA.

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2002460.htm>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamplifier Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| PARAMETER | UNCERTAINTY |
|---------------------------------------|-------------|
| Conducted Disturbance, 0.15 to 30 MHz | +/- 2.5 dB |
| Radiated Disturbance, 30 to 1000 MHz | +/- 3.4 dB |

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The Wall Switch, p/n CWD-CWC-WH and CWS-CWC-WH is a 2.4 GHz DSSS transceiver used with light fixtures. The Wall Switch contains an O-QPSK modulation and a 250 kbps data rate. The Wall Switch receives signals from other devices to control the fixture.

The radio module is manufactured by Cree Inc.

Part Number CWD-CWC-WH was the unit tested. Part Number CWD-CWC-WH is the same as CWS-CWC-WH except CWS-CWC-WH is a depopulated version of the tested version. CWD-CWC-WH has added dimming functions and circuitry that p/n CWS-CWC-WH does not.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

| Frequency Range (MHz) | Mode | Output Power (dBm) | Output Power (mW) |
|--------------------------|--------|-----------------------|----------------------|
| 2405 - 2480 | O-QPSK | 3.9 | 2.5 |

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a Monopole, PCB-Trace antenna, with a maximum gain of 1.4 dBi.

5.4. SOFTWARE AND FIRMWARE

Wall Controls – CWD-CWC-WH and CWS-CWC-WH

128RFR2_MOD_11.hex
128RFR2_MOD_18.hex
128RFR2_MOD_22.hex
128RFR2_NO_RADIO.elf

All firmware has the following parameters:

- Channel 11 and 18 have transmit power of 3.5dBm, channel 26 has a transmit power of 1.2dBm.
- Channel 11 and 18 have no transmit filter, channel 26 uses a transmit filter.
- All firmware files labelled 128RFR2_MOD_XX.hex are radio tests for the ATMEGA128RFR2, where XX is the channel being constantly transmitted on.
- All firmware files labelled RFR2_MOD_XX.hex are the equivalent for the ATMEGA256RFR2.
- The 128RFR2_NO_RADIO and RFR2_NO_RADIO files put the ATMEGAXXXRFR2 into a non-transmitting, idle state.
- The XMEGA_STRESS.hex file is the stress test that puts the XMEGA into a maximal power usage state.
- The XMEGA.elf file is the standard conditions XMEGA file for testing the CT.

5.5. WORST-CASE CONFIGURATION AND MODE

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that the X orientation (upright) was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

Radiated-emission testing in the 30-1000MHz range and power line conducted-emission testing were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

The Wall Switch, p/n CWD-CWC-WH is being tested as a standalone device. No other equipment is a part of the configuration.

I/O CABLES

None.

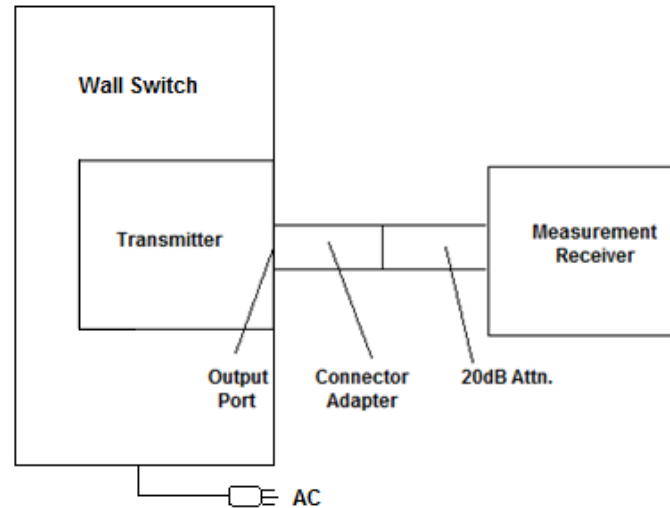
TEST SETUP

Different Wall Switches were provided. 3 units were provided for Radiated Emissions testing (Low Channel, Mid Channel and High Channel) and 3 units were provided for Conducted Port tests (Low Channel, Mid-Channel and High-Channel).

Note, the Low and Mid Channel's output power was set for 3.5dBm during testing. The High Channel output power was set for 1.2 dBm during testing.

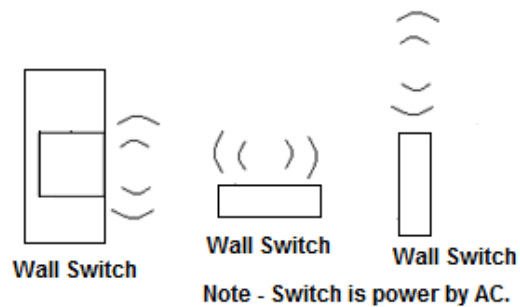
SETUP DIAGRAM FOR TESTS

CONDUCTED PORT TESTS

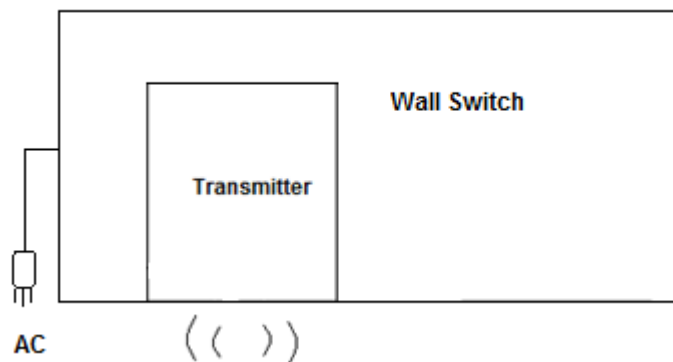


10dB Attenuator used instead of 20dB shown

RADIATED SPURIOUS ORIENTATIONS



POWER-LINE CONDUCTED EMISSIONS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Antenna-Port Conducted Measurement Equipment

| Equipment ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|--------------|------------------------------|----------------------|---------------------------------|------------|------------|
| SA0016 | Spectrum Analyzer / Receiver | Agilent Technologies | N9030A | 2012-10-29 | 2013-10-31 |
| PSSENSOR001 | RF Power Meter Sensor Head | Rohde & Schwartz | NRP-Z81 (w/ NRP-Z3 USB adapter) | 2012-08-21 | 2013-08-31 |
| HI0041 | Temp/Humid/Pressure Meter | Cole-Parmer | 99760-00 | 2013-01-25 | 2014-01-31 |

Radiated Disturbance Emissions (Prior to 2014-09-01)

| Equip. ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|-----------|---|----------------------|--------------------------|------------|------------|
| | 1-18 GHz | | | | |
| AT0026 | Horn Antenna 1 to 18 GHz | EMC Test Systems | 3115 | 2013-02-20 | 2014-02-28 |
| AT0062 | Horn Antenna 1 to 18 GHz | ETS-Lindgren | 3117 | 2012-07-26 | 2013-07-31 |
| | 18-26 GHz | | | | |
| AT0053 | Antenna | ARA | SWH-28 (S/N 1004) | 2012-09-25 | 2013-09-30 |
| | Amplifier (S/Ns 859993, 860112, 859864) | Miteq | JSD42-1800400-30-5A | 2012-09-25 | 2013-09-30 |
| | Cable (S/N 204158-001) | Micro-coax | UFA147A-0-1181-200200 | 2012-09-25 | 2013-09-30 |
| | Gain-Loss Chains | | | | |
| ATA144 | Amplifier | Miteq | AFS42-00101800-25-N-42MF | 2012-08-31 | 2013-08-31 |
| AMP011 | Amplifier | Miteq | AMF-6D-01002000-22-10P | 2013-06-26 | 2014-06-30 |
| | Receiver & Software | | | | |
| SAR003 | Spectrum Analyzer / Receiver | Rohde & Schwarz | 1088.7490K40 | 2012-08-28 | 2013-08-31 |
| SA0016 | Spectrum Analyzer / Receiver | Agilent Technologies | N9030A | 2012-10-29 | 2013-10-31 |
| SOFTEMI | EMI Software | UL | Version 9.5 | NA | NA |
| | Additional Equipment used | | | | |
| HI0034 | Temp/Humid/Pressure Meter | Cole-Parmer | 99760-00 | 2013-01-25 | 2014-01-31 |
| BRF003 | Band Reject Filter - 2400 to 2500 MHz | Microtronics | BRM50702-01 | 2012-09-04 | 2013-09-30 |

Radiated Disturbance Emissions (After 2014-09-01)

| Equip. ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|--------------------------------------|---|--------------------------|--------------------------|------------|------------|
| | Below 30 MHz Range | | | | |
| AT0037 | Loop Antenna (Low Range) | Electro-Metrics | EM-6871 | 2013-06-19 | 2014-06-30 |
| AT0036 | Loop Antenna (High Range) | Electro-Metrics | EM-6872 | 2013-06-20 | 2014-06-30 |
| | 30-1000 MHz Range | | | | |
| AT0022 | Log-periodic Antenna, 200 MHz to 1000 MHz | Chase | UPA6109 | 2013-01-29 | 2014-01-31 |
| AT0025 | Biconical Antenna, 30 to 300 MHz | Schaffner-Chase EMC Ltd. | VBA6106A | 2013-06-14 | 2014-06-30 |
| | Gain-Loss Chains | | | | |
| SAC_C (Biconical 3m location) | Gain-Loss string for biconical antenna at 3m | Various | Various | 2013-09-06 | 2014-09-30 |
| SAC_D (Log-Periodic 3m location) | Gain-Loss string for log-periodic antenna at 3m | Various | Various | 2013-09-06 | 2014-09-30 |
| SAC_E_LR (Loop & Rod 3m location) | Gain-Loss string for loop/rod antenna at 3m | Various | Various | 2013-09-06 | 2014-09-30 |
| | Receiver & Software | | | | |
| SAR003 | Spectrum Analyzer / Receiver | Rohde & Schwarz | ESIB40 (1088.7490.40) | 2013-09-03 | 2014-09-30 |
| SOFTEMI | EMI Software | UL | Version 9.5 | NA | NA |
| | Additional Equipment used | | | | |
| HI0034 | Temp/Humid/Pressure Meter | Cole-Parmer | 99760-00 | 2013-01-25 | 2014-01-31 |

Power-line Conducted Disturbance Emissions

| Equipment ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|--------------|--|---------------------|--------------------------|------------|------------|
| ATA016 | Coaxial cable, 20 ft., BNC -male to BNC-male | UL | RG-223 | 2013-09-05 | 2014-09-30 |
| ATA508 | Transient Limiter, 0.009 to 100 MHz | Electro-Metrics | EM 7600 | 2013-09-06 | 2014-09-30 |
| HI0041 | Temp/Humid/Pressure Meter | Cole-Parmer | 99760-00 | 2013-01-25 | 2014-01-25 |
| LISN002 | LISN, 50-ohm/50-uH, 2-conductor, 25A | Fischer Custom Com. | FCC-LISN-50-25-2-01-550V | 2013-09-03 | 2014-09-30 |
| SA0015 | EMI Test Receiver 9kHz-7GHz | Rohde & Schwarz | ESCI 7 | 2013-09-04 | 2014-09-30 |
| SOFTEMI | EMI Software | UL | Version 9.5 | NA | NA |

7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

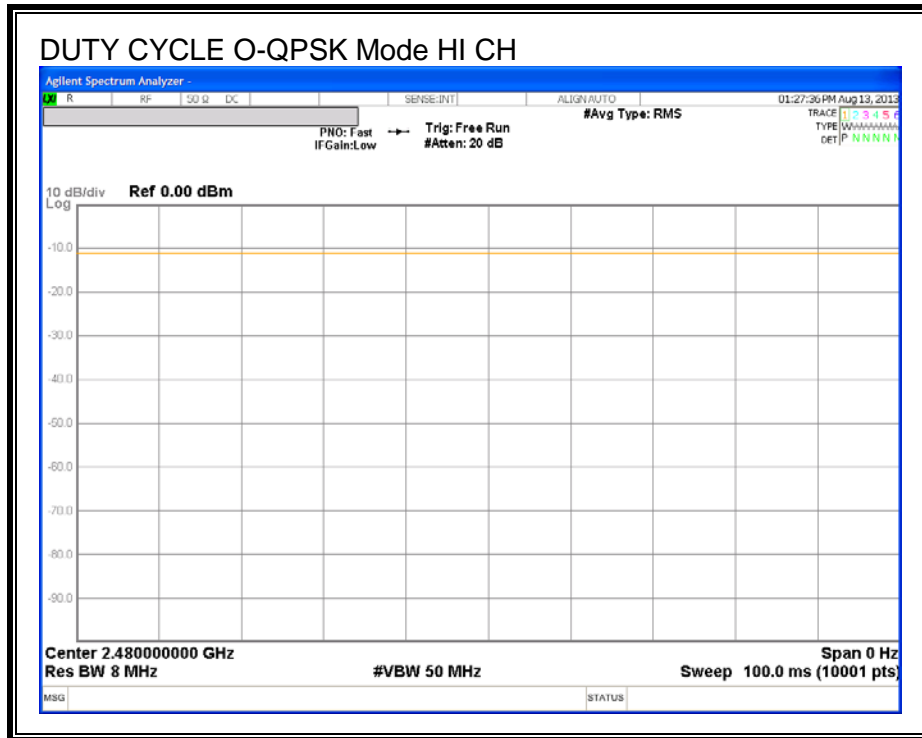
None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

7.1. ON TIME AND DUTY CYCLE RESULTS

| Mode | ON Time B (msec) | Period (msec) | Duty Cycle x (linear) | Duty Cycle (%) | Duty Cycle Correction Factor (dB) | 1/B Minimum VBW (kHz) |
|--------------------|------------------------|------------------|-----------------------------|----------------------|---|-----------------------------|
| 2.4GHz Band | | | | | | |
| O-QPSK Mode | 100.000 | 100.000 | 1.000 | 100.00% | 0.00 | 0.010 |



8. ANTENNA PORT TEST RESULTS

8.1. O-QPSK (DSSS) MODE IN THE 2.4 GHz BAND

8.1.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

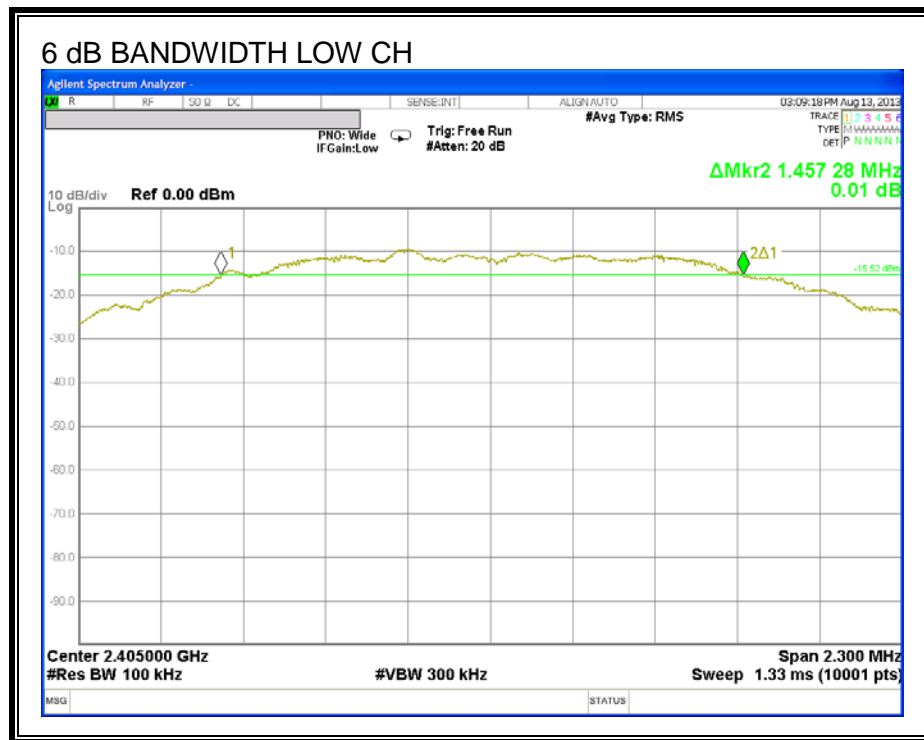
The minimum 6 dB bandwidth shall be at least 500 kHz.

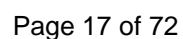
TEST PROCEDURE

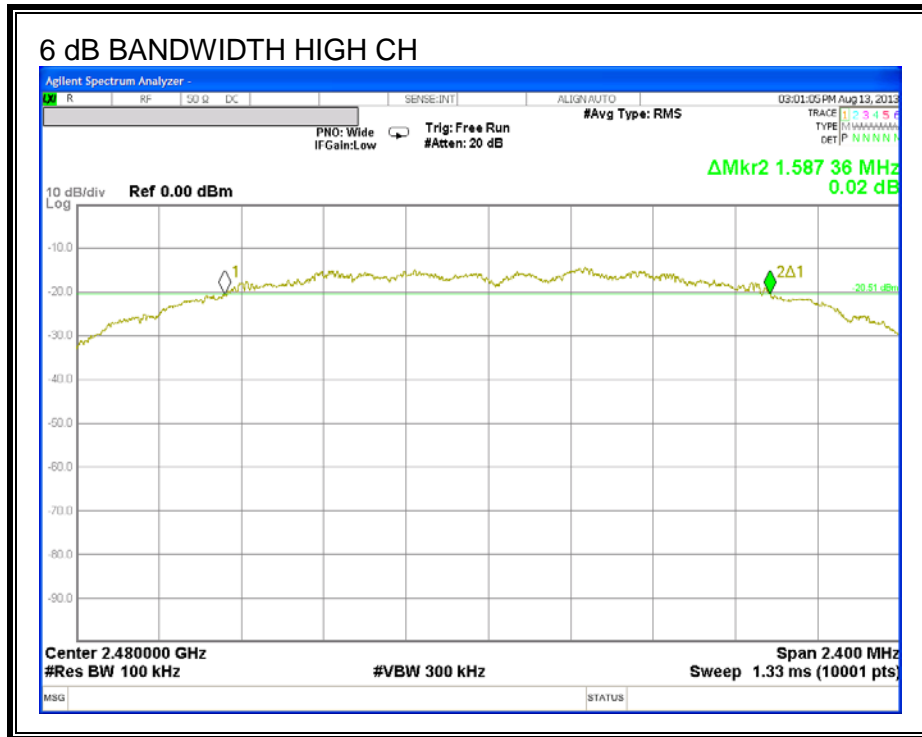
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

| Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | Minimum Limit (MHz) |
|---------|--------------------|-------------------------|------------------------|
| Low | 2405 | 1.457 | 0.5 |
| Middle | 2440 | 1.552 | 0.5 |
| High | 2480 | 1.587 | 0.5 |







8.1.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

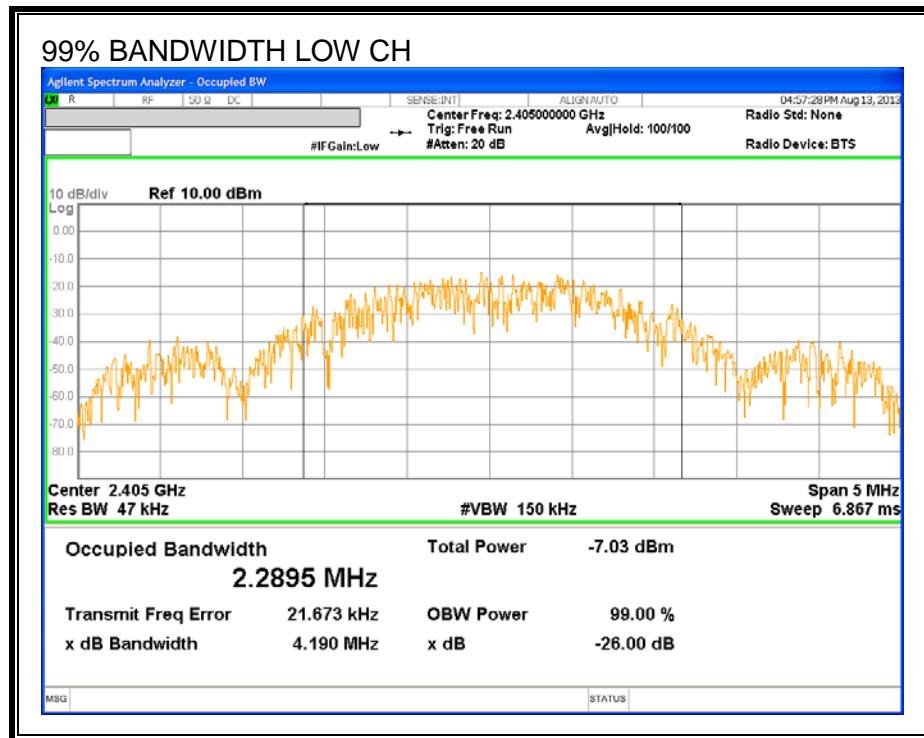
TEST PROCEDURE

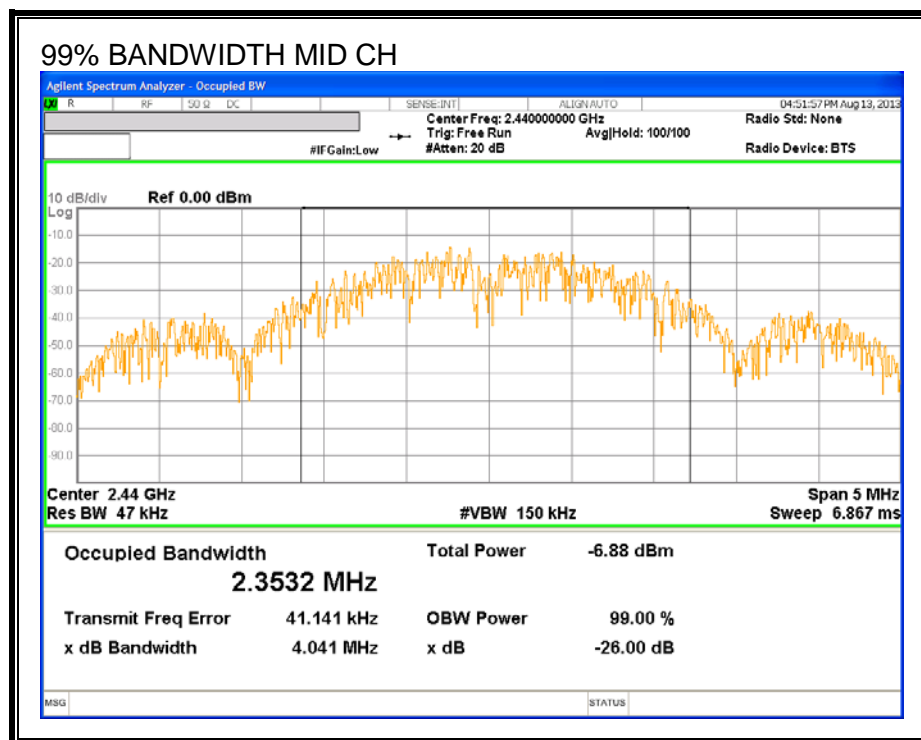
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

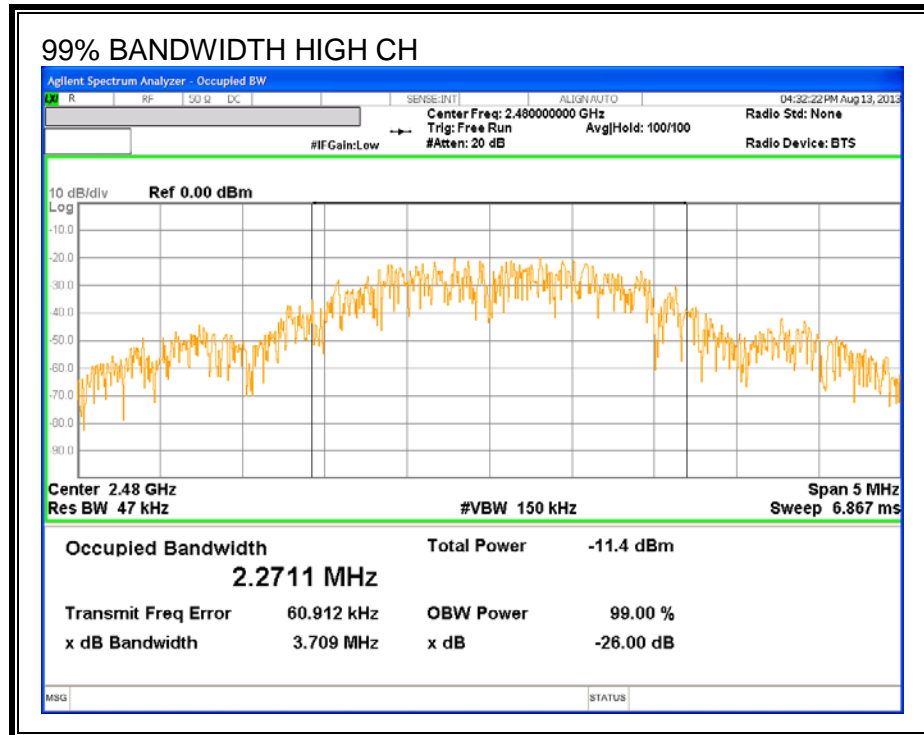
RESULTS

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|--------------------|------------------------|
| Low | 2405 | 2.290 |
| Middle | 2440 | 2.353 |
| High | 2480 | 2.271 |

99% BANDWIDTH







8.1.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

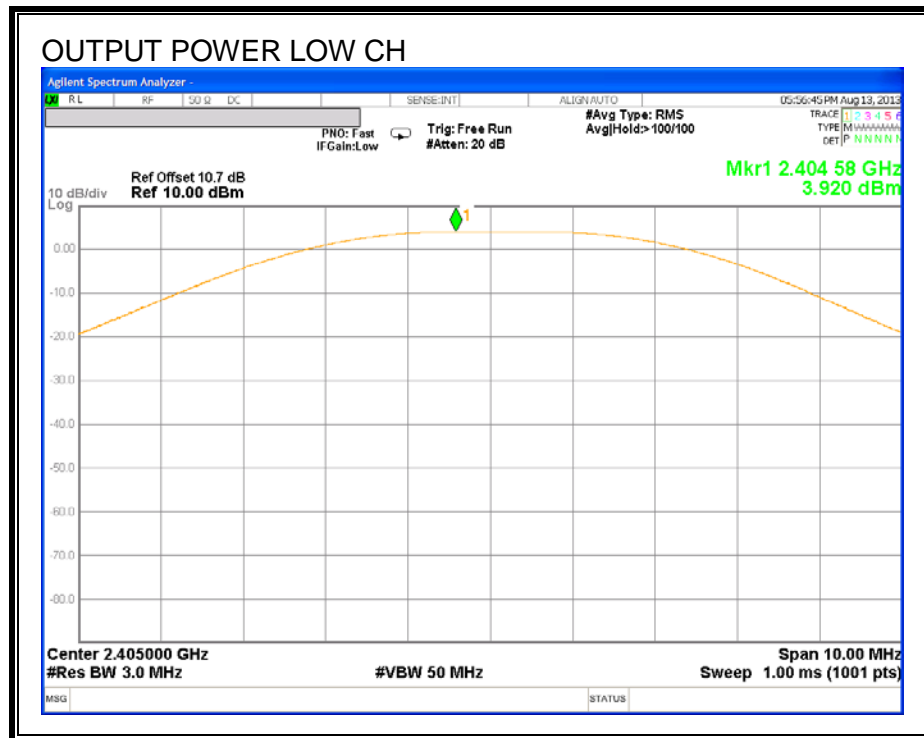
TEST PROCEDURE

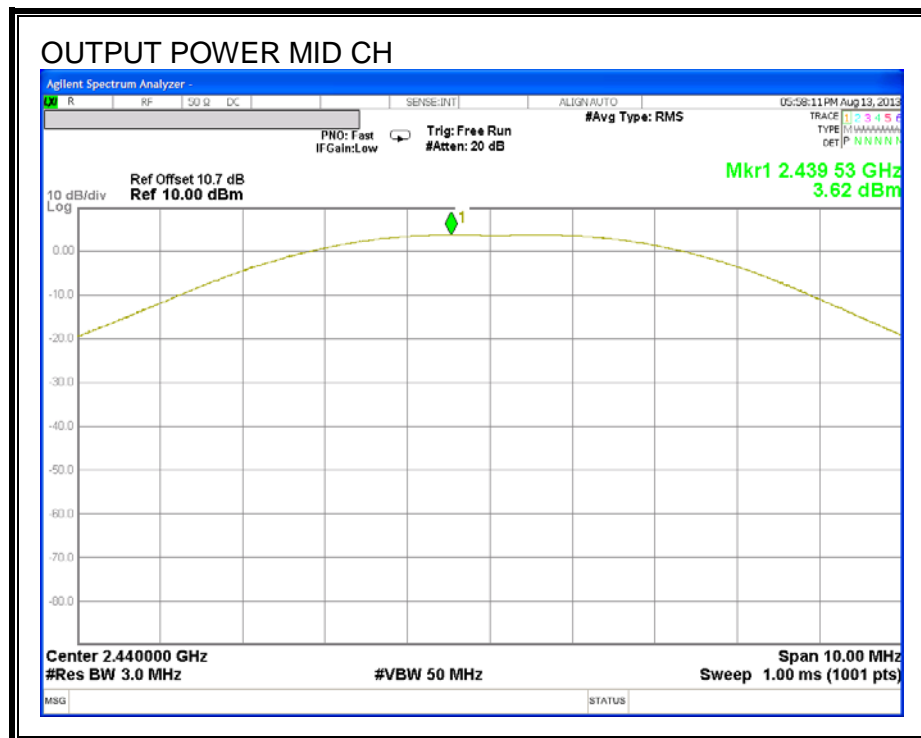
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 99% bandwidth of the EUT.

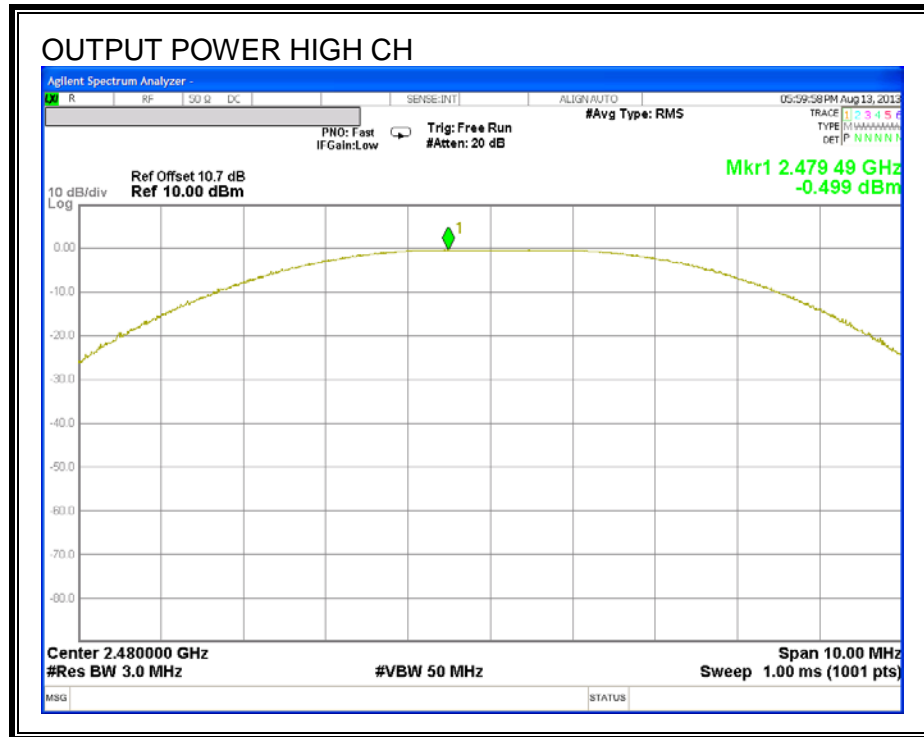
RESULTS

| Channel | Frequency (MHz) | Output Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|--------------------------|----------------|----------------|
| Low | 2405 | 3.92 | 30 | -26.08 |
| Middle | 2440 | 3.62 | 30 | -26.38 |
| High | 2480 | -0.50 | 30 | -30.50 |

OUTPUT POWER







8.1.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.7 dB (including 10 dB pad and 0.7 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

| Channel | Frequency (MHz) | Power (dBm) |
|---------|--------------------|----------------|
| Low | 2405 | 3.91 |
| Middle | 2440 | 3.58 |
| High | 2480 | -0.52 |

8.1.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

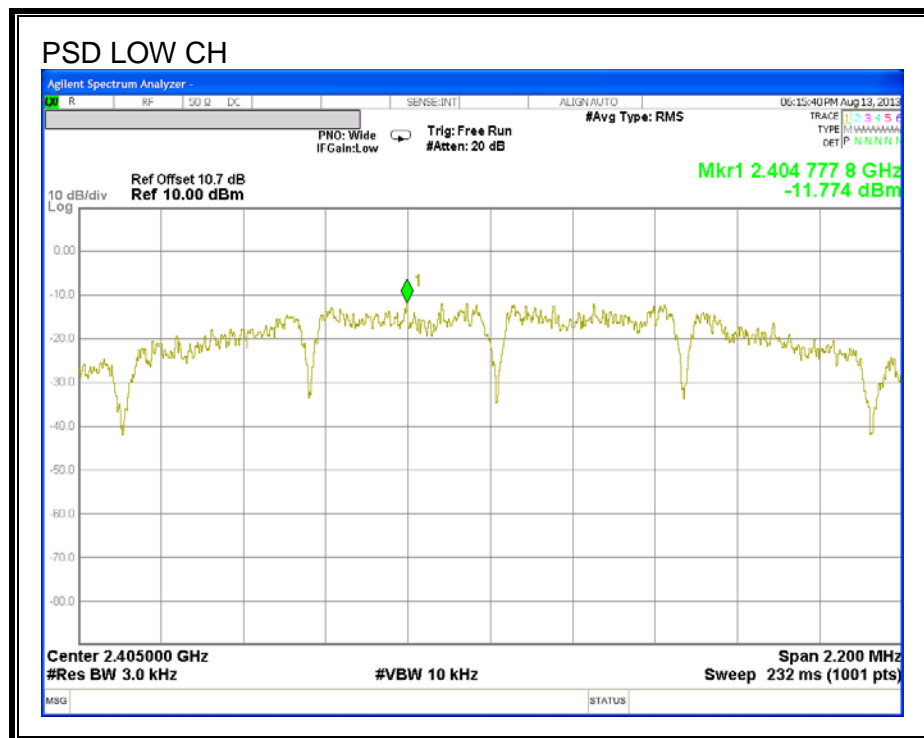
TEST PROCEDURE

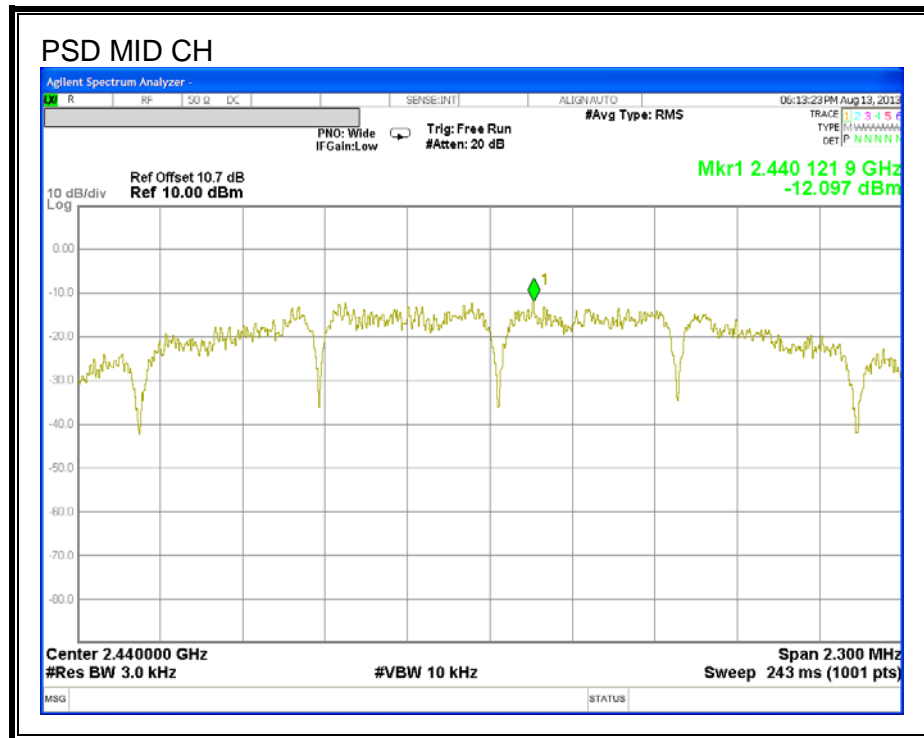
Output power was measured based on the use of a peak measurement.

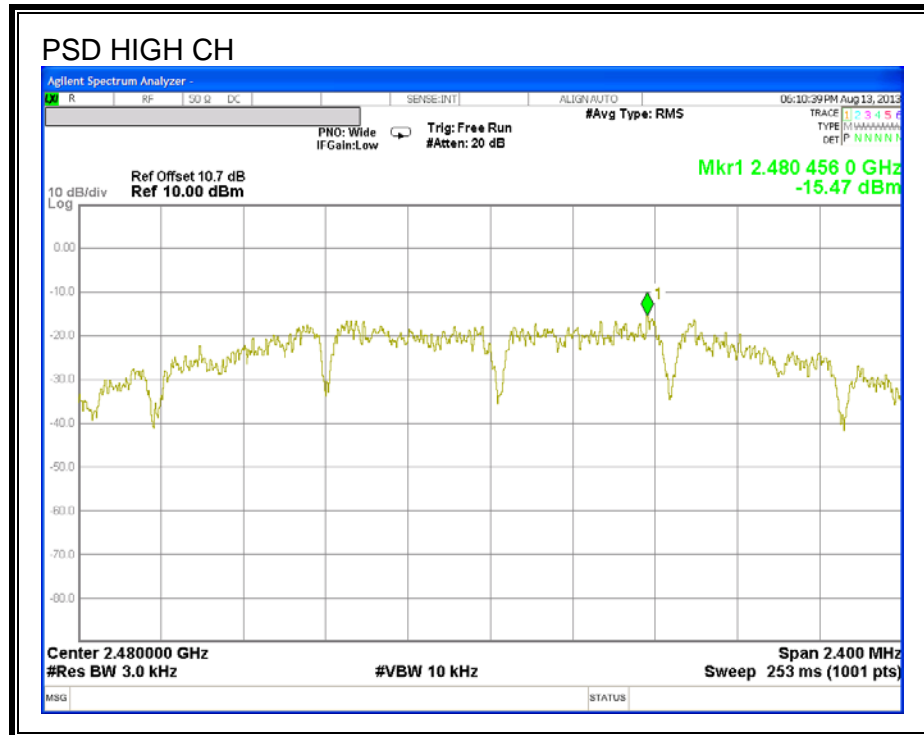
RESULTS

| Channel | Frequency (MHz) | PPSD (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|---------------|----------------|----------------|
| Low | 2405 | -11.77 | 8 | -19.77 |
| Middle | 2440 | -12.10 | 8 | -20.10 |
| High | 2480 | -15.47 | 8 | -23.47 |

POWER SPECTRAL DENSITY







8.1.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

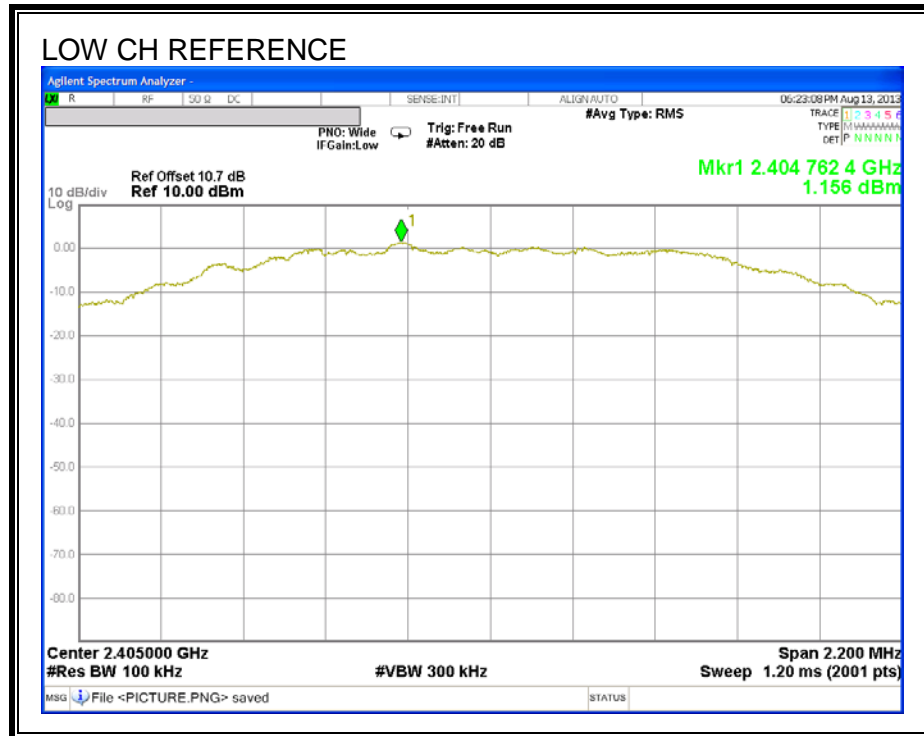
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

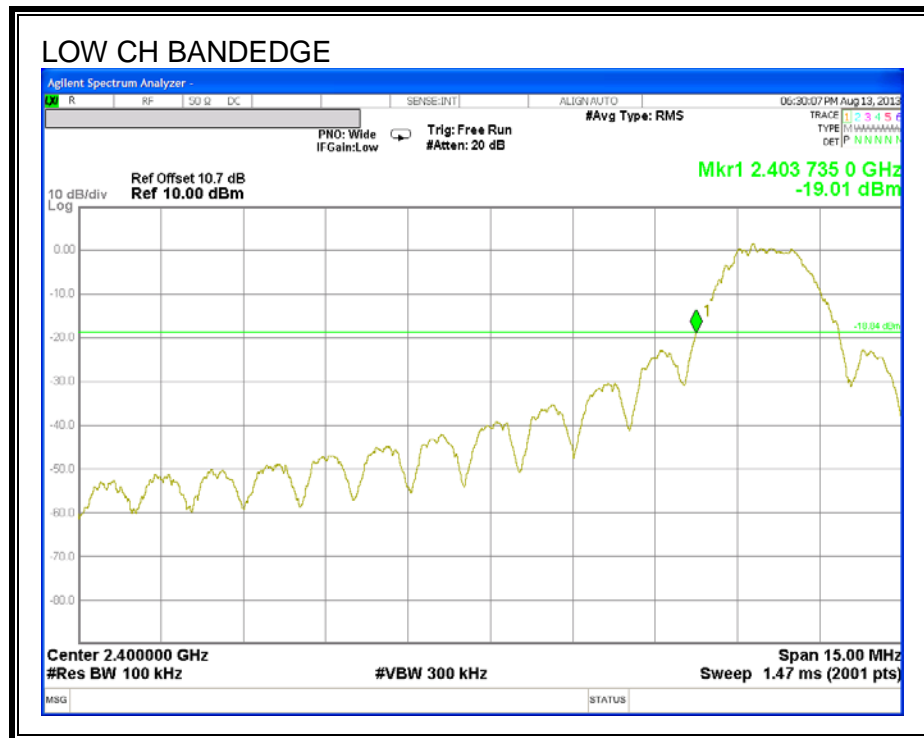
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

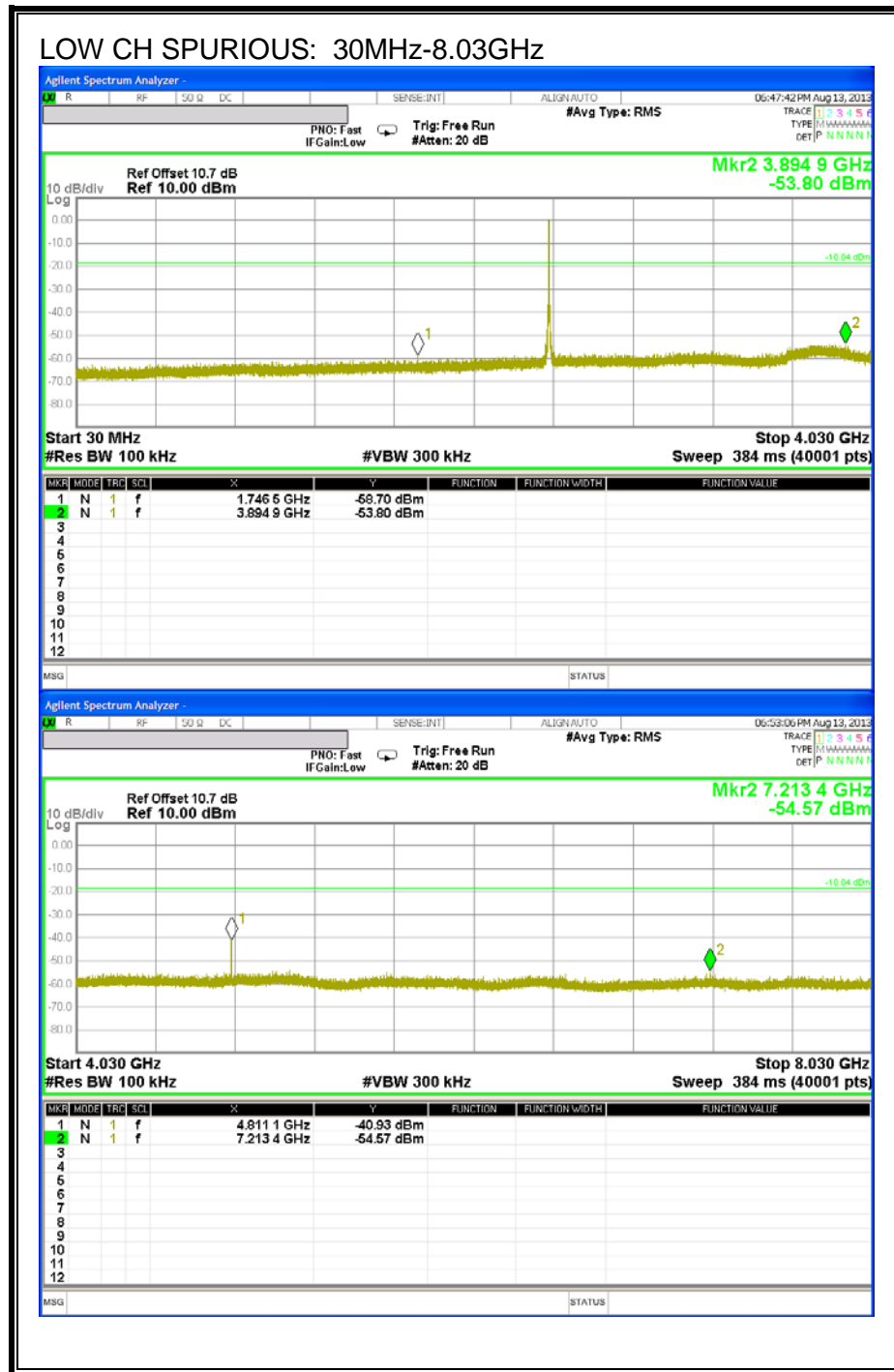
SPURIOUS EMISSIONS, LOW CHANNEL



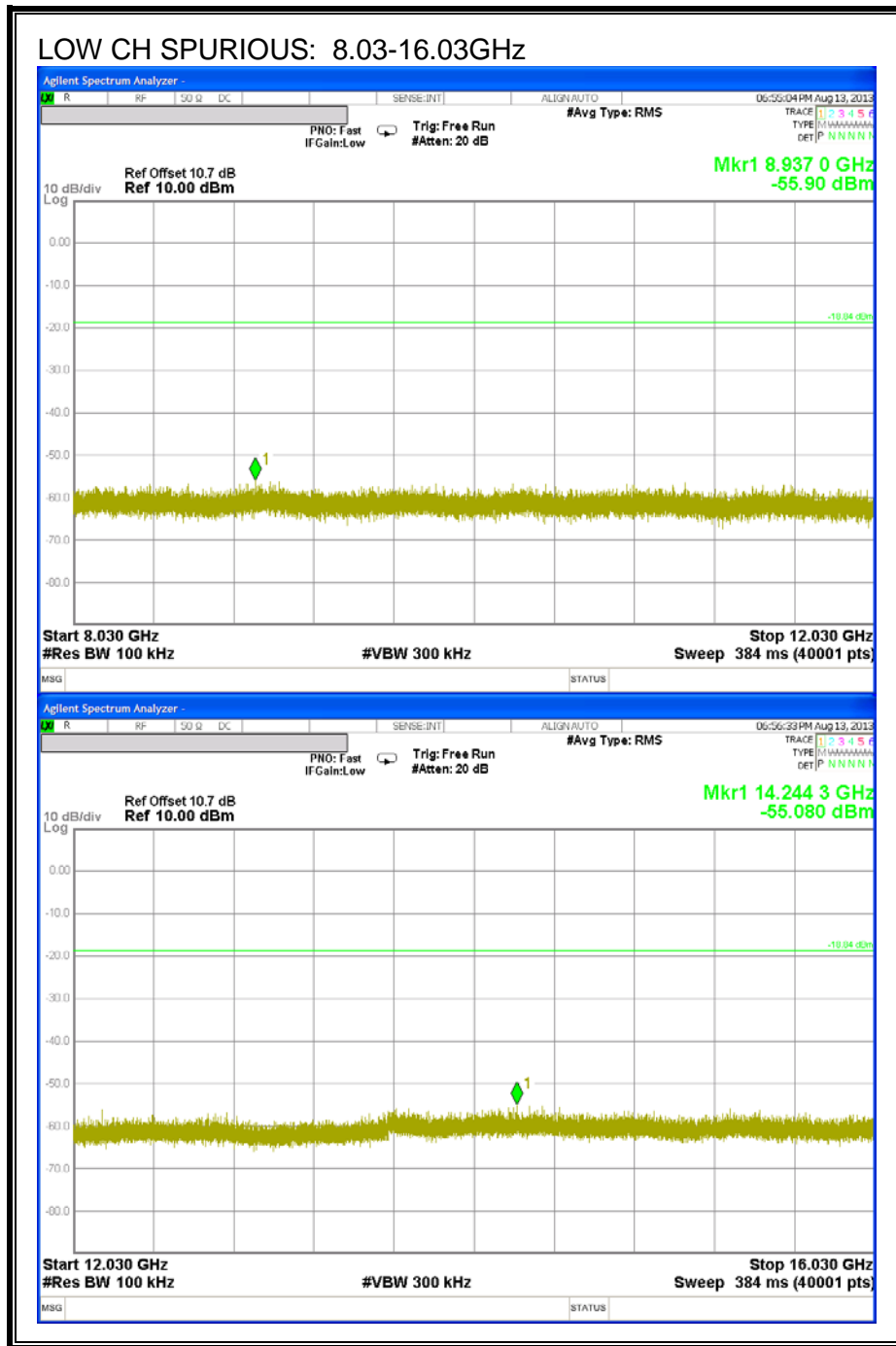
Note: Low channel had the highest peak power. Therefore, the low channel was used as the reference.

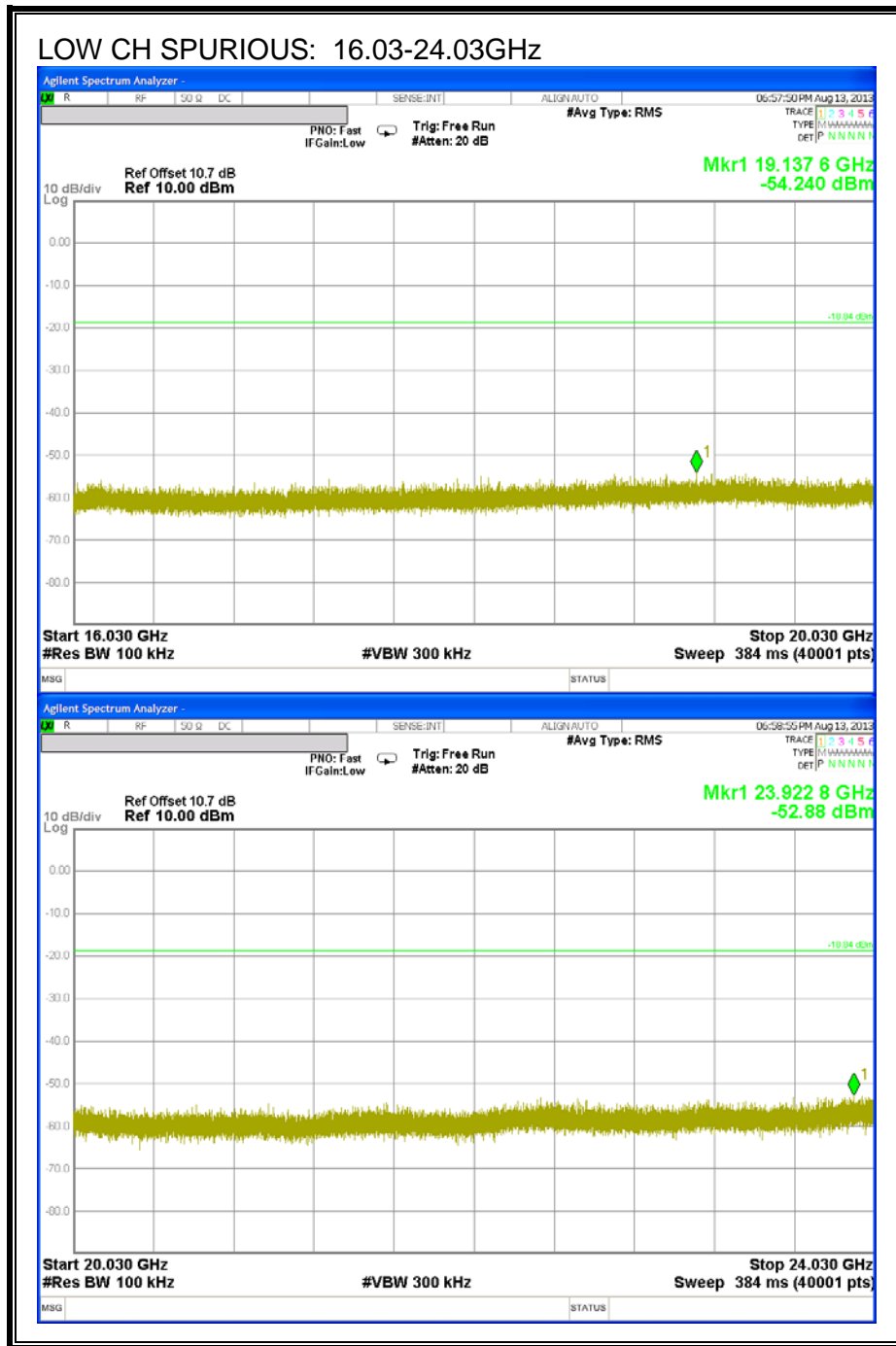


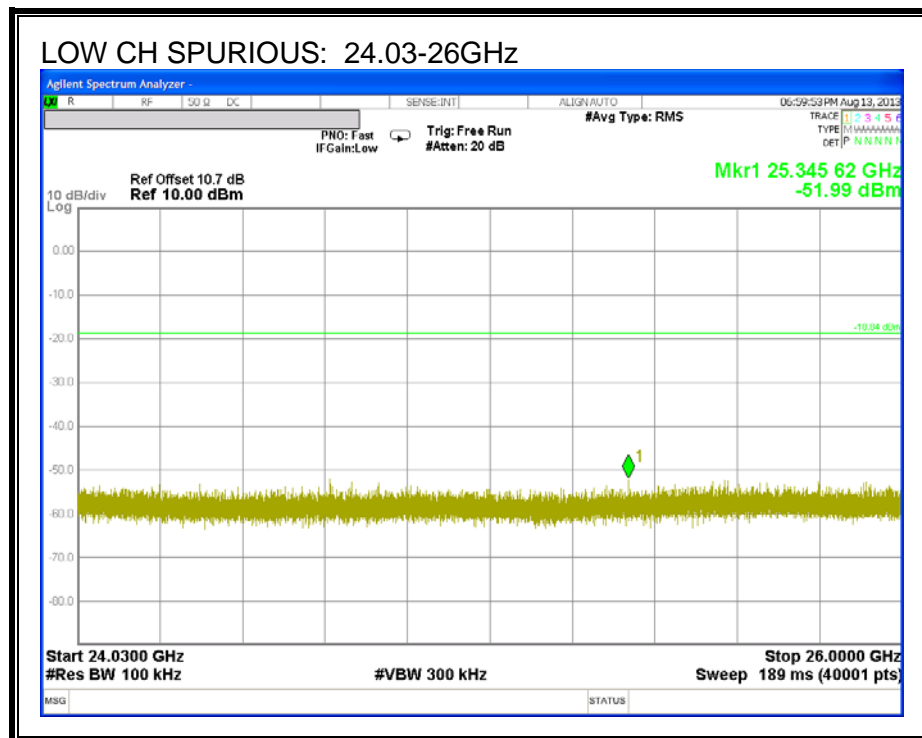
Note – 2.4 GHz is the center frequency. The waveform was measured at the point on the signal that is 20dB below the reference channel peak. Based on this, the band edge is below the 20 dB threshold.



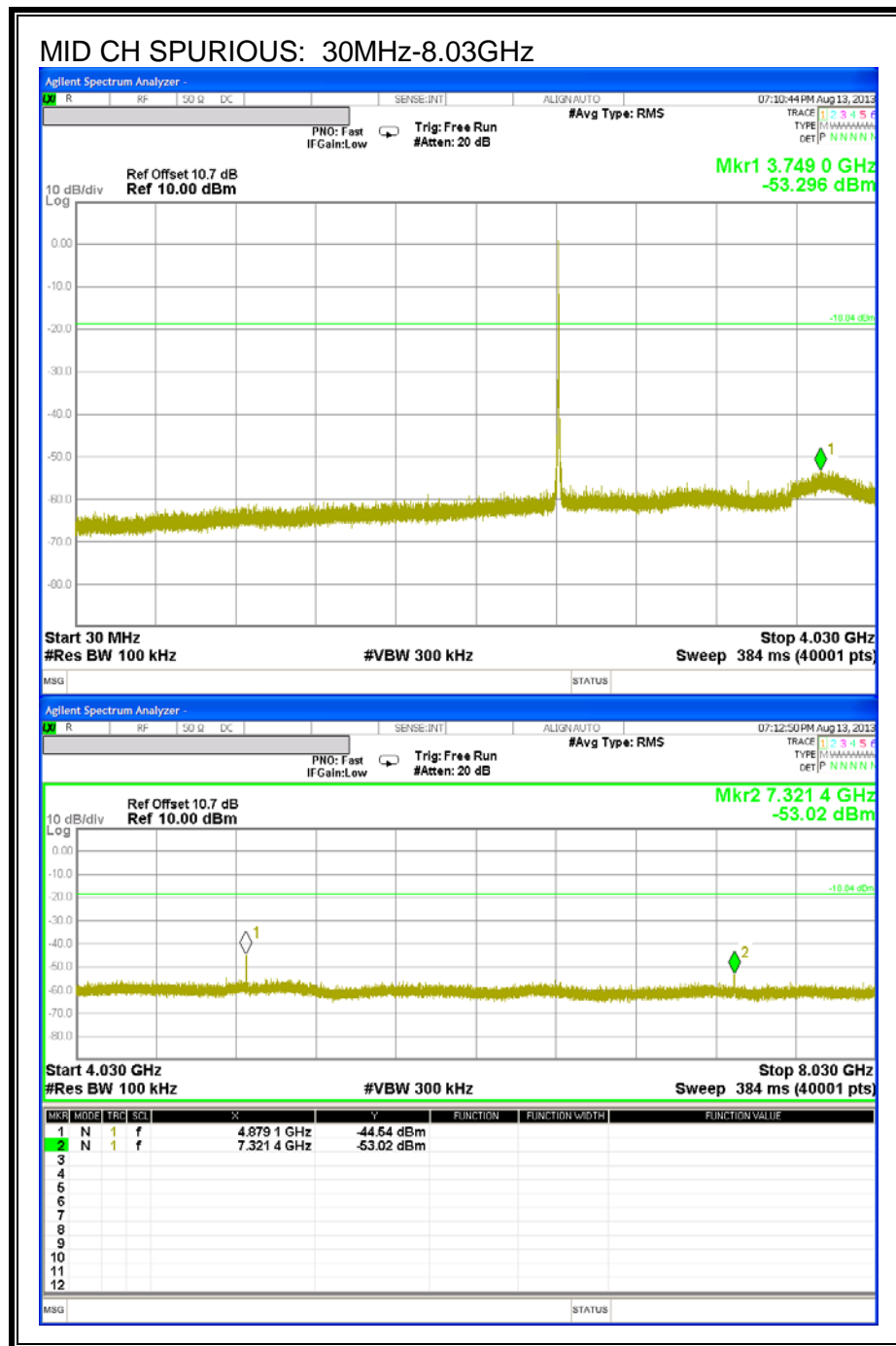
Note: Per KDB 558074, number of points must be \geq Span/RBW. Therefore, seven plots are needed to satisfy this requirement over the range of 30MHz-26GHz.



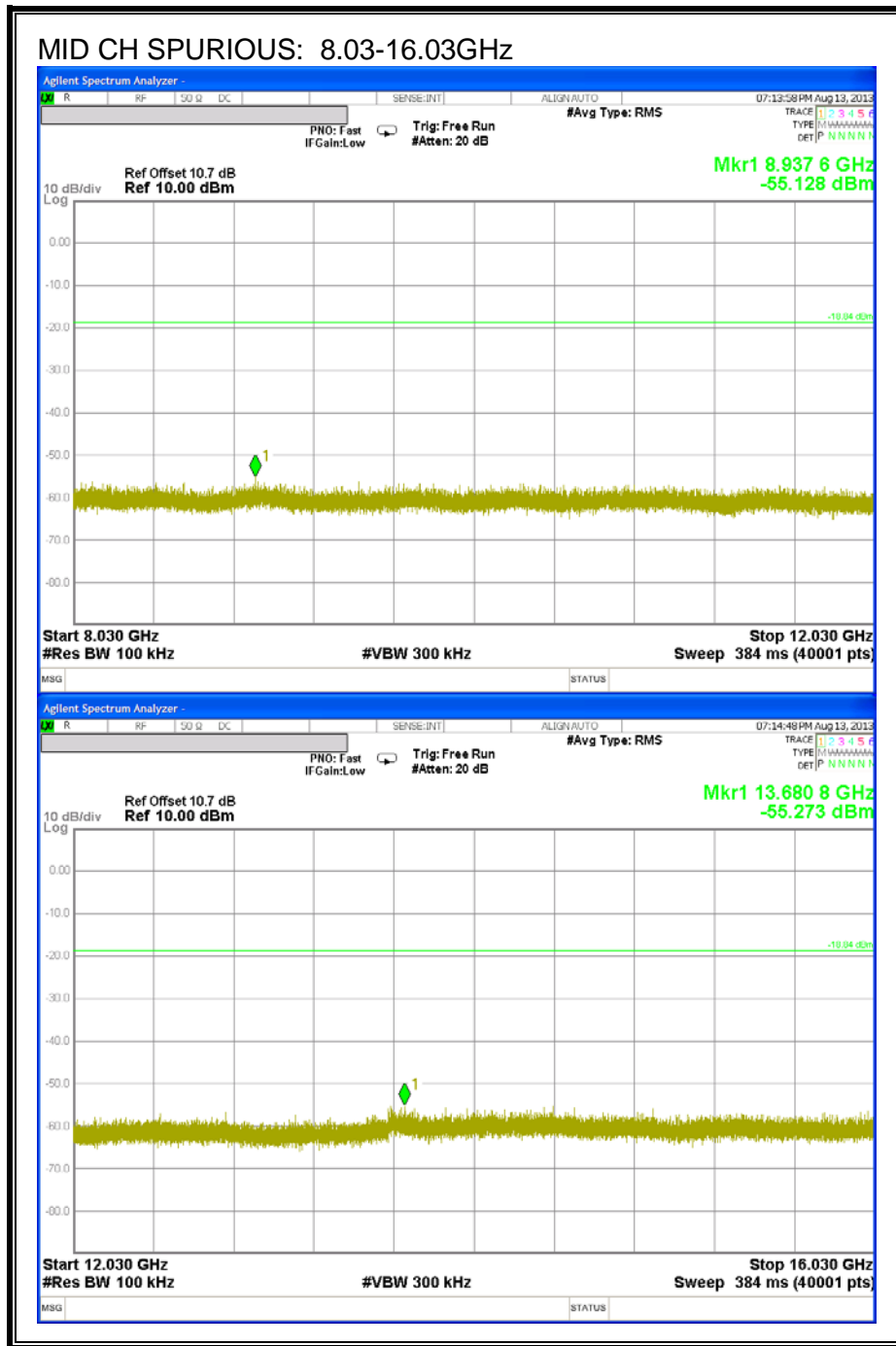


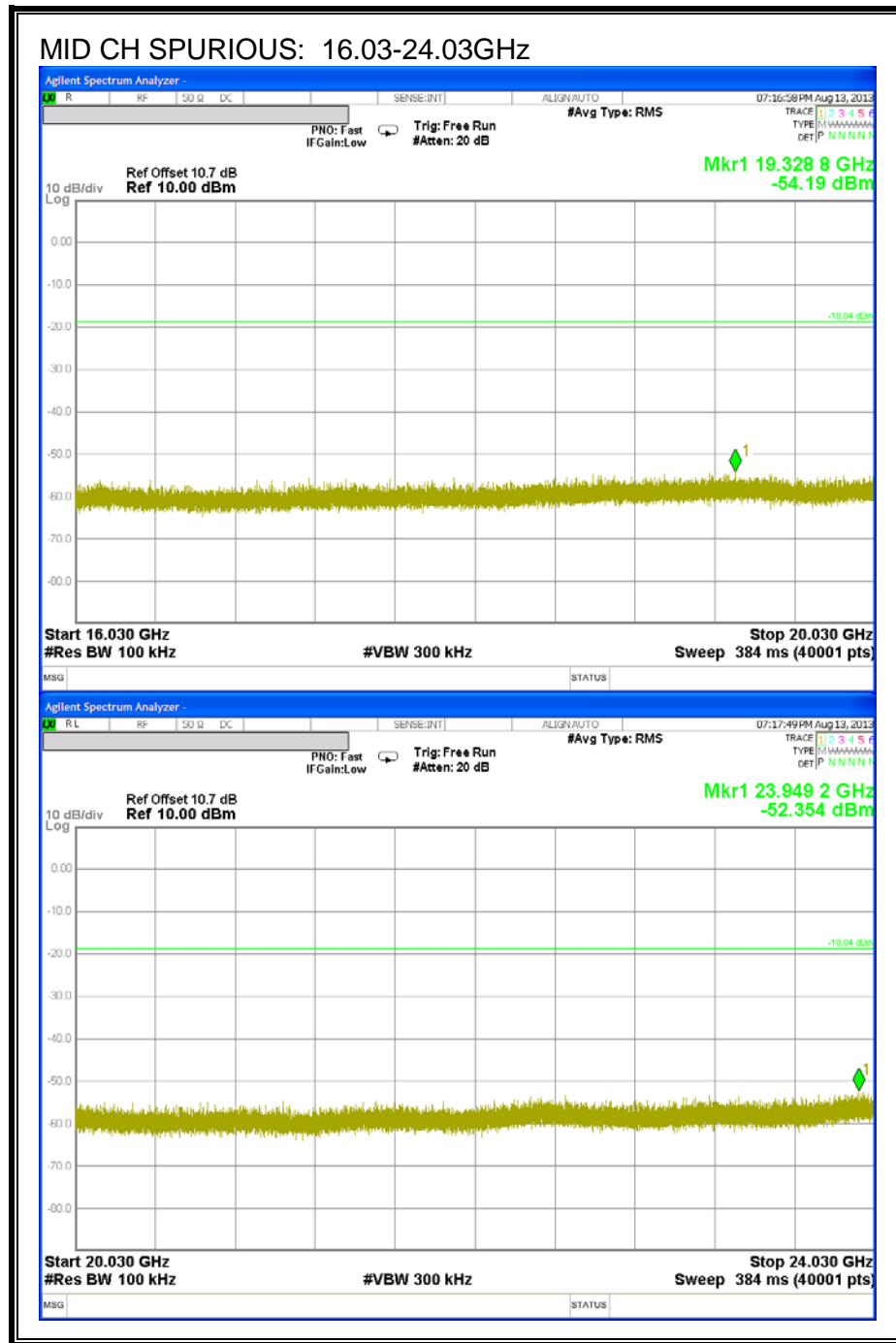


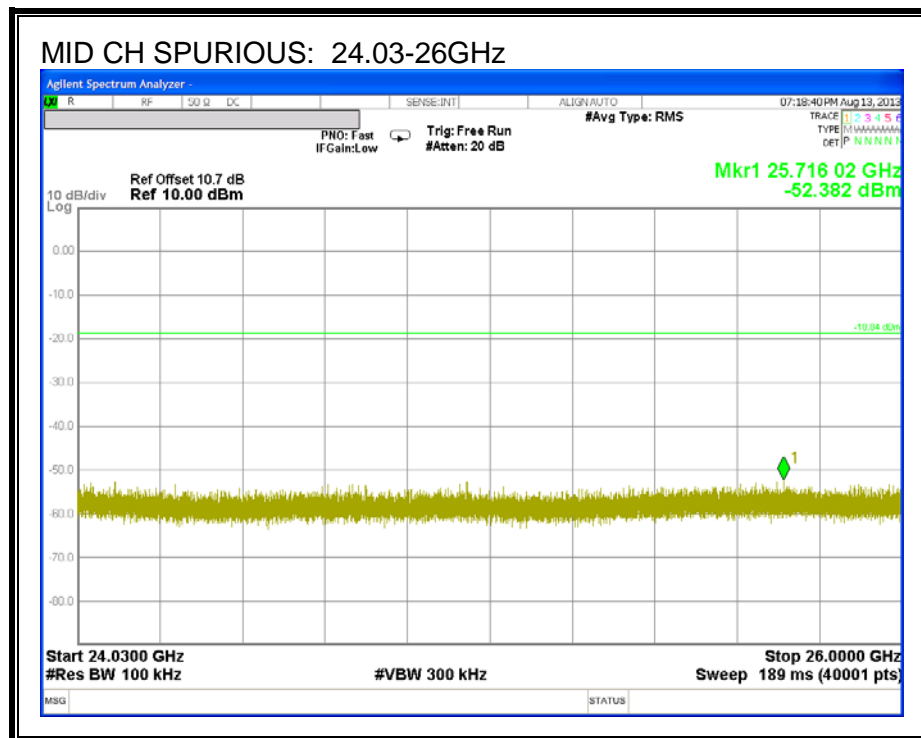
SPURIOUS EMISSIONS, MID CHANNEL



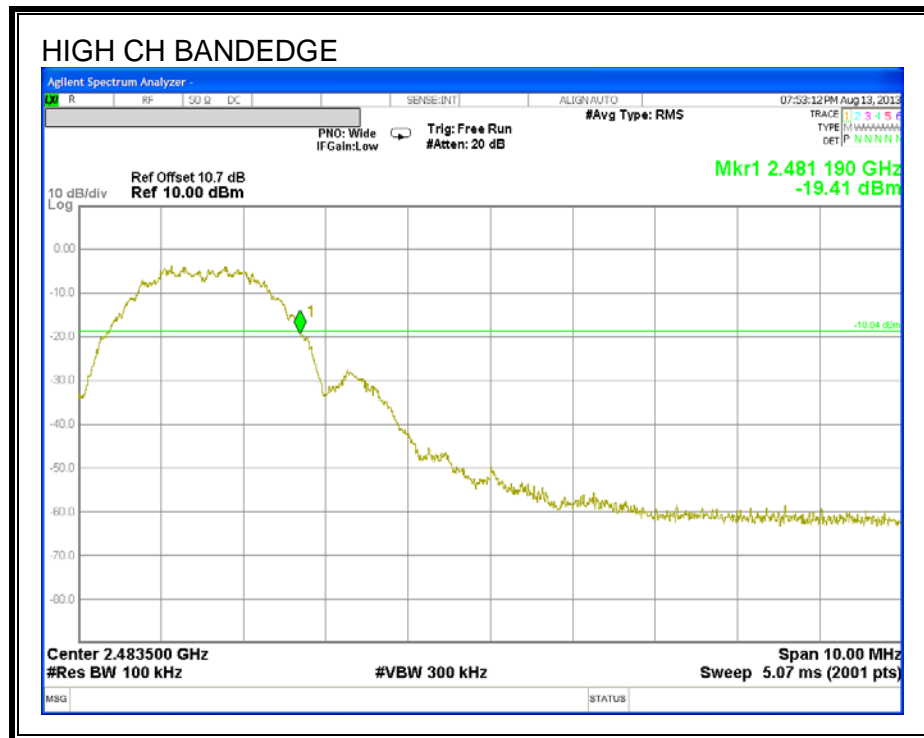
Note: Per KDB 558074, number of points must be \geq Span/RBW. Therefore, seven plots are needed to satisfy this requirement over the range of 30MHz-26GHz.



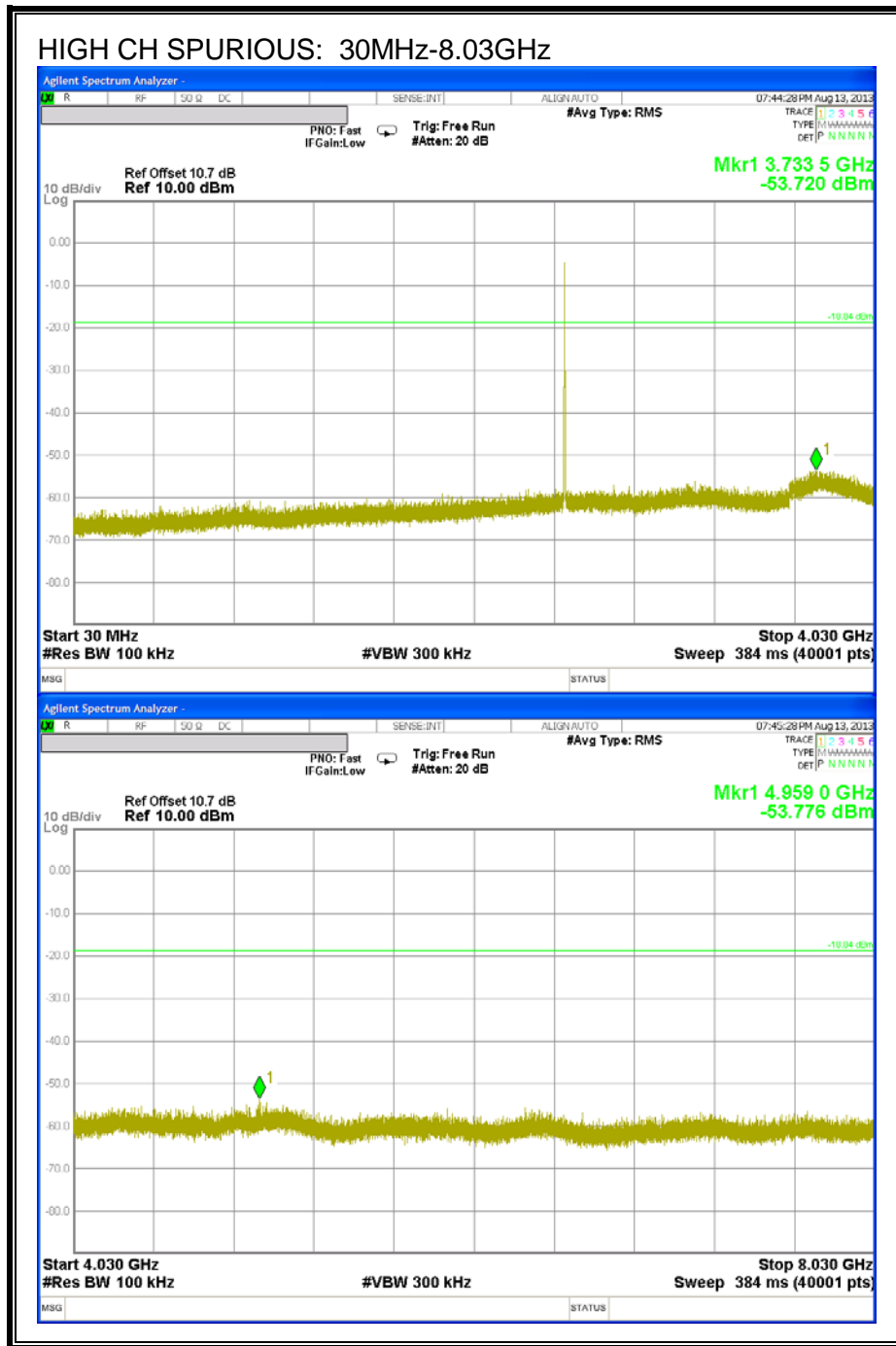




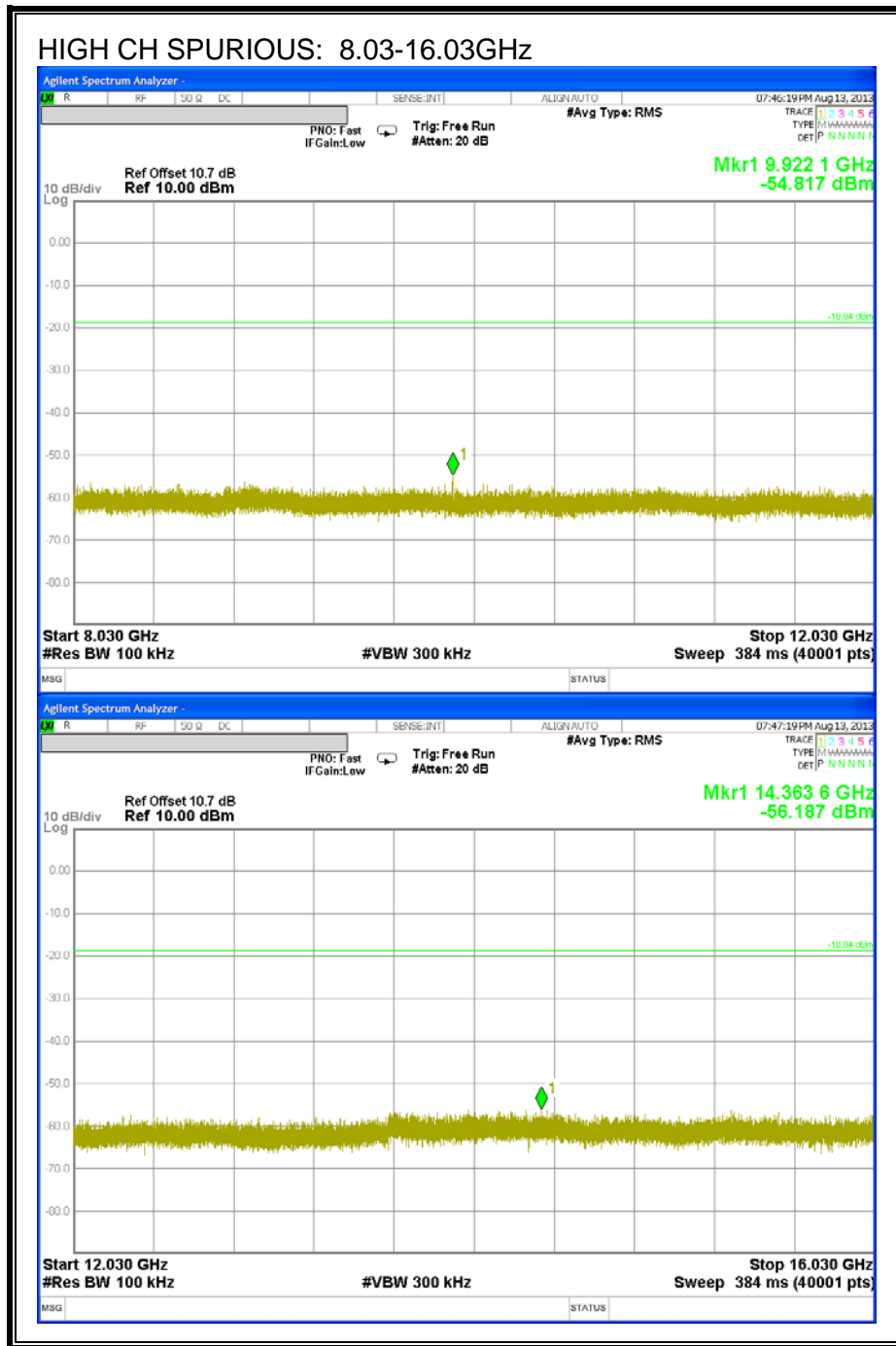
SPURIOUS EMISSIONS, HIGH CHANNEL

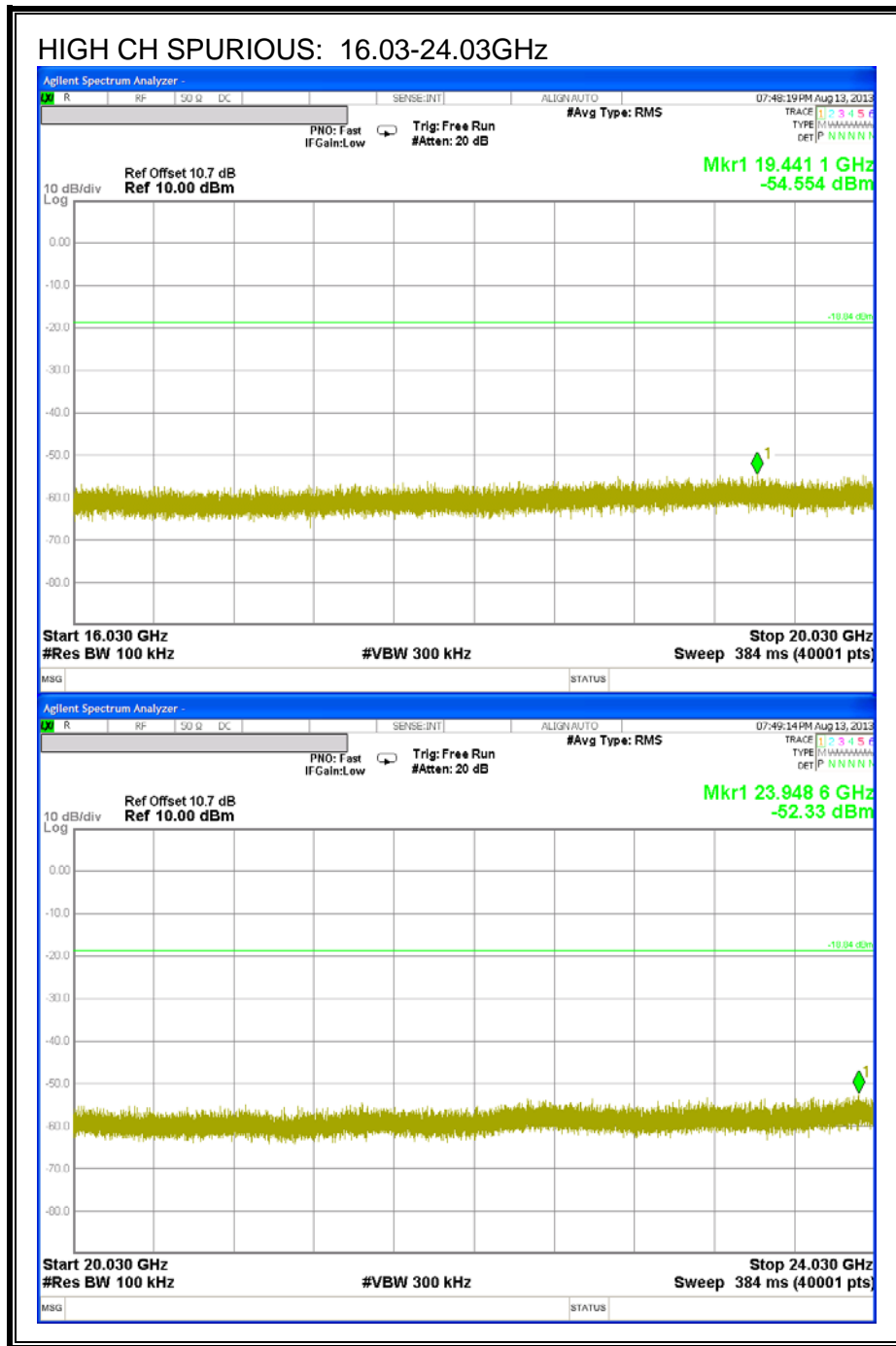


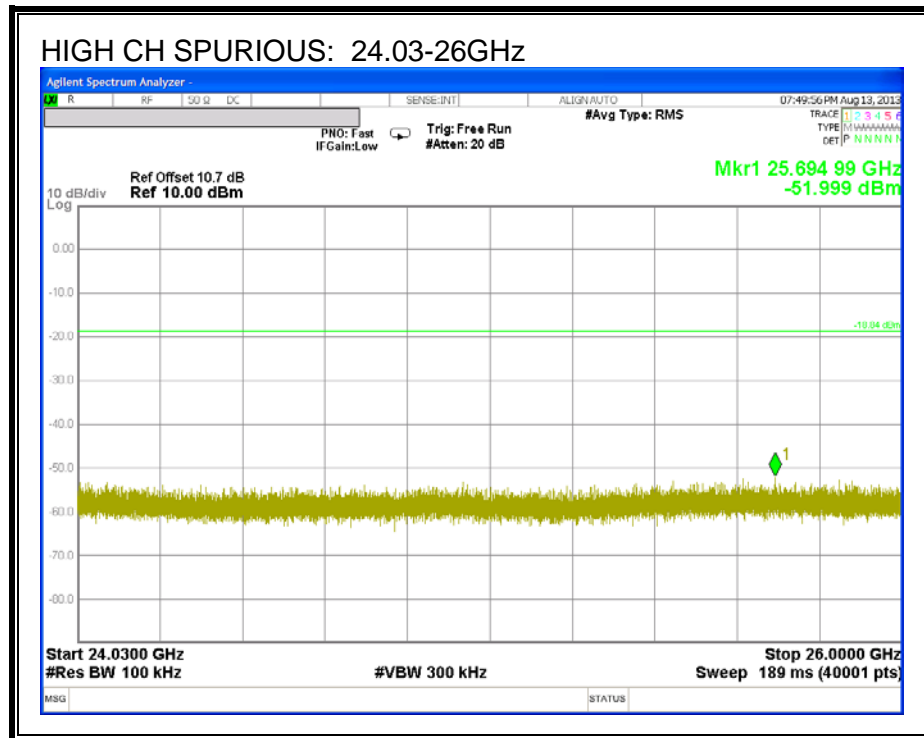
Note – 2.483 GHz is the center frequency. The waveform was measured at the point on the signal that is 20dB below the reference channel peak. Based on this, the band edge is below the 20 dB threshold.



Note: Per KDB 558074, number of points must be \geq Span/RBW. Therefore, seven plots are needed to satisfy this requirement over the range of 30MHz-26GHz.







9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

| Frequency Range (MHz) | Field Strength Limit (uV/m) at 3 m | Field Strength Limit (dBuV/m) at 3 m |
|-----------------------|------------------------------------|--------------------------------------|
| 30 - 88 | 100 | 40 |
| 88 - 216 | 150 | 43.5 |
| 216 - 960 | 200 | 46 |
| Above 960 | 500 | 54 |

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements between 30 MHz and 1 GHz the resolution bandwidth is set to 120 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 1 MHz for peak measurements and as applicable for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

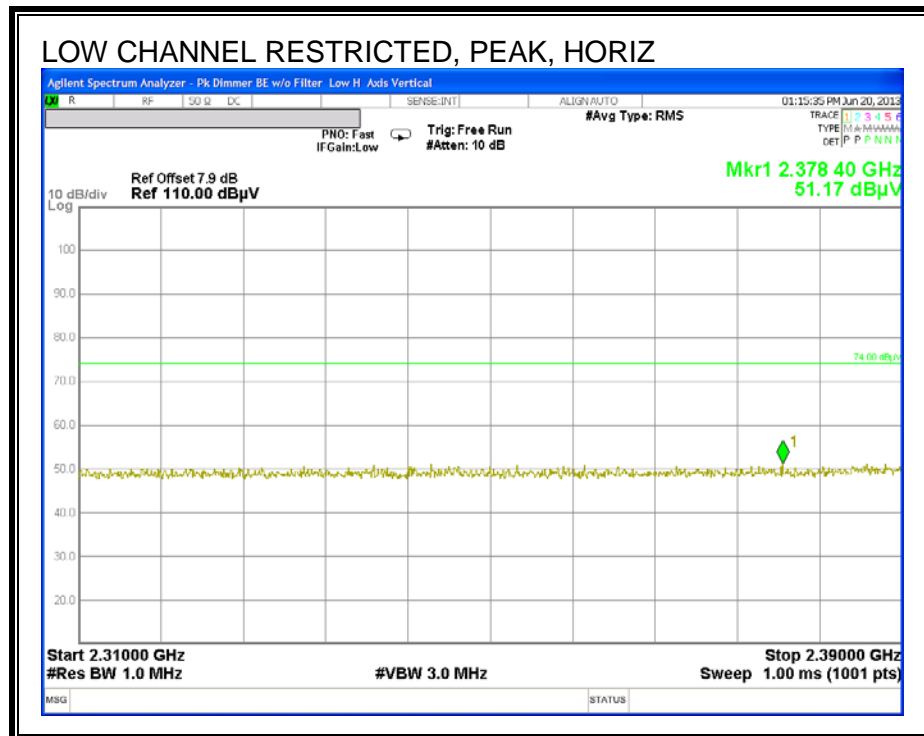
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

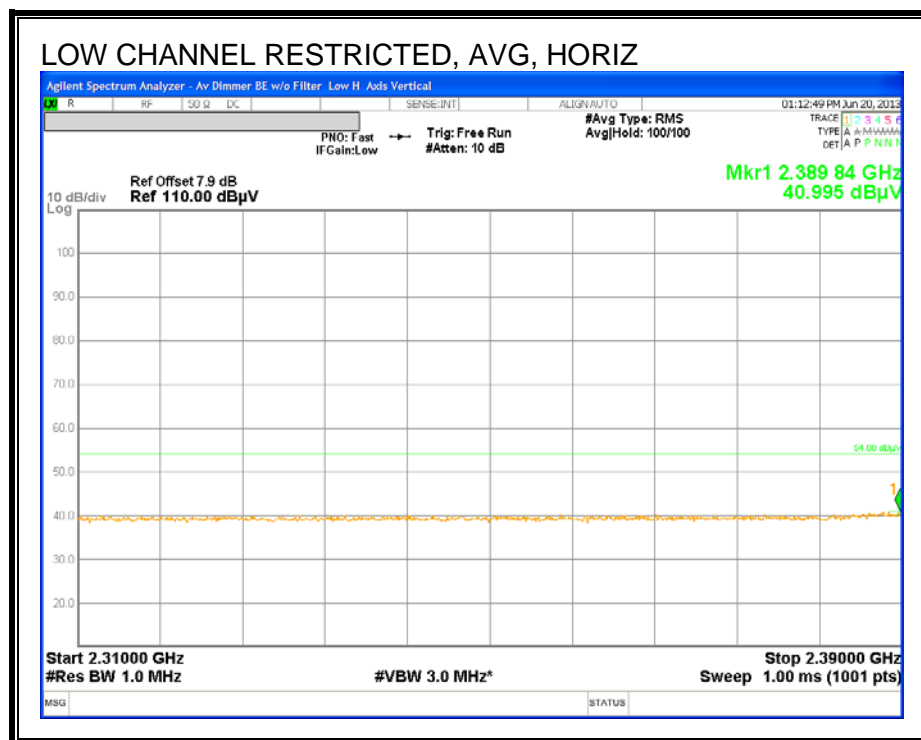
For measurements below 30 MHz loop antennas were used per FCC requirements, and measurement equipment settings test method were consistent with ANSI C63.4.

9.2. TRANSMITTER ABOVE 1 GHz

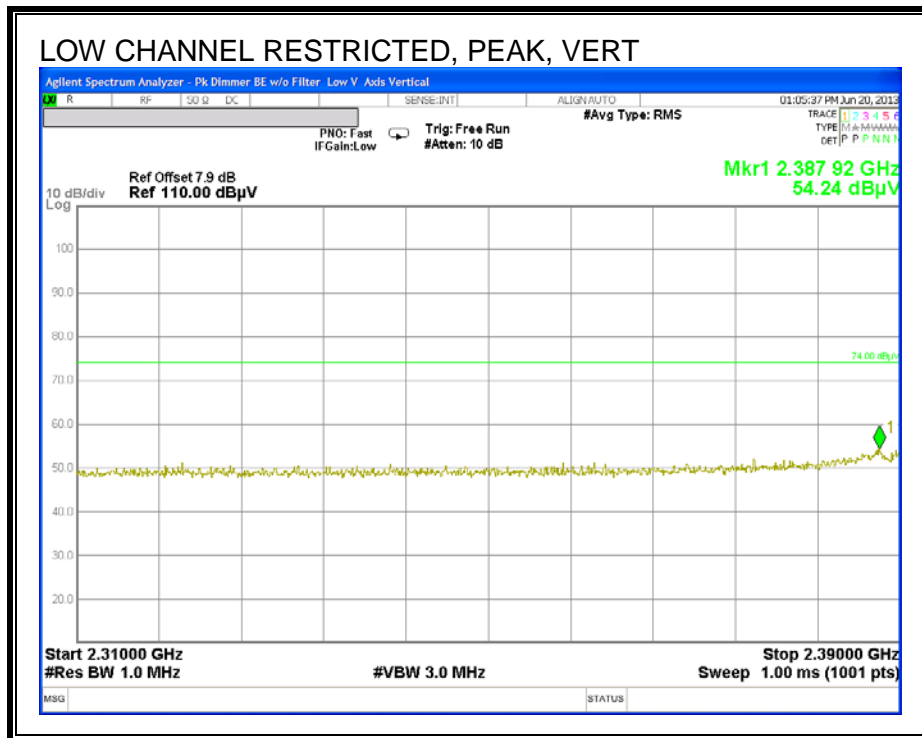
9.2.1. TX ABOVE 1 GHz FOR O-QPSK (DSSS) MODE IN THE 2.4 GHz BAND

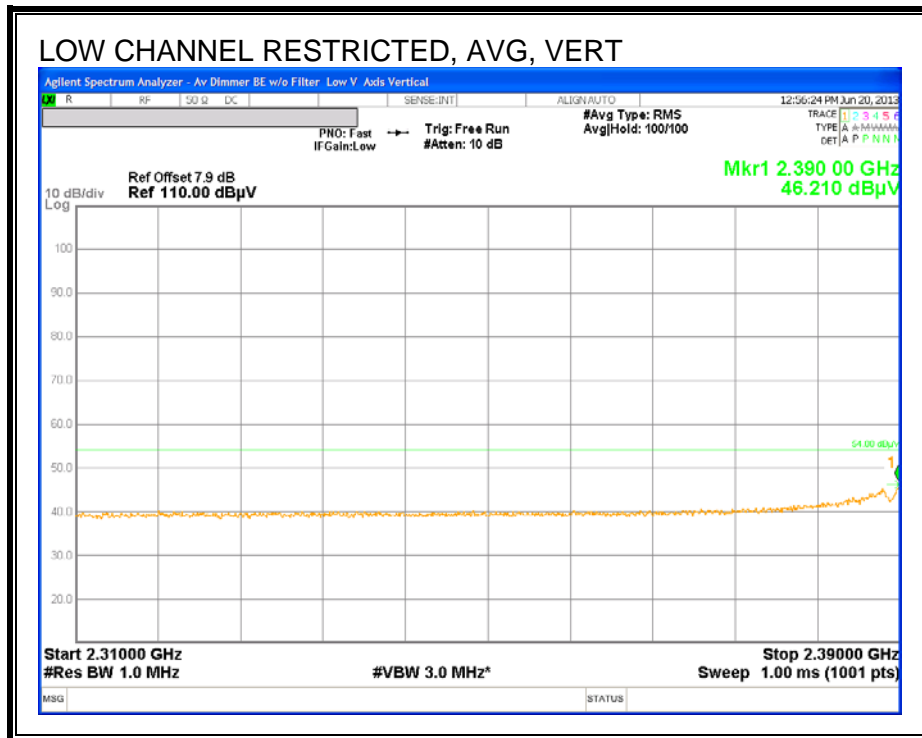
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



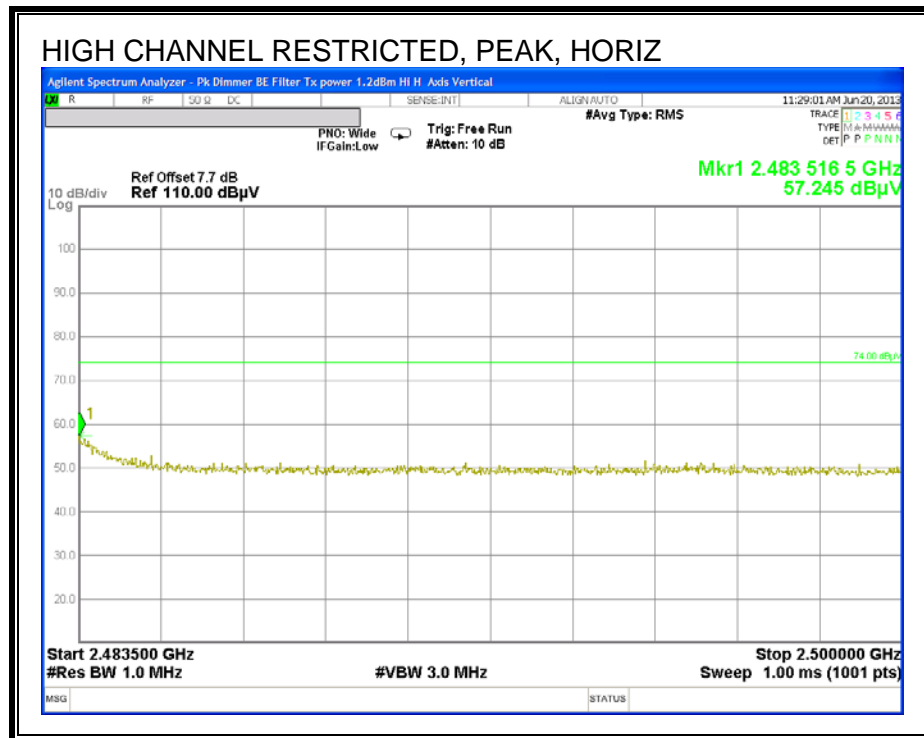


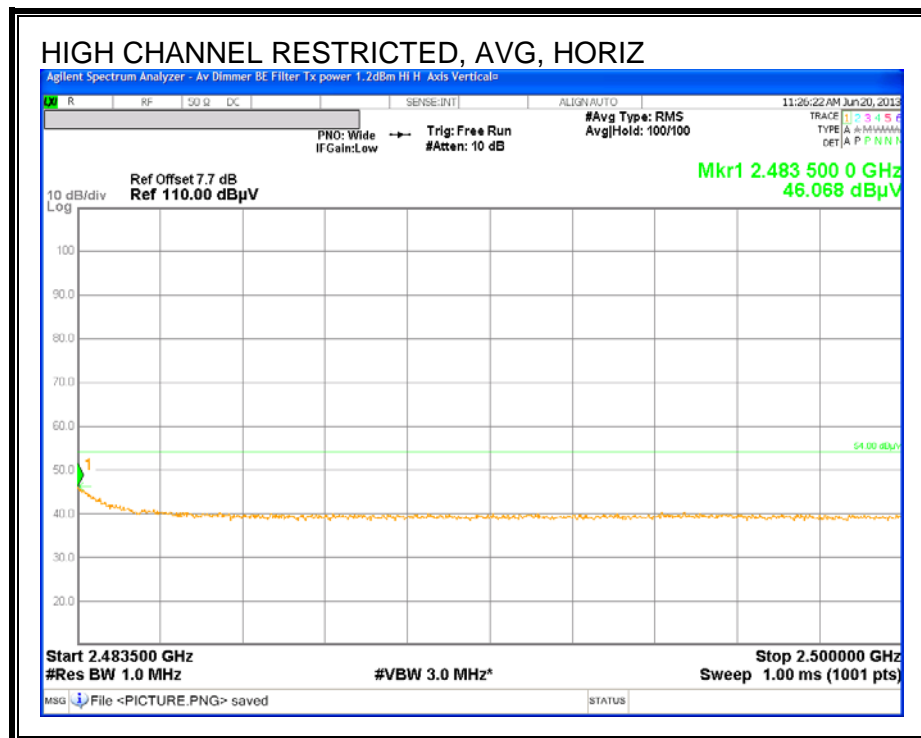
RESTRICTED BANEDGE (LOW CHANNEL, VERTICAL)



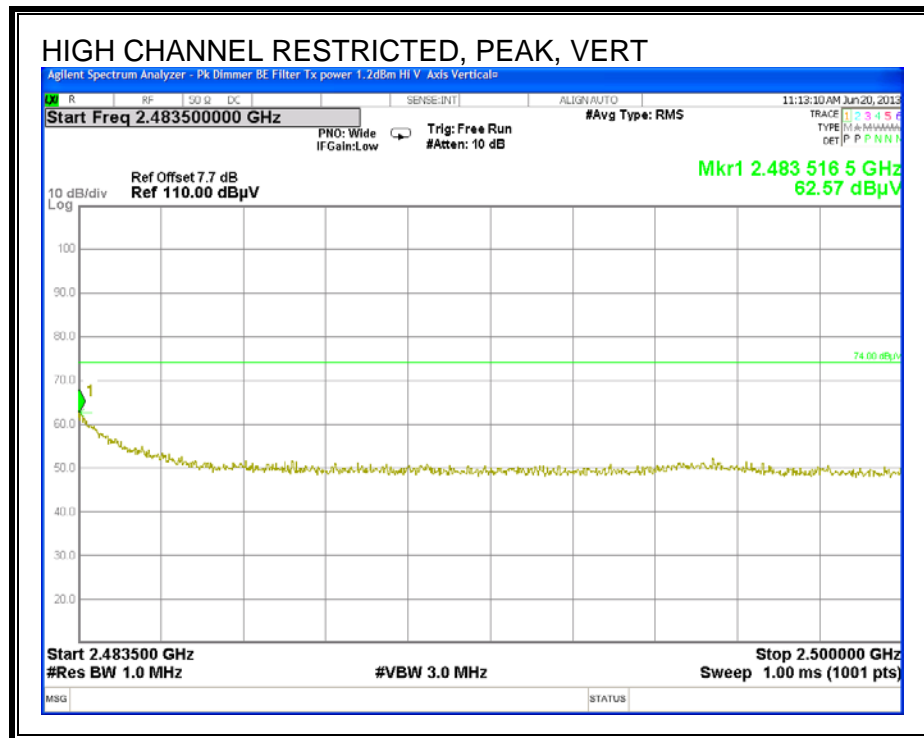


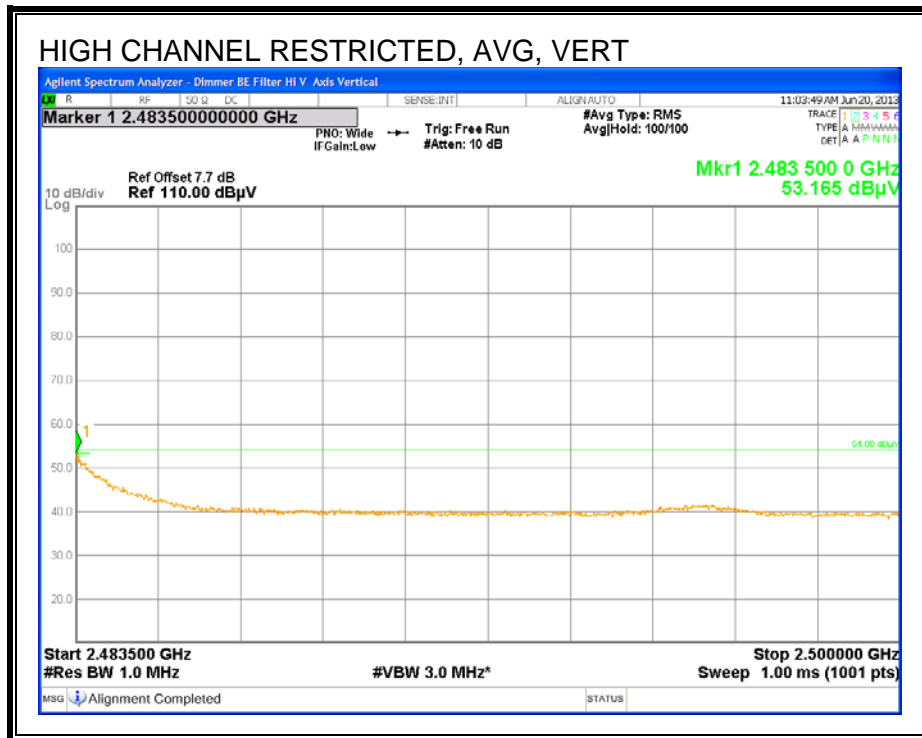
RESTRICTED BANEDGE (HIGH CHANNEL, HORIZONTAL)



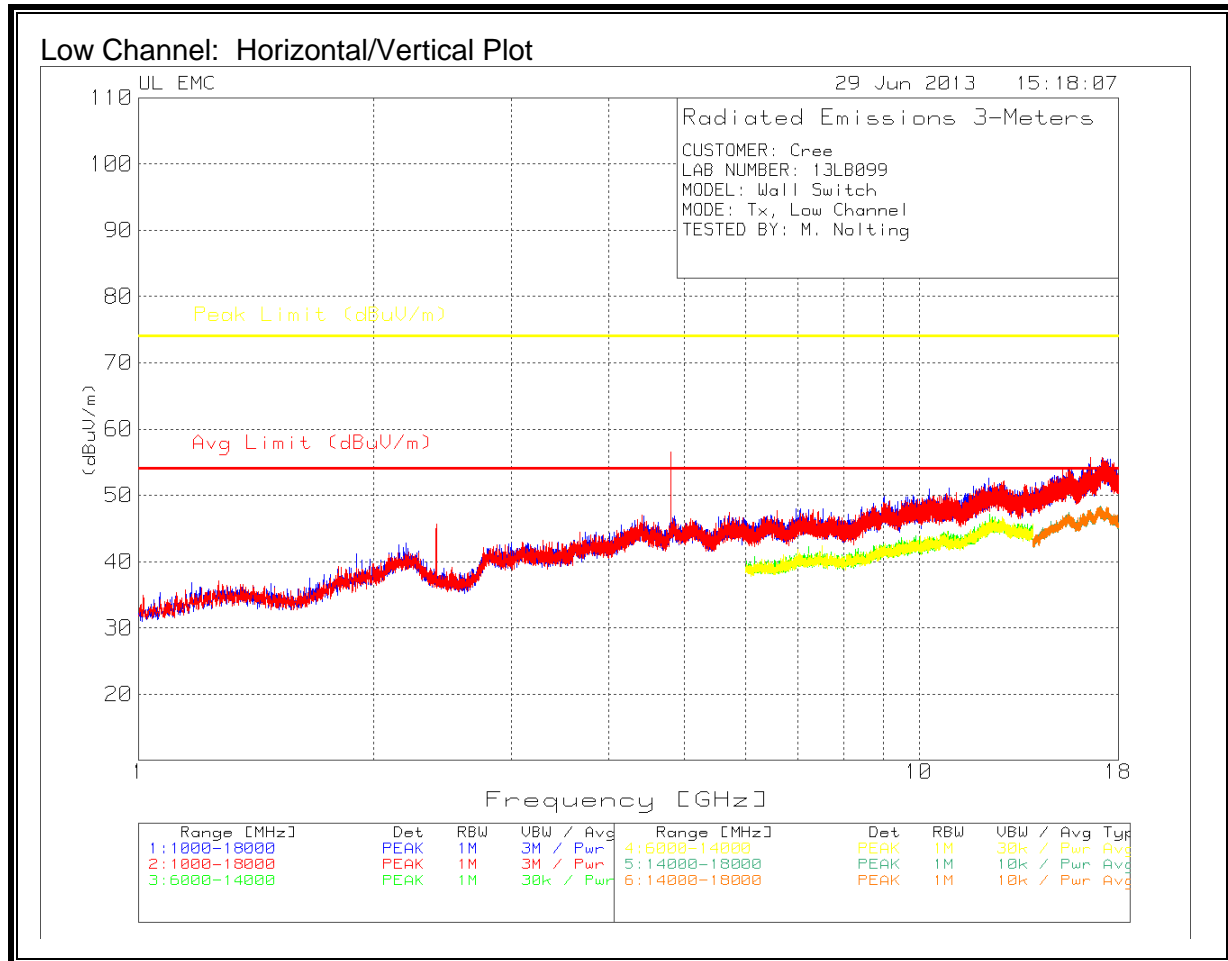


RESTRICTED BANEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS



Low Channel: Tabular Data

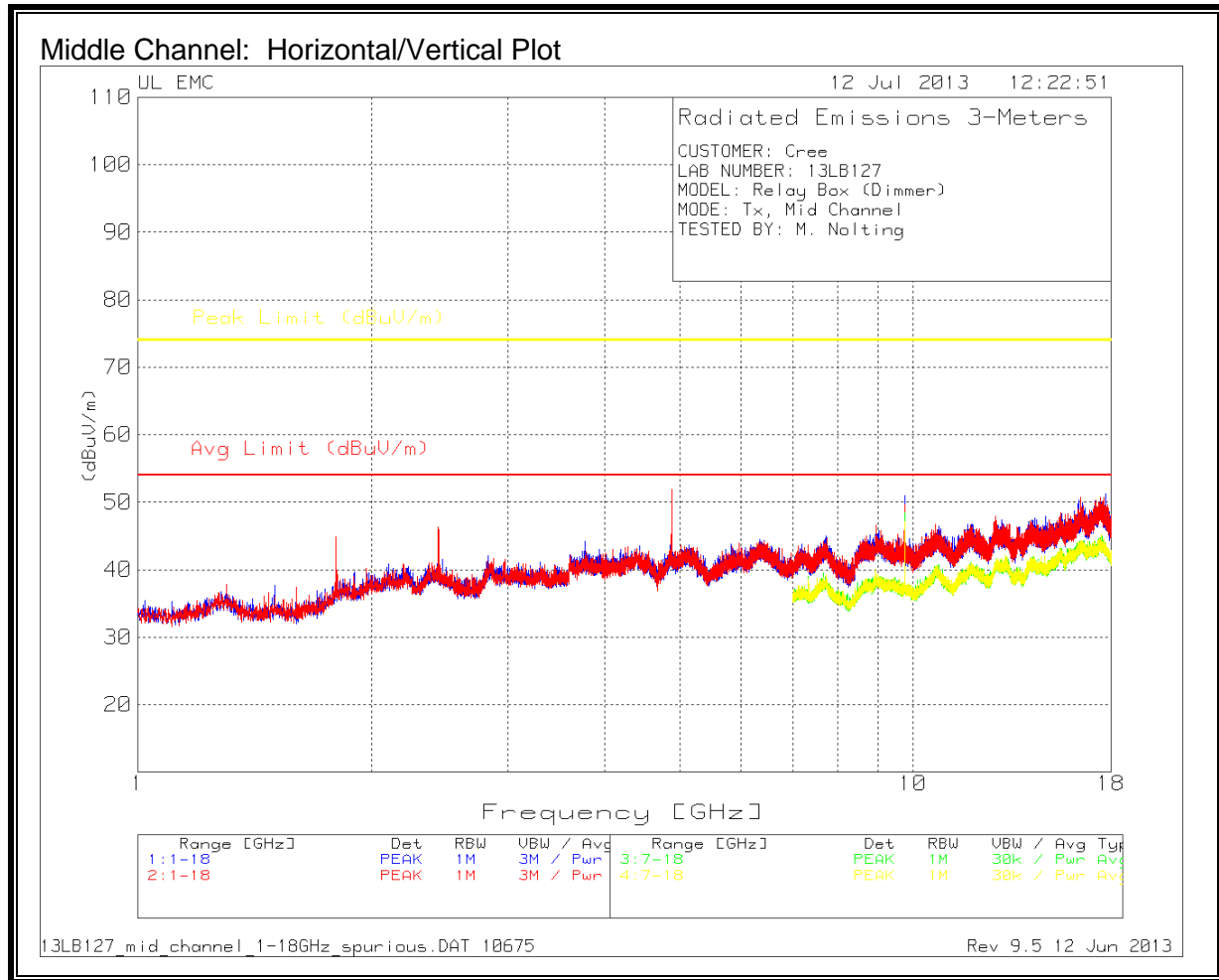
CUSTOMER: Cree
LAB NUMBER: 13LB099
MODEL: Wall Switch (Dimmer)
MODE: Tx, Low Channel
TESTED BY: M. Nolting

| Freq (GHz) | Meter Reading [dBuV] | Detector | Antenna Factor [dB/m] | Gain/Loss [dB] | Field Strength [dBuV/m] | Average Limit [dBuV/m] | Margin [dB] | Peak Limit [dBuV/m] | Margin [dB] | Antenna Polarity | In Restricted Band? |
|------------|----------------------|----------|-----------------------|----------------|-------------------------|------------------------|-------------|---------------------|-------------|------------------|---------------------|
| 4.810 | 53.23 | PK | 34.00 | -38.30 | 48.9 | - | - | 74.0 | -25.1 | H | Y |
| 4.811 | 49.72 | MAV1 | 34.00 | -38.30 | 45.4 | 54.0 | -8.6 | - | - | H | Y |
| 4.810 | 60.80 | PK | 34.00 | -38.30 | 56.5 | - | - | 74.0 | -17.5 | V | Y |
| 4.809 | 57.13 | MAV1 | 34.00 | -38.30 | 52.8 | 54.0 | -1.2 | - | - | V | Y |
| 7.214 | 48.21 | PK | 35.60 | -35.90 | 47.9 | - | - | - | - | H | N |
| 7.217 | 40.36 | MAV1 | 35.60 | -35.90 | 40.1 | - | - | - | - | H | N |
| 9.622 | 39.78 | MAV1 | 36.70 | -35.10 | 41.4 | - | - | - | - | H | N |
| 9.618 | 39.07 | MAV1 | 36.70 | -35.10 | 40.7 | - | - | - | - | V | N |

PK - Peak detector

MAV1 - KDB558074 Option 1 Maximum RMS Average

18-26GHz frequency range: No EUT-related noise observed in this range.



Middle Channel: Tabular Data

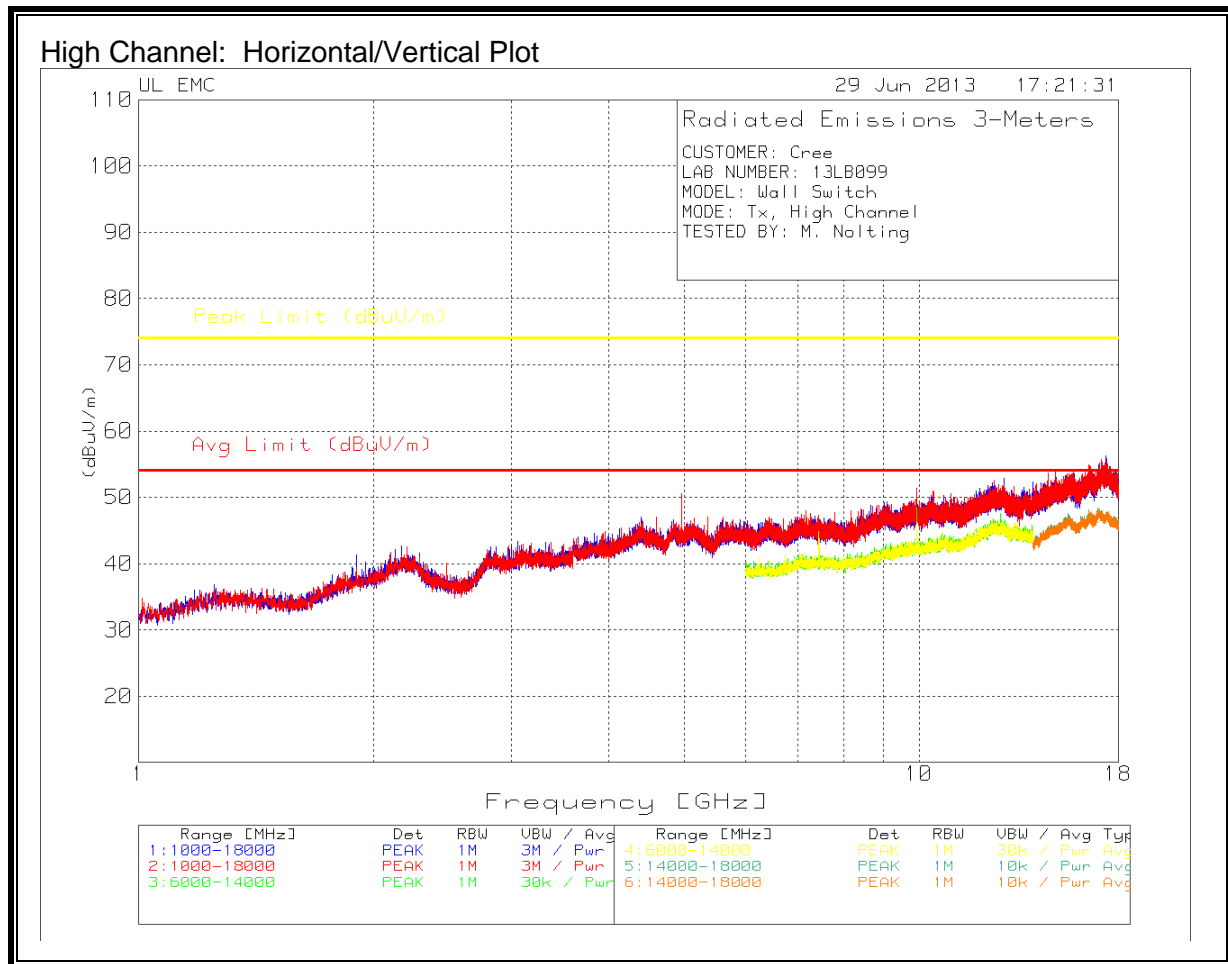
CUSTOMER: Cree
LAB NUMBER: 13LB099
MODEL: Wall Switch (Dimmer)
MODE: Tx, Mid Channel
TESTED BY: M. Nolting

| Freq (GHz) | Meter Reading [dBuV] | Detector | Antenna Factor [dB/m] | Gain/Loss [dB] | Field Strength [dBuV/m] | Average Limit [dBuV/m] | Margin [dB] | Peak Limit [dBuV/m] | Margin [dB] | Antenna Polarity | In Restricted Band? |
|------------|----------------------|----------|-----------------------|----------------|-------------------------|------------------------|-------------|---------------------|-------------|------------------|---------------------|
| 4.881 | 47.09 | PK | 34.00 | -34.90 | 46.2 | - | - | 74.0 | -27.8 | H | Y |
| 7.322 | 41.72 | PK | 35.60 | -31.00 | 46.3 | - | - | 74.0 | -27.7 | H | Y |
| 4.879 | 43.22 | MAv1 | 34.00 | -34.90 | 42.3 | 54.0 | -11.7 | - | - | H | Y |
| 7.319 | 38.70 | MAv1 | 35.60 | -31.00 | 43.3 | 54.0 | -10.7 | - | - | H | Y |
| 1.222 | 50.49 | PK | 28.40 | -35.30 | 43.6 | 54.0 | -10.4 | 74.0 | -30.4 | V | Y |
| 4.882 | 55.36 | PK | 34.00 | -34.90 | 54.5 | - | - | 74.0 | -19.5 | V | Y |
| 7.319 | 43.73 | PK | 35.60 | -31.00 | 48.3 | - | - | 74.0 | -25.7 | V | Y |
| 4.881 | 49.01 | MAv1 | 34.00 | -34.90 | 48.1 | 54.0 | -5.9 | - | - | V | Y |
| 7.319 | 38.22 | MAv1 | 35.60 | -31.00 | 42.8 | 54.0 | -11.2 | - | - | V | Y |
| 1.801 | 48.50 | PK | 30.30 | -35.20 | 43.6 | - | - | - | - | H | N |
| 9.759 | 38.08 | PK | 36.90 | -29.50 | 45.5 | - | - | - | - | H | N |
| 9.763 | 39.47 | PK | 36.90 | -29.50 | 46.9 | - | - | - | - | V | N |

PK - Peak detector

MAv1 - KDB558074 Option 1 Maximum RMS Average

18-26GHz frequency range: No EUT-related noise observed in this range.



High Channel: Tabular Data

CUSTOMER: Cree

LAB NUMBER: 13LB099

MODEL: Wall Switch (Dimmer)

MODE: Tx, High Channel

TESTED BY: M. Nolting

| Freq (GHz) | Meter Reading [dBuV] | Detector | Antenna Factor [dB/m] | Gain/Loss [dB] | Field Strength [dBuV/m] | Average Limit [dBuV/m] | Margin [dB] | Peak Limit [dBuV/m] | Margin [dB] | Antenna Polarity | In Restricted Band? |
|------------|----------------------|----------|-----------------------|----------------|-------------------------|------------------------|-------------|---------------------|-------------|------------------|---------------------|
| 4.961 | 52.70 | PK | 34.00 | -4.50 | 48.5 | - | - | 74.0 | -25.5 | H | Y |
| 7.438 | 45.62 | PK | 35.70 | -0.10 | 45.9 | - | - | 74.0 | -28.1 | H | Y |
| 4.961 | 47.56 | MAV1 | 34.00 | -38.20 | 43.4 | 54.0 | -10.6 | - | - | H | Y |
| 7.441 | 42.80 | MAV1 | 35.70 | -35.40 | 43.1 | 54.0 | -10.9 | - | - | H | Y |
| 4.960 | 54.75 | PK | 34.00 | -4.50 | 50.6 | - | - | 74.0 | -23.5 | V | Y |
| 7.442 | 47.02 | PK | 35.70 | -0.10 | 47.3 | - | - | 74.0 | -26.7 | V | Y |
| 4.961 | 53.23 | MAV1 | 34.00 | -38.20 | 49.0 | 54.0 | -5.0 | - | - | V | Y |
| 7.441 | 42.99 | MAV1 | 35.70 | -35.40 | 43.3 | 54.0 | -10.7 | - | - | V | Y |
| 9.923 | 49.28 | PK | 37.10 | 1.70 | 51.4 | - | - | - | - | H | N |
| 9.918 | 46.45 | MAV1 | 37.10 | -35.00 | 48.6 | - | - | - | - | H | N |
| 9.920 | 49.19 | PK | 37.10 | 1.70 | 51.3 | - | - | - | - | V | N |
| 9.922 | 44.44 | MAV1 | 37.10 | -35.00 | 46.5 | - | - | - | - | V | N |

PK - Peak detector

MAV1 - KDB558074 Option 1 Maximum RMS Average

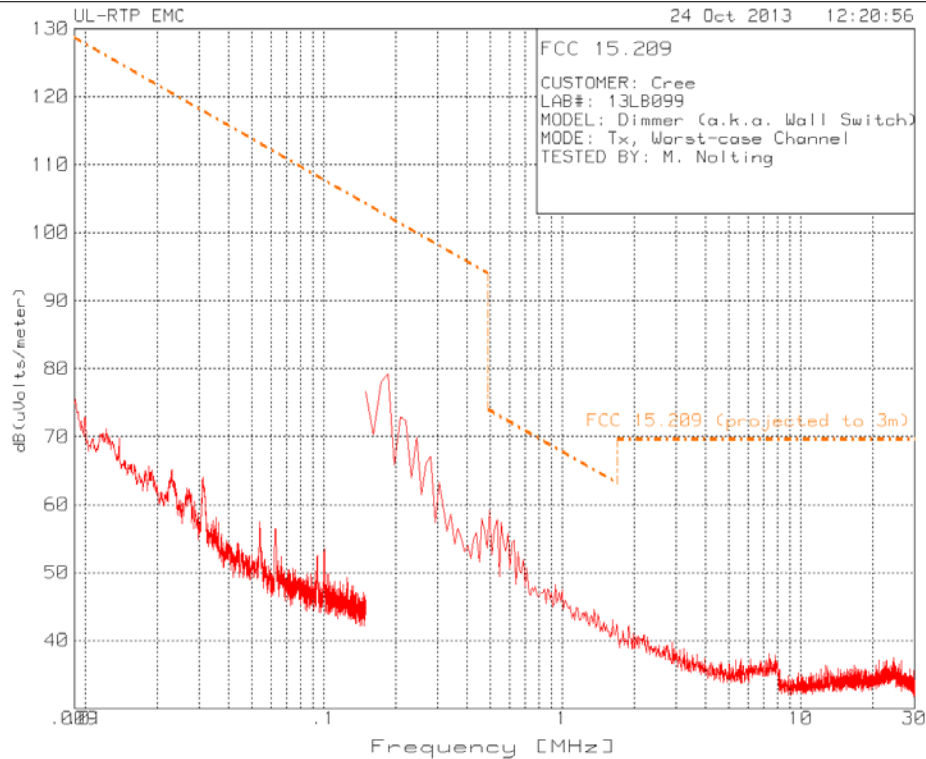
18-26GHz frequency range: No EUT-related noise observed in this range.

9.3. WORST-CASE BELOW 1 GHz

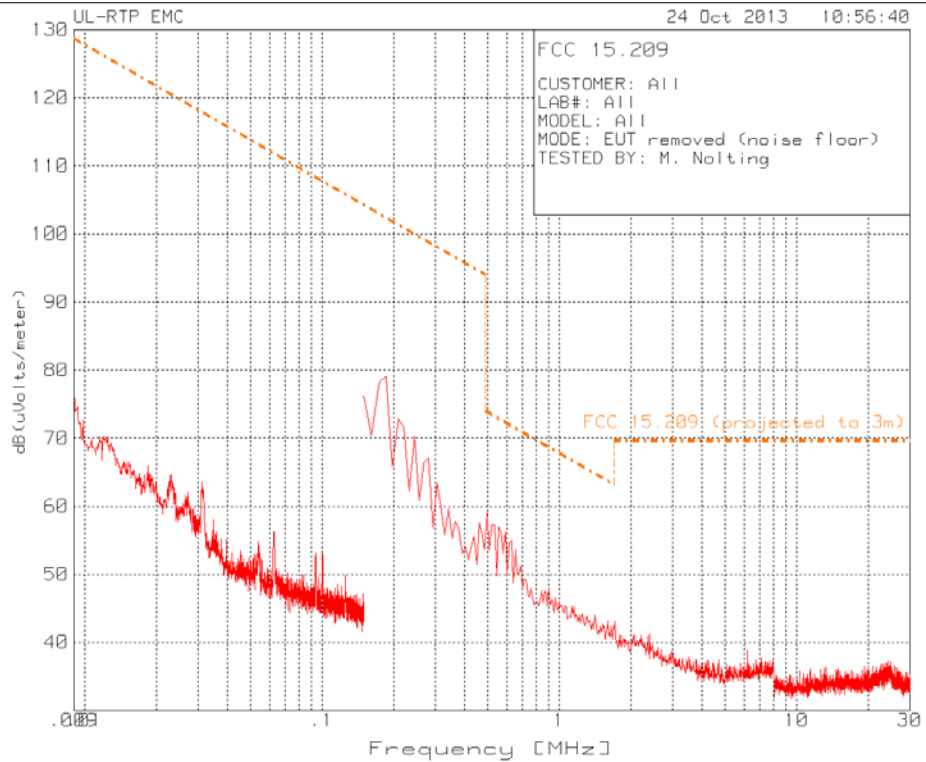
SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)

Note: All measurements were made at a test distance of 3 m. The limits in the plots and tabular data are the FCC/IC limits extrapolated from the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to the measurement distance to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were $40 \cdot \log(\text{specification distance} / \text{test distance})$.

EUT PLOT

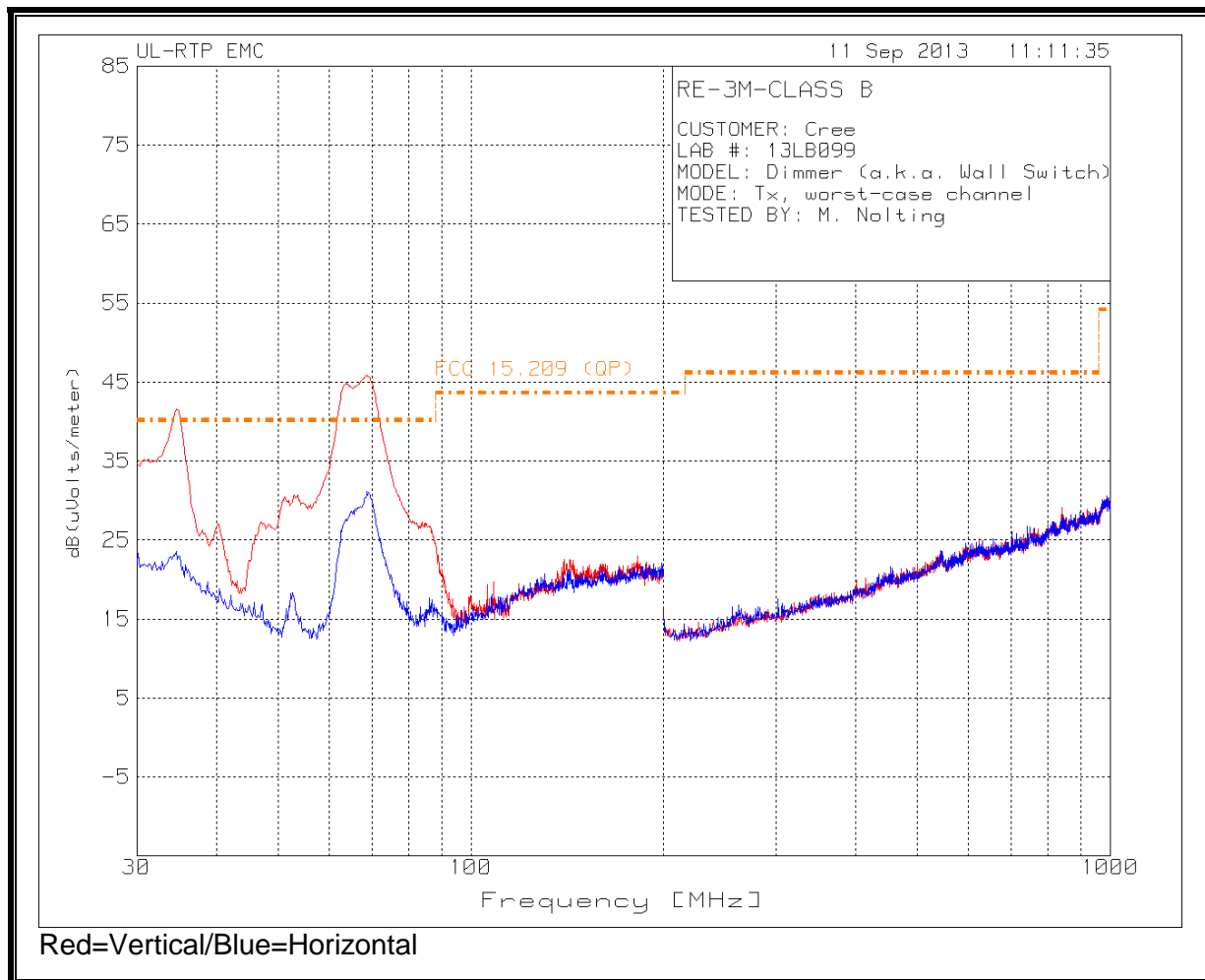


NOISE-FLOOR PLOT



The above plots demonstrate there were no EUT-related emissions of interest relative to the FCC 15.209 limit below 30MHz.

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)



TABULAR DATA

CUSTOMER: Cree
LAB NUMBER: 13LB099
MODEL: Dimmer (a.k.a. Wall Switch)
MODE: Tx, worst-case channel
TESTED BY: M. Nolting

| Freq (MHz) | Meter Reading [dBuV] | Detector | Antenna Factor [dB/m] | Gain/Loss [dB] | Field Strength [dBuV/m] | 15.209 QP Limit [dBuV/m] | Margin [dB] | Antenna Polarity | In Restricted Band? |
|--------------------------|----------------------|----------|-----------------------|----------------|-------------------------|--------------------------|-------------|------------------|---------------------|
| 37.500 | 31.20 | QP | 14.60 | -24.20 | 21.6 | 40.0 | -18.4 | Vert | Y |
| 73.000 | 52.98 | QP | 6.50 | -24.00 | 35.5 | 40.0 | -4.5 | Vert | Y |
| | | | | | | | | | |
| | | | | | | | | | |
| 34.595 | 49.98 | PK | 15.80 | -24.20 | 41.6 | - | - | Vert | N |
| 40.210 | 37.77 | PK | 13.50 | -24.20 | 27.1 | - | - | Vert | N |
| 53.484 | 46.58 | PK | 8.00 | -24.10 | 30.5 | - | - | Vert | N |
| | | | | | | | | | |
| 68.799 | 48.93 | PK | 6.20 | -24.00 | 31.1 | - | - | Horz | N |
| PK - Peak detector | | | | | | | | | |
| QP - Quasi-peak detector | | | | | | | | | |

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

| Frequency of Emission (MHz) | Conducted Limit (dBuV) | |
|-----------------------------|------------------------|-----------------------|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56 [*] | 56 to 46 [*] |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

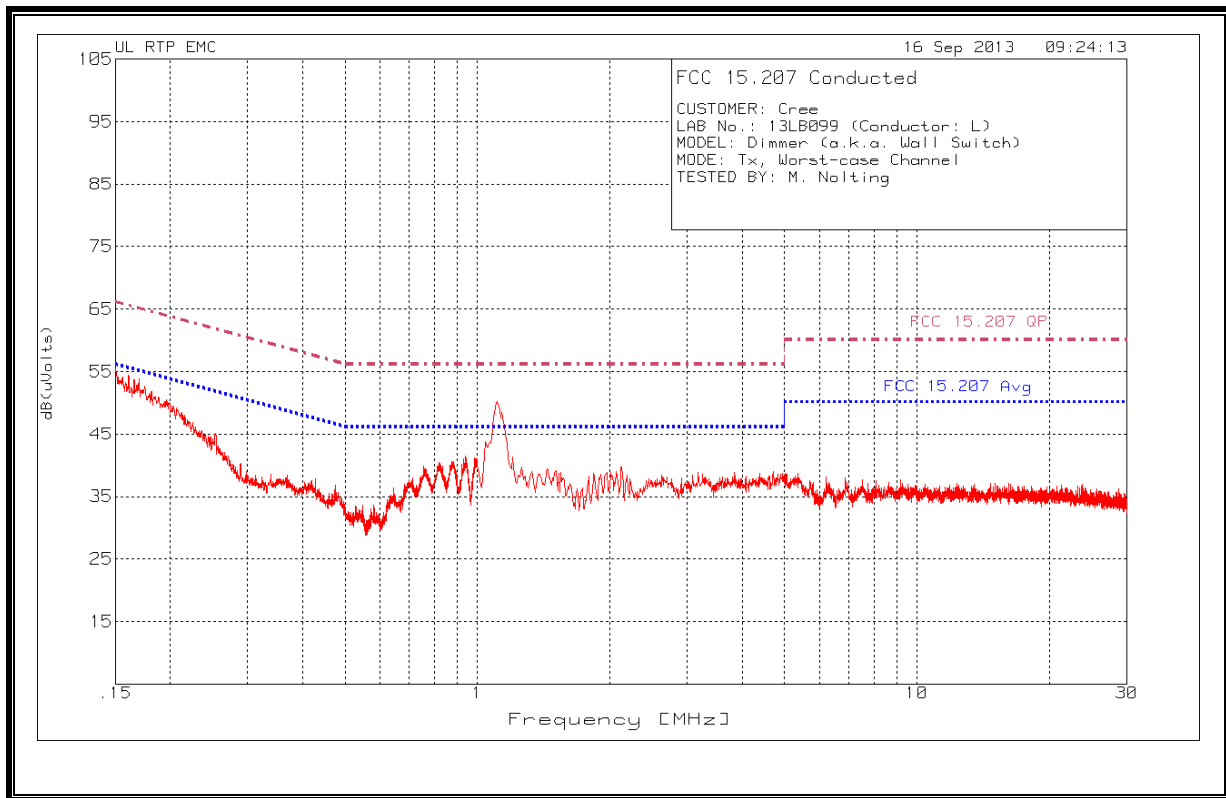
^{*} Decreases with the logarithm of the frequency.

TEST PROCEDURE

ANSI C63.4

RESULTS

LINE CONDUCTOR PLOT



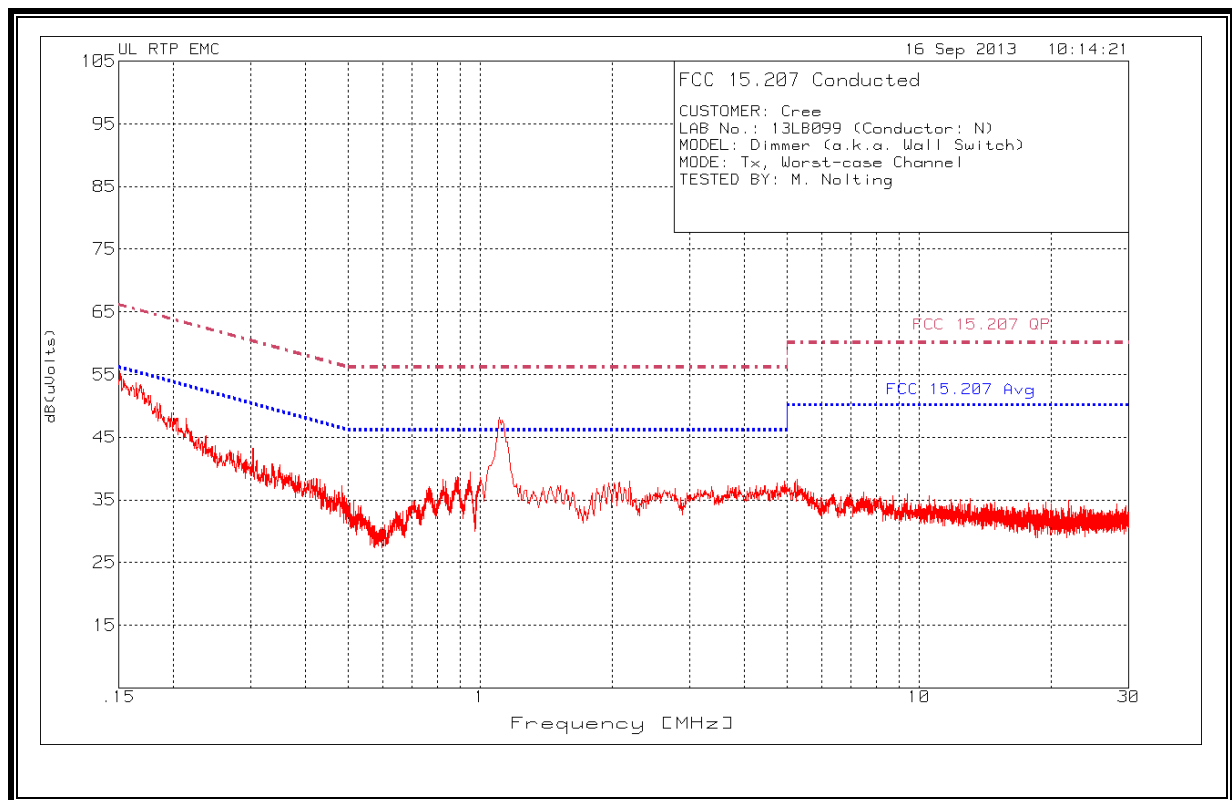
LINE CONDUCTOR TABULAR DATA

CUSTOMER: Cree
LAB No.: 13LB099 (Conductor: L)
MODEL: Dimmer (a.k.a. Wall Switch)
MODE: Tx, Worst-case Channel
TESTED BY: M. Nolting

| Test Frequency [MHz] | Meter Reading [dBuV] | Detector* | LISN [dB] | Cable Loss [dB] | RF Line Voltage [dBuV] | FCC 15.207 (QP) [dBuV] | Margin [dB] | FCC 15.207 (AV) [dBuV] | Margin [dB] |
|----------------------|----------------------|-----------|-----------|-----------------|------------------------|------------------------|-------------|------------------------|-------------|
| 0.150 | 45.93 | PK | 0.4 | 9.3 | 55.63 | 66.0 | -10.4 | - | - |
| 0.161 | 44.76 | PK | 0.4 | 9.3 | 54.46 | 65.4 | -10.9 | - | - |
| 0.170 | 44.22 | PK | 0.3 | 9.3 | 53.82 | 65.0 | -11.2 | - | - |
| 0.937 | 32.04 | PK | 0.1 | 9.3 | 41.44 | 56.0 | -14.6 | - | - |
| 0.988 | 31.59 | PK | 0.1 | 9.3 | 40.99 | 56.0 | -15.0 | - | - |
| 1.043 | 34.38 | PK | 0.1 | 9.3 | 43.78 | 56.0 | -12.2 | - | - |
| 1.109 | 40.84 | PK | 0.1 | 9.3 | 50.24 | 56.0 | -5.8 | - | - |
| 0.152 | 29.74 | AV | 0.4 | 9.3 | 39.44 | - | - | 55.9 | -16.5 |
| 0.161 | 29.42 | AV | 0.4 | 9.3 | 39.12 | - | - | 55.4 | -16.3 |
| 0.170 | 29.29 | AV | 0.3 | 9.3 | 38.89 | - | - | 55.0 | -16.1 |
| 0.176 | 29.64 | AV | 0.3 | 9.3 | 39.24 | - | - | 54.7 | -15.5 |
| 1.002 | 24.85 | AV | 0.1 | 9.3 | 34.25 | - | - | 46.0 | -11.8 |
| 1.056 | 26.14 | AV | 0.1 | 9.3 | 35.54 | - | - | 46.0 | -10.5 |
| 1.108 | 32.64 | AV | 0.1 | 9.3 | 42.04 | - | - | 46.0 | -4.0 |

*PK = Peak, QP = Quasi-Peak, AV = Average

NEUTRAL CONDUCTOR PLOT



NEUTRAL CONDUCTOR TABULAR DATA

CUSTOMER: Cree
LAB No.: 13LB099 (Conductor: N)
MODEL: Dimmer (a.k.a. Wall Switch)
MODE: Tx, Worst-case Channel
TESTED BY: M. Nolting

| Test Frequency [MHz] | Meter Reading [dBuV] | Detector* | LISN [dB] | Cable Loss [dB] | RF Line Voltage [dBuV] | FCC 15.207 (QP) [dBuV] | Margin [dB] | FCC 15.207 (AV) [dBuV] | Margin [dB] |
|---|----------------------|-----------|-----------|-----------------|------------------------|------------------------|-------------|------------------------|-------------|
| 0.151 | 45.92 | PK | 0.4 | 9.3 | 55.62 | 65.9 | -10.3 | - | - |
| 0.169 | 43.82 | PK | 0.3 | 9.3 | 53.42 | 65.0 | -11.6 | - | - |
| 0.187 | 40.68 | PK | 0.3 | 9.3 | 50.28 | 64.2 | -13.9 | - | - |
| 0.884 | 28.67 | PK | 0.1 | 9.3 | 38.07 | 56.0 | -17.9 | - | - |
| 0.948 | 29.99 | PK | 0.1 | 9.3 | 39.39 | 56.0 | -16.6 | - | - |
| 1.109 | 38.72 | PK | 0.1 | 9.3 | 48.12 | 56.0 | -7.9 | - | - |
| | | | | | | | | | |
| 0.156 | 26.30 | AV | 0.4 | 9.3 | 36.00 | - | - | 55.7 | -19.7 |
| 0.174 | 28.57 | AV | 0.3 | 9.3 | 38.17 | - | - | 54.8 | -16.6 |
| 0.186 | 28.31 | AV | 0.3 | 9.3 | 37.91 | - | - | 54.2 | -16.3 |
| 0.883 | 22.23 | AV | 0.1 | 9.3 | 31.63 | - | - | 46.0 | -14.4 |
| 0.946 | 22.34 | AV | 0.1 | 9.3 | 31.74 | - | - | 46.0 | -14.3 |
| 1.112 | 30.37 | AV | 0.1 | 9.3 | 39.77 | - | - | 46.0 | -6.2 |
| *PK = Peak, QP = Quasi-Peak, AV = Average | | | | | | | | | |

END OF REPORT