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

CERTIFICATION TEST REPORT

FOR

RELAY MODULE

MODEL NUMBER: CIF-10V-CWC-SNSR, CIF-10VC1-CWC-SNSR

FCC ID: 2ACQ6-CIF
IC: 11481A-CIF

REPORT NUMBER: R10015052-RF

ISSUE DATE: 2014-08-20

Prepared for
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DURHAM, NC 27709 USA

Prepared by
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NVLAP LAB CODE 200246-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	2013-11-06	Initial Issue	Jeff Moser
1	2014-07-15	Grantee Code Revised (previous one issued in error)	Jeff Moser
2	2014-08-18	Revised references to KDB 558074	Jeff Moser
3	2014-08-20	Revised to include additional part number (CIF-10VC1-CWC-SNSR)	Jeff Moser

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: Relay Module with Transceiver

MODEL: Relay Module, p/n CIF-10V-CWC-SNSR, CIF-10VC1-CWC-SNSR

SERIAL NUMBER: None

DATE TESTED: 2013-07-09- 2013-08-30, 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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

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 Relay Modules, p/n CIF-10V-CWC-SNSR and CIF-10VC1-CWC-SNSR are 2.4 GHz DSSS transceivers used with light fixtures. The Relay Module utilizes O-QPSK modulation and a 250 kbps data rate. The Relay Module receives signals from other devices to control the fixture.

The radio module is manufactured by Cree Inc.

Relay module, p/n CIF-10VC1-CWC-SNSR is constructed to route the control wires and power wires out of one opening. Relay module, p/n CIF-10V-CWC-SNSR is constructed to route the control wires out of an opening next to the RJ11 port. The power wires are routed through the same opening as the CIF-10VC1-CWC-SNSR.

The power and control wiring are not routed near the radio circuit and are strictly in the area of the unintentional circuitry.

Relay module p/n CIF-10V-CWC-SNSR was the unit used for testing.

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	3.4	2.2

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

0-10V Interface – CIF-10V-CWC-SNSR
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-tranmitting, 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 Y orientation (lying on back) was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y 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 Relay Module, p/n CIF-10V-CWC-SNSR was tested as a standalone device. No other equipment is a part of the configuration.

I/O CABLES

None.

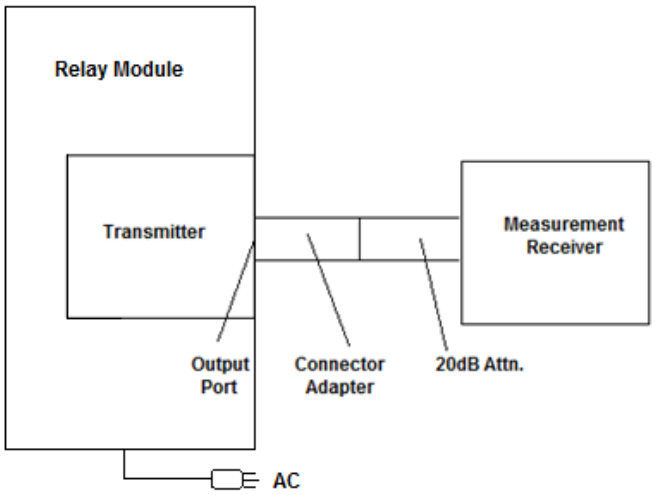
TEST SETUP

Different Relay Modules were provided. 4 units were provided for Radiated Emissions testing (Low Channel, Mid Channel and High Channel) and 4 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.

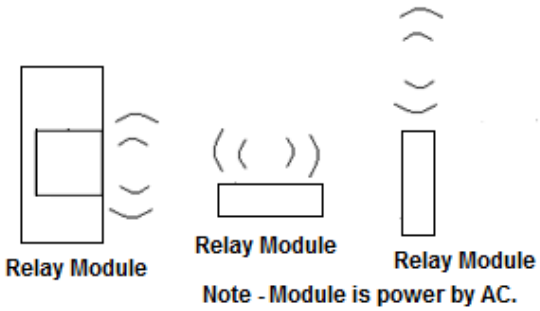
SETUP DIAGRAM FOR TESTS

CONDUCTED PORT TESTS

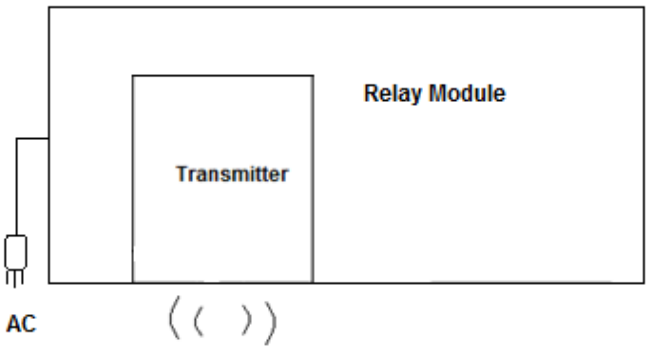


10dB Attenuator used instead of 20dB shown

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
PSENSOR001	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 2013-09-01)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	30-1000 MHz Range				
AT0021	Biconical Antenna, 30 to 300 MHz	Schaffner-Chase EMC Ltd.	VBA6106A	2013-05-10	2014-05-31
AT0022	Log-periodic Antenna, 200 MHz to 1000 MHz	Chase	UPA6109	2013-01-29	2014-01-31
	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				
AT0063	Antenna	ARA	MWH-1826/B	2012-10-12	2013-10-31
	Gain-Loss Chains				
SAC_C (Biconical 3m location)	(1) ATA084: Attenuator (2) ATA061: Amplifier (3) ATA167: Cable (4) ATA221: Cable (5) ATA229: DC Bias Tee (6) ATA199: Cable	(1) Pasternack (2) Miteq (3) Eupen (4) Micro-Coax (5) Miteq (6) Micro-Coax	(1) PE7002-6 (2) AM-3A-000110-N (3) CMS/RG 214 (4) UFA210A-0-6000-50U-50U (5) BT2000-C (6) UFB293C-0-0720-5GU50U)	2012-08-01	2013-08-31
SAC_D (Log-Periodic 3m location)	(1) ATA085: Attenuator (2) ATA125: Amplifier (3) ATA225: Cable (4) ATA189: Cable (5) ATA115: DC Bias Tee (6) ATA198: Cable	(1) Pasternack (2) Miteq (3) Eupen (4) UL (5) Miteq (6) Micro-Coax	(1) PE7002-6 (2) AM-3A-000110-N (3) CMS/RG 214 (4) RG-214 (5) AM-1523-7687 (6) UFB293C-0-0720-5GU50U	2013-02-04	2013-08-31
ATA144	Amplifier, 1-18GHz	Miteq	AFS42-00101800-25-N-42MF	2012-08-31	2013-08-31

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AMP013	Amplifier, 18-40GHz	Miteq	JS44-18004000-33-8P	2013-07-10	2014-07-31
	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 2013-09-01)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
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
SAC_E_LR (Loop & Rod 3m location)	Gain-Loss string for loop/rod antenna at 3m	Various	Various	2013-09-06	2014-09-30
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
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	2012-08-31	2013-08-31
ATA508	Transient Limiter, 0.009 to 100 MHz	Electro-Metrics	EM 7600	2012-08-31	2013-08-31
HI0041	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2013-01-25	2014-01-25
LISN002	LISN, 50-ohm/50-uH, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2013-01-09	2014-01-31
SA0015	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2012-08-28	2013-08-31
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

7.2. DUTY CYCLE PLOTS

2.4 GHz BAND

DUTY CYCLE O-QPSK Mode Low CH

8. ANTENNA PORT TEST RESULTS

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

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

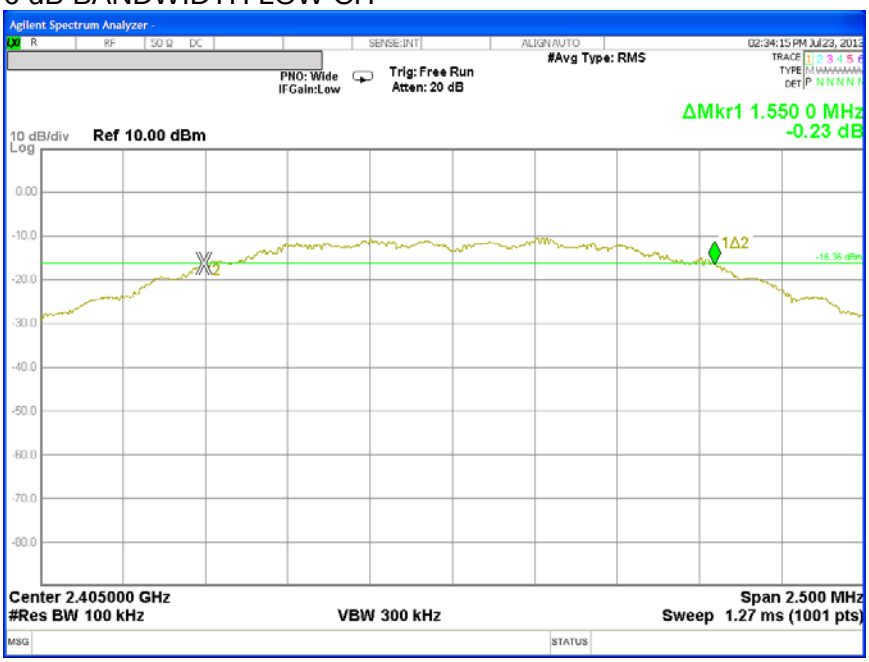
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

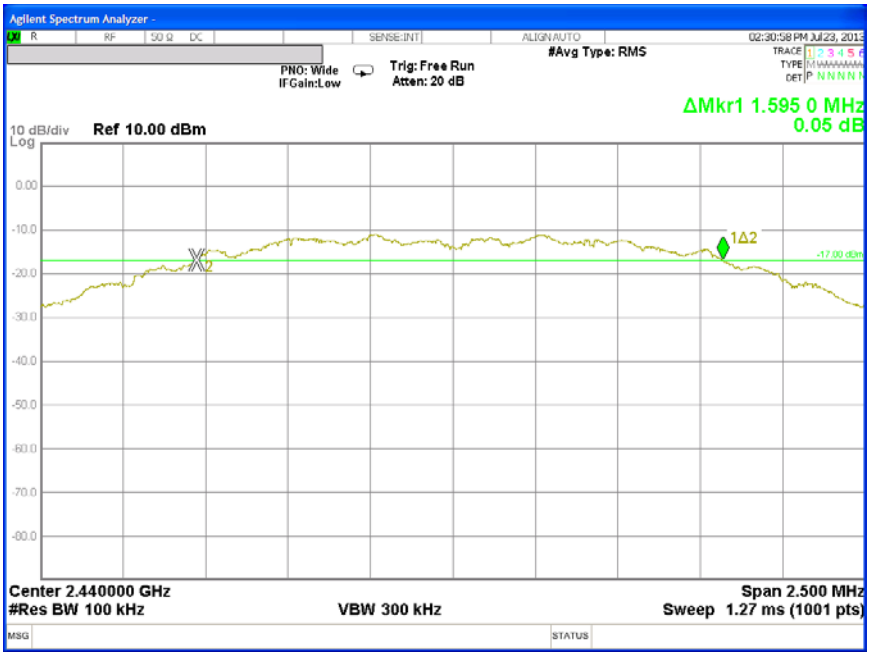
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2405	1.550	0.5
Middle	2440	1.595	0.5
High	2480	1.548	0.5

6 dB BANDWIDTH

6 dB BANDWIDTH LOW CH



6 dB BANDWIDTH MID CH



6 dB BANDWIDTH HIGH CH

8.1.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

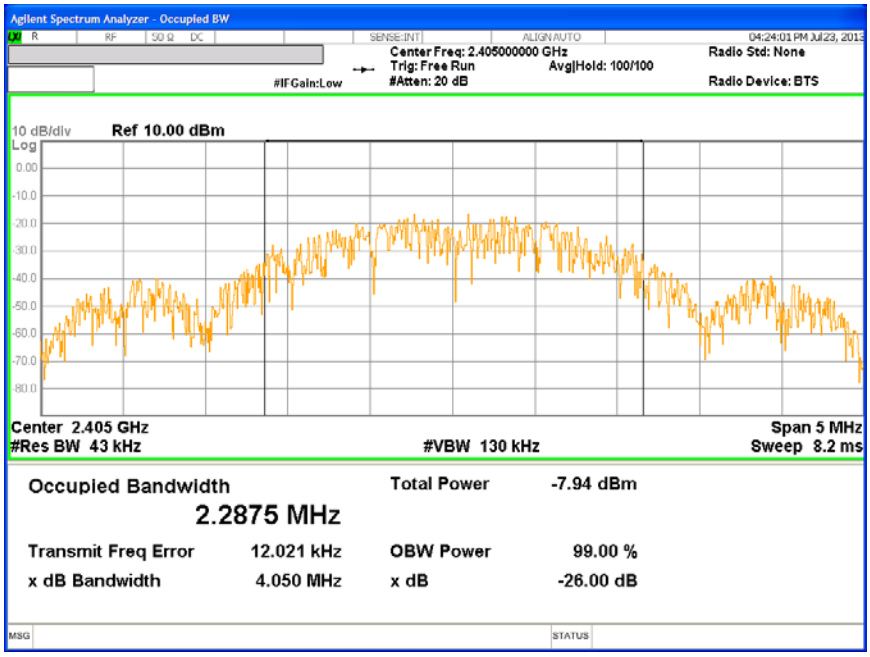
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

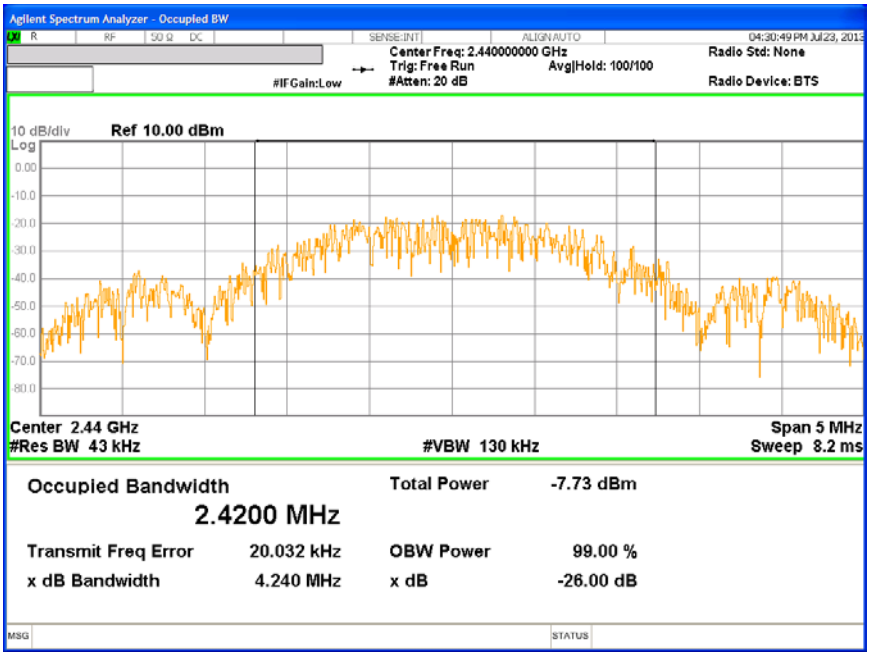
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2405	2.288
Middle	2440	2.420
High	2480	2.267

99% BANDWIDTH

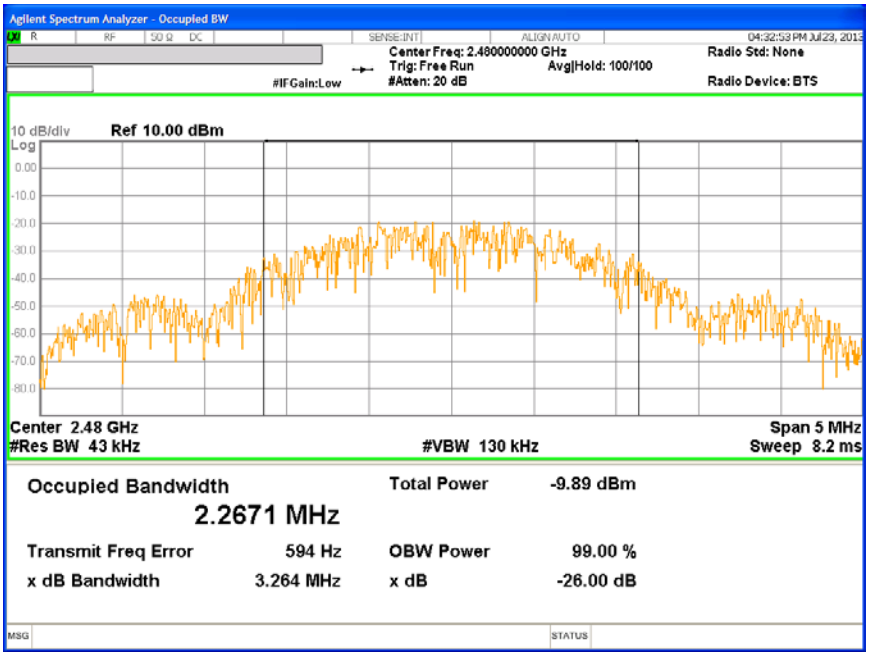
99% BANDWIDTH LOW CH



99% BANDWIDTH MID CH



99% BANDWIDTH HIGH CH



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

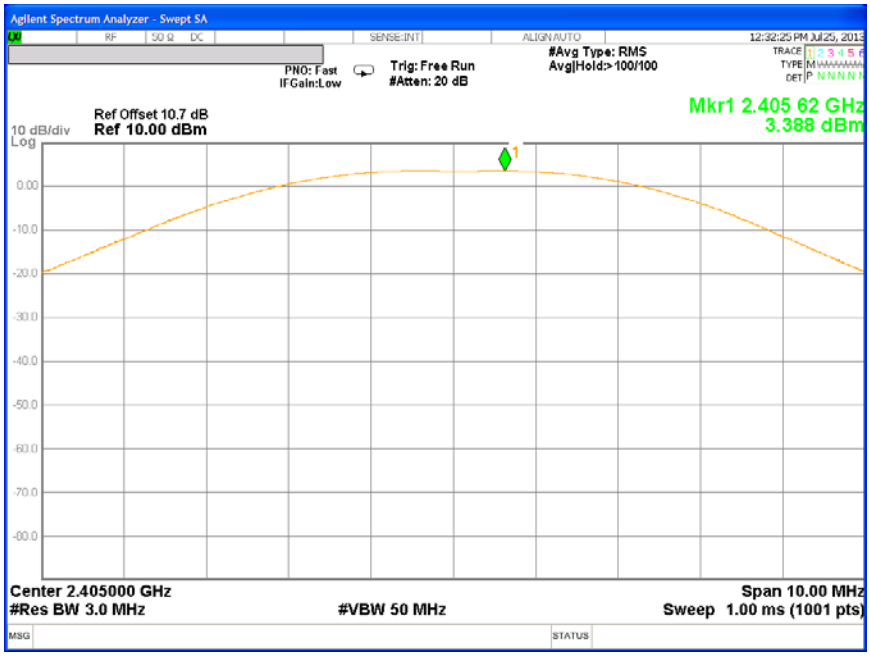
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 99% bandwidth of the EUT.

RESULTS

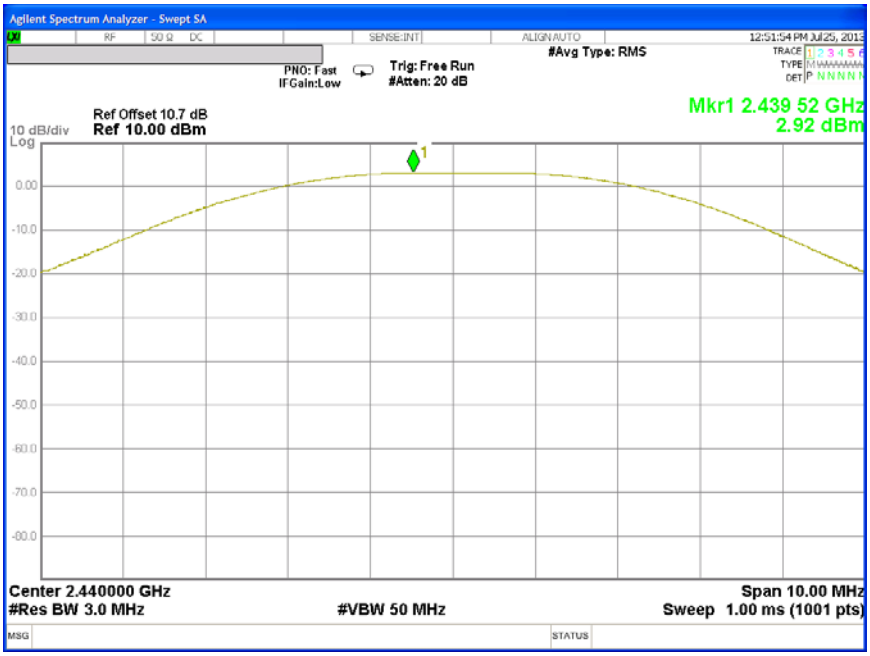
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2405	3.388	30	-26.61
Middle	2440	2.920	30	-27.08
High	2480	-0.776	30	-30.78

OUTPUT POWER

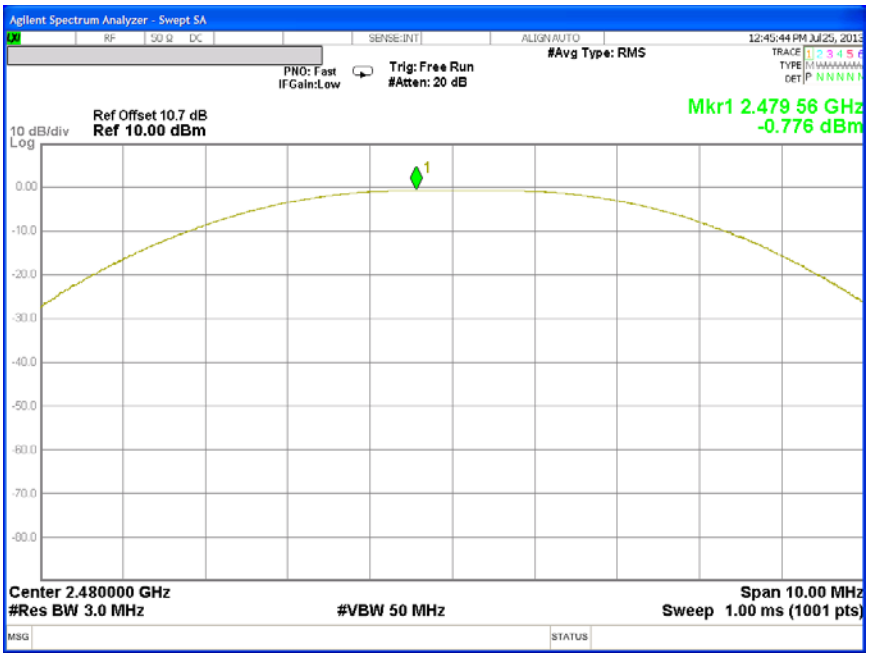
OUTPUT POWER LOW CH



OUTPUT POWER MID CH



OUTPUT POWER HIGH CH



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	3.380
Middle	2440	2.900
High	2480	-0.750

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

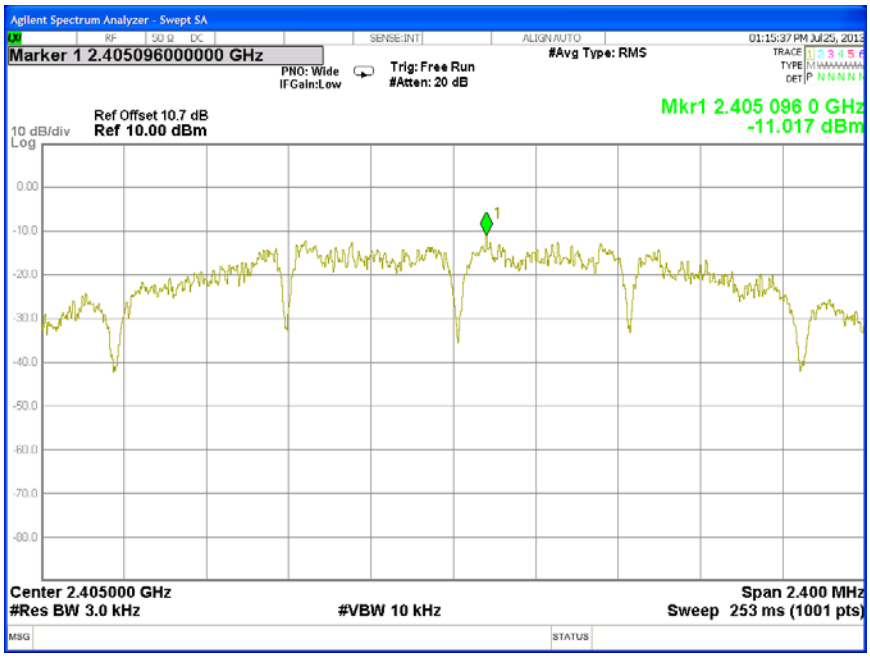
Output power was measured based on the use of a peak measurement.

RESULTS

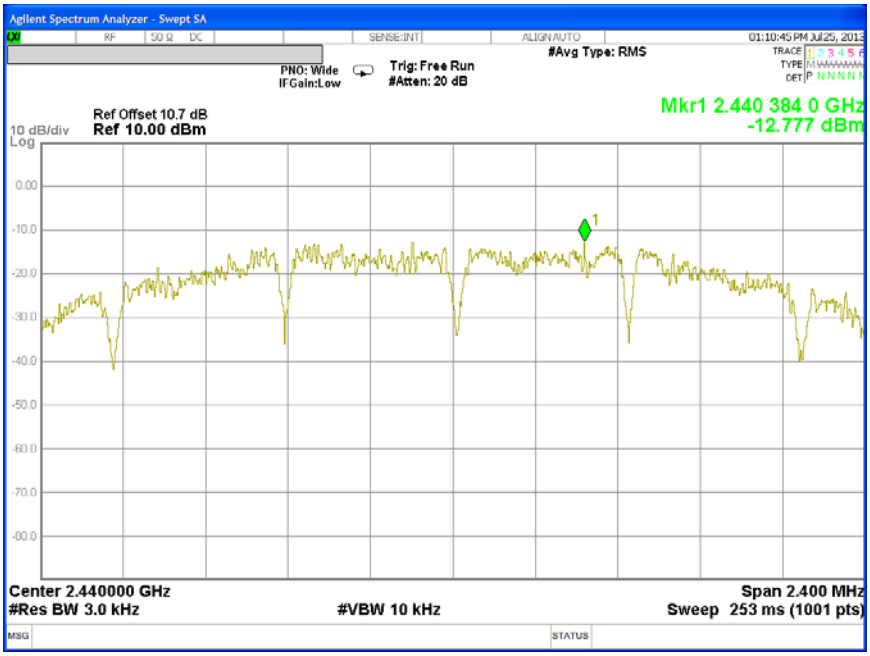
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2405	-11.02	8	-19.02
Middle	2440	-12.78	8	-20.78
High	2480	-16.31	8	-24.31

POWER SPECTRAL DENSITY

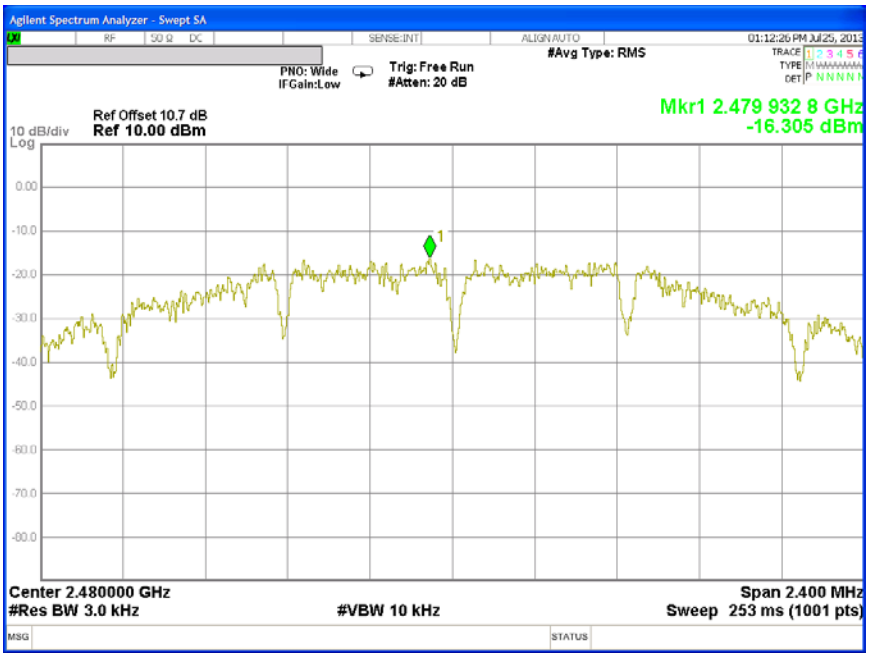
PSD LOW CH



PSD MID CH



PSD HIGH CH



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

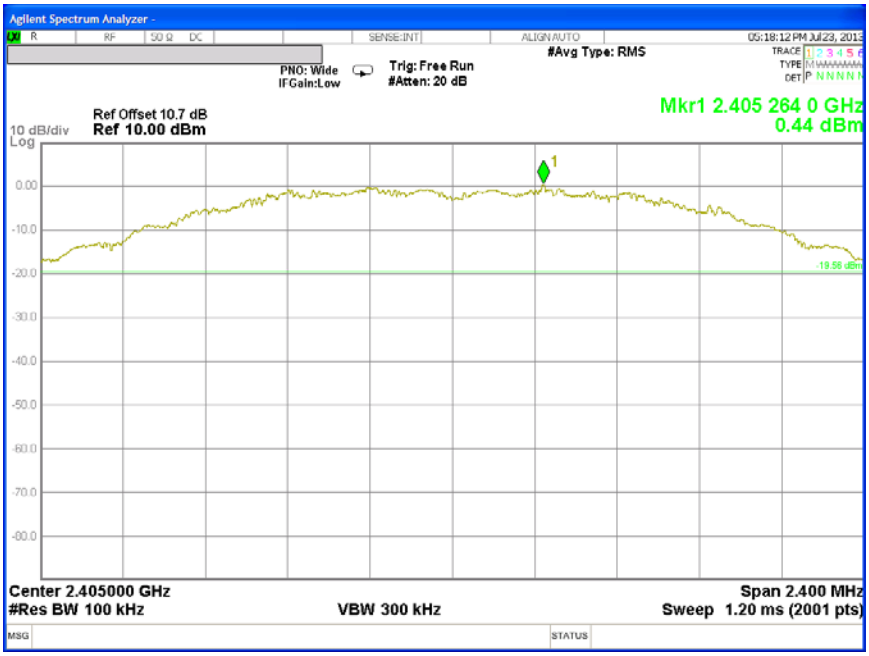
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

RESULTS

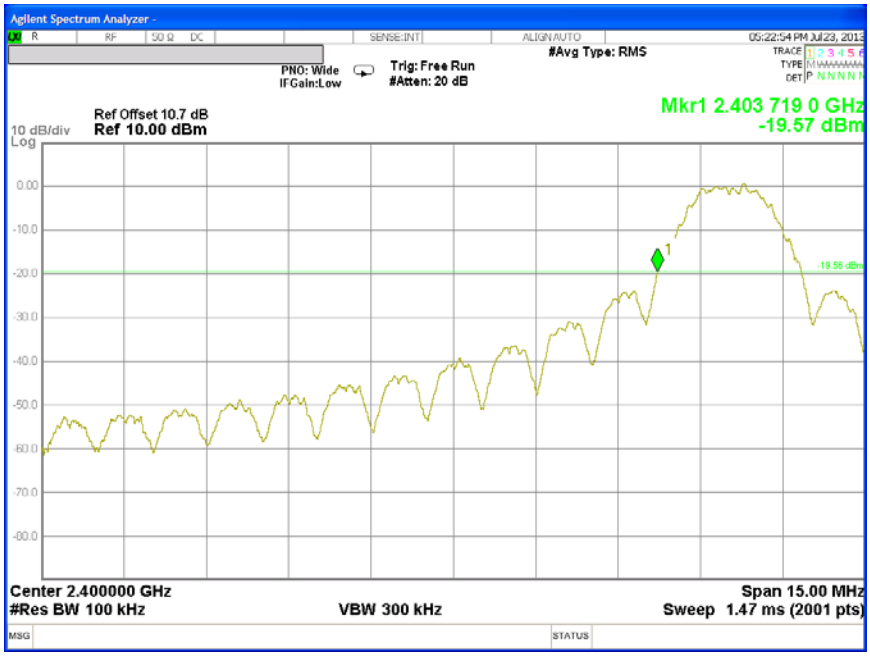
SPURIOUS EMISSIONS, LOW CHANNEL

LOW CH REFERENCE



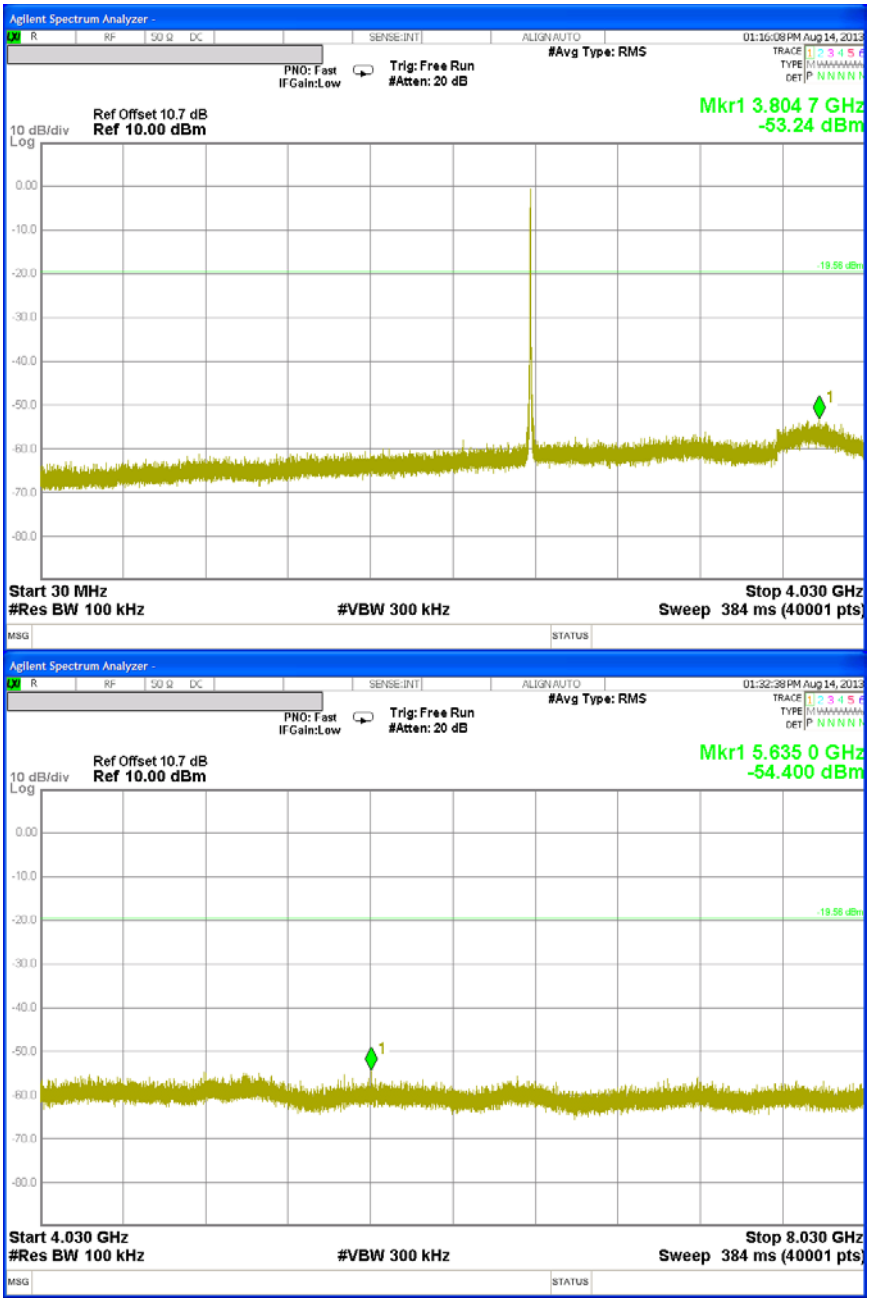
Note: Low channel had the highest peak power. Therefore, the low channel was used as the reference.

LOW CH BANDEDGE



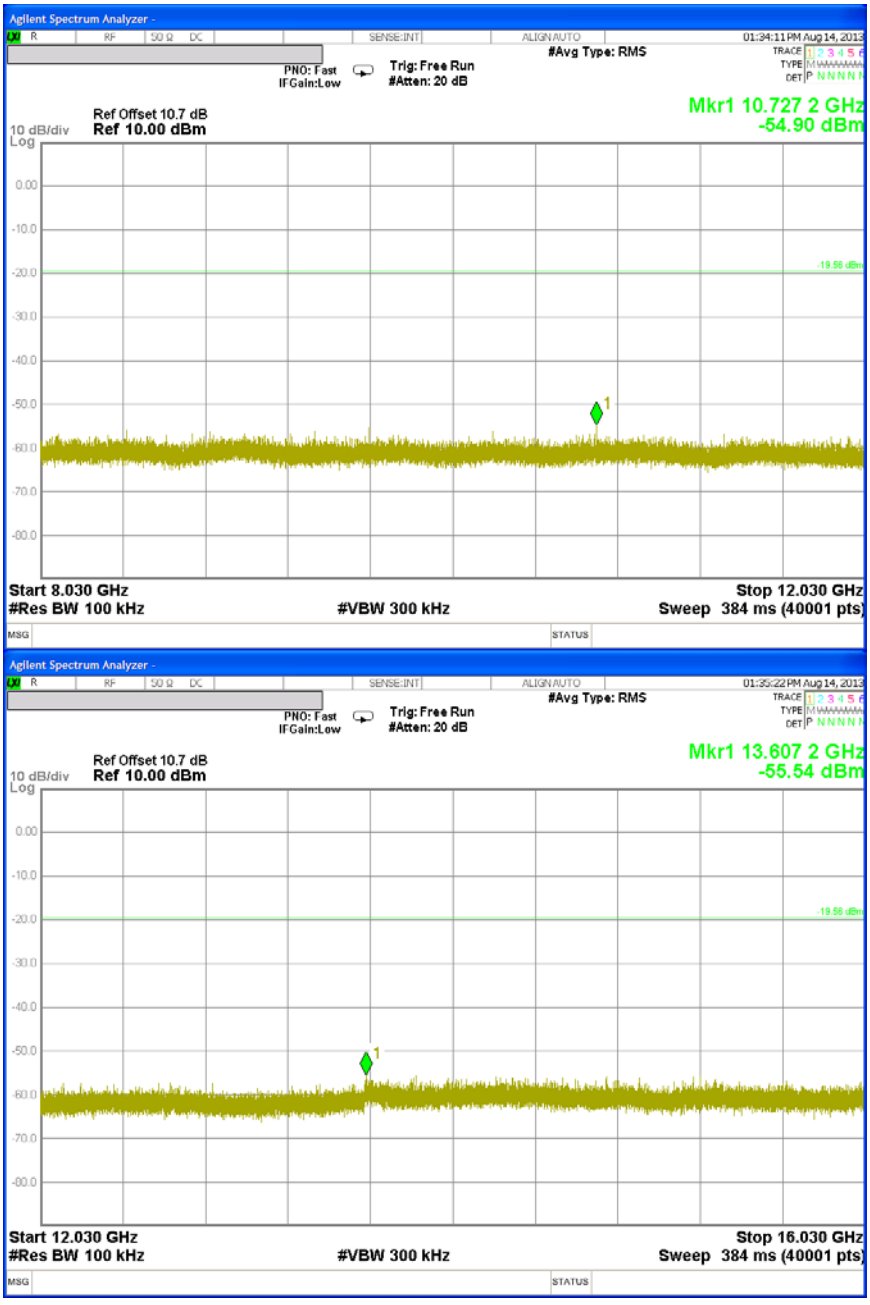
Note – 2.4 GHz is the center frequency. The waveform was measured at the point on the signal that is 20dB below the reference channel peak. Based on this, the band edge is below the 20 dB threshold.

LOW CH SPURIOUS: 30MHz-8.03GHz

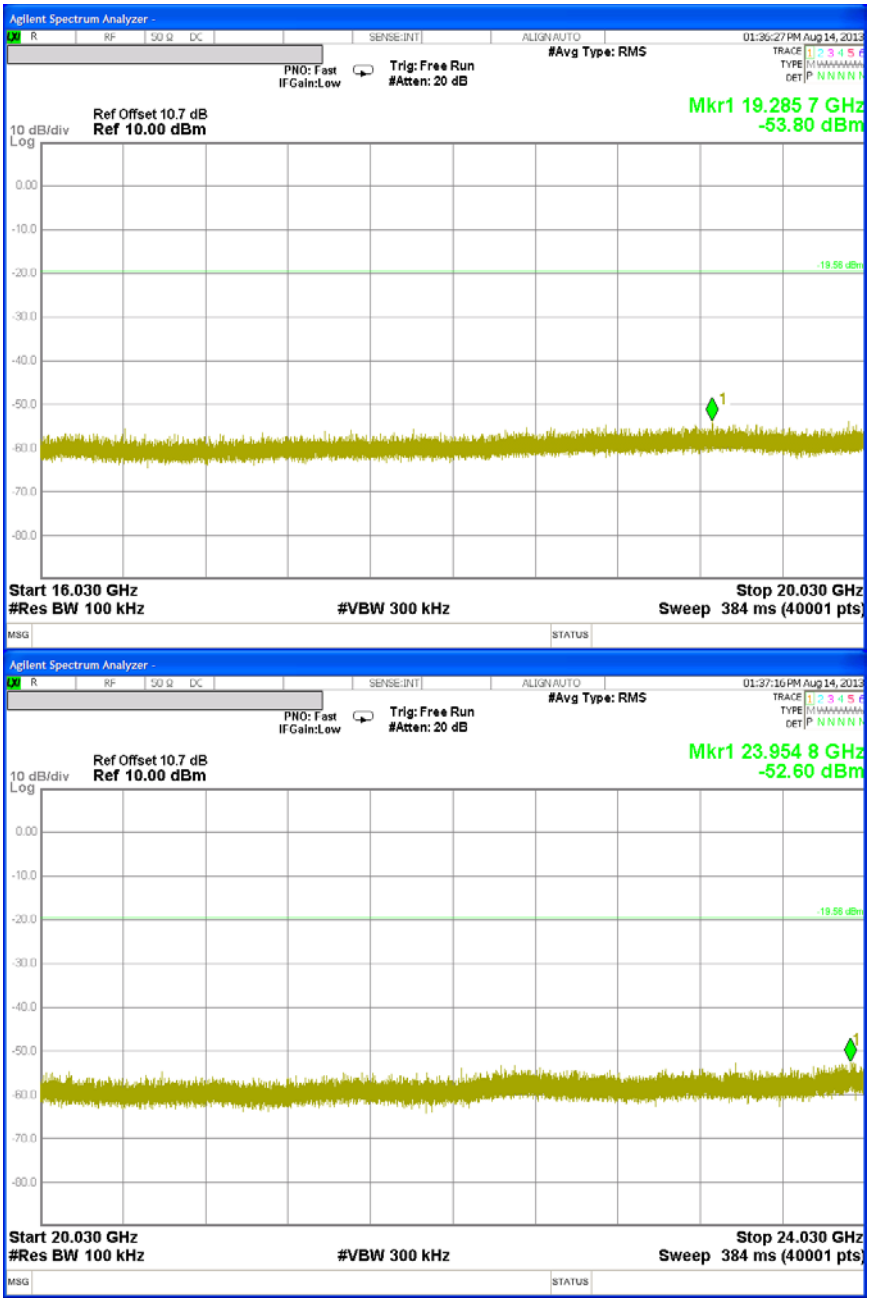


Note: Per KDB 558074, number of points must be >/= Span/RBW. Therefore, seven plots are needed to satisfy this requirement over the range of 30MHz-26GHz.

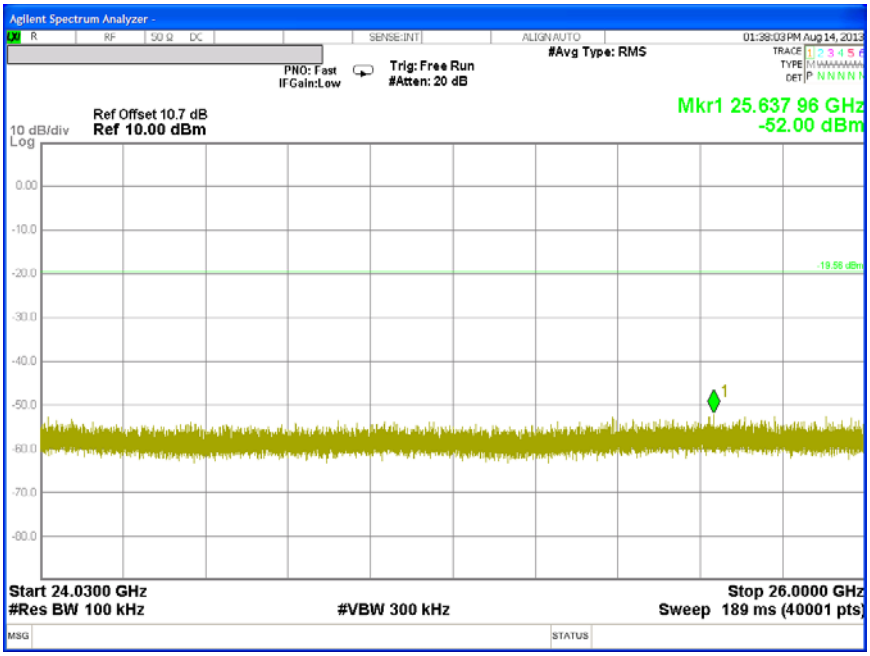
LOW CH SPURIOUS: 8.03-16.03GHz



LOW CH SPURIOUS: 16.03-24.03GHz

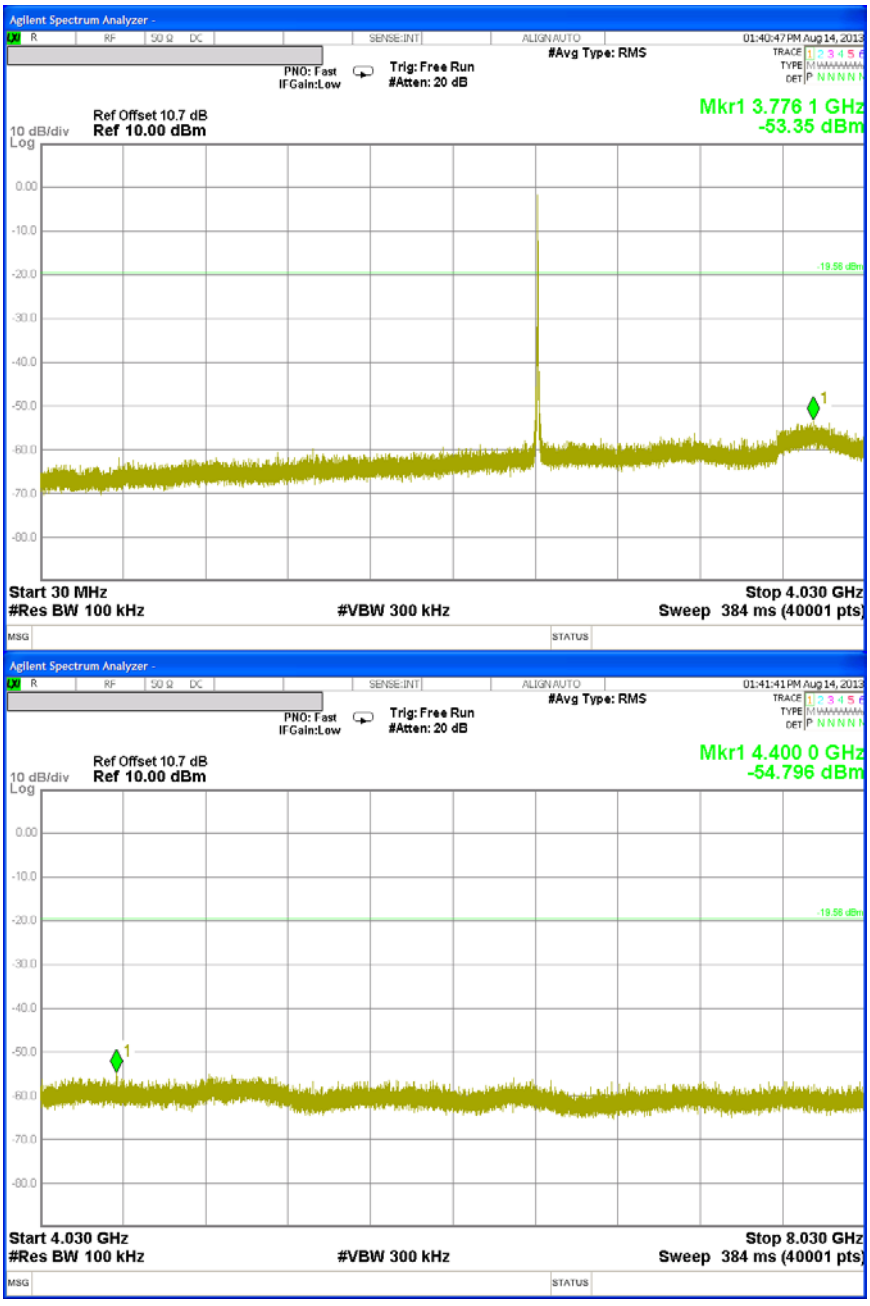


LOW CH SPURIOUS: 24.03-26GHz



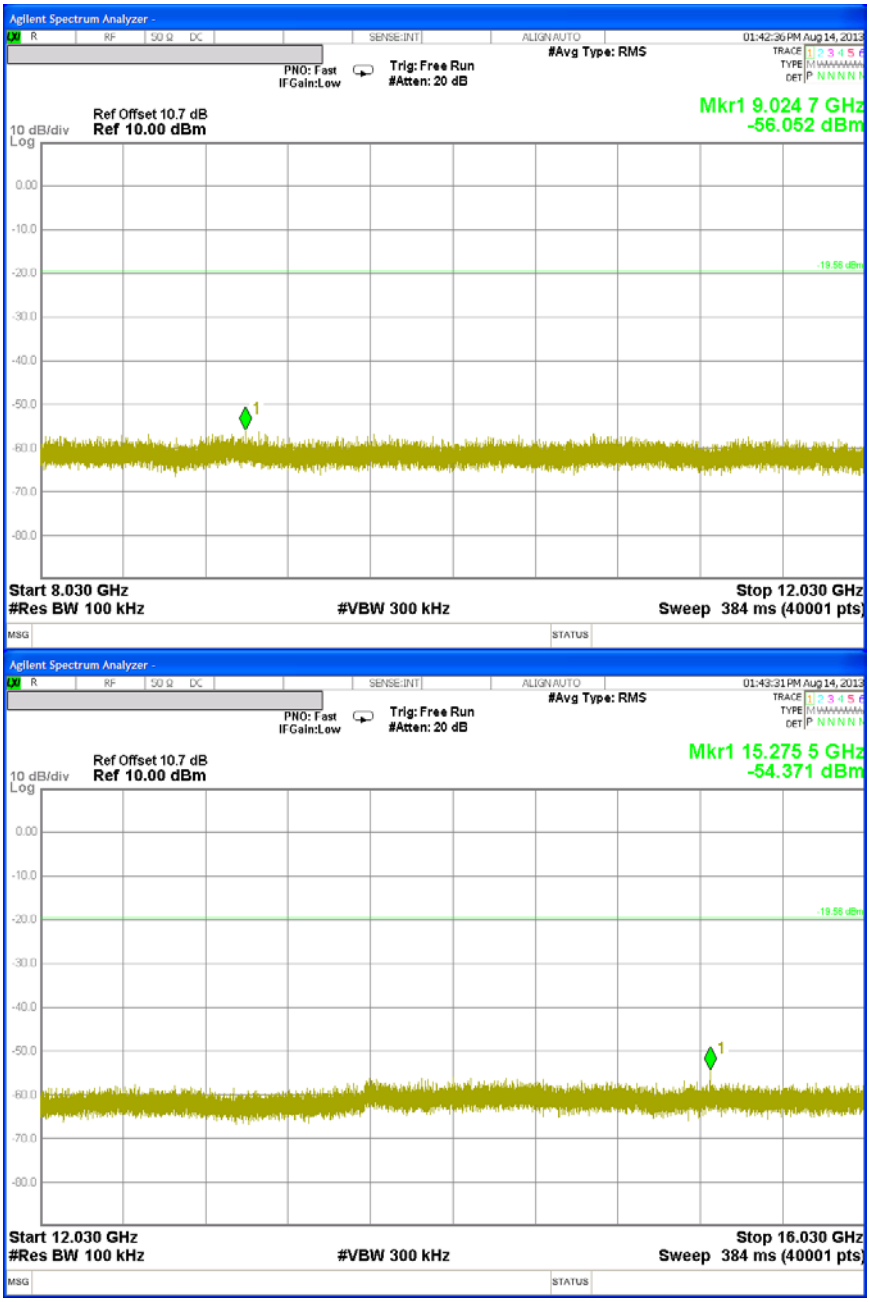
SPURIOUS EMISSIONS, MID CHANNEL

MID CH SPURIOUS: 30MHz-8.03GHz

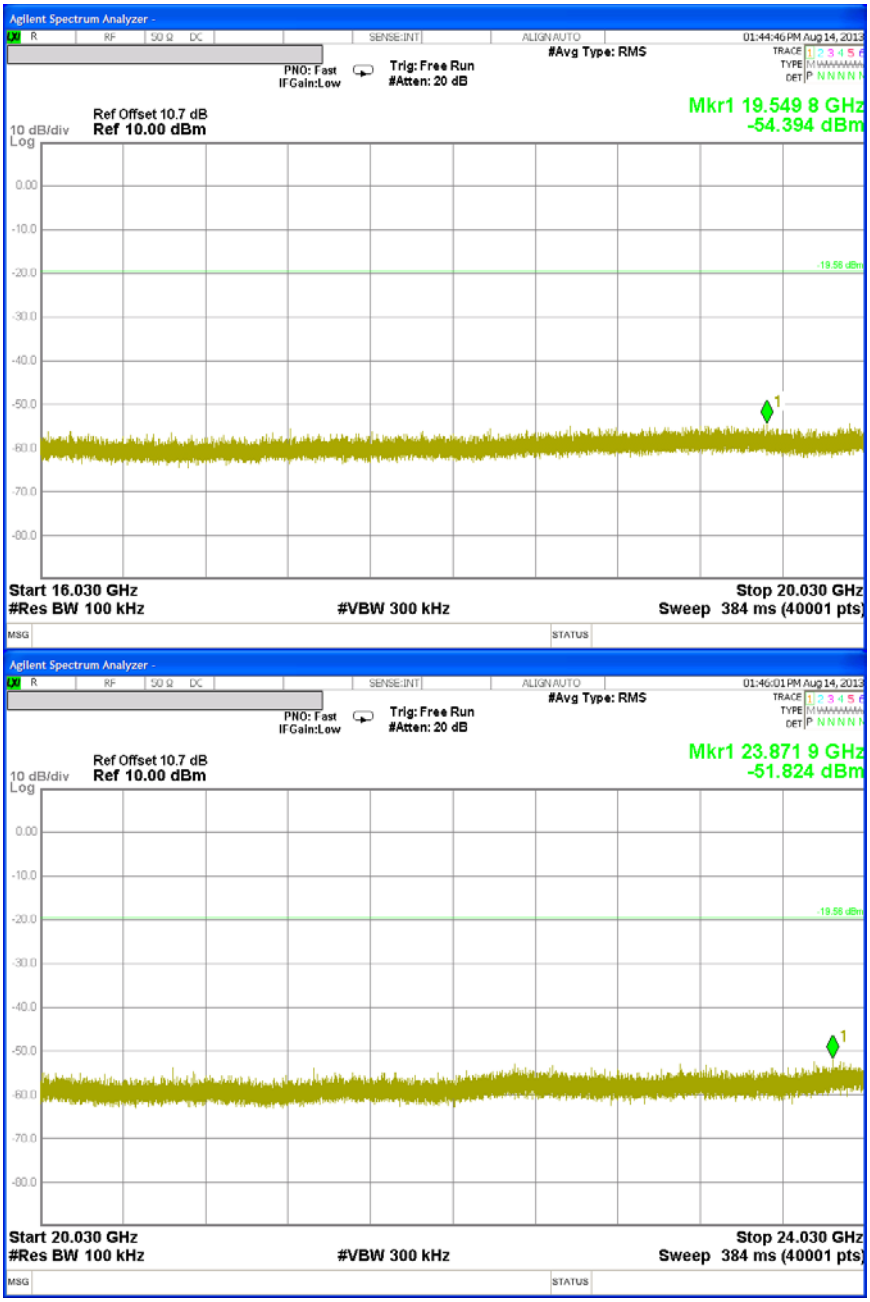


Note: Per KDB 558074, number of points must be >/= Span/RBW. Therefore, seven plots are needed to satisfy this requirement over the range of 30MHz-26GHz.

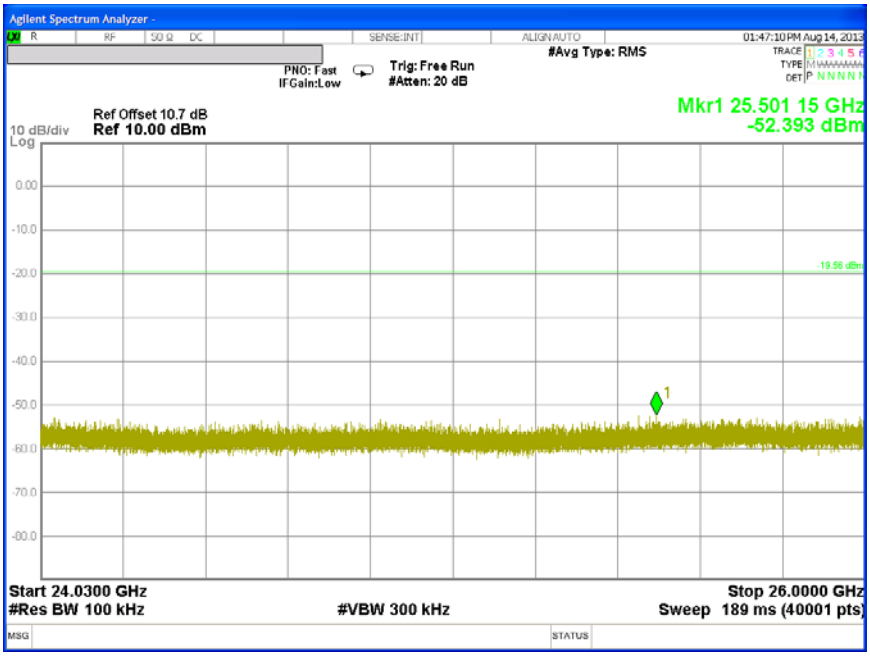
MID CH SPURIOUS: 8.03-16.03GHz



MID CH SPURIOUS: 16.03-24.03GHz

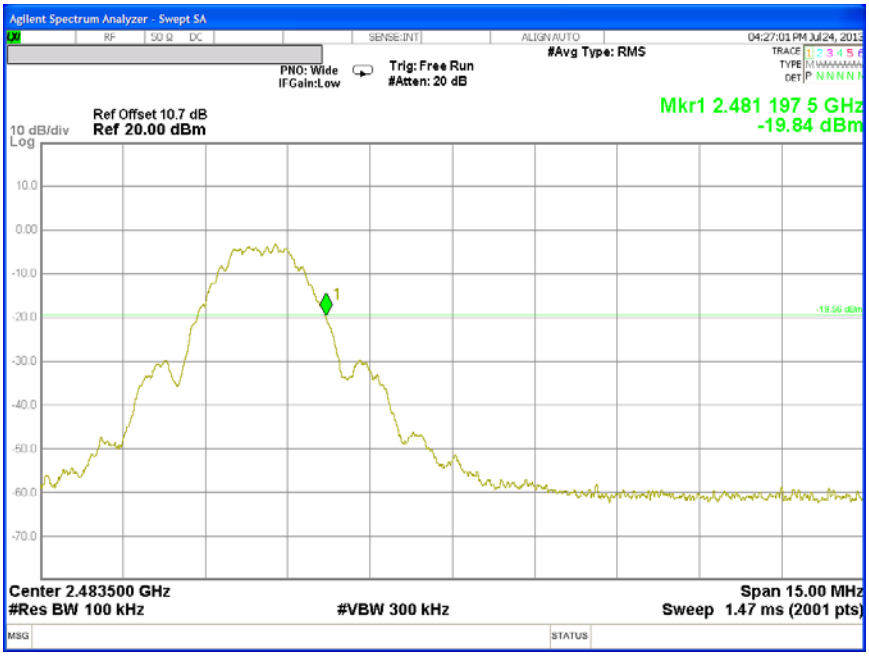


MID CH SPURIOUS: 24.03-26GHz



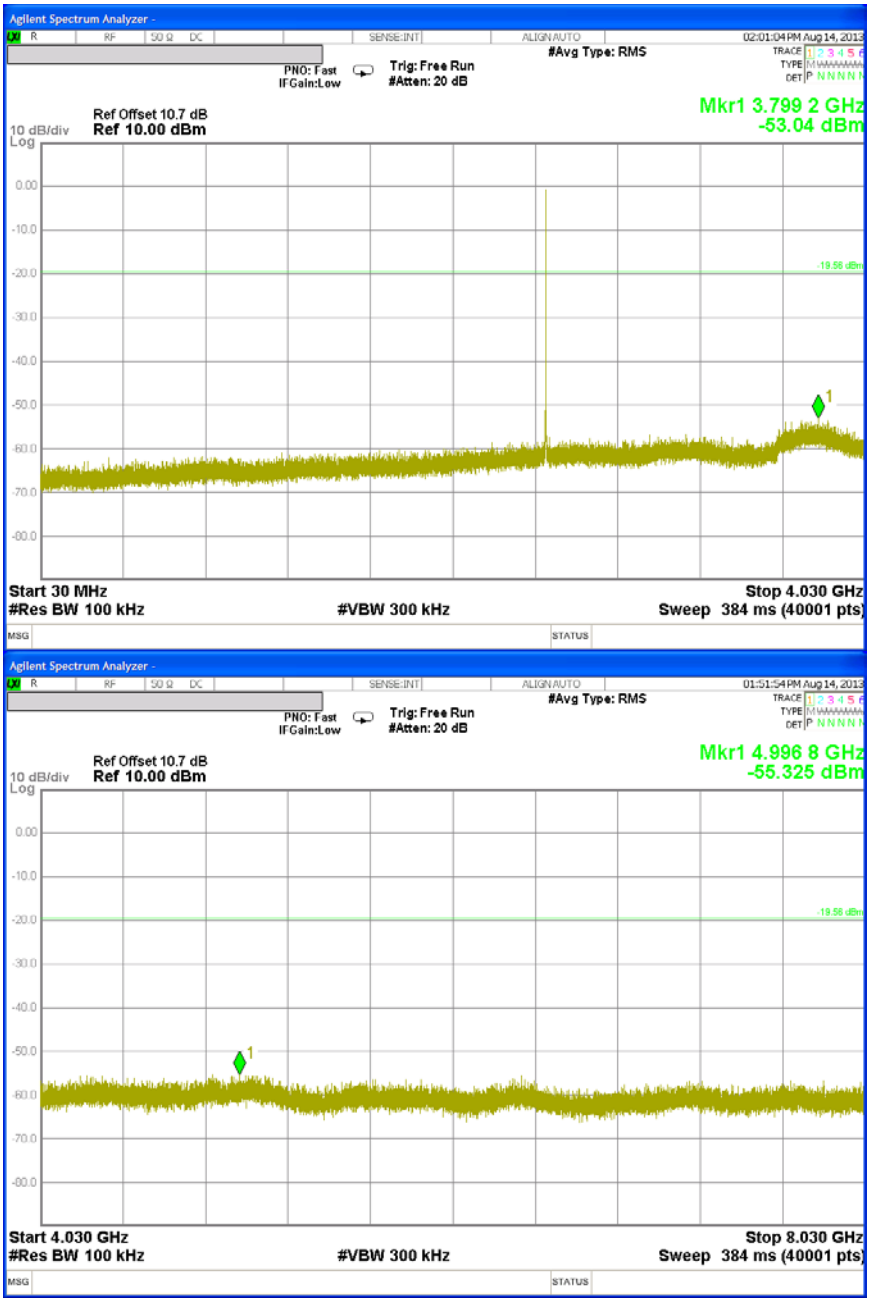
SPURIOUS EMISSIONS, HIGH CHANNEL

HIGH CH BANDEDGE



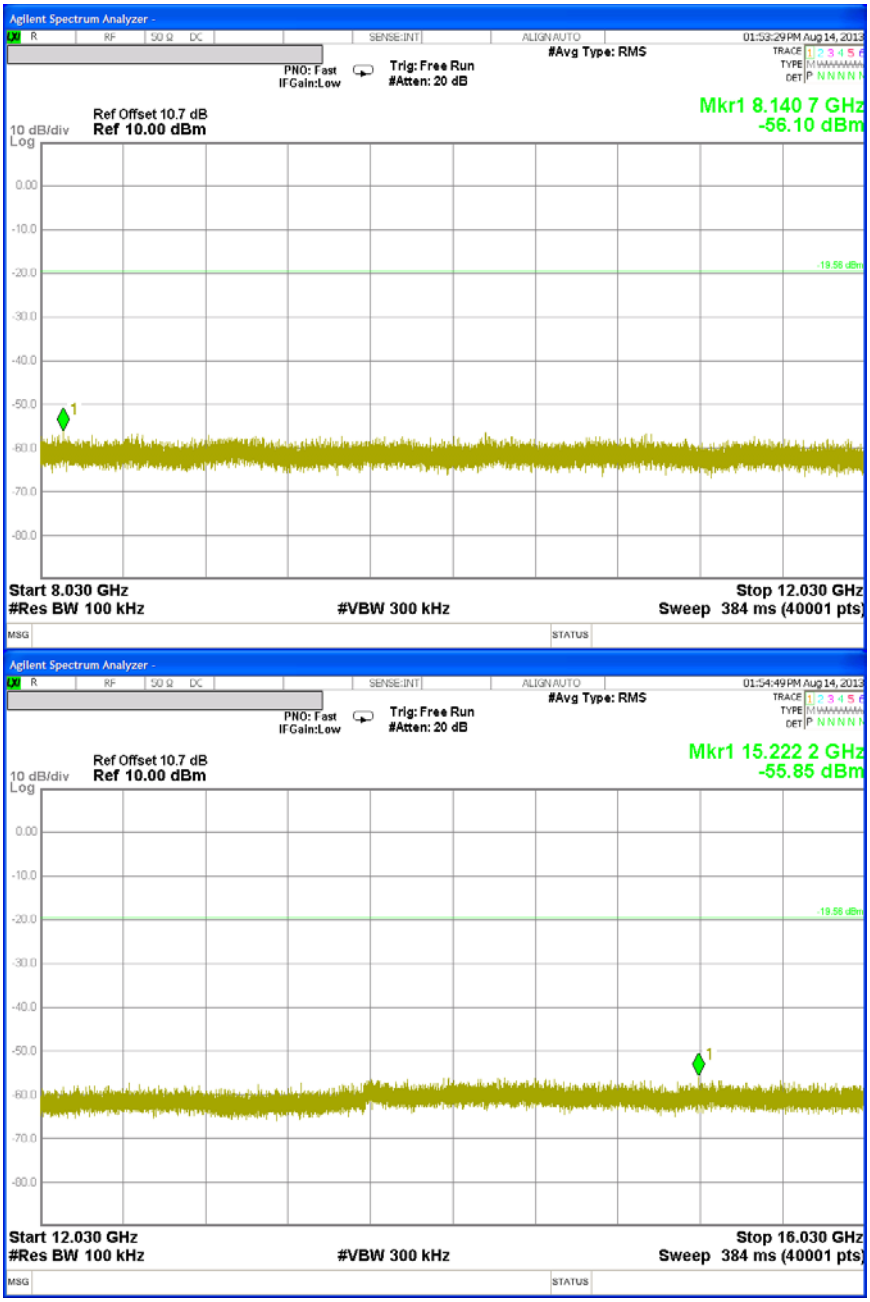
Note – 2.483 GHz is the center frequency. The waveform was measured at the point on the signal that is 20dB below the reference channel peak. Based on this, the band edge is below the 20 dB threshold.

HIGH CH SPURIOUS: 30MHz-8.03GHz

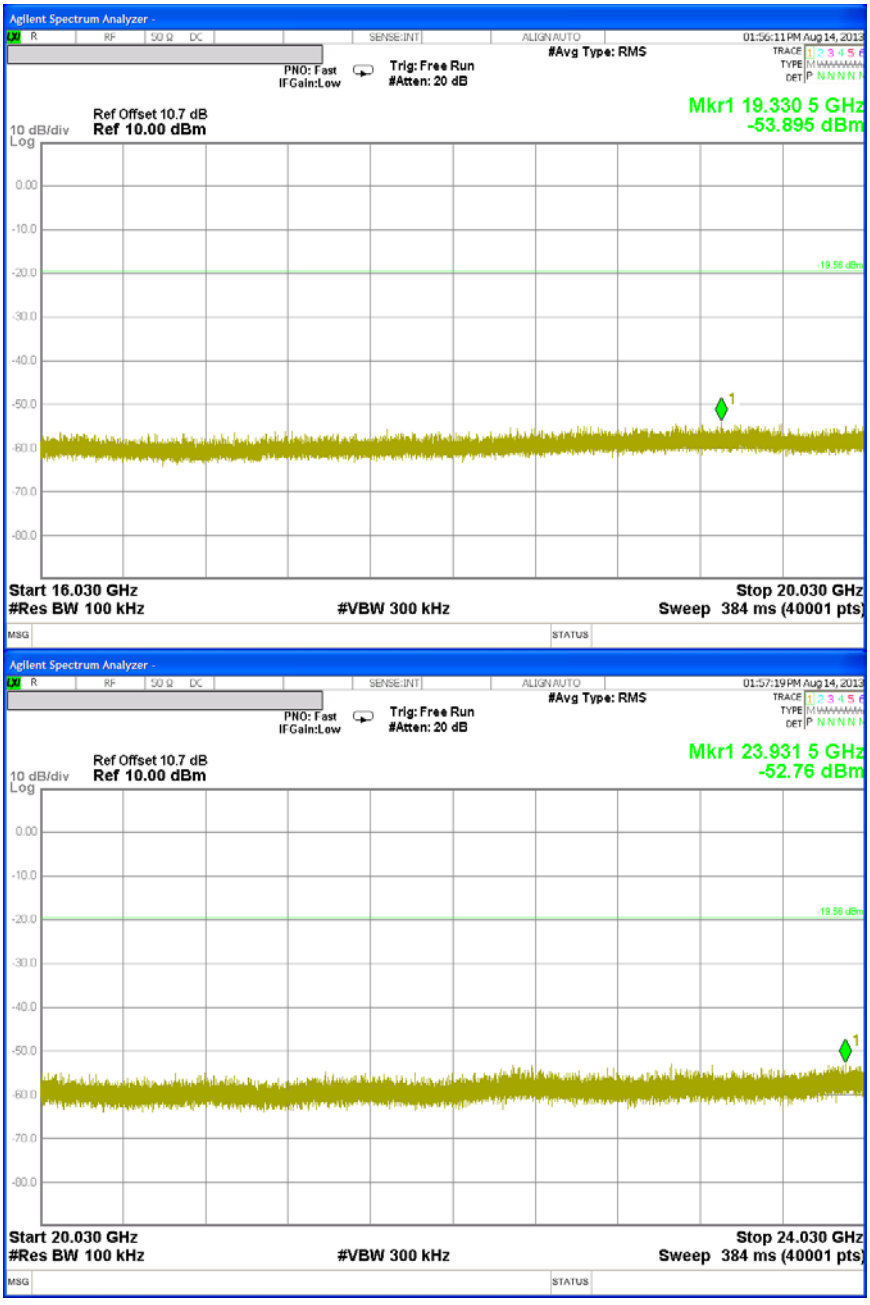


Note: Per KDB 558074, number of points must be >/= Span/RBW. Therefore, seven plots are needed to satisfy this requirement over the range of 30MHz-26GHz.

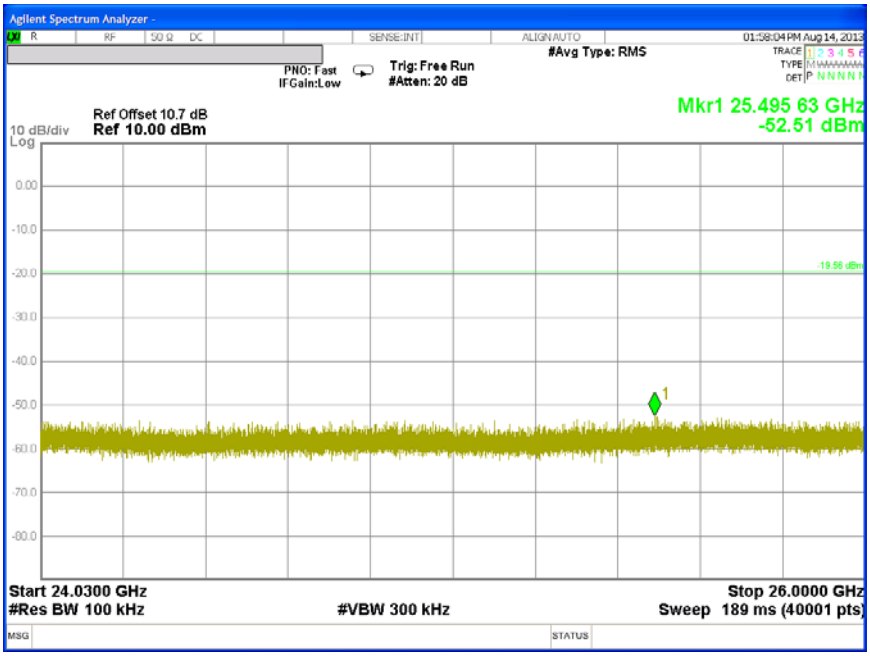
HIGH CH SPURIOUS: 8.03-16.03GHz



HIGH CH SPURIOUS: 16.03-24.03GHz



HIGH CH SPURIOUS: 24.03-26GHz



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.

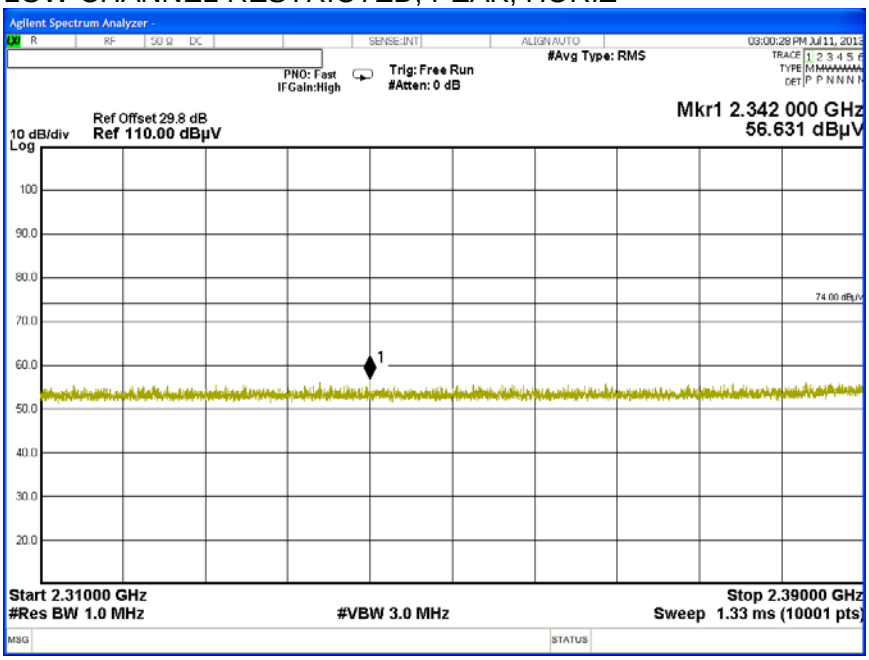
For measurements below 30 MHz loop antennas were used per FCC requirements, and measurement equipment settings test method were consistent with ANSI C63.4.

9.2. TRANSMITTER ABOVE 1 GHz

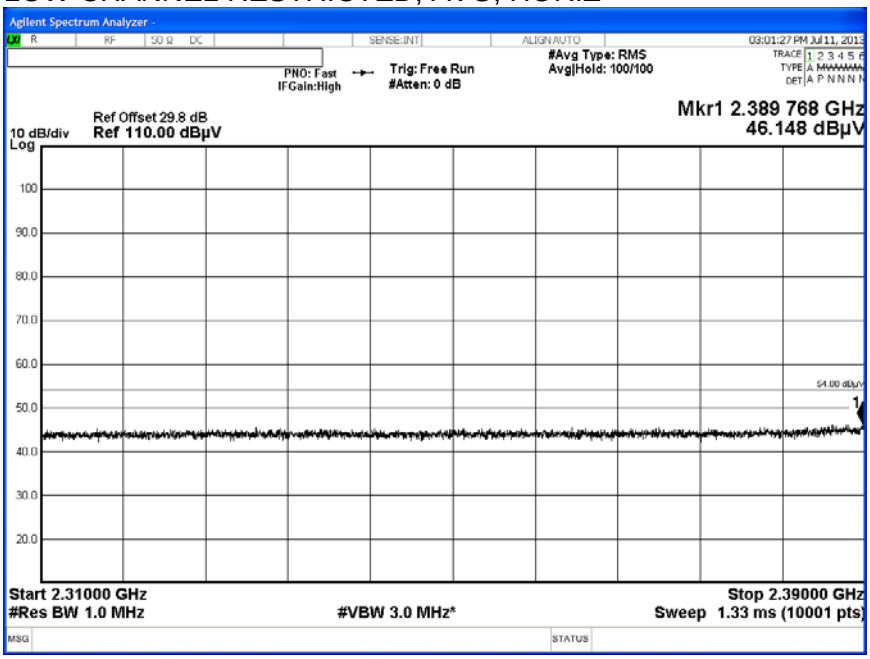
9.2.1. TX ABOVE 1 GHz FOR O-QPSK (DSSS) MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ

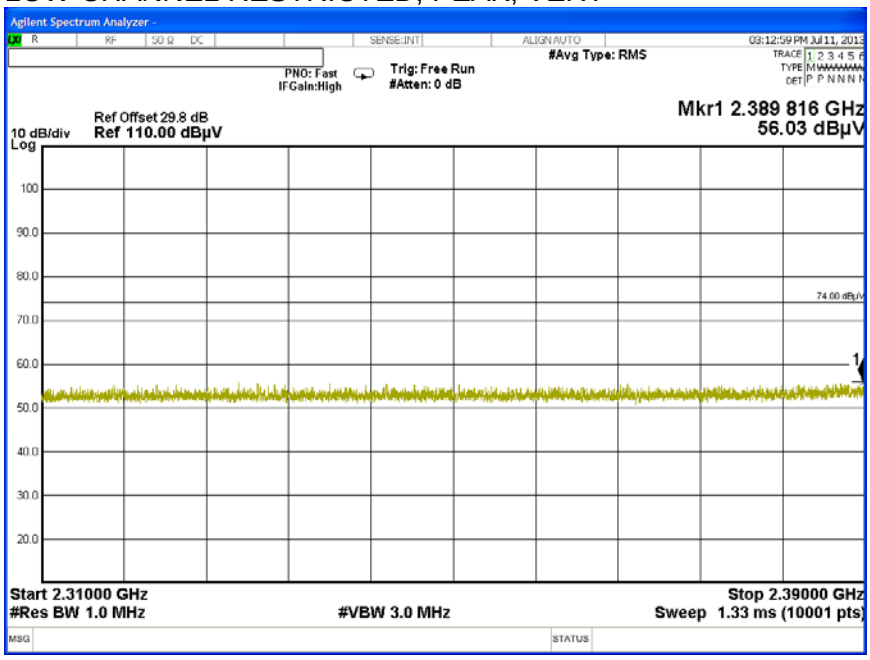


LOW CHANNEL RESTRICTED, AVG, HORIZ

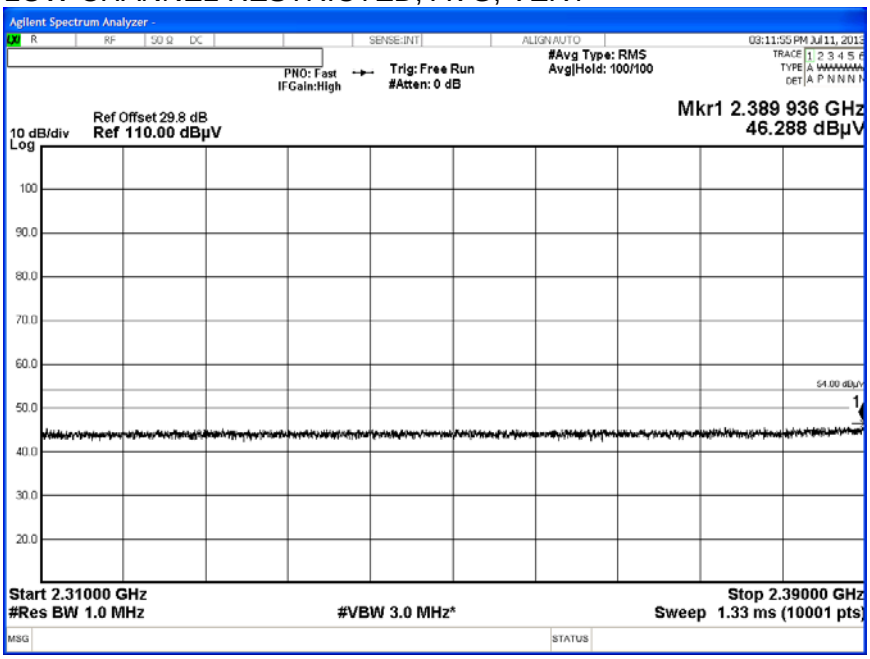


RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, VERT

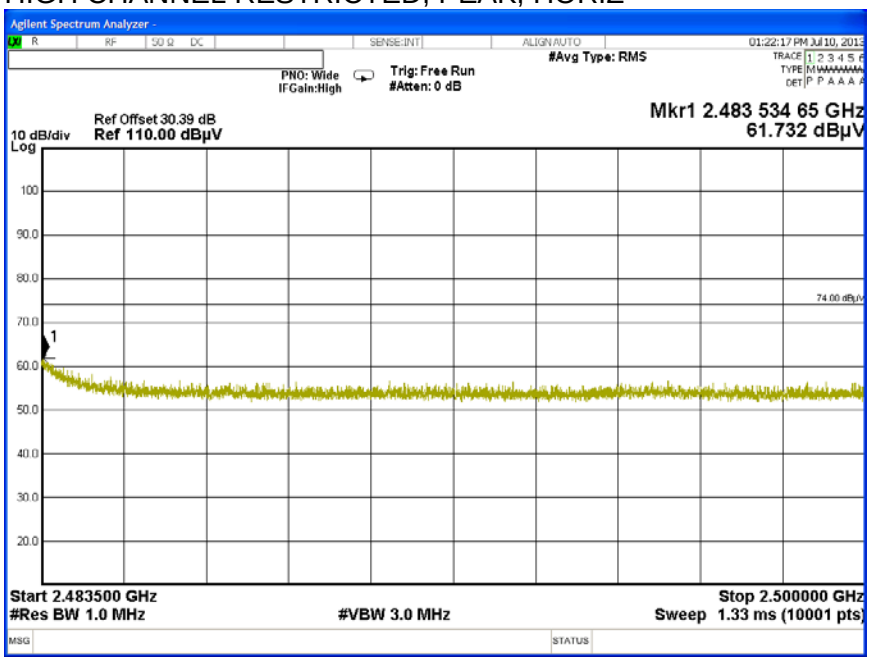


LOW CHANNEL RESTRICTED, AVG, VERT

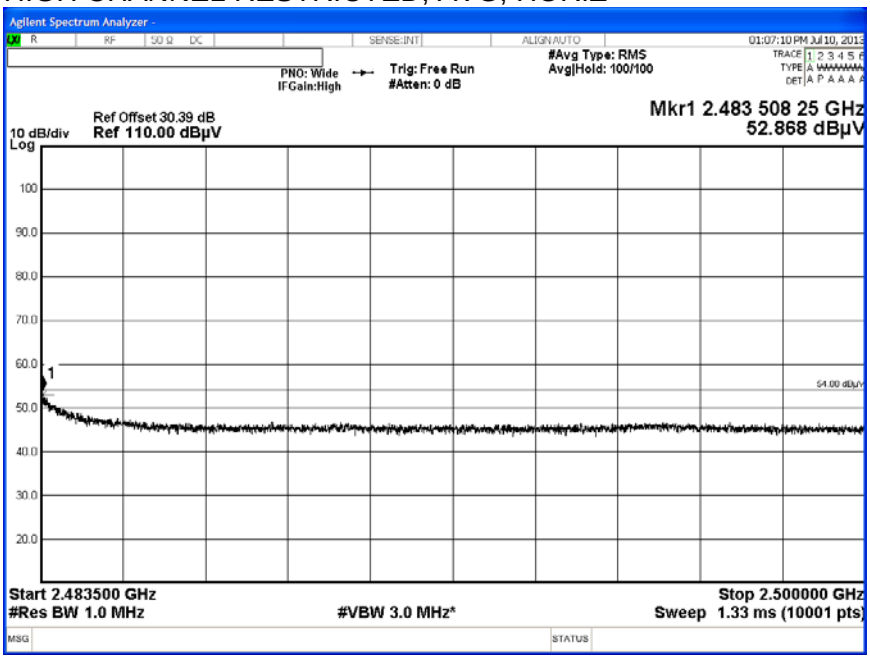


RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL RESTRICTED, PEAK, HORIZ

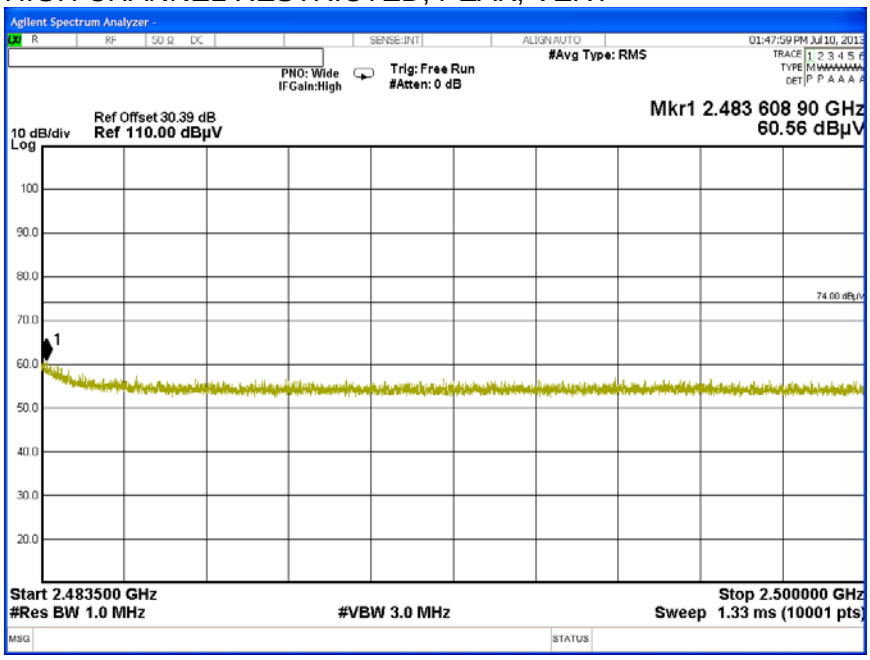


HIGH CHANNEL RESTRICTED, AVG, HORIZ

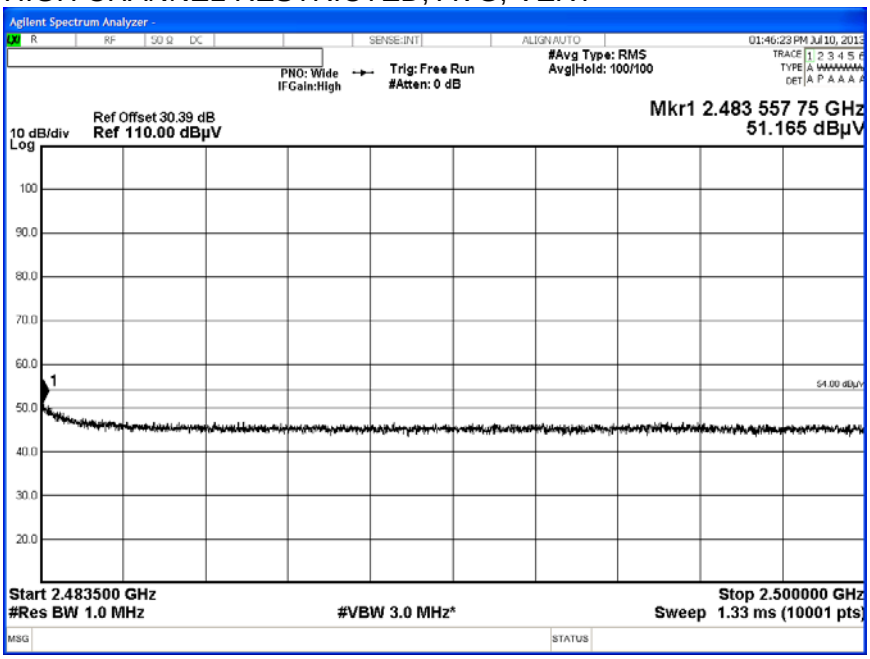


RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, PEAK, VERT

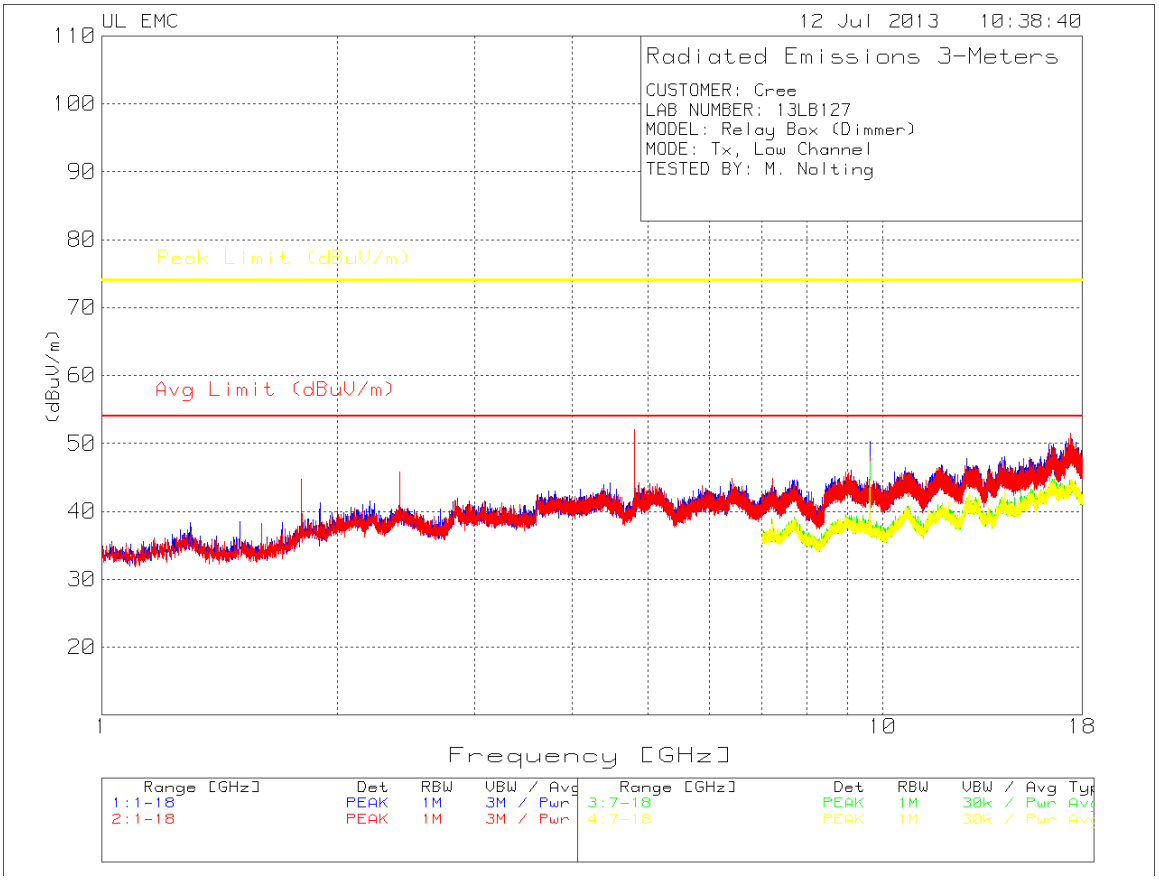


HIGH CHANNEL RESTRICTED, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

Low Channel: Horizontal/Vertical Plot



Low Channel: Tabular Data

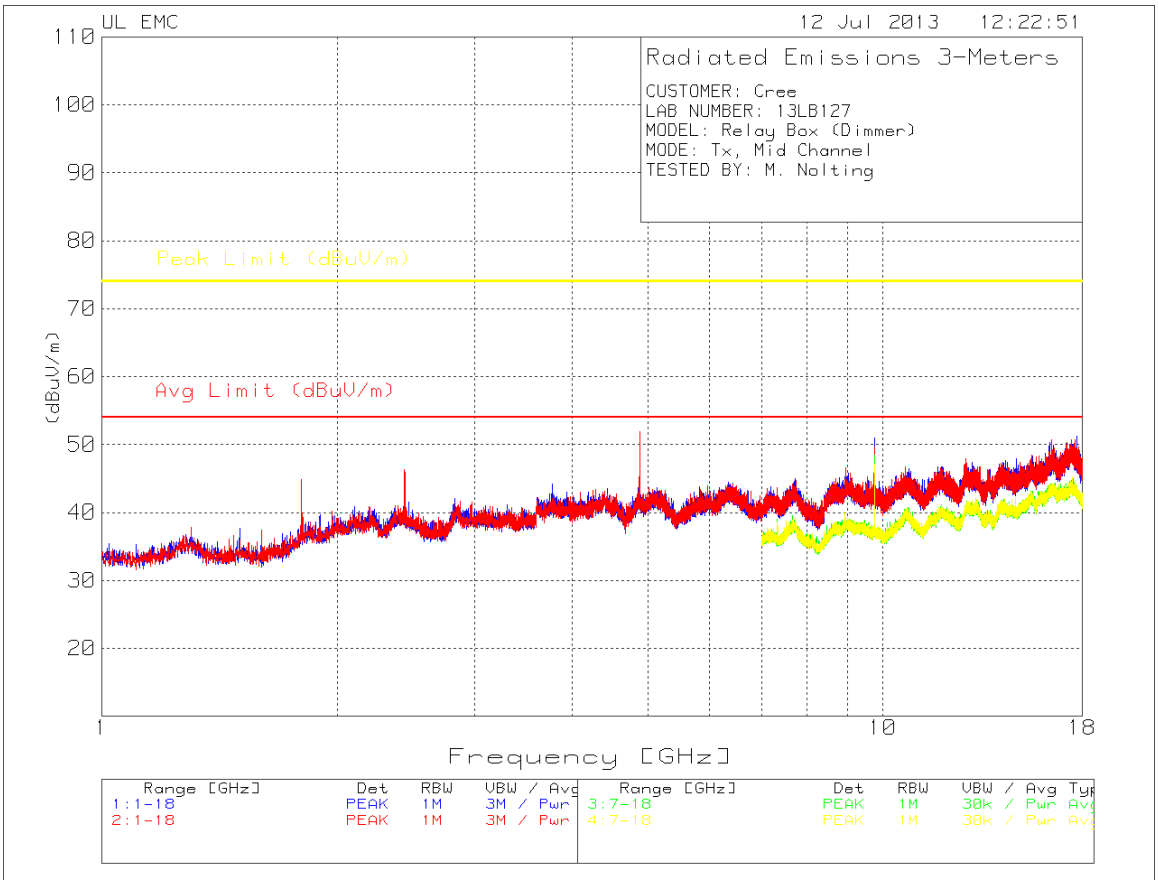
CUSTOMER: Cree
LAB NUMBER: 13LB127
MODEL: Relay Box
MODE: Tx, Low Channel
TESTED BY: M. Nolting

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?
4.811	50.46	PK	34.00	-35.30	49.2	-	-	74.0	-24.8	H	Y
4.809	46.31	MAv1	34.00	-35.30	45.0	54.0	-9.0	-	-	H	Y
4.810	53.30	PK	34.00	-35.30	52.0	-	-	74.0	-22.0	V	Y
4.809	49.75	MAv1	34.00	-35.30	48.5	54.0	-5.6	-	-	V	Y
1.801	48.16	PK	30.30	-35.20	43.3	-	-	-	-	H	N
7.215	40.00	PK	35.60	-31.30	44.3	-	-	-	-	H	N
9.619	43.19	PK	36.70	-29.60	50.3	-	-	-	-	H	N
9.622	39.51	MAv1	36.70	-29.60	46.6	-	-	-	-	H	N
1.801	49.57	PK	30.30	-35.20	44.7	-	-	-	-	V	N
7.217	40.61	PK	35.60	-31.30	44.9	-	-	-	-	V	N
9.619	41.00	PK	36.70	-29.60	48.1	-	-	-	-	V	N
9.622	36.33	MAv1	36.70	-29.60	43.4	-	-	-	-	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: Horizontal/Vertical Plot



Middle Channel: Tabular Data

CUSTOMER: Cree
LAB NUMBER: 13LB127
MODEL: Relay Box
MODE: Tx, Mid Channel
TESTED BY: M. Nolting

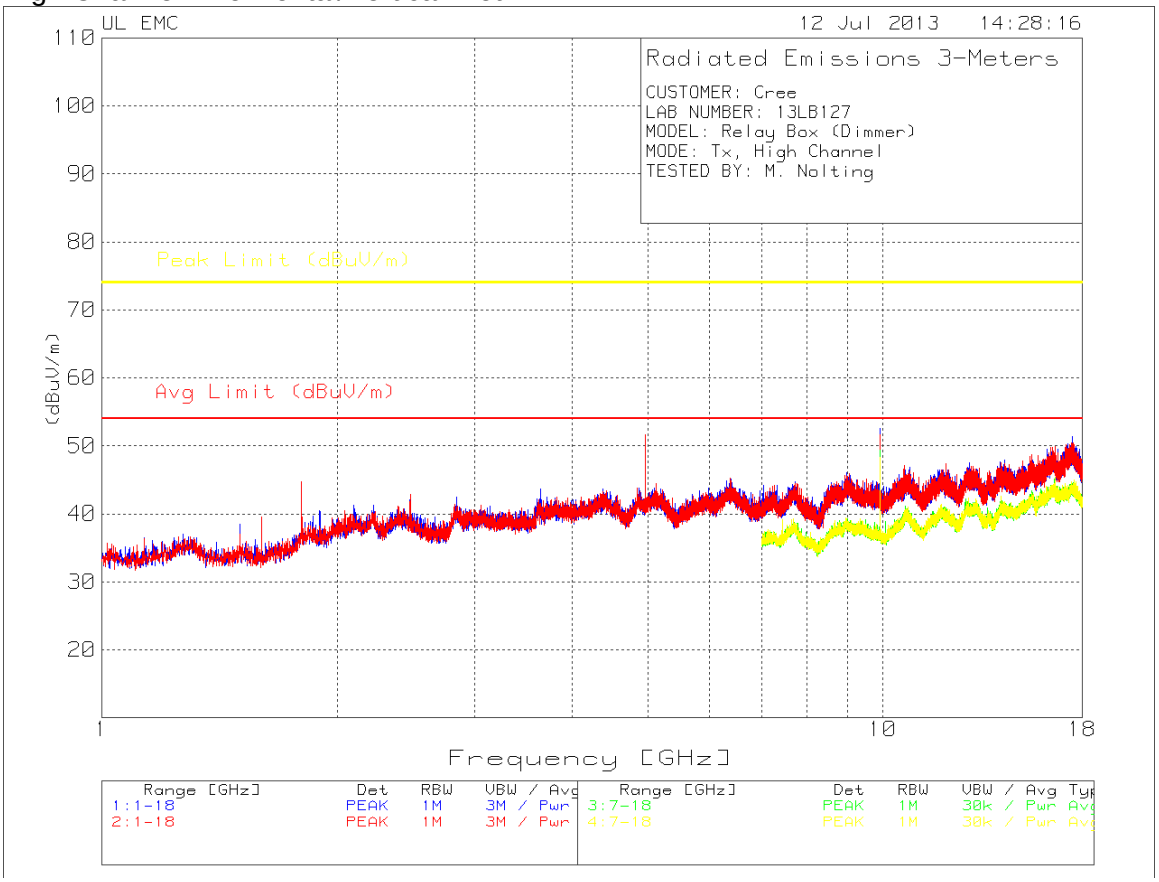
Freq (GHz)	Meter Reading [dBuV]	Detector	Antenna Factor [dB/m]	Gain/Loss [dB]	Field Strength [dBuV/m]	Average Limit [dBuV/m]	Margin [dB]	Peak Limit [dBuV/m]	Margin [dB]	Antenna Polarity	In Restricted Band?
4.882	51.75	PK	34.00	-34.90	50.9	-	-	74.0	-23.2	H	Y
7.319	38.56	PK	35.60	-31.00	43.2	-	-	74.0	-30.8	H	Y
4.879	49.64	MAv1	34.00	-34.90	48.7	54.0	-5.3	-	-	H	Y
7.322	33.57	MAv1	35.60	-31.00	38.2	54.0	-15.8	-	-	H	Y
4.882	52.74	PK	34.00	-34.90	51.8	-	-	74.0	-22.2	V	Y
7.322	39.06	PK	35.60	-31.00	43.7	-	-	74.0	-30.3	V	Y
4.879	49.09	MAv1	34.00	-34.90	48.2	54.0	-5.8	-	-	V	Y
7.322	32.92	MAv1	35.60	-31.00	37.5	54.0	-16.5	-	-	V	Y
1.801	47.72	PK	30.30	-35.20	42.8	-	-	-	-	H	N
9.759	43.59	PK	36.90	-29.50	51.0	-	-	-	-	H	N
9.762	41.29	MAv1	36.90	-29.50	48.7	-	-	-	-	H	N
1.801	49.81	PK	30.30	-35.20	44.9	-	-	-	-	V	N
9.759	42.26	PK	36.90	-29.50	49.7	-	-	-	-	V	N
9.758	37.55	MAv1	36.90	-29.50	45.0	-	-	-	-	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: Horizontal/Vertical Plot



High Channel: Tabular Data

CUSTOMER: Cree
LAB NUMBER: 13LB127
MODEL: Relay Box
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?
4.960	48.69	PK	34.00	-35.00	47.7	-	-	74.0	-26.3	H	Y
7.442	37.18	PK	35.70	-30.80	42.1	54.0	-11.9	74.0	-31.9	H	Y
4.961	46.36	MAv1	34.00	-35.00	45.4	54.0	-8.6	-	-	H	Y
4.959	52.58	PK	34.00	-35.00	51.6	-	-	74.0	-22.4	V	Y
7.443	38.26	PK	35.70	-30.80	43.2	54.0	-10.8	74.0	-30.8	V	Y
4.959	48.15	MAv1	34.00	-35.00	47.2	54.0	-6.9	-	-	V	Y
1.801	46.08	PK	30.30	-35.20	41.2	-	-	-	-	H	N
9.920	45.61	PK	37.10	-30.20	52.5	-	-	-	-	H	N
9.922	44.25	MAv1	37.10	-30.20	51.2	-	-	-	-	H	N
1.801	49.64	PK	30.30	-35.20	44.7	-	-	-	-	V	N
9.920	44.73	PK	37.10	-30.20	51.6	-	-	-	-	V	N
9.922	39.92	MAv1	37.10	-30.20	46.8	-	-	-	-	V	N

PK - Peak detector
MAv1 - KDB558074 Option 1 Maximum RMS Average

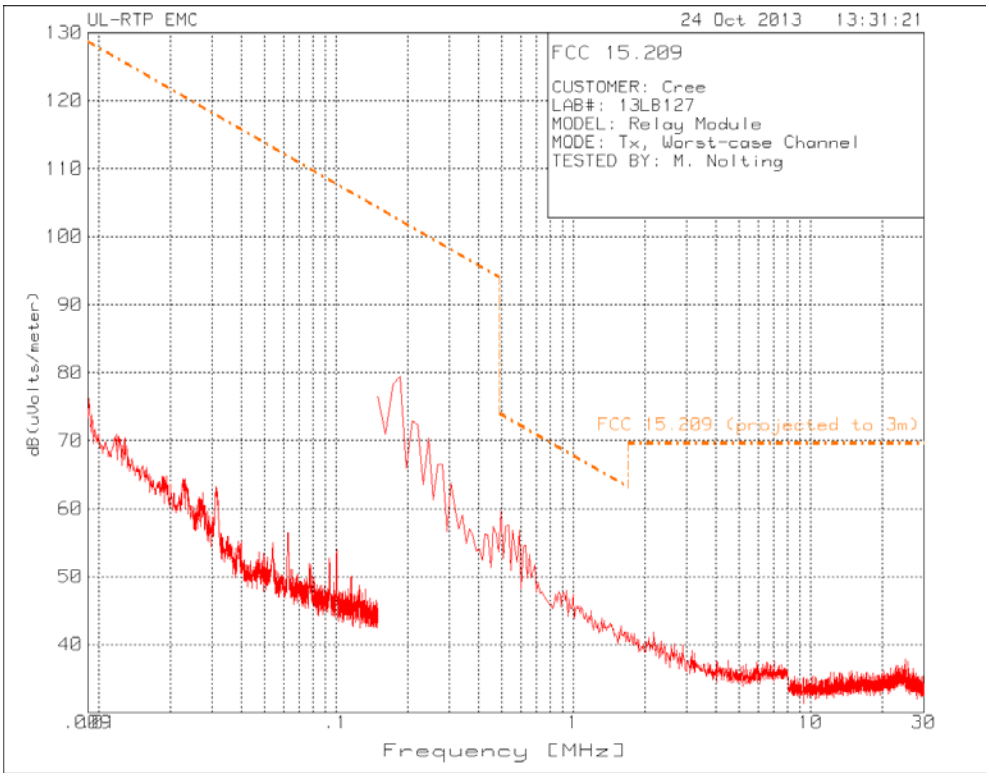
18-26GHz frequency range: No EUT-related noise observed in this range.

9.3. WORST-CASE BELOW 1 GHz

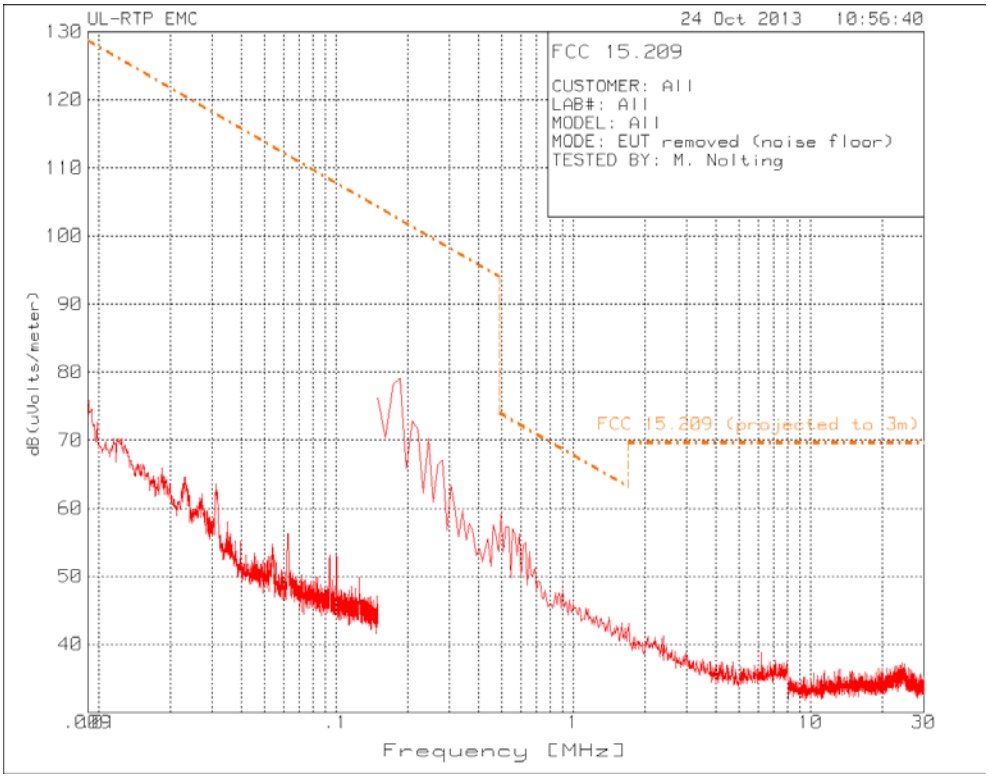
SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)

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*Log (specification distance / test distance).

EUT PLOT

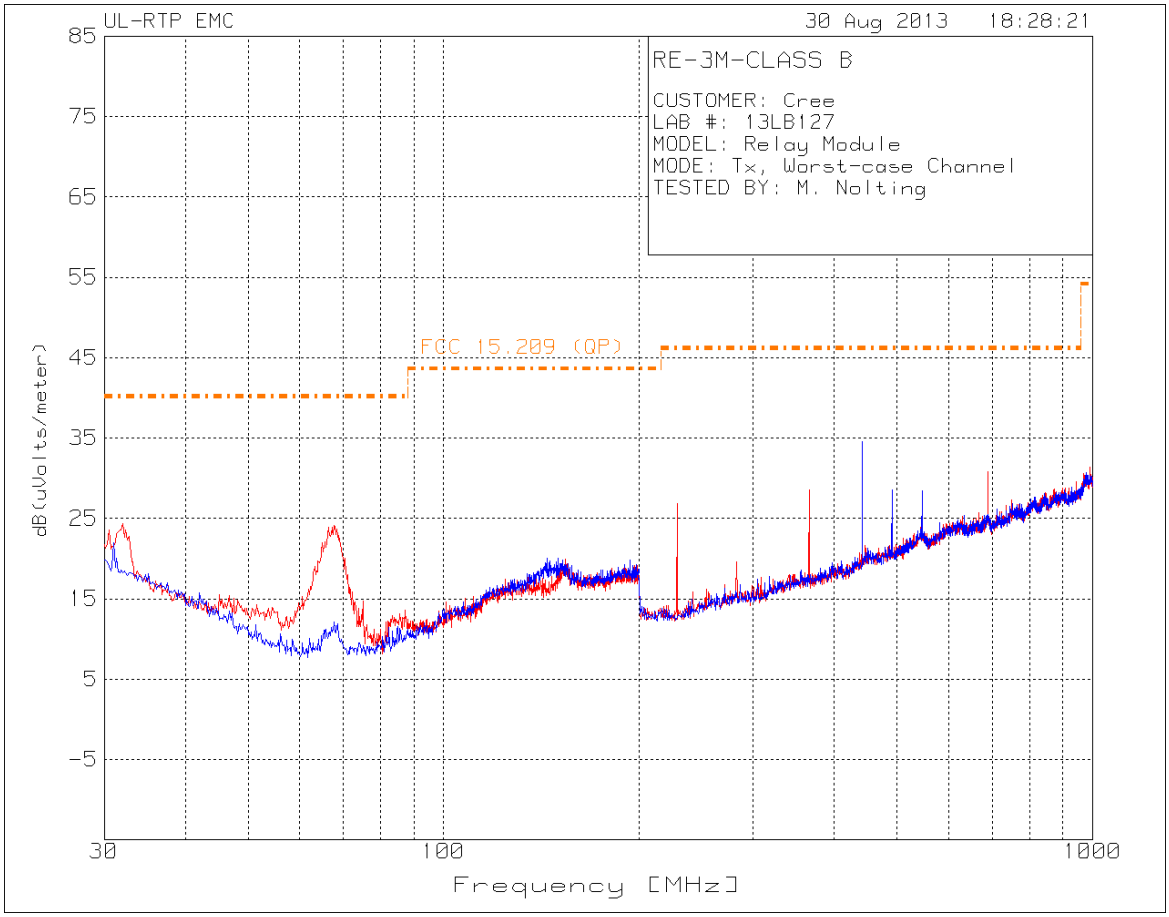


NOISE-FLOOR PLOT



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



Red=Vertical/Blue=Horizontal

TABULAR DATA

CUSTOMER: Cree
LAB NUMBER: 13LB127
MODEL: Relay Module
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?
32.042	36.68	PK	16.70	-29.00	24.4	40.0	-15.6	Vert	N
67.778	46.69	PK	6.10	-28.70	24.1	40.0	-15.9	Vert	N
228.819	44.10	PK	10.90	-28.10	26.9	46.0	-19.1	Vert	N
365.977	40.76	PK	14.70	-26.90	28.6	46.0	-17.4	Vert	N
689.927	35.86	PK	20.70	-25.70	30.9	46.0	-15.1	Vert	N
441.761	44.53	PK	16.70	-26.70	34.5	46.0	-11.5	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

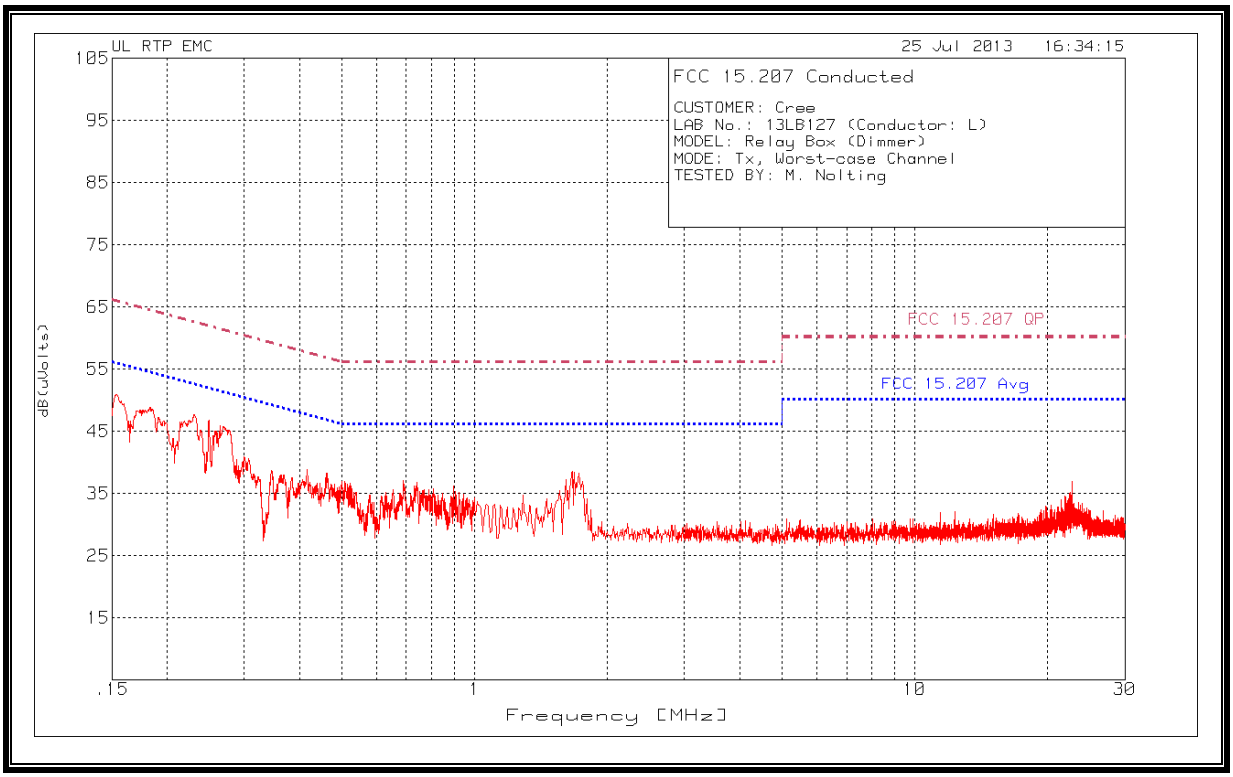
* Decreases with the logarithm of the frequency.

TEST PROCEDURE

ANSI C63.4

RESULTS

LINE CONDUCTOR PLOT



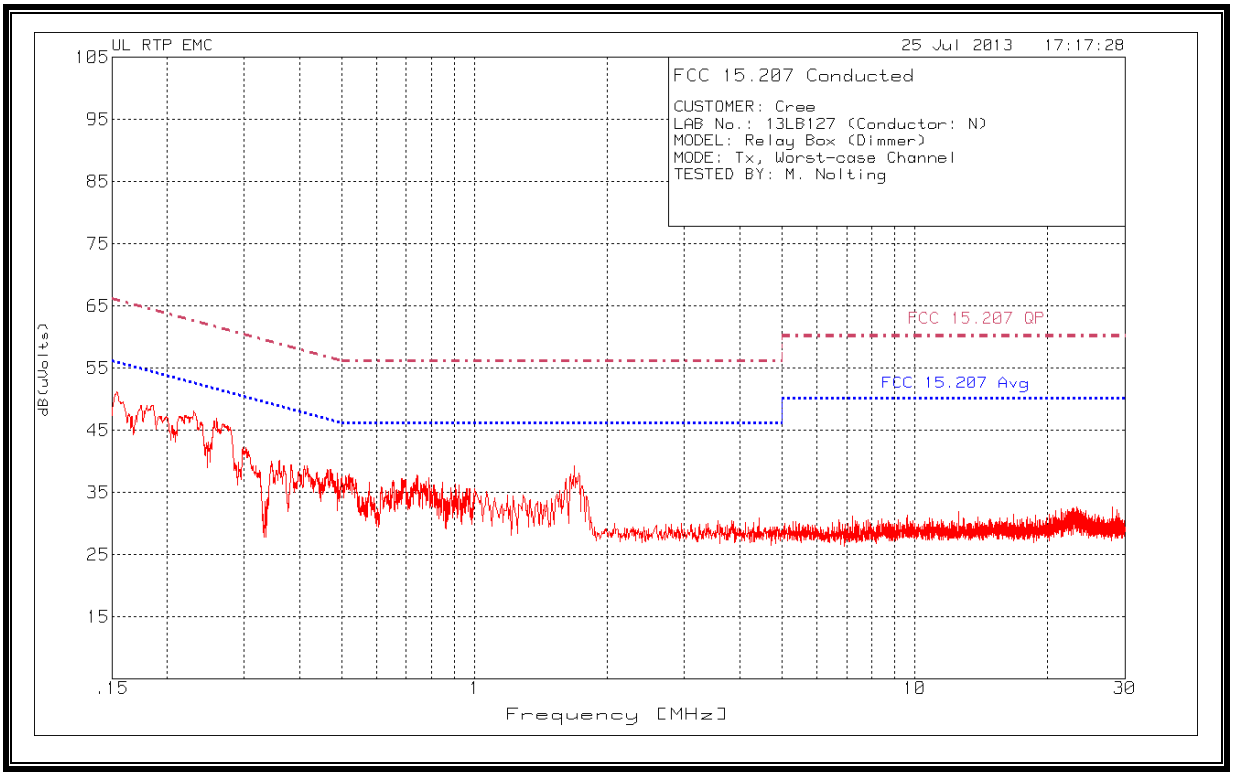
LINE CONDUCTOR TABULAR DATA

CUSTOMER: Cree
LAB No.: 13LB127 (Conductor: L)
MODEL: Relay Box (Dimmer)
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]
0.154	41.08	PK	0.4	9.5	50.98	65.8	-14.8	-	-
0.183	39.07	PK	0.3	9.5	48.87	64.3	-15.4	-	-
0.231	38.01	PK	0.2	9.5	47.71	62.4	-14.7	-	-
0.249	37.17	PK	0.2	9.5	46.87	61.8	-14.9	-	-
0.270	35.81	PK	0.2	9.6	45.61	61.1	-15.5	-	-
1.667	28.82	PK	0.1	9.6	38.52	56.0	-17.5	46.0	-7.5
22.748	26.92	PK	0.3	9.8	37.02	60.0	-23.0	50.0	-13.0
0.154	29.80	AV	0.4	9.5	39.70	-	-	55.8	-16.1
0.183	18.36	AV	0.3	9.5	28.16	-	-	54.3	-26.1
0.231	28.82	AV	0.2	9.5	38.52	-	-	52.4	-13.9
0.250	0.53	AV	0.2	9.6	10.33	-	-	51.8	-41.5
0.269	30.32	AV	0.2	9.6	40.12	-	-	51.1	-11.0

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

NEUTRAL CONDUCTOR PLOT



NEUTRAL CONDUCTOR TABULAR DATA

CUSTOMER: Cree
LAB No.: 13LB127 (Conductor: N)
MODEL: Relay Box (Dimmer)
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]
0.154	41.30	PK	0.4	9.5	51.20	65.8	-14.6	-	-
0.187	38.81	PK	0.3	9.5	48.61	64.2	-15.6	-	-
0.230	38.35	PK	0.2	9.5	48.05	62.5	-14.5	-	-
0.268	36.21	PK	0.2	9.6	46.01	61.2	-15.2	-	-
0.300	31.91	PK	0.1	9.6	41.61	60.2	-18.6	50.2	-8.6
0.154	30.63	AV	0.4	9.5	40.53	-	-	55.8	-15.3
0.187	22.92	AV	0.3	9.5	32.72	-	-	54.2	-21.5
0.192	30.07	AV	0.3	9.5	39.87	-	-	53.9	-14.0
0.231	29.63	AV	0.2	9.5	39.33	-	-	52.4	-13.1
0.269	30.84	AV	0.2	9.6	40.64	-	-	51.1	-10.5

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

END OF REPORT