



FCC 47 CFR PART 15 SUBPART C

**BLUETOOTH LOW ENERGY
CERTIFICATION TEST REPORT**

FOR

**HOME AUTOMATION GATEWAY PRODUCT: 802.11a/b/g/n 2x2 MIMO,
BLUETOOTH, BLUETOOTH LOW ENERGY, ZigBee and Z-WAVE**

MODEL NUMBER: ID: 087

FCC ID: DKNCS08

REPORT NUMBER: R10526502-RF4A

ISSUE DATE: 2015-05-27

Prepared for
**ECHOSTAR TECHNOLOGIES LLC
90 INVERNESS CIRCLE EAST
ENGLEWOOD
CO, 80112, USA**

Prepared by
**UL LLC
12 LABORATORY DR.
RESEARCH TRIANGLE PARK, NC 27709 USA
TEL: (919) 549-1400**



NVLAP LAB CODE 200246-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	2015-05-27	Initial Issue	Jeff Moser

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	5
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATION	6
4. CALIBRATION AND UNCERTAINTY	6
4.1. MEASURING INSTRUMENT CALIBRATION	6
4.2. SAMPLE CALCULATION	6
4.3. MEASUREMENT UNCERTAINTY	7
5. EQUIPMENT UNDER TEST	8
5.1. DESCRIPTION OF EUT	8
5.2. MAXIMUM OUTPUT POWER.....	8
5.3. DESCRIPTION OF AVAILABLE ANTENNAS	8
5.4. SOFTWARE AND FIRMWARE.....	9
5.5. WORST-CASE CONFIGURATION AND MODE.....	9
5.6. DESCRIPTION OF TEST SETUP.....	10
6. TEST AND MEASUREMENT EQUIPMENT	12
7. MEASUREMENT METHODS	14
8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS	15
8.1. ON TIME AND DUTY CYCLE RESULTS.....	15
8.2. DUTY CYCLE PLOT	16
9. ANTENNA PORT TEST RESULTS	17
9.1. 6 dB BANDWIDTH.....	17
9.2. 99% BANDWIDTH.....	21
9.3. OUTPUT POWER.....	25
9.4. AVERAGE POWER.....	29
9.5. POWER SPECTRAL DENSITY	30
9.6. CONDUCTED SPURIOUS EMISSIONS.....	34
10. RADIATED TEST RESULTS	41
10.1. LIMITS AND PROCEDURE.....	41
10.2. TRANSMITTER ABOVE 1 GHz.....	42
10.2.1. TX ABOVE 1 GHz FOR BLUETOOTH LOW ENERGY MODE IN THE 2.4 GHz BAND	42
10.3. WORST-CASE BELOW 1 GHz	49

10.4.	WORST-CASE 18-26GHz.....	50
11.	AC POWER LINE CONDUCTED EMISSIONS	51
12.	SETUP PHOTOS	54

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: ECHOSTAR TECHNOLOGIES LLC
90 INVERNESS CIRCLE EAST
ENGLEWOOD CO, 80112, USA

EUT DESCRIPTION: HOME AUTOMATION GATEWAY PRODUCT

MODEL: ID: 087

SERIAL NUMBER: FCC1, FCC9 (RE06039Z00418L)

DATE TESTED: February 18, 2015 – April 21, 2015

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	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:



Michael Ferrer
EMC Program Manager
UL – Consumer Technology Division

Prepared By:



Jeff Moser
EMC Program Manager
UL – Consumer Technology Division

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

Note – Radiated testing above 1GHz was performed on a 1.5m table height, per ANSI C63.10: 2013. All other testing was performed per ANSI C63.10: 2009.

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.

12 Laboratory Dr., RTP, NC 27709	
☐	Chamber A
☒	Chamber C

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:

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

4.3. MEASUREMENT UNCERTAINTY

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

Test	Uncertainty
Conducted Emissions (0.150-30MHz)	+/- 2.37 dB
Total RF power, conducted	+/- 0.45 dB
RF power density, conducted	+/- 1.5 dB
Spurious emissions, conducted	+/- 1.46 dB
Radiated Emissions (30-1000 MHz)	+/- 6.04 dB (3m)
Radiated Emissions (1-6 GHz)	+/- 5.96 dB
Radiated Emissions (6-18 GHz)	+/- 6.10 dB
Radiated Emissions (18-26 GHz)	+/- 6.81 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT, EchoStar's ID:087 Home Automation Gateway Product, is a controller with a portfolio of connected devices offered as part of connected home services which allows the user to manage their home automation connected devices on the TV and their connected mobile hand held devices.

The EUT contains an 802.11a/b/g/n (n - 20MHz/40MHz) 2x2 MIMO transceiver, along with Bluetooth, Bluetooth Low Energy, ZigBee and Z-Wave (908 MHz and 916 MHz) transceivers.

The Bluetooth v4.0 2.4GHz radio in the ID:087 is derived from the MediaTek MT7632U chipset.

This report covers the Bluetooth Low Energy radio. Other reports were issued to cover the other radio technologies:

- R10526502-RF1: 802.11 b/g/n 2.4 GHz
- R10526502-RF2: 802.11 a/n 5 GHz
- R10526502-RF3: Bluetooth
- R10526502-RF5: ZigBee
- R10526502-RF6: Z-Wave

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)
2402 - 2480	BLE	6.34	4.31

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The Bluetooth antenna is a trace antenna on the PCB. The trace antenna has a gain of 3dBi.

The 802.11a/b/g/n 2.4/5GHz radio uses two Airgain, model N2420DS series antennas.

WLAN Antenna 0 has a gain of 3.1dBi in the 2.4GHz band and 2.5dBi in the 5GHz band.
WLAN Antenna 1 has a gain of 3.1dBi in the 2.4GHz band and 2.5dBi in the 5GHz band.

The Zigbee antenna is a trace antenna on the PCB. The trace antenna has a gain of 3dBi.

The Z-wave antenna is a trace antenna on the PCB. The trace antenna has a gain of 1.6dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware in all units was: Linux kernel version 3.1.10

The driver for Bluetooth: HCI Control 1.0

The driver SW for Zigbee: Nodetest version 1.0

The driver for Z-wave: ZWave test ZM5304

The driver for Wi-Fi: Linux MT7662 0.0.00

The test utility SW: Python Test Scripts rev. 1.0

5.5. WORST-CASE CONFIGURATION AND MODE

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

The device is a table-top device and was positioned as such during radiated and line-conducted testing.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
EUT AC adapter	LITEON	PB-1180-2ES1	ETC1444046079	-
Laptop PC	HP	EliteBook 8470p	CNU342CL9Z	-
Laptop PC AC adapter	HP	677774-001	WCNXA0C3U5IA7F	

I/O CABLES

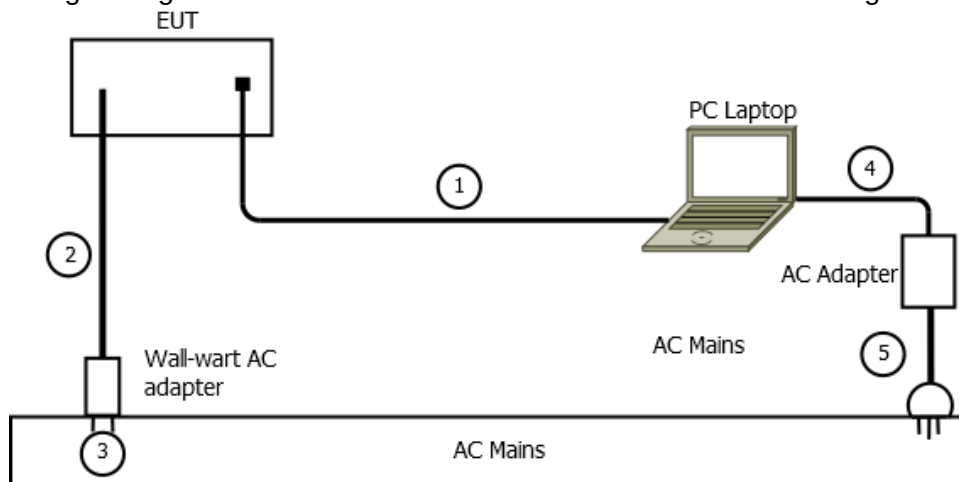
I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Ethernet	1	RJ45	CAT5UTP	15	Connection between laptop PC and EUT used to control the transmitter function of the EUT.
2	DC (12V)	1	2C DC	Unshielded	1.8	Wall-wart AC adapter DC output to EUT. Non-detachable.
3	AC	1	2C AC	N/A	0	Wall-wart AC adapter's AC input.
4	DC	1	2C DC	Unshielded	1.8	Laptop AC adapter output to laptop PC. Non-detachable
5	AC	1	3C AC	Unshielded	1.8	Laptop PC power adapter AC input. Detachable.

TEST SETUP

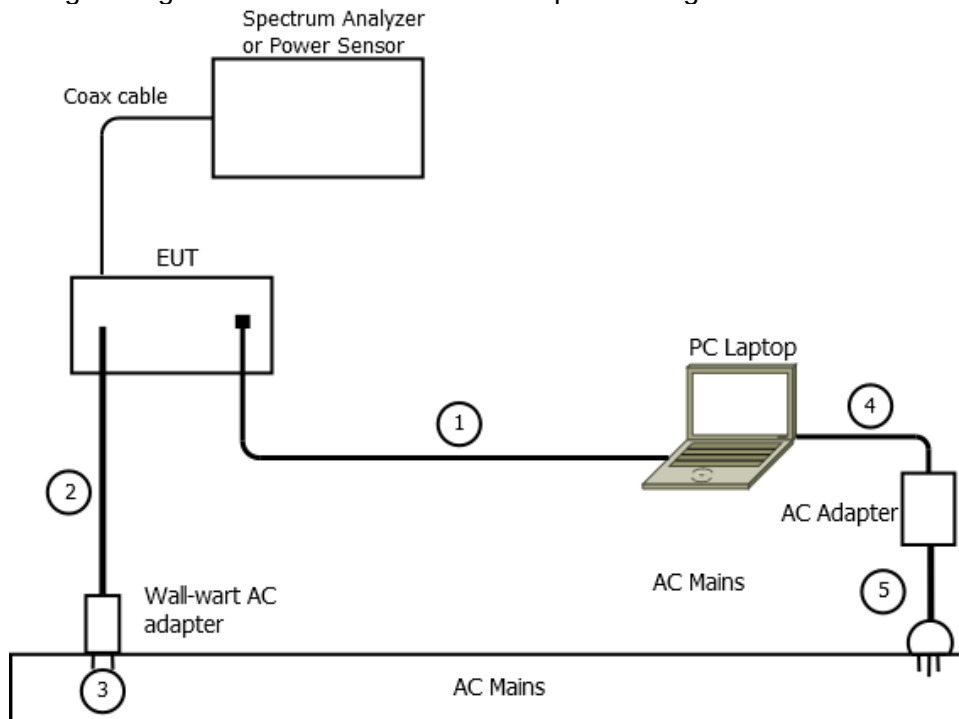
The EUT was configured as a table-top device connected to a located laptop PC over an Ethernet cable. This Ethernet connection was used to control the transmitter function of the EUT.

SETUP DIAGRAM FOR TESTS

The following arrangement was used for radiated and line-conducted testing.



The following arrangement was used for antenna-port testing.



6. TEST AND MEASUREMENT EQUIPMENT

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

Radiated Disturbance Emissions (E-field) – Chamber C

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0066	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB1	2014-07-10	2015-07-31
AT0062 (Testing after 02/28/2015)	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2014-07-22	2015-07-31
AT0067 (Testing before 03/01/2015)	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2014-02-19	2015-02-28
AT0063	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2014-07-23	2015-07-31
SAC_G (Hybrid)	Gain-Loss string for Hybrid antenna at 3m	Various	Various	2015-02-01	2016-02-29
SAC_G (3117)	Gain-Loss string for 3117 antenna at 3m	Various	Various	2015-02-01	2016-02-29
SAC_G (MWH-1826/B)	Gain-Loss string for MWH-1826/B antenna at 3m	Various	Various	2015-01-26	2016-01-31
SA0018	Spectrum Analyzer	Agilent	N9030A	2014-06-26	2015-06-30
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
HPF009	1GHz High-pass Filter	Micro-Tronics	HPM17672	2015-01-28	2016-01-31
HI0069	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2014-06-27	2015-06-27

Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Common Equipment				
SA0020	Spectrum Analyzer, 3Hz-44GHz	Agilent Technologies	E4446	2015-02-26	2016-02-29
PAR0037	Power Meter, 100kHz to 110 GHz	HP	437B	2015-01-19	2016-01-31
MM0143	Digital Multimeter	Fluke	175	2014-09-04	2016-09-30
HI0069	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2014-06-27	2015-06-27

Power-line Conducted Disturbance Emissions - Voltage

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SA0021	EMI Test Receiver 9kHz-3.6GHz	Rohde & Schwarz	ESR3	2014-05-26	2015-05-31
ATA509	Coaxial cable, 20 ft., BNC -male to BNC-male	UL	RG-223	2014-09-15	2015-07-31
HI0041	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2015-03-23	2016-03-31
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
ATA508	Transient Limiter, 0.009 to 100 MHz	Electro-Metrics	EM 7600	2014-09-03	2015-09-30
LISN002 (EUT)	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2014-09-04	2015-09-30
LISN003 (AUX)	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2014-09-04	2015-09-30

7. MEASUREMENT METHODS

6 dB BW: KDB 558074 D01 v03r02, Section 8.1.

Output Power: KDB 558074 D01 v03r02, Section 9.1.1.

Power Spectral Density: KDB 558074 D01 v03r02, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v03r02, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v03r02, Section 12.0.

8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None; for reporting purposes only.

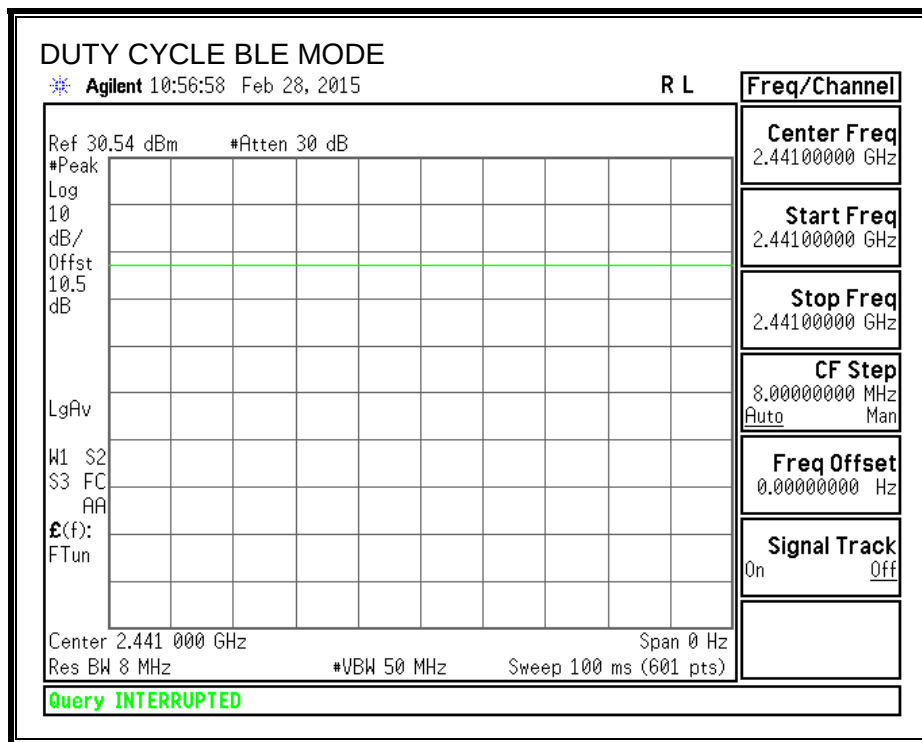
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

8.1. 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)
BLE	100.00	100.00	1.00	1.00	0.00	0.010

8.2. DUTY CYCLE PLOT



9. ANTENNA PORT TEST RESULTS

9.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

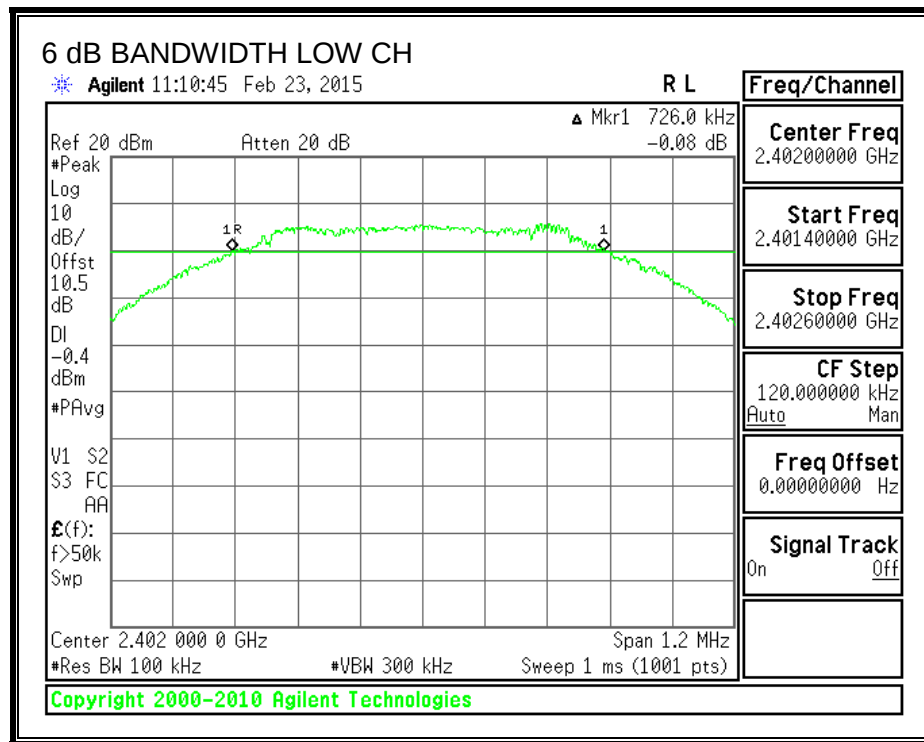
The minimum 6 dB bandwidth shall be at least 500 kHz.

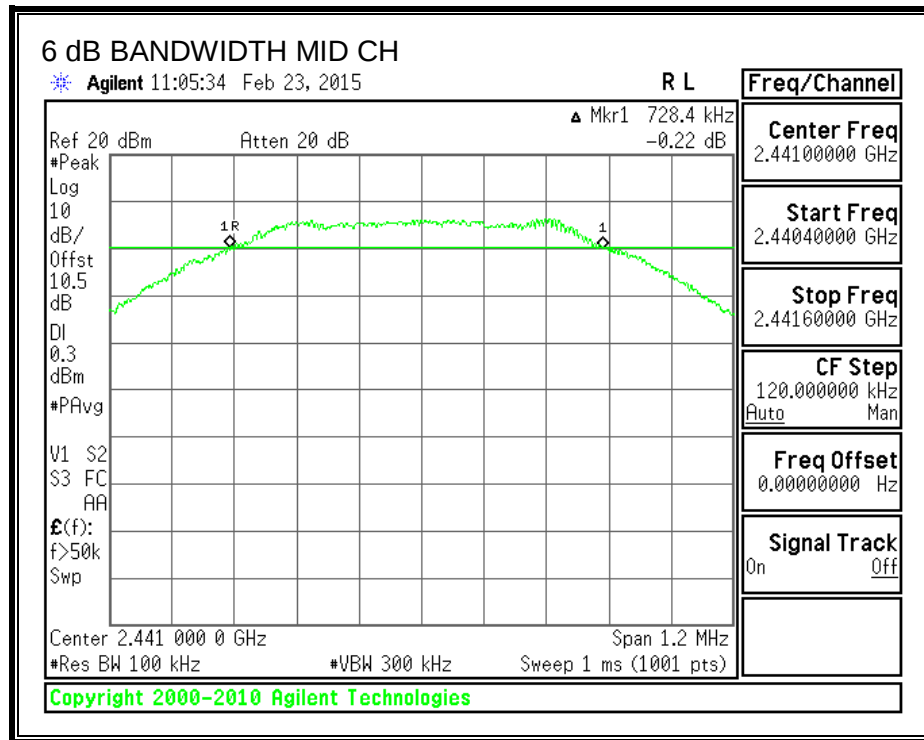
RESULTS

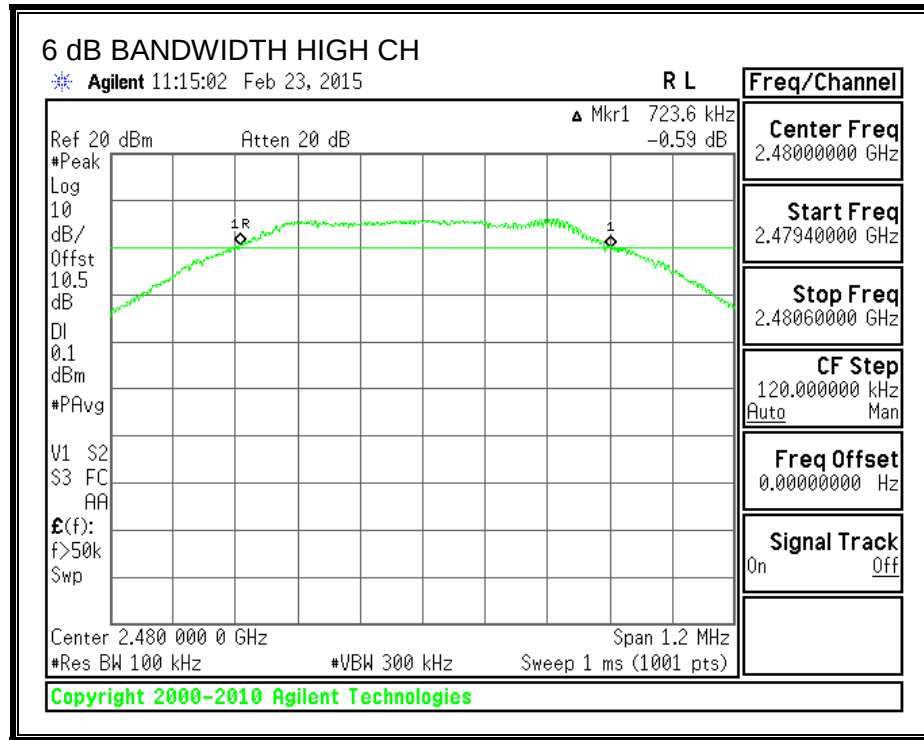
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.7260	0.5
Middle	2441	0.7284	0.5
High	2480	0.7236	0.5

Note – For test purposes, 2441 MHz was used for the middle channel. However, in normal operation the middle channel will be 2440 MHz (2 MHz channel separation)

6 dB BANDWIDTH







9.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

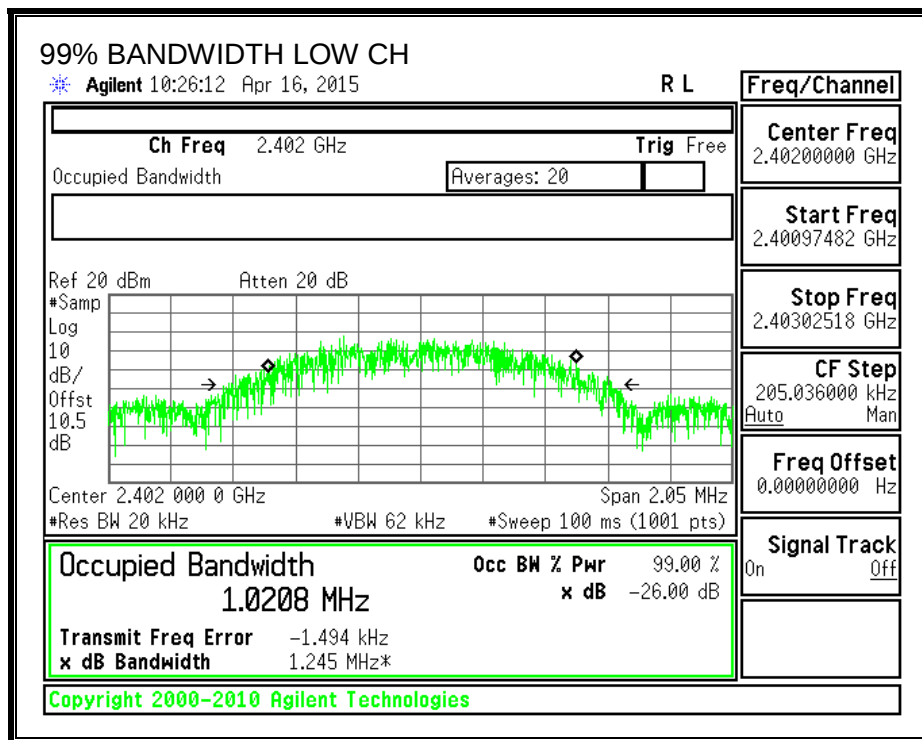
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth and to 1% of the span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

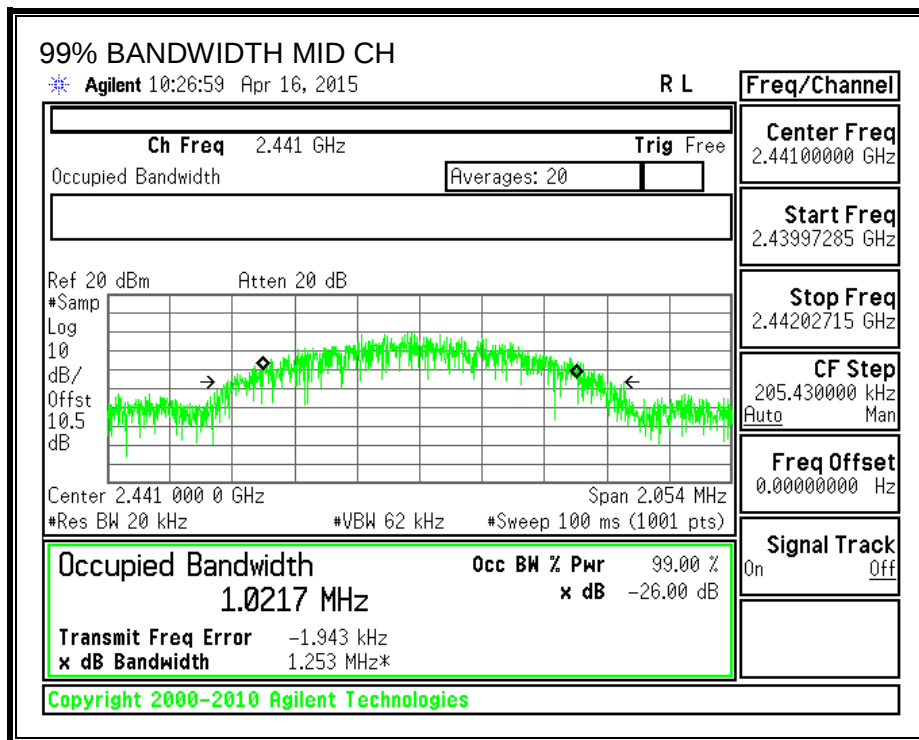
RESULTS

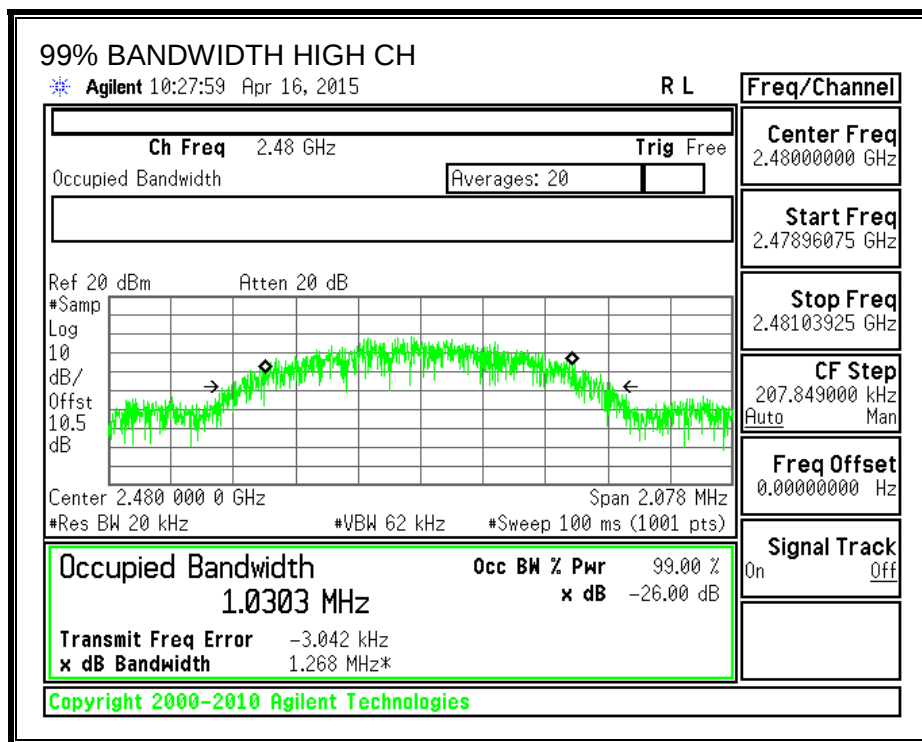
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0208
Middle	2441	1.0217
High	2480	1.0303

Note – For test purposes, 2441 MHz was used for the middle channel. However, in normal operation the middle channel will be 2440 MHz (2 MHz channel separation)

99% BANDWIDTH







9.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

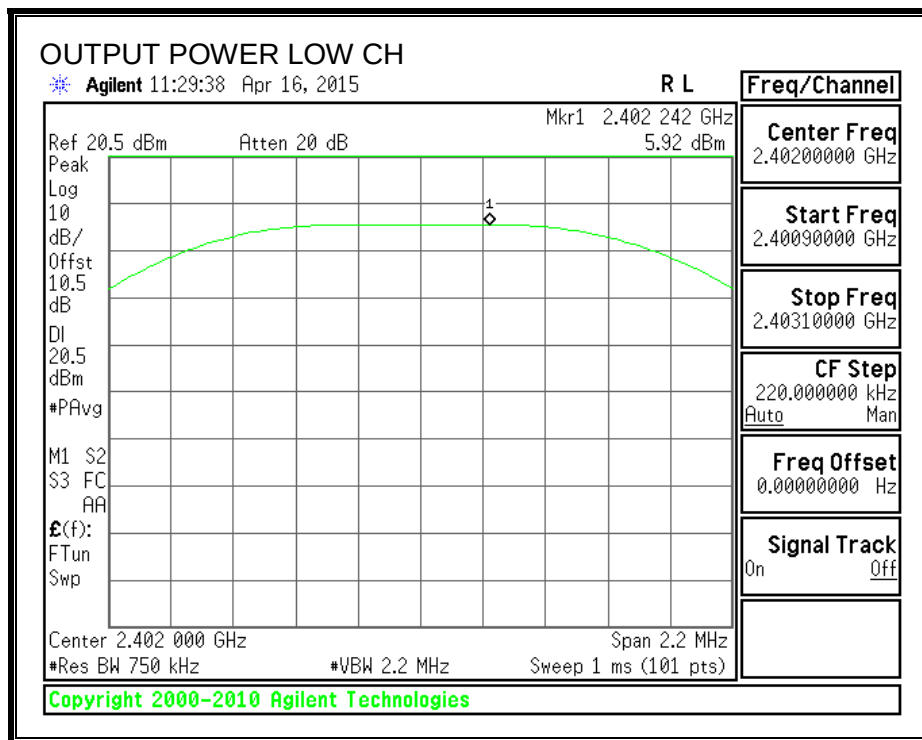
The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

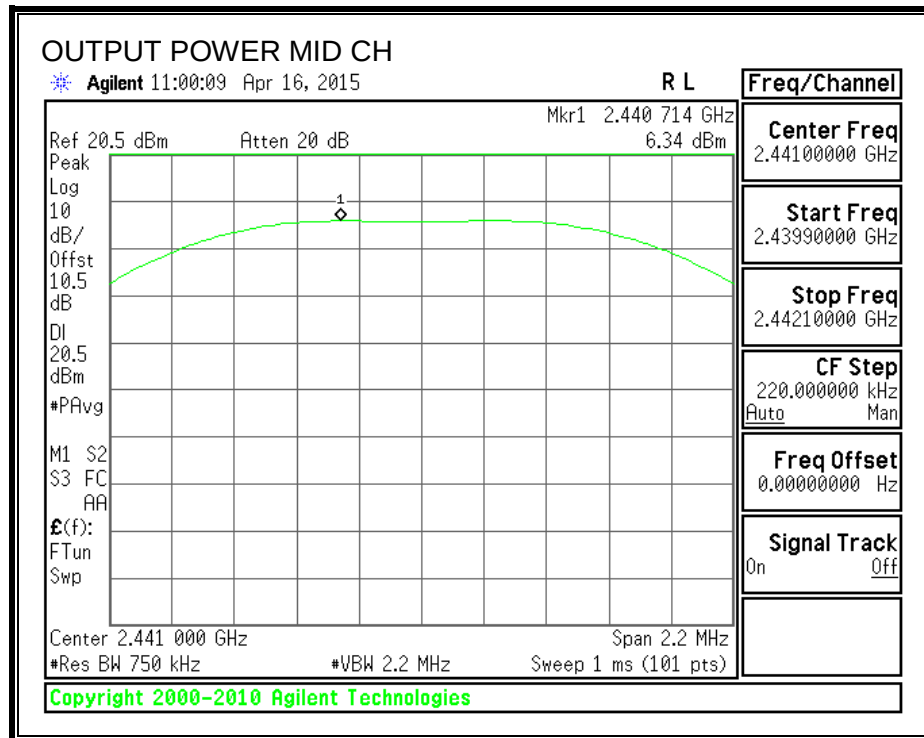
RESULTS

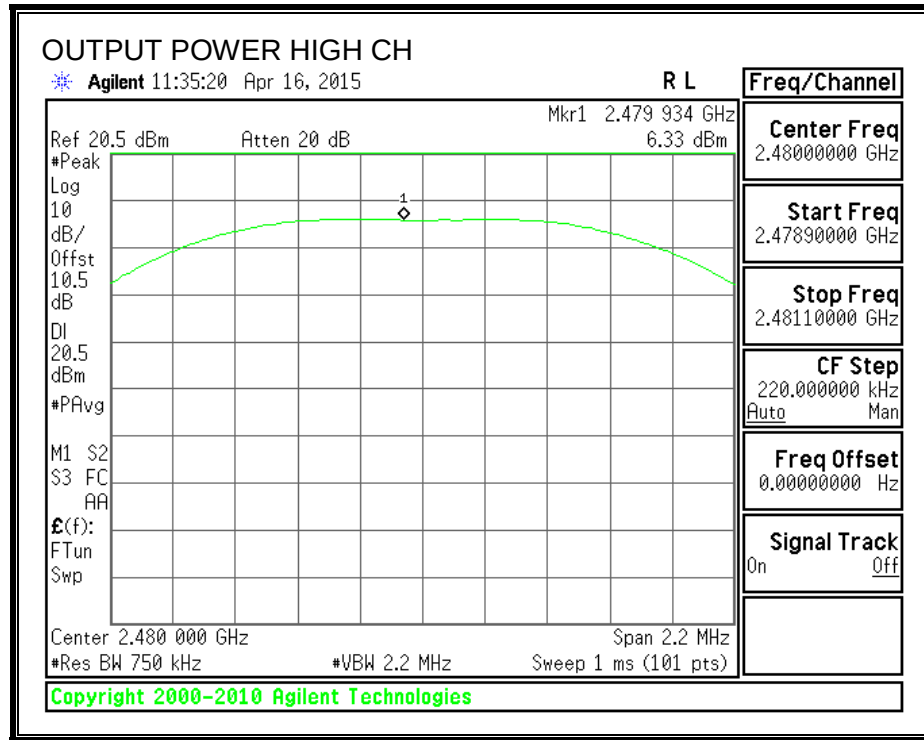
Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	5.92	30	-24.080
Middle	2441	6.34	30	-23.660
High	2480	6.33	30	-23.670

Note – For test purposes, 2441 MHz was used for the middle channel. However, in normal operation the middle channel will be 2440 MHz (2 MHz channel separation)

OUTPUT POWER







9.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

The cable assembly insertion loss of 10.54 dB (including 10 dB pad and 0.54 dB cable) was entered as an offset in the power meter to allow for direct reading of power. The duty cycle was 100% during the measurement.

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	5.02
Middle	2441	5.65
High	2480	5.49

Note – For test purposes, 2441 MHz was used for the middle channel. However, in normal operation the middle channel will be 2440 MHz (2 MHz channel separation)

9.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

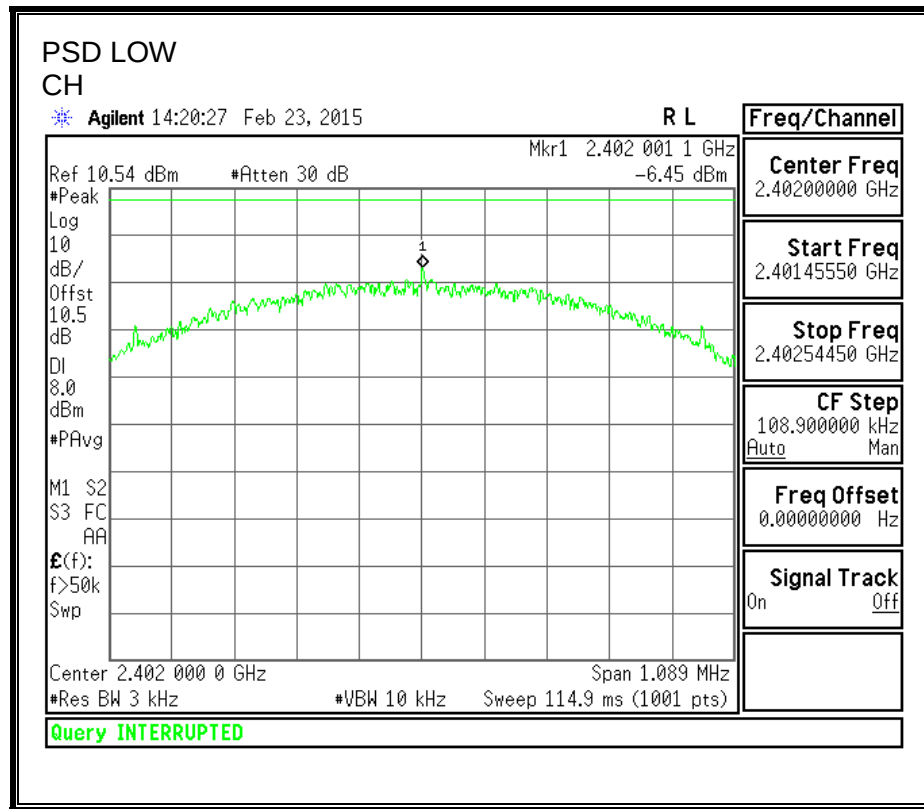
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

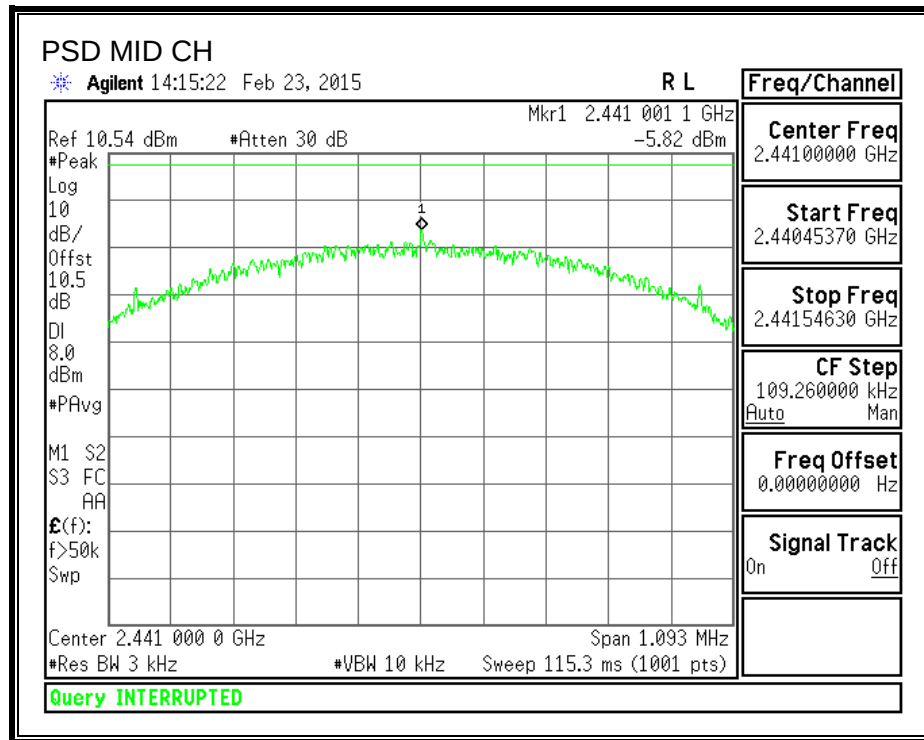
RESULTS

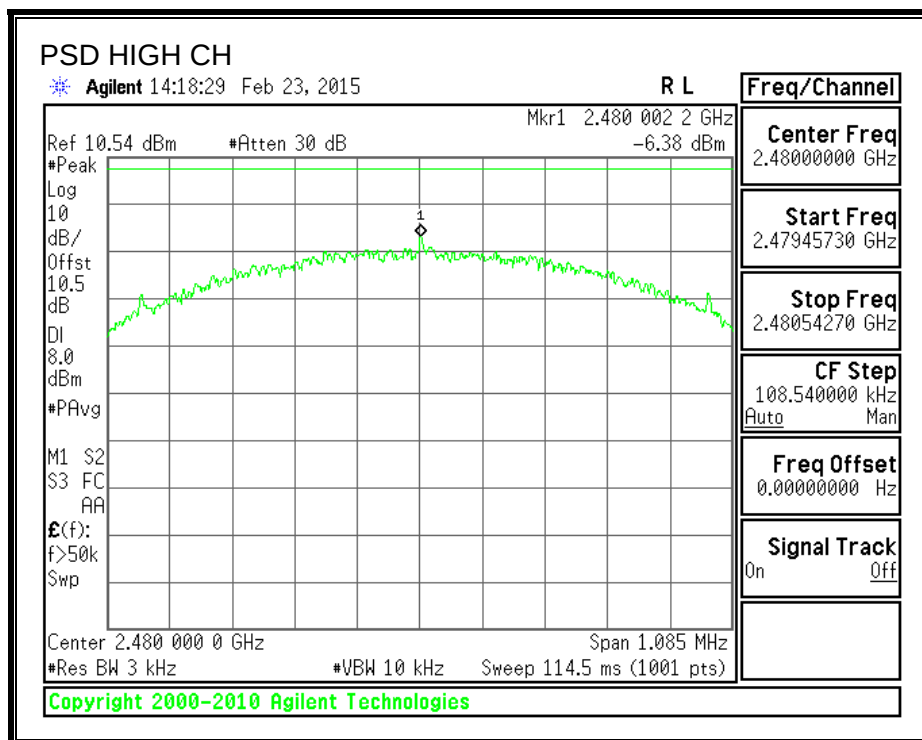
Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-6.45	8	-14.45
Middle	2441	-5.82	8	-13.82
High	2480	-6.38	8	-14.38

Note – For test purposes, 2441 MHz was used for the middle channel. However, in normal operation the middle channel will be 2440 MHz (2 MHz channel separation)

POWER SPECTRAL DENSITY







9.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

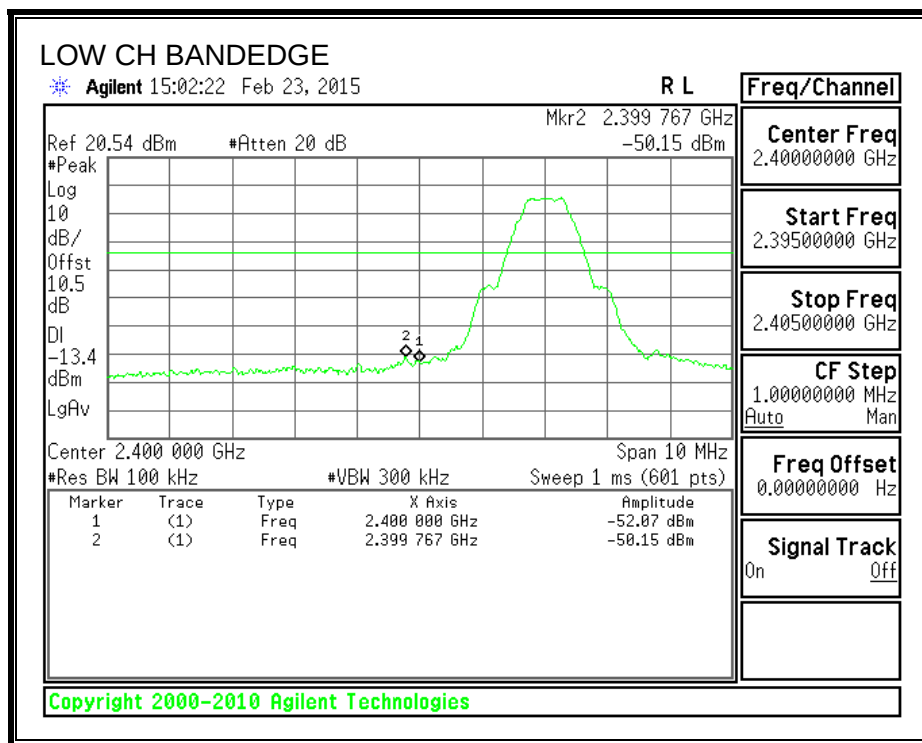
FCC §15.247 (d)

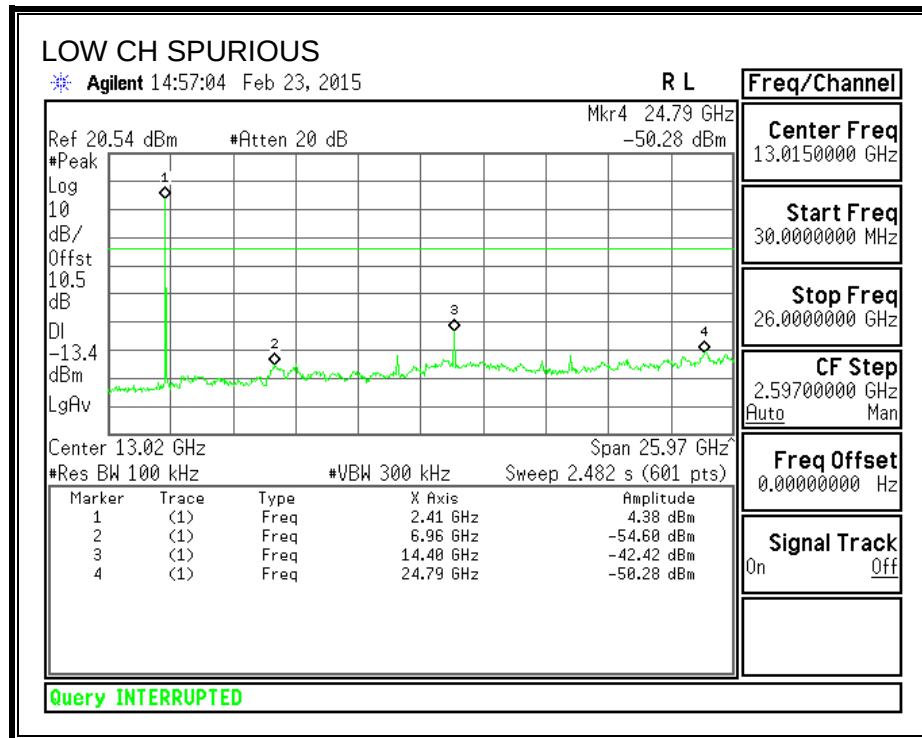
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

Note – For test purposes, 2441 MHz was used for the middle channel. However, in normal operation the middle channel will be 2440 MHz (2 MHz channel separation)

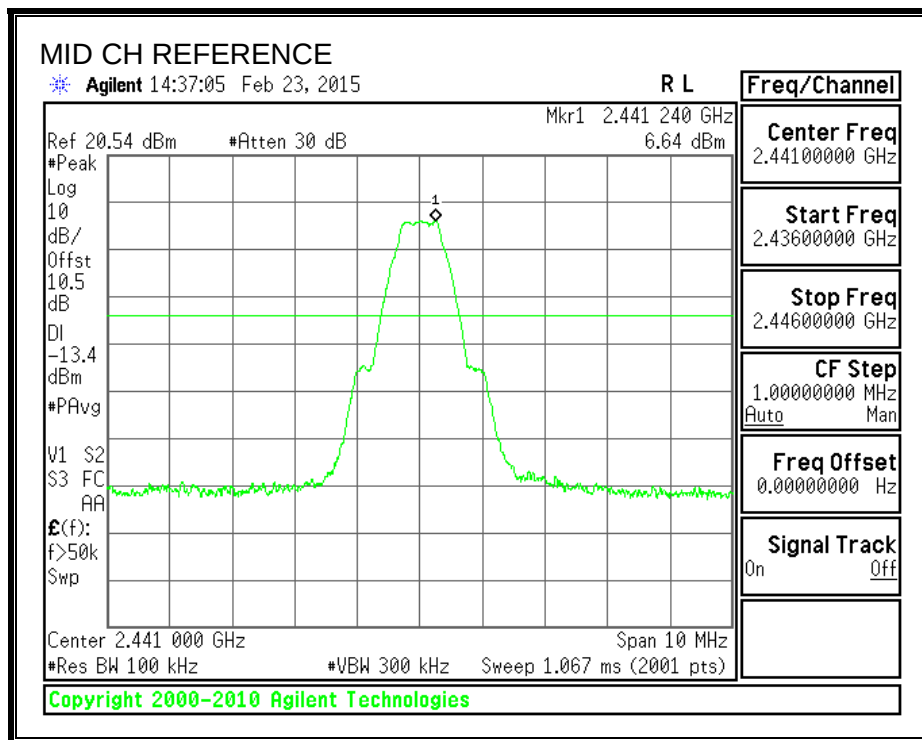
RESULTS

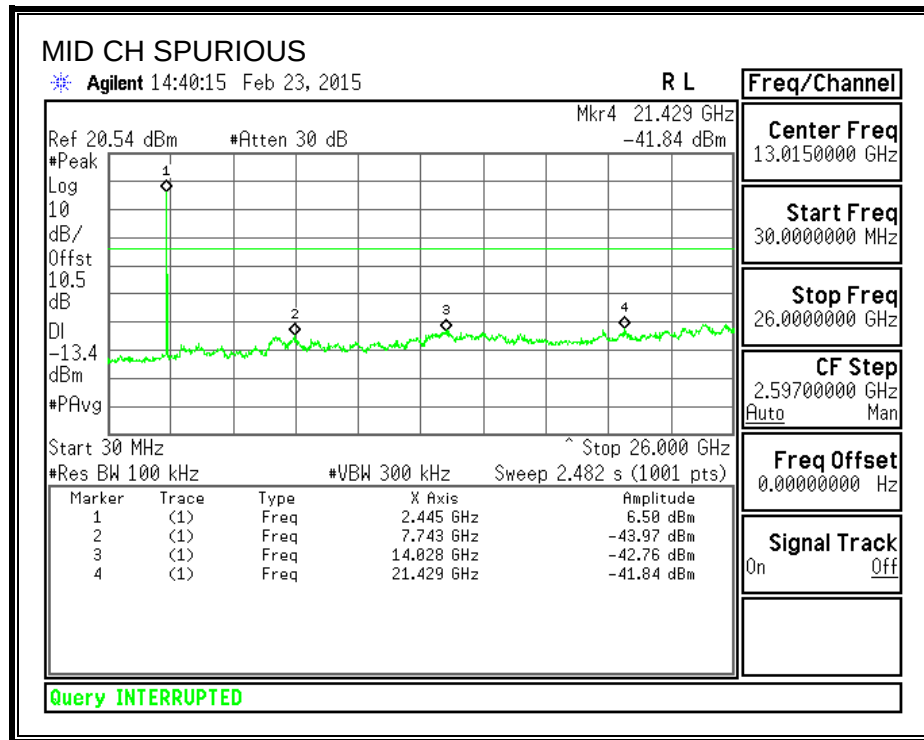
SPURIOUS EMISSIONS, LOW CHANNEL



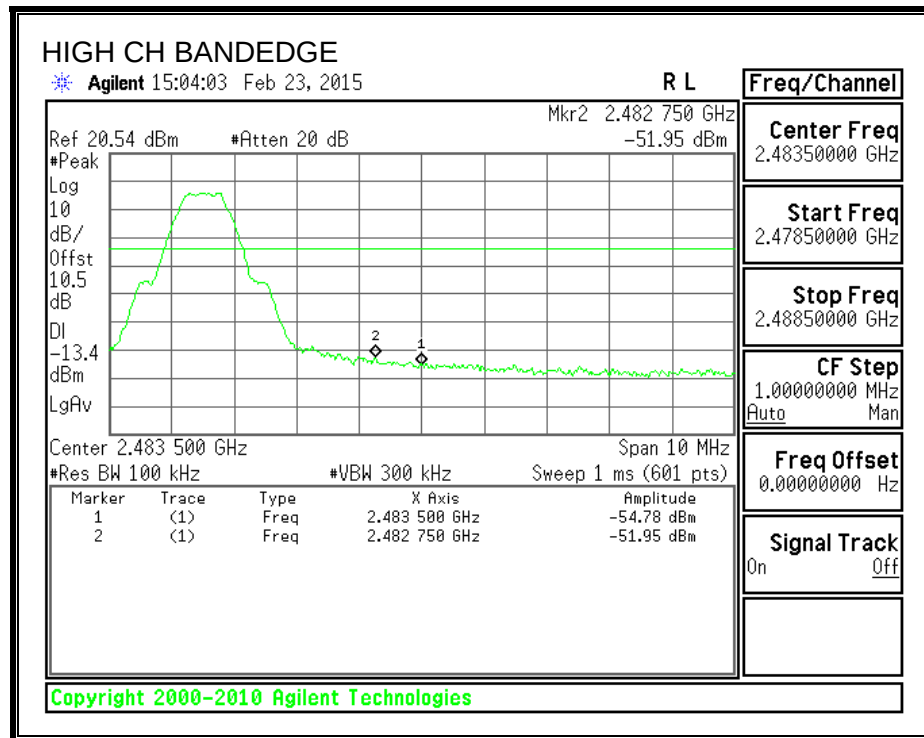


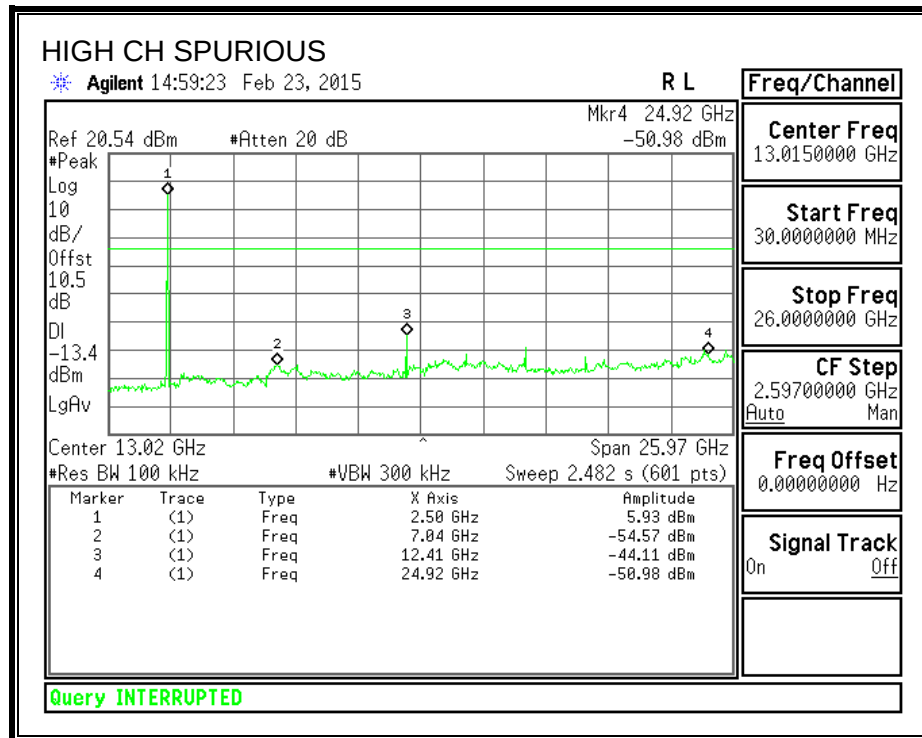
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





10. RADIATED TEST RESULTS

10.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

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 for below 1GHz measurements and 1.5 m above the ground plane for above 1GHz measurements. The antenna to EUT distance is 3 meters.

For measurements below 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 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

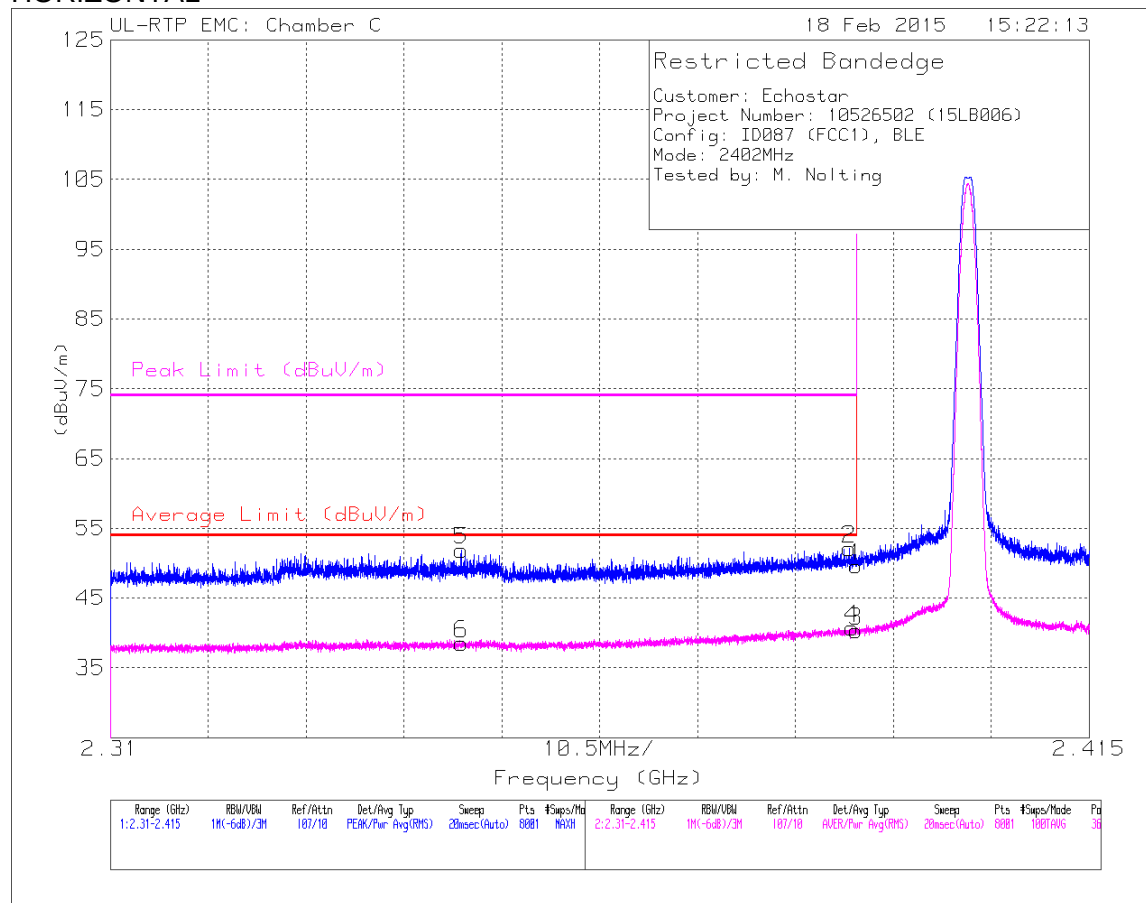
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. TX ABOVE 1 GHz FOR BLUETOOTH LOW ENERGY MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL



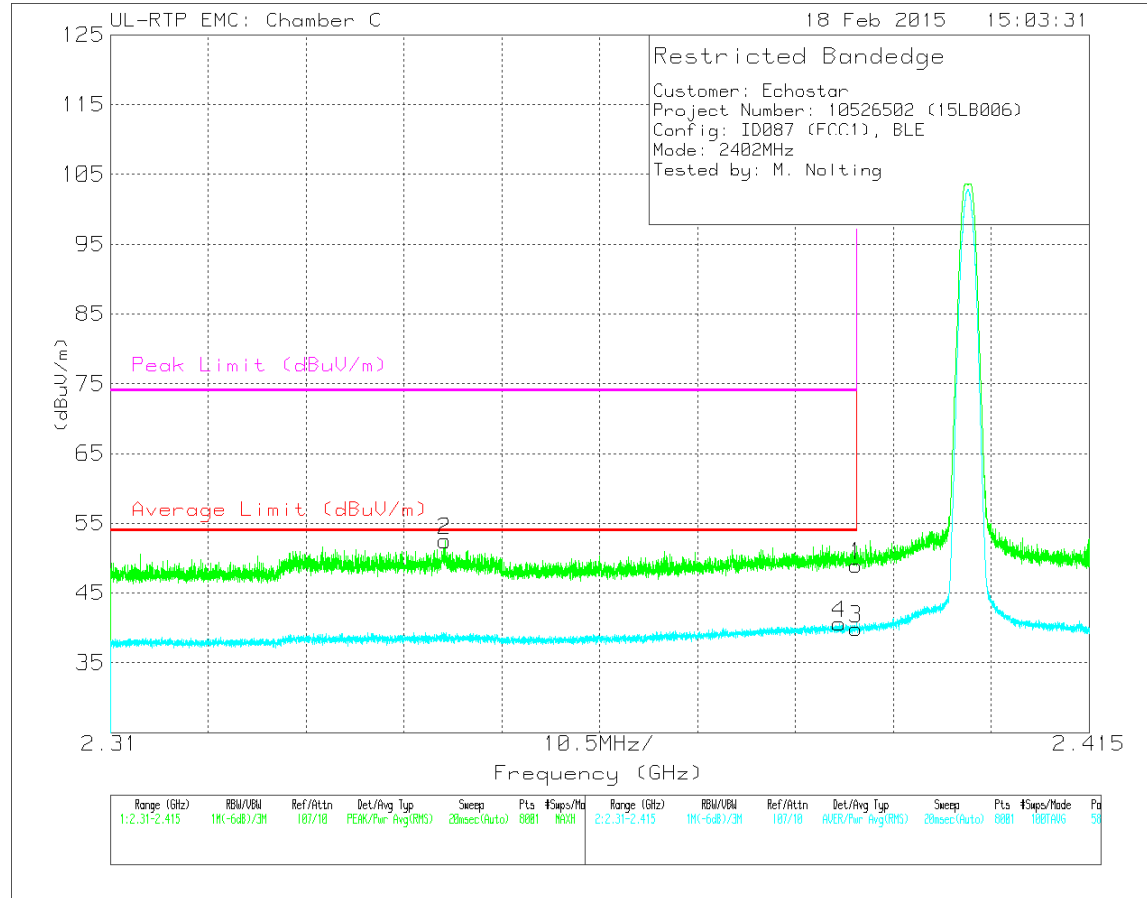
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/ Ftr/Pad	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	43.99	Pk	32.3	-26.7	49.59	-	-	74	-24.41	36	132	H
2	* 2.389	46.49	Pk	32.3	-26.7	52.09	-	-	74	-21.91	36	132	H
5	* 2.348	46.39	Pk	32.2	-26.7	51.89	-	-	74	-22.11	36	132	H
3	* 2.39	34.71	RMS	32.3	-26.7	40.31	54	-13.69	-	-	36	132	H
4	* 2.39	35.1	RMS	32.3	-26.7	40.7	54	-13.3	-	-	36	132	H
6	* 2.348	32.99	RMS	32.2	-26.7	38.49	54	-15.51	-	-	36	132	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/ Fltr/Pad	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.346	47.24	Pk	32.1	-26.8	52.54	-	-	74	-21.46	58	331	V
4	* 2.388	35.04	RMS	32.3	-26.7	40.64	54	-13.36	-	-	58	331	V
1	* 2.39	43.35	Pk	32.3	-26.7	48.95	-	-	74	-25.05	58	331	V
3	* 2.39	34.29	RMS	32.3	-26.7	39.89	54	-14.11	-	-	58	331	V

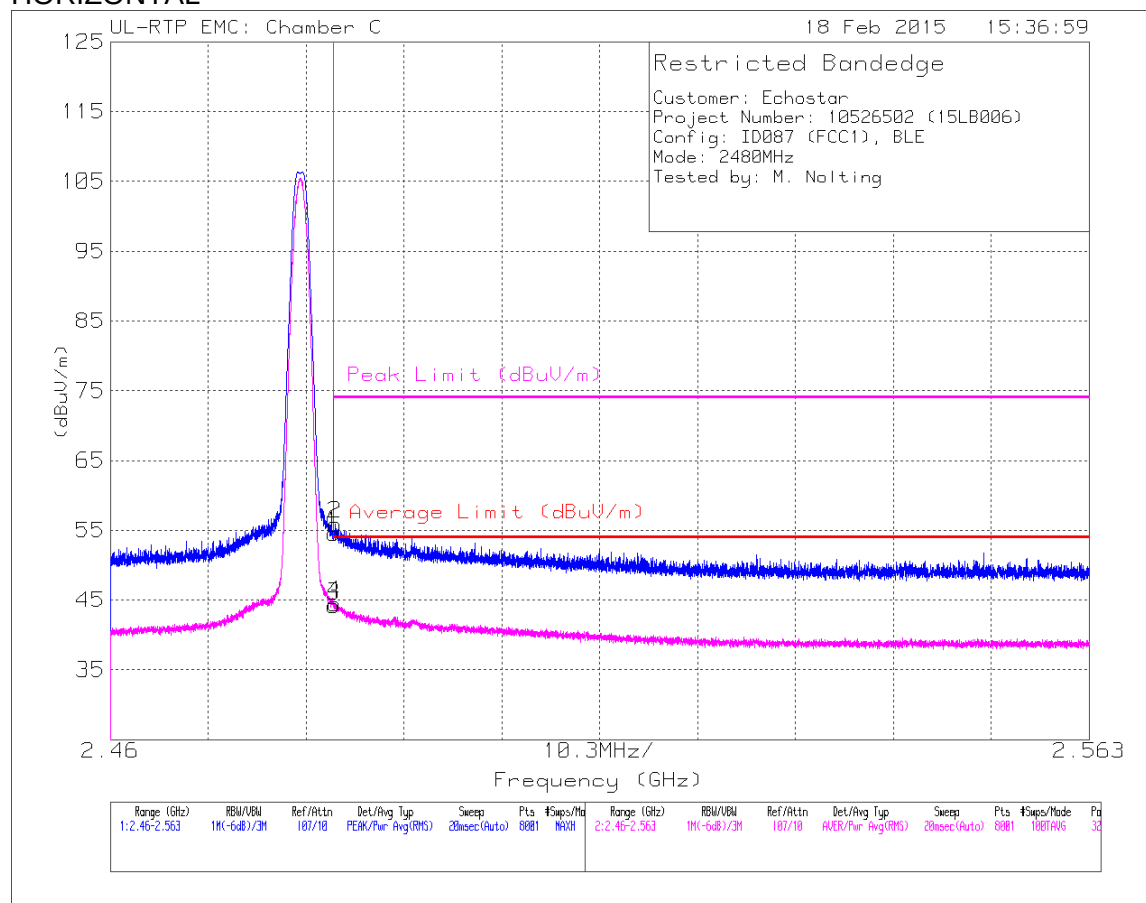
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

RESTRICTED BANDEDGE (HIGH CHANNEL)

HORIZONTAL



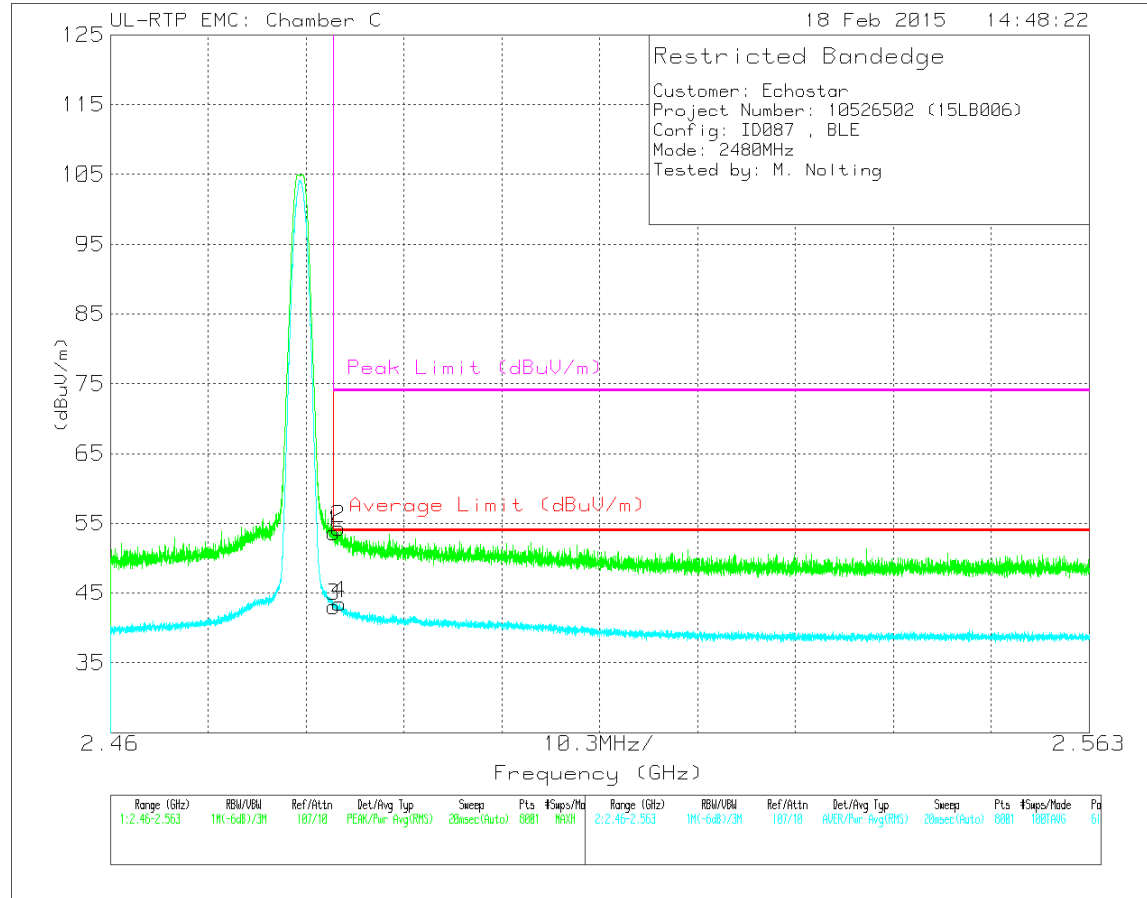
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/ Fltr/Pad	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	48.45	Pk	32.6	-26.5	54.55	-	-	74	-19.45	326	123	H
2	* 2.484	49.8	Pk	32.6	-26.5	55.9	-	-	74	-18.1	326	123	H
3	* 2.484	38.08	RMS	32.6	-26.5	44.18	54	-9.82	-	-	326	123	H
4	* 2.484	38.35	RMS	32.6	-26.5	44.45	54	-9.55	-	-	326	123	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL



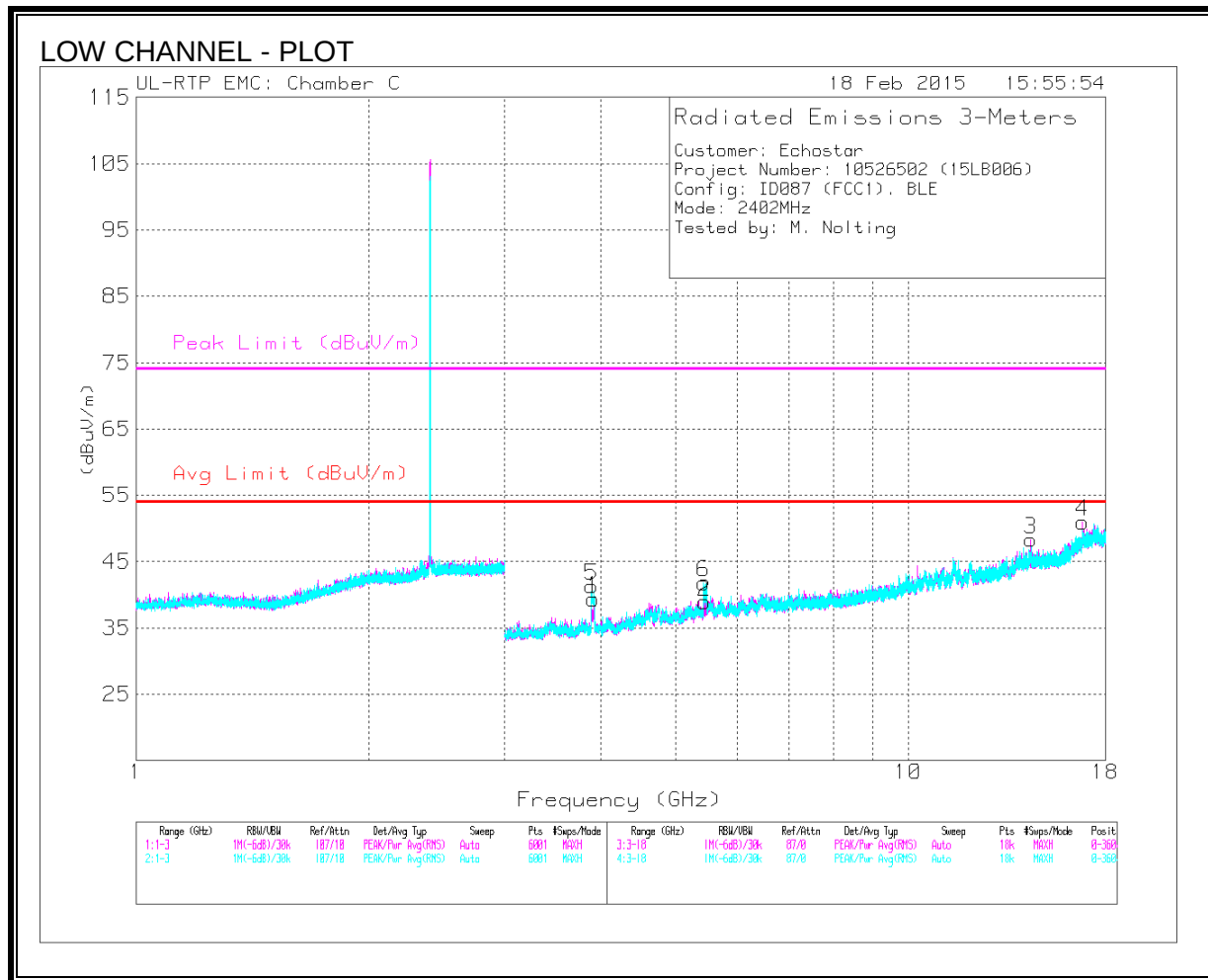
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/ Ftr/Pad	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	47.53	Pk	32.6	-26.5	53.63	-	-	74	-20.37	61	344	V
2	* 2.484	48.19	Pk	32.6	-26.5	54.29	-	-	74	-19.71	61	344	V
3	* 2.484	36.95	RMS	32.6	-26.5	43.05	54	-10.95	-	-	61	344	V
4	* 2.484	37.39	RMS	32.6	-26.5	43.49	54	-10.51	-	-	61	344	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS



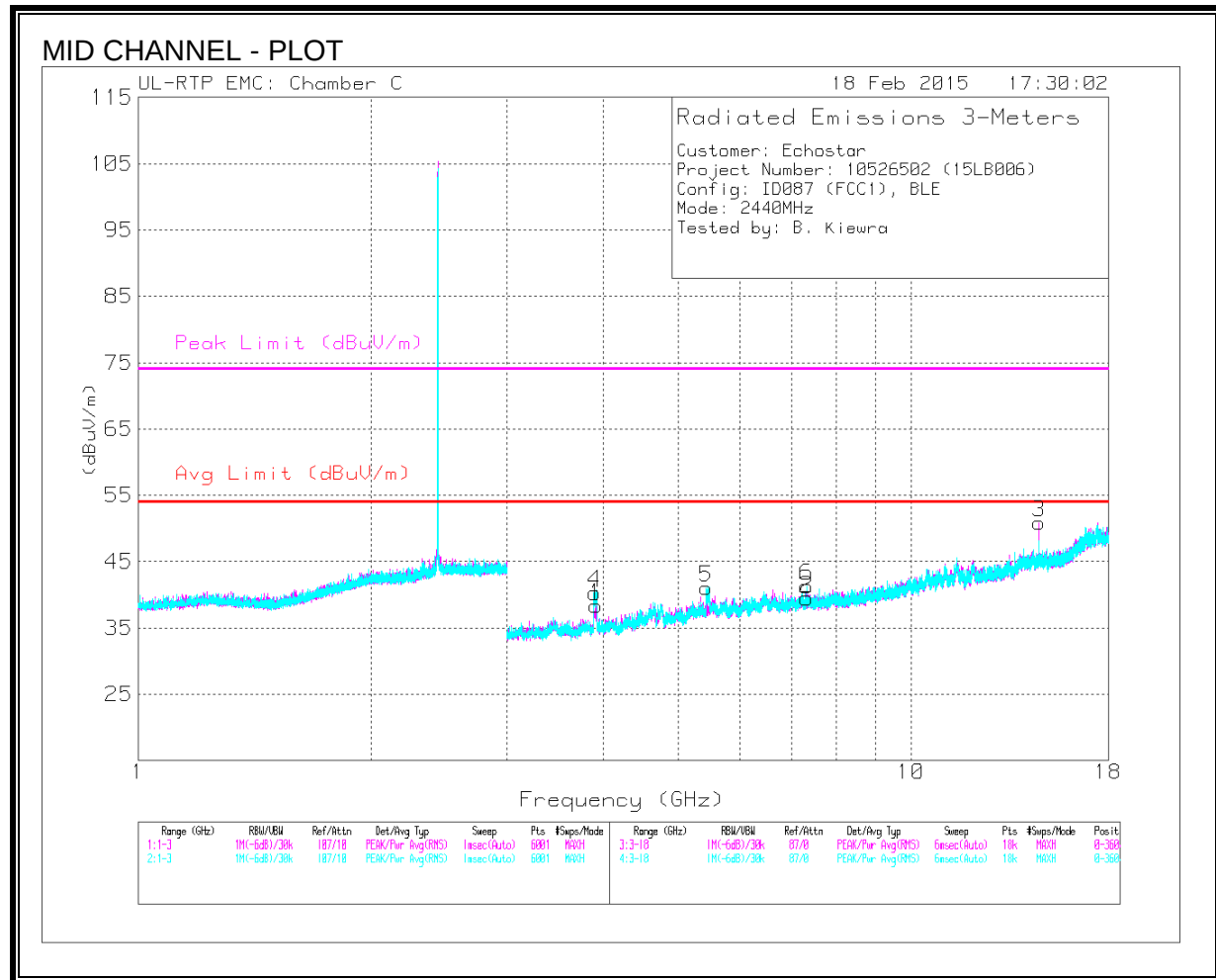
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 3.891	52.03	PK2	33.7	-34.5	51.23	-	-	74	-22.77	128	390	H
	* 3.885	36.02	MAv1	33.7	-34.5	35.22	54	-18.78	-	-	128	390	H
2	* 5.446	45.51	PK2	35.8	-32	49.31	-	-	74	-24.69	132	266	H
	* 5.458	31.29	MAv1	35.8	-31.9	35.19	54	-18.81	-	-	132	266	H
5	* 3.891	51.59	PK2	33.7	-34.5	50.79	-	-	74	-23.21	81	251	V
	* 3.885	35.95	MAv1	33.7	-34.5	35.15	54	-18.85	-	-	81	251	V
6	* 5.447	47.59	PK2	35.8	-32	51.39	-	-	74	-22.61	90	310	V
	* 5.454	32.18	MAv1	35.8	-32	35.98	54	-18.02	-	-	90	310	V
3	14.412	31.01	Pk	39.8	-22.5	48.31	-	-	74	-25.69	0-360	250	H
4	16.814	29.88	Pk	42.2	-21.1	50.98	-	-	74	-23.02	0-360	250	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average



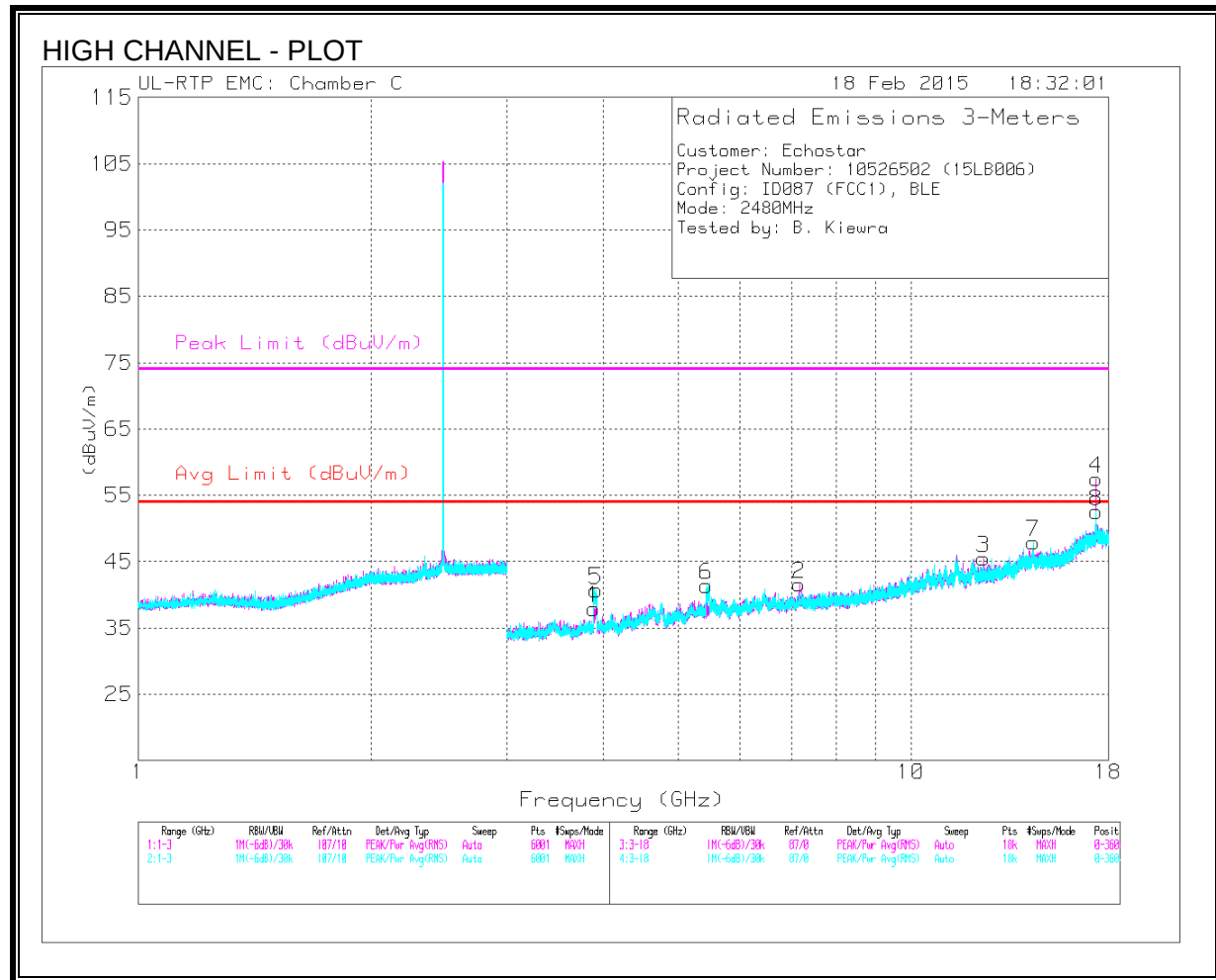
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/ Fltr/Pad	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 3.89	52.1	PK2	33.7	-34.5	51.3	-	-	74	-22.7	128	390	H
	* 3.885	36.13	MAv1	33.7	-34.5	35.33	54	-18.67	-	-	128	390	H
2	* 7.323	42.74	PK2	36.2	-29.1	49.84	-	-	74	-24.16	31	254	H
	* 7.323	31.5	MAv1	36.2	-29.1	38.6	54	-15.4	-	-	31	254	H
4	* 3.89	51.39	PK2	33.7	-34.5	50.59	-	-	74	-23.41	81	251	V
	* 3.886	36.2	MAv1	33.7	-34.5	35.4	54	-18.6	-	-	81	251	V
5	* 5.436	46.65	PK2	35.8	-31.9	50.55	-	-	74	-23.45	90	343	V
	* 5.457	32.18	MAv1	35.8	-31.9	36.08	54	-17.92	-	-	90	343	V
6	* 7.323	43.7	PK2	36.2	-29.1	50.8	-	-	74	-23.2	300	230	V
	* 7.323	33.68	MAv1	36.2	-29.1	40.78	54	-13.22	-	-	300	230	V
3	14.647	34.17	Pk	39.9	-23.2	50.87	-	-	74	-23.13	0-360	250	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 3.89	49.14	PK2	33.7	-34.5	48.34	-	-	74	-25.66	240	300	H
	* 3.891	34.46	MAv1	33.7	-34.5	33.66	54	-20.34	-	-	240	300	H
2	7.165	34.61	Pk	36.2	-29.2	41.61	-	-	74	-32.39	0-360	250	H
3	* 12.4	41.31	PK2	39.3	-26	54.61	-	-	74	-19.39	227	250	H
	* 12.4	30.5	MAv1	39.3	-26	43.8	54	-10.2	-	-	227	250	H
4	17.36	35.5	Pk	42.2	-20.2	57.5	-	-	74	-16.5	0-360	250	H
5	* 3.89	50.87	PK2	33.7	-34.5	50.07	-	-	74	-23.93	76	215	V
	* 3.886	35.92	MAv1	33.7	-34.5	35.12	54	-18.88	-	-	76	215	V
6	* 5.446	47.59	PK2	35.8	-32	51.39	-	-	74	-22.61	79	210	V
	* 5.457	32.26	MAv1	35.8	-31.9	36.16	54	-17.84	-	-	79	210	V
7	14.396	30.33	Pk	39.8	-22.2	47.93	-	-	74	-26.07	0-360	250	V
8	17.36	30.55	Pk	42.2	-20.2	52.55	-	-	74	-21.45	0-360	250	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

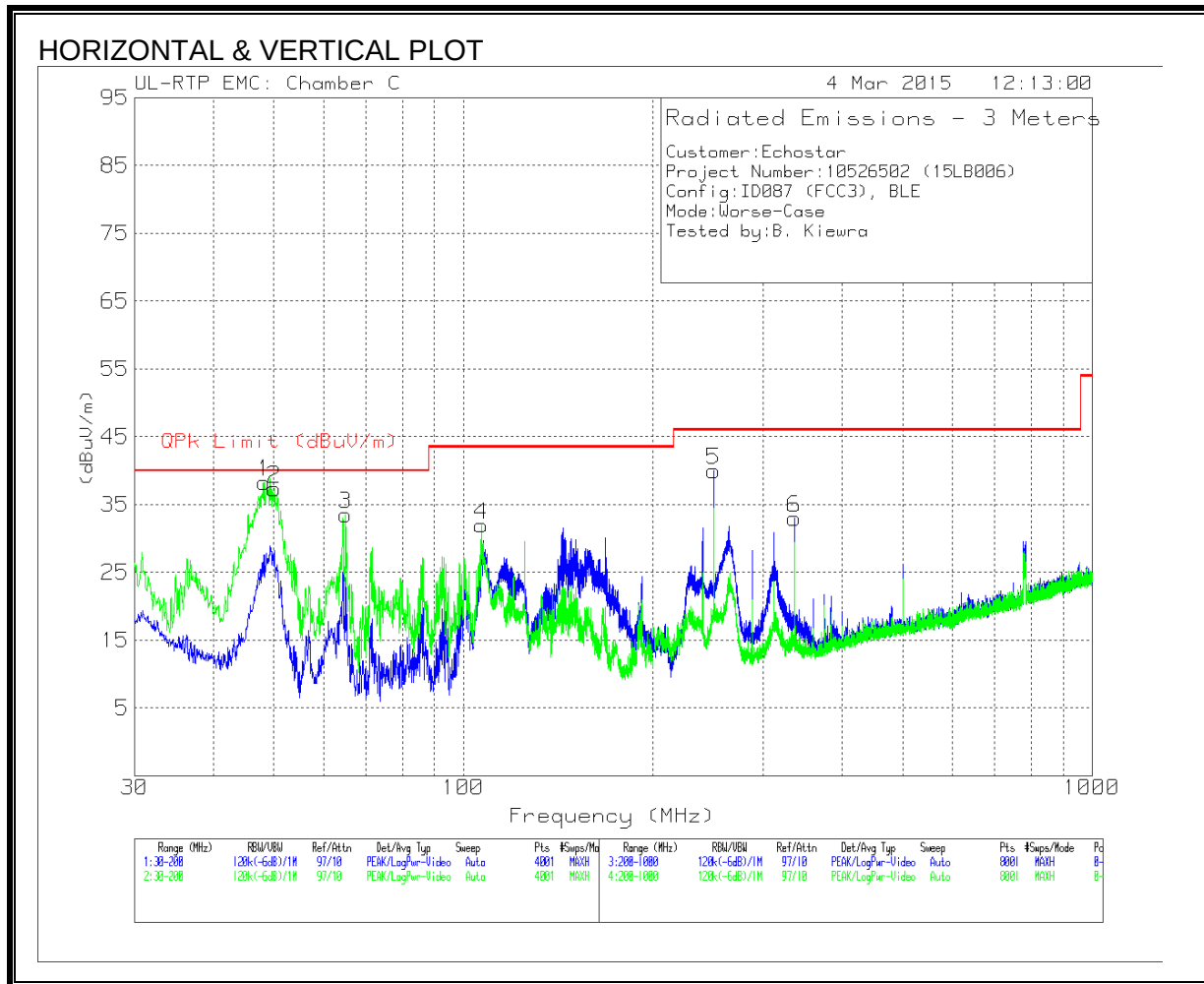
Pk - Peak detector

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

10.3. WORST-CASE BELOW 1 GHz

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



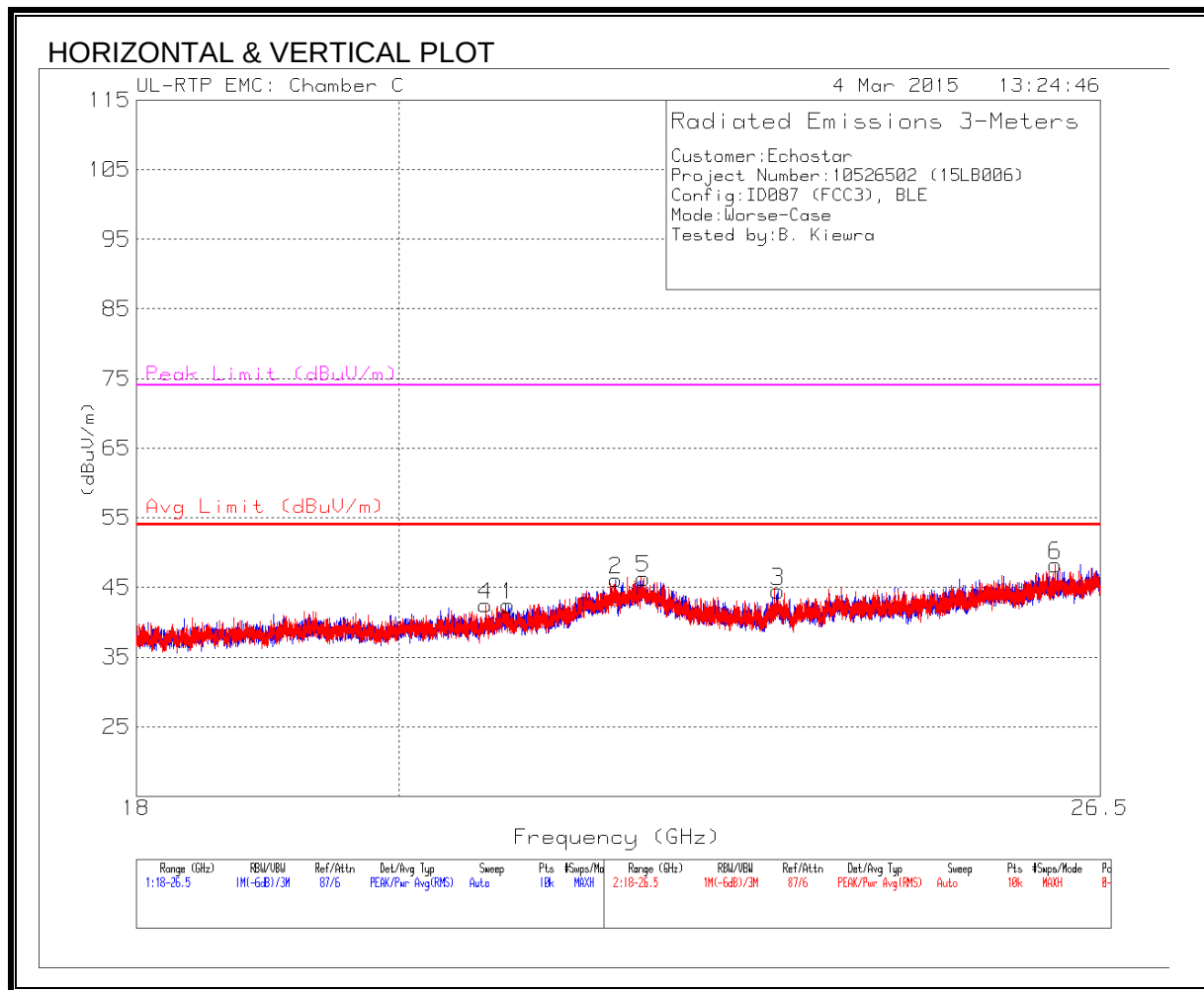
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0066 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	* 250	58.8	Qp	11.5	-30	40.3	46.02	-5.72	256	105	H
1	47.7845	58.7	Qp	8.8	-31.4	36.1	40	-3.9	52	101	V
2	49.318	56.94	Qp	8.1	-31.4	33.64	40	-6.36	31	108	V
3	64.9775	56.46	Pk	8.3	-31.2	33.56	40	-6.44	0-360	101	V
4	106.925	50.68	Pk	12.1	-30.8	31.98	43.52	-11.54	0-360	101	V
6	336.3	48.78	Pk	13.9	-29.7	32.98	46.02	-13.04	0-360	101	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

10.4. WORST-CASE 18-26GHz

SPURIOUS EMISSIONS 18 TO 26GHz (WORST-CASE CONFIGURATION)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0063 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 20.897	41.27	Pk	33.5	-32.3	42.47	54	-11.53	74	-31.53	0-360	250	H
4	* 20.707	41.88	Pk	33	-32.4	42.48	54	-11.52	74	-31.52	0-360	151	V
5	* 22.064	41.26	Pk	36.9	-31.8	46.36	54	-7.64	74	-27.64	0-360	250	V
2	21.82	41.42	Pk	36.5	-31.8	46.12	-	-	74	-27.88	0-360	250	H
3	23.286	41.97	Pk	33.5	-31	44.47	-	-	74	-29.53	0-360	150	H
6	26.029	42.53	Pk	34	-28.3	48.23	-	-	74	-25.77	0-360	151	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

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

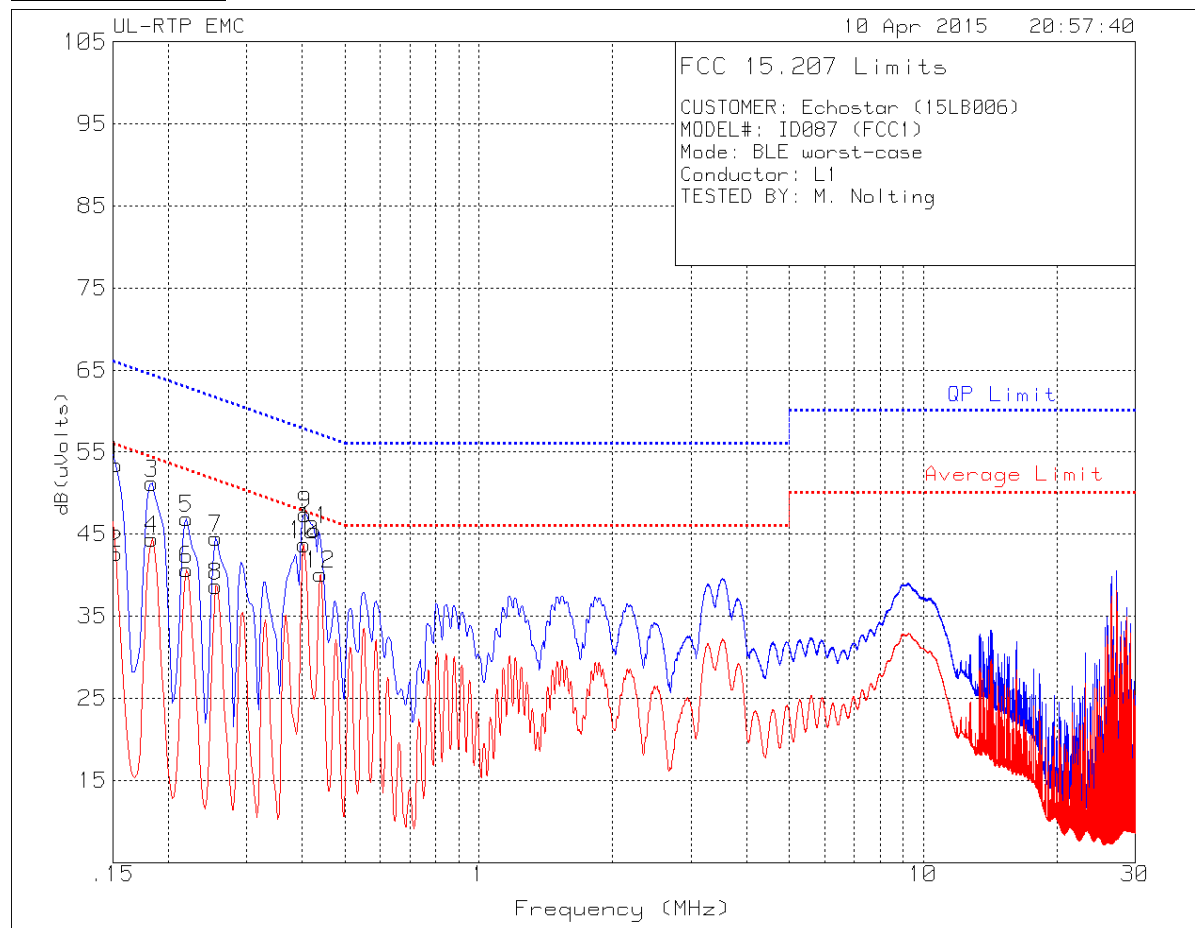
^{*} Decreases with the logarithm of the frequency.

TEST PROCEDURE

Consistent with ANSI C63.4 and ANSI C63.10.

RESULTS

LINE 1 RESULTS

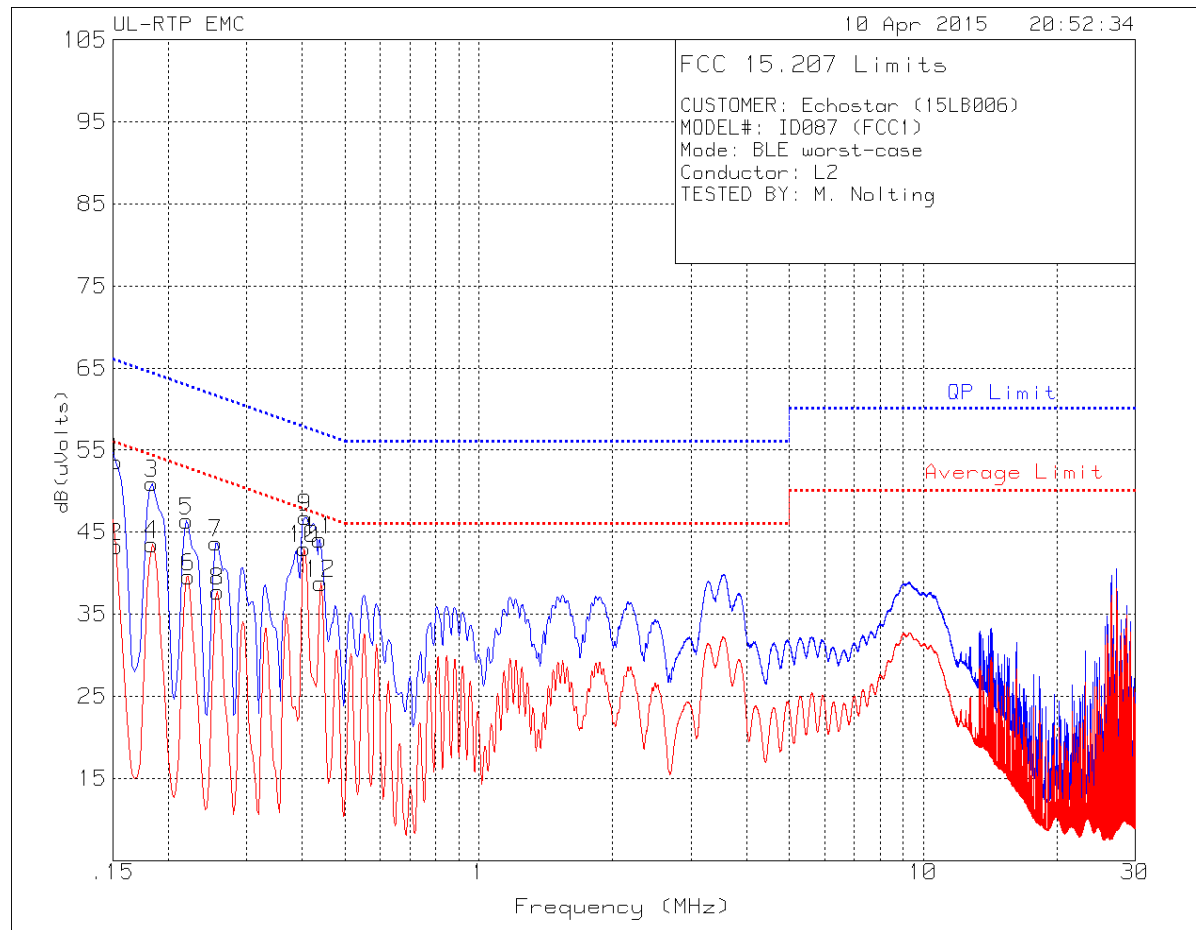


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN (dB)	Limiter & Cable (dB)	Corrected Reading (dBuV)	QP Limit	QP Margin (dB)	Average Limit	Average Margin (dB)
1	.15225	43.65	Qp	.4	9.4	53.45	65.88	-12.43	-	-
2	.15225	32.84	Ca	.4	9.4	42.64	-	-	55.88	-13.24
3	.18375	41.52	Qp	.3	9.4	51.22	64.31	-13.09	-	-
4	.18375	34.7	Ca	.3	9.4	44.4	-	-	54.31	-9.91
5	.21975	37.29	Qp	.2	9.4	46.89	62.83	-15.94	-	-
6	.21975	31.07	Ca	.2	9.4	40.67	-	-	52.83	-12.16
7	.25575	34.92	Qp	.2	9.4	44.52	61.57	-17.05	-	-
8	.25575	29.07	Ca	.2	9.4	38.67	-	-	51.57	-12.9
10	.40425	34.25	Ca	.1	9.4	43.75	-	-	47.77	-4.02
9	.4065	37.91	Qp	.1	9.4	47.41	57.72	-10.31	-	-
11	.42675	36.03	Qp	.1	9.4	45.53	57.32	-11.79	-	-
12	.44025	30.63	Ca	.1	9.4	40.13	-	-	47.06	-6.93

Qp - Quasi-Peak detector

Ca - CISPR average detection

LINE 2 RESULTS



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN (dB)	Limiter & Cable (dB)	Corrected Reading (dBuV)	QP Limit	QP Margin (dB)	Average Limit	Average Margin (dB)
1	.15225	43.78	Qp	.4	9.4	53.58	65.88	-12.3	-	-
2	.15225	33.46	Ca	.4	9.4	43.26	-	-	55.88	-12.62
3	.18375	41.24	Qp	.3	9.4	50.94	64.31	-13.37	-	-
4	.18375	33.82	Ca	.3	9.4	43.52	-	-	54.31	-10.79
5	.21975	36.77	Qp	.2	9.4	46.37	62.83	-16.46	-	-
6	.222	29.99	Ca	.2	9.4	39.59	-	-	52.74	-13.15
7	.25575	34.08	Qp	.2	9.4	43.68	61.57	-17.89	-	-
8	.258	28.17	Ca	.2	9.4	37.77	-	-	51.5	-13.73
10	.40425	33.5	Ca	.1	9.4	43	-	-	47.77	-4.77
9	.4065	37.3	Qp	.1	9.4	46.8	57.72	-10.92	-	-
11	.438	34.57	Qp	.1	9.4	44.07	57.1	-13.03	-	-
12	.44025	29.28	Ca	.1	9.4	38.78	-	-	47.06	-8.28

Qp - Quasi-Peak detector

Ca - CISPR average detection