



CERTIFICATION TEST REPORT

Report Number. : 11747459 - E1V3

Applicant : ECHOSTAR TECHNOLOGIES,LLC
94 INVERNESS TERRACE EAST
ENGLEWOOD, CO 80112,U.S.A

FCC ID : DKNJ2

IC ID : 1707A-J2

EUT Description : RF4CE ZIGBEE RADIO

Test Standard(s) : FCC CFR47 PART 15 SUBPART C

Date Of Issue:

July 10, 2017

Prepared by:

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NVLAP LAB CODE 200065-0

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	06/23/17	Initial Issue	D. Coronia
V2	07/06/17	Updated Section 5.2, 5.5 9.1, 9.2, 10 & 11	D. Coronia
V3	07/10/17	Updated Section 5.2 & 8.4 and remove IC standard reference	E.Yu

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Echostar Technologies LLC

EUT DESCRIPTION: RF4CE ZIGBEE RADIO

MODEL: JOEY 3.0 E97

SERIAL NUMBER: RBEXSD00303D (Conducted),
RBEXSD00254D (Radiated)

DATE TESTED: JUNE 14- JULY 10, 2017

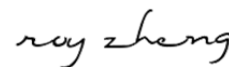
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass

UL Verification Services Inc. 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 Verification Services Inc. 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 Verification Services Inc. and all revisions are duly noted in the revision section. Any alteration of this document not carried out by UL Verification Services Inc. 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.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, and FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
<input type="checkbox"/> Chamber A(IC: 2324B-1)	<input type="checkbox"/> Chamber D(IC: 22541-1)
<input type="checkbox"/> Chamber B(IC: 2324B-2)	<input type="checkbox"/> Chamber E(IC: 22541-2)
<input checked="" type="checkbox"/> Chamber C(IC: 2324B-3)	<input type="checkbox"/> Chamber F(IC: 22541-3)
	<input type="checkbox"/> Chamber G(IC: 22541-4)
	<input type="checkbox"/> Chamber H(IC: 22541-5)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

Chambers A through C are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-3, respectively. Chambers D through H are covered under Industry Canada company address code 22541 with site numbers 22541 -1 through 22541-5, respectively.

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:

Parameter	Uncertainty
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a RF4CE Zigbee Radio.

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)
2425-2475	ZIGBEE	6.46	4.43

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an FPCB antenna, with a maximum gain of 0dBi.

5.4. WORST-CASE CONFIGURATION AND MODE

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

The EUT can only be investigated in orientations X, therefore, all final radiated testing was performed with the EUT in X orientation.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	Liteon	PB-1180-6ES1	ETC1620121353	N/A
Support Host	Echostar	JOEY 3.0 E97	RBEXSD00254D	N/A
IR remote	N/A	N/A	N/A	N/A
Laptop	Lenovo	T460	PC0C3DUA	DoC
AC/DC Adapter	Lenovo	ADLX65NCC2A	11S45N0263Z1ZS9946S904	DoC

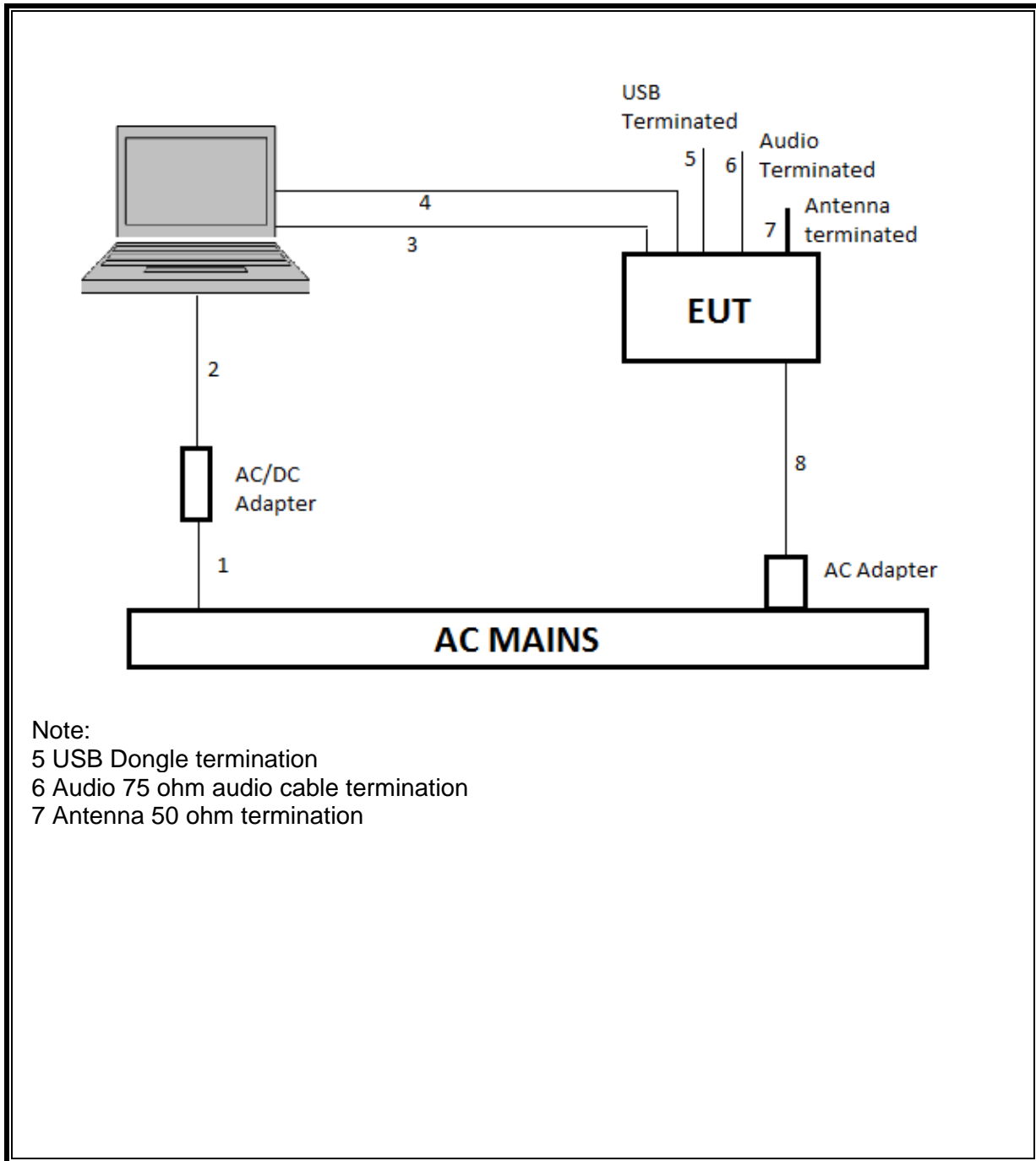
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-Shielded	1.2	AC Mains to AC/DC Adapter
2	DC	1	DC	Un-Shielded	1.5	AC/DC Adapter to Laptop
3	HDMI	1	HDMI	Shielded	1.2	Laptop to EUT
4	Ethernet	1	RJ45	Un-Shielded	1.5	Laptop to EUT
5	USB	1	USB	Un-Shielded	0.1	USB Dongle
6	Audio	1	Audio	Shielded	0.5	Audio cable
7	TNC	1	TNC	Shielded	0.1	NA
8	AC	1	AC	Un-Shielded	1.2	AC Mains to EUT

TEST SETUP

EUT was controlled with IR remote to enable ZIGBEE communications.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
Antenna, Broadband Hybrid 30MHz to 2000MHz	Sunol Sciences	JB3	408	11/10/17
Antenna, Active Loop 9kHz-30MHz	ETS-Lindgren	6502	T1683	02/17/18
Antenna, Horn 1-18GHz	ETS Lindgren	3117	712	01/30/18
Amplifier, 1-18GHz	Miteq	AFS42-00101800-25-S-42	931	08/26/17
Amplifier, 10kHz-1GHz	Agilent (Keysight) Technologies	8447D	T15	08/26/17
Amplifier, 1-8 GHz	MITEQ	AMF-4D-01000800-30-29P	1156	02/15/18
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	905	01/11/18

Test Software List			
Description	Manufacturer	Model	Version
Radiated Software	UL	UL EMC	Ver 9.5, June 24, 2015
Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015
Antenna Port Software	UL	UL RF	Ver 3.9.1, Dec 28, 2015

7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
15.247 (a)(2)	Occupied Bandwidth (6dB)	>500KHz	Conducted	Pass
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-20dBc		Pass
15.247	TX conducted output power	<30dBm		Pass
15.247	PSD	<8dBm		Pass
15.207 (a)	AC Power Line conducted emissions	Section 10	Radiated	Pass
15.205, 15.209	Radiated Spurious Emission	< 54dBuV/m		Pass

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME, DUTY CYCLE

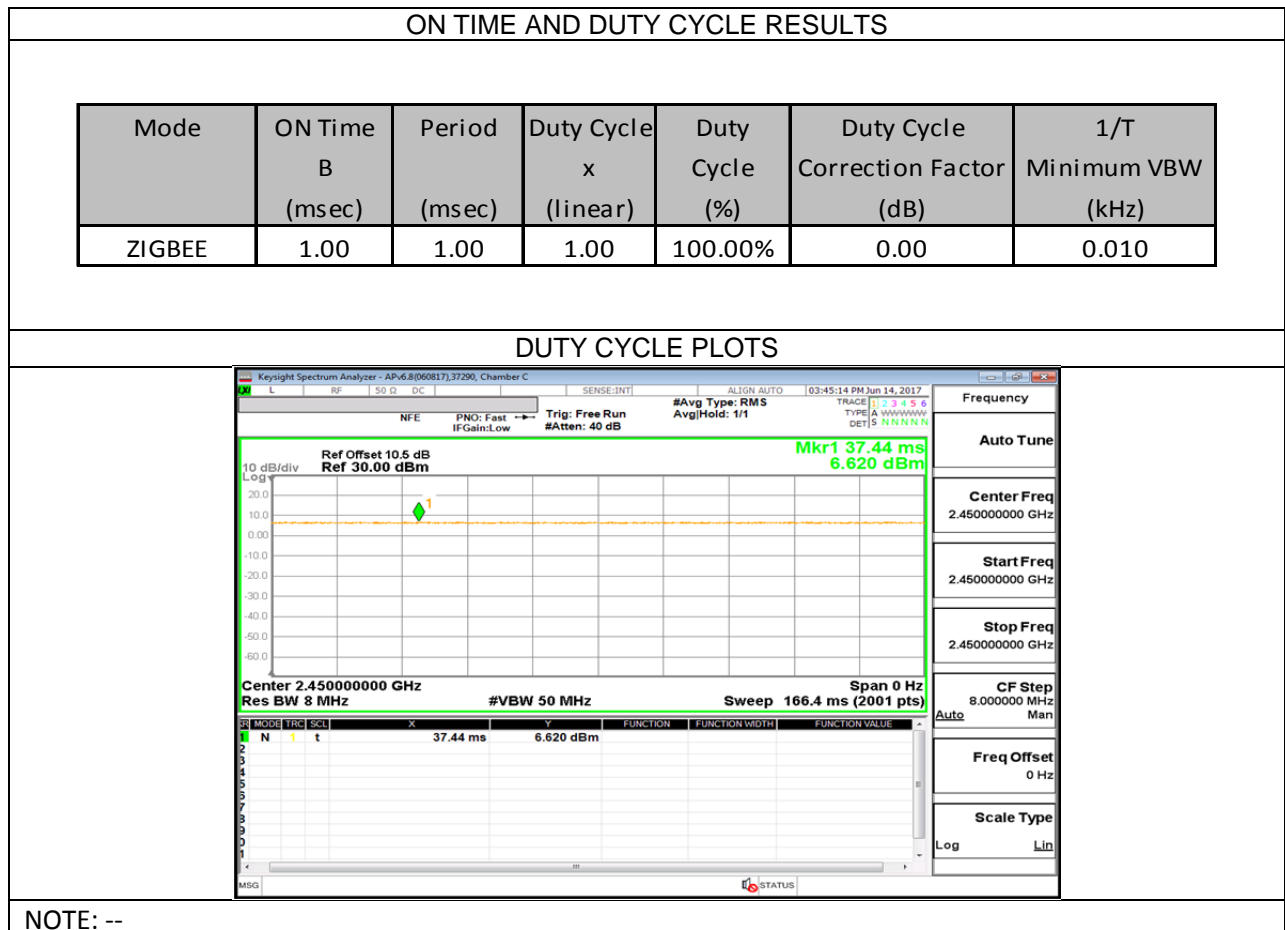
LIMITS

None; for reporting purposes only

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method

RESULTS



8.2. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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

8.2.1. 6 dB BANDWIDTH PLOTS AND TABLE



8.3. 99% BANDWIDTH

LIMITS

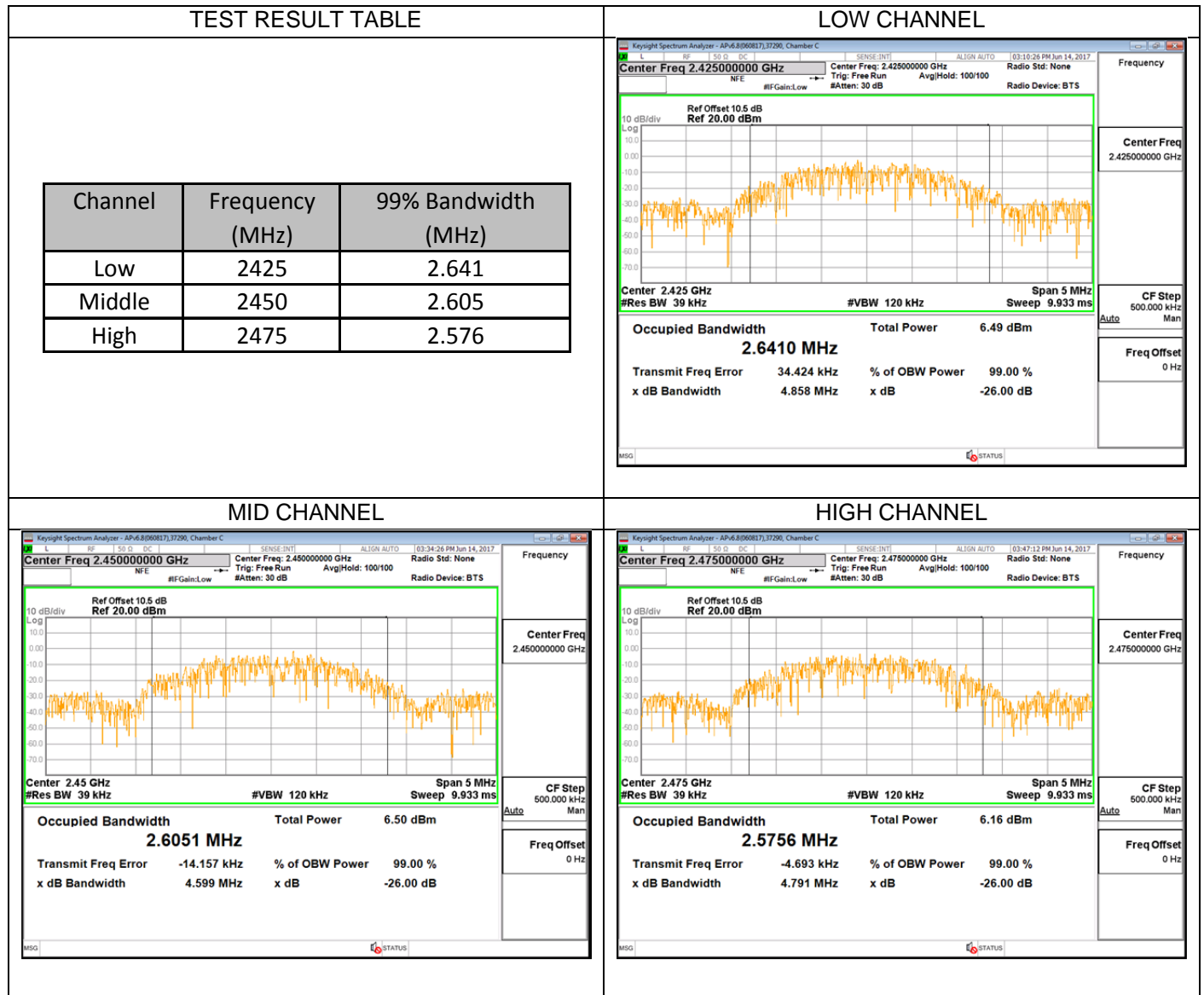
None; for reporting purposes only.

TEST PROCEDURE

Refer to KDB558074 D01 DTS Meas Guidance v04: 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

8.3.1. 99% BANDWIDTH PLOTS AND TABLE



8.4. OUTPUT POWER

LIMITS

FCC §15.247

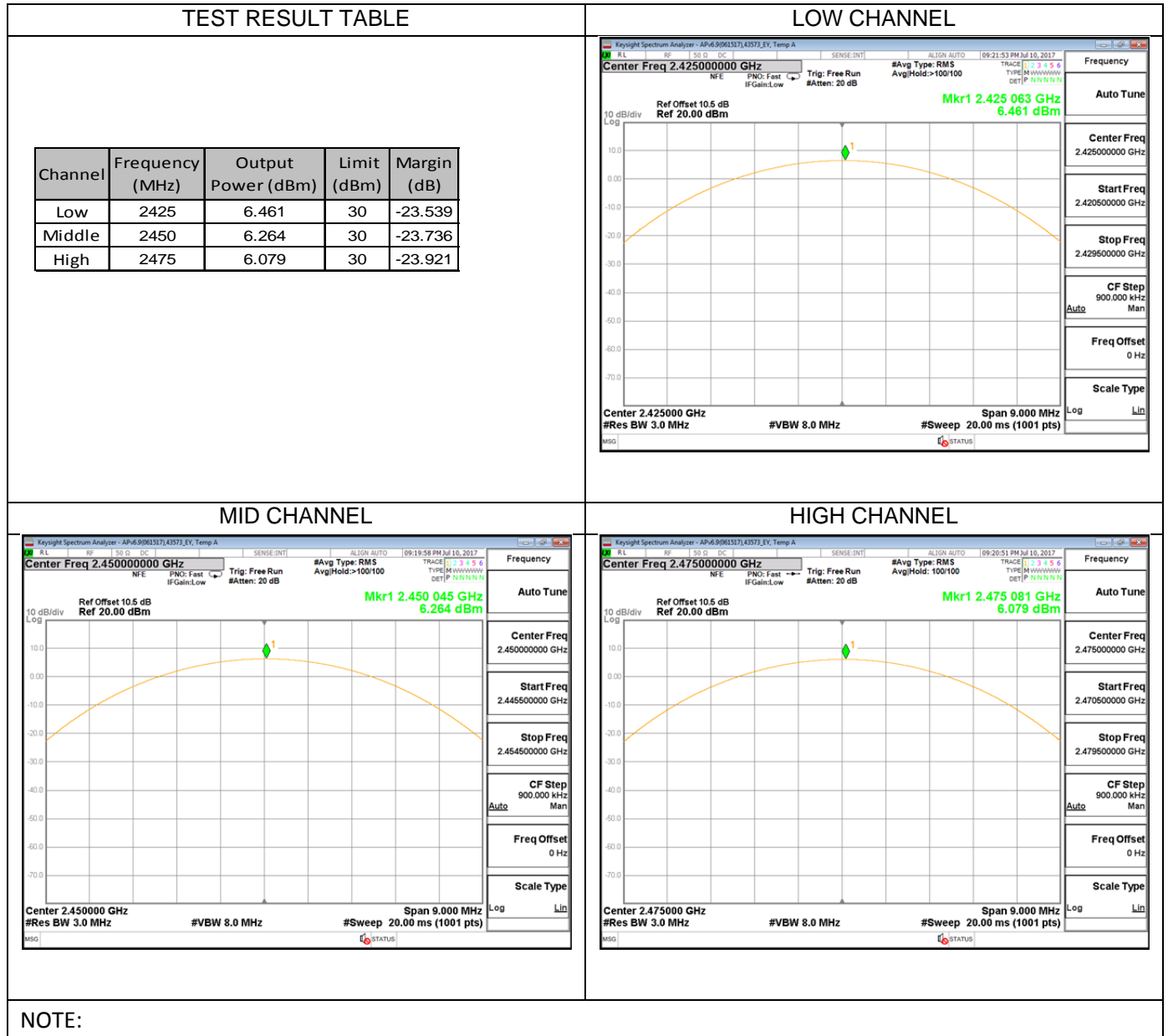
The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

Peak power is measured using KDB558074 D01 DTS Meas Guidance v04 spectrum analyzer.

RESULTS

8.4.1. OUTPUT POWER PLOTS



8.5. 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 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2425	6.100
Middle	2450	5.980
High	2475	5.840

NOTE: --

8.6. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247

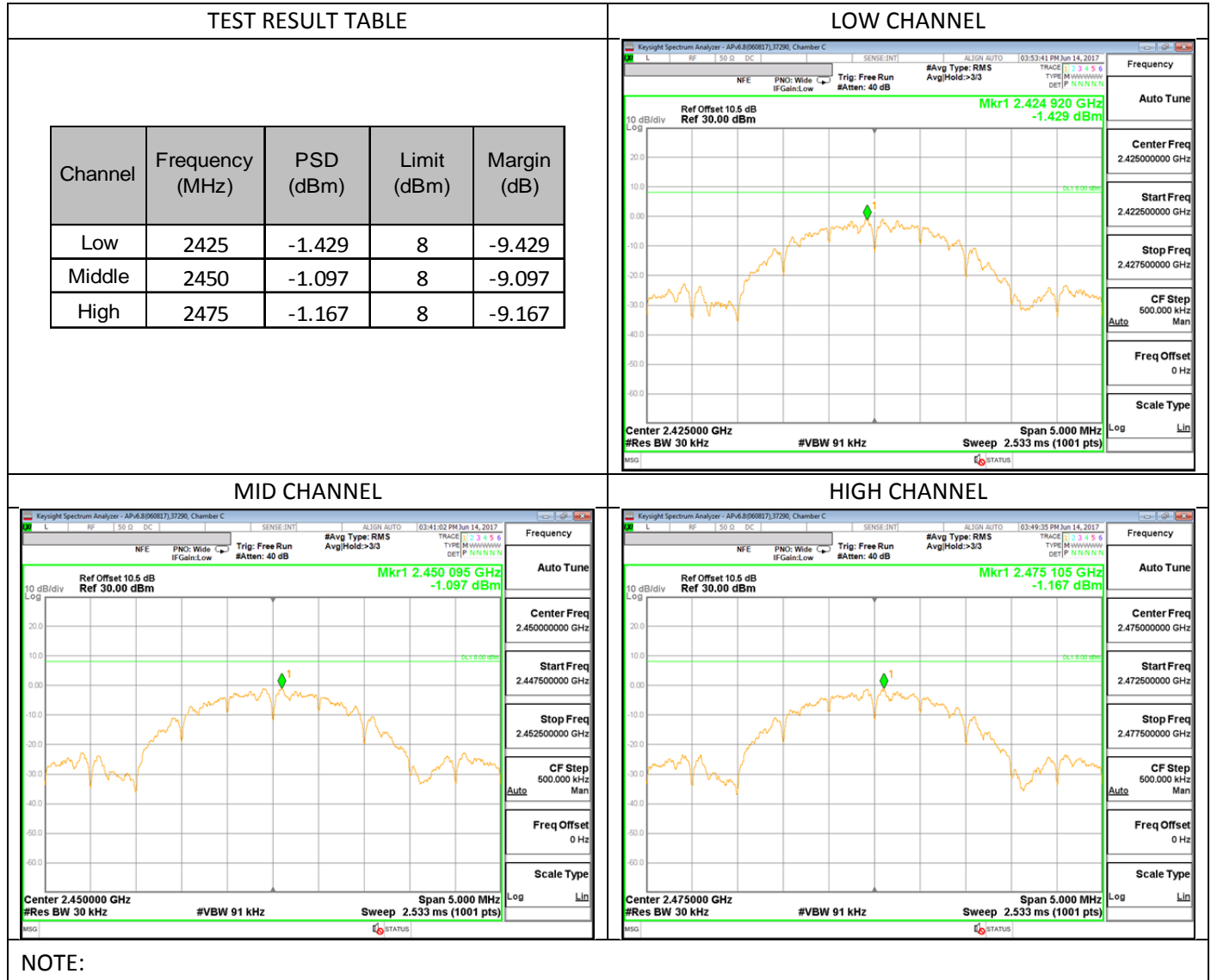
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

TEST PROCEDURE

Power Spectral Density was performed utilizing the "Method PKPSD (Peak PSD)" under KDB558074 D01 DTS Meas Guidance v04.

RESULTS

8.6.1. POWER SPECTRAL DENSITY PLOTS AND TABLE



8.7. 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.

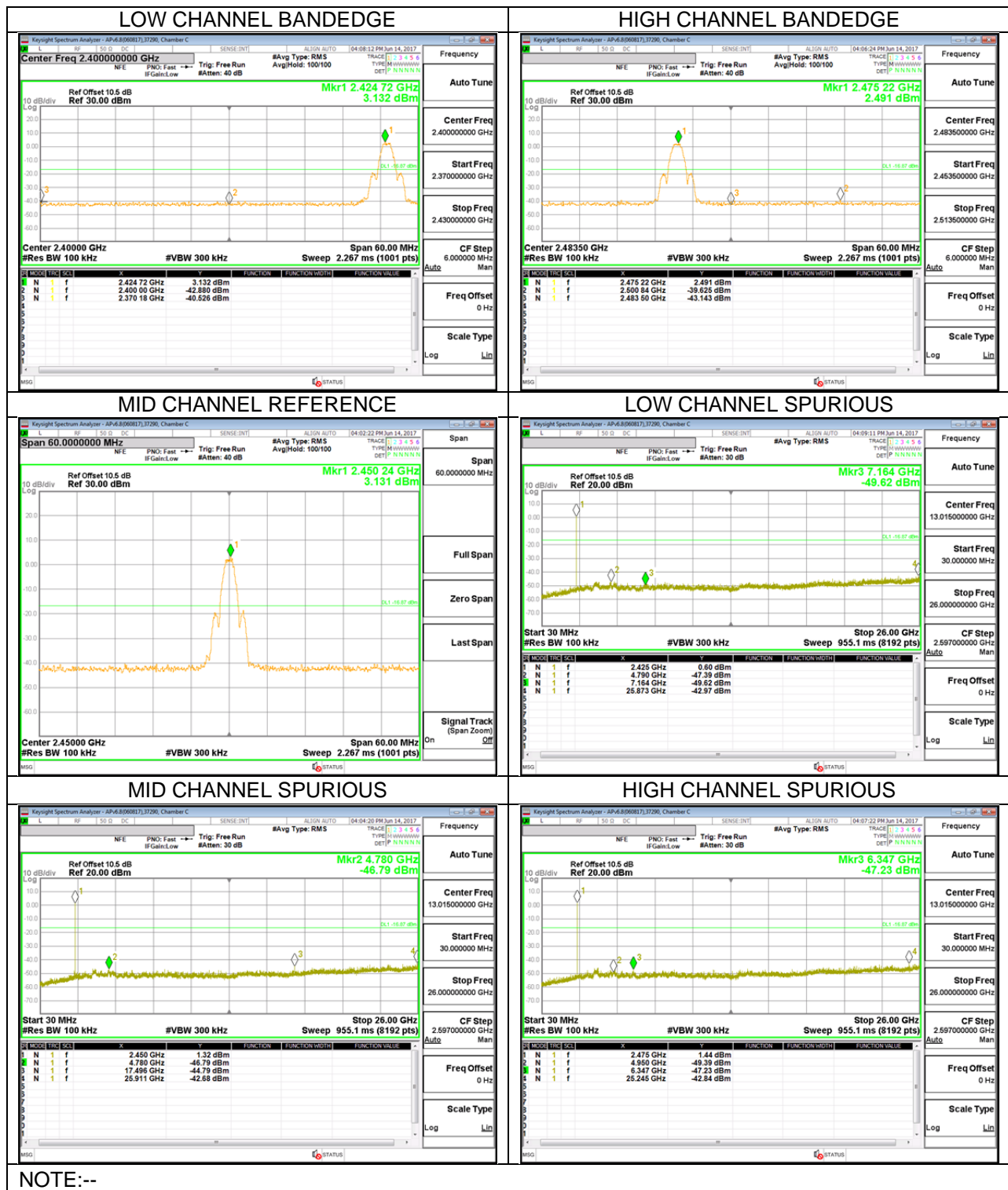
TEST PROCEDURE

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

8.7.1. BANDEDGE AND SPURIOUS EMISSIONS PLOTS



9. RADIATED TEST RESULTS

LIMITS

FCC §15.205 and §15.209

IC RSS-GEN, Section 8.9 and 8.10.

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 and 150cm for above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 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, then the video bandwidth is set to 1 MHz for peak and 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.

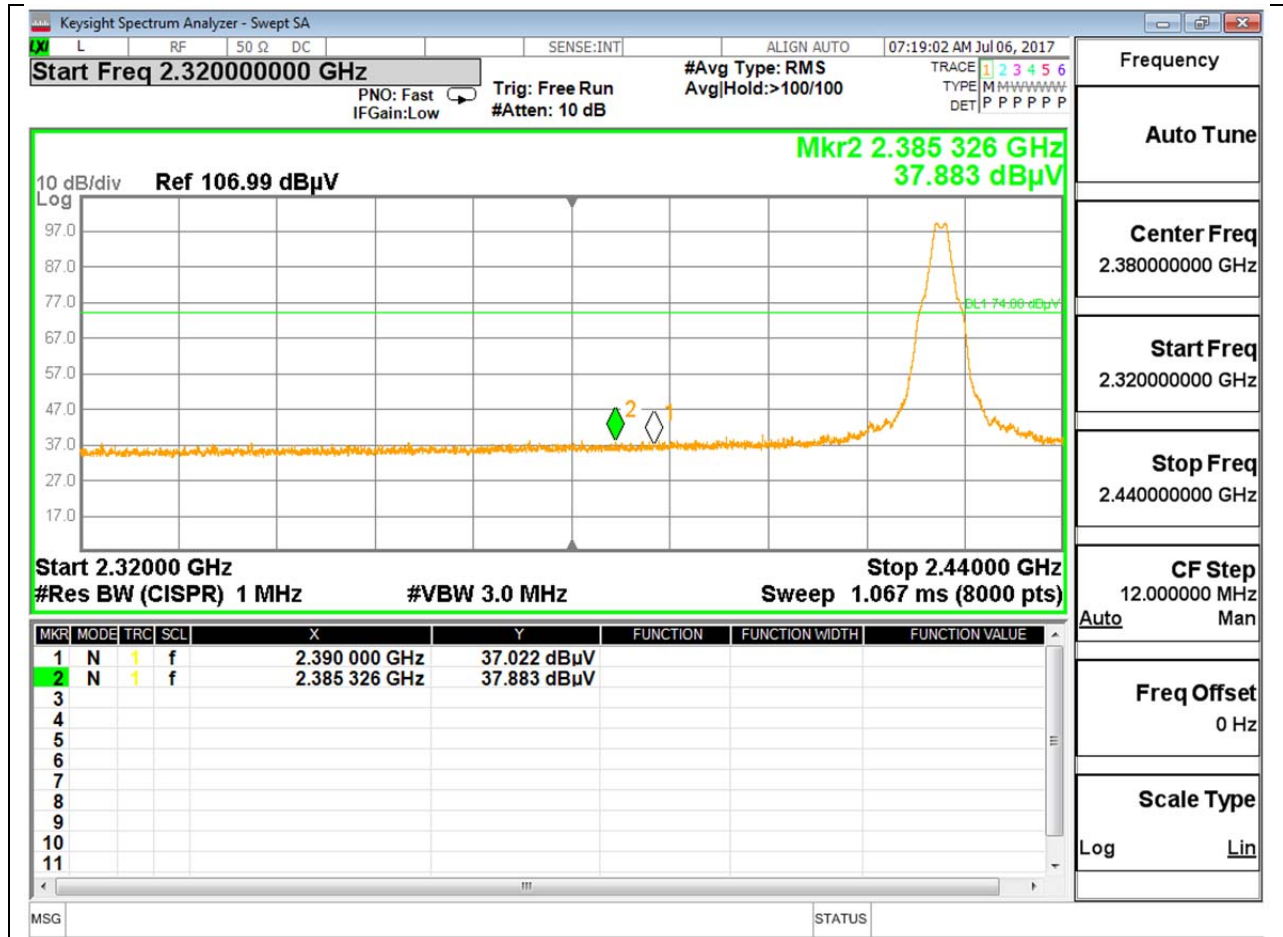
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

RESULTS

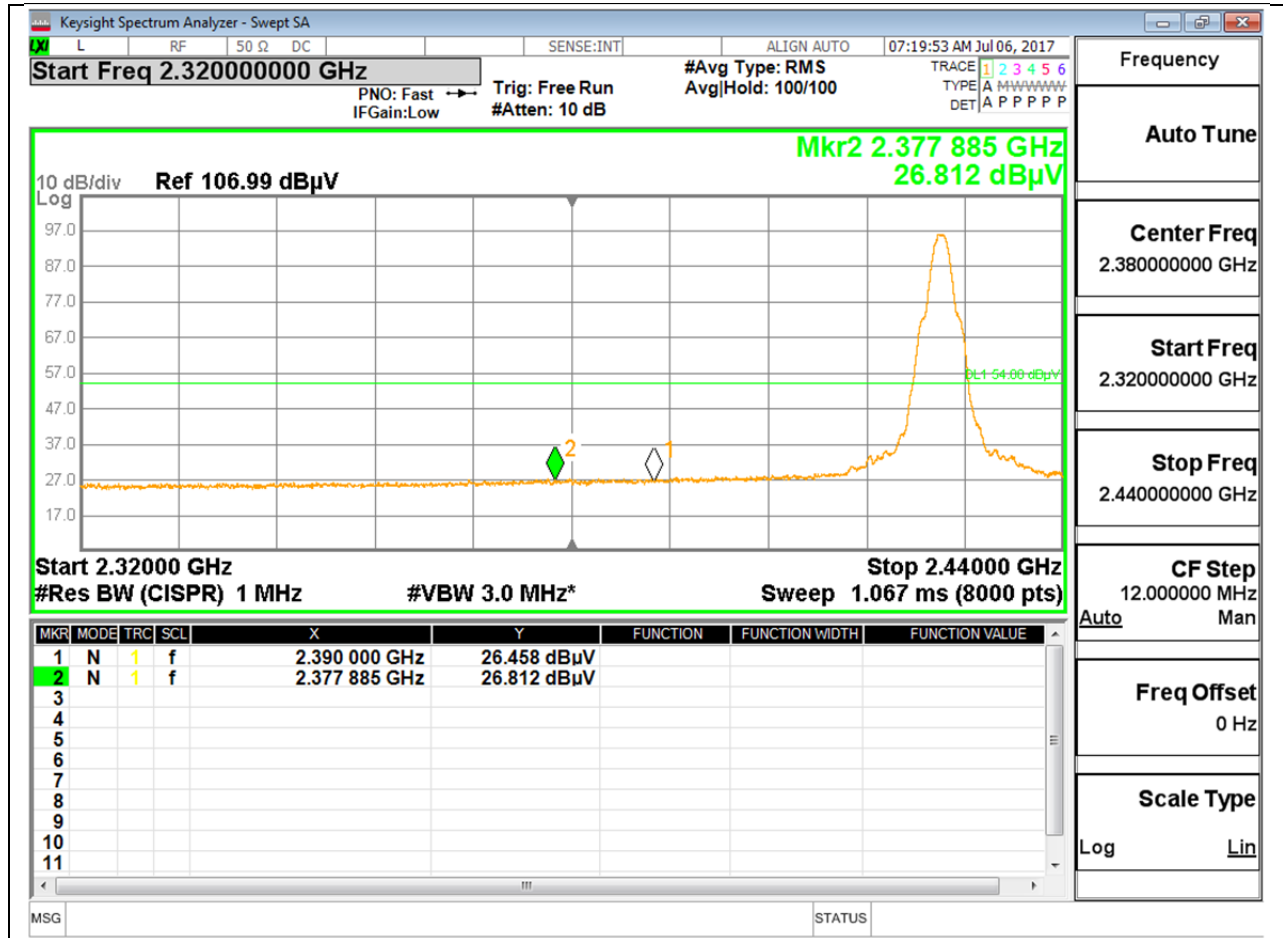
9.1. TRANSMITTER ABOVE 1 GHz

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK PLOT



HORIZONTAL AVERAGE PLOT

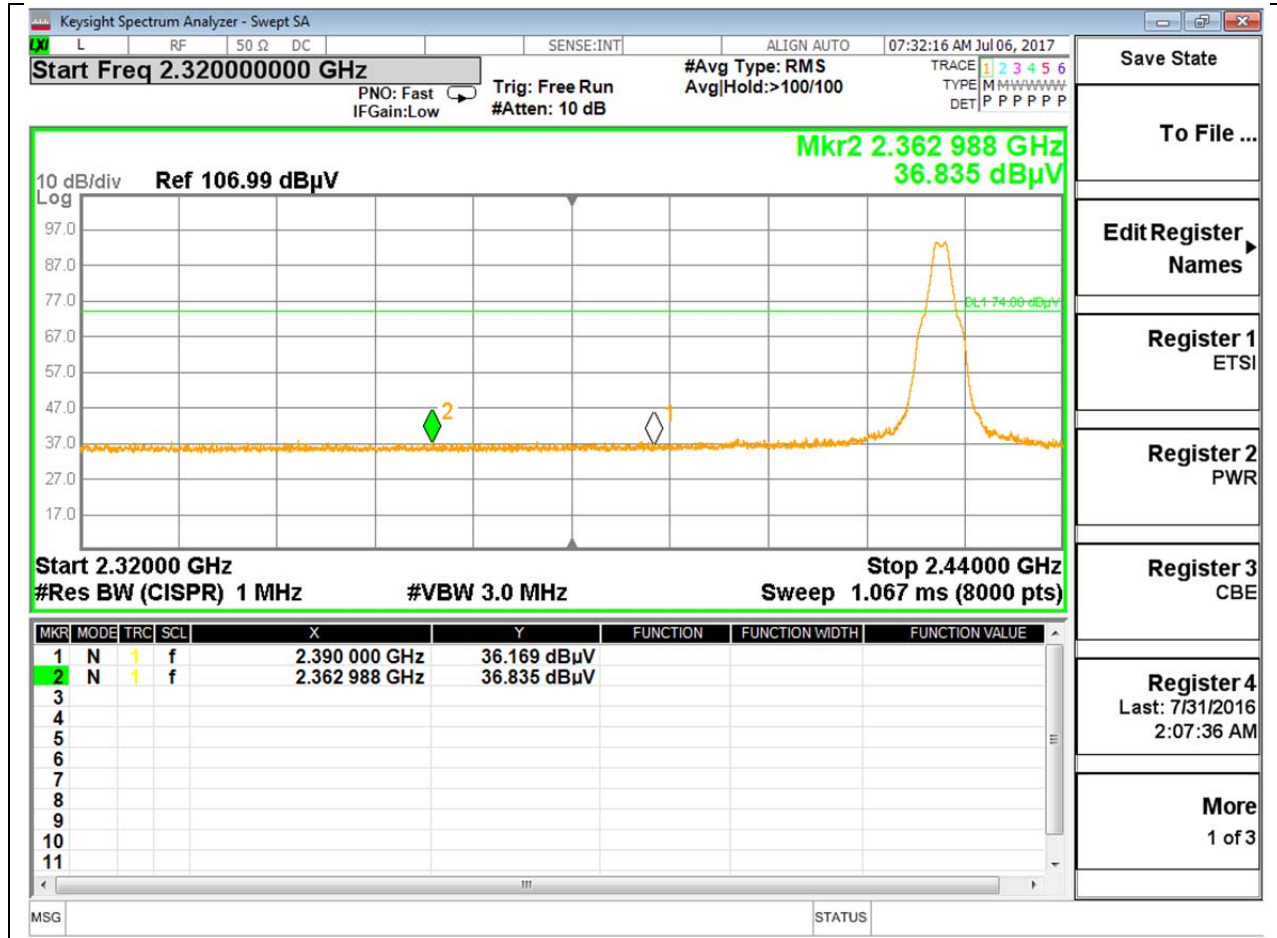


HORIZONTAL DATA

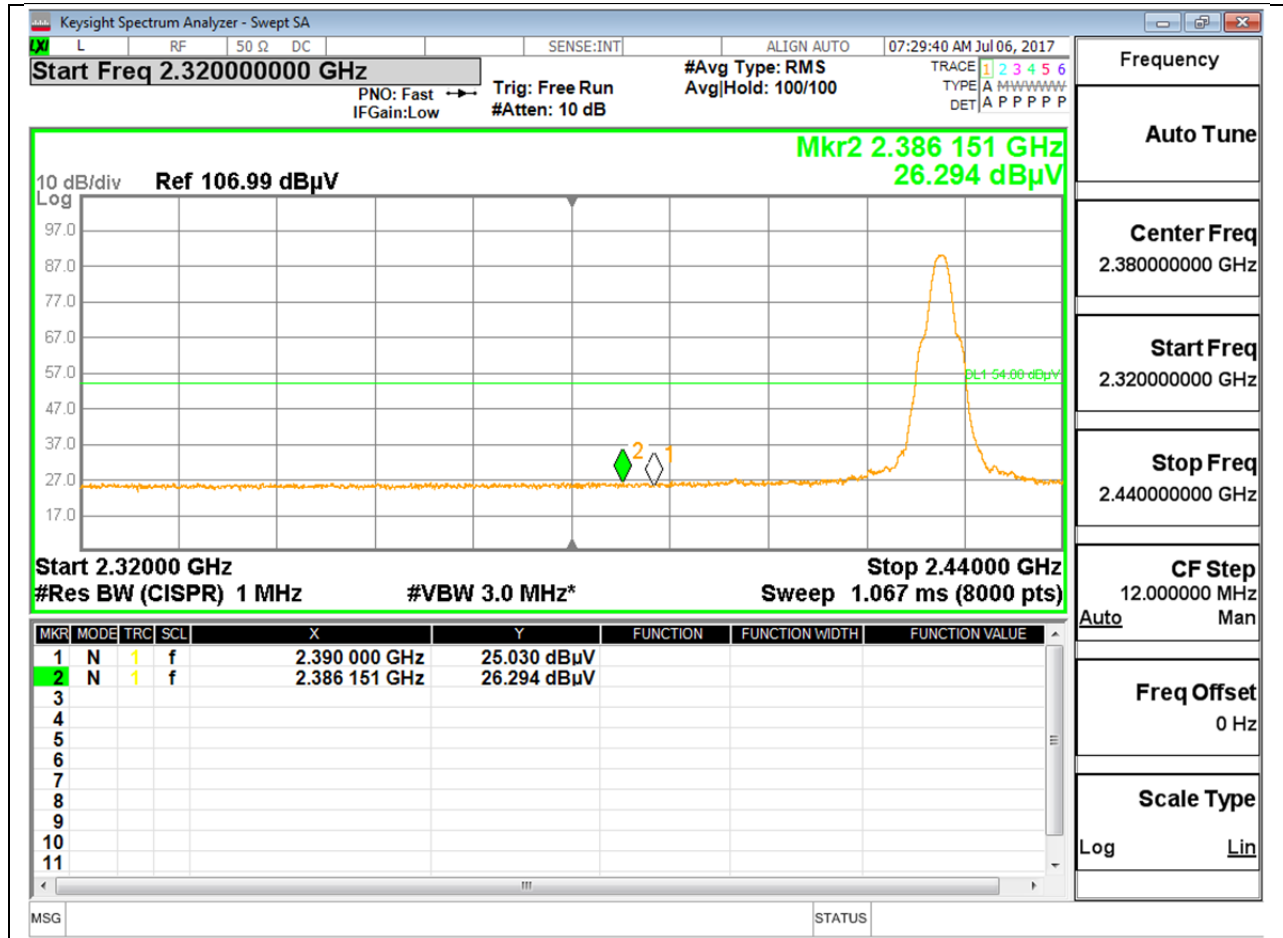
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T712 (dB/m)	Amp/Cb/Filtr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.39	37.02	Pk	31.9	-20.8	48.12	-	-	74	-25.88	356	400	H
* 2.385	37.88	Pk	31.8	-20.9	48.98	-	-	74	-25.02	356	400	H
* 2.39	26.46	RMS	31.9	-20.8	37.56	54	-16.44	-	-	356	400	H
* 2.378	26.81	RMS	31.9	-20.9	37.81	54	-16.19	-	-	356	400	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector
 RMS - RMS detection

VERTICAL PEAK PLOT



VERTICAL AVERAGE PLOT



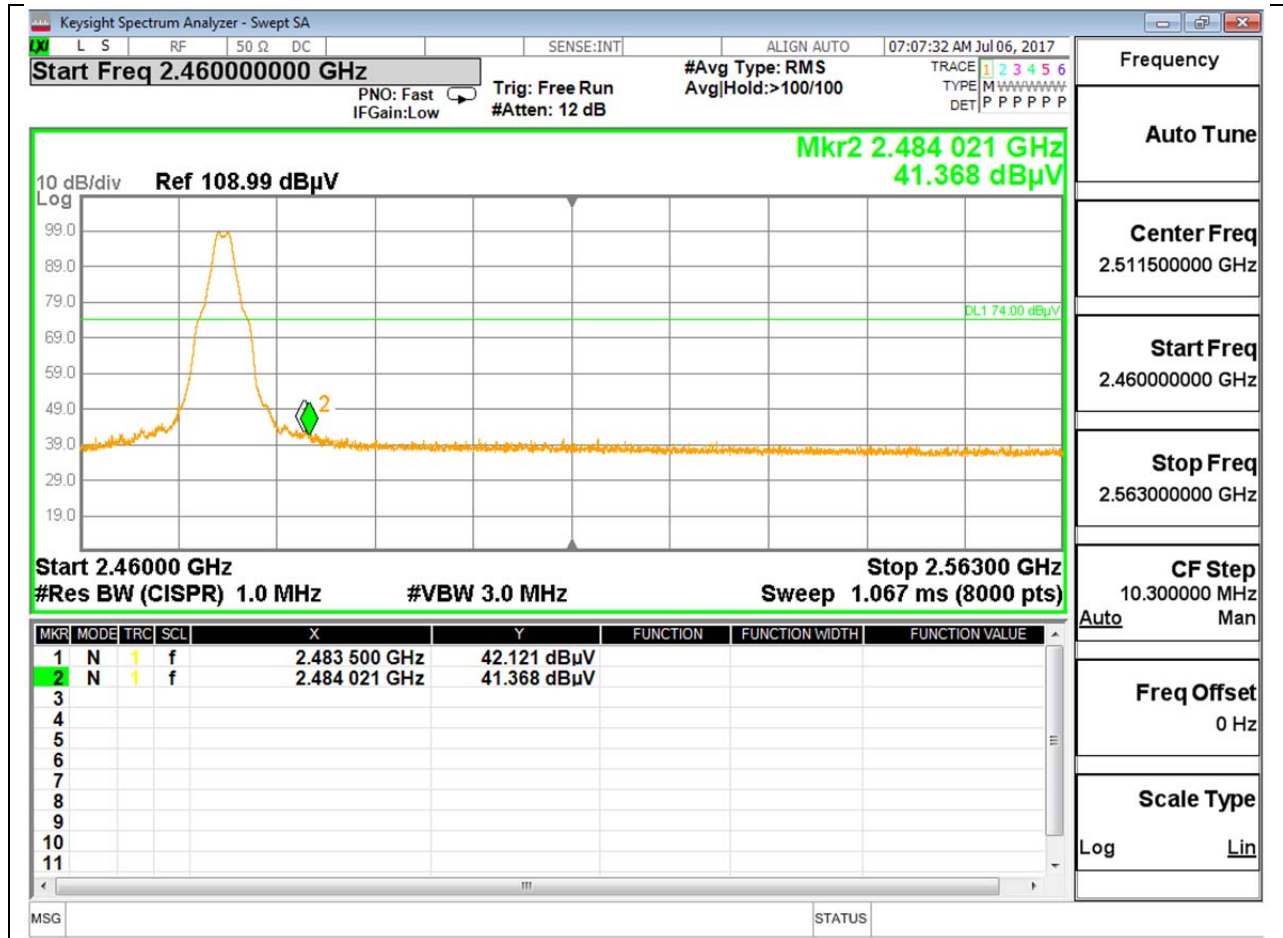
VERTICAL DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T712 (dB/m)	Amp/Cb/Filtr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.39	36.17	Pk	31.9	-20.8	47.27	-	-	74	-26.73	262	147	V
* 2.363	36.84	Pk	31.9	-20.7	48.04	-	-	74	-25.96	262	147	V
* 2.39	25.03	RMS	31.9	-20.8	36.13	54	-17.87	-	-	262	147	V
* 2.386	26.29	RMS	31.9	-20.9	37.29	54	-16.71	-	-	262	147	V

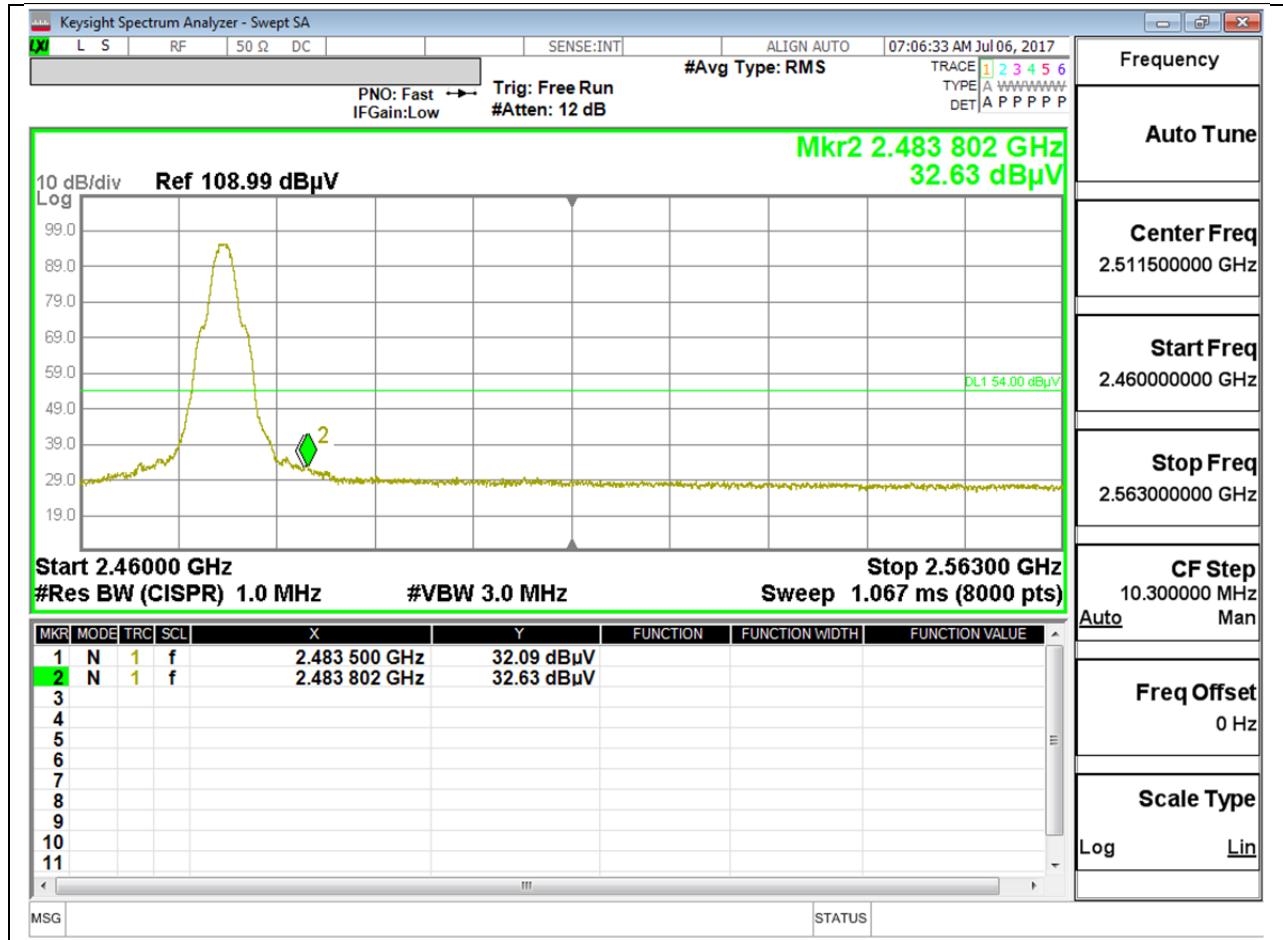
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector
 RMS - RMS detection

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK PLOT



HORIZONTAL AVERAGE PLOT



HORIZONTAL DATA

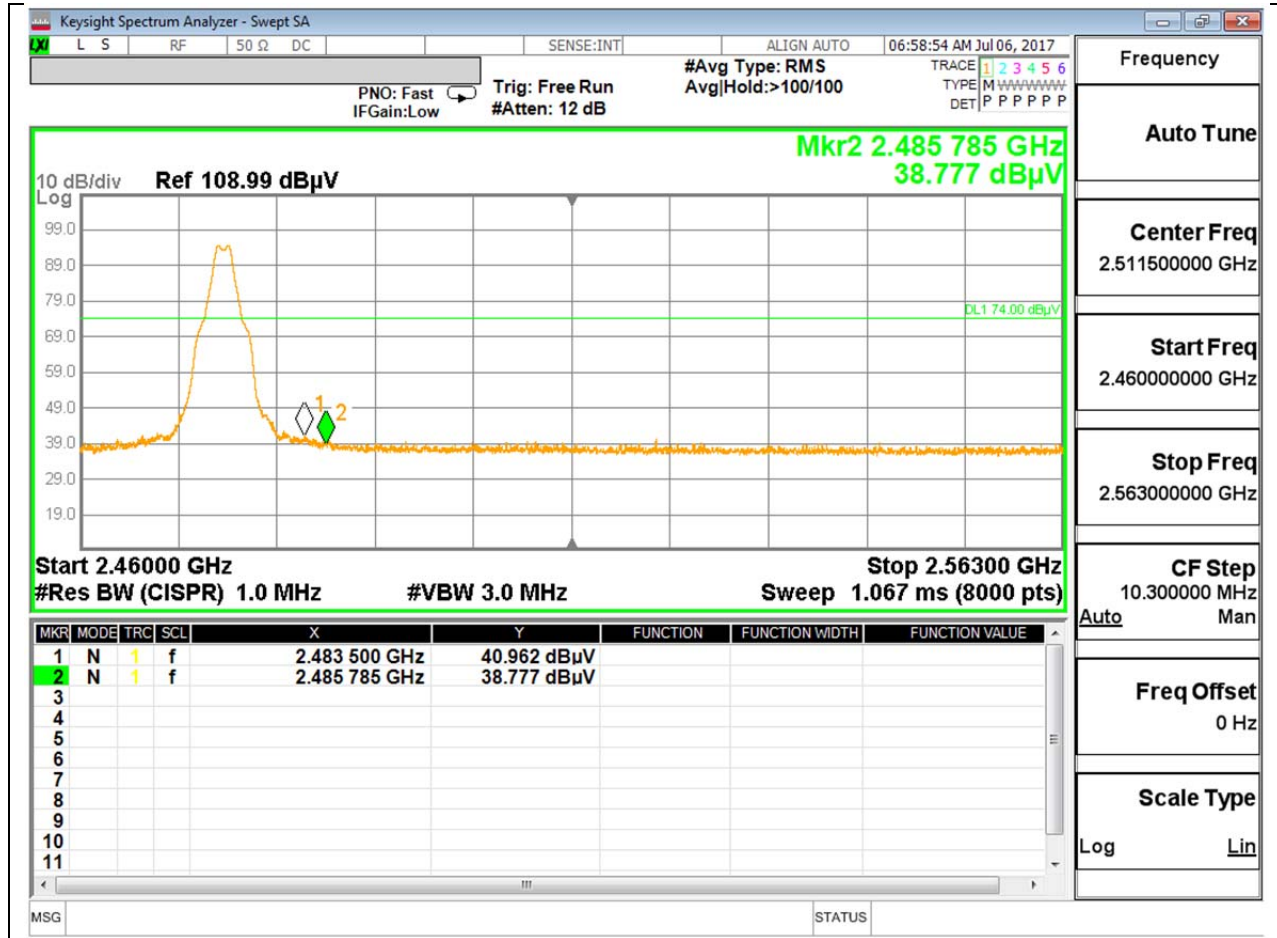
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.484	42.12	Pk	32.3	-23.1	51.32	-	-	74	-22.68	254	126	H
* 2.484	41.37	Pk	32.3	-23.1	50.57	-	-	74	-23.43	254	126	H
* 2.484	32.09	RMS	32.3	-23.1	41.29	54	-12.71	-	-	254	126	H
* 2.484	32.63	RMS	32.3	-23.1	41.83	54	-12.17	-	-	254	126	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

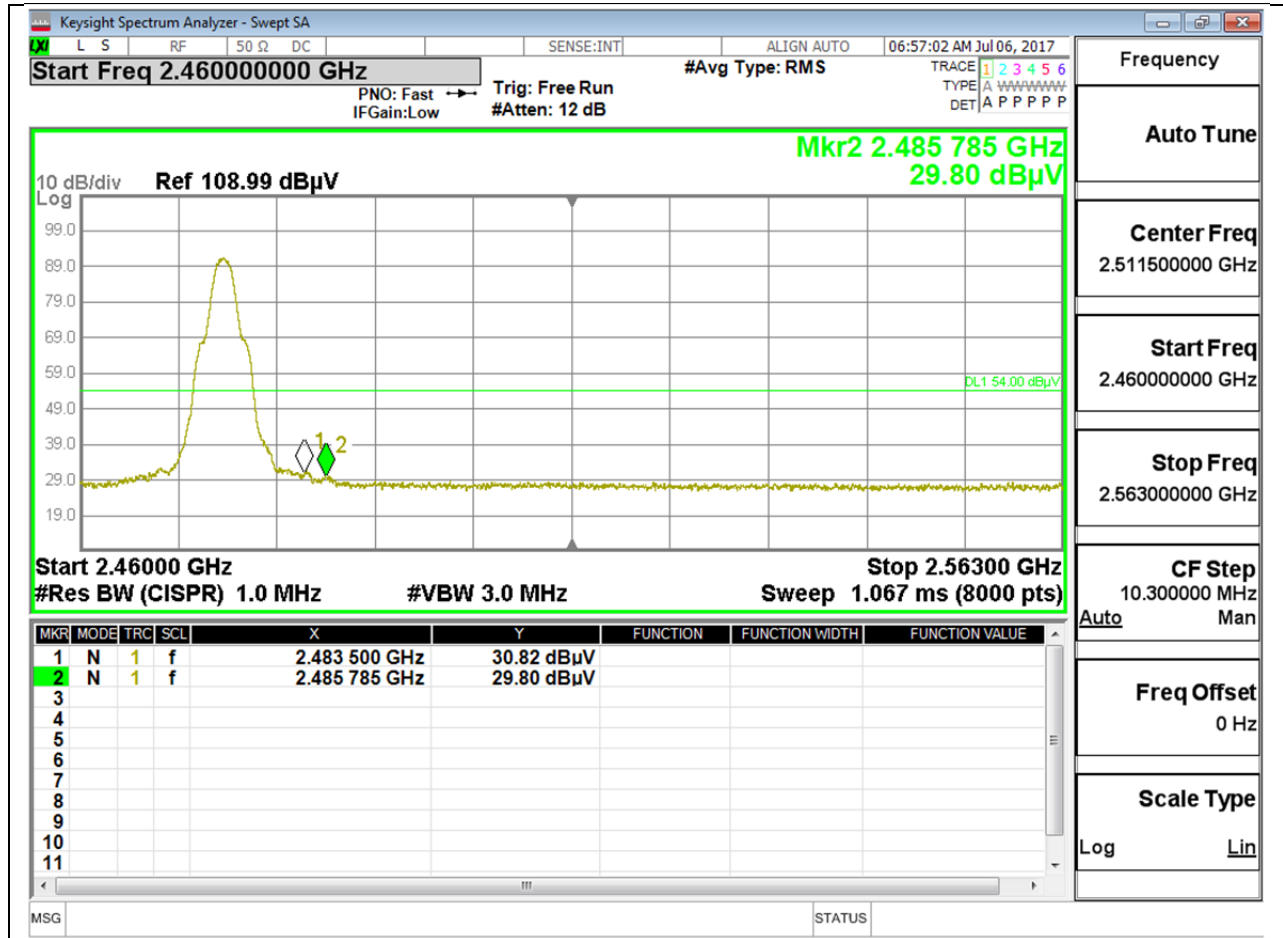
Pk - Peak detector

RMS - RMS detection

VERTICAL PEAK PLOT



VERTICAL AVERAGE PLOT



VERTICAL DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.484	40.96	Pk	32.3	-23.1	50.16	-	-	74	-23.84	344	340	V
* 2.486	38.78	Pk	32.3	-23.1	47.98	-	-	74	-26.02	344	340	V
* 2.484	30.82	RMS	32.3	-23.1	40.02	54	-13.98	-	-	344	340	V
* 2.486	29.8	RMS	32.3	-23.1	39	54	-15	-	-	344	340	V

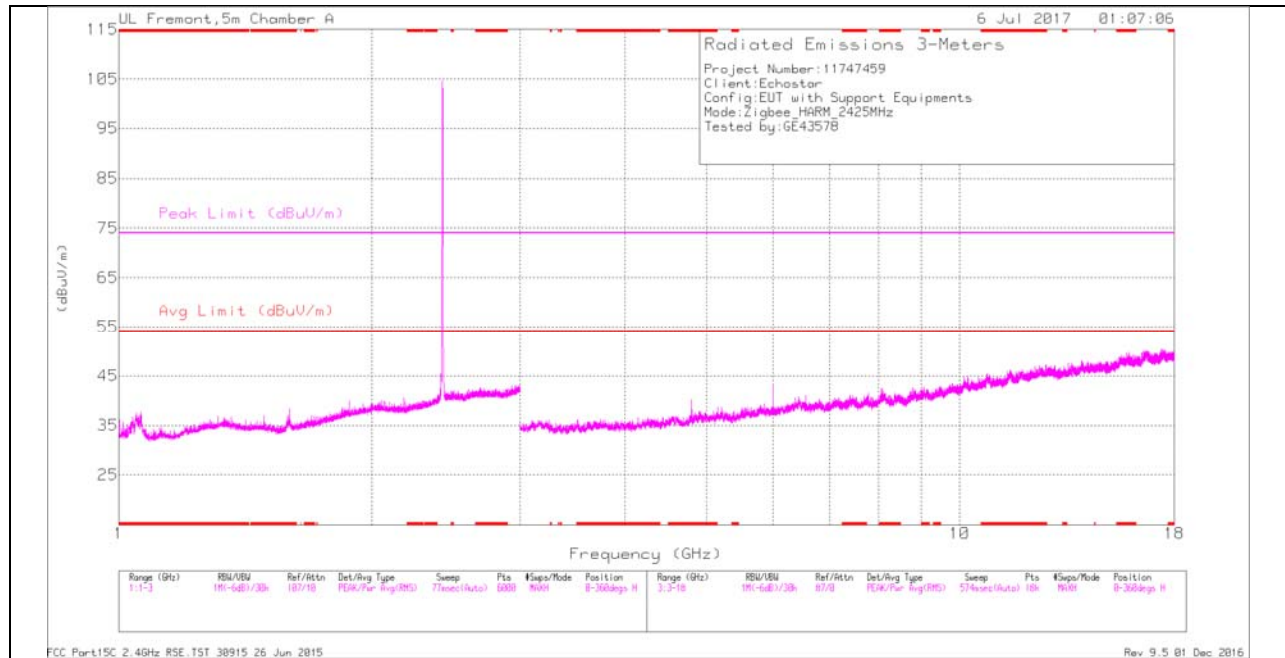
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

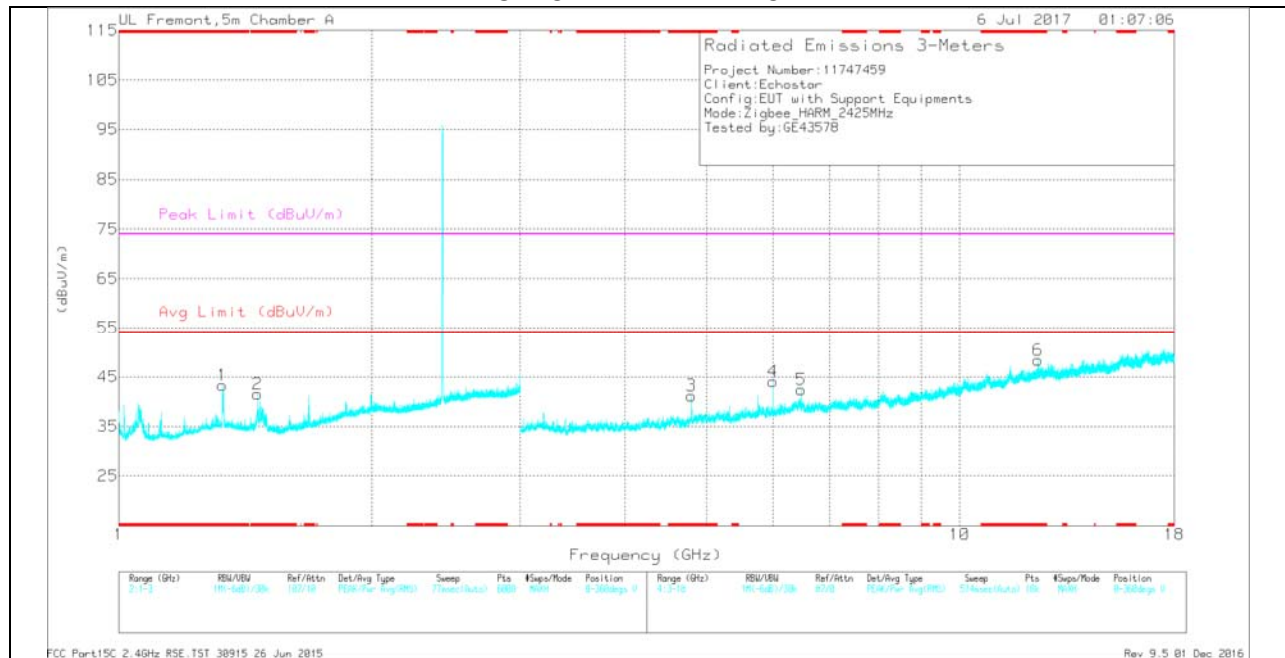
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

LOW CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cb/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.328	37.36	PK	29.5	-23.5	0	43.36	-	-	74	-30.64	0-360	200	V
2	* 1.462	36.17	PK	28.7	-23.3	0	41.57	-	-	74	-32.43	0-360	101	V
3	* 4.799	34.62	PK	34.2	-27.6	0	41.22	-	-	74	-32.78	0-360	200	V
6	* 12.399	28.36	PK	38.9	-18.9	0	48.36	-	-	74	-25.64	0-360	200	V
4	5.999	35.29	PK	35.3	-26.5	0	44.09	-	-	-	-	0-360	101	V
5	6.479	30.97	PK	35.7	-24.2	0	42.47	-	-	-	-	0-360	101	V

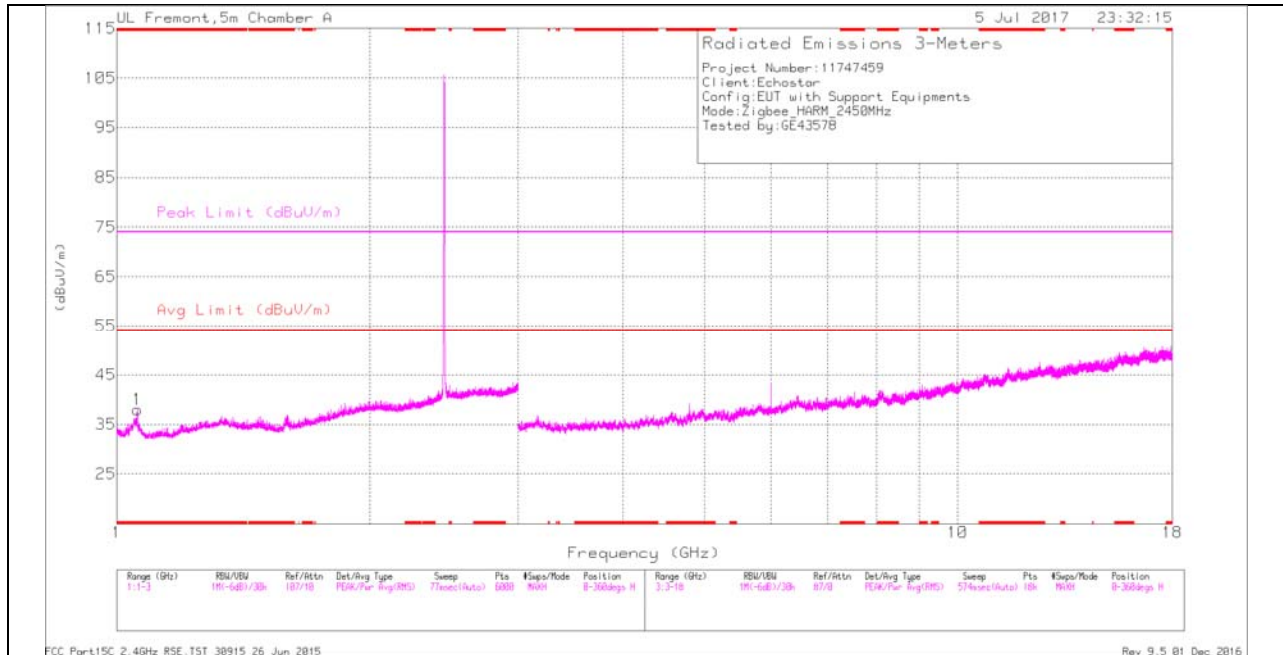
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PK - Peak detector

Radiated Emissions

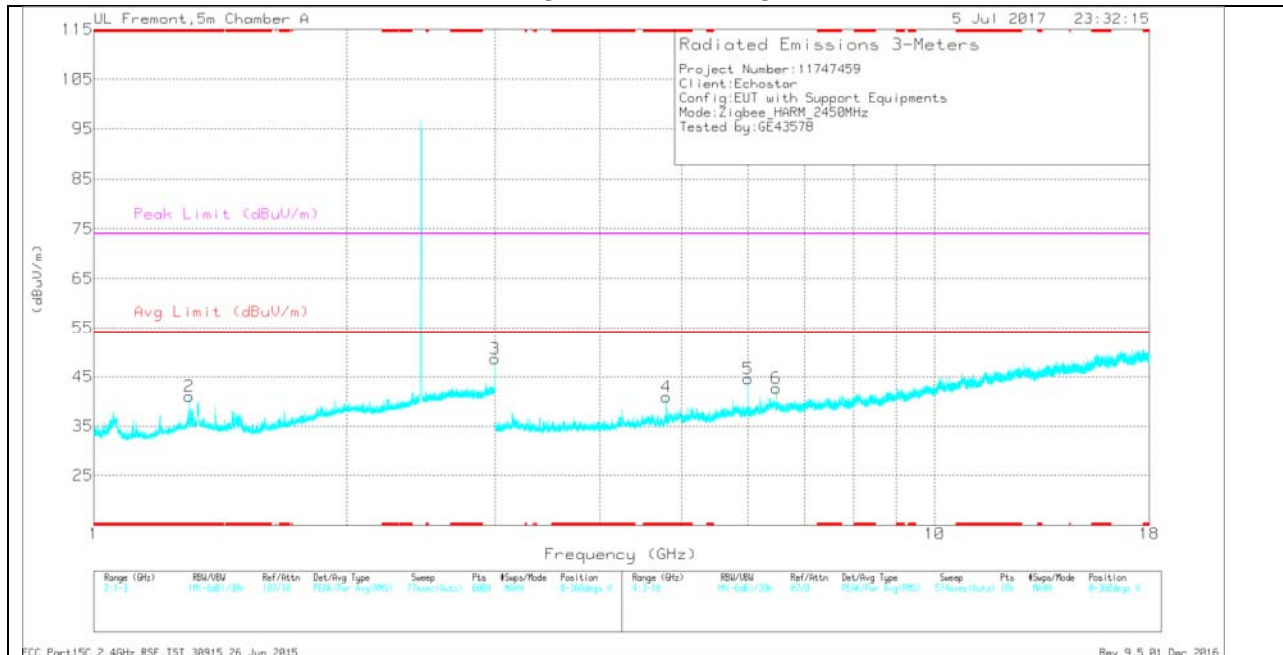
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cb/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.327	41.79	PK2	29.5	-23.5	0	47.79	-	-	74	-26.21	98	173	V
* 1.328	25.35	MAV1	29.5	-23.5	0	31.35	54	-22.65	-	-	98	173	V
* 1.463	43.08	PK2	28.7	-23.3	0	48.48	-	-	74	-25.52	110	187	V
* 1.462	25.34	MAV1	28.7	-23.3	0	30.74	54	-23.26	-	-	110	187	V
* 4.8	39.47	PK2	34.2	-27.6	0	46.07	-	-	74	-27.93	164	201	V
* 4.8	30.37	MAV1	34.2	-27.6	0	36.97	54	-17.03	-	-	164	201	V
* 12.398	33.79	PK2	38.9	-18.9	0	53.79	-	-	74	-20.21	234	201	V
* 12.399	21.32	MAV1	38.9	-18.9	0	41.32	54	-12.68	-	-	234	201	V
6	38.87	PK2	35.3	-26.5	0	47.67	-	-	-	-	252	102	V
6.48	36.26	PK2	35.7	-24.2	0	47.76	-	-	-	-	34	115	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PK2 - KDB558074 Method: Maximum Peak
 MAV1 - KDB558074 Option 1 Maximum RMS Average

MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

MID CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cb/Fitr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.057	34.74	Pk	27.2	-24	0	37.94	-	-	74	-36.06	0-360	101	H
2	* 1.299	35.12	Pk	29.4	-23.5	0	41.02	-	-	74	-32.98	0-360	200	V
4	* 4.8	34.31	Pk	34.2	-27.6	0	40.91	-	-	74	-33.09	0-360	200	V
3	3	37.8	Pk	32.3	-21.5	0	48.6	-	-	-	-	0-360	101	V
5	6	35.78	Pk	35.3	-26.5	0	44.58	-	-	-	-	0-360	101	V
6	6.479	31.15	Pk	35.7	-24.2	0	42.65	-	-	-	-	0-360	200	V

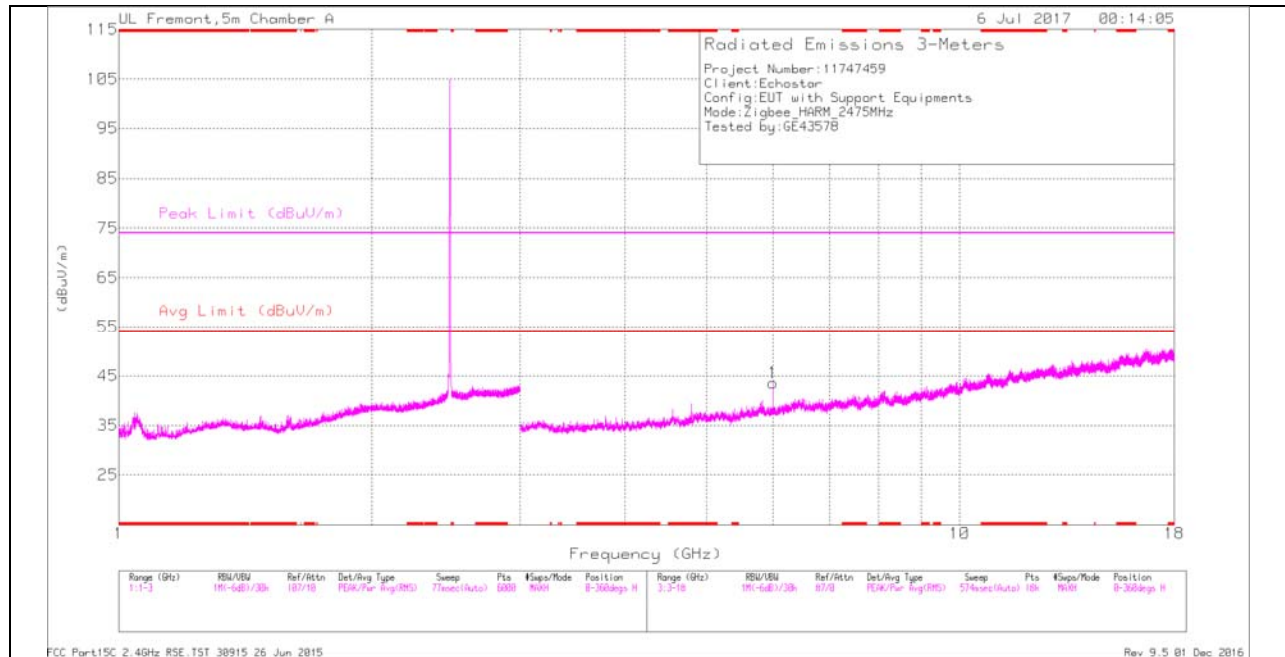
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector

Radiated Emissions

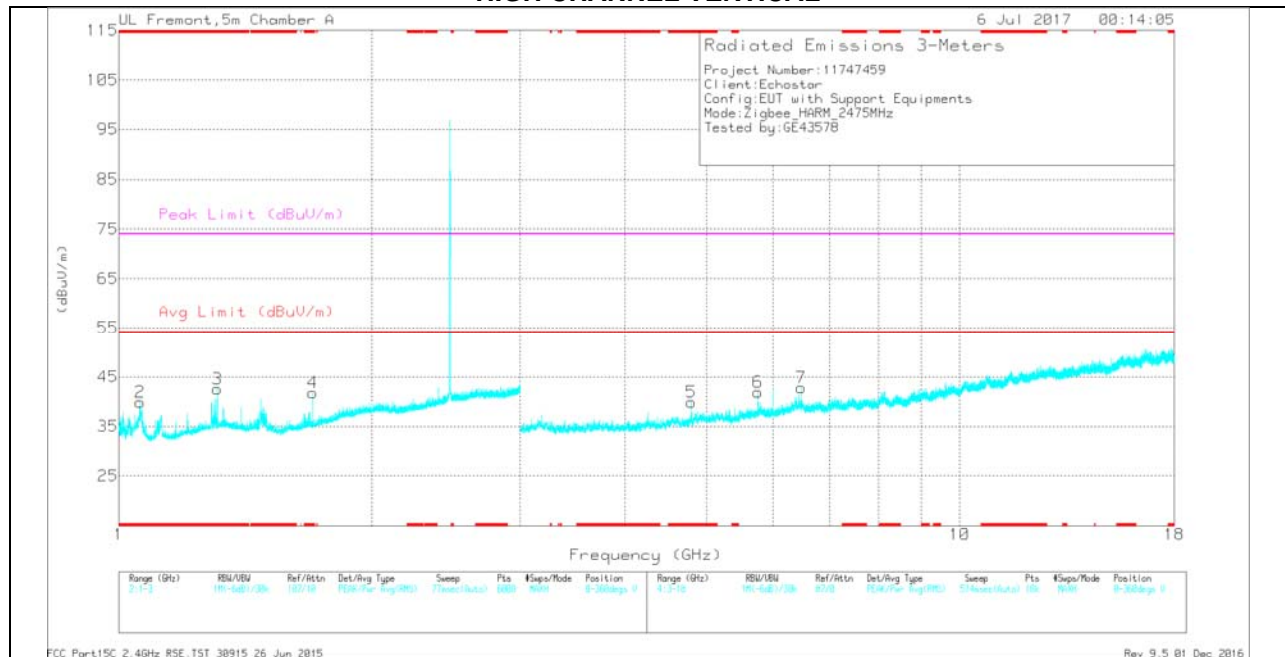
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cb/Fitr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.057	43.57	PK2	27.2	-24	0	46.77	-	-	74	-27.23	62	309	H
* 1.057	27.45	MAv1	27.2	-24	0	30.65	54	-23.35	-	-	62	309	H
* 1.299	48.03	PK2	29.4	-23.5	0	53.93	-	-	74	-20.07	192	192	V
* 1.299	24.07	MAv1	29.4	-23.5	0	29.97	54	-24.03	-	-	192	192	V
* 4.8	40.36	PK2	34.2	-27.6	0	46.96	-	-	74	-27.04	295	235	V
* 4.8	31.42	MAv1	34.2	-27.6	0	38.02	54	-15.98	-	-	295	235	V
3	37.61	PK2	32.3	-21.5	0	48.41	-	-	-	-	87	369	V
6	38.38	PK2	35.3	-26.5	0	47.18	-	-	-	-	124	103	V
6.48	37.15	PK2	35.7	-24.2	0	48.65	-	-	-	-	107	206	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PK2 - KDB558074 Method: Maximum Peak
 MAv1 - KDB558074 Option 1 Maximum RMS Average

HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 1.059	36.64	Pk	27.2	-24	0	39.84	-	-	74	-34.16	0-360	101	V
3	* 1.309	36.7	Pk	29.4	-23.6	0	42.5	-	-	74	-31.5	0-360	200	V
4	* 1.701	36.09	Pk	29	-23.3	0	41.79	-	-	74	-32.21	0-360	200	V
5	* 4.799	33.27	Pk	34.2	-27.6	0	39.87	-	-	74	-34.13	0-360	200	V
6	5.76	32.96	Pk	35	-26	0	41.96	-	-	-	-	0-360	200	V
1	5.999	34.81	Pk	35.3	-26.5	0	43.61	-	-	-	-	0-360	199	H
7	6.48	31.35	Pk	35.7	-24.2	0	42.85	-	-	-	-	0-360	200	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector

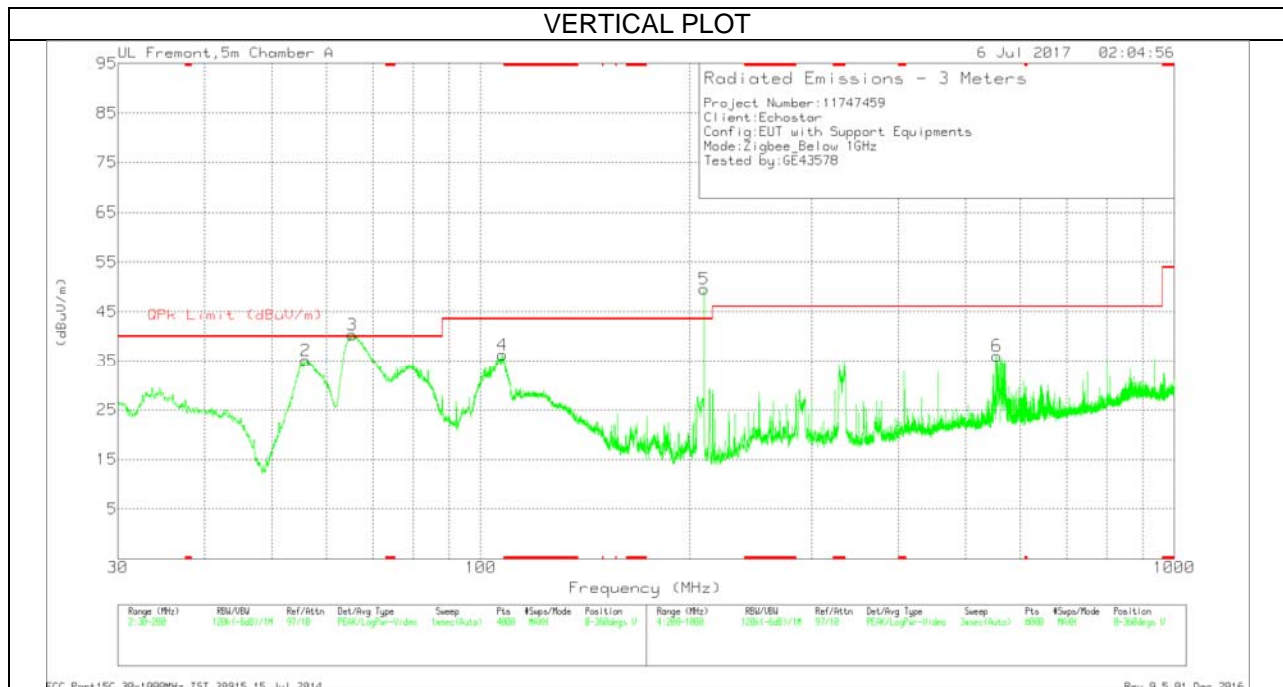
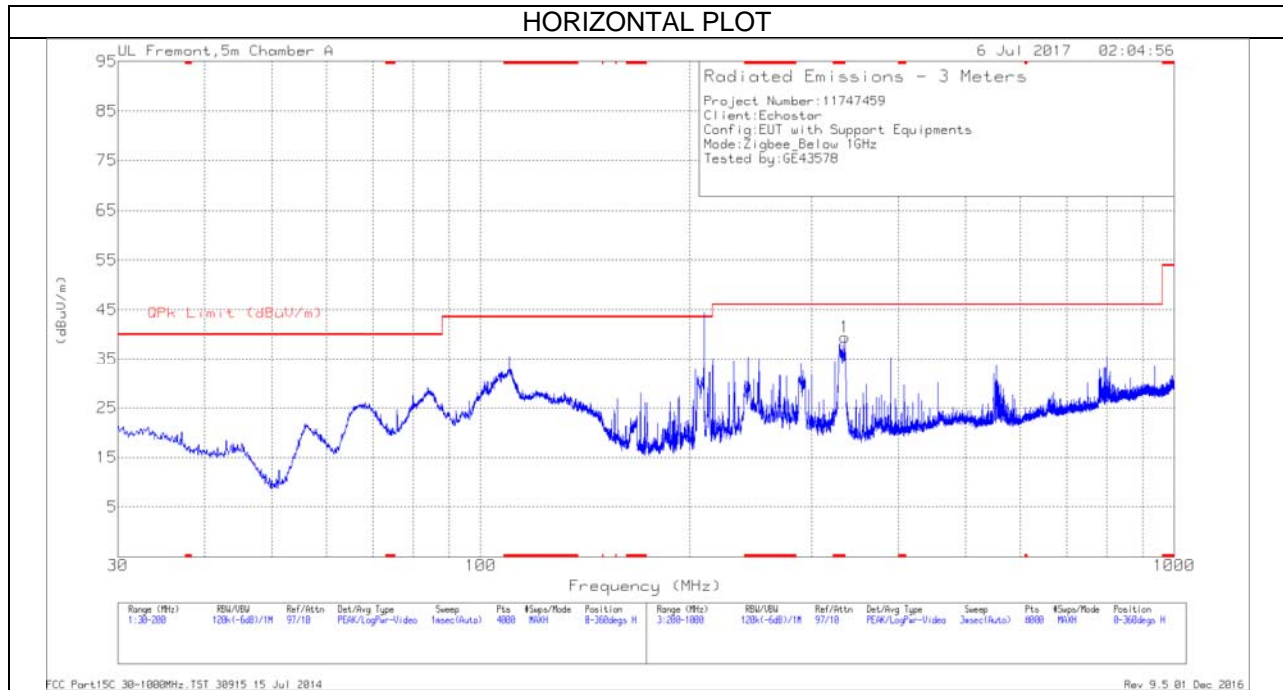
Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.06	45.08	PK2	27.2	-24	0	48.28	-	-	74	-25.72	97	101	V
* 1.059	26.27	MAV1	27.2	-24	0	29.47	54	-24.53	-	-	97	101	V
* 1.309	36.11	PK2	29.4	-23.6	0	41.91	-	-	74	-32.09	8	239	V
* 1.309	24.12	MAV1	29.4	-23.6	0	29.92	54	-24.08	-	-	8	239	V
* 1.701	37.45	PK2	29	-23.3	0	43.15	-	-	74	-30.85	223	389	V
* 1.701	24.65	MAV1	29	-23.3	0	30.35	54	-23.65	-	-	223	389	V
* 4.8	39.14	PK2	34.2	-27.6	0	45.74	-	-	74	-28.26	298	175	V
* 4.8	29.17	MAV1	34.2	-27.6	0	35.77	54	-18.23	-	-	298	175	V
5.759	35.59	PK2	35	-26	0	44.59	-	-	-	-	161	201	V
6	40.4	PK2	35.3	-26.5	0	49.2	-	-	-	-	286	245	H
6.48	36.72	PK2	35.7	-24.2	0	48.22	-	-	-	-	109	201	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PK2 - KDB558074 Method: Maximum Peak
 MAV1 - KDB558074 Option 1 Maximum RMS Average

9.2. WORST-CASE BELOW 1 GHz

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



BELOW 1 GHz TABLE

Radiated Emissions

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 335.295	41	Qp	18	-29.2	29.8	46.02	-16.22	335	102	H
2	56.1175	50.62	Qp	11.2	-30.9	30.92	40	-9.08	191	133	V
3	65.5097	52.49	Qp	12.4	-30.8	34.09	40	-5.91	222	115	V
4	107.3927	45.26	Qp	16.1	-30.5	30.86	43.52	-12.66	181	100	V
5	209.9743	50.97	Qp	14.5	-29.9	35.57	43.52	-7.95	31	102	V
6	554.9739	36.49	Qp	22.4	-28.6	30.29	46.02	-15.73	29	124	V

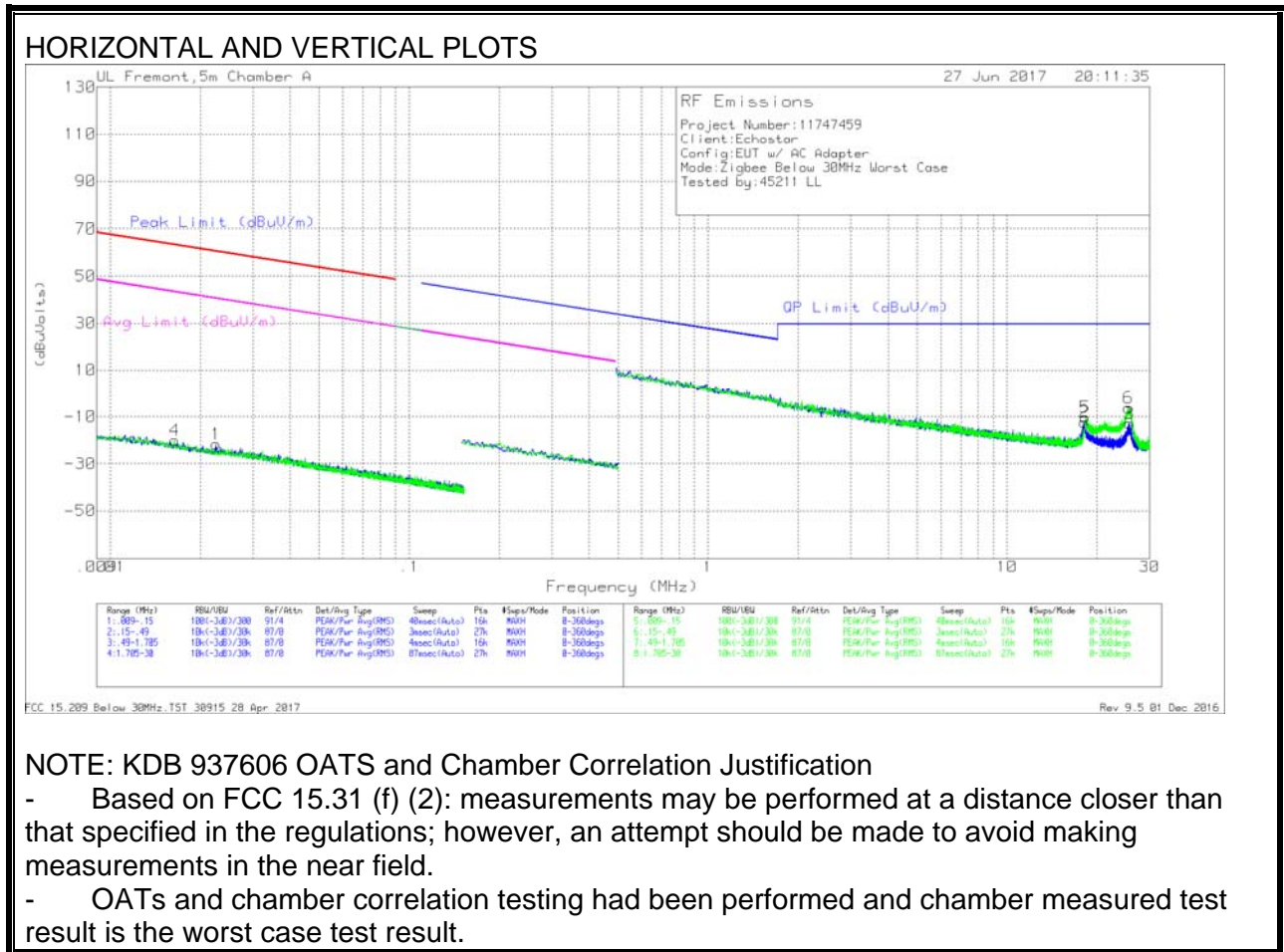
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Qp - Quasi-Peak detector

9.3. WORST-CASE BELOW 30 MHz

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



NOTE: KDB 937606 OATS and Chamber Correlation Justification

- Based on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.
- OATs and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
4	.01643	43.03	Pk	16.8	.1	-80	-20.07	63.27	-83.34	43.27	-63.34	0-360
1	.02263	43.19	Pk	15	.1	-80	-21.71	60.49	-82.2	40.49	-62.2	0-360

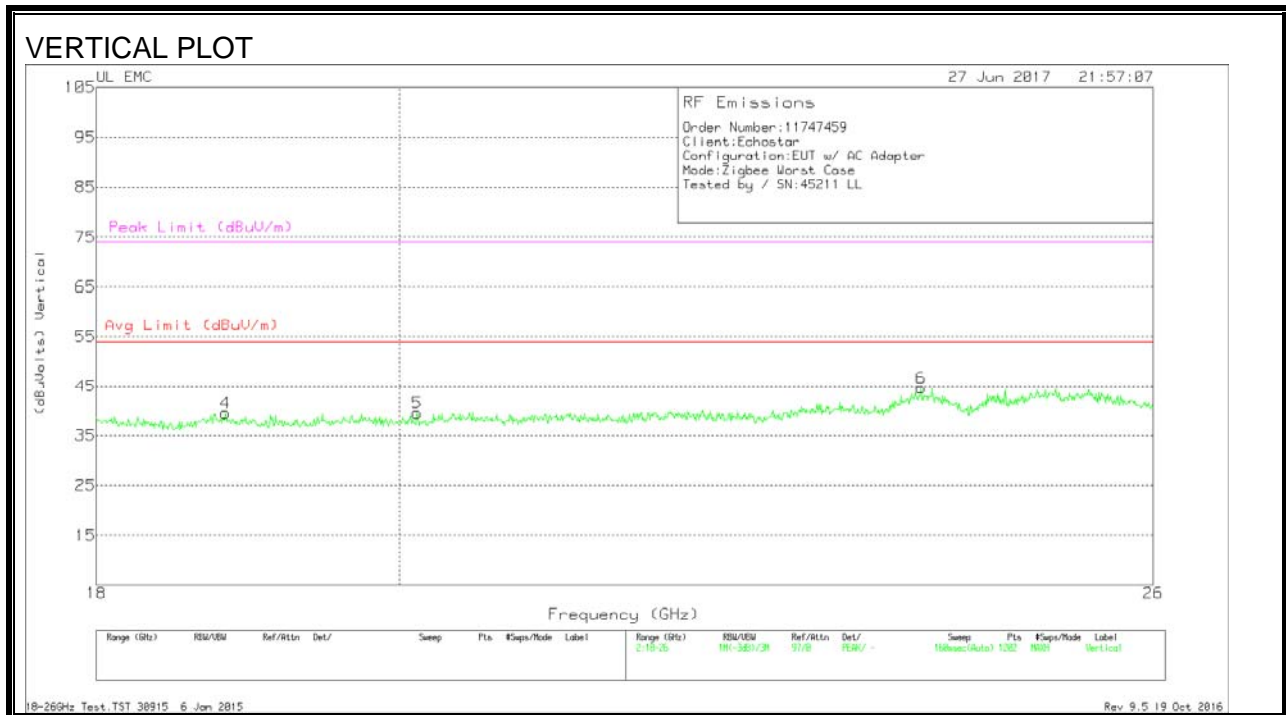
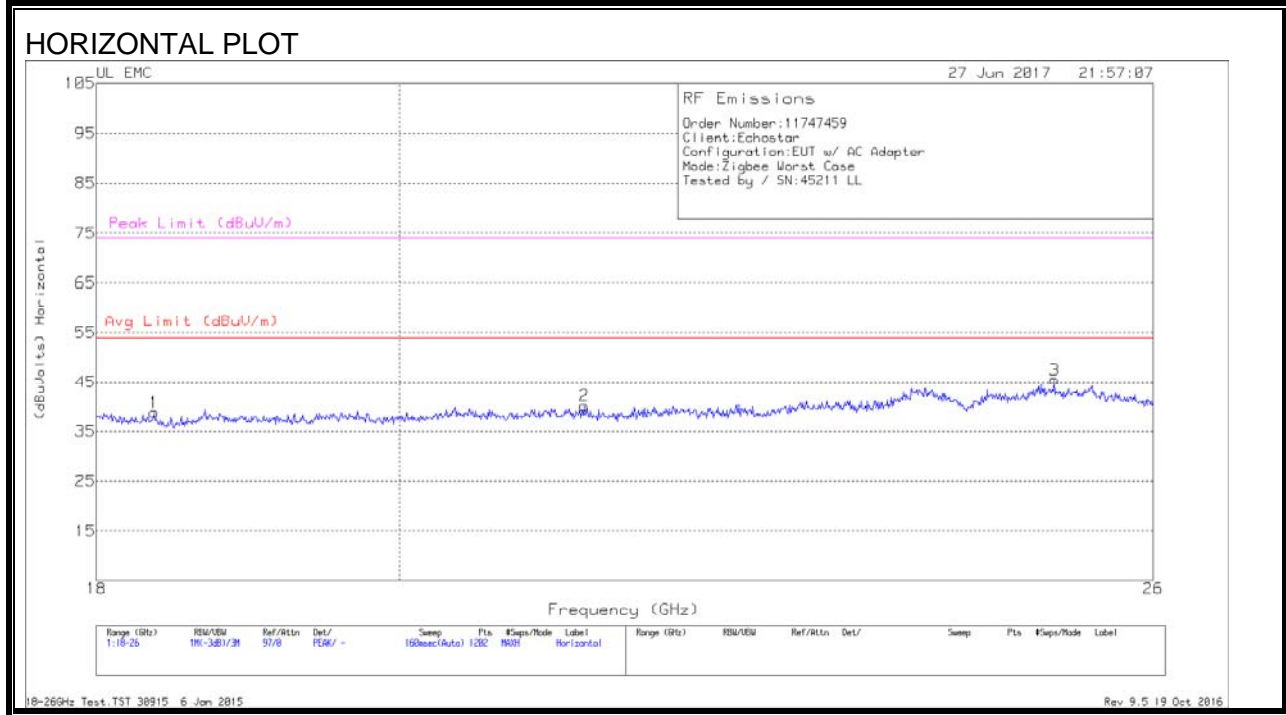
Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 30m	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
2	18.12349	17.09	Pk	9.9	.6	-40	-12.41	29.5	-41.91	-	-	-	-	0-360
5	18.26026	19.26	Pk	9.9	.6	-40	-10.24	29.5	-39.74	-	-	-	-	0-360
6	25.41862	24.25	Pk	8.8	.7	-40	-6.25	29.5	-35.75	-	-	-	-	0-360
3	25.6759	17.63	Pk	8.8	.7	-40	-12.87	29.5	-42.37	-	-	-	-	0-360

Pk - Peak detector

9.4. WORST-CASE 18 to 26 GHz

SPURIOUS EMISSIONS 18 TO 26 GHz (WORST-CASE CONFIGURATION, HORIZONTAL & VERTICAL)



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T449 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	18.366	41.13	Pk	32.3	-25.1	-9.5	38.83	54	-15.17	74	-35.17
2	21.331	41.77	Pk	33.1	-25.2	-9.5	40.17	54	-13.83	74	-33.83
3	25.121	45.3	Pk	34.3	-24.6	-9.5	45.5	54	-8.5	74	-28.5
4	18.826	41.6	Pk	32.4	-25	-9.5	39.5	54	-14.5	74	-34.5
5	20.125	41.4	Pk	32.8	-25.2	-9.5	39.5	54	-14.5	74	-34.5
6	23.982	44.57	Pk	33.9	-24.3	-9.5	44.67	54	-9.33	74	-29.33

Pk - Peak detector

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

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

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

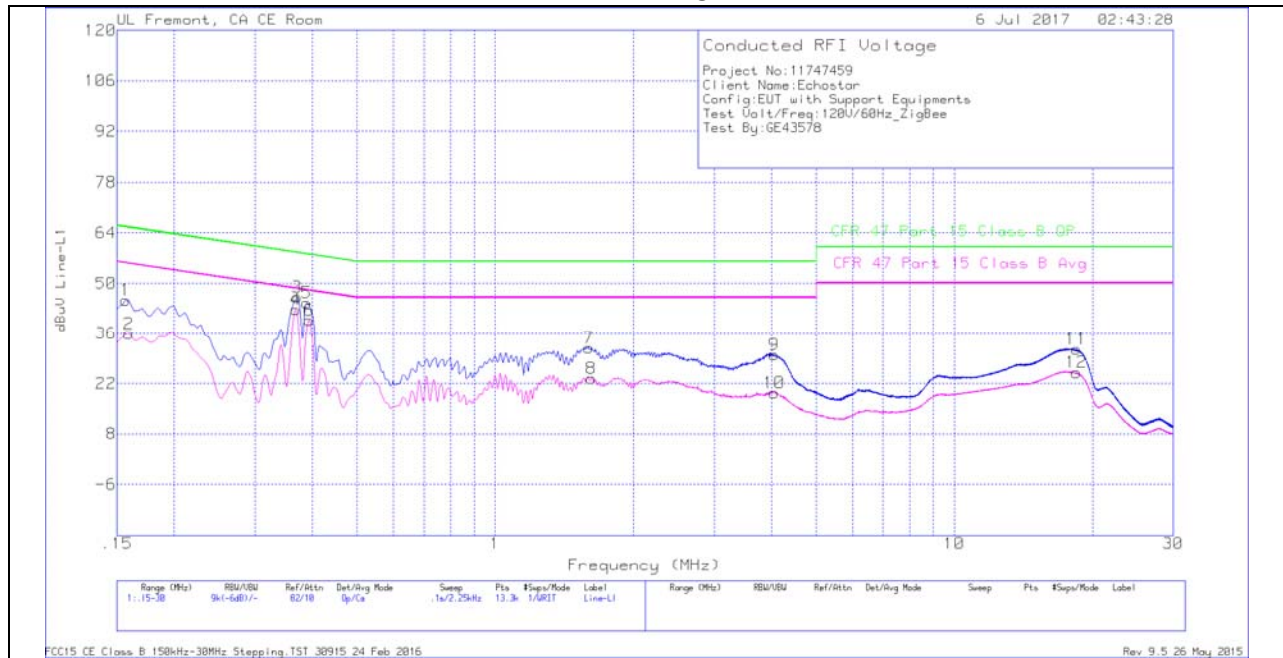
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

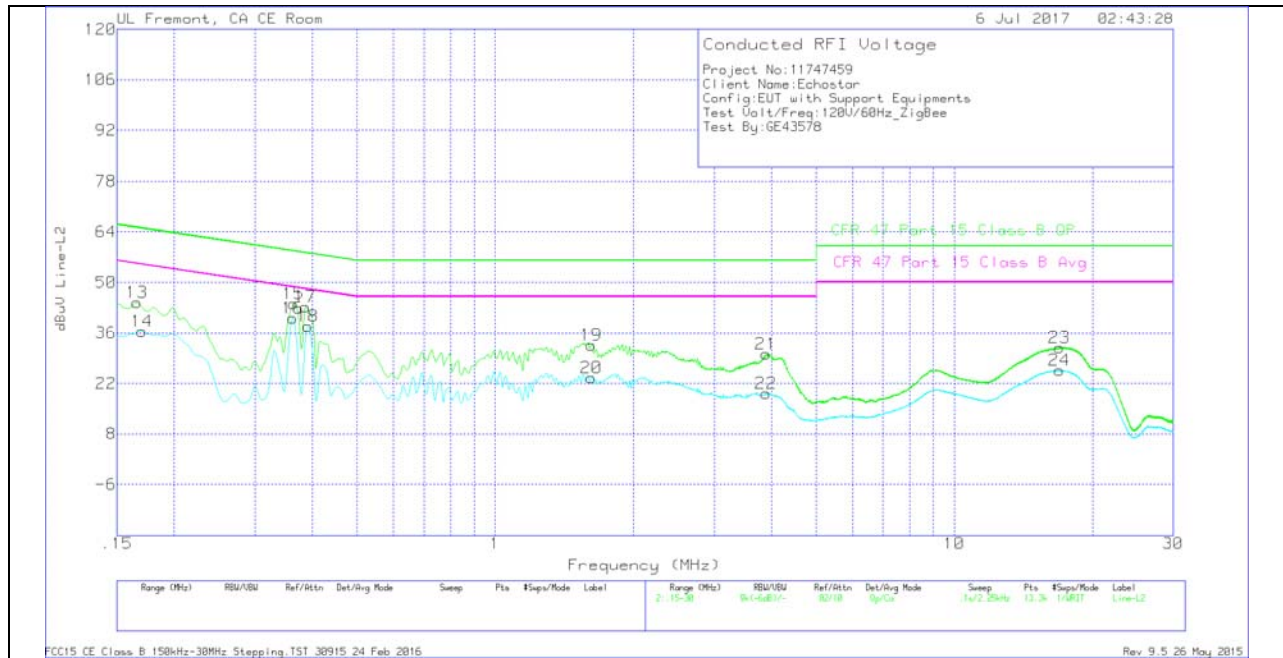
RESULTS

6 WORST EMISSIONS

LINE 1 PLOT



LINE 2 PLOT



LINE 1 and 2 RESULT

Trace Markers

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
1	.15675	35.09	Qp	.1	.1	10.1	45.39	65.63	-20.24	-	-
2	.159	25.56	Ca	.1	.1	10.1	35.86	-	-	55.52	-19.66
3	.3705	35.93	Qp	0	.1	10.1	46.13	58.49	-12.36	-	-
4	.36825	32.54	Ca	0	.1	10.1	42.74	-	-	48.54	-5.8
5	.3885	34.4	Qp	0	.1	10.1	44.6	58.1	-13.5	-	-
6	.393	29.56	Ca	0	.1	10.1	39.76	-	-	48	-8.24
7	1.599	21.66	Qp	0	.1	10.1	31.86	56	-24.14	-	-
8	1.6215	13.27	Ca	0	.1	10.1	23.47	-	-	46	-22.53
9	4.047	19.87	Qp	0	.1	10.1	30.07	56	-25.93	-	-
10	4.056	9.24	Ca	0	.1	10.1	19.44	-	-	46	-26.56
11	18.447	20.96	Qp	0	.3	10.3	31.56	60	-28.44	-	-
12	18.447	14.46	Ca	0	.3	10.3	25.06	-	-	50	-24.94

Qp - Quasi-Peak detector
 Ca - CISPR average detection

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
13	.16575	34.34	Qp	0	0	10.1	44.44	65.17	-20.73	-	-
14	.17025	26.26	Ca	0	.1	10.1	36.46	-	-	54.95	-18.49
15	.36375	33.84	Qp	0	.1	10.1	44.04	58.64	-14.6	-	-
16	.36262	29.92	Ca	0	.1	10.1	40.12	-	-	48.67	-8.55
17	.38625	32.96	Qp	0	.1	10.1	43.16	58.14	-14.98	-	-
18	.39075	27.65	Ca	0	.1	10.1	37.85	-	-	48.05	-10.2
19	1.61925	22.41	Qp	0	.1	10.1	32.61	56	-23.39	-	-
20	1.6215	13.45	Ca	0	.1	10.1	23.65	-	-	46	-22.35
21	3.88725	19.96	Qp	0	.1	10.1	30.16	56	-25.84	-	-
22	3.8895	9.04	Ca	0	.1	10.1	19.24	-	-	46	-26.76
23	16.953	21.43	Qp	0	.2	10.3	31.93	60	-28.07	-	-
24	16.95975	15.14	Ca	0	.2	10.3	25.64	-	-	50	-24.36

Qp - Quasi-Peak detector
 Ca - CISPR average detection