CERTIFICATION TEST REPORT

Report Number : 11395475-E1V5

Applicant	:	SRAM LLC. 1000 W Fulton Market, 4th Floor Chicago, IL. 60607, U.S.A
Model	:	0824
FCC ID	:	C9O-KILO2
IC ID	:	10161A-KILO2
EUT Description	:	Quarq Kilo Bicycle Power Meter
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C INDUSTRY CANADA RSS-247 ISSUE 1

Date of Issue:
9/13/2016

Prepared by:
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	08/16/16	Initial Issue	
V2	09/6/16	Updated Section 3.6, Added Section 5.3 & updated set-up diagram	Kiya Kedida
V3	09/8/16	Updated Section 3.6, 5.1 & 5.2	D. Coronia
V4	09/12/16	Added test engineer information	D. Coronia
V5	09/13/16	Updated Section 3.5, 5.1	D. Coronia

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SRAM LLC.
1000 W Fulton Market, 4th Floor
Chicago, IL. 60607, U.S.A

EUT DESCRIPTION: Quarq Kilo Bicycle Power Meter

MODEL: 0824

SERIAL NUMBER: AFS61570

DATE TESTED: AUGUST 11 – SEPTEMBER 6, 2016

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-247 Issue 1	Pass
INDUSTRY CANADA RSS-GEN Issue 4	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 revisions 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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UL Verification Services Inc.

2. SUMMARY OF TESTING

2.1. 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
☒ Chamber A(IC: 2324B-1)	☐ Chamber D(IC: 2324B-4)
☐ Chamber B(IC: 2324B-2)	☐ Chamber E(IC: 2324B-5)
☒ Chamber C(IC: 2324B-3)	☐ Chamber F(IC: 2324B-6)
	☐ Chamber G(IC: 2324B-7)
	☐ Chamber H(IC: 2324B-8)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through H are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-8, respectively.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

2.2. SUMMARY TABLE

FCC Part Section	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result
15.247 (a)(2)	RSS-247 5.2.1	Occupied Band width (6dB)	>500KHz	Conducted	.655MHz
2.1051, 15.247 (d)	RSS-247 5.5	Band Edge / Conducted Spurious Emission	-20dBc		-35.36dBm
15.247	RSS-247 5.4.4	TX conducted output power	<30dBm		Pass
15.247	RSS-247 5.2.2	PSD	<8dBm		2.327dBm
15.207 (a)	RSS-GEN 8.8	AC Power Line conducted emissions	Section 10		Pass
15.205, 15.209	RSS-GEN 8.9/7	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass

2.3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 4, and RSS-247 Issue 1.

2.4. CALIBRATION AND UNCERTAINTY

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.

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

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	3.84 dB
Radiated Disturbance, 9KHz to 30 MHz	2.14 dB
Radiated Disturbance, 30 to 1000 MHz	4.98 dB
Radiated Disturbance,1000 to 6000 MHz	3.86 dB
Radiated Disturbance,6000 to 18000 MHz	4.23 dB
Radiated Disturbance,18000 to 26000 MHz	5.30 dB
Radiated Disturbance,26000 to 40000 MHz	5.23 dB

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

2.5. MEASUREMENT METHOD

On Time and Duty Cycle: KDB 558074 D01 v03r05, Section 6.

6 dB Emission BW: KDB 558074 D01 v03r05, Section 8.

Conducted Output Power: KDB 558074 D01 v03r05, Section 9.1.2 (Method PKPM1).

Power Spectral Density: KDB 558074 D01 v03r05, Section 10.2 (Method PKPSD).

Unwanted emissions in restricted bands: KDB 558074 D01 v03r05, Section 12.0, 12.2.

Unwanted emissions in non-restricted bands: KDB 558074 D01 v03r05, Section 11.1, 11.2, and 11.3

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2.6. 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**	**T No.**	**Cal Date**	**Cal Due**
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	1450	12/12/15	12/12/16
PSA Spectrum Analyzer 40GHz	Agilent	E4446A	146	07/13/16	07/13/17
Spectrum Analyzer, PXA 3Hz to 44Ghz	Keysight	N9030A	908	04/13/16	04/13/17
Amplifier, 1 to 7 GHz, 10dB Gain minimum, 6dB NF	Amplical	AMP1G7-10-27	1370	04/15/16	04/15/17
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	300	11/05/15	11/05/16
Antenna, Broadband Hybrid 30MHz to 2000MHz	Sunol Science	JB3	899	05/26/16	05/26/17
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	346	02/22/16	02/22/17
Loop Antenna, 10KHz-30MHz	EMCO	6502	35	03/24/16	03/24/17
Power Meter, P-series single channel	Keysight	N1911A	1262	07/08/16	07/08/17
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Agilent	N1921A	750	09/17/25	09/17/16
Spectrum Analyzer, PXA 3Hz to 44Ghz	Keysight	N9030A	908	04/13/16	04/13/17
Antenna, Broadband Hybrid 30MHz to 2000MHz	Sunol Sciences	JB3	899	05/26/16	05/26/17
Antenna, Horn 1-18GHz	ETS Lindgren	3117	346	02/22/16	02/22/17
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	300	11/05/15	11/05/16
Filter, HPF 6.0 HPF	Micro-Tronics	HPS17542	484	07/20/16	07/20/17
Filter, HPF 3.0 GHz	Micro-Tronics	HPM17543	486	07/20/16	07/20/17
Filter, LPF 5 GHz	Micro-Tronics	LPS17541	481	07/20/16	07/20/17
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	907	01/06/16	01/06/17
Antenna, Horn 1-18GHz	ETS Lindgren	3117	345	03/07/16	03/07/17
Antenna, Active Loop 9KHz to 30MHz	Emco	6502	35	03/24/16	03/24/17
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB1	130	09/01/15	09/01/16
Amplifier, 10KHz to 1GHz, 32dB	Keysight	8447D	10	02/01/16	02/01/17
Amplifier, 1 to 8 GHz, 35dB	Miteq	-4D-01000800-30	1156	03/09/16	03/09/17
Filter, HPF 3GHz	Micro-Tronics	HPM17543	485	03/09/16	03/09/17
Filter, LPF 5GHz	Micro-Tronics	LPS17541	482	03/09/16	03/09/17

Test Software List			
Description	**Manufacturer**	**Model**	**Version**
Radiated Software	UL	UL EMC	Ver 9.5, Apr 26, 2016
Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015
Antenna Port Software	UL	UL RF	Ver 5.1.1, July 15, 2016

3. EQUIPMENT UNDER TEST

3.1. DESCRIPTION OF EUT

The EUT is a BICYCLE POWER METER with ANT+ & BLE

3.2. 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	2.80	1.91

3.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a 2.4 GHz surface mount Device (SMD) on-ground Antenna with 3 dBi (peak) gain.

3.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 10531.

The test utility software used during testing was 10328.

3.5. WORST-CASE CONFIGURATION AND MODE

Above 1GHz Low/Middle/High channel were tested for radiated emissions and the below 1GHz, above 18GHz the channel with the highest output power was tested.

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

3.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	SL510	LR-LNCPB	N/A
AC Adapter	Lenovo	42T4418	PA-1650-53I	N/A
DC Power Supply	AMETEK	XT15-4	T464	N/A

I/O CABLES

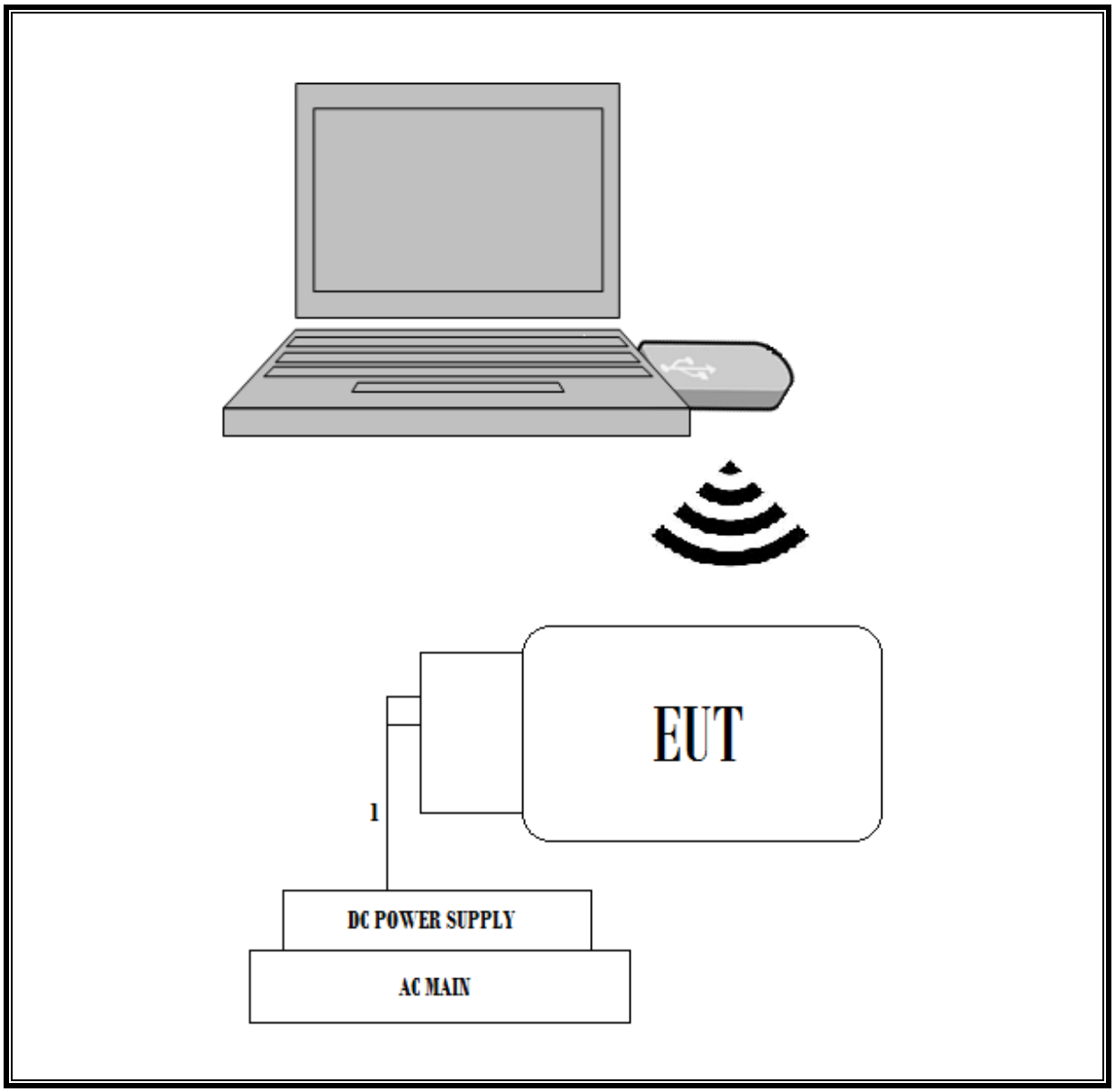
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	Banand Plug	Un-shielded	0.4m	N/A

TEST SETUP

The firmware installed in the EUT during testing was 10531 provided by SRAM.

The EUT is a stand-alone unit during the tests. Python Script exercised the radio card and the radio card will communicate with the EUT.

SETUP DIAGRAM FOR TESTS



4. ANTENNA PORT TEST RESULTS

4.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

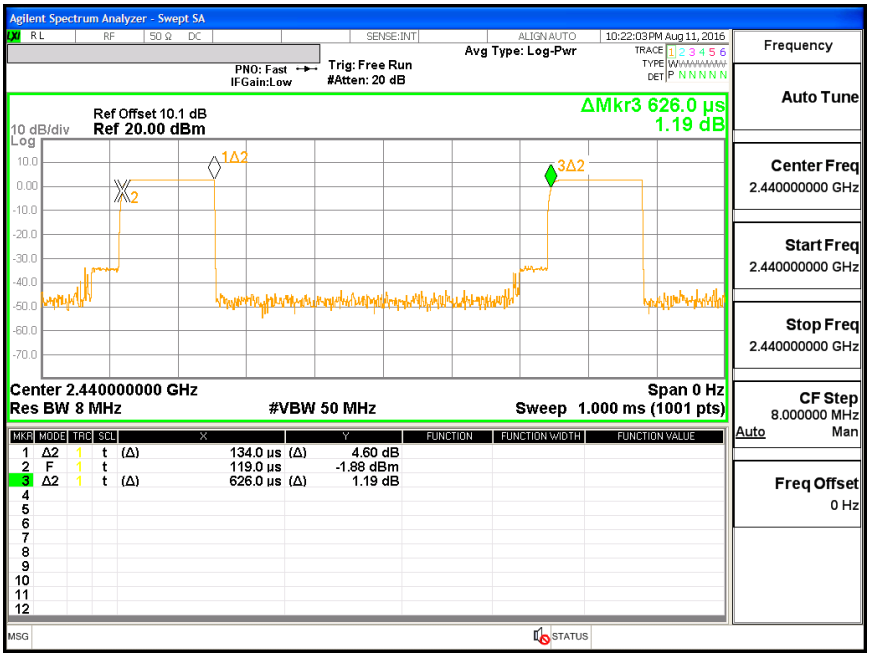
KDB 558074 Zero-Span Spectrum Analyzer Method.

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	0.134	0.626	0.214	21.41%	6.69	7.463

DUTY CYCLE PLOTS

DUTY CYCLE BLE MODE



ID:	37290	Date:	08/11/16

4.2. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-247 5.2 (1)

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

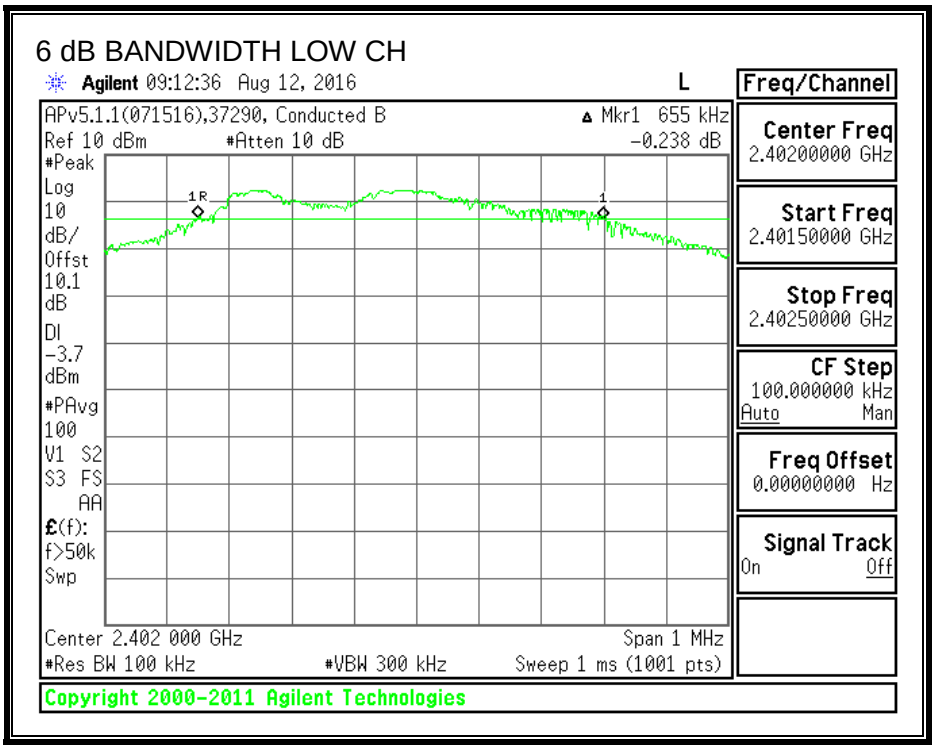
TEST PROCEDURE

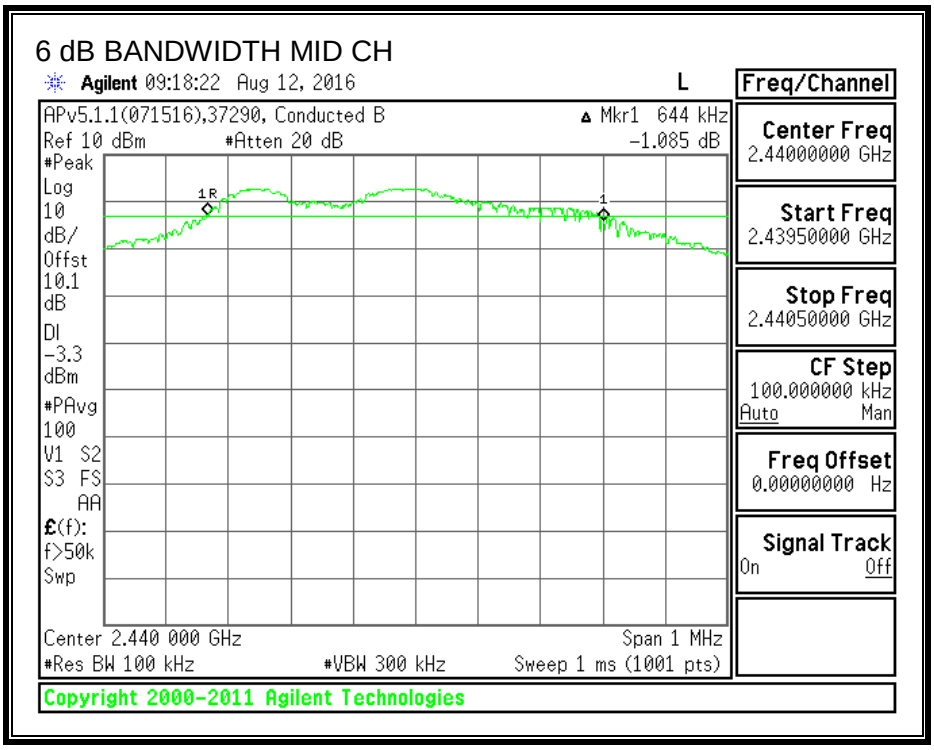
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

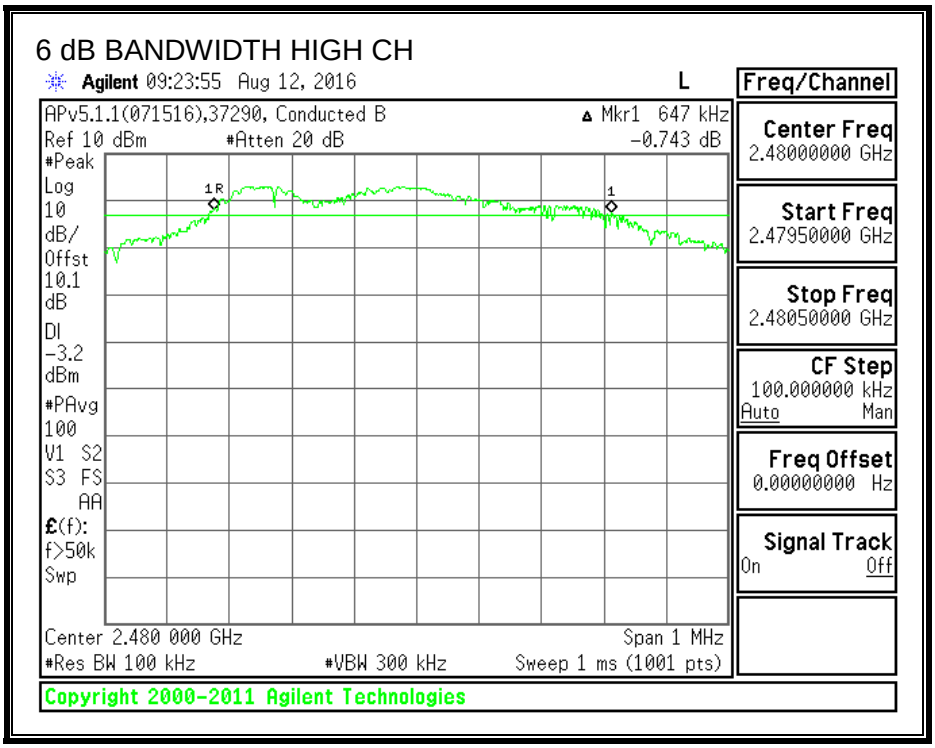
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.655	0.5
Middle	2440	0.644	0.5
High	2480	0.647	0.5

6 dB BANDWIDTH







4.3. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

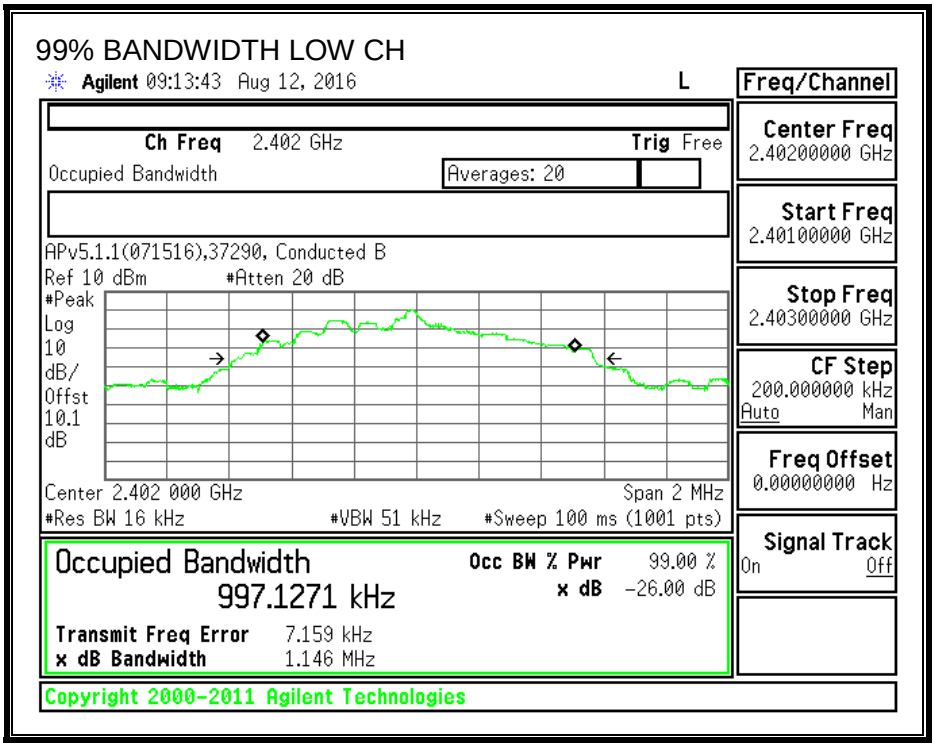
Reference to ANSI C63.10-2013, section 6.9.2 and RSS Gen Issue 4, section 6.6: The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth and to 1% of the span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

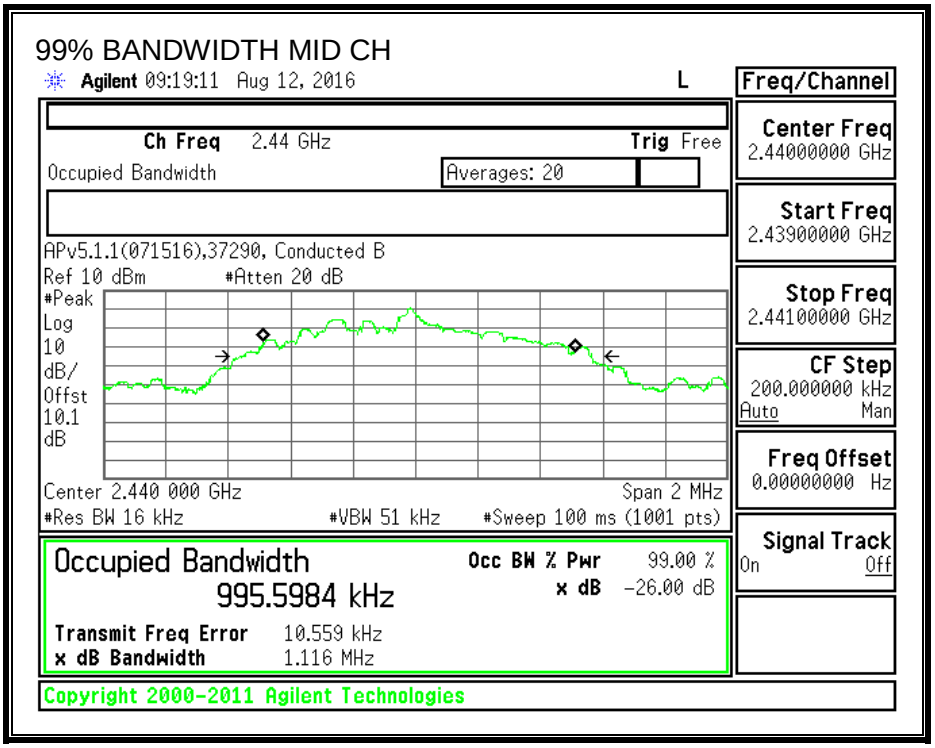
RESULTS

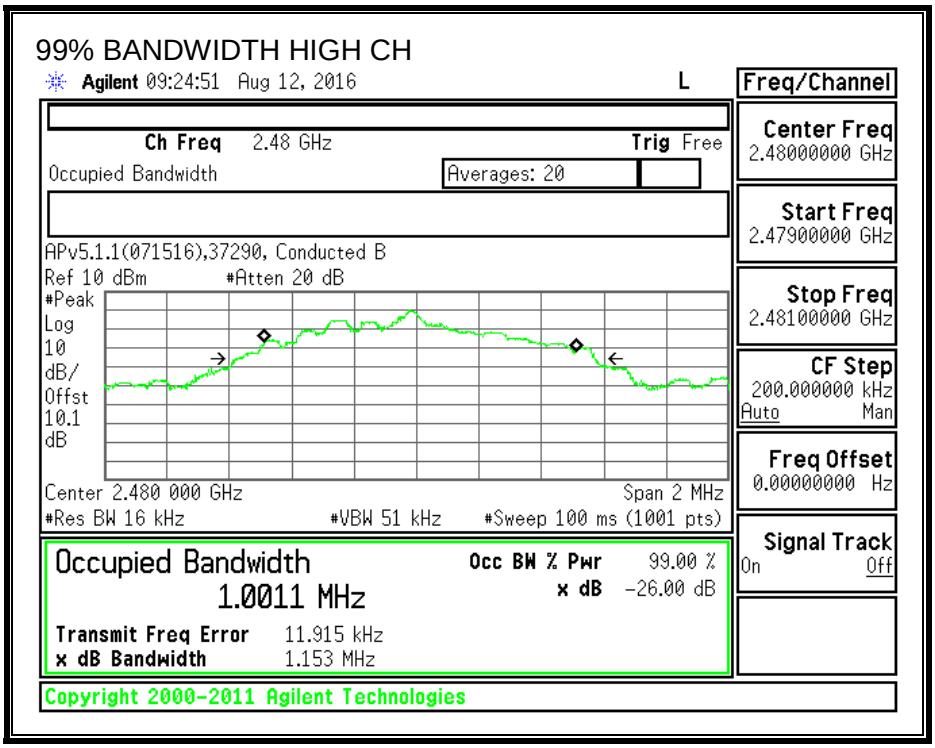
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	0.9971
Middle	2440	0.9956
High	2480	1.0011

ID:	37290	Date:	08/12/16

99% BANDWIDTH







4.4. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-247 5.4 (4)

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 v03r05 utilizing spectrum analyzer.

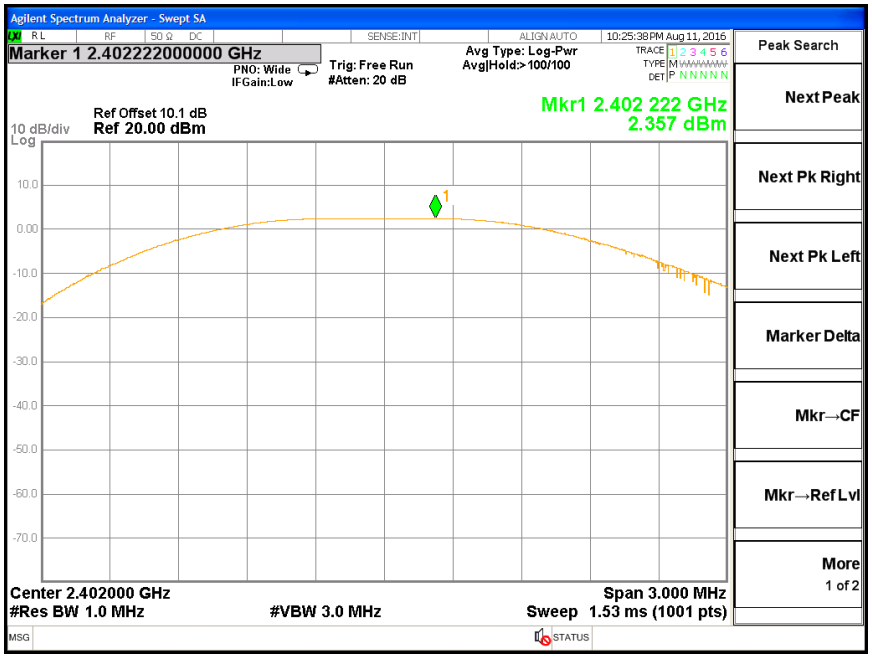
RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	2.357	30	-27.643
Middle	2440	2.665	30	-27.335
High	2480	2.802	30	-27.198

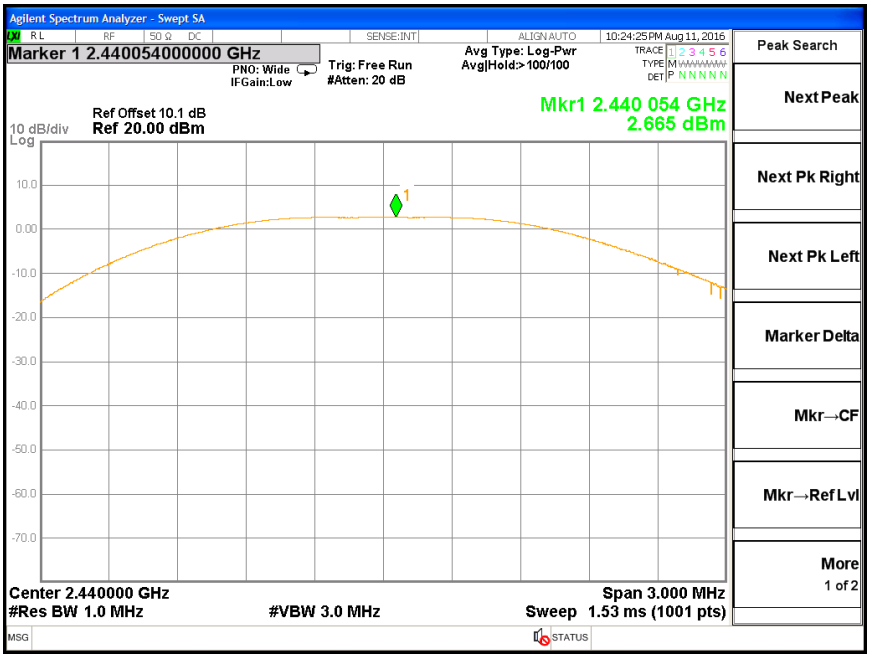
ID:	37290	Date:	08/11/16

OUTPUT POWER RESULT

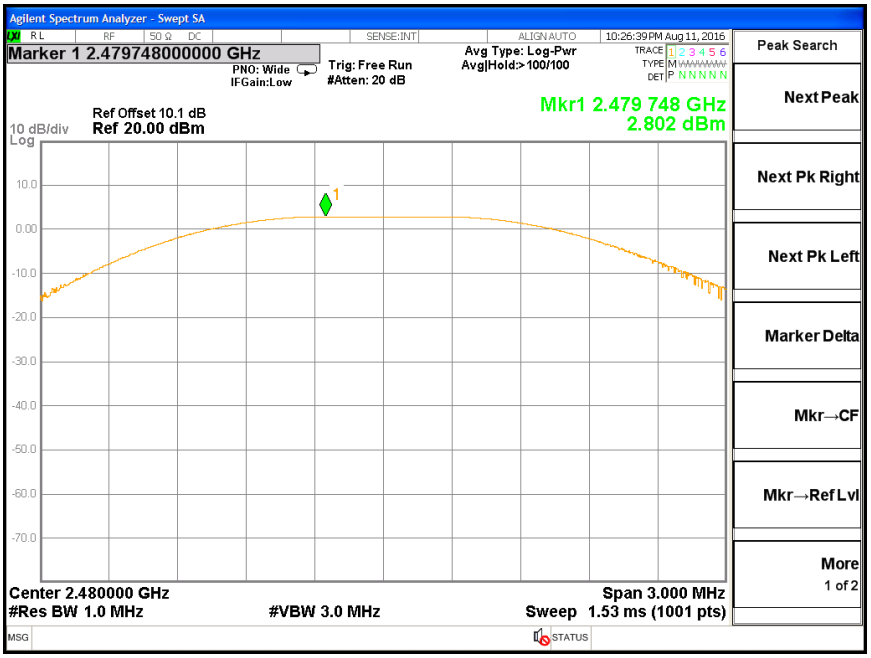
OUTPUT POWER LOW CH



OUTPUT POWER MID CH



OUTPUT POWER HIGH CH



4.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-247 5.2 (2)

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

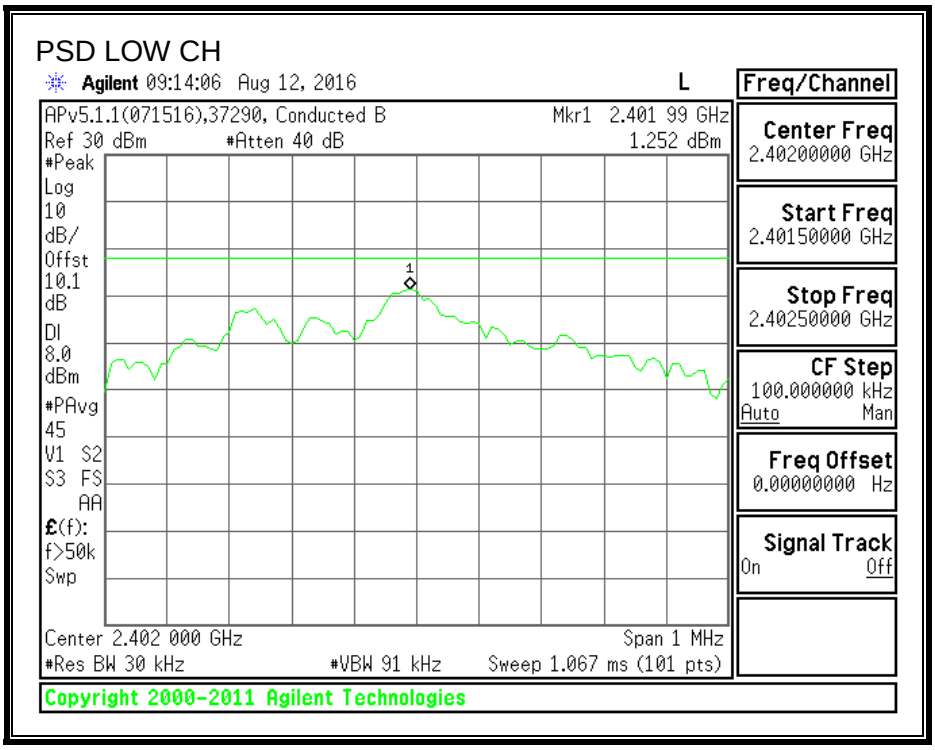
Power Spectral Density was performed utilizing the “Method PKPSD (Peak PSD)” under KDB558074 D01 DTS Meas Guidance v03r02.

RESULTS

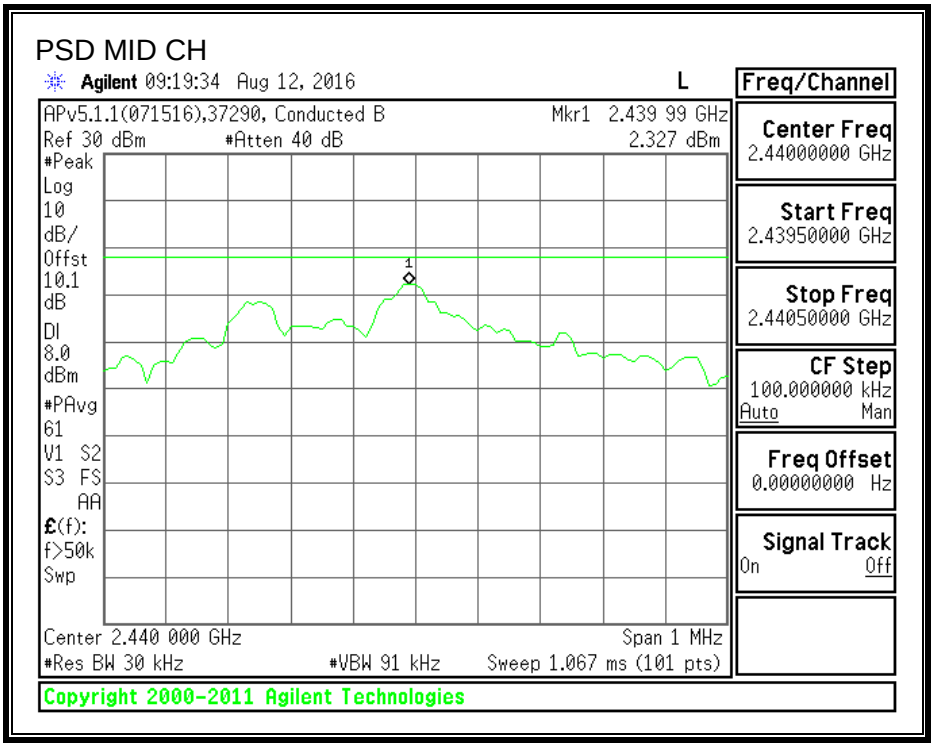
Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	1.252	8	-6.75
Middle	2440	2.327	8	-5.67
High	2480	1.675	8	-6.33

POWER SPECTRAL DENSITY

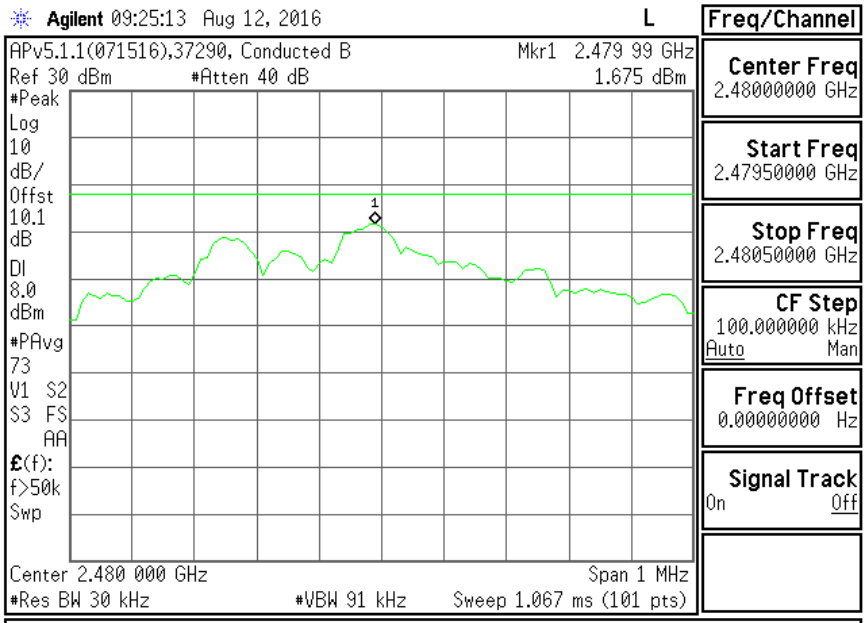
PSD LOW CH



PSD MID CH



PSD HIGH CH



4.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-247 5.5

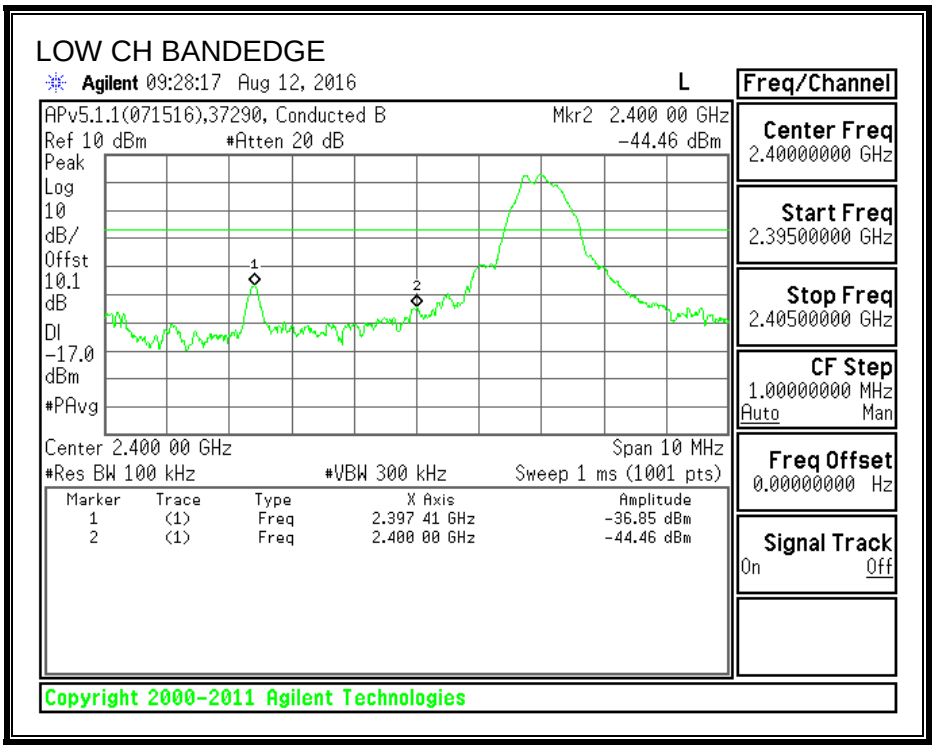
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

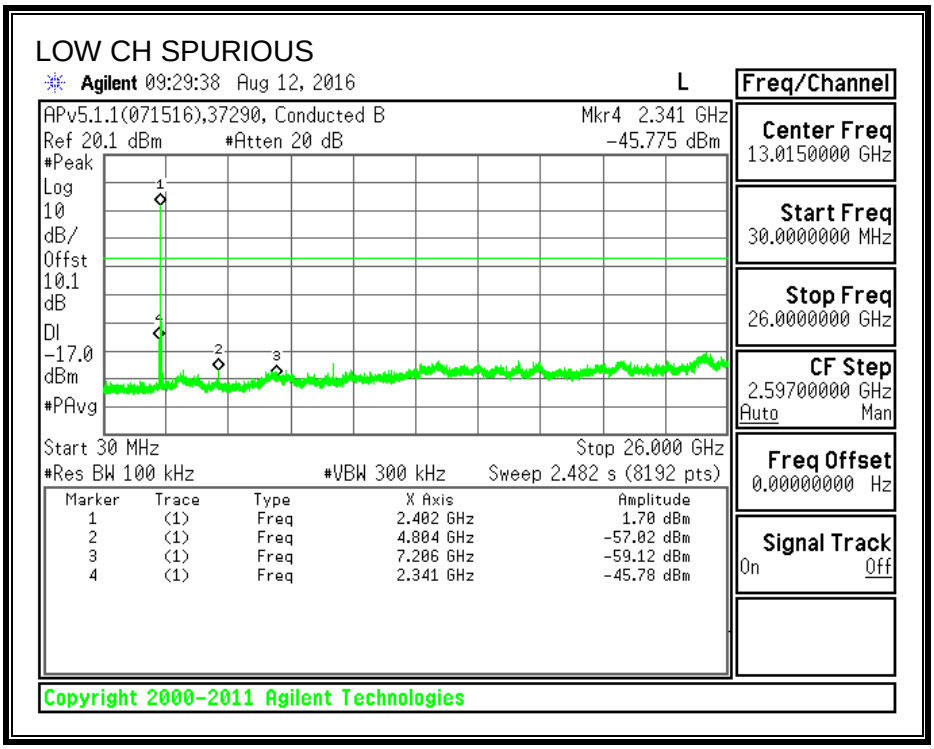
TEST PROCEDURE

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.

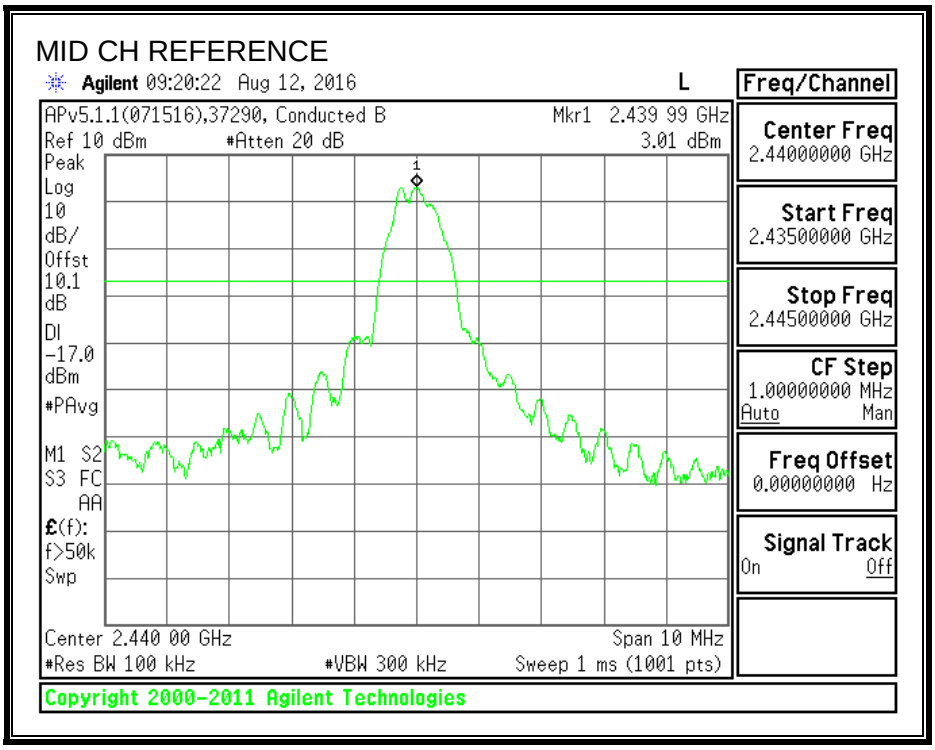
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

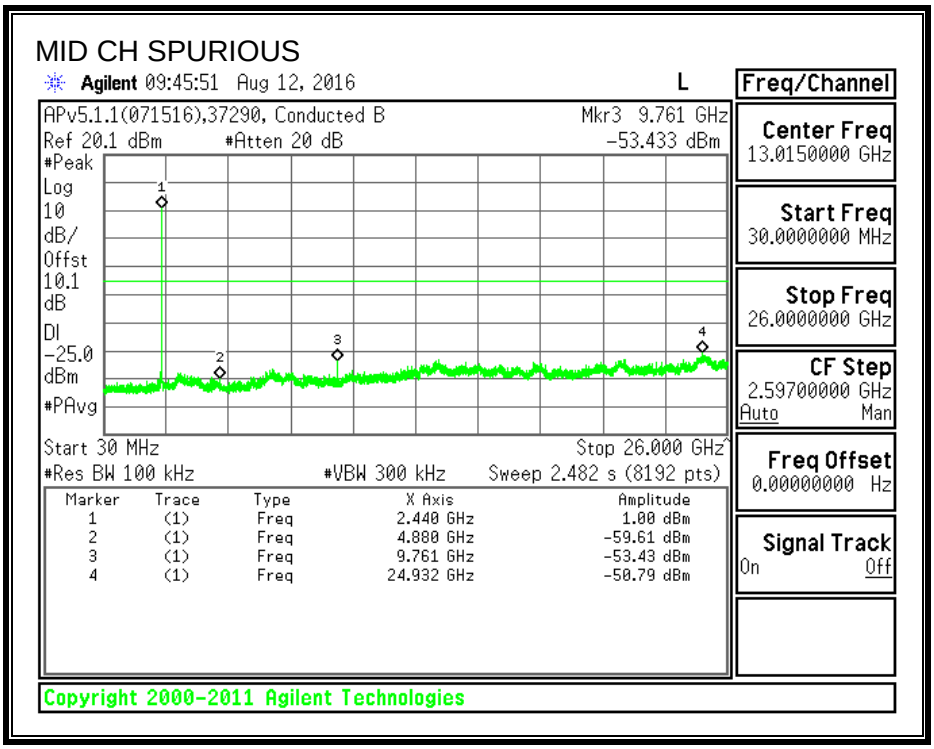
SPURIOUS EMISSIONS, LOW CHANNEL





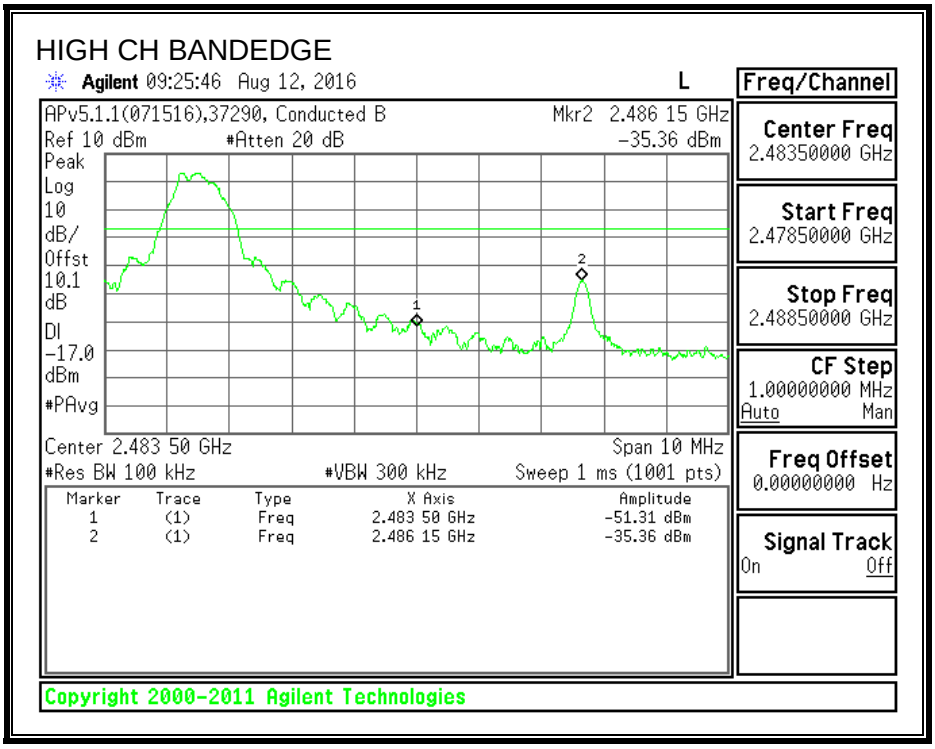
SPURIOUS EMISSIONS, MID CHANNEL

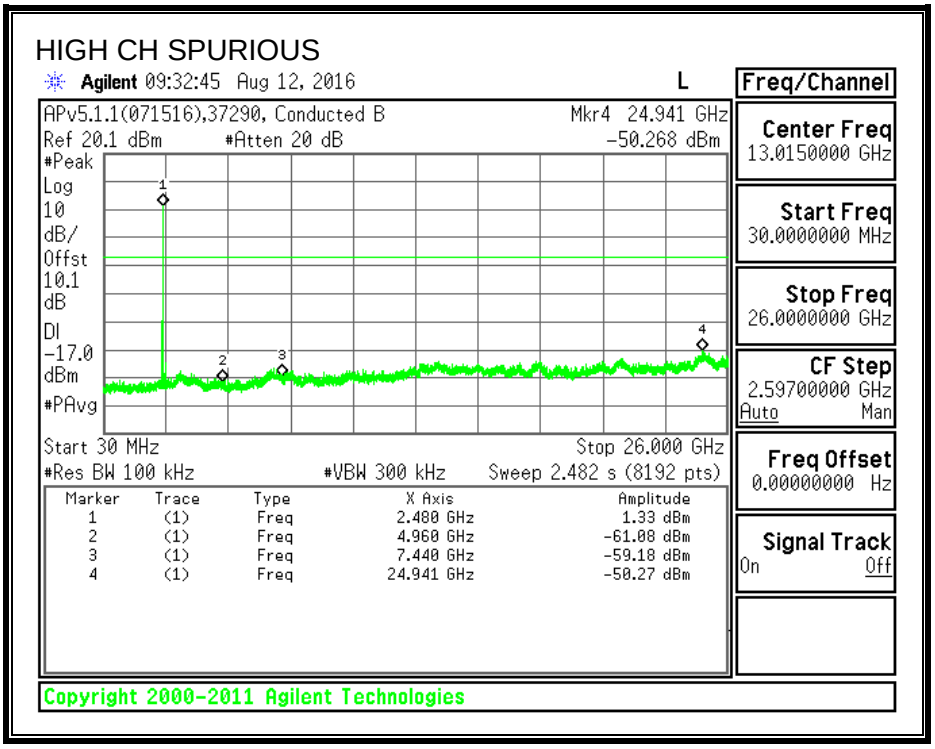




Note: Conducted spurious limit should be -17.0dBm, but compliant to lower limit of -25dBm.

SPURIOUS EMISSIONS, HIGH CHANNEL





5. TRANSMITTER RADIATED EMISSIONS

5.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-GEN Clause 8.9 (Transmitter)

IC RSS-GEN Clause 7.1.2 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009 – 0.490	2400/F (kHz)	2400/F (kHz)
0.490 – 1.705	24000/F (kHz)	24000/F (kHz)
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

NOTE: KDB 937606 OATS and Chamber Correlation Justification

- Device is a small bicycle power meter.
- Base 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.

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 3 MHz for peak measurements and add duty cycle factor for average measurements.
Note: The pre-scan measurements above 1GHz the VBW is set to 30 kHz.

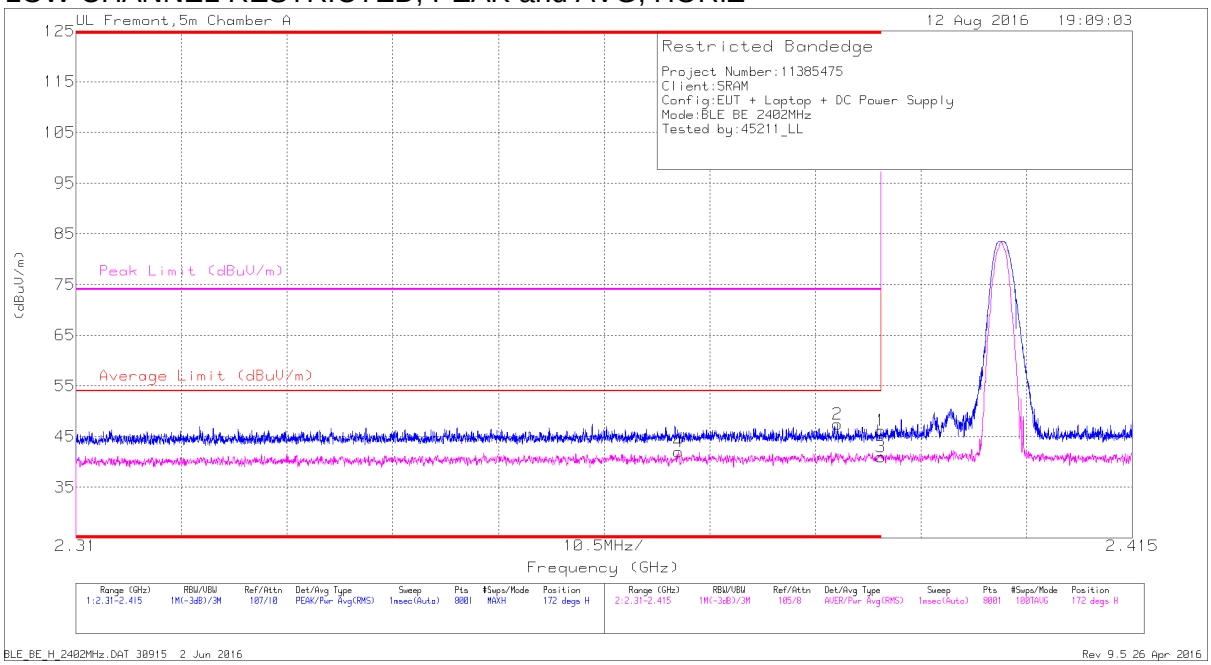
The spectrum from 9 kHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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.

5.2. TRANSMITTER ABOVE 1 GHz

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK and AVG, HORIZ



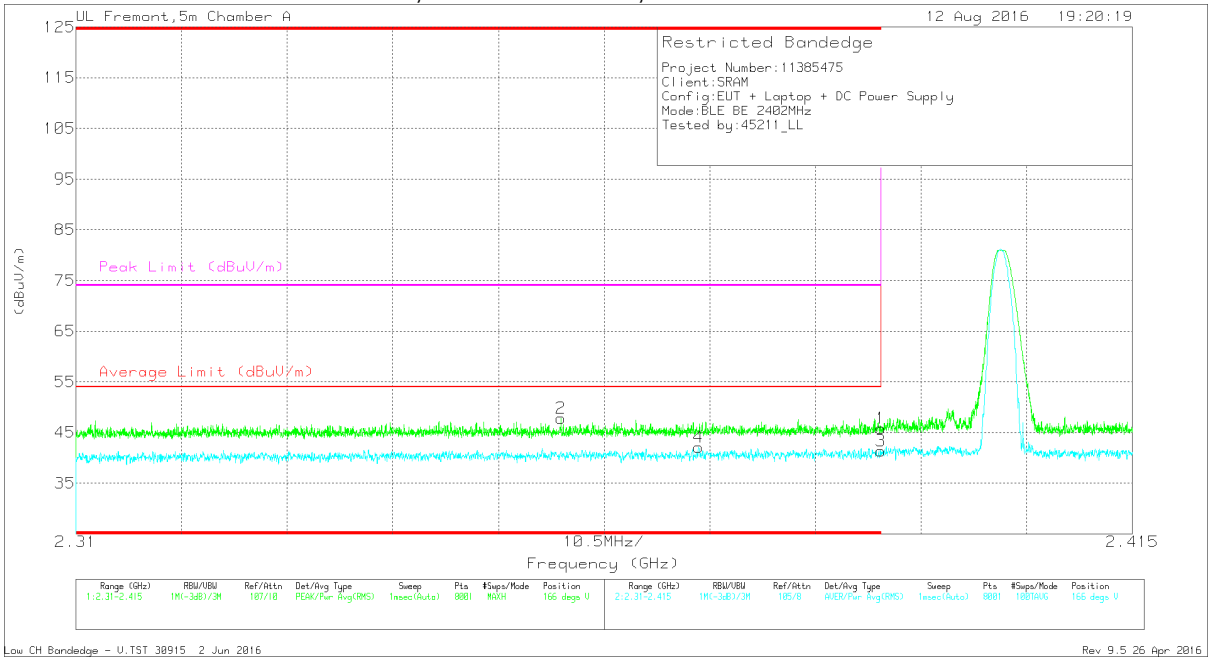
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (db/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	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	37.61	Pk	32.3	-23.7	0	46.21	-	-	74	-27.79	172	114	H
2	* 2.386	38.94	Pk	32.2	-23.7	0	47.44	-	-	74	-26.56	172	114	H
3	* 2.39	25.66	RMS	32.3	-23.7	6.69	40.95	54	-13.05	-	-	172	114	H
4	* 2.37	26.75	RMS	32.2	-23.7	6.69	41.94	54	-12.06	-	-	172	114	H

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

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK and AVG, VERT



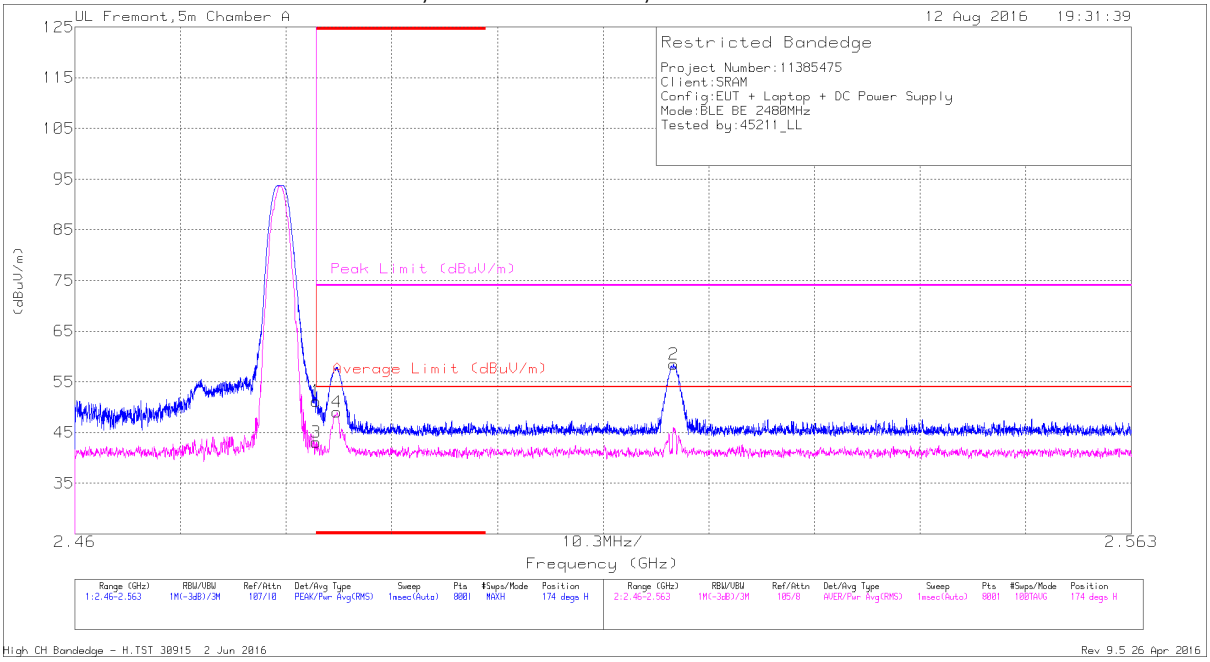
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (db/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	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	37.22	Pk	32.3	-23.7	0	45.82	-	-	74	-28.18	166	231	V
2	* 2.358	39.37	Pk	32.1	-23.7	0	47.77	-	-	74	-26.23	166	231	V
3	* 2.39	26.04	RMS	32.3	-23.7	6.69	41.33	54	-12.67	-	-	166	231	V
4	* 2.372	26.9	RMS	32.2	-23.7	6.69	42.09	54	-11.91	-	-	166	231	V

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

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL RESTRICTED, PEAK and AVG, HORIZ



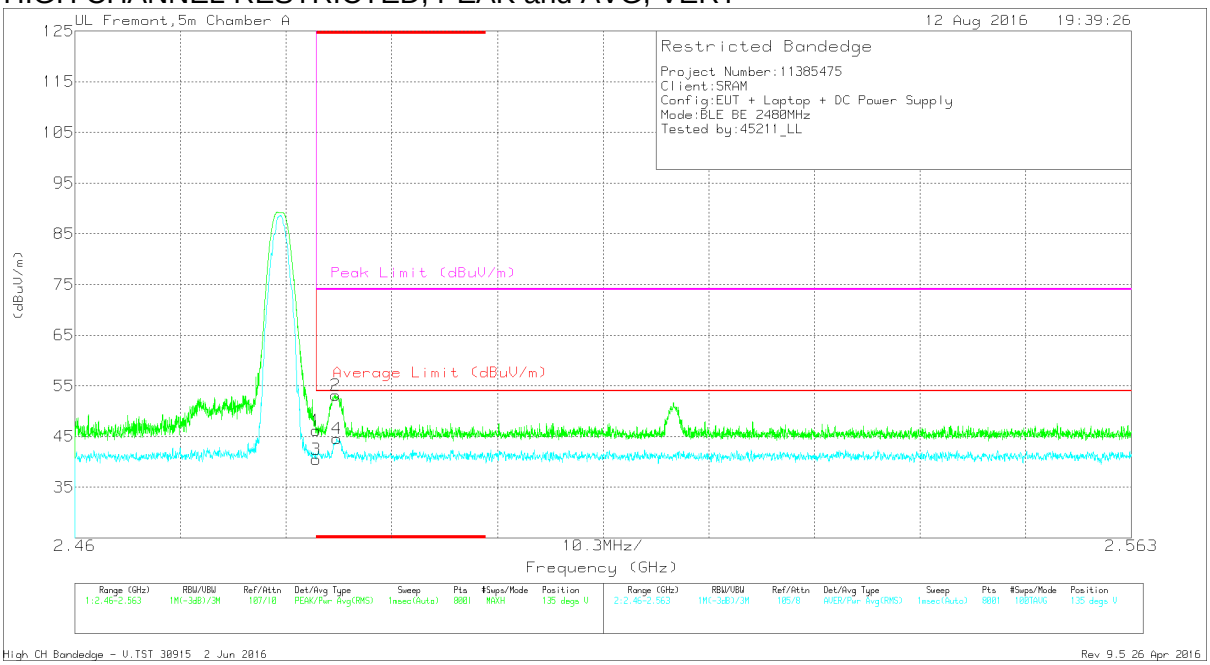
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (db/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	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	42.42	Pk	32.4	-23.6	0	51.22	-	-	74	-22.78	174	106	H
3	* 2.484	27.56	RMS	32.4	-23.6	6.69	43.05	54	-10.95	-	-	174	106	H
4	* 2.486	33.64	RMS	32.4	-23.7	6.69	49.03	54	-4.97	-	-	174	106	H
2	2.518	49.65	Pk	32.4	-23.6	0	58.45	-	-	74	-15.55	174	106	H

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

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, PEAK and AVG, VERT



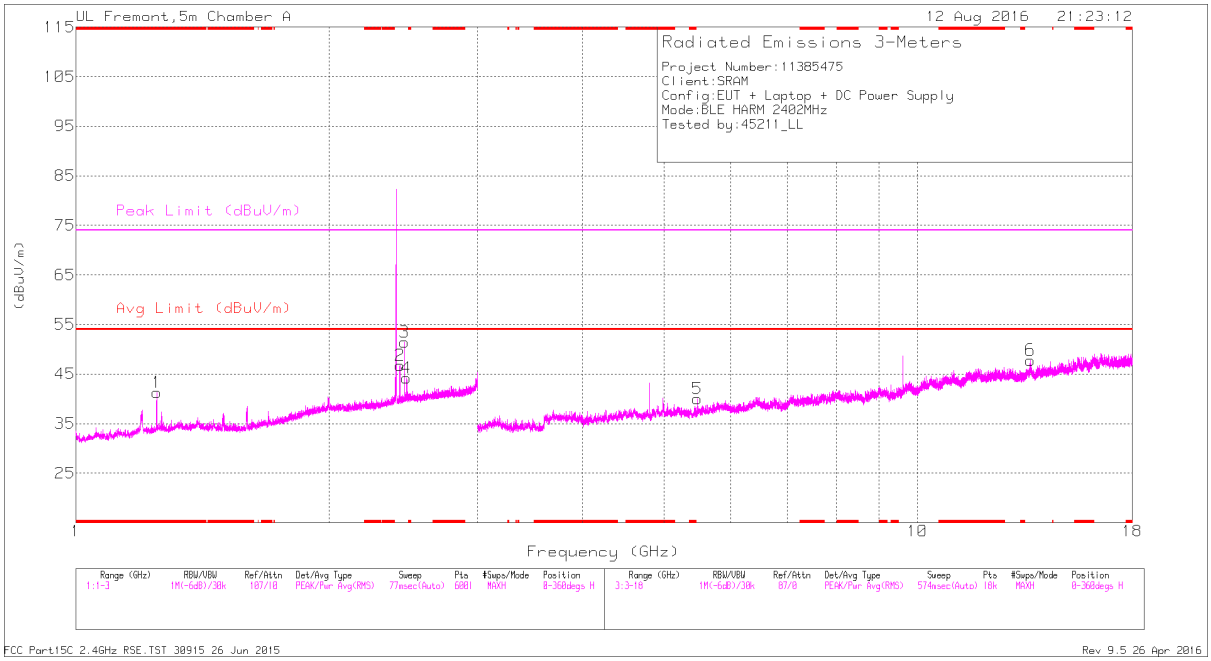
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (db/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	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	37.36	Pk	32.4	-23.6	0	46.16	-	-	74	-27.84	135	254	V
2	* 2.485	44.5	Pk	32.4	-23.7	0	53.2	-	-	74	-20.8	135	254	V
3	* 2.484	25.04	RMS	32.4	-23.6	6.69	40.53	54	-13.47	-	-	135	254	V
4	* 2.486	29.24	RMS	32.4	-23.7	6.69	44.63	54	-9.37	-	-	135	254	V

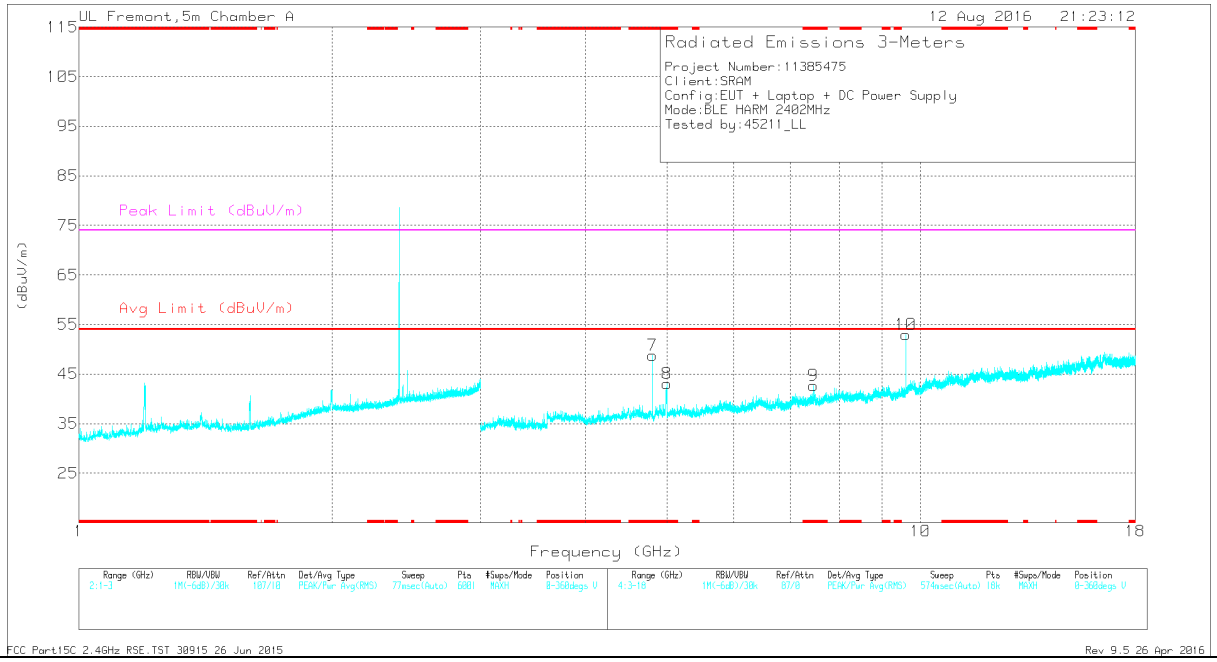
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL

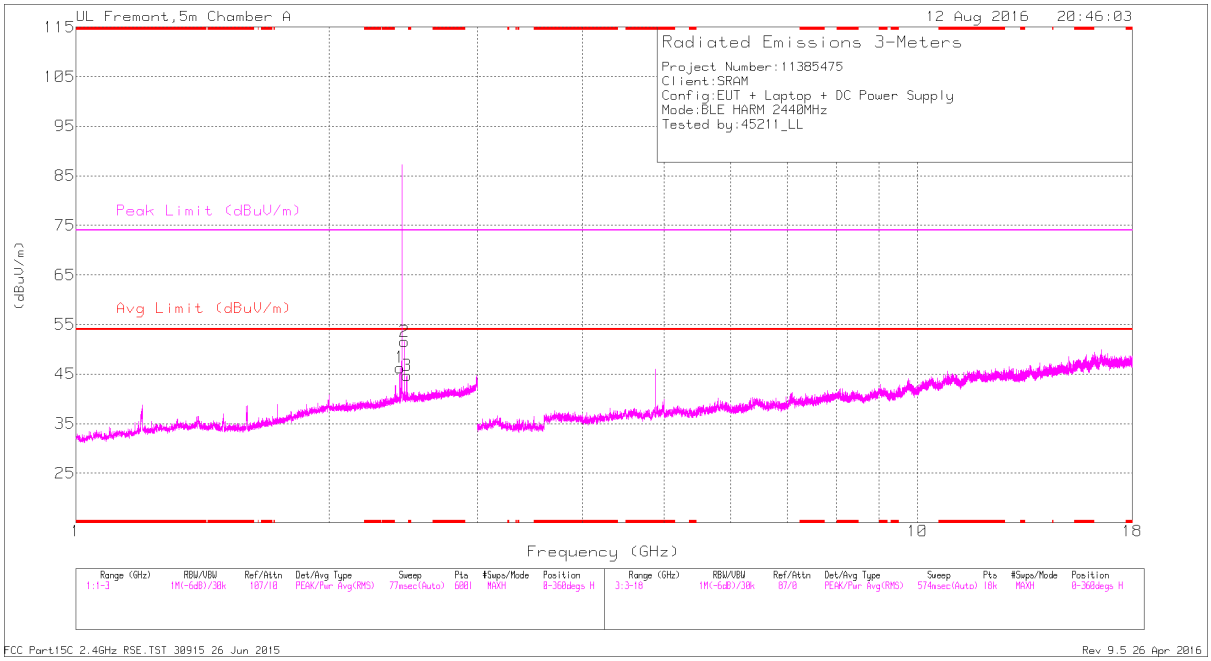


LOW CHANNEL DATA

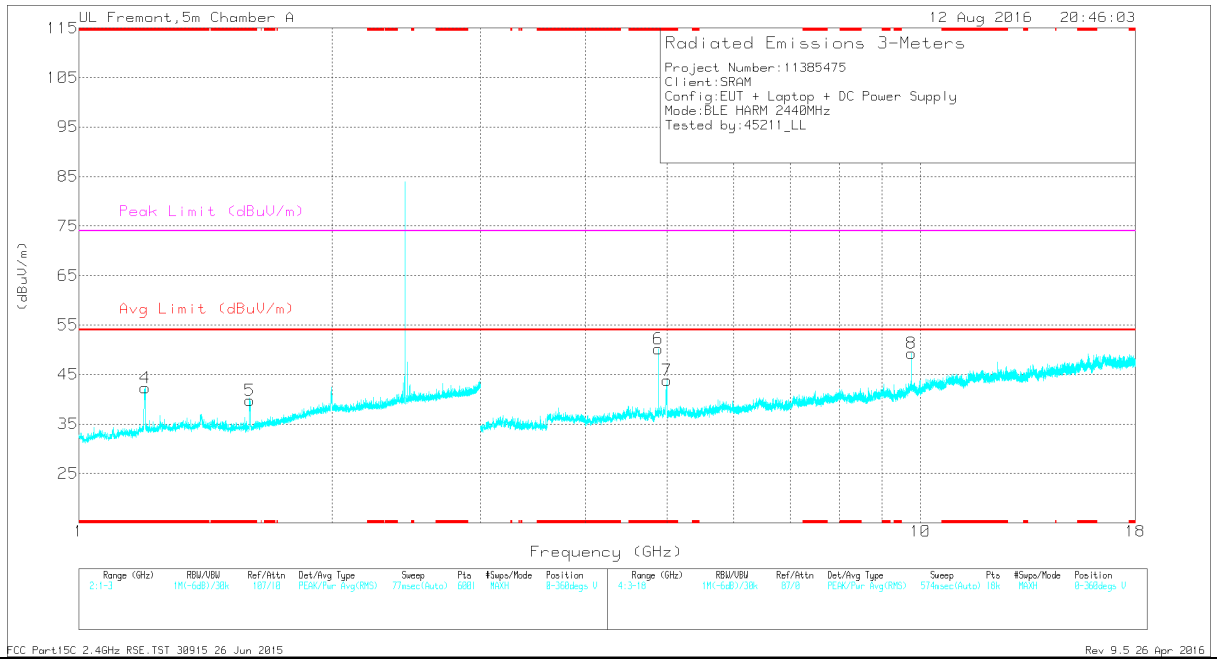
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (db/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.249	44.59	PK2	28.6	-24	0	49.19	-	-	74	-24.81	187	266	H
	* 1.248	25.64	MAv1	28.6	-24	6.69	36.93	54	-17.07	-	-	187	266	H
7	* 4.803	46.8	PK2	34.3	-28.6	0	52.5	-	-	74	-21.5	293	310	V
	* 4.804	37.75	MAv1	34.3	-28.6	6.69	50.14	54	-3.86	-	-	293	310	V
8	* 4.995	44.05	PK2	34.3	-29	0	49.35	-	-	74	-24.65	108	212	V
	* 4.996	31.22	MAv1	34.3	-29	6.69	43.21	54	-10.79	-	-	108	212	V
9	* 7.468	36.35	PK2	35.8	-23.5	0	48.65	-	-	74	-25.35	212	186	V
	* 7.47	23.72	MAv1	35.8	-23.6	6.69	42.61	54	-11.39	-	-	212	186	V
2	**2.426	38.02	Pk	32.4	-23.7	0	46.72	-	-	-	-	0-360	200	H
3	**2.457	42.69	Pk	32.4	-23.6	0	51.49	-	-	-	-	0-360	200	H
4	**2.472	35.44	Pk	32.4	-23.6	0	44.24	-	-	-	-	0-360	200	H
5	5.481	36.78	PK2	34.8	-27.2	0	44.38	-	-	-	-	66	233	H
10	9.609	42.83	PK2	36.5	-22.1	0	57.23	-	-	-	-	308	101	V
6	13.626	33.18	PK2	39.1	-20.4	0	51.88	-	-	-	-	69	218	H

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

MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL

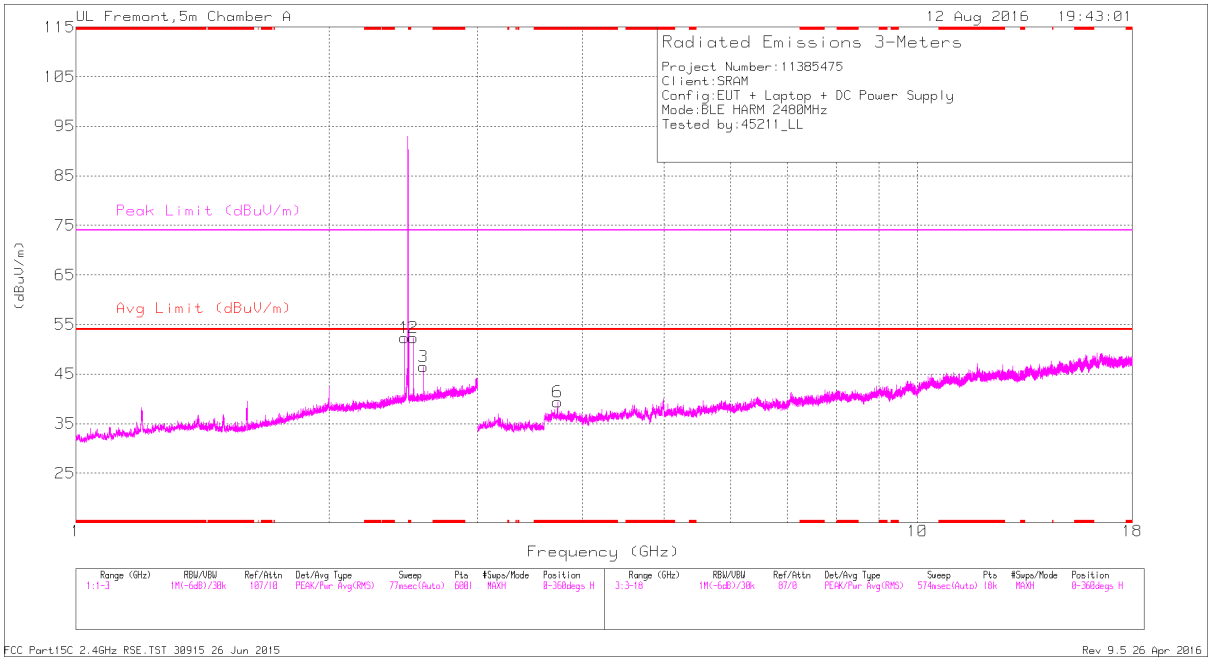


MID CHANNEL DATA

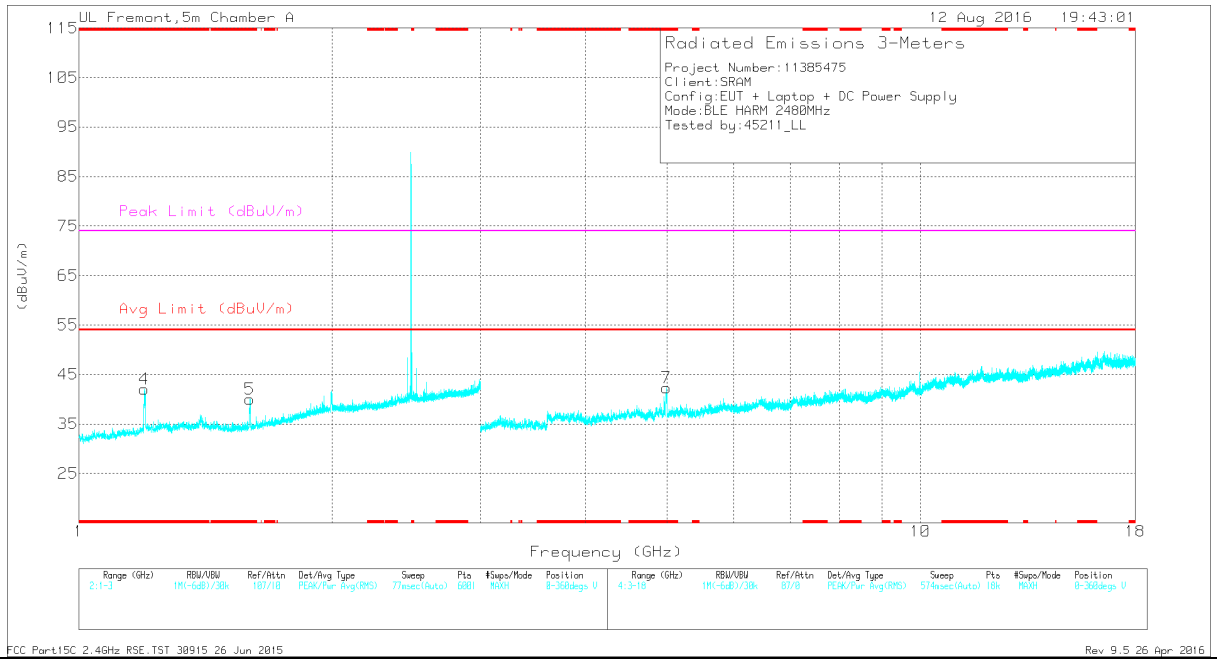
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (db/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	* 1.195	43.75	PK2	28.3	-24.2	0	47.85	-	-	74	-26.15	193	271	V
	* 1.2	30.8	MAv1	28.3	-24.1	6.69	41.69	54	-12.31	-	-	193	271	V
5	* 1.597	42.32	PK2	28.2	-23.6	0	46.92	-	-	74	-27.08	66	200	V
	* 1.599	28.09	MAv1	28.2	-23.6	6.69	39.38	54	-14.62	-	-	66	200	V
6	* 4.88	46.45	PK2	34.3	-27.9	0	52.85	-	-	74	-21.15	297	155	V
	* 4.88	36.35	MAv1	34.3	-27.9	6.69	49.44	54	-4.56	-	-	297	155	V
7	* 4.992	44.25	PK2	34.3	-29	0	49.55	-	-	74	-24.45	109	269	V
	* 4.996	31.99	MAv1	34.3	-29	6.69	43.98	54	-10.02	-	-	109	269	V
1	**2.426	37.6	Pk	32.4	-23.7	0	46.3	-	-	-	-	0-360	101	H
2	**2.457	42.76	Pk	32.4	-23.6	0	51.56	-	-	-	-	0-360	101	H
3	**2.472	35.87	Pk	32.4	-23.6	0	44.67	-	-	-	-	0-360	199	H
8	9.76	39.96	PK2	36.7	-21.2	0	55.46	-	-	-	-	307	115	V

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

HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



HIGH CHANNEL DATA

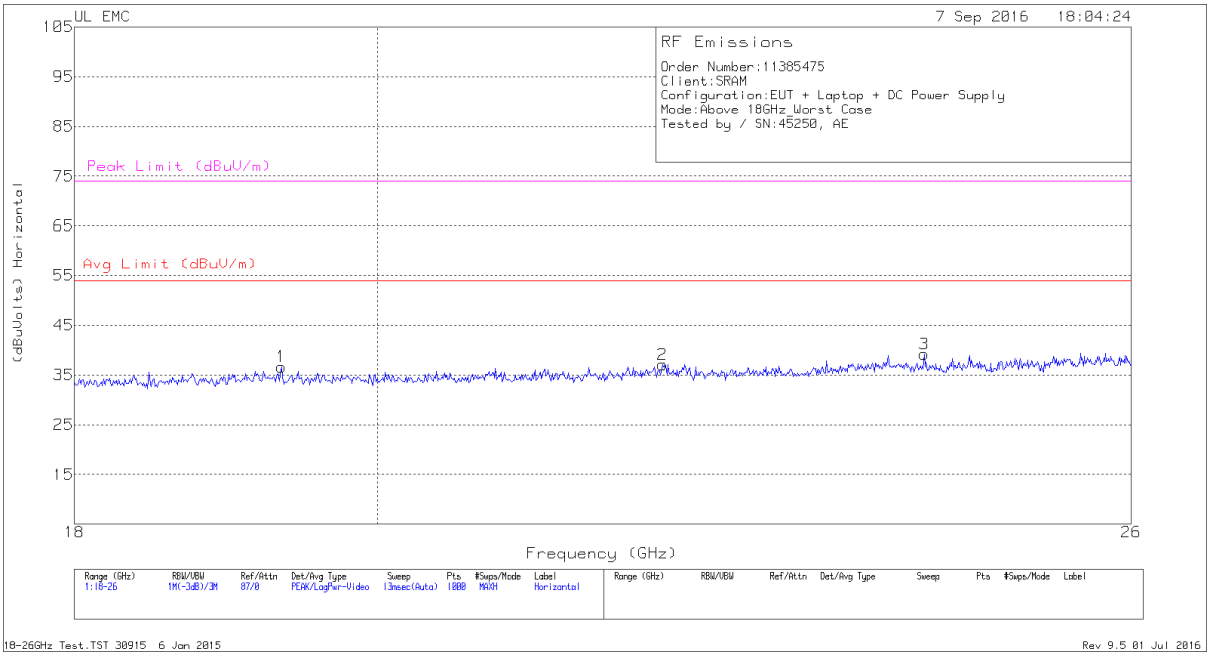
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (db/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	* 1.199	43.99	PK2	28.3	-24.1	0	48.19	-	-	74	-25.81	193	206	V
	* 1.2	31.58	MAv1	28.3	-24	6.69	42.57	54	-11.43	-	-	193	206	V
5	* 1.594	41.99	PK2	28.1	-23.6	0	46.49	-	-	74	-27.51	71	227	V
	* 1.598	28.2	MAv1	28.2	-23.6	6.69	39.49	54	-14.51	-	-	71	227	V
6	* 3.737	46.39	PK2	33.6	-30	0	49.99	-	-	74	-24.01	46	244	H
	* 3.734	28.33	MAv1	33.6	-30	6.69	38.62	54	-15.38	-	-	46	244	H
7	* 4.996	44.78	PK2	34.3	-29	0	50.08	-	-	74	-23.92	112	225	V
	* 4.994	31.71	MAv1	34.3	-29	6.69	43.7	54	-10.3	-	-	112	225	V
1	**2.457	43.55	Pk	32.4	-23.6	0	52.35	-	-	-	-	0-360	199	H
2	2.518	49.15	PK2	32.4	-23.6	0	57.95	-	-	-	-	173	107	H
3	2.587	43.96	PK2	32.3	-23.5	0	52.76	-	-	-	-	350	223	H

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

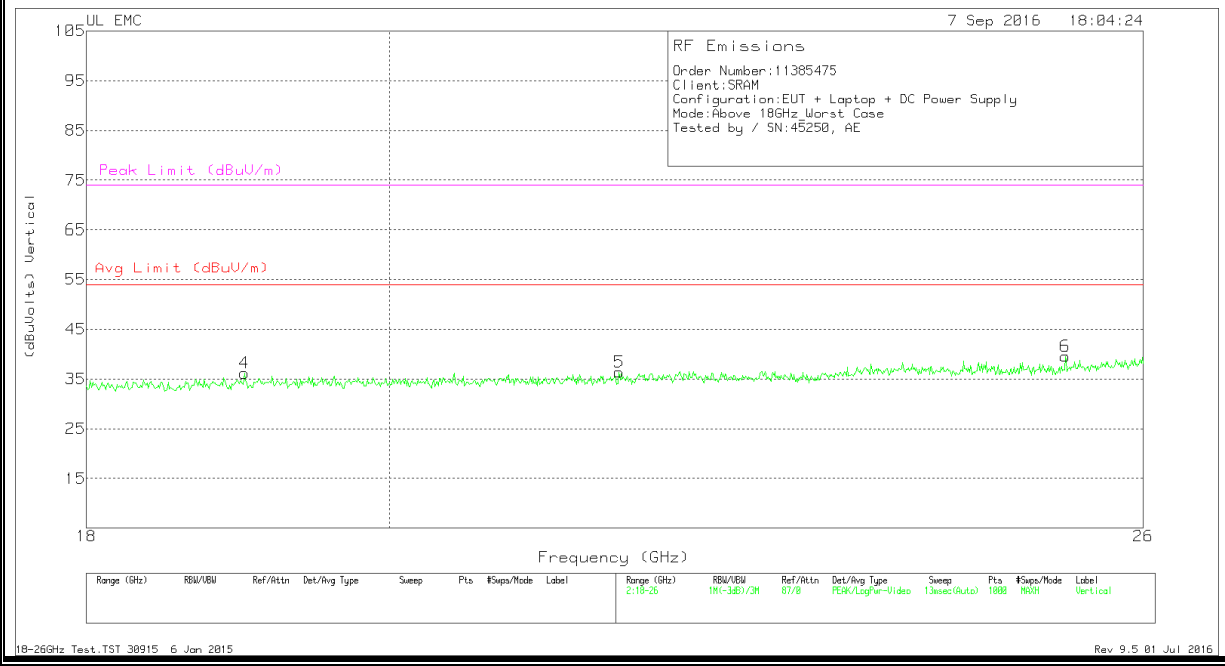
5.3. WORST-CASE 18 - 26 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



Trace Markers

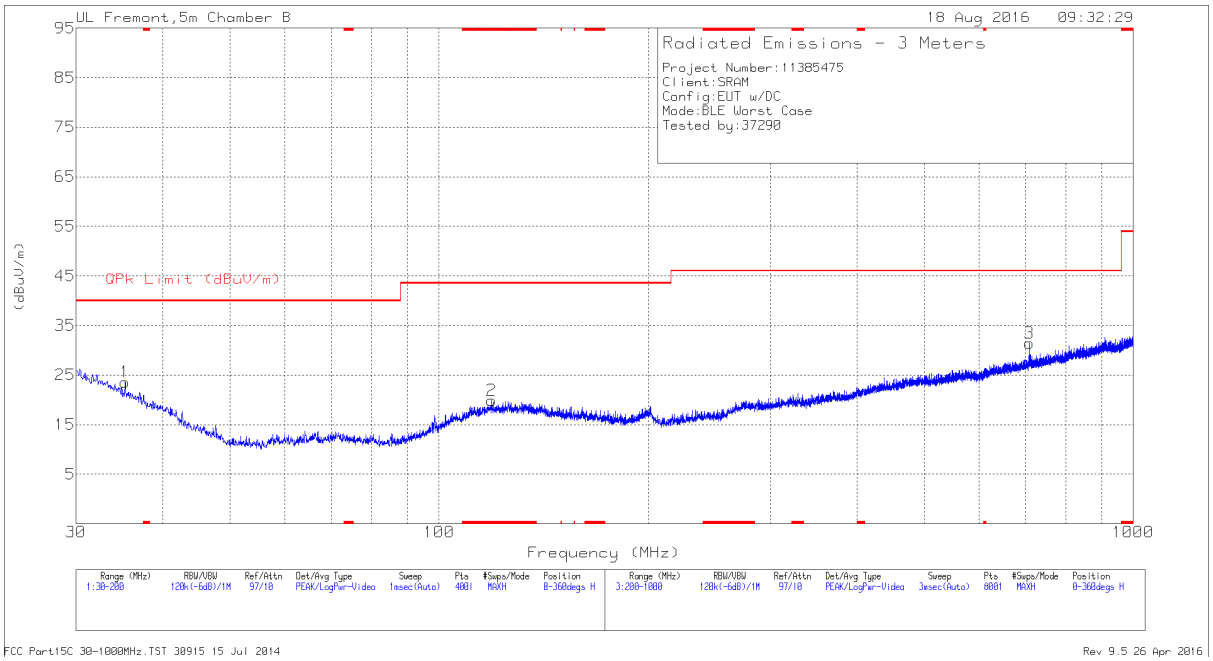
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T449 (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	19.344	38.15	Pk	32.7	-24.7	-9.5	36.65	54	-17.35	74	-37.35
2	22.088	38.38	Pk	33.5	-25.3	-9.5	37.08	54	-16.92	74	-36.92
3	24.192	38.90	Pk	33.9	-24.1	-9.5	39.20	54	-14.80	74	-34.80
4	19.016	37.78	Pk	32.6	-24.7	-9.5	36.18	54	-17.82	74	-37.82
5	21.664	37.88	Pk	33.2	-25.2	-9.5	36.38	54	-17.62	74	-37.62
6	25.304	39.27	Pk	34.3	-24.5	-9.5	39.57	54	-14.43	74	-34.43

* - indicates frequency in CFR15.205/IC8.10 Restricted Band
Pk - Peak detector

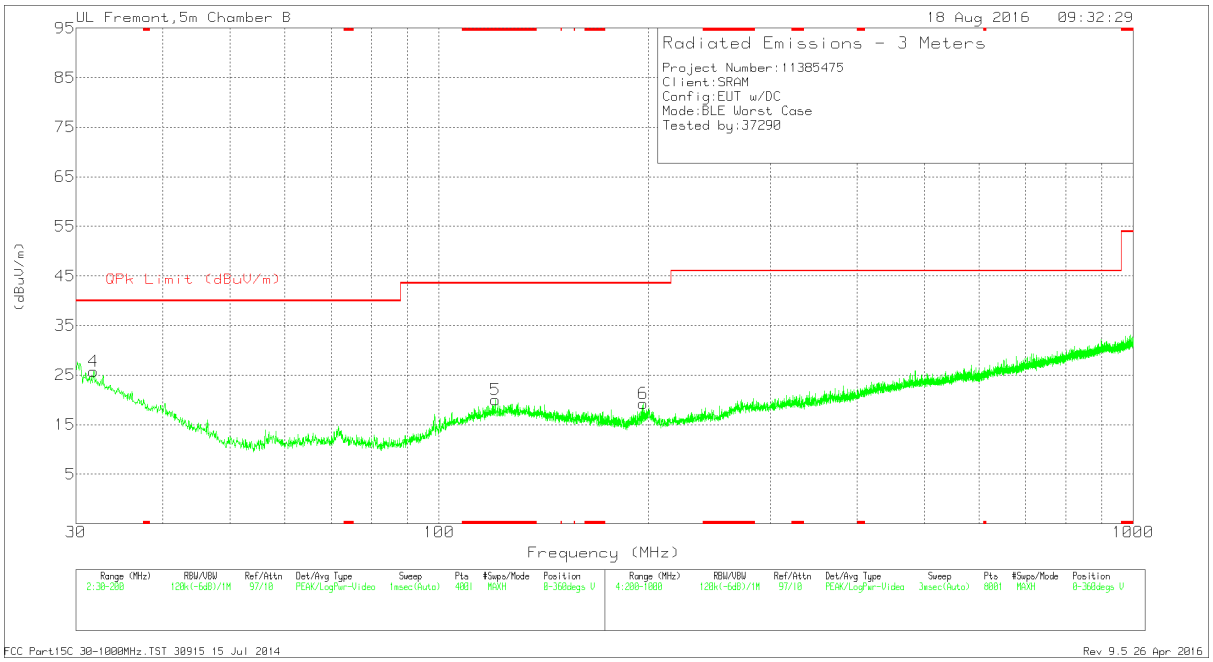
5.4. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



Below 1GHz Data

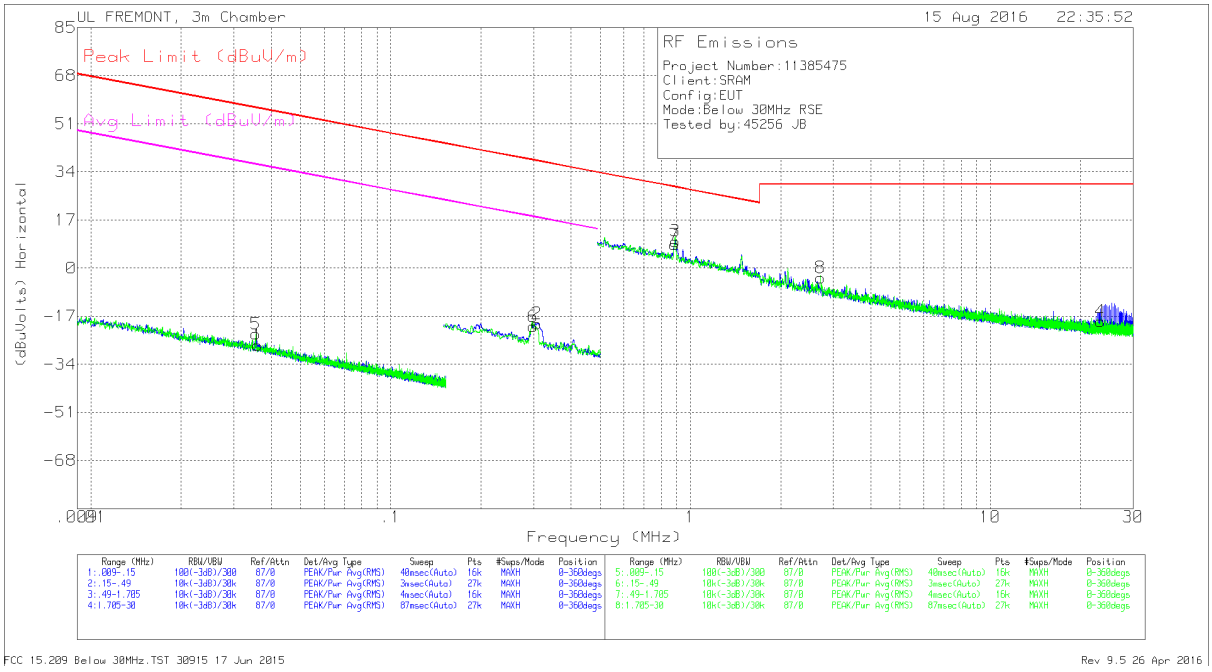
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 119.08	30.09	Pk	17.7	-27.9	19.89	43.52	-23.63	0-360	100	H
5	* 120.61	30.12	Pk	17.8	-27.9	20.02	43.52	-23.5	0-360	100	V
4	31.8275	30.77	Pk	23.9	-28.9	25.77	40	-14.23	0-360	100	V
1	35.3125	31.02	Pk	21.4	-28.8	23.62	40	-16.38	0-360	200	H
6	196.8125	30.28	Pk	16.1	-27.1	19.28	43.52	-24.24	0-360	100	V
3	708.3	32.46	Pk	24.2	-25.2	31.46	46.02	-14.56	0-360	200	H

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

5.5. WORST-CASE BELOW 30MHz

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)

PLOT



Note: The anechoic chamber has been properly calibrated so that the measurement results correspond to what would be obtained from an open field sites.

Below 30MHz Data

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)
5	.03547	42.75	Pk	12.5	1.4	-80	-23.35	56.61	-79.96	36.61	-59.96	0-360
1	.036	38.75	Pk	12.5	1.4	-80	-27.35	56.48	-83.83	36.48	-63.83	0-360
6	.29933	47.02	Pk	10.8	1.5	-80	-20.68	38.08	-58.76	18.08	-38.76	0-360
2	.30774	48.03	Pk	10.8	1.5	-80	-19.67	37.84	-57.51	17.84	-37.51	0-360
7	.88459	36.03	Pk	10.7	1.5	-40	8.23	28.67	-20.44	-	-	0-360
3	.89006	37.29	Pk	10.7	1.5	-40	9.49	28.62	-19.13	-	-	0-360
8	2.72156	24.25	Pk	10.8	1.5	-40	-3.45	29.54	-32.99	-	-	0-360
4	23.32629	10	Pk	9.5	1.7	-40	-18.8	29.54	-48.34	-	-	0-360

Pk - Peak detector