FCC 47 CFR PART 15 SUBPART C

BLUETOOTH LOW ENERGY
CERTIFICATION TEST REPORT

FOR

AUTHENTICATION BUTTON

MODEL NUMBER: GP GO225

FCC ID: 2AH88-225

REPORT NUMBER: R11219234-E1

ISSUE DATE: 2016-09-16

Prepared for
VASCO DATA SECURITY NV/SA
KONINGIN ASTRIDLAAN 164
WEMMEL 1780
BELGIUM

Prepared by
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NVLAP Lab code: 200246-0

Revision History

Ver.	Issue Date	Revisions	Revised By
1	2016-09-07	Initial Issue	Richard Jankovics
2	2016-09-16	Added clarifying information regarding the EUT power source in Section 5.1 and removed Line Conducted Test Method reference from Section 7.	Jeff Moser

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	VASCO DATA SECURITY NV/SA KONINGIN ASTRIDLAAN 164 WEMMEL 1780 BELGIUM
EUT DESCRIPTION:	AUTHENTICATION BUTTON
MODEL:	GP GO225
SERIAL NUMBER:	Non-serialized
DATE TESTED:	2016-05-17 – 2016-07-08

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:

Jeffrey Moser
EMC Program Manager
UL – Consumer Technology Division

Prepared By:

Richard Jankovics
WiSE Engineer
UL – Consumer Technology Division

2. TEST METHODOLOGY

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

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 and 2800 Suite B, Perimeter Park Drive, Morrisville, NC 27560.

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

2800 Suite B Perimeter Park Dr., Morrisville, NC 27560
☒ Chamber NORTH
☒ Chamber SOUTH

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at http://www.nist.gov/nvlap/

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER		UNCERTAINTY
Total RF power, conducted	+/-	0.45
RF power density, conducted	+/-	1.50
Spurious emissions, conducted	+/-	2.94
All emissions, radiated up to 40 GHz	+/-	5.36
Temperature	+/-	0.07
Humidity	+/-	2.26
DC and low frequency voltages	+/-	1.27
Conducted Emissions (0.150-30MHz)	+/-	3.65

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an Authentication Button with a BLE transceiver and is powered by a coin cell battery (type CR2012).

The radio module is manufactured by NORDIC SEMICONDUCTOR.

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	-7.01	0.20

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an one antenna, with a maximum gain of -33 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was CE.T.2.

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

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

None.

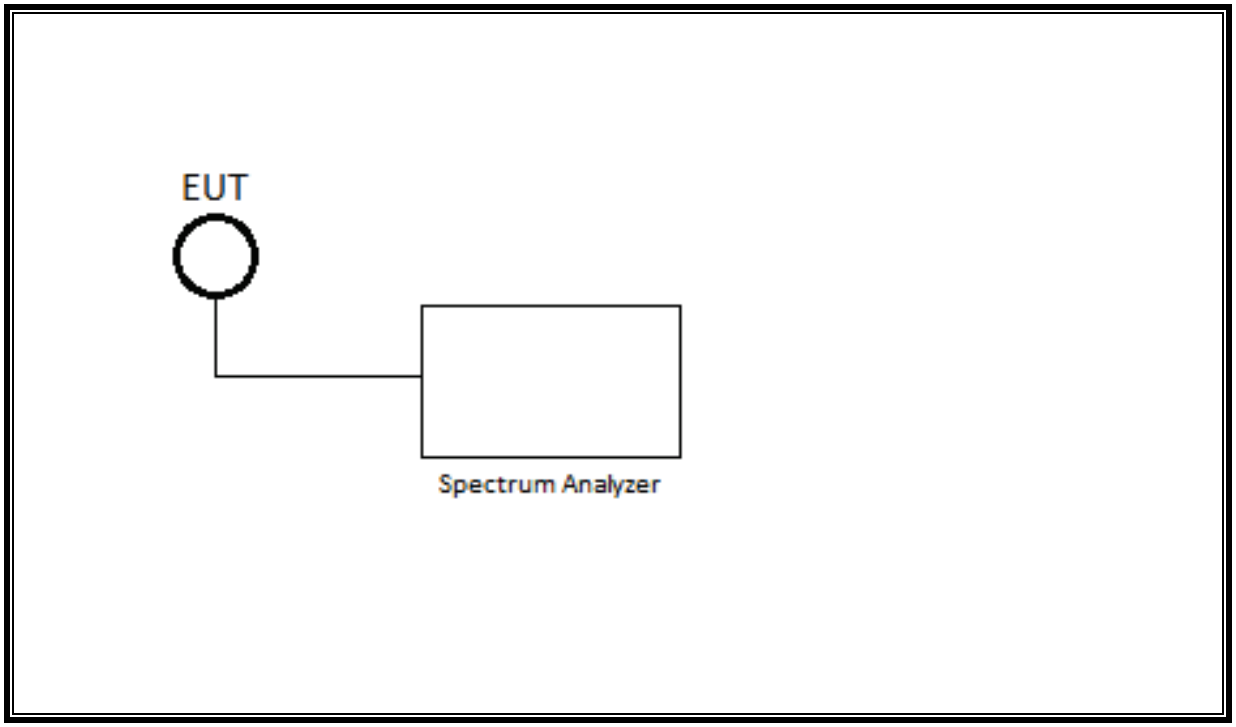
I/O CABLES

None.

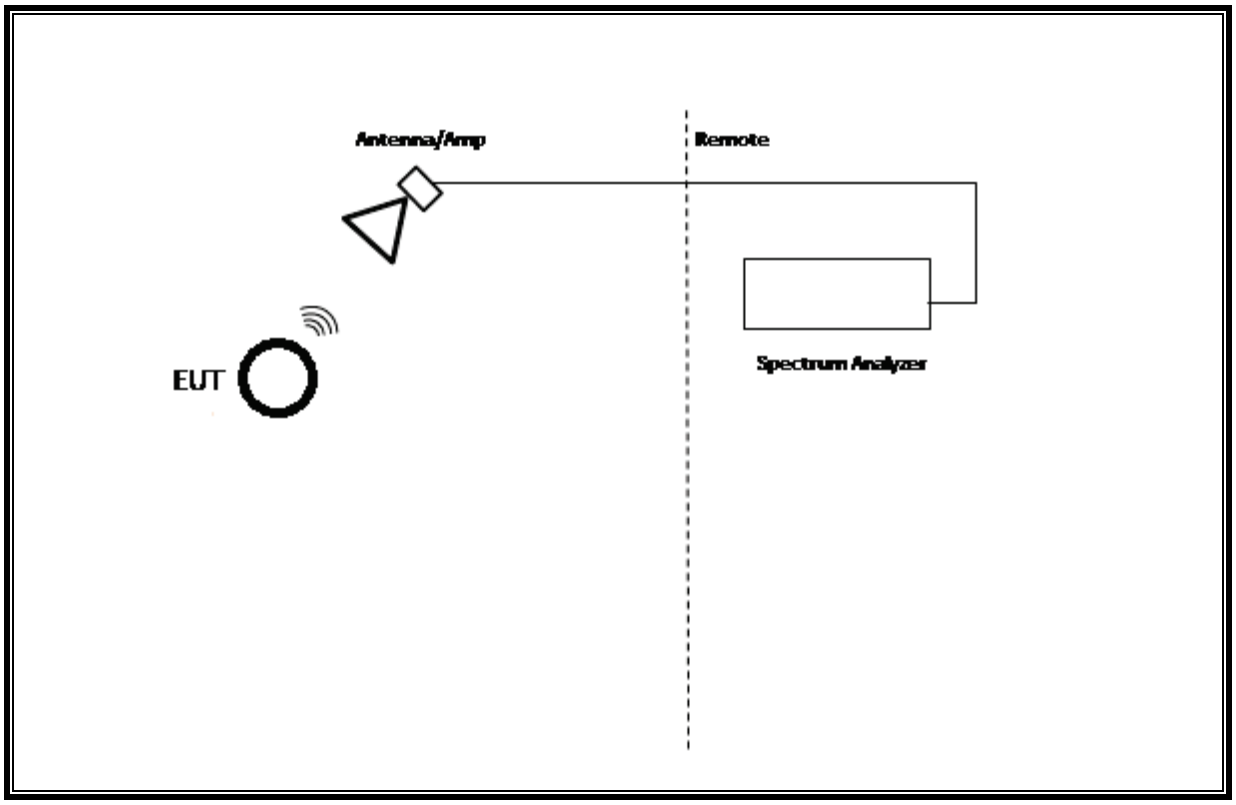
TEST SETUP

The EUT is a standalone device loaded with firmware designed to transmit at the desired operating conditions. The mode button of the device is used to toggle between the various modes of operation

SETUP DIAGRAM FOR CONDUCTED TESTS



SETUP DIAGRAM FOR RADIATED TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Conducted Room 1				
SA0019	Spectrum Analyzer	Agilent Technologies	E4446A	2015-09-02	2016-09-30
PWM004	RF Power Meter	Keysight Technologies	N1911A	2015-06-08, 2016-06-22	2016-06-30, 2017-06-22
PWS004	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	E9323A	2015-06-05, 2016-06-22	2016-06-30, 2017-06-22
HI0079	Temp/Humid/Pressure Meter	Springfield	PreciseTemp	2015-07-01	2016-07-31
HI0078	Temp/Humid/Pressure Meter	Springfield	PreciseTemp	2016-06-13	2017-06-13
MM0167	True RMS Multimeter	Agilent	U1232A	2015-08-17	2016-08-31

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - North Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2016-03-07	2017-03-31
	Gain-Loss Chains				
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2015-09-29	2016-09-30
	Receiver & Software				
SA0027	Spectrum Analyzer	Agilent	N9030A	2016-02-08	2017-02-08
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
HI0079	Temp/Humid/Pressure Meter	Springfield Precision	PreciseTemp	2015-07-01	2016-07-31

Note – This test chamber was used prior to 2016-06-30

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	**(Loop Ant.)**			
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2015-12-08	2016-12-31
	30-1000 MHz				
AT0073	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2015-06-10	2016-06-30
	1-18 GHz				
AT0069	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2016-03-07	2017-03-31
	18-26.5 GHz				
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2015-08-27	2016-08-31
	Gain-Loss Chains				
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2015-10-07	2016-10-31
S-SAC02	Gain-loss string: 30-1000MHz	Various	Various	2015-06-09	2016-06-30
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2015-08-22	2016-08-31
S-SAC04	Gain-loss string: 18-40GHz	Various	Various	2016-02-29	2017-02-28
	Receiver & Software				
SA0025	Spectrum Analyzer	Agilent	N9030A	2016-03-17	2017-03-31
SA0026 (18-40GHz RSE)	Spectrum Analyzer	Agilent	N9030A	2016-02-24	2017-02-28
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
HI0050	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2015-07-01	2016-07-31

Note – This test chamber was used prior to 2016-06-30

7. MEASUREMENT METHODS

Duty Cycle: KDB 558074 D01 v03r05 Section 6.0

6 dB BW: KDB 558074 D01 v03r05, Section 8.1.

99% Occupied Bandwidth: ANSI C63.10-2013, Section 6.9.3

Output Power: KDB 558074 D01 v03r05, Section 9.1.2.

Power Spectral Density: KDB 558074 D01 v03r05, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v03r05, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v03r05, Section 12.1.

General Radiated Emissions: ANSI C63.10:2013 Sections 6.3-6.6

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None; for reporting purposes only.

PROCEDURE

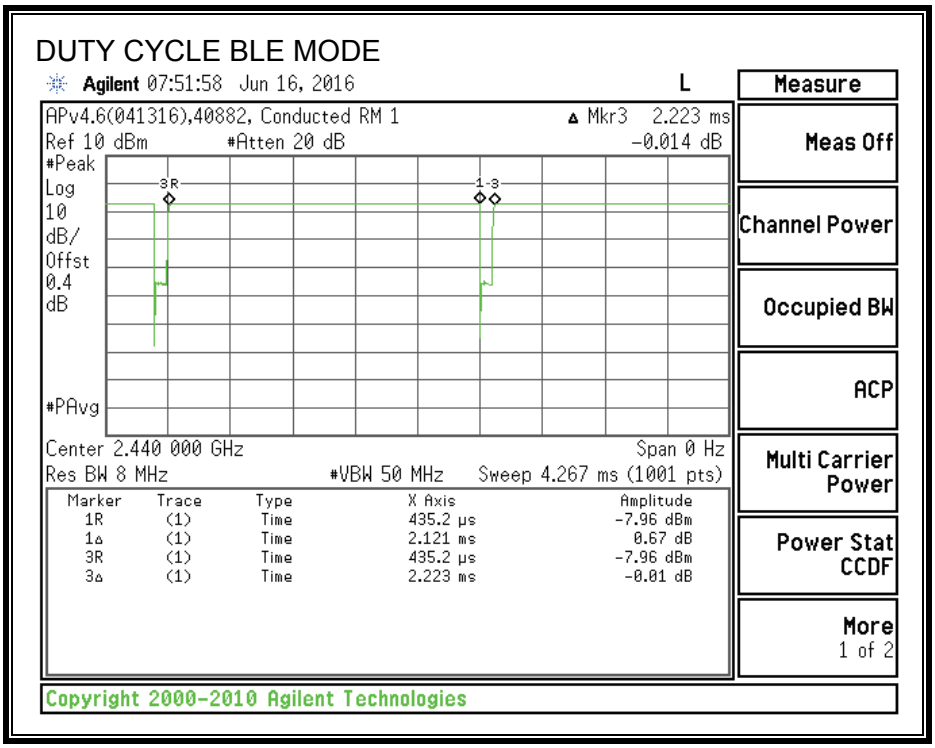
KDB 558074 Zero-Span Spectrum Analyzer Method.

8.1.1. 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	2.121	2.223	0.954	95.41%	0.20	0.471

Test Performed: Jeff Cabrera
Test Date: 2016-06-16

8.1.2. DUTY CYCLE PLOTS



8.2. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-247 5.2 (1)

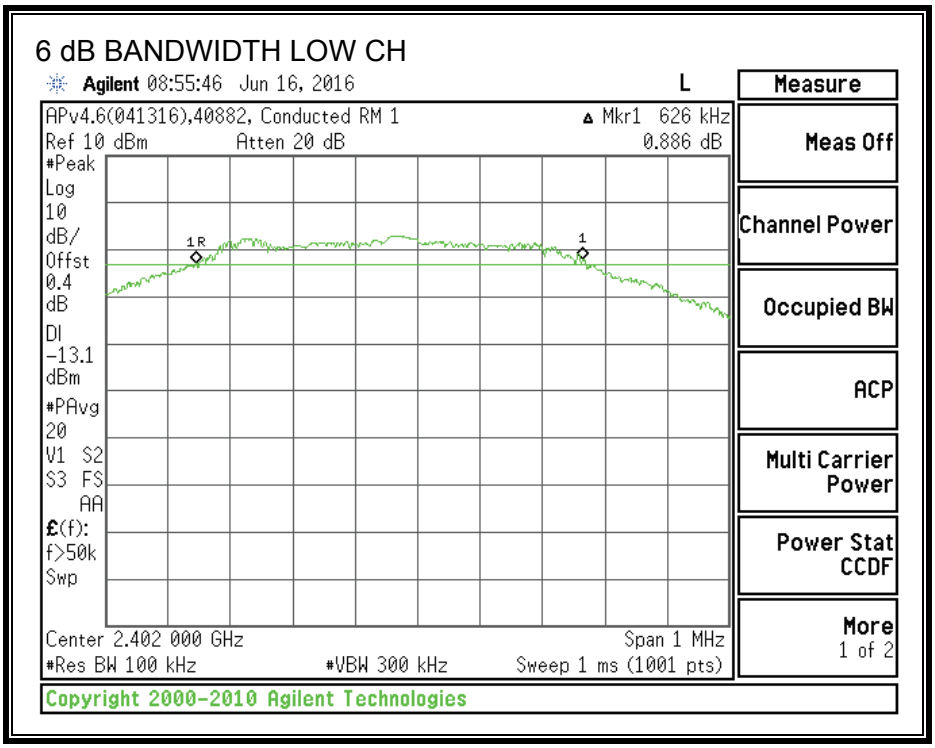
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

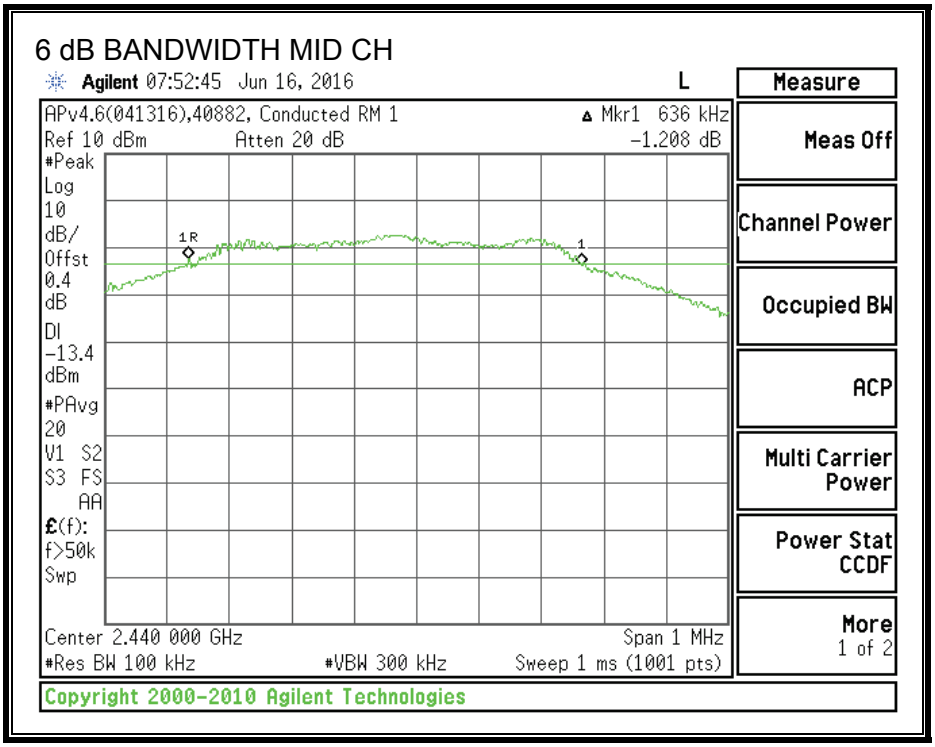
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.6260	0.5
Middle	2440	0.6360	0.5
High	2480	0.6410	0.5

Test Performed: Jeff Cabrera
Test Date: 2016-06-16

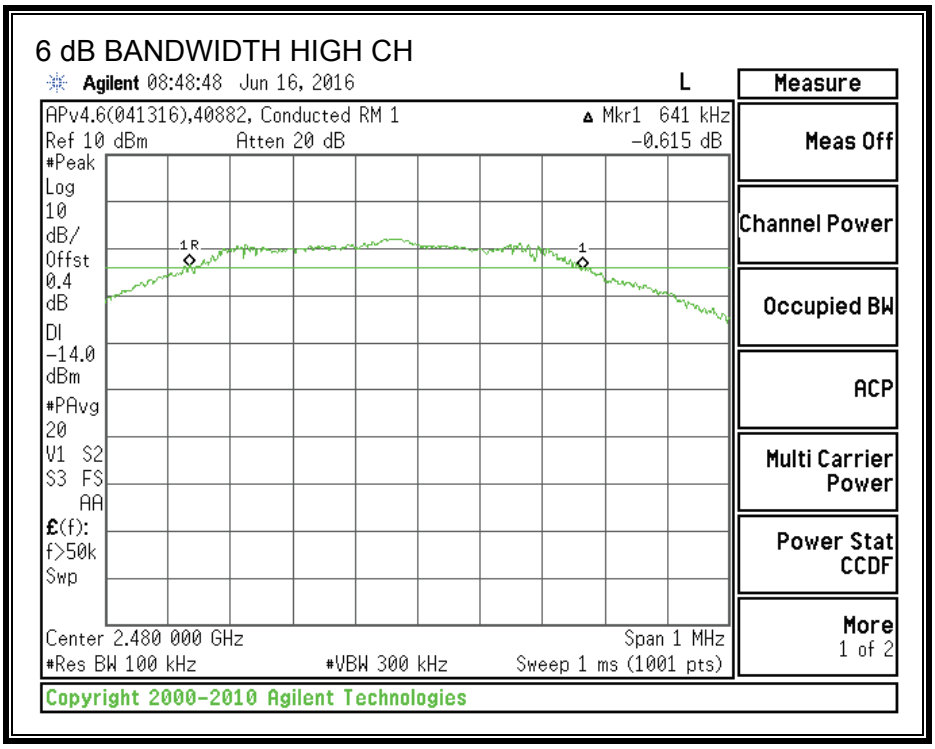
6 dB BANDWIDTH



6 dB BANDWIDTH MID CH



6 dB BANDWIDTH HIGH CH



8.3. 99% BANDWIDTH

LIMITS

None; for reporting purposes only. Testing per RSS-Gen Clause 6.6.

TEST PROCEDURE

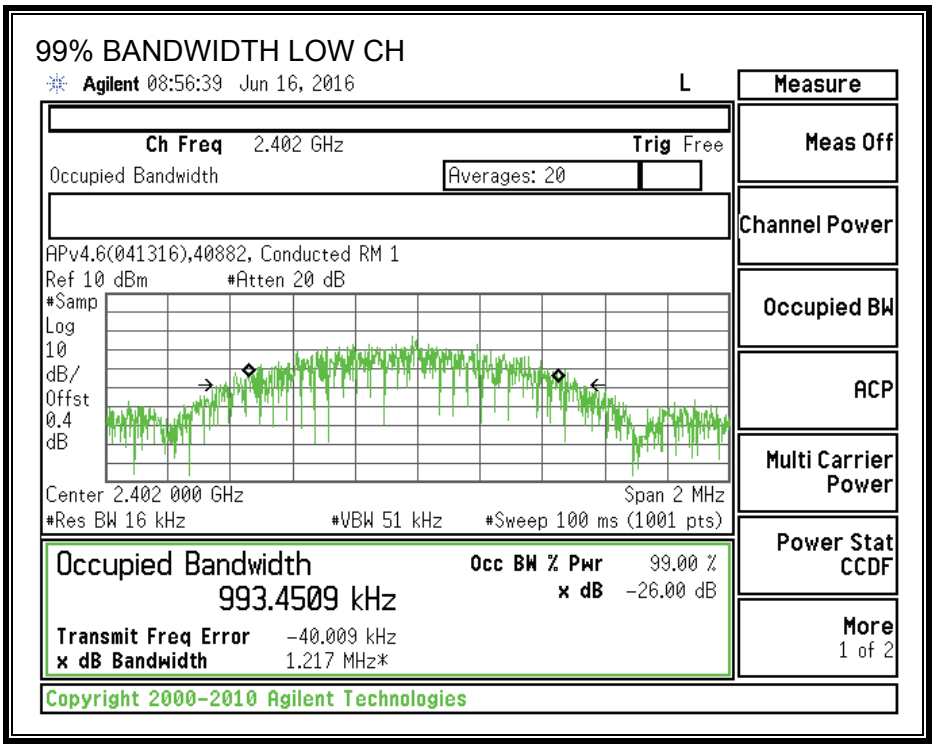
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 5% of the 99 % bandwidth and to 1% of the span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

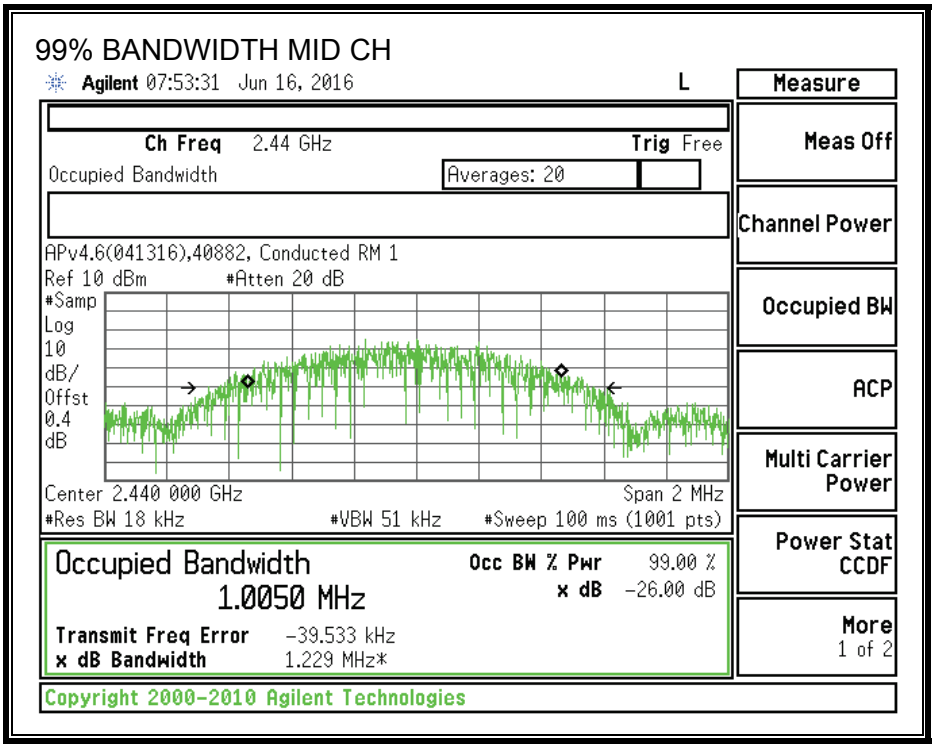
RESULTS

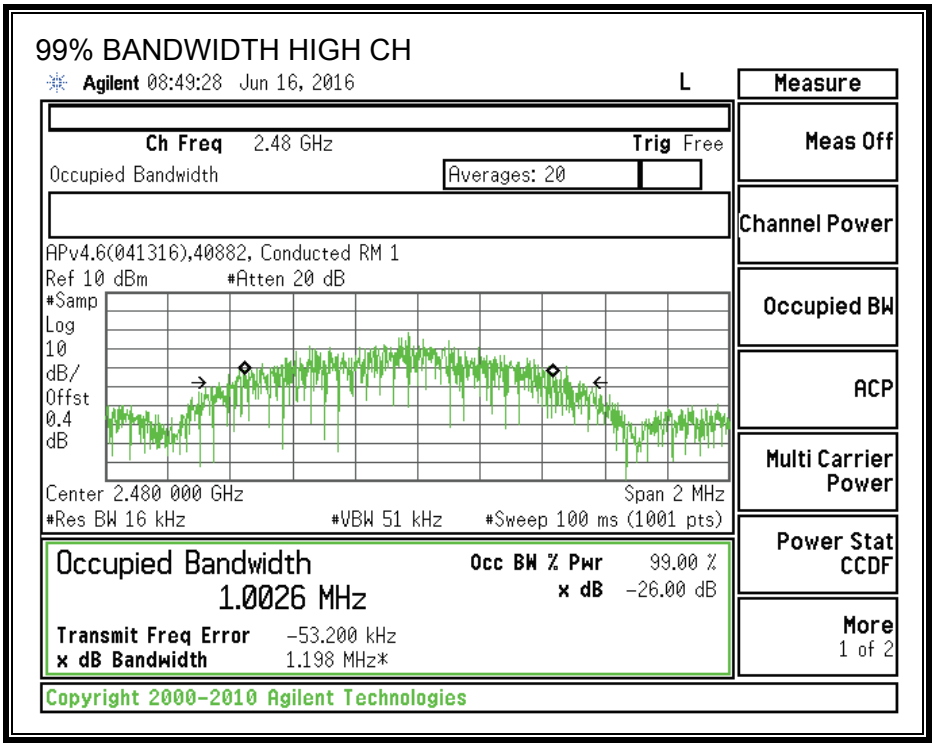
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	0.9935
Middle	2440	1.0050
High	2480	1.0026

Test Performed: Jeff Cabrera
Test Date: 2016-06-16

99% BANDWIDTH







8.4. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-247 5.4

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

TEST PROCEDURE

The transmitter output was connected to a power meter equipped with a power sensor capable of measuring peak power. The cable assembly insertion loss of 0.4 dB (including 0.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-7.010	30	-37.010
Middle	2440	-7.280	30	-37.280
High	2480	-7.910	30	-37.910

Test Performed: Jeff Cabrera
Test Date: 2016-06-16

8.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

The cable assembly insertion loss of 0.4 dB (including 0.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	-7.29
Middle	2440	-7.59
High	2480	-8.28

Test Performed: Jeff Cabrera
Test Date: 2016-06-16

8.6. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-247 5.2 (2)

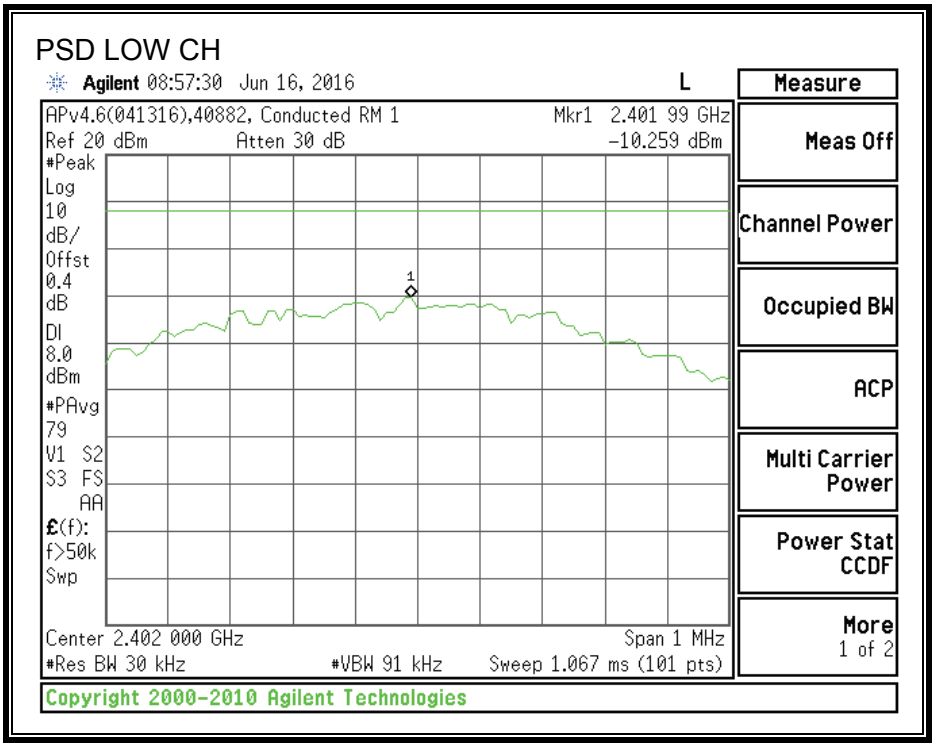
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

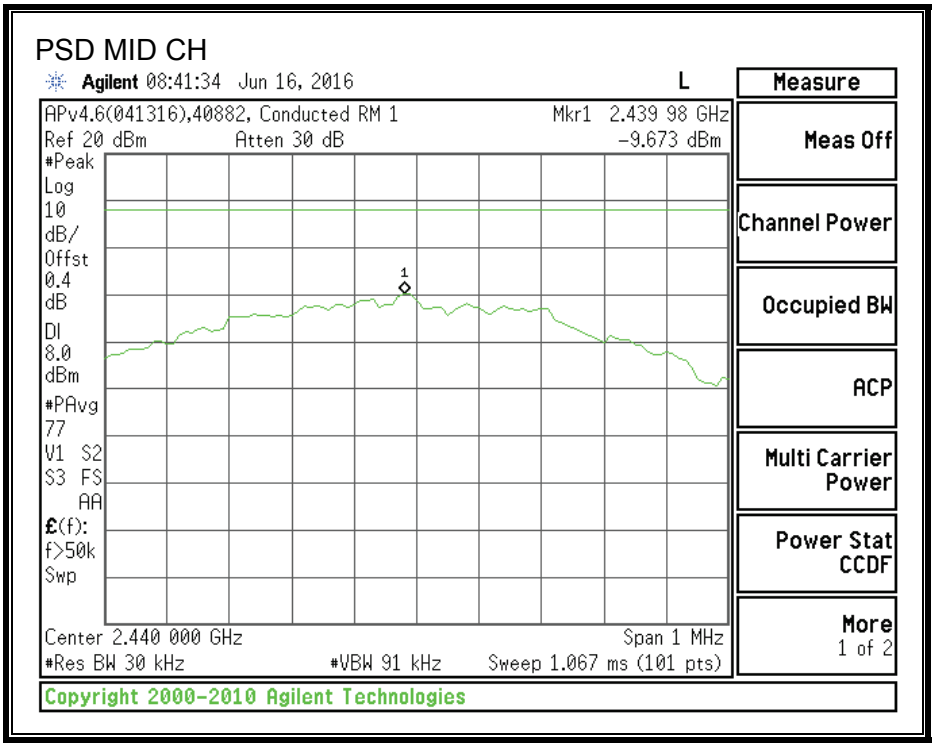
Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-10.26	8	-18.26
Middle	2440	-9.67	8	-17.67
High	2480	-9.13	8	-17.13

Test Performed: Jeff Cabrera
Test Date: 2016-06-16

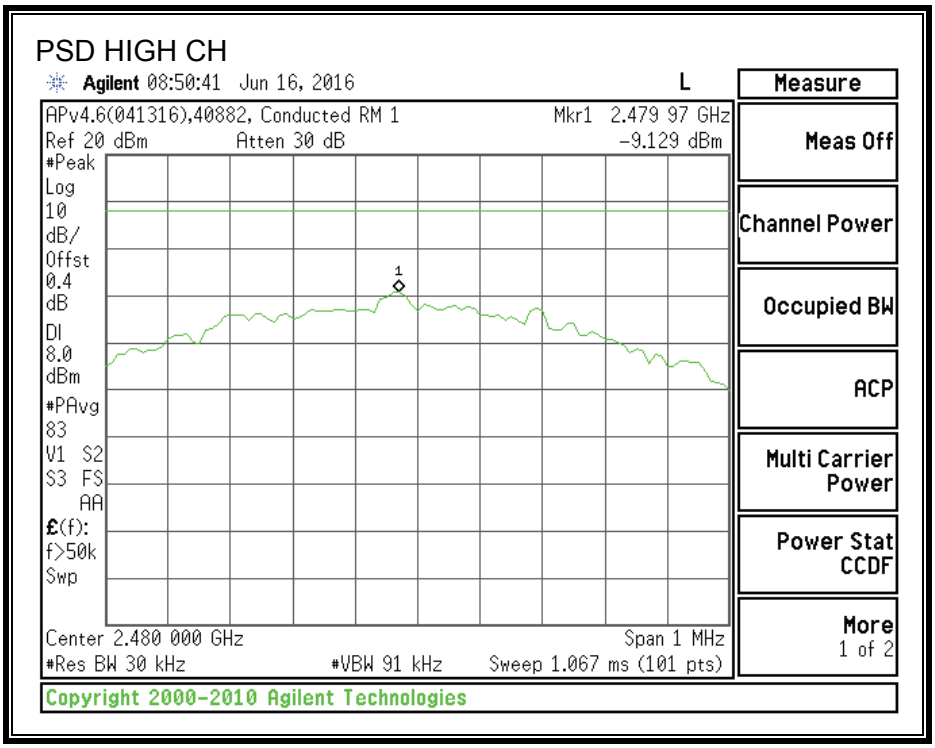
POWER SPECTRAL DENSITY



PSD MID CH



PSD HIGH CH



8.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

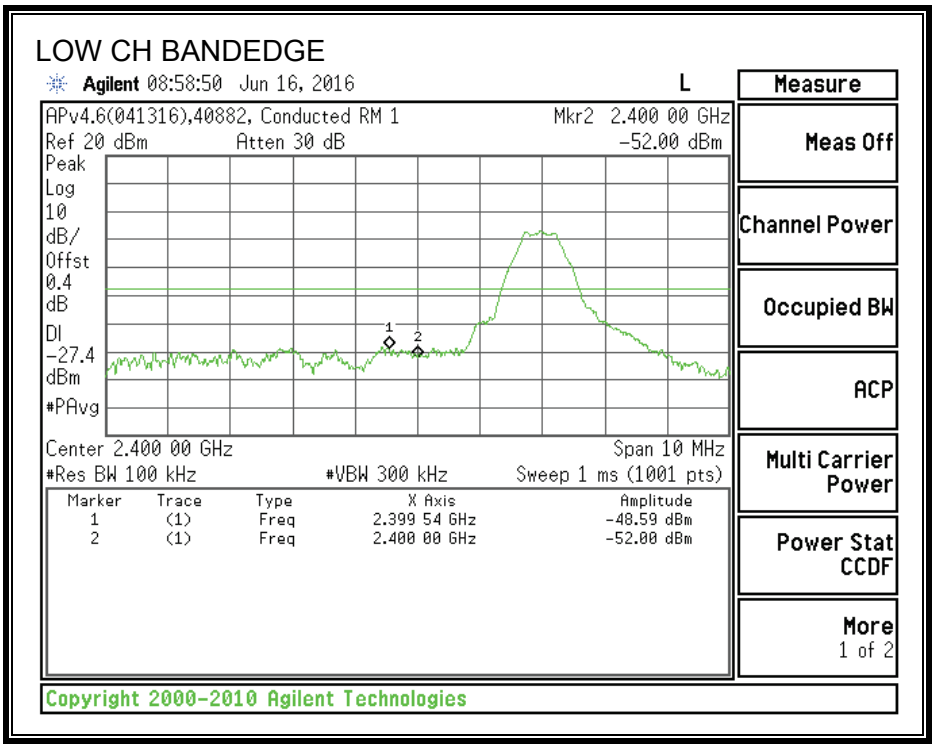
IC RSS-247 5.5

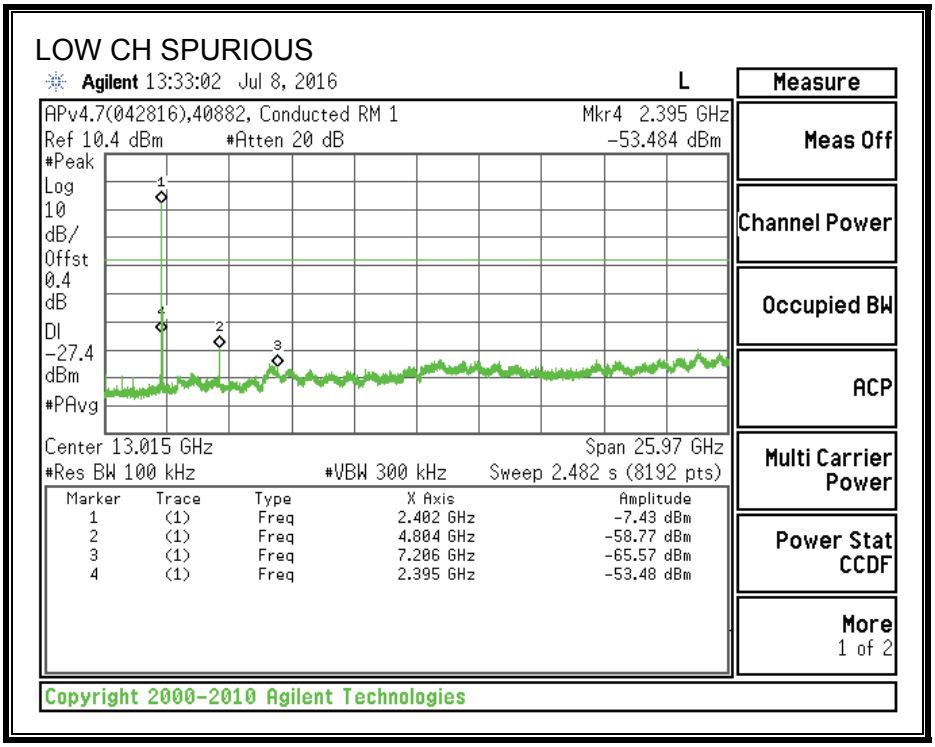
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

RESULTS

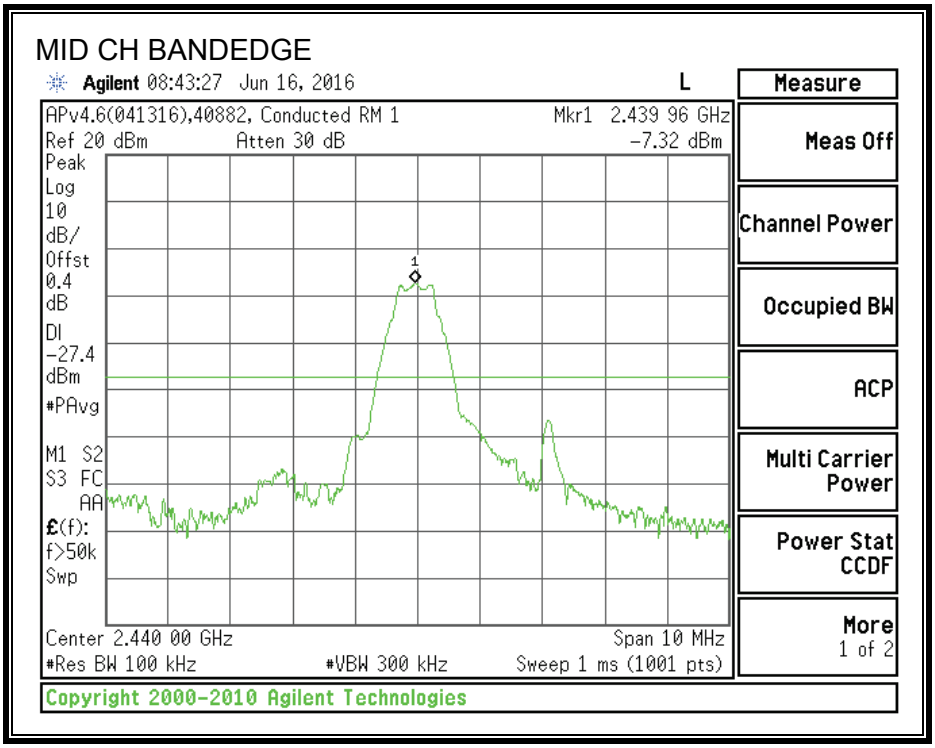
Test Performed: Jeff Cabrera
Test Date: 2016-06-16

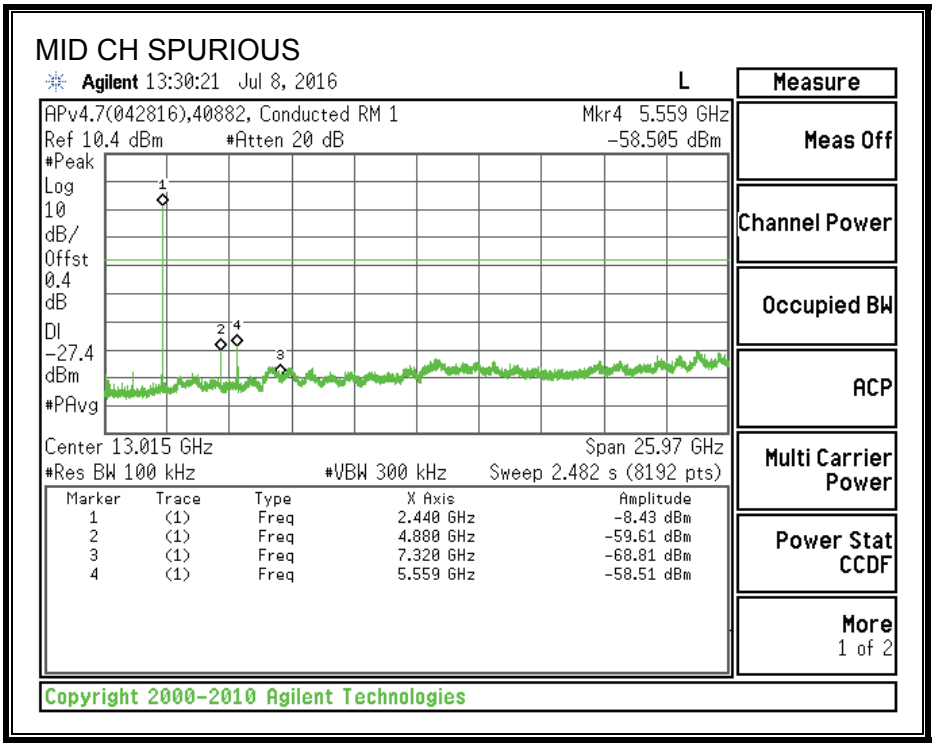
SPURIOUS EMISSIONS, LOW CHANNEL



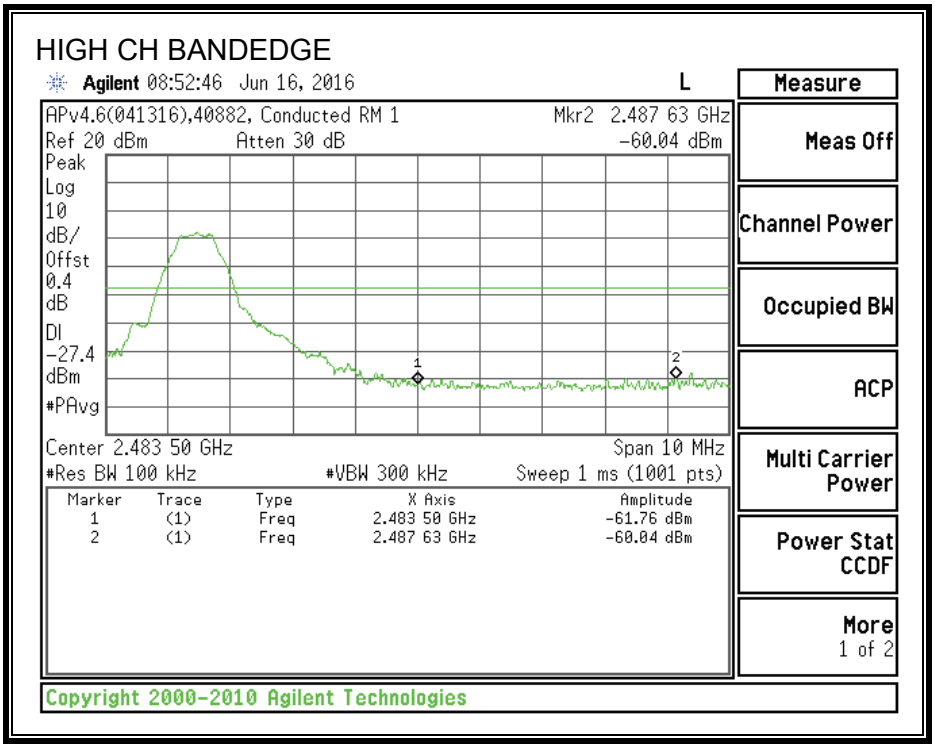


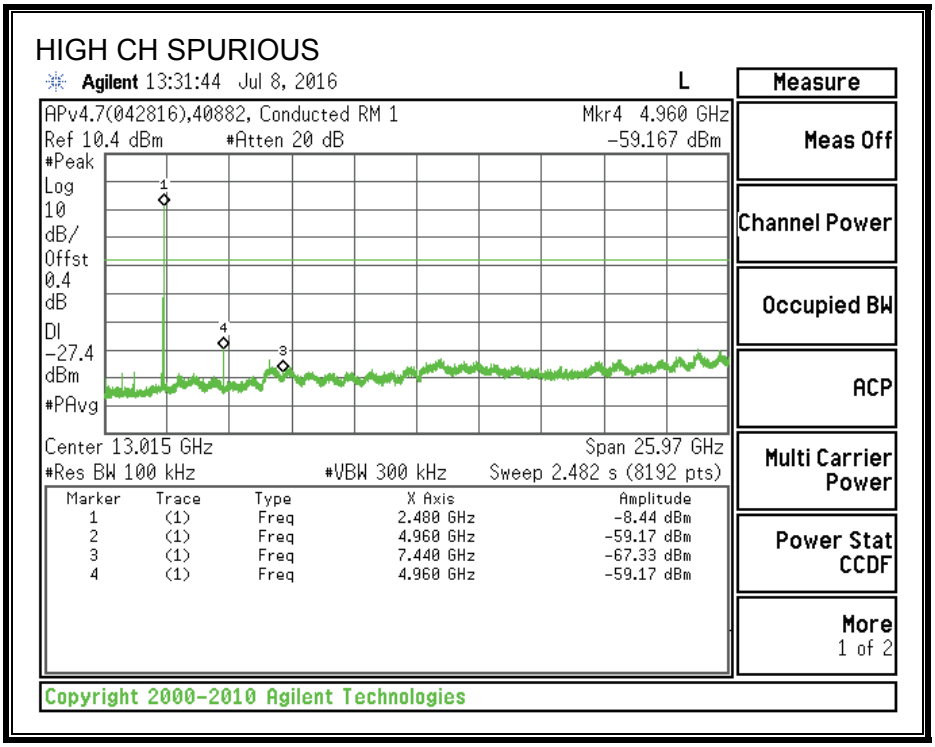
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205, §15.209, §15.247 (d)

IC RSS-GEN Clause 8.9 (Transmitter)

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) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
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 for the 30-1000 MHz range, 9 kHz for peak detection measurements or 9 kHz for quasi-peak detection measurements for the 0.15-30 MHz range and 200 Hz for peak detection measurements or 200 Hz for quasi-peak detection measurements for the 9 to 150 kHz range. Peak detection is used unless otherwise noted as quasi-peak.

For peak measurements above 1 GHz, the resolution bandwidth is set to 1 MHz and the video bandwidth is set to 3 MHz. For average measurements above 1GHz, the resolution bandwidth and video bandwidth are set as described in ANSI C63.10:2013 for the applicable measurement. For this evaluation, RMS Power Averaging was used and the resolution/video bandwidth settings were 1MHz/3MHz.

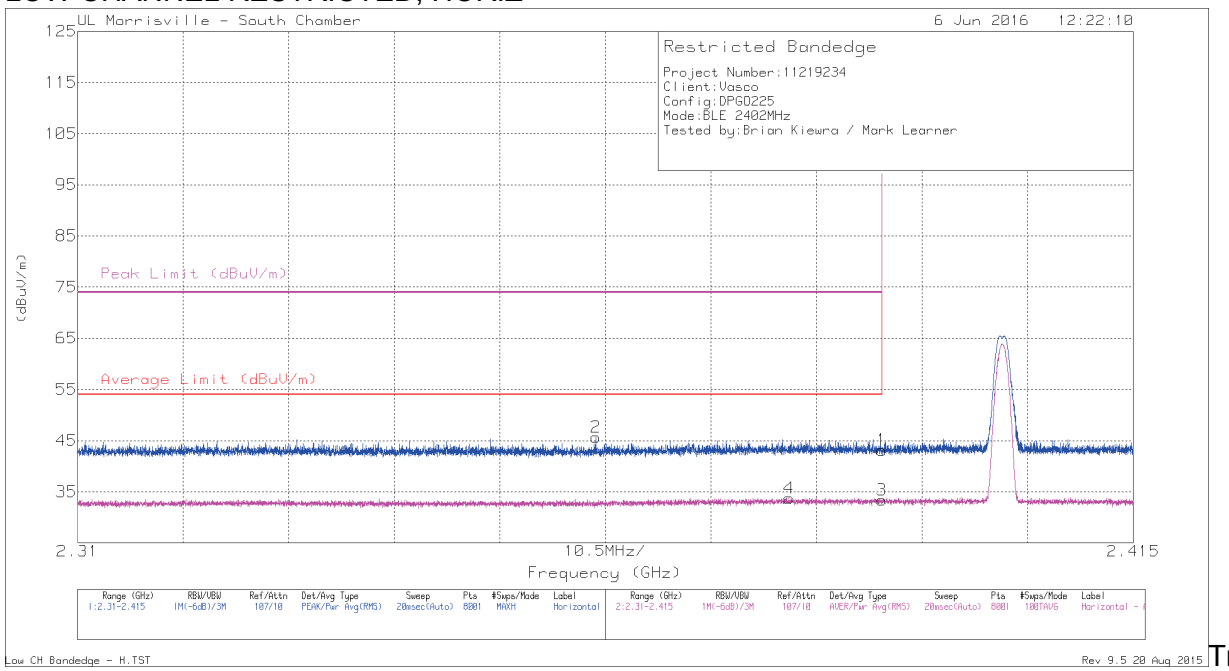
The spectrum from 9 kHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

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.

9.2. TRANSMITTER 1-18 GHz

RESTRICTED BANDEDGE (LOW CHANNEL)

LOW CHANNEL RESTRICTED, HORIZ

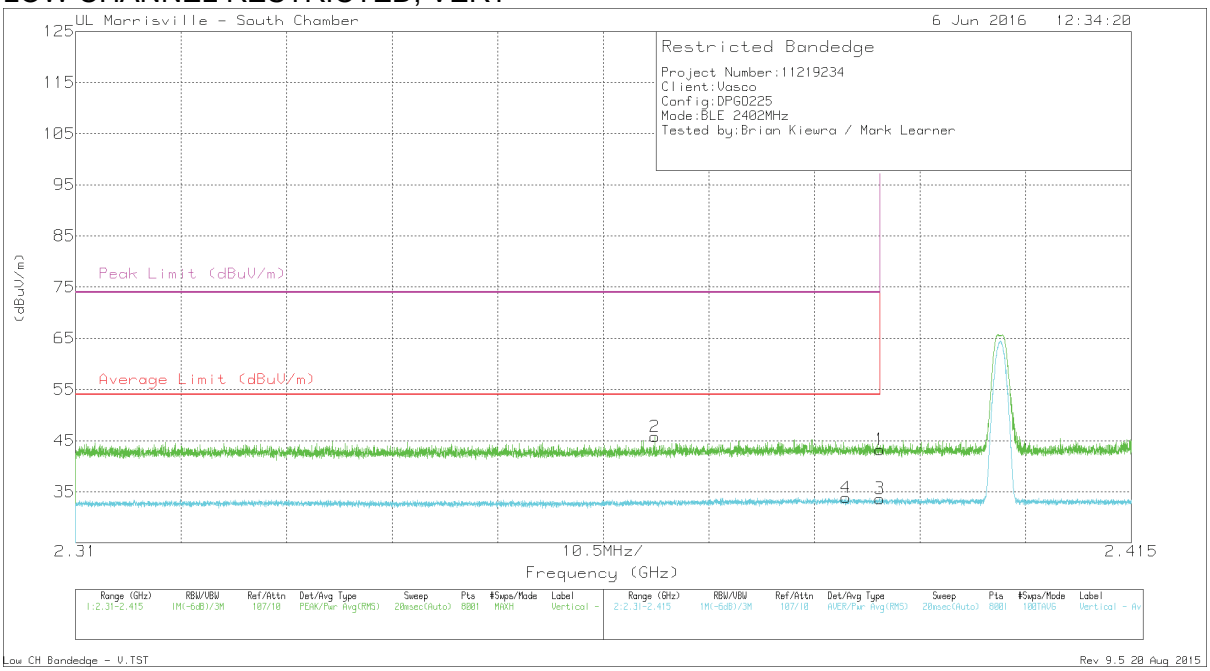


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	35.16	Pk	32.2	-24.2	0	43.16	-	-	74	-30.84	276	115	H
2	* 2.362	37.94	Pk	31.9	-24.2	0	45.64	-	-	74	-28.36	276	115	H
3	* 2.39	25.18	RMS	32.2	-24.2	.2	33.38	54	-20.62	-	-	276	115	H
4	* 2.381	25.47	RMS	32.1	-24	.2	33.77	54	-20.23	-	-	276	115	H

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

LOW CHANNEL RESTRICTED, VERT



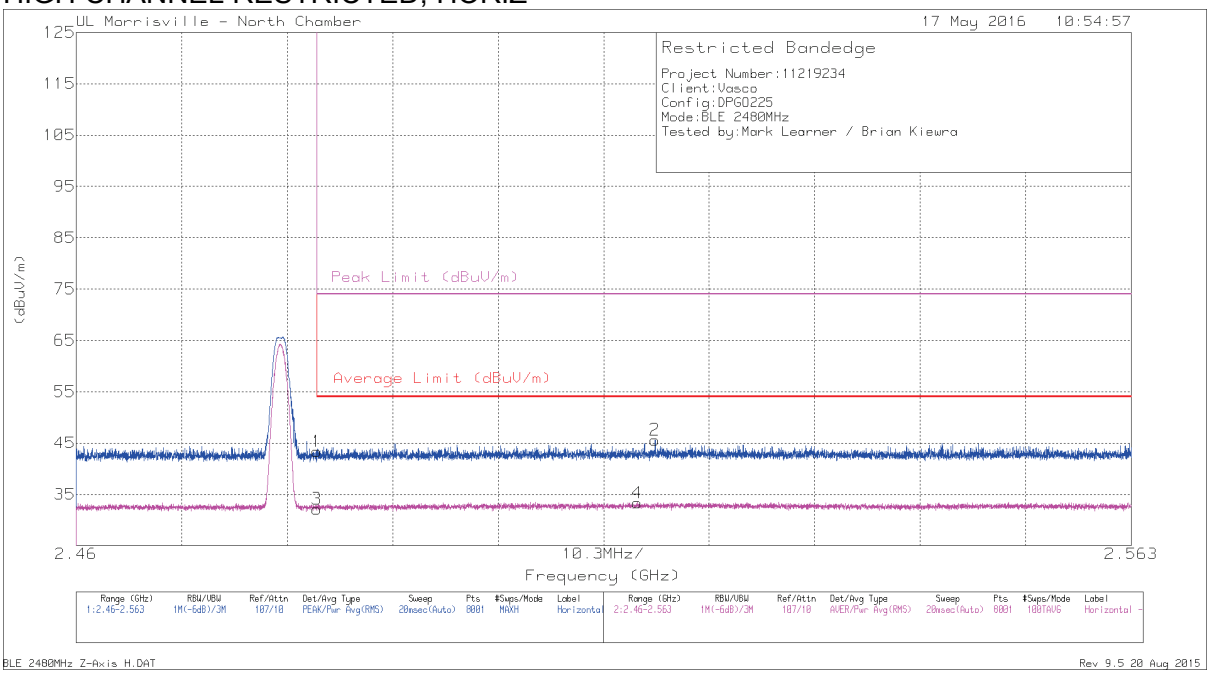
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	35.27	Pk	32.2	-24.2	0	43.27	-	-	74	-30.73	334	102	V
2	* 2.368	37.86	Pk	32	-24.1	0	45.76	-	-	74	-28.24	334	102	V
3	* 2.39	25.47	RMS	32.2	-24.2	.2	33.67	54	-20.33	-	-	334	102	V
4	* 2.387	25.56	RMS	32.2	-24.1	.2	33.86	54	-20.14	-	-	334	102	V

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

RESTRICTED BANDEDGE (LOW CHANNEL)

HIGH CHANNEL RESTRICTED, HORIZ

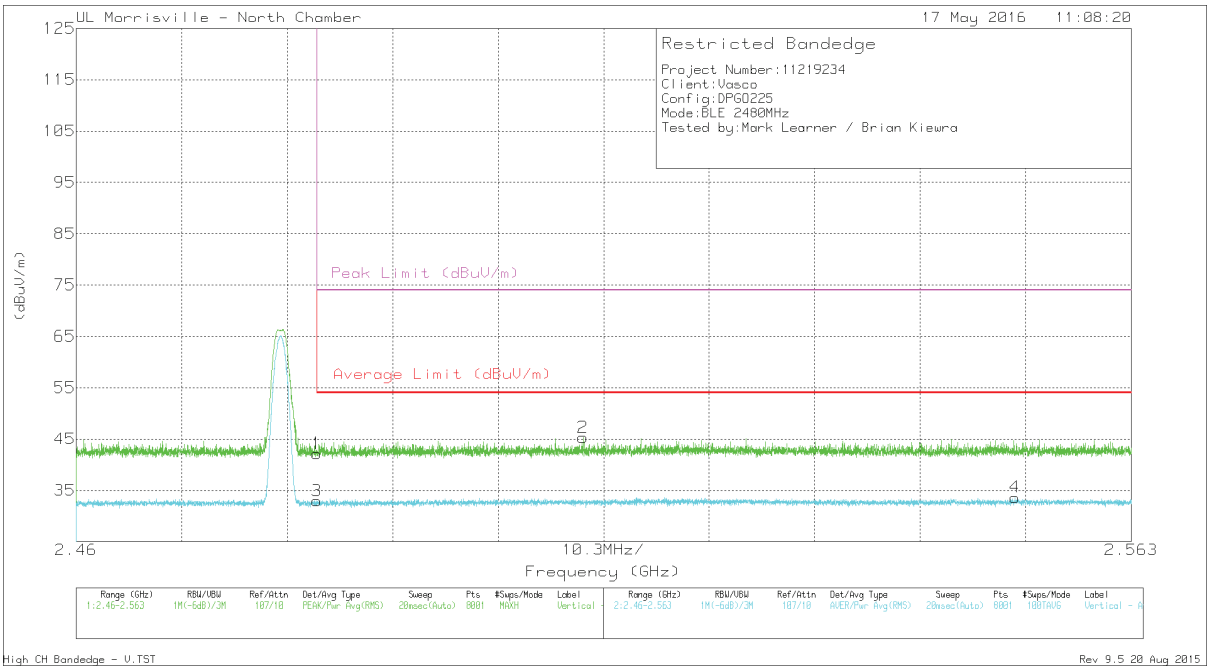


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (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	35.87	Pk	32.3	-24.8	0	43.37	-	-	74	-30.63	195	136	H
3	* 2.484	24.64	RMS	32.3	-24.8	.2	32.34	54	-21.66	-	-	195	136	H
4	2.515	25.65	RMS	32.3	-24.6	.2	33.55	54	-20.45	-	-	195	136	H
2	2.517	37.89	Pk	32.3	-24.6	0	45.59	-	-	74	-28.41	195	136	H

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

HIGH CHANNEL RESTRICTED, VERT



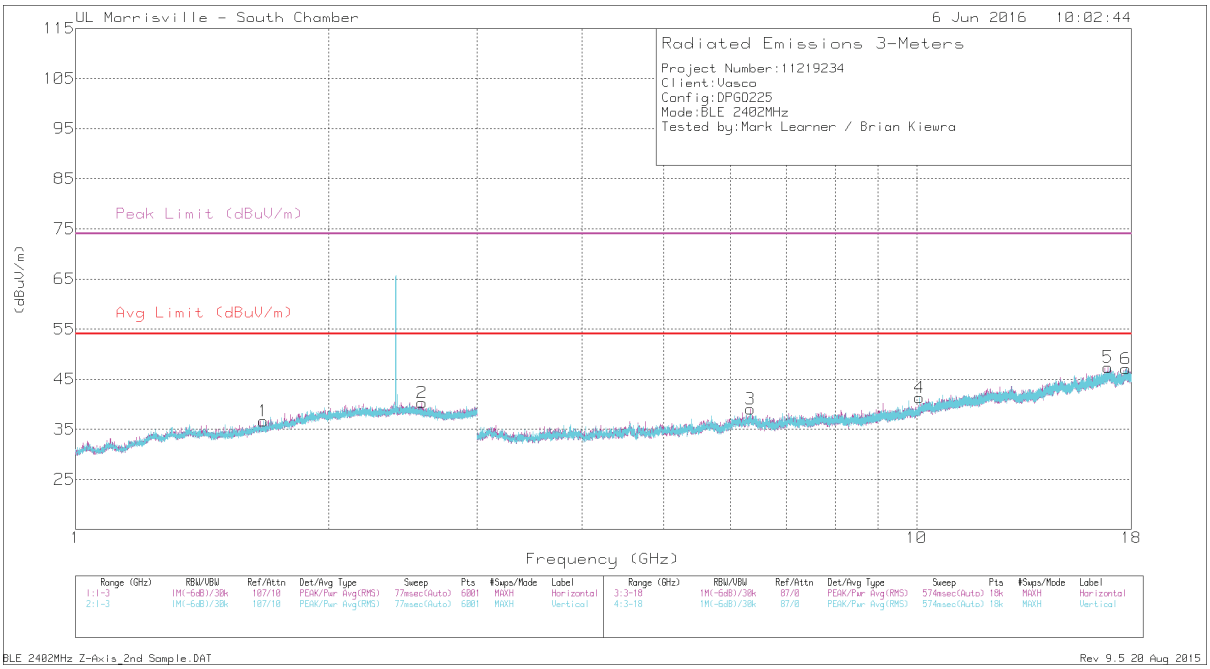
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (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	34.66	Pk	32.3	-24.8	0	42.16	-	-	74	-31.84	201	135	V
3	* 2.484	25.25	RMS	32.3	-24.8	.2	32.95	54	-21.05	-	-	201	135	V
2	2.509	37.71	Pk	32.3	-24.7	0	45.31	-	-	74	-28.69	201	135	V
4	2.552	25.75	RMS	32.3	-24.6	.2	33.65	54	-20.35	-	-	201	135	V

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

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL

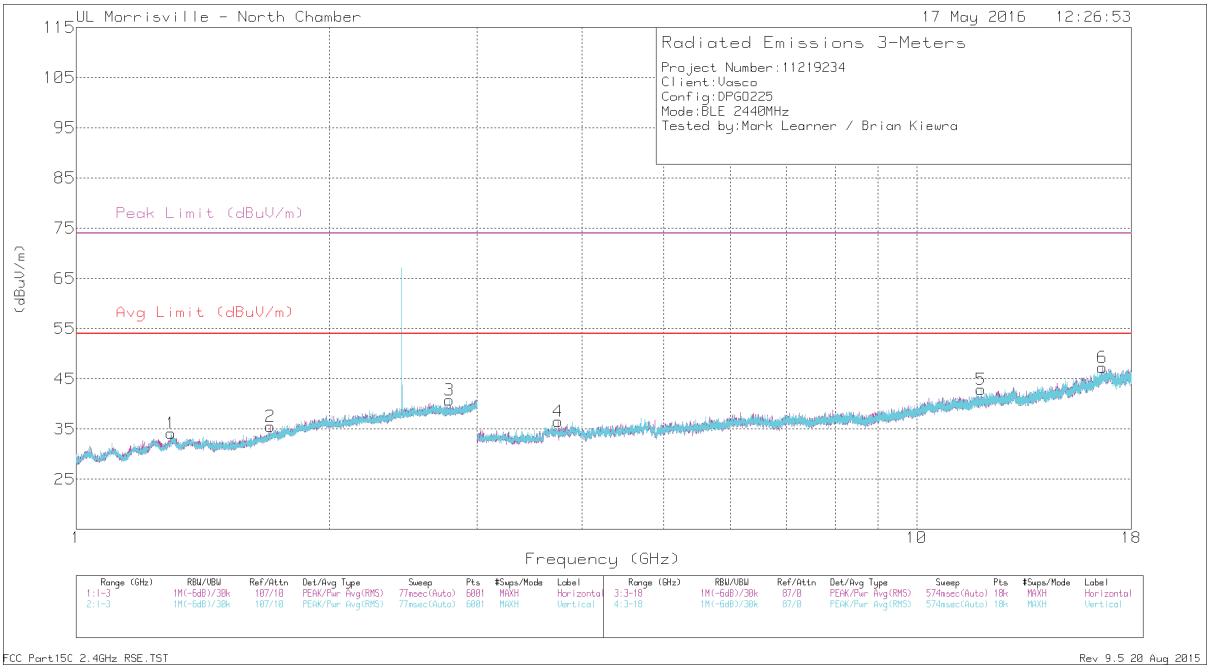


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	* 1.673	35.49	PK2	28.8	-22.4	0	41.89	-	-	74	-32.11	339	198	V
	* 1.671	23.56	MAv1	28.8	-22.4	.2	30.16	54	-23.84	-	-	339	198	V
6	* 17.737	34.46	PK2	41.2	-22.5	0	53.16	-	-	74	-20.84	327	103	V
	* 17.736	23.35	MAv1	41.2	-22.5	.2	42.25	54	-11.75	-	-	327	103	V
2	2.582	33.17	Pk	32.4	-25.3	0	40.27	-	-	-	-	0-360	199	H
3	6.346	32.13	Pk	35.5	-28.6	0	39.03	-	-	-	-	0-360	199	H
4	10.083	30.08	Pk	37.3	-26.1	0	41.28	-	-	-	-	0-360	102	V
5	16.897	29.48	Pk	41.6	-23.7	0	47.38	-	-	-	-	0-360	102	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK2 - Maximum Peak
MAv1 - Maximum RMS Average

MID CHANNEL

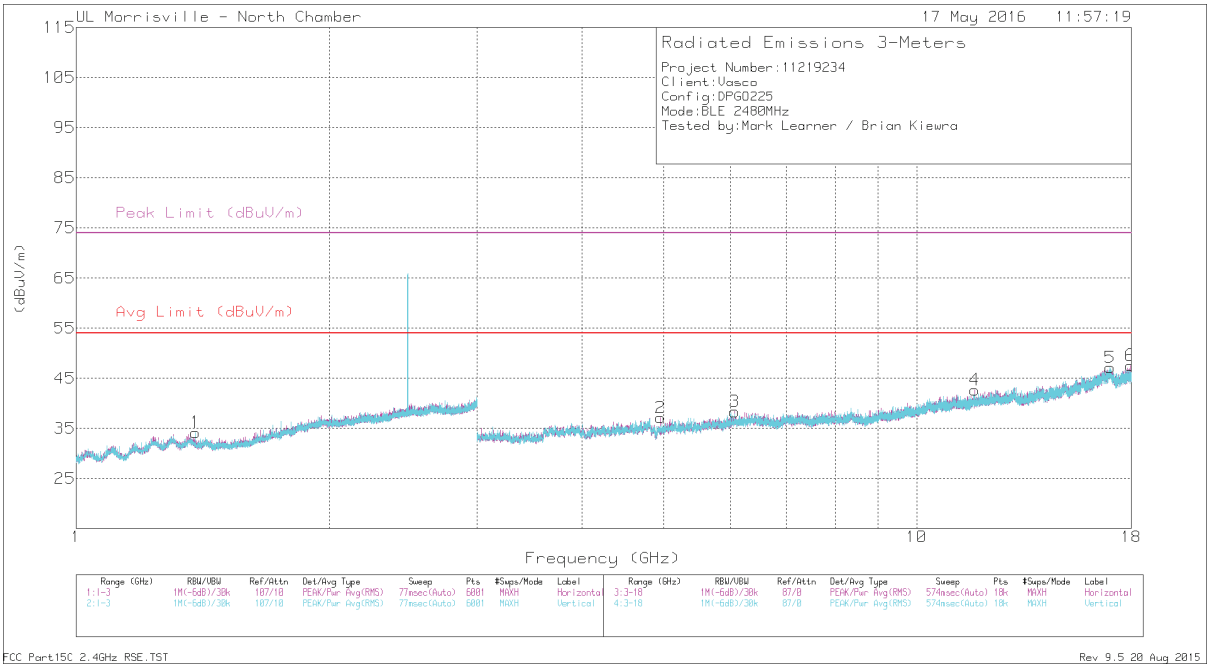


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (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
2	* 1.703	35.62	PK2	29.3	-24.7	0	40.22	-	-	74	-33.78	360	198	H
	* 1.703	23.98	MAv1	29.3	-24.7	.2	28.78	54	-25.22	-	-	360	198	H
1	* 1.297	36.7	PK2	29.1	-25.9	0	39.9	-	-	74	-34.1	9	198	V
	* 1.299	24.6	MAv1	29.1	-25.9	.2	28	54	-26	-	-	9	198	V
3	* 2.779	36.86	PK2	32.1	-24.2	0	44.76	-	-	74	-29.24	189	198	V
	* 2.781	25.05	MAv1	32.1	-24.2	.2	33.15	54	-20.85	-	-	189	198	V
4	* 3.743	41.73	PK2	33.4	-33.4	0	41.73	-	-	74	-32.27	212	102	H
	* 3.745	30.02	MAv1	33.4	-33.5	.2	30.12	54	-23.88	-	-	212	102	H
5	* 11.922	35.65	PK2	38.7	-27	0	47.35	-	-	74	-26.65	6	199	V
	* 11.92	24.19	MAv1	38.7	-26.9	.2	36.19	54	-17.81	-	-	6	199	V
6	16.63	29.66	Pk	41.9	-24.3	0	47.26	-	-	-	-	0-360	101	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK2 - Maximum Peak
MAv1 - Maximum RMS Average

HIGH CHANNEL



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (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	* 1.388	35.78	PK2	28.9	-25.6	0	39.08	-	-	74	-34.92	162	198	V
	* 1.384	23.56	MAv1	28.9	-25.6	.2	27.06	54	-26.94	-	-	162	198	V
2	* 4.96	42.2	PK2	34.2	-33.2	0	43.2	-	-	74	-30.8	301	198	H
	* 4.96	31.01	MAv1	34.2	-33.2	.2	32.21	54	-21.79	-	-	301	198	H
4	* 11.728	35.55	PK2	38.5	-26.6	0	47.45	-	-	74	-26.55	81	102	H
	* 11.729	23.94	MAv1	38.5	-26.6	.2	36.04	54	-17.96	-	-	81	102	H
6	* 17.977	35.84	PK2	41.4	-25.1	0	52.14	-	-	74	-21.86	226	102	H
	* 17.977	24.54	MAv1	41.4	-25.1	.2	41.04	54	-12.96	-	-	226	102	H
3	6.072	33.86	Pk	35.1	-30.6	0	38.36	-	-	-	-	0-360	199	H
5	16.986	30.73	Pk	41.9	-25.5	0	47.13	-	-	-	-	0-360	199	V

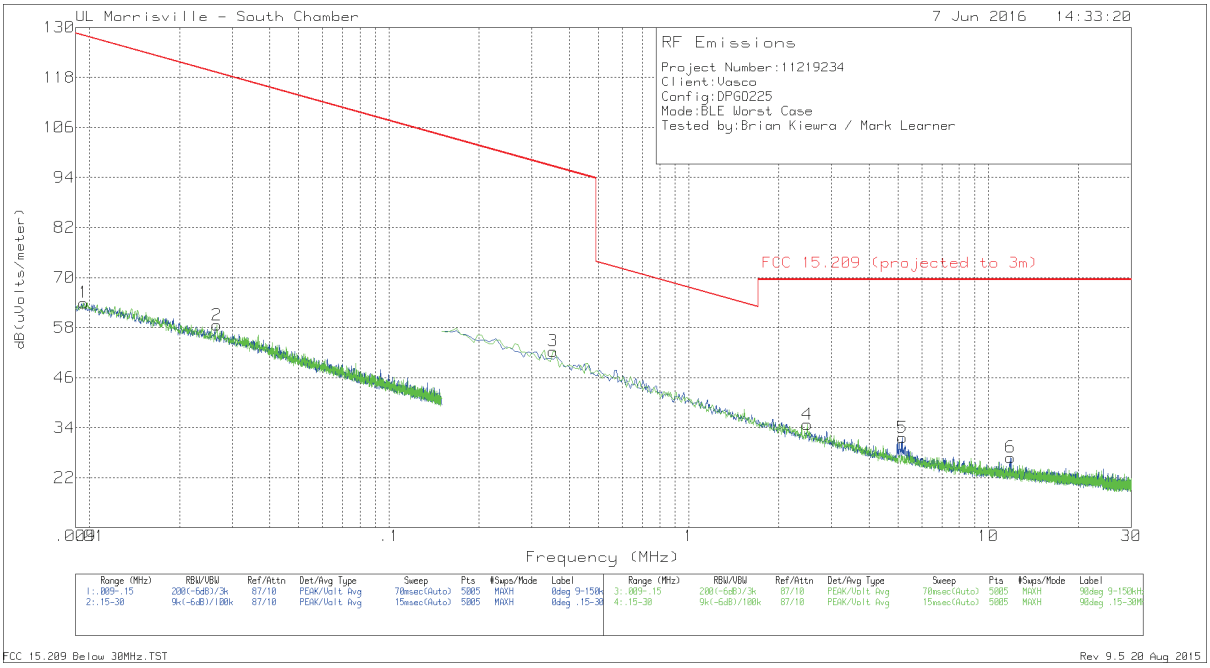
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK2 - Maximum Peak
MAv1 - Maximum RMS Average

9.3. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 9 kHz TO 30 MHz (WORST-CASE CONFIGURATION)

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

Although these tests were performed at a test site other than an open area test site, adequate comparison measurements were confirmed against an open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

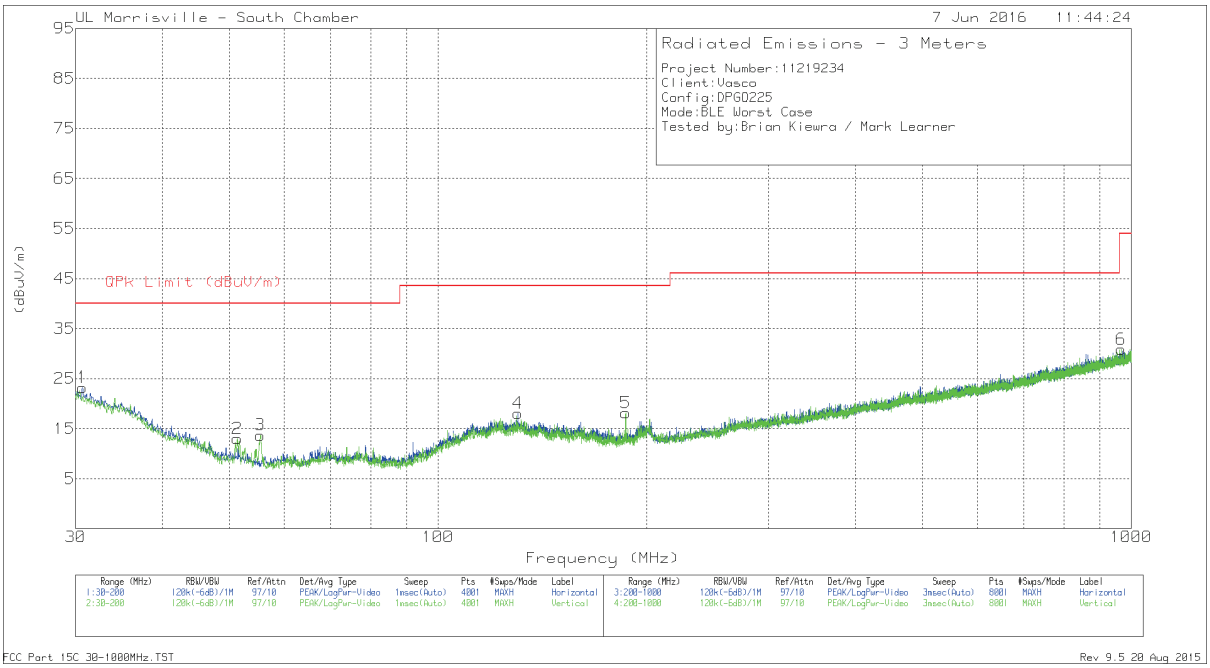


Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Corrected Reading dB(uV/m)	FCC 15.209 (projected to 3m)	Margin (dB)	Azimuth (Degs)	Polarity (Degs)
1	.00959	44.57	Pk	19.3	.1	63.97	127.97	-64	0-360	0
2	.02664	44.17	Pk	14.3	.1	58.57	119.09	-60.52	0-360	90
3	.35281	40.36	Pk	11.9	.1	52.36	96.65	-44.29	0-360	90
4	2.48828	22.49	Pk	12.1	.2	34.79	69.54	-34.75	0-360	90
5	5.1606	19.93	Pk	11.3	.4	31.63	69.54	-37.91	0-360	0
6	11.84737	15.37	Pk	10.9	.6	26.87	69.54	-42.67	0-360	0

Pk - Peak detector

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



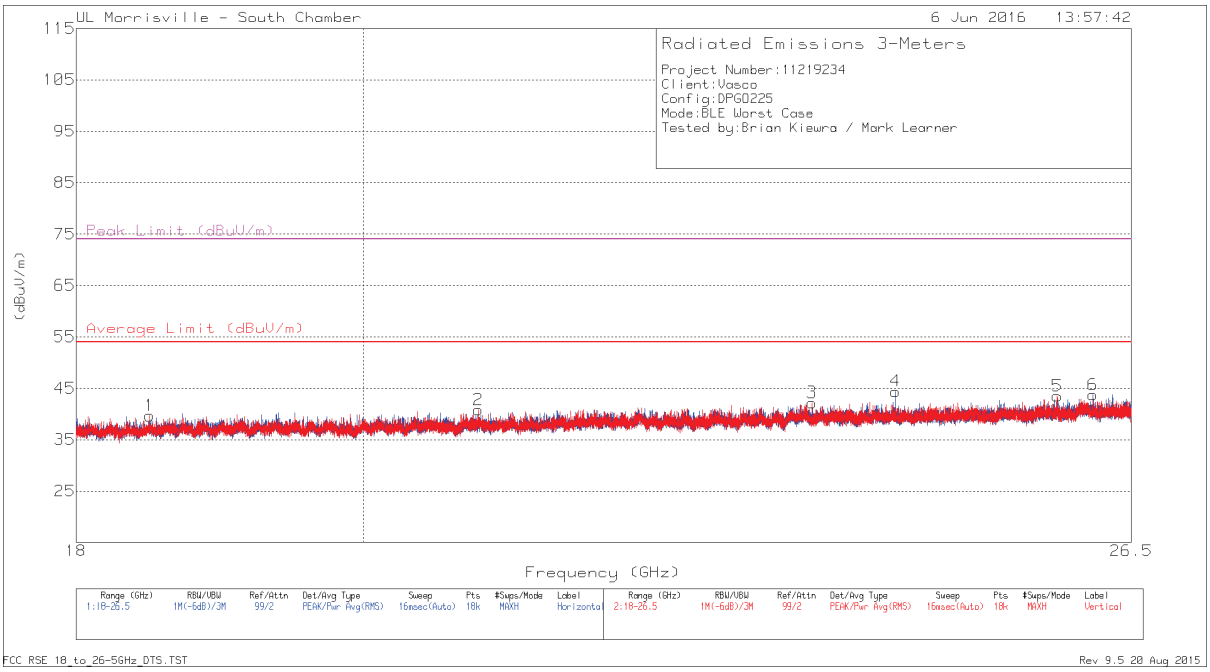
Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0073 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	* 130.2662	23.82	Qp	18.1	-30.7	11.22	43.52	-32.3	99	100	H
6	* 966.7666	22.19	Qp	27.6	-26.1	23.69	53.97	-30.28	143	298	V
1	30.68	29.43	Pk	25.6	-31.8	23.23	40	-16.77	0-360	100	H
2	51.335	32.19	Pk	12.4	-31.6	12.99	40	-27.01	0-360	102	V
3	55.415	33.51	Pk	11.8	-31.6	13.71	40	-26.29	0-360	102	V
5	186.485	32.8	Pk	15.7	-30.3	18.2	43.52	-25.32	0-360	102	V

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

9.4. WORST-CASE 18-26GHz

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



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0076 (dB/m)	Amp/Cbl (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 18.494	48.17	PK2	32.6	-40.7	0	40.07	54	-13.93	74	-33.93	47	202	V
2	* 20.859	47.27	PK2	33.4	-40.1	0	40.57	54	-13.43	74	-33.43	183	103	V
3	23.574	47.2	Pk	34.2	-39.2	0	42.2	54	-11.8	74	-31.8	0-360	252	V
4	24.308	48.82	Pk	34.4	-38.8	0	44.42	54	-9.58	74	-29.58	0-360	199	H
5	25.791	46.28	Pk	34.8	-37.6	0	43.48	54	-10.52	74	-30.52	0-360	101	V
6	26.127	46.35	Pk	34.9	-37.5	0	43.75	54	-10.25	74	-30.25	0-360	249	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK2 - Maximum Peak
MAv1 - Maximum RMS Average