CERTIFICATION TEST REPORT

Report Number. : 12561386-E1V2

Applicant	:	Valve Corporation 10400 NE 4th Street, Suite 1400 Bellevue, WA 98004 U.S.A.
Model	:	1005
FCC ID	:	2AES41005
IC	:	20207-1005
EUT Description	:	Valve Left Controller
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 5

Date Of Issue:
December 20, 2018

Prepared by:
UL Verification Services Inc.
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NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	12/12/2018	Initial Issue	
V2	12/20/2018	Updated Section 6	KK

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Valve Corporation
10400 NE 4th Street, Suite 1400
Bellevue, WA 98004 U.S.A.

EUT DESCRIPTION: Valve Left Controller

MODEL: 1005

SERIAL NUMBER: Conducted: 1880275
Radiated: 1880276

DATE TESTED: OCTOBER 31, 2018 – NOVEMBER 9, 2018

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

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 the U.S. government.

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Approved & Released For
UL Verification Services Inc. By:

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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, KDB 558074 D01 v05, RSS-GEN Issue 5, and RSS-247 Issue 2.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, 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	47658 Kato Rd
☒ Chamber A (ISED:2324B-1)	☐ Chamber D (ISED:22541-1)	☒ Chamber I (ISED:2324A-5)
☐ Chamber B (ISED:2324B-2)	☐ Chamber E (ISED:22541-2)	☐ Chamber J (ISED:2324A-6)
☐ Chamber C (ISED:2324B-3)	☐ Chamber F (ISED:22541-3)	☐ Chamber K (ISED:2324A-1)
	☐ Chamber G (ISED:22541-4)	☐ Chamber L (ISED:2324A-3)
	☐ Chamber H (ISED:22541-5)	

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code

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

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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

RADIATED EMISSIONS

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

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%.

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5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The EUT is a Valve Left Controller.

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	Valve Protocol	4.76	2.99

5.1. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Band (GHz)	Antenna Peak Gain (dBi)
2.4	0.90

5.2. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was VRC version: 1538763457.

The test radio version software used during testing was 1538760414.

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5.3. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

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

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5.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	TP00050C	PC0C3DUA	DoC
Laptop AC/DC Adapter	Lenovo	ADLX45DLC2A	8SSA10E75792UICZ641CLB1	DoC
Laptop	DELL	Inspiron15	B871412	DoC
Laptop AC/DC Adapter	DELL	HA65NS5-00	A065R039L	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	Unshielded	1	AC Mains to AC/DC Adapter
2	DC	1	DC	Unshielded	1.5	AC/DC Adapter to Laptop
3	USB	1	USB	Shielded	1	Laptop to EUT
4	Antenna	1	SMA	Unshielded	0.08	To spectrum analyzer

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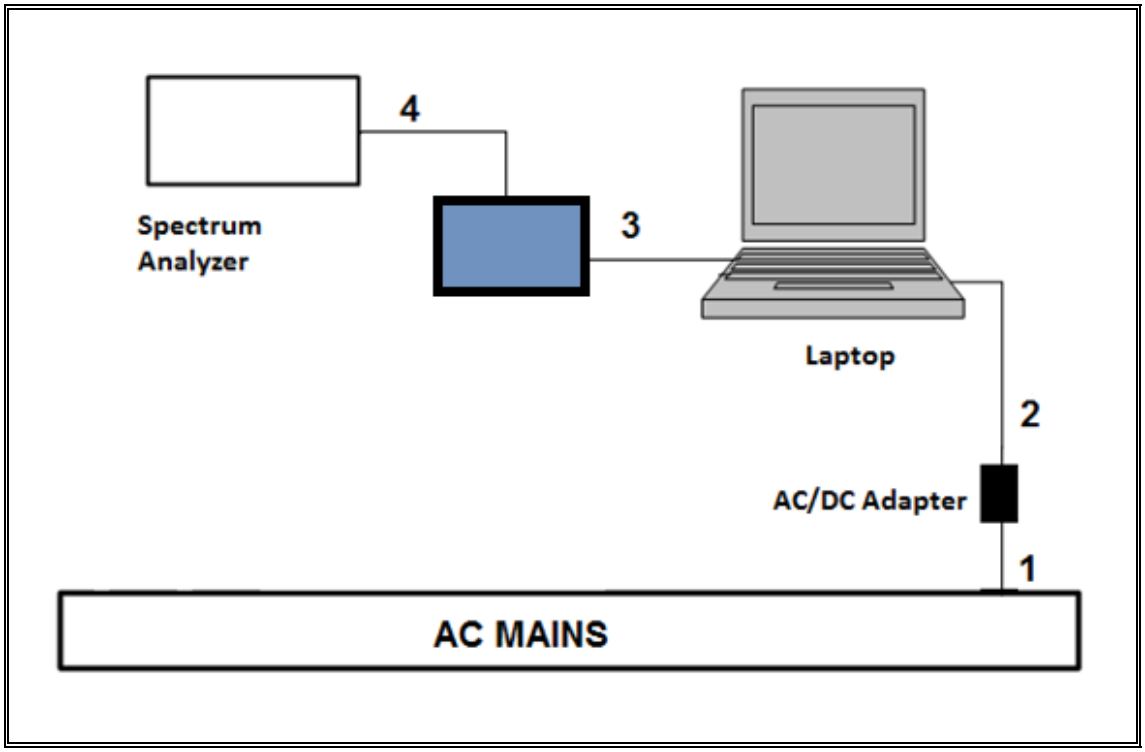
TEST SETUP

The EUT is connected to a test laptop during the tests. Test software exercised the EUT.

SETUP DIAGRAM – CONDUCTED TEST



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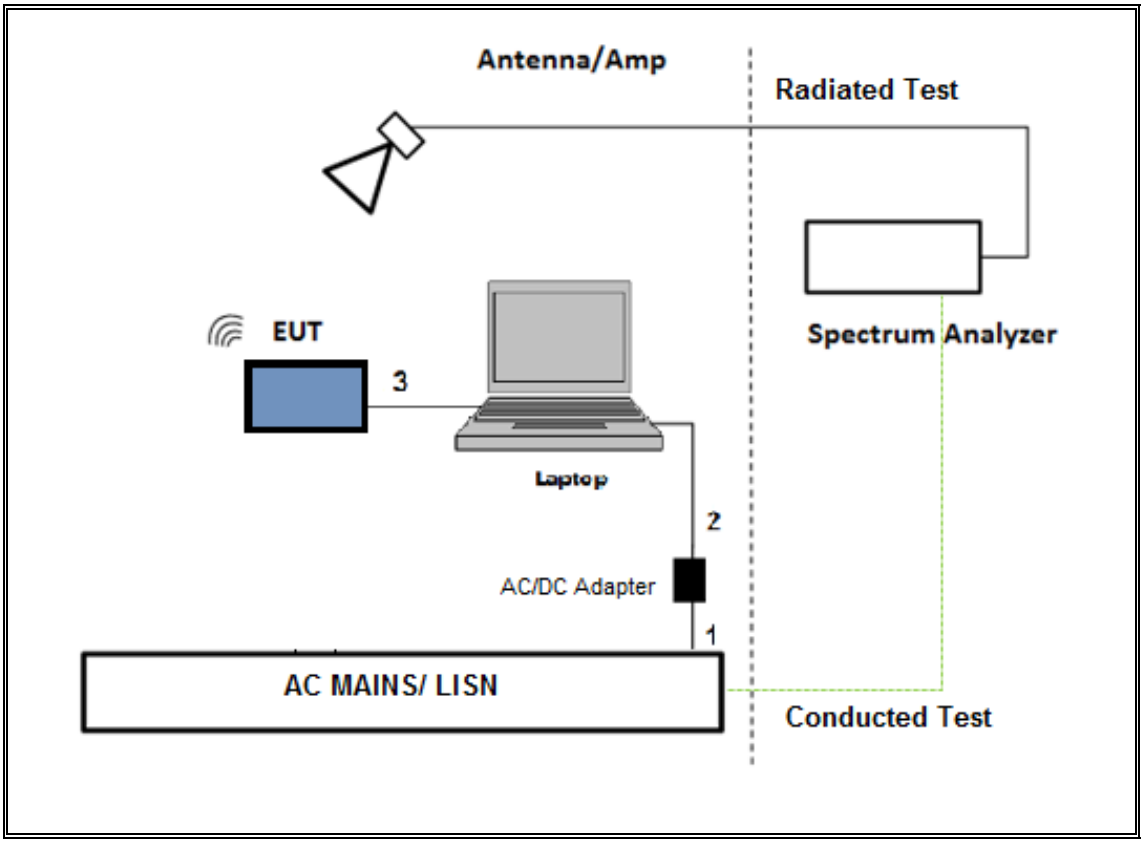
SETUP DIAGRAM - AC LINE CONDUCTED TEST AND RADIATED TEST



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6. MEASUREMENT METHOD

On Time and Duty Cycle: ANSI C63.10-2013 Section 11.6.

6 dB BW: ANSI C63.10 Section 11.8.1. Option 1

Output Power: ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G (Measurement using a gated RF average-reading power meter)

Peak Output Power: ANSI C63.10-2013 Section 7.8.5

Power Spectral Density: ANSI C63.10 Section 11.10.3 Method AVGPSD-1.

Radiated emissions non-restricted frequency bands: ANSI C63.10 Section 11.12.1

Radiated emissions restricted frequency bands: ANSI C63.10 Section 11.12.1.

Conducted emissions in restricted frequency bands: ANSI C63.10 Section 11.12.2.

Band-edge: ANSI C63.10 Subclause -11.13.3.4 Integration method -Trace averaging across ON and OFF times DC correction

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

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7. 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**	**ID Num**	**Cal Due**	**Last Cal**
6 port rf switch, 1-18GHz	Pasternack	PE7159	171455	08/01/2019	08/01/2018
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	T130	06/18/2019	06/18/2018
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T862	05/25/2019	05/25/2018
RF Amplifier, 1-18GHz	MITEQ	AFS42-00101800-25-S-42	171460	08/01/2019	08/01/2018
18-26.5 GHz Horn Antenna	Seavey Division	MWH-1826/B	T447	6/16/2019	6/16/2018
Pre-Amp 1-26.5 GHz	Agilent	8449B	T404	3/9/2019	3/9/2018
L.I.S.N.	FCC INC.	FCC LISN 50/250	T1310	06/15/2019	06/15/2018
L.I.S.N.	FCC INC.	FCC LISN 50/250	T24	03/06/2019	03/06/2018
EMI Receiver	Rohde & Schwarz	ESR	T1436	02/21/2019	02/21/2018
Antenna, Active Loop 9kHz-30MHz	Com-Power Corp.	AL-130R	PRE0165308	12/13/2018	12/13/2017
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T1269	04/05/2019	04/05/2018
Power Sensor, P-series, 50MHz to 18GHz, Wideband	Agilent (Keysight) Technologies	N1921A	T1225	04/10/2019	04/10/2018
PXA Spectrum Analyzer, 3Hz to 44GHz	Keysight	N9030A	T1113	12/21/2018	12/21/2017
PXA Spectrum Analyzer, 3Hz to 44GHz	Keysight	N9030A	T339	9/11/2019	9/11/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (keysight) Technologies	N9030A	T1466	11/25/2018	11/25/2017
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179367	04/25/2019	04/25/2018

Test Software List			
Description	**Manufacturer**	**Model**	**Version**
Radiated Software	UL	UL EMC	Rev 9.5, Jun 22, 2018
Antenna Port Software	UL	UL RF	Rev 8.9.1, Oct 18, 2018

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8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
Valve Protocol	0.348	1.500	0.232	23.20%	6.35	2.874

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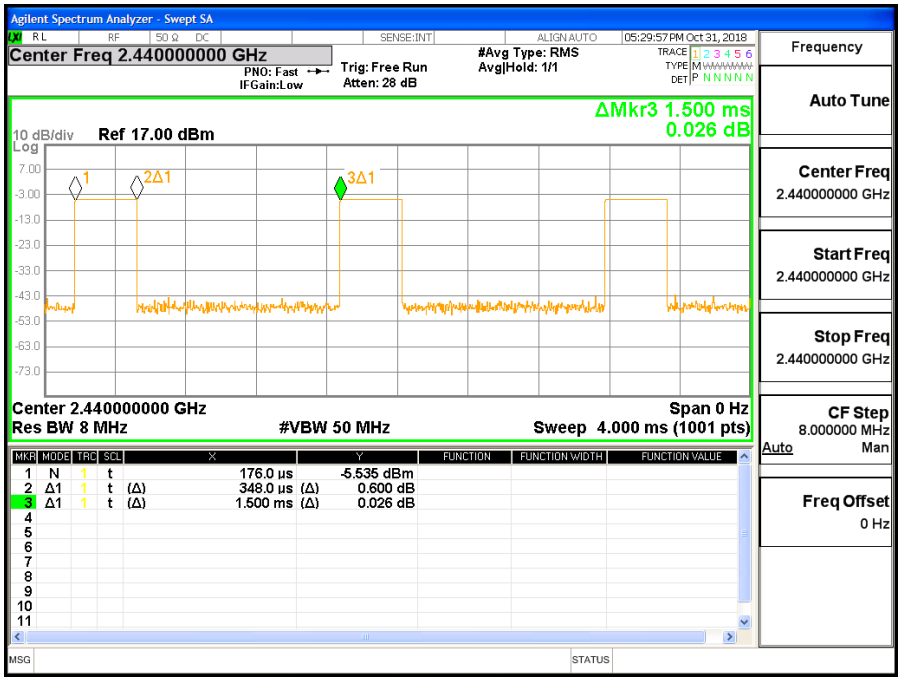
DUTY CYCLE PLOTS



DUTY CYCLE BLE

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8.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

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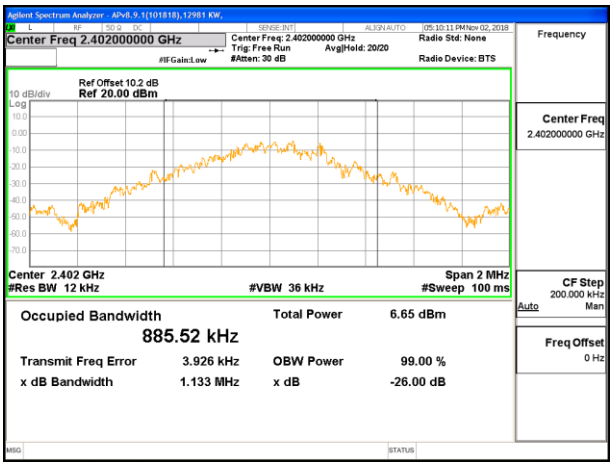
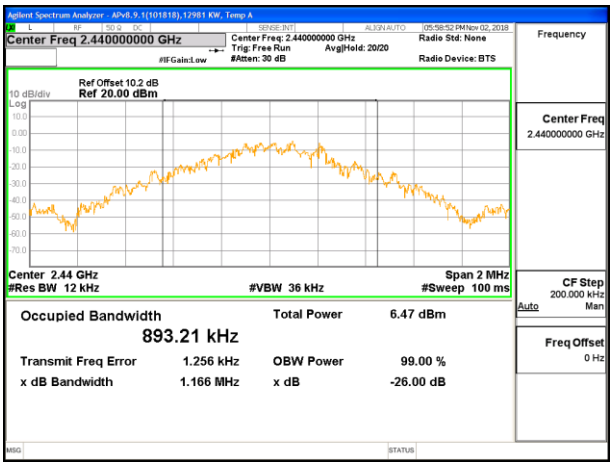
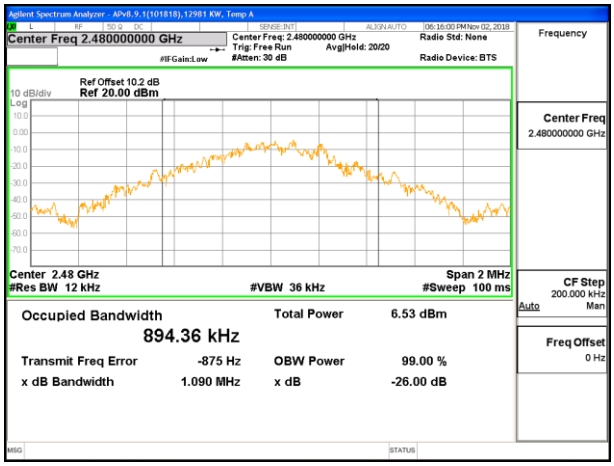
Channel	Frequency (MHz)	99% Bandwidth (kHz)
Low	2402	885.52
Middle	2440	893.21
High	2480	894.36



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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8.3. 6 dB BANDWIDTH

LIMITS

FCC §15.407 (e)

RSS-247 5.2 (a)

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

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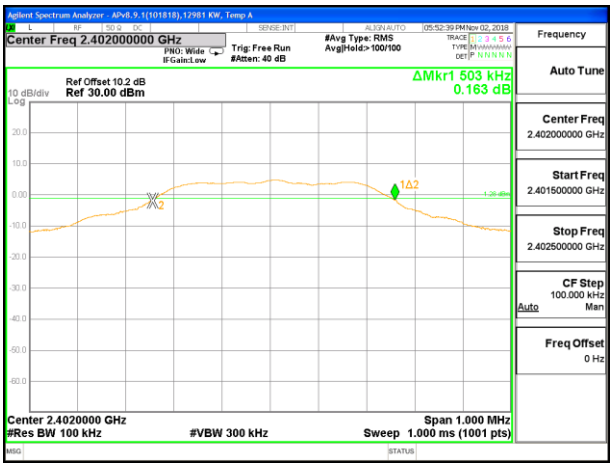
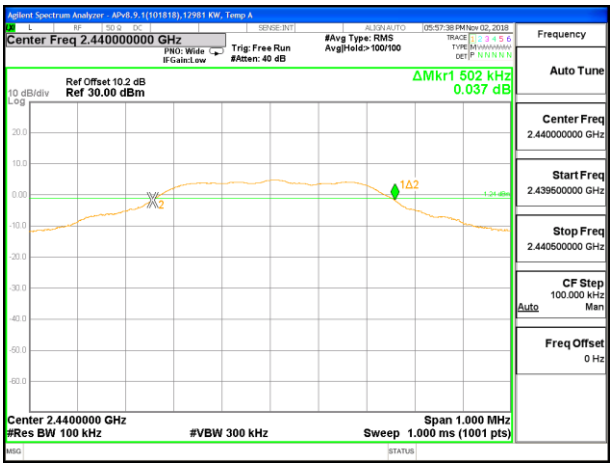
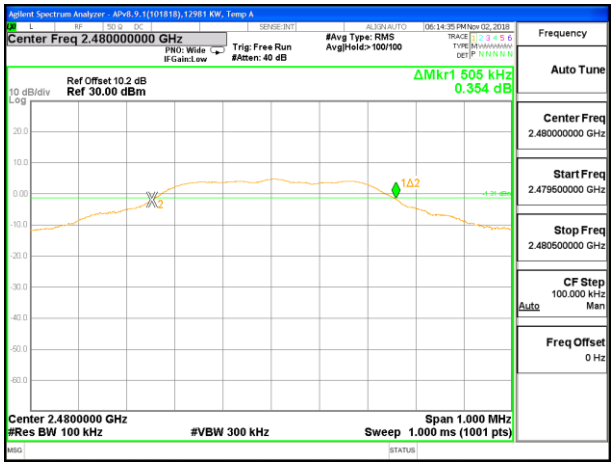
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.503	0.5
Middle	2440	0.502	0.5
High	2480	0.505	0.5



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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8.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

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

TEST PROCEDURE

The transmitter output is connected to a power meter. The cable assembly insertion was entered as an offset in the power meter to allow for a gated peak reading of power.

RESULTS

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Tested By:	12981 KW
Date:	11/2/2018

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	4.75	30	-25.250
Middle	2440	4.76	30	-25.240
High	2480	4.74	30	-25.260

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8.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter. The cable assembly insertion loss was entered as an offset in the power meter to allow for a gated average reading of power.

RESULTS

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Tested By:	12981 KW
Date:	11/2/2018

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	4.65
Middle	2440	4.66
High	2480	4.64

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8.6. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

RSS-247 (5.2) (b)

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

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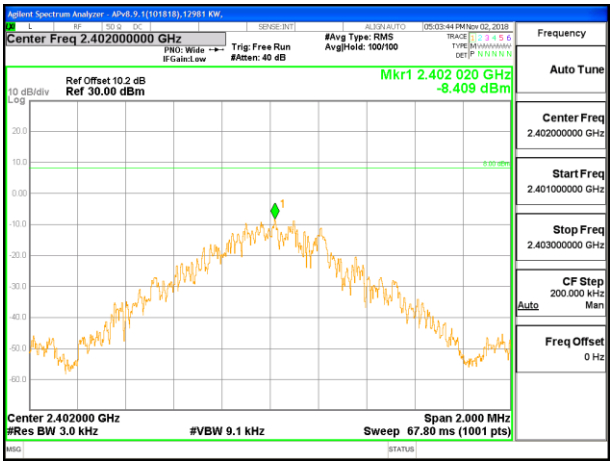
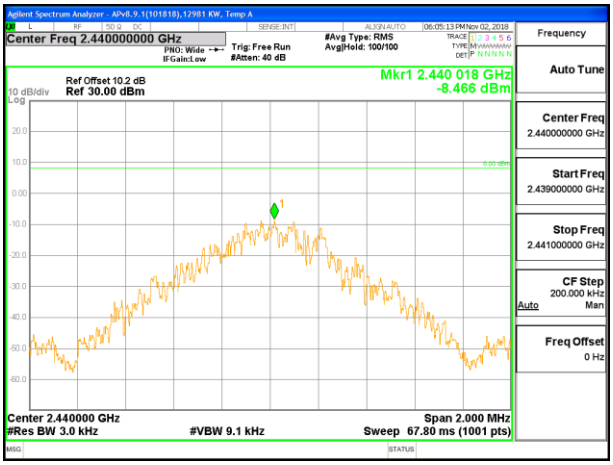
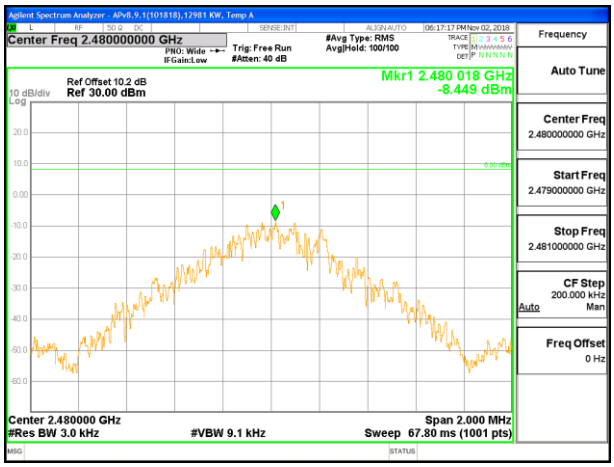
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-8.409	8	-16.409
Middle	2440	-8.466	8	-16.466
High	2480	-8.449	8	-16.449



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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8.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

RSS-247 5.5

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

RESULTS

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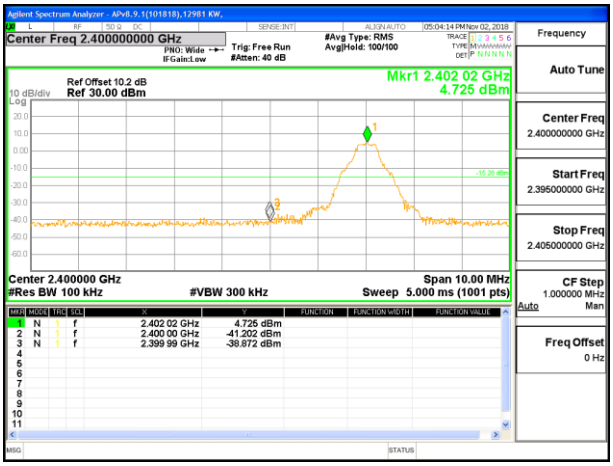
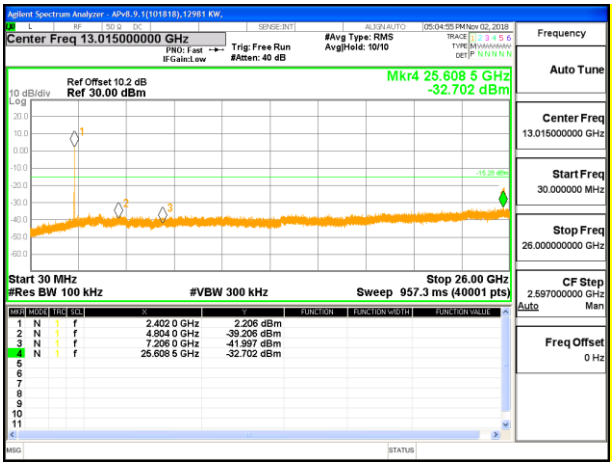
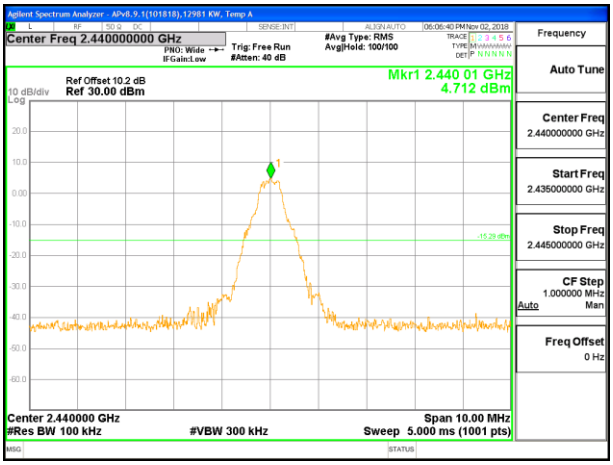


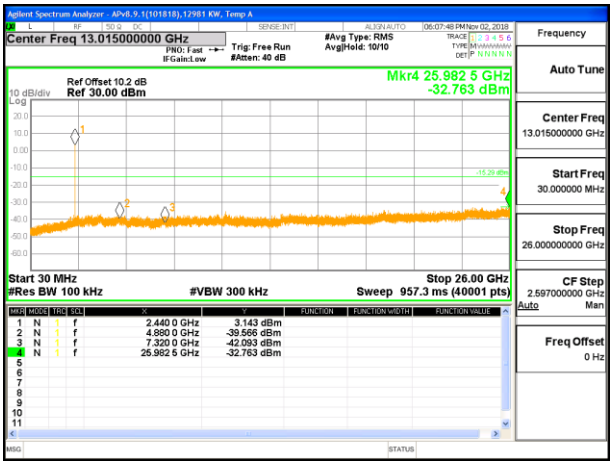
LOW CHANNEL BANDEDGE



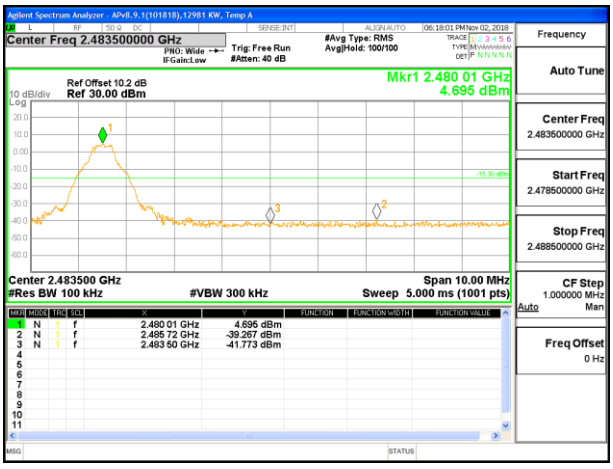
OUT-OF-BAND LOW CHANNEL



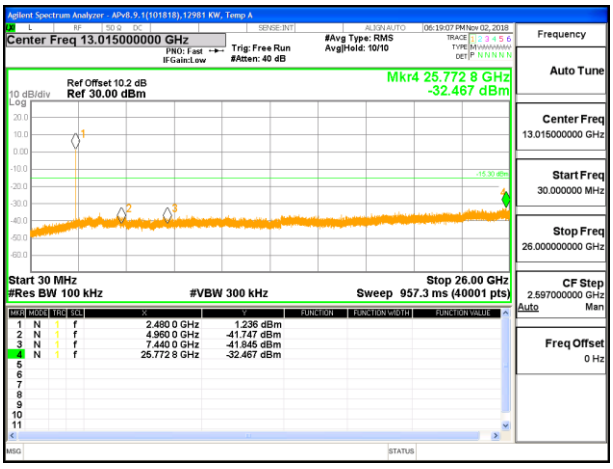
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

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
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 measurement below 1GHz; 1.5 m above the ground plane for measurement 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 pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

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.

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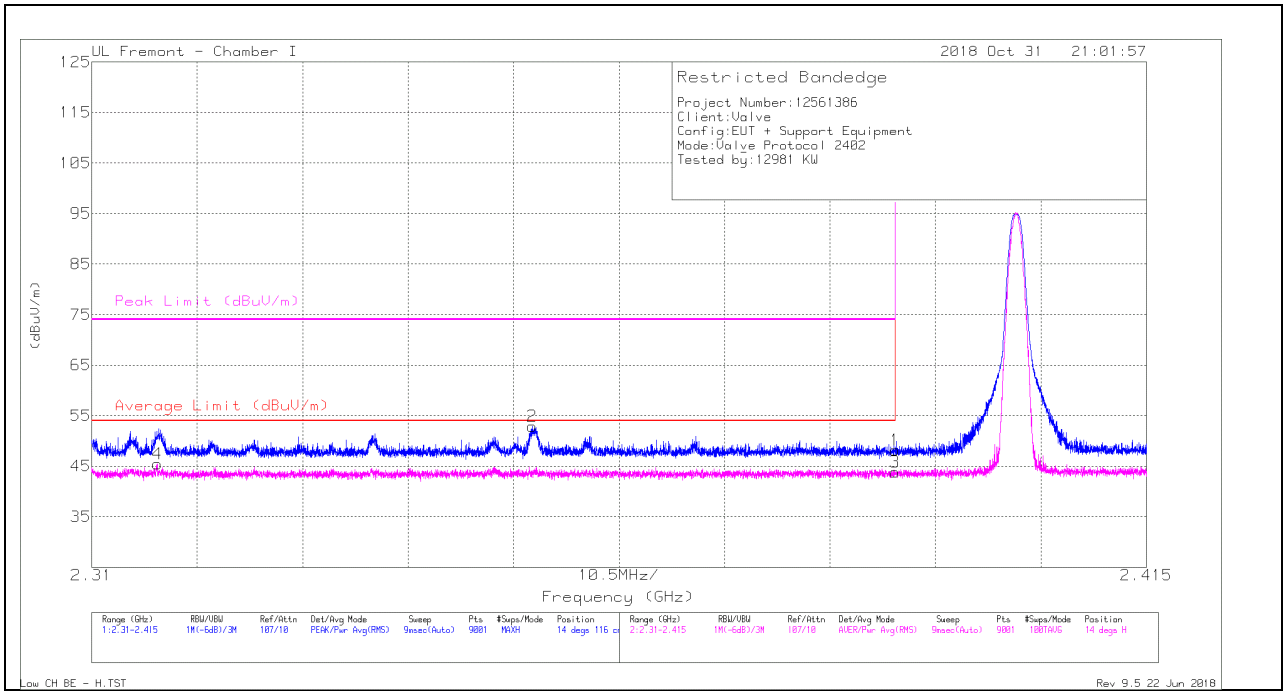
9.2. TRANSMITTER ABOVE 1 GHz

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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	37.98	Pk	31.8	-21.6	0	48.18	-	-	74	-25.82	14	116	H
2	* 2.354	42.82	Pk	31.6	-21.5	0	52.92	-	-	74	-21.08	14	116	H
3	* 2.39	27.25	RMS	31.8	-21.6	6.35	43.8	54	-10.2	-	-	14	116	H
4	* 2.317	28.85	RMS	31.6	-21.4	6.35	45.4	54	-8.6	-	-	14	116	H

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

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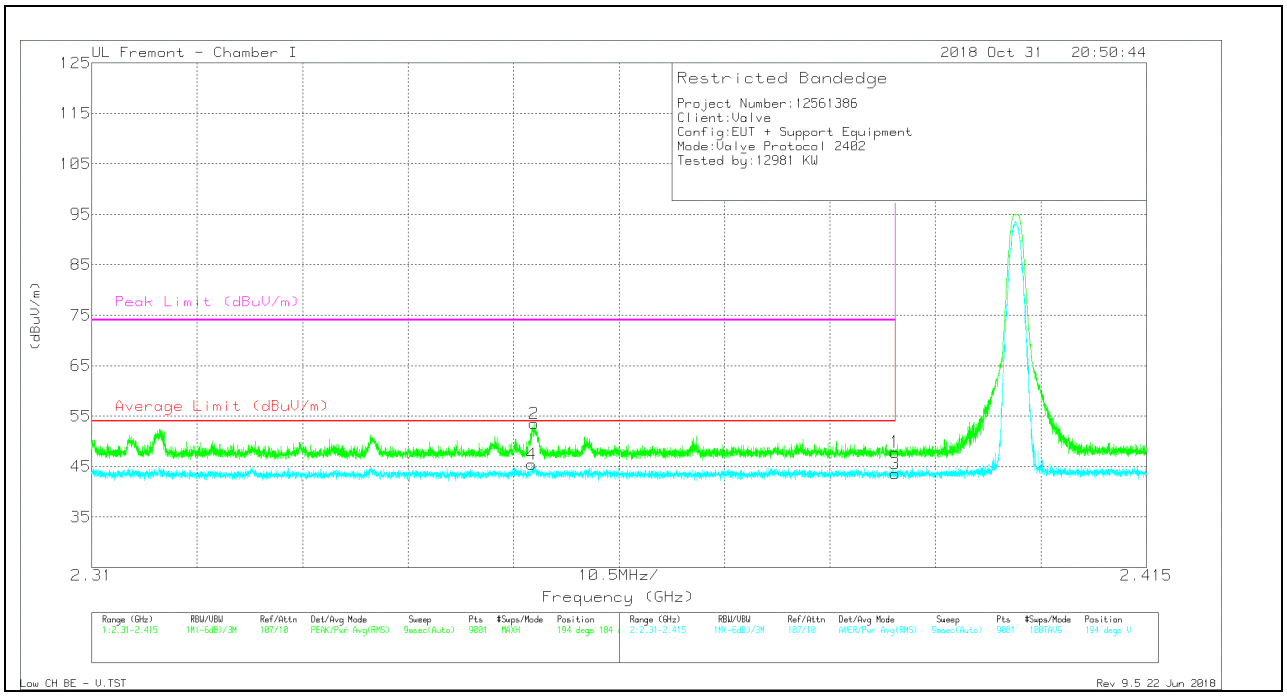
VERTICAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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	37.67	Pk	31.8	-21.6	0	47.87	-	-	74	-26.13	194	184	V
2	* 2.354	43.41	Pk	31.6	-21.5	0	53.51	-	-	74	-20.49	194	184	V
3	* 2.39	27.06	RMS	31.8	-21.6	6.35	43.61	54	-10.39	-	-	194	184	V
4	* 2.354	29.04	RMS	31.6	-21.5	6.35	45.49	54	-8.51	-	-	194	184	V

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

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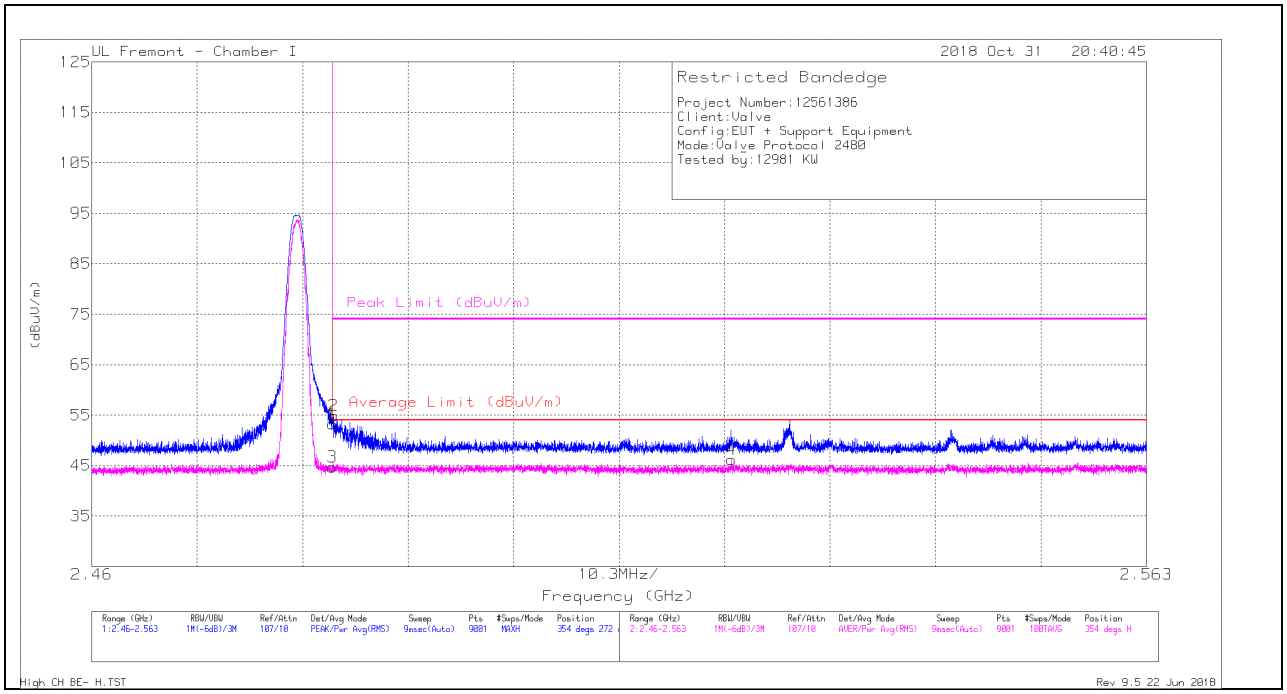
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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	42.61	Pk	32.4	-21.7	0	53.31	-	-	74	-20.69	354	272	H
2	* 2.484	44.17	Pk	32.4	-21.7	0	54.87	-	-	74	-19.13	354	272	H
3	* 2.484	27.65	RMS	32.4	-21.7	6.35	44.7	54	-9.3	-	-	354	272	H
4	2.522	29.13	RMS	32.4	-21.7	6.35	46.18	54	-7.82	-	-	354	272	H

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

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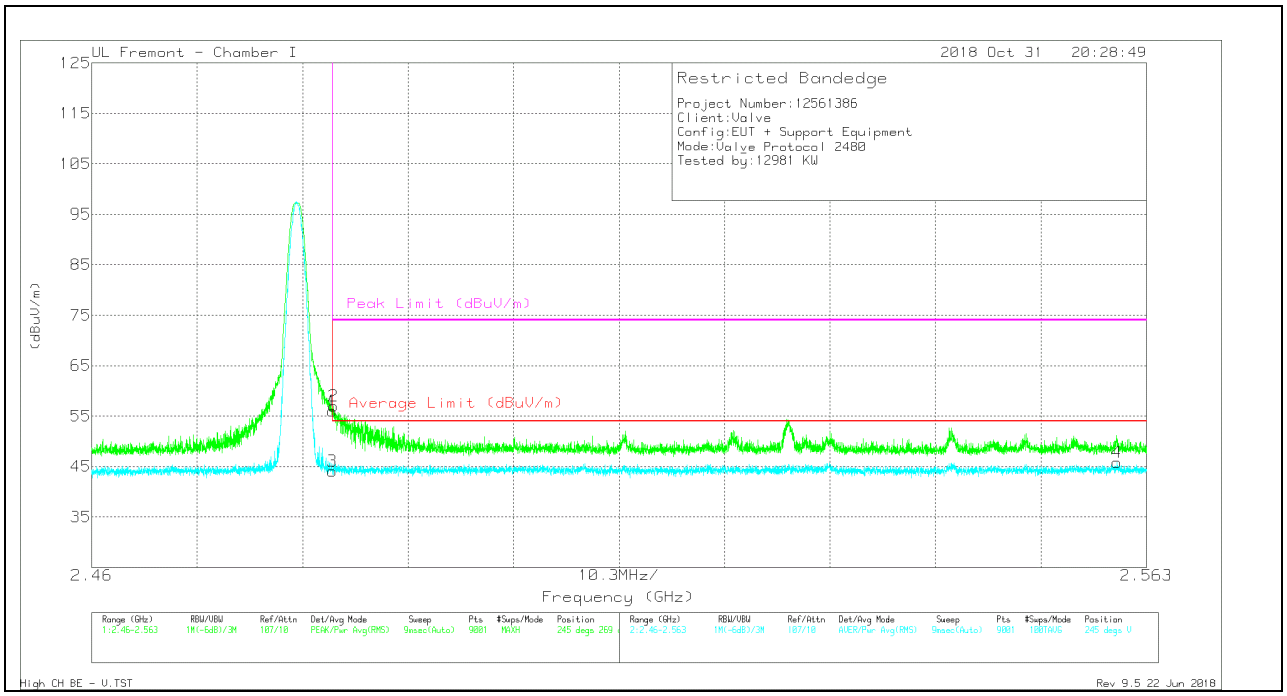
VERTICAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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	45.32	Pk	32.4	-21.7	0	56.02	-	-	74	-17.98	245	269	V
2	* 2.484	46.28	Pk	32.4	-21.7	0	56.98	-	-	74	-17.02	245	269	V
3	* 2.484	27.07	RMS	32.4	-21.7	6.35	44.12	54	-9.88	-	-	245	269	V
4	2.56	28.71	RMS	32.4	-21.6	6.35	45.86	54	-8.14	-	-	245	269	V

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

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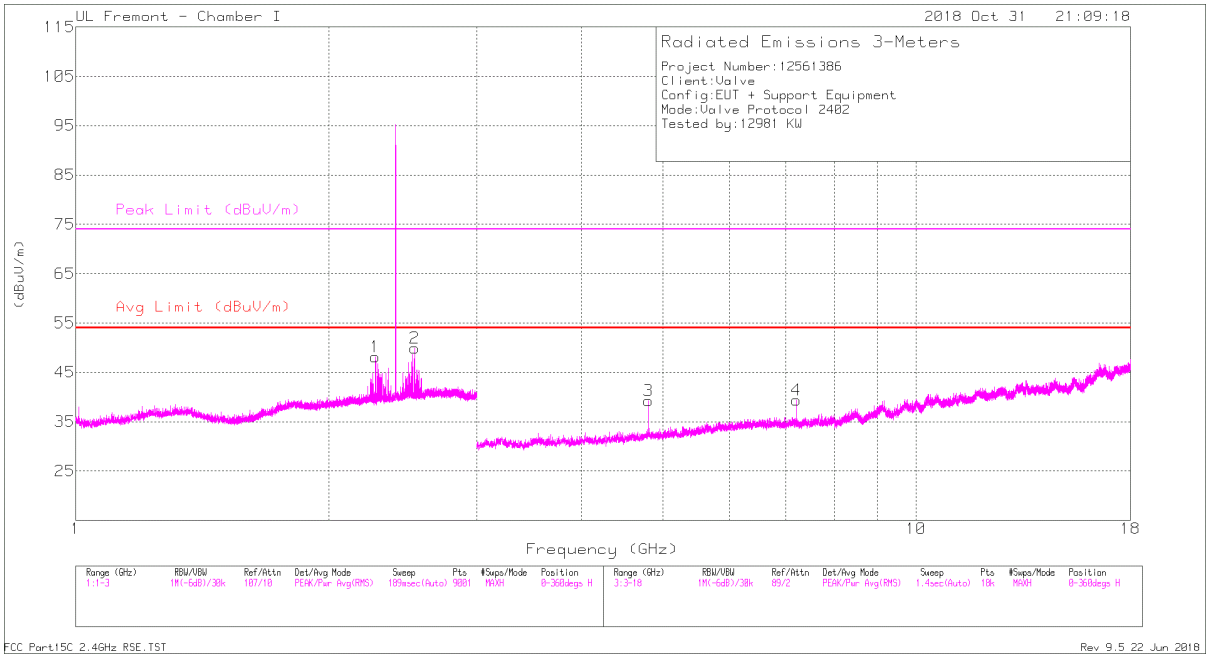
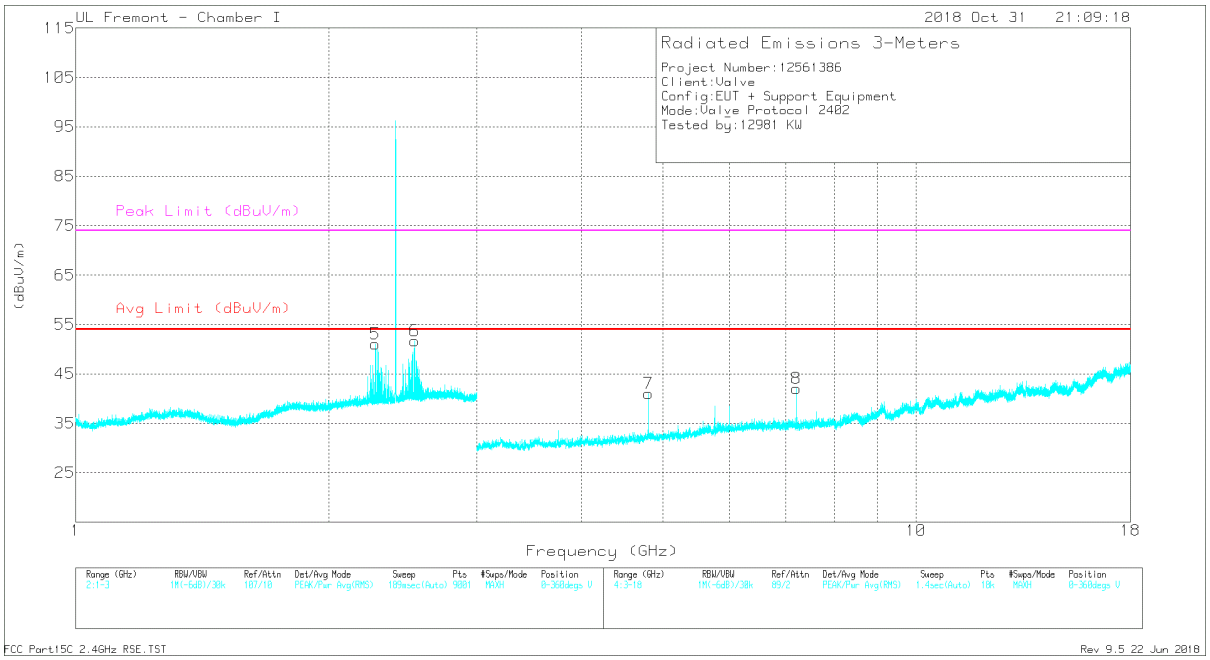
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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	* 2.274	42.56	PK2	31.3	-21.5	0	52.36	-	-	74	-21.64	30	170	H
	* 2.274	28.73	MAv1	31.3	-21.5	6.35	44.88	54	-9.12	-	-	30	170	H
2	2.53	39.26	Pk	32.4	-21.7	0	49.96	-	-	-	-	0-360	198	H
5	* 2.274	41.69	PK2	31.3	-21.5	0	51.49	-	-	74	-22.51	264	106	V
	* 2.274	27.91	MAv1	31.3	-21.5	6.35	44.06	54	-9.94	-	-	264	106	V
6	2.53	41.05	Pk	32.4	-21.7	0	51.75	-	-	-	-	0-360	198	V
3	* 4.804	38.15	PK2	34.2	-28	0	44.35	-	-	74	-29.65	326	110	H
	* 4.804	26.43	MAv1	34.3	-28	6.35	39.08	54	-14.92	-	-	326	110	H
4	7.206	29.82	Pk	35.6	-26	0	39.42	-	-	-	-	0-360	100	H
7	* 4.804	39.92	PK2	34.3	-28	0	46.22	-	-	74	-27.78	65	100	V
	* 4.804	25.9	MAv1	34.2	-28	6.35	38.45	54	-15.55	-	-	65	100	V
8	7.205	32.46	Pk	35.6	-26	0	42.06	-	-	-	-	0-360	198	V

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

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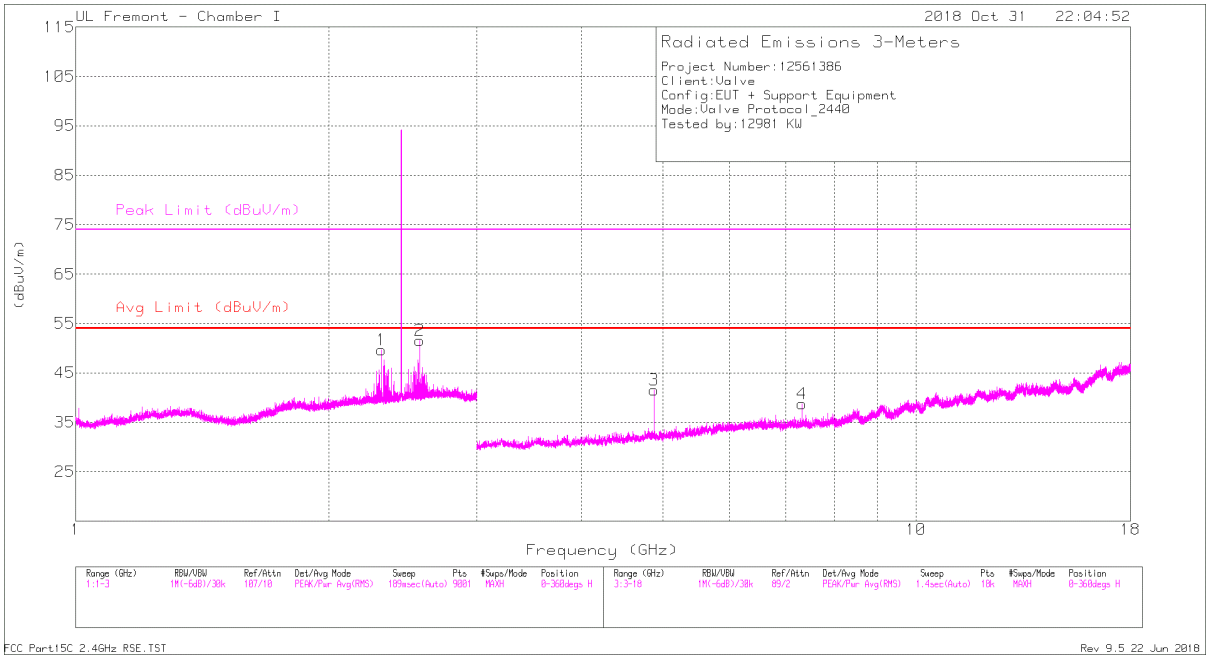
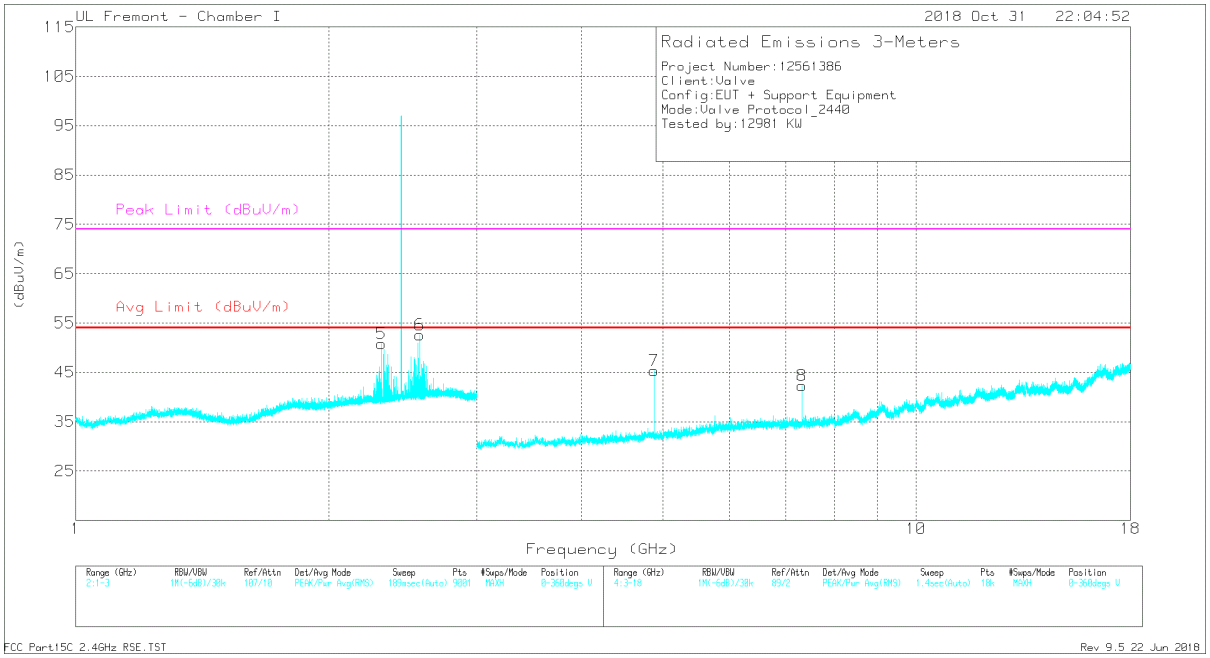
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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	* 2.312	44.66	PK2	31.5	-21.5	0	54.66	-	-	74	-19.34	36	146	H
	* 2.312	30.67	MAv1	31.5	-21.5	6.35	47.02	54	-6.98	-	-	36	146	H
2	2.568	40.84	Pk	32.4	-21.7	0	51.54	-	-	-	-	0-360	100	H
5	* 2.312	47.06	PK2	31.5	-21.5	0	57.06	-	-	74	-16.94	263	100	V
	* 2.312	31.24	MAv1	31.5	-21.5	6.35	47.59	54	-6.41	-	-	263	100	V
6	2.568	41.93	Pk	32.4	-21.7	0	52.63	-	-	-	-	0-360	100	V
3	* 4.88	39.88	PK2	34.1	-28.8	0	45.18	-	-	74	-28.82	48	130	H
	* 4.88	27.82	MAv1	34.1	-28.8	6.35	39.47	54	-14.53	-	-	48	130	H
4	* 7.319	31.69	PK2	35.6	-26	0	41.29	-	-	74	-32.71	130	178	H
	* 7.318	23.83	MAv1	35.6	-26	6.35	39.78	54	-14.22	-	-	130	178	H
7	* 4.88	41.67	PK2	34.2	-28.8	0	47.07	-	-	74	-26.93	75	107	V
	* 4.878	26.51	MAv1	34.2	-28.7	6.35	38.36	54	-15.64	-	-	75	107	V
8	* 7.32	34.42	PK2	35.6	-26	0	44.02	-	-	74	-29.98	11	176	V
	* 7.32	25.73	MAv1	35.6	-26	6.35	41.68	54	-12.32	-	-	11	176	V

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

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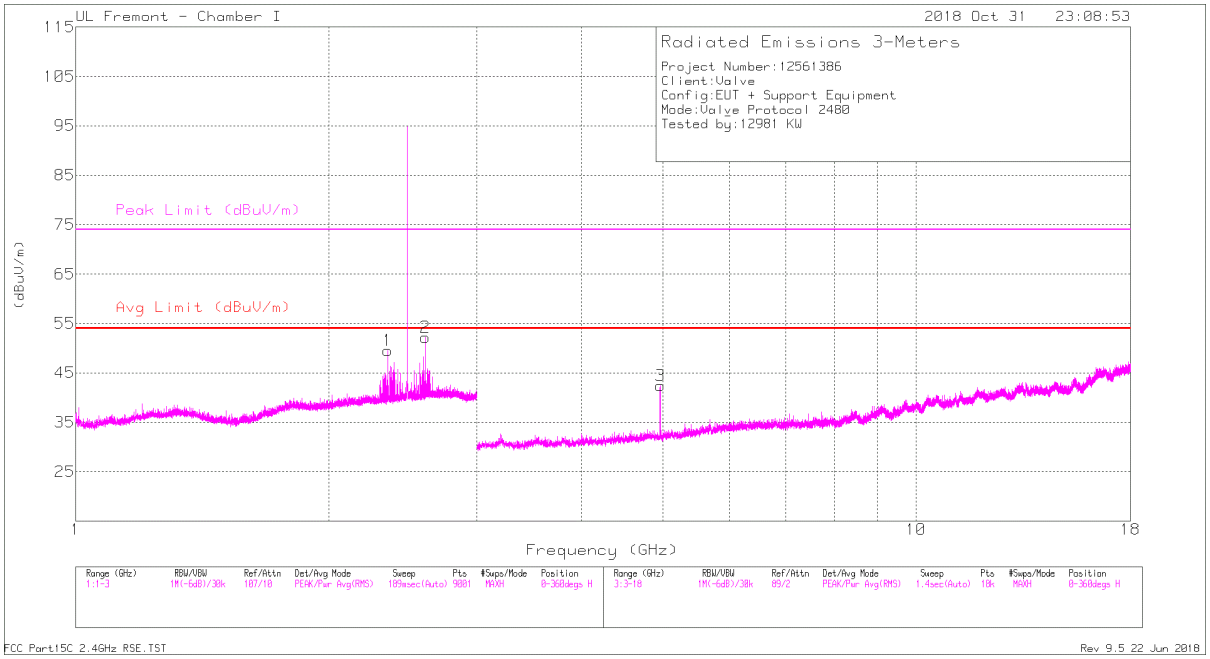
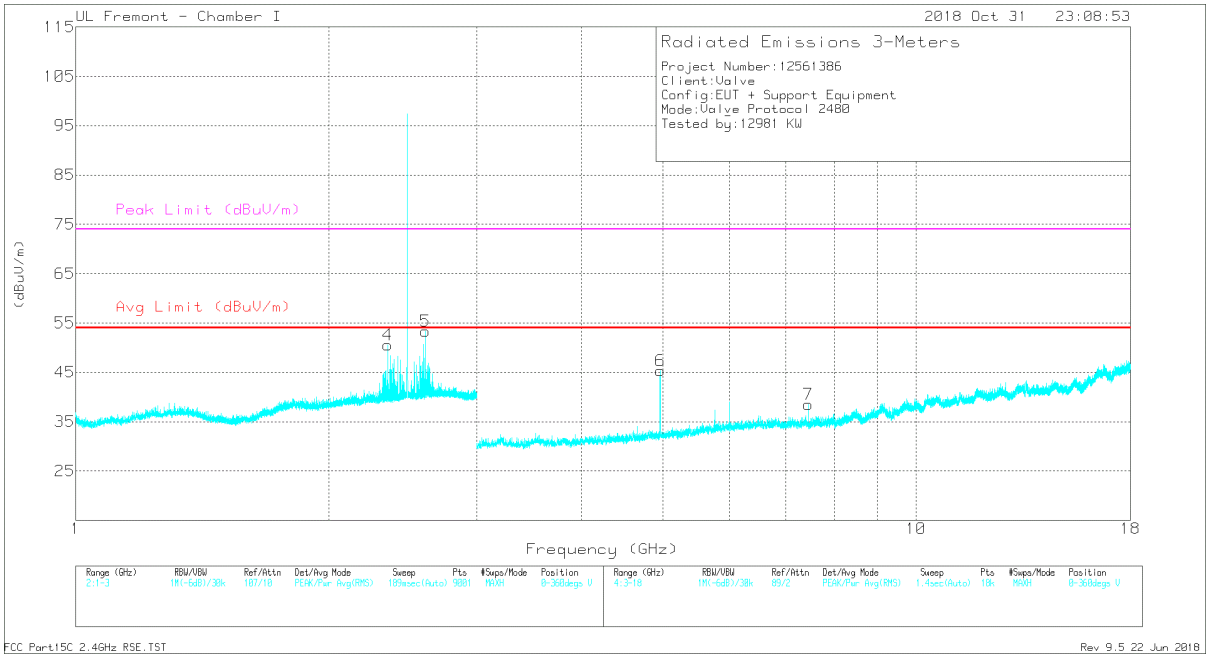
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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	* 2.352	42.36	PK2	31.6	-21.5	0	52.46	-	-	74	-21.54	165	357	H
	* 2.352	28.34	MAv1	31.6	-21.5	6.35	44.79	54	-9.21	-	-	165	357	H
2	2.608	41.33	Pk	32.5	-21.6	0	52.23	-	-	-	-	0-360	100	H
4	* 2.352	42.14	PK2	31.6	-21.5	0	52.24	-	-	74	-21.76	261	111	V
	* 2.352	28.11	MAv1	31.6	-21.5	6.35	44.56	54	-9.44	-	-	261	111	V
5	2.608	42.4	Pk	32.5	-21.6	0	53.3	-	-	-	-	0-360	100	V
3	* 4.96	40.11	PK2	34.2	-29	0	45.31	-	-	74	-28.69	50	112	H
	* 4.96	27.8	MAv1	34.2	-29	6.35	39.35	54	-14.65	-	-	50	112	H
6	* 4.958	39.71	PK2	34.2	-29	0	44.91	-	-	74	-29.09	85	100	V
	* 4.96	28.36	MAv1	34.2	-29	6.35	39.91	54	-14.09	-	-	85	100	V
7	* 7.44	34.82	PK2	35.6	-26	0	44.42	-	-	74	-29.58	15	181	V
	* 7.44	25.89	MAv1	35.6	-26	6.35	41.84	54	-12.16	-	-	15	181	V

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

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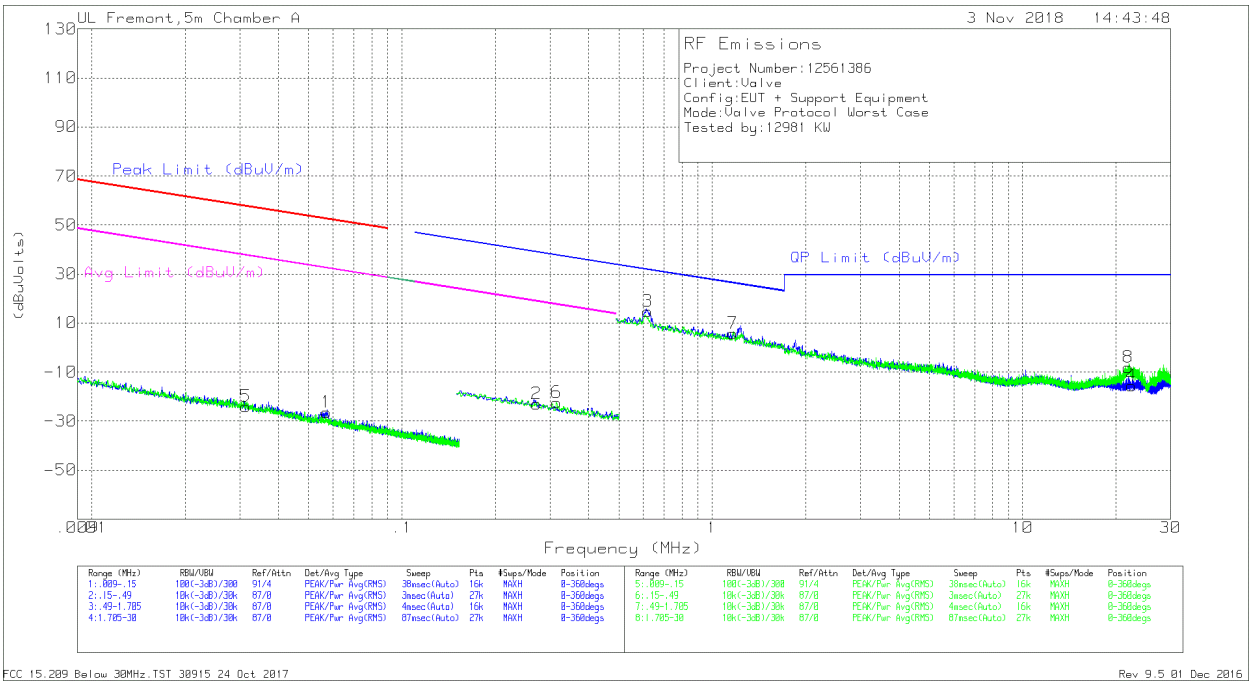
9.3. Worst Case Below 30 MHz

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

HORIZONTAL AND VERTICAL PLOT



NOTE: KDB 414788 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.

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Below 30 MHz Data

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)
5	.03136	40.55	Pk	15.4	.1	-80	-23.95	57.66	-81.61	37.66	-61.61	0-360
1	.05711	38.94	Pk	14.4	.1	-80	-26.56	52.45	-79.01	32.45	-59.01	0-360
2	.27132	43	Pk	13.8	.1	-80	-23.1	38.94	-62.04	18.94	-42.04	0-360
6	.31509	43.61	Pk	13.8	.1	-80	-22.49	37.64	-60.13	17.64	-40.13	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)	Azimuth (Degs)
3	.61901	40.64	Pk	14	.1	-40	14.74	31.78	-17.04	0-360
7	1.16496	31.18	Pk	14.3	.2	-40	5.68	26.3	-20.62	0-360
8	21.91149	16.89	Pk	14.2	.7	-40	-8.21	29.5	-37.71	0-360
4	22.44282	9.82	Pk	14	.7	-40	-15.48	29.5	-44.98	0-360

Pk - Peak detector

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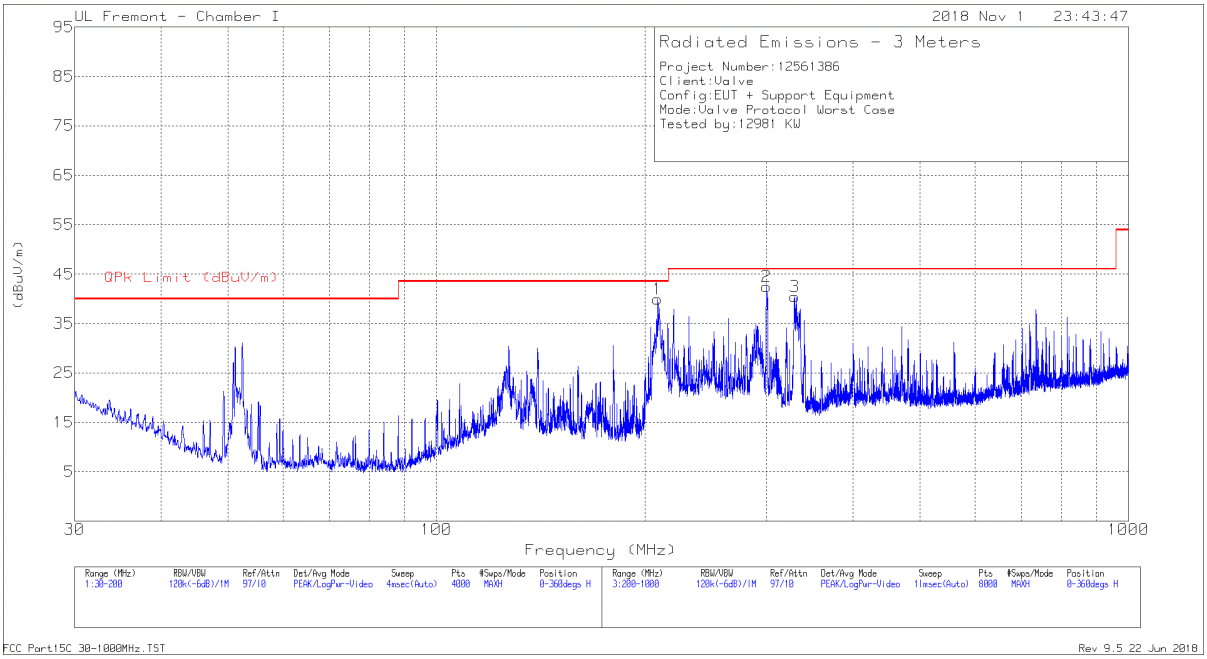
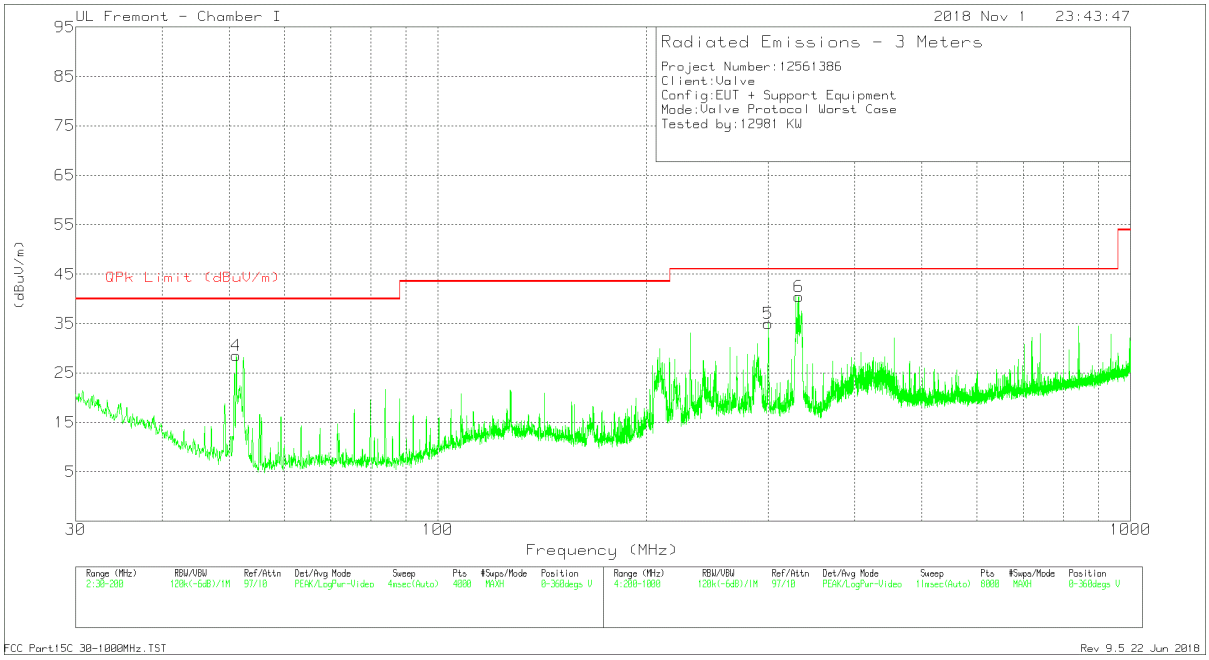
9.4. Worst Case Below 1 GHz

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



HORIZONTAL



VERTICAL

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Below 1GHz Data

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
4	51.0594	50.12	Pk	11.2	-31.1	30.22	40	-9.78	93	124	H
	51.0594	46.45	Qp	11.2	-31.1	26.55	40	-13.45	93	124	H
1	208.2416	56.11	Pk	14.3	-30.2	40.21	43.52	-3.31	129	185	H
	208.2416	47.51	Qp	14.3	-30.2	31.61	43.52	-11.91	129	185	H
2	299.8425	55.31	Pk	17.4	-29.8	42.91	46.02	-3.11	115	166	V
	299.8425	45.75	Qp	17.4	-29.8	33.35	46.02	-12.67	115	166	V
3	328.5184	52.87	Pk	17.9	-29.6	41.17	46.02	-4.85	268	241	V
	328.5184	43.84	Qp	17.9	-29.6	32.14	46.02	-13.88	268	241	V
5	298.8424	48.32	Pk	17.4	-29.8	35.92	43.52	-7.6	193	153	V
	298.8424	39.62	Qp	17.4	-29.8	27.22	43.52	-16.3	193	153	V
6	330.8489	53.64	Pk	17.8	-29.7	41.74	43.52	-1.78	240	158	H
	330.8489	42.15	Qp	17.8	-29.7	30.25	43.52	-13.27	240	158	H

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

Pk - Peak detector

Qp - Quasi-Peak detector

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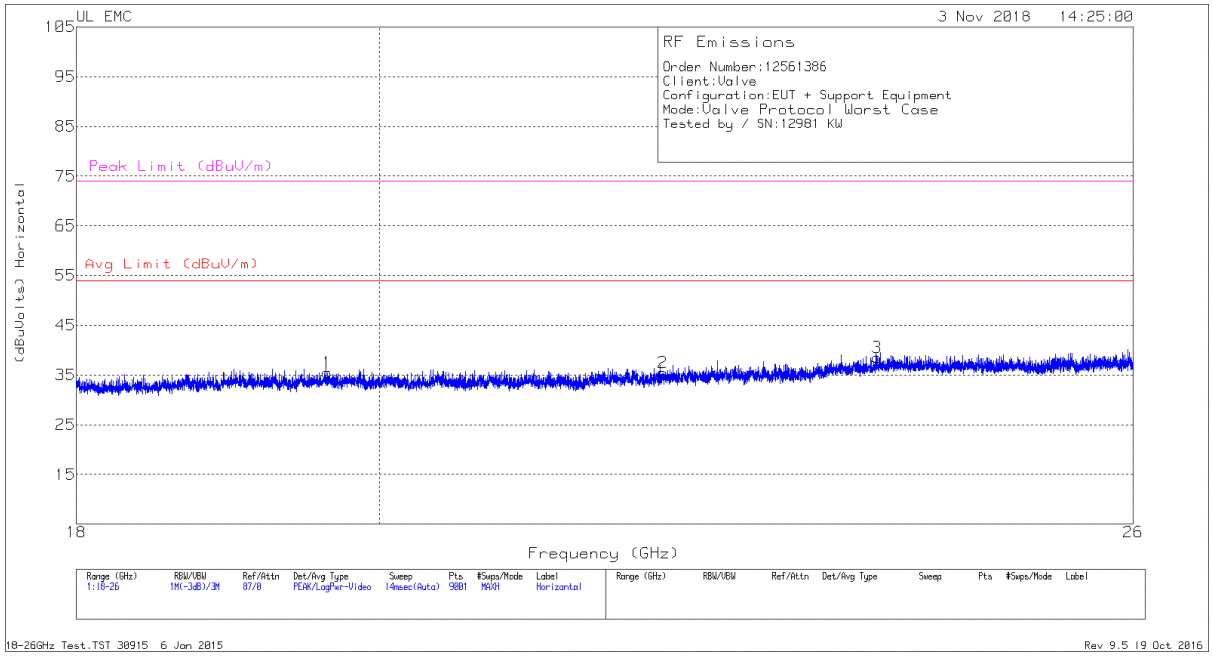
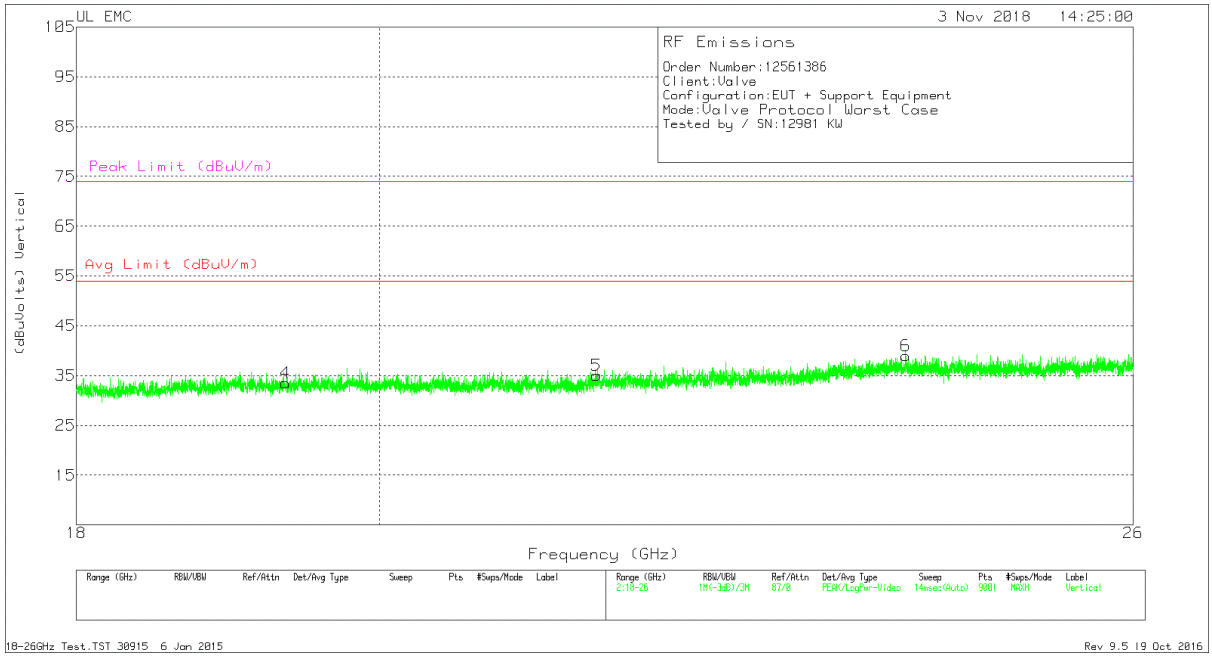
9.5. Worst Case 18-26 GHz

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



HORIZONTAL



VERTICAL

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18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T447 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	19.642	37.19	Pk	32.8	-25	-9.5	35.49	54	-18.51	74	-38.51
2	22.075	36.99	Pk	33.3	-25.3	-9.5	35.49	54	-18.51	74	-38.51
3	23.781	38.09	Pk	34.1	-24.2	-9.5	38.49	54	-15.51	74	-35.51
4	19.357	35.21	Pk	32.7	-24.9	-9.5	33.51	54	-20.49	74	-40.49
5	21.568	36.65	Pk	33.1	-25.2	-9.5	35.05	54	-18.95	74	-38.95
6	24.02	38.37	Pk	34.3	-24.2	-9.5	38.97	54	-15.03	74	-35.03

Pk - Peak detector

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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

* Decreases with the logarithm of the frequency.

RESULTS

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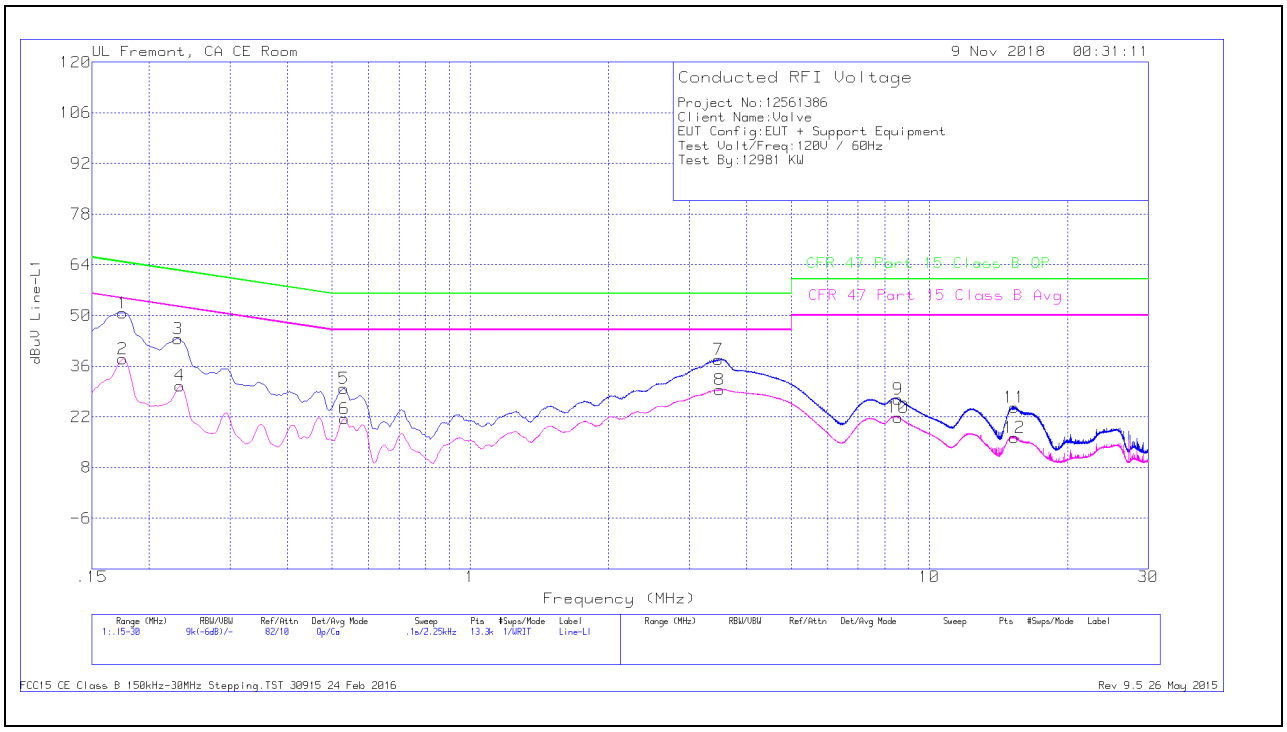
10.1.1. AC Power Line Norm

LINE 1 RESULTS



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	.17475	40.62	Qp	0	0	10.1	50.72	64.73	-14.01	-	-
2	.17475	27.85	Ca	0	0	10.1	37.95	-	-	54.73	-16.78
3	.231	33.52	Qp	0	0	10.1	43.62	62.41	-18.79	-	-
4	.23325	20.52	Ca	0	0	10.1	30.62	-	-	52.33	-21.71
5	.53137	19.78	Qp	0	0	10.1	29.88	56	-26.12	-	-
6	.5325	11.34	Ca	0	0	10.1	21.44	-	-	46	-24.56
7	3.47325	27.64	Qp	0	.1	10.1	37.84	56	-18.16	-	-
8	3.49575	19.28	Ca	0	.1	10.1	29.48	-	-	46	-16.52
9	8.55375	16.49	Qp	0	.2	10.2	26.89	60	-33.11	-	-
10	8.547	11.51	Ca	0	.2	10.2	21.91	-	-	50	-28.09
11	15.31275	14.04	Qp	.1	.3	10.2	24.64	60	-35.36	-	-
12	15.31163	5.64	Ca	.1	.3	10.2	16.24	-	-	50	-33.76

Qp - Quasi-Peak detector
Ca - CISPR average detection

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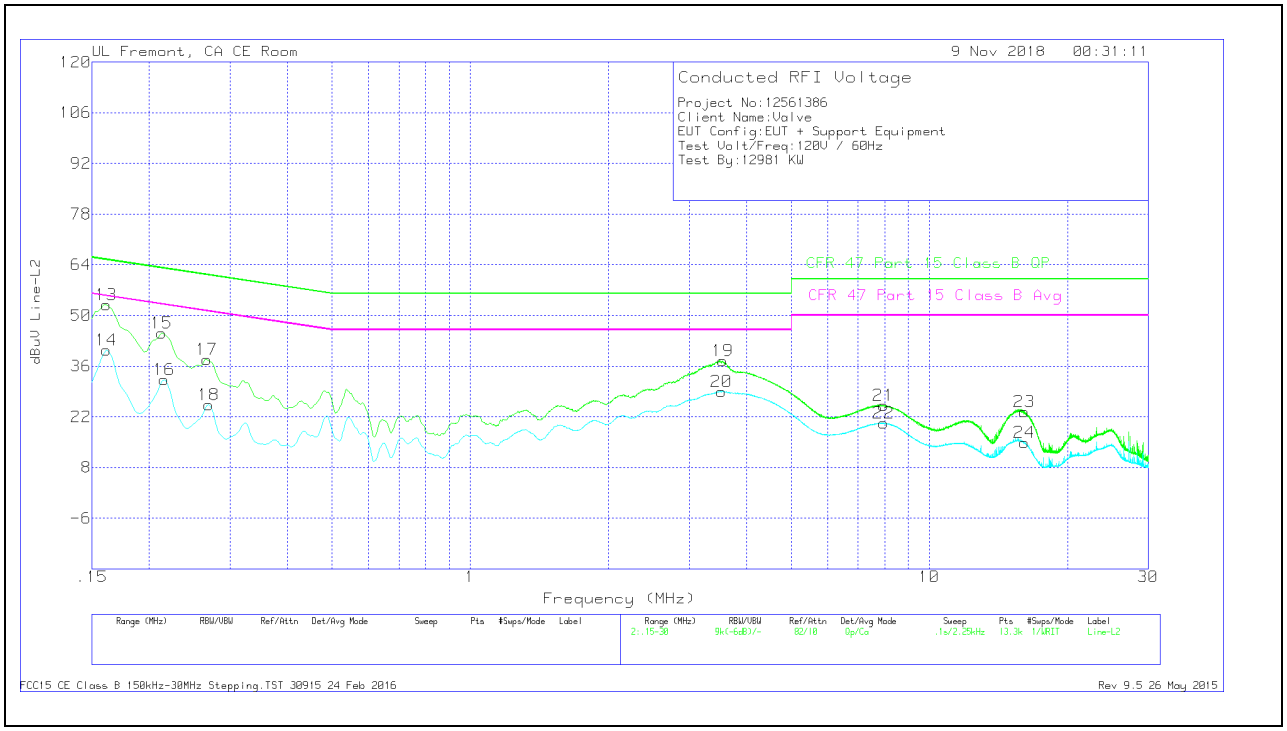
LINE 2 RESULTS



Trace Markers

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	.16125	42.7	Qp	.1	0	10.1	52.9	65.4	-12.5	-	-
14	.16125	30.27	Ca	.1	0	10.1	40.47	-	-	55.4	-14.93
15	.213	35.01	Qp	0	0	10.1	45.11	63.09	-17.98	-	-
16	.21525	22.15	Ca	0	0	10.1	32.25	-	-	53	-20.75
17	.267	27.77	Qp	0	0	10.1	37.87	61.21	-23.34	-	-
18	.26925	15.25	Ca	0	0	10.1	25.35	-	-	51.14	-25.79
19	3.54863	27.23	Qp	0	.1	10.1	37.43	56	-18.57	-	-
20	3.5295	18.83	Ca	0	.1	10.1	29.03	-	-	46	-16.97
21	7.9575	14.73	Qp	0	.2	10.2	25.13	60	-34.87	-	-
22	7.95525	9.81	Ca	0	.2	10.2	20.21	-	-	50	-29.79
23	16.12275	12.66	Qp	.1	.3	10.3	23.36	60	-36.64	-	-
24	16.11713	4.12	Ca	.1	.3	10.3	14.82	-	-	50	-35.18

Qp - Quasi-Peak detector
Ca - CISPR average detection

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