FCC CFR47 PART 15 SUBPART C

Bluetooth Low Energy

CERTIFICATION TEST REPORT

FOR

DTS b/g/n, LE and NFC player

MODEL NUMBER : IWINGTV 100

FCC ID: 2AUMM-IWING100

REPORT NUMBER: 4789155370-E2V2

ISSUE DATE: NOV 19, 2019

Prepared for
MFLARE CO.,LTD
B-516, 152, MAGOKSEO-RO, GANGSEO-GU,
SEOUL, REPUBLIC OF KOREA

Prepared by
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IAS ACCREDITED
Testing Laboratory
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	11/08/19	Initial issue	Hoonpyo, Lee
V2	11/19/19	Updated to address about the TCB's question	Hoonpyo, Lee

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: MFLARE CO.,LTD

EUT DESCRIPTION: DTS b/g/n, LE and NFC player

MODEL NUMBER: IWINGTV 100

SERIAL NUMBER: #1 (CONDUCTED)
#2 (RADIATED);

DATE TESTED: SEP 18, 2019 – NOV 18, 2019;

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

UL Korea, Ltd. 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 Korea, Ltd. 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 Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. 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 IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Korea, Ltd. By:

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Suwon Lab Engineer
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Tested By:

Hoonpyo Lee
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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 15.
3. KDB 558074 D01 15.247 Meas Guidance v05r02.
4. ANSI C63.10-2013.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 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.

218 Maeyeong-ro
☒ Chamber 1
☒ Chamber 2
☐ Chamber 3

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at http://www.iasonline.org/wp-content/uploads/2017/05/TL-637.pdf.

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
Conducted Disturbance, 0.15 to 30 MHz	2.35 dB
Radiated Disturbance, 9 kHz to 30 MHz	1.72 dB
Radiated Disturbance, 30 MHz to 1 GHz	3.49 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.82 dB
Radiated Disturbance, 18 GHz to 40 GHz	5.49 dB

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

4.4. DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 1, Clause 4.4.2 in IEC Guide 115:2007.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a DTS b/g/n, LE and NFC player.
This test report addresses the DTS (BLE) operational mode.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum total conducted output power as follows:

Frequency Range [MHz]	Power Mode	Output Power [dBm]	Output Power [mW]
2402 - 2480	Peak	7.319	5.39
	Average	6.694	4.67

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antenna, with a maximum gain of 3 dBi.

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5.4. WORST-CASE CONFIGURATION AND MODE

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

Radiated emission above 1GHz was performed with the EUT set to transmit low/mid/high channels.

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

Note : The radiated tests for 30MHz ~1000MHz were performed with monitor for the worst case condition mode. The remaining tests were similar or worst in standalone.

Power verification

Symbol Rate [Ms/s]	Mode	Frequency [MHz]	Conducted Burst Avg (dBm)
1	1Mbps (37 pkt)	2402	5.300
		2440	***6.694***
		2480	6.637

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

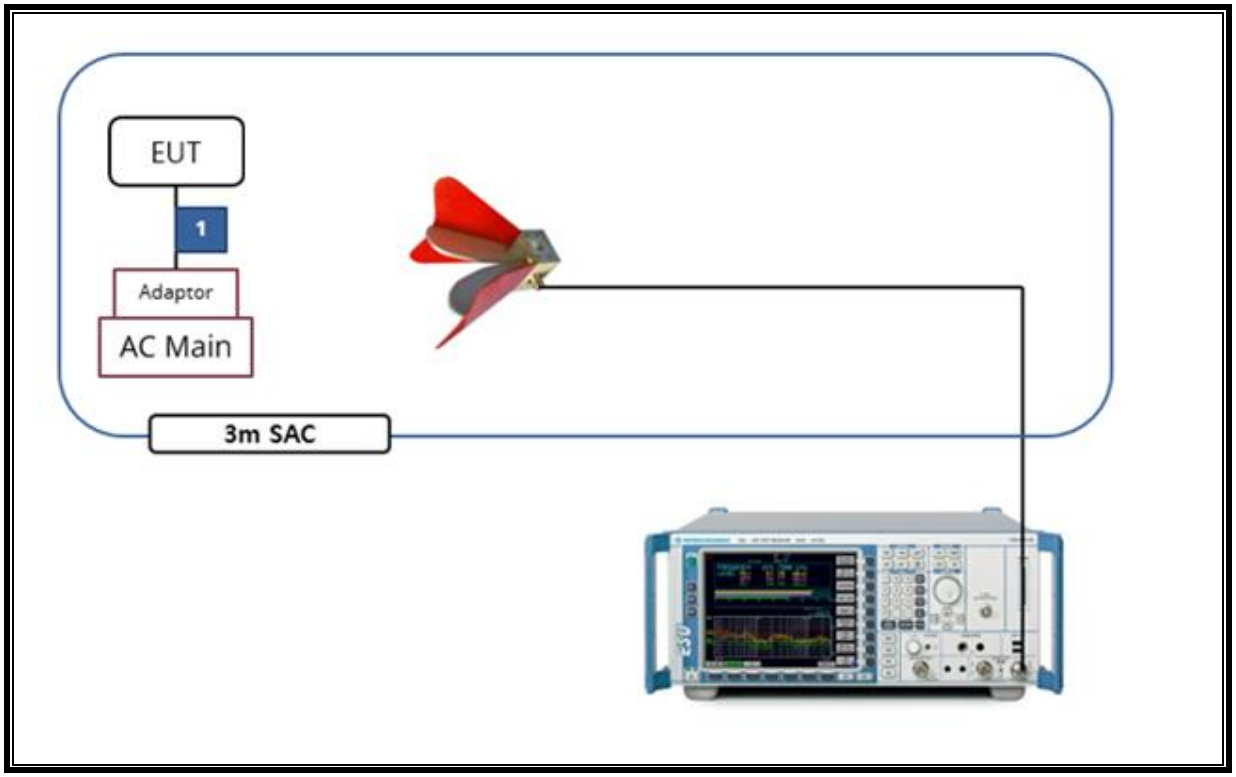
Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Adapter	SAMSUNG	EP-TA200	R37M14P3GY1SE3	N/A
Micro USB Cable	N/A	N/A	N/A	N/A
Monitor	SAMSUNG	LS24PULKF/EN	PU24H9XZ201088Y	N/A
Adapter (For Monitor)	SAMSUNG	ADS-30SI-12-2	N/A	N/A
HDMI Cable	SONY	N/A	N/A	N/A

TEST SETUP

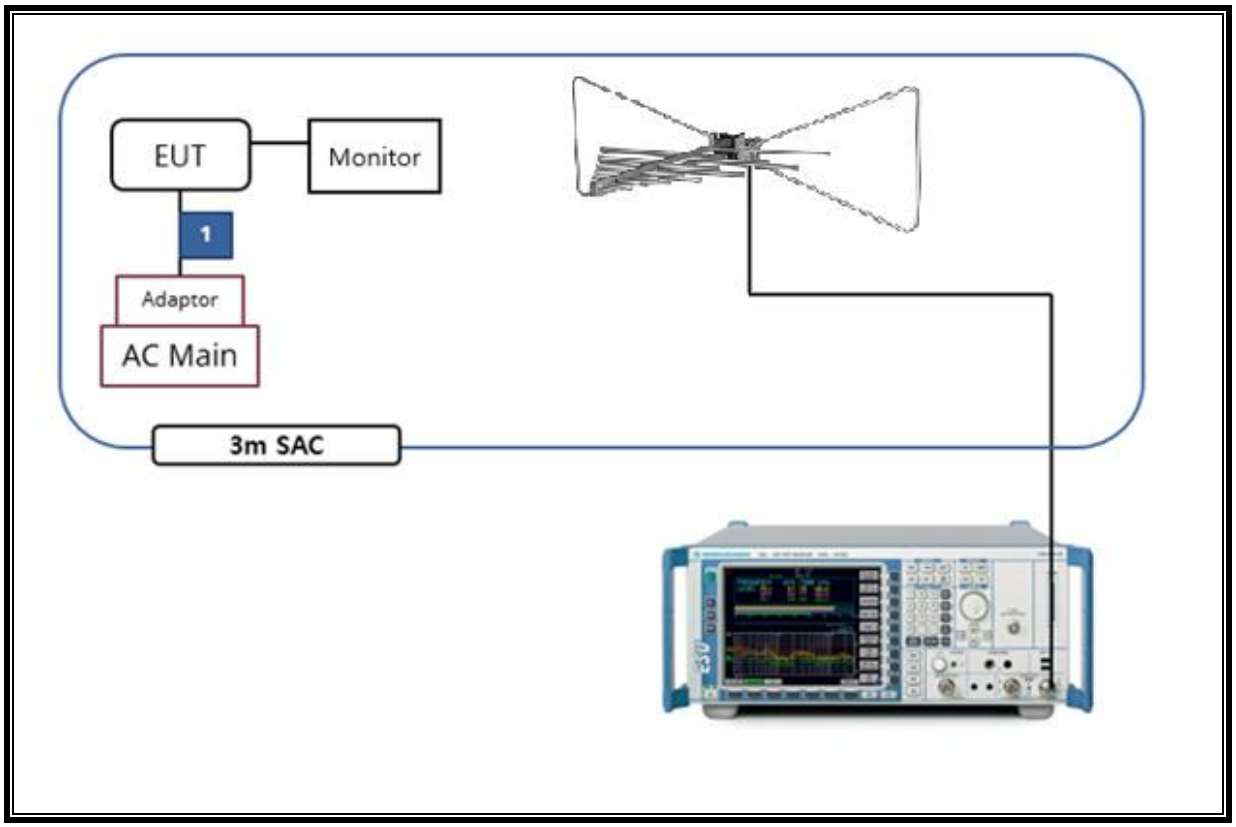
The EUT was forced to transmit using software.

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)

SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST FOR 30MHz – 1000MHz SETUP)



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**	**S/N**	**Cal Due**
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00167211	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00161451	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168724	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168717	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00205959	08-04-20
Antenna, Horn, 40 GHz	ETS	3116C	00166155	08-14-20
Antenna, Horn, 40 GHz	ETS	3116C	00168645	10-02-21
Preamplifier	ETS	3116C-PA	00168841	08-08-20
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-05-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-06-20
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-06-20
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-06-20
Spectrum Analyzer, 43.5 GHz	R&S	FSW43	104089	08-06-20
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-09-20
Attenuator	PASTERNACK	PE7087-10	A001	08-08-20
Attenuator	PASTERNACK	PE7087-10	A008	08-08-20
Attenuator	PASTERNACK	PE7004-10	2	08-06-20
Attenuator	PASTERNACK	PE7087-10	A009	08-08-20
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-06-20
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-06-20
EMI Test Receive, 44 GHz	R&S	ESW44	101590	08-05-20
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-05-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-06-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-06-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	020	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	020	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	021	08-06-20
LISN	R&S	ENV-216	101837	08-09-20
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	10-02-21

UL Software			
Description	**Manufacturer**	**Model**	**Version**
Radiated software	UL	UL EMC	Ver 9.5
AC Line Conducted software	UL	UL EMC	Ver 9.5

7. REFERENCE MEASUREMENT RESULTS

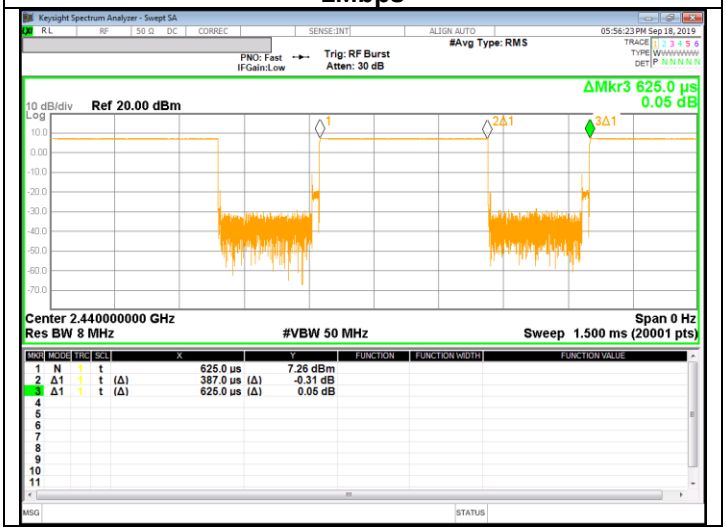
7.1. ON TIME AND DUTY CYCLE RESULTS

LIMITS

None: for reporting purposes only.

Mode	ON Time B [msec]	Period [msec]	Duty Cycle x [linear]	Duty Cycle [%]	Duty Cycle Correction Factor [dB]	1/T Minimum VBW [kHz]
2400MHz Bands						
BLE	0.387	0.625	0.619	61.9%	2.08	2.584

1Mbps



7.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

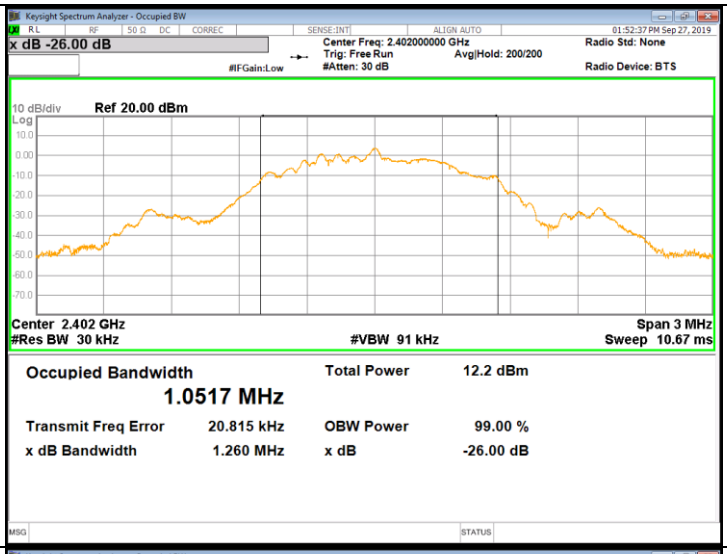
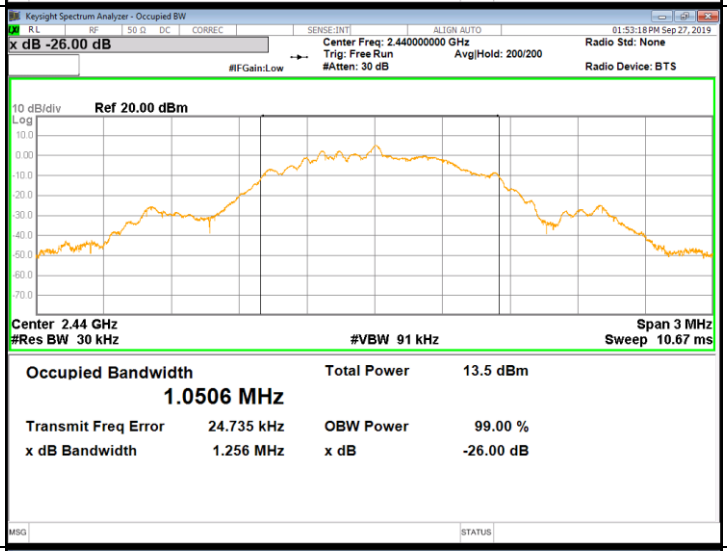
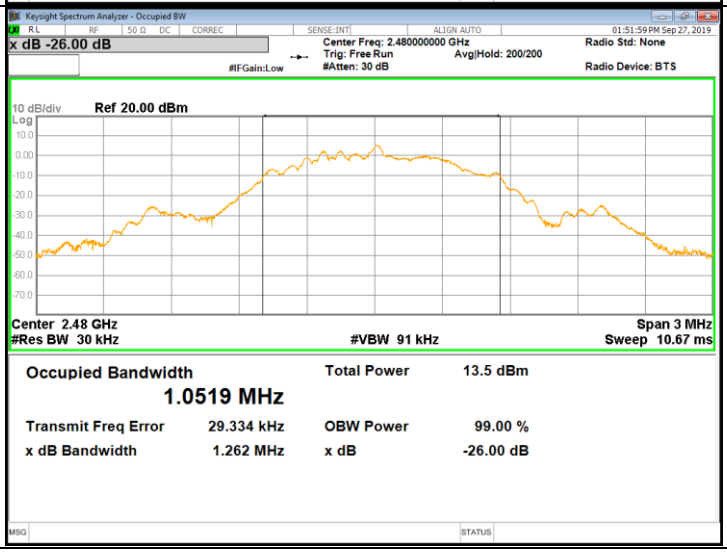
TEST PROCEDURE

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

RESULTS

Channel	Frequency [MHz]	99% Bandwidth [MHz]
Low	2402	1.052
Mid	2440	1.051
High	2480	1.052
Worst		1.052

99% BANDWIDTH PLOTS

Low CH	
Middle CH	
High CH	

8. MEASUREMENT METHODS

6 dB BW : KDB 558074 D01 v05r02, Section 8.2.

OUTPUT POWER : KDB 558074 D01 v05r02, Section 8.3.1.1

POWER SPECTRAL DENSITY : KDB 558074 D01 v05r02, Section 8.4.

Out-of-band Emissions (Conducted) : KDB 558074 D01 v05r02, Section 8.5.

Out-of-band Emissions in Non-restricted Bands: KDB 558074 D01 v05r02, Section 8.5.

Out-of-band Emissions in Restricted Bands : KDB 558074 D01 v05r02, Section 8.6.

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

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9. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
15.247 (a)(2)	Occupied Band width (6dB)	>500kHz	Conducted	Pass
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-20dBc		Pass
15.247 (b)(3)	TX conducted output power	<30dBm		Pass
15.247 (e)	PSD	<8dBm		Pass
15.207 (a)	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass
15.205, 15.209	Radiated Spurious Emission	< 54dBuV/m(Av)	Radiated	Pass

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10. ANTENNA PORT TEST RESULTS

10.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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

TEST PROCEDURE

Reference to section 11.8 in ANSI C63.10(2013): The transmitter output is connected to a spectrum analyzer with the RBW set to100kHz, the VBW >= 3 x RBW, peak detector and max hold.

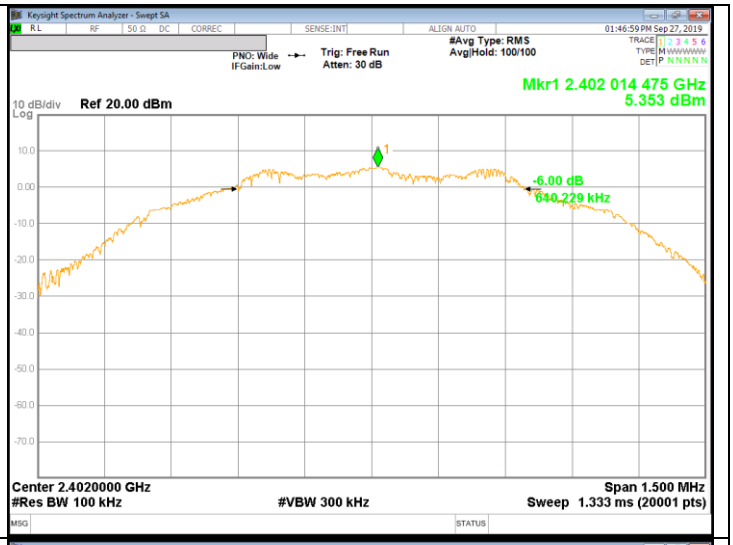
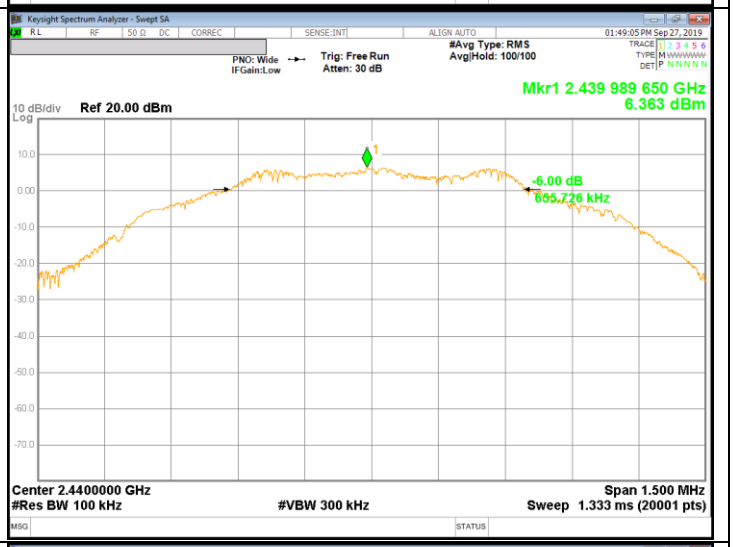
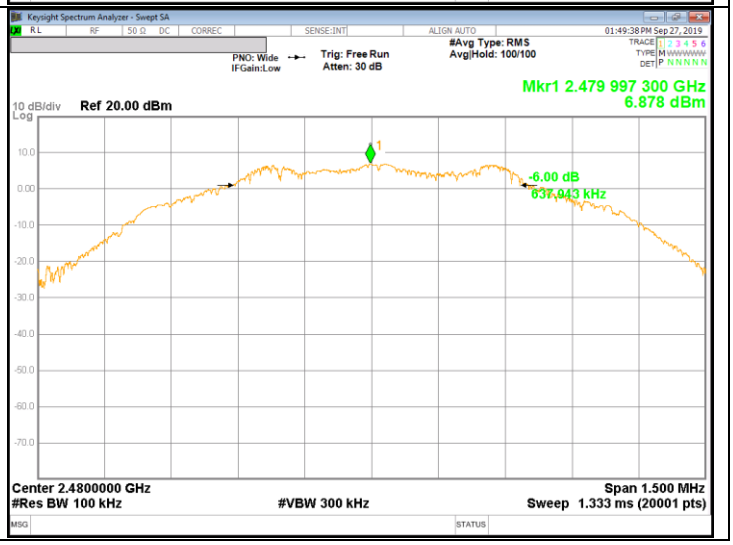
RESULTS

- 1Mbps

Channel	Frequency [MHz]	6 dB Bandwidth [kHz]	Minimum Limit [kHz]
Low	2402	640.23	500.0
Mid	2440	655.73	500.0
High	2480	637.94	500.0
Worst		637.94	500.0

6 dB BANDWIDTH PLOTS

- 1Mbps

Low CH	
Middle CH	
High CH	

10.2. OUTPUT POWER

LIMITS

FCC §15.247 (b)

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

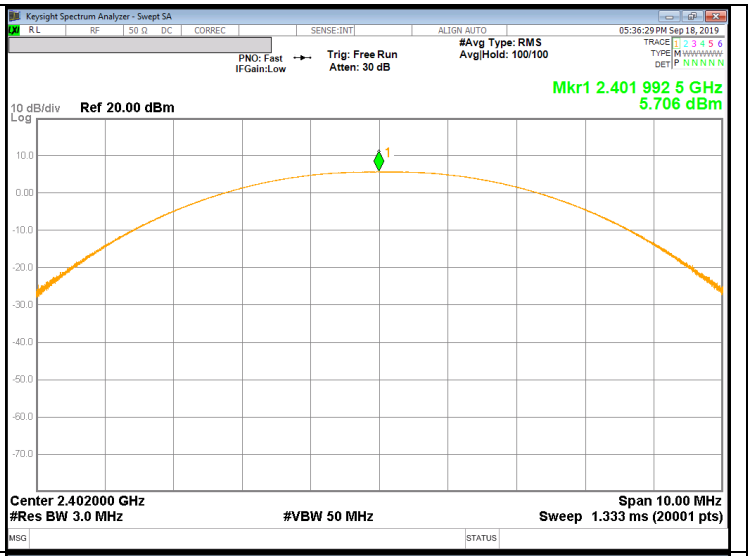
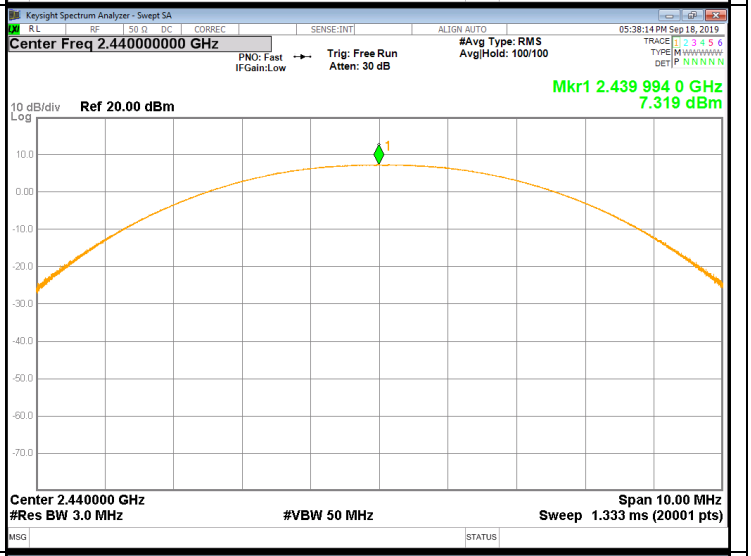
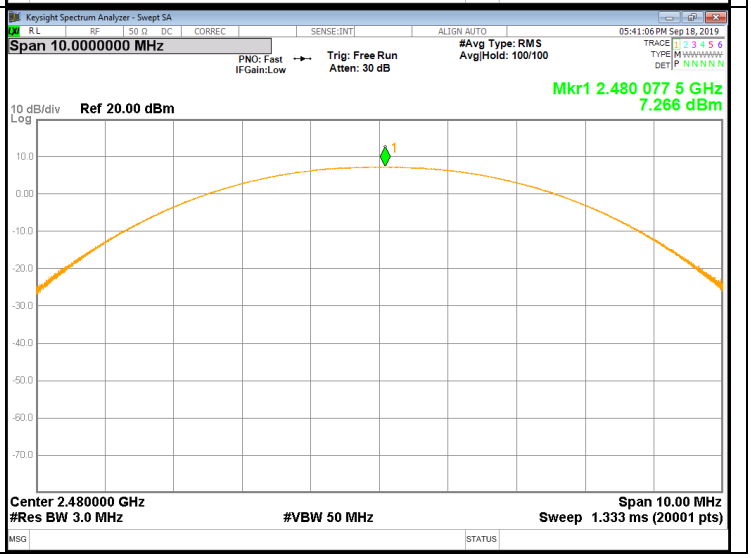
TEST PROCEDURE

Peak power is measured using ANSI C63.10(2013) under section 11.9.1.1 utilizing spectrum analyzer.

RESULTS

Channel	Frequency [MHz]	Peak Power Reading [dBm]	Limit [dBm]	Margin [dB]
Low	2402	5.706	30.000	-24.294
Mid	2440	7.319	30.000	-22.681
High	2480	7.266	30.000	-22.734
Worst		7.319	30.000	-22.681

OUTPUT POWER PLOTS

Low CH	
Middle CH	
High CH	

10.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss was entered as an offset in the power meter to allow for direct reading of power. The duty factor already has been added.

- 1Mbps

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	5.301	3.389
Middle	2440	**6.695**	**4.672**
High	2480	6.638	4.611

10.4. PSD

LIMITS

FCC §15.247

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

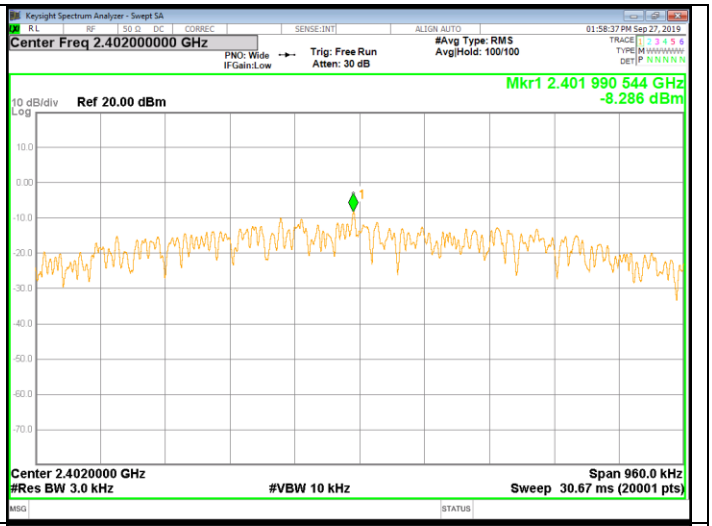
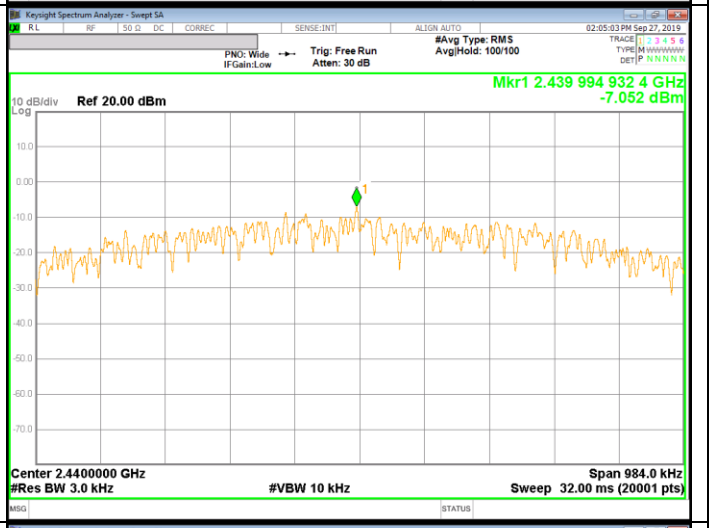
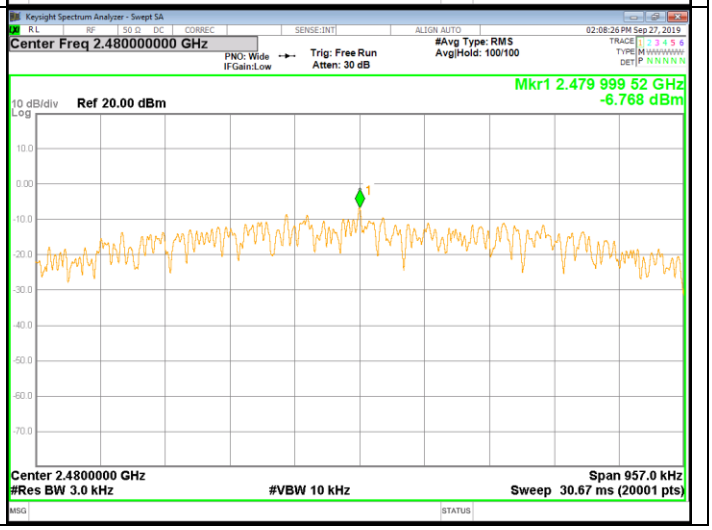
TEST PROCEDURE

Power Spectral Density was performed utilizing the ANSI C63.10 section 11.10.2 (Method PKPSD).

RESULTS

Channel	Frequency [MHz]	PSD [dBm/3kHz]	Limit [dBm/3kHz]	Margin [dB]
Low	2402	-8.29	8.00	-16.29
Mid	2440	-7.05	8.00	-15.05
High	2480	-6.77	8.00	-14.77

POWER SPECTRAL DENSITY PLOTS

Low CH	
Middle CH	
High CH	

10.5. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

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 with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

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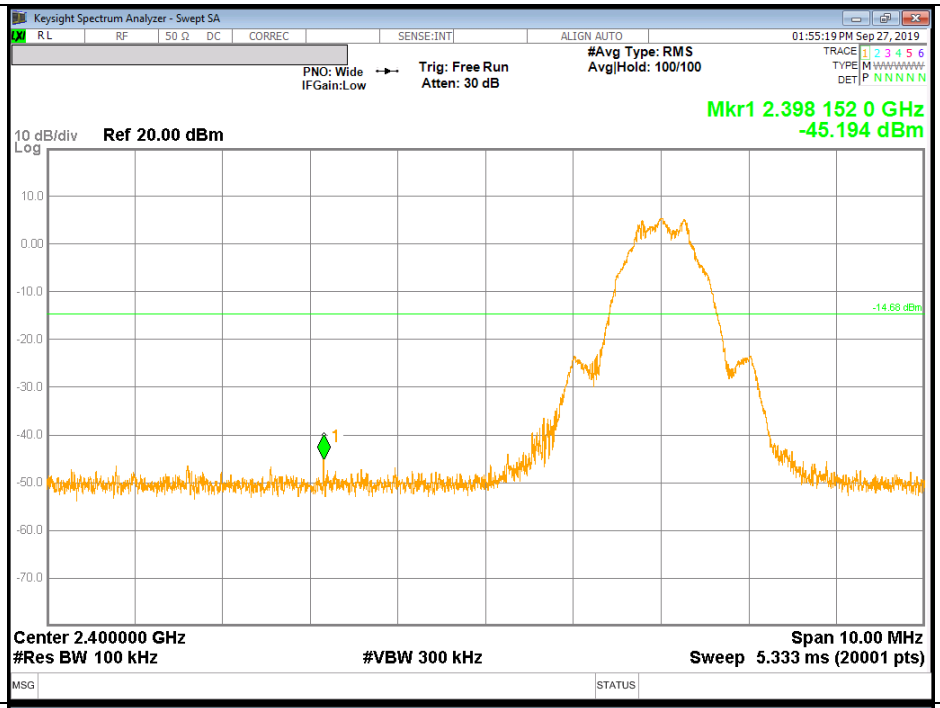
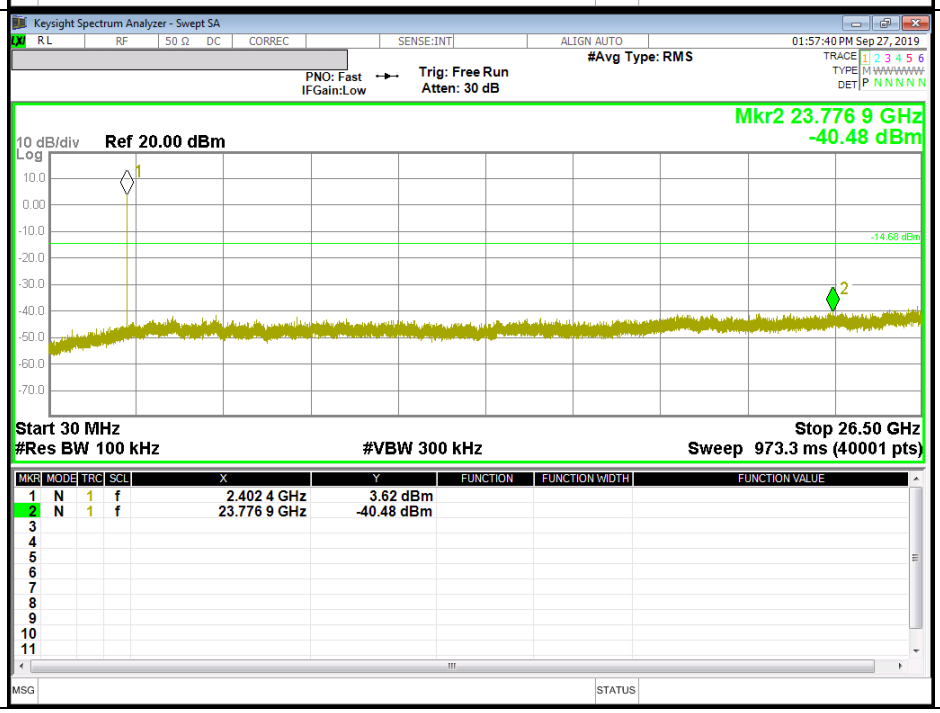
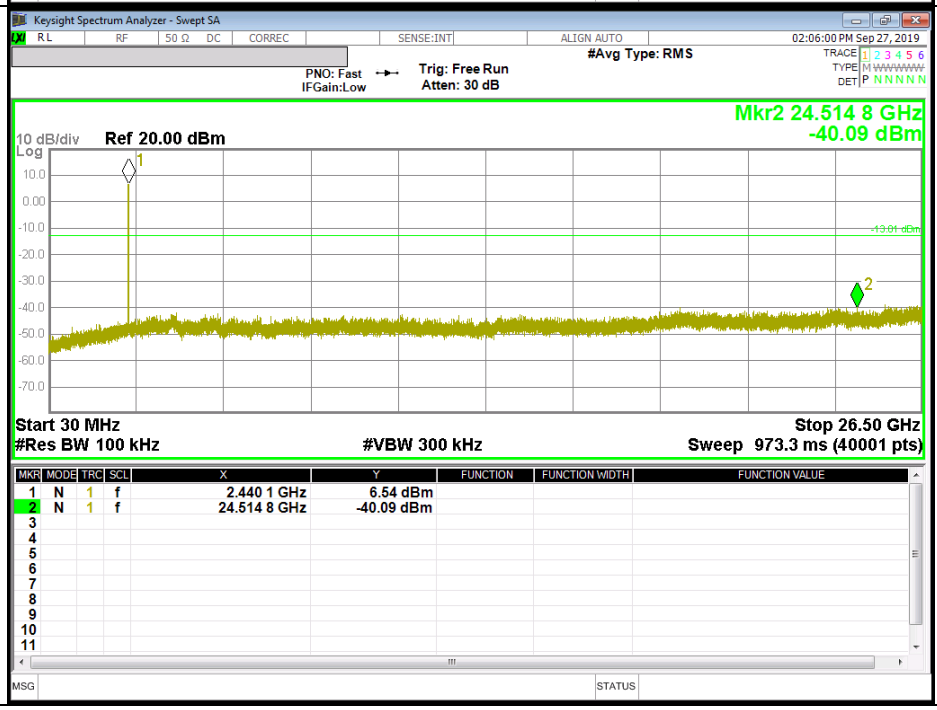
RESULTS

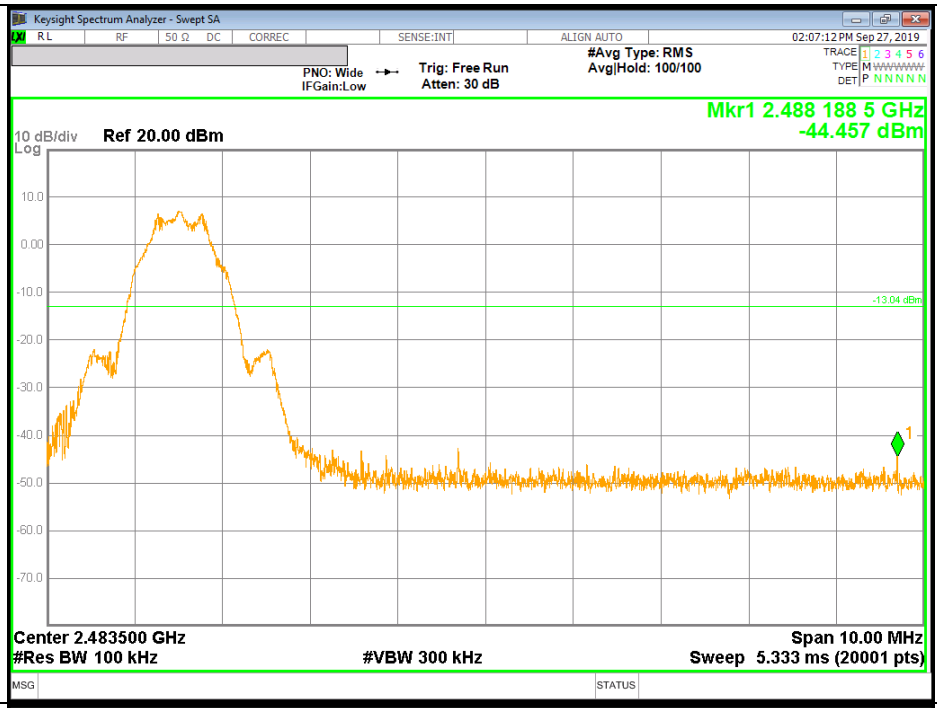
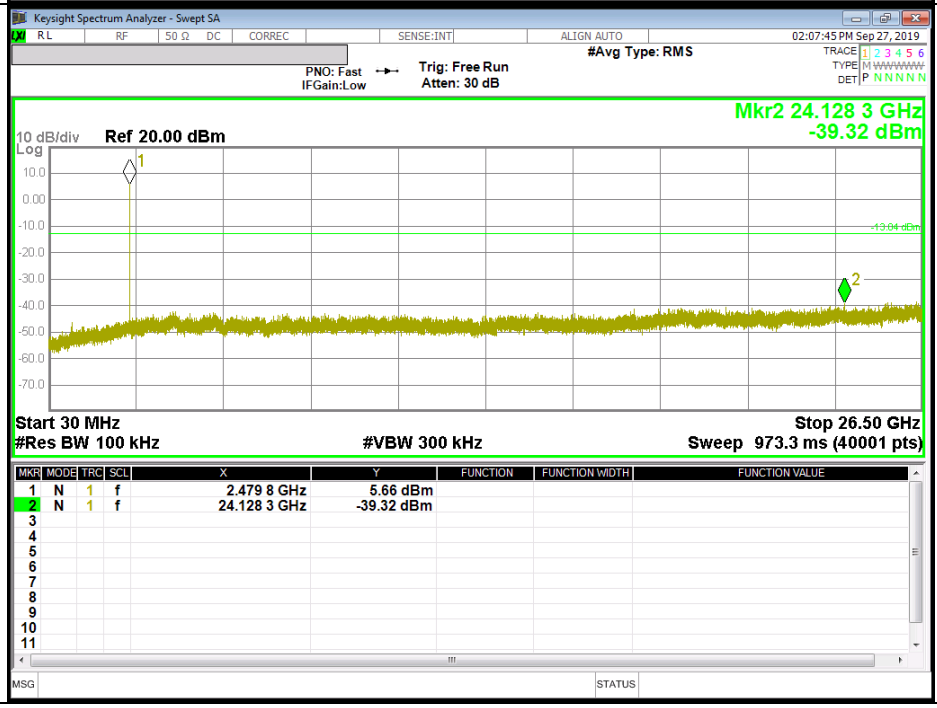
BANDEDGE & SPURIOUS EMISSIONS, LOW CHANNEL

Low CH BandEdge	
Low CH Spurious	

BANDEDGE & SPURIOUS EMISSIONS, MID CHANNEL

Middle CH Ref	
Middle CH Spurious	

BANDEDGE & SPURIOUS EMISSIONS, HIGH CHANNEL

High CH BandEdge	
High CH Spurious	

11. RADIATED TEST RESULTS

11.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

Limits for radiated disturbance of an intentional radiator		
Frequency range (MHz)	Limits (μV/m)	Measurement Distance (m)
0.009 – 0.490	2400 / F (kHz)	300
0.490 – 1.705	24000 / F (kHz)	30
1.705 – 30.0	30	30
30 – 88	100**	3
88 - 216	150**	3
216 – 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§ 15.231 and 15.241.

FCC Part 15.205 (a) : Only spurious emissions are permitted in any of the frequency bands listed below :

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~ 156.52525	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.7 ~ 156.9	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	162.0125 ~ 167.17	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	167.72 ~ 173.2	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	240 ~ 285	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	322 ~ 335.4	2655 ~ 2900		
8.291 ~ 8.294	37.5 ~ 38.25	399.90 ~ 410	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	608 ~ 614	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	960 ~ 1240	3345.8 ~ 3358		
			3600 ~ 4400		

▪ FCC Part 15.205(b) : The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz and 150 cm 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. (Restriced bandedge, Final detection of spurious harmonic emissions)Duty cycle factor = 10 log (1/x). For this sample: DCF = 10log(1/0.619)=2.08 dB

Pre-scans to detect harmonic and spurious emissions, the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 kHz for peak measurements.

The spectrum from 1 GHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.
(From 30MHz to 1GHz, test was performed with the EUT set to transmit at the channel with highest output power)

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.

Note : Emission was pre-scanned from 9kHz to 30MHz; No emissions were detected which was at least 20dB below the specification limit (consider distance correction factor).
Per FCC part 15.31(o), test results were not reported.

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open are test site.
Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the one of tests made in an open field based on KDB 414788.

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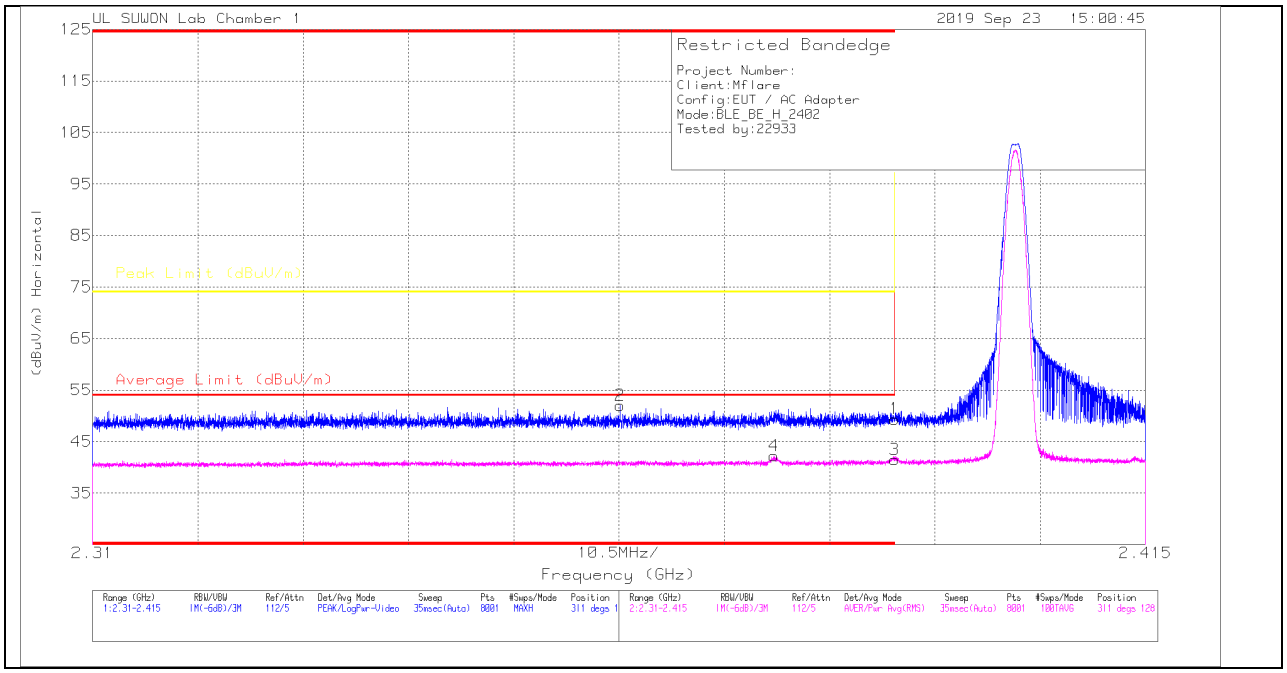
11.2. TRANSMITTER ABOVE 1 GHz

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



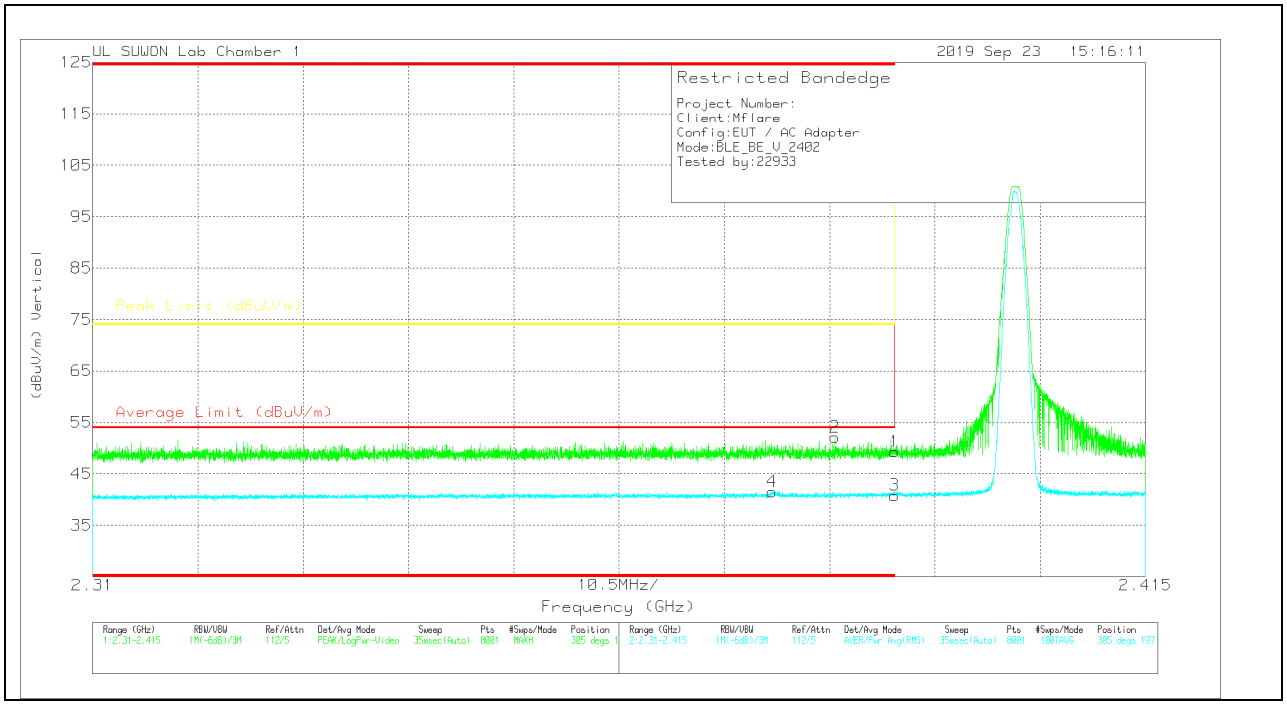
HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB[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	43.17	Pk	31.7	-25.5	0	49.37	-	-	74	-24.63	311	128	H
2	* 2.36261	45.98	Pk	31.6	-25.6	0	51.98	-	-	74	-22.02	311	128	H
3	* 2.39	33.18	RMS	31.7	-25.5	2.08	41.46	54	-12.54	-	-	311	128	H
4	* 2.37797	34.02	RMS	31.6	-25.5	2.08	42.2	54	-11.8	-	-	311	128	H

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

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

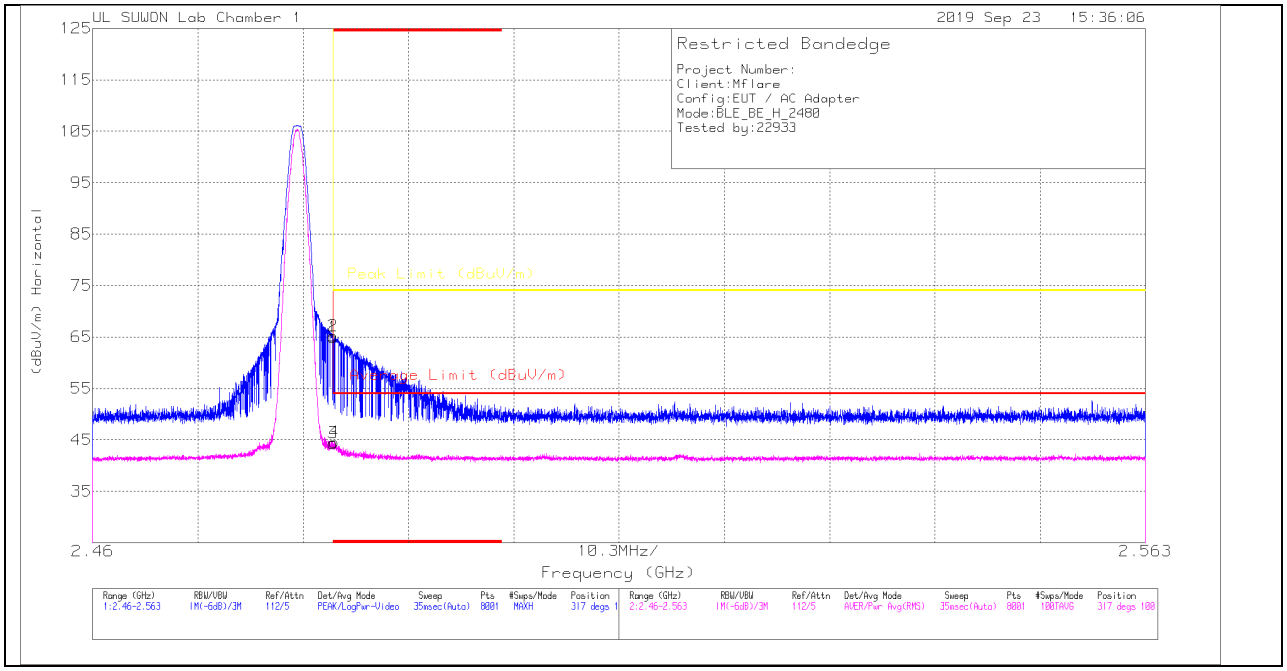
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB[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	43.11	Pk	31.7	-25.5	0	49.31	-	-	74	-24.69	305	197	V
2	* 2.38405	46.05	Pk	31.7	-25.6	0	52.15	-	-	74	-21.85	305	197	V
3	* 2.39	32.54	RMS	31.7	-25.5	2.08	40.82	54	-13.18	-	-	305	197	V
4	* 2.37774	33.36	RMS	31.6	-25.5	2.08	41.54	54	-12.46	-	-	305	197	V

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

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



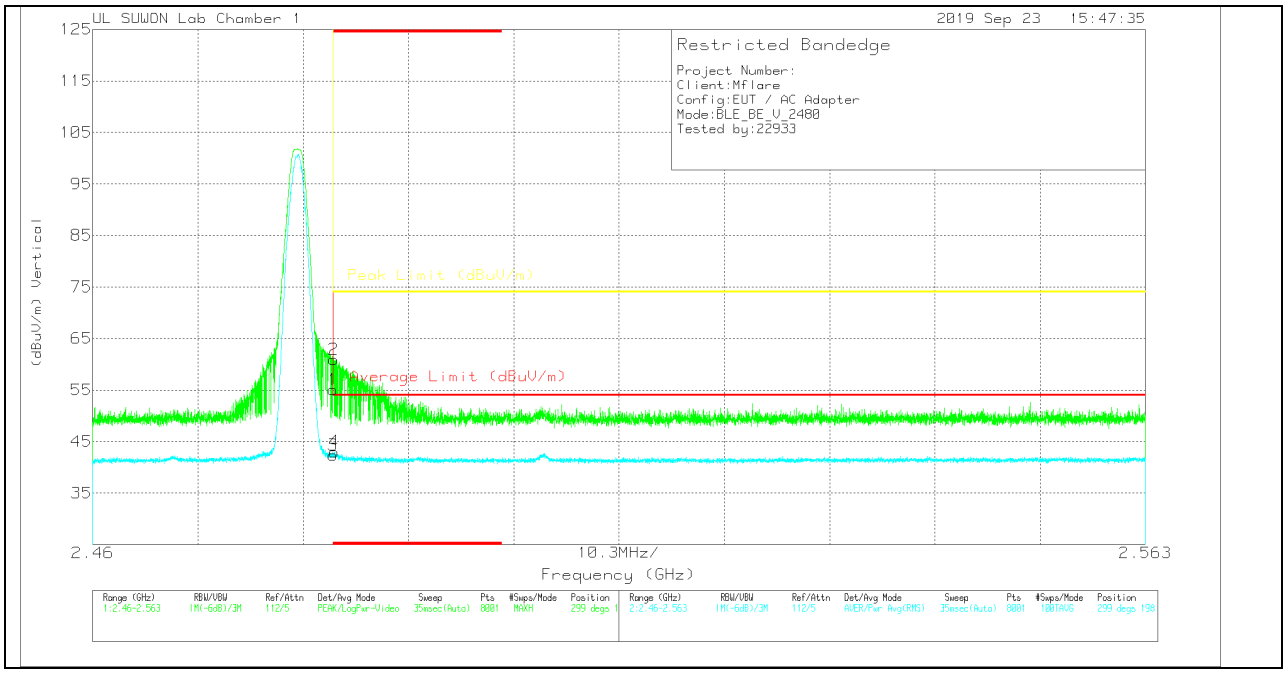
HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB[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	* 2.48351	58.35	Pk	31.9	-25.3	0	64.95	-	-	74	-9.05	317	100	H
2	* 2.48354	58.62	Pk	31.9	-25.3	0	65.22	-	-	74	-8.78	317	100	H
3	* 2.48351	35.69	RMS	31.9	-25.3	2.08	44.37	54	-9.63	-	-	317	100	H
4	* 2.48364	35.88	RMS	31.9	-25.3	2.08	44.56	54	-9.44	-	-	317	100	H

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

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

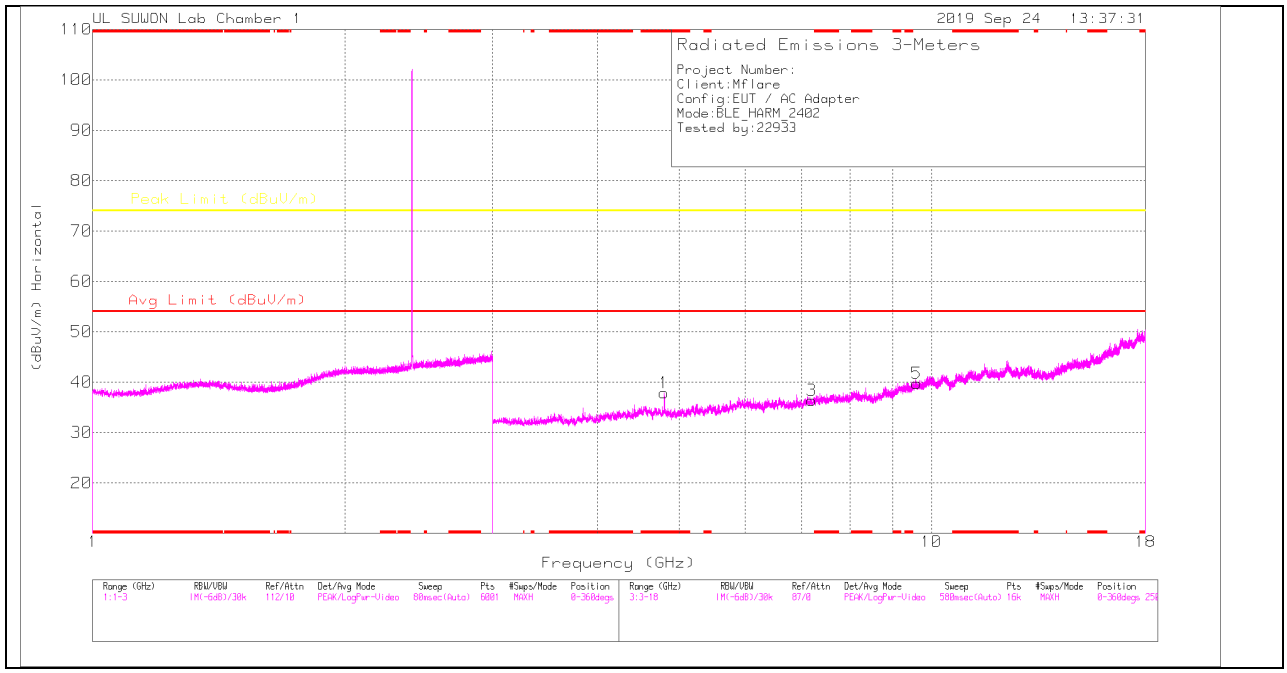
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB[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	* 2.48351	48.45	Pk	31.9	-25.3	0	55.05	-	-	74	-18.95	299	198	V
2	* 2.48356	54.34	Pk	31.9	-25.3	0	60.94	-	-	74	-13.06	299	198	V
3	* 2.48351	33.66	RMS	31.9	-25.3	2.08	42.34	54	-11.66	-	-	299	198	V
4	* 2.48365	34.32	RMS	31.9	-25.3	2.08	43	54	-11	-	-	299	198	V

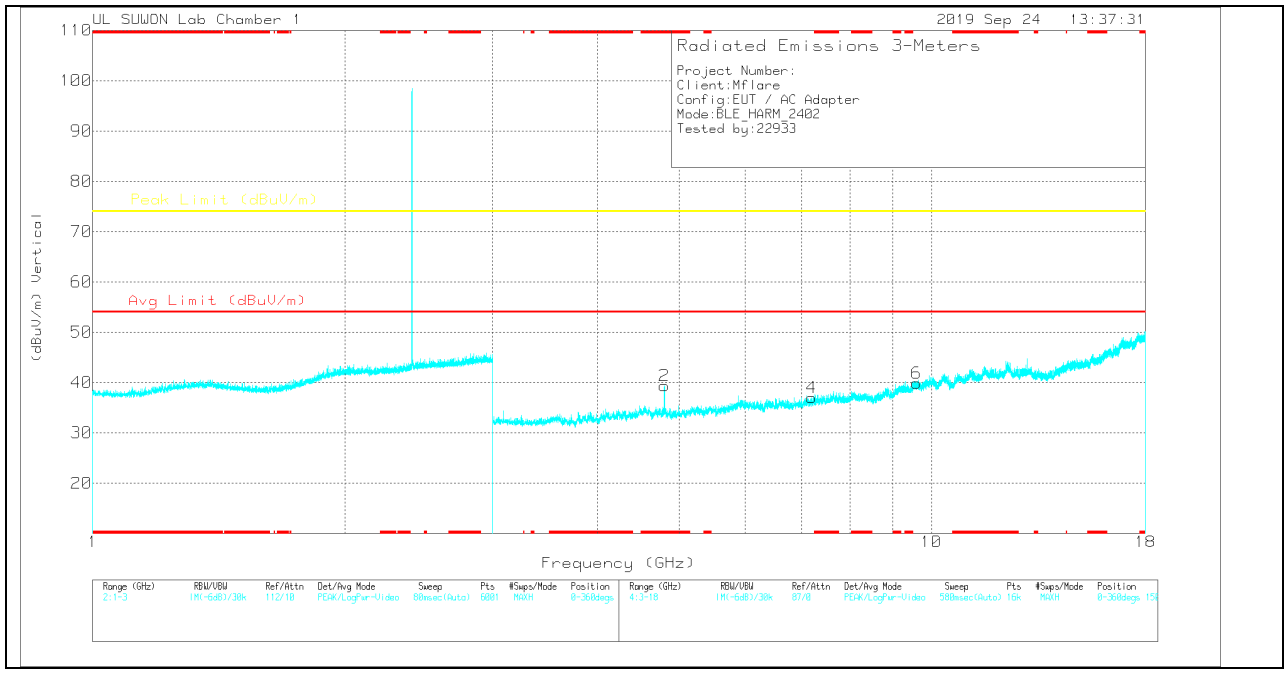
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



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

LOW CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.8027	35.09	PK	34.2	-31.4	0	37.89	-	-	74	-36.11	0-360	150	H
3	7.20349	28.46	PK	35.8	-27.9	0	36.36	-	-	74	-37.64	0-360	150	H
5	9.60427	25.83	PK	37	-23.1	0	39.73	-	-	74	-34.27	0-360	250	H
2	* 4.80457	36.56	PK	34.2	-31.4	0	39.36	-	-	74	-34.64	0-360	150	V
4	7.20255	29.1	PK	35.8	-27.9	0	37	-	-	74	-37	0-360	150	V
6	9.60615	25.94	PK	37	-23.1	0	39.84	-	-	74	-34.16	0-360	150	V

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

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.80454	43.45	PK2	34.2	-31.4	0	46.25	-	-	74	-27.75	90	290	H
* 4.80178	33.14	MAv1	34.2	-31.4	2.08	38.02	54	-15.98	-	-	90	290	H
* 4.8037	44.98	PK2	34.2	-31.4	0	47.78	-	-	74	-26.22	242	146	V
* 4.80376	34.84	MAv1	34.2	-31.4	2.08	39.72	54	-14.28	-	-	242	146	V

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

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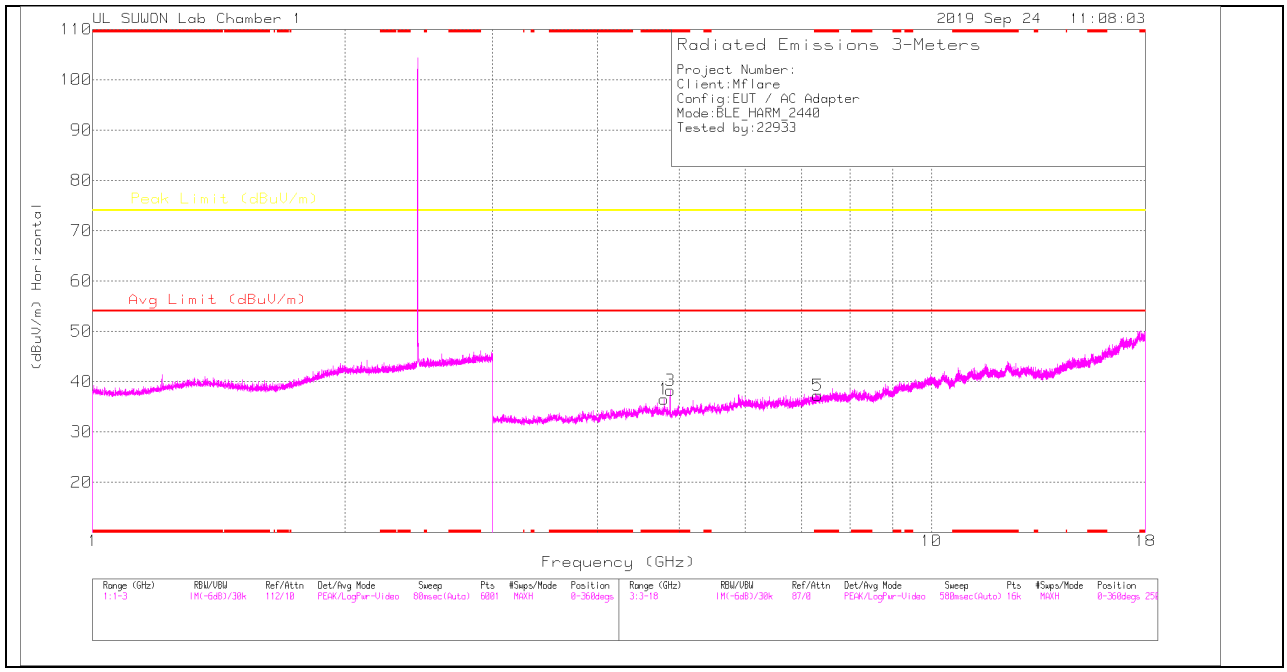
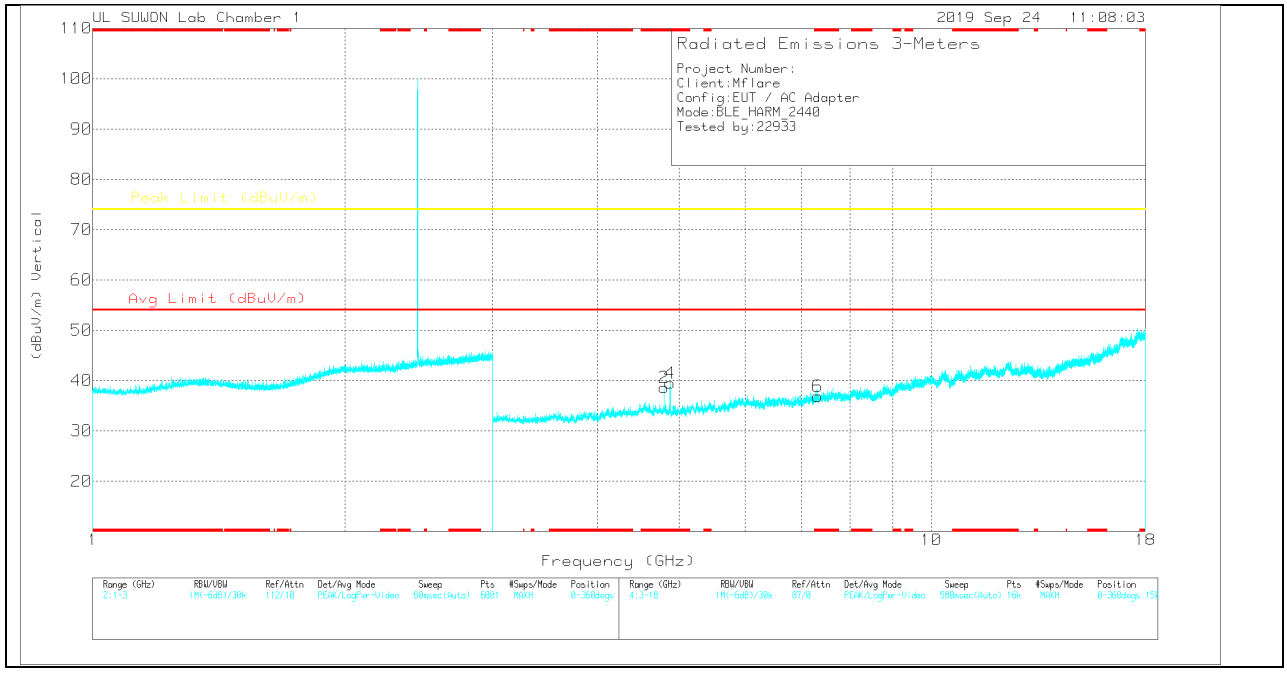
MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



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

MID CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.80176	33.66	PK	34.2	-31.4	0	36.46	-	-	74	-37.54	0-360	150	H
3	* 4.88051	35.55	PK	34.2	-31.5	0	38.25	-	-	74	-35.75	0-360	150	H
5	* 7.31785	28.75	PK	35.8	-27.3	0	37.25	-	-	74	-36.75	0-360	250	H
2	* 4.80176	35.8	PK	34.2	-31.4	0	38.6	-	-	74	-35.4	0-360	150	V
4	* 4.87957	36.77	PK	34.2	-31.5	0	39.47	-	-	74	-34.53	0-360	250	V
6	* 7.31785	28.38	PK	35.8	-27.3	0	36.88	-	-	74	-37.12	0-360	250	V

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

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.80184	43.04	PK2	34.2	-31.4	0	45.84	-	-	74	-28.16	67	100	H
* 4.80174	33.06	MAv1	34.2	-31.4	2.08	37.94	54	-16.06	-	-	67	100	H
* 4.80178	42.7	PK2	34.2	-31.4	0	45.5	-	-	74	-28.5	21	369	V
* 4.80182	32.76	MAv1	34.2	-31.4	2.08	37.64	54	-16.36	-	-	21	369	V
* 4.88047	44.11	PK2	34.2	-31.5	0	46.81	-	-	74	-27.19	254	117	H
* 4.87977	34.65	MAv1	34.2	-31.5	2.08	39.43	54	-14.57	-	-	254	117	H
* 4.88059	45.21	PK2	34.2	-31.5	0	47.91	-	-	74	-26.09	242	121	V
* 4.87973	35.99	MAv1	34.2	-31.5	2.08	40.77	54	-13.23	-	-	242	121	V

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

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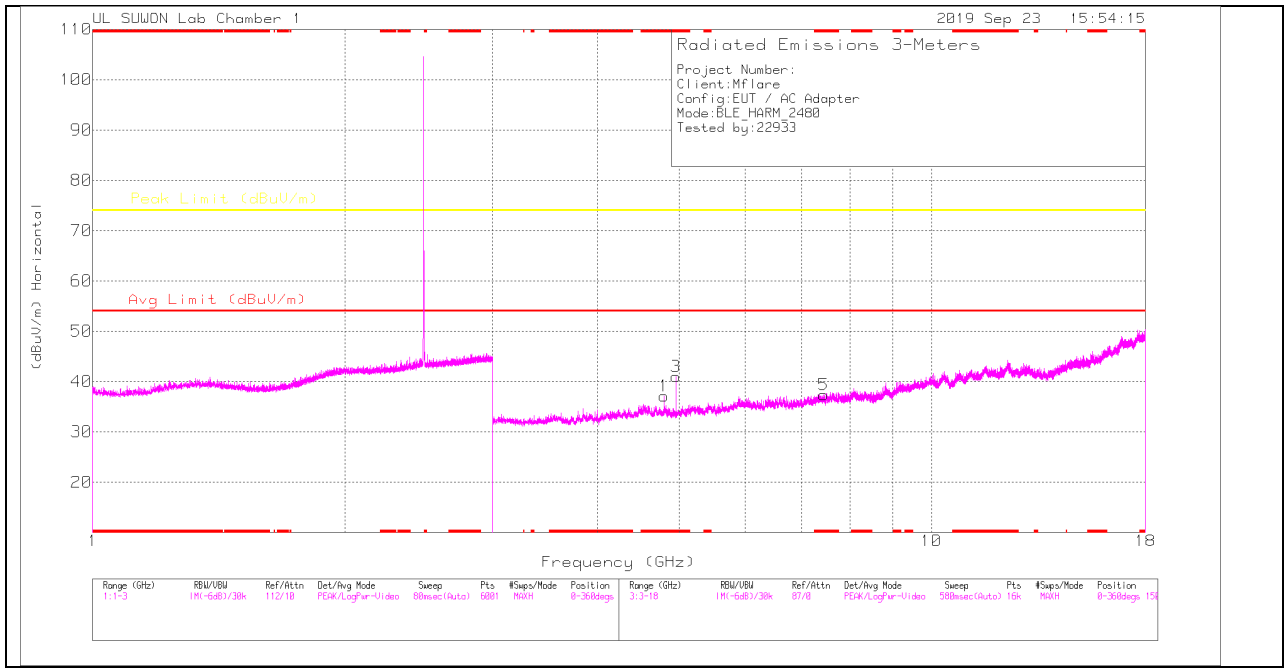
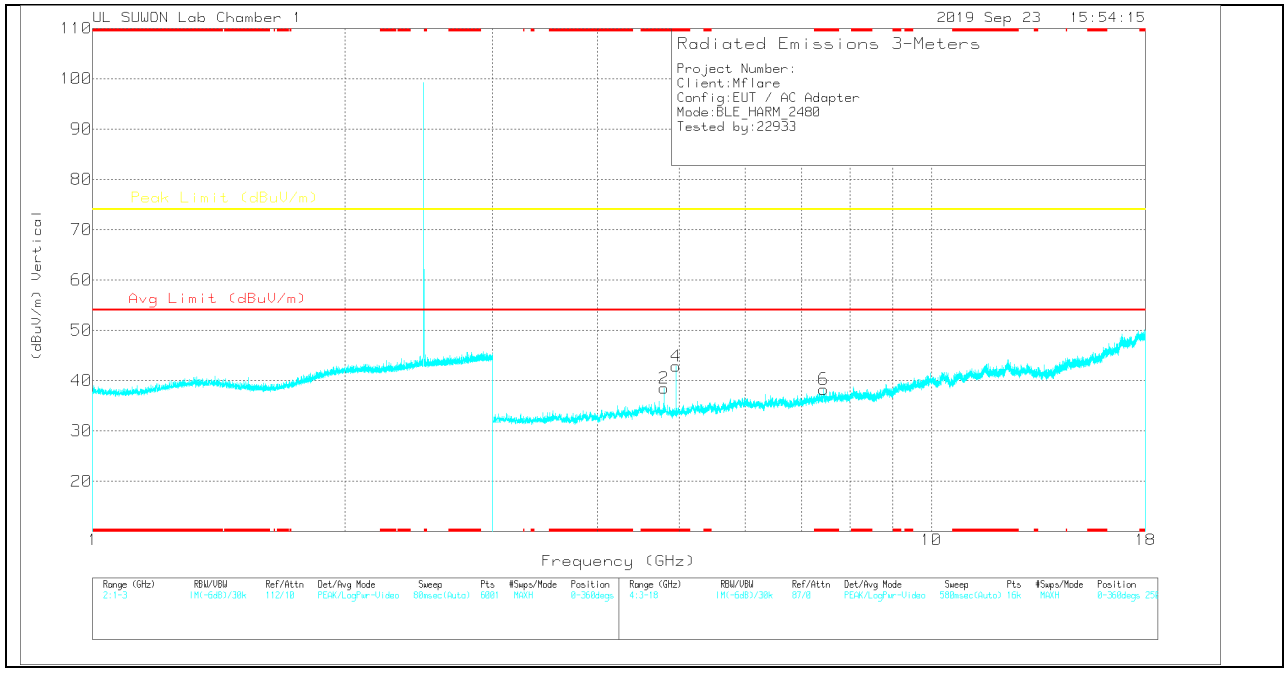
HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



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

HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.80176	34.3	PK	34.2	-31.4	0	37.1	-	-	74	-36.9	0-360	150	H
3	* 4.96019	38.16	PK	34.2	-31.4	0	40.96	-	-	74	-33.04	0-360	250	H
5	* 7.43878	28.56	PK	35.8	-27	0	37.36	-	-	74	-36.64	0-360	250	H
2	* 4.80176	35.66	PK	34.2	-31.4	0	38.46	-	-	74	-35.54	0-360	150	V
4	* 4.96019	40.09	PK	34.2	-31.4	0	42.89	-	-	74	-31.11	0-360	150	V
6	* 7.44066	29.48	PK	35.8	-27	0	38.28	-	-	74	-35.72	0-360	150	V

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

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.80178	43.53	PK2	34.2	-31.4	0	46.33	-	-	74	-27.67	51	362	H
* 4.80186	33.65	MAv1	34.2	-31.4	2.08	38.53	54	-15.47	-	-	51	362	H
* 4.80164	42.4	PK2	34.2	-31.4	0	45.2	-	-	74	-28.8	79	372	V
* 4.80178	32.92	MAv1	34.2	-31.4	2.08	37.8	54	-16.2	-	-	79	372	V
* 4.95941	44.96	PK2	34.2	-31.4	0	47.76	-	-	74	-26.24	284	150	H
* 4.95961	35.99	MAv1	34.2	-31.4	2.08	40.87	54	-13.13	-	-	284	150	H
* 4.96043	44.61	PK2	34.2	-31.4	0	47.41	-	-	74	-26.59	323	160	V
* 4.95977	35.62	MAv1	34.2	-31.4	2.08	40.5	54	-13.5	-	-	323	160	V

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

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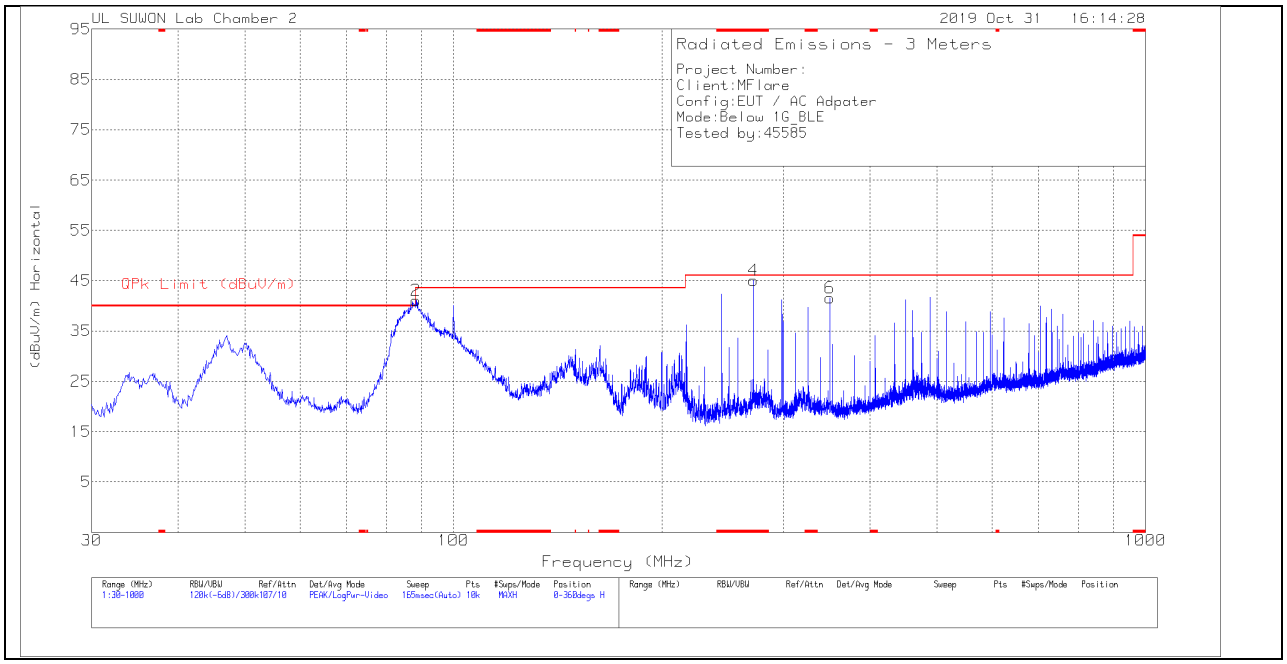
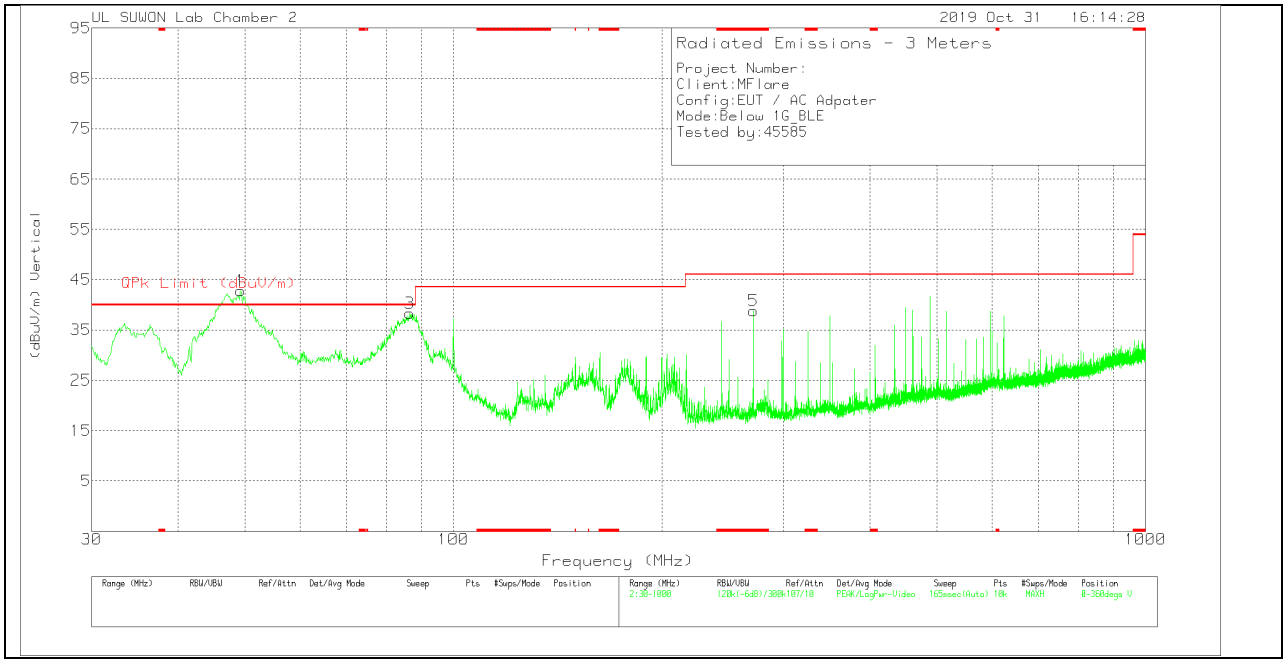
11.3. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz

HORIZONTAL PLOT



VERTICAL PLOT



BELOW 1 GHz TABLE

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163_749	Below_1G[dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	88.297	57.7	Pk	14.9	-31.5	41.1	43.52	-2.42	0-360	300	H
4	* 271.142	56.96	Pk	18.6	-30.5	45.06	46.02	-.96	0-360	100	H
6	350.003	50.67	Pk	21.1	-30.2	41.57	46.02	-4.45	0-360	100	H
1	49.206	54.84	Pk	19.8	-31.8	42.84	40	2.84	0-360	100	V
3	86.454	55.65	Pk	14.1	-31.4	38.35	40	-1.65	0-360	100	V
5	* 271.142	50.72	Pk	18.6	-30.5	38.82	46.02	-7.2	0-360	100	V

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

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163_749	Below_1G[dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 271.1945	56.37	Qp	18.6	-30.4	44.57	46.02	-1.45	202	105	H
47.082	50.85	Qp	19.8	-31.7	38.95	40	-1.05	222	129	V

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

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15(C)(3)
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12. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

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

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

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

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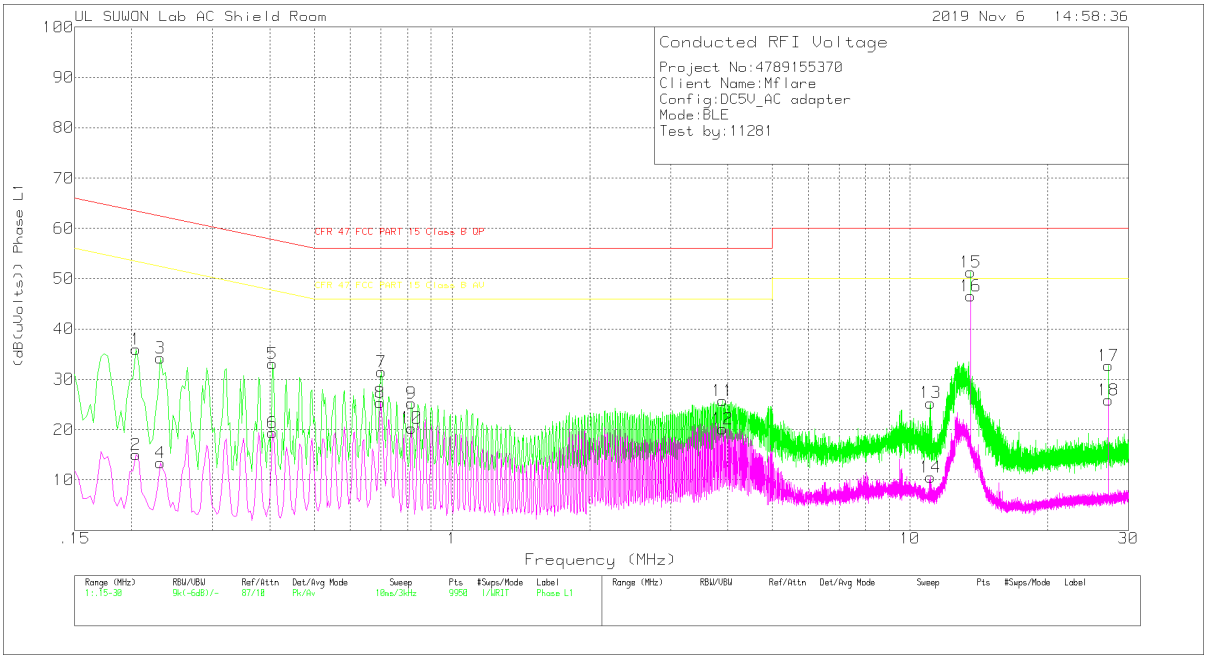
RESULTS

WORST EMISSIONS

LINE 1 PLOT



LINE 1 RESULTS

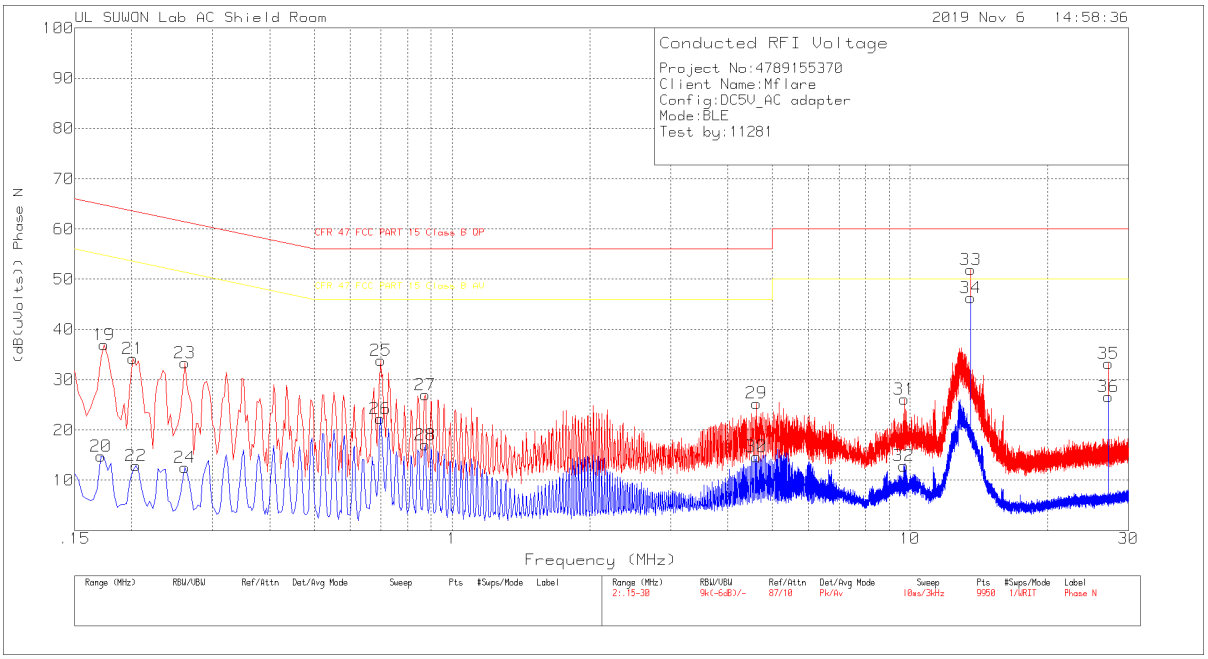
Trace Markers

Range 1: Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101836_With Ex_L1[dB]	CABLELOSS(dB)	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
1	.204	25.83	Pk	9.9	.2	35.93	63.45	-27.52	-	-
2	.204	4.95	Av	9.9	.2	15.05	-	-	53.45	-38.4
3	.231	24.28	Pk	9.8	.2	34.28	62.41	-28.13	-	-
4	.231	3.43	Av	9.8	.2	13.43	-	-	52.41	-38.98
5	.405	22.99	Pk	9.9	.2	33.09	57.75	-24.66	-	-
6	.405	9.25	Av	9.9	.2	19.35	-	-	47.75	-28.4
7	.702	21.34	Pk	9.9	.2	31.44	56	-24.56	-	-
8	.696	15.23	Av	9.9	.2	25.33	-	-	46	-20.67
9	.816	15.17	Pk	9.9	.2	25.27	56	-30.73	-	-
10	.816	10.23	Av	9.9	.2	20.33	-	-	46	-25.67
11	3.903	15.63	Pk	9.8	.3	25.73	56	-30.27	-	-
12	3.897	10.01	Av	9.8	.3	20.11	-	-	46	-25.89
13	11.097	15.02	Pk	10	.3	25.32	60	-34.68	-	-
14	11.097	.27	Av	10	.3	10.57	-	-	50	-39.43
15	13.56	40.86	Pk	10.1	.4	51.36	60	-8.64	-	-
16	13.56	36.07	Av	10.1	.4	46.57	-	-	50	-3.43
17	27.12	21.79	Pk	10.6	.3	32.69	60	-27.31	-	-
18	27.12	14.93	Av	10.6	.3	25.83	-	-	50	-24.17

Pk - Peak detector
Av - Average detection

LINE 2 PLOT



LINE 2 RESULTS

Trace Markers

Range 2: Phase N .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101836_With EX_N[dB]	CABLELOSS(dB)	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
19	.174	26.8	Pk	10	.2	37	64.77	-27.77	-	-
20	.171	4.52	Av	10.1	.2	14.82	-	-	54.91	-40.09
21	.201	24.16	Pk	9.9	.2	34.26	63.57	-29.31	-	-
22	.204	2.8	Av	9.9	.2	12.9	-	-	53.45	-40.55
23	.261	23.51	Pk	9.7	.2	33.41	61.4	-27.99	-	-
24	.261	2.6	Av	9.7	.2	12.5	-	-	51.4	-38.9
25	.699	23.74	Pk	9.9	.2	33.84	56	-22.16	-	-
26	.696	12.19	Av	9.9	.2	22.29	-	-	46	-23.71
27	.873	16.88	Pk	9.8	.3	26.98	56	-29.02	-	-
28	.873	6.95	Av	9.8	.3	17.05	-	-	46	-28.95
29	4.623	15.22	Pk	9.8	.3	25.32	56	-30.68	-	-
30	4.623	4.62	Av	9.8	.3	14.72	-	-	46	-31.28
31	9.708	15.68	Pk	10	.4	26.08	60	-33.92	-	-
32	9.693	2.56	Av	9.9	.4	12.86	-	-	50	-37.14
33	13.56	41.48	Pk	10.1	.4	51.98	60	-8.02	-	-
34	13.56	35.85	Av	10.1	.4	46.35	-	-	50	-3.65
35	27.12	22.21	Pk	10.7	.3	33.21	60	-26.79	-	-
36	27.12	15.68	Av	10.7	.3	26.68	-	-	50	-23.32

Pk - Peak detector
Av - Average detection