FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-247 ISSUE 2

RF4CE

CERTIFICATION TEST REPORT

FOR

RF4CE and BLE Hands-Free Remote

MODEL NUMBER : XR19-RQ

FCC ID: TX4XR19RQ
IC : 11438A-XR19RQ

REPORT NUMBER: 4789245332-FR2V2

ISSUE DATE: FEB 17, 2020

Prepared for
Remote Solution Co., Ltd.
326-14,Apo-Daero,Nam-Myeon,Gimcheon-Si,
Gyeongsangbuk-Do,Korea

Prepared by
UL Korea, Ltd.
26th floor, 152, Teheran-ro, Gangnam-gu Seoul, 06236, Korea

Suwon Test Site: UL Korea, Ltd. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16675, Korea
TEL: (031) 337-9902
FAX: (031) 213-5433

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Testing Laboratory
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	01/20/20	Initial issue	Jaejin Lee
V2	02/17/20	Added note to address about the TCB's question	Jaejin Lee

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Remote Solution Co., Ltd.

EUT DESCRIPTION: RF4CE and BLE Hands-Free Remote

MODEL NUMBER: XR19-RQ

SERIAL NUMBER: proto type(RADIATED);
proto type (CONDUCTED)

DATE TESTED: DEC 3, 2019 - JAN 08, 2020

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-247 Issue 2	Pass
INDUSTRY CANADA RSS-GEN Issue 5	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:

Changyoung Choi
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Jaejin Lee
Suwon Lab Engineer
UL Korea, Ltd.

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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. IC RSS-247 Issue 2
4. IC RSS-GEN Issue 5
5. KDB 558074 D01 15.247 Meas Guidance v05r02.
6. 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

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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

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

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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	2.32 dB
Radiated Disturbance, Below 1GHz	3.86 dB
Radiated Disturbance, Above 1 GHz	5.97 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 RF4CE and BLE Hands-Free Remote.
This test report addresses the DTS (RF4CE) operational mode.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range [MHz]	Mode	Power Mode	Output Power [dBm]	Output Power [mW]
2425 - 2475	RF4CE	Peak	6.14	4.11
		Average	5.88	3.87

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antenna, with a maximum gain of -1.0 dBi.

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5.4. WORST-CASE CONFIGURATION AND MODE

Radiated emission below 1GHz was 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.

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.

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5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Adaptor	COMCAST	ML08-7050150-A1	None	None

I/O CABLE

Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
N/A	N/A	N/A	N/A	N/A	N/A	N/A

TEST SETUP

The EUT is a stand-alone unit during the tests.
The EUT was forced to transmit using software.

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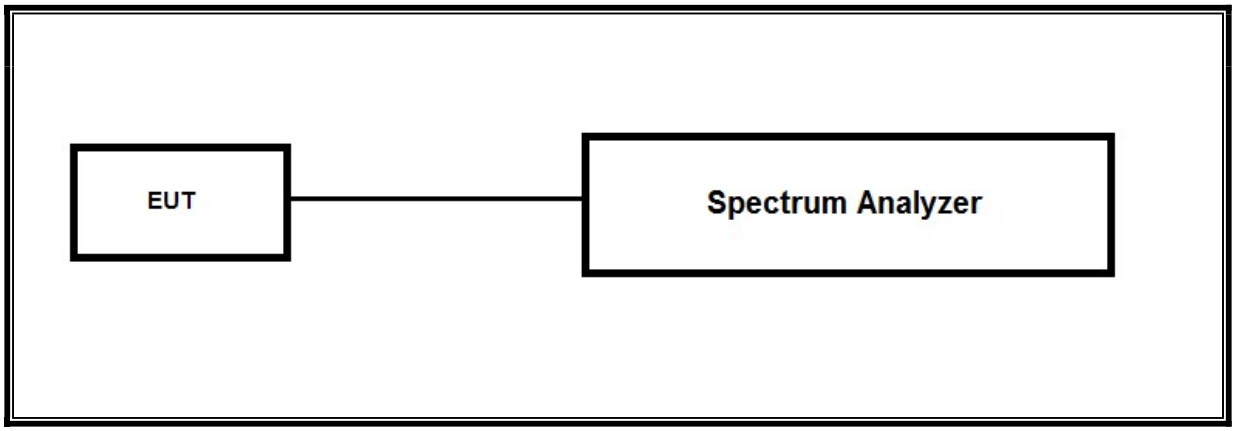
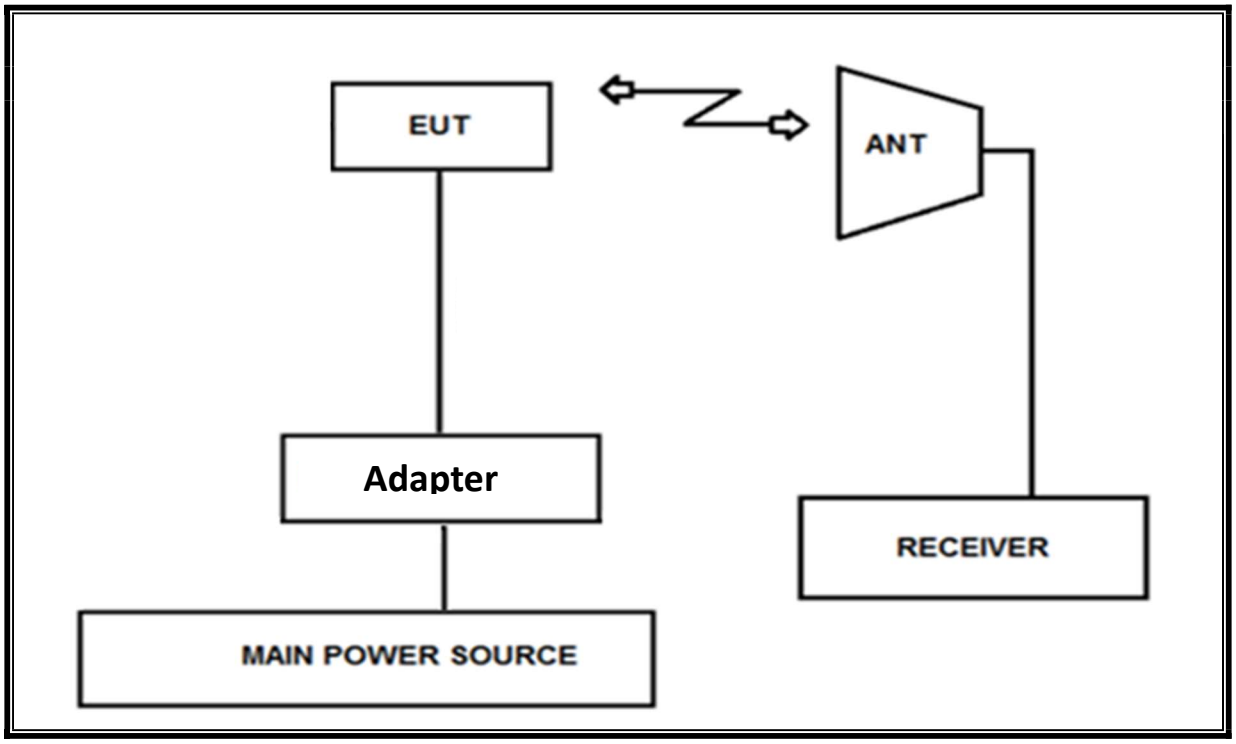
SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



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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
Antenna, Horn, 40 GHz	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	08-05-20
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
Signal Analyzer, 40 GHz	R&S	FSV40	101237	08-05-20
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	PE7087-10	2	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	102592	06-28-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-05-20
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	08-05-20
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	08-05-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	021	08-06-20
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	09-30-20
LISN	R&S	ENV216	102478	11-15-20
UL Software				
Description	**Manufacturer**	**Model**	**Version**	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	R&S	EMC32	10.50.40	

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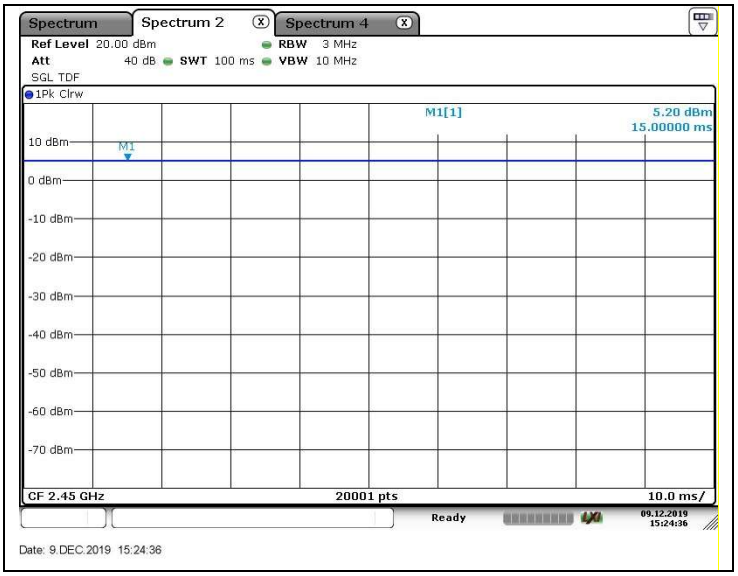
7. REFERENCE MEASUREMENT RESULTS

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						
RF4CE	100.000	100.000	1.000	100.0%	0.00	0.010



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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	2425	2.334
Mid	2450	2.347
High	2475	2.338
Worst		2.347

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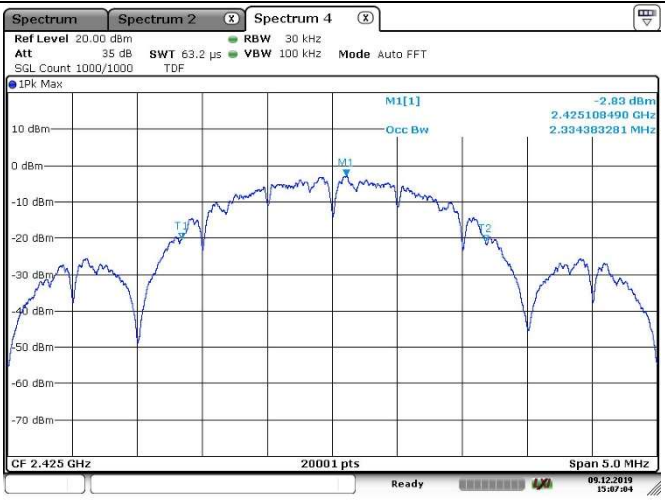
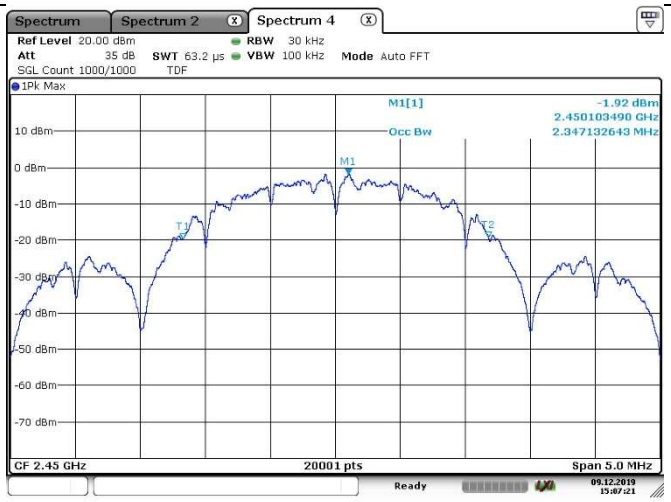
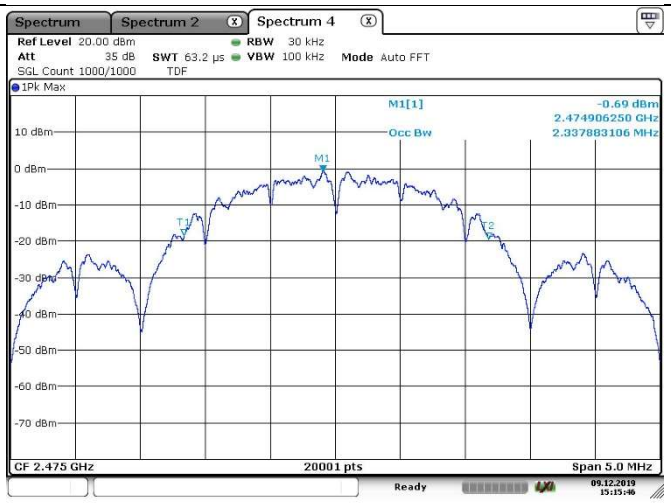
99% BANDWIDTH PLOTS

Low CH	
Middle CH	
High CH	

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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	IC Section	Test Description	Test Limit	Test Condition	Test Result
15.247 (a)(2)	RSS-247 5.2(a)	Occupied Band width (6dB)	>500KHz	Conducted	Pass
2.1051, 15.247 (d)	RSS-247 5.5	Band Edge / Conducted Spurious Emission	-20dBc		Pass
15.247 (b)(3)	RSS-247 5.4(d)	TX conducted output power	<30dBm		Pass
15.247 (e)	RSS-247 5.2(b)	PSD	<8dBm		Pass
15.207 (a)	RSS-GEN Clause 8.8	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass
15.205, 15.209	RSS-GEN Clause 7 & 8.9	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) / IC RSS-247 §5.2 (a)

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

Channel	Frequency [MHz]	6 dB Bandwidth [kHz]	Minimum Limit [kHz]
Low	2425	1576.92	500.0
Mid	2450	1595.92	500.0
High	2475	1624.42	500.0
Worst		1576.92	500.0

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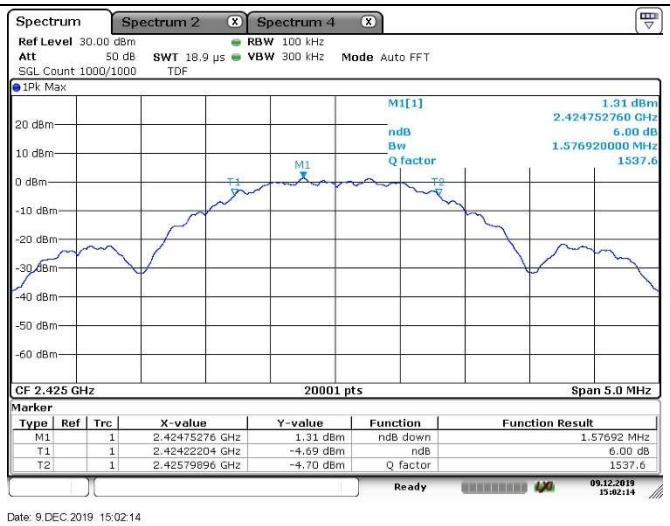
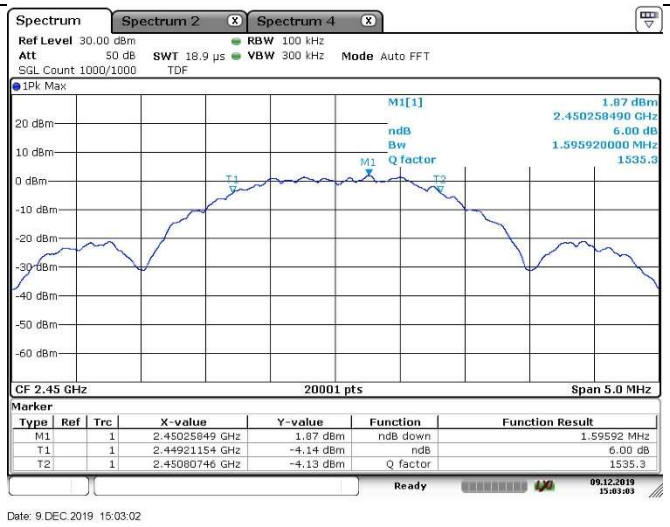
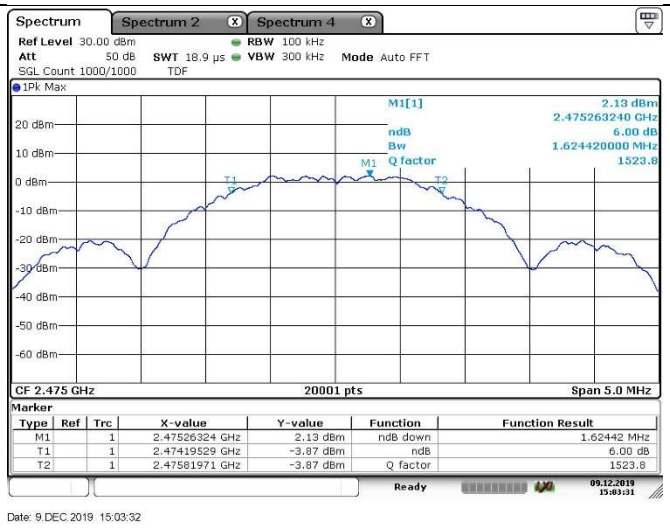
6 dB BANDWIDTH PLOTS

Low CH	
Middle CH	
High CH	

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10.2. OUTPUT POWER

LIMITS

FCC §15.247 (b) / IC 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

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	2425	4.47	30.00	-25.53
Mid	2450	5.35	30.00	-24.65
High	2475	6.14	30.00	-23.86
Worst		6.14	30.00	-23.86

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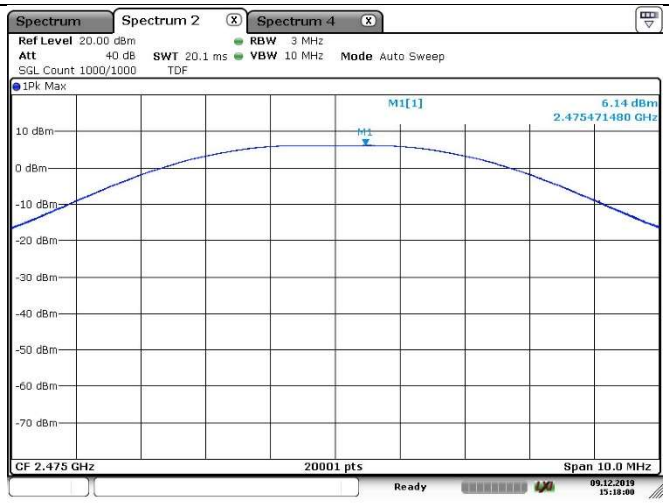
OUTPUT POWER PLOTS

- RF4CE

Low CH	
Middle CH	
High CH	

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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.

- RF4CE

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2425	4.20	2.63
Middle	2450	5.11	3.24
High	2475	**5.88**	**3.87**

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10.4. PSD

LIMITS

FCC §15.247 / IC 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.

TEST PROCEDURE

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

RESULTS

- RF4CE

Channel	Frequency [MHz]	PSD [dBm/3kHz]	Limit [dBm/3kHz]	Margin [dB]
Low	2425	-10.76	8.00	-18.76
Mid	2450	-9.46	8.00	-17.46
High	2475	-8.52	8.00	-16.52

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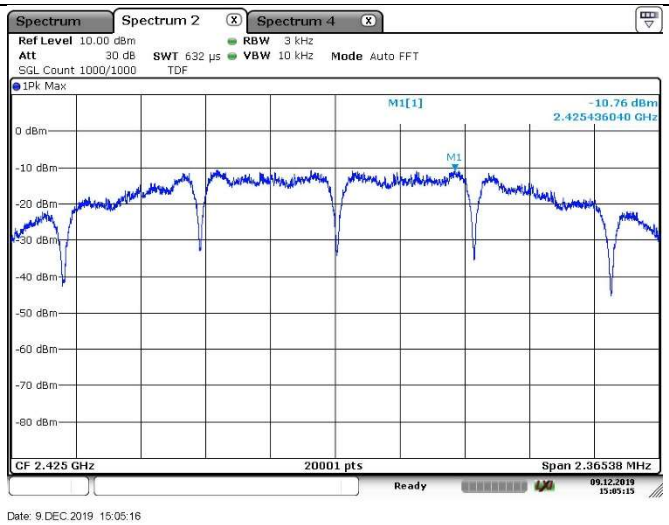
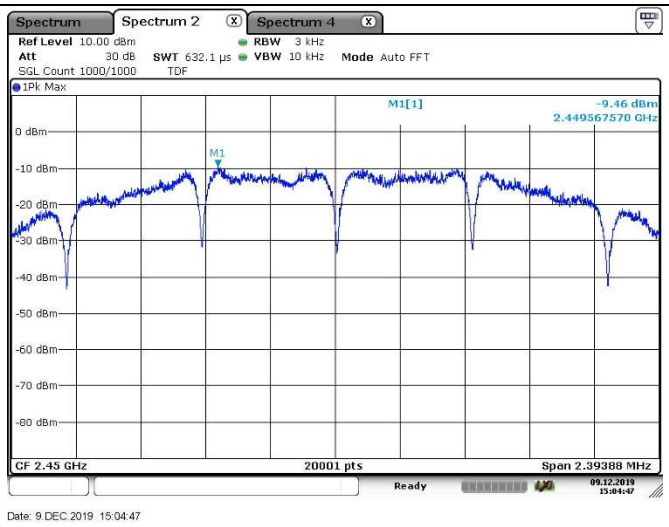
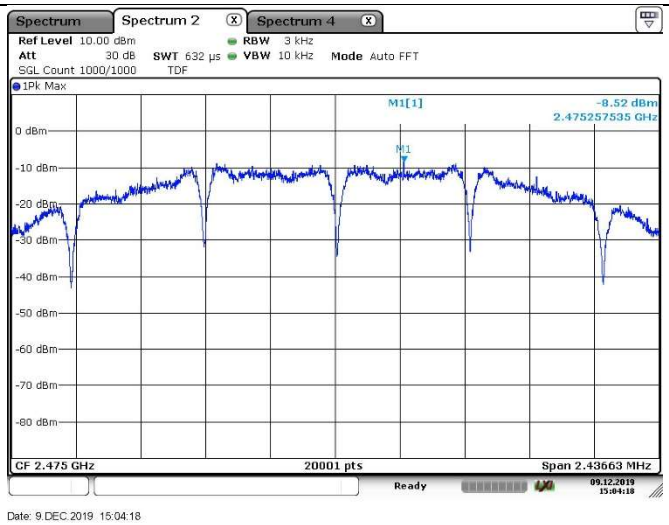
POWER SPECTRAL DENSITY PLOTS

- RF4CE

Low CH	
Middle CH	
High CH	

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10.5. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d) / IC RSS-247 §5.5

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

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer 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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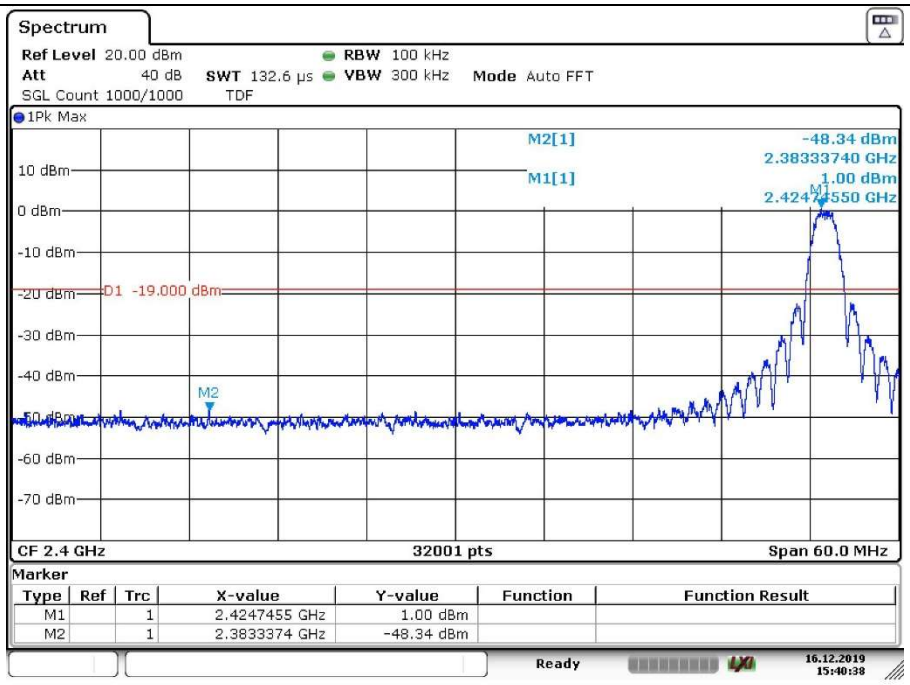
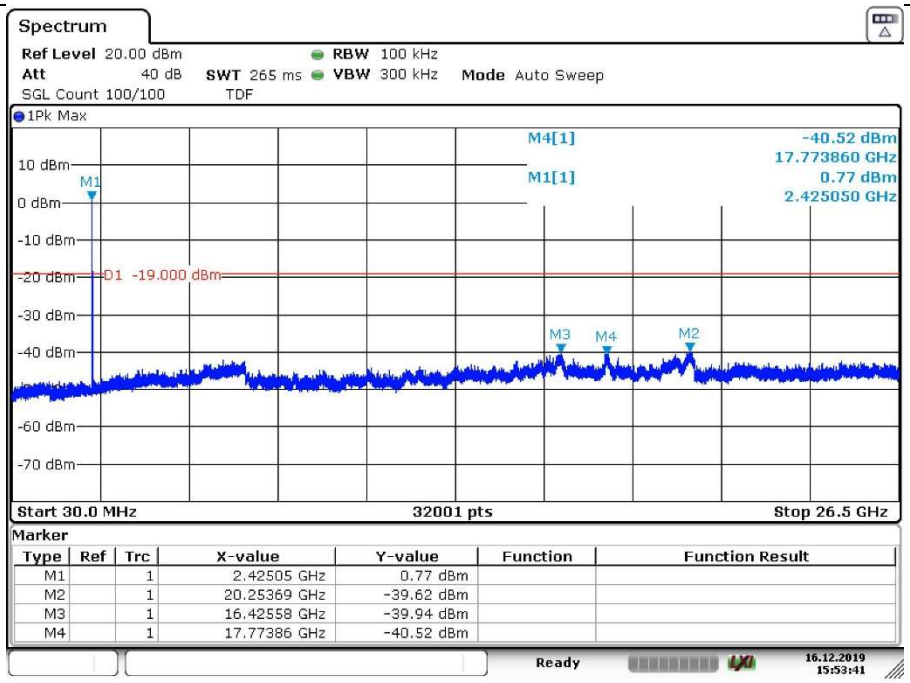
RESULTS

BANDEDGE & SPURIOUS EMISSIONS, LOW CHANNEL

Low CH
BandEdge



Low CH
Spurious



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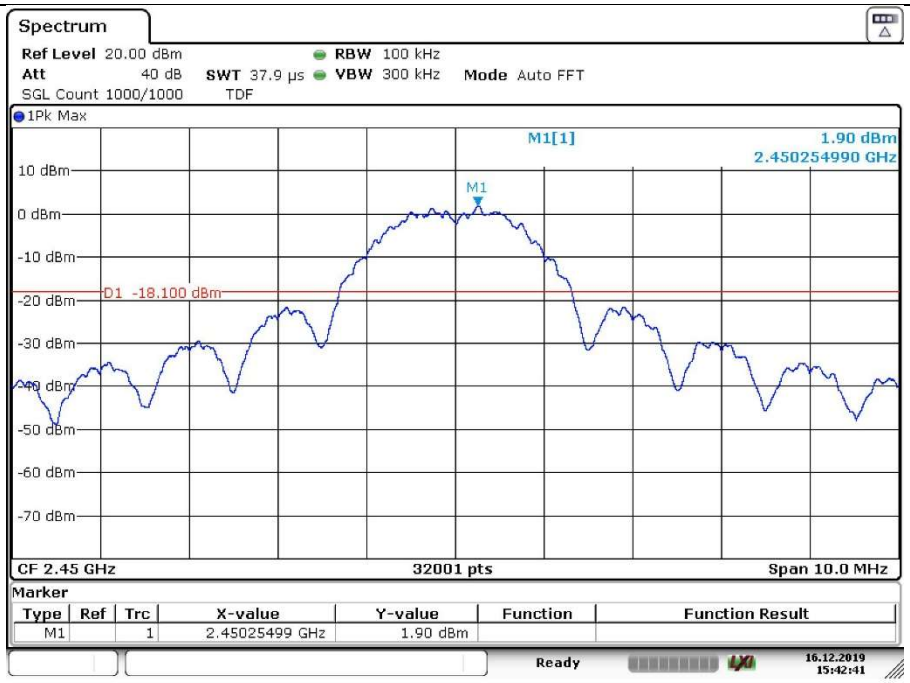
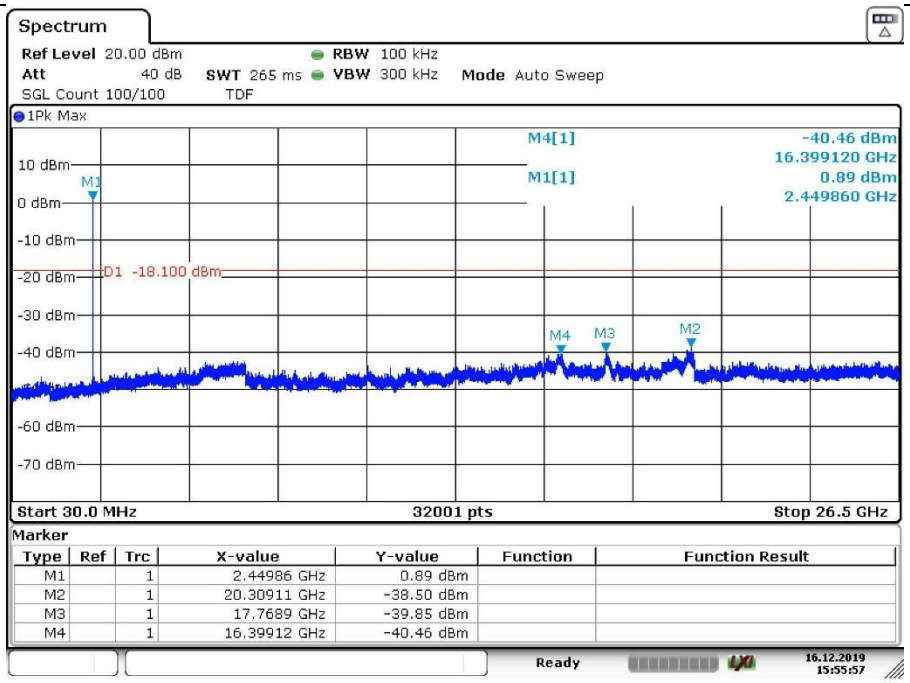
SPURIOUS EMISSIONS, MID CHANNEL

Middle CH BandEdge	
Middle CH Spurious	

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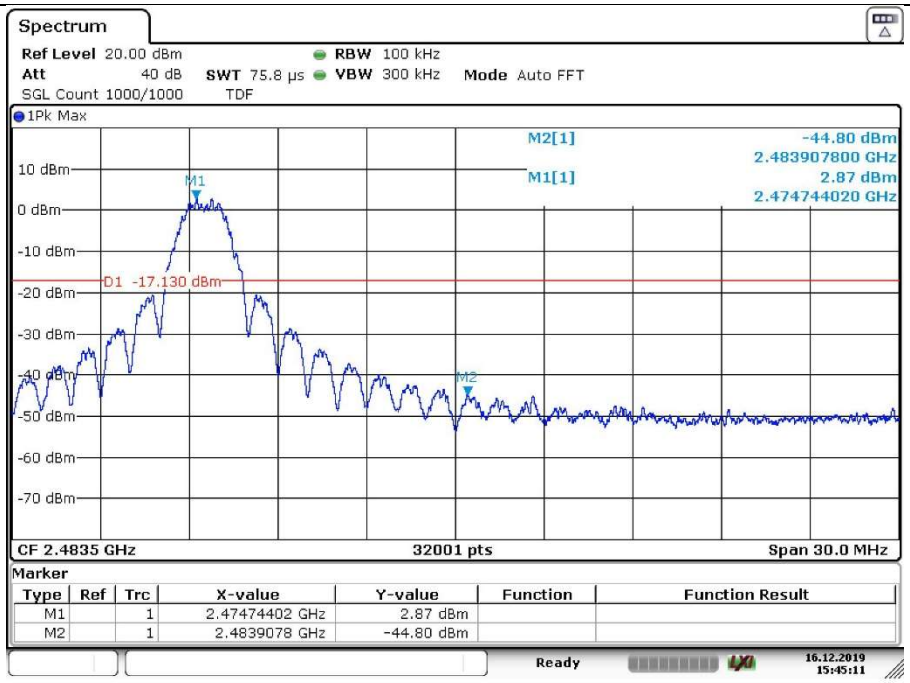
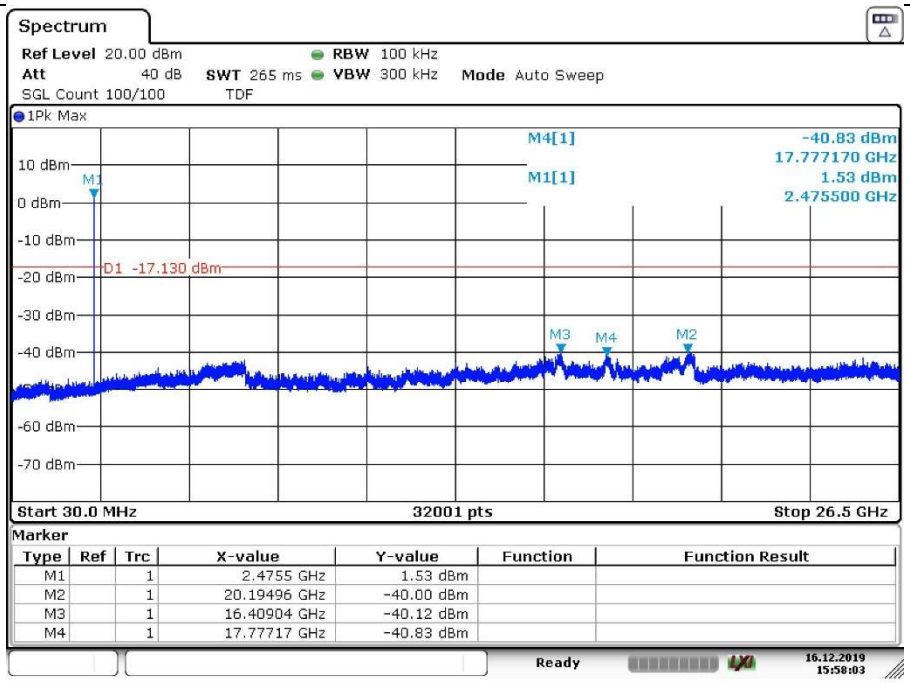
SPURIOUS EMISSIONS, HIGH CHANNEL

High CH
BandEdge



High CH
Spurious



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11. RADIATED TEST RESULTS

11.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209
IC RSS-GEN Clause 8.9 (Transmitter)
IC RSS-GEN Clause 7 (Receiver)
IC RSS-GEN Clause 8.10

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.

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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 and Duty 100%.

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 = 20 log (Tx ontime(ms)/100ms).
For this sample: (Refer to the operation description)

- Actual maximum transmit time= 50 ms in a 100ms interval;
- DCF = 20log(50ms/100ms)= -6 dB;
  (Refer to the operation description)

Note: During testing the device was in a test mode to enable 100% duty factor but under normal operation the maximum duty cycle in any 100ms period is 50% as detailed in the operational description.

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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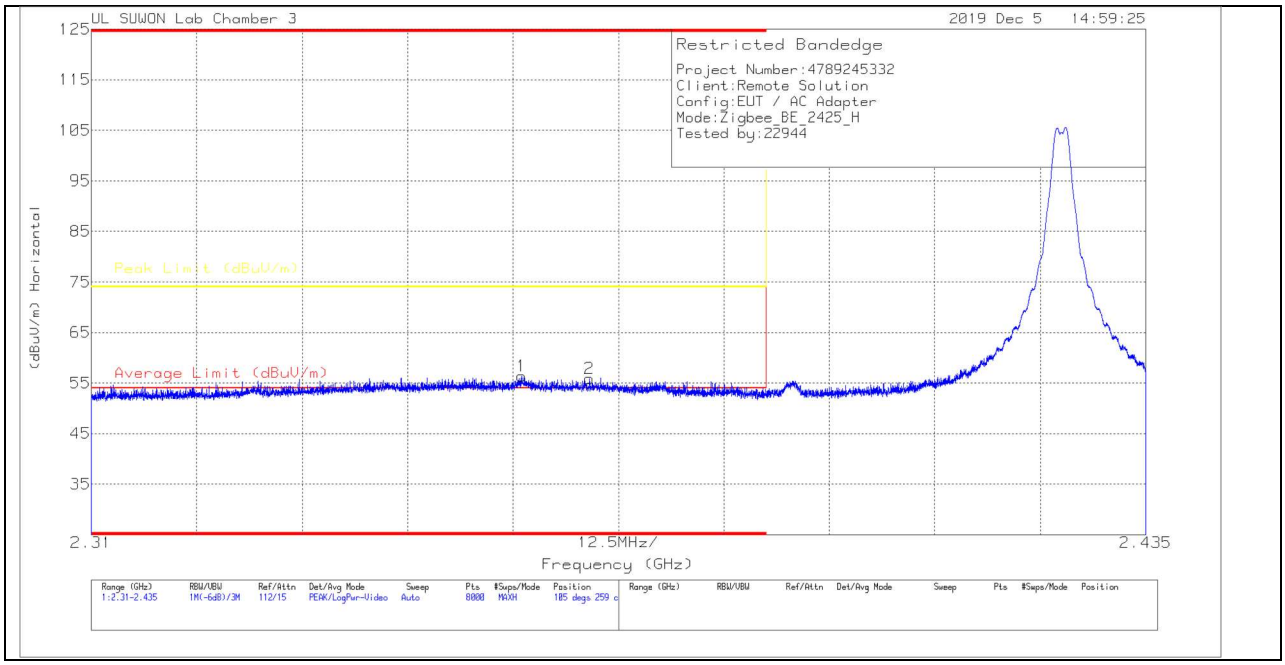
11.2. TRANSMITTER ABOVE 1 GHz

11.2.1. RF4CE MODE

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_002059 59	10dB_ATT[dB]	Duty Cylce Factor (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Av Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.36101	47.74	Pk	31.6	-23	-	56.34	-	-	74	-17.66	105	259	H
1	* 2.36101	-	Av	-	-	-6.0	50.34	54	-3.66	-	-	-	-	-
2	* 2.36907	47.21	Pk	31.6	-22.9	-	55.91	-	-	74	-18.09	105	259	H
2	* 2.36907	-	Av	-	-	-6.0	49.91	54	-4.09	-	-	-	-	-

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
Av - Peak reusut (Corrected Reading) (dBuV/m) + duty cycle factor (dB)

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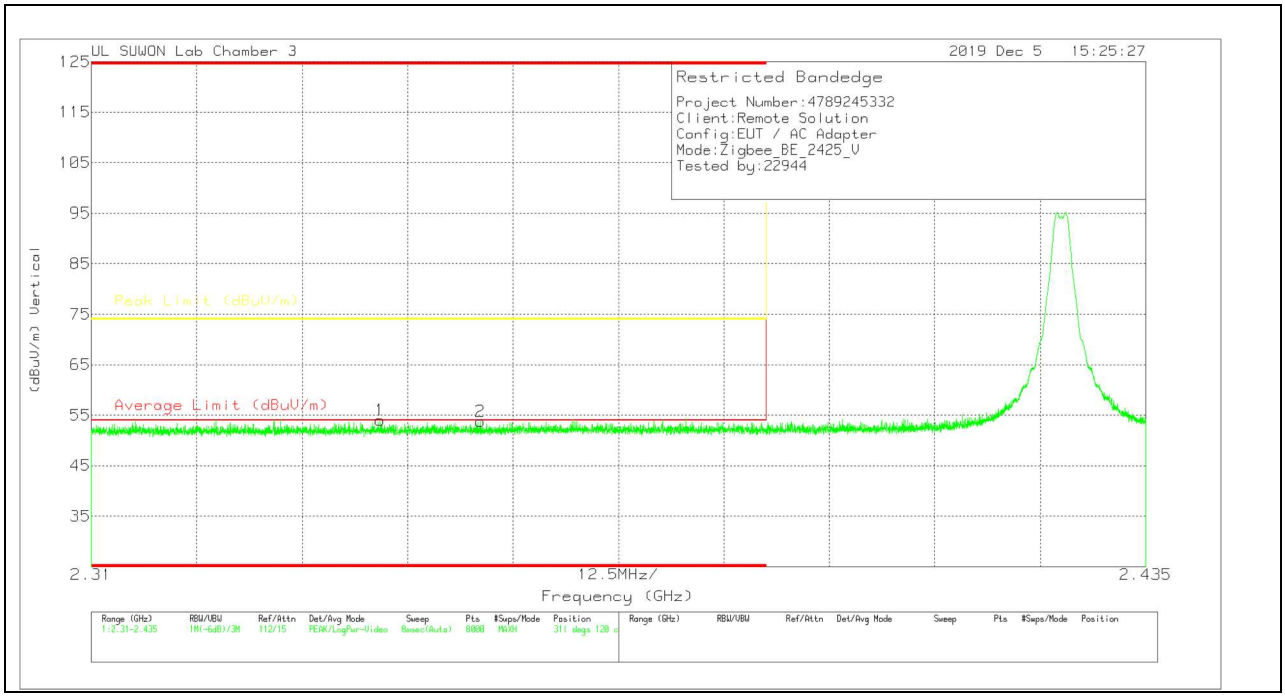
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00205959	10dB_ATT[dB]	Duty Cylce Factor (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.34425	45.34	Pk	31.6	-22.9	-	54.04	-	-	74	-19.96	311	120	V
1	* 2.34425	-	Av	-	-	-6.0	48.04	54	-5.96	-	-	-	-	-
2	* 2.35608	45.07	Pk	31.6	-22.9	-	53.77	-	-	74	-20.23	311	120	V
2	* 2.35608	-	Av	-	-	-6.0	47.77	54	-6.23	-	-	-	-	-

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
Av - Peak reusut (Corrected Reading) (dBuV/m) + duty cycle factor (dB)

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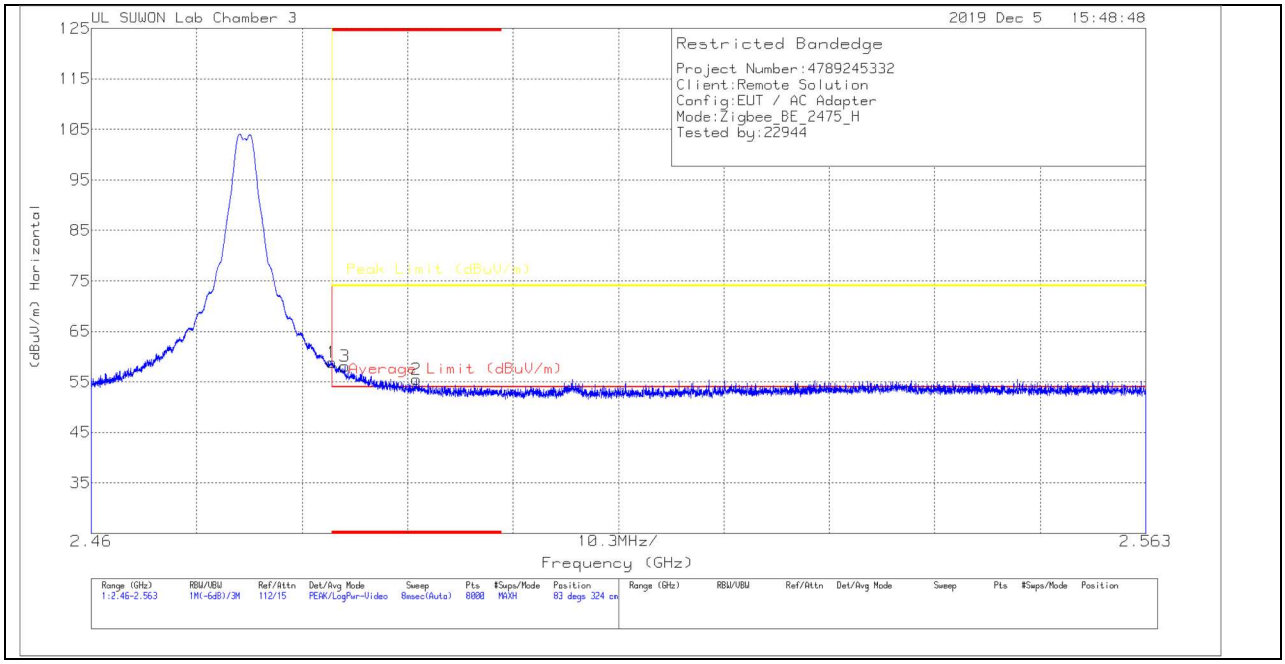
AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00205959	10dB_ATT[dB]	Duty Cylce Factor (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	49.74	Pk	31.9	-22.8	-	58.84	-	-	74	-15.16	83	324	H
1	* 2.48351	-	Av	-	-	-6.0	52.84	54	-1.16	-	-	-	-	-
2	* 2.49175	46.4	Pk	31.9	-22.8	-	55.5	-	-	74	-18.5	83	324	H
2	* 2.49175	-	Av	-	-	-6.0	49.5	54	-4.5	-	-	-	-	-
3	* 2.48475	49.03	Pk	31.9	-22.8	-	58.13	-	-	74	-15.87	83	324	H
3	* 2.48475	-	Av	-	-	-6.0	52.13	54	-1.87	-	-	-	-	-

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
Av - Peak reusut (Corrected Reading) (dBuV/m) + duty cycle factor (dB)

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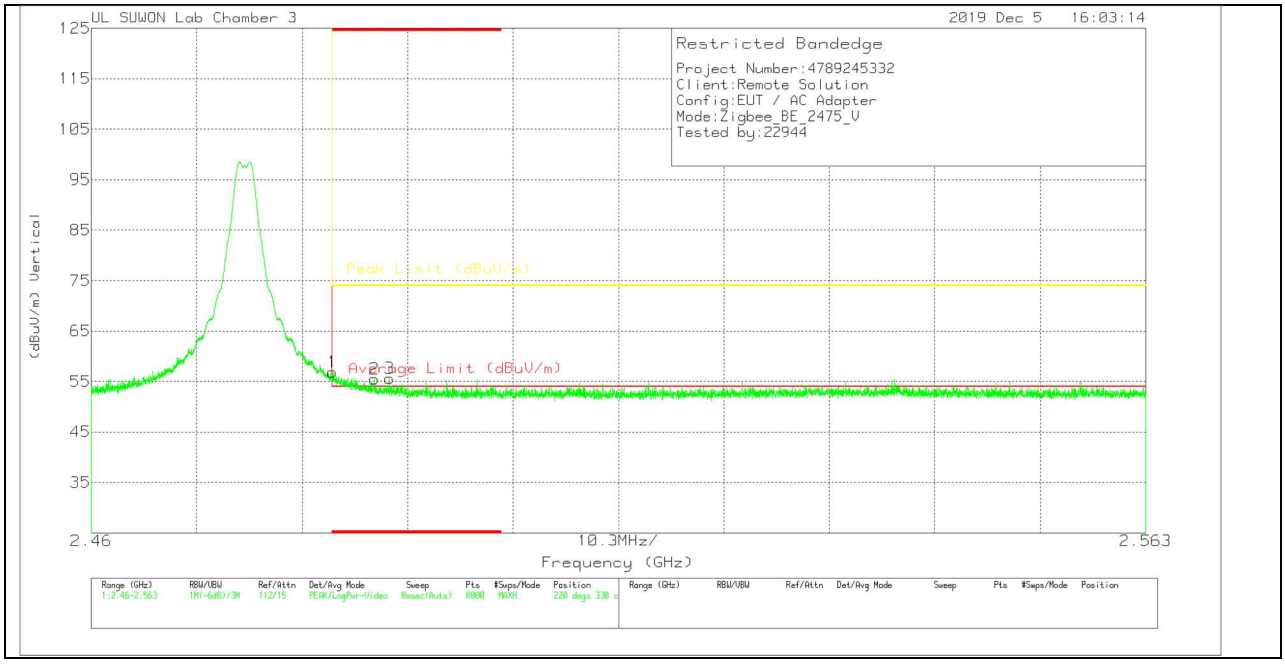
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00205959	10dB_ATT[dB]	Duty Cylce Factor (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48358	47.76	Pk	31.9	-22.8	-	56.86	-	-	74	-17.14	220	330	V
1	* 2.48358	-	Av	-	-	-6.0	50.86	54	-3.14	-	-	-	-	-
2	* 2.48769	46.41	Pk	31.9	-22.8	-	55.51	-	-	74	-18.49	220	330	V
2	* 2.48769	-	Av	-	-	-6.0	49.51	54	-4.49	-	-	-	-	-
3	* 2.48914	46.5	Pk	31.9	-22.8	-	55.6	-	-	74	-18.4	220	330	V
3	* 2.48914	-	Av	-	-	-6.0	49.6	54	-4.4	-	-	-	-	-

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
Av - Peak reusut (Corrected Reading) (dBuV/m) + duty cycle factor (dB)

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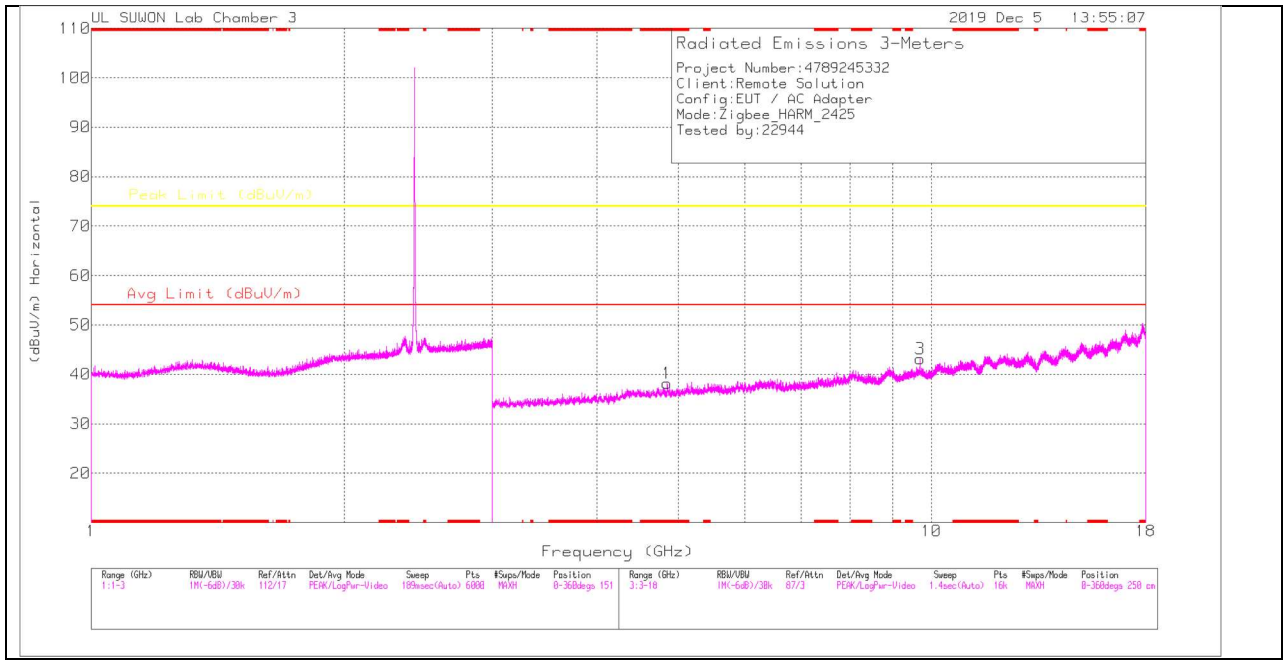
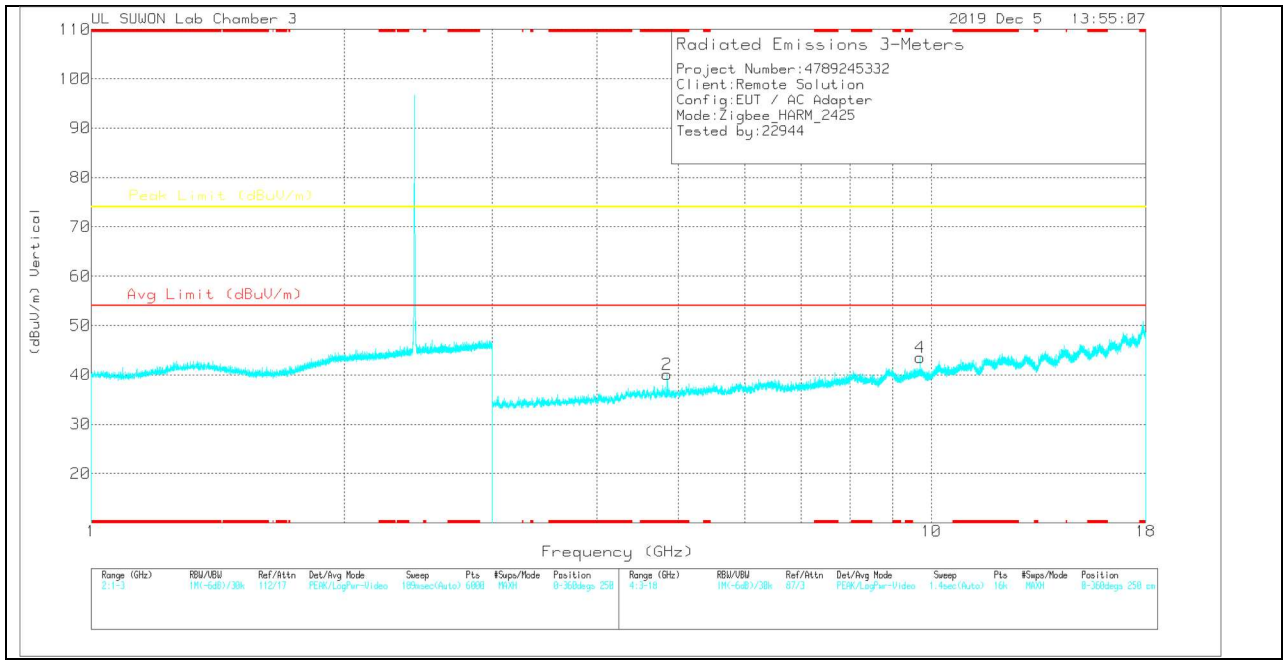
HARMONICS AND SPURIOUS EMISSIONS

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.

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LOW CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00205959	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.84887	32.39	PK	34.2	-28.4	38.19	-	-	74	-35.81	0-360	150	H
3	9.70167	25.26	PK	37.1	-19.2	43.16	-	-	74	-30.84	0-360	250	H
2	* 4.84887	34.33	PK	34.2	-28.4	40.13	-	-	74	-33.87	0-360	250	V
4	9.70167	25.62	PK	37.1	-19.2	43.52	-	-	74	-30.48	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_00205959	3GHz_HP[dB]	Duty Cylce Factor (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.84906	42.4	PK2	34.2	-28.4	-	48.2	-	-	74	-25.8	262	106	H
* 4.84906	-	Av	-	-	-6.0	42.2	54	-11.8	-	-	-	-	-
9.70211	34	PK2	37.1	-19.2	-	51.9	-	-	74	-22.1	289	100	H
9.70211	-	Av	-	-	-6.0	45.9	54	-8.1	-	-	-	-	-
* 4.84908	42.92	PK2	34.2	-28.4	-	48.72	-	-	74	-25.28	0	111	V
* 4.84908	-	Av	-	-	-6.0	42.72	54	-11.28	-	-	-	-	-
9.70194	35.51	PK2	37.1	-19.2	-	53.41	-	-	74	-20.59	48	216	V
9.70194	-	Av	-	-	-6.0	47.41	54	-6.59	-	-	-	-	-

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
Av - Peak reusut (Corrected Reading) (dBuV/m) + duty cycle factor (dB)

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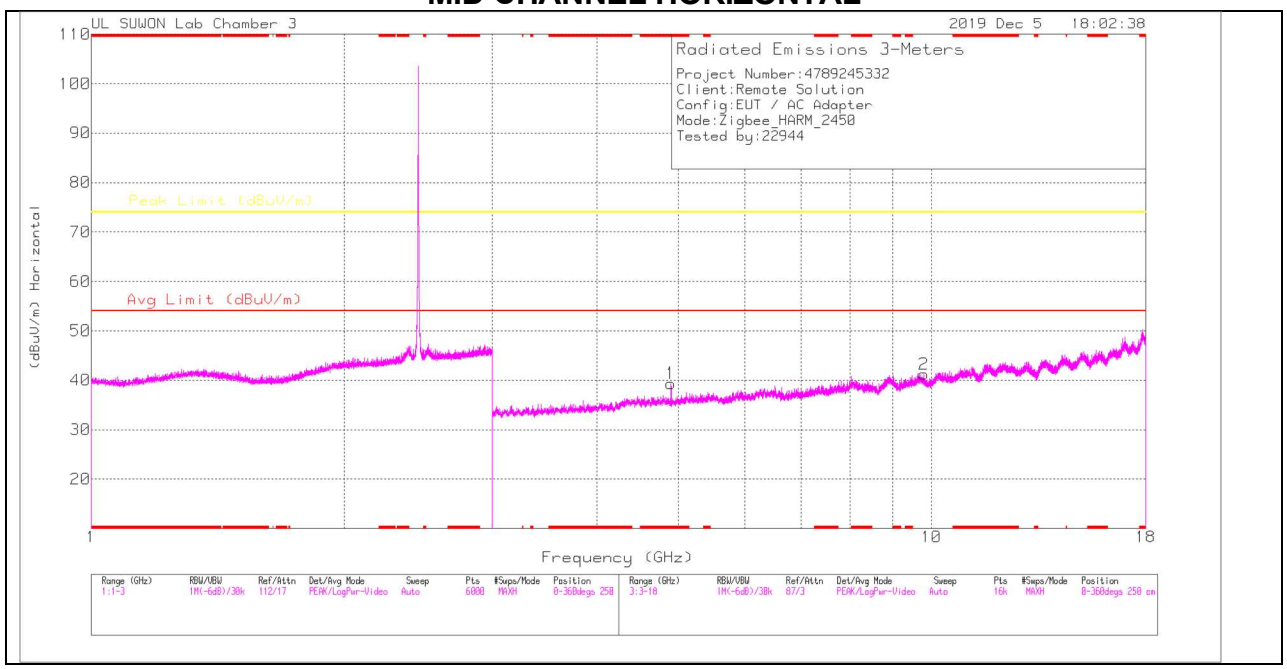
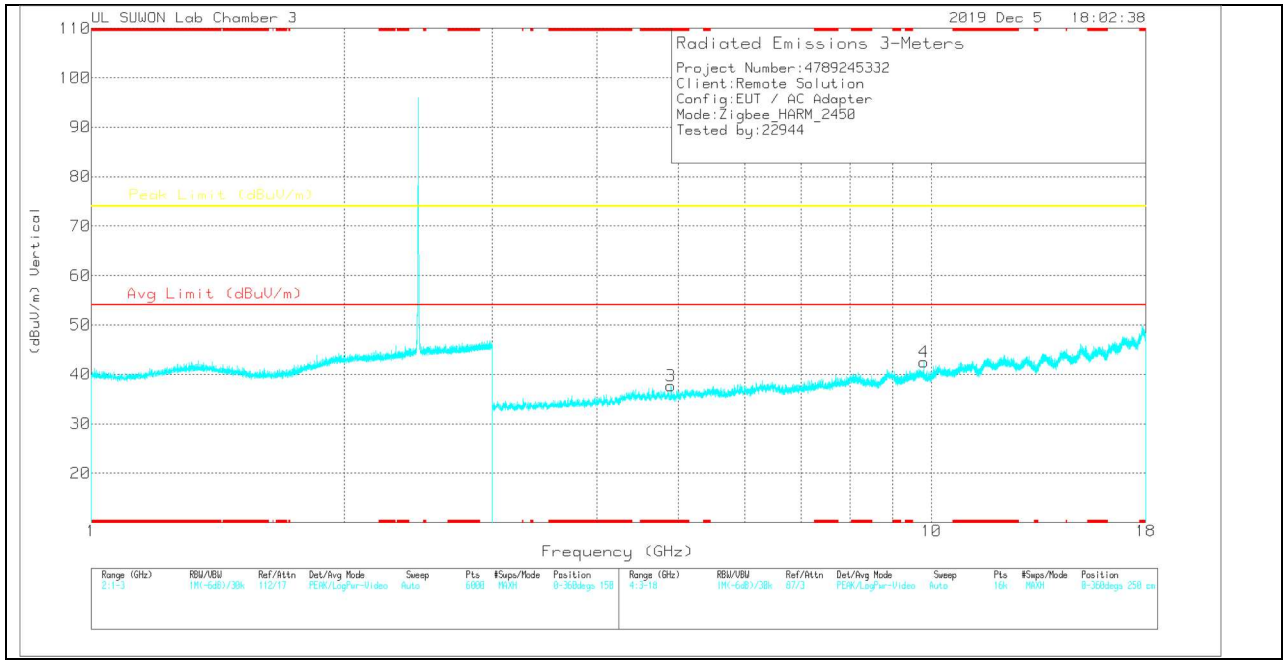
MID CHANNEL HORIZONTAL



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.

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MID CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00205959	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.89856	33.99	PK	34.2	-28.8	39.39	-	-	74	-34.61	0-360	150	H
2	9.79824	23.48	PK	37.3	-19.5	41.28	-	-	74	-32.72	0-360	250	H
3	* 4.89949	32.23	PK	34.2	-28.8	37.63	-	-	74	-36.37	0-360	250	V
4	9.80199	24.7	PK	37.3	-19.5	42.5	-	-	74	-31.5	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_00205959	3GHz_HP[dB]	Duty Cylce Factor (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.89895	43.78	PK2	34.2	-28.8	-	49.18	-	-	74	-24.82	42	101	H
* 4.89895	-	Av	-	-	-6.0	43.18	54	-10.82	-	-	-	-	-
9.79984	31.8	PK2	37.3	-19.5	-	49.6	-	-	74	-24.4	109	159	H
9.79984	-	Av	-	-	-6.0	43.6	54	-10.4	-	-	-	-	-
* 4.90082	42.64	PK2	34.2	-28.9	-	47.94	-	-	74	-26.06	215	129	V
* 4.90082	-	Av	-	-	-6.0	41.94	54	-12.06	-	-	-	-	-
9.80209	33.68	PK2	37.3	-19.5	-	51.48	-	-	74	-22.52	340	102	V
9.80209	-	Av	-	-	-6.0	45.48	54	-8.52	-	-	-	-	-

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
Av - Peak reusut (Corrected Reading) (dBuV/m) + duty cycle factor (dB)

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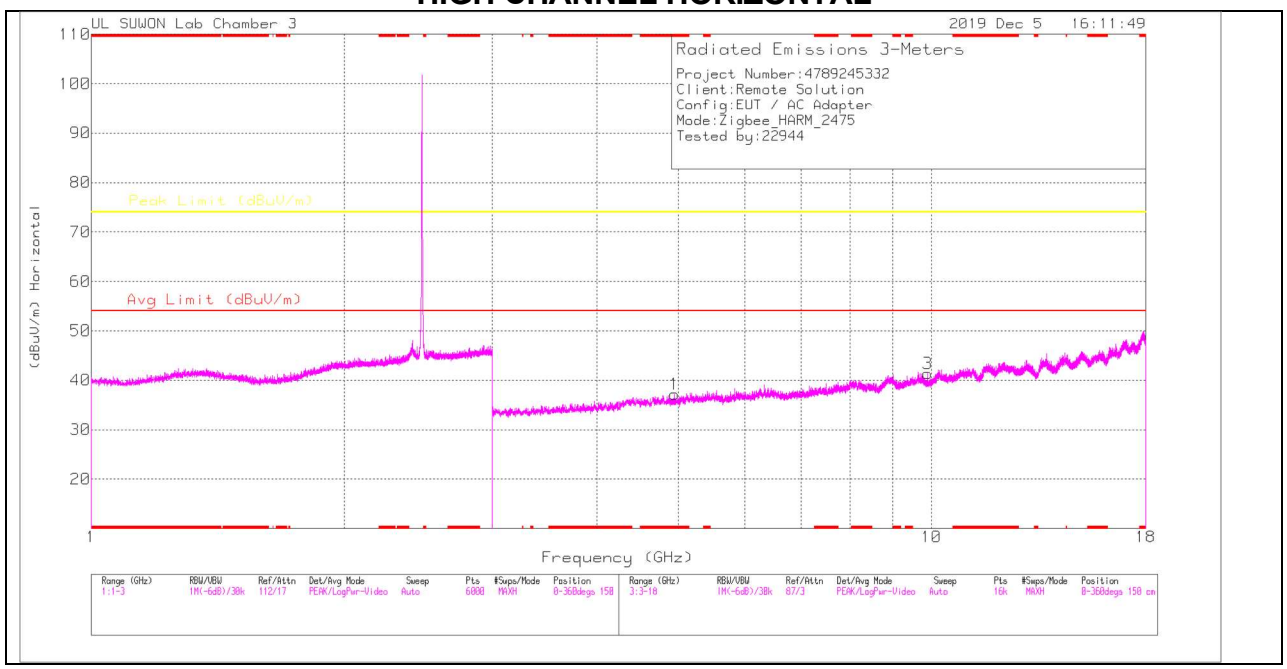
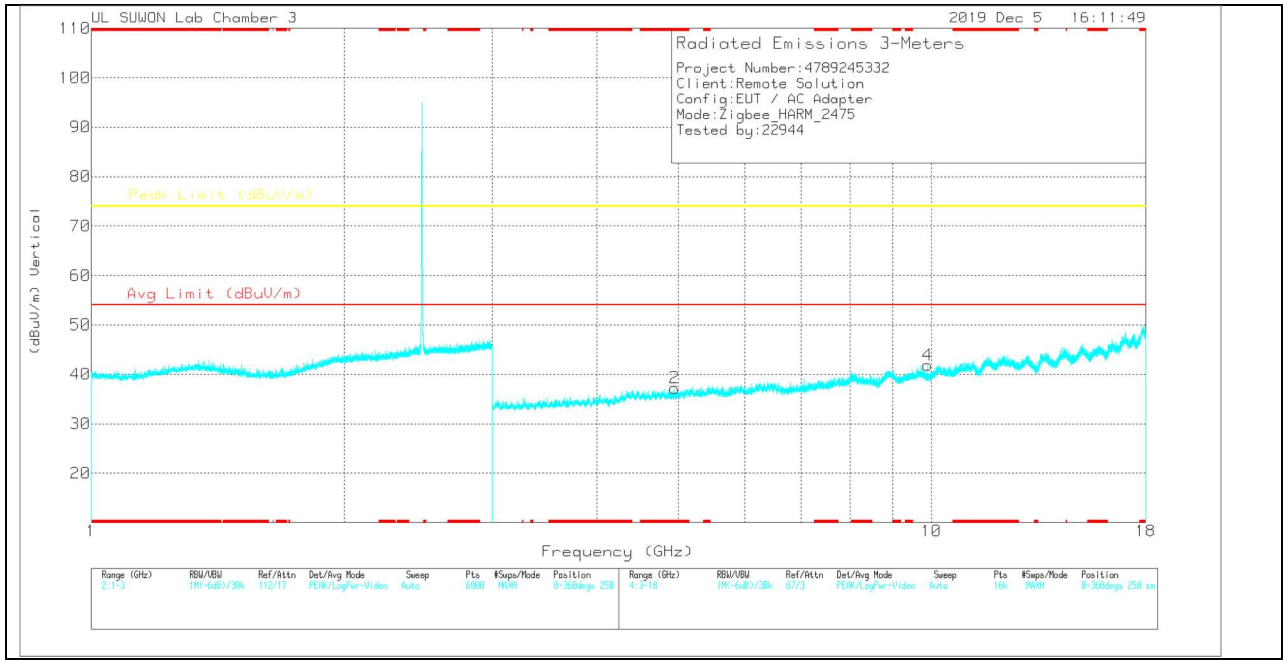
HIGH CHANNEL HORIZONTAL



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.

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HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00205959	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.94825	31.54	PK	34.2	-28.6	37.14	-	-	74	-36.86	0-360	250	H
3	9.90231	23.5	PK	37.4	-19.5	41.4	-	-	74	-32.6	0-360	250	H
2	* 4.95012	31.64	PK	34.2	-28.6	37.24	-	-	74	-36.76	0-360	150	V
4	9.90231	24.01	PK	37.4	-19.5	41.91	-	-	74	-32.09	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_00205959	3GHz_HP[dB]	Duty Cylce Factor (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.94898	40.18	PK2	34.2	-28.6	-	45.78	-	-	74	-28.22	62	232	H
* 4.94898	-	Av	-	-	-6.0	39.78	54	-14.22	-	-	-	-	-
9.89781	32.69	PK2	37.4	-19.5	-	50.59	-	-	74	-23.41	193	139	H
9.89781	-	Av	-	-	-6.0	44.59	54	-9.41	-	-	-	-	-
* 4.95073	42.13	PK2	34.2	-28.6	-	47.73	-	-	74	-26.27	86	100	V
* 4.95073	-	Av	-	-	-6.0	41.73	54	-12.27	-	-	-	-	-
9.90208	31.62	PK2	37.4	-19.5	-	49.52	-	-	74	-24.48	44	100	V
9.90208	-	Av	-	-	-6.0	43.52	54	-10.48	-	-	-	-	-

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
Av - Peak reusut (Corrected Reading) (dBuV/m) + duty cycle factor (dB)

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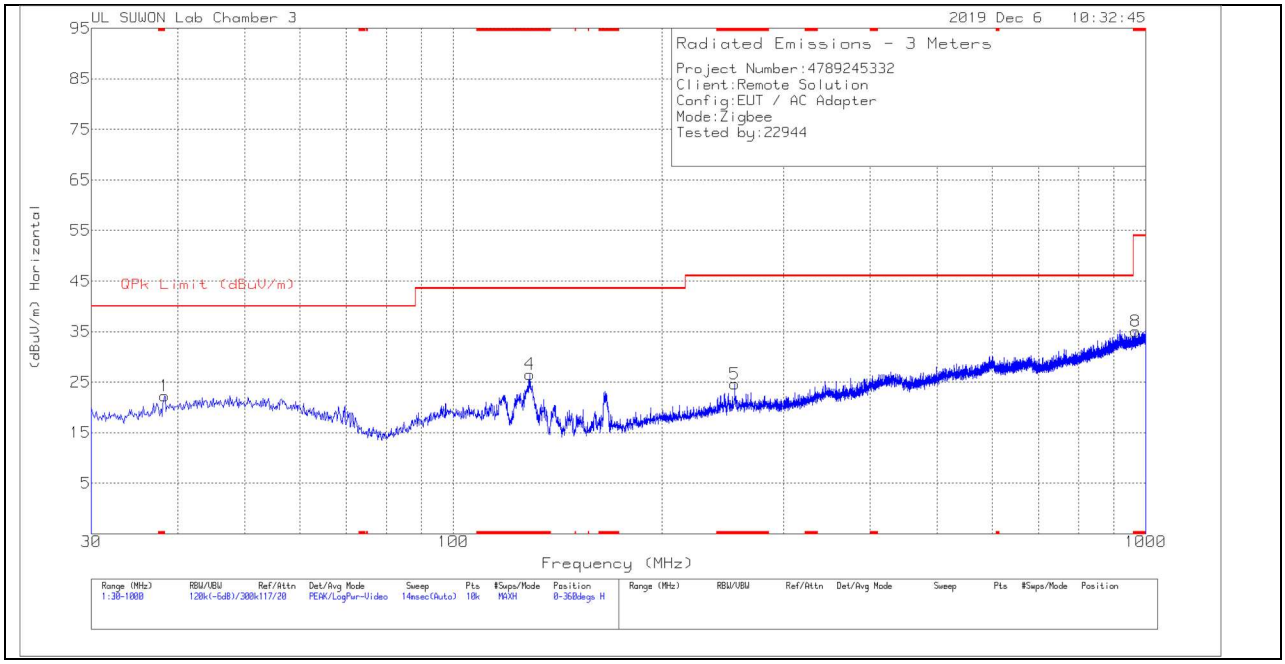
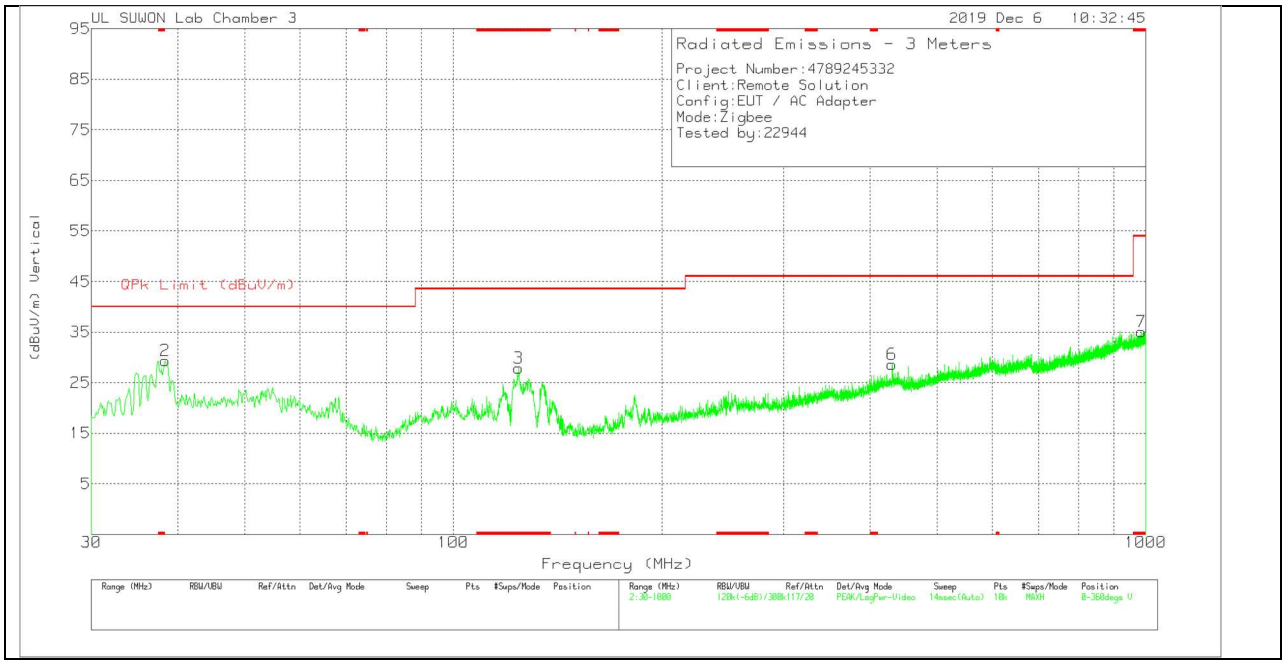
11.3. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz

HORIZONTAL PLOT



VERTICAL PLOT



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BELOW 1 GHz TABLE

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163-845	Below_1G[dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 38.2459	36.23	Pk	18.3	-32.2	22.33	40	-17.67	0-360	300	H
4	* 129.0472	43.26	Pk	14.8	-31.5	26.56	43.52	-16.96	0-360	200	H
5	* 254.8692	37.24	Pk	18.4	-31	24.64	46.02	-21.38	0-360	100	H
8	* 967.9897	34.61	Pk	28.3	-27.8	35.11	53.97	-18.86	0-360	100	H
2	38.3429	43.24	Pk	18.3	-32.2	29.34	40	-10.66	0-360	100	V
3	* 124.2937	44.01	Pk	15.4	-31.6	27.81	43.52	-15.71	0-360	100	V
6	430.3603	37.01	Pk	22.1	-30.5	28.61	46.02	-17.41	0-360	300	V
7	* 985.7425	34.29	Pk	28.4	-27.6	35.09	53.97	-18.88	0-360	300	V

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

Note : Because peak result is lower than the Quasi-Peak limit that Quasi-Peak measurement can be saved.

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12. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)
IC RSS-GEN Clause 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.

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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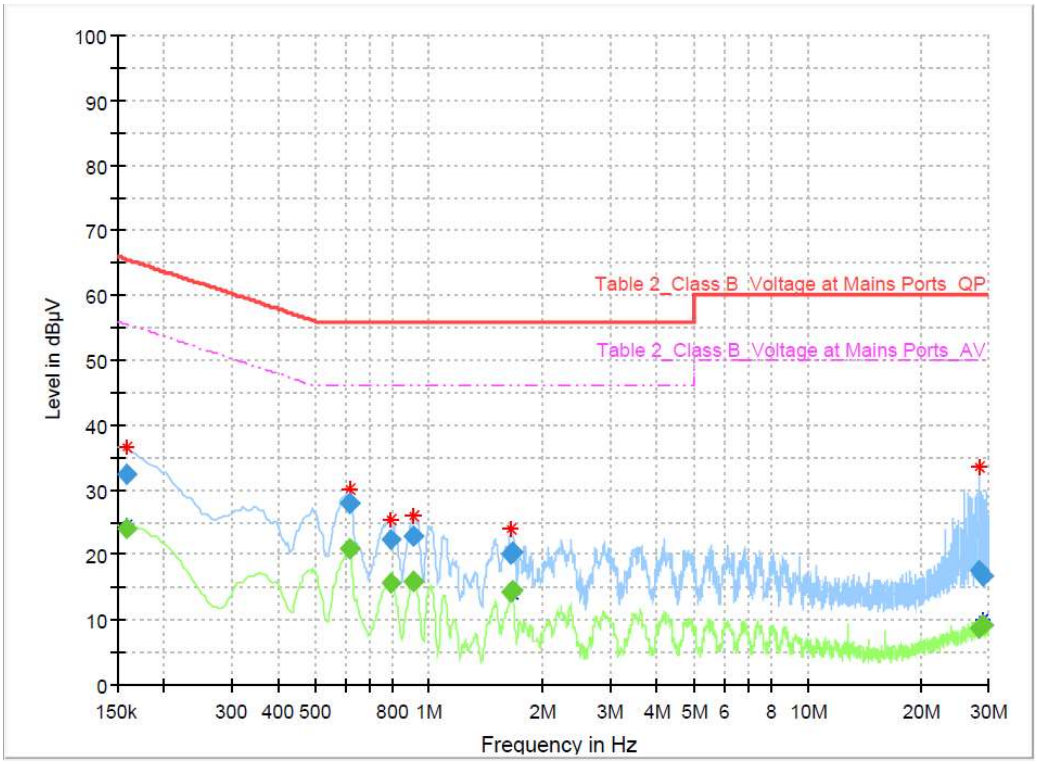
RESULTS

WORST EMISSIONS

LINE 1 PLOT



LINE 1 RESULTS

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.158000	---	24.13	55.57	31.44	L1	10.0
0.158000	32.50	---	65.57	33.07	L1	10.0
0.612919	---	20.89	46.00	25.11	L1	10.1
0.612919	27.98	---	56.00	28.02	L1	10.1
0.613309	---	20.92	46.00	25.08	L1	10.1
0.613309	28.00	---	56.00	28.00	L1	10.1
0.788507	---	15.56	46.00	30.44	L1	10.0
0.788507	22.24	---	56.00	33.76	L1	10.0
0.910640	---	16.05	46.00	29.95	L1	10.0
0.910640	22.80	---	56.00	33.20	L1	10.0
0.912198	---	16.04	46.00	29.96	L1	10.0
0.912198	22.83	---	56.00	33.17	L1	10.0
1.646059	20.21	---	56.00	35.79	L1	10.0
1.646059	---	14.27	46.00	31.73	L1	10.0
1.652890	20.44	---	56.00	35.56	L1	10.0
1.652890	---	14.41	46.00	31.59	L1	10.0
28.189831	---	8.78	50.00	41.22	L1	11.1
28.189831	17.62	---	60.00	42.38	L1	11.1
28.928081	---	9.16	50.00	40.84	L1	11.1
28.928081	16.71	---	60.00	43.30	L1	11.1

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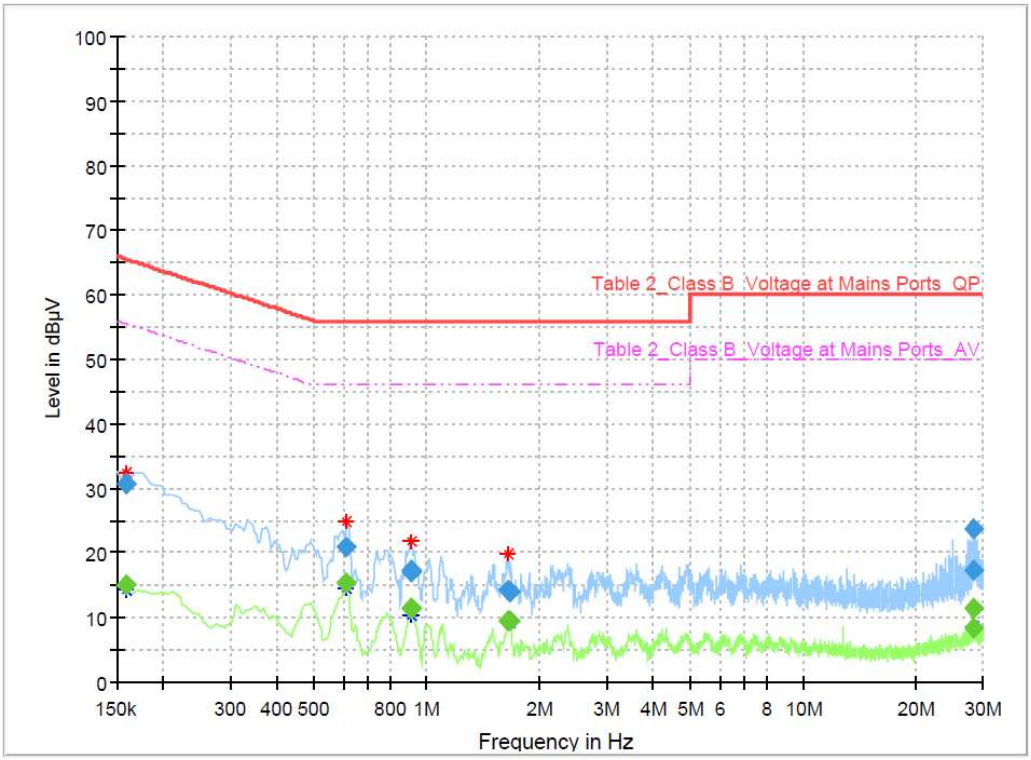
LINE 2 PLOT



LINE 2 RESULTS

Frequency (MHz)	QuasiPeak (dB 긺)	CAverage (dB 긺)	Limit (dB 긺)	Margin (dB)	Line	Corr. (dB)
0.158000	---	15.00	55.57	40.57	N	10.0
0.158000	30.64	---	65.57	34.92	N	10.0
0.609309	---	15.47	46.00	30.53	N	10.1
0.609309	20.87	---	56.00	35.13	N	10.1
0.911029	---	11.40	46.00	34.60	N	10.1
0.911029	17.17	---	56.00	38.83	N	10.1
0.912198	---	11.54	46.00	34.46	N	10.1
0.912198	17.18	---	56.00	38.82	N	10.1
1.644110	---	9.62	46.00	36.38	N	10.0
1.644110	14.33	---	56.00	41.67	N	10.0
1.661669	---	9.58	46.00	36.42	N	10.0
1.661669	14.00	---	56.00	42.00	N	10.0
28.256353	---	11.42	50.00	38.58	N	11.1
28.256353	23.64	---	60.00	36.36	N	11.1
28.478875	---	8.37	50.00	41.63	N	11.1
28.478875	17.36	---	60.00	42.64	N	11.1

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