CERTIFICATION TEST REPORT

Report Number. : 4789551399-E5V3

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	SM-G780F/DSM, SM-G780F/DS, SM-G780F
FCC ID	:	A3LSMG780F
EUT Description	:	GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, WPT and NFC
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
August 24, 2020

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IAS ACCREDITED
TL-637

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	08/13/20	Initial issue	Jihyeon Park
V2	08/20/20	Updated to address customer's request.	Jihyeon Park
V3	08/24/20	Updated to address TCB's question	Jihyeon Park

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.

EUT DESCRIPTION: GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, WPT and NFC

MODEL: SM-G780F/DSM, SM-G780F/DS, SM-G780F

SERIAL NUMBER: 438379084f1e7ece (CONDUCTED); 43837048921e7ece, 43837048981e7ece, R38N705CJ2K (RADIATED);

DATE TESTED: JUL 20, 2020 – AUG 20, 2020;

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

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
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Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Jihyeon Park
Suwon Lab Technician
UL Korea, Ltd.

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2. TEST METHODOLOGY

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

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4. DECISION RULES AND MEASUREMENT UNCERTAINTY

4.1. METROLOGICAL TRACEABILITY

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)

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

4.3. DECISION RULES

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

4.4. 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, 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%.

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5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The EUT is a GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax,
WPT and NFC. This test report addresses the DTS (BLE) operational mode.

This report covers the Samsung models SM-G780F/DSM and SM-G780F/DS, SM-G780F.
These models are identical in hardware except SM-G780F/DS has dual SIM tray(MST not supported). And SM-G780F has single SIM tray. With some pre-scan, model SM-G780F/DSM (Dual SIM tray, MST supported) was set for final test.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range [MHz]	Mode	Power Mode	Output Power [dBm]	Output Power [mW]
2 402 ~ 2 480	500kbps	Peak	7.066	5.089
		Average	6.824	4.813
	2Mbps	Peak	7.226	5.280
		Average	6.600	4.571

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The internal antenna was Permanently attached.
Therefore this E.U.T Complies with the requirement of §15.203.

Bluetooth LE operates on single antenna.
The radio utilizes an internal antenna, with a maximum gain of -4.51 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.

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 : All radiated and power line conducted tests were performed attached with travel adapter for the worst case condition mode.

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Power verification

The Output Power of all data rate are all investigated, the 500 kbps(37 pkt) and 2 Mbps(37 pkt) power is the worst case for symbol rate. All tests were performed in these two modes.

Symbol Rate [Ms/s]	Mode	Frequency [MHz]	Conducted Burst Avg [dBm]	Symbol Rate [Ms/s]	Mode	Frequency [MHz]	Conducted Burst Avg [dBm]
1	1Mbps (37 pkt)	2402	5.166	2	2Mbps (37 pkt)	2402	4.973
		2404	5.508			2404	5.315
		2440	6.745			***2440***	**6.600**
		2480	5.307			2480	5.134
	1Mbps (255 pkt)	2402	5.188		2Mbps (255 pkt)	2402	4.992
		2404	5.476			2404	5.327
		2440	6.739			2440	6.580
		2480	5.259			2480	5.136
1	125 kbps (37 pkt)	2402	5.182				
		2404	5.512				
		2440	6.757				
		2480	5.279				
	125 kbps (255 pkt)	2402	5.172				
		2404	5.491				
		2440	6.737				
		2480	5.248				
	500 kbps (37 pkt)	2402	5.239				
		2404	5.540				
		2440	**6.824**				
		2480	5.350				
	500 kbps (255 pkt)	2402	5.200				
		2404	5.492				
		2440	6.776				
		2480	5.269				

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5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA200	R37M4NQ2ZZ1SE3	N/A
Data Cable	SAMSUNG	EP-DR140AWE	N/A	N/A

I/O CABLE

I/O Cable List						
Cable No.	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length(m)**	**Remarks**
1	DC Power	1	C Type	Shielded	1.1m	N/A

TEST SETUP

The EUT is a stand-alone unit during the tests.
Test software in hidden menu exercised the EUT to enable BLE mode.

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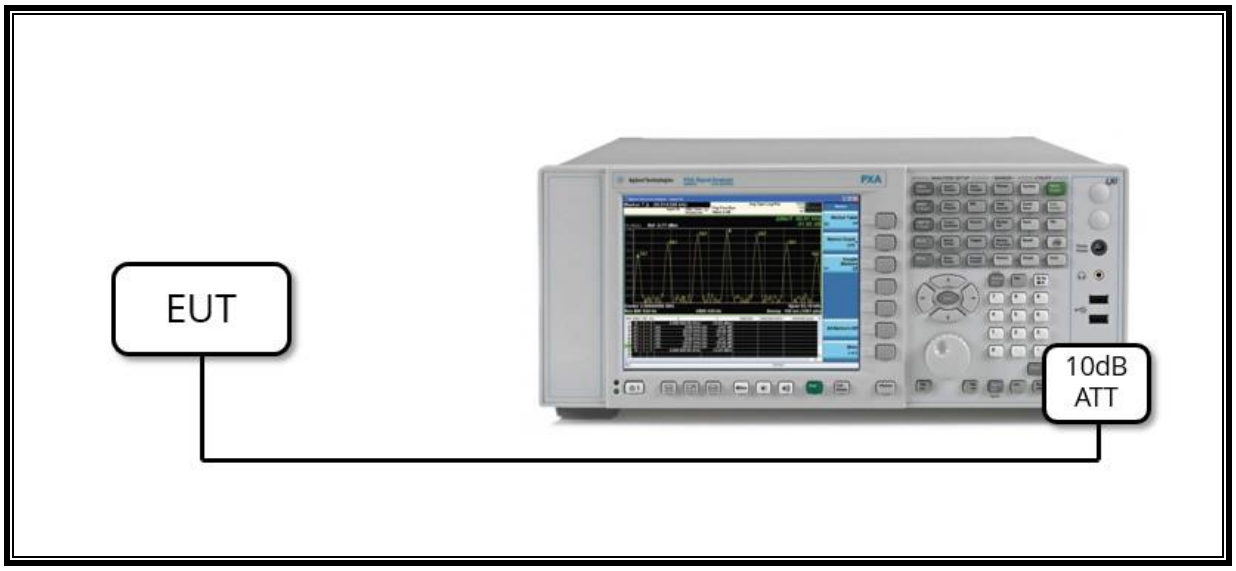
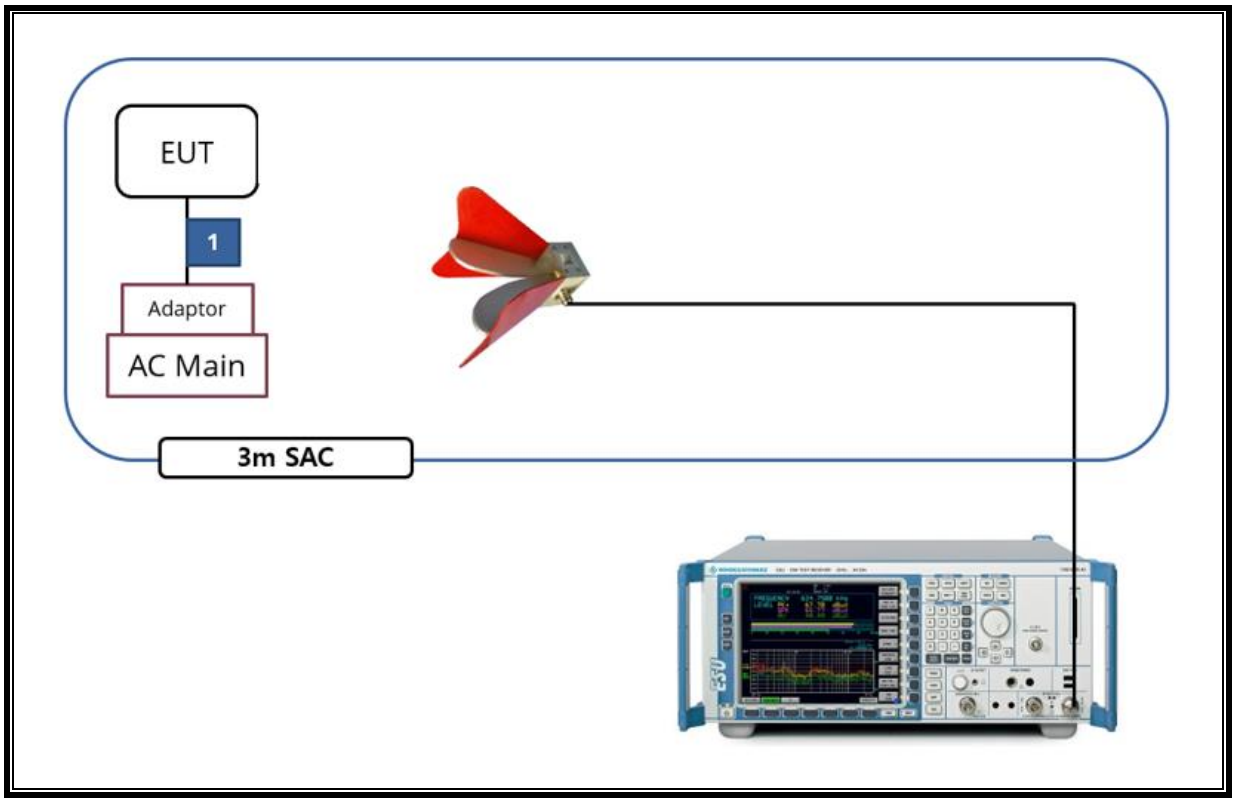
SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



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6. MEASUREMENT METHOD

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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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**	**S/N**	**Next Cal. Date**	
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845(Note)	08-04-20	08-13-22
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749(Note)	08-04-20	08-13-22
Antenna, Horn, 18 GHz	ETS	3115	00167211	08-04-20	07-27-22
Antenna, Horn, 18 GHz	ETS	3117	00168724	08-04-20	07-27-22
Antenna, Horn, 40 GHz	ETS	3116C	00166155	08-13-20	08-04-22
Antenna, Horn, 40 GHz	ETS	3116C	00168645	10-02-21	
Preamplifier	ETS	3116C-PA	00168841	08-08-20	08-06-21
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-05-20	08-03-21
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-05-20	08-03-21
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-06-20	08-03-21
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-06-20	08-03-21
Spectrum Analyzer, 44 GHz	Keysight	N9030B	MY57143717	01-20-21	
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-06-20	08-05-21
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-06-20	08-05-21
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-09-20	08-05-21
Attenuator	PASTERNACK	PE7087-10	A001	08-08-20	08-03-21
Attenuator	PASTERNACK	PE7087-10	A008	08-08-20	08-03-21
Attenuator	PASTERNACK	PE7087-10	A007	08-08-20	08-03-21
Attenuator	PASTERNACK	PE7087-10	A009	08-08-20	08-05-21
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-06-20	08-03-21
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-06-20	08-03-21
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-05-20	08-03-21
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-06-20	08-03-21
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-06-20	08-03-21
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-06-20	08-03-21
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-06-20	08-03-21
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	08-06-20	08-03-21
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	08-06-20	08-03-21
LISN	R&S	ENV216	101837	08-09-20	08-06-21
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		

Note. The above antenna was not used for testing from August 4th to August 13th.

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8. TEST RESULTS SUMMARY

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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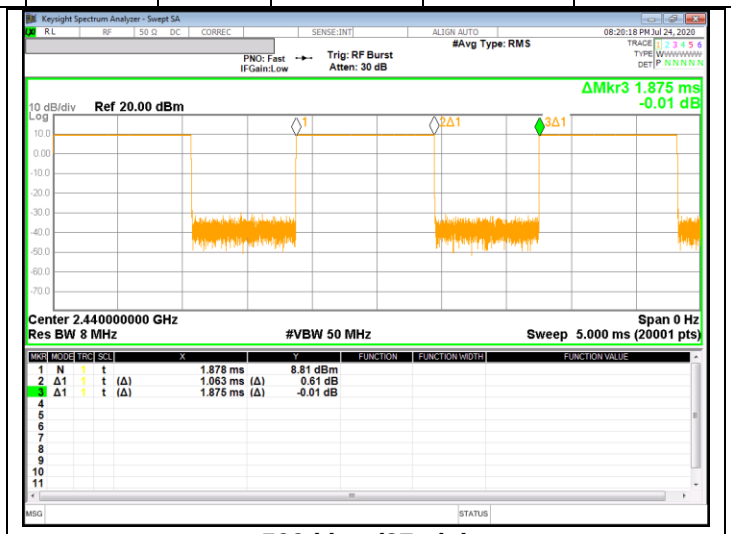
9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

Mode	On time [msec]	Period [msec]	Duty cycle x [Linear]	Duty Cycle [%]	Duty Cycle Correction Factor [dB]	1/T Minimum CBW [kHz]
2 400 ~ 2 483.5 MHz Bands						
BLE 500 kbps [37pkt]	1.063	1.875	0.567	56.693	2.465	0.941
BLE 2 Mbps [37pkt]	0.202	0.625	0.323	32.304	4.908	4.950



500 kbps(37 pkt)

2 Mbps(37 pkt)

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9.2. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

RSS-247 5.2 (a)

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

RESULTS

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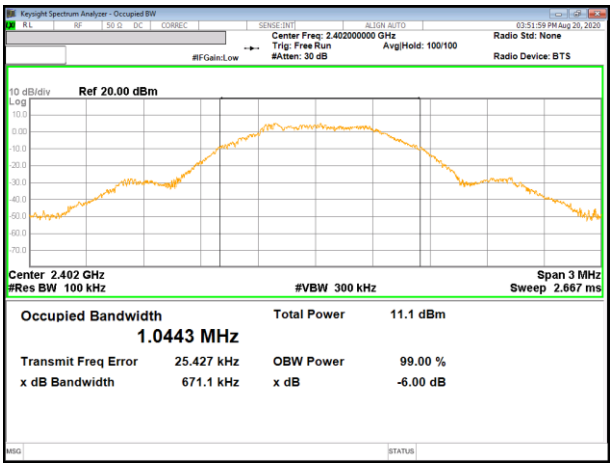
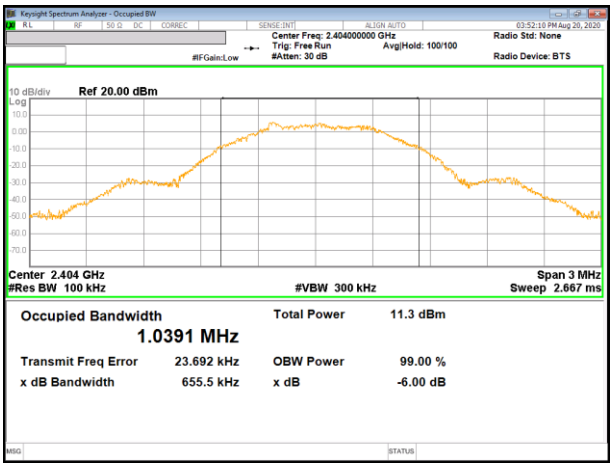
9.2.1. BLE (500kbps)

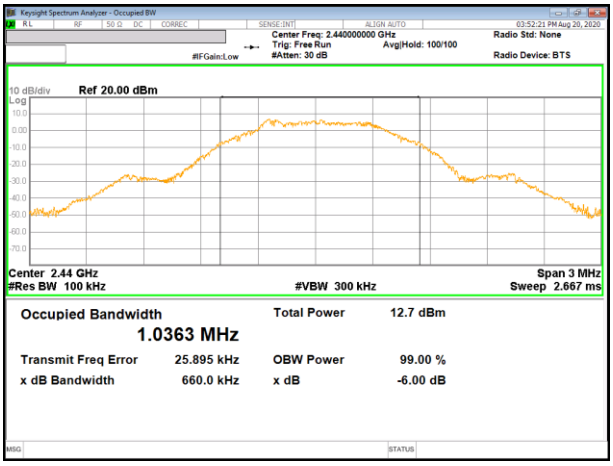
Channel	Frequency [MHz]	6 dB Bandwidth [kHz]	Minimum Limit [kHz]
0	2 402	671.1	500.0
1	2 404	655.5	500.0
19	2 440	660.0	500.0
39	2 480	647.4	500.0
Worst		647.4	500.0



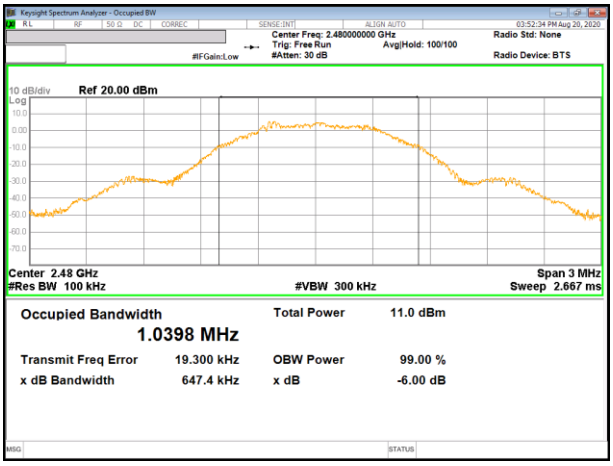
LOW CHANNEL (0 Ch.)



LOW CHANNEL (1 Ch.)



MID CHANNEL (19 Ch.)



HIGH CHANNEL (39 Ch.)

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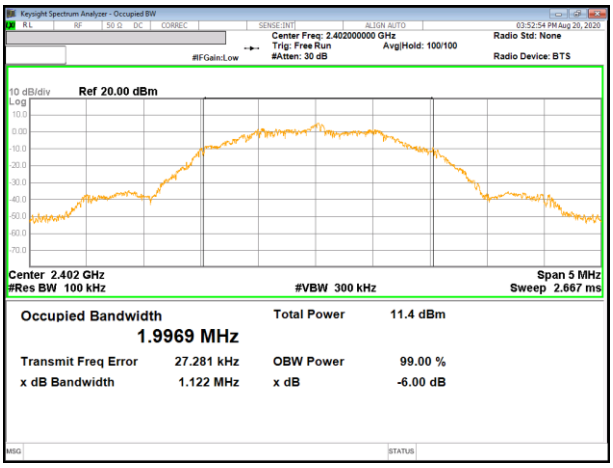
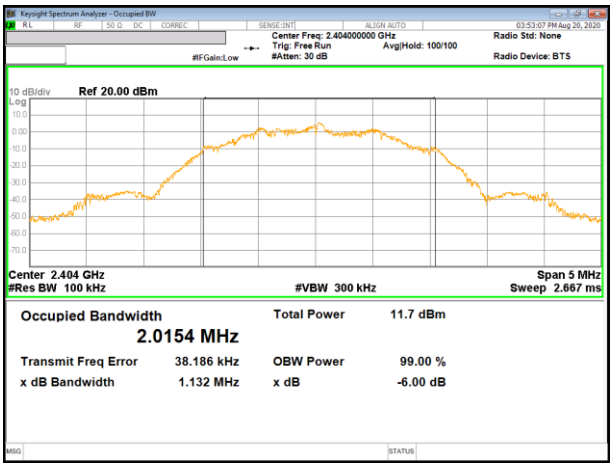
9.2.2. BLE (2Mbps)

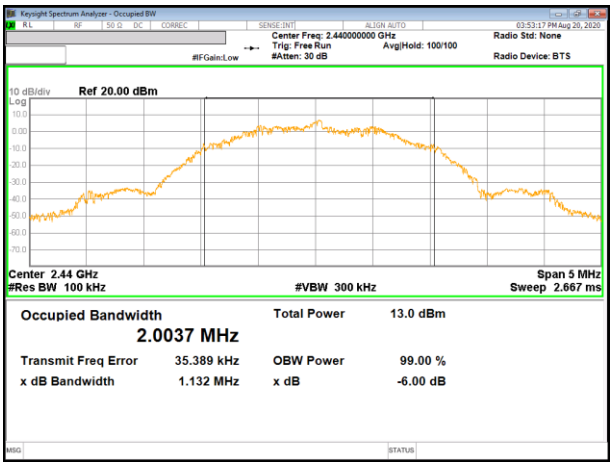
Channel	Frequency [MHz]	6 dB Bandwidth [kHz]	Minimum Limit [kHz]
0	2 402	1122.0	500.0
1	2 404	1132.0	500.0
19	2 440	1132.0	500.0
39	2 480	1143.0	500.0
Worst		1122.0	500.0



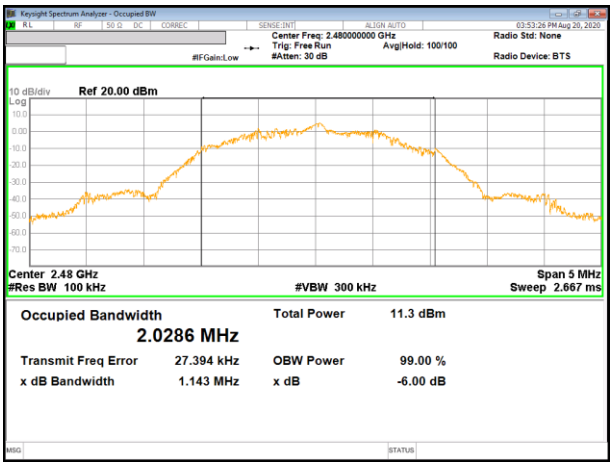
LOW CHANNEL (0 Ch.)



LOW CHANNEL (1 Ch.)



MID CHANNEL (19 Ch.)



HIGH CHANNEL (39 Ch.)

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9.3. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

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

- 500 kbps

Channel	Frequency [MHz]	Peak Power [dBm]	Limit [dBm]	Margin [dB]
0	2402	5.494	30.000	-24.506
1	2404	5.793	30.000	-24.207
19	2440	7.066	30.000	-22.934
39	2480	5.650	30.000	-24.350
Worst		7.066	30.000	-22.934

- 2 Mbps

Channel	Frequency [MHz]	Peak Power [dBm]	Limit [dBm]	Margin [dB]
0	2402	5.599	30.000	-24.401
1	2404	5.917	30.000	-24.083
19	2440	7.226	30.000	-22.774
39	2480	5.778	30.000	-24.222
Worst		7.226	30.000	-22.774

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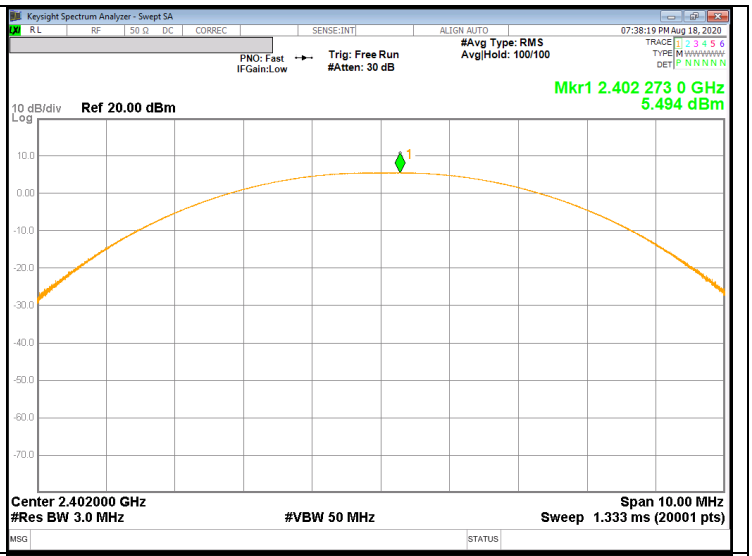
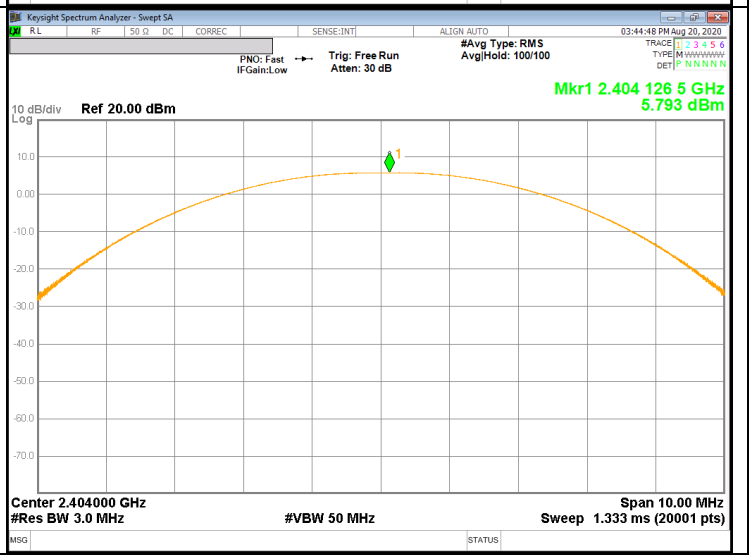
9.3.1. BLE (500 kbps)

PEAK OUTPUT POWER PLOTS

Low Ch 0.	
Low Ch 1.	

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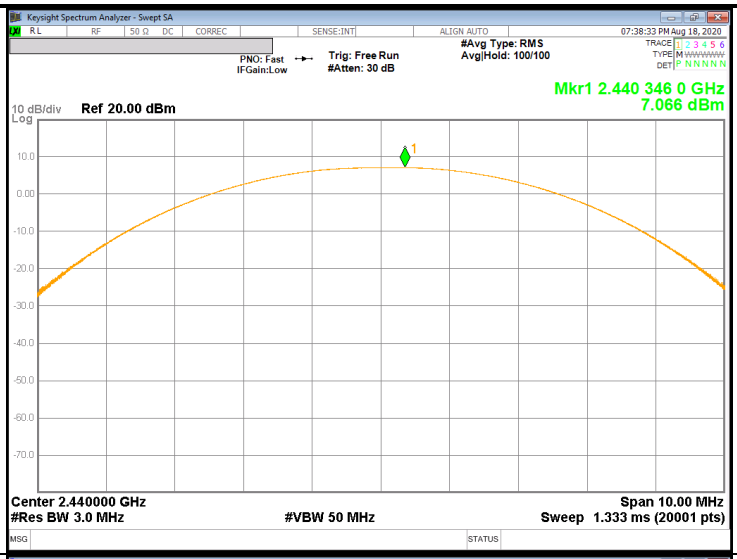
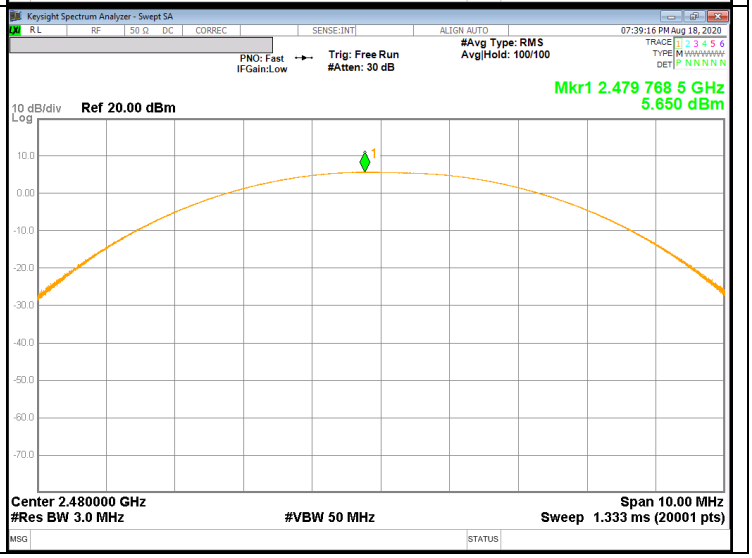
Middle Ch 19.	
High Ch 39.	

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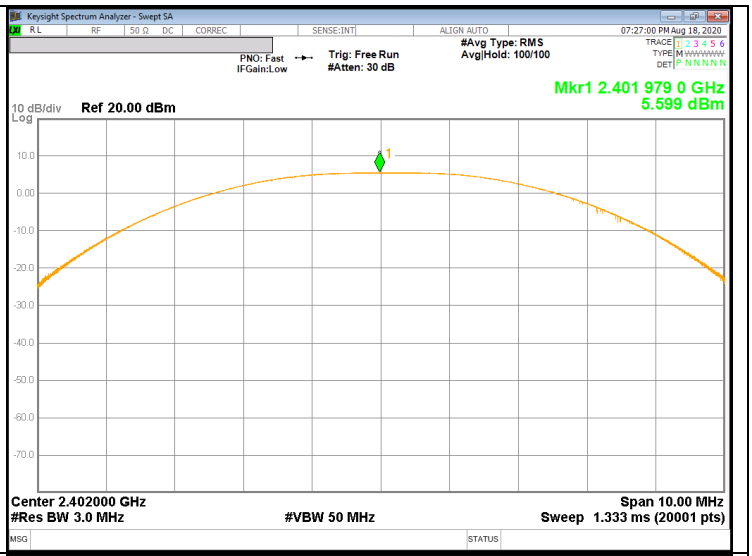
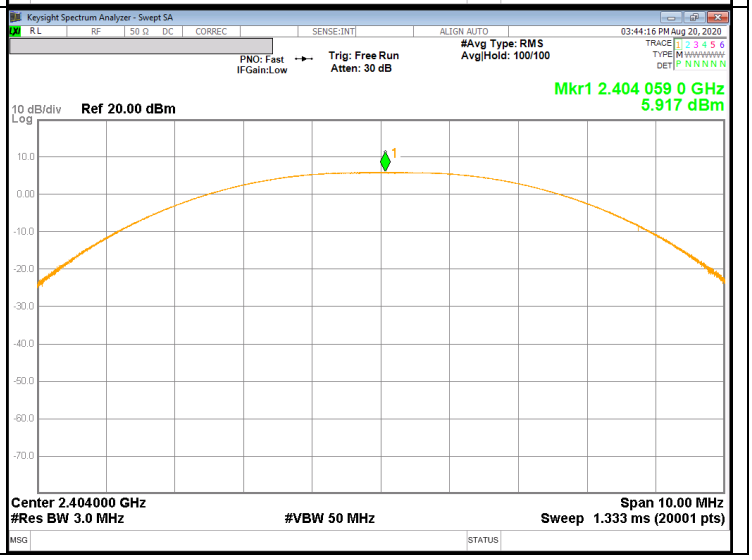
9.3.2. BLE (2 Mbps)

PEAK OUTPUT POWER PLOTS

Low Ch 0.	
Low Ch 1.	

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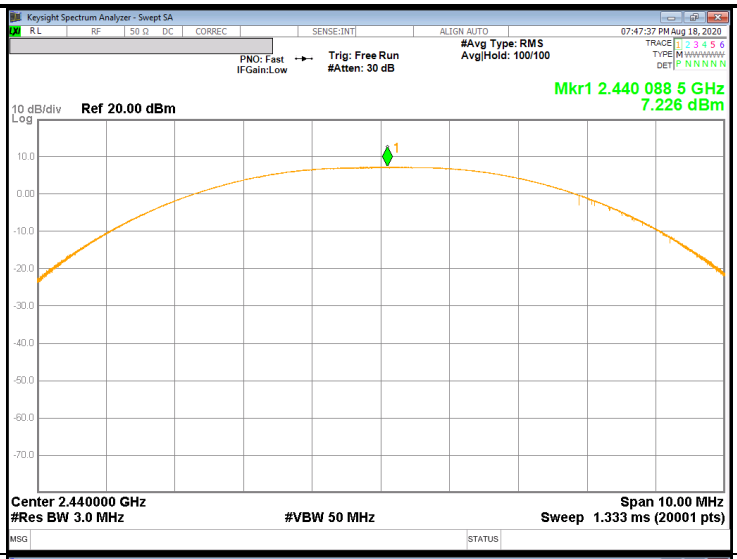
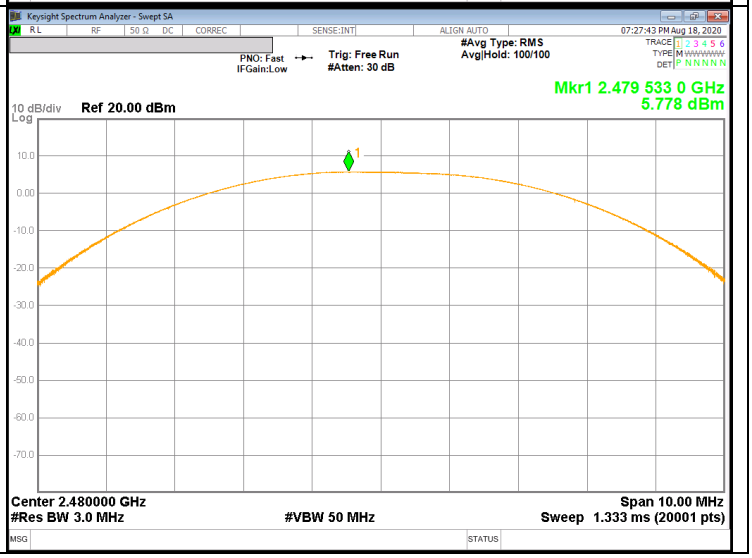
Middle Ch 19.	
High Ch 39.	

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9.4. 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.

- 500 kbps

Channel	Frequency [MHz]	AV Power [dBm]	AV Power [mW]
0	2402	5.239	3.341
1	2404	5.540	3.581
19	2440	**6.824**	**4.813**
39	2480	5.350	3.428

- 2 Mbps

Channel	Frequency [MHz]	AV Power [dBm]	AV Power [mW]
0	2402	4.973	3.143
1	2404	5.315	3.400
19	2440	**6.600**	**4.571**
39	2480	5.134	3.261

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9.5. 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.

RESULTS

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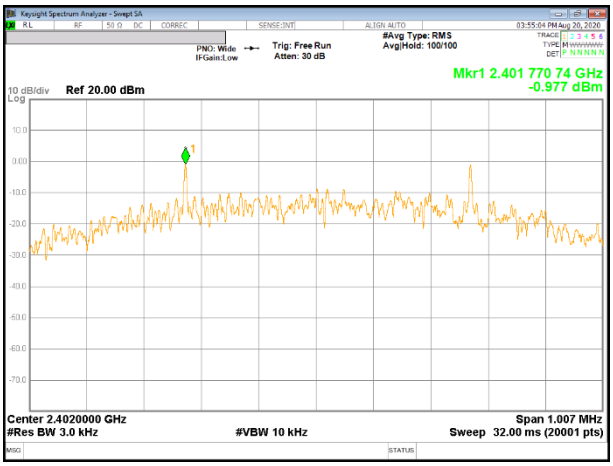
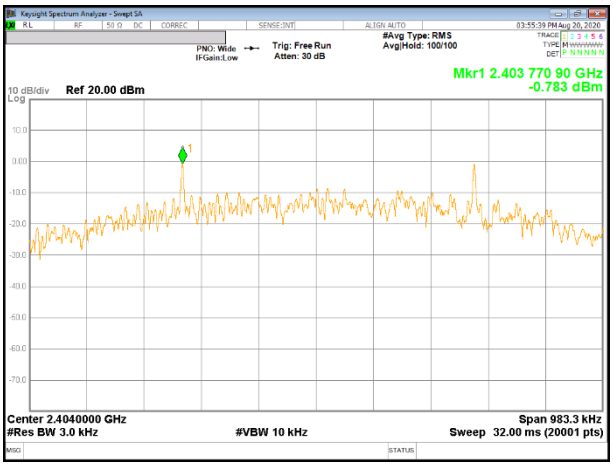
9.5.1. BLE (500 kbps)

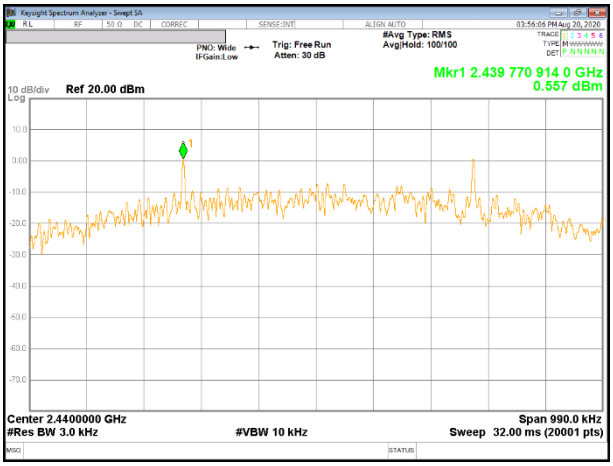
Channel	Frequency [MHz]	PSD [dBm/3kHz]	Limit [dBm/3kHz]	Margin [dB]
0	2402	-0.977	8.000	-8.977
1	2404	-0.783	8.000	-8.783
19	2440	0.557	8.000	-7.443
39	2480	-0.944	8.000	-8.944



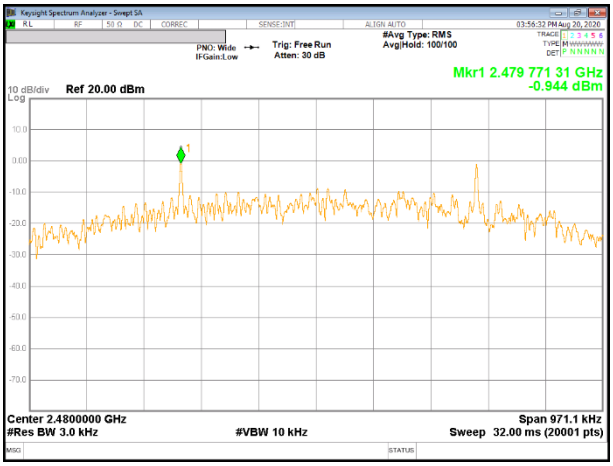
LOW CHANNEL (0 Ch.)



LOW CHANNEL (1 Ch.)



MID CHANNEL (19 Ch.)



HIGH CHANNEL (39 Ch.)

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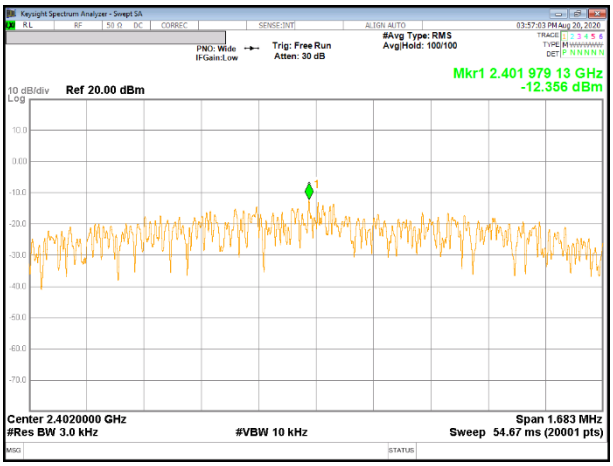
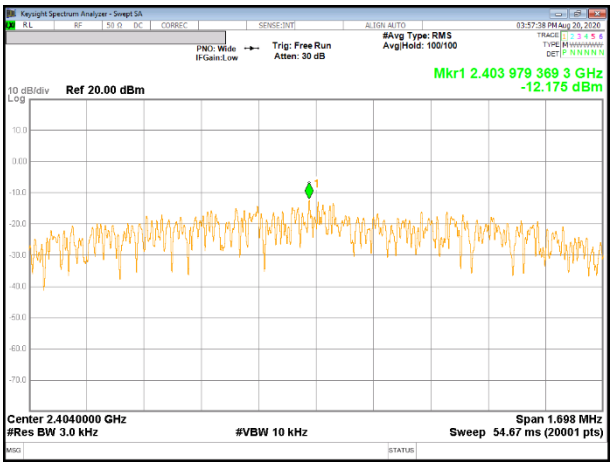
9.5.2. BLE (2Mbps)

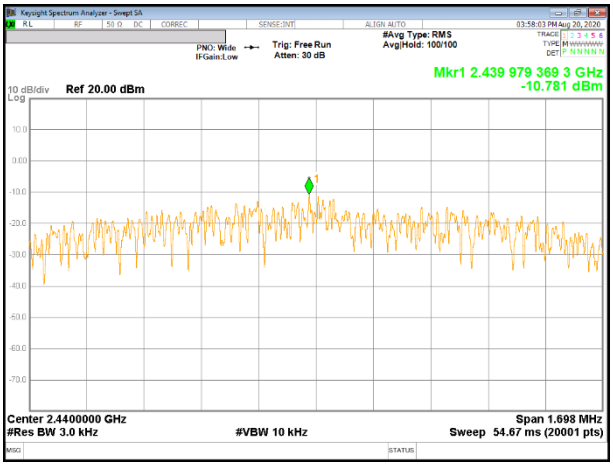
Channel	Frequency [MHz]	PSD [dBm/3kHz]	Limit [dBm/3kHz]	Margin [dB]
0	2402	-12.356	8.000	-20.356
1	2404	-12.175	8.000	-20.175
19	2440	-10.781	8.000	-18.781
39	2480	-12.340	8.000	-20.340



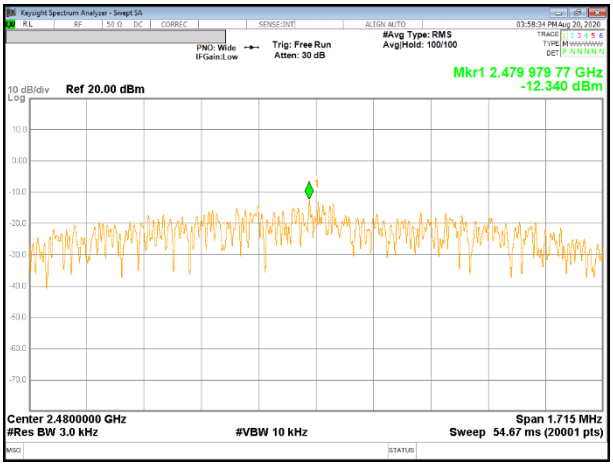
LOW CHANNEL (0 Ch.)



LOW CHANNEL (1 Ch.)



MID CHANNEL (19 Ch.)



HIGH CHANNEL (39 Ch.)

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9.6. 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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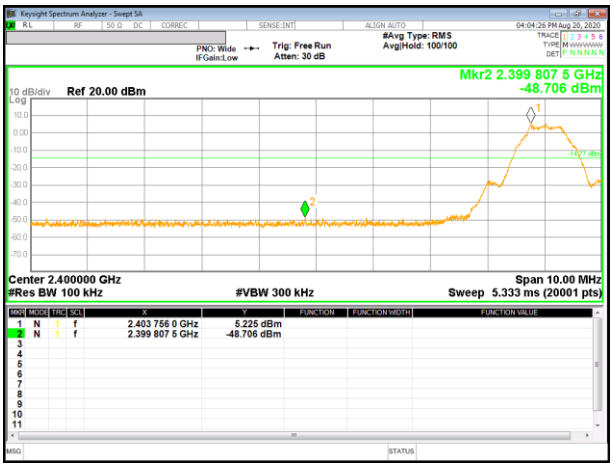
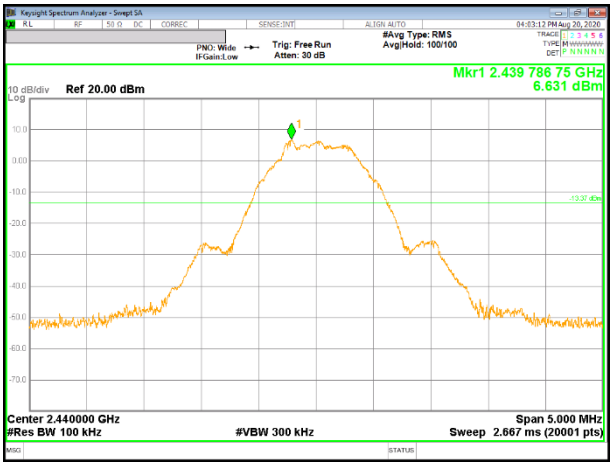
9.6.1. BLE (500 kbps)

LOW CHANNEL(0 Ch.) BANDEDGE



LOW CHANNEL(1 Ch.) BANDEDGE

OUT-OF-BAND LOW CHANNEL(1 Ch.)



IN-BAND REFERENCE LEVEL

OUT-OF-BAND MID CHANNEL(19 Ch.)

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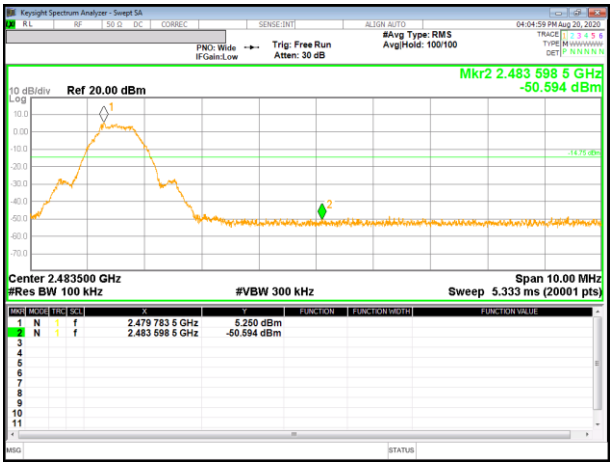

HIGH CHANNEL BANDEDGE(39 Ch.)

OUT-OF-BAND HIGH CHANNEL(39 Ch.)

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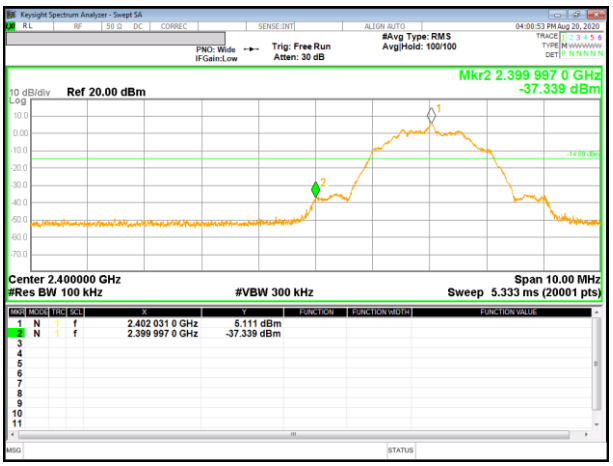
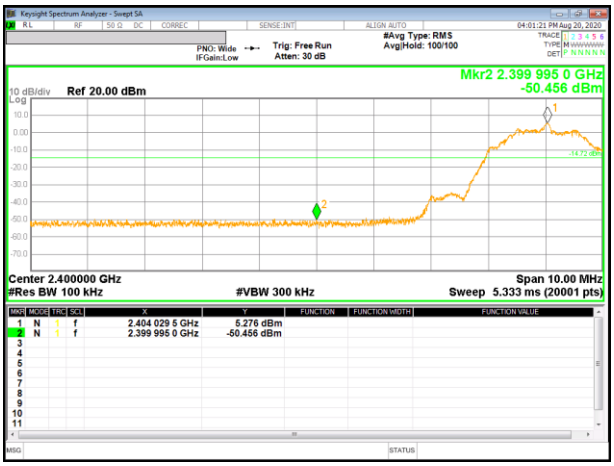
9.6.2. BLE (2Mbps)

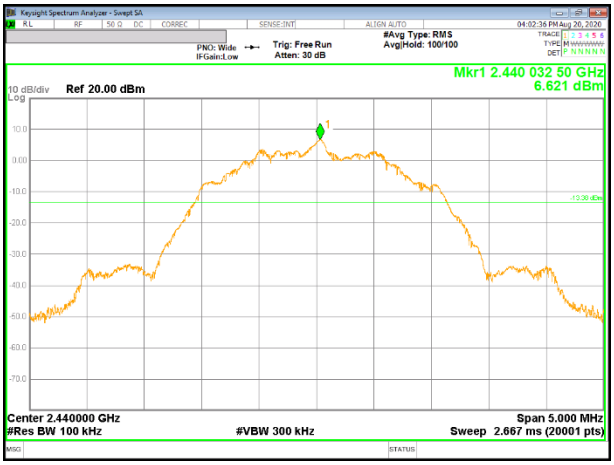


LOW CHANNEL(0 Ch.) BANDEDGE



LOW CHANNEL(1 Ch.) BANDEDGE

OUT-OF-BAND LOW CHANNEL(1 Ch.)



IN-BAND REFERENCE LEVEL

OUT-OF-BAND MID CHANNEL(19 Ch.)

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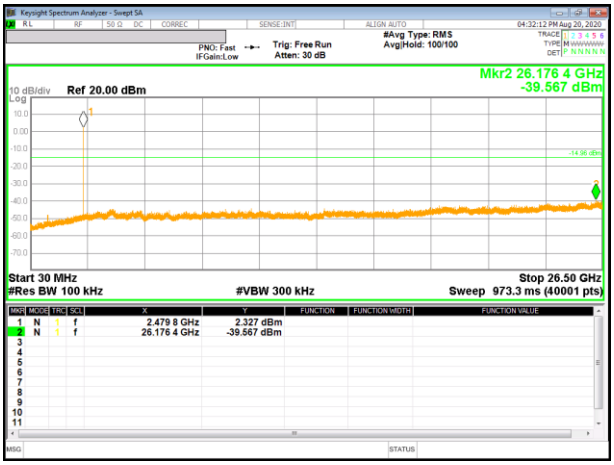
HIGH CHANNEL BANDEDGE(39 Ch.)



OUT-OF-BAND HIGH CHANNEL(39 Ch.)

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10. RADIATED TEST RESULTS

10.1. 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.

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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.

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: For 500kbps, DCF = 10log(1/0.567)= 2.464 dB (Spectrum Analyzer round it up to 2.46 dB) and for 2Mbps, DCF = 10log(1/0.323)= 4.907 dB (Spectrum Analyzer round it up to 4.91 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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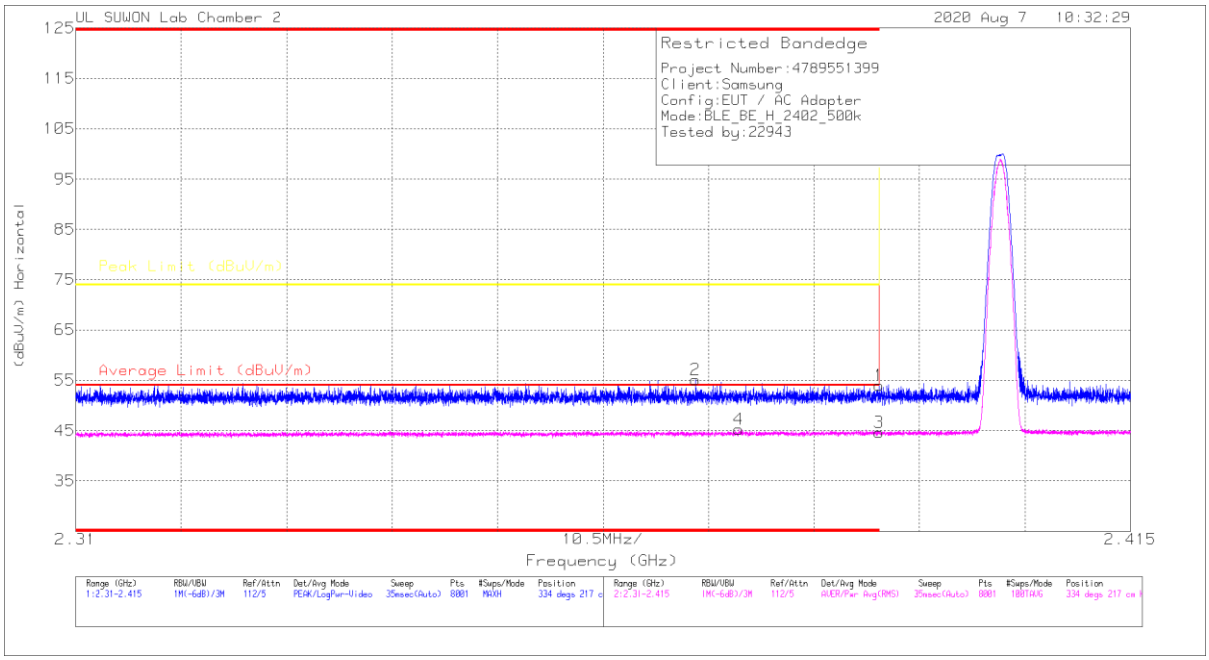
10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. BLE (500kbps)

BANDEDGE (LOW CHANNEL 0)

HORIZONTAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	10dB_ATT[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	42.64	Pk	31.9	-20.6	0	53.94	-	-	74	-20.06	334	217	H
2	* 2.37173	44	Pk	31.8	-20.7	0	55.1	-	-	74	-18.9	334	217	H
3	* 2.39	30.86	RMS	31.9	-20.6	2.46	44.62	54	-9.38	-	-	334	217	H
4	* 2.37601	31.51	RMS	31.9	-20.6	2.46	45.27	54	-8.73	-	-	334	217	H

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

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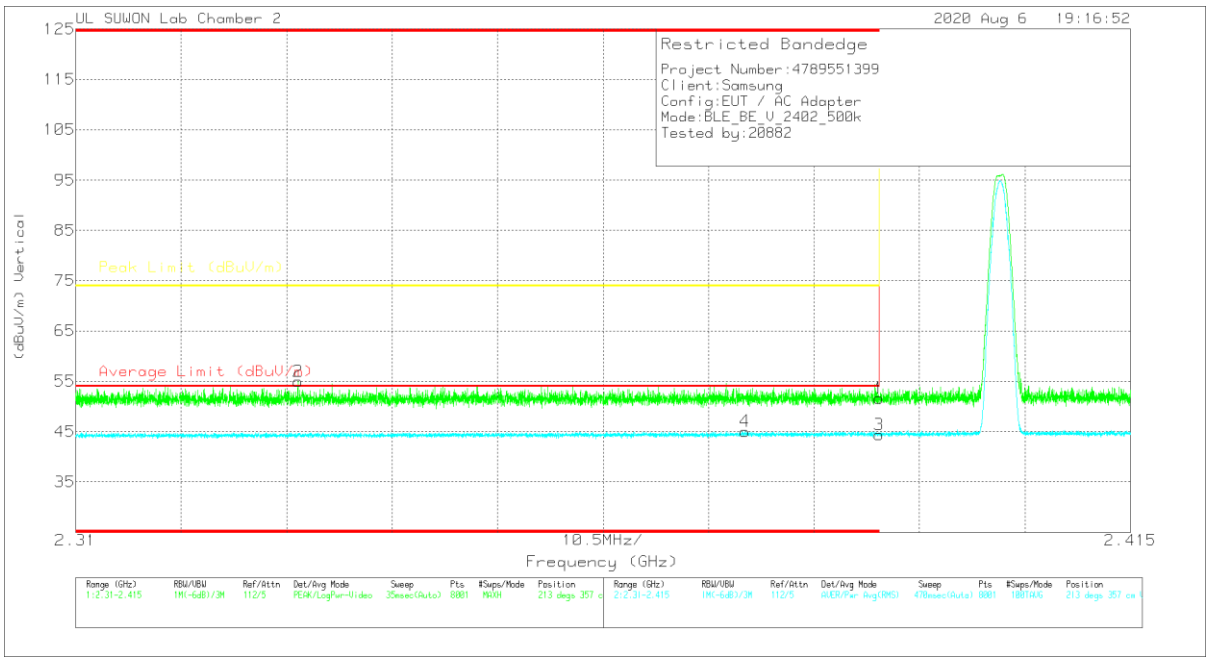
VERTICAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	10dB_ATT[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	40.27	Pk	31.9	-20.6	0	51.57	-	-	74	-22.43	213	357	V
2	* 2.33212	43.85	Pk	31.8	-20.7	0	54.95	-	-	74	-19.05	213	357	V
3	* 2.39	30.61	RMS	31.9	-20.6	2.46	44.37	54	-9.63	-	-	213	357	V
4	* 2.37662	31.32	RMS	31.9	-20.6	2.46	45.08	54	-8.92	-	-	213	357	V

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

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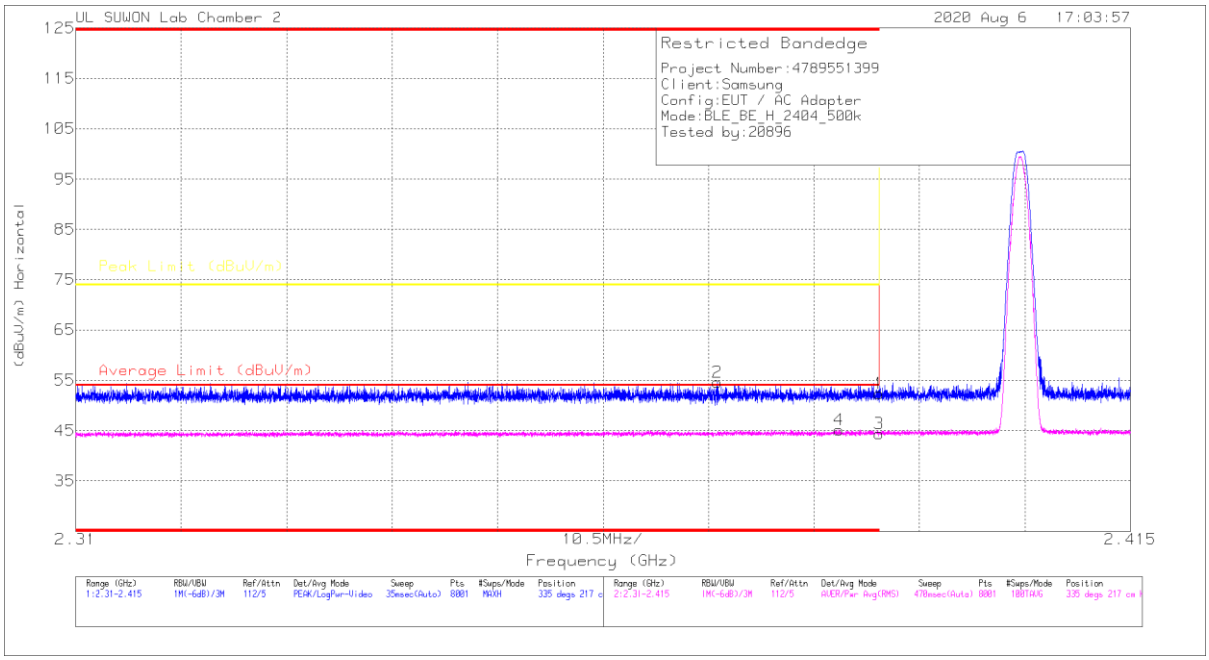
BANDEDGE (LOW CHANNEL 1)

HORIZONTAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	10dB_ATT[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	41.1	Pk	31.9	-20.6	0	52.4	-	-	74	-21.6	335	217	H
2	* 2.37391	43.46	Pk	31.9	-20.7	0	54.66	-	-	74	-19.34	335	217	H
3	* 2.39	30.64	RMS	31.9	-20.6	2.46	44.4	54	-9.6	-	-	335	217	H
4	* 2.38598	31.4	RMS	31.9	-20.6	2.46	45.16	54	-8.84	-	-	335	217	H

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

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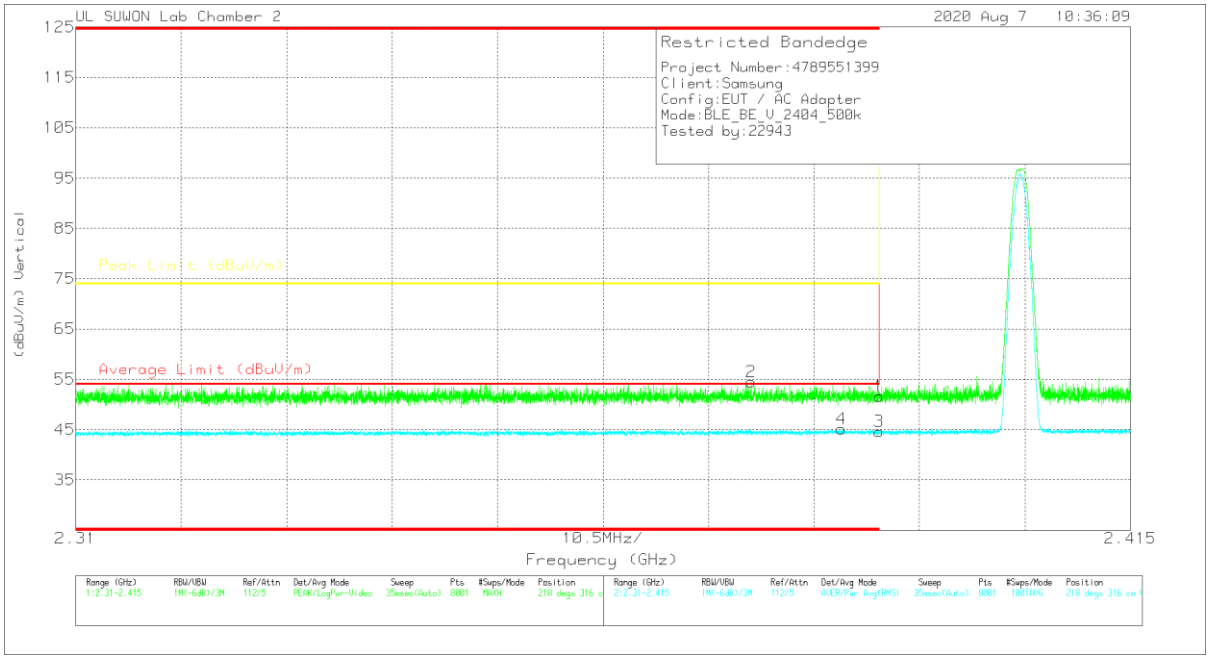
VERTICAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	10dB_ATT[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	40.27	Pk	31.9	-20.6	0	51.57	-	-	74	-22.43	218	316	V
2	* 2.37724	43.17	Pk	31.9	-20.6	0	54.47	-	-	74	-19.53	218	316	V
3	* 2.39	30.85	RMS	31.9	-20.6	2.46	44.61	54	-9.39	-	-	218	316	V
4	* 2.38626	31.39	RMS	31.9	-20.6	2.46	45.15	54	-8.85	-	-	218	316	V

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

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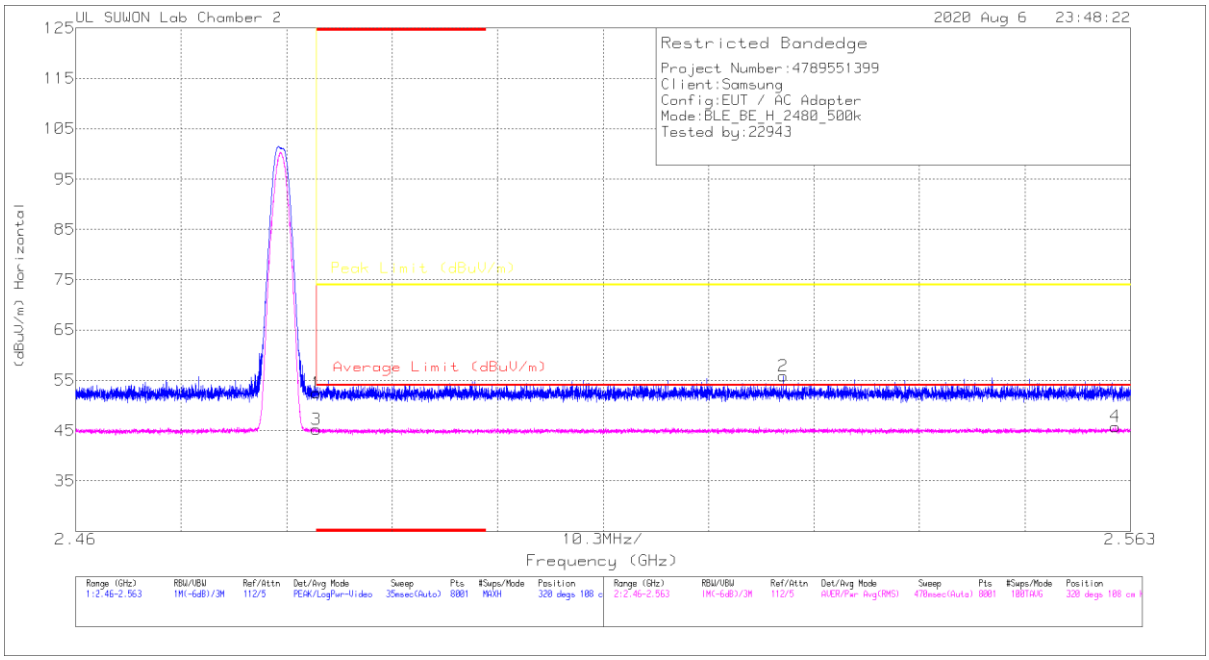
BANDEDGE (HIGH CHANNEL 39)

HORIZONTAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	10dB_ATT[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	40.93	Pk	32	-20.4	0	52.53	-	-	74	-21.47	320	108	H
2	2.5291	44.19	Pk	32.1	-20.4	0	55.89	-	-	74	-18.11	320	108	H
3	* 2.48351	31.23	RMS	32	-20.4	2.46	45.29	54	-8.71	-	-	320	108	H
4	2.56156	31.57	RMS	32.2	-20.4	2.46	45.83	54	-8.17	-	-	320	108	H

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

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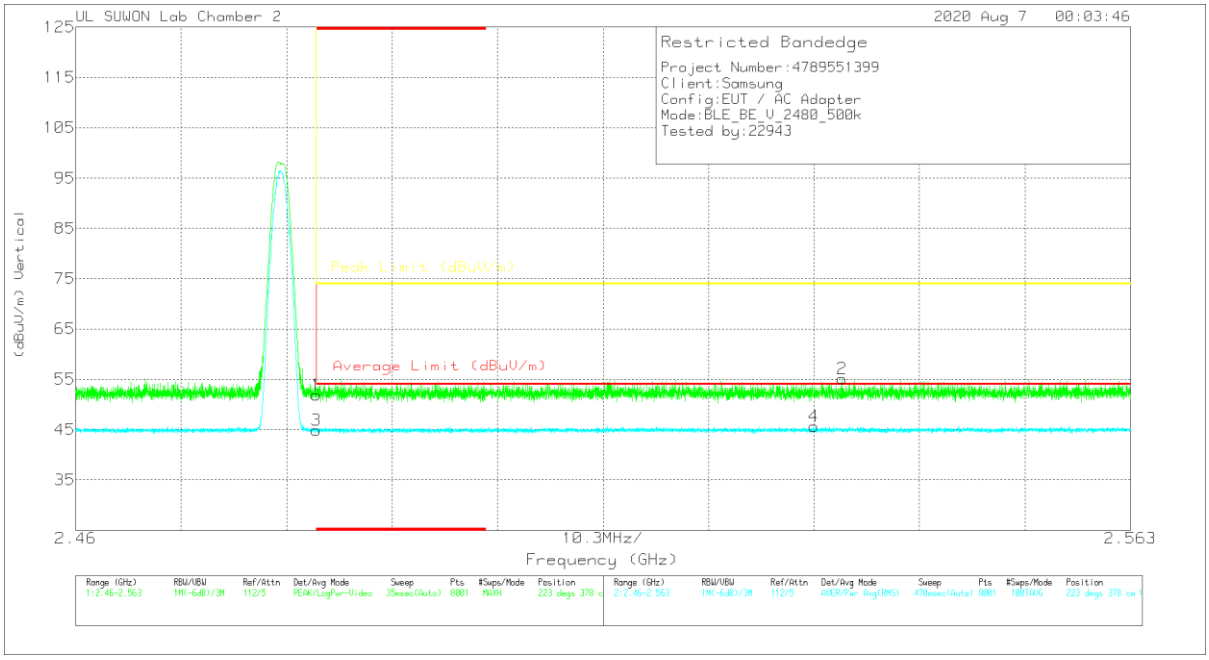
VERTICAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	10dB_ATT[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	40.32	Pk	32	-20.4	0	51.92	-	-	74	-22.08	223	378	V
2	2.53484	43.42	Pk	32.1	-20.4	0	55.12	-	-	74	-18.88	223	378	V
3	* 2.48351	30.85	RMS	32	-20.4	2.46	44.91	54	-9.09	-	-	223	378	V
4	2.53211	31.5	RMS	32.1	-20.4	2.46	45.66	54	-8.34	-	-	223	378	V

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

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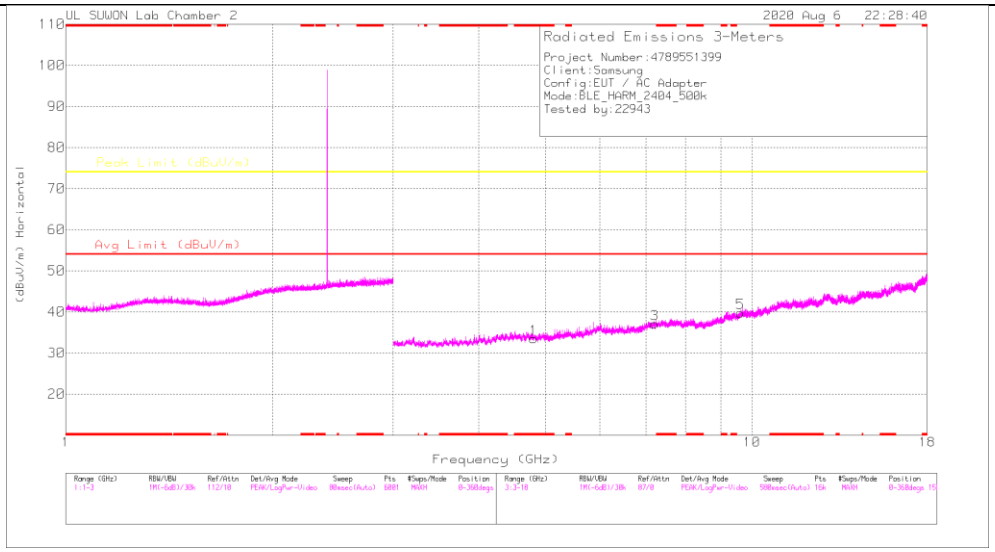
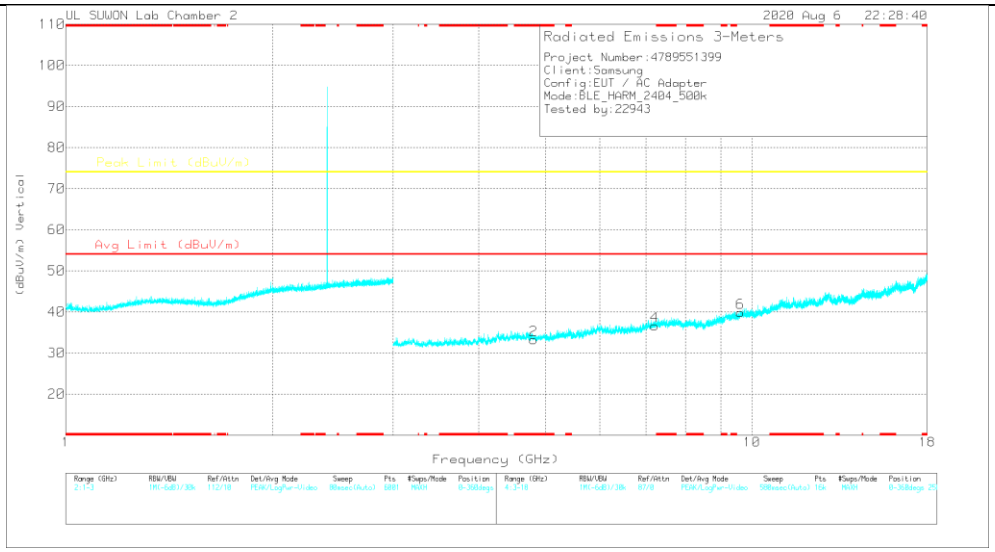
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	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
* 4.80892	36.19	PK2	34.1	-28	0	42.29	-	-	74	-31.71	360	100	H
* 4.80858	37.3	PK2	34.1	-28	0	43.4	-	-	74	-30.6	360	100	V
7.21261	35.41	PK2	36.2	-25.3	0	46.31	-	-	74	-27.69	360	100	H
7.21181	34.8	PK2	36.2	-25.3	0	45.7	-	-	74	-28.3	360	100	V
9.6162	33.28	PK2	37	-21.6	0	48.68	-	-	74	-25.32	360	100	H
9.61646	32.98	PK2	37	-21.6	0	48.38	-	-	74	-25.62	360	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak

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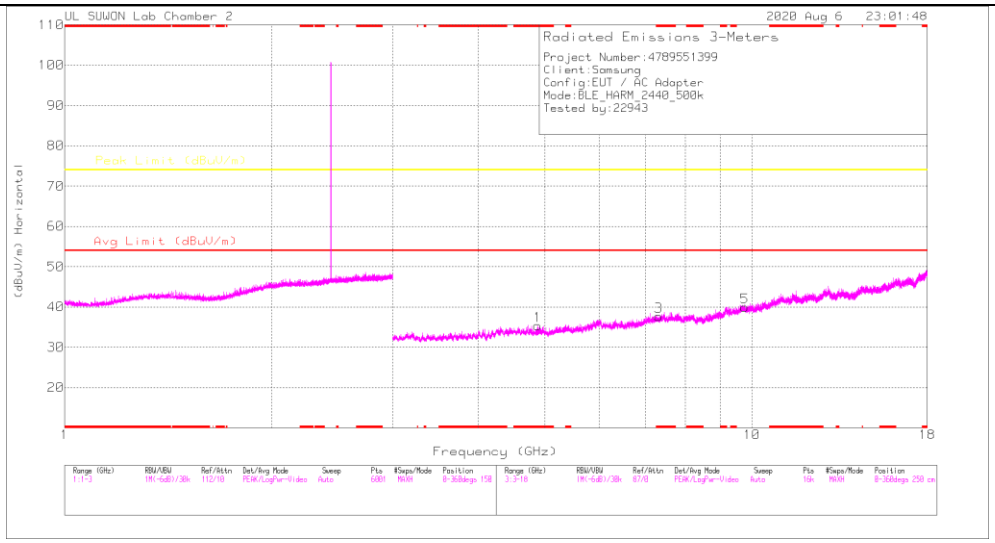
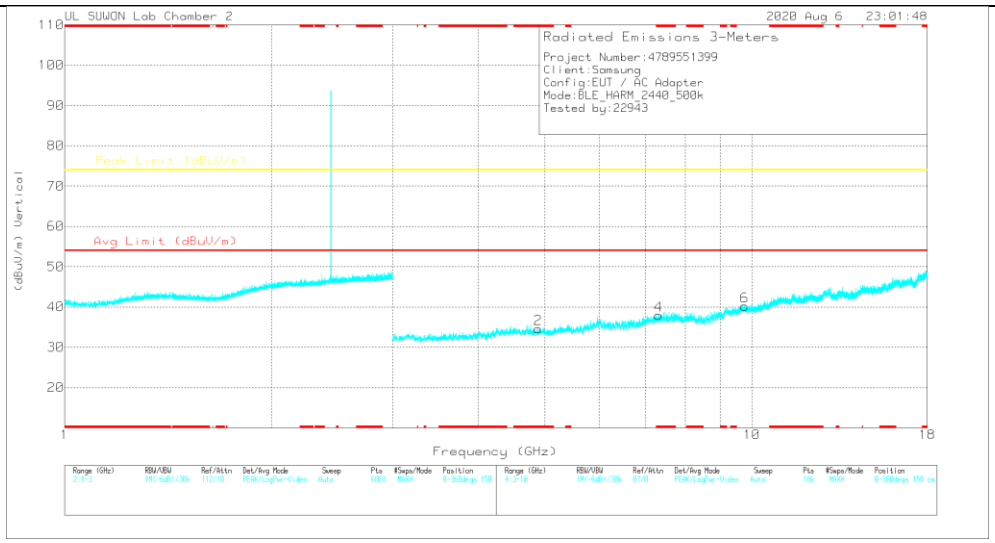
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	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
* 4.8788	36.8	PK2	34.1	-27.8	0	43.1	-	-	74	-30.9	360	100	H
* 4.88048	36.9	PK2	34.1	-27.8	0	43.2	-	-	74	-30.8	360	100	V
* 7.31867	35.61	PK2	36.1	-24.8	0	46.91	-	-	74	-27.09	360	100	H
* 7.32047	35.08	PK2	36.1	-24.8	0	46.38	-	-	74	-27.62	360	100	V
9.75955	32.68	PK2	37.2	-21.2	0	48.68	-	-	74	-25.32	360	100	H
9.75889	32.49	PK2	37.2	-21.2	0	48.49	-	-	74	-25.51	360	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak

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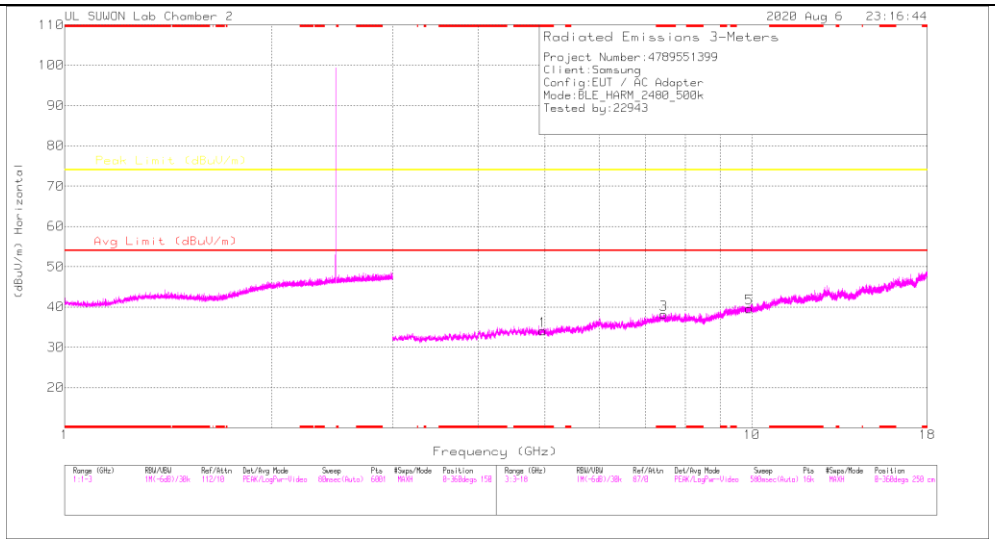
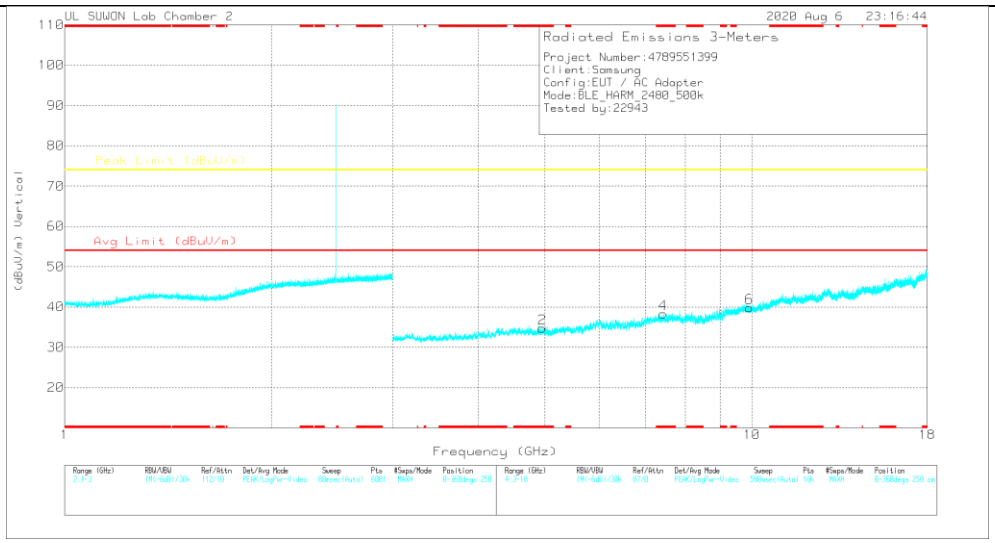
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	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
* 4.95962	36.73	PK2	34.1	-27	0	43.83	-	-	74	-30.17	360	100	H
* 4.96047	36.12	PK2	34.1	-27	0	43.22	-	-	74	-30.78	360	100	V
* 7.44028	33.98	PK2	36	-23.9	0	46.08	-	-	74	-27.92	360	100	H
* 7.44012	34.53	PK2	36	-23.9	0	46.63	-	-	74	-27.37	360	100	V
9.91893	31.94	PK2	37.4	-20.9	0	48.44	-	-	74	-25.56	360	100	H
9.91981	31.87	PK2	37.4	-20.9	0	48.37	-	-	74	-25.63	360	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak

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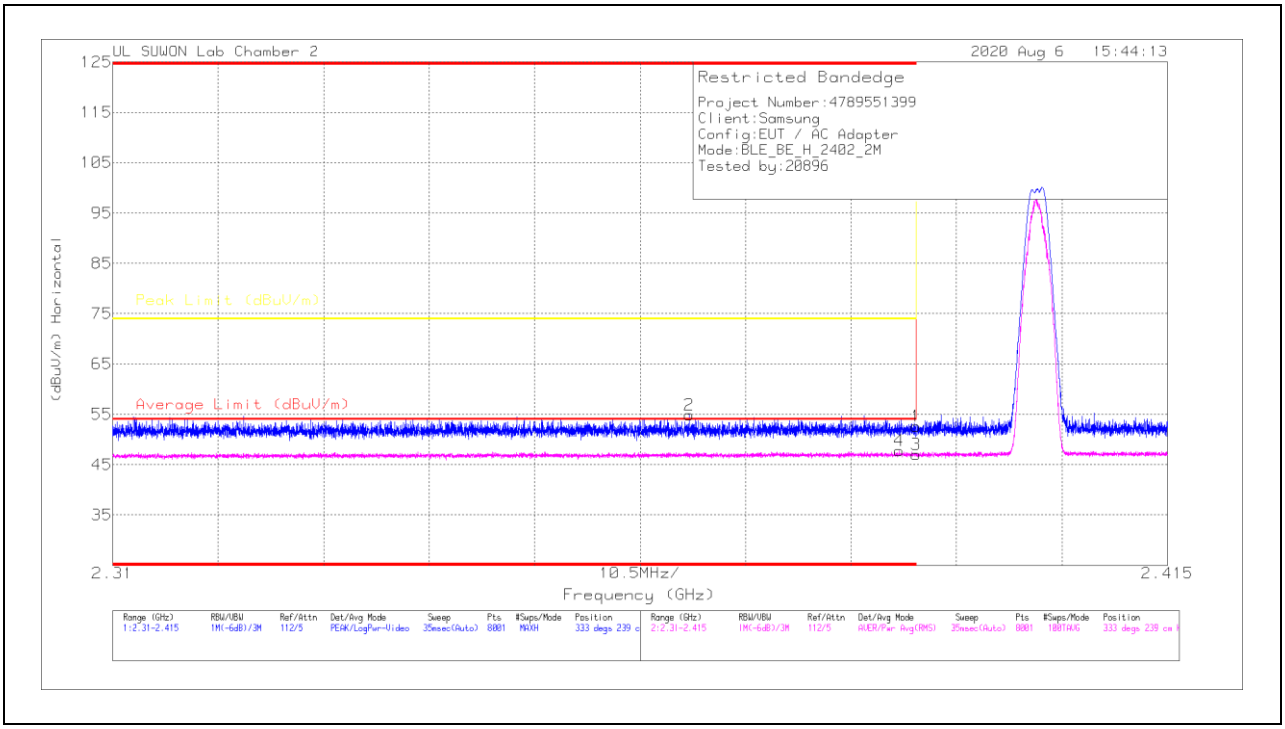
10.2.2. BLE (2Mbps)

BANDEDGE (LOW CHANNEL 0)

HORIZONTAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	10dB_ATT[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	41.36	Pk	31.9	-20.6	0	52.66	-	-	74	-21.34	333	239	H
2	* 2.36737	43.71	Pk	31.8	-20.6	0	54.91	-	-	74	-19.09	333	239	H
3	* 2.39	30.82	RMS	31.9	-20.6	4.91	47.03	54	-6.97	-	-	333	239	H
4	* 2.38829	31.61	RMS	31.9	-20.6	4.91	47.82	54	-6.18	-	-	333	239	H

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

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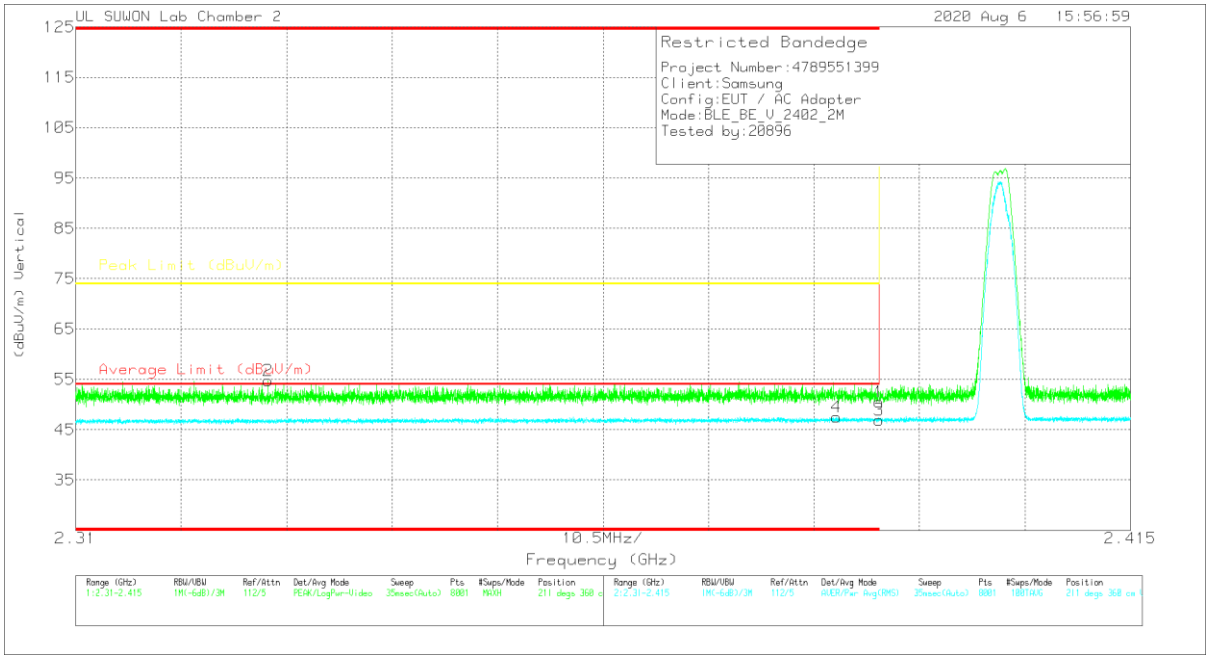
VERTICAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	10dB_ATT[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	39.16	Pk	31.9	-20.6	0	50.46	-	-	74	-23.54	211	360	V
2	* 2.32915	43.65	Pk	31.8	-20.7	0	54.75	-	-	74	-19.25	211	360	V
3	* 2.39	30.74	RMS	31.9	-20.6	4.91	46.95	54	-7.05	-	-	211	360	V
4	* 2.38573	31.36	RMS	31.9	-20.6	4.91	47.57	54	-6.43	-	-	211	360	V

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

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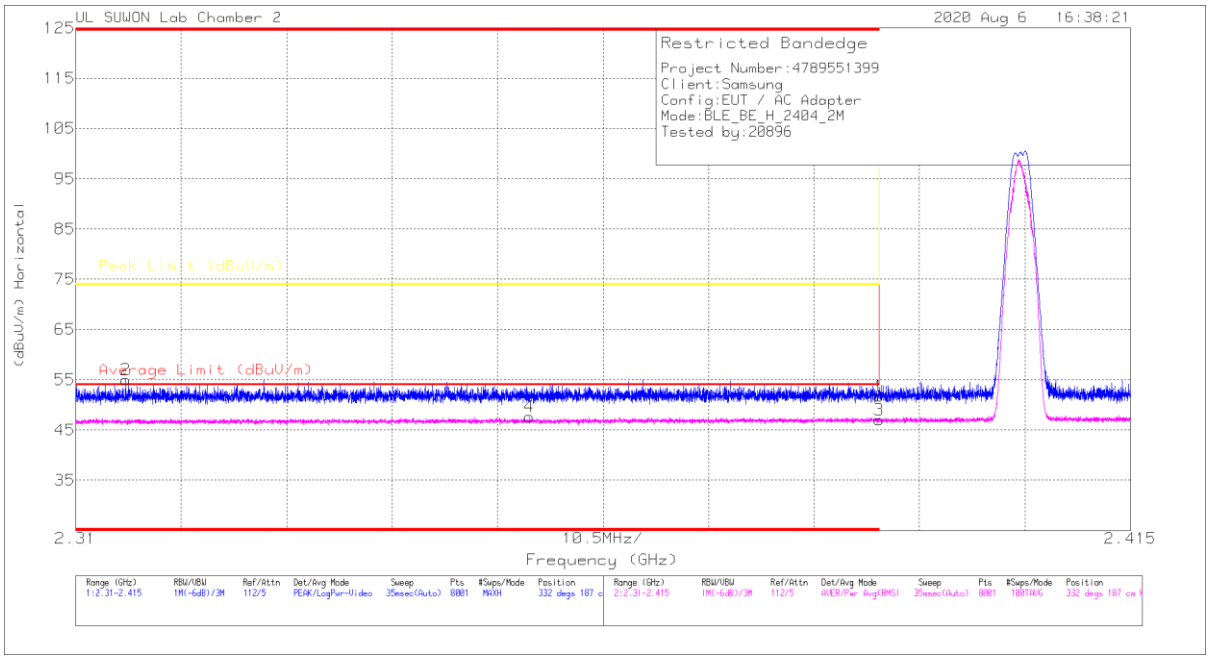
BANDEDGE (LOW CHANNEL 1)

HORIZONTAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	10dB_ATT[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	40.43	Pk	31.9	-20.6	0	51.73	-	-	74	-22.27	332	187	H
2	* 2.31496	44.09	Pk	31.7	-20.8	0	54.99	-	-	74	-19.01	332	187	H
3	* 2.39	30.77	RMS	31.9	-20.6	4.91	46.98	54	-7.02	-	-	332	187	H
4	* 2.35516	31.63	RMS	31.8	-20.7	4.91	47.64	54	-6.36	-	-	332	187	H

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

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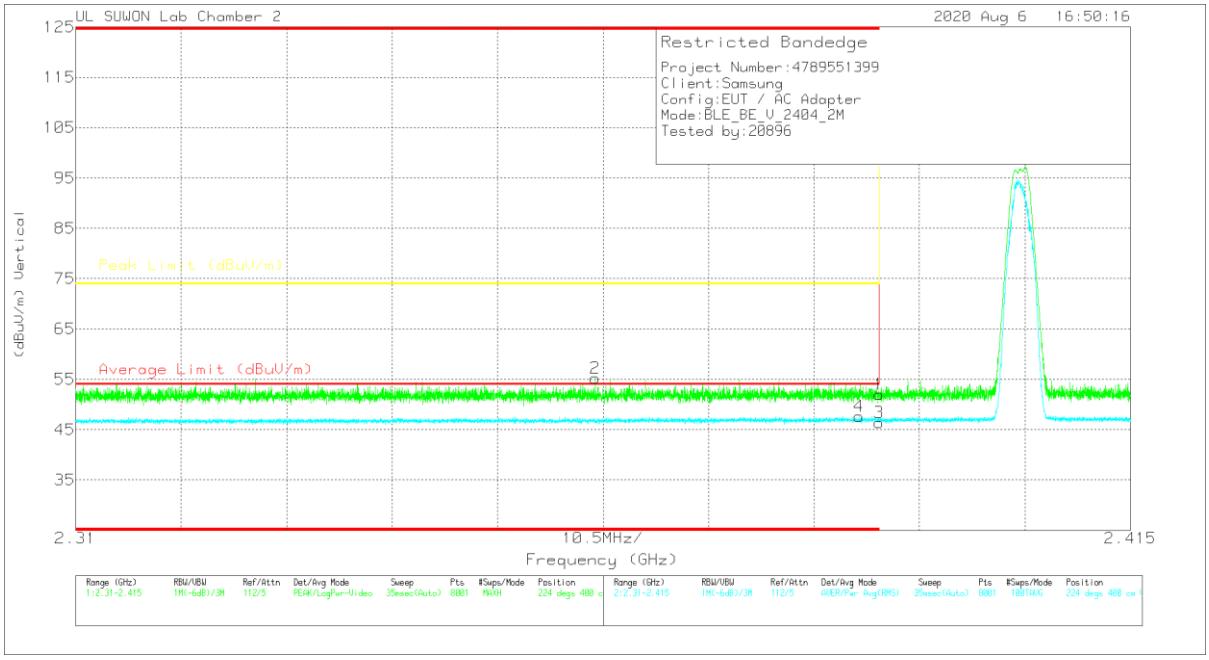
VERTICAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	10dB_ATT[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	40.71	Pk	31.9	-20.6	0	52.01	-	-	74	-21.99	224	400	V
2	* 2.36173	44.14	Pk	31.8	-20.7	0	55.24	-	-	74	-18.76	224	400	V
3	* 2.39	30.22	RMS	31.9	-20.6	4.91	46.43	54	-7.57	-	-	224	400	V
4	* 2.38796	31.43	RMS	31.9	-20.6	4.91	47.64	54	-6.36	-	-	224	400	V

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

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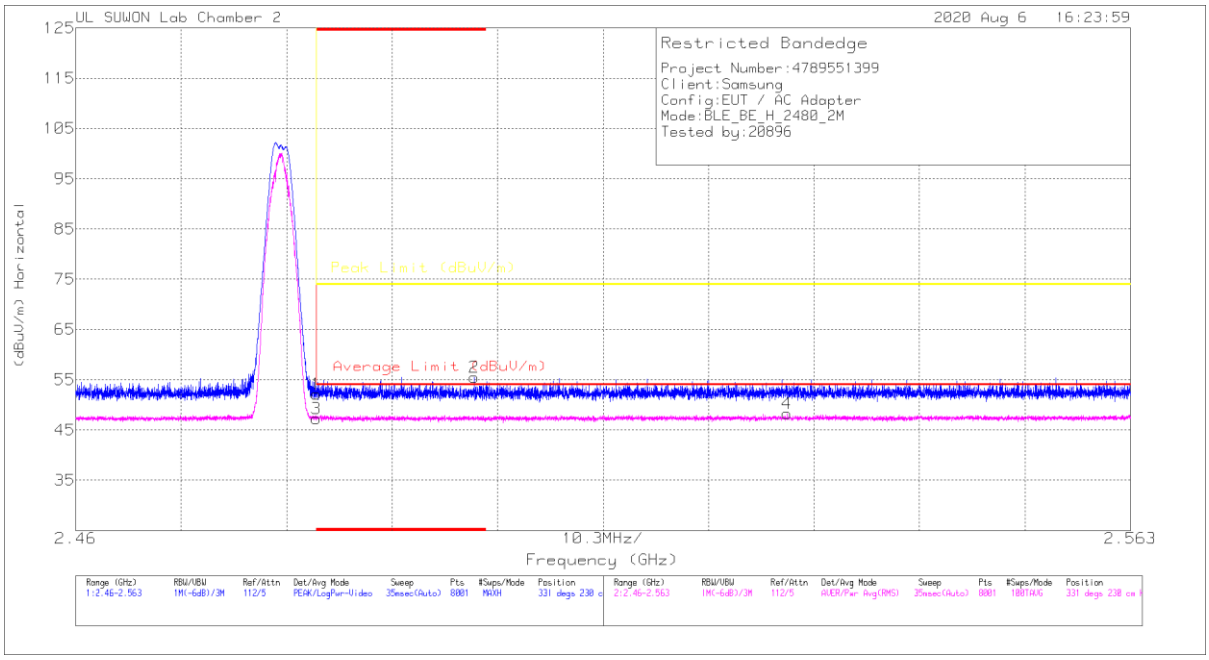
BANDEDGE (HIGH CHANNEL 39)

HORIZONTAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	10dB_ATT[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	40.52	Pk	32	-20.4	0	52.12	-	-	74	-21.88	331	230	H
2	* 2.49892	43.92	Pk	32.1	-20.5	0	55.52	-	-	74	-18.48	331	230	H
3	* 2.48351	30.79	RMS	32	-20.4	4.91	47.3	54	-6.7	-	-	331	230	H
4	2.52947	31.63	RMS	32.1	-20.4	4.91	48.24	54	-5.76	-	-	331	230	H

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

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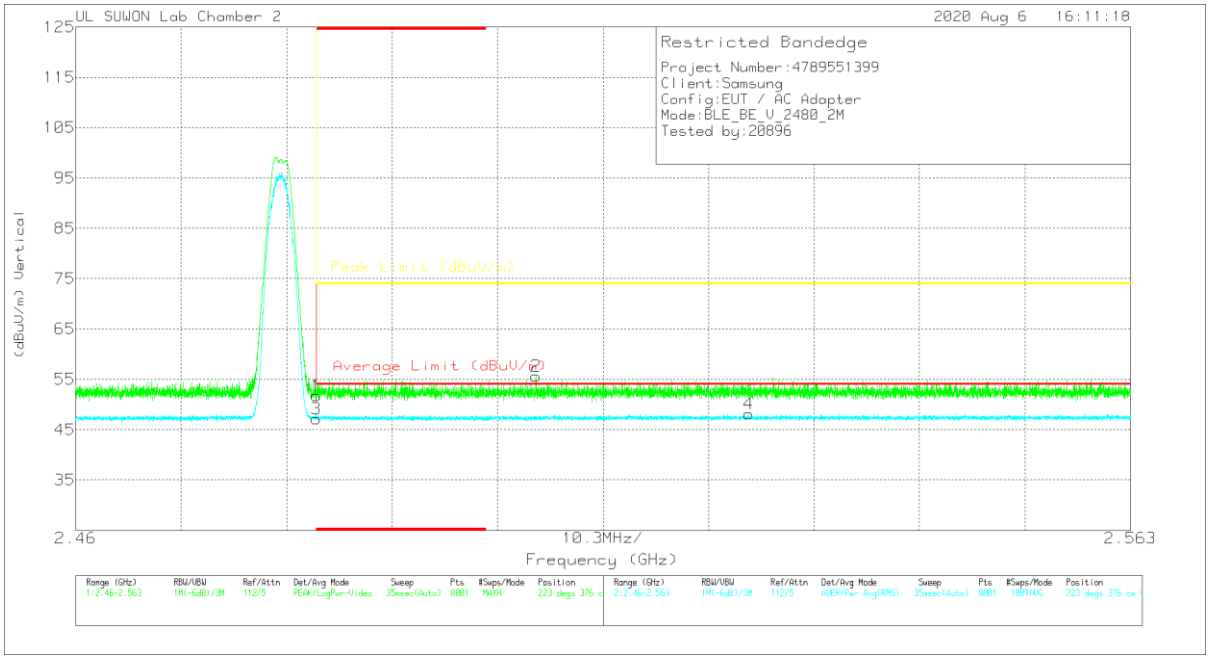
VERTICAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	10dB_ATT[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	40.1	Pk	32	-20.4	0	51.7	-	-	74	-22.3	223	376	V
2	2.50495	43.96	Pk	32.1	-20.5	0	55.56	-	-	74	-18.44	223	376	V
3	* 2.48351	30.59	RMS	32	-20.4	4.91	47.1	54	-6.9	-	-	223	376	V
4	2.52575	31.6	RMS	32.1	-20.5	4.91	48.11	54	-5.89	-	-	223	376	V

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

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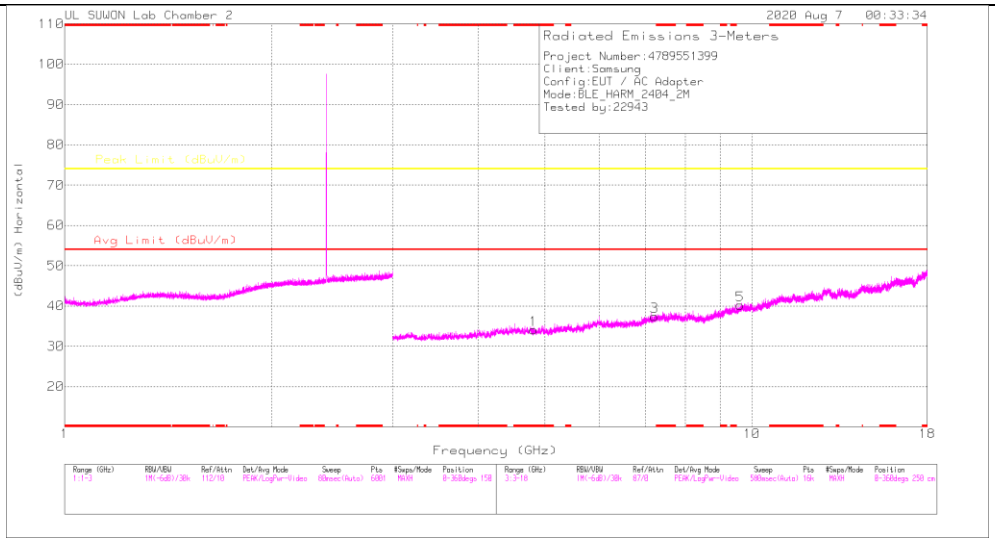
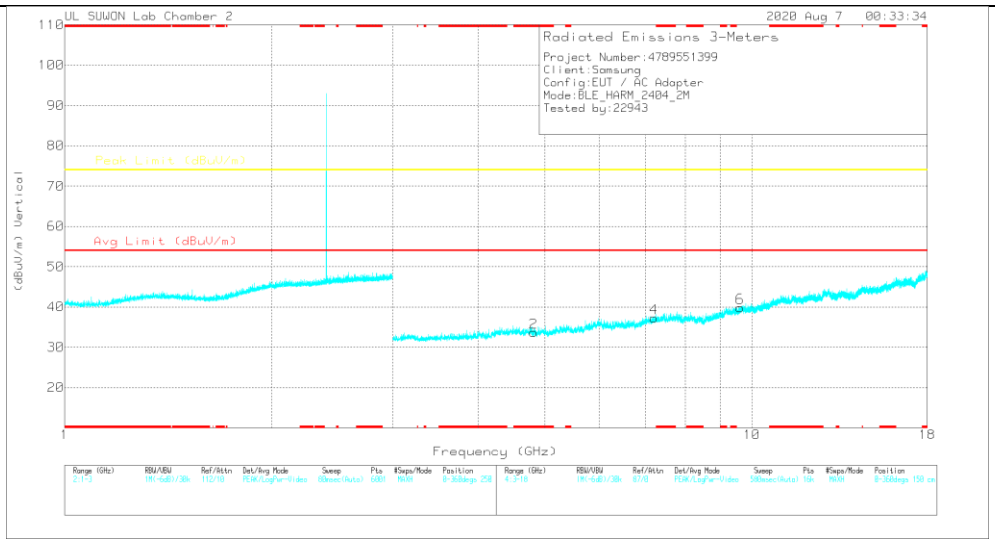
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	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
* 4.80929	36.92	PK2	34.1	-28	0	43.02	-	-	74	-30.98	360	100	H
* 4.80777	36.39	PK2	34.1	-28	0	42.49	-	-	74	-31.51	360	100	V
7.21385	34.98	PK2	36.2	-25.3	0	45.88	-	-	74	-28.12	360	100	H
7.21121	35.12	PK2	36.2	-25.3	0	46.02	-	-	74	-27.98	360	100	V
9.61458	33.43	PK2	37	-21.6	0	48.83	-	-	74	-25.17	360	100	H
9.61743	33.84	PK2	37	-21.6	0	49.24	-	-	74	-24.76	360	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak

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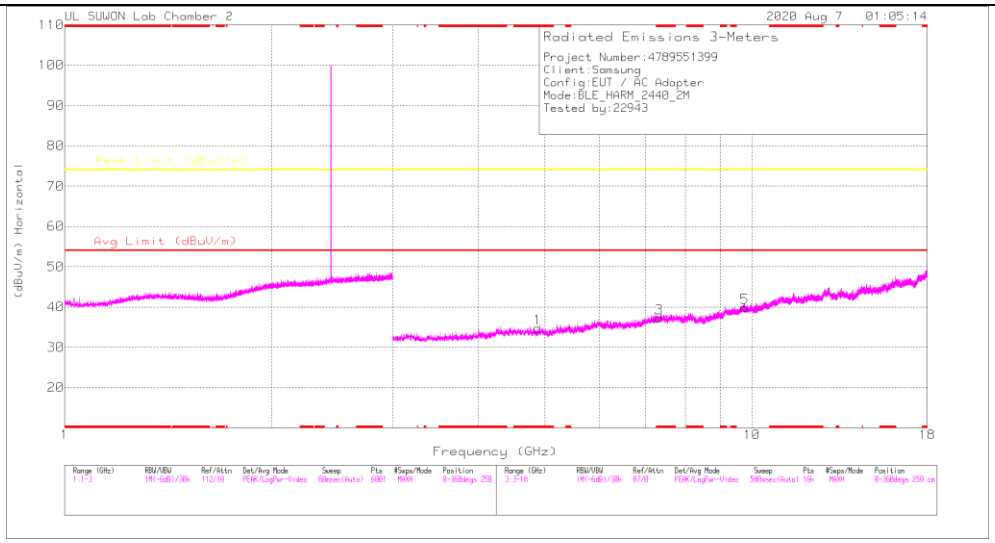
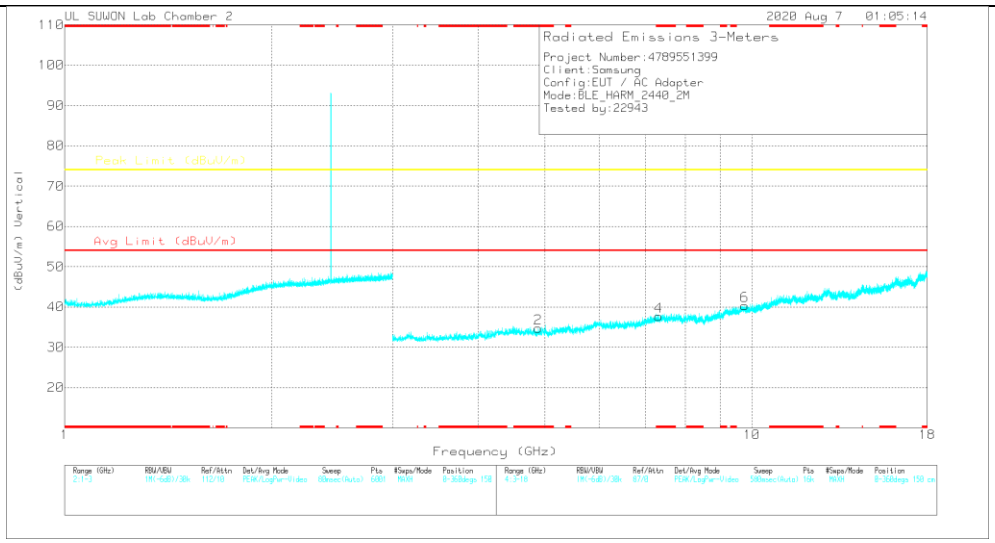
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	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
* 4.88125	37.23	PK2	34.1	-27.8	0	43.53	-	-	74	-30.47	360	100	H
* 4.8789	36.91	PK2	34.1	-27.8	0	43.21	-	-	74	-30.79	360	100	V
* 7.32049	35.19	PK2	36.1	-24.8	0	46.49	-	-	74	-27.51	360	100	H
* 7.31809	35.22	PK2	36.1	-24.8	0	46.52	-	-	74	-27.48	360	100	V
9.76165	33.08	PK2	37.2	-21.2	0	49.08	-	-	74	-24.92	360	100	H
9.76061	32.83	PK2	37.2	-21.2	0	48.83	-	-	74	-25.17	360	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak

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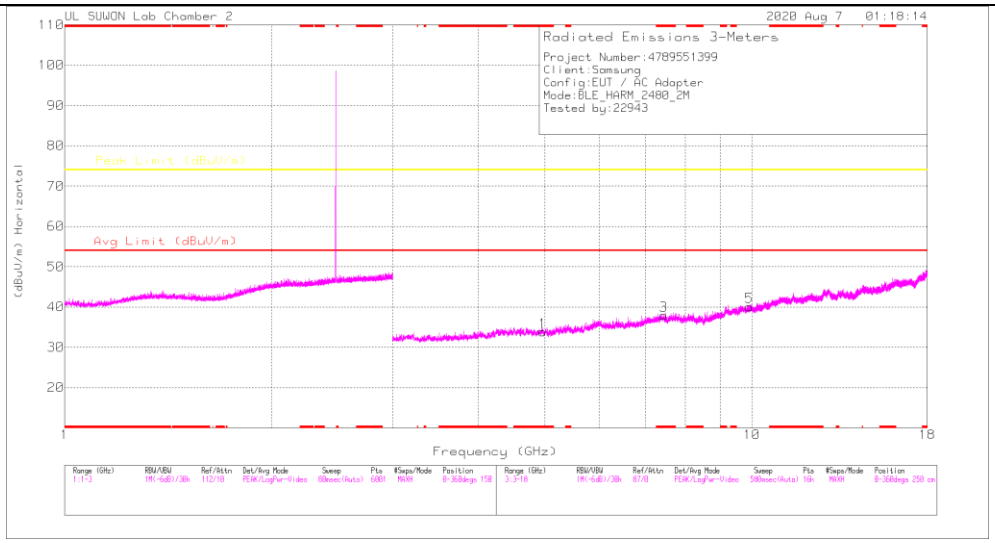
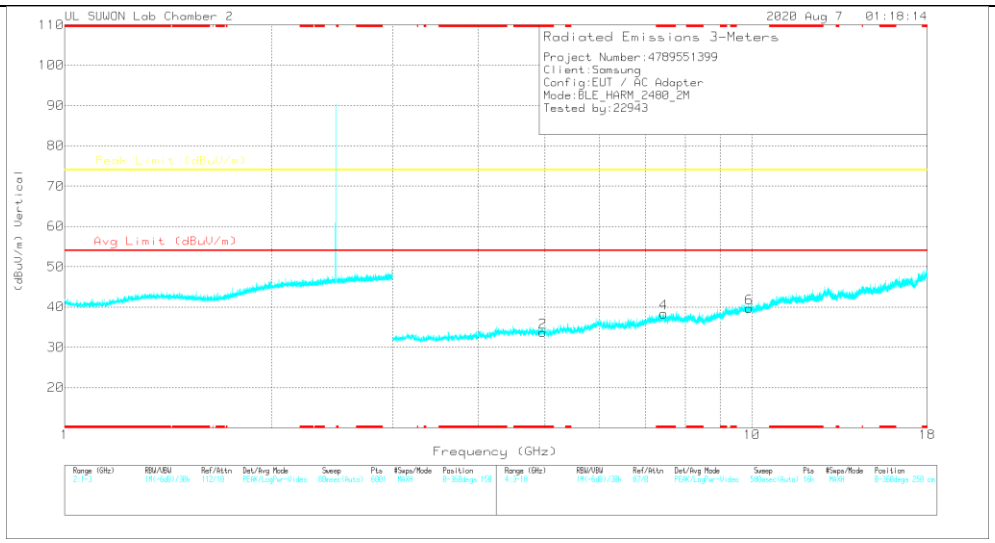
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	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
* 4.95827	36.26	PK2	34.1	-27	0	43.36	-	-	74	-30.64	360	100	H
* 4.95901	36.09	PK2	34.1	-27	0	43.19	-	-	74	-30.81	360	100	V
* 7.44094	34.85	PK2	36	-23.9	0	46.95	-	-	74	-27.05	360	100	H
* 7.44132	34.53	PK2	36	-23.9	0	46.63	-	-	74	-27.37	360	100	V
9.91954	31.75	PK2	37.4	-20.9	0	48.25	-	-	74	-25.75	360	100	H
9.91945	32.05	PK2	37.4	-20.9	0	48.55	-	-	74	-25.45	360	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(04)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
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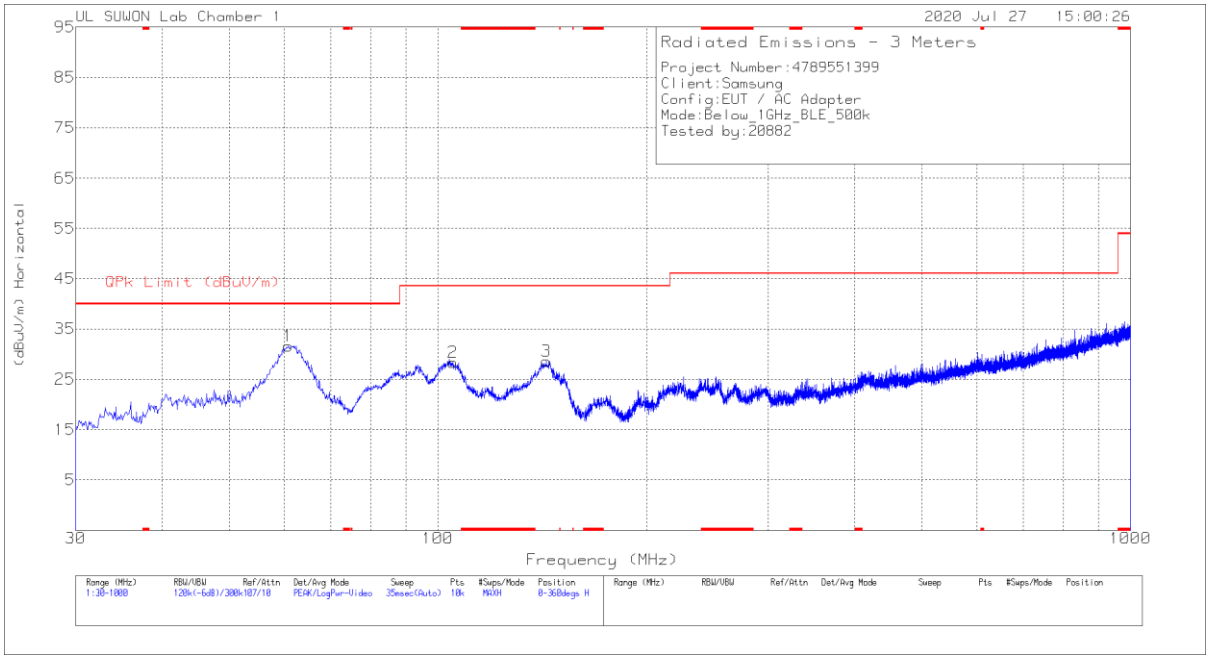
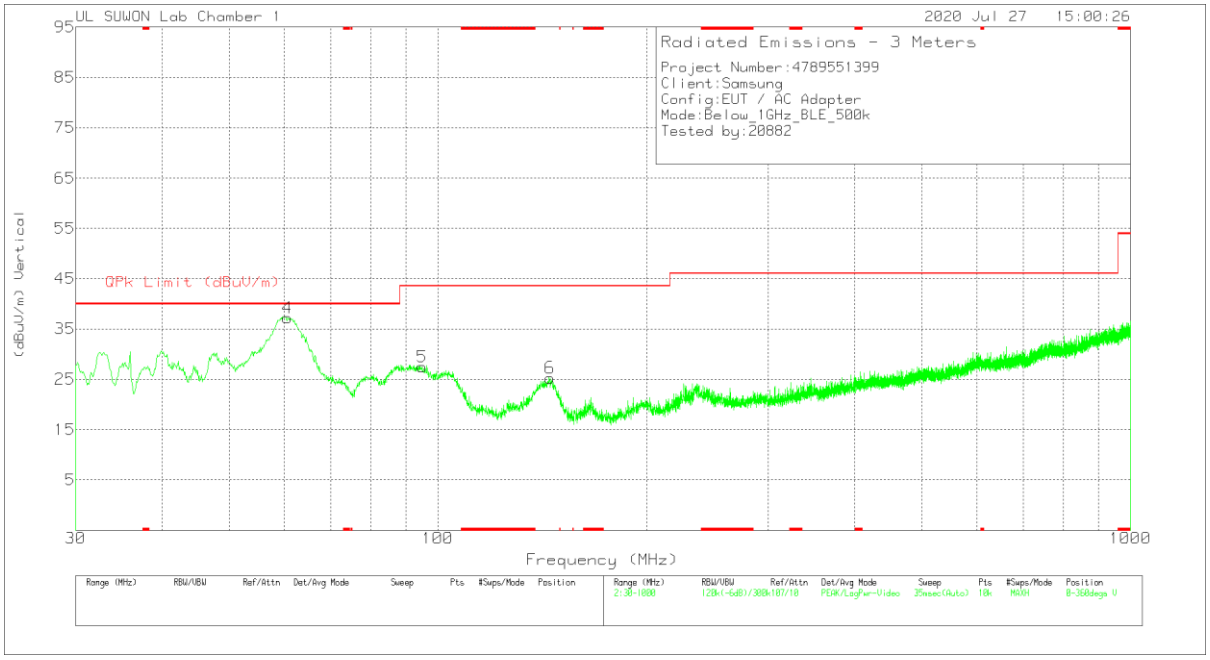
10.3. WORST CASE BELOW 1 GHZ

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



HORIZONTAL



VERTICAL

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Below 1GHz Data

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163_750	Below_1G[dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	60.749	43.45	Pk	18.4	-30.2	31.65	40	-8.35	0-360	300	H
2	105.078	40.17	Pk	17.8	-29.6	28.37	43.52	-15.15	0-360	300	H
3	143.393	43.46	Pk	14.1	-29	28.56	43.52	-14.96	0-360	200	H
4	60.652	48.14	Pk	18.4	-29.3	37.24	40	-2.76	0-360	100	V
5	94.893	38.93	Pk	17.3	-28.8	27.43	43.52	-16.09	0-360	100	V
6	145.139	39.3	Pk	14.1	-28.1	25.3	43.52	-18.22	0-360	200	V

Pk - Peak detector

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163_750	Below_1G[dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
60.652	46.49	Qp	18.4	-29.3	35.59	40	-4.41	227	125	V

Qp - Quasi-Peak detector

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218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
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11. 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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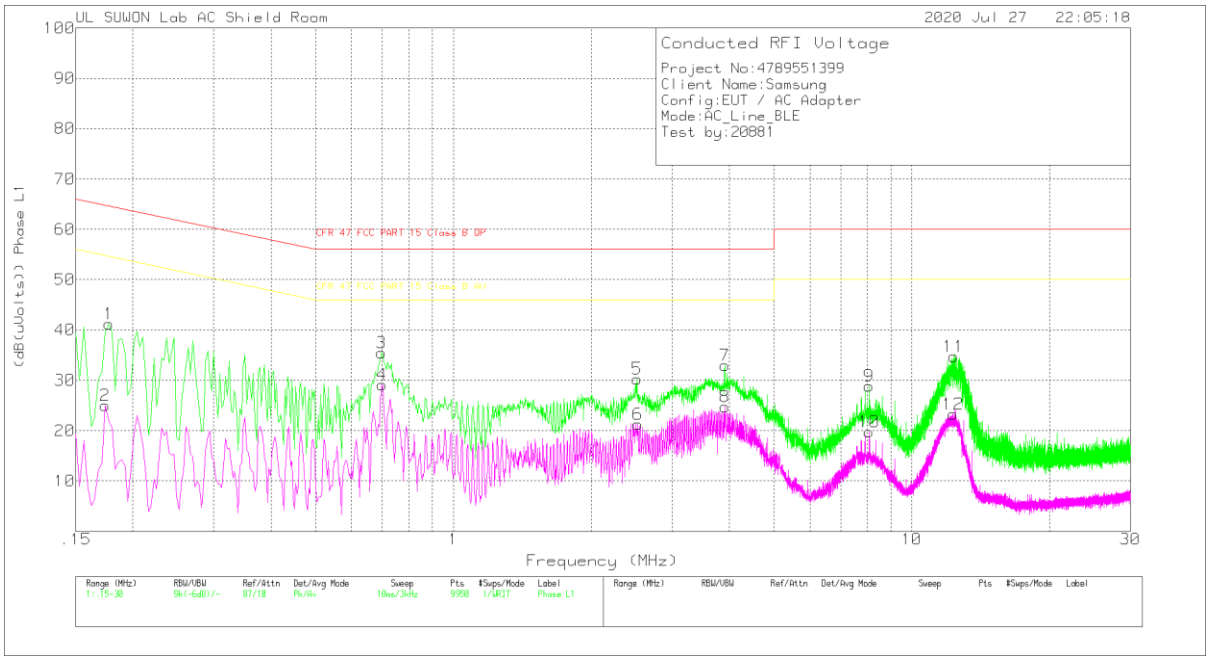
11.1.1. AC Power Line

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	.177	31.06	Pk	10	.2	41.26	64.63	-23.37	-	-
2	.174	14.67	Av	10.1	.2	24.97	-	-	54.77	-29.8
3	.696	25.38	Pk	9.9	.2	35.48	56	-20.52	-	-
4	.699	19.03	Av	9.9	.2	29.13	-	-	46	-16.87
5	2.514	20.2	Pk	9.8	.3	30.3	56	-25.7	-	-
6	2.529	11.19	Av	9.8	.3	21.29	-	-	46	-24.71
7	3.909	22.88	Pk	9.8	.3	32.98	56	-23.02	-	-
8	3.909	14.71	Av	9.8	.3	24.81	-	-	46	-21.19
9	8.073	18.7	Pk	9.9	.3	28.9	60	-31.1	-	-
10	8.073	9.53	Av	9.9	.3	19.73	-	-	50	-30.27
11	12.348	24.42	Pk	10	.3	34.72	60	-25.28	-	-
12	12.294	12.99	Av	10	.3	23.29	-	-	50	-26.71

Pk - Peak detector
Av - Average detection

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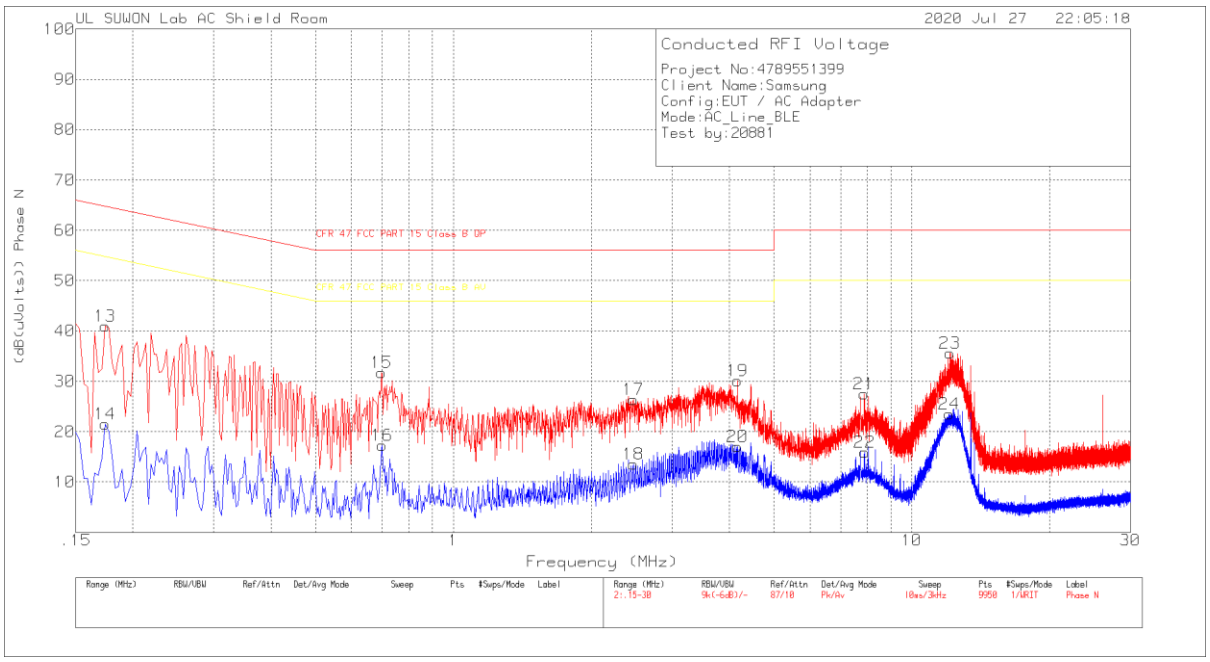
LINE 2 RESULTS



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)
13	.174	30.8	Pk	10	.2	41	64.77	-23.77	-	-
14	.174	11.34	Av	10	.2	21.54	-	-	54.77	-33.23
15	.696	21.67	Pk	9.9	.2	31.77	56	-24.23	-	-
16	.699	7.18	Av	9.9	.2	17.28	-	-	46	-28.72
17	2.469	16.25	Pk	9.8	.3	26.35	56	-29.65	-	-
18	2.469	3.45	Av	9.8	.3	13.55	-	-	46	-32.45
19	4.164	20.06	Pk	9.8	.3	30.16	56	-25.84	-	-
20	4.164	6.95	Av	9.8	.3	17.05	-	-	46	-28.95
21	7.878	17.27	Pk	9.9	.3	27.47	60	-32.53	-	-
22	7.884	5.73	Av	9.9	.3	15.93	-	-	50	-34.07
23	12.108	25.27	Pk	10	.3	35.57	60	-24.43	-	-
24	12.072	13.26	Av	10	.3	23.56	-	-	50	-26.44

Pk - Peak detector
Av - Average detection

END OF TEST REPORT

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