CERTIFICATION TEST REPORT

Report Number. : 4789746865-E4V3

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	SM-A525F/DS, SM-A525F
FCC ID	:	A3LSMA525F
EUT Description	:	GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac and NFC
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
February 05, 2021

Prepared by:
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IAS ACCREDITED
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	01/28/21	Initial issue	SunGeun Lee
V2	02/02/21	Updated to address TCB's question	SunGeun Lee
V3	02/05/21	Updated to address TCB's question	SunGeun Lee

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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 and NFC
MODEL:	SM-A525F/DS, SM-A525F
SERIAL NUMBER:	R38NB02RCJH (CONDUCTED, Original); R38NB02RD9T (RADIATED, Original); R38NC03HD9J, R38NC03HCYN (RADIATED, Spot check);
DATE TESTED:	NOV 30, 2020 – JAN 05, 2021(Original); JAN 21, 2021 – JAN 22, 2021(Spot check);

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
UL Korea, Ltd. By:

Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Sungeun Lee
Suwon Lab Engineer
UL Korea, Ltd.

1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMA525M DTS BLE(FCC CFR 47 Part 15C). And the applicant takes full responsibility that the test data as referenced in this report represent compliance for this FCC ID.

1.2. DIFFERENCE

The FCC ID: A3LSMA525F shares the same enclosure and circuit board as FCC ID: A3LSMA525M. The BLE antenna and surrounding circuitry and layout are identical between these two units.

After confirming through preliminary radiated emissions that the performance of the FCC ID: A3LSMA525M remains representative of FCC ID: A3LSMA525F. The test data of FCC ID: A3LSMA525M being submitted for this application to cover BLE features.

1.3. SPOT CHECK VERIFICATION DATA

(Worst case of the radiated spurious and band edge emissions)

Band	Test Item	Mode	Frequency	Test Limit	Original model	Spot check model	Deviation	Remark
					SM-A525M/DS Results	SM-A525F/DS Results		
					FCC ID : A3LSMA525M	FCC ID : A3LSMA525F		
DTS BLE (2.4GHz)	Band Edge	500 kbps	2480 MHz	54 dBuV/m	42.90 dBuV/m	42.75 dBuV/m	-0.15 dB	
	RSE	500 kbps	9920 MHz	74 dBuV/m	50.49 dBuV/m	48.83 dBuV/m	-1.66 dB	Noise Floor
	Band Edge	2 Mbps	2480 MHz	54 dBuV/m	45.32 dBuV/m	45.15 dBuV/m	-0.17 dB	
	RSE	2 Mbps	9920 MHz	74 dBuV/m	50.85 dBuV/m	49.71 dBuV/m	-1.14 dB	Noise Floor

Comparison of two models, upper deviation is within 3 dB range and all test results are under FCC Technical Limits.

1.4. REFERENCE DETAIL

Reference application that contains the reused reference data in the individual test reports:

Equipment Class	Reference FCC ID (Parent)	Application Type	Reference Test report number	Exhibit Type	Variant Test Report Number	Data Re-used
PCE	A3LSMA525M	Original Grant	4789746830-E2	Test Report	4789746865-E2	All
DTS	A3LSMA525M	Original Grant	4789746830-E3 (802.11b,g,n)	Test Report	4789746865-E3 (802.11b,g,n)	All
			4789746830-E4 (Bluetooth LE)	Test Report	4789746865-E4 (Bluetooth LE)	All
DSS	A3LSMA525M	Original Grant	4789746830-E5 (Bluetooth)	Test Report	4789746865-E5 (Bluetooth)	All
NII	A3LSMA525M	Original Grant	4789746830-E6 (802.11a,n,ac)	Test Report	4789746865-E6 (802.11a,n,ac)	All
DXX	A3LSMA525M	Original Grant	4789746830-E7 (NFC)	Test Report	4789746865-E7 (NFC)	All

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

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

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	3.01 dB
Radiated Disturbance, 30 MHz to 1 GHz	4.26 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.90 dB
Radiated Disturbance, 18 GHz to 40 GHz	5.49 dB

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

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 and NFC.
This test report addresses the DTS (BLE) operational mode.

This report covers the Samsung models SM-A525F/DS and SM-A525F.
These models are identical in hardware except SM-A525F has single SIM tray.
With some pre-scan, model SM-A525F/DS was set for final test.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range [MHz]	Mode	Power Mode	Output Power [dBm]	Output Power [mW]
2 402 ~ 2 480	500 kbps	Peak	7.000	5.012
		Average	6.735	4.715
	2Mbps	Peak	7.227	5.281
		Average	6.610	4.581

5.3. DESCRIPTION OF AVAILABLE ANTENNA

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.

The radio utilizes an internal antenna, with a maximum gain of -3.57 dBi.

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 Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

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

Power verification

The Output Power of all data rate are all investigated, 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	5.015	2	**2Mbps (37 pkt)**	2402	5.097
		2440	6.360			2440	6.392
		2480	6.444			**2480**	**6.610**
	1Mbps (255 pkt)	2402	5.065		2Mbps (255 pkt)	2402	5.084
		2440	6.289			2440	6.361
		2480	6.381			2480	6.560
	125 kbps (37 pkt)	2402	5.227				
		2440	6.495				
		2480	6.673				
	125 kbps (255 pkt)	2402	5.232				
		2440	6.502				
		2480	6.634				
	500 kbps (37 pkt)	2402	5.275				
		2440	6.552				
		2480	**6.735**				
	500 kbps (255 pkt)	2402	5.220				
		2440	6.471				
		2480	6.654				

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA200	R37N6KYPMH2SE3	N/A
Data Cable	SAMSUNG	EP-DR140AWE	N/A	N/A
Earphone	SAMSUNG	EHS64AVFWE	N/A	N/A

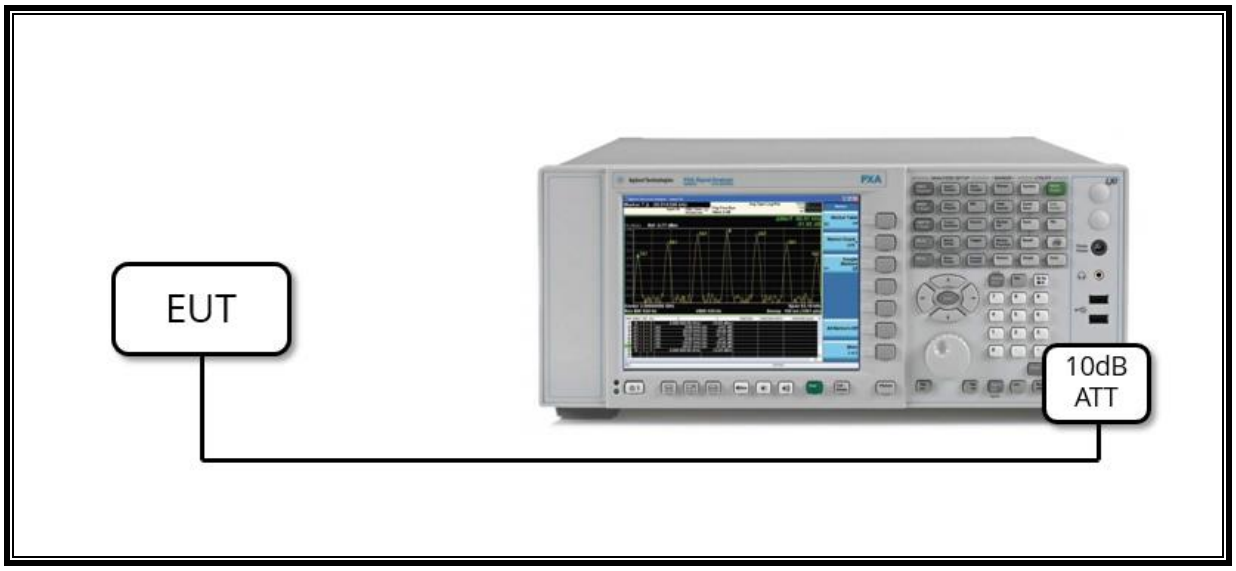
I/O CABLE

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	1.0 m	N/A
2	Audio	2	Mini-Jack	Unshielded	1.2 m	N/A

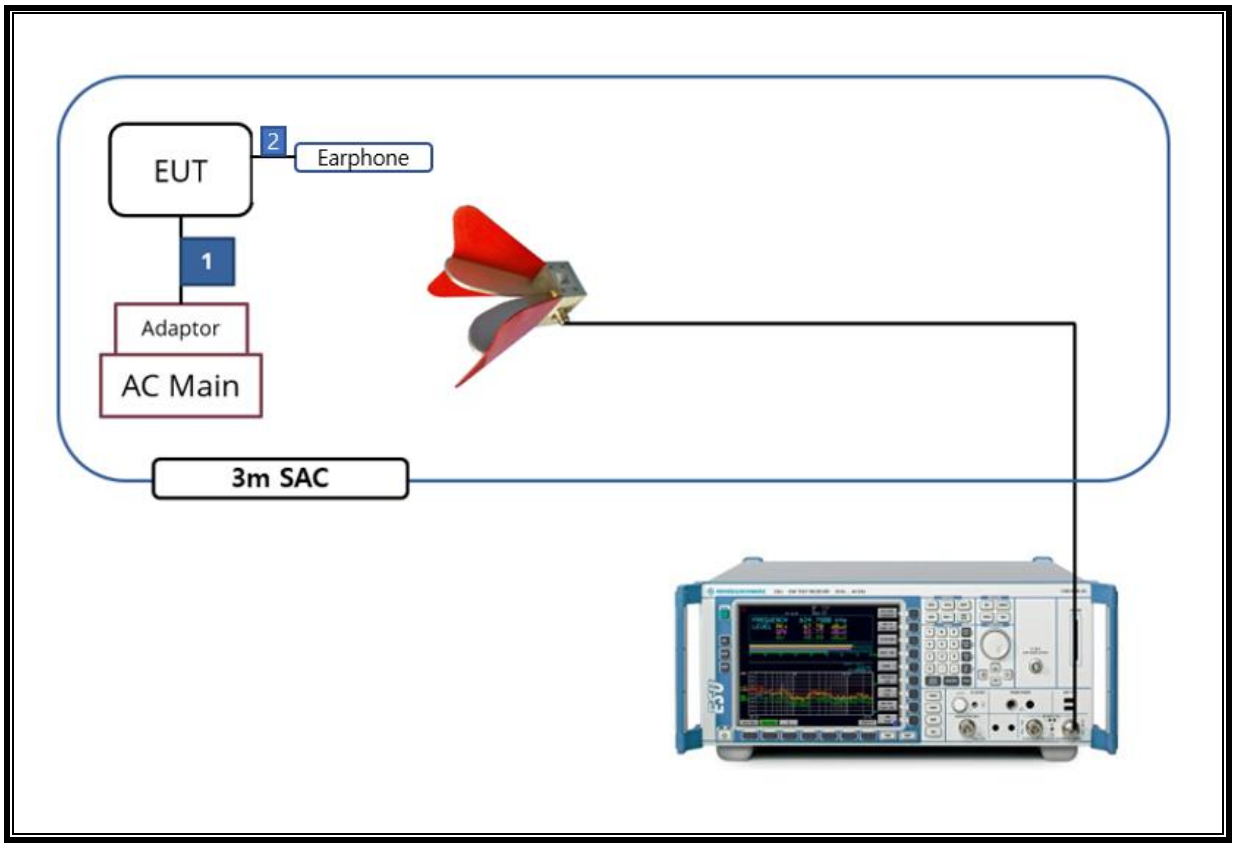
TEST SETUP

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

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



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

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**	**Cal Due**
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	08-19-22
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	08-13-22
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	08-13-22
Antenna, Horn, 18 GHz	ETS	3115	00167211	07-27-22
Antenna, Horn, 18 GHz	ETS	3115	00161451	08-15-22
Antenna, Horn, 18 GHz	ETS	3117	00168724	07-27-22
Antenna, Horn, 18 GHz	ETS	3117	00168717	08-15-22
Antenna, Horn, 40 GHz	ETS	3116C	00166155	08-04-22
Antenna, Horn, 40 GHz	ETS	3116C	00168645	10-02-21
Preamplifier	ETS	3116C-PA	00168841	08-06-21
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-03-21
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-03-21
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-06-21
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-03-21
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-03-21
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-04-21
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-05-21
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-05-21
Spectrum Analyzer, 43.5 GHz	R&S	FSW43	104089	08-06-21
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-05-21
Attenuator	PASTERNACK	PE7087-10	A001	08-03-21
Attenuator	PASTERNACK	PE7087-10	A008	08-03-21
Attenuator	PASTERNACK	PE7004-10	2	08-04-21
Attenuator	PASTERNACK	PE7087-10	A009	08-03-21
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-03-21
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-03-21
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-03-21
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-03-21
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-03-21
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	020	08-04-21
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-03-21
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-03-21
High Pass Filter 3GHz	Micro-Tronics	HPM17543	020	08-04-21
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	08-03-21
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	08-03-21
High Pass Filter 6GHz	Micro-Tronics	HPS17542	021	08-04-21
LISN	R&S	ENV-216	101837	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

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

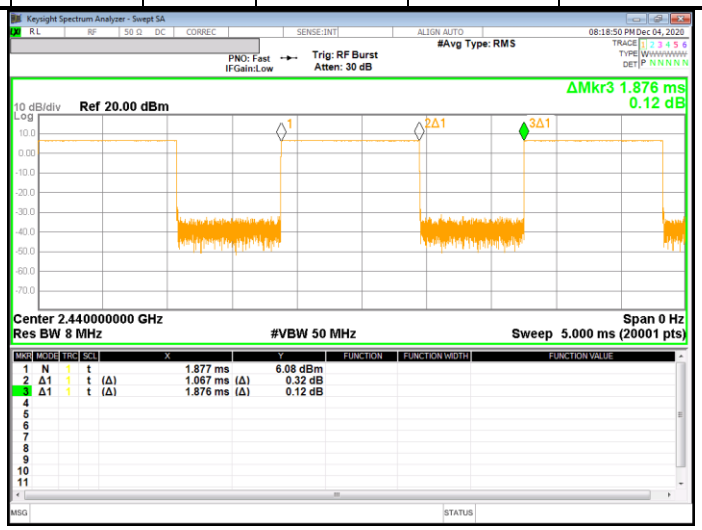
9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

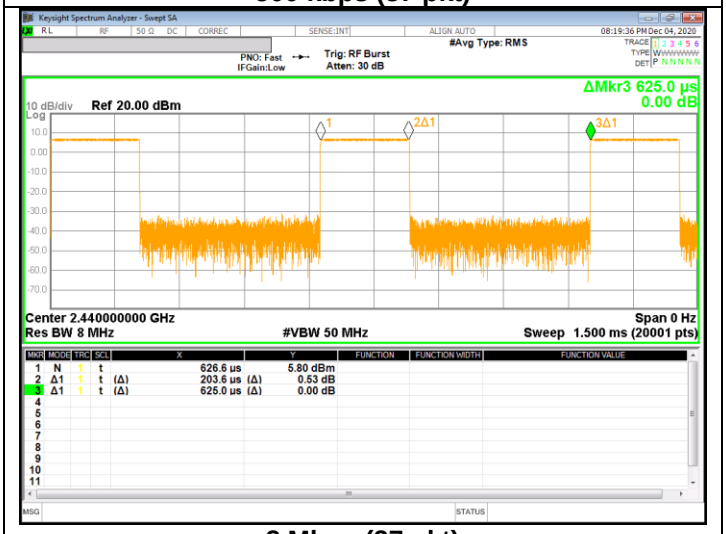
LIMITS

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 VBW [kHz]
2 400 ~ 2 483.5 MHz Bands						
BLE 500 kbps [37pkt]	1.067	1.876	0.57	56.88	2.45	0.94
BLE 2 Mbps [37pkt]	0.204	0.625	0.33	32.58	4.87	4.90



500 kbps (37 pkt)



2 Mbps (37 pkt)

9.2. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

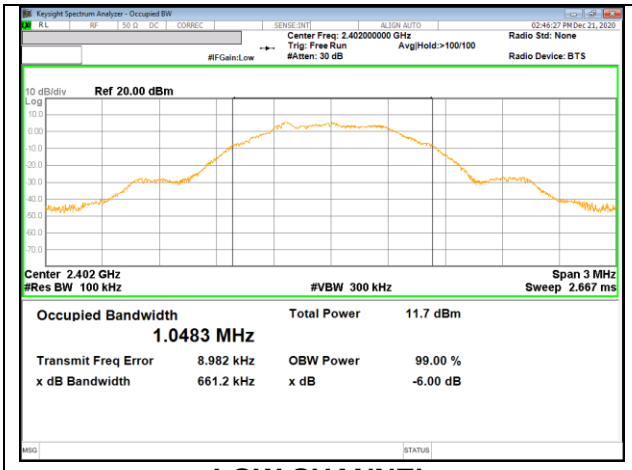
RSS-247 5.2 (a)

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

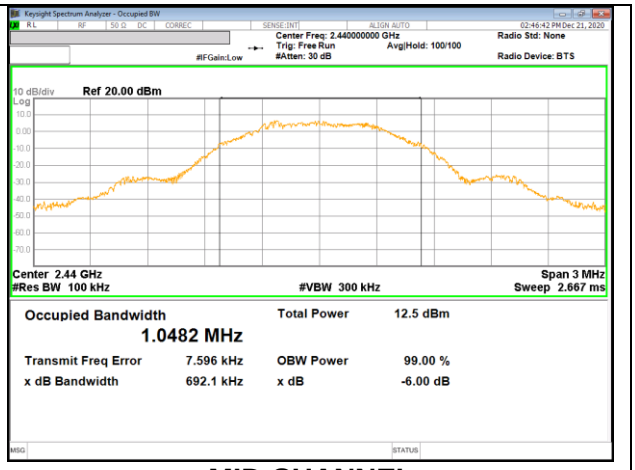
RESULTS

9.2.1. BLE (500 kbps)

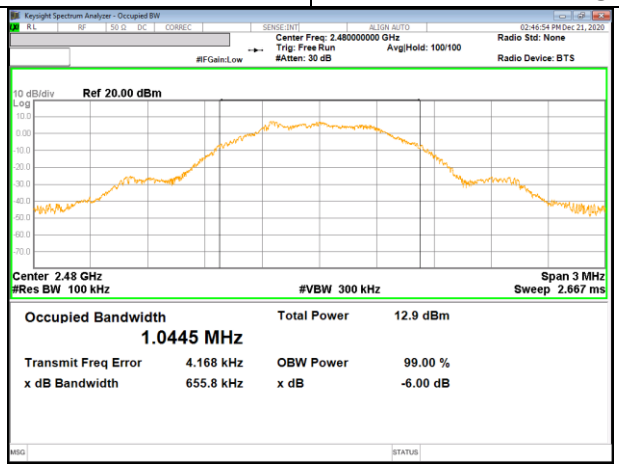
Channel	Frequency [MHz]	6 dB Bandwidth [kHz]	Minimum Limit [kHz]
Low	2 402	661.2	500.0
Mid	2 440	692.1	500.0
High	2 480	**655.8**	500.0
Worst		**655.8**	500.0



LOW CHANNEL



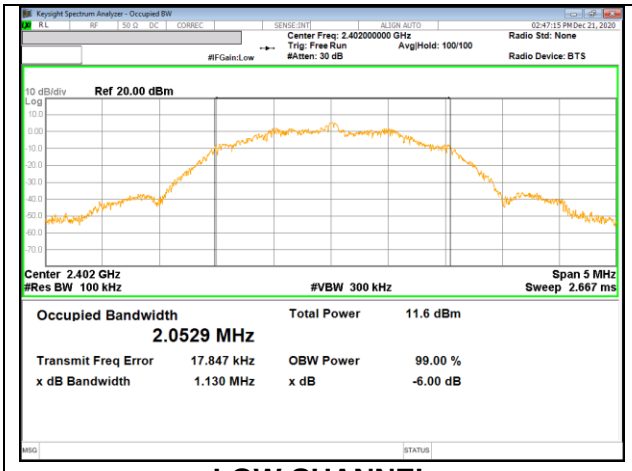
MID CHANNEL



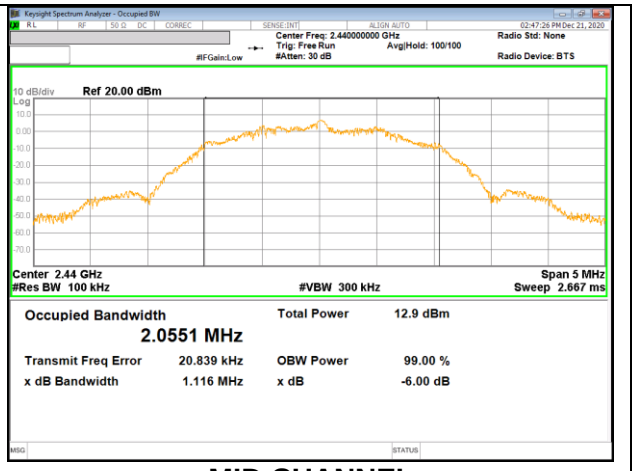
HIGH CHANNEL

9.2.2. BLE (2Mbps)

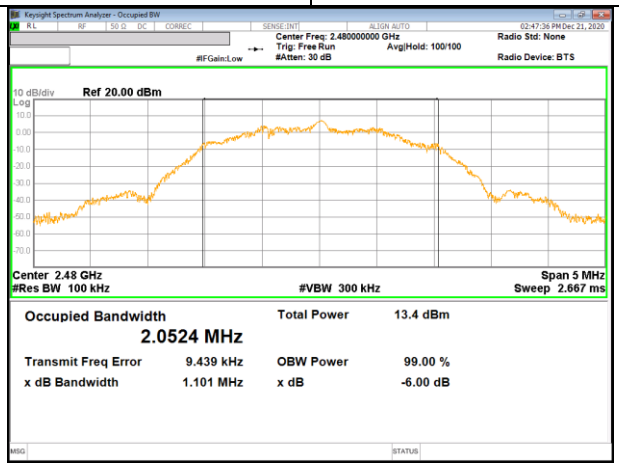
Channel	Frequency [MHz]	6 dB Bandwidth [kHz]	Minimum Limit [kHz]
Low	2 402	1130.0	500.0
Mid	2 440	1116.0	500.0
High	2 480	**1101.0**	500.0
Worst		**1101.0**	500.0



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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

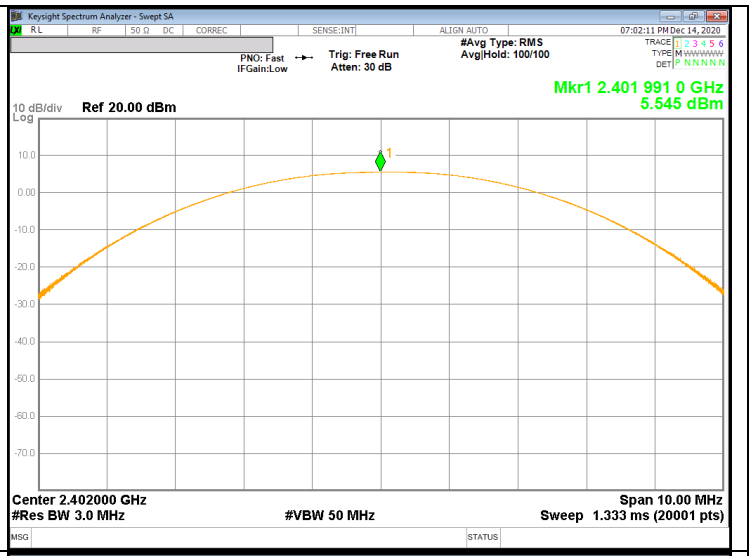
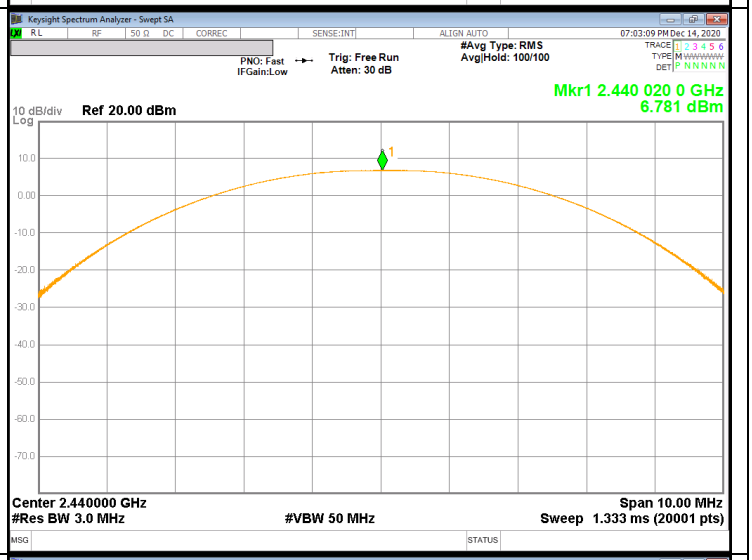
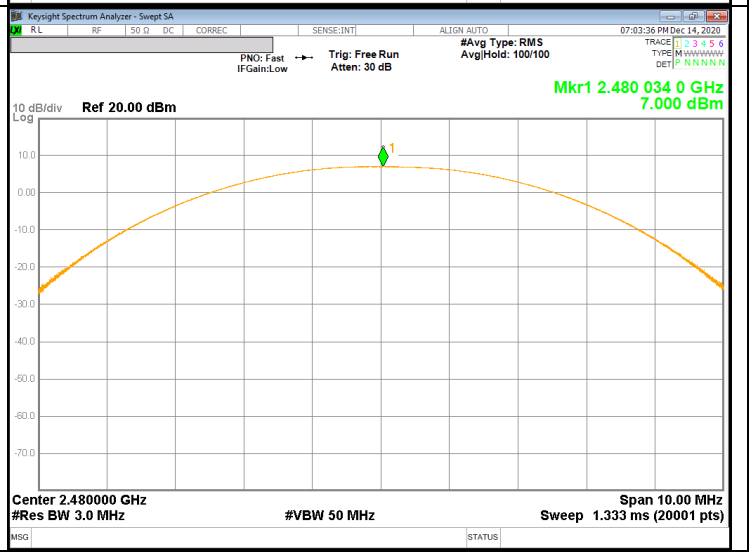
Channel	Frequency [MHz]	Peak Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	5.545	30.000	-24.455
Mid	2440	6.781	30.000	-23.219
High	2480	**7.000**	30.000	**-23.000**
Worst		**7.000**	30.000	**-23.000**

- 2 Mbps

Channel	Frequency [MHz]	Peak Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	5.687	30.000	-24.313
Mid	2440	7.052	30.000	-22.948
High	2480	**7.227**	30.000	**-22.773**
Worst		**7.227**	30.000	**-22.773**

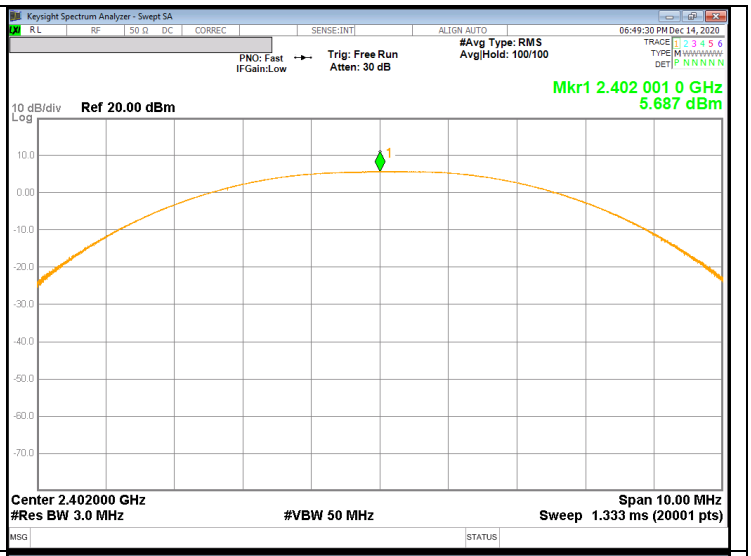
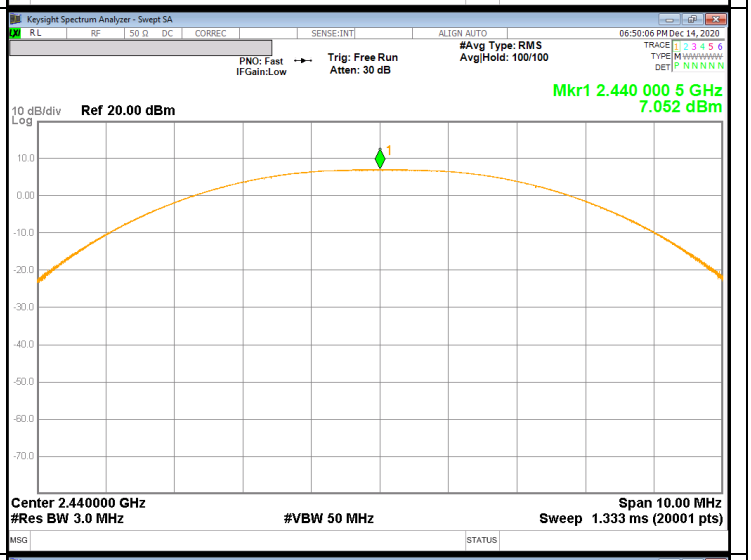
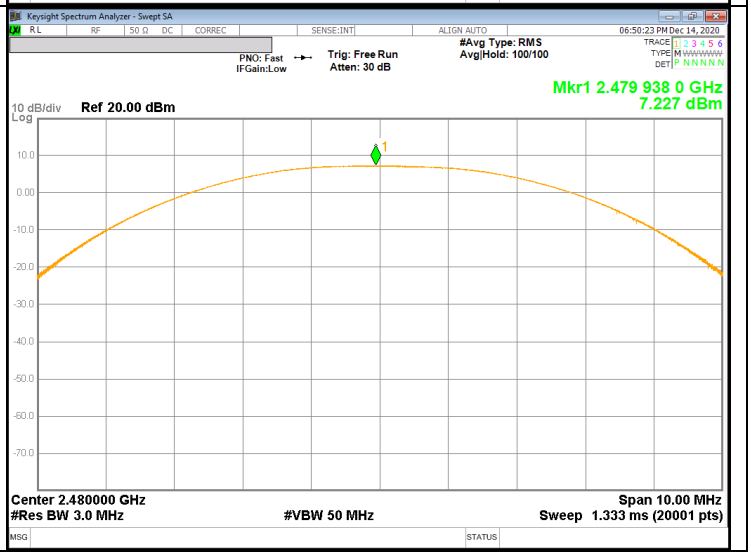
9.3.1. BLE (500 kbps)

PEAK OUTPUT POWER PLOTS

Low Ch.	
Middle Ch.	
High Ch.	

9.3.2. BLE (2 Mbps)

PEAK OUTPUT POWER PLOTS

Low Ch.	
Middle Ch.	
High Ch.	

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]
Low	2402	5.275	3.369
Mid	2440	6.552	4.521
High	2480	6.735	4.715

- 2 Mbps

Channel	Frequency [MHz]	AV Power [dBm]	AV Power [mW]
Low	2402	5.097	3.234
Mid	2440	6.392	4.357
High	2480	6.610	4.581

9.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

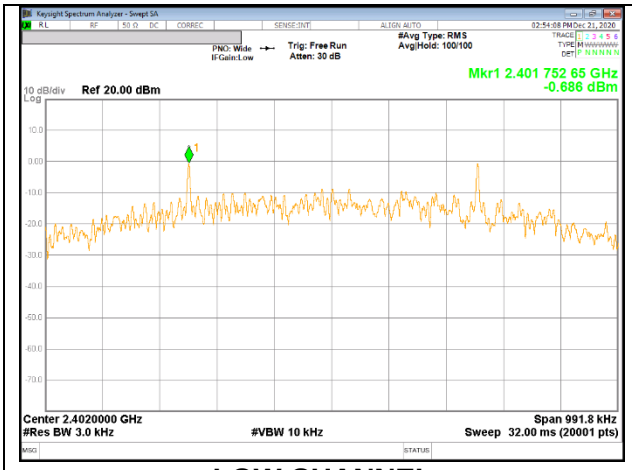
RSS-247 (5.2) (b)

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.

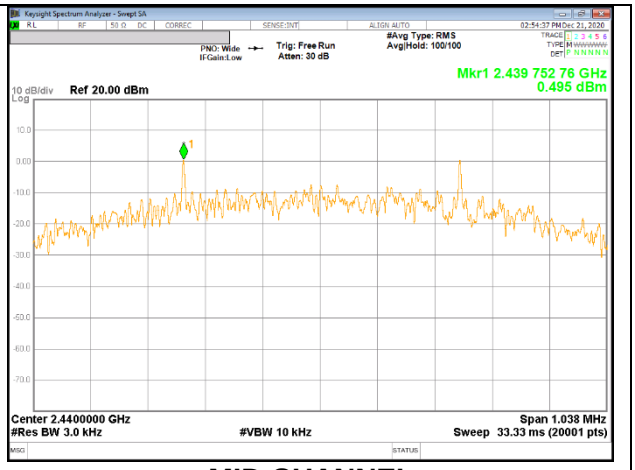
RESULTS

9.5.1. BLE (500 kbps)

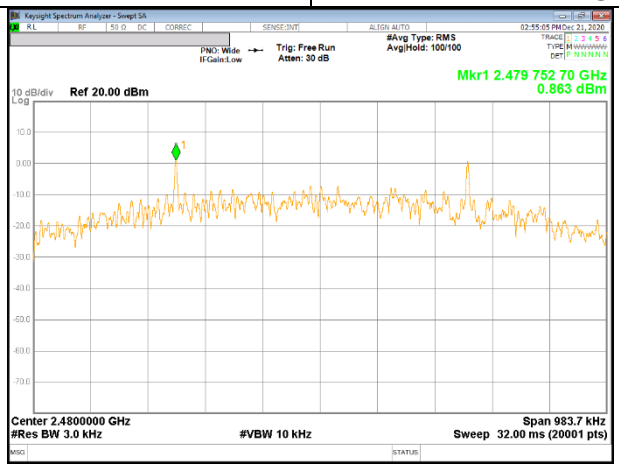
Channel	Frequency [MHz]	PSD [dBm/3kHz]	Limit [dBm/3kHz]	Margin [dB]
Low	2402	-0.686	8.000	-8.686
Mid	2440	0.495	8.000	-7.505
High	2480	0.863	8.000	-7.137



LOW CHANNEL



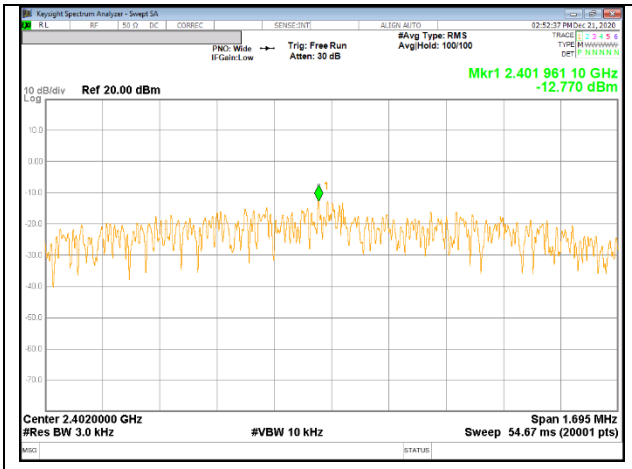
MID CHANNEL



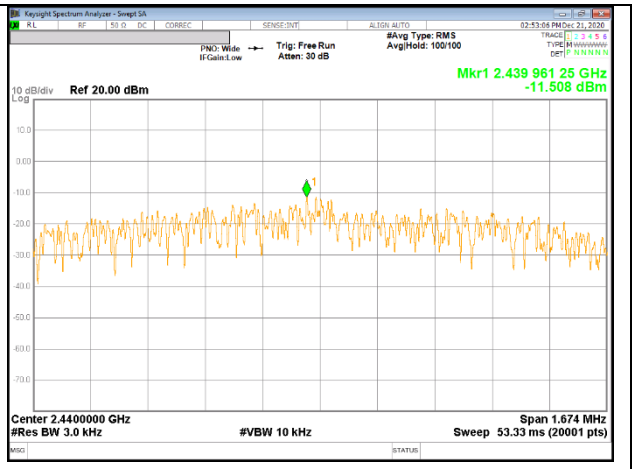
HIGH CHANNEL

9.5.2. BLE (2Mbps)

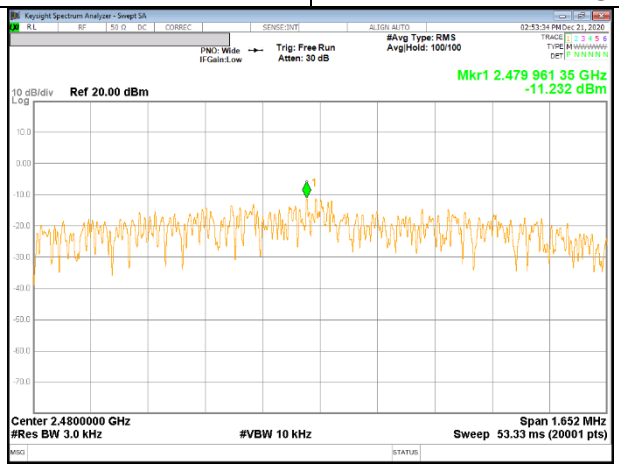
Channel	Frequency [MHz]	PSD [dBm/3kHz]	Limit [dBm/3kHz]	Margin [dB]
Low	2402	-12.770	8.000	-20.770
Mid	2440	-11.508	8.000	-19.508
High	2480	-11.232	8.000	-19.232



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

9.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

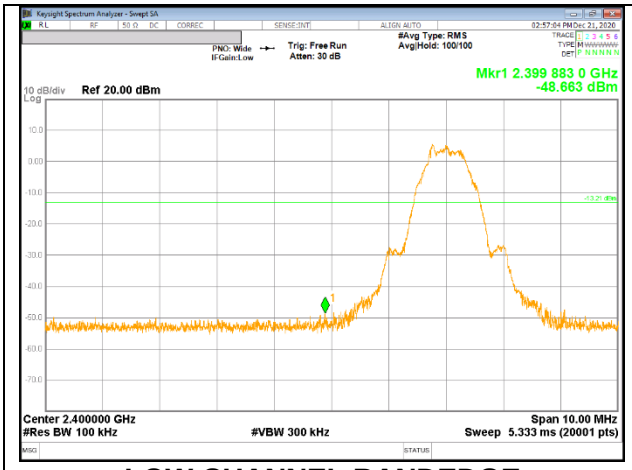
FCC §15.247 (d)

RSS-247 5.5

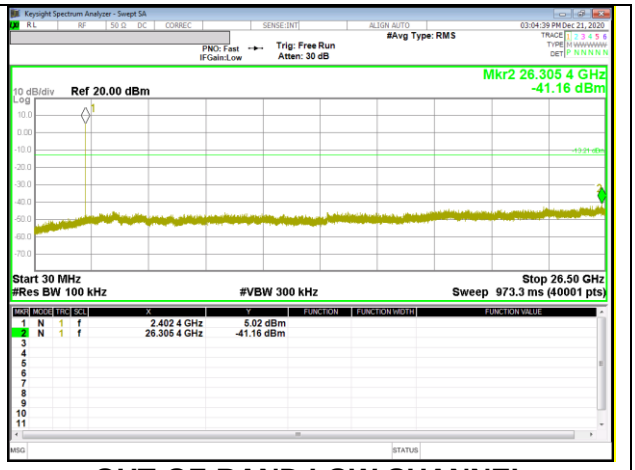
Output power was measured based on the use of a peak measurement.
Therefore, spurious emissions are required to be 20 dBc.

RESULTS

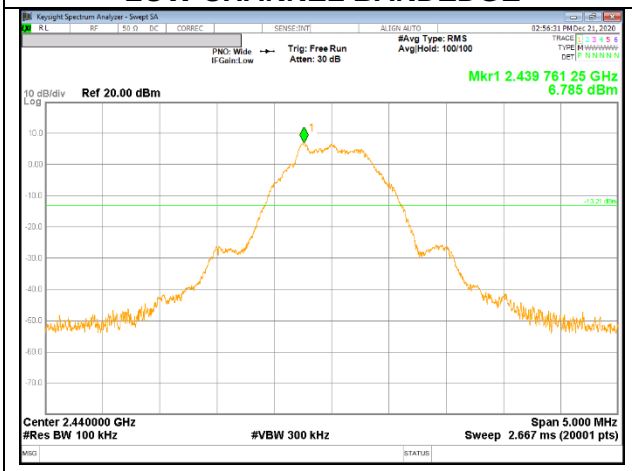
9.6.1. BLE (500 kbps)



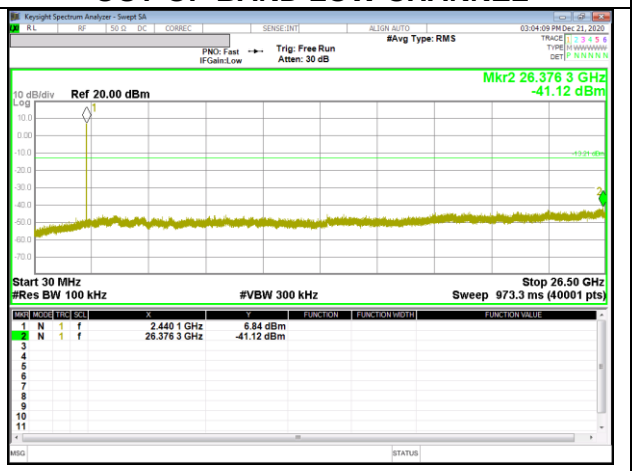
LOW CHANNEL BANDEDGE



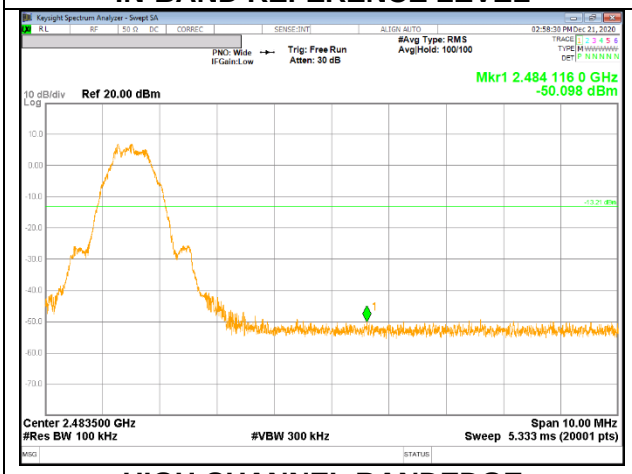
OUT-OF-BAND LOW CHANNEL



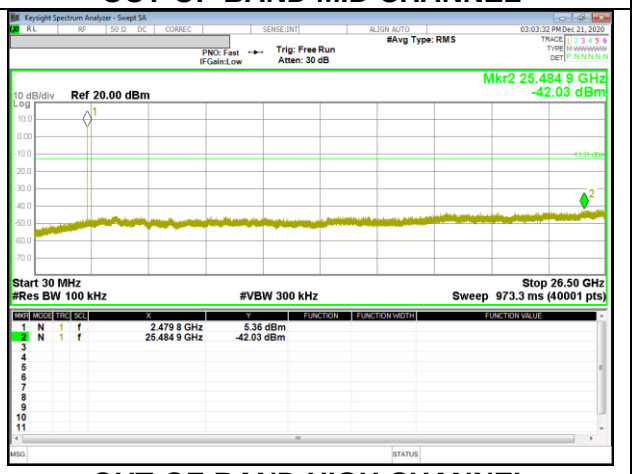
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL

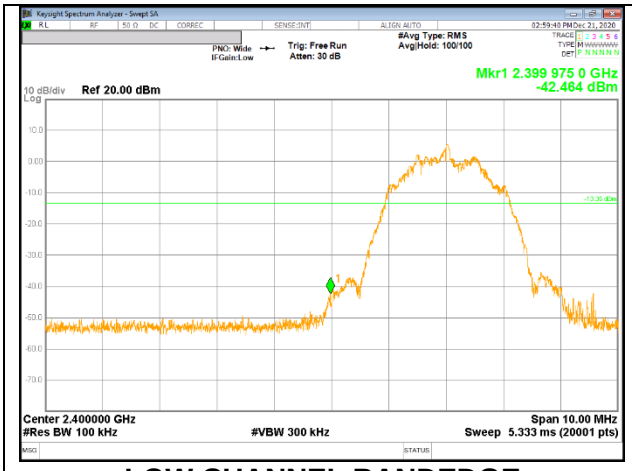


HIGH CHANNEL BANDEDGE

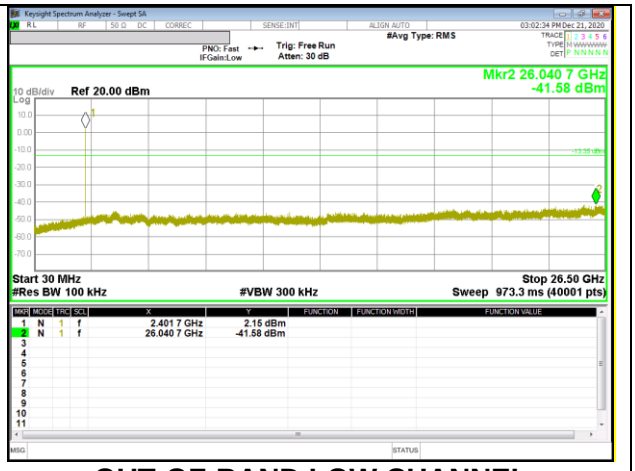


OUT-OF-BAND HIGH CHANNEL

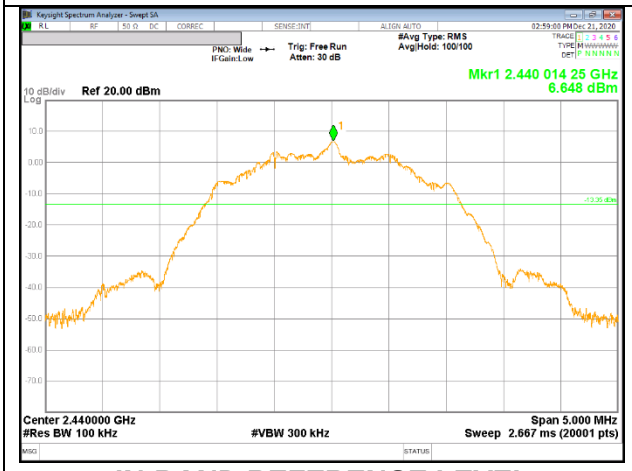
9.6.2. BLE (2 Mbps)



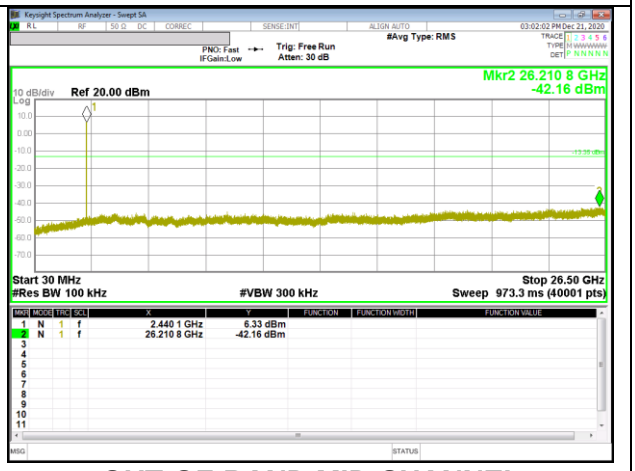
LOW CHANNEL BANDEDGE



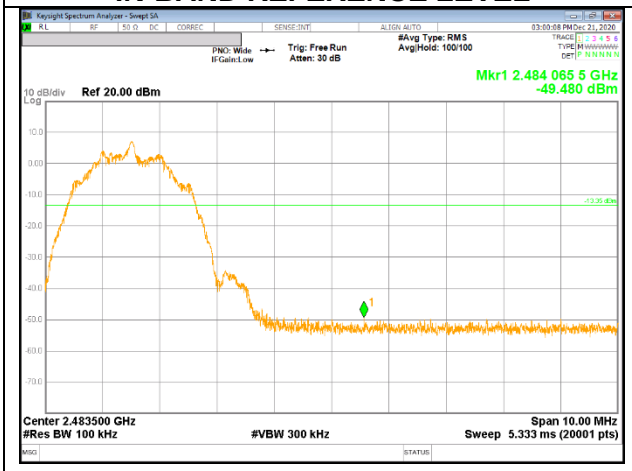
OUT-OF-BAND LOW CHANNEL



IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE

OUT-OF-BAND HIGH CHANNEL

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.

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(Restricted band-edge, Final detection of spurious harmonic emissions).
Duty cycle factor = 10 log (1/x). For this sample: For 500 kbps, DCF = 10log(1/0.569)=2.451 dB (Spectrum Analyzer round it up to 2.45 dB) and for 2Mbps, DCF = 10log(1/0.326)=4.871 dB (Spectrum Analyzer round it up to 4.90 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.

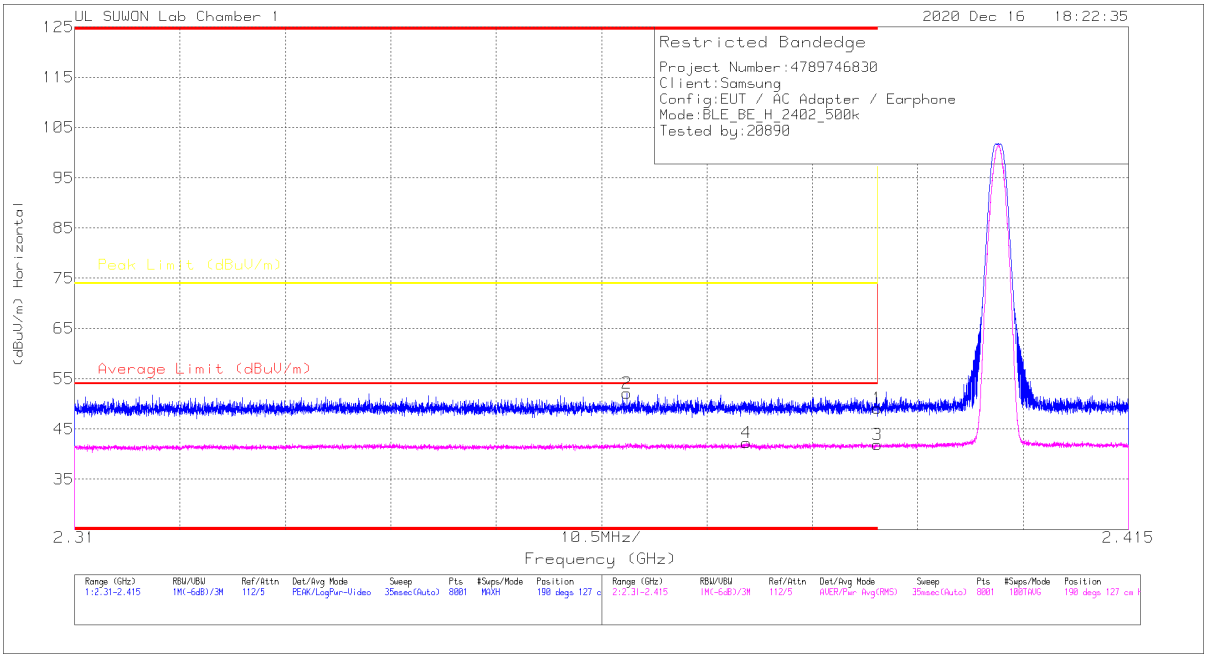
Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open are test site.
Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the one of tests made in an open field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

10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. BLE (500 kbps)

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT

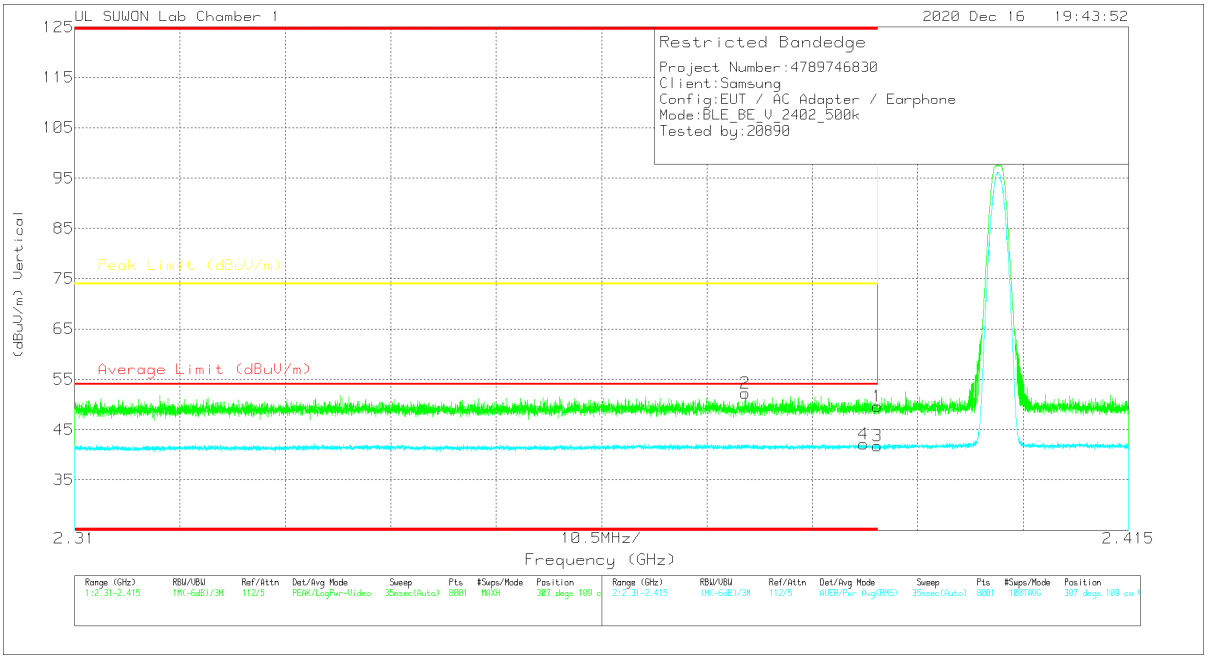


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	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	42.99	Pk	31.8	-25.6	0	49.19	-	-	74	-24.81	190	127	H
2	* 2.36503	46	Pk	31.7	-25.6	0	52.1	-	-	74	-21.9	190	127	H
3	* 2.39	33.25	RMS	31.8	-25.6	2.45	41.9	54	-12.1	-	-	190	127	H
4	* 2.37694	33.51	RMS	31.8	-25.5	2.45	42.26	54	-11.74	-	-	190	127	H

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

VERTICAL RESULT



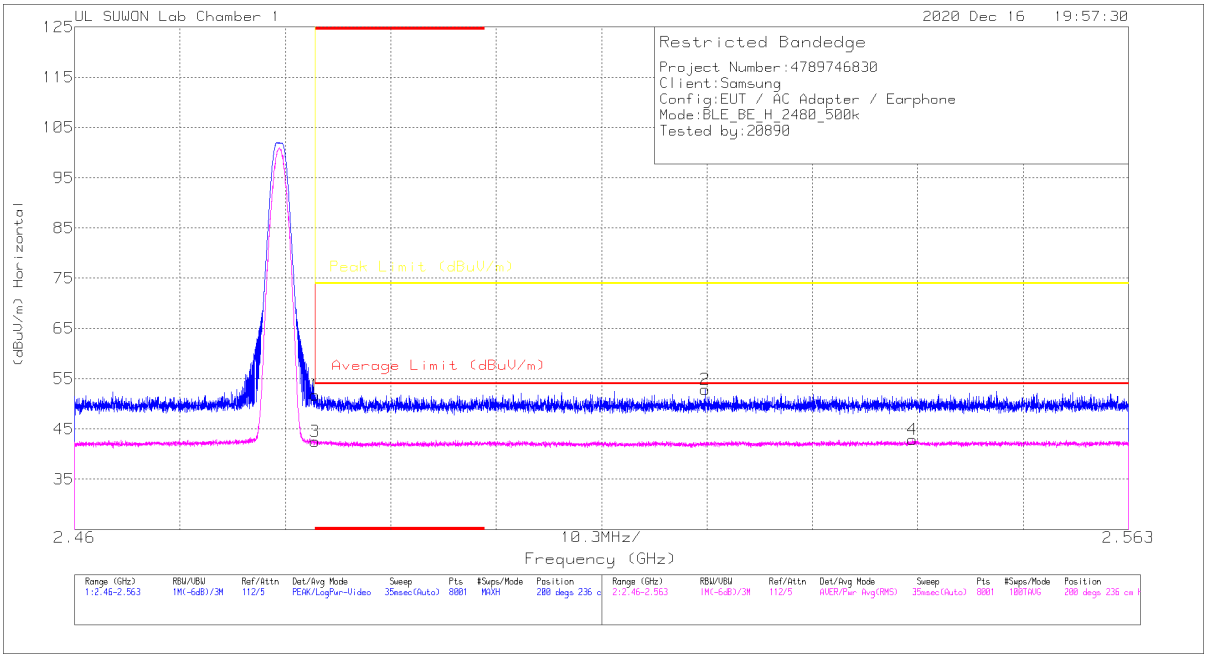
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	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	43.47	Pk	31.8	-25.6	0	49.67	-	-	74	-24.33	307	109	V
2	* 2.37681	45.91	Pk	31.8	-25.5	0	52.21	-	-	74	-21.79	307	109	V
3	* 2.39	33.12	RMS	31.8	-25.6	2.45	41.77	54	-12.23	-	-	307	109	V
4	* 2.38863	33.43	RMS	31.8	-25.5	2.45	42.18	54	-11.82	-	-	307	109	V

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

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT

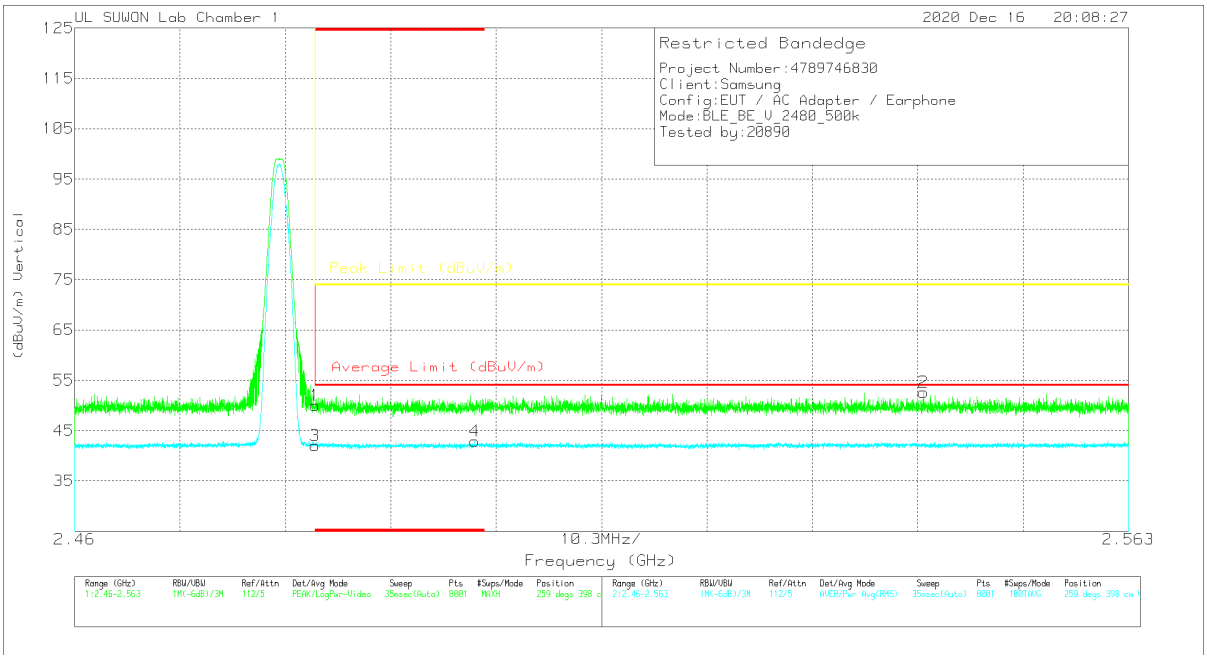


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	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	45.08	Pk	32	-25.3	0	51.78	-	-	74	-22.22	200	236	H
2	2.52161	46.03	Pk	32	-25.1	0	52.93	-	-	74	-21.07	200	236	H
3	* 2.48351	33.32	RMS	32	-25.3	2.45	42.47	54	-11.53	-	-	200	236	H
4	2.54191	33.39	RMS	32	-25	2.45	42.84	54	-11.16	-	-	200	236	H

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

VERTICAL RESULT



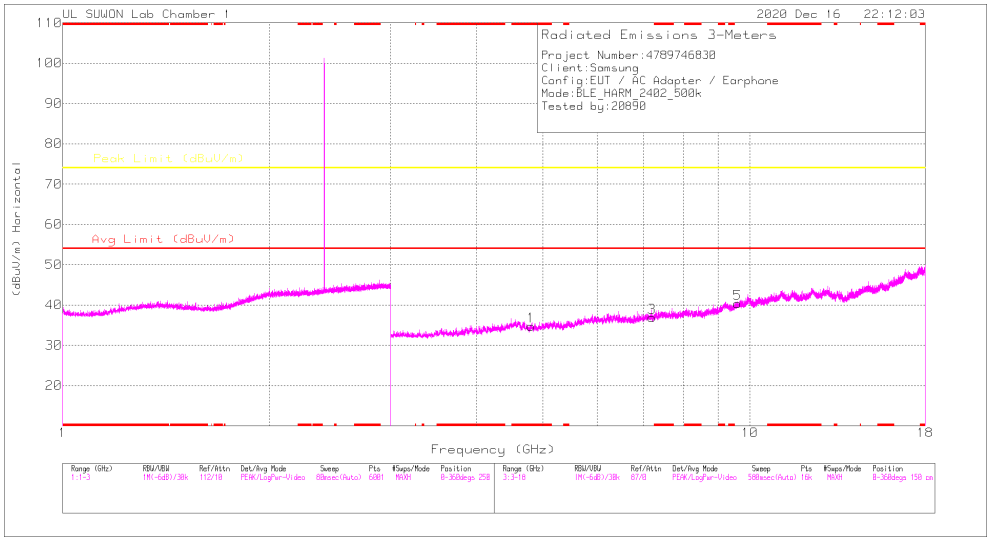
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	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	43.27	Pk	32	-25.3	0	49.97	-	-	74	-24.03	259	398	V
2	2.54295	45.74	Pk	32	-25.1	0	52.64	-	-	74	-21.36	259	398	V
3	* 2.48351	32.85	RMS	32	-25.3	2.45	42	54	-12	-	-	259	398	V
4	* 2.4991	33.54	RMS	32	-25.1	2.45	42.8	54	-11.2	-	-	259	398	V

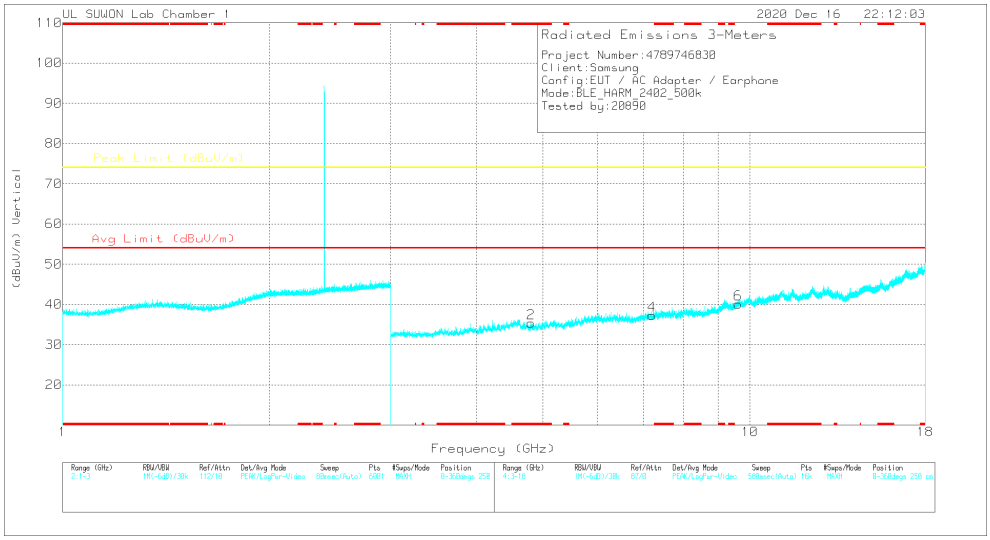
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



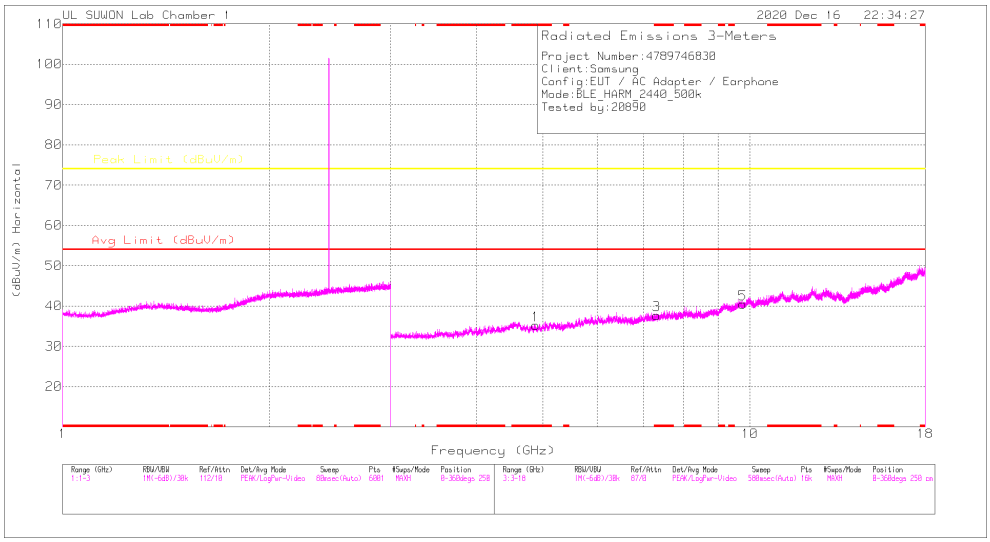
VERTICAL

Radiated Emissions

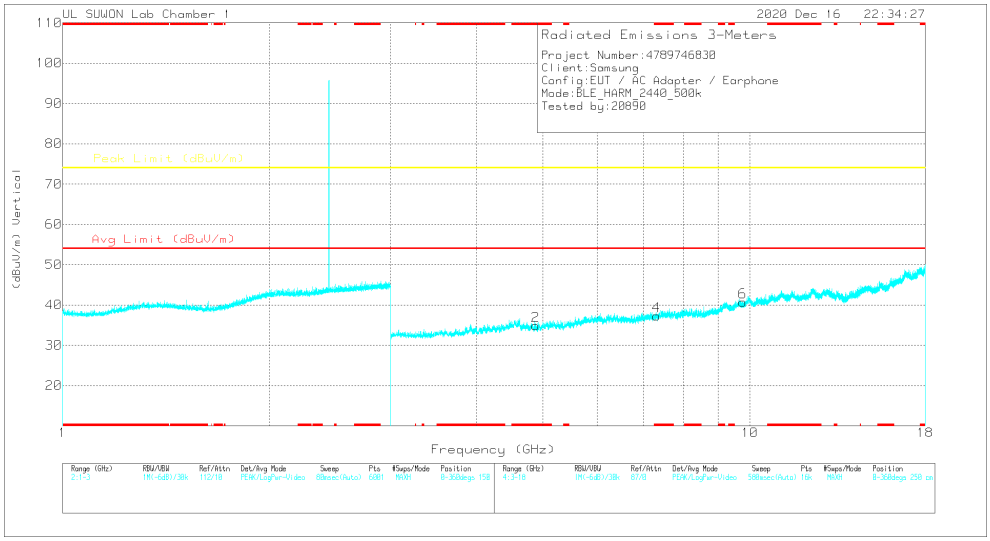
Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.81138	41.88	PK2	34.1	-31.3	0	44.68	-	-	74	-29.32	360	100	H
* 4.80918	41.62	PK2	34.1	-31.4	0	44.32	-	-	74	-29.68	360	100	V
7.21372	37.97	PK2	35.9	-27.6	0	46.27	-	-	74	-27.73	360	100	H
7.19965	38.65	PK2	35.9	-27.7	0	46.85	-	-	74	-27.15	360	100	V
9.60855	35.3	PK2	37.1	-23	0	49.4	-	-	74	-24.6	360	100	H
9.61614	35.18	PK2	37.2	-23.1	0	49.28	-	-	74	-24.72	360	100	V

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

MID CHANNEL RESULTS



HORIZONTAL



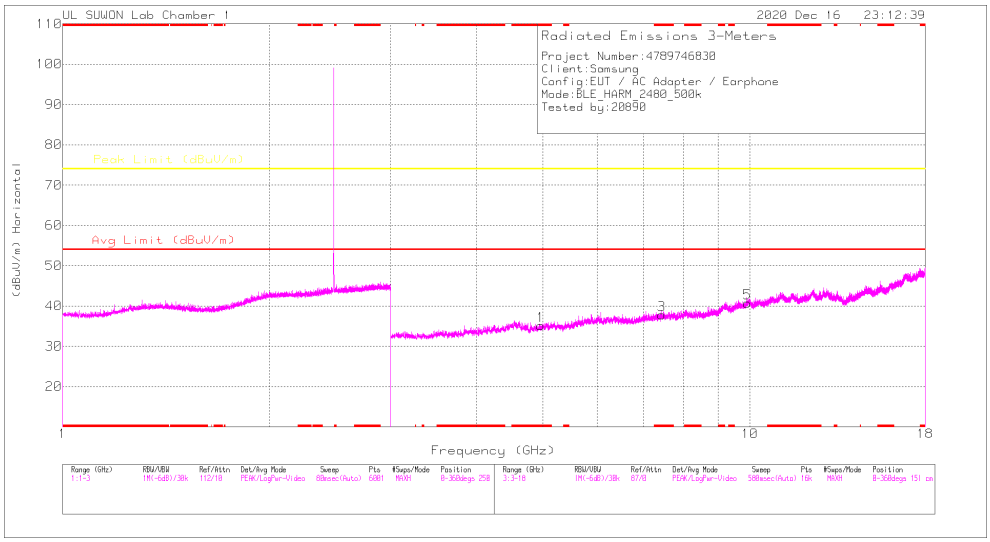
VERTICAL

Radiated Emissions

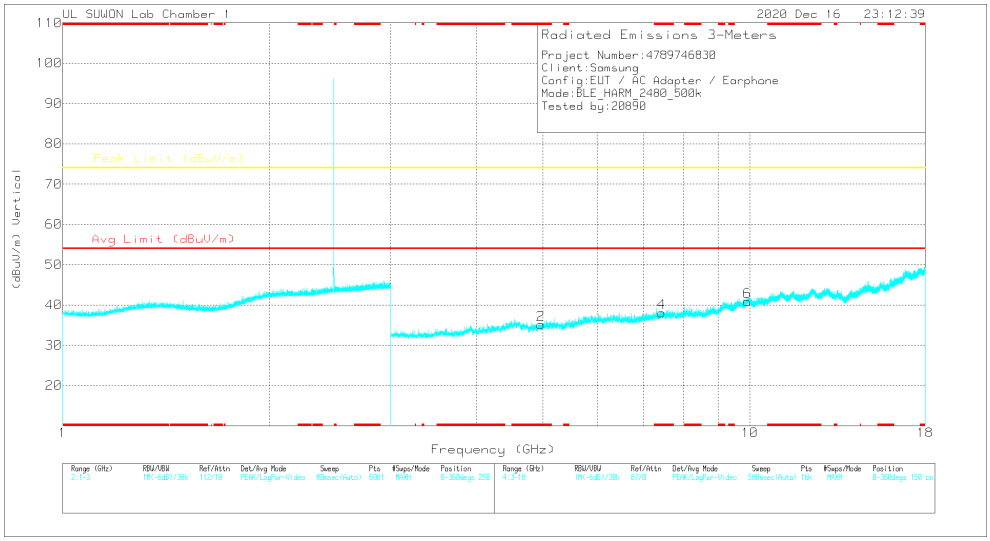
Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.87826	41.27	PK2	34.1	-31.4	0	43.97	-	-	74	-30.03	360	100	H
* 4.87745	41.56	PK2	34.1	-31.4	0	44.26	-	-	74	-29.74	360	100	V
* 7.32563	38.7	PK2	35.8	-27.3	0	47.2	-	-	74	-26.8	360	100	H
* 7.32087	38.3	PK2	35.8	-27.3	0	46.8	-	-	74	-27.2	360	100	V
9.75626	35.8	PK2	37.4	-23.7	0	49.5	-	-	74	-24.5	360	100	H
9.7556	35.82	PK2	37.4	-23.7	0	49.52	-	-	74	-24.48	360	100	V

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

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

Radiated Emissions

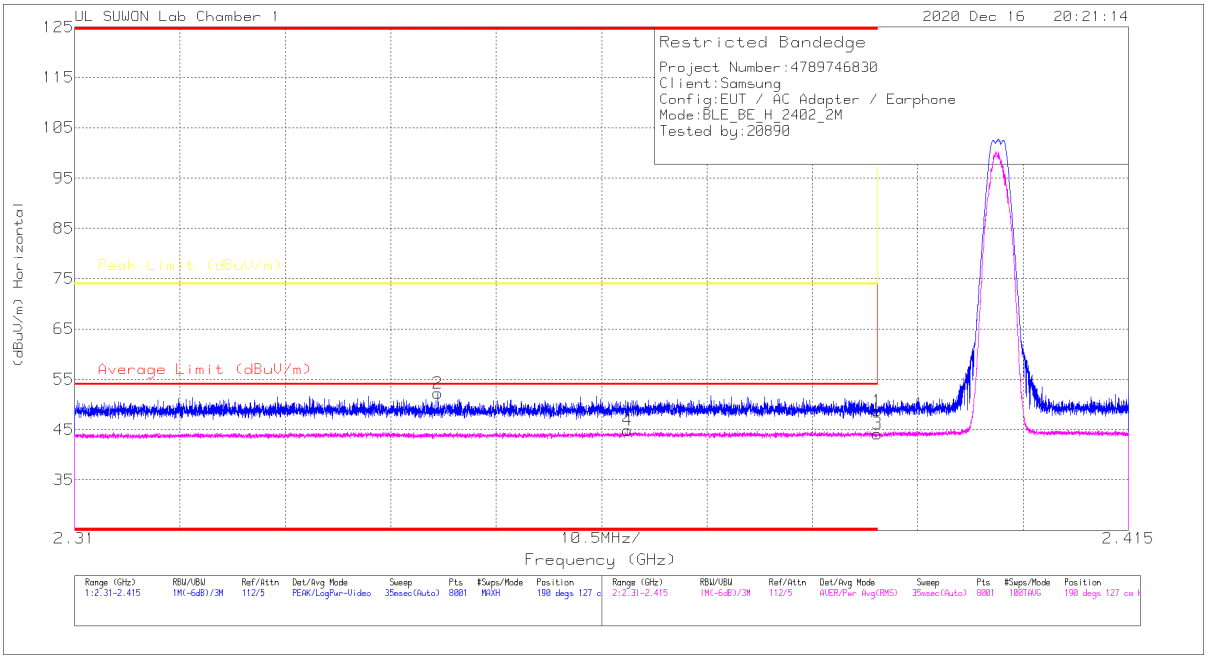
Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.95719	41.1	PK2	34.1	-31.4	0	43.8	-	-	74	-30.2	360	100	H
* 4.95941	40.97	PK2	34.1	-31.4	0	43.67	-	-	74	-30.33	360	100	V
* 7.43289	37.85	PK2	35.8	-26.8	0	46.85	-	-	74	-27.15	360	100	H
* 7.43272	37.8	PK2	35.8	-26.8	0	46.8	-	-	74	-27.2	360	100	V
9.91015	34.49	PK2	37.7	-21.7	0	50.49	-	-	74	-23.51	360	100	H
9.90925	34.27	PK2	37.7	-21.8	0	50.17	-	-	74	-23.83	360	100	V

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

10.2.2. BLE (2 Mbps)

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT

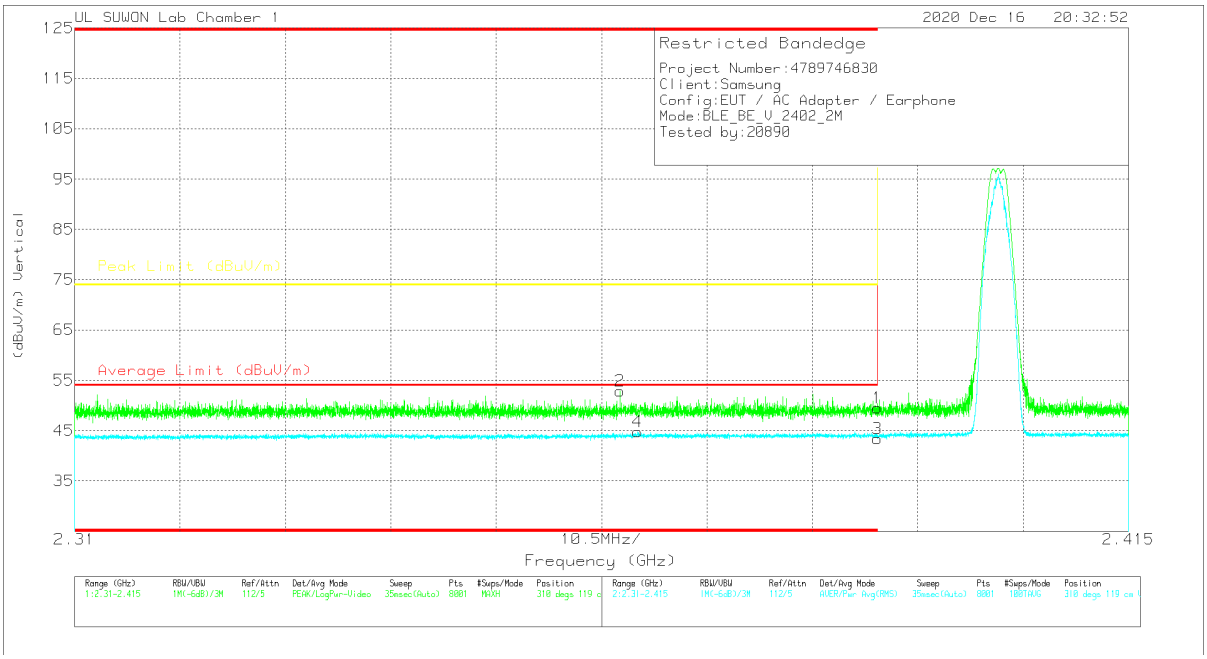


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	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	42.52	Pk	31.8	-25.6	0	48.72	-	-	74	-25.28	190	127	H
2	* 2.3462	46.3	Pk	31.7	-25.7	0	52.3	-	-	74	-21.7	190	127	H
3	* 2.39	33.11	RMS	31.8	-25.6	4.9	44.21	54	-9.79	-	-	190	127	H
4	* 2.3651	33.85	RMS	31.7	-25.6	4.9	44.85	54	-9.15	-	-	190	127	H

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

VERTICAL RESULT



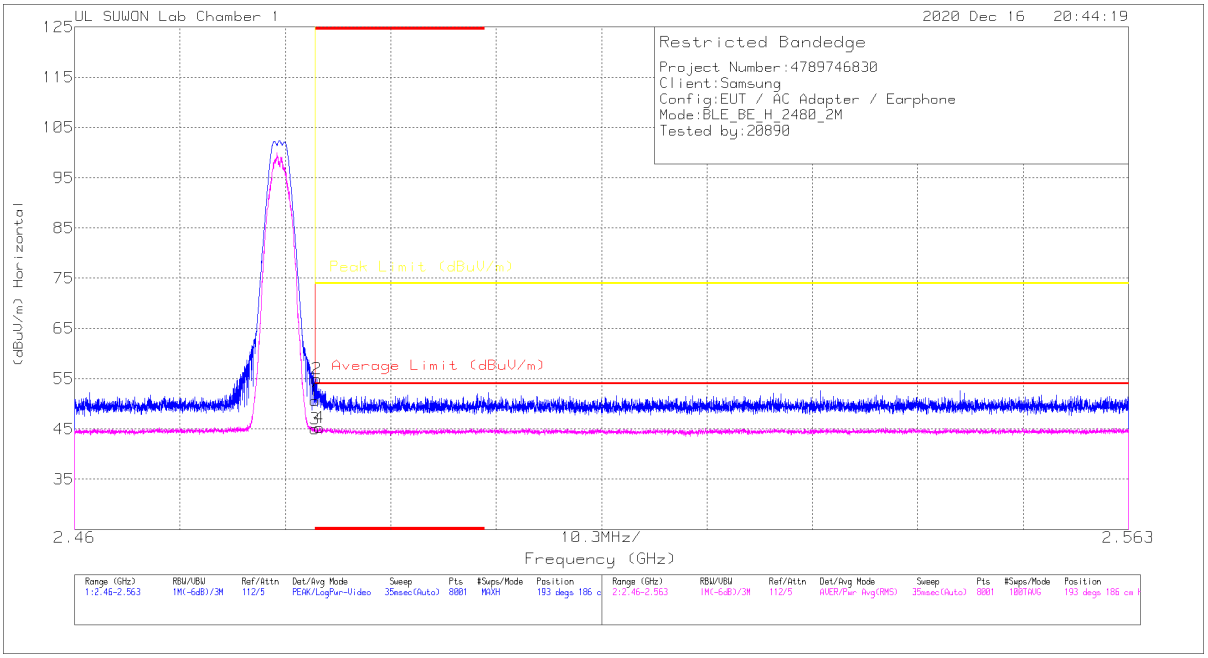
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	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	43.31	Pk	31.8	-25.6	0	49.51	-	-	74	-24.49	310	119	V
2	* 2.36434	46.75	Pk	31.7	-25.6	0	52.85	-	-	74	-21.15	310	119	V
3	* 2.39	32.29	RMS	31.8	-25.6	4.9	43.39	54	-10.61	-	-	310	119	V
4	* 2.36607	33.68	RMS	31.7	-25.5	4.9	44.78	54	-9.22	-	-	310	119	V

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

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT

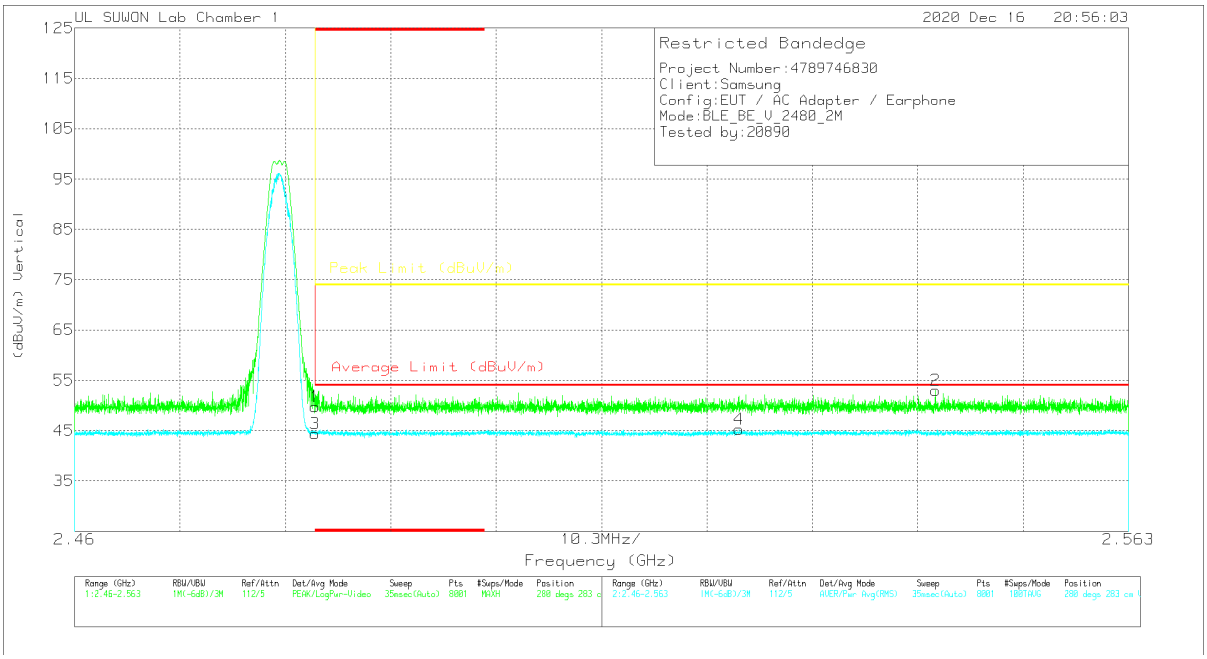


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	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	43.92	Pk	32	-25.3	0	50.62	-	-	74	-23.38	193	186	H
2	* 2.48368	48.3	Pk	32	-25.3	0	55	-	-	74	-19	193	186	H
3	* 2.48351	33.4	RMS	32	-25.3	4.9	45	54	-9	-	-	193	186	H
4	* 2.48393	33.64	RMS	32	-25.3	4.9	45.24	54	-8.76	-	-	193	186	H

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

VERTICAL RESULT



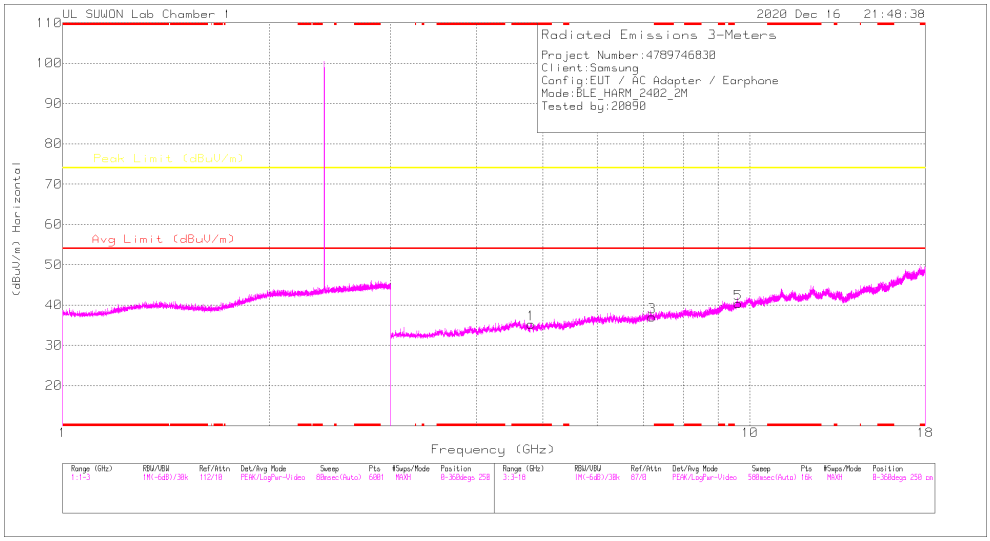
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	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	43.09	Pk	32	-25.3	0	49.79	-	-	74	-24.21	280	283	V
2	2.54414	46.2	Pk	32	-25.2	0	53	-	-	74	-21	280	283	V
3	* 2.48351	32.84	RMS	32	-25.3	4.9	44.44	54	-9.56	-	-	280	283	V
4	2.52495	33.42	RMS	32	-25	4.9	45.32	54	-8.68	-	-	280	283	V

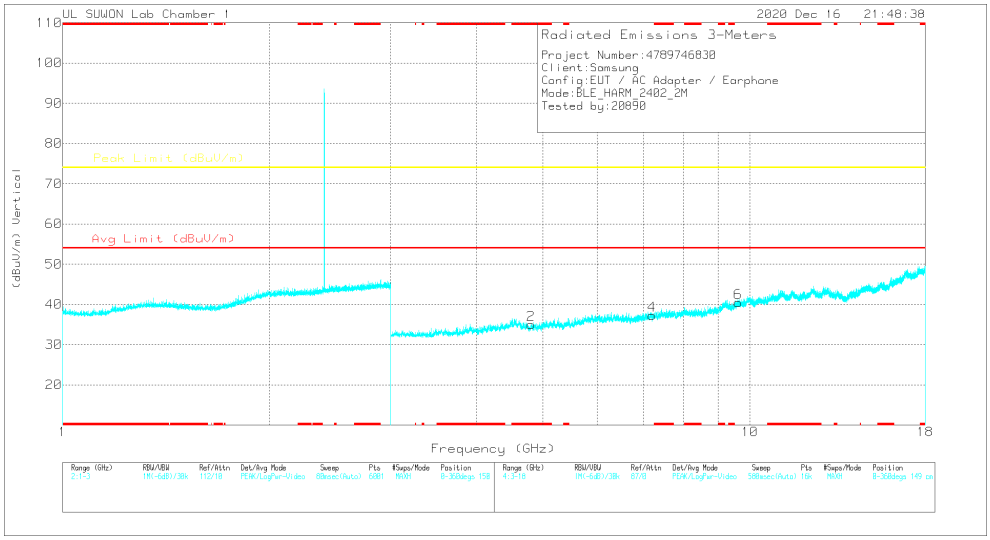
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



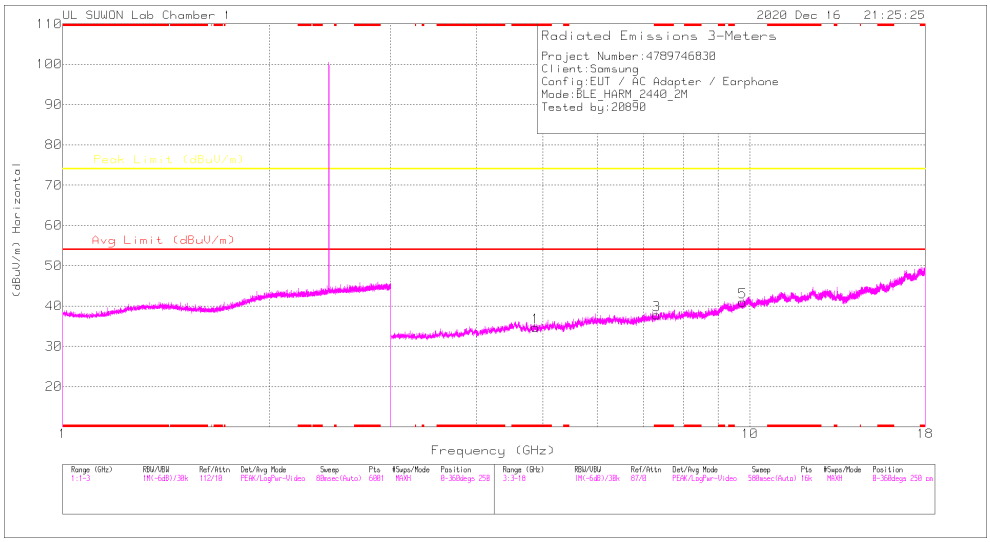
VERTICAL

Radiated Emissions

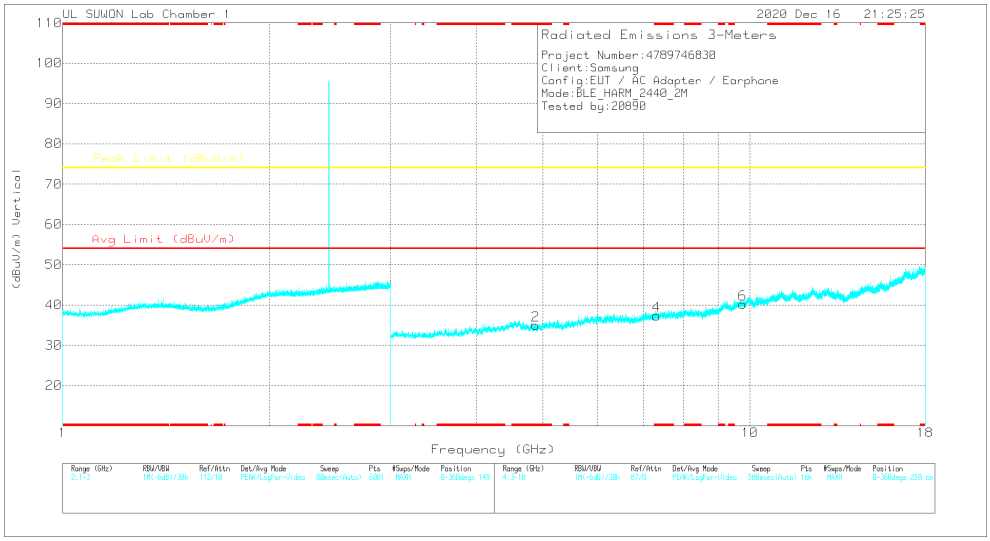
Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.80092	41.56	PK2	34.1	-31.5	0	44.16	-	-	74	-29.84	360	100	H
* 4.81105	41.96	PK2	34.1	-31.4	0	44.66	-	-	74	-29.34	360	100	V
7.21103	38.46	PK2	35.9	-27.6	0	46.76	-	-	74	-27.24	360	100	H
7.21648	38.16	PK2	35.9	-27.5	0	46.56	-	-	74	-27.44	360	100	V
9.60209	35.66	PK2	37.1	-23	0	49.76	-	-	74	-24.24	360	100	H
9.61821	34.73	PK2	37.2	-23.1	0	48.83	-	-	74	-25.17	360	100	V

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

MID CHANNEL RESULTS



HORIZONTAL



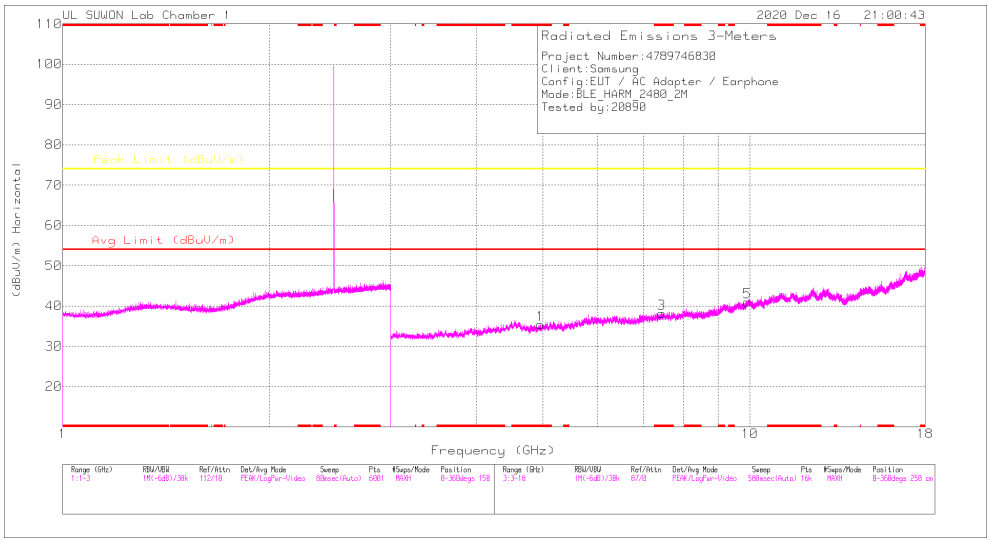
VERTICAL

Radiated Emissions

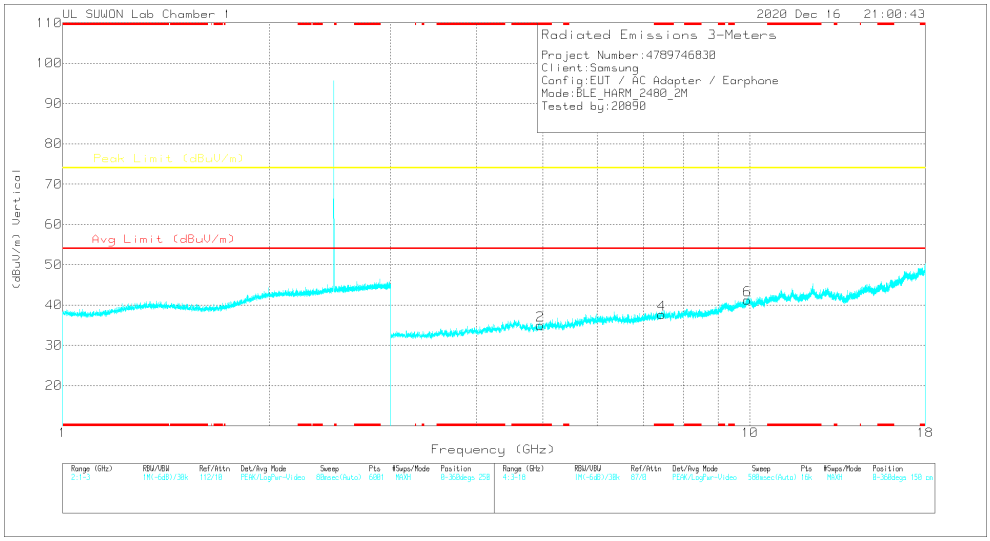
Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.87531	41.34	PK2	34.1	-31.3	0	44.14	-	-	74	-29.86	360	100	H
* 4.88077	41.1	PK2	34.1	-31.4	0	43.8	-	-	74	-30.2	360	100	V
* 7.3257	38.13	PK2	35.8	-27.3	0	46.63	-	-	74	-27.37	360	100	H
* 7.3149	38.2	PK2	35.8	-27.4	0	46.6	-	-	74	-27.4	360	100	V
9.75691	35.44	PK2	37.4	-23.7	0	49.14	-	-	74	-24.86	360	100	H
9.75723	35.46	PK2	37.4	-23.7	0	49.16	-	-	74	-24.84	360	100	V

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

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

Radiated Emissions

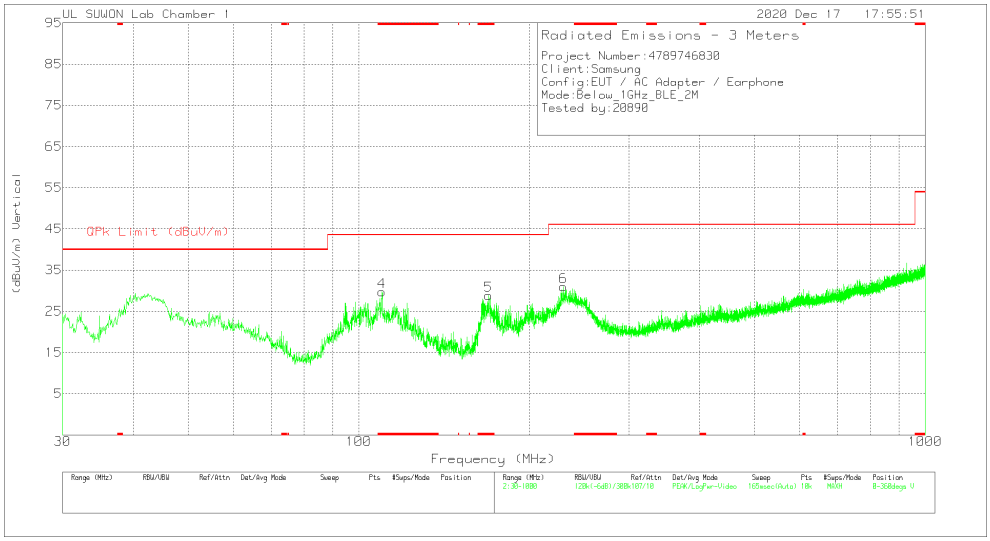
Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.94972	41.15	PK2	34.1	-31.5	0	43.75	-	-	74	-30.25	360	100	H
* 4.94741	40.77	PK2	34.1	-31.5	0	43.37	-	-	74	-30.63	360	100	V
* 7.43417	37.81	PK2	35.8	-26.8	0	46.81	-	-	74	-27.19	360	100	H
* 7.44435	38.08	PK2	35.8	-26.8	0	47.08	-	-	74	-26.92	360	100	V
9.9305	34.39	PK2	37.7	-21.5	0	50.59	-	-	74	-23.41	360	100	H
9.93096	34.65	PK2	37.7	-21.5	0	50.85	-	-	74	-23.15	360	100	V

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

10.3. WORST CASE BELOW 1 GHZ

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

HORIZONTAL



VERTICAL

Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163_750	Below_1G[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 110.025	46.65	Pk	17.2	-29.6	0	34.25	43.52	-9.27	0-360	300	H
2	185.394	43.97	Pk	15.9	-28.6	0	31.27	43.52	-12.25	0-360	200	H
3	* 247.377	42.88	Pk	18.4	-28	0	33.28	46.02	-12.74	0-360	100	H
4	* 109.734	41.96	Pk	17.3	-29.5	0	29.76	43.52	-13.76	0-360	300	V
5	* 169.486	43.02	Pk	14.6	-28.8	0	28.82	43.52	-14.7	0-360	100	V
6	229.82	41.42	Pk	17.6	-28.1	0	30.92	46.02	-15.1	0-360	100	V

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

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.

TEST PROCEDURE

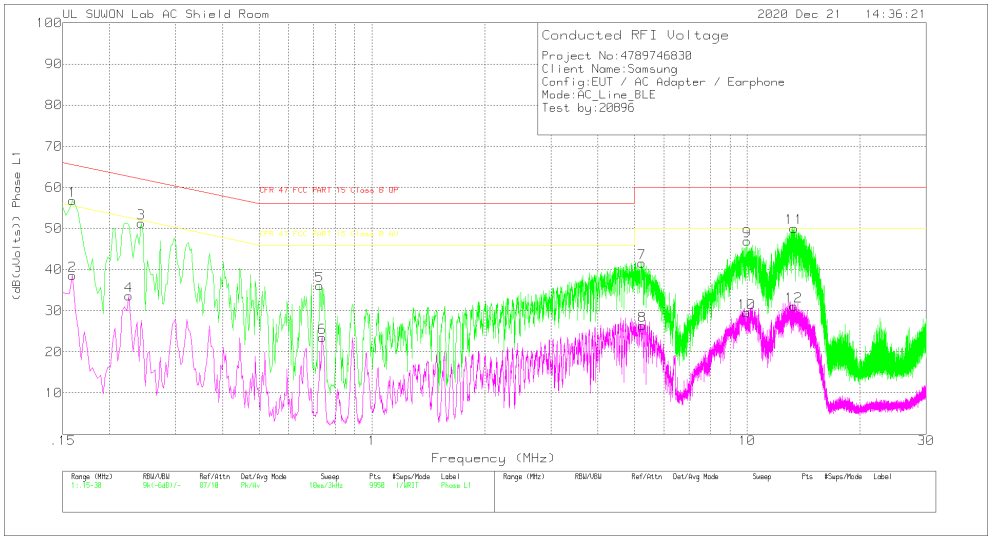
The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10
.
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

RESULTS

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	.159	46.75	Pk	9.9	.1	56.75	65.52	-8.77	-	-
2	.159	28.54	Av	9.9	.1	38.54	-	-	55.52	-16.98
3	.243	41.39	Pk	9.7	.2	51.29	61.99	-10.7	-	-
4	.225	23.57	Av	9.8	.2	33.57	-	-	52.63	-19.06
5	.726	25.97	Pk	9.9	.2	36.07	56	-19.93	-	-
6	.738	13.41	Av	9.9	.2	23.51	-	-	46	-22.49
7	5.244	31.52	Pk	9.8	.3	41.62	60	-18.38	-	-
8	5.265	16.33	Av	9.8	.3	26.43	-	-	50	-23.57
9	9.99	36.6	Pk	9.9	.4	46.9	60	-13.1	-	-
10	9.969	19.17	Av	9.9	.4	29.47	-	-	50	-20.53
11	13.335	39.72	Pk	10	.4	50.12	60	-9.88	-	-
12	13.332	20.73	Av	10	.4	31.13	-	-	50	-18.87

Pk - Peak detector
Av - Average detection

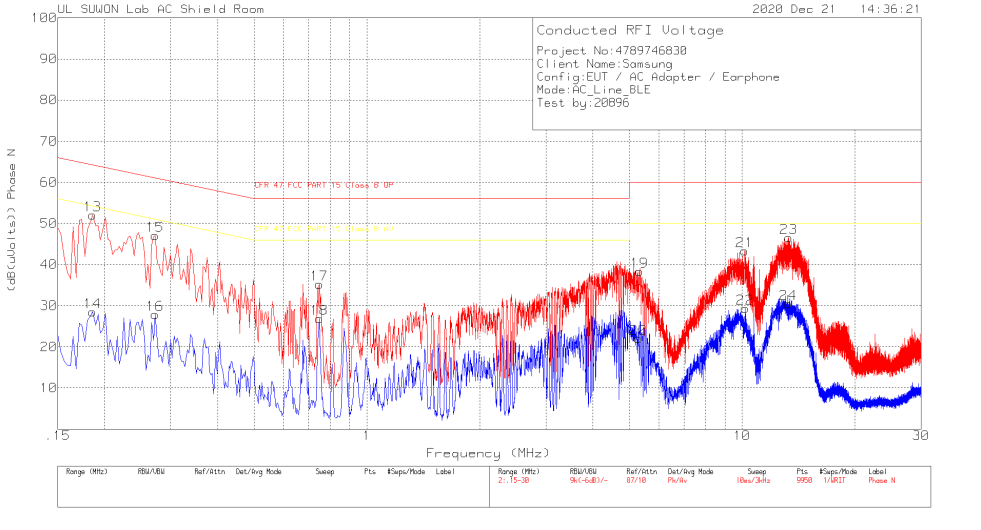
Quasi-Peak Emissions

Range 1: Phase L1 .15 - 30MHz

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)
.15975	37.96	Qp	9.9	.1	47.96	65.48	-17.52	-	-
13.3352	29.77	Qp	10	.4	40.17	60	-19.83	-	-

Qp - Quasi-Peak detector

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	.186	41.82	Pk	10	.2	52.02	64.21	-12.19	-	-
14	.186	18.35	Av	10	.2	28.55	-	-	54.21	-25.66
15	.273	37.14	Pk	9.7	.2	47.04	61.03	-13.99	-	-
16	.273	17.97	Av	9.7	.2	27.87	-	-	51.03	-23.16
17	.747	25.13	Pk	9.9	.2	35.23	56	-20.77	-	-
18	.747	16.72	Av	9.9	.2	26.82	-	-	46	-19.18
19	5.319	28.23	Pk	9.8	.3	38.33	60	-21.67	-	-
20	5.298	11.88	Av	9.8	.3	21.98	-	-	50	-28.02
21	10.158	33.08	Pk	9.9	.4	43.38	60	-16.62	-	-
22	10.179	19.05	Av	9.9	.4	29.35	-	-	50	-20.65
23	13.299	36.11	Pk	10.1	.4	46.61	60	-13.39	-	-
24	13.266	20.03	Av	10.1	.4	30.53	-	-	50	-19.47

Pk - Peak detector
Av - Average detection

END OF TEST REPORT