CERTIFICATION TEST REPORT

Report Number. : 4789497455-E4V2

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	SM-N985F/DS, SM-N985F
FCC ID	:	A3LSMN985F
EUT Description	:	GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, UWB, WPT and NFC
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
July 08, 2020

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IAS ACCREDITED
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	07/02/20	Initial issue	Jihyeon Park
V2	07/08/20	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, UWB, WPT and NFC

MODEL: SM-N985F/DS, SM-N985F

SERIAL NUMBER: 43d9e5cc711e7ece, 41a26381d91f7ece(CONDUCTED, Original)
R3CN40FXTJZ, R3CN40CD5BN, R3CN40CD4FP (RADIATED, Original);
R38N406WLZB (Spot-Check);

DATE TESTED: MAY 04, 2020 – JUN 15, 2020(Original);
JUN 02, 2020 – JUN 26, 2020(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:

Jihyeon Park
Suwon Lab Technician
UL Korea, Ltd.

1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMN986B 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: A3LSMN985F shares the same enclosure and circuit board as FCC ID: A3LSMN986B. The BLE antennas and surrounding circuitry and layout are identical between these two units.

After confirming through preliminary radiated emissions that the performance of the FCC ID: A3LSMN986B remains representative of FCC ID: A3LSMN985F. The test data of FCC ID: A3LSMN986B being submitted for this application to cover BLE features.

1.3. SPOT CHECK VERIFICATION DATA

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

Band	Test Item	Mode	Frequency	Test Limit	Original model	Spot-check model	Deviation	Remark
					SM-N986B/DS Results	SM-N985F/DS Results		
					FCC ID : A3LSMN986B	FCC ID : A3LSMN985F		
DTS BLE (2.4GHz)	Band Edge	1Mbps	2480 MHz	54 dBuV/m	45.30 dBuV/m	45.31 dBuV/m	0.01 dB	-
	RSE	1Mbps	9760 MHz	74 dBuV/m	49.12 dBuV/m	40.93 dBuV/m	-8.19 dB	Noise floor
	Band Edge	2Mbps	2480 MHz	54 dBuV/m	48.21 dBuV/m	48.06 dBuV/m	-0.15 dB	-
	RSE	2Mbps	9760 MHz	74 dBuV/m	48.61 dBuV/m	48.60 dBuV/m	-0.01 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	A3LSMN986B	Original Grant	4789468331-E2	Test Report	4789497455-E2	All
DTS	A3LSMN986B	Original Grant	4789468331-E3 (802.11b/g/n/ax)	Test Report	4789497455-E3 (802.11b/g/n/ax)	All
			4789468331-E4 Bluetooth LE	Test Report	4789497455-E4 Bluetooth LE	All
DSS	A3LSMN986B	Original Grant	4789468331-E5 (Bluetooth)	Test Report	4789497455-E5 (Bluetooth)	All
NII	A3LSMN986B	Original Grant	4789468331-E6 (802.11a/n/ac/ax)	Test Report	4789497455-E6 (802.11a/n/ac/ax)	All
DXX	A3LSMN986B	Original Grant	4789468331-E7 (NFC)	Test Report	4789497455-E7 (NFC)	All
DCD	A3LSMN986B	Original Grant	4789468331-E8 (WPT)	Test Report	4789497455-E8 (WPT)	All

For this application the data reuse is summarized below for each equipment class:

Equipment Class	Reference FCC ID (Parent)	Application Type	Test Item	Data Re-used
PCE	A3LSMN986B	Original Grant	WWAN	All except SAR (full test), HAC (full test)
DTS	A3LSMN986B	Original Grant	BLE	All
			WLAN	All except SAR (full test), HAC (full test)
			WLAN 802.11ax	All except HAC (full test)
DSS	A3LSMN986B	Original Grant	BT	All except SAR (full test)
NII	A3LSMN986B	Original Grant	WLAN	All except SAR (full test), HAC (full test)
			WLAN 802.11ax	All except HAC (full test)
DXX	A3LSMN986B	Original Grant	NFC	All
DCD	A3LSMN986B	Original Grant	WPT	All except RF exposure

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.
5. KDB 484596 D01 Referencing Test Data v01

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	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%.

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

This report covers the Samsung models SM-N986B/DS and SM-N986B.
These models are identical in hardware except SM-N986B has single SIM tray.
With some pre-scan, model SM-N986B/DS 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	1Mbps	Peak	8.211	6.62
		Average	6.934	4.94
	2Mbps	Peak	9.417	8.74
		Average	7.877	6.13

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.

The radio utilizes an internal antenna, with a maximum gain of -5.12 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 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.

Power verification

The Output Power of all data rate are all investigated, the 1 Mbps(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]
1	1Mbps (37 pkt)	2402	6.038
		2440	***6.934***
		2480	6.616
	1Mbps (255 pkt)	2402	5.989
		2440	6.799
		2480	6.584
1	Coded S=8 125 kbps (37 pkt)	2402	5.958
		2440	6.771
		2480	6.555
	Coded S=8 125 kbps (128 pkt)	2402	5.987
		2440	6.911
		2480	6.584
	Coded S=2 500 kbps (37 pkt)	2402	6.007
		2440	***6.930***
		2480	6.593
	Coded S=2 500 kbps (128 pkt)	2402	5.993
		2440	6.920
		2480	6.596

Symbol Rate [Ms/s]	Mode	Frequency [MHz]	Conducted Burst Avg [dBm]
2	2Mbps (37 pkt)	2402	6.997
		2440	***7.877***
		2480	7.234
	2Mbps (255 pkt)	2402	6.946
		2440	7.827
		2480	7.180

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA800	R37N39301T8SE3	N/A
Data Cable	SAMSUNG	EP-DG980	N/A	N/A

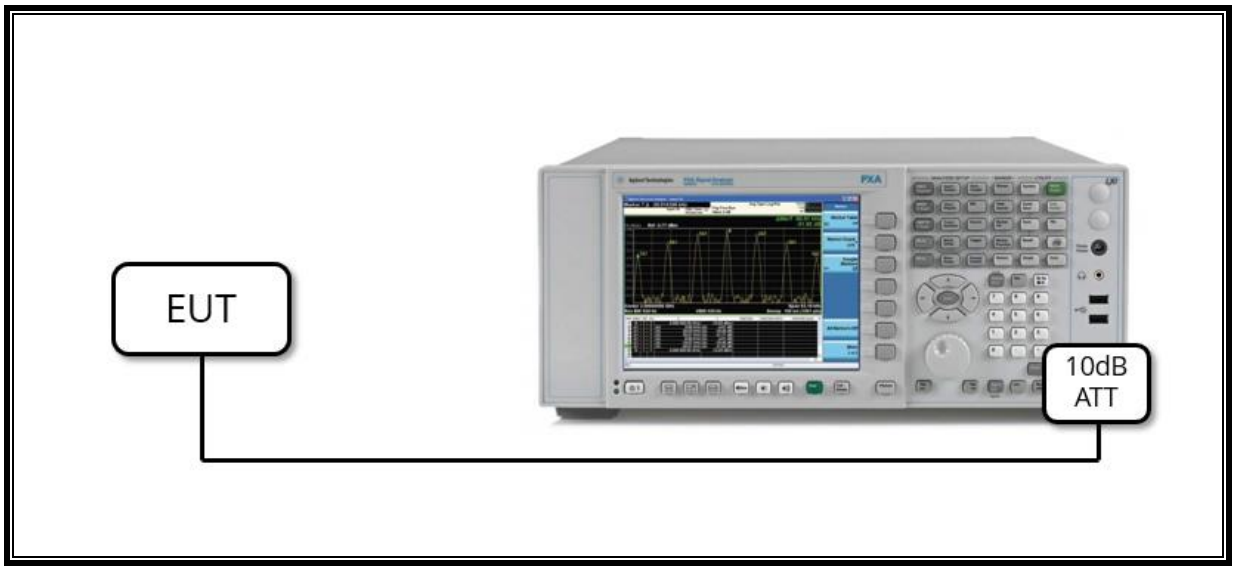
I/O CABLE

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

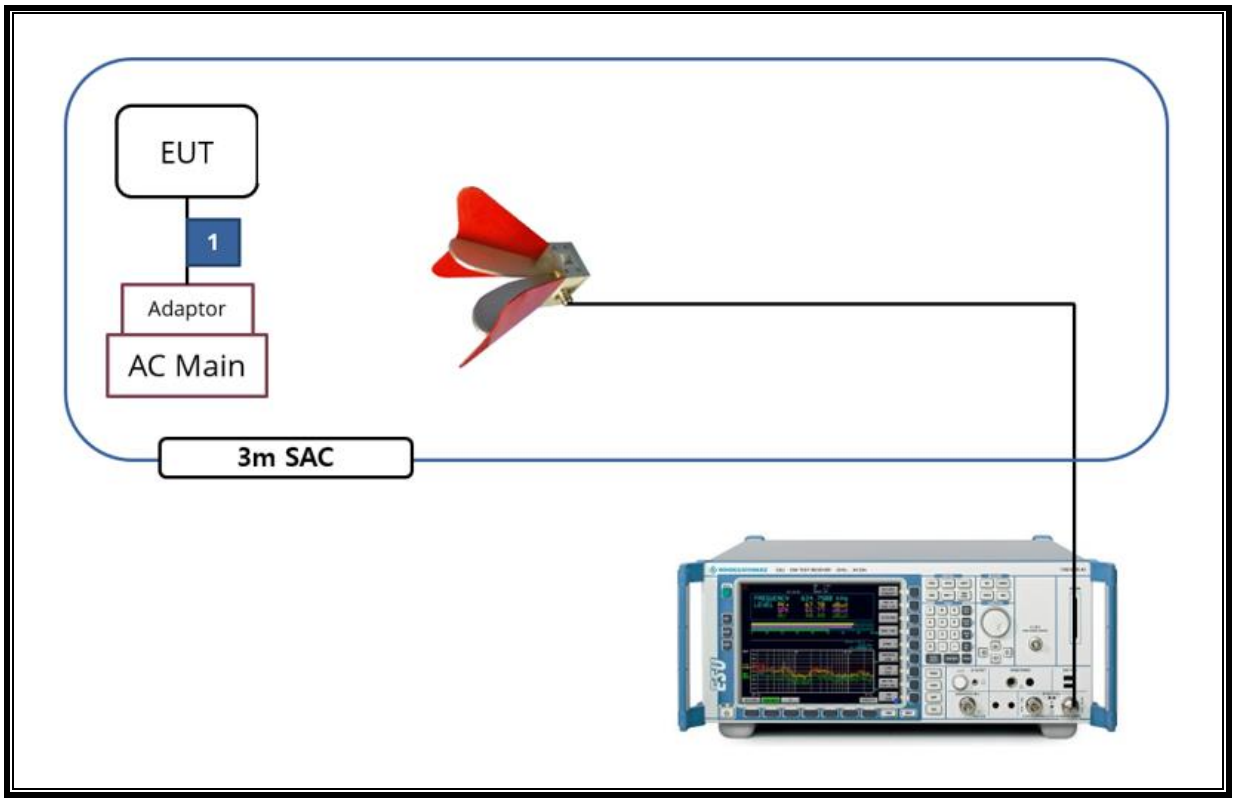
TEST SETUP

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

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**	**Next Cal. Date**
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00167211	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00161451	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168724	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168717	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00205959	08-04-20
Antenna, Horn, 40 GHz	ETS	3116C	00166155	08-14-20
Antenna, Horn, 40 GHz	ETS	3116C	00168645	10-02-21
Preamplifier	ETS	3116C-PA	00168841	08-08-20
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-05-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-06-20
Spectrum Analyzer, 44 GHz	Keysight	N9030B	MY57143717	01-20-21
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-06-20
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-06-20
Spectrum Analyzer, 43.5 GHz	R&S	FSW43	104089	08-06-20
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-09-20
Attenuator	PASTERNACK	PE7087-10	A001	08-08-20
Attenuator	PASTERNACK	PE7087-10	A008	08-08-20
Attenuator	PASTERNACK	PE7004-10	2	08-06-20
Attenuator	PASTERNACK	PE7087-10	A009	08-08-20
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-06-20
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-06-20
EMI Test Receive, 44 GHz	R&S	ESW44	101590	08-05-20
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-05-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-06-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-06-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	020	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	020	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	021	08-06-20
LISN	R&S	ENV-216	101837	08-09-20
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	10-02-21

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

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

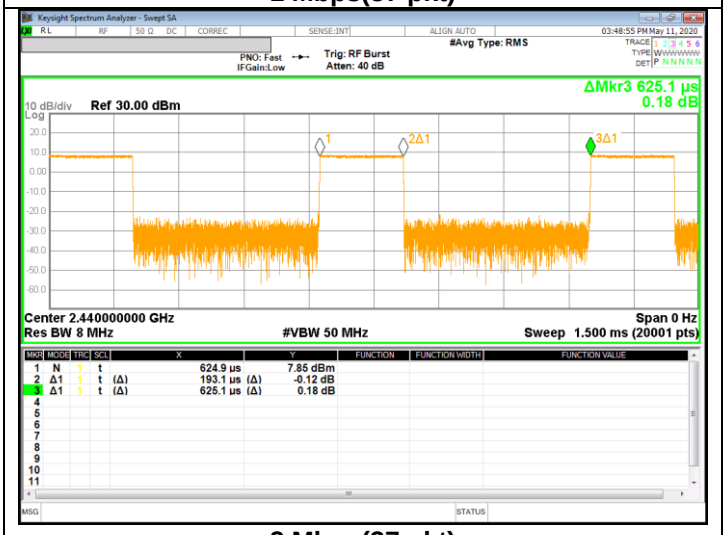
9.1. ON TIME AND DUTY CYCLE

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 1 Mbps[37pkt]	0.377	0.625	0.604	60.352	2.193	2.651
BLE 2 Mbps[37pkt]	0.193	0.625	0.309	30.891	5.102	5.179

1 Mbps(37 pkt)



2 Mbps(37 pkt)

9.2. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

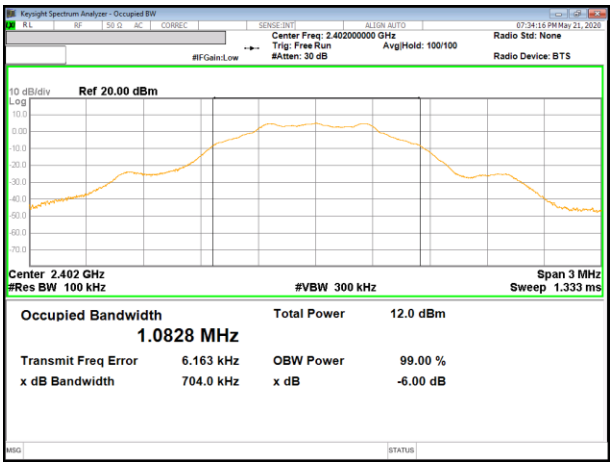
RSS-247 5.2 (a)

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

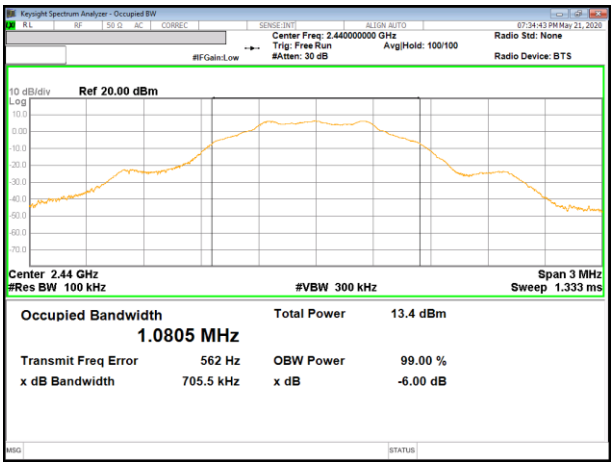
RESULTS

9.2.1. BLE (1Mbps)

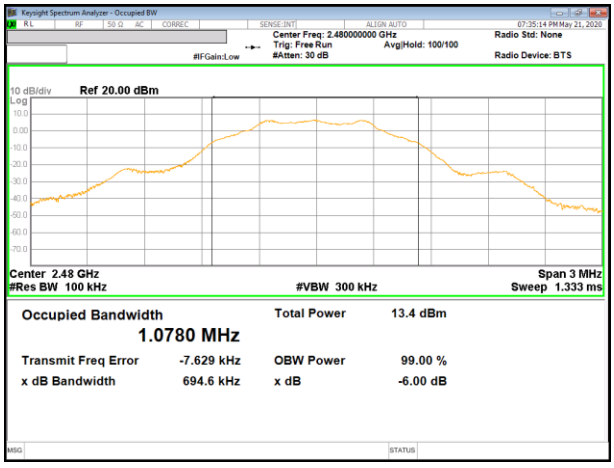
Channel	Frequency [MHz]	6 dB Bandwidth [kHz]	Minumun Limit [kHz]
Low	2 402	704.00	500.00
Mid	2 440	705.50	500.00
High	2 480	**694.60**	500.00
Worst		694.60	500.00



LOW CHANNEL



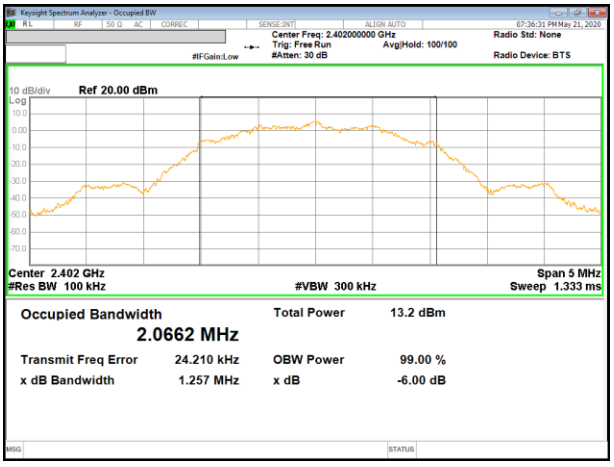
MID CHANNEL



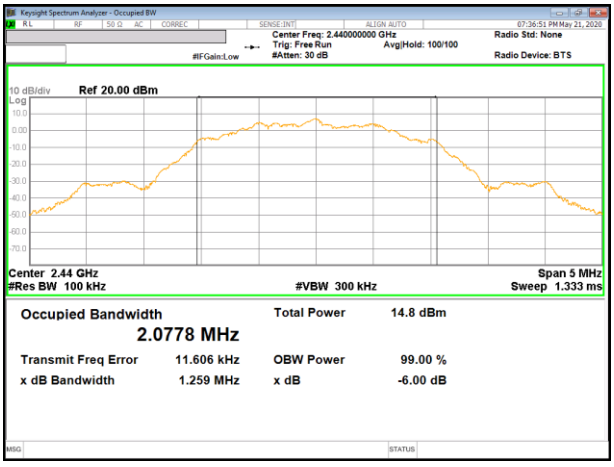
HIGH CHANNEL

9.2.2. BLE (2Mbps)

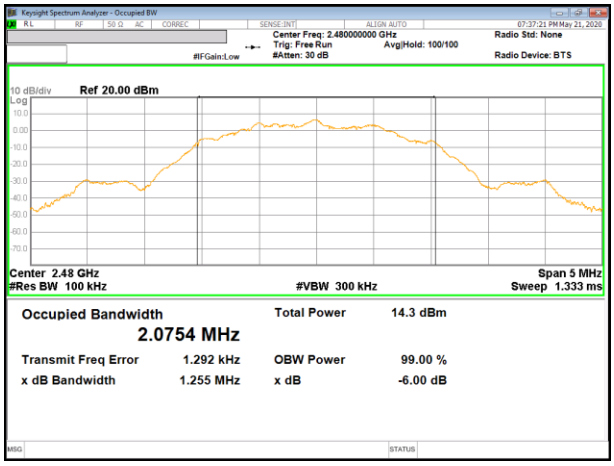
Channel	Frequency [MHz]	6 dB Bandwidth [kHz]	Minumun Limit [kHz]
Low	2 402	1257.00	500.00
Mid	2 440	1259.00	500.00
High	2 480	**1255.00**	500.00
Worst		1255.00	500.00



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

- 1 Mbps

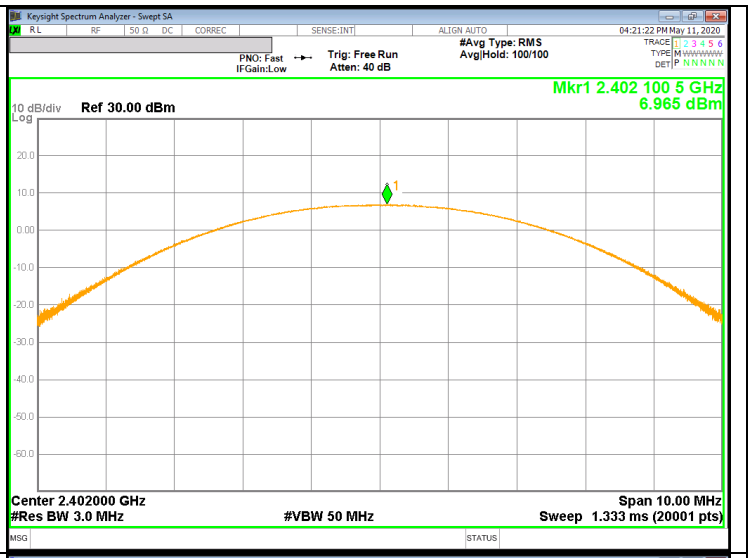
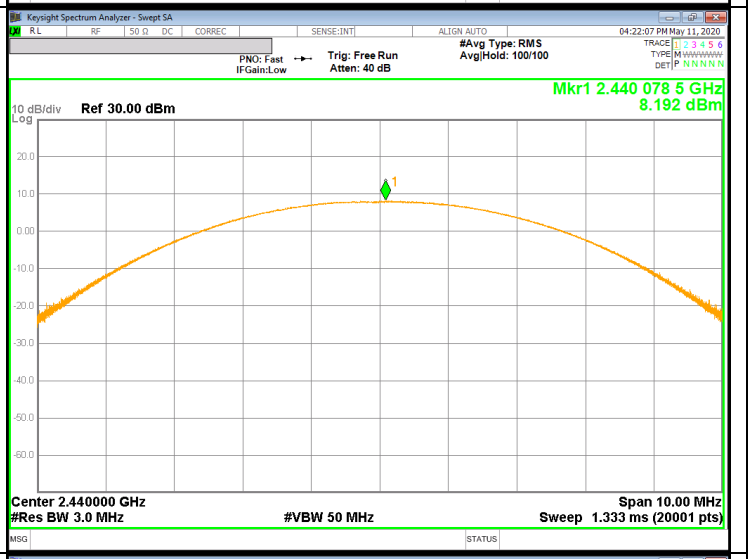
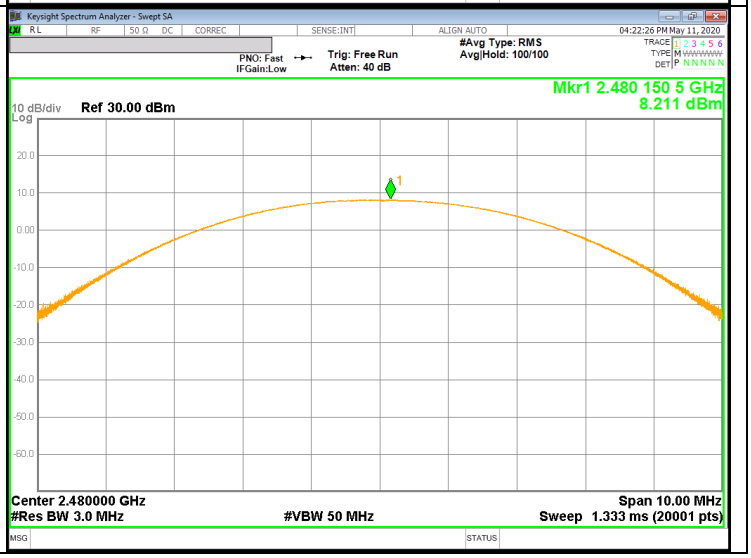
Channel	Frequency [MHz]	Peak Power [dBm]	Limit [dBm]	Margin [dB]
Low	2 402	6.965	30.000	-23.035
Mid	2 440	8.192	30.000	-21.808
High	2 480	**8.211**	30.000	-21.789
Worst		8.211	30.000	-21.789

- 2 Mbps

Channel	Frequency [MHz]	Peak Power [dBm]	Limit [dBm]	Margin [dB]
Low	2 402	8.155	30.000	-21.845
Mid	2 440	**9.417**	30.000	-20.583
High	2 480	8.934	30.000	-21.066
Worst		9.417	30.000	-20.583

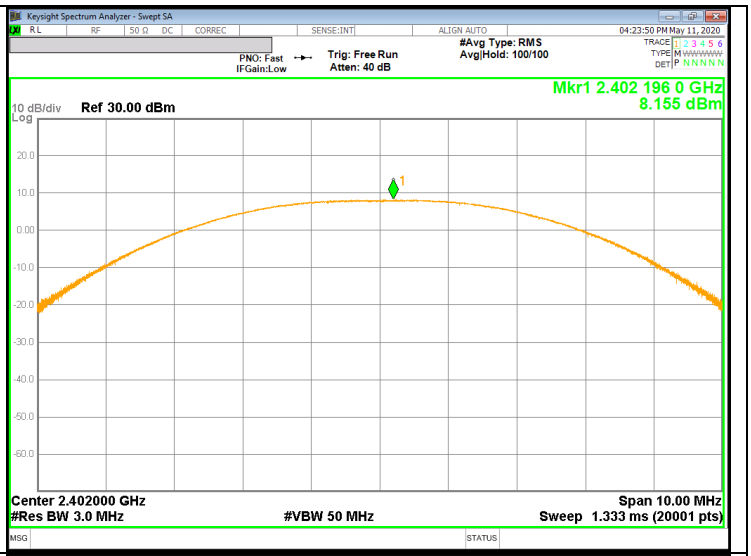
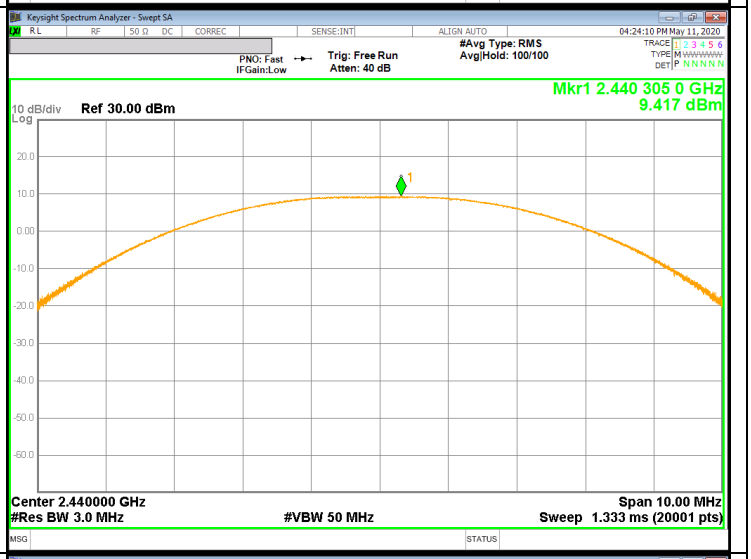
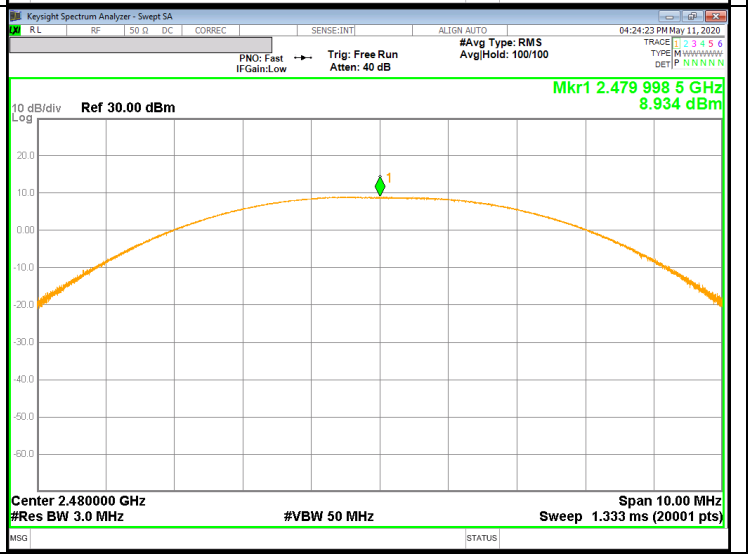
9.3.1. BLE (1 Mbps)

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.

- 1 Mbps

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2 402	6.038	4.016
Middle	2 440	**6.934**	**4.936**
High	2 480	6.616	4.587

- 2 Mbps

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2 402	6.997	5.008
Middle	2 440	**7.877**	**6.134**
High	2 480	7.234	5.289

9.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

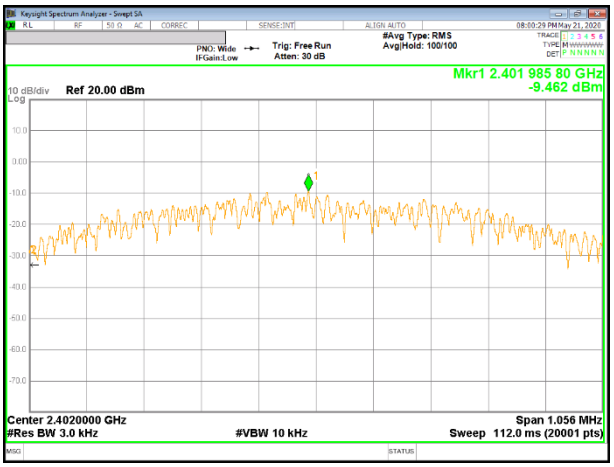
RSS-247 (5.2) (b)

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.

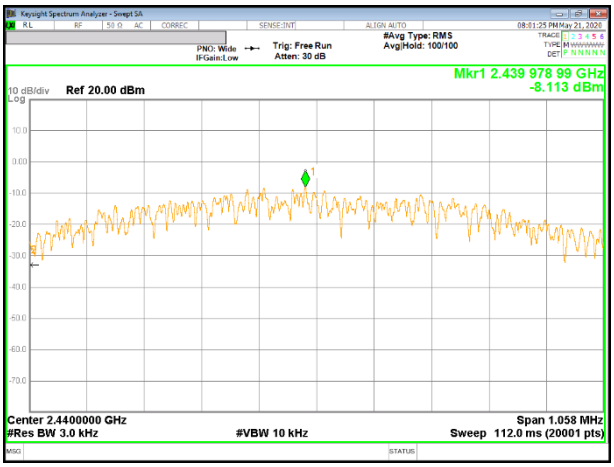
RESULTS

9.5.1. BLE (1Mbps)

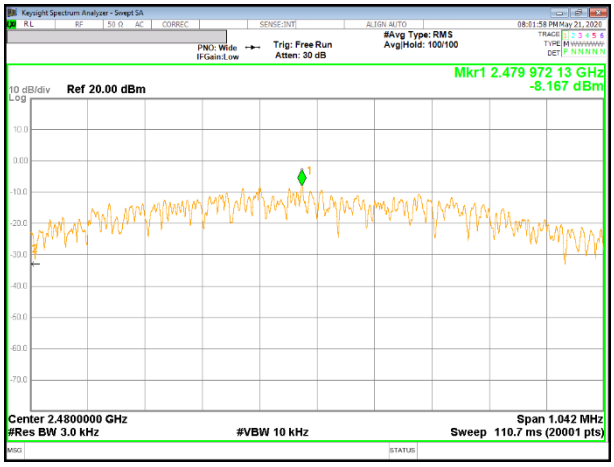
Channel	Frequency [MHz]	PSD [dBm/3kHz]	Limit [dBm/3kHz]	Margin [dB]
Low	2 402	-9.46	8.00	-17.46
Mid	2 440	**-8.11**	**8.00**	**-16.11**
High	2 480	-8.17	8.00	-16.17



LOW CHANNEL



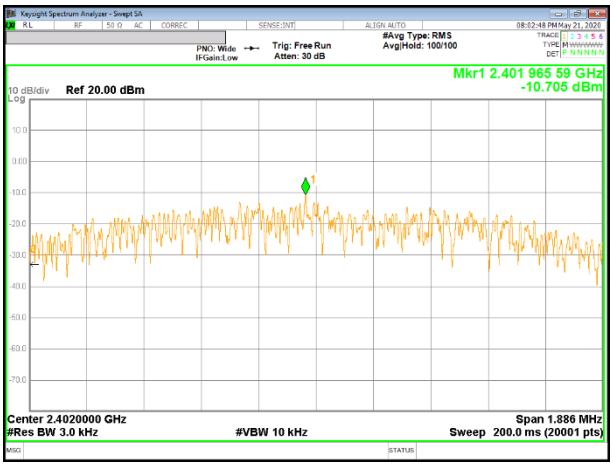
MID CHANNEL



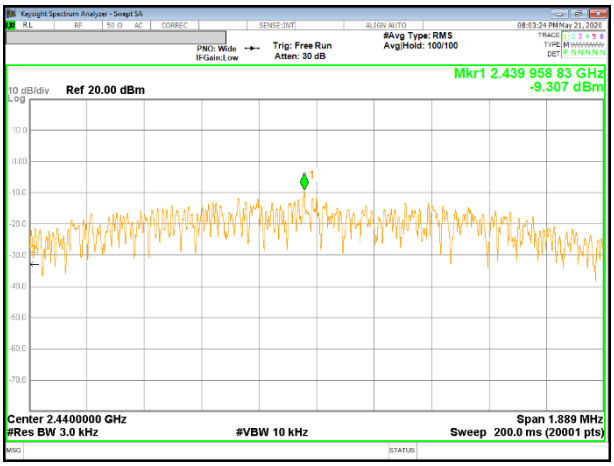
HIGH CHANNEL

9.5.2. BLE (2Mbps)

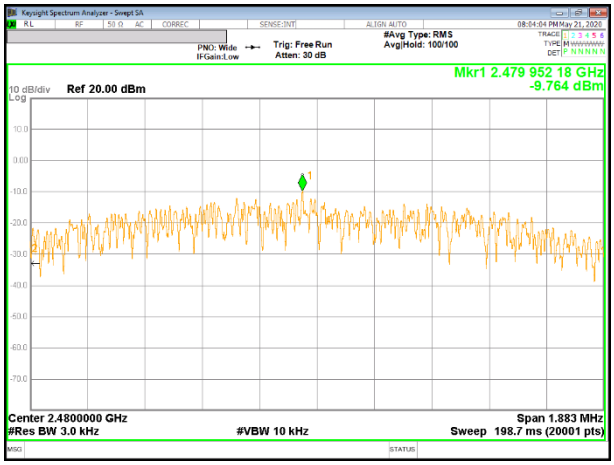
Channel	Frequency [MHz]	PSD [dBm/3kHz]	Limit [dBm/3kHz]	Margin [dB]
Low	2 402	-10.71	8.00	-18.71
Mid	2 440	**-9.31**	**8.00**	**-17.31**
High	2 480	-9.76	8.00	-17.76



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

9.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

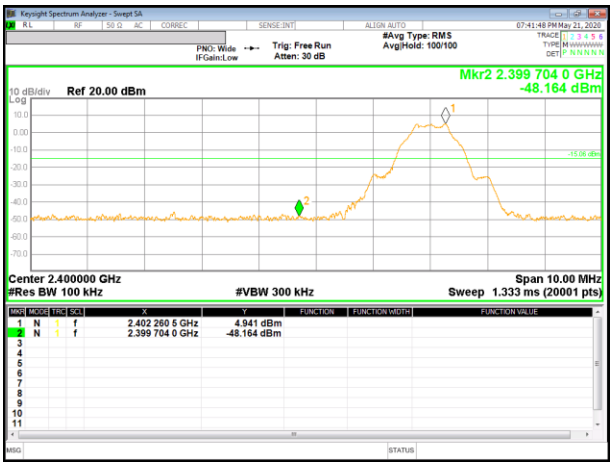
FCC §15.247 (d)

RSS-247 5.5

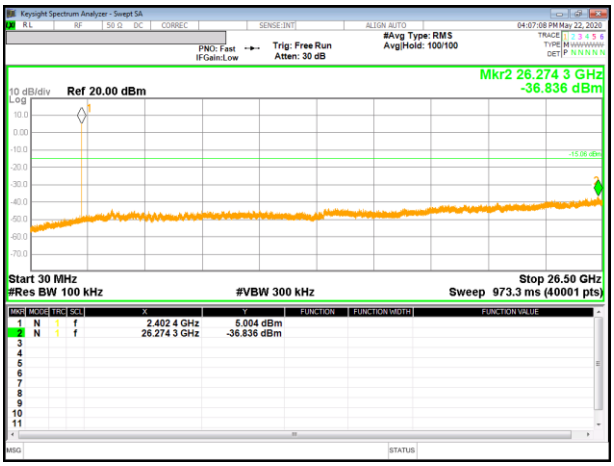
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

RESULTS

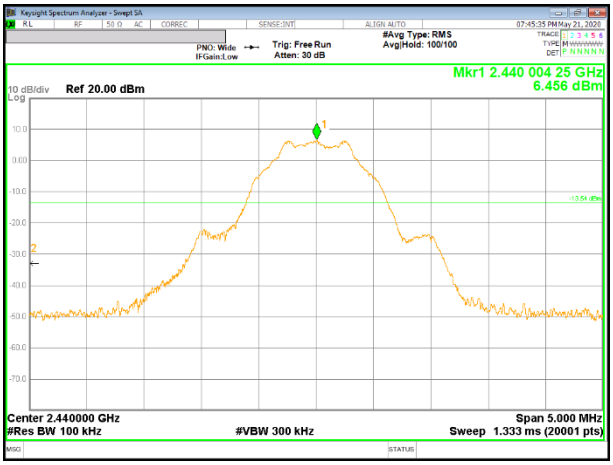
9.6.1. BLE (1Mbps)



LOW CHANNEL BANDEDGE



OUT-OF-BAND LOW CHANNEL



IN-BAND REFERENCE LEVEL

OUT-OF-BAND MID CHANNEL

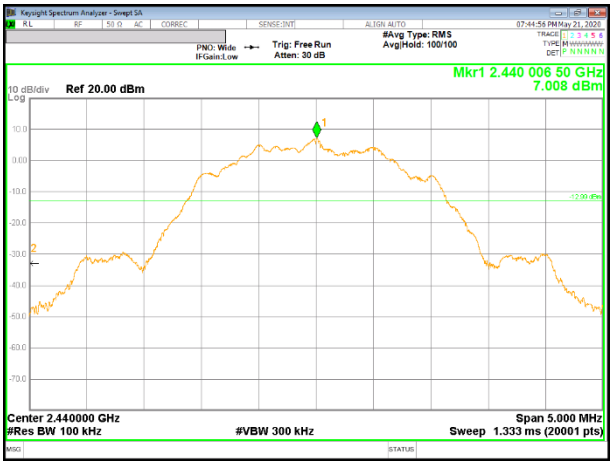
HIGH CHANNEL BANDEDGE

OUT-OF-BAND HIGH CHANNEL

9.6.2. BLE (2Mbps)

LOW CHANNEL BANDEDGE

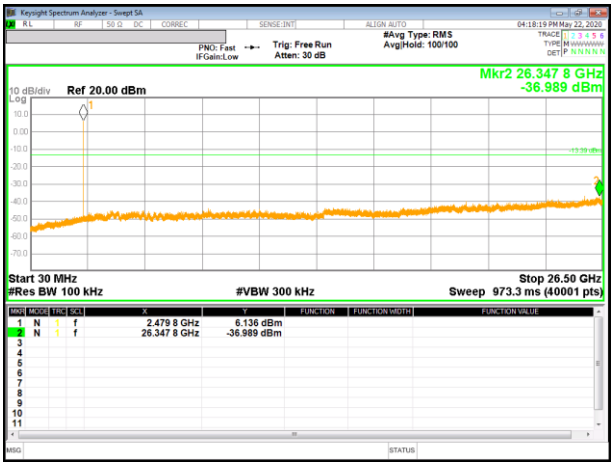
OUT-OF-BAND LOW CHANNEL



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. (Restriced bandedge, Final detection of spurious harmonic emissions)Duty cycle factor = 10 log (1/x). For this sample: For 1Mbps, DCF = 10log(1/0.604)=2.193 dB (Spectrum Analyzer round it up to 2.19 dB) and for 2Mbps, DCF = 10log(1/0.309)=5.102 dB (Spectrum Analyzer round it up to 5.10 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.

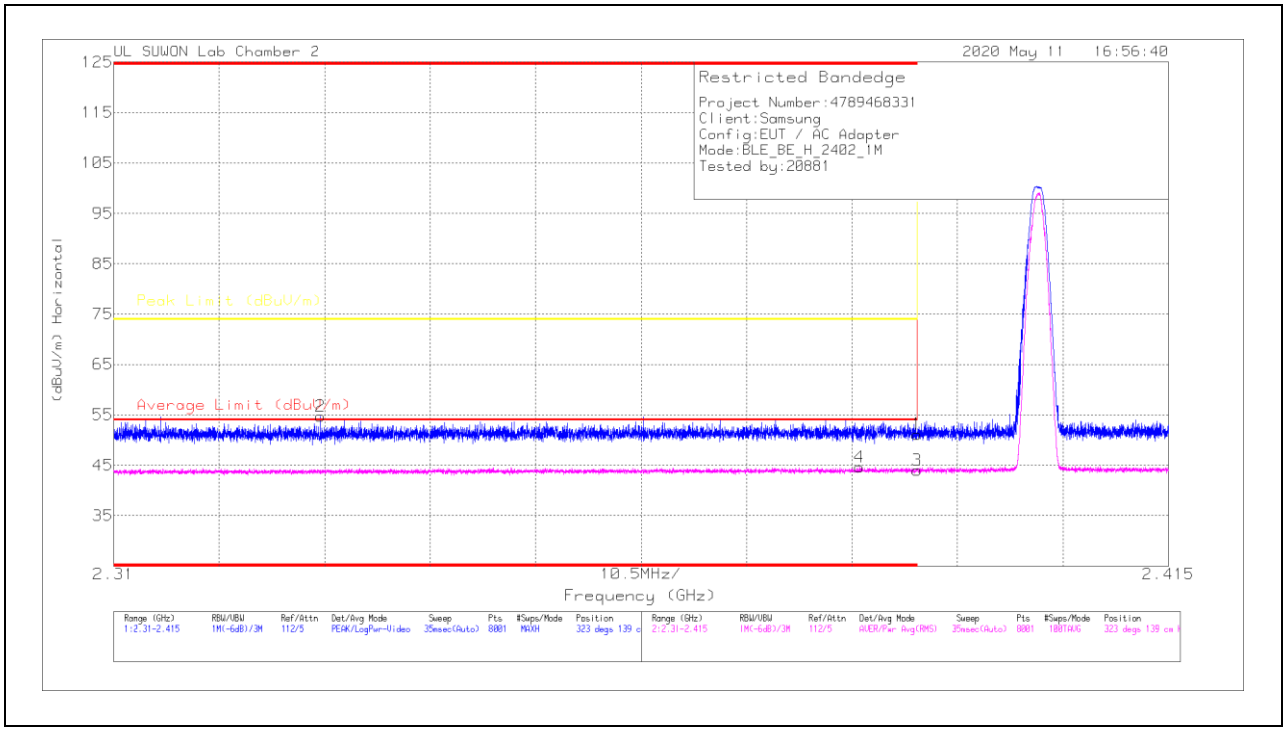
Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open are test site.
Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the one of tests made in an open field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

10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. BLE (1Mbps)

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT

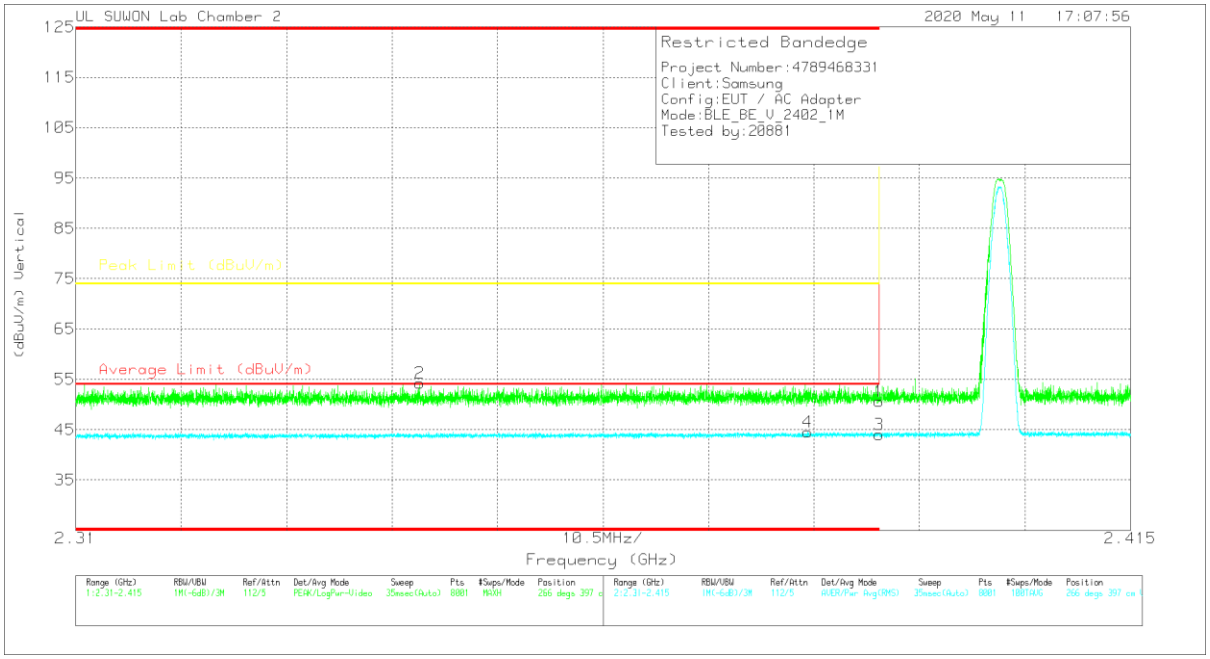


Trace Markers

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	40.19	Pk	31.6	-20.6	0	51.19	-	-	74	-22.81	323	139	H
2	* 2.33058	43.89	Pk	31.5	-20.7	0	54.69	-	-	74	-19.31	323	139	H
3	* 2.39	30.78	RMS	31.6	-20.6	2.19	43.97	54	-10.03	-	-	323	139	H
4	* 2.38422	31.43	RMS	31.6	-20.6	2.19	44.62	54	-9.38	-	-	323	139	H

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

VERTICAL RESULT



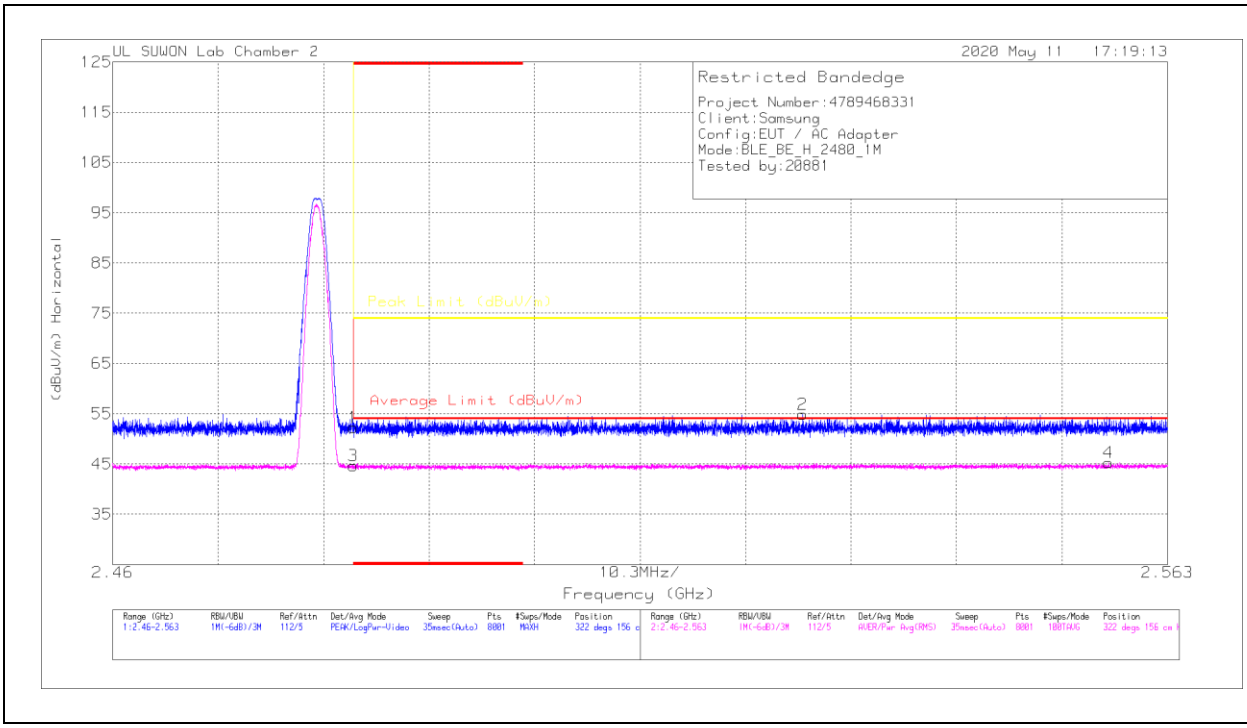
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_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	39.61	Pk	31.6	-20.6	0	50.61	-	-	74	-23.39	266	397	V
2	* 2.34424	43.45	Pk	31.5	-20.7	0	54.25	-	-	74	-19.75	266	397	V
3	* 2.39	30.81	RMS	31.6	-20.6	2.19	44	54	-10	-	-	266	397	V
4	* 2.38284	31.35	RMS	31.6	-20.6	2.19	44.54	54	-9.46	-	-	266	397	V

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

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT

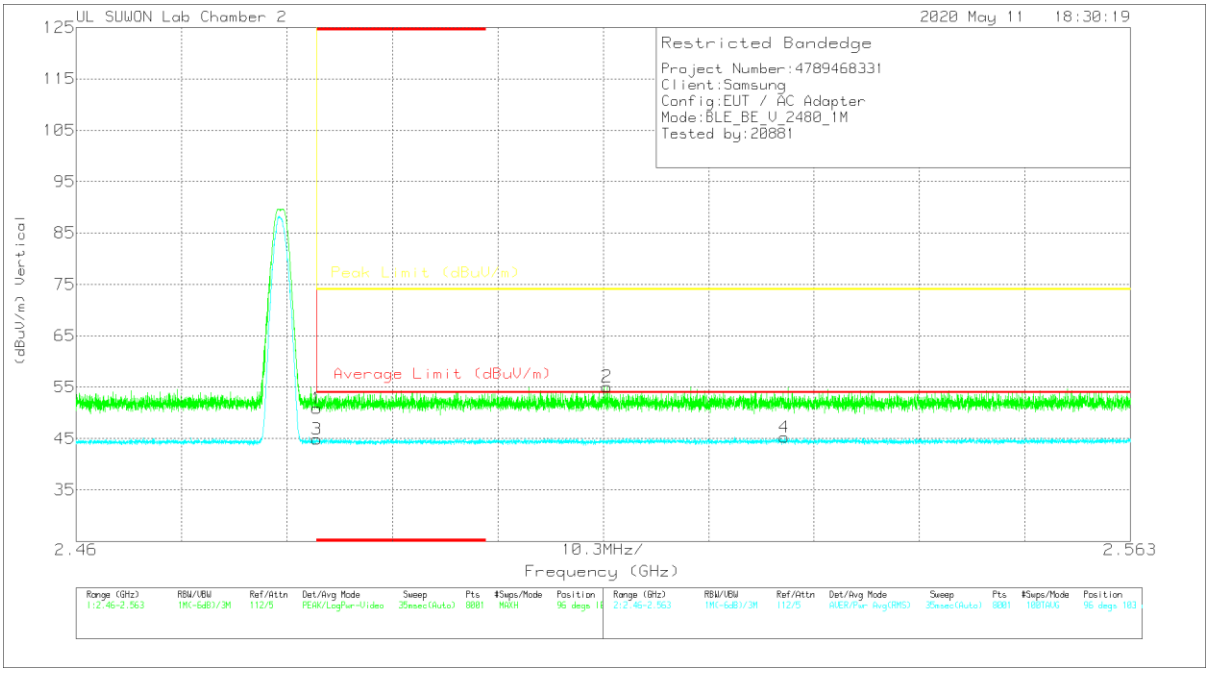


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_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	40.77	Pk	31.9	-20.4	0	52.27	-	-	74	-21.73	322	156	H
2	2.52737	43.42	Pk	31.9	-20.4	0	54.92	-	-	74	-19.08	322	156	H
3	* 2.48351	30.95	RMS	31.9	-20.4	2.19	44.64	54	-9.36	-	-	322	156	H
4	2.55727	31.61	RMS	32	-20.5	2.19	45.3	54	-8.7	-	-	322	156	H

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

VERTICAL RESULT



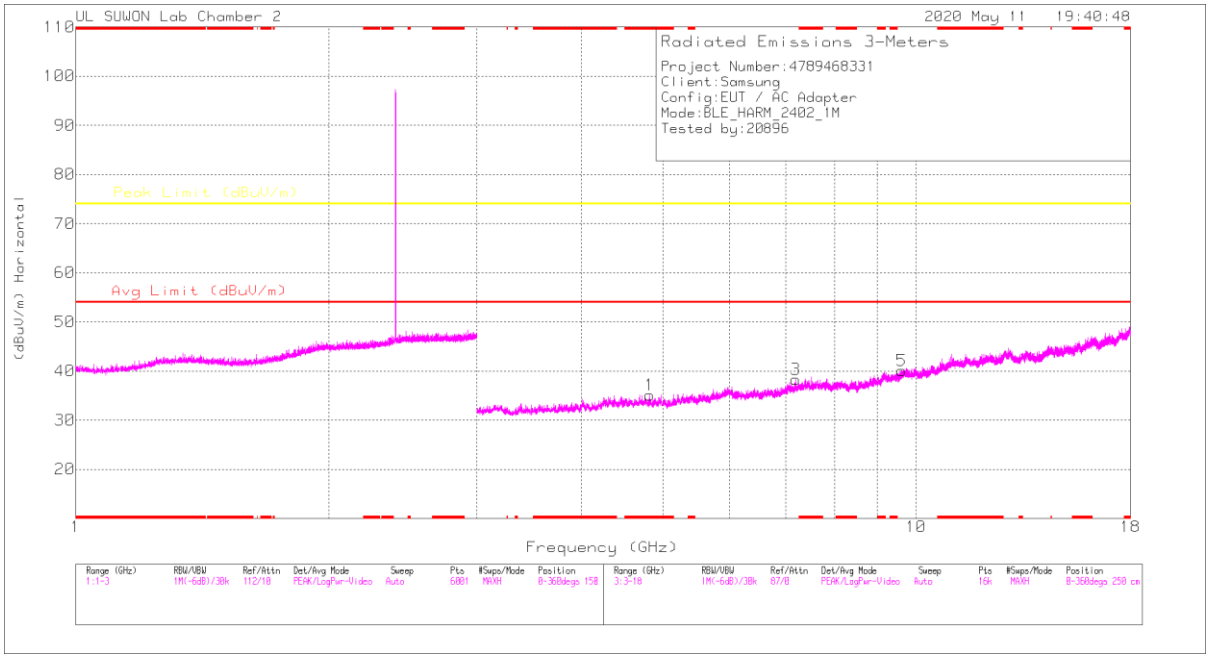
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_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	39.38	Pk	31.9	-20.4	0	50.88	-	-	74	-23.12	96	103	V
2	2.51186	43.58	Pk	31.9	-20.4	0	55.08	-	-	74	-18.92	96	103	V
3	* 2.48351	31.21	RMS	31.9	-20.4	2.19	44.9	54	-9.1	-	-	96	103	V
4	2.52919	31.47	RMS	32	-20.4	2.19	45.26	54	-8.74	-	-	96	103	V

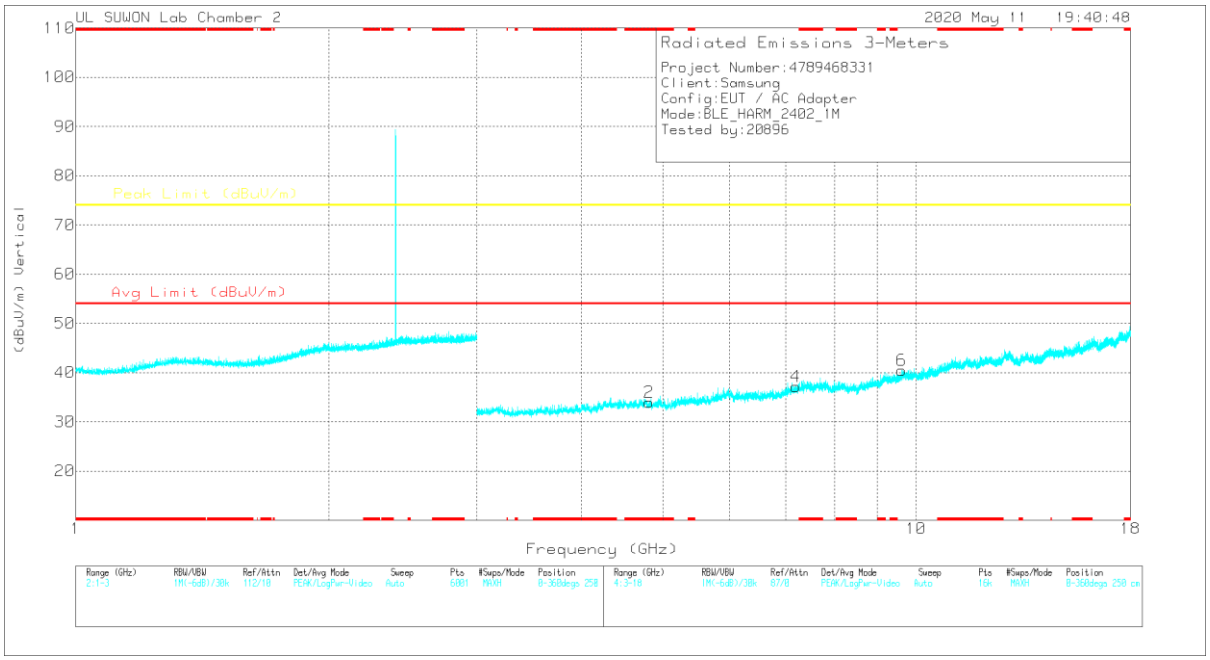
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



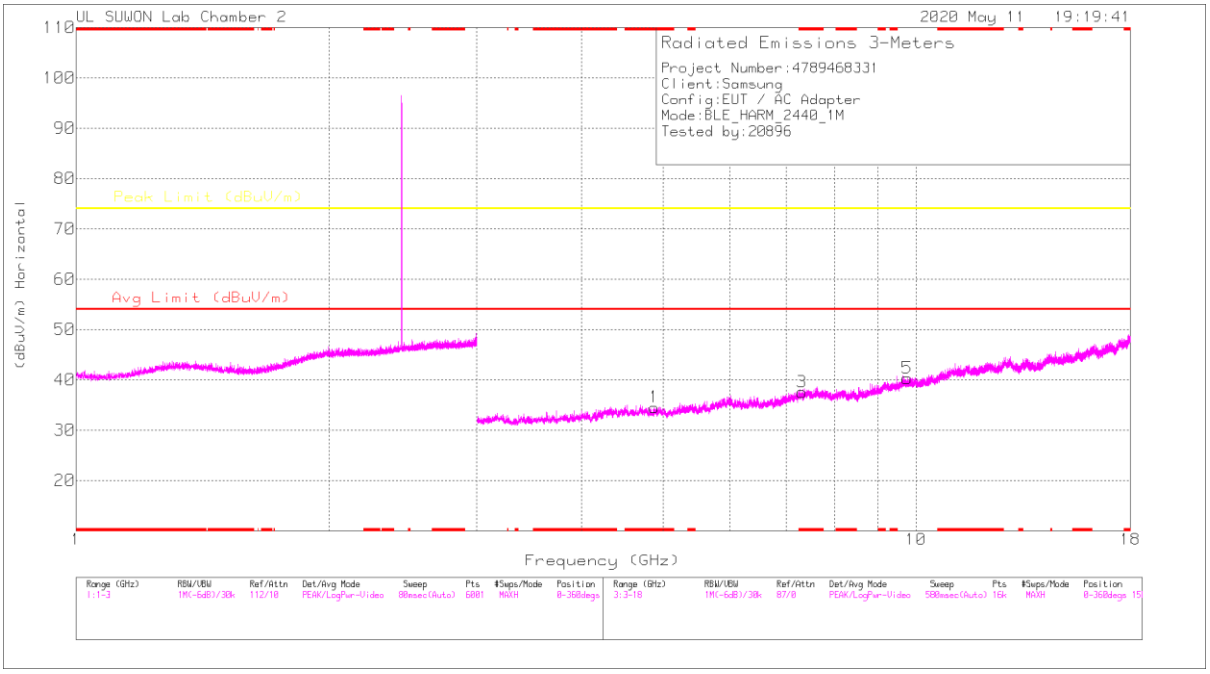
VERTICAL

RADIATED EMISSIONS

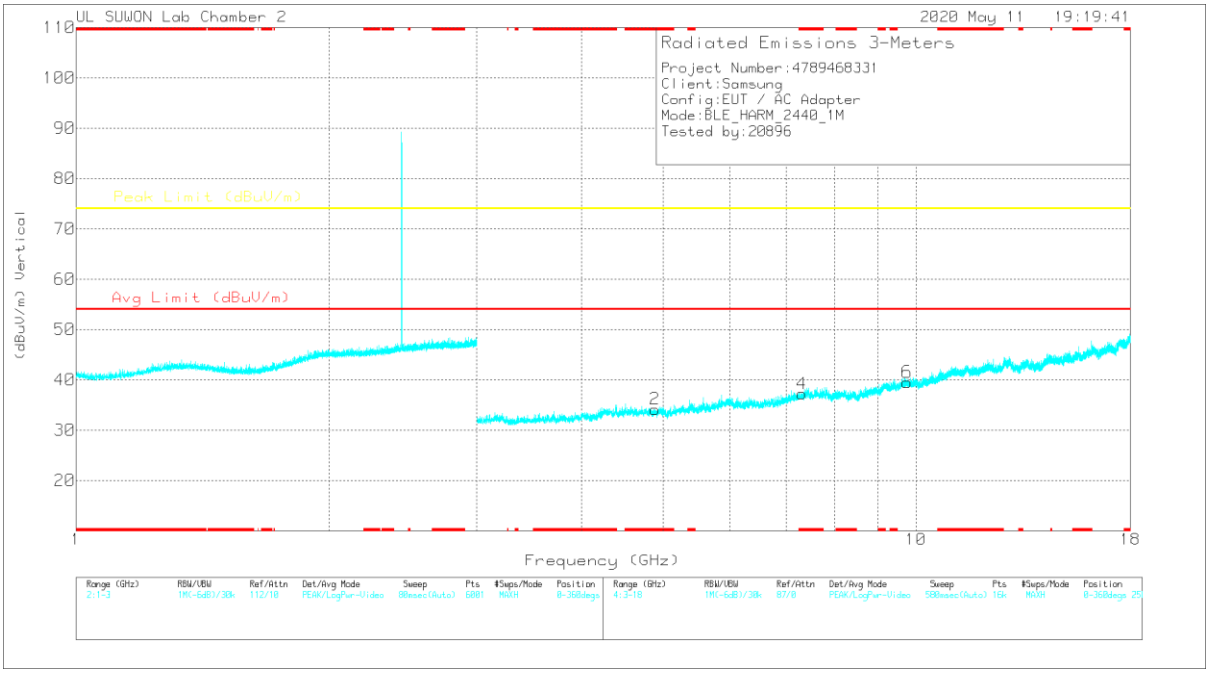
Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.82218	36.99	PK2	34	-28.1	0	42.89	-	-	74	-31.11	0	100	H
* 4.82225	36.69	PK2	34	-28.1	0	42.59	-	-	74	-31.41	0	100	V
7.1936	35.17	PK2	36.1	-25.1	0	46.17	-	-	74	-27.83	0	100	H
7.19247	35.18	PK2	36.1	-25.1	0	46.18	-	-	74	-27.82	0	100	V
9.61257	33.61	PK2	37	-21.6	0	49.01	-	-	74	-24.99	0	100	H
9.61375	33.03	PK2	37	-21.6	0	48.43	-	-	74	-25.57	0	100	V

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

MID CHANNEL RESULTS



HORIZONTAL



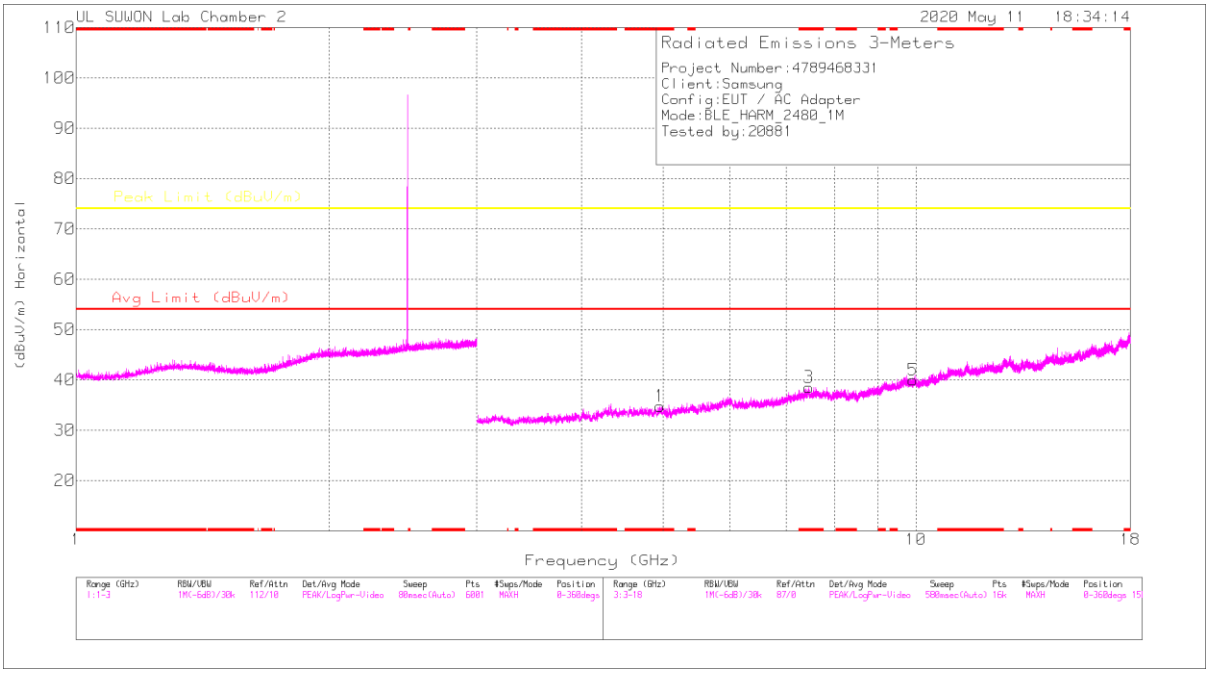
VERTICAL

RADIATED EMISSIONS

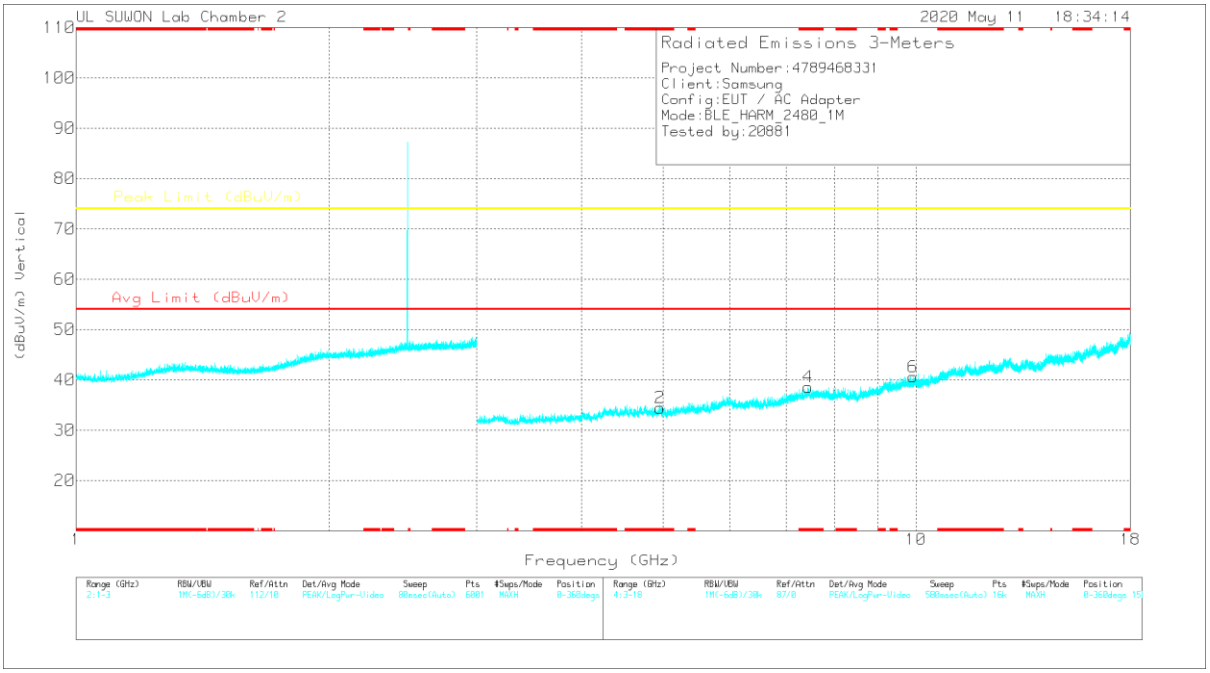
Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.87917	36.61	PK2	34	-27.8	0	42.81	-	-	74	-31.19	0	100	H
* 4.87969	36.96	PK2	34	-27.8	0	43.16	-	-	74	-30.84	0	100	V
* 7.31353	35.84	PK2	36.2	-24.9	0	47.14	-	-	74	-26.86	0	100	H
* 7.31364	35.18	PK2	36.2	-24.9	0	46.48	-	-	74	-27.52	0	100	V
9.75926	33.12	PK2	37.2	-21.2	0	49.12	-	-	74	-24.88	0	100	H
9.75794	32.45	PK2	37.2	-21.2	0	48.45	-	-	74	-25.55	0	100	V

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

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

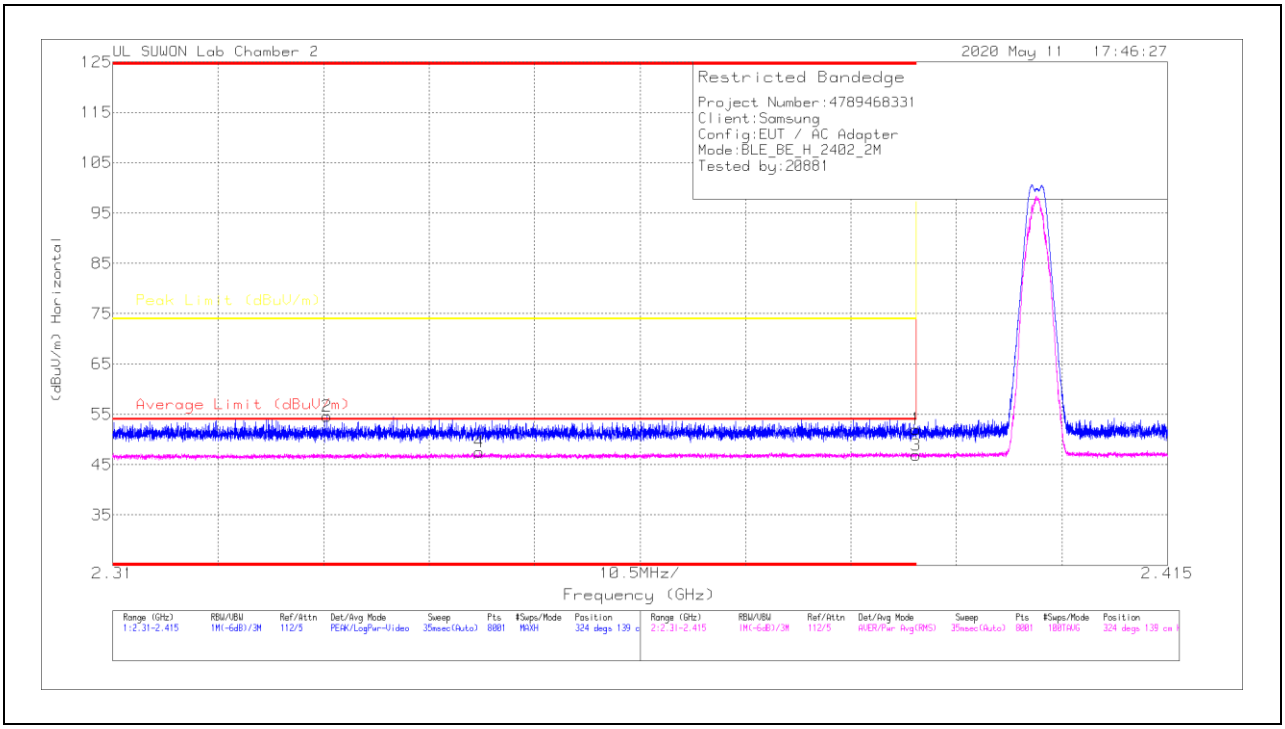
Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.95825	36.28	PK2	34.1	-27	0	43.38	-	-	74	-30.62	0	100	H
* 4.96054	36.03	PK2	34.1	-27	0	43.13	-	-	74	-30.87	0	100	V
* 7.45581	33.92	PK2	36.2	-24.1	0	46.02	-	-	74	-27.98	0	100	H
* 7.45779	34.57	PK2	36.2	-24.1	0	46.67	-	-	74	-27.33	0	100	V
9.92416	32.04	PK2	37.4	-20.9	0	48.54	-	-	74	-25.46	0	100	H
9.92202	31.84	PK2	37.4	-20.9	0	48.34	-	-	74	-25.66	0	100	V

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

10.2.2. BLE (2Mbps)

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT

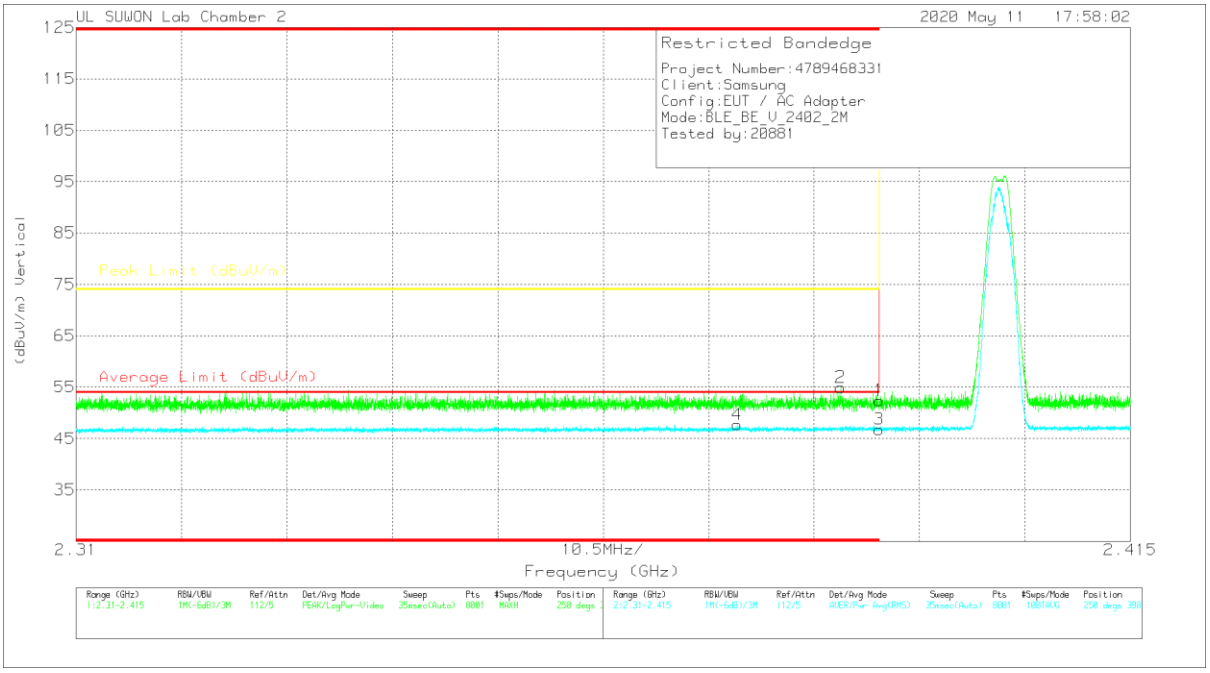


Trace Markers

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	41.06	Pk	31.6	-20.6	0	52.06	-	-	74	-21.94	324	139	H
2	* 2.33132	43.86	Pk	31.5	-20.7	0	54.66	-	-	74	-19.34	324	139	H
3	* 2.39	30.81	RMS	31.6	-20.6	5.1	46.91	54	-7.09	-	-	324	139	H
4	* 2.34649	31.56	RMS	31.6	-20.7	5.1	47.56	54	-6.44	-	-	324	139	H

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

VERTICAL RESULT



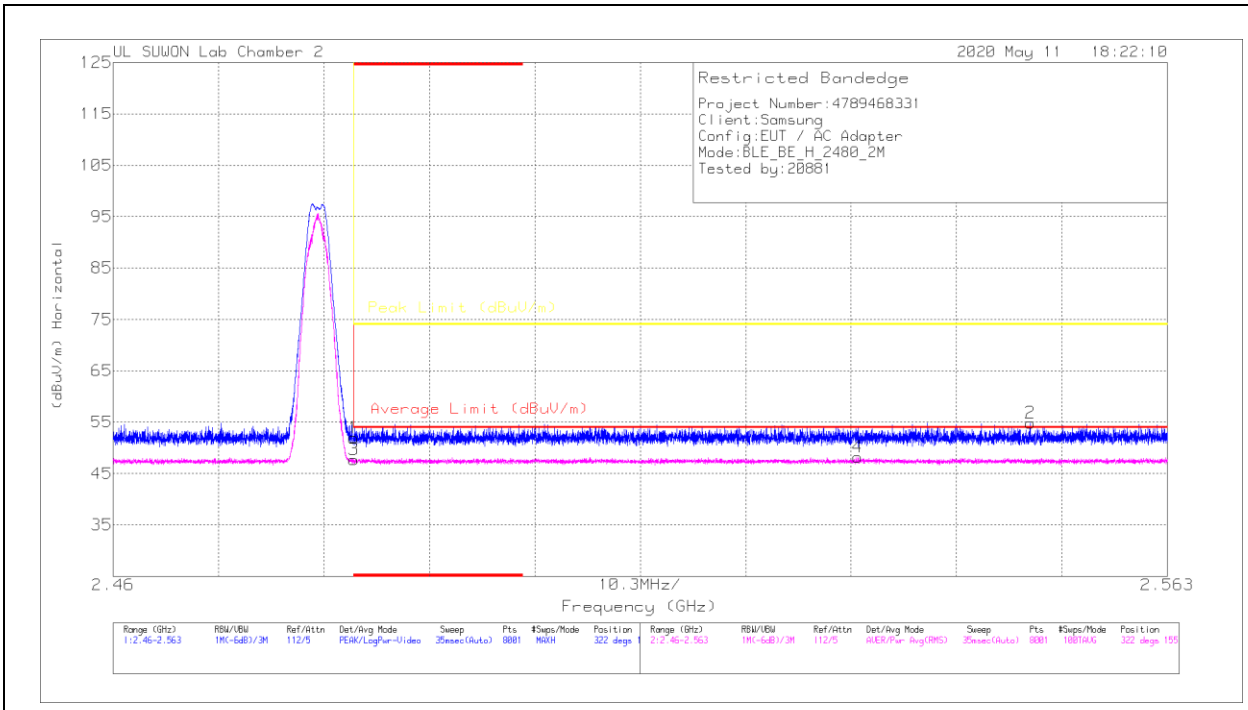
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_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	41.38	Pk	31.6	-20.6	0	52.38	-	-	74	-21.62	250	398	V
2	* 2.38614	43.94	Pk	31.6	-20.6	0	54.94	-	-	74	-19.06	250	398	V
3	* 2.39	30.69	RMS	31.6	-20.6	5.1	46.79	54	-7.21	-	-	250	398	V
4	* 2.37585	31.59	RMS	31.6	-20.6	5.1	47.69	54	-6.31	-	-	250	398	V

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

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT

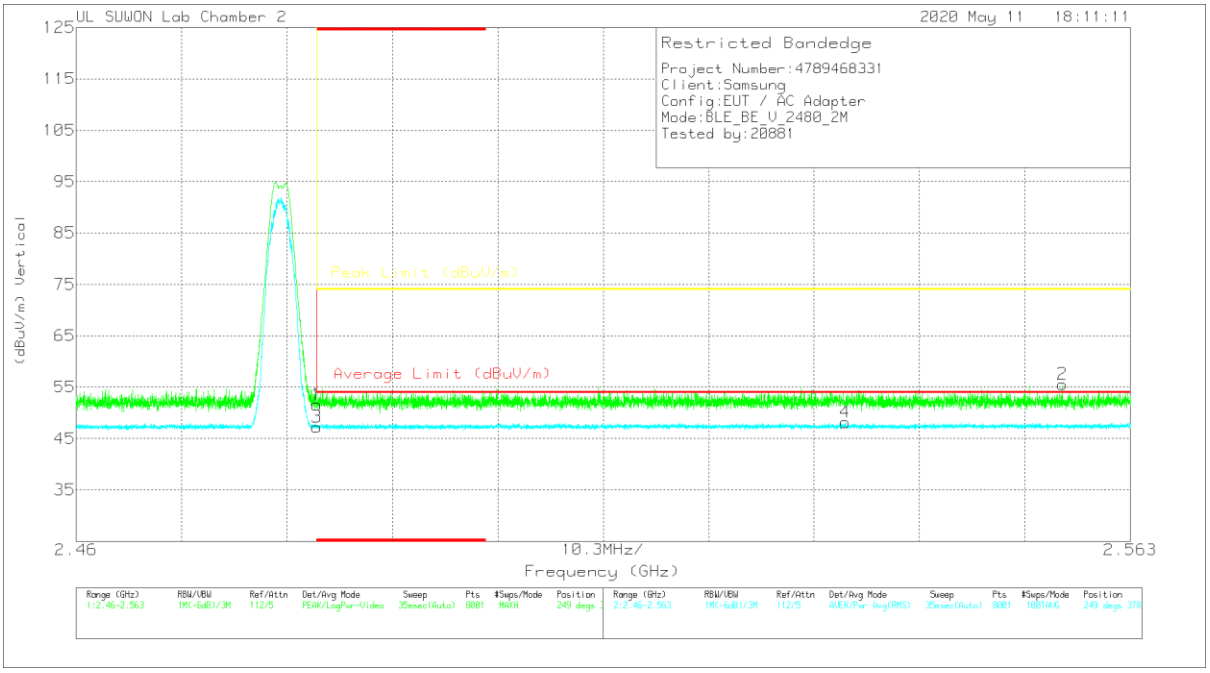


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_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	40.44	Pk	31.9	-20.4	0	51.94	-	-	74	-22.06	322	155	H
2	2.54962	43.35	Pk	32	-20.5	0	54.85	-	-	74	-19.15	322	155	H
3	* 2.48351	31.16	RMS	31.9	-20.4	5.1	47.76	54	-6.24	-	-	322	155	H
4	2.53274	31.51	RMS	32	-20.4	5.1	48.21	54	-5.79	-	-	322	155	H

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

VERTICAL RESULT



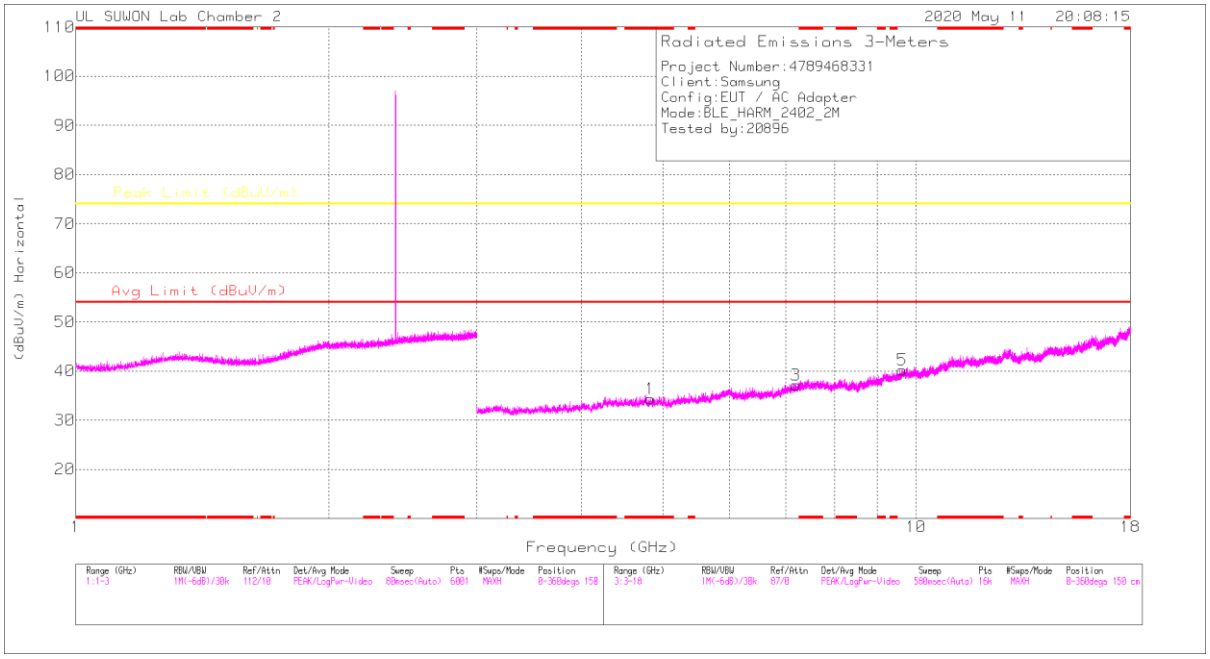
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_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	40.09	Pk	31.9	-20.4	0	51.59	-	-	74	-22.41	249	378	V
2	2.55637	43.97	Pk	32	-20.4	0	55.57	-	-	74	-18.43	249	378	V
3	* 2.48351	30.66	RMS	31.9	-20.4	5.1	47.26	54	-6.74	-	-	249	378	V
4	2.53516	31.47	RMS	32	-20.4	5.1	48.17	54	-5.83	-	-	249	378	V

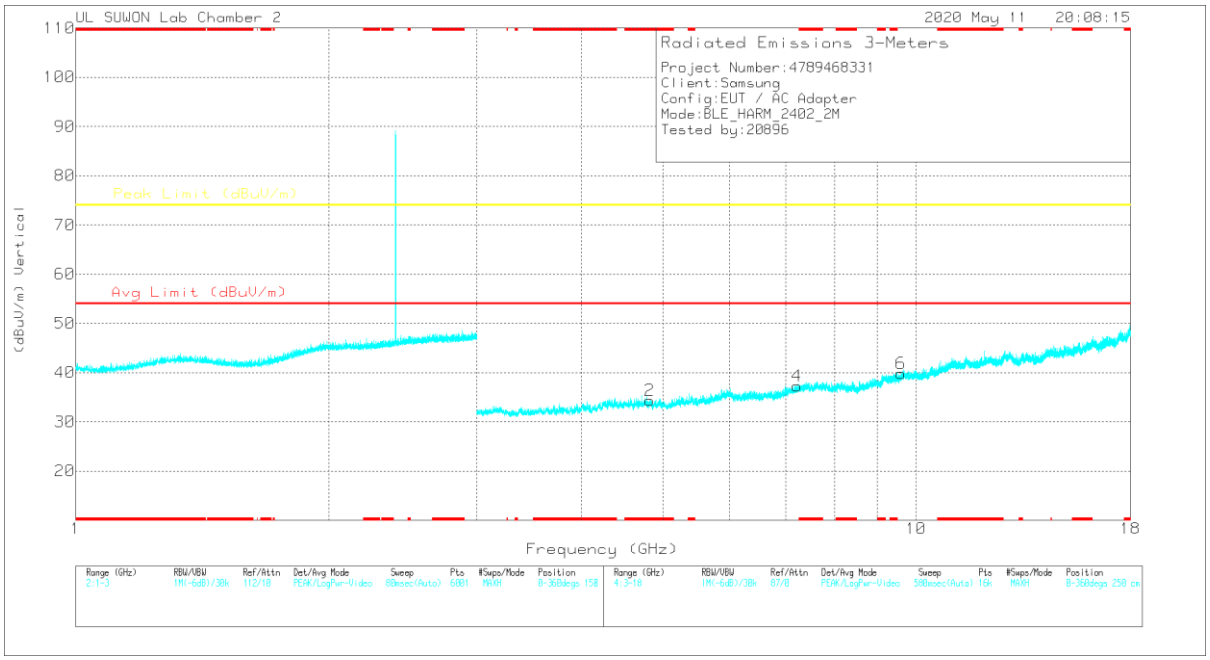
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



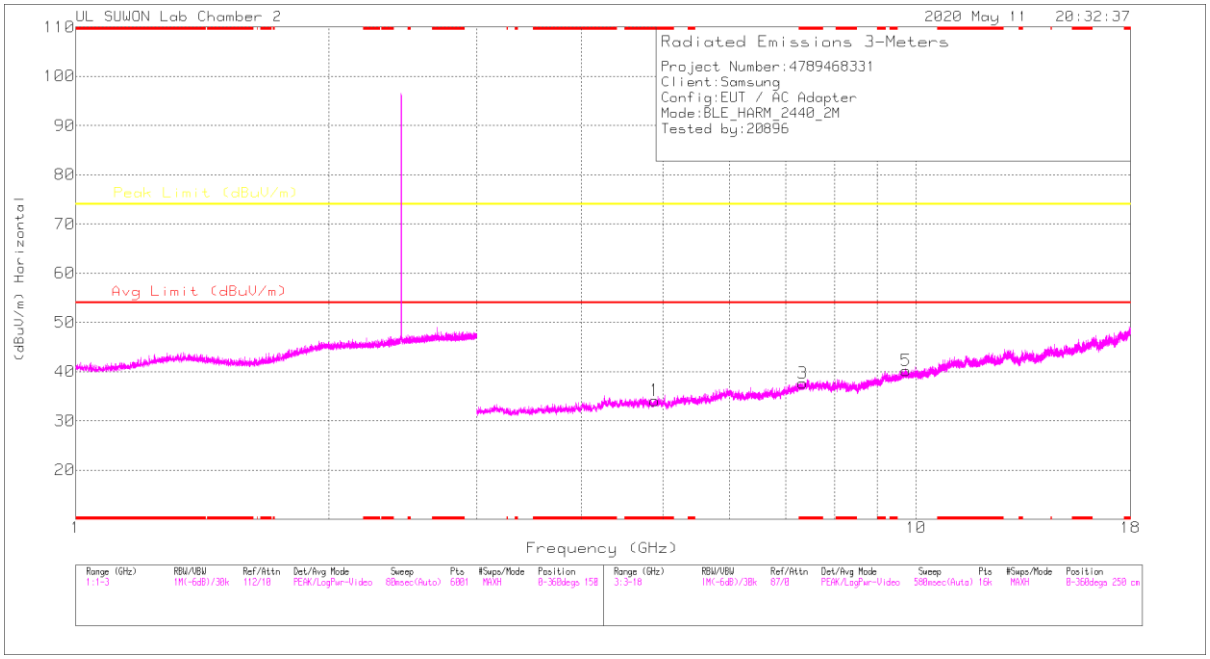
VERTICAL

RADIATED EMISSIONS

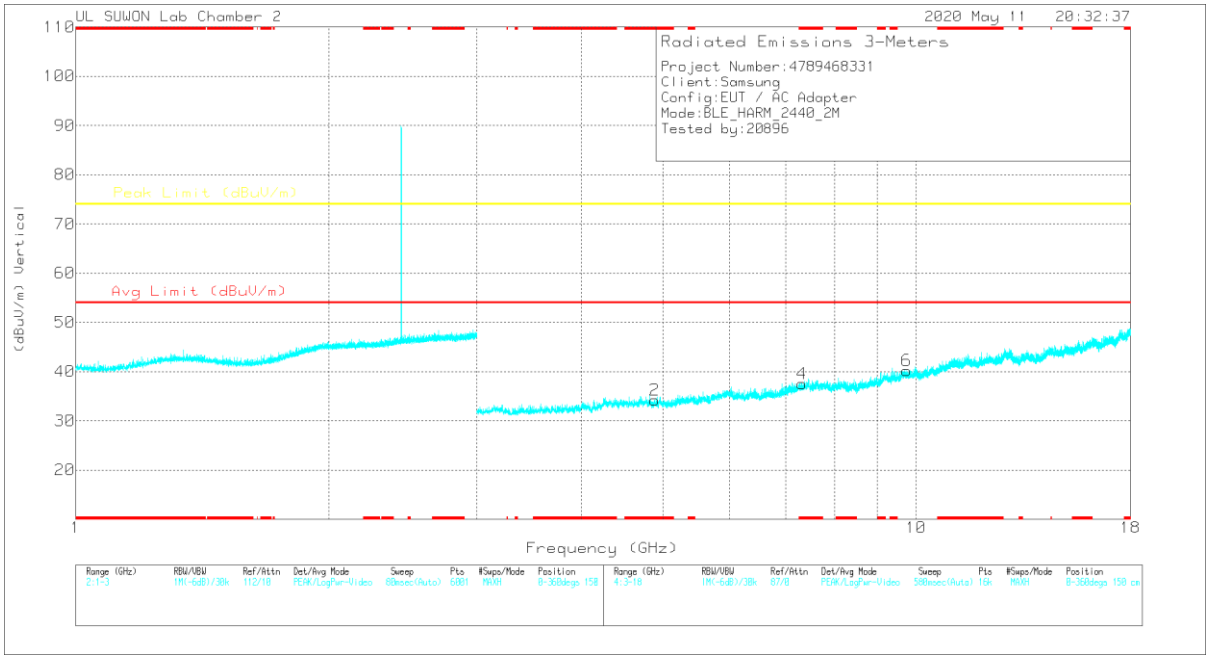
Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.83028	36.75	PK2	34	-28.2	0	42.55	-	-	74	-31.45	0	100	H
* 4.83091	37.21	PK2	34	-28.1	0	43.11	-	-	74	-30.89	0	100	V
7.19135	35.54	PK2	36.1	-25.1	0	46.54	-	-	74	-27.46	0	100	H
7.19163	35.38	PK2	36.1	-25.1	0	46.38	-	-	74	-27.62	0	100	V
9.63391	32.69	PK2	37	-21.5	0	48.19	-	-	74	-25.81	0	100	H
9.63432	33.26	PK2	37	-21.5	0	48.76	-	-	74	-25.24	0	100	V

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

MID CHANNEL RESULTS



HORIZONTAL



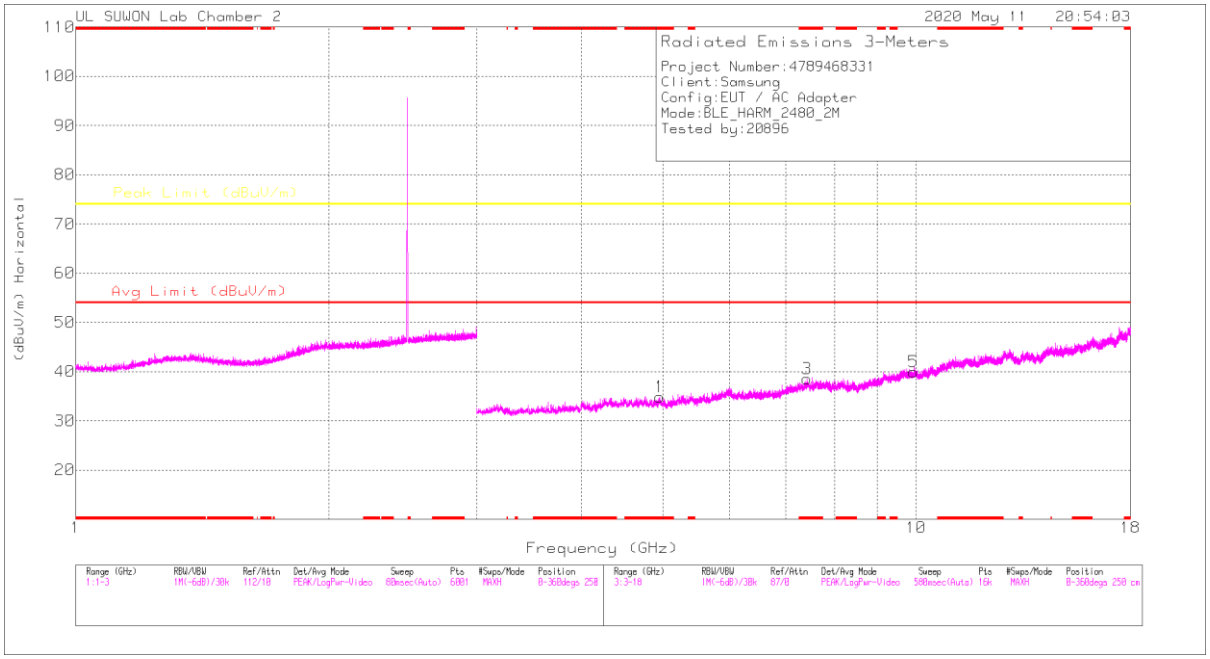
VERTICAL

RADIATED EMISSIONS

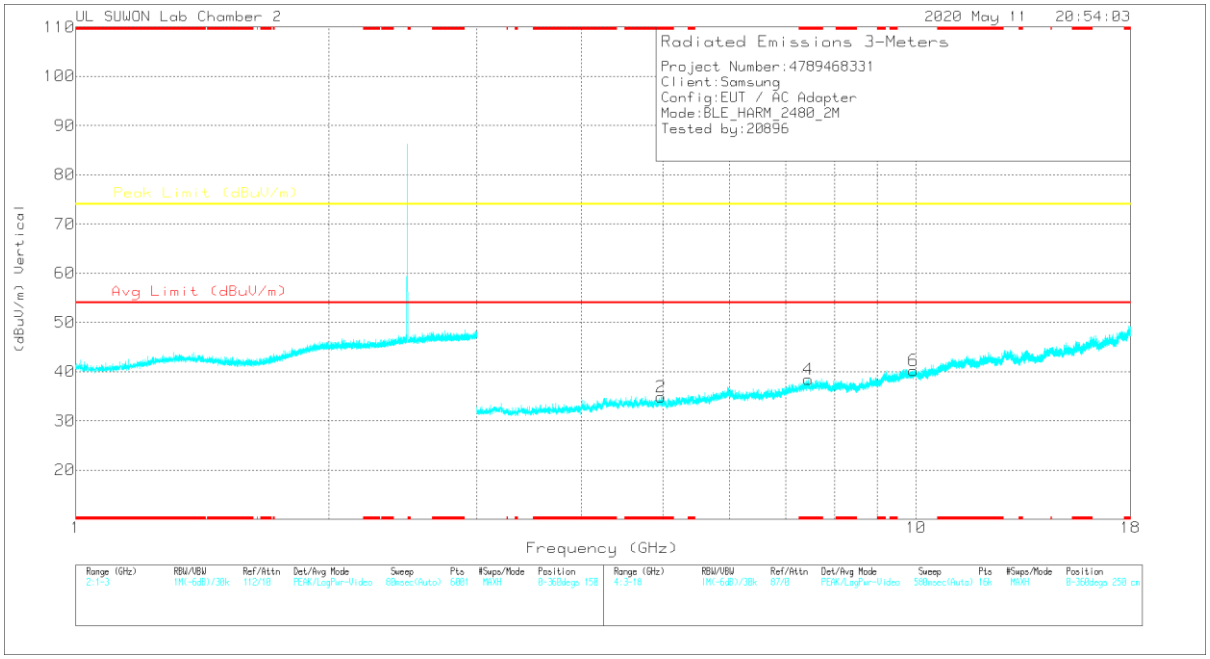
Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168724	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.88901	36.37	PK2	34	-27.7	0	42.67	-	-	74	-31.33	0	100	H
* 4.88984	36.81	PK2	34	-27.7	0	43.11	-	-	74	-30.89	0	100	V
* 7.33669	34.95	PK2	36.2	-24.6	0	46.55	-	-	74	-27.45	0	100	H
* 7.33375	35.11	PK2	36.2	-24.7	0	46.61	-	-	74	-27.39	0	100	V
9.74108	32.55	PK2	37.2	-21.2	0	48.55	-	-	74	-25.45	0	100	H
9.74086	32.61	PK2	37.2	-21.2	0	48.61	-	-	74	-25.39	0	100	V

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

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

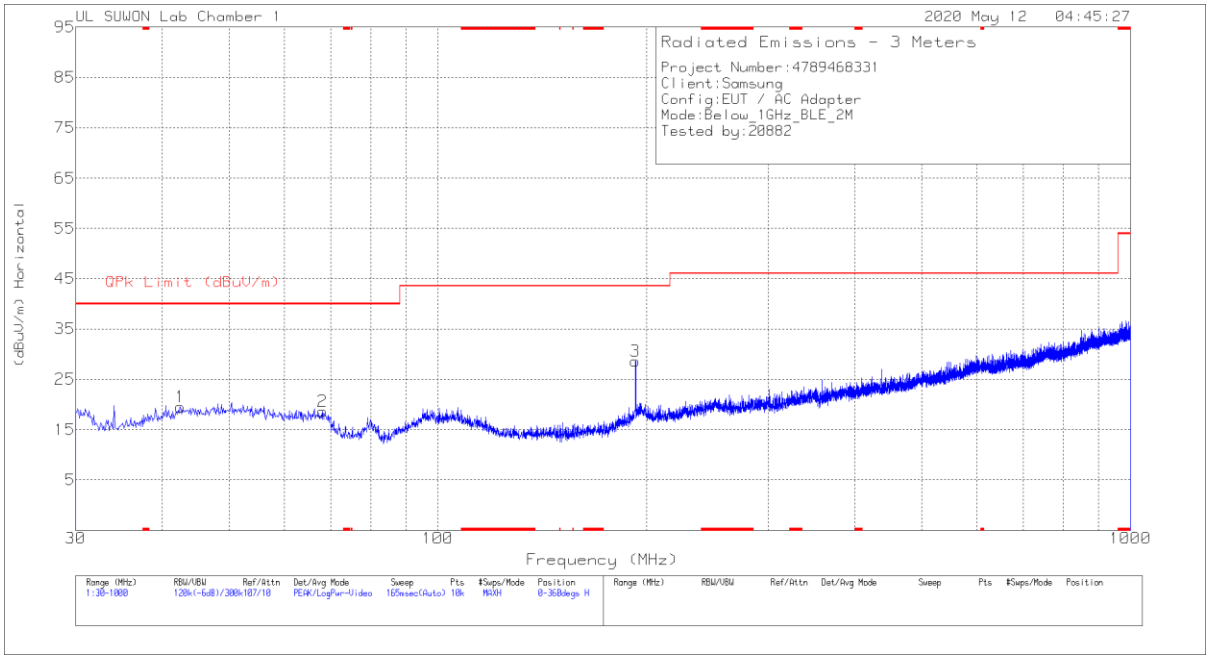
RADIATED EMISSIONS

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_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
* 4.95124	35.94	PK2	34.1	-27	0	43.04	-	-	74	-30.96	0	100	H
* 4.95318	35.91	PK2	34.1	-27	0	43.01	-	-	74	-30.99	0	100	V
* 7.41775	34.33	PK2	36.2	-23.9	0	46.63	-	-	74	-27.37	0	100	H
* 7.41959	34.26	PK2	36.2	-23.9	0	46.56	-	-	74	-27.44	0	100	V
9.93535	32.03	PK2	37.4	-20.7	0	48.73	-	-	74	-25.27	0	100	H
9.93598	31.87	PK2	37.4	-20.7	0	48.57	-	-	74	-25.43	0	100	V

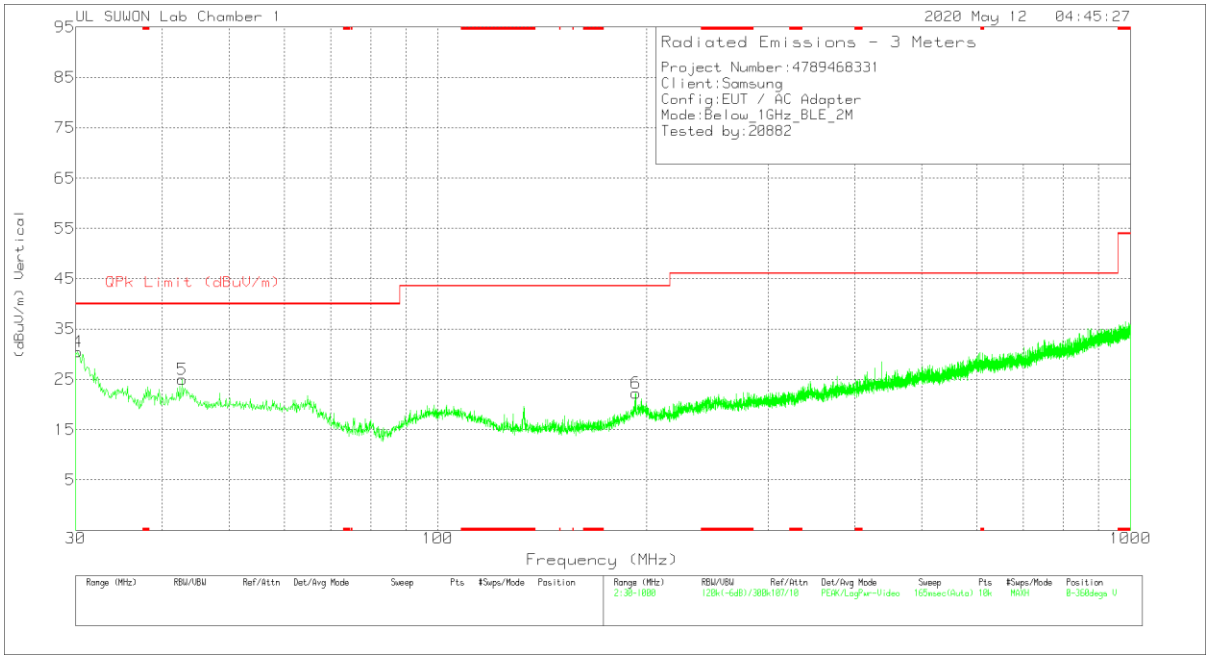
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak

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	42.513	30.86	Pk	19.2	-30.6	0	19.46	40	-20.54	0-360	400	H
2	68.218	32.54	Pk	16.2	-30.1	0	18.64	40	-21.36	0-360	200	H
3	192.96	39.54	Pk	17.6	-28.5	0	28.64	43.52	-14.88	0-360	100	H
4	30.194	44.32	Pk	16	-29.9	0	30.42	40	-9.58	0-360	100	V
5	42.707	35.51	Pk	19.3	-29.8	0	25.01	40	-14.99	0-360	100	V
6	193.057	32.14	Pk	17.7	-27.6	0	22.24	43.52	-21.28	0-360	300	V

Pk - Peak detector

11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

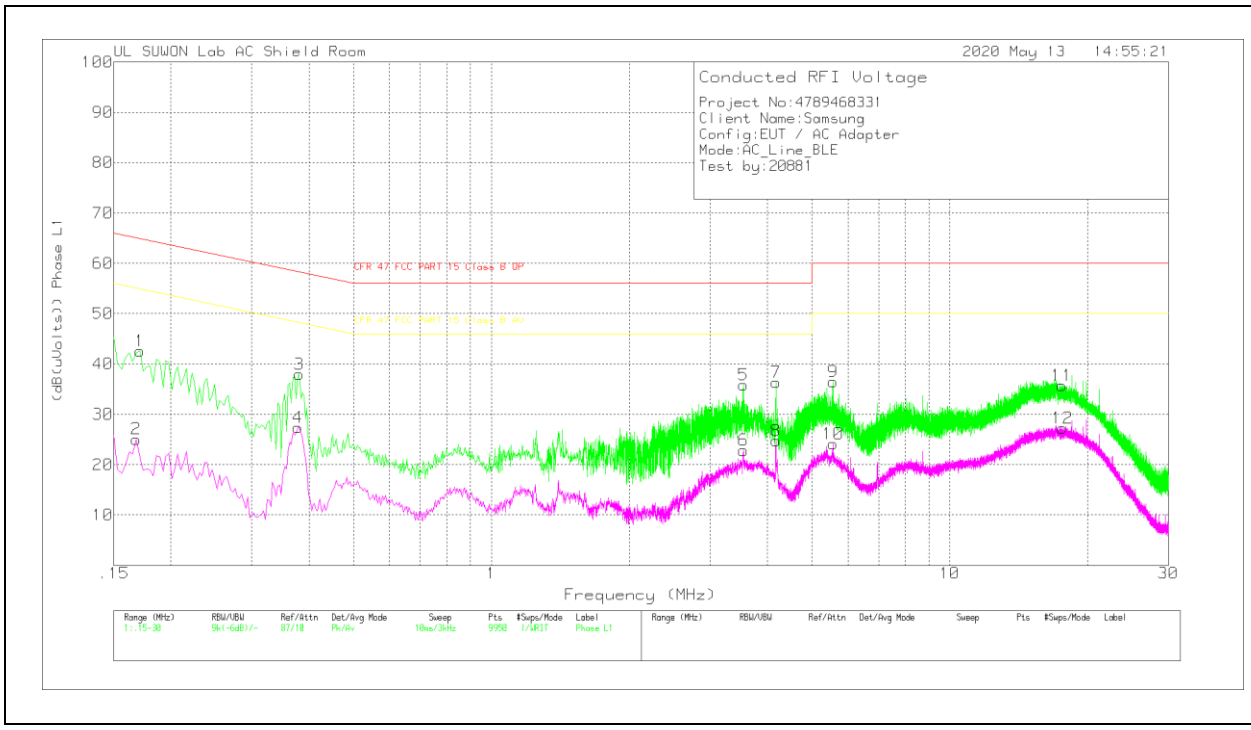
Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

RESULTS

11.1.1. AC Power Line

LINE 1 RESULTS



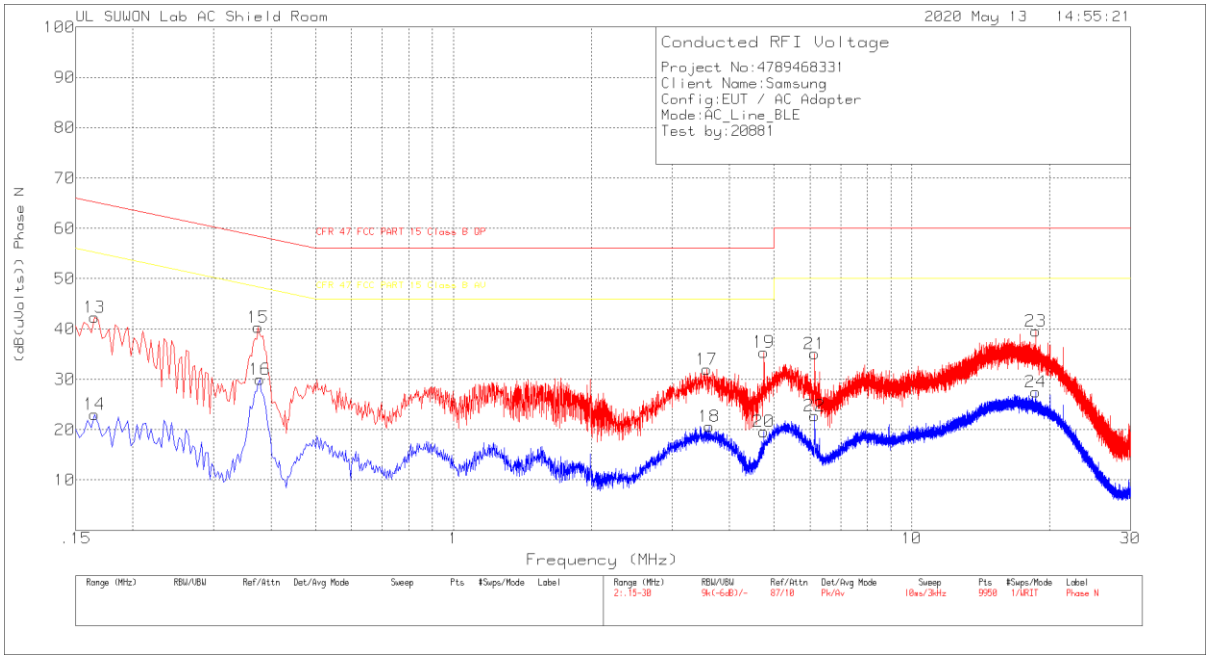
Trace Markers

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	.171	32.24	Pk	10.1	.2	42.54	64.91	-22.37	-	-
2	.168	14.97	Av	10	.1	25.07	-	-	55.06	-29.99
3	.381	27.84	Pk	9.9	.2	37.94	58.26	-20.32	-	-
4	.378	17.26	Av	9.9	.2	27.36	-	-	48.32	-20.96
5	3.546	25.73	Pk	9.8	.3	35.83	56	-20.17	-	-
6	3.546	12.73	Av	9.8	.3	22.83	-	-	46	-23.17
7	4.182	26.29	Pk	9.8	.3	36.39	56	-19.61	-	-
8	4.176	14.71	Av	9.8	.3	24.81	-	-	46	-21.19
9	5.559	26.41	Pk	9.8	.3	36.51	60	-23.49	-	-
10	5.559	14.05	Av	9.8	.3	24.15	-	-	50	-25.85
11	17.571	25.16	Pk	10.2	.4	35.76	60	-24.24	-	-
12	17.619	16.68	Av	10.2	.4	27.28	-	-	50	-22.72

Pk - Peak detector
Av - Average detection

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	.165	32.2	Pk	10	.1	42.3	65.21	-22.91	-	-
14	.165	12.97	Av	10	.1	23.07	-	-	55.21	-32.14
15	.375	30.2	Pk	9.9	.2	40.3	58.39	-18.09	-	-
16	.378	19.86	Av	9.9	.2	29.96	-	-	48.32	-18.36
17	3.576	21.86	Pk	9.8	.3	31.96	56	-24.04	-	-
18	3.618	10.5	Av	9.8	.3	20.6	-	-	46	-25.4
19	4.761	25.31	Pk	9.8	.3	35.41	56	-20.59	-	-
20	4.761	9.49	Av	9.8	.3	19.59	-	-	46	-26.41
21	6.144	24.96	Pk	9.8	.3	35.06	60	-24.94	-	-
22	6.144	12.69	Av	9.8	.3	22.79	-	-	50	-27.21
23	18.633	28.87	Pk	10.3	.4	39.57	60	-20.43	-	-
24	18.633	16.84	Av	10.3	.4	27.54	-	-	50	-22.46

Pk - Peak detector
Av - Average detection

END OF TEST REPORT