



FCC CFR47 PART 15 SUBPART C

Bluetooth Low Energy

CERTIFICATION TEST REPORT

FOR

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

MODEL NUMBER : SM-G973F/DS, SM-G973F, SM-G973X

FCC ID: A3LSMG973F

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Testing
Laboratory

TL-637

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	12/20/18	Initial issue	Hoonpyo Lee
V2	12/24/18	Updated to address TCB's question	Hoonpyo 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/ax, ANT+, NFC and WPT
MODEL NUMBER: SM-G973F/DS, SM-G973F, SM-G973X
SERIAL NUMBER: R38KA0BE3PA (RADIATED);
R38KA0BCW9H (CONDUCTED)
DATE TESTED: NOV 06, 2018 - NOV 29, 2018

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

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document JUN 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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SungGil Park
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:



Hoonpyo Lee
Suwon Lab Engineer
UL Korea, Ltd.

2. TEST METHODOLOGY

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

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 15.
3. KDB 558074 D01 15.247 Meas Guidance v05.
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	
<input type="checkbox"/>	Chamber 1
<input checked="" type="checkbox"/>	Chamber 2
<input type="checkbox"/>	Chamber 3

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at <http://www.iasonline.org/PDF/TL/TL-637.pdf>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	2.32 dB
Radiated Disturbance, Below 1GHz	3.86 dB
Radiated Disturbance, Above 1 GHz	5.97 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

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

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range [MHz]	Mode	Power Mode	Output Power [dBm]	Output Power [mW]
2402 - 2480	BLE	Peak	9.299	8.51
		Average	8.809	7.60
	BLE	Peak	10.206	10.49
		Average	9.346	8.60

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antenna, with a maximum gain of -5.0 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 connected with earphone and charger for evaluation of worst case mode.

Power verification

The Output Power of all data rate are all investigated, the 1Mbps(37 pkt) and 2Mbps(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	7.189	2	2Mbps (37 pkt)	2402	8.009		
		2440	8.809			2440	9.346		
		2480	7.797			2480	8.573		
	1Mbps (128 pkt)	2402	7.120		2	2Mbps (128 pkt)	2402	7.941	
		2440	8.761				2440	9.308	
		2480	7.727				2480	8.545	
	Coded S=8 125 kbps (37 pkt)	2402	7.042			1	Coded S=8 125 kbps (128 pkt)	2402	7.055
		2440	8.699					2440	8.710
		2480	7.721					2480	7.701
	Coded S=8 125 kbps (128 pkt)	2402	7.055		Coded S=2 500 kbps (37 pkt)		2402	7.168	
		2440	8.710				2440	8.728	
		2480	7.701				2480	7.777	
	Coded S=2 500 kbps (37 pkt)	2402	7.168	Coded S=2 500 kbps (128 pkt)	2402		7.170		
		2440	8.728		2440		8.730		
		2480	7.777		2480		7.761		

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA200	R37KB5B03T1SE3	N/A
Data Cable	SAMSUNG	EP-DG970BBE	N/A	N/A
Earphone	SAMSUNG	EO-IG955	N/A	N/A

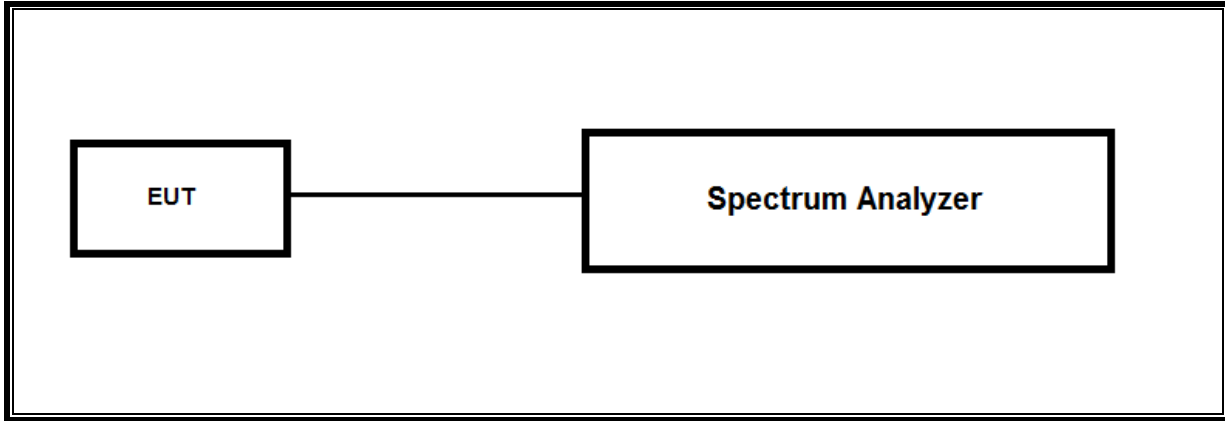
I/O CABLE

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

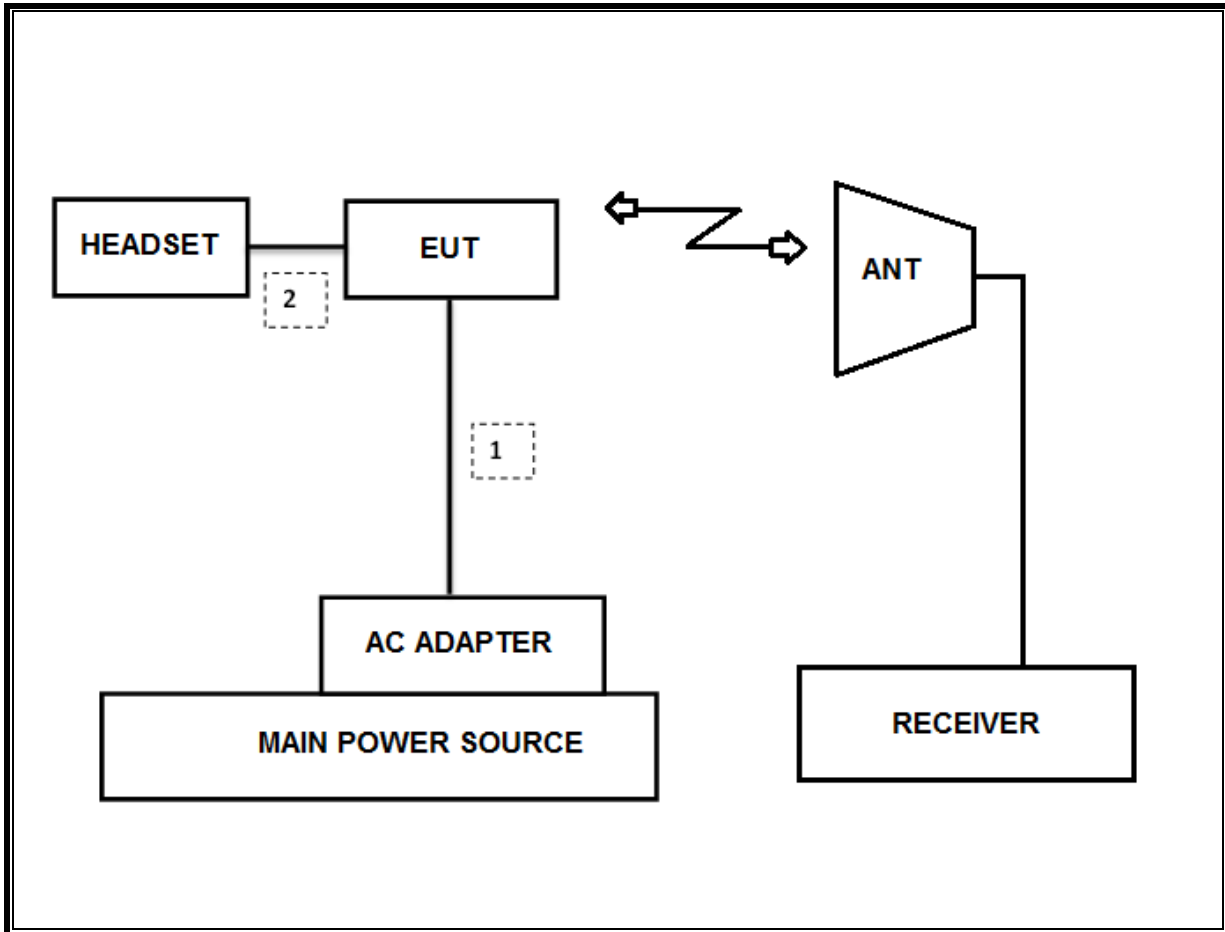
TEST SETUP

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. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	Manufacturer	Model	S/N	Cal Due
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00167211	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00161451	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168724	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168717	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00205959	08-04-20
Antenna, Horn, 40 GHz	ETS	3116C	00166155	12-04-19
Antenna, Horn, 40 GHz	ETS	3116C	00168645	08-09-19
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	08-07-19
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-07-19
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-06-19
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-07-19
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-07-19
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-07-19
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-07-19
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-06-19
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-06-19
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-07-19
Attenuator	PASTERNAK	PE7087-10	A001	08-08-19
Attenuator	PASTERNAK	PE7087-10	A008	08-08-19
Attenuator	PASTERNAK	PE7087-10	2	08-07-19
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-06-19
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-06-19
EMI Test Receive, 44 GHz	R&S	ESW44	101590	08-06-19
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-06-19
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-07-19
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-07-19
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	020	08-06-19
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-07-19
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-07-19
High Pass Filter 3GHz	Micro-Tronics	HPM17543	020	08-06-19
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	08-07-19
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	08-07-19
High Pass Filter 6GHz	Micro-Tronics	HPS17542	021	08-06-19
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	10-26-19
LISN	R&S	ENV-216	101837	08-09-19
UL Software				
Description	Manufacturer	Model	Version	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

7. REFERENCE MEASUREMENT RESULTS

7.1. ON TIME AND DUTY CYCLE RESULTS

LIMITS

None: for reporting purposes only.

Mode	ON Time B [msec]	Period [msec]	Duty Cycle x [linear]	Duty Cycle [%]	Duty Cycle Correction Factor [dB]	1/T Minimum VBW [kHz]
2400MHz Bands						
BLE 1M	0.377	0.625	0.604	60.4%	2.19	2.650
BLE 2M	0.193	0.625	0.309	30.9%	5.09	5.171



8. MEASUREMENT METHODS

6 dB BW : KDB 558074 D01 v05, Section 8.2.

OUTPUT POWER : KDB 558074 D01 v05, Section 8.3

POWER SPECTRAL DENSITY : KDB 558074 D01 v05, Section 8.4.

Out-of-band EMISSIONS (Conducted) : KDB 558074 D01 v05, Section 8.5.

Out-of-band EMISSIONS IN NON-RESTRICTED BANDS: KDB 558074 D01 v05, Section 8.5.

Out-of-band EMISSIONS IN RESTRICTED BANDS : KDB 558074 D01 v05, Section 8.6.

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

9. SUMMARY TABLE

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

10. ANTENNA PORT TEST RESULTS

10.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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

TEST PROCEDURE

Reference to KDB 558074 D01 15.247 Meas Guidance: The transmitter output is connected to a spectrum analyzer with the RBW set to 100kHz, the VBW $\geq 3 \times$ RBW, peak detector and max hold.

RESULTS

- 1Mbps

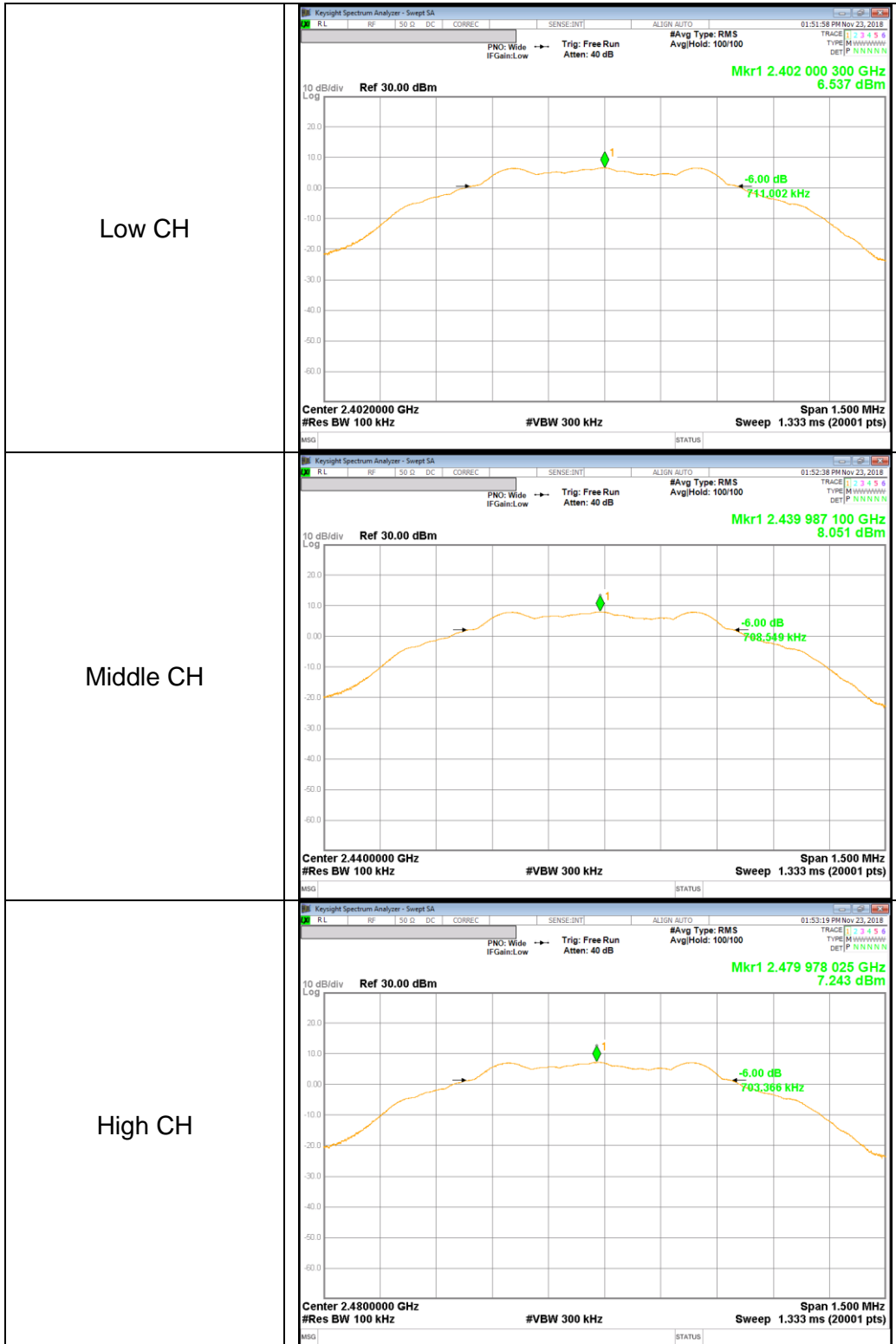
Channel	Frequency [MHz]	6 dB Bandwidth [kHz]	Minimum Limit [kHz]
Low	2402	711.00	500.0
Mid	2440	708.55	500.0
High	2480	703.37	500.0
Worst		703.37	500.0

- 2Mbps

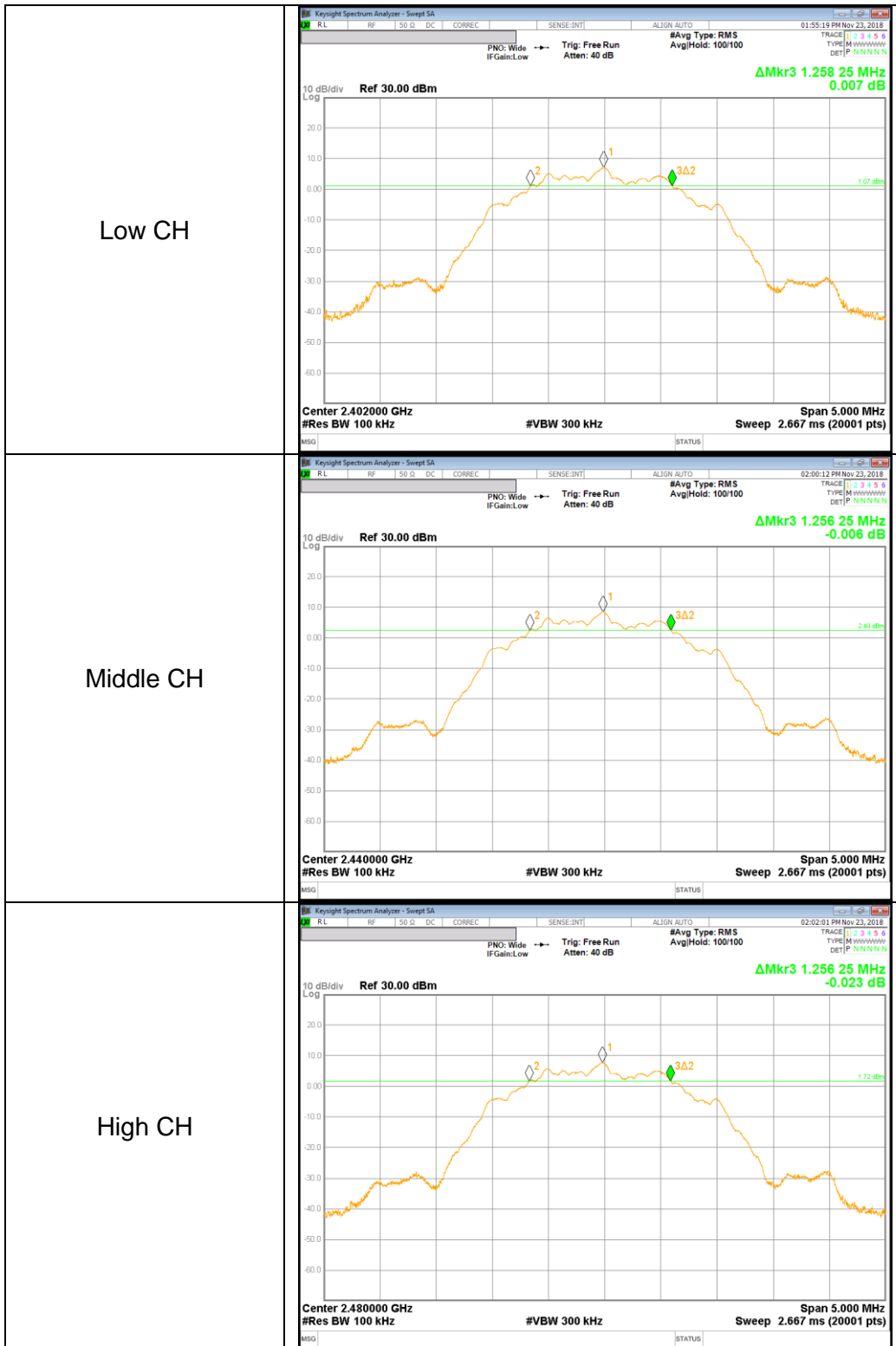
Channel	Frequency [MHz]	6 dB Bandwidth [kHz]	Minimum Limit [kHz]
Low	2402	1258.25	500.0
Mid	2440	1256.25	500.0
High	2480	1256.25	500.0
Worst		1256.25	500.0

6 dB BANDWIDTH PLOTS

- 1Mbps



- 2Mbps



10.2. OUTPUT POWER

LIMITS

FCC §15.247 (b)

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

TEST PROCEDURE

Peak power is measured using ANSI C63.10 section 11.9.1.1 (RBW>=DTS bandwidth measurement method).

RESULTS

- 1Mbps

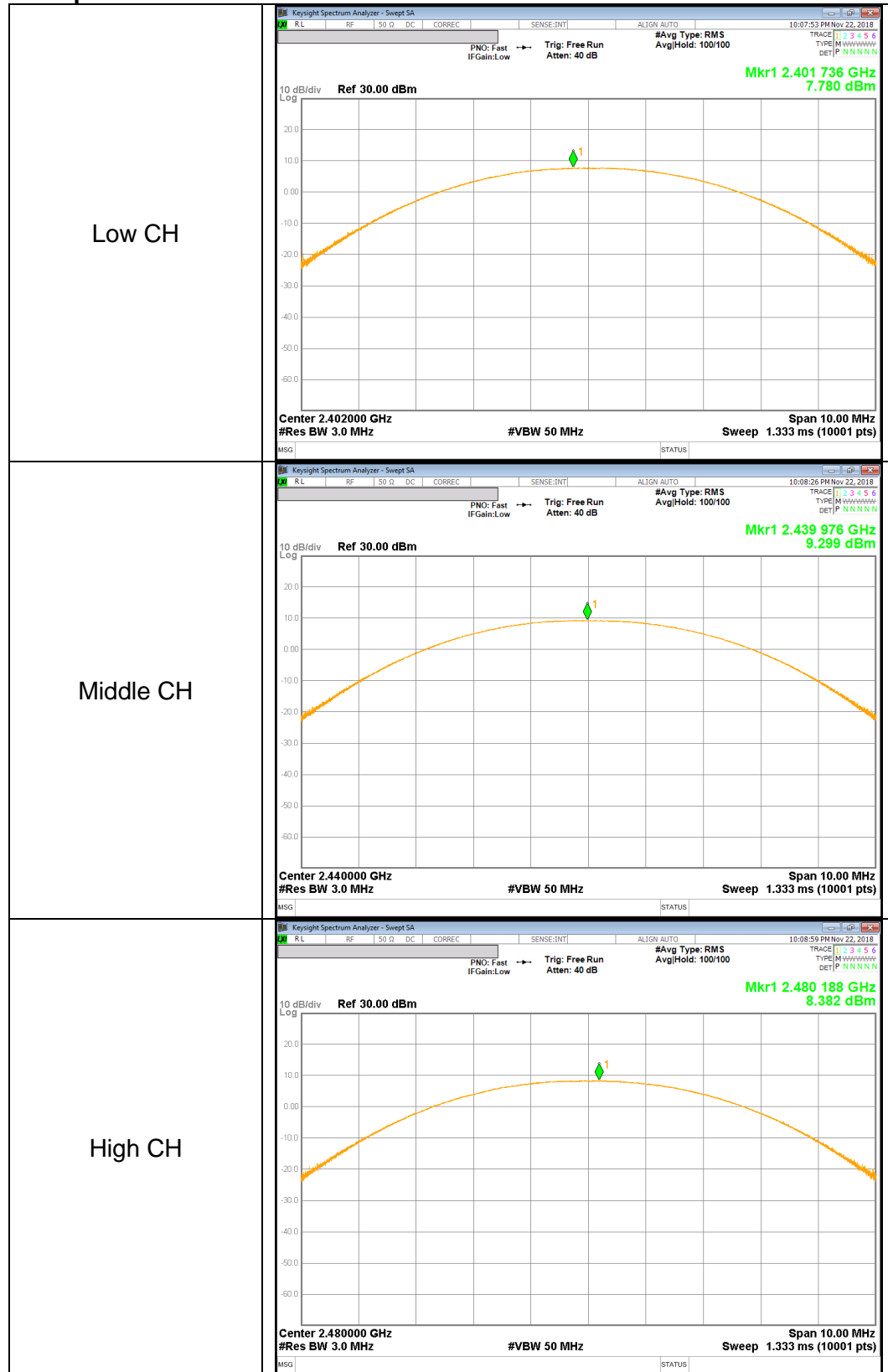
Channel	Frequency [MHz]	Peak Power Reading [dBm]	Limit [dBm]	Margin [dB]
Low	2402	7.780	30.000	-22.220
Mid	2440	9.299	30.000	-20.701
High	2480	8.382	30.000	-21.618
Worst		9.299	30.000	-20.701

- 2Mbps

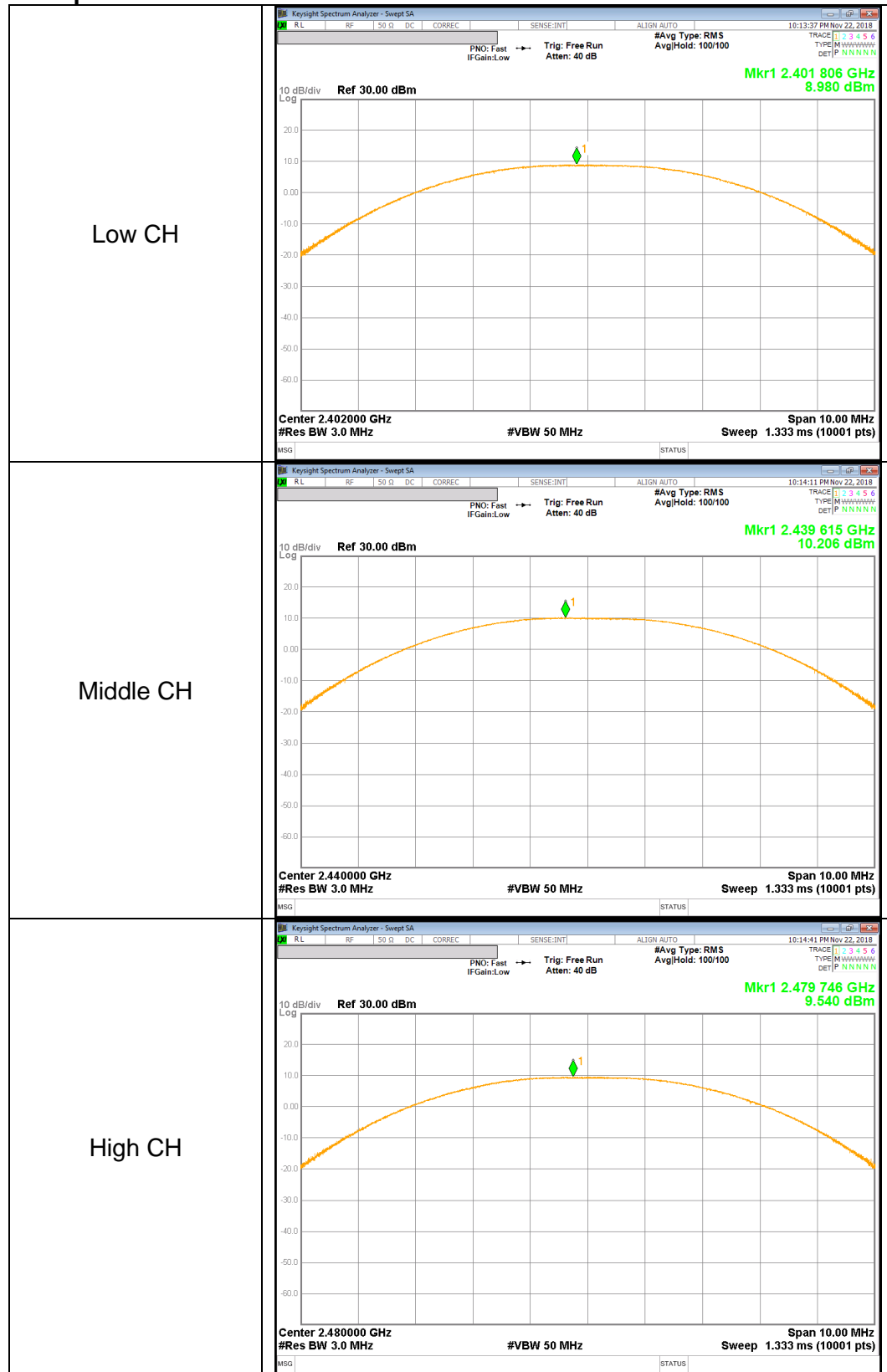
Channel	Frequency [MHz]	Peak Power Reading [dBm]	Limit [dBm]	Margin [dB]
Low	2402	8.980	30.000	-21.020
Mid	2440	10.206	30.000	-19.794
High	2480	9.540	30.000	-20.460
Worst		10.206	30.000	-19.794

OUTPUT POWER PLOTS

- 1Mbps



- 2Mbps



10.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.
The duty factor already has been added.

RESULTS

The cable assembly insertion loss was entered as an offset in the power meter to allow for direct reading of power.

- 1Mbps

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	7.189	5.235
Middle	2440	8.809	7.602
High	2480	7.797	6.022

- 2Mbps

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	8.009	6.323
Middle	2440	9.346	8.602
High	2480	8.573	7.199

10.4. PSD

LIMITS

FCC §15.247

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

TEST PROCEDURE

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

RESULTS

- 1Mbps

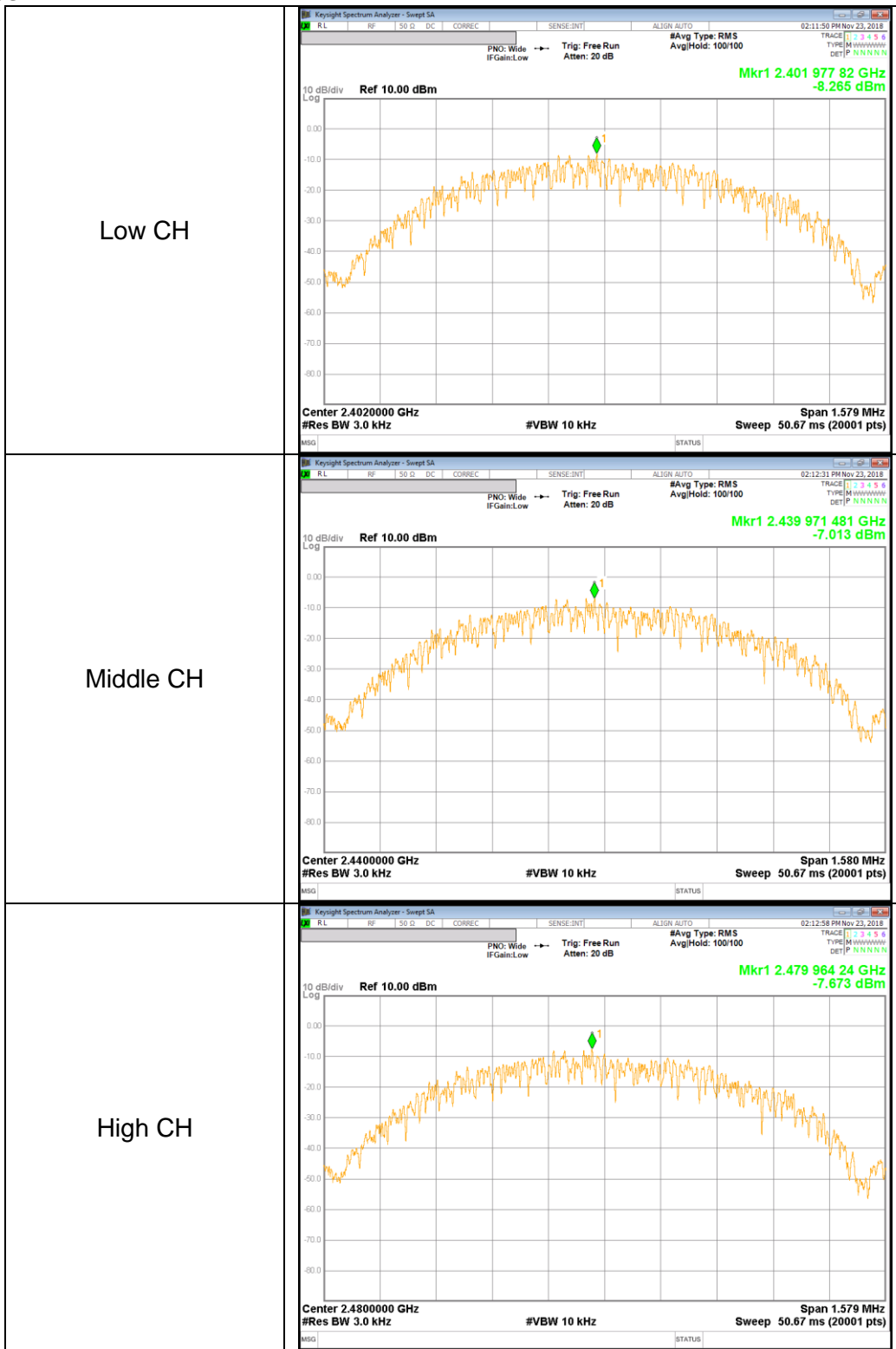
Channel	Frequency [MHz]	PSD [dBm/3kHz]	Limit [dBm/3kHz]	Margin [dB]
Low	2402	-8.27	8.00	-16.27
Mid	2440	-7.01	8.00	-15.01
High	2480	-7.67	8.00	-15.67

- 2Mbps

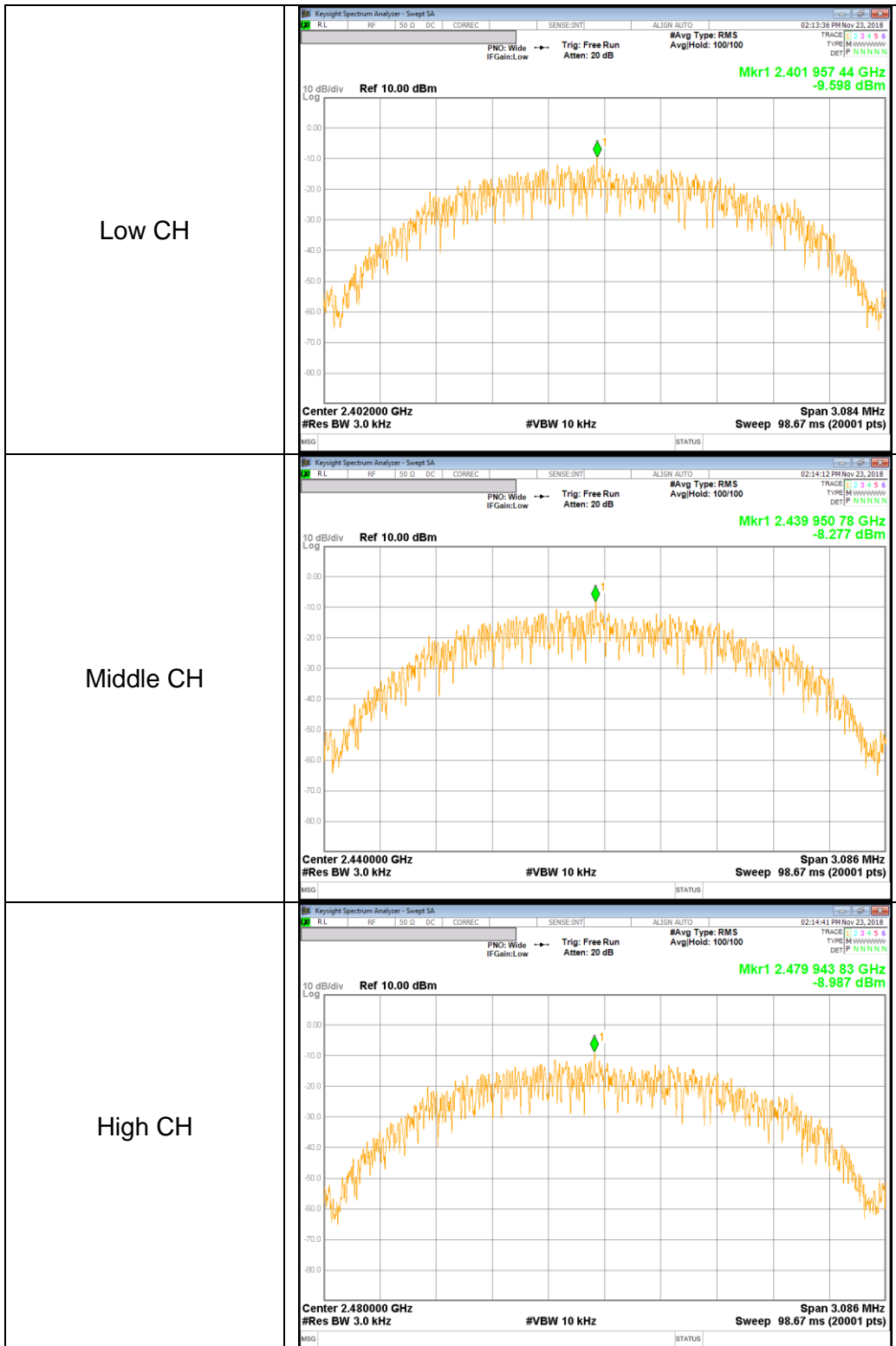
Channel	Frequency [MHz]	PSD [dBm/3kHz]	Limit [dBm/3kHz]	Margin [dB]
Low	2402	-9.60	8.00	-17.60
Mid	2440	-8.28	8.00	-16.28
High	2480	-8.99	8.00	-16.99

POWER SPECTRAL DENSITY PLOTS

- 1Mbps



- 2Mbps



10.5. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

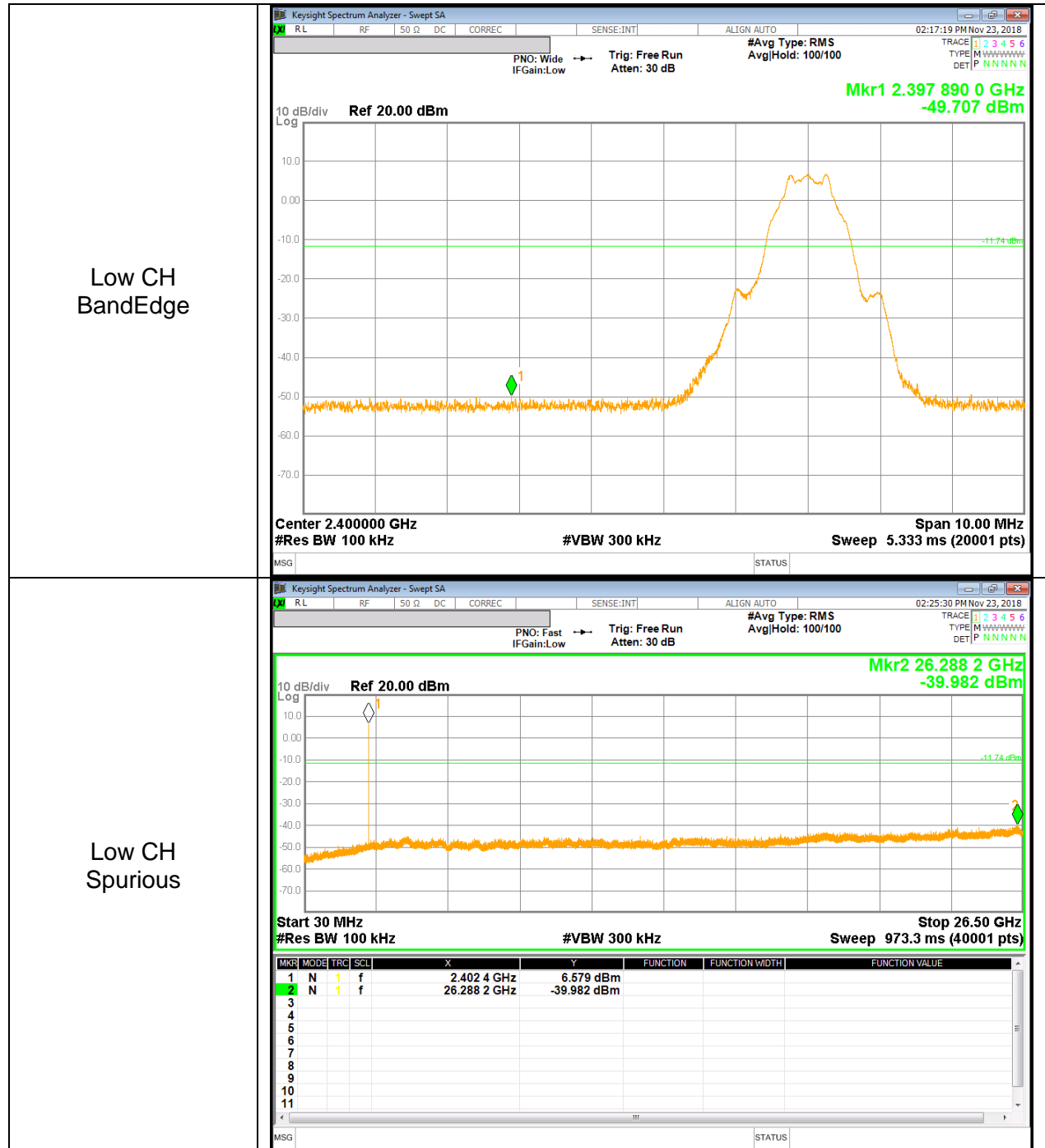
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

TEST PROCEDURE

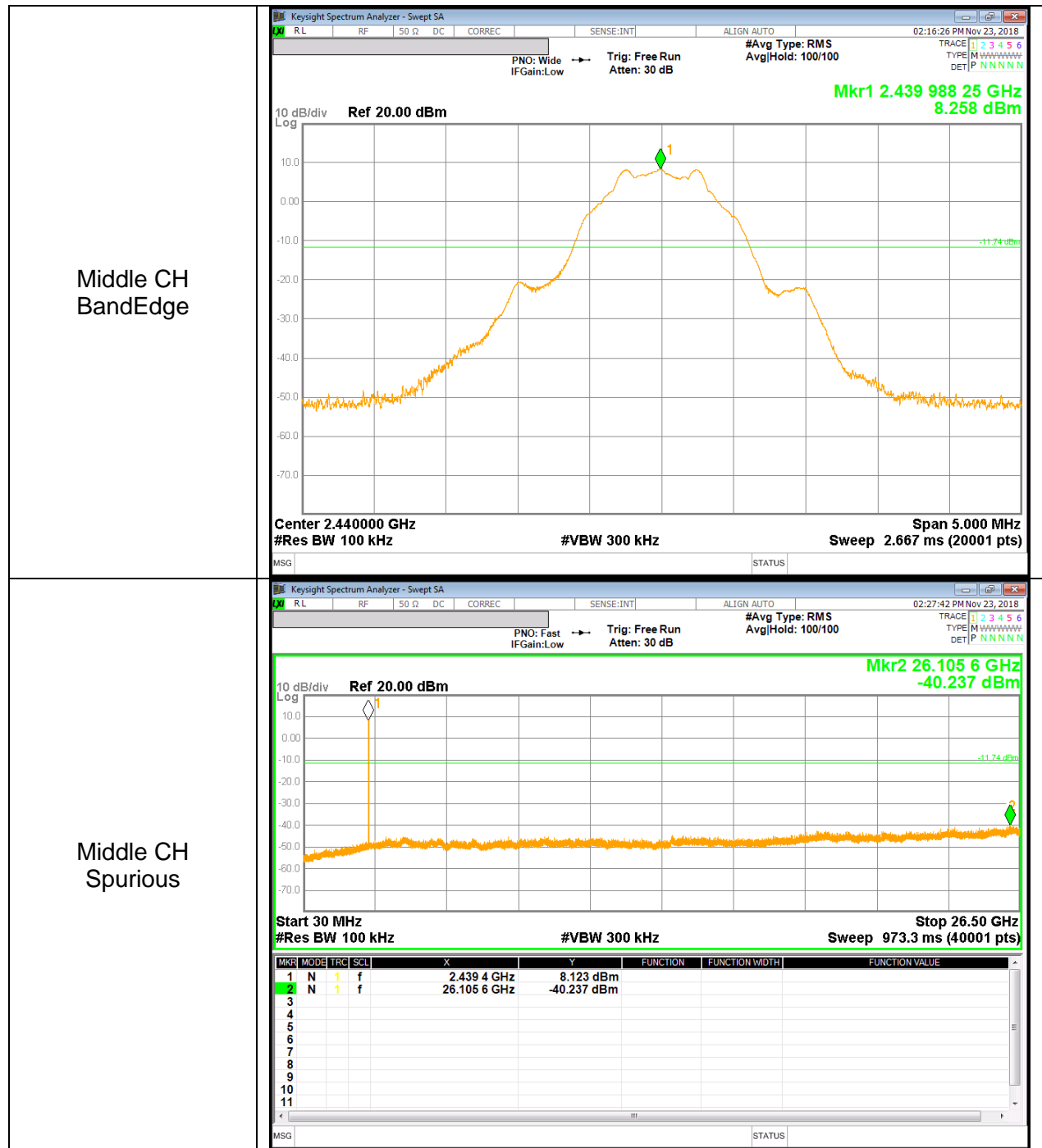
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

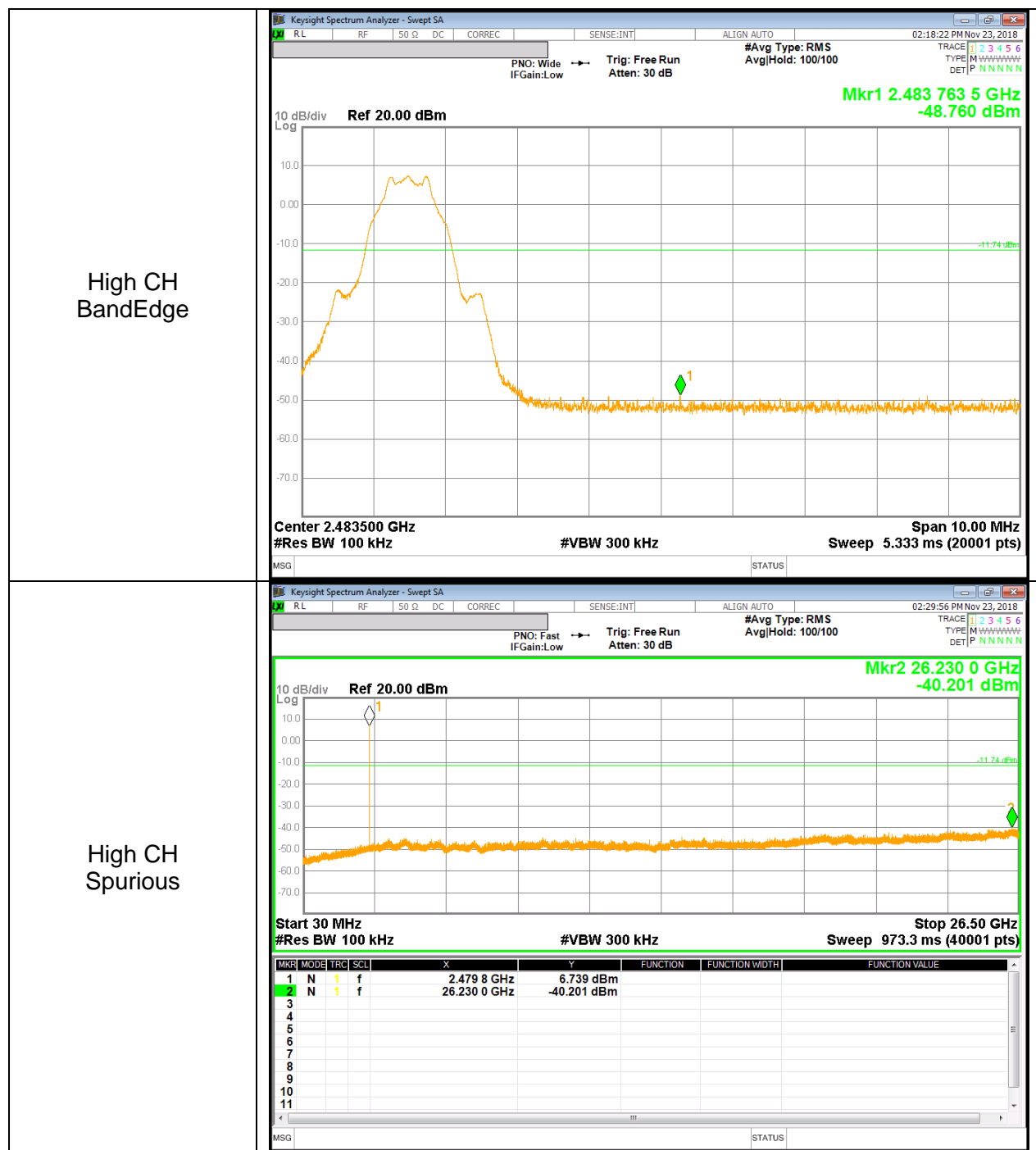
BANDEDGE & SPURIOUS EMISSIONS, LOW CHANNEL (1Mbps)



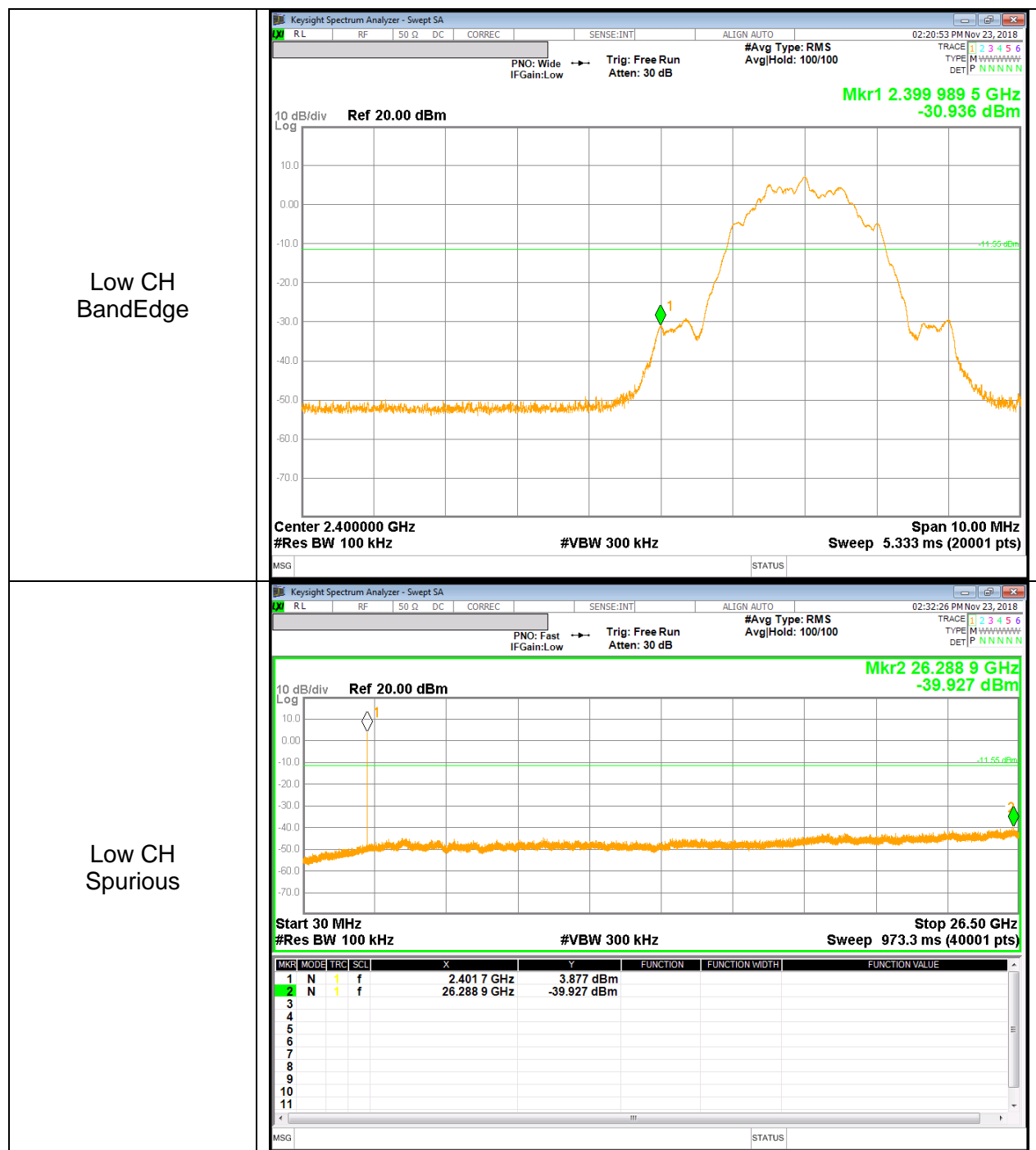
SPURIOUS EMISSIONS, MID CHANNEL (1Mbps)



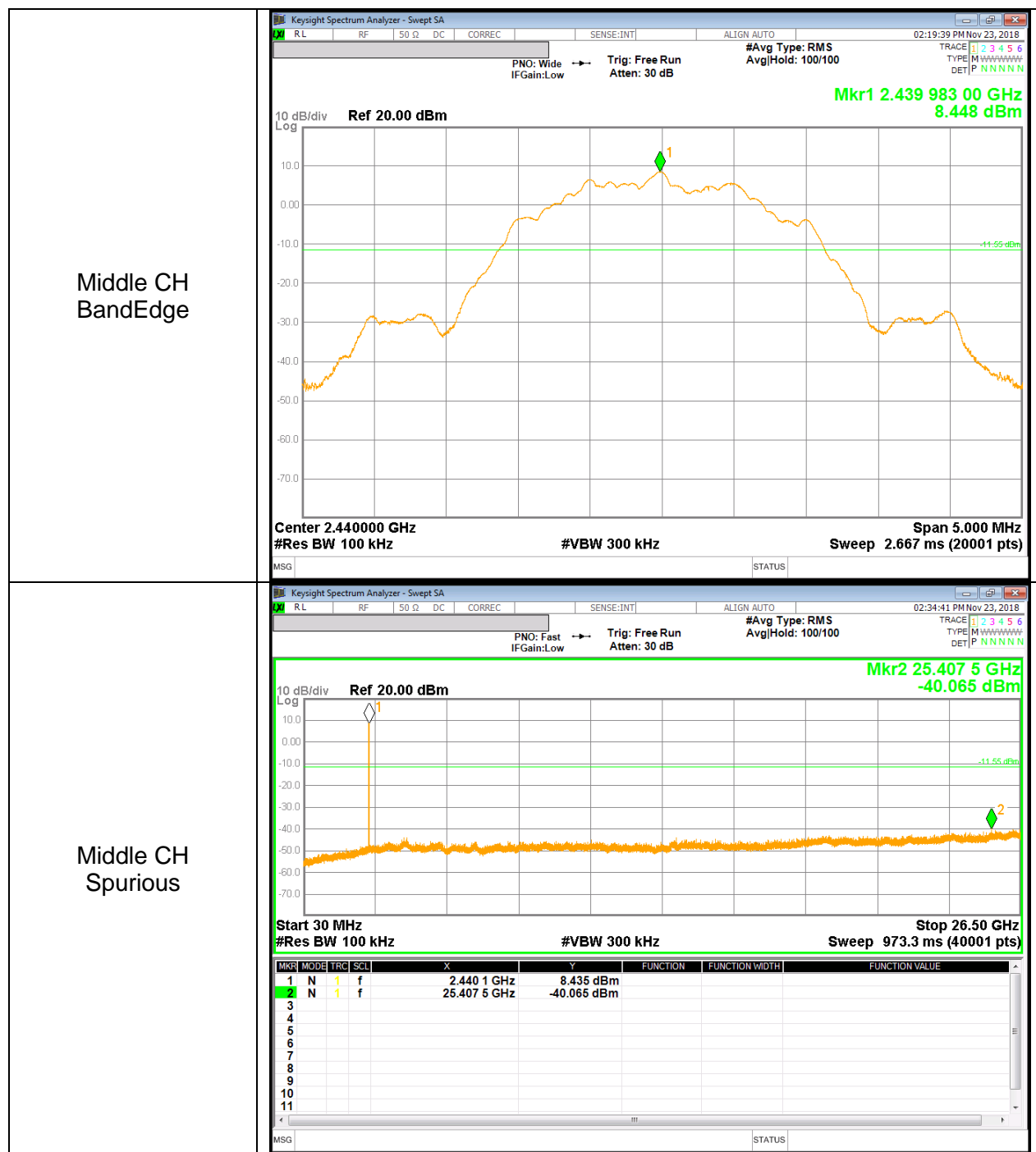
SPURIOUS EMISSIONS, HIGH CHANNEL (1Mbps)



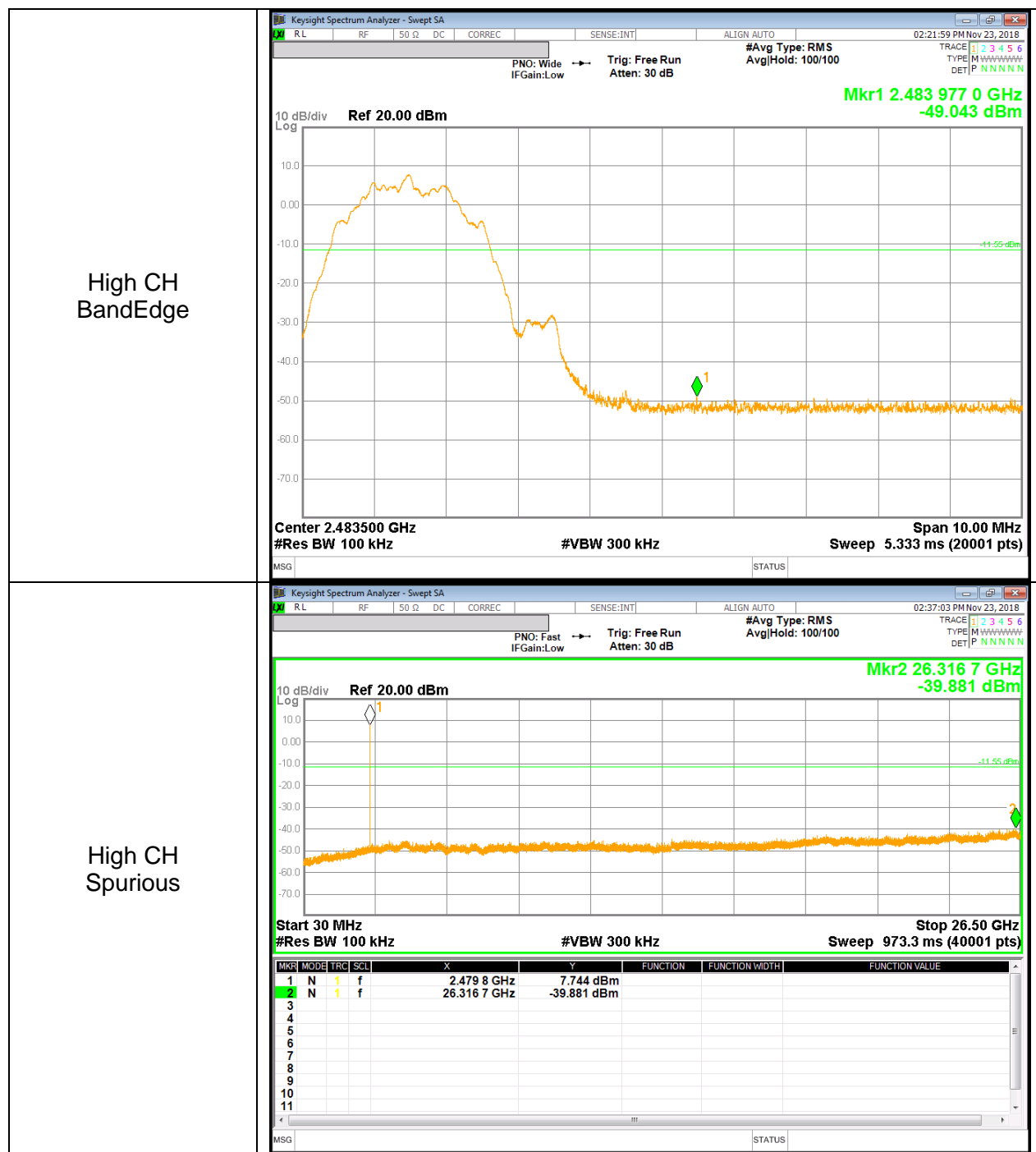
BANDEDGE & SPURIOUS EMISSIONS, LOW CHANNEL (2Mbps)



SPURIOUS EMISSIONS, MID CHANNEL (2Mbps)



SPURIOUS EMISSIONS, HIGH CHANNEL (2Mbps)



11. RADIATED TEST RESULTS

11.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

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

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

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 bandedge, Final detection of spurious harmonic emissions) Duty cycle factor = $10 \log(1/x)$. For this sample: For 1Mbps, DCF = $10 \log(1/0.604) = 2.2 \text{ dB}$ (Spectrum Analyzer round it up to 2.2dB) and for 2Mbps, DCF = $10 \log(1/0.309) = 5.1 \text{ dB}$ (Spectrum Analyzer round it up to 5.1dB)

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.

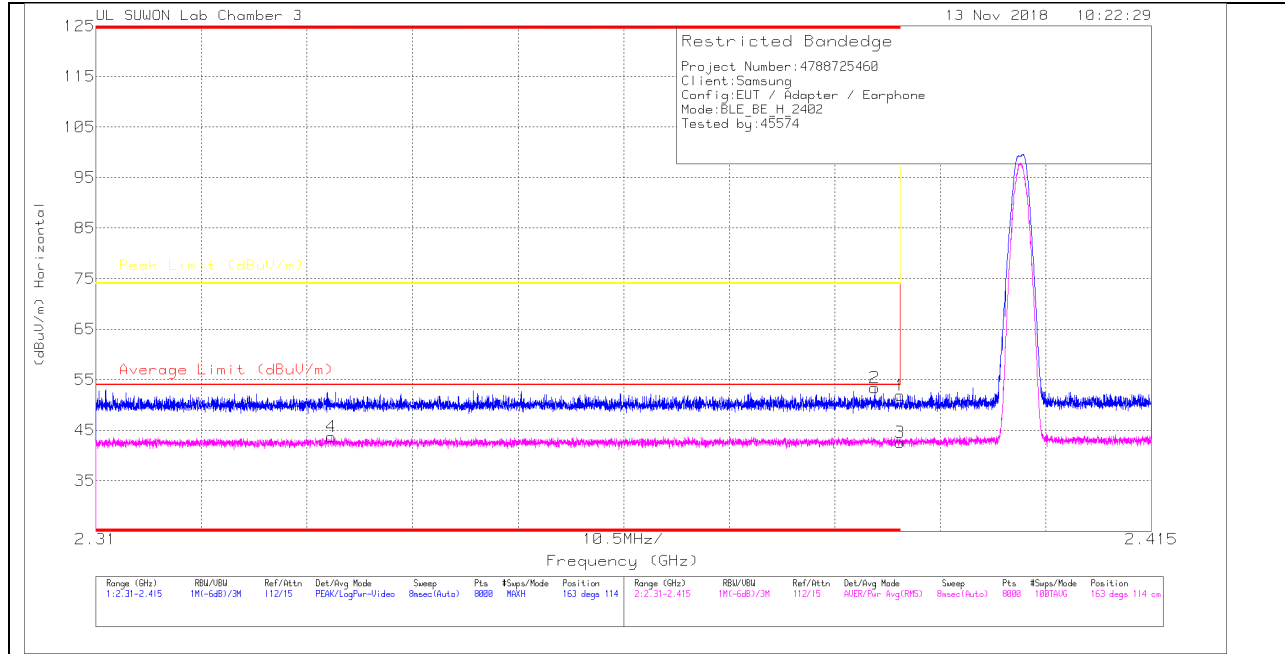
Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site.
Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the one of tests made in an open field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

11.2. TRANSMITTER ABOVE 1 GHz

11.2.1. 1Mbps MODE

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00209559	10dB(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	43.63	Pk	31.7	-23.4	0	51.93	-	-	74	-22.07	163	114	H
2	* 2.387	45.04	Pk	31.7	-23.4	0	53.34	-	-	74	-20.66	163	114	H
3	* 2.39	32.14	RMS	31.7	-23.4	2.2	42.64	54	-11.36	-	-	163	114	H
4	* 2.333	33.31	RMS	31.5	-23.3	2.2	43.71	54	-10.29	-	-	163	114	H

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

Pk - Peak detector

RMS - RMS detection

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00209599	10dB(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	40.72	Pk	31.7	-23.4	0	49.02	-	-	74	-24.98	16	359	V
2	* 2.363	44.78	Pk	31.6	-23.4	0	52.98	-	-	74	-21.02	16	359	V
3	* 2.39	32.21	RMS	31.7	-23.4	2.2	42.71	54	-11.29	-	-	16	359	V
4	* 2.374	33.52	RMS	31.6	-23.4	2.2	43.92	54	-10.08	-	-	16	359	V

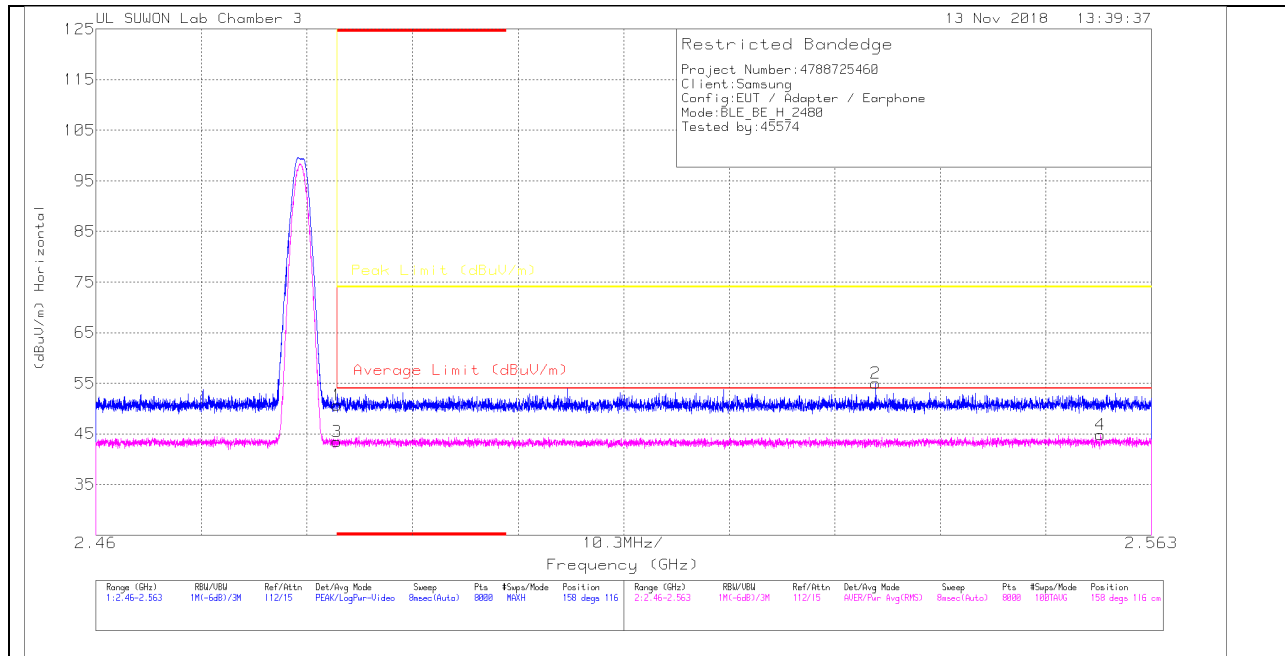
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

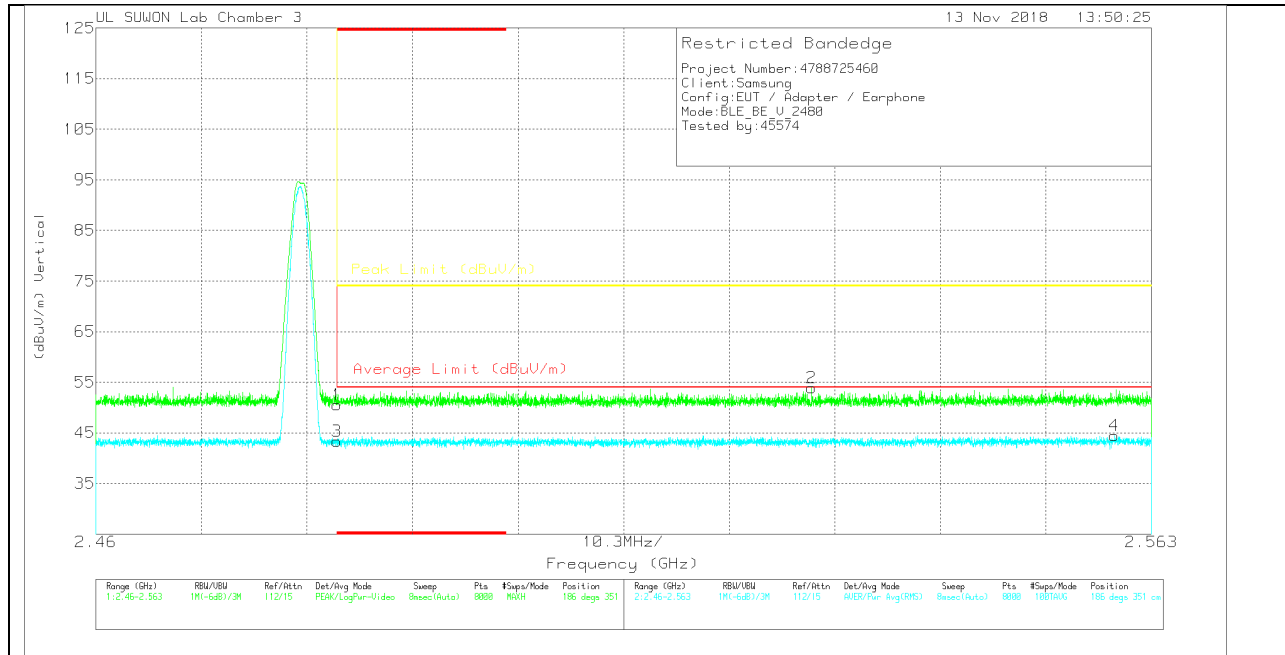
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00209959	10dB(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	41.94	Pk	31.9	-23.2	0	50.64	-	-	74	-23.36	158	116	H
2	2.536	46.16	Pk	32	-23.2	0	54.96	-	-	74	-19.04	158	116	H
3	* 2.484	32.57	RMS	31.9	-23.2	2.2	43.47	54	-10.53	-	-	158	116	H
4	2.558	33.82	RMS	32	-23.2	2.2	44.82	54	-9.18	-	-	158	116	H

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

Pk - Peak detector

RMS - RMS detection

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00209599	10dB(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	41.88	Pk	31.9	-23.2	0	50.58	-	-	74	-23.42	186	351	V
2	2.53	45.14	Pk	32	-23.2	0	53.94	-	-	74	-20.06	186	351	V
3	* 2.484	32.43	RMS	31.9	-23.2	2.2	43.33	54	-10.67	-	-	186	351	V
4	2.559	33.36	RMS	32	-23.1	2.2	44.46	54	-9.54	-	-	186	351	V

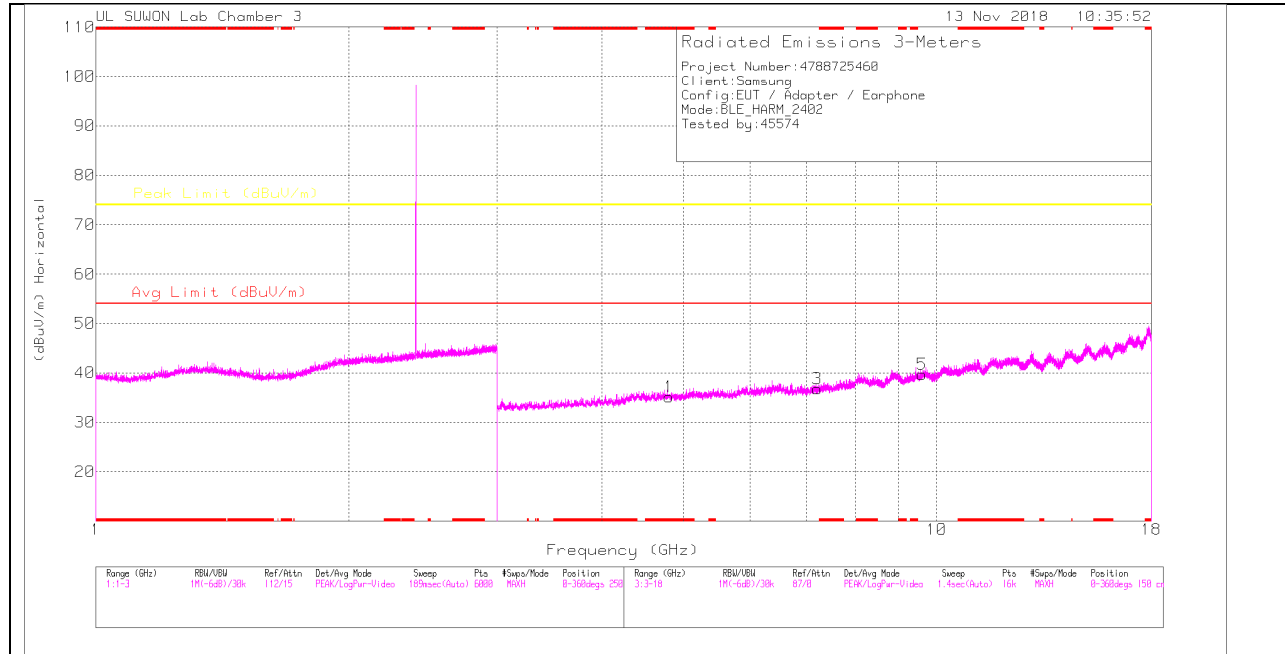
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

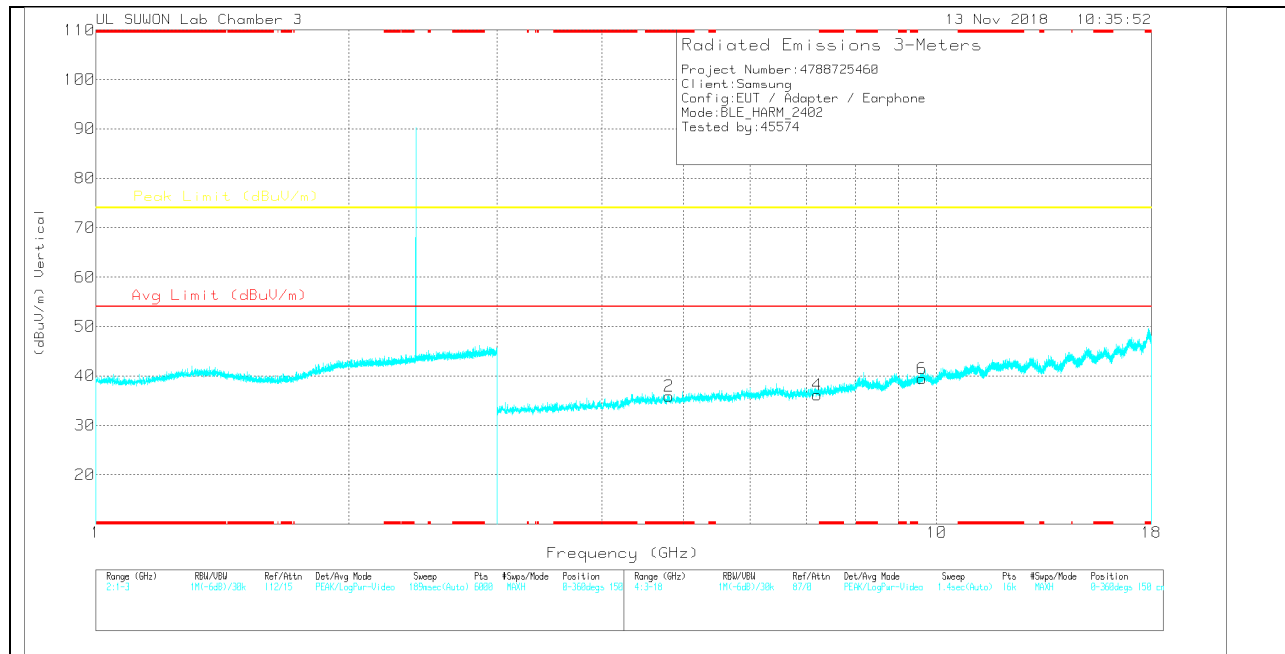
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



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

LOW CHANNEL DATA

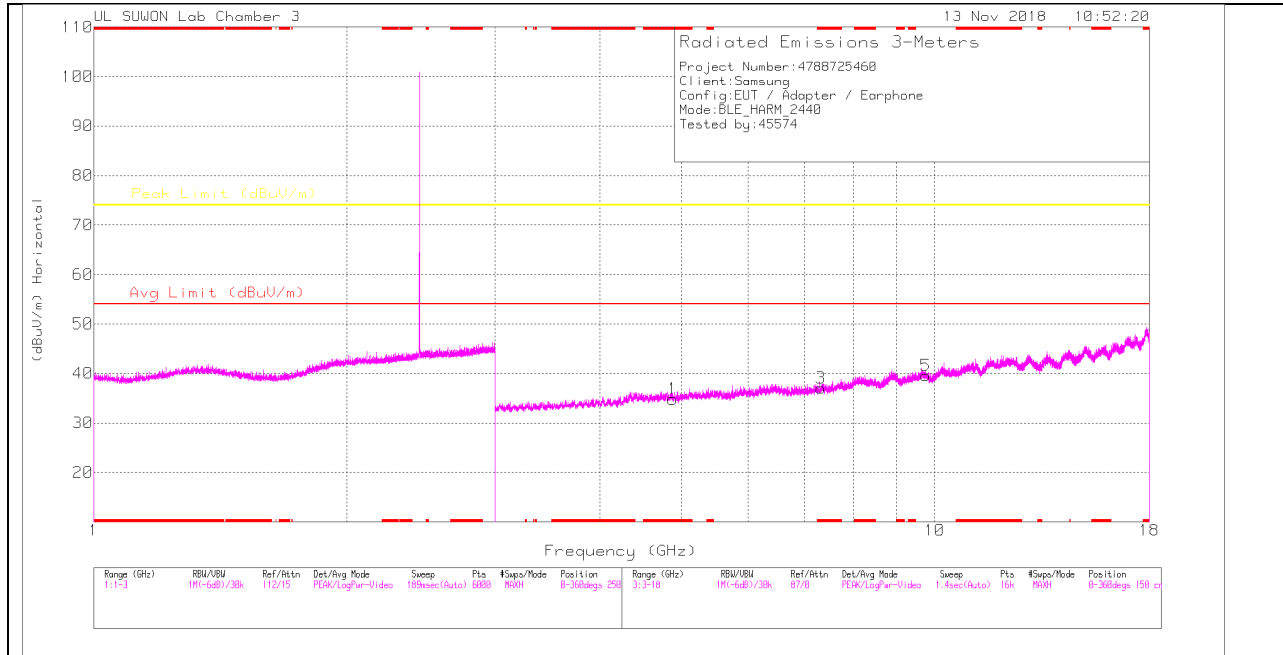
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00209959	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity	
1	* 4.805	29.39	PK		34.2	-28.4	0	35.19	-	-	74	-38.81	0-360	250	H
3	7.207	25.11	PK		35.8	-24.1	0	36.81	-	-	74	-37.19	0-360	250	H
5	9.609	22.63	PK		37	-19.9	0	39.73	-	-	74	-34.27	0-360	150	H
2	* 4.805	30.1	PK		34.2	-28.4	0	35.9	-	-	74	-38.1	0-360	250	V
4	7.207	24.43	PK		35.8	-24.1	0	36.13	-	-	74	-37.87	0-360	150	V
6	9.609	22.4	PK		37	-19.9	0	39.5	-	-	74	-34.5	0-360	250	V

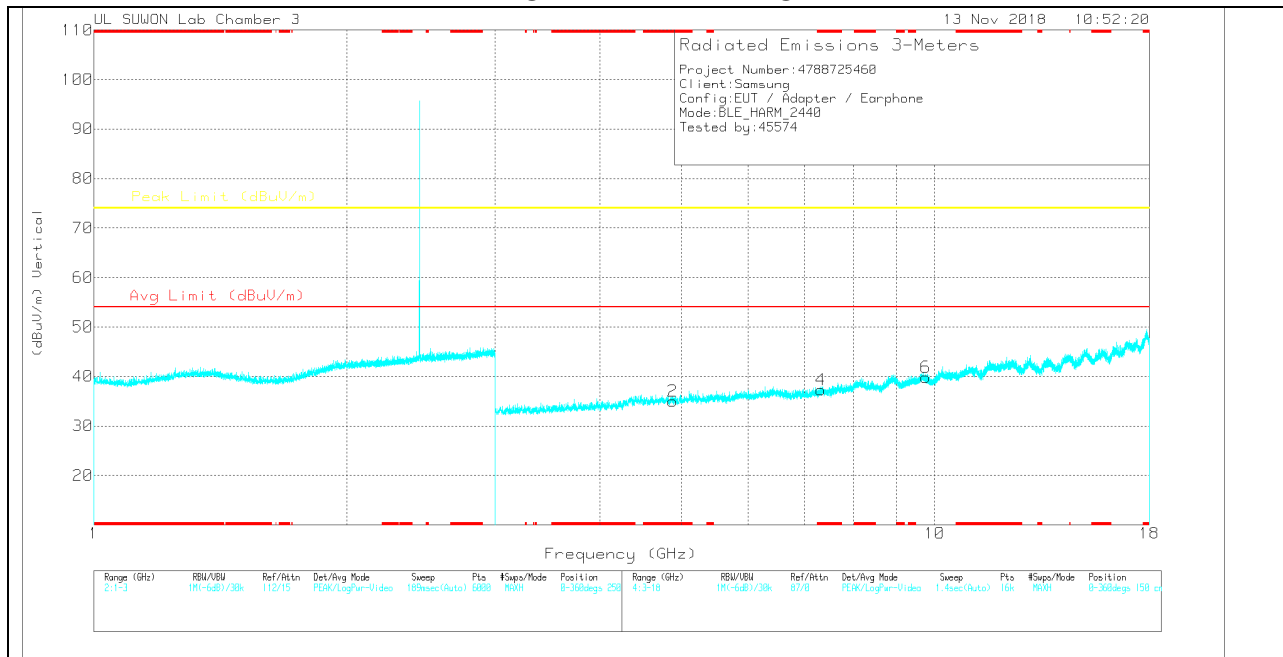
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PK – Peak Detector

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



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

MID CHANNEL DATA

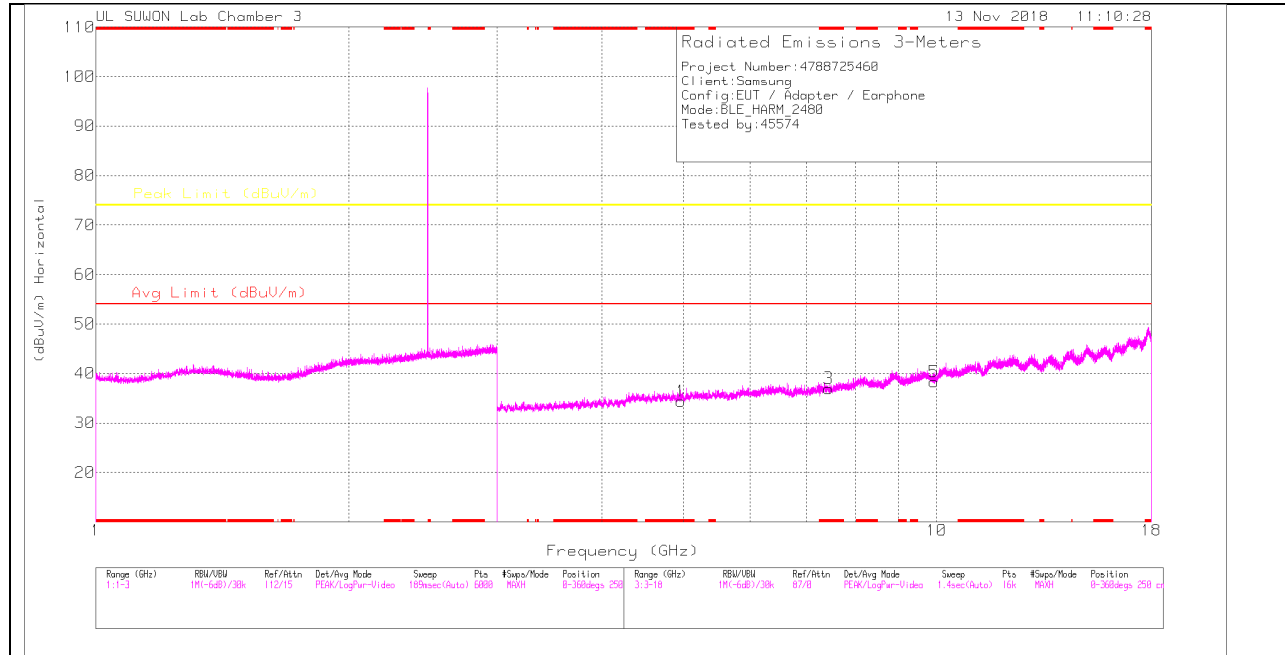
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00205959	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.881	29.73	PK	34.2	-29.1	0	34.83	-	-	74	-39.17	0-360	250	H
3	* 7.321	24.99	PK	35.8	-23.7	0	37.09	-	-	74	-36.91	0-360	250	H
5	9.761	21.93	PK	37.2	-19.5	0	39.63	-	-	74	-34.37	0-360	250	H
2	* 4.881	29.87	PK	34.2	-29.1	0	34.97	-	-	74	-39.03	0-360	250	V
4	* 7.321	25.19	PK	35.8	-23.7	0	37.29	-	-	74	-36.71	0-360	250	V
6	9.761	22.12	PK	37.2	-19.5	0	39.82	-	-	74	-34.18	0-360	250	V

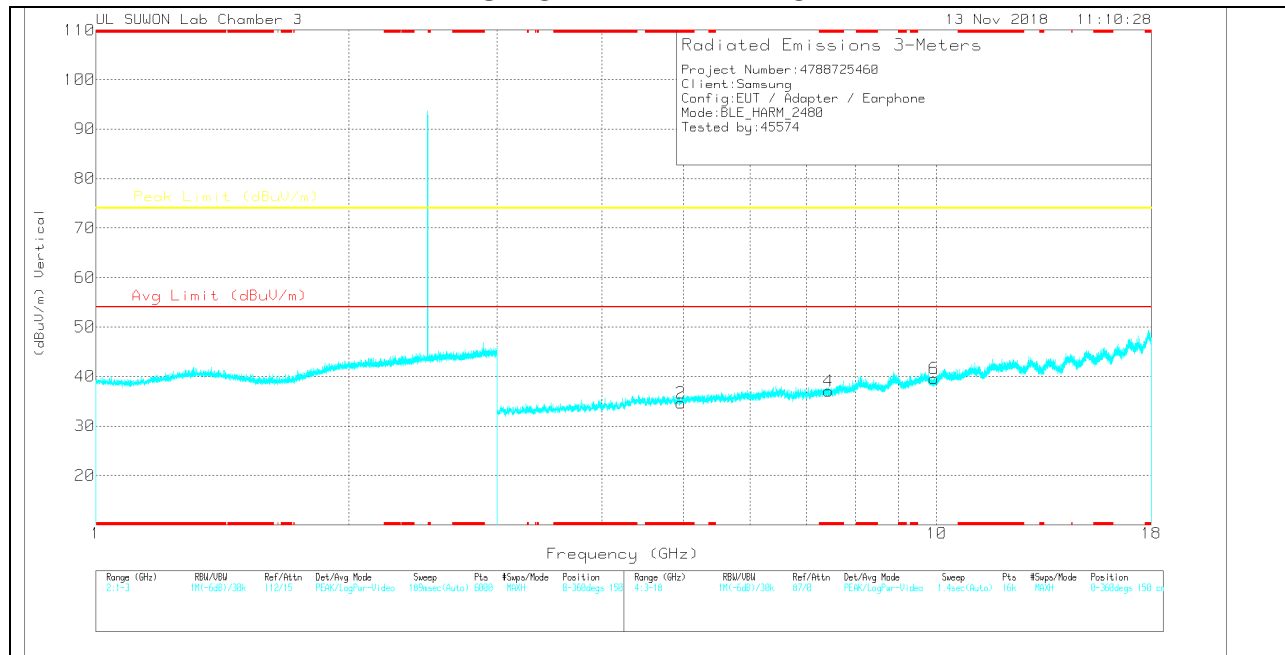
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PK – Peak Detector

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



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

HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00205959	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.96	29.09	PK	34.2	-28.9	0	34.39	-	-	74	-39.61	0-360	250	H
3	* 7.44	24.58	PK	35.8	-23.4	0	36.98	-	-	74	-37.02	0-360	250	H
5	9.92	20.57	PK	37.5	-19.7	0	38.37	-	-	74	-35.63	0-360	250	H
2	* 4.96	29.37	PK	34.2	-28.9	0	34.67	-	-	74	-39.33	0-360	250	V
4	* 7.439	24.6	PK	35.8	-23.4	0	37	-	-	74	-37	0-360	150	V
6	9.921	21.82	PK	37.5	-19.7	0	39.62	-	-	74	-34.38	0-360	250	V

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

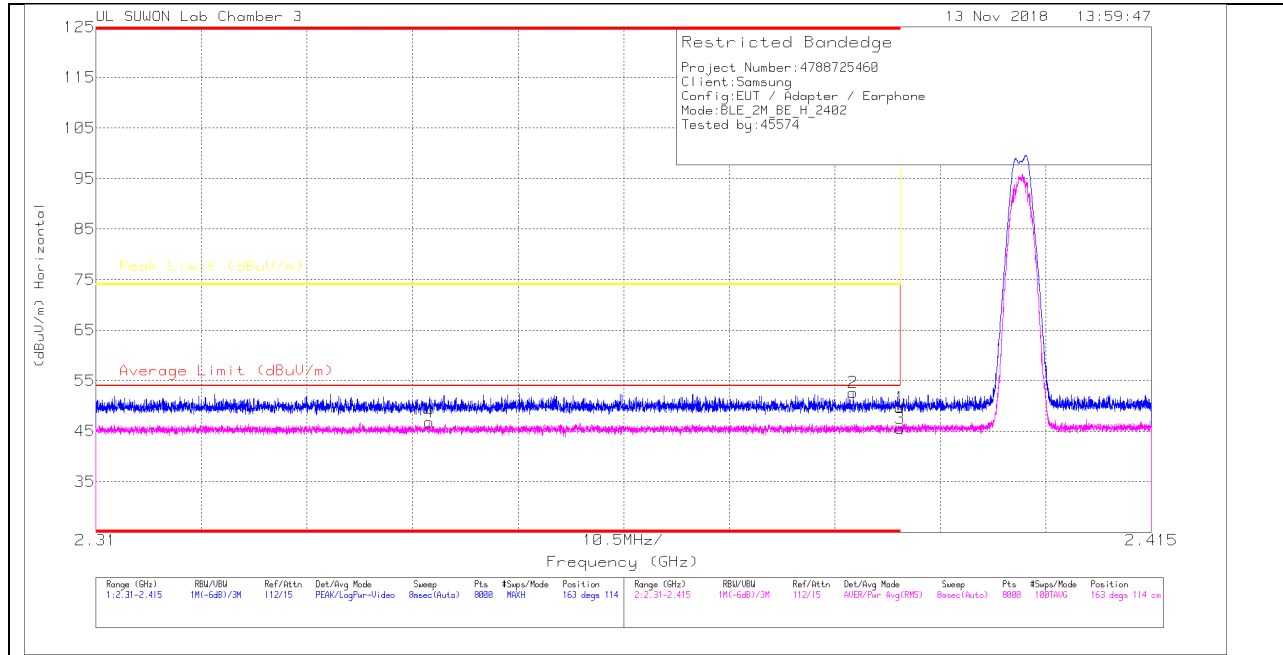
PK – Peak Detector

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

11.2.2. 2Mbps MODE

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00209559	10dB(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Pk Margin (dB)	Altitude (Degs)	Height (cm)	Polarity
1	* 2.39	41.34	PK	31.7	-23.4	0	49.64	-	-	74	-24.36	163	114	H
2	* 2.385	44.34	PK	31.7	-23.4	0	52.64	-	-	74	-21.36	163	114	H
3	* 2.39	32.16	RMS	31.7	-23.4	5.1	45.56	54	-8.44	-	-	163	114	H
4	* 2.343	33.46	RMS	31.6	-23.4	5.1	46.76	54	-7.24	-	-	163	114	H

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

PK - Peak detector

RMS - RMS detection

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBu)	Det	3117_00209599	10dB(dB)	DC Corr (dB)	Corrected Reading (dBu/m)	Average Limit (dBu/m)	Margin (dB)	Peak Limit (dBu/m)	PK Margin (dB)	Azimuth (Deg)	Height (cm)	Polarity
1	* 2.39	41.2	Pk	31.7	-23.4	0	49.5	-	-	74	-24.5	16	359	V
2	* 2.366	44.93	Pk	31.6	-23.4	0	53.13	-	-	74	-20.87	16	359	V
3	* 2.39	31.74	RMS	31.7	-23.4	5.1	45.14	54	-8.86	-	-	16	359	V
4	* 2.36	33.36	RMS	31.6	-23.4	5.1	46.66	54	-7.34	-	-	16	359	V

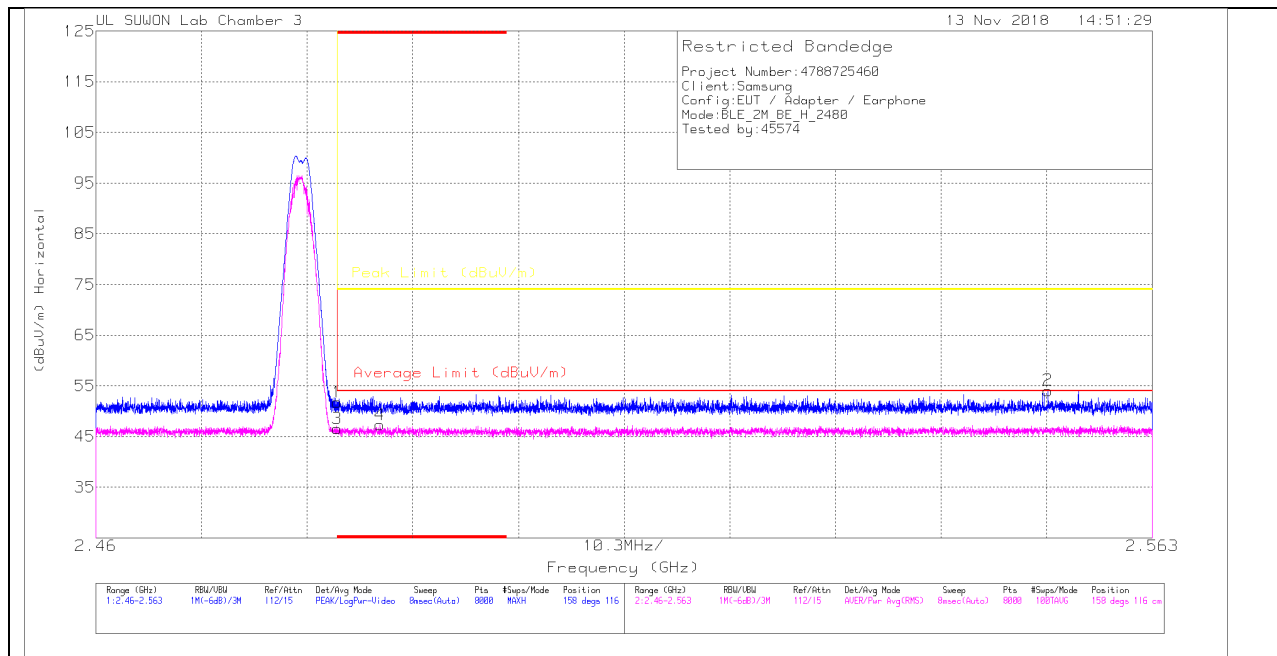
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

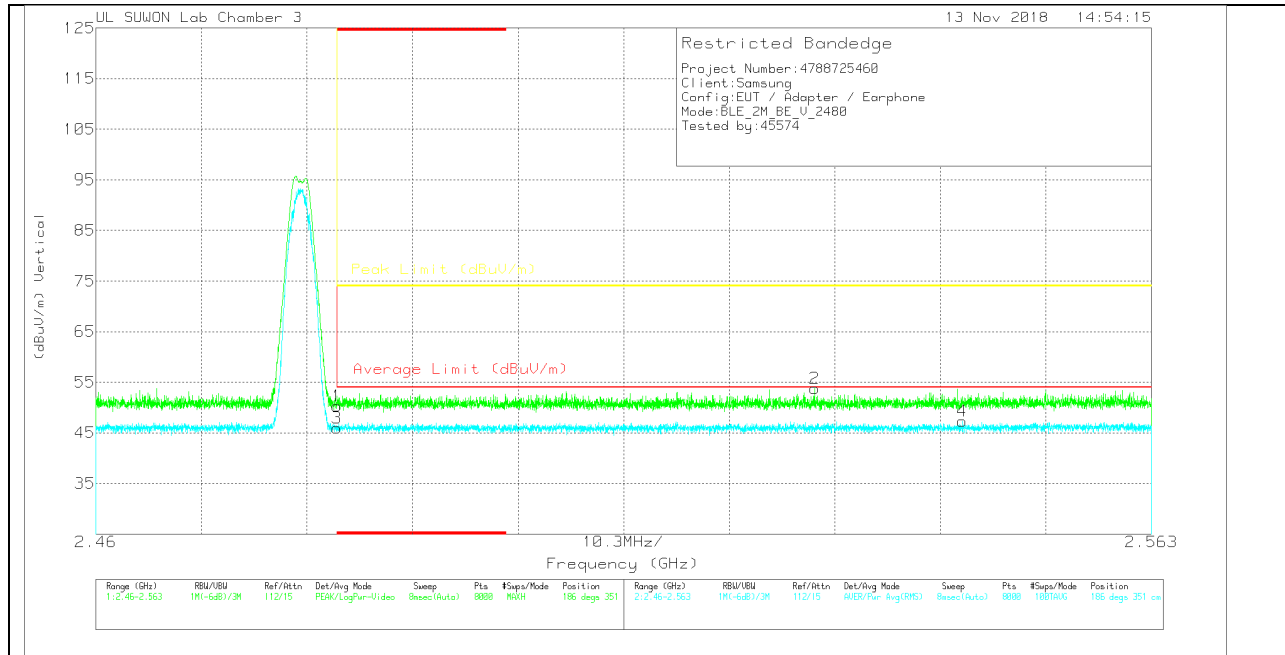
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00209959	10dB(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Altitude (Degs)	Height (cm)	Polarity
1	* 2.484	43.12	Pk	31.9	-23.2	0	51.82	-	-	74	-22.18	158	116	H
2	2.553	45.18	Pk	32	-23.1	0	54.08	-	-	74	-19.92	158	116	H
3	* 2.484	32.81	RMS	31.9	-23.2	5.1	46.61	54	-7.39	-	-	158	116	H
4	* 2.488	33.55	RMS	31.9	-23.2	5.1	47.35	54	-6.65	-	-	158	116	H

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

Pk - Peak detector

RMS - RMS detection

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00205959	10dB(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	41.56	Pk	31.9	-23.2	0	50.26	-	-	74	-23.74	186	351	V
2	2.53	45.03	Pk	32	-23.3	0	53.73	-	-	74	-20.27	186	351	V
3	* 2.484	32.1	RMS	31.9	-23.2	5.1	45.9	54	-8.1	-	-	186	351	V
4	2.545	33.4	RMS	32	-23.2	5.1	47.3	54	-6.7	-	-	186	351	V

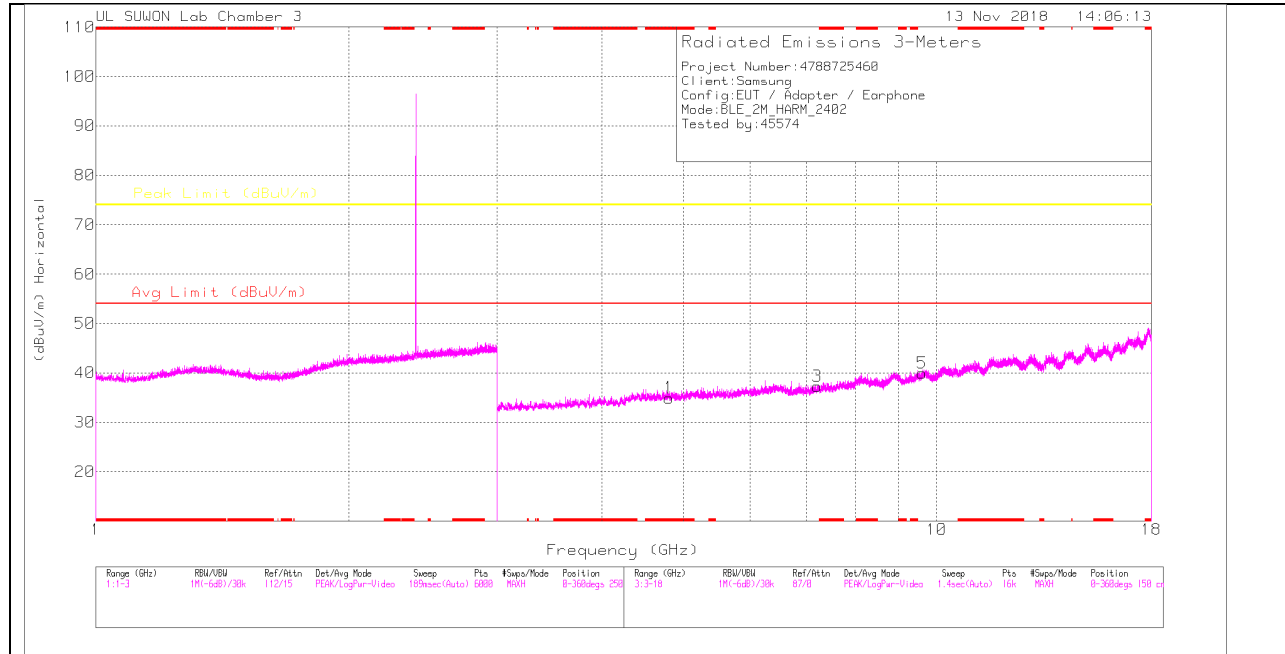
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

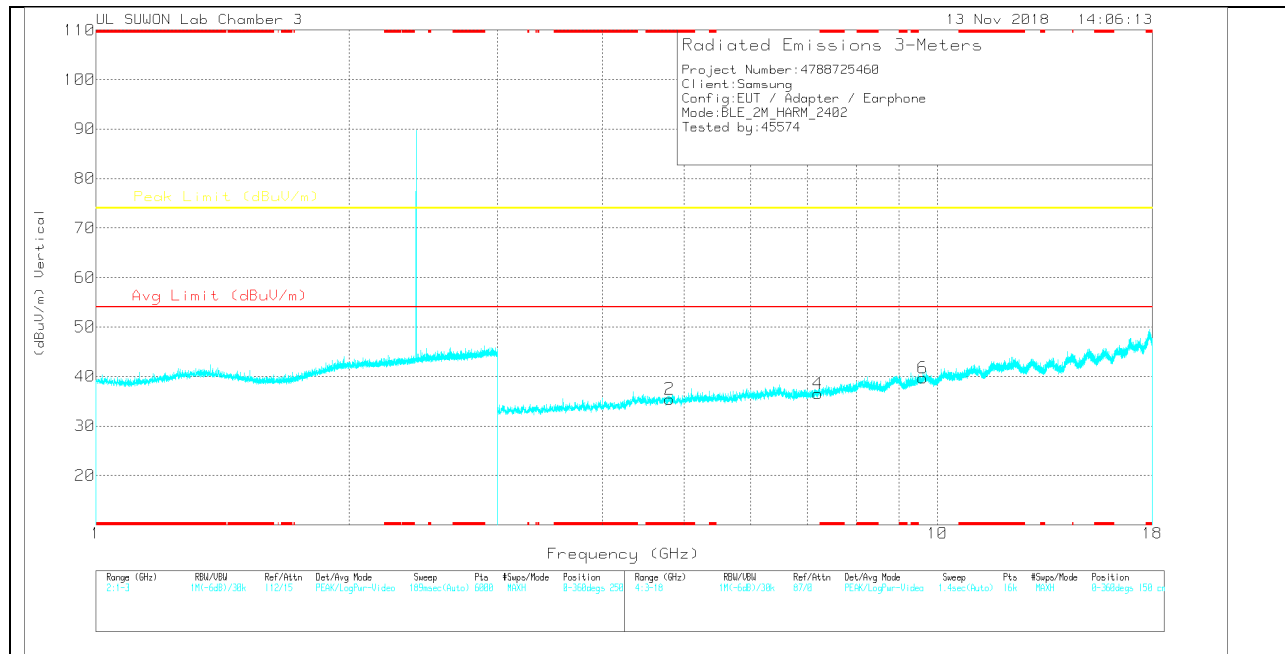
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



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

LOW CHANNEL DATA

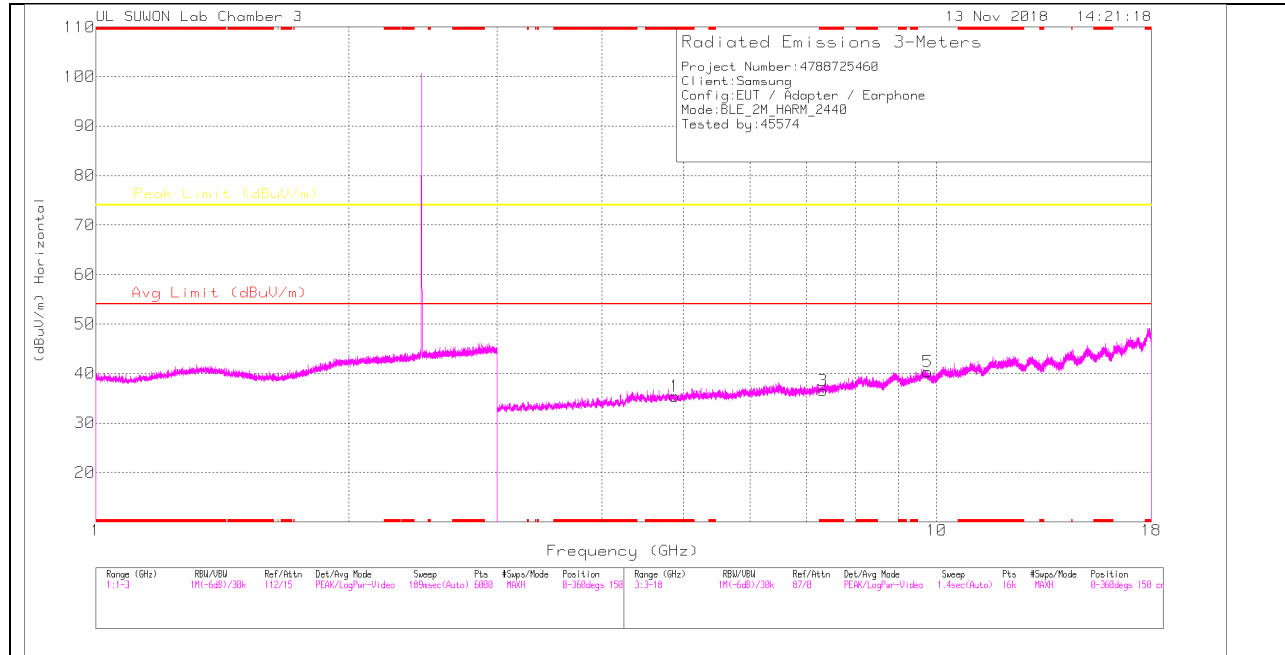
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00209959	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.805	29.15	PK	34.2	-28.4	0	34.95	-	-	74	-39.05	0-360	250	H
3	7.205	25.71	PK	35.8	-24.2	0	37.31	-	-	74	-36.69	0-360	150	H
5	9.609	22.81	PK	37	-19.9	0	39.91	-	-	74	-34.09	0-360	150	H
2	* 4.805	29.66	PK	34.2	-28.4	0	35.46	-	-	74	-38.54	0-360	250	V
4	7.205	24.97	PK	35.8	-24.2	0	36.57	-	-	74	-37.43	0-360	250	V
6	9.607	22.71	PK	37	-20	0	39.71	-	-	74	-34.29	0-360	150	V

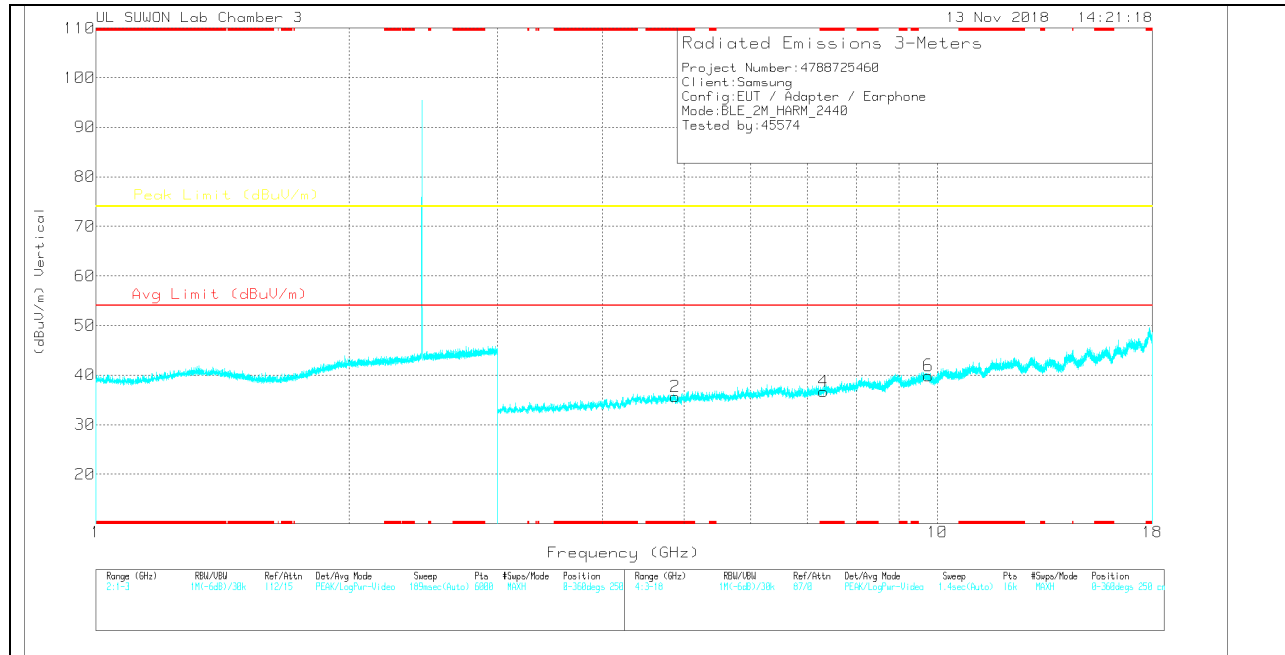
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PK – Peak Detector

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



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

MID CHANNEL DATA

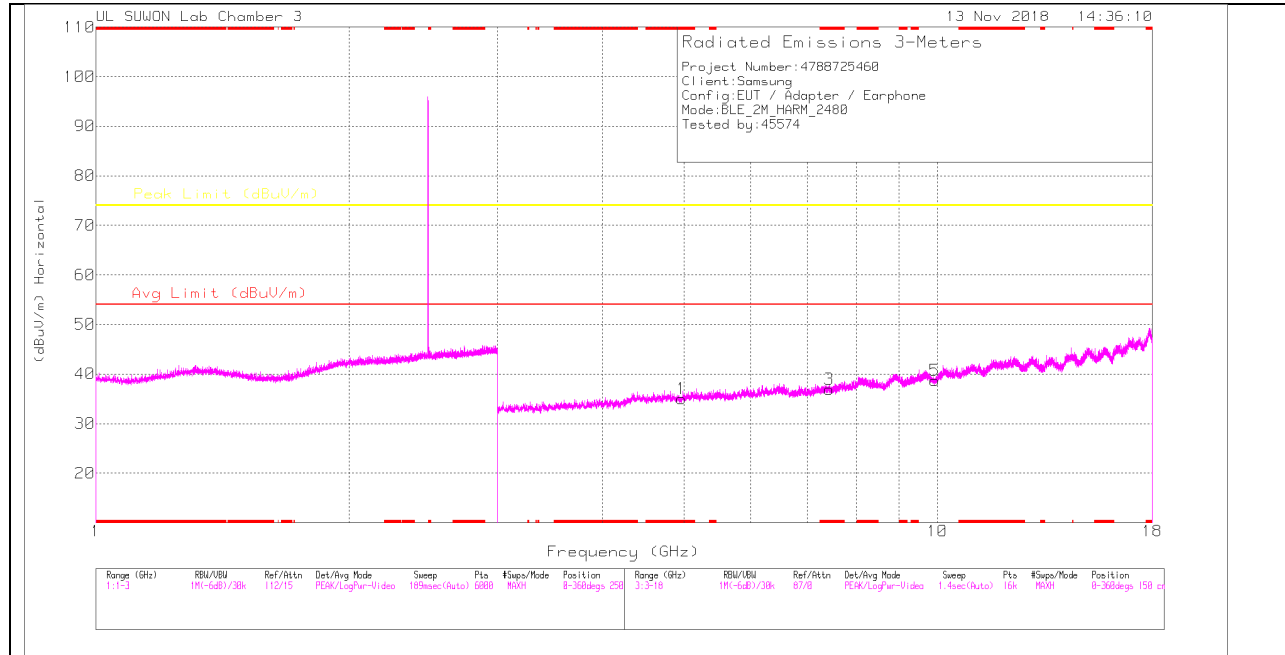
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00205959	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.881	30.25	PK	34.2	-29.1	0	35.35	-	-	74	-38.65	0-360	250	H
3	* 7.32	24.44	PK	35.8	-23.7	0	36.54	-	-	74	-37.46	0-360	250	H
5	9.761	22.65	PK	37.2	-19.5	0	40.35	-	-	74	-33.65	0-360	150	H
2	* 4.879	30.52	PK	34.2	-29.1	0	35.62	-	-	74	-38.38	0-360	150	V
4	* 7.32	24.55	PK	35.8	-23.7	0	36.65	-	-	74	-37.35	0-360	250	V
6	9.761	22.2	PK	37.2	-19.5	0	39.9	-	-	74	-34.1	0-360	250	V

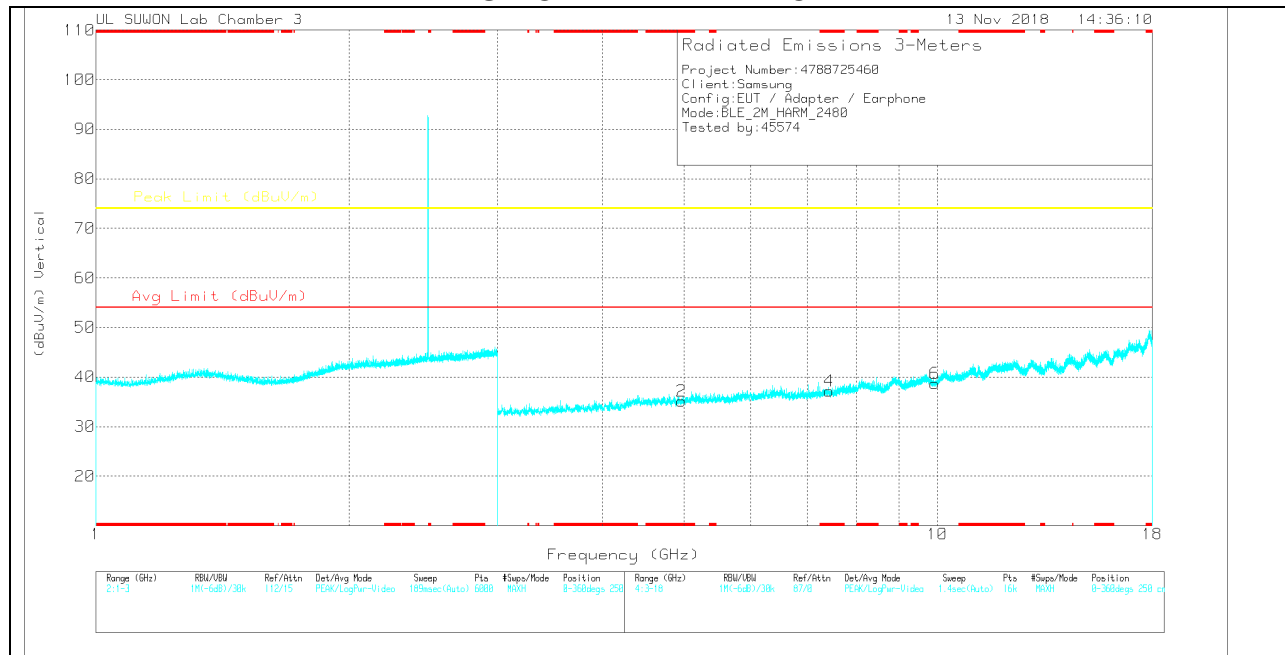
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PK – Peak Detector

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



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

HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00205959	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.961	29.6	PK	34.2	-28.8	0	35	-	-	74	-39	0-360	150	H
3	* 7.44	24.57	PK	35.8	-23.4	0	36.97	-	-	74	-37.03	0-360	250	H
5	9.92	20.93	PK	37.5	-19.7	0	38.73	-	-	74	-35.27	0-360	150	H
2	* 4.962	29.85	PK	34.2	-28.9	0	35.15	-	-	74	-38.85	0-360	150	V
4	* 7.441	24.73	PK	35.8	-23.4	0	37.13	-	-	74	-36.87	0-360	250	V
6	9.92	20.88	PK	37.5	-19.7	0	38.68	-	-	74	-35.32	0-360	150	V

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

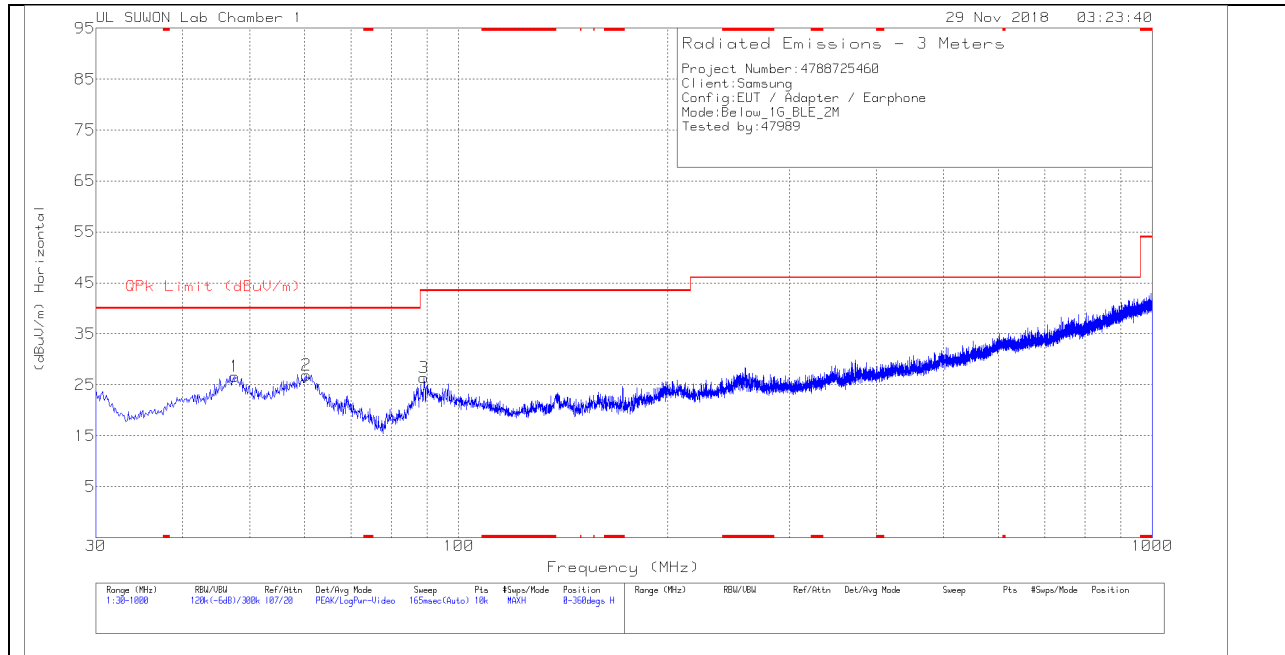
PK – Peak Detector

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

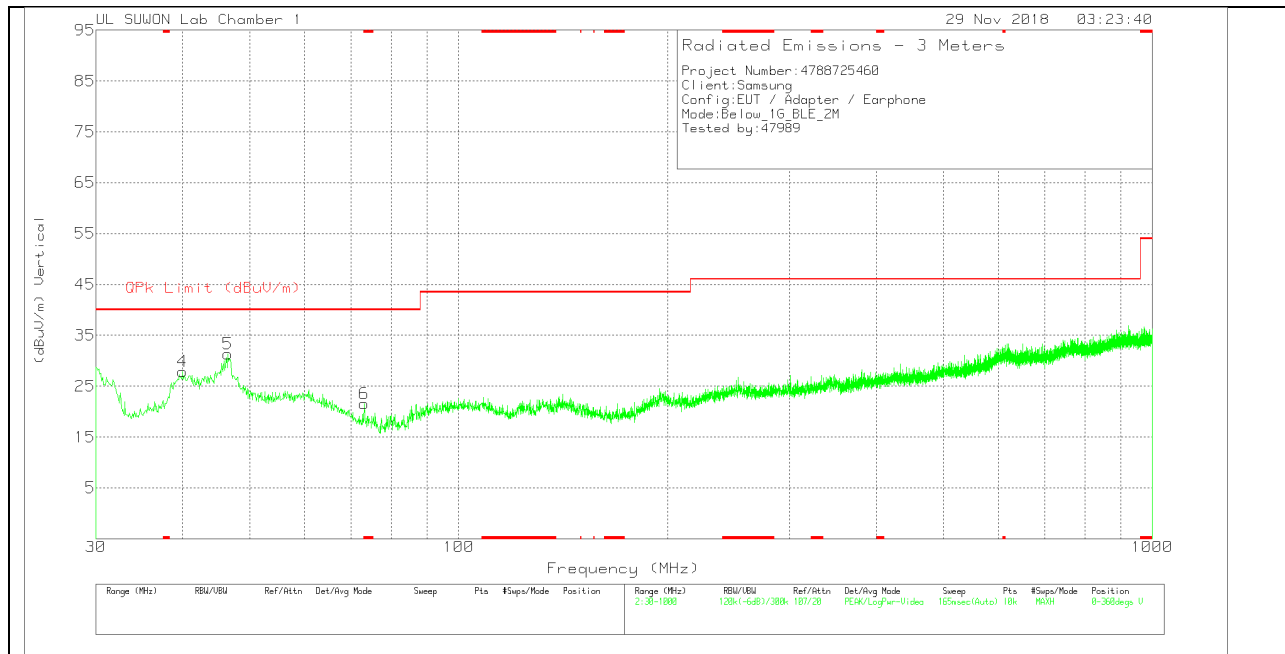
11.3. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (2Mbps)

HORIZONTAL PLOT



VERTICAL PLOT



BELOW 1 GHz TABLE

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	47.557	37.3	Pk	19.8	-30.5	26.6	40	-13.4	0-360	300	H
2	60.361	38.71	Pk	18.5	-30.3	26.91	40	-13.09	0-360	400	H
3	89.073	40.94	Pk	15.3	-29.9	26.34	43.52	-17.18	0-360	300	H
4	39.991	39.82	Pk	18.7	-30.7	27.82	40	-12.18	0-360	100	V
5	46.49	42.1	Pk	19.7	-30.5	31.3	40	-8.7	0-360	100	V
6	* 73.068	37.35	Pk	14.3	-30.1	21.55	40	-18.45	0-360	100	V

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

Pk - Peak detector

12. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

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

*Decreases with the logarithm of the frequency.

TEST PROCEDURE

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

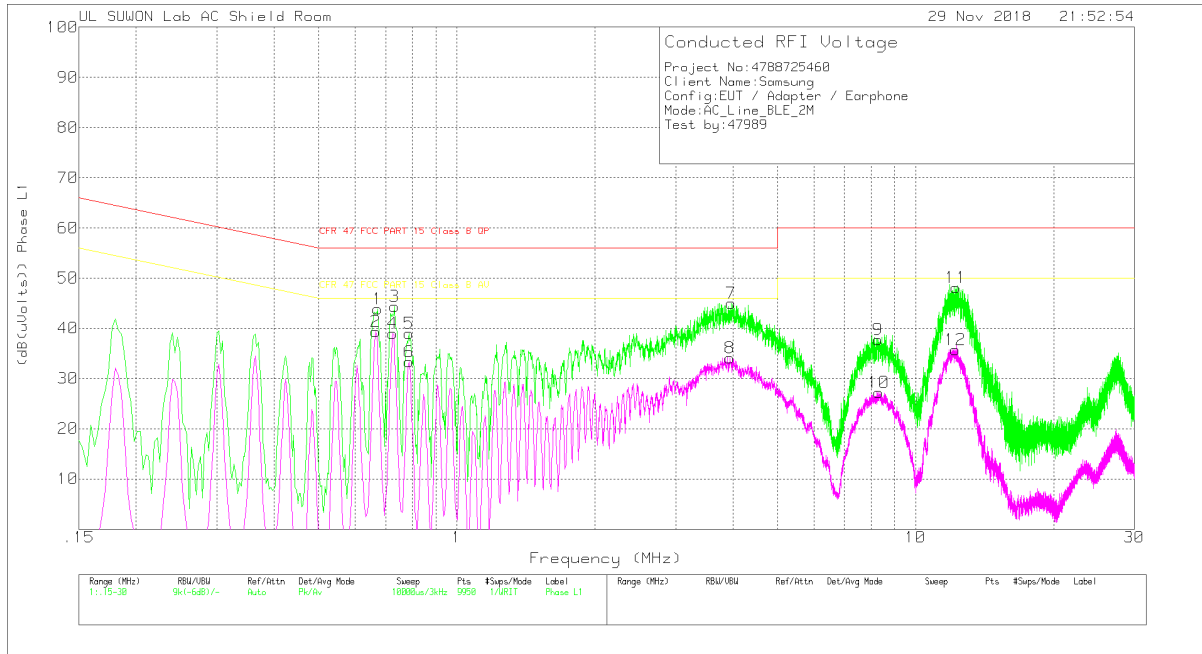
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

RESULTS

WORST EMISSIONS (2Mbps)

LINE 1 PLOT



LINE 1 RESULTS

Trace Markers

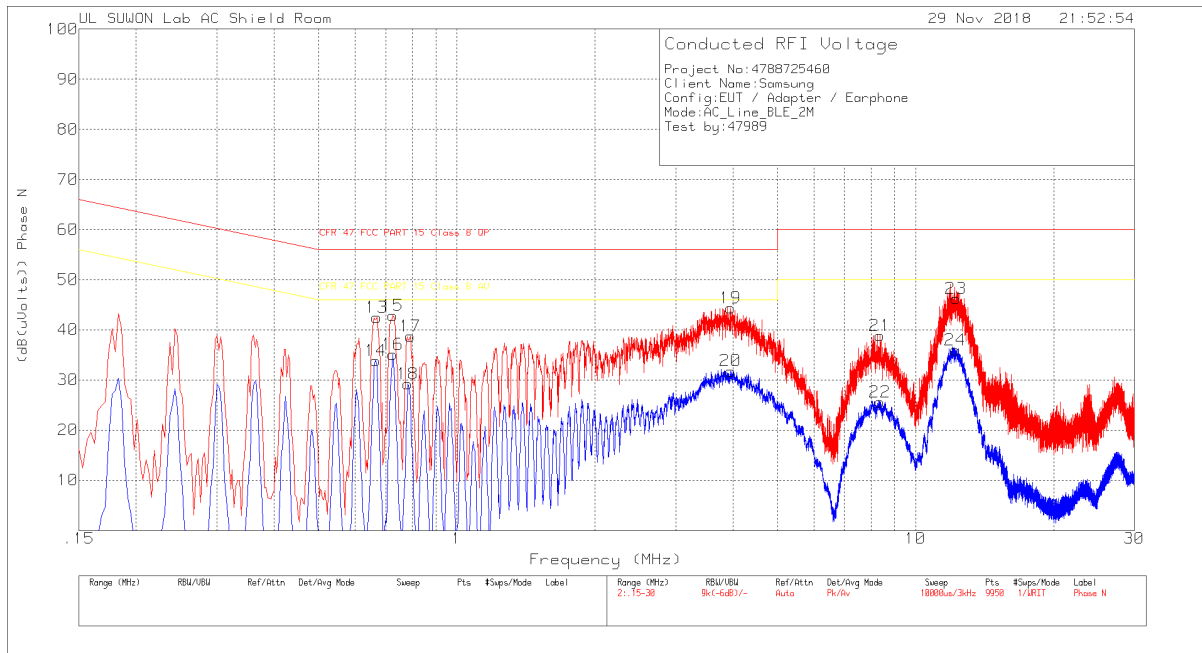
Range 1: Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	ENV216_10183 6_With ex-cord_L1	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	.672	33.77	Pk	9.9	.2	43.87	56	-12.13	-	-
2	.666	29.28	Av	9.9	.2	39.38	-	-	46	-6.62
3	.732	34.27	Pk	9.9	.2	44.37	56	-11.63	-	-
4	.726	28.92	Av	9.9	.2	39.02	-	-	46	-6.98
5	.786	28.92	Pk	9.9	.2	39.02	56	-16.98	-	-
6	.786	23.24	Av	9.9	.2	33.34	-	-	46	-12.66
7	3.96	34.91	Pk	9.8	.3	45.01	56	-10.99	-	-
8	3.939	23.99	Av	9.8	.3	34.09	-	-	46	-11.91
9	8.28	27.58	Pk	9.9	.3	37.78	60	-22.22	-	-
10	8.31	16.99	Av	9.9	.3	27.19	-	-	50	-22.81
11	12.24	37.73	Pk	10.1	.3	48.13	60	-11.87	-	-
12	12.195	25.32	Av	10.1	.3	35.72	-	-	50	-14.28

Pk - Peak detector

Av - Average detection

LINE 2 PLOT



LINE 2 RESULTS

Trace Markers

Range 2: Phase N .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	ENV216_10183 6_With ex-cord_N	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	.669	32.43	Pk	9.9	.2	42.53	56	-13.47	-	-
14	.666	23.8	Av	9.9	.2	33.9	-	-	46	-12.1
15	.726	32.77	Pk	9.9	.2	42.87	56	-13.13	-	-
16	.726	24.99	Av	9.9	.2	35.09	-	-	46	-10.91
17	.792	28.71	Pk	9.8	.2	38.71	56	-17.29	-	-
18	.783	19.19	Av	9.8	.2	29.19	-	-	46	-16.81
19	3.954	34.27	Pk	9.8	.3	44.37	56	-11.63	-	-
20	3.951	21.69	Av	9.8	.3	31.79	-	-	46	-14.21
21	8.364	28.63	Pk	9.9	.3	38.83	60	-21.17	-	-
22	8.361	15.4	Av	9.9	.3	25.6	-	-	50	-24.4
23	12.24	35.88	Pk	10.1	.3	46.28	60	-13.72	-	-
24	12.204	25.6	Av	10.1	.3	36	-	-	50	-14

Pk - Peak detector

Av - Average detection