



FCC CFR47 PART 15 SUBPART C

Bluetooth Low Energy

CERTIFICATION TEST REPORT

FOR

IoT Network Device

MODEL NUMBER : SM-V110A

FCC ID: A3LSMV110A

REPORT NUMBER: 4788403941-E2V2

ISSUE DATE: JUL 05, 2018

Prepared for
SAMSUNG ELECTRONICS CO., LTD.
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,
GYEONGGI-DO, 16677, KOREA

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

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



TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	06/11/18	Initial issue	Junwhan Lee
V2	07/05/18	Updated about the TCB's question	Junwhan Lee

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	5
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATION	6
4. CALIBRATION AND UNCERTAINTY	6
4.1. MEASURING INSTRUMENT CALIBRATION	6
4.2. SAMPLE CALCULATION	6
4.3. MEASUREMENT UNCERTAINTY	7
5. EQUIPMENT UNDER TEST	8
5.1. DESCRIPTION OF EUT	8
5.2. MAXIMUM OUTPUT POWER	8
5.3. DESCRIPTION OF AVAILABLE ANTENNAS	8
5.4. WORST-CASE CONFIGURATION AND MODE	8
5.5. DESCRIPTION OF TEST SETUP	9
6. TEST AND MEASUREMENT EQUIPMENT	11
7. REFERENCE MEASUREMENT RESULTS	12
7.1. ON TIME AND DUTY CYCLE RESULTS	12
7.2. 99% BANDWIDTH	13
8. MEASUREMENT METHODS	15
9. SUMMARY TABLE	16
10. ANTENNA PORT TEST RESULTS	17
10.1. 6 dB BANDWIDTH	17
10.2. OUTPUT POWER	19
10.3. AVERAGE POWER	21
10.4. PSD	22
10.5. OUT-OF-BAND EMISSIONS	24
11. RADIATED TEST RESULTS	28
11.1. LIMITS AND PROCEDURE	28
11.2. TRANSMITTER ABOVE 1 GHz	30

11.3.	WORST-CASE BELOW 1 GHz	40
12.	AC POWER LINE CONDUCTED EMISSIONS	42
13.	SETUP PHOTOS	47

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.

EUT DESCRIPTION: IoT Network Device

MODEL NUMBER: SM-V110A

SERIAL NUMBER: R3BK3000GNR (RADIATED);
R3BK20007DL (CONDUCTED)

DATE TESTED: MAR 22, 2018 - MAR 30, 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 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:



SungGil Park
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:



Junwhan 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 DTS Meas Guidance v04.
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 <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:

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

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 IoT Network Device.
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	9.794	9.54
		Average	9.422	8.75

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antenna, with a maximum gain of -1.91 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 connected with charger for evaluation of worst case mode.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA50JWE	RT3K301BS/A-E	N/A
Data Cable	SAMSUNG	ECB-DU68WE	N/A	N/A

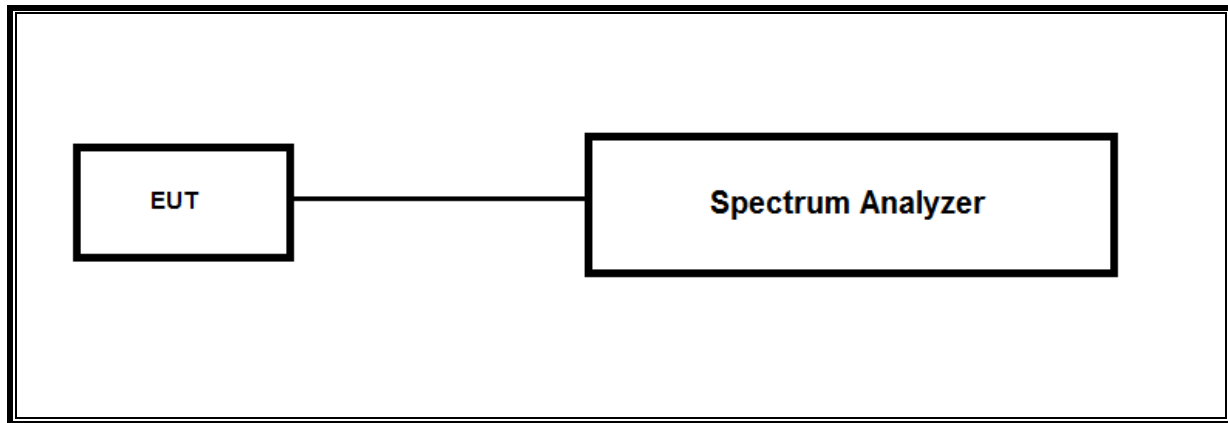
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	Mini-USB	Shielded	1.2m	N/A

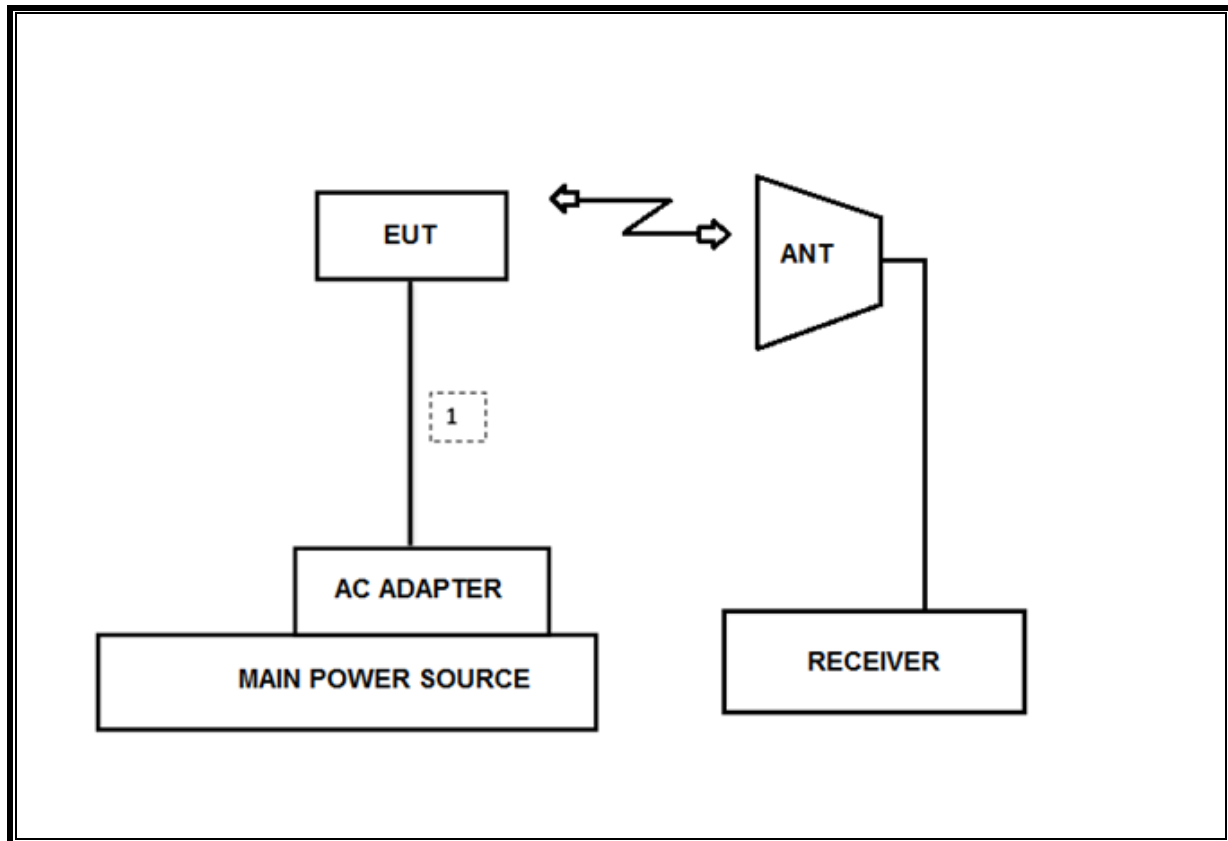
TEST SETUP

The EUT is a stand-alone unit during the tests.
Test control the EUT using serial communication with PC.

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	08-31-19
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	09-14-19
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	08-31-19
Antenna, Horn, 18 GHz	ETS	3115	00167211	10-14-18
Antenna, Horn, 18 GHz	ETS	3115	00161451	03-10-19
Antenna, Horn, 18 GHz	ETS	3117	00168724	05-31-19
Antenna, Horn, 18 GHz	ETS	3117	00168717	05-31-19
Antenna, Horn, 18 GHz	ETS	3117	00205959	11-29-18
Antenna, Horn, 40 GHz	ETS	3116C	00166155	12-04-19
Antenna, Horn, 40 GHz	ETS	3116C	00168645	12-04-19
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	11-13-19
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-09-18
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-07-18
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-10-18
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-08-18
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-08-18
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-11-18
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-08-18
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-08-18
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-08-18
Attenuator	PASTERNAK	PE7087-10	A001	08-08-18
Attenuator	PASTERNAK	PE7087-10	A008	08-08-18
Attenuator	PASTERNAK	PE7087-10	2	08-10-18
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-08-18
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-08-18
EMI Test Receive, 44 GHz	R&S	ESW44	101590	08-09-18
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-07-18
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-08-18
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-08-18
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	020	08-11-18
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-08-18
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-08-18
High Pass Filter 3GHz	Micro-Tronics	HPM17543	020	08-11-18
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	08-08-18
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	08-08-18
High Pass Filter 6GHz	Micro-Tronics	HPS17542	021	08-11-18
LISN	R&S	ENV-216	101837	08-09-18
UL Software				
Description	Manufacturer	Model	Version	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

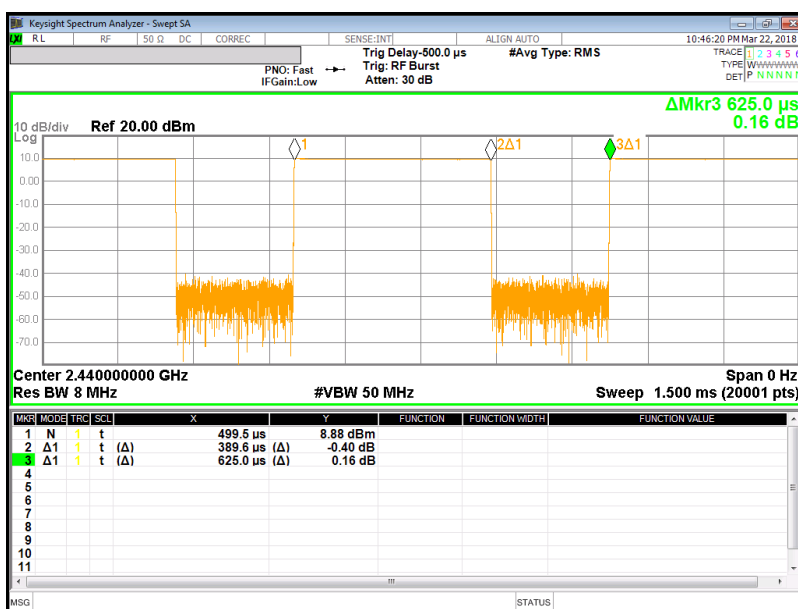
7. REFERENCE MEASUREMENT RESULTS

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	0.390	0.625	0.623	62.3%	2.05	2.567



7.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

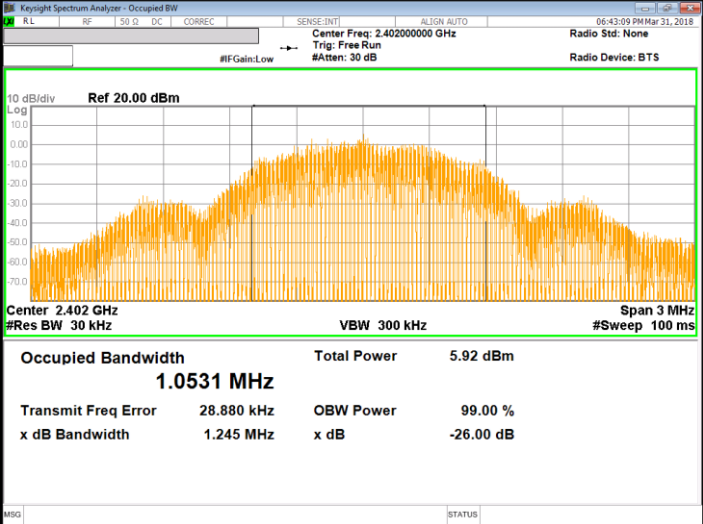
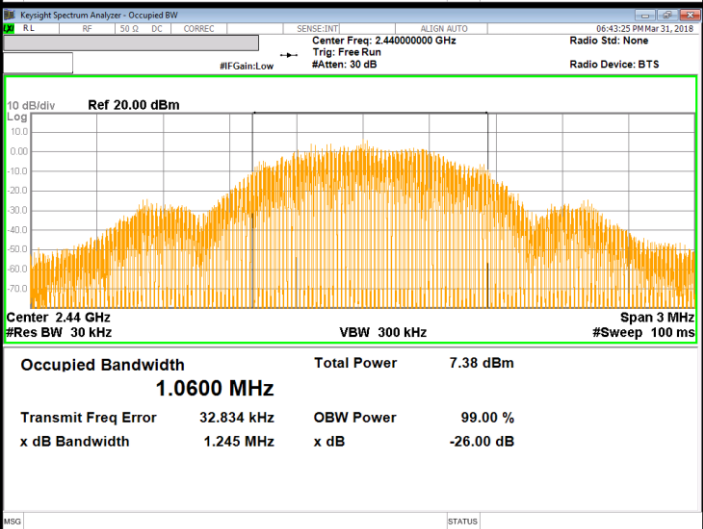
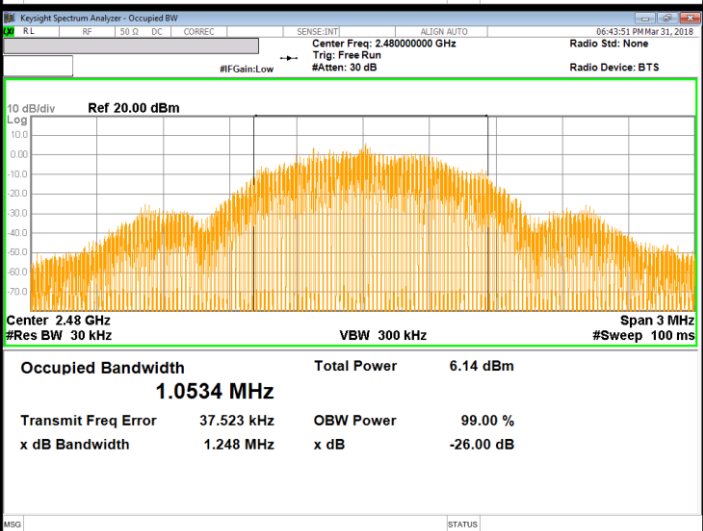
TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth and to 1% of the span. The VBW is set to ≥ 3 times the RBW. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency [MHz]	99% Bandwidth [MHz]
Low	2402	1.053
Mid	2440	1.060
High	2480	1.053
Worst		1.060

99% BANDWIDTH PLOTS

Low CH	 KeySight Spectrum Analyzer - Occupied BW Center Freq: 2.40200000 GHz Trig: Free Run #Atten: 30 dB Radio Std: None Radio Device: BTS 10 dB/div Ref 20.00 dBm Center 2.402 GHz Span 3 MHz #Res BW 30 kHz VBW 300 kHz #Sweep 100 ms Occupied Bandwidth 1.0531 MHz Total Power 5.92 dBm Transmit Freq Error 28.880 kHz OBW Power 99.00 % x dB Bandwidth 1.245 MHz x dB -26.00 dB
Middle CH	 KeySight Spectrum Analyzer - Occupied BW Center Freq: 2.44000000 GHz Trig: Free Run #Atten: 30 dB Radio Std: None Radio Device: BTS 10 dB/div Ref 20.00 dBm Center 2.44 GHz Span 3 MHz #Res BW 30 kHz VBW 300 kHz #Sweep 100 ms Occupied Bandwidth 1.0600 MHz Total Power 7.38 dBm Transmit Freq Error 32.834 kHz OBW Power 99.00 % x dB Bandwidth 1.245 MHz x dB -26.00 dB
High CH	 KeySight Spectrum Analyzer - Occupied BW Center Freq: 2.48000000 GHz Trig: Free Run #Atten: 30 dB Radio Std: None Radio Device: BTS 10 dB/div Ref 20.00 dBm Center 2.48 GHz Span 3 MHz #Res BW 30 kHz VBW 300 kHz #Sweep 100 ms Occupied Bandwidth 1.0534 MHz Total Power 6.14 dBm Transmit Freq Error 37.523 kHz OBW Power 99.00 % x dB Bandwidth 1.248 MHz x dB -26.00 dB

8. MEASUREMENT METHODS

6 dB BW : KDB 558074 D01 v04, Section 8.1.

OUTPUT POWER : KDB 558074 D01 v04, Section 9.1.1 (Peak) / 9.2.3.1 (Average).

POWER SPECTRAL DENSITY : KDB 558074 D01 v04, Section 10.2.

Out-of-band EMISSIONS (Conducted) : KDB 558074 D01 v04, Section 11.1, 11.2.

Out-of-band EMISSIONS IN NON-RESTRICTED BANDS: KDB 558074 D01 v04, Section 11.0.

Out-of-band EMISSIONS IN RESTRICTED BANDS : KDB 558074 D01 v04, Section 12.1.

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.

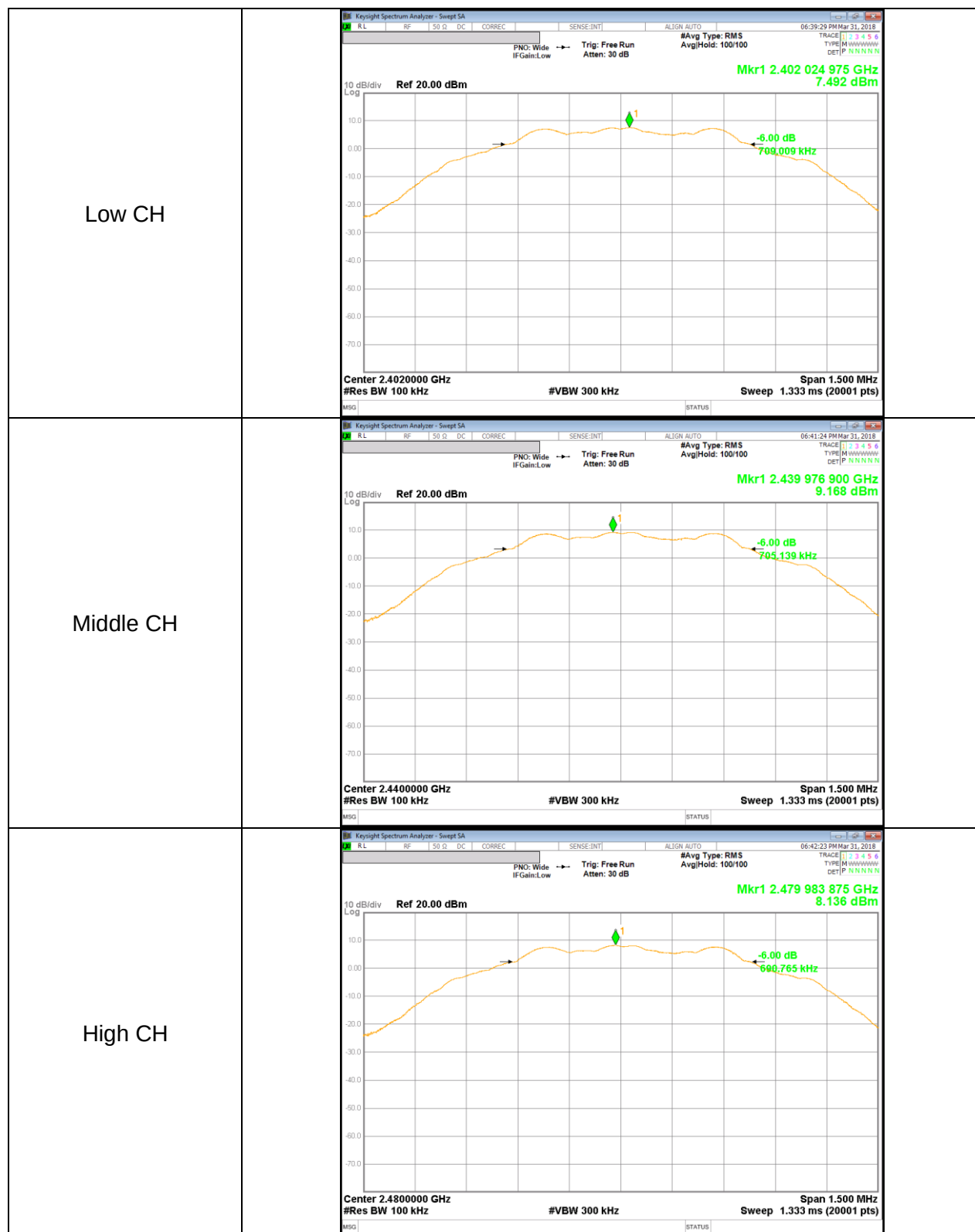
TEST PROCEDURE

Reference to KDB 558074 D01 DTS Meas Guidance v04: The transmitter output is connected to a spectrum analyzer with the RBW set to 100 KHz, the VBW $\geq 3 \times$ RBW, peak detector and max hold.

RESULTS

Channel	Frequency [MHz]	6 dB Bandwidth [kHz]	Minimum Limit [kHz]
Low	2402	709.01	500.0
Mid	2440	705.14	500.0
High	2480	690.77	500.0
Worst		690.77	500.0

6 dB BANDWIDTH PLOTS



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.

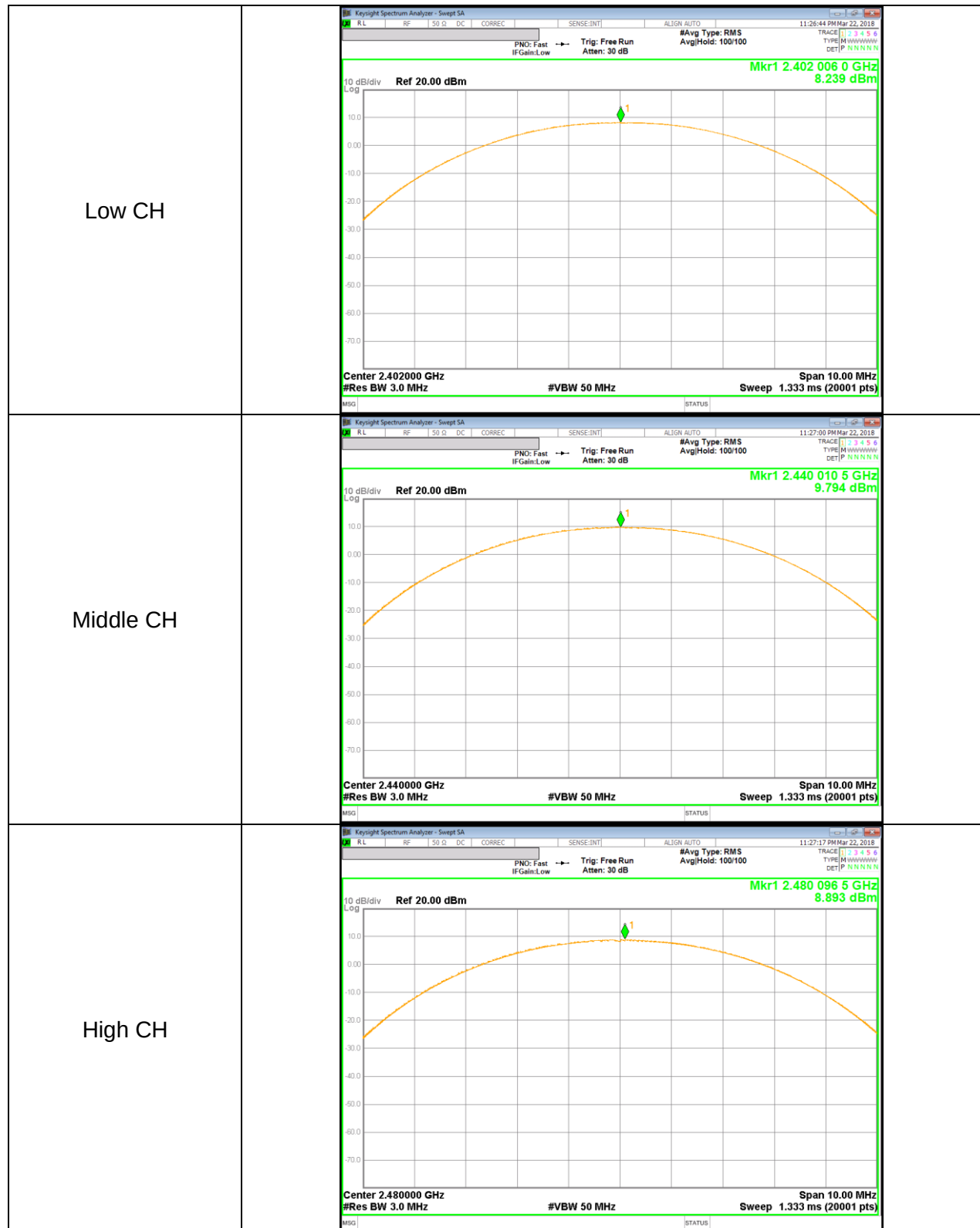
TEST PROCEDURE

Peak power is measured using KDB558074 D01 DTS Meas Guidance v04 under section 9.1.1 utilizing spectrum analyzer.

RESULTS

Channel	Frequency [MHz]	Peak Power Reading [dBm]	Limit [dBm]	Margin [dB]
Low	2402	8.239	30.000	-21.761
Mid	2440	9.794	30.000	-20.206
High	2480	8.893	30.000	-21.107
Worst		9.794		-20.206

OUTPUT POWER PLOTS



10.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Average power is measured using KDB558074 D01 DTS Meas Guidance v04 under 9.2.3.1 utilizing 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.

And duty cycle correction factor is already added to the average output power results.

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	7.937	6.219
Middle	2440	9.422	8.754
High	2480	8.264	6.704

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.

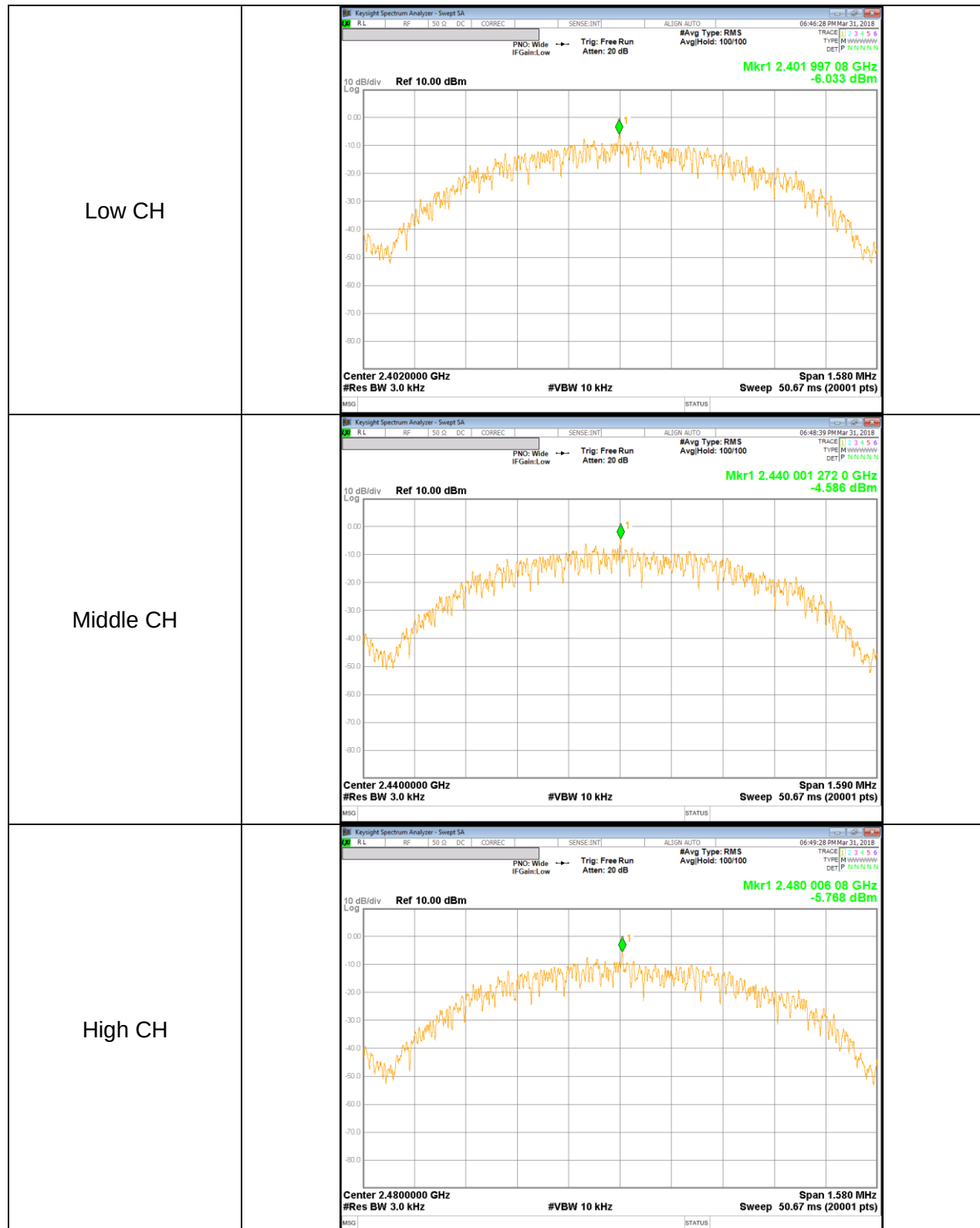
TEST PROCEDURE

Power Spectral Density was performed utilizing the “§10.2 Method PKPSD (Peak PSD)” under KDB558074 D01 DTS Meas Guidance v04

RESULTS

Channel	Frequency [MHz]	PSD [dBm/3kHz]	Limit [dBm/3kHz]	Margin [dB]
Low	2402	-6.03	8.00	-14.03
Mid	2440	-4.59	8.00	-12.59
High	2480	-5.77	8.00	-13.77

POWER SPECTRAL DENSITY PLOTS



10.5. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

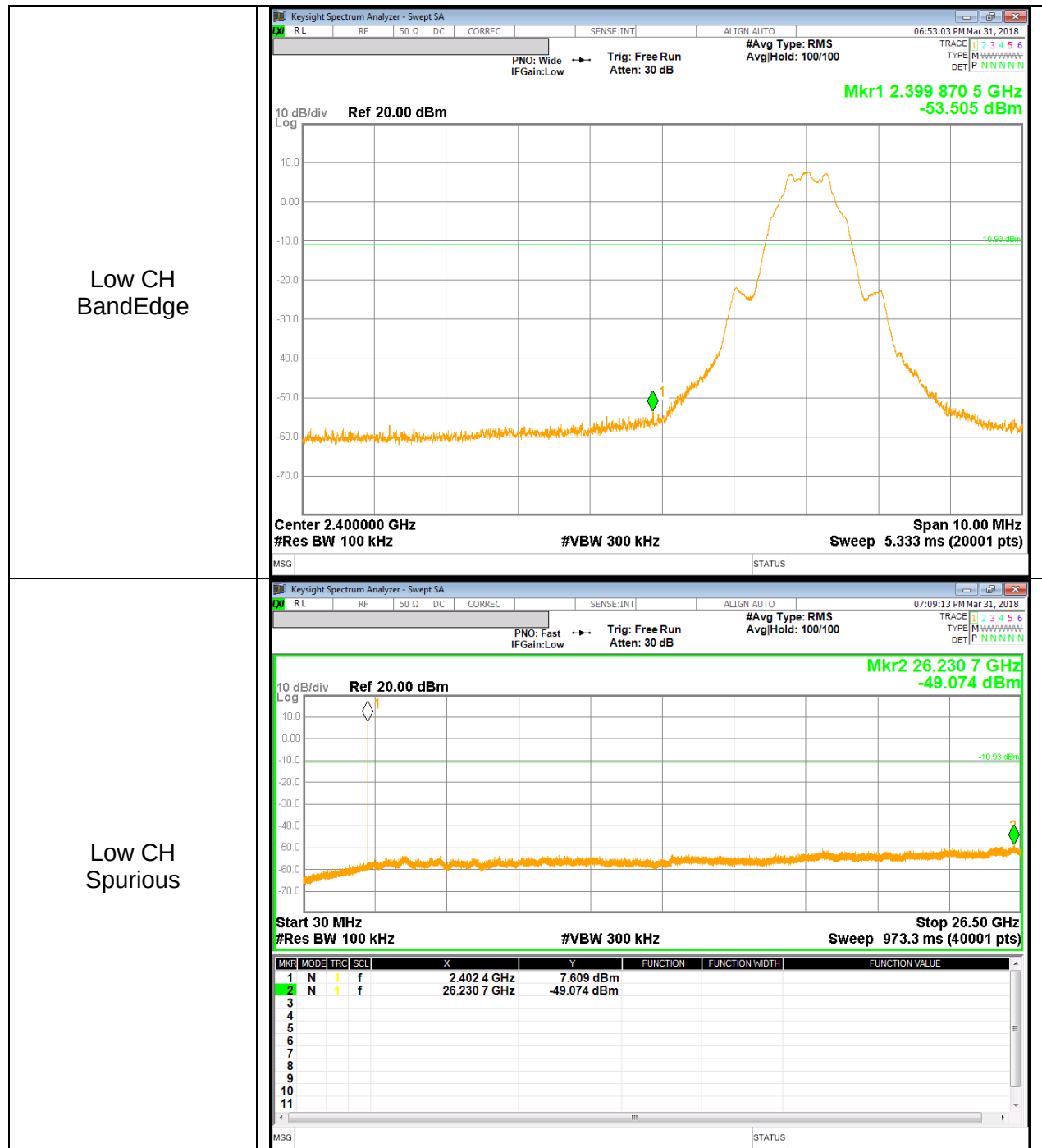
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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

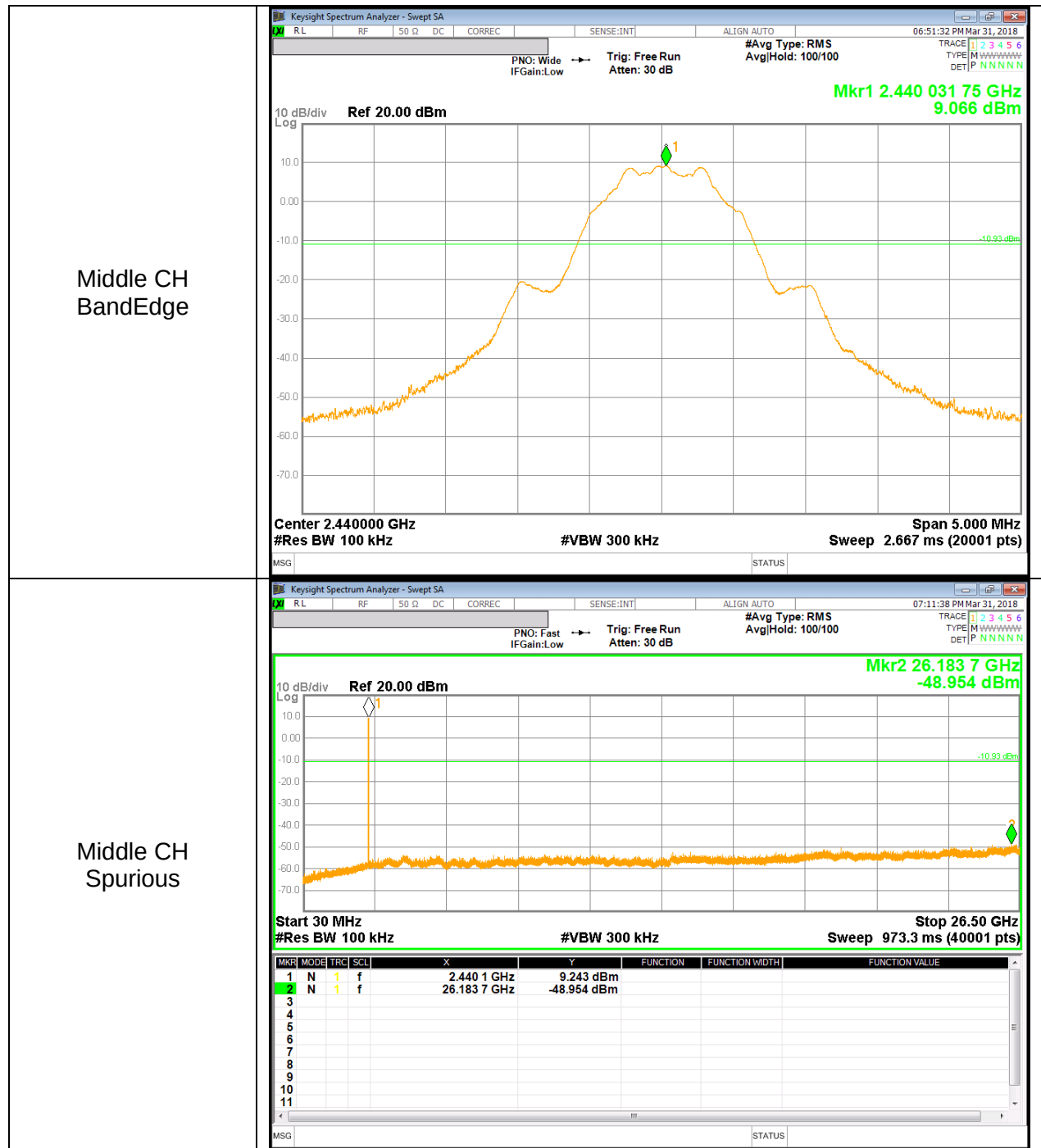
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

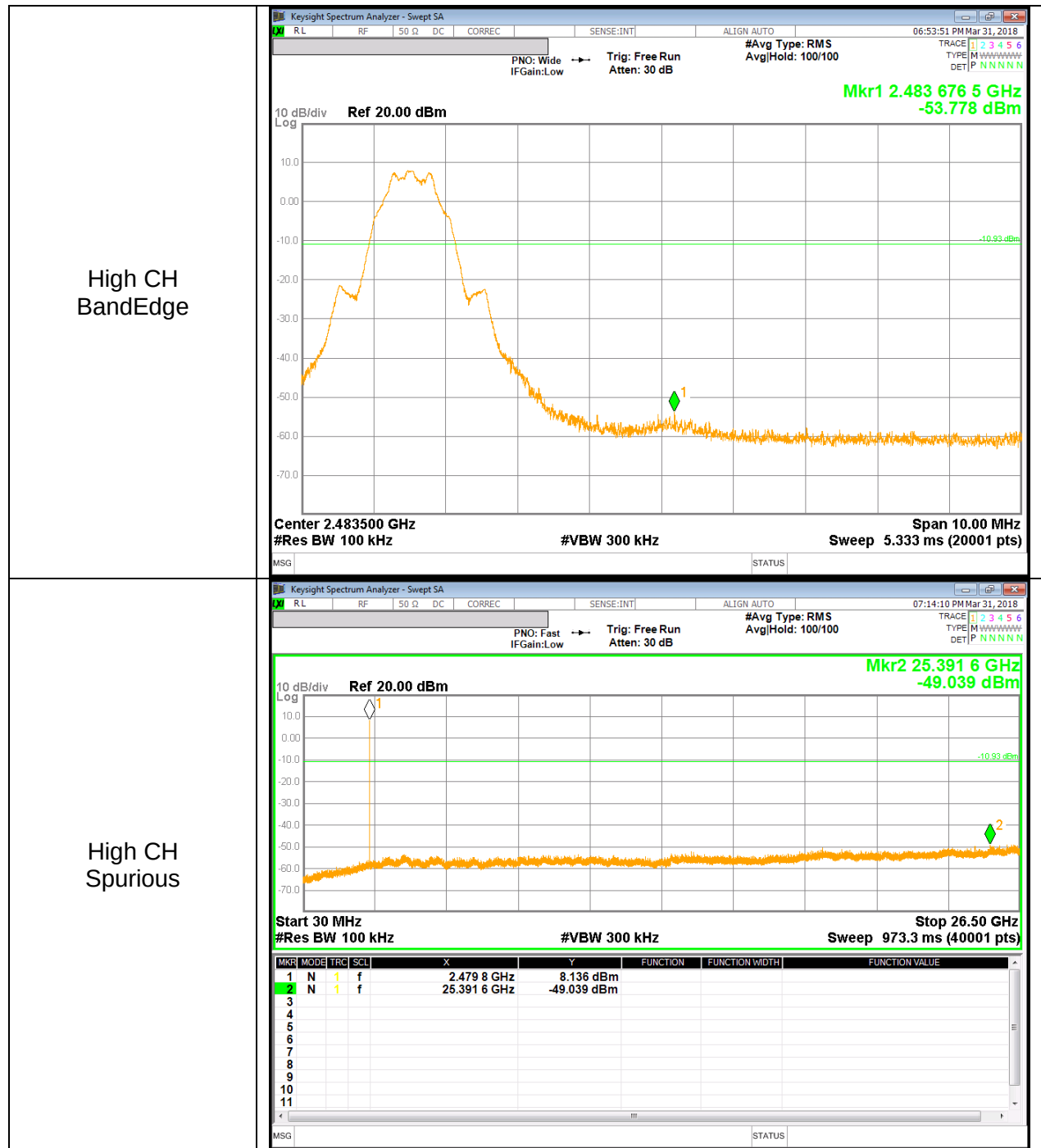
BANDEDGE & SPURIOUS EMISSIONS, LOW CHANNEL



SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL



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: DCF = $10 \log(1/0.623) = 2.06 \text{ dB}$ (Spectrum Analyzer round it up to 2.06dB)

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)

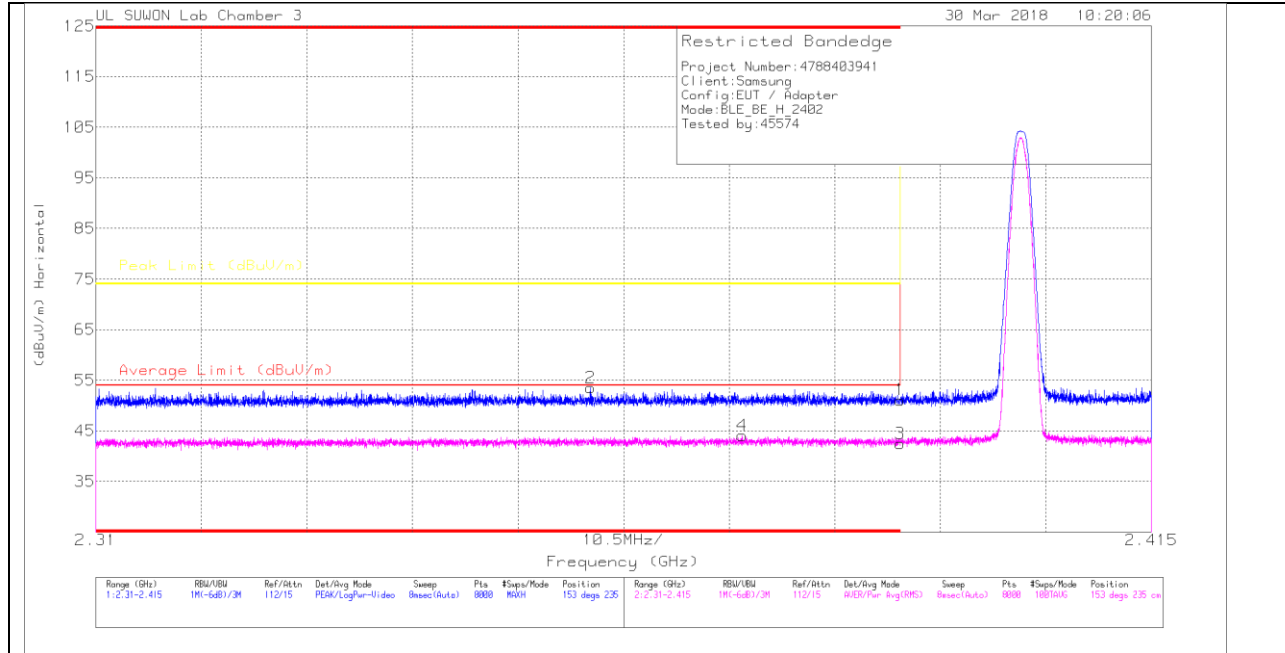
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized 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 area 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 RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

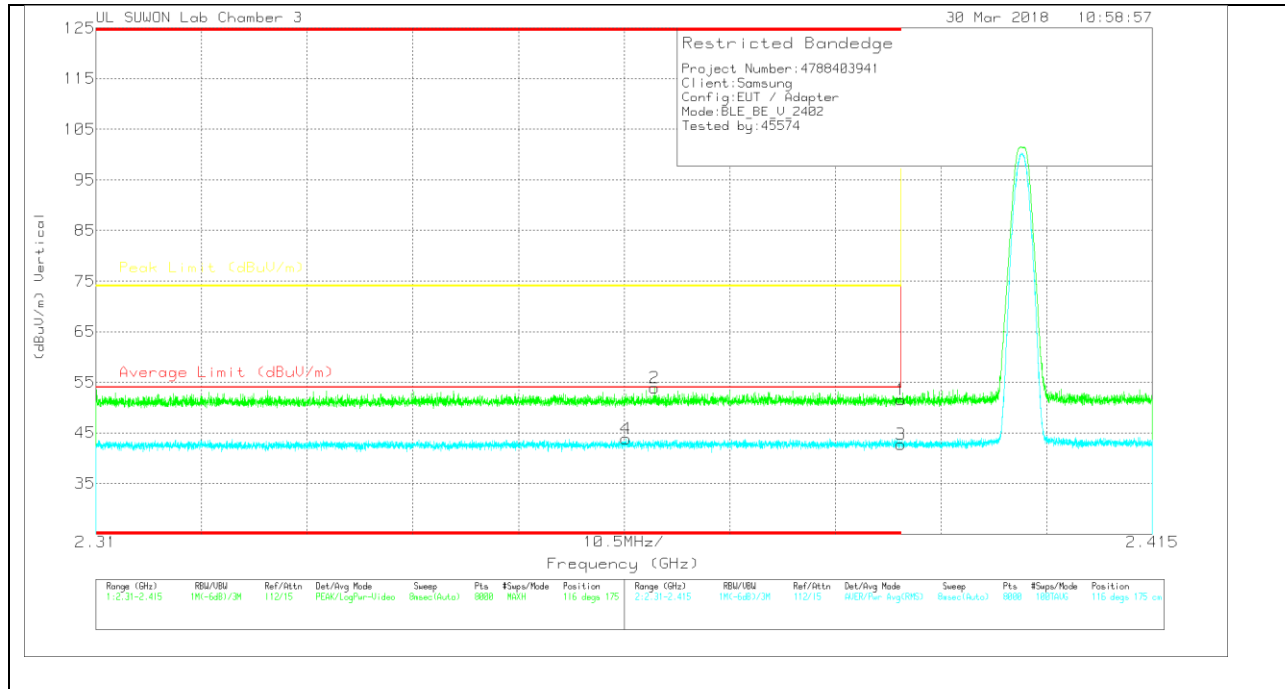
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00205959)	10dB_ATT(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Altitude (Degs)	Height (cm)	Polarity
1	* 2.39	42.6	Pk	31.8	-23.3	0	51.1	-	-	74	-22.9	153	235	H
2	* 2.359	45.02	Pk	31.7	-23.2	0	53.52	-	-	74	-20.48	153	235	H
3	* 2.39	31.97	RMS	31.8	-23.3	2.05	42.52	54	-11.48	-	-	153	235	H
4	* 2.374	33.51	RMS	31.7	-23.2	2.05	44.06	54	-9.94	-	-	153	235	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_ATT(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	42.98	Pk	31.8	-23.3	0	51.48	-	-	74	-22.52	116	175	V
2	* 2.366	45.34	Pk	31.7	-23.2	0	53.84	-	-	74	-20.16	116	175	V
3	* 2.39	32.12	RMS	31.8	-23.3	2.05	42.67	54	-11.33	-	-	116	175	V
4	* 2.363	33.43	RMS	31.7	-23.3	2.05	43.88	54	-10.12	-	-	116	175	V

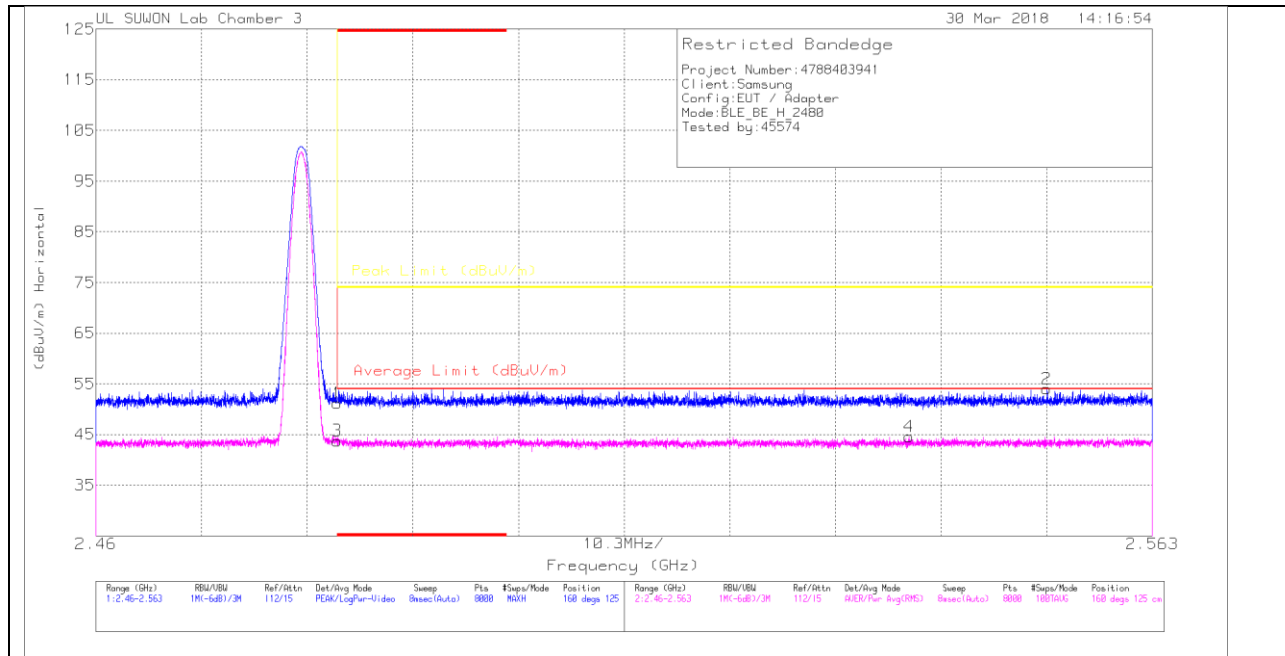
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

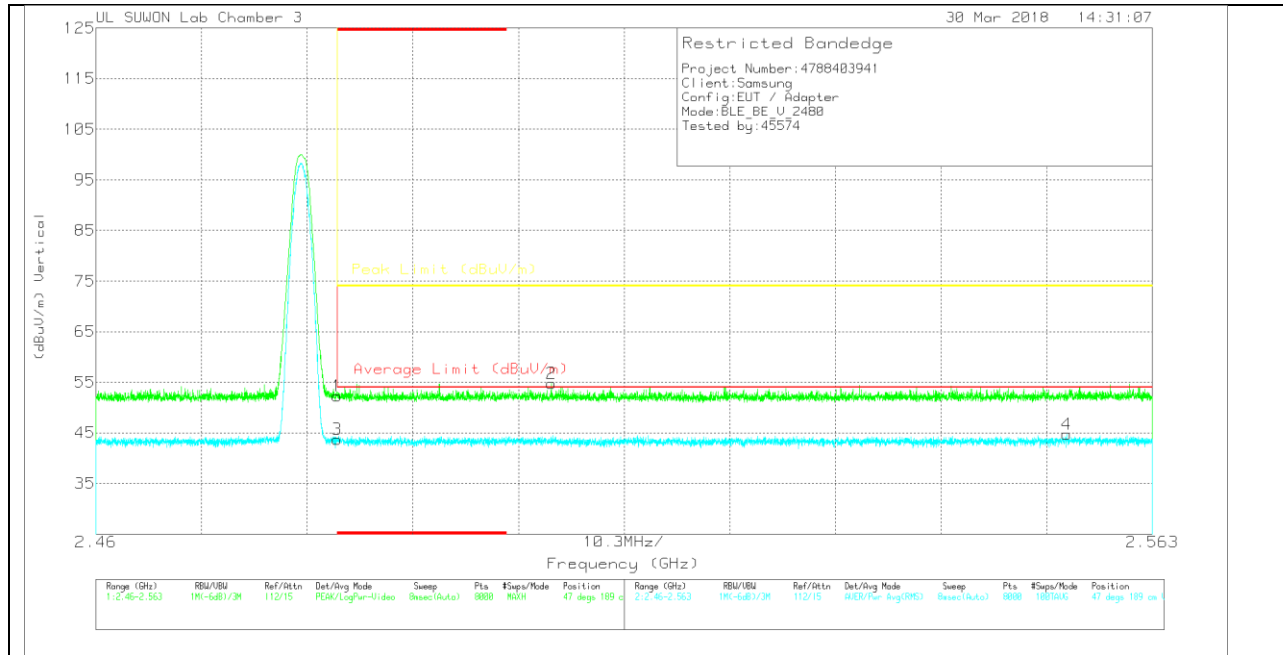
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00205959)	10dB_ATT(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Altitude (Degs)	Height (cm)	Polarity
1	* 2.484	42.09	Pk	32.1	-23	0	51.19	-	-	74	-22.81	160	125	H
2	2.553	44.92	Pk	32.1	-23	0	54.02	-	-	74	-19.98	160	125	H
3	* 2.484	32.62	RMS	32.1	-23	2.05	43.77	54	-10.23	-	-	160	125	H
4	2.539	33.48	RMS	32.1	-23	2.05	44.63	54	-9.37	-	-	160	125	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_ATT[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Altitude (m)	Height (cm)	Polarity
1	* 2.484	43.13	Pk	32.1	-23	0	52.23	-	-	74	-21.77	47	189	V
2	2.504	45.7	Pk	32.1	-23	0	54.8	-	-	74	-19.2	47	189	V
3	* 2.484	32.57	RMS	32.1	-23	2.05	43.72	54	-10.28	-	-	47	189	V
4	2.555	33.54	RMS	32.1	-23	2.05	44.69	54	-9.31	-	-	47	189	V

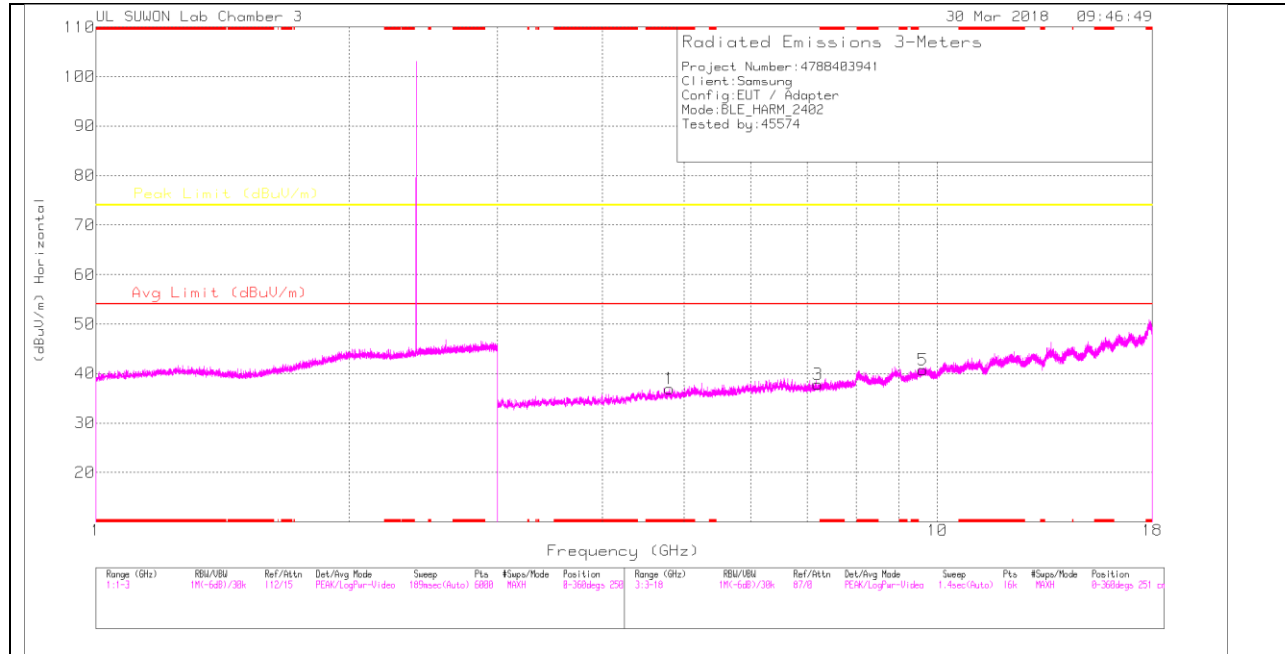
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

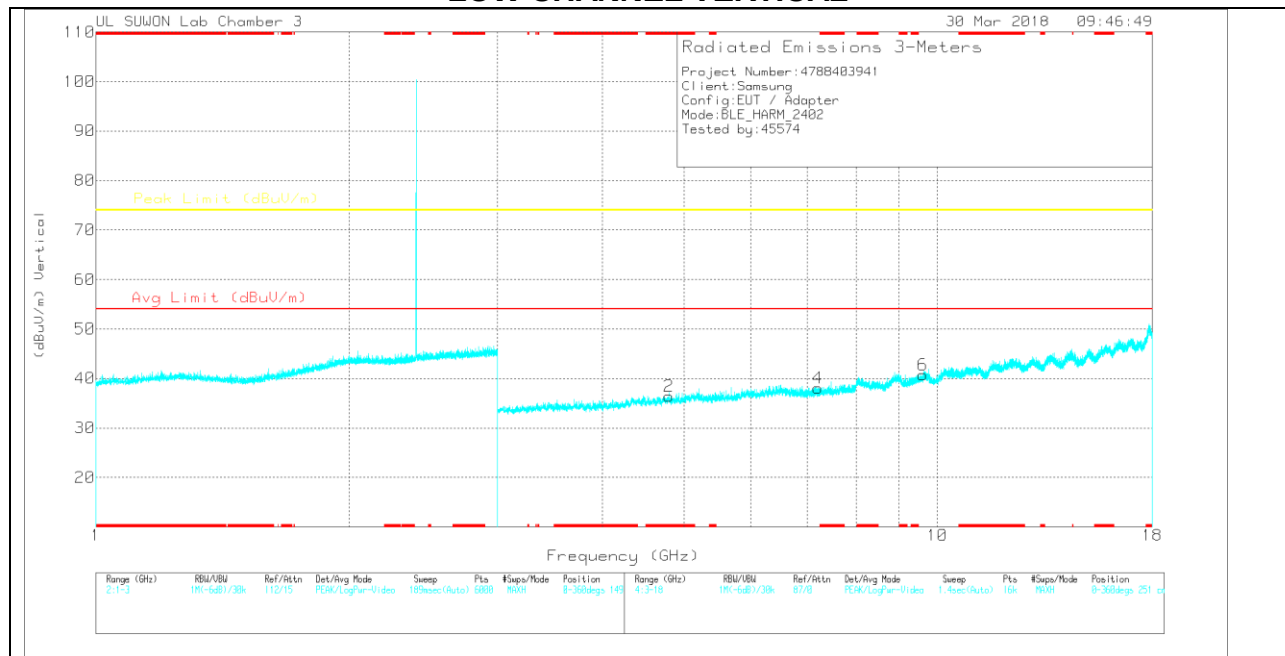
RMS - RMS detection

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

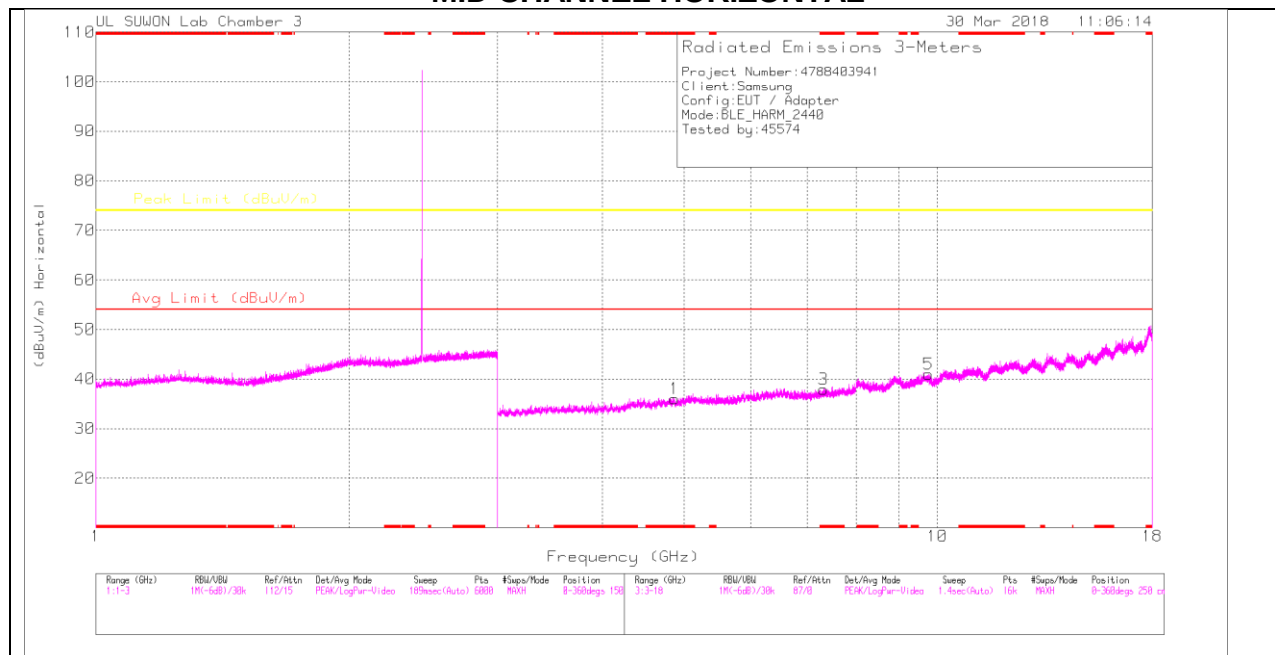
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00205959)	3GHz_HP(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.801	31.07	PK	33.9	-28.1	0	36.87	-	-	74	-37.13	0-360	251	H
3	7.206	26.06	PK	35.6	-23.9	0	37.76	-	-	74	-36.24	0-360	150	H
5	9.611	23.96	PK	36.7	-19.9	0	40.76	-	-	74	-33.24	0-360	150	H
2	* 4.8	30.68	PK	33.9	-28.2	0	36.38	-	-	74	-37.62	0-360	251	V
4	7.209	26.33	PK	35.6	-23.9	0	38.03	-	-	74	-35.97	0-360	251	V
6	9.612	23.9	PK	36.7	-19.9	0	40.7	-	-	74	-33.3	0-360	149	V

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

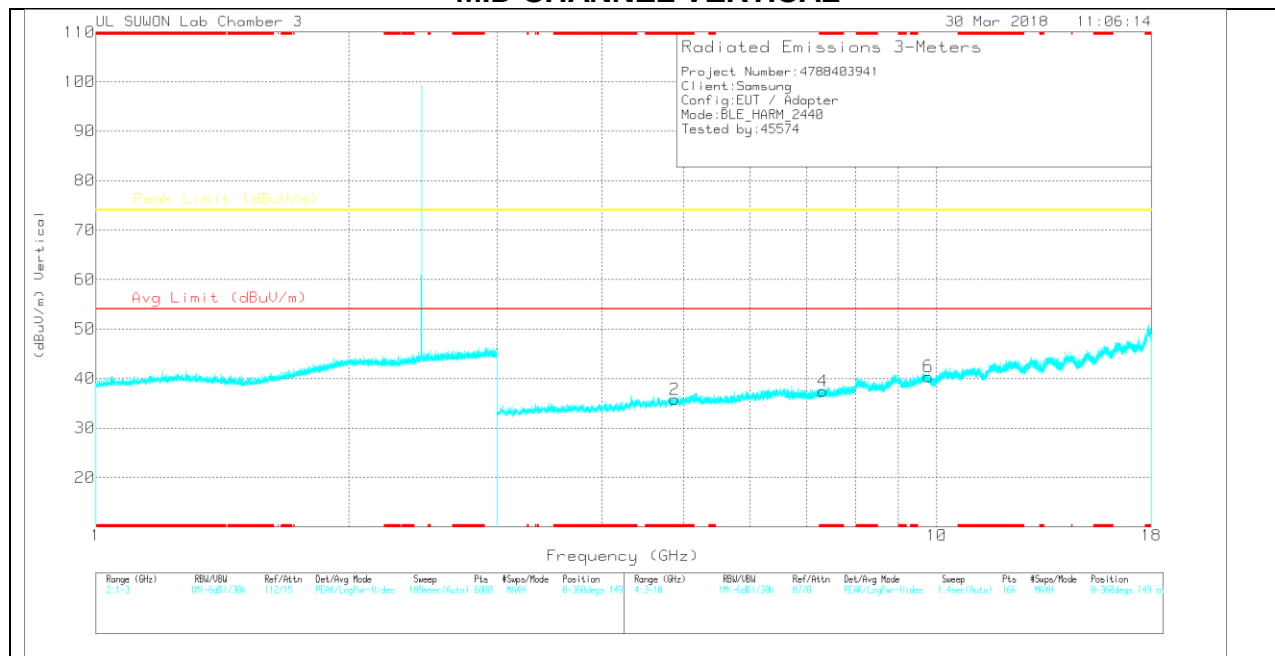
PK – Peak Detector

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

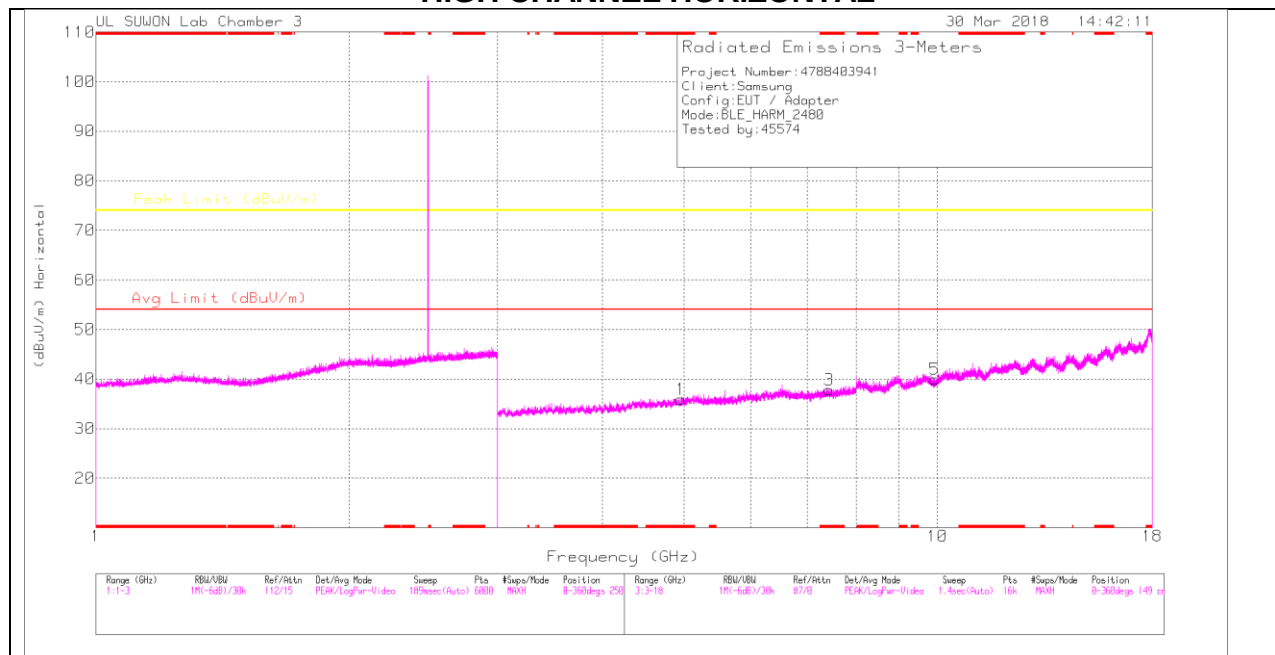
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00205959)	3GHz_HP(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.872	30.86	PK	34	-28.8	0	36.06	-	-	74	-37.94	0-360	250	H
3	* 7.323	25.76	PK	35.6	-23.4	0	37.96	-	-	74	-36.04	0-360	250	H
5	9.764	23.53	PK	36.9	-19.5	0	40.93	-	-	74	-33.07	0-360	149	H
2	* 4.876	30.6	PK	34	-28.8	0	35.8	-	-	74	-38.2	0-360	250	V
4	* 7.325	25.17	PK	35.6	-23.4	0	37.37	-	-	74	-36.63	0-360	250	V
6	9.767	23.11	PK	36.9	-19.6	0	40.41	-	-	74	-33.59	0-360	149	V

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

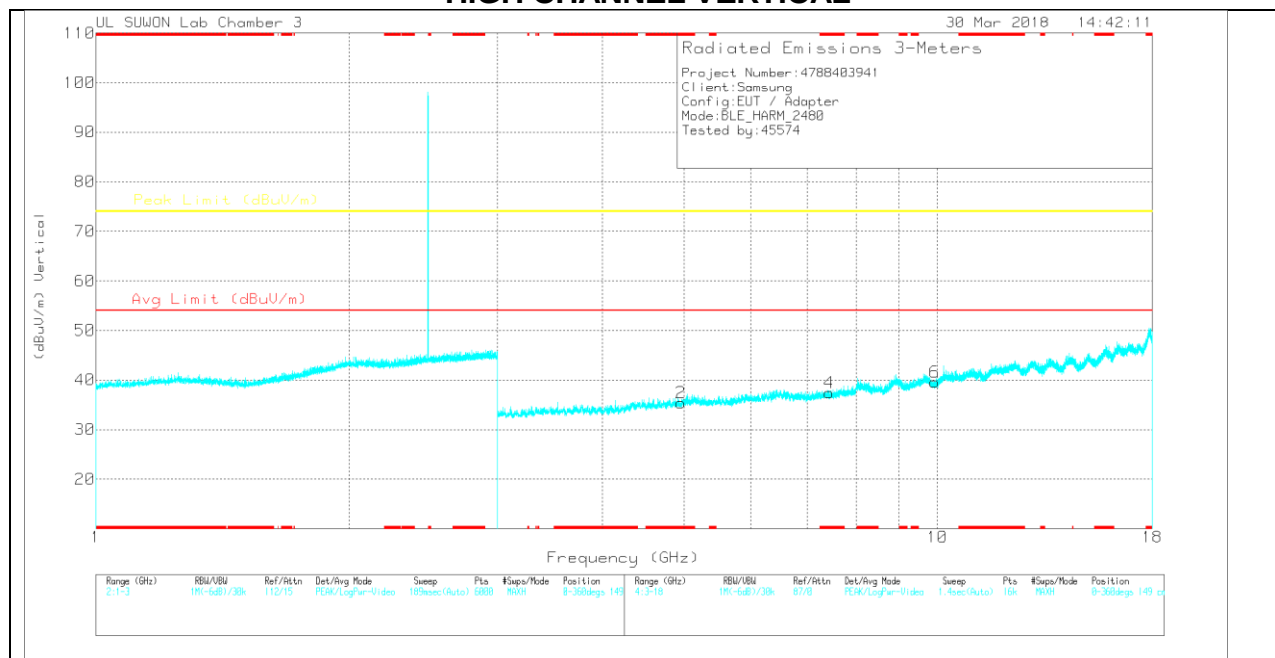
PK – Peak Detector

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	* 4.957	30.31	PK	34.1	-28.5	0	35.91	-	-	74	-38.09	0-360	149	H
3	* 7.439	25.48	PK	35.6	-23.3	0	37.78	-	-	74	-36.22	0-360	250	H
5	9.929	22.68	PK	37	-19.7	0	39.98	-	-	74	-34.02	0-360	149	H
2	* 4.959	29.82	PK	34.1	-28.5	0	35.42	-	-	74	-38.58	0-360	250	V
4	* 7.44	25	PK	35.6	-23.2	0	37.4	-	-	74	-36.6	0-360	149	V
6	9.924	22.18	PK	37	-19.6	0	39.58	-	-	74	-34.42	0-360	149	V

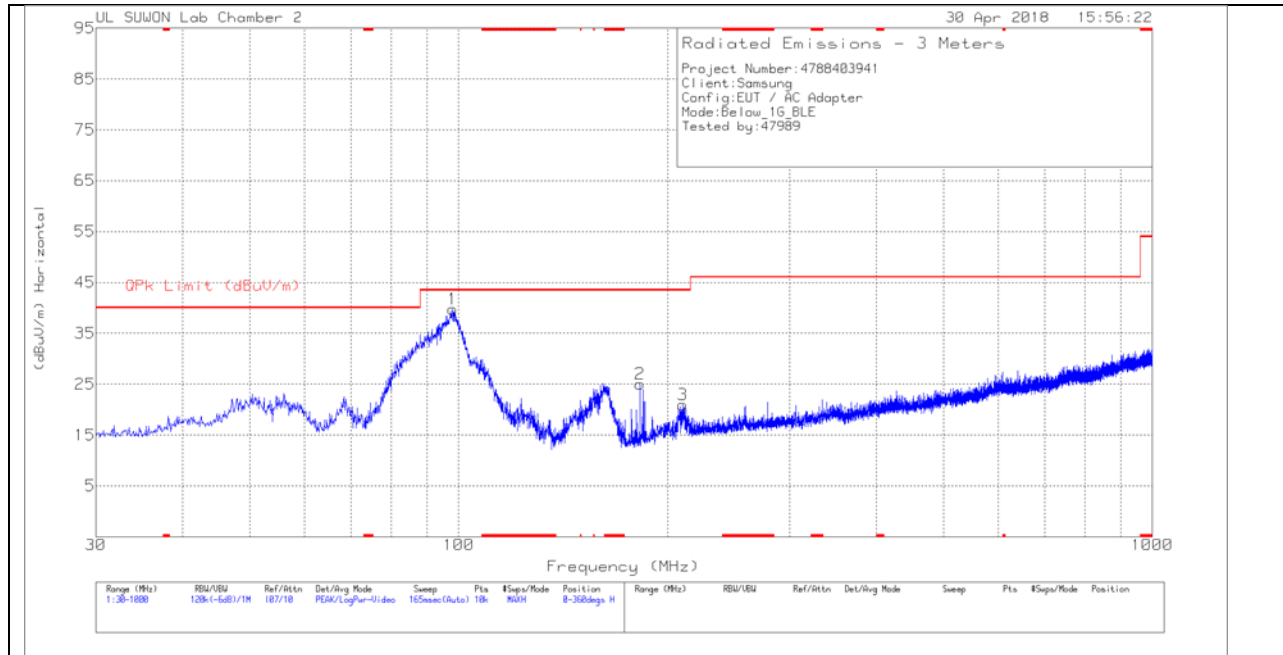
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak Detector

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

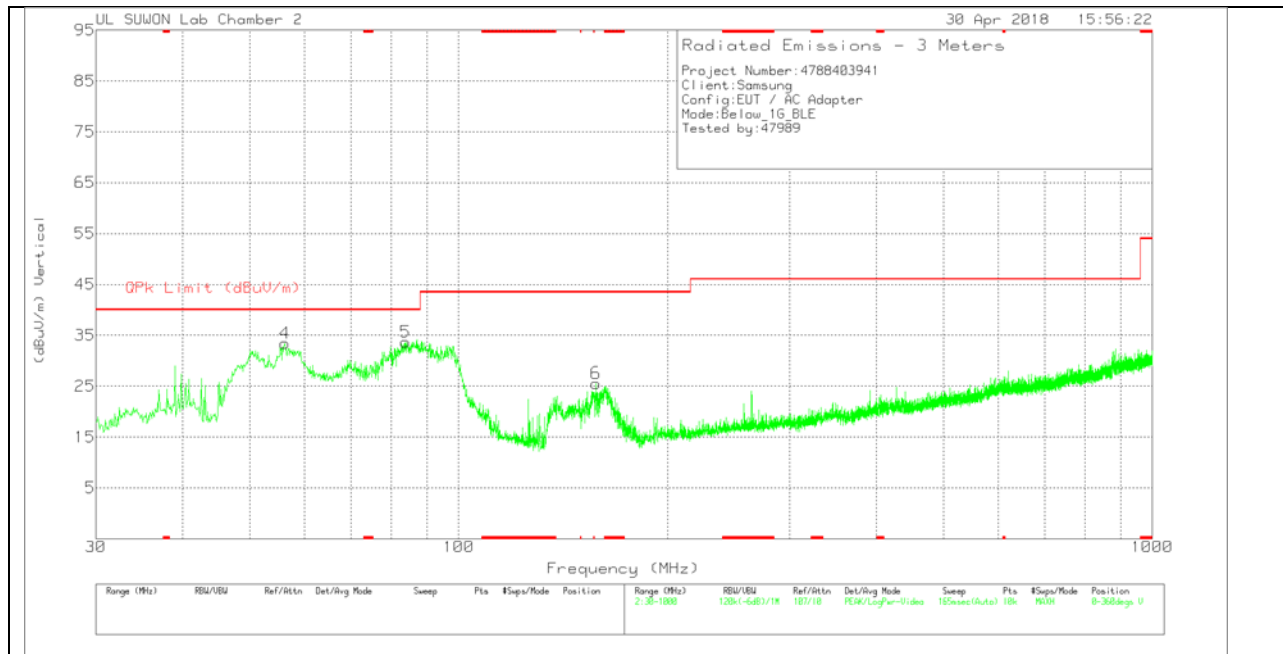
11.3. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



BELOW 1 GHz TABLE

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163-749	30-1000MHz[dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	98.094	53.62	Pk	17.2	-31.1	39.72	43.52	-3.8	0-360	300	H
2	182.581	40.05	Pk	15.6	-30.6	25.05	43.52	-18.47	0-360	300	H
3	210.42	34.67	Pk	16.7	-30.4	20.97	43.52	-22.55	0-360	200	H
4	56.19	45.76	Pk	19.1	-31.4	33.46	40	-6.54	0-360	100	V
5	83.932	50.99	Pk	13.9	-31.2	33.69	40	-6.31	0-360	100	V
6	157.846	42.18	Pk	14.1	-30.7	25.58	43.52	-17.94	0-360	100	V

Pk - Peak detector

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163-749	30-1000MHz[dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
98.8934	48.87	Qp	17.3	-31.1	35.07	43.52	-8.45	310	308	H

Qp - Quasi-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.

LINE 1 RESULTS

Trace Markers

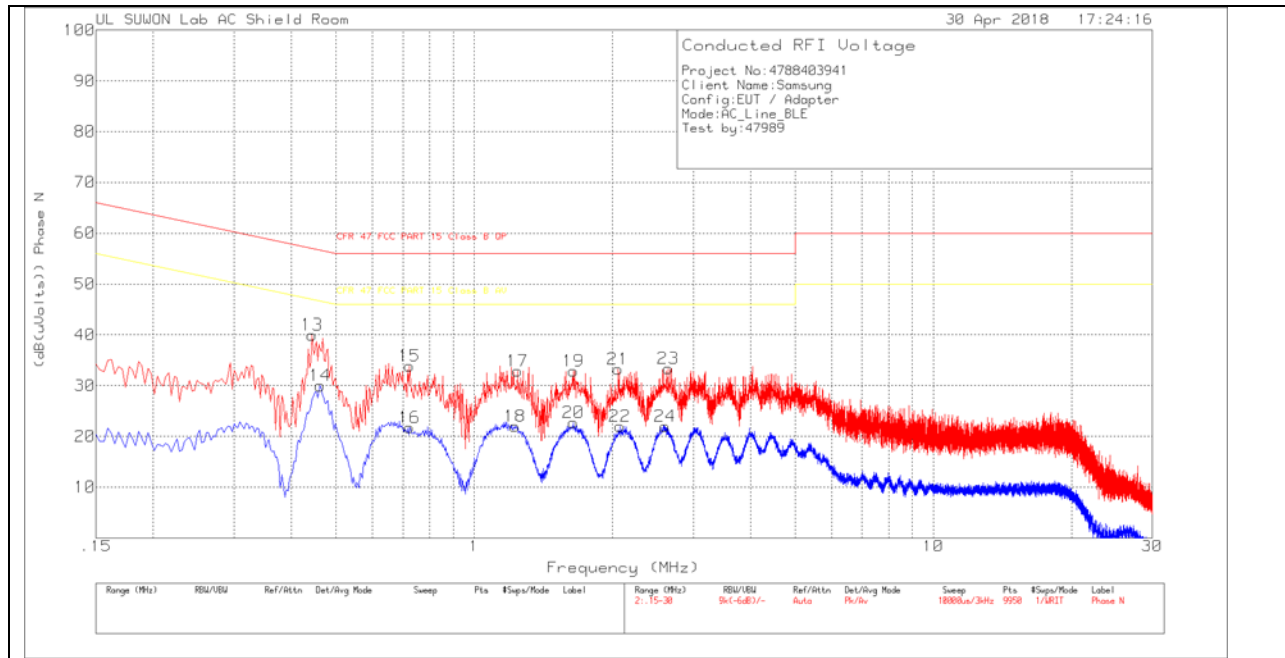
Range 1: Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_L1_wit h extension	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	.45	30.06	Pk	9.7	.2	39.96	56.88	-16.92	-	-
2	.459	21.21	Av	9.7	.2	31.11	-	-	46.71	-15.6
3	.714	23.91	Pk	9.7	.2	33.81	56	-22.19	-	-
4	.693	13.53	Av	9.7	.2	23.43	-	-	46	-22.57
5	1.239	24.29	Pk	9.9	.3	34.49	56	-21.51	-	-
6	1.224	13.52	Av	9.9	.3	23.72	-	-	46	-22.28
7	1.683	23.29	Pk	9.9	.3	33.49	56	-22.51	-	-
8	1.65	13.66	Av	9.9	.3	23.86	-	-	46	-22.14
9	2.19	23	Pk	9.9	.3	33.2	56	-22.8	-	-
10	2.142	12.7	Av	9.9	.3	22.9	-	-	46	-23.1
11	2.655	22.6	Pk	9.8	.3	32.7	56	-23.3	-	-
12	2.655	12.29	Av	9.8	.3	22.39	-	-	46	-23.61

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	101837_N_with extension	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	.444	29.98	Pk	9.8	.2	39.98	56.99	-17.01	-	-
14	.462	19.97	Av	9.8	.2	29.97	-	-	46.66	-16.69
15	.723	23.84	Pk	9.8	.2	33.84	56	-22.16	-	-
16	.723	11.79	Av	9.8	.2	21.79	-	-	46	-24.21
17	1.242	22.62	Pk	9.9	.3	32.82	56	-23.18	-	-
18	1.227	11.83	Av	9.9	.3	22.03	-	-	46	-23.97
19	1.644	22.68	Pk	9.9	.3	32.88	56	-23.12	-	-
20	1.644	12.51	Av	9.9	.3	22.71	-	-	46	-23.29
21	2.058	22.99	Pk	9.9	.3	33.19	56	-22.81	-	-
22	2.079	11.78	Av	9.9	.3	21.98	-	-	46	-24.02
23	2.646	23.15	Pk	9.9	.3	33.35	56	-22.65	-	-
24	2.61	11.75	Av	9.9	.3	21.95	-	-	46	-24.05

Pk - Peak detector

Av - Average detection