



# **CERTIFICATION TEST REPORT**

**Report Number. :** 4789238252-E1V2

**Applicant :** SAMSUNG ELECTRONICS CO., LTD.  
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,  
GYEONGGI-DO, 16677, KOREA

**Model :** EJ-PN770

**FCC ID :** A3LEJPN770

**EUT Description :** BLE

**Test Standard(s) :** FCC 47 CFR PART 15 SUBPART C

**Date Of Issue:**

November 25, 2019

**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



ACCREDITED

**Testing Laboratory**

**TL-637**

---

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	11/20/19	Initial issue	Seokhwan Hong
V2	11/25/19	Updated to address TCB's question	Seokhwan Hong

## TABLE OF CONTENTS

<b>1. ATTESTATION OF TEST RESULTS .....</b>	<b>5</b>
<b>2. TEST METHODOLOGY .....</b>	<b>6</b>
<b>3. FACILITIES AND ACCREDITATION .....</b>	<b>6</b>
<b>4. CALIBRATION AND UNCERTAINTY .....</b>	<b>6</b>
4.1. MEASURING INSTRUMENT CALIBRATION.....	6
4.2. SAMPLE CALCULATION.....	6
4.3. MEASUREMENT UNCERTAINTY .....	7
4.4. DECISION RULE .....	7
<b>5. EQUIPMENT UNDER TEST .....</b>	<b>8</b>
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 .....	9
5.5. DESCRIPTION OF TEST SETUP .....	9
<b>6. TEST AND MEASUREMENT EQUIPMENT .....</b>	<b>11</b>
<b>7. REFERENCE MEASUREMENT RESULTS.....</b>	<b>12</b>
7.1. ON TIME AND DUTY CYCLE RESULTS.....	12
7.2. 99% BANDWIDTH .....	13
<b>8. MEASUREMENT METHODS .....</b>	<b>15</b>
<b>9. SUMMARY TABLE .....</b>	<b>16</b>
<b>10. ANTENNA PORT TEST RESULTS .....</b>	<b>17</b>
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
<b>11. RADIATED TEST RESULTS .....</b>	<b>28</b>
11.1. LIMITS AND PROCEDURE .....	28
11.2. TRANSMITTER ABOVE 1 GHz .....	30
11.3. WORST-CASE BELOW 1 GHz.....	40

---

**12. SETUP PHOTOS .....42**

# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SAMSUNG ELECTRONICS CO., LTD.  
**EUT DESCRIPTION:** BLE  
**MODEL NUMBER:** EJ-PN770  
**SERIAL NUMBER:** 9451 (CONDUCTED), 9453 (RADIATED);  
**DATE TESTED:** NOV 04, 2019 – NOV 08, 2019;

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:

Tested By:



Junwhan Lee  
Suwon Lab Engineer  
UL Korea, Ltd.

Seokhwan Hong  
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 v05r02.
4. ANSI C63.10-2013.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

218 Maeyeong-ro	
<input checked="" type="checkbox"/>	Chamber 1
<input 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/wp-content/uploads/2017/05/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:

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

### 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	2.35 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%.

### 4.4. DECISION RULE

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

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a BLE. This test report addresses the DTS (BLE) operational mode.  
The EUT is support only 1Mbps.

### 5.2. MAXIMUM OUTPUT POWER

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

Frequency Range [MHz]	Power Mode	Output Power [dBm]	Output Power [mW]
2402 - 2480	Peak	0.223	1.05
	Average	0.070	1.02

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antenna, with a maximum gain of -3.5 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.

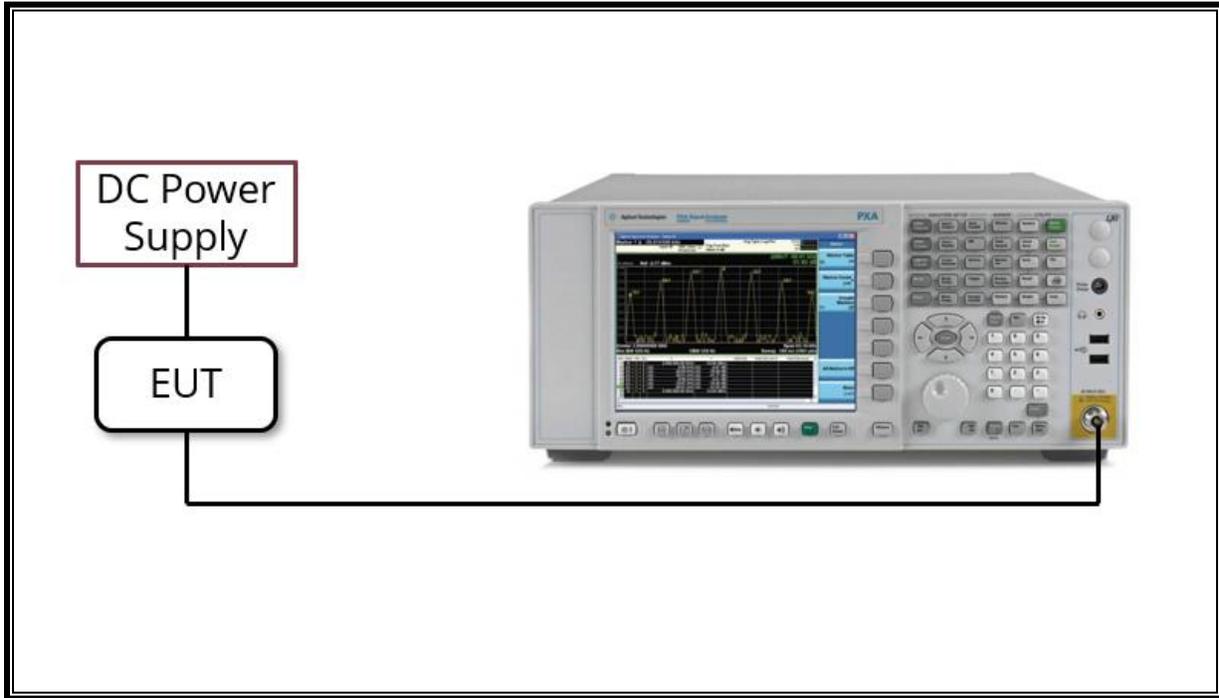
The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

## 5.5. DESCRIPTION OF TEST SETUP

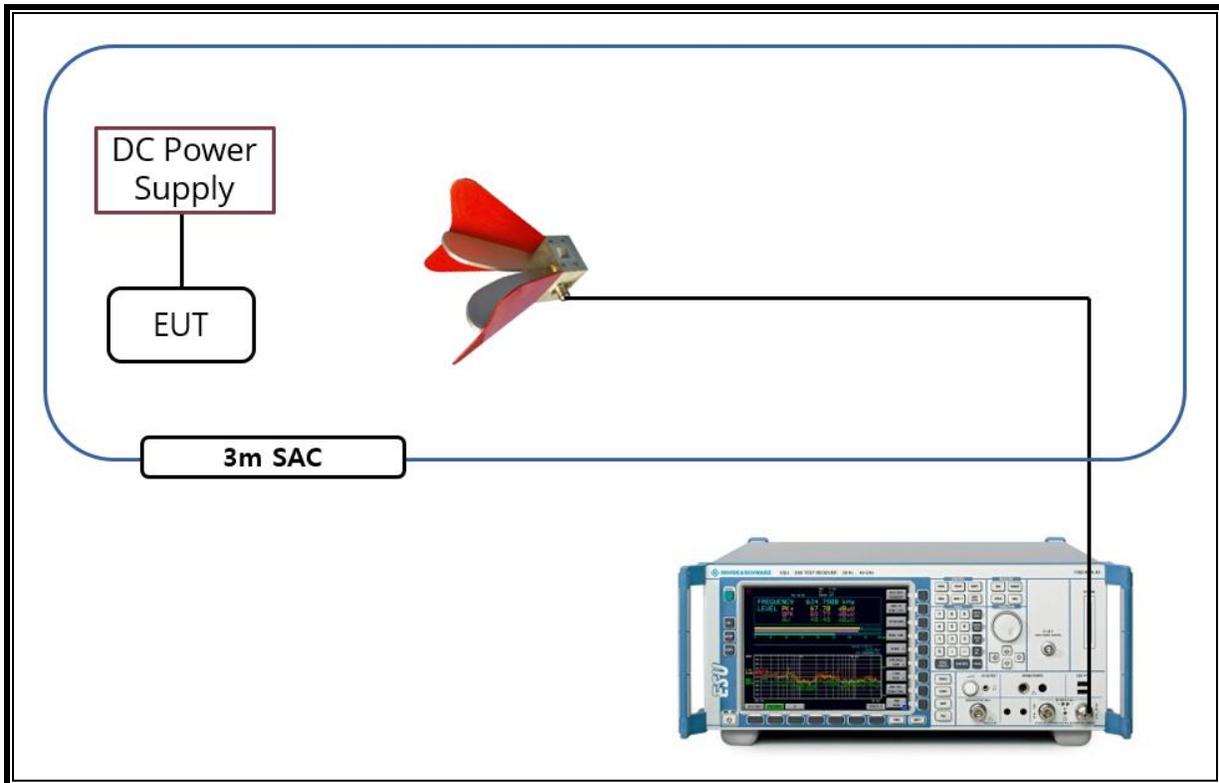
### TEST SETUP

The EUT is a stand-alone unit during the tests.  
The EUT was tested while powered by a DC power source.

**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	08-14-20
Antenna, Horn, 40 GHz	ETS	3116C	00168645	10-02-21
DC Power Supply	Agilent / HP	E3640A	MY54226395	08-06-20
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	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
Bluetooth Tester	TESCOM	TC-3000C	3000C000546	08-07-20
Attenuator	PASTERNAK	PE7087-10	A001	08-08-20
Attenuator	PASTERNAK	PE7087-10	A008	08-08-20
Attenuator	PASTERNAK	PE7004-10	2	08-06-20
Attenuator	PASTERNAK	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	

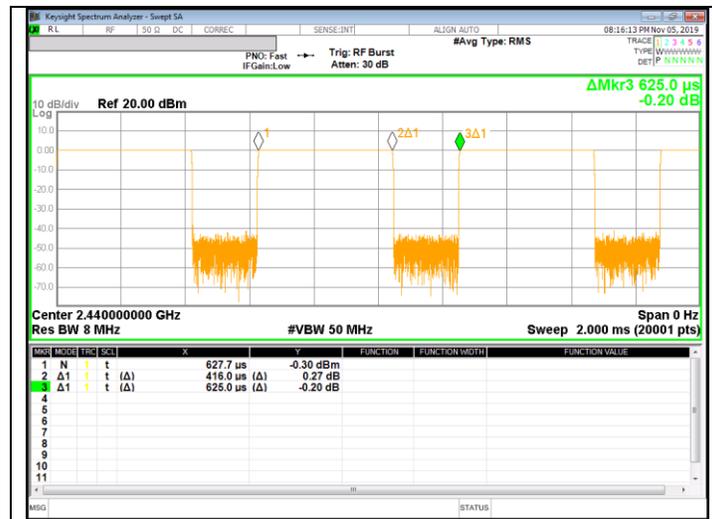
## 7. REFERENCE MEASUREMENT RESULTS

### 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]
<b>2400MHz Bands</b>						
BLE	0.416	0.625	0.665	66.5%	1.77	2.404



## 7.2. 99% BANDWIDTH

### LIMITS

None; for reporting purposes only.

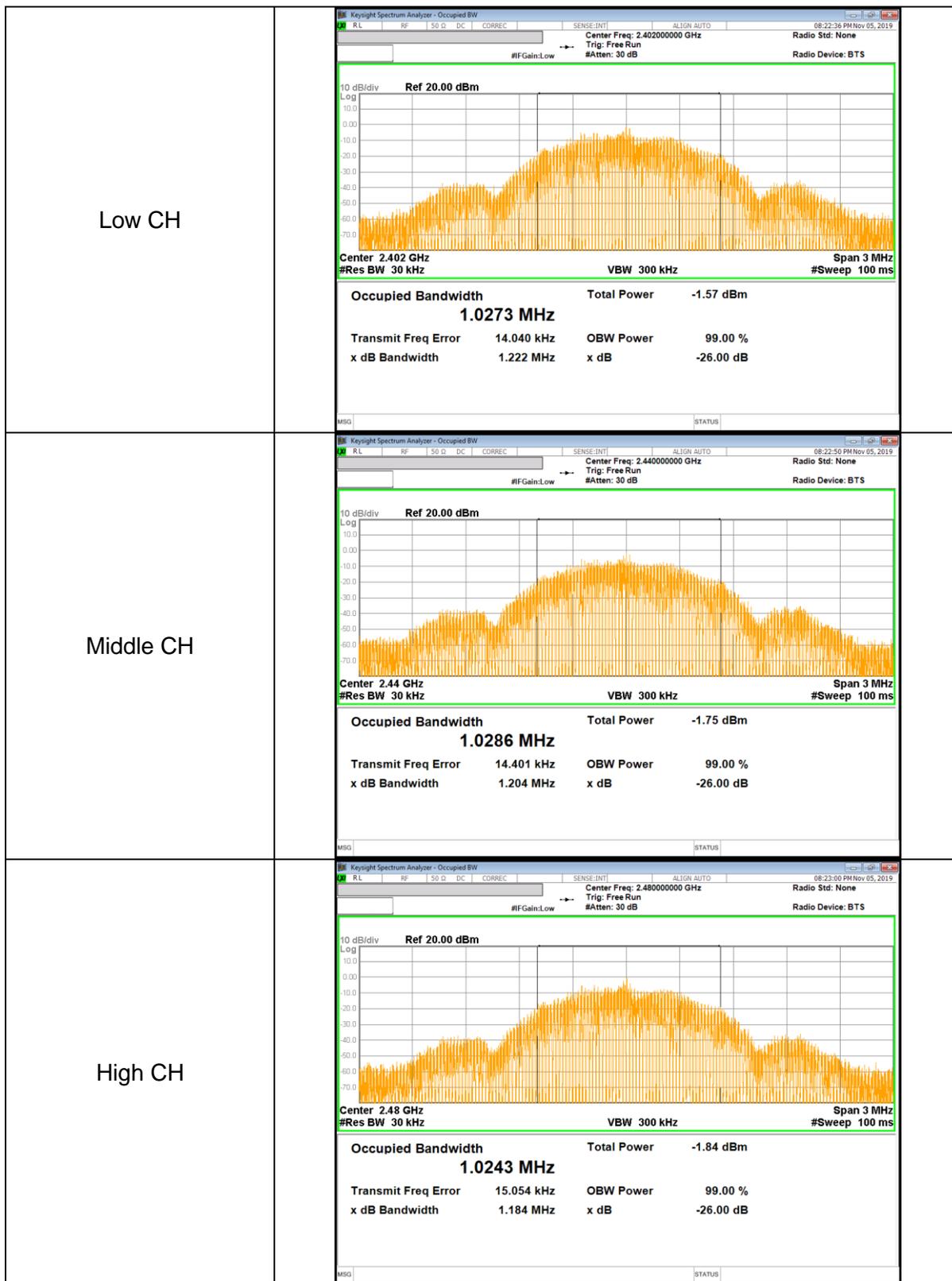
### TEST PROCEDURE

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  $\geq 3$  times the RBW. The spectrum analyzer internal 99% bandwidth function is utilized.

### RESULTS

Channel	Frequency [MHz]	99% Bandwidth [MHz]
Low	2402	1.027
Mid	2440	1.029
High	2480	1.024
Worst		1.029

**99% BANDWIDTH PLOTS**



## 8. MEASUREMENT METHODS

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.

## 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
15.205, 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.

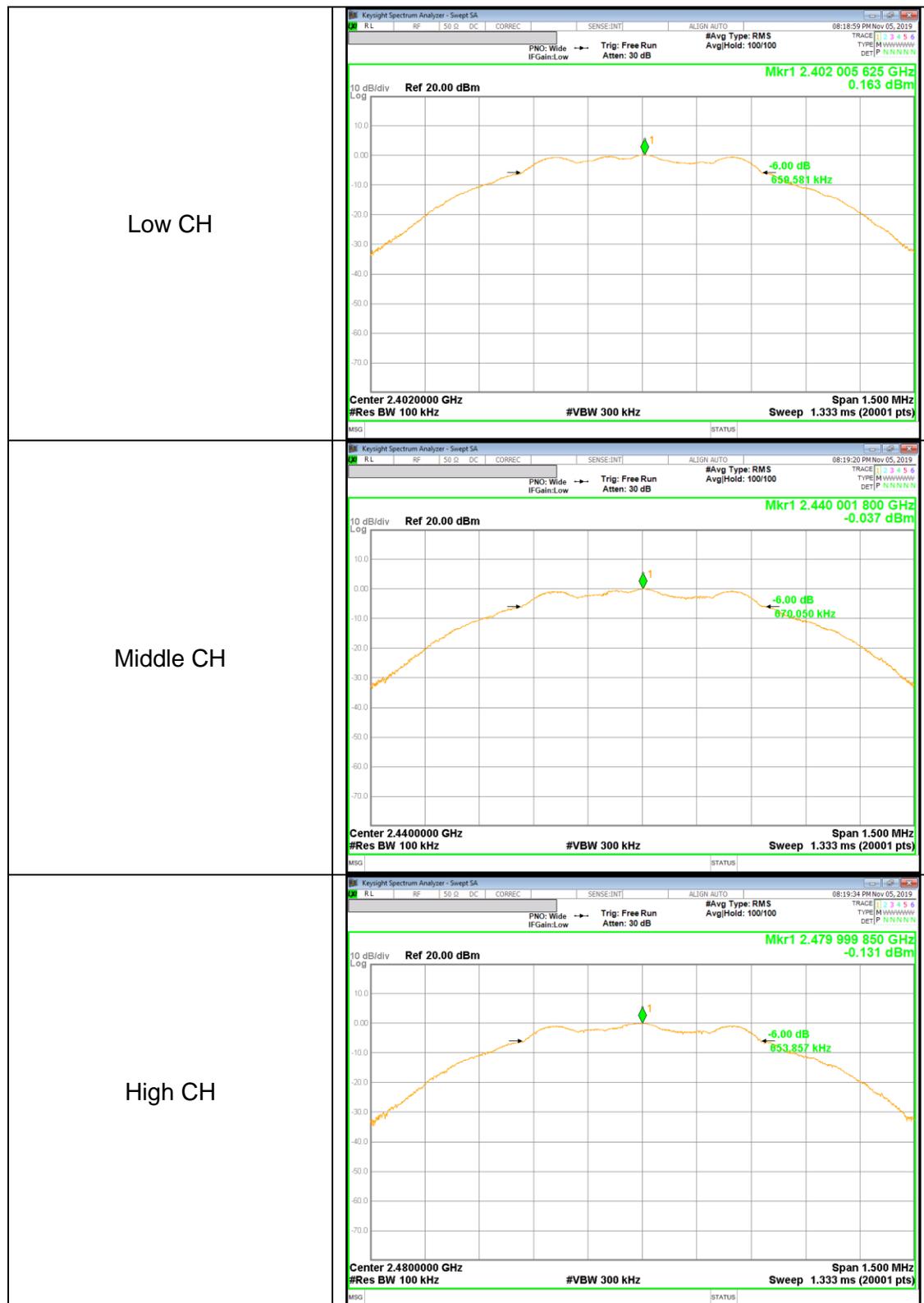
#### TEST PROCEDURE

Reference to section 11.8 in ANSI C63.10(2013): 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

Channel	Frequency [MHz]	6 dB Bandwidth [kHz]	Minimum Limit [kHz]
Low	2402	659.58	500.0
Mid	2440	670.05	500.0
High	2480	653.86	500.0
Worst		653.86	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.

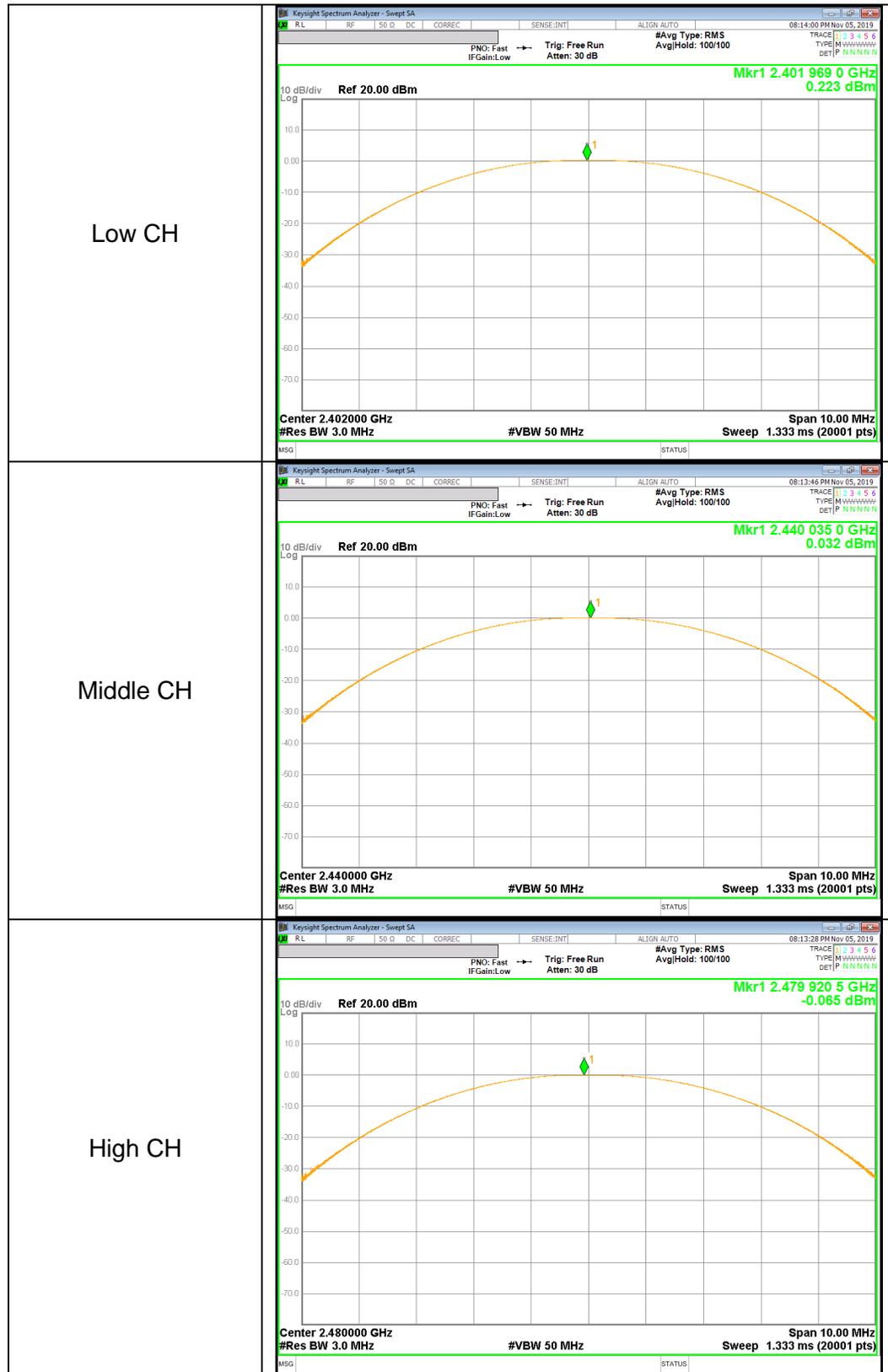
### TEST PROCEDURE

Peak power is measured using ANSI C63.10(2013) under section 11.9.1.1 utilizing spectrum analyzer.

### RESULTS

Channel	Frequency [MHz]	Peak Power Reading [dBm]	Limit [dBm]	Margin [dB]
Low	2402	0.223	30.000	-29.777
Mid	2440	0.032	30.000	-29.968
High	2480	-0.065	30.000	-30.065
Worst		0.223	30.000	-29.777

**OUTPUT POWER PLOTS**



### 10.3. 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.

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	<b>0.070</b>	<b>1.016</b>
Middle	2440	-0.126	0.971
High	2480	-0.233	0.948

## 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.

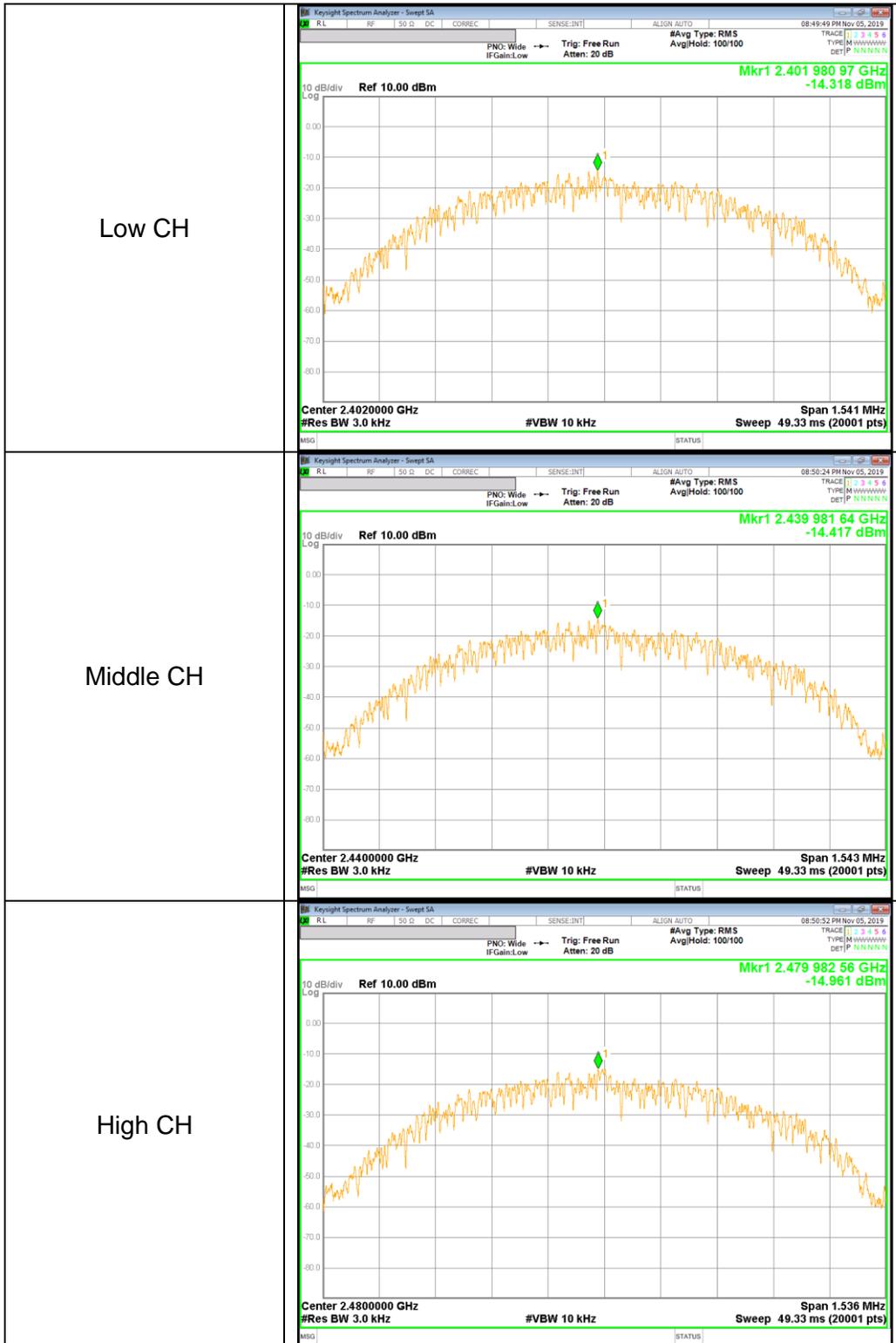
### TEST PROCEDURE

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

### RESULTS

Channel	Frequency [MHz]	PSD [dBm/3kHz]	Limit [dBm/3kHz]	Margin [dB]
Low	2402	-14.32	8.00	-22.32
Mid	2440	-14.42	8.00	-22.42
High	2480	-14.96	8.00	-22.96

**POWER SPECTRAL DENSITY PLOTS**



## 10.5. OUT-OF-BAND EMISSIONS

### LIMITS

FCC §15.247 (d)

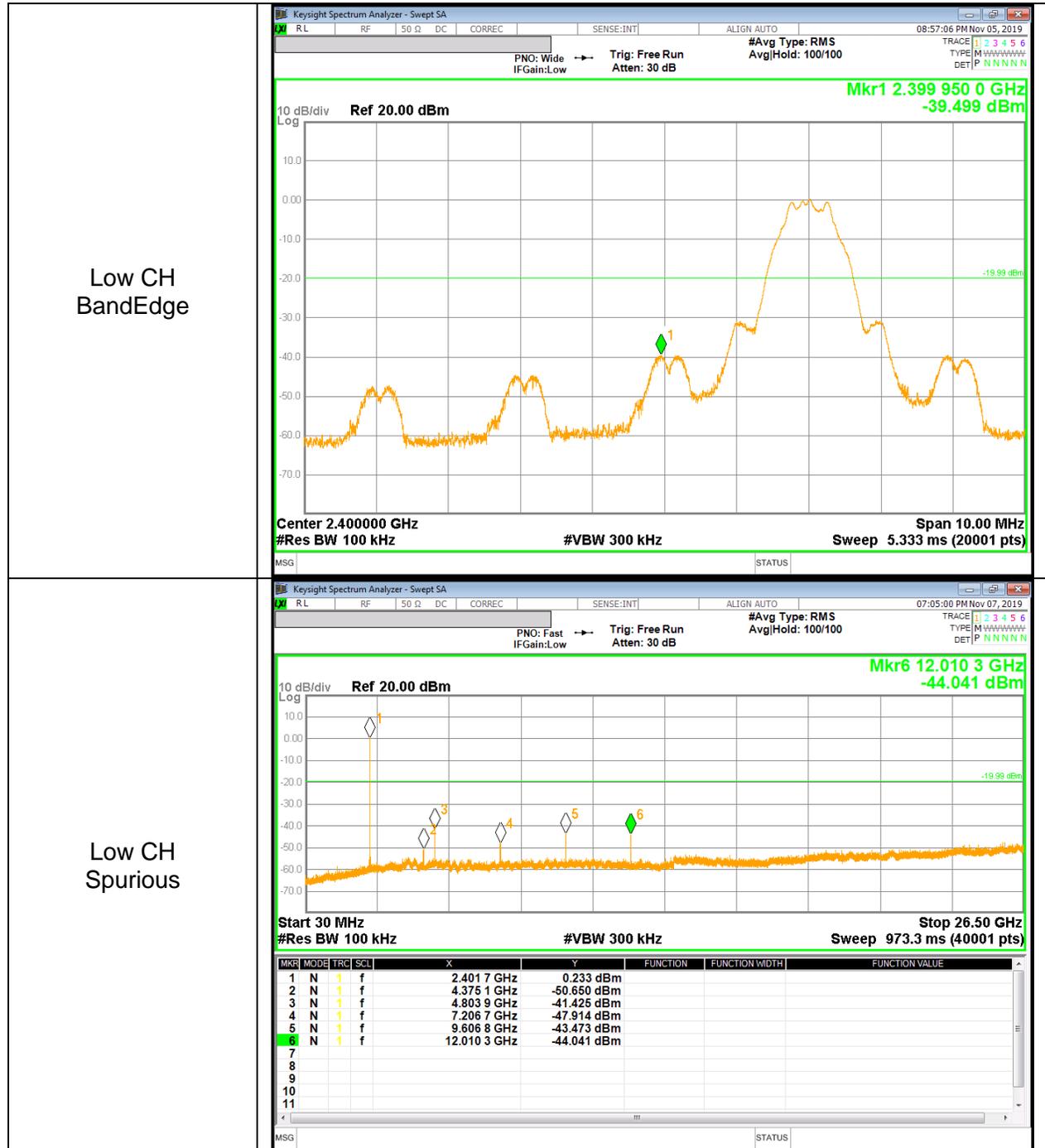
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

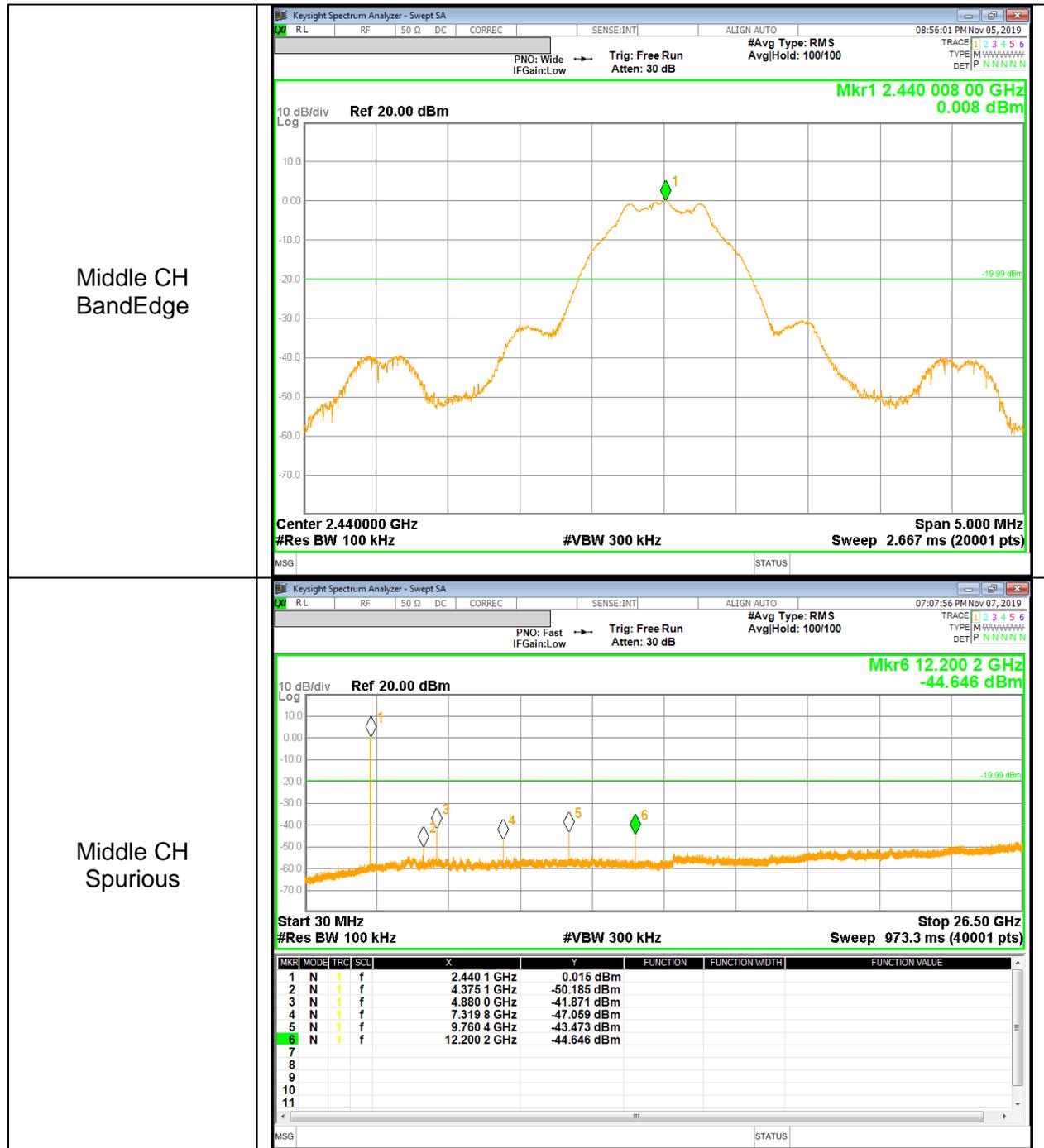
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

**RESULTS**

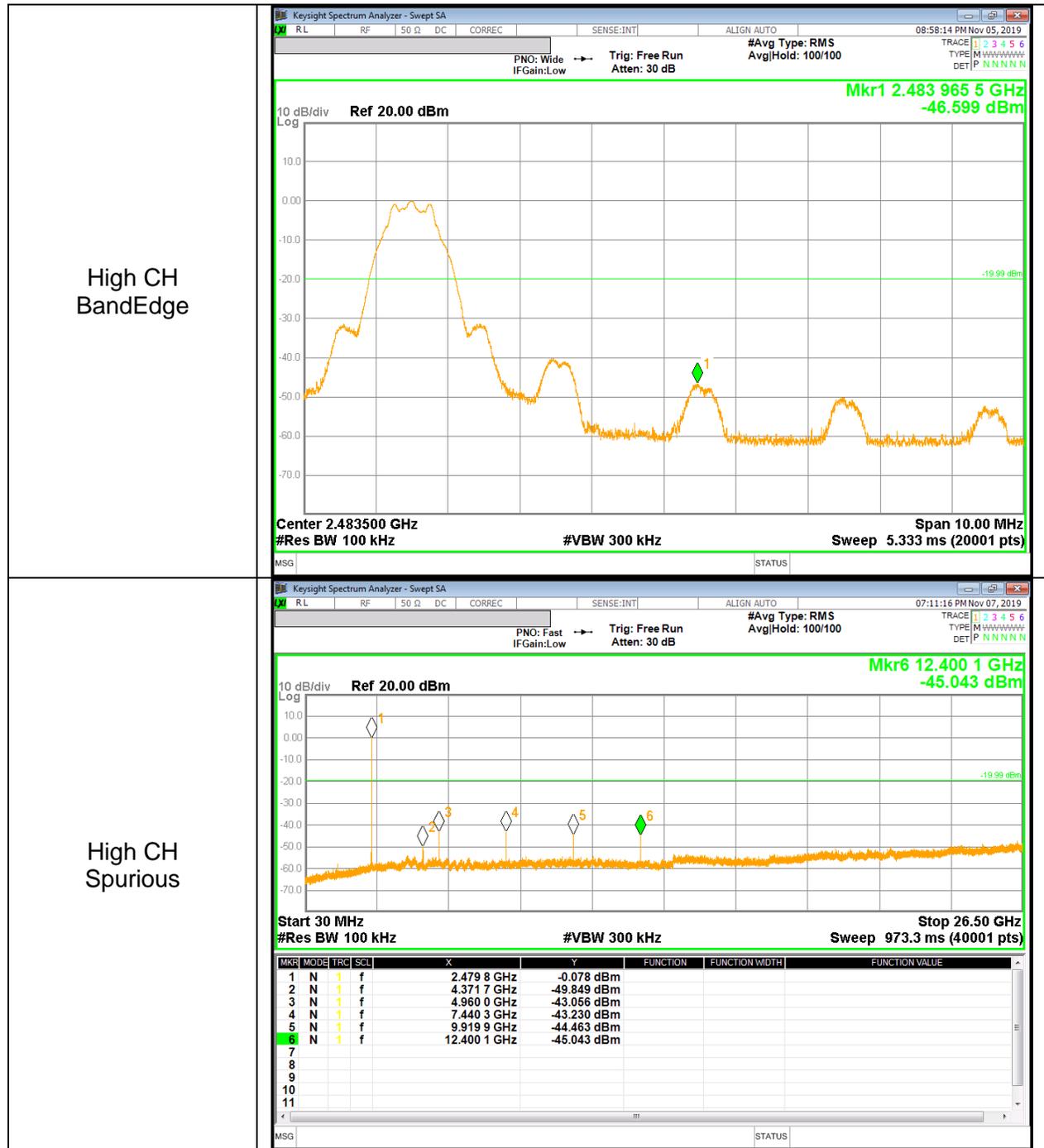
**BANDEDGE & SPURIOUS EMISSIONS, LOW CHANNEL**



**BANDEDGE & SPURIOUS EMISSIONS, MID CHANNEL**



**BANDEDGE & 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: For 1Mbps, DCF =  $10 \log(1/0.665) = 1.77$  dB (Spectrum Analyzer round it up to 1.77dB)

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.

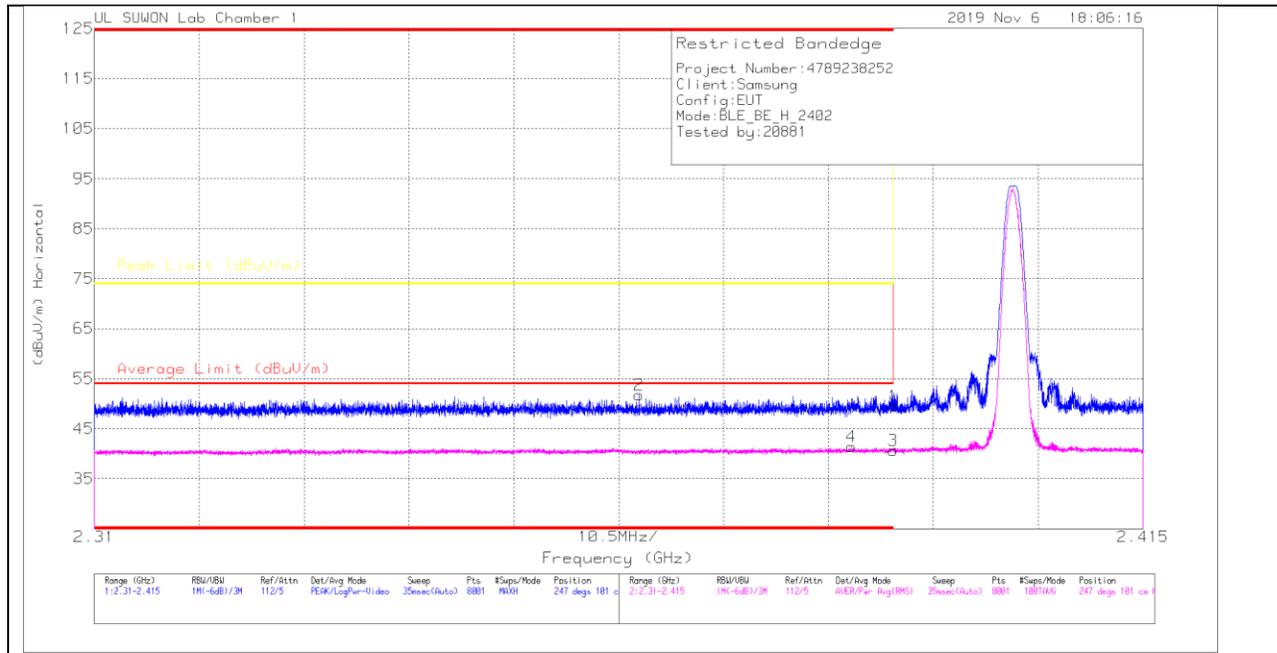
Note : Emission was pre-scanned from 9KHz to 30MHz; No emissions were detected which was at least 20dB below the specification limit (consider distance correction factor).  
Per FCC part 15.31(o), test results were not reported.

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open 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

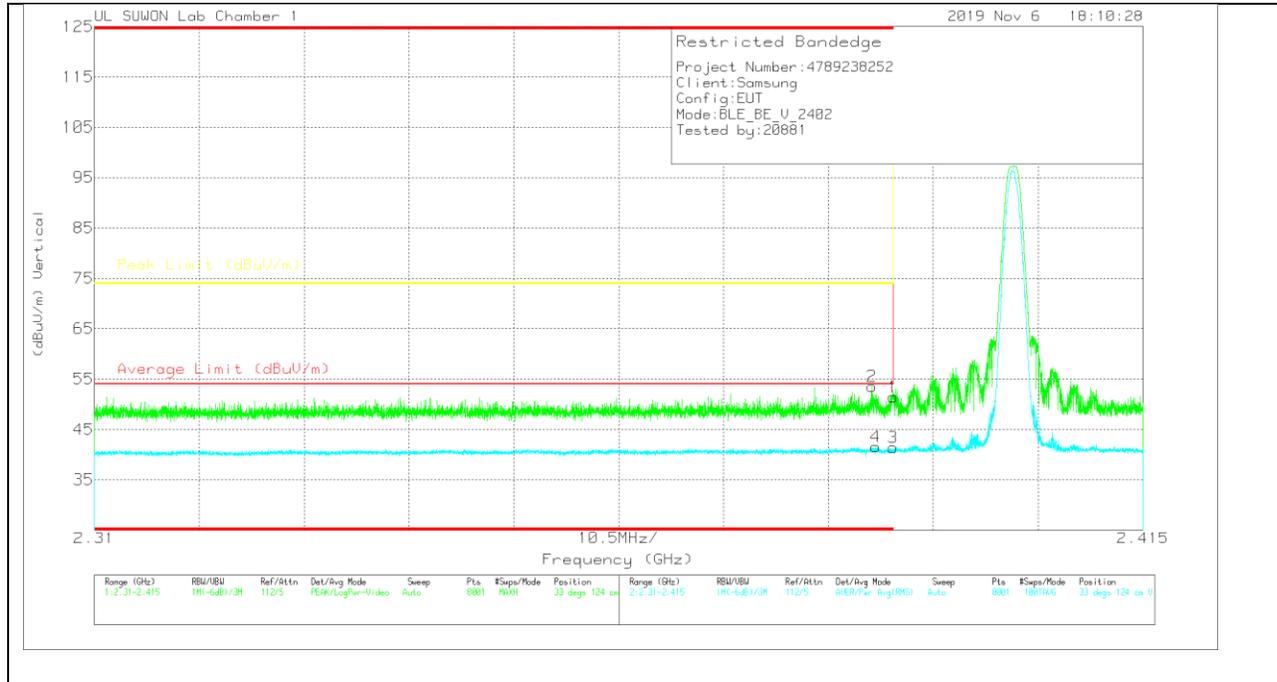
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	43.32	Pk	31.7	-25.5	0	49.52	-	-	74	-24.48	247	101	H
2	* 2.36455	45.84	Pk	31.6	-25.7	0	51.74	-	-	74	-22.26	247	101	H
3	* 2.39	32.71	RMS	31.7	-25.5	1.77	40.68	54	-13.32	-	-	247	101	H
4	* 2.38578	33.44	RMS	31.7	-25.5	1.77	41.41	54	-12.59	-	-	247	101	H

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

Pk - Peak detector

RMS - RMS detection

**VERTICAL PEAK AND AVERAGE PLOT**



**VERTICAL DATA**

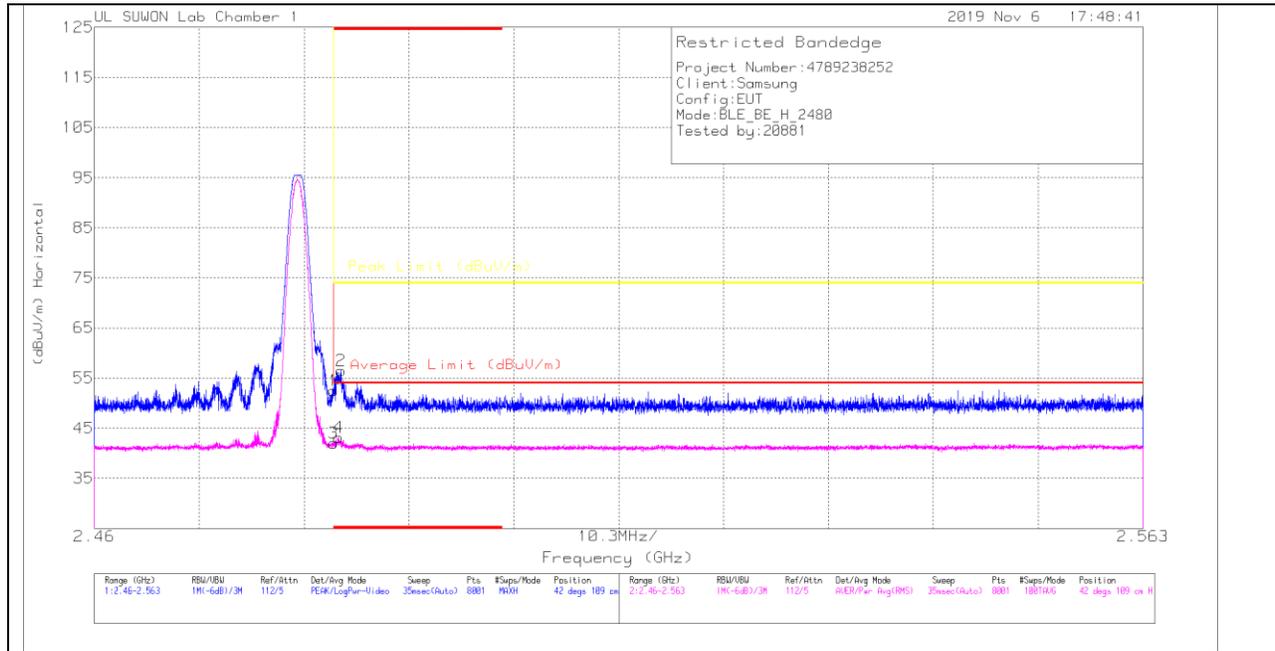
**Trace Markers**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	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	45.29	Pk	31.7	-25.5	0	51.49	-	-	74	-22.51	33	124	V
2	* 2.38786	47.36	Pk	31.7	-25.5	0	53.56	-	-	74	-20.44	33	124	V
3	* 2.39	33.44	RMS	31.7	-25.5	1.77	41.41	54	-12.59	-	-	33	124	V
4	* 2.38825	33.58	RMS	31.7	-25.5	1.77	41.55	54	-12.45	-	-	33	124	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

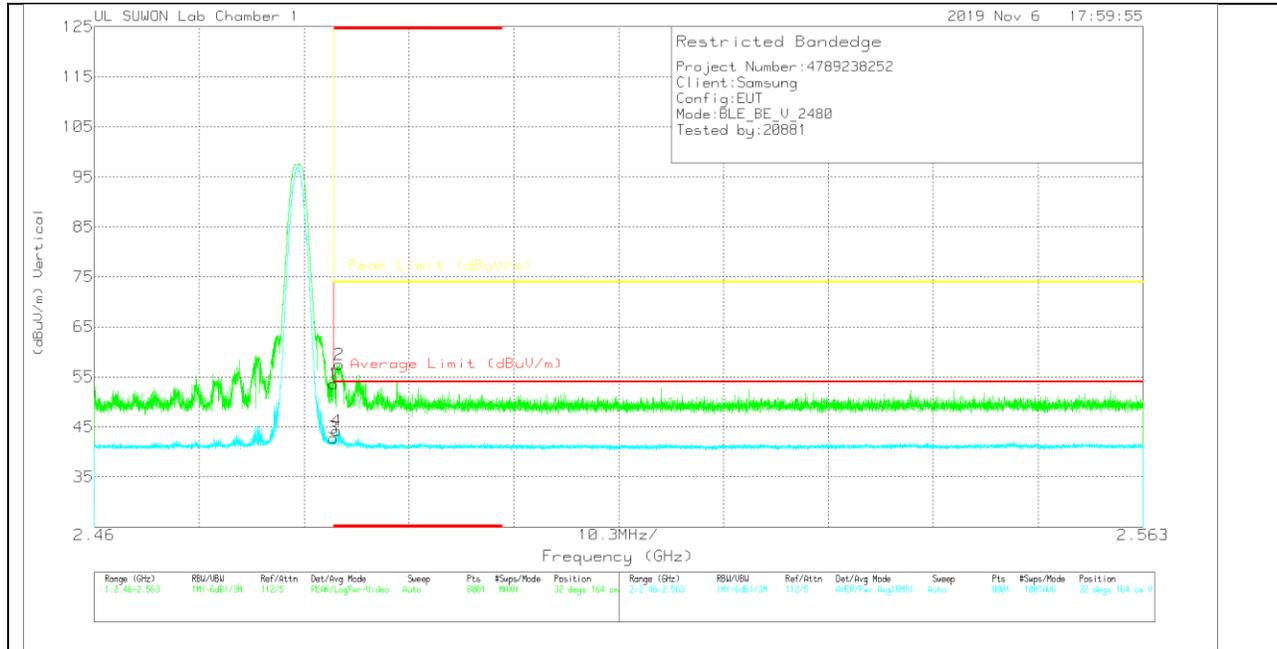
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	45.76	Pk	31.9	-25.2	0	52.46	-	-	74	-21.54	42	109	H
2	* 2.48422	49.65	Pk	31.9	-25.1	0	56.45	-	-	74	-17.55	42	109	H
3	* 2.48351	33.54	RMS	31.9	-25.2	1.77	42.01	54	-11.99	-	-	42	109	H
4	* 2.48397	34.59	RMS	31.9	-25.1	1.77	43.16	54	-10.84	-	-	42	109	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_00168717	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	* 2.48351	46.95	Pk	31.9	-25.2	0	53.65	-	-	74	-20.35	32	164	V
2	* 2.48406	50.63	Pk	31.9	-25.1	0	57.43	-	-	74	-16.57	32	164	V
3	* 2.48351	34.37	RMS	31.9	-25.2	1.77	42.84	54	-11.16	-	-	32	164	V
4	* 2.48378	35.8	RMS	31.9	-25.2	1.77	44.27	54	-9.73	-	-	32	164	V

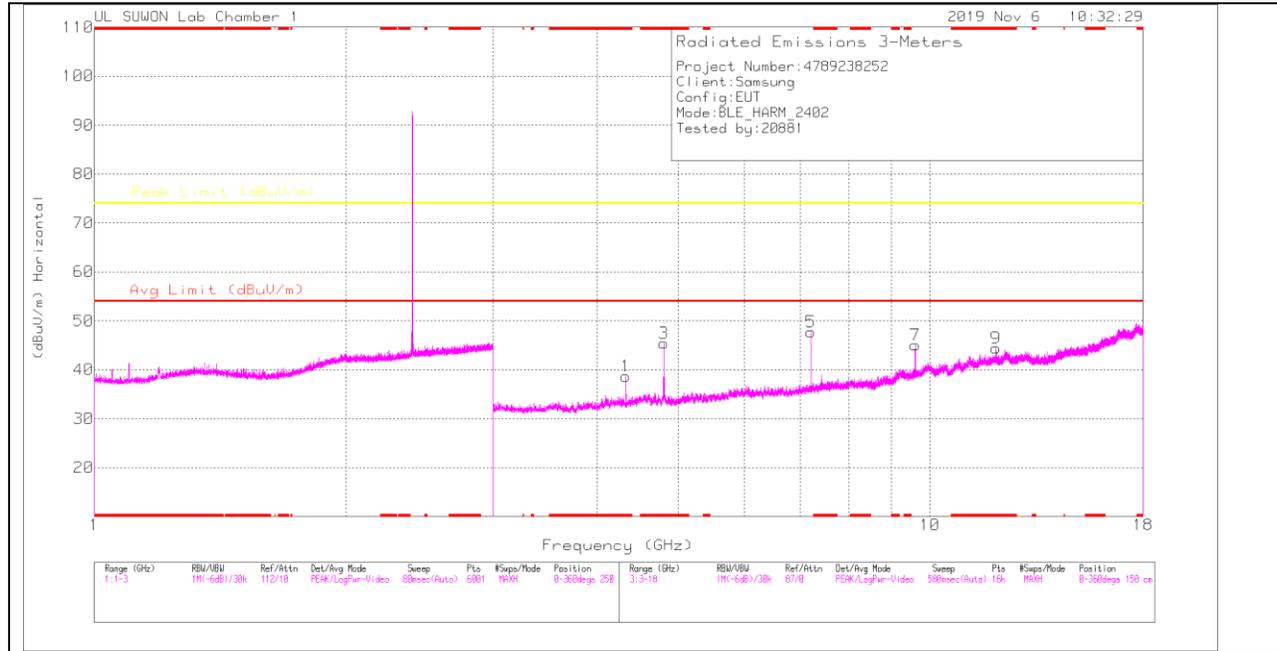
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

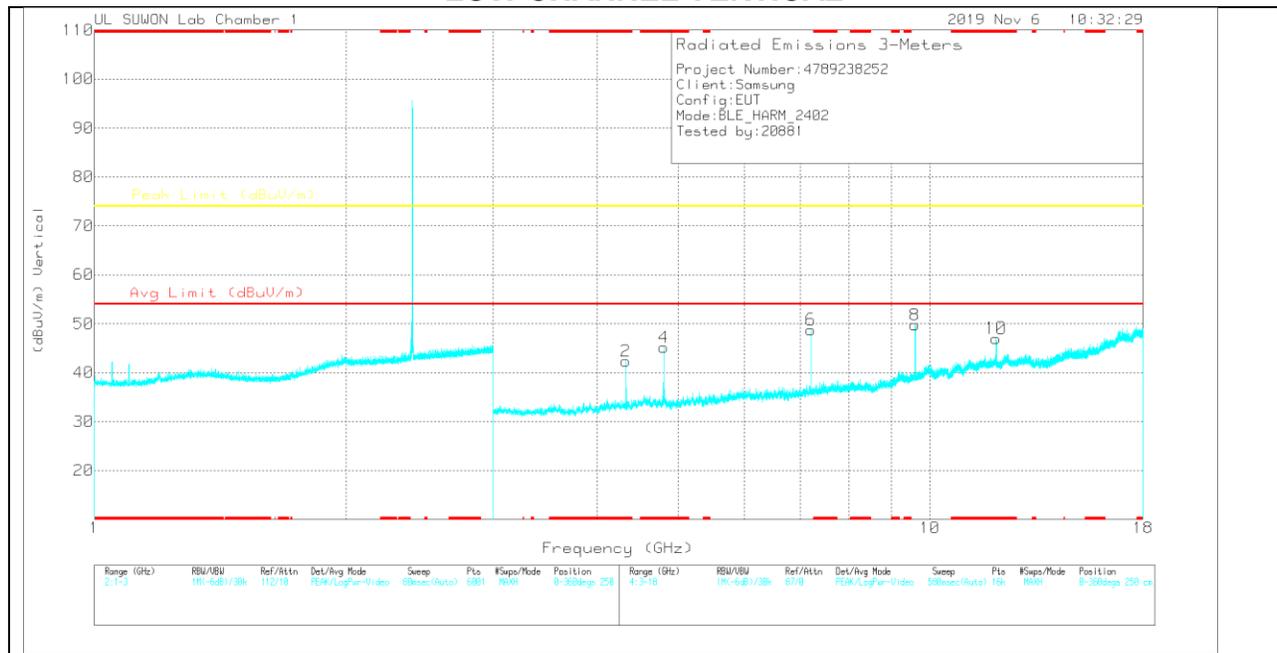
RMS - RMS detection

**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_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.32742	38.99	PK	34	-32.3	0	38.69	-	-	74	-35.31	0-360	250	H
3	* 4.80364	42.72	PK	34.2	-31.5	0	45.42	-	-	74	-28.58	0-360	250	H
5	7.20536	39.68	PK	35.8	-27.8	0	47.68	-	-	74	-26.32	0-360	150	H
7	9.60802	31.26	PK	37	-23.2	0	45.06	-	-	74	-28.94	0-360	250	H
9	* 12.00881	26.86	PK	39	-21.5	0	44.36	-	-	74	-29.64	0-360	150	H
2	* 4.32742	40.65	PK	34	-32.3	0	42.35	-	-	74	-31.65	0-360	250	V
4	* 4.80364	42.45	PK	34.2	-31.5	0	45.15	-	-	74	-28.85	0-360	250	V
6	7.20536	40.8	PK	35.8	-27.8	0	48.8	-	-	74	-25.2	0-360	250	V
8	9.60708	35.98	PK	37	-23.2	0	49.78	-	-	74	-24.22	0-360	250	V
10	* 12.00881	29.52	PK	39	-21.5	0	47.02	-	-	74	-26.98	0-360	250	V

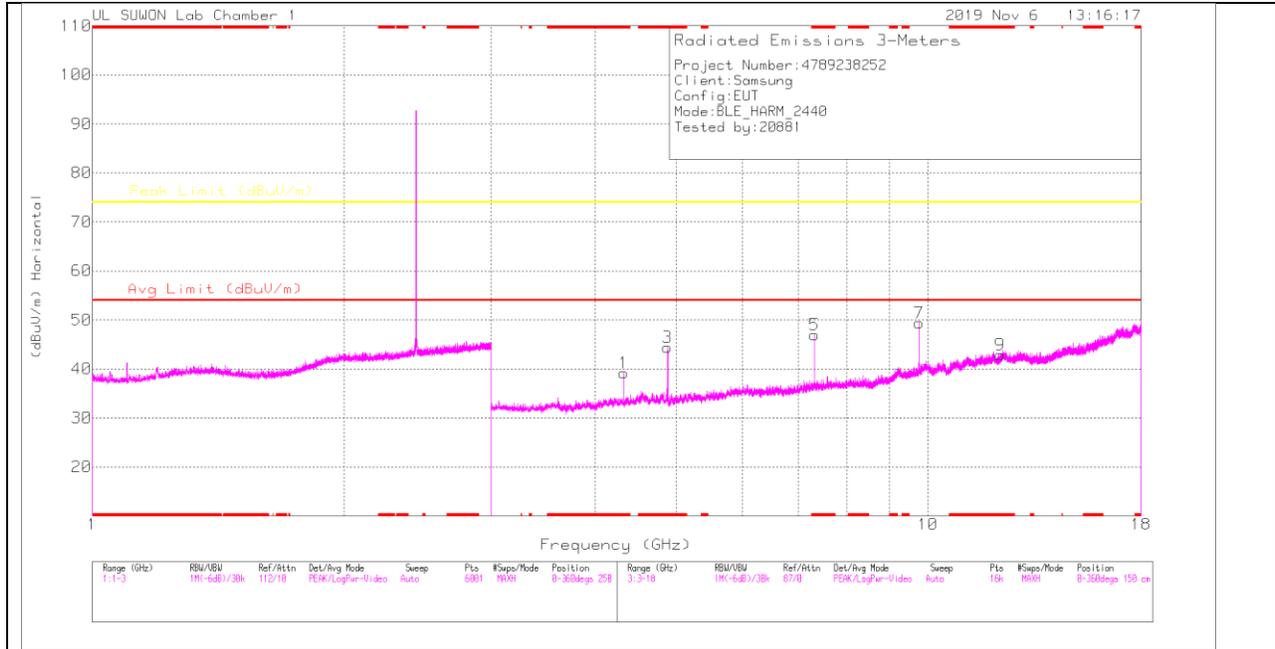
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 PK - Peak Detector

### Radiated Emissions

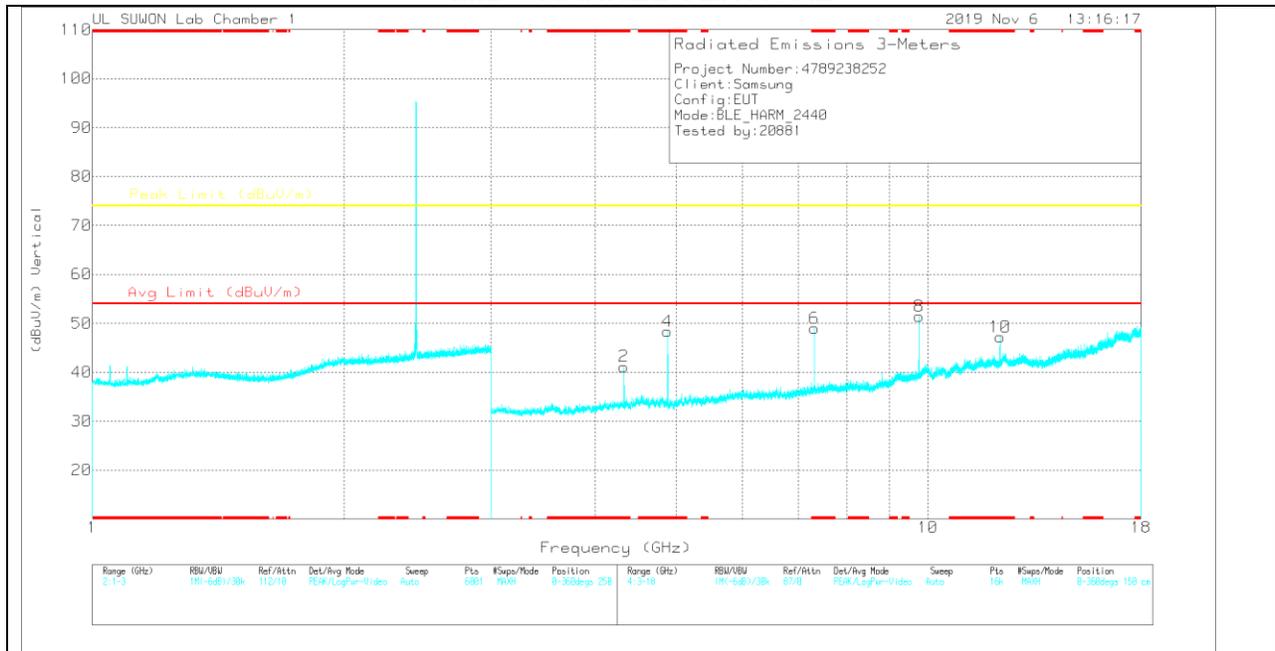
Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.32838	47.66	PK2	34	-32.3	0	49.36	-	-	74	-24.64	347	129	H
* 4.32804	31.1	MAV1	34	-32.3	1.77	34.57	54	-19.43	-	-	347	129	H
* 4.32842	48.67	PK2	34	-32.3	0	50.37	-	-	74	-23.63	248	158	V
* 4.32828	32.14	MAV1	34	-32.3	1.77	35.61	54	-18.39	-	-	248	158	V
* 4.80356	47.89	PK2	34.2	-31.5	0	50.59	-	-	74	-23.41	146	100	H
* 4.80384	40.55	MAV1	34.2	-31.5	1.77	45.02	54	-8.98	-	-	146	100	H
* 4.80448	47.88	PK2	34.2	-31.5	0	50.58	-	-	74	-23.42	227	147	V
* 4.8037	40.43	MAV1	34.2	-31.5	1.77	44.9	54	-9.1	-	-	227	147	V
7.2056	43.98	PK2	35.8	-27.8	0	51.98	-	-	74	-22.02	167	100	H
7.20654	44.13	PK2	35.8	-27.8	0	52.13	-	-	74	-21.87	113	342	V
9.60802	40.37	PK2	37	-23.2	0	54.17	-	-	74	-19.83	255	147	H
9.607	44.52	PK2	37	-23.2	0	58.32	-	-	74	-15.68	64	348	V
* 12.01125	35.79	PK2	39	-21.6	0	53.19	-	-	74	-20.81	286	198	H
* 12.00907	24.79	MAV1	39	-21.5	1.77	44.06	54	-9.94	-	-	286	198	H
* 12.00873	38.58	PK2	39	-21.5	0	56.08	-	-	74	-17.92	91	174	V
* 12.00875	29	MAV1	39	-21.5	1.77	48.27	54	-5.73	-	-	91	174	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 PK2 - KDB558074 Method: Maximum Peak  
 MAV1 - KDB558074 Option 1 Maximum RMS Average

### 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_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.32742	37.49	PK	34	-32.3	0	39.19	-	-	74	-34.81	0-360	250	H
3	* 4.87957	41.76	PK	34.2	-31.6	0	44.36	-	-	74	-29.64	0-360	250	H
5	* 7.32067	38.36	PK	35.8	-27.2	0	46.86	-	-	74	-27.04	0-360	250	H
7	9.75895	36.12	PK	37.2	-23.9	0	49.42	-	-	74	-24.58	0-360	250	H
9	* 12.19911	26.13	PK	39	-22.2	0	42.93	-	-	74	-31.07	0-360	250	H
2	* 4.32835	39.46	PK	34	-32.3	0	41.16	-	-	74	-32.84	0-360	250	V
4	* 4.87957	45.71	PK	34.2	-31.6	0	48.31	-	-	74	-25.69	0-360	250	V
6	* 7.31973	40.41	PK	35.8	-27.2	0	49.01	-	-	74	-24.99	0-360	250	V
8	9.75895	38.13	PK	37.2	-23.9	0	51.43	-	-	74	-22.57	0-360	150	V
10	* 12.20005	30.32	PK	39	-22.1	0	47.22	-	-	74	-26.78	0-360	250	V

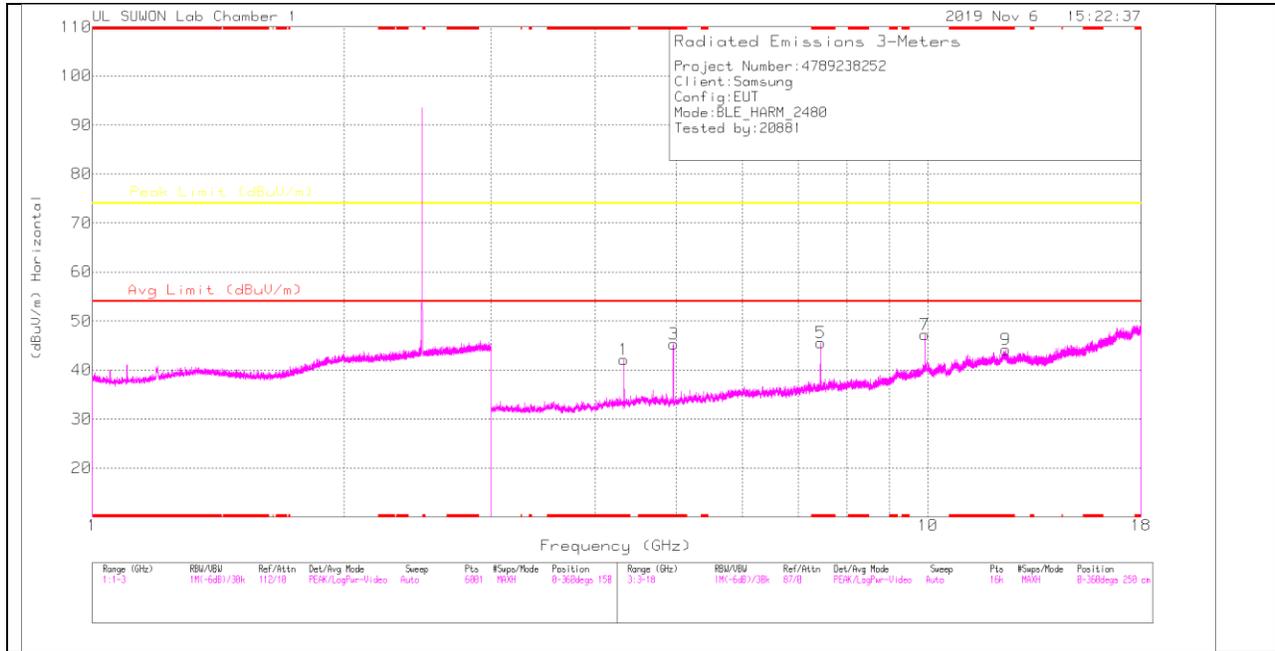
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 PK - Peak Detector

Radiated Emissions

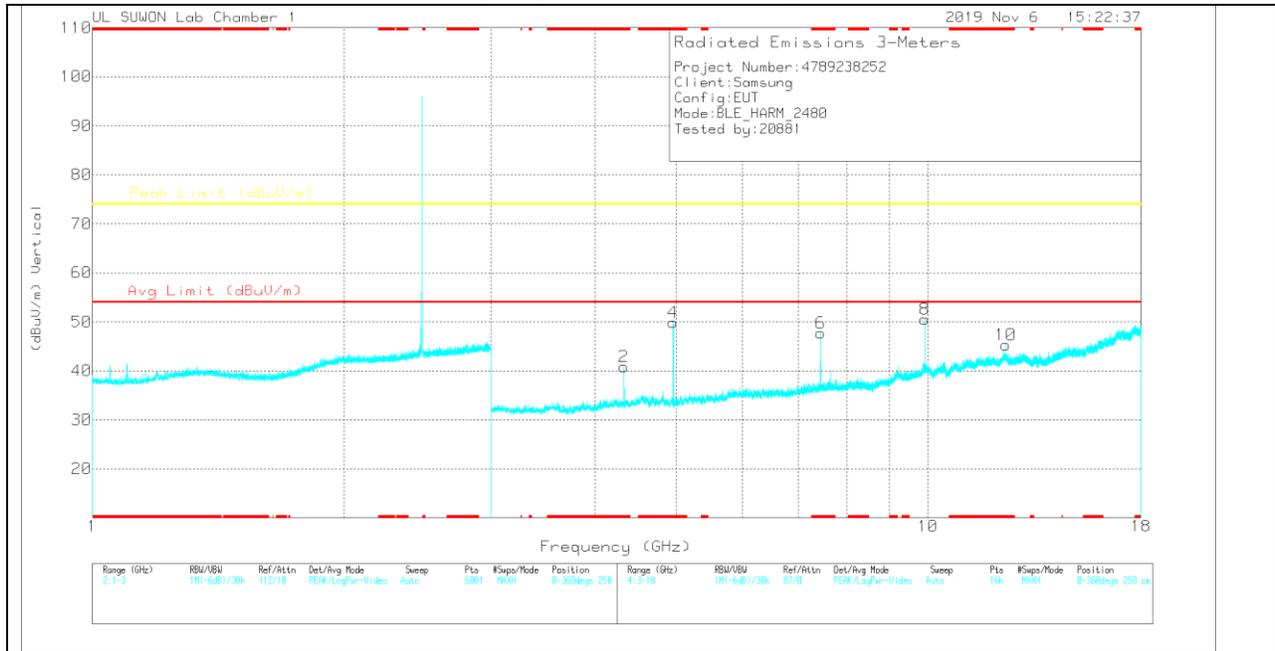
Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.33053	45.81	PK2	34	-32.3	0	47.51	-	-	74	-26.49	340	104	H
* 4.32785	30.16	MAV1	34	-32.3	1.77	33.63	54	-20.37	-	-	340	104	H
* 4.33039	48.29	PK2	34	-32.3	0	49.99	-	-	74	-24.01	242	114	V
* 4.32823	31.53	MAV1	34	-32.3	1.77	35	54	-19	-	-	242	114	V
* 4.87963	46.33	PK2	34.2	-31.6	0	48.93	-	-	74	-25.07	158	101	H
* 4.87995	38.1	MAV1	34.2	-31.7	1.77	42.37	54	-11.63	-	-	158	101	H
* 4.88003	46.63	PK2	34.2	-31.7	0	49.13	-	-	74	-24.87	189	154	V
* 4.87989	39.17	MAV1	34.2	-31.7	1.77	43.44	54	-10.56	-	-	189	154	V
* 7.31998	45.16	PK2	35.8	-27.2	0	53.76	-	-	74	-20.24	24	102	H
* 7.31926	36.64	MAV1	35.8	-27.3	1.77	46.91	54	-7.09	-	-	24	102	H
* 7.31986	45.24	PK2	35.8	-27.2	0	53.84	-	-	74	-20.16	345	100	V
* 7.31934	37.2	MAV1	35.8	-27.3	1.77	47.47	54	-6.53	-	-	345	100	V
9.75901	42.05	PK2	37.2	-23.9	0	55.35	-	-	74	-18.65	263	200	H
9.75903	42.93	PK2	37.2	-23.9	0	56.23	-	-	74	-17.77	329	124	V
* 12.19889	36.3	PK2	39	-22.2	0	53.1	-	-	74	-20.9	273	192	H
* 12.19897	24.96	MAV1	39	-22.2	1.77	43.53	54	-10.47	-	-	273	192	H
* 12.20105	37.1	PK2	39	-22.1	0	54	-	-	74	-20	101	100	V
* 12.19873	26.81	MAV1	39	-22.2	1.77	45.38	54	-8.62	-	-	101	100	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 PK2 - KDB558074 Method: Maximum Peak  
 MAV1 - KDB558074 Option 1 Maximum RMS Average

### 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_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.32742	40.36	PK	34	-32.3	0	42.06	-	-	74	-31.94	0-360	250	H
3	* 4.95019	42.72	PK	34.2	-31.6	0	45.32	-	-	74	-28.68	0-360	250	H
5	* 7.43978	36.83	PK	35.8	-27.1	0	45.53	-	-	74	-28.47	0-360	250	H
7	9.91831	31.77	PK	37.5	-22.1	0	47.17	-	-	74	-26.83	0-360	250	H
9	* 12.39878	26.15	PK	38.9	-20.9	0	44.15	-	-	74	-29.85	0-360	150	H
2	* 4.32742	39.09	PK	34	-32.3	0	40.79	-	-	74	-33.21	0-360	250	V
4	* 4.95925	47.3	PK	34.2	-31.6	0	49.9	-	-	74	-24.1	0-360	250	V
6	* 7.43972	38.97	PK	35.8	-27.1	0	47.67	-	-	74	-26.33	0-360	250	V
8	9.91925	35.08	PK	37.5	-22	0	50.58	-	-	74	-23.42	0-360	250	V
10	* 12.39878	27.34	PK	38.9	-20.9	0	45.34	-	-	74	-28.66	0-360	250	V

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

#### Radiated Emissions

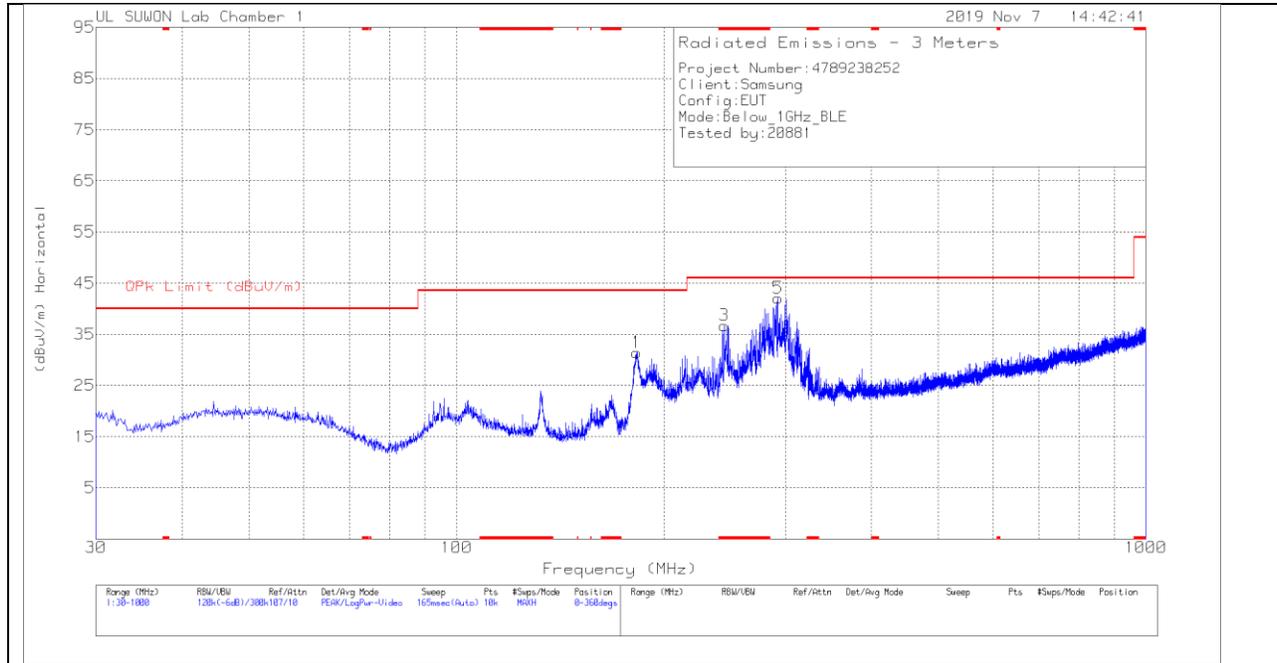
Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.3284	47.51	PK2	34	-32.3	0	49.21	-	-	74	-24.79	352	104	H
* 4.32784	31.07	MAV1	34	-32.3	1.77	34.54	54	-19.46	-	-	352	104	H
* 4.328	48.72	PK2	34	-32.3	0	50.42	-	-	74	-23.58	242	114	V
* 4.32812	31.74	MAV1	34	-32.3	1.77	35.21	54	-18.79	-	-	242	114	V
* 4.95941	45.73	PK2	34.2	-31.6	0	48.33	-	-	74	-25.67	355	111	H
* 4.95983	37.67	MAV1	34.2	-31.6	1.77	42.04	54	-11.96	-	-	355	111	H
* 4.96041	46.31	PK2	34.2	-31.6	0	48.91	-	-	74	-25.09	49	229	V
* 4.95971	39	MAV1	34.2	-31.6	1.77	43.37	54	-10.63	-	-	49	229	V
* 7.43998	44.95	PK2	35.8	-27.1	0	53.65	-	-	74	-20.35	55	396	H
* 7.43942	36.92	MAV1	35.8	-27.1	1.77	47.39	54	-6.61	-	-	55	396	H
* 7.44054	45.02	PK2	35.8	-27.1	0	53.72	-	-	74	-20.28	141	374	V
* 7.43948	37.09	MAV1	35.8	-27.1	1.77	47.56	54	-6.44	-	-	141	374	V
9.92091	38.76	PK2	37.5	-22	0	54.26	-	-	74	-19.74	256	293	H
9.92085	40.07	PK2	37.5	-22	0	55.57	-	-	74	-18.43	323	134	V
* 12.40124	34.49	PK2	38.8	-20.8	0	52.49	-	-	74	-21.51	288	197	H
* 12.3987	22.97	MAV1	38.9	-20.9	1.77	42.74	54	-11.26	-	-	288	197	H
* 12.40088	35.96	PK2	38.8	-20.9	0	53.86	-	-	74	-20.14	55	355	V
* 12.39886	25.13	MAV1	38.9	-20.9	1.77	44.9	54	-9.1	-	-	55	355	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 PK2 - KDB558074 Method: Maximum Peak  
 MAV1 - KDB558074 Option 1 Maximum RMS Average

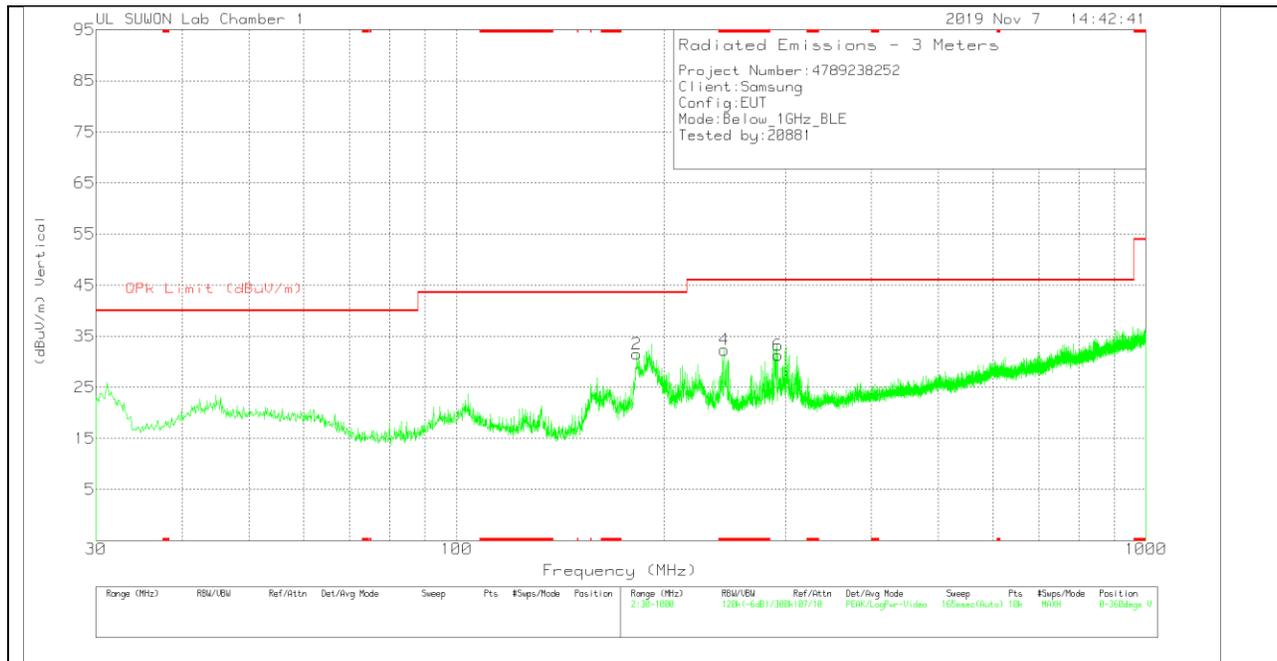
### 11.3. WORST-CASE BELOW 1 GHz

#### SPURIOUS EMISSIONS 30 TO 1000 MHz

#### 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	182.678	43.24	Pk	16	-27.8	31.44	43.52	-12.08	0-360	200	H
3	* 244.661	45.32	Pk	18.8	-27.4	36.72	46.02	-9.3	0-360	100	H
5	292.676	49.88	Pk	19.2	-27	42.08	46.02	-3.94	0-360	100	H
2	182.581	43.23	Pk	16	-27.7	31.53	43.52	-11.99	0-360	100	V
4	* 244.661	40.94	Pk	18.8	-27.4	32.34	46.02	-13.68	0-360	200	V
6	292.676	39.08	Pk	19.2	-27	31.28	46.02	-14.74	0-360	100	V

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

#### Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163_750	Below_1G[dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 244.661	45.06	Qp	18.8	-27.4	36.46	46.02	-9.56	341	119	H
* 244.661	39.36	Qp	18.8	-27.4	30.76	46.02	-15.26	107	185	V
292.676	48.63	Qp	19.2	-27	40.83	46.02	-5.19	330	107	H
292.676	38.86	Qp	19.2	-27	31.06	46.02	-14.96	113	128	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 Qp - Quasi-Peak detector