



CERTIFICATION TEST REPORT

Report Number. : 4789746865-E3V3

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

Model : SM-A525F/DS, SM-A525F

FCC ID : A3LSMA525F

EUT Description : GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac and NFC

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

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Testing Laboratory

TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	01/28/21	Initial issue	SunGeun Lee
V2	02/02/21	Updated to address TCB's question	SunGeun Lee
V3	02/04/21	Updated to address TCB's question	SunGeun Lee

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.

EUT DESCRIPTION: GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac and NFC

MODEL NUMBER: SM-A525F/DS, SM-A525F

SERIAL NUMBER: R38NB02RCJH (CONDUCTED, Original);
R38NB02RD9T, R38NB02S41F (RADIATED, Original);
R38NC03HCYN (RADIATED, Spot check);

DATE TESTED: NOV 30, 2020 – JAN 26, 2021(Original);
JAN 21, 2021(Spot check);

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

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

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

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1.1. INTRODUCTION OF TEST DATA REUSE

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

1.2. DIFFERENCE

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

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

1.3. SPOT CHECK VERIFICATION DATA (Worst case of the radiated spurious and band edge emissions)

Band	Test Item	Mode	Frequency	Test Limit	Original model	Spot check model	Deviation	Remark
					SM-A525M/DS Results	SM-A525F/DS Results		
					FCC ID : A3LSMA525M	FCC ID : A3LSMA525F		
DTS WLAN (2.4GHz)	Band Edge	802.11b	2472 MHz	54 dBuV/m	50.58 dBuV/m	50.30 dBuV/m	-0.28 dB	
	RSE	802.11b	4824 MHz	54 dBuV/m	48.53 dBuV/m	44.76 dBuV/m	-3.77 dB	
	Band Edge	802.11g	2472 MHz	54 dBuV/m	51.68 dBuV/m	50.01 dBuV/m	-1.67 dB	
	RSE	802.11g	4824 MHz	54 dBuV/m	34.94 dBuV/m	33.47 dBuV/m	-1.47 dB	
	Band Edge	802.11n HT20	2462 MHz	54 dBuV/m	51.55 dBuV/m	45.33 dBuV/m	-6.22 dB	
	RSE	802.11n HT20	4824 MHz	54 dBuV/m	35.19 dBuV/m	33.12 dBuV/m	-2.07 dB	

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

1.4. REFERENCE DETAIL

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

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

2. TEST METHODOLOGY

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 15.
3. KDB 558074 D01 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	
☒	Chamber 1
☒	Chamber 2
☐	Chamber 3

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

4. 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:

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

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

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

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. EUT DESCRIPTION

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

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

WiFi operating mode

Frequency rage	Mode	WIFI 2.4G
2.4GHz (2412 MHz ~ 2472 MHz)	802.11b SISO	TX/RX
	802.11g SISO	TX/RX
	802.11n(HT20) SISO	TX/RX

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range [MHz]	Mode	Output Power [dBm]	Output Power [mW]
2412 - 2472	802.11b SISO	19.47	88.51
	802.11g SISO	17.75	59.57
	802.11n(HT20) SISO	17.59	57.41

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

**The internal antenna was Permanently attached.
Therefore this E.U.T Complies with the requirement of §15.203.**

The radio utilizes an internal antennas, with Antenna 1's maximum gain of -3.57 dBi.

5.4. TESTED CHANNELS LIST

Ch.	Frequency [MHz]	11b [SISO]	11g [SISO]	11n(HT20) [SISO]
1	2 412	O	O	O
6	2 437	O	O	O
10	2 457	-	O	O
11	2 462	O	O	O
12	2 467	O	O	O
13	2 472	O	O	O

5.5. 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.

Based on the baseline scan, the worst-case data rates were:

802.11b mode: 1 Mbps 1TX

802.11g mode: 6 Mbps 1TX

802.11n HT20 mode: MCS0 1TX

Note1. 802.11b & g & n (HT20) mode: Only supports SISO mode.

Note2. All radiated and power line conducted tests were performed attached with travel adapter and earphone for the worst case condition mode.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

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

I/O CABLE

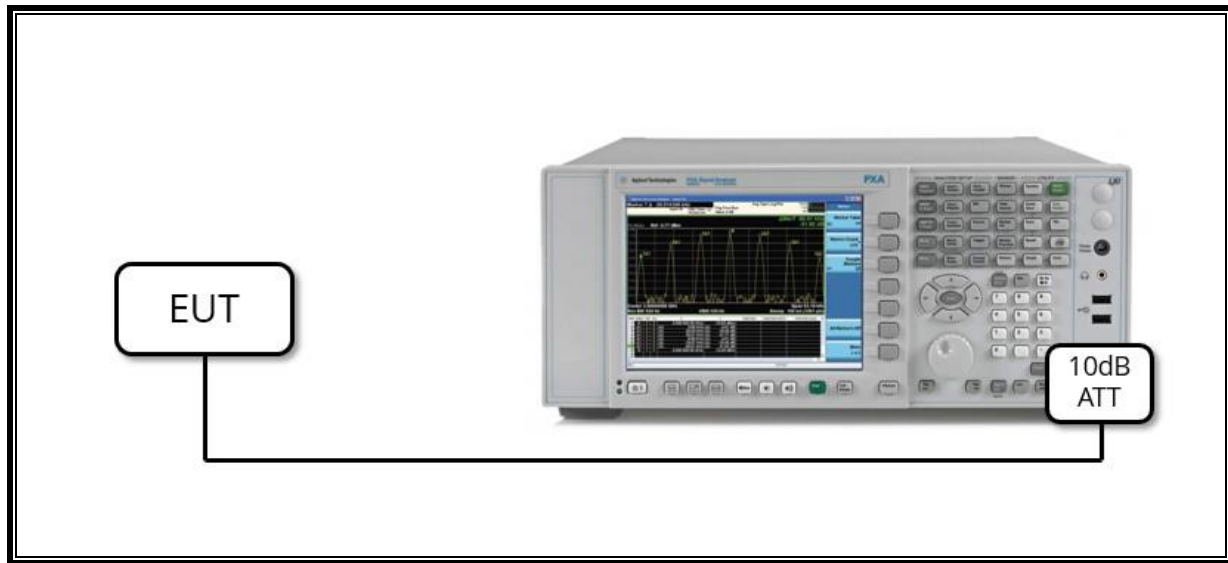
I/O Cable List						
Cable No.	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	C Type	Shielded	1.0 m	N/A
2	Audio	2	Mini-Jack	Unshielded	1.2 m	N/A

TEST SETUP

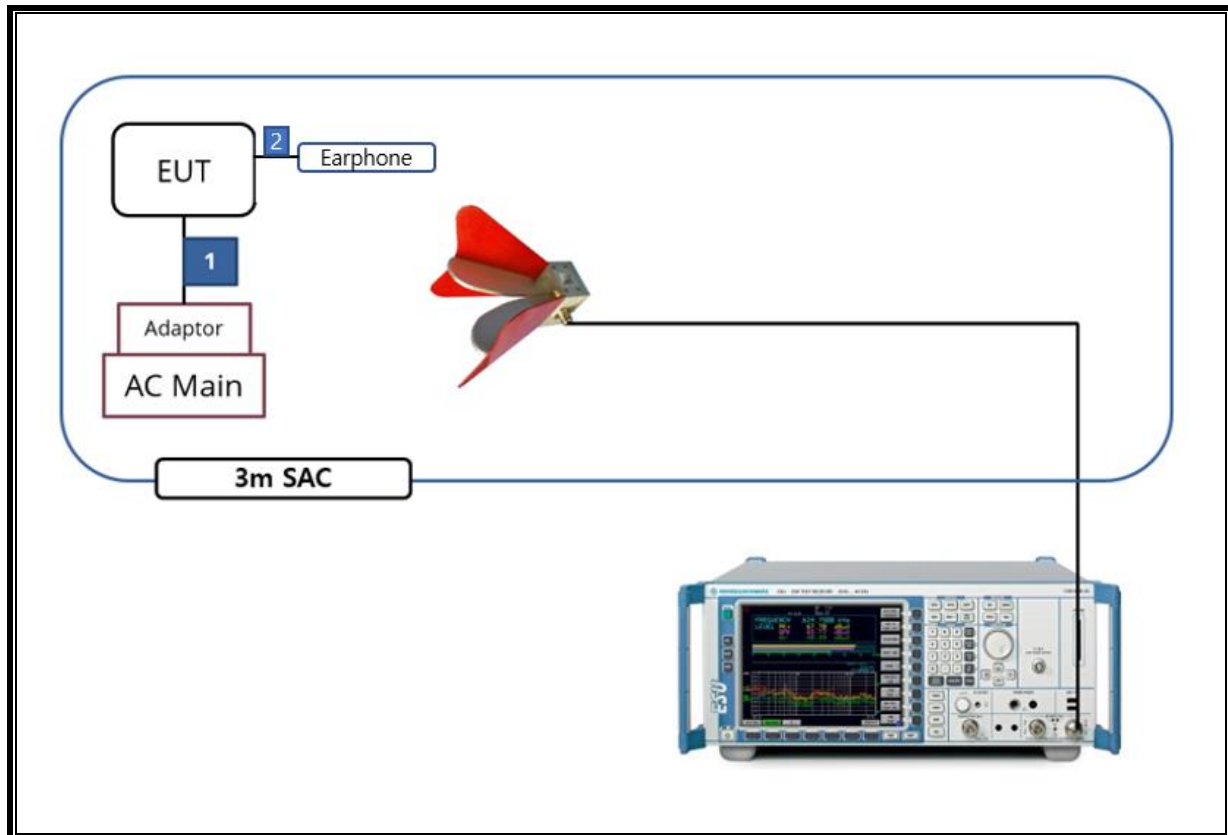
The EUT is a stand-alone unit during the tests.

Test software in hidden menu exercised the EUT to enable DTS mode.

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



6. MEASUREMENT METHOD

6 dB BW: KDB 558074 D01 v05r02, Section 8.2

OUTPUT POWER: KDB 558074 D01 v05r02, Section 8.3.2.3.

POWER SPECTRAL DENSITY: KDB 558074 D01 v05r02, Section 8.4.

Out-of-band EMISSIONS (Conducted): KDB 558074 D01 v05r02, Section 8.5.

Out-of-band EMISSIONS IN NON-RESTRICTED BANDS: KDB 558074 D01 v05r02, Section 8.5.

Out-of-band EMISSIONS IN RESTRICTED BANDS: KDB 558074 D01 v05r02, Section 8.6.

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

7. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List				
Description	Manufacturer	Model	S/N	Cal Due
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	08-19-22
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	08-13-22
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	08-13-22
Antenna, Horn, 18 GHz	ETS	3115	00167211	07-27-22
Antenna, Horn, 18 GHz	ETS	3115	00161451	08-15-22
Antenna, Horn, 18 GHz	ETS	3117	00168724	07-27-22
Antenna, Horn, 18 GHz	ETS	3117	00168717	08-15-22
Antenna, Horn, 40 GHz	ETS	3116C	00166155	08-04-22
Antenna, Horn, 40 GHz	ETS	3116C	00168645	10-02-21
Preamplifier	ETS	3116C-PA	00168841	08-06-21
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-03-21
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-03-21
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-06-21
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-03-21
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-03-21
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-04-21
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-05-21
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-05-21
Spectrum Analyzer, 43.5 GHz	R&S	FSW43	104089	08-06-21
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-05-21
Attenuator	PASTERNAK	PE7087-10	A001	08-03-21
Attenuator	PASTERNAK	PE7087-10	A008	08-03-21
Attenuator	PASTERNAK	PE7004-10	2	08-04-21
Attenuator	PASTERNAK	PE7087-10	A009	08-03-21
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-03-21
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-03-21
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-03-21
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-03-21
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-03-21
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	020	08-04-21
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-03-21
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-03-21
High Pass Filter 3GHz	Micro-Tronics	HPM17543	020	08-04-21
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	08-03-21
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	08-03-21
High Pass Filter 6GHz	Micro-Tronics	HPS17542	021	08-04-21
LISN	R&S	ENV-216	101837	08-06-21
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	10-02-21
UL Software				
Description	Manufacturer	Model	Version	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

8. 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	-30dBc		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 11	Power Line conducted	Pass
15.205, 15.209	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass

9. ANTENNA PORT TEST RESULTS

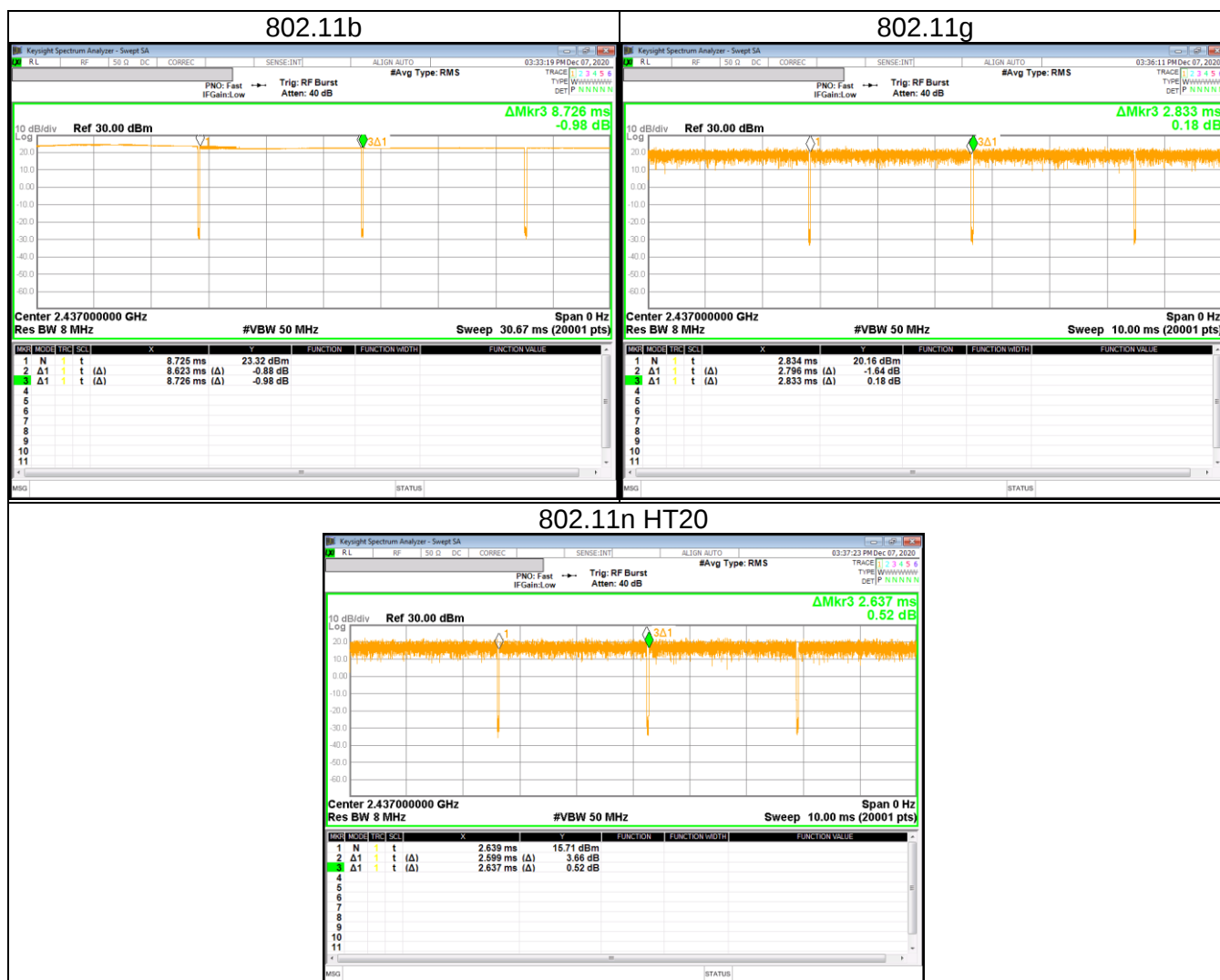
9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

Mode	On Time [ms]	Period [ms]	Duty Cycle X [Linear]	Duty Cycle X [%]	Duty Cycle Correction Factor[dB]	1/T Minimum VBW[kHz]
802.11b	8.623	8.726	0.99	98.8	0.00	0.12
802.11g	2.796	2.833	0.99	98.7	0.00	0.36
802.11n(HT20)	2.599	2.637	0.99	98.6	0.00	0.38

Note. According to ANSI C63.10 Section 11.6, do not apply the Duty Cycle Correction Factor judging that a duty cycle of greater than or equal to 98% is continuous signal.



9.2. 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 100 kHz, the VBW $\geq 3 \times$ RBW, peak detector and max hold.

RESULTS

- Please refer to the next page

9.2.1. 802.11b MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Minimum Limit [MHz]
1	2 412	8.071	0.5
6	2 437	8.556	
11	2 462	8.062	
12	2 467	8.543	
13	2 472	9.035	
Worst		8.062	

9.2.2. 802.11g MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Minimum Limit [MHz]
1	2 412	13.820	0.5
6	2 437	13.840	
10	2 457	15.030	
11	2 462	13.830	
12	2 467	15.060	
13	2 472	15.050	
Worst		13.820	

9.2.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Minimum Limit [MHz]
1	2 412	13.830	0.5
6	2 437	15.040	
10	2 457	15.060	
11	2 462	15.010	
12	2 467	15.060	
13	2 472	15.010	
Worst		13.830	

9.2.4. 6 dB BANDWIDTH TEST PLOTS

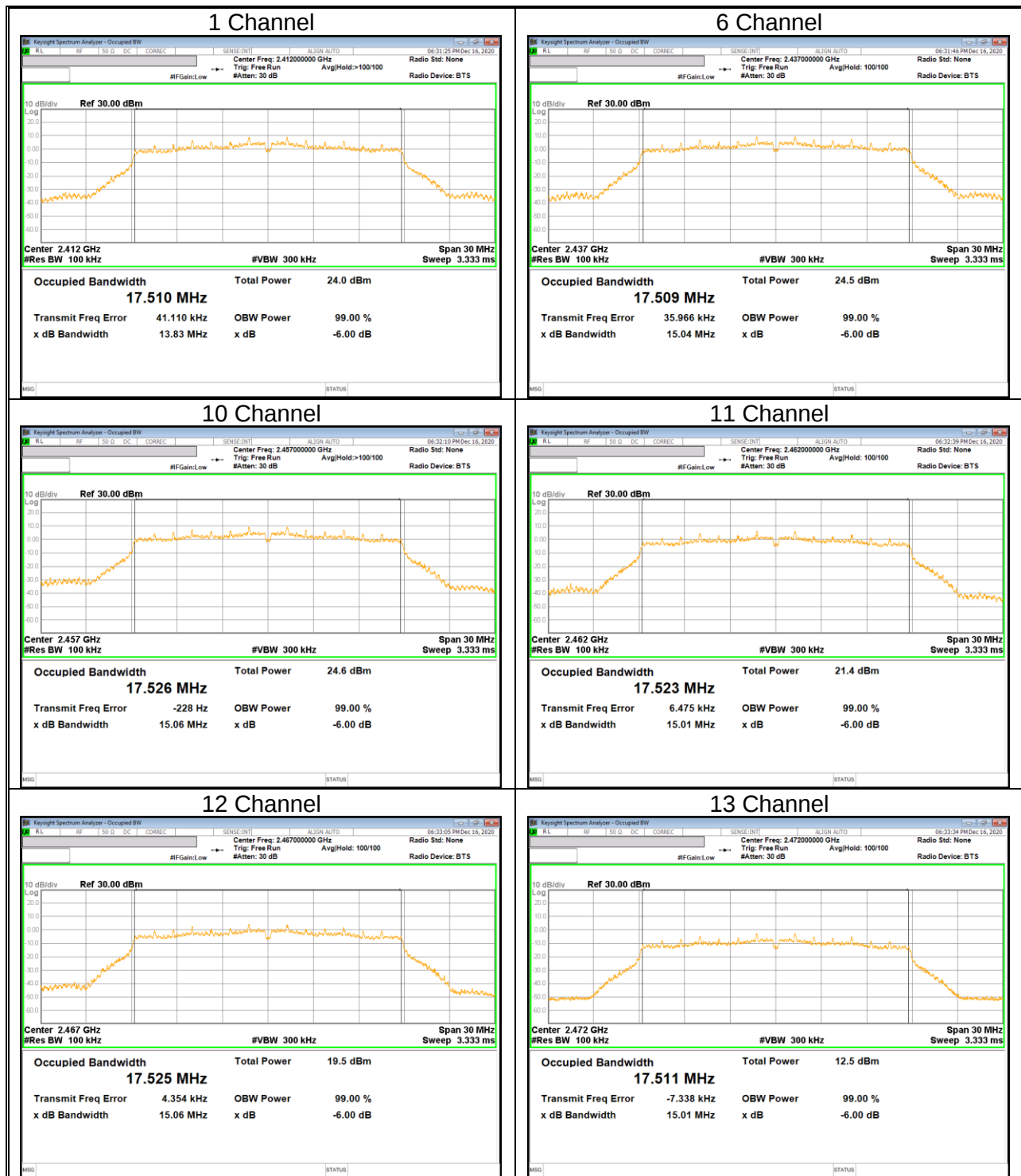
DTS 2.4 GHz IEEE 802.11b mode



DTS 2.4 GHz IEEE 802.11g mode



DTS 2.4 GHz IEEE 802.11n HT20 mode



9.3. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

Measurements perform using a wideband RF frame average power sensor.

The cable assembly insertion loss and duty cycle correction factor was entered as an offset in the power sensor to allow for direct reading of power.

Output power measurement was performed utilizing the 8.3.2.3 under KDB558074 D01 15.247 Meas Guidance – method AVGPM.

DIRECTIONAL ANTENNA GAIN

The antenna gain is -3.57 dBi.

9.3.1. TEST RESULTS

Included in Calculations of Corr'd Power			
Duty Cycle CF	802.11b SISO	0.00	dB
	802.11g SISO	0.00	dB
	802.11n HT20 SISO	0.00	dB

Calculation of Output Power result

→ Average Power = Meas. Power + Duty Cycle CF

- SISO Mode

Mode	Channel	Frequency [MHz]	Average Power [dBm]	Power Limit [dBm]
802.11b	1	2 412	18.93	30.00
	6	2 437	19.47	
	11	2 462	19.42	
	12	2 467	17.30	
	13	2 472	13.85	
Worst Case			19.47	
802.11g	1	2 412	17.23	30.00
	6	2 437	17.74	
	10	2 457	17.75	
	11	2 462	14.78	
	12	2 467	12.82	
	13	2 472	7.81	
Worst Case			17.75	
802.11n(HT20)	1	2 412	17.05	30.00
	6	2 437	17.59	
	10	2 457	17.53	
	11	2 462	14.54	
	12	2 467	12.65	
	13	2 472	5.48	
Worst Case			17.59	

9.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

RSS-247 (5.2) (b)

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

TEST PROCEDURE

Power Spectral Density was performed utilizing the section 8.4 under KDB558074 D01 15.247 Meas Guidance.

RESULTS

9.4.1. 802.11b/g/n HT20 MODE TEST RESULTS

Included in Calculations of Corr'd Power			
Duty Cycle CF	802.11b SISO	0.00	dB
	802.11g SISO	0.00	dB
	802.11n HT20 SISO	0.00	dB

Calculation of Output PSD result

1. 1TX : Corr'd PSD = Meas PSD + Duty Cycle CF

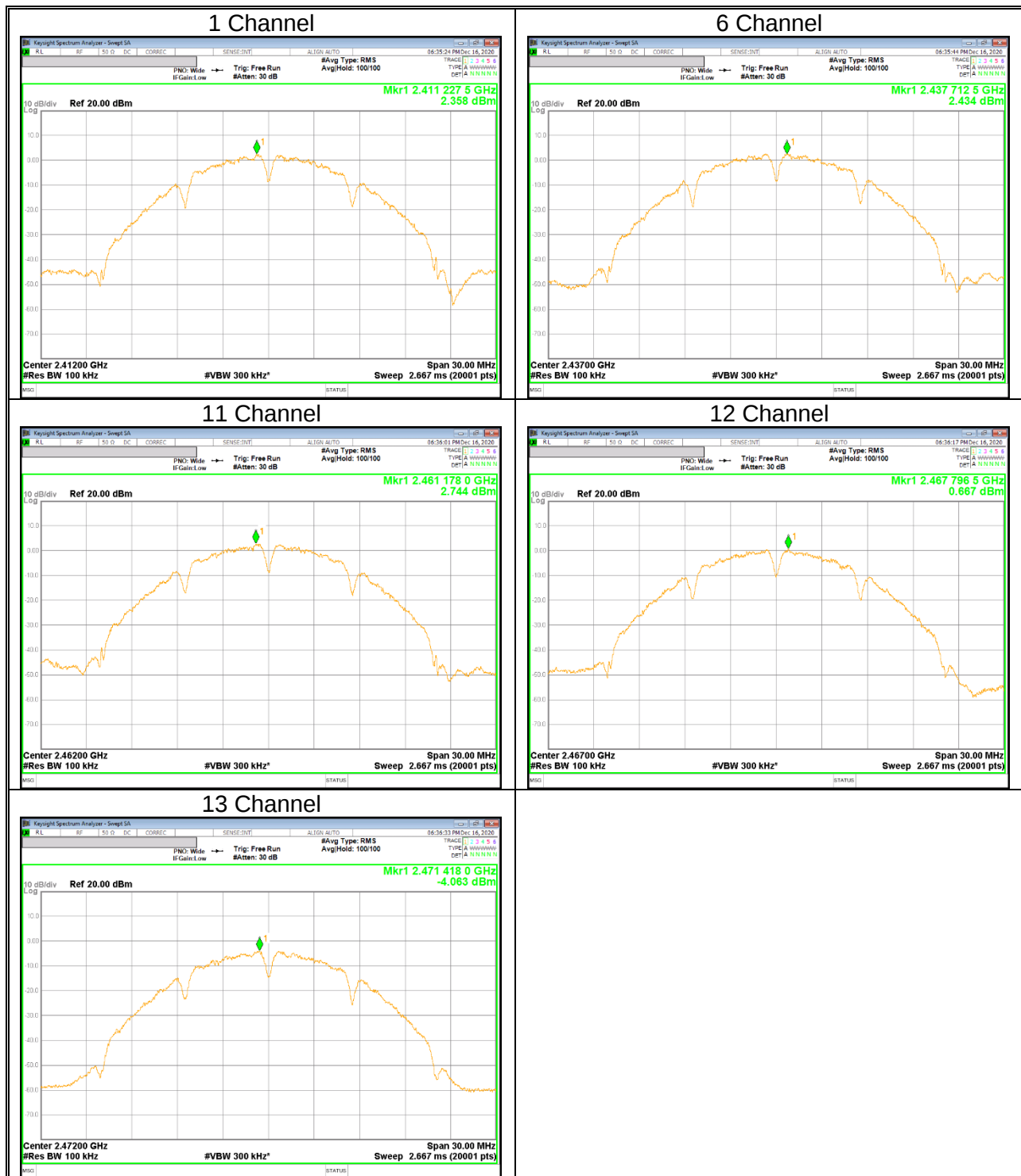
- SISO Mode

Mode	Channel	Frequency [MHz]	Meas PSD [dBm/100kHz]	Total Corr'd PSD [dBm/100kHz]	PSD Limit [dBm/3kHz]
802.11b	1	2 412	2.358	2.358	8.00
	6	2 437	2.434	2.434	
	11	2 462	2.744	2.744	
	12	2 467	0.667	0.667	
	13	2 472	-4.063	-4.063	
802.11g	1	2 412	-0.007	-0.007	
	6	2 437	0.598	0.598	
	10	2 457	0.505	0.505	
	11	2 462	-2.889	-2.889	
	12	2 467	-4.843	-4.843	
	13	2 472	-9.576	-9.576	
802.11n HT20	1	2 412	-0.724	-0.724	
	6	2 437	0.010	0.010	
	10	2 457	-0.267	-0.267	
	11	2 462	-3.473	-3.473	
	12	2 467	-5.203	-5.203	
	13	2 472	-11.952	-11.952	

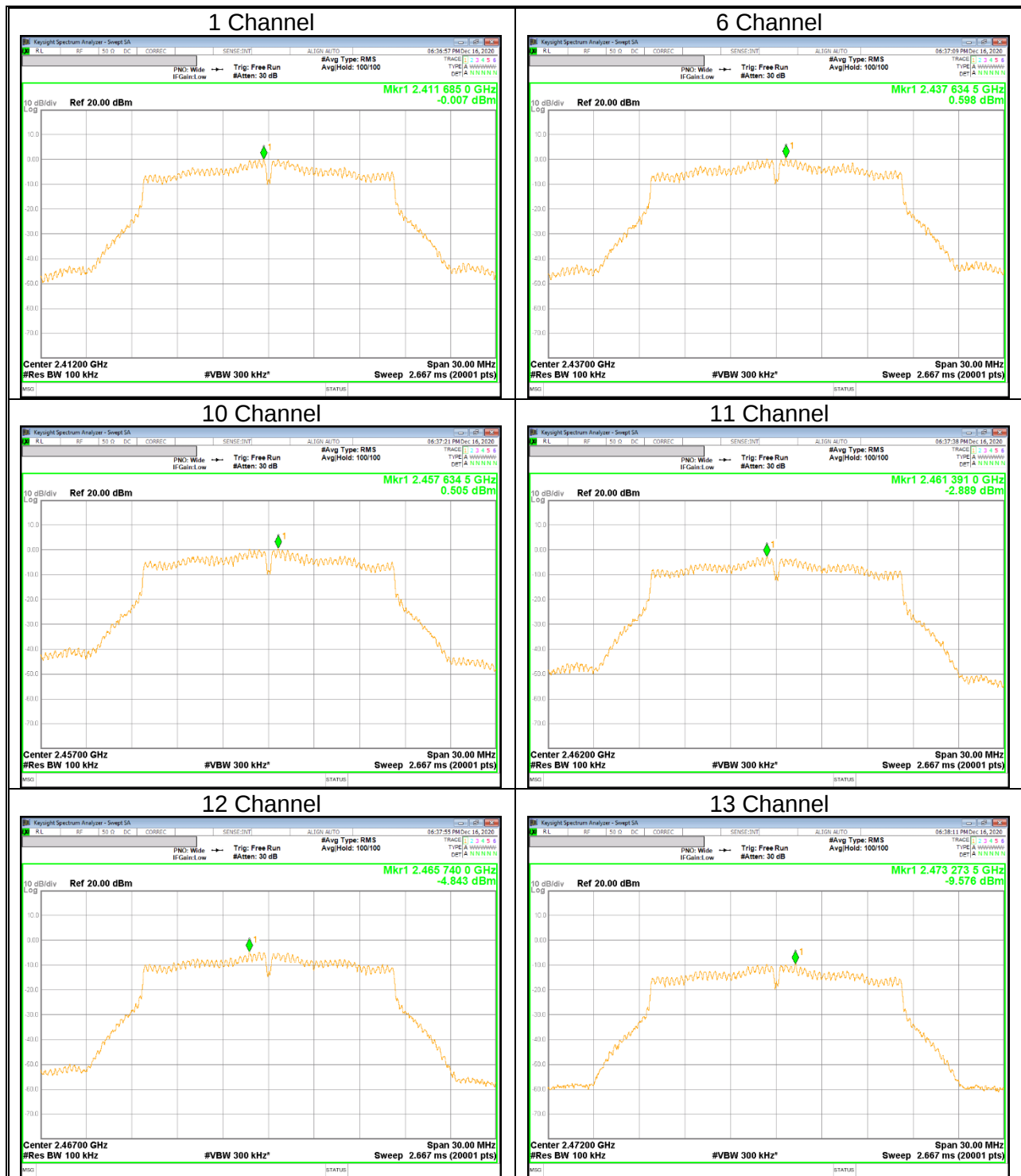
Note. RBW 100kHz measurement data is lower than 8dBm/3kHz limit.

9.4.2. PSD TEST PLOTS

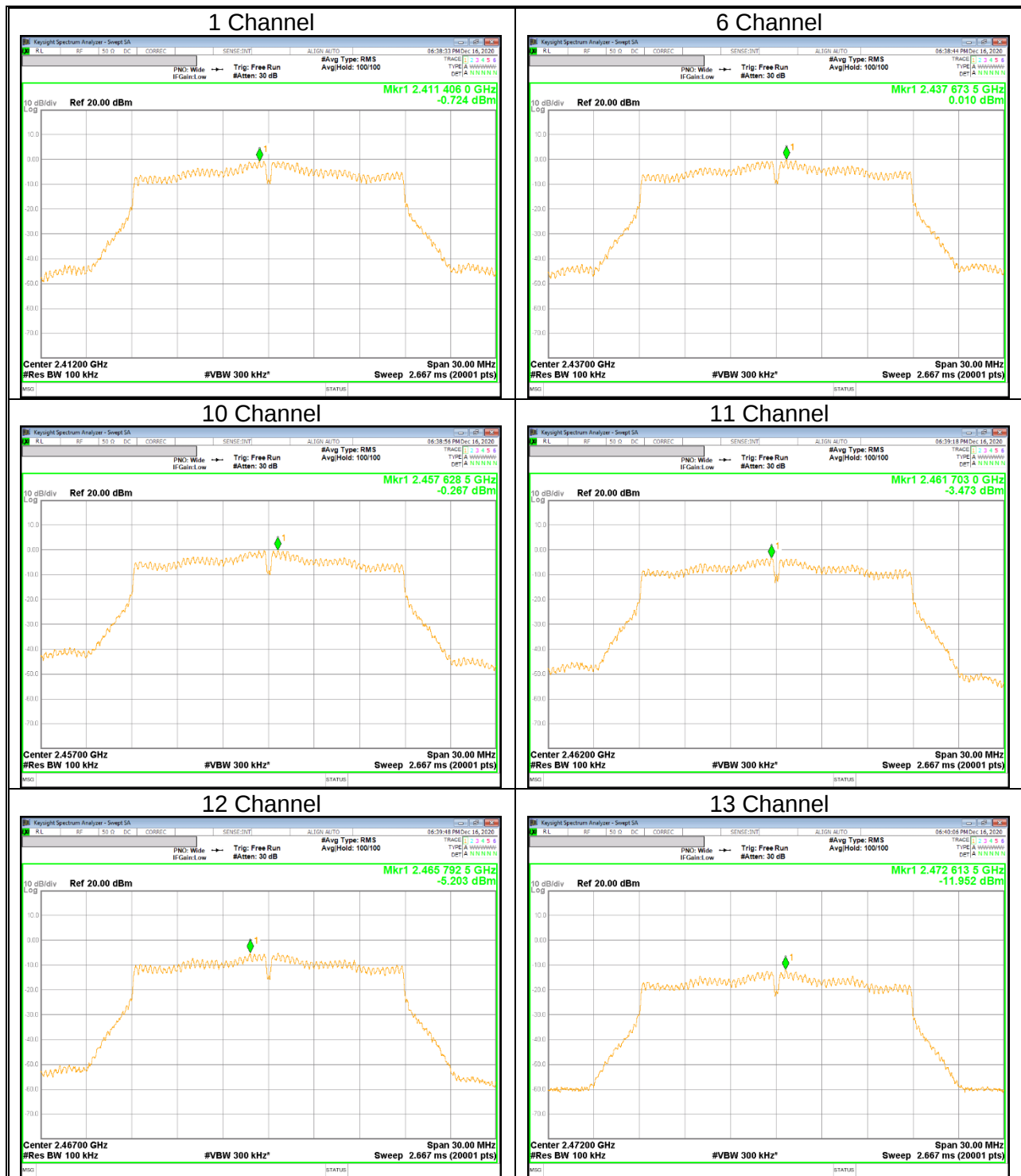
DTS 2.4 GHz IEEE 802.11b mode



DTS 2.4 GHz IEEE 802.11g mode



DTS 2.4 GHz IEEE 802.11n HT20 mode



9.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

RSS-247 5.5

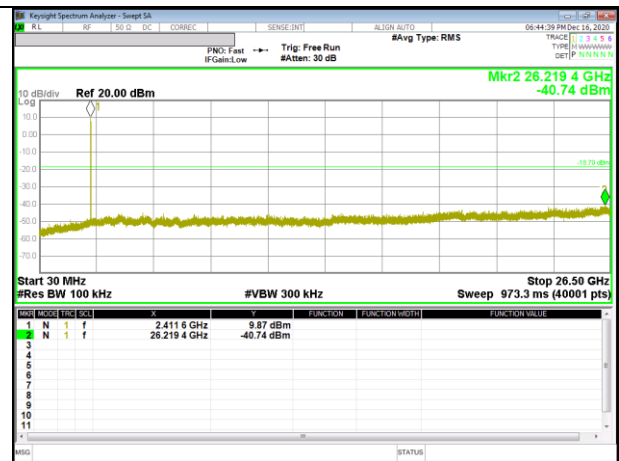
Output power was measured based on the use of average measurement.
Therefore, spurious emissions are required to be 30 dBc.

RESULTS

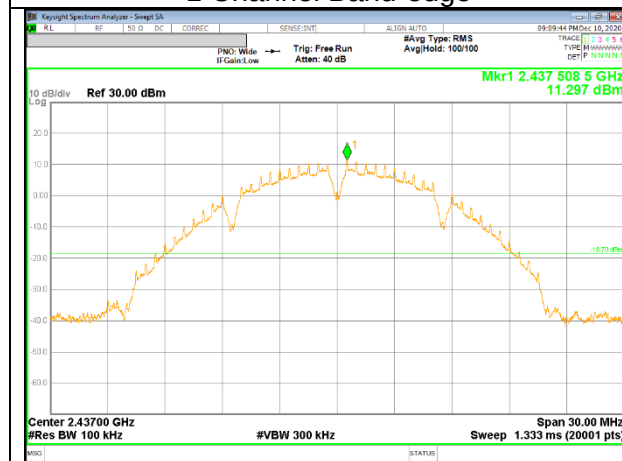
9.5.1. 802.11b MODE



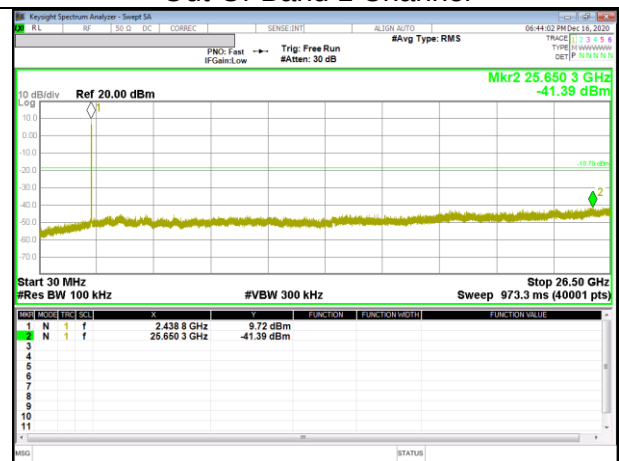
1 Channel Band-edge



Out-Of-Band 1 Channel



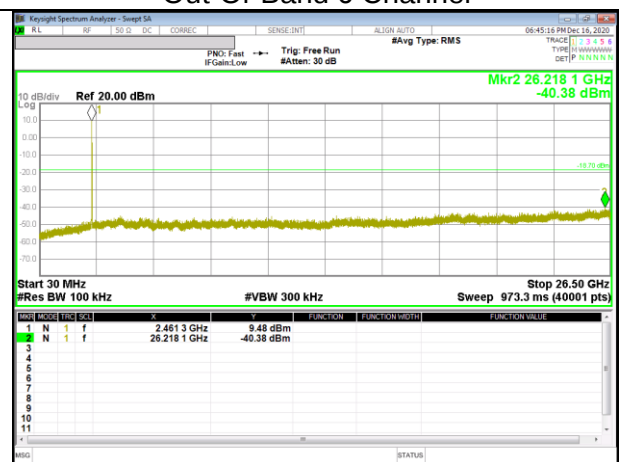
In-Band Reference Level



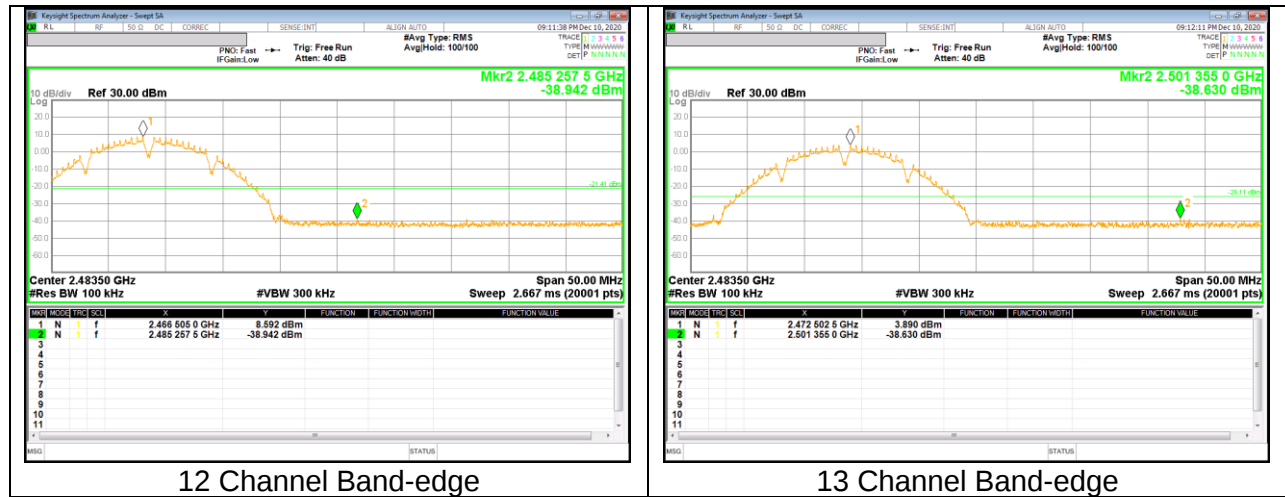
Out-Of-Band 6 Channel



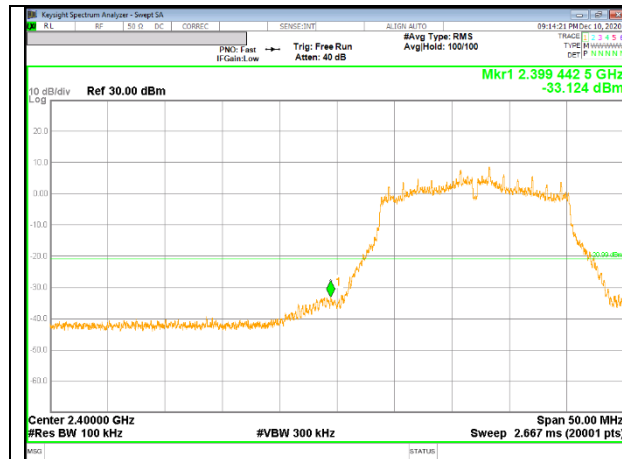
11 Channel Band-edge



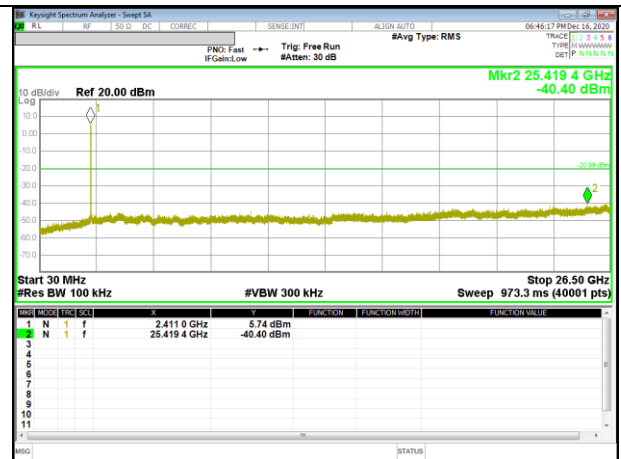
Out-Of-Band 11 Channel



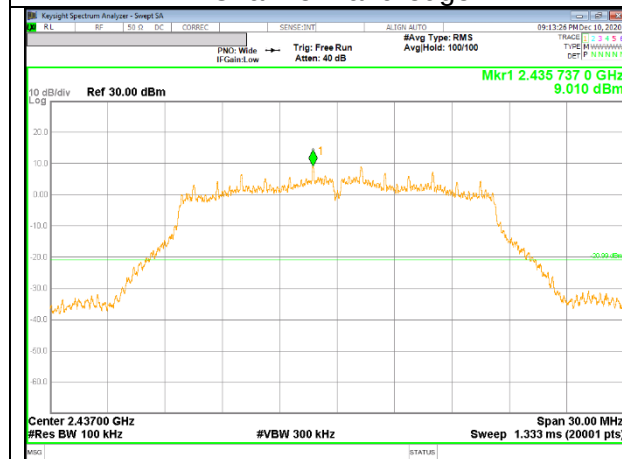
9.5.2. 802.11g MODE



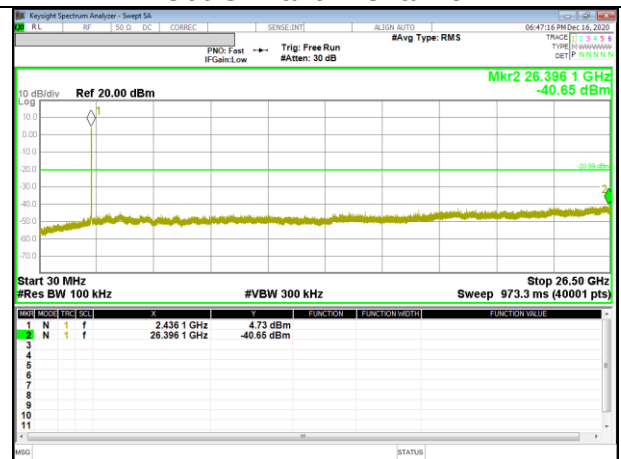
1 Channel Band-edge



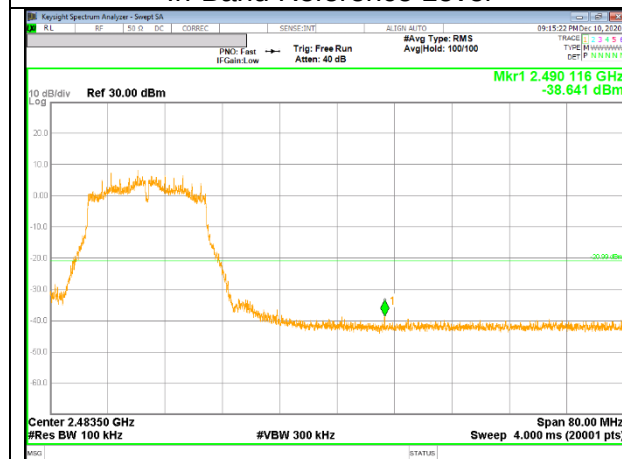
Out-Of-Band 1 Channel



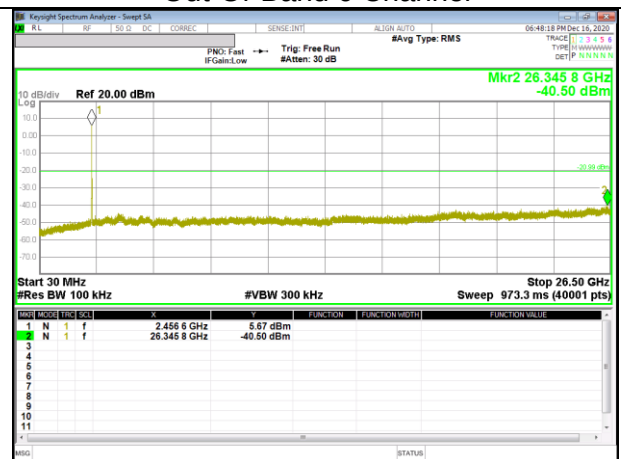
In-Band Reference Level



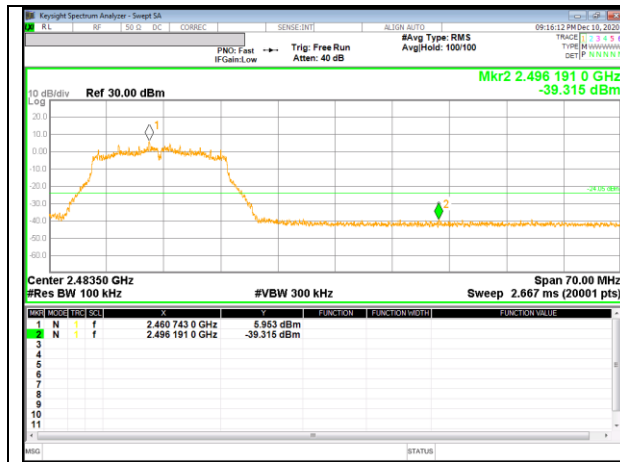
Out-Of-Band 6 Channel



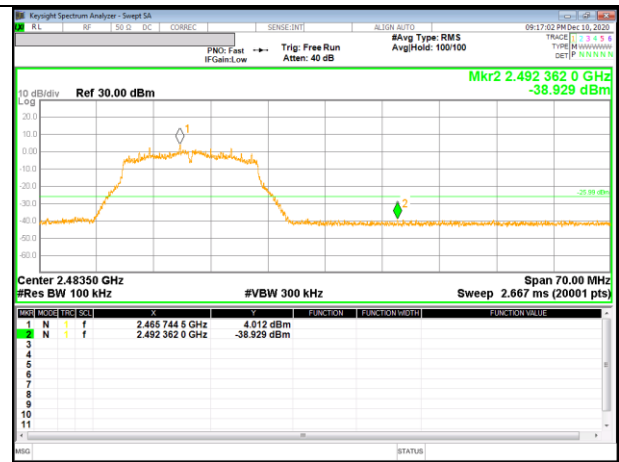
10 Channel Band-edge



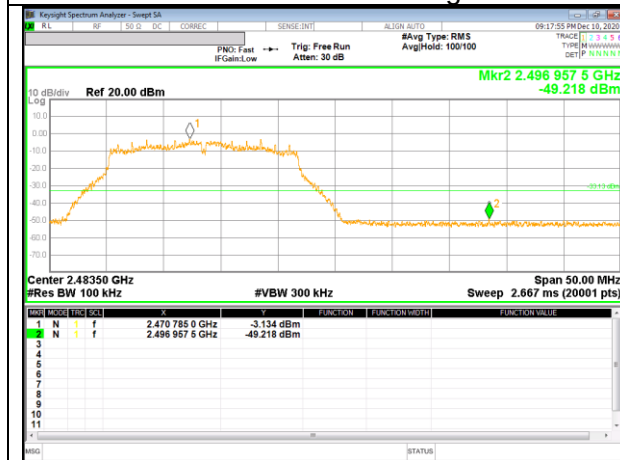
Out-Of-Band 10 Channel



11 Channel Band-edge

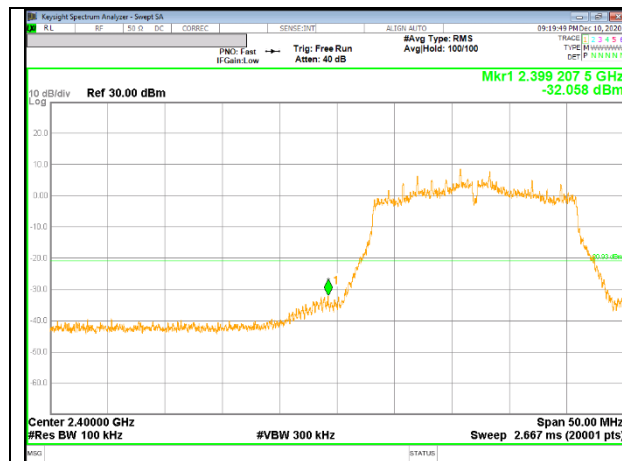


12 Channel Band-edge

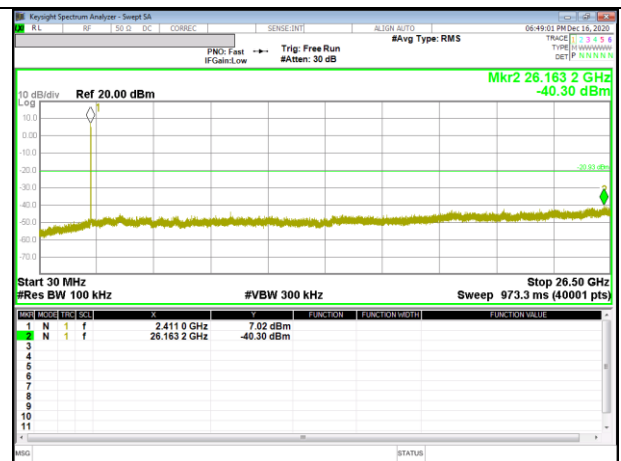


13 Channel Band-edge

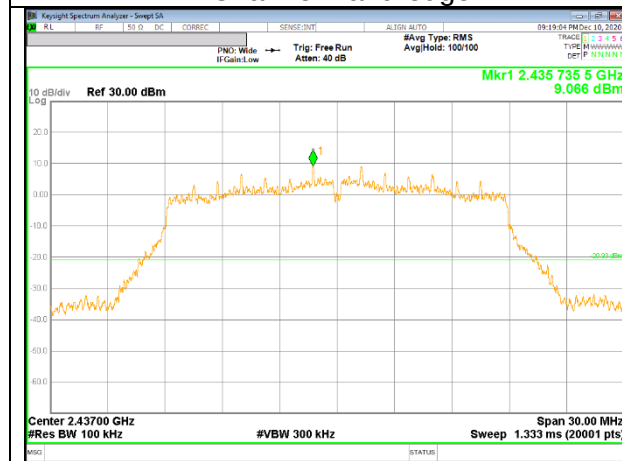
9.5.3. 802.11n HT20 MODE



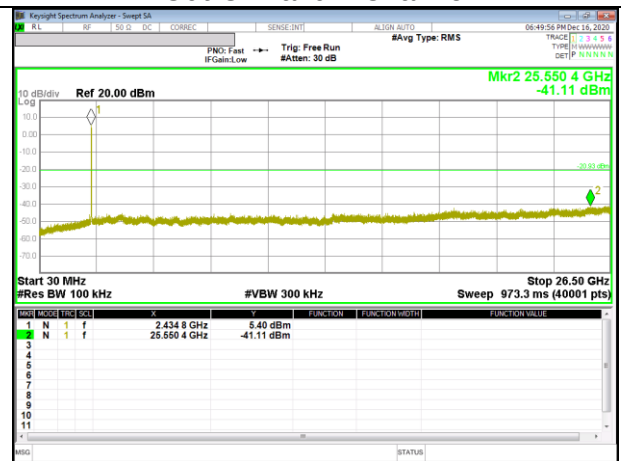
1 Channel Band-edge



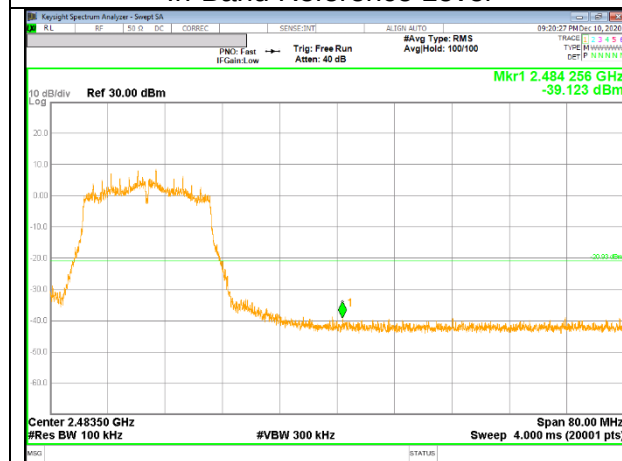
Out-Of-Band 1 Channel



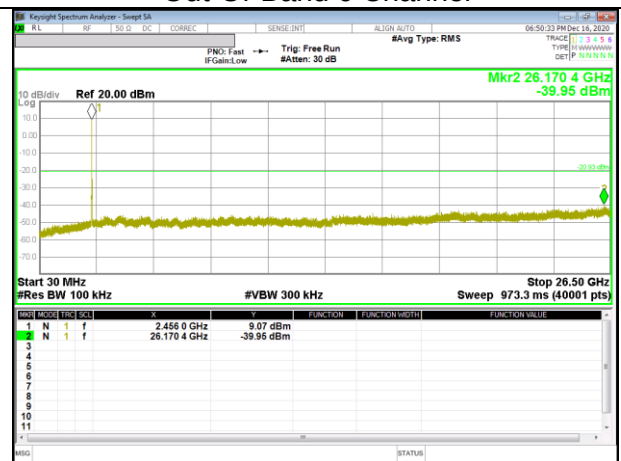
In-Band Reference Level



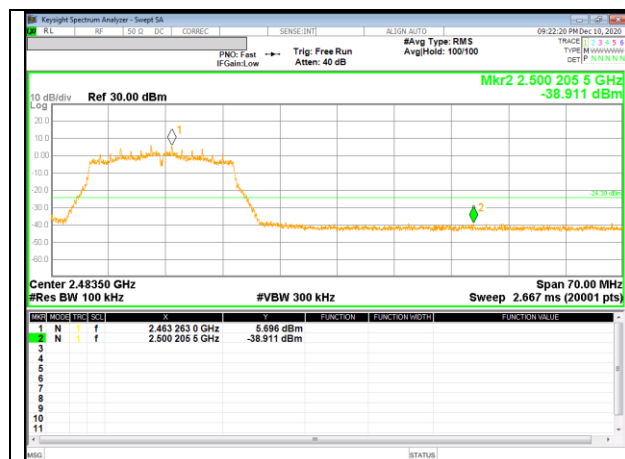
Out-Of-Band 6 Channel



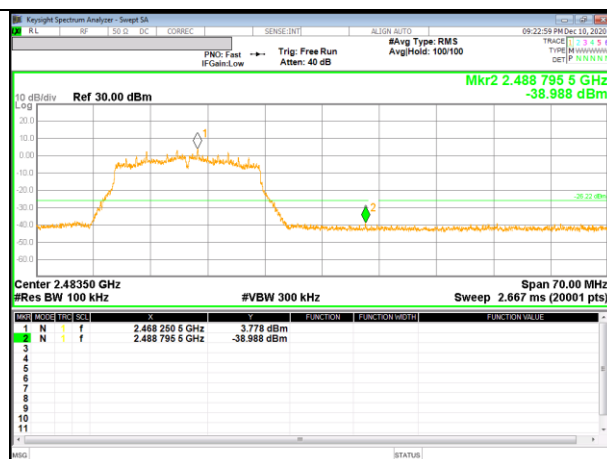
10 Channel Band-edge



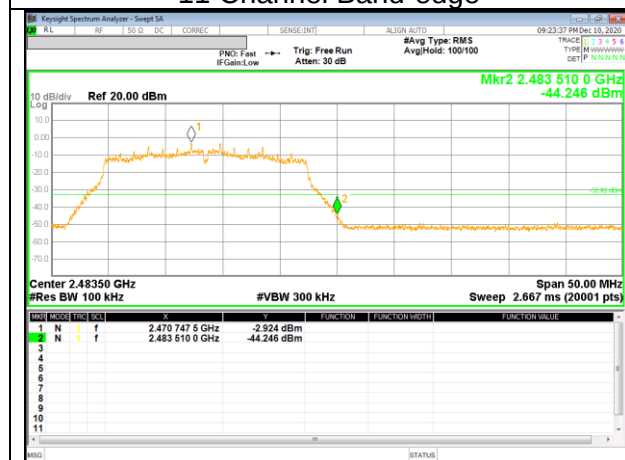
Out-Of-Band 10 Channel



11 Channel Band-edge



12 Channel Band-edge



13 Channel Band-edge

10. RADIATED TEST RESULTS

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.

FCC Part 15.205 (a) : Only spurious emissions are permitted in any of the frequency bands listed below :

MHz	MHz	MHz	MHz	GHz	GHz
0.009 – 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.52525	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	156.7 ~ 156.9	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	162.0125 ~	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	167.17	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	167.72 ~ 173.2	2655 ~ 2900		
8.291 ~ 8.294	37.5 ~ 38.25	240 ~ 285	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	322 ~ 335.4	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	399.90 ~ 410	3345.8 ~ 3358		
		608 ~ 614	3600 ~ 4400		
		960 ~ 1240			

▪ FCC Part 15.205(b) : The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1 GHz and 150 cm for above 1 GHz. 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; 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:

802.11b SISO mode = 0 dB (duty cycle > 98%);
802.11g SISO mode = 0 dB (duty cycle > 98%);
802.11n(HT20) SISO mode = 0 dB (duty cycle > 98%);

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 each applicable 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 9 kHz to 30 MHz; 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.

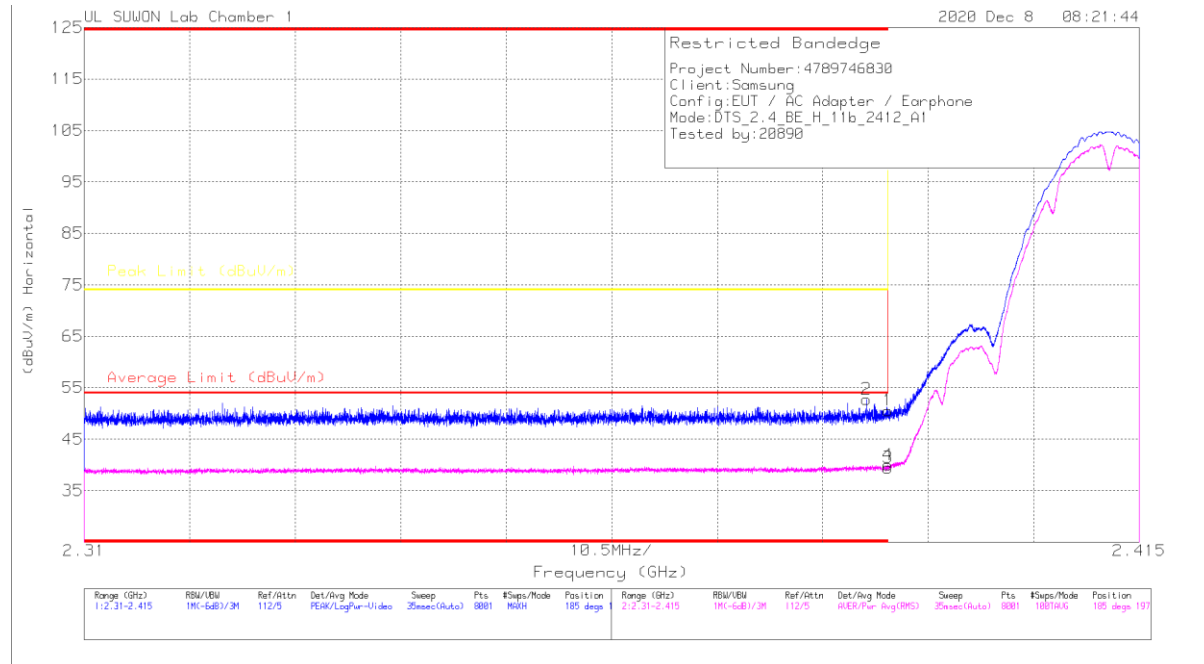
Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site.
Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the one of tests made in an open field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

10.1. TRANSMITTER ABOVE 1 GHz

10.1.1. TX ABOVE 1 GHz 802.11b MODE IN THE 2.4 GHz BAND

BANDEDGE (LOW CHANNEL, CH 1)

HORIZONTAL RESULT



Trace Markers

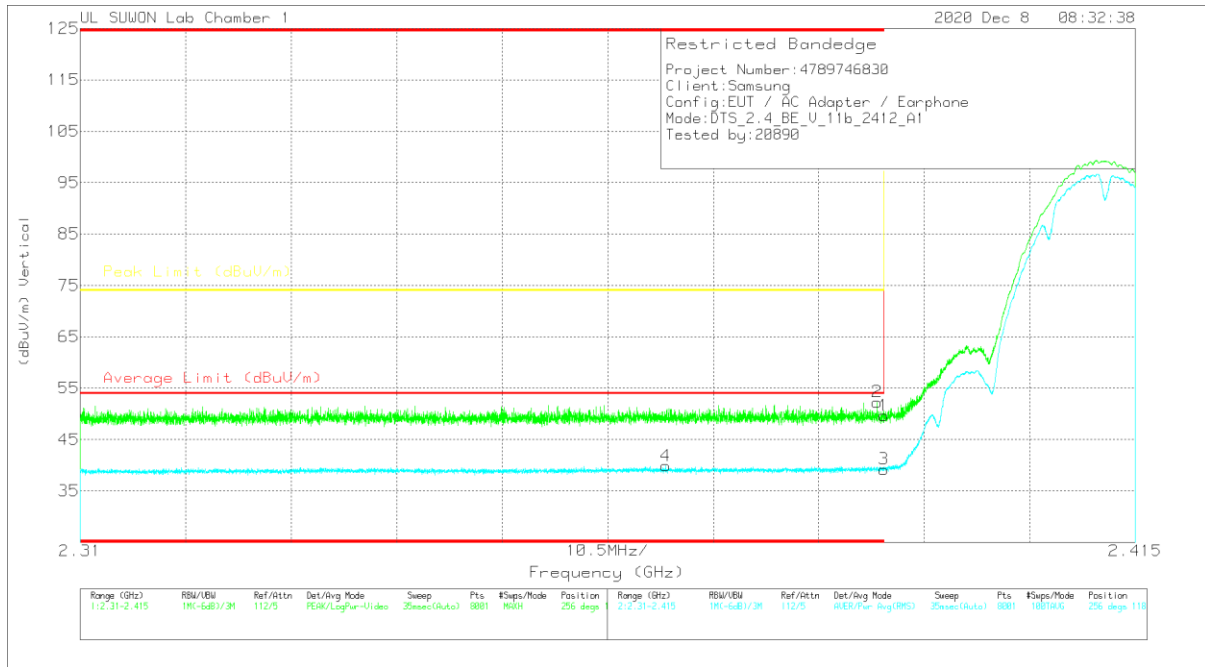
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	44.39	PK	31.8	-25.6	0	50.59	-	-	74	-23.41	185	197	H
2	* 2.38786	46.44	PK	31.8	-25.6	0	52.74	-	-	74	-21.26	185	197	H
3	* 2.39	33.27	RMS	31.8	-25.6	0	39.47	54	-14.53	-	-	185	197	H
4	* 2.38996	33.81	RMS	31.8	-25.6	0	40.01	54	-13.99	-	-	185	197	H

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

PK - Peak detector

RMS - RMS detection

VERTICAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meas Reading (dBuV)	Det	3117_00168717	10dB_ATT(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Altitude (m)	Height (cm)	Polarity
1	* 2.39	43.47	PK		-25.6	0	49.67	-	-	74	-24.33	256	118	V
2	* 2.38931	45.99	PK		-25.5	0	52.29	-	-	74	-21.71	256	118	V
3	* 2.39	33.01	RMS		-25.6	0	39.21	54	-14.79	-	-	256	118	V
4	* 2.38826	33.66	RMS		-25.5	0	39.86	54	-14.14	-	-	256	118	V

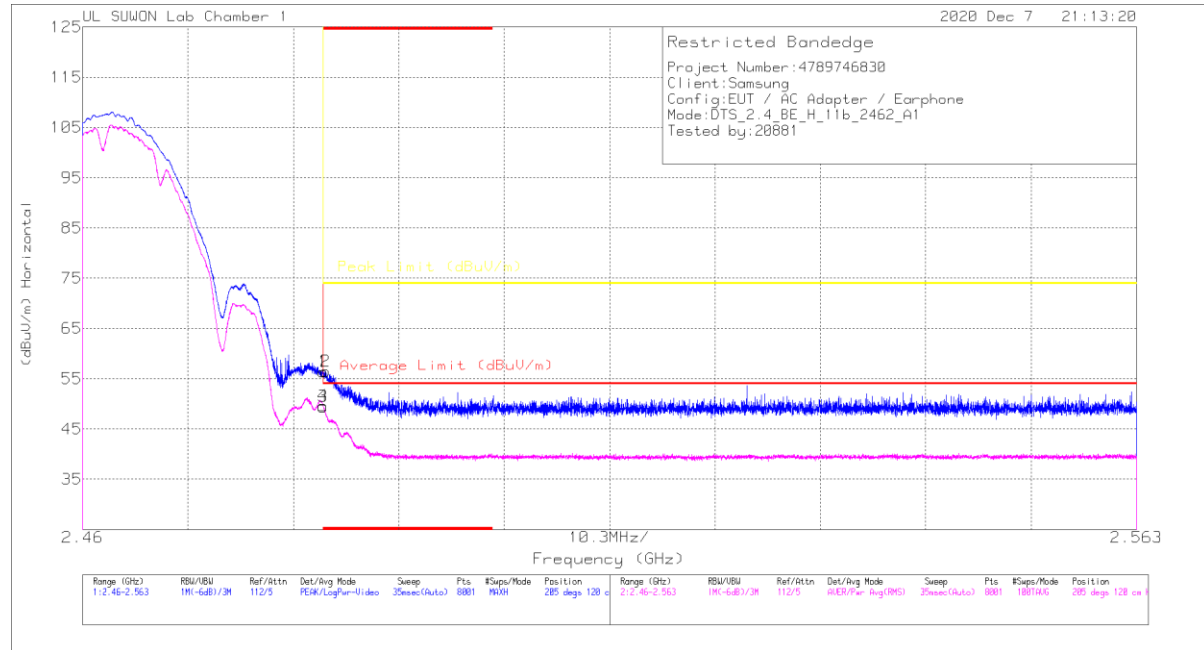
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK - Peak detector

RMS - RMS detection

BANDEDGE (HIGH CHANNEL, CH 11)

HORIZONTAL RESULT

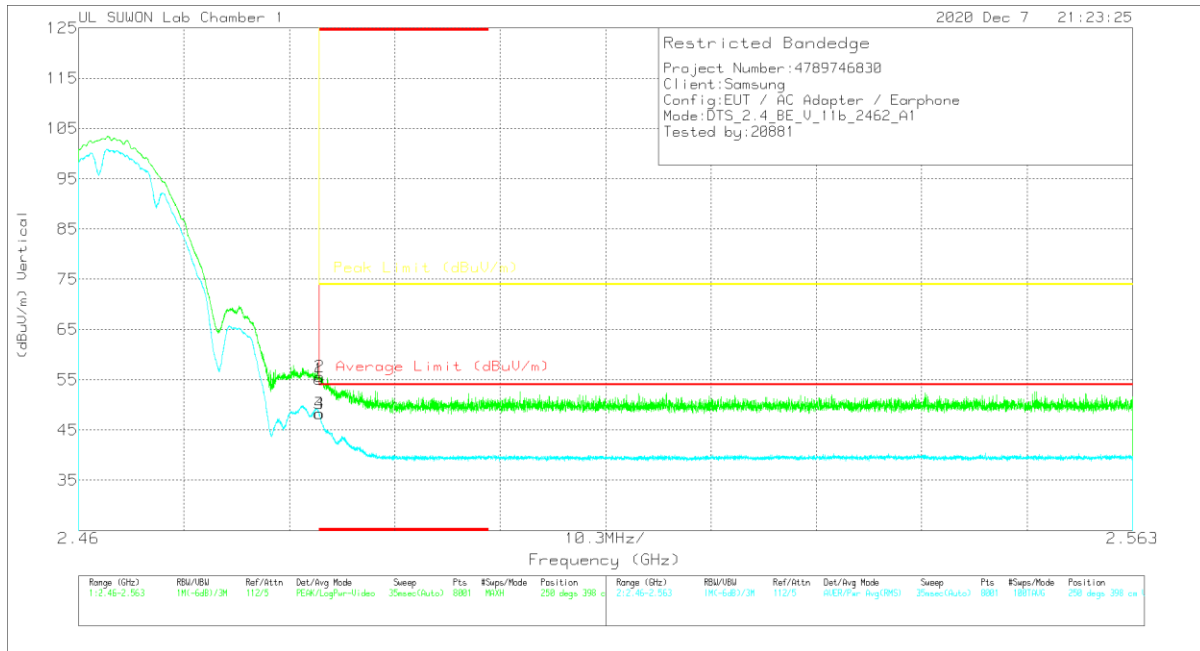


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Altitude (Degs)	Height (cm)	Polarity
1	* 2.48351	49.72	PK	32	-25.3	0	56.42	-	-	74	-17.58	205	120	H
2	* 2.48375	49.82	PK	32	-25.3	0	56.52	-	-	74	-17.48	205	120	H
3	* 2.48351	42.75	RMS	32	-25.3	0	49.45	54	-4.55	-	-	205	120	H
4	* 2.48352	42.94	RMS	32	-25.3	0	49.64	54	-4.36	-	-	205	120	H

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

VERTICAL RESULT



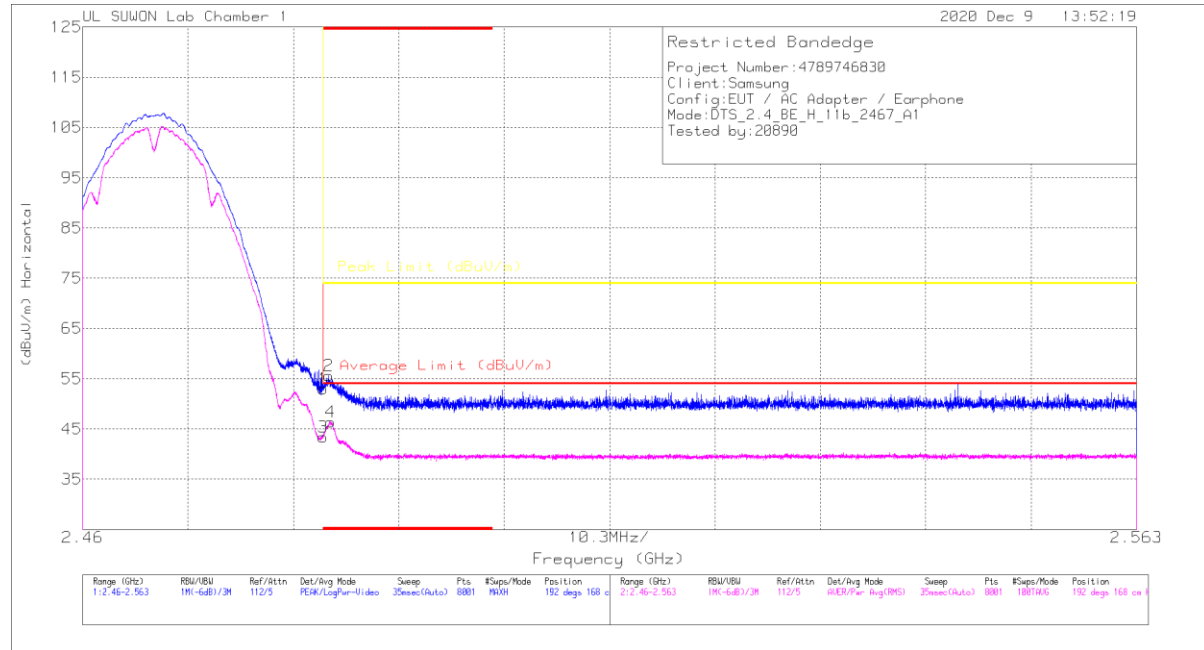
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168727	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	* 2.48351	48.42	PK	32	-25.3	0	55.12	-	-	74	-18.88	250	398	V
2	* 2.48355	48.96	PK	32	-25.3	0	55.66	-	-	74	-18.34	250	398	V
3	* 2.48351	41.57	RMS	32	-25.3	0	48.27	54	-5.73	-	-	250	398	V
4	* 2.48354	41.56	RMS	32	-25.3	0	48.26	54	-5.74	-	-	250	398	V

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

BANDEDGE (HIGH CHANNEL, CH 12)

HORIZONTAL RESULT

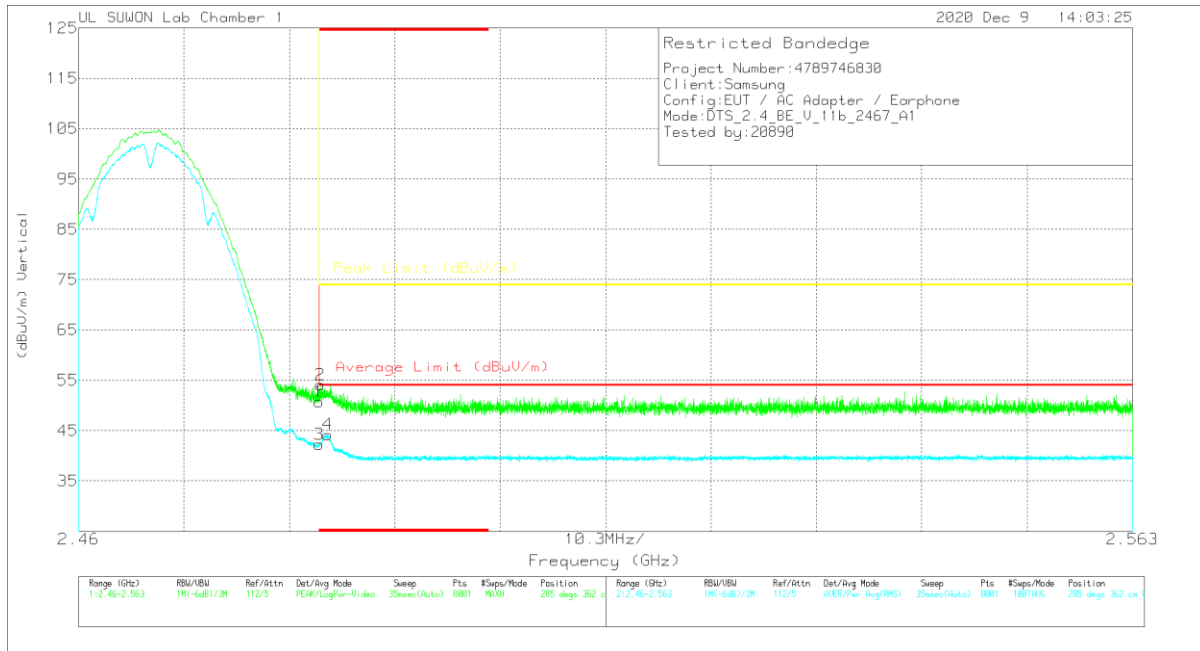


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Altitude (deg)	Height (cm)	Polarity
1	* 2.48351	46.28	PK	32	-25.3	0	52.98	-	-	74	-21.02	192	168	H
2	* 2.48402	48.92	PK	32	-25.3	0	55.62	-	-	74	-18.38	192	168	H
3	* 2.48351	36.7	RMS	32	-25.3	0	43.4	54	-10.6	-	-	192	168	H
4	* 2.48423	39.69	RMS	32	-25.3	0	46.39	54	-7.61	-	-	192	168	H

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

VERTICAL RESULT



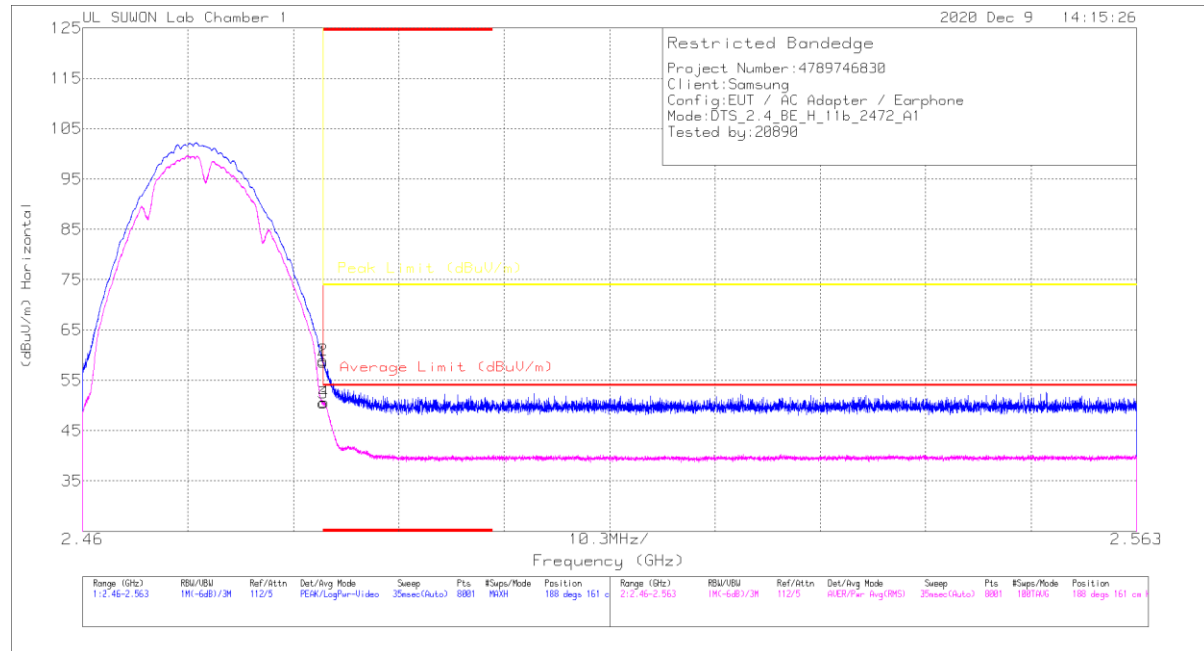
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168727	10dB_ATT(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	44.06	PK	32	-25.3	0	50.76	-	-	74	-23.24	285	362	V
2	* 2.48361	47.41	PK	32	-25.3	0	54.11	-	-	74	-19.89	285	362	V
3	* 2.48351	35.53	RMS	32	-25.3	0	42.23	54	-11.77	-	-	285	362	V
4	* 2.48433	37.41	RMS	32	-25.2	0	44.21	54	-9.79	-	-	285	362	V

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

BANDEDGE (HIGH CHANNEL, CH 13)

HORIZONTAL RESULT

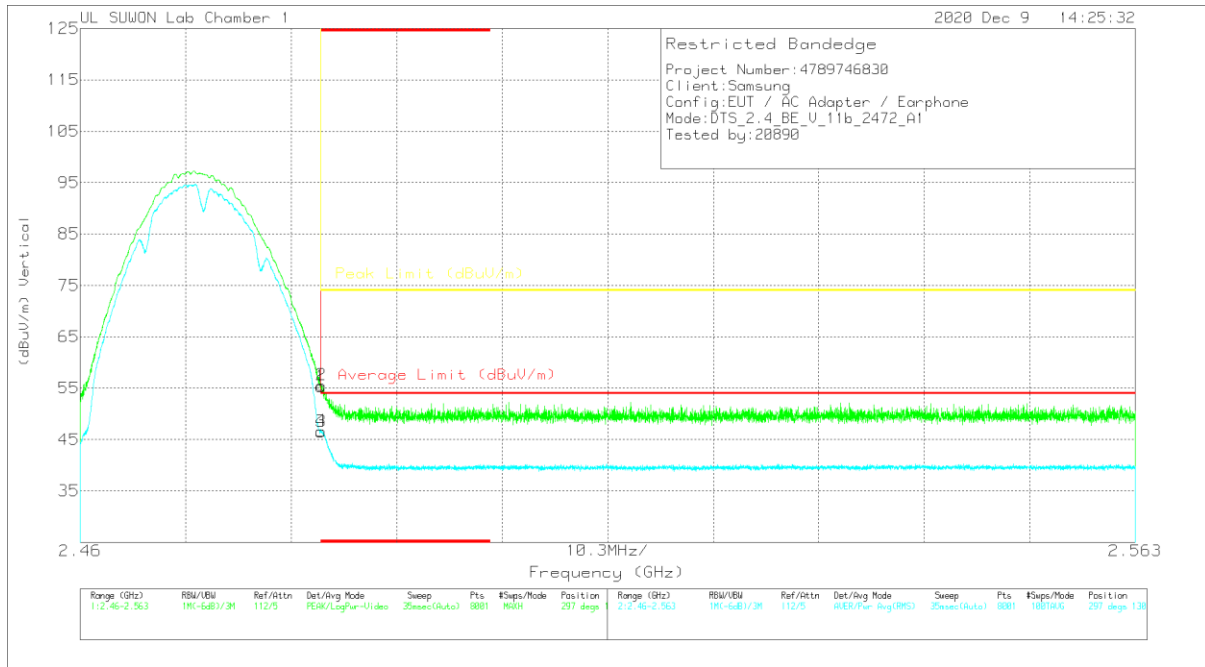


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Altitude (m)	Height (cm)	Polarity
1	* 2.48351	51.96	PK	32	-25.3	0	58.66	-	-	74	-15.34	188	161	H
2	* 2.48352	52.25	PK	32	-25.3	0	58.95	-	-	74	-15.05	188	161	H
3	* 2.48351	43.8	RMS	32	-25.3	0	50.5	54	-3.5	-	-	188	161	H
4	* 2.48359	43.88	RMS	32	-25.3	0	50.58	54	-3.42	-	-	188	161	H

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

VERTICAL RESULT



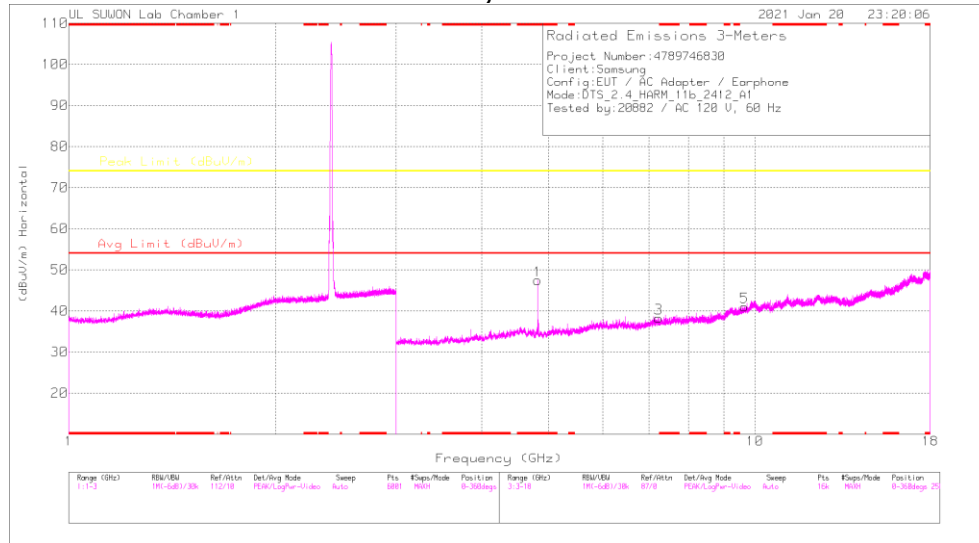
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Altitude (Degs)	Height (cm)	Polarity
1	* 2.48351	45.64	PK	32	-25.3	0	55.34	-	-	74	-18.66	297	130	V
2	* 2.48354	48.9	PK	32	-25.3	0	55.6	-	-	74	-18.4	297	130	V
3	* 2.48351	39.87	RMS	32	-25.3	0	46.57	54	-7.43	-	-	297	130	V
4	* 2.48352	39.95	RMS	32	-25.3	0	46.65	54	-7.35	-	-	297	130	V

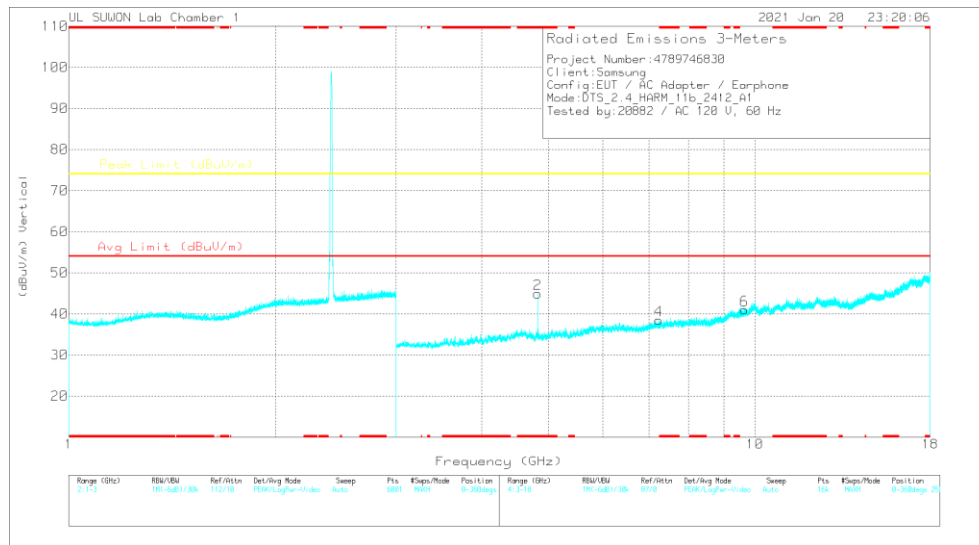
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK - Peak detector
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL, CH 1 RESULTS



HORIZONTAL



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.

Radiated Emissions

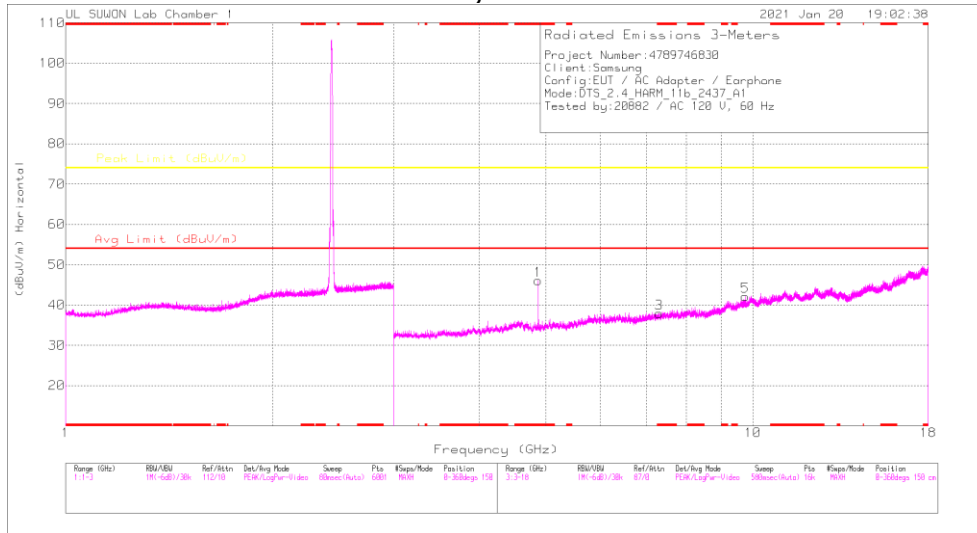
Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.82406	49.29	PK2	34.1	-31.3	0	52.09	-	-	74	-21.91	185	107	H
* 4.824	45.73	MAV1	34.1	-31.3	0	48.53	54	-5.47	-	-	185	107	H
* 4.824	47.78	PK2	34.1	-31.3	0	50.58	-	-	74	-23.42	297	115	V
* 4.824	43.49	MAV1	34.1	-31.3	0	46.29	54	-7.71	-	-	297	115	V
7.23483	38.6	PK2	35.8	-27.6	0	46.8	-	-	74	-27.2	360	100	H
7.23454	38.48	PK2	35.8	-27.5	0	46.78	-	-	74	-27.22	360	100	V
9.6497	35.62	PK2	37.2	-23.1	0	49.72	-	-	74	-24.28	360	100	H
9.64674	35.66	PK2	37.2	-23.1	0	49.76	-	-	74	-24.24	360	100	V

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

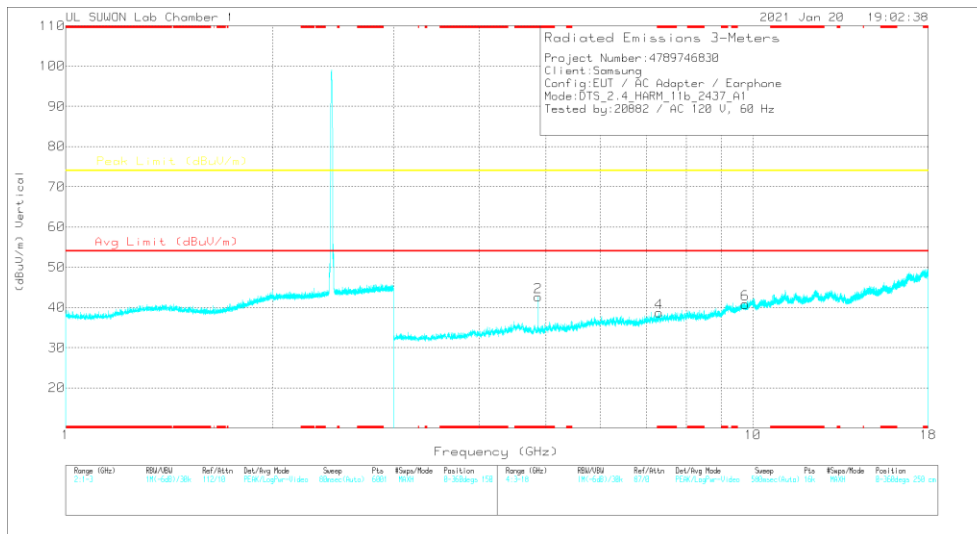
PK2 - KDB558074 Method: Maximum Peak

MAV1 - KDB558074 Option 1 Maximum RMS Average

MID CHANNEL, CH 6 RESULTS



HORIZONTAL



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.

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_0016871 7	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
* 4.87386	47.94	PK2	34.1	-31.3	0	50.74	-	-	74	-23.26	184	151	H
* 4.87396	43.71	MAV1	34.1	-31.3	0	46.51	54	-7.49	-	-	184	151	H
* 4.87394	45.59	PK2	34.1	-31.3	0	48.39	-	-	74	-25.61	258	350	V
* 4.874	39.87	MAV1	34.1	-31.3	0	42.67	54	-11.33	-	-	258	350	V
* 7.31056	38.27	PK2	35.8	-27.4	0	46.67	-	-	74	-27.33	360	100	H
* 7.31001	38.95	PK2	35.8	-27.4	0	47.35	-	-	74	-26.65	360	100	V
9.7536	35.24	PK2	37.4	-23.7	0	48.94	-	-	74	-25.06	360	100	H
9.75628	35.48	PK2	37.4	-23.7	0	49.18	-	-	74	-24.82	360	100	V

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