FCC CFR47 PART 15 SUBPART C

DTS Wireless LAN

CERTIFICATION TEST REPORT

FOR

GSM/WCDMA/LTE Phone + BT/BLE, DTS b/g/n and ANT+

MODEL NUMBER : SM-G611M/DS. SM-G611M

FCC ID: A3LSMG611M

REPORT NUMBER: 4788312281-E1V3

ISSUE DATE: FEB 26, 2018

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

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ACCREDITED
Testing Laboratory

TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	02/20/18	Initial issue	Junwhan Lee
V2	02/22/18	Updated to address TCB's question	Junwhan Lee
V3	02/26/18	Revised section 1.4	Junwhan 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 b/g/n and ANT+

MODEL NUMBER: SM-G611M/DS, SM-G611M

SERIAL NUMBER: R38K102TCNM, R38K102TCPK (RADIATED, Spot check):
R38K102TD1Y (CONDUCTED, Spot check):
R38K102WFSP (RADIATED, Original);
R38K102WTZW (CONDUCTED. Original)

DATE TESTED: JAN 22, 2018 - JAN 30, 2018 (Original)
FEB 01, 2018 – FEB 09, 2018 (Spot check)

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.

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1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMG611MT, 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: A3LSMG611M shares the same enclosure and circuit board as FCC ID: A3LSMTG611MT. The WLAN circuitry and layout are identical between these two units.
The WLAN antennas and surrounding circuitry are the same between these two units.

After confirming through preliminary radiated emissions that the performance of the FCC ID: A3LSMG611MT remains representative of FCC ID: A3LSMG611M. The test data of FCC ID: A3LSMG611MT being submitted for this application to cover WLAN features.

Due to difference of charger, radiated emission under 1GHz and AC line conducted test were performed newly.

Also SM-G611M/DS and SM-G611M are same hardware, but for different number of SIM card slot.SM-G611M has one slot and SM-G611M/DS is dual SIM version.
SM-G611M/DS used for the spot check tests.

1.3. SPOT CHECK VERIFICATION DATA

Band	Test Item	Mode	Frequency	Test Limit	Original model	Spot check model	Deviation	Remark
					SM-G611MT/DS Results	SM-G611M/DS Results		
					FCC ID : A3LSMG611MT	FCC ID : A3LSMG611M		
DTS WLAN (2.4GHz)	Band Edge	802.11b	2472 MHz	54 dBuV/m	42.72 dBuV/m	46.78 dBuV/m	-0.94 dB	
	RSE	802.11b	2462 MHz	54 dBuV/m	37.18 dBuV/m	40.12 dBuV/m	2.94 dB	3rd Harmonic
	Band Edge	802.11g	2462 MHz	54 dBuV/m	50.87 dBuV/m	51.4 dBuV/m	0.53 dB	
	RSE	802.11g	2462 MHz	74 dBuV/m	40.66 dBuV/m	40.88 dBuV/m	0.22 dB	Noise floor level
	Band Edge	802.11n	2472 MHz	54 dBuV/m	50.30 dBuV/m	48.12 dBuV/m	-2.18 dB	
	RSE	802.11n	2437 MHz	74 dBuV/m	40.97 dBuV/m	40.71 dBuV/m	-0.26 dB	Noise floor level

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

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1.4. REFERENCE DETAIL

Reference application that contains the reused reference data.

Equipment Class	Reference FCC ID	Type Grant/Permissive Change	Reference Application	Folder Test/RF Exposure	Report Tittle / Section
DTS	A3LSMG611MT	Grant	4788312331-E1V3	Test	FCC Report DTS WLAN All sections (Except Section 10.3, 11)
			4788312331-E2V3	Test	FCC Report BLE All sections (Except Section 10.3, 11)
DSS	A3LSMG611MT	Grant	4788312331-E3V3	Test	FCC Report BT / All sections (Except Section 10.3, 11)
PCE	A3LSMG611MT	Grant	4788312331-E5V3	Test	FCC Report WWAN / All sections (Except Conducted Output Power)

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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. KDB 484596 D01 Referencing Test Data DR01-42712
5. 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

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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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

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%.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

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

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	17.38	54.70
	802.11g	16.34	43.05
	802.11n HT20	15.21	33.19

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antennas, with a antenna's maximum gain of -2.1 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 Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

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

802.11b mode: 1 Mbps
802.11g mode: 6 Mbps
802.11n HT20 mode: MCS0

Note : All radiated and power line conducted tests were performed connected with earphone and charger for evaluation of worst case mode.

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5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA50JWS	DK6J523VS-A -E	N/A
Data Cable	SAMSUNG	ECB-DU68WE	N/A	N/A
Earphone	SAMSUNG	EHS61ASFWE	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
2	Audio	2	Mini-Jack	Unshielded	1.2m	N/A

TEST SETUP

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

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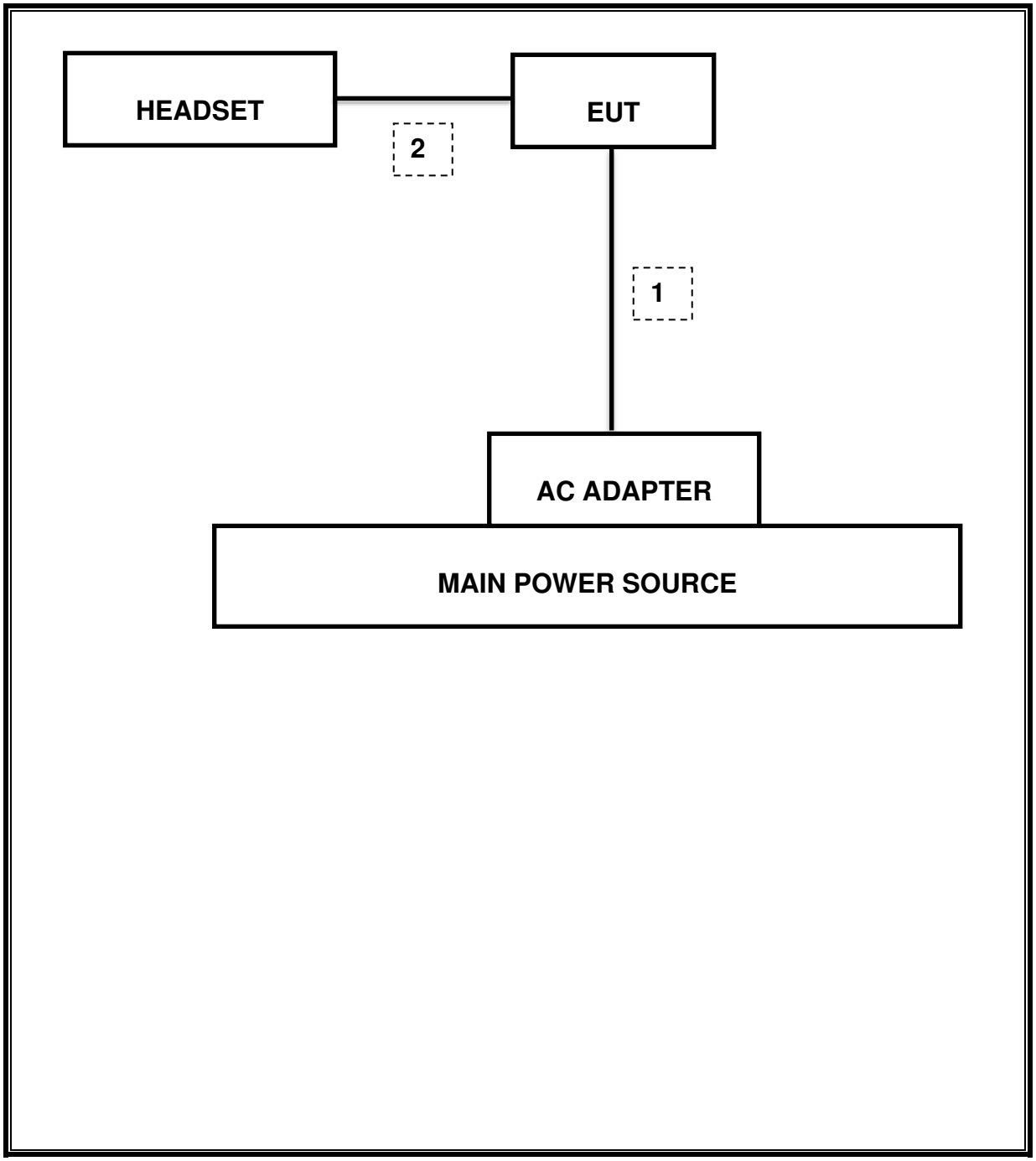
SETUP DIAGRAM FOR TESTS



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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	04-14-19
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	11-29-18
Antenna, Horn, 18 GHz	ETS	3117	00205959	05-31-19
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	PASTERNACK	PE7087-10	A001	08-08-18
Attenuator	PASTERNACK	PE7087-10	A008	08-08-18
Attenuator	PASTERNACK	PE7087-10	2	08-10-18
Attenuator	PASTERNACK	PE7087-10	A009	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	

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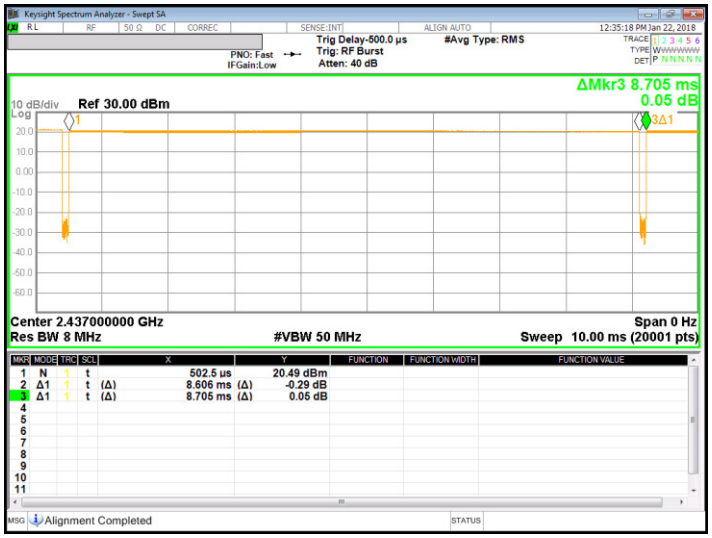
7. REFERENCE MEASUREMENT RESULTS

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						
802.11b	8.606	8.705	0.989	98.9%	0.00	0.010
802.11g	1.428	1.528	0.935	93.5%	0.29	0.700
802.11n HT20	1.336	1.437	0.930	93.0%	0.32	0.749



[802.11b]

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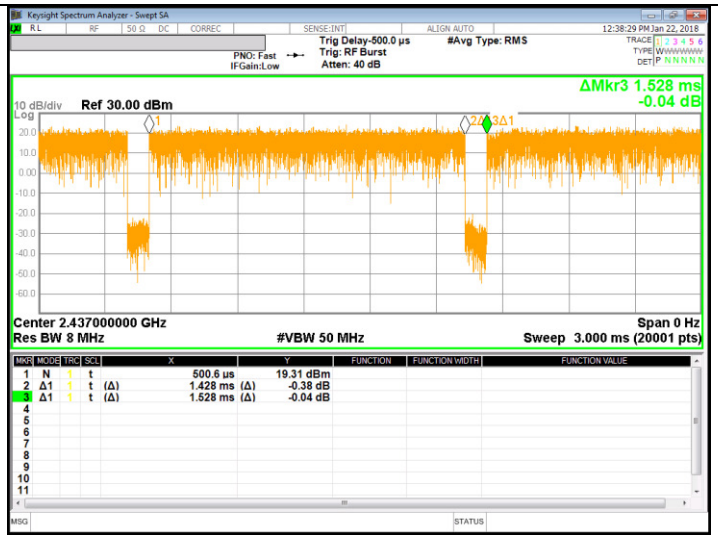

[802.11g]

[802.11n]

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8. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result	Worst Case
15.247 (a)(2)	Occupied Band width (6dB)	>500KHz	Conducted	Pass	7.991 MHz
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-30dBc		Pass	-27.609 dBm
15.247 (b)(3)	TX conducted output power	<30dBm		Pass	17.38 dBm
15.247 (e)	PSD	<8dBm		Pass	-13.523 dBm
15.207 (a)	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass	43.36 dBuV (Pk)
15.205, 15.209	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass	50.87 dBuV/m (Av)

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9. ANTENNA PORT TEST RESULTS

9.1. 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 to100KHz, the VBW >= 3 x RBW, peak detector and max hold.

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RESULTS

9.1.1. 802.11b MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Minimum Limit [MHz]
Low	2412	7.991	0.5
Mid	2437	8.546	0.5
High	2462	9.536	0.5
12	2467	9.008	0.5
13	2472	8.566	0.5
Worst		7.991	0.5

9.1.2. 802.11g MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Minimum Limit [MHz]
Low	2412	15.070	0.5
Mid	2437	15.520	0.5
High	2462	15.100	0.5
12	2467	14.440	0.5
13	2472	14.450	0.5
Worst		14.440	0.5

9.1.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Minimum Limit [MHz]
Low	2412	13.840	0.5
Mid	2437	14.980	0.5
High	2462	15.000	0.5
12	2467	15.100	0.5
13	2472	15.010	0.5
Worst		13.840	0.5

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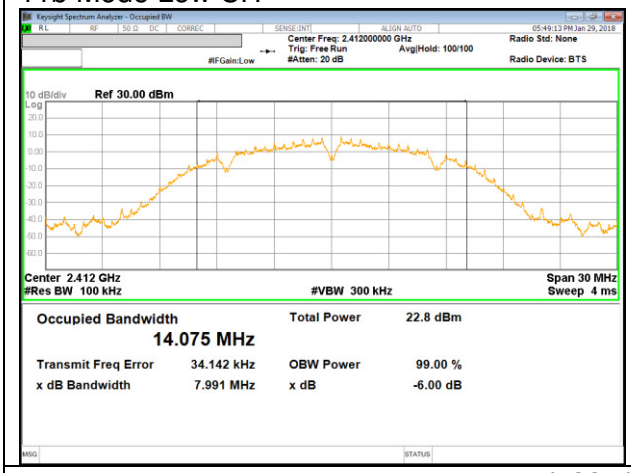
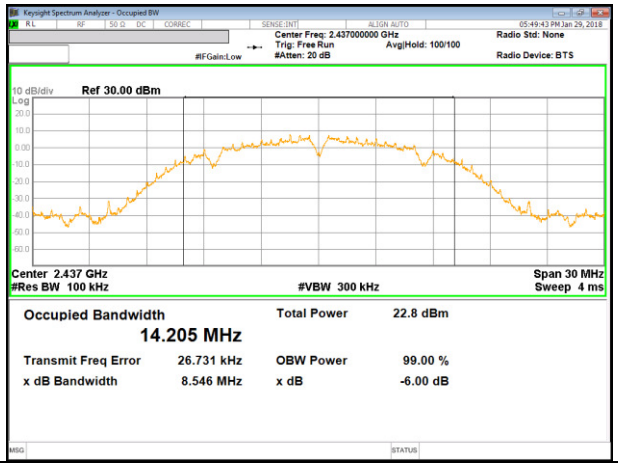
9.1.4. 6 dB BANDWIDTH PLOTS

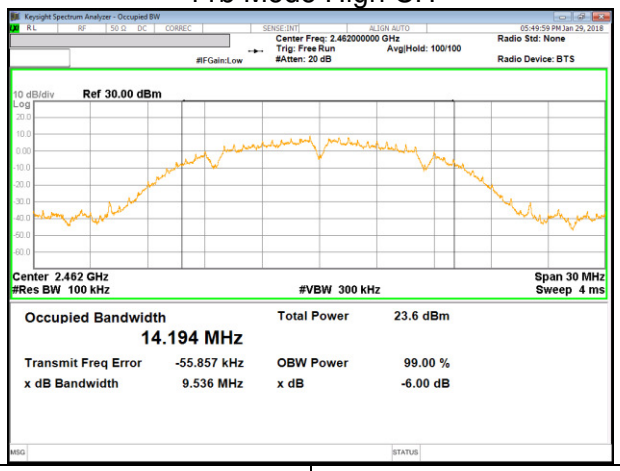
11b Mode Low CH



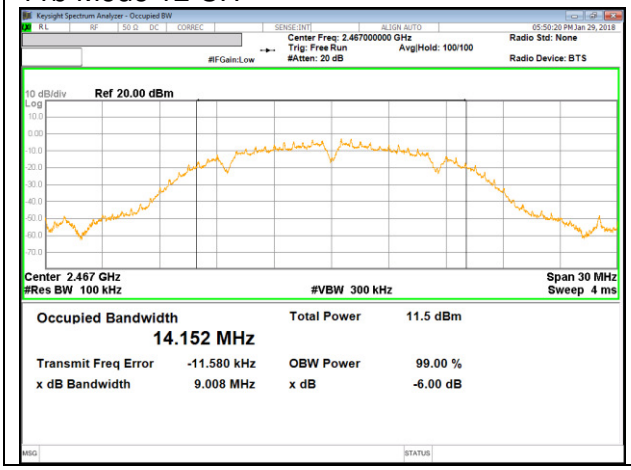
11b Mode Middle CH



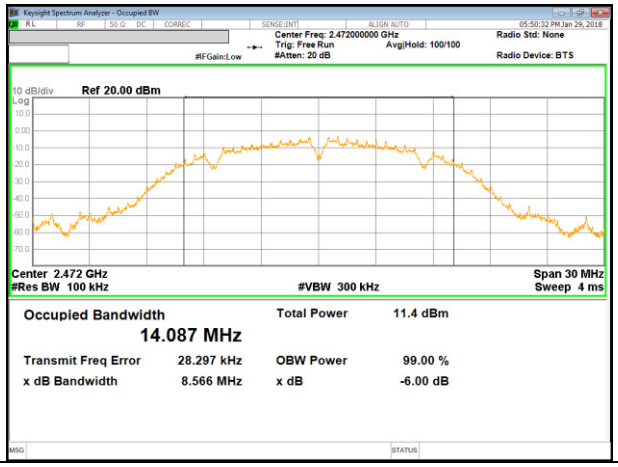
11b Mode High CH



11b Mode 12 CH



11b Mode 13 CH



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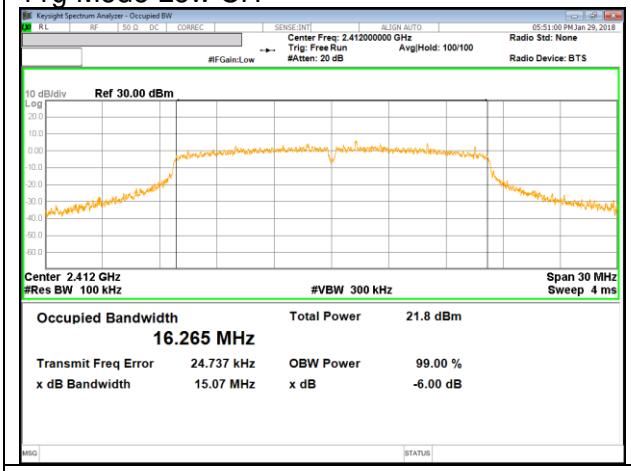
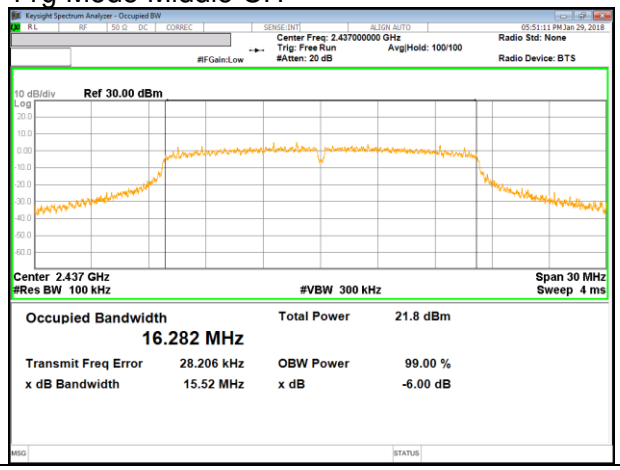
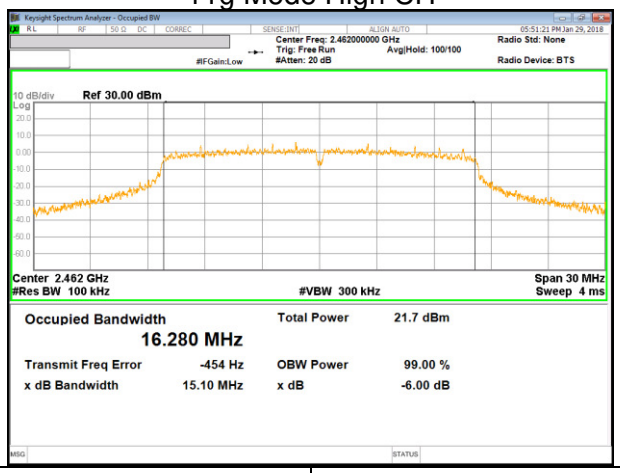
11g Mode Low CH



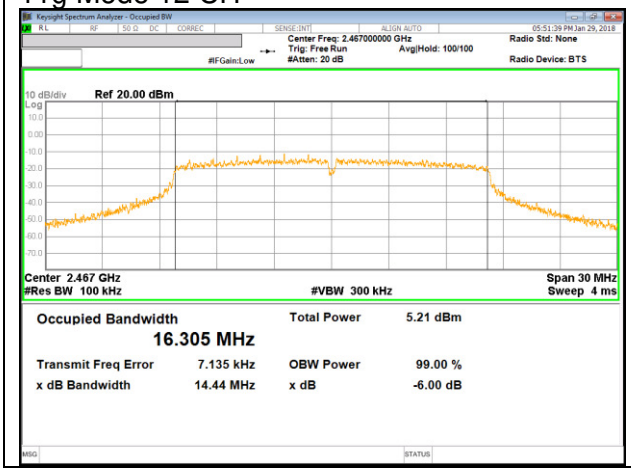
11g Mode Middle CH



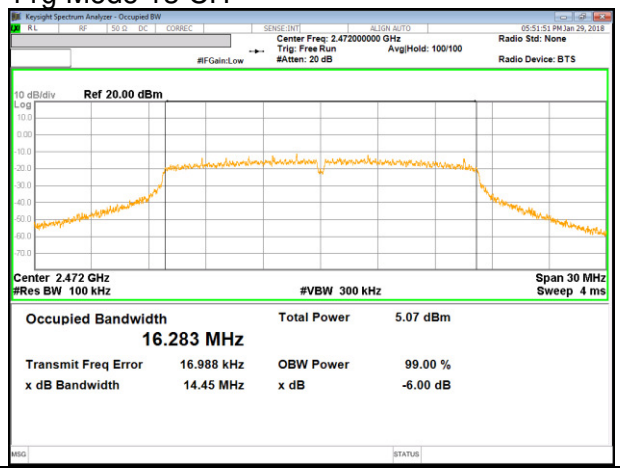
11g Mode High CH



11g Mode 12 CH



11g Mode 13 CH



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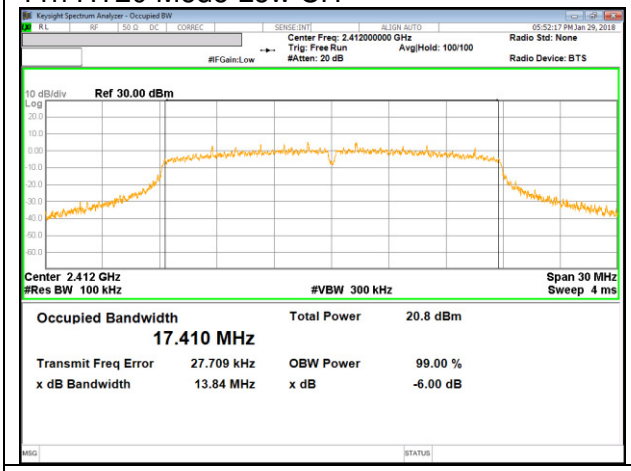
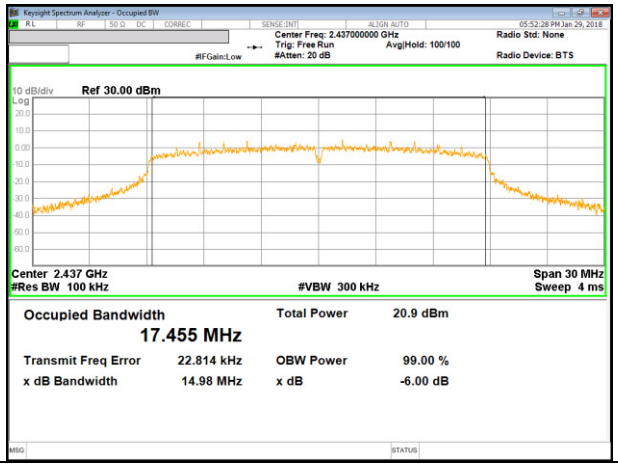
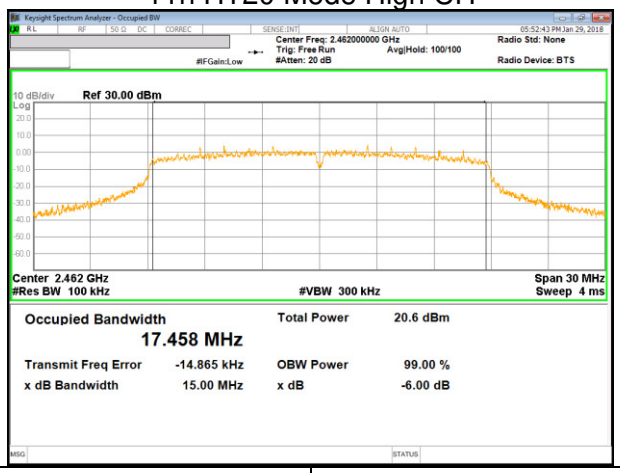
11n HT20 Mode Low CH



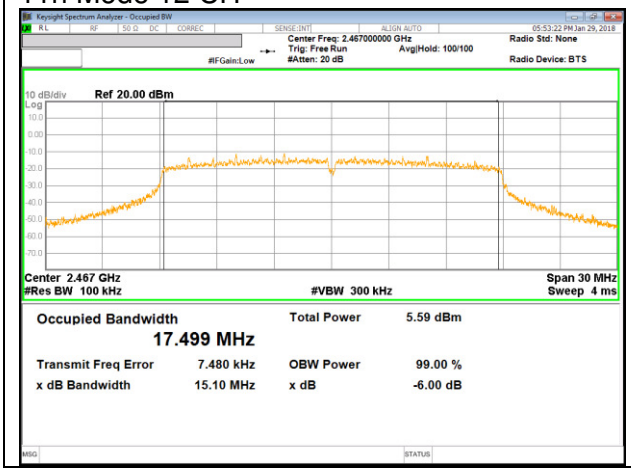
11n HT20 Mode Middle CH



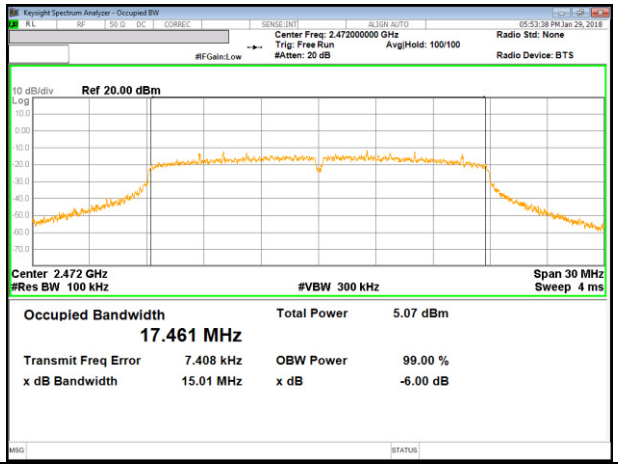
11n HT20 Mode High CH



11n Mode 12 CH



11n Mode 13 CH



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9.2. OUTPUT POWER

LIMITS

FCC §15.247

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.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

TEST PROCEDURE

The transmitter output is connected to a power meter.

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

Output power measurement was performed utilizing the “§9.2.3.1 AVGPM” under KDB558074 D01 DTS Meas Guidance v04.

Duty cycle correction factor is already added to the average output power results for duty cycle factor < 98%. (802.11g, 802.11n mode)

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RESULTS

9.2.1. 802.11b MODE IN THE 2.4 GHz BAND

Limits

Channel	Frequency [MHz]	Directional Gain Primary [dBi]	FCC Power Limit [dBm]	Max Power [dBm]
Low	2412	-2.10	30.00	30.00
Mid	2437	-2.10	30.00	30.00
High	2462	-2.10	30.00	30.00
12	2467	-2.10	30.00	30.00
13	2472	-2.10	30.00	30.00

Results

Channel	Frequency [MHz]	Meas Power [dBm]	Total Power [dBm]	Power Limit [dBm]	Margin [dB]
Low	2412	16.51	16.51	30.00	-13.49
Mid	2437	16.55	16.55	30.00	-13.45
High	2462	17.38	17.38	30.00	-12.62
12	2467	5.25	5.25	30.00	-24.75
13	2472	5.03	5.03	30.00	-24.97
Worst			17.38	30.00	-12.62

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9.2.2. 802.11g MODE IN THE 2.4 GHz BAND

Limits

Channel	Frequency [MHz]	Directional Gain Primary [dBi]	FCC Power Limit [dBm]	Max Power [dBm]
Low	2412	-2.10	30.00	30.00
Mid	2437	-2.10	30.00	30.00
High	2462	-2.10	30.00	30.00
12	2467	-2.10	30.00	30.00
13	2472	-2.10	30.00	30.00

Results

Channel	Frequency [MHz]	Meas Power [dBm]	Total Power [dBm]	Power Limit [dBm]	Margin [dB]
Low	2412	16.24	16.24	30.00	-13.76
Mid	2437	16.34	16.34	30.00	-13.66
High	2462	16.06	16.06	30.00	-13.94
12	2467	-0.04	-0.04	30.00	-30.04
13	2472	-0.19	-0.19	30.00	-30.19
Worst			16.34	30.00	-13.66

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9.2.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

Limits

Channel	Frequency [MHz]	Directional Gain Primary [dBi]	FCC Power Limit [dBm]	Max Power [dBm]
Low	2412	-2.10	30.00	30.00
Mid	2437	-2.10	30.00	30.00
High	2462	-2.10	30.00	30.00
12	2467	-2.10	30.00	30.00
13	2472	-2.10	30.00	30.00

Results

Channel	Frequency [MHz]	Meas Power [dBm]	Total Power [dBm]	Power Limit [dBm]	Margin [dB]
Low	2412	15.09	15.09	30.00	-14.91
Mid	2437	15.21	15.21	30.00	-14.79
High	2462	15.05	15.05	30.00	-14.95
12	2467	-0.39	-0.39	30.00	-30.39
13	2472	-0.56	-0.56	30.00	-30.56
Worst			15.21	30.00	-14.79

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9.3. 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 “Method §10.3 AVGPSD-1 (802.11 b mode) and §10.5 AVGPSD-2(802.11 g/n mode)” under KDB558074 D01 DTS Meas Guidance v04.

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RESULTS

9.3.1. 802.11b MODE IN THE 2.4 GHz BAND

PSD Results

Channel	Frequency [MHz]	PSD Meas [dBm]	Duty Factor [dB]	Final PSD [dBm]	Limit [dBm]	Margin [dB]
Low	2412	-14.357	0.00	-14.357	8.00	-22.357
Mid	2437	-14.299	0.00	-14.299	8.00	-22.299
High	2462	-13.523	0.00	-13.523	8.00	-21.523
12	2467	-25.583	0.00	-25.583	8.00	-33.583
13	2472	-25.157	0.00	-25.157	8.00	-33.157

9.3.2. 802.11g MODE IN THE 2.4 GHz BAND

PSD Results

Channel	Frequency [MHz]	PSD Meas [dBm]	Duty Factor [dB]	Final PSD [dBm]	Limit [dBm]	Margin [dB]
Low	2412	-17.012	0.29	-16.722	8.00	-25.012
Mid	2437	-17.102	0.29	-16.812	8.00	-25.102
High	2462	-17.093	0.29	-16.803	8.00	-25.093
12	2467	-33.560	0.29	-33.270	8.00	-41.560
13	2472	-34.103	0.29	-33.813	8.00	-42.103

9.3.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

PSD Results

Channel	Frequency [MHz]	PSD Meas [dBm]	Duty Factor [dB]	Final PSD [dBm]	Limit [dBm]	Margin [dB]
Low	2412	-17.936	0.32	-17.616	8.00	-25.936
Mid	2437	-17.992	0.32	-17.672	8.00	-25.992
High	2462	-18.290	0.32	-17.970	8.00	-26.290
12	2467	-33.829	0.32	-33.509	8.00	-41.829
13	2472	-33.656	0.32	-33.336	8.00	-41.656

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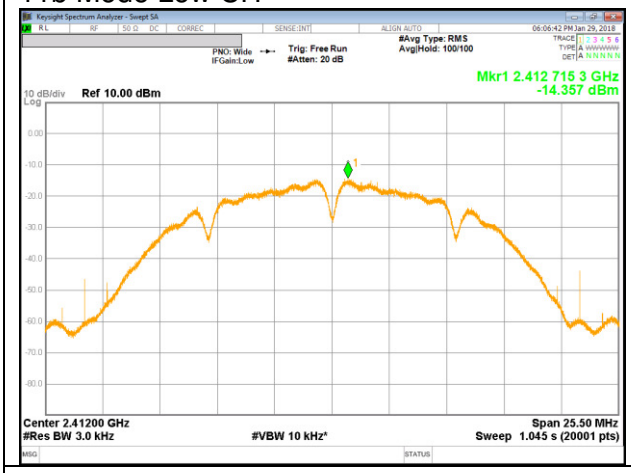
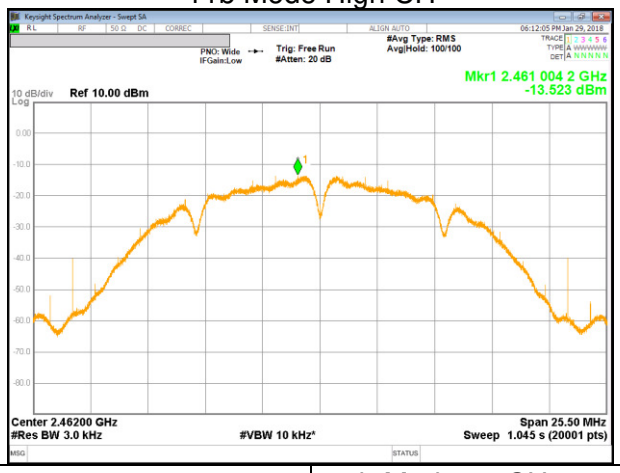
9.3.4. PSD PLOTS

11b Mode Low CH

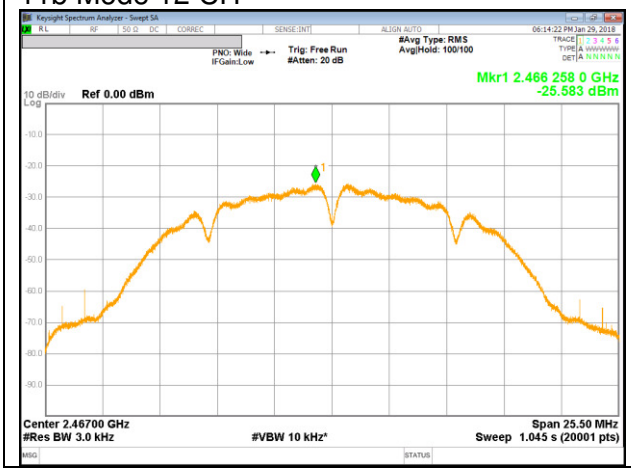


11b Mode Middle CH

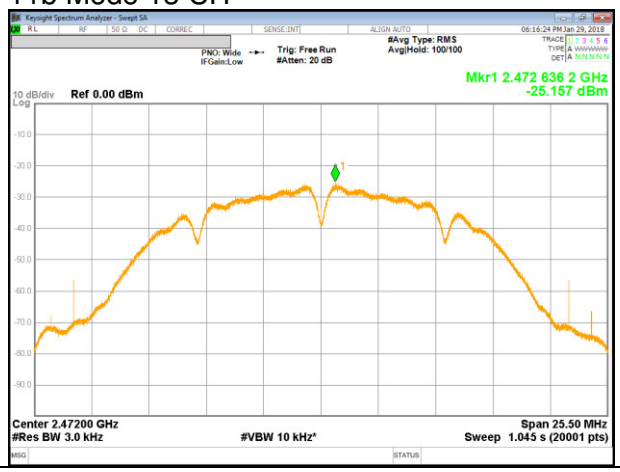
11b Mode High CH



11b Mode 12 CH



11b Mode 13 CH



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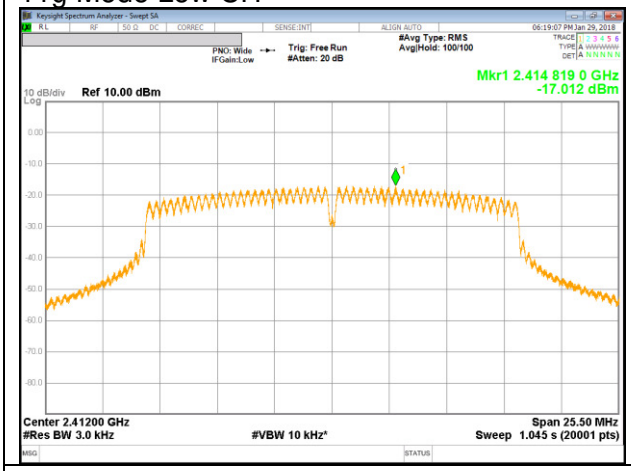
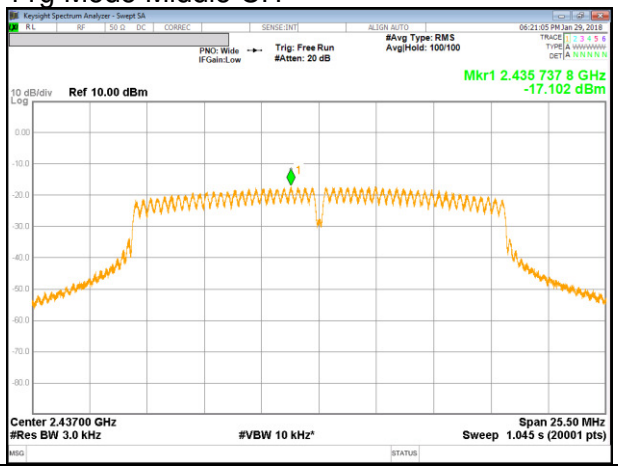
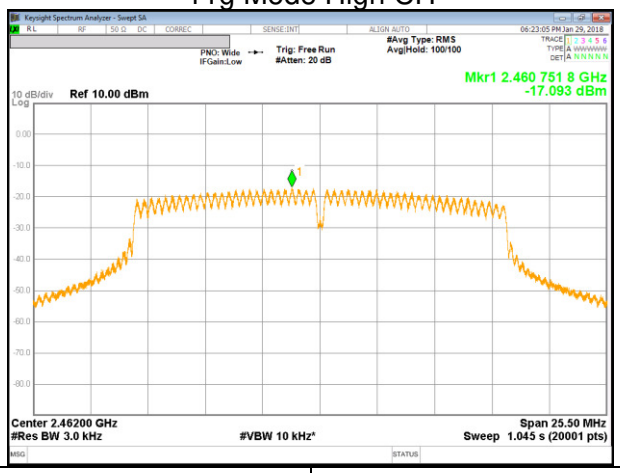
11g Mode Low CH



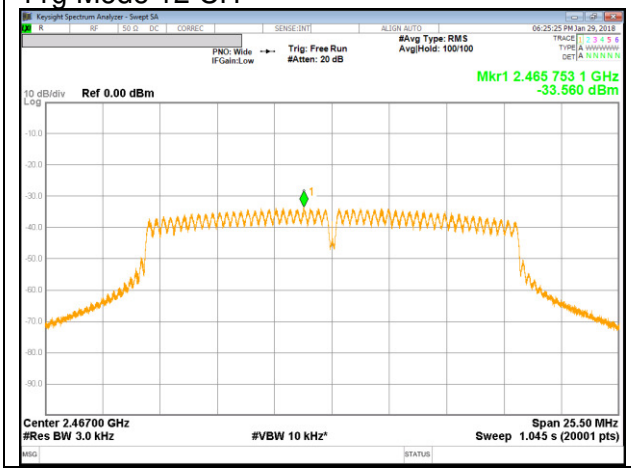
11g Mode Middle CH



11g Mode High CH



11g Mode 12 CH



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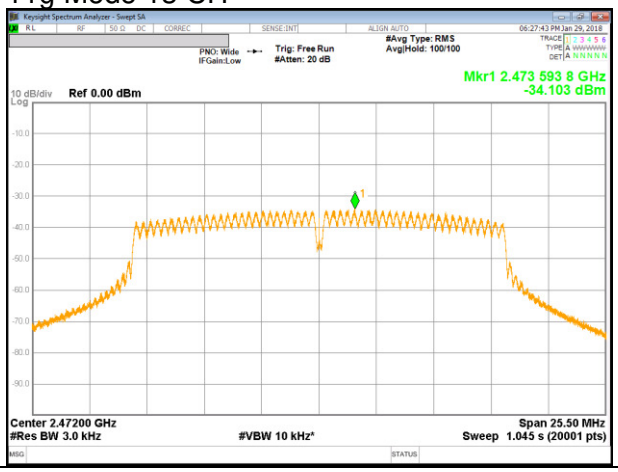

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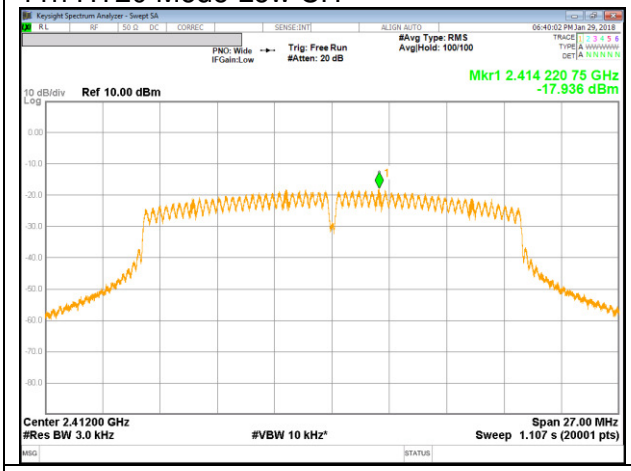
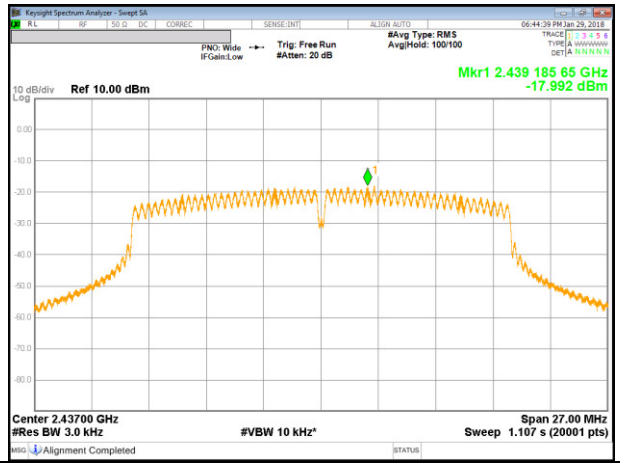
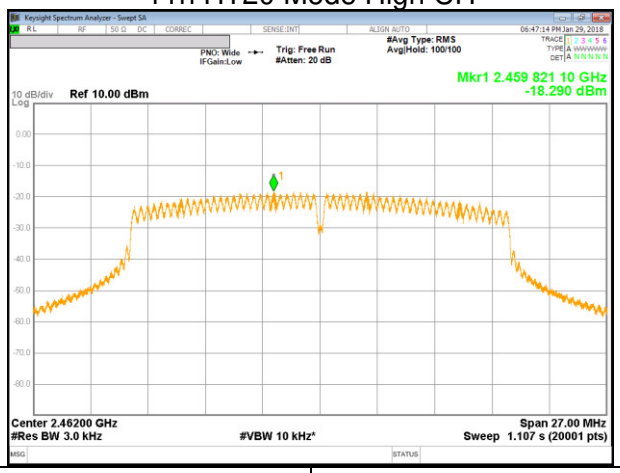
11n HT20 Mode Low CH



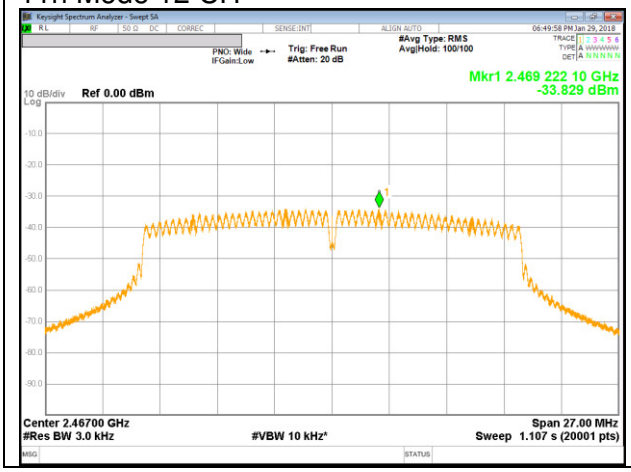
11n HT20 Mode Middle CH



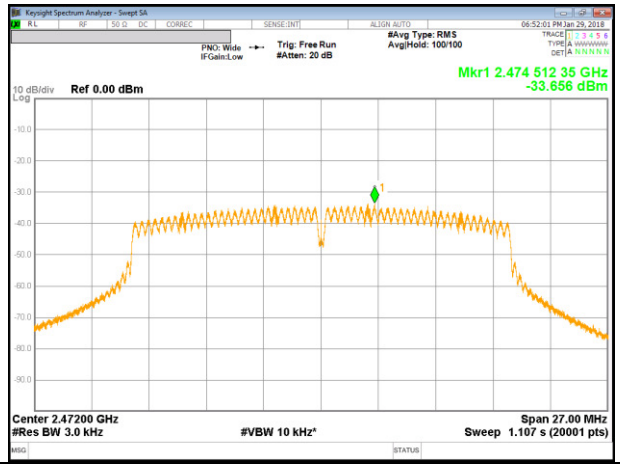
11n HT20 Mode High CH



11n Mode 12 CH



11n Mode 13 CH



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9.4. 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.

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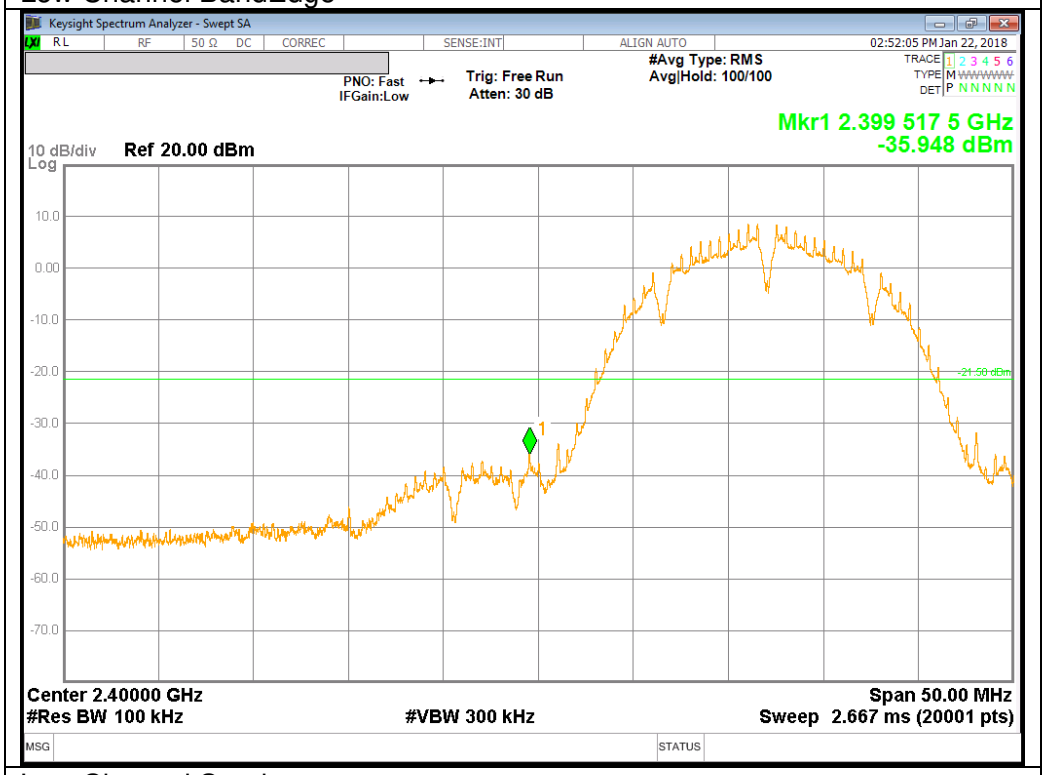
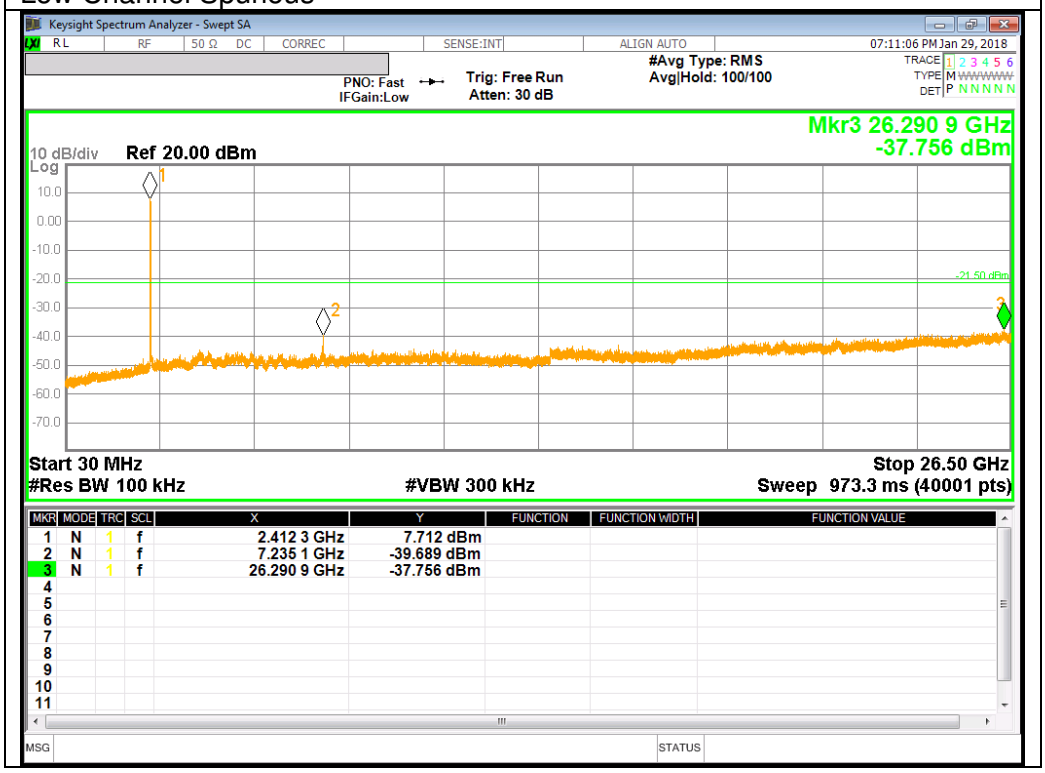
RESULTS

9.4.1. 802.11b MODE IN THE 2.4 GHz BAND

Low Channel BandEdge



Low Channel Spurious



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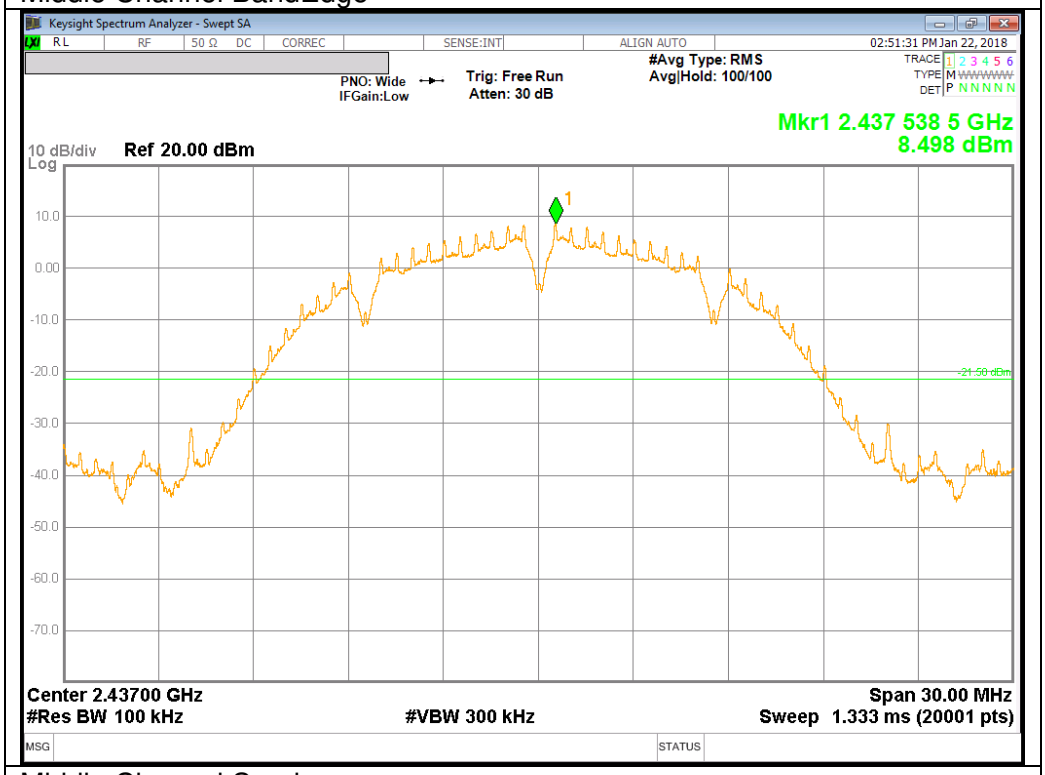
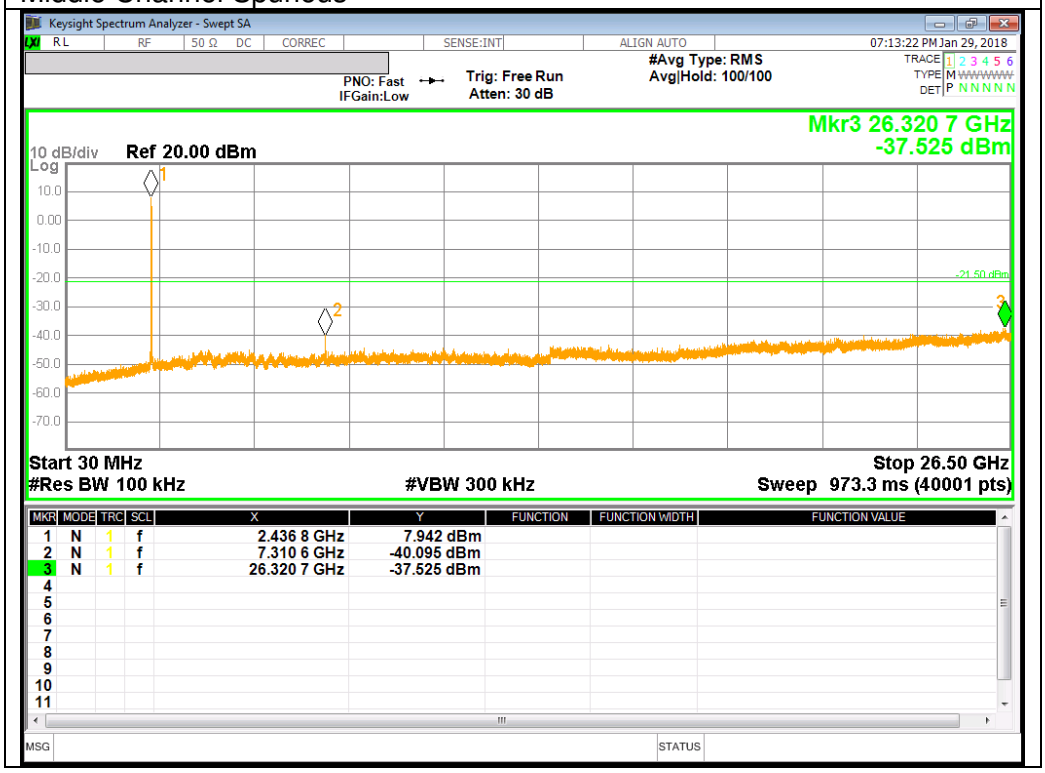
Middle Channel BandEdge



Middle Channel Spurious



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.436 8 GHz	7.942 dBm			
2	N	1	f	7.310 6 GHz	-40.095 dBm			
3	N	1	f	26.320 7 GHz	-37.525 dBm			
4								
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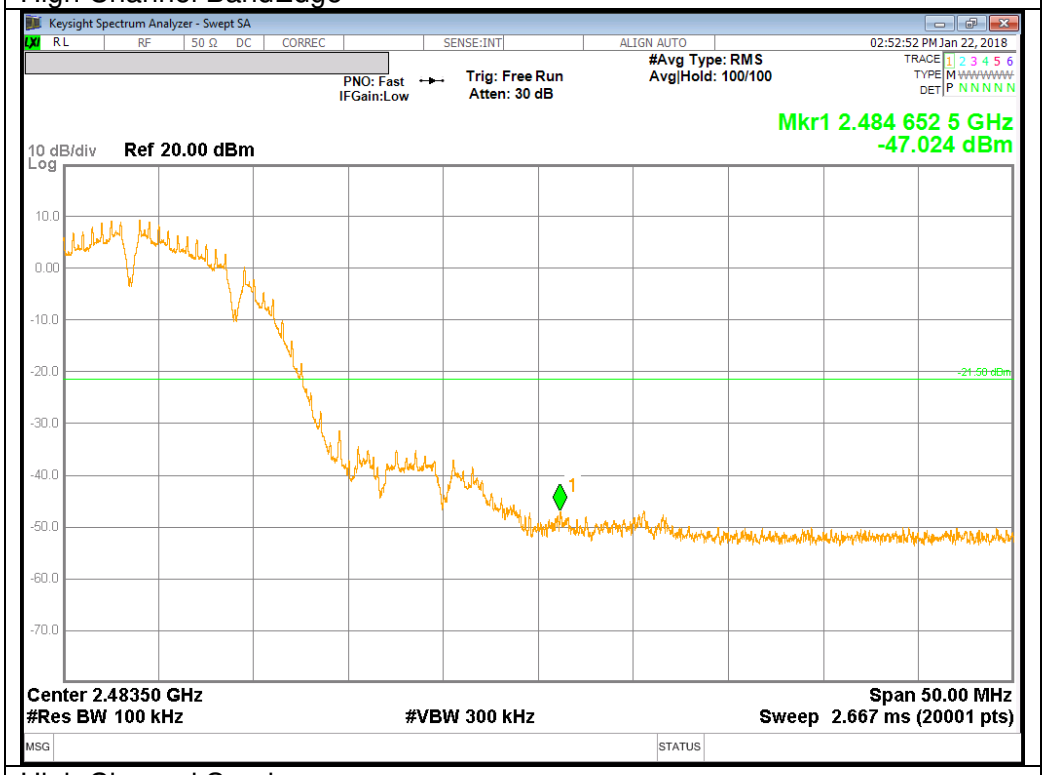
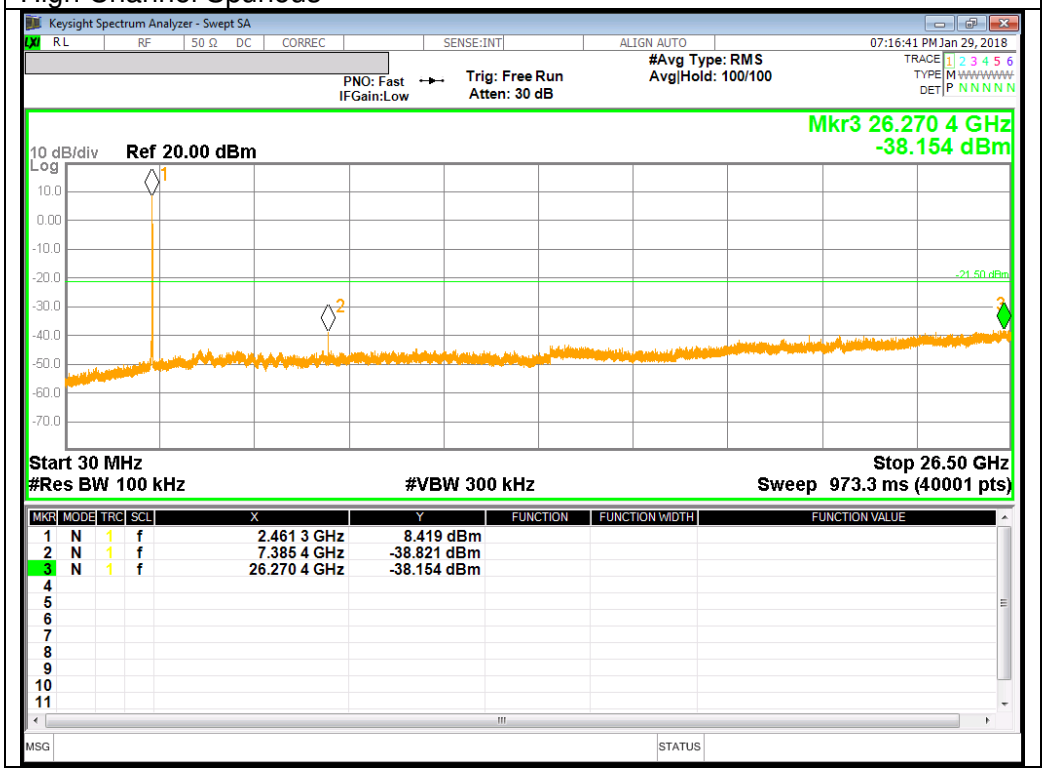
High Channel BandEdge



High Channel Spurious



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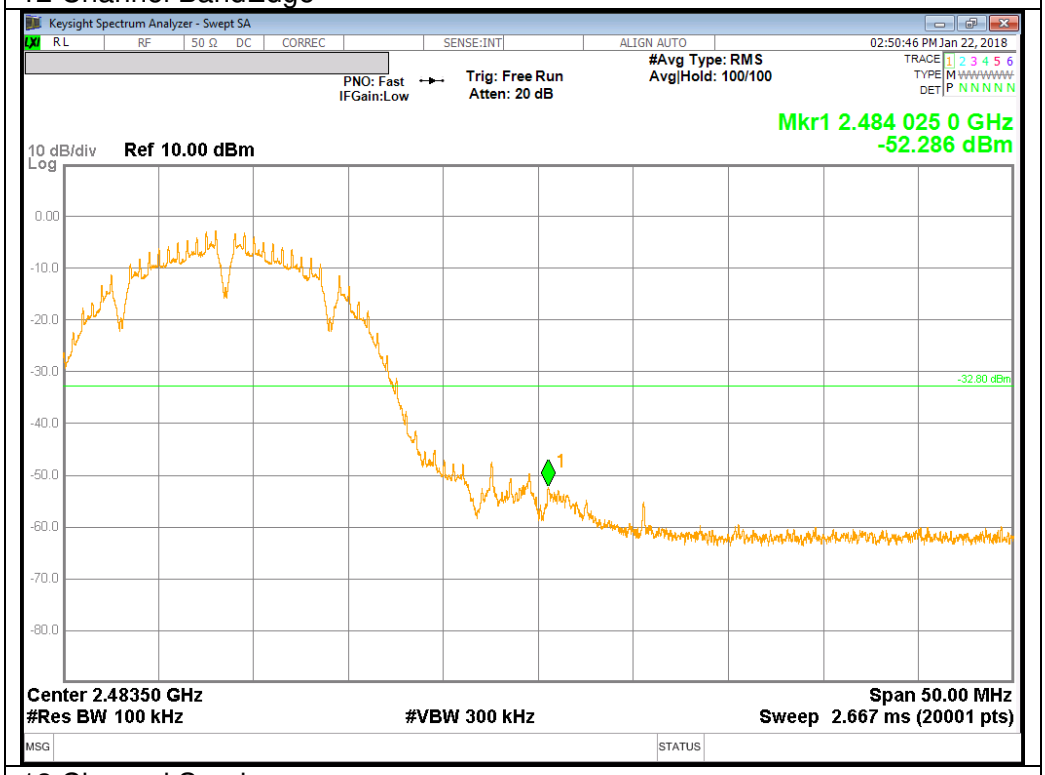
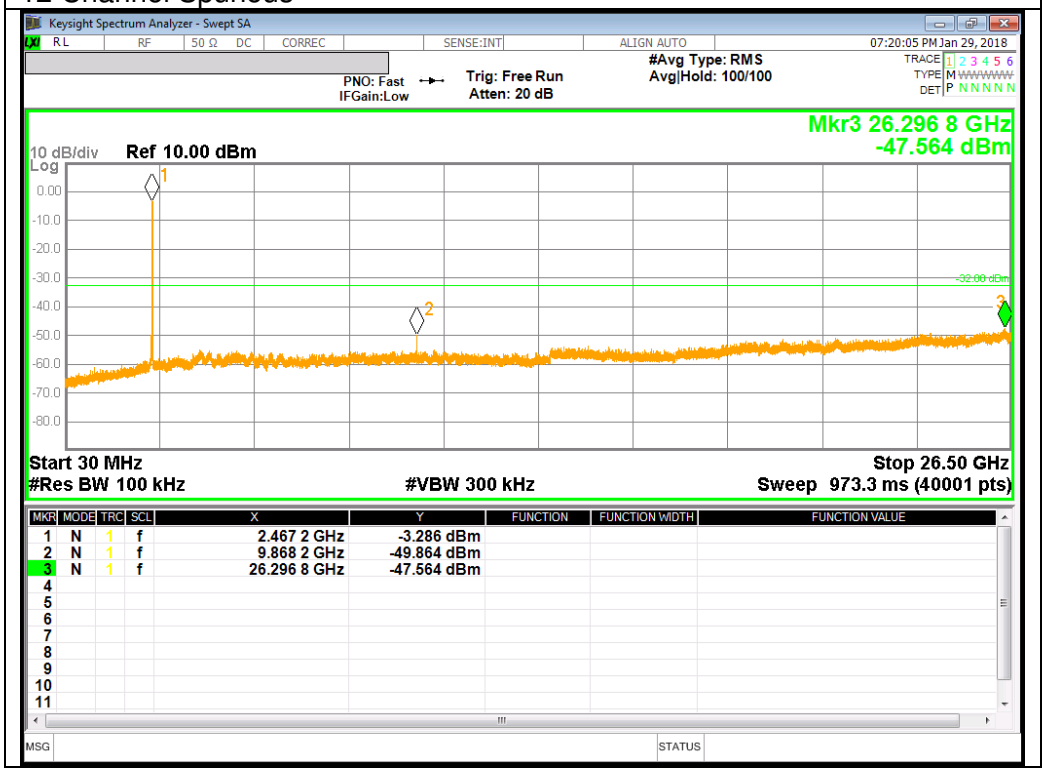
12 Channel BandEdge



12 Channel Spurious



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.467 2 GHz	-3.286 dBm			
2	N	1	f	9.868 2 GHz	-49.864 dBm			
3	N	1	f	26.296 8 GHz	-47.564 dBm			
4								
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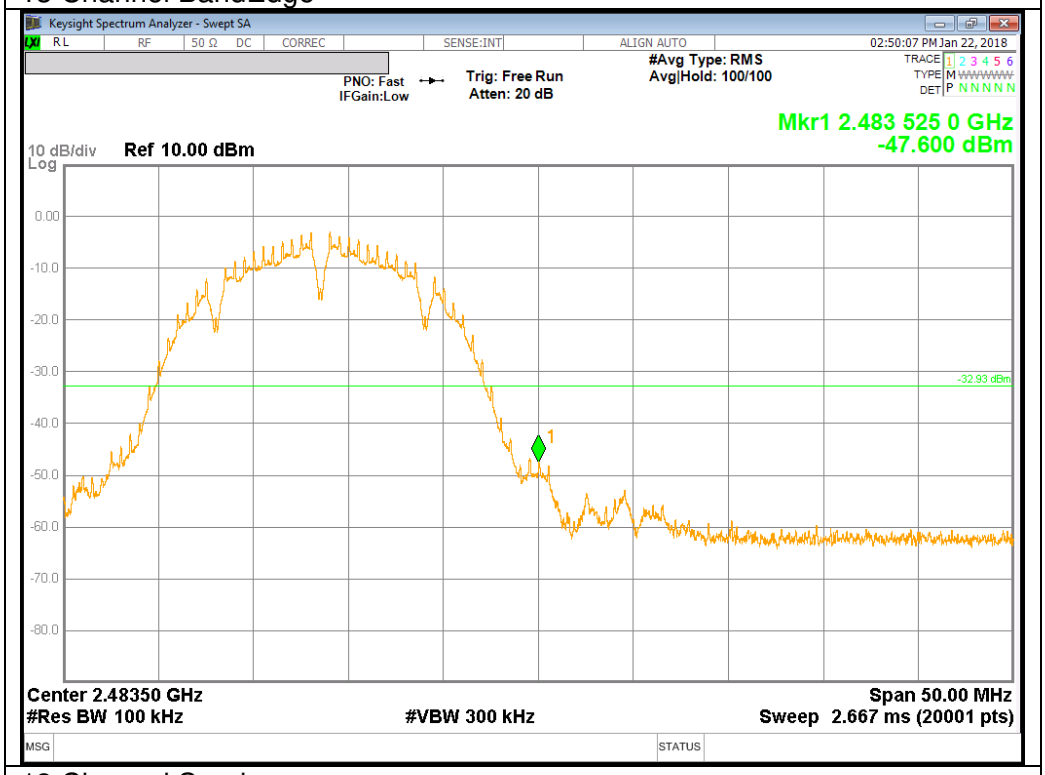
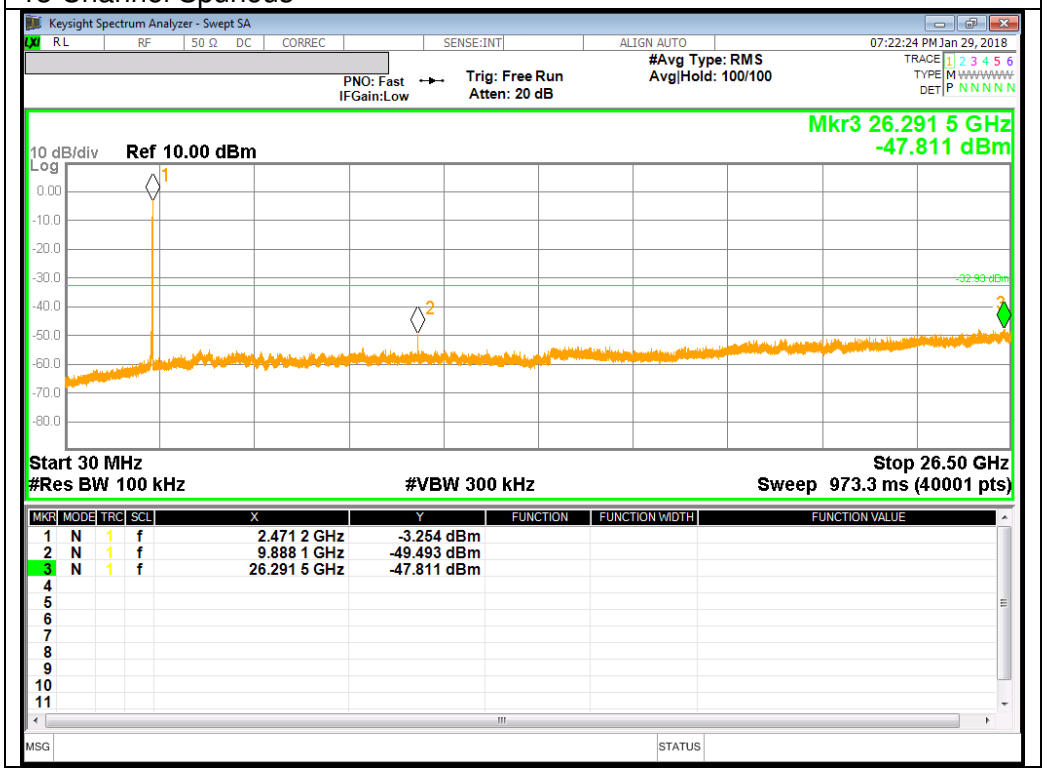
13 Channel BandEdge



13 Channel Spurious



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.471 2 GHz	-3.254 dBm			
2	N	1	f	9.888 1 GHz	-49.493 dBm			
3	N	1	f	26.291 5 GHz	-47.811 dBm			
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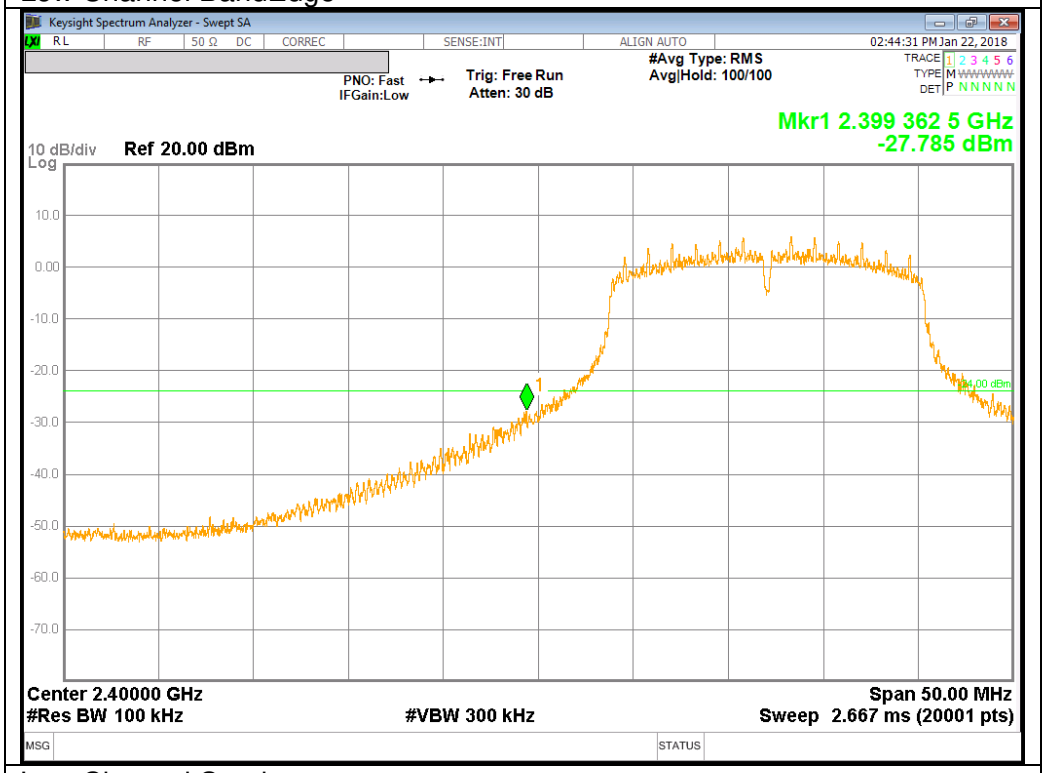
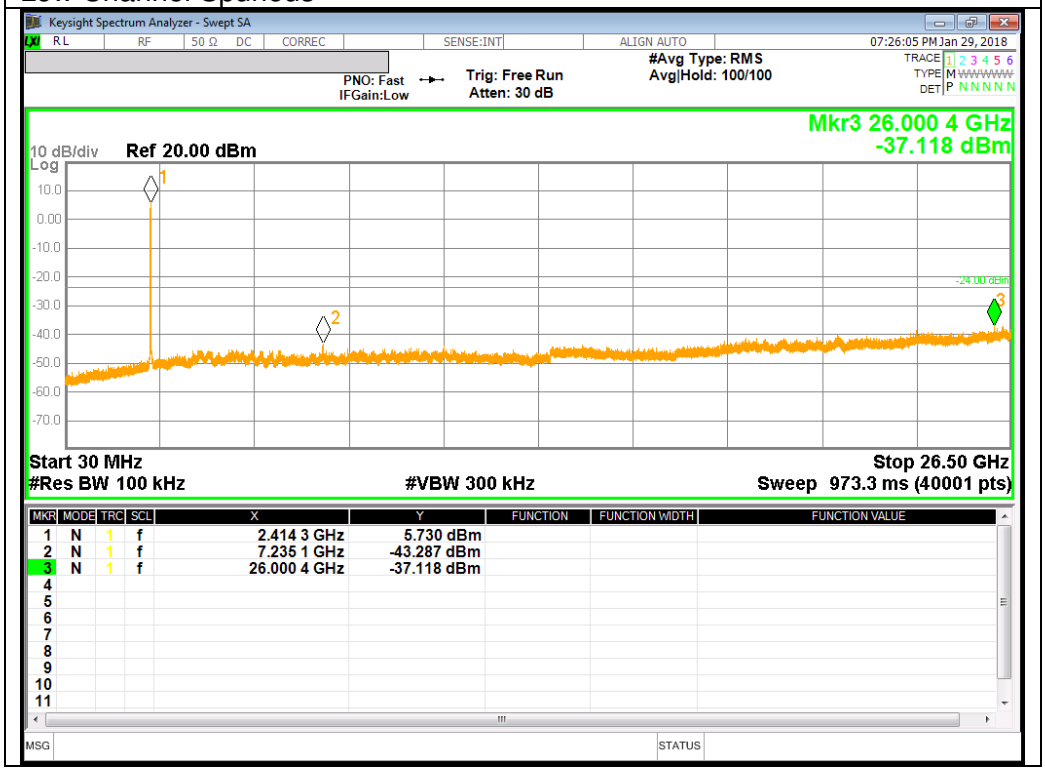
9.4.2. 802.11g MODE IN THE 2.4 GHz BAND

Low Channel BandEdge



Low Channel Spurious



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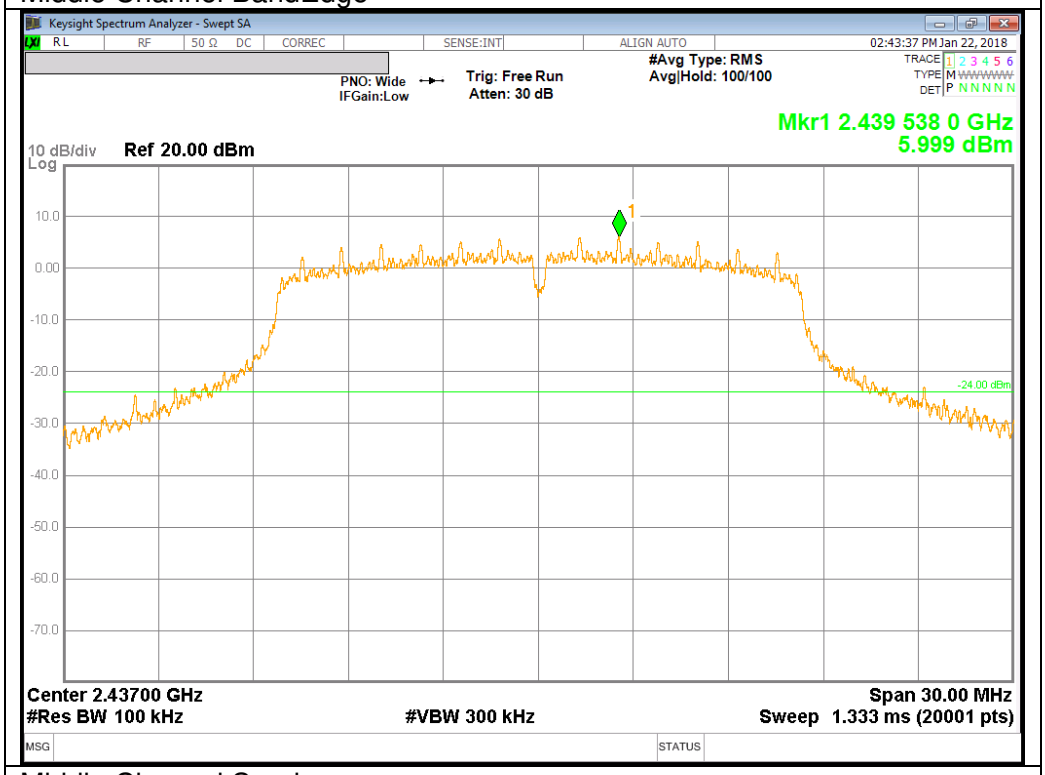
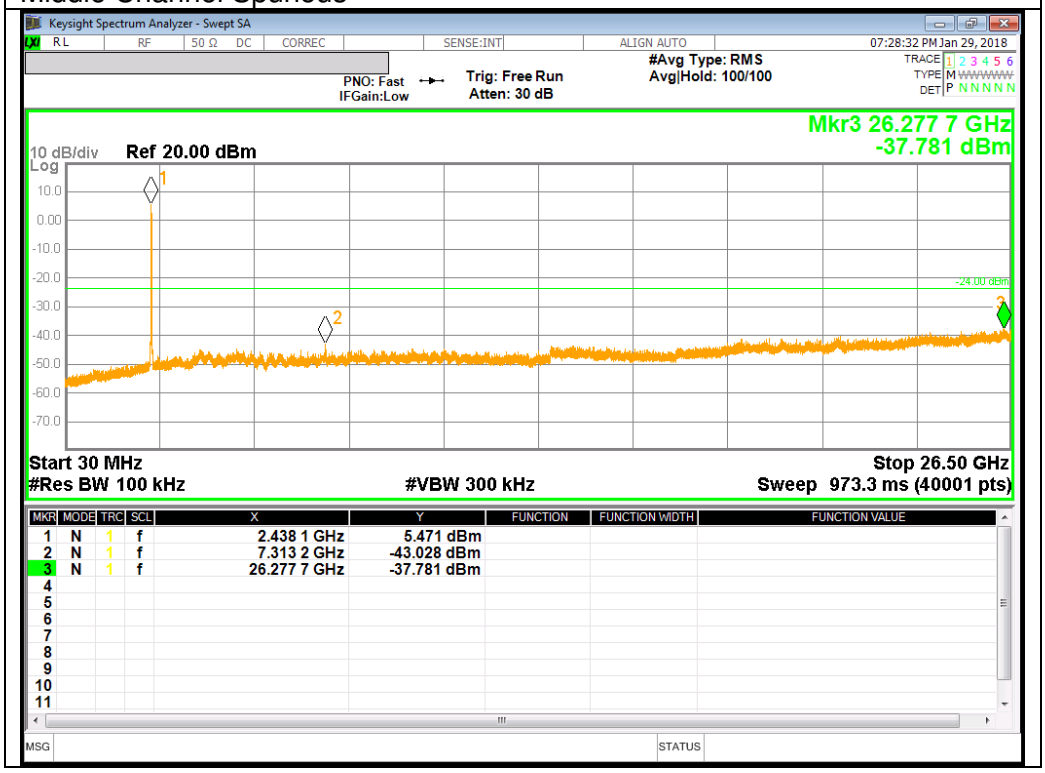
Middle Channel BandEdge



Middle Channel Spurious



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.438 1 GHz	5.471 dBm			
2	N	1	f	7.313 2 GHz	-43.028 dBm			
3	N	1	f	26.277 7 GHz	-37.781 dBm			
4								
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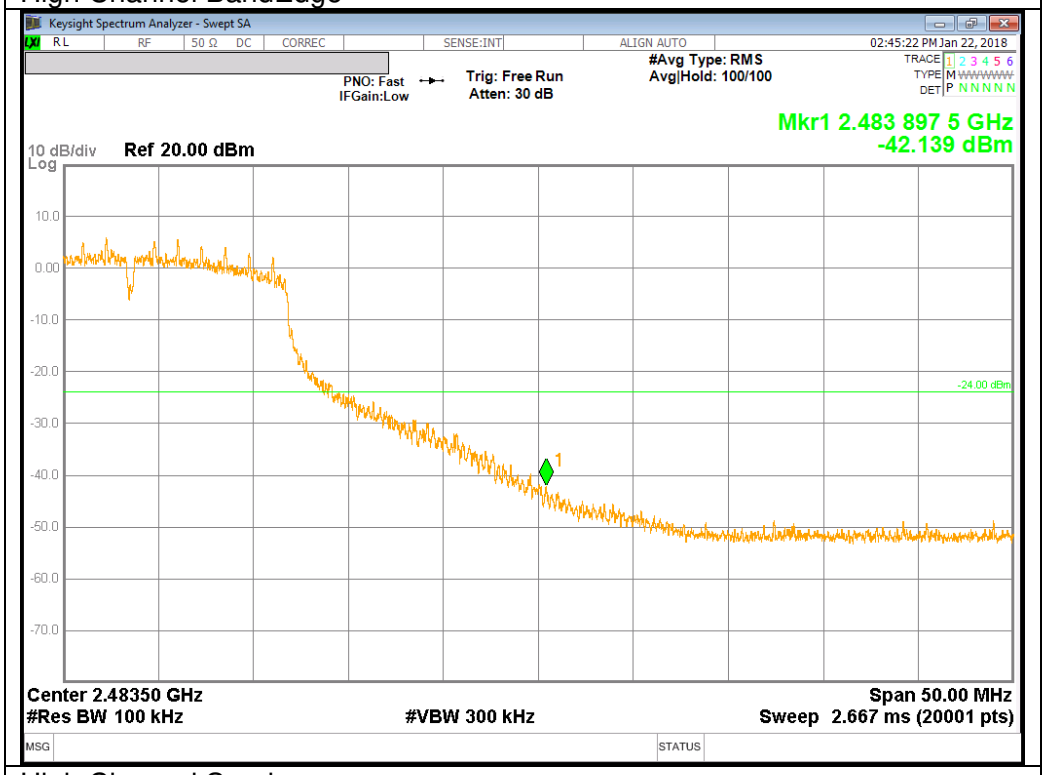
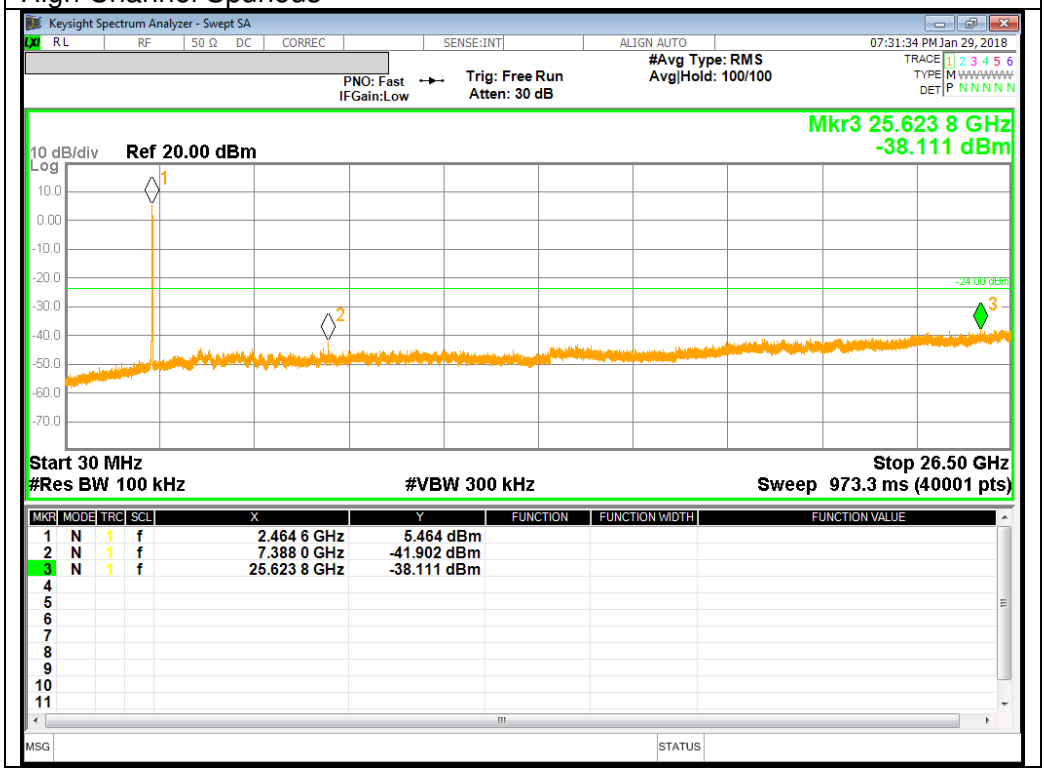
High Channel BandEdge



High Channel Spurious



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.464 6 GHz	5.464 dBm			
2	N	1	f	7.388 0 GHz	-41.902 dBm			
3	N	1	f	25.623 8 GHz	-38.111 dBm			
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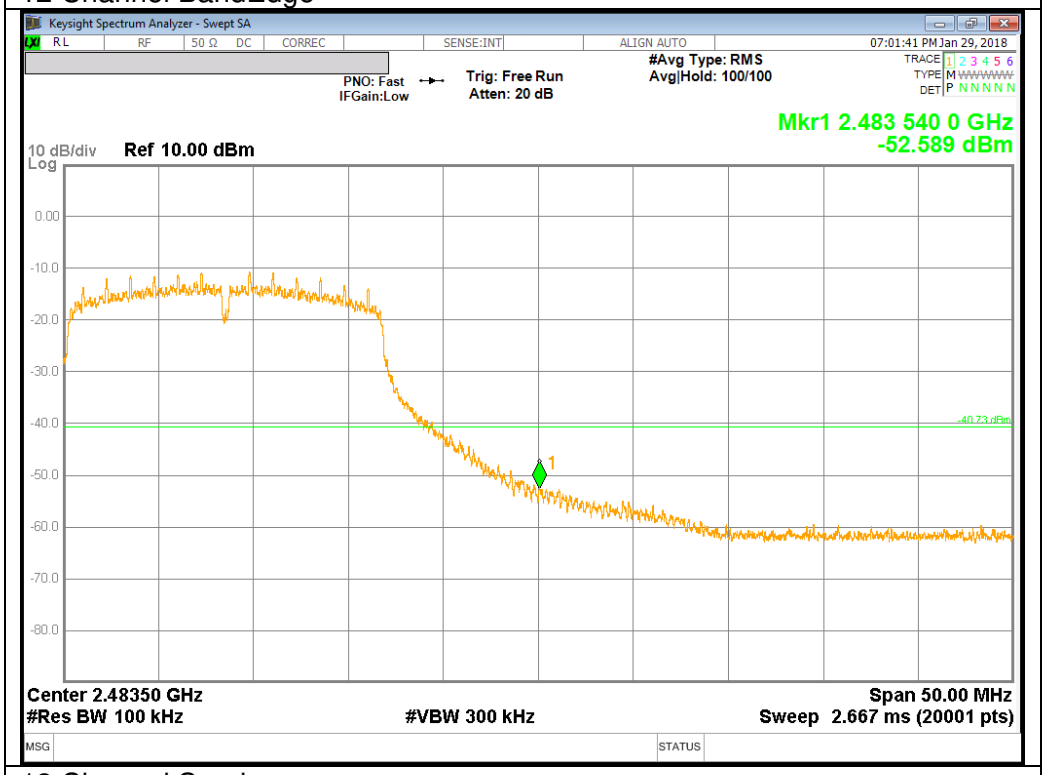
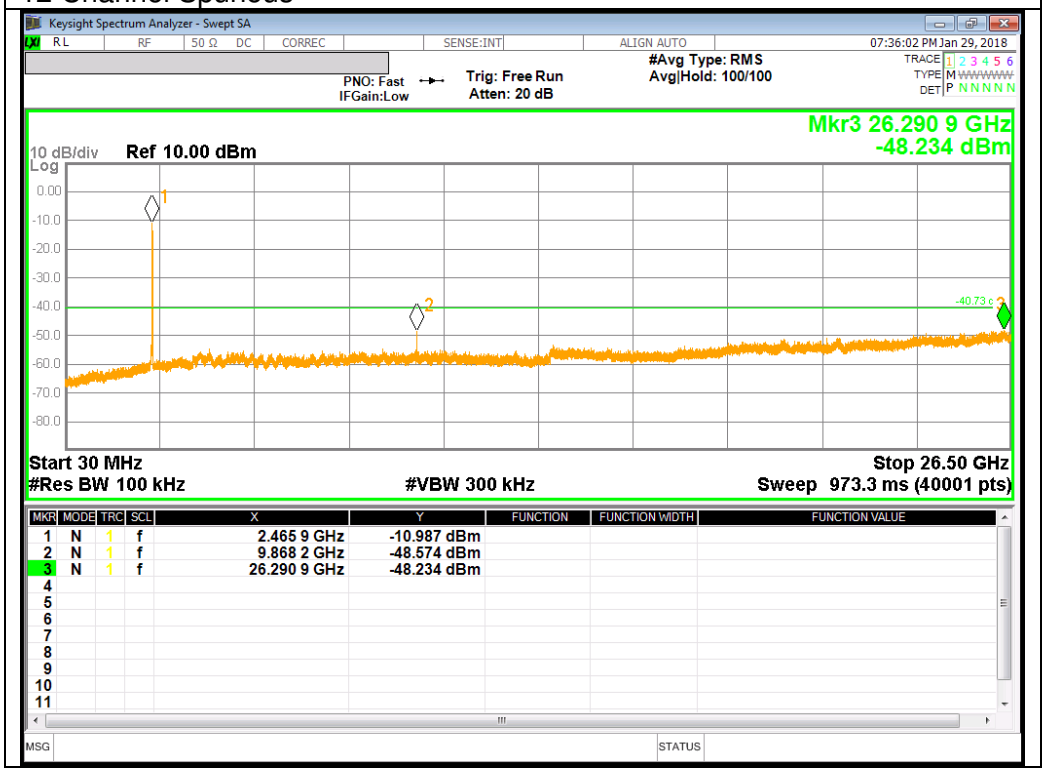
12 Channel BandEdge



12 Channel Spurious



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.465 9 GHz	-10.987 dBm			
2	N	1	f	9.868 2 GHz	-48.574 dBm			
3	N	1	f	26.290 9 GHz	-48.234 dBm			
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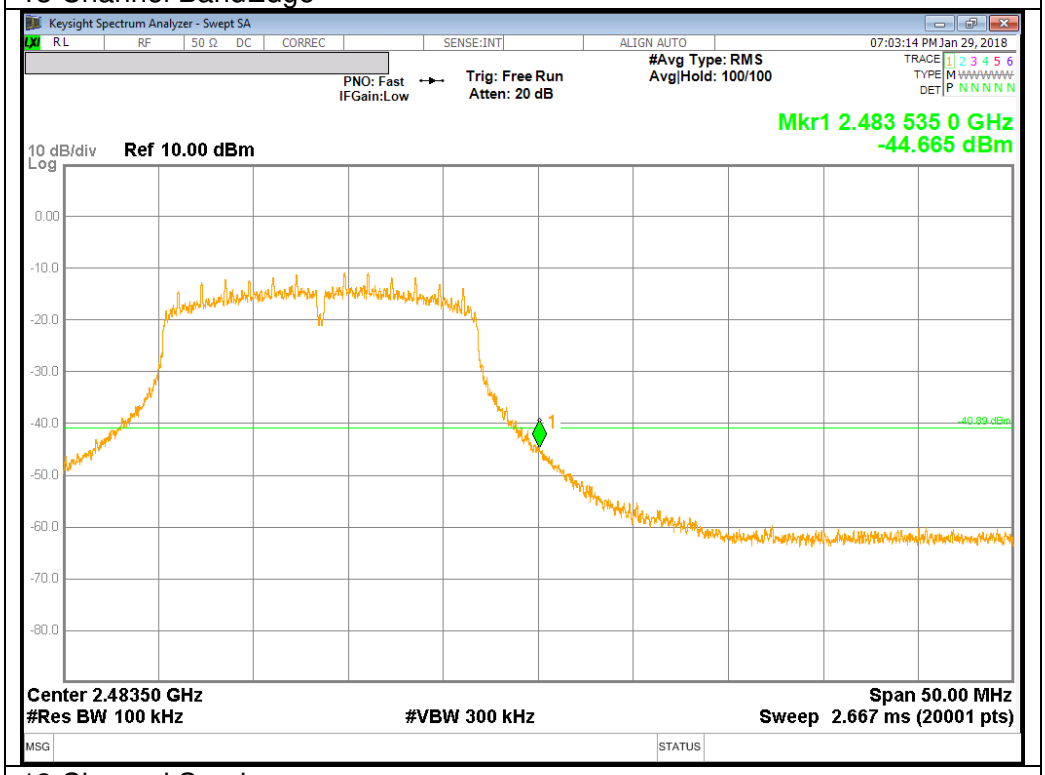
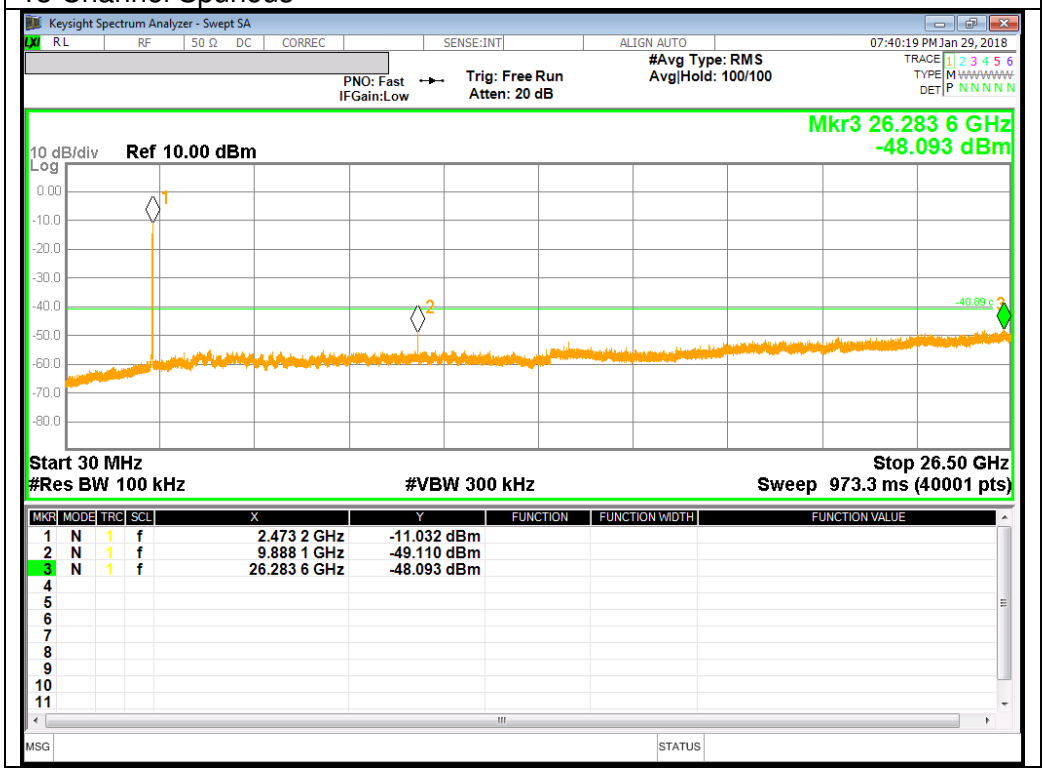
13 Channel BandEdge



13 Channel Spurious



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.473 2 GHz	-11.032 dBm			
2	N	1	f	9.888 1 GHz	-49.110 dBm			
3	N	1	f	26.283 6 GHz	-48.093 dBm			
4								
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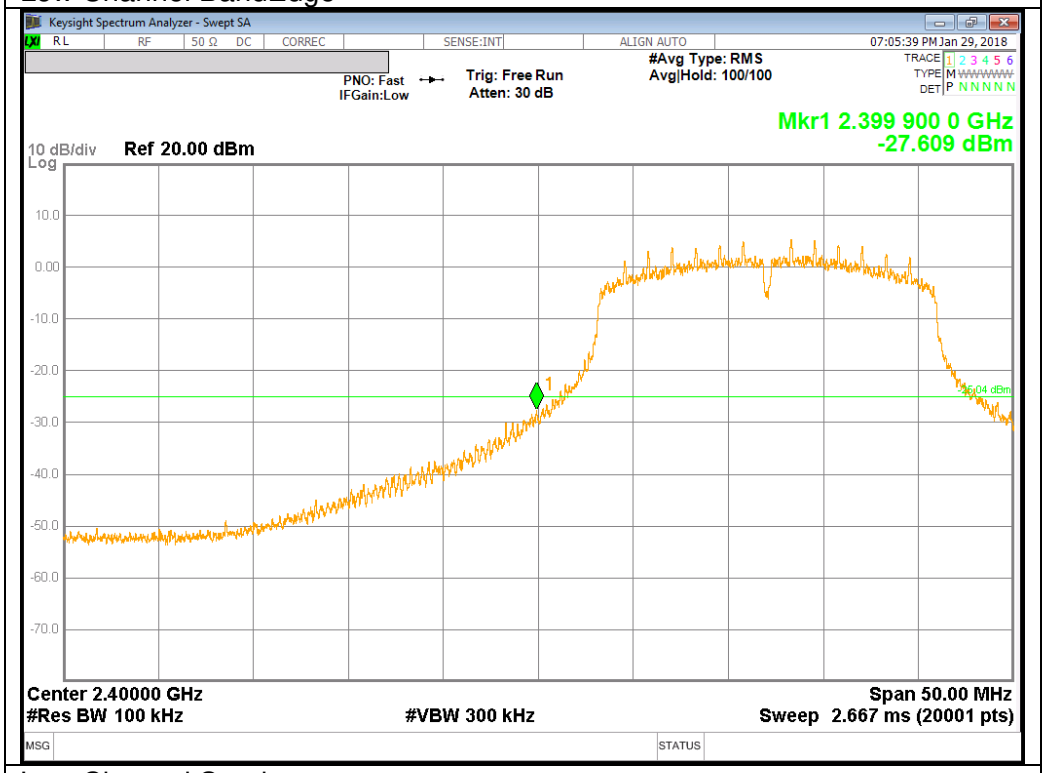
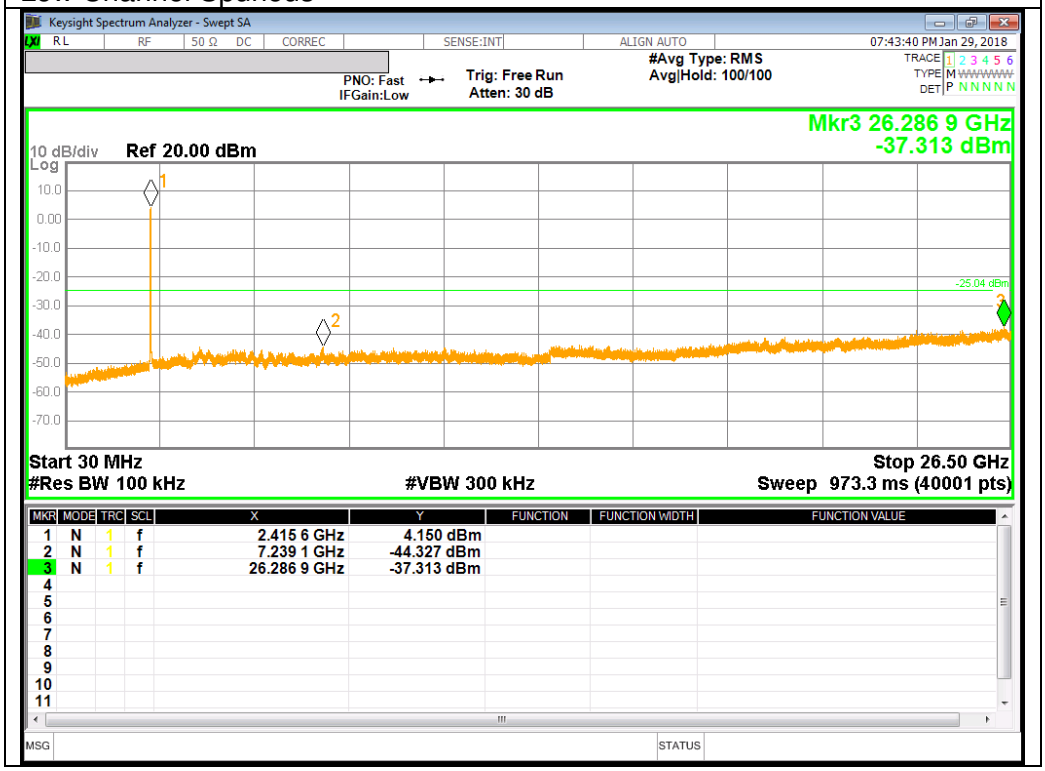
9.4.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

Low Channel BandEdge



Low Channel Spurious



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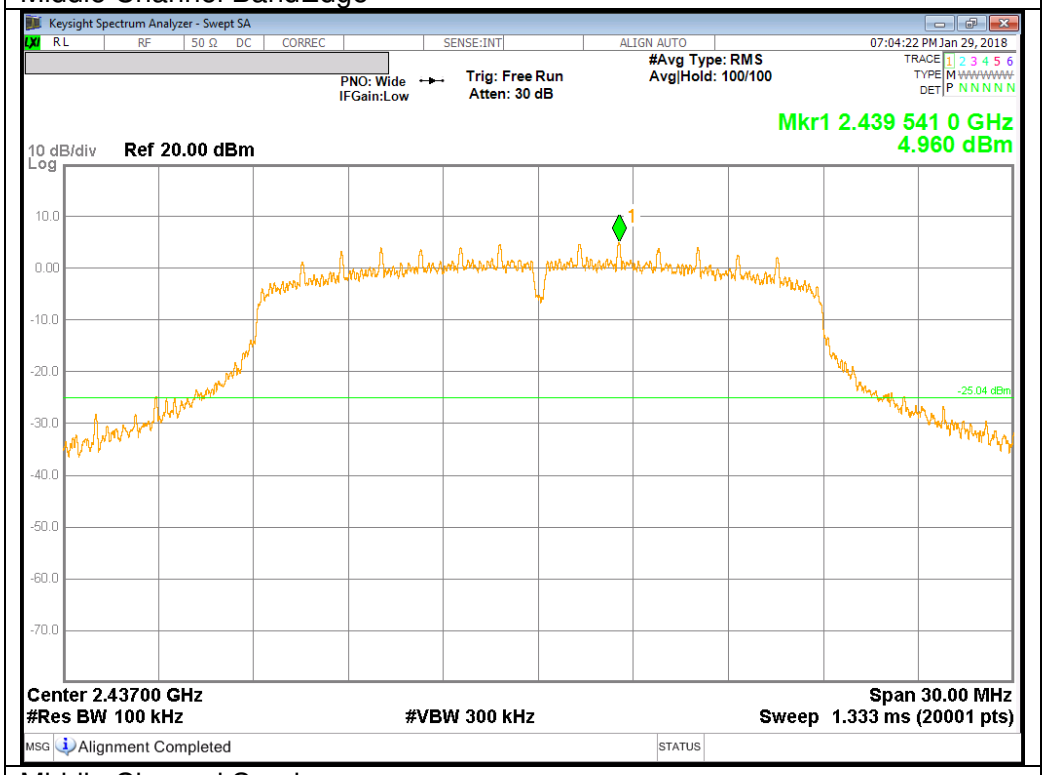
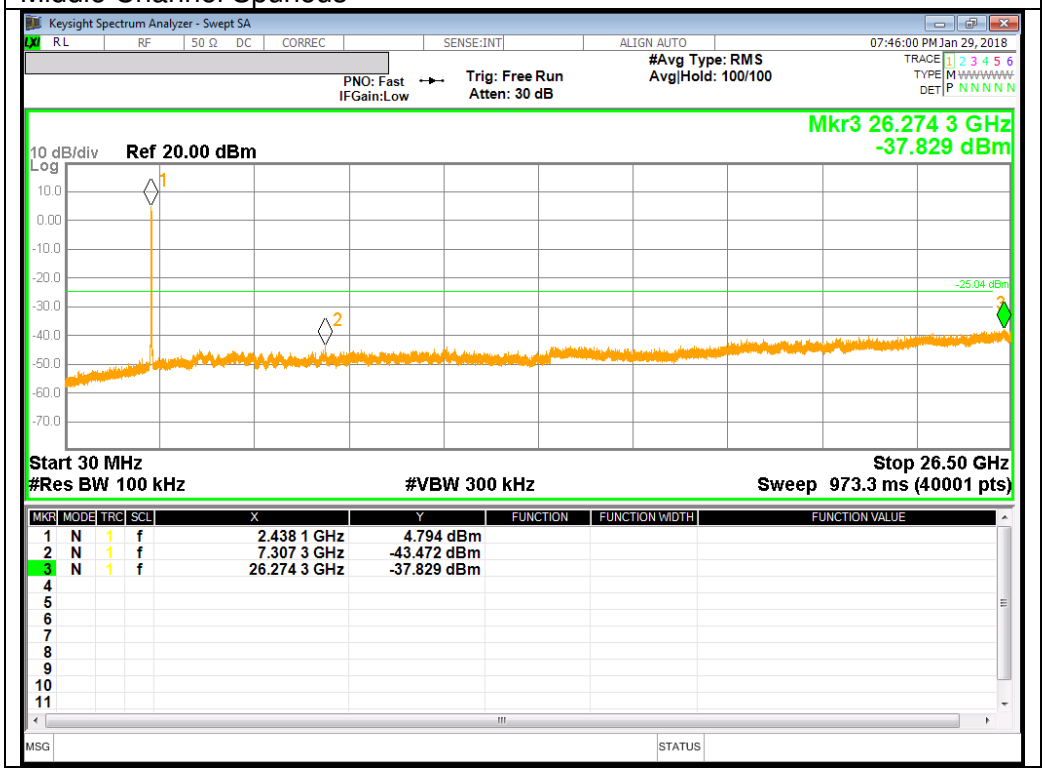
Middle Channel BandEdge



Middle Channel Spurious



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.438 1 GHz	4.794 dBm			
2	N	1	f	7.307 3 GHz	-43.472 dBm			
3	N	1	f	26.274 3 GHz	-37.829 dBm			
4								
5								
6								
7								
8								
9								
10								
11								

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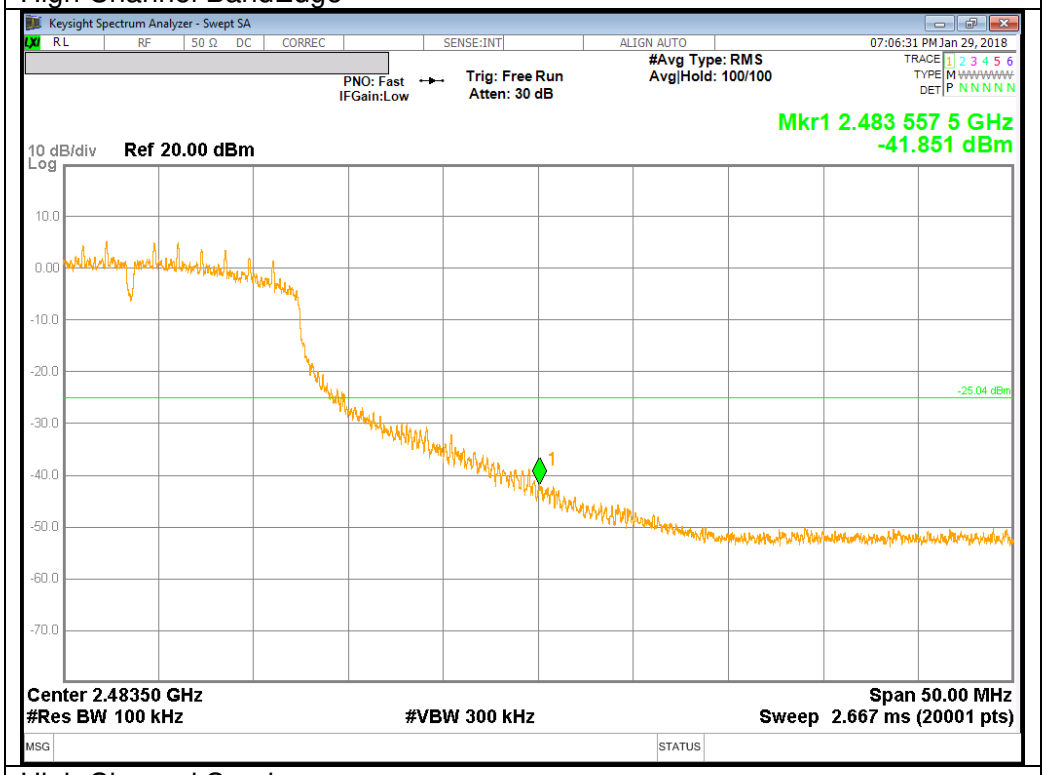
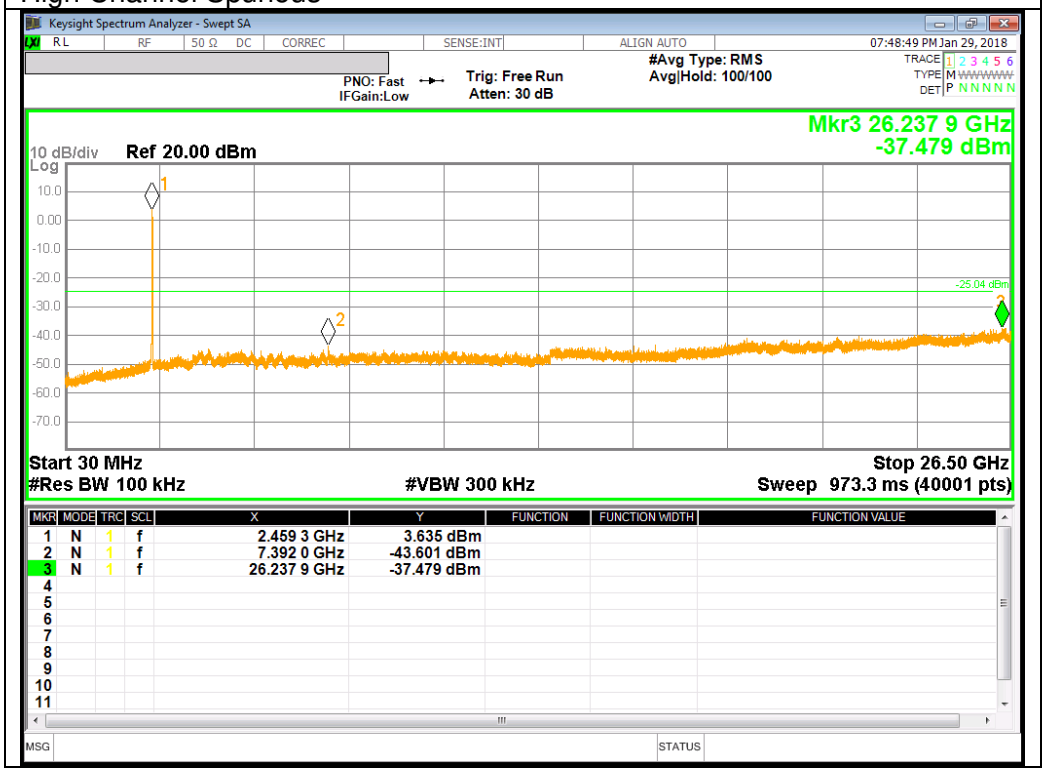
High Channel BandEdge



High Channel Spurious



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.459 3 GHz	3.635 dBm			
2	N	1	f	7.392 0 GHz	-43.601 dBm			
3	N	1	f	26.237 9 GHz	-37.479 dBm			
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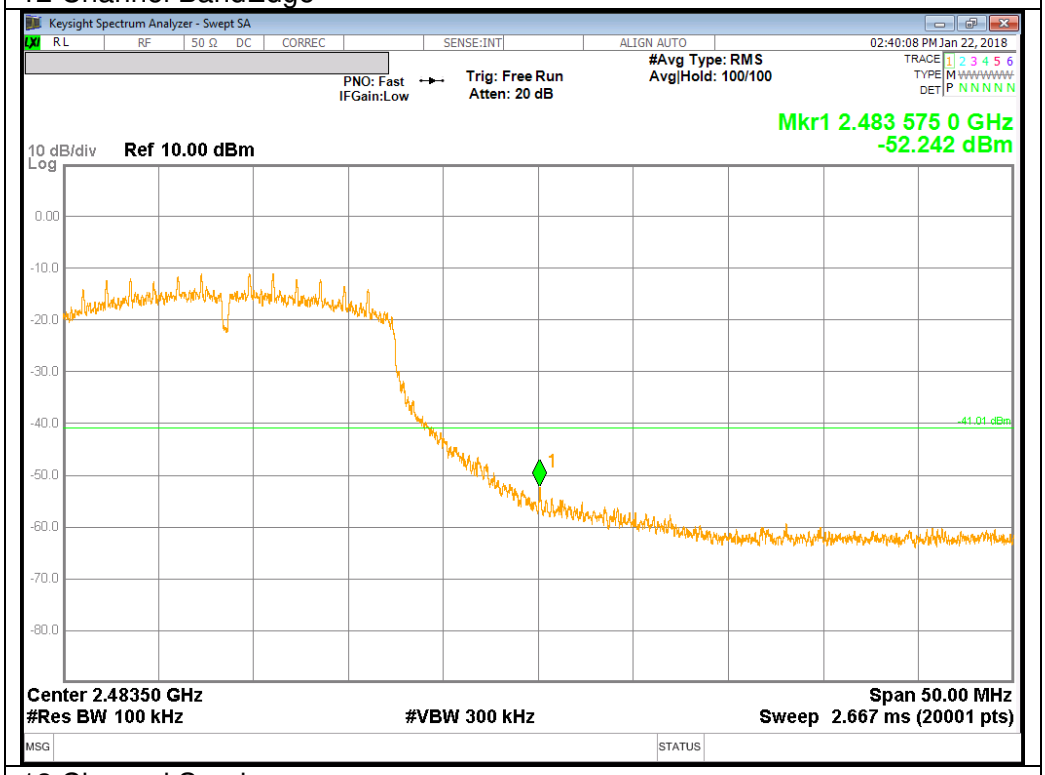
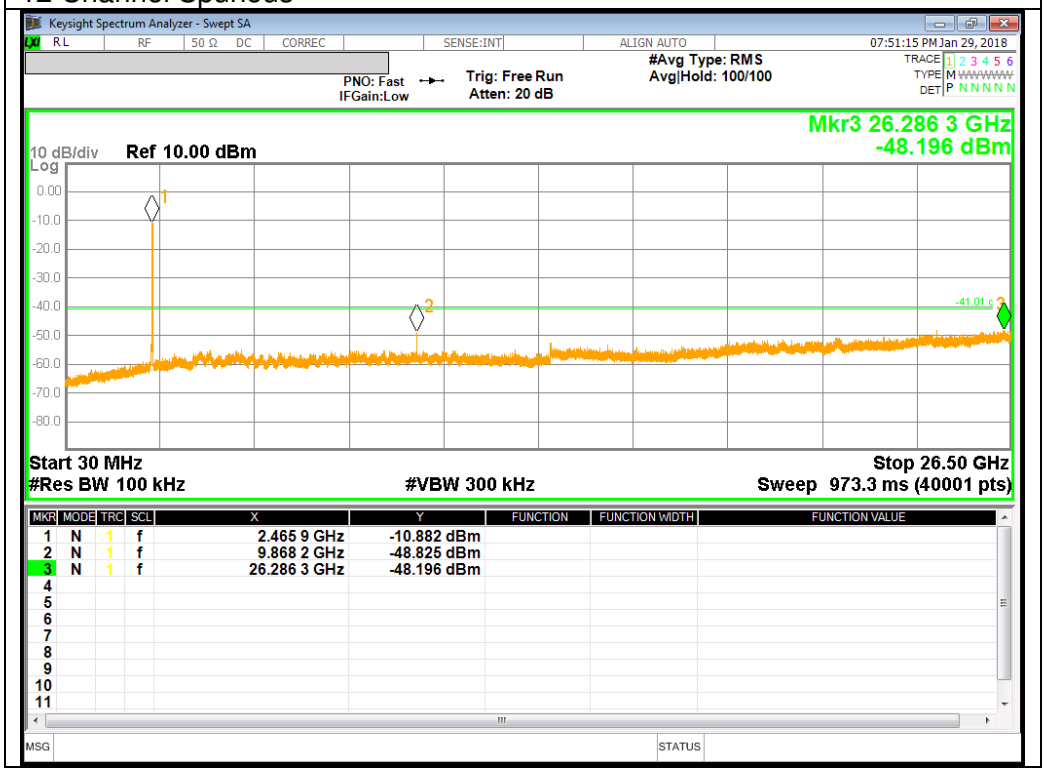
12 Channel BandEdge



12 Channel Spurious



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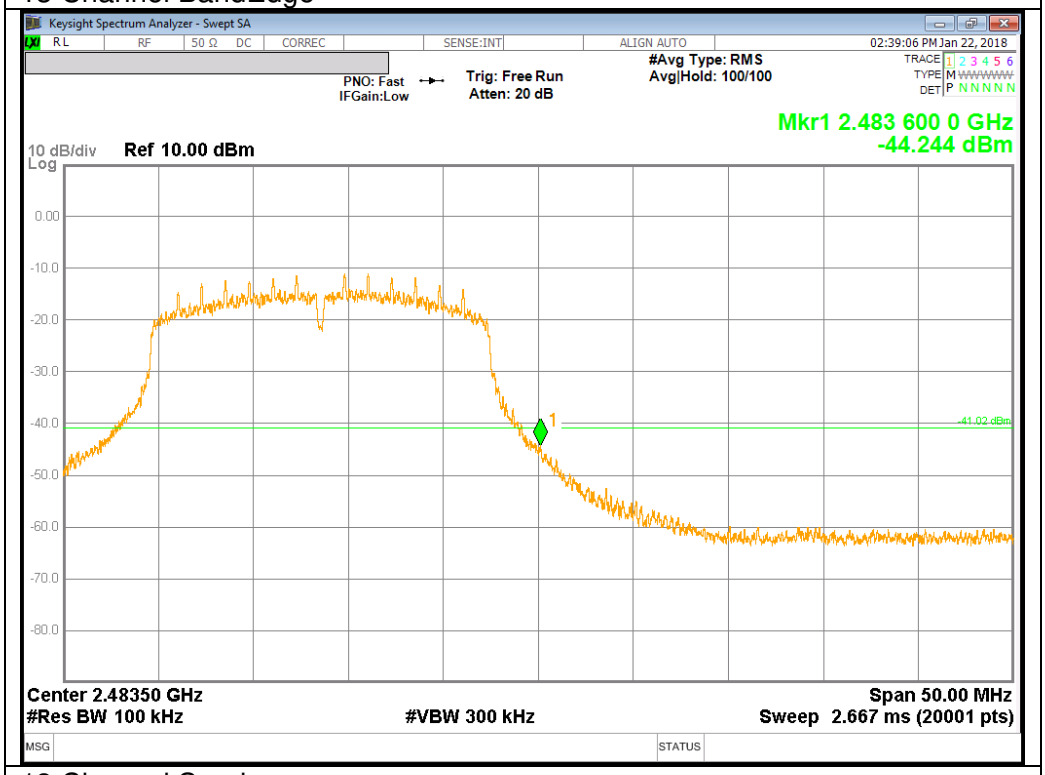
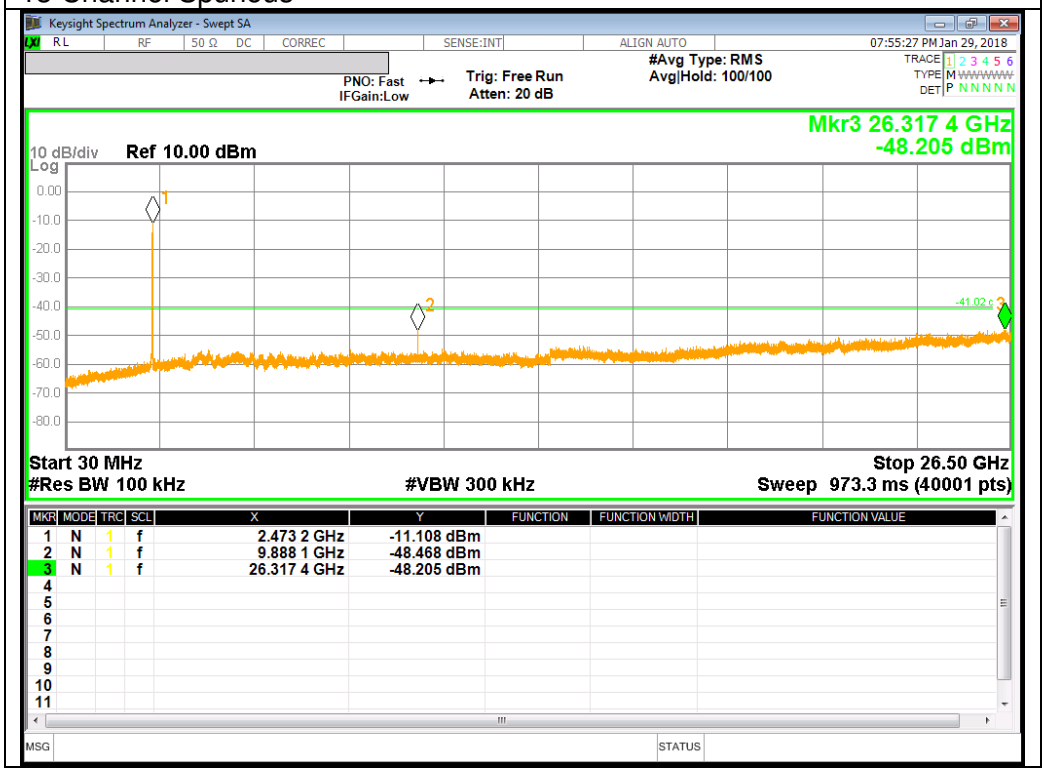
13 Channel BandEdge



13 Channel Spurious



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10. RADIATED TEST RESULTS

10.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

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

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

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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; the video bandwidth is set to 3 MHz for peak measurements and add duty cycle factor for average measurements. (Restriced bandedge, Final detection of spurious harmonic emissions)
Duty cycle factor= 10log (1/x) For this sample B mode = 0dB (duty cycle >98%); G mode = 0.29dB; N mode = 0.32dB.

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.

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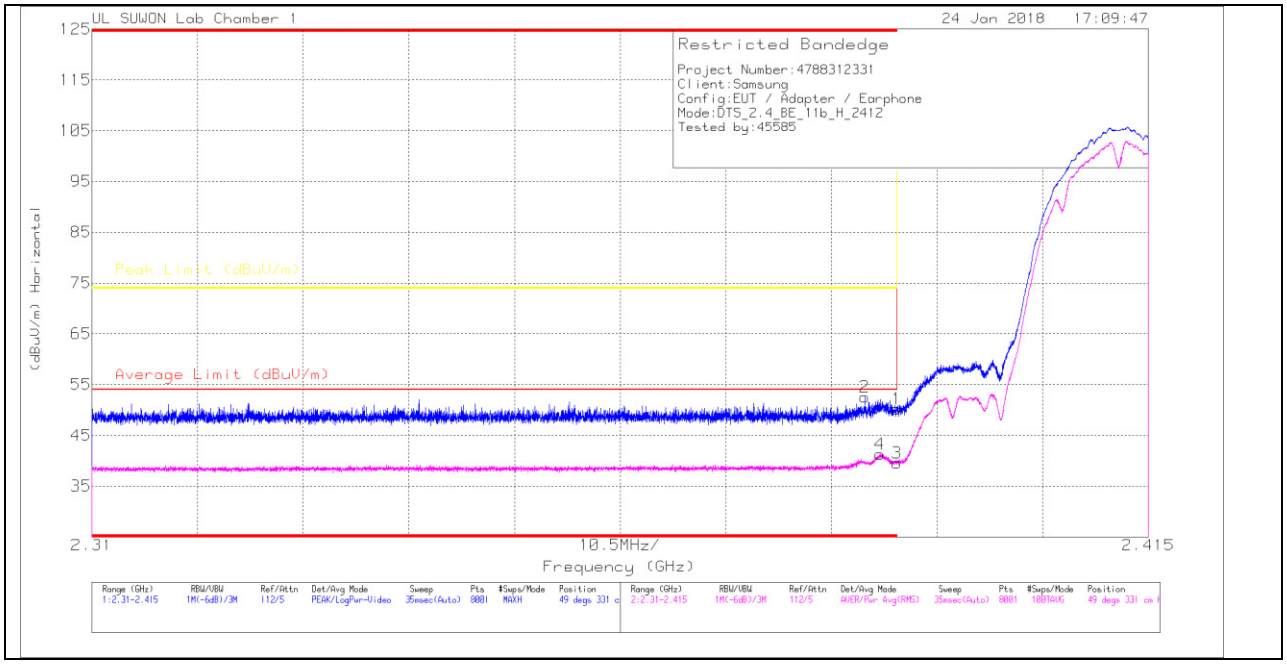
10.2. TRANSMITTER ABOVE 1 GHz

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

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	20170531_3117_00168717	10dB_ATT(dB)_170809	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	44.63	Pk	31.3	-25.7	0	50.23	-	-	74	-23.77	49	331	H
2	* 2.387	46.9	Pk	31.3	-25.7	0	52.5	-	-	74	-21.5	49	331	H
3	* 2.39	33.95	RMS	31.3	-25.7	0	39.55	54	-14.45	-	-	49	331	H
4	* 2.388	35.75	RMS	31.3	-25.7	0	41.35	54	-12.65	-	-	49	331	H

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

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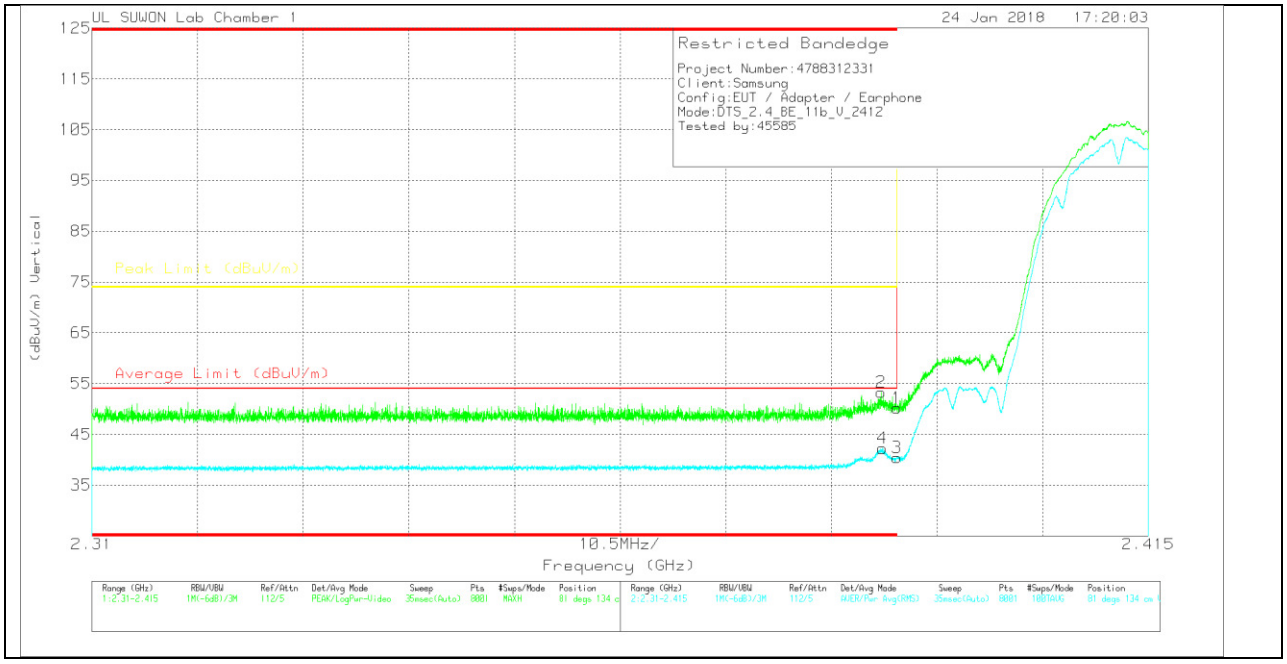
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	20170531_3117_00168717	10dB_ATT(dB)_170809	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	44.58	Pk	31.3	-25.7	0	50.18	-	-	74	-23.82	81	134	V
2	* 2.388	47.65	Pk	31.3	-25.7	0	53.25	-	-	74	-20.75	81	134	V
3	* 2.39	34.82	RMS	31.3	-25.7	0	40.42	54	-13.58	-	-	81	134	V
4	* 2.389	36.63	RMS	31.3	-25.7	0	42.23	54	-11.77	-	-	81	134	V

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

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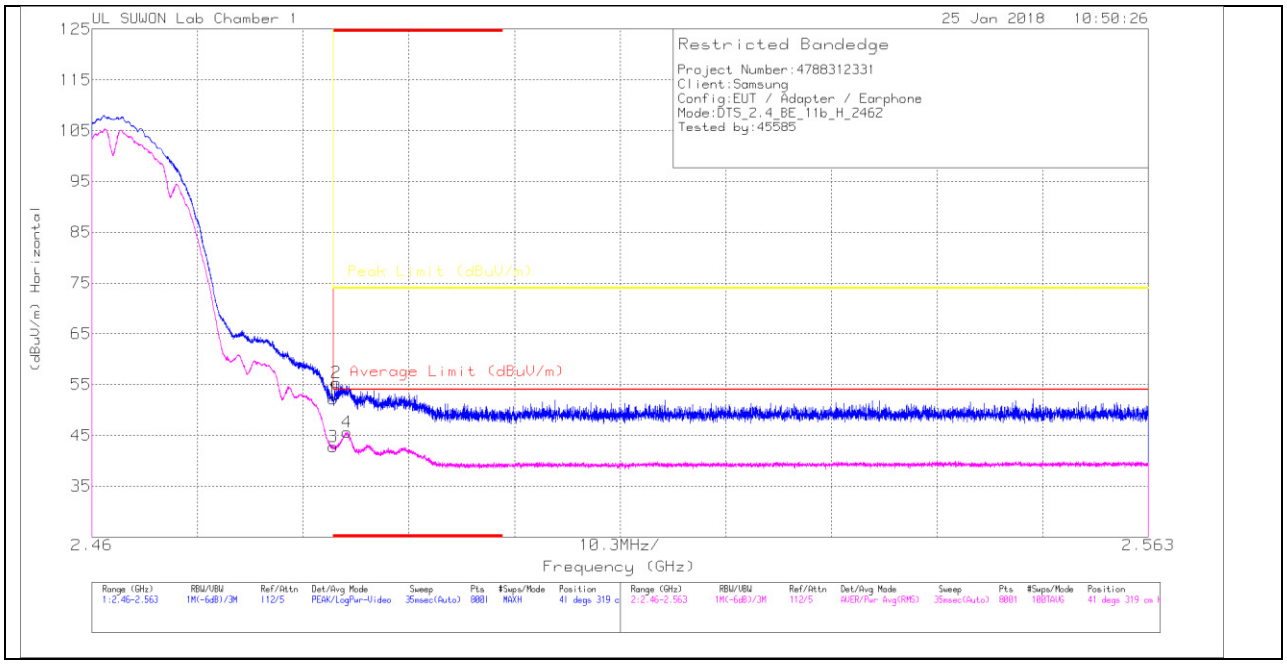
AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	20170531_3117_00168717	10dB_ATT(dB)_170809	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	46.11	Pk	31.6	-25.5	0	52.21	-	-	74	-21.79	41	319	H
2	* 2.484	49.34	Pk	31.6	-25.5	0	55.44	-	-	74	-18.56	41	319	H
3	* 2.484	36.63	RMS	31.6	-25.5	0	42.73	54	-11.27	-	-	41	319	H
4	* 2.485	39.57	RMS	31.6	-25.5	0	45.67	54	-8.33	-	-	41	319	H

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

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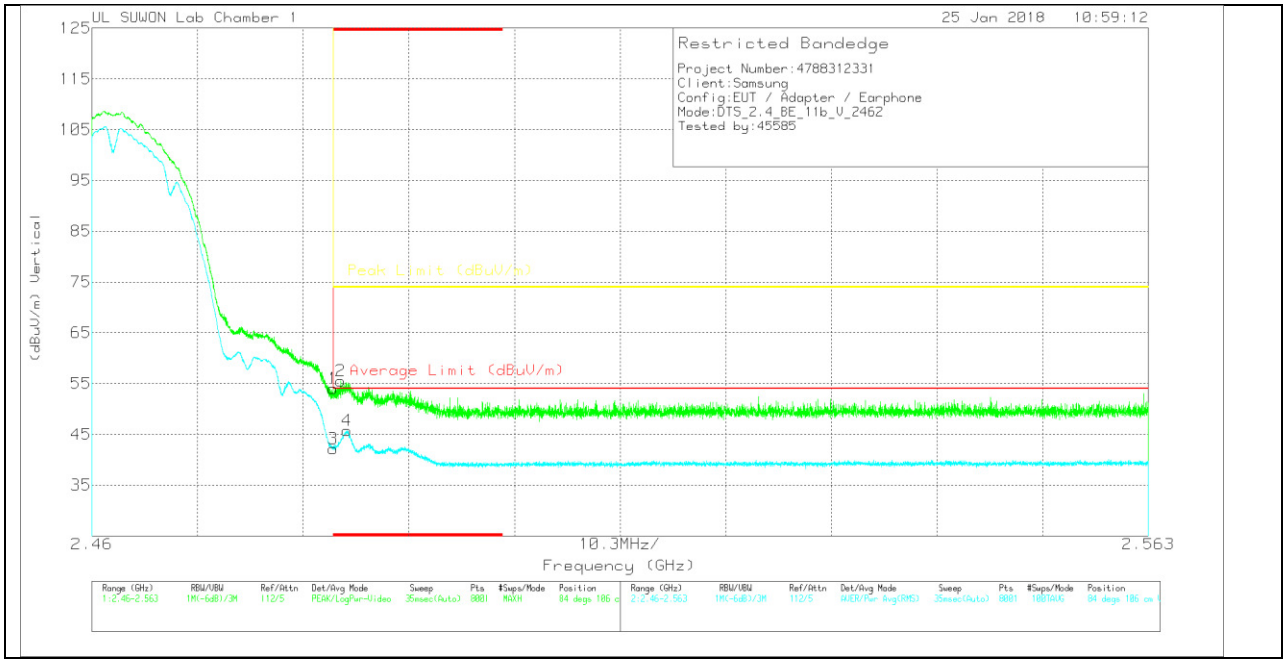
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	20170531_3117_00168717	10dB_ATT(dB)_170809	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	47.89	Pk	31.6	-25.5	0	53.99	-	-	74	-20.01	84	106	V
2	* 2.484	49.38	Pk	31.6	-25.5	0	55.48	-	-	74	-18.52	84	106	V
3	* 2.484	36.1	RMS	31.6	-25.5	0	42.2	54	-11.8	-	-	84	106	V
4	* 2.485	39.67	RMS	31.6	-25.5	0	45.77	54	-8.23	-	-	84	106	V

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

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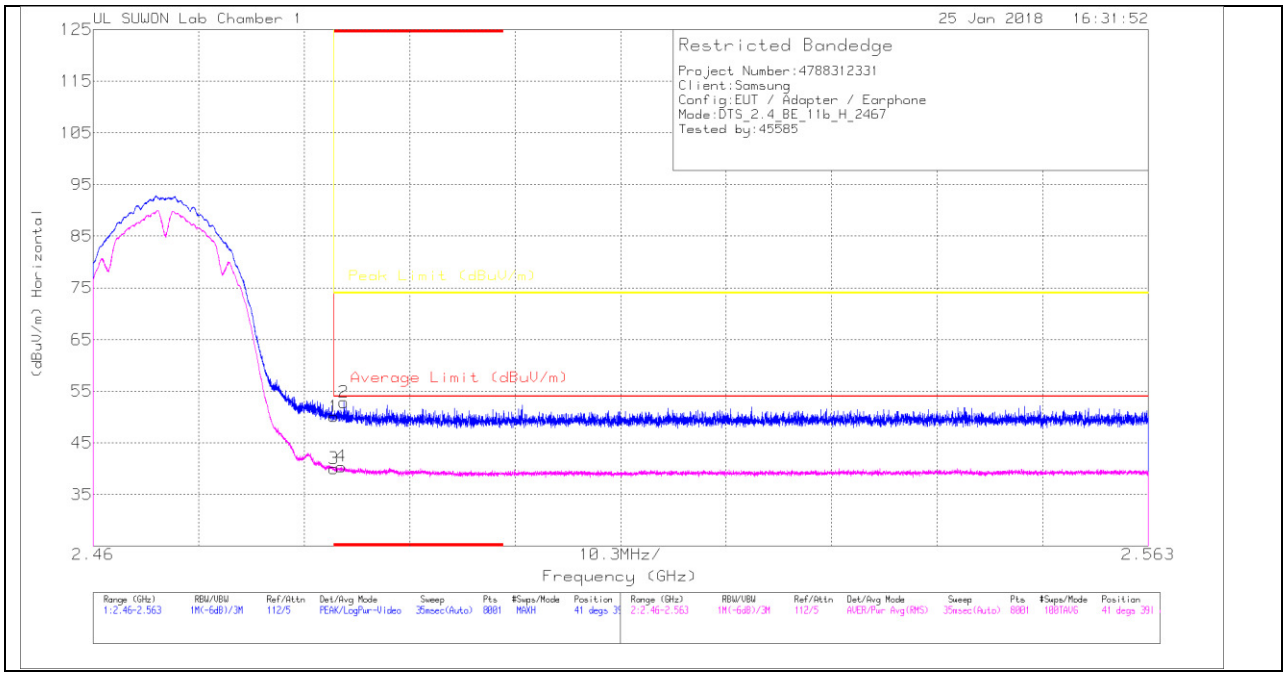
AUTHORIZED BANDEDGE (12 CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	20170531_3117_00168717	10dB_ATT(dB)_170809	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	44.02	Pk	31.6	-25.5	0	50.12	-	-	74	-23.88	41	391	H
2	* 2.485	46.78	Pk	31.6	-25.5	0	52.88	-	-	74	-21.12	41	391	H
3	* 2.484	33.93	RMS	31.6	-25.5	0	40.03	54	-13.97	-	-	41	391	H
4	* 2.484	34.34	RMS	31.6	-25.5	0	40.44	54	-13.56	-	-	41	391	H

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

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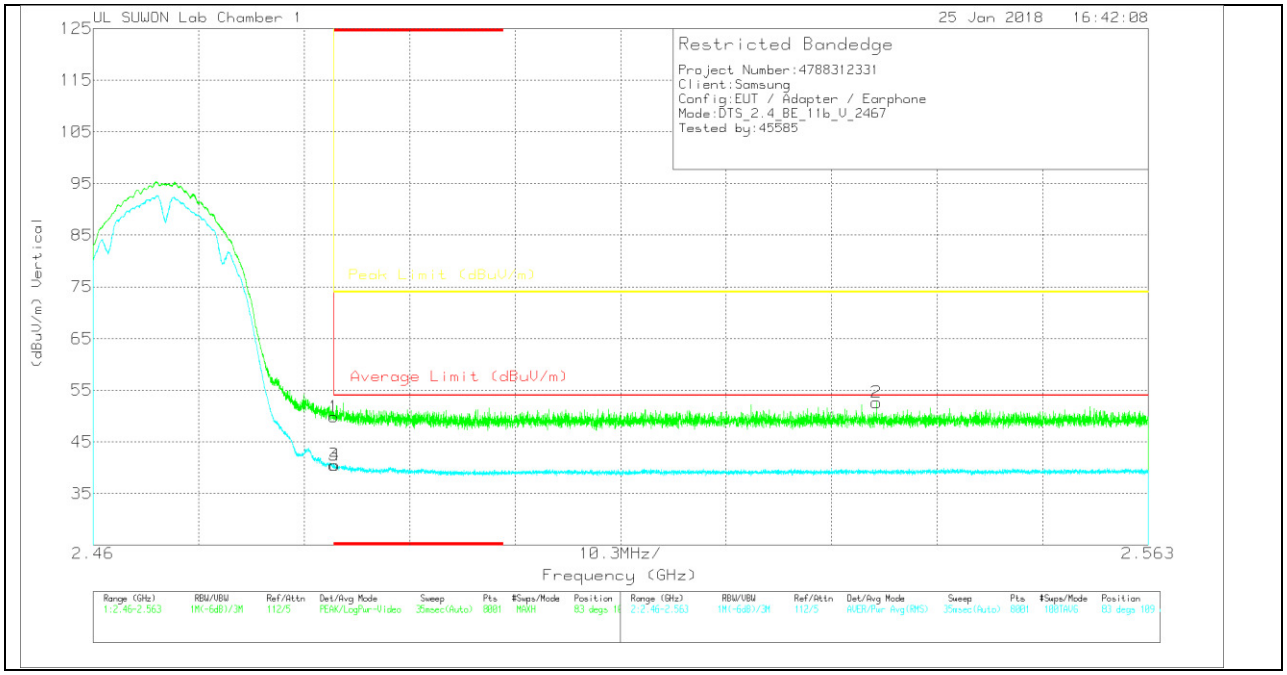
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	20170531_3117_00168717	10dB_ATT(dB)_170809	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	43.75	Pk	31.6	-25.5	0	49.85	-	-	74	-24.15	83	109	V
2	2.536	46.33	Pk	31.7	-25.4	0	52.63	-	-	74	-21.37	83	109	V
3	* 2.484	34.45	RMS	31.6	-25.5	0	40.55	54	-13.45	-	-	83	109	V
4	* 2.484	34.41	RMS	31.6	-25.5	0	40.51	54	-13.49	-	-	83	109	V

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

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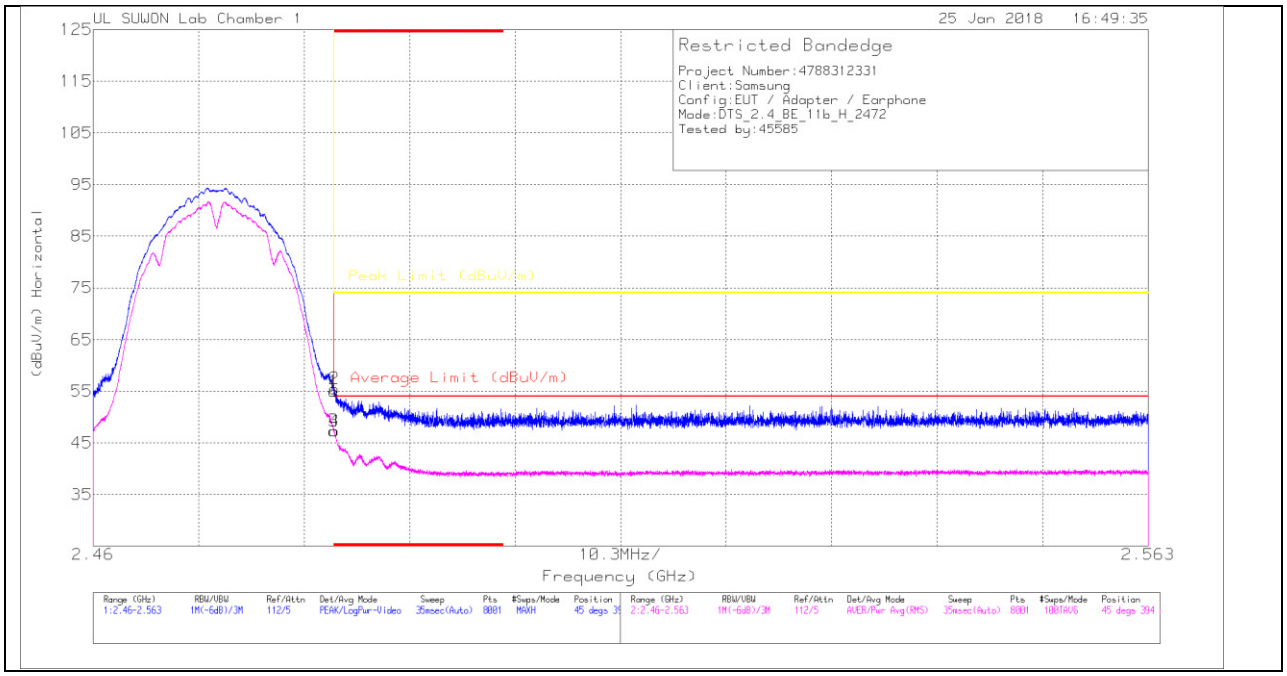
AUTHORIZED BANDEDGE (13 CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	20170531_3117_00168717	10dB_ATT(dB)_170809	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	48.88	Pk	31.6	-25.5	0	54.98	-	-	74	-19.02	45	394	H
2	* 2.484	49.39	Pk	31.6	-25.5	0	55.49	-	-	74	-18.51	45	394	H
3	* 2.484	41.24	RMS	31.6	-25.5	0	47.34	54	-6.66	-	-	45	394	H
4	* 2.484	41.23	RMS	31.6	-25.5	0	47.33	54	-6.67	-	-	45	394	H

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

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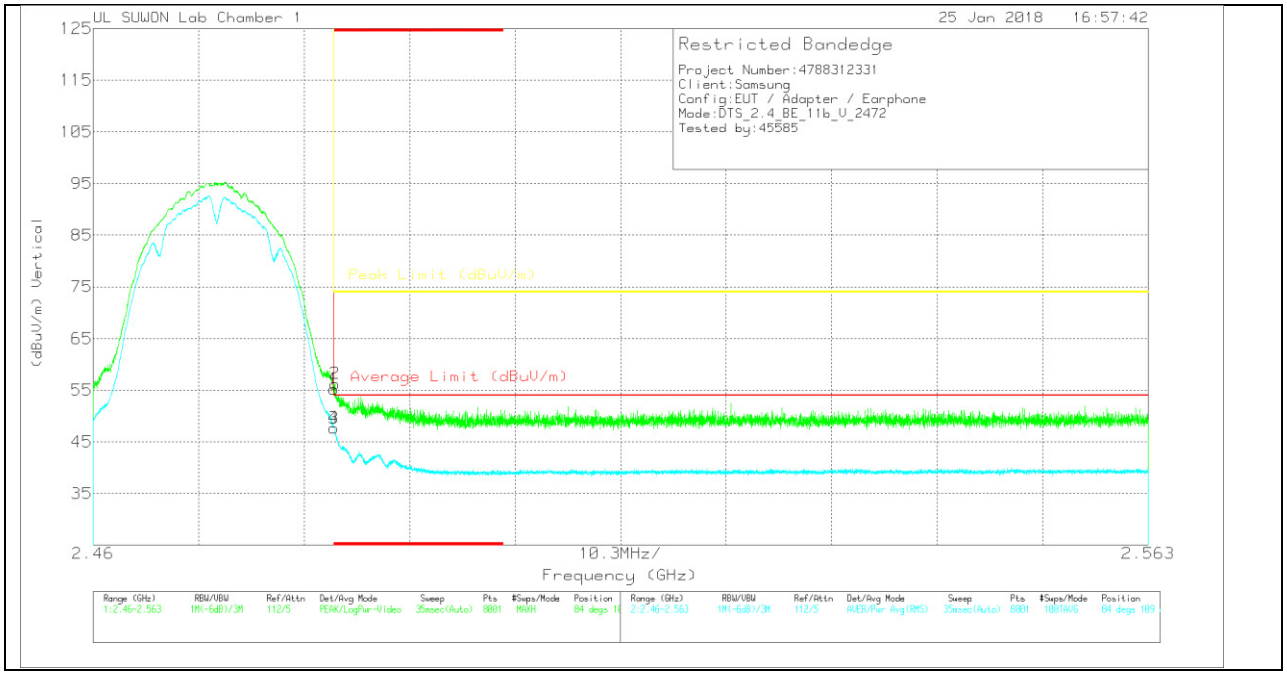
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	20170531_3117_00168717	10dB_ATT(dB)_170809	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	49.14	Pk	31.6	-25.5	0	55.24	-	-	74	-18.76	84	109	V
2	* 2.484	50.16	Pk	31.6	-25.5	0	56.26	-	-	74	-17.74	84	109	V
3	* 2.484	41.55	RMS	31.6	-25.5	0	47.65	54	-6.35	-	-	84	109	V
4	* 2.484	41.62	RMS	31.6	-25.5	0	47.72	54	-6.28	-	-	84	109	V

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

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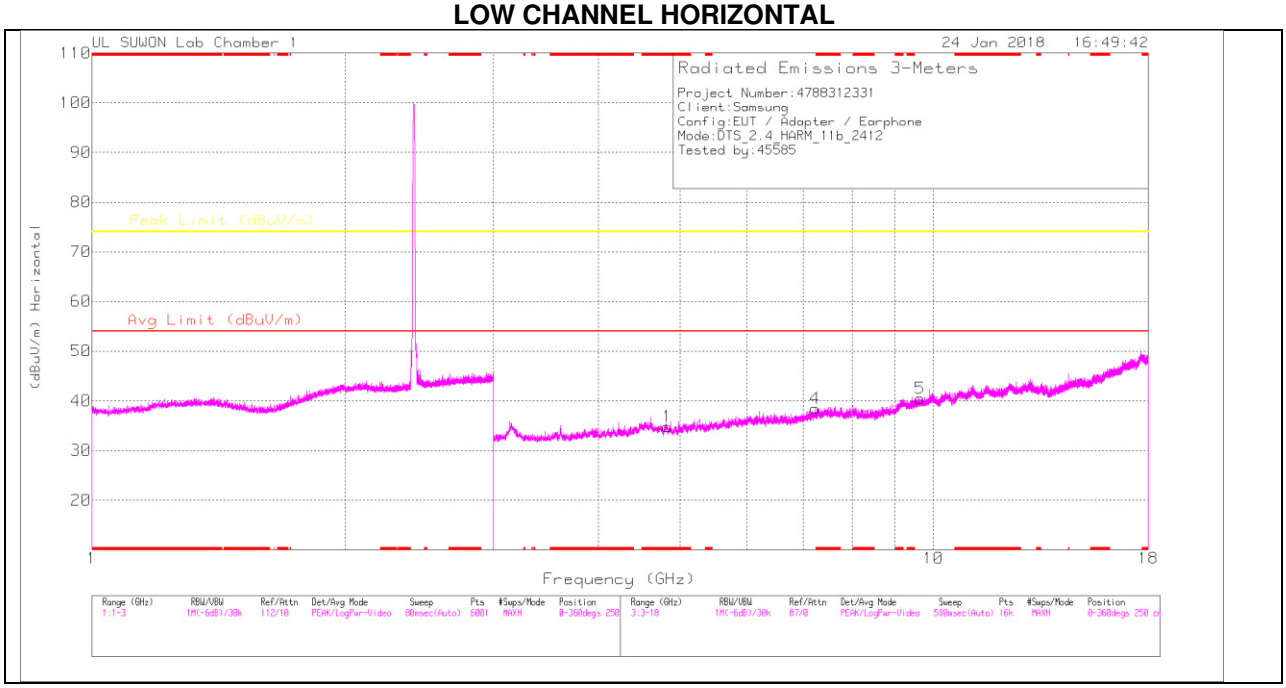
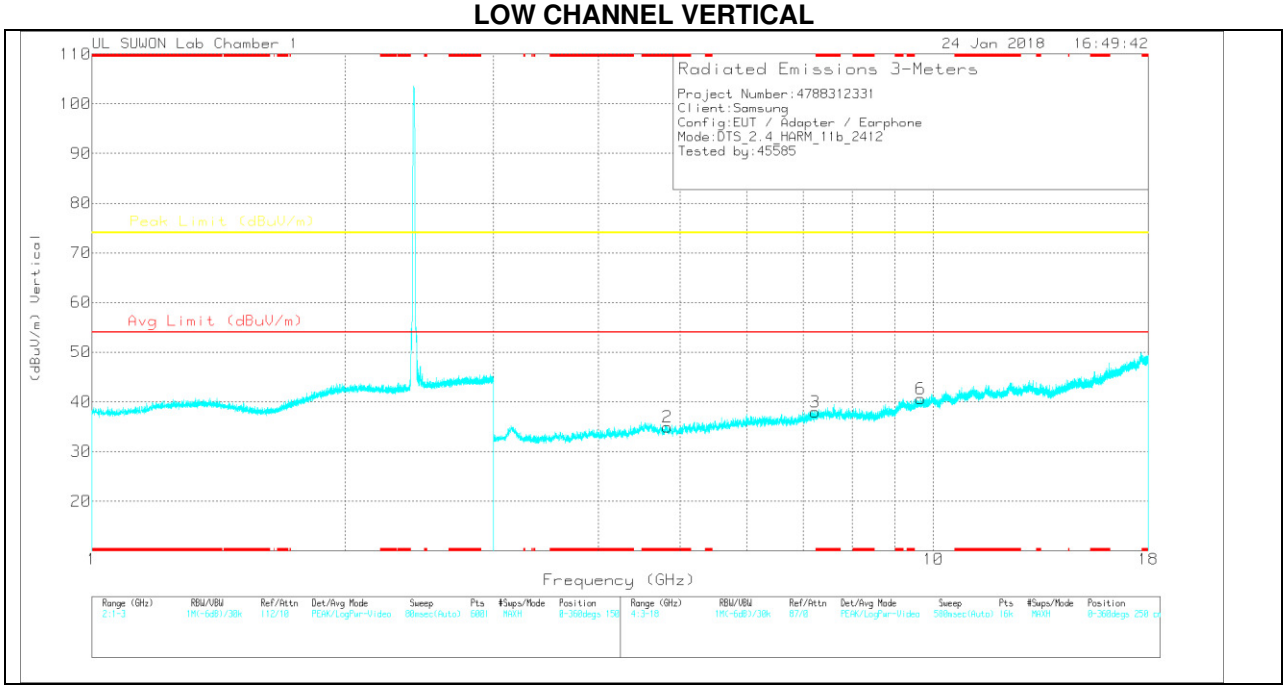
HARMONICS AND SPURIOUS EMISSIONS

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.

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LOW CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	20170531_3117_00168717	3GHz_HP(dB)_170809	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	* 4.827	32.62	PK	33.8	-31.6	0	34.82	-	-	74	-39.18	0-360	250	H
4	7.236	30.52	PK	35.9	-28	0	38.42	-	-	74	-35.58	0-360	250	H
5	9.648	27.37	PK	36.8	-23.7	0	40.47	-	-	74	-33.53	0-360	150	H
2	* 4.827	32.68	PK	33.8	-31.6	0	34.88	-	-	74	-39.12	0-360	150	V
3	7.235	30.11	PK	35.9	-28.1	0	37.91	-	-	74	-36.09	0-360	250	V
6	9.649	27.46	PK	36.8	-23.7	0	40.56	-	-	74	-33.44	0-360	250	V

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

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

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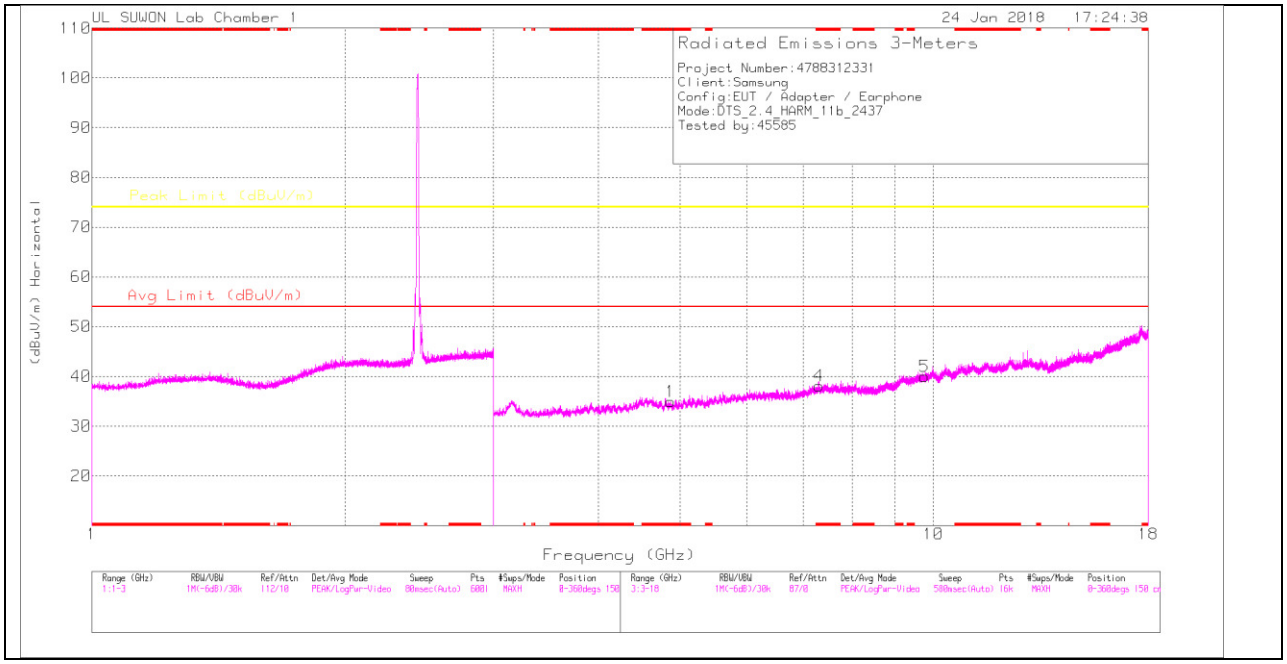
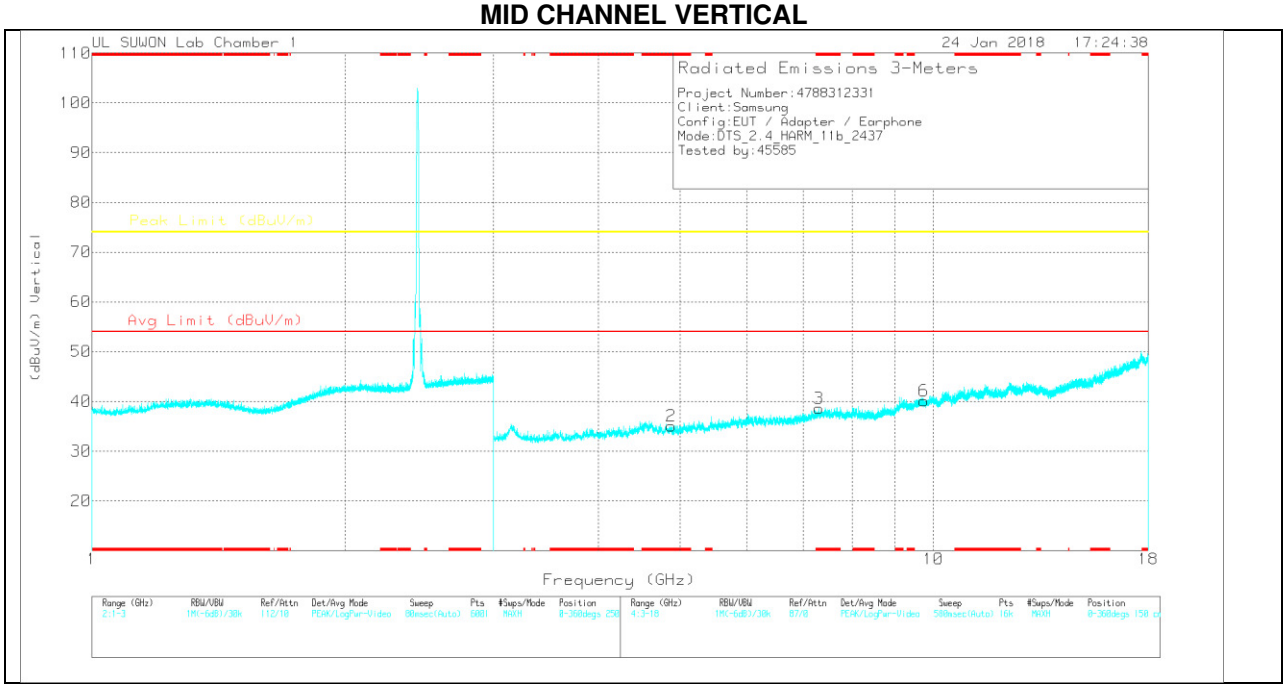
MID CHANNEL HORIZONTAL



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.

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MID CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	20170531_3117_00168717	3GHz_HP(dB)_170809	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	* 4.873	32.78	PK	33.8	-31.7	0	34.88	-	-	74	-39.12	0-360	250	H
4	* 7.315	29.76	PK	35.9	-27.6	0	38.06	-	-	74	-35.94	0-360	250	H
5	9.75	27.28	PK	36.9	-24.2	0	39.98	-	-	74	-34.02	0-360	150	H
2	* 4.879	32.98	PK	33.8	-31.7	0	35.08	-	-	74	-38.92	0-360	150	V
3	* 7.314	30.26	PK	35.9	-27.6	0	38.56	-	-	74	-35.44	0-360	250	V
6	9.746	27.43	PK	36.9	-24.2	0	40.13	-	-	74	-33.87	0-360	250	V

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

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

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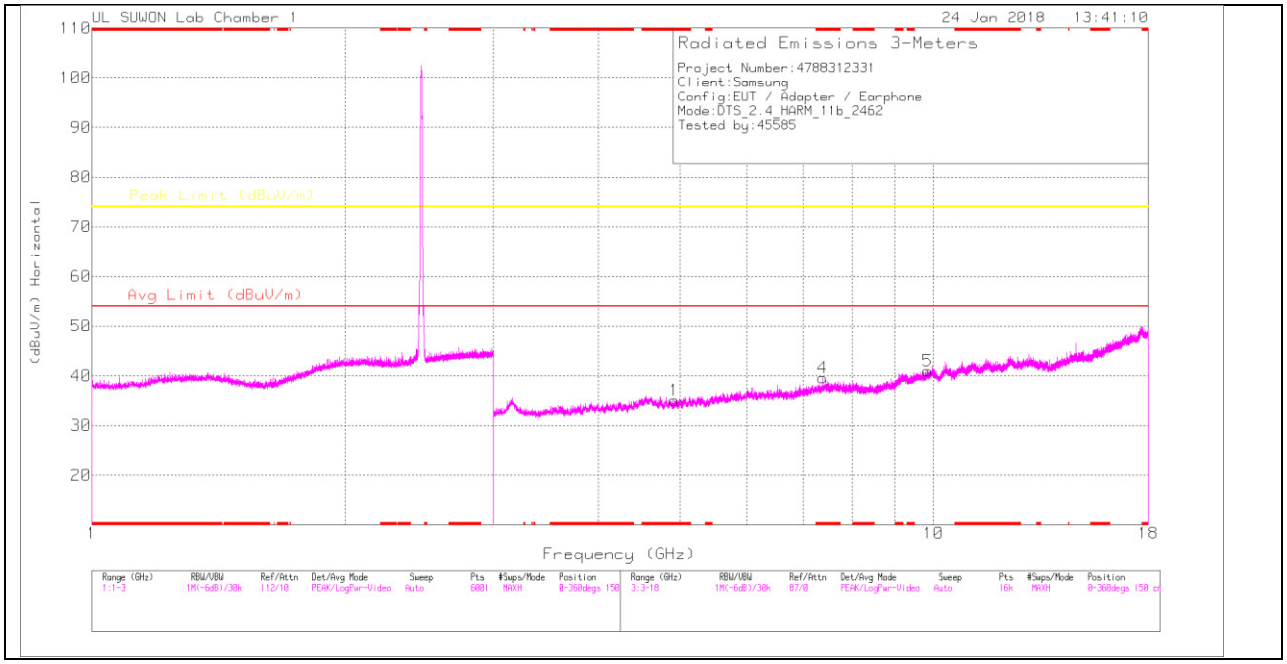
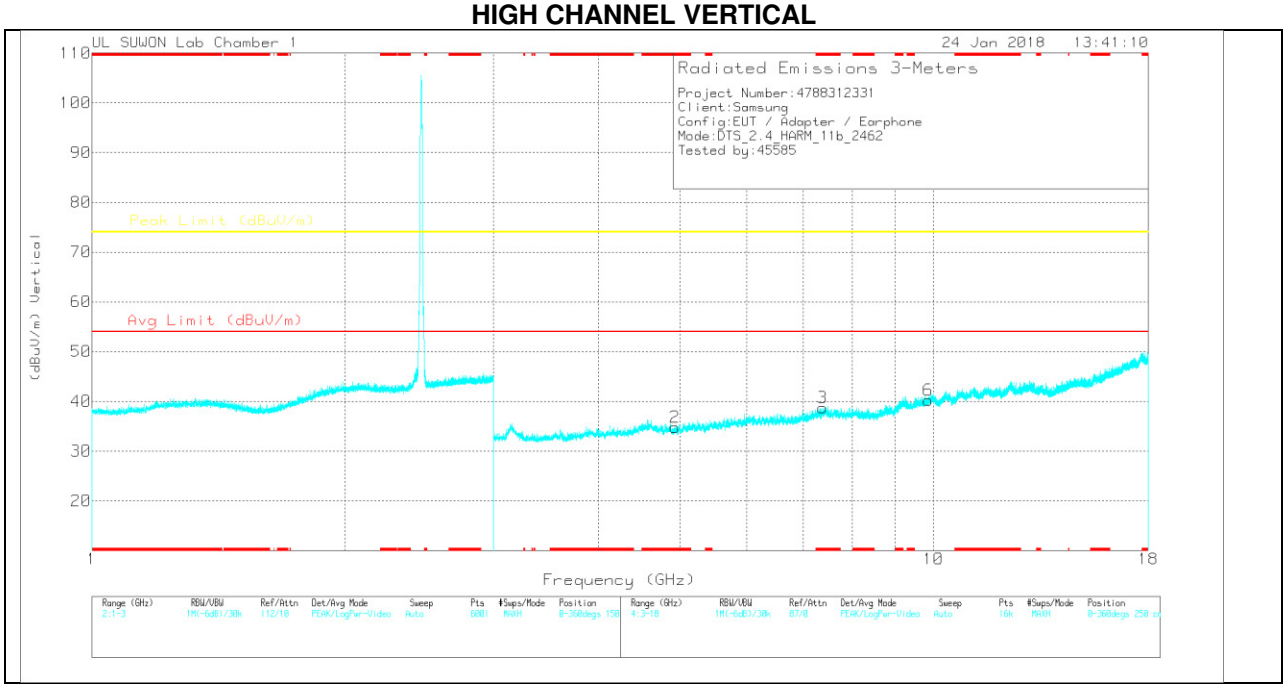
HIGH CHANNEL HORIZONTAL



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.

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HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	20170531_3117_00168717	3GHz_HP(dB)_170809	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	* 4.923	33.06	PK	33.8	-31.8	0	35.06	-	-	74	-38.94	0-360	150	H
4	* 7.383	30.89	PK	35.9	-27.2	0	39.59	-	-	74	-34.41	0-360	250	H
5	9.847	27.42	PK	37	-23.4	0	41.02	-	-	74	-32.98	0-360	250	H
2	* 4.929	32.84	PK	33.8	-31.8	0	34.84	-	-	74	-39.16	0-360	150	V
3	* 7.384	30.03	PK	35.9	-27.2	0	38.73	-	-	74	-35.27	0-360	150	V
6	9.855	26.48	PK	37	-23.3	0	40.18	-	-	74	-33.82	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	20170531_3117_00168717	3GHz_HP(dB)_170809	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 7.385	39.78	PK2	35.9	-27.2	0	48.48	-	-	74	-25.52	268	123	H
* 7.385	28.48	MAv1	35.9	-27.2	0	37.18	54	-16.82	-	-	268	123	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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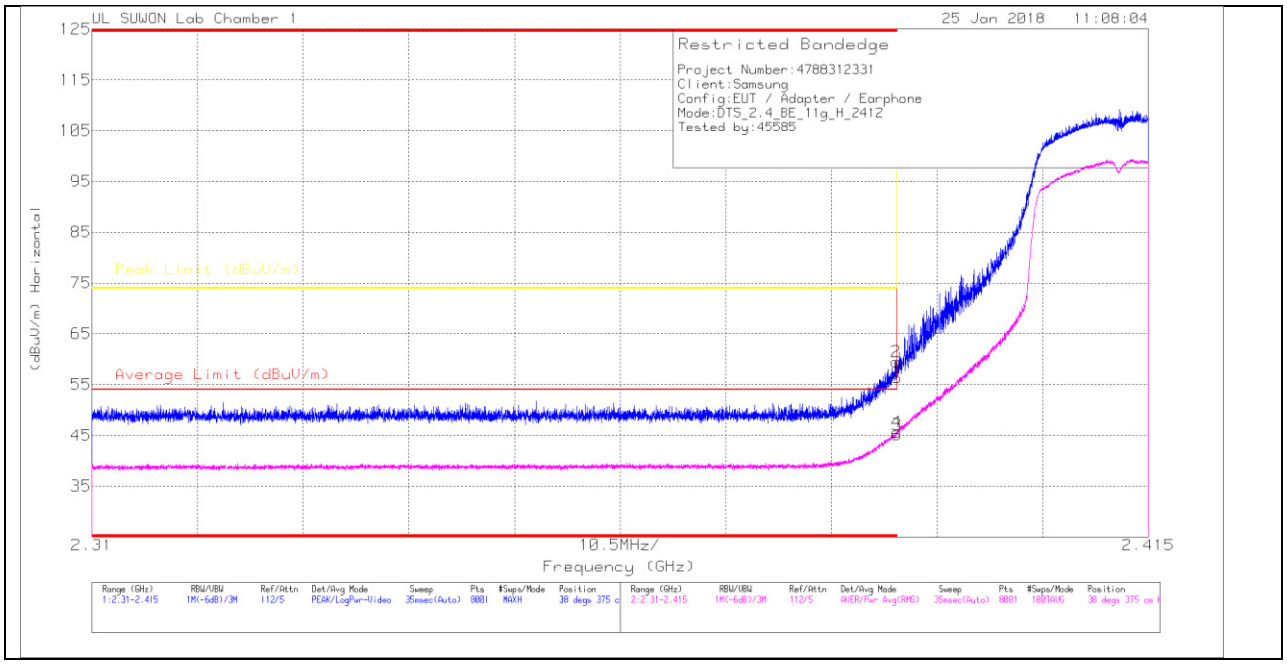
10.2.2.TX ABOVE 1 GHz 802.11g MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	20170531_3117_00168717	10dB_ATT(dB)_170809	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	50.84	Pk	31.3	-25.7	0	56.44	-	-	74	-17.56	38	375	H
2	* 2.39	53.9	Pk	31.3	-25.7	0	59.5	-	-	74	-14.5	38	375	H
3	* 2.39	39.29	RMS	31.3	-25.7	.29	45.18	54	-8.82	-	-	38	375	H
4	* 2.39	39.73	RMS	31.3	-25.7	.29	45.62	54	-8.38	-	-	38	375	H

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

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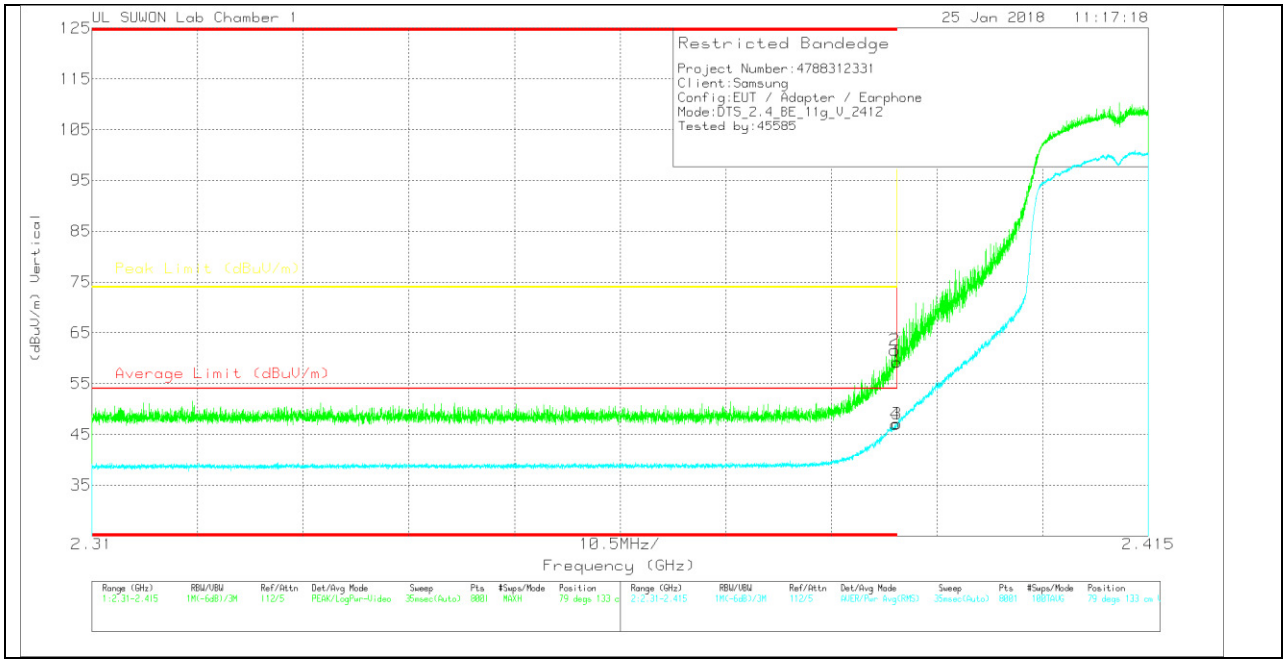
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	20170531_3117_00168717	10dB_ATT(dB)_170809	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	53.62	Pk	31.3	-25.7	0	59.22	-	-	74	-14.78	79	133	V
2	* 2.39	55.96	Pk	31.3	-25.7	0	61.56	-	-	74	-12.44	79	133	V
3	* 2.39	41.2	RMS	31.3	-25.7	.29	47.09	54	-6.91	-	-	79	133	V
4	* 2.39	41.08	RMS	31.3	-25.7	.29	46.97	54	-7.03	-	-	79	133	V

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

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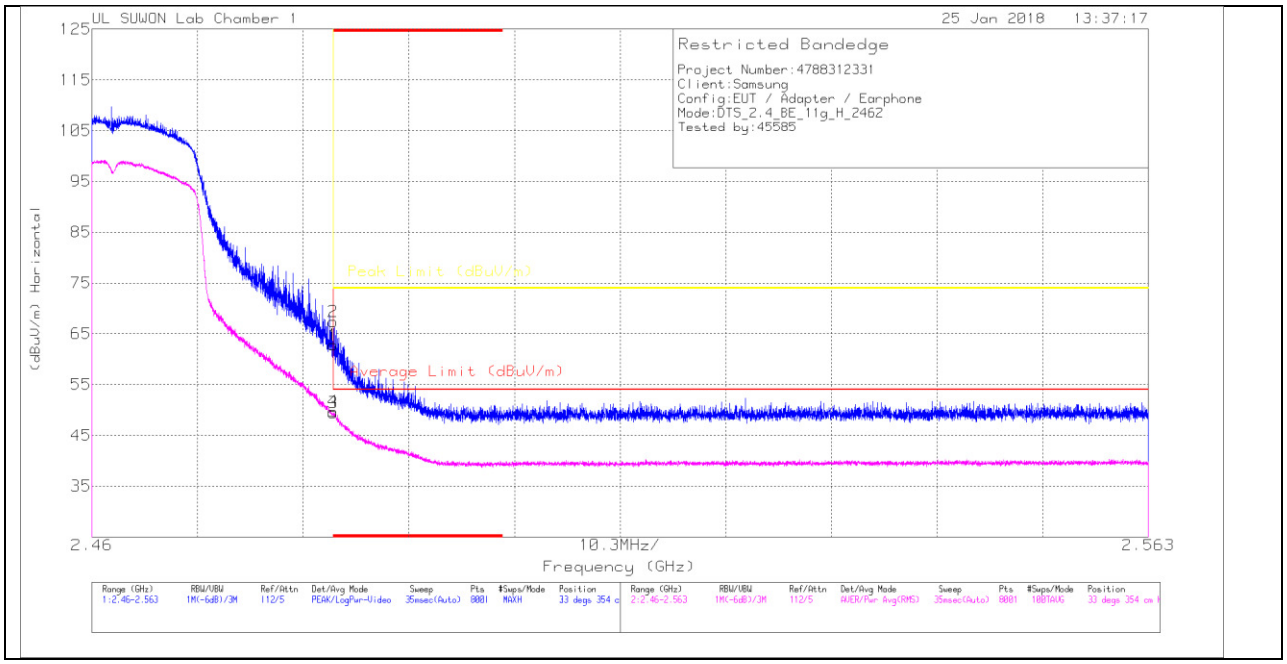
AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	20170531_3117_00168717	10dB_ATT(dB)_170809	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	56.69	Pk	31.6	-25.5	0	62.79	-	-	74	-11.21	33	354	H
2	* 2.484	61.32	Pk	31.6	-25.5	0	67.42	-	-	74	-6.58	33	354	H
3	* 2.484	43.1	RMS	31.6	-25.5	.29	49.49	54	-4.51	-	-	33	354	H
4	* 2.484	43.33	RMS	31.6	-25.5	.29	49.72	54	-4.28	-	-	33	354	H

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

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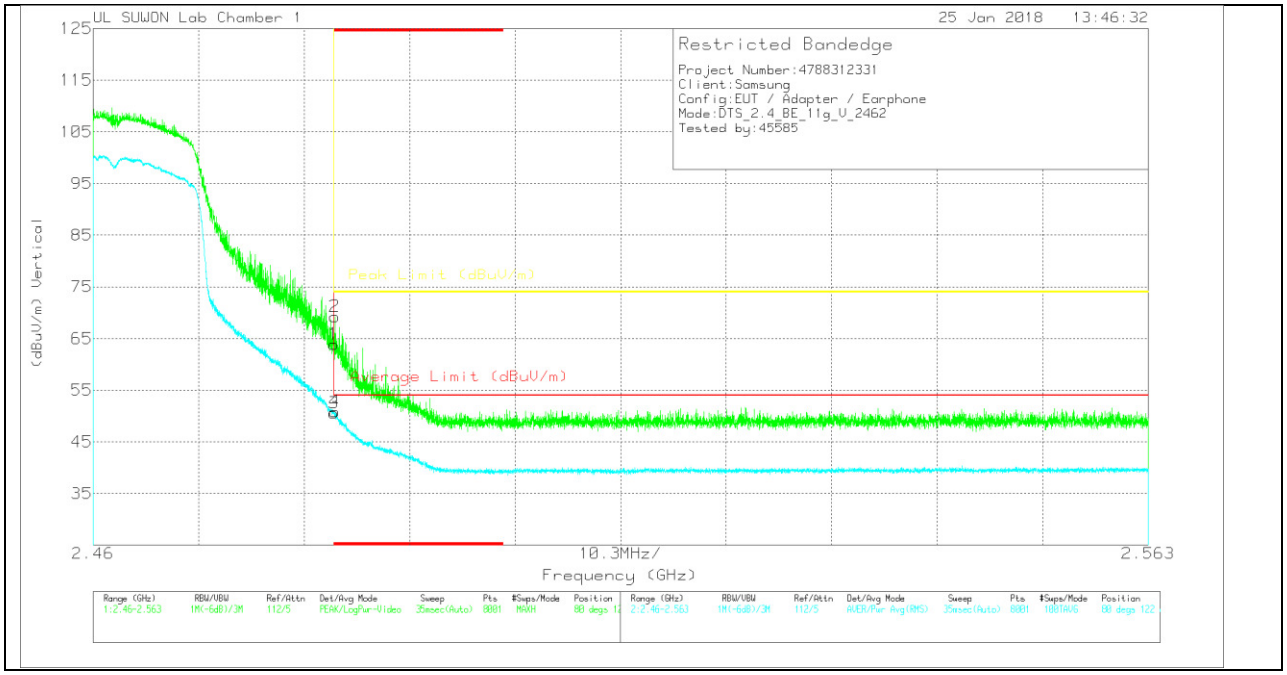
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	20170531_3117_00168717	10dB_ATT(dB)_170809	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	57.81	Pk	31.6	-25.5	0	63.91	-	-	74	-10.09	80	122	V
2	* 2.484	63.16	Pk	31.6	-25.5	0	69.26	-	-	74	-4.74	80	122	V
3	* 2.484	44.2	RMS	31.6	-25.5	.29	50.59	54	-3.41	-	-	80	122	V
4	* 2.484	44.48	RMS	31.6	-25.5	.29	50.87	54	-3.13	-	-	80	122	V

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

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