FCC CFR47 PART 15 SUBPART C

DTS Wireless LAN

CERTIFICATION TEST REPORT

FOR

GSM/WCDMA/LTE Tablet + Bluetooth/BLE, DTS/UNII a/b/g/n/ac and ANT+

MODEL NUMBER : SM-T825C

FCC ID: A3LSMT825C

REPORT NUMBER: 4787821324-E1V2

ISSUE DATE: MAR 13, 2017

Prepared for
SAMSUNG ELECTRONICS CO., LTD.
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,
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Prepared by
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ACCREDITED
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	02/24/17	Initial issue	Junwhan Lee
V2	03/13/17	Revised section 10	Junwhan Lee

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TABLE OF CONTENTS

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION:	GSM/WCDMA/LTE Tablet + Bluetooth/BLE, DTS/UNII a/b/g/n/ac and ANT+
MODEL NUMBER:	SM-T825C
SERIAL NUMBER:	R22HC00979E, R22HC0097EN (RADIATED); R22HC00975D, R22HC00QNAA (CONDUCTED)
DATE TESTED:	JAN 11, 2017 - FEB 24, 2017

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
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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 v03r05.
4. KDB 662911 D01 v02r01
5. KDB 594280 D01 Software configuration control v02r01.
6. 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

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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	4.14 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 Tablet + Bluetooth/BLE, DTS/UNII a/b/g/n/ac and ANT+.
This test report addresses the DTS (WLAN) operational mode.

WiFi MIMO Condition

Frequency	Mode	Antenna 1	Antenna 2
2.4 GHz	802.11b	TX / RX	TX / RX
	802.11g	TX / RX	TX / RX
	802.11g MIMO	TX / RX	TX / RX
	802.11n	TX / RX	TX / RX
	802.11n MIMO	TX / RX	TX / RX
5 GHz	802.11a	TX / RX	TX / RX
	802.11a MIMO	TX / RX	TX / RX
	802.11n	TX / RX	TX / RX
	802.11n MIMO	TX / RX	TX / RX
	802.11ac	TX / RX	TX / RX
	802.11ac MIMO	TX / RX	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]	
		Antenna1	Antenna2	Antenna1	Antenna2
2412 - 2462	802.11b	13.88	13.99	24.43	25.06
	802.11g SISO	13.77	13.68	23.82	23.33
	802.11g MIMO	16.73		47.10	
	802.11n20 SISO	13.62	13.52	23.01	22.49
	802.11n20 MIMO	16.58		45.50	

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes internal antenna, with a antenna1's maximum gain of -1.83 dBi and antenna2's maximum gain of -2.95 dBi .

5.4. LIST OF TEST REDUCTION AND MODES

The output power on covered modes is equal to or less than one referenced.

Frequency Range (MHz)	Mode	Covered by
2412 - 2462	802.11b Legacy 1TX	802.11b Legacy 1TX
	802.11g 1TX	802.11g CDD 2TX
	802.11g CDD 2TX	802.11g CDD 2TX
	802.11n HT20 1TX	802.11n HT20 CDD 2TX
	802.11n HT20 SDM/CDD 2TX	802.11n HT20 CDD 2TX

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 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 (Legacy 1TX)
802.11g mode: 6 Mbps (2TX CDD)
802.11n HT20 mode: MCS0 (2TX CDD)

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Adapter	SAMSUNG	EP-TA200	R37HB5B0CH1SE3	N/A
Data Cable	SAMSUNG	EP-DN930CWE	N/A	N/A
Earphone	SAMSUNG	EO-EG920BW	N/A	N/A

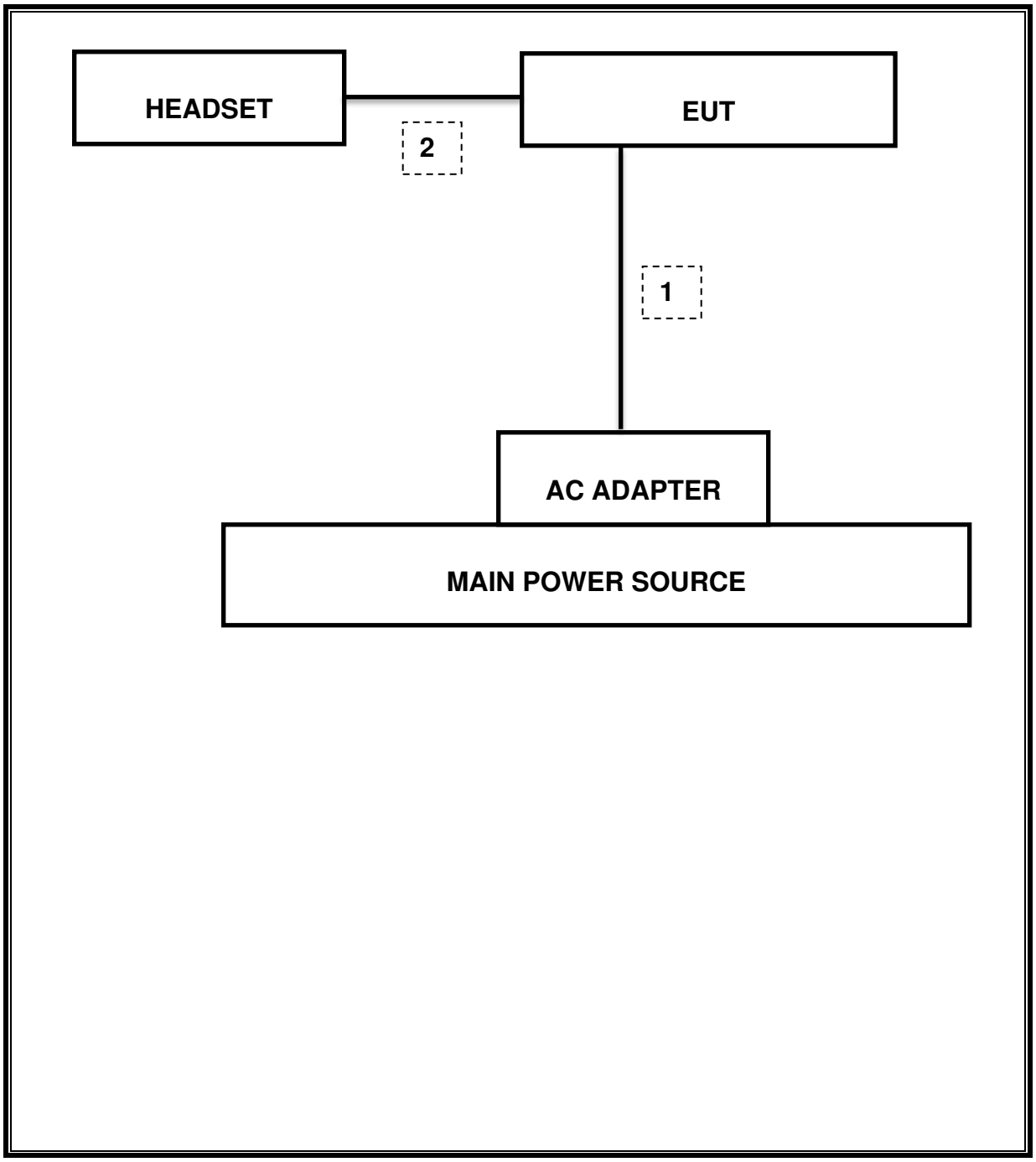
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	C Type USB	Shielded	1.2m	N/A
2	Audio	2	Mini-Jack	Unshielded	1.1m	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



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	10-14-18
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	04-25-17
Antenna, Horn, 18 GHz	ETS	3115	00167211	10-14-18
Antenna, Horn, 18 GHz	ETS	3115	00161451	03-17-17
Antenna, Horn, 18 GHz	ETS	3117	00168724	06-17-17
Antenna, Horn, 18 GHz	ETS	3117	00168717	06-17-17
Antenna, Horn, 40 GHz	ETS	3116C	00166155	11-30-17
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	12-15-17
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-17-17
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-16-17
Preamplifier	ETS	3115-PA	00167475	08-17-17
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-16-17
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-17-17
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-16-17
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	11-25-17
Average Power Sensor	R&S	NRP-Z91	102681	08-16-17
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-17-17
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-17-17
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-16-17
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-16-17
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-17-17
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-16-17
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-17-17
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-16-17
High Pass Filter 6GHz	Micro-Tronics	HPM17542	009	08-17-17
High Pass Filter 6GHz	Micro-Tronics	HPM17542	016	08-16-17
LISN	R&S	ENV-216	101836	08-16-17
LISN	R&S	ENV-216	101837	08-16-17
Attenuator	PASTERNACK	PE7087-10	A009	08-16-17
UL Software				
Description	**Manufacturer**	**Model**	**Version**	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

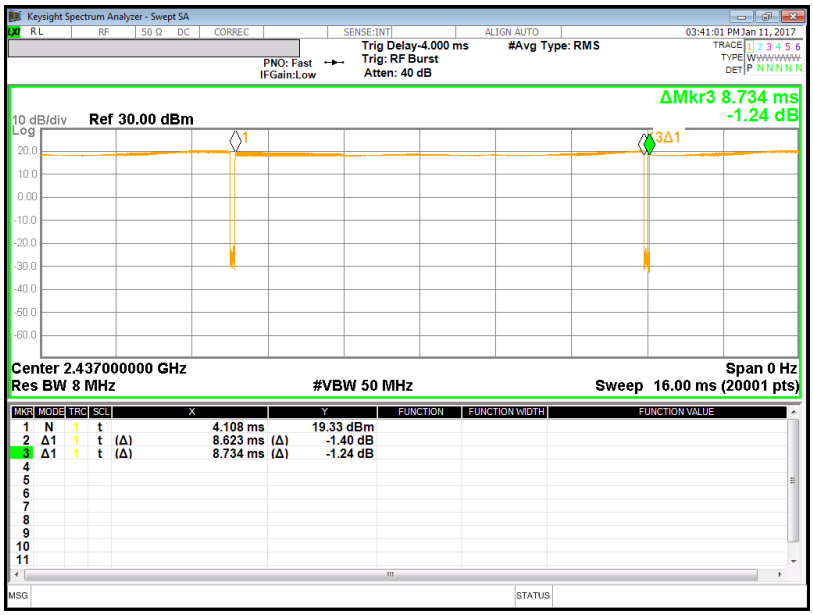
7. REFERENCE MEASUREMENT RESULTS

7.1. ON TIME AND DUTY CYCLE RESULTS

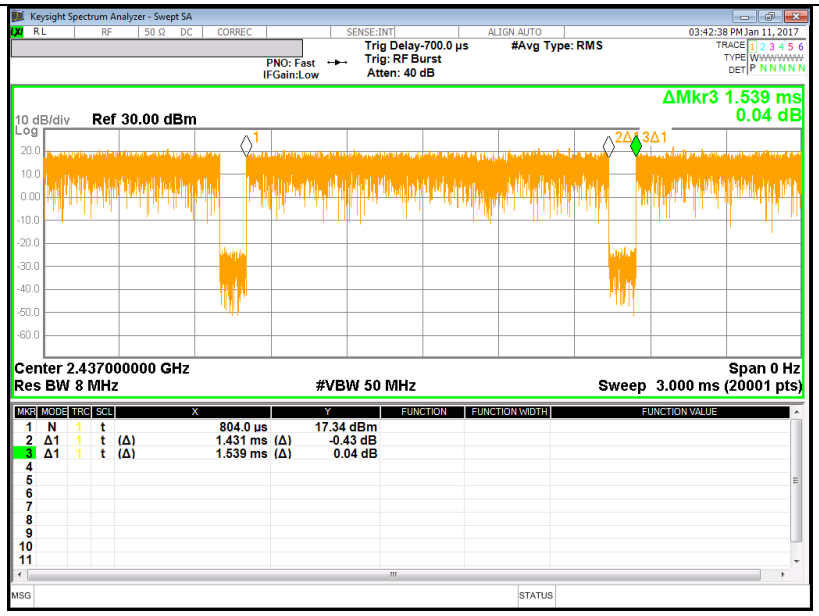
Mode	ON Time B [msec)	Period [msec]	Duty Cycle x [linear]	Duty Cycle [%]	Duty Cycle Correction Factor [dB]	1/T Minimum VBW [kHz]
2400MHz Bands						
802.11b	8.623	8.734	0.987	98.7%	0.00	0.010
802.11g	1.431	1.539	0.930	93.0%	0.32	0.699
802.11n HT20	1.34	1.447	0.926	92.6%	0.33	0.746

LIMITS

None; for reporting purposes only.



[802.11b Mode]

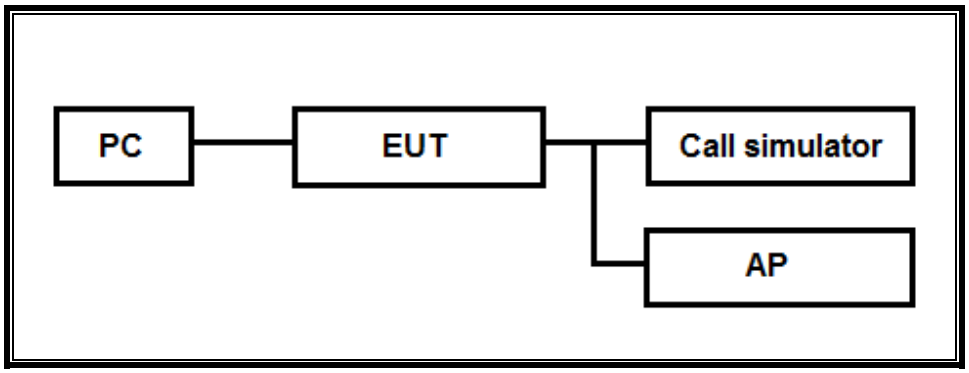


[802.11g Mode]

[802.11n HT20 Mode]

7.2. Verification of geo-location functioning for Wi-Fi Ch. 12& 13

7.2.1. Setup Configuration



7.2.2. Test Results

7.2.3 MCC	US	Non-US (KR)	Airplane
Country	United States	Korea	Default mode (US)
Channel 1	Connected	Connected	Connected
Channel 2	Connected	Connected	Connected
Channel 3	Connected	Connected	Connected
Channel 4	Connected	Connected	Connected
Channel 5	Connected	Connected	Connected
Channel 6	Connected	Connected	Connected
Channel 7	Connected	Connected	Connected
Channel 8	Connected	Connected	Connected
Channel 9	Connected	Connected	Connected
Channel 10	Connected	Connected	Connected
Channel 11	Connected	Connected	Connected
Channel 12	Not Connected	Connected	Not Connected
Channel 13	Not Connected	Connected	Not Connected

Note : Test scripts used are fully described in the operational description

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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	8.039 MHz
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-30.679 dBm
15.247	TX conducted output power	<30dBm		Pass	16.73 dBm (AV)
15.247	PSD	<8dBm		Pass	-16.67 dBm (AV)
15.207 (a)	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass	41.35 dBuV (Pk)
15.205, 15.209	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass	51.77 dBuV/m (AV)

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 v03r05: 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	6 dB Bandwidth [MHz]		Minimum Limit
	[MHz]	Primary Antenna 1	Secondary Antenna 2	[MHz]
1	2412	8.039	8.540	0.5
6	2437	8.052	8.040	0.5
11	2462	8.059	8.064	0.5
Worst		8.039		0.5

9.1.2. 802.11g MODE IN THE 2.4 GHz BAND

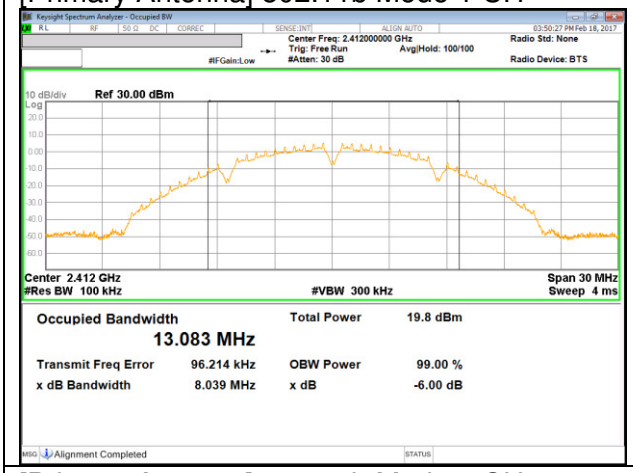
Channel	Frequency	6 dB Bandwidth [MHz]		Minimum Limit
	[MHz]	Primary Antenna 1	Secondary Antenna 2	[MHz]
1	2412	16.04	15.93	0.5
6	2437	16.28	15.93	0.5
11	2462	16.05	16.31	0.5
Worst		15.93		0.5

9.1.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

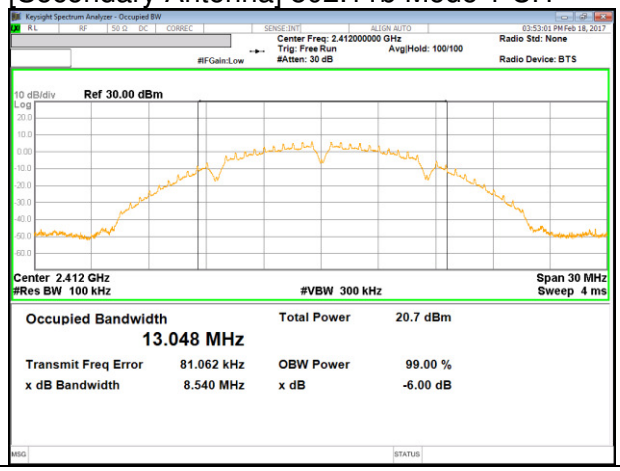
Channel	Frequency	6 dB Bandwidth [MHz]		Minimum Limit
	[MHz]	Chain 0	Chain 1	[MHz]
1	2412	16.90	16.53	0.5
6	2437	16.28	16.50	0.5
11	2462	16.89	16.80	0.5
Worst		16.28		0.5

9.1.4. 6 dB BANDWIDTH PLOTS

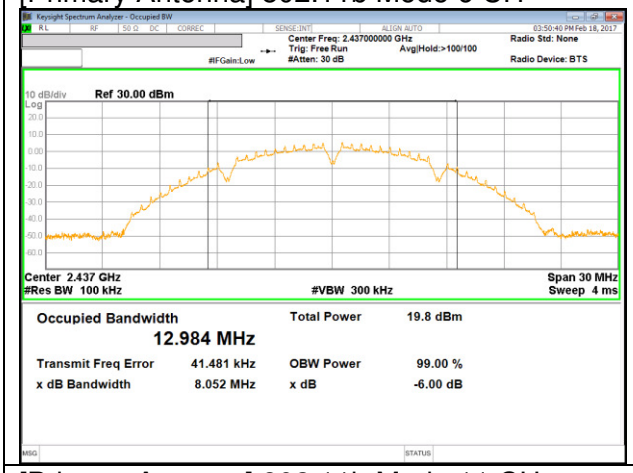
[Primary Antenna] 802.11b Mode 1 CH



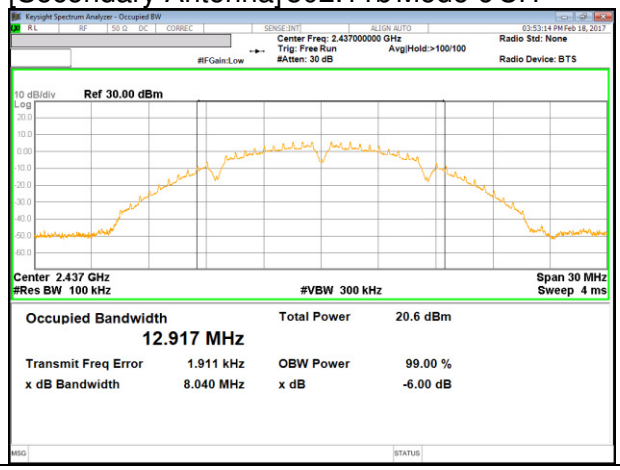
[Secondary Antenna] 802.11b Mode 1 CH



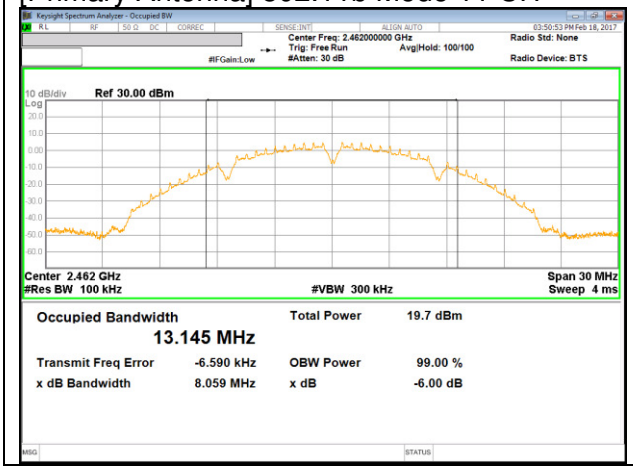
[Primary Antenna] 802.11b Mode 6 CH



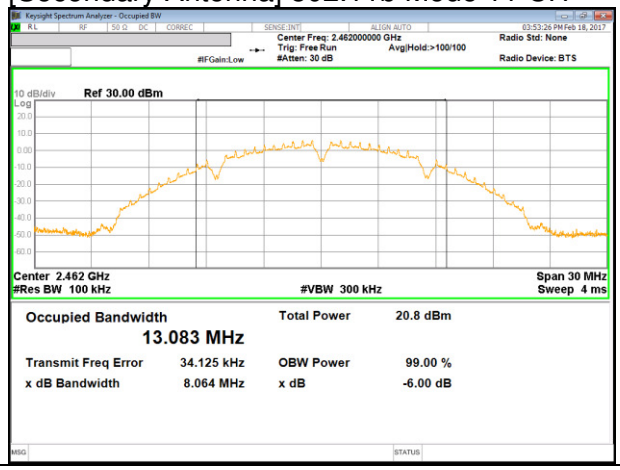
[Secondary Antenna] 802.11b Mode 6 CH



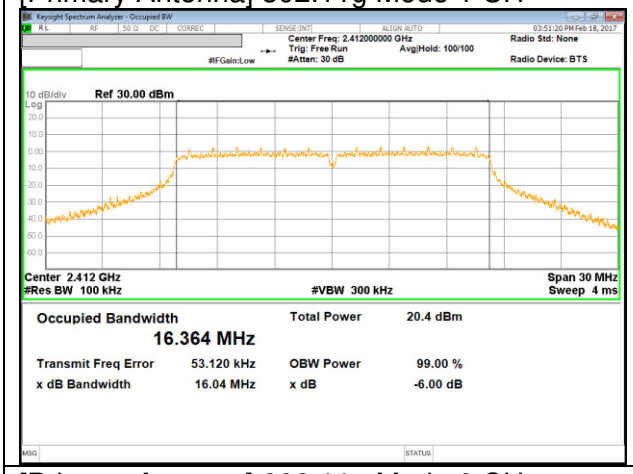
[Primary Antenna] 802.11b Mode 11 CH



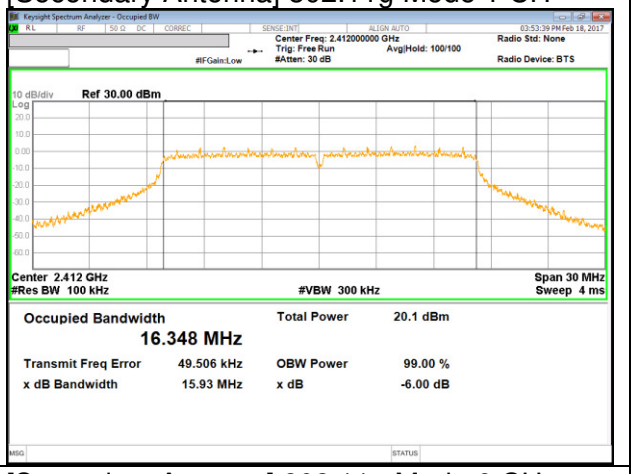
[Secondary Antenna] 802.11b Mode 11 CH



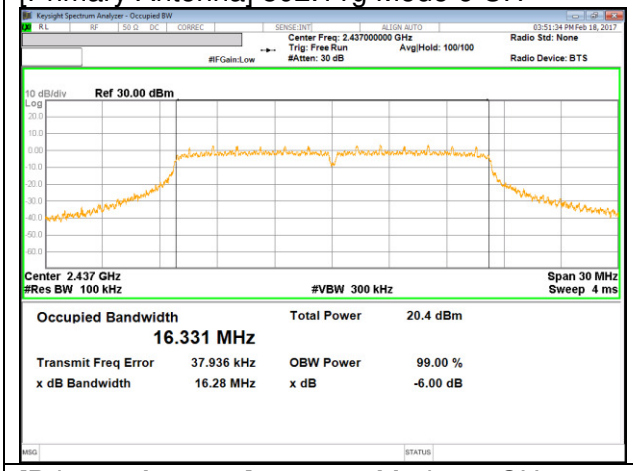
[Primary Antenna] 802.11g Mode 1 CH



[Secondary Antenna] 802.11g Mode 1 CH



[Primary Antenna] 802.11g Mode 6 CH



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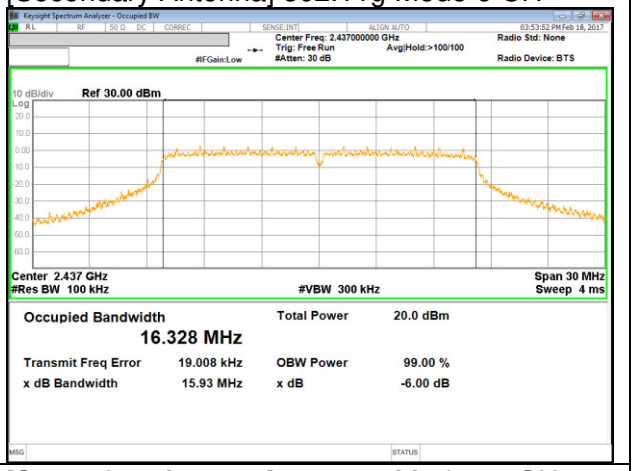
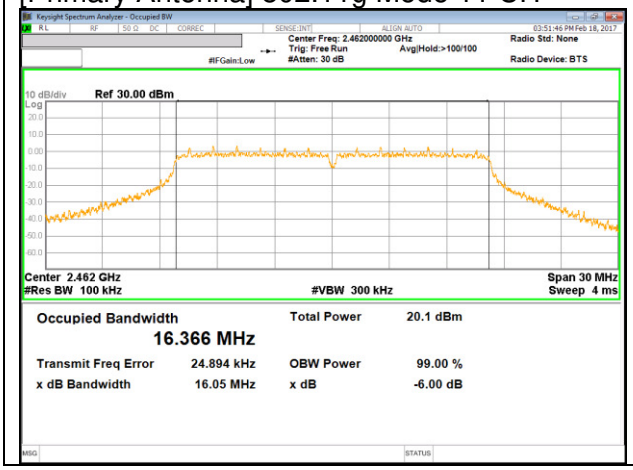
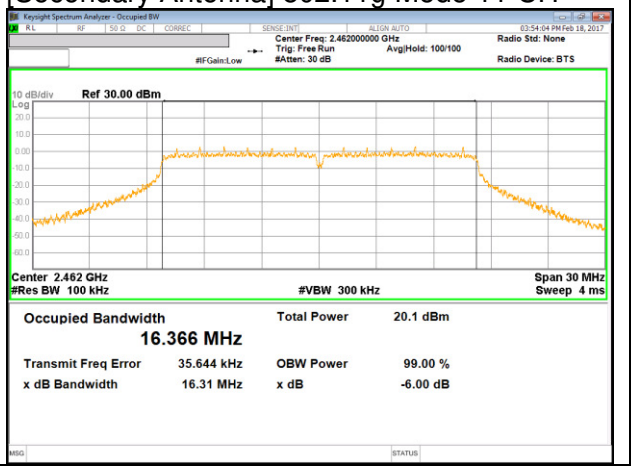


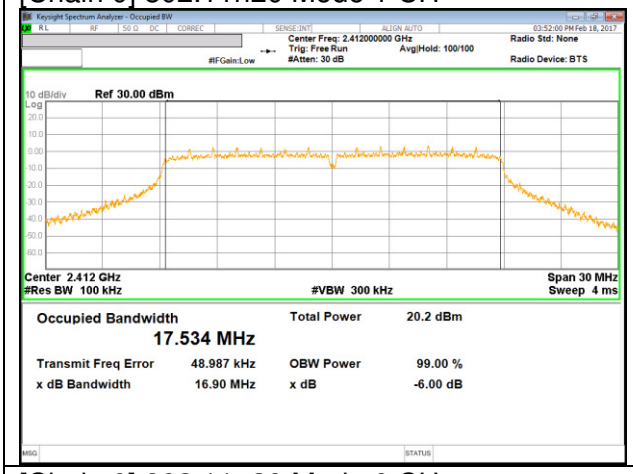
[Primary Antenna] 802.11g Mode 11 CH



[Secondary Antenna] 802.11g Mode 11 CH



[Chain 0] 802.11n20 Mode 1 CH



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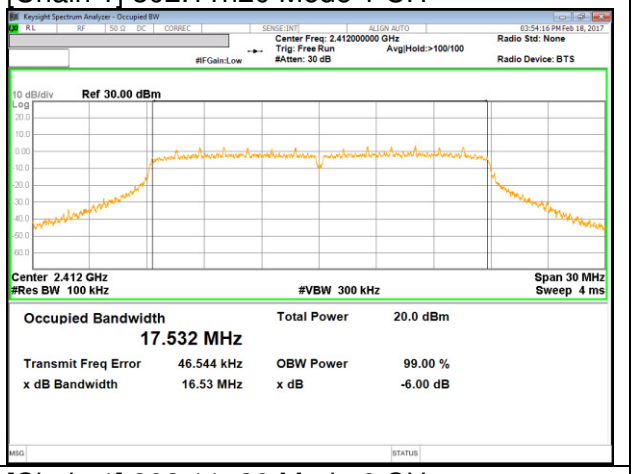

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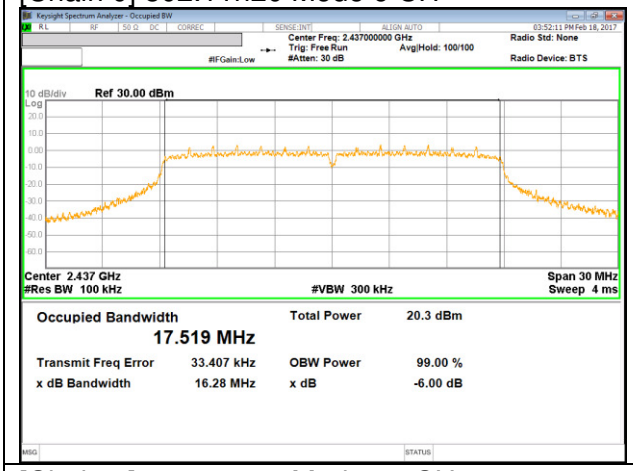

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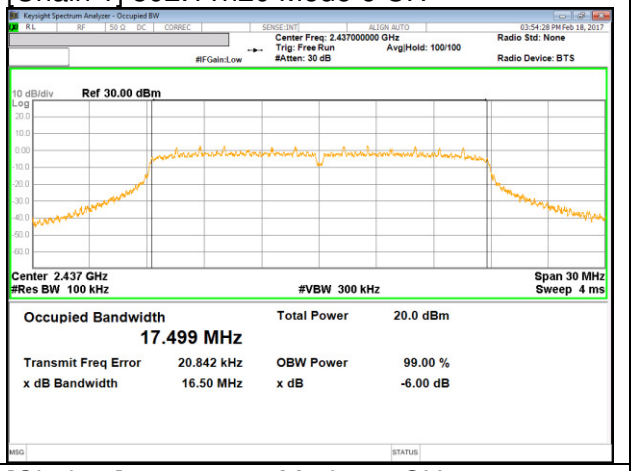

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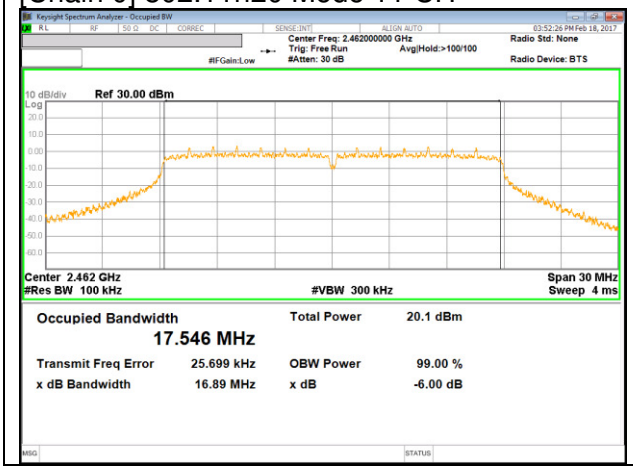
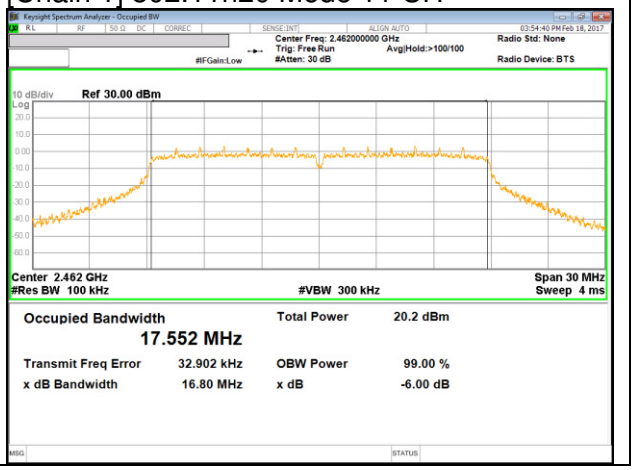


[Chain 1] 802.11n20 Mode 11 CH



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.

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 v03r05.

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

DIRECTIONAL ANTENNA GAIN

The TX chains are correlated and the antenna gain is unequal among the chains.
The directional gain is:

2.4GHz

Chain 0 Antenna Gain [dBi]	Chain 1 Antenna Gain [dBi]	Correlated Chains Directional Gain [dBi]
-1.83	-2.95	0.64

- IEEE 802.11b Mode is not supported MIMO operation. So can't transmit on two antennas as the same time.

RESULTS

9.2.1. 802.11b MODE IN THE 2.4 GHz BAND

Limits

Channel	Frequency [MHz]	Directional Gain Primary [dBi]	Directional Gain Secondary [dBi]	FCC Power Limit [dBm]	Max Power [dBm]
1	2412	-1.83	-2.95	30.00	30.00
6	2437	-1.83	-2.95	30.00	30.00
11	2462	-1.83	-2.95	30.00	30.00

Duty Cycle CF [dB]	0.00	Included in Calculations of Corr'd Power

Results

Channel	Frequency [MHz]	Primary Meas Power [dBm]	Secondary Meas Power [dBm]	Maximum Power [dBm]	Power Limit [dBm]	Margin [dB]
1	2412	13.09	13.99	13.99	30.00	16.01
6	2437	13.12	13.74	13.74	30.00	16.26
11	2462	13.88	13.97	13.97	30.00	16.03
Worst				13.99	30.00	16.01

9.2.2. 802.11g MODE IN THE 2.4 GHz BAND

Limits

Channel	Frequency [MHz]	Directional Gain [dBi]	FCC Power Limit [dBm]	Max Power EIRP Limit [dBm]
1	2412	0.64	30.00	30.00
6	2437	0.64	30.00	30.00
11	2462	0.64	30.00	30.00

Duty Cycle CF [dB]	0.32	Included in Calculations of Corr'd Power

Results

Channel	Frequency [MHz]	Primary Meas Power [dBm]	Secondary Meas Power [dBm]	Total Corr'd Power [dBm]	Power Limit [dBm]	Margin [dB]
1	2412	13.76	13.68	16.73	30.00	13.27
6	2437	13.77	13.43	16.61	30.00	13.39
11	2462	13.54	13.67	16.62	30.00	13.38
Worst				16.73	30.00	13.27

9.2.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

Limits

Channel	Frequency [MHz]	Directional Gain [dBi]	FCC Power Limit [dBm]	Max Power EIRP Limit [dBm]
1	2412	0.64	30.00	30.00
6	2437	0.64	30.00	30.00
11	2462	0.64	30.00	30.00

Duty Cycle CF [dB]	0.33	Included in Calculations of Corr'd Power

Results

Channel	Frequency [MHz]	Chain 0 Meas Power [dBm]	Chain 1 Meas Power [dBm]	Total Corr'd Power [dBm]	Power Limit [dBm]	Margin [dB]
1	2412	13.62	13.52	16.58	30.00	13.42
6	2437	13.61	13.27	16.45	30.00	13.55
11	2462	13.43	13.52	16.49	30.00	13.51
Worst				16.58	30.00	13.42

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 v03r05

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RESULTS

9.3.1. 802.11b MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	Primary Antenna 1 [dBm]	Secendary Antenna 2 [dBm]	Max PSD [dBm]	Limit [dBm]	Margin [dB]
1	2412	-17.98	-16.83	-16.83	8.00	-24.83
6	2437	-17.68	-16.92	-16.92	8.00	-24.92
11	2462	-17.00	-16.67	-16.67	8.00	-24.67

Duty Cycle CF [dB]	0.00	Included in Calculations of PPSD

9.3.2. 802.11g MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	Primary Antenna 1 [dBm]	Secendary Antenna 2 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]
1	2412	-19.95	-20.20	-16.74	8.00	-24.74
6	2437	-20.49	-20.22	-17.02	8.00	-25.02
11	2462	-20.68	-20.45	-17.23	8.00	-25.23

Duty Cycle CF [dB]	0.32	Included in Calculations of PPSD

9.3.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	Chain 0 Meas [dBm]	Chain 1 Meas [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]
1	2412	-20.49	-20.31	-17.05	8.00	-25.05
6	2437	-20.43	-20.61	-17.18	8.00	-25.18
11	2462	-20.84	-20.71	-17.43	8.00	-25.43

Duty Cycle CF [dB]	0.33	Included in Calculations of PPSD

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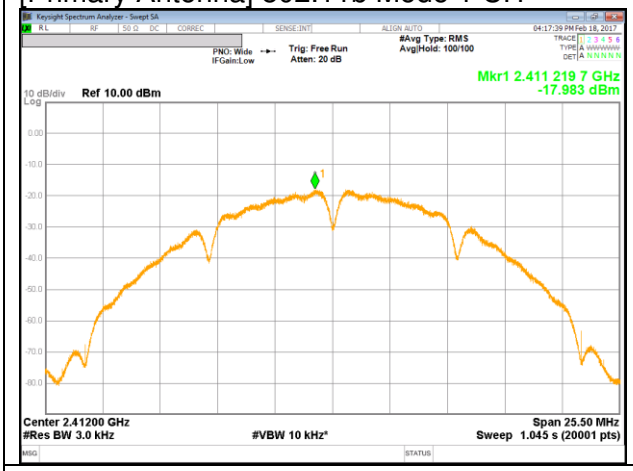
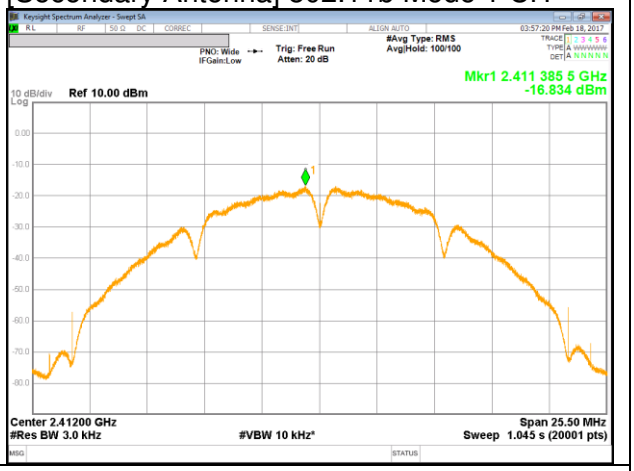
9.3.4. PSD PLOTS

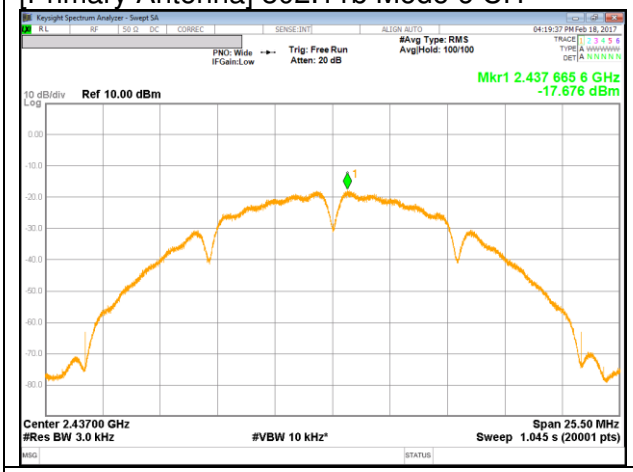
[Primary Antenna] 802.11b Mode 1 CH



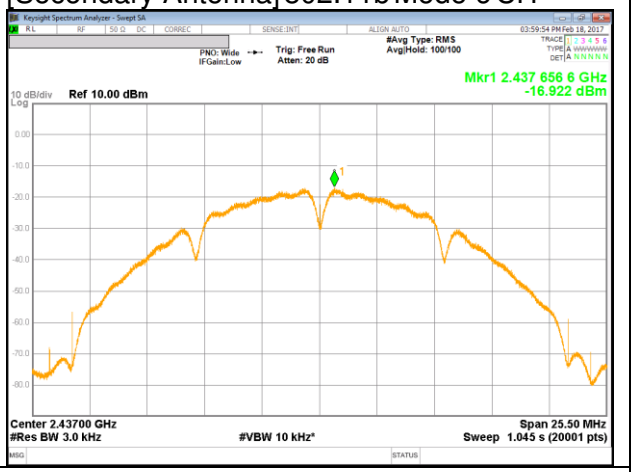
[Secondary Antenna] 802.11b Mode 1 CH



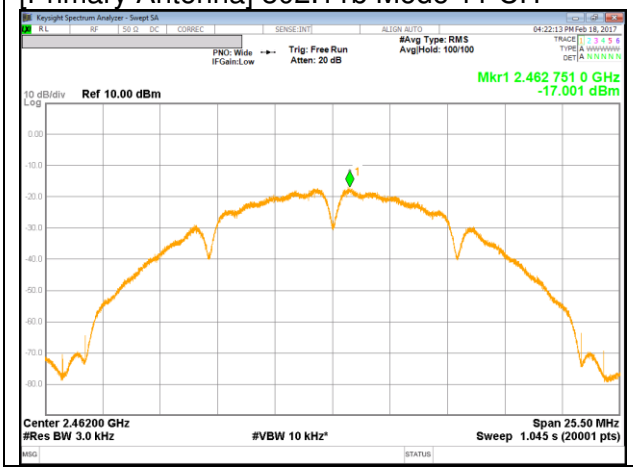
[Primary Antenna] 802.11b Mode 6 CH



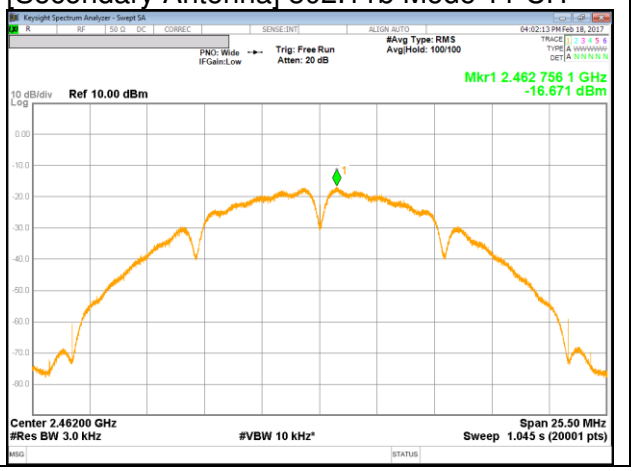
[Secondary Antenna] 802.11b Mode 6 CH



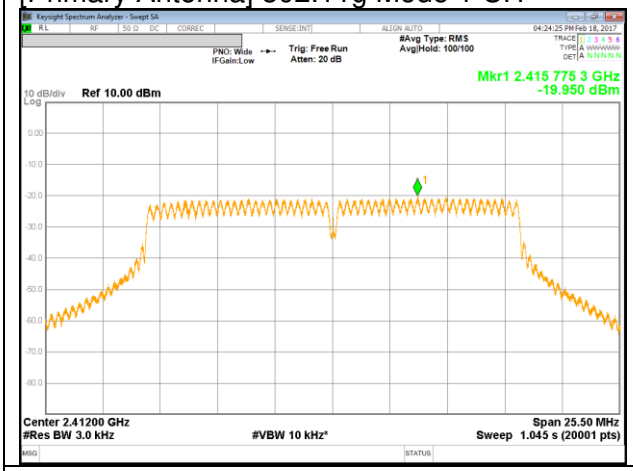
[Primary Antenna] 802.11b Mode 11 CH



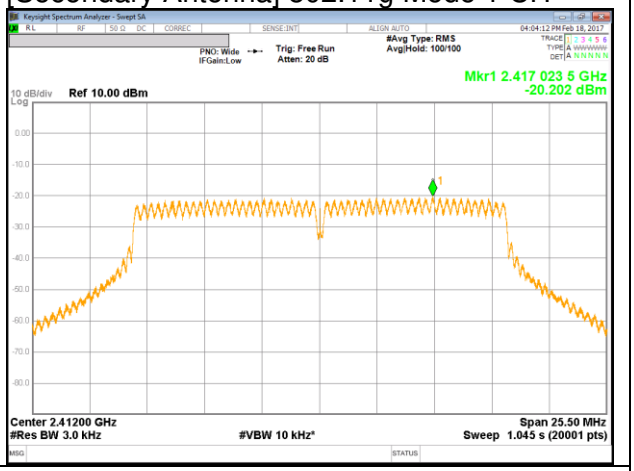
[Secondary Antenna] 802.11b Mode 11 CH



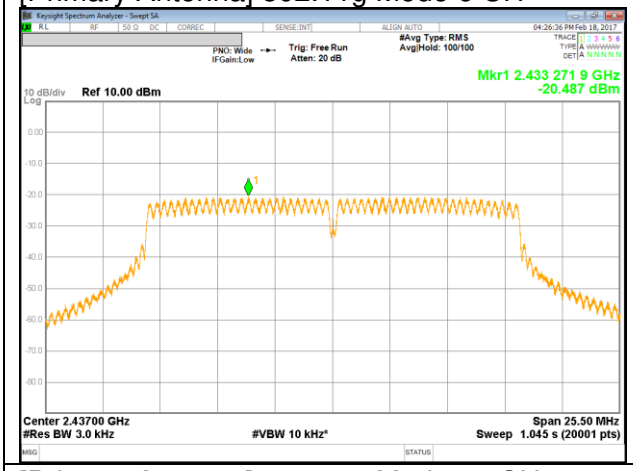
[Primary Antenna] 802.11g Mode 1 CH



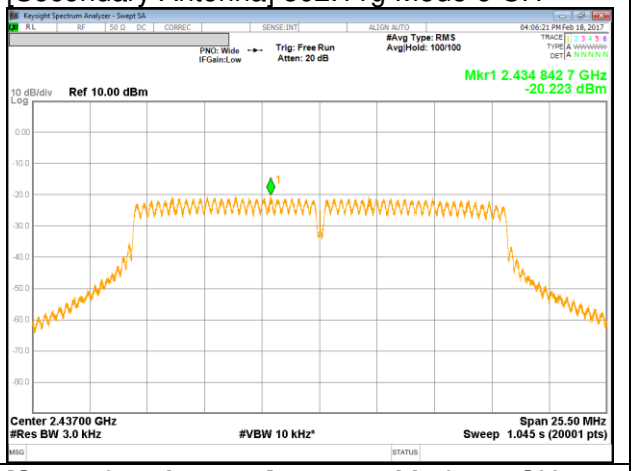
[Secondary Antenna] 802.11g Mode 1 CH



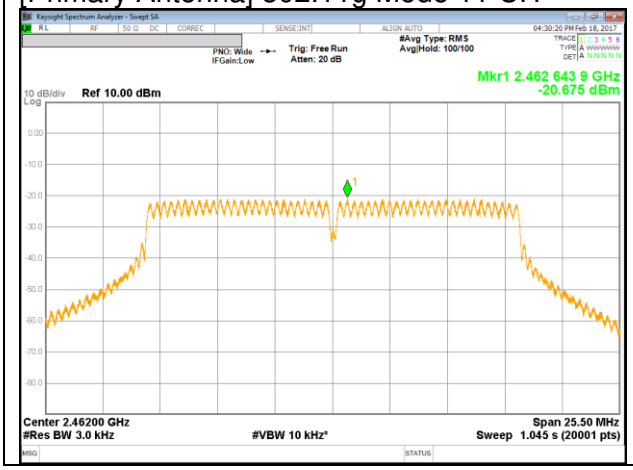
[Primary Antenna] 802.11g Mode 6 CH



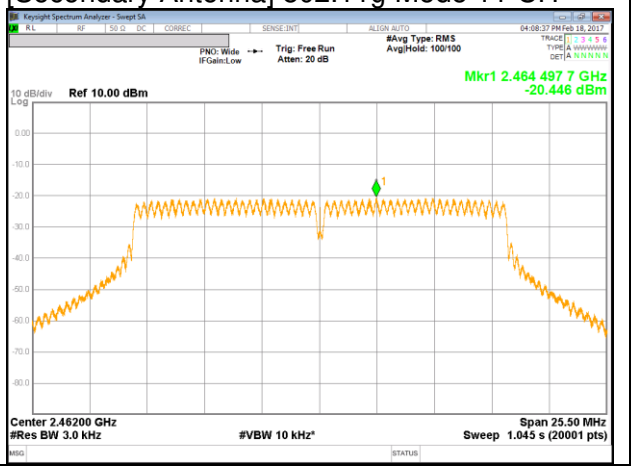
[Secondary Antenna] 802.11g Mode 6 CH



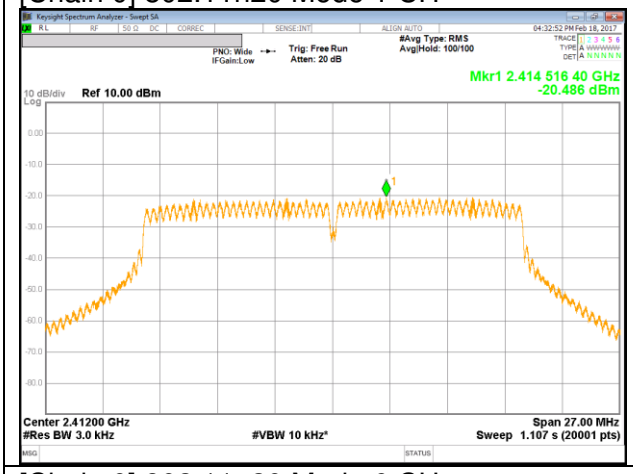
[Primary Antenna] 802.11g Mode 11 CH



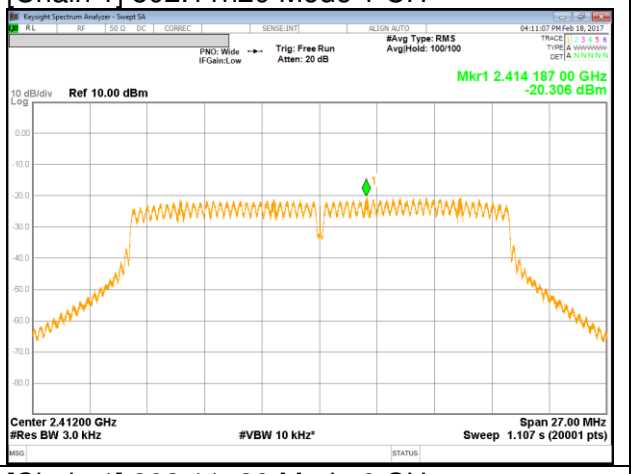
[Secondary Antenna] 802.11g Mode 11 CH



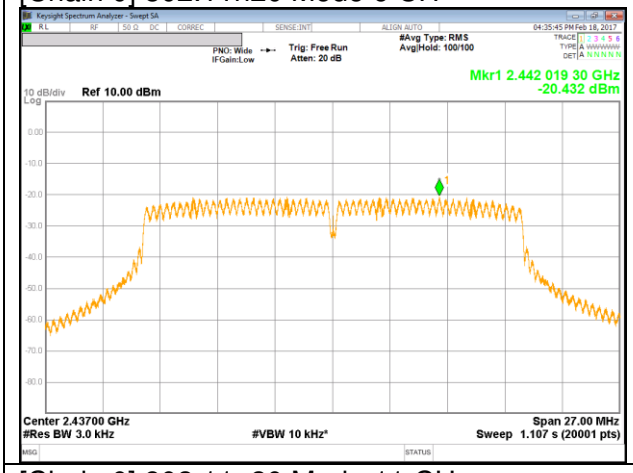
[Chain 0] 802.11n20 Mode 1 CH



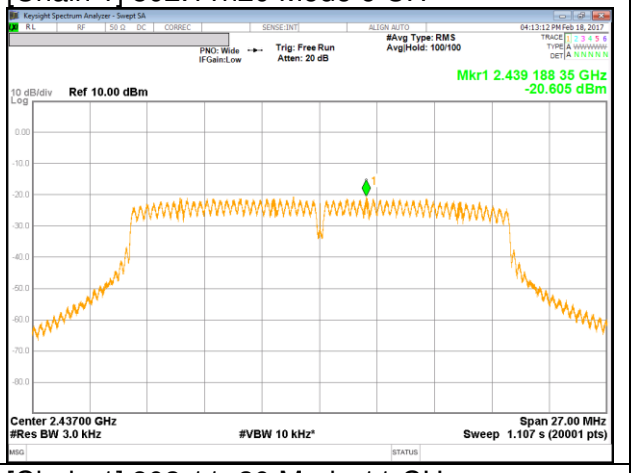
[Chain 1] 802.11n20 Mode 1 CH



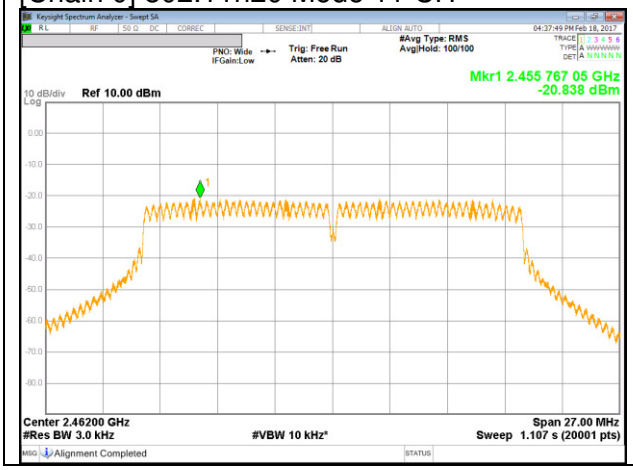
[Chain 0] 802.11n20 Mode 6 CH



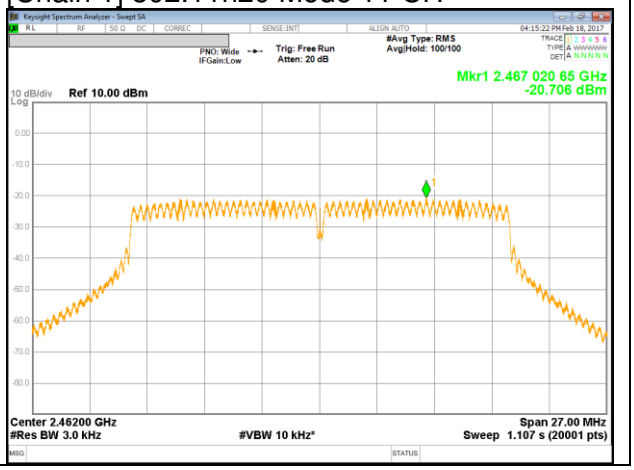
[Chain 1] 802.11n20 Mode 6 CH



[Chain 0] 802.11n20 Mode 11 CH



[Chain 1] 802.11n20 Mode 11 CH



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.

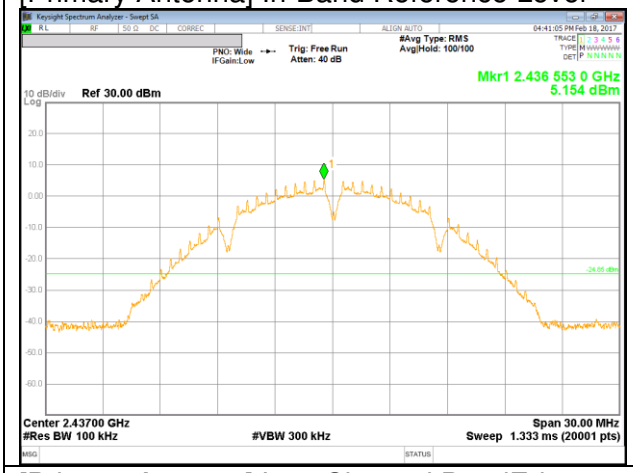
TEST PROCEDURE

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.

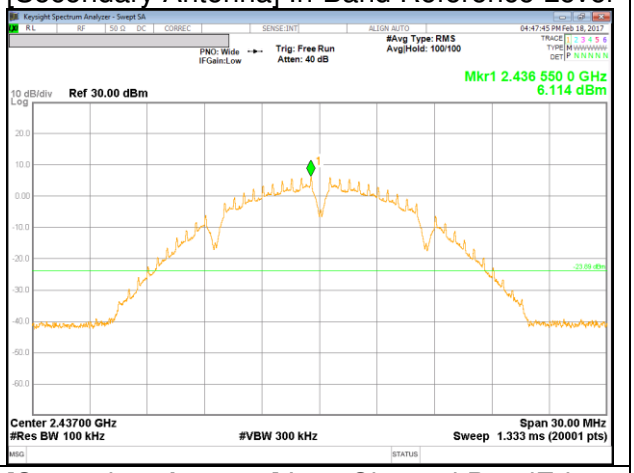
RESULTS

9.4.1. 802.11b MODE IN THE 2.4 GHz BAND

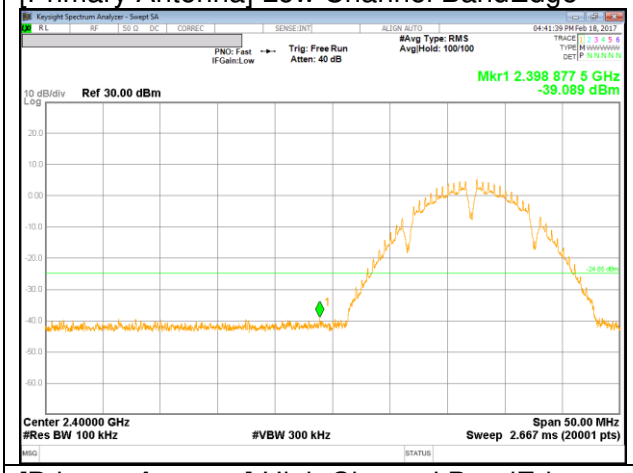
[Primary Antenna] In-Band Reference Level



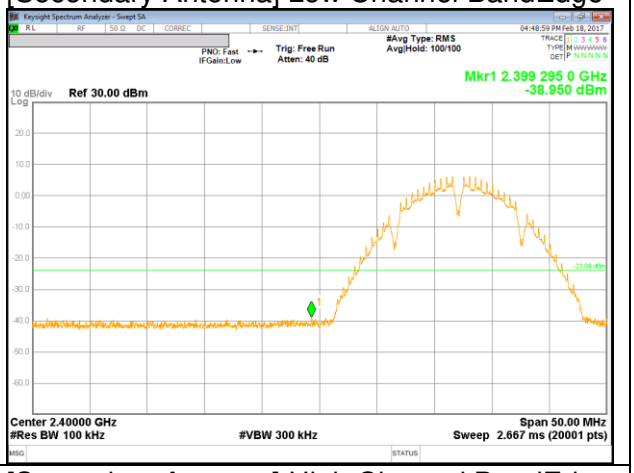
[Secondary Antenna] In-Band Reference Level



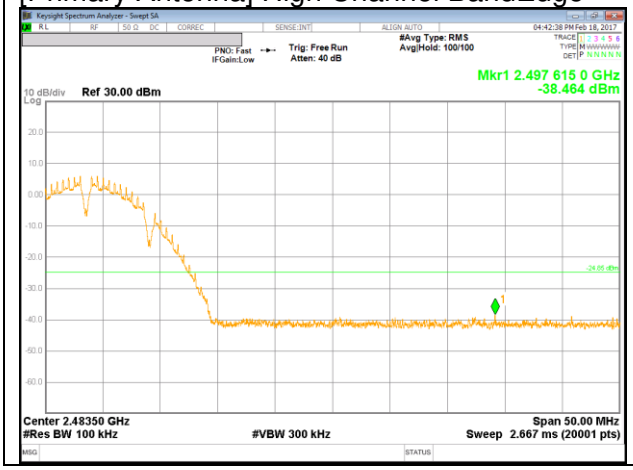
[Primary Antenna] Low Channel BandEdge



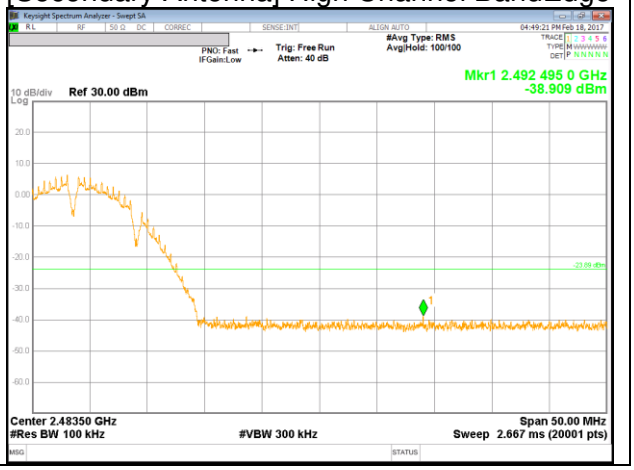
[Secondary Antenna] Low Channel BandEdge



[Primary Antenna] High Channel BandEdge



[Secondary Antenna] High Channel BandEdge



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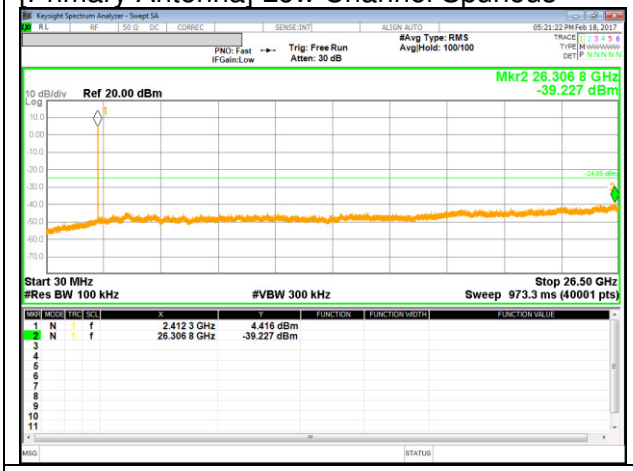
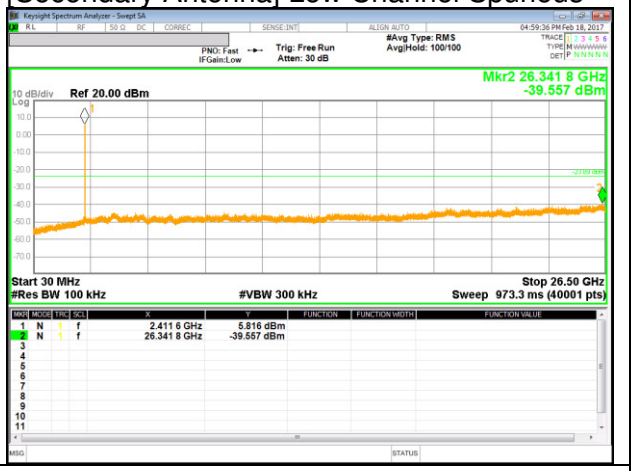
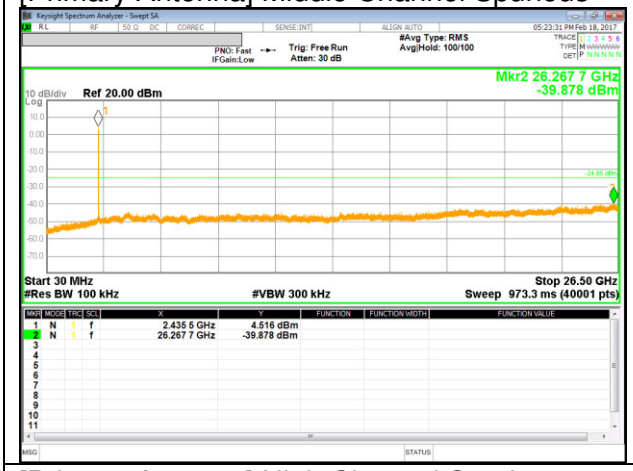
[Primary Antenna] Low Channel Spurious



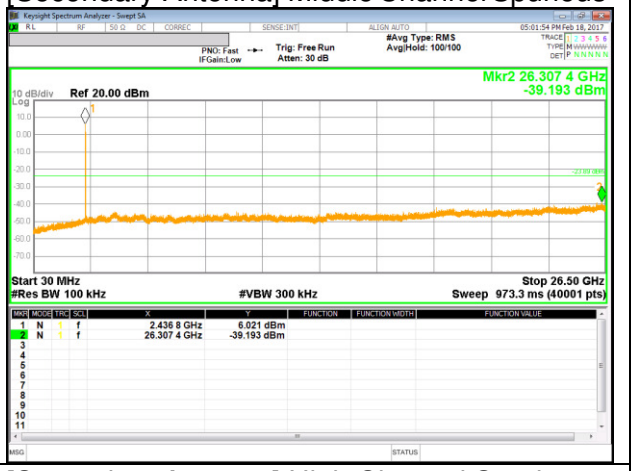
[Secondary Antenna] Low Channel Spurious



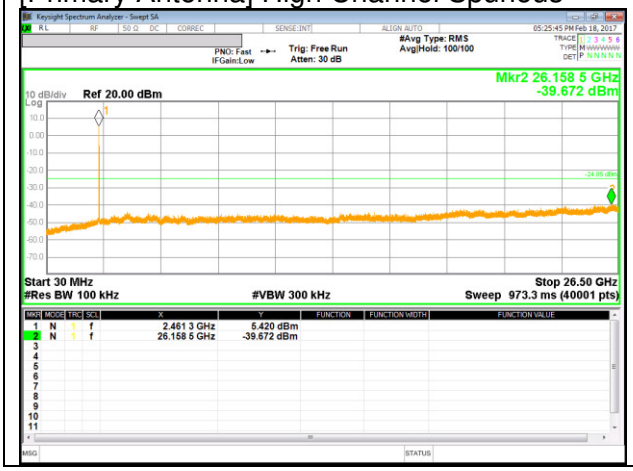
[Primary Antenna] Middle Channel Spurious



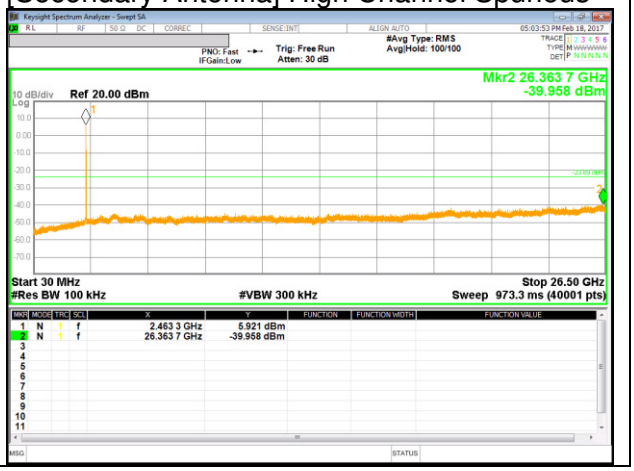
[Secondary Antenna] Middle Channel Spurious



[Primary Antenna] High Channel Spurious

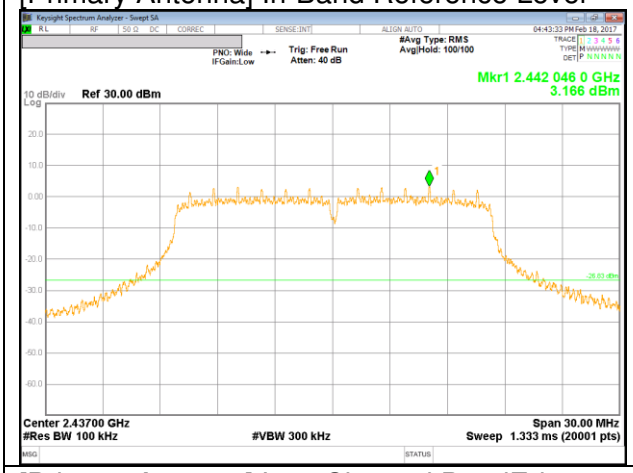


[Secondary Antenna] High Channel Spurious

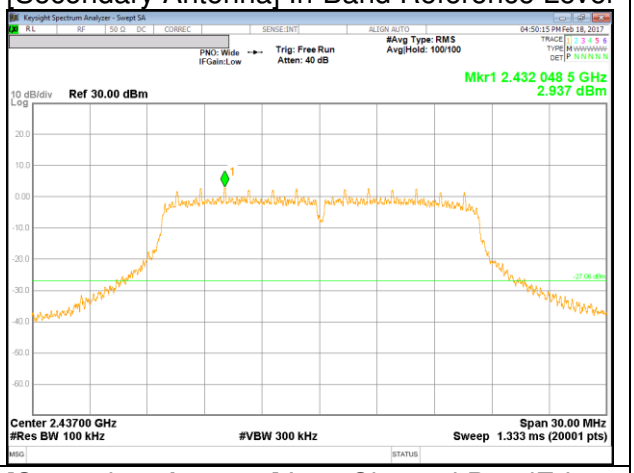


9.4.2. 802.11g MODE IN THE 2.4 GHz BAND

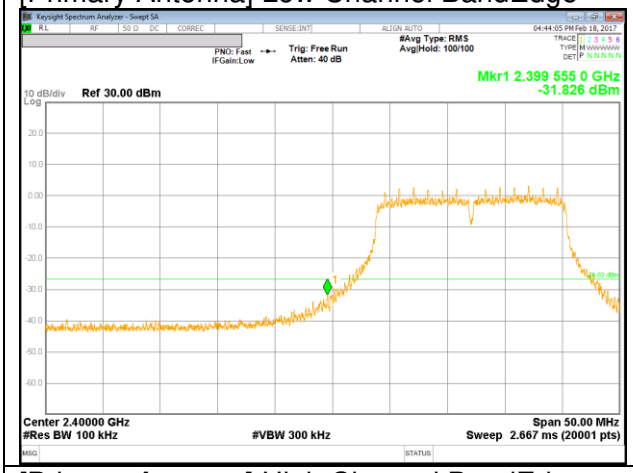
[Primary Antenna] In-Band Reference Level



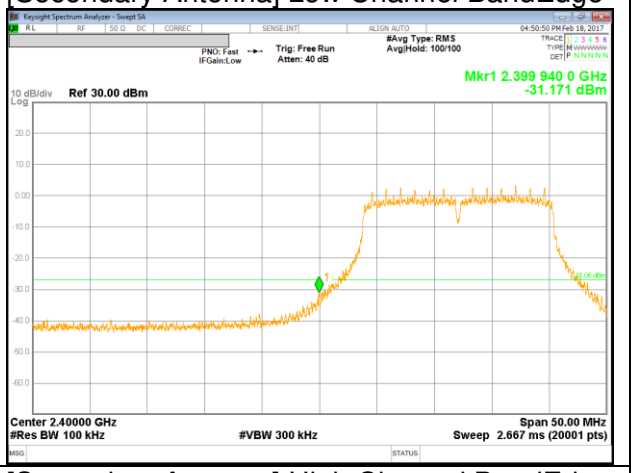
[Secondary Antenna] In-Band Reference Level



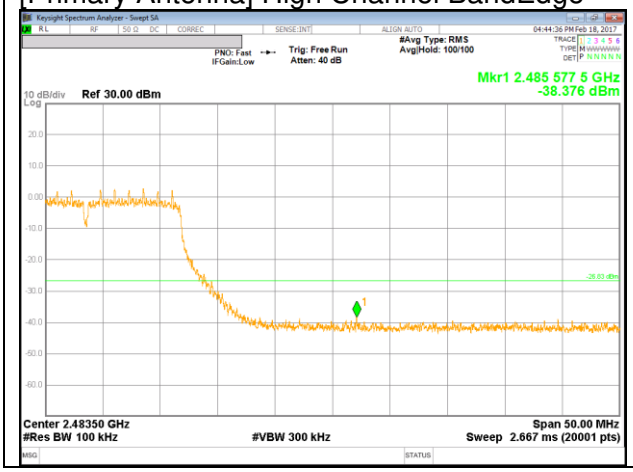
[Primary Antenna] Low Channel BandEdge



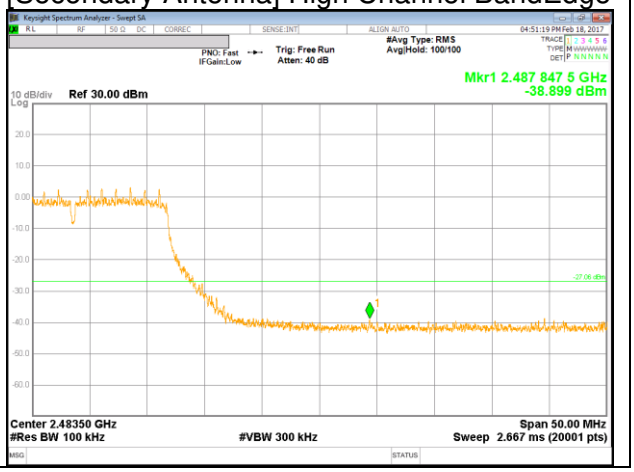
[Secondary Antenna] Low Channel BandEdge



[Primary Antenna] High Channel BandEdge



[Secondary Antenna] High Channel BandEdge



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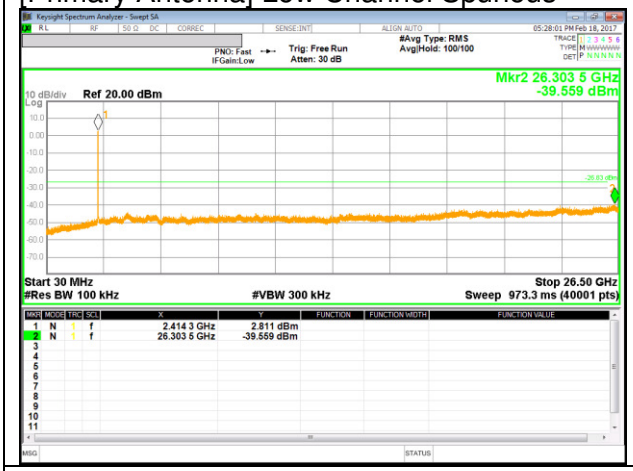
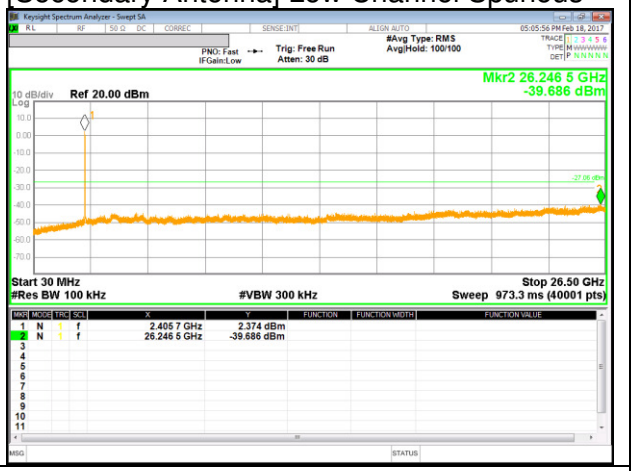
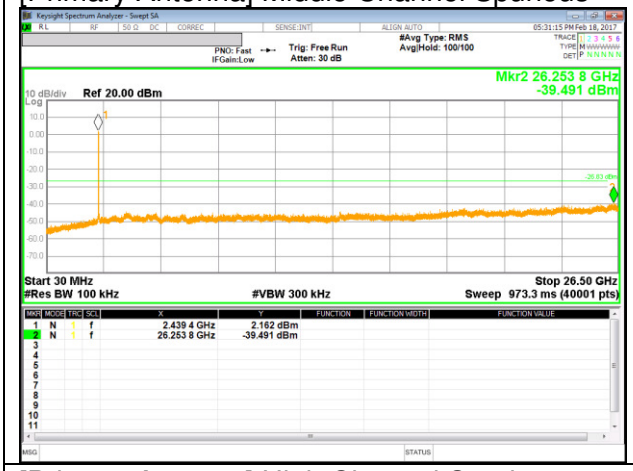
[Primary Antenna] Low Channel Spurious



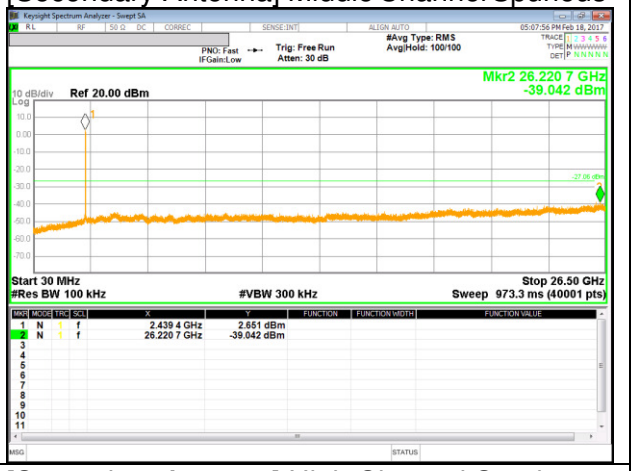
[Secondary Antenna] Low Channel Spurious



[Primary Antenna] Middle Channel Spurious

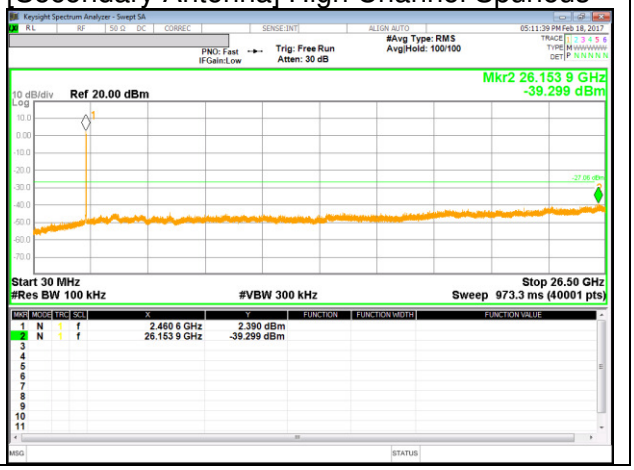


[Secondary Antenna] Middle Channel Spurious



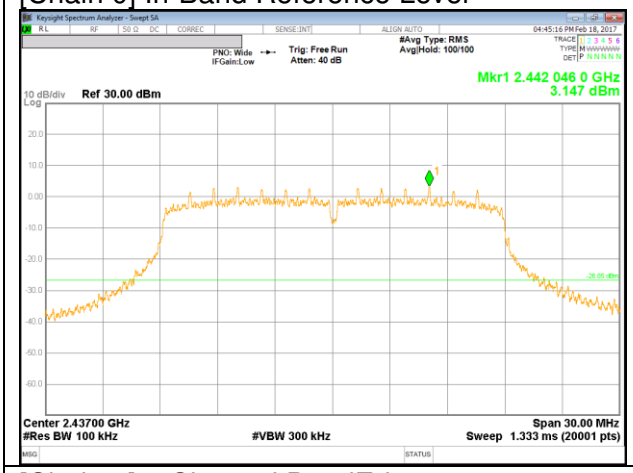
[Primary Antenna] High Channel Spurious

[Secondary Antenna] High Channel Spurious

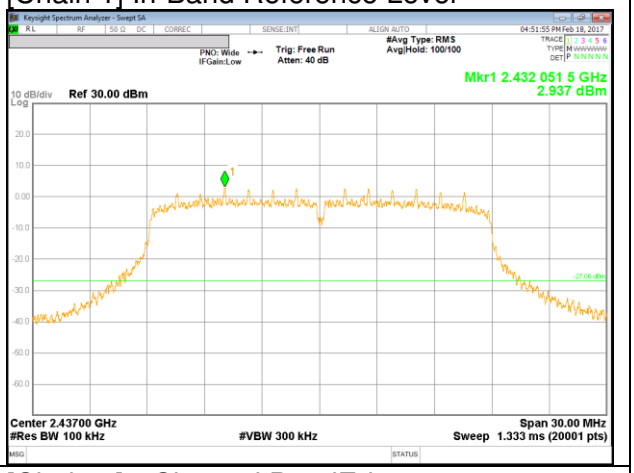


9.4.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

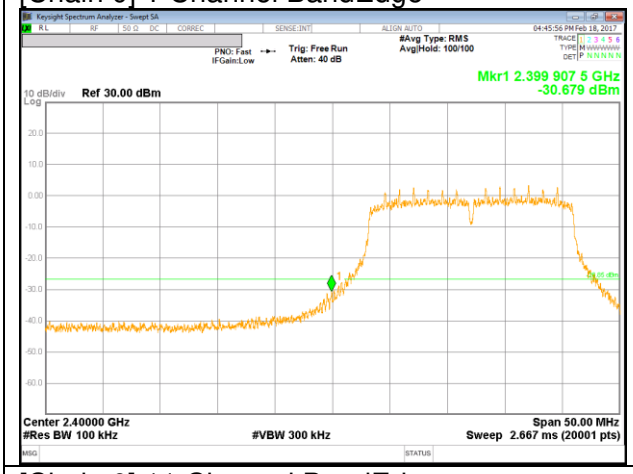
[Chain 0] In-Band Reference Level



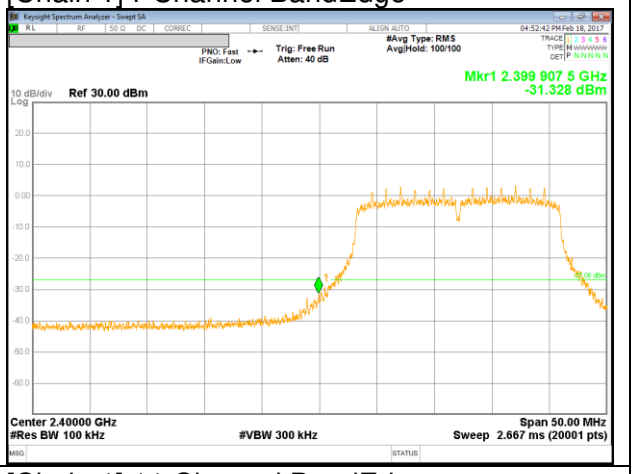
[Chain 1] In-Band Reference Level



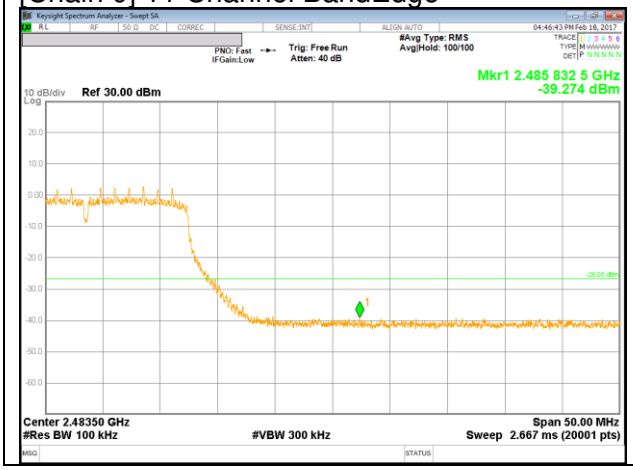
[Chain 0] 1 Channel BandEdge



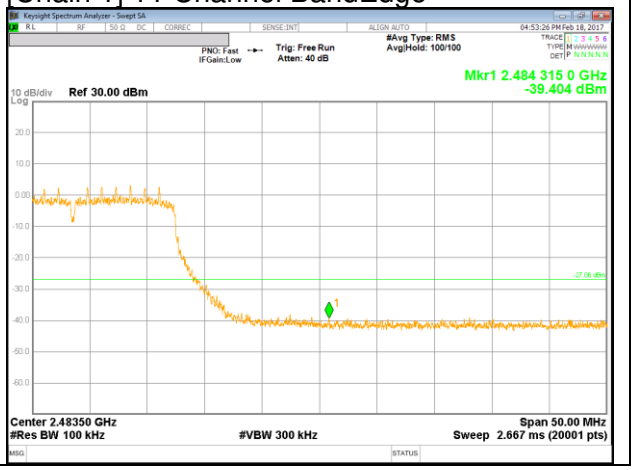
[Chain 1]1 Channel BandEdge



[Chain 0] 11 Channel BandEdge



[Chain 1] 11 Channel BandEdge



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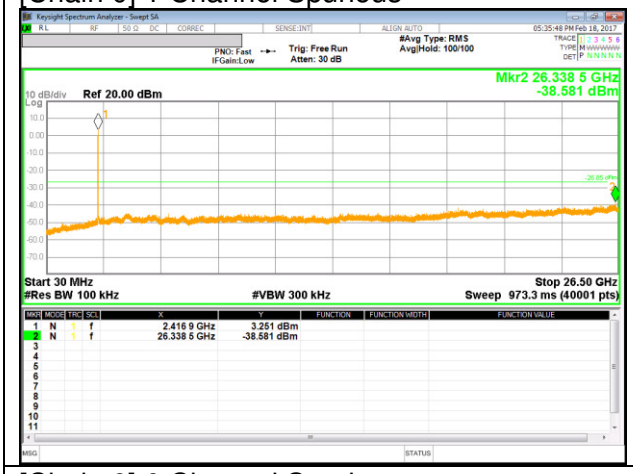
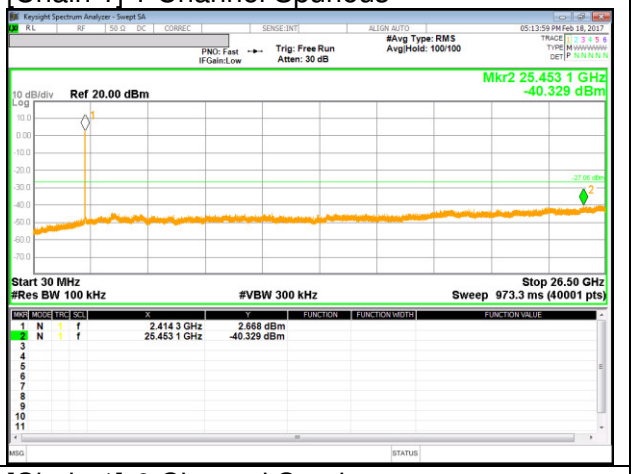
[Chain 0] 1 Channel Spurious

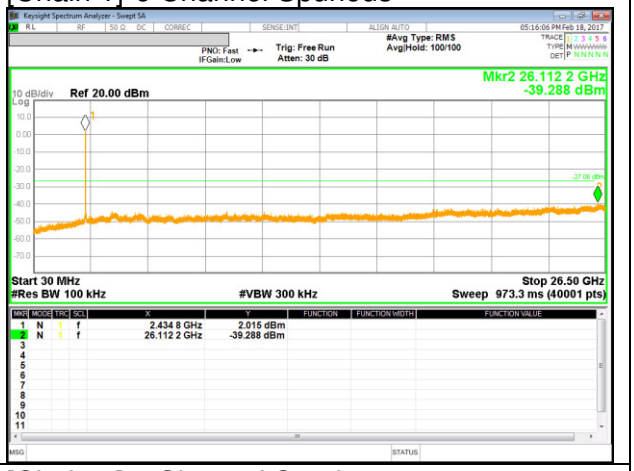


[Chain 1] 1 Channel Spurious

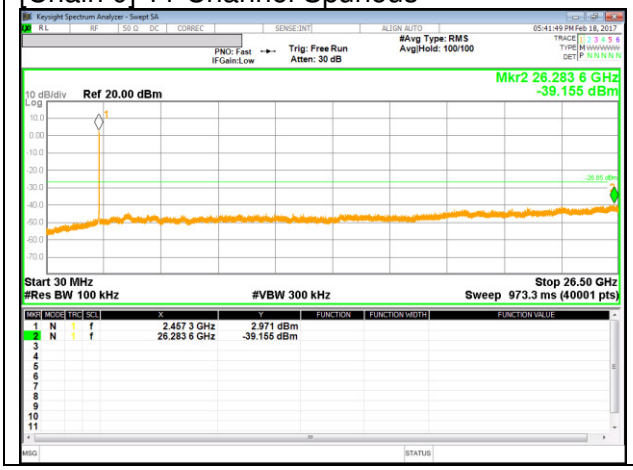


[Chain 0] 6 Channel Spurious

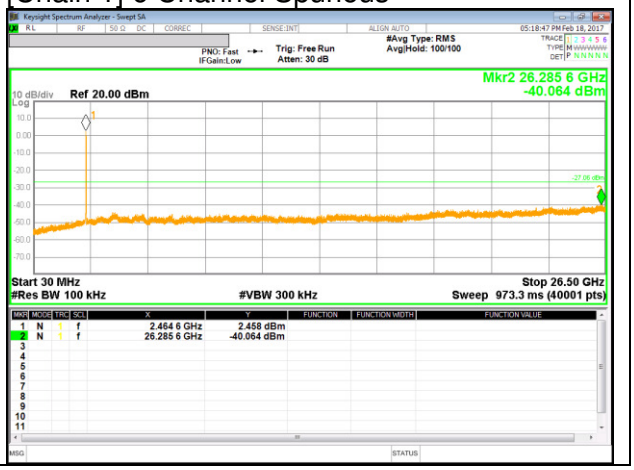
[Chain 1] 6 Channel Spurious



[Chain 0] 11 Channel Spurious



[Chain 1] 6 Channel Spurious



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.

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 = 0.32dB; N20 mode = 0.33dB.

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.

Unwanted emissions within Restricted Bands are measured using traditional radiated procedures.
Band edge emissions within Restricted Bands are measured using RMS with duty cycle factor offset method.

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

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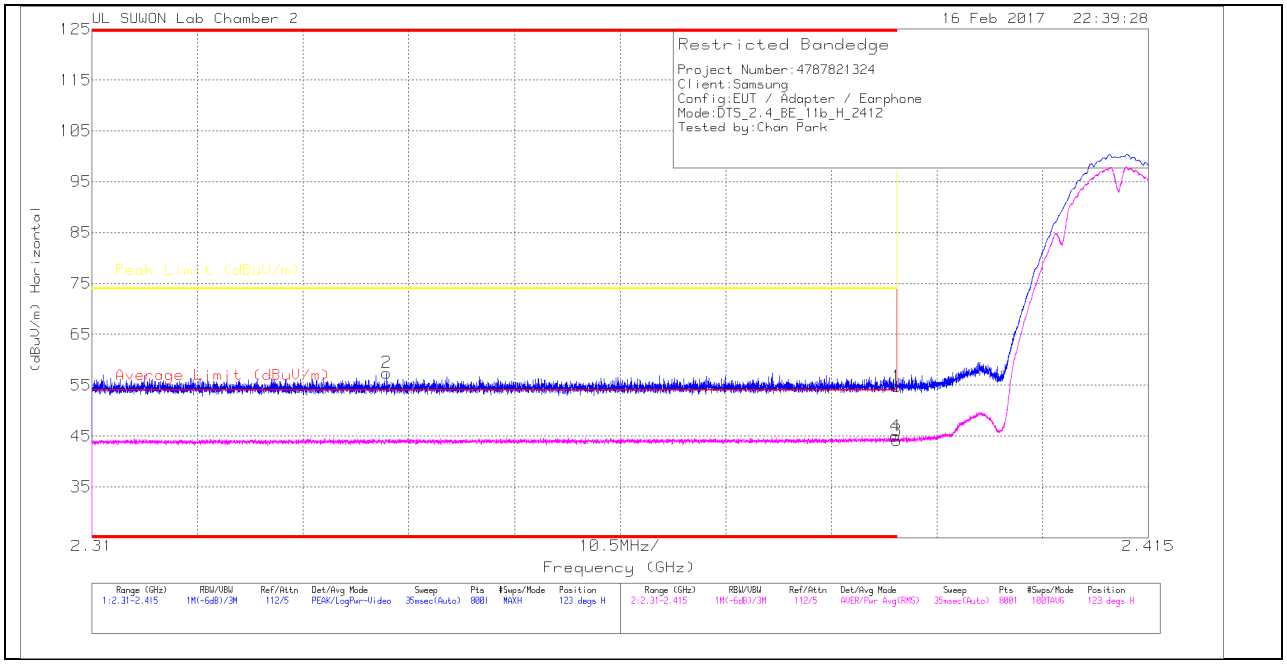
10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. TX ABOVE 1 GHz 802.11b MODE IN THE 2.4 GHz BAND ANT1

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

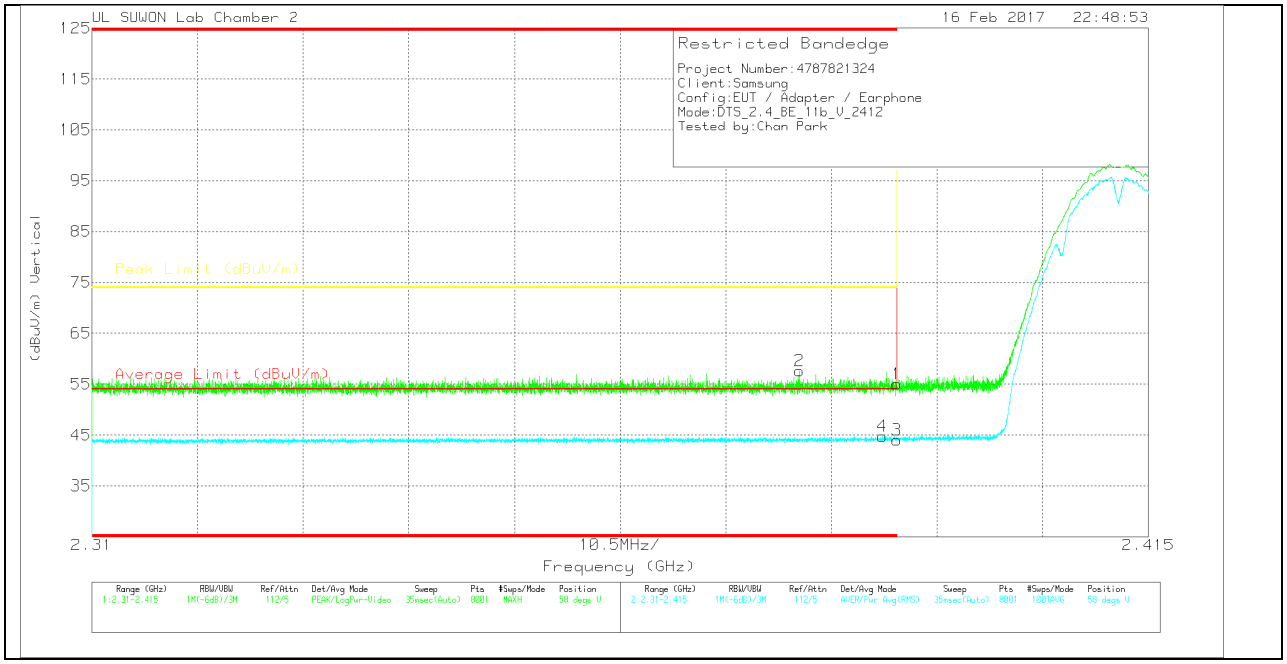
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	10dB[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	41.29	Pk	31.7	-18.2	0	54.79	-	-	74	-19.21	123	142	H
2	* 2.339	44.14	Pk	31.6	-18.3	0	57.44	-	-	74	-16.56	123	142	H
3	* 2.39	30.62	RMS	31.7	-18.2	0	44.12	54	-9.88	-	-	123	142	H
4	* 2.39	31.47	RMS	31.7	-18.2	0	44.97	54	-9.03	-	-	123	142	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	10dB[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	41.53	Pk	31.7	-18.2	0	55.03	-	-	74	-18.97	58	173	V
2	* 2.38	44.21	Pk	31.7	-18.3	0	57.61	-	-	74	-16.39	58	173	V
3	* 2.39	30.55	RMS	31.7	-18.2	0	44.05	54	-9.95	-	-	58	173	V
4	* 2.389	31.3	RMS	31.7	-18.2	0	44.8	54	-9.2	-	-	58	173	V

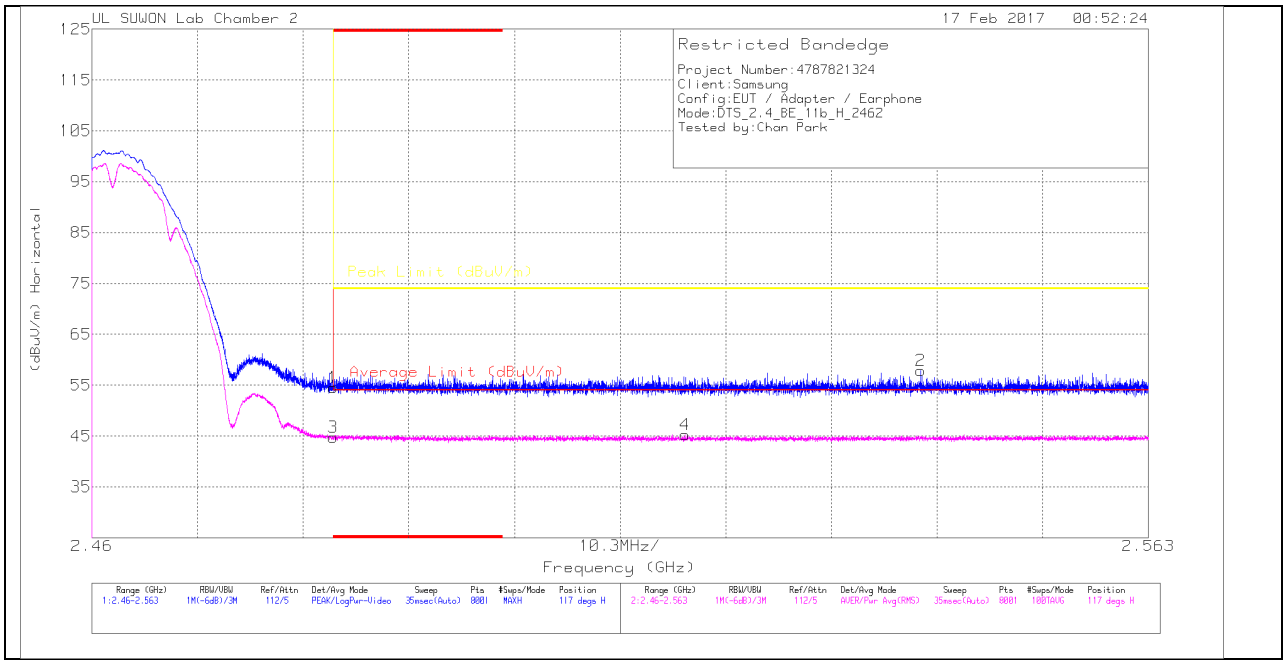
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	10dB[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.74	Pk	31.8	-18	0	54.54	-	-	74	-19.46	117	230	H
2	2.541	43.99	Pk	31.9	-18	0	57.89	-	-	74	-16.11	117	230	H
3	* 2.484	31.01	RMS	31.8	-18	0	44.81	54	-9.19	-	-	117	230	H
4	2.518	31.36	RMS	31.9	-18	0	45.26	54	-8.74	-	-	117	230	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

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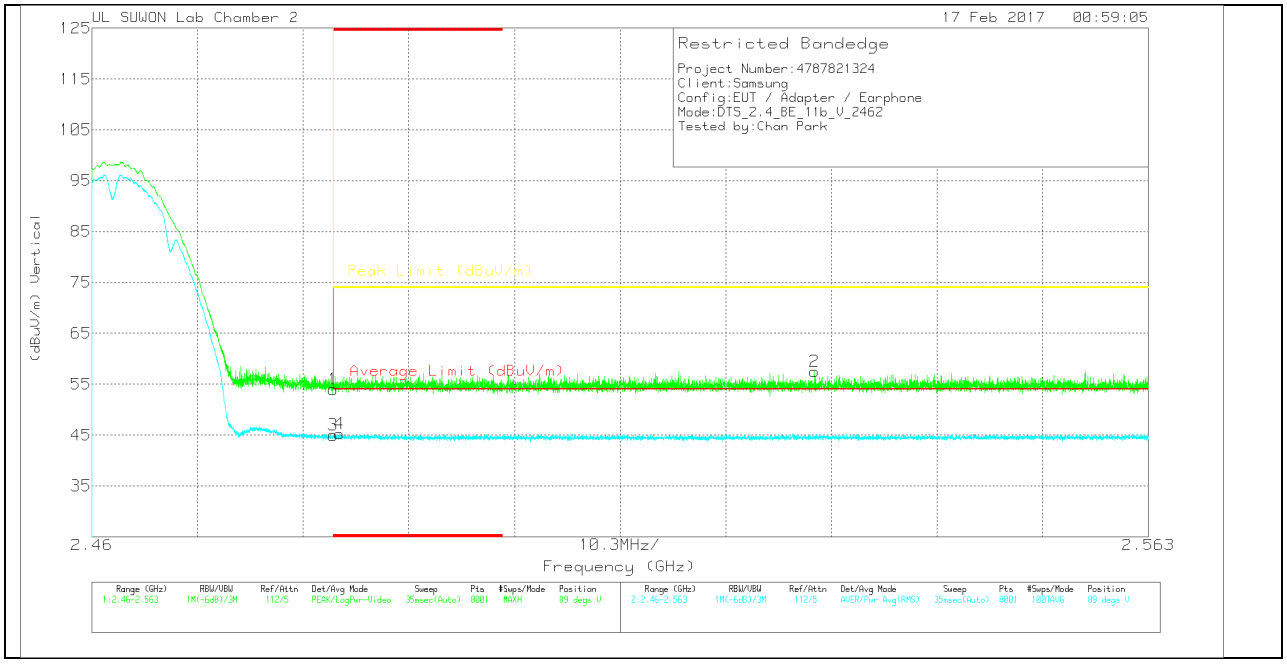
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	10dB[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.18	Pk	31.8	-18	0	53.98	-	-	74	-20.02	89	309	V
2	2.53	43.64	Pk	31.9	-18	0	57.54	-	-	74	-16.46	89	309	V
3	* 2.484	31.15	RMS	31.8	-18	0	44.95	54	-9.05	-	-	89	309	V
4	* 2.484	31.47	RMS	31.8	-18	0	45.27	54	-8.73	-	-	89	309	V

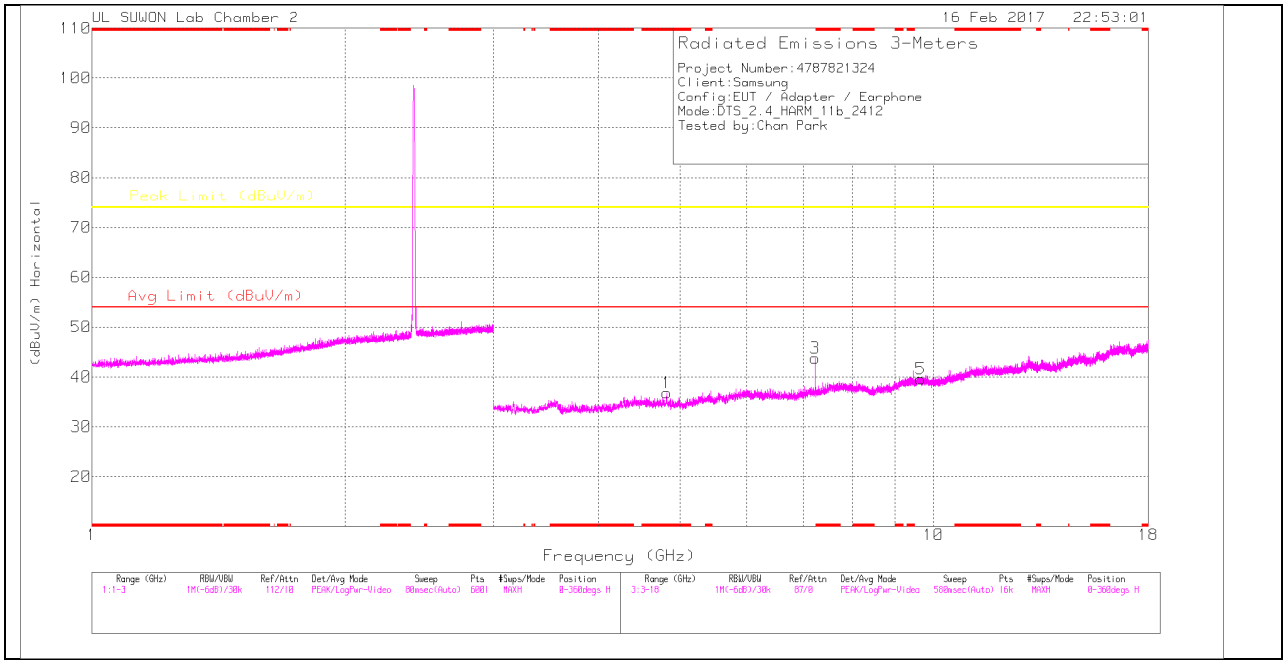
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

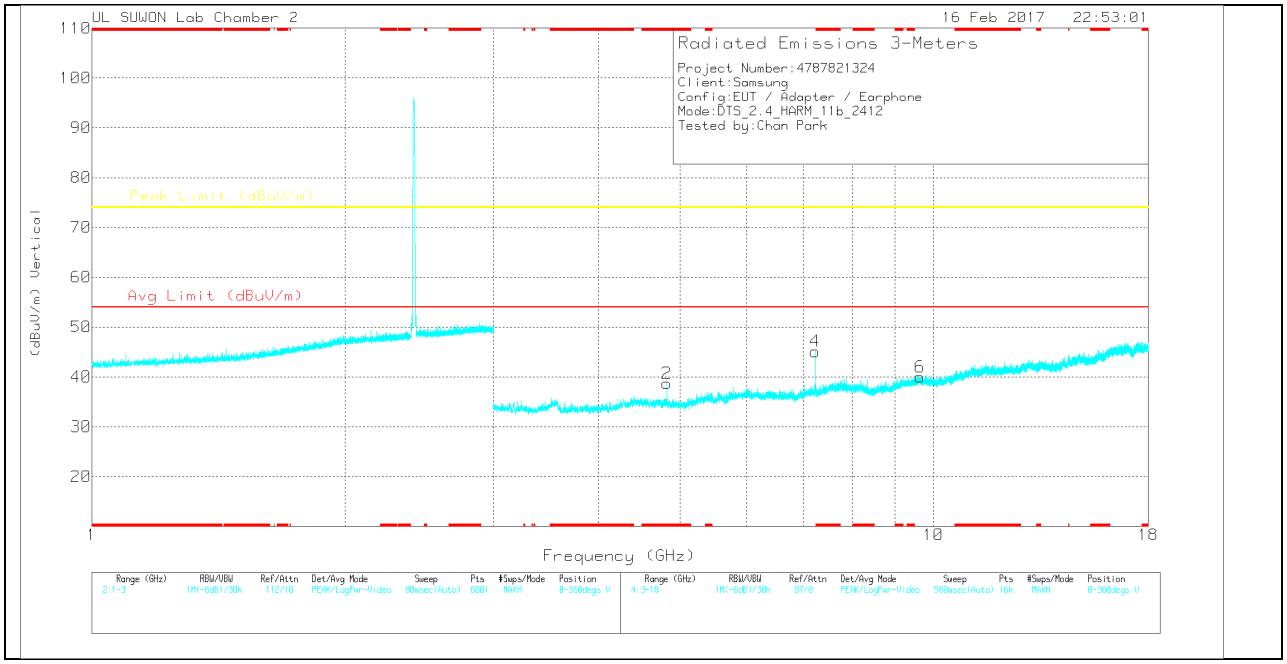
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



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

LOW CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.823	27.18	Pk	33.9	-24.3	0	36.78	-	-	74	-37.22	0-360	250	H
3	7.235	29.91	Pk	35.8	-21.9	0	43.81	-	-	74	-30.19	0-360	250	H
5	9.65	20.99	Pk	36.9	-18.3	0	39.59	-	-	74	-34.41	0-360	250	H
2	* 4.823	29.1	Pk	33.9	-24.3	0	38.7	-	-	74	-35.3	0-360	150	V
4	7.234	31.21	Pk	35.8	-21.9	0	45.11	-	-	74	-28.89	0-360	250	V
6	9.645	21.4	Pk	36.9	-18.3	0	40	-	-	74	-34	0-360	250	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk – Peak detector

Radiated Emissions

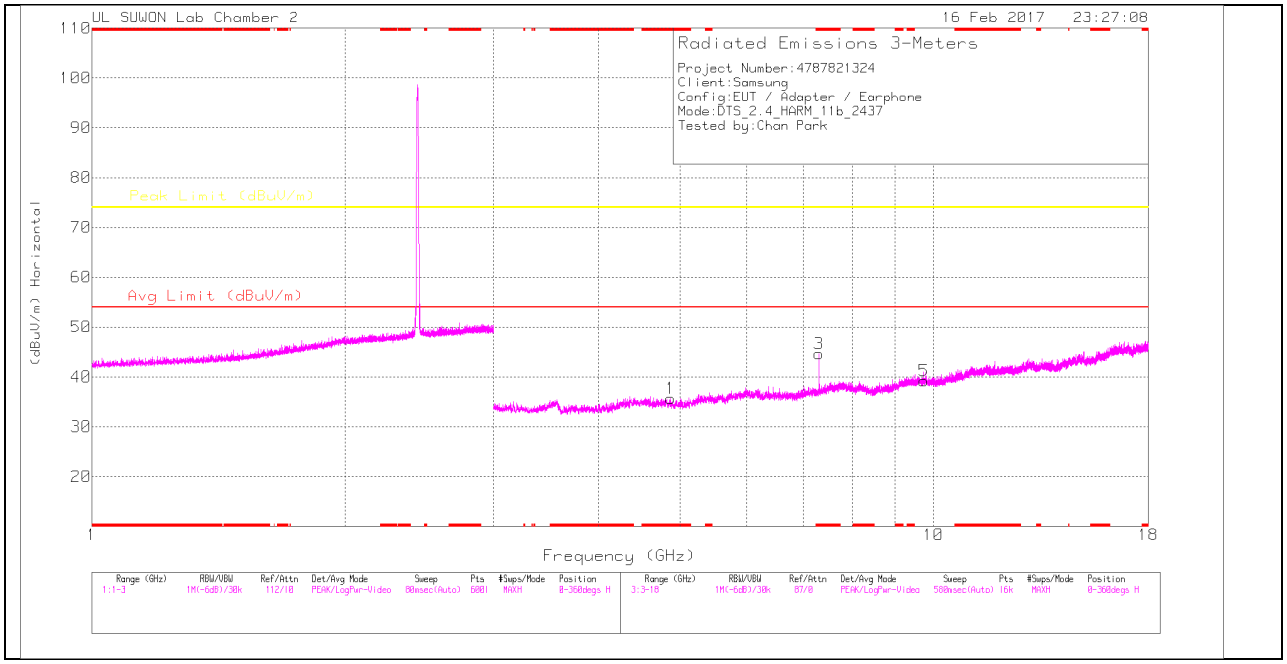
Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7.235	39.44	PK2	35.8	-21.9	0	53.34	-	-	74	-20.66	155	140	H
* 4.823	38.6	PK2	33.9	-24.3	0	48.2	-	-	74	-25.8	129	156	V
* 4.824	28.93	MAv1	33.9	-24.3	0	38.53	54	-15.47	-	-	129	156	V
7.237	39.03	PK2	35.8	-22	0	52.83	-	-	74	-21.17	189	244	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

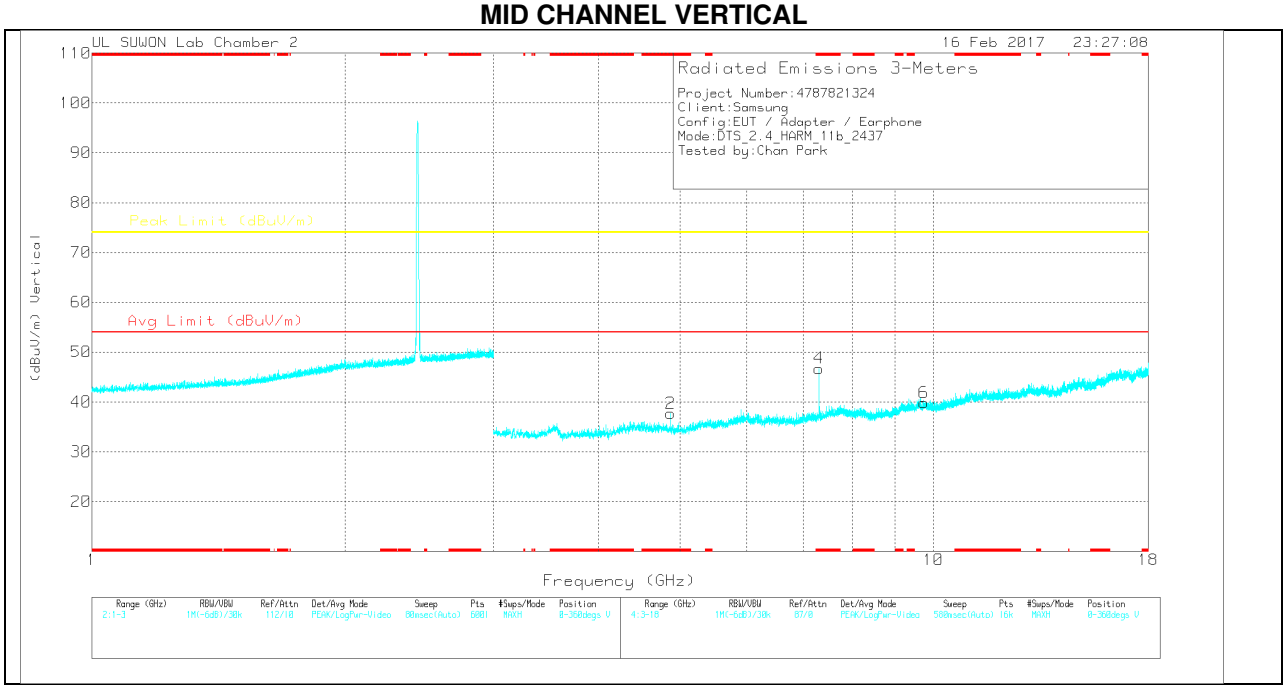
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



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

MID CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.874	26.28	Pk	33.9	-24.5	0	35.68	-	-	74	-38.32	0-360	150	H
3	* 7.313	30.82	Pk	35.9	-22	0	44.72	-	-	74	-29.28	0-360	150	H
5	9.748	20.29	Pk	37	-18.1	0	39.19	-	-	74	-34.81	0-360	250	H
2	* 4.874	28.35	Pk	33.9	-24.5	0	37.75	-	-	74	-36.25	0-360	150	V
4	* 7.309	32.85	Pk	35.9	-22	0	46.75	-	-	74	-27.25	0-360	250	V
6	9.744	20.94	Pk	37	-18.1	0	39.84	-	-	74	-34.16	0-360	250	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk – Peak detector

Radiated Emissions

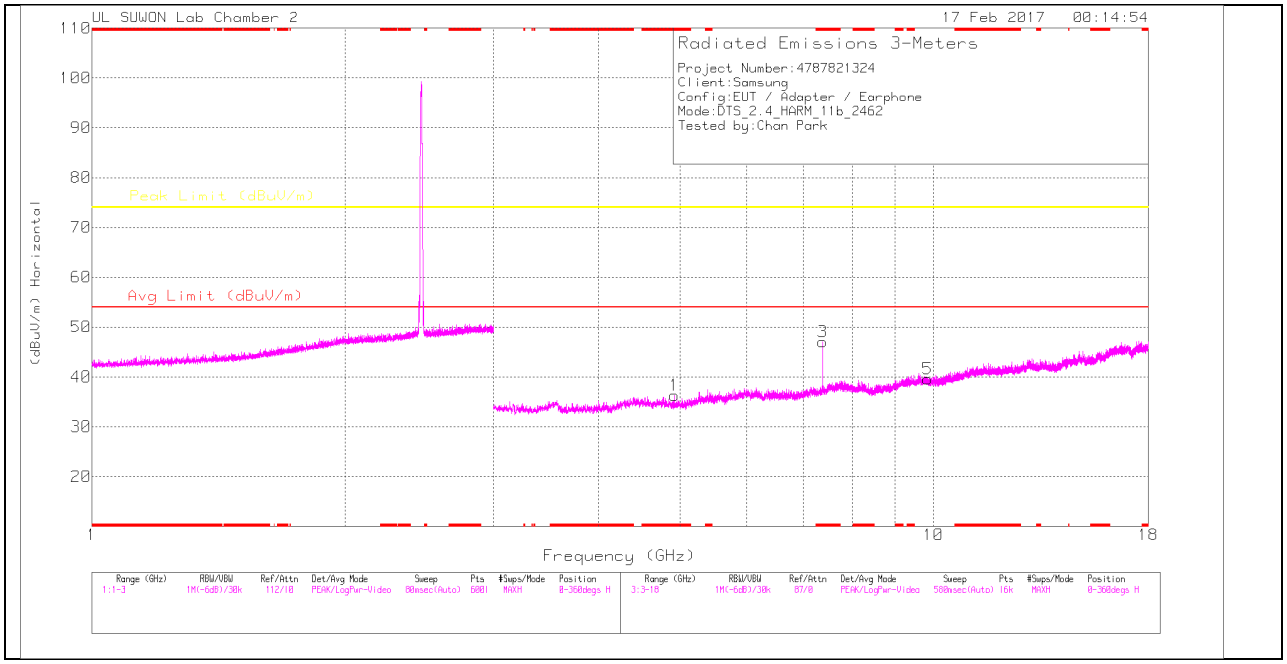
Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 7.309	39.83	PK2	35.9	-22	0	53.73	-	-	74	-20.27	198	110	H
* 7.312	32.07	MAv1	35.9	-22	0	45.97	54	-8.03	-	-	198	110	H
* 4.874	37.88	PK2	33.9	-24.5	0	47.28	-	-	74	-26.72	152	173	V
* 4.874	28.41	MAv1	33.9	-24.5	0	37.81	54	-16.19	-	-	152	173	V
* 7.312	40.77	PK2	35.9	-22	0	54.67	-	-	74	-19.33	181	247	V
* 7.312	32.78	MAv1	35.9	-22	0	46.68	54	-7.32	-	-	181	247	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

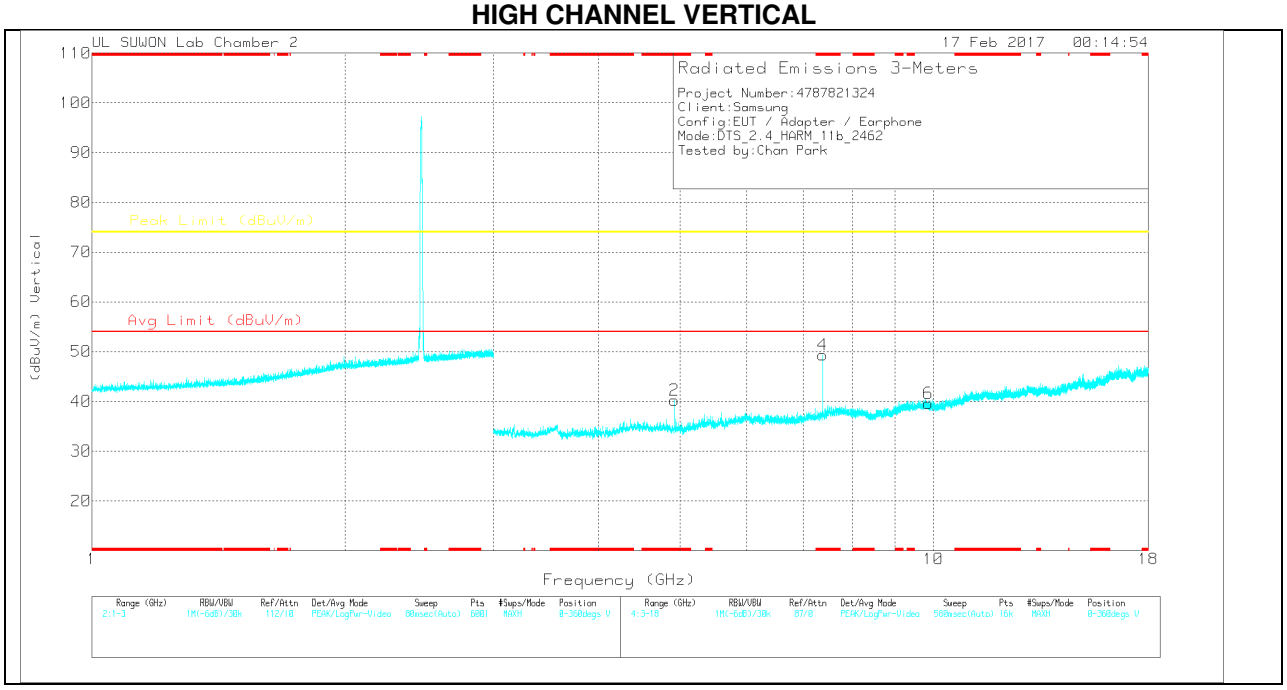
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



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

HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.924	27.16	Pk	33.9	-24.7	0	36.36	-	-	74	-37.64	0-360	250	H
3	* 7.384	32.6	Pk	35.9	-21.4	0	47.1	-	-	74	-26.9	0-360	150	H
5	9.847	20.42	Pk	37.1	-17.9	0	39.62	-	-	74	-34.38	0-360	250	H
2	* 4.924	31.05	Pk	33.9	-24.7	0	40.25	-	-	74	-33.75	0-360	150	V
4	* 7.387	34.88	Pk	35.9	-21.4	0	49.38	-	-	74	-24.62	0-360	250	V
6	9.851	20.45	Pk	37.1	-17.9	0	39.65	-	-	74	-34.35	0-360	250	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk – Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	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
* 4.924	37.7	PK2	33.9	-24.7	0	46.9	-	-	74	-27.1	225	260	H
* 4.924	26.97	MAv1	33.9	-24.7	0	36.17	54	-17.83	-	-	225	260	H
* 4.924	39.29	PK2	33.9	-24.7	0	48.49	-	-	74	-25.51	152	163	V
* 4.924	30.82	MAv1	33.9	-24.7	0	40.02	54	-13.98	-	-	152	163	V
* 7.387	41.23	PK2	35.9	-21.4	0	55.73	-	-	74	-18.27	179	274	V
* 7.385	34.25	MAv1	35.9	-21.4	0	48.75	54	-5.25	-	-	179	274	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK2 - KDB558074 Method: Maximum Peak

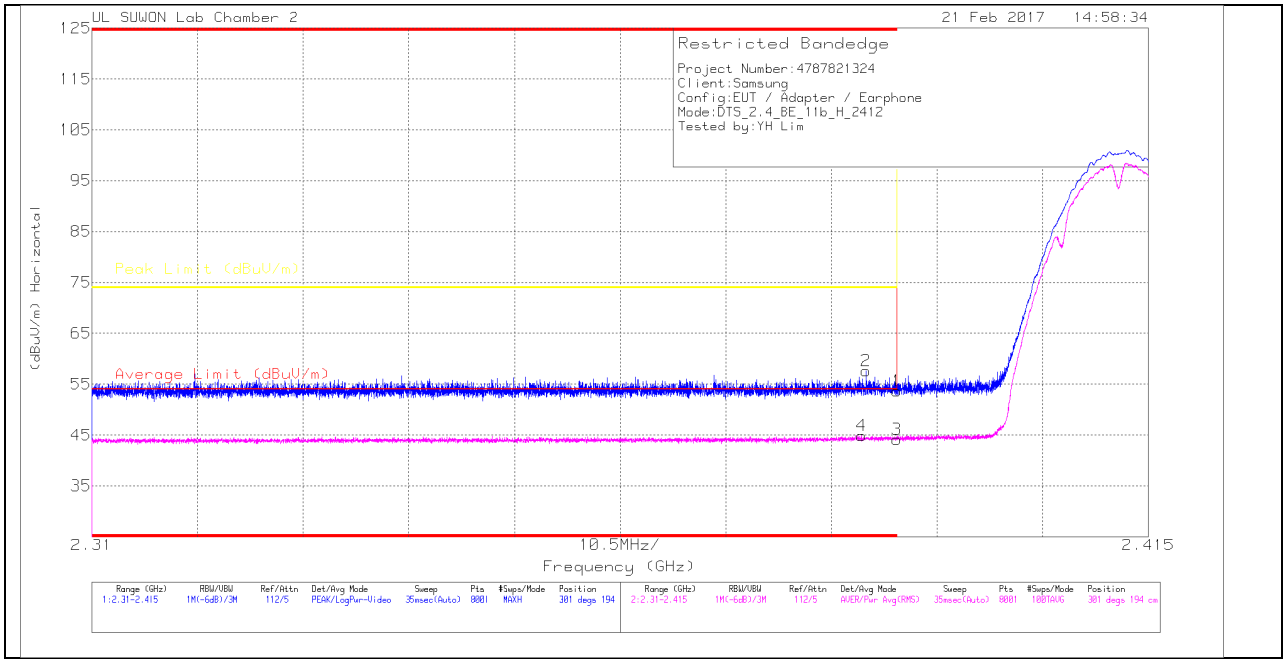
MAv1 - KDB558074 Option 1 Maximum RMS Average

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

10.2.2. TX ABOVE 1 GHz 802.11b MODE IN THE 2.4 GHz BAND ANT2

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

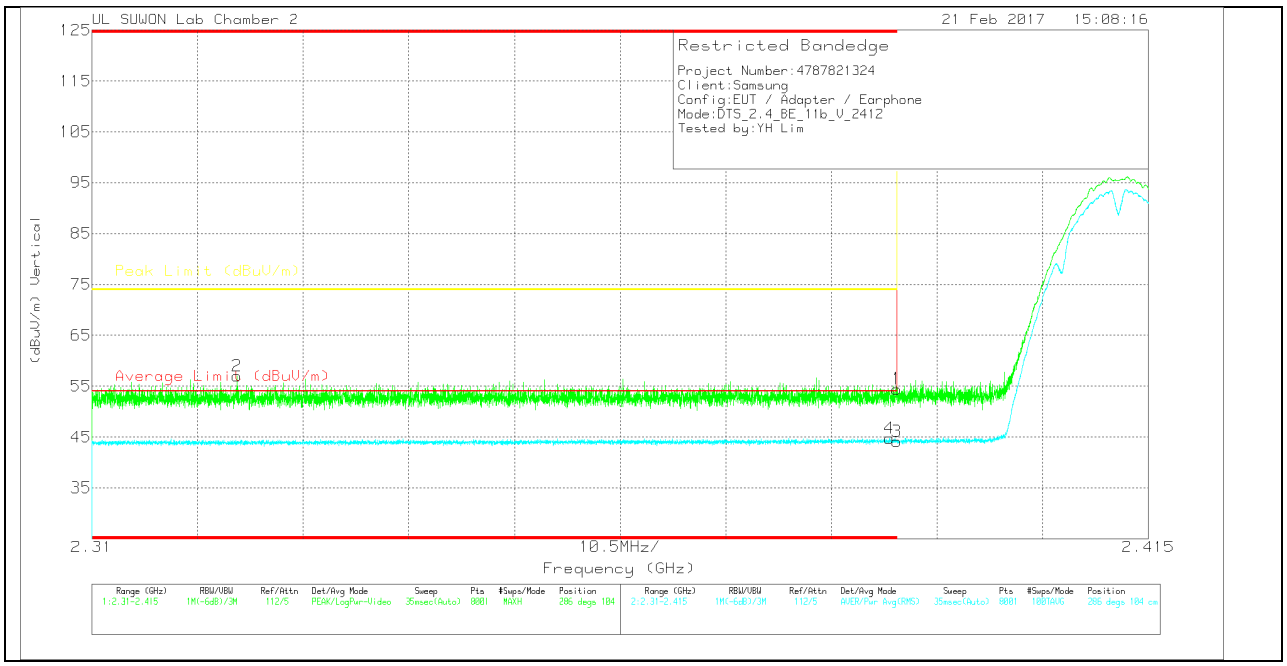
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	10dB[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	40.17	Pk	31.7	-18.2	0	53.67	-	-	74	-20.33	301	194	H
2	* 2.387	44.15	Pk	31.7	-18.2	0	57.65	-	-	74	-16.35	301	194	H
3	* 2.39	30.59	RMS	31.7	-18.2	0	44.09	54	-9.91	-	-	301	194	H
4	* 2.386	31.36	RMS	31.7	-18.2	0	44.86	54	-9.14	-	-	301	194	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	10dB[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	40.97	Pk	31.7	-18.2	0	54.47	-	-	74	-19.53	286	104	V
2	* 2.324	43.78	Pk	31.6	-18.4	0	56.98	-	-	74	-17.02	286	104	V
3	* 2.39	30.59	RMS	31.7	-18.2	0	44.09	54	-9.91	-	-	286	104	V
4	* 2.389	31.27	RMS	31.7	-18.2	0	44.77	54	-9.23	-	-	286	104	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection