



FCC CFR47 PART 15 SUBPART C
DTS Wireless LAN
CERTIFICATION TEST REPORT
FOR
AIRWAY CLEARANCE SYSTEM
PRODUCT NAME: PMACS1WI
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Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	12/21/16	Initial issue	Junwhan Lee
V2	12/26/16	Addressed TCB's questions	Junwhan Lee

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Hill-Rom Services Private Limited
EUT DESCRIPTION: Airway Clearance System
PRODUCT NAME: PMACS1WI
SERIAL NUMBER: PREDVM0036 (RADIATED & CONDUCTED)
DATE TESTED: OCT 07, 2016 - DEC 21, 2016

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 FCC CFR 47 Part 2, FCC CFR 47 Part 15, KDB 558074 D01 v03r05 and 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:

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

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	2.32 dB
Radiated Disturbance, Below 1GHz	4.14 dB
Radiated Disturbance, Above 1 GHz	5.97 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Airway Clearance System with DTS/UNII a/b/g/n and BT/BLE features.
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	Average Power [dBm]	Average Power [mW]	Output Power [dBm] (Peak)	Output Power [mW] (Peak)
2412 - 2462	802.11b	15.49	35.40	21.51	141.58
	802.11g	14.32	27.04	22.42	174.58
	802.11n HT20	12.08	16.14	20.29	106.91

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an PCB antennas, with a antenna's maximum gain of 0.99 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 X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

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

802.11b mode: 11 Mbps
802.11g mode: 54 Mbps
802.11n HT20 mode: MCS7

This device supports simultaneous transmission operation, Which allows for two modules(Bluetooth & WLAN) to operate independent of one another in the Bluetooth(2.4GHz) and WLAN(2.4GHz & 5GHz) bands simultaneously on each antenna. The following tables show the worst case configurations determined during testing. The data for Scenario A configuration is contained in this test report.

Scenario A Configuration: Bluetooth transmitting in 2.4GHz and WLAN in 2.4GHz mode

Description	Bluetooth 2.4GHz Tx	WLAN 2.4GHz Tx
Channel	78	11
Operating Frequency(MHz)	2480	2462
Data Rate	1 Mbps	11 Mbps
Mode	Basic FSK	802.11b

Scenario B Configuration: Bluetooth transmitting in 2.4GHz and WLAN in 5GHz mode

Description	Bluetooth 2.4GHz Tx	WLAN 5GHz Tx
Channel	78	48
Operating Frequency(MHz)	2480	5240
Data Rate	1 Mbps	6 Mbps
Mode	Basic FSK	802.11a

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Adapter	SHENZHEN MEGMEET ELECTRICAL CO., LTD	MANGO120-24CK	8801631000045	N/A

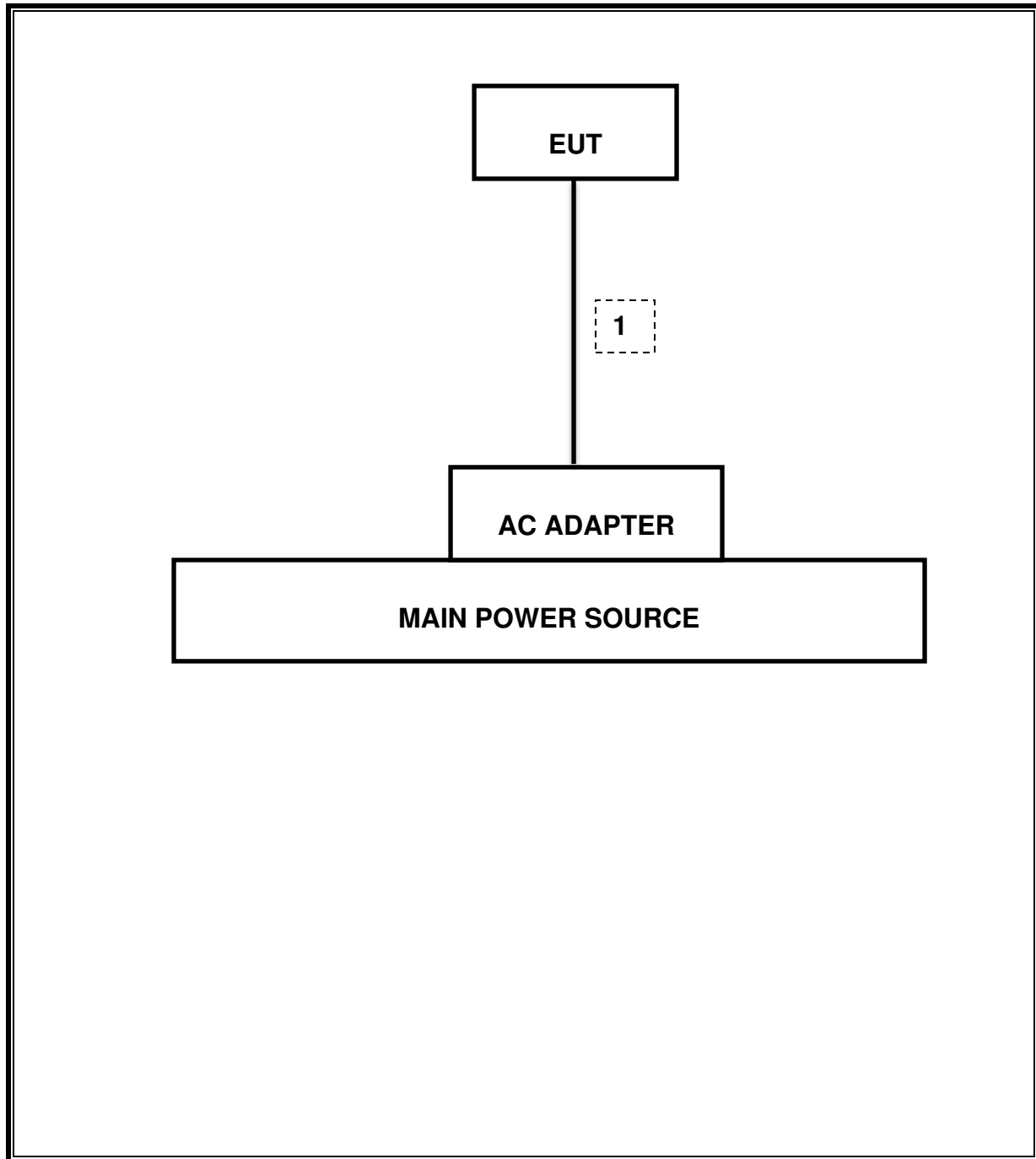
I/O CABLES

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

TEST SETUP

The EUT is a stand-alone unit during the tests.
Test software 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	749	04-25-17
Antenna, Horn, 18 GHz	ETS	3115	00161451	05-17-17
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
Bluetooth Tester	TESCOM	TC-3000C	3000C000546	08-18-17
Average Power Sensor	R&S	NRZ-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
Attenuator / Switch driver	HP	11713A	3748A04272	N/A
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	PASTERNAK	PE7087-10	A009	08-16-17
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	11-25-17

7. MEASUREMENT METHODS

KDB 558074 D01 DTS Meas Guidance v03r05: Measurement Procedure §9.2.3.1 AVGPM is used for average power and §9.1.1 is used for peak power and §10.2 is used for peak power spectral density.

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.

8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

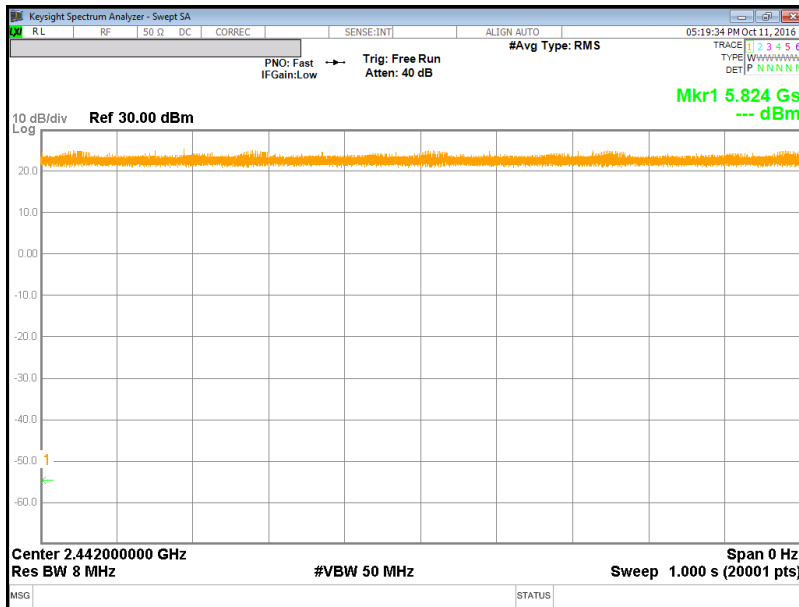
None; for reporting purposes only.

8.1. ON TIME AND DUTY CYCLE RESULTS

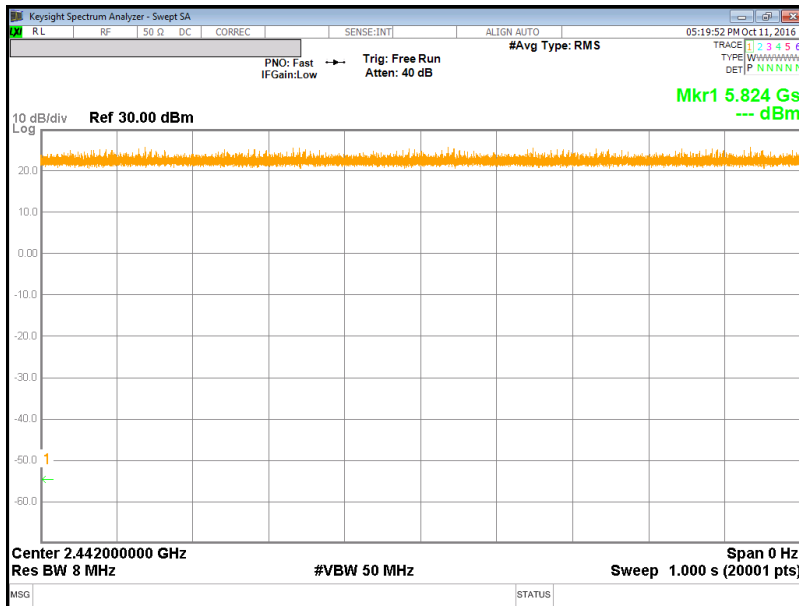
Mode	ON Time B [msec]	Period [msec]	Duty Cycle x [linear]	Duty Cycle [%]	Duty Cycle Correction Factor [dB]	1/T Minimum VBW [kHz]
2400MHz Bands						
802.11b	1000	1000	1.000	100.0%	0.00	0.010
802.11g	1000	1000	1.000	100.0%	0.00	0.010
802.11n HT20	1000	1000	1.000	100.0%	0.00	0.010



[802.11b]



[802.11g]



[802.11n]

9. 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	9.062 MHz
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-31.029 dBm
15.247	TX conducted output power	<30dBm		Pass	22.42 dBm (Peak)
15.247	PSD	<8dBm		Pass	5.902 dBm
15.207 (a)	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass	48.6 dBuV (Qp)
15.205, 15.209	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass	53.05 dBuV/m (Av)

10. ANTENNA PORT TEST RESULTS

10.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

The minimum 6 dB bandwidth shall be at least 500 kHz.

TEST PROCEDURE

Reference to KDB 558074 D01 DTS Meas Guidance v03r05: The transmitter output is connected to a spectrum analyzer with the RBW set to 100kHz, the VBW $\geq 3 \times$ RBW, peak detector and max hold.

RESULTS

10.1.1. 802.11b MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Minimum Limit [MHz]
Low	2412	9.062	0.5
Mid	2437	9.063	0.5
High	2462	9.086	0.5
Worst		9.062	0.5

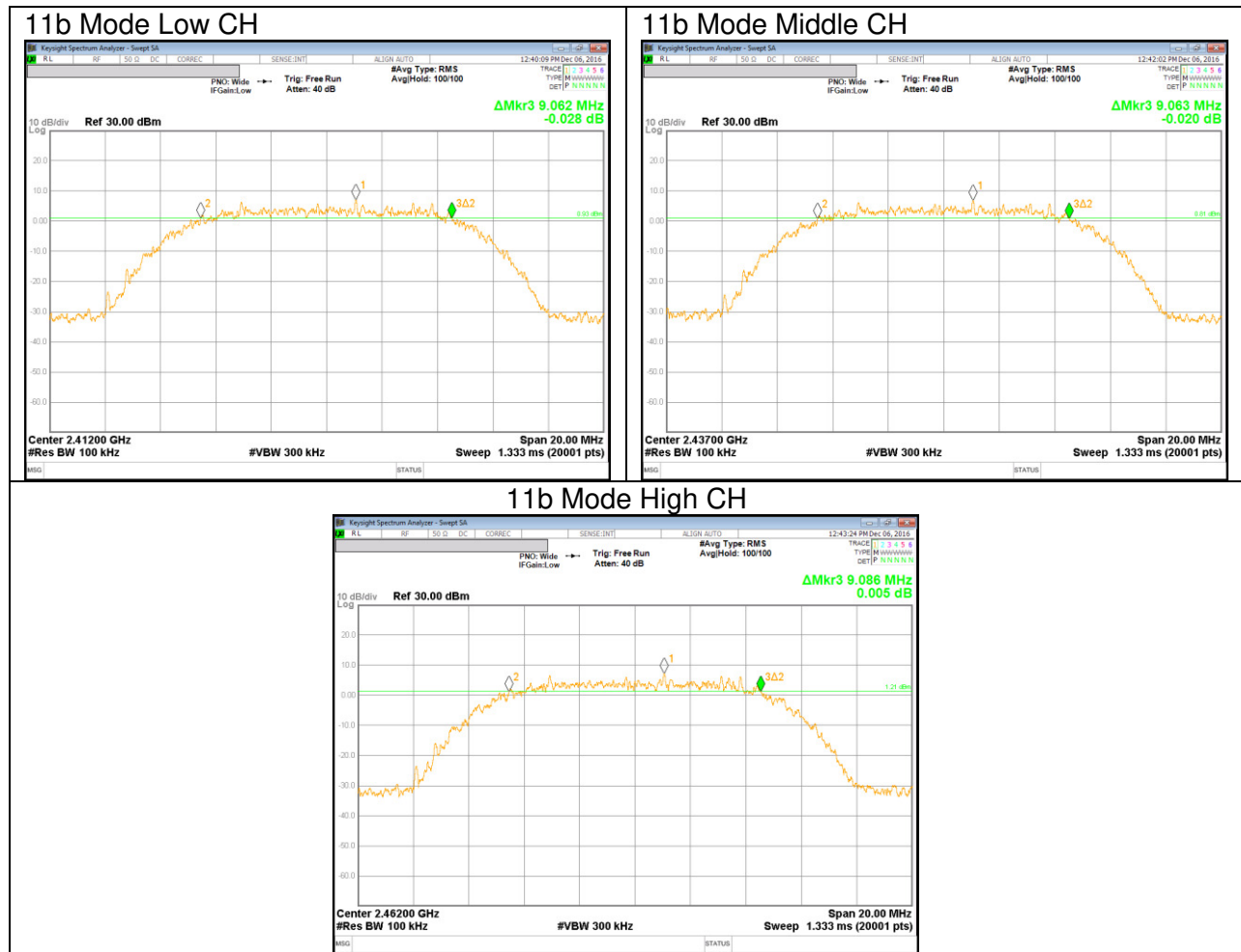
10.1.2. 802.11g MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Minimum Limit [MHz]
1	2412	16.523	0.5
4	2427	16.509	0.5
6	2437	16.496	0.5
8	2447	16.490	0.5
11	2462	16.473	0.5
Worst		16.473	0.5

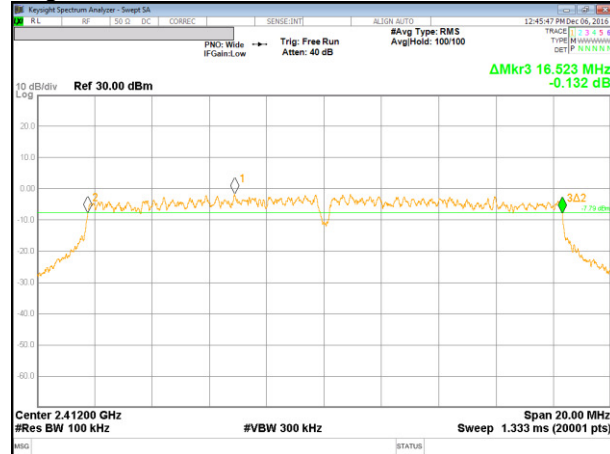
10.1.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Minimum Limit [MHz]
1	2412	17.753	0.5
4	2427	17.752	0.5
6	2437	17.762	0.5
8	2447	17.750	0.5
11	2462	17.779	0.5
Worst		17.750	0.5

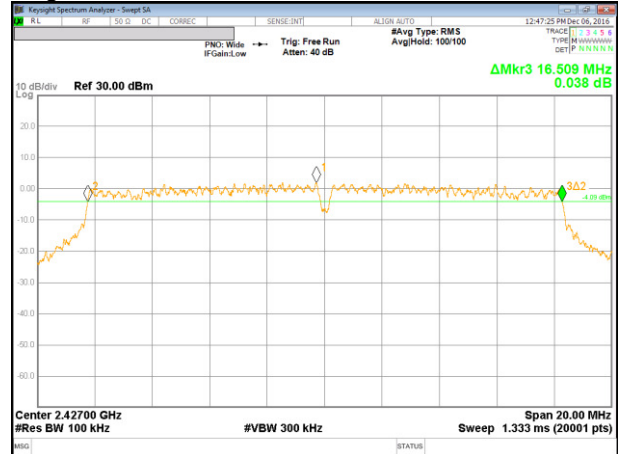
10.1.4. 6 dB BANDWIDTH PLOTS



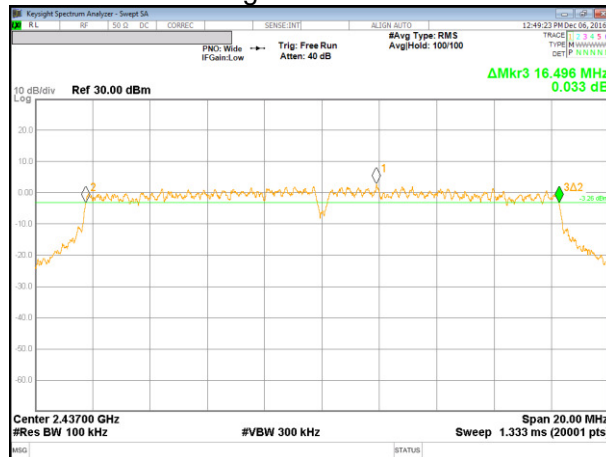
11g Mode 1 CH



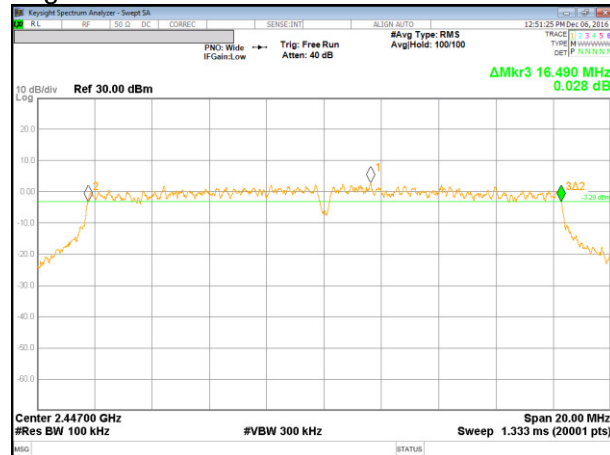
11g Mode 4 CH



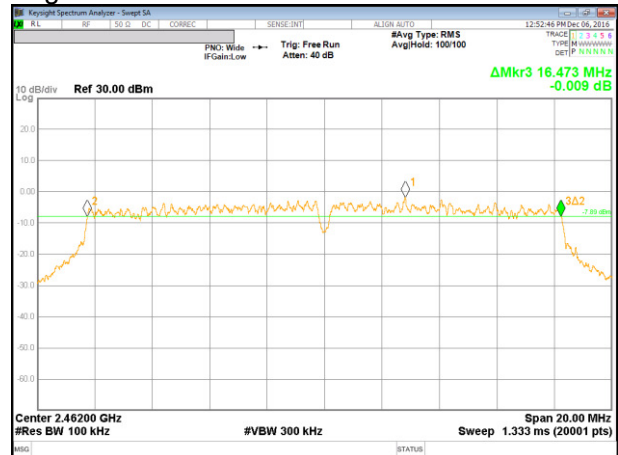
11g Mode 6 CH



11g Mode 8 CH



11g Mode 11 CH





10.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

10.2.1. 802.11b MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	99% Bandwidth [MHz]
Low	2412	11.817
Mid	2437	11.797
High	2462	11.819
Worst		11.819

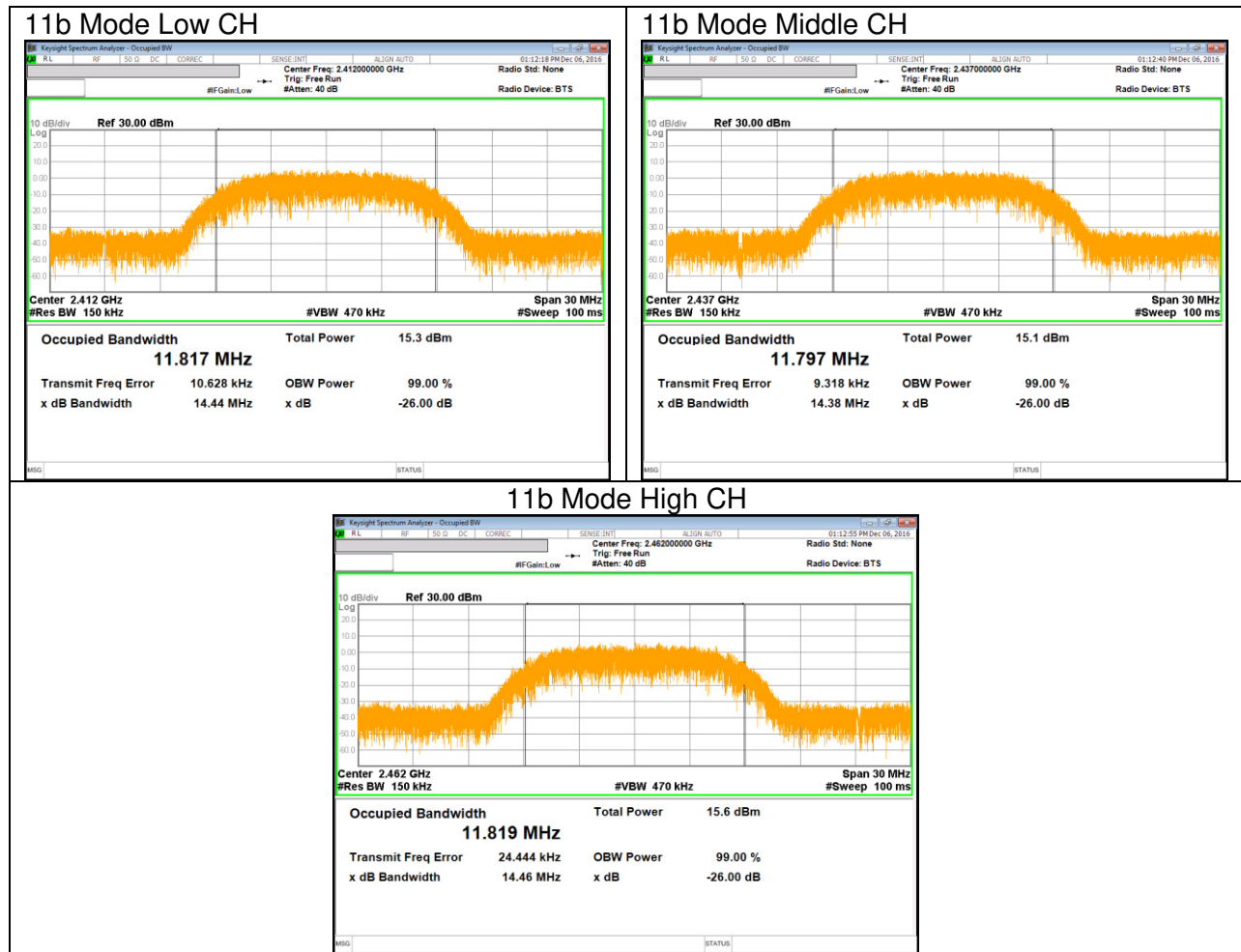
10.2.2. 802.11g MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	99% Bandwidth [MHz]
1	2412	16.494
4	2427	16.532
6	2437	16.532
8	2447	16.527
11	2462	16.498
Worst		16.532

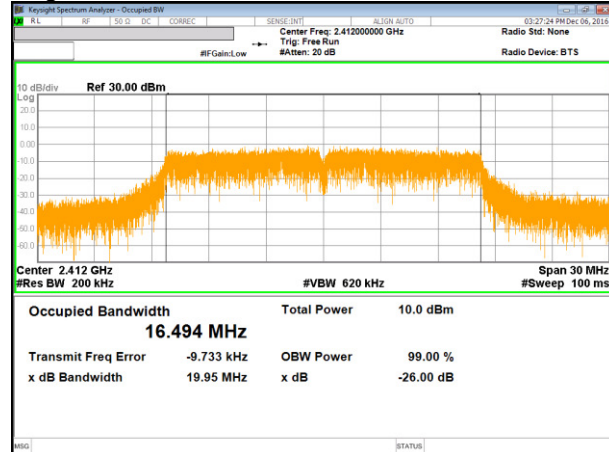
10.2.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	99% Bandwidth [MHz]
1	2412	17.655
4	2427	17.678
6	2437	17.682
8	2447	17.657
11	2462	17.668
Worst		17.682

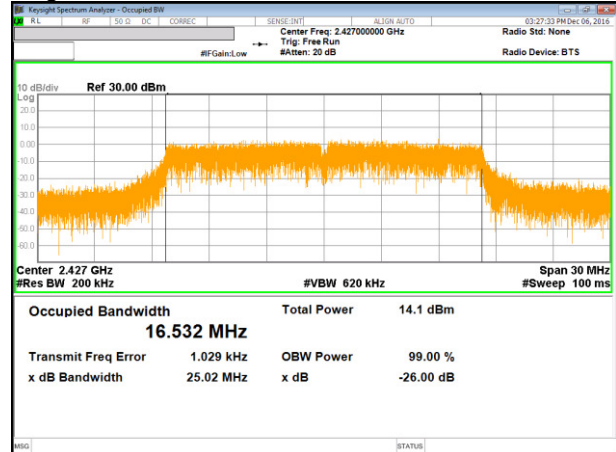
10.2.4. 99% BANDWIDTH PLOTS



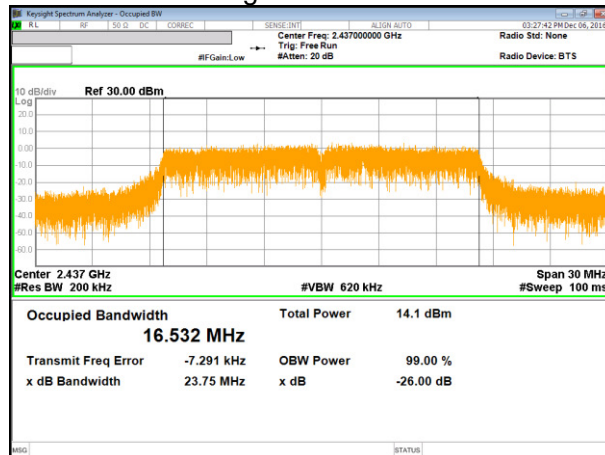
11g Mode 1 CH



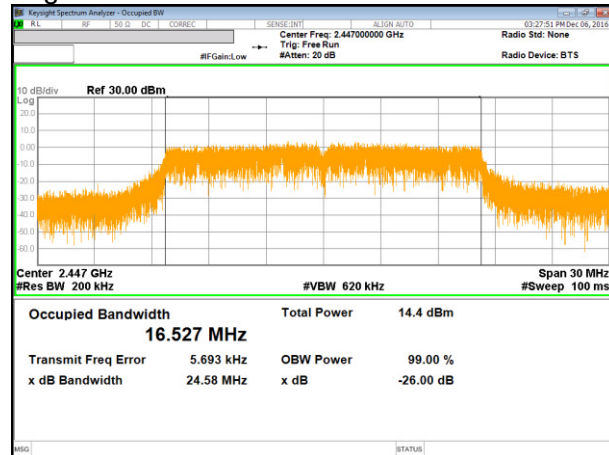
11g Mode 4 CH



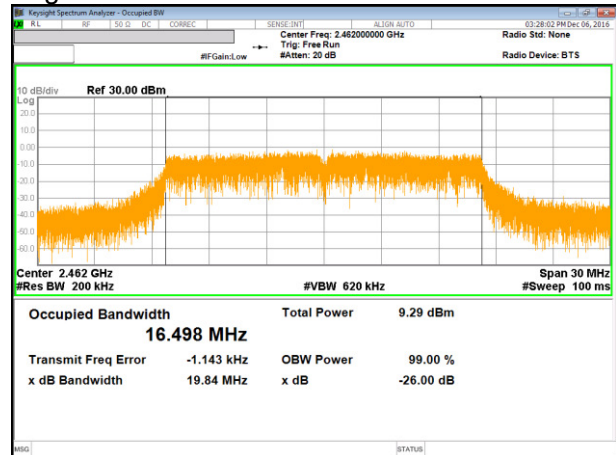
11g Mode 6 CH



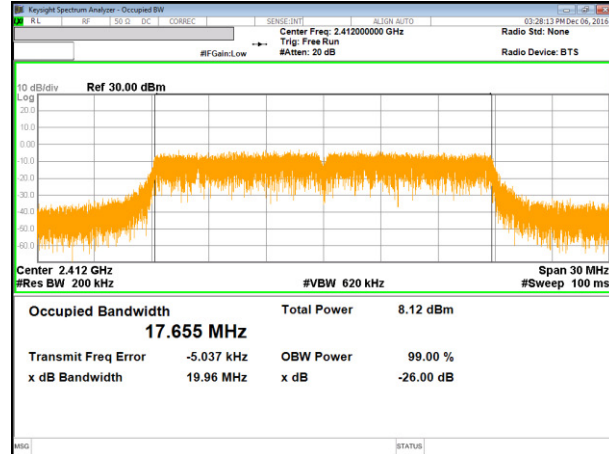
11g Mode 8 CH



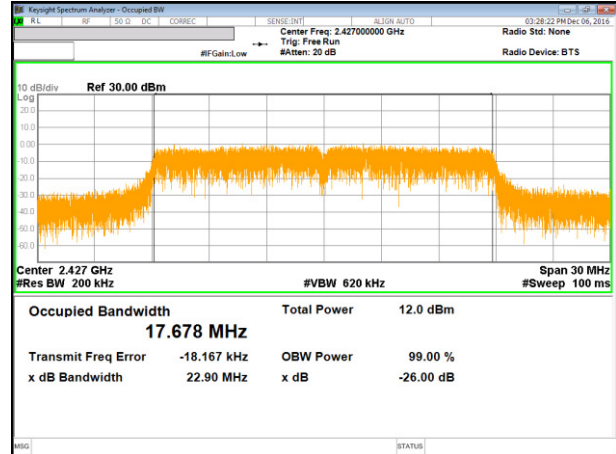
11g Mode 11 CH



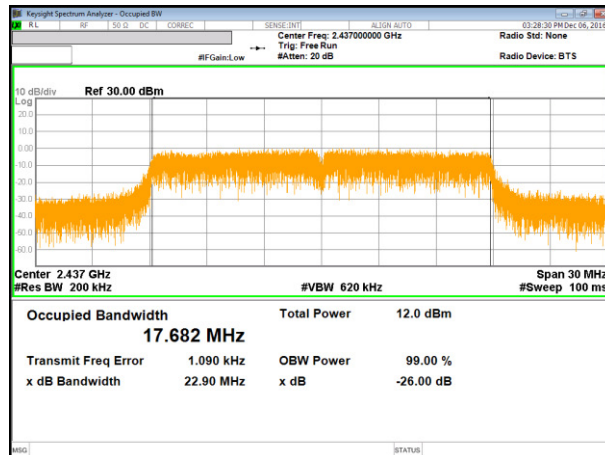
11n HT20 Mode 1 CH



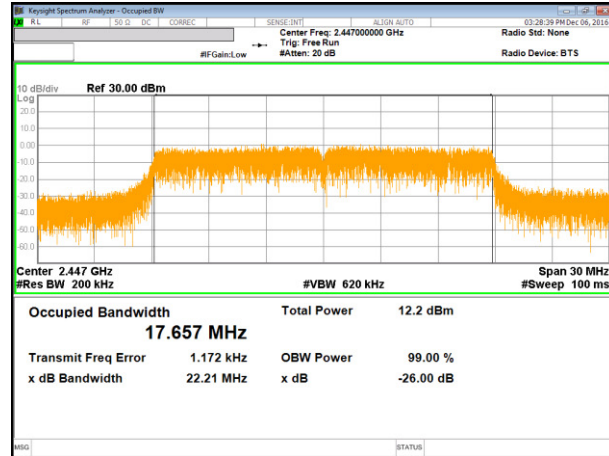
11n HT20 Mode 4 CH



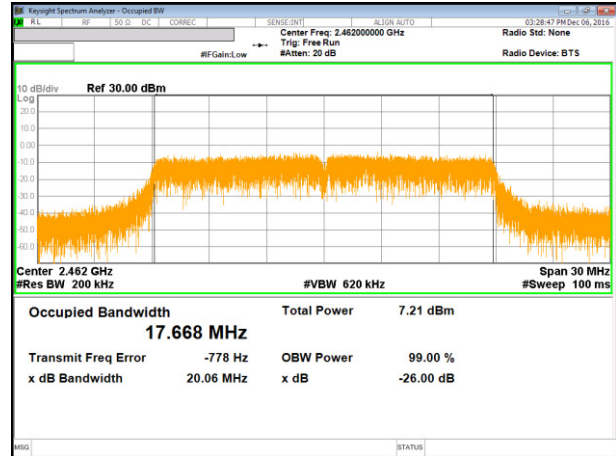
11n HT20 Mode 6 CH



11n HT20 Mode 8 CH



11n HT20 Mode 11 CH



10.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.1 dB (including 10 dB pad and 0.1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

10.3.1. 802.11b MODE IN THE 2.4 GHz BAND

Channel	Frequency (MHz)	Avg Power (dBm)
Low	2412	15.13
Mid	2437	15.14
High	2462	15.49
Worst		15.49

10.3.2. 802.11g MODE IN THE 2.4 GHz BAND

Channel	Frequency (MHz)	Avg Power (dBm)
1	2412	10.03
4	2427	14.11
6	2437	14.09
8	2447	14.32
11	2462	9.13
Worst		14.32

10.3.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

Channel	Frequency (MHz)	Avg Power (dBm)
1	2412	8.05
4	2427	11.96
6	2437	11.96
8	2447	12.08
11	2462	7.04
Worst		12.08

10.4. OUTPUT POWER(Peak)

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.

RESULTS

10.4.1. 802.11b MODE IN THE 2.4 GHz BAND

Limits

Channel	Frequency [MHz]	Directional Gain Primary [dBi]	FCC Power Limit [dBm]	IC Power Limit [dBm]	IC EIRP Limit [dBm]	Max Power [dBm]
Low	2412	0.99	30.00	30.00	36.00	30.00
Mid	2437	0.99	30.00	30.00	36.00	30.00
High	2462	0.99	30.00	30.00	36.00	30.00

Results

Channel	Frequency [MHz]	Primary Meas Power [dBm]	Total Power [dBm]	Power Limit [dBm]	Margin [dB]
Low	2412	21.11	21.11	30.00	-8.89
Mid	2437	21.01	21.01	30.00	-8.99
High	2462	21.51	21.51	30.00	-8.49
Worst			21.51	30.00	-8.49

10.4.2. 802.11g MODE IN THE 2.4 GHz BAND

Limits

Channel	Frequency [MHz]	Directional Gain Primary [dBi]	FCC Power Limit [dBm]	IC Power Limit [dBm]	IC EIRP Limit [dBm]	Max Power [dBm]
1	2412	0.99	30.00	30.00	36.00	30.00
4	2427	0.99	30.00	30.00	36.00	30.00
6	2437	0.99	30.00	30.00	36.00	30.00
8	2447	0.99	30.00	30.00	36.00	30.00
11	2462	0.99	30.00	30.00	36.00	30.00

Results

Channel	Frequency [MHz]	Primary Meas Power [dBm]	Total Power [dBm]	Power Limit [dBm]	Margin [dB]
1	2412	18.20	18.20	30.00	-11.80
4	2427	22.20	22.20	30.00	-7.80
6	2437	22.16	22.16	30.00	-7.84
8	2447	22.42	22.42	30.00	-7.58
11	2462	17.49	17.49	30.00	-12.51
Worst			22.42	30.00	-7.58

10.4.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

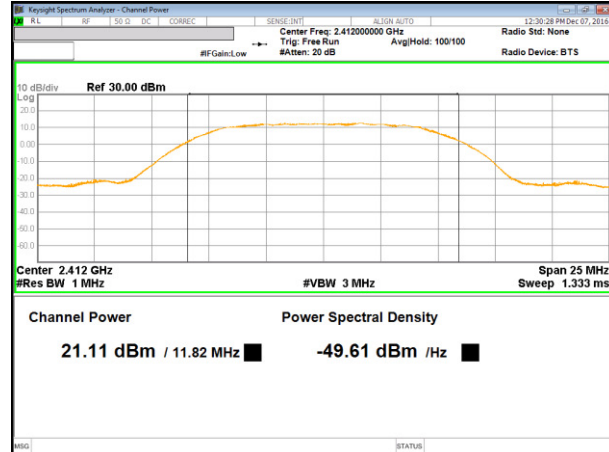
Limits

Channel	Frequency [MHz]	Directional Gain Primary [dBi]	FCC Power Limit [dBm]	IC Power Limit [dBm]	IC EIRP Limit [dBm]	Max Power [dBm]
1	2412	0.99	30.00	30.00	36.00	30.00
4	2427	0.99	30.00	30.00	36.00	30.00
6	2437	0.99	30.00	30.00	36.00	30.00
8	2447	0.99	30.00	30.00	36.00	30.00
11	2462	0.99	30.00	30.00	36.00	30.00

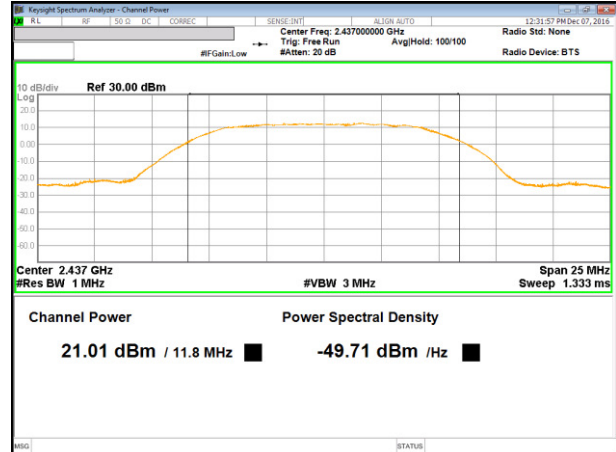
Results

Channel	Frequency [MHz]	Primary Meas Power [dBm]	Total Power [dBm]	Power Limit [dBm]	Margin [dB]
1	2412	16.35	16.35	30.00	-13.65
4	2427	20.18	20.18	30.00	-9.82
6	2437	20.10	20.10	30.00	-9.90
8	2447	20.29	20.29	30.00	-9.71
11	2462	15.35	15.35	30.00	-14.65
Worst			20.29	30.00	-9.71

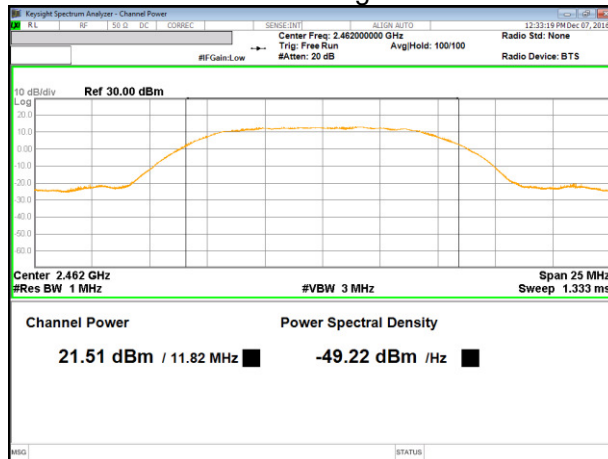
11b Mode Low CH

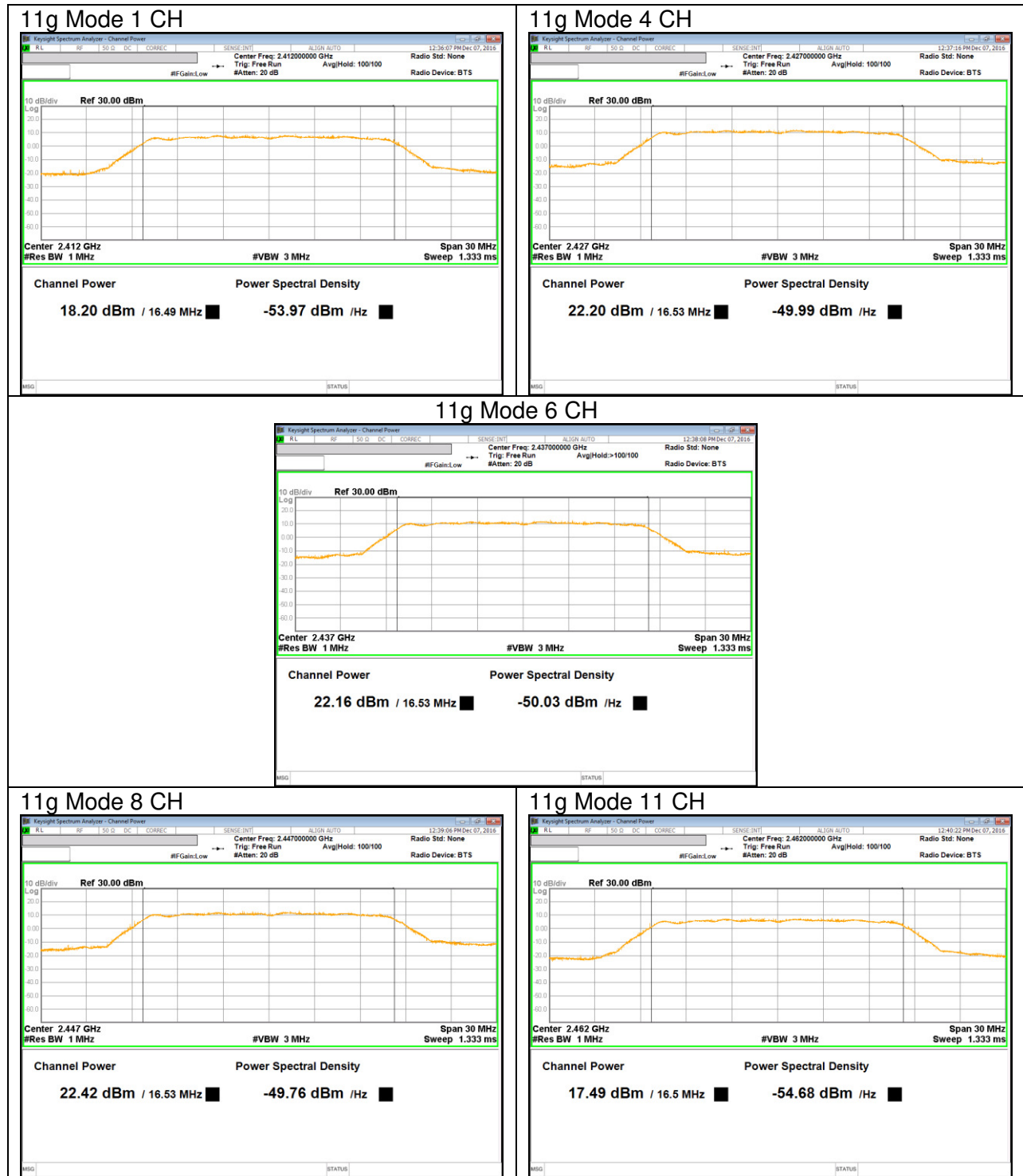


11b Mode Middle CH

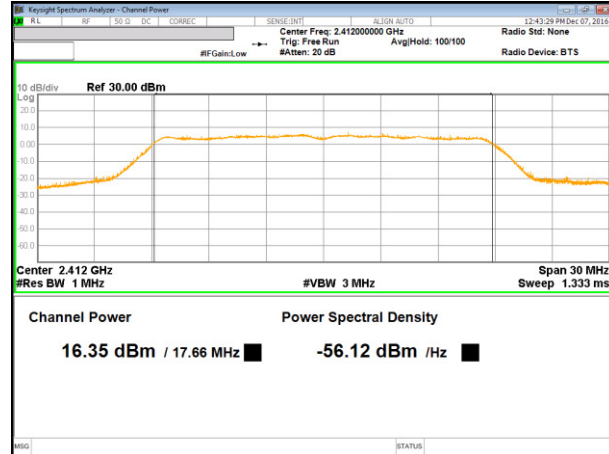


11b Mode High CH

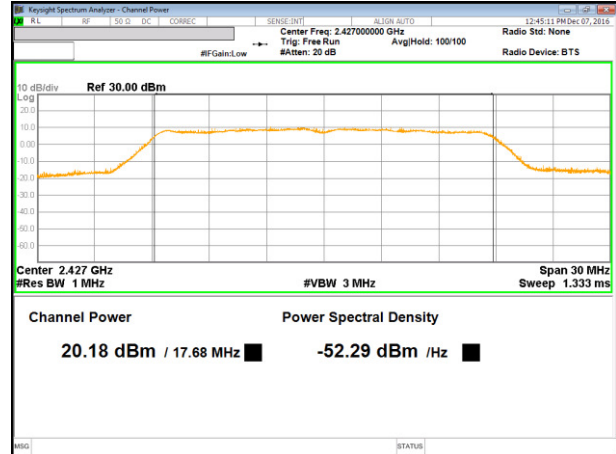




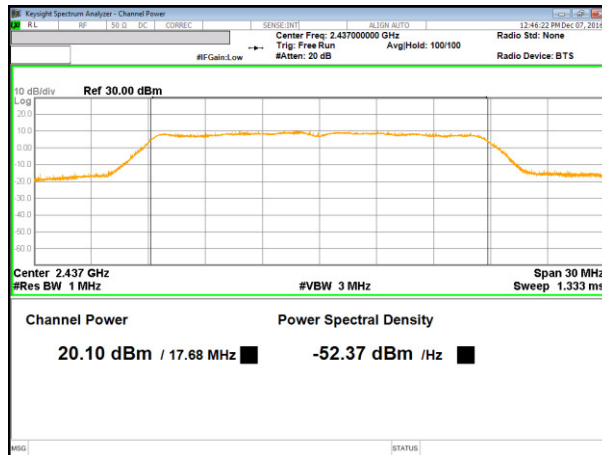
11n HT20 Mode 1 CH



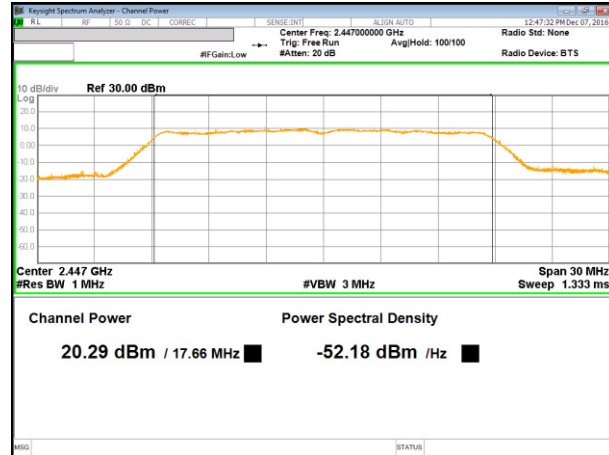
11n HT20 Mode 4 CH



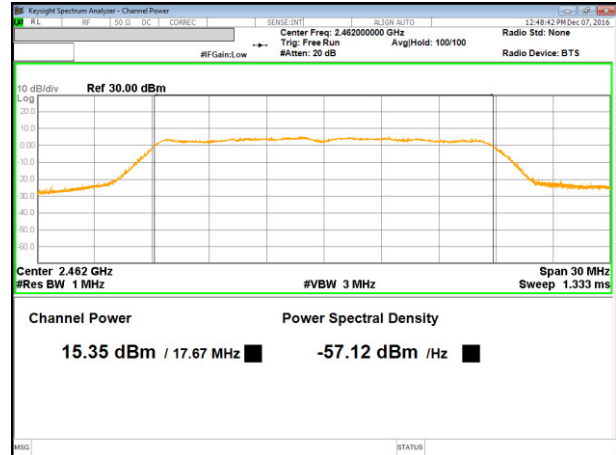
11n HT20 Mode 6 CH



11n HT20 Mode 8 CH



11n HT20 Mode 11 CH



10.5. 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 PkPSD(10.1)" under KDB558074 D01 DTS Meas Guidance v03r05

RESULTS

10.5.1. 802.11b MODE IN THE 2.4 GHZ BAND

PSD Results

Channel	Frequency [MHz]	PSD Meas [dBm]		Final PSD [dBm]	Limit [dBm]	Margin [dB]
Low	2412	5.65		5.650	8.00	-2.350
Mid	2437	5.661		5.661	8.00	-2.339
High	2462	5.902		5.902	8.00	-2.098

10.5.2. 802.11g MODE IN THE 2.4 GHZ BAND

PSD Results

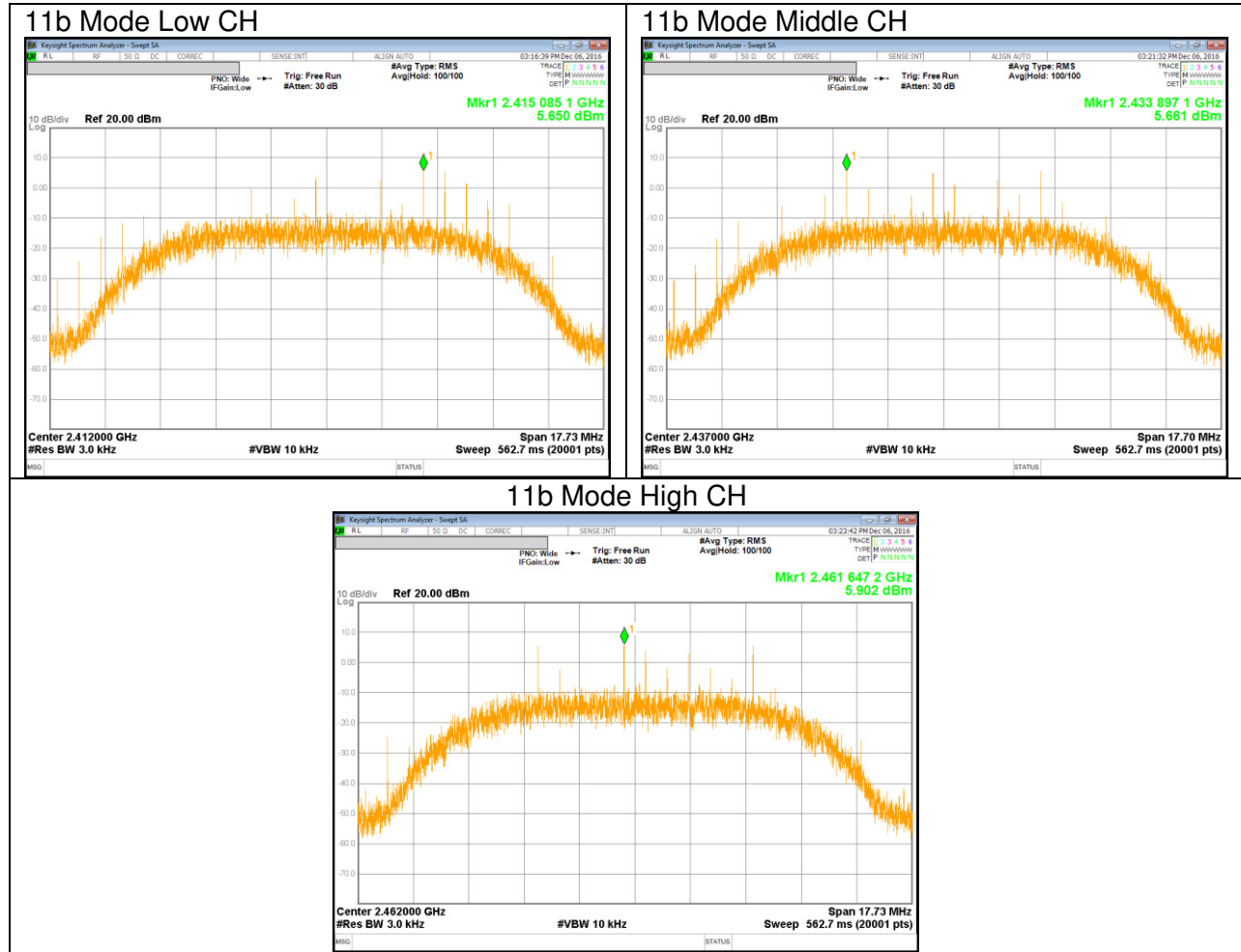
Channel	Frequency [MHz]	PSD Meas [dBm]		Final PSD [dBm]	Limit [dBm]	Margin [dB]
1	2412	-15.383		-15.383	8.00	-23.383
4	2427	-11.737		-11.737	8.00	-19.737
6	2437	-11.459		-11.459	8.00	-19.459
8	2447	-11.128		-11.128	8.00	-19.128
11	2462	-16.355		-16.355	8.00	-24.355

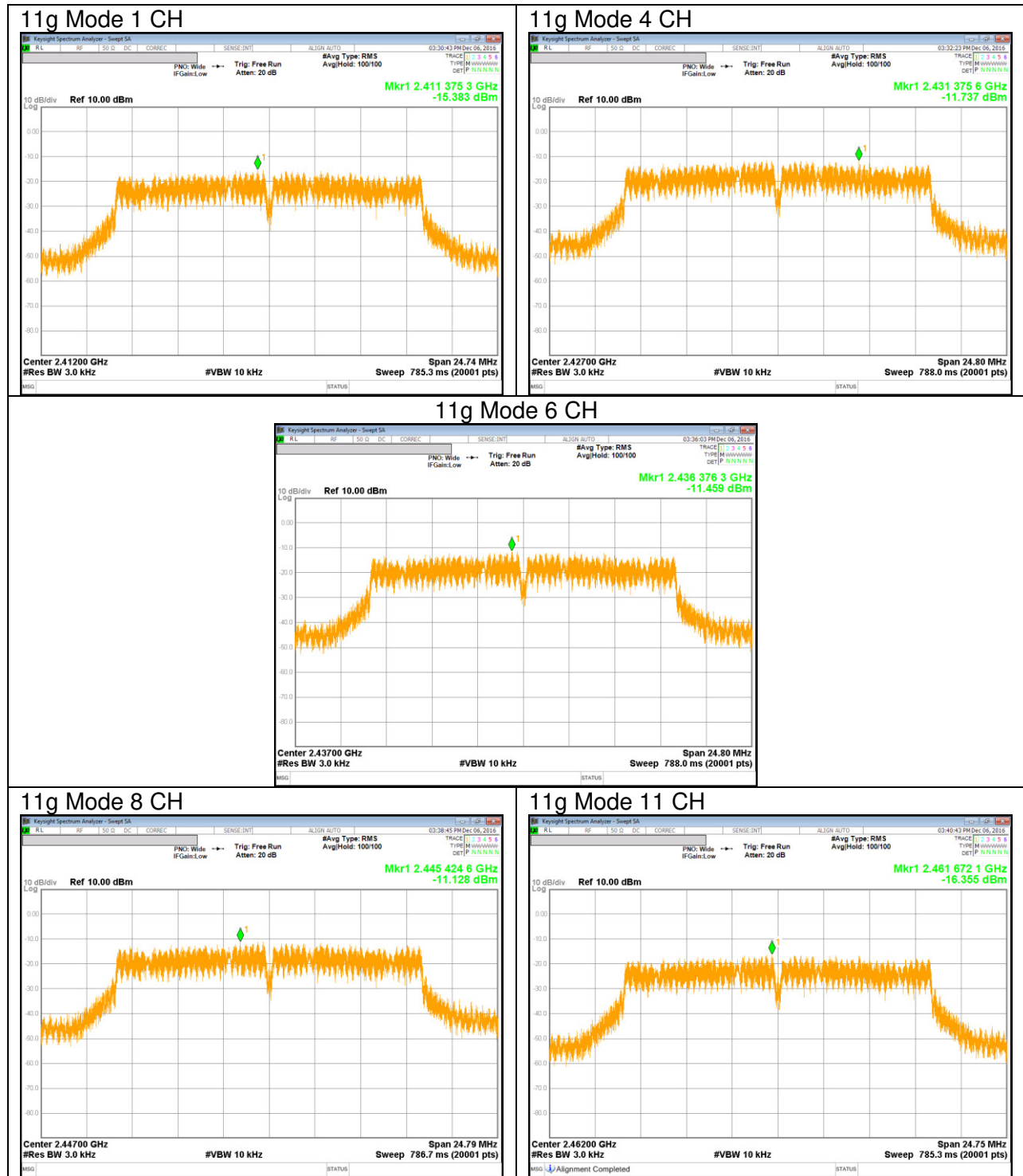
10.5.3. 802.11n HT20 MODE IN THE 2.4 GHZ BAND

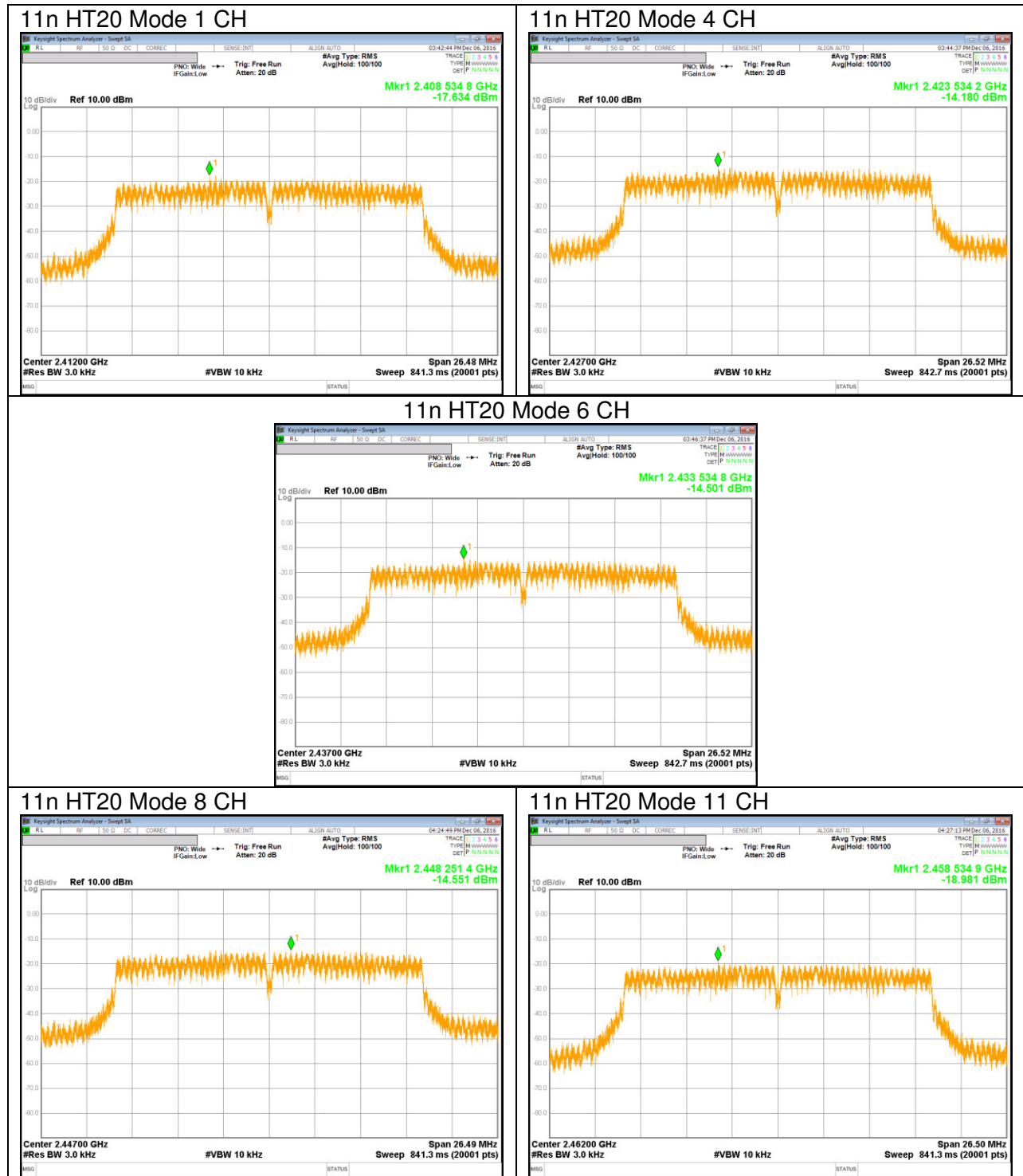
PSD Results

Channel	Frequency [MHz]	PSD Meas [dBm]		Final PSD [dBm]	Limit [dBm]	Margin [dB]
1	2412	-17.634		-17.634	8.00	-25.634
4	2427	-14.180		-14.180	8.00	-22.180
6	2437	-14.501		-14.501	8.00	-22.501
8	2447	-14.551		-14.551	8.00	-22.551
11	2462	-18.981		-18.981	8.00	-26.981

10.5.4. PSD PLOTS







10.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

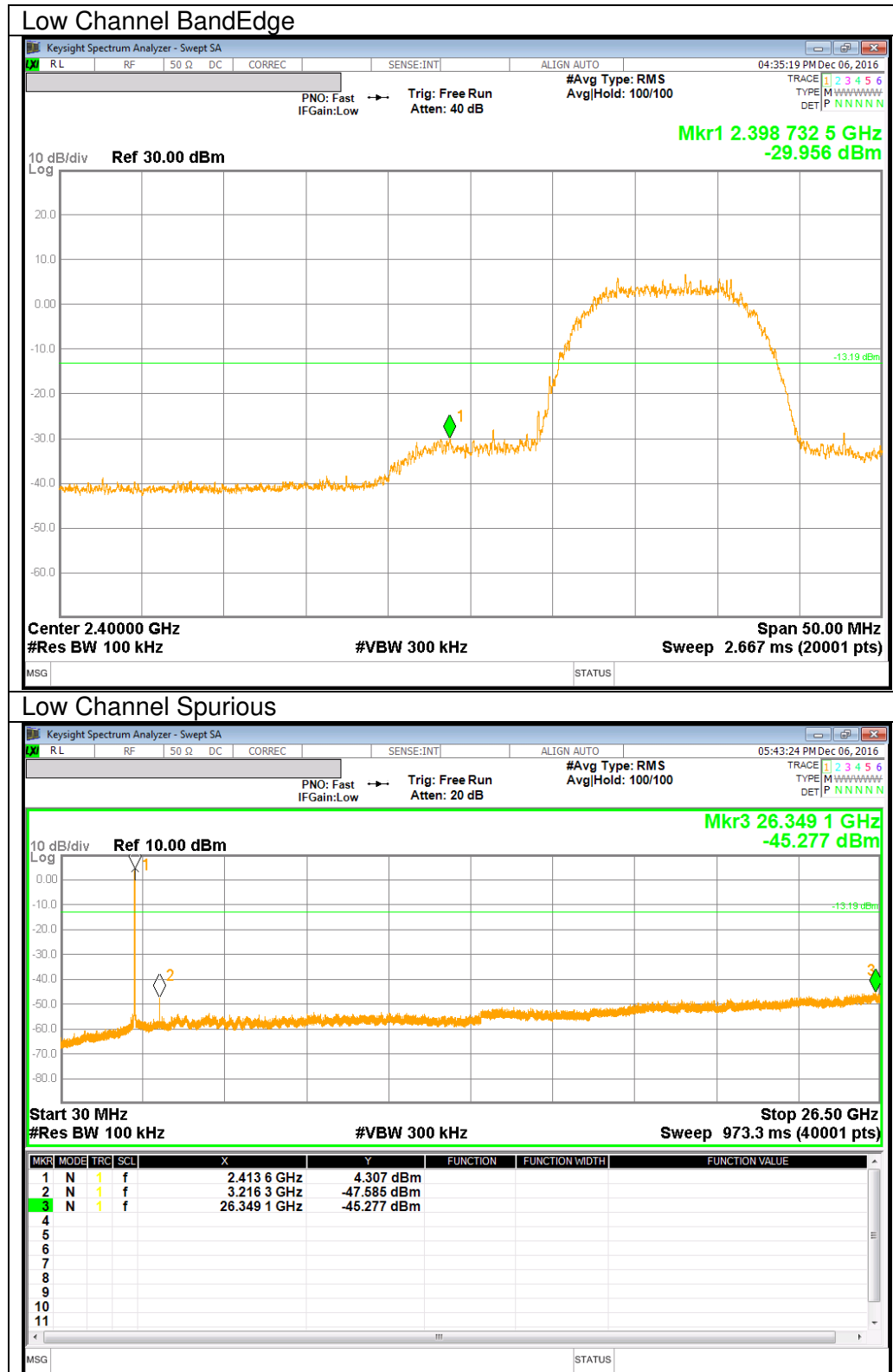
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

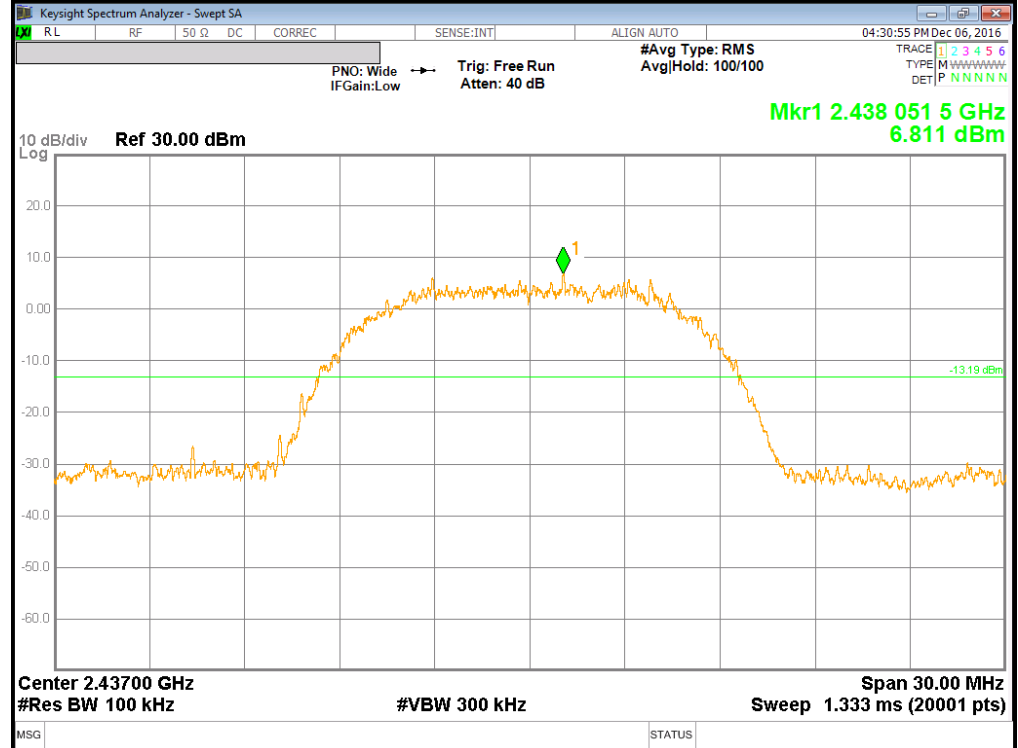
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

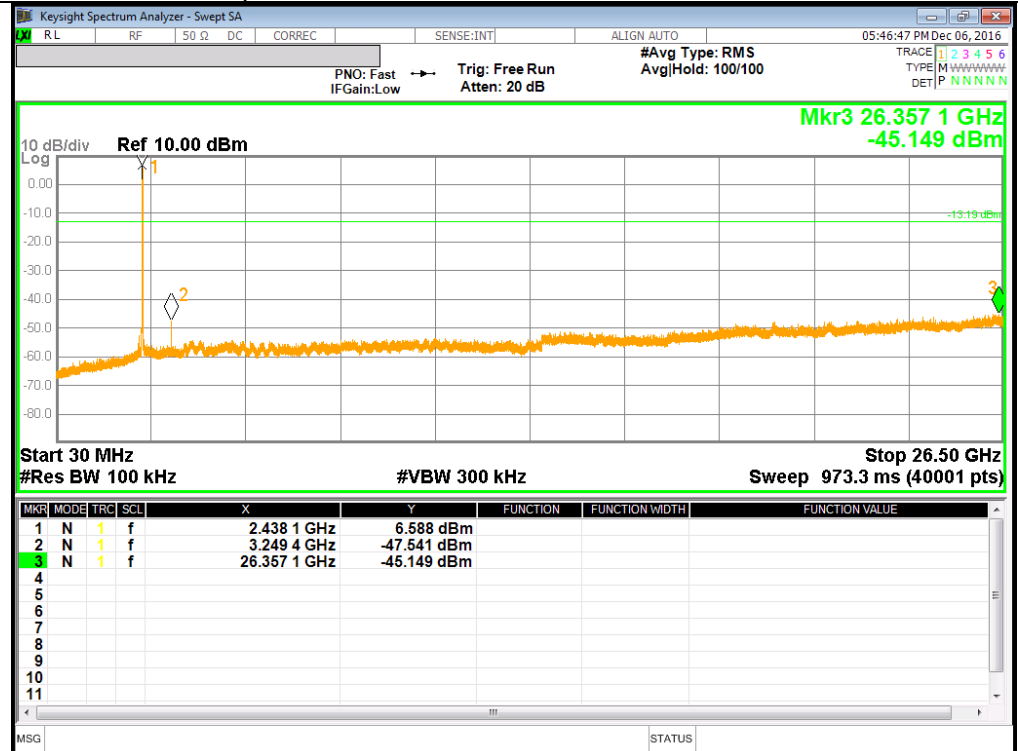
10.6.1. 802.11b MODE IN THE 2.4 GHz BAND

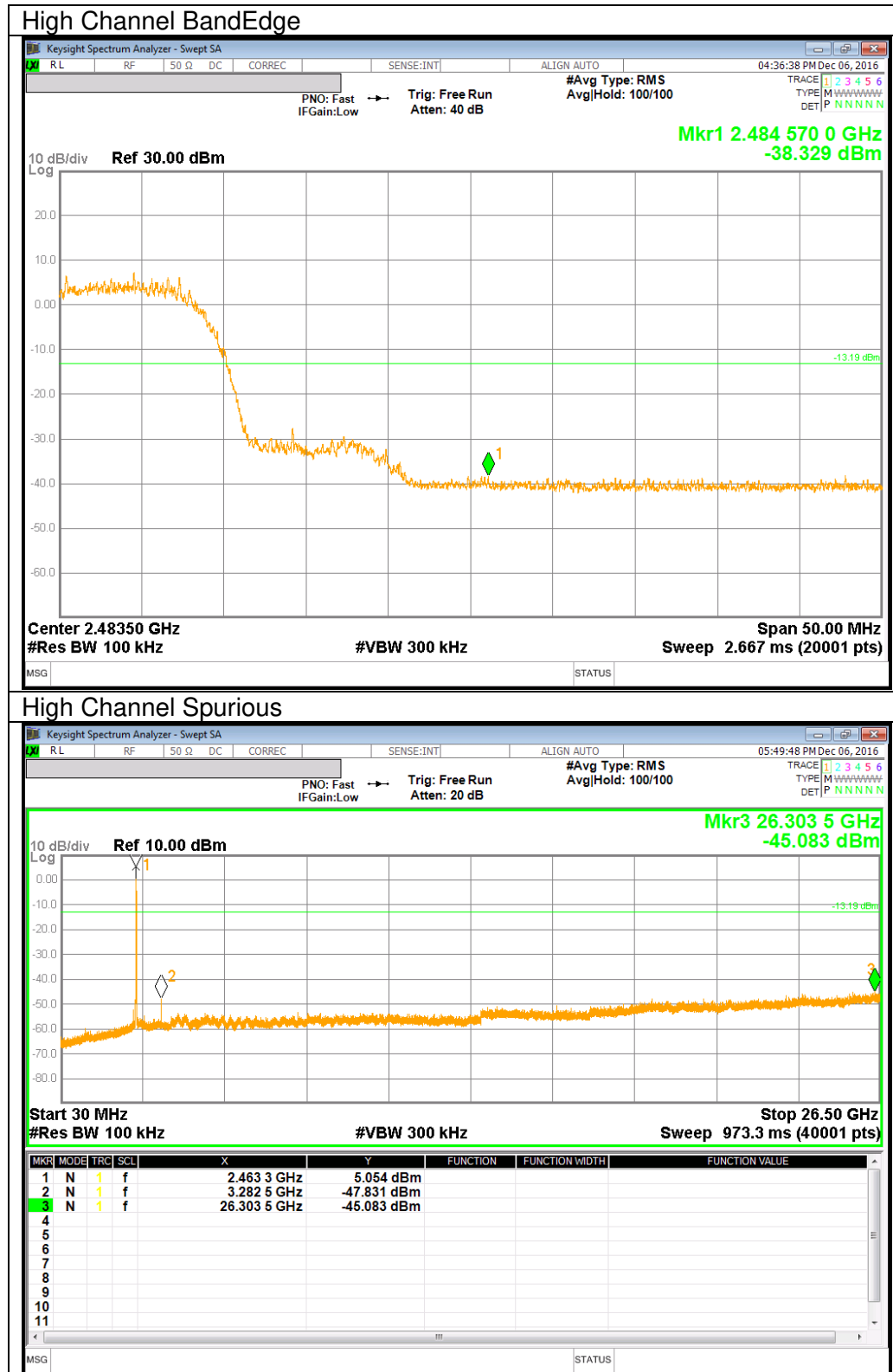


Middle Channel BandEdge

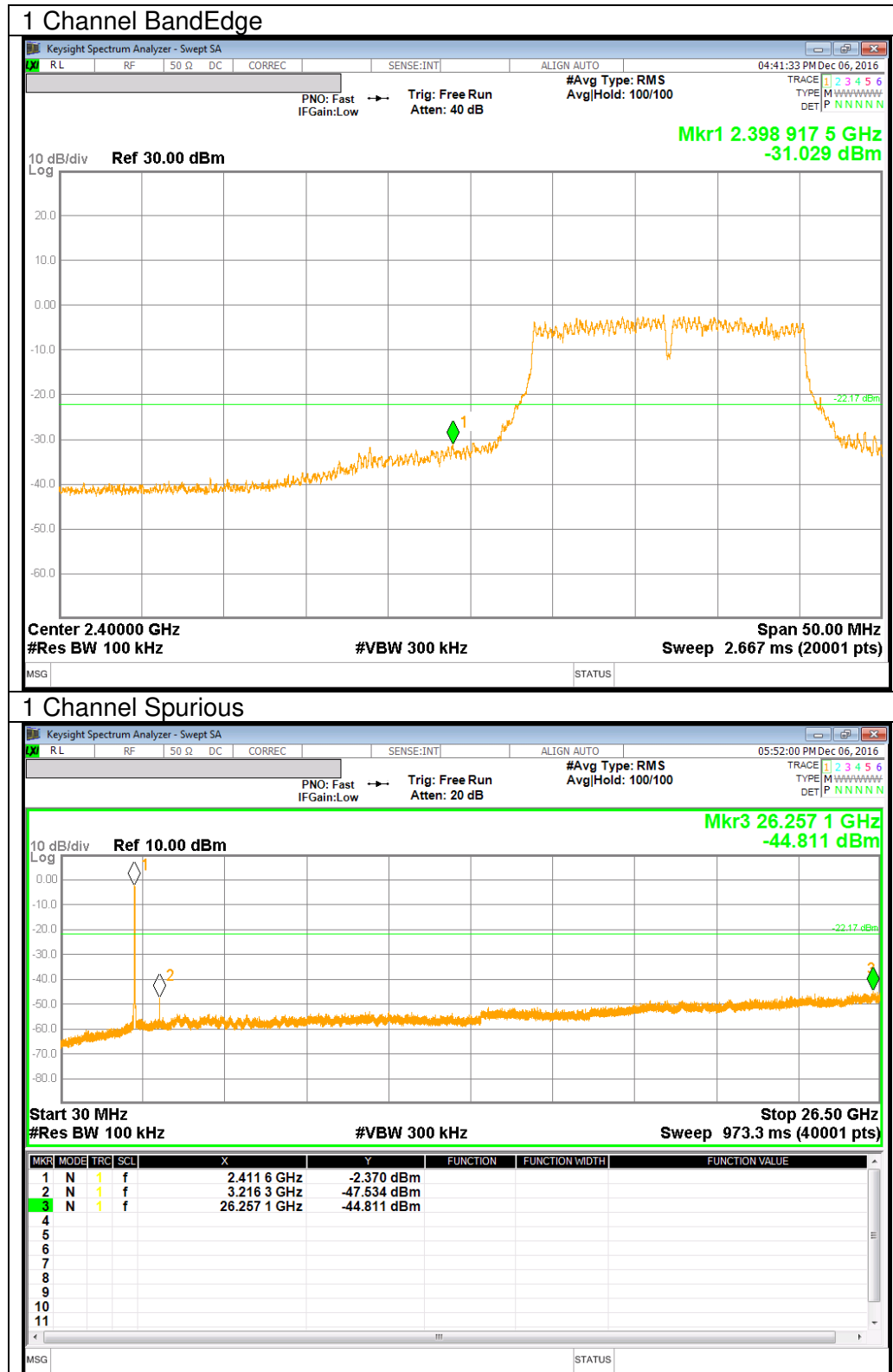


Middle Channel Spurious

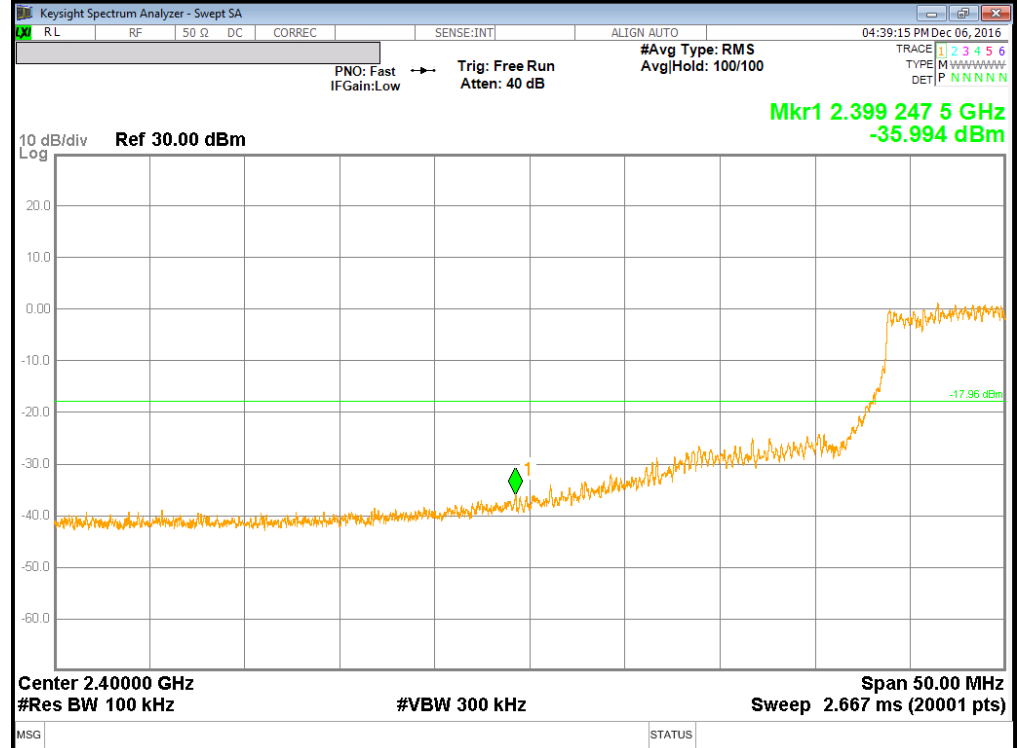




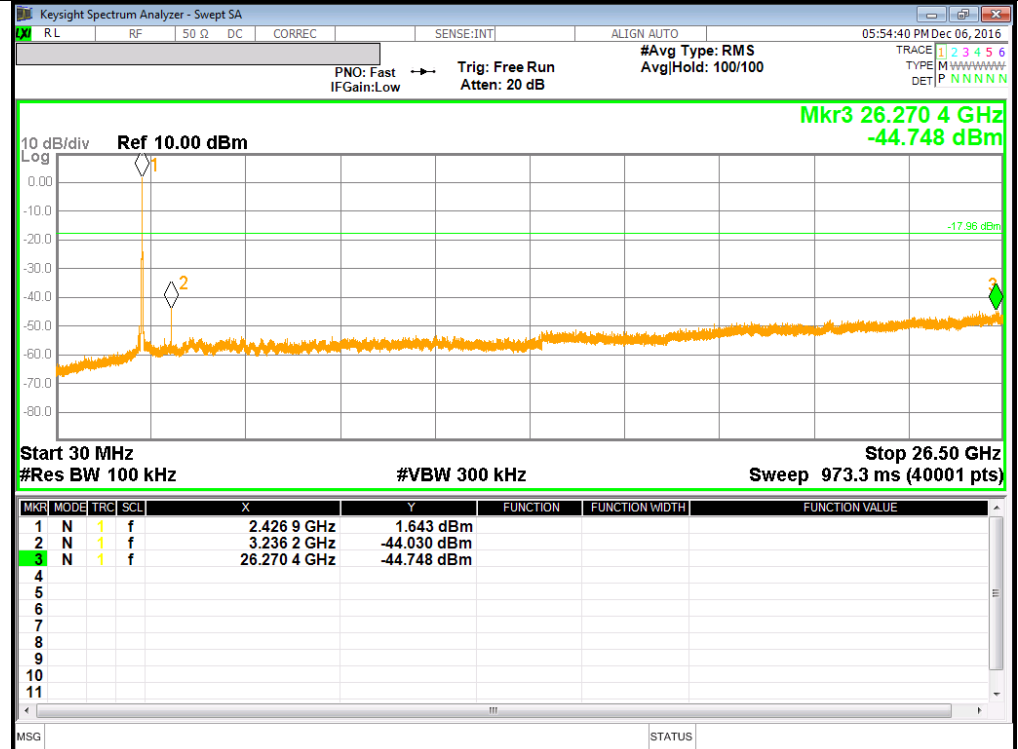
10.6.2. 802.11g MODE IN THE 2.4 GHz BAND



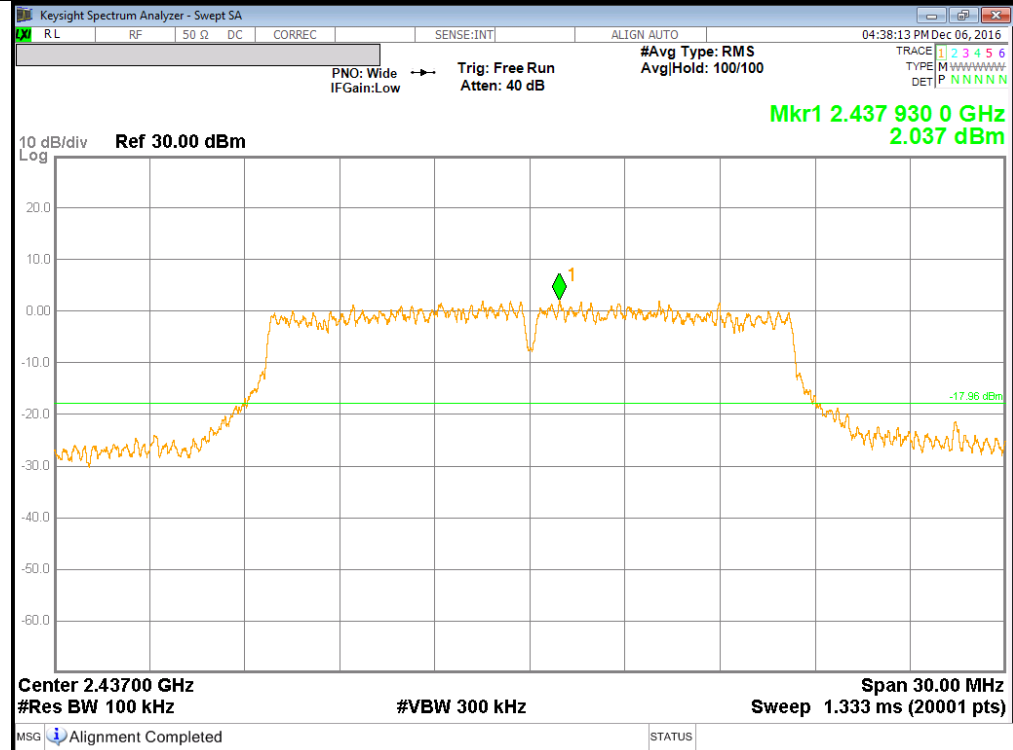
4 Channel BandEdge



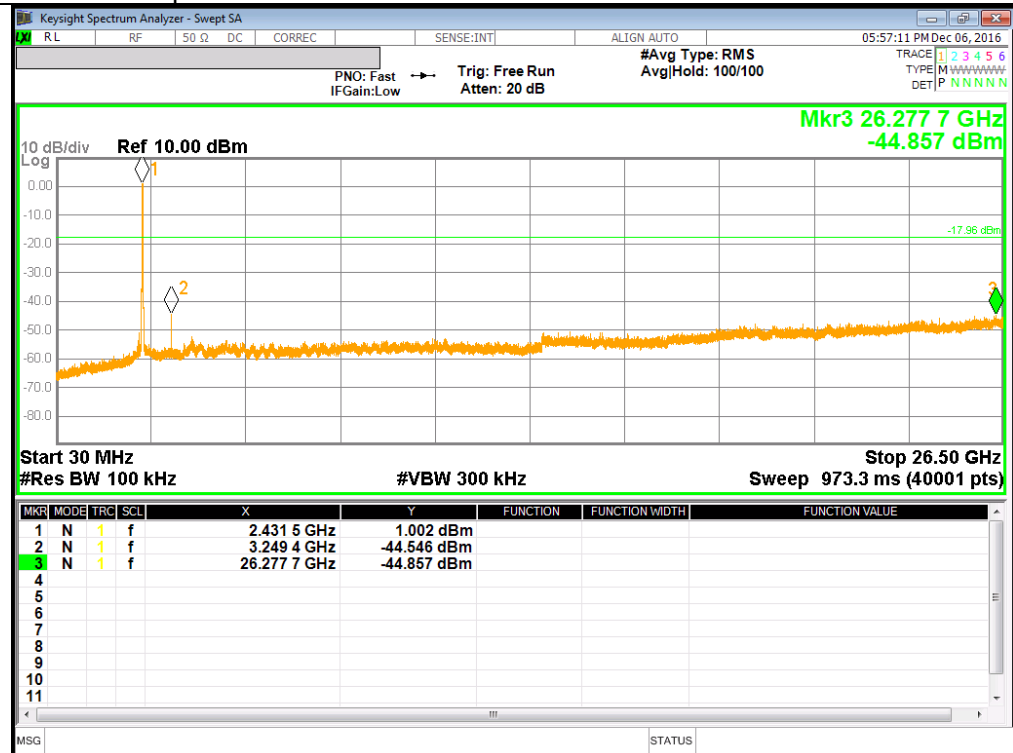
4 Channel Spurious



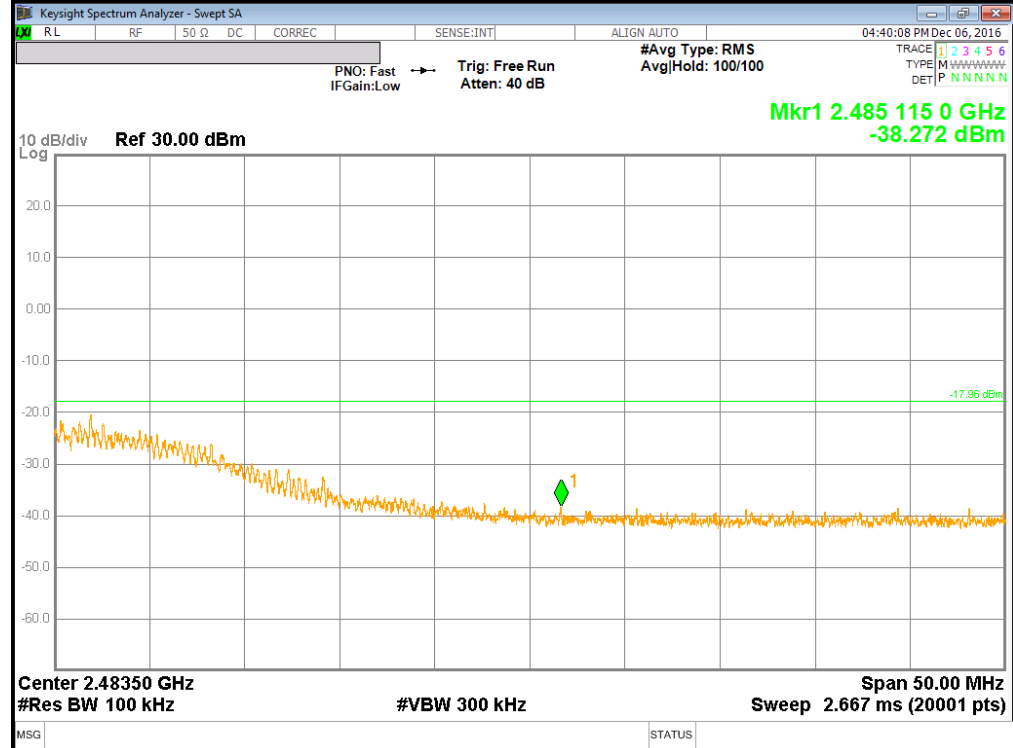
6 Channel BandEdge



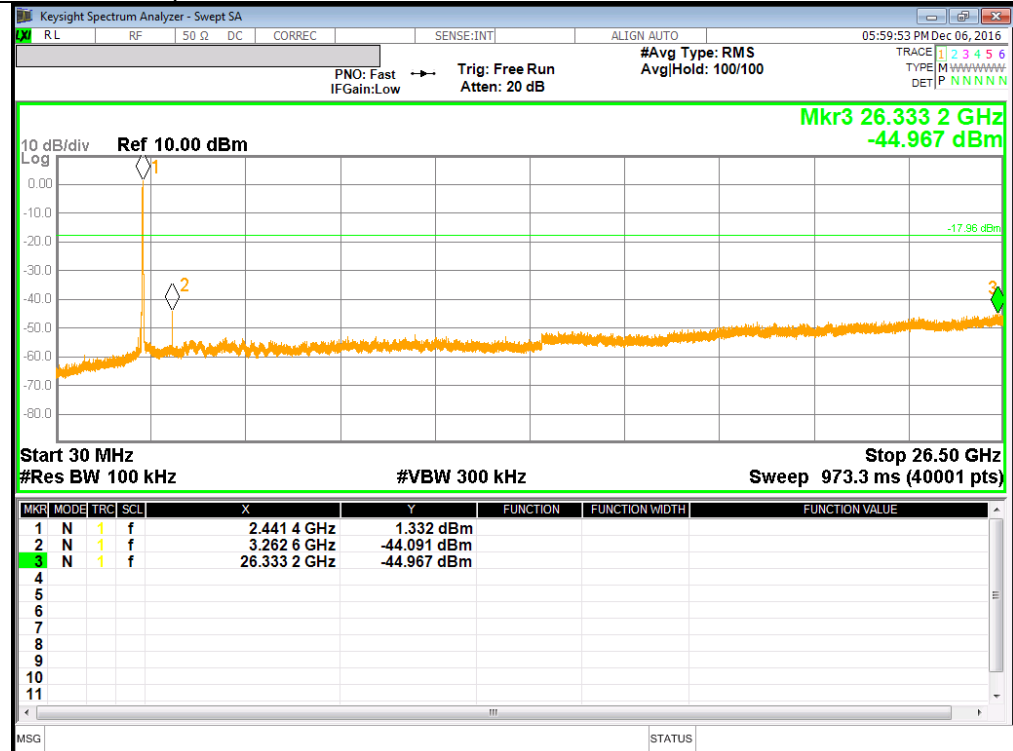
6 Channel Spurious



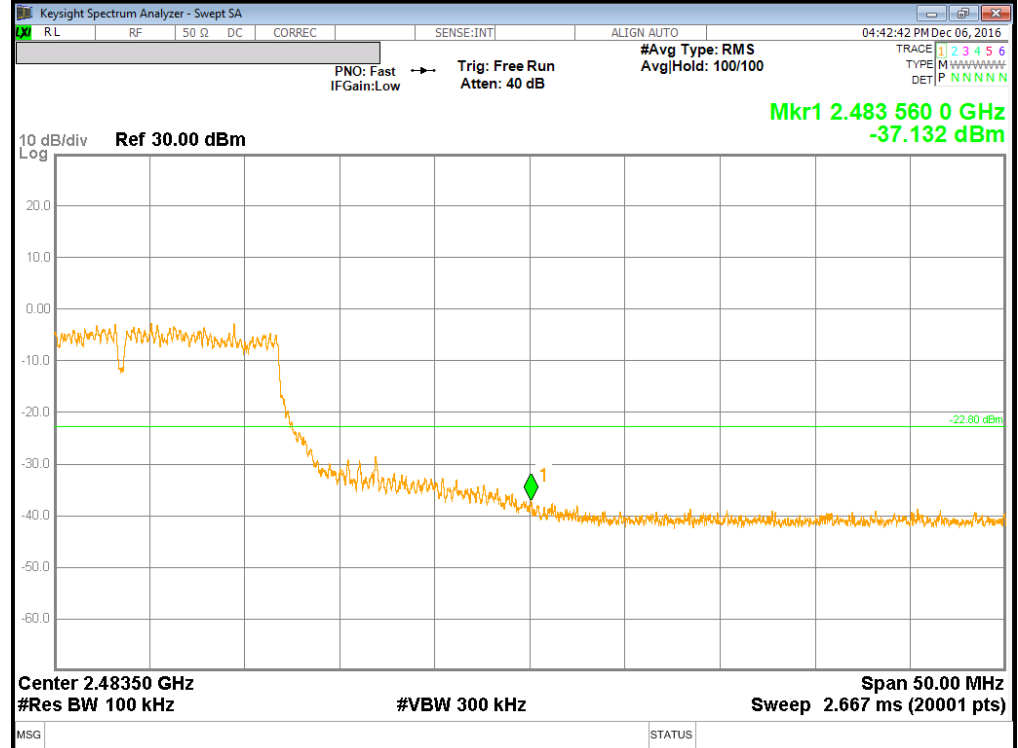
8 Channel BandEdge



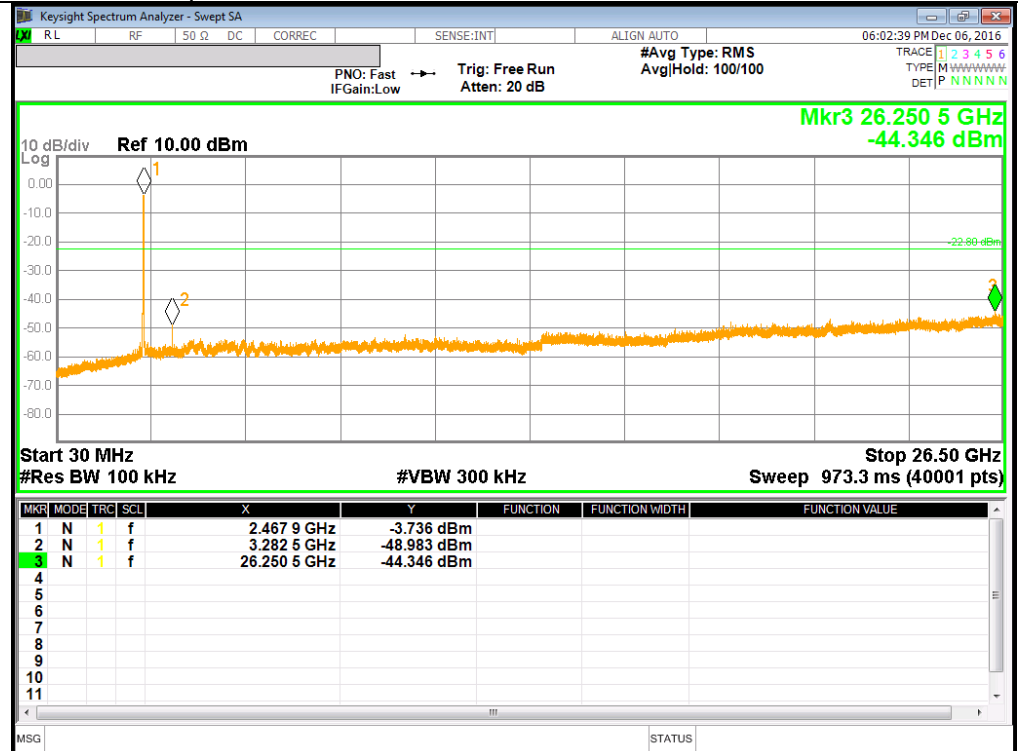
8 Channel Spurious



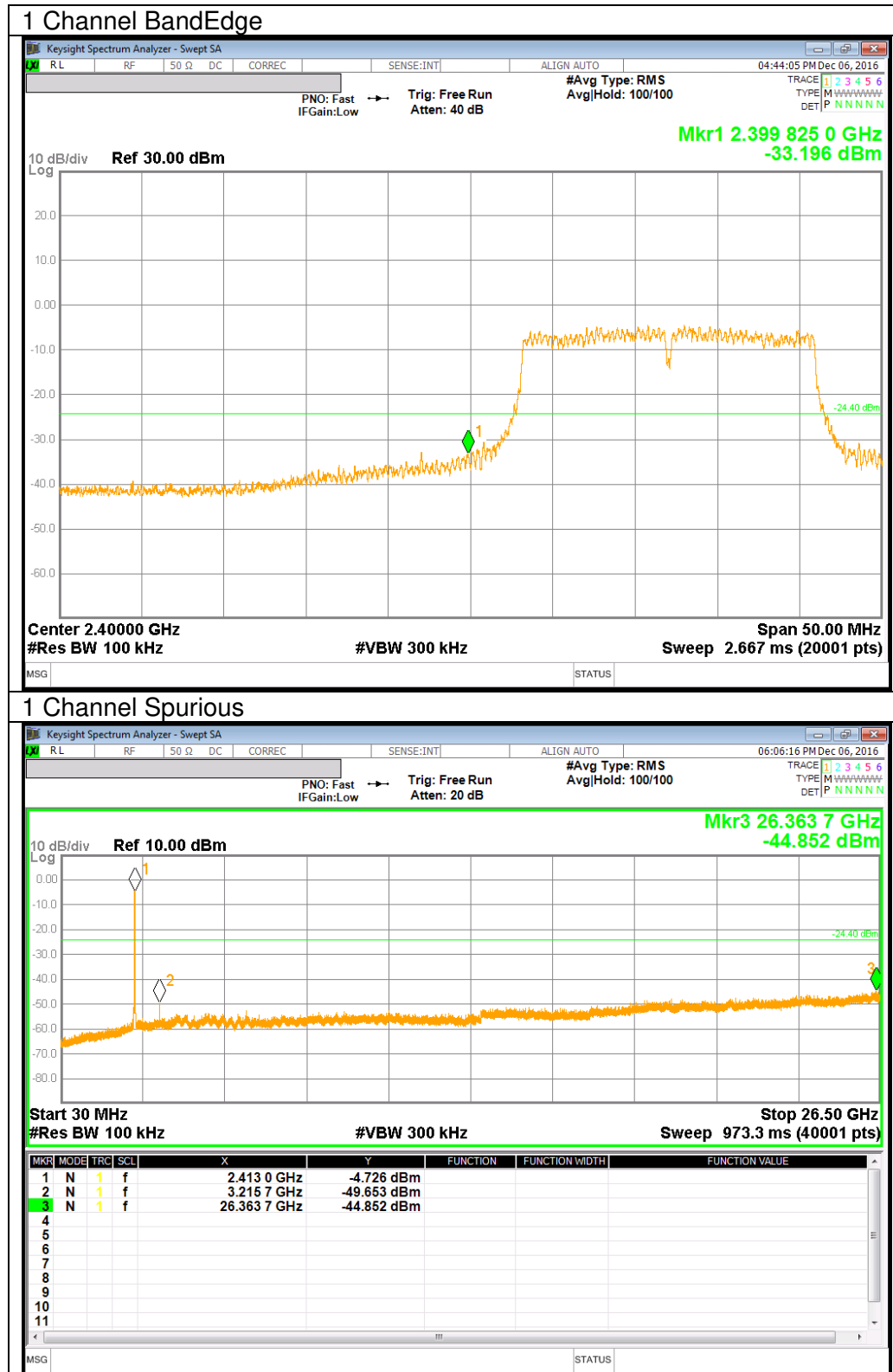
11 Channel BandEdge



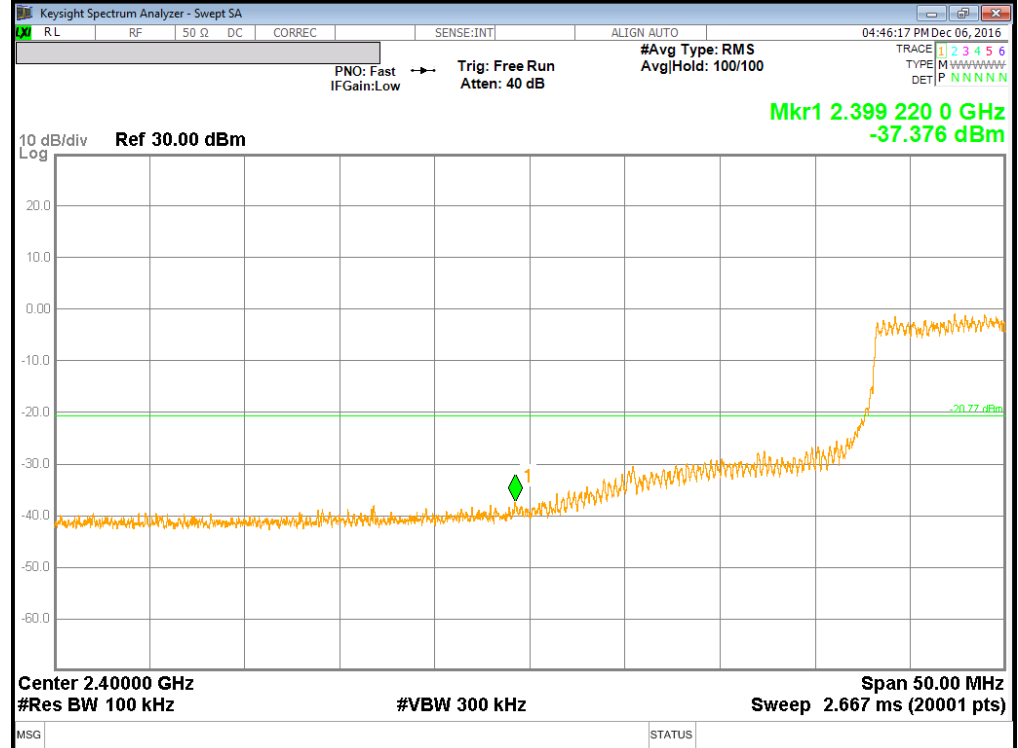
11 Channel Spurious



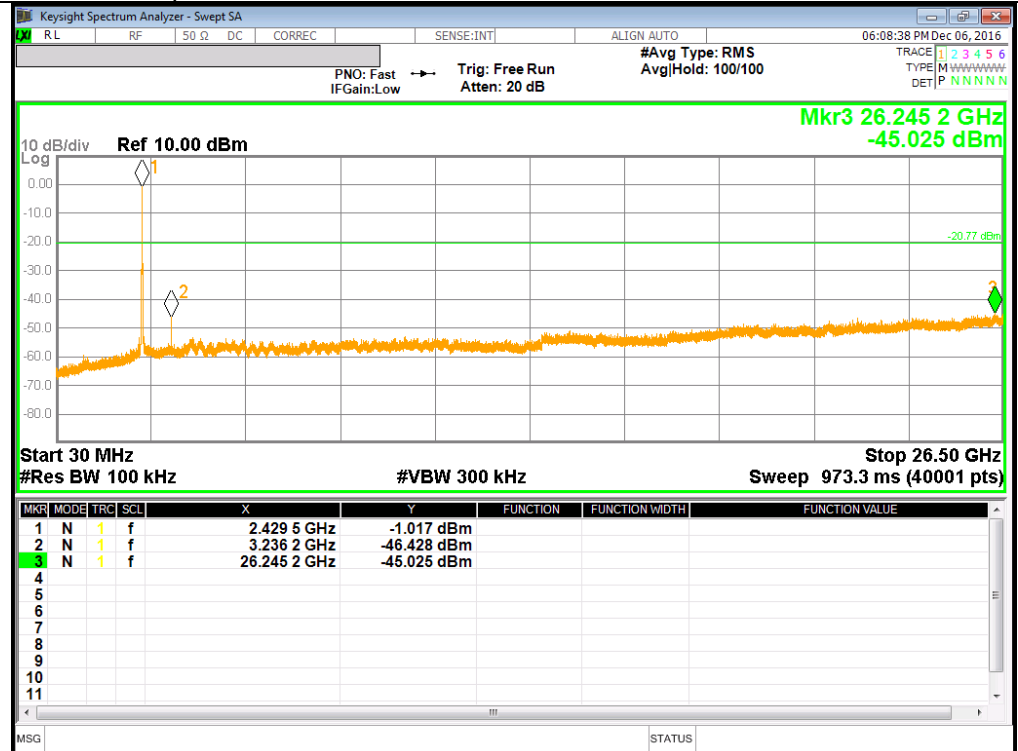
10.6.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND



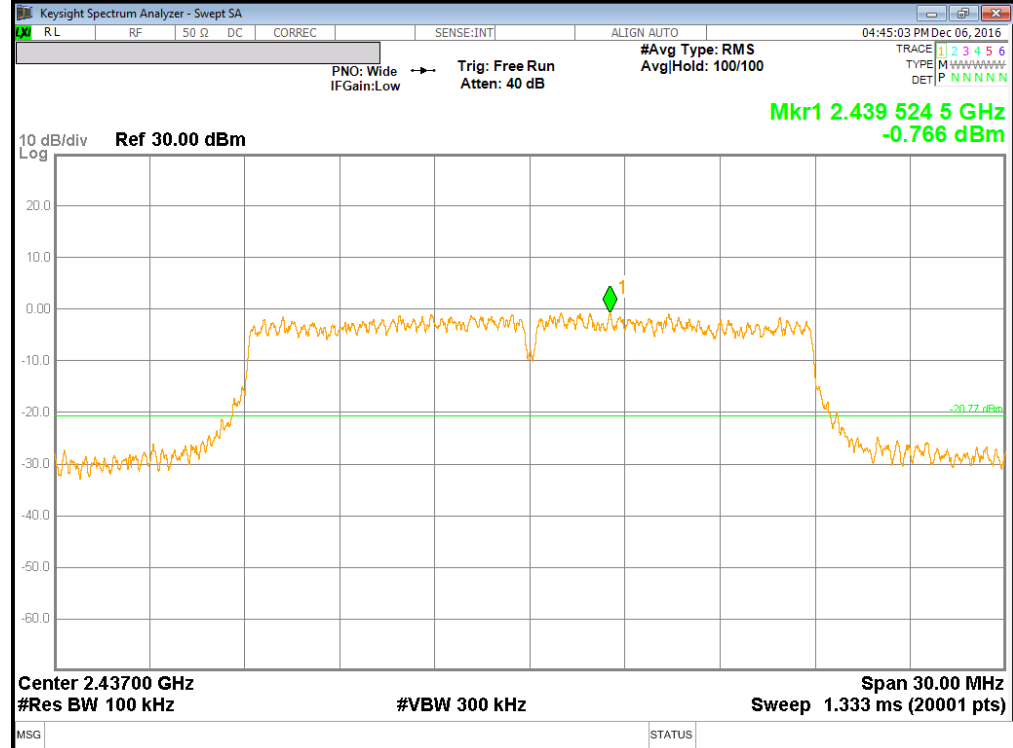
4 Channel BandEdge



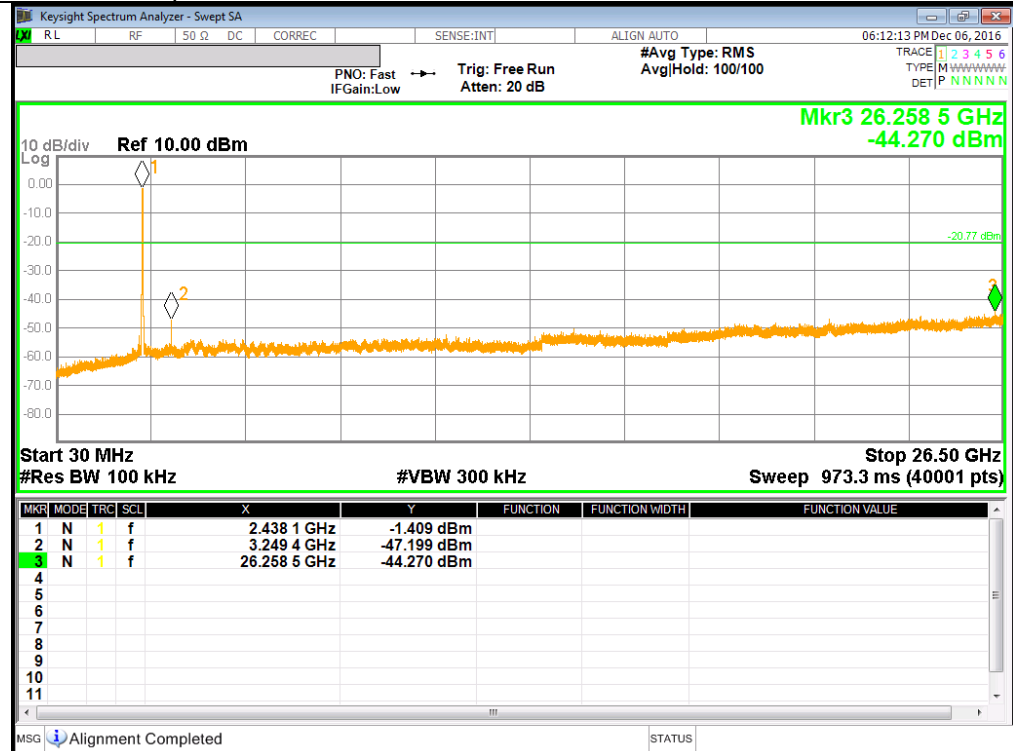
4 Channel Spurious



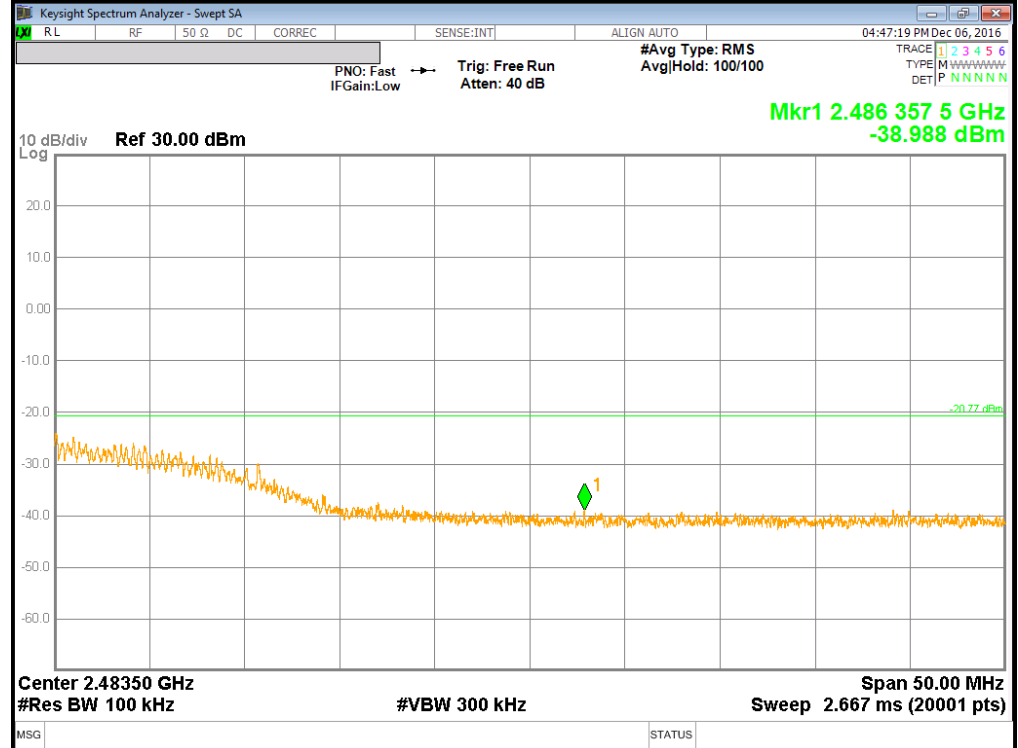
6 Channel BandEdge



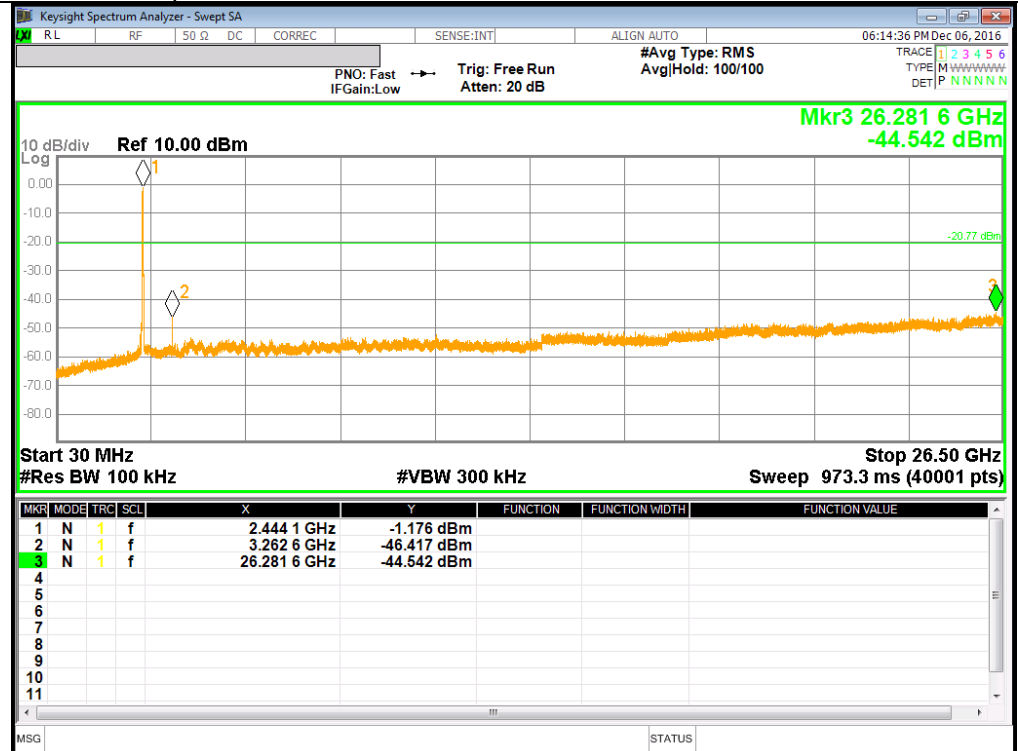
6 Channel Spurious



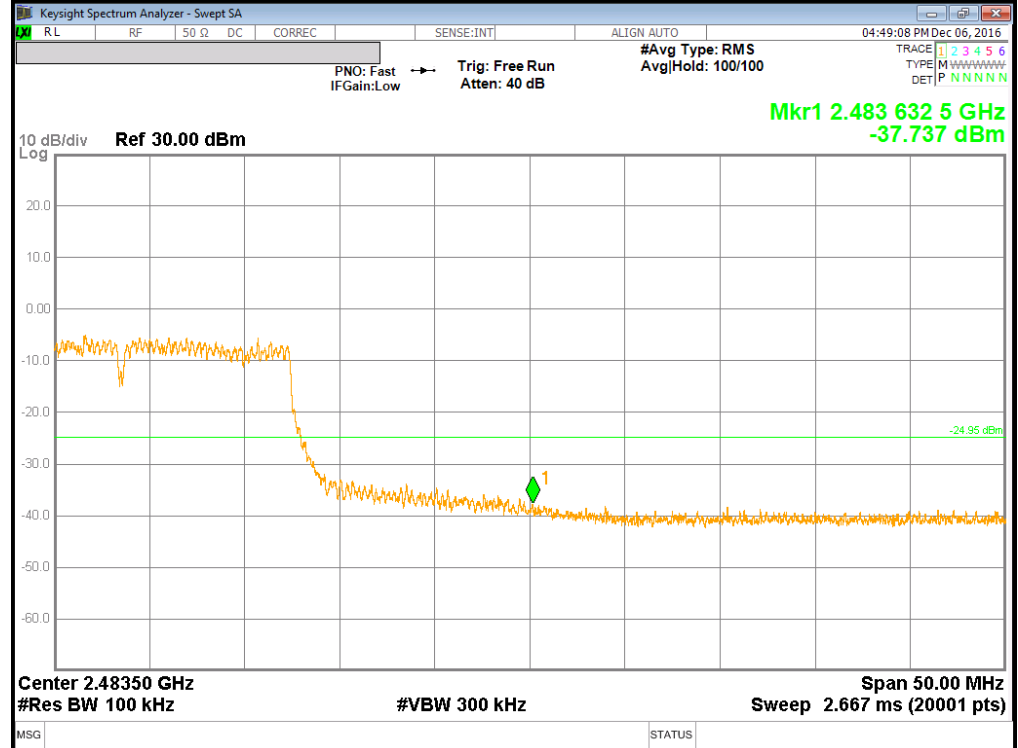
8 Channel BandEdge



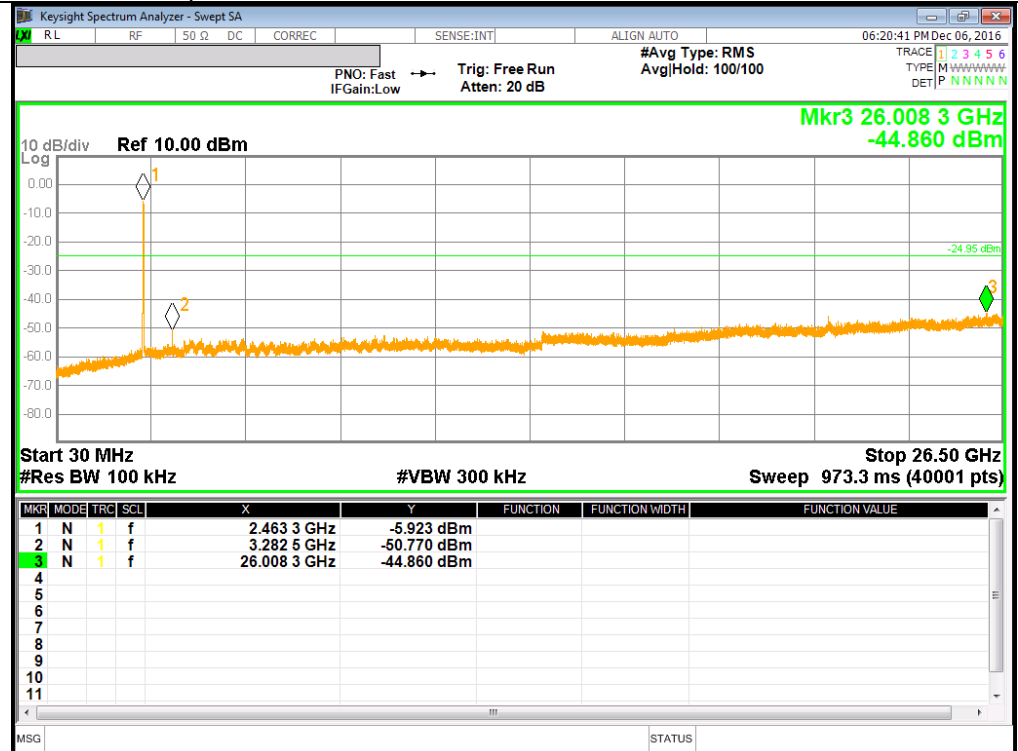
8 Channel Spurious



11 Channel BandEdge



11 Channel Spurious



11. RADIATED TEST RESULTS

11.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

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

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

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz and 150 cm for above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

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

Pre-scans to detect harmonic and spurious emissions, the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

The spectrum from 1 GHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.
(From 30MHz to 1GHz, test was performed with the EUT set to transmit at the channel with highest output power)

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

Note : Emission was pre-scanned from 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.

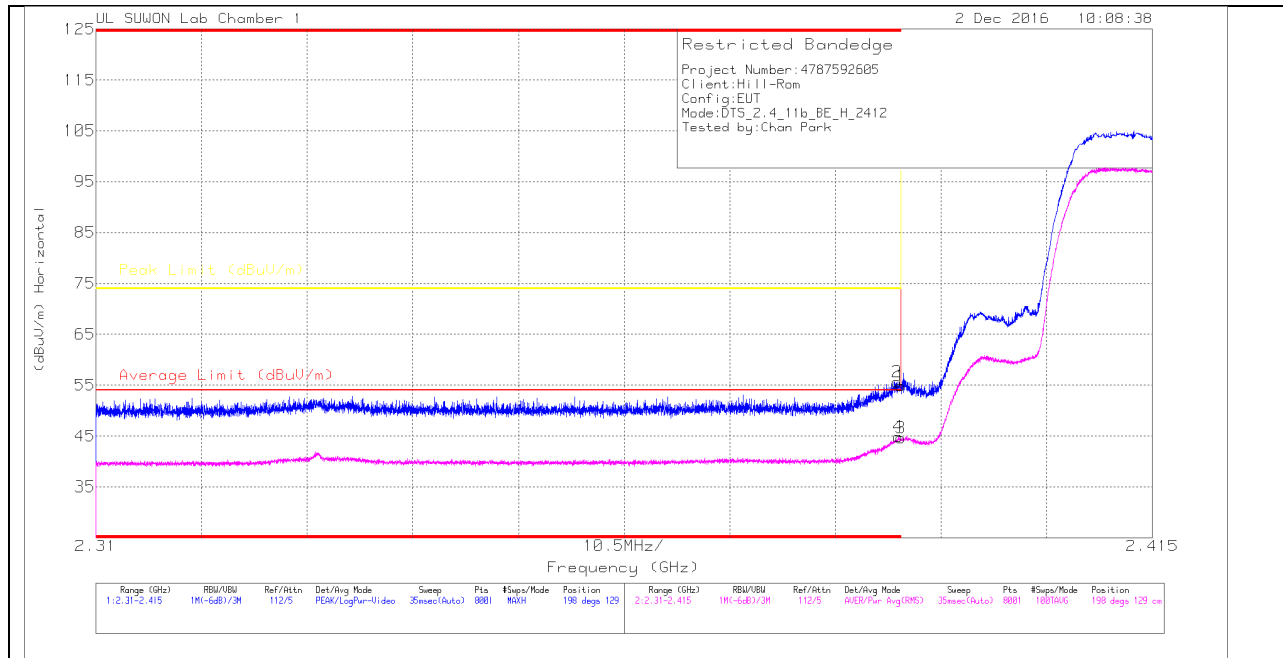
Formula for converting the field strength from uV/m to dBuV/m is:
Limit (dBuV/m) = $20 \log \text{limit (uV/m)}$

11.2. TRANSMITTER ABOVE 1 GHz

11.2.1. 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

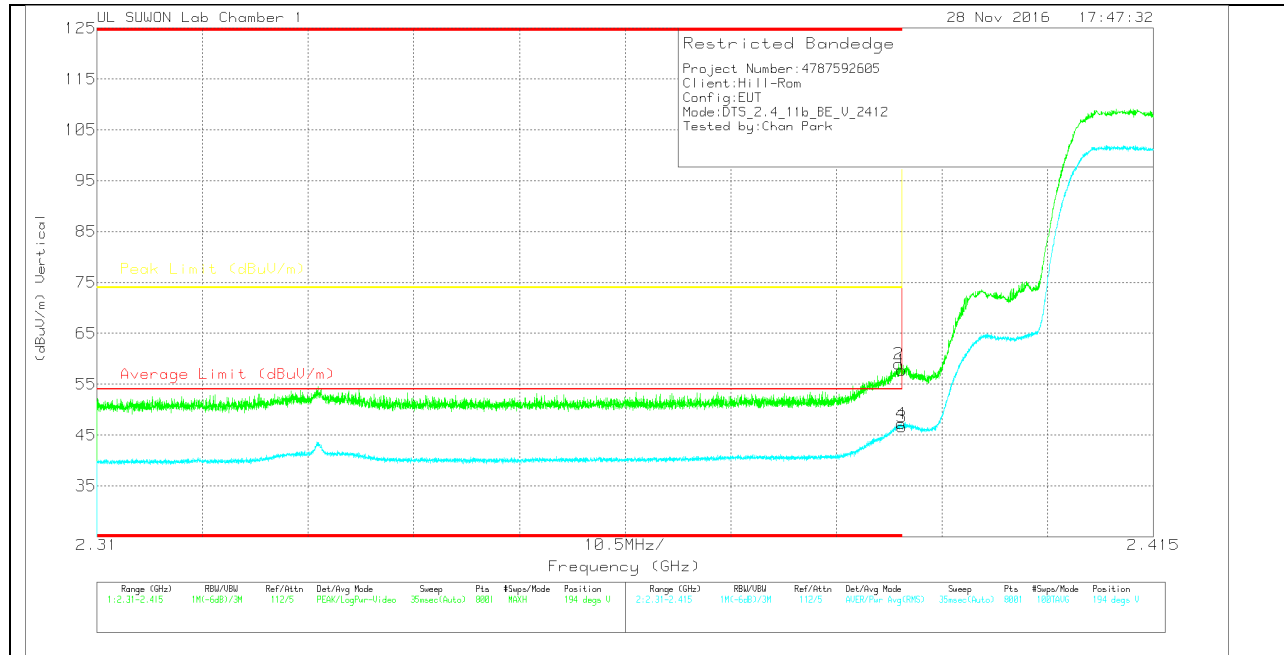
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117/0016 8717/_150 619	10dB[dB]	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	51.54	Pk		-28.4	54.94	-	-	74	-19.06	198	129	H
2	* 2.39	52.22	Pk		-28.4	55.62	-	-	74	-18.38	198	129	H
3	* 2.39	41.25	RMS		-28.4	44.65	54	-9.35	-	-	198	129	H
4	* 2.39	41.49	RMS		-28.4	44.89	54	-9.11	-	-	198	129	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(0016 8717)_150 619	10dB[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	54.33	Pk	31.8	-28.4	57.73	-	-	74	-16.27	194	187	V
2	* 2.39	55.57	Pk	31.8	-28.4	58.97	-	-	74	-15.03	194	187	V
3	* 2.39	43.22	RMS	31.8	-28.4	46.62	54	-7.38	-	-	194	187	V
4	* 2.39	43.86	RMS	31.8	-28.4	47.26	54	-6.74	-	-	194	187	V

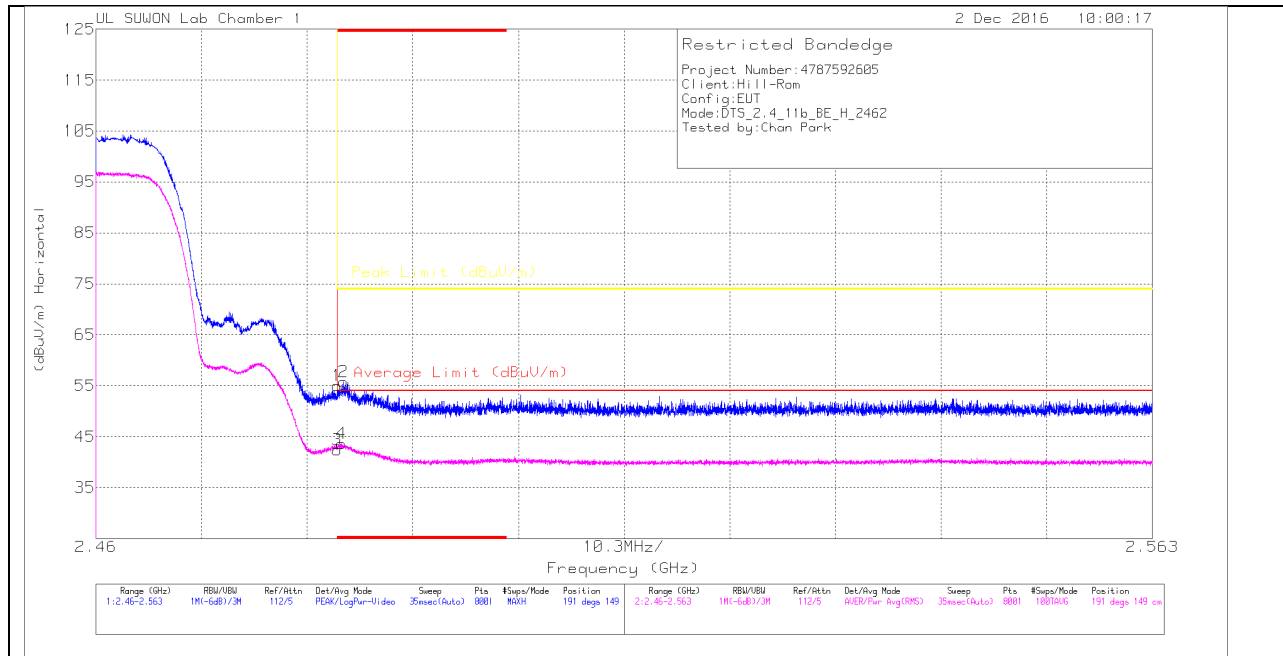
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

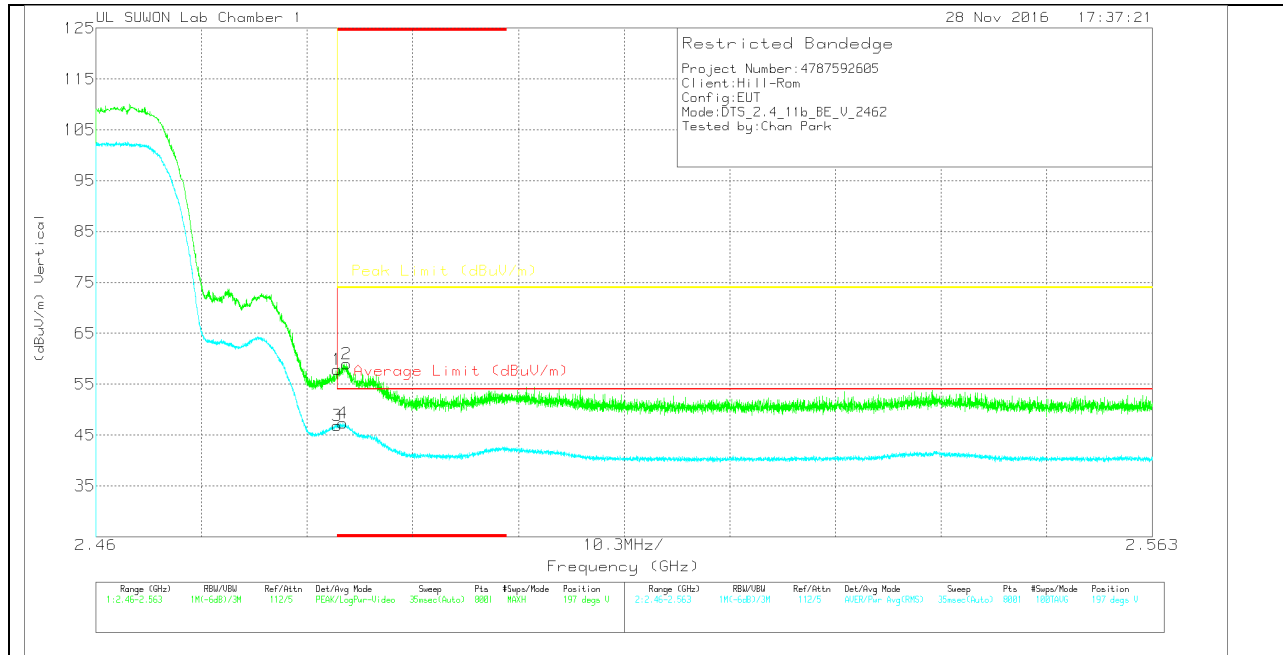
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	10dB[dB]	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	51.28	Pk	32	-28.3	54.98	-	-	74	-19.02	191	149	H
2	* 2.484	52.03	Pk	32	-28.3	55.73	-	-	74	-18.27	191	149	H
3	* 2.484	38.76	RMS	32	-28.3	42.46	54	-11.54	-	-	191	149	H
4	* 2.484	39.93	RMS	32	-28.3	43.63	54	-10.37	-	-	191	149	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(0016 8717)_150 619	10dB[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	54.17	Pk	32	-28.3	57.87	-	-	74	-16.13	197	203	V
2	* 2.484	55.3	Pk	32	-28.3	59	-	-	74	-15	197	203	V
3	* 2.484	43.2	RMS	32	-28.3	46.9	54	-7.1	-	-	197	203	V
4	* 2.484	43.62	RMS	32	-28.3	47.32	54	-6.68	-	-	197	203	V

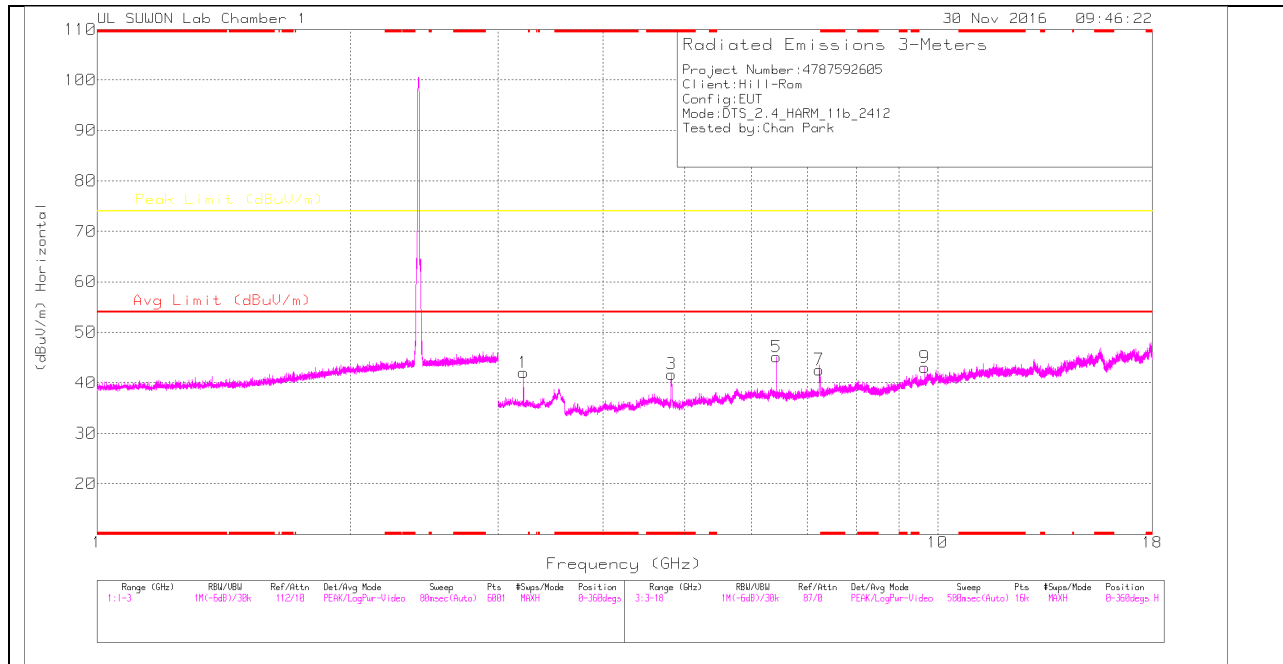
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

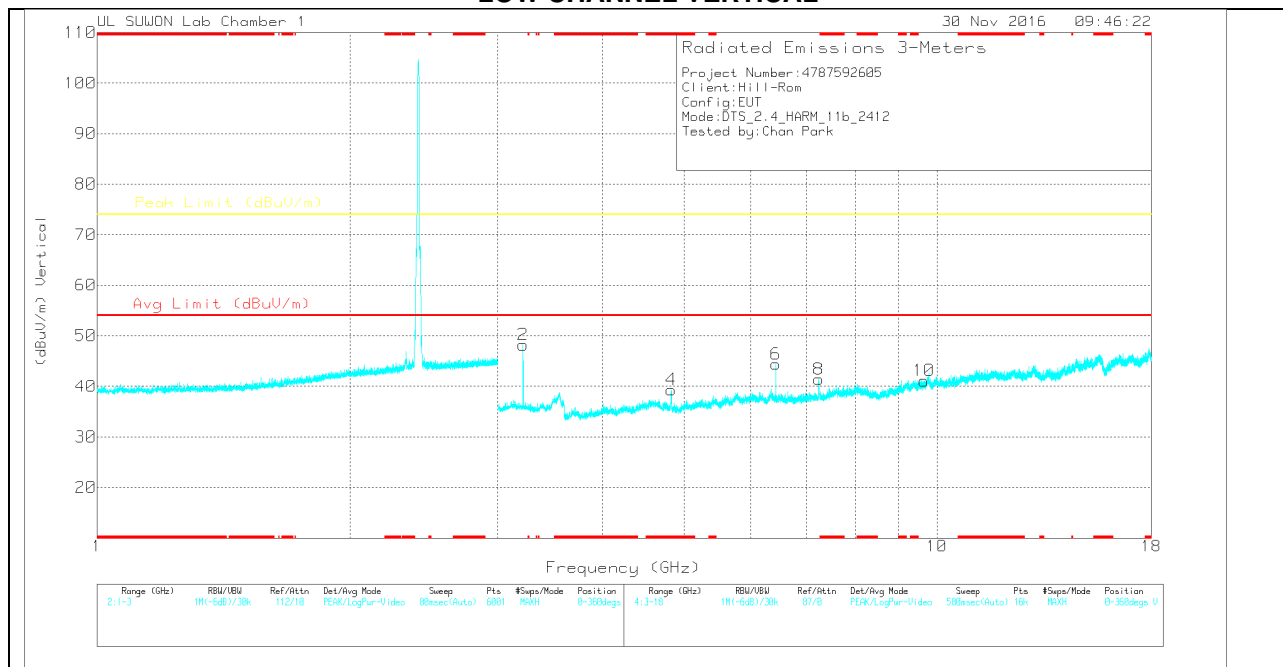
RMS - RMS detection

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(0016 8717)_150 619	3GHz_HP[d B]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	3.216	45.5	PK	32.6	-36.1	42	-	-	74	-32	0-360	250	H
3	* 4.825	41.22	PK	34	-33.5	41.72	-	-	74	-32.28	0-360	150	H
5	6.432	40.62	PK	35.4	-30.9	45.12	-	-	74	-28.88	0-360	250	H
7	7.232	37.65	PK	35.7	-30.8	42.55	-	-	74	-31.45	0-360	150	H
9	9.648	33.35	PK	37.1	-27.4	43.05	-	-	74	-30.95	0-360	150	H
2	3.216	51.72	PK	32.6	-36.1	48.22	-	-	74	-25.78	0-360	150	V
4	* 4.828	38.82	PK	34	-33.5	39.32	-	-	74	-34.68	0-360	250	V
6	6.432	39.9	PK	35.4	-30.9	44.4	-	-	74	-29.6	0-360	250	V
8	7.233	36.48	PK	35.7	-30.8	41.38	-	-	74	-32.62	0-360	250	V
10	9.647	31.41	PK	37.1	-27.4	41.11	-	-	74	-32.89	0-360	250	V

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

PK – Peak detector

Radiated Emissions

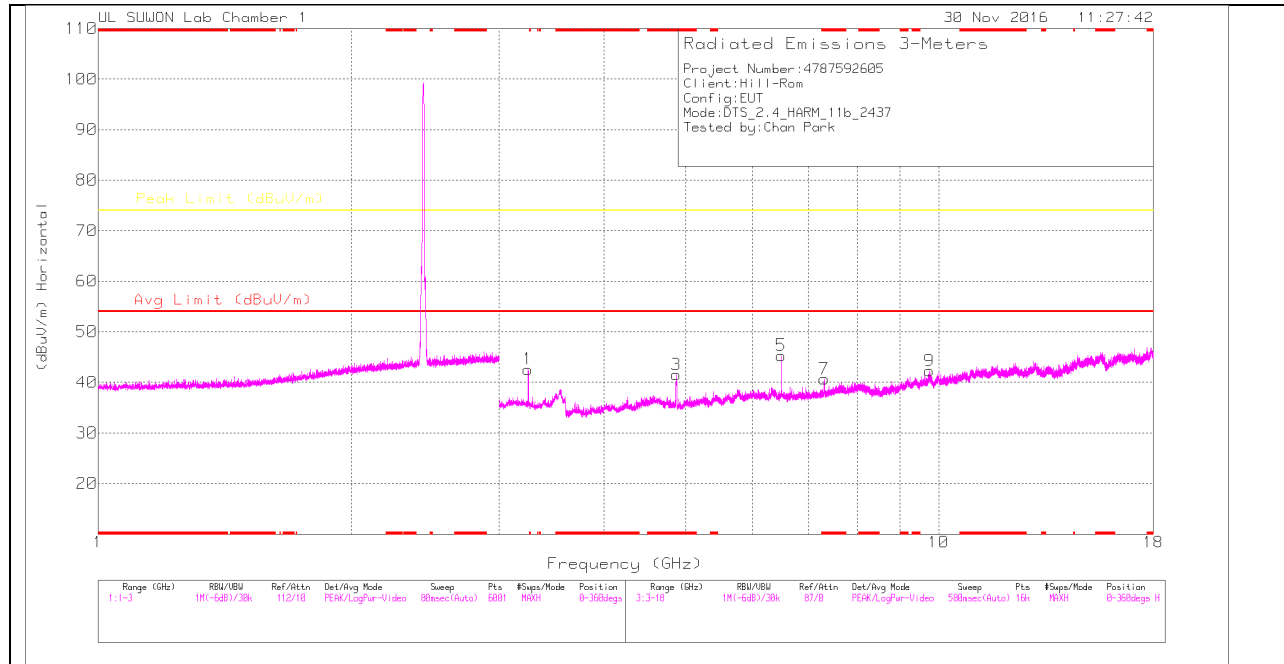
Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3.216	52.94	PK2	32.6	-36.1	49.44	-	-	74	-24.56	317	283	H
* 4.824	53.44	PK2	34	-33.5	53.94	-	-	74	-20.06	246	160	H
* 4.824	41.3	MAv1	34	-33.5	41.8	54	-12.2	-	-	246	160	H
6.432	47.24	PK2	35.4	-30.9	51.74	-	-	74	-22.26	298	254	H
7.236	48.84	PK2	35.7	-30.8	53.74	-	-	74	-20.26	252	144	H
3.216	56.54	PK2	32.6	-36.1	53.04	-	-	74	-20.96	172	326	V
* 4.824	51.24	PK2	34	-33.5	51.74	-	-	74	-22.26	334	113	V
* 4.823	38.97	MAv1	34	-33.5	39.47	54	-14.53	-	-	334	113	V
6.432	47.13	PK2	35.4	-30.9	51.63	-	-	74	-22.37	213	209	V
7.236	47.86	PK2	35.7	-30.8	52.76	-	-	74	-21.24	142	148	V

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

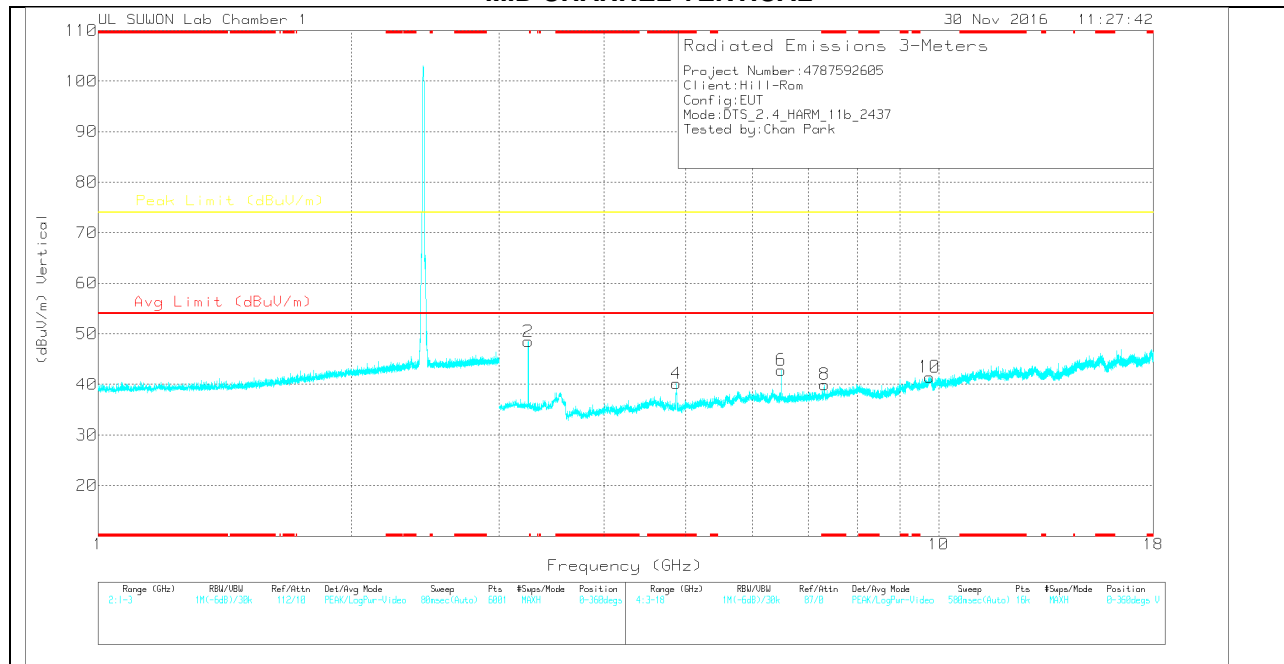
PK2 - KDB558074 Method: Maximum Peak

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(0016 8717)_150 619	3GHz_HP[d B]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	3.248	45.79	PK	32.6	-35.8	42.59	-	-	74	-31.41	0-360	250	H
3	* 4.874	41.13	PK	34	-33.6	41.53	-	-	74	-32.47	0-360	150	H
5	6.499	40.59	PK	35.4	-30.7	45.29	-	-	74	-28.71	0-360	250	H
7	* 7.309	35.44	PK	35.7	-30.5	40.64	-	-	74	-33.36	0-360	150	H
9	9.748	31.89	PK	37.2	-26.8	42.29	-	-	74	-31.71	0-360	250	H
2	3.249	51.69	PK	32.6	-35.8	48.49	-	-	74	-25.51	0-360	150	V
4	* 4.873	39.75	PK	34	-33.6	40.15	-	-	74	-33.85	0-360	150	V
6	6.499	38.13	PK	35.4	-30.7	42.83	-	-	74	-31.17	0-360	250	V
8	* 7.311	34.77	PK	35.7	-30.5	39.97	-	-	74	-34.03	0-360	150	V
10	9.752	30.95	PK	37.2	-26.7	41.45	-	-	74	-32.55	0-360	150	V

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

PK – Peak detector

Radiated Emissions

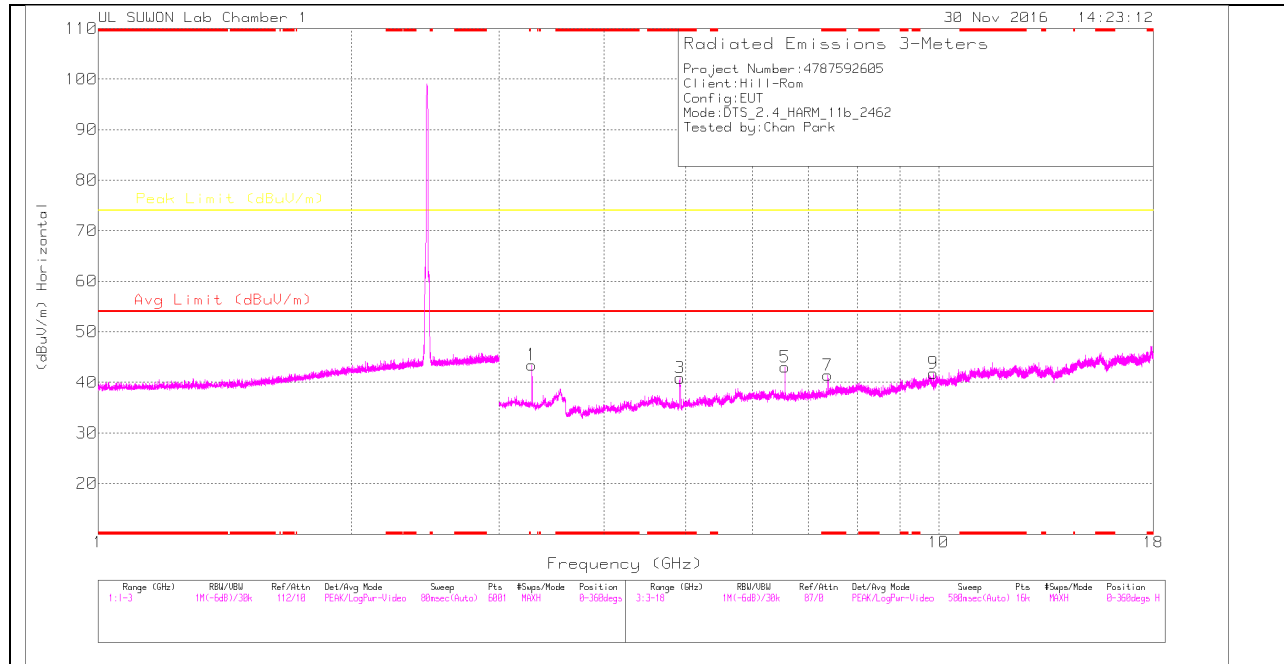
Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	3GHz_HP[d B]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3.249	52.97	PK2	32.6	-35.8	49.77	-	-	74	-24.23	316	281	H
* 4.874	53.4	PK2	34	-33.6	53.8	-	-	74	-20.2	241	168	H
* 4.873	40.4	MAv1	34	-33.6	40.8	54	-13.2	-	-	241	168	H
6.498	46.62	PK2	35.4	-30.7	51.32	-	-	74	-22.68	292	296	H
* 7.309	47.57	PK2	35.7	-30.5	52.77	-	-	74	-21.23	252	135	H
* 7.309	35.65	MAv1	35.7	-30.5	40.85	54	-13.15	-	-	252	135	H
3.249	56.13	PK2	32.6	-35.8	52.93	-	-	74	-21.07	163	166	V

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

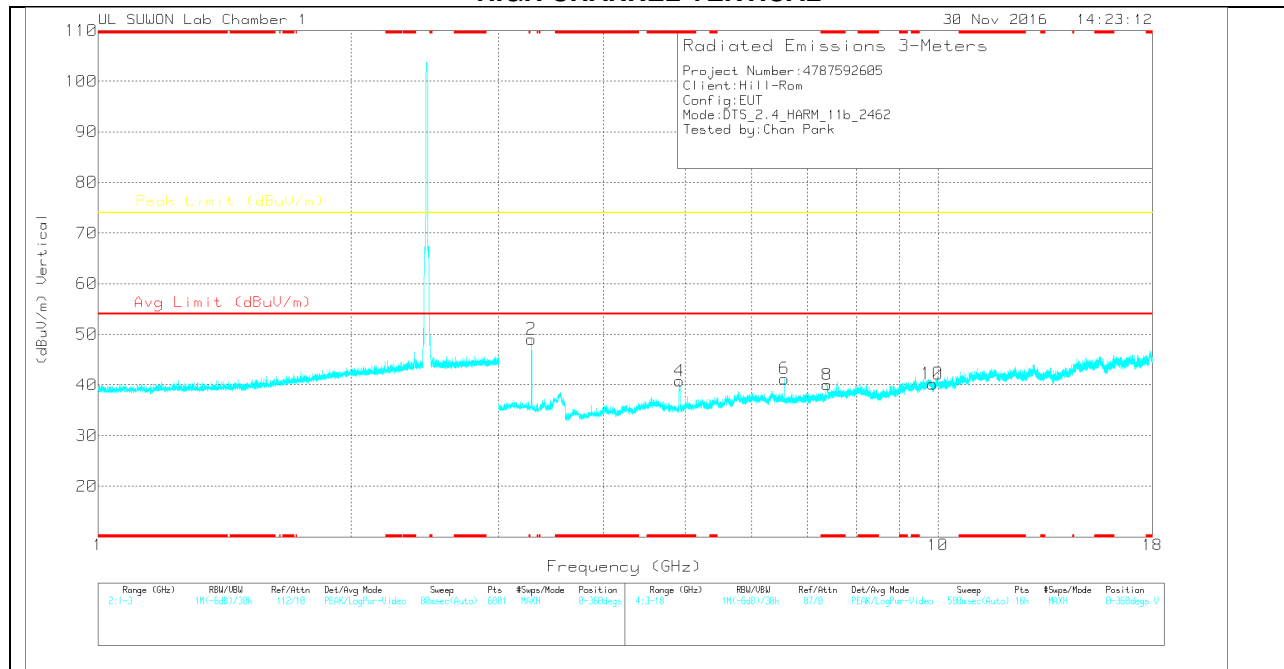
PK2 - KDB558074 Method: Maximum Peak

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(0016 8717)_150 619	3GHz_HP[d B]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	3.282	46.53	PK	32.6	-35.7	43.43	-	-	74	-30.57	0-360	250	H
3	* 4.923	40.28	PK	34	-33.4	40.88	-	-	74	-33.12	0-360	250	H
5	6.565	38.42	PK	35.5	-30.9	43.02	-	-	74	-30.98	0-360	250	H
7	* 7.382	36.18	PK	35.8	-30.6	41.38	-	-	74	-32.62	0-360	150	H
9	9.848	32.02	PK	37.3	-27.5	41.82	-	-	74	-32.18	0-360	250	H
2	3.282	52.13	PK	32.6	-35.7	49.03	-	-	74	-24.97	0-360	150	V
4	* 4.923	40.19	PK	34	-33.4	40.79	-	-	74	-33.21	0-360	250	V
6	6.565	36.62	PK	35.5	-30.9	41.22	-	-	74	-32.78	0-360	250	V
8	* 7.381	34.84	PK	35.8	-30.6	40.04	-	-	74	-33.96	0-360	250	V
10	9.847	30.41	PK	37.3	-27.5	40.21	-	-	74	-33.79	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(0016 8717)_150 619	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3.283	52.11	PK2	32.6	-35.7	49.01	-	-	74	-24.99	229	168	H
* 4.924	53.24	PK2	34	-33.4	53.84	-	-	74	-20.16	249	149	H
* 4.924	40.48	MAv1	34	-33.4	41.08	54	-12.92	-	-	249	149	H
6.565	46.7	PK2	35.5	-30.9	51.3	-	-	74	-22.7	301	296	H
* 7.386	47.78	PK2	35.8	-30.6	52.98	-	-	74	-21.02	256	136	H
* 7.384	35.47	MAv1	35.8	-30.6	40.67	54	-13.33	-	-	256	136	H
3.283	56.09	PK2	32.6	-35.7	52.99	-	-	74	-21.01	161	147	V
* 4.924	52.2	PK2	34	-33.4	52.8	-	-	74	-21.2	334	146	V
* 4.923	39.38	MAv1	34	-33.4	39.98	54	-14.02	-	-	334	146	V

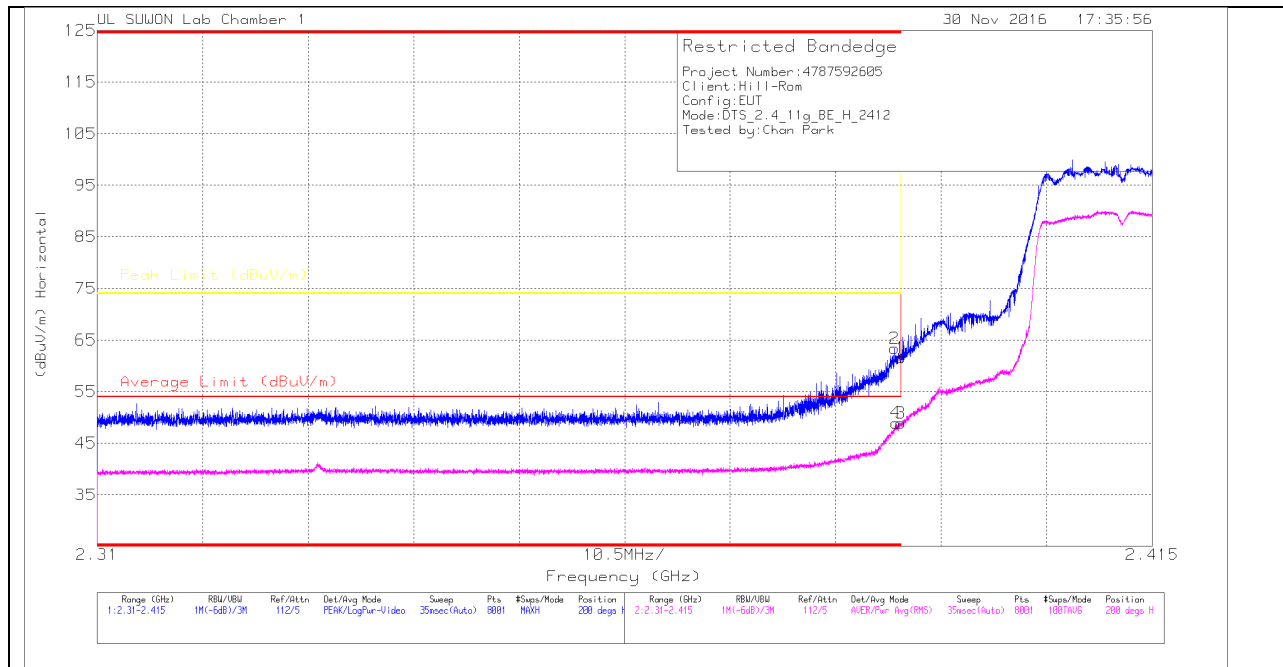
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK2 - KDB558074 Method: Maximum Peak

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

RESTRICTED BANDEDGE (1 CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

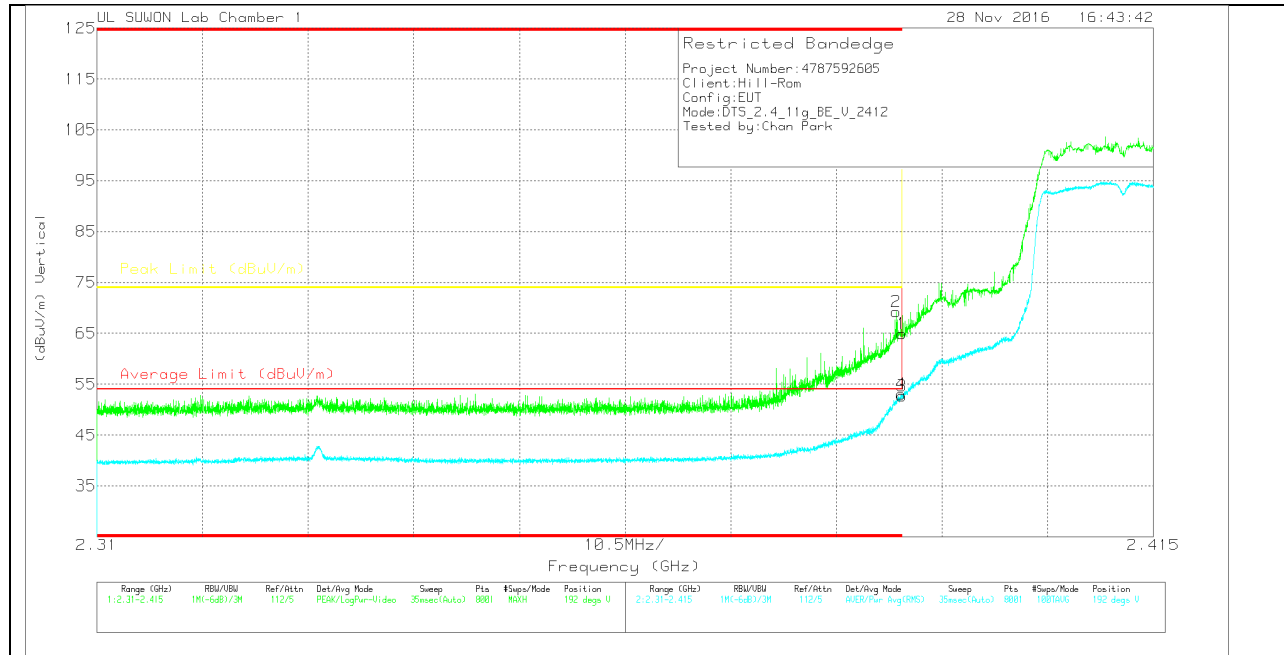
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	10dB[dB]	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	58.15	Pk		-28.4	61.55	-	-	74	-12.45	200	159	H
2	* 2.389	59.98	Pk		-28.4	63.38	-	-	74	-10.62	200	159	H
3	* 2.39	45.5	RMS		-28.4	48.9	54	-5.1	-	-	200	159	H
4	* 2.389	45.55	RMS		-28.4	48.95	54	-5.05	-	-	200	159	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(0016 8717)_150 619	10dB[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	61.52	Pk	31.8	-28.4	64.92	-	-	74	-9.08	192	199	V
2	* 2.389	65.84	Pk	31.8	-28.4	69.24	-	-	74	-4.76	192	199	V
3	* 2.39	49.32	RMS	31.8	-28.4	52.72	54	-1.28	-	-	192	199	V
4	* 2.39	49.69	RMS	31.8	-28.4	53.09	54	-91	-	-	192	199	V

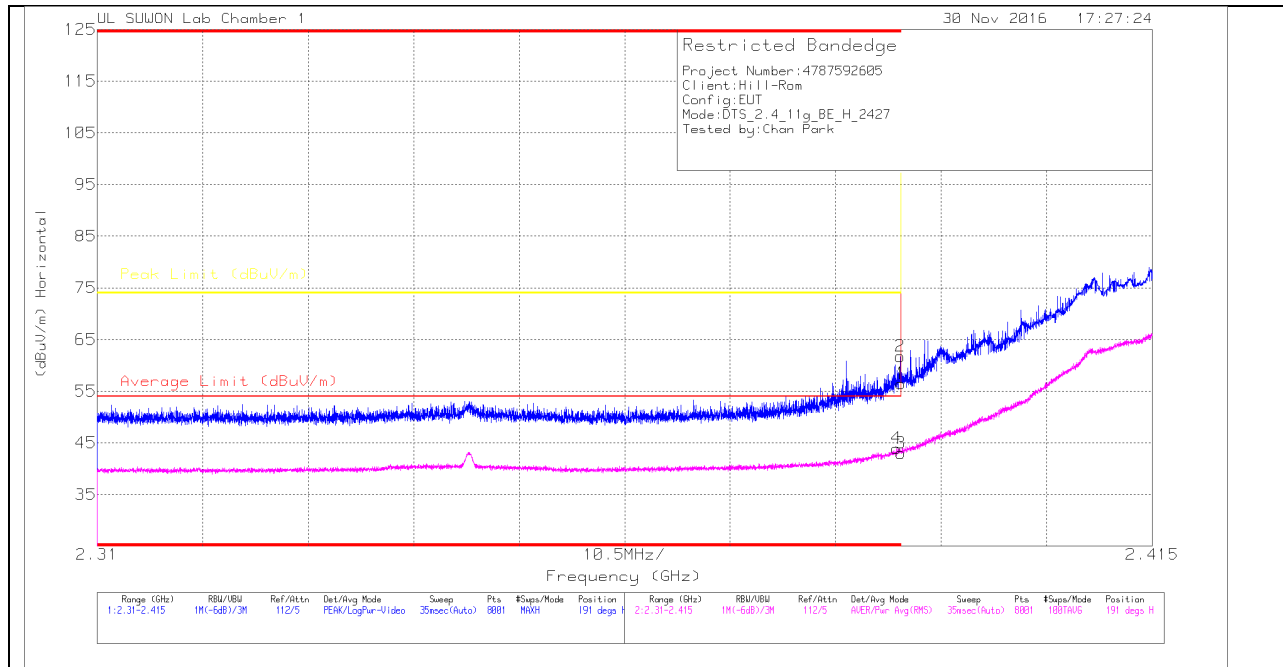
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

RESTRICTED BANDEDGE (4 CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

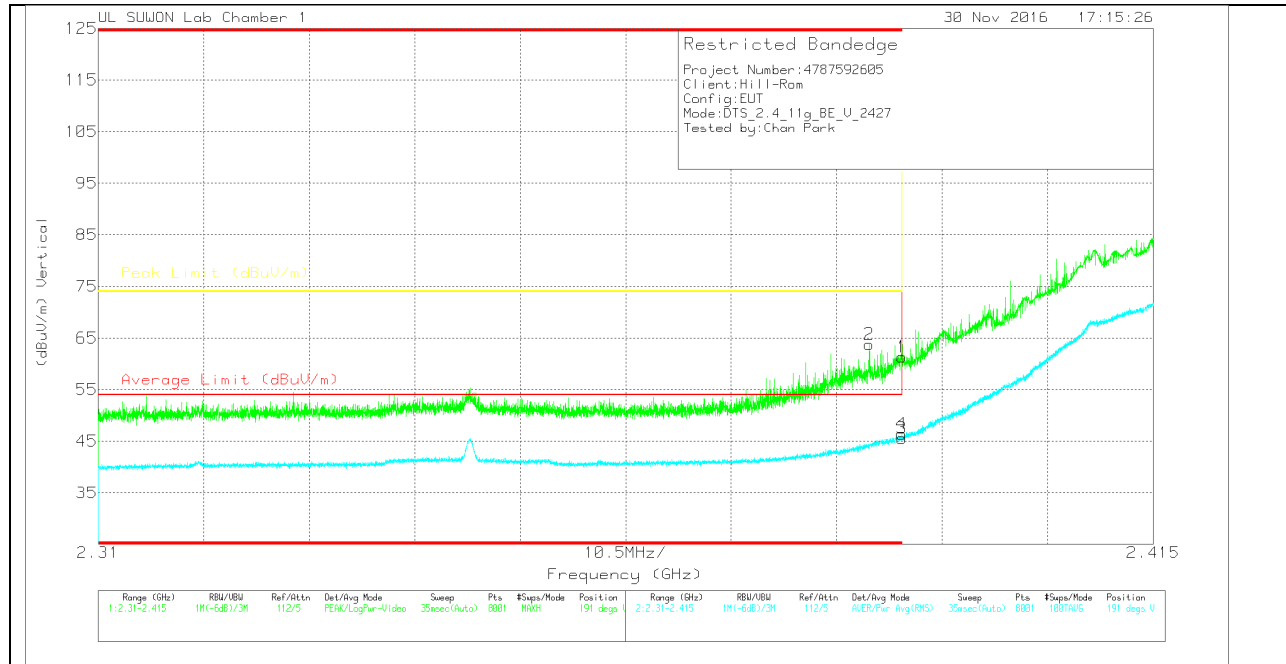
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	10dB[dB]	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	53.09	Pk	31.8	-28.4	56.49	-	-	74	-17.51	191	131	H
2	* 2.39	58.35	Pk	31.8	-28.4	61.75	-	-	74	-12.25	191	131	H
3	* 2.39	39.62	RMS	31.8	-28.4	43.02	54	-10.98	-	-	191	131	H
4	* 2.39	40.55	RMS	31.8	-28.4	43.95	54	-10.05	-	-	191	131	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(0016 8717)_150 619	10dB[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	57.93	Pk	31.8	-28.4	61.33	-	-	74	-12.67	191	178	V
2	* 2.387	60.47	Pk	31.8	-28.5	63.77	-	-	74	-10.23	191	178	V
3	* 2.39	42.16	RMS	31.8	-28.4	45.56	54	-8.44	-	-	191	178	V
4	* 2.39	43.02	RMS	31.8	-28.4	46.42	54	-7.58	-	-	191	178	V

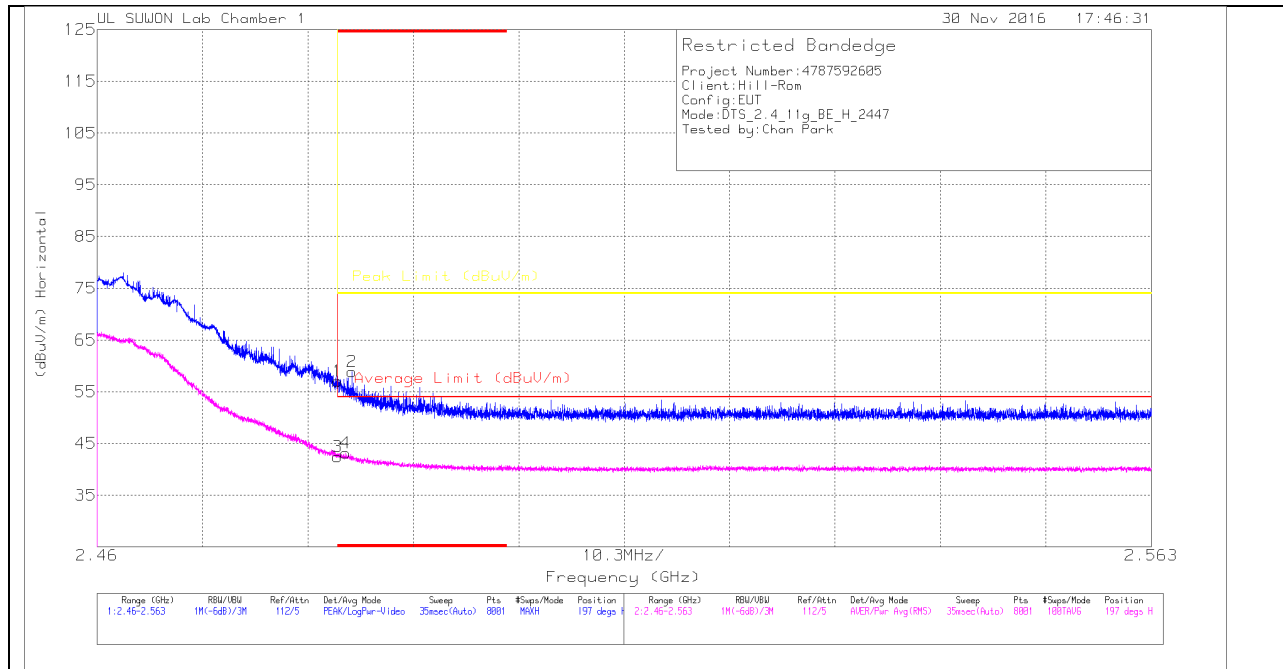
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

RESTRICTED BANDEDGE (8 CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

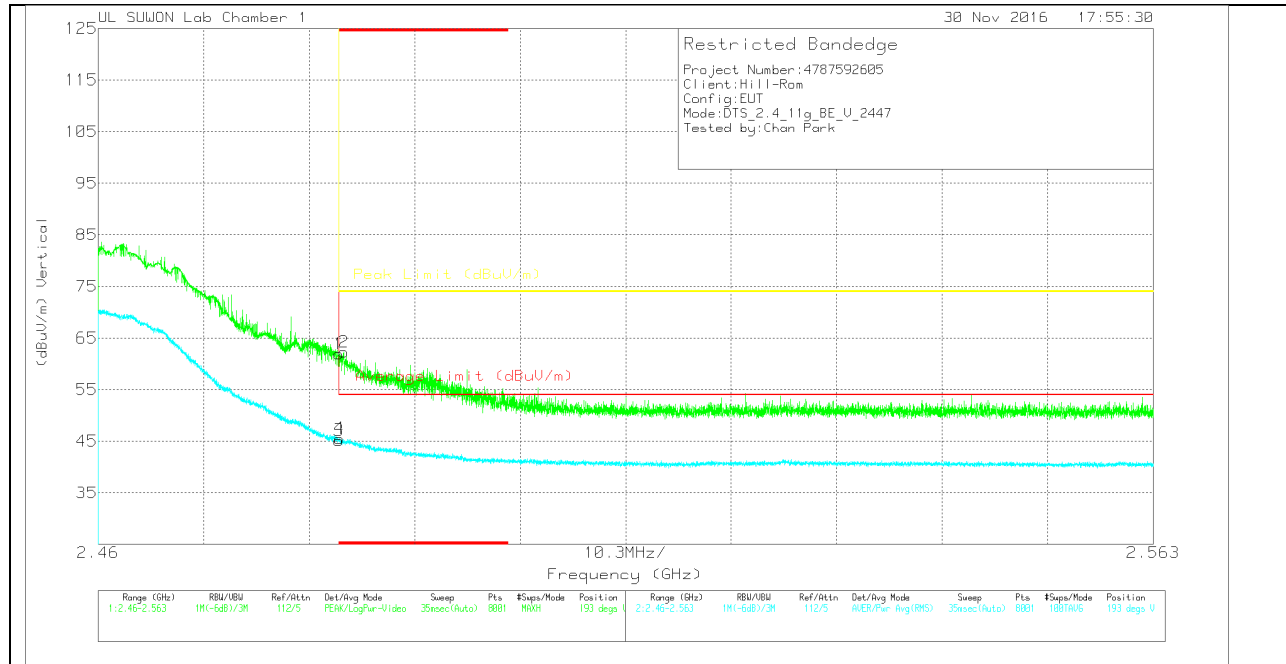
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	10dB[dB]	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	53.36	Pk	32	-28.3	57.06	-	-	74	-16.94	197	174	H
2	* 2.485	55.19	Pk	32	-28.3	58.89	-	-	74	-15.11	197	174	H
3	* 2.484	38.73	RMS	32	-28.3	42.43	54	-11.57	-	-	197	174	H
4	* 2.484	39.48	RMS	32	-28.3	43.18	54	-10.82	-	-	197	174	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(0016 8717)_150 619	10dB[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	58.22	Pk	32	-28.3	61.92	-	-	74	-12.08	193	207	V
2	* 2.484	58.57	Pk	32	-28.3	62.27	-	-	74	-11.73	193	207	V
3	* 2.484	41.45	RMS	32	-28.3	45.15	54	-8.85	-	-	193	207	V
4	* 2.484	41.84	RMS	32	-28.3	45.54	54	-8.46	-	-	193	207	V

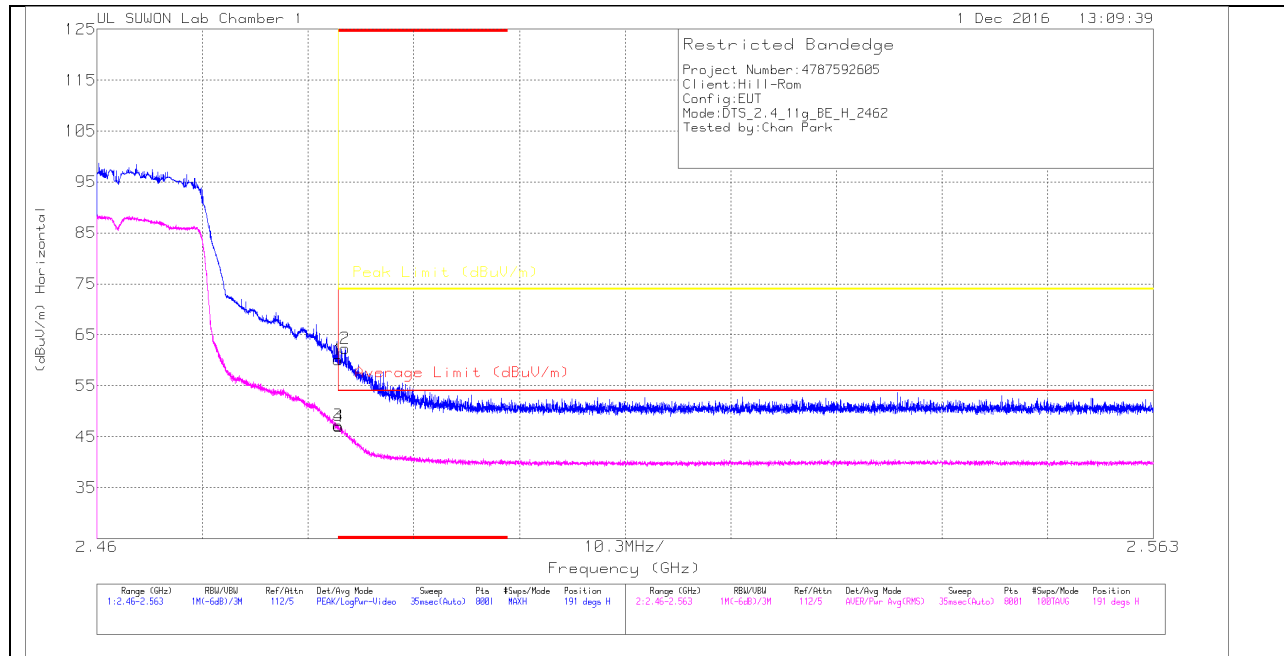
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

RESTRICTED BANDEDGE (11 CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	10dB[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	56.4	Pk	32	-28.3	60.1	-	-	74	-13.9	191	149	H
2	* 2.484	58.57	Pk	32	-28.3	62.27	-	-	74	-11.73	191	149	H
3	* 2.484	43.55	RMS	32	-28.3	47.25	54	-6.75	-	-	191	149	H
4	* 2.484	43.26	RMS	32	-28.3	46.96	54	-7.04	-	-	191	149	H

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

Pk - Peak detector

RMS - RMS detection