FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

For

GPON Terminal

MODEL NUMBER: EchoLife EG8247Q

FCC ID: QISEG8247Q

REPORT NUMBER: 4788418338.1-1

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Prepared for

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Revision History

Rev.	Issue Date	Revisions	Revised By
V0	10/25/2018	Initial Issue	Miller.Ma
V1	11/02/2018	Updated TABLE OF CONTENTS, 26 pages of data, and added instructions for Note4 on 214 pages.	Miller.Ma

Summary of Test Results			
Clause	**Test Items**	**FCC/IC Rules**	**Test Results**
1	6dB Bandwidth and 99% Occupied Bandwidth	FCC Part 15.247 (a) (2) RSS-247 Clause 5.2 (a) ISED RSS-Gen Clause 6.7	Pass
2	Peak & average Conducted Output Power	FCC Part 15.247 (b) (3) RSS-247 Clause 5.4 (e)	Pass
3	Power Spectral Density	FCC Part 15.247 (e) RSS-247 Clause 5.2 (b)	Pass
4	Conducted Bandedge and Spurious Emission	FCC Part 15.247 (d) RSS-247 Clause 5.5	Pass
5	Radiated Bandedge and Spurious Emission	FCC Part 15.247 (d) FCC Part 15.209 FCC Part 15.205 RSS-247 Clause 5.5 RSS-GEN Clause 8.9	Pass
6	Conducted Emission Test For AC Power Port	FCC Part 15.207 RSS-GEN Clause 8.8	Pass
7	Antenna Requirement	FCC Part 15.203 RSS-GEN Clause 8.3	Pass

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1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name:	HUAWEI TECHNOLOGIES CO., LTD.
Address:	Administration Building, Huawei Technologies Co., Ltd. Bantian, Longgang District, Shenzhen, P.R. China, 518129

Manufacturer Information

Company Name:	HUAWEI TECHNOLOGIES CO., LTD.
Address:	Administration Building, Huawei Technologies Co., Ltd. Bantian, Longgang District, Shenzhen, P.R. China, 518129

EUT Description

EUT Name:	GPON Terminal
Model:	EchoLife EG8247Q
Brand Name:	HUAWEI
Sample Status:	Normal
Sample ID:	1607492
Sample Received Date:	April 13, 2018
Date of Tested:	April 20, 2018~ June 22, 2018

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	PASS

Tested By:

Miller Ma
Engineer Project Associate

Checked By:

Shawn Wen
Operations Leader

Approved By:

Stephen Guo

Operations Manager

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, KDB558074 D01 DTS Meas Guidance v04, KDB414788 D01 Radiated Test Site v01, ANSI C63.10-2013 and KDB 662911 D01 Multiple Transmitter Output v02r01.

3. FACILITIES AND ACCREDITATION

Accreditation Certificate	**A2LA (Certificate No.: 4102.01)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with A2LA. **FCC (FCC Designation No.: CN1187)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. Has been recognized to perform compliance testing on equipment subject to the Commission's Delcaration of Conformity (DoC) and Certification rules **IC(Company No.: 21320)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been registered and fully described in a report filed with Industry Canada. The Company Number is 21320. **VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793. Facility Name: Chamber D, the VCCI registration No. is G-20019 and R-20004 Shielding Room B, the VCCI registration No. is C-20012 and T-20011

Note 1: All tests measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China

Note 2: The test anechoic chamber in UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.

Note 3: For below 30MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. And these measurements below 30MHz had been correlated to measurements performed on an OATS.

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 recognize national standards.

4.2. MEASUREMENT UNCERTAINTY

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

Test Item	Uncertainty
Uncertainty for Conduction emission test	2.90dB
Uncertainty for Radiation Emission test(include Fundamental emission) (9KHz-30MHz)	2.2dB
Uncertainty for Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	4.52dB
Uncertainty for Radiation Emission test (1GHz to 26GHz)(include Fundamental emission)	5.04dB(1-6GHz)
	5.30dB (6GHz-18Gz)
	5.23dB (18GHz-26Gz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

Equipment	GPON Terminal		
EUT Description	The EUT is an GPON Terminal with 2.4GHz and 5GHz WIFI.		
Model Name	EchoLife EG8247Q		
Series M/N:	EchoLife EG8245Q; EchoLife HG8247Q5; EchoLife HG8245Q5.		
Model Difference:	EchoLife EG8245Q: The model name is different, the CATV module is removed and a USB port is removed. EchoLife HG8247Q5: Only model name is different. EchoLife HG8245Q5: The model name is different, the CATV module is removed and a USB port is removed.		
	IEEE802.11b/g/n HT20/n HT40		
Operation frequency	IEEE 802.11b: 2412MHz—2462MHz IEEE 802.11g: 2412MHz—2462MHz IEEE 802.11n HT20: 2412MHz—2462MHz IEEE 802.11n HT40: 2422MHz—2452MHz		
Modulation	IEEE 802.11b: DSSS(CCK) IEEE 802.11g: OFDM(BPSK, QPSK, 16QAM, 64QAM) IEEE 802.11n HT20: OFDM (BPSK, QPSK, 16QAM, 64QAM) IEEE 802.11n HT40: OFDM (BPSK, QPSK, 16QAM, 64QAM)		
Power Supply	Power Adapter	Input	AC 100~240V, 50~60Hz, 0.8A
		Output	12V,2.0A

5.2. MAXIMUM OUTPUT POWER

Frequency Range (MHz)	Number of Transmit ANTs (NTX)	IEE Std. 802.11	Channel Number	Max Output Peak Power (dBm)
2412-2462	1	b	1-11[11]	22.01
2412-2462	3	g	1-11[11]	29.39
2412-2462	3	n HT20	1-11[11]	29.78
2422-2452	3	n HT40	3-9[7]	25.33

5.3. CHANNEL LIST

Channel List for 802.11b/g/n (20 MHz)							
Channel	Frequency (MHz)	Channel	Frequency(MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	5	2432	9	2452		
2	2417	6	2437	10	2457		
3	2422	7	2442	11	2462		
4	2427	8	2447				

Channel List for 802.11n (40 MHz)							
Channel	Frequency (MHz)	Channel	Frequency(MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	7	2442				
4	2427	8	2447				
5	2432	9	2452				
6	2437						

5.4. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel	Frequency
WiFi TX(802.11b)	CH 1, CH 6, CH 11	2412MHz, 2437MHz, 2462MHz
WiFi TX(802.11g)	CH 1, CH 6, CH 11	2412MHz, 2437MHz, 2462MHz
WiFi TX(802.11n HT20)	CH 1, CH 6, CH 11	2412MHz, 2437MHz, 2462MHz
WiFi TX(802.11n HT40)	CH 3, CH 6, CH 9	2422MHz, 2437MHz, 2452MHz

5.5. THE WORSE CASE CONFIGURATIONS

SISO Mode

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band							
Test Software		QSPR					
Modulation Mode	Transmit Antenna Number	Test Channel					
		NCB: 20MHz			NCB: 40MHz		
		CH 1	CH 6	CH 11	CH 3	CH 6	CH 9
802.11b	0	20.5	21.5	21.5	N/A		
802.11g	0	18.5	23	17.5			
802.11n HT20	0	17.5	24	17			
802.11n HT40	0	N/A	N/A	N/A	14	17.5	14

MIMO Mode

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band							
Test Software		QSPR					
Modulation Mode	Transmit Antenna Number	Test Channel					
		NCB: 20MHz			NCB: 40MHz		
		CH 1	CH 6	CH 11	CH 3	CH 6	CH 9
802.11g	0&1&2	16	19	15.5	N/A		
802.11n HT20	0&1&2	14.5	19.5	15.5			
802.11n HT40	0&1&2	N/A	N/A	N/A	10	14.5	12

Remarks: EUT support for diversity and CDD MIMO Transmission, 802.11b only supports SISO mode ,all modes and antennas are pre-scanned, antenna 0 is worst for SISO mode worst case, 0&1&2 is worst case for MIMO mode.

For MIMO mode 2TX and 3TX single Chain power settings are the same, so 3TX mode covers mode 2TX.

5.6. TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests	
Relative Humidity	35 ~ 65%	
Atmospheric Pressure:	1025Pa	
Temperature	TN	23 ~ 28°C
Voltage :	VL	N/A
	VN	AC 120V/60Hz
	VH	N/A

Note: VL= Lower Extreme Test Voltage
VN= Nominal Voltage
VH= Upper Extreme Test Voltage
TN= Normal Temperature

5.7. DESCRIPTION OF AVAILABLE ANTENNAS

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)	Antenna Technology
0	2412-2462	Omni-Directional	2	SISO&MIMO

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)	Antenna Technology
1	2412-2462	Omni-Directional	2	SISO&MIMO

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)	Antenna Technology
2	2412-2462	Omni-Directional	2	SISO&MIMO

Directional gain				
Mode	Frequency (MHz)	Max Antenna Gain (dBi)	For power measurements Directional gain Gain (dBi)	For power spectral density (PSD) measurements Gain (dBi)
SISO	2412-2462	2	2	2
CDD 2TX	2412-2462	2	2	5
CDD 3TX	2412-2462	2	2	6.77

Note：Directional gain = GANT + Array Gain
For power spectral density (PSD) measurements on all devices,
Array Gain = 10 log(N_{ANT}/NSS) dB.
For power measurements on IEEE 802.11 devices, [1,2]
Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any NANT;
Array Gain = 5 log(NANT/NSS) dB or 3 dB, whichever is less, for 20-MHz channel widths with NANT ≥ 5.

5.8. WORST-CASE CONFIGURATIONS

IEE Std. 802.11	Modulation Technology	Modulation Type	Data Rate (Mbps)	Worst Case (Mbps)
b	DSSS	CCK	11/5.5/2/1	1
g	OFDM	BPSK, QPSK, 16QAM, 64QAM	54/48/36/24/18/12/9/6	6
n HT20	OFDM	BPSK, QPSK, 16QAM, 64QAM	(MCS0~MCS23)	MCS0
n HT40	OFDM	BPSK, QPSK, 16QAM, 64QAM	(MCS0~MCS23)	MCS0

5.9. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	P/N
1	Laptop	ThinkPad	T460S	SL10K24796 JS
2	Telephone	TCL	HCD868	--
3	TV	SHARP	LCD-40DS72	0878505917102
4	Media Converter	Youke	YKF2300-MLC-5M	--
5	Fash Disk	Kingston	DTSE9	--
6	Fash Disk	Kingston	DTSE9	--

I/O CABLES

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	LAN	RJ45	Unshielded	6	--
2	RJ45	RJ45	Unshielded	6	--
3	CATV	CATV	Shielded	7	--
4	Optical	Optical	Unshielded	6	--

ACCESSORY

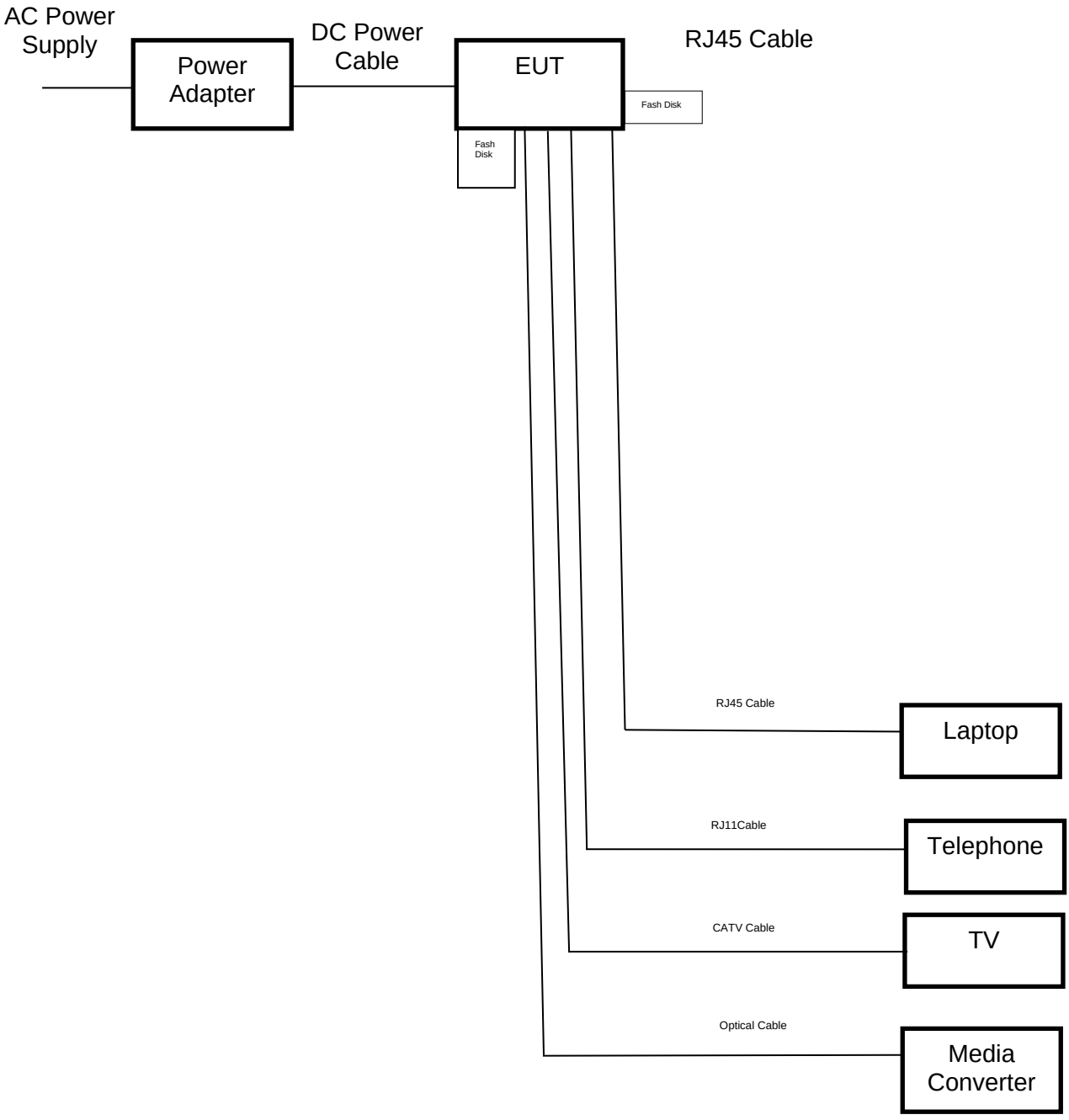
Item	Equipment	Brand Name	Model Name	Remarks
1	POWER ADAPTER	HUAWEI	120200U7W	Input: AC 100~240V, 50~60Hz, 0.8A Output: 12V,2.0A

Note: POWER ADAPTER is supplied by SHENZHEN HUNTKEY ELECTRIC CO., LTD or DONGGUANFUHUA ELECTRIC CO., LTD.

TEST SETUP

The EUT can work in engineering mode with software through a Laptop.

SETUP DIAGRAM FOR TESTS



5.10. MEASURING INSTRUMENT AND SOFTWARE USED

Conducted Emissions						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
☑	EMI Test Receiver	R&S	ESR3	101961	Dec.12, 2017	Dec.12, 2018
☑	Two-Line V-Network	R&S	ENV216	101983	Jan.16, 2018	Jan.16, 2019
☑	Artificial Mains Networks	Schwarzbeck	NSLK 8126	8126465	Dec.12, 2017	Dec.12, 2018
Software						
Used	Description		Manufacturer	Name	Version	
☑	Test Software for Conducted disturbance		UL	Antenna port	Ver. 7.2	
Radiated Emissions						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
☑	MXE EMI Receiver	KESIGHT	N9038A	MY56400036	Dec.12, 2017	Dec.12, 2018
☑	Hybrid Log Periodic Antenna	TDK	HLP-3003C	130960	Jan.09, 2016	Jan.09, 2019
☑	Preamplifier	HP	8447D	2944A09099	Dec.12, 2017	Dec.12, 2018
☑	EMI Measurement Receiver	R&S	ESR26	101377	Dec.12, 2017	Dec.12, 2018
☑	Horn Antenna	TDK	HRN-0118	130939	Jan. 09, 2016	Jan. 09, 2019
☑	High Gain Horn Antenna	Schwarzbeck	BBHA-9170	691	Jan.06, 2016	Jan.06, 2019
☑	Preamplifier	TDK	PA-02-0118	TRS-305-00066	Dec.12, 2017	Dec.12, 2018
☑	Preamplifier	TDK	PA-02-2	TRS-307-00003	Dec.12, 2017	Dec.12, 2018
☑	Loop antenna	Schwarzbeck	1519B	00008	Mar. 26, 2016	Mar. 26, 2019
Software						
Used	Description		Manufacturer	Name	Version	
☑	Test Software for Radiated disturbance		Farad	EZ-EMC	Ver. UL-3A1	
Other instruments						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
☑	Spectrum Analyzer	Keysight	N9030A	MY55410512	Dec.12, 2017	Dec.12, 2018
☑	Power Meter	Keysight	N9031A	MY55416024	Dec.12, 2017	Dec.12, 2018
☑	Power Sensor	Keysight	N9323A	MY55440013	Dec.12, 2017	Dec.12, 2018
☑	Power Sensor	Keysight	U2021XA	MY57030004	Dec.12, 2017	Dec.12, 2018

6. MEASUREMENT METHODS

No.	Test Item	KDB Name	Section
1	6dB Bandwidth and 99% Bandwidth	KDB 558074 D01 DTS Meas Guidance v04	8.0
2	Peak Output Power	KDB 558074 D01 DTS Meas Guidance v04	9.1.3
3	average Output Power	KDB 558074 D01 DTS Meas Guidance v04	9.2.3
4	Power Spectral Density	KDB 558074 D01 DTS Meas Guidance v04	10.2
5	Out-of-band emissions in non-restricted bands	KDB 558074 D01 DTS Meas Guidance v04	11.0
6	Out-of-band emissions in restricted bands	KDB 558074 D01 DTS Meas Guidance v04	12.1
7	Band-edge	KDB 558074 D01 DTS Meas Guidance v04	13.3.2
8	Conducted Emission Test For AC Power Port	ANSI C63.10-2013	6.2

7. ANTENNA PORT TEST RESULTS

7.1. ON TIME AND DUTY CYCLE

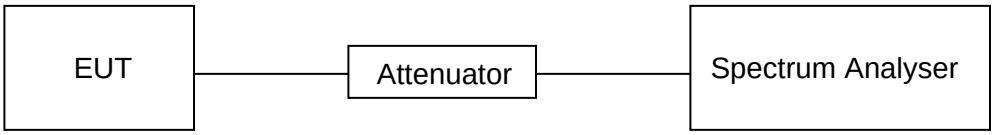
LIMITS

None; for reporting purposes only

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method

TEST SETUP



RESULTS

ANTENNA0

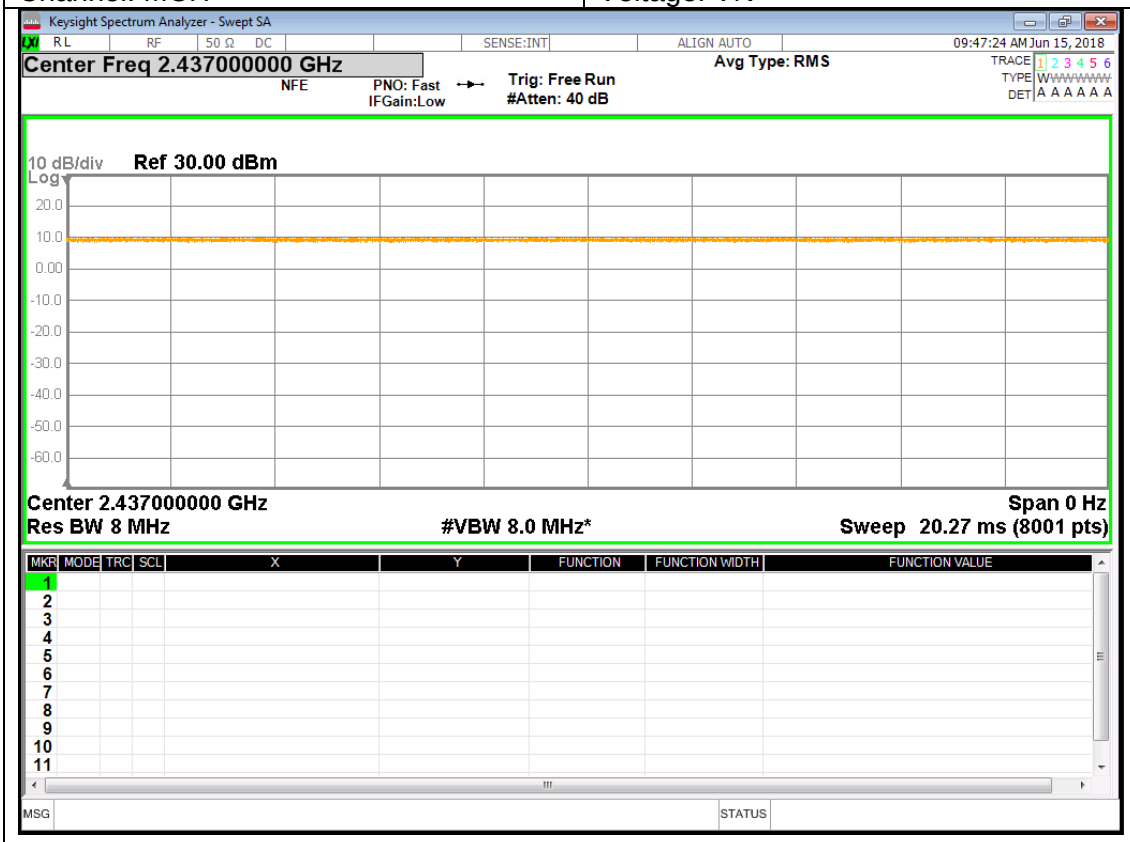
Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (db)	1/T Minimum VBW (KHz)	Final setting For VBW (KHz)
11b	20.27	20.27	1	100	0.00	0.01	0.01
11g	5.355	5.409	0.990016639	99	0.04	0.19	0.01
11n20	4.958	5.013	0.989028526	99	0.05	0.20	0.01
11n40	2.402	2.448	0.98120915	98	0.08	0.42	0.01

Note: Duty Cycle Correction Factor=10log (1/x).
Where: x is Duty Cycle (Linear)`
Where: T is On Time
Antenna 0, Antenna 1 and Antenna 2 has the same duty cycle, only Antenna 0 data show here.

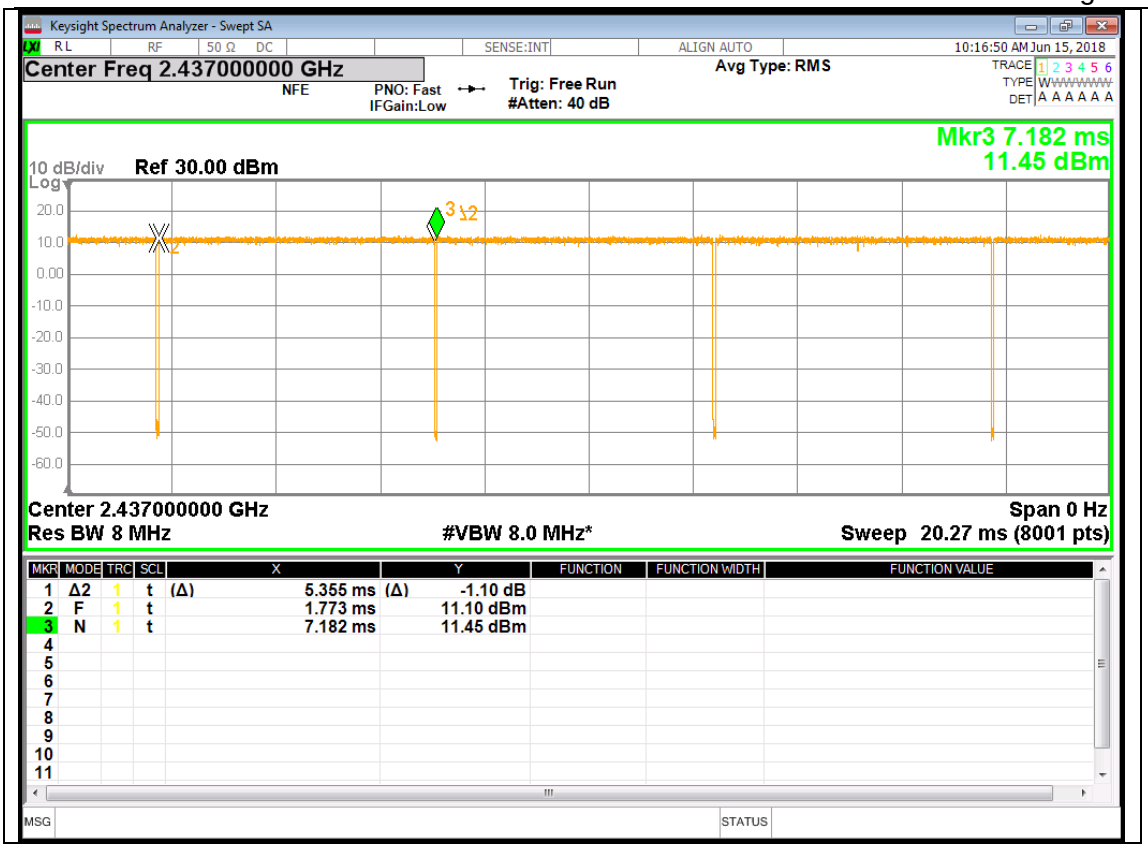
If the duty cycle is greater than 98%，Final VBW will be set to 10Hz.

Test Case: Duty Cycle

Mode: 11B	Ant: Ant 0
Channel: MCH	Voltage: VN

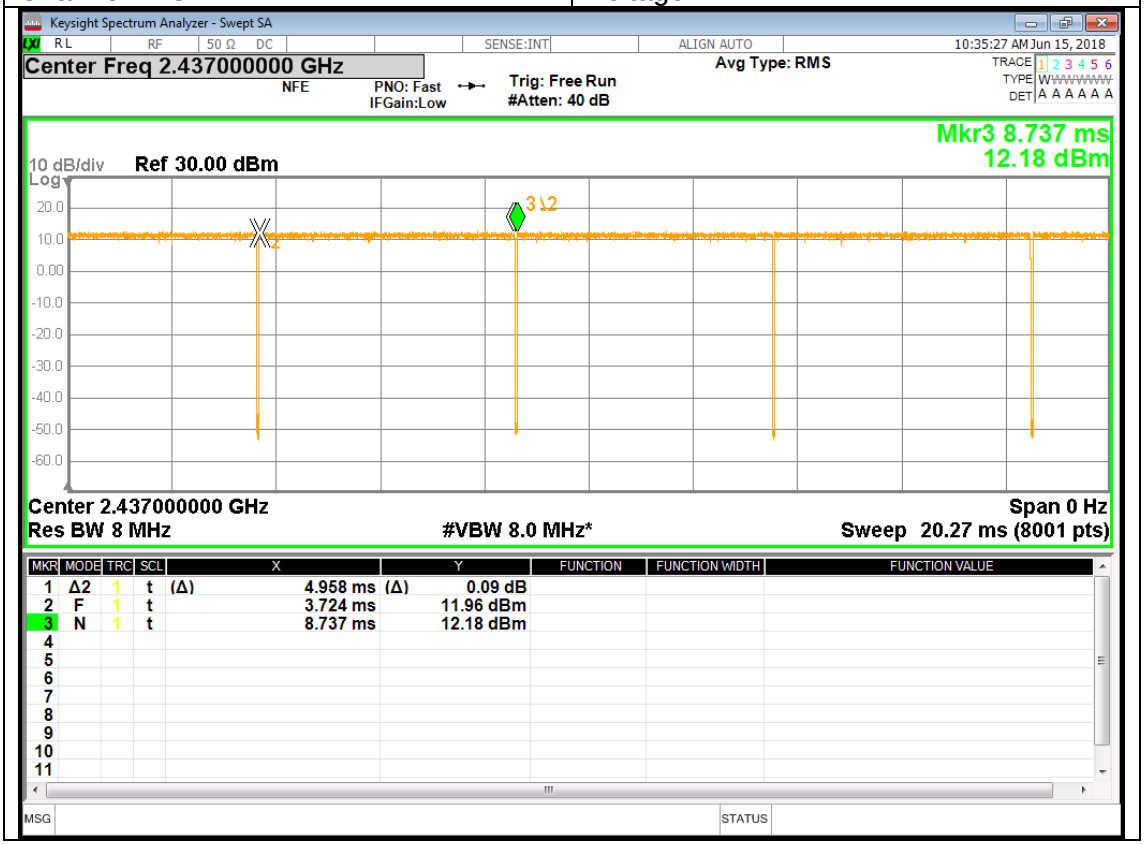


Test Case: Duty Cycle	
Mode: 11G 3TX	Ant: Ant 0
Channel: MCH	Voltage: VN



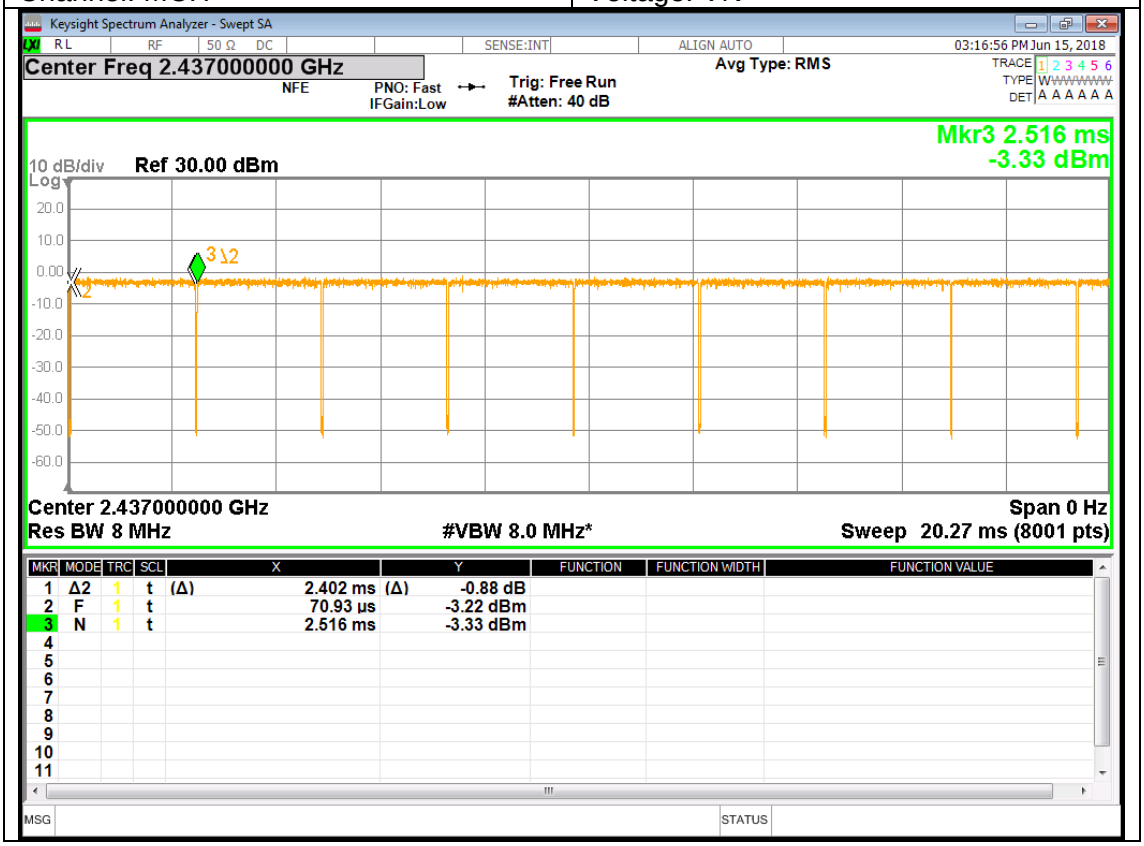
Test Case: Duty Cycle	
Mode: 11N20 3TX	Ant: Ant 0

Channel: MCH	Voltage: VN



Test Case: Duty Cycle

Mode: 11N40 3TX	Ant: Ant 0
Channel: MCH	Voltage: VN



7.2. 6 dB DTS BANDWIDTH AND 99% BANDWIDTH

LIMITS

FCC Part15 (15.247) Subpart C RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247(a)(2) RSS-247 5.1 (a)	6 dB Bandwidth	>= 500KHz	2400-2483.5
RSS-Gen Clause 6.6	99% Bandwidth	For reporting purposes only.	2400-2483.5

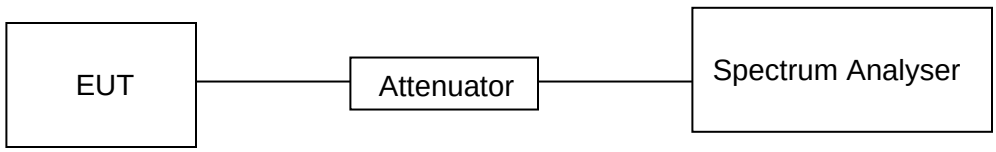
TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	For 6dB Bandwidth :100K
VBW	For 6dB Bandwidth : ≥3 × RBW
Trace	Max hold
Sweep	Auto couple

Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB and 99% relative to the maximum level measured in the fundamental emission.

TEST SETUP



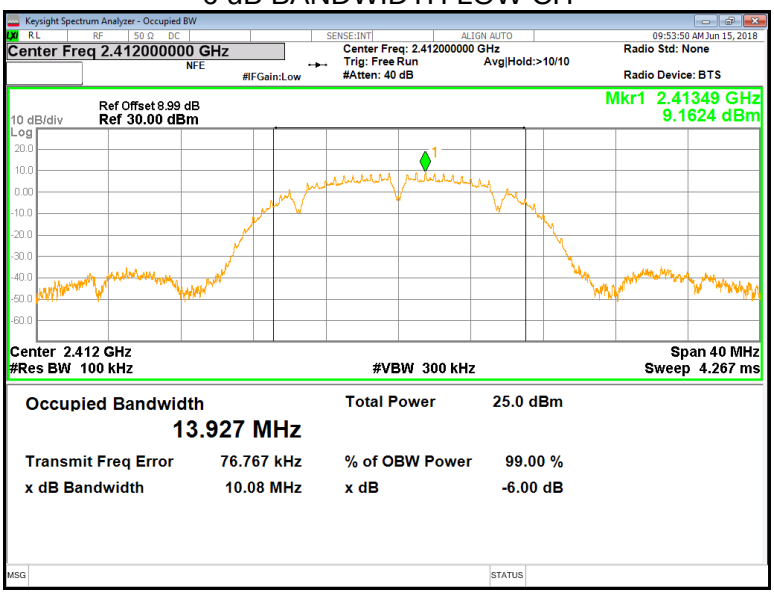
RESULTS

7.2.1. 802.11b SISO MODE

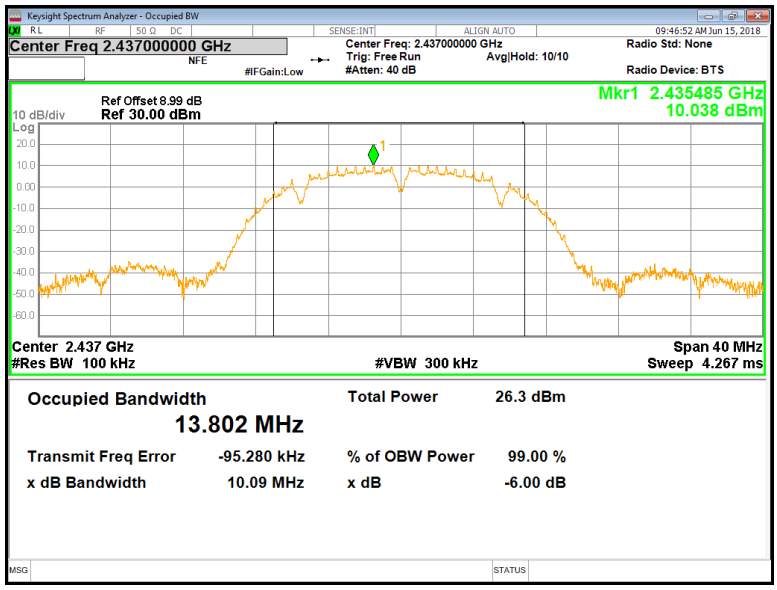
ANTENNA 0

Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Limit For 6dB (kHz)	Result
2412	10.08	13.927	500	Pass
2437	10.09	13.802	500	Pass
2462	10.07	13.881	500	Pass

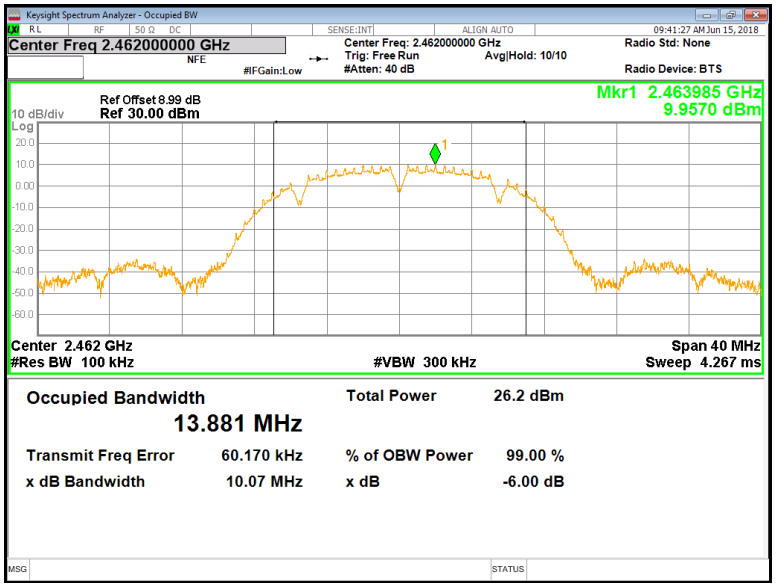
6 dB BANDWIDTH LOW CH



6 dB BANDWIDTH MID CH



6 dB BANDWIDTH HIGH CH

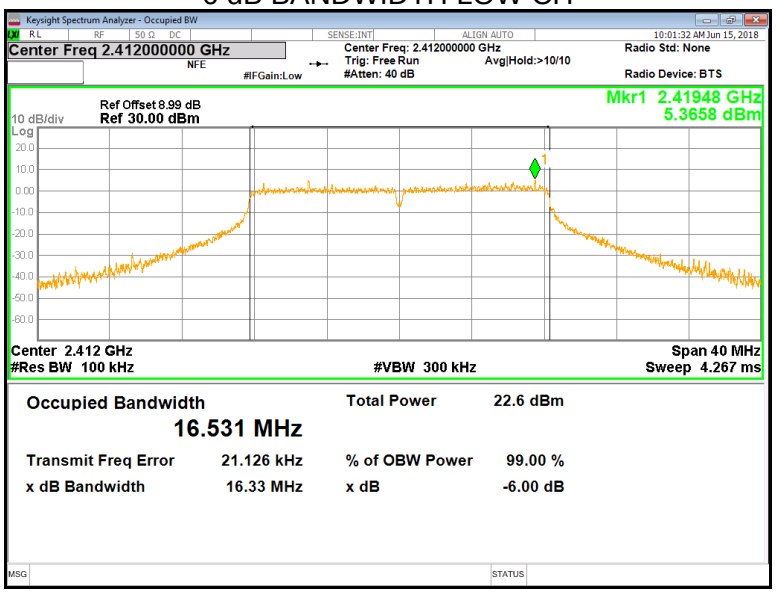


7.2.2. 802.11g SISO MODE

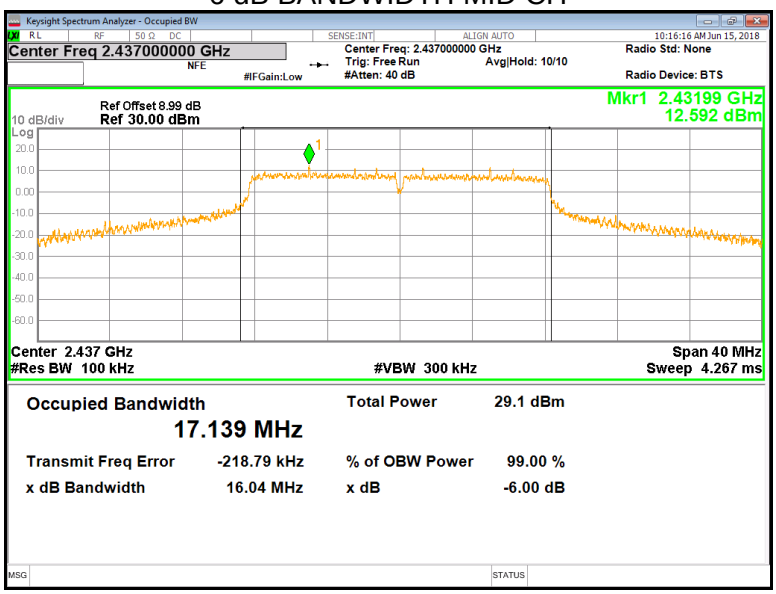
ANTENNA 0

Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Limit For 6dB (kHz)	Result
2412	16.33	16.531	500	Pass
2437	16.04	17.139	500	Pass
2452	16.31	16.494	500	Pass

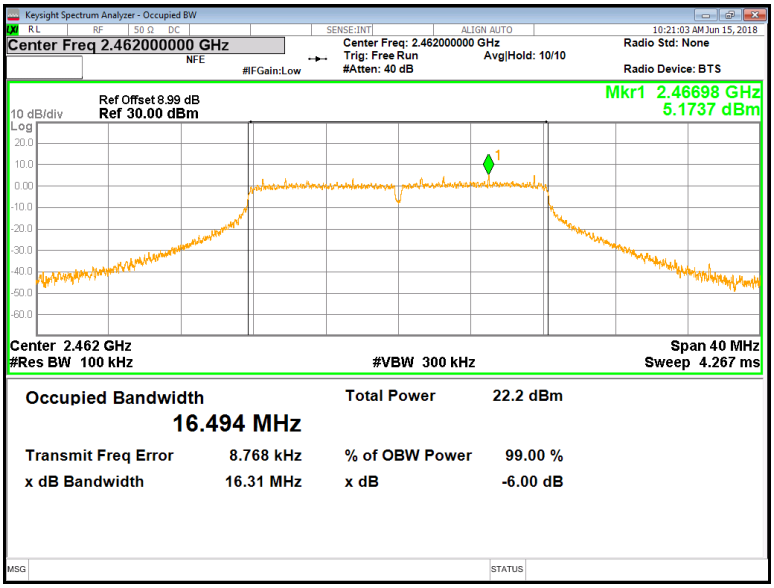
6 dB BANDWIDTH LOW CH



6 dB BANDWIDTH MID CH



6 dB BANDWIDTH HIGH CH

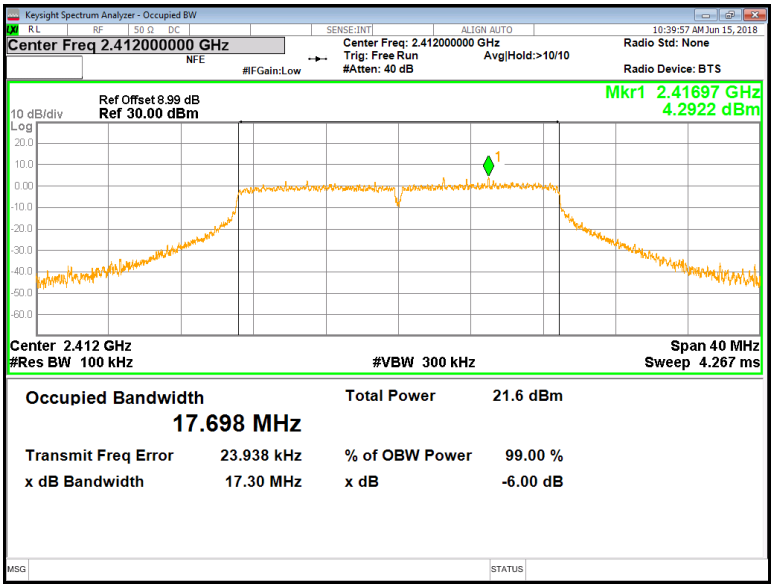


7.2.3. 802.11n20 SISO MODE

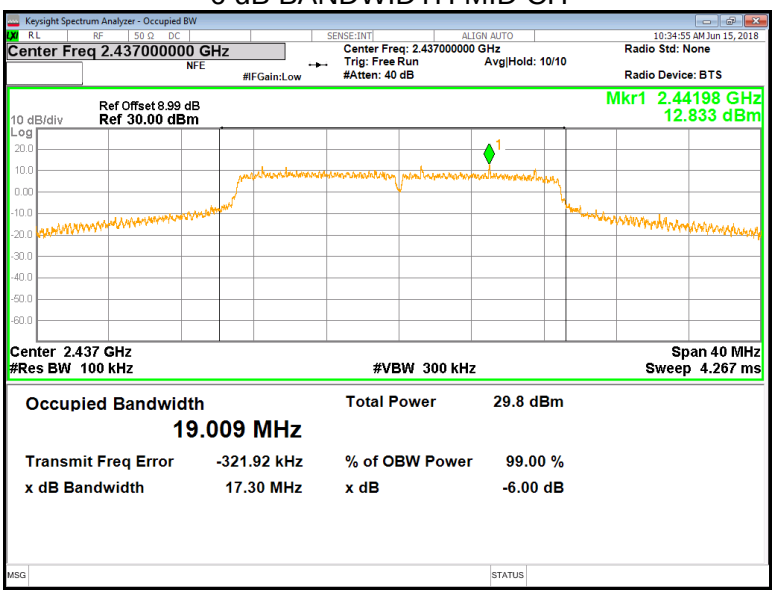
ANTENNA 0

Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Limit For 6dB (kHz)	Result
2412	17.30	17.698	500	Pass
2437	17.30	19.009	500	Pass
2462	17.58	17.692	500	Pass

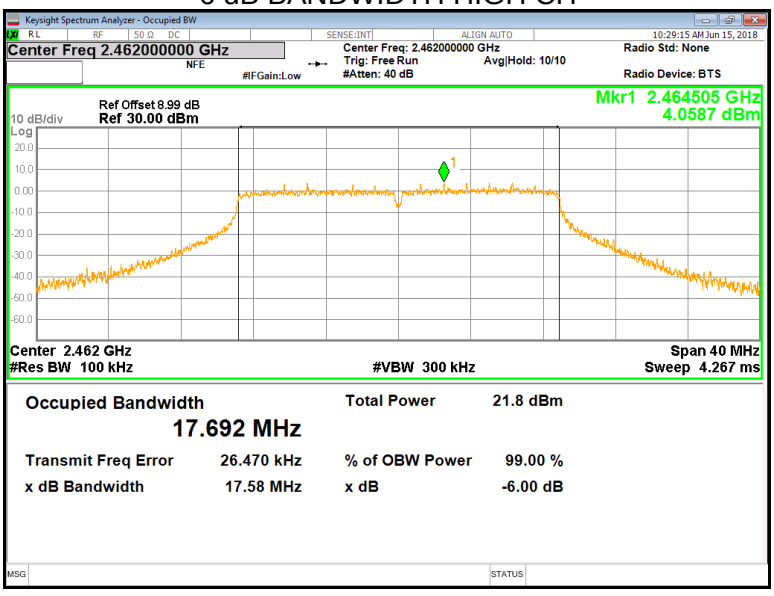
6 dB BANDWIDTH LOW CH



6 dB BANDWIDTH MID CH



6 dB BANDWIDTH HIGH CH

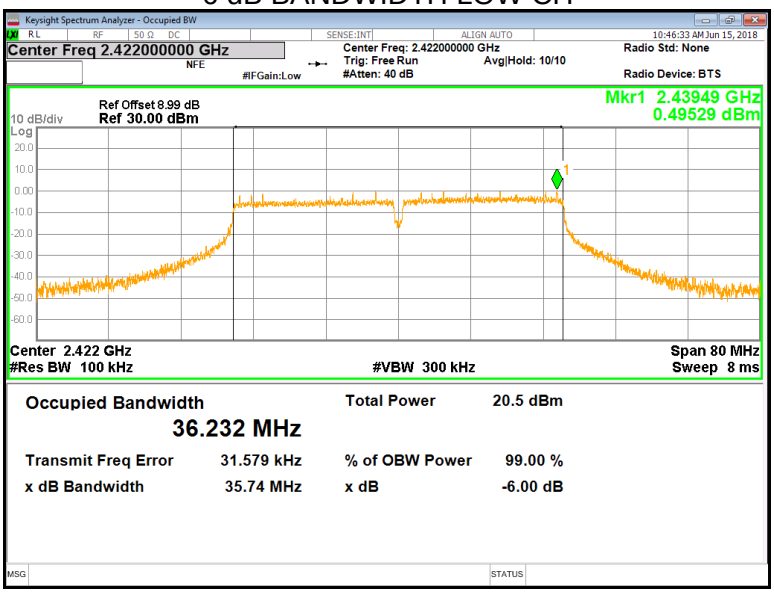


7.2.4. 802.11n40 SISO MODE

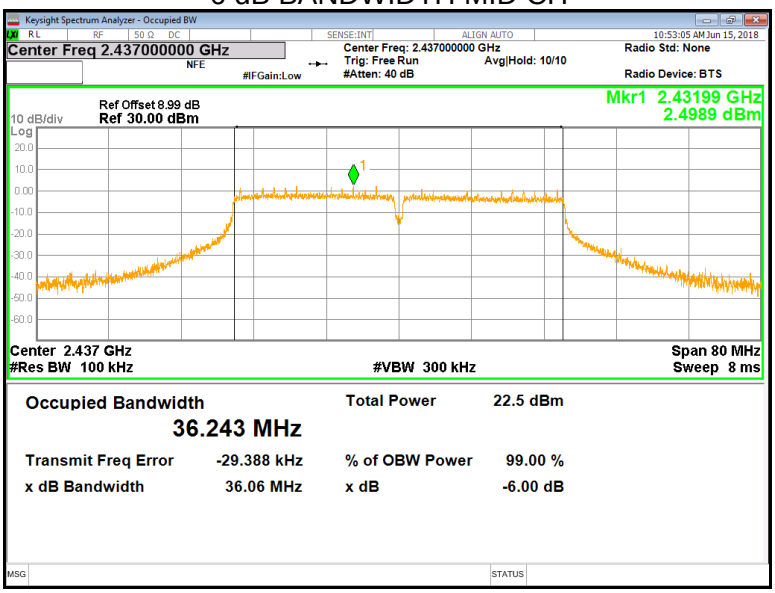
ANTENNA 0

Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Limit For 6dB (kHz)	Result
2422	35.74	36.232	500	Pass
2437	36.06	36.243	500	Pass
2452	36.33	36.350	500	Pass

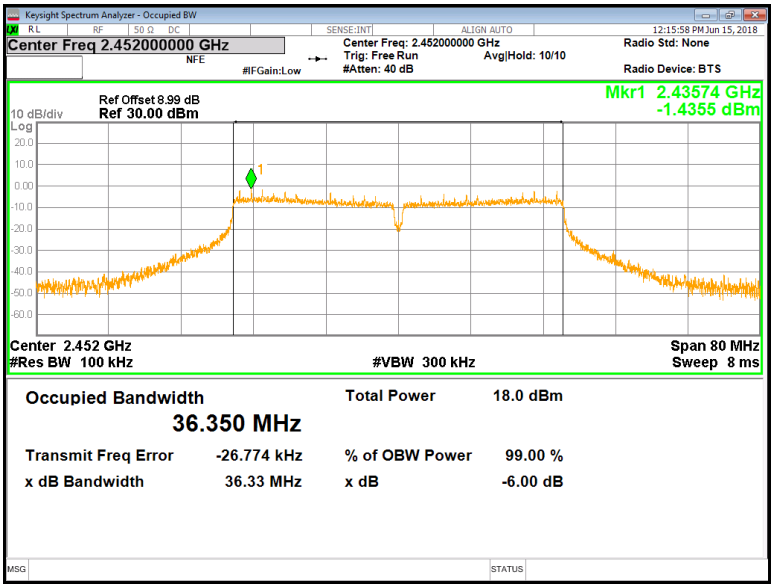
6 dB BANDWIDTH LOW CH



6 dB BANDWIDTH MID CH



6 dB BANDWIDTH HIGH CH



Note: All the modulation and antennas had been tested, but only the worst data recorded in the report.

7.3. Maximum conducted (Peak&average) output power

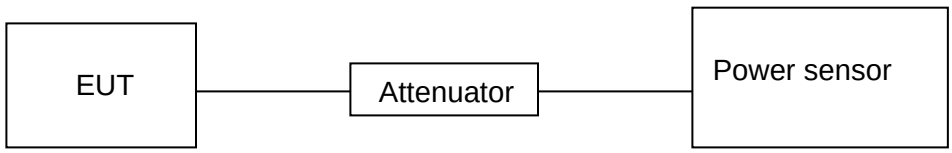
LIMITS

FCC Part15 (15.247) Subpart C RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247(b)(3) RSS-247 5.4 (e)	Average Output Power	1 watt or 30dBm	2400-2483.5

TEST PROCEDURE

Place the EUT on the table and set it in the transmitting mode.
Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Power sensor.
Measure Peak & average power each channel.

TEST SETUP



RESULTS

7.3.1. SISO Mode

SISO Mode (Average)					
Mode	**Channel**	**Antenna**	**Maximum Conducted Outpower [dBm]**	**Limit [dBm]**	**Verdict**
802.11b	LCH	0	18.44	30	PASS
	MCH	0	19.61	30	PASS
	HCH	0	19.71	30	PASS
802.11g	LCH	0	16.52	30	PASS
	MCH	0	22.01	30	PASS
	HCH	0	16.07	30	PASS
802.11n20	LCH	0	15.49	30	PASS
	MCH	0	21.16	30	PASS
	HCH	0	15.77	30	PASS
802.11n40	LCH	0	14.10	30	PASS
	MCH	0	16.28	30	PASS
	HCH	0	12.05	30	PASS

SISO Mode (Peak)					
Mode	**Channel**	**Antenna**	**Maximum Conducted Outpower [dBm]**	**Limit [dBm]**	**Verdict**
802.11b	LCH	0	20.54	30	PASS
	MCH	0	22.01	30	PASS
	HCH	0	21.87	30	PASS
802.11g	LCH	0	23.85	30	PASS
	MCH	0	29.13	30	PASS
	HCH	0	23.39	30	PASS
802.11n20	LCH	0	22.67	30	PASS
	MCH	0	29.01	30	PASS
	HCH	0	23.04	30	PASS
802.11n40	LCH	0	21.58	30	PASS
	MCH	0	23.68	30	PASS
	HCH	0	19.28	30	PASS

Note: All the modulation and antennas had been tested, but only the worst data recorded in the report.

7.3.2. MIMO Mode

MIMO Mode (Average)						
Mode	Channel	Antenna	Maximum Conducted Outpower [dBm]		Limit [dBm]	Verdict
			Single	Total		
802.11 g	LCH	0	14.530	19.06	30	PASS
		1	14.100			
		2	14.240			
	MCH	0	18.490	22.72	30	PASS
		1	18.000			
		2	17.270			
	HCH	0	13.370	18.32	30	PASS
		1	13.530			
		2	13.730			
802.11n20	LCH	0	12.590	17.18	30	PASS
		1	12.210			
		2	12.420			
	MCH	0	18.630	22.90	30	PASS
		1	18.040			
		2	17.650			
	HCH	0	13.700	18.39	30	PASS
		1	13.430			
		2	13.720			
802.11n40	LCH	0	10.130	14.14	30	PASS
		1	8.750			
		2	9.120			
	MCH	0	13.480	17.81	30	PASS
		1	12.680			
		2	12.910			
	HCH	0	10.770	15.08	30	PASS
		1	10.360			
		2	9.730			

Note: All the modulation and antennas had been tested, but only the worst data recorded in the report.

MIMO Mode (Peak)						
Mode	Channel	Antenna	Maximum Conducted Outpower [dBm]		Limit [dBm]	Verdict
			Single	Total		
802.11 g	LCH	0	21.980	26.81	30	PASS
		1	21.800			
		2	22.320			
	MCH	0	24.920	29.39	30	PASS
		1	24.520			
		2	24.390			
	HCH	0	20.680	26.05	30	PASS
		1	21.190			
		2	21.870			
802.11n20	LCH	0	19.870	24.60	30	PASS
		1	19.590			
		2	20.010			
	MCH	0	25.350	29.78	30	PASS
		1	24.940			
		2	24.700			
	HCH	0	20.860	25.76	30	PASS
		1	20.820			
		2	21.280			
802.11n40	LCH	0	17.440	21.63	30	PASS
		1	16.220			
		2	16.830			
	MCH	0	20.850	25.33	30	PASS
		1	20.170			
		2	20.640			
	HCH	0	18.160	22.54	30	PASS
		1	17.880			
		2	17.210			

7.4. POWER SPECTRAL DENSITY

LIMITS

FCC Part15 (15.247) Subpart C RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
FCC §15.247 (e) RSS-247 5.2 (b)	Power Spectral Density	8 dBm in any 3 kHz band	2400-2483.5
Note:	1. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. 2. Limit=8dBm – (Directional gain -6)dBi Directional gain = G_{ANT} + 10 log(N_{ANT}) dBi, where N_{ANT} is the number of outputs, G_{ANT} is the Antenna gain.		

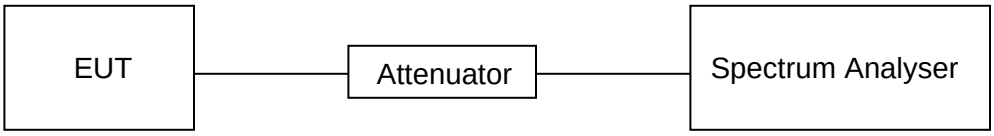
TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	3 kHz ≤ RBW ≤ 100 kHz.
VBW	≥3 × RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.
If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST SETUP



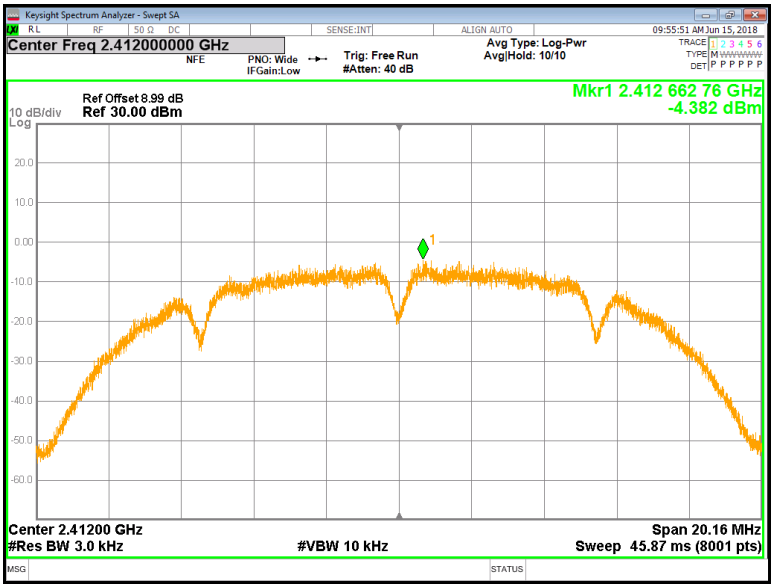
RESULTS

7.4.1. SISO Mode

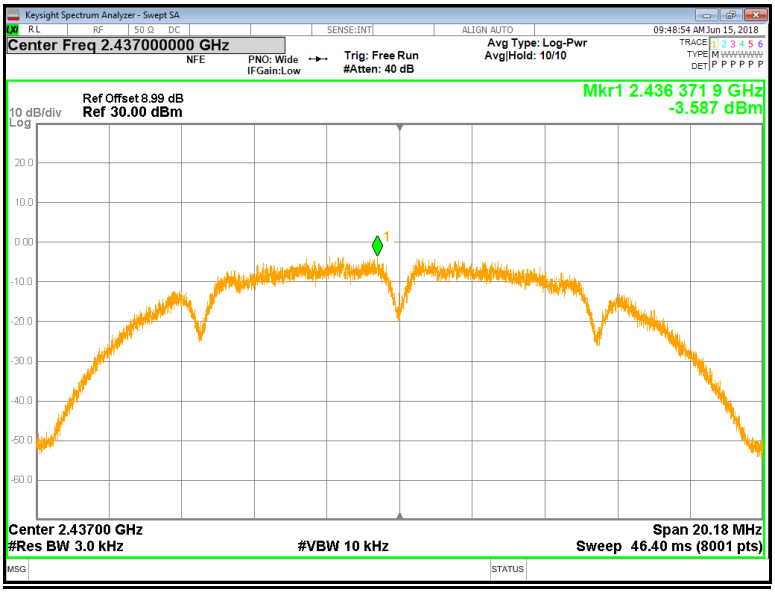
SISO Mode					
Mode	**Channel**	**Antenna**	**Meas.Level [dBm/3kHz]**	**Limit (dBm/3KHz)**	**Verdict**
802.11b	LCH	0	-4.328	8	PASS
	MCH	0	-3.587	8	PASS
	HCH	0	-3.01	8	PASS
802.11g	LCH	0	-8.277	8	PASS
	MCH	0	-2.084	8	PASS
	HCH	0	-8.291	8	PASS
802.11n20	LCH	0	-8.415	8	PASS
	MCH	0	-1.415	8	PASS
	HCH	0	-8.813	8	PASS
802.11n40	LCH	0	-12.369	8	PASS
	MCH	0	-10.762	8	PASS
	HCH	0	-16.071	8	PASS

802.11b

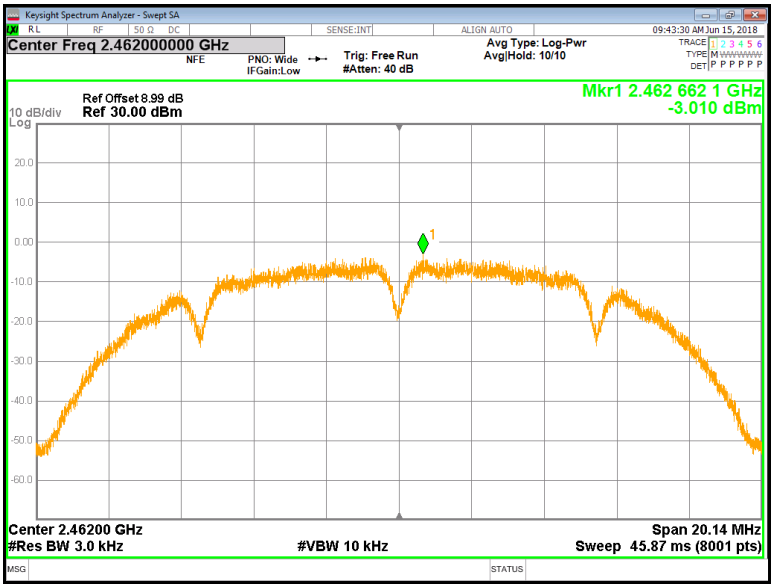
PSD LOW CH



PSD MID CH

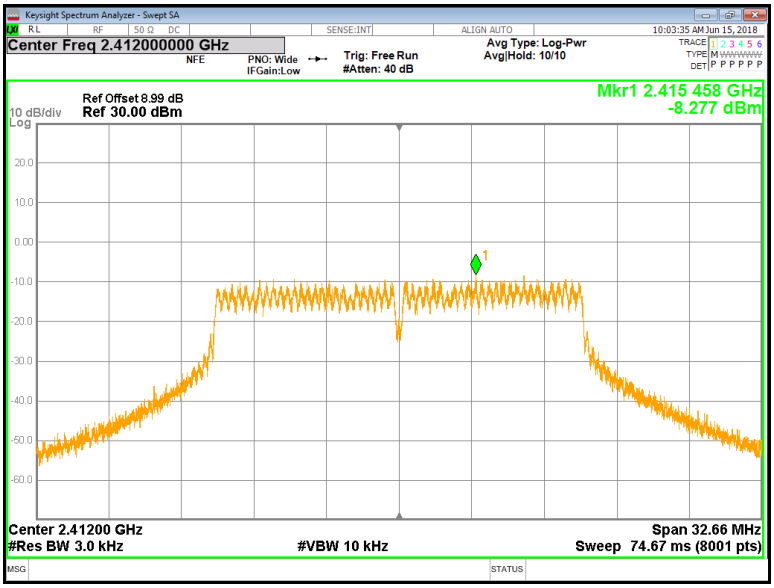


PSD HIGH CH

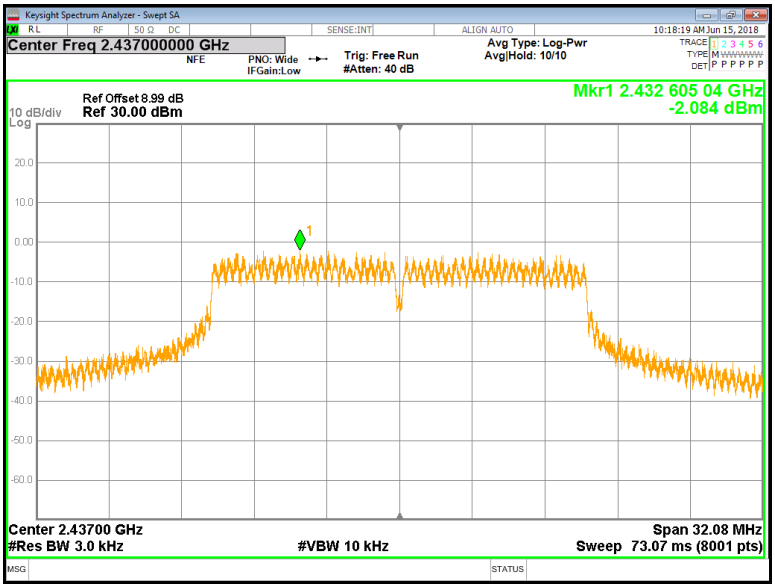


802.11g

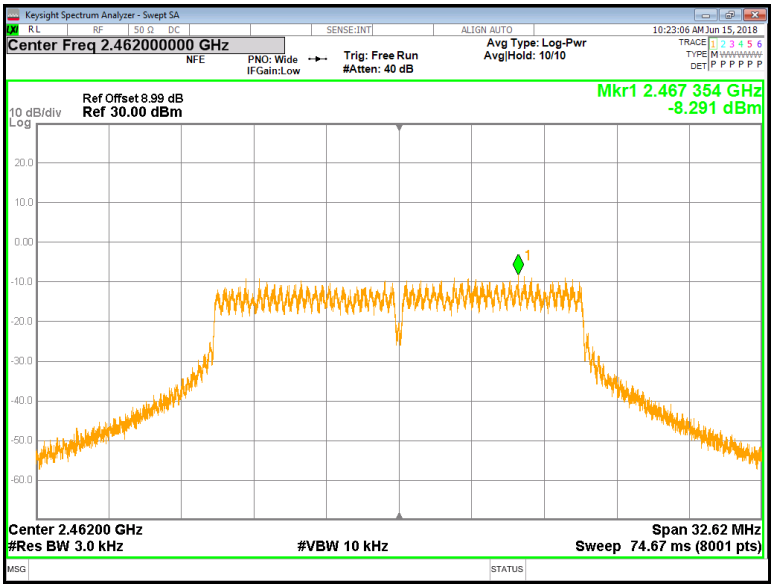
PSD LOW CH



PSD MID CH

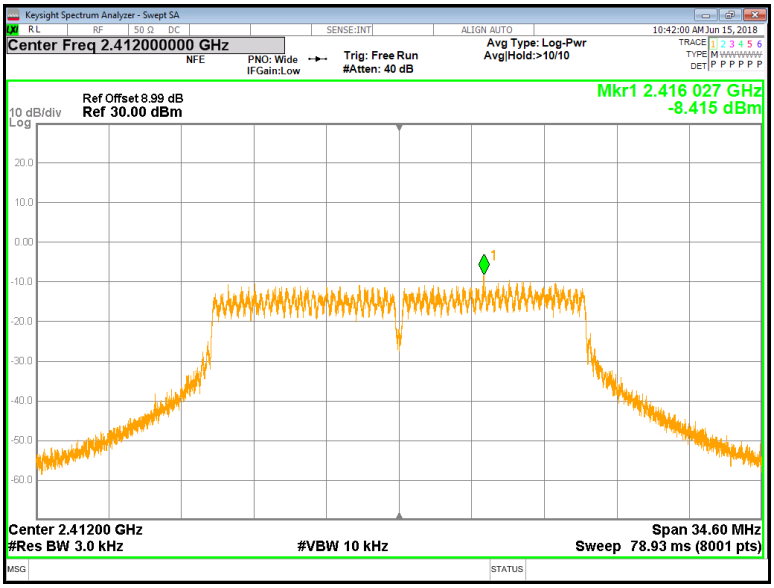


PSD HIGH CH

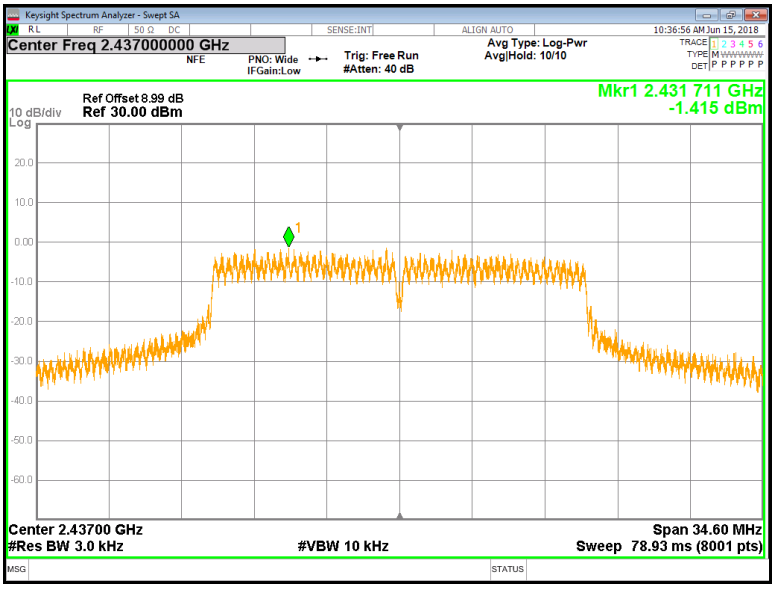


802.11n Ht20

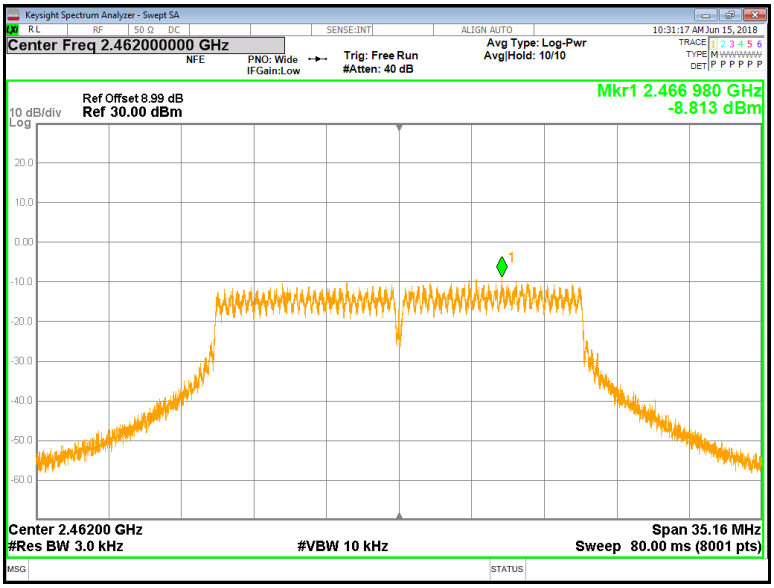
PSD LOW CH



PSD MID CH

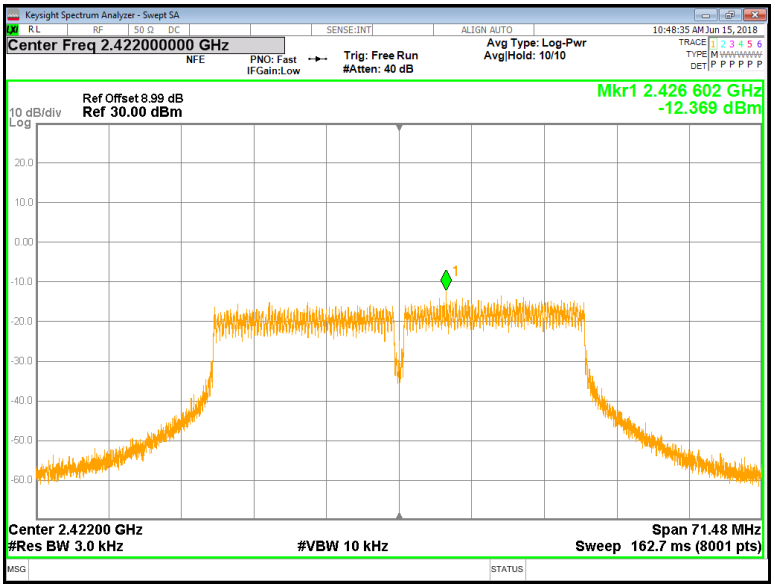


PSD HIGH CH

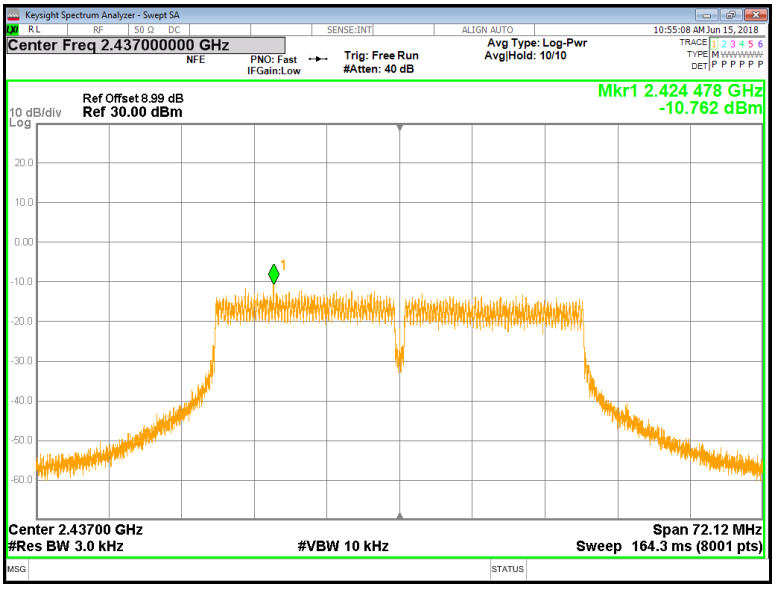


802.11 Ht40

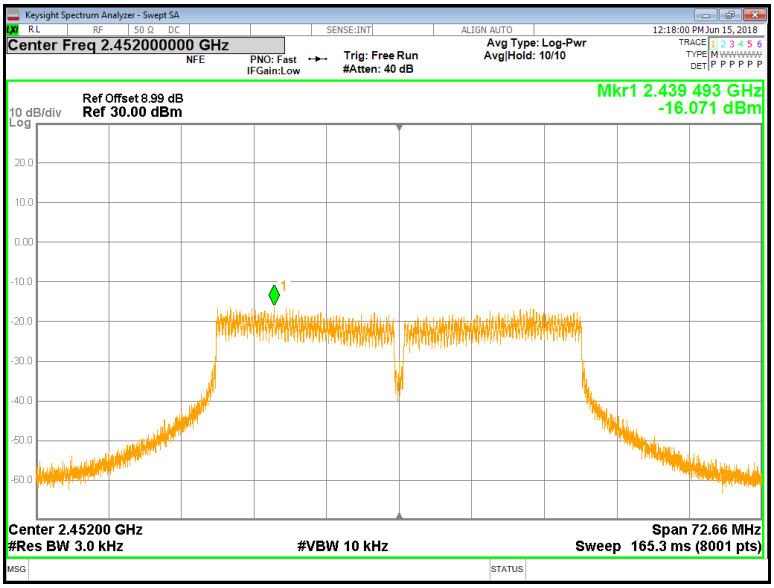
PSD LOW CH



PSD MID CH



PSD HIGH CH



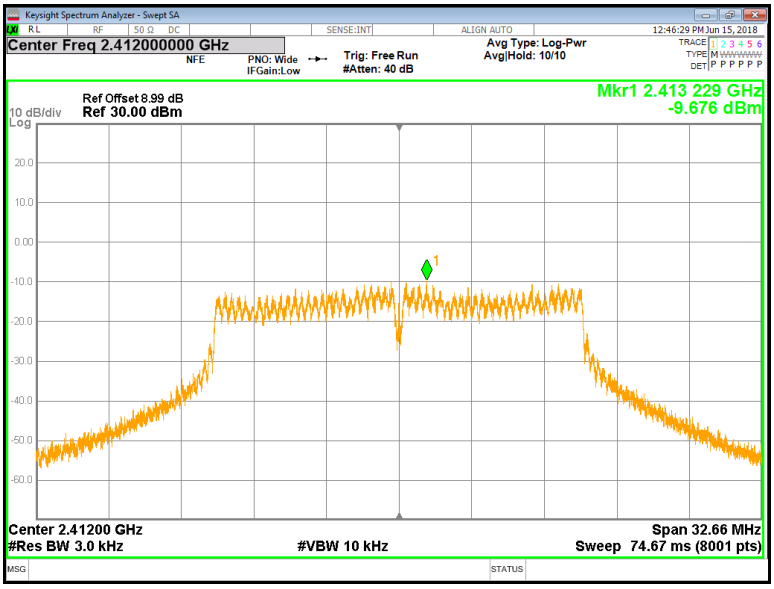
7.4.2. MIMO Mode

MIMO CDD Mode						
Mode	**Channel**	**Antenna**	**Meas.Level [dBm/3kHz]**	**Total [dBm/3kHz]**	**Limit (dBm/3KHz)**	**Verdict**
802.11g	LCH	0	-9.676	-5.50	7.22	PASS
		1	-11.028			
		2	-10.222			
	MCH	0	-4.556	-1.09	7.22	PASS
		1	-6.352			
		2	-7.087			
	HCH	0	-11.053	-6.21	7.22	PASS
		1	-10.613			
		2	-11.309			
802.11n20	LCH	0	-11.261	-7.18	7.22	PASS
		1	-12.530			
		2	-12.172			
	MCH	0	-4.417	-0.46	7.22	PASS
		1	-5.658			
		2	-5.745			
	HCH	0	-9.227	-5.09	7.22	PASS
		1	-10.295			
		2	-10.146			
802.11n40	LCH	0	-15.807	-12.90	7.22	PASS
		1	-19.901			
		2	-18.304			
	MCH	0	-14.244	-9.66	7.22	PASS
		1	-13.944			
		2	-15.213			
	HCH	0	-15.721	-11.86	7.22	PASS
		1	-16.916			
		2	-17.426			

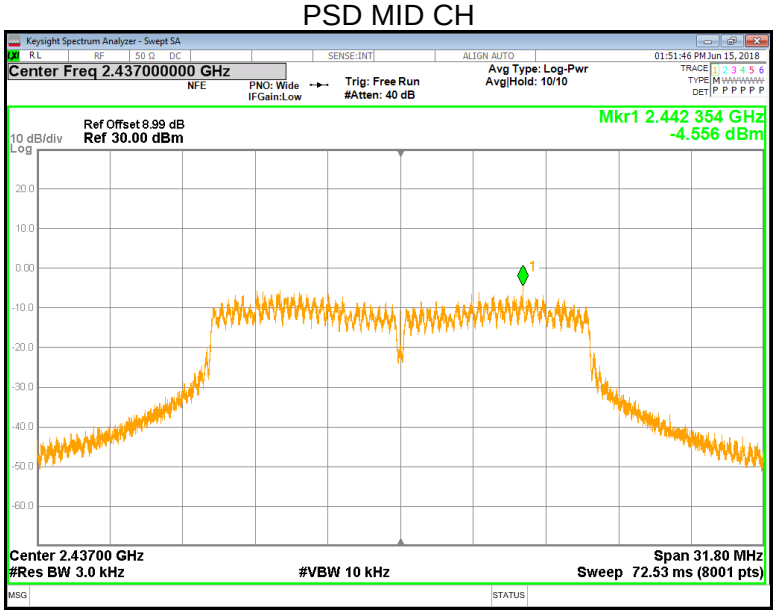
802.11g

Antenna 0

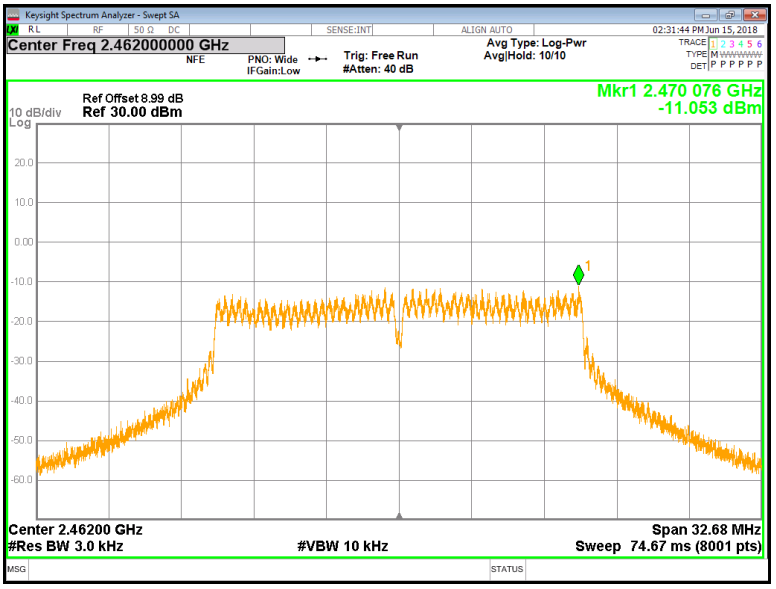
PSD LOW CH



PSD MID CH

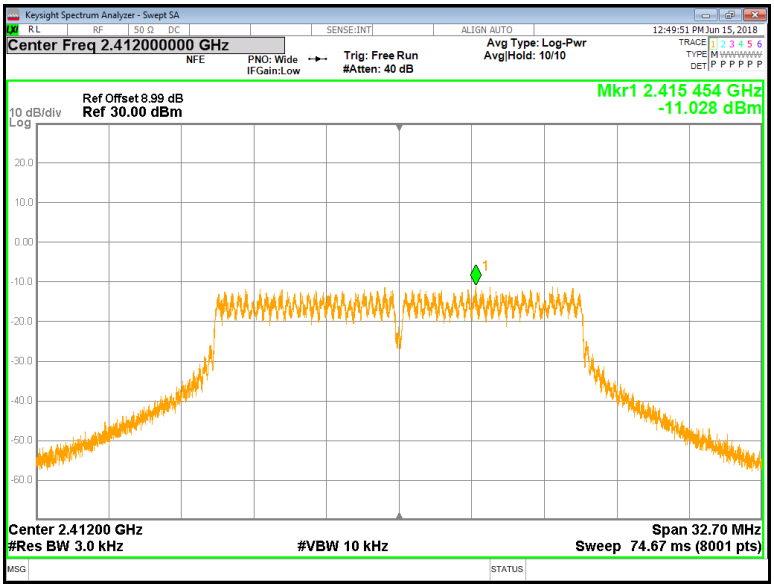


PSD HIGH CH

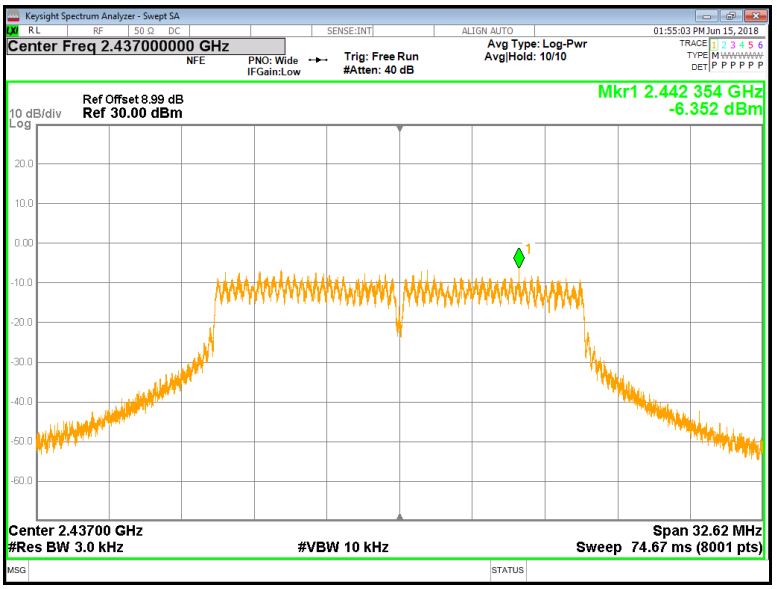


Antenna 1

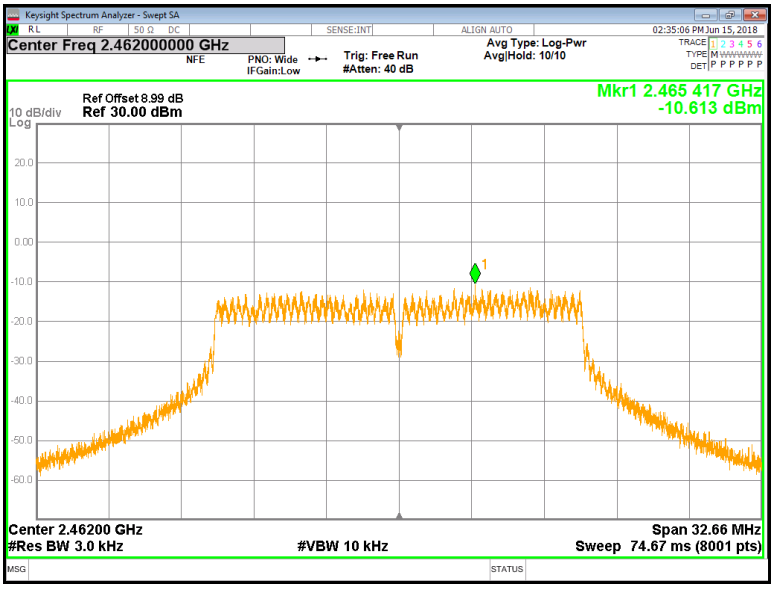
PSD LOW CH



PSD MID CH

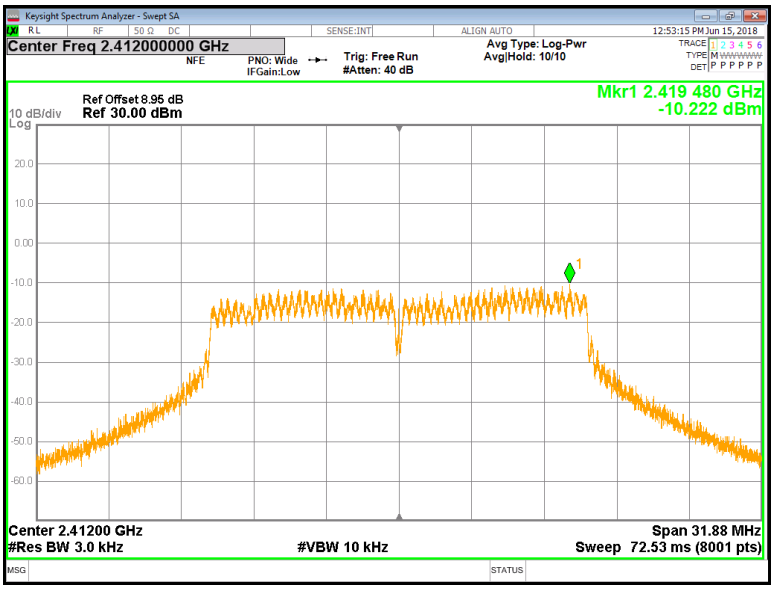


PSD HIGH CH

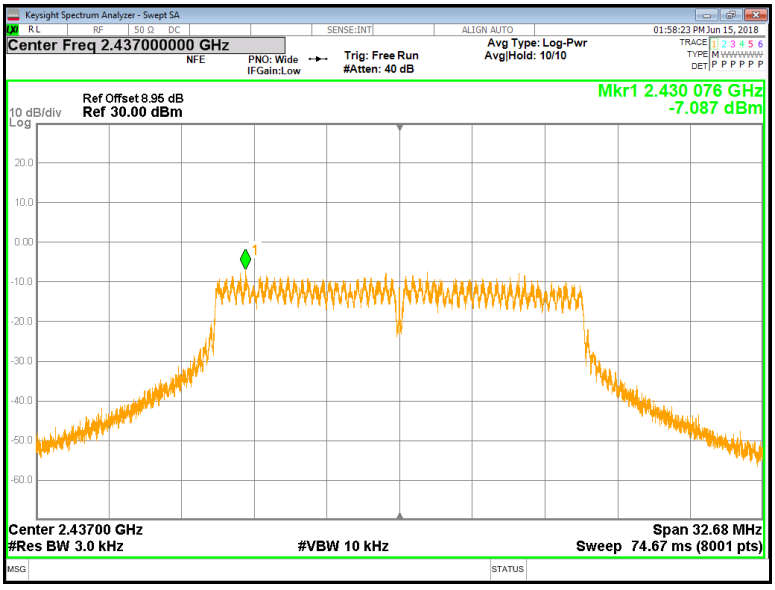


Antenna 3

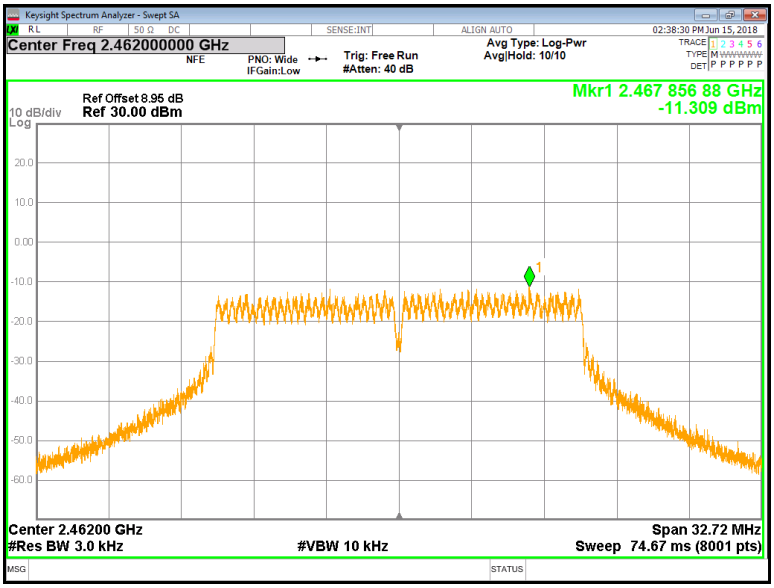
PSD LOW CH



PSD MID CH



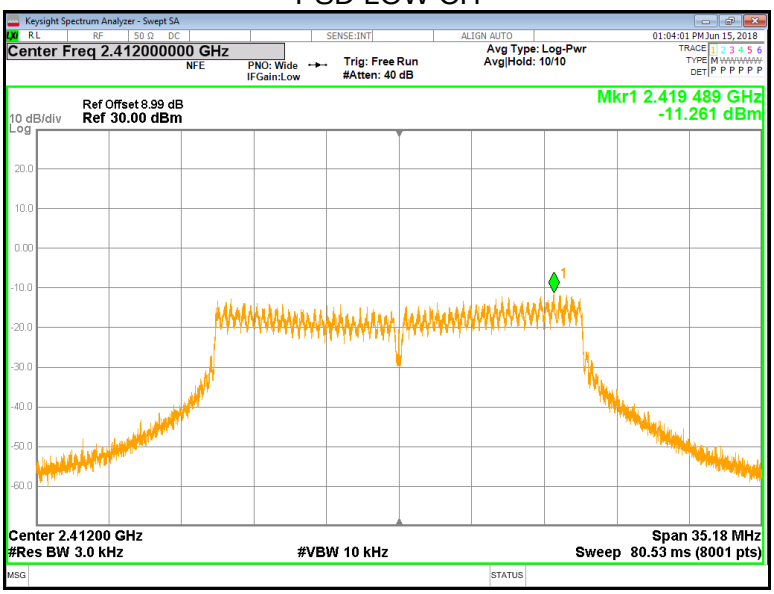
PSD HIGH CH



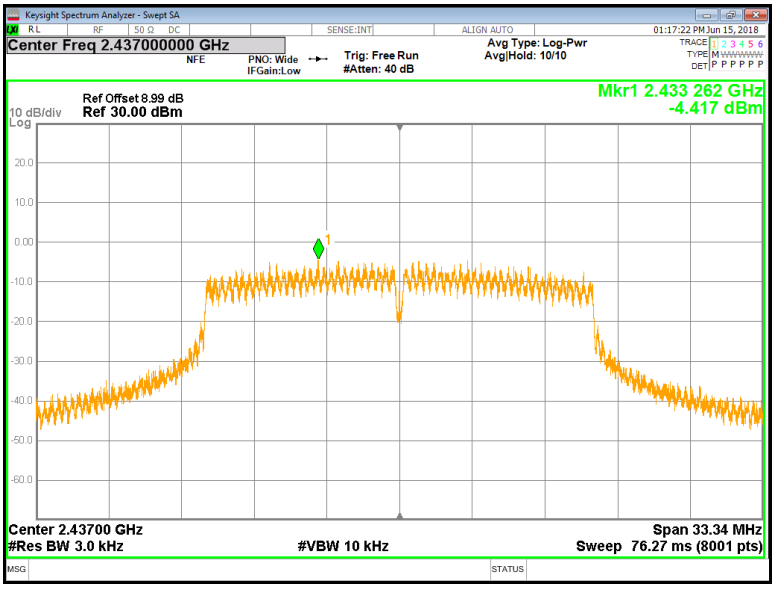
802.11n20

Antenna 0

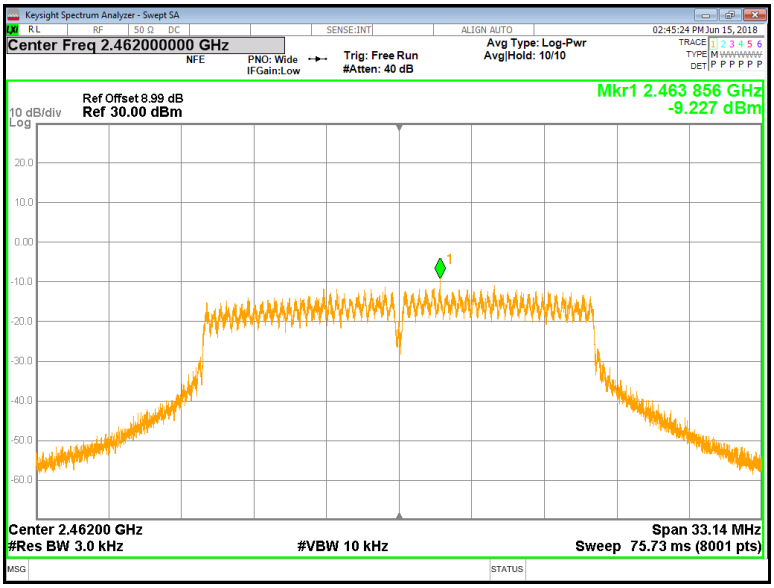
PSD LOW CH



PSD MID CH

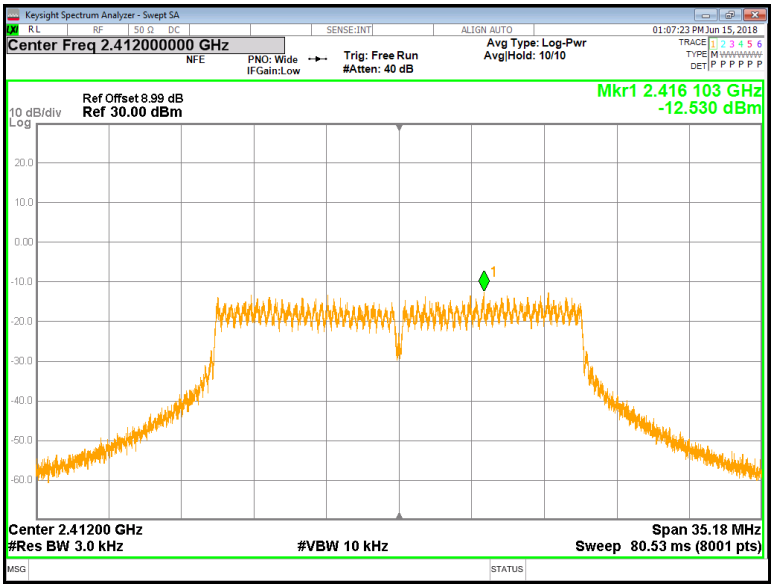


PSD HIGH CH

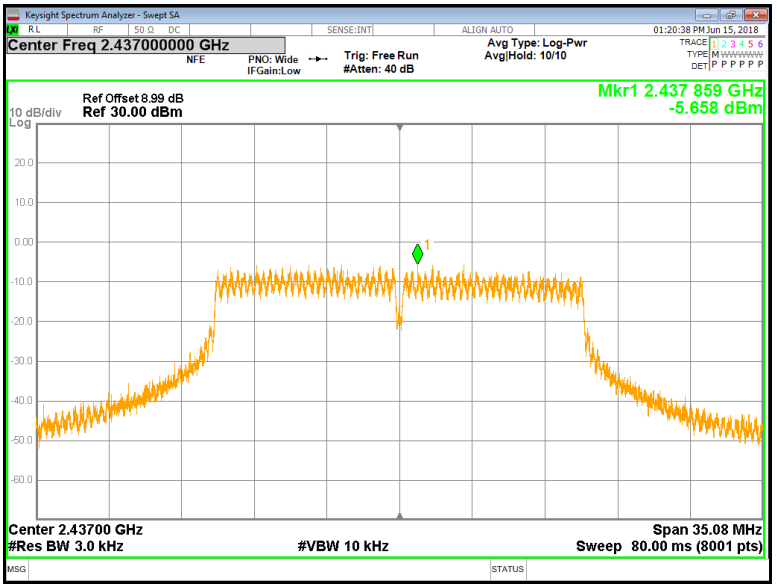


Antenna 1

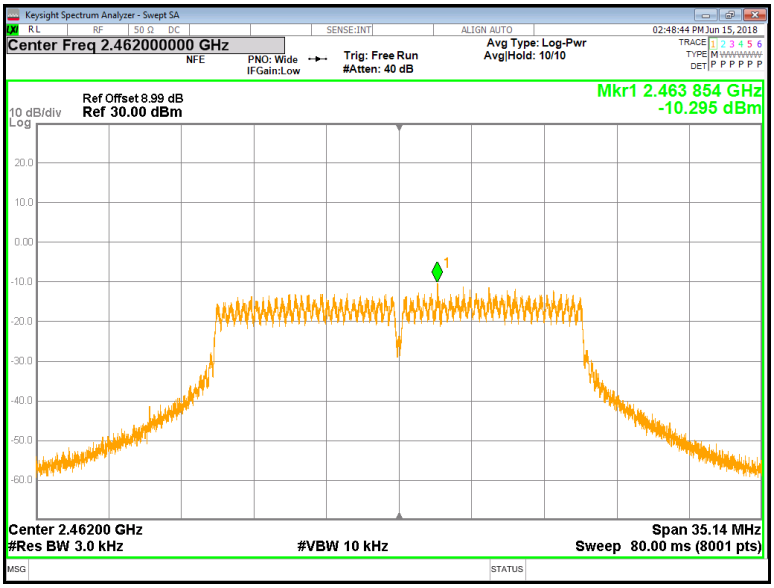
PSD LOW CH



PSD MID CH

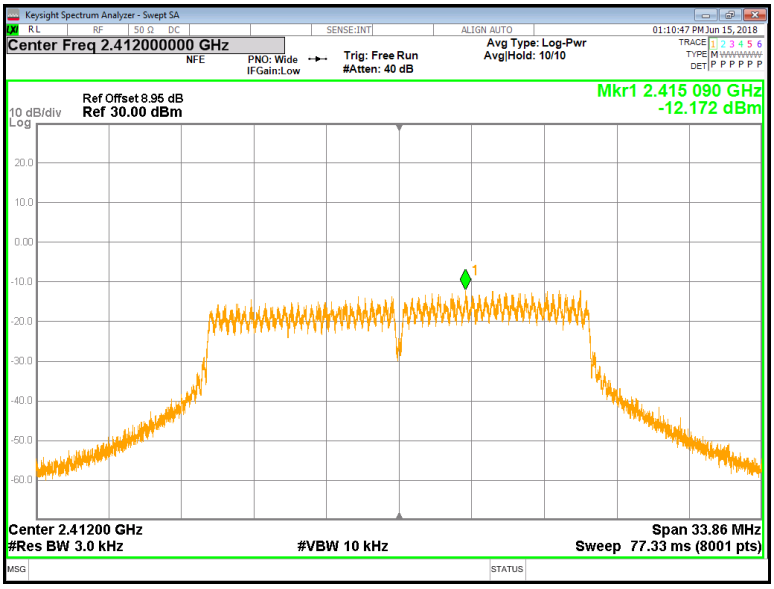


PSD HIGH CH

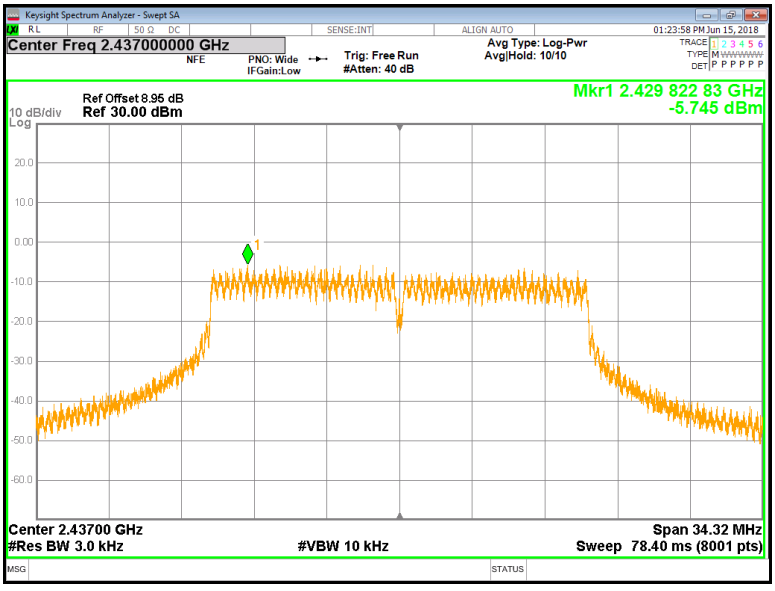


Antenna 2

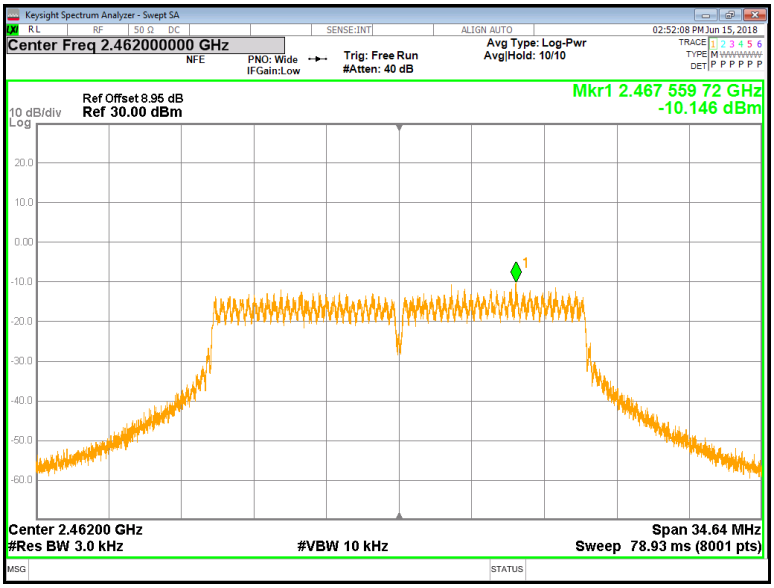
PSD LOW CH



PSD MID CH



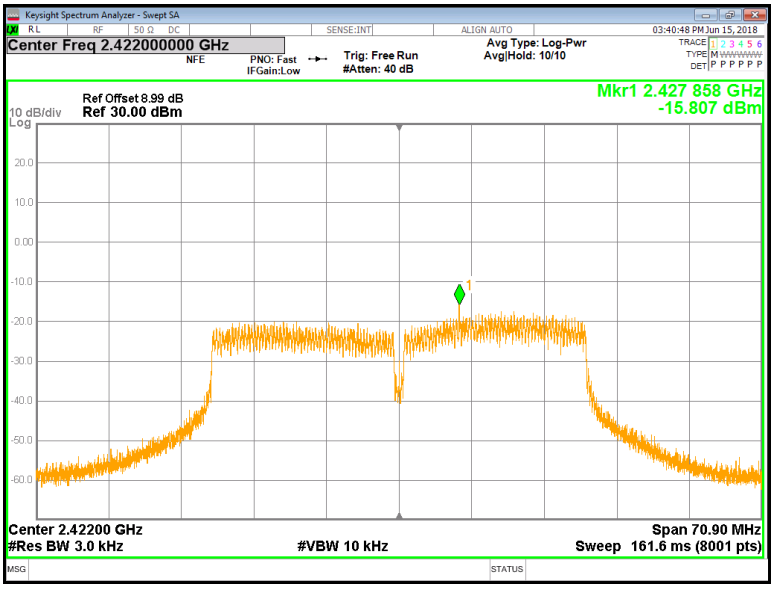
PSD HIGH CH



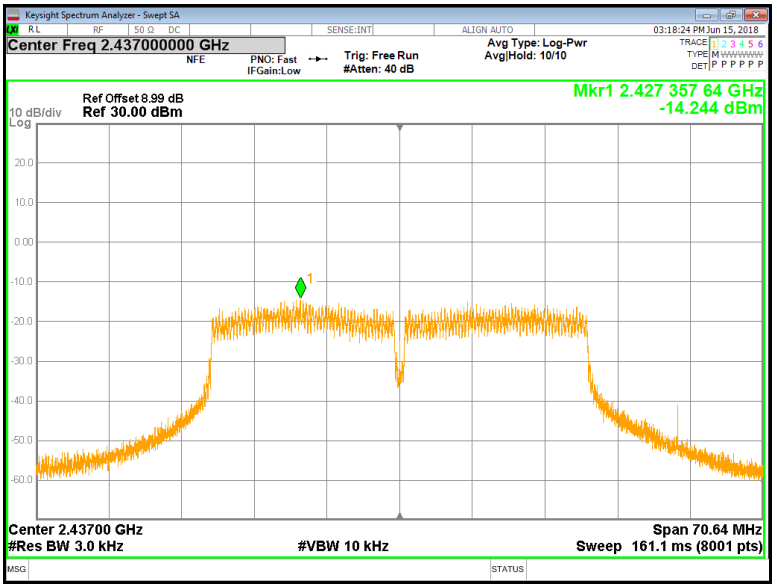
802.11n40

Antenna 0

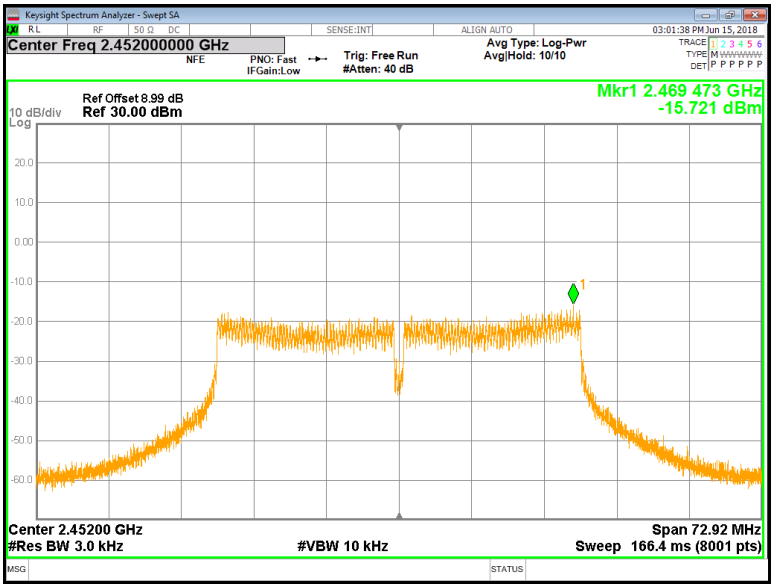
PSD LOW CH



PSD MID CH

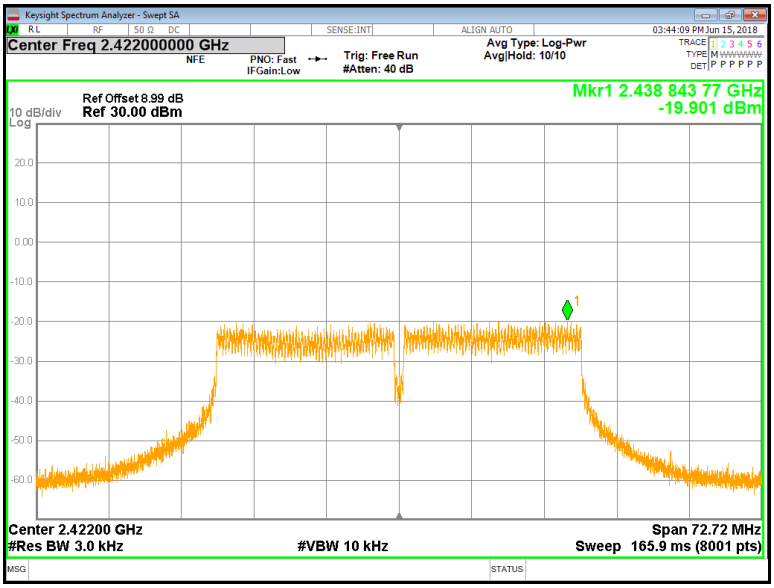


PSD HIGH CH

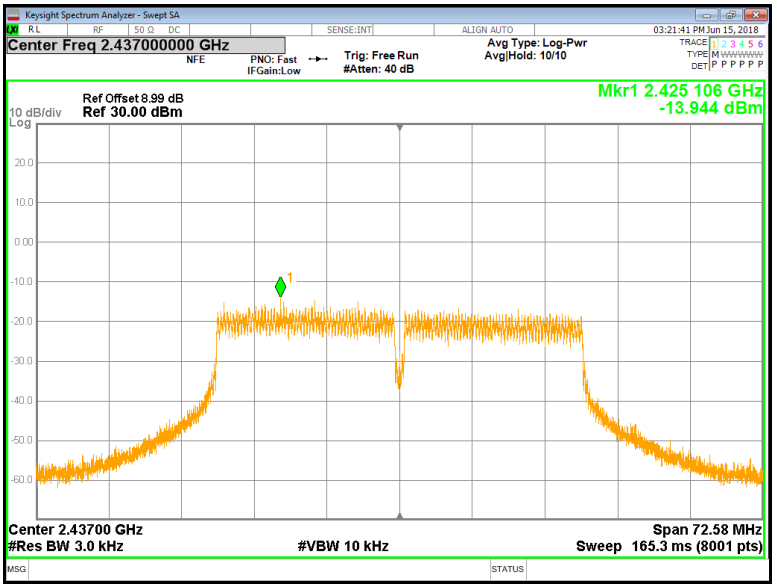


Antenna 1

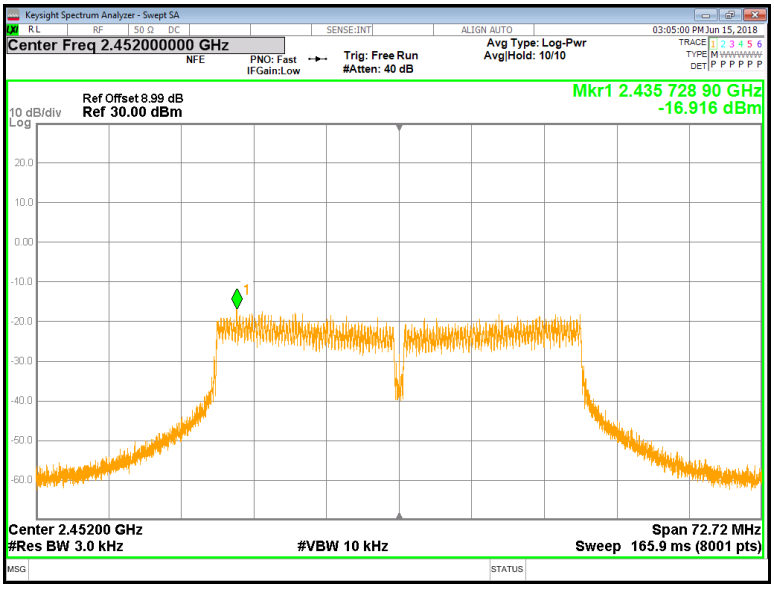
PSD LOW CH



PSD MID CH

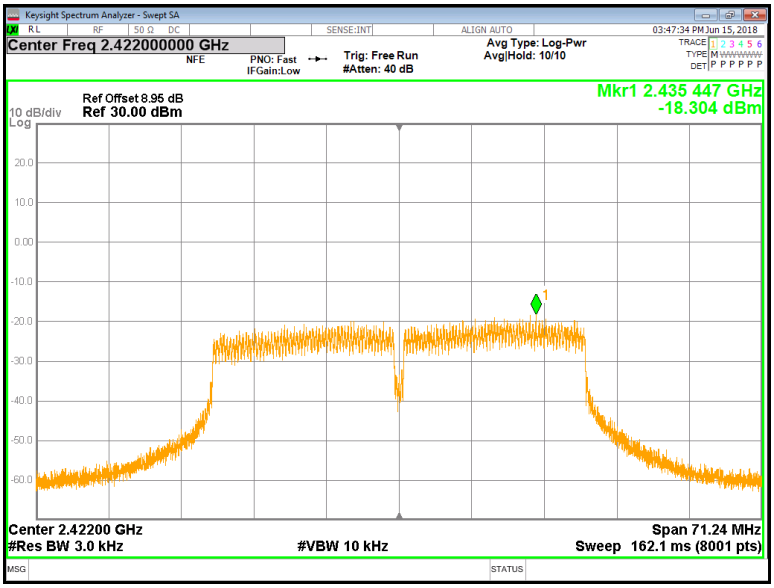


PSD HIGH CH

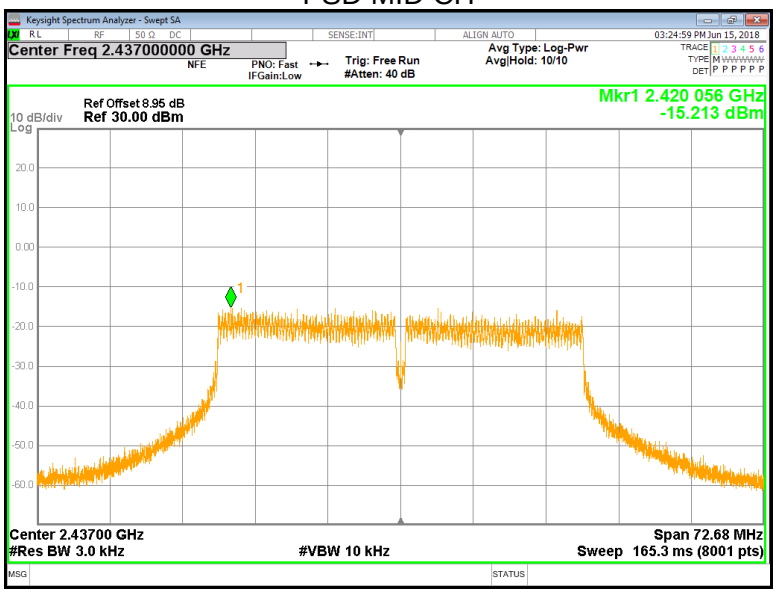


Antenna 2

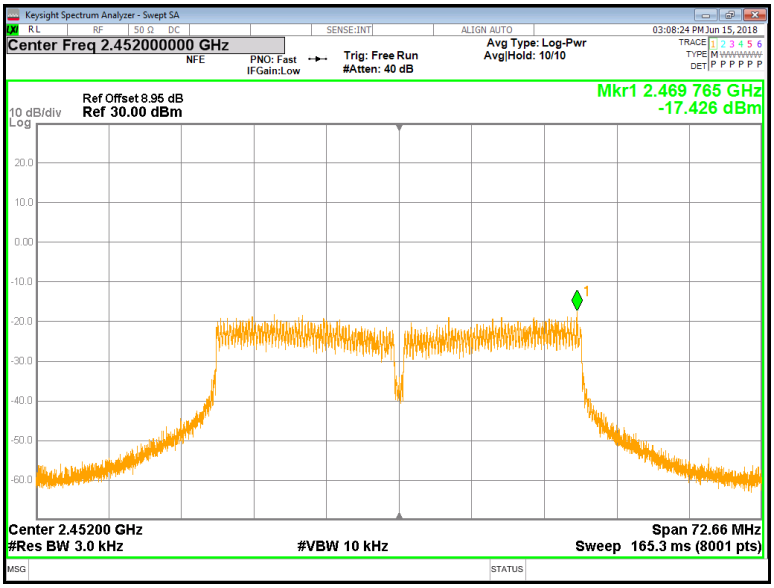
PSD LOW CH



PSD MID CH



PSD HIGH CH



7.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

LIMITS

FCC Part15 (15.247) Subpart C RSS-247 ISSUE 2		
Section	Test Item	Limit
FCC §15.247 (d) RSS-247 5.5	Conducted Bandedge and Spurious Emissions	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

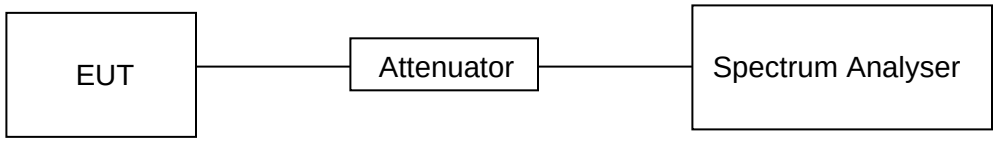
Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	100K
VBW	≥3 × RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

Use the peak marker function to determine the maximum PSD level.

Span	Set the center frequency and span to encompass frequency range to be measured
Detector	Peak
RBW	100K
VBW	≥3 × RBW
measurement points	≥span/RBW
Trace	Max hold
Sweep time	Auto couple.

Use the peak marker function to determine the maximum amplitude level**.**

TEST SETUP

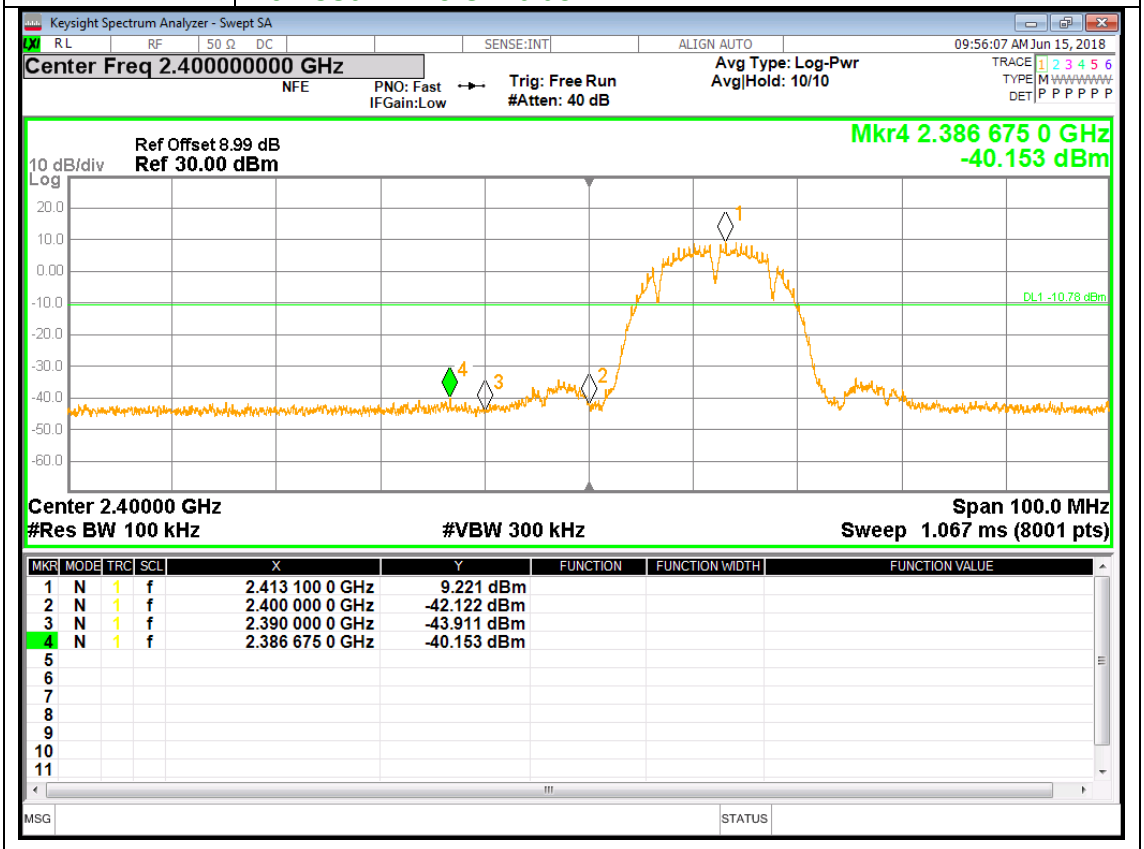


RESULTS

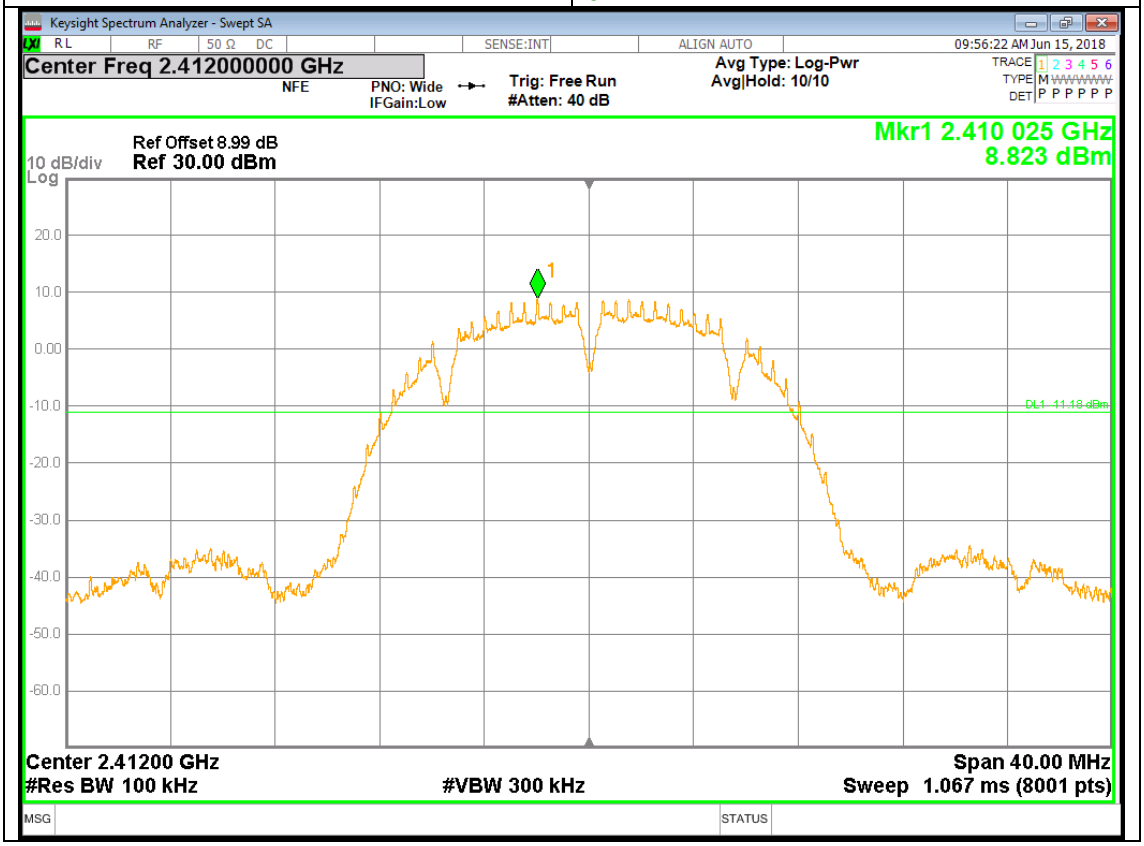
7.5.1. 802.11b SISO MODE

Low Channel

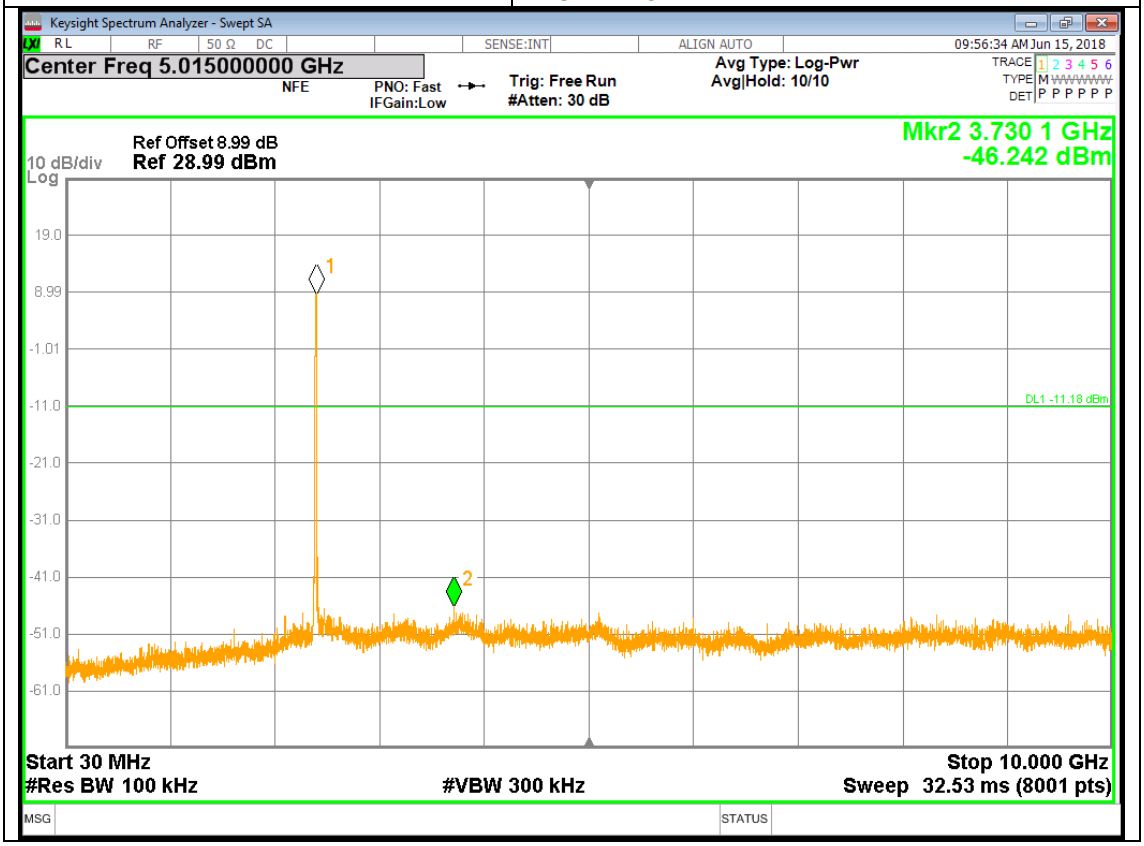
Test Case: Bandedge Compliance	
Mode: 11B	Ant: Ant 0
Channel: LCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Peak:9.221dBm;Max:2386.675MHz@-40.153dBm49.374dbc**



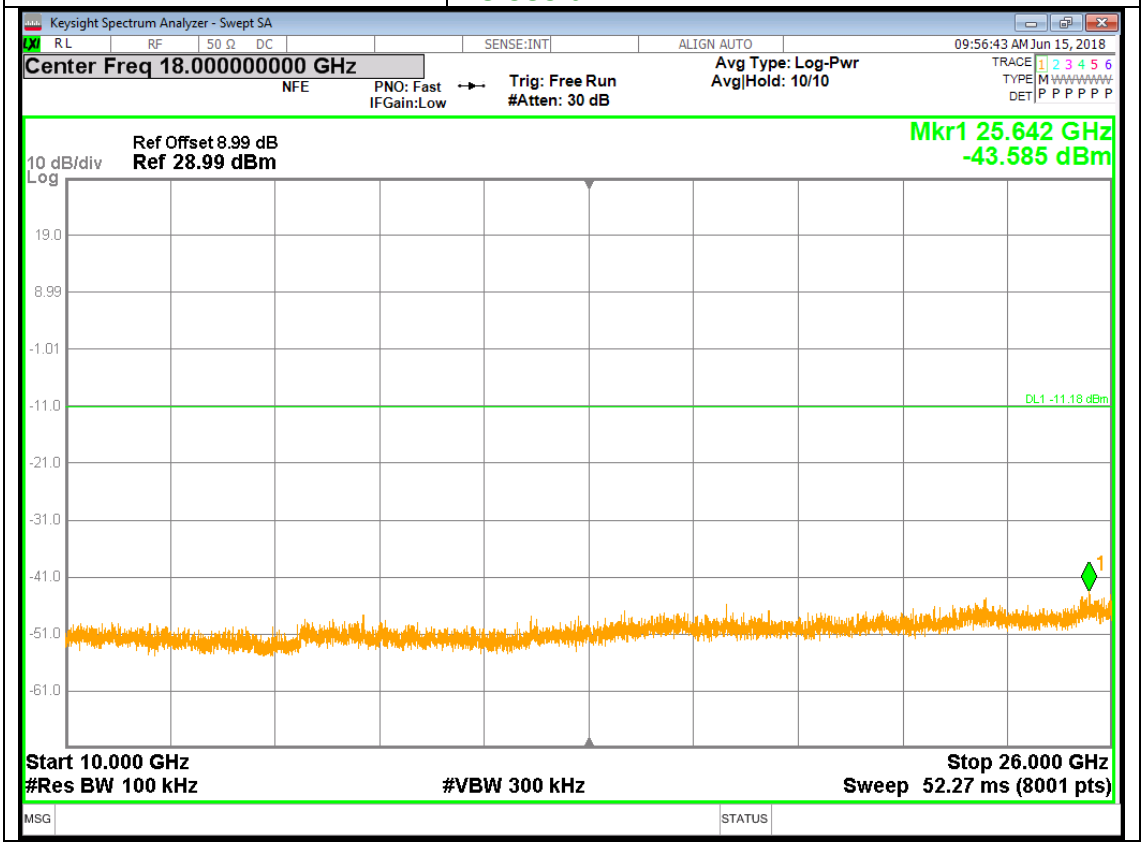
Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11B	Ant: Ant 0
Channel: LCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Pref:2410.025MHz@8.823 dBm**



Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11B	Ant: Ant 0
Channel: LCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:30~10000;3730.116MHz@ -46.242 dBm**

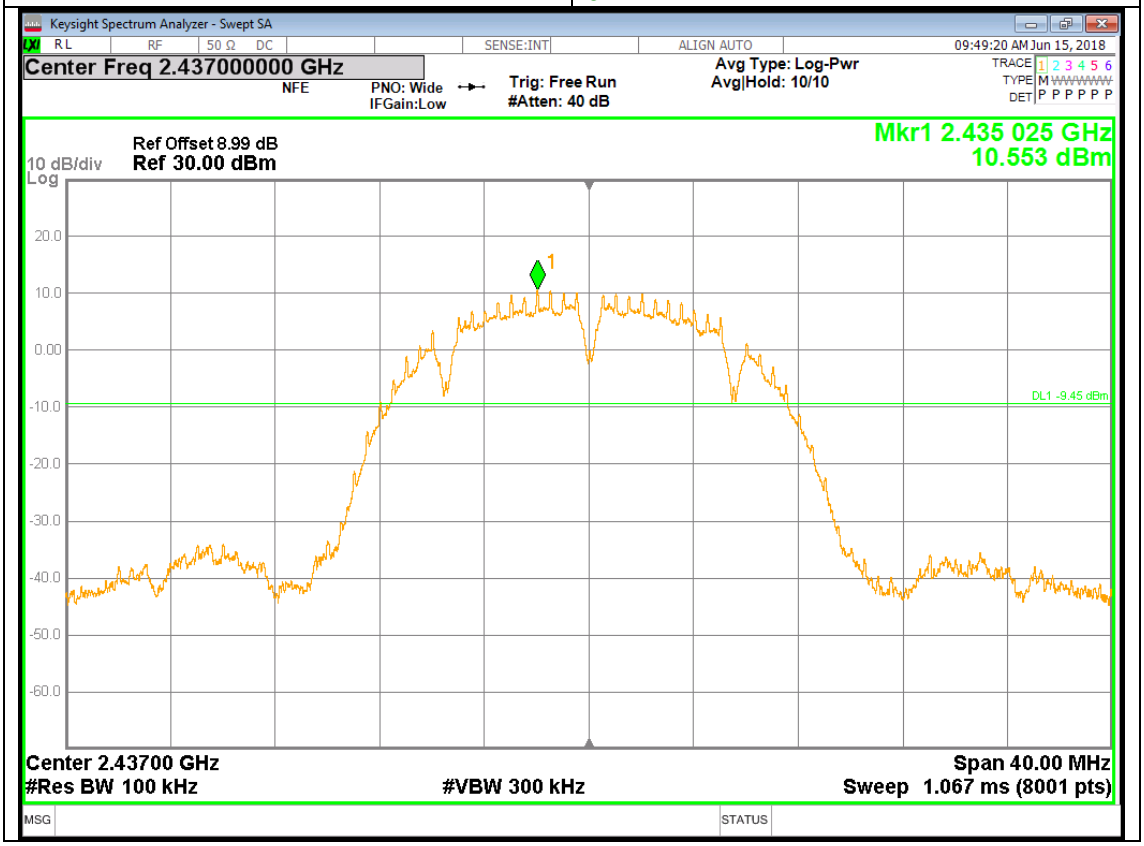


Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11B	Ant: Ant 0
Channel: LCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:10000~26000;25642.000MHz@-43.585 dBm**

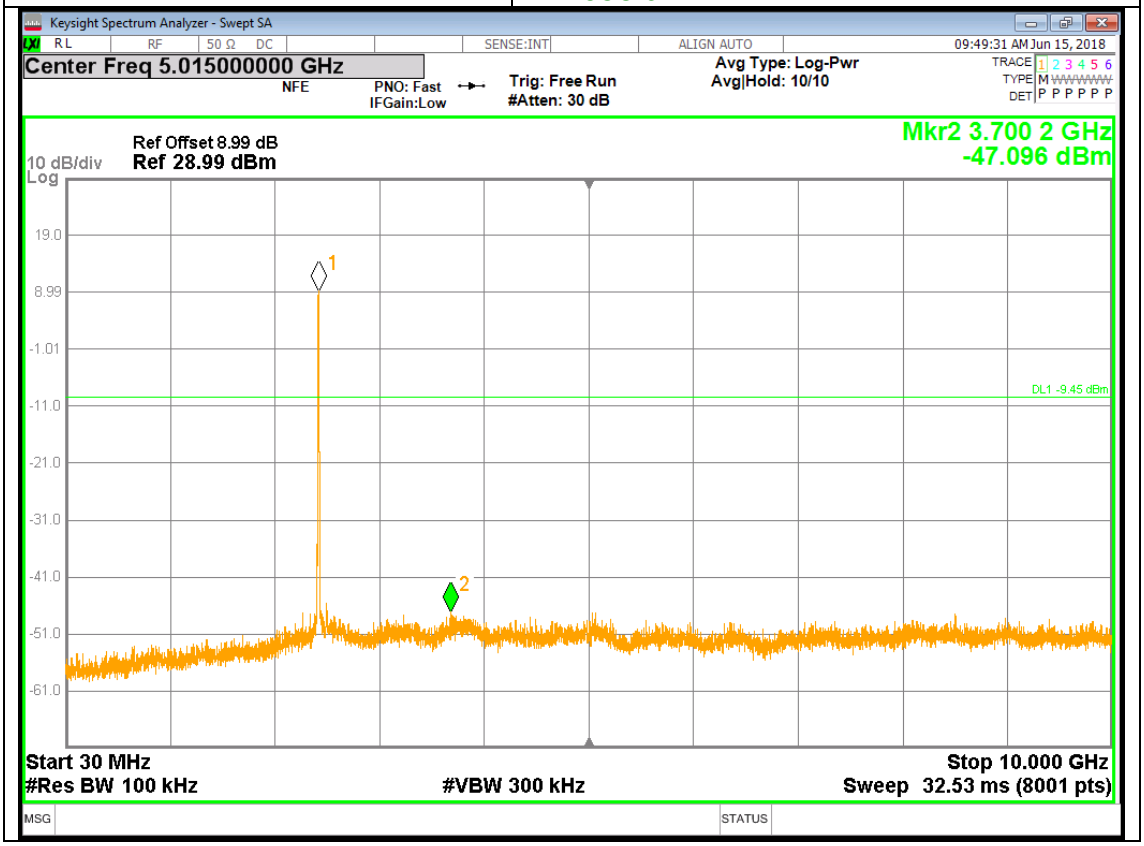


Middle Channel

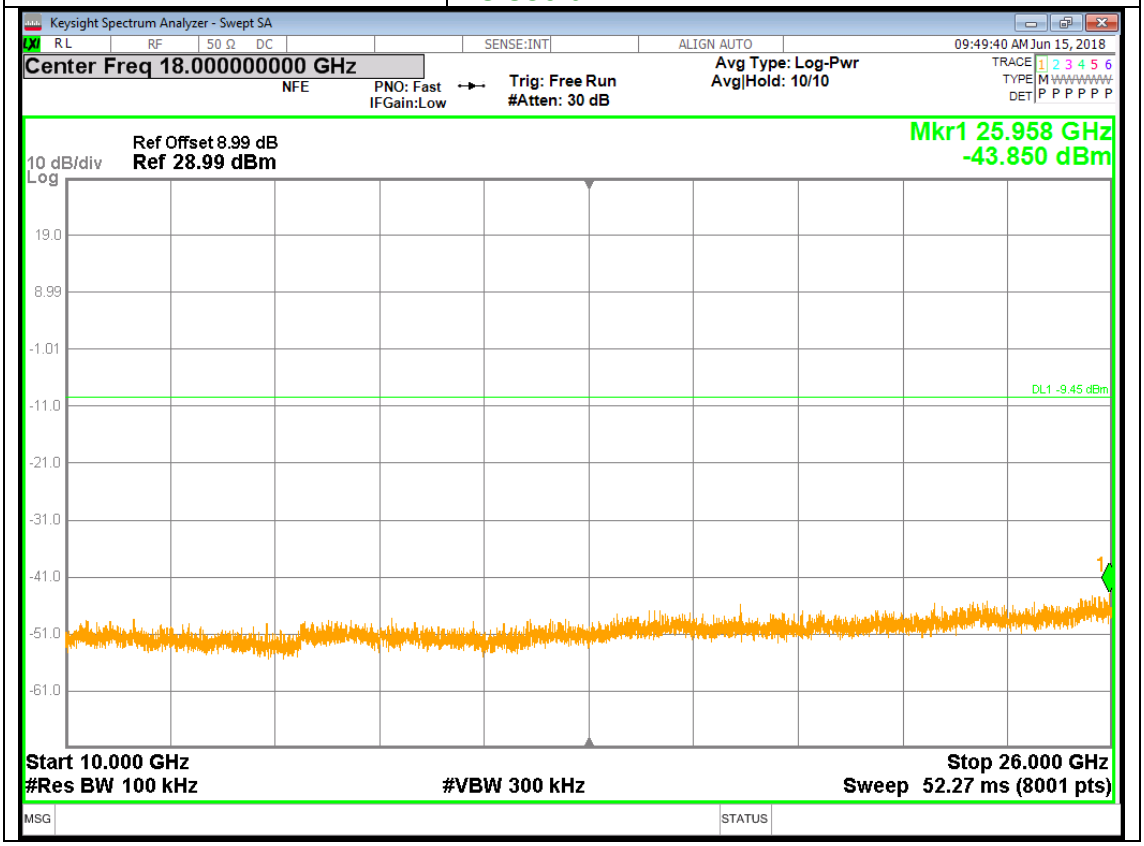
Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11B	Ant: Ant 0
Channel: MCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Pref:2435.025MHz@10.553 dBm**



Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11B	Ant: Ant 0
Channel: MCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:30~10000;3700.206MHz@ -47.096 dBm**

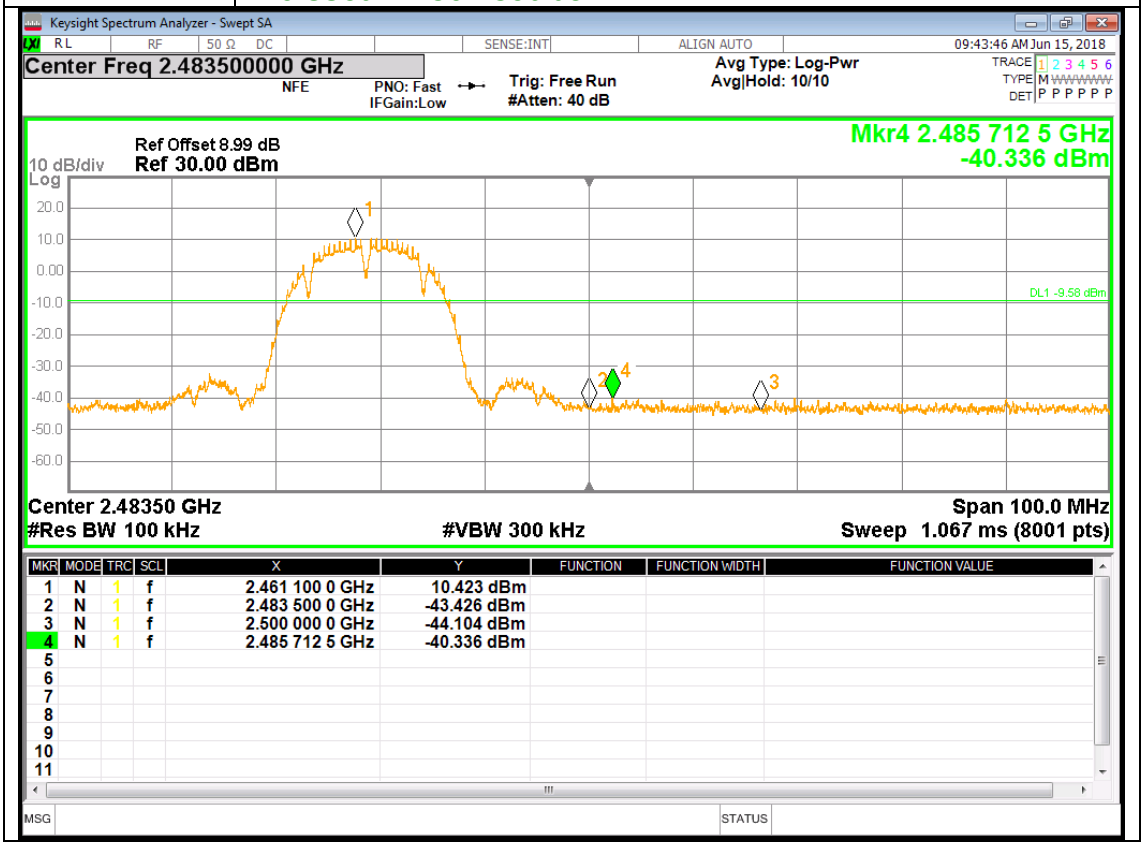


Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11B	Ant: Ant 0
Channel: MCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:10000~26000;25958.000MHz@-43.850 dBm**

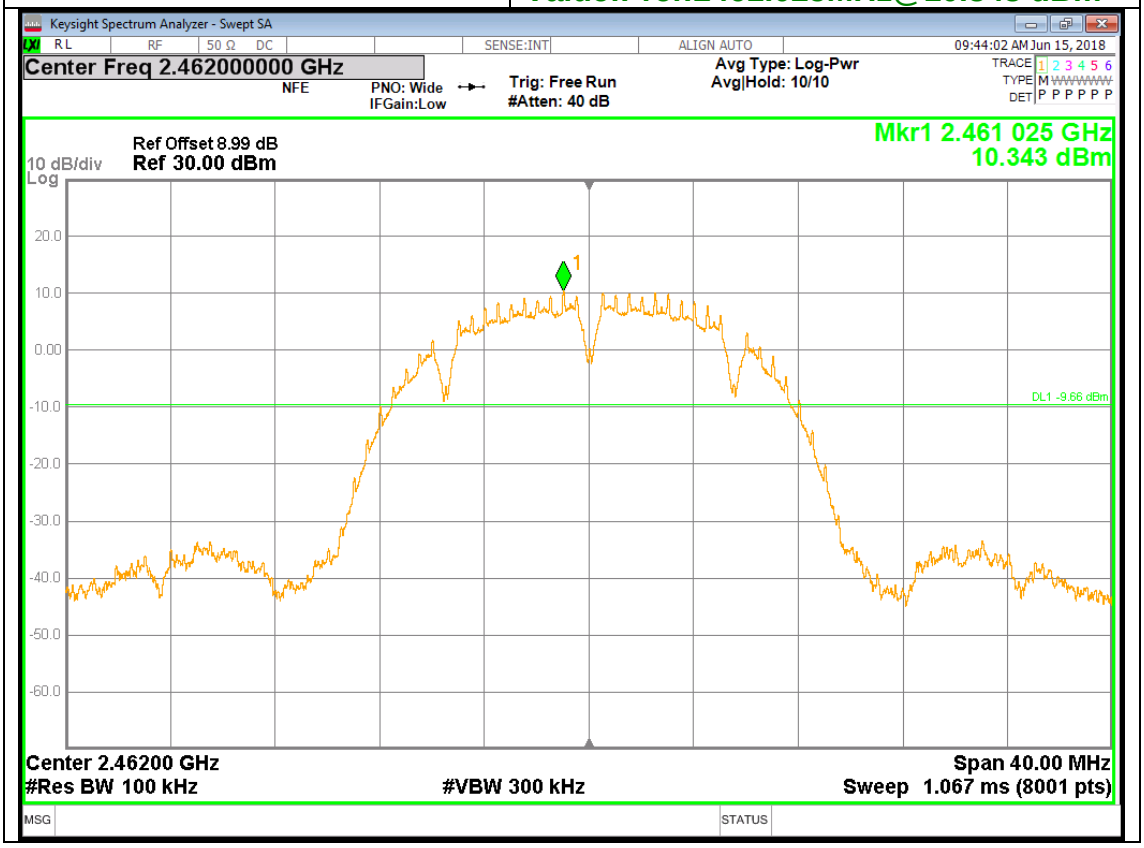


High Channel

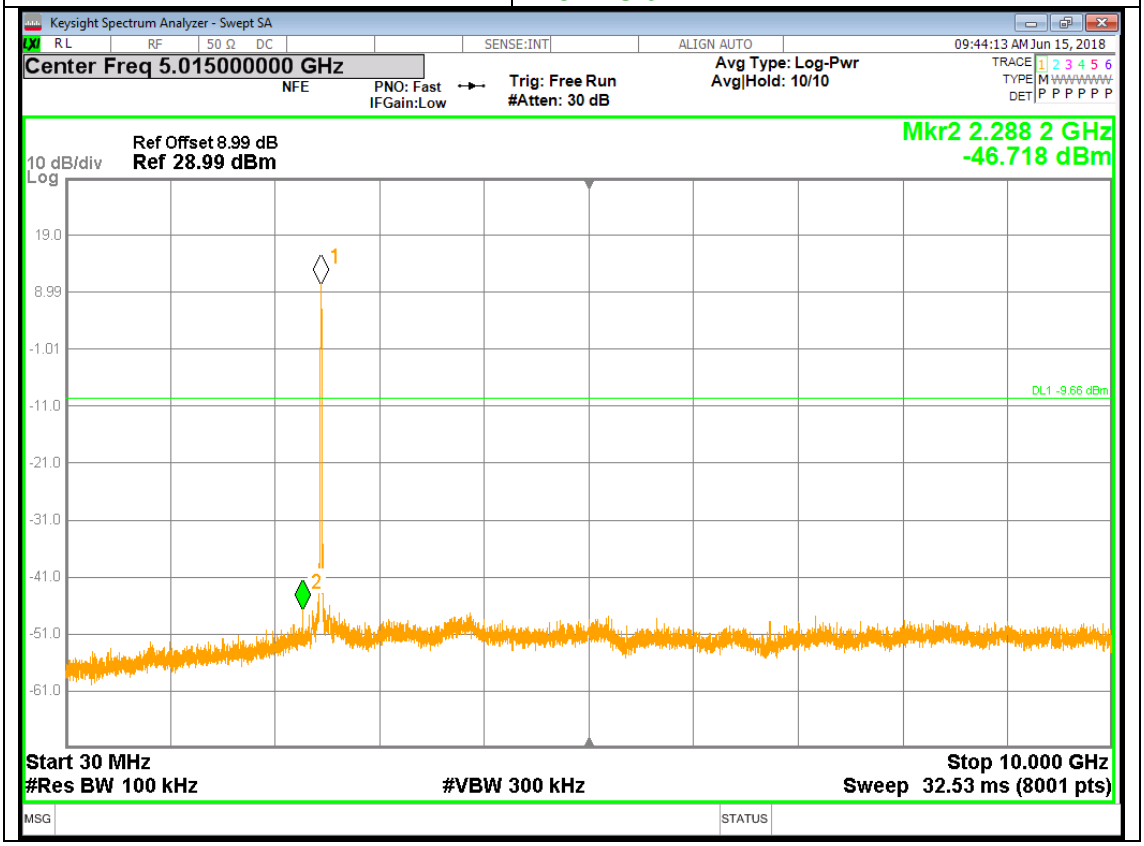
Test Case: Bandedge Compliance	
Mode: 11B	Ant: Ant 0
Channel: HCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Peak:10.423dBm;Max:2485.713MHz@ -40.336dBm50.759dbc**



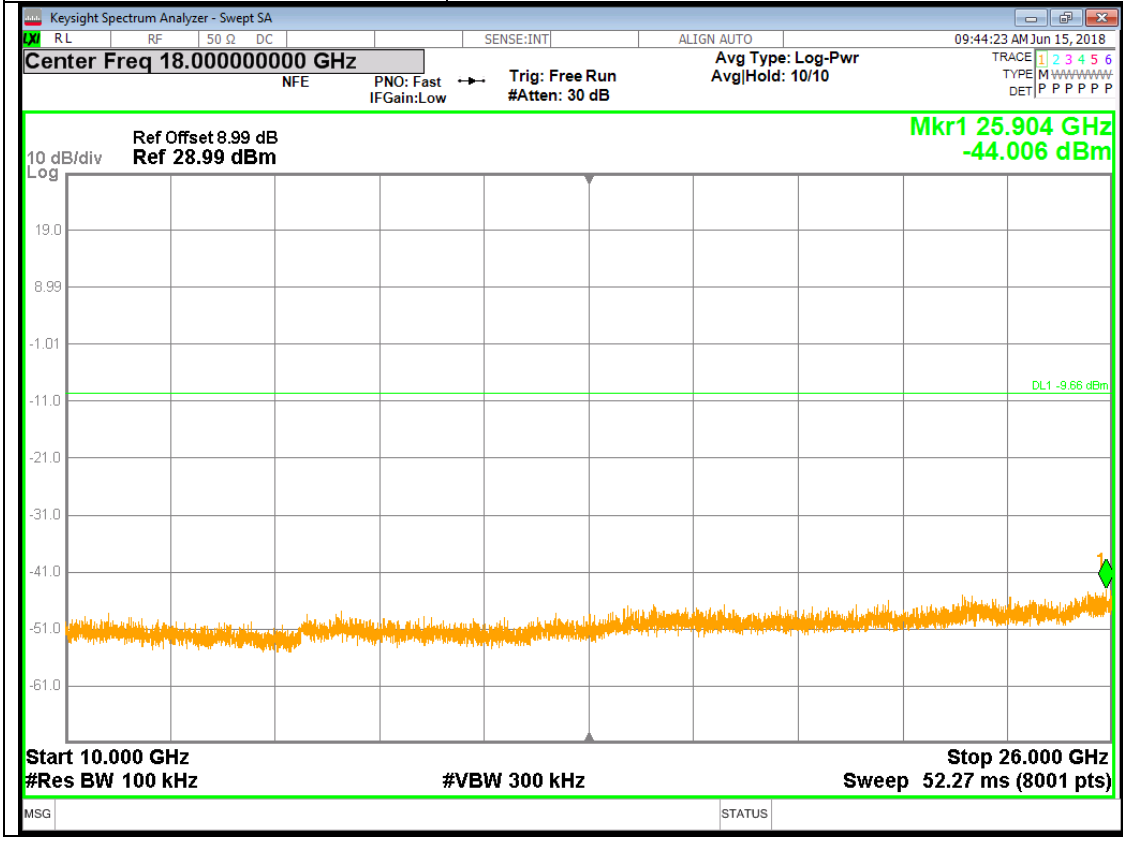
Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11B	Ant: Ant 0
Channel: HCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Pref:2461.025MHz@10.343 dBm**



Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11B	Ant: Ant 0
Channel: HCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:30~10000;2288.205MHz@ -46.718 dBm**



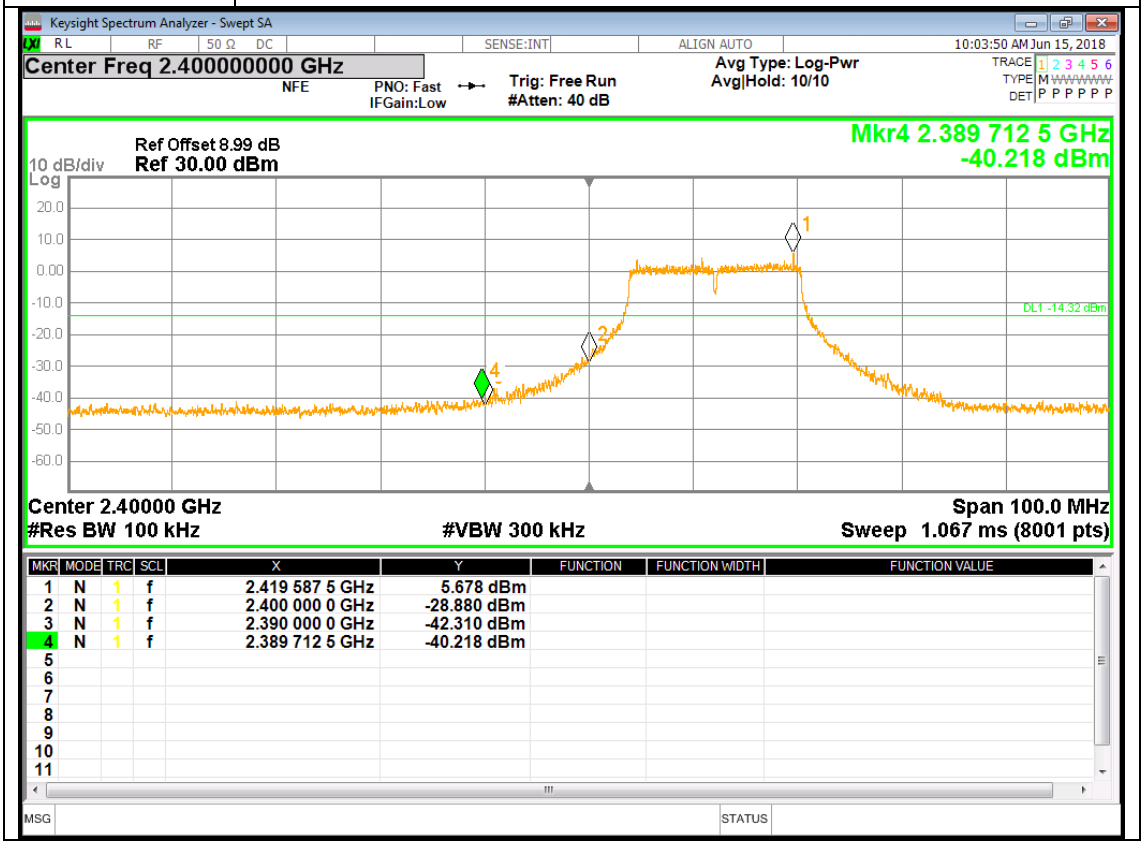
Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11B	Ant: Ant 0
Channel: HCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:10000~26000;25904.000MHz@ -44.006 dBm**



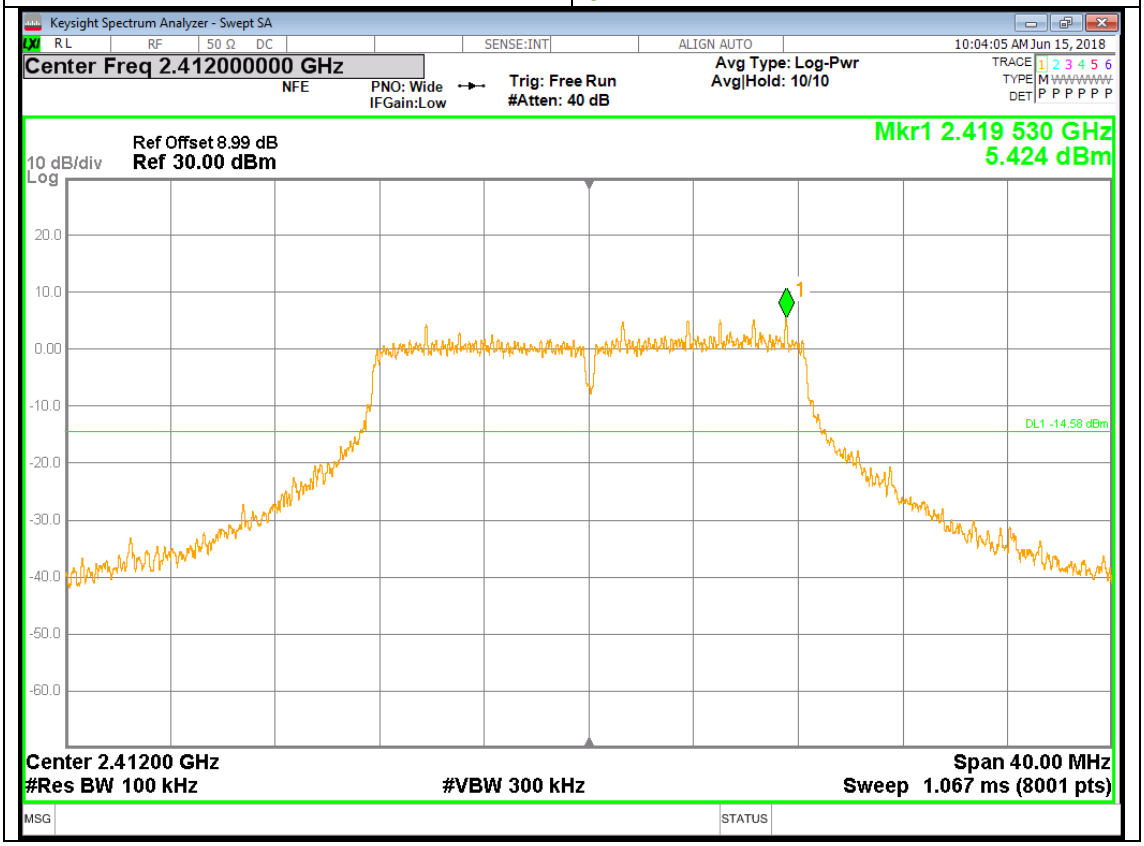
7.5.2. 802.11g SISO MODE

Low Channel

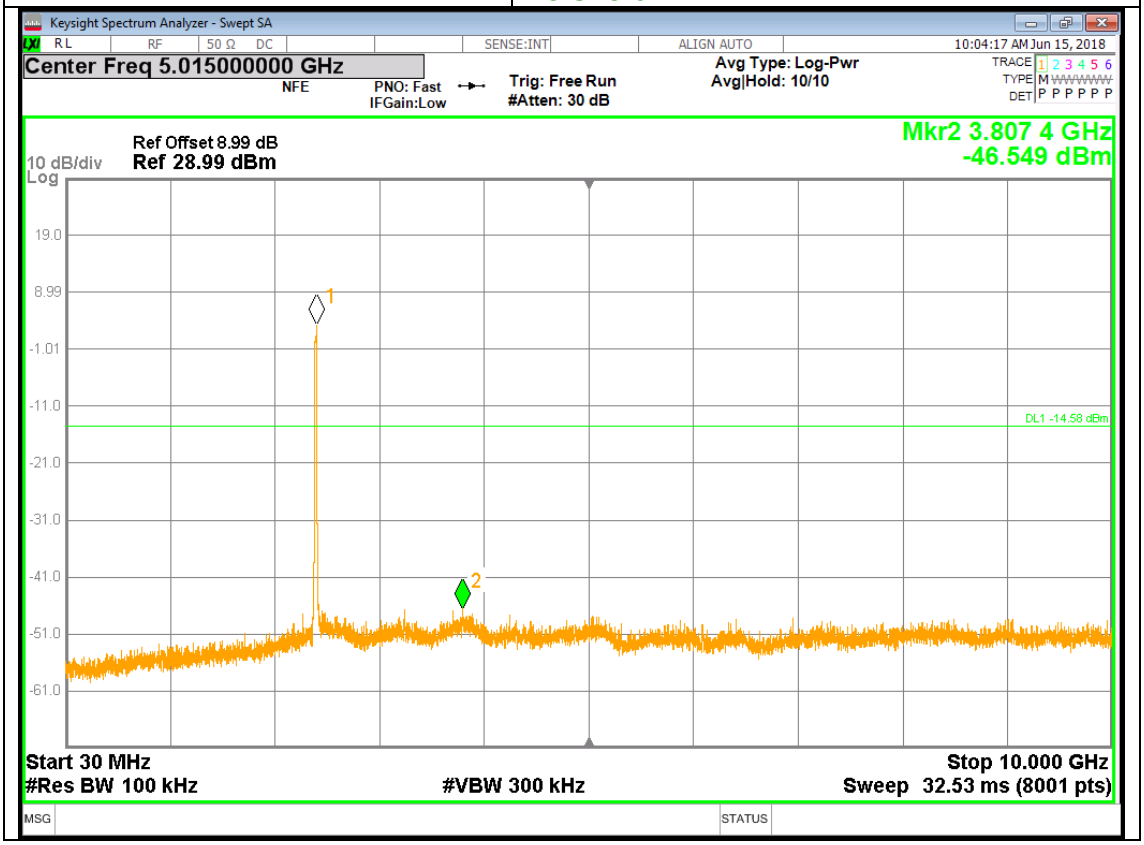
Test Case: Bandedge Compliance	
Mode: 11G	Ant: Ant 0
Channel: LCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Peak:5.678dBm;Max:2389.713MHz@ -40.218dBm45.896dbc**



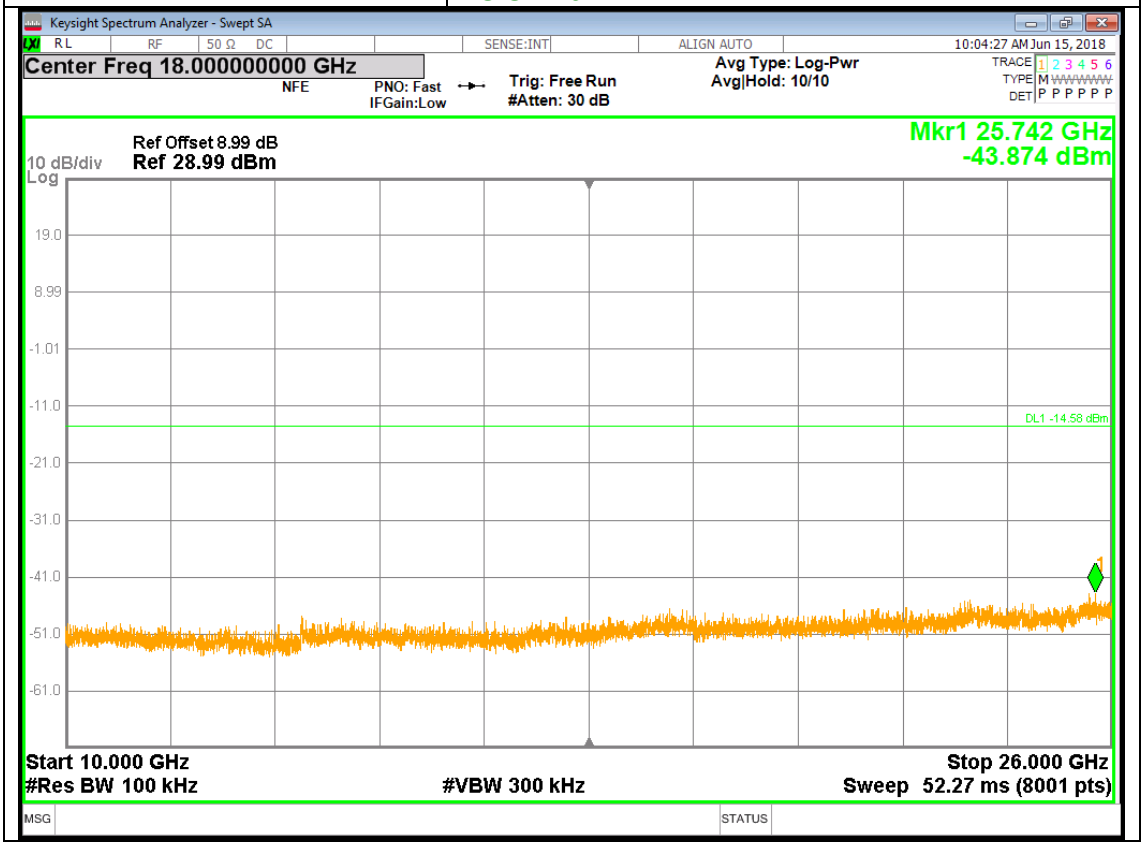
Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11G	Ant: Ant0
Channel: LCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Pref:2419.530MHz@5.424 dBm**



Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11G	Ant: Ant1
Channel: LCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:30~10000;3807.384MHz@-46.549 dBm**

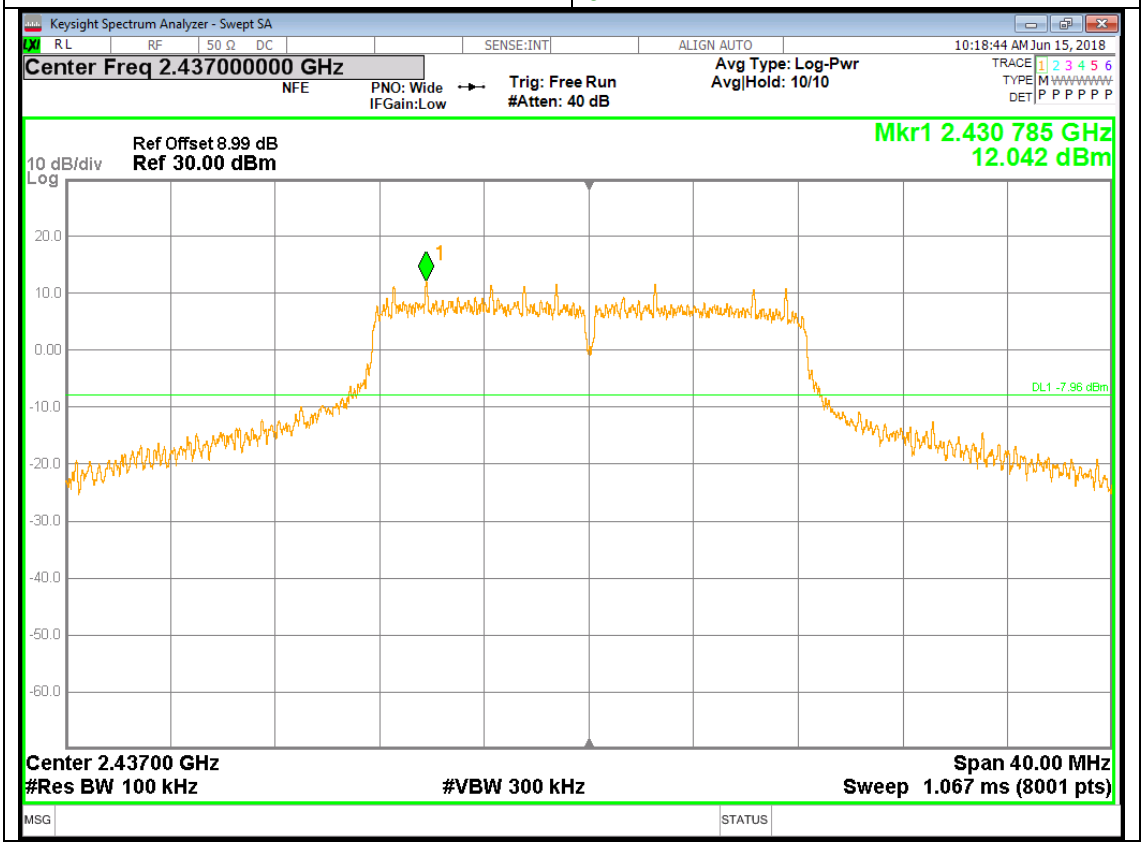


Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11G	Ant: Ant 0
Channel: LCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:10000~26000;25742.000MHz@-43.874 dBm**

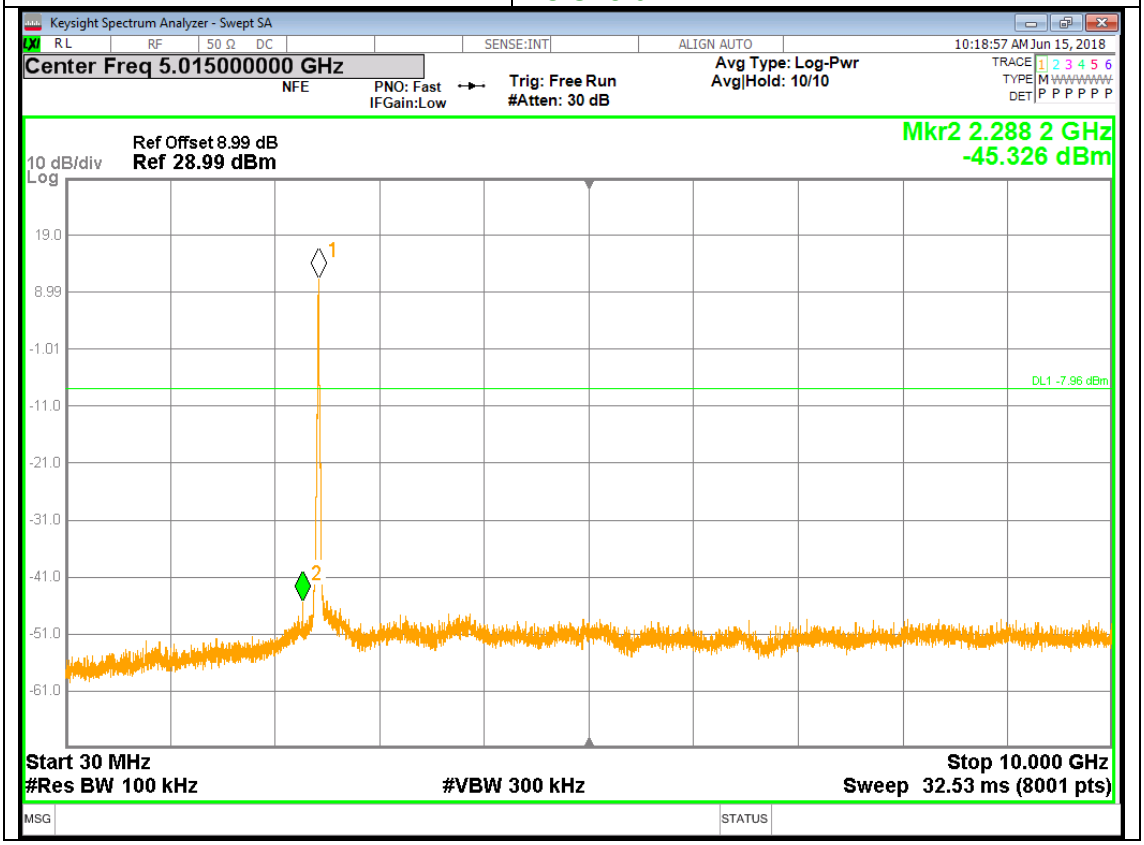


Middle Channel

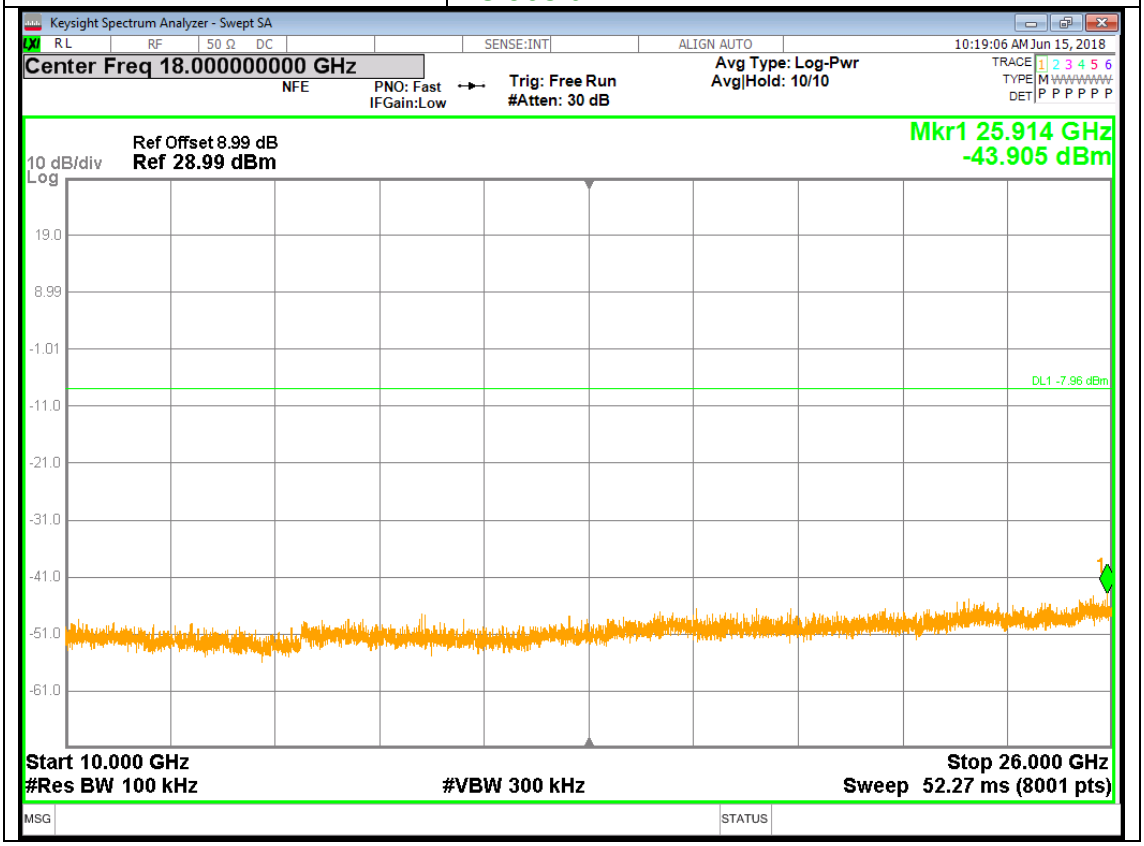
Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11G	Ant: Ant0
Channel: MCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Pref:2430.785MHz@12.042 dBm**



Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11G	Ant: Ant0
Channel: MCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:30~10000;2288.205MHz@-45.326 dBm**

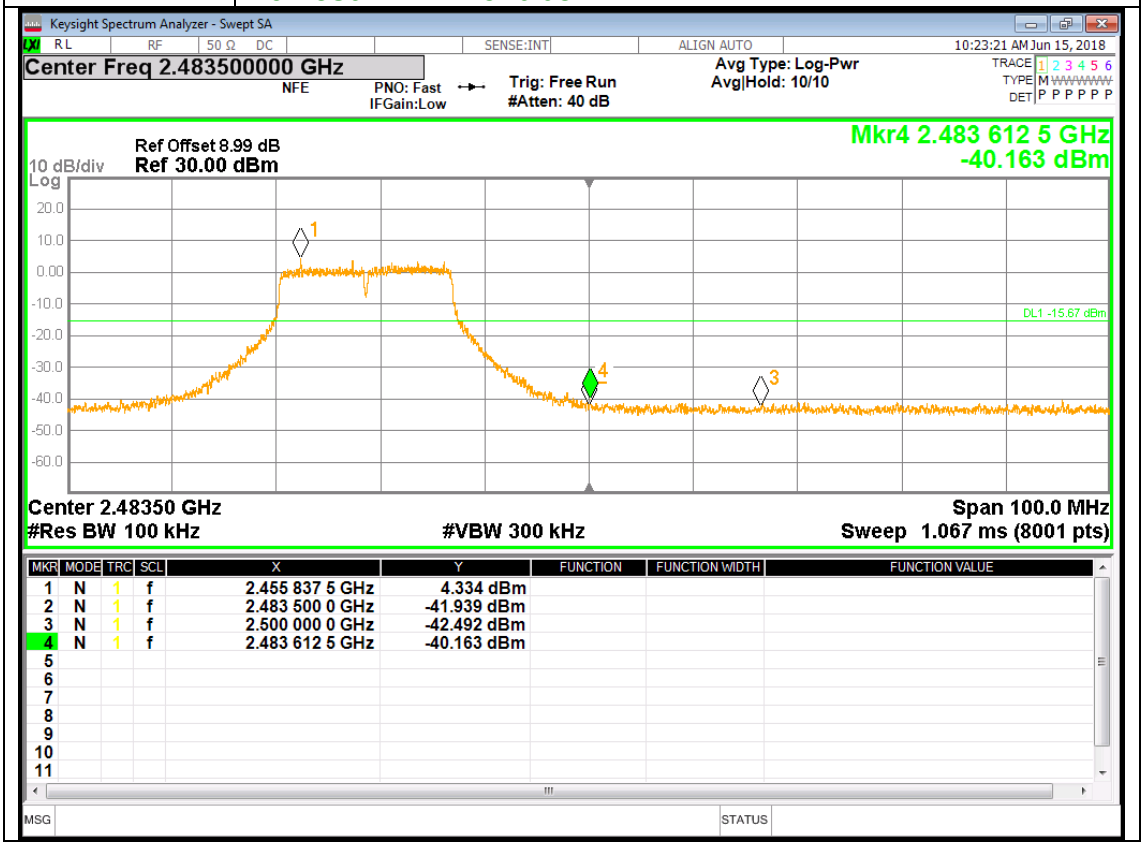


Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11G	Ant: Ant0
Channel: MCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:10000~26000;25914.000MHz@-43.905 dBm**

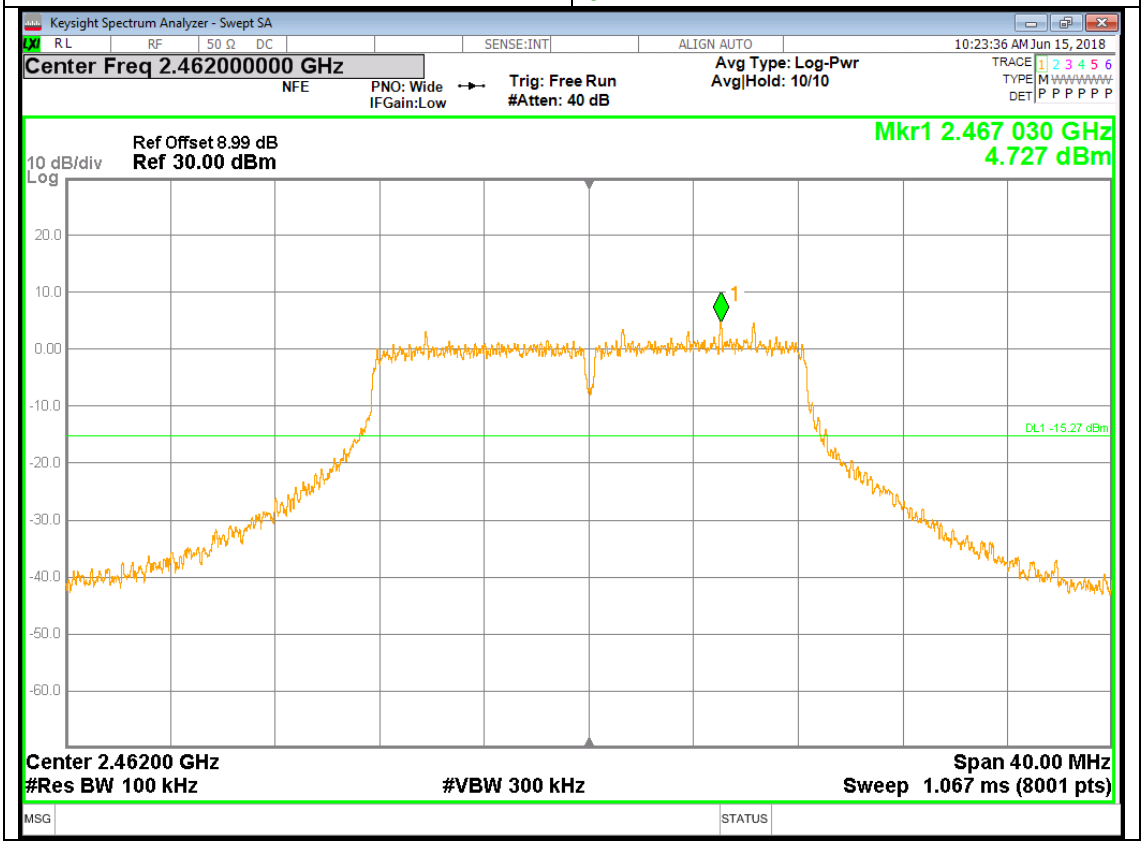


High Channel

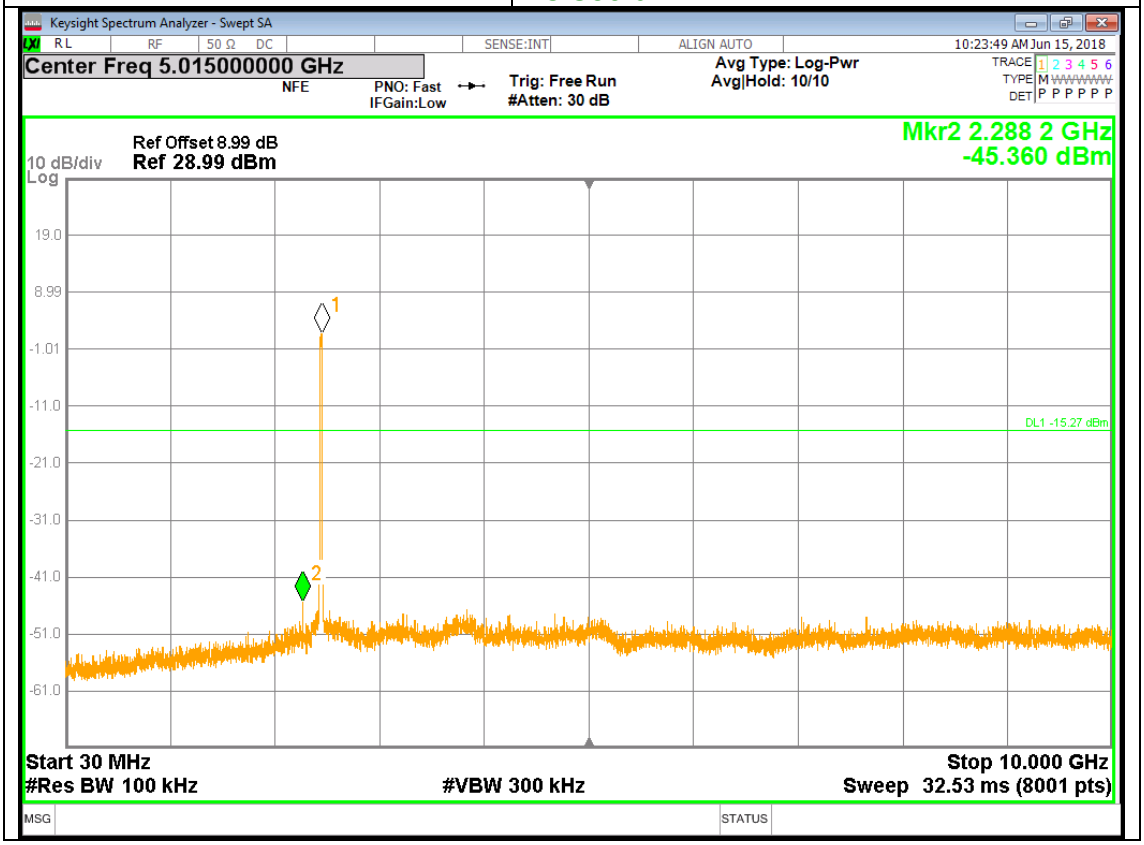
Test Case: Bandedge Compliance	
Mode: 11G	Ant: Ant0
Channel: HCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Peak:4.334dBm;Max:2483.613MHz@-40.163dBm44.497dbc**



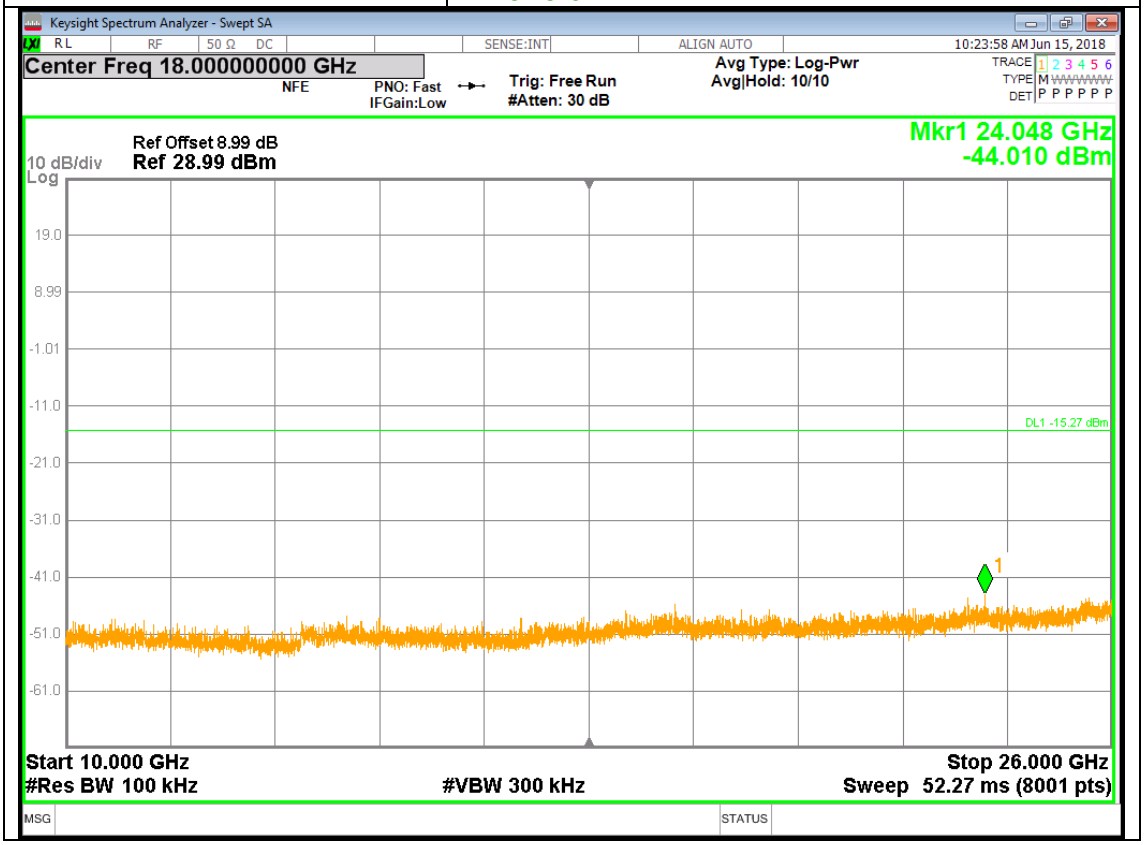
Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11G	Ant: Ant0
Channel: HCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Pref:2467.030MHz@4.727 dBm**



Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11G	Ant: Ant0
Channel: HCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:30~10000;2288.205MHz@-45.360 dBm**



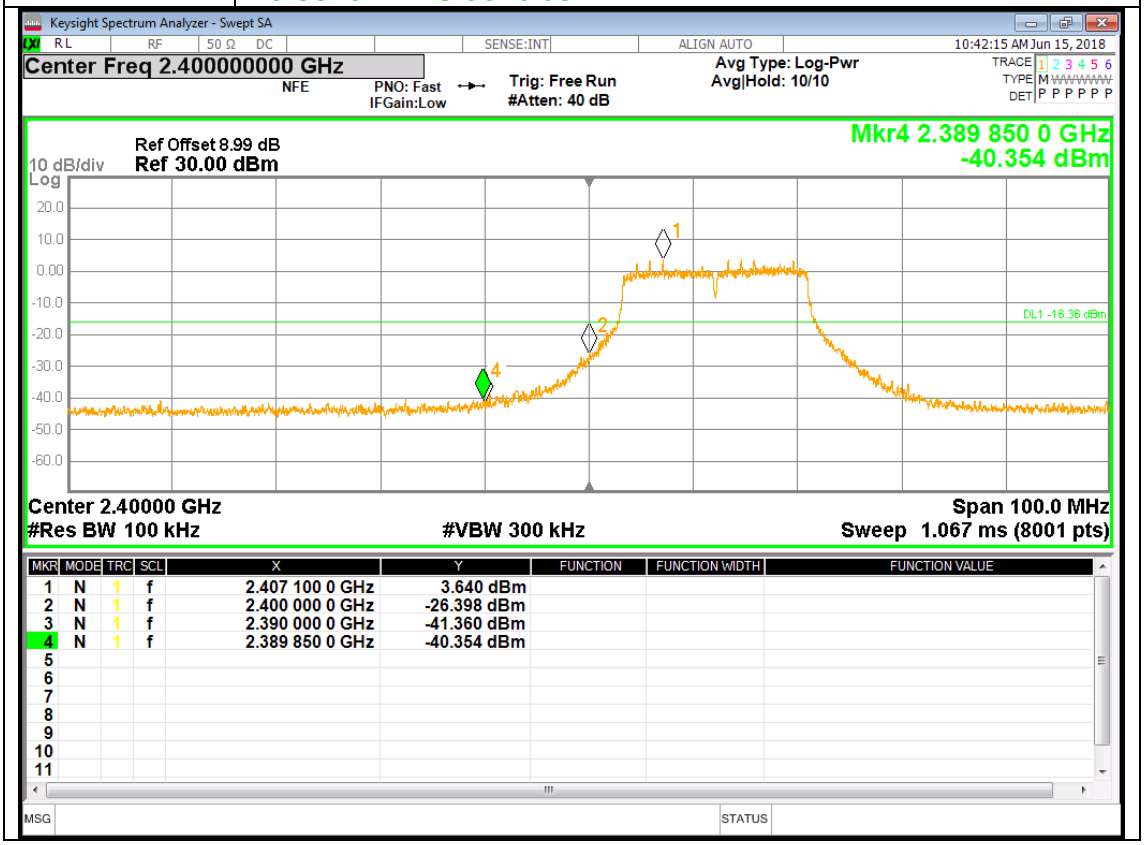
Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11G	Ant: Ant0
Channel: HCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:10000~26000;24048.000MHz@-44.010 dBm**



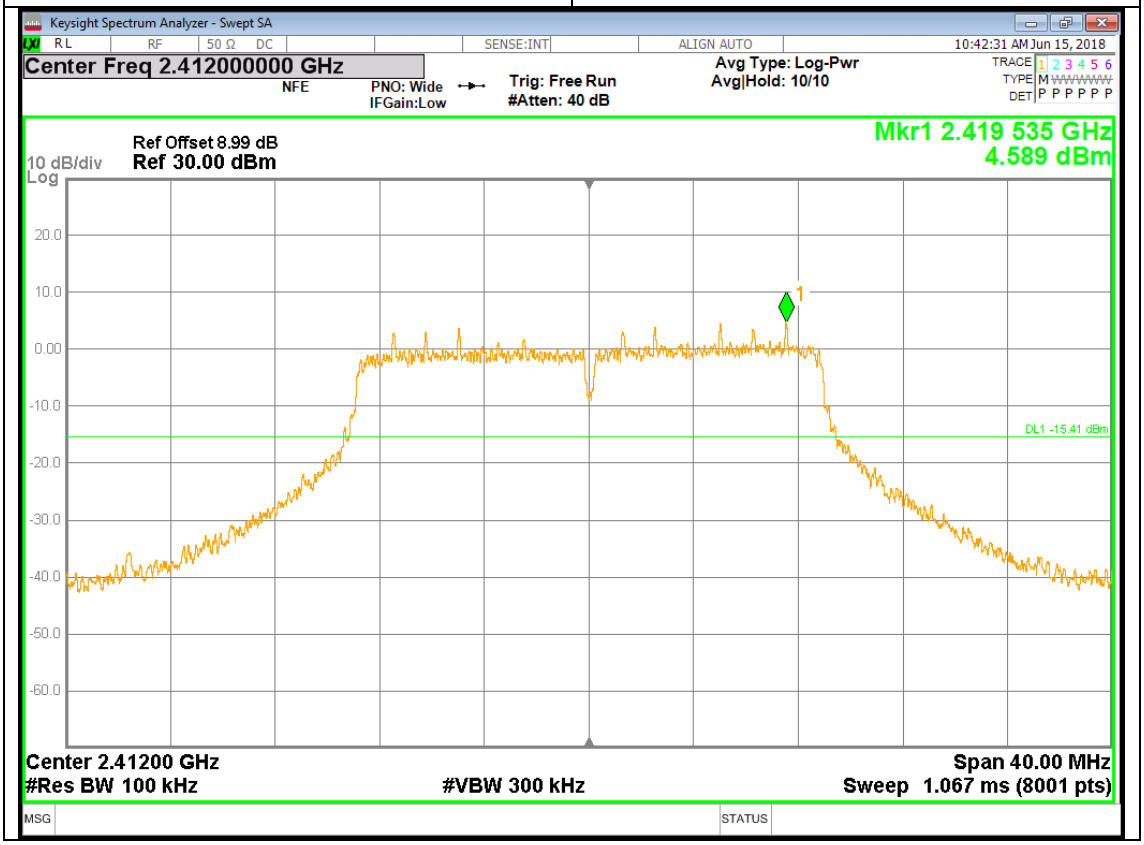
7.5.3. 802.11n20 SISO MODE

Low Channel

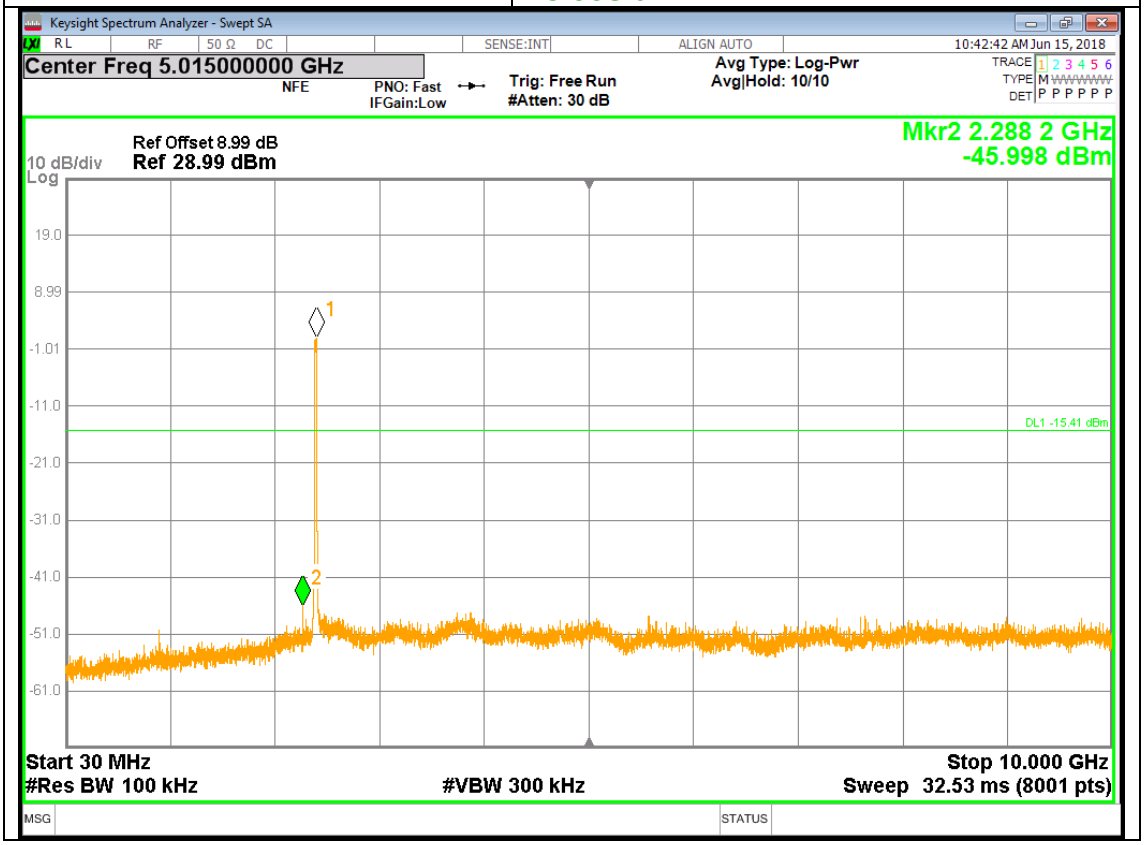
Test Case: Bandedge Compliance	
Mode: 11N20SISO	Ant: Ant0
Channel: LCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Peak:3.640dBm;Max:2389.850MHz@-40.354dBm43.994dbc**



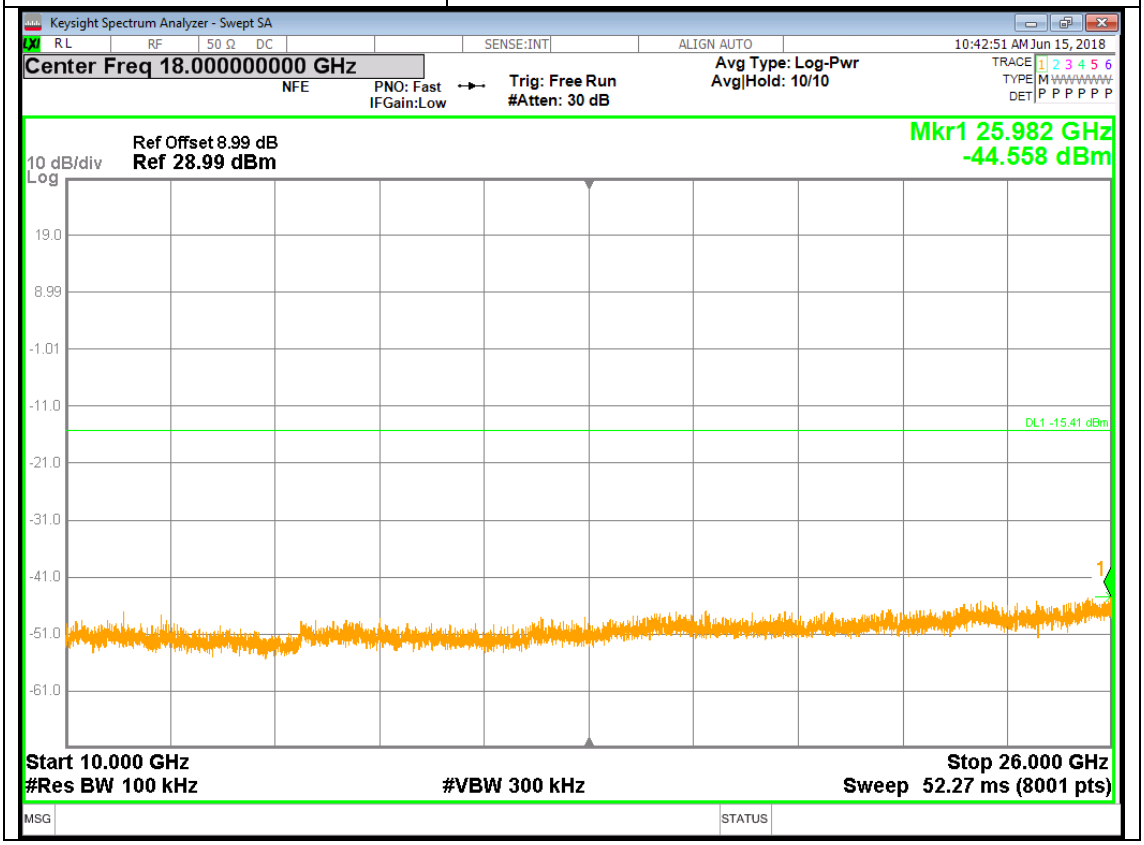
Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11N20SISO	Ant: Ant0
Channel: LCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Pref:2419.535MHz@4.589 dBm**



Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11N20SISO	Ant: Ant0
Channel: LCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:30~10000;2288.205MHz@-45.998 dBm**

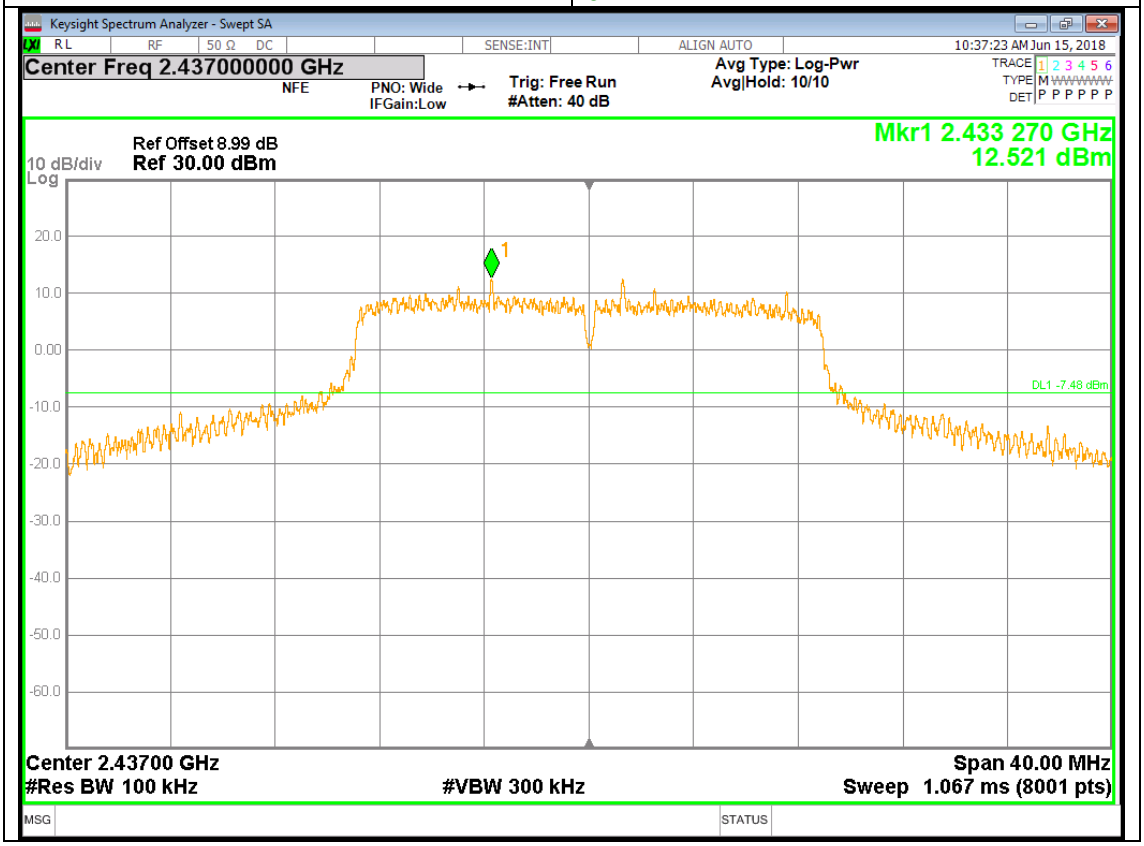


Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11N20SISO	Ant: Ant0
Channel: LCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:10000~26000;25982.000MHz@-44.558 dBm**

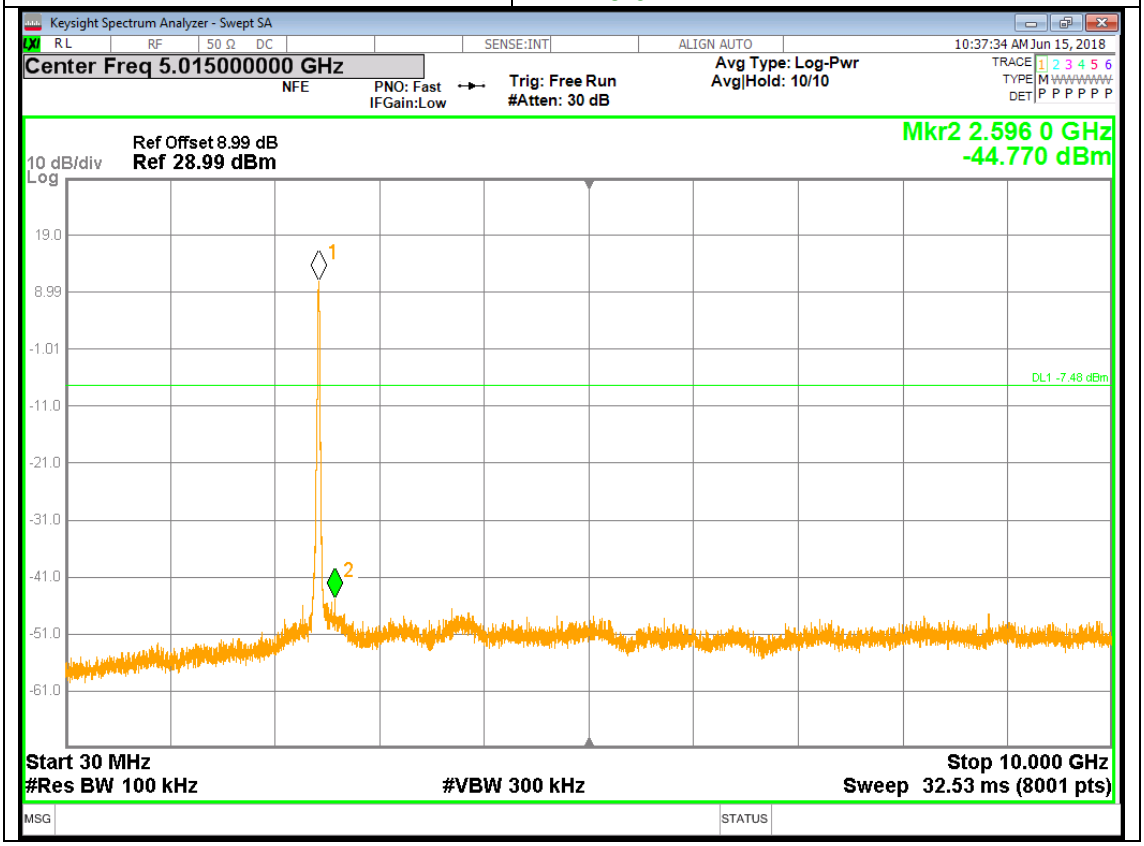


Middle Channel

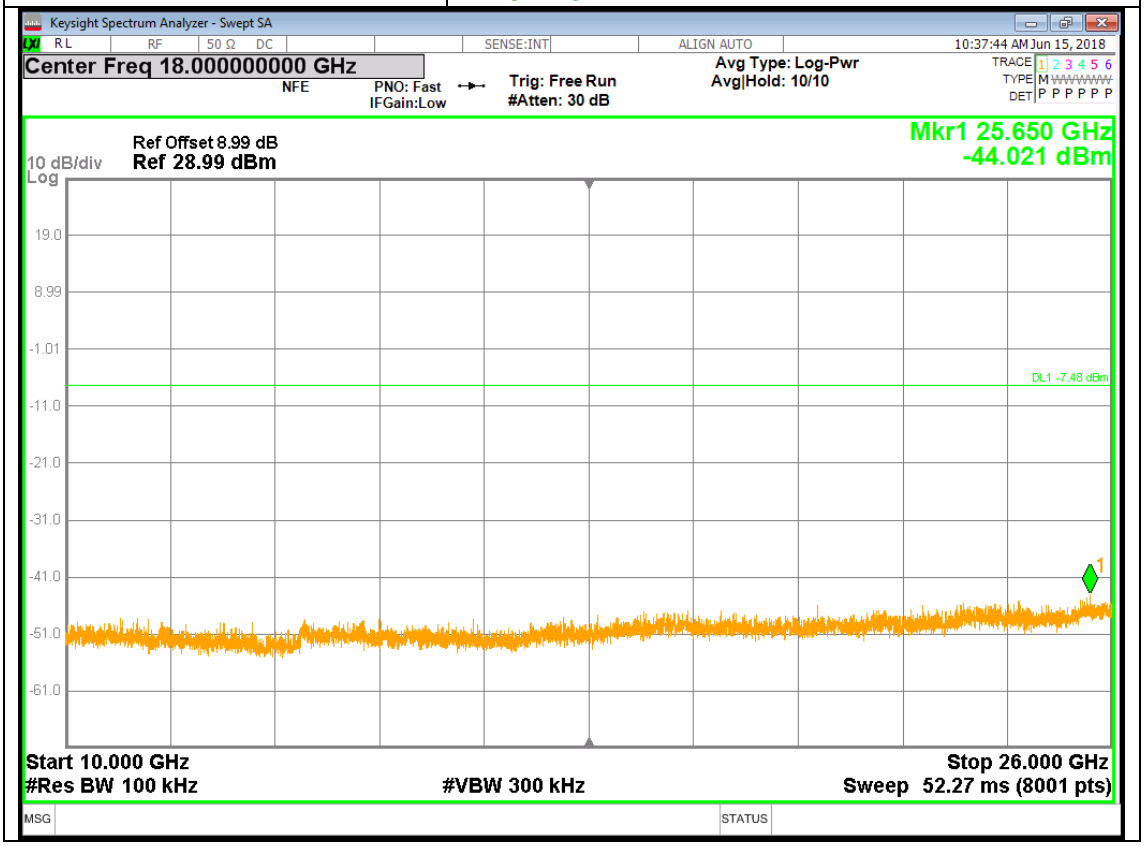
Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11N20SISO	Ant: Ant0
Channel: MCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Pref:2433.270MHz@12.521 dBm**



Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11N20SISO	Ant: Ant0
Channel: MCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:30~10000;2596.029MHz@-44.770 dBm**

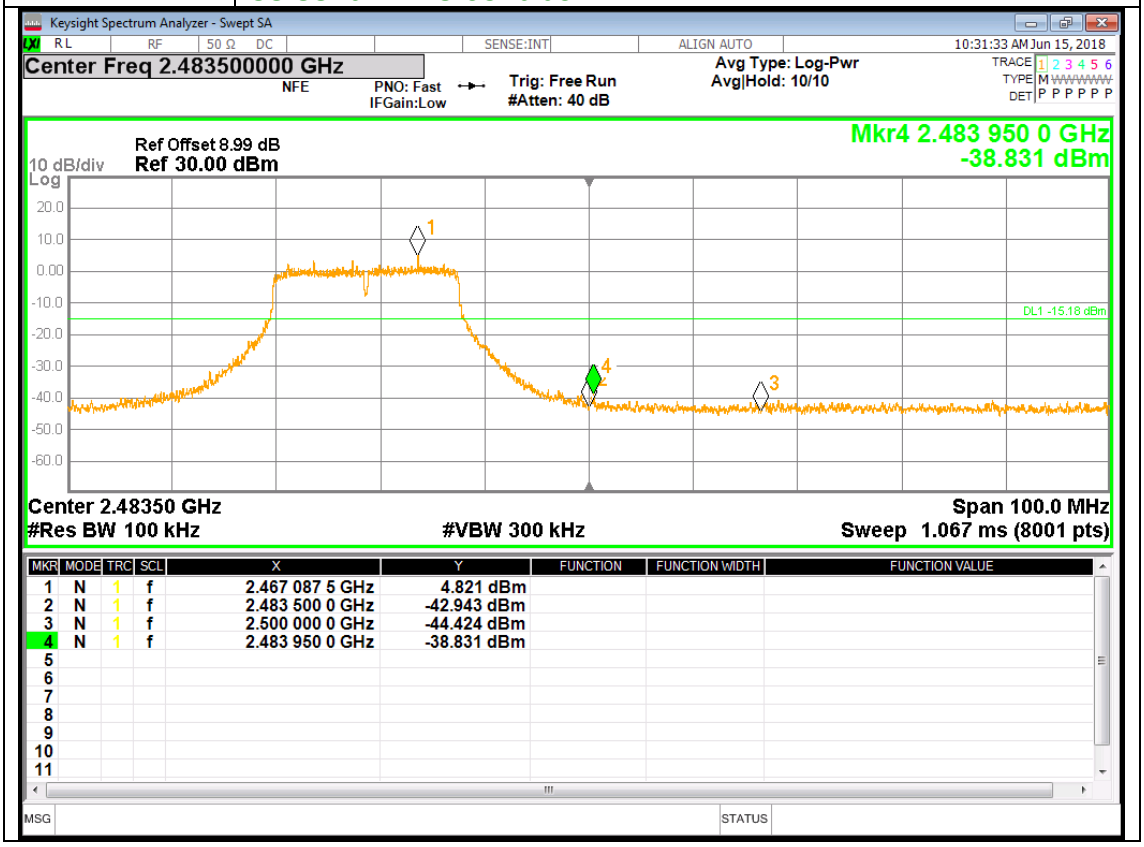


Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11N20SISO	Ant: Ant0
Channel: MCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:10000~26000;25650.000MHz@-44.021 dBm**

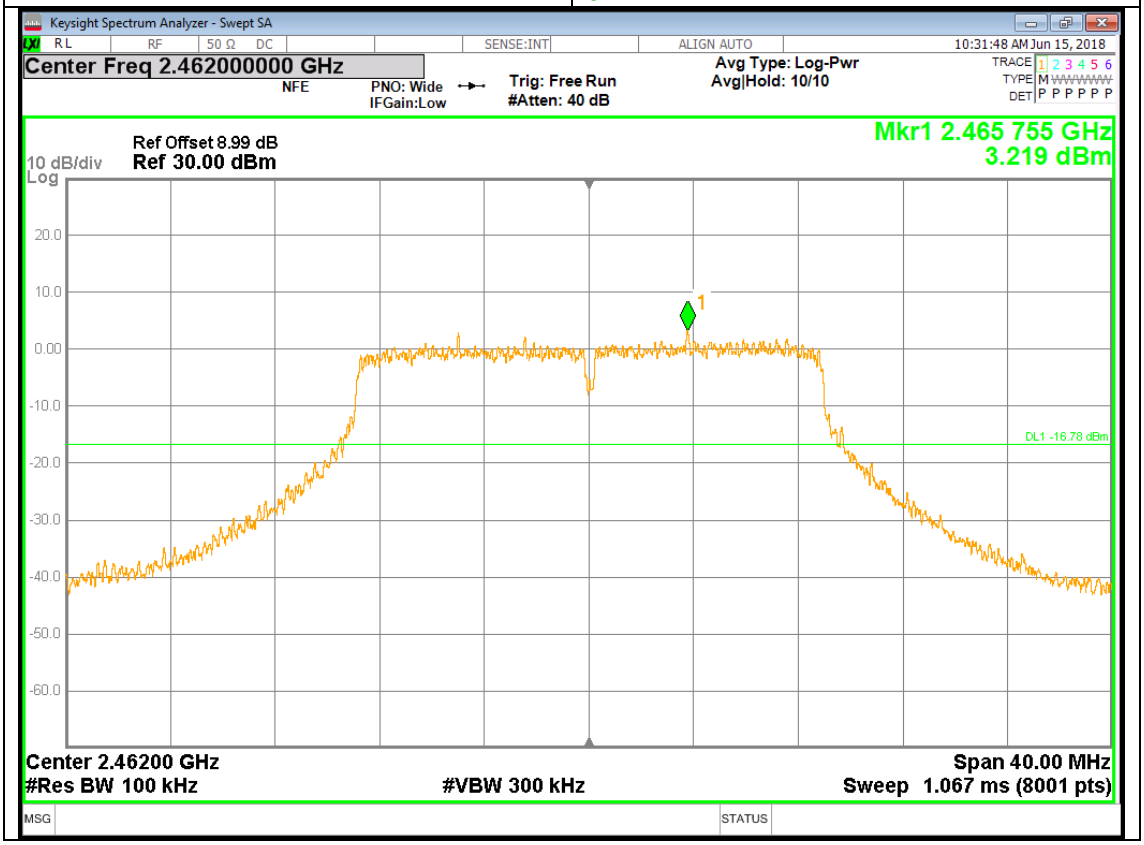


High Channel

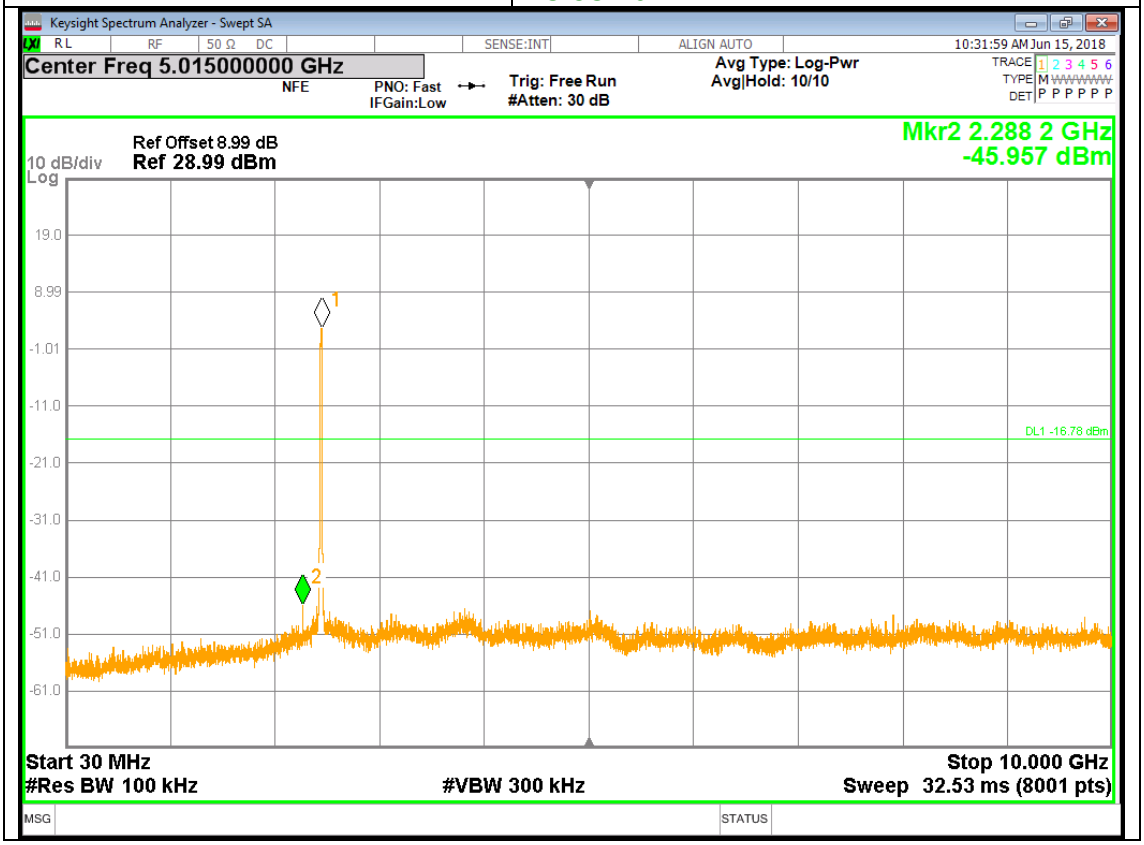
Test Case: Bandedge Compliance	
Mode: 11N20SISO	Ant: Ant0
Channel: HCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Peak:4.821dBm;Max:2483.950MHz@-38.831dBm43.652dbc**



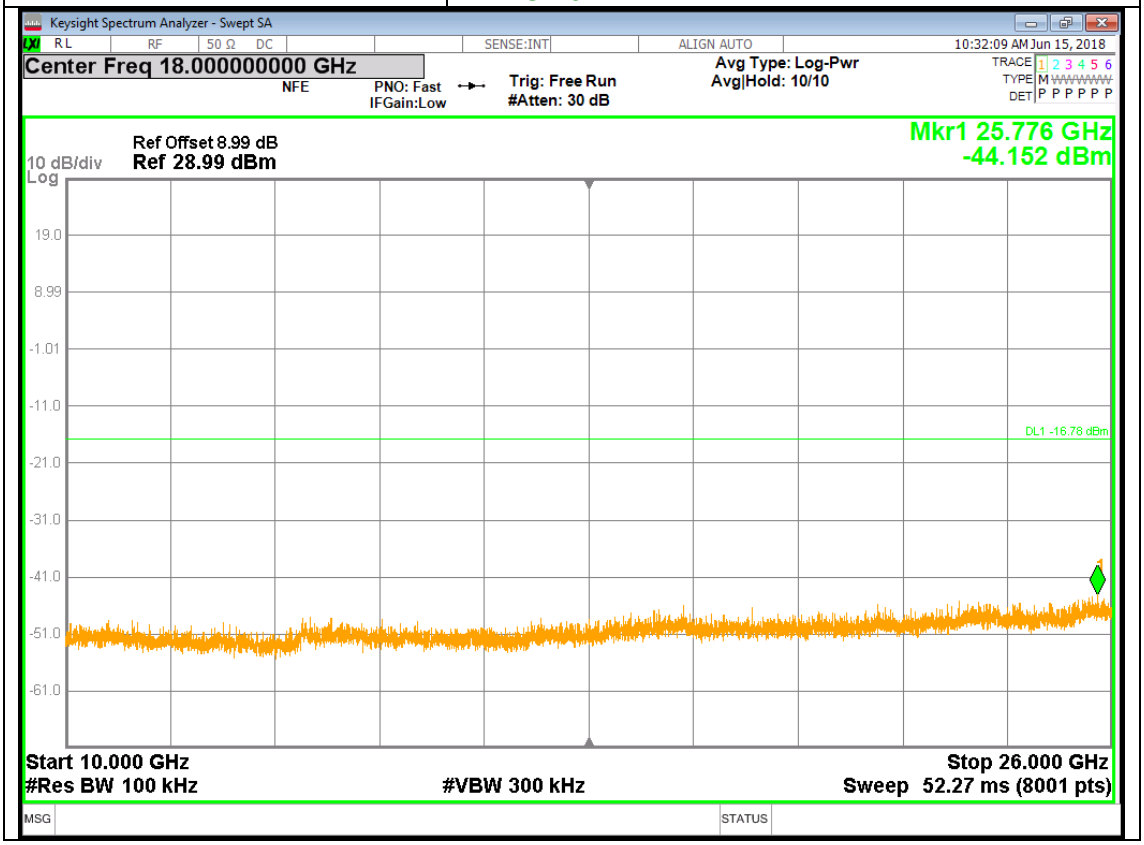
Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11N20SISO	Ant: Ant0
Channel: HCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Pref:2465.755MHz@3.219 dBm**



Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11N20SISO	Ant: Ant0
Channel: HCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:30~10000;2288.205MHz@-45.957 dBm**



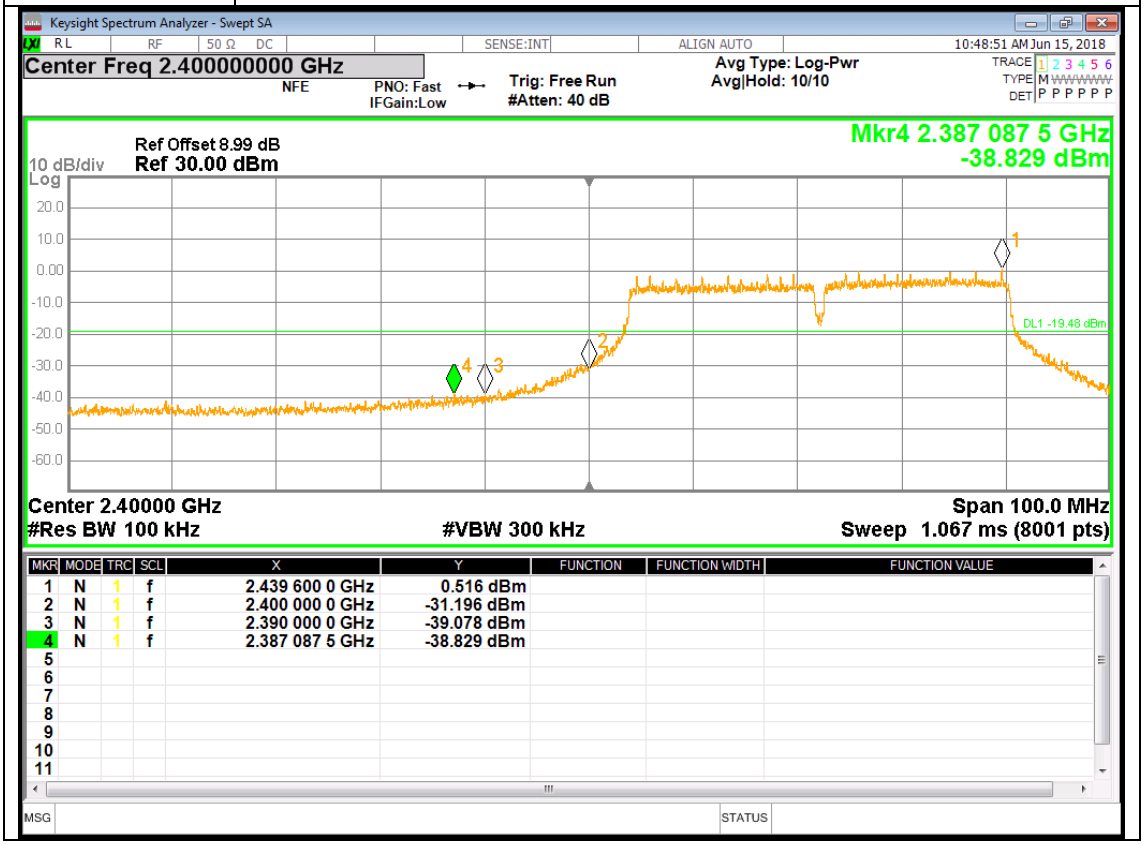
Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11N20SISO	Ant: Ant0
Channel: HCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:10000~26000;25776.000MHz@-44.152 dBm**



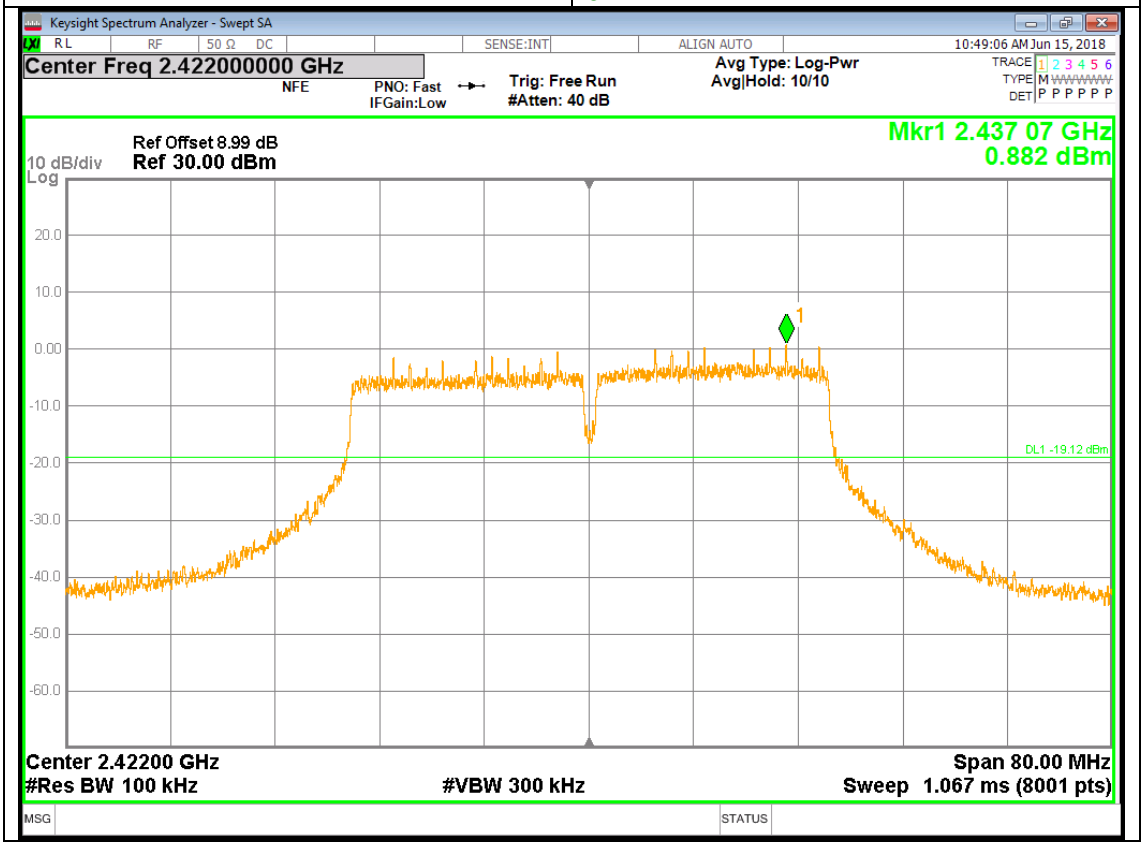
7.5.4. 802.11n40 SISO MODE

Low Channel

Test Case: Bandedge Compliance	
Mode: 11N40SISO	Ant: Ant0
Channel: LCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Peak:0.516dBm;Max:2387.088MHz@-38.829dBm39.345dbc**



Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11N40SISO	Ant: Ant0
Channel: LCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Pref:2437.070MHz@0.882 dBm**



Test Case: Unwanted Emissions In Non-restricted Frequency Bands	
Mode: 11N40SISO	Ant: Ant0
Channel: LCH	Voltage: VN
Temperature: TN	**Result: PASS** **Value:Puw:30~10000;3939.486MHz@-46.450 dBm**