RADIO TEST REPORT

Product	:	MiiS Horus Control Unit Set
Model Name	:	MiiS Horus Scope DSC 300
Model No. of Lens	:	MiiS Horus^{+} Scope DEC 200, MiiS Horus^{+} Scope DEA 200, MiiS Horus^{+} Scope DGC 200, MiiS Horus Scope DAR 100
FCC ID	:	2AFB3M-DSC300
Test Regulation	:	FCC 47 CFR Part 15 Subpart C (Section 15.247)
Received Date	:	May 28, 2019
Test Date	:	May 28, 2019 ~ Jul. 5, 2019
Issued Date	:	Aug. 6, 2019
Applicant	:	Medimaging Integrated Solution Inc. 3F., No.24-2, Industry E. Rd. IV, Hsinchu Science Park, Hsinchu, Taiwan 30077, R.O.C.
Issued By	:	Underwriters Laboratories Taiwan Co., Ltd. Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Testing Laboratory
3398

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REVISION HISTORY

Original Test Report No.: 4788934739-US-R0-V0

Rev.	Test report No.	Date	Page revised	Contents
Original	4788934739-US-R0-V0	Aug. 6, 2019	-	Initial issue

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1. Attestation of Test Results

APPLICANT:	Medimaging Integrated Solution Inc. 3F., No.24-2, Industry E. Rd. IV, Hsinchu Science Park, Hsinchu, Taiwan 30077, R.O.C.
MANUFACTURER	Medimaging Integrated Solution Inc. 3F., No.24-2, Industry E. Rd. IV, Hsinchu Science Park, Hsinchu, Taiwan 30077, R.O.C.
EUT DESCRIPTION:	MiiS Horus Control Unit Set
BRAND:	horus SCOPE
MODEL:	MiiS Horus Scope DSC 300
MODEL NO. OF LENS:	MiiS Horus^{+} Scope DEC 200, MiiS Horus^{+} Scope DEA 200, MiiS Horus^{+} Scope DGC 200, MiiS Horus Scope DAR 100
SAMPLE STAGE:	Production equivalent
DATE of TESTED:	May 28, 2019 ~ Jul. 5, 2019

APPLICABLE STANDARDS	
STANDARD	**Test Results**
FCC 47 CFR PART 15 Subpart C (Section 15.247)	PASS

Underwriters Laboratories Taiwan Co., 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 Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. 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 Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., 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 NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

Cindy Hsin Date : Aug. 6, 2019
Project Handler

Approved and Authorized By:

Stanley Wu Date : Aug. 6, 2019
Senior Project Engineer

2. Summary of Test Results

Summary of Test Results		
FCC Clause	**Test Items**	**Result**
15.247(a)(2)	6dB Bandwidth	PASS
15.247(b)	Conducted Output Power	PASS
15.247(e)	Power Spectral Density	PASS
15.247(d)	Antenna Port Emission	PASS
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS
15.207	AC Power Conducted Emission	PASS
15.203	Antenna Requirement	PASS

Note:
1. For the Radiated Band Edge test plots were recorded in Appendix I, the Radiated Emissions test plots were recorded in Appendix II.

3. 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 v05r02, KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013 and KDB 662911 D01 Multiple Transmitter Output v02r01.

4. Facilities and Accreditation

Test Location	Underwriters Laboratories Taiwan Co., Ltd.
Address	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Accreditation Certificate	Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398. The full scope of accreditation can be viewed at http://accreditation.taftw.org.tw/taf/public/basic/viewApplyItems.action?unitNo=3398

5. Measurement Uncertainty

For statement of conformity, accuracy method (Section 8.2.4 and 8.2.5 of ISO Guide 98-4) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor k=2.

Test Item	Measurement Frequency Range	K	U(dB)
Conducted disturbance at mains terminals ports	0.15MHz ~ 30MHz	2	1.7
RF Conducted	9 kHz - 40GHz	2	1.0
Radiated disturbance below 30MHz	9 kHz - 30 MHz	2	2.2
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	2	5.3
Radiated disturbance above 1GHz	1GHz ~ 40GHz	2	4.8

6. Equipment under Test

6.1. Description of EUT

Product	MiiS Horus Control Unit Set
Brand Name	horus SCOPE
Model Name	MiiS Horus Scope DSC 300
Model No. of Lens	MiiS Horus+ Scope DEC 200, MiiS Horus+ Scope DEA 200, MiiS Horus+ Scope DGC 200, MiiS Horus Scope DAR 100
Operating Frequency	2412MHz ~ 2462MHz
Modulation	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Transfer Rate	802.11b: up to 11 Mbps 802.11g: up to 54 Mbps 802.11n: up to MCS15
Number of Channel	11 for 802.11b, 802.11g, 802.11n (HT20) 7 for 802.11n (HT40)
Maximum Output Power	802.11b: 19.11dBm 802.11g: 23.71 dBm 802.11n (HT20): 22.97 dBm 802.11n (HT40): 22.82 dBm
Normal Voltage	5Vdc (adapter or host equipment) 3.6Vdc for battery
Hardware Version	B1
Software Version	V1.0-190620-0022.01-MI

Note:

1. The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers.

Modulation Mode	Tx,Rx Function
802.11b	1TX,1RX
802.11g	1TX,1RX
802.11n (HT20)	2TX,2RX
802.11n (HT40)	2TX,2RX

2. The EUT contains following accessory devices

Product	Brand	Model	Description
Adapter	EDAC	EM1005AVRU	I/P:100-240Vac,50-60Hz, 0.6~0.3A O/P: 5.0 Vdc, 1.2A
Battery	Chi Jiun Tech Co.	33.0103350101	3.6 Vdc, 3350 mAh
USB AM TO MINI USB-5P	N/A	N/A	1.8 meter, shielded with core
HDMI cable	PX	HDMI-2MS	2 meter, shielded without core
Charging Station	Miis	Charging Station DSC 300	N/A
SD card	Kingston	SDCS/16G	16 GB
Portable Chin Rest	MiiS Horus	CR 100	(Optional)
Slit-Lamp Jig	MiiS Horus	Slit-Lamp Jig	(Optional)

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual.

6.2. Channel List

11 channels are provided for 802.11b, 802.11g and 802.11n (HT20):

Channel	Frequency	Channel	Frequency
1	2412MHz	7	2442MHz
2	2417MHz	8	2447MHz
3	2422MHz	9	2452MHz
4	2427MHz	10	2457MHz
5	2432MHz	11	2462MHz
6	2437MHz	-	-

7 channels are provided for 802.11n (HT40):

Channel	Frequency	Channel	Frequency
3	2422MHz	7	2442MHz
4	2427MHz	8	2447MHz
5	2432MHz	9	2452MHz
6	2437MHz	-	-

6.3. Test Condition

Test Item	Test Site No.	Environmental Condition	Input Power	Test Date	Tested by
Antenna Port Conducted Measurement	SR4	25°C / 65%RH	120Vac / 60 Hz	May 28, 2019 ~ Jun. 05., 2019	Howard Kao
Radiated Spurious Emission	966-2	24°C / 68%RH	120Vac / 60 Hz	May 28, 2019 ~ Jul. 05., 2019	Will Chen
AC power Line Conducted Emission	SR1	23°C / 60%RH	120Vac / 60 Hz	Jun. 24, 2019 ~ Jun. 25, 2019	Will Chen

FCC Test Firm Registration Number: 498077

6.4. Description Of Available Antennas

Antenna	Brand Name	Model Name	Antenna Type	Antenna Gain(dBi)
Chain(0)	Aristotle	RFA-02-AP303-70-200	PCB	2
Chain(1)	Aristotle	RFA-02-AP303-70-200	PCB	2

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual.

6.5. Test Mode Applicability and Tested Channel Detail

Product :		**MiiS Horus Scope DSC 300 (Control unit)**					
Combination :		**MiiS Horus⁺ Scope DGC 200 (Digital eye surface camera)**					
Test item	**Mode**	**Modulation Technology**	**Modulation Type**	**Available Channel**	**Test Channel**	**Data Rate**	**Power Mode**
Radiated Emissions (Above 1GHz)	802.11b	DSSS	DBPSK	1 to 11	1,6,11	1.0	Adapter
	802.11g	OFDM	BPSK	1 to 11	1,6,11	6.0	
	802.11n(HT20)	OFDM	BPSK	1 to 11	1,6,11	MCS0	
	802.11n(HT40)	OFDM	BPSK	3 to 9	3,6,9	MCS0	
Radiated Emissions (Below 1GHz)	802.11n(HT40)	OFDM	BPSK	3 to 9	9	MCS0	
AC Power Line Conducted Emission	802.11n(HT40)	OFDM	BPSK	3 to 9	9	MCS0	
Antenna Port Conducted Measurement	802.11b	DSSS	DBPSK	1 to 11	1,6,11	1.0	
	802.11g	OFDM	BPSK	1 to 11	1,6,11	6.0	
	802.11n(HT20)	OFDM	BPSK	1 to 11	1,6,11	MCS0	
	802.11n(HT40)	OFDM	BPSK	3 to 9	3,6,9	MCS0	
Radiated Emissions (Below 1GHz)	802.11n(HT40)	OFDM	BPSK	3 to 9	9	MCS0	Charging Station
AC Power Line Conducted Emission	802.11n(HT40)	OFDM	BPSK	3 to 9	9	MCS0	
Combination :		**1. MiiS Horus Scope DAR 100 (Digital auto refractometer)** **2. MiiS Horus⁺ Scope DEA 200 (Digital eye anterior camera)** **3. MiiS Horus⁺ Scope DEC 200 (Digital eye fundus camera)** **4. MiiS Horus⁺ Scope DEC 200 (Digital eye fundus camera) with CR-100** **5. MiiS Horus⁺ Scope DEC 200 (Digital eye fundus camera) with Slit lamp jig**					
Test item	**Mode**	**Modulation Technology**	**Modulation Type**	**Available Channel**	**Test Channel**	**Data Rate**	**Power Mode**
Radiated Emissions	802.11n(HT40)	OFDM	BPSK	3 to 9	9	MCS0	Adapter

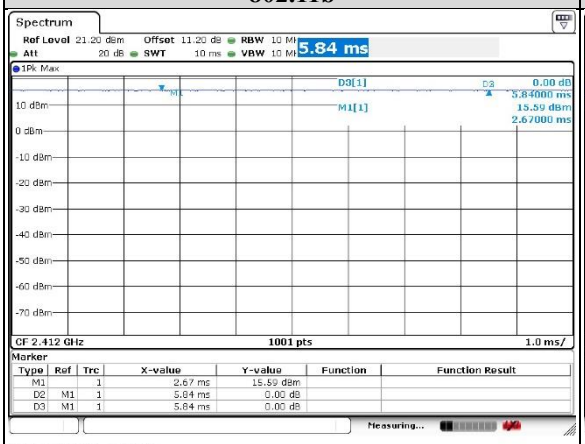
Note:
1. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

2. For below 1 GHz radiated emission and AC power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case.
3. For Antenna Port Conducted Measurement, this item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
4. The fundamental of the EUT was investigated in three orthogonal axes X/Y/Z, it was determined that Y axis was worst-case . Therefore, all final radiated testing was performed with the EUT in Y axis.
5. For 9 kHz to 30 MHz, the loop antenna is studied in three polarization parallel/vertical/ground parallel directions, and parallel polarization has been determined to be the worst case of pre-scan radiation.
6. Pre-scan radiation has been determined by the product MiiS Horus Scope DSC 300 with MiiS Horus^{+} Scope DGC 200 (the worst case). Therefore, other combinations mode were verified test at Radiated Emissions only.

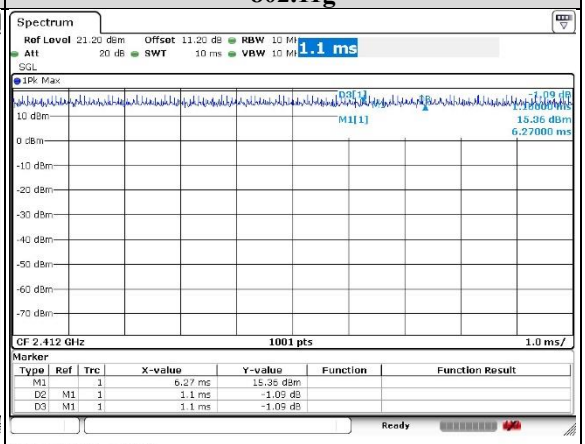
6.6. Duty cycle

Duty cycle of test signal is ≥ 98 %, duty factor is not required.

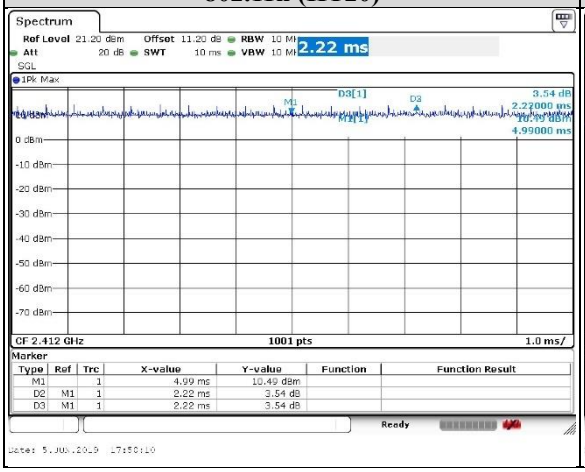
802.11b



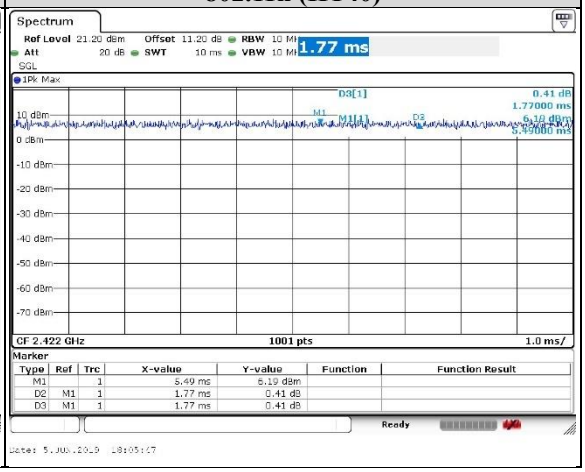
802.11g



802.11n (HT20)



802.11n (HT40)



7. Test Equipment

Test Equipment List					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Cal. Interval**
Radiated Spurious Emission					
Spectrum Analyzer	Keysight	N9010A	MY56070827	Nov. 8, 2018	1 year
EMI Test Receiver	Rohde & Schwarz	ESR7	101754	Nov. 8, 2018	1 year
Loop Antenna	ETS lindgren	6502	00213440	Dec. 11, 2018	1 year
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	774 & AT-N0538	Jan. 14, 2019	1 year
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01690	Jan. 25, 2019	1 year
Horn Antenna (18-40 GHz)	Schwarzbeck	BBHA 9170	781	Jan.16, 2019	1 year
Preamplifier (30-1000 MHz)	EMCI	EMC330E	980405	Jan. 30, 2019	1 year
Preamplifier (1-18 GHz)	EMCI	EMC051835BE	980406	Jan. 29, 2019	1 year
Preamplifier (18-40GHz)	EMCI	EMC184040SE E	980426	May 8, 2019	1 year
RF Cable (9 KHz~18 GHz)	UltraPhase & EMC Instrument	A1K50-UP0358-A1K50-1500&EMC106-NM-SM-2500/7000	170111-4&170219/170102	Jan. 29, 2019	1 year
RF Cable (18 GHz~40 GHz)	UltraPhase	K1K50-UP0264-K1K50-2500/2500/600	170214-2/170214-6/170111-1	Jan. 29, 2019	1 year

Test Equipment List					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Cal. Interval**
Antenna Port Conducted Measurement					
Spectrum Analyzer	Keysight	N9010A	MY56070834	Nov. 8, 2018	1 year
Spectrum Analyzer	Rohde & Schwarz	FSV40	101490	Sep. 25, 2018	1 year
Pulse Power Sensor	Anrisu	MA2411B	1531202	Dec. 17, 2018	1 year
Power Meter	Anrisu	ML2495A	1645002	Dec. 17, 2018	1 year
AC power Line Conducted Emission					
EMI Test Receiver	Rohde & Schwarz	ESR7	101753	Nov. 14, 2018	1 year
Two-Line V-Network	Rohde & Schwarz	ENV216	102136	Aug. 5, 2018	1 year
Impuls-Begrenzer Pulse Limiter	Rohde & Schwarz	ESH3-Z2	102219-Qt	Aug. 2, 2018	1 year
Cables	Huber+Suhner	RG 214/U	FCC-BCICF-4_RF	Jan. 29, 2019	1 year

UL Software		
Description	**Name**	**Version**
Radiated measurement	EZ_EMC	1.1.4.2
Conducted measurement	Keysight.TestSystem	1.0.0.0
AC power Line Conducted Emission	EZ_EMC	1.1.4.2

8. Description of Test Setup

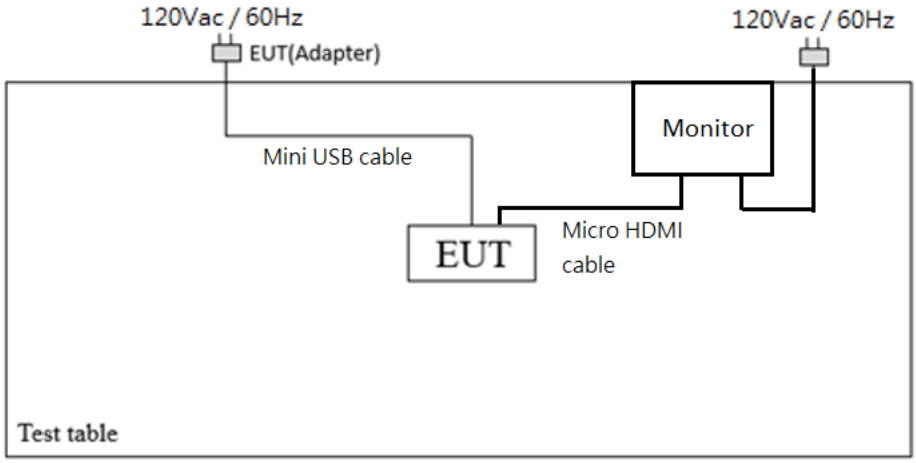
Support Equipment

Item	Equipment	Brand Name	Model Name	S/N
1	Notebook	DELL	Latitude E5470	3JFKWF2
2	Monitor	DELL	UP3216Q	CN-02GX26-74445-72O-915P

Test Setup

Controlled using a bespoke application (RTL11ac_8822BU_USB_v6.00) on a test Notebook. The application was used to enable a continuous transmission mode and to select the test channels, data rates, modulation schemes and power setting as required.

Setup Diagram for Test



9. Test Results

9.1. 6dB Bandwidth

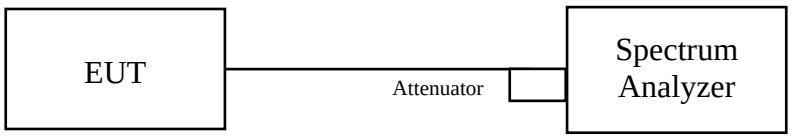
Requirements

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

Test procedure

a. Set resolution bandwidth (RBW) = 100kHz
b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.
c. Trace mode = max hold.
d. Sweep = auto couple.
e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

Test Data

802.11b

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	9.091	0.5	Pass
6	2437	9.091	0.5	Pass
11	2462	9.091	0.5	Pass

802.11g

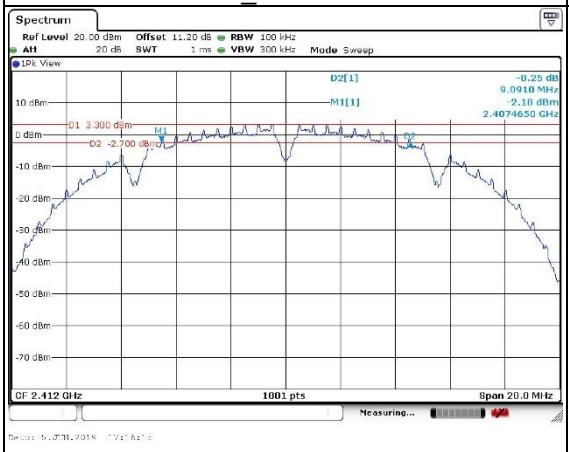
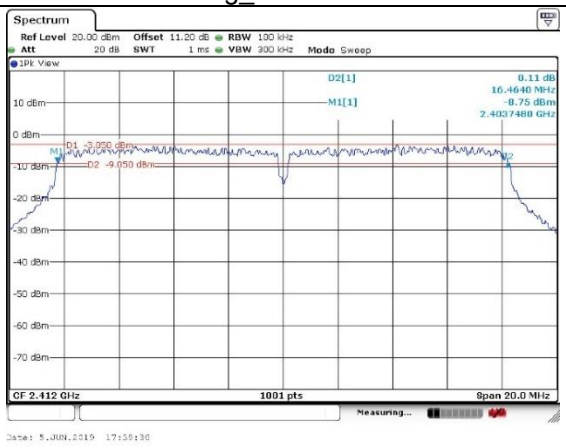
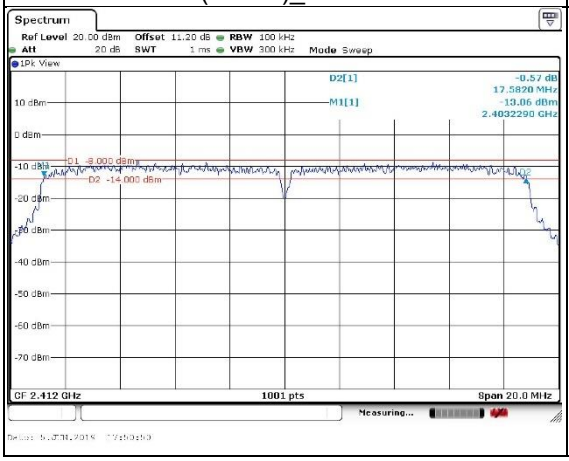
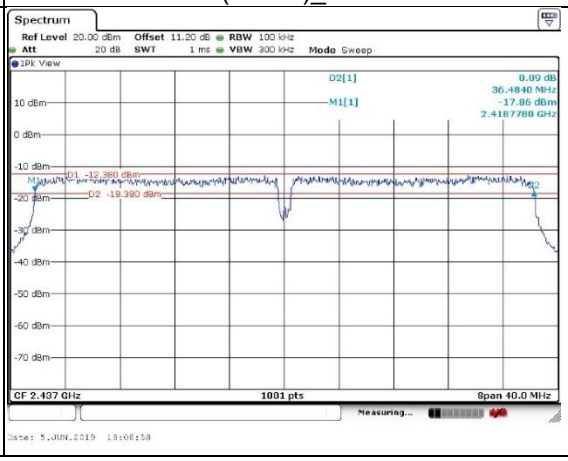
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	16.464	0.5	Pass
6	2437	16.464	0.5	Pass
11	2462	16.503	0.5	Pass

802.11n (HT20)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	17.582	17.582	0.5	Pass
6	2437	17.602	17.582	0.5	Pass
11	2462	17.602	17.602	0.5	Pass

802.11n (HT40)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
3	2422	36.523	36.523	0.5	Pass
6	2437	36.484	36.523	0.5	Pass
9	2452	36.484	36.523	0.5	Pass

Spectrum Plot of Worst Value	
802.11b_Chain 0 / CH1	802.11g_Chain 0 / CH1
	
802.11n (HT-20)_Chain 0 / CH1	802.11n (HT-40)_Chain 0 / CH6
	

9.2. Conducted output power

Requirements

For systems using digital modulation in the 2400-2483.5 MHz bands: 1 Watt.

Per KDB 662911 D01 Multiple Transmitter Output Method of conducted output power measurement on IEEE 802.11 devices,

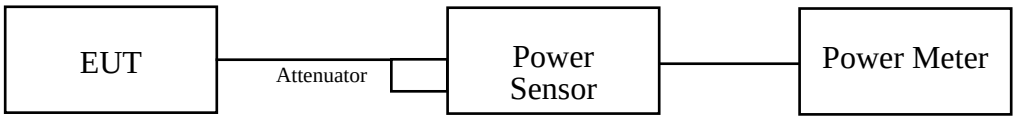
Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any NANT;
Array Gain = 5 log(NANT/NSS) dB or 3 dB, whichever is less for 20-MHz channel widths with NANT ≥ 5.

For power measurements on all other devices: Array Gain = 10 log(NANT/NSS) dB.

Test Procedure

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

Test Setup



The loss between RF output port of the EUT and the input port of the Power Meter has been taken into consideration.

Test Data

802.11b

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	81.10	19.09	30	Pass
6	2437	81.47	19.11	30	Pass
11	2462	78.16	18.93	30	Pass

802.11g

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	229.09	23.60	30	Pass
6	2437	234.96	23.71	30	Pass
11	2462	217.27	23.37	30	Pass

802.11n (HT20)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	20.03	19.89	198.19	22.97	30	Pass
6	2437	19.87	19.64	189.10	22.77	30	Pass
11	2462	19.56	20.14	193.64	22.87	30	Pass

802.11n (HT40)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	19.91	19.68	190.85	22.81	30	Pass
6	2437	19.86	19.73	190.80	22.81	30	Pass
9	2452	19.77	19.85	191.45	22.82	30	Pass

9.3. Power Spectral Density

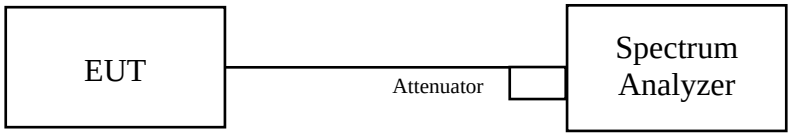
Requirements

The Maximum of Power Spectral Density Measurement is 8dBm in any 3 kHz.

Test procedure

a. Set analyzer center frequency to DTS channel center frequency.
b. Set the span to 1.5 times the DTS bandwidth.
c. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d. Set the VBW ≥ 3 × RBW.
e. Detector = peak.
f. Sweep time = auto couple.
g. Trace mode = max hold.
h. Allow trace to fully stabilize.
i. Use the peak marker function to determine the maximum amplitude level within the RBW.

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

Test Data

802.11b

Channel	Frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
1	2412	-17.11	8	Pass
6	2437	-16.98	8	Pass
11	2462	-17.32	8	Pass

802.11g

Channel	Frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
1	2412	-18.04	8	Pass
6	2437	-17.94	8	Pass
11	2462	-18.18	8	Pass

802.11n (HT20)

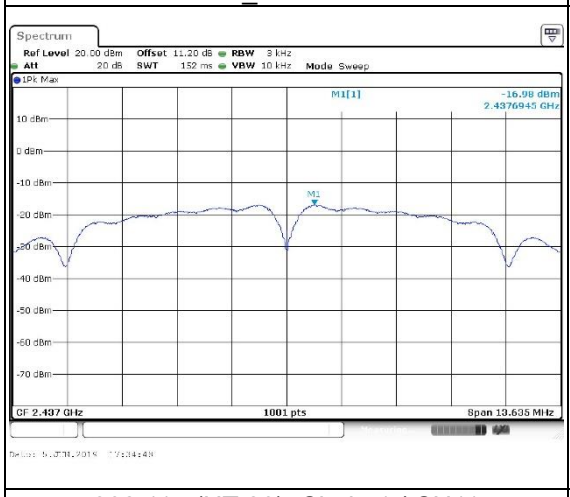
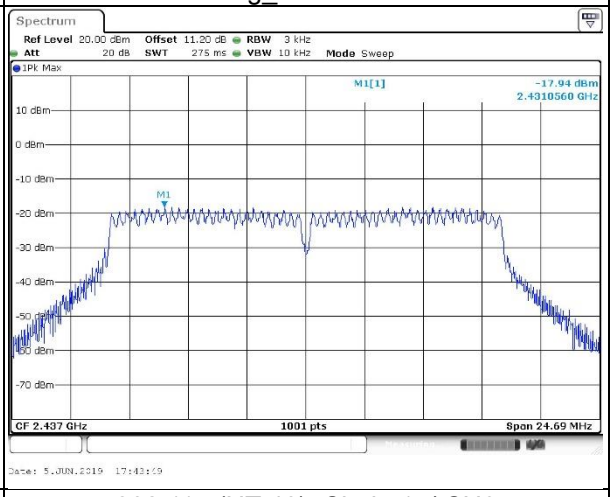
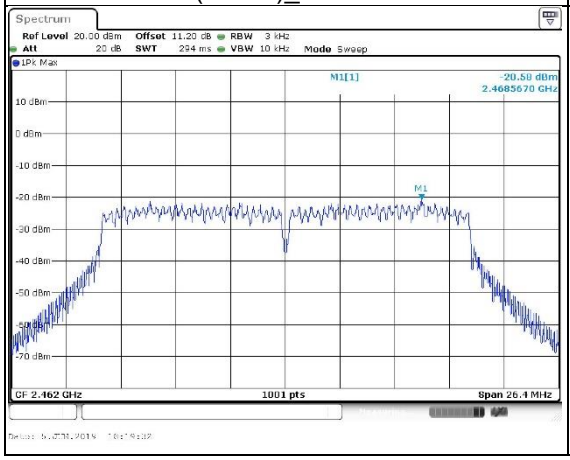
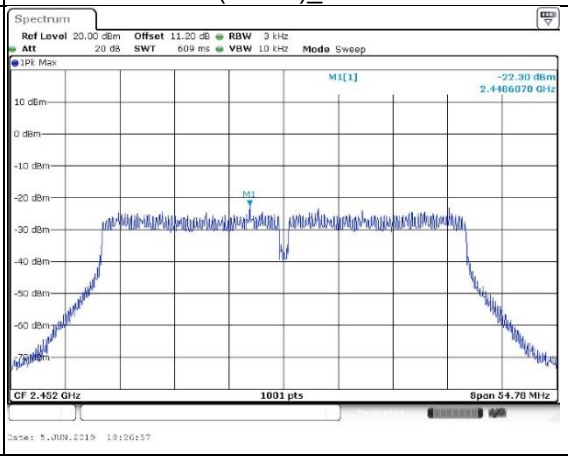
TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	1	2412	-22.59	3.01	-19.58	8	Pass
	6	2437	-22.18	3.01	-19.17	8	Pass
	11	2462	-22.98	3.01	-19.97	8	Pass
1	1	2412	-21.18	3.01	-18.17	8	Pass
	6	2437	-21.11	3.01	-18.10	8	Pass
	11	2462	-20.58	3.01	-17.57	8	Pass

NOTE: Directional gain = 2 dBi + 10log(2) = 5.01 dBi < 6 dBi, so the limit no need to reduced.

802.11n (HT40)

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	3	2422	-25.04	3.01	-22.03	8	Pass
	6	2437	-24.62	3.01	-21.61	8	Pass
	9	2452	-25.04	3.01	-22.03	8	Pass
1	3	2422	-23.70	3.01	-20.69	8	Pass
	6	2437	-22.62	3.01	-19.61	8	Pass
	9	2452	-22.30	3.01	-19.29	8	Pass

NOTE: Directional gain = 2 dBi + 10log(2) = 5.01 dBi < 6 dBi, so the limit no need to reduced.

Spectrum Plot of Worst Value	
802.11b_Chain 0 / CH6	802.11g_Chain 0 / CH6
	
802.11n (HT-20)_Chain 1 / CH11	802.11n (HT-40)_Chain 1 / CH9
	

9.4. Conducted Out of Band Emission

Requirements

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.

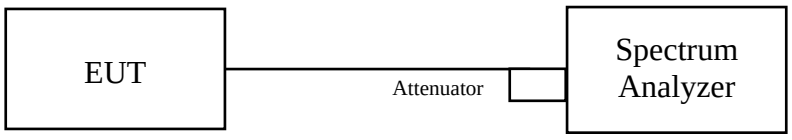
Test procedure

Measurement Procedure REF

1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 300 kHz.
3. Set the span to 1.5 times the DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

Measurement Procedure OOBE
1. Set RBW = 100 kHz.
2. Set VBW ≥ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

Test Setup

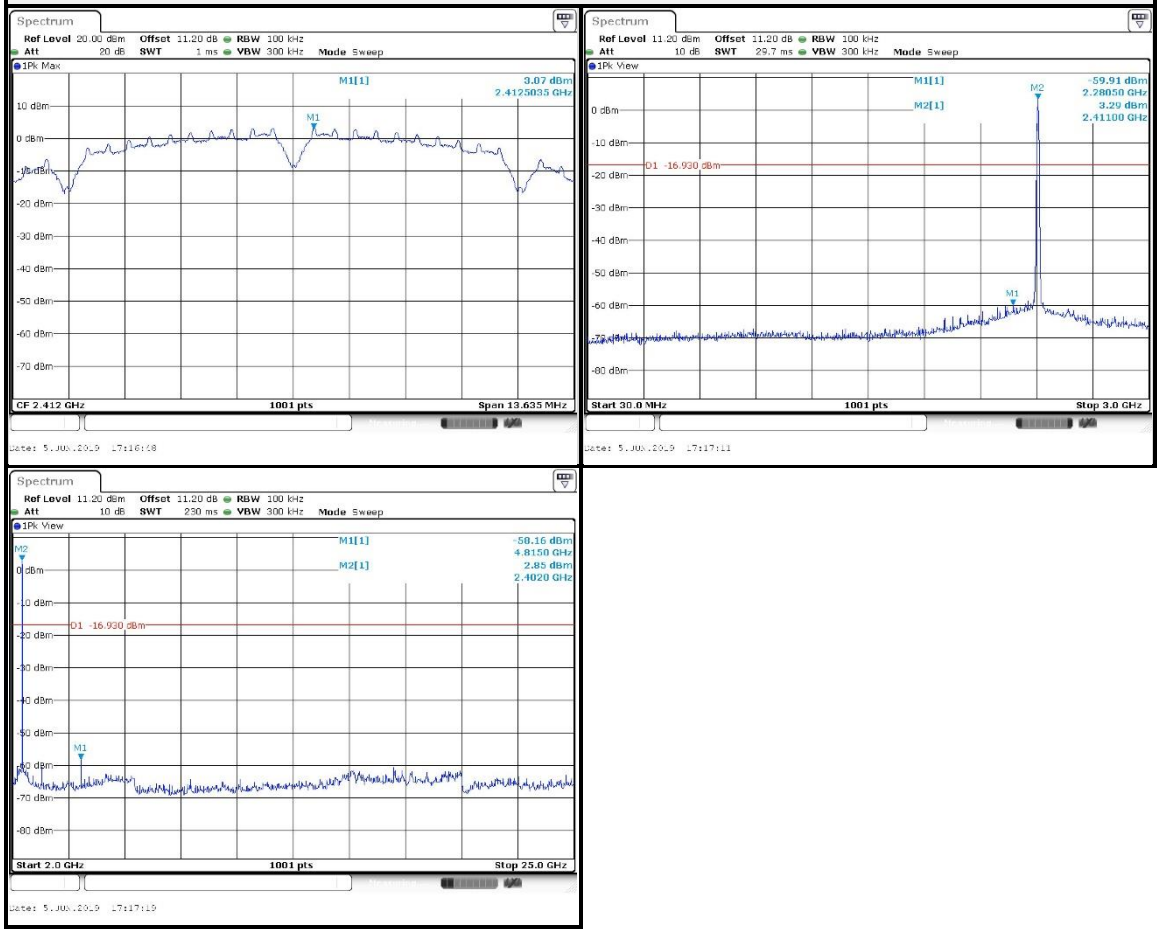


The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

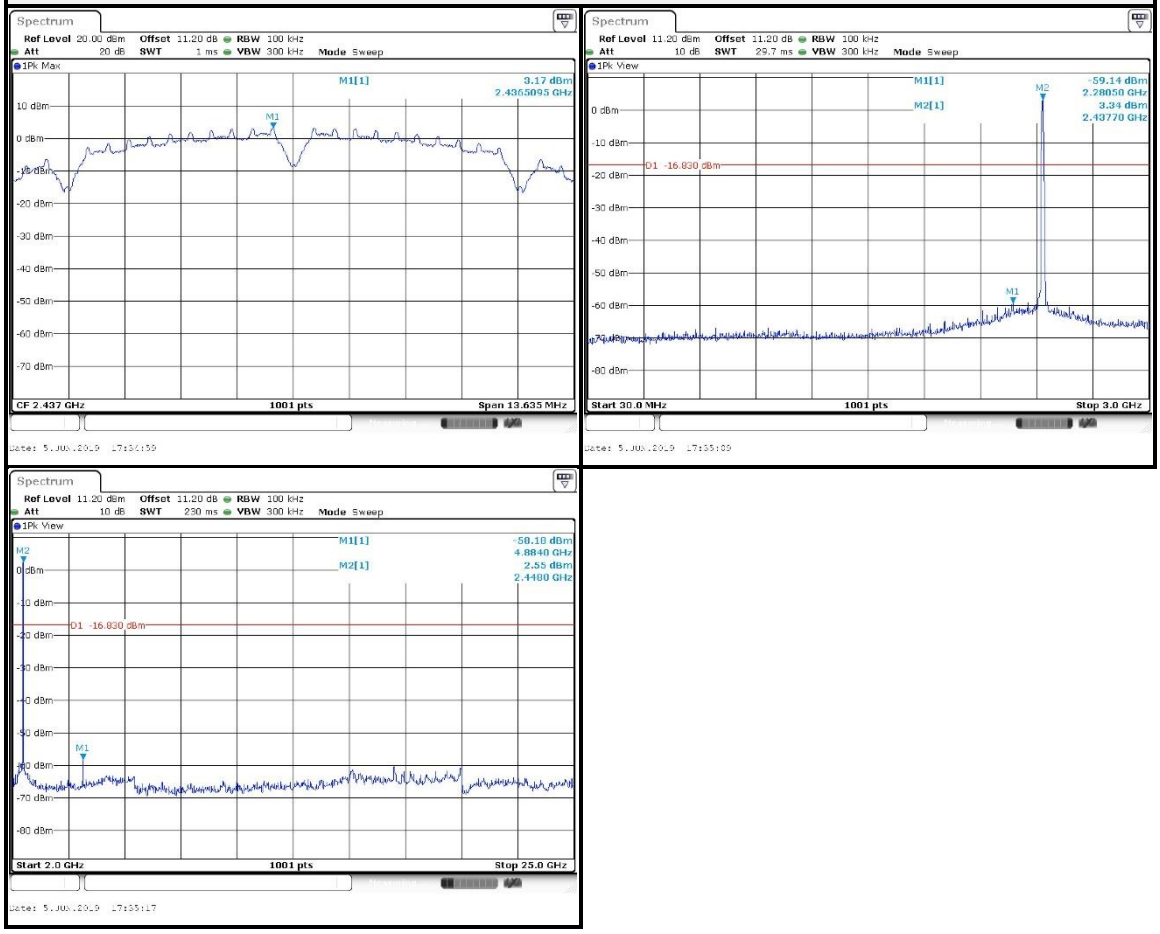
Test Data

802.11b

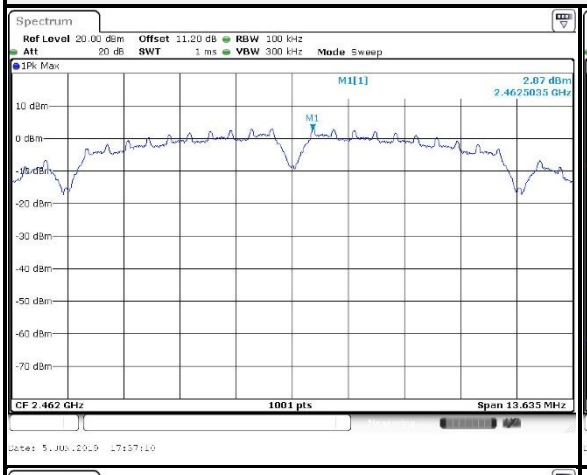
Ch 1

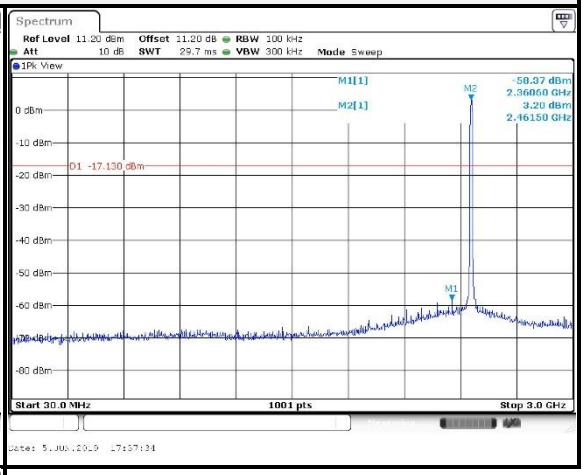


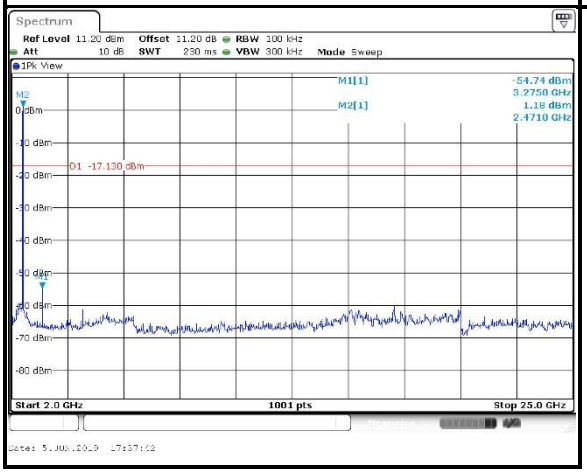
Ch 6


Spectrum
Ref Level 20.00 dBm Offset 11.20 dB RBW 100 kHz
Att 20 dB SWT 1 ms VBW 300 kHz Mode Sweep
1Pk Max
M1[1] 3.17 dBm 2.4365095 GHz
CF 2.437 GHz 1001 pts Span 13.635 MHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 29.7 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -59.14 dBm 2.28050 GHz
M2[1] 3.34 dBm 2.43770 GHz
D1 -16.830 dBm
Start 30.0 MHz 1001 pts Stop 3.0 GHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 230 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -50.10 dBm 4.8840 GHz
M2[1] 2.55 dBm 2.4480 GHz
D1 -16.830 dBm
Start 2.0 GHz 1001 pts Stop 25.0 GHz

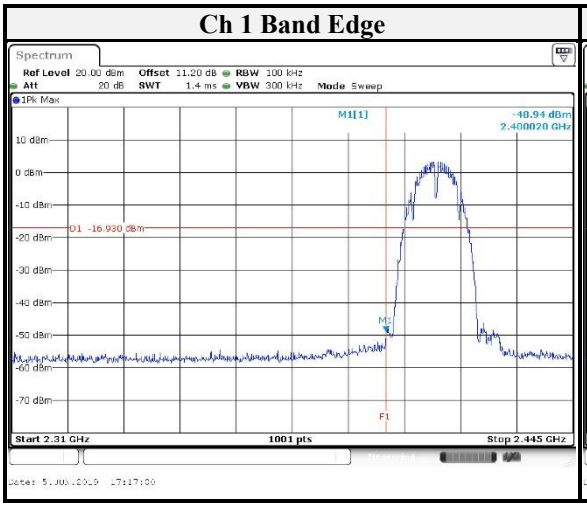
Ch 11



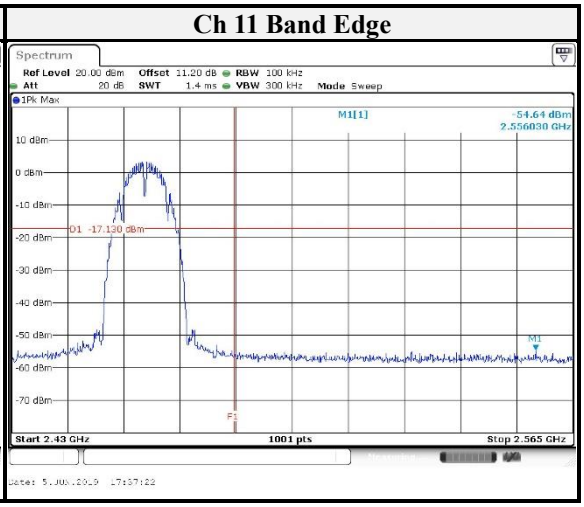




Ch 1 Band Edge

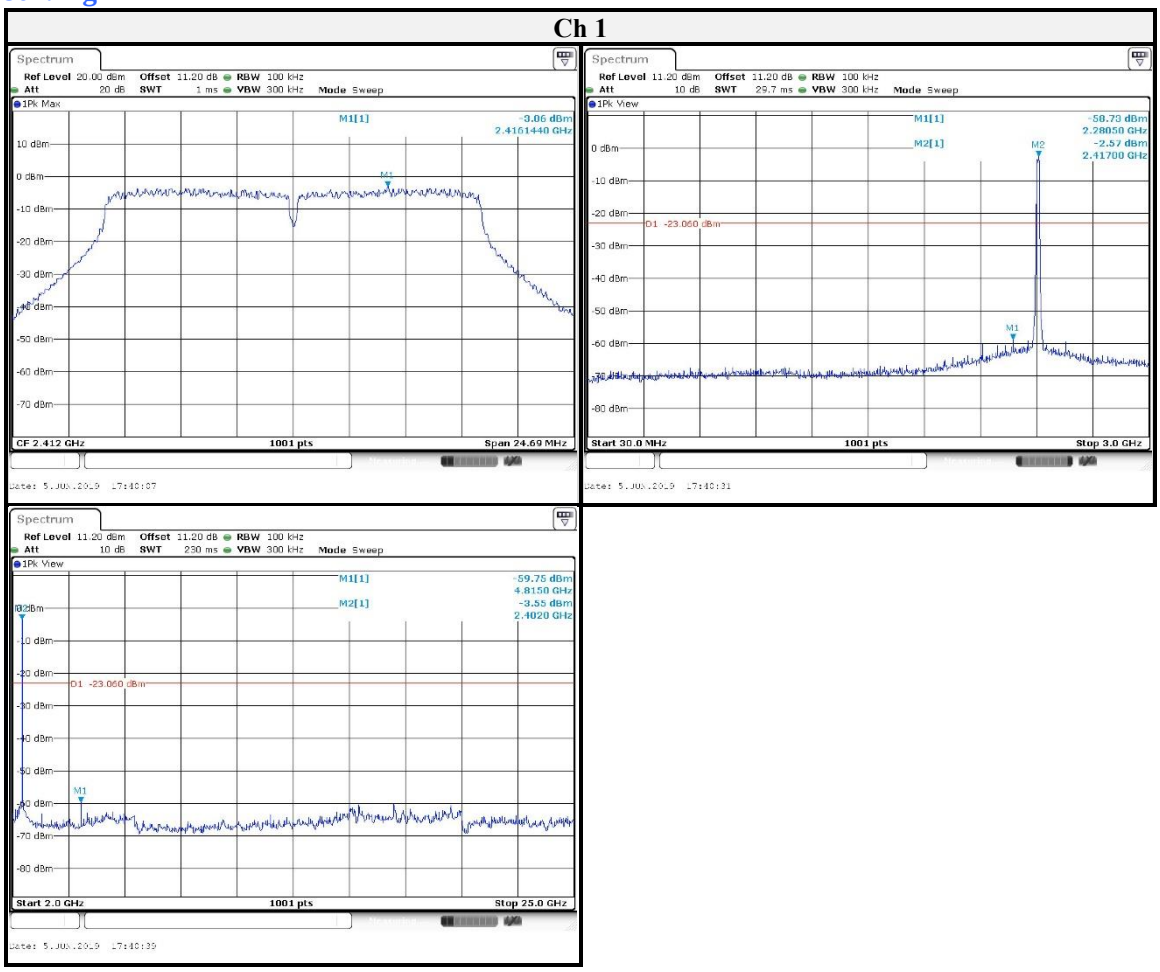


Ch 11 Band Edge

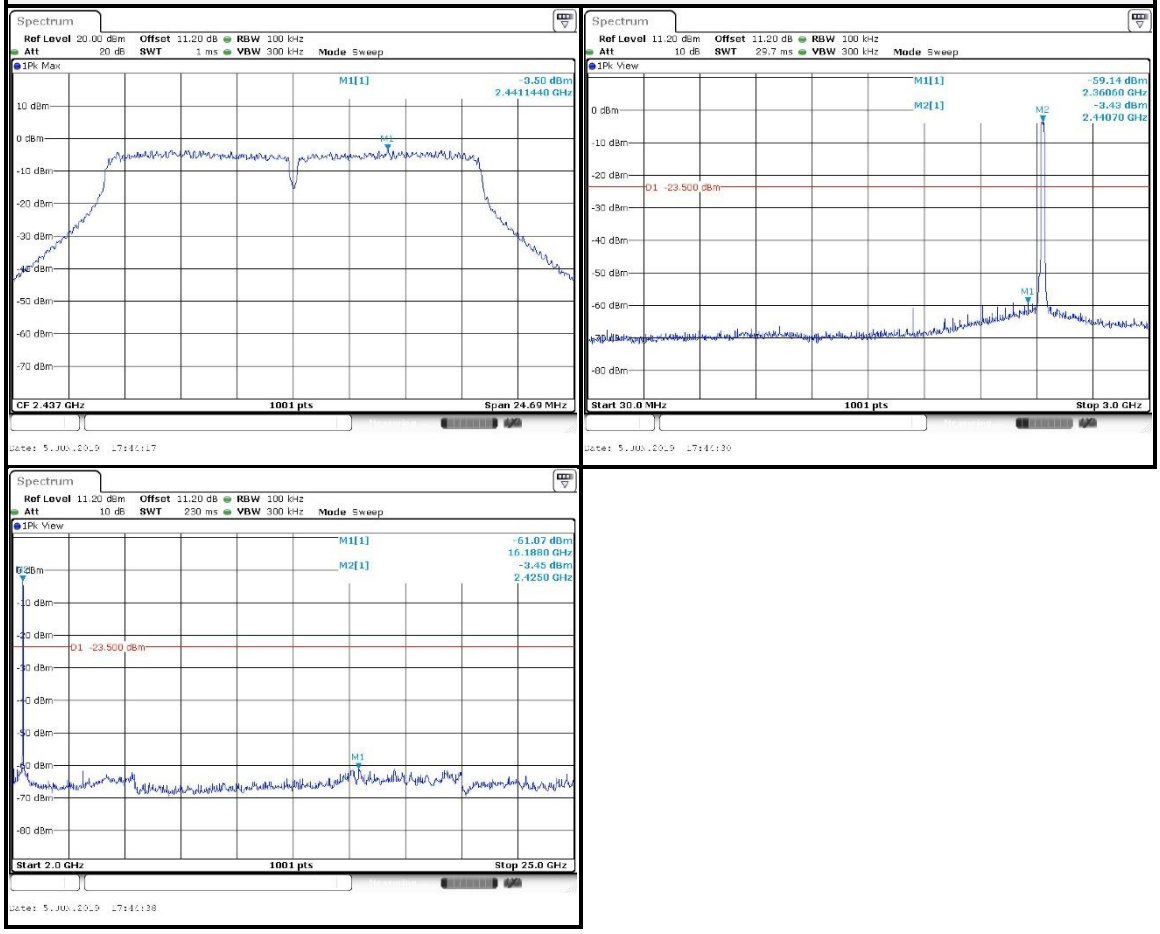


802.11g

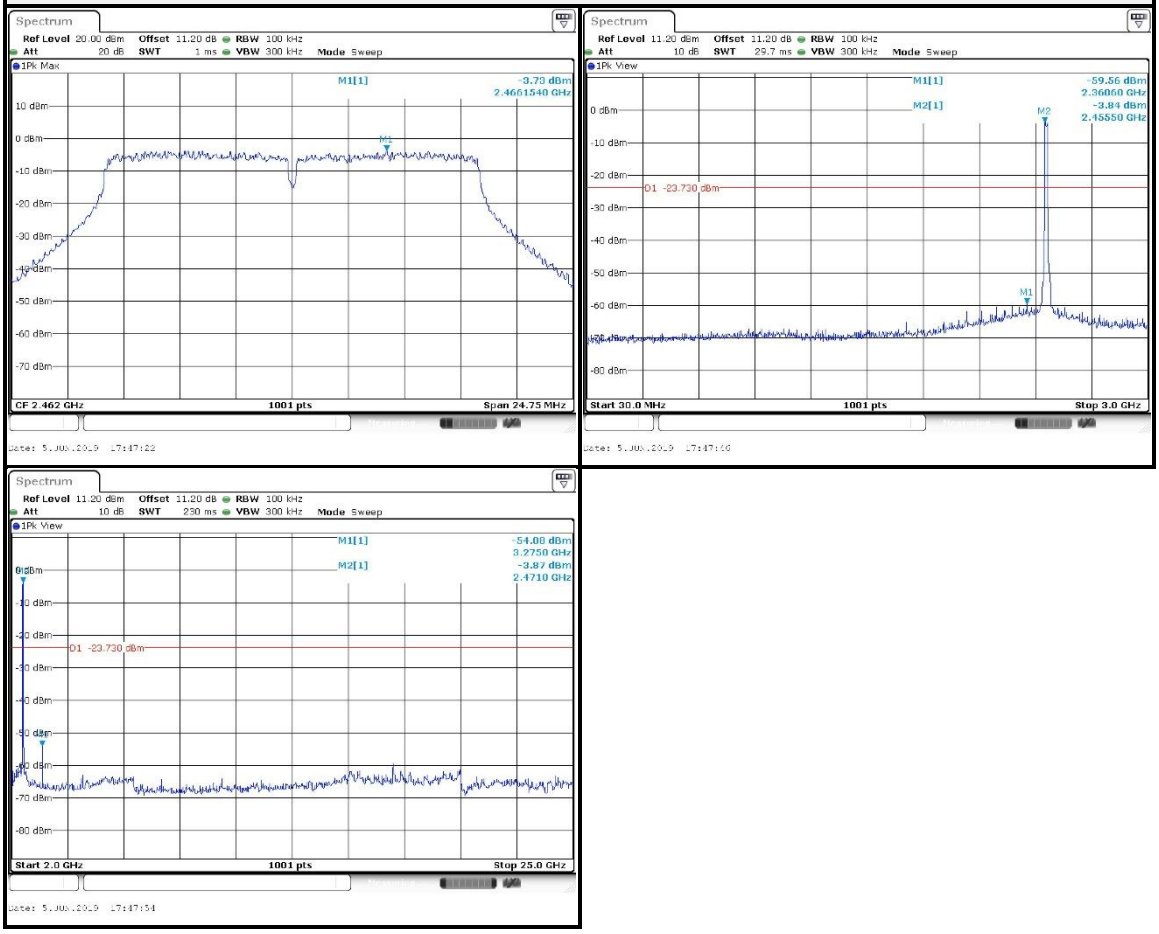
Ch 1


Spectrum
Ref Level 20.00 dBm Offset 11.20 dB RBW 100 kHz
Att 20 dB SWT 1 ms VBW 300 kHz Mode Sweep
1Pk Max
M1[1] -3.06 dBm 2.4161440 GHz
CF 2.412 GHz 1001 pts Span 24.69 MHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 29.7 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -58.79 dBm 2.28050 GHz
M2[1] -2.57 dBm 2.41700 GHz
D1 -23.060 dBm
Start 30.0 MHz 1001 pts Stop 3.0 GHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 230 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -59.75 dBm 4.8150 GHz
M2[1] -3.55 dBm 2.4020 GHz
D1 -23.060 dBm
Start 2.0 GHz 1001 pts Stop 25.0 GHz

Ch 6

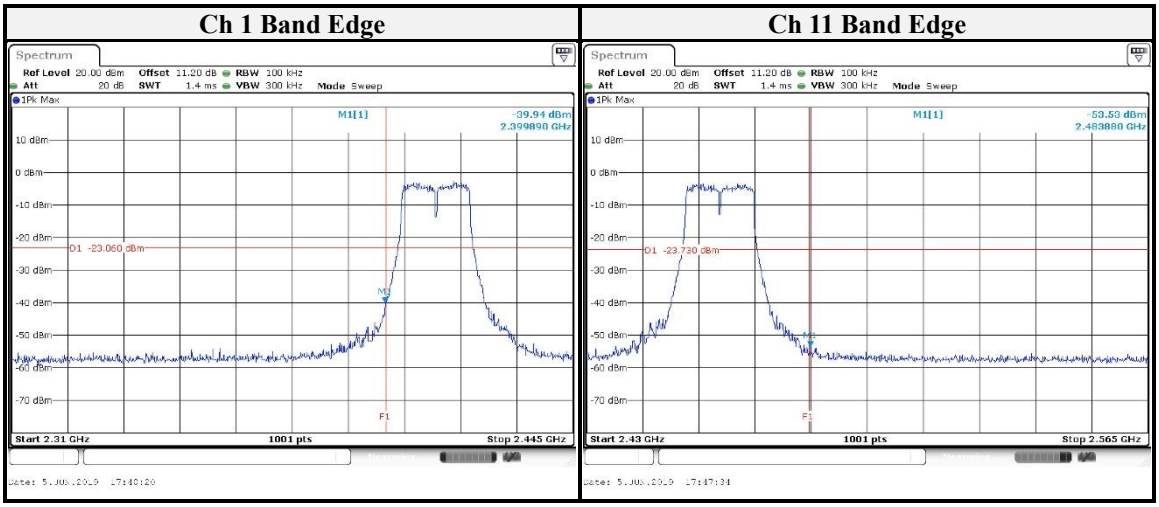

Spectrum
Ref Level 20.00 dBm Offset 11.20 dB RBW 100 kHz
Att 20 dB SWT 1 ms VBW 300 kHz Mode Sweep
1Pk Max
M1[1] -3.50 dBm 2.4411440 GHz
CF 2.437 GHz 1001 pts Span 24.69 MHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 29.7 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -59.14 dBm 2.36060 GHz
M2[1] -3.43 dBm 2.44070 GHz
D1 -23.500 dBm
Start 30.0 MHz 1001 pts Stop 3.0 GHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 230 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -61.07 dBm 16.1880 GHz
M2[1] -3.45 dBm 2.4250 GHz
D1 -23.500 dBm
Start 2.0 GHz 1001 pts Stop 25.0 GHz

Ch 11



Ch 1 Band Edge

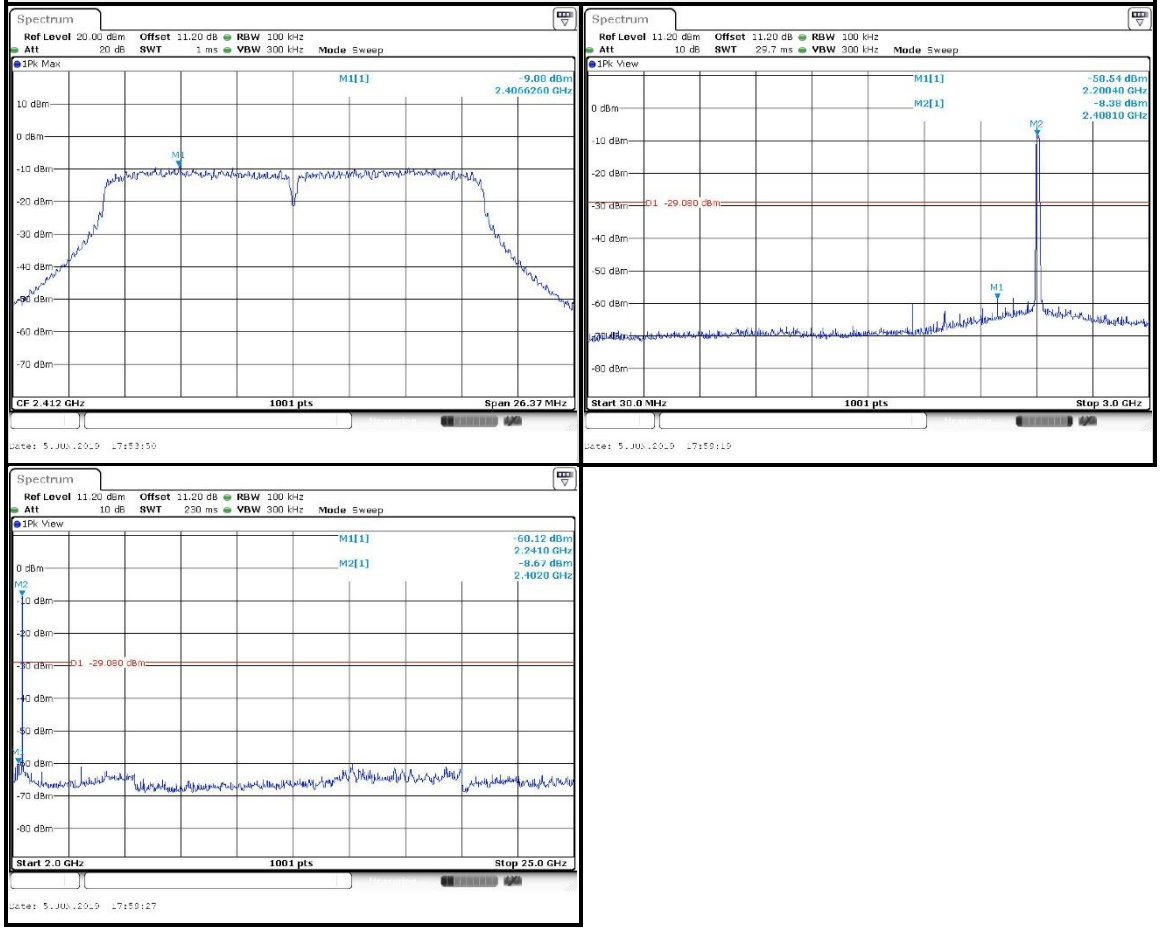
Ch 11 Band Edge



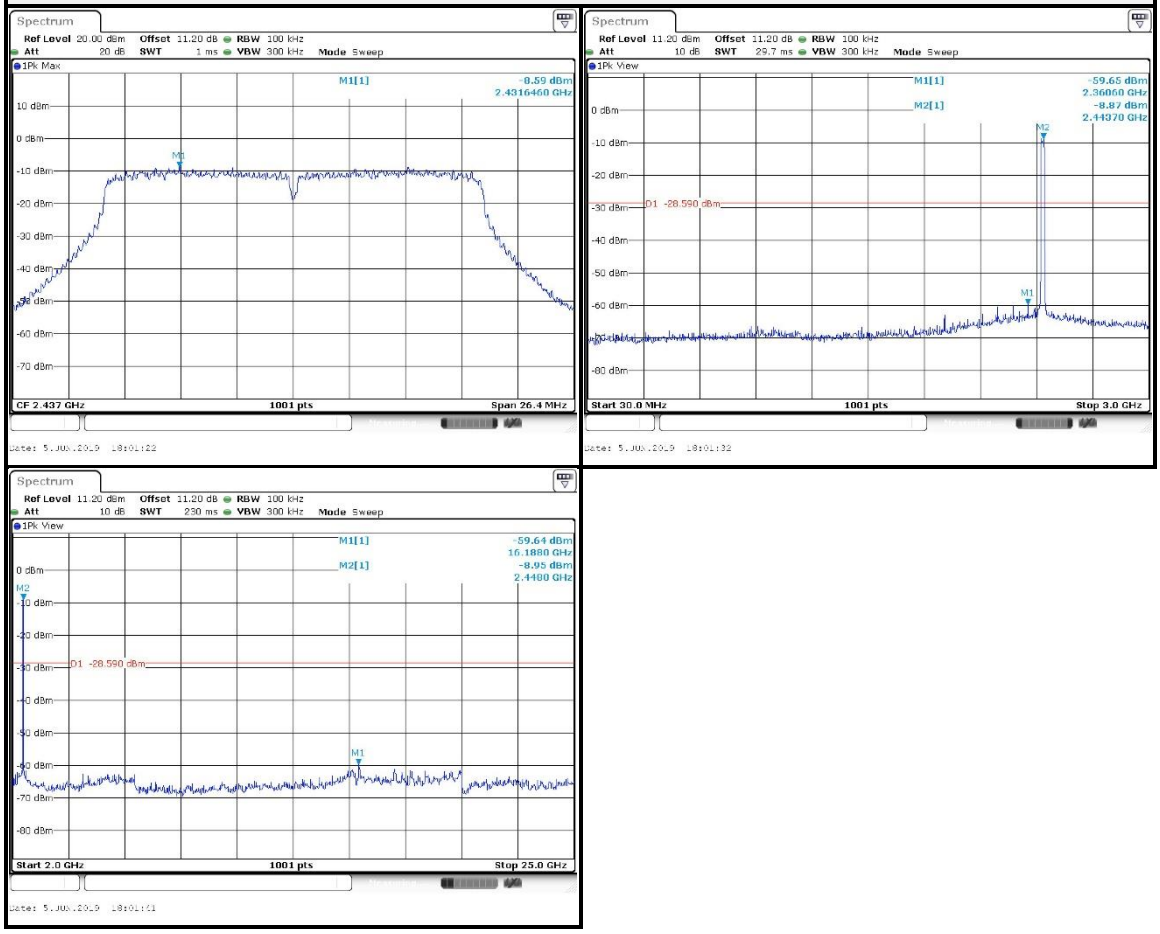
802.11n (HT20)

CHAIN 0

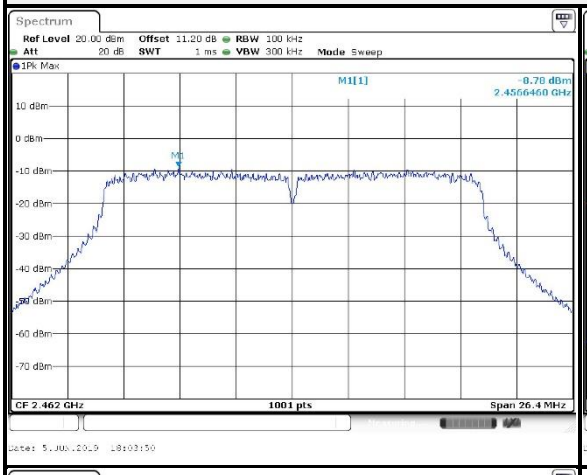
Ch 1

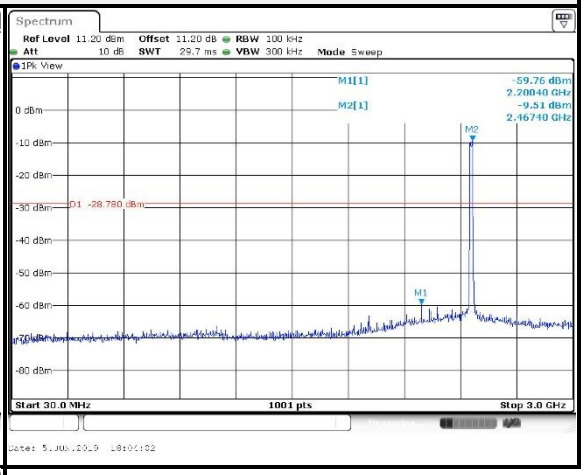


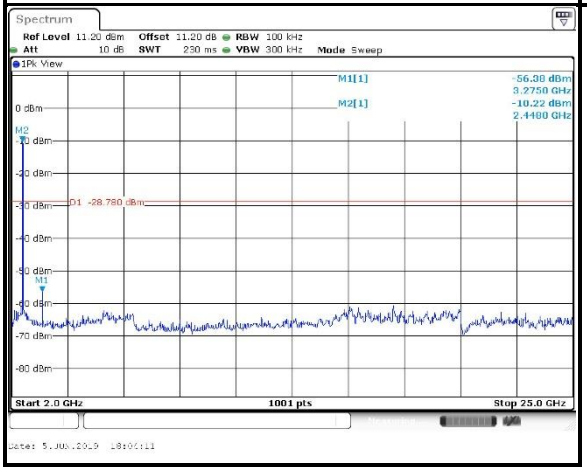
Ch 6


Spectrum
Ref Level 20.00 dBm Offset 11.20 dB RBW 100 kHz
Att 20 dB SWT 1 ms VBW 300 kHz Mode Sweep
1Pk Max
M1[1] -8.59 dBm 2.4316460 GHz
CF 2.437 GHz 1001 pts Span 26.4 MHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 29.7 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -59.65 dBm 2.36060 GHz
M2[1] -8.87 dBm 2.44970 GHz
D1 -28.590 dBm
Start 30.0 MHz 1001 pts Stop 3.0 GHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 230 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -59.64 dBm 16.1880 GHz
M2[1] -8.95 dBm 2.4480 GHz
D1 -28.590 dBm
Start 2.0 GHz 1001 pts Stop 25.0 GHz

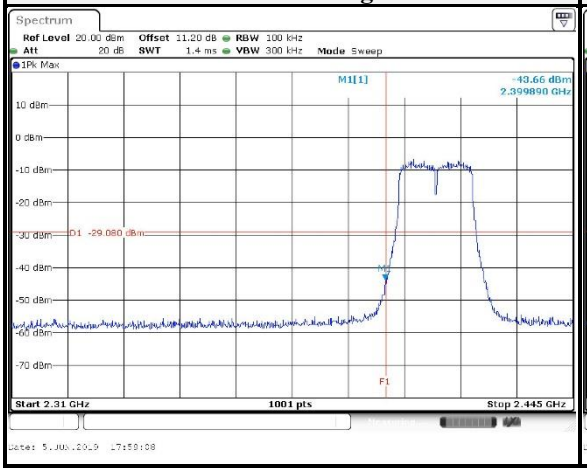
Ch 11



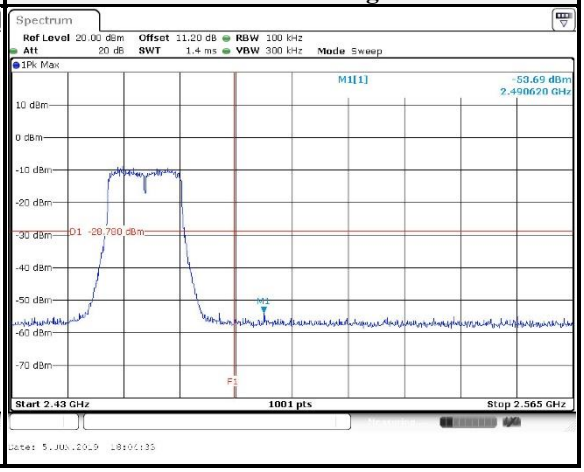




Ch 1 Band Edge

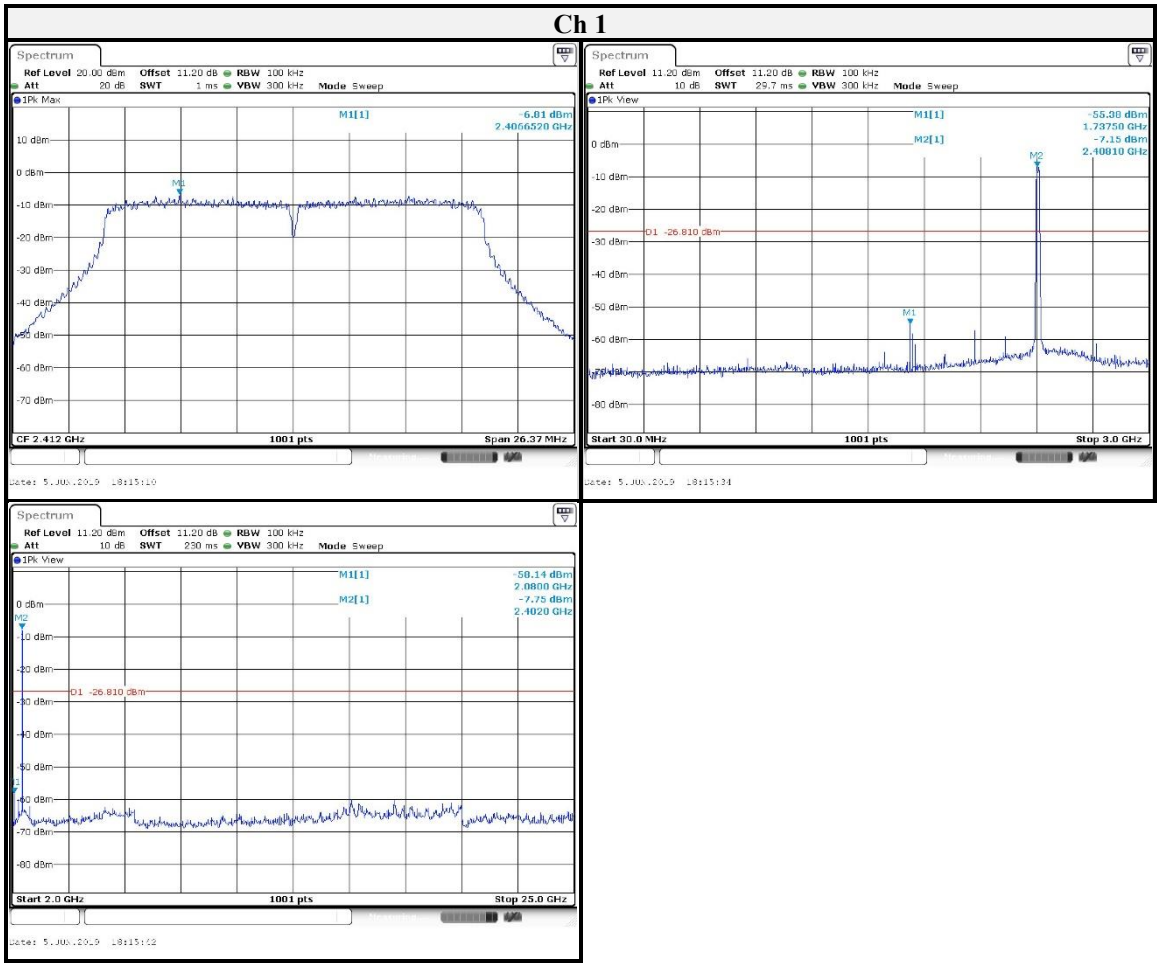


Ch 11 Band Edge

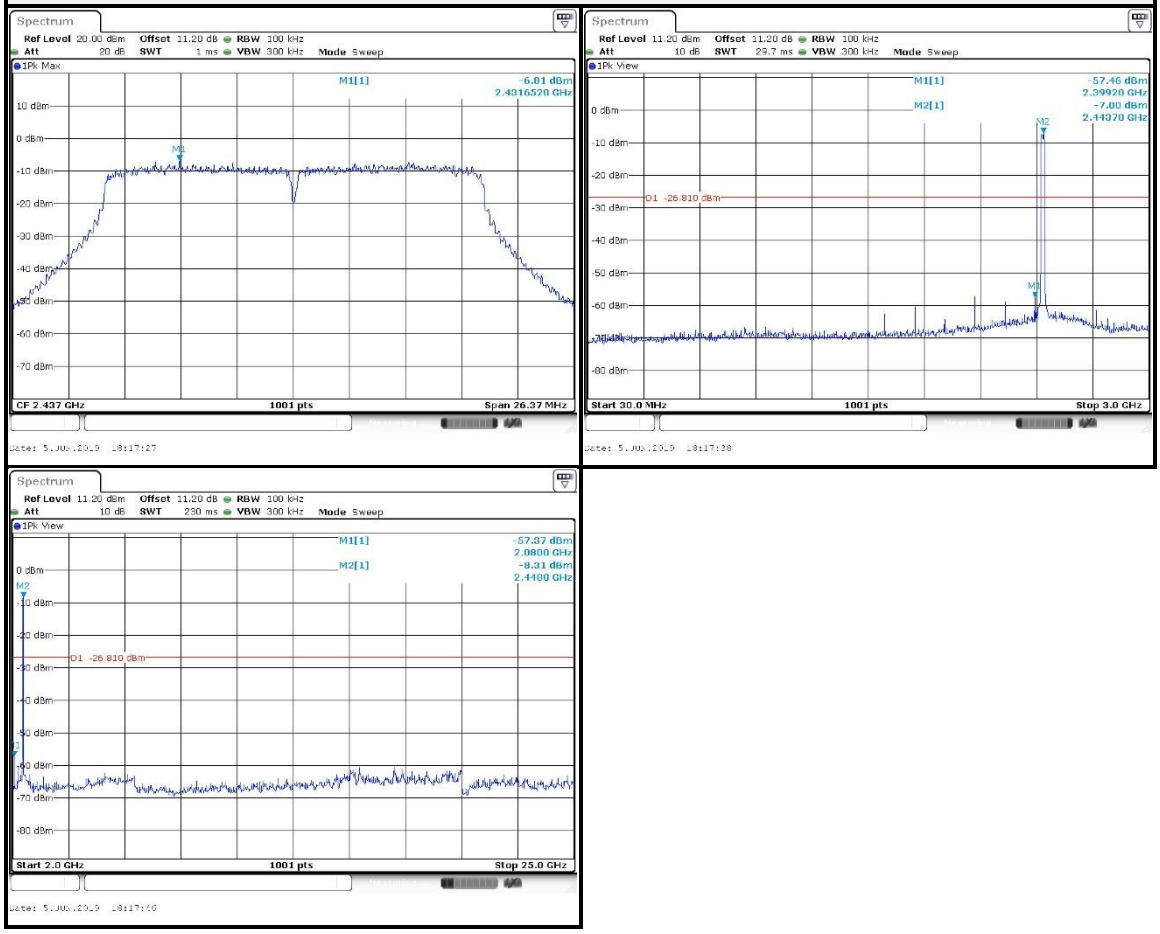


CHAIN 1

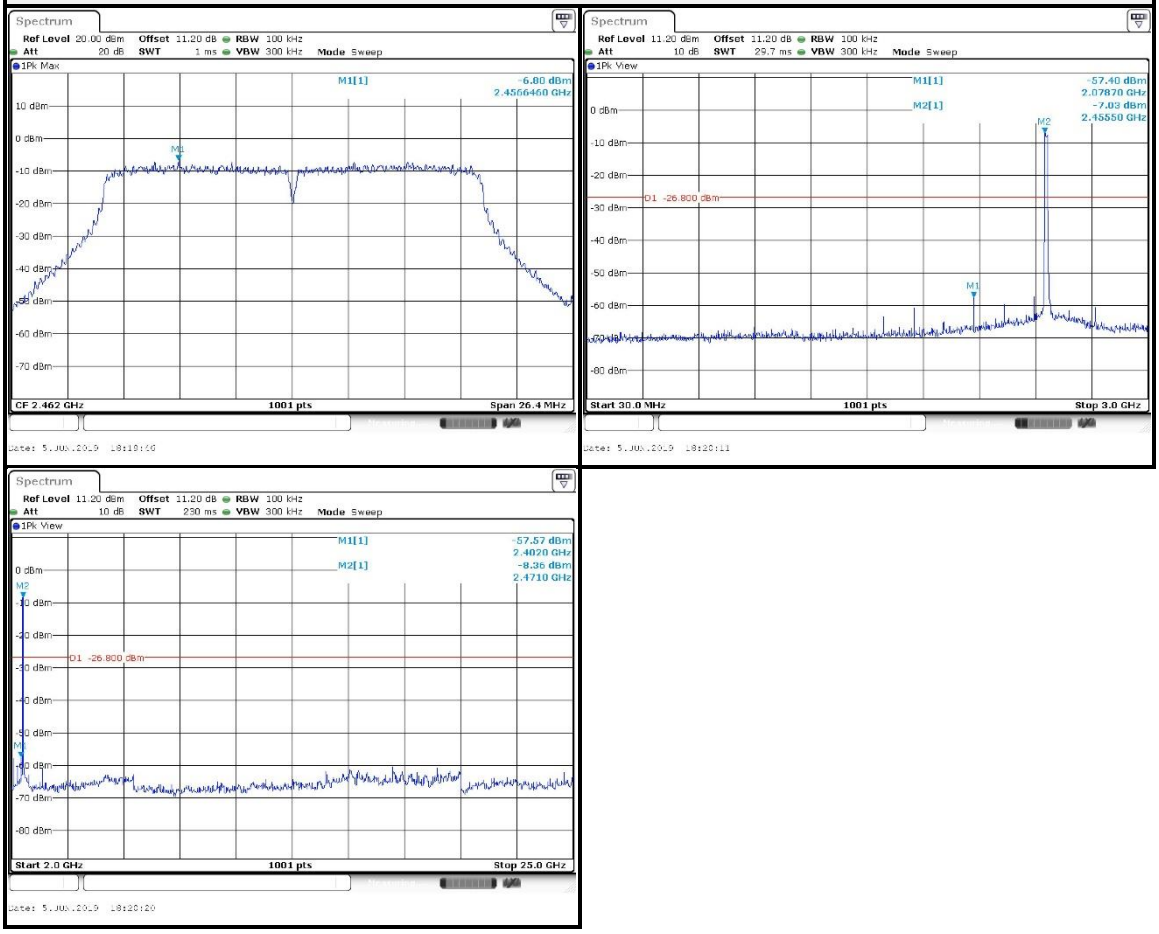
Ch 1


Spectrum
Ref Level 20.00 dBm Offset 11.20 dB RBW 100 kHz
Att 20 dB SWT 1 ms VBW 300 kHz Mode Sweep
1Pk Max
M1[1] -6.81 dBm 2.4066520 GHz
CF 2.412 GHz 1001 pts Span 26.37 MHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 29.7 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -55.38 dBm 1.73750 GHz
M2[1] -7.15 dBm 2.40810 GHz
D1 -26.810 dBm
Start 30.0 MHz 1001 pts Stop 3.0 GHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 230 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -50.14 dBm 2.0800 GHz
M2[1] -7.75 dBm 2.4020 GHz
D1 -26.810 dBm
Start 2.0 GHz 1001 pts Stop 25.0 GHz

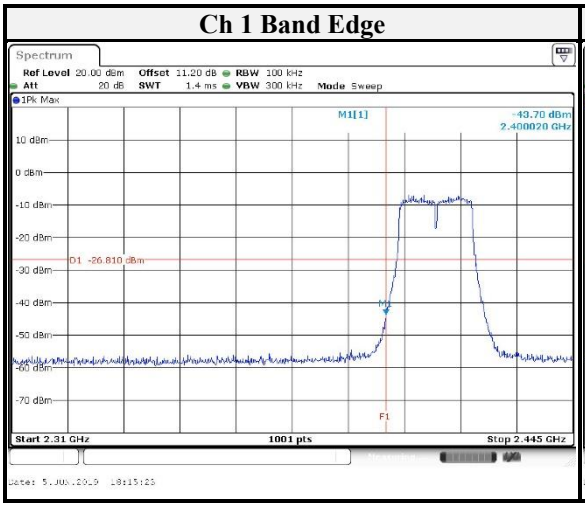
Ch 6


Spectrum
Ref Level 20.00 dBm Offset 11.20 dB RBW 100 kHz
Att 20 dB SWT 1 ms VBW 300 kHz Mode Sweep
1Pk Max
M1[1] -6.81 dBm 2.4316520 GHz
CF 2.437 GHz 1001 pts Span 26.37 MHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 29.7 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -57.46 dBm 2.39920 GHz
M2[1] -7.00 dBm 2.44970 GHz
D1 -26.810 dBm
Start 30.0 MHz 1001 pts Stop 3.0 GHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 230 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -57.37 dBm 2.0800 GHz
M2[1] -8.31 dBm 2.4480 GHz
D1 -26.810 dBm
Start 2.0 GHz 1001 pts Stop 25.0 GHz

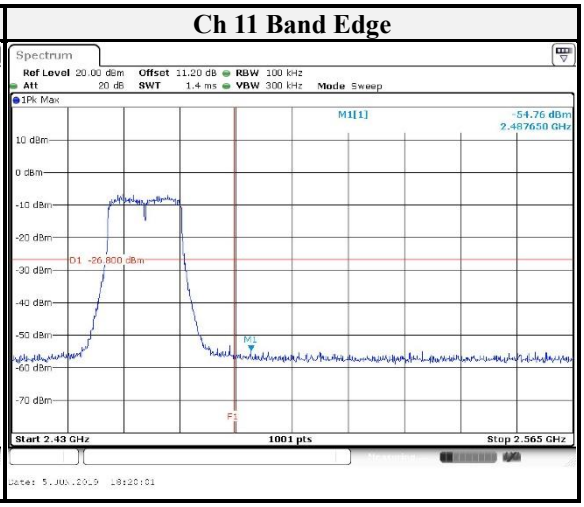
Ch 11



Ch 1 Band Edge



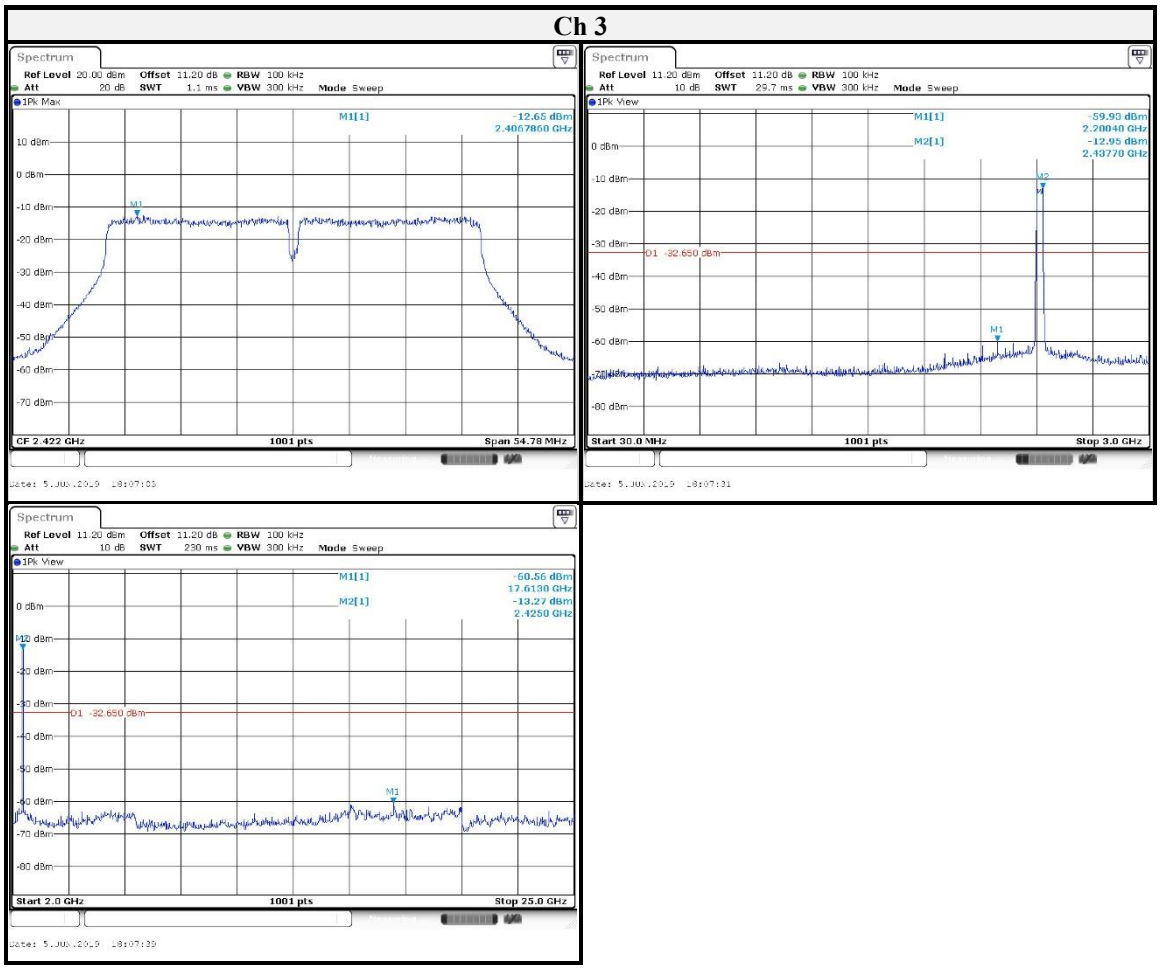
Ch 11 Band Edge



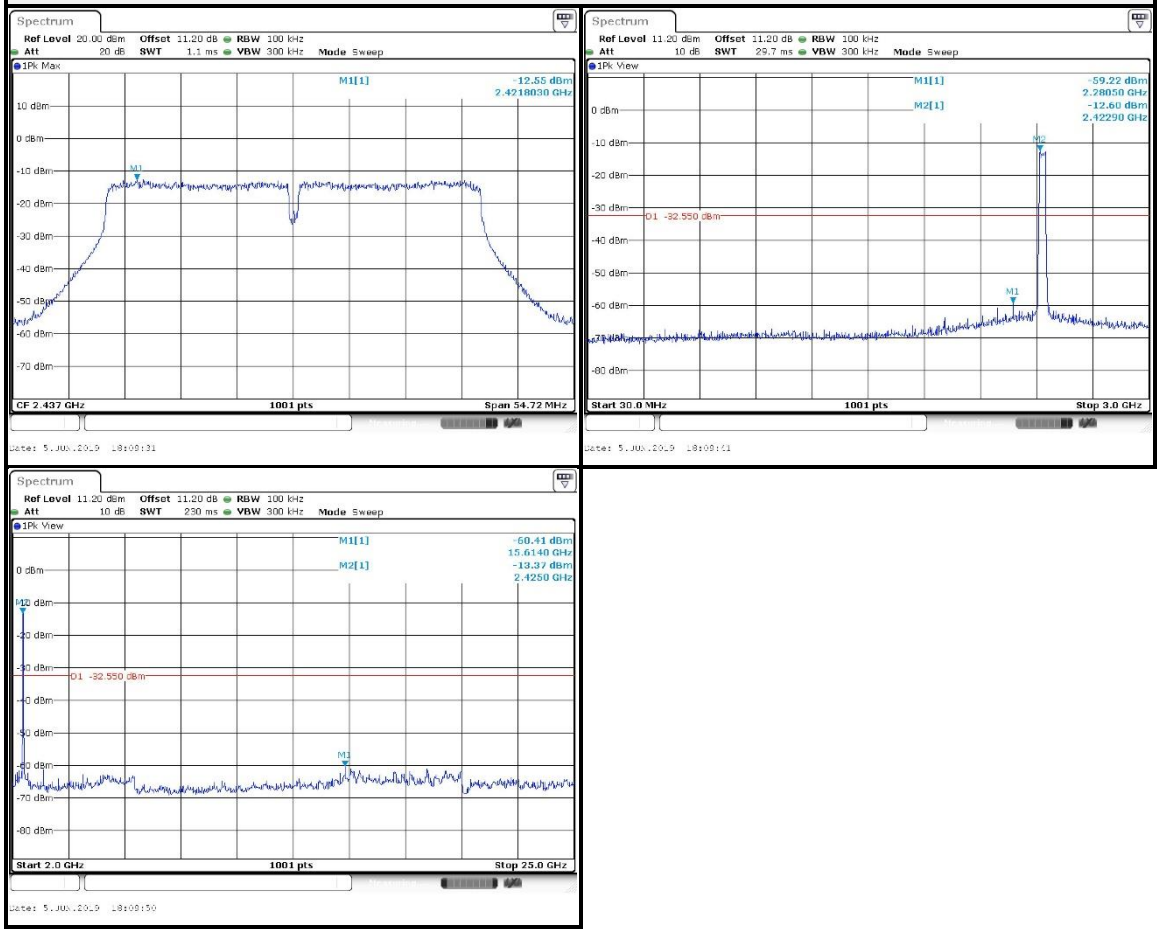
802.11n (HT40)

CHAIN 0

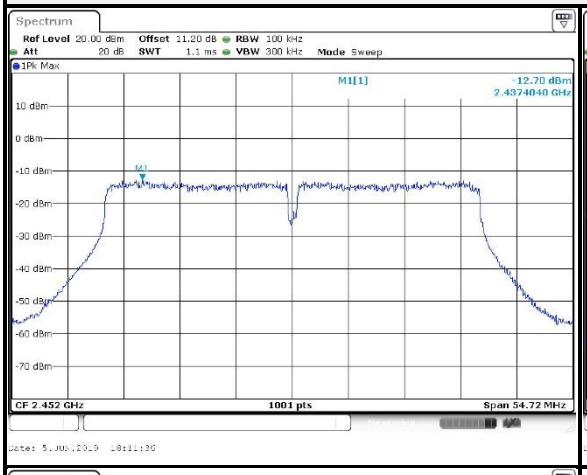
Ch 3

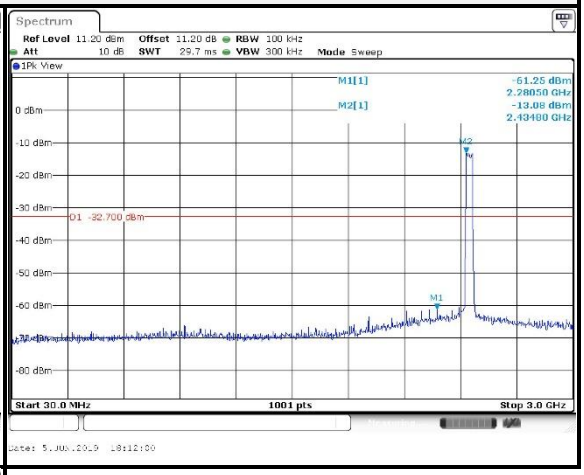


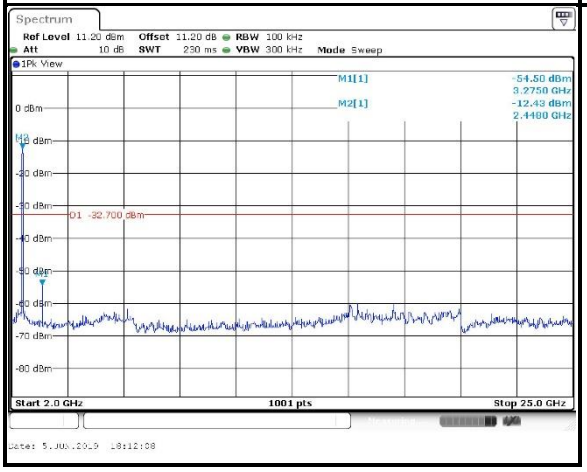
Ch 6


Spectrum
Ref Level 20.00 dBm Offset 11.20 dB RBW 100 kHz
Att 20 dB SWT 1.1 ms VBW 300 kHz Mode Sweep
1Pk Max
M1[1] -12.55 dBm 2.4218030 GHz
CF 2.437 GHz 1001 pts Span 54.72 MHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 29.7 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -59.22 dBm 2.28050 GHz
M2[1] -12.60 dBm 2.42290 GHz
D1 -32.550 dBm
Start 30.0 MHz 1001 pts Stop 3.0 GHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 230 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -60.41 dBm 15.6140 GHz
M2[1] -13.37 dBm 2.4250 GHz
D1 -32.550 dBm
Start 2.0 GHz 1001 pts Stop 25.0 GHz

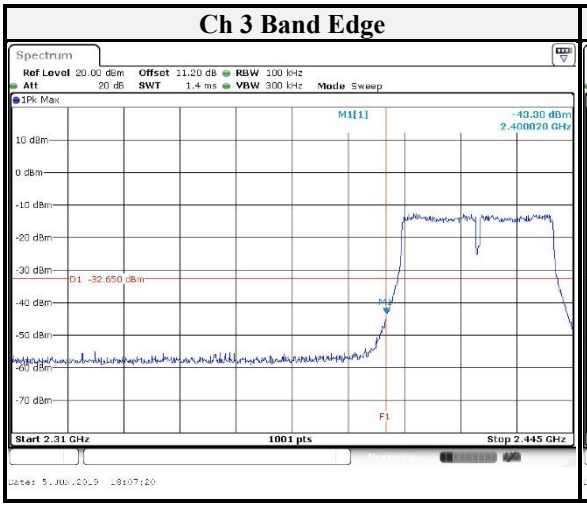
Ch 9



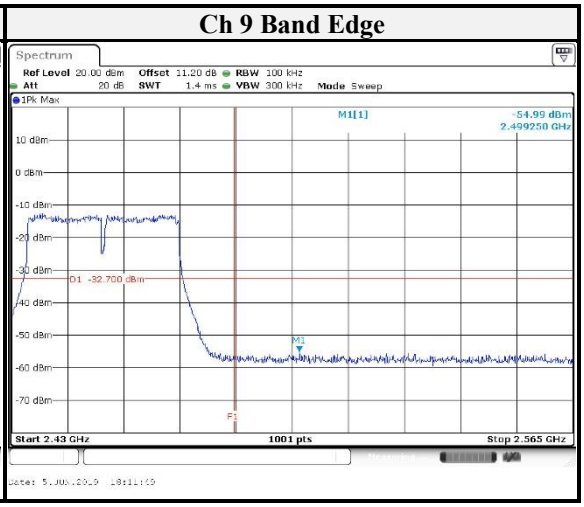




Ch 3 Band Edge

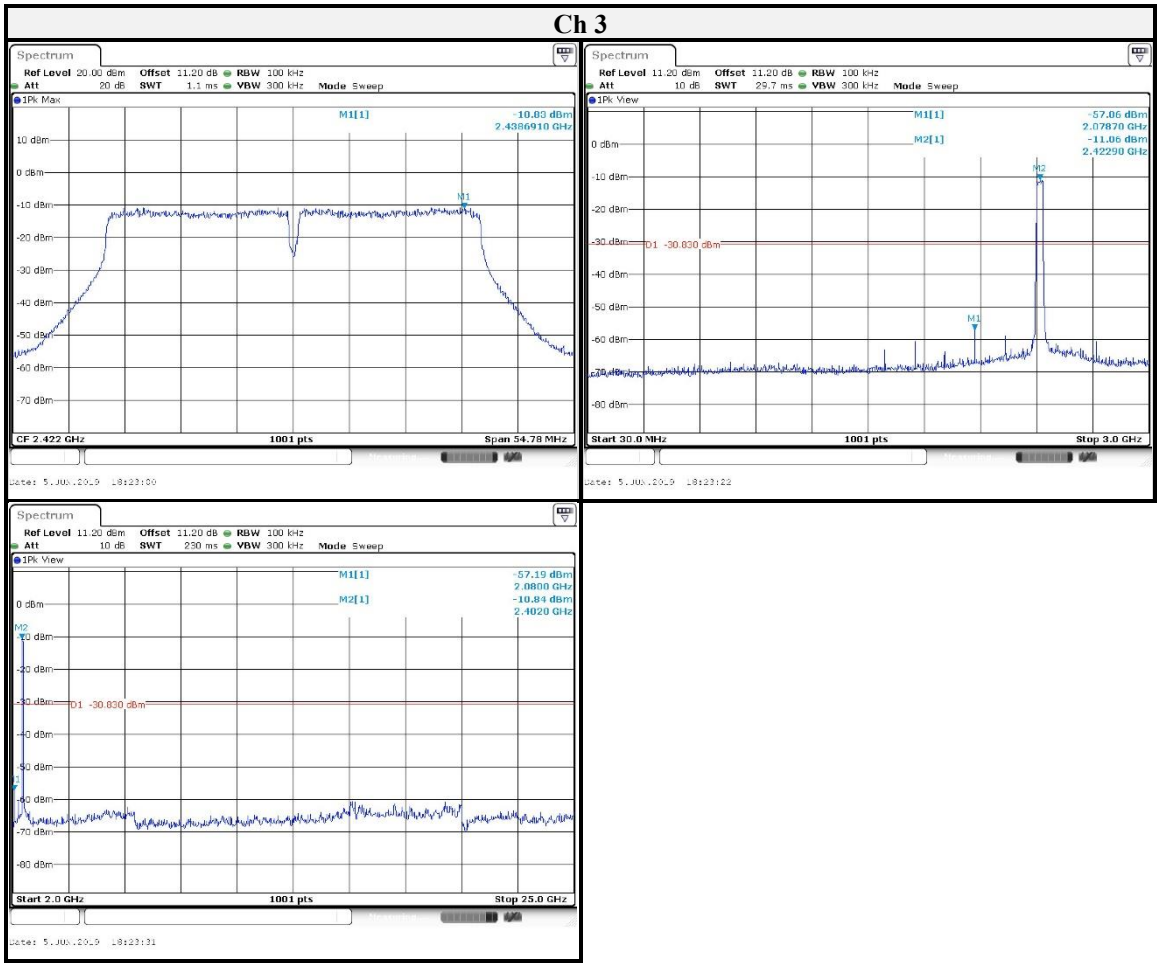


Ch 9 Band Edge

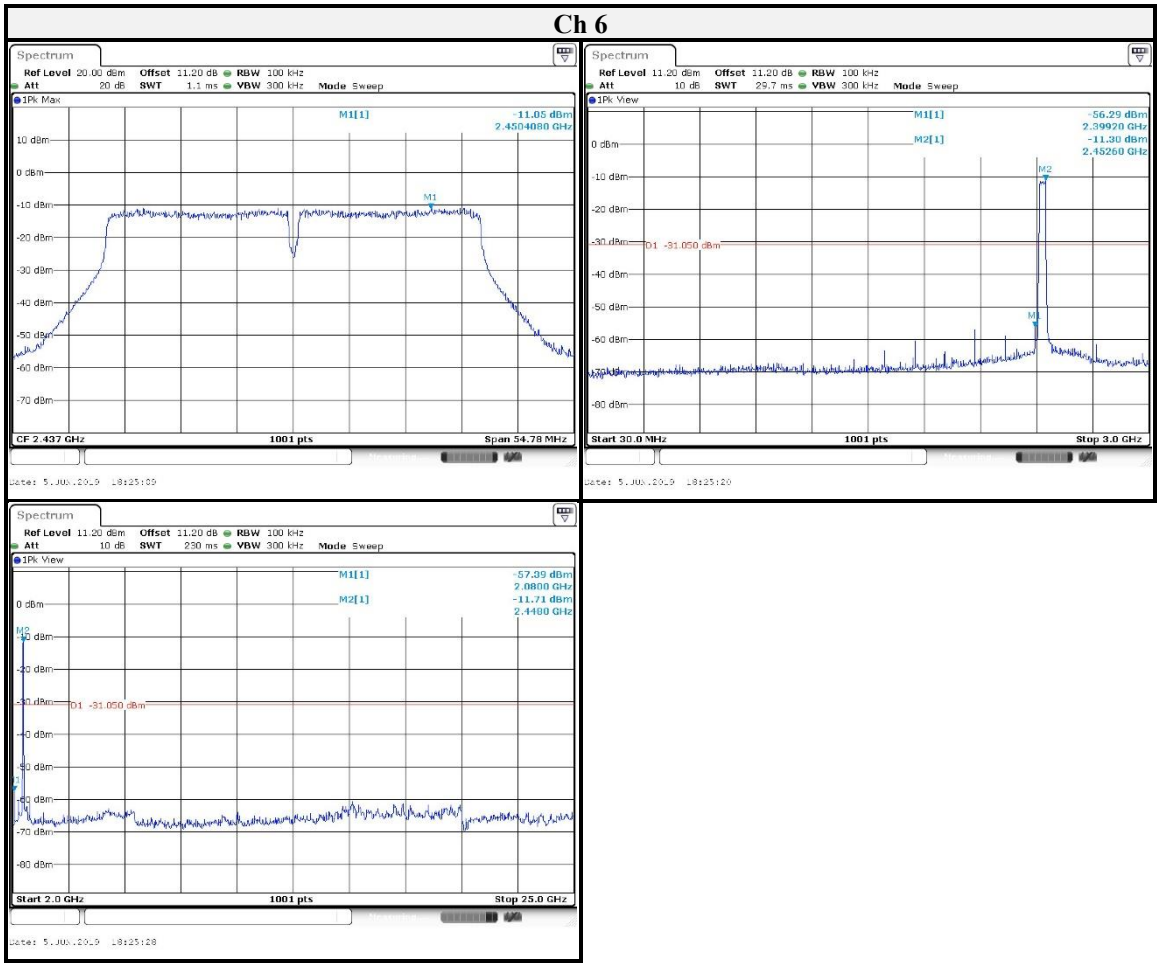


CHAIN 1

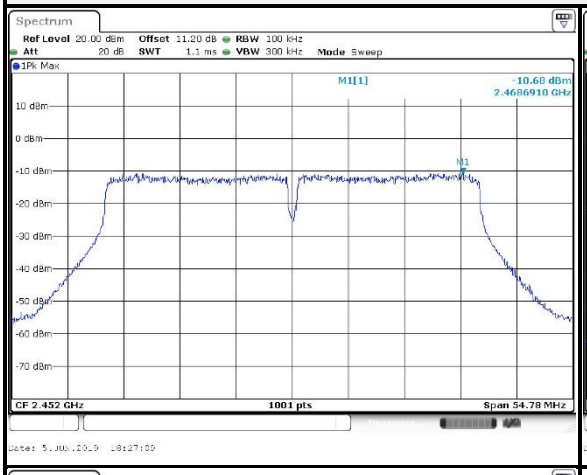
Ch 3

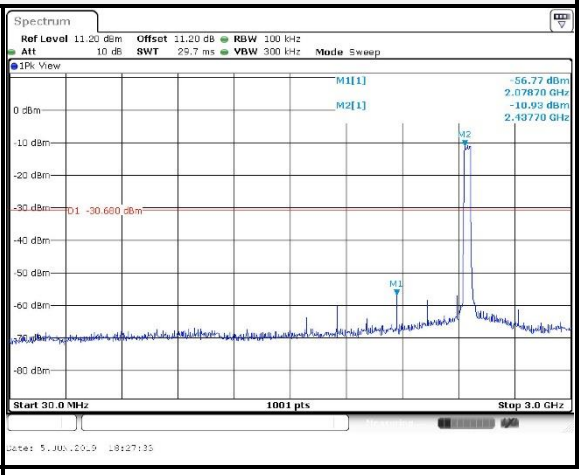

Spectrum
Ref Level 20.00 dBm Offset 11.20 dB RBW 100 kHz
Att 20 dB SWT 1.1 ms VBW 300 kHz Mode Sweep
1Pk Max
M1[1] -10.83 dBm 2.4386910 GHz
CF 2.422 GHz 1001 pts Span 54.78 MHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 29.7 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -57.86 dBm 2.07870 GHz
M2[1] -11.06 dBm 2.42290 GHz
D1 -30.830 dBm
Start 30.0 MHz 1001 pts Stop 3.0 GHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 230 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -57.19 dBm 2.0800 GHz
M2[1] -10.84 dBm 2.4020 GHz
D1 -30.830 dBm
Start 2.0 GHz 1001 pts Stop 25.0 GHz

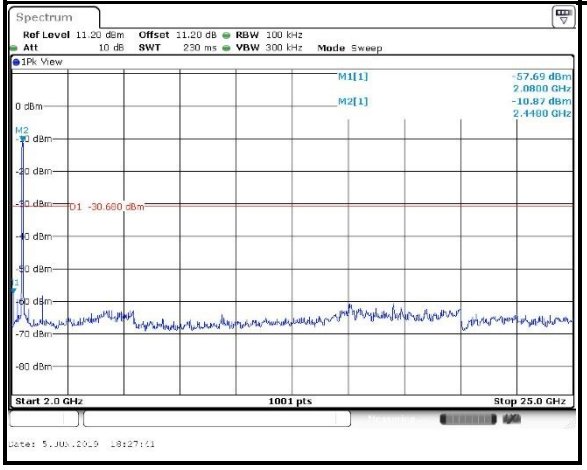
Ch 6


Spectrum
Ref Level 20.00 dBm Offset 11.20 dB RBW 100 kHz
Att 20 dB SWT 1.1 ms VBW 300 kHz Mode Sweep
1Pk Max
M1[1] -11.05 dBm 2.4504080 GHz
CF 2.437 GHz 1001 pts Span 54.78 MHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 29.7 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -56.29 dBm 2.39920 GHz
M2[1] -11.30 dBm 2.45260 GHz
D1 -31.050 dBm
Start 30.0 MHz 1001 pts Stop 3.0 GHz
Spectrum
Ref Level 11.20 dBm Offset 11.20 dB RBW 100 kHz
Att 10 dB SWT 230 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -57.39 dBm 2.0800 GHz
M2[1] -11.71 dBm 2.4480 GHz
D1 -31.050 dBm
Start 2.0 GHz 1001 pts Stop 25.0 GHz

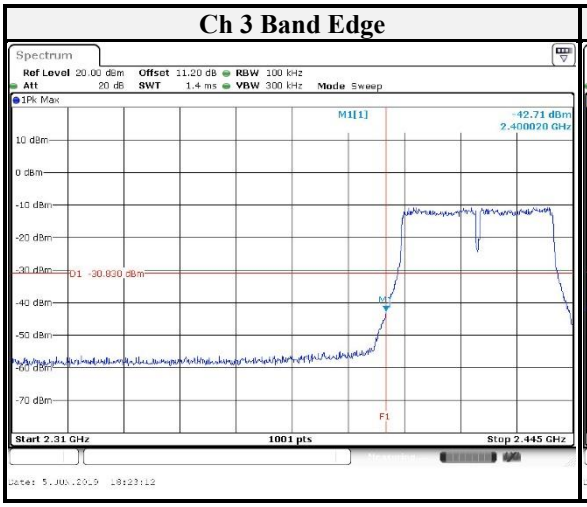
Ch 9



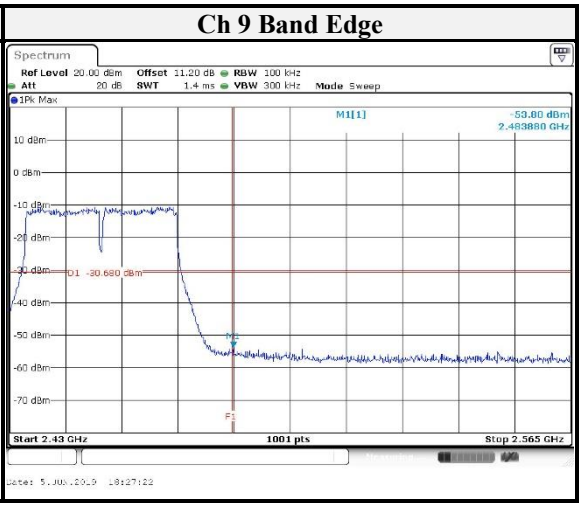




Ch 3 Band Edge



Ch 9 Band Edge



9.5. Radiated Spurious Emission

Requirements

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequency(MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
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

NOTE:
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

Test Procedures

[For 9 kHz ~ 30 MHz]

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. For measurement below 30MHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

NOTE:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

[For above 30 MHz]

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.

b. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.

c. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.

Configuration	Average	
	RBW	VBW
802.11b	1MHz	10 Hz
802.11g		10 Hz
802.11n (HT20)		10 Hz
802.11n (HT40)		10 Hz

Note: Refer to section 6.6 for duty cycle.

d. All modes of operation were investigated and the worst-case emissions are reported.