RADIO TEST REPORT

Product	:	WLAN and BT Wireless Module
Model Name	:	WBU058-BGA-V11
Series Model	:	WBU058-BGA-V13, WBU058-BGA-V15
FCC ID	:	RX3-WBU058BGA
Test Regulation	:	FCC 47 CFR Part 15 Subpart C (Section 15.247)
Received Date	:	2024/8/9
Test Date	:	2024/08/13 ~ 2024/09/06
Issued Date	:	2024/10/7

Applicant	:	Hon Hai Precision Industry Co., Ltd. No.151, Sec. 1, Nankan Rd., Lujhu Dist.,Taoyuan City 33859, Taiwan
Issued By	:	Underwriters Laboratories Taiwan Co., Ltd. Building A, B and E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Testing Laboratory
3398

The results reported herein have been performed in accordance with the laboratory's terms of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory. The results in this report are responsible of the test sample(s) provided by the client only and are not to be used to indicate applicability to other similar products.

REVISION HISTORY

Original Test Report No.: 4791426387A-US-R0-V0

Revision	Test report No.	Date	Page revised	Contents
Original	4791426387A-US-R0-V0	2024/10/7	-	Initial issue

Table of Contents

1. Attestation of Test Results

APPLICANT:	Hon Hai Precision Industry Co., Ltd. No.151, Sec. 1, Nankan Rd., Lujhu Dist.,Taoyuan City 33859, Taiwan
MANUFACTURER:	HON HAI PRECISION IND. CO., LTD No.151, Sec. 1, Nankan Rd., Lujhu Dist.,Taoyuan City 33859, Taiwan
EUT DESCRIPTION:	WLAN and BT Wireless Module
BRAND:	FOXCONN
MODEL:	WBU058-BGA-V11
SERIES MODEL:	WBU058-BGA-V13, WBU058-BGA-V15
SAMPLE STAGE:	Engineering Verification Test Sample
DATE of TESTED:	2024/08/13 ~ 2024/09/06

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 : 2024/10/7
Project Handler

Approved and Authorized By:

Eric Lee Date : 2024/10/7
Senior Laboratory 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

3. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with 47 CFR FCC Part 2, KDB558074 D01 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 A, B and 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.

5. Measurement Uncertainty

For statement of conformity, Simple acceptance (Section 3.1.4 of IEC Guide 115) 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.

Determining compliance based on the results of the compliance measurement, not considering measurement instrumentation uncertainty.

Measurement	Frequency	Uncertainty
Conducted disturbance at mains terminals ports	150kHz ~ 30MHz	3.1 dB
RF Conducted	9 kHz - 40GHz	2.3 dB
Radiated disturbance below 30MHz	9 kHz - 30 MHz	3.2 dB
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	6.1 dB
Radiated disturbance above 1 GHz	1GHz ~ 40GHz	5.1 dB

6. Equipment under Test

6.1. Description of EUT

Product	WLAN and BT Wireless Module
Brand Name	FOXCONN
Model Name	WBU058-BGA-V11
Series Model	WBU058-BGA-V13, WBU058-BGA-V15
Normal Voltage	3.3Vdc from Host

Operating Frequency	2412MHz ~ 2462MHz
Modulation	CCK, DQPSK, DBPSK for DSSS
	1024QAM, 256QAM, 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
	802.11ac: up to MCS9
	802.11ax: up to MCS11
Maximum Output Power	2412MHz ~ 2462MHz: 22.51 dBm
Sample ID	Conducted Test:7472206
	Radiated Test:7528177

Note:
1. The differences between the models are shown in the table below.:

Model	Light Sensor	IR	Power Switch	Thermal Sensor	MIC
WBU058-BGA-V11	V	V	V	-	-
WBU058-BGA-V13	V	V	V	V	-
WBU058-BGA-V15	V	V	V	-	V

2. EUT provides a complete 2Tx port and 2Rx port. Please refer to the following working transmission conditions:

Modulation Mode	Tx/Rx Function	
802.11b	2Tx	2Rx
802.11g	2Tx	2Rx
802.11n (HT20)	2Tx	2Rx
802.11n (HT40)	2Tx	2Rx
802.11ax (HE20)	2Tx	2Rx
802.11ax (HE40)	2Tx	2Rx

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual, the laboratory shall not be held responsible

6.2. Channel List

11 channels are provided for WLAN 20MHz bandwidth system:

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

7 channels are provided for WLAN 40MHz bandwidth system:

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

6.3. Test Condition

Test Item	Test Site No.	Environmental	Input Power	Test Date	Tested by
Antenna Port Conducted Measurement	SR4	23~25℃/ 63~67%RH	3.3Vdc	2024/08/20~ 2024/09/06	Rex Chen/ Jubo Shen
Radiated Spurious Emission	966-2	22~26℃/ 62~68%RH	3.3Vdc	2024/08/13~ 2024/08/28	Rex Chen
AC power Line Conducted Emission	SR1	24℃/ 62%RH	120Vac/ 60Hz	2024/08/21	Rex Chen

Sample Calculation:

Antenna Port Conducted Measurement:

- Where relevant, the follow sample calculation is provided:
  Result Value (dBm) = Reading Value (dBm) +Attenuator Factor (dB) + Cable Loss (dB).
  Example: Result Value (10dBm) = Reading Value (-2dBm) +Attenuator Factor (10dB) + Cable Loss(2dB).
  *Test plot only shown the “Result Value”.

Radiated Spurious Emission:

- Where relevant, the follow sample calculation is provided:
  Result Value (dBuV/m) = Reading Value (dBuV) + Correction Factor (dB/m).
  Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB) - Preamp Factor (dB).
  Example: Result Value (34.5dBuV/m) = Reading Value (40.1dBuV) + Antenna Factor (18.7dB/m) + Cable Loss (4.2dB) - Preamp Factor (28.5dB).

AC power Line Conducted Emission:

- Where relevant, the follow sample calculation is provided:
  Result Value (dBuV) = Reading Value (dBuV) + Correction Factor (dB).
  Correction Factor (dB) = Insertion loss(dB) + Cable loss(dB).
  Example: Result Value (53.7dBuV) = Reading Value (35.1dBuV) + Insertion loss(18.1dB) + Cable loss(0.5dB).

6.4. Description of Available Antennas

Ant. No.	Transmitter Circuit	Frequency Range	Brand Name	Model Name	Maximum Gain (dBi)	Ant. Type	Connector Type
WLAN ANT1	Chain0	2.412~2.472GHz 5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.85GHz 5.925~6.425GHz 6.425~6.525GHz 6.525~6.875GHz 6.875~7.125GHz	FOXCONN	WBU058-BGA	2.412~2.472GHz: 3.91 5.15~5.25GHz: 4.11 5.25~5.35GHz: 5.18 5.47~5.725GHz: 4.62 5.725~5.85GHz: 4.28 5.925~6.425GHz: 3.34 6.425~6.525GHz: 3.35 6.525~6.875GHz: 4.88 6.875~7.125GHz: 4.72	Printing	N/A
WLAN ANT2	Chain1	2.412~2.472GHz 5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.85GHz 5.925~6.425GHz 6.425~6.525GHz 6.525~6.875GHz 6.875~7.125GHz	FOXCONN	WBU058-BGA	2.412~2.472GHz: 4.94 5.15~5.25GHz: 3.8 5.25~5.35GHz: 3.76 5.47~5.725GHz: 3.36 5.725~5.85GHz: 3.34 5.925~6.425GHz: 3.07 6.425~6.525GHz: 3.39 6.525~6.875GHz: 4.01 6.875~7.125GHz: 2.97	Printing	N/A

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, the laboratory shall not be held responsible.

6.5. Test Mode Applicability and Tested Channel Detail

Test Item	Mode	Modulation Technology	Modulation Type	Available Channel	Test Channel	Data Rate
Radiated Bandedge	802.11b	DSSS	DBPSK	1 to 11	1,6,11	1 Mbps
	802.11g	OFDM	BPSK	1 to 11	1,6,11	6 Mbps
	802.11n20	OFDM	BPSK	1 to 11	1,6,11	MCS0 Nss1
	802.11n40	OFDM	BPSK	3 to 9	3,6,9	MCS0 Nss1
	802.11ax20	OFDM	BPSK	1 to 11	1,6,11	MCS0 Nss1
	802.11ax40	OFDM	BPSK	3 to 9	3,6,9	MCS0 Nss1
Radiated Emissions (Above 1GHz)	802.11b	DSSS	DBPSK	1 to 11	1,6,11	1 Mbps
	802.11g	OFDM	BPSK	1 to 11	1,6,11	6 Mbps
Radiated Emissions (Below 1GHz)	802.11g	OFDM	BPSK	1 to 11	11	6 Mbps
AC Power Line Conducted Emission	802.11g	OFDM	BPSK	1 to 11	11	6 Mbps
Antenna Port Conducted Measurement	802.11b	DSSS	DBPSK	1 to 11	1,6,11	1 Mbps
	802.11g	OFDM	BPSK	1 to 11	1,6,11	6 Mbps
	802.11n20	OFDM	BPSK	1 to 11	1,6,11	MCS0 Nss1
	802.11n40	OFDM	BPSK	3 to 9	1,6,11	MCS0 Nss1
	802.11ax20	OFDM	BPSK	1 to 11	3,6,9	MCS0 Nss1
	802.11ax40	OFDM	BPSK	3 to 9	3,6,9	MCS0 Nss1

*Note: For Antenna Port Conducted Measurement item, Inner channels only test Power and Conducted Out of Band Emission.

- The fundamental of the EUT was investigated in three orthogonal axes X-Y/Y-Z/X-Z, it was determined that X-Y plane was worst-case. Therefore, all final radiated testing was performed with the EUT in X-Y plane.

  The EUT has 3 types of Models: WBU058-BGA-V11, WBU058-BGA-V13, and WBU058-BGA-V15, The above Model was pre-tested radiated emission, the worst case was found in Model: WBU058-BGA-V11, and therefore only the worst case test data was recorded in this report.

- The radiated spurious emission test was performed in all test modes. The worst case were 802.11b and 802.11g, and therefore, only the worst case data is shown in this report to represent all test modes.

- In the transmit mode, 802.11g channel 11 has the highest RF output power. Therefore, the AC conduction were performed using this worst-case mode.

- In the transmit mode, 802.11g channel 11 has the worst case of Tx spurious emission (above 1GHz). Therefore, all final tests for the spurious emission (below 1GHz) were performed using this worst-case mode.

- 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.

- For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.

- 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).

Simultaneously transmission condition:

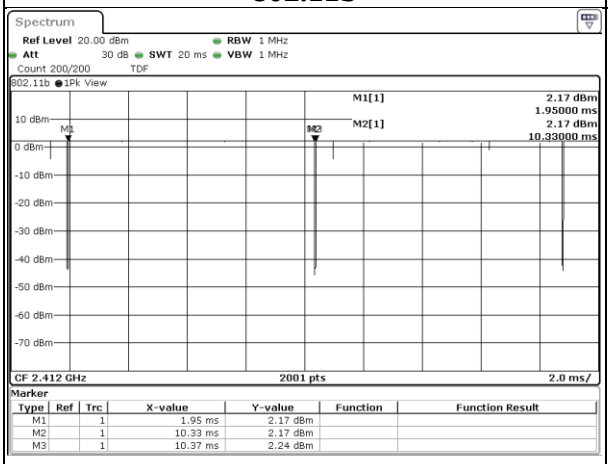
Condition	Technology	
1	WLAN (2.4GHz)	BT LE
2	WLAN (2.4GHz)	BT EDR

Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.

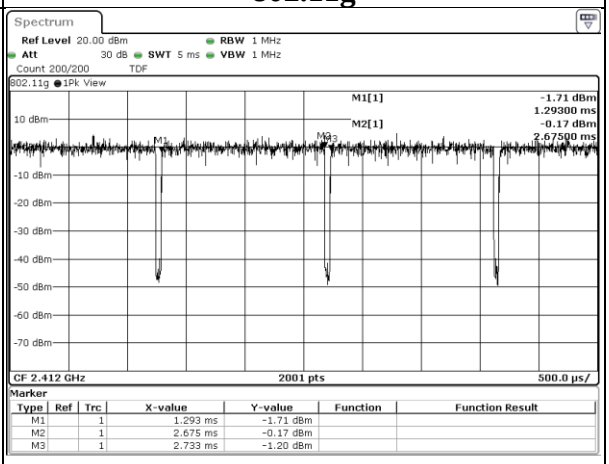
6.6. Duty cycle

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle	Duty Factor (dB)	VBW Set (above 1GHz)
802.11b	8.380	8.420	0.9952	N/A	10Hz
802.11g	1.382	1.440	0.9597	0.18	1kHz
802.11n(HT20)	1.287	1.345	0.9569	0.19	1kHz
802.11n(HT40)	0.648	0.692	0.9364	0.29	2kHz
802.11ax(HE20)	1.013	1.070	0.9467	0.24	1kHz
802.11ax(HE40)	0.543	0.586	0.9266	0.33	2kHz

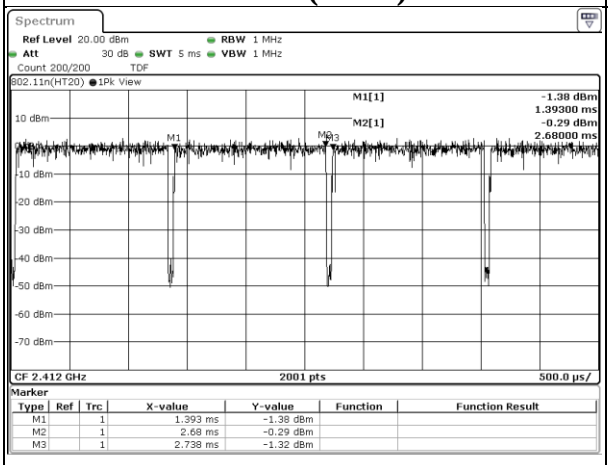
802.11b



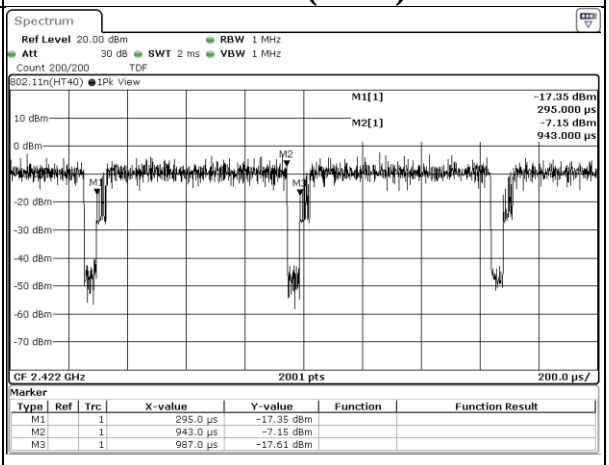
802.11g



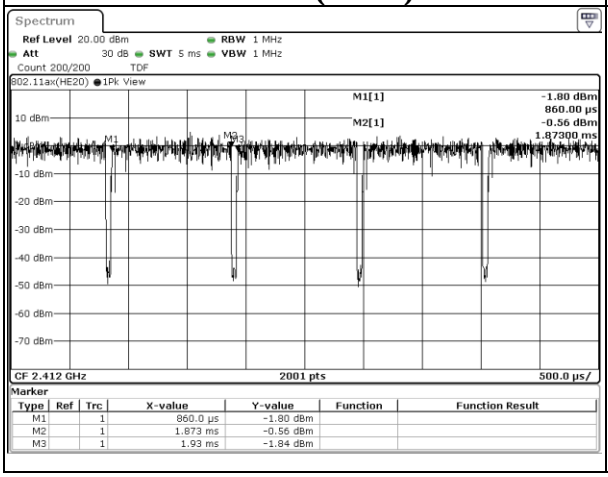
802.11n(HT20)



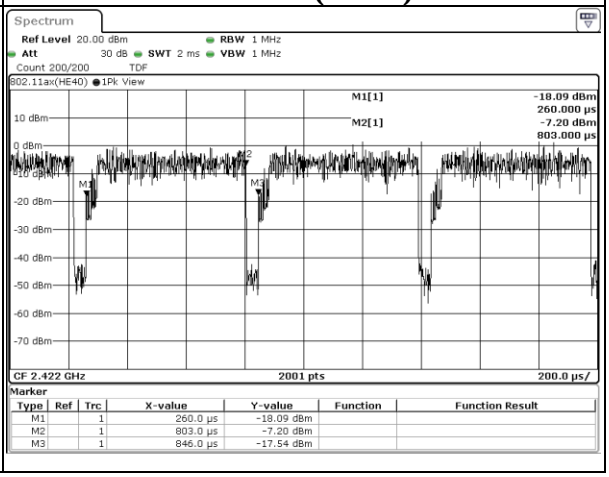
802.11n(HT40)



802.11ax(HE20)



802.11ax(HE40)



7. Test Equipment

Test Equipment List					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Expired date**
Radiated Spurious Emission					
Spectrum Analyzer	Keysight	N9010A	MY56070827	2024/3/29	2025/3/28
EMI Test Receiver	Rohde & Schwarz	ESR7	101754	2023/11/22	2024/11/21
Loop Antenna	ETS lindgren	6502	00213440	2023/12/13	2024/12/12
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	774 & AT-N0538	2024/1/5	2025/1/4
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01690	2023/12/8	2024/12/7
Horn Antenna (18-40 GHz)	Schwarzbeck	BBHA 9170	781	2023/12/27	2024/12/26
Preamplifier (30-1000 MHz)	EMCI	EMC330E	980405	2024/5/28	2025/5/27
Preamplifier (1-18 GHz)	EMCI	EMC051835BE	980406	2024/1/23	2025/1/22
Preamplifier (18-40GHz)	EMCI	EMC184040SEE	980426	2024/4/16	2025/4/15
Cables (9k-18 GHz)	Hanyitek	K1K50-UP0264-K1K50-2500	170214-4 & 170425-2	2023/11/29	2024/11/28
Cables (18-40GHz)	Hanyitek	K1K50-UP0264-K1K50-2500	170214-1 & 170214-2	2023/11/29	2024/11/28

Test Equipment List					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Expired date**
Antenna Port Conducted Measurement					
Signal Analyzer	Rohde & Schwarz	FSVA3044	101281	2024/3/18	2025/3/17
Signal Analyzer	Rohde & Schwarz	FSV40	101490	2023/9/13	2024/9/12
Attenuator	EMCI	EMC-40ATK2W10	17002	2023/11/15	2024/11/14
USB Power Sensor	Anritsu	MA24408A	12031	2024/7/13	2025/7/12
Temperature &Humidity Test Chamber	GIANT FORCE	GTH-150- 40-CP-AR	MAA1701-010	2024/3/6	2025/3/5
AC power Line Conducted Emission					
EMI Test Receiver	Rohde & Schwarz	ESR7	101753	2023/10/23	2024/10/22
Two-Line V-Network	Rohde & Schwarz	ENV216	102136	2024/5/14	2025/5/13
Impuls-Begrenzer Pulse Limiter	Rohde & Schwarz	ESH3-Z2	102219-Qt	2023/9/7	2024/9/6
Cables	TITAN	CFD200	T0732ACFD 20020A300-2	2024/5/14	2025/5/13

UL Software		
Description	**Name**	**Version**
Radiated measurement	e3	6.191211 (V6)
Conducted measurement	RF-Conducted-FCC 15247	ver 1.0
AC power Line Conducted Emission	EZ_EMC	UL-3A1.2

8. Description of Test Setup

Tx Mode

Support Equipment

ID	Equipment	Brand Name	Model Name	S/N	Remark
A	Laptop	DELL	Latitude E5470	3JFKWF2	Provided by Lab
B	DC Power Supply	Gwinstek	GPD-2303S	N/A	Provided by Lab

I/O Cables

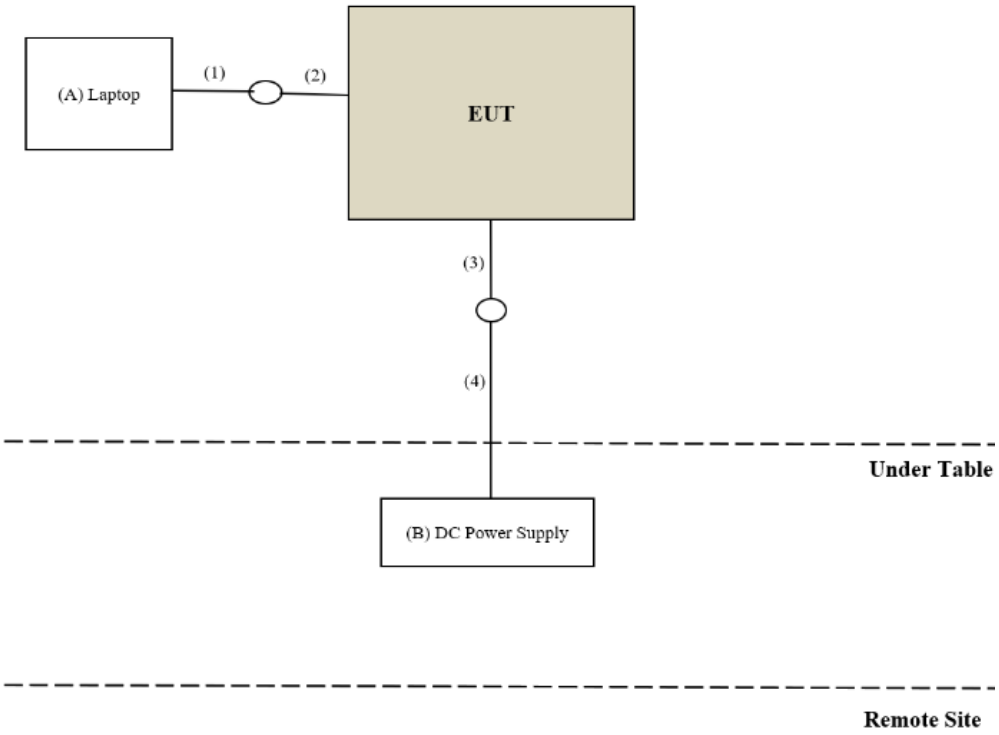
ID	Equipment	Brand Name	Model Name	Length (m)	Remark
1	USB Cable	UGREEN	VW-1	0.53	Supplied by client
2	DC Cable	TAYA	PT0020-2	0.1	Supplied by client
3	DC Cable	TAYA	PT0020-2	0.1	Supplied by client
4	DC Cable	TAYA	PT0020-2	2	Provided by Lab

Test Setup

Controlled using a bespoke application (MT7961 QA 0.0.2.39) 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

Tx Mode



9. Test Results

9.1. 6dB Bandwidth

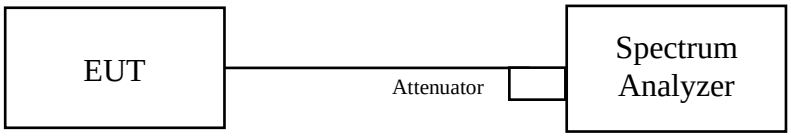
Requirements

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

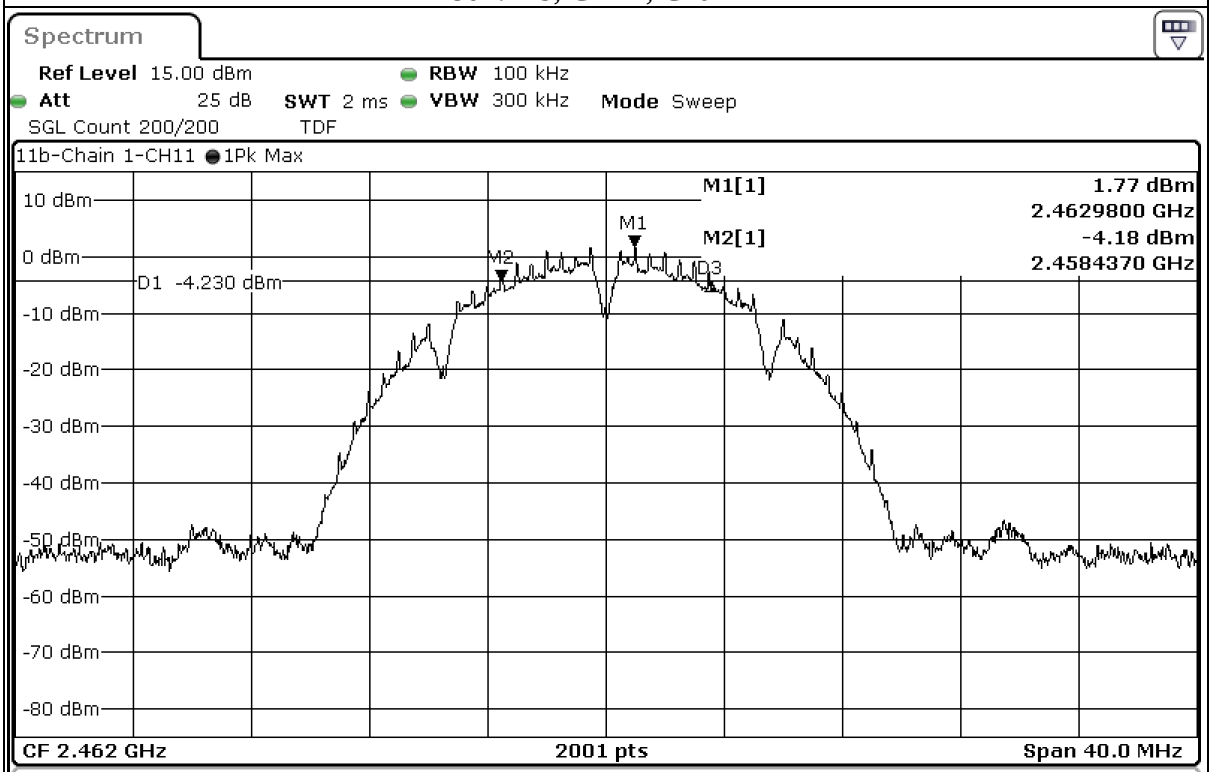


The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

Test Data

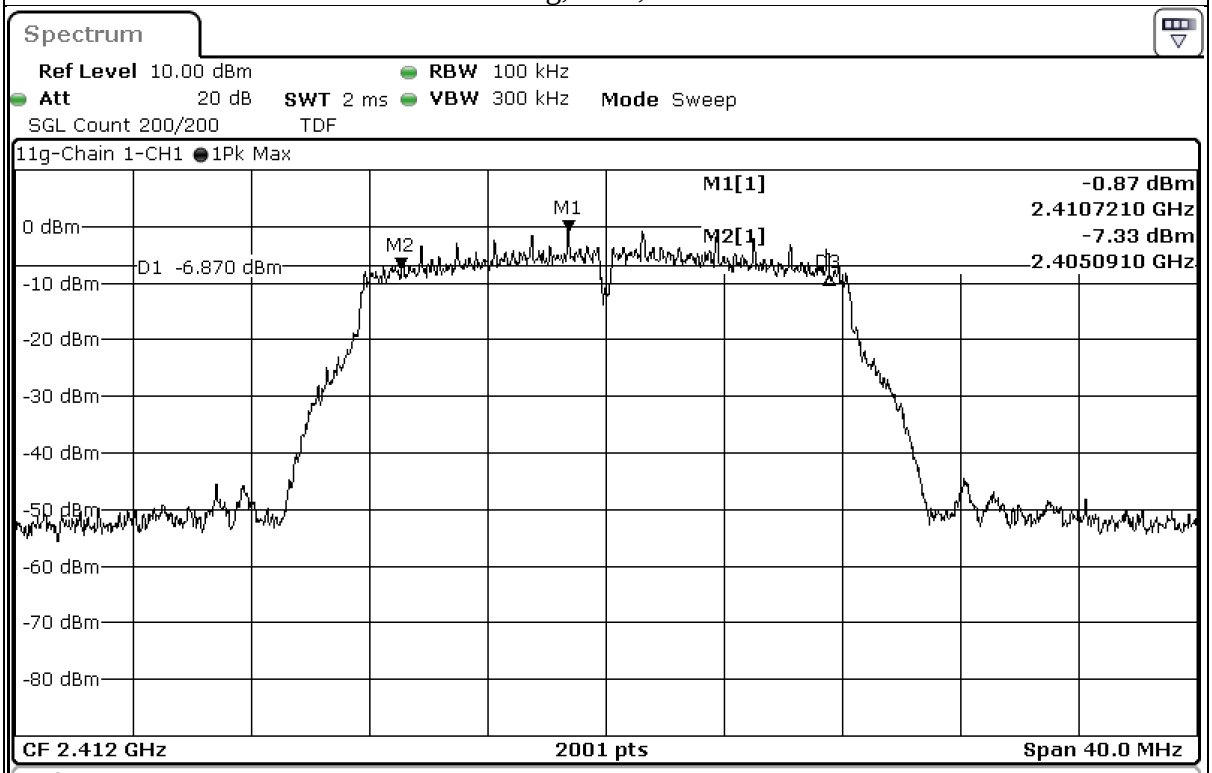
Mode	CH	Freq (MHz)	6dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11b	1	2412	7.089	8.034	0.5	PASS
	6	2437	8.071	7.576	0.5	PASS
	11	2462	7.091	7.081	0.5	PASS

802.11b, CH11, Chain 1



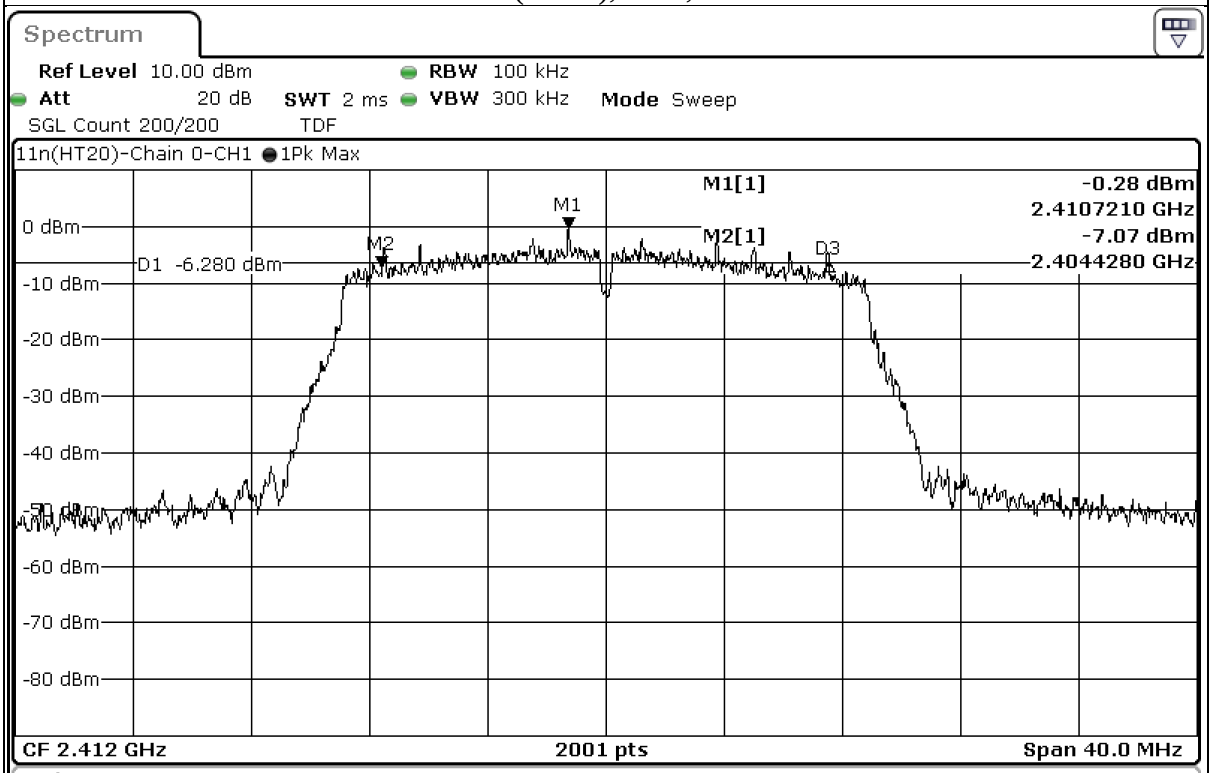
Mode	CH	Freq (MHz)	6dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11g	1	2412	15.072	14.456	0.5	PASS
	6	2437	15.431	15.711	0.5	PASS
	11	2462	15.127	16.320	0.5	PASS

802.11g, CH1, Chain 1



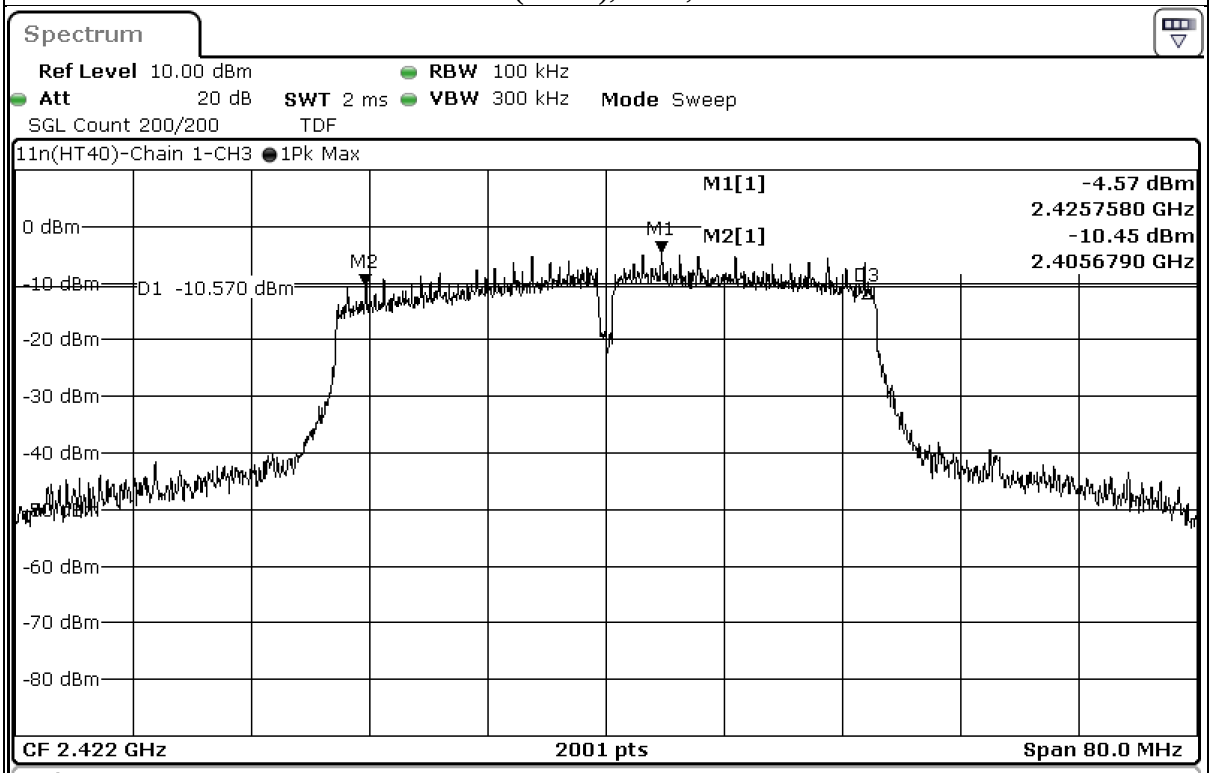
Mode	CH	Freq (MHz)	6dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11n(HT20)	1	2412	15.114	16.323	0.5	PASS
	6	2437	15.132	16.313	0.5	PASS
	11	2462	17.290	17.529	0.5	PASS

802.11n(HT20), CH1, Chain 0



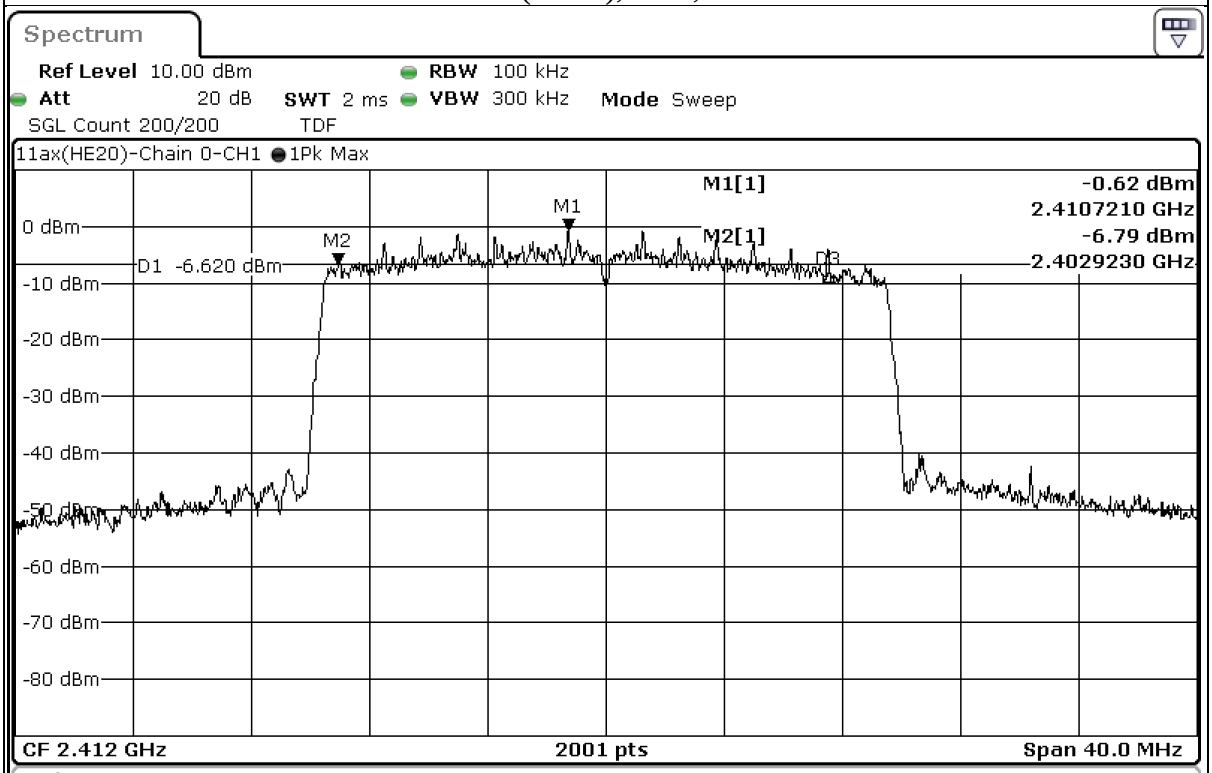
Mode	CH	Freq (MHz)	6dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11n(HT40)	3	2422	35.119	34.067	0.5	PASS
	6	2437	35.099	35.081	0.5	PASS
	9	2452	35.034	35.139	0.5	PASS

802.11n(HT40), CH3, Chain 1



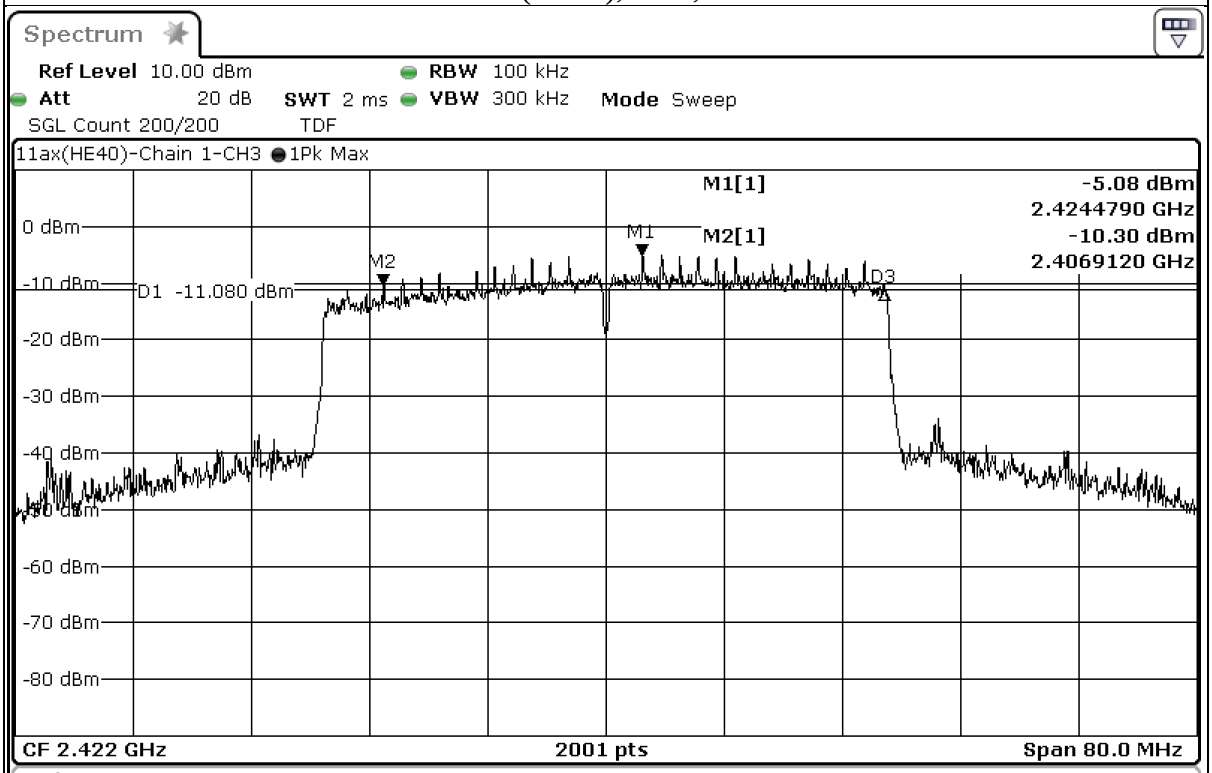
Mode	CH	Freq (MHz)	6dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11ax(HE20)	1	2412	16.624	17.536	0.5	PASS
	6	2437	17.669	16.773	0.5	PASS
	11	2462	17.578	18.074	0.5	PASS

802.11ax(HE20), CH1, Chain 0



Mode	CH	Freq (MHz)	6dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11ax(HE40)	3	2422	36.726	33.961	0.5	PASS
	6	2437	35.807	36.393	0.5	PASS
	9	2452	36.927	36.399	0.5	PASS

802.11ax(HE40), CH3, Chain 1



9.2. Conducted Output Power

Requirements

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

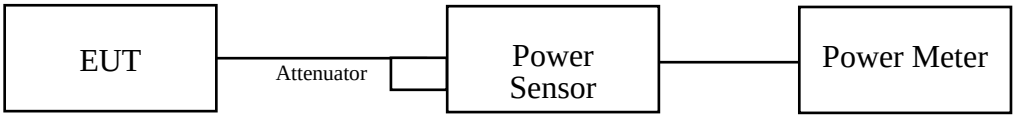
Note:
1. P_{Out} = maximum conducted output power in dBm, G_{TX} = the maximum transmitting antenna directional gain in dBi, B is the 26 dB emission bandwidth in megahertz
2. If EUT with Multiple Transmitter Output:
   a. Directional Gain = 10 log[$(10^{G1/20} + 10^{G2/20} + ... + 10^{Gn/20})^2$ / Nant] dBi.
   Nant: Number of Transmit Antennas
   G1, G2,..., Gn: Gain of Individual Antennas
   Example: two antenna and gain 5 dBi / 3dBi, so if it was used for TxBF power measurement
   Directional Gain = 10 log[(105/20 + 103/20)2 / 2] dBi = 7.07 dBi
   b. Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices, CDD
   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.
   Example: Maximum antenna gain = 5 dBi and NANT ≤ 4, so if it was used for CDD power measurement
   Directional Gain = 5 dBi + Array Gain = 5 dBi + 0 dB = 5 dBi
   c. For power measurement of KDB 662911 is used with multiple transmitter output. Total conducted power is the sum of the conducted power levels measured at the various output ports.

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.
to measure max output power of TX on burst. Duty factor is not added to measured value.

a. Set the RBW ≥ DTS bandwidth.
b. Set VBW ≥ 3 × RBW.
c. Set span ≥ 3 x RBW.
d. Sweep time = auto couple.
e. Detector = peak.
f. Trace mode = max hold.
g. Allow trace to fully stabilize.
h. Use peak marker function to determine the peak amplitude 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

Mode	CH	Freq. (MHz)	Peak Power (dBm)		Total PK Power (mW)	Total PK Power (dBm)	AVG Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Result
			Chain 0	Chain 1			Chain 0	Chain 1				
802.11b	1	2412	14.78	14.17	56.234	17.5	12.26	11.56	31.117	14.93	30	PASS
	6	2437	14.7	14.14	55.463	17.44	12.22	11.58	31.046	14.92	30	PASS
	11	2462	14.47	14.15	53.951	17.32	12	11.63	30.409	14.83	30	PASS
802.11g	1	2412	19.92	19.02	177.828	22.5	12.08	11.21	29.376	14.68	30	PASS
	6	2437	19.59	18.84	167.494	22.24	12.16	11.55	30.761	14.88	30	PASS
	11	2462	19.94	19.01	178.238	22.51	12.23	11.61	31.189	14.94	30	PASS
802.11n (HT20)	1	2412	19.27	19.22	168.267	22.26	11.52	10.8	26.242	14.19	30	PASS
	6	2437	18.84	18.13	141.579	21.51	11.31	10.69	25.235	14.02	30	PASS
	11	2462	18.73	18.53	145.881	21.64	11.33	10.98	26.122	14.17	30	PASS
802.11n (HT40)	3	2422	19.9	19.01	177.419	22.49	10.82	10.17	22.491	13.52	30	PASS
	6	2437	18.52	18.05	134.896	21.3	10.79	10.24	22.542	13.53	30	PASS
	9	2452	19.31	17.71	144.212	21.59	10.7	10.29	22.439	13.51	30	PASS
802.11ax (HE20)	1	2412	19.21	19.6	174.582	22.42	11.34	11.04	26.303	14.2	30	PASS
	6	2437	19.06	18.6	153.109	21.85	11.56	10.95	26.792	14.28	30	PASS
	11	2462	18.65	18.7	147.571	21.69	11.42	11.19	27.04	14.32	30	PASS
802.11ax (HE40)	3	2422	18.62	18.36	141.254	21.5	11.14	10.4	23.988	13.8	30	PASS
	6	2437	18.72	17.88	135.831	21.33	11.08	10.52	24.099	13.82	30	PASS
	9	2452	19.31	17.83	145.881	21.64	11.24	10.41	24.322	13.86	30	PASS

Note: Average Power is for reference Only.

9.3. Power Spectral Density

Requirements

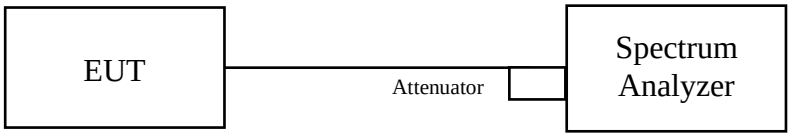
The Maximum of Power Spectral Density Measurement is 8dBm in any 3 kHz (If G_{TX} > 6 dBi, then PSD = 8 – (G_{TX} – 6)).

Note:
1. PSD = power spectral density that he same method as used to determine the conducted output power shall be used to determine the power spectral density. And power spectral density in dBm/MHz.
2. G_{TX} = the maximum transmitting antenna directional gain in dBi.
3. If EUT with Multiple Transmitter Output:
   a. Directional Gain = 10 log[($10^{G1/20}$ + $10^{G2/20}$ +...+$10^{Gn/20}$)^2 / Nant] dBi.
      N*a*nt: Number of Transmit Antennas
      G1, G2,..., Gn: Gain of Individual Antennas
      Example: two antenna and gain 5 dBi / 3dBi, so if it was used for power density measurement
      Directional Gain = 10 log[($10^{5/20}$ + $10^{3/20}$)^2 / 2] dBi = 7.07 dBi
   b. "PSD per chain" of the report shown is maximum value for each chain, at the "Total PSD" is summing entire spectra across corresponding frequency bins on the various outputs by computer, refer KDB 662911 Method a) for calculating total power density.
   c. Method a) of power density measurement of KDB 662911 is used for calculating total power density with multiple transmitter output. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.

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



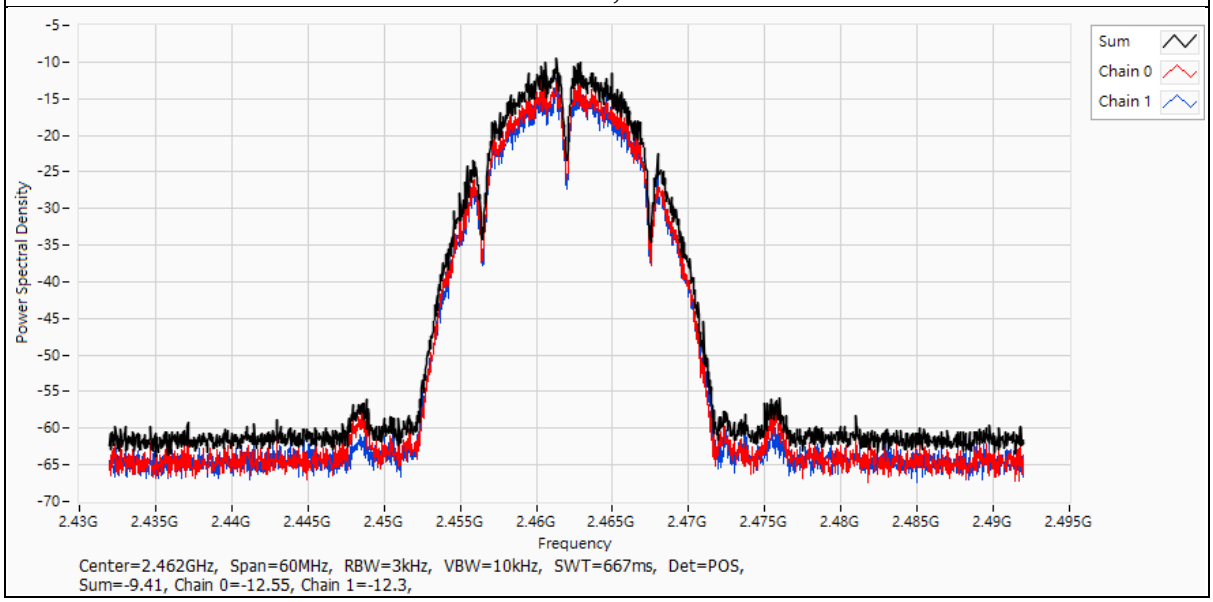
The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

Test Data

Mode	CH	Freq (MHz)	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Directional Gain (dBi)	Result
802.11b	1	2412	-10.09	6.55	7.45	PASS
	6	2437	-10.38	6.55	7.45	PASS
	11	2462	-9.41	6.55	7.45	PASS

Mode	CH	Freq (MHz)	PSD per Chain (dBm/3kHz)	
			Chain 0	Chain 1
802.11b	1	2412	-11.71	-13.21
	6	2437	-11.71	-13.26
	11	2462	-12.16	-12.3

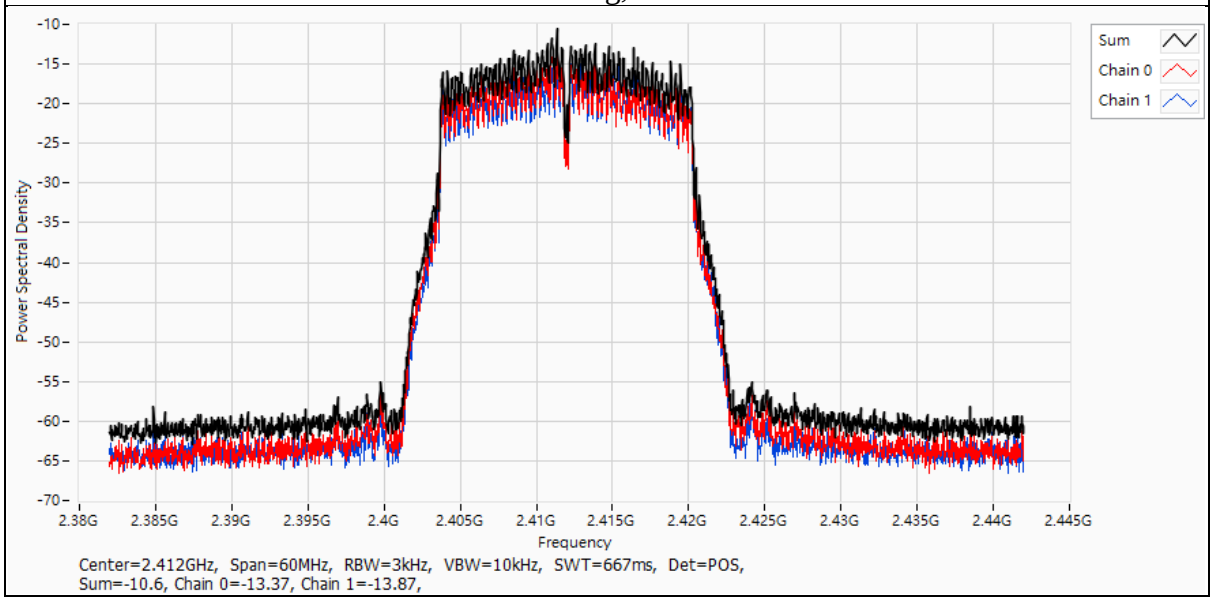
802.11b, CH11



Mode	CH	Freq (MHz)	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Directional Gain (dBi)	Result
802.11g	1	2412	-10.6	6.55	7.45	PASS
	6	2437	-10.61	6.55	7.45	PASS
	11	2462	-12.11	6.55	7.45	PASS

Mode	CH	Freq (MHz)	PSD per Chain (dBm/3kHz)	
			Chain 0	Chain 1
802.11g	1	2412	-13.37	-13.87
	6	2437	-13.55	-11.93
	11	2462	-14.42	-14.53

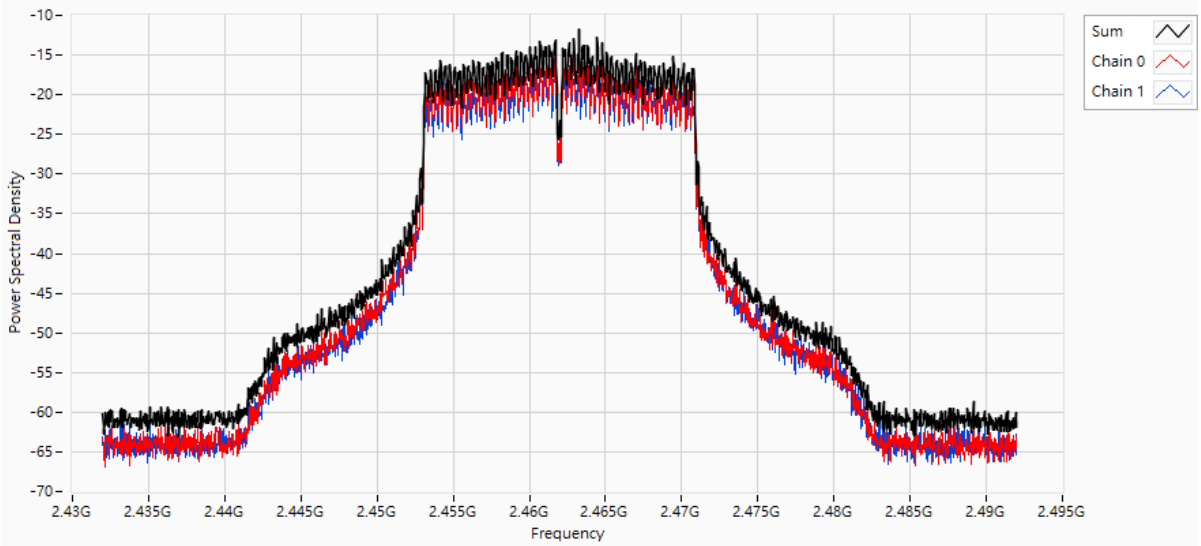
802.11g, CH1



Mode	CH	Freq (MHz)	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Directional Gain (dBi)	Result
802.11n(HT20)	1	2412	-11.98	6.55	7.45	PASS
	6	2437	-12.79	6.55	7.45	PASS
	11	2462	-11.73	6.55	7.45	PASS

Mode	CH	Freq (MHz)	PSD per Chain (dBm/3kHz)	
			Chain 0	Chain 1
802.11n(HT20)	1	2412	-14.7	-14.23
	6	2437	-15	-15.67
	11	2462	-14.6	-13.57

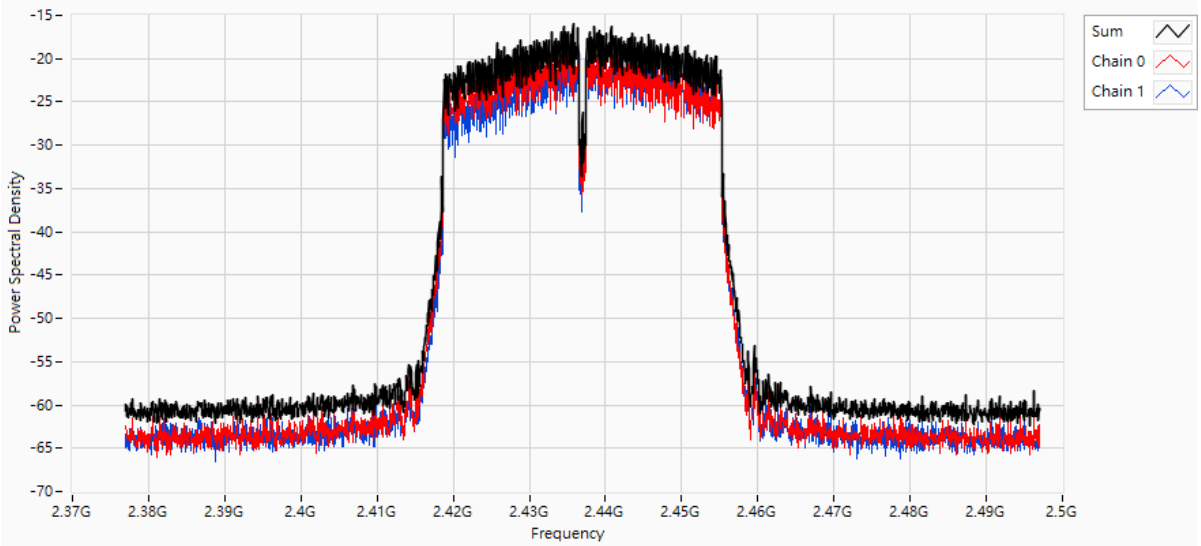
802.11n(HT20), CH11



Mode	CH	Freq (MHz)	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Directional Gain (dBi)	Result
802.11n(HT40)	3	2422	-16.41	6.55	7.45	PASS
	6	2437	-15.94	6.55	7.45	PASS
	9	2452	-16.62	6.55	7.45	PASS

Mode	CH	Freq (MHz)	PSD per Chain (dBm/3kHz)	
			Chain 0	Chain 1
802.11n(HT40)	3	2422	-18.51	-19.07
	6	2437	-18.93	-18.09
	9	2452	-18.06	-19.49

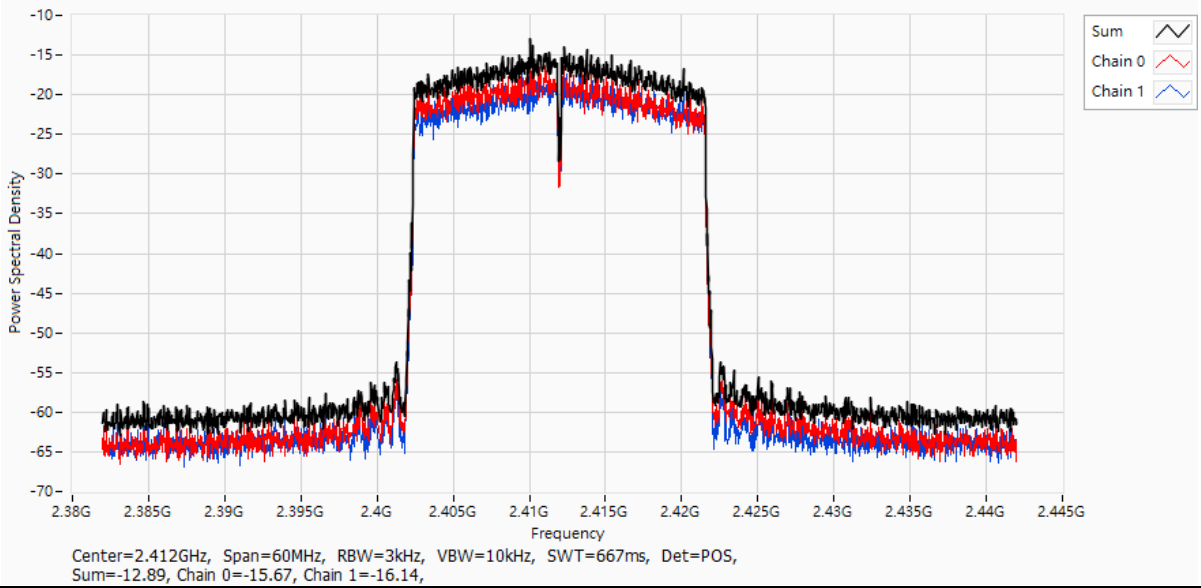
802.11n(HT40), CH6



Mode	CH	Freq (MHz)	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Directional Gain (dBi)	Result
802.11ax(HE20)	1	2412	-12.89	6.55	7.45	PASS
	6	2437	-13.31	6.55	7.45	PASS
	11	2462	-13.19	6.55	7.45	PASS

Mode	CH	Freq (MHz)	PSD per Chain (dBm/3kHz)	
			Chain 0	Chain 1
802.11ax(HE20)	1	2412	-15.67	-16.14
	6	2437	-15.36	-15.33
	11	2462	-15.47	-14.93

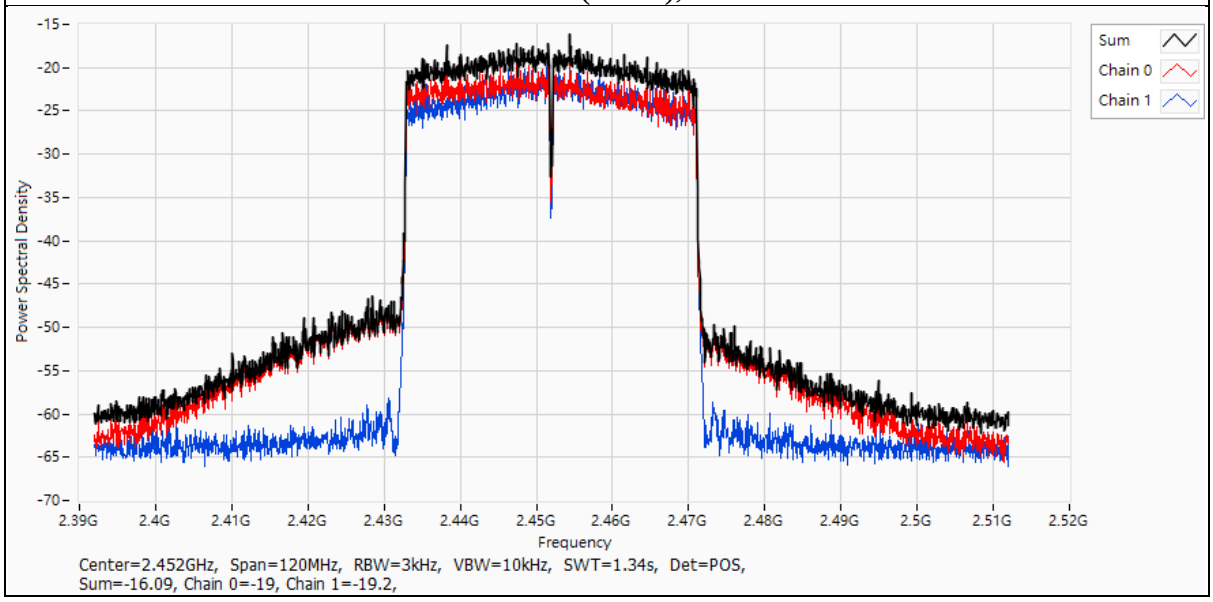
802.11ax(HE20), CH1



Mode	CH	Freq (MHz)	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Directional Gain (dBi)	Result
802.11ax(HE40)	3	2422	-17.45	6.55	7.45	PASS
	6	2437	-16.25	6.55	7.45	PASS
	9	2452	-16.09	6.55	7.45	PASS

Mode	CH	Freq (MHz)	PSD per Chain (dBm/3kHz)	
			Chain 0	Chain 1
802.11ax(HE40)	3	2422	-19.55	-19.8
	6	2437	-18.19	-19.38
	9	2452	-18.59	-19.2

802.11ax(HE40), 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.

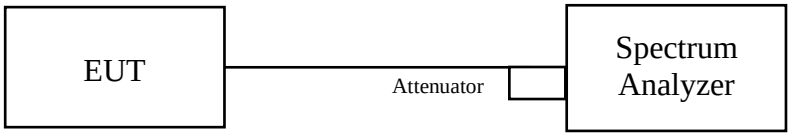
Test procedure

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.

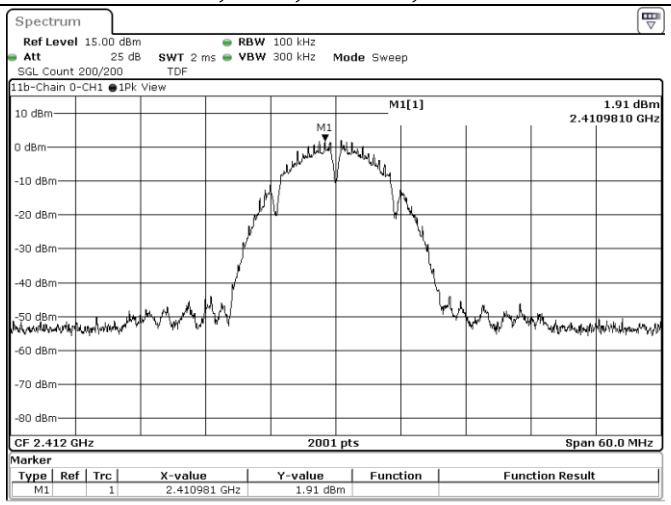
Test Setup



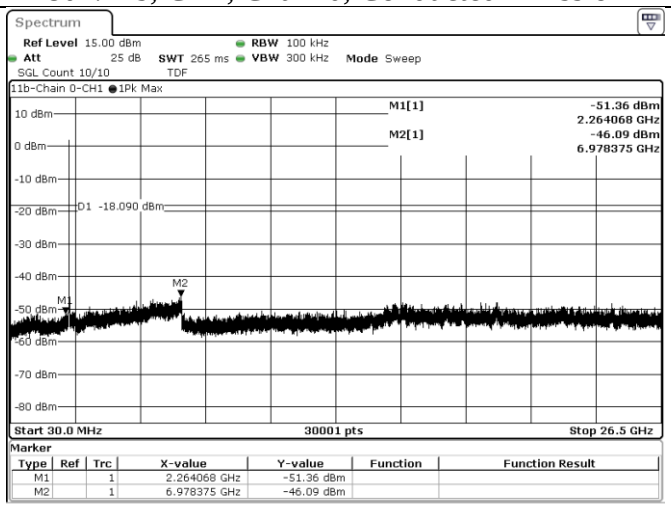
The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

Test Data

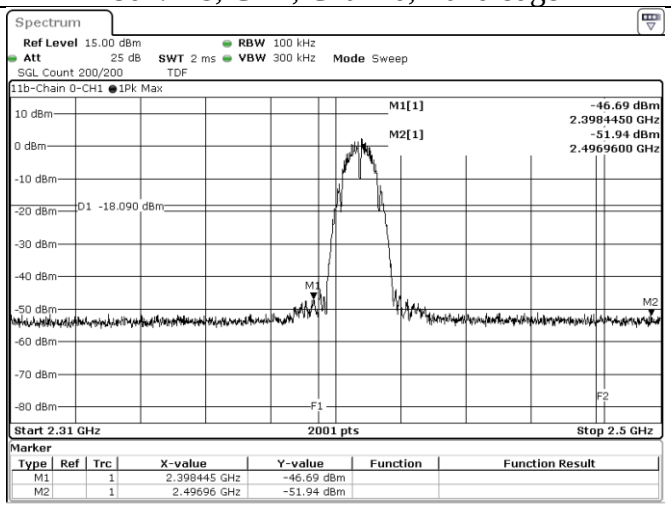
802.11b, CH1, Chain 0, Reference



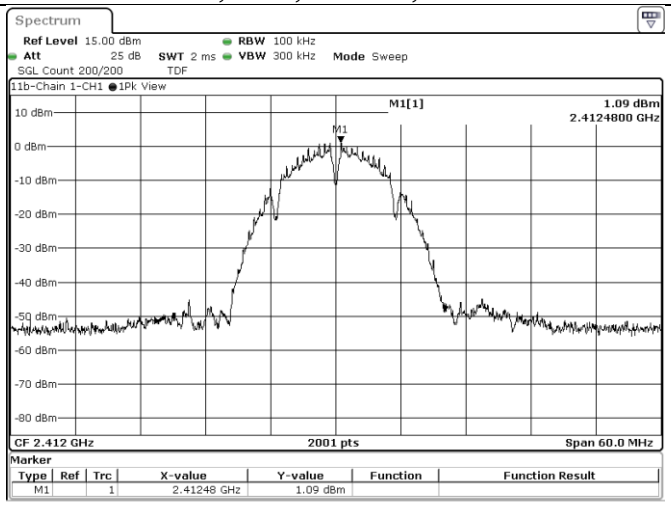
802.11b, CH1, Chain 0, Conducted Emission



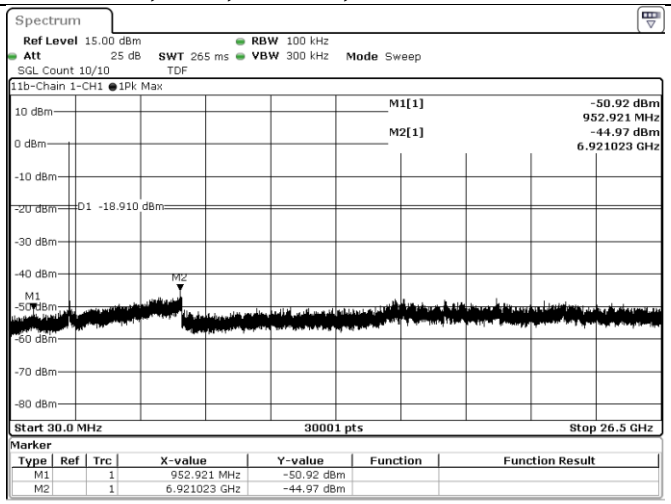
802.11b, CH1, Chain 0, Band edge



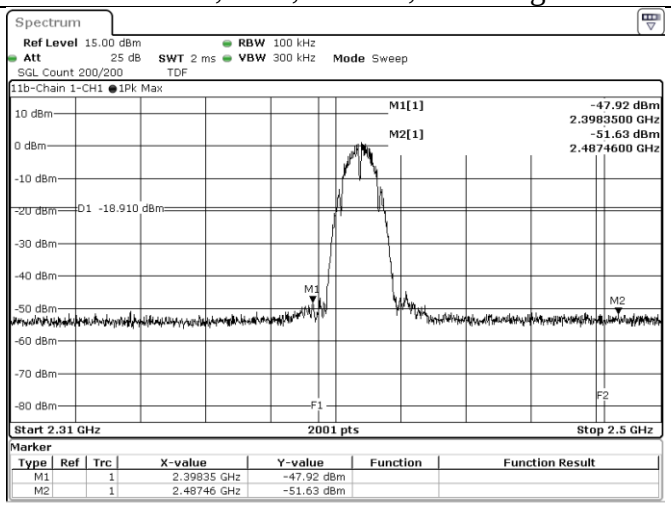
802.11b, CH1, Chain 1, Reference



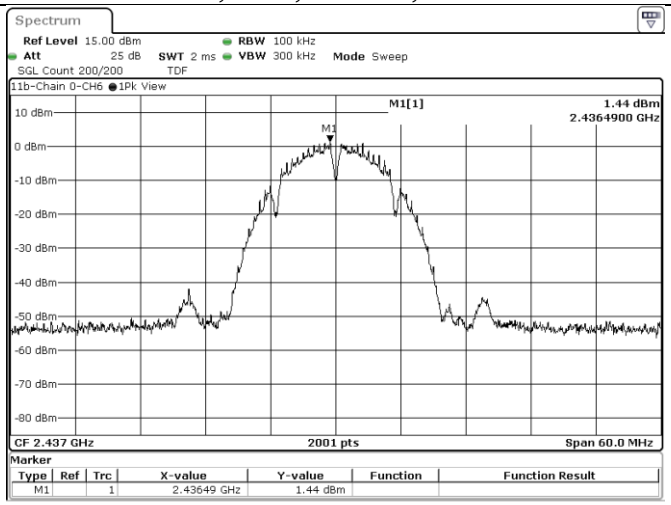
802.11b, CH1, Chain 1, Conducted Emission



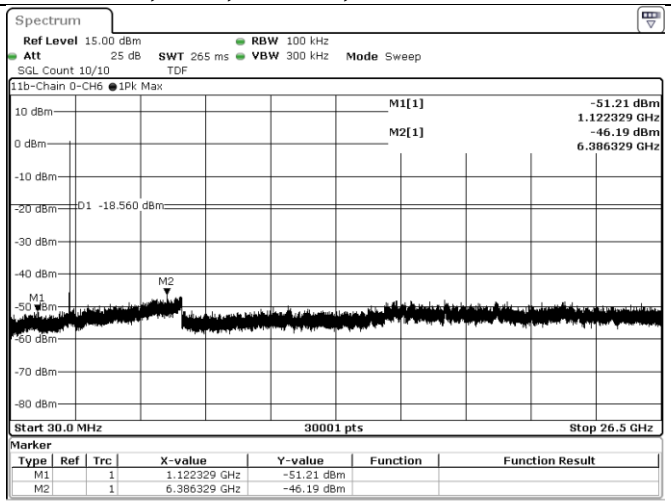
802.11b, CH1, Chain 1, Band edge



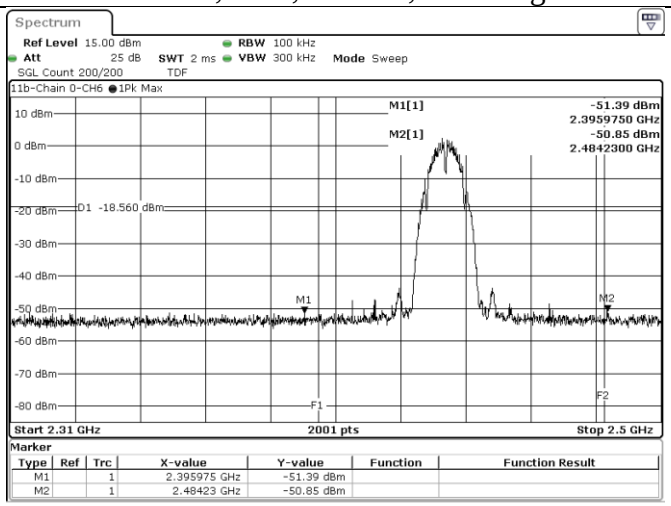
802.11b, CH6, Chain 0, Reference



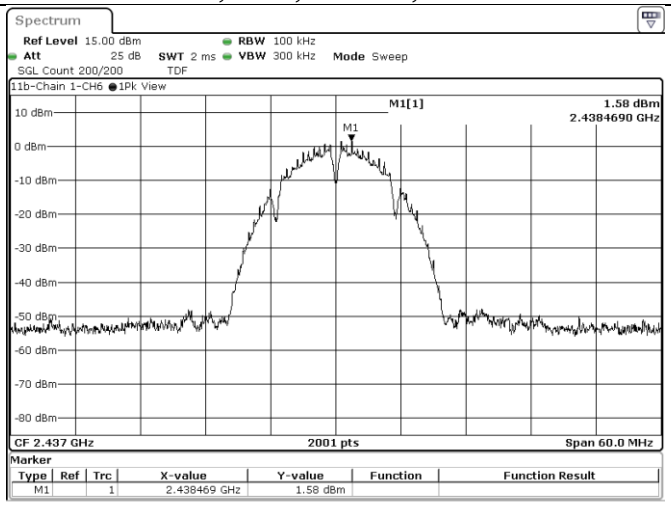
802.11b, CH6, Chain 0, Conducted Emission



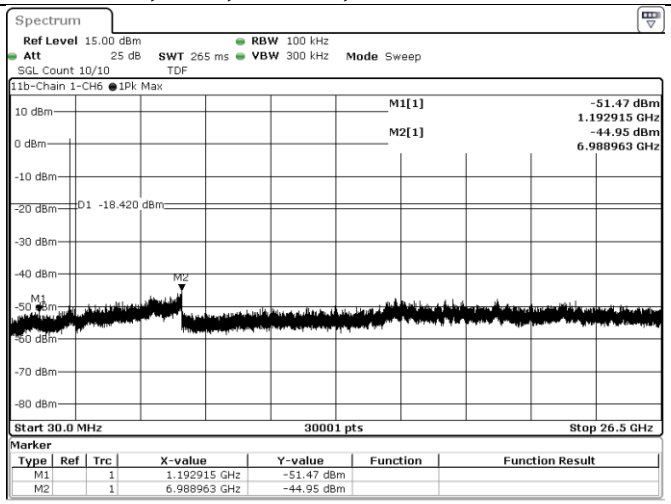
802.11b, CH6, Chain 0, Band edge



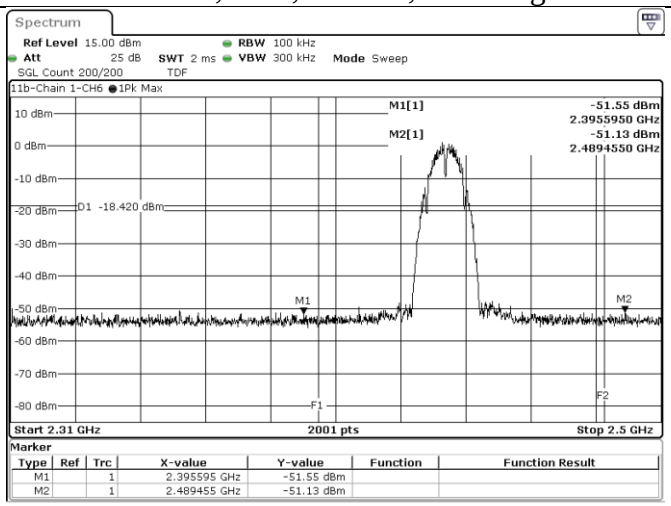
802.11b, CH6, Chain 1, Reference



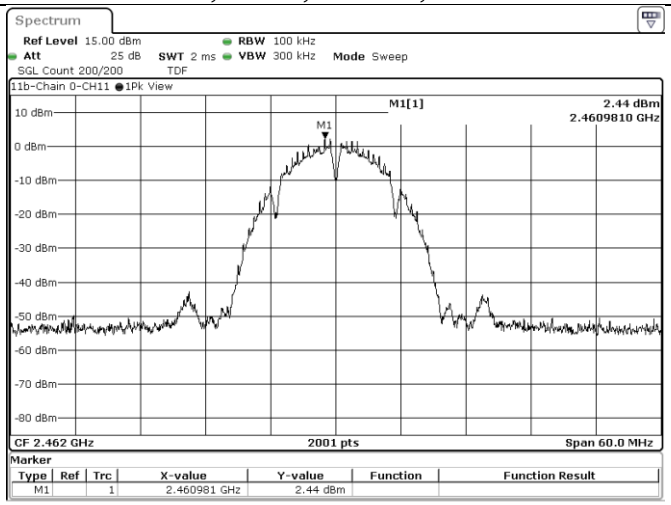
802.11b, CH6, Chain 1, Conducted Emission



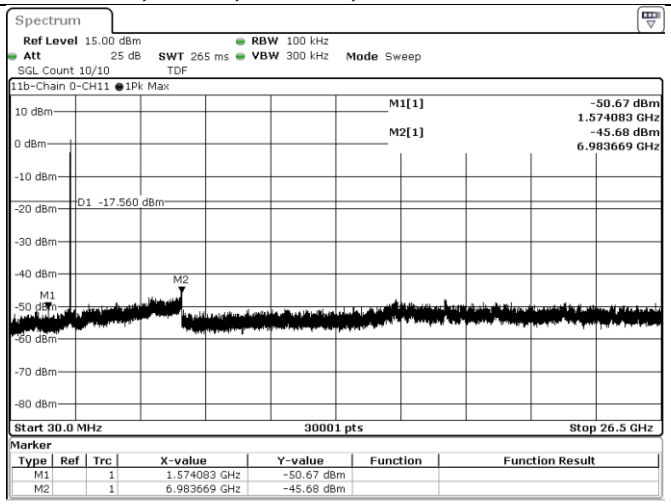
802.11b, CH6, Chain 1, Band edge



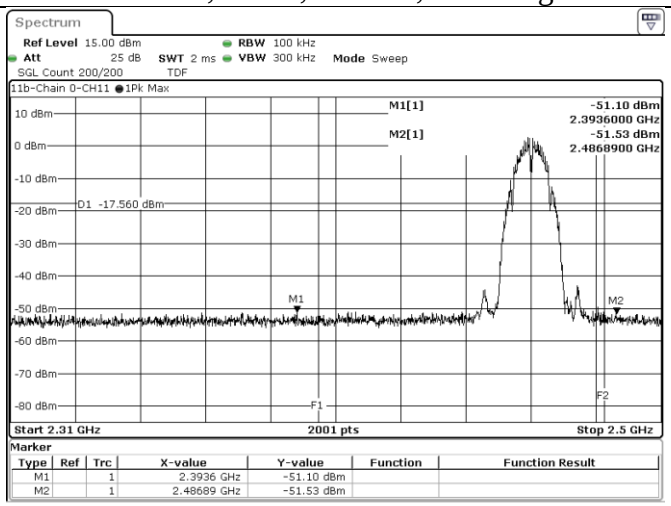
802.11b, CH11, Chain 0, Reference



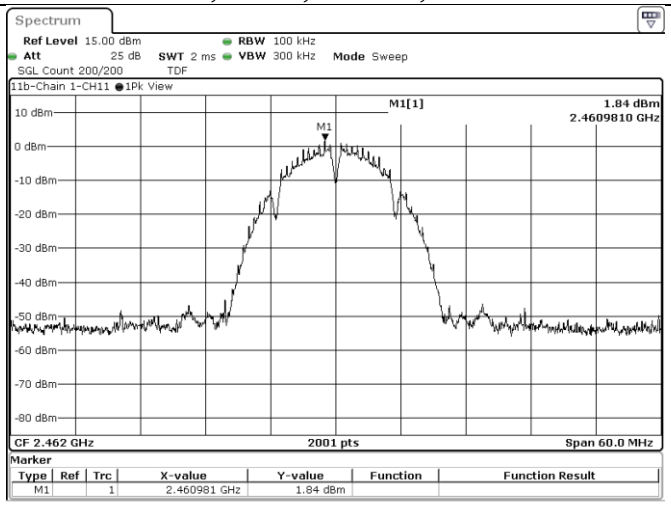
802.11b, CH11, Chain 0, Conducted Emission



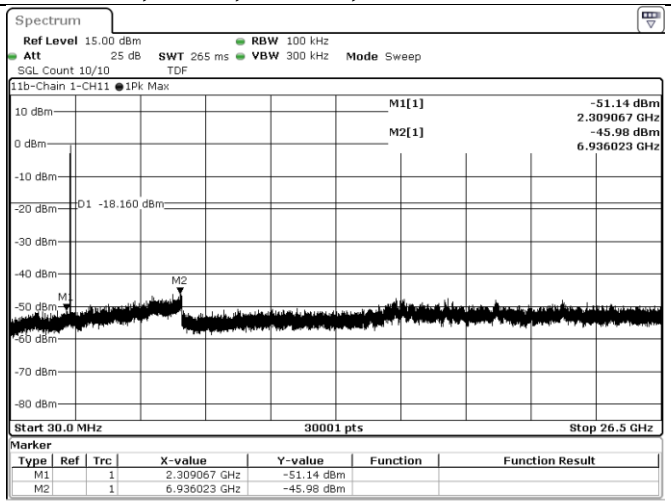
802.11b, CH11, Chain 0, Band edge



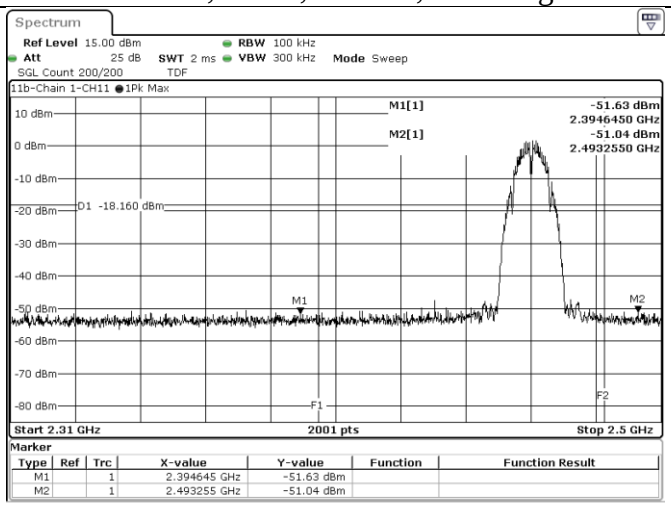
802.11b, CH11, Chain 1, Reference



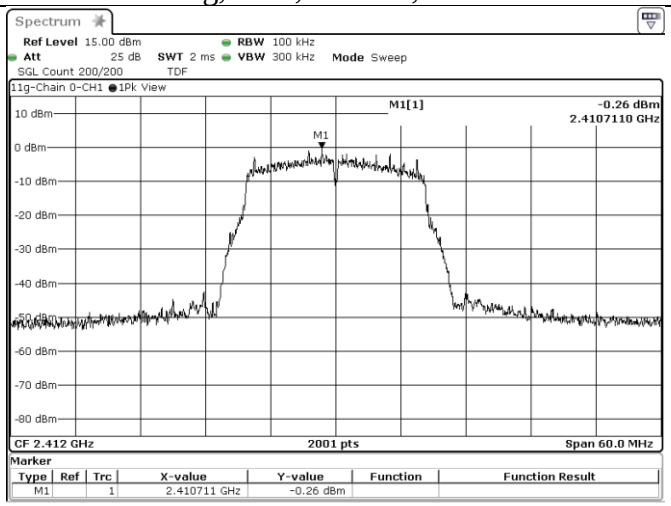
802.11b, CH11, Chain 1, Conducted Emission



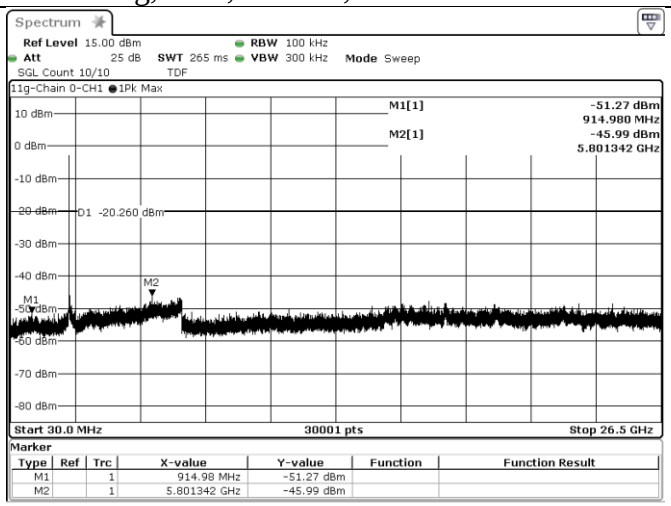
802.11b, CH11, Chain 1, Band edge



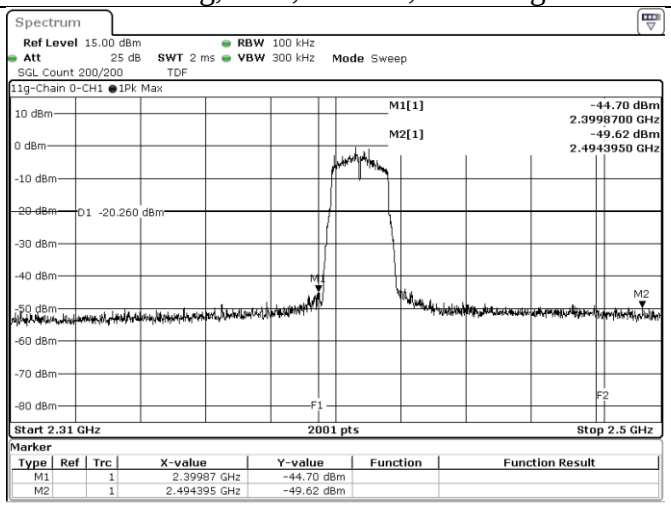
802.11g, CH1, Chain 0, Reference



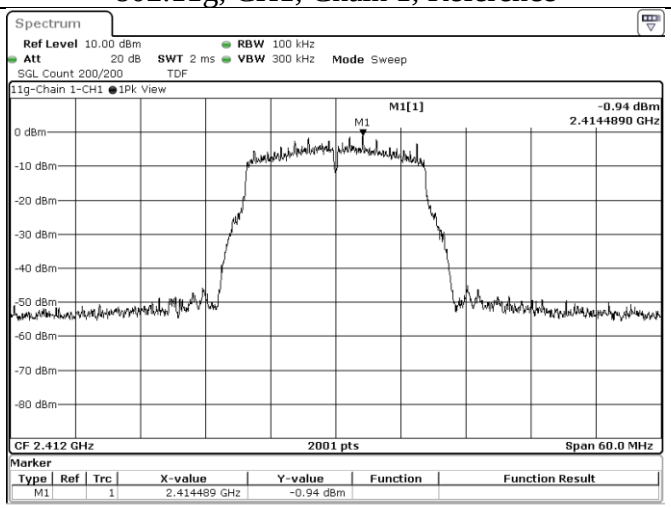
802.11g, CH1, Chain 0, Conducted Emission



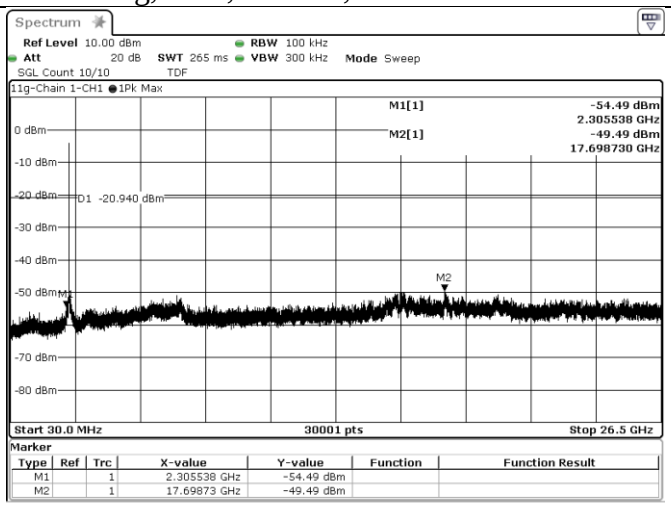
802.11g, CH1, Chain 0, Band edge



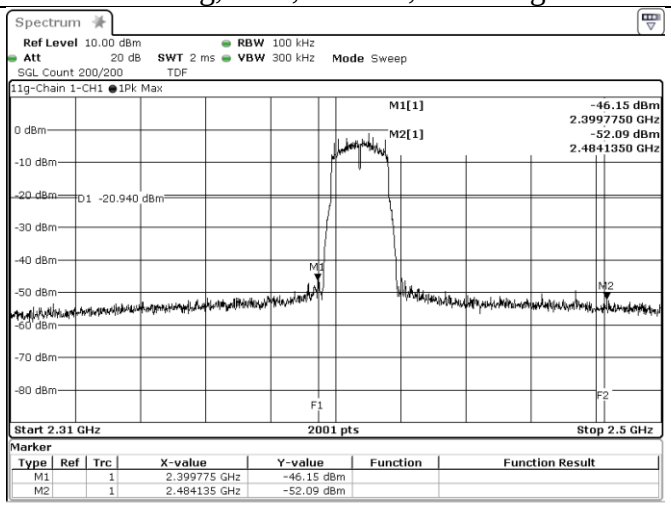
802.11g, CH1, Chain 1, Reference



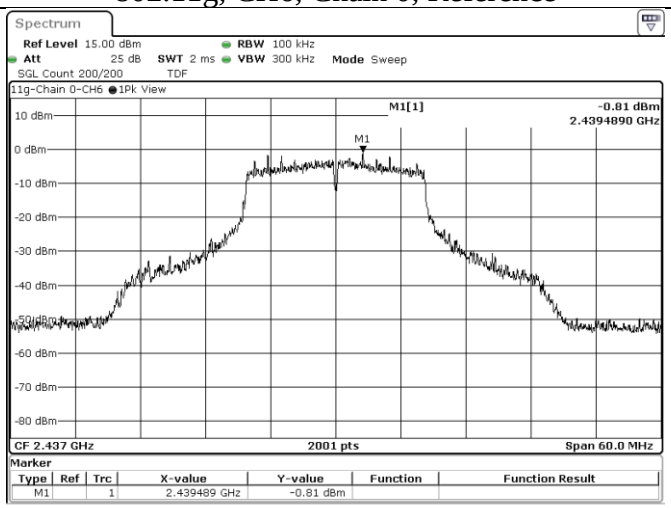
802.11g, CH1, Chain 1, Conducted Emission



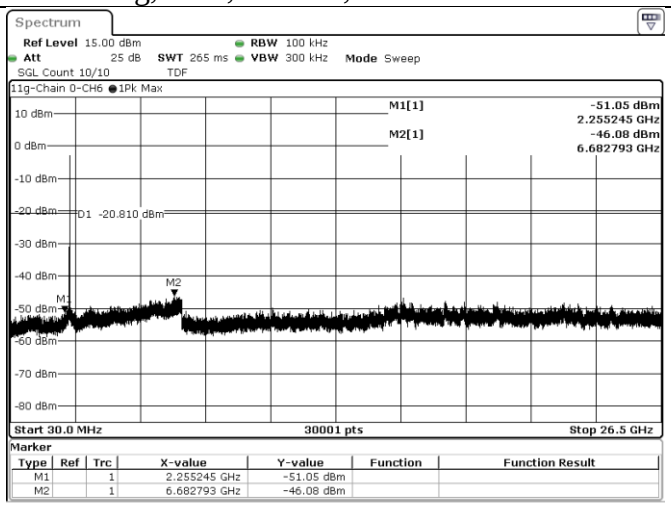
802.11g, CH1, Chain 1, Band edge



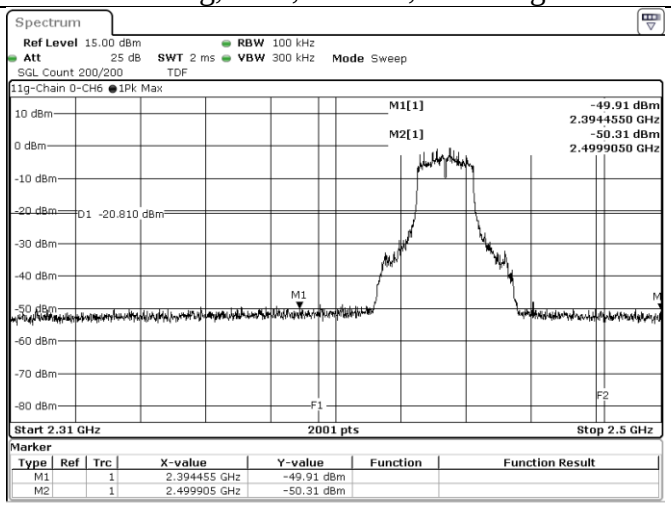
802.11g, CH6, Chain 0, Reference



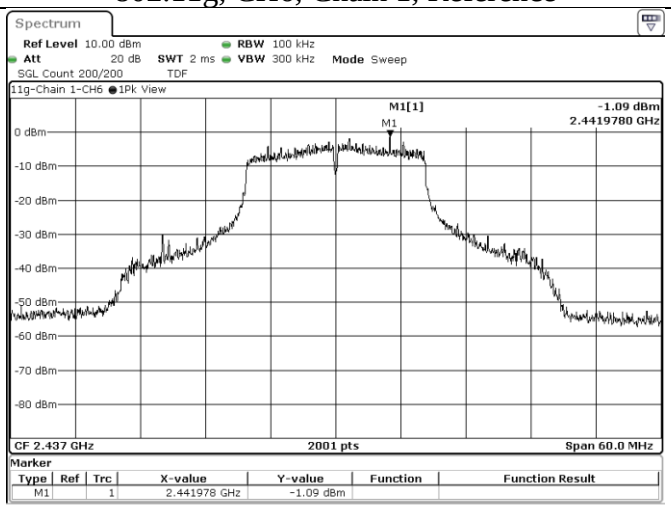
802.11g, CH6, Chain 0, Conducted Emission



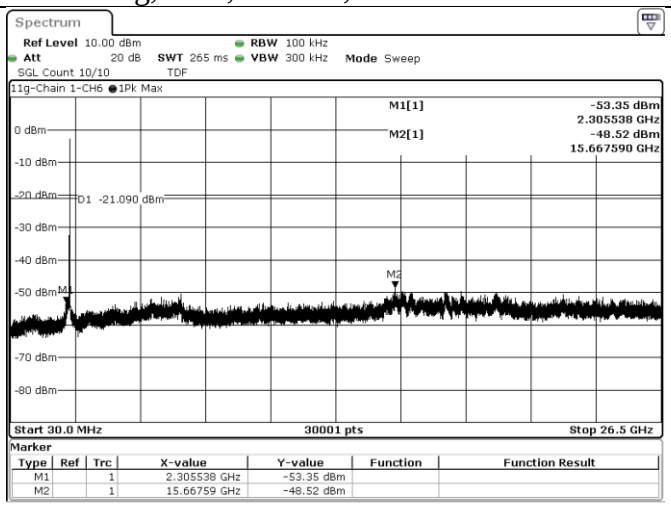
802.11g, CH6, Chain 0, Band edge



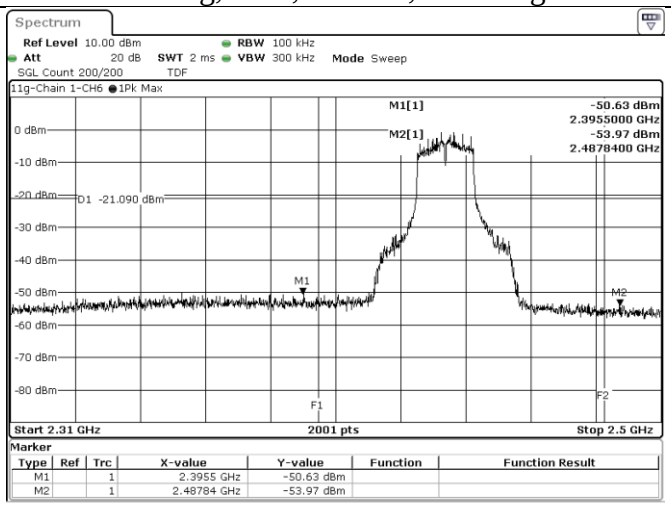
802.11g, CH6, Chain 1, Reference



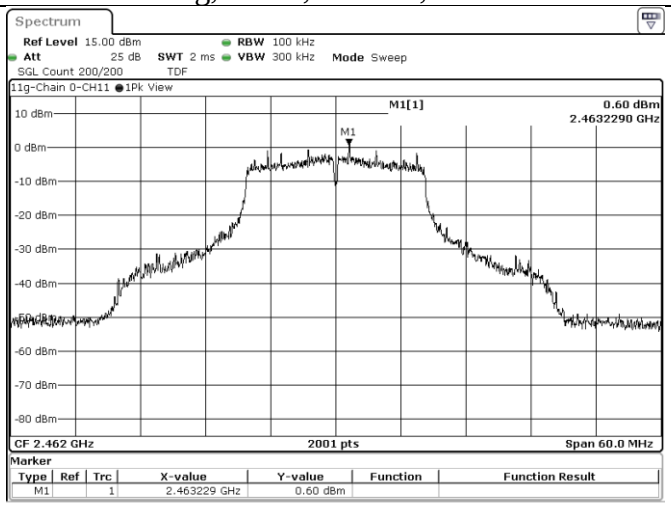
802.11g, CH6, Chain 1, Conducted Emission



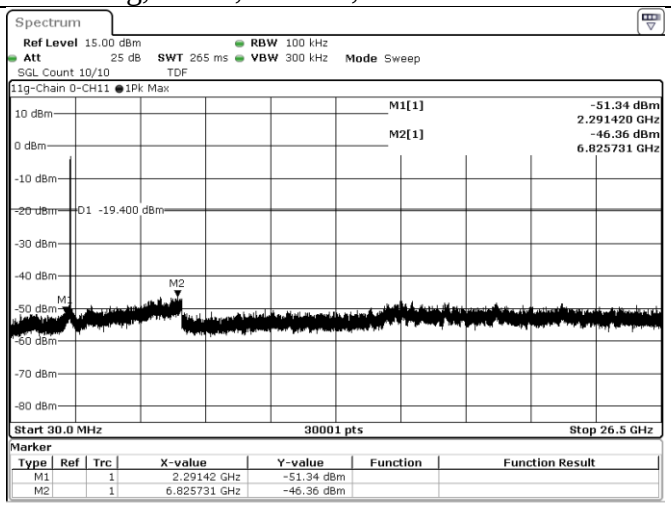
802.11g, CH6, Chain 1, Band edge



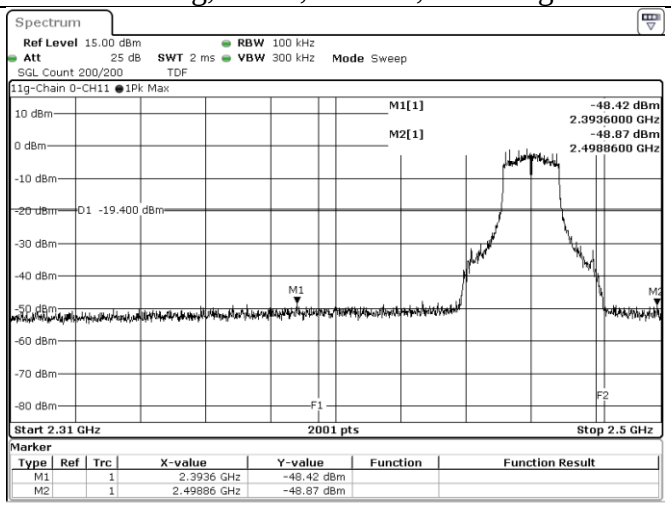
802.11g, CH11, Chain 0, Reference



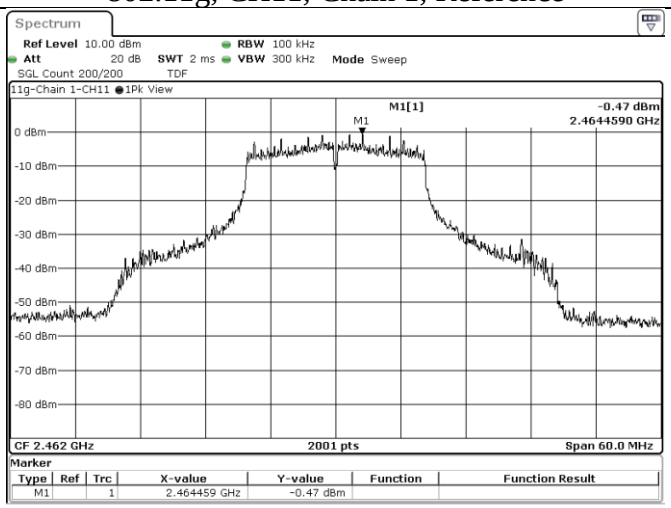
802.11g, CH11, Chain 0, Conducted Emission



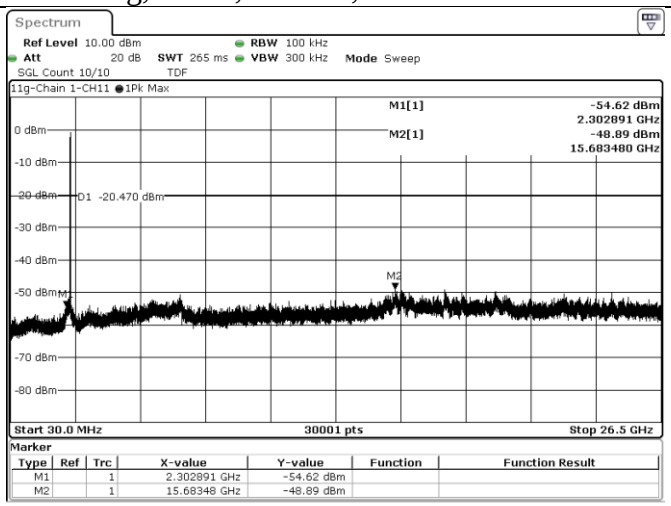
802.11g, CH11, Chain 0, Band edge



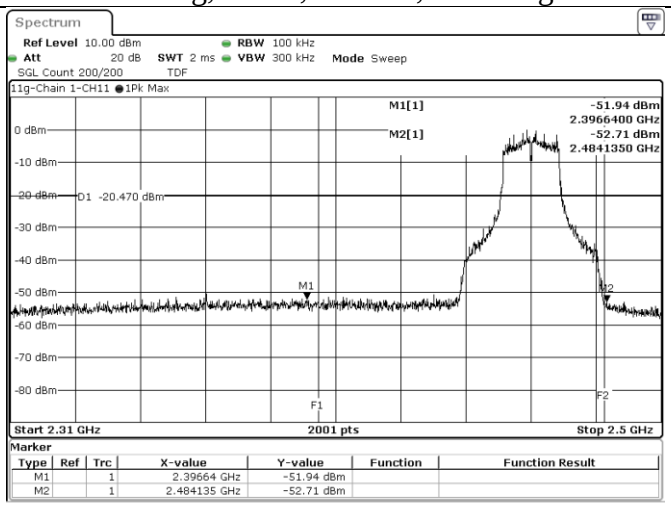
802.11g, CH11, Chain 1, Reference



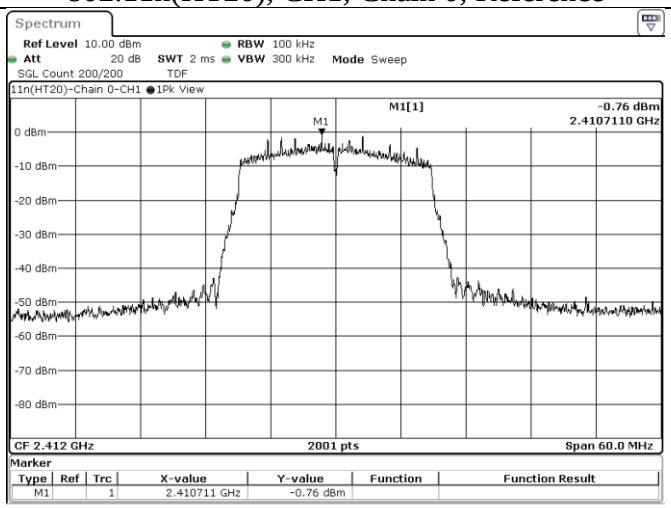
802.11g, CH11, Chain 1, Conducted Emission



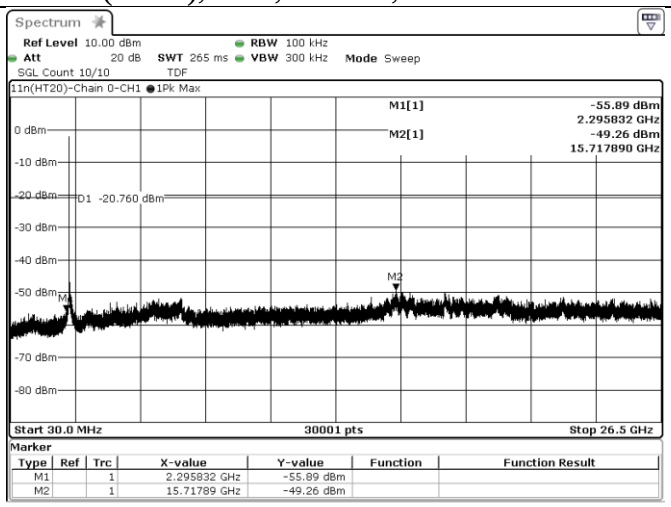
802.11g, CH11, Chain 1, Band edge



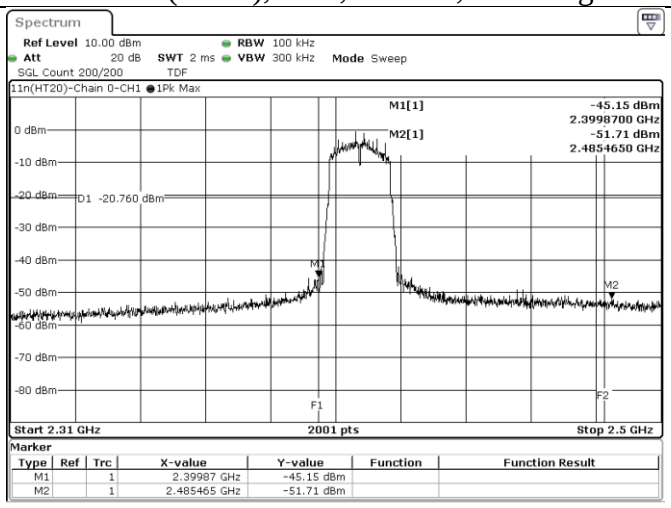
802.11n(HT20), CH1, Chain 0, Reference



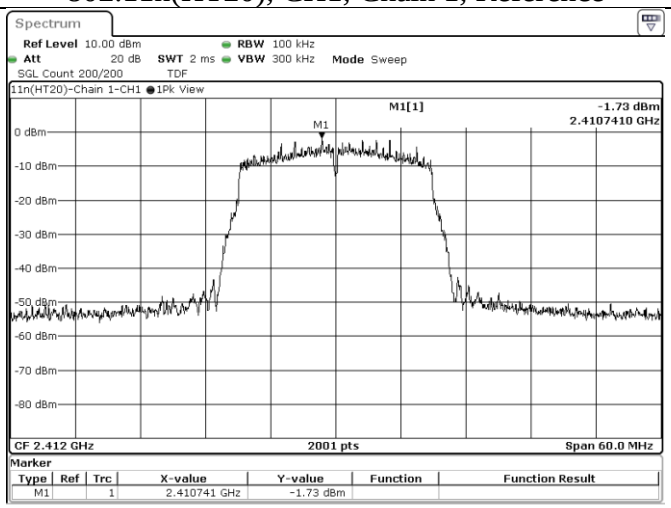
802.11n(HT20), CH1, Chain 0, Conducted Emission



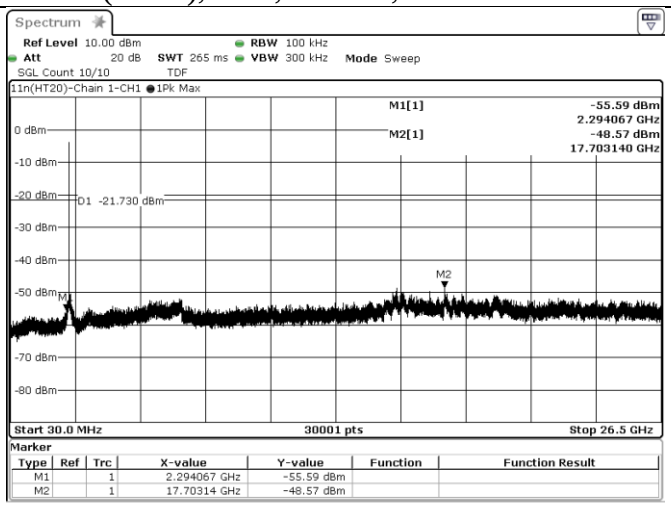
802.11n(HT20), CH1, Chain 0, Band edge



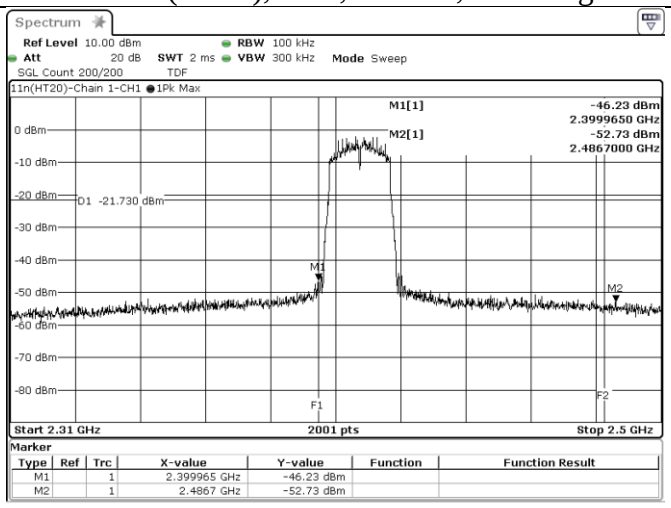
802.11n(HT20), CH1, Chain 1, Reference



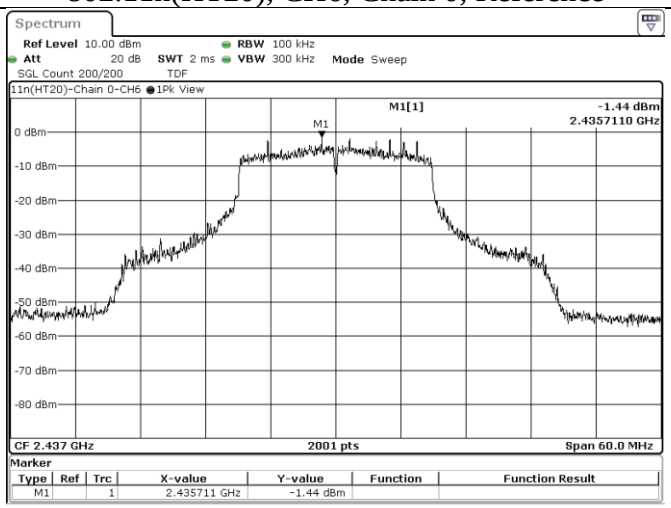
802.11n(HT20), CH1, Chain 1, Conducted Emission



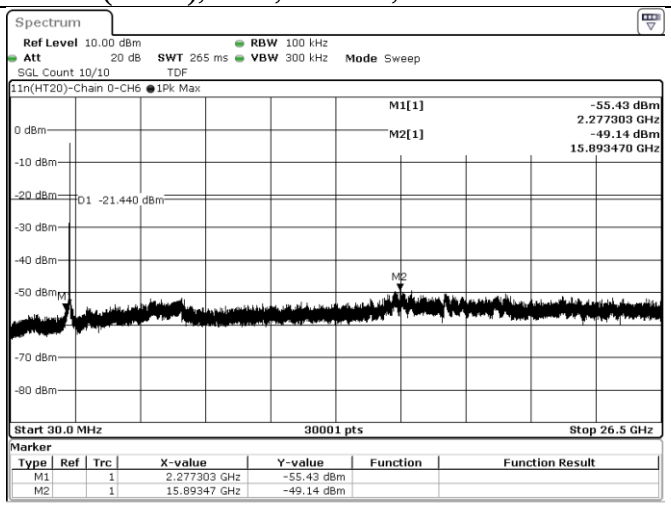
802.11n(HT20), CH1, Chain 1, Band edge



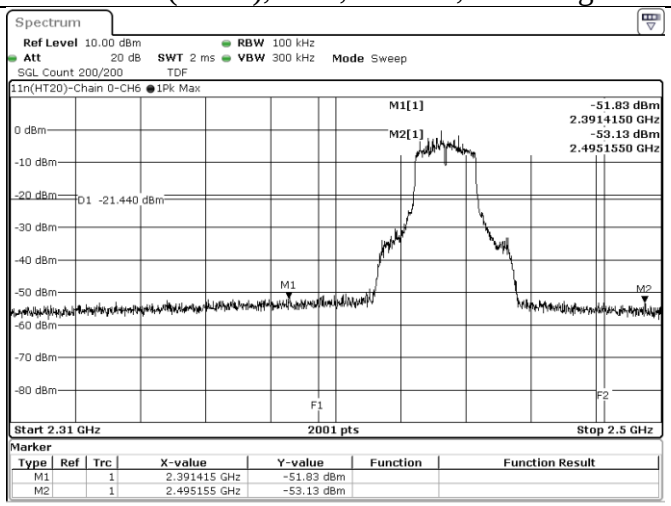
802.11n(HT20), CH6, Chain 0, Reference



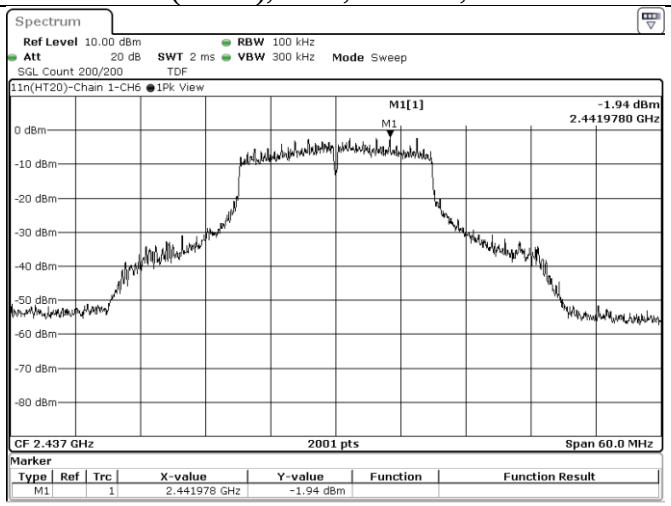
802.11n(HT20), CH6, Chain 0, Conducted Emission



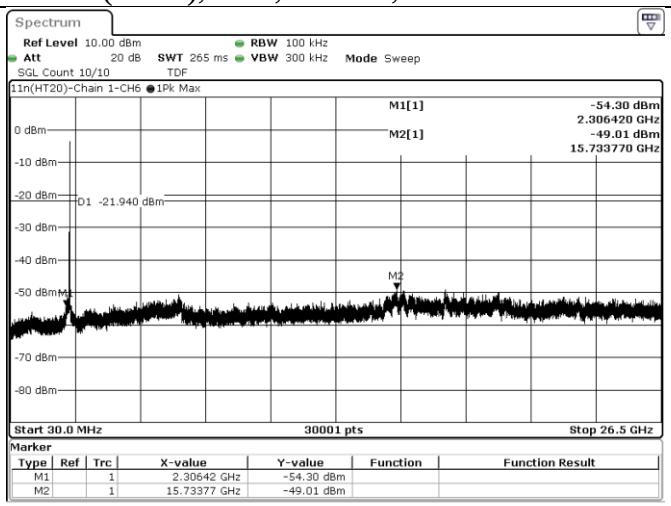
802.11n(HT20), CH6, Chain 0, Band edge



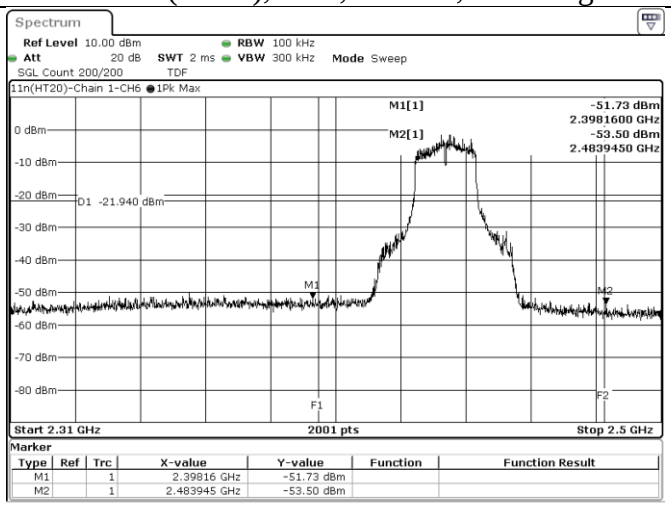
802.11n(HT20), CH6, Chain 1, Reference



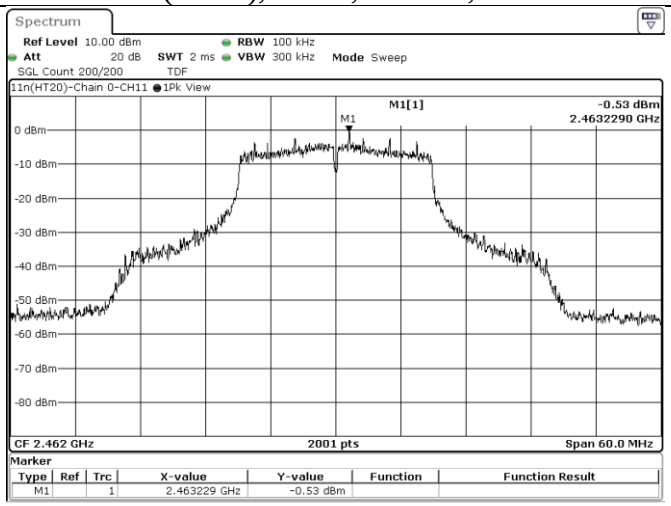
802.11n(HT20), CH6, Chain 1, Conducted Emission



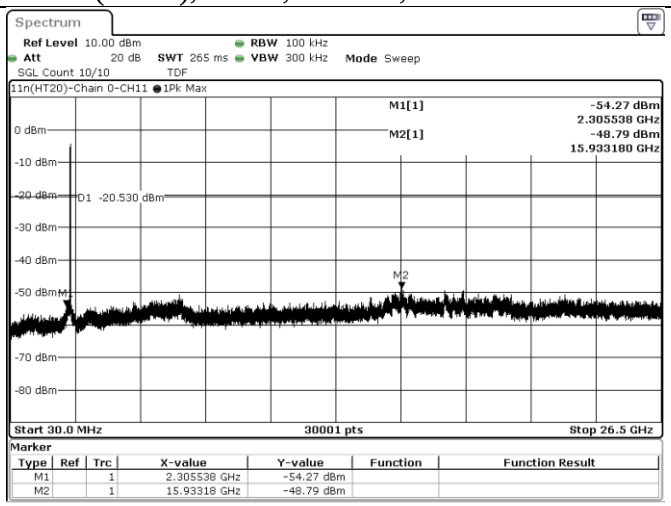
802.11n(HT20), CH6, Chain 1, Band edge



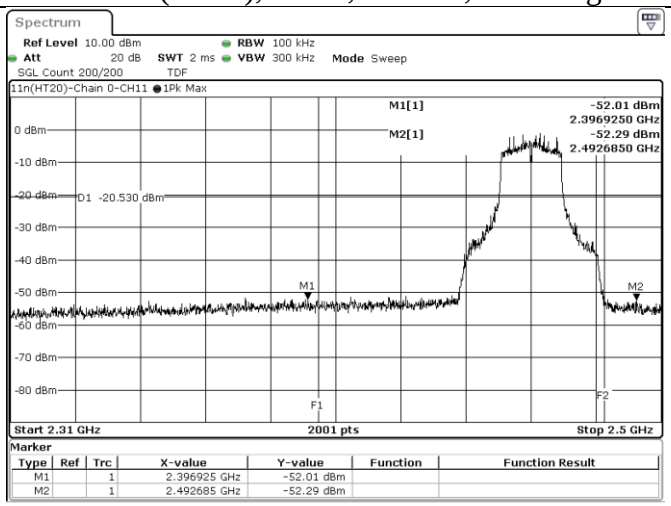
802.11n(HT20), CH11, Chain 0, Reference



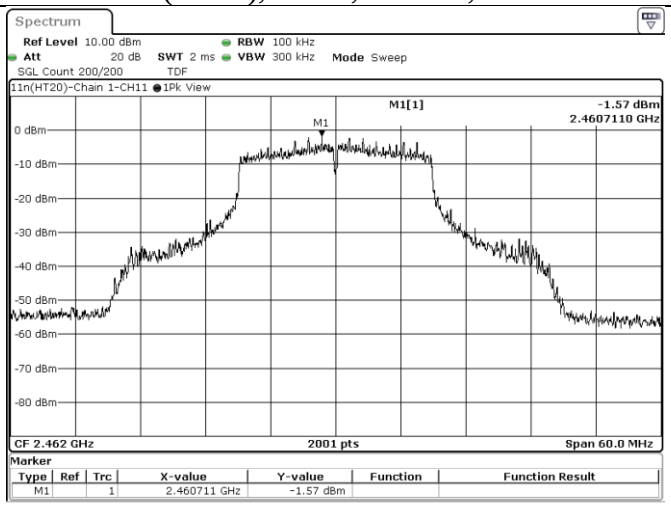
802.11n(HT20), CH11, Chain 0, Conducted Emission



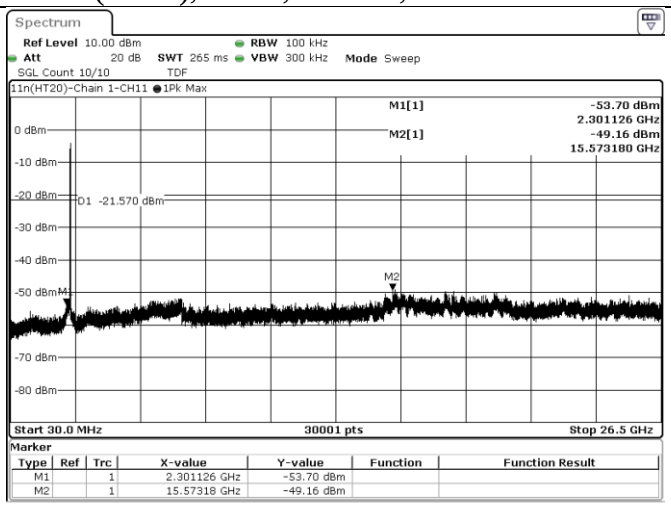
802.11n(HT20), CH11, Chain 0, Band edge



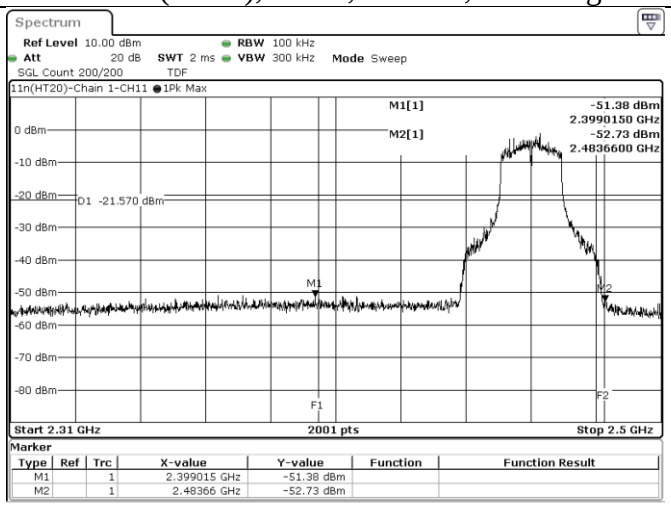
802.11n(HT20), CH11, Chain 1, Reference



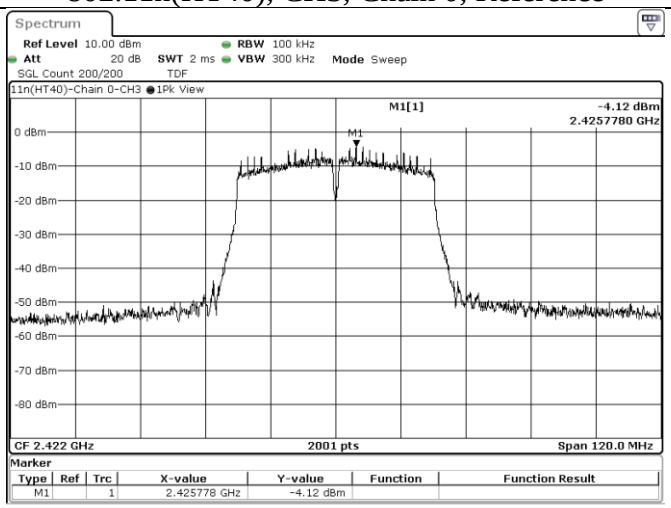
802.11n(HT20), CH11, Chain 1, Conducted Emission



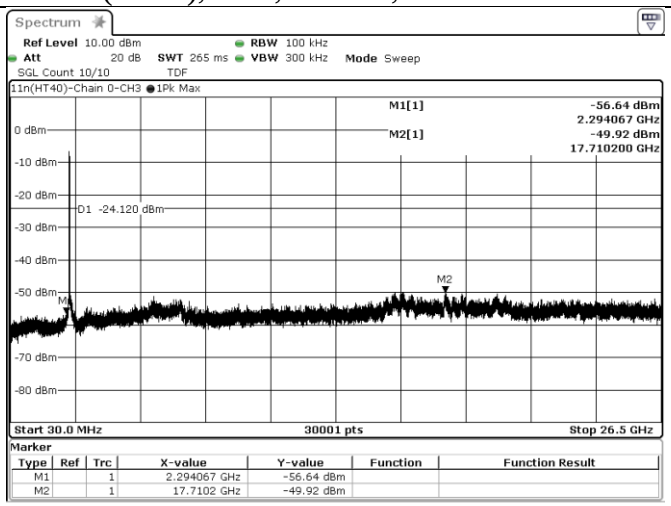
802.11n(HT20), CH11, Chain 1, Band edge



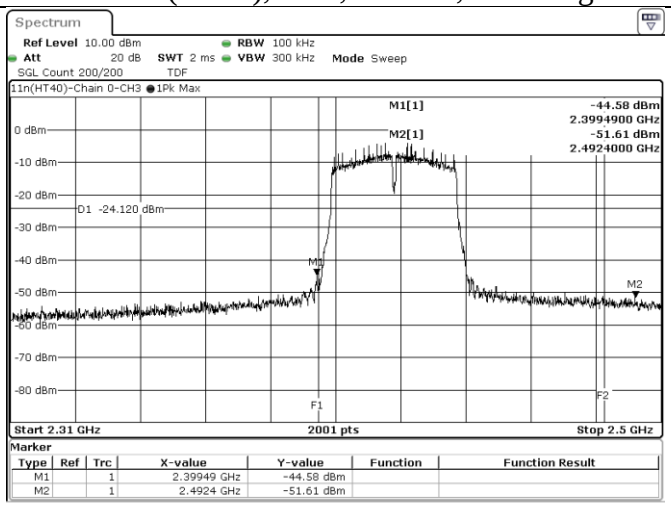
802.11n(HT40), CH3, Chain 0, Reference



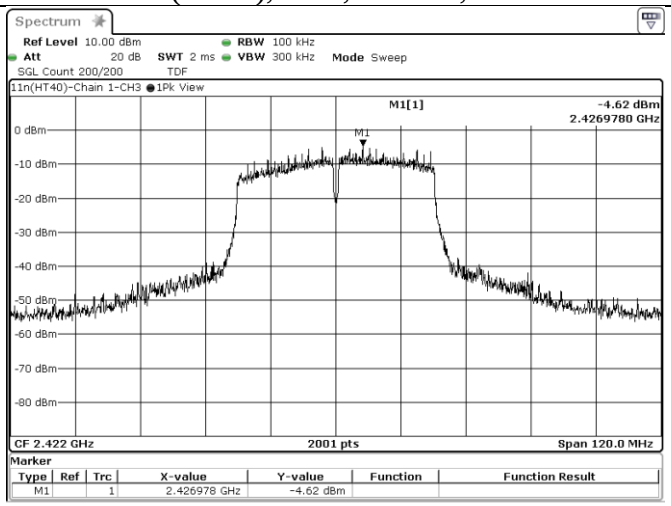
802.11n(HT40), CH3, Chain 0, Conducted Emission



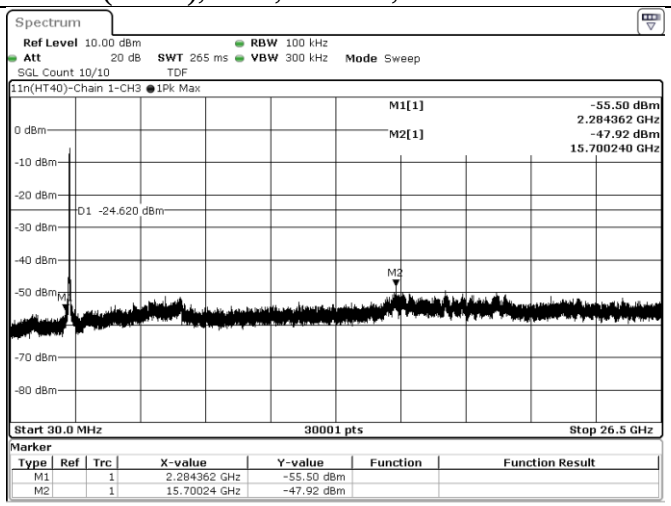
802.11n(HT40), CH3, Chain 0, Band edge



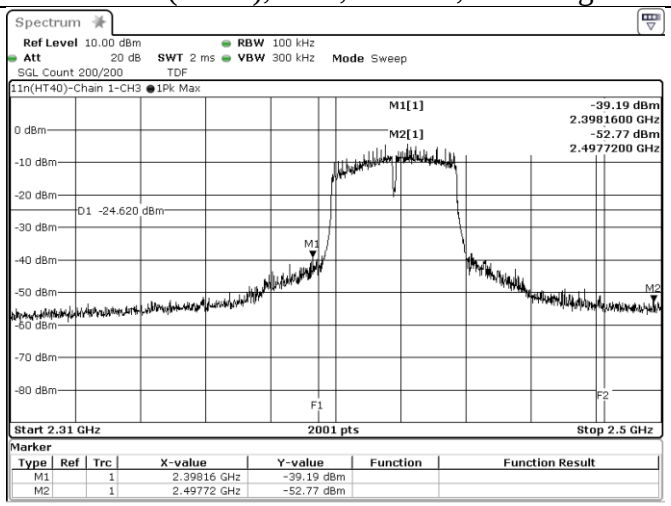
802.11n(HT40), CH3, Chain 1, Reference



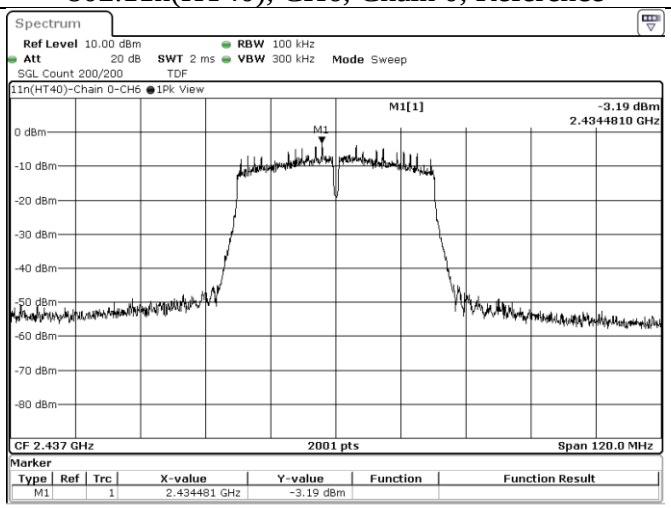
802.11n(HT40), CH3, Chain 1, Conducted Emission



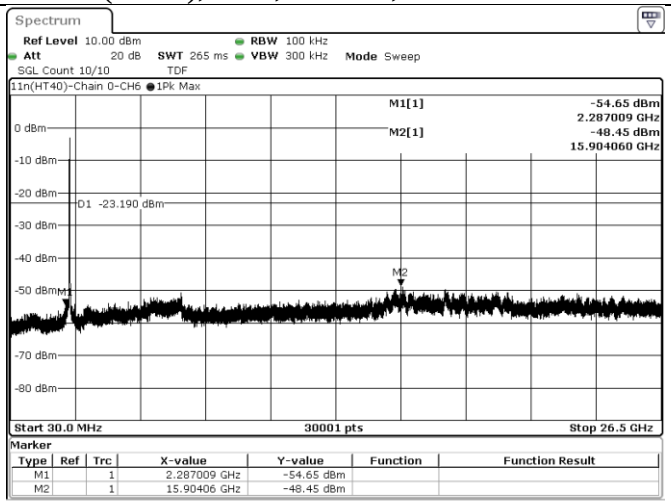
802.11n(HT40), CH3, Chain 1, Band edge



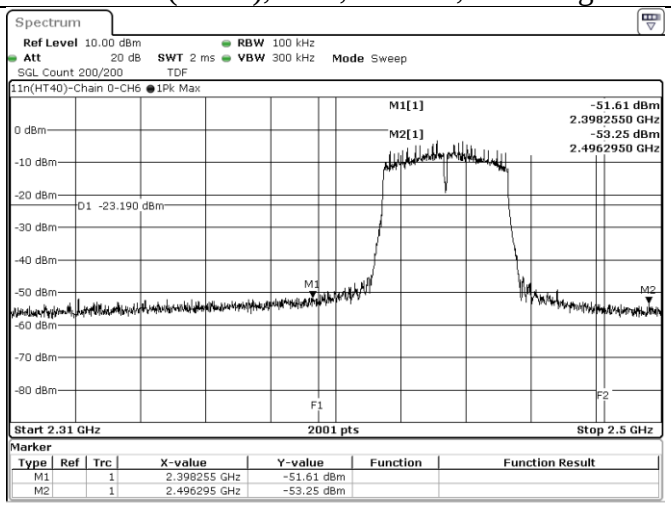
802.11n(HT40), CH6, Chain 0, Reference



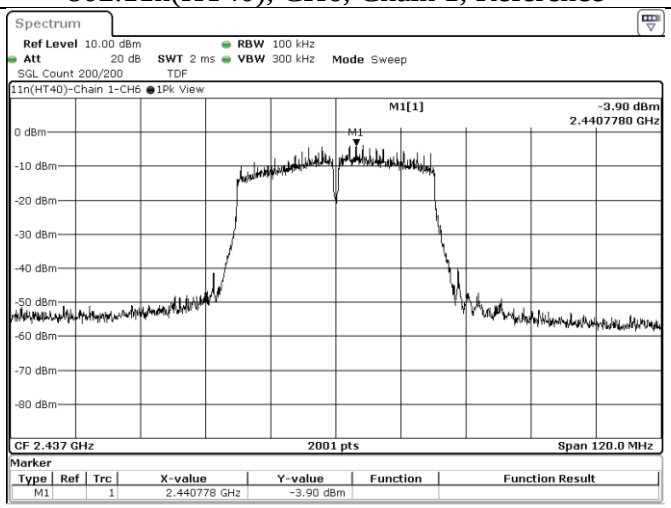
802.11n(HT40), CH6, Chain 0, Conducted Emission



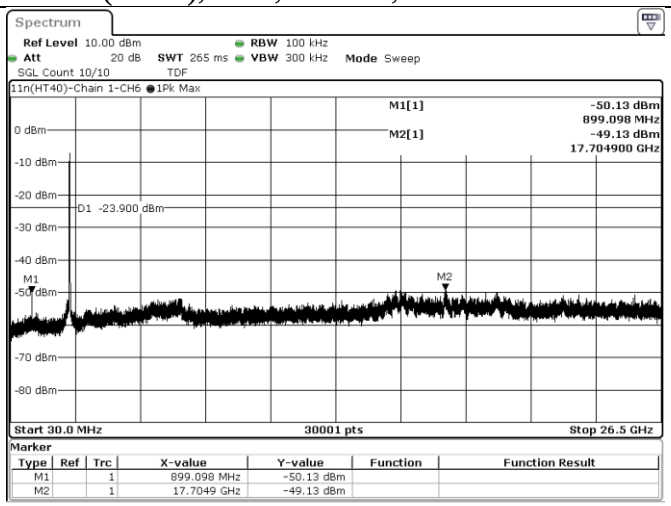
802.11n(HT40), CH6, Chain 0, Band edge



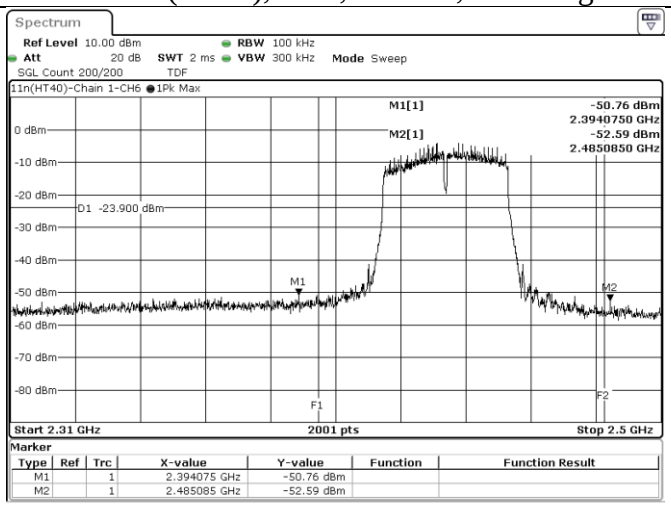
802.11n(HT40), CH6, Chain 1, Reference



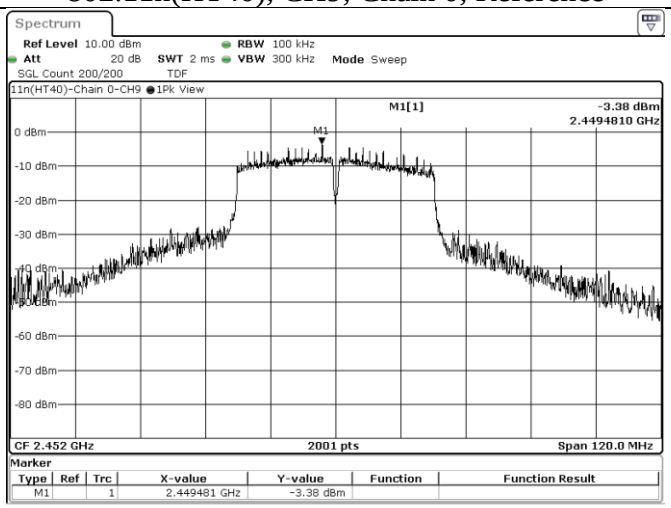
802.11n(HT40), CH6, Chain 1, Conducted Emission



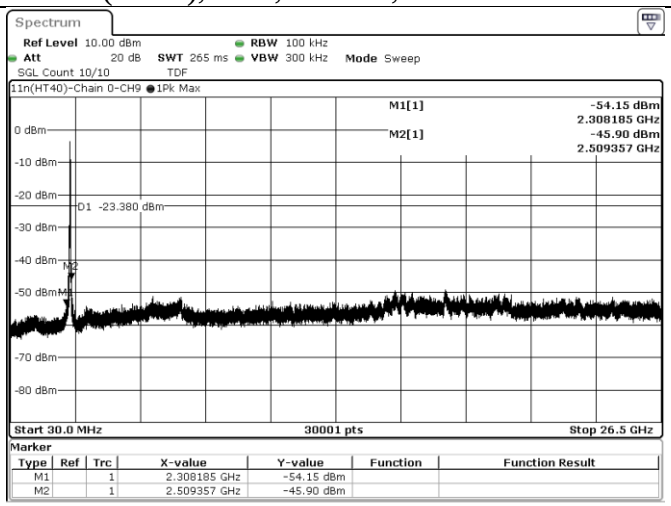
802.11n(HT40), CH6, Chain 1, Band edge



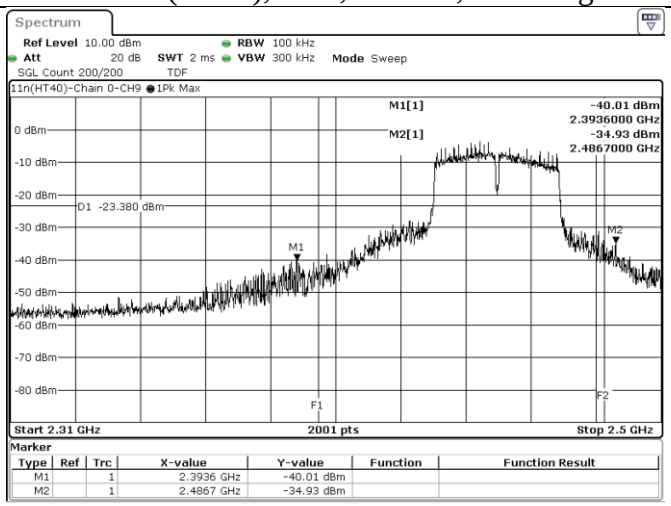
802.11n(HT40), CH9, Chain 0, Reference



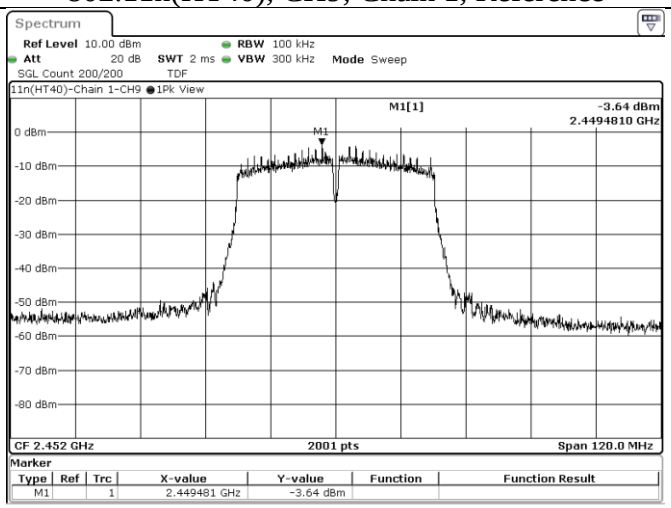
802.11n(HT40), CH9, Chain 0, Conducted Emission



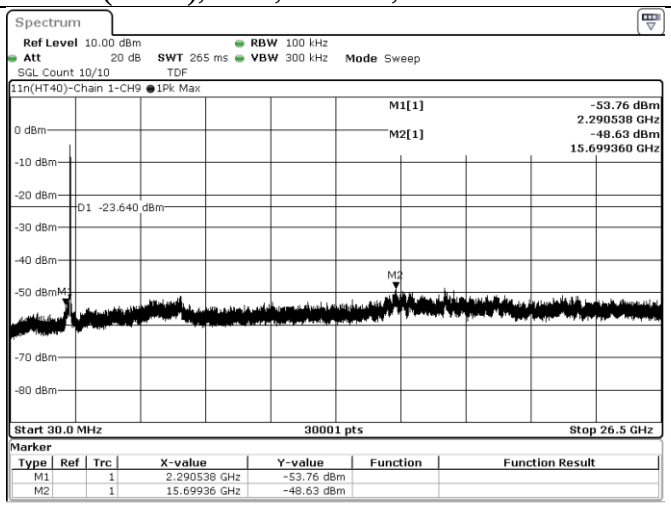
802.11n(HT40), CH9, Chain 0, Band edge



802.11n(HT40), CH9, Chain 1, Reference



802.11n(HT40), CH9, Chain 1, Conducted Emission



802.11n(HT40), CH9, Chain 1, Band edge