RADIO TEST REPORT

Product	:	Wireless console module
Model Name	:	CIC15101
FCC ID	:	2A3HV-CIC15A
Test Regulation	:	FCC 47 CFR Part 15 Subpart E (Section 15.407)
Received Date	:	2021/12/23
Test Date	:	2021/12/27 ~ 2022/1/21
Issued Date	:	2022/2/17
Applicant	:	Hydrow, Inc. 10 Summer St, 5th Floor Boston MA 02110
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.: 4790239884-US-R1-V0

Rev.	Test report No.	Date	Page revised	Contents
Original	4790239884-US-R1-V0	2022/2/17	-	Initial issue

Table of Contents

1. Attestation of Test Results

APPLICANT:	Hydrow, Inc. 10 Summer St, 5th Floor Boston MA 02110
MANUFACTURER:	InnoComm Mobile Technology Corporation 3F, No. 6, Hsin Ann Rd., Hsinchu Science Park, Hsinchu 300092, Taiwan
EUT DESCRIPTION:	Wireless console module
BRAND:	Hydrow, Inc.
MODEL:	CIC15101
SAMPLE STAGE:	Design Verification Test sample
DATE of TESTED:	2021/12/27 ~ 2022/1/21

APPLICABLE STANDARDS	
STANDARD	**Test Results**
FCC 47 CFR PART 15 Subpart E (Section 15.407)	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:

Sally Lu Date : 2022/2/17
Project Handler

Approved and Authorized By:

Waternil Guan Date : 2022/2/17
Engineer

2. Summary of Test Results

Summary of Test Results		
FCC Clause	**Test Items**	**Result**
15.407(e)	6dB Bandwidth	PASS
15.403(i)	26dB Bandwidth	PASS
2.1049	Occupied Bandwidth	See Note1
15.407(a)(1/2/3)	Conducted Output Power	PASS
15.407(a)(1/2/3)	Power Spectral Density	PASS
15.407(g)	Frequency Stability	PASS
15.407(b) (1/2/3/4(i/ii)/9)	Radiated Emissions and Band Edge Measurement	PASS
15.407(b)(9)	AC Power Conducted Emission	PASS
15.203	Antenna Requirement	PASS
15.407(h)	Dynamic Frequency Selection	See Note2

Note:
1. The Occupied Bandwidth was reference only.
2. The “Dynamic Frequency Selection measurement” was recorded in Report No.: 4790239884-US-R2-V0.

3. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with 47 CFR FCC Part 2, KDB 789033 D02 General UNII Test Procedure New Rules v02r01, 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.

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.

Measurement	Frequency	Uncertainty
Conducted disturbance at mains terminals ports	150kHz ~ 30MHz	±3.1 dB
RF Conducted	9 kHz - 40GHz	±1.9 dB
Radiated disturbance below 30MHz	9 kHz - 30 MHz	±1.9 dB
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	±5.4 dB
Radiated disturbance above 1 GHz	1GHz ~ 40GHz	±4.7 dB

6. Equipment under Test

6.1. Description of EUT

Product	Wireless console module	
Brand Name	Hydrow, Inc.	
Model Name	CIC15101	
Operating Frequency	5180 ~ 5240 MHz, 5260 ~ 5320 MHz, 5500 ~ 5700 MHz, 5745 ~ 5825 MHz	
Modulation	256QAM, 64QAM, 16QAM, QPSK, BPSK	
Transfer Rate	802.11a: up to 54 Mbps 802.11n: up to MCS15 802.11ac: up to MCS9	
Number of Channel	5180 ~ 5240 MHz	4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20)
		2 for 802.11n (HT40), 802.11ac (VHT40)
		1 for 802.11ac (VHT80)
	5260 ~ 5320 MHz	4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20)
		2 for 802.11n (HT40), 802.11ac (VHT40)
		1 for 802.11ac (VHT80)
	5500 ~ 5700 MHz	11 for 802.11a, 802.11n (HT20), 802.11ac (VHT20)
		5 for 802.11n (HT40), 802.11ac (VHT40)
		2 for 802.11ac (VHT80)
	5745 ~ 5825 MHz	5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20)
		2 for 802.11n (HT40), 802.11ac (VHT40)
		1 for 802.11ac (VHT80)
Maximum Output Power	5180 ~ 5240 MHz: 17.52 dBm 5260 ~ 5320 MHz: 18.50 dBm 5500 ~ 5700 MHz: 22.47 dBm 5745 ~ 5825 MHz: 22.05 dBm	
Normal Voltage	120Vac/ 60Hz	
Sample ID	4602151	
Software Version	Android verson 11	

Note:

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

Modulation Mode	Tx,Rx Function
802.11a	2TX,2RX
802.11n (HT20)	2TX,2RX
802.11n (HT40)	2TX,2RX
802.11ac (VHT20)	2TX,2RX
802.11ac (VHT40)	2TX,2RX
802.11ac (VHT80)	2TX,2RX

* The modulation and bandwidth are similar for 802.11n mode for HT20 / HT40 and 802.11ac mode for VHT20 / VHT40, therefore investigated worst case to representative mode in test report.

2. 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

FOR 5180 ~ 5240MHz

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
42	5210MHz

FOR 5260 ~ 5320MHz

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
52	5260 MHz	60	5300 MHz
56	5280 MHz	64	5320 MHz

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
54	5270 MHz	62	5310 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
58	5290MHz

FOR 5500 ~ 5700MHz

11 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
100	5500 MHz	124	5620 MHz
104	5520 MHz	128	5640 MHz
108	5540 MHz	132	5660 MHz
112	5560 MHz	136	5680 MHz
116	5580 MHz	140	5700 MHz
120	5600 MHz	-	-

5 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
102	5510 MHz	126	5630 MHz
110	5550 MHz	134	5670 MHz
118	5590 MHz	-	-

2 channels are provided for 802.11ac (VHT80):

Channel	Frequency	Channel	Frequency
106	5530MHz	122	5610 MHz

FOR 5745 ~ 5825MHz:

5 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
149	5745MHz	161	5805MHz
153	5765MHz	165	5825MHz
157	5785MHz	-	-

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
155	5775MHz

6.3. Test Condition

Test Item	Test Site No.	Environmental Condition	Input Power	Test Date	Tested by
Antenna Port Conducted Measurement	SR4	20~26℃/ 62~68%RH	120Vac/ 60Hz	2021/12/27~ 2022/01/20	Mike Cai
Radiated Spurious Emission	966-2	20~26℃/ 62~68%RH	120Vac/ 60Hz	2021/12/27~ 2022/01/21	Mike Cai
AC power Line Conducted Emission	SR1	20~26℃/ 62~68%RH	120Vac/ 60Hz	2021/12/27~ 2022/01/20	Mike Cai

FCC Test Firm Registration Number: 498077

6.4. Description of Available Antennas

Ant. No.	Transmitter Circuit	Ant. Type	Maximum Gain (dBi)
1	Chain (0)+(1)	PCB	2.4GHz: 3.14 5GHz: 4.63

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

- The fundamental of the EUT's Antenna was investigated in three orthogonal axes X-Y/Y-Z/X-Z, it was determined that Y-Z plane was worst-case. Therefore, all final radiated testing was performed with the Y-Z plane at Antenna.
- 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.
- For below 1 GHz radiated emission and AC power line conducted emission have performed all modes of operation were investigated and the worst-case emissions are reported.
- 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).

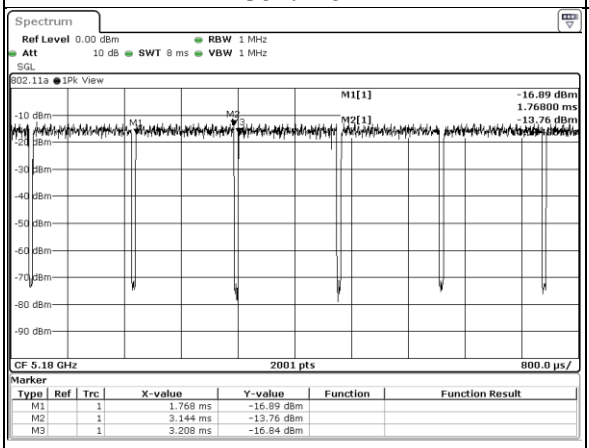
Test Item	Mode	Modulation Technology	Modulation Type	Available Channel	Test Channel	Data Rate
Radiated Emissions (Above 1GHz)	802.11a	5180-5240	OFDM	36 to 48	36, 44, 48	6Mbps
	802.11ac20			36 to 48	36, 44, 48	MCS0
	802.11ac40			38 to 46	38, 46	MCS0
	802.11ac80			42	42	MCS0
	802.11a	5260-5320	OFDM	52 to 64	52, 60, 64	6Mbps
	802.11ac20			52 to 64	52, 60, 64	MCS0
	802.11ac40			54 to 62	54, 62	MCS0
	802.11ac80			58	58	MCS0
	802.11a	5500-5700	OFDM	100 to 140	100, 116, 140	6Mbps
	802.11ac20			100 to 140	100, 116, 140	MCS0
	802.11ac40			102 to 134	102, 110, 134	MCS0
	802.11ac80			106, 122	106, 122	MCS0
	802.11a	5745-5825	OFDM	149 to 165	149, 157, 165	6Mbps
	802.11ac20			149 to 165	149, 157, 165	MCS0
	802.11ac40			151 to 159	151, 159	MCS0
	802.11ac80			155	155	MCS0
Radiated Emissions (Below 1GHz)	802.11ac80	5500-5700	OFDM	106, 122	106	MCS0
AC Power Line Conducted Emission	802.11ac80	5500-5700	OFDM	106, 122	106	MCS0

Test Item	Mode	Modulation Technology	Modulation Type	Available Channel	Test Channel	Data Rate
Antenna Port Conducted Measurement	802.11a	5180-5240	OFDM	36 to 48	36, 44, 48	6Mbps
	802.11ac20			36 to 48	36, 44, 48	MCS0
	802.11ac40			38 to 46	38, 46	MCS0
	802.11ac80			42	42	MCS0
	802.11a	5260-5320	OFDM	52 to 64	52, 60, 64	6Mbps
	802.11ac20			52 to 64	52, 60, 64	MCS0
	802.11ac40			54 to 62	54, 62	MCS0
	802.11ac80			58	58	MCS0
	802.11a	5500-5700	OFDM	100 to 140	100, 116, 140	6Mbps
	802.11ac20			100 to 140	100, 116, 140	MCS0
	802.11ac40			102 to 134	102, 110, 134	MCS0
	802.11ac80			106, 122	106, 122	MCS0
	802.11a	5745-5825	OFDM	149 to 165	149, 157, 165	6Mbps
	802.11ac20			149 to 165	149, 157, 165	MCS0
	802.11ac40			151 to 159	151, 159	MCS0
	802.11ac80			155	155	MCS0

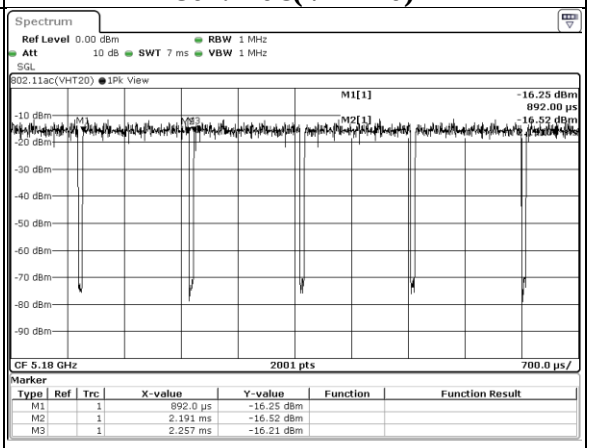
6.6. Duty cycle

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle	Duty Factor (dB)	VBW Set (above 1GHz)
802.11a	1.376	1.440	0.96	0.20	1kHz
802.11ac(VHT20)	1.298	1.365	0.95	0.22	1kHz
802.11ac(VHT40)	0.652	0.706	0.92	0.35	2kHz
802.11ac(VHT80)	0.325	0.378	0.86	0.66	5.1kHz

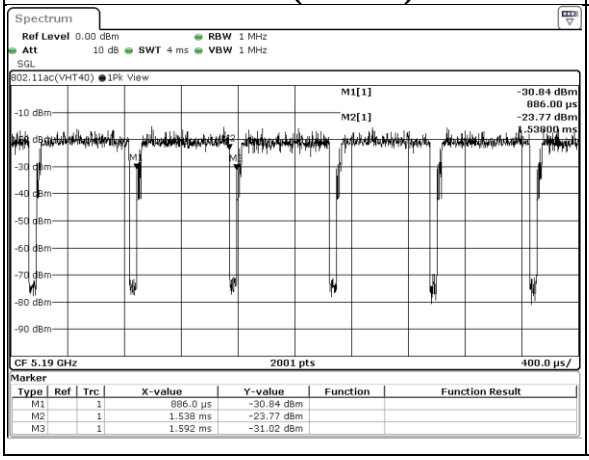
802.11a



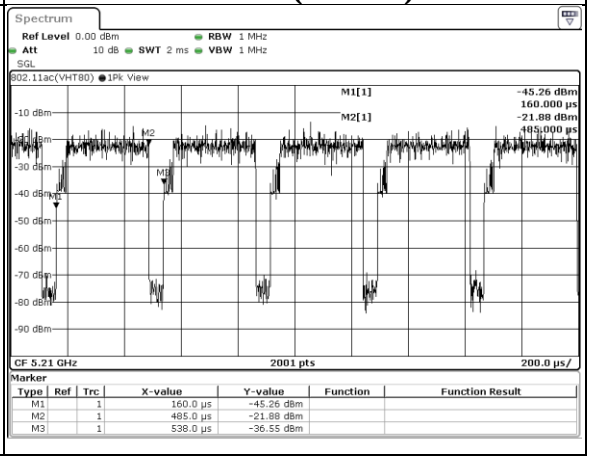
802.11ac(VHT20)



802.11ac(VHT40)



802.11ac(VHT80)



7. Test Equipment

Test Equipment List					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Expired date**
Radiated Spurious Emission					
Spectrum Analyzer	Keysight	N9010A	MY56070827	2021/11/9	2022/11/8
EMI Test Receiver	Rohde & Schwarz	ESR7	101754	2021/12/10	2022/12/9
Loop Antenna	ETS lindgren	6502	00213440	2021/12/23	2022/12/22
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	9168-773 & AT-N0539	2021/3/11	2022/3/10
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01690	2021/12/13	2022/12/12
Horn Antenna (18-40 GHz)	Schwarzbeck	BBHA 9170	781	2021/12/17	2022/12/16
Preamplifier (30-1000 MHz)	EMCI	EMC330E	980405	2021/6/8	2022/6/7
Preamplifier (1-18 GHz)	EMCI	EMC051835BE	980406	2021/2/3	2022/2/2
Preamplifier (18-40GHz)	EMCI	EMC184040SEE	980426	2021/5/19	2022/5/18
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-4 & 170425-2	2021/1/22	2022/1/21
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-1 & 170214-2	2021/1/22	2022/1/21

Test Equipment List					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Expired date**
Antenna Port Conducted Measurement					
Spectrum Analyzer	Keysight	N9010A	MY56070834	2021/10/29	2022/10/28
Pulse Power Sensor	Anritsu	MA2411B	1531202	2021/12/22	2022/12/21
Power Meter	Anritsu	ML2495A	1645002	2021/12/22	2022/12/21
Temperature &Humidity Test Chamber	GIANT FORCE	GTH-150- 40-CP-AR	MAA1701-010	2021/3/22	2022/3/21
AC power Line Conducted Emission					
EMI Test Receiver	Rohde & Schwarz	ESR7	101753	2021/11/15	2022/11/14
Two-Line V-Network	Rohde & Schwarz	ENV216	102136	2021/8/30	2022/8/29
Impuls-Begrenzer Pulse Limiter	Rohde & Schwarz	ESH3-Z2	102219-Qt	2021/8/26	2022/8/25
Cables	TITAN	CFD200	T0732ACFD200 20A300-1	2021/3/2	2022/3/1

UL Software		
Description	**Name**	**Version**
Radiated measurement	e3	6.191211 (V6)
Conducted measurement	RF Conducted Test Tools	ver 2.4.0.620b
AC power Line Conducted Emission	EZ_EMC	UL-3A1.2

8. Description of Test Setup

Support Equipment

ID	Equipment	Brand Name	Model Name	S/N	Remark
A	Laptop	Lenovo	T460	PC0FWU5Y	Provide by lab
B	Test tool	GoldenCrow	MB-R002	NA	Supplied by client
C	Adapter	TECH	ATS050-P121	NA	Supplied by client

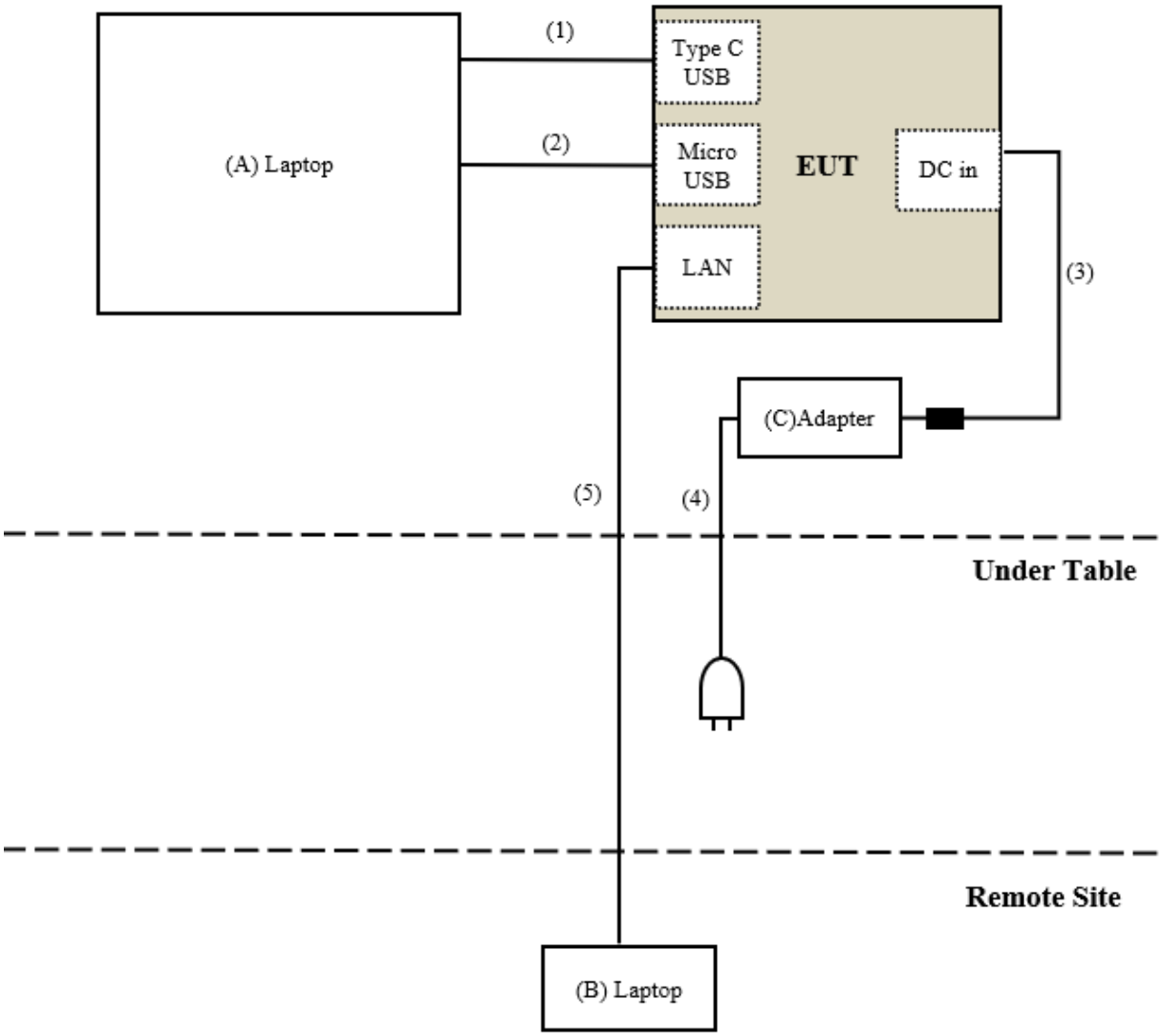
I/O Cables

ID	Equipment	Brand Name	Model Name	Length (m)	Remark
1	Type C to USB Cable	UGREEN	US287	1	Provide by lab
2	Micro USB Cable	fujiei	Z08145	1	Provide by lab
3	DC Cable	TECH	ATS050-P121	1.5	with one core, Supplied by client
4	AC Cable	NA	NA	1.75	Supplied by client
5	RJ45	Fastlink	FL-61STU-04	10	Provide by lab

Test Setup

The EUT was worked in engineering mode to transmit signal.

Setup Diagram for Test



9. Test Results

9.1. 6dB Bandwidth

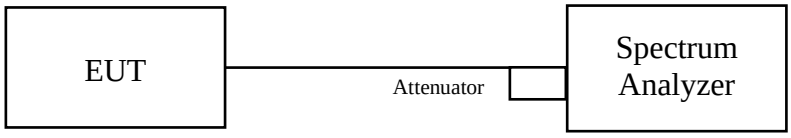
Requirements

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

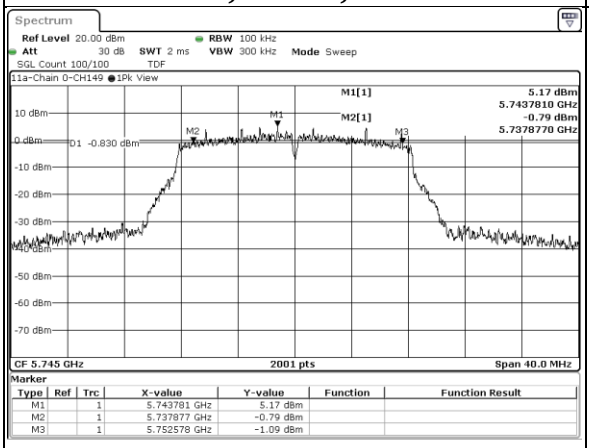


The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

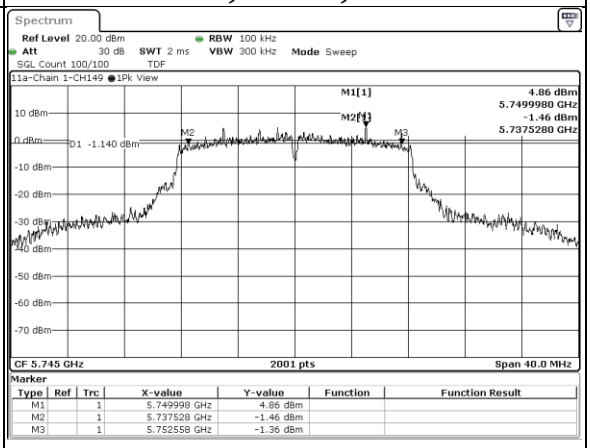
Test Data

Mode	CH	Freq (MHz)	6dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11a	149	5745	14.701	15.031	0.5	Pass
	157	5785	15.731	15.337	0.5	Pass
	165	5825	13.23	16.306	0.5	Pass

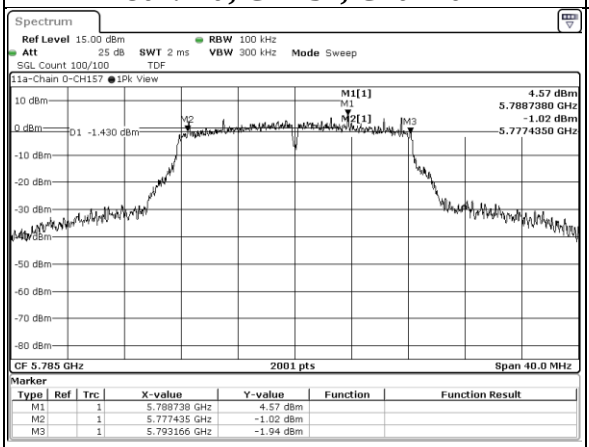
802.11a, CH149, Chain 0



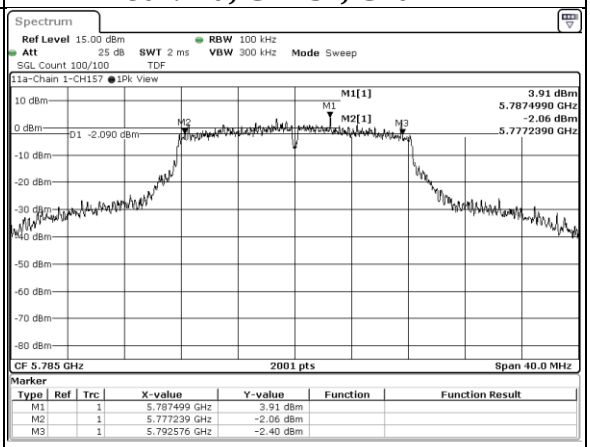
802.11a, CH149, Chain 1



802.11a, CH157, Chain 0



802.11a, CH157, Chain 1



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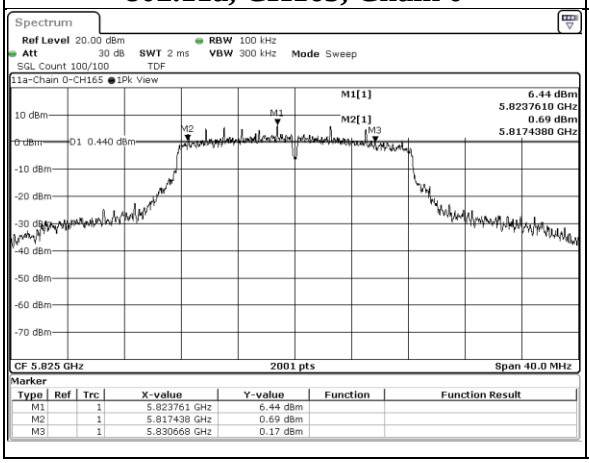
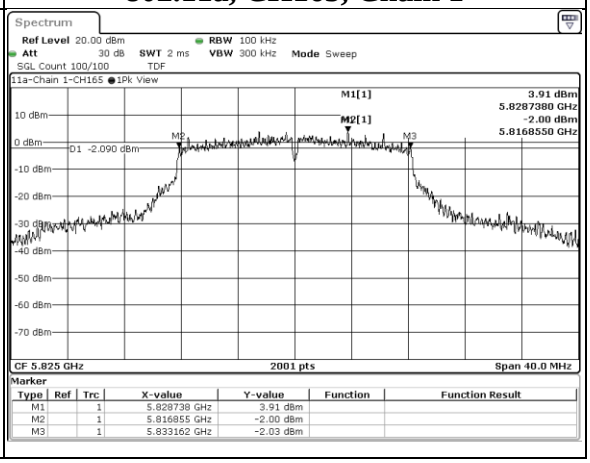
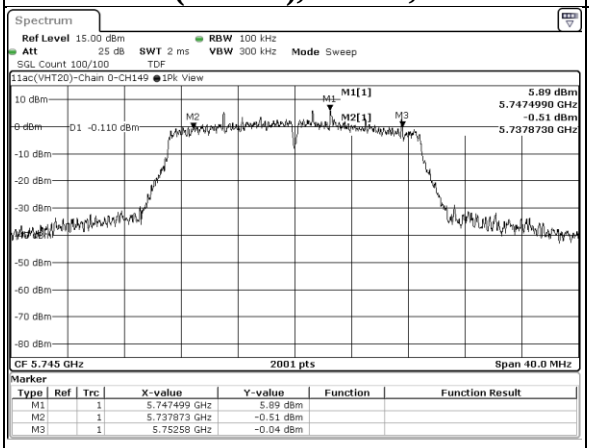


802.11a, CH165, Chain 1

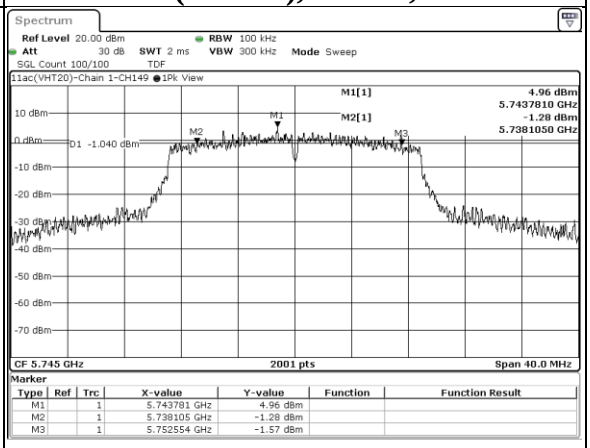


Mode	CH	Freq (MHz)	6dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11ac(VHT20)	149	5745	14.708	14.449	0.5	Pass
	157	5785	13.294	15.909	0.5	Pass
	165	5825	15.052	16.556	0.5	Pass

802.11ac(VHT20), CH149, Chain 0



802.11ac(VHT20), CH149, Chain 1



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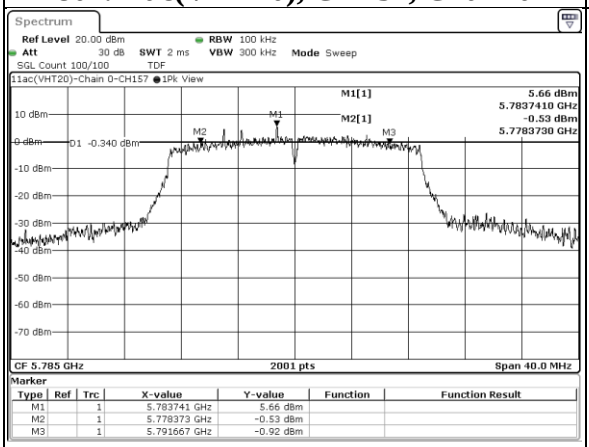
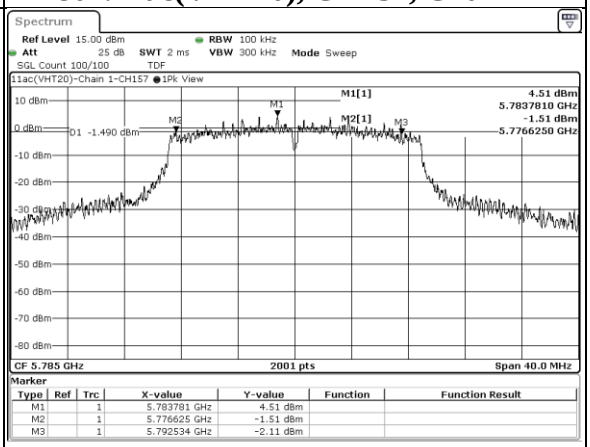
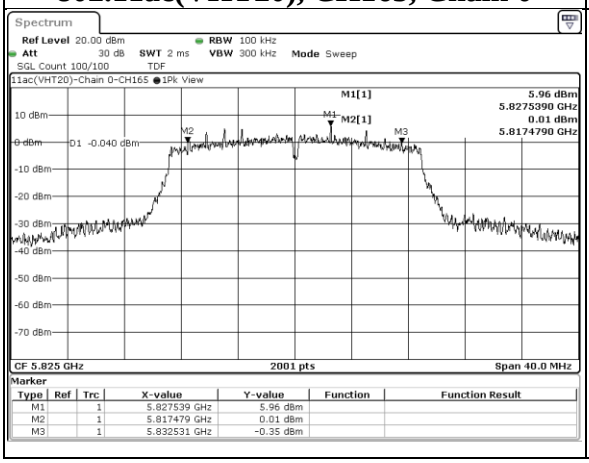


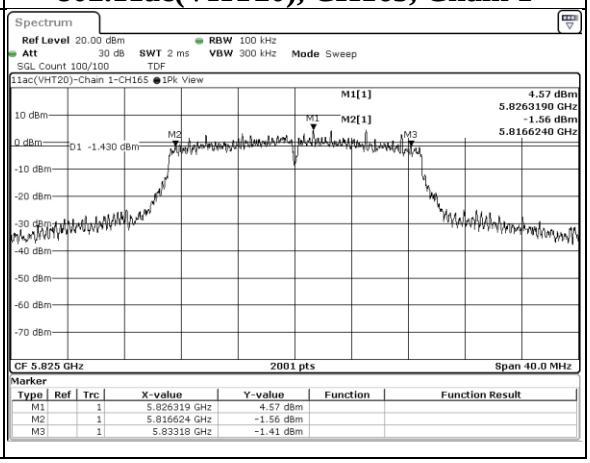
802.11ac(VHT20), CH157, Chain 1



802.11ac(VHT20), CH165, Chain 0

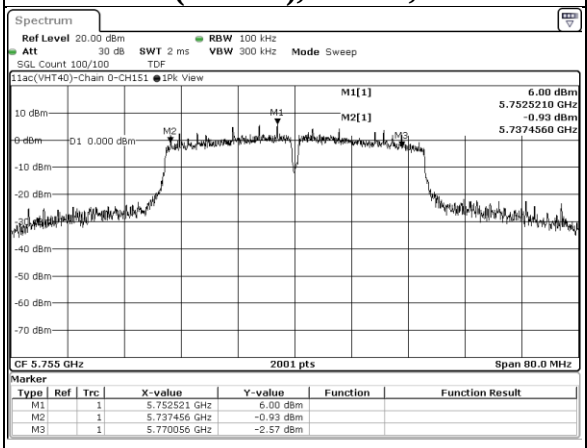


802.11ac(VHT20), CH165, Chain 1

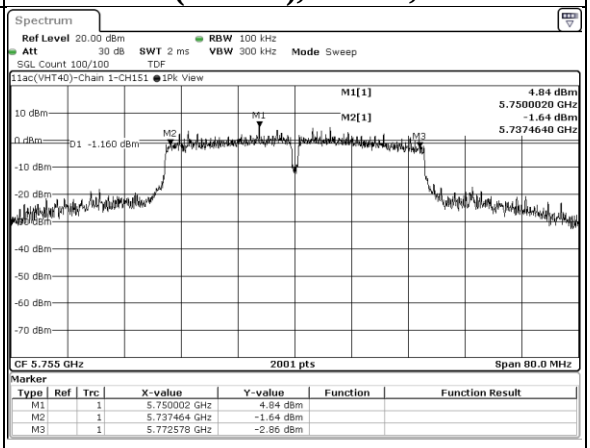


Mode	CH	Freq (MHz)	6dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11ac(VHT40)	151	5755	32.6	35.114	0.5	Pass
	159	5795	33.853	35.063	0.5	Pass

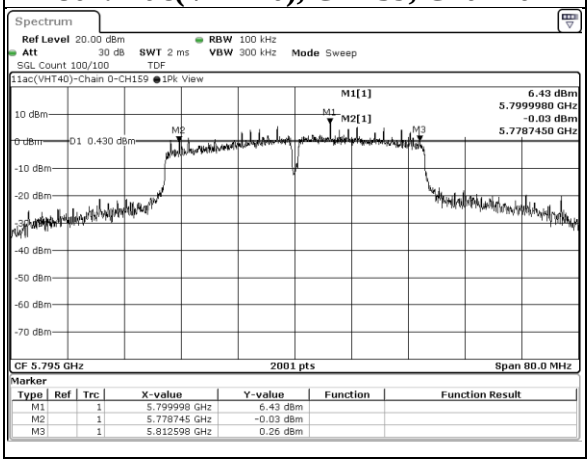
802.11ac(VHT40), CH151, Chain 0



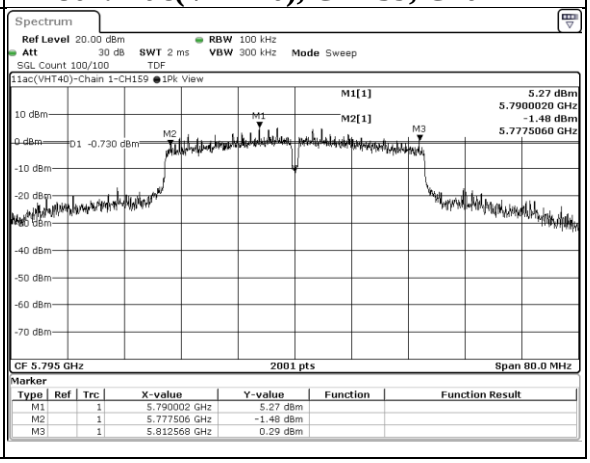
802.11ac(VHT40), CH151, Chain 1



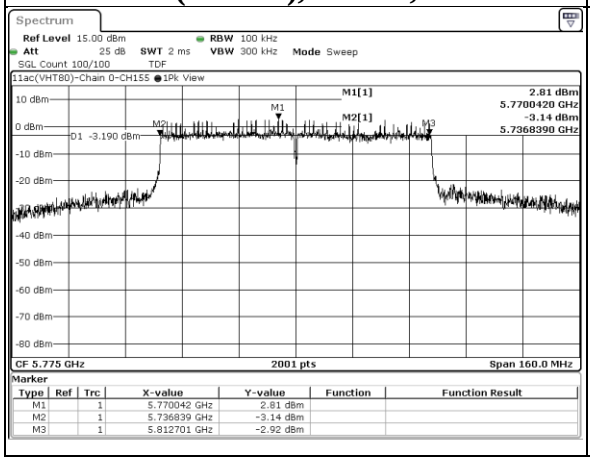
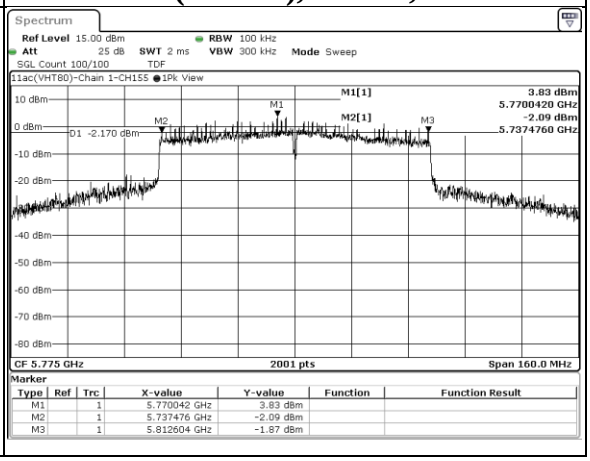
802.11ac(VHT40), CH159, Chain 0



802.11ac(VHT40), CH159, Chain 1



Mode	CH	Freq (MHz)	6dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11ac(VHT80)	155	5775	75.862	75.129	0.5	Pass

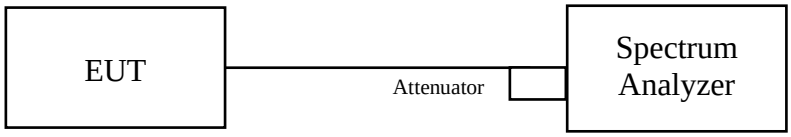
802.11ac(VHT80), CH155, Chain 0	802.11ac(VHT80), CH155, Chain 1
	

9.2. 26dB Bandwidth

Test procedure

a. Set RBW = approximately 1% of the emission bandwidth.
b. Set the VBW > RBW.
c. Detector = Peak.
d. Trace mode = max hold.
e. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

Test Setup

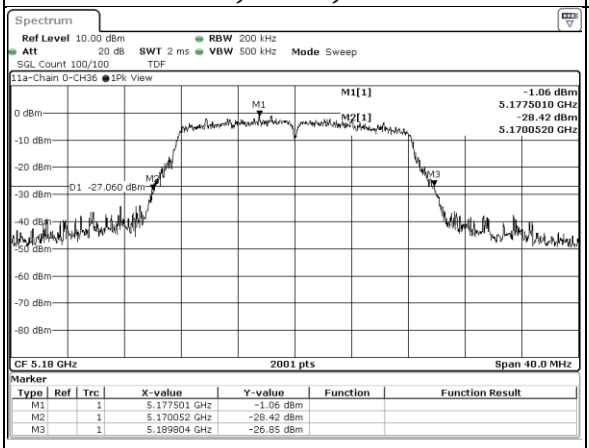


The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

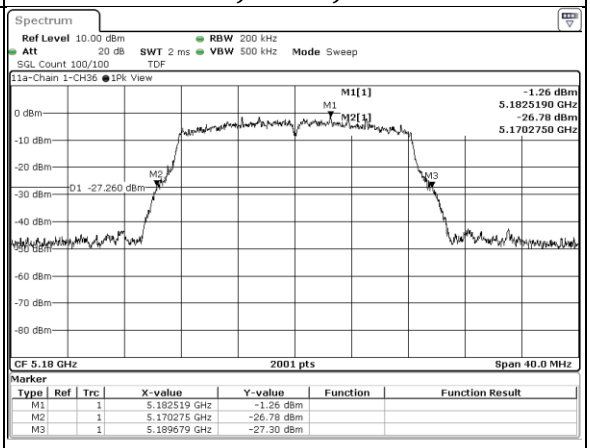
Test Data

Mode	CH	Freq (MHz)	26dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11a	36	5180	19.752	19.404	N/A	Pass
	44	5220	19.479	19.368	N/A	Pass
	48	5240	19.414	19.239	N/A	Pass
	52	5260	19.701	19.939	N/A	Pass
	60	5300	19.793	19.981	N/A	Pass
	64	5320	19.935	19.923	N/A	Pass
	100	5500	19.728	19.706	N/A	Pass
	116	5580	19.829	19.649	N/A	Pass
	140	5700	19.984	20.188	N/A	Pass

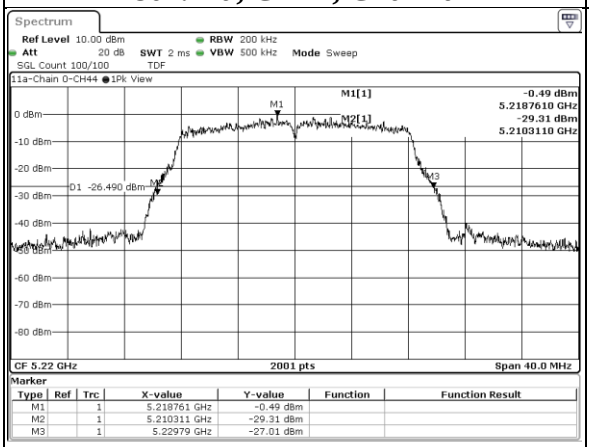
802.11a, CH36, Chain 0



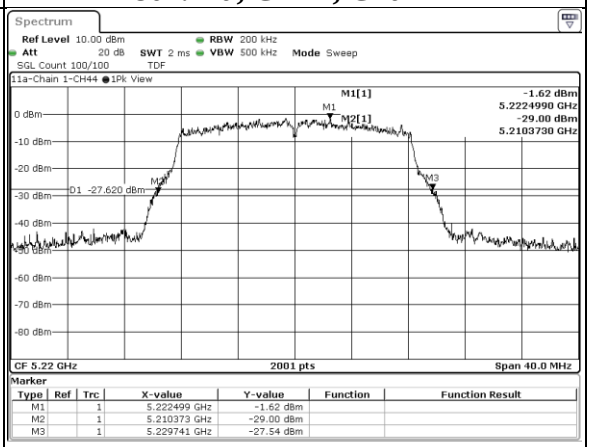
802.11a, CH36, Chain 1



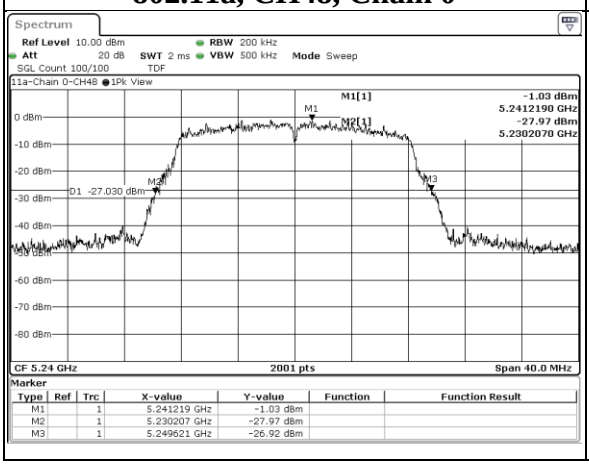
802.11a, CH44, Chain 0



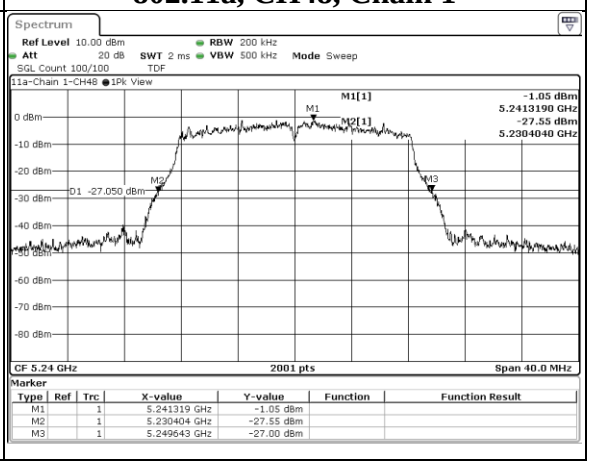
802.11a, CH44, Chain 1



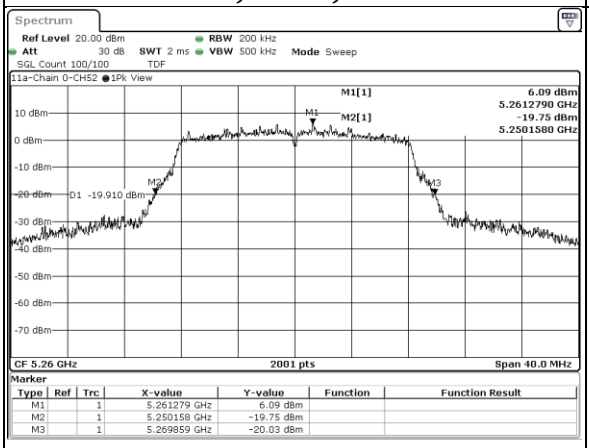
802.11a, CH48, Chain 0



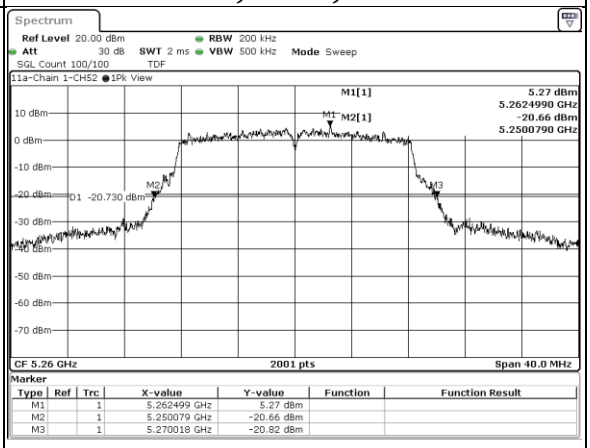
802.11a, CH48, Chain 1



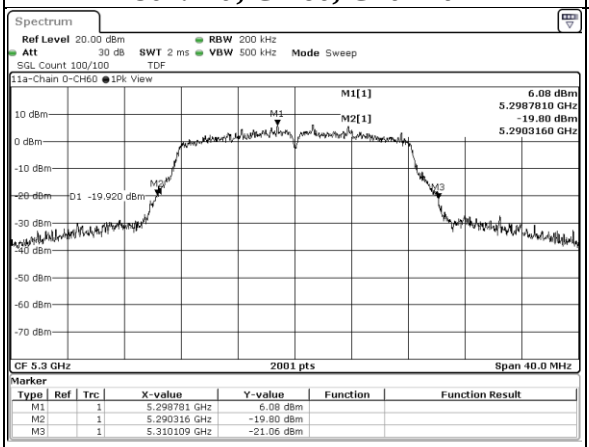
802.11a, CH52, Chain 0



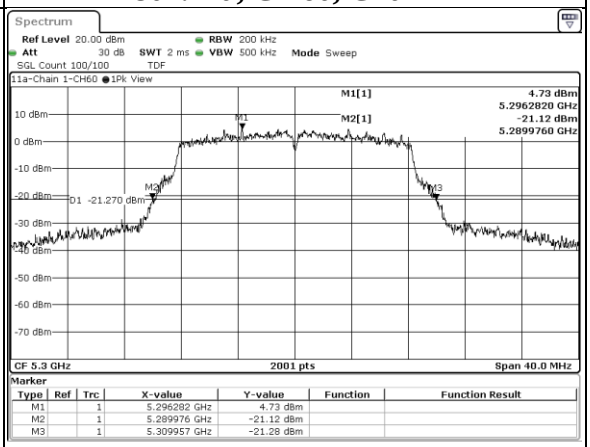
802.11a, CH52, Chain 1



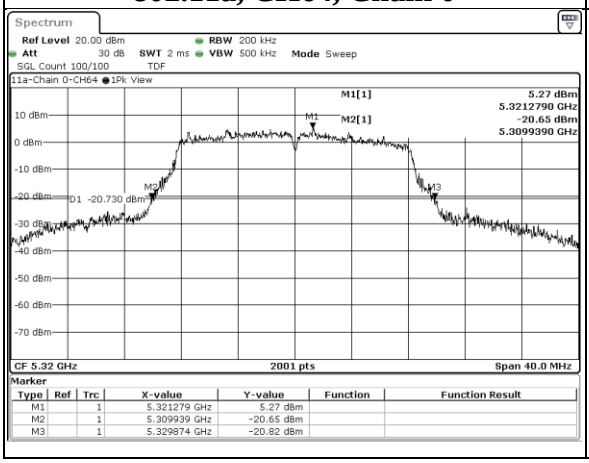
802.11a, CH60, Chain 0



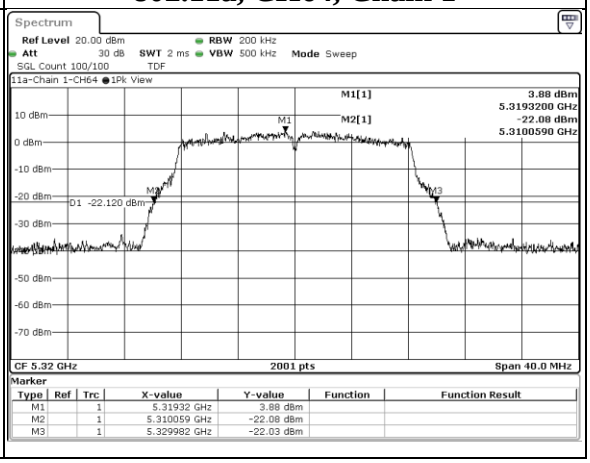
802.11a, CH60, Chain 1



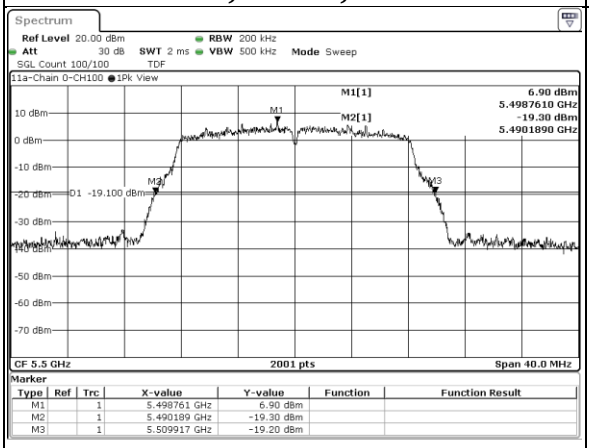
802.11a, CH64, Chain 0



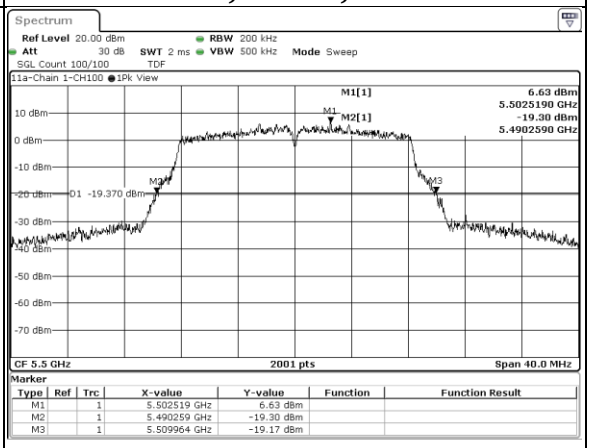
802.11a, CH64, Chain 1



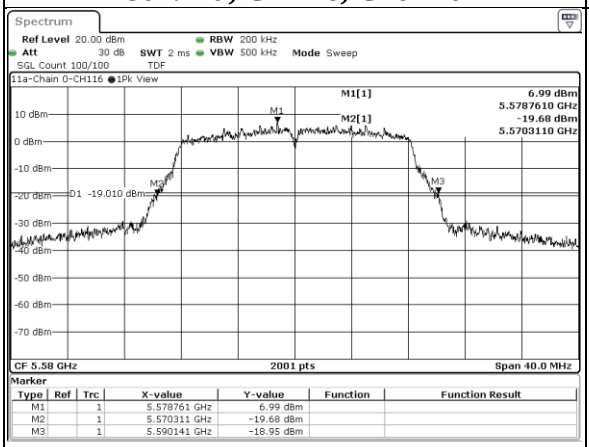
802.11a, CH100, Chain 0



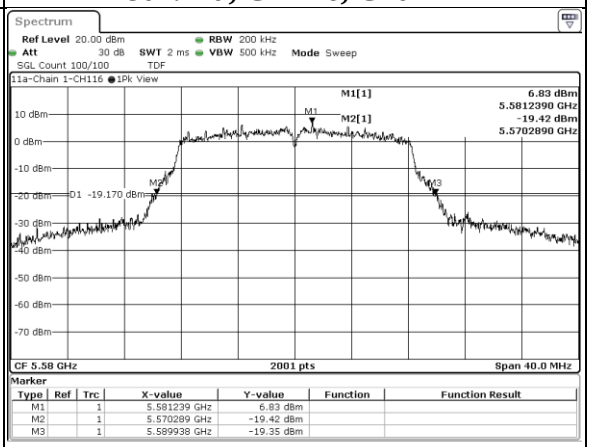
802.11a, CH100, Chain 1



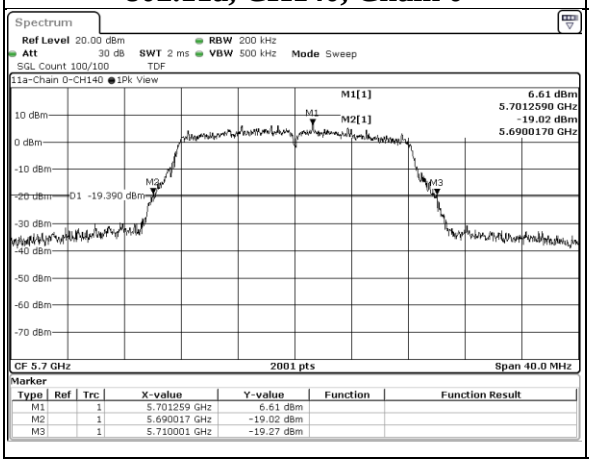
802.11a, CH116, Chain 0



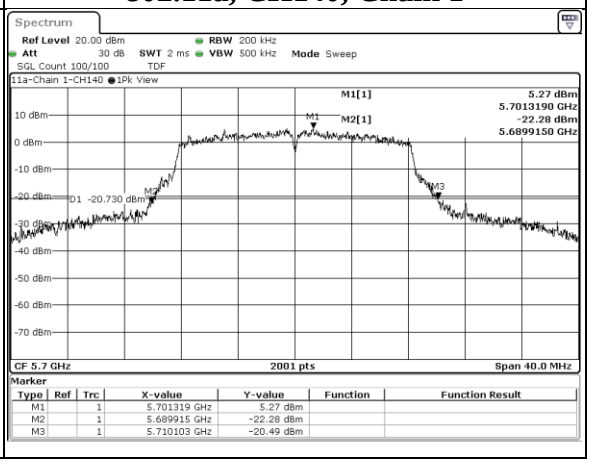
802.11a, CH116, Chain 1



802.11a, CH140, Chain 0

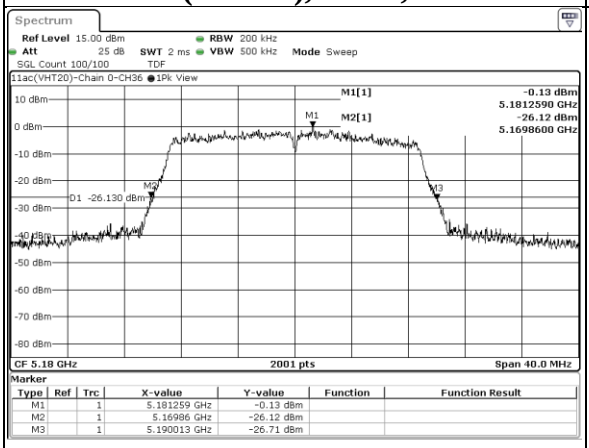


802.11a, CH140, Chain 1

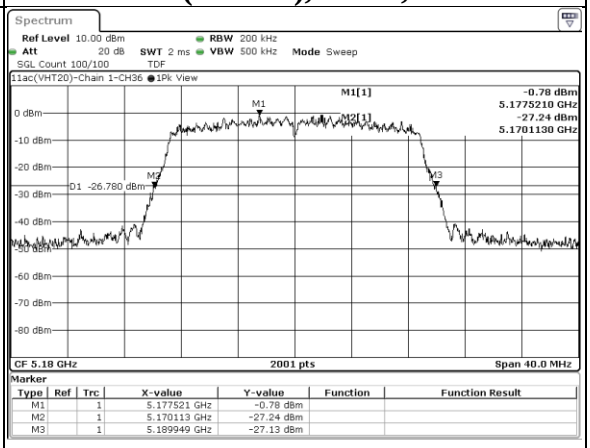


Mode	CH	Freq (MHz)	26dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11ac(VHT20)	36	5180	20.153	19.837	N/A	Pass
	44	5220	19.879	19.769	N/A	Pass
	48	5240	19.929	19.872	N/A	Pass
	52	5260	20	19.812	N/A	Pass
	60	5300	20.028	19.903	N/A	Pass
	64	5320	20.223	19.81	N/A	Pass
	100	5500	19.986	19.938	N/A	Pass
	116	5580	19.951	19.875	N/A	Pass
	140	5700	20.155	20.536	N/A	Pass

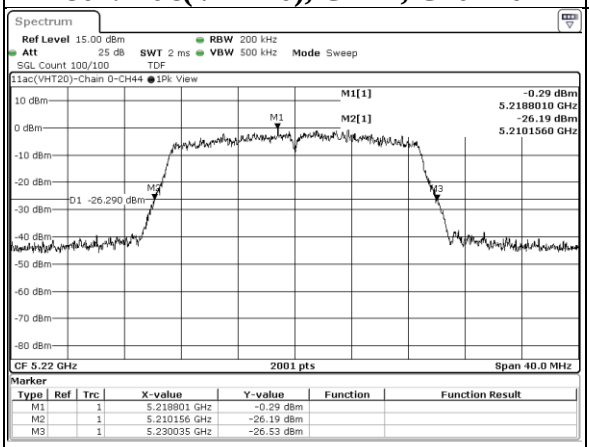
802.11ac(VHT20), CH36, Chain 0



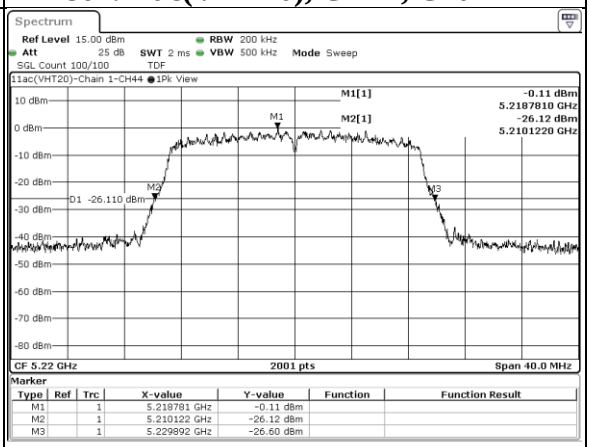
802.11ac(VHT20), CH36, Chain 1



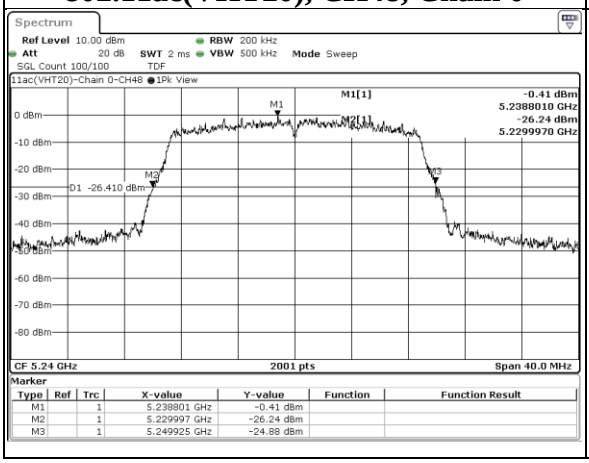
802.11ac(VHT20), CH44, Chain 0



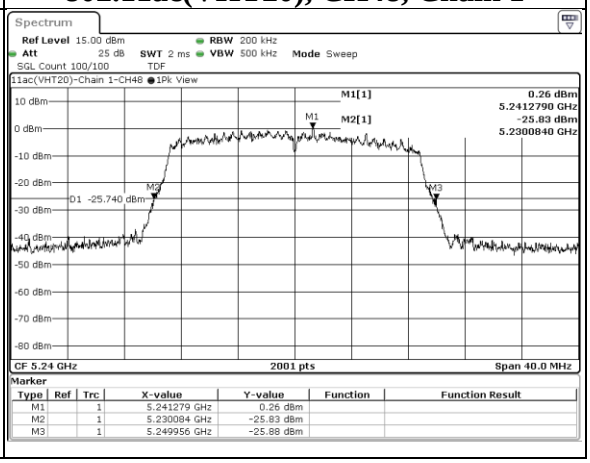
802.11ac(VHT20), CH44, Chain 1



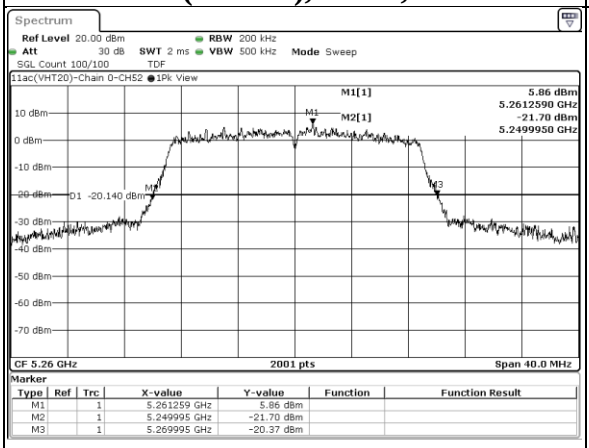
802.11ac(VHT20), CH48, Chain 0



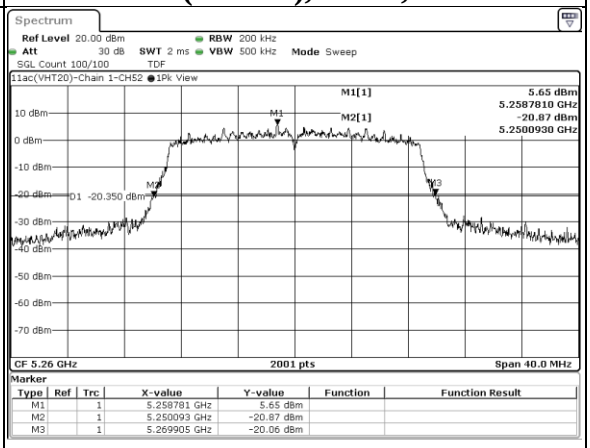
802.11ac(VHT20), CH48, Chain 1



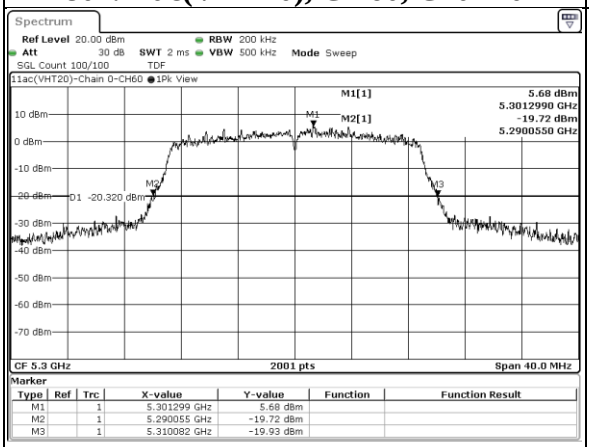
802.11ac(VHT20), CH52, Chain 0



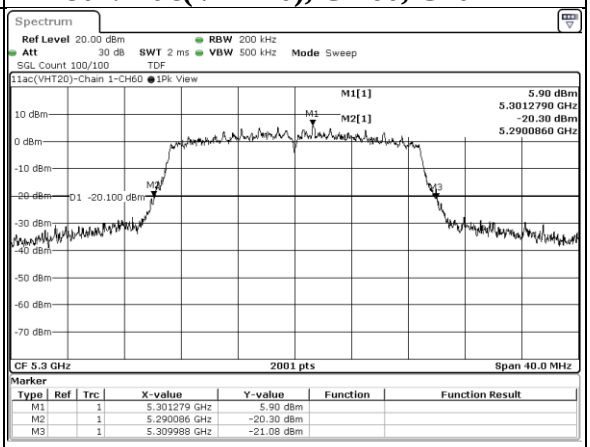
802.11ac(VHT20), CH52, Chain 1



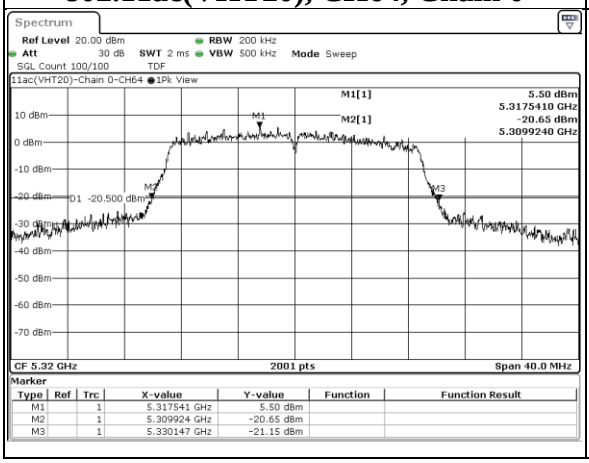
802.11ac(VHT20), CH60, Chain 0



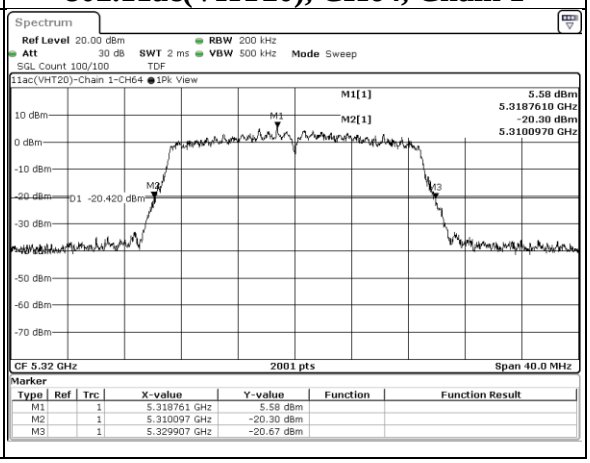
802.11ac(VHT20), CH60, Chain 1



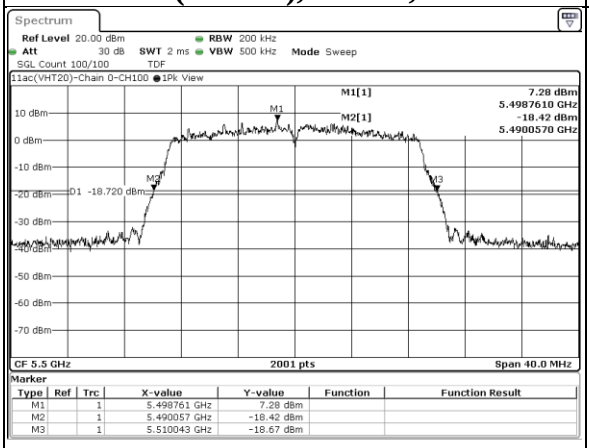
802.11ac(VHT20), CH64, Chain 0



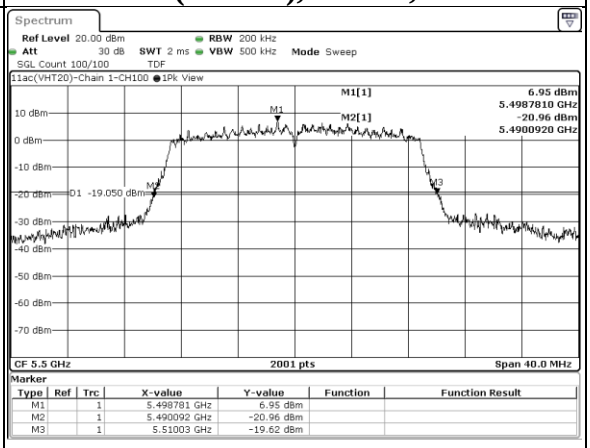
802.11ac(VHT20), CH64, Chain 1



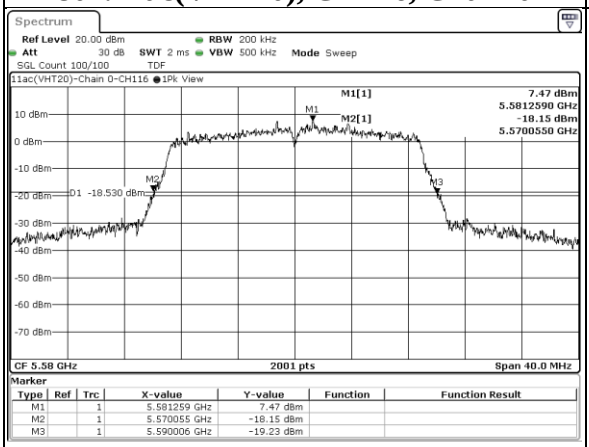
802.11ac(VHT20), CH100, Chain 0



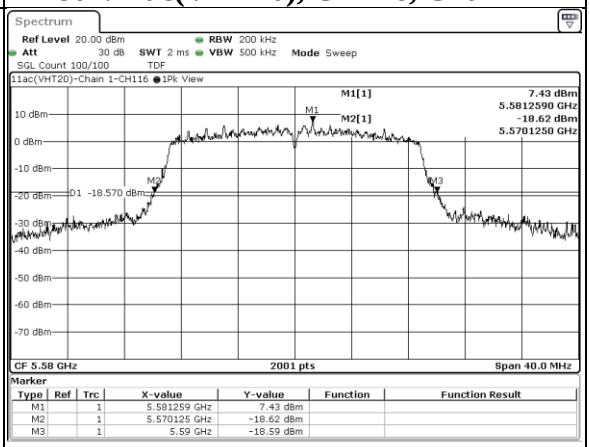
802.11ac(VHT20), CH100, Chain 1



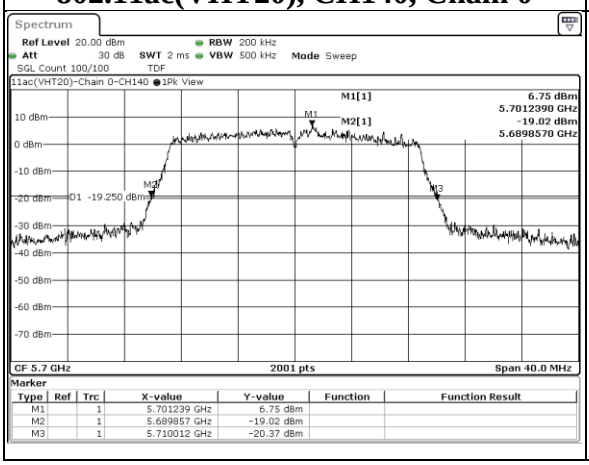
802.11ac(VHT20), CH116, Chain 0



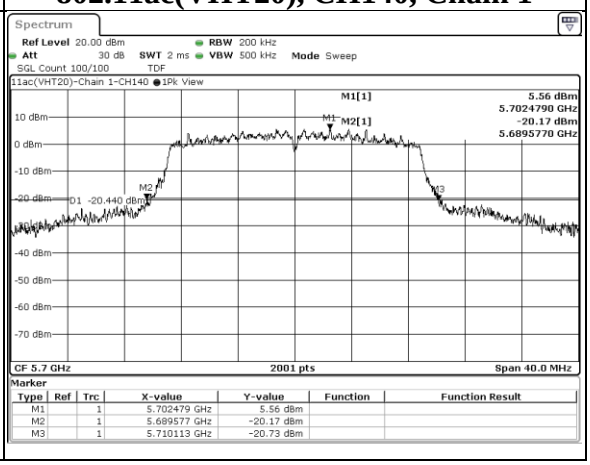
802.11ac(VHT20), CH116, Chain 1



802.11ac(VHT20), CH140, Chain 0

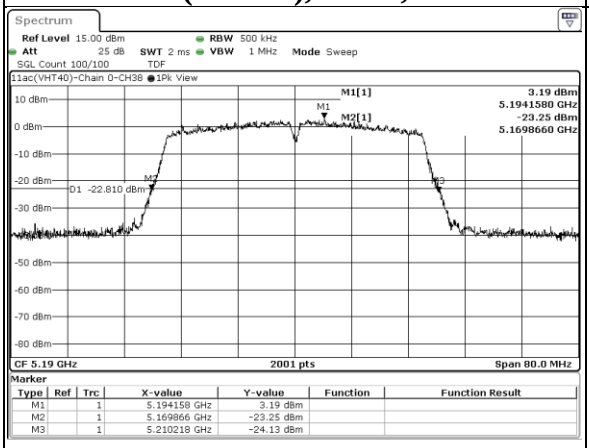


802.11ac(VHT20), CH140, Chain 1

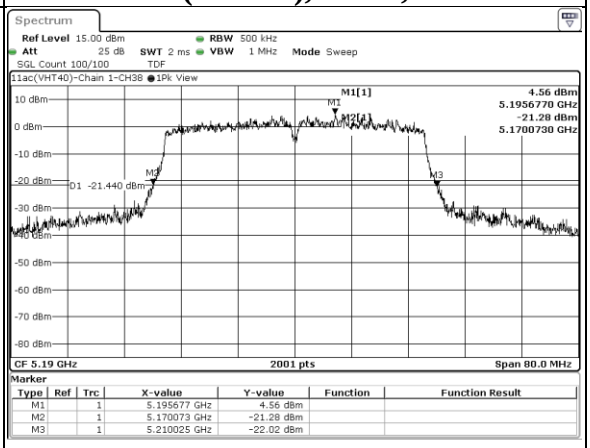


Mode	CH	Freq (MHz)	26dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11ac(VHT40)	38	5190	40.352	39.952	N/A	Pass
	46	5230	40.494	39.257	N/A	Pass
	54	5270	41.033	39.672	N/A	Pass
	62	5310	40.396	39.418	N/A	Pass
	102	5510	40.287	39.85	N/A	Pass
	110	5550	41.152	40.854	N/A	Pass
	134	5670	43.929	50.566	N/A	Pass

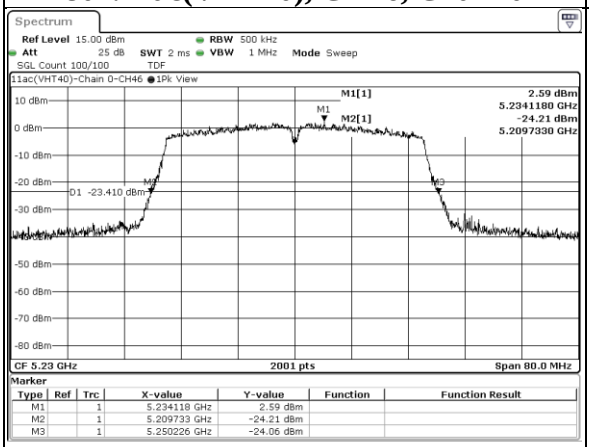
802.11ac(VHT40), CH38, Chain 0



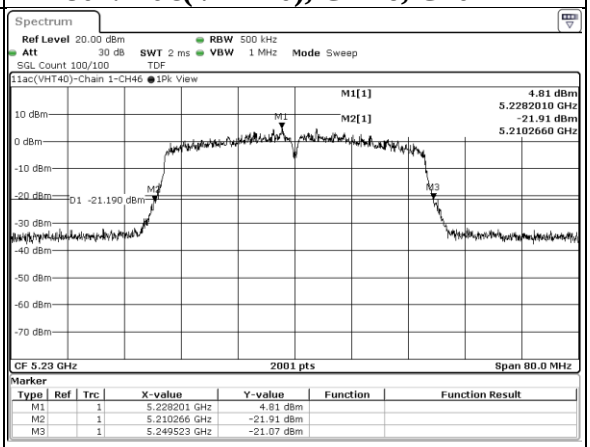
802.11ac(VHT40), CH38, Chain 1



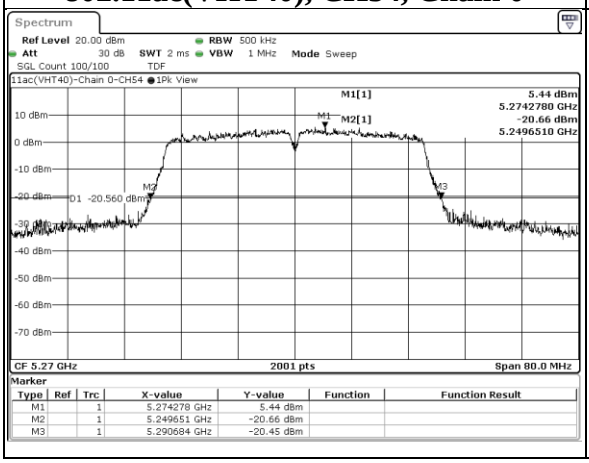
802.11ac(VHT40), CH46, Chain 0



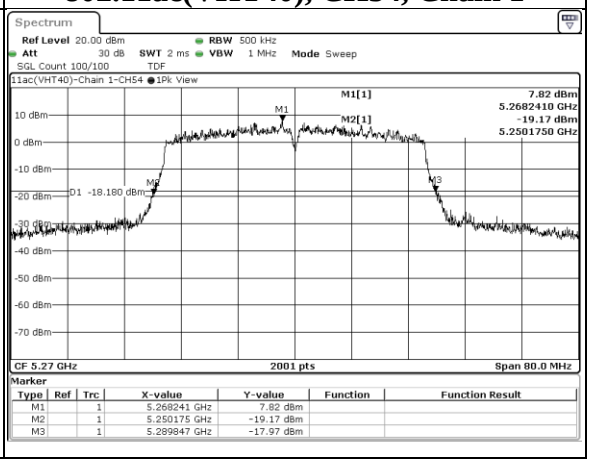
802.11ac(VHT40), CH46, Chain 1



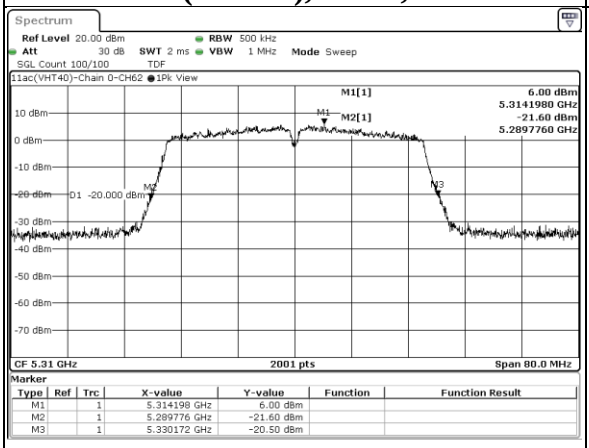
802.11ac(VHT40), CH54, Chain 0



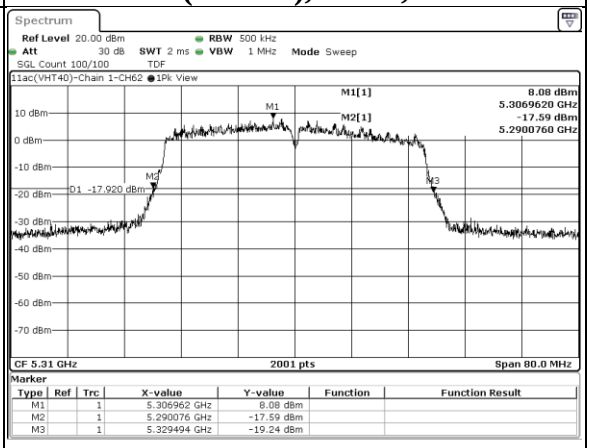
802.11ac(VHT40), CH54, Chain 1



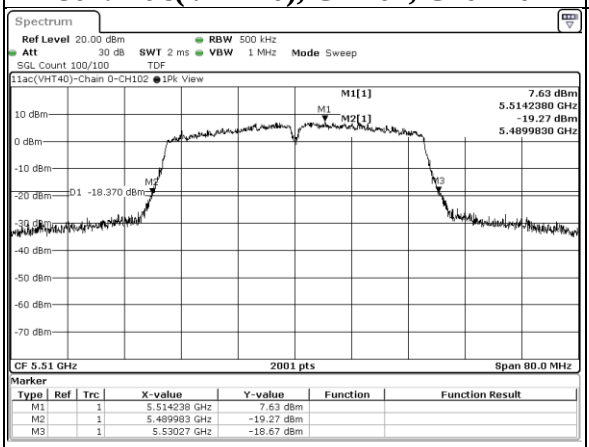
802.11ac(VHT40), CH62, Chain 0



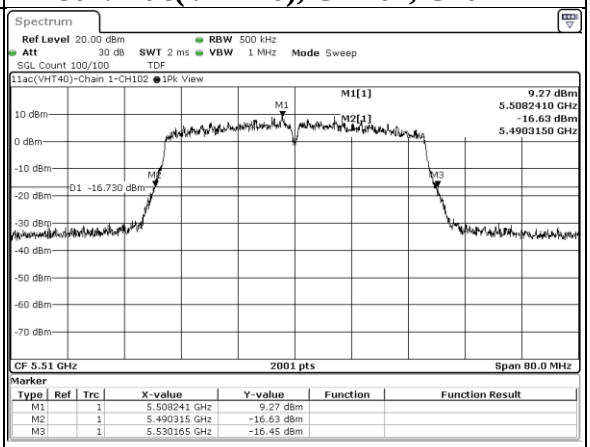
802.11ac(VHT40), CH62, Chain 1



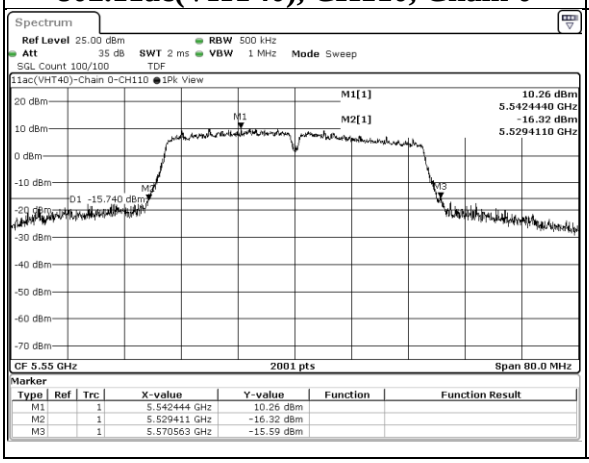
802.11ac(VHT40), CH102, Chain 0



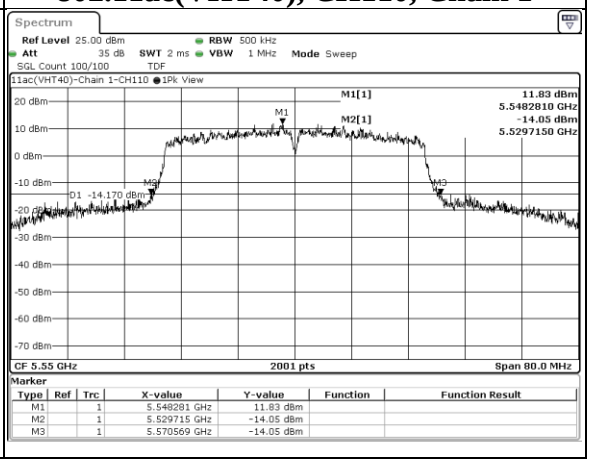
802.11ac(VHT40), CH102, Chain 1



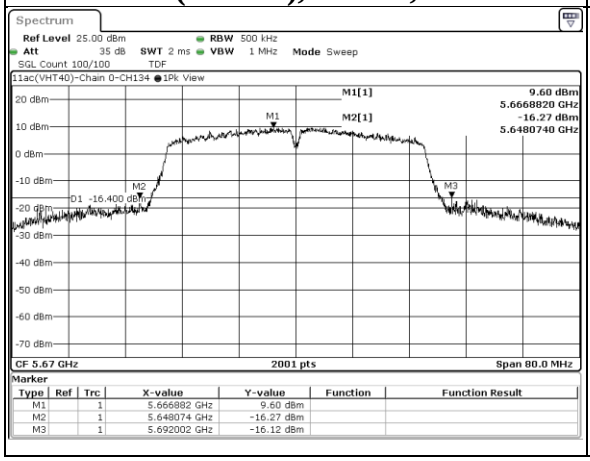
802.11ac(VHT40), CH110, Chain 0

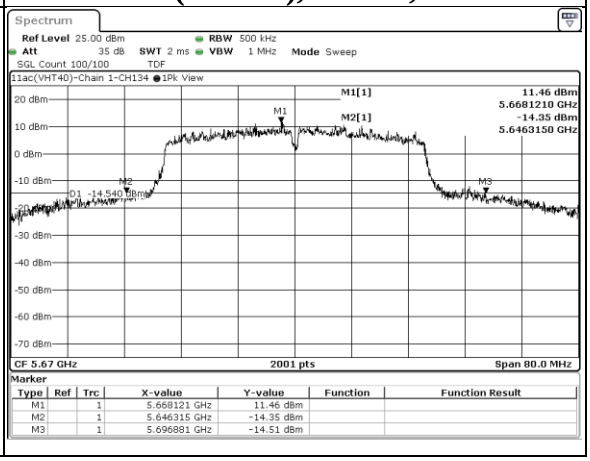


802.11ac(VHT40), CH110, Chain 1



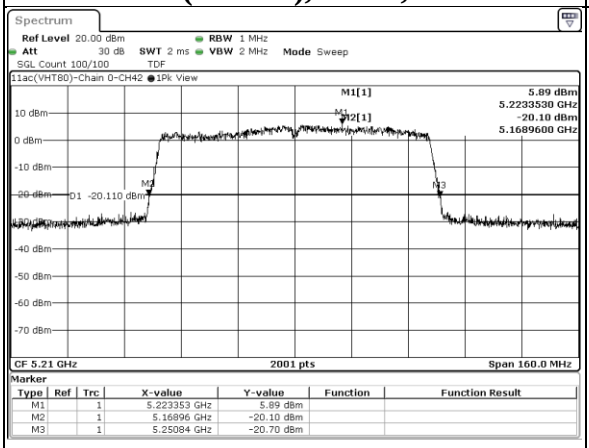
802.11ac(VHT40), CH134, Chain 0	802.11ac(VHT40), CH134, Chain 1



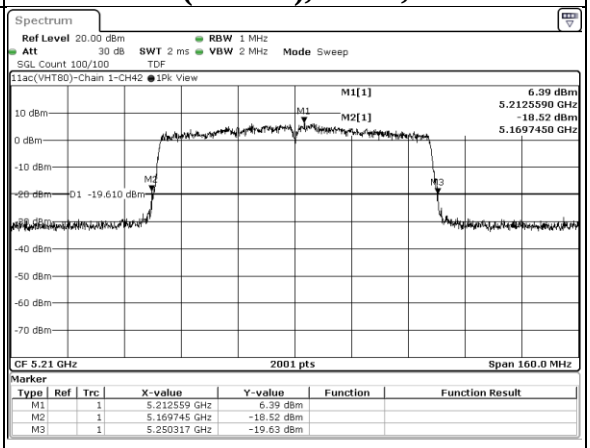


Mode	CH	Freq (MHz)	26dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11ac(VHT80)	42	5210	81.881	80.572	N/A	Pass
	58	5290	81.258	80.332	N/A	Pass
	106	5530	80.618	79.821	N/A	Pass
	122	5610	81.44	102.578	N/A	Pass

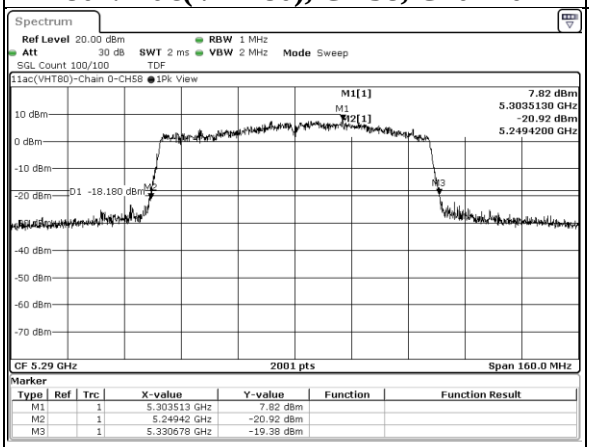
802.11ac(VHT80), CH42, Chain 0



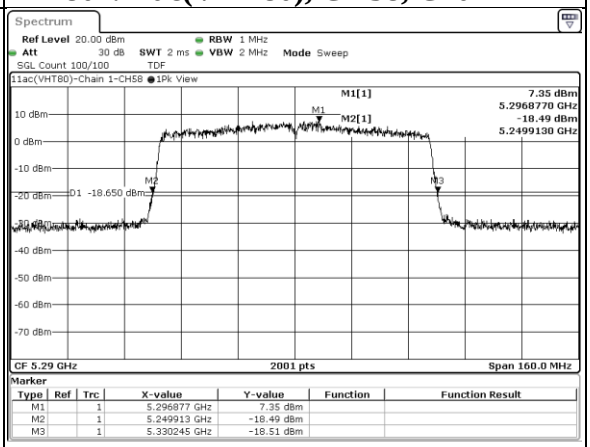
802.11ac(VHT80), CH42, Chain 1



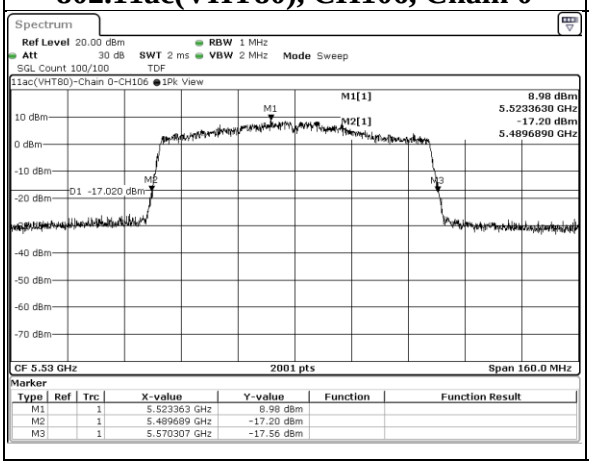
802.11ac(VHT80), CH58, Chain 0



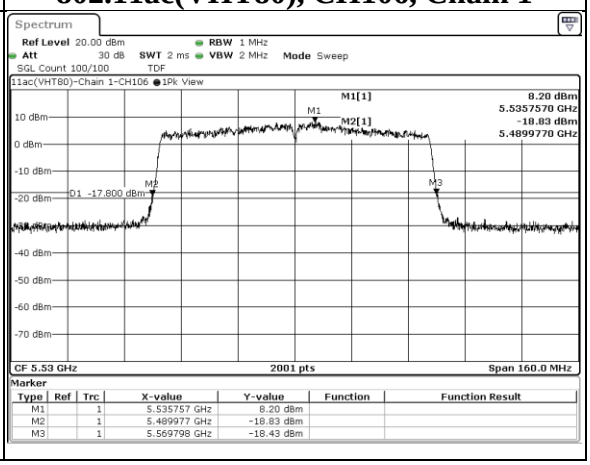
802.11ac(VHT80), CH58, Chain 1

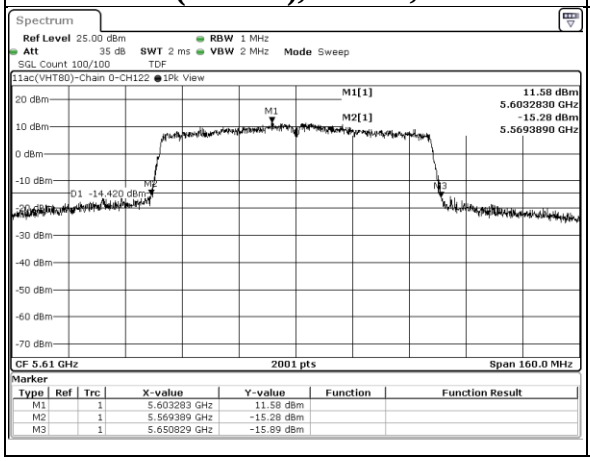
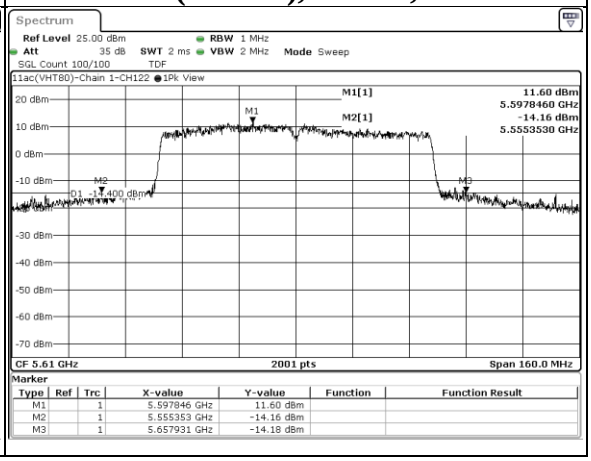


802.11ac(VHT80), CH106, Chain 0



802.11ac(VHT80), CH106, Chain 1



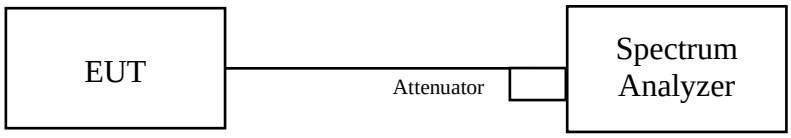
802.11ac(VHT80), CH122, Chain 0	802.11ac(VHT80), CH122, Chain 1
	

9.3. Occupied Bandwidth

Test procedure

a. Set center frequency to the nominal EUT channel center frequency.
b. Set span = 1.5 times to 5.0 times the OBW.
c. Set RBW = 1% to 5% of the OBW
d. Set VBW ≥ 3 x RBW
e. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
f. Use the 99% power bandwidth function of the instrument (if available).
g. If the instrument does not have a 99% power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

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

802.11a

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
36	5180	17.02	16.67
44	5220	17.00	16.63
48	5240	16.86	16.67
52	5260	17.06	16.75
60	5300	16.98	16.81
64	5320	16.99	16.78
100	5500	16.96	16.70
116	5580	17.00	16.77
140	5700	17.06	16.76
149	5745	16.99	16.84
157	5785	17.10	16.93
165	5825	17.10	16.92

802.11ac (VHT20)

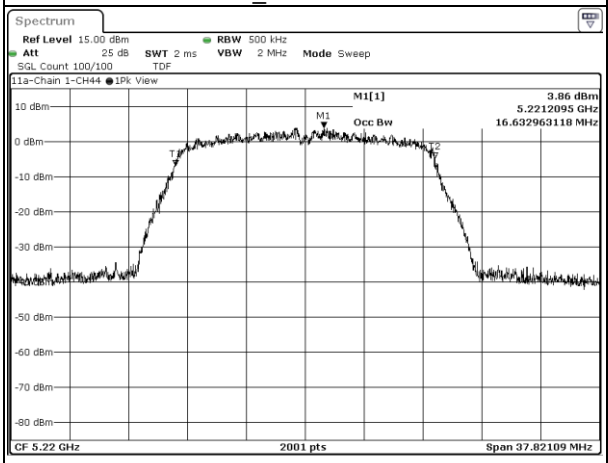
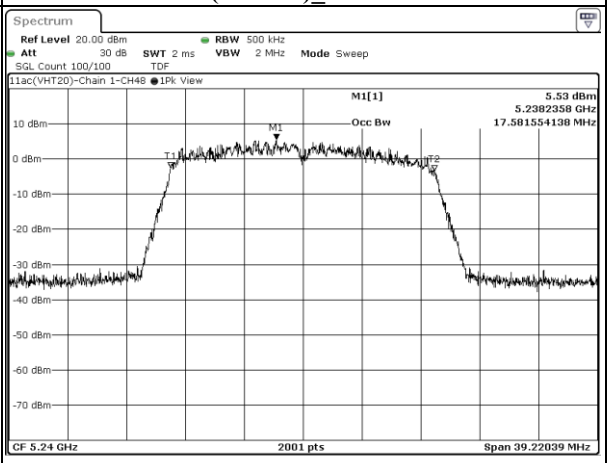
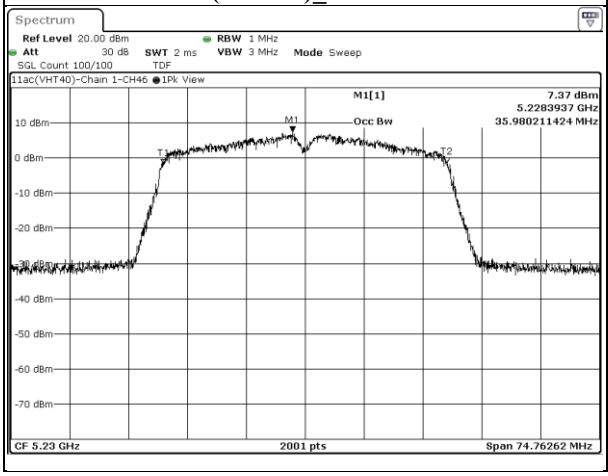
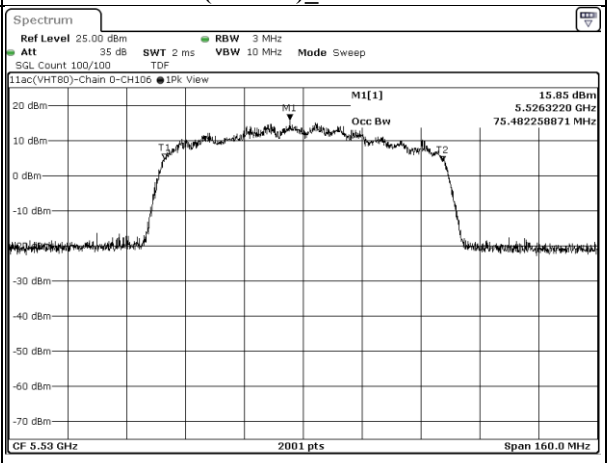
Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
36	5180	17.94	17.67
44	5220	17.91	17.65
48	5240	17.85	17.58
52	5260	18.01	17.74
60	5300	17.94	17.68
64	5320	17.93	17.71
100	5500	17.89	17.74
116	5580	17.92	17.69
140	5700	17.98	17.72
149	5745	17.94	17.86
157	5785	18.03	17.91
165	5825	18.04	17.87

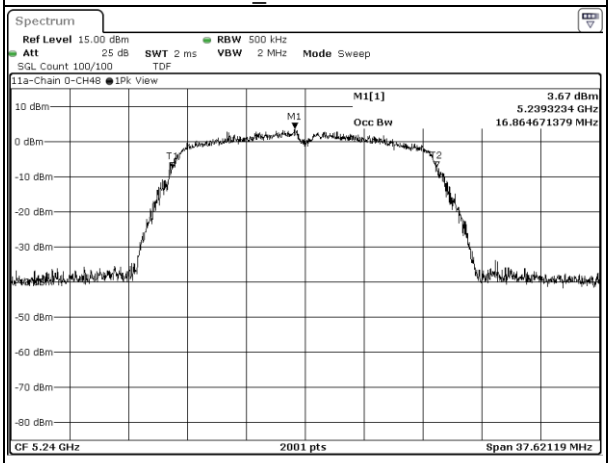
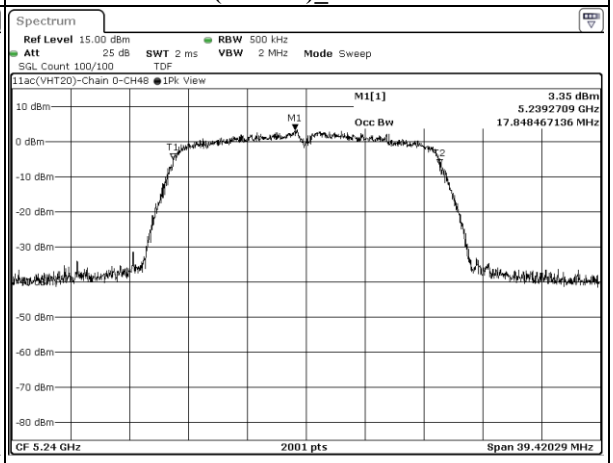
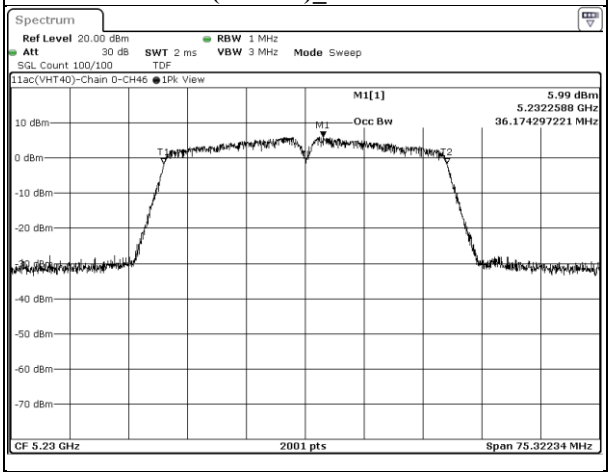
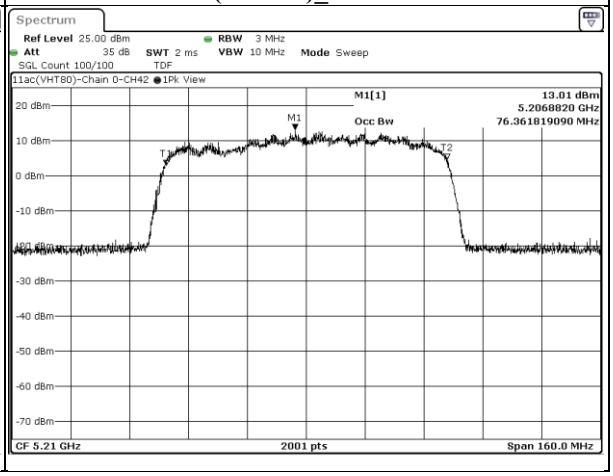
802.11ac (VHT40)

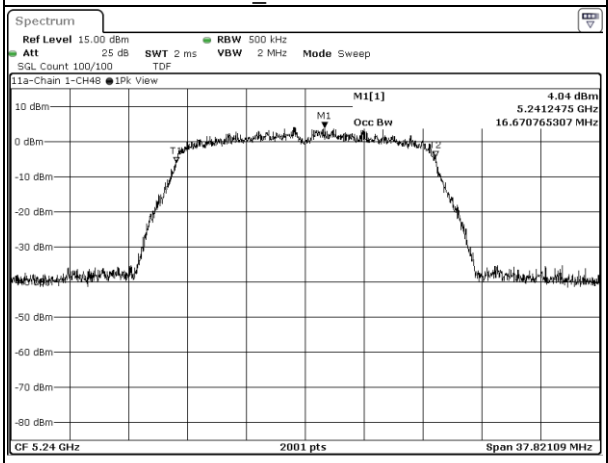
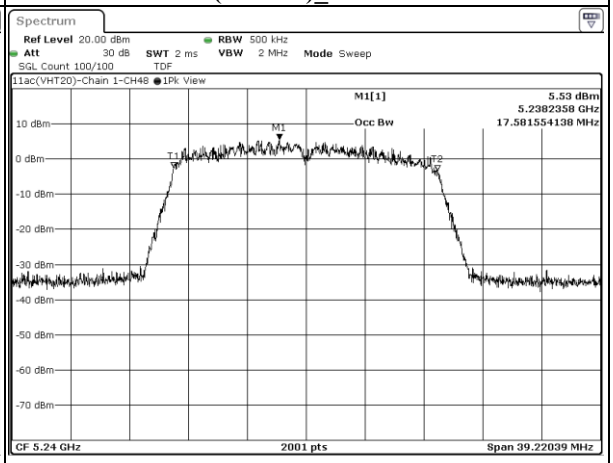
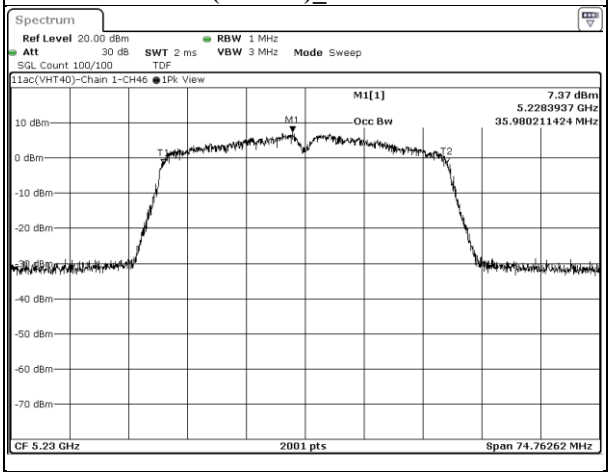
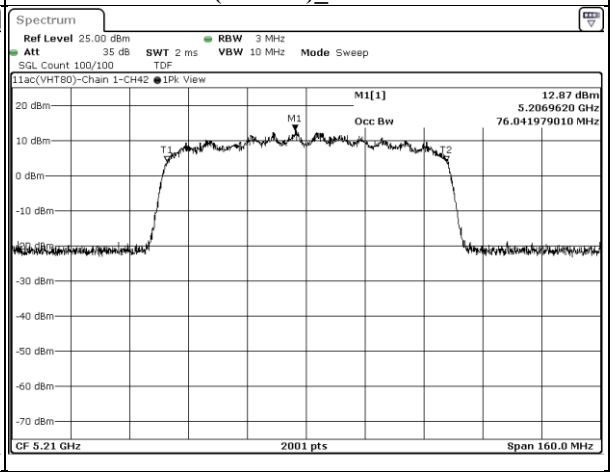
Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
38	5190	36.13	36.48
46	5230	36.17	35.98
54	5270	36.33	36.21
62	5310	36.13	36.09
102	5510	36.10	36.29
110	5550	36.41	36.56
134	5670	36.10	36.74
151	5755	36.52	37.11
159	5795	36.74	37.07

802.11ac (VHT80)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
42	5210	76.36	76.04
58	5290	75.72	75.88
106	5530	75.48	75.80
122	5610	76.44	77.08
155	5775	78.12	77.96

Spectrum Plot of Worst Value	
802.11a_Chain 1 / CH44	**802.11ac (VHT20)_Chain 1 / CH48**
	
802.11ac (VHT40)_Chain 1 / CH46	**802.11ac (VHT80)_Chain 0 / CH106**
	

Spectrum Plot for UNII-1 nearly DFS band Channels	
802.11a_Chain 0 / CH48	**802.11ac (VHT20)_Chain 0 / CH48**
	
802.11ac (VHT40)_Chain 0 / CH46	**802.11ac (VHT80)_Chain 0 / CH42**
	

Spectrum Plot for UNII-1 nearly DFS band Channels	
802.11a_Chain 1 / CH48	**802.11ac (VHT20)_Chain 1 / CH48**
	
802.11ac (VHT40)_Chain 1 / CH46	**802.11ac (VHT80)_Chain 1 / CH42**
	

Note: The observed T2 is all <5250 MHz, so UNII-1 band channels which in nearly DFS band no need for DFS function.

9.4. Conducted output power

Requirements

Operation Band	EUT Category		Limit
U-NII-1		Outdoor Access Point	1 Watt (30 dBm) Max. e.i.r.p ≦ 125mW(21 dBm) at any elevation angle above 30 degrees as measured from the horizon If G_{TX} > 6 dBi, then P_{Out} = 30 – (G_{TX} – 6)
		Fixed point-to-point Access Point	1 Watt (30 dBm) If G_{TX} > 23 dBi, then P_{Out} = 30 – (G_{TX} – 23)
		Indoor Access Point	1 Watt (30 dBm) If G_{TX} > 6 dBi, then P_{Out} = 30 – (G_{TX} – 6)
	√	Client device	250mW (24 dBm) If G_{TX} > 6 dBi, then P_{Out} = 23.98 – (G_{TX} – 6)
U-NII-2A	√		250mW (24 dBm) or 11 dBm+10 log B* If G_{TX} > 6 dBi, then P_{Out} = 23.98 – (G_{TX} – 6)
U-NII-2C	√		250mW (24 dBm) or 11 dBm+10 log B* If G_{TX} > 6 dBi, then P_{Out} = 23.98 – (G_{TX} – 6)
U-NII-3	√		For Point-to-multipoint systems (P2M): 1 Watt (30 dBm). If G_{TX} > 6 dBi, then P_{Out} = 30 – (G_{TX} – 6) For Point-to-point systems (P2P): 1 Watt (30 dBm)

Note:
1. P_{Out} = maximum conducted output power in dBm,
2. G_{TX} = the maximum transmitting antenna directional gain in dBi.
3. B is the 26 dB emission bandwidth in megahertz
4. Directional Gain = G_{ant} + 10 log (Nant) dBi.

   Nαnt: Number of Transmit Antennas
   G1, G2,..., Gn: Gain of Individual Antennas (Same for Each Antenna)

5. Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices,

   Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
   Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};
   Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

Test Procedure

For Average Power Measurement

Test method PM-G

For 802.11a, 802.11ac (VHT20), 802.11ac (VHT40)

Method PM is used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst and set the detector to AVERAGE. Duty factor is not added to measured value.

Test method SA-1

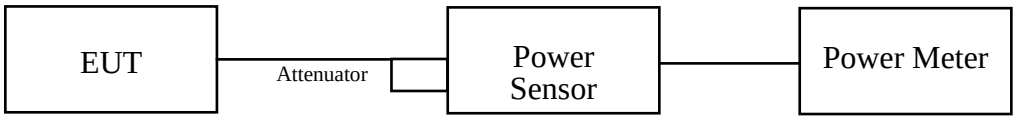
For 802.11ac (VHT80)

a. Set span to encompass the entire 26 dB EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
b. Set sweep trigger*.
c. Set RBW = 1 MHz.
d. Set VBW ≥ 3 MHz
e. Number of points in sweep ≥ 2 Span / RBW.
f. Sweep time ≤ (number of points in sweep) * T
g. Using emission bandwidth to determine the frequency span for integration the channel bandwidth.
h. Detector = RMS.
i. Trace mode = max hold.
j. Allow max hold to run for at least 60 seconds, or longer as needed to allow the trace to stabilize.

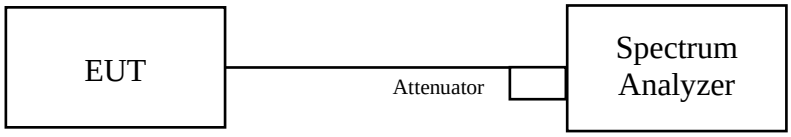
* If transmit duty cycle < 98%, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98%, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run."

Test Setup

For Average Power Measurement



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



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

Test Data

802.11a

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass/Fail
		Chain 0	Chain 1				
36	5180	9.35	8.96	16.482	12.17	23.98	PASS
44	5220	9.12	9.20	16.482	12.17	23.98	PASS
48	5240	9.43	9.41	17.498	12.43	23.98	PASS
52	5260	15.64	15.34	70.795	18.50	23.94	PASS
60	5300	15.51	15.34	69.823	18.44	23.96	PASS
64	5320	15.27	15.49	69.024	18.39	23.99	PASS
100	5500	16.54	16.43	89.125	19.50	23.94	PASS
116	5580	16.46	16.19	85.901	19.34	23.93	PASS
140	5700	16.49	15.96	83.946	19.24	24	PASS
149	5745	17.06	16.26	93.111	19.69	30	PASS
157	5785	16.61	15.83	84.14	19.25	30	PASS
165	5825	17.37	16.52	99.541	19.98	30	PASS

Note: The directional gain = 4.63 dBi < 6 dBi, so the power limit shall not be reduced.

802.11ac (VHT20)

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass/Fail
		Chain 0	Chain 1				
36	5180	9.57	9.59	18.155	12.59	23.98	PASS
44	5220	9.47	9.71	18.197	12.60	23.98	PASS
48	5240	9.57	9.93	18.88	12.76	23.98	PASS
52	5260	15.42	15.32	68.865	18.38	23.96	PASS
60	5300	15.44	15.40	69.663	18.43	23.98	PASS
64	5320	15.02	15.15	64.565	18.10	23.96	PASS
100	5500	16.82	16.81	96.161	19.83	23.99	PASS
116	5580	16.86	16.64	94.624	19.76	23.98	PASS
140	5700	16.77	16.37	90.782	19.58	23.98	PASS
149	5745	16.84	16.24	90.365	19.56	30	PASS
157	5785	16.44	15.74	81.47	19.11	30	PASS
165	5825	16.72	16.01	86.896	19.39	30	PASS

Note: The directional gain = 4.63 dBi < 6 dBi, so the power limit shall not be reduced.

802.11ac (VHT40)

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass/Fail
		Chain 0	Chain 1				
38	5190	12.26	12.11	33.113	15.20	23.98	PASS
46	5230	11.77	11.82	30.269	14.81	23.98	PASS
54	5270	15.33	14.96	65.464	18.16	23.98	PASS
62	5310	15.32	15.04	65.917	18.19	23.98	PASS
102	5510	16.72	16.74	94.189	19.74	23.98	PASS
110	5550	19.37	19.23	170.216	22.31	23.98	PASS
134	5670	19.38	19.09	167.88	22.25	23.98	PASS
151	5755	19.24	18.77	159.221	22.02	30	PASS
159	5795	19.06	18.58	152.757	21.84	30	PASS

Note: The directional gain = 4.63 dBi < 6 dBi, so the power limit shall not be reduced.

802.11ac (VHT80)

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass/Fail
		Chain 0	Chain 1				
42	5210	14.63	14.38	56.494	17.52	23.98	PASS
58	5290	15.49	15.23	68.707	18.37	23.98	PASS
106	5530	16.10	16.20	82.414	19.16	23.98	PASS
122	5610	19.57	19.35	176.604	22.47	23.98	PASS
155	5775	19.33	18.72	160.325	22.05	30	PASS

Note: The directional gain = 4.63 dBi < 6 dBi, so the power limit shall not be reduced.

9.5. Power Spectral Density

Requirements

Operation Band	EUT Category		Limit
U-NII-1		Outdoor Access Point	17dBm/ MHz If G_{TX} > 6 dBi, then PSD = 17 – (G_{TX} – 6)
		Fixed point-to-point Access Point	17dBm/ MHz If G_{TX} > 23 dBi, then PSD = 17 – (G_{TX} – 23)
		Indoor Access Point	17dBm/ MHz If G_{TX} > 6 dBi, then PSD = 17 – (G_{TX} – 6)
	√	Client device	11dBm/ MHz If G_{TX} > 6 dBi, then PSD = 11 – (G_{TX} – 6)
U-NII-2A	√		11dBm/ MHz If G_{TX} > 6 dBi, then PSD = 11 – (G_{TX} – 6)
U-NII-2C	√		11dBm/ MHz If G_{TX} > 6 dBi, then PSD = 11 – (G_{TX} – 6)
U-NII-3	√		For Point-to-multipoint systems (P2M): 30dBm/ 500kHz. If G_{TX} > 6 dBi, then PSD = 30 – (G_{TX} – 6) For Point-to-point systems (P2P): 30dBm/ 500kHz

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. Directional Gain = G_{ant} + 10 log (Nant) dBi.

   N*a*nt: Number of Transmit Antennas
   G1, G2,..., Gn: Gain of Individual Antennas (Same for Each Antenna)

4. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.

Test procedure

For U-NII-1, U-NII-2A, U-NII-2C band:

Using method as below:

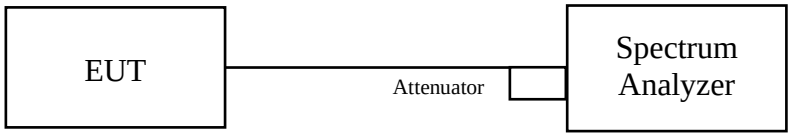
a. Set span to encompass the entire emission bandwidth (EBW) of the signal.
b. Set RBW = 1 MHz, Set VBW ≥ 3 RBW, Detector = RMS
c. Sweep time = auto, trigger set to "free run".
d. Trace average at least 100 traces in power averaging mode.
e. Record the max value. (if Duty cycle <98 %, add 10 log (1/duty cycle))

For U-NII-3 band:

Using method as below:

a. Set span to encompass the entire emission bandwidth (EBW) of the signal.
b. Set RBW = 300 kHz, Set VBW ≥ 1 MHz, Detector = RMS
c. Use the peak marker function to determine the maximum power level in any 300 kHz band segment within the fundamental EBW.
d. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10 log (500 kHz/300kHz)
e. Sweep time = auto, trigger set to "free run".
f. Trace average at least 100 traces in power averaging mode.
g. Record the max value. (if Duty cycle <98 %, add 10 log (1/duty cycle))

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

For U-NII-1, U-NII-2A, U-NII-2C band

802.11a

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/MHz)		Total PSD with duty factor (dBm/MHz)	PSD Maximum Limit (dBm/MHz)	Pass/Fail
		Chain 0	Chain 1			
36	5180	-1.62	-1.60	1.6	9.36	PASS
44	5220	-1.03	-1.42	1.99	9.36	PASS
48	5240	-1.15	-1.20	2.04	9.36	PASS
52	5260	4.77	4.62	7.91	9.36	PASS
60	5300	4.82	4.35	7.8	9.36	PASS
64	5320	4.70	4.29	7.71	9.36	PASS
100	5500	6.16	5.57	9.09	9.36	PASS
116	5580	5.82	5.72	8.98	9.36	PASS
140	5700	5.67	4.88	8.5	9.36	PASS

Note:

1. Directional gain = 7.64 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

802.11ac (VHT20)

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/MHz)		Total PSD with duty factor (dBm/MHz)	PSD Maximum Limit (dBm/MHz)	Pass/Fail
		Chain 0	Chain 1			
36	5180	-1.24	-0.83	2.2	9.36	PASS
44	5220	-0.99	-0.90	2.29	9.36	PASS
48	5240	-1.11	-0.54	2.41	9.36	PASS
52	5260	4.26	4.50	7.61	9.36	PASS
60	5300	4.76	4.26	7.75	9.36	PASS
64	5320	4.14	4.31	7.46	9.36	PASS
100	5500	5.94	5.81	9.11	9.36	PASS
116	5580	6.15	6.06	9.34	9.36	PASS
140	5700	6.09	5.47	9.02	9.36	PASS

Note:

1. Directional gain = 7.64 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

802.11ac (VHT40)

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/MHz)		Total PSD with duty factor (dBm/MHz)	PSD Maximum Limit (dBm/MHz)	Pass/Fail
		Chain 0	Chain 1			
38	5190	-1.30	-1.27	2.08	9.36	PASS
46	5230	-1.06	-1.49	2.09	9.36	PASS
54	5270	1.43	1.45	4.8	9.36	PASS
62	5310	1.39	1.79	4.95	9.36	PASS
102	5510	3.84	3.29	6.93	9.36	PASS
110	5550	5.77	5.43	8.96	9.36	PASS
134	5670	6.12	5.35	9.11	9.36	PASS

Note:

1. Directional gain = 7.64 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

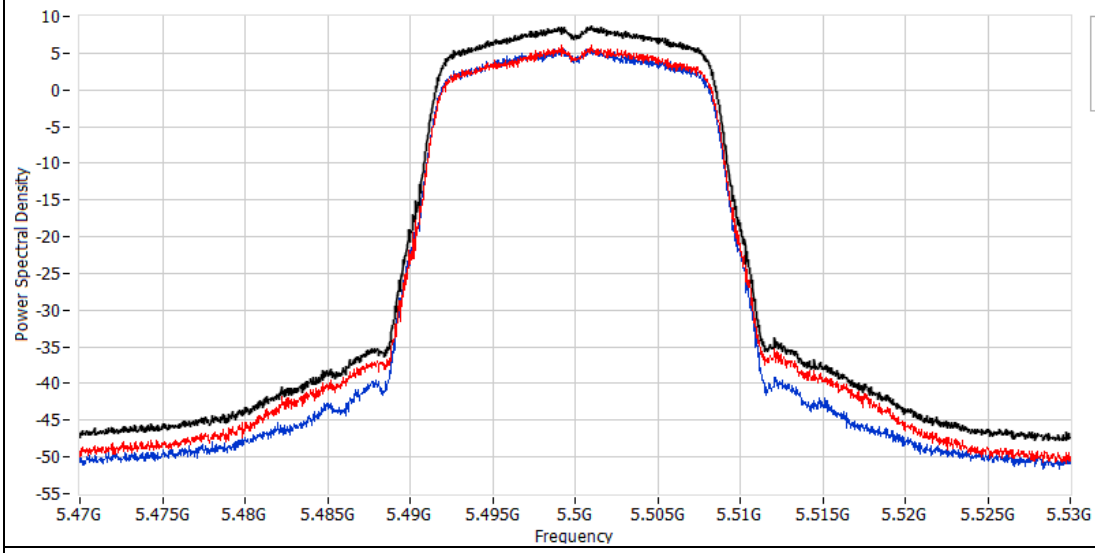
802.11ac (VHT80)

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/MHz)		Total PSD with duty factor (dBm/MHz)	PSD Maximum Limit (dBm/MHz)	Pass/Fail
		Chain 0	Chain 1			
42	5210	-1.91	-1.81	1.81	9.36	PASS
58	5290	-0.14	-0.32	3.44	9.36	PASS
106	5530	1.51	-0.46	4.31	9.36	PASS
122	5610	3.62	3.30	7.13	9.36	PASS

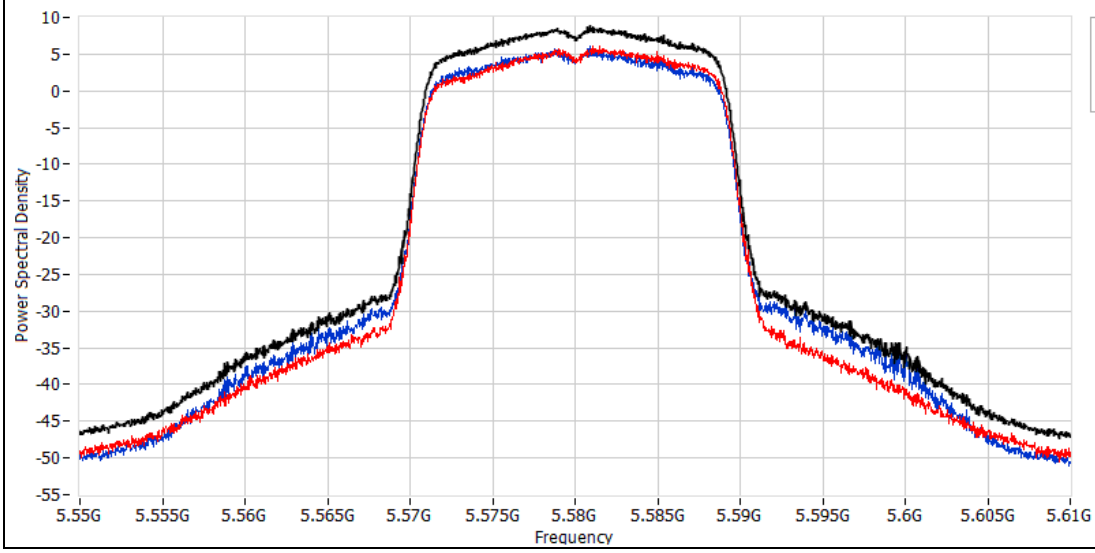
Note:

1. Directional gain = 7.64 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

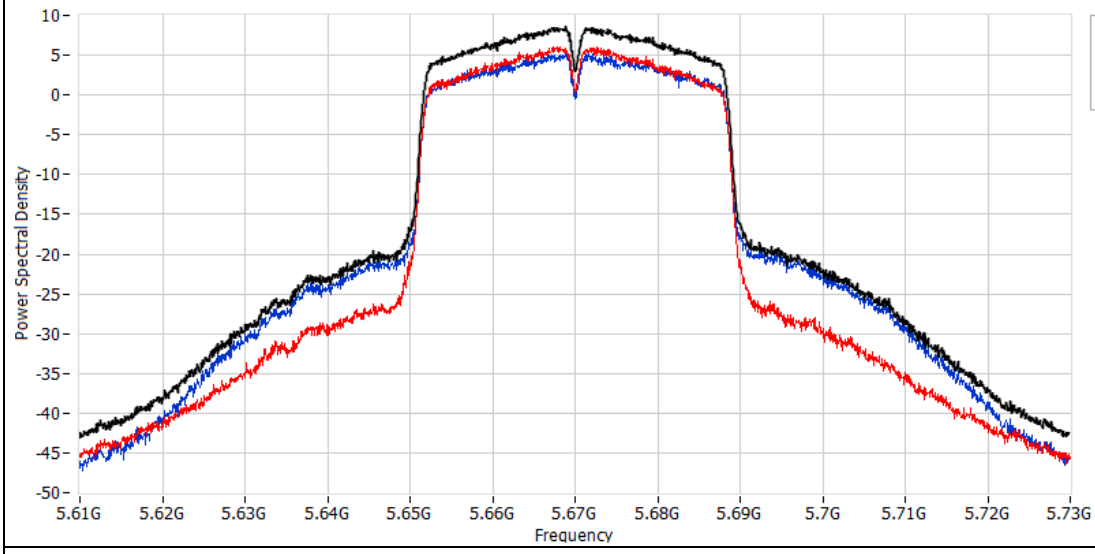
Spectrum Plot of Worst Value
802.11a / CH100



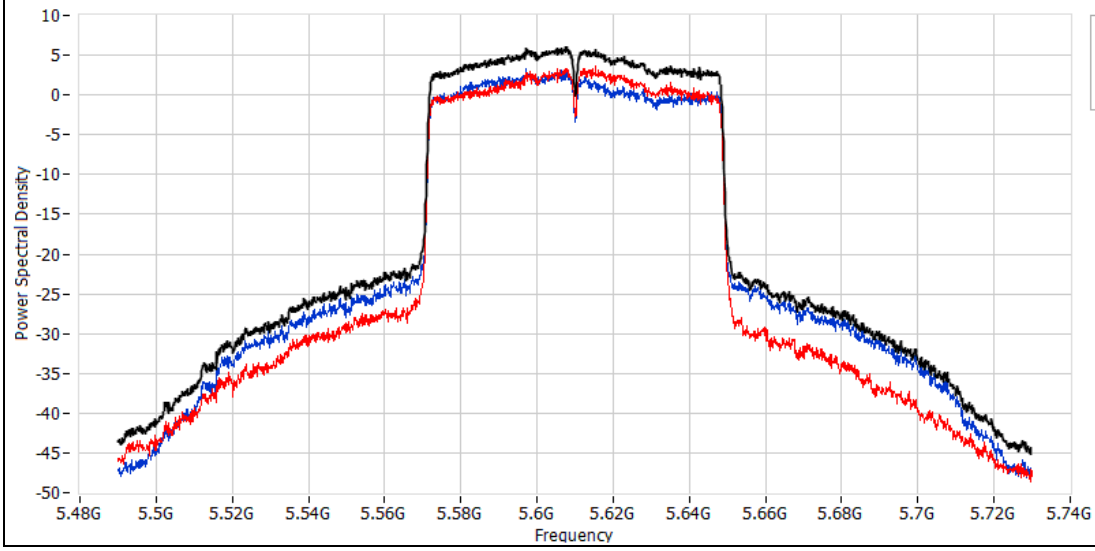
802.11ac (VHT20) / CH116



802.11ac (VHT40) / CH134



802.11ac (VHT80) / CH122



For U-NII-3 Band

802.11a

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/300 kHz)		Total PSD w/o BWCF (dBm/300 kHz)	Total PSD with BWCF (dBm/500 kHz)	Total PSD with duty factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
		Chain 0	Chain 1					
149	5745	3.67	3.07	6.39	8.61	8.81	28.36	PASS
157	5785	3.35	2.11	5.78	8.00	8.2	28.36	PASS
165	5825	4.03	3.14	6.62	8.84	9.04	28.36	PASS

Note:

1. Directional gain = 7.64 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.
3. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log(500 kHz/300kHz).

802.11ac (VHT20)

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/300 kHz)		Total PSD w/o BWCF (dBm/300 kHz)	Total PSD with BWCF (dBm/500 kHz)	Total PSD with duty factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
		Chain 0	Chain 1					
149	5745	3.51	3.16	6.35	8.57	8.79	28.36	PASS
157	5785	3.34	2.41	5.91	8.13	8.35	28.36	PASS
165	5825	3.83	2.49	6.22	8.44	8.66	28.36	PASS

Note:

1. Directional gain = 7.64 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.
3. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log(500 kHz/300kHz).

802.11ac (VHT40)

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/300 kHz)		Total PSD w/o BWCF (dBm/300 kHz)	Total PSD with BWCF (dBm/500 kHz)	Total PSD with duty factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
		Chain 0	Chain 1					
151	5755	3.14	2.52	5.85	8.07	8.42	28.36	PASS
159	5795	3.21	2.31	5.79	8.01	8.36	28.36	PASS

Note:

1. Directional gain = 7.64 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.
3. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log(500 kHz/300kHz).

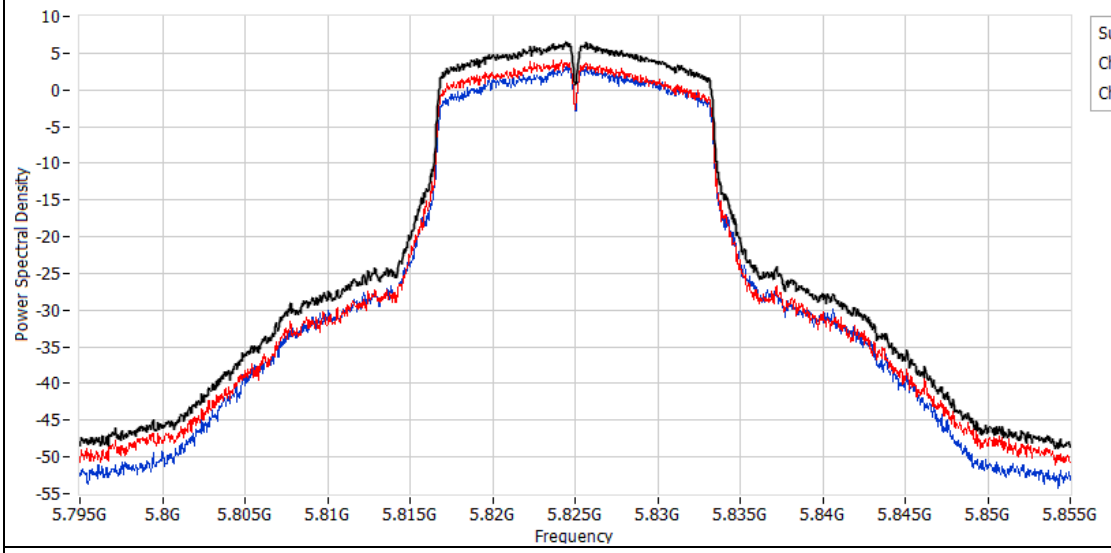
802.11ac (VHT80)

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/300 kHz)		Total PSD w/o BWCF (dBm/300 kHz)	Total PSD with BWCF (dBm/500 kHz)	Total PSD with duty factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
		Chain 0	Chain 1					
155	5775	-0.31	-0.34	2.69	4.91	5.57	28.36	PASS

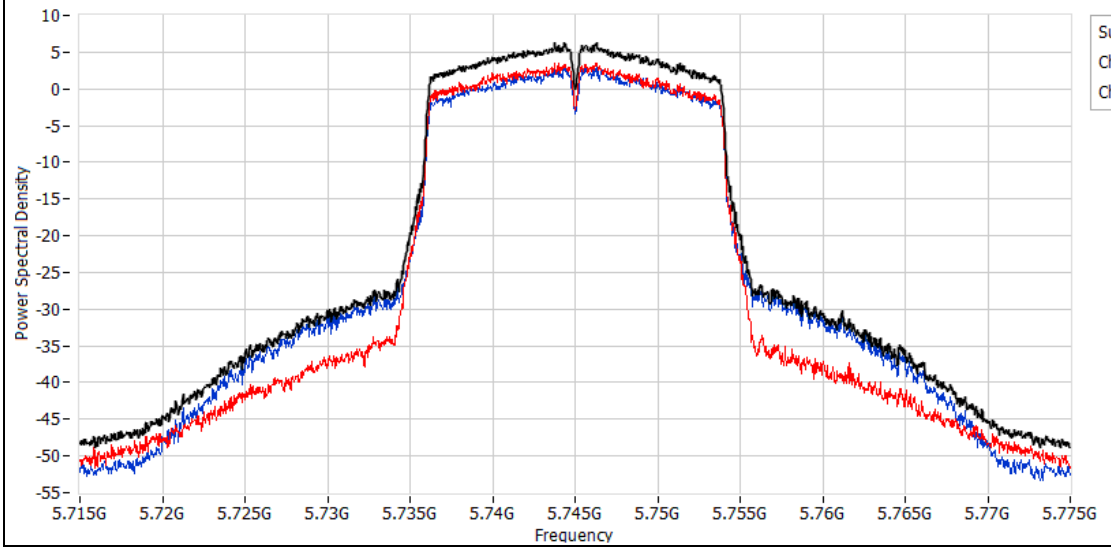
Note:

1. Directional gain = 7.64 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.
3. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log(500 kHz/300kHz).

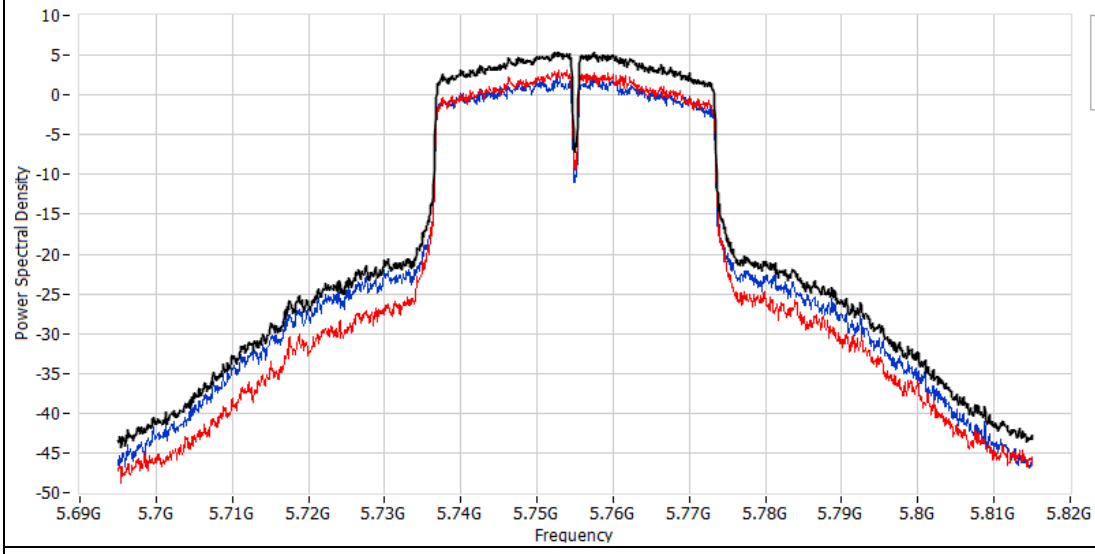
Spectrum Plot of Worst Value
802.11a / CH165



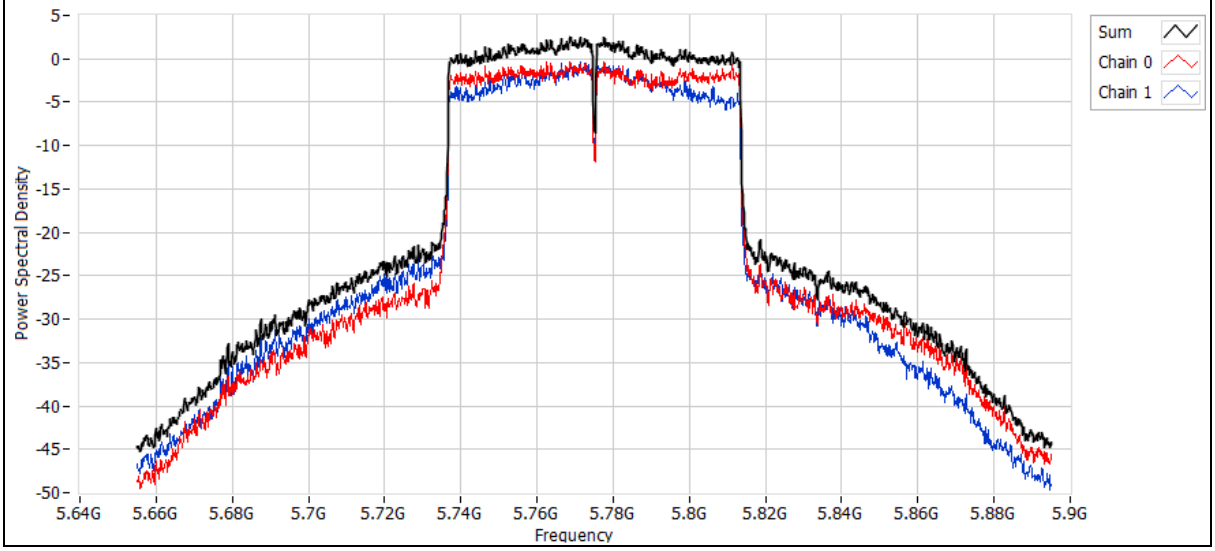
802.11ac (VHT20) / CH149



802.11ac (VHT40) / CH151



802.11ac (VHT80) / CH122



9.6. Frequency Stability

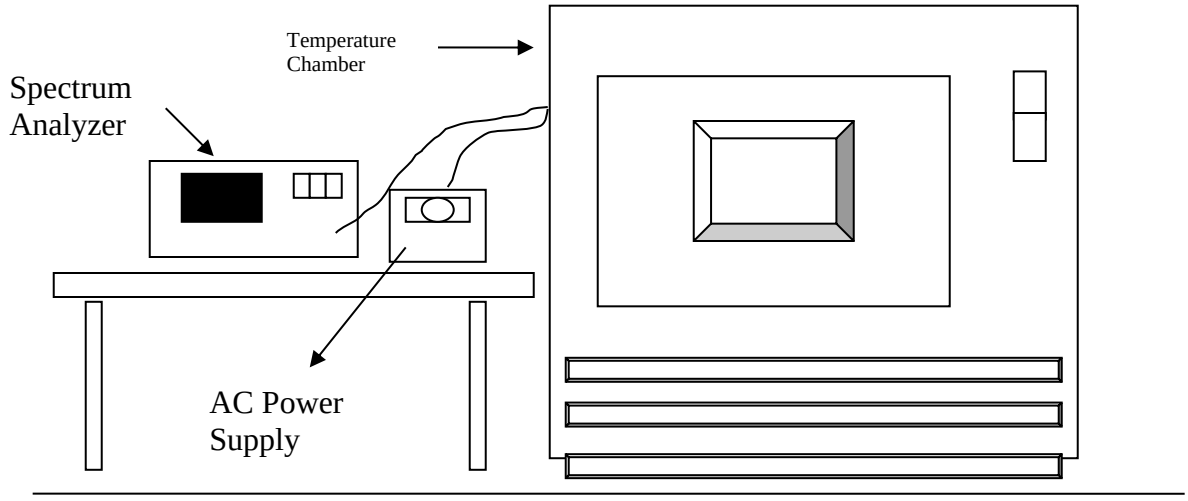
Requirements

The frequency of the carrier signal shall be maintained within band of operation.

Test procedure

a. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
b. Turn the EUT on and couple its output to a spectrum analyzer.
c. Turn the EUT off and set the chamber to the highest temperature specified.
d. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 Minutes.
e. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 Minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

Test Setup



Test Data

Frequency Stability Versus Temp.									
Operating Frequency: 5180 MHz									
TEMP. (°C)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)
50	120	5180.0197	3.80	5180.0183	3.53	5180.0191	3.69	5180.0202	3.90
40	120	5180.0175	3.38	5180.0179	3.46	5180.0158	3.05	5180.0146	2.82
30	120	5179.9972	-0.54	5179.9944	-1.08	5179.9963	-0.71	5179.9951	-0.95
20	120	5180.0133	2.57	5180.0124	2.39	5180.0149	2.88	5180.0156	3.01
10	120	5179.9896	-2.01	5179.9866	-2.59	5179.9848	-2.93	5179.9852	-2.86
0	120	5180.0188	3.63	5180.0143	2.76	5180.0184	3.55	5180.0183	3.53
-10	120	5180.0265	5.12	5180.0267	5.15	5180.027	5.21	5180.024	4.63
-20	120	5180.0038	0.73	5180.0052	1.00	5180.0042	0.81	5180.0051	0.98
-30	120	5179.9829	-3.30	5179.9849	-2.92	5179.9835	-3.19	5179.9829	-3.30
TEMP. (°C)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)
20	138	5180.0124	2.39	5180.012	2.32	5180.0142	2.74	5180.0149	2.88
20	120	5180.0133	2.57	5180.0124	2.39	5180.0149	2.88	5180.0156	3.01
20	102	5180.0124	2.39	5180.0128	2.47	5180.0156	3.01	5180.0161	3.11

9.7. Radiated Spurious Emission

Requirements

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

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.

Limits of unwanted emission out of the restricted bands

Applicable To		Limit	
789033 D02 General UNII Test Procedure New Rules v02r01		Field Strength at 3m	
		PK:74 (dBµV/m)	AV:54 (dBµV/m)
Frequency Band	**Applicable To**	**EIRP Limit**	**Equivalent Field Strength at 3m**
5150~5250 MHz	15.407(b)(1)	PK:-27 (dBm/MHz)	PK:68.2(dBµV/m)
5250~5350 MHz	15.407(b)(2)		
5470~5725 MHz	15.407(b)(3)		
5725~5850 MHz	15.407(b)(4)(i)	PK:-27 (dBm/MHz) *1 PK:10 (dBm/MHz) *2 PK:15.6 (dBm/MHz) *3 PK:27 (dBm/MHz) *4	PK: 68.2(dBµV/m) *1 PK:105.2 (dBµV/m) *2 PK: 110.8(dBµV/m) *3 PK:122.2 (dBµV/m) *4
*1 beyond 75 MHz or more above of the band edge. *2 below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above. *3 below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above. *4 from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.			

Note:
The following formula is used to convert the effective isotropic radiated power (eirp) to field strength:

$E = \frac{1000000\sqrt{30P}}{3}$ µV/m, where P is the eirp (Watts).

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.

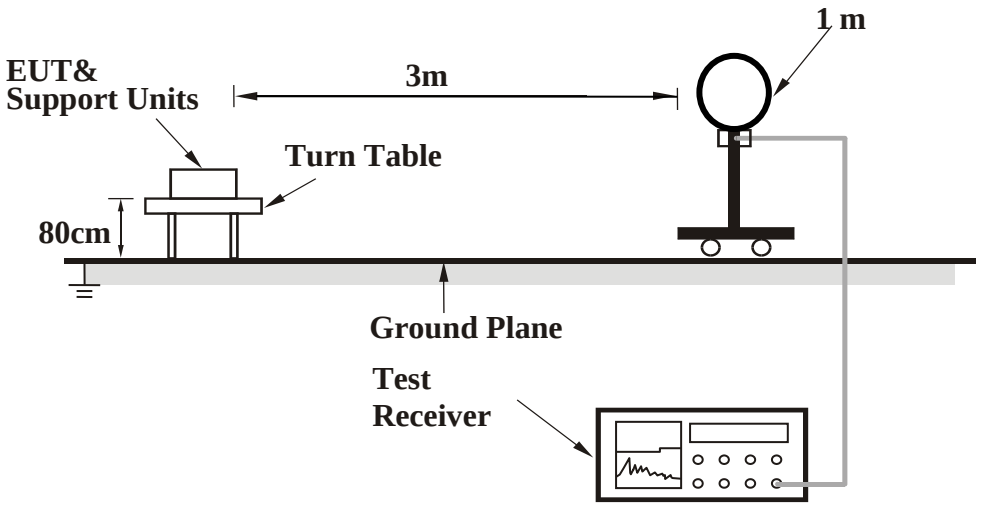
Configuration	Average	
	RBW	VBW
802.11a	1MHz	1kHz
802.11n (HT20)		1kHz
802.11n (HT40)		2kHz
802.11ac (VHT80)		5.1kHz

Note: Refer to section 6.6 for duty cycle.

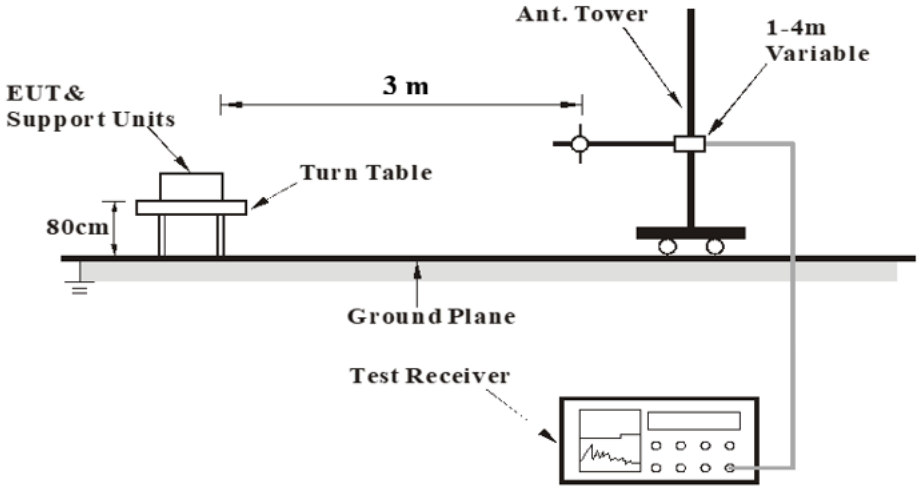
d. All modes of operation were investigated (includes all external accessories) and the worst-case emissions are reported, the other emission levels were low against the limit.
e. Test data of Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
f. Test data of Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
g. Test data of Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
h. Test data of Notation "@" = Fundamental Frequency
i. Test data of Notation " * " = Only required peak limit or the peak result under 20 dB above and complies with AVG limit, AVG result is deemed to comply with AVG limit.

Test Setup

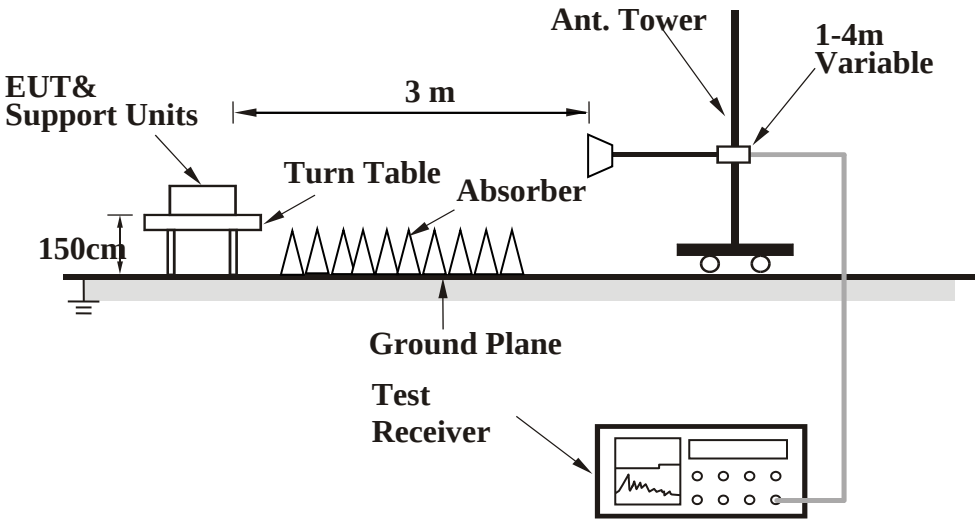
<Frequency Range 9 kHz ~ 30 MHz>



<Frequency Range 30 MHz ~ 1 GHz >



<Frequency Range above 1 GHz>



For the actual test configuration, please refer to the Setup Configurations.

Test Data

Above 1 GHz

Mode	802.11a	Channel	36

Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal		5149.8	48.86	13.43	62.29	74	-11.71	PK
		5149.8	35.2	13.43	48.63	54	-5.37	AVG
	@	5180	97.96	13.4	111.36	N/A	N/A	PK
	@	5180	90.12	13.4	103.52	N/A	N/A	AVG
	*	10360	38.68	17.39	56.07	68.2	-12.13	PK
Vertical		5105.35	37.54	13.46	51	74	-23	PK
		5148.75	33.23	13.42	46.65	54	-7.35	AVG
	@	5180	88.07	13.4	101.47	N/A	N/A	PK
	@	5180	87.09	13.4	100.49	N/A	N/A	AVG
	*	10360	49.87	17.39	67.26	68.2	-0.94	PK