



Test report No. : 4790058688-US-R0-V0
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Issued date : 2021/10/4
FCC ID : RYK-WPEQ405AX

RADIO TEST REPORT

Product : 11ax/ac/a/n 4T4R WiFi Mini PCIe Module

Model Name : WPEQ-405AX

FCC ID : RYK-WPEQ405AX

Test Regulation : FCC 47 CFR Part 15 Subpart E (Section 15.407)

Received Date : 2021/7/22

Test Date : 2021/7/26 ~ 2021/9/16

Issued Date : 2021/10/4

Applicant : SparkLAN Communications, Inc.
8F., No.257, Sec. 2, Tiding Blvd., Neihu District, Taipei City
11493, Taiwan (R.O.C.)

Issued By : Underwriters Laboratories Taiwan Co., Ltd.
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd.,
Zhudong Township, Hsinchu County, Taiwan



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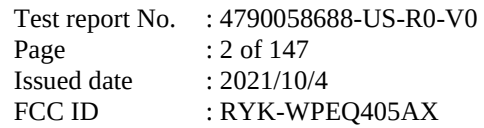
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Doc No: 17-EM-F0878 / 6.0



Original Test Report No.: 4790058688-US-R0-V0

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1. Attestation of Test Results

APPLICANT: SparkLAN Communications, Inc.
8F., No.257, Sec. 2, Tiding Blvd., Neihu District, Taipei City 11493,
Taiwan (R.O.C.)

MANUFACTURER: SparkLAN Communications, Inc.
8F., No.257, Sec. 2, Tiding Blvd., Neihu District, Taipei City
11493, Taiwan (R.O.C.)

EUT DESCRIPTION: 11ax/ac/a/n 4T4R WiFi Mini PCIe Module

BRAND: SparkLAN

MODEL: WPEQ-405AX

SAMPLE STAGE: Engineering Verification Test sample

DATE of TESTED: 2021/7/26 ~ 2021/9/16

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
Project Handler

Date : 2021/10/4

Approved and Authorized By:

Mike Cai
Engineer Project Associate

Date : 2021/10/4

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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 Note2
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 Note3

Note:

1. For the Radiated Band Edge and OOB test plots were recorded in Appendix I, the Radiated Emissions test plots were recorded in Appendix II.
2. The Occupied Bandwidth was reference only.
3. The “Dynamic Frequency Selection measurement” was recorded in Report No.: 4790058688-US-R1-V0.

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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.

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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

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6. Equipment under Test

6.1. Description of EUT

Product	11ax/ac/a/n 4T4R WiFi Mini PCIe Module	
Brand Name	SparkLAN	
Model Name	WPEQ-405AX	
Operating Frequency	5180 ~ 5240 MHz, 5260 ~ 5320 MHz, 5500 ~ 5700 MHz, 5745 ~ 5825 MHz	
Modulation	1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK	
Transfer Rate	802.11a: up to 54 Mbps 802.11n: up to MCS31 802.11ac: up to MCS9 802.11ax: up to MCS11	
Number of Channel	5180 ~ 5240 MHz	4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		2 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40)
		1 for 802.11ac (VHT80), 802.11ax (HE80)
	5260 ~ 5320 MHz	4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		2 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40)
		1 for 802.11ac (VHT80), 802.11ax (HE80)
		1 for 802.11ac (VHT160), 802.11ax (HE160)
	5500 ~ 5700 MHz	11 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		5 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40)
		2 for 802.11ac (VHT80), 802.11ax (HE80)
		1 for 802.11ac (VHT160), 802.11ax (HE160)
	5745 ~ 5825 MHz	5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		2 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40)
		1 for 802.11ac (VHT80), 802.11ax (HE80)

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Maximum Output Power	Non-Beamforming mode: 5180 ~ 5240 MHz: 22.22 dBm 5260 ~ 5320 MHz: 22.39 dBm 5500 ~ 5700 MHz: 23.39 dBm 5745 ~ 5825 MHz: 29.58 dBm Beamforming mode: 5180 ~ 5240 MHz: 20.55 dBm 5260 ~ 5320 MHz: 20.63 dBm 5500 ~ 5700 MHz: 20.71 dBm 5745 ~ 5825 MHz: 29.50 dBm
Normal Voltage	3.3Vdc from Host
Sample ID	4091428
Software Version	N/A

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Note:

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

Modulation Mode	Tx,Rx Function
802.11a	4TX,4RX
802.11n (HT20)	4TX,4RX
802.11n (HT40)	4TX,4RX
802.11ac (VHT20)	4TX,4RX
802.11ac (VHT40)	4TX,4RX
802.11ac (VHT80)	4TX,4RX
802.11ac (VHT160)	4TX,4RX
802.11ax (HE20)	4TX,4RX
802.11ax (HE40)	4TX,4RX
802.11ax (HE80)	4TX,4RX
802.11ax (HE160)	4TX,4RX

* The modulation and bandwidth are similar for 802.11n mode for HT20 / HT40 and 802.11ac mode for VHT20 / VHT40 / VHT80 / VHT160 and 802.11ax mode for HE20 / HE40 / HE80 / HE160, therefore investigated worst case to representative mode in test report.

2. The EUT contains following accessory devices.

Product	Brand	Model	Description
Dipole Antenna 1	SparkLAN	AD-103AG	2.4 GHz: 2.02 dBi 5 GHz: 2.03 dBi RP-SMA
Dipole Antenna 2	SparkLAN	AD-302N	2.4 GHz: 3.14 dBi 5 GHz: 2.74 dBi RP-SMA
Dipole Antenna 3	SparkLAN	AD-303N	2.4 GHz: 3.14 dBi 5 GHz: 3.24dBi RP-SMA

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

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6.2. Channel List

FOR 5180 ~ 5240MHz

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20):

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), 802.11ax (HE40):

Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac (VHT80), 802.11ax (HE80):

Channel	Frequency
42	5210MHz

FOR 5260 ~ 5320MHz

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20):

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), 802.11ax (HE40):

Channel	Frequency	Channel	Frequency
54	5270 MHz	62	5310 MHz

1 channel is provided for 802.11ac (VHT80), 802.11ax (HE80):

Channel	Frequency
58	5290MHz

1 straddle channel is provided for 802.11ac (VHT160), 802.11ax (HE160):

Channel	Frequency
50	5250MHz

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FOR 5500 ~ 5700MHz

11 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20):

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), 802.11ax (HE40):

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), 802.11ax (HE80):

Channel	Frequency	Channel	Frequency
106	5530MHz	122	5610 MHz

1 channel is provided for 802.11ac (VHT160), 802.11ax (HE160):

Channel	Frequency
114	5570MHz

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FOR 5745 ~ 5825MHz:

5 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20):

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), 802.11ax (HE40):

Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

1 channel is provided for 802.11ac (VHT80), 802.11ax (HE80):

Channel	Frequency
155	5775MHz

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6.3. Test Condition

Test Item	Test Site No.	Environmental Condition	Input Power	Test Date	Tested by
Antenna Port Conducted Measurement	SR4	20~26°C/ 62~68%RH	3.3Vdc	2021/07/26~ 2021/09/16	Wayne Chen
Radiated Spurious Emission	966-2	20~26°C/ 62~68%RH	3.3Vdc	2021/07/26~ 2021/08/18	Wayne Chen
AC power Line Conducted Emission	SR1	20~26°C/ 62~68%RH	3.3Vdc	2021/08/29~ 2021/08/29	Wayne Chen

FCC Test Firm Registration Number: 498077

6.4. Description of Available Antennas

Ant. No.	Transmitter Circuit	Brand Name	Model Name	Ant. Type	Maximum Gain (dBi)	Remark
1	Chain (0)+(1)+(2)+(3)	SparkLAN	AD-103AG	Dipole	2.03	Length of Antenna cable:150mm Connector type of Antenna cable: I-PEX/MHF4 to RP-SMA(F)
2	Chain (0)+(1)+(2)+(3)	SparkLAN	AD-302N	Dipole	2.73	
3	Chain (0)+(1)+(2)+(3)	SparkLAN	AD-303N	Dipole	3.24	

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.

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6.5. Test Mode Applicability and Tested Channel Detail

- The antenna No.3 has the highest gain, therefore, it was determined antenna No.3 was worst-case, the antenna No.3 was selected for the final test.
- The fundamental of the dipole antenna was investigated in two orthogonal (lay and stand), it was determined that stand mode was worst-case. Therefore, all final radiated testing was performed with the dipole antenna in stand mode.
- For AC power line conducted emissions, the pre-scan has been determined by AC power 120Vac/60Hz (worst case)
- 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).

Non-Beamforming mode:

Test item	Mode	Frequency Band (MHz)	Modulation Technology	Available Channel	Test Channel	Data Rate
Radiated Emissions (Above 1GHz)	802.11a	5180-5240	OFDM	36 to 48	36, 44, 48	6Mbps
	802.11ax20		OFDMA	36 to 48	36, 44, 48	HE0
	802.11ax40			38 to 46	38, 46	HE0
	802.11ax80			42	42	HE0
	802.11a	5260-5320	OFDM	52 to 64	52, 60, 64	6Mbps
	802.11ax20		OFDMA	52 to 64	52, 60, 64	HE0
	802.11ax40			54 to 62	54, 62	HE0
	802.11ax80			58	58	HE0
	802.11ax160			50	50	HE0
	802.11a	5500-5700	OFDM	100 to 140	100,116,140	6Mbps
	802.11ax20		OFDMA	100 to 140	100,116,140	HE0
	802.11ax40			102 to 134	102, 110, 134	HE0
	802.11ax80			106, 122	106, 122	HE0
	802.11ax160			114	114	HE0
	802.11a	5745-5825	OFDM	149 to 165	149, 157, 165	6Mbps
	802.11ax20		OFDMA	149 to 165	149, 157, 165	HE0
	802.11ax40			151 to 159	151, 159	HE0
	802.11ax80			155	155	HE0
Radiated Emissions (Below 1GHz)	802.11ax20	5745-5825	OFDMA	149 to 165	149	HE0
AC Power Line Conducted Emission	802.11ax20	5745-5825	OFDMA	149 to 165	149	HE0

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Test item	Mode	Frequency Band (MHz)	Modulation Technology	Available Channel	Test Channel	Data Rate
Antenna Port Conducted Measurement	802.11a	5180-5240	OFDM	36 to 48	36, 44, 48	6Mbps
	802.11ax20		OFDMA	36 to 48	36, 44, 48	HE0
	802.11ax40			38 to 46	38, 46	HE0
	802.11ax80			42	42	HE0
	802.11a	5260-5320	OFDM	52 to 64	52, 60, 64	6Mbps
	802.11ax20		OFDMA	52 to 64	52, 60, 64	HE0
	802.11ax40			54 to 62	54, 62	HE0
	802.11ax80			58	58	HE0
	802.11ax160			50	50	HE0
	802.11a	5500-5700	OFDM	100 to 140	100,116,140	6Mbps
	802.11ax20		OFDMA	100 to 140	100,116,140	HE0
	802.11ax40			102 to 134	102, 110, 134	HE0
	802.11ax80			106, 122	106, 122	HE0
	802.11ax160			114	114	HE0
	802.11a	5745-5825	OFDM	149 to 165	149, 157, 165	6Mbps
	802.11ax20		OFDMA	149 to 165	149, 157, 165	HE0
	802.11ax40			151 to 159	151, 159	HE0
	802.11ax80			155	155	HE0

Beamforming mode:

Test item	Mode	Frequency Band (MHz)	Modulation Technology	Available Channel	Test Channel	Data Rate
Antenna Port Conducted Measurement	802.11ax20	5180-5240	OFDMA	36 to 48	36, 44, 48	HE0
	802.11ax40			38 to 46	38, 46	HE0
	802.11ax80			42	42	HE0
	802.11ax20	5260-5320	OFDMA	52 to 64	52, 60, 64	HE0
	802.11ax40			54 to 62	54, 62	HE0
	802.11ax80			58	58	HE0
	802.11ax160			50	50	HE0
	802.11ax20	5500-5700	OFDMA	100 to 140	100,116,140	HE0
	802.11ax40			102 to 134	102, 110, 134	HE0
	802.11ax80			106, 122	106, 122	HE0
	802.11ax160			114	114	HE0
	802.11ax20	5745-5825	OFDMA	149 to 165	149, 157, 165	HE0
	802.11ax40			151 to 159	151, 159	HE0
	802.11ax80			155	155	HE0

*Note: The worse spurious emissions test and maximum output power was found in Non-Beamforming mode. Therefore Beamforming mode only the test data of the RF output power were recorded in this report.

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6.6. Duty cycle

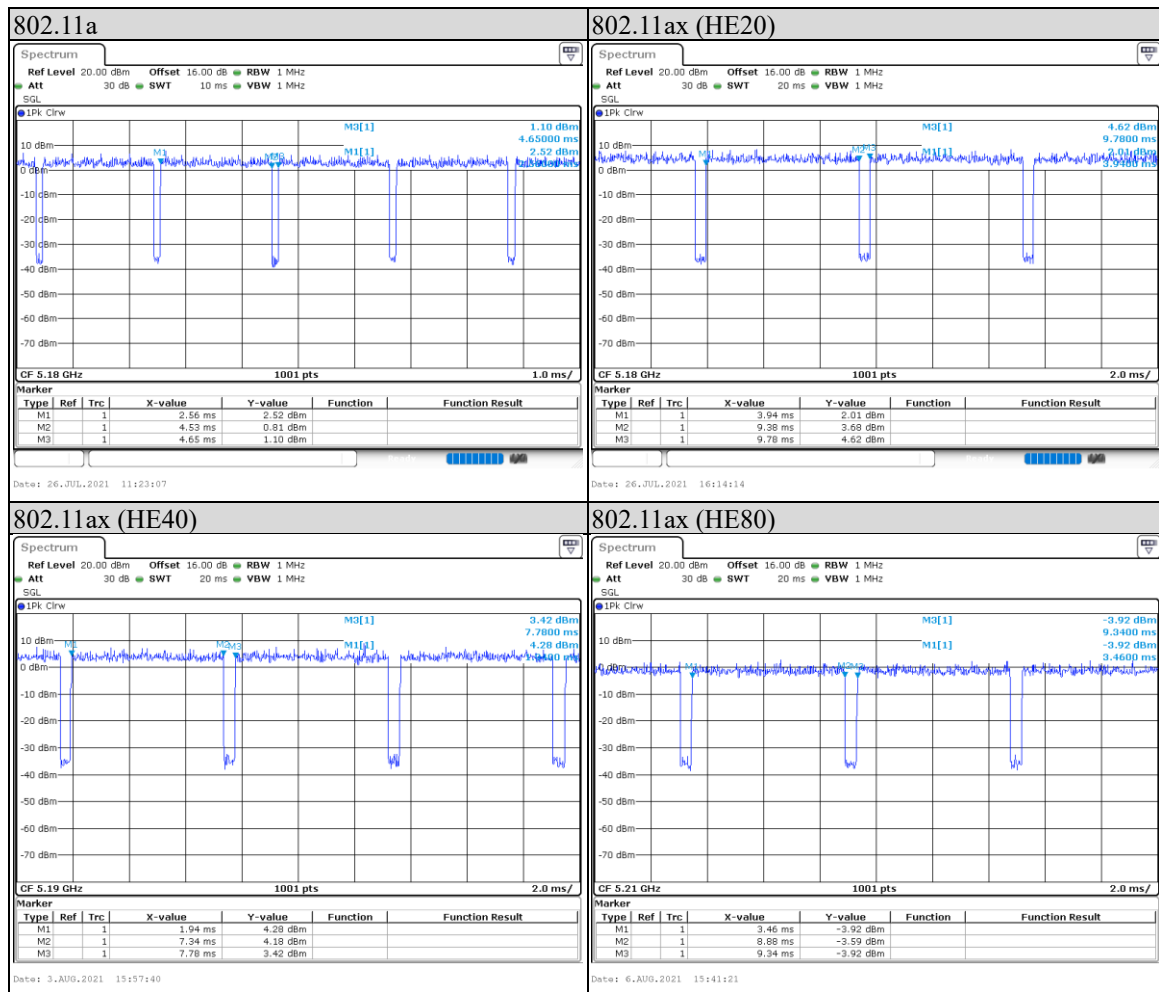
802.11a: Duty cycle = $1.97/2.09 = 0.943$, Duty factor(dB) = $10 * \log(1/0.943) = 0.26$

802.11ax HE20: Duty cycle = $5.44/5.84 = 0.932$, Duty factor(dB) = $10 * \log(1/0.932) = 0.31$

802.11ax HE40: Duty cycle = $5.4/5.84 = 0.925$, Duty factor(dB) = $10 * \log(1/0.925) = 0.34$

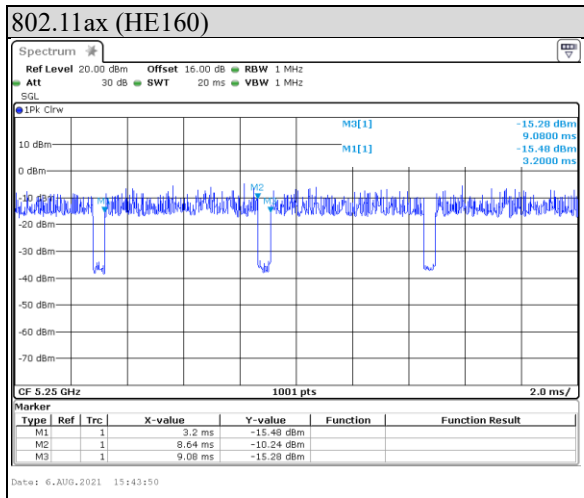
802.11ax HE80: Duty cycle = $5.42/5.88 = 0.922$, Duty factor(dB) = $10 * \log(1/0.922) = 0.36$

802.11ax HE160: Duty cycle = $5.44/5.88 = 0.925$, Duty factor(dB) = $10 * \log(1/0.925) = 0.34$





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7. Test Equipment

Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Expired date
Radiated Spurious Emission					
Spectrum Analyzer	Keysight	N9010A	MY56070827	2020/11/11	2021/11/10
EMI Test Receiver	Rohde & Schwarz	ESR7	101754	2020/12/11	2021/12/10
Loop Antenna	ETS lindgren	6502	00213440	2020/12/25	2021/12/24
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	774 & AT-N0538	2021/1/13	2022/1/12
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01690	2020/12/30	2021/12/29
Horn Antenna (18-40 GHz)	Schwarzbeck	BBHA 9170	781	2020/12/30	2021/12/29
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

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Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Expired date
Antenna Port Conducted Measurement					
Spectrum Analyzer	Keysight	N9010A	MY56070834	2020/11/6	2021/11/5
Pulse Power Sensor	Anritsu	MA2411B	1531202	2020/12/21	2021/12/20
Power Meter	Anritsu	ML2495A	1645002	2020/12/21	2021/12/20
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	2020/11/17	2021/11/16
V-LISN 9kHz - 30MHz	SCHWARZBECK	NSLK 8127	8127-946	2020/11/3	2021/11/2
Cables	TITAN	CFD200	T0732ACFD20 020A300-1	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

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8. Description of Test Setup

Support Equipment

ID	Equipment	Brand Name	Model Name	S/N	Remark
A	Adapter	I.T.E. Power Supply	F18W2-120150SPAC	N/A	Provide by Client
B	Fixture	N/A	N/A	N/A	Provide by Client
C	Laptop	DELL	Latitude E5470	CXSKWF2	Provide by lab

I/O Cables

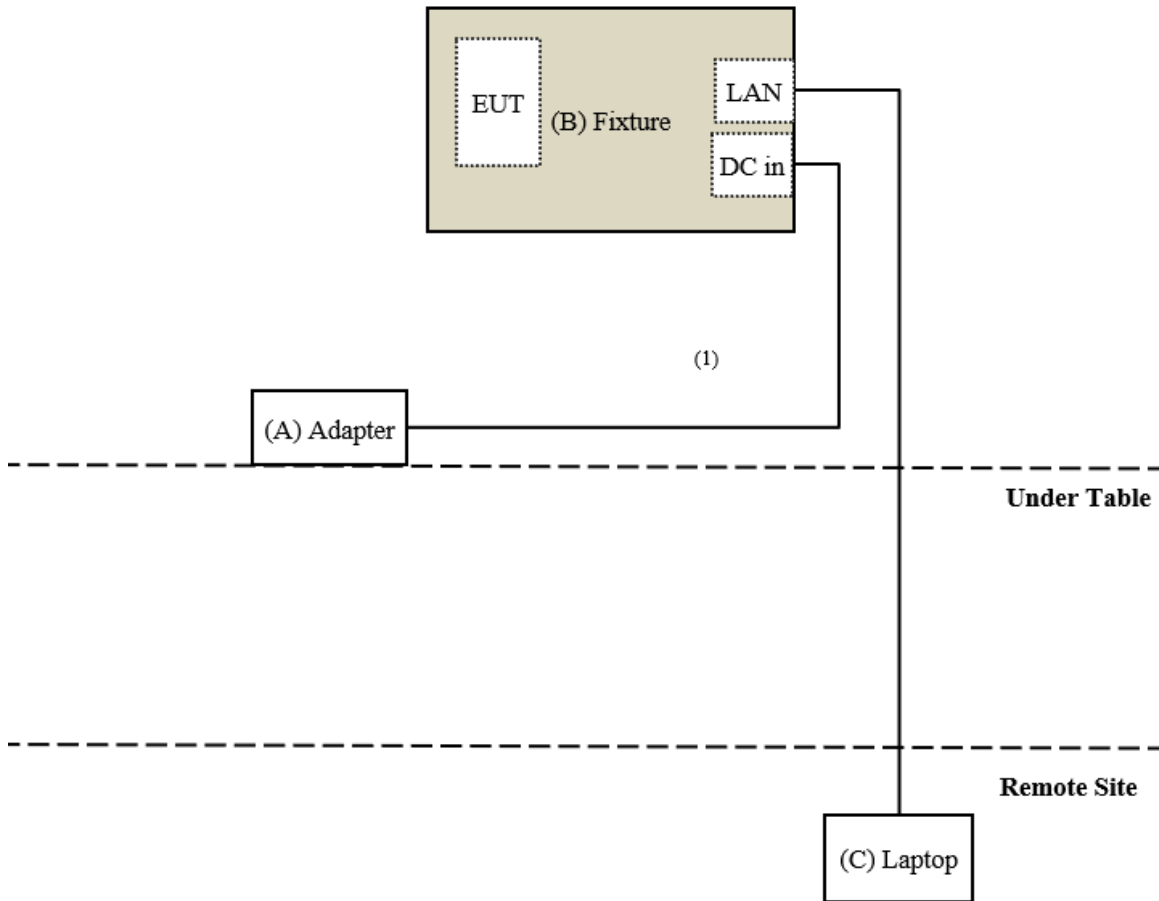
ID	Equipment	Brand Name	Model Name	Length (m)	Remark
1	RJ-45 Cable	Fastlink	FL-61STU-04	10	Provide by lab

Test Setup

Controlled using a bespoke application (Tera Term tool to paste RF command) 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



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9. Test Results

9.1. 6dB Bandwidth

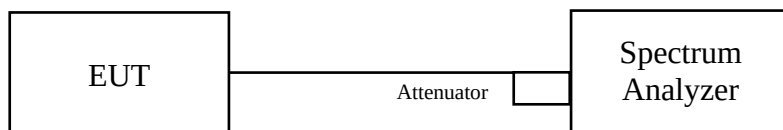
Requirements

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

Test procedure

- Set resolution bandwidth (RBW) = 100kHz
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- 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.

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Test Data

802.11a

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)				Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3		
149	5745	16.30	16.30	16.30	16.30	0.5	PASS
157	5785	16.30	16.30	16.30	16.30	0.5	PASS
165	5825	16.34	16.34	16.34	16.34	0.5	PASS

802.11ax (HE20)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)				Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3		
149	5745	19.02	18.98	18.98	18.90	0.5	PASS
157	5785	19.02	19.02	19.02	18.94	0.5	PASS
165	5825	18.98	19.10	18.98	18.94	0.5	PASS

802.11ax (HE40)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)				Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3		
151	5755	37.80	37.40	37.64	37.24	0.5	PASS
159	5795	37.48	37.56	37.40	37.64	0.5	PASS

802.11ax (HE80)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)				Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3		
155	5775	77.68	77.68	78.00	78.00	0.5	PASS

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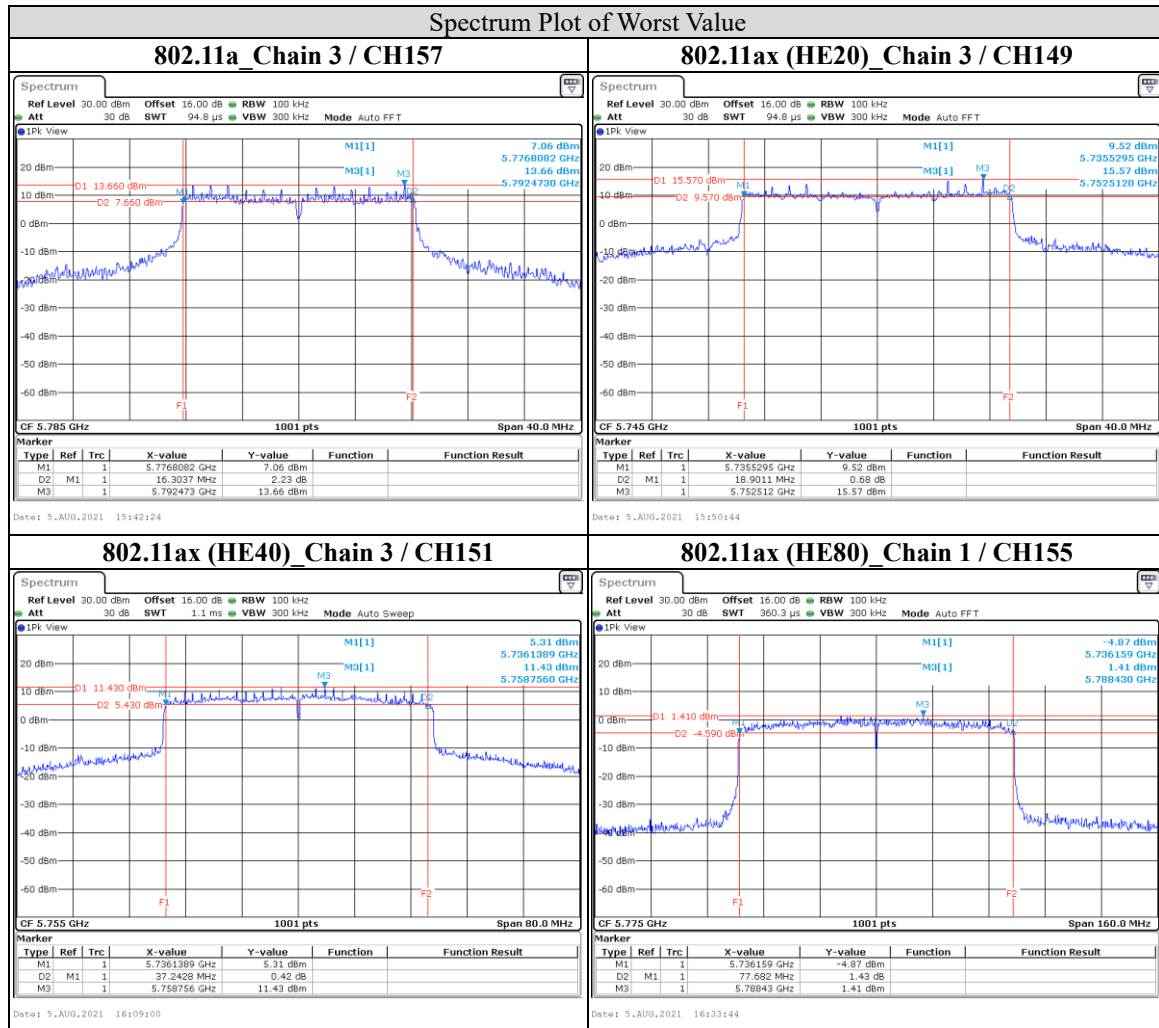
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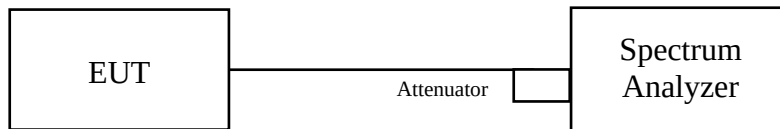


9.2. 26dB Bandwidth

Test procedure

- Set RBW = approximately 1% of the emission bandwidth.
- Set the VBW > RBW.
- Detector = Peak.
- Trace mode = max hold.
- 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.

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Test Data

802.11a

Channel	Channel Frequency (MHz)	26 dB Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
36	5180	20.26	20.34	20.22	19.94
44	5220	20.50	20.58	20.30	19.98
48	5240	20.70	20.42	20.02	20.50
52	5260	20.22	20.50	20.26	19.94
60	5300	20.62	20.50	20.46	20.46
64	5320	20.06	20.34	20.58	20.54
100	5500	20.38	20.50	20.18	20.50
116	5580	20.30	20.50	20.46	20.42
140	5700	20.82	20.30	20.30	20.50

802.11ax (HE20)

Channel	Channel Frequency (MHz)	26 dB Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
36	5180	21.54	22.06	21.94	21.78
44	5220	21.62	22.14	21.98	22.14
48	5240	21.58	21.74	21.62	21.54
52	5260	21.58	21.94	21.58	21.94
60	5300	21.66	21.66	21.54	21.82
64	5320	21.86	21.50	21.70	21.90
100	5500	21.82	21.34	21.94	21.74
116	5580	21.78	21.70	22.06	21.66
140	5700	21.74	21.46	21.42	21.62

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802.11ax (HE40)

Channel	Channel Frequency (MHz)	26 dB Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
38	5190	40.68	40.44	40.44	40.52
46	5230	40.52	40.68	40.36	40.44
54	5270	40.36	40.52	40.44	40.36
62	5310	40.60	40.52	40.60	40.20
102	5510	40.52	40.60	40.28	40.28
110	5550	40.52	40.28	40.52	40.44
134	5670	40.60	40.28	40.52	40.36

802.11ax (HE80)

Channel	Channel Frequency (MHz)	26 dB Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
42	5210	82.32	82.00	82.64	82.00
58	5290	82.32	82.64	82.48	81.68
106	5530	82.00	82.64	82.48	82.16
122	5610	82.80	82.00	82.16	82.00

802.11ax (HE160)

Channel	Channel Frequency (MHz)	26 dB Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
50	5250	165.59	164.32	164.32	165.27
50 (U-NII-1 Band)	5250	82.80	82.16	81.84	82.48
50 (U-NII-2A Band)	5250	82.79	82.16	82.48	82.79
114	5570	164.96	164.96	165.27	164.64

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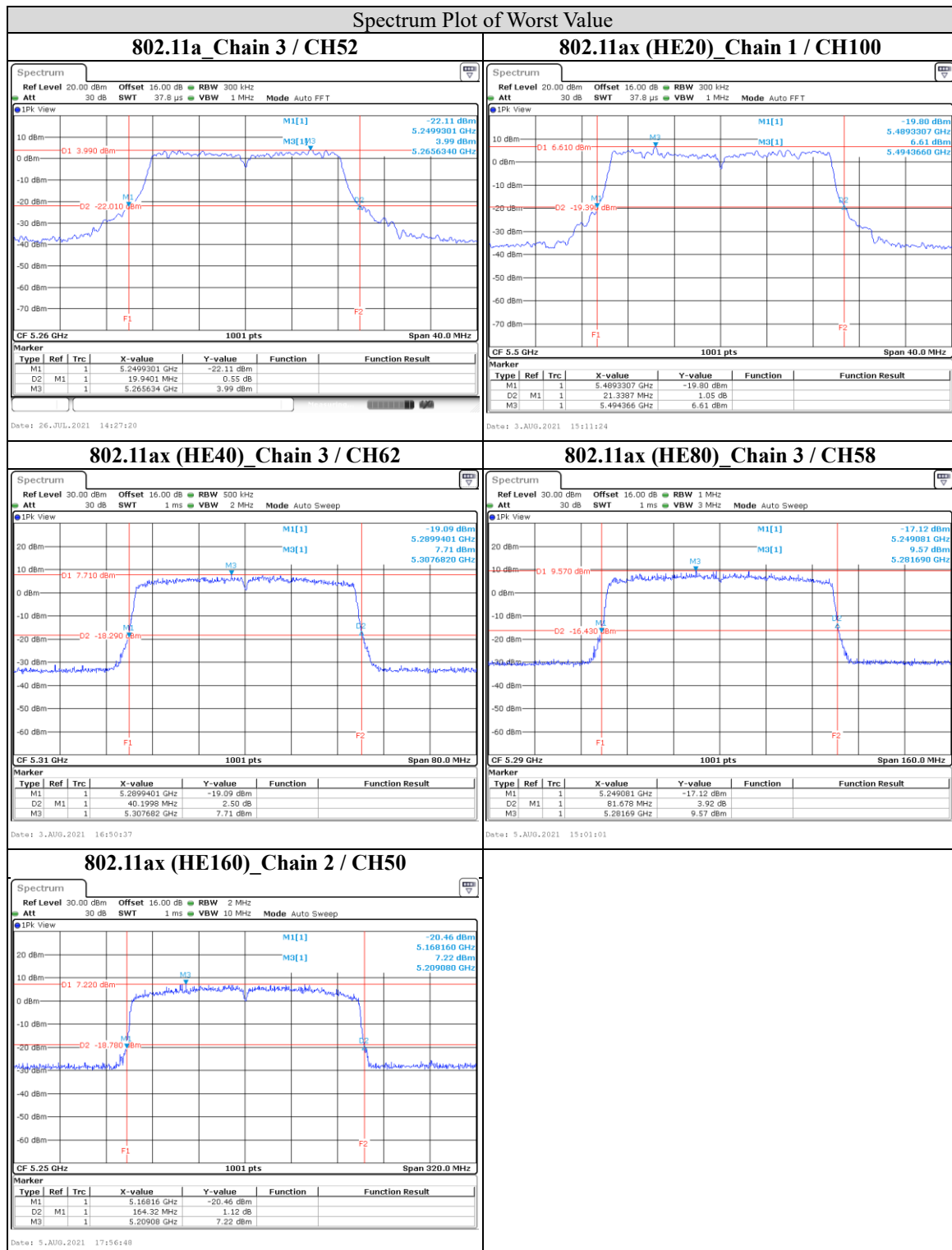
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Note: 802.11ax (HE160) CH50 bandwidth below 5250MHz = 5250MHz – Marker 1
802.11ax (HE160) CH50 bandwidth below 5250MHz = Delta 2 – (5250MHz – Marker 1)

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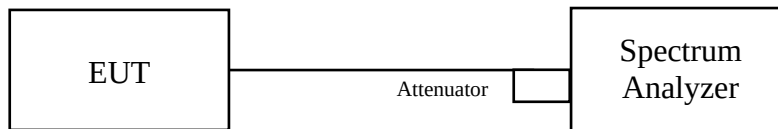


9.3. Occupied Bandwidth

Test procedure

- Set center frequency to the nominal EUT channel center frequency.
- Set span = 1.5 times to 5.0 times the OBW.
- Set RBW = 1% to 5% of the OBW
- Set VBW $\geq 3 \times$ RBW
- 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.
- Use the 99% power bandwidth function of the instrument (if available).
- 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.

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Test Data

802.11a

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
36	5180	16.62	16.62	16.70	16.70
44	5220	16.70	16.62	16.74	16.62
48	5240	16.66	16.70	16.66	16.66
52	5260	16.70	16.66	16.66	16.62
60	5300	16.66	16.70	16.66	16.66
64	5320	16.70	16.70	16.70	16.62
100	5500	16.66	16.66	16.66	16.62
116	5580	16.62	16.66	16.66	16.62
140	5700	16.70	16.66	16.74	16.58
149	5745	17.62	17.50	17.34	17.38
157	5785	17.02	17.02	17.10	17.02
165	5825	17.34	17.18	17.10	17.02

802.11ax (HE20)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
36	5180	19.10	19.22	19.18	19.18
44	5220	19.10	19.14	19.22	19.10
48	5240	19.18	19.10	19.14	19.14
52	5260	19.18	19.18	19.14	19.14
60	5300	19.10	19.14	19.18	19.26
64	5320	19.18	19.14	19.14	19.14
100	5500	19.14	19.14	19.18	19.22
116	5580	19.18	19.10	19.10	19.10
140	5700	19.10	19.18	19.06	19.18
149	5745	19.82	19.66	19.82	19.94
157	5785	19.38	19.42	19.38	19.26
165	5825	19.42	19.38	19.26	19.26

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802.11ax (HE40)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
38	5190	37.64	37.72	37.56	37.64
46	5230	37.64	37.72	37.56	37.64
54	5270	37.64	37.72	37.64	37.64
62	5310	37.64	37.56	37.64	37.64
102	5510	37.56	37.72	37.72	37.56
110	5550	37.72	37.64	37.64	37.56
134	5670	37.64	37.64	37.64	37.72
151	5755	38.20	38.12	38.12	38.20
159	5795	38.20	38.40	38.12	38.12

802.11ax (HE80)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
42	5210	77.04	77.20	77.04	77.20
58	5290	77.04	77.20	77.04	76.88
106	5530	77.20	77.20	77.04	77.20
122	5610	77.04	77.04	77.04	77.04
155	5775	77.20	77.20	77.20	77.20

802.11ax (HE160)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
50	5250	155.04	154.73	154.73	154.73
50 (U-NII-1 Band)	5250	77.36	77.36	77.04	77.04
50 (U-NII-2A Band)	5250	77.68	77.36	77.68	77.68
114	5570	155.04	154.41	155.04	154.73

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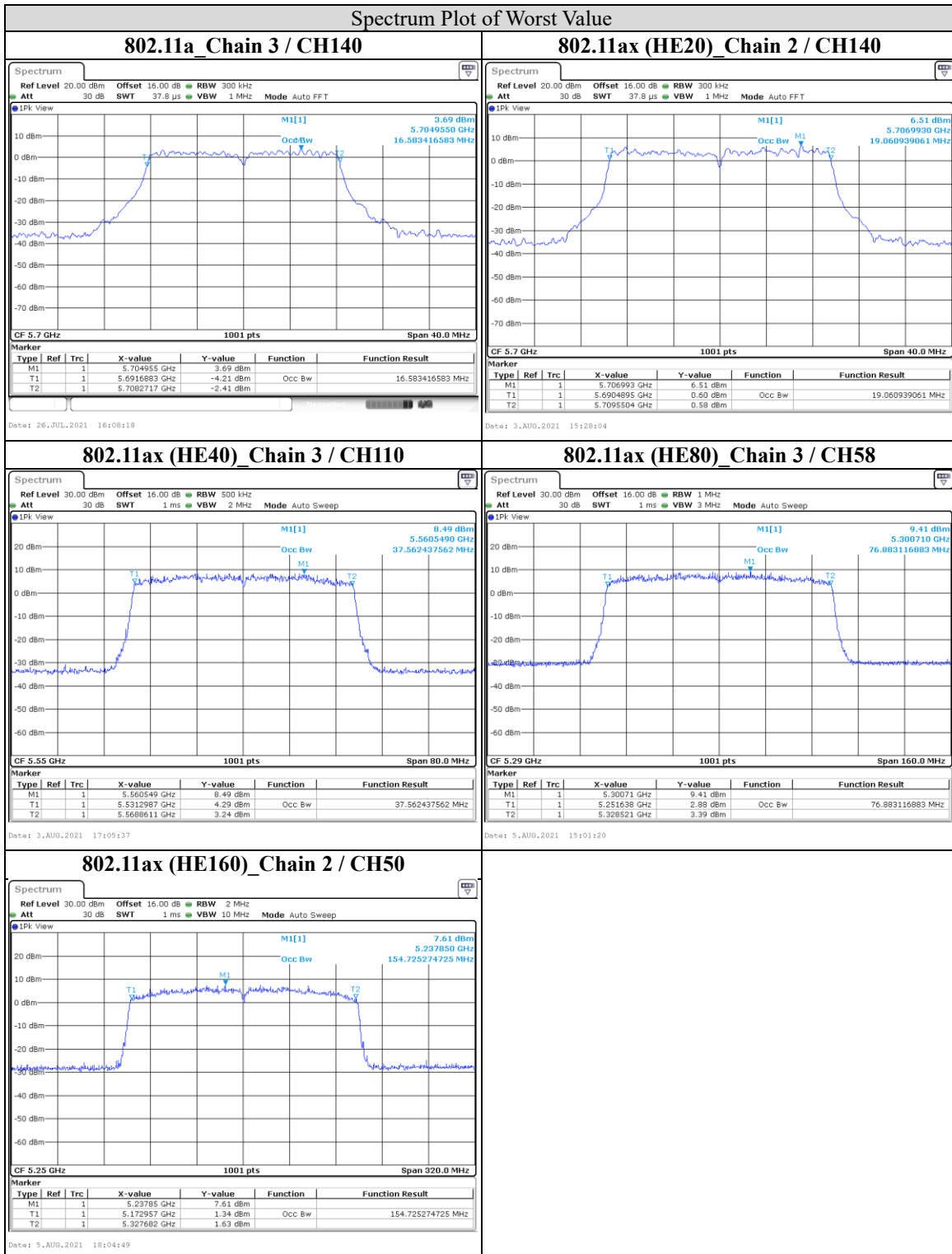
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Note: 802.11ax (HE160) CH50 bandwidth below 5250MHz = 5250MHz – T1
802.11ax (HE160) CH50 bandwidth below 5250MHz = T2 – 5250MHz

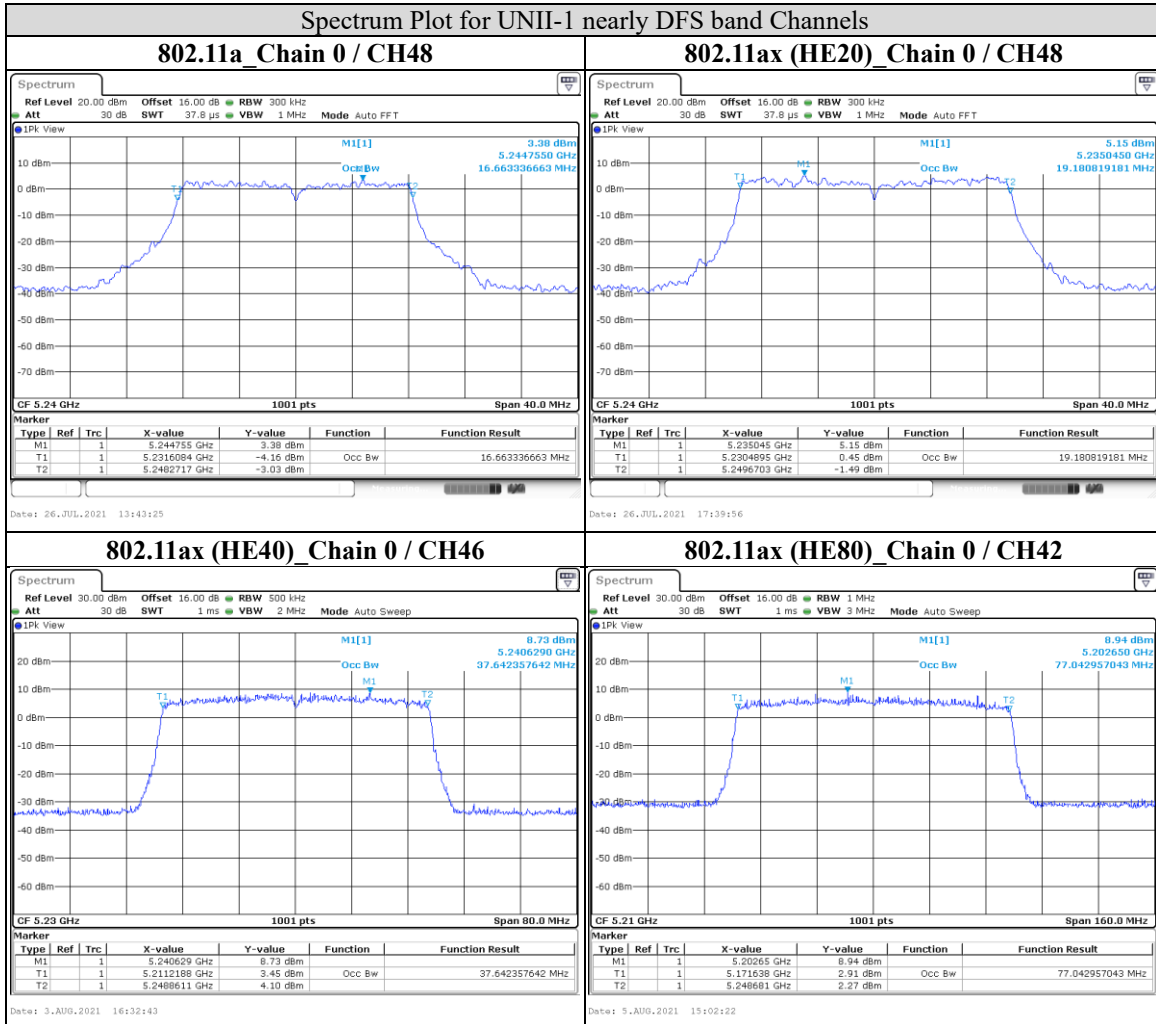
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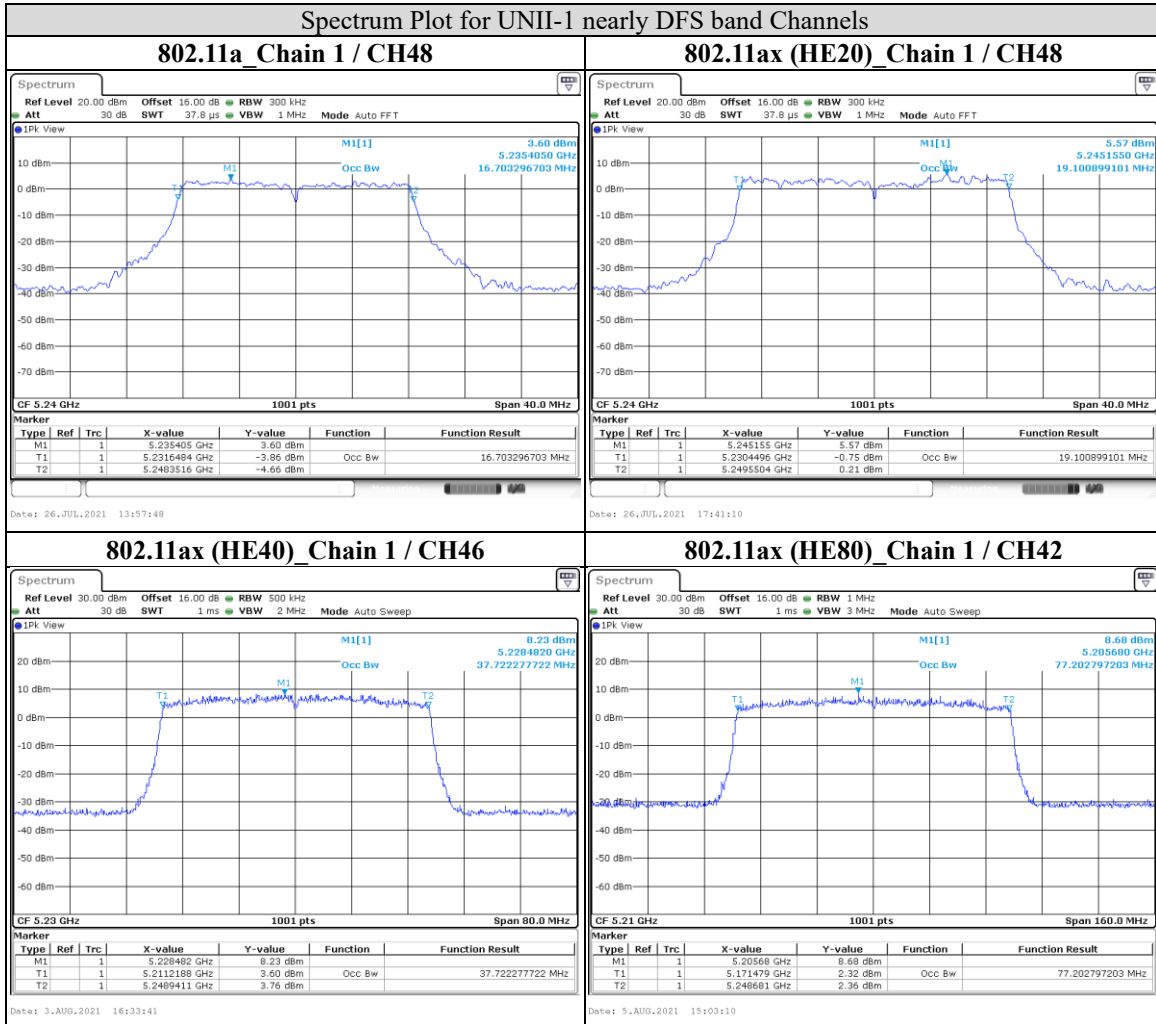
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Note: The observed T2 is all <5250 MHz, so UNII-1 band channels which in nearly DFS band no need for DFS function.



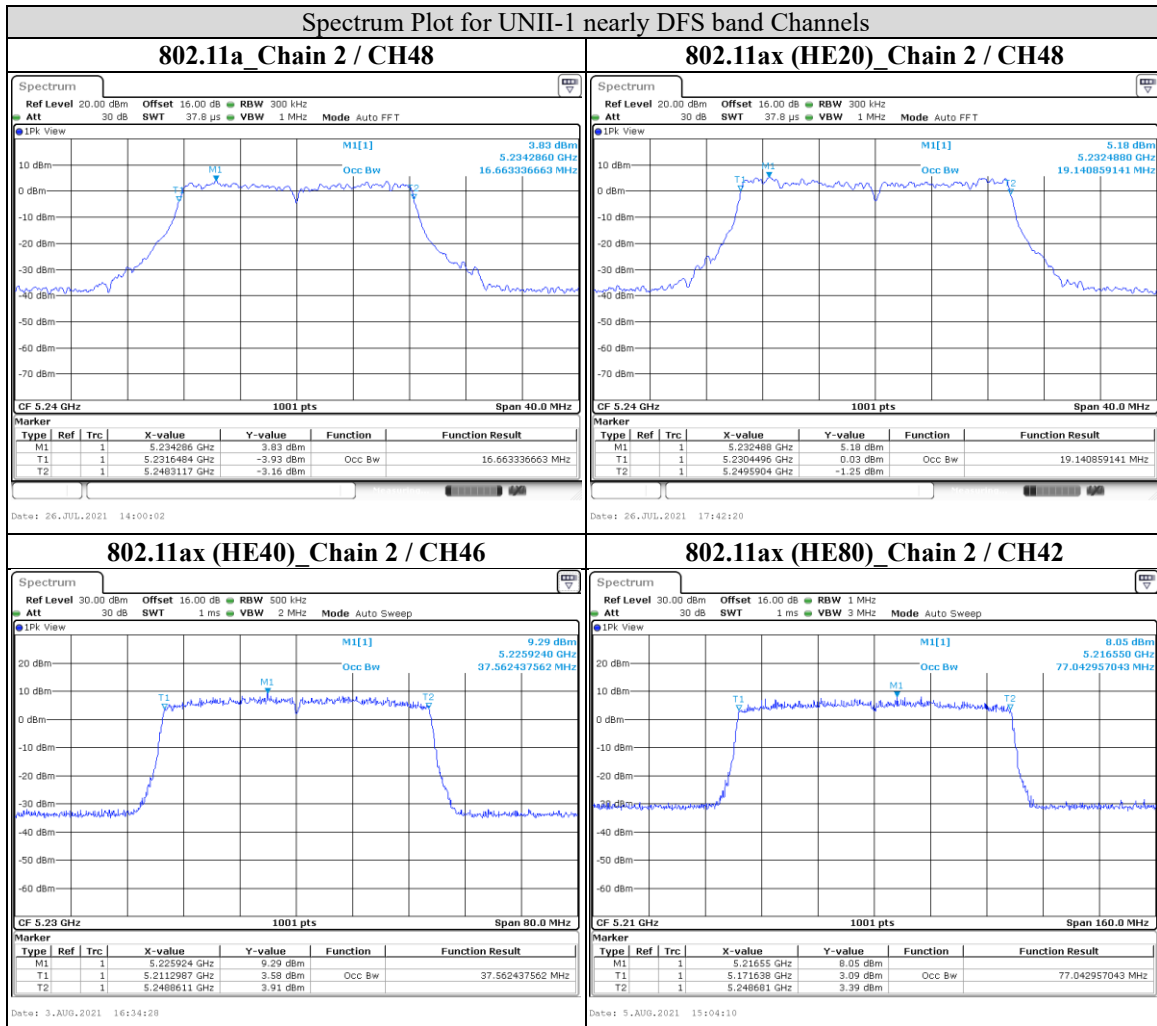
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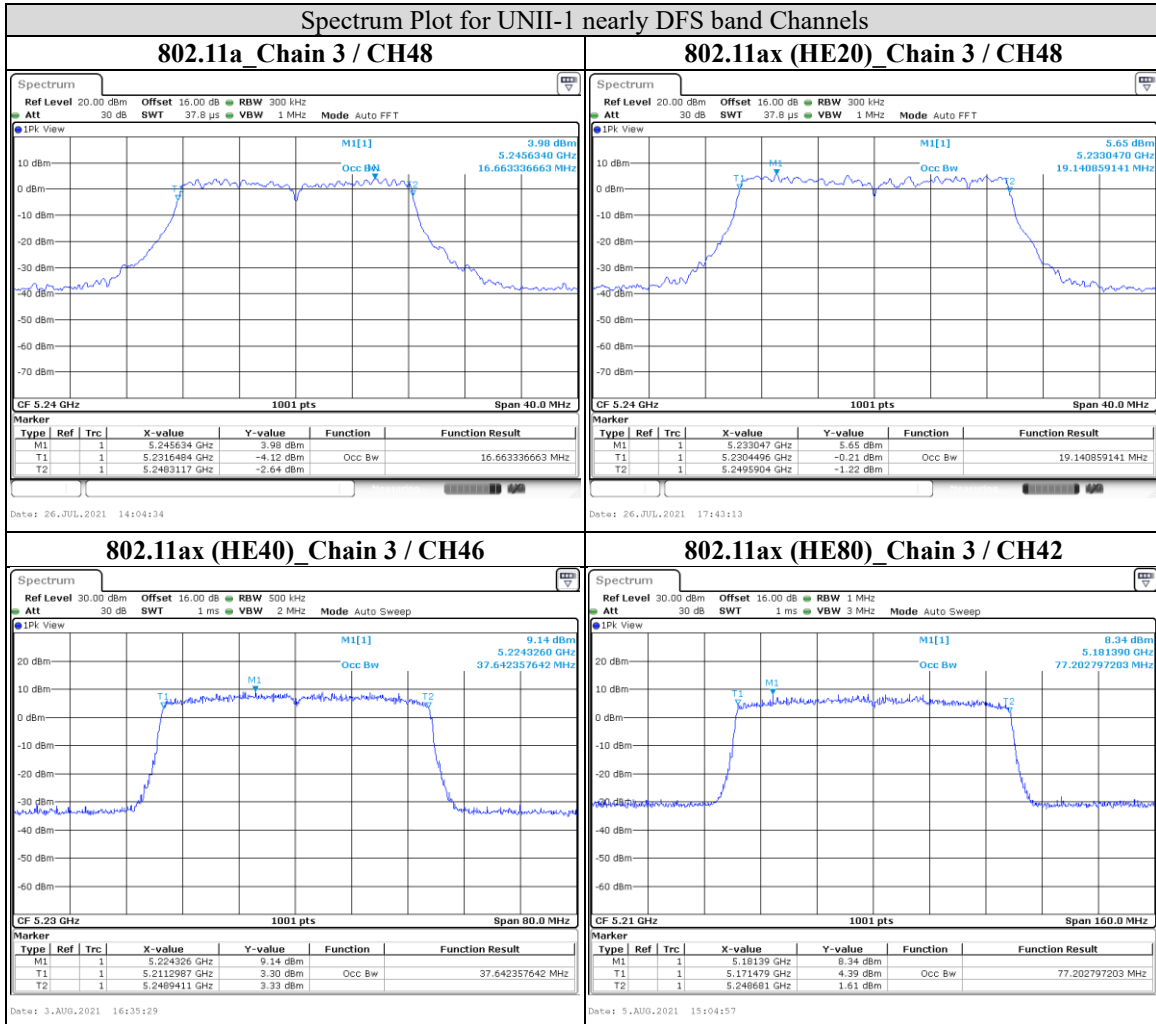
Note: The observed T2 is all <5250 MHz, so UNII-1 band channels which in nearly DFS band no need for DFS function.



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



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 $\leq$ 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:

- 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
- Directional Gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{Gn/20})^2 / N_{ant}]$ dBi.

N_{ant} : Number of Transmit Antennas
 $G1, G2, \dots, Gn$: Gain of Individual Antennas
- 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 $N_{ANT} \geq 5$.

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Test Procedure

For Average Power Measurement

Test method PM-G

For 802.11a, 802.11ax (HE20), 802.11ax (HE40)

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 802.11ax (HE80), 802.11ax (HE160)

- 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 $\geq$ 3 MHz.
- e. Number of points in sweep $\geq$ 2 Span / RBW.
- f. Sweep time $\leq$ (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 $\geq$ 98%, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run.”

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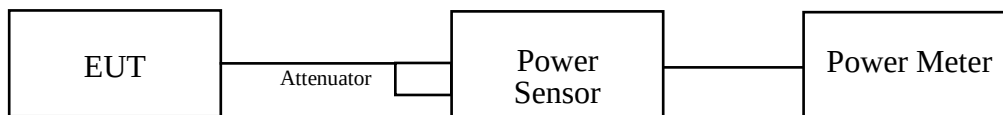
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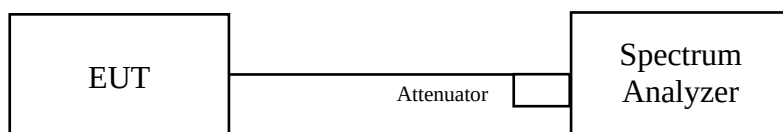


Test Setup

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.

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Test Data

Non-Beamforming mode

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	Chain 2	Chain 3				
36	5180	13.18	13.08	12.72	13.56	82.604	19.17	23.98	PASS
44	5220	13.25	13.01	13.10	13.49	83.946	19.24	23.98	PASS
48	5240	13.32	13.19	13.22	13.67	86.497	19.37	23.98	PASS
52	5260	13.27	13.17	13.18	13.72	86.298	19.36	23.99	PASS
60	5300	13.18	13.27	13.22	13.78	86.896	19.39	23.98	PASS
64	5320	12.97	13.09	13.18	13.66	84.14	19.25	23.98	PASS
100	5500	12.84	12.82	13.11	13.57	81.658	19.12	23.98	PASS
116	5580	13.48	13.30	13.42	13.87	89.95	19.54	23.98	PASS
140	5700	13.33	13.41	13.24	13.68	87.902	19.44	23.98	PASS
149	5745	23.37	23.44	23.42	23.69	891.251	29.50	30	PASS
157	5785	23.31	23.49	23.33	23.54	879.023	29.44	30	PASS
165	5825	23.24	23.25	23.08	23.19	833.681	29.21	30	PASS

Note: The directional gain = 3.24 dBi < 6 dBi, so the power limit shall not be reduced.

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802.11ax (HE20)

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)				Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass/Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
36	5180	14.07	13.88	13.55	14.47	100.693	20.03	23.98	PASS
44	5220	14.12	13.89	13.89	14.45	102.565	20.11	23.98	PASS
48	5240	13.78	13.62	13.66	14.27	96.828	19.86	23.98	PASS
52	5260	13.51	13.62	13.67	14.31	95.719	19.81	23.98	PASS
60	5300	13.53	13.64	13.71	14.39	96.605	19.85	23.98	PASS
64	5320	13.43	13.59	13.69	14.27	95.06	19.78	23.98	PASS
100	5500	13.24	13.33	13.37	14.06	89.743	19.53	23.98	PASS
116	5580	13.88	13.78	13.72	14.46	99.77	19.99	23.98	PASS
140	5700	13.71	13.87	13.45	14.14	95.94	19.82	23.98	PASS
149	5745	23.27	23.43	23.24	23.63	874.984	29.42	30	PASS
157	5785	23.23	23.39	23.09	23.47	855.067	29.32	30	PASS
165	5825	23.54	23.59	23.21	23.59	893.305	29.51	30	PASS

Note: The directional gain = 3.24 dBi < 6 dBi, so the power limit shall not be reduced.

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802.11ax (HE40)

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)				Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass/Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
38	5190	15.45	15.41	15.41	15.85	142.889	21.55	23.98	PASS
46	5230	16.11	16.08	16.01	16.59	166.725	22.22	23.98	PASS
54	5270	16.25	16.24	16.03	16.91	173.38	22.39	23.98	PASS
62	5310	15.61	15.54	15.57	16.31	151.008	21.79	23.98	PASS
102	5510	15.99	16.03	16.09	16.78	168.267	22.26	23.98	PASS
110	5550	16.36	16.32	16.47	16.92	179.473	22.54	23.98	PASS
134	5670	16.34	16.37	15.99	16.66	172.584	22.37	23.98	PASS
151	5755	23.32	23.36	23.28	23.55	870.964	29.40	30	PASS
159	5795	23.53	23.71	23.37	23.61	907.821	29.58	30	PASS

Note: The directional gain = 3.24 dBi < 6 dBi, so the power limit shall not be reduced.

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802.11ax (HE80)

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)				Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass/Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
42	5210	14.49	14.35	14.37	14.90	113.501	20.55	23.98	PASS
58	5290	14.58	14.53	14.59	15.27	119.399	20.77	23.98	PASS
106	5530	14.94	14.89	14.87	15.25	126.183	21.01	23.98	PASS
122	5610	17.21	17.09	17.28	17.86	218.273	23.39	23.98	PASS
155	5775	21.24	21.61	21.45	21.92	572.796	27.58	30	PASS

Note: The directional gain = 3.24 dBi < 6 dBi, so the power limit shall not be reduced.

802.11ax (HE160)

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)				Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass/Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
50	5250	14.56	14.46	14.43	14.96	115.611	20.63	23.98	PASS
50 (U-NII-1 Band)	5250	11.55	11.45	11.40	11.94	57.677	17.61	23.98	PASS
50 (U-NII-2A Band)	5250	11.55	11.45	11.44	11.96	57.81	17.62	23.98	PASS
114	5570	15.54	15.45	15.45	15.89	144.877	21.61	23.98	PASS

Note: The directional gain = 3.24 dBi < 6 dBi, so the power limit shall not be reduced.



Beamforming mode

802.11ax (HE20)

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)				Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass/Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
36	5180	14.07	13.88	13.55	14.47	100.693	20.03	20.72	PASS
44	5220	14.12	13.89	13.89	14.45	102.565	20.11	20.72	PASS
48	5240	13.78	13.62	13.66	14.27	96.828	19.86	20.72	PASS
52	5260	13.51	13.62	13.67	14.31	95.719	19.81	20.72	PASS
60	5300	13.53	13.64	13.71	14.39	96.605	19.85	20.72	PASS
64	5320	13.43	13.59	13.69	14.27	95.06	19.78	20.72	PASS
100	5500	13.24	13.33	13.37	14.06	89.743	19.53	20.72	PASS
116	5580	13.88	13.78	13.72	14.46	99.77	19.99	20.72	PASS
140	5700	13.71	13.87	13.45	14.14	95.94	19.82	20.72	PASS
149	5745	20.10	20.33	20.42	20.77	439.542	26.43	26.74	PASS
157	5785	20.03	20.20	20.19	20.64	425.598	26.29	26.74	PASS
165	5825	20.36	20.56	20.01	20.65	438.531	26.42	26.74	PASS

Note: The directional gain = 9.26 dBi > 6 dBi, so the power limit shall be reduced.

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802.11ax (HE40)

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)				Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass/Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
38	5190	14.13	14.19	14.38	14.40	107.152	20.30	20.72	PASS
46	5230	14.40	14.60	14.56	14.23	111.429	20.47	20.72	PASS
54	5270	13.93	14.02	14.11	14.69	105.196	20.22	20.72	PASS
62	5310	13.79	14.14	13.92	14.60	103.276	20.14	20.72	PASS
102	5510	13.87	14.01	14.02	14.64	103.992	20.17	20.72	PASS
110	5550	14.24	14.16	14.43	14.81	110.662	20.44	20.72	PASS
134	5670	14.15	14.27	13.98	14.53	106.17	20.26	20.72	PASS
151	5755	20.24	20.33	20.26	20.35	428.549	26.32	26.74	PASS
159	5795	20.46	20.67	20.23	20.41	443.609	26.47	26.74	PASS

Note: The directional gain = 9.26 dBi > 6 dBi, so the power limit shall be reduced.

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802.11ax (HE80)

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)				Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass/Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
42	5210	14.49	14.35	14.37	14.90	113.501	20.55	20.72	PASS
58	5290	14.33	14.06	14.35	14.47	107.895	20.33	20.72	PASS
106	5530	14.35	14.21	14.35	14.61	109.648	20.40	20.72	PASS
122	5610	14.21	14.14	14.21	14.52	106.905	20.29	20.72	PASS
155	5775	20.08	20.45	20.30	20.88	442.588	26.46	26.74	PASS

Note: The directional gain = 9.26 dBi > 6 dBi, so the power limit shall be reduced.

802.11ax (HE160)

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)				Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass/Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
50	5250	14.56	14.46	14.43	14.96	115.611	20.63	20.72	PASS
50 (U-NII-1 Band)	5250	11.52	11.40	11.38	11.92	57.28	17.58	20.72	PASS
50 (U-NII-2A Band)	5250	11.47	11.43	11.39	11.90	57.28	17.58	20.72	PASS
114	5570	14.81	14.54	14.68	14.71	117.761	20.71	20.72	PASS

Note: The directional gain = 9.26 dBi > 6 dBi, so the power limit shall be reduced.

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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:

- PSD = power spectral density that the 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
- G_{TX} = the maximum transmitting antenna directional gain in dBi.
- Directional Gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{Gn/20})^2 / Nant]$ dBi.
Nant: Number of Transmit Antennas
 $G1, G2, \dots, Gn$: Gain of Individual Antennas
- 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.

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Test procedure

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

Using method as below:

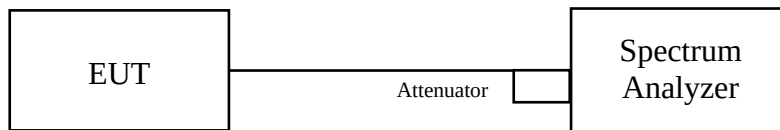
- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 1 MHz, Set VBW $\geq$ 3 RBW, Detector = RMS
- Sweep time = auto, trigger set to “free run”.
- Trace average at least 100 traces in power averaging mode.
- Record the max value. (if Duty cycle <98 %, add 10 log (1/duty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

For U-NII-3 band:

Using method as below:

- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 300 kHz, Set VBW $\geq$ 1 MHz, Detector = RMS
- Use the peak marker function to determine the maximum power level in any 300 kHz band segment within the fundamental EBW.
- 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 $BWCF = 10 \log (500 \text{ kHz}/300\text{kHz})$
- Sweep time = auto, trigger set to “free run”.
- Trace average at least 100 traces in power averaging mode.
- 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.

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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	Chain 2	Chain 3			
36	5180	1.19	1.02	0.90	1.44	7.42	7.74	PASS
44	5220	1.09	1.01	1.02	1.49	7.44	7.74	PASS
48	5240	1.20	1.25	1.20	1.41	7.55	7.74	PASS
52	5260	1.18	1.21	1.16	1.46	7.53	7.74	PASS
60	5300	1.16	1.19	1.06	1.27	7.45	7.74	PASS
64	5320	0.89	1.10	1.00	1.38	7.38	7.74	PASS
100	5500	0.88	0.94	1.13	1.50	7.4	7.74	PASS
116	5580	1.24	1.22	1.14	1.36	7.52	7.74	PASS
140	5700	1.04	1.17	1.00	1.03	7.34	7.74	PASS

Note:

1. Directional gain = 9.26 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

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802.11ax (HE20)

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	Chain 2	Chain 3			
36	5180	1.21	1.28	0.70	1.56	7.53	7.74	PASS
44	5220	1.20	1.04	1.07	1.54	7.55	7.74	PASS
48	5240	0.74	0.92	0.96	1.65	7.41	7.74	PASS
52	5260	0.99	0.78	0.82	1.63	7.4	7.74	PASS
60	5300	0.76	0.82	0.78	1.58	7.33	7.74	PASS
64	5320	0.58	0.61	0.68	1.35	7.15	7.74	PASS
100	5500	0.49	0.47	0.50	1.19	7	7.74	PASS
116	5580	1.04	0.77	0.75	1.49	7.35	7.74	PASS
140	5700	0.94	1.05	0.57	1.24	7.29	7.74	PASS

Note:

1. Directional gain = 9.26 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

802.11ax (HE40)

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	Chain 2	Chain 3			
38	5190	0.57	0.52	0.14	0.60	6.82	7.74	PASS
46	5230	1.17	1.01	0.84	1.56	7.51	7.74	PASS
54	5270	1.23	1.01	0.56	1.58	7.47	7.74	PASS
62	5310	0.78	0.68	0.69	1.07	7.17	7.74	PASS
102	5510	0.88	0.78	0.82	1.10	7.26	7.74	PASS
110	5550	1.12	1.08	1.26	1.43	7.59	7.74	PASS
134	5670	1.18	1.25	1.00	1.47	7.59	7.74	PASS

Note:

1. Directional gain = 9.26 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

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802.11ax (HE80)

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	Chain 2	Chain 3			
42	5210	-3.20	-3.35	-3.35	-2.49	3.3	7.74	PASS
58	5290	-6.34	-3.17	-2.98	-2.37	2.91	7.74	PASS
106	5530	-2.71	-2.94	-2.73	-2.35	3.7	7.74	PASS
122	5610	1.21	1.10	1.12	1.46	7.61	7.74	PASS

Note:

1. Directional gain = 9.26 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

802.11ax (HE160)

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	Chain 2	Chain 3			
50 (U-NII-1 Band)	5250	-6.17	-6.38	-5.99	-6.05	0.22	7.74	PASS
50 (U-NII-2A Band)	5250	-6.17	-6.38	-5.99	-6.05	0.22	7.74	PASS
114	5570	-5.20	-5.30	-5.25	-4.48	1.32	7.74	PASS

Note:

1. Directional gain = 9.26 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

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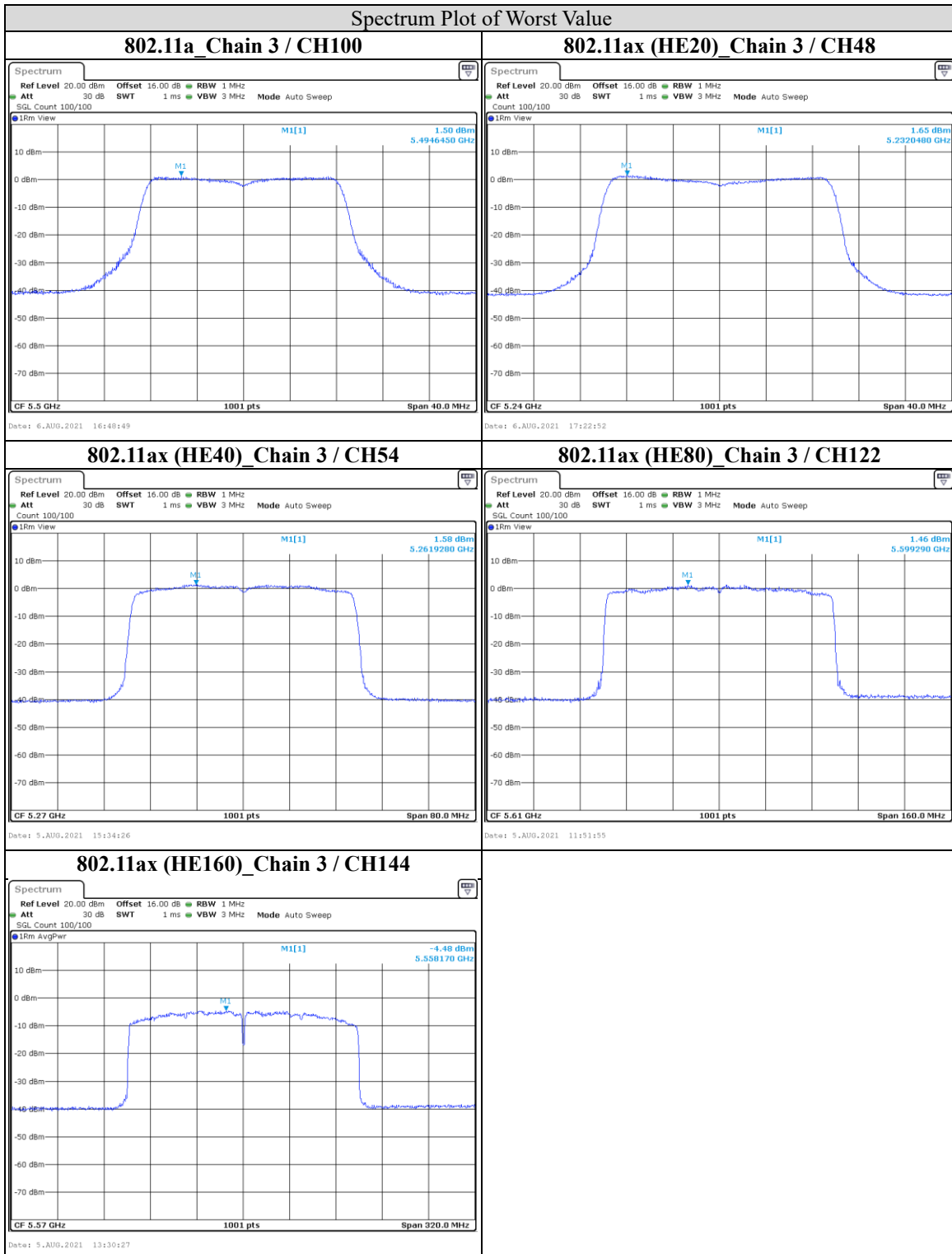
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For U-NII-3 Band

802.11a

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/500 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	Chain 2	Chain 3					
149	5745	6.17	6.18	6.08	6.65	12.3	14.52	14.78	26.74	PASS
157	5785	6.24	6.26	6.04	6.14	12.19	14.41	14.67	26.74	PASS
165	5825	6.25	5.97	5.85	6.07	12.06	14.28	14.54	26.74	PASS

Note:

1. Directional gain = 9.26 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 $BWCF = 10\log(500 \text{ kHz}/300\text{kHz})$.

802.11ax (HE20)

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/500 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	Chain 2	Chain 3					
149	5745	5.27	5.58	5.19	6.11	11.57	13.79	14.1	26.74	PASS
157	5785	5.59	5.81	5.10	5.45	11.52	13.74	14.05	26.74	PASS
165	5825	5.46	5.86	5.22	5.76	11.6	13.82	14.13	26.74	PASS

Note:

1. Directional gain = 9.26 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 $BWCF = 10\log(500 \text{ kHz}/300\text{kHz})$.

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802.11ax (HE40)

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/500 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	Chain 2	Chain 3					
151	5755	2.79	2.89	2.96	3.25	9	11.22	11.56	26.74	PASS
159	5795	3.27	3.70	3.19	3.81	9.52	11.74	12.08	26.74	PASS

Note:

1. Directional gain = 9.26 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 $BWCF = 10\log(500 \text{ kHz}/300\text{kHz})$.

802.11ax (HE80)

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/500 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	Chain 2	Chain 3					
155	5775	-2.05	-2.04	-2.07	-1.34	4.16	6.38	6.74	26.74	PASS

Note:

1. Directional gain = 9.26 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 $BWCF = 10\log(500 \text{ kHz}/300\text{kHz})$.

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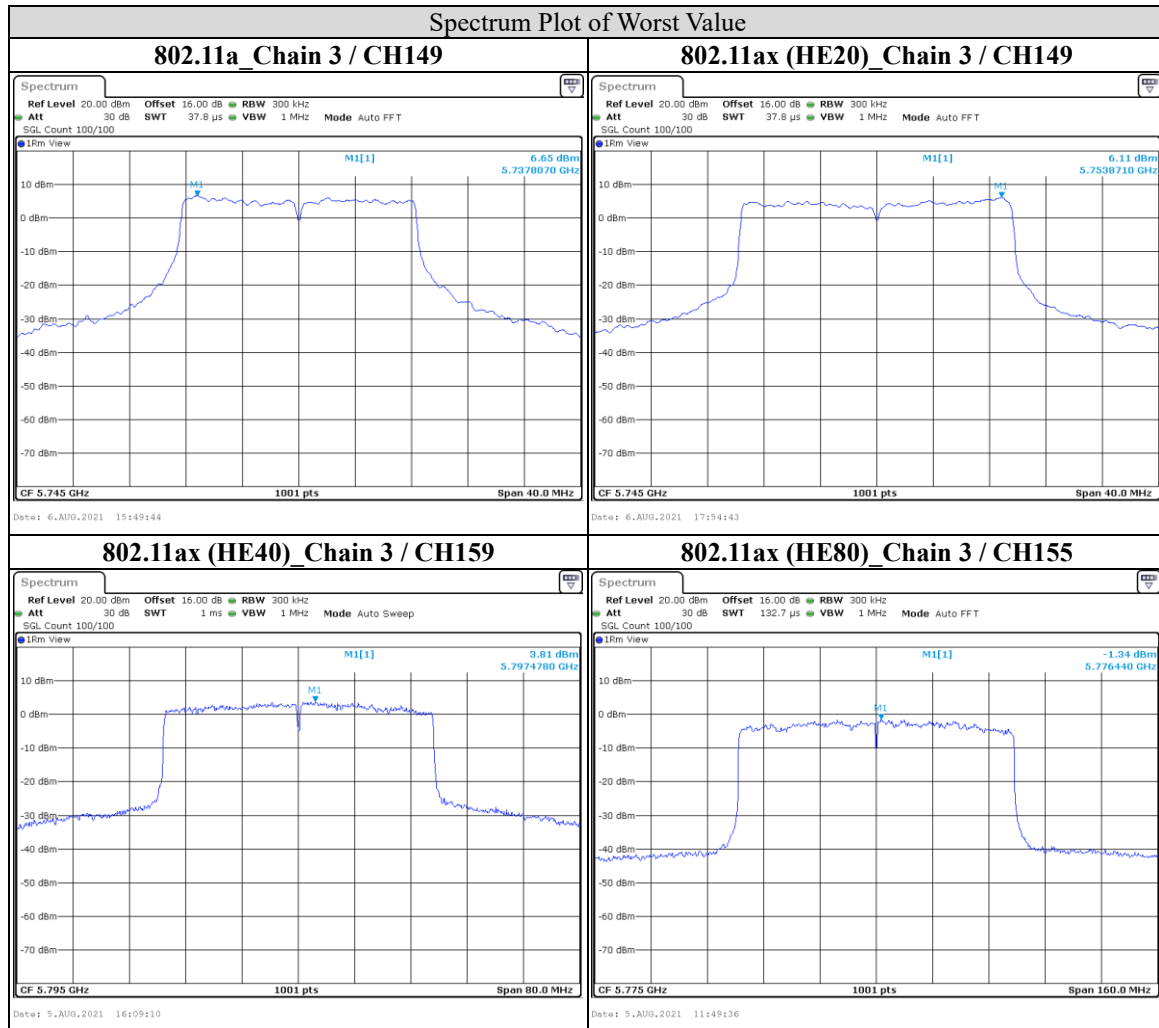
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9.6. Frequency Stability

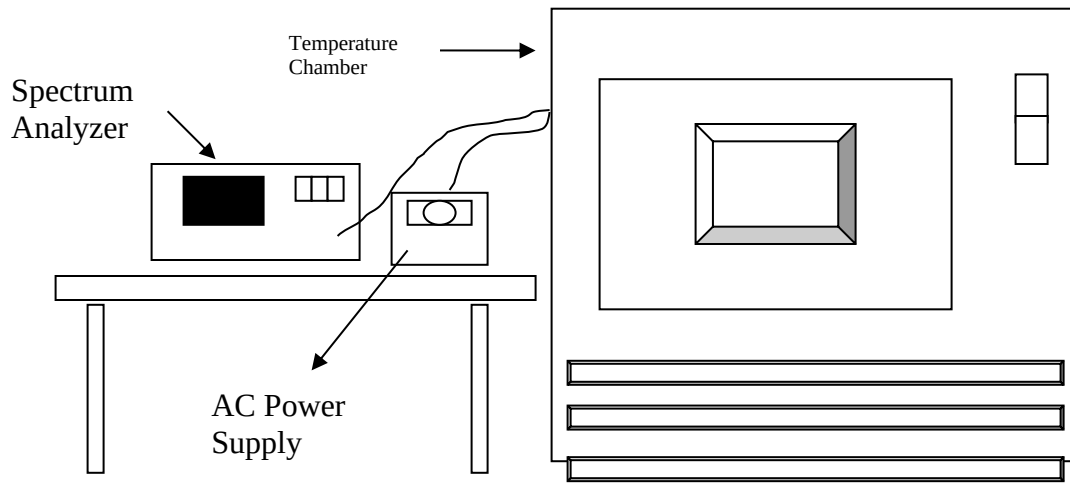
Requirements

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

Test procedure

- The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
- Turn the EUT on and couple its output to a spectrum analyzer.
- Turn the EUT off and set the chamber to the highest temperature specified.
- 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.
- Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
- 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





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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)
70	120	5179.9893	-2.07	5179.9925	-1.45	5179.9897	-1.99	5179.9913	-1.68
60	120	5179.9976	-0.46	5179.9947	-1.02	5179.9954	-0.89	5179.9963	-0.71
50	120	5180.0058	1.12	5180.0061	1.18	5180.0092	1.78	5180.0069	1.33
40	120	5180.0161	3.11	5180.0146	2.82	5180.0165	3.19	5180.0185	3.57
30	120	5179.9984	-0.31	5179.9933	-1.29	5179.9967	-0.64	5179.9972	-0.54
20	120	5180.013	2.51	5180.0102	1.97	5180.0143	2.76	5180.0124	2.39
10	120	5179.9874	-2.43	5179.9896	-2.01	5179.9897	-1.99	5179.9877	-2.37
0	120	5180.001	0.19	5180.0008	0.15	5180.001	0.19	5180.0019	0.37
-10	120	5180.0104	2.01	5180.011	2.12	5180.0151	2.92	5180.0123	2.37
-20	120	5179.9758	-4.67	5179.9755	-4.73	5179.9755	-4.73	5179.9757	-4.69
-30	120	5179.9858	-2.74	5179.9816	-3.55	5179.9854	-2.82	5179.9833	-3.22
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	5180.0102	1.97	5180.0141	2.72	5180.013	2.51
20	120	5180.013	2.51	5180.0102	1.97	5180.0143	2.76	5180.0124	2.39
20	102	5180.0137	2.64	5180.0099	1.91	5180.0144	2.78	5180.0123	2.37

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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.

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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:

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

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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.

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Note:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- 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.
- The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle $< 98\%$) or 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.

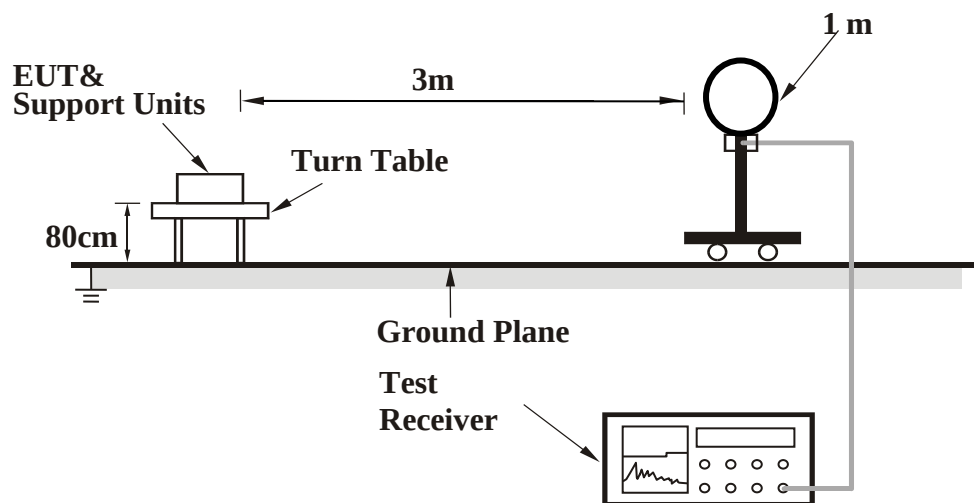
Configuration	Average	
	RBW	VBW
802.11a	1MHz	510Hz
802.11ax (HE20)		200Hz
802.11ax (HE40)		200Hz
802.11ax (HE80)		200Hz
802.11ax (HE160)		200Hz

Note: Refer to section 6.6 for duty cycle.

- All modes of operation were investigated (includes all external accessories) and the worst-case emissions are reported.

Test Setup

<Frequency Range 9 kHz ~ 30 MHz>



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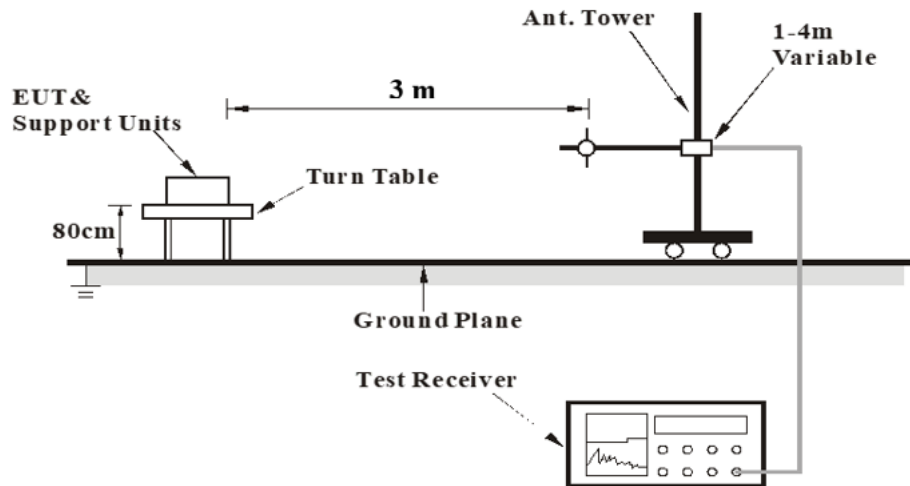
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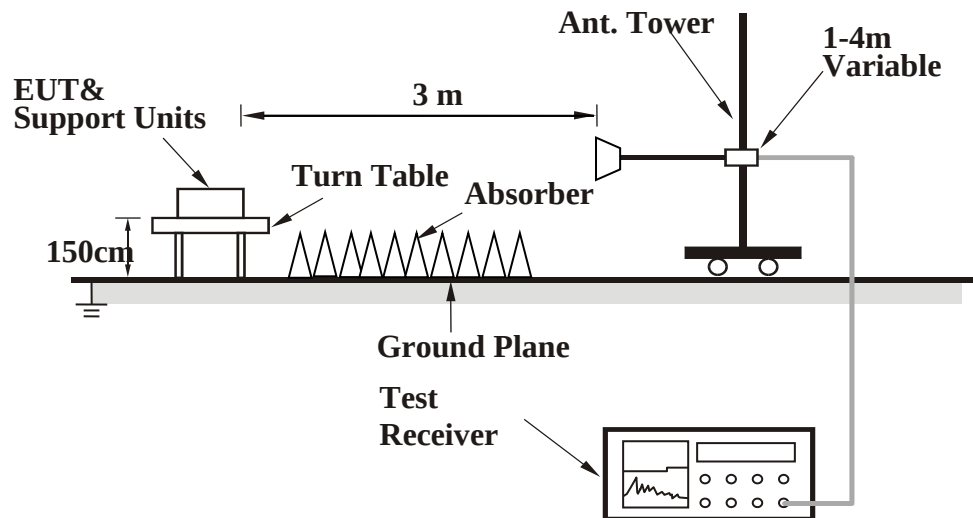
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<Frequency Range 30 MHz ~ 1 GHz >



<Frequency Range above 1 GHz>



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



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Test Data

Above 1GHz Data

802.11a

EUT Test Condition		Measurement Detail	
Channel	Channel 36	Frequency Range	1 GHz ~ 40 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	10360	31.87	17.39	49.26	68.2	-18.94	Peak
-	5115.5	30.87	13.45	44.32	54	-9.68	Average
@	5180	81.52	13.4	94.92	-	-	Average
-	5115.15	41.79	13.45	55.24	74	-18.76	Peak
@	5180	88.72	13.4	102.12	-	-	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	10360	31.77	17.39	49.16	68.2	-19.04	Peak
-	5126.7	32.35	13.44	45.79	54	-8.21	Average
@	5180	94.42	13.4	107.82	-	-	Average
-	5129.5	42.75	13.44	56.19	74	-17.81	Peak
@	5180	101.42	13.4	114.82	-	-	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 44	Frequency Range	1 GHz ~ 40 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	10440	31.21	17.63	48.84	68.2	-19.36	Peak
-	5098.7	30.87	13.46	44.33	54	-9.67	Average
@	5220	80.53	13.33	93.86	-	-	Average
-	5057.4	42.89	13.32	56.21	74	-17.79	Peak
@	5220	87.69	13.33	101.02	-	-	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	10440	32.07	17.63	49.7	68.2	-18.5	Peak
-	5023.1	33.36	13	46.36	54	-7.64	Average
@	5220	93.84	13.33	107.17	-	-	Average
-	5074.55	37.99	13.38	51.37	74	-22.63	Peak
@	5220	95.58	13.33	108.91	-	-	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 48	Frequency Range	1 GHz ~ 40 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	10480	30.93	17.69	48.62	68.2	-19.58	Peak
-	5105.35	30.72	13.46	44.18	54	-9.82	Average
@	5240	80.75	13.27	94.02	-	-	Average
-	5005.25	42.19	12.8	54.99	74	-19.01	Peak
@	5240	87.99	13.27	101.26	-	-	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	10480	31.69	17.69	49.38	68.2	-18.82	Peak
-	5040.6	32.93	13.2	46.13	54	-7.87	Average
@	5240	93.22	13.27	106.49	-	-	Average
-	5040.6	41.63	13.2	54.83	74	-19.17	Peak
@	5240	95.12	13.27	108.39	-	-	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 52	Frequency Range	1 GHz ~ 40 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	10520	31.27	17.73	49	68.2	-19.2	Peak
@	5260	80.09	13.24	93.33	-	-	Average
-	5451	28.46	13.67	42.13	54	-11.87	Average
@	5260	88.69	13.24	101.93	-	-	Peak
-	5443.5	40.98	13.64	54.62	74	-19.38	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	10520	31.21	17.73	48.94	68.2	-19.26	Peak
@	5260	93.24	13.24	106.48	-	-	Average
-	5351.7	29.65	13.26	42.91	54	-11.09	Average
@	5260	100.58	13.24	113.82	-	-	Peak
-	5377.8	40.67	13.35	54.02	74	-19.98	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 60	Frequency Range	1 GHz ~ 40 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	10600	31.07	17.73	48.8	68.2	-19.4	Peak
@	5300	81.28	13.21	94.49	-	-	Average
-	5452.8	28.51	13.68	42.19	54	-11.81	Average
@	5300	88.97	13.21	102.18	-	-	Peak
-	5435.4	39.68	13.6	53.28	74	-20.72	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	10600	31.15	17.73	48.88	68.2	-19.32	Peak
@	5300	93.56	13.21	106.77	-	-	Average
-	5352.6	30.5	13.27	43.77	54	-10.23	Average
@	5300	100.28	13.21	113.49	-	-	Peak
-	5401.8	40.21	13.43	53.64	74	-20.36	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 64	Frequency Range	1 GHz ~ 40 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
*	10640	30.94	17.82	48.76	74	-25.24	Peak
@	5320	83.96	13.23	97.19	-	-	Average
-	5460	28.51	13.7	42.21	54	-11.79	Average
@	5320	91.82	13.23	105.05	-	-	Peak
-	5456.4	40.06	13.69	53.75	74	-20.25	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
*	10640	30.77	17.82	48.59	74	-25.41	Peak
@	5320	92.07	13.23	105.3	-	-	Average
-	5422.8	29.77	13.53	43.3	54	-10.7	Average
@	5320	101.09	13.23	114.32	-	-	Peak
-	5458.5	40.37	13.7	54.07	74	-19.93	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. " * ": The peak result under 20 dB above and complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 100	Frequency Range	1 GHz ~ 40 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
*	11000	32.33	18.28	50.61	74	-23.39	Peak
-	5427.3	28.59	13.56	42.15	54	-11.85	Average
-	5427.3	39.48	13.56	53.04	74	-20.96	Peak
-	5470	39.58	13.74	53.32	68.2	-14.88	Peak
@	5500	81.19	13.83	95.02	-	-	Average
@	5500	89.56	13.83	103.39	-	-	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
*	11000	33.4	18.28	51.68	74	-22.32	Peak
-	5457.75	30.01	13.7	43.71	54	-10.29	Average
-	5457.75	40.73	13.7	54.43	74	-19.57	Peak
-	5468.25	39.93	13.74	53.67	68.2	-14.53	Peak
@	5500	91.84	13.83	105.67	-	-	Average
@	5500	100.96	13.83	114.79	-	-	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. " * ": The peak result under 20 dB above and complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 116	Frequency Range	1 GHz ~ 40 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
*	11160	32.11	18.32	50.43	74	-23.57	Peak
-	5458.45	28.53	13.7	42.23	54	-11.77	Average
-	5458.45	39.91	13.7	53.61	74	-20.39	Peak
-	5468.95	41.61	13.74	55.35	68.2	-12.85	Peak
@	5580	79.98	13.98	93.96	-	-	Average
@	5580	88.27	13.98	102.25	-	-	Peak
-	5741.6	40.08	14.27	54.35	68.2	-13.85	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	11160	26.84	18.32	45.16	54	-8.84	Average
-	11160	35.88	18.32	54.2	74	-19.8	Peak
-	5431.85	29.27	13.58	42.85	54	-11.15	Average
-	5431.85	40.86	13.58	54.44	74	-19.56	Peak
-	5461.25	40.85	13.71	54.56	68.2	-13.64	Peak
@	5580	91.61	13.98	105.59	-	-	Average
@	5580	99.48	13.98	113.46	-	-	Peak
-	5728.3	41.03	14.19	55.22	68.2	-12.98	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. " * ": The peak result under 20 dB above and complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 140	Frequency Range	1 GHz ~ 40 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
*	11400	33.87	18.74	52.61	74	-21.39	Peak
@	5700	80.32	14.05	94.37	-	-	Average
@	5700	88.18	14.05	102.23	-	-	Peak
-	5737.75	40.85	14.24	55.09	68.2	-13.11	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	11400	26.96	18.74	45.7	54	-8.3	Average
-	11400	35.36	18.74	54.1	74	-19.9	Peak
@	5700	92.21	14.05	106.26	-	-	Average
@	5700	101.46	14.05	115.51	-	-	Peak
-	5729	42.74	14.2	56.94	68.2	-11.26	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. " * ": The peak result under 20 dB above and complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 149	Frequency Range	1 GHz ~ 40 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	11490	29.75	19.02	48.77	54	-5.23	Average
-	11490	38.67	19.02	57.69	74	-16.31	Peak
-	5579.5	41.09	13.98	55.07	68.2	-13.13	Peak
-	5697.5	41.06	14.05	55.11	103.36	-48.25	Peak
@	5745	98.85	14.28	113.13	-	-	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	11490	34.46	19.02	53.48	54	-0.52	Average
-	11490	43.44	19.02	62.46	74	-11.54	Peak
-	5546.5	44.3	13.88	58.18	68.2	-10.02	Peak
-	5695	53.24	14.05	67.29	101.51	-34.22	Peak
@	5745	106.76	14.28	121.04	-	-	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 157	Frequency Range	1 GHz ~ 40 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	11570	29.84	18.88	48.72	54	-5.28	Average
-	11570	38.9	18.88	57.78	74	-16.22	Peak
-	5586	41.16	14	55.16	68.2	-13.04	Peak
-	5694.5	40.48	14.05	54.53	101.15	-46.62	Peak
@	5785	99.21	14.48	113.69	-	-	Peak
-	5876.5	40.34	14.89	55.23	104.09	-48.86	Peak
-	5965	40.13	15.07	55.2	68.2	-13	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	11570	34.92	18.88	53.8	54	-0.2	Average
-	11570	43.99	18.88	62.87	74	-11.13	Peak
-	5586	44.35	14	58.35	68.2	-9.85	Peak
-	5679.5	41.11	14.03	55.14	90.07	-34.93	Peak
@	5785	105.84	14.48	120.32	-	-	Peak
-	5877	41.41	14.89	56.3	103.71	-47.41	Peak
-	5972.5	41.54	15.08	56.62	68.2	-11.58	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 165	Frequency Range	1 GHz ~ 40 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	11650	29.85	18.63	48.48	54	-5.52	Average
-	11650	38.9	18.63	57.53	74	-16.47	Peak
@	5825	97.07	14.69	111.76	-	-	Peak
-	5925	41.11	14.99	56.1	68.2	-12.1	Peak
-	5925	41.11	14.99	56.1	68.2	-12.1	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	11650	34.87	18.63	53.5	54	-0.5	Average
-	11650	43.96	18.63	62.59	74	-11.41	Peak
@	5825	106.15	14.69	120.84	-	-	Peak
-	5877.5	51.19	14.89	66.08	103.34	-37.26	Peak
-	5996.5	41.29	15.16	56.45	68.2	-11.75	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. The other emission levels were very low against the limit.

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