



Test report No. : 4789400505B-US-R0-V0
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Issued date : Mar. 31, 2021
FCC ID : VGY2865AX

RADIO TEST REPORT

Product : 35b & G.Fast Security Router

Model Name : Vigor2866FVax

Series Model : Refer to Ch.6.1

FCC ID : VGY2865AX

Test Regulation : FCC 47 CFR Part 15 Subpart C (Section 15.247)

Received Date : Jul. 7, 2020

Test Date : Sep. 10, 2020 ~ Dec. 25, 2020

Issued Date : Mar. 31, 2021

Applicant : DrayTek Corp.
No.26 Fu Shing Rd., HuKou County, Hsin-Chu Industrial Park,
Hsin-Chu, Taiwan 303 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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Doc No: 17-EM-F0876 / 5.0



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1. Attestation of Test Results

APPLICANT: DrayTek Corp.
 No.26 Fu Shing Rd., HuKou County, Hsin-Chu Industrial Park, Hsin-Chu, Taiwan 303 R.O.C

MANUFACTURER DrayTek Corp.
 No.26 Fu Shing Rd., HuKou County, Hsin-Chu Industrial Park, Hsin-Chu, Taiwan 303 R.O.C

EUT DESCRIPTION: 35b & G.Fast Security Router

BRAND: DrayTek

MODEL: Vigor2866FVax

SERIES MODEL: Refer to Ch.6.1

SAMPLE STAGE: Engineering sample

DATE of TESTED: Sep. 10, 2020 ~ Dec. 25, 2020

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

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

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 Project Handler

Date : Mar. 31, 2021

Approved and Authorized By:

Mike Cai
 Engineer Project Associate

Date : Mar. 31, 2021

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2. Summary of Test Results

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

Note:

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

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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, KDB558074 D01 Meas Guidance v05r02, KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013 and KDB 662911 D01 Multiple Transmitter Output v02r01.

4. Facilities and Accreditation

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

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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 $k=2$.

Test Item	Measurement Frequency Range	K	U(dB)
Conducted disturbance at mains terminals ports	0.15MHz ~ 30MHz	2	1.5
RF Conducted	9 kHz - 40GHz	2	1.0
Radiated disturbance below 30MHz	9 kHz - 30 MHz	2	1.9
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	2	5.4
Radiated disturbance above 1GHz	1GHz ~ 40GHz	2	4.7

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6. Equipment under Test

6.1. Description of EUT

Product	35b & G.Fast Security Router
Brand Name	DrayTek
Model Name	Vigor2866FVax
Series Model	Vigor2865ax, Vigor2865Vax, Vigor2865Fax, Vigor2865FVax, Vigor2866ax, Vigor2866Vax, Vigor2866Fax, Vigor2927ax, Vigor2927Vax, Vigor2927Fax, Vigor2927FVax, Vigor2923ax, Vigor2923Vax, Vigor2923Fax, Vigor2923FVax, Vigor2925ax, Vigor2925Vax, Vigor2925Fax, Vigor2925FVax, Vigor2926_v1ax, Vigor2926_v1Vax, Vigor2926_v1Fax, Vigor2926_v1FVax
S/N	2031449BC0800C8
Operating Frequency	2412MHz ~ 2462MHz
Modulation	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDMA
Transfer Rate	802.11b: up to 11 Mbps 802.11g: up to 54 Mbps 802.11n: up to MCS15 802.11ax: up to HE11
Number of Channel	11 for 802.11b, 802.11g, 802.11n (HT20), 802.11ax (HE20) 7 for 802.11n (HT40), 802.11ax (HE40)
Maximum Output Power	Non-Beamforming mode: 802.11b: 23.22 dBm 802.11g: 29.58dBm 802.11ax (HE20): 29.53 dBm 802.11ax (HE40): 24.37 dBm Beamforming mode: 802.11ax (HE20): 29.90 dBm 802.11ax (HE40): 17.57 dBm
Normal Voltage	12Vdc from adapter

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Note:

1. The models difference table as below:

Main Model Name	DSL	G. fast	SFP	WWAN	LAN	Wi-Fi 2.4G	Wi-Fi 5G	FXS
Vigor2866FVax	VDSL2/35b	V	V	-	Eth/RJ45x5	V	V	V
Series Model Name	DSL	G. fast	SFP	WWAN	LAN	Wi-Fi 2.4G	Wi-Fi 5G	FXS
Vigor2865ax	VDSL2/35b	-	-	-	Eth/RJ45x6	V	V	-
Vigor2865Vax	VDSL2/35b	-	-	-	Eth/RJ45x6	V	V	V
Vigor2865Fax	VDSL2/35b	-	V	-	Eth/RJ45x5	V	V	-
Vigor2865FVax	VDSL2/35b	-	V	-	Eth/RJ45x5	V	V	V
Vigor2866ax	VDSL2/35b	V	-	-	Eth/RJ45x6	V	V	-
Vigor2866Vax	VDSL2/35b	V	-	-	Eth/RJ45x6	V	V	V
Vigor2866Fax	VDSL2/35b	V	V	-	Eth/RJ45x5	V	V	-
Vigor2927ax	-	-	-	-	Eth/RJ45x6	V	V	-
Vigor2927Vax	-	-	-	-	Eth/RJ45x6	V	V	V
Vigor2927Fax	-	-	V	-	Eth/RJ45x6	V	V	-
Vigor2927FVax	-	-	V	-	Eth/RJ45x6	V	V	V
Vigor2923ax	-	-	-	-	Eth/RJ45x6	V	V	-
Vigor2923Vax	-	-	-	-	Eth/RJ45x6	V	V	V
Vigor2923Fax	-	-	V	-	Eth/RJ45x6	V	V	-
Vigor2923FVax	-	-	V	-	Eth/RJ45x6	V	V	V
Vigor2925ax	-	-	-	-	Eth/RJ45x6	V	V	-
Vigor2925Vax	-	-	-	-	Eth/RJ45x6	V	V	V
Vigor2925Fax	-	-	V	-	Eth/RJ45x6	V	V	-
Vigor2925FVax	-	-	V	-	Eth/RJ45x6	V	V	V
Vigor2926_v1ax	-	-	-	-	Eth/RJ45x6	V	V	-
Vigor2926_v1Vax	-	-	-	-	Eth/RJ45x6	V	V	V
Vigor2926_v1Fax	-	-	V	-	Eth/RJ45x6	V	V	-
Vigor2926_v1FVax	-	-	V	-	Eth/RJ45x6	V	V	V

Note:

The above model are declared by manufacturer for market segmentation that difference between main model and the series model is the combination of hardware design and appearance, there is nothing changed to RF related part that does not affect the RF characteristics.

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

Modulation Mode	Tx,Rx Function
802.11b	1TX,1RX
802.11g	2TX,2RX
802.11n (HT20)	2TX,2RX
802.11ax (HE20)	2TX,2RX
802.11n (HT40)	2TX,2RX
802.11ax (HE40)	2TX,2RX

3. The EUT contains following accessory devices

Product	Brand	Model	Description	Remark
AC adapter 1	Channel Well Technology	2ABN036F	Input: 100-240Vac, 1.0A Output: 12Vdc, 3A Length: 1.5m	Optional
AC adapter 2	Channel Well Technology	2ABL030F	Input: 100-240Vac, 1.0A Output: 12Vdc, 2.5A Length: 1.5m	Optional
AC adapter 3	Channel Well Technology	2ABL024F	Input: 100-240Vac, 0.8A Output: 12Vdc, 2A Length: 1.5m	Optional
RJ-45 Cable (Ethernet)	Tung-Li	5U422-20	Length: 3meter, non-shielded cable	-
RJ-11 Cable	N/A	N/A	Length: 1.8meter, non-shielded cable, 6P4C	-

4. 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

11 channels are provided for 802.11b, 802.11g, 802.11n (HT20) and 802.11ax (HE20):

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

7 channels are provided for 802.11n (HT40) and 802.11ax (HE40):

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

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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	22~24°C / 59~69%RH	120Vac / 60 Hz	Sep. 17, 2020 ~ Dec. 25, 2020	WaterNil Guan
Radiated Spurious Emission	966-2	20~26°C / 63~70%RH	120Vac / 60 Hz	Sep. 10, 2020 ~ Dec. 22, 2020	WaterNil Guan
AC power Line Conducted Emission	SR1	22~24°C / 58~62%RH	120Vac / 60 Hz	Dec. 24, 2020 ~ Dec. 25, 2020	Patrick Kuan

FCC Test Firm Registration Number: 498077

6.4. Description Of Available Antennas

Ant. No.	Transmitter Circuit	Brand Name	Model Name	Antenna Type	Maximum Gain (dBi)
1	Chain (0)+(1)	Walsin	RFDPA131300SBLB805	Dipole	2.3
2	Chain (0)+(1)	Walsin	RFDPA131300SBLB806	Dipole	2.3
3	Chain (0)+(1)	Angeei	DPD2430SRW	Dipole	2.3
4	Chain (0)+(1)	Angeei	DPD2430SRB	Dipole	2.3

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual. The antenna RFDPA131300SBLB805 is the worst case. Therefore, all of the test items are represented by this model.

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6.5. Test Mode Applicability and Tested Channel Detail

- 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).
- 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.
- 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.
- The fundamental of the EUT was investigated in three orthogonal axes XY/YZ/XZ, it was determined that XY axis was worst-case . Therefore, all final radiated testing was performed with the EUT in XY axis.
- 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 AC power line conducted emissions, the pre-scan has been determined by 2ABL030F adapter of AC power 120Vac/60Hz (worst case)
- Pre-scan radiation has been determined by the Model: Vigor2866FVax (the worst case).

Non-Beamforming Mode

Test item	Mode	Modulation Technology	Modulation Type	Available Channel	Test Channel	Data Rate
Radiated Emissions (Above 1GHz)	802.11b	DSSS	DBPSK	1 to 11	1,2,6,10,11	1Mbps
	802.11g	OFDM	BPSK	1 to 11	1,2,6,10,11	6Mbps
	802.11ax(HE20)	OFDMA	BPSK	1 to 11	1,2,6,10,11	MCS0
	802.11ax(HE40)	OFDMA	BPSK	3 to 9	3,4,6,8,9	MCS0
Radiated Emissions (Below 1GHz)	802.11b	DSSS	DBPSK	1 to 11	11	1Mbps
AC Power Line Conducted Emission	802.11b	DSSS	DBPSK	1 to 11	11	1Mbps
Antenna Port Conducted Measurement	802.11b	DSSS	DBPSK	1 to 11	1,2,6,10,11	1Mbps
	802.11g	OFDM	BPSK	1 to 11	1,2,6,10,11	6Mbps
	802.11ax(HE20)	OFDMA	BPSK	1 to 11	1,2,6,10,11	MCS0
	802.11ax(HE40)	OFDMA	BPSK	3 to 9	3,4,6,8,9	MCS0

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Beamforming Mode

Test item	Mode	Modulation Technology	Modulation Type	Available Channel	Test Channel	Data Rate
Radiated Emissions (Above 1GHz)	802.11ax(HE20)	OFDMA	BPSK	1 to 11	1,2,6,10,11	MCS0
	802.11ax(HE40)	OFDMA	BPSK	3 to 9	3,6,9	MCS0
Radiated Emissions (Below 1GHz)	802.11ax(HE20)	OFDMA	BPSK	1 to 11	6	MCS0
AC Power Line Conducted Emission	802.11ax(HE20)	OFDMA	BPSK	1 to 11	6	MCS0
Antenna Port Conducted Measurement	802.11ax(HE20)	OFDMA	BPSK	1 to 11	1,2,6,10,11	MCS0
	802.11ax(HE40)	OFDMA	BPSK	3 to 9	3,6,9	MCS0

Co-Location Mode

Non-Beamforming Mode

Test item	Mode	Modulation Technology	Modulation Type	Available Channel	Test Channel	Data Rate
Radiated Emissions	802.11b	DSSS	DBPSK	1 to 11	11+149	1Mbps
	802.11a	OFDM	BPSK	36 to 48 149 to 165		6Mbps

Beamforming Mode

Test item	Mode	Modulation Technology	Modulation Type	Available Channel	Test Channel	Data Rate
Radiated Emissions	802.11ax(HE20)	OFDMA	BPSK	1 to 11	6+165	MCS0
	802.11ax(HE20)	OFDMA	BPSK	36 to 48 149 to 165		MCS0

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6.6. Duty cycle

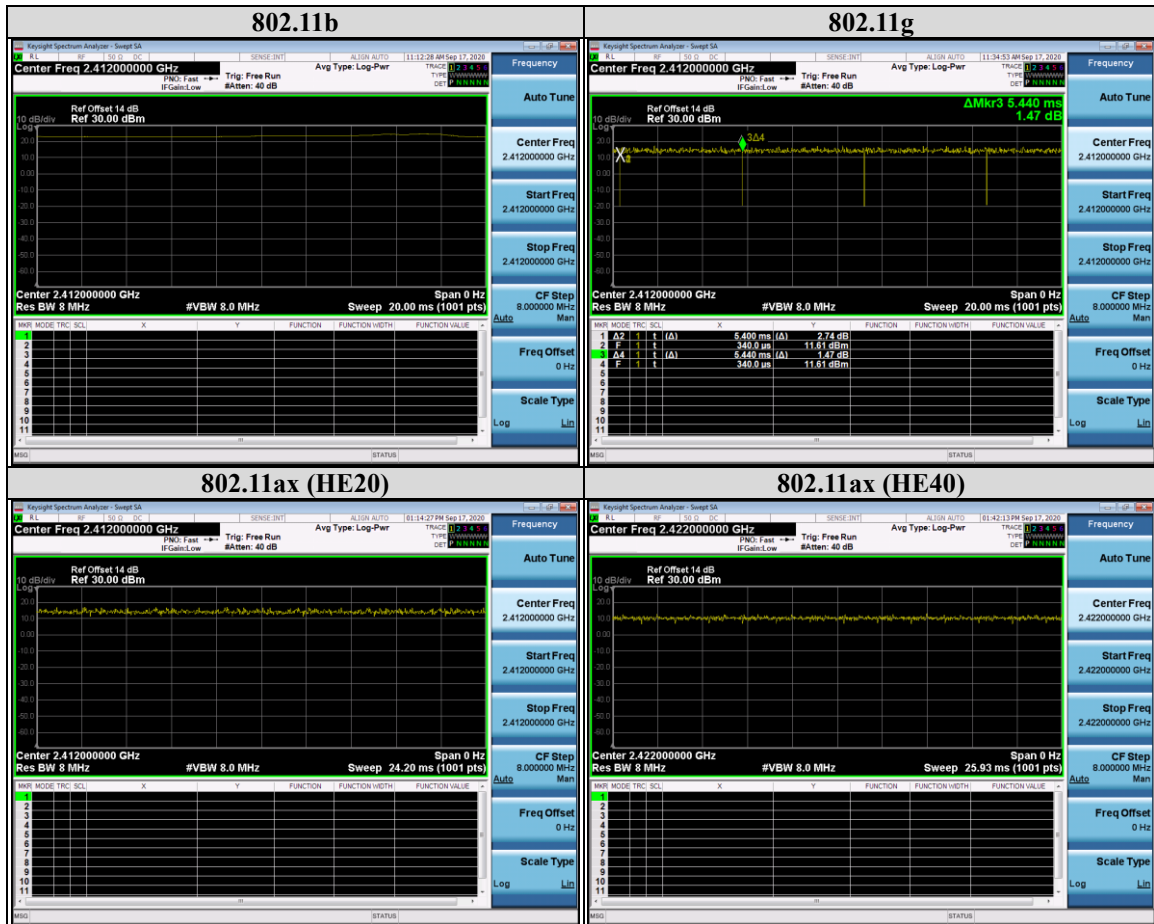
Non-Beamforming mode

802.11b: Duty cycle = Duty cycle of test signal is 100 %, duty factor is not required.

802.11g: Duty cycle = $5.4/5.44 = 0.993$, duty cycle of test signal is $\geq 98\%$, duty factor is not required.

802.11ax (HE20): Duty cycle of test signal is 100 %, duty factor is not required.

802.11ax (HE40): Duty cycle of test signal is 100 %, duty factor is not required.

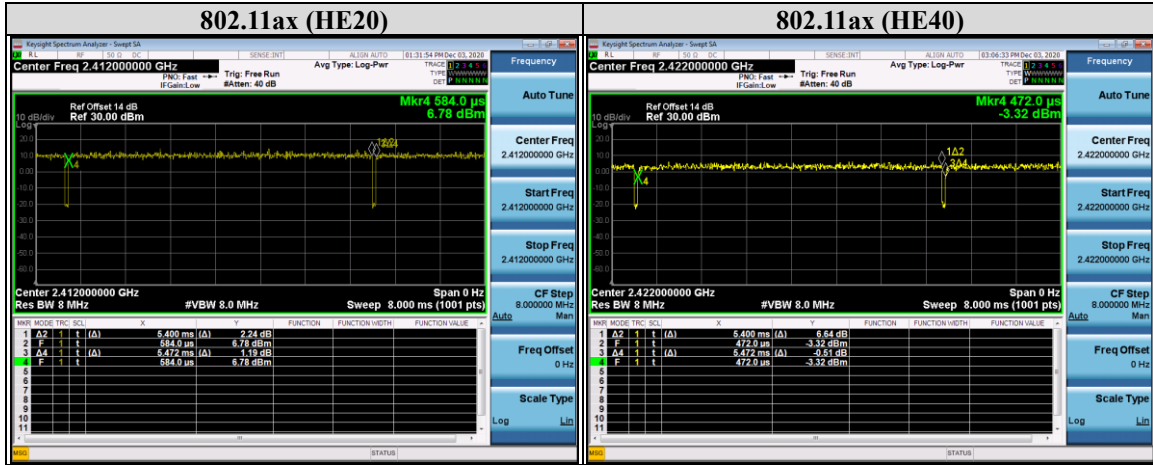




Beamforming mode

802.11ax (HE20): Duty cycle = 5.4/5.472 = 0.987, duty cycle of test signal is $\geq 98\%$, duty factor is not required.

802.11ax (HE40): Duty cycle = 5.4/5.472 = 0.987, duty cycle of test signal is $\geq 98\%$, duty factor is not required.



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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	2019/11/13	2020/11/12
				2020/11/11	2021/11/10
EMI Test Receiver	Rohde & Schwarz	ESR7	101754	2019/12/17	2020/12/16
				2020/12/11	2021/12/10
Loop Antenna	ETS lindgren	6502	00213440	2019/12/19	2020/12/18
				2020/12/25	2021/12/24
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	774 & AT-N0538	2020/1/3	2021/1/2
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01690	2020/1/3	2021/1/2
Horn Antenna (18-40 GHz)	Schwarzbeck	BBHA 9170	781	2019/12/27	2020/12/26
Preamplifier (30-1000 MHz)	EMCI	EMC330E	980405	2020/6/9	2021/6/8
Preamplifier (1-18 GHz)	EMCI	EMC051835BE	980406	2020/2/4	2021/2/2
Preamplifier (18-40GHz)	EMCI	EMC184040SEE	980426	2020/5/19	2021/5/18
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-4 & 170425-2	2020/7/2	2021/7/1
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-1 & 170214-2	2020/1/8	2021/1/7

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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	MY56070821	2019/12/4	2020/12/3
				2020/12/15	2021/12/14
Pulse Power Sensor	Anritsu	MA2411B	1531202	2019/12/23	2020/12/22
				2020/12/21	2021/12/20
Power Meter	Anritsu	ML2495A	1645002	2019/12/23	2020/12/22
				2020/12/21	2021/12/20
AC power Line Conducted Emission					
EMI Test Receiver	Rohde & Schwarz	ESR7	101753	2020/11/17	2021/11/16
Two-Line V-Network	Rohde & Schwarz	ENV216	102136	2020/8/19	2021/8/18
Impuls-Begrenzer Pulse Limiter	Rohde & Schwarz	ESH3-Z2	102219-Qt	2020/8/12	2021/8/11
Cables	HARBOUR INDUSTRIES	LL142	170205-5000-1	2020/2/5	2021/2/4

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

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8. Description of Test Setup

Support Equipment

Equipment	Brand Name	Model Name	S/N	Remark
Notebook	DELL	Latitude E5470	3JFKWF2	N/A
Notebook	DELL	Latitude E5470	JVSKWF2	N/A
Connector	N/A	N/A	N/A	RJ-45 to RJ-45
USB Device	Transcend	N/A	N/A	8GB
Fiber Module	Fiberpon	SFP+10G-T	N/A	N/A
Rx Device (BF Client)	ASUS	RT-AX88U	K6ITHP000052	MSQ-RTAXHP00

I/O Cables

Equipment	Brand Name	Model Name	S/N	Remark
RJ-45 cable	Fastlink	FL-61STU-04	N/A	Length : 10m
RJ-45 cable	Fastlink	FL-61STU-04	N/A	Length : 1.5m
RJ-45 cable	Fastlink	FL-61STU-04	N/A	Length : 1.5m
RJ-45 cable	Fastlink	FL-61STU-04	N/A	Length : 1.5m
RJ-45 cable	Fastlink	FL-61STU-04	N/A	Length : 1.5m
RJ-45 cable	Fastlink	FL-61STU-04	N/A	Length : 1.5m

Test Setup

Controlled using a bespoke application (DUT GUI Version 6.10.26) 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.

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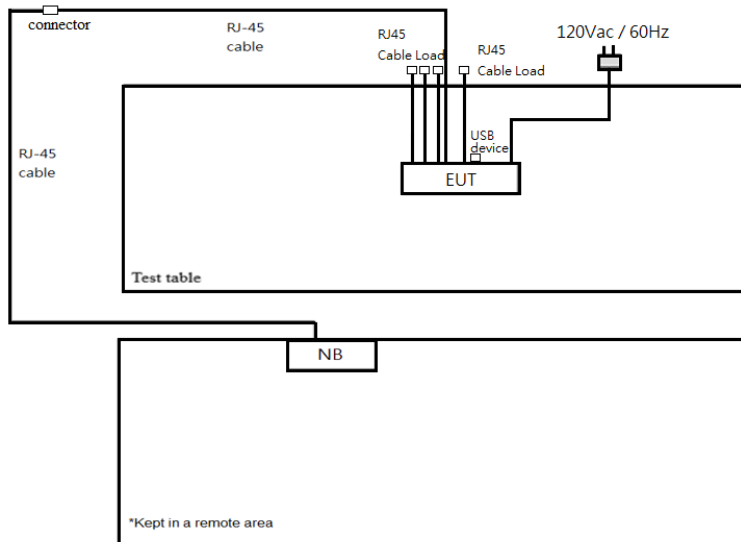
Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0876 / 5.0

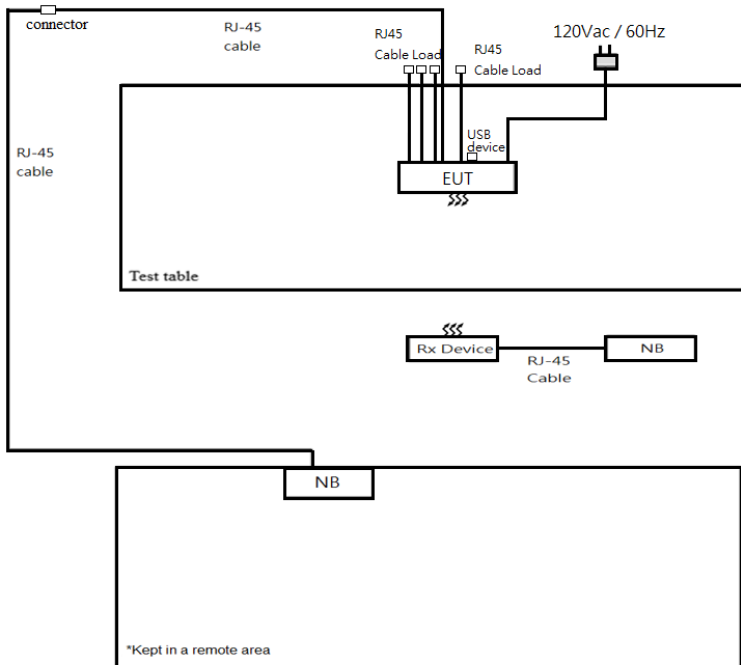


Setup Diagram for Test

Non-Beamforming Mode



Beamforming Mode



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9. Test Results

9.1. 6dB Bandwidth

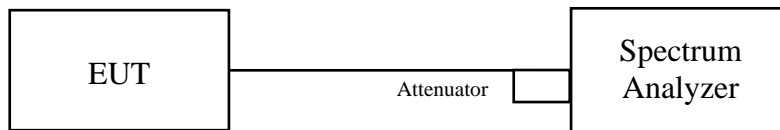
Requirements

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

Non-Beamforming mode

802.11b

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	8.085	0.5	Pass
2	2417	8.085	0.5	Pass
6	2437	8.089	0.5	Pass
10	2457	8.085	0.5	Pass
11	2462	8.554	0.5	Pass

802.11g

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	16.395	16.418	0.5	Pass
2	2417	16.440	16.418	0.5	Pass
6	2437	16.421	16.459	0.5	Pass
10	2457	16.403	16.436	0.5	Pass
11	2462	16.388	16.399	0.5	Pass

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802.11ax (HE20)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	19.069	19.024	0.5	Pass
2	2417	19.076	19.084	0.5	Pass
6	2437	19.069	19.058	0.5	Pass
10	2457	19.091	19.095	0.5	Pass
11	2462	19.005	19.099	0.5	Pass

802.11ax (HE40)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
3	2422	38.123	38.190	0.5	Pass
4	2427	38.130	38.100	0.5	Pass
6	2437	38.108	38.100	0.5	Pass
8	2447	38.138	38.160	0.5	Pass
9	2452	38.145	38.123	0.5	Pass

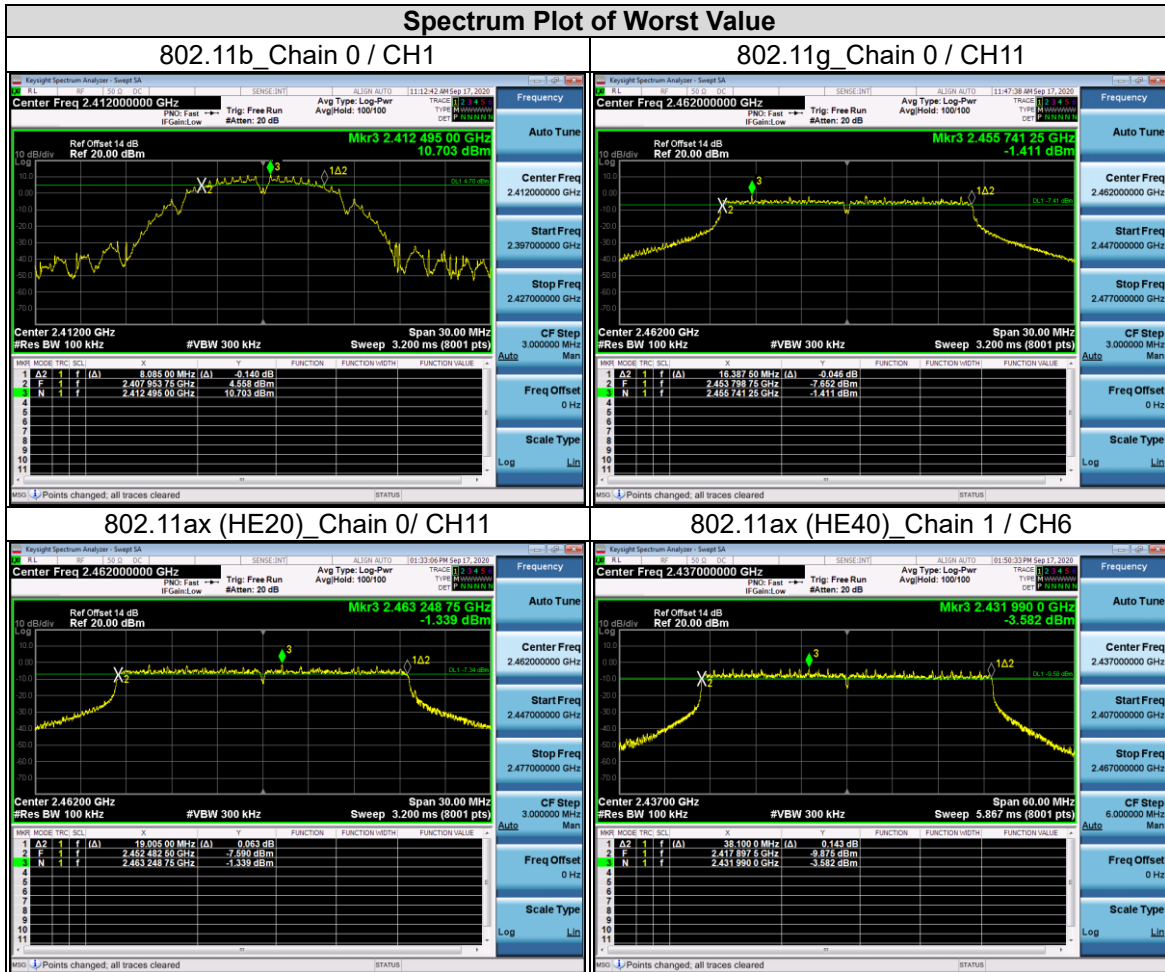
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Beamforming mode

802.11ax (HE20)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	11.344	19.114	0.5	Pass
2	2417	11.340	18.825	0.5	Pass
6	2437	7.740	17.933	0.5	Pass
10	2457	9.810	18.728	0.5	Pass
11	2462	11.246	18.833	0.5	Pass

802.11ax (HE40)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
3	2422	32.535	36.015	0.5	Pass
6	2437	13.838	35.535	0.5	Pass
9	2452	7.035	33.315	0.5	Pass

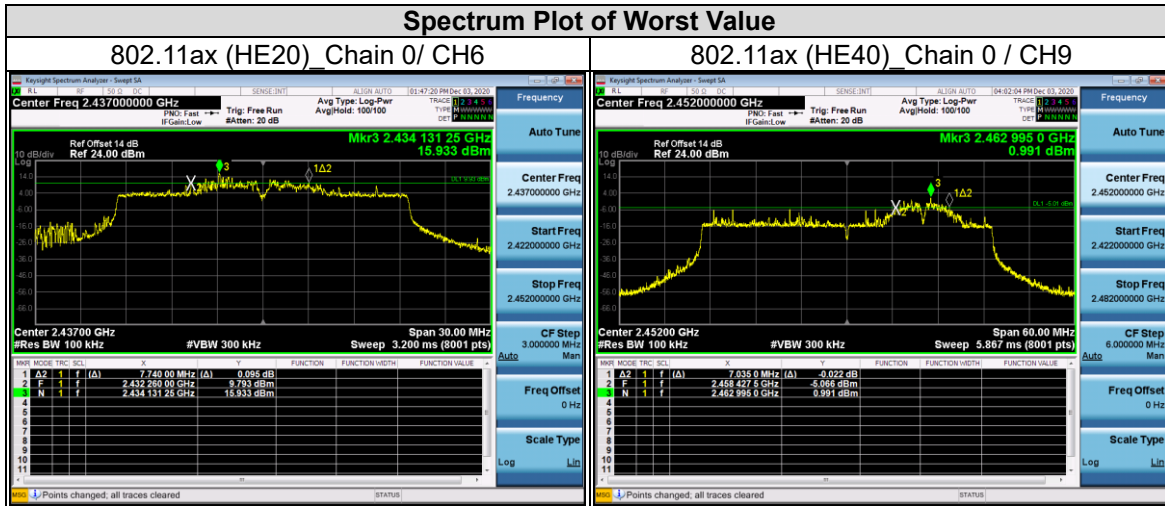
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9.2. Conducted output power

Requirements

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

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

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT} ;

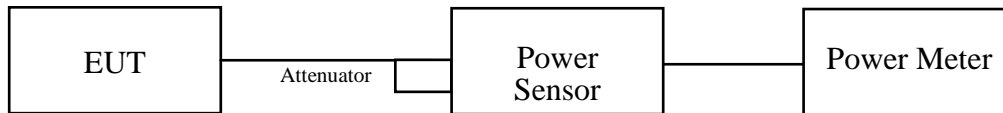
Array Gain = $5 \log(N_{ANT}/N_{SS})$ dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

For power measurements on all other devices: Array Gain = $10 \log(N_{ANT}/N_{SS})$ dB.

Test Procedure

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

Test Setup



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

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Test Data

Non-Beamforming mode

Peak Power

802.11b

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	191.867	22.83	30	Pass
2	2417	200.909	23.03	30	Pass
6	2437	209.894	23.22	30	Pass
10	2457	201.372	23.04	30	Pass
11	2462	201.837	23.05	30	Pass

802.11g

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	20.76	20.3	226.276	23.55	30	Pass
2	2417	24.95	24.78	613.216	27.88	30	Pass
6	2437	26.73	26.41	908.499	29.58	30	Pass
10	2457	25.28	24.85	642.779	28.08	30	Pass
11	2462	21.54	21.17	273.479	24.37	30	Pass

Note : The power of channel 3/4/5 are the same as tune up power of channel 2.

The power of channel 7/8/9 are the same as tune up power of channel 10.

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802.11ax (HE20)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	20.70	20.05	218.648	23.40	30	Pass
2	2417	24.02	23.80	492.231	26.92	30	Pass
6	2437	26.68	26.36	898.1	29.53	30	Pass
10	2457	23.26	23.06	414.138	26.17	30	Pass
11	2462	20.37	20.21	213.847	23.30	30	Pass

Note : The power of channel 3/4/5 are the same as tune up power of channel 2.

The power of channel 7/8/9 are the same as tune up power of channel 10.

802.11ax (HE40)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	19.71	19.24	177.487	22.49	30	Pass
4	2427	19.69	19.26	177.444	22.49	30	Pass
6	2437	21.47	21.24	273.326	24.37	30	Pass
8	2447	20.24	19.86	202.51	23.06	30	Pass
9	2452	20.02	19.72	194.218	22.88	30	Pass

Note : The power of channel 5 is the same as tune up power of channel 4.

The power of channel 7 is the same as tune up power of channel 8.

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Average Power (Reference Only)

802.11b

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)
1	2412	89.331	19.51
2	2422	94.624	19.76
6	2437	98.401	19.93
10	2457	95.280	19.79
11	2462	98.401	19.93

802.11g

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	10.39	9.93	20.78	13.18
2	2417	14.58	14.41	56.314	17.51
6	2437	16.4	16.1	84.39	19.26
10	2457	14.93	14.5	59.301	17.73
11	2462	11.15	10.82	25.11	14.00

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802.11ax (HE20)

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	10.61	10.60	22.99	13.62
2	2417	14.3	13.66	50.142	17.00
6	2437	17.35	16.59	99.929	20.00
10	2457	13.8	13.39	45.815	16.61
11	2462	10.92	10.56	23.735	13.75

802.11ax (HE40)

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
3	2422	9.84	9.35	18.248	12.61
4	2427	9.92	9.26	18.25	12.61
6	2437	11.59	11.41	28.257	14.51
8	2447	10.36	10.08	21.05	13.23
9	2452	10.09	9.88	19.936	13.00

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Beamforming mode

Peak Power

802.11ax (HE20)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	16.90	16.82	97.062	19.87	30	Pass
2	2417	20.15	20.13	206.553	23.15	30	Pass
6	2437	26.99	26.79	977.564	29.90	30	Pass
10	2457	20.45	20.31	218.316	23.39	30	Pass
11	2462	16.15	16.30	83.868	19.24	30	Pass

Note : The power of channel 3/4/5 are the same as tune up power of channel 2.

The power of channel 7/8/9 are the same as tune up power of channel 10.

802.11ax (HE40)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	13.90	13.67	47.828	16.80	30	Pass
6	2437	15.05	14.01	57.166	17.57	30	Pass
9	2452	13.45	13.16	42.832	16.32	30	Pass

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Average Power (Reference Only)

802.11ax (HE20)

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	6.48	6.40	8.811	9.45
2	2417	9.65	9.52	18.18	12.60
6	2437	16.51	16.32	87.626	19.43
10	2457	9.96	9.8	19.458	12.89
11	2462	6.12	5.95	8.029	9.05

802.11ax (HE40)

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
3	2422	3.94	3.41	4.67	6.69
6	2437	5.68	5.02	6.875	8.37
9	2452	3.78	3.36	4.556	6.59

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9.3. Power Spectral Density

Requirements

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

Note:

1. PSD = power spectral density that he same method as used to determine the conducted output power shall be used to determine the power spectral density. And power spectral density in dBm/MHz.
2. G_{TX} = the maximum transmitting antenna directional gain in dBi.
3. Directional Gain = $G_{ant} + 10 \log(N_{ant})$ dBi.

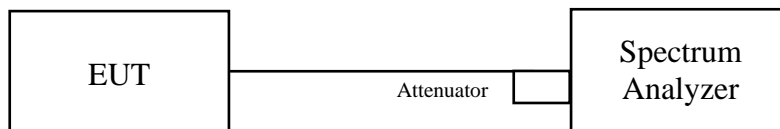
N_{ant} : Number of Transmit Antennas

G_1, G_2, \dots, G_n : Gain of Individual Antennas (Same for Each Antenna)

Test procedure

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

Test Setup



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

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Test Data

Non-Beamforming mode

802.11b

Channel	Frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
1	2412	-3.02	8	Pass
2	2417	-3.16	8	Pass
6	2437	-1.43	8	Pass
10	2457	-2.03	8	Pass
11	2462	-2.67	8	Pass

802.11g

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	1	2412	-15.16	3.01	-12.15	8	Pass
	2	2417	-9.86	3.01	-6.85	8	Pass
	6	2437	-8.48	3.01	-5.46	8	Pass
	10	2457	-10.86	3.01	-7.85	8	Pass
	11	2462	-15.18	3.01	-12.17	8	Pass
1	1	2412	-15.74	3.01	-12.72	8	Pass
	2	2417	-11.00	3.01	-7.99	8	Pass
	6	2437	-9.94	3.01	-6.93	8	Pass
	10	2457	-11.61	3.01	-8.60	8	Pass
	11	2462	-15.72	3.01	-12.71	8	Pass

NOTE: Directional gain = 5.31 dBi < 6 dBi, so the limit no need to reduced.

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802.11ax (HE20)

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	1	2412	-16.72	3.01	-13.71	8	Pass
	2	2417	-12.68	3.01	-9.67	8	Pass
	6	2437	-10.00	3.01	-6.99	8	Pass
	10	2457	-13.69	3.01	-10.68	8	Pass
	11	2462	-15.65	3.01	-12.64	8	Pass
1	1	2412	-16.17	3.01	-13.16	8	Pass
	2	2417	-13.02	3.01	-10.01	8	Pass
	6	2437	-9.86	3.01	-6.85	8	Pass
	10	2457	-14.19	3.01	-11.18	8	Pass
	11	2462	-16.63	3.01	-13.62	8	Pass

NOTE: Directional gain = 5.31 dBi < 6 dBi, so the limit no need to reduced.

802.11ax (HE40)

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	3	2422	-20.17	3.01	-17.16	8	Pass
	4	2427	-20.77	3.01	-17.76	8	Pass
	6	2437	-16.95	3.01	-13.94	8	Pass
	8	2447	-19.68	3.01	-16.67	8	Pass
	9	2452	-20.10	3.01	-17.08	8	Pass
1	3	2422	-19.88	3.01	-16.87	8	Pass
	4	2427	-20.21	3.01	-17.20	8	Pass
	6	2437	-18.51	3.01	-15.50	8	Pass
	8	2447	-19.67	3.01	-16.66	8	Pass
	9	2452	-19.59	3.01	-16.58	8	Pass

NOTE: Directional gain = 5.31 dBi < 6 dBi, so the limit no need to reduced.

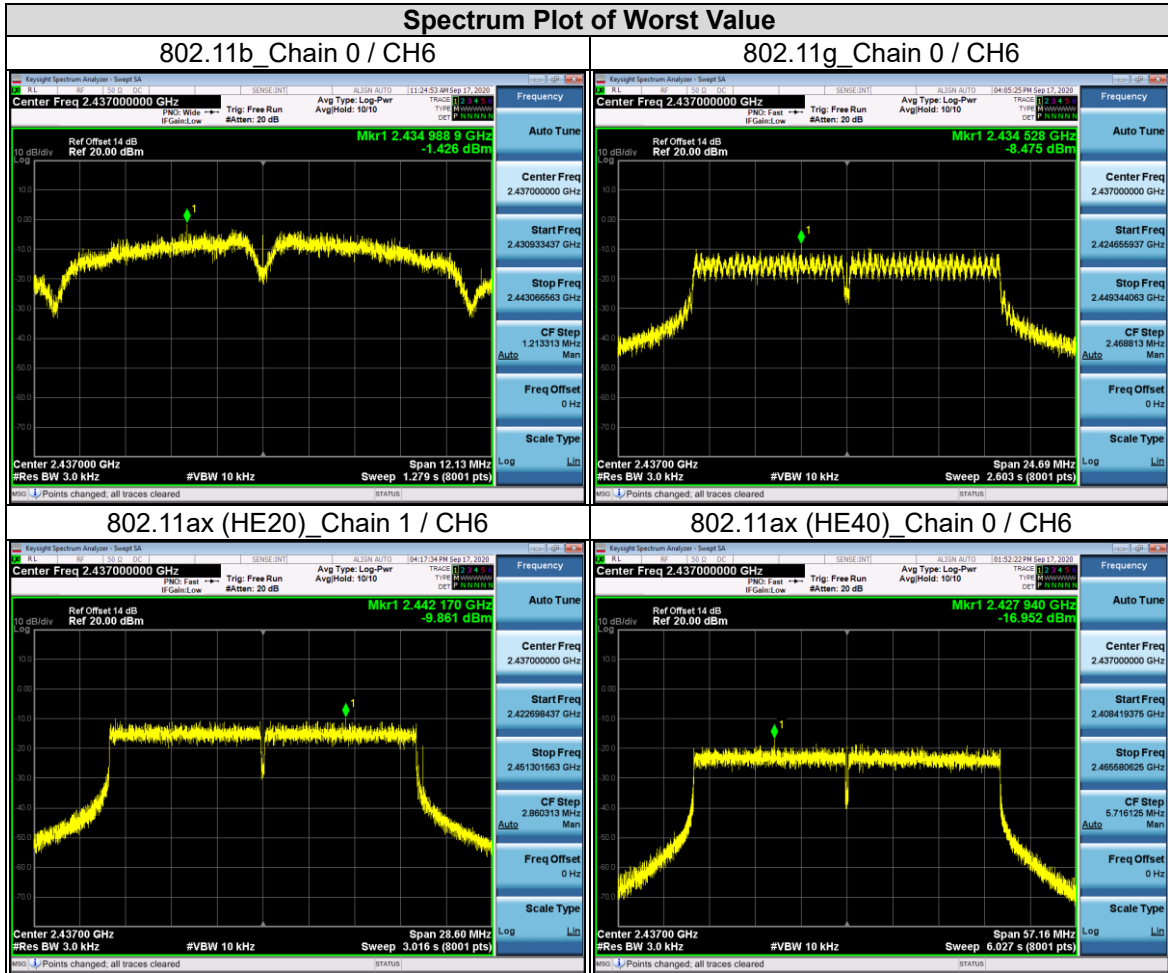
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Beamforming mode

802.11ax (HE20)

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	1	2412	-14.36	3.01	-11.35	8	Pass
	2	2417	-10.92	3.01	-7.91	8	Pass
	6	2437	-1.36	3.01	1.66	8	Pass
	10	2457	-10.81	3.01	-7.80	8	Pass
	11	2462	-10.66	3.01	-7.65	8	Pass
1	1	2412	-20.09	3.01	-17.08	8	Pass
	2	2417	-17.73	3.01	-14.72	8	Pass
	6	2437	-9.42	3.01	-6.41	8	Pass
	10	2457	-17.46	3.01	-14.45	8	Pass
	11	2462	-20.70	3.01	-17.68	8	Pass

NOTE: Directional gain = 5.31 dBi < 6 dBi, so the limit no need to reduced.

802.11ax (HE40)

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	3	2422	-9.96	3.01	-6.94	8	Pass
	6	2437	1.20	3.01	4.21	8	Pass
	9	2452	-9.72	3.01	-6.71	8	Pass
1	3	2422	-24.52	3.01	-21.50	8	Pass
	6	2437	-13.06	3.01	-10.05	8	Pass
	9	2452	-24.90	3.01	-21.89	8	Pass

NOTE: Directional gain = 5.31 dBi < 6 dBi, so the limit no need to reduced.

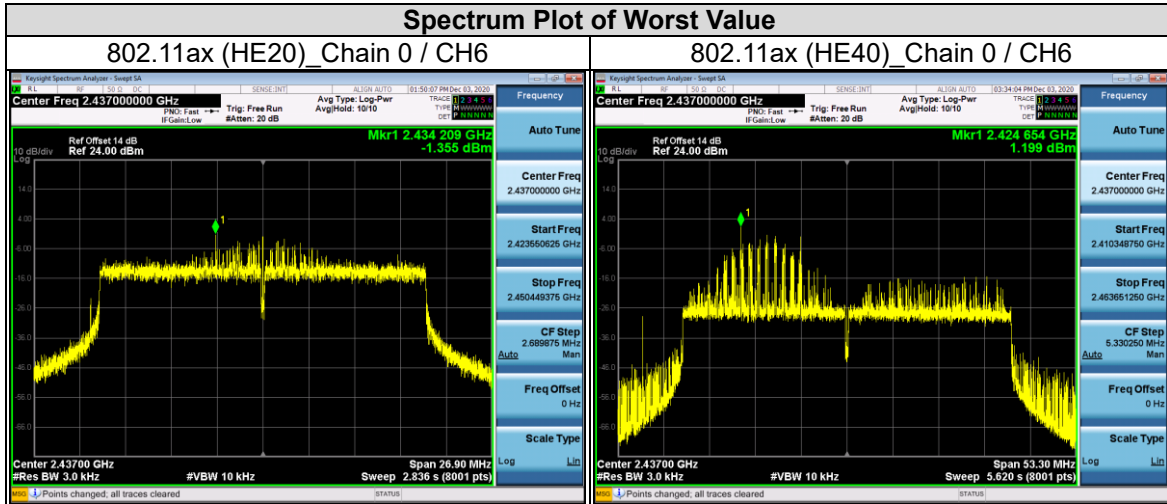
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9.4. Conducted Out of Band Emission

Requirements

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b) (3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209 (a) is not required.

Test procedure

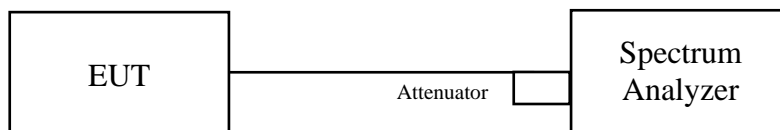
Measurement Procedure REF

- Set the RBW = 100 kHz.
- Set the VBW \geq 300 kHz.
- Set the span to 1.5 times the DTS bandwidth.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

Measurement Procedure OOBE

- Set RBW = 100 kHz.
- Set VBW \geq 300 kHz.
- Detector = peak.
- Sweep = auto couple.
- Trace Mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

Test Setup



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

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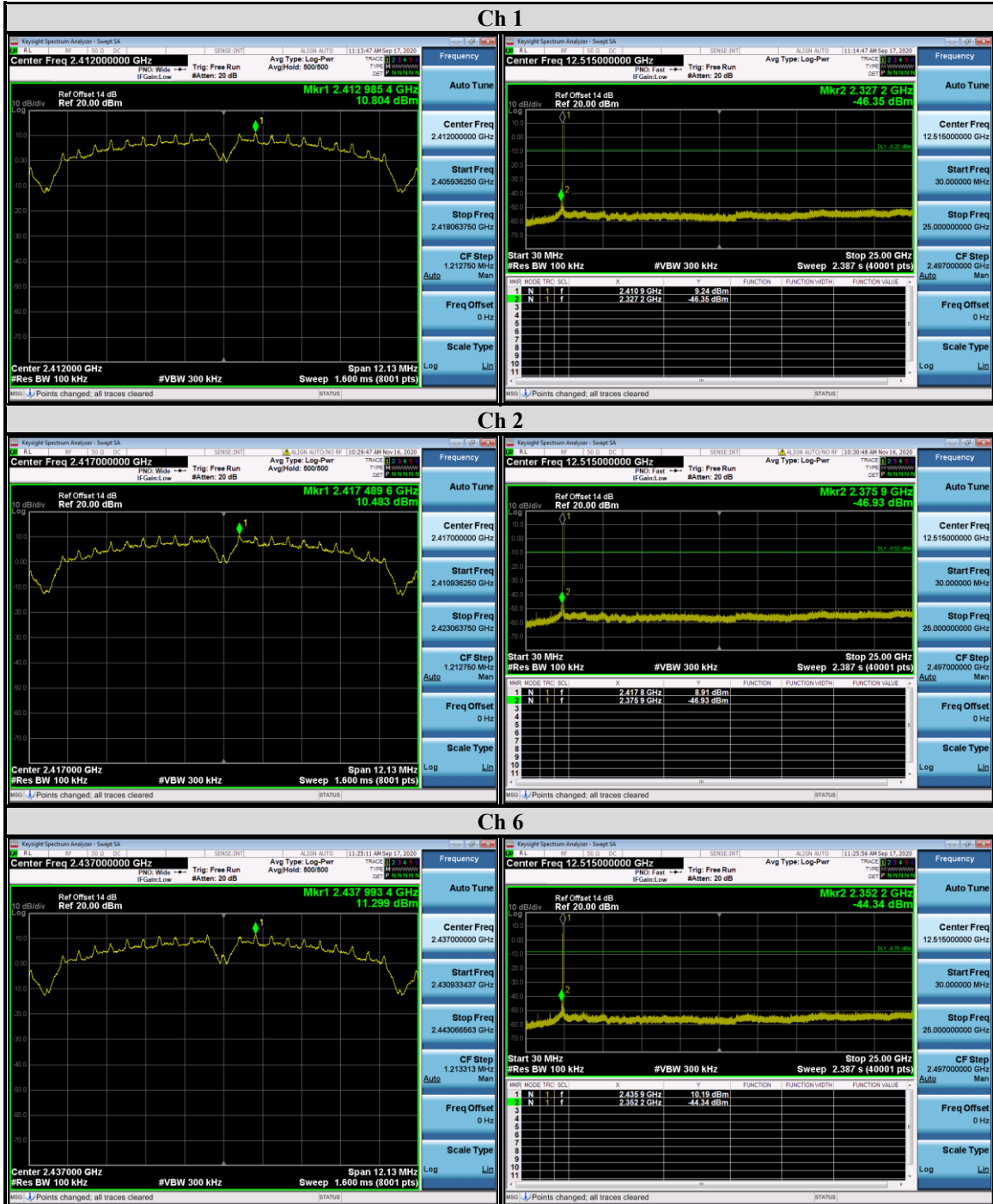
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Test Data

Non-Beamforming mode

802.11b



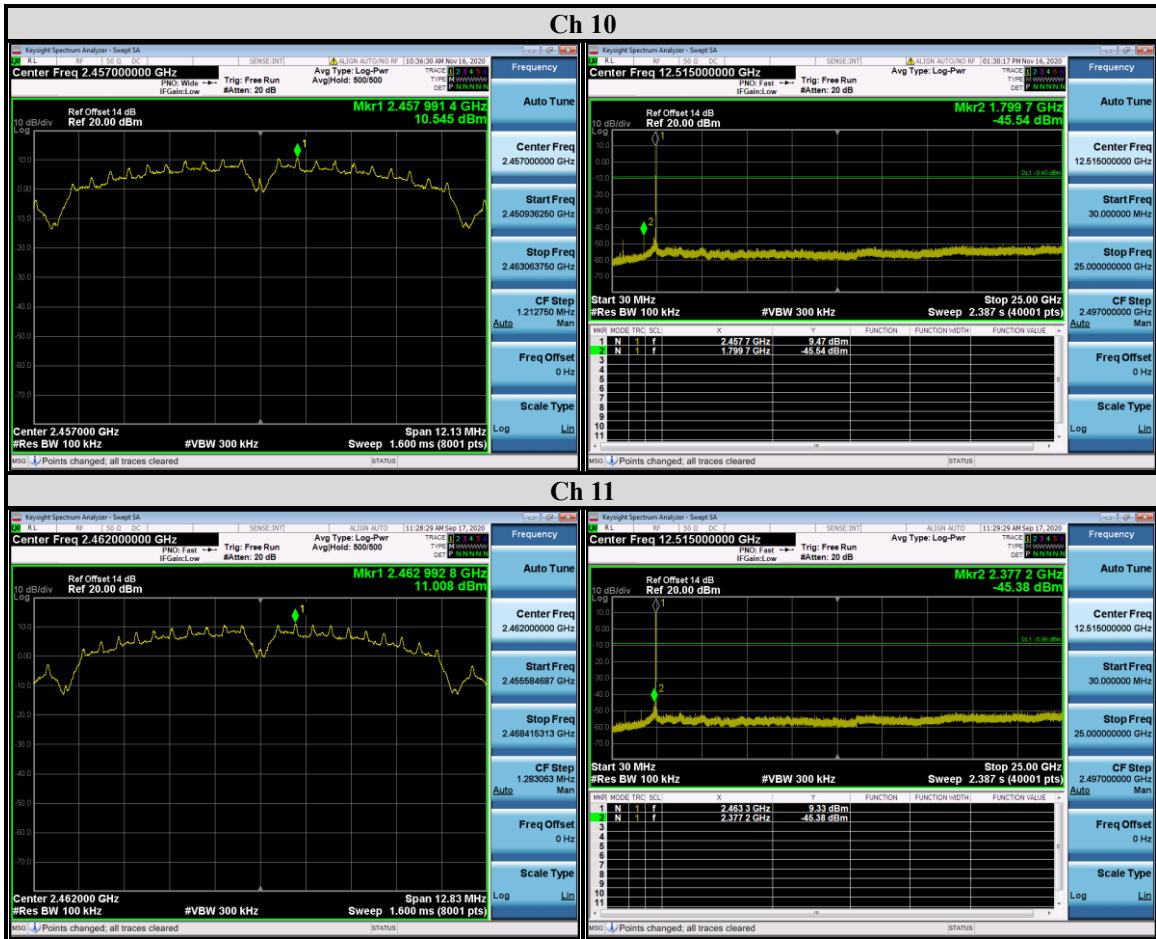
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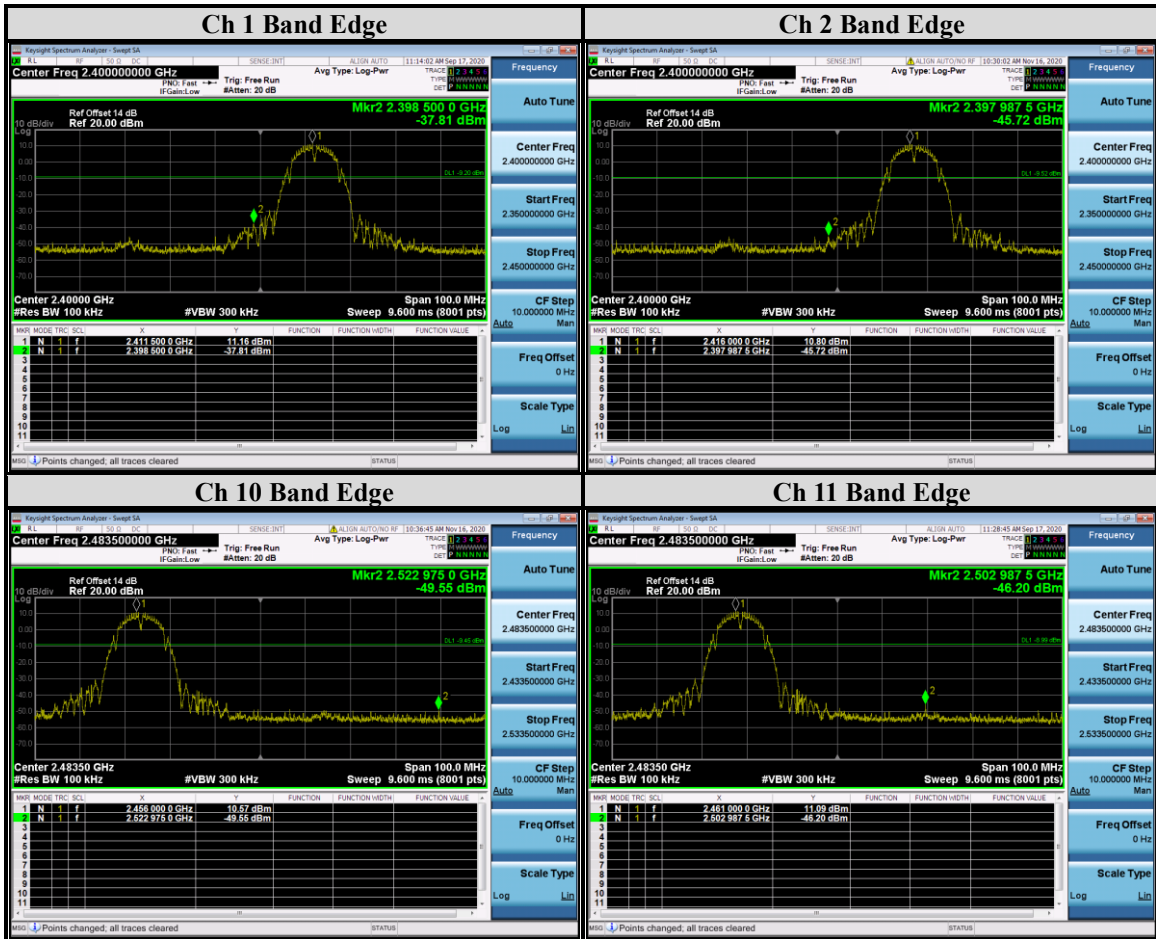


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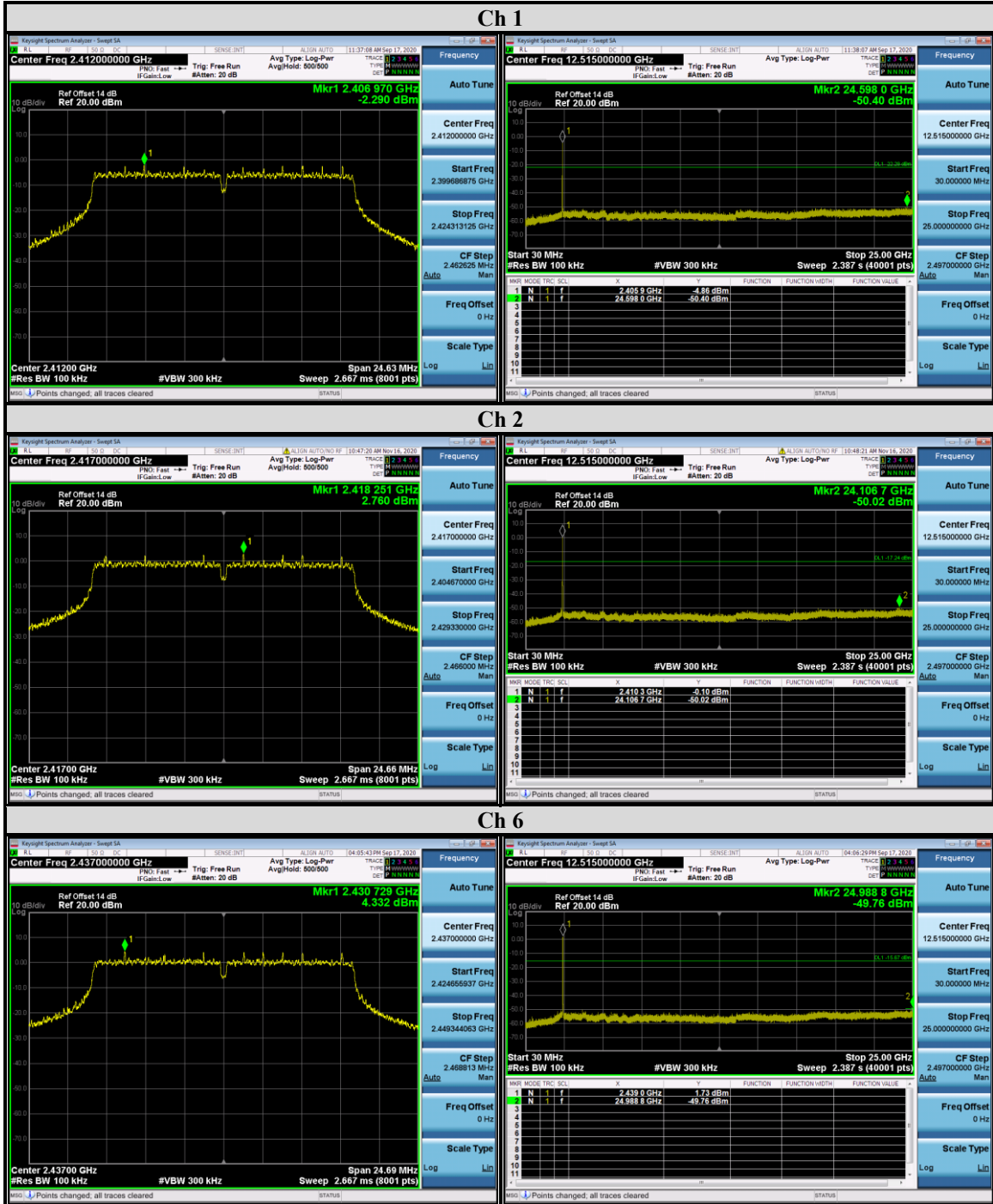
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802.11g

CHAIN 0



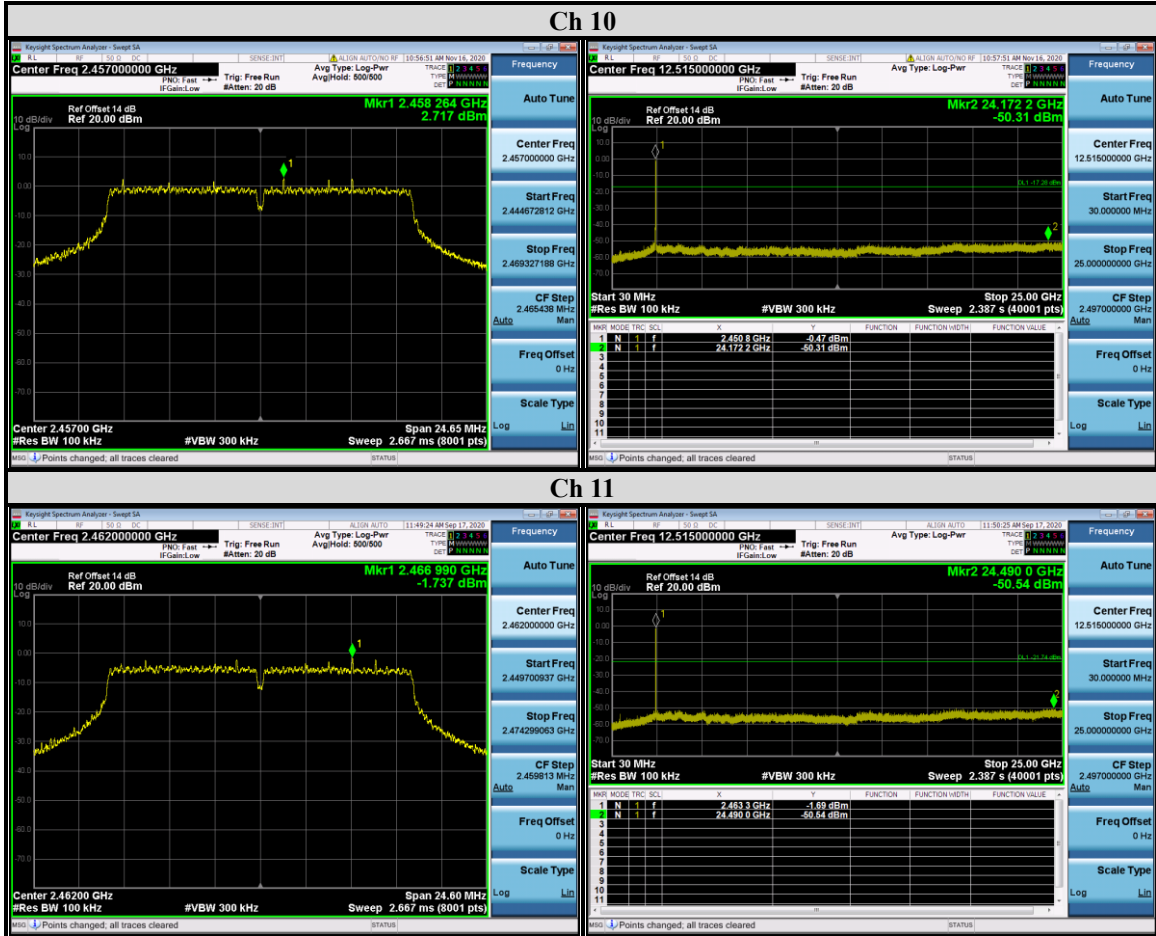
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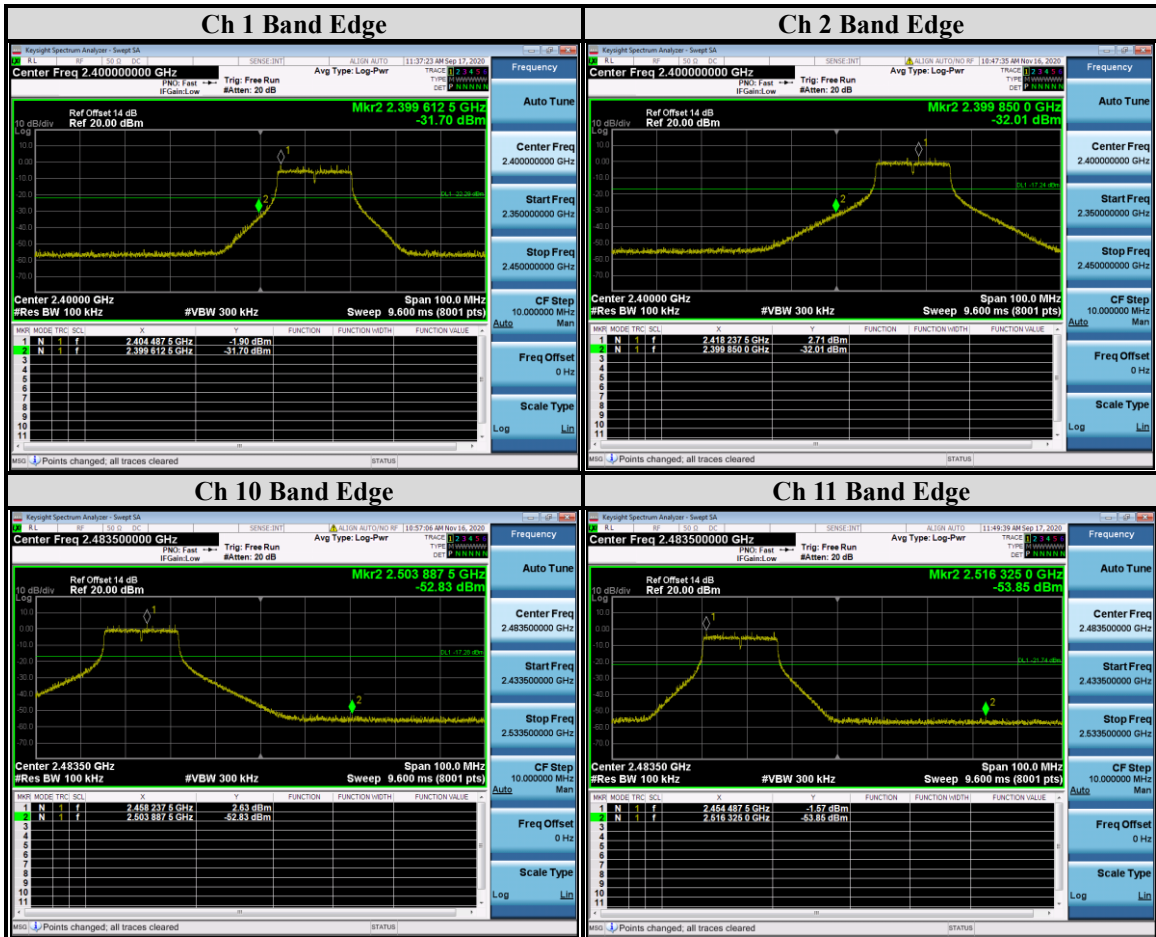
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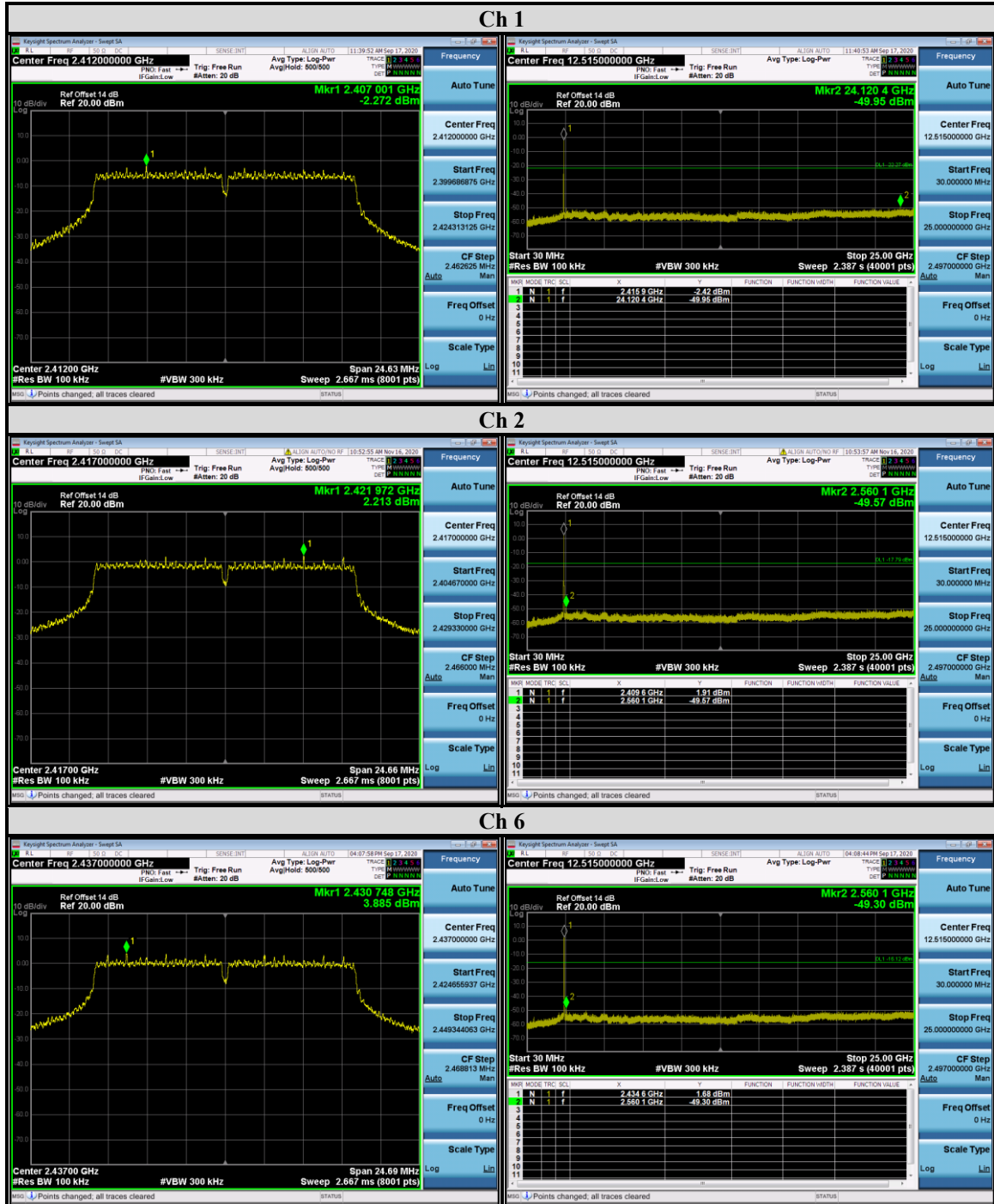
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