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TEST REPORT

Eurofins KCTL Co.,Ltd. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-70-5008-1021 FAX: 82-505-299-8311 www.kctl.co.kr	Report No.: KR25-SRF0108 Page (1) of (73)	eurofins KCTL

1. Client

- Name : SAM JIN CO., LTD.
- Address : 81, Anyangcheonseo-ro, Manan-gu, Anyang-si, Gyeonggi-do, Republic of Korea
- Date of Receipt : 2025-03-14

2. Use of Report : Certification

3. Name of Product / Model : V4 HUB / GP-AEOHUBV4US

4. Manufacturer / Country of Origin : SAM JIN CO., LTD. / Indonesia

5. FCC ID : 2AF4SGP-AEOHUBV4US

6. IC Certificate No. : 20753-GPAEOHUBV4

7. Date of Test : 2025-05-14 to 2025-05-22

8. Location of Test : ■ Permanent Testing Lab ☐ On Site Testing
(Address:65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea)

9. Test method used : FCC Part 15 Subpart E, 15.407
RSS-247 Issue 3 August 2023
RSS-Gen Issue 5 February 2021

10. Test Result : Refer to the test result in the test report

Affirmation	Tested by Name : Hosung Lee (Signature)	Technical Manager Name : Harim Lee (Signature)

2025-06-12

Eurofins KCTL Co.,Ltd.

As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by Eurofins KCTL Co.,Ltd.

REPORT REVISION HISTORY

Date	Revision	Page No
2025-06-12	Originally issued	-

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General remarks for test reports

Statement concerning the uncertainty of the measurement systems used for the tests

(may be required by the product standard or client)

☐ **Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:**

Procedure number, issue date and title:

Calculations leading to the reported values are on file with the testing laboratory that conducted the testing.

☒ **Statement not required by the standard or client used for type testing**

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1. General information

Client	:	SAM JIN CO., LTD.
Address	:	81, Anyangcheonseo-ro, Manan-gu, Anyang-si, Gyeonggi-do, Republic of Korea
Manufacturer	:	SAM JIN CO., LTD.
Address	:	81, Anyangcheonseo-ro, Manan-gu, Anyang-si, Gyeonggi-do, Republic of Korea
Factory	:	PT.SAMJIN
Address	:	Bekasi International Industrial Estate,Jl. Inti Raya Ⅱ Block C2 No. 10, Desa Sukaresmi,Kec, Cikarang Selatan Bekasi 17550
Laboratory	:	Eurofins KCTL Co.,Ltd.
Address	:	65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
Accreditations	:	FCC Site Designation No: KR0040, FCC Site Registration No: 687132 VCCI Registration No. : R-20080, G-20078, C-20059, T-20056 CAB Identifier: KR0040, ISED Number: 8035A KOLAS No.: KT231

2. Device information

Equipment under test	:	V4 HUB
Model	:	GP-AEOHUBV4US
Derivative Model for FCC	:	IM6001-V4P01, IM6001-V4P02, IM6001-V4P03, IM6001-V4P04, IM6001-V4P05, IM6001-V4P06, IM6001-V4P07, IM6001-V4P08, IM6001-V4P09, IM6001-V4P10, GP-AEOHUBV4EU, GP-AEOHUBV4EU1, GP-AEOHUBV4EU2, GP-AEOHUBV4EU3, GP-AEOHUBV4EU4, GP-AEOHUBV4EU5, GP-AEOHUBV4EU6, GP-AEOHUBV4EU7, GP-AEOHUBV4EU8, GP-AEOHUBV4EU9, GP-AEOHUBV4EU10, GP-AEOHUBV4US1, GP-AEOHUBV4US2, GP-AEOHUBV4US3, GP-AEOHUBV4US4, GP-AEOHUBV4US5, GP-AEOHUBV4US6, GP-AEOHUBV4US7, GP-AEOHUBV4US8, GP-AEOHUBV4US9, GP-AEOHUBV4US10, GP-AEOHUBV4AN, GP-AEOHUBV4CN
Modulation technique		WIFI(802.11a/n/ac) : OFDM
Number of channels		UNII 1 : 4 ch (20 ㎒), 2 ch (40 ㎒), 1 ch (80 ㎒) UNII 3 : 5 ch (20 ㎒), 2 ch (40 ㎒), 1 ch (80 ㎒)
Power source	:	DC 5 V
Antenna specification		SMD Antenna
Antenna gain	:	UNII 1 : 4.39 dBi UNII 3 : 3.73 dBi
Frequency range		UNII 1 : 5 180 ㎒ ~ 5 240 ㎒ (802.11a/n/ac_HT20/VHT20) UNII 1 : 5 190 ㎒ ~ 5 230 ㎒ (802.11n/ac_HT40/VHT40) UNII 1 : 5 210 ㎒ (802.11ac_VHT80) UNII 3 : 5 745 ㎒ ~ 5 825 ㎒ (802.11a/n/ac_HT20/VHT20) UNII 3 : 5 755 ㎒ ~ 5 795 ㎒ (802.11n/ac_HT40/VHT40) UNII 3 : 5 775 ㎒ (802.11ac_VHT80)
Software version	:	V1.0
Hardware version	:	V1.0
Test device serial No.	:	Conducted : 503200012 Radiated : 503200014
Operation temperature	:	0 ℃ ~ 40 ℃

2.1. Information about derivative model

The difference between basic model and alternative model is as below.

	Derivative Model Name	Information
FCC	IM6001-V4P01, IM6001-V4P02, IM6001-V4P03, IM6001-V4P04, IM6001-V4P05, IM6001-V4P06, IM6001-V4P07, IM6001-V4P08, IM6001-V4P09, IM6001-V4P10, GP-AEOHUBV4EU, GP-AEOHUBV4EU1, GP-AEOHUBV4EU2, GP-AEOHUBV4EU3, GP-AEOHUBV4EU4, GP-AEOHUBV4EU5, GP-AEOHUBV4EU6, GP-AEOHUBV4EU7, GP-AEOHUBV4EU8, GP-AEOHUBV4EU9, GP-AEOHUBV4EU10, GP-AEOHUBV4US1, GP-AEOHUBV4US2, GP-AEOHUBV4US3, GP-AEOHUBV4US4, GP-AEOHUBV4US5, GP-AEOHUBV4US6, GP-AEOHUBV4US7, GP-AEOHUBV4US8, GP-AEOHUBV4US9, GP-AEOHUBV4US10, GP-AEOHUBV4AN, GP-AEOHUBV4CN	Marketing and External casing difference

2.2. Frequency/channel operations

This device contains the following capabilities:
WLAN (11a/n/ac)

UNII 1

Ch.	Frequency (MHz)
36	5 180
40	5 200
48	5 240

UNII 3

Ch.	Frequency (MHz)
149	5 745
157	5 785
165	5 825

Table 2.2-1. 802.11a/n/ac HT20/VHT20 mode

UNII 1

Ch.	Frequency (MHz)
38	5 190
46	5 230

UNII 3

Ch.	Frequency (MHz)
151	5 755
159	5 795

Table 2.2-2. 802.11n/ac HT40/VHT40 mode

UNII 1

Ch.	Frequency (MHz)
42	5 210

UNII 3

Ch.	Frequency (MHz)
155	5 775

Table 2.2-3. 802.11ac VHT80 mode

2.3. RF power setting in TEST SW

Test Program	Test mode
Qualcomm QRCT v4.1	802.11a/n_HT20/40/ac_VHT20/40/80

Mode	Frequency Band	RF Power setting value
802.11a	UNII-1	17
	UNII-3	17
802.11n_HT20	UNII-1	18
	UNII-3	17
802.11n_HT40	UNII-1	13
	UNII-3	16
802.11ac_VHT20	UNII-1	18
	UNII-3	17
802.11ac_VHT40	UNII-1	13
	UNII-3	16
802.11ac_VHT80	UNII-1	11
	UNII-3	16

2.4. Simultaneously transmission condition

Item	Technology	Test Mode	Frequency [㎒]
Case 1	Thread	CH26	2 480
	Bluetooth Low Energy	1 Mbps	2 480
Case 2	Thread	CH26	2 480
	WLAN 2.4 ㎓	802.11n HT40	2 422
Case 3	Thread	CH26	2 480
	WLAN 5 ㎓	802.11ac VHT20	5 180

Notes.
Simultaneous condition was performed as a worst case which is configured as a combination of lowest margin for each mode during radiated spurious emission.

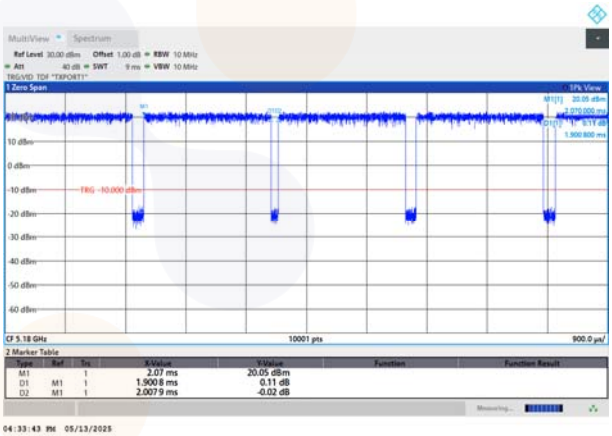
2.5. Duty Cycle Factor

Test mode	Period (ms)	T_{on} time (ms)	Duty cycle		Duty cycle factor (dB)
			(Linear)	(%)	
802.11a	2.136	2.030	0.950 3	95.03	0.22
802.11n_HT20	2.059	1.889	0.917 4	91.74	0.37
802.11n_HT40	1.034	0.928	0.897 5	89.75	0.47
802.11ac_VHT20	2.008	1.901	0.946 7	94.67	0.24
802.11ac_VHT40	1.445	0.936	0.647 8	64.78	1.89
802.11ac_VHT80	0.562	0.456	0.811 5	81.15	0.91

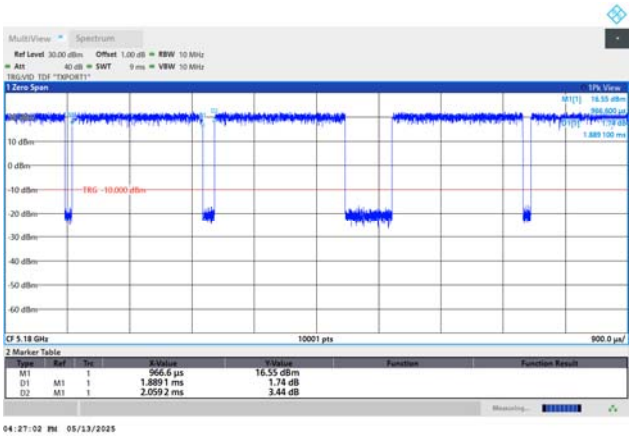
Notes.
1. Duty cycle (Linear) = T_{on} time / Period
2. DCF(Duty cycle factor) = 10log(1/duty cycle)
3. DCF is not compensated to average result if duty cycle is more than 98%

802.11a

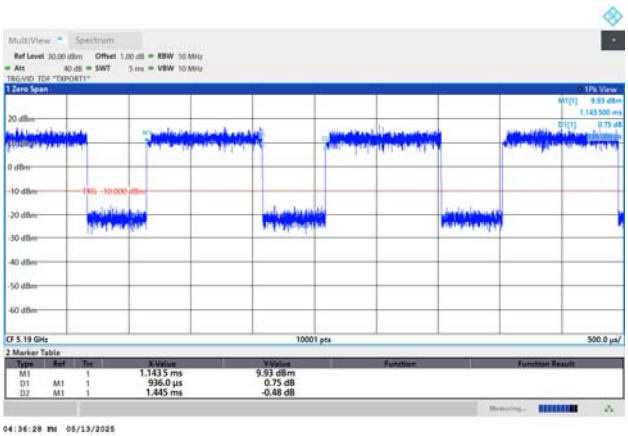
802.11ac_VHT20

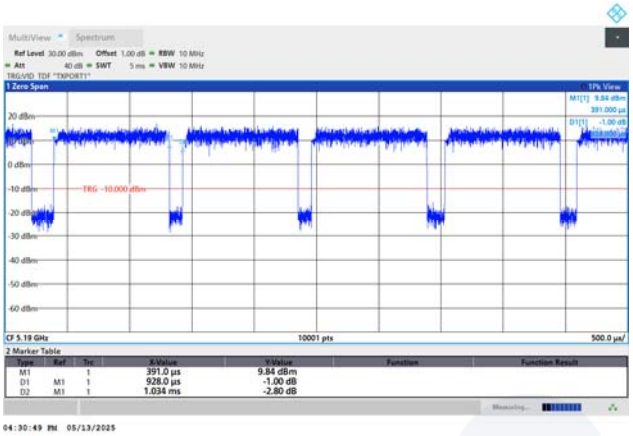


802.11n_HT20



802.11ac_VHT40



802.11n_HT40	802.11ac_VHT80
	

3. Antenna requirement

Requirement of FCC part section 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

Requirement of RSS-Gen Section 6.8:

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

- The transmitter has permanently attached SMD Antenna (Internal antenna) on board.
- The E.U.T Complies with the requirement of §15.203, §15.247, §15.407.

4. Summary of tests

FCC Part section(s)	IC Rule Reference	Parameter	Test Condition	Test results
15.407(a)	RSS-247 Issue 2, 6.2	Maximum conducted output power	Conducted	Pass
15.407(a)	RSS-247 Issue 2, 6.2	Maximum power spectral density		Pass
15.407(a)	RSS-Gen Issue 5, 6.7	26 dB Channel Bandwidth		Pass
15.407(e)	RSS-247 Issue 2, 6.2.4	6 dB Channel Bandwidth		Pass
-	RSS-Gen Issue 5, 6.7	Occupied Bandwidth		Pass
15.407(g)	RSS-Gen 6.11	Frequency Stability		Pass
15.407(h)	-	DFS -Channel closing transmission time -Channel move time -Non occupied period		Pass
15.207(a)	RSS-Gen Issue 5, 8.8	AC Conducted Emissions		Pass
15.407(b), 15.205(a), 15.209(a)	RSS-Gen Issue 5, 8.9, 8.10 RSS-247 Issue 2, 6.2	Spurious emission	Radiated	Pass
		Band-edge, restricted band		Pass

Notes:

1. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst-case emissions.
2. According to exploratory test no any obvious emission were detected from 9 ㎑ to 30 ㎒. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore, sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.
3. EUT was investigated in three orthogonal orientations X, Y and Z. it was determined that **X** orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in **X** orientation.
4. The test procedure(s) in this report were performed in accordance as following.
   - ANSI C63.10-2013
   - KDB 662911 D01 v02r01
   - KDB 789033 D02 v02r01
   - KDB 905462 D02 UNII DFS compliance procedure new rules.
5. Based on the baseline scan, the worst-case data rates were:
   802.11a mode: 6Mbps
   802.11n HT20 mode: MCS0
   802.11n HT40 mode: MCS0
   802.11ac VHT20 mode: MCS0
   802.11ac VHT40 mode: MCS0
   802.11ac VHT80 mode: MCS0
6. For Simultaneous radiated spurious emission, please refer to thread test report(KR25-SRF0110).

5. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of k=2 to indicated a 95 % level of confidence. The measurement data shown herein meets of exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded uncertainty (±)	
Maximum Peak Output Power	0.9 dB	
Peak Power Spectral Density	1.0 dB	
Channel Bandwidth	0.1 %	
Occupied Bandwidth	0.1 %	
Dynamic Frequency Selection	0.1 ms	
Conducted spurious emission	2.0 dB	
Radiated spurious Emissions (Bandedge, restricted band)	Below 30 MHz	2.3 dB
	30 MHz to 1 000 MHz	2.6 dB
	1 000 MHz to 18 000 MHz	4.8 dB
	Above 18 000 MHz	4.8 dB
Conducted Emissions	150 kHz to 30 MHz	2.9 dB

6. Measurement results explanation example

The offset level is set in the spectrum analyzer to compensate the RF cable loss factor between EUT conducted output port and spectrum analyzer.
With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Frequency (㎒)	Factor(㏈)	Frequency (㎒)	Factor(㏈)
30	9.78	9 000	12.26
50	9.86	10 000	12.35
100	9.98	11 000	12.52
200	10.15	12 000	12.49
300	10.26	13 000	12.57
400	10.41	14 000	12.68
500	10.45	15 000	12.73
600	10.58	16 000	12.79
700	10.68	17 000	12.81
800	10.75	18 000	13.04
900	10.82	19 000	13.05
1 000	10.86	20 000	13.29
2 000	11.41	21 000	13.23
3 000	11.74	22 000	13.18
4 000	11.94	23 000	13.42
5 000	12.01	24 000	13.11
6 000	12.08	25 000	13.34
7 000	12.29	26 000	13.51
8 000	12.23	26 500	13.52

Notes:
Offset(㏈) = RF cable loss(㏈) + Attenuator(㏈)

7. Test results

7.1. Maximum conducted output power

Test setup

EUT — Attenuator — Spectrum analyzer

Limit

According to §15.407(a), RSS-247(6.2)

FCC

Band	EUT category		Conducted output power limit
UNII-1		Outdoor access point	1 W (30 dBm)
		Indoor access point	
		Fixed point-to-point access point	
	√	Client device	250 mW (23.98 dBm)
UNII-2A			250 mW or 11 dBm + 10logB[1)]
UNII-2C			250 mW or 11 dBm + 10logB[1)]
UNII-3	√		1 W (30 dBm)

IC

Band	Maximum e.i.r.p. limit
UNII-1	200 mW or 10 + 10 logB[2)], dBm
UNII-2A	1 W or 17 dBm + 10logB[2)]
UNII-2C	1 W or 17 dBm + 10logB[2)]
UNII-3	1 W (30 dBm)

Note:

1) Conducted output power limit B is the 26 dB emission bandwidth.
2) Maximum e.i.r.p. limit B is the 99% emission bandwidth.

Test procedure

ANSI C63.10-2013-Section 12.3.2.4 or 12.3.3.1, 14.2
KDB 789033 D02 v02r01 - Section E.2.d) or E.3.a)
KDB 662911 D01 v02r01 – Section E).1) and Section F)

Test settings
Used test method is Section E.3.a)

◆ **KDB 789033 D02 v02r01**

Section E.2.d)
Method SA-2 (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction):

(i) Measure the duty cycle, x, of the transmitter output signal as described in II.B..
(ii) Set span to encompass the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
(iii) Set RBW = 1 ㎒
(iv) Set RBW ≥ 3 ㎒
(v) Number of points in sweep ≥ 2×span/RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
(vi) Sweep time = auto.
(vii) Detector = power averaging (rms), if available. Otherwise use sample detector mode.
(viii) Do not use sweep triggering. Allow the sweep to "free run."
(ix) Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed to ensure that the average accurately represents the true average over the on and off periods of the transmitter.
(x) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 ㎒ intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
(xi) Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10 log(1/0,25) = 6 ㏈ if the duty cycle is 25%.

Section E.3.a)
Method PM (Measurement using an RF average power meter):

(i) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

- The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
- At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
- The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five

(ii) If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in II
(iii) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
(iv) Adjust the measurement in ㏈m by adding 10 log (1/x) where x is the duty cycle (e.g., 10 log (1/0.25) if the duty cycle is 25%).

Test results

Conducted Output Power

Test mode	Band	Frequency (MHz)	Measured output power			FCC Limit (dBm)	IC Limit (dBm)
			Reading (dBm)	DCF (dB)	Result (dBm)		
802.11a	UNII 1	5 180	**17.16**	0.22	17.38	23.98	22.17
		5 200	17.07		17.29	23.98	22.17
		5 240	16.87		17.09	23.98	22.17
	UNII 3	5 745	**18.23**		18.45	30.00	30.00
		5 785	17.47		17.69	30.00	30.00
		5 825	16.88		17.10	30.00	30.00
802.11n HT20	UNII 1	5 180	17.57	0.37	17.94	23.98	22.48
		5 200	**17.70**		18.07	23.98	22.48
		5 240	17.44		17.81	23.98	22.48
	UNII 3	5 745	**17.73**		18.10	30.00	30.00
		5 785	17.11		17.48	30.00	30.00
		5 825	16.33		16.70	30.00	30.00
802.11n HT40	UNII 1	5 190	12.03	0.47	12.50	23.98	23.01
		5 230	**12.22**		12.69	23.98	23.01
	UNII 3	5 755	**16.71**		17.18	30.00	30.00
		5 795	16.07		16.54	30.00	30.00
802.11ac VHT20	UNII 1	5 180	**17.60**	0.24	17.84	23.98	22.48
		5 200	17.54		17.78	23.98	22.48
		5 240	17.37		17.61	23.98	22.48
	UNII 3	5 745	**17.59**		17.83	30.00	30.00
		5 785	17.18		17.42	30.00	30.00
		5 825	16.47		16.71	30.00	30.00
802.11ac VHT40	UNII 1	5 190	**12.04**	1.89	13.93	23.98	23.01
		5 230	11.76		13.65	23.98	23.01
	UNII 3	5 755	**16.72**		18.61	30.00	30.00
		5 795	16.12		18.01	30.00	30.00
802.11ac VHT80	UNII 1	5 210	**9.95**	0.91	10.86	23.98	23.01
	UNII 3	5 775	**16.49**		17.40	30.00	30.00

Note:

1. Conducted Output power(dB m) = Average Reading (dB m) + DCF(dB)

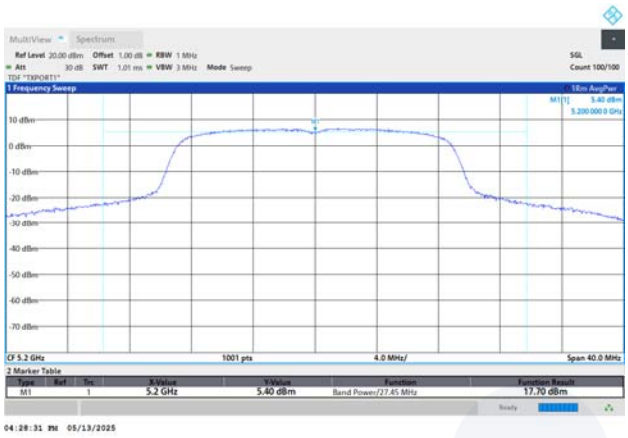
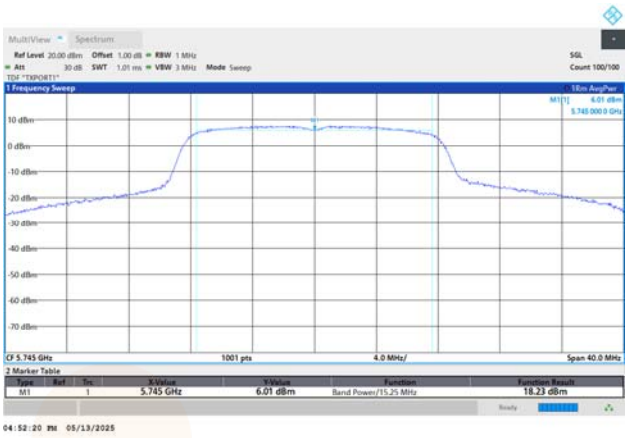
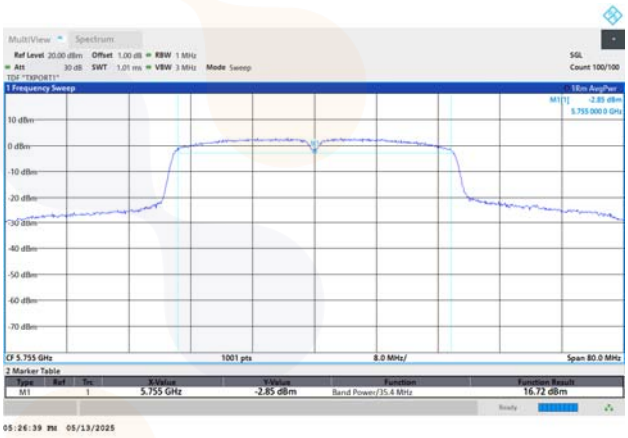
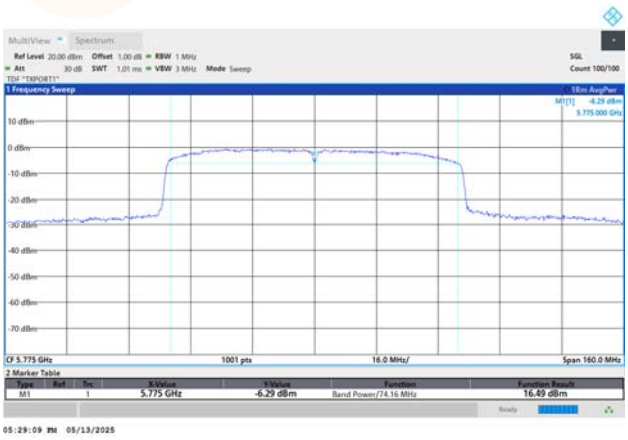
E.I.R.P.

Test mode	Band	Frequency (MHz)	Measured output power			MAX e.i.r.p Limit (dBm)
			Conducted output power (dBm)	ANT gain (dBi)	MAX e.i.r.p (dBm)	
802.11a	UNII 1	5 180	17.38	4.39	21.77	22.17
		5 200	17.29		21.68	22.17
		5 240	17.09		21.48	22.17
	UNII 3	5 745	18.45	3.73	22.18	30.00
		5 785	17.69		21.42	30.00
		5 825	17.10		20.83	30.00
802.11n HT20	UNII 1	5 180	17.94	4.39	22.33	22.48
		5 200	18.07		22.46	22.48
		5 240	17.81		22.20	22.48
	UNII 3	5 745	18.10	3.73	21.83	30.00
		5 785	17.48		21.21	30.00
		5 825	16.70		20.43	30.00
802.11n HT40	UNII 1	5 190	12.50	4.39	16.89	23.01
		5 230	12.69		17.08	23.01
	UNII 3	5 755	17.18	3.73	20.91	30.00
		5 795	16.54		20.27	30.00
802.11ac VHT20	UNII 1	5 180	17.84	4.39	22.23	22.48
		5 200	17.78		22.17	22.48
		5 240	17.61		22.00	22.48
	UNII 3	5 745	17.83	3.73	21.56	30.00
		5 785	17.42		21.15	30.00
		5 825	16.71		20.44	30.00
802.11ac VHT40	UNII 1	5 190	13.93	4.39	18.32	23.01
		5 230	13.65		18.04	23.01
	UNII 3	5 755	18.61	3.73	22.34	30.00
		5 795	18.01		21.74	30.00
802.11ac VHT80	UNII 1	5 210	10.86	4.39	15.25	23.01
	UNII 3	5 775	17.40	3.73	21.13	30.00

Notes:

1. E.I.R.P. Calculation: E.I.R.P. (dBm) = Conducted output power (dBm) + Antenna gain (dBi)

In order to simplify the report, attached plots were the worst case per bandwidth

UNII 1 / 802.11n HT20 / Mid ch.	UNII 3 / 802.11a / Low ch.
	
UNII 1 / 802.11n HT40 / High ch.	**UNII 3 / 802.11ac VHT40 / Low ch.**
	
UNII 1 / 802.11ac VHT80 / Mid ch.	**UNII 3 / 802.11ac VHT80 / Mid ch.**
	

7.2. Maximum Power Spectral Density

Test setup

EUT	—	Attenuator	—	Spectrum analyzer

Limit

According to §15.407(a), RSS-247(6.2)

Band	EUT category		Limit
UNII-1		Outdoor access point	17dBm/MHz
		Indoor access point	
		Fixed point-to-point access point	
	√	Client device	11 dBm /MHz
UNII-2A			11 dBm /MHz
UNII-2C			11 dBm /MHz
UNII-3	√		30 dBm /500 kHz

Test procedure

ANSI C63.10-2013 Section 12.3.2.2, 14.3.2.2
KDB 789033 D02 v02r01 – Section E and F
KDB 662911 D01 v02r01 - Section E). 2) and Section F)

Test settings

Section F

The rules requires "maximum power spectral density" measurements where the intent is to measure the maximum value of the time average of the power spectral density measured during a period of continuous transmission. Refer to III.A for additional guidance for devices that use channel aggregation.

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, "Compute power…." (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
2. Search function on the instrument to find the peak of the spectrum and record its value.
3. Adjustments to the peak value of the spectrum, if applicable:

   a) If Method SA-2 or SA-2 Alternative was used, add 10 log (1/x), where x is the duty cycle, to the peak of the spectrum.
   b) If Method SA-3 Alternative was used and the linear mode was used in II.E.2.g) (viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
4. The result is the Maximum PSD over 1MHz reference bandwidth
5. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the preceding procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in Section 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of RBWs less than 1MHz, or 500 kHz, "provided that the measured power is integrated over the full

reference bandwidth" to show the total power over the specified measurement bandwidth(i.e., 1 ㎒, or 500 ㎑). If measurements are performed using a reduced resolution bandwidth (< 1 ㎒, or < 500 ㎑) and integrated over 1 ㎒, or 500 ㎑ bandwidth, the following adjustments to the procedures apply:

a) Set RBW≥1/T, where T is defined in II.B.I.a).
b) Set VBW≥3 RBW.
c) If measurement bandwidth of Maximum PSD is specified in 500 ㎑, add 10 log (500 ㎑ /RBW) to the measured result, whereas RBW (<500 ㎑) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
d) If measurement bandwidth of Maximum PSD is specified in 1 ㎒, add 10 log (1㎒/RBW) to the measured result, whereas RBW (< 1 ㎒) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note:

- As a practical matter, it is recommended to use reduced RBW of 100 ㎑ for the II.F.5.c) and II.F.5.d), since RBW=100 ㎑ is available on nearly all spectrum analyzers.
- Method SA-2 is used.

Test results

Power spectral density

Test mode	Band	Frequency (MHz)	Measured PSD (dBm/MHz)	DCF (dB)	Maximum PSD (dB m/MHz)	Limit (dBm/MHz)
802.11a	UNII 1	5 180	5.13	0.22	5.35	11.00
		5 200	**5.21**		5.43	
		5 240	5.05		5.27	
802.11n HT20	UNII 1	5 180	4.70	0.37	5.07	11.00
		5 200	4.66		5.03	
		5 240	4.67		5.04	
802.11n HT40	UNII 1	5 190	-1.70	0.47	-1.23	11.00
		5 230	**-1.59**		-1.12	
802.11ac VHT20	UNII 1	5 180	4.57	0.24	4.81	11.00
		5 200	4.80		5.04	
		5 240	4.80		5.04	
802.11ac VHT40	UNII 1	5 190	-1.93	1.89	-0.04	11.00
		5 230	-1.69		0.20	
802.11ac VHT80	UNII 1	5 210	**-7.01**	0.91	-6.10	11.00

Test mode	Band	Frequency (MHz)	Measured PSD (dBm/500 kHz)	DCF (dB)	Maximum PSD (dB m /500 kHz)	Limit (dBm /500 kHz)
802.11a	UNII 3	5 745	**4.85**	0.22	5.07	30.00
		5 785	4.30		4.52	
		5 825	3.71		3.93	
802.11n HT20		5 745	4.45	0.37	4.82	
		5 785	4.01		4.38	
		5 825	3.28		3.65	
802.11n HT40		5 755	**0.55**	0.47	1.02	
		5 795	-0.44		0.03	
802.11ac VHT20		5 745	4.33	0.24	4.57	
		5 785	4.05		4.29	
		5 825	3.66		3.90	
802.11ac VHT40		5 755	0.23	1.89	2.12	
		5 795	-0.38		1.51	
802.11ac VHT80		5 775	**-3.32**	0.91	-2.41	

Notes:

1. Maximum PSD(dB m/500 kHz) = Reading (dB m/500 kHz) + D.C.F(dB)

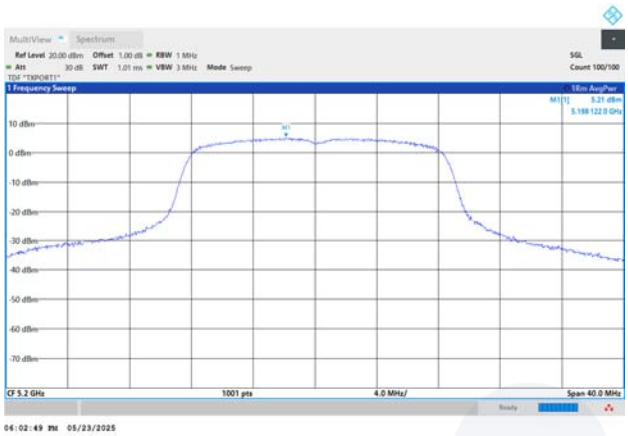
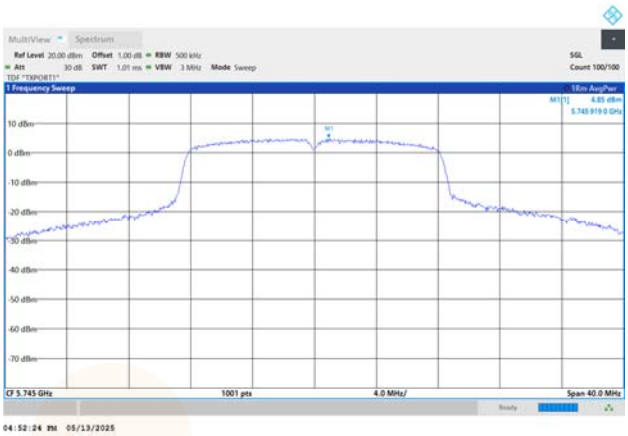
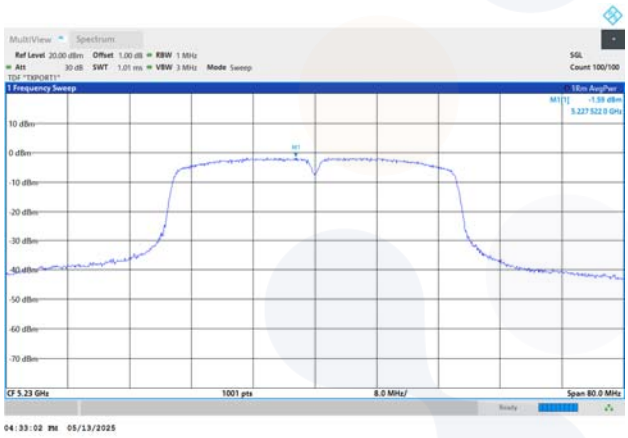
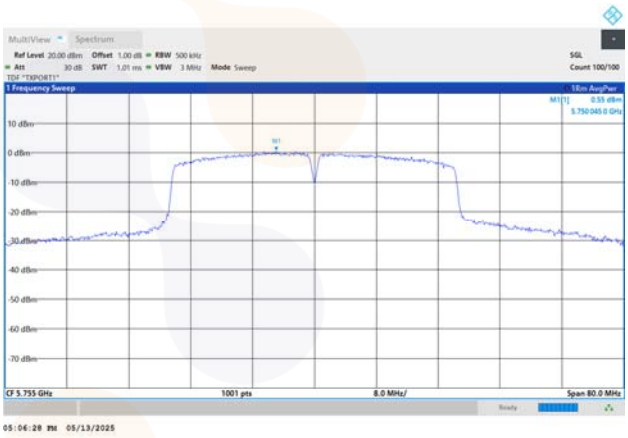
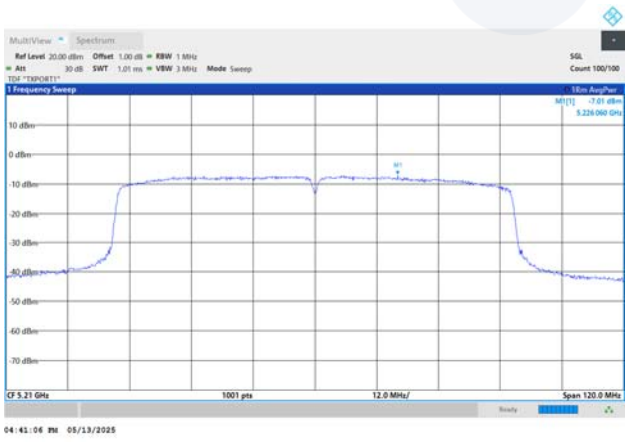
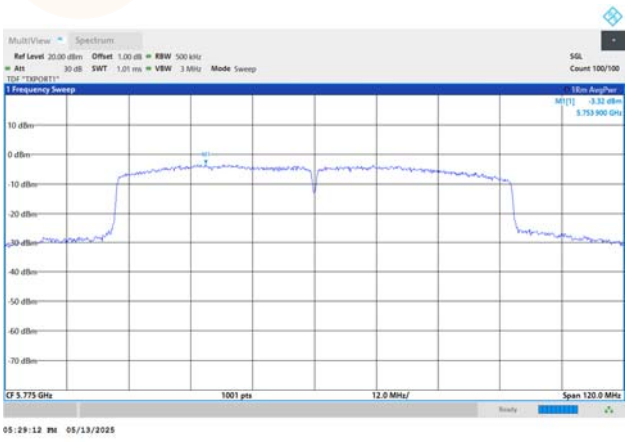
e.i.r.p spectral density

Test mode	Band	Frequency (MHz)	Measured PSD (dBm/MHz)	DCF (dB)	Maximum PSD (dBm/MHz)	ANT Gain (dBi)	E.I.R.P. PSD (dBm/MHz)	Limit (dBm/MHz)
802.11a	UNII 1	5 180	5.13	0.22	5.35	4.39	9.74	11.00
		5 200	5.21		5.43		9.82	
		5 240	5.05		5.27		9.66	
802.11n HT20	UNII 1	5 180	4.70	0.37	5.07	4.39	9.46	11.00
		5 200	4.66		5.03		9.42	
		5 240	4.67		5.04		9.43	
802.11n HT40	UNII 1	5 190	-1.70	0.47	-1.23	4.39	3.16	11.00
		5 230	-1.59		-1.12		3.27	
802.11ac VHT20	UNII 1	5 180	4.57	0.24	4.81	4.39	9.20	11.00
		5 200	4.80		5.04		9.43	
		5 240	4.80		5.04		9.43	
802.11ac VHT40	UNII 1	5 190	-1.93	1.89	-0.04	4.39	4.35	11.00
		5 230	-1.69		0.20		4.59	
802.11ac VHT80	UNII 1	5 210	-7.01	0.91	-6.10	4.39	-1.71	11.00

Notes:

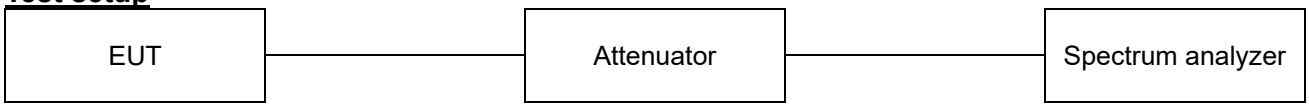
1. Maximum PSD(dBm/MHz) = Reading (dBm/MHz) + D.C.F(dB)
2. E.I.R.P PSD (dBm/MHz) = Maximum PSD (dBm/MHz) + Antenna gain (dBi)

In order to simplify the report, attached plots were the worst case per bandwidth

UNII 1 / 802.11a / Mid ch.	UNII 3 / 802.11a / Low ch.
	
UNII 1 / 802.11n HT40 / High ch.	**UNII 3 / 802.11n HT40 / Low ch..**
	
UNII 1 / 802.11ac VHT80 / Mid ch.	**UNII 3 / 802.11ac VHT80 / Mid ch.**
	

7.3. 26 dB Bandwidth & 99% Bandwidth

Test setup



Limit

N/A

Test procedure

ANSI C63.10-2013 Section 12.4
KDB 789033 D02 v02r01 - Section C.1 (26dB bandwidth)
KDB 789033 D02 v02r01 - Section D (99% bandwidth)

Test settings

1. 26 dB Bandwidth

a. Set RBW = approximately 1% of the emission bandwidth.
b. Set the VBW > RBW.
c. Detector = Peak.
d. Trace mode = max hold.
e. Measure the maximum width of the emission that is 26 dB down from the maximum 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%.

2. 99% Occupied Bandwidth

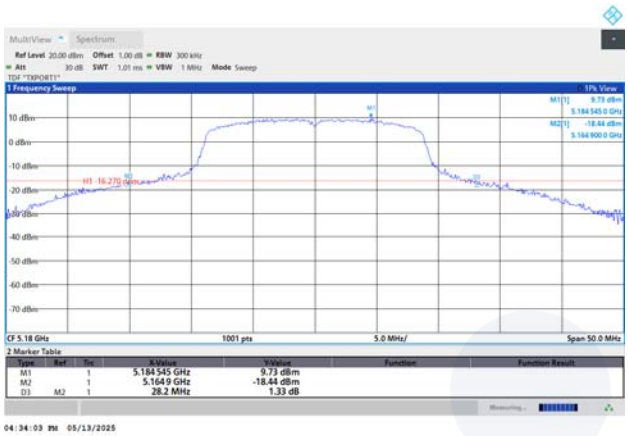
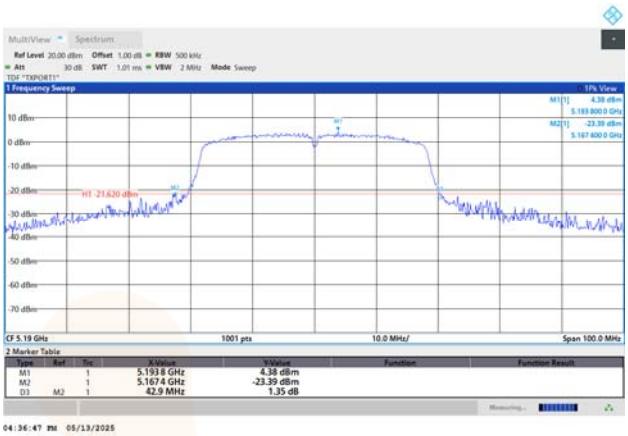
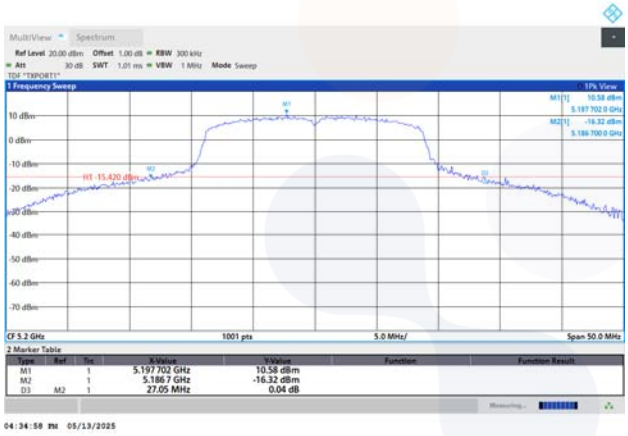
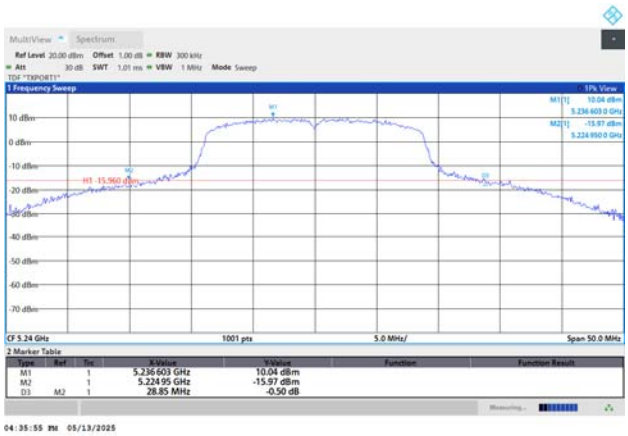
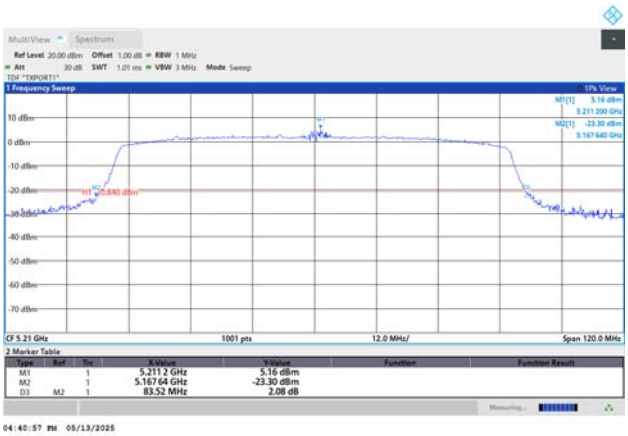
a. Set center frequency to the nominal EUT channel center frequency.
b. Set span = 1.5 times to 5.0 times the OBW.
c. Set RBW = 1% to 5% of the OBW
d. Set VBW ≥ 3 x RBW
e. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection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

Test results

Test mode	Band	Frequency(㎒)	26 ㏈ bandwidth (㎒)	99% bandwidth (㎒)
802.11a	UNII 1	5 180	22.800	16.499
		5 200	23.450	16.550
		5 240	23.050	16.555
802.11n HT20	UNII 1	5 180	27.450	17.681
		5 200	27.450	17.689
		5 240	29.550	17.713
802.11n HT40	UNII 1	5 190	43.000	36.018
		5 230	43.800	36.014
802.11ac VHT20	UNII 1	5 180	**28.200**	17.684
		5 200	**27.050**	17.732
		5 240	**28.850**	17.736
802.11ac VHT40	UNII 1	5 190	**42.900**	36.003
		5 230	**42.700**	36.007
802.11ac VHT80	UNII 1	5 210	**83.520**	74.996

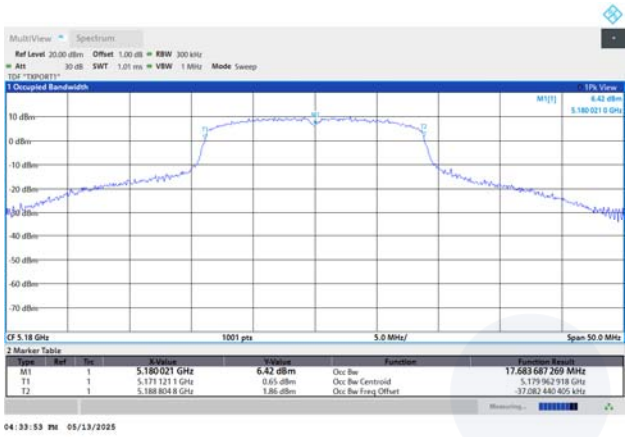
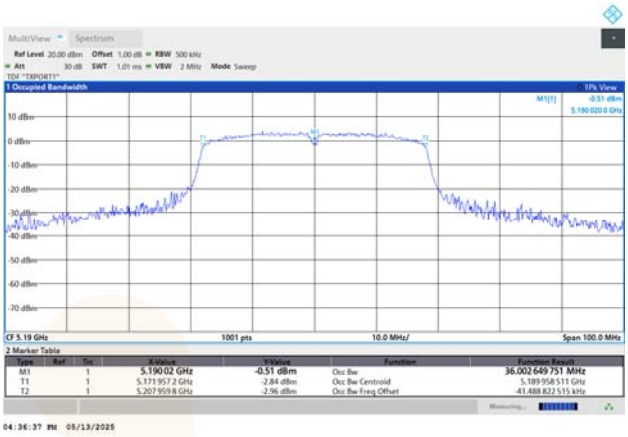
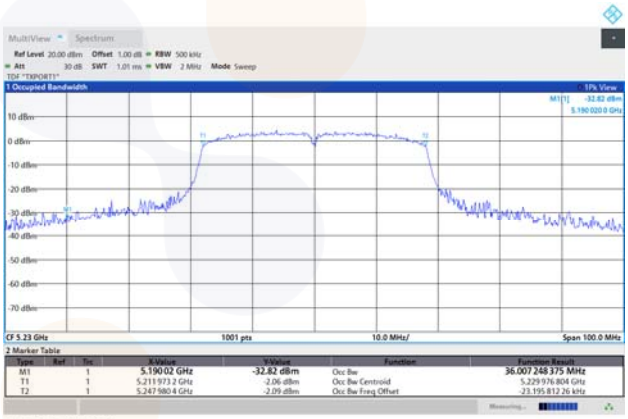
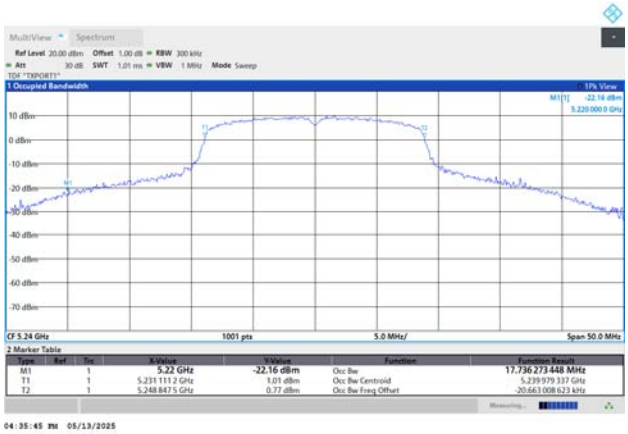
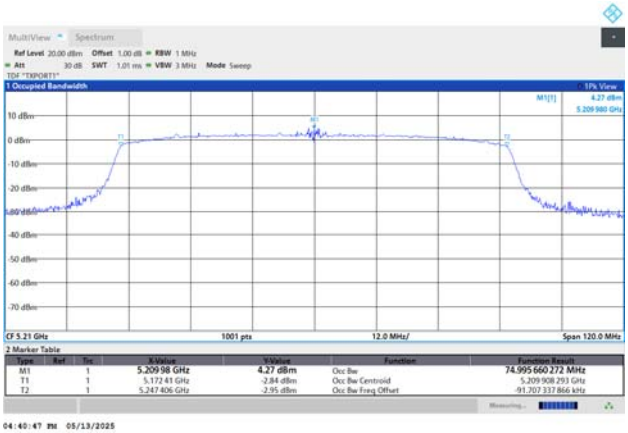
In order to simplify the report, attached plots were the worst case per bandwidth

26 dB bandwidth

UNII 1 / 802.11ac VHT20 / Low ch.	UNII 1 / 802.11ac VHT40 / Low ch.
	
UNII 1 / 802.11ac VHT20 / Mid ch.	**UNII 1 / 802.11ac VHT40 / High ch.**
	
UNII 1 / 802.11ac VHT20 / High ch.	**UNII 1 / 802.11ac VHT80 / Mid ch.**
	

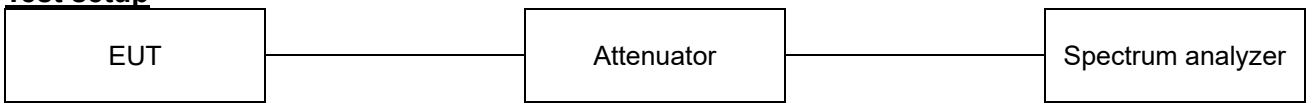
In order to simplify the report, attached plots were the worst case per bandwidth

99% bandwidth

UNII 1 / 802.11ac VHT20 / Low ch.	UNII 1 / 802.11ac VHT40 / Low ch.
	
UNII 1 / 802.11ac VHT20 / Mid ch.	**UNII 1 / 802.11ac VHT40 / High ch.**
	
UNII 1 / 802.11ac VHT20 / High ch.	**UNII 1 / 802.11ac VHT80 / Mid ch.**
	

7.4. 6 dB Bandwidth & 99% Bandwidth

Test setup



Limit

According to §15.407(e),

Within the 5.725-5.850 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500kHz.

Test procedure

ANSI C63.10-2013 Section 6.9.2
KDB 789033 D02 v02r01 - Section C.2

Test settings

Minimum Emission Bandwidth for the band 5.725−5.85 GHz.

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 kHz for the band 5.725−5.85 GHz band. The following procedure shall be used for measuring this Bandwidth:

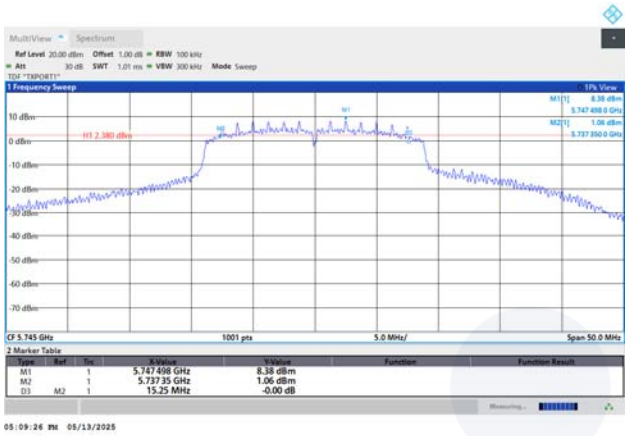
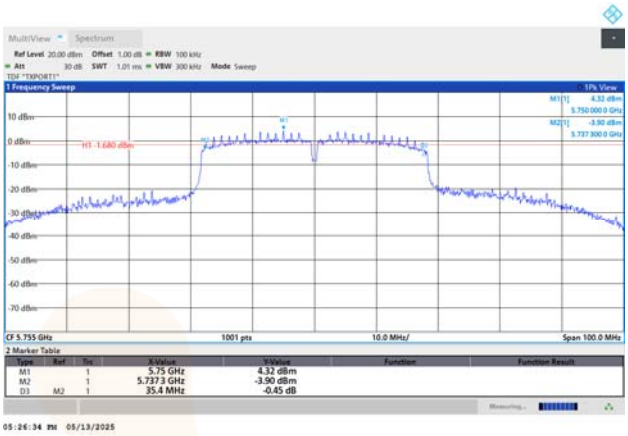
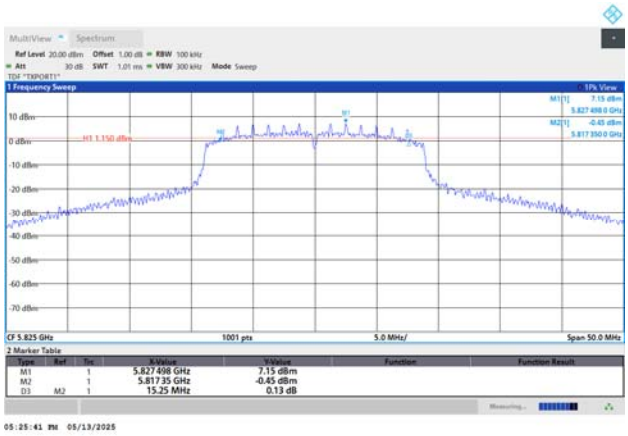
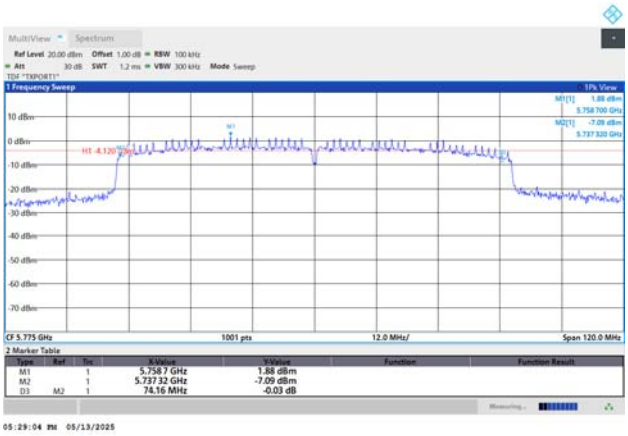
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test results

Test mode	Band	Frequency (MHz)	6dB bandwidth (MHz)	Limit (MHz)	99% bandwidth (MHz)
802.11a	UNII 3	5 745	15.250	0.500	17.943
		5 785	15.250		17.081
		5 825	15.250		16.653
802.11n HT20	UNII 3	5 745	15.550		18.169
		5 785	15.250		18.029
		5 825	15.250		17.657
802.11n HT40	UNII 3	5 755	35.400		37.007
		5 795	35.400		36.316
802.11ac VHT20	UNII 3	5 745	15.250		19.607
		5 785	15.800		18.046
		5 825	15.250		17.635
802.11ac VHT40	UNII 3	5 755	35.400		36.797
		5 795	35.400		36.300
802.11ac VHT80	UNII 3	5 775	74.160		75.824

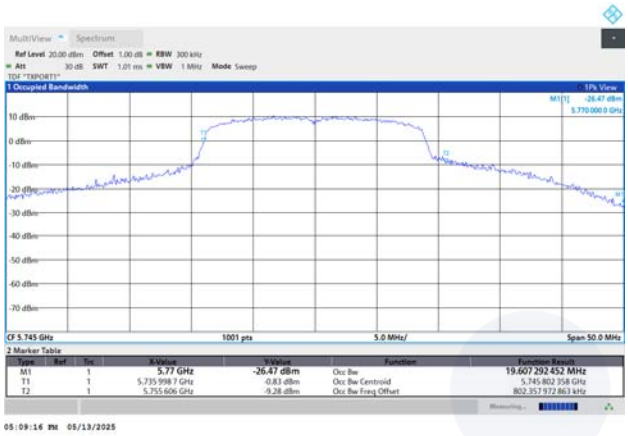
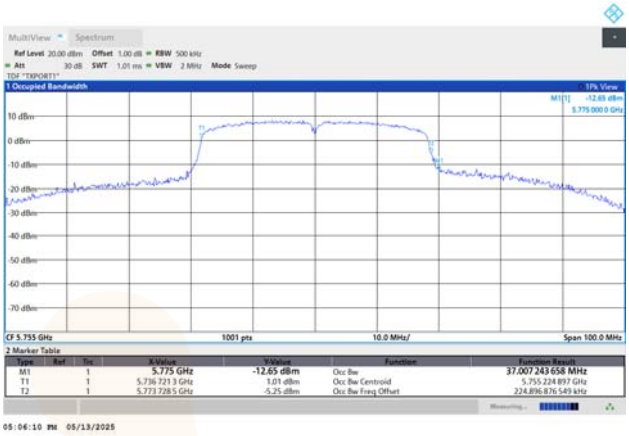
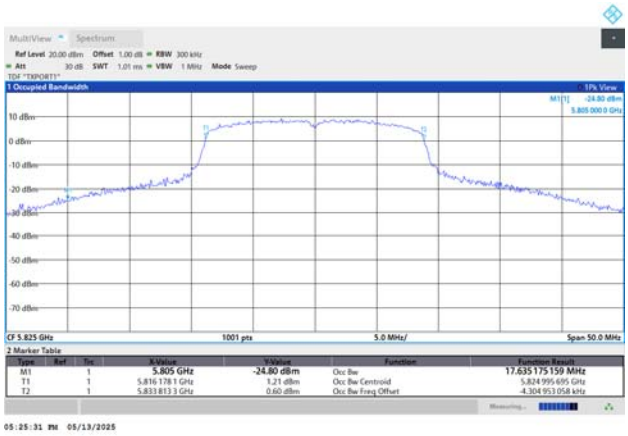
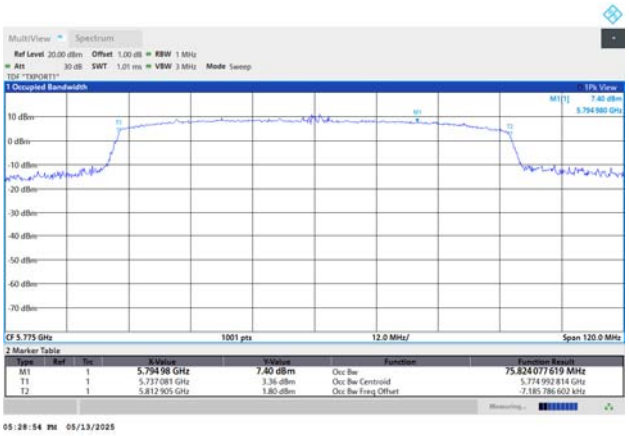
In order to simplify the report, attached plots were the worst case per bandwidth

6 dB bandwidth

UNII 3 / 802.11ac VHT 20 / Low ch.	UNII 3 / 802.11ac VHT40 / Low ch.
	
UNII 3 / 802.11ac VHT 20 / Mid ch.	**UNII 3 / 802.11ac VHT40 / High ch.**
UNII 3 / 802.11ac VHT 20 / High ch.	**UNII 3 / 802.11ac VHT80 / Mid ch.**
	

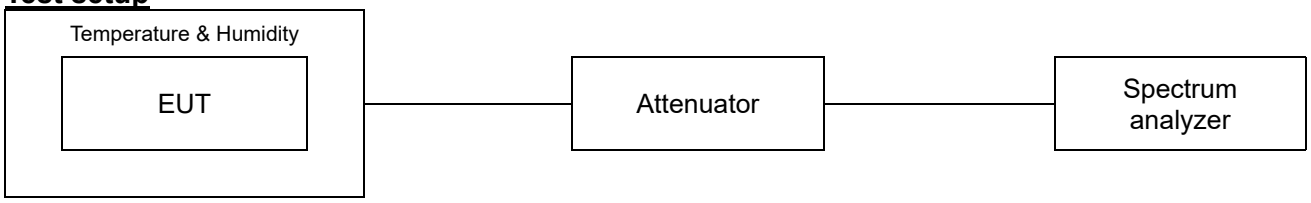
In order to simplify the report, attached plots were the worst case per bandwidth

99% bandwidth

UNII 3 / 802.11ac VHT 20 / Low ch.	UNII 3 / 802.11n HT40 / Low ch.
	
UNII 3 / 802.11ac VHT 20 / Mid ch.	**UNII 3 / 802.11n HT40 / High ch.**
UNII 3 / 802.11ac VHT 20 / High ch.	**UNII 3 / 802.11ac VHT80 / Mid ch.**
	

7.5. Frequency stability

Test setup



Limit

According to §15.407(g),
Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

According to RSS-GEN(6.11),
For licence-exempt devices, the following conditions apply:

(a) at the temperatures of -20°C (-4°F), +20°C (+68°F) and +50°C (+122°F), and at the manufacturer's rated supply voltage

(b) at the temperature of +20°C (+68°F) and at ±15% of the manufacturer's rated supply voltage

If the frequency stability limits are only met within a temperature range that is smaller than the range specified in (a) for licensed or licence-exempt devices, the frequency stability requirement will be deemed to be met if the transmitter is automatically prevented from operating outside this smaller temperature range and if the published operating characteristics for the equipment are revised to reflect this restricted temperature range.

If the device contains both licence and licence-exempt transmitter modules, the device's frequency stability shall be measured under the most stringent condition specified in the applicable RSS of the transmitter module.

In addition, if an unmodulated carrier is not available, the method used to measure frequency stability shall be described in the test report.

According to RSS-GEN(8.11),
If the frequency stability of the licence-exempt radio apparatus is not specified in the applicable RSS, the fundamental emissions of the radio apparatus should be kept within at least the central 80% of its permitted operating frequency band in order to minimize the possibility of out-of-band operation. In addition, its occupied bandwidth shall be entirely outside the restricted bands and the prohibited TV bands of 54-72 ㎒, 76-88 ㎒, 174-216 ㎒, and 470-602 ㎒, unless otherwise indicated.

Test procedure
ANSI C63.10-2013 - Section 6.8.1

Test results

Test band : UNII-1

Frequency (Hz) : 5 180 000 000

Voltage (%)	Power (V)	Temp. (°C)	Frequency (Hz)	Frequency error (Hz)	Deviation	
					(ppm)	(%)
100	5.00	22(Ref.)	5 179 973 630	-26370.000	-5.09	-0.000509
		0	5 180 008 990	8990.000	1.74	0.000174
		10	5 179 991 210	-8790.000	-1.7	-0.00017
		20	5 179 977 620	-22380.000	-4.32	-0.000432
		30	5 179 966 830	-33170.000	-6.4	-0.00064
		40	5 179 966 030	-33970.000	-6.56	-0.000656
85	5.50	22(Ref.)	5 179 973 830	-26170.000	-5.05	-0.000505
115	4.50	22(Ref.)	5 179 974 030	-25970.000	-5.01	-0.000501

Test band : UNII-3

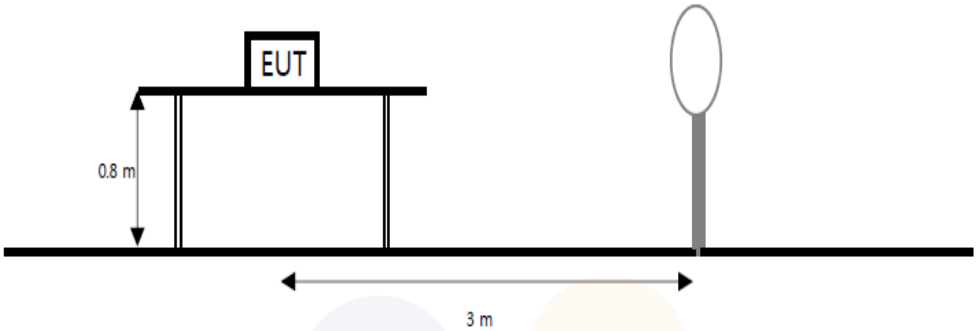
Frequency (Hz) : 5 745 000 000

Voltage (%)	Power (V)	Temp. (°C)	Frequency (Hz)	Frequency error (Hz)	Deviation	
					(ppm)	(%)
100	5.00	22(Ref.)	5 744 974 830	-25170.000	-4.38	-0.000438
		0	5 745 008 990	8990.000	1.56	0.000156
		10	5 744 988 010	-11990.000	-2.09	-0.000209
		20	5 744 974 830	-25170.000	-4.38	-0.000438
		30	5 744 963 440	-36560.000	-6.36	-0.000636
		40	5 744 961 840	-38160.000	-6.64	-0.000664
85	5.50	22(Ref.)	5 744 974 830	-25170.000	-4.38	-0.000438
115	4.50	22(Ref.)	5 744 975 020	-24980.000	-4.35	-0.000435

7.6. Spurious Emission, Band Edge and Restricted bands

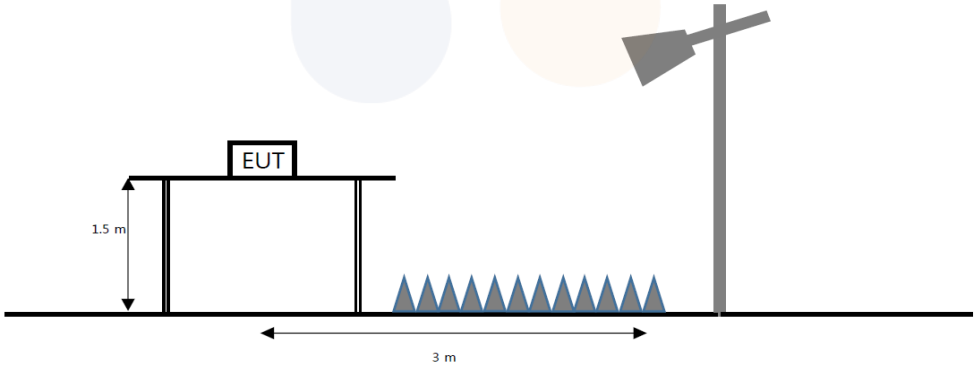
Test setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.

The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to the tenth harmonic of the highest fundamental frequency or to 40 ㎓ emissions, whichever is lower.



Limit

FCC

According to section 15.209(a),

except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (㎒)	Field strength (㎛/m)	Measurement distance (m)
0.009 - 0.490	2 400/F(㎑)	300
0.490 - 1.705	24 000/F(㎑)	30
1.705 - 30	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 ㎒, 76–88 ㎒, 174–216 ㎒ or 470–806 ㎒. However, operation within these frequency bands is permitted under other sections of this part, e.g., Section15.231 and 15.241.

According to section 15.205(a) and (b),

only spurious emissions are permitted in any of the frequency bands listed below:

㎒	㎒	㎒	㎓
0.009 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.694 75 - 16.695 25	608 - 614	5.35 - 5.46
2.173 5 - 2.190 5	16.804 25 - 16.804 75	960 – 1 240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1 300 – 1 427	8.025 - 8.5
4.177 25 - 4.177 75	37.5 - 38.25	1 435 – 1 626.5	9.0 - 9.2
4.207 25 - 4.207 75	73 - 74.6	1 645.5 – 1 646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1 660 – 1 710	10.6 - 12.7
6.267 75 - 6.268 25	108 - 121.94	1 718.8 – 1 722.2	13.25 - 13.4
6.311 75 - 6.312 25	123 - 138	2 200 – 2 300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2 310 – 2 390	15.35 - 16.2
8.362 - 8.366	156.524 75 - 156.525 25	2 483.5 – 2 500	17.7 - 21.4
8.376 25 - 8.386 75		2 690 – 2 900	22.01 - 23.12
8.414 25 - 8.414 75	156.7 - 156.9	3 260 – 3 267	23.6 - 24.0
12.29 - 12.293	162.012 5 - 167.17	3 332 – 3 339	31.2 - 31.8
12.519 75 - 12.520 25	167.72 - 173.2	3 345.8 – 3 358	36.43 - 36.5
12.576 75 - 12.577 25	240 - 285	3 600 – 4 400	Above 38.6
13.36 - 13.41	322 - 335.4		

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in section 15.209. At frequencies equal to or less than 1 000 ㎒, compliance with the limits in section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 ㎒, compliance with the emission limits in section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in section 15.35 apply to these measurements.

According to section 15.407(b),
undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

For transmitters operating in the 5.15-5.25 ㎓ band: All emissions outside of the 5.15-5.35 ㎓ band shall not exceed an e.i.r.p. of −27 ㏈m/㎒
For transmitters operating in the 5.25-5.35 ㎓ band: All emissions outside of the 5.15-5.35 ㎓ band shall not exceed an e.i.r.p. of −27 ㏈m/㎒.
For transmitters operating in the 5.47-5.725 ㎓ band: All emissions outside of the 5.15-5.35 ㎓ band shall not exceed an e.i.r.p. of −27 ㏈m/㎒.

For transmitters operating in the 5.725-5.85 ㎓ band: All emissions shall be limited to a level of -27 ㏈m/㎒ at 75 ㎒ or more above or below the band edge increasing linearly to 10 ㏈m/㎒ at 25 ㎒ above or below the band edge, and form 25 ㎒ above or below the band edge increasing linearly to a level of 15.6 ㏈m/㎒ at 5 ㎒ above or below the band edge, and from 5 ㎒ above or below the band edge increasing linearly to a level of 27 ㏈m/㎒ at the band edge.

IC

According to RSS-247(5.5),

In any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 ㏈ instead of 20 ㏈. Attenuation below the general field strength limits specified in RSS-Gen is not required.

According to RSS-Gen(8.9),

Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

Table 5- General field strength limits at frequencies above 30 ㎒

Frequency(㎒)	Field strength (㎶/m at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 6- General field strength limits at frequencies below 30 ㎒

Frequency	Magnetic field strength (H-Field) (㎂/m)	Measurement distance(m)
9 – 490 ㎑[1)]	6.37/F (F in ㎑)	300
490 – 1705 ㎑	63.7/F (F in ㎑)	30
1.705 - 30 ㎒	0.08	30

According to RSS-Gen(8.10),

Restricted frequency bands, identified in table 7, are designated primarily for safety-of-life services (distress calling and certain aeronautical activities), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following conditions related to the restricted frequency bands apply:

(a) The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 7 except for apparatus compliant with RSS-287, Emergency Position Indicating Radio Beacons (EPIRB), Emergency Locator Transmitters (ELT), Personal Locator Beacons (PLB), and Maritime Survivor Locator Devices (MSLD).
(b) Unwanted emissions that fall into restricted frequency bands listed in table 7 shall comply with the limits specified in table 5 and table 6.
(c) Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6.

Table 7- Restricted frequency bands*

MHz	MHz	GHz
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 - 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 - 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 - 8500	
108 - 138	--	

* Certain frequency bands listed in table 7 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

Test procedure

ANSI C63.10-2013 Section 12.7.7.2, 12.7.5, 12.7.6
KDB 789033 D02 v02r01 – Section G

Test settings

Peak field strength measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = as specified in table
3. VBW ≥ (3×RBW)
4. Detector = peak
5. Sweep time = auto
6. Trace mode = max hold
7. Allow sweeps to continue until the trace stabilizes

Table. RBW as a function of frequency

Frequency	RBW
9 ㎑ to 150 ㎑	200 ㎐ to 300 ㎐
0.15 ㎒ to 30 ㎒	9 ㎑ to 10 ㎑
30 ㎒ to 1 000 ㎒	100 ㎑ to 120 ㎑
> 1 000 ㎒	1 ㎒

Average field strength measurements

Trace averaging with continuous EUT transmission at full power

If the EUT can be configured or modified to transmit continuously (D ≥ 98%), then the average emission levels shall be measured using the following method (with EUT transmitting continuously):

1. RBW = 1 ㎒ (unless otherwise specified).
2. VBW ≥ (3×RBW).
3. Detector = RMS (power averaging), if [span / (# of points in sweep)] ≤ (RBW / 2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.
4. Averaging type = power (i.e., rms):
   1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
   2) Some instruments require linear display mode to use linear voltage averaging. Log or ㏈ averaging shall not be used.
5. Sweep time = auto.
6. Perform a trace average of at least 100 traces.

Trace averaging across ON and OFF times of the EUT transmissions followed by duty cycle correction

If continuous transmission of the EUT (D ≥ 98%) cannot be achieved and the duty cycle is constant (duty cycle variations are less than ±2%), then the following procedure shall be used:

1. The EUT shall be configured to operate at the maximum achievable duty cycle.
2. Measure the duty cycle D of the transmitter output signal as described in 11.6.
3. RBW = 1 ㎒ (unless otherwise specified).
4. VBW ≥ [3 × RBW].
5. Detector = RMS (power averaging), if [span / (# of points in sweep)] ≤ (RBW / 2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.
6. Averaging type = power (i.e., rms):
   1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
   2) Some instruments require linear display mode to use linear voltage averaging. Log or ㏈ averaging shall not be used.
7. Sweep time = auto.
8. Perform a trace average of at least 100 traces.
9. A correction factor shall be added to the measurement results prior to comparing with the emission limit to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
   1) If power averaging (rms) mode was used in step f), then the applicable correction factor is [10 log (1 / D)], where D is the duty cycle.
   2) If linear voltage averaging mode was used in step f), then the applicable correction factor is [20 log (1 / D)], where D is the duty cycle.
   3) If a specific emission is demonstrated to be continuous (D ≥ 98%) rather than turning ON and OFF with with the transmit cycle, then no duty cycle correction is required for that emission.

Band edge measurements

Integration Method

For maximum emissions measurements, follow the procedures described in II.G.5., "Procedures for unwanted maximum Emissions Measurements above 1000 ㎒. Except for the following changes:

1. Set RBW = 100 ㎑
2. Set VBW ≥ 3 × RBW
3. Perform a band-power integration across the 1 ㎒ bandwidth in which the band edge emission level is to be measured. CAUTION: you must ensure that the spectrum analyzer or EMI receiver is set for peak detection and max-hold for this measurement.

For average emissions measurements, follow the procedures described in II.G.6., "Procedures for average unwanted Emissions Measurements above 1000 ㎒. Except for the following changes:

1. Set RBW = 100 ㎑
2. Set VBW ≥ 3 × RBW
3. Perform a band-power integration across the 1 ㎒ bandwidth in which the band edge emission level is to be measured.

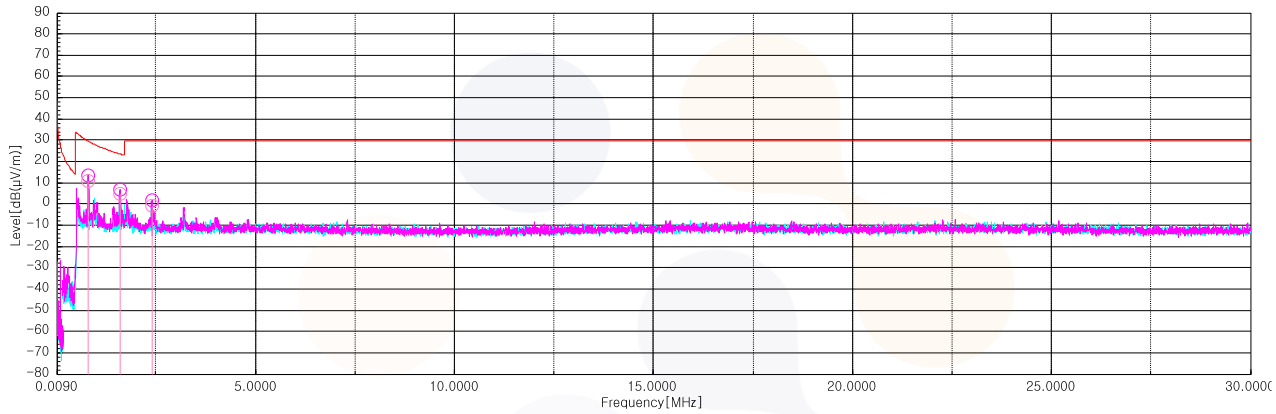
Notes:

1. *f* <30 ㎒, extrapolation factor of 40 ㏈/decade of distance. $F_d = 40\log(D_m/D_s)$
   f ≥30 ㎒, extrapolation factor of 20 ㏈/decade of distance. $F_d = 20\log(D_m/D_s)$
   Where:
   F_d= Distance factor in ㏈
   D_m= Measurement distance in meters
   D_s= Specification distance in meters
2. Factors(㏈) = Antenna factor(㏈/m) + Cable loss(㏈) + or Amp. gain(㏈) + or F_d(㏈)
3. The worst-case emissions are reported however emissions whose levels were not within 20 ㏈ of respective limits were not reported.
4. Average test would be performed if the peak result were greater than the average limit.
5. [1)] means restricted band.
6. Above 1 ㎓ the worst results between two antenna polarizations (H and V) were documented in the test report.
7. Below 30 ㎒ frequency range, In order to search for the worst result, all orientations about parallel, perpendicular, and ground-parallel were investigated then reported. when the emission level was higher than 20 ㏈ of the limit, then the following statement shall be made: "No spurious emissions were detected within 20 ㏈ of the limit."
8. For above 1 ㎓ pre-scan to detect harmonic and spurious emissions, the resolution bandwidth is set to 1 ㎒; the video bandwidth is set to 30 ㎑ for peak measurements.
9. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency X ㎑ resulted in a level of Y ㏈㎶/m, which is equivalent to Y - 51.5 = Z ㏈㎶/m, which has the same margin, W ㏈, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

Test results (Below 30 ㎒) – Worst case: 802.11ac VHT20/ UNII 1_5 180 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data								
0.80	H	63.70	19.96	-32.92	40.00	10.74	29.54	18.80
1.59	H	57.00	20.03	-32.86	40.00	4.17	23.52	19.35
2.41	H	51.80	20.07	-32.79	40.00	-0.92	29.54	30.46

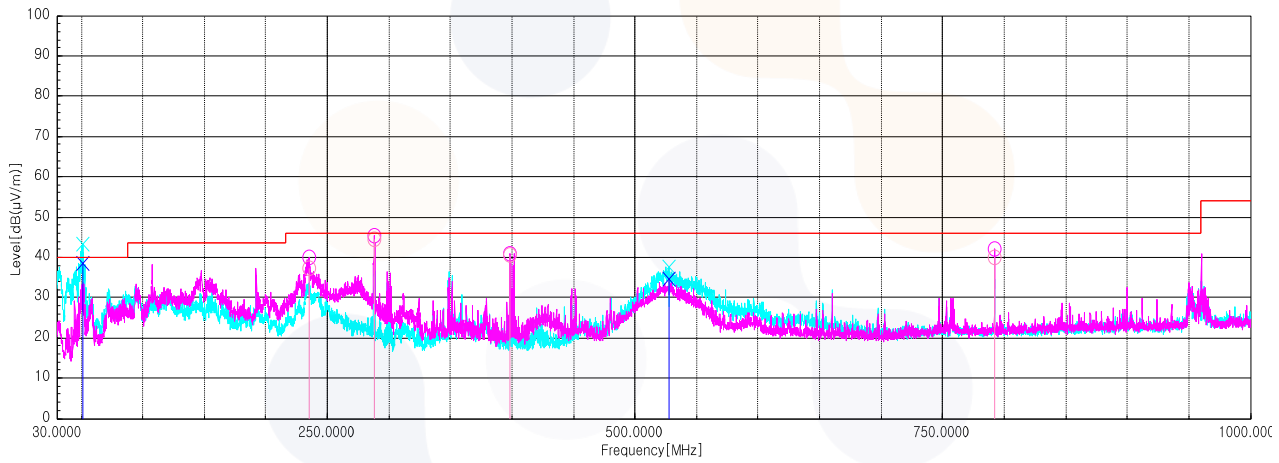
Horizontal/Vertical



Test results (Below 1 000 ㎒) – Worst case: 802.11ac VHT20/ UNII 1_5 180 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data								
50.98	V	57.00	13.61	-31.99	-	38.62	40.00	1.38
234.79	H	51.90	16.58	-31.27	-	37.21	46.00	8.79
288.14	H	56.90	18.90	-31.16	-	44.64	46.00	1.36
398.36	H	50.20	21.42	-31.09	-	40.53	46.00	5.47
527.37	V	42.30	23.30	-30.97	-	34.63	46.00	11.37
792.06	H	44.40	25.80	-30.23	-	39.97	46.00	6.03

Horizontal/Vertical



Test results (Above 1 000 ㎒)

UNII 1 SISO

802.11a_Lowest Channel (5 180 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 149.66[1)]	H	65.30	33.20	-26.63	-	71.87	74.00	2.13
1 136.22[1)]	V	66.80	25.20	-48.01	-	43.99	74.00	30.01
6 906.72	H	55.80	36.00	-42.06	-	49.74	68.20	18.46
10 361.32	V	63.30	38.78	-43.04	-	59.04	68.20	9.16
15 552.64[1)]	H	54.70	37.99	-41.03	-	51.66	74.00	22.34
Average Data								
5 149.66[1)]	H	45.17	33.20	-26.63	-	51.74	54.00	2.26
15 552.64[1)]	H	44.75	37.99	-41.03	-	41.71	54.00	12.29

802.11a_Middle Channel (5 200 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
1 131.82[1)]	V	65.00	25.20	-48.02	-	42.18	74.00	31.82
6 933.55	V	55.70	36.00	-42.19	-	49.51	68.20	18.69
10 408.47	H	62.60	38.80	-43.05	-	58.35	68.20	9.85
15 563.11[1)]	H	54.40	37.95	-41.01	-	51.34	74.00	22.66
Average Data								
15 563.11[1)]	H	44.54	37.95	-41.01	-	41.48	54.00	12.52

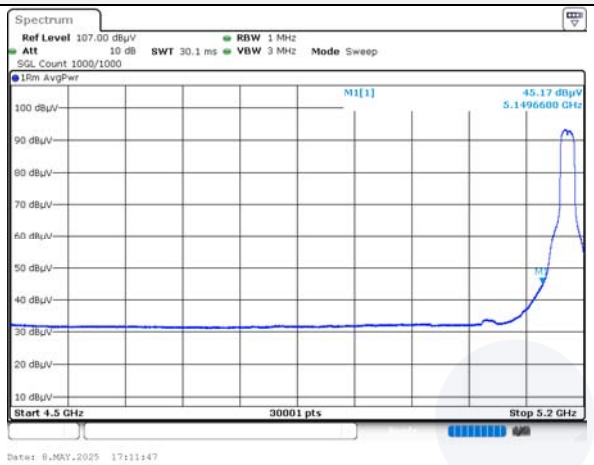
802.11a_Highest Channel (5 240 ㎒)

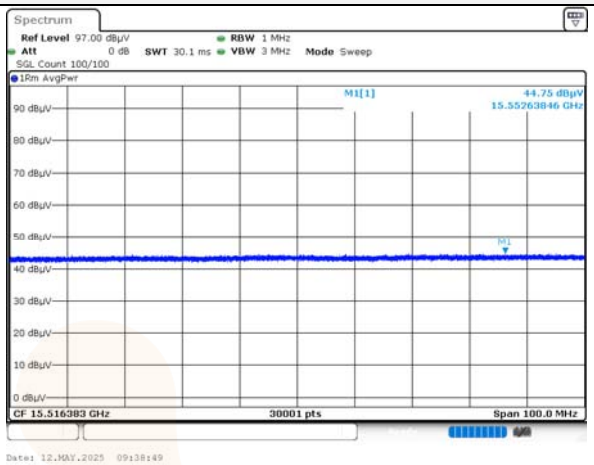
Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
1 143.00[1)]	V	64.90	25.20	-48.01	-	42.09	74.00	31.91
6 986.83	H	56.50	36.17	-42.45	-	50.22	68.20	17.98
10 482.83	V	62.80	38.97	-43.06	-	58.71	68.20	9.49
15 714.25[1)]	H	55.70	37.90	-40.83	-	52.77	74.00	21.23
Average Data								
15 714.25[1)]	H	45.20	37.90	-40.83	-	42.27	54.00	11.73

In order to simplify the report, attached plots were only the lowest margin condition

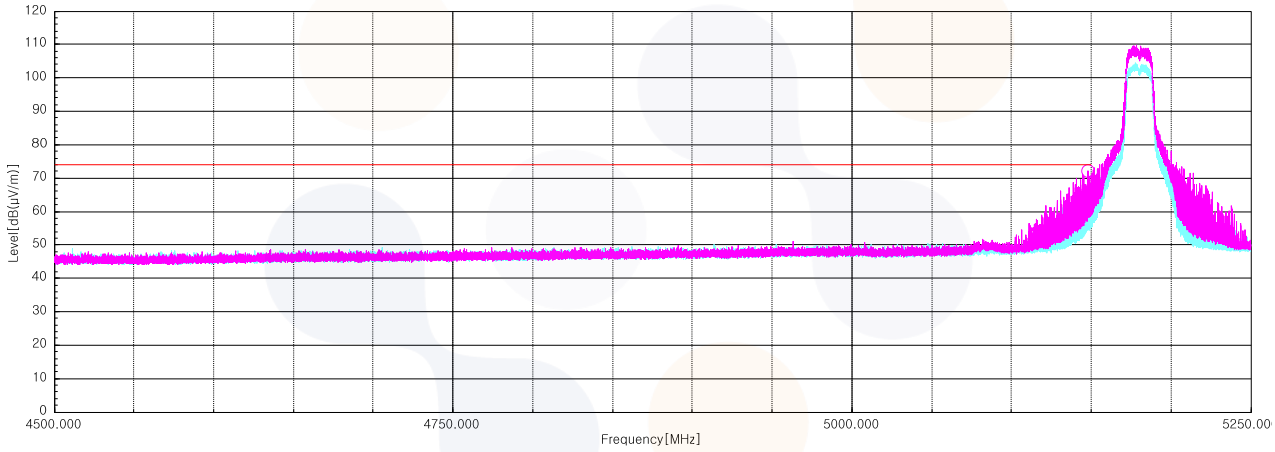
802.11a_Lowest Channel (5 180 ㎒)

Average data





Horizontal/Vertical for Band-edge



802.11n_HT20_Lowest Channel (5 180 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 149.92[1)]	H	64.90	33.20	-26.63	-	71.47	74.00	2.53
1 134.93[1)]	V	64.30	25.20	-48.01	-	41.49	74.00	32.51
6 907.10	H	55.90	36.00	-42.06	-	49.84	68.20	18.36
10 355.95	V	62.00	38.79	-43.04	-	57.75	68.20	10.45
15 623.20[1)]	H	55.50	37.85	-40.94	-	52.41	74.00	21.59
Average Data								
5 149.92[1)]	H	45.17	33.20	-26.63	-	51.74	54.00	2.26
15 623.20[1)]	H	44.89	37.85	-40.94	-	41.80	54.00	12.20

802.11n_HT20_Middle Channel (5 200 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
1 133.47[1)]	H	63.10	25.20	-48.01	-	40.29	74.00	33.71
6 933.55	H	56.30	36.00	-42.19	-	50.11	68.20	18.09
10 393.52	V	62.40	38.71	-43.05	-	58.06	68.20	10.14
15 648.79[1)]	V	55.70	37.80	-40.91	-	52.59	74.00	21.41
Average Data								
15 648.79[1)]	V	45.16	37.80	-40.91	-	42.05	54.00	11.95

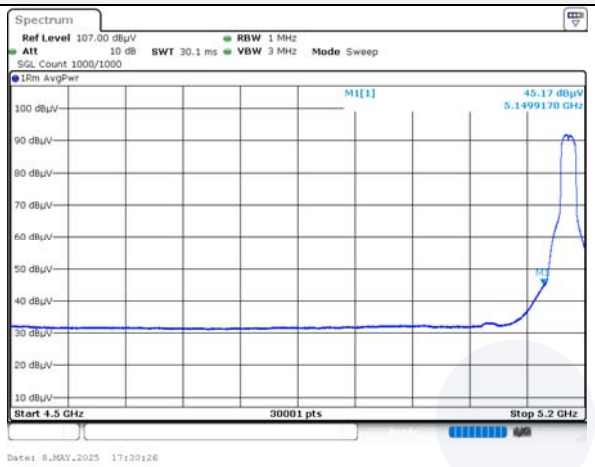
802.11n_HT20_Highest Channel (5 240 ㎒)

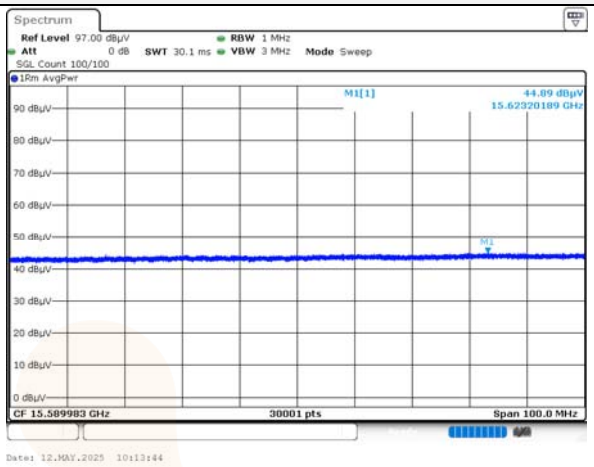
Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
1 135.67[1)]	V	66.50	25.20	-48.01	-	43.69	74.00	30.31
6 986.83	H	56.10	36.17	-42.45	-	49.82	68.20	18.38
10 483.22	V	61.90	38.97	-43.06	-	57.81	68.20	10.39
15 770.66[1)]	V	55.20	37.90	-40.77	-	52.33	74.00	21.67
Average Data								
15 770.66[1)]	V	44.82	37.90	-40.77	-	41.95	54.00	12.05

In order to simplify the report, attached plots were only the lowest margin condition

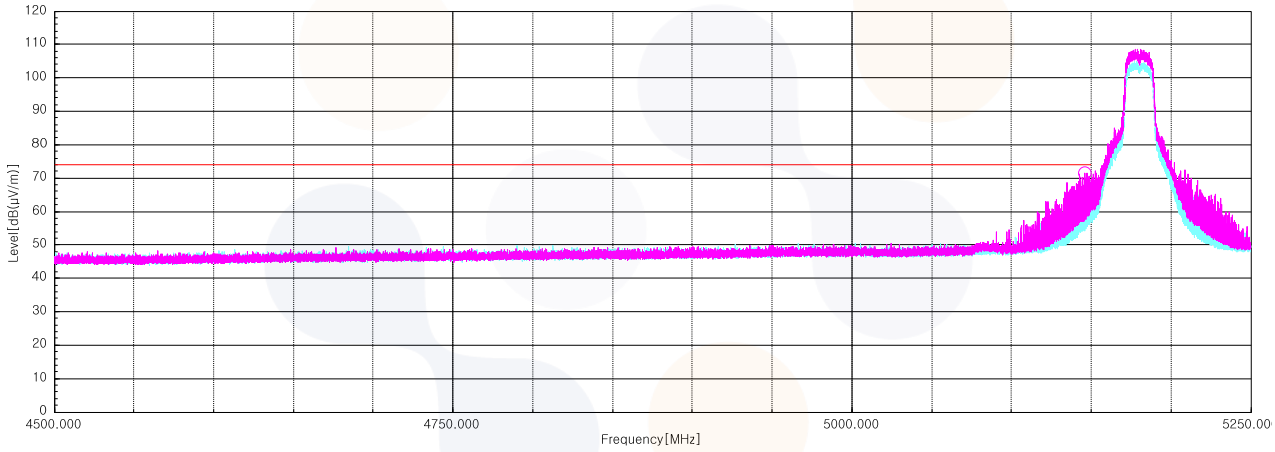
802.11n_HT20_Lowest Channel (5 180 ㎒)

Average data





Horizontal/Vertical for Band-edge



802.11n_HT40_Lowest Channel (5 190 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 149.85[1)]	H	60.10	33.20	-26.63	-	66.67	74.00	7.33
1 137.32[1)]	V	63.60	25.20	-48.01	-	40.79	74.00	33.21
6 920.13	H	58.30	36.00	-42.12	-	52.18	68.20	16.02
10 372.05	V	56.50	38.76	-43.04	-	52.22	68.20	15.98
15 632.37[1)]	V	55.20	37.84	-40.93	-	52.11	74.00	21.89
Average Data								
5 149.85[1)]	H	42.67	33.20	-26.63	-	49.24	54.00	4.76
15 632.37[1)]	V	44.89	37.84	-40.93	-	41.80	54.00	12.20

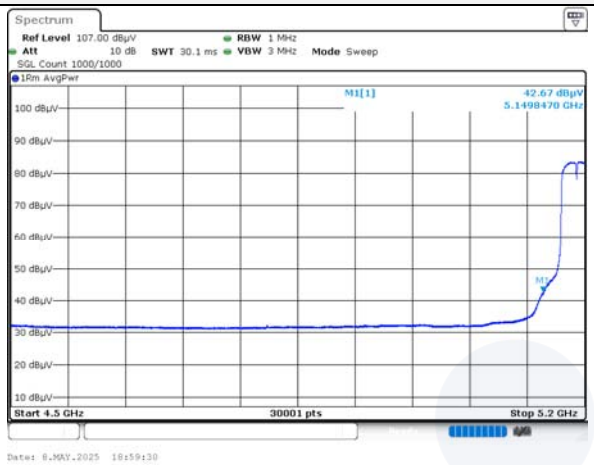
802.11n_HT40_Highest Channel (5 230 ㎒)

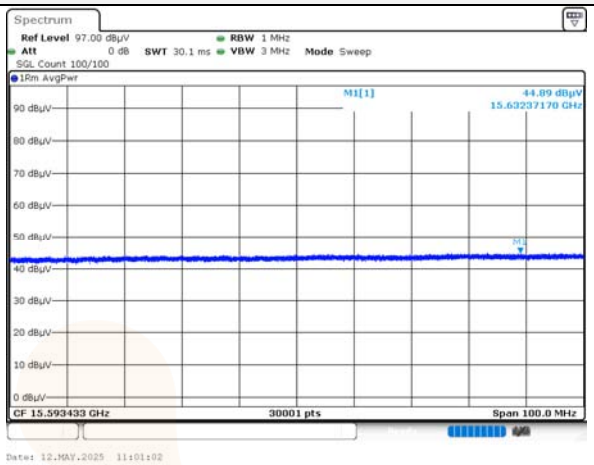
Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
1 140.98[1)]	V	64.30	25.20	-48.01	-	41.49	74.00	32.51
6 973.80	H	57.40	36.15	-42.39	-	51.16	68.20	17.04
10 454.47	V	57.10	38.91	-43.05	-	52.96	68.20	15.24
15 709.26[1)]	V	55.40	37.90	-40.84	-	52.46	74.00	21.54
Average Data								
15 709.26[1)]	V	44.86	37.90	-40.84	-	41.92	54.00	12.08

In order to simplify the report, attached plots were only the lowest margin condition

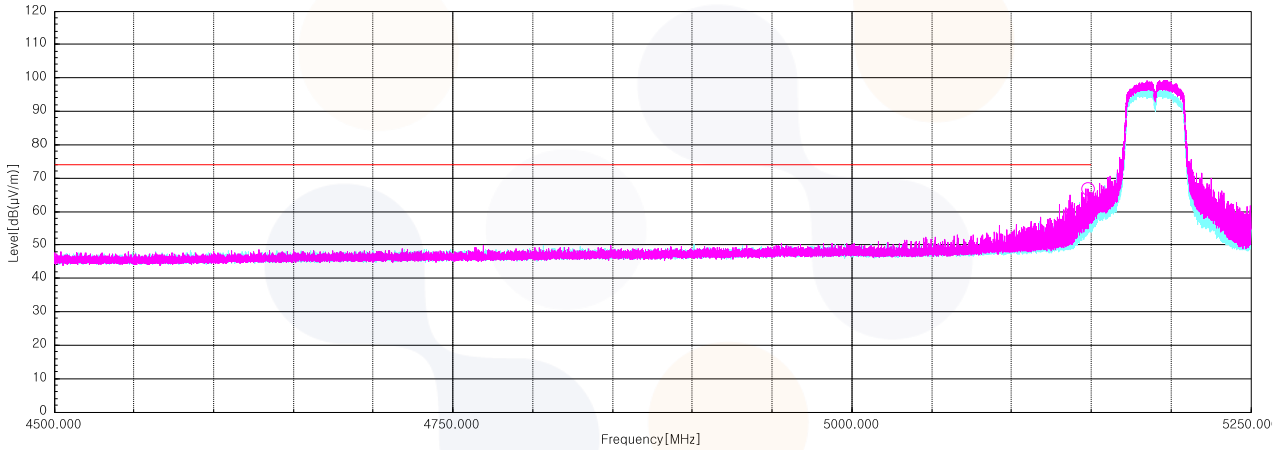
802.11n_HT40_Lowest Channel (5 190 ㎒)

Average data





Horizontal/Vertical for Band-edge



802.11ac_VHT20_Lowest Channel (5 180 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 149.94[1)]	H	65.30	33.20	-26.63	-	71.87	74.00	2.13
1 136.77[1)]	V	64.30	25.20	-48.01	-	41.49	74.00	32.51
6 907.48	H	56.90	36.00	-42.06	-	50.84	68.20	17.36
10 359.40	V	61.80	38.78	-43.04	-	57.54	68.20	10.66
15 513.74[1)]	H	56.00	38.17	-41.07	-	53.10	74.00	20.90
Average Data								
5 149.94[1)]	H	46.21	33.20	-26.63	-	52.78	54.00	1.22
15 513.74[1)]	H	44.40	38.17	-41.07	-	41.50	54.00	12.50

802.11ac_VHT20_Middle Channel (5 200 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
1 137.13[1)]	V	64.30	25.20	-48.01	-	41.49	74.00	32.51
6 933.55	H	57.40	36.00	-42.19	-	51.21	68.20	16.99
10 403.10	V	61.00	38.80	-43.05	-	56.75	68.20	11.45
15 637.80[1)]	H	55.10	37.82	-40.92	-	52.00	74.00	22.00
Average Data								
15 637.80[1)]	H	44.93	37.82	-40.92		41.83	54.00	12.17

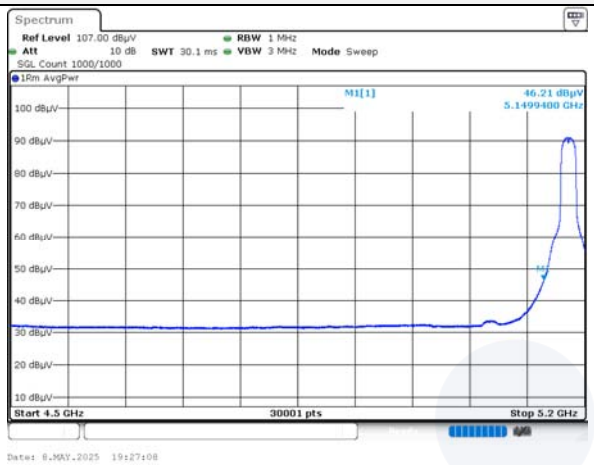
802.11ac_VHT20_Highest Channel (5 240 ㎒)

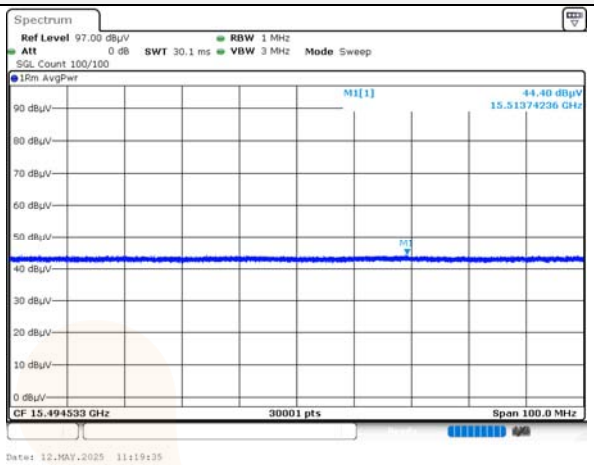
Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
1 137.68[1)]	H	62.80	25.20	-48.01	-	39.99	74.00	34.01
6 986.83	H	56.10	36.17	-42.45	-	49.82	68.20	18.38
10 477.85	V	61.60	38.96	-43.06	-	57.50	68.20	10.70
15 820.06[1)]	V	56.00	37.90	-40.72	-	53.18	74.00	20.82
Average Data								
15 820.06[1)]	V	44.87	37.90	-40.72	-	42.05	54.00	11.95

In order to simplify the report, attached plots were only the lowest margin condition

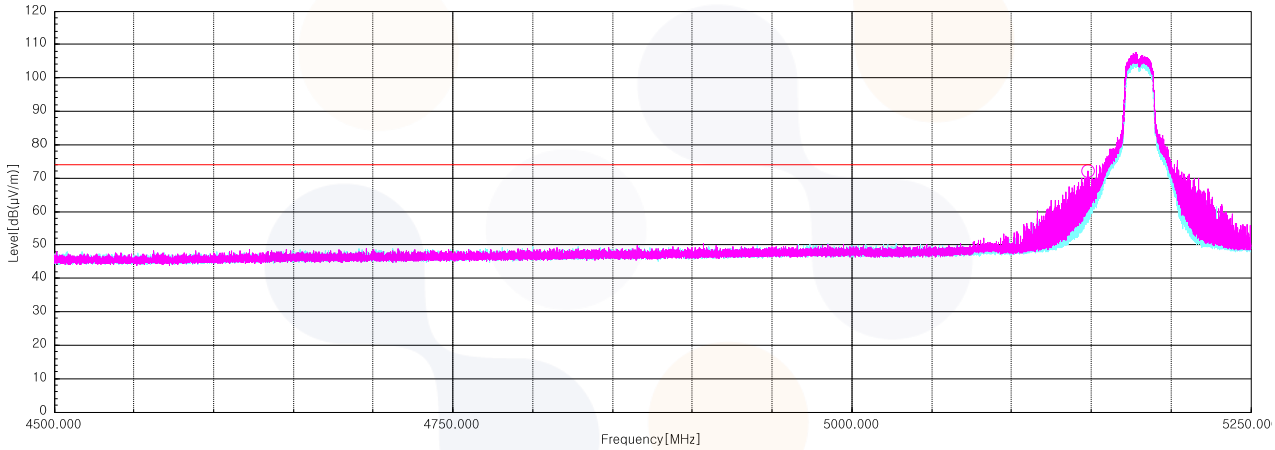
802.11ac_VHT20_Lowest Channel (5 180 ㎒)

Average data





Horizontal/Vertical for Band-edge



802.11ac_VHT40_Lowest Channel (5 190 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
1 136.77[1)]	V	63.60	25.20	-48.01	-	40.79	74.00	33.21
5 149.89[1)]	H	59.50	33.20	-26.63	-	66.07	74.00	7.93
6 920.13	H	57.40	36.00	-42.12	-	51.28	68.20	16.92
10 381.25	V	55.90	38.74	-43.05	-	51.59	68.20	16.61
15 626.76[1)]	V	55.90	37.85	-40.94	-	52.81	74.00	21.19
Average Data								
5 149.89[1)]	H	42.05	33.20	-26.63	-	48.62	54.00	5.38
15 626.76[1)]	V	45.09	37.85	-40.94	-	42.00	54.00	12.00

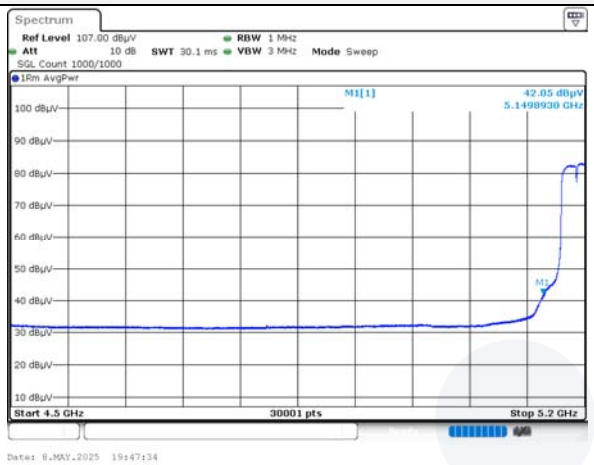
802.11ac_VHT40_Highest Channel (5 230 ㎒)

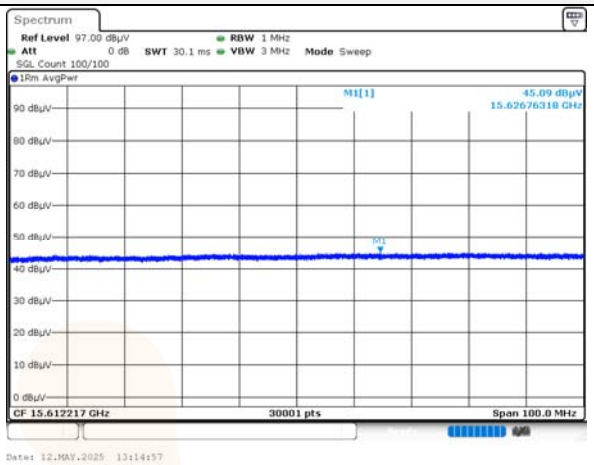
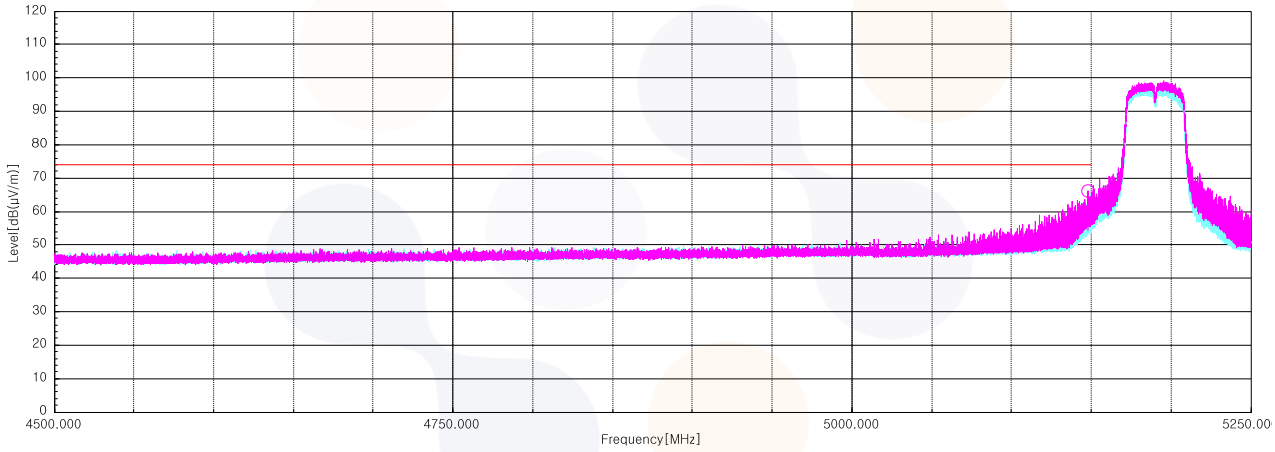
Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
1 135.85[1)]	H	63.90	25.20	-48.01	-	41.09	74.00	32.91
6 973.42	H	56.60	36.15	-42.39	-	50.36	68.20	17.84
10 472.10	H	57.70	38.94	-43.06	-	53.58	68.20	14.62
15 728.44[1)]	V	55.80	37.90	-40.82	-	52.88	74.00	21.12
Average Data								
15 728.44[1)]	V	45.22	37.90	-40.82	-	42.30	54.00	11.70

In order to simplify the report, attached plots were only the lowest margin condition

802.11ac_VHT40_Lowest Channel (5 190 ㎒)

Average data





Horizontal/Vertical for Band-edge