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.: KR23-SRF0212-A Page (1) of (46)	eurofins | KCTL

1. Client

- Name : MIRATEK INCORPORATION
- Address : 65, Guryongdong-gil, Toechon-myeon, Gwangju-si, Gyeonggi-do, Republic of Korea
- Date of Receipt : 2023-03-13

2. Use of Report : Certification

3. Name of Product / Model : HT LinkVue ECU / HT LinkVue 2C

4. Manufacturer / Country of Origin : MIRATEK INCORPORATION / Korea

5. FCC ID : 2BAK4LINKVUE

6. IC Certificate No. : 30270-LINKVUE

7. Date of Test : 2023-04-05 to 2023-09-07

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 2 February 2017
RSS-Gen Issue 5 February 2021

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

	Tested by	Technical Manager
Affirmation	Name : Minki kim (Signature)	Name : Heesu Ahn (Signature)

2023-09-27

Eurofins KCTL Co.,Ltd.

REPORT REVISION HISTORY

Date	Revision	Page No
2023-09-27	Originally issued	-
2023-10-16	Updated	3, 5, 11, 13, 15, 16, 29, 46

Note. The report No. KR23-SRF0212 is superseded by the report No. KR23-SRF0212-A.

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**

CONTENTS

1. General information

Client	:	MIRATEK INCORPORATION
Address	:	65, Guryongdong-gil, Toechon-myeon, Gwangju-si, Gyeonggi-do, Republic of Korea
Manufacturer	:	MIRATEK INCORPORATION
Address	:	65, Guryongdong-gil, Toechon-myeon, Gwangju-si, Gyeonggi-do, Republic of Korea
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	:	HT LinkVue ECU
Model	:	HT LinkVue 2C
Derivative model	:	HT LinkVue
Modulation technique	:	WIFI(802.11ac): OFDM
Number of channels	:	UNII-1 : 1 ch UNII-3 : 1 ch
Power source	:	DC 12 V / DC 24 V
Antenna specification	:	ANT 1, 2 : Dipole Antenna
Antenna gain	:	ANT1 ANT2 UNII-1 : 11.23 dBi 11.23 dBi UNII-3 : 11.37 dBi 11.37 dBi
Frequency range	:	UNII-1 : 5 210 ㎒(802.11ac_VHT80) UNII-3 : 5 775 ㎒(802.11ac_VHT80)
Software version	:	HT LinkVue 1.0
Hardware version	:	HT LinkVue 1.0
Test device serial No.	:	MT V1 2308 0001
Operation temperature	:	-40 ℃ ~ 80 ℃

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
Micro SD Card	SanDisk	SDSDQAF4-256G-ID/ SDSQQNR-256G-GN61A	-	-
GPS Receiver	fourstech	FCE100A-UA2-034SMP-4	-	3 V~5 V
CAMERA	SOMO VISION	HTLinkvue Camera	-	10 V

2.2 Information about derivative model

The difference between basic model and derivative models is:
MIRATEK INCORPORATION declare the differences for between original model and variant models.

Type		Model name	Difference in number of connectable cameras
Tested model	**Basic Model**	**HT LinkVue 2C**	6 ea
-	Variant Model	HT LinkVue	4 ea

2.3. Frequency/channel operations

This device contains the following capabilities:
WLAN 802.11ac_VHT80

UNII-1

Ch.	Frequency (MHz)
42	5 210

UNII-3

Ch.	Frequency (MHz)
155	5 775

Table 2.3.1. 802.11ac VHT80 mode

2.4. RF power setting in TEST SW

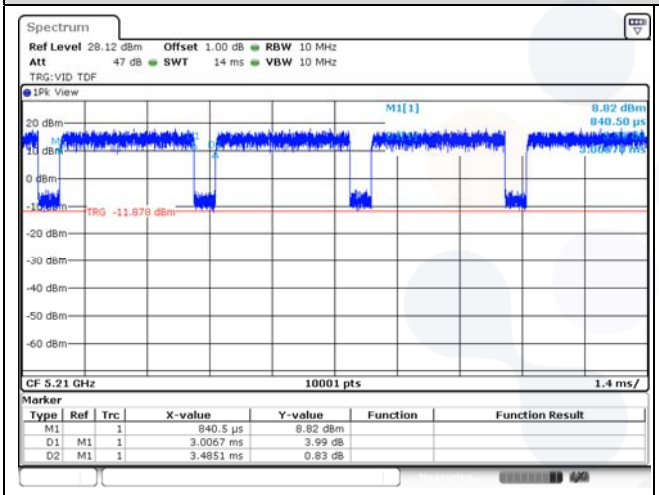
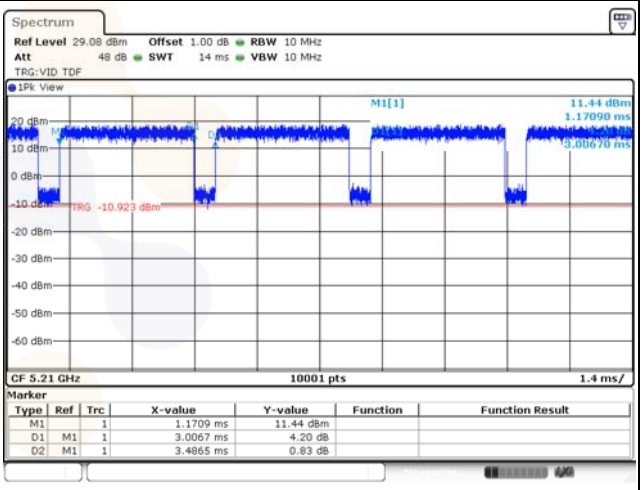
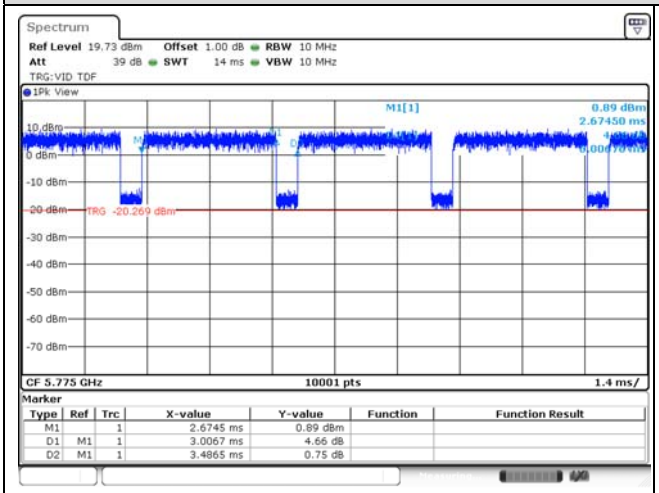
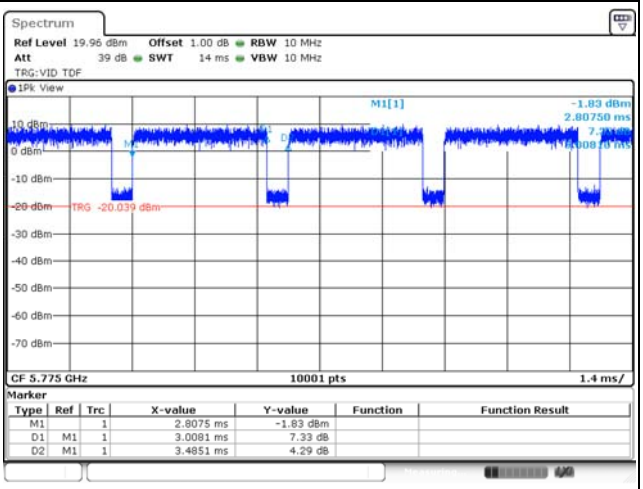
Test Mode	Band	Frequency [MHz]	Power Level Setting		
			SISO [ANT 1]	SISO [ANT 2]	MIMO [ANT 1+2]
802.11ac VHT80	UNII 3	5 210	7	7	4
		5 775	13	13	8

2.5. Duty Cycle Factor

Ant	Voltage	Test Mode	Frequency (㎒)	Period (㎳)	Ton time (㎳)	Duty cycle		Duty Cycle Factor (dB)
						(Linear)	(%)	
SISO	DC 12 V	UNII-1_802.11ac_VHT80	5 210	3.485 1	3.006 7	86.27	0.862 7	0.64
		UNII-3_802.11ac_VHT80	5 775	3.486 5	3.006 7	86.24	0.862 4	0.64
	DC 24 V	UNII-1_802.11ac_VHT80	5 210	3.486 5	3.006 7	86.24	0.862 4	0.64
		UNII-3_802.11ac_VHT80	5 775	3.485 1	3.008 1	86.31	0.863 1	0.64

Notes.

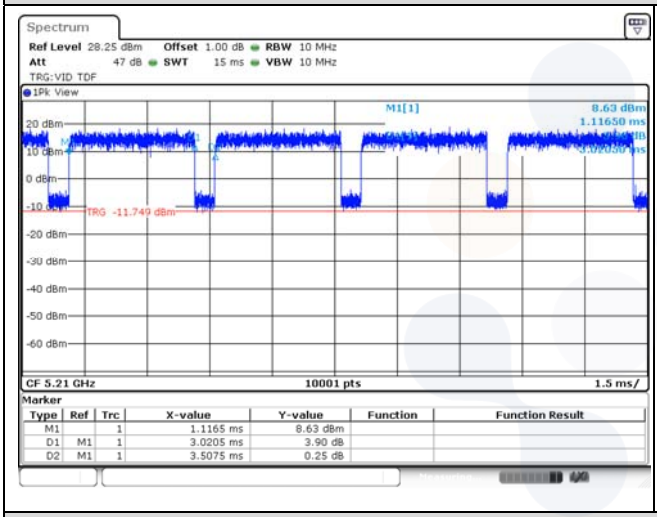
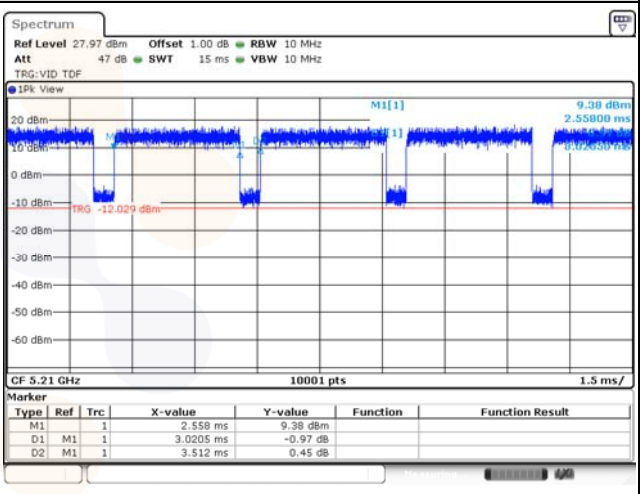
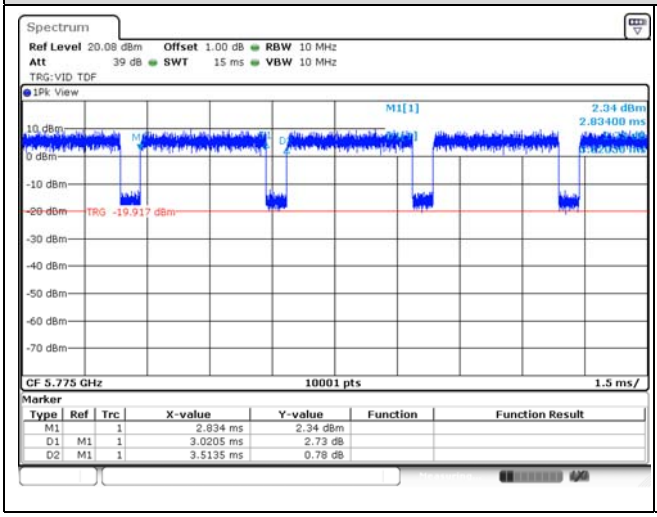
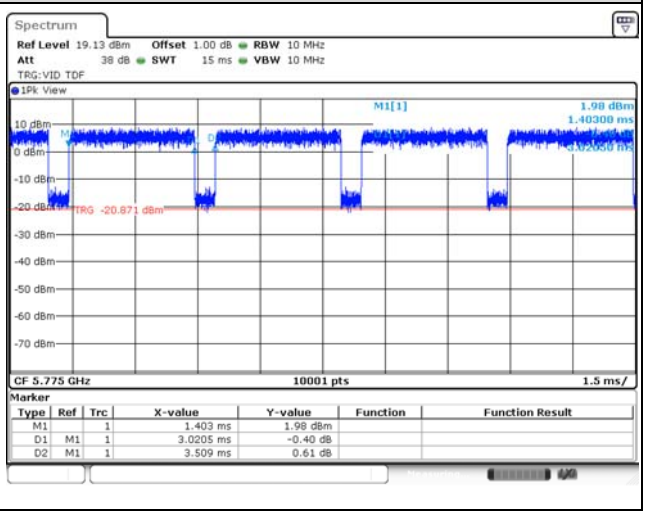
1. Duty cycle (Linear) = T_{on} time / Period
2. DCF(Duty Cycle Factor) = 10log(1/duty cycle)
3. DCF is not compensated to average result if duty cycle is more than 98%

DC 12 V	DC 24 V
UNII-1_802.11ac_VHT80_5 210 ㎒	
	
UNII-3_802.11ac_VHT80_5 775 ㎒	
	

Ant	Voltage	Test Mode	Frequency (㎒)	Period (㎳)	T_{on} time (㎳)	Duty cycle		Duty Cycle Factor (dB)
						(Linear)	(%)	
MIMO	DC 12 V	UNII-1_802.11ac_VHT80	5 210	3.507 5	3.020 5	86.12	0.861 2	0.65
		UNII-3_802.11ac_VHT80	5 775	3.513 5	3.020 5	85.97	0.859 7	0.66
	DC 24 V	UNII-1_802.11ac_VHT80	5 210	3.512 0	3.020 5	86.01	0.860 1	0.65
		UNII-3_802.11ac_VHT80	5 775	3.509 0	3.020 5	86.08	0.860 8	0.65

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%

DC 12 V	DC 24 V
UNII-1_802.11ac_VHT80_5 210 ㎒	
	
UNII-3_802.11ac_VHT80_5 775 ㎒	
	

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 Dipole Antenna (External antenna in the enclosure) on board.
- The E.U.T Complies with the requirement of §15.203, §15.407.

3.1 Antenna information

Mode	SISO		MIMO
	ANT 1	ANT 2	ANT 1 + 2
802.11ac_VHT80	√	√	√

√ = Support, ✕ = Not support

3.2 Directional Gain Calculations

According to clause F), 2), d), (i) of KDB 662911 D01 Multiple Transmitter Output, Directional gain may be calculated by using the formulas as below.

3.2.1. Directional Antenna Gain

Band	ANT 1 Gain (dBi)	ANT 2 Gain (dBi)	Power Directional Gain (dBi)
UNII 1	11.23	11.23	14.24
UNII 3	11.37	11.37	14.38

Note.

1) Unequal antenna gains, with equal transmit powers. For antenna gains given by G_1, G_2, …, G_N dBi
Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}]$ dBi

2) If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain if the antenna exceeds 6 dBi.

Sample calculation

In case of UNII 1, directional gain = $10\log[(10^{11.23/20} + 10^{11.23/20})^2 / 2] = 14.24$ dBi.
In case of UNII 3, directional gain = $10\log[(10^{11.37/20} + 10^{11.37/20})^2 / 2] = 14.38$ dBi.

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
15.207(a)	RSS-Gen Issue 5, 8.8	AC Conducted Emissions		N/T[1)]
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		

Notes: (N/T: Not Tested, N/A: Not Applicable)

1. This test is not applicable because the EUT only connects DC power line.
2. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
3. 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.
4. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
5. The fundamental of the 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.
6. The test procedure(s) in this report were performed in accordance as following.
   - ANSI C63.10-2013
   - KDB 789033 D02 v02r01
7. Based on the baseline scan, the worst-case data rates were:
   802.11ac_VHT80 mode: MCS0

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 (±)	
Occupied Channel Bandwidth	1.0 %	
Conducted RF power	0.9 dB	
Conducted spurious emissions	1.3 dB	
Radiated spurious emissions	Below 30 ㎒	2.3 dB
	30 ㎒ to 1 000 ㎒	2.5 dB
	1 000 ㎒ to 18 000 ㎒	4.7 dB
	Above 18 000 ㎒	4.8 dB
Conducted emissions	150 ㎑ to 30 ㎒	2.7 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.

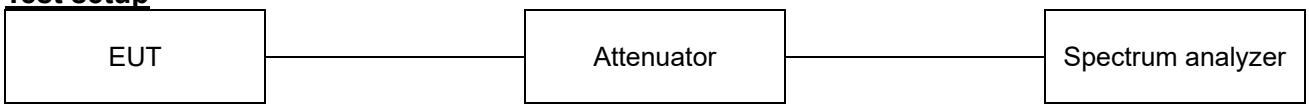
Frequency (㎒)	Factor (dB)	Frequency (㎒)	Factor (dB)
30	10.02	9 000	12.62
50	10.03	10 000	12.65
100	10.14	11 000	12.56
200	10.22	12 000	12.68
300	10.34	13 000	13.28
400	10.32	14 000	12.89
500	10.44	15 000	13.09
600	10.42	16 000	13.15
700	10.56	17 000	13.47
800	10.57	18 000	13.24
900	10.57	19 000	13.52
1 000	10.63	20 000	13.54
2 000	10.92	21 000	13.86
3 000	11.15	22 000	13.59
4 000	11.39	23 000	13.68
5 000	11.66	24 000	13.55
6 000	11.85	25 000	13.94
7 000	11.91	26 000	14.03
8 000	12.27	26 500	14.01

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

7. Test results

7.1. Maximum conducted output power

Test setup



Limit

According to §15.407(a), RSS-247(6.2)

Notes:

If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power And the peak power spectral density shall be reduced by the amount in dB that the directional gain if the antenna exceed 6 dBi

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 + 10log10B[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)

Frequency band 5 150-5 250 MHz

LE-LAN devices are restricted to indoor operation only in the band 5150-5250 MHz.
However, original equipment manufacturer (OEM) devices, which are installed in vehicles by vehicles manufacturers, are permitted.

Power limits

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 $\log_{10}$B, dBm, whichever is less, where B is the 99% emission bandwidth in megahertz. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

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
KDB 789033 D02 v02r01 - Section E.2.d) or E.3.a)

Test settings
Used test method is Section E.2.d)

◆ **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 X 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%.

Test Results

Conducted output power

Ant	Voltage	Test Mode	Band	Frequency (㎒)	Measured output power					Limit (dBm)
					Reading (dBm)		DCF (dB)	Result (dBm)		
					ANT1	ANT2		ANT1	ANT2	
SISO	DC 12 V	802.11ac VHT80	UNII 1	5 210	2.65	1.83	0.64	3.29	2.47	18.75
			UNII 3	5 775	7.01	10.28	0.64	7.65	10.92	24.63
	DC 24 V		UNII 1	5 210	2.55	2.05	0.64	3.19	2.69	18.75
			UNII 3	5 775	7.19	10.49	0.64	7.83	11.13	24.63

Ant	Voltage	Test Mode	Band	Frequency (㎒)	Measured output power				Limit (dBm)
					Reading (dBm)		DCF (dB)	Result (dBm)	
					ANT1	ANT2		ANT1+ANT2	
MIMO	DC 12 V	802.11ac VHT80	UNII 1	5 210	-2.47	-4.65	0.65	0.23	15.74
			UNII 3	5 775	1.25	3.02	0.66	5.89	21.62
	DC 24 V		UNII 1	5 210	-2.84	-4.38	0.65	0.12	15.74
			UNII 3	5 775	1.37	2.99	0.65	5.92	21.62

Notes:

1. Average result(㏈m) = Average Reading (㏈m) + DCF(㏈)

e.i.r.p.

Ant	Voltage	Test Mode	Band	Frequency (㎒)	Measured output power					MAX. e.i.r.p. Limit (dBm)
					Conducted output power (dBm)		ANT gain (dBi)	MAX. e.i.r.p. (dBm)		
					ANT1	ANT2		ANT1	ANT2	
SISO	DC 12 V	802.11ac VHT80	UNII 1	5 210	3.29	2.47	11.23	14.52	13.70	14.77
			UNII 3	5 775	7.65	10.92	11.37	19.02	22.29	24.63
	DC 24 V		UNII 1	5 210	3.19	2.69	11.23	14.42	13.92	14.77
			UNII 3	5 775	7.83	11.13	11.37	19.20	22.50	24.63

Ant	Voltage	Test Mode	Band	Frequency (㎒)	Measured output power			MAX. e.i.r.p. Limit (dBm)
					Conducted output power (dBm)	ANT gain (dBi)	MAX. e.i.r.p. Result (dBm)	
					ANT1+ANT2		ANT1+ANT2	
MIMO	DC 12 V	802.11ac VHT80	UNII 1	5 210	0.23	14.24	14.47	14.77
			UNII 3	5 775	5.89	14.38	20.27	21.62
	DC 24 V		UNII 1	5 210	0.12	14.24	14.36	14.77
			UNII 3	5 775	5.92	14.38	20.30	21.62

Notes:

1. e.i.r.p. Calculation:
   e.i.r.p. (㏈m) = Conducted output power (㏈m) + Antenna gain (㏈i)

Transmitter Power Control(TPC) e.i.r.p.

Ant	Voltage	Test Mode	Band	Frequency (㎒)	Measured output power					MAX. e.i.r.p. Limit (dBm)
					Conducted output power (dBm)		ANT gain (dBi)	MAX. e.i.r.p. (dBm)		
					ANT1	ANT2		ANT1	ANT2	
SISO	DC 12 V	802.11ac VHT80	UNII 1	5 210	0.32	-0.87	11.23	11.55	10.36	11.77
	DC 24 V		UNII 1	5 210	0.27	-1.05	11.23	11.50	10.18	11.77

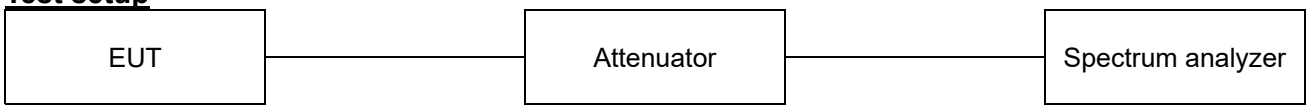
Ant	Voltage	Test Mode	Band	Frequency (㎒)	Measured output power			MAX. e.i.r.p. Limit (dBm)
					Conducted output power (dBm)	ANT gain (dBi)	MAX. e.i.r.p. Result (dBm)	
					ANT1+ANT2		ANT1+ANT2	
MIMO	DC 12 V	802.11ac VHT80	UNII 1	5 210	-2.89	14.24	11.35	11.77
	DC 24 V		UNII 1	5 210	-2.74	14.24	11.50	11.77

Notes:

1. e.i.r.p. Calculation:
   e.i.r.p. (dB m) = Conducted output power (dB m) + Antenna gain (dB i)

7.2. Maximum Power Spectral Density

Test setup



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

Notes:

If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power And the peak power spectral density shall be reduced by the amount in dB that the directional gain if the antenna exceed 6 dBi

Test procedure

ANSI C63.10-2013 Section 12.3.2.2, 14.3.2.2
KDB 789033 D02 v02r01 - 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 1 MHz 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 ㎑ RBW, thus a narrower RBW may need to be used. The rules permit the use of RBWs less than 1 ㎒, or 500 ㎑, “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.

Test Results

SISO										
Voltage	Test Mode	Band	Frequency (㎒)	Measured PSD (dBm/㎒)		DCF (dB)	Maximum PSD (dBm/㎒)		FCC Limit (dBm/㎒)	IC Limit (dBm/㎒)
				ANT1	ANT2		ANT1	ANT2		
DC 12 V	802.11ac VHT80	UNII 1	5 210	-0.46	-6.27	0.64	0.18	-5.63	5.77	11.00
DC 24 V				-0.43	-6.26	0.64	0.21	-5.62	5.77	11.00

SISO										
Voltage	Test Mode	Band	Frequency (㎒)	Measured PSD (dBm /500 ㎑)		DCF (dB)	Maximum PSD (dB m /500 ㎑)		FCC Limit (dBm /500 ㎑)	IC Limit (dBm /500 ㎑)
				ANT1	ANT2		ANT1	ANT2		
DC 12 V	802.11ac VHT80	UNII 3	5 775	-12.90	-9.21	0.64	-12.26	-8.57	24.63	24.63
DC 24 V				-12.84	-9.20	0.64	-12.20	-8.56	24.63	24.63

MIMO									
Voltage	Test Mode	Band	Frequency (㎒)	Measured PSD (dBm/㎒)		DCF (dB)	Maximum PSD	FCC Limit (dBm/㎒)	IC Limit (dBm/㎒)
				ANT1	ANT2		Reading (dBm/㎒)		
DC 12 V	802.11ac VHT80	UNII 1	5 210	-2.07	-6.16	0.65	0.01	2.76	11.00
DC 24 V				-2.54	-6.44	0.65	-0.40	2.76	11.00

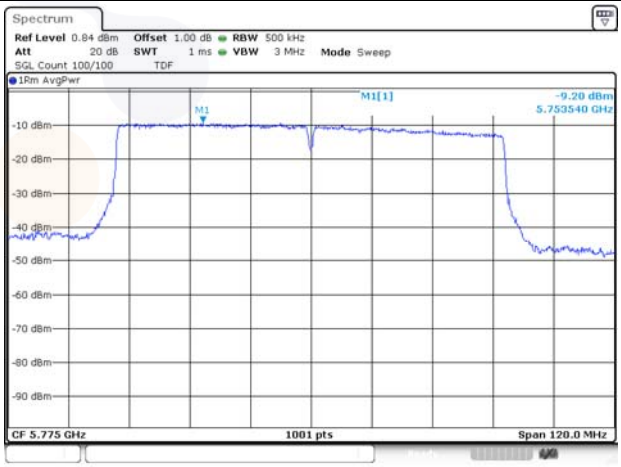
MIMO									
Voltage	Test Mode	Band	Frequency (㎒)	Measured PSD (dBm /500 ㎑)		DCF (dB)	Maximum PSD	FCC Limit (dBm /500 ㎑)	IC Limit (dBm /500 ㎑)
				ANT1	ANT2		Reading (dBm /500 ㎑)		
DC 12 V	802.11ac VHT80	UNII 3	5 775	-11.82	-8.93	0.66	-6.47	21.62	21.62
DC 24 V				-11.57	-8.53	0.65	-6.13	21.62	21.62

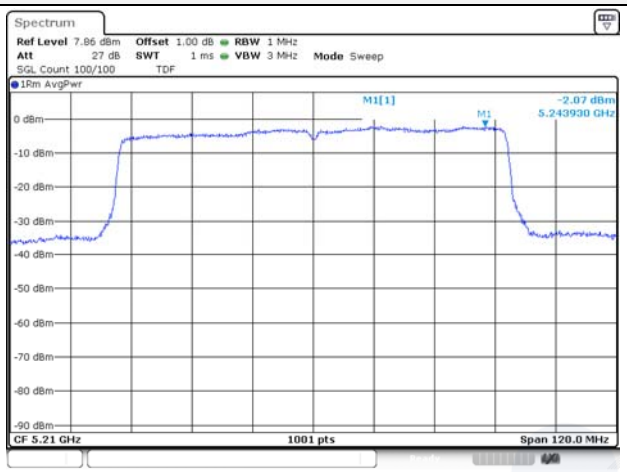
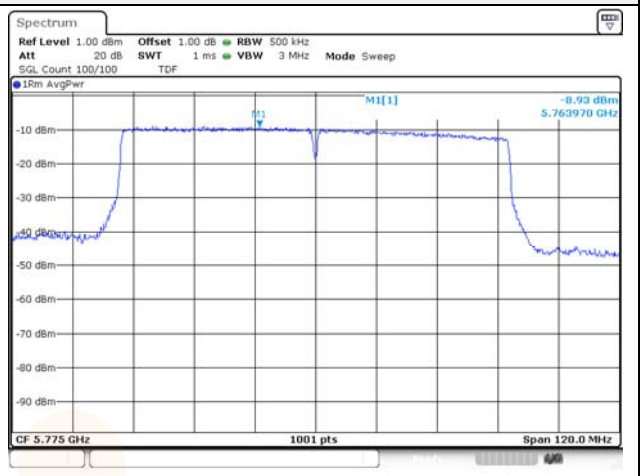
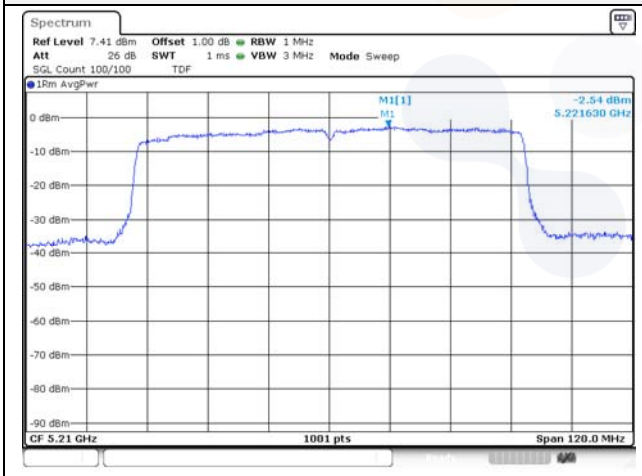
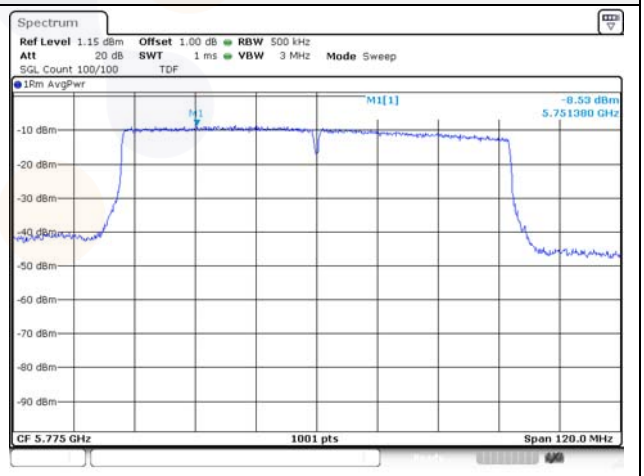
Notes:

1. Maximum PSD calculation

- Maximum PSD = Measured PSD + D.C.F

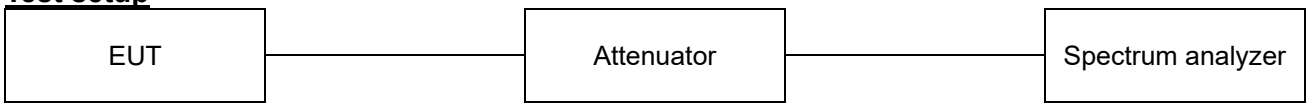
In order to simplify the report, attached plots were only worst Maximum Power Spectral Density

SISO	
DC 12 V	
ANT1	**ANT2**
UNII-1 / 802.11ac VHT80 / 5 210 ㎒	**UNII-3 / 802.11ac VHT80 / 5 775 ㎒**
	
DC 24 V	
ANT1	**ANT2**
UNII-1 / 802.11ac VHT80 / 5 210 ㎒	**UNII-3 / 802.11ac VHT80 / 5 775 ㎒**
	

MIMO	
DC 12 V	
ANT1	**ANT2**
UNII-1 / 802.11ac VHT80 / 5 210 ㎒	**UNII-3 / 802.11ac VHT80 / 5 775 ㎒**
	
DC 24 V	
ANT1	**ANT2**
UNII-1 / 802.11ac VHT80 / 5 210 ㎒	**UNII-3 / 802.11ac VHT80 / 5 775 ㎒**
	

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.

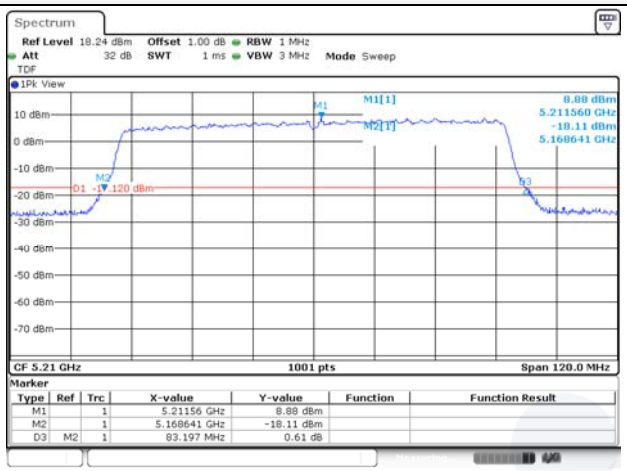
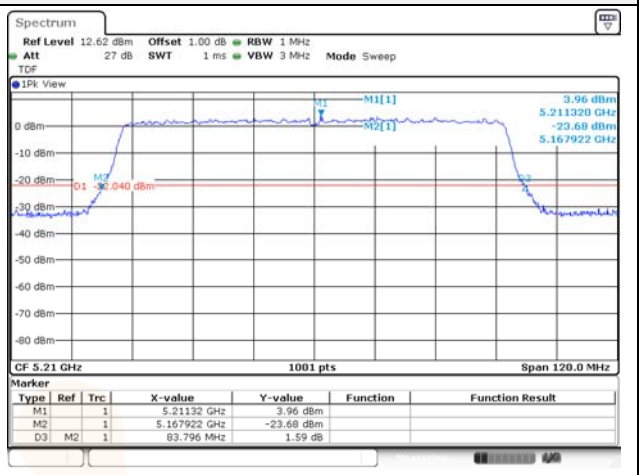
Test Results

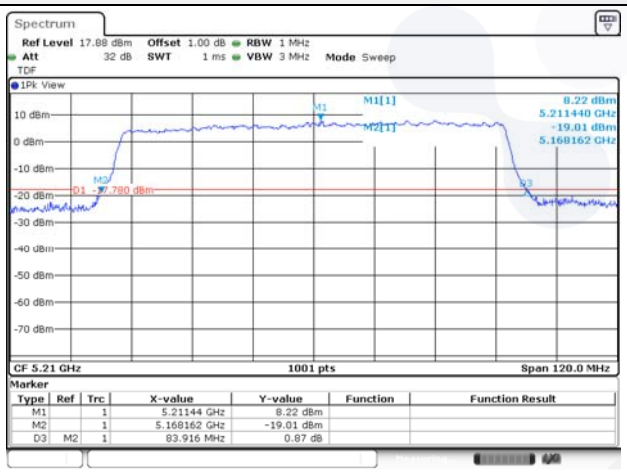
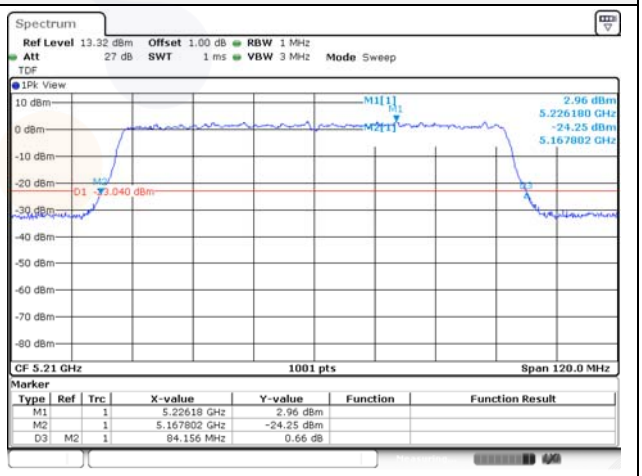
Ant	Voltage	Test Mode	Band	Frequency(㎒)	26 ㏈ bandwidth (㎒)		99% bandwidth (㎒)	
					ANT1	ANT2	ANT1	ANT2
SISO	DC 12 V	802.11ac VHT80	UNII 1	5 210	83.20	83.80	75.64	75.64
	DC 24 V				82.72	83.44	75.64	75.64

Ant	Voltage	Test Mode	Band	Frequency(㎒)	26 ㏈ bandwidth (㎒)		99% bandwidth (㎒)	
					ANT1	ANT2	ANT1	ANT2
MIMO	DC 12 V	802.11ac VHT80	UNII 1	5 210	83.80	84.16	75.64	76.00
	DC 24 V				83.92	83.80	75.76	75.76

26 dB bandwidth

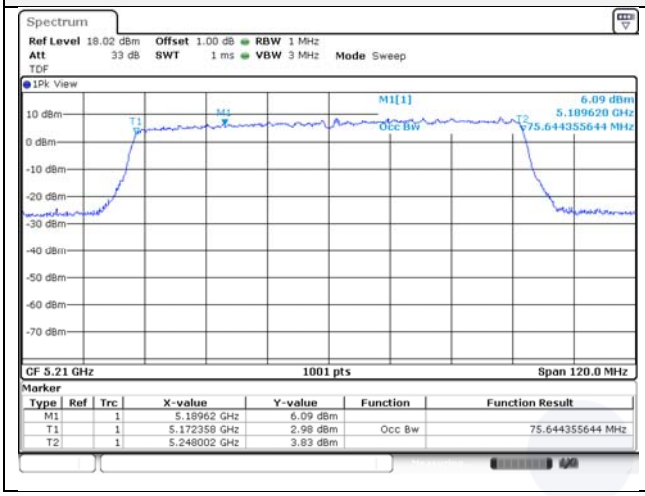
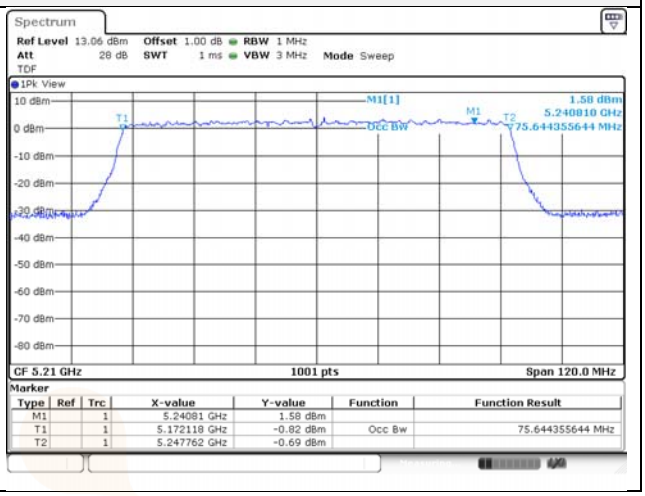
In order to simplify the report, attached plots were only worst bandwidth

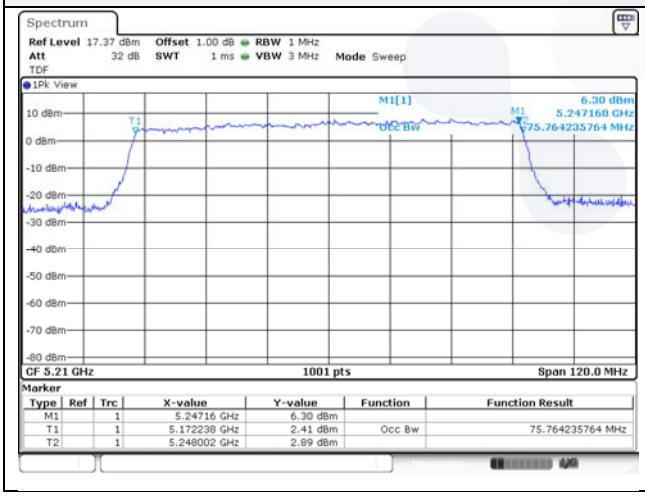
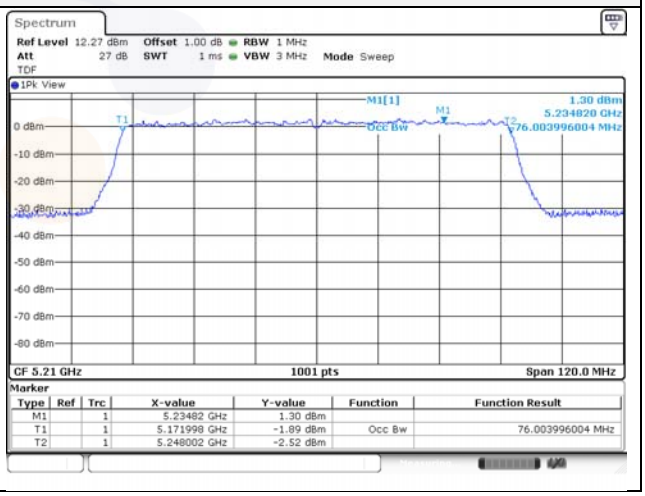
SISO_UNII-1 / 802.11ac VHT80 / 5 210 ㎒	
DC 12 V	**DC 12 V**
ANT1	**ANT2**
	

MIMO_UNII-1 / 802.11ac VHT80 / 5 210 ㎒	
DC 24 V	**DC 12 V**
ANT1	**ANT2**
	

99% Bandwidth

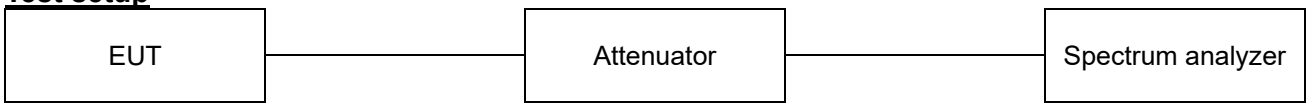
In order to simplify the report, attached plots were only worst bandwidth

SISO_UNII-1 / 802.11ac VHT80 / 5 210 ㎒	
DC 12 V	**DC 24 V**
ANT1	**ANT2**
	

MIMO_UNII-1 / 802.11ac VHT80 / 5 210 ㎒	
DC 24 V	**DC 12 V**
ANT1	**ANT2**
	

7.4. 6 dB Bandwidth

Test setup



Limit

According to §15.407(e), RSS-247(6.2.4), Within the 5.725-5.850 ㎓ bands, the minimum 6 ㏈ bandwidth of U-NII devices shall be at least 500 ㎑.

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 ㎓

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

1. Set RBW = 100 ㎑.
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 ㏈ relative to the maximum level measured in the fundamental emission.

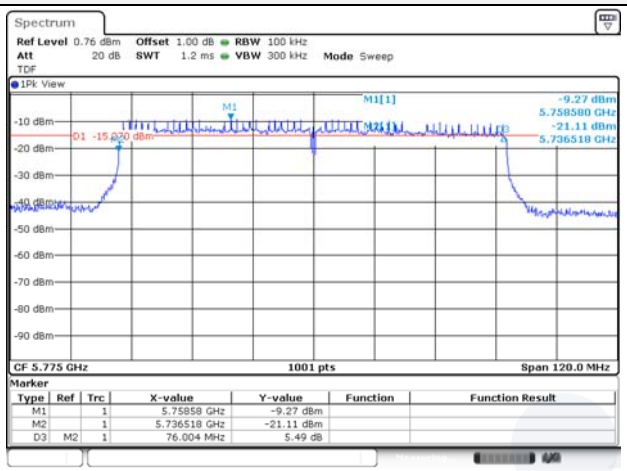
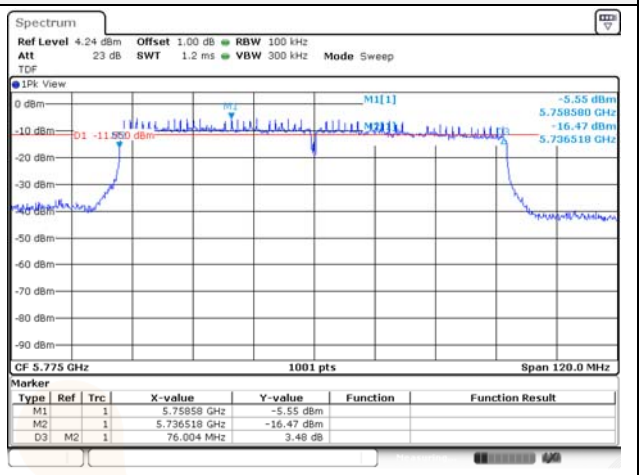
Test Results

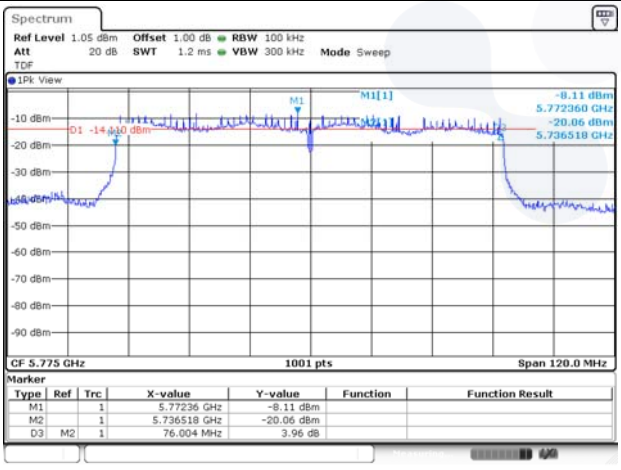
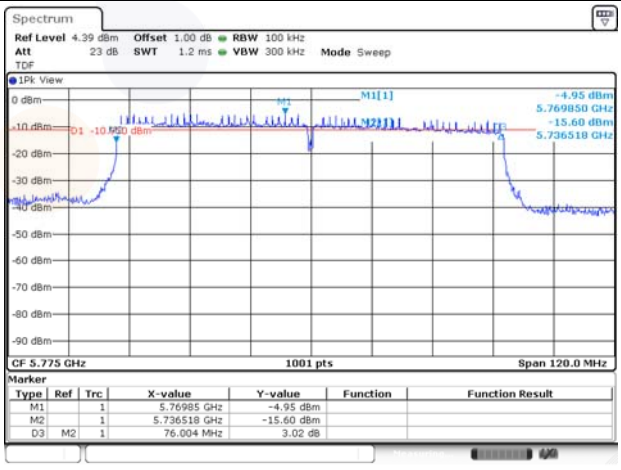
Ant	Voltage	Test Mode	Band	Frequency (㎒)	6 ㏈ bandwidth (㎒)		Limit (㎒)	99% bandwidth (㎒)	
					ANT1	ANT2		ANT1	ANT2
SISO	DC 12 V	802.11ac VHT80	UNII-3	5 775	76.00	76.00	0.50	76.00	76.00
	DC 24 V				76.00	76.00	0.50	75.76	75.76

Ant	Voltage	Test Mode	Band	Frequency (㎒)	6 ㏈ bandwidth (㎒)		Limit (㎒)	99% bandwidth (㎒)	
					ANT1	ANT2		ANT1	ANT2
MIMO	DC 12 V	802.11ac VHT80	UNII-3	5 775	76.00	76.00	0.50	76.00	76.00
	DC 24 V				76.00	76.00	0.50	75.76	75.76

6 dB bandwidth

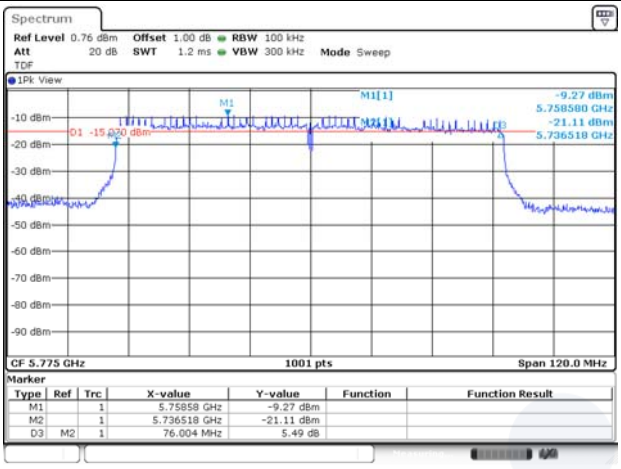
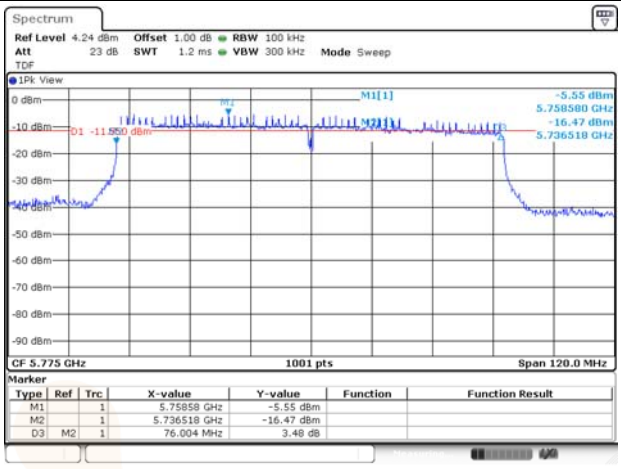
In order to simplify the report, attached plots were only worst bandwidth

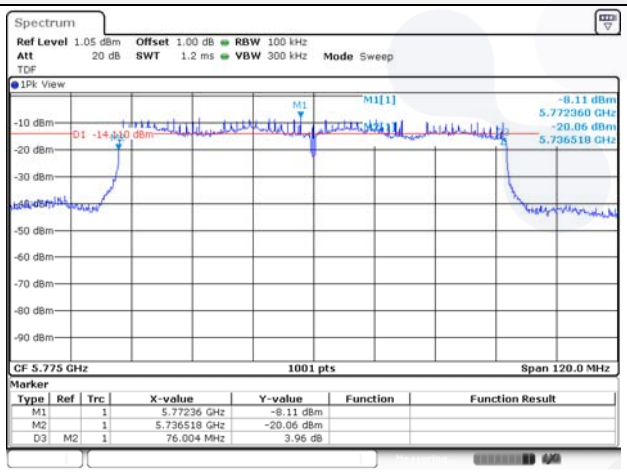
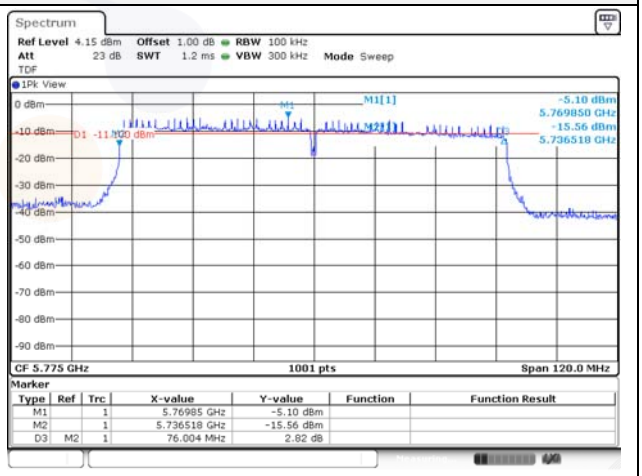
SISO_UNII-3 / 802.11ac VHT80 / 5 775 ㎒	
DC 12 V	**DC 12 V**
ANT1	**ANT2**
	

MIMO_UNII-3 / 802.11ac VHT80 / 5 775 ㎒	
DC 12 V	**DC 12 V**
ANT1	**ANT2**
	

99% Bandwidth

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

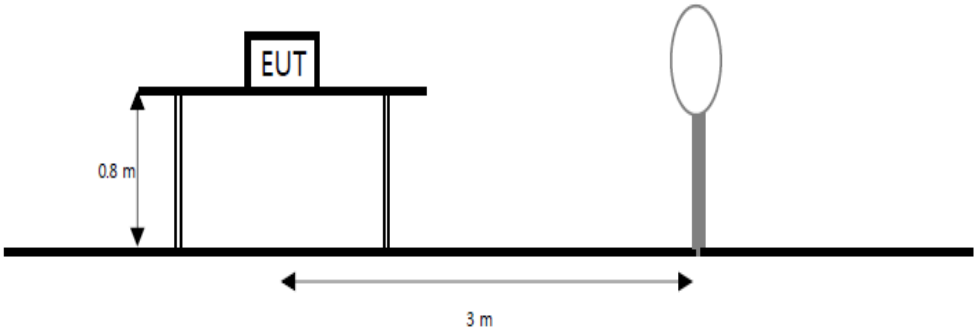
SISO_UNII-3 / 802.11ac VHT80 / 5 775 ㎒	
DC 12 V	DC 12 V
ANT1	ANT2
	

MIMO_UNII-3 / 802.11ac VHT80 / 5 775 ㎒	
DC 12 V	DC 12 V
ANT1	ANT2
	

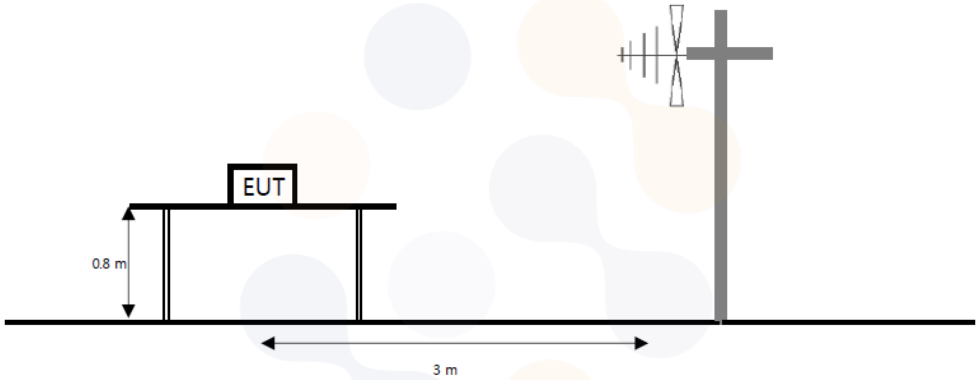
7.5. Spurious Emission, Band Edge and Restricted bands

Test setup

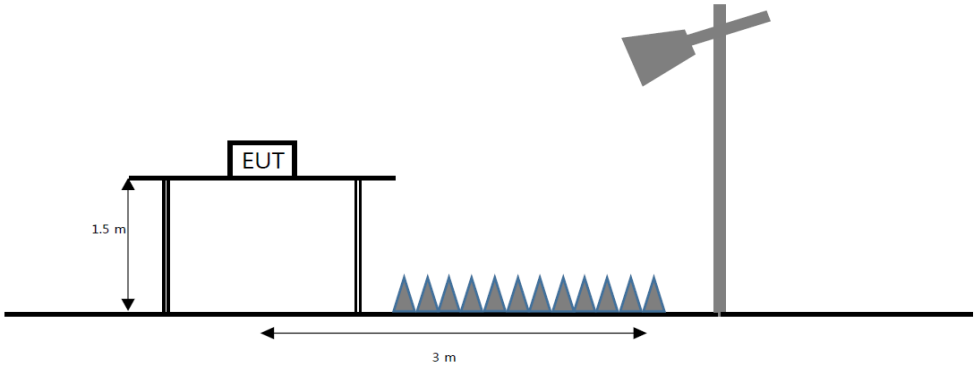
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions



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	156.7 - 156.9	2 690 – 2 900	22.01 - 23.12
8.414 25 - 8.414 75	162.012 5 - 167.17	3 260 – 3 267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3 332 – 3 339	31.2 - 31.8
12.519 75 - 12.520 25	240 - 285	3 345.8 – 3 358	36.43 - 36.5
12.576 75 - 12.577 25	322 - 335.4	3 600 – 4 400	Above 38.6
13.36 - 13.41			

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 5.725-5.85 ㎓ 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 dB 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.

Notes:

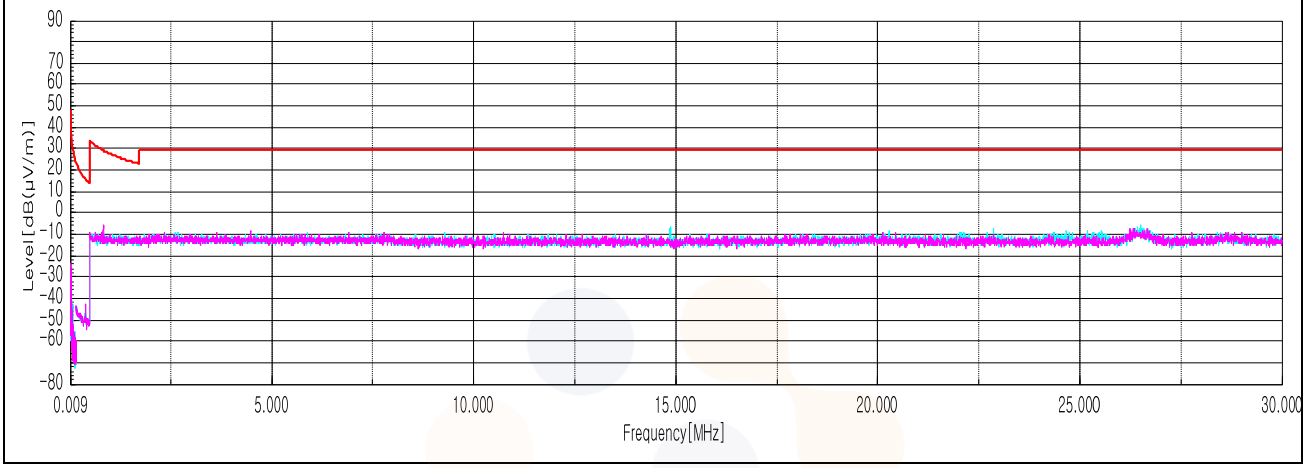
1. *f* <30 ㎒, extrapolation factor of 40 dB/decade of distance. $F_d = 40\log(D_m/D_s)$
   f ≥30 ㎒, extrapolation factor of 20 dB/decade of distance. $F_d = 20\log(D_m/D_s)$
   Where:
   F_d= Distance factor in dB
   D_m= Measurement distance in meters
   D_s= Specification distance in meters
2. Factors(dB) = Antenna factor(dB/m) + Cable loss(dB) + or Amp. gain(dB) - or F_d(dB)
3. The worst-case emissions are reported however emissions whose levels were not within 20 dB 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. 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 dB of the limit, then the following statement shall be made: “No spurious emissions were detected within 20 dB of the limit.”
7. 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.
8. 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 dBμV/m, which is equivalent to Y - 51.5 = Z dBμA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.
9. All tests were performed on the power type (DC 12 V, DC 24 V).
   Since the output deviation is not large, only the worst-case power mode(DC 24 V) due to the client’s request was reported

[DC 24 V]

Test Results (Below 30 ㎒) – Worst case: 802.11ac VHT80 / UNII-3 SISO ANT2 5 775 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
No spurious emissions were detected within 20 dB of the limit.								

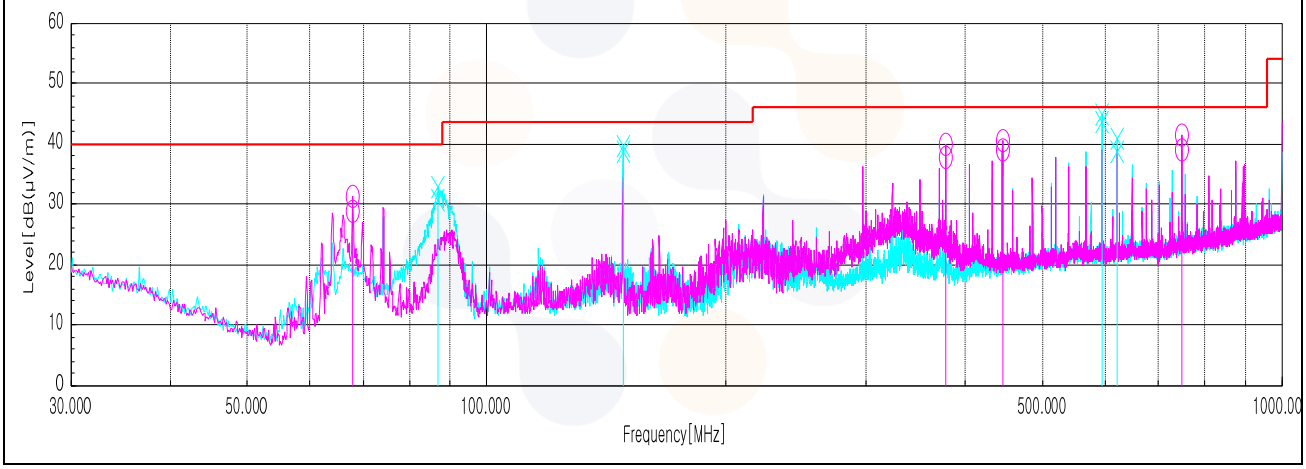
Horizontal/Vertical



Test Results (Below 1 000 ㎒) – Worst case: 802.11ac VHT80 / UNII-3 SISO ANT2 5 775 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data								
67.83	H	46.70	12.26	-30.05	-	28.91	40.00	11.09
86.99	V	45.90	14.30	-29.69	-	30.51	40.00	9.49
148.46	V	50.80	16.57	-28.69	-	38.68	43.50	4.82
377.99	H	42.50	20.77	-25.58	-	37.69	46.00	8.31
445.52	H	41.30	22.12	-24.82	-	38.60	46.00	7.40
594.06	V	43.10	24.04	-23.52	-	43.62	46.00	2.38
620.97	V	37.40	24.16	-23.52	-	38.04	46.00	7.96
749.98	H	35.90	24.85	-22.62	-	38.13	46.00	7.87

Horizontal/Vertical



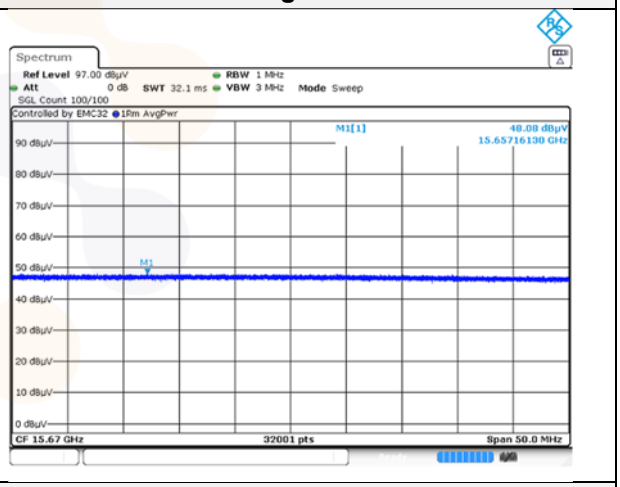
Test Results (Above 1 000 ㎒)

802.11ac VHT80 / UNII-1_SISO ANT1_5 210 ㎒

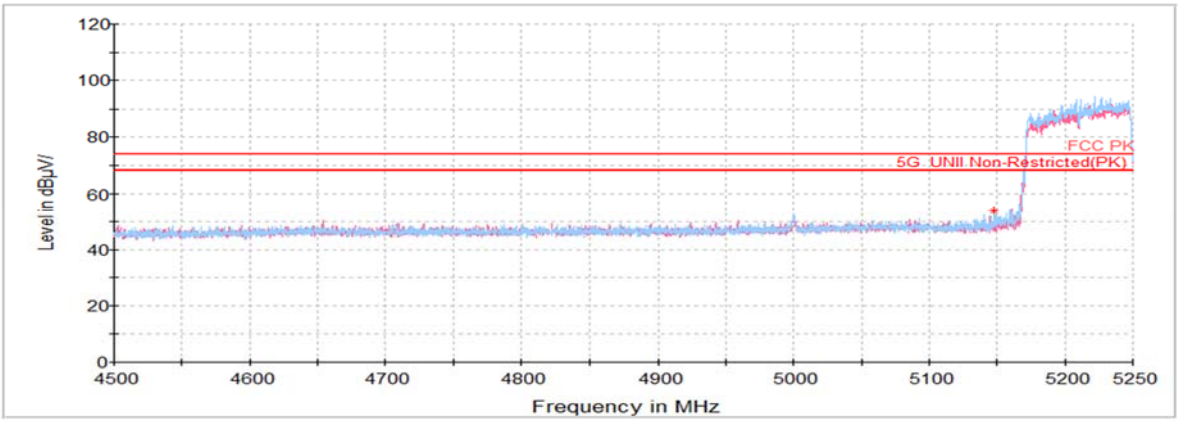
Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
1 194.91[1)]	V	73.19	28.12	-52.72	-	48.59	74.00	25.41
4 999.93[1)]	H	44.14	33.70	-23.92	-	53.92	74.00	20.08
6 946.70	H	72.00	35.11	-52.13	-	54.98	68.20	13.22
10 457.08	V	61.12	37.17	-47.89	-	50.40	68.20	17.80
15 657.16[1)]	V	58.58	40.43	-47.10	-	51.91	74.00	22.09
Average Data								
4 999.93[1)]	H	36.95	33.70	-23.92	0.64	47.37	54.00	6.63
15 657.16[1)]	V	48.08	40.43	-47.10	0.64	42.05	54.00	11.95

Average Data

Average Data

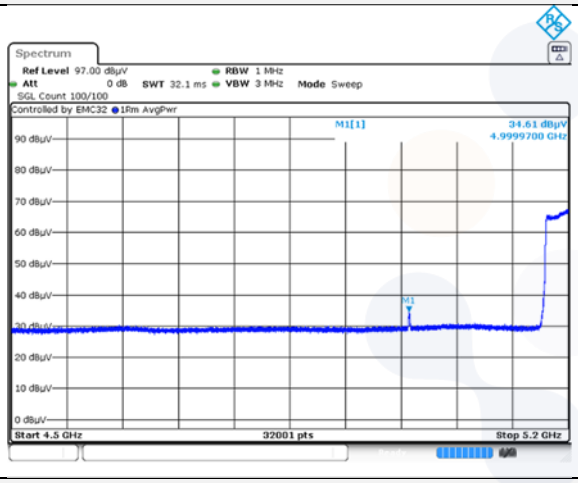


Horizontal/Vertical for Band-edge

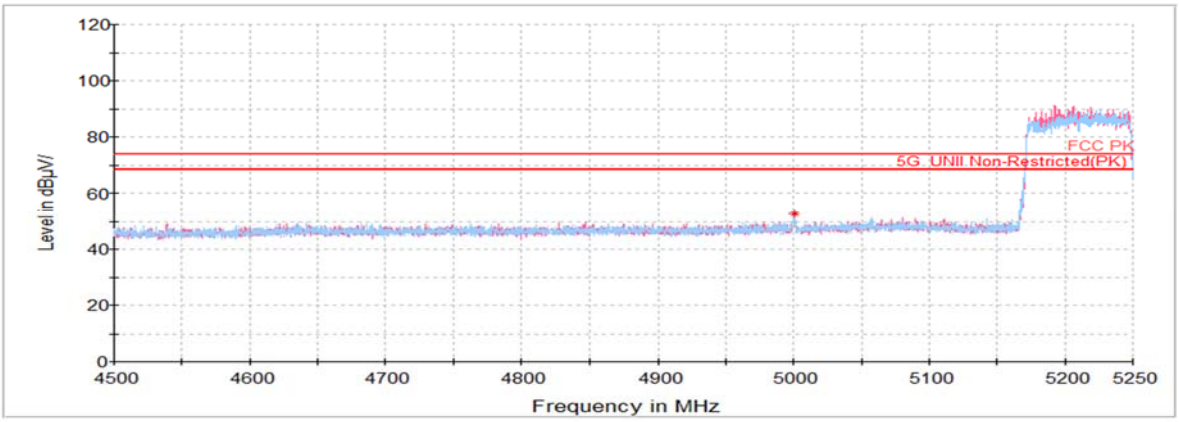


802.11ac VHT80 / UNII-1 SISO ANT2 5 210 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
1 195.59[1)]	V	72.11	28.12	-52.72	-	47.51	74.00	26.49
4 999.97[1)]	V	43.03	33.70	-23.92	-	52.81	74.00	21.19
6 946.70	V	66.58	35.11	-52.13	-	49.56	68.20	18.64
10 346.75	V	57.74	37.08	-47.99	-	46.83	68.20	21.37
15 639.98[1)]	V	57.45	40.41	-47.14	-	50.72	74.00	23.28
Average Data								
4 999.97[1)]	V	34.61	33.70	-23.92	0.64	45.03	54.00	8.97

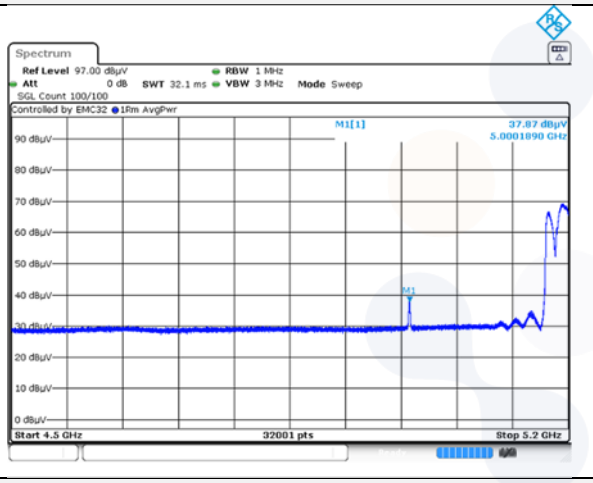
Average Data	-
	Blank

Horizontal/Vertical for Band-edge

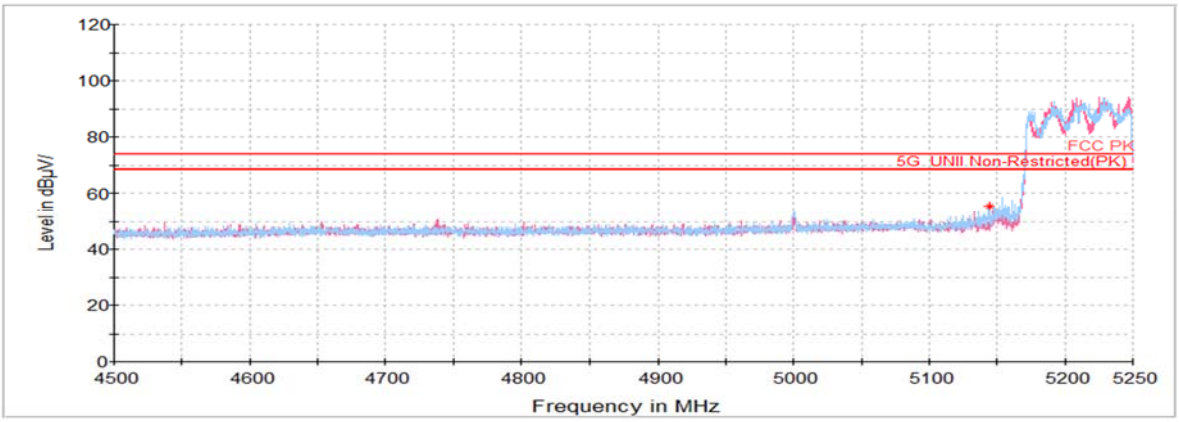


802.11ac VHT80 / UNII-1_MIMO_5 210 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
1 194.56[1)]	H	72.09	28.12	-52.72	-	47.49	74.00	26.51
5 000.19[1)]	H	45.98	33.70	-23.92	-	55.76	74.00	18.24
6 947.06	V	69.96	35.11	-52.13	-	52.94	68.20	15.26
10 420.42	H	57.54	37.14	-47.92	-	46.76	68.20	21.44
15 622.02[1)]	H	57.36	40.40	-47.17	-	50.59	74.00	23.41
Average Data								
5 000.19[1)]	H	37.87	33.70	-23.92	0.65	48.30	54.00	5.70

Average Data	-
	Blank

Horizontal/Vertical for Band-edge

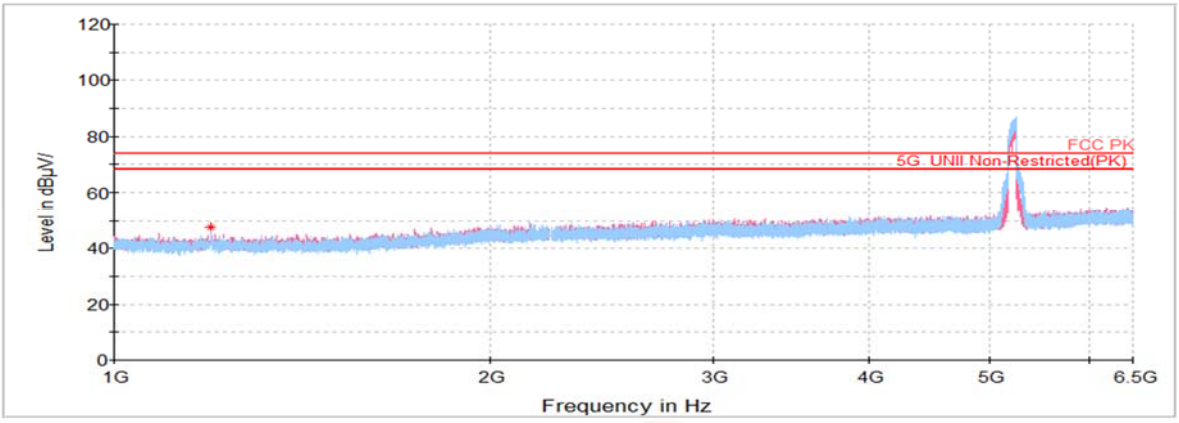


Plot of Harmonics and Spurious Emissions

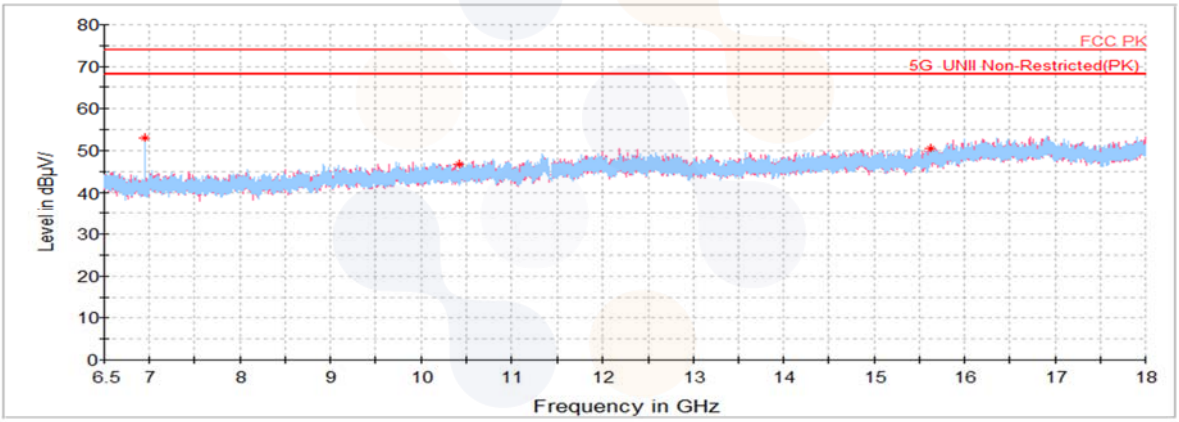
In order to simplify the report, attached plots were only the lowest margin condition

802.11ac VHT80 / UNII-1_MIMO_5 210 ㎒

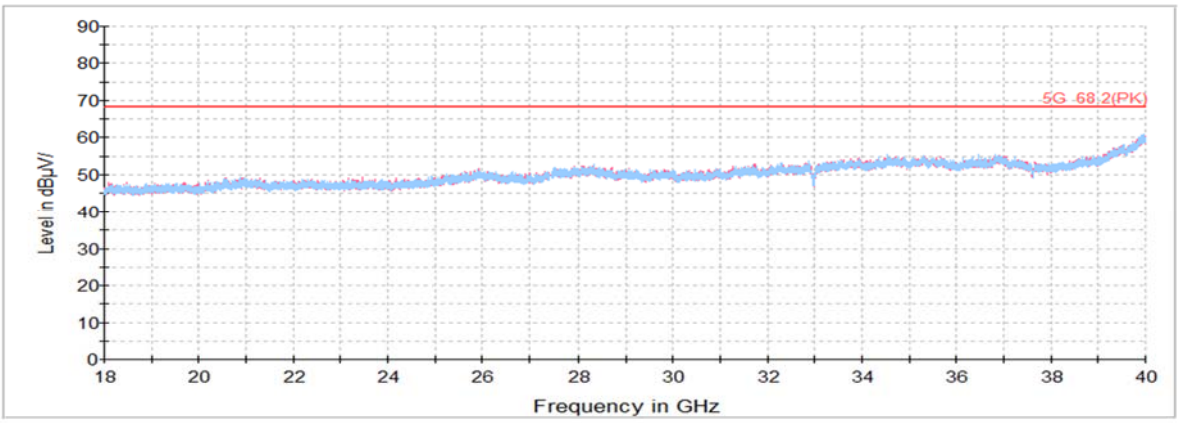
Horizontal/Vertical for 1 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓



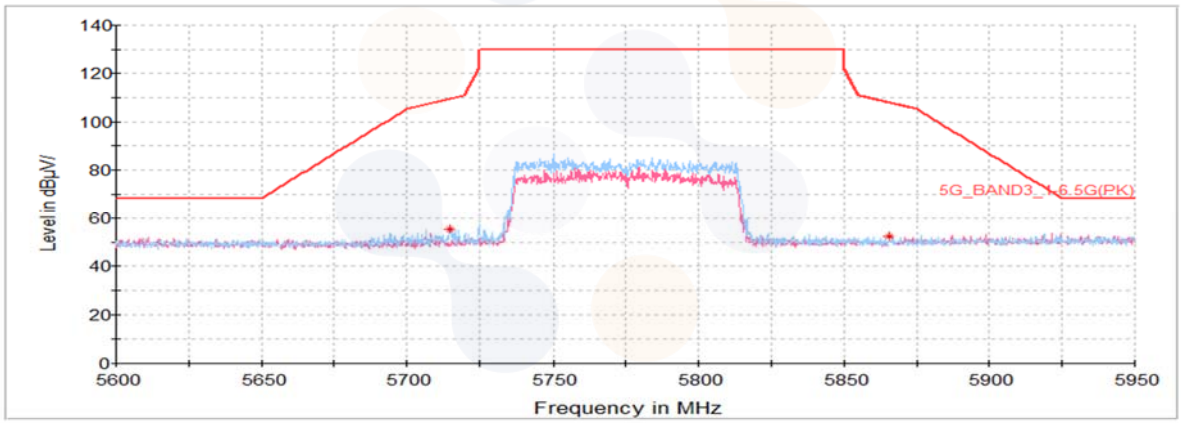
Horizontal/Vertical for 18 ㎓ ~ 40 ㎓



802.11ac VHT80 / UNII-3 SISO ANT1 5 775 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
1 194.56[1)]	V	73.02	28.12	-52.72	-	48.42	74.00	25.58
5 714.70	H	44.20	34.69	-23.36	-	55.53	109.32	53.79
5 865.44	H	40.05	34.96	-22.69	-	52.32	107.88	55.56
6 859.02	H	62.83	35.13	-52.14	-	45.82	68.20	22.38
7 700.31[1)]	V	64.44	35.28	-51.78	-	47.94	74.00	26.06
11 512.56[1)]	H	57.58	38.01	-47.46	-	48.13	74.00	25.87
17 326.89	H	57.15	41.37	-45.35	-	53.17	68.20	15.03
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

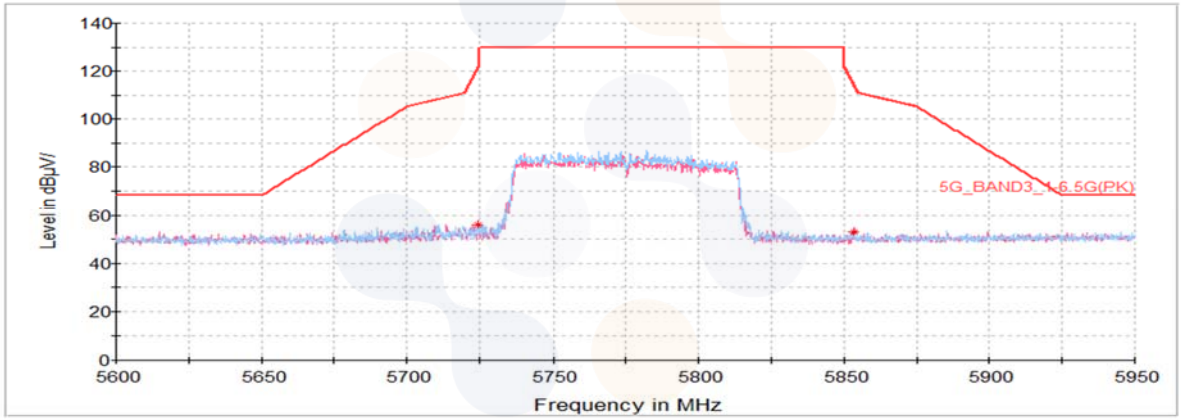
Horizontal/Vertical for Band-edge



802.11ac VHT80 / UNII-3 SISO ANT2 5 775 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
1 195.42[1)]	V	72.54	28.12	-52.72	-	47.94	74.00	26.06
5 724.67	H	44.69	34.70	-23.30	-	56.09	121.45	65.36
5 853.41	H	40.65	34.94	-22.72	-	52.87	114.43	61.56
7 700.31[1)]	H	65.67	35.28	-51.78	-	49.17	74.00	24.83
11 556.41[1)]	V	57.92	38.05	-47.46	-	48.51	74.00	25.49
17 314.31	V	56.27	41.39	-45.32	-	52.34	68.20	15.86
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

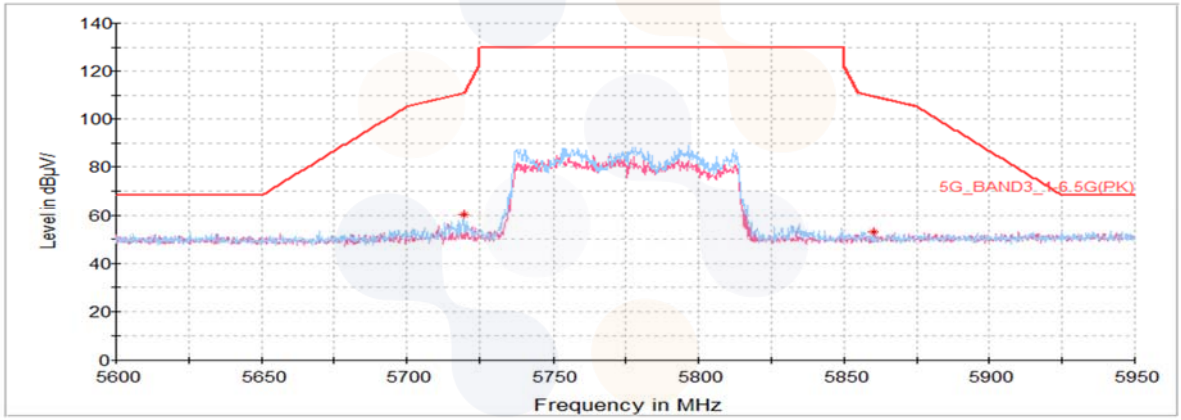
Horizontal/Vertical for Band-edge



802.11ac VHT80 / UNII-3 MIMO 5 775 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
1 195.42[1)]	V	72.80	28.12	-52.72	-	48.20	74.00	25.80
5 719.52	H	48.87	34.70	-23.33	-	60.24	110.66	50.43
5 860.11	H	40.61	34.95	-22.70	-	52.86	109.37	56.51
7 699.95[1)]	V	64.46	35.28	-51.78	-	47.96	74.00	26.04
11 544.91[1)]	V	56.91	38.04	-47.46	-	47.49	74.00	26.51
17 302.09	V	56.86	41.40	-45.30	-	52.96	68.20	15.24
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

Horizontal/Vertical for Band-edge

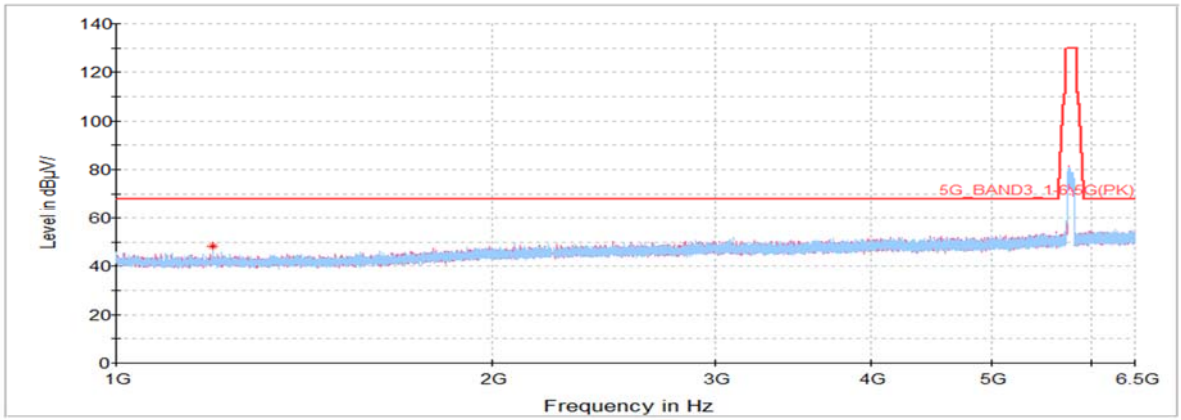


Plot of Harmonics and Spurious Emissions

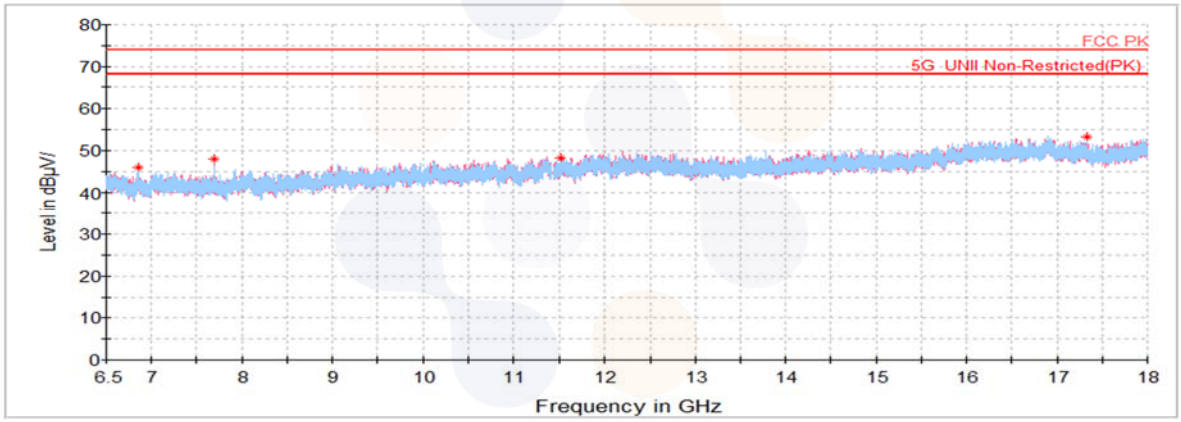
In order to simplify the report, attached plots were only the lowest margin condition

802.11ac VHT80 / UNII-3_SISO ANT1_5 775 ㎒

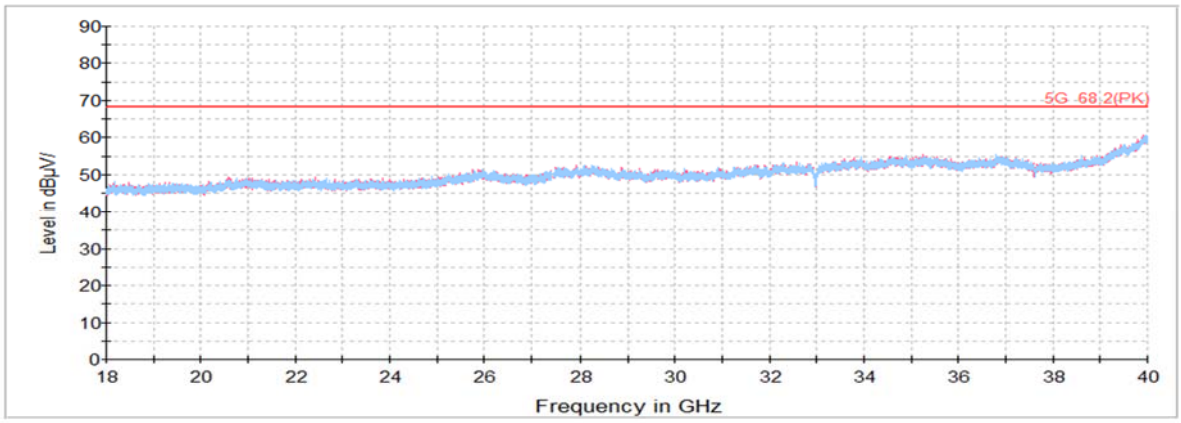
Horizontal/Vertical for 1 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓



Horizontal/Vertical for 18 ㎓ ~ 40 ㎓



8. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Spectrum Analyzer	R&S	FSV30	100808	24.07.03
Attenuator	API Inmet	40AH2W-10	10	24.07.04
DC Power Supply	AGILENT	E3632A	MY40004791	24.07.03
Spectrum Analyzer	R&S	FSV40	100989	24.10.13
Horn antenna	ETS.lindgren	3117	251528	24.02.02
Horn antenna	ETS.lindgren	3116	86632	24.01.25
AMPLIFIER	B&Z Technologies	BZRT-00504000-481055-382525	26299-27735	24.07.04
AMPLIFIER	B&Z Technologies	BZR-0050400-551028-252525	27736	24.07.04
Attenuator	API Inmet	40AH2W-10	12	24.05.03
High pass Filter	WT	WT-A1699-HS	WT160411002	24.04.25
High pass Filter	Qotana	DBHF058004000A	20070100016	24.07.04
Signal Generator	R&S	SMB100A	176206	24.01.19
EMI TEST RECEIVER	R&S	ESCI7	100732	24.03.03
Bi-Log Antenna	TESEQ	CBL 6112D	62438	24.08.24
Amplifier	SONOMA INSTRUMENT	310N	284608	24.08.18
ATTENUATOR	KEYSIGHT	8491B-6dB	MY39271060	24.04.27
LOOP Antenna	R&S	HFH2-Z2	100355	24.08.10
Antenna Mast	Innco Systems	MA4640-XP-ET	-	-
Controller	Innco Systems	CO3000	1175/45850319/P	-
Antenna Mast	Innco Systems	MA4000-EP	303	-
Turn Table	Innco Systems	CO3000	1175/45850319/P	-

End of test report