verify No.685976299027

TEST REPORT

KCTL Inc. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-31-285-0894 FAX: 82-505-299-8311 www.kctl.co.kr	Report No.: KR19-SRF0066-B Page (1) of (66)	KCTL

1. Client

- Name : RNware Co., Ltd.
- Address : 3F, 37, Alphacity 1-ro 31-gil, Suseong-gu, Daegu, Republic of Korea
- Date of Receipt : 2019-02-07

2. Use of Report : -

3. Name of Product and Model : ANYSYNC 4K (Receiver) / ANYSYNC-4KRH

4. Manufacturer and Country of Origin : RNware Co., Ltd. / Korea

5. FCC ID : 2ASNV-ANYSYNC-4KRH

6. Date of Test : 2019-05-01 to 2019-05-13

7. Test Standards : FCC Part 15 Subpart E, 15.407

8. Test Results : Refer to the test result in the test report

Affirmation	Tested by Name : Myeonghwa Jang (Signature)	Technical Manager Name : Seungyong Kim (Signature)

2019-06-10

KCTL Inc.

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 KCTL Inc.

Report revision history

Date	Revision	Page No
2019-05-27	Initial report	-
2019-06-03	Updated	4, 5, 7, 24~27
2019-06-10	Updated	5, 7

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1. General information

Client	:	RNware Co., Ltd.
Address	:	3F, 37, Alphacity 1-ro 31-gil, Suseong-gu, Daegu, Republic of Korea
Manufacturer	:	RNware Co., Ltd.
Address	:	3F, 37, Alphacity 1-ro 31-gil, Suseong-gu, Daegu, Republic of Korea
Laboratory	:	KCTL Inc.
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-3327, G-198, C-3706, T-1849
		Industry Canada Registration No. : 8035A-2
		KOLAS No.: KT231

2. Device information

Equipment under test	:	ANYSYNC 4K (Receiver)
Model	:	ANYSYNC-4KRH
Derivative model	:	ANYSYNC-WURH
Frequency range	:	WIFI(802.11n HT20)_5 180 ㎒ ~ 5 240 ㎒ (UNII 1)
		5 745 ㎒ ~ 5 825 ㎒ (UNII 3)
Modulation technique	:	OFDM
Number of channels	:	WIFI(802.11n HT20)_4 ch (UNII 1)
		5 ch (UNII 3)
Power source	:	DC 5 V
Antenna specification	:	External - WiFi PCB Substrate Antenna
Antenna gain	:	ANT0_UNII-1: 4.0 ㏈i, UNII-3: 3.98 ㏈i
		ANT1_UNII-1: 4.0 ㏈i, UNII-3: 3.98 ㏈i
Software version	:	19.3.25
Hardware version	:	REV.5
Test device serial No.	:	N/A
Operation temperature	:	0 ℃ ~ 40 ℃

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
Li-ion Battery	Foshan Zhaoneng Battery Industrial Co., Ltd	ZN 754948	-	3.7V, 3500mAh, 12.95Wh
LED Monitor	LG Electronics Inc.	24EA53VA	406NDAYEK144	19 V, 1.5 A
AC/DC Adapter	Samsung Electronics Co., Ltd	EP-TA21KBK	R37K6924GV5RT3	AC 100-240V 50-60Hz 0.50 A

2.2. Information about derivative model

The basic and derivative model are electrically identical.
The derivative models is only for the volume of memory.
(DDR4 1 GB x 2EA --> DDR4 512 MB x 2EA)

2.3. Frequency/channel operations

This device contains the following capabilities:
802.11n HT20

UNII-1

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

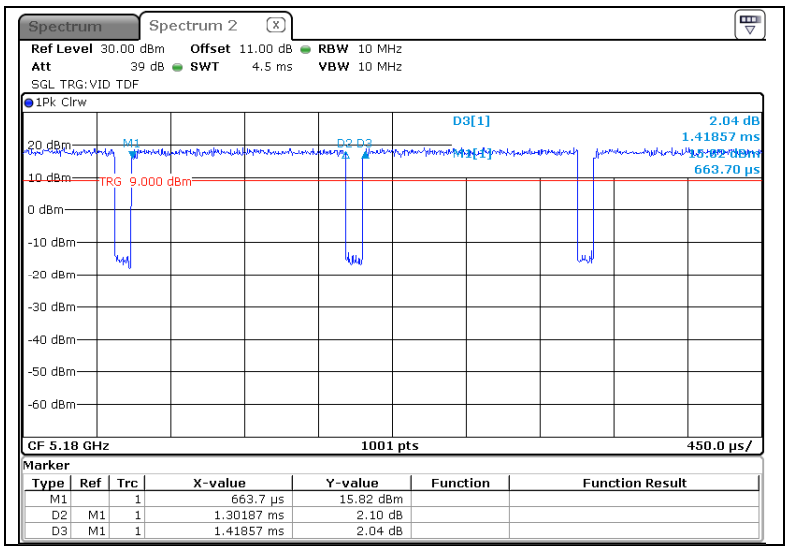
UNII-3

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

Table 2.3.1. 802.11n HT20 mode

2.4. Duty Cycle Correction Factor

- 802.11n HT20 (ANT0)

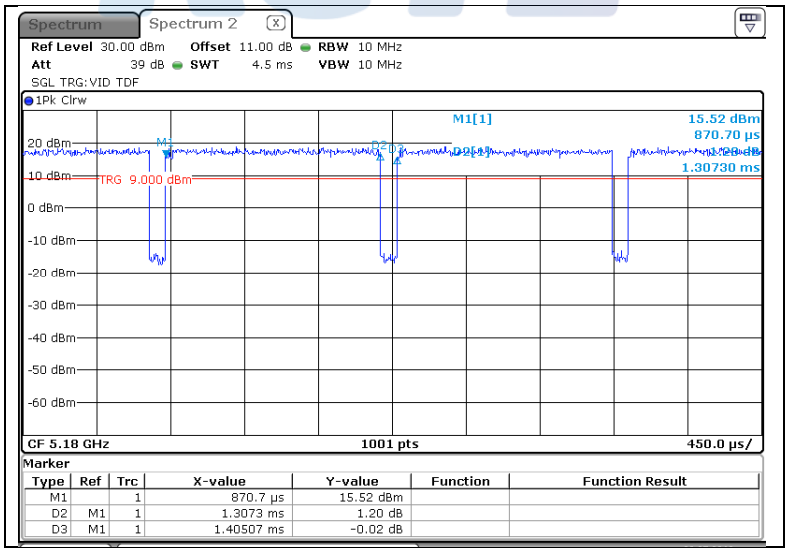


Note1) : period : 1.42 ㎳, On time : 1.32 ㎳

Note2) : DCCF = 10 log(1 / x) = 10 log(1/0.92) = 0.37 ㏈, x = 1.32/1.42 = 0.92

Note3) : 802.11n HT20 is a continuous transmission (duty cycle <= 95 %)

- 802.11n HT20 (ANT1)



Note1) : period : 1.41 ㎳, On time : 1.31 ㎳

Note2) : DCCF = 10 log(1 / x) = 10 log(1/0.93) = 0.31 ㏈, x = 1.31/1.41 = 0.93

Note3) : 802.11n HT20 is a continuous transmission (duty cycle <= 95 %)

3. Antenna requirement

According to §15.203, §15.407

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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."

- The transmitter has attached Wi-Fi PCB Substrate Antenna of U Fl type(external antenna) on board.
- The E.U.T Complies with the requirement of §15.203, §15.407

3.1 Antenna information

Band	SISO		MIMO	
	ANT0	ANT1	ANT0	ANT1
UNII-1	√	√	×	×
UNII-3	√	√	×	×

√ = Support, × = Not support

4. Summary of tests

FCC Part section(s)	Parameter	Test results
15.407(a)	Maximum conducted output power	Pass
15.407(a)	Maximum power spectral density	Pass
15.407(a)	26 dB bandwidth & 99% Occupied bandwidth	Pass
15.407(e)	6 dB bandwidth	Pass
15.407(g)	Frequency stability	Pass
15.407(d), 15.205(a), 15.209(a)	Spurious emission	Pass
	Band-edge, restricted band	Pass
15.207(a)	Conducted emissions	Pass

Notes:

1. Device operates only in the 802.11n HT20 mode. The mode 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 kHz to 30 MHz. 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. 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
4. The test procedure(s) in this report were performed in accordance as following.
   - ANSI C63.10-2013
   - KDB 789033 D02 v02r01
5. This device only operates SISO mode and does not operate MIMO mode.
6. The worst-case data rate was:
   802.11n_HT20 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	
Conducted RF power	1.76 dB	
Conducted spurious emissions	4.03 dB	
Radiated spurious emissions	9 kHz ~ 30 MHz	2.28 dB
	30 MHz ~ 300 MHz	4.98 dB
	300 MHz ~ 1 000 MHz	5.14 dB
	1 GHz ~ 6 GHz	6.70 dB
	Above 6 GHz	6.60 dB
Conducted emissions	9 kHz ~ 150 kHz	3.66 dB
	150 kHz ~ 30 MHz	3.26 dB

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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	0.42	9 000	0.87
100	0.28	10 000	0.61
200	0.39	11 000	0.38
300	0.48	12 000	1.17
400	0.40	13 000	2.07
500	-0.54	14 000	2.10
600	0.53	15 000	1.43
700	0.60	16 000	1.79
800	0.67	17 000	1.75
900	0.71	18 000	2.39
1 000	0.68	19 000	2.59
2 000	0.98	20 000	2.11
3 000	1.06	21 000	2.80
4 000	1.60	22 000	1.36
5 000	1.85	23 000	2.12
6 000	2.23	24 000	2.69
7 000	0.59	25 000	2.74
8 000	0.69	26 000	2.87

Note.
Offset(㏈) = RF cable loss(㏈) + EUT cable loss(㏈)

7. Test results

7.1. Maximum conducted output power

Test setup

EUT — Attenuator — Power sensor

Limit

According to §15.407(a)

Band	EUT category		Limit
UNII-1		Outdoor access point	1 W (30 dBm)
		Indoor access point	
		Fixed point-to-point access point	
	√	Client device	250 mW (24 dBm)
UNII-2A			250 mW or 11 dBm + 10logB*
UNII-2C			250 mW or 11 dBm + 10logB*
UNII-3	√		1 W (30 dBm)

Notes:

FCC Limit B is the 26 dB emission bandwidth.

Test procedure

ANSI C63.10-2013-Section 12.3.3.2 and 14.2
KDB 789033 D02 v02r01 - Section E.3.a) or b)

Test settings

◆ KDB 789033 D02 v02r01

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 dBm 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%).

Section E.3.b)
Method PM-G (Measurement using a gated RF average power meter):
Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

Test results

ANT0

Test mode	Band	Frequency(㎒)	Measured output power			Limit(dBm)
			Reading(dBm)	Duty Factor(dB)	Result(dBm)	
802.11n HT20	UNII-1	5 180	14.01	0.22	14.23	24.00
		5 200	14.12	0.22	14.34	
		5 240	14.43	0.22	14.65	
	UNII-3	5 745	10.94	0.22	11.16	30.00
		5 785	10.61	0.22	10.83	
		5 825	10.10	0.22	10.32	

ANT1

Test mode	Band	Frequency(㎒)	Measured output power			Limit(dBm)
			Reading(dBm)	Duty Factor(dB)	Result(dBm)	
802.11n HT20	UNII-1	5 180	14.38	0.37	14.75	24.00
		5 200	14.48	0.37	14.85	
		5 240	14.93	0.37	15.30	
	UNII-3	5 745	12.96	0.37	13.33	30.00
		5 785	13.25	0.37	13.62	
		5 825	13.40	0.37	13.77	

Note.
1. Result(dB m) = Reading(dB m) + Duty Factor(dB)

7.2. Maximum Power Spectral Density

Test setup

EUT	—	Attenuator	—	Spectrum analyzer

Limit

According to §15.407(a)

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:

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

Test procedure

KDB 789033 D02 v02r01 - Section F
ANSI C63.10-2013

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. serch 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 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz 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 kHz, add 10 log (500 kHz /RBW) to the measured result, whereas RBW (<500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10 log (1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) 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 kHz for the II.F.5.c) and II.F.5.d), since RBW=100 kHz is available on nearly all spectrum analyzers.

Test results

UNII-1

Test mode	ANT	Frequency(㎒)	Peak Power Spectral Density			Limit (dBm/㎒)
			Reading(dBm)	Duty Factor (dB)	Result [1] (dBm/㎒)	
802.11n HT20	0	5 180	2.83	0.22	3.05	11.00
		5 200	2.63	0.22	2.85	
		5 240	3.74	0.22	3.96	
	1	5 180	2.84	0.22	3.06	
		5 200	2.84	0.22	3.06	
		5 240	3.78	0.22	4.00	

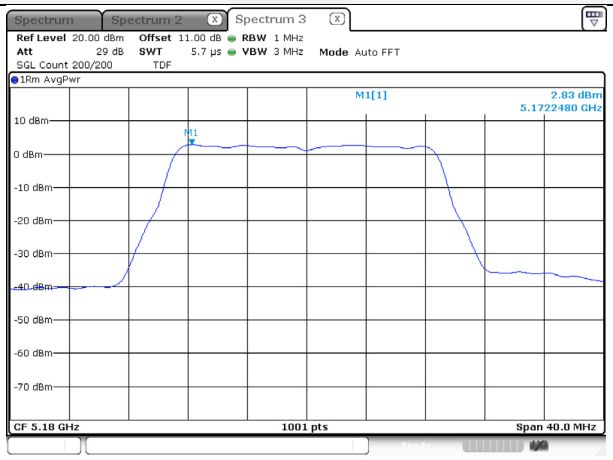
UNII-3

Test mode	ANT	Frequency(㎒)	Peak Power Spectral Density			Limit (dBm/500㎑)
			Reading(dBm)	Duty Factor (dB)	Result [1] (dBm/500㎑)	
802.11n HT20	0	5 745	-2.47	0.22	-2.25	30.00
		5 785	-3.01	0.22	-2.79	
		5 825	-3.15	0.22	-2.93	
	1	5 745	-1.14	0.22	-0.92	
		5 785	-0.51	0.22	-0.29	
		5 825	-0.58	0.22	-0.36	

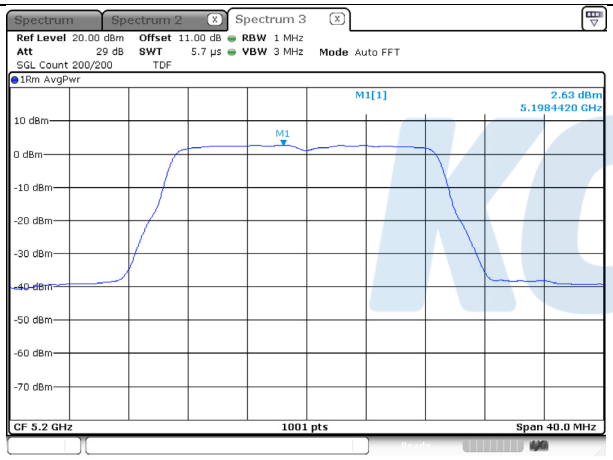
Note.
1. Result(dB m) = Reading(dB m) + Duty Factor(dB)

ANT0_802.11n HT20

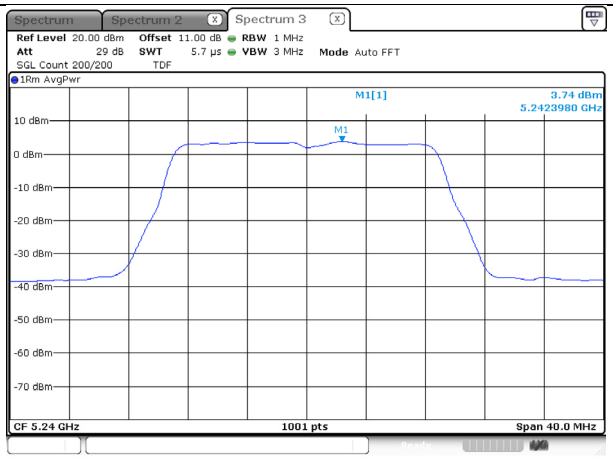
UNII-1



5 180 ㎒

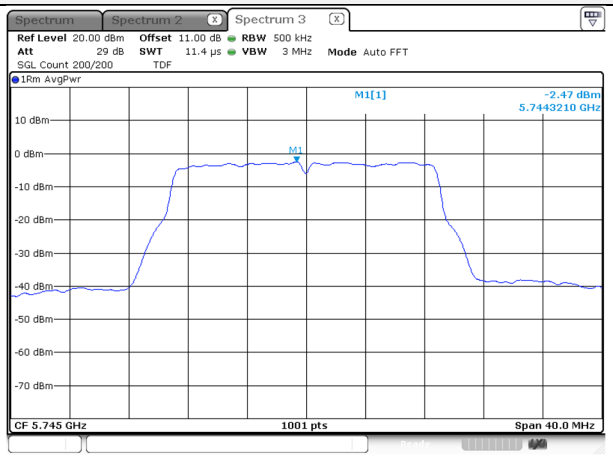


5 200 ㎒

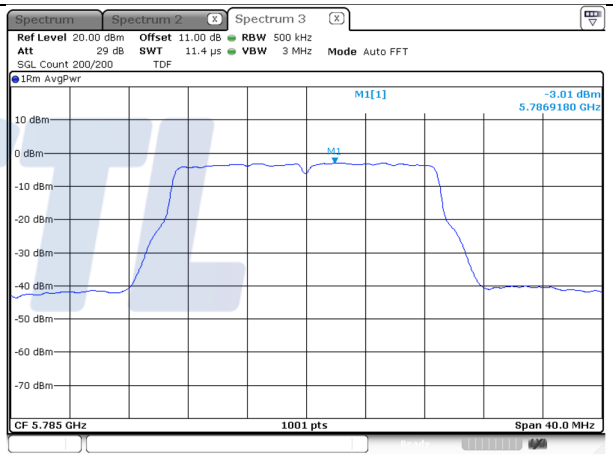


5 240 ㎒

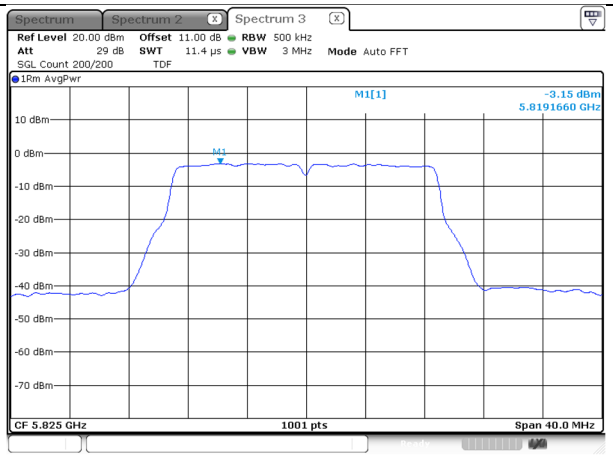
UNII-3



5 745 ㎒



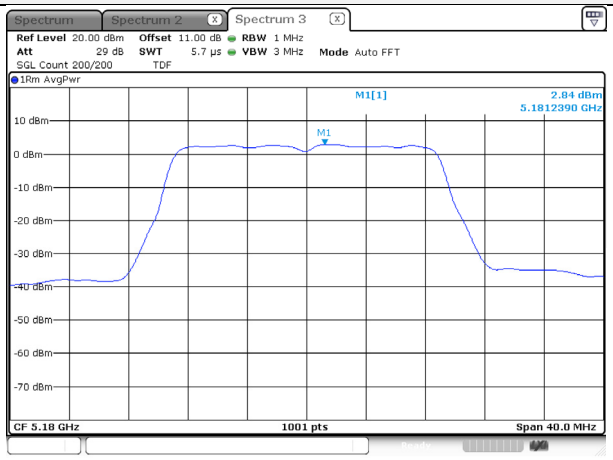
5 785 ㎒



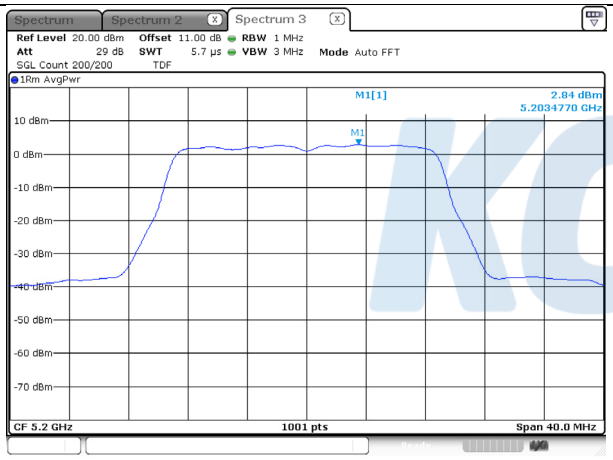
5 825 ㎒

ANT1_802.11n HT20

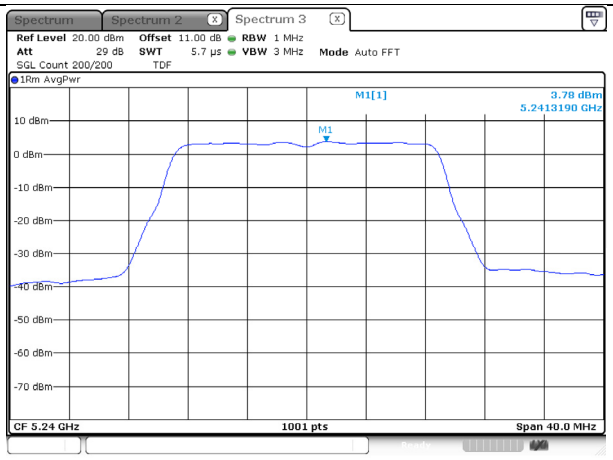
UNII-1



5 180 MHz

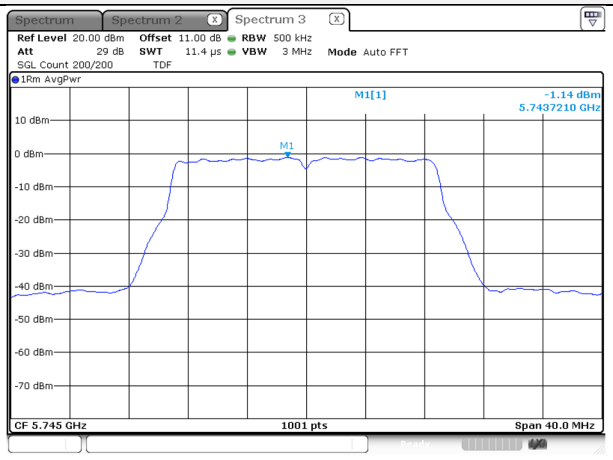


5 200 MHz

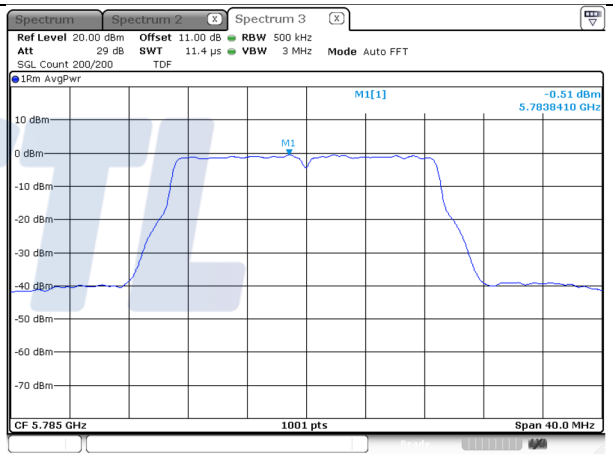


5 240 MHz

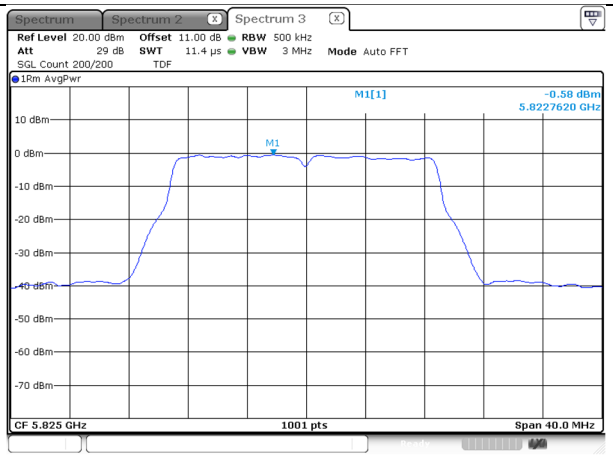
UNII-3



5 745 MHz



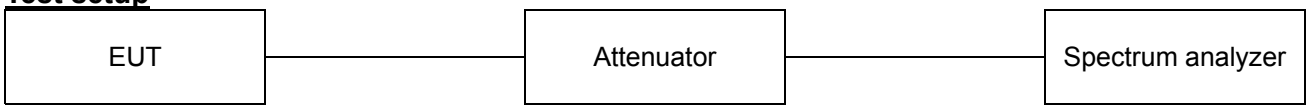
5 785 MHz



5 825 MHz

7.3. 26 dB Bandwidth & 99% Occupied Bandwidth

Test setup



Limit
N/A

Test procedure

26dBbandwidth
KDB 789033 D02 v02r01 - Section C.1

99% bandwidth
KDB 789033 D02 v02r01 - Section D

Test settings

1. 26dB Bandwidth

1. Set RBW = approximately 1% of the emission bandwidth.
2. Set the VBW > RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. 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

1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1% to 5% of the OBW
4. Set VBW ≥ 3 x RBW
5. 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.
6. Use the 99% power bandwidth function of the instrument (if available).
7. 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.

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Test results

ANT0

26 dB bandwidth(MHz)

Test mode	Frequency(MHz)	26 dB bandwidth(MHz)
802.11n HT20_UNII-1	5 180	21.66
	5 200	21.90
	5 240	21.86

99 % bandwidth(MHz)

Test mode	Frequency(MHz)	99 % bandwidth(MHz)
802.11n HT20_UNII-1	5 240	18.18

ANT1

26 dB bandwidth(MHz)

Test mode	Frequency(MHz)	26 dB bandwidth(MHz)
802.11n HT20_UNII-1	5 180	21.58
	5 200	21.34
	5 240	21.34

99 % bandwidth(MHz)

Test mode	Frequency(MHz)	99 % bandwidth(MHz)
802.11n HT20_UNII-1	5 240	17.98

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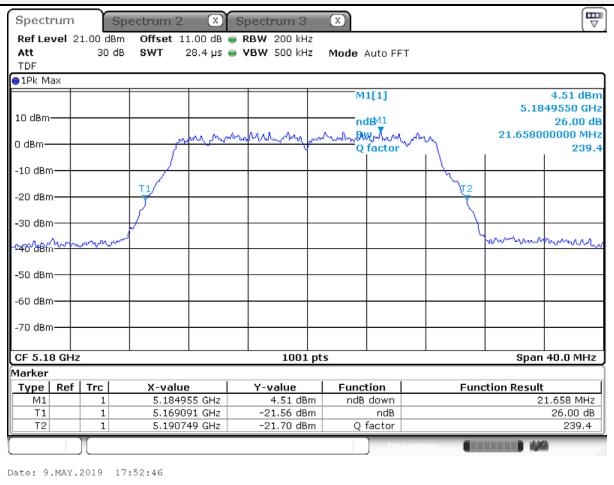
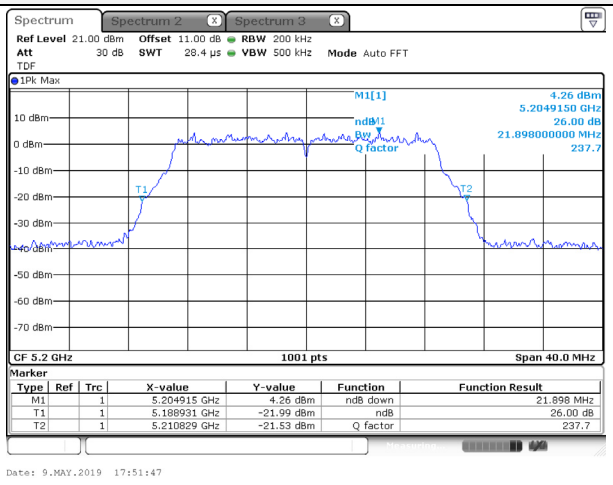
ANT0

26 dB bandwidth(MHz)

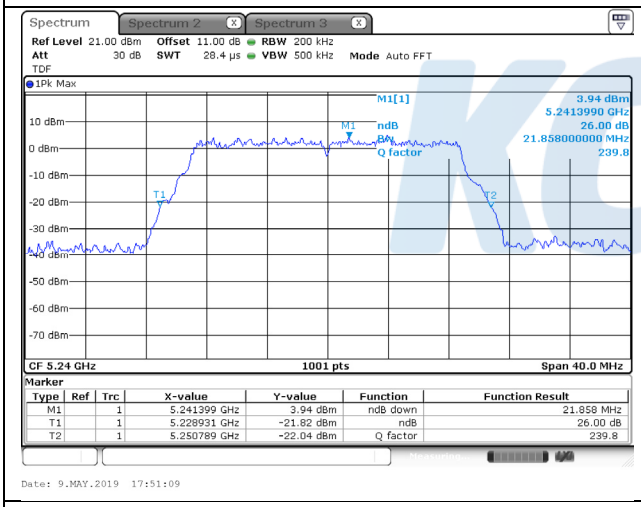
UNII-1



5 180 MHz



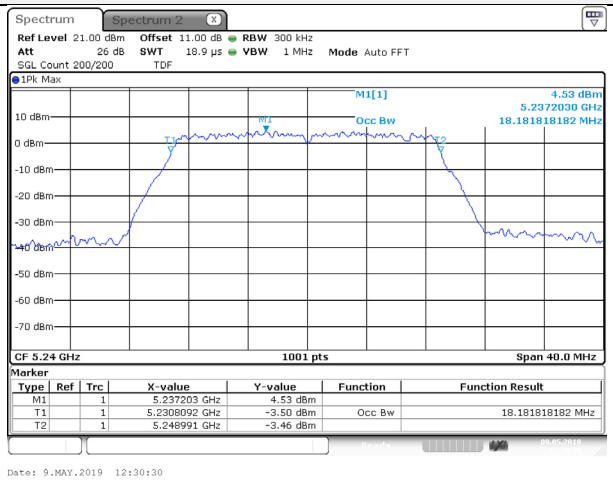
5 200 MHz



5 240 MHz

Blank

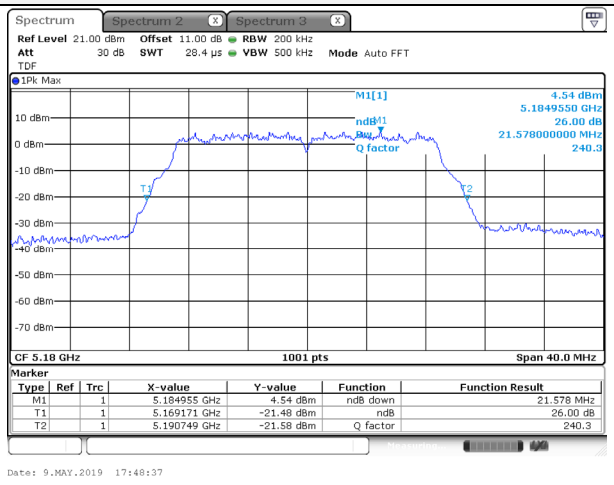
99 % bandwidth(㎒)

UNII-1	
	Blank
5 240 ㎒	

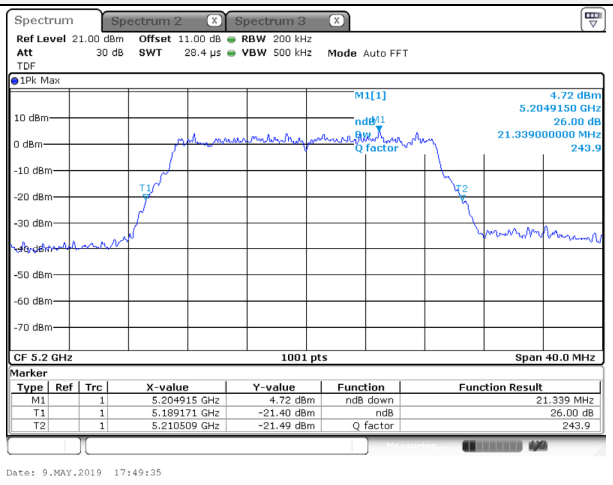
ANT1

26 dB bandwidth(MHz)

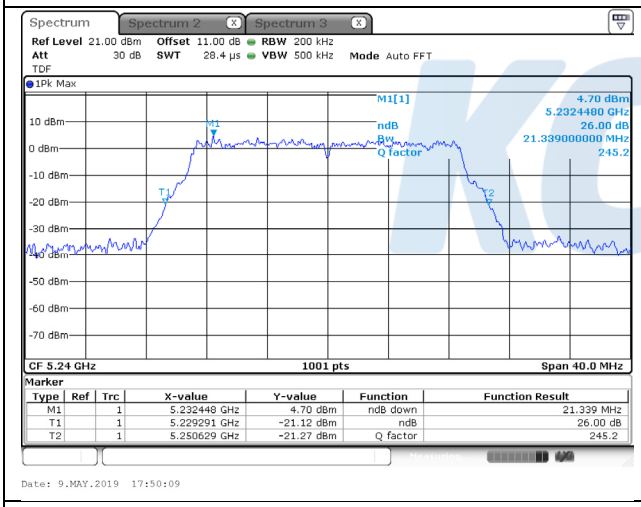
UNII-1



5 180 MHz



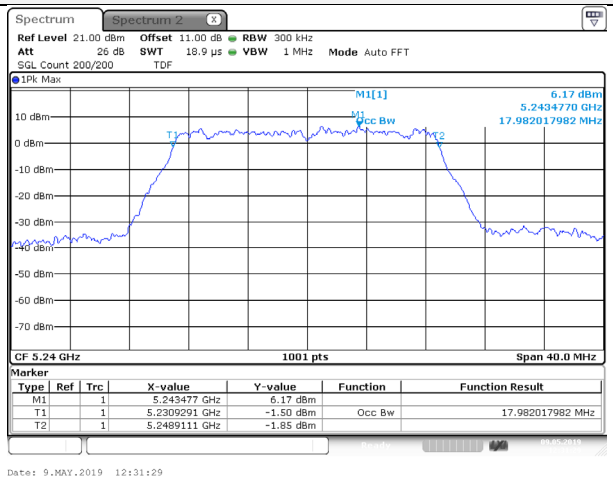
5 200 MHz



5 240 MHz

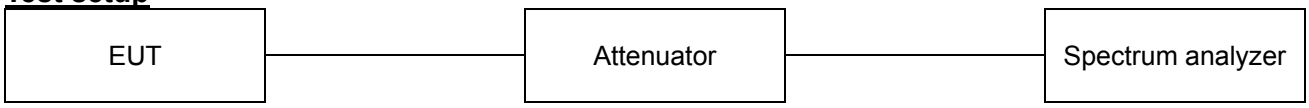
Blank

99 % bandwidth(㎒)

UNII-1	
	Blank
5 240 ㎒	

7.4. 6 dB Bandwidth

Test setup



Limit

Within the 5.725-585 GHz band, the minimum 6 dB bandwidth if U-NII devices shall be at least 500kHz

Test procedure

KDB 789033 D02 v02r01 - Section C.2

Test settings

2. 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. 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

ANT0

Test mode	Frequency (MHz)	Measured Bandwidth (MHz)
802.11n HT20_UNII-3	5 745	17.59
	5 785	17.58
	5 825	17.59

ANT1

Test mode	Frequency (MHz)	Measured Bandwidth (MHz)
802.11n HT20_UNII-3	5 745	17.45
	5 785	17.59
	5 825	17.61

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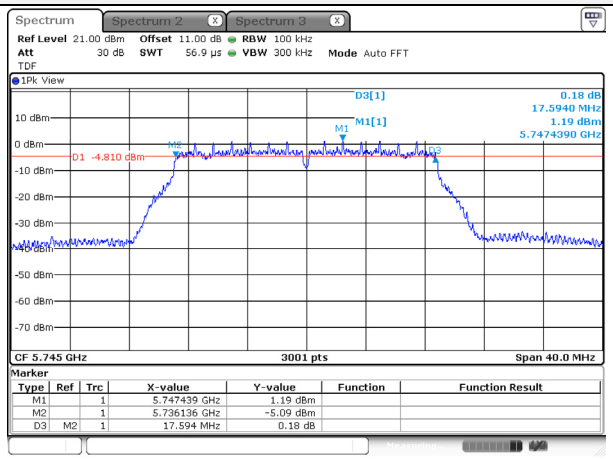
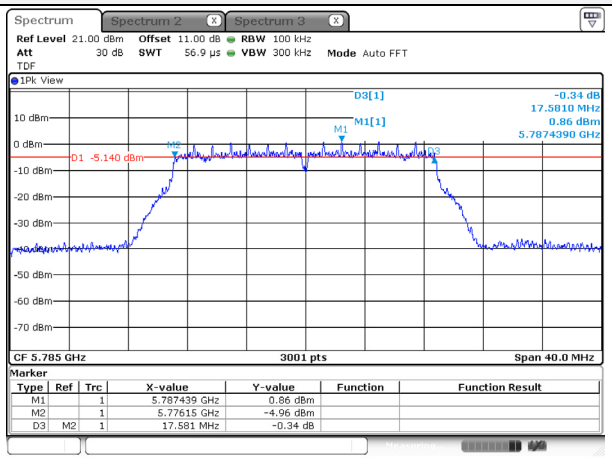
ANT0

6 dB bandwidth

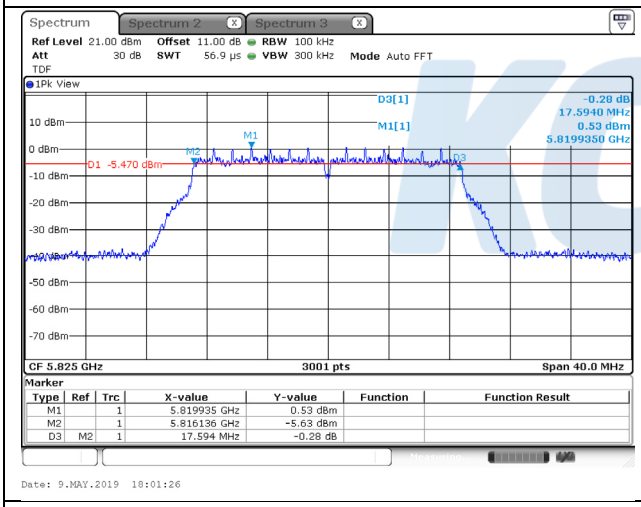
802.11n HT20_UNII-3



5 745 MHz



5 785 MHz



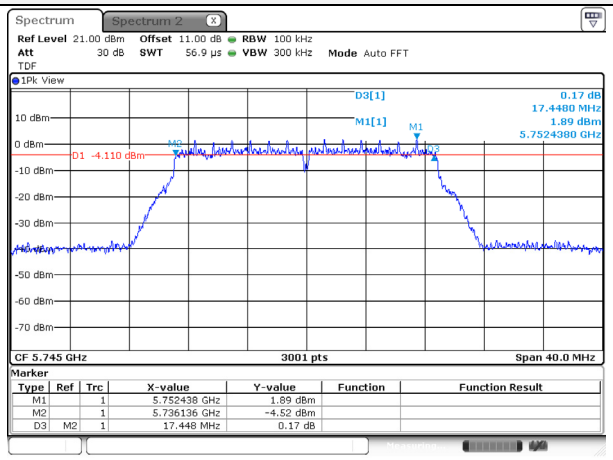
5 825 MHz

Blank

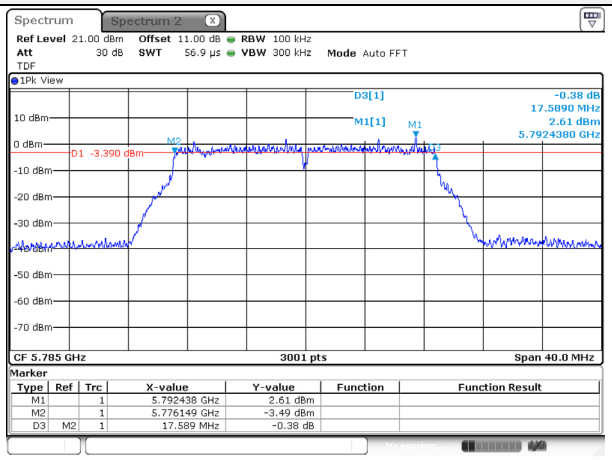
ANT1

6 dB bandwidth

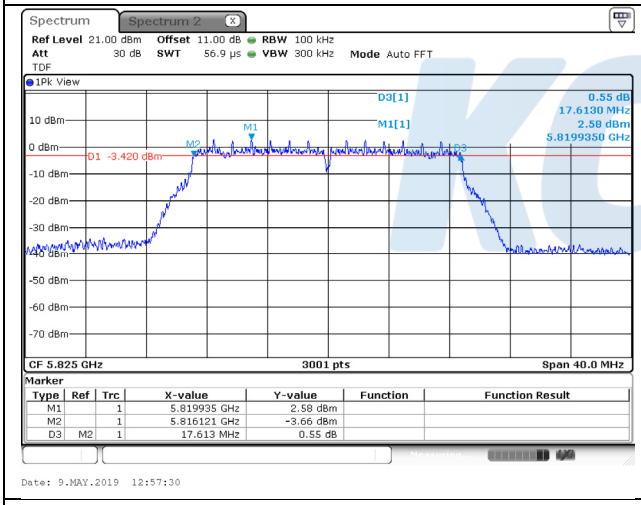
802.11n HT20_UNII-3



5 745 MHz



5 785 MHz



5 825 MHz

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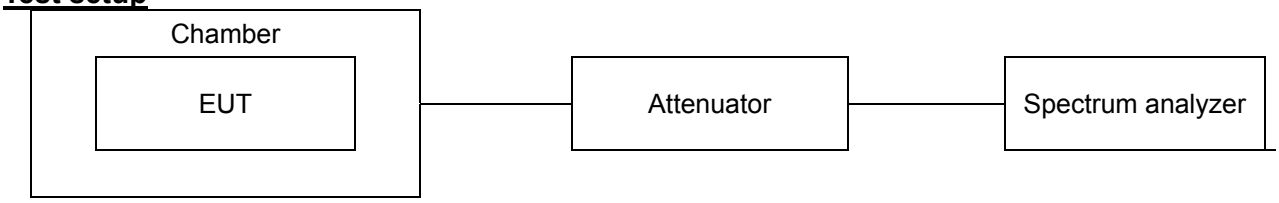
7.5. Frequency Stability

Test setup



Limit

N/A

Test procedure

ANSI C63.10-2013, clause 6.8.1

Test settings

The frequency stability of the carrier frequency of the intentional radiator shall be maintained all conditions of normal operation as specified in the users manual. The frequency stability shall be maintained over a temperature variation of specified in the users manual at normal supply voltage, and over a variation in the primary supply voltage of specified in the users manual of the rated supply voltage at a temperature of 20 °C. For equipment that is capable only of operating from a battery, the frequency stability tests shall be performed using a new battery without any further requirement to vary supply voltage.

1. The EUT was placed inside the environmental test chamber.
2. The temperature was incremented by 10 °C intervals from lowest temperature.
3. Each increase step of temperature measured the frequency.
4. The test temperature was set 20°C and the supply voltage was then adjusted on the EUT from 85 % to 115% and the frequency record.
5. While maintaining a constant temperature inside the environmental chamber, turn the EUT on and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.

Test results

Test mode : UNII-1

Frequency(Hz) : 5 180 000 000

Voltage [%]	Voltage [V]	TEMP [℃]	Maintaining time	Measure frequency [Hz]	Frequency deviation [Hz]	Deviation [%]
100	3.70	20	Startup	5179 942 429	-575 71.00	-0.001 11
			2 minutes	5179 940 710	-592 90.00	-0.001 14
			5 minutes	5179 944 766	-552 34.00	-0.001 07
			10 minutes	5179 949 762	-502 38.00	-0.000 97
		0	Startup	5179 958 406	-415 94.00	-0.000 80
			2 minutes	5179 949 086	-509 14.00	-0.000 98
			5 minutes	5179 955 873	-441 27.00	-0.000 85
			10 minutes	5179 957 291	-427 09.00	-0.000 82
		10	Startup	5179 948 360	-516 40.00	-0.001 00
			2 minutes	5179 957 217	-427 83.00	-0.000 83
			5 minutes	5179 947 000	-530 00.00	-0.001 02
			10 minutes	5179 940 430	-595 70.00	-0.001 15
		25	Startup	5179 940 381	-596 19.00	-0.001 15
			2 minutes	5179 940 890	-591 10.00	-0.001 14
			5 minutes	5179 940 331	-596 69.00	-0.001 15
			10 minutes	5179 941 071	-589 29.00	-0.001 14
		30	Startup	5179 945 835	-541 65.00	-0.001 05
			2 minutes	5179 946 784	-532 16.00	-0.001 03
			5 minutes	5179 945 486	-545 14.00	-0.001 05
			10 minutes	5179 945 785	-542 15.00	-0.001 05
		40	Startup	5179 939 791	-602 09.00	-0.001 16
			2 minutes	5179 945 636	-543 64.00	-0.001 05
			5 minutes	5179 944 637	-553 63.00	-0.001 07
			10 minutes	5179 944 786	-552 14.00	-0.001 07
		50	Startup	5179 940 191	-598 09.00	-0.001 15
			2 minutes	5179 948 283	-517 17.00	-0.001 00
			5 minutes	5179 943 438	-565 62.00	-0.001 09
			10 minutes	5179 942 039	-579 61.00	-0.001 12
85	3.15	20	Startup	5179 940 990	-590 10.00	-0.001 14
			2 minutes	5179 941 709	-582 91.00	-0.001 13
			5 minutes	5179 949 302	-506 98.00	-0.000 98
			10 minutes	5179 953 158	-468 42.00	-0.000 90
115	4.26	20	Startup	5179 940 151	-598 49.00	-0.001 16
			2 minutes	5179 940 451	-595 49.00	-0.001 15
			5 minutes	5179 946 724	-532 76.00	-0.001 03
			10 minutes	5179 948 663	-513 37.00	-0.000 99

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Test mode : UNII-3

Frequency(Hz) : 5 745 000 000

Voltage [%]	Voltage [V]	TEMP [℃]	Maintaining time	Measure frequency [Hz]	Frequency deviation [Hz]	Deviation [%]
100	3.70	20	Startup	5744 937 509	-624 91.00	-0.001 09
			2 minutes	5744 930 421	-695 79.00	-0.001 21
			5 minutes	5744 935 631	-643 69.00	-0.001 12
			10 minutes	5744 934 386	-656 14.00	-0.001 14
		0	Startup	5744 939 972	-600 28.00	-0.001 04
			2 minutes	5744 944 169	-558 31.00	-0.000 97
			5 minutes	5744 955 370	-446 30.00	-0.000 78
			10 minutes	5744 959 393	-406 07.00	-0.000 71
		10	Startup	5744 931 086	-689 14.00	-0.001 20
			2 minutes	5744 930 073	-699 27.00	-0.001 22
			5 minutes	5744 395 196	-604 804.00	-0.010 53
			10 minutes	5744 391 317	-608 683.00	-0.010 60
		25	Startup	5744 932 534	-674 66.00	-0.001 17
			2 minutes	5744 937 802	-621 98.00	-0.001 08
			5 minutes	5744 395 805	-604 195.00	-0.010 52
			10 minutes	5744 931 260	-687 40.00	-0.001 20
		30	Startup	5744 930 738	-692 62.00	-0.001 21
			2 minutes	5744 938 118	-618 82.00	-0.001 08
			5 minutes	5744 936 092	-639 08.00	-0.001 11
			10 minutes	5744 931 809	-681 91.00	-0.001 19
		40	Startup	5744 976 380	-236 20.00	-0.000 41
			2 minutes	5744 980 142	-198 58.00	-0.000 35
			5 minutes	5744 972 761	-272 39.00	-0.000 47
			10 minutes	5744 976 727	-232 73.00	-0.000 41
		50	Startup	5744 942 048	-579 52.00	-0.001 01
			2 minutes	5744 941 990	-580 10.00	-0.001 01
			5 minutes	5744 977 247	-227 53.00	-0.000 40
			10 minutes	5745 024 302	243 02.00	0.000 42
85	3.15	20	Startup	5745 003 581	358 1.00	0.000 06
			2 minutes	5745 012 091	120 91.00	0.000 21
			5 minutes	5745 049 184	491 84.00	0.000 86
			10 minutes	5745 042 956	429 56.00	0.000 75
115	4.26	20	Startup	5745 059 744	597 44.00	0.001 04
			2 minutes	5745 049 785	497 85.00	0.000 87
			5 minutes	5745 046 485	464 85.00	0.000 81
			10 minutes	5745 050 769	507 69.00	0.000 88

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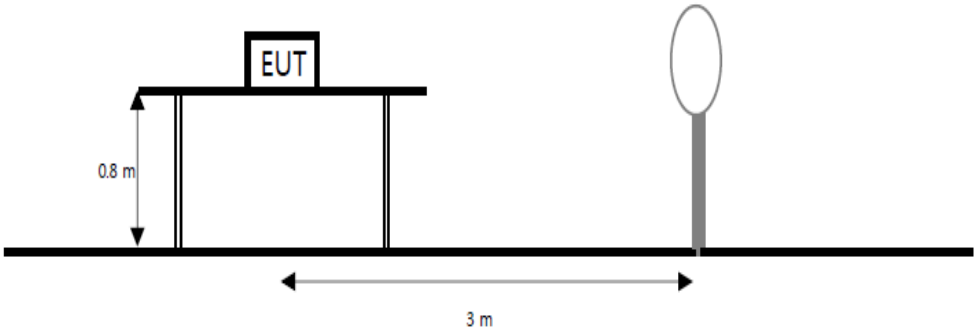
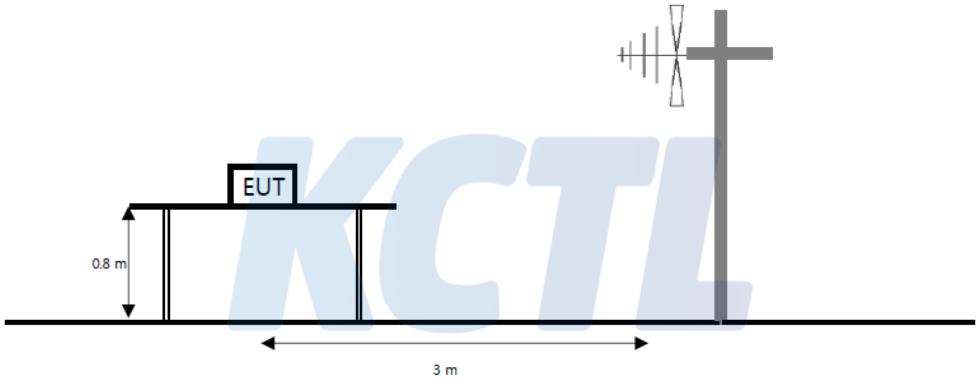
7.6. Spurious Emission, Band Edge and Restricted bands

Test setup

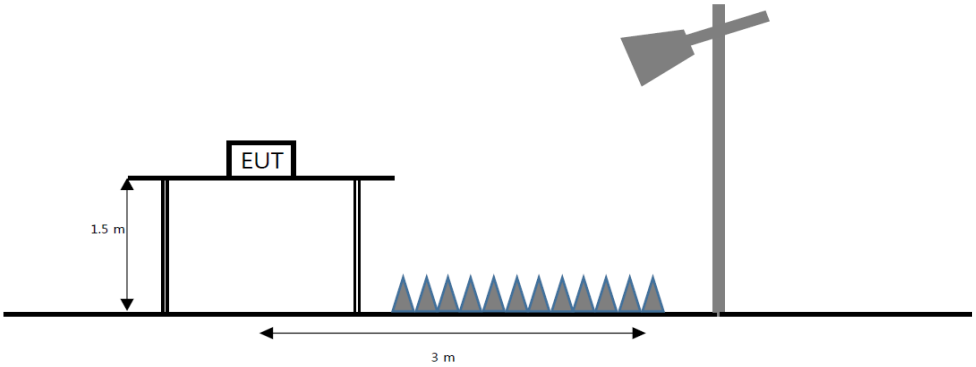
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions



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

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 (MHz)	Field strength (μV/m)	Measurement distance (m)
0.009 - 0.490	2 400/F(kHz)	300
0.490 - 1.705	24 000/F(kHz)	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 MHz, 76–88 MHz, 174–216 MHz or 470–806 MHz. 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:

MHz	MHz	MHz	GHz
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 MHz, compliance with the limits in section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 MHz, 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 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz

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.

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Test procedure

ANSI C63.10-2013
KDB 789033 D2 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.

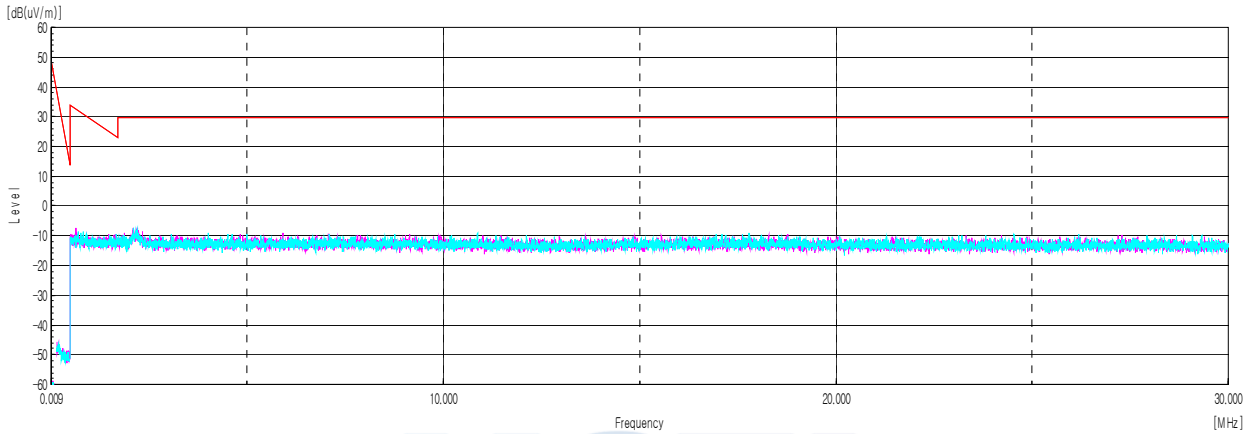
Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1 kHz(≥1/T) for Average detection (AV) at frequency above 1 GHz. (where T = pulse width)
2. *f* <30 MHz, extrapolation factor of 40 dB/decade of distance. F_d = 40log(D_m/Ds)
   f ≥30 MHz, extrapolation factor of 20 dB/decade of distance. F_d = 20log(D_m/Ds)
   Where:
   F_d= Distance factor in dB
   D_m= Measurement distance in meters
   D_s= Specification distance in meters
3. Factors(dB) = Antenna factor(dB/m) + Cable loss(dB) + or Amp. gain(dB) + or F_d(dB)
4. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
5. Average test would be performed if the peak result were greater than the average limit.
6. 1) mean is restricted band.
7. According to part 15.31(f)(2), an extrapolation factor of 40 dB/decade is applied because measured distance of radiated emission is 3 m.

Test results (Below 30 ㎒) – Worst case: 802.11n HT20_ANT0_UNII-1 Highest frequency

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

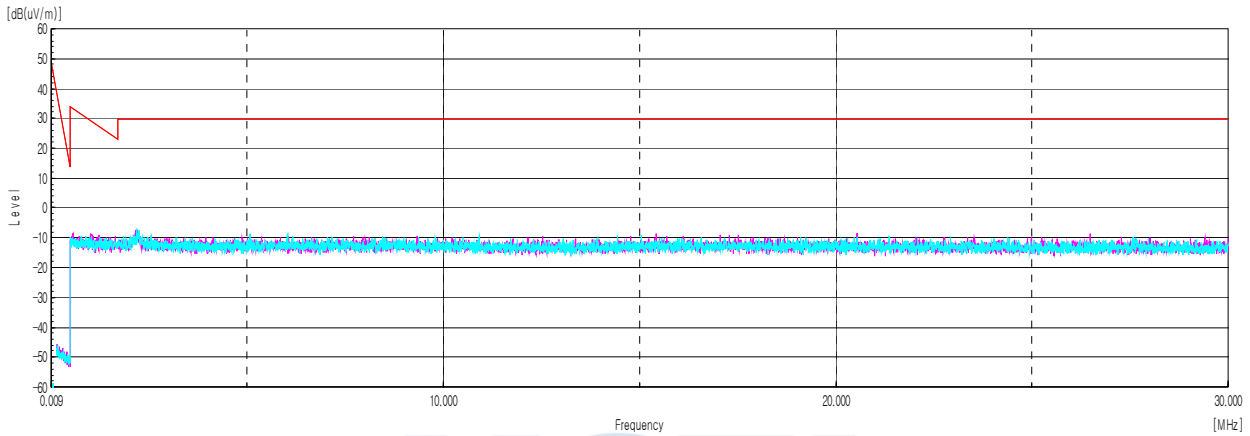
Horizontal/Vertical



Test results (Below 30 ㎒) – Worst case: 802.11n HT20_ANT1_UNII-1 Highest frequency

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

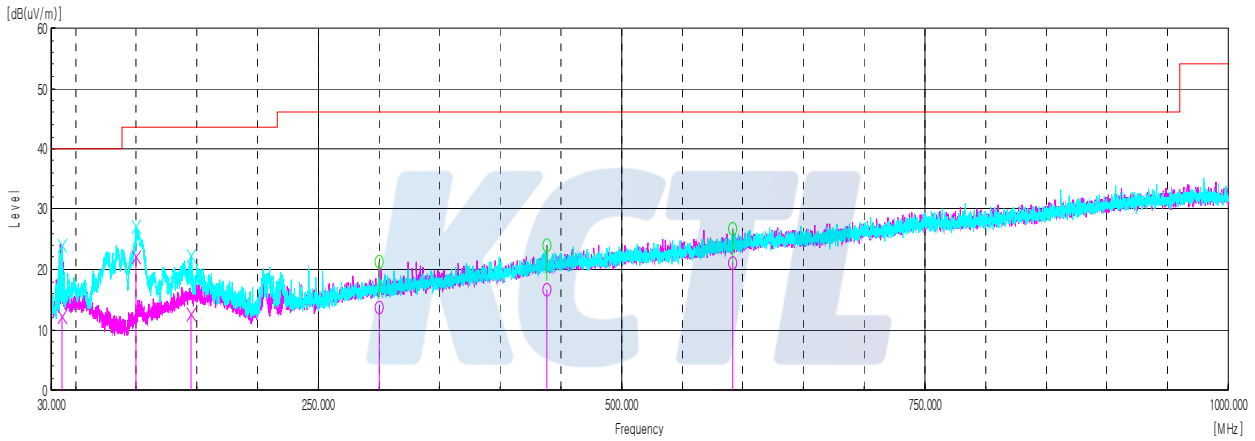
Horizontal/Vertical



Test results (Below 1 000 ㎒) – Worst case: 802.11n HT20_ANT0_UNII-1 Highest frequency

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data								
38.85	V	24.80	18.17	-30.83	-	12.14	40.00	27.86
99.96	V	37.20	14.99	-30.03	-	22.16	43.50	21.34
145.31	V	23.10	19.11	-29.47	-	12.74	43.50	30.76
300.02	H	22.50	19.30	-28.19	-	13.61	46.00	32.39
438.13	H	21.10	22.76	-27.31	-	16.55	46.00	29.45
591.87	H	22.10	25.54	-26.59	-	21.05	46.00	24.95

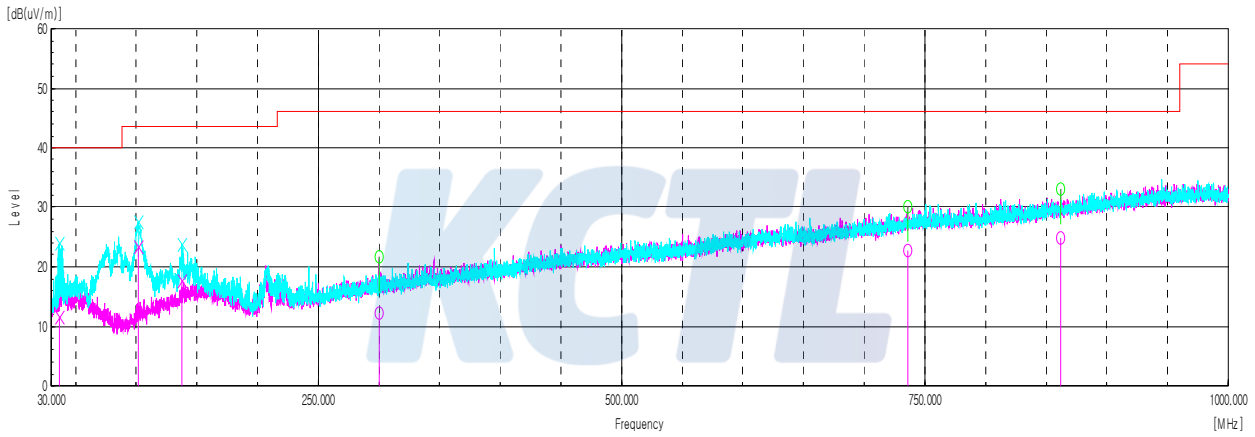
Horizontal/Vertical



Test results (Below 1 000 ㎒) – Worst case: 802.11n HT20_ANT1_UNII-1 Highest frequency

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data								
36.67	V	24.70	17.73	-30.86	-	11.57	40.00	28.43
101.90	V	38.20	15.27	-30.01	-	23.46	43.50	20.04
137.55	V	28.60	18.60	-29.58	-	17.62	43.50	25.88
300.02	H	21.20	19.30	-28.19	-	12.31	46.00	33.69
735.55	H	20.80	27.62	-25.74	-	22.68	46.00	23.32
862.02	H	20.70	28.90	-24.80	-	24.80	46.00	21.20

Horizontal/Vertical



Test results (Above 1 000 ㎒)

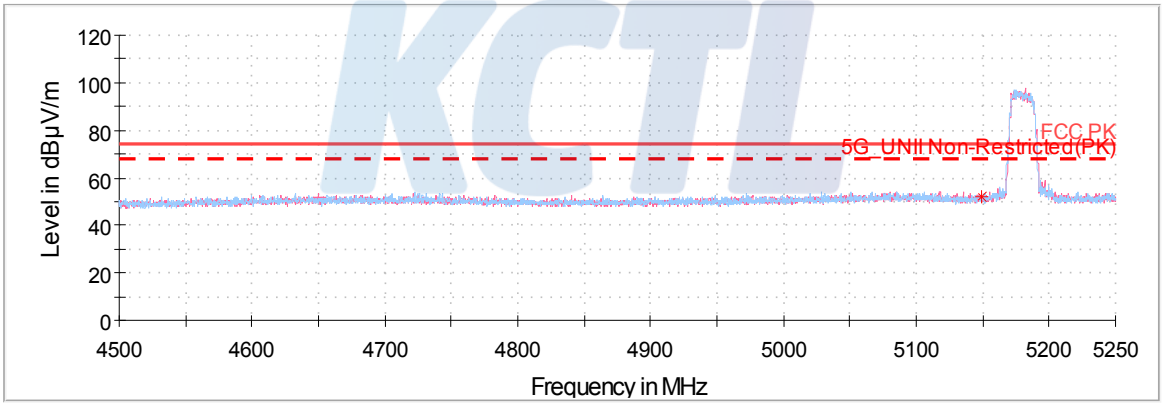
ANT0

802.11n HT20 UNII-1

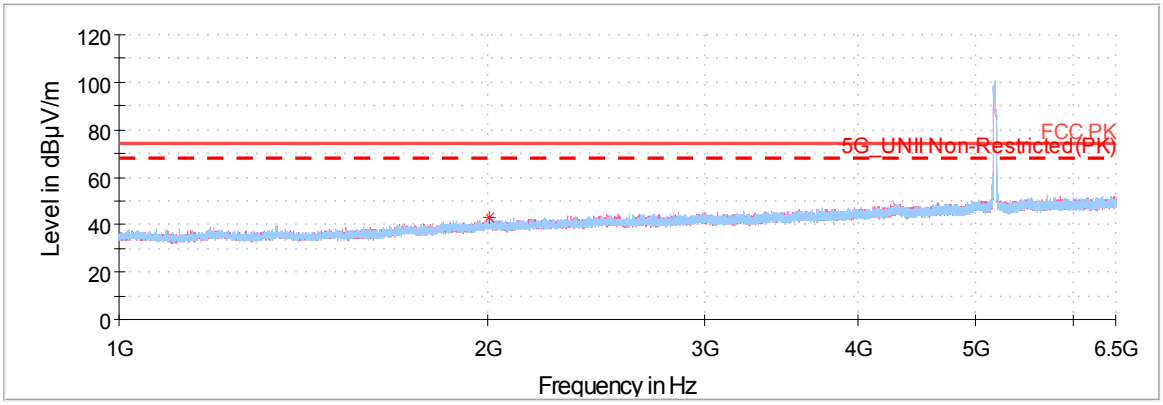
Lowest Channel (5 180 ㎒)

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 149.41[1)]	H	46.35	34.08	-28.13	-	52.30	74.00	21.70
10 359.69	H	59.36	37.32	-52.5	-	44.18	68.20	24.02
15 545.47[1)]	H	55.07	40.02	-48.82	-	46.27	74.00	27.73
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

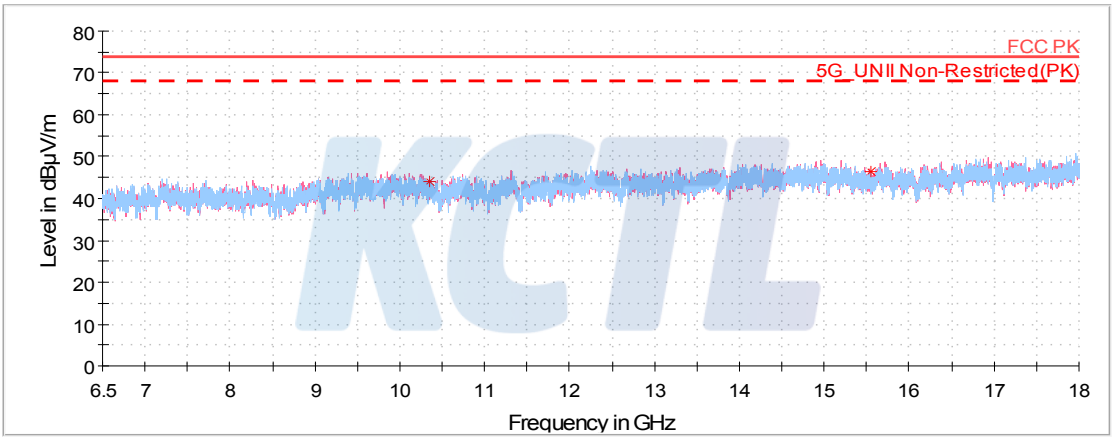
Horizontal/Vertical for Band-edge



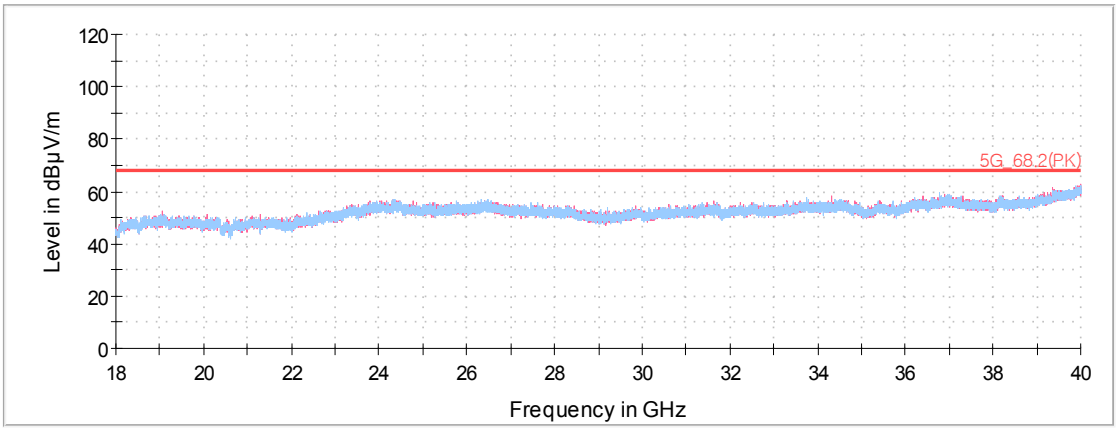
Horizontal/Vertical for 1 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓



Horizontal/Vertical for 18 ㎓ ~ 40 ㎓

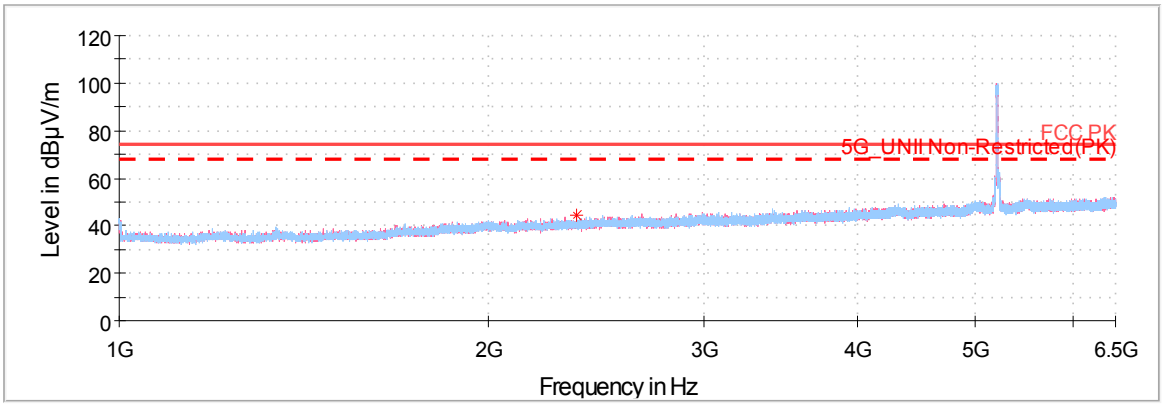


Middle Channel (5 200 ㎒)

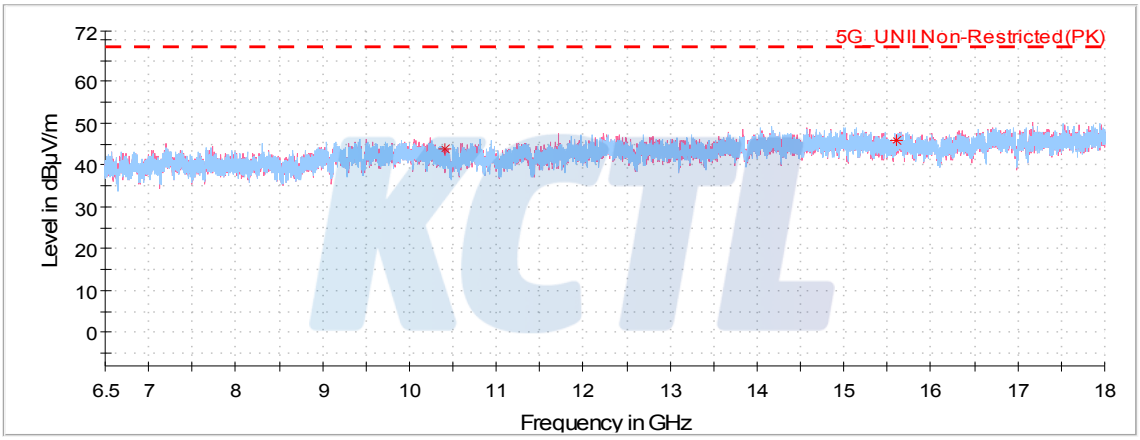
Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
10 400.66	V	58.92	37.34	-52.56	-	43.70	68.20	24.50
15 601.89[1)]	H	54.64	40.04	-48.92	-	45.76	74.00	28.24
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

KCTL

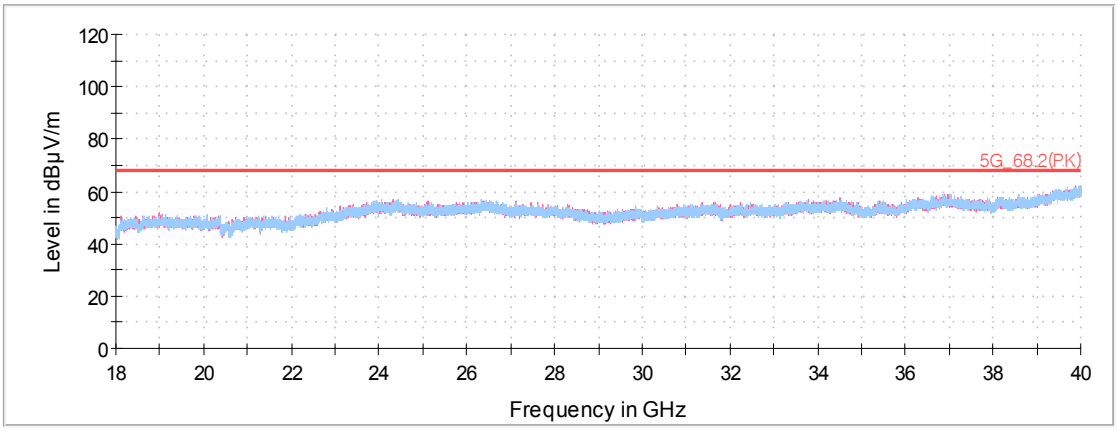
Horizontal/Vertical for 1 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓



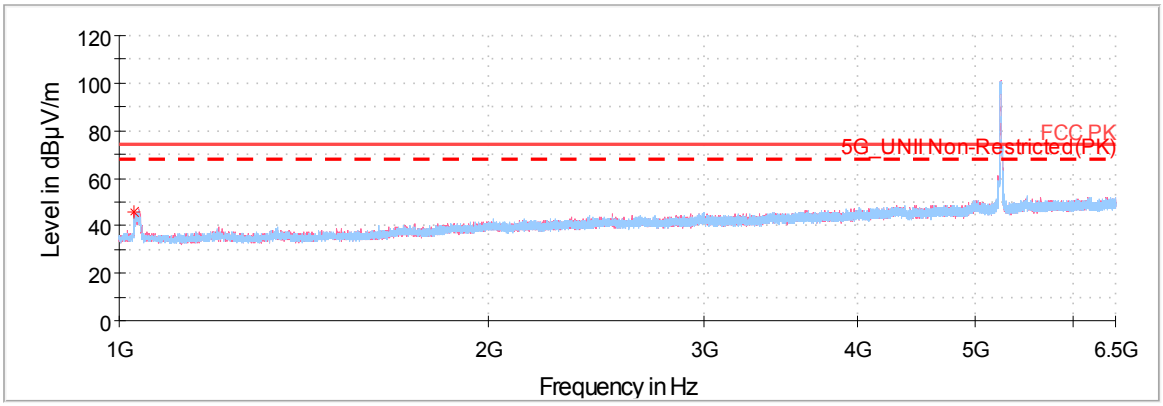
Horizontal/Vertical for 18 ㎓ ~ 40 ㎓



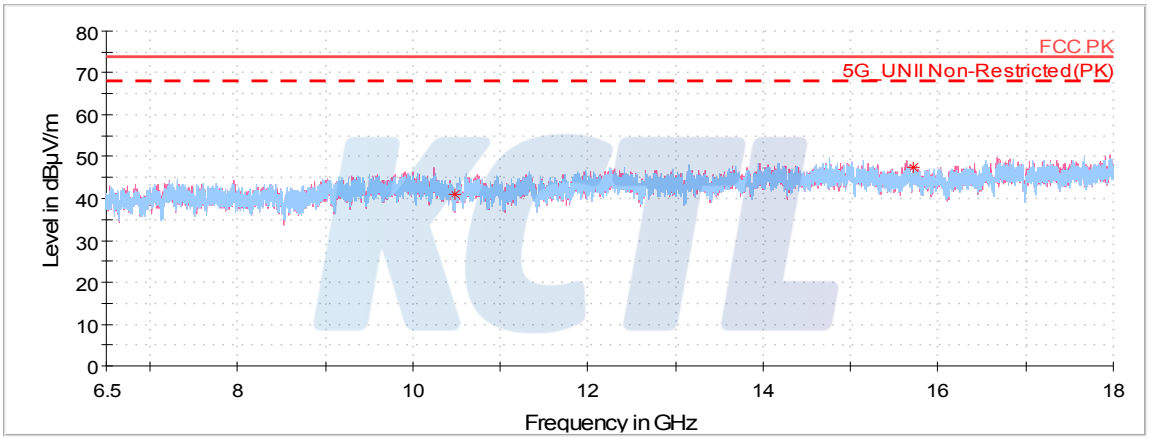
Highest Channel (5 240 ㎒)

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
10 480.08	V	56.23	37.39	-52.69	-	40.93	68.20	27.27
15 719.05[1)]	H	56.61	40.09	-49.12	-	47.58	74.00	26.42
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

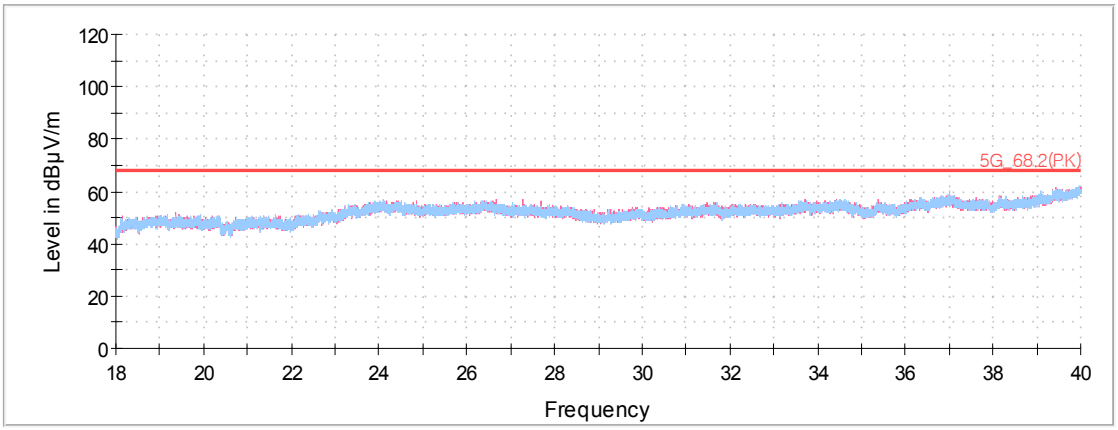
Horizontal/Vertical for 1 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓



Horizontal/Vertical for 18 ㎓ ~ 40 ㎓

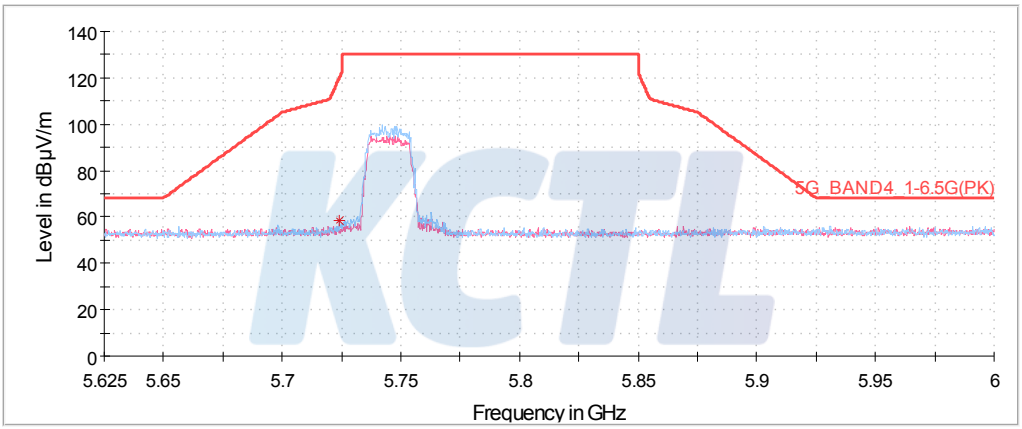


802.11n HT20 UNII-3

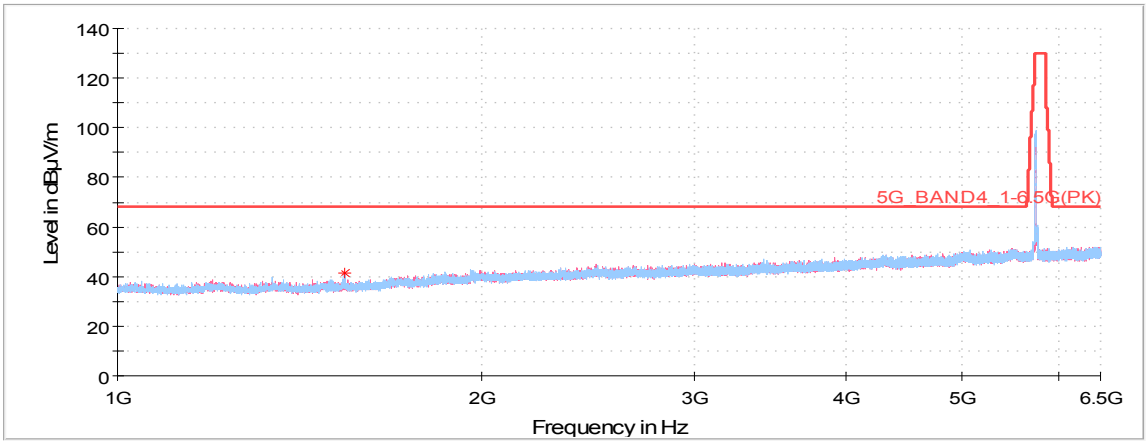
Lowest Channel (5 745 ㎒)

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 724.16	H	51.18	34.77	-27.29	-	58.66	120.28	61.62
11 488.84[1)]	H	55.89	38.19	-51.5	-	42.58	74.00	31.42
17 235.25	H	52.93	41.79	-48.63	-	46.09	68.20	22.11
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

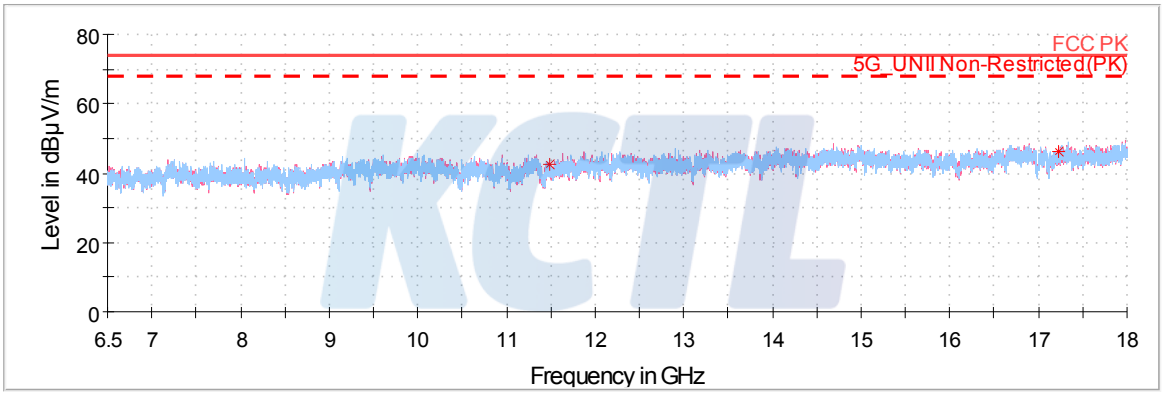
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓

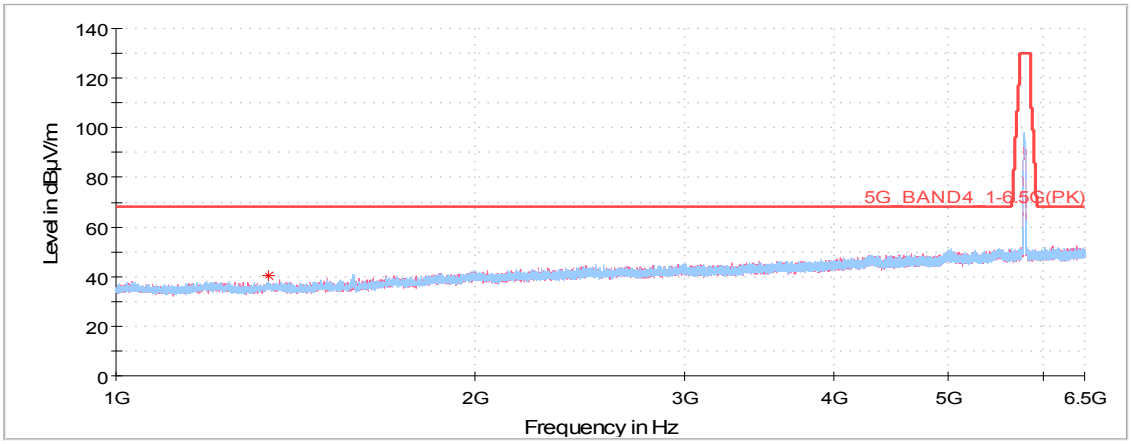


Horizontal/Vertical for 18 ㎓ ~ 40 ㎓

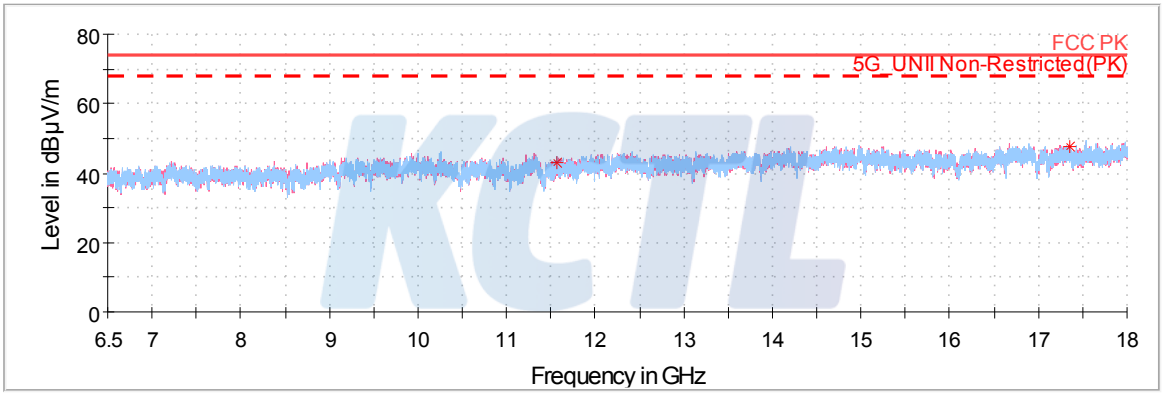
Middle Channel (5 785 ㎒)

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
11 570.78[1)]	H	56.19	38.28	-51.43	-	43.04	74.00	30.96
17 356.36	V	54.57	41.84	-48.65	-	47.76	68.20	20.44
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

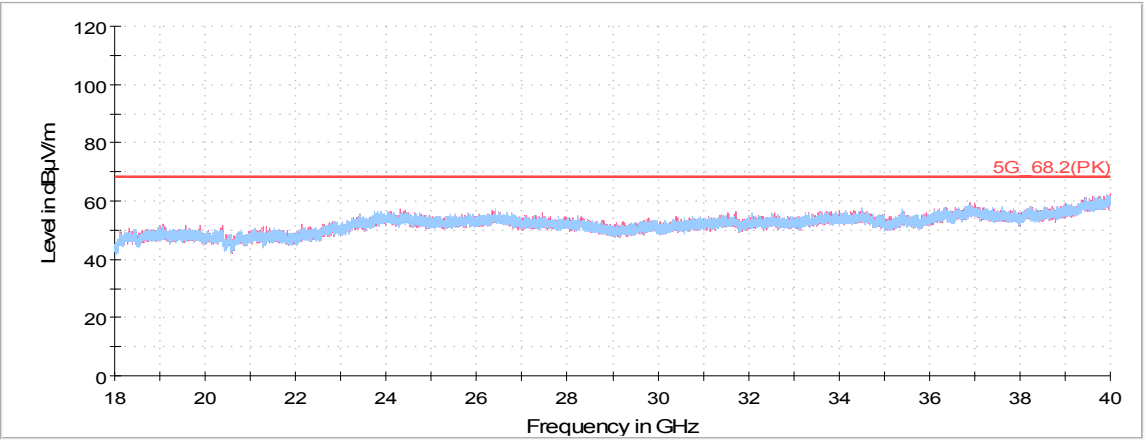
Horizontal/Vertical for 1 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓



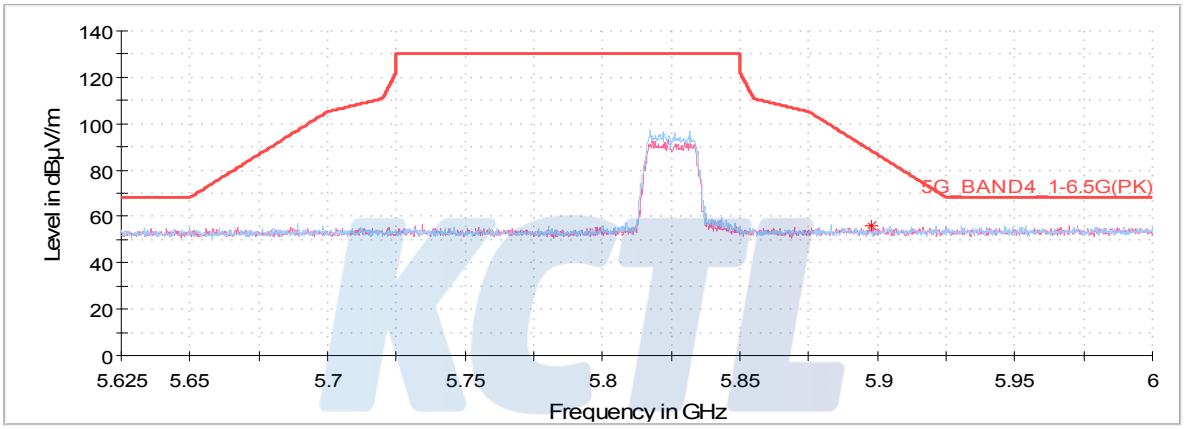
Horizontal/Vertical for 18 ㎓ ~ 40 ㎓



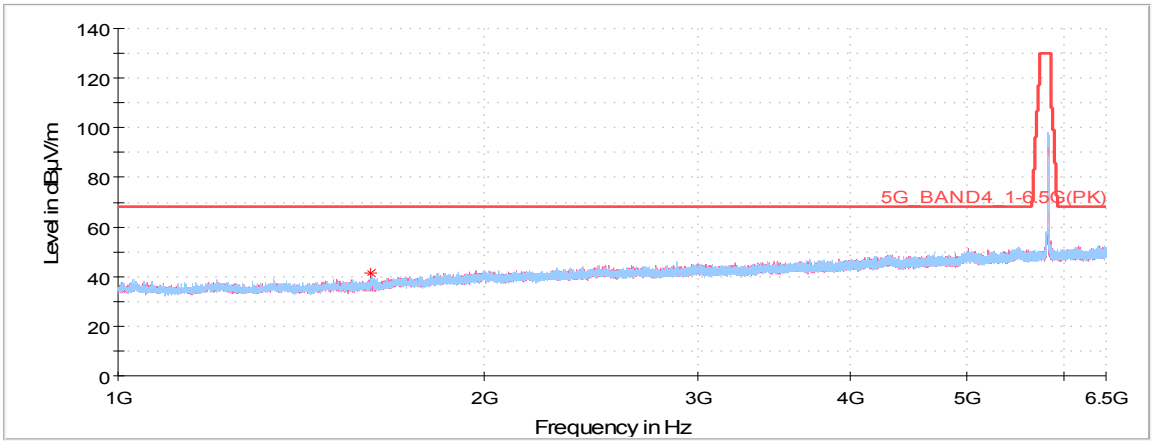
Highest Channel (5 825 ㎒)

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 897.75	V	47.97	34.98	-27.23	-	55.72	88.37	32.65
11 647.33[1)]	V	56.15	38.38	-51.38	-	43.15	74.00	30.85
17 472.44	H	53.12	41.89	-48.67	-	46.34	68.20	21.86
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

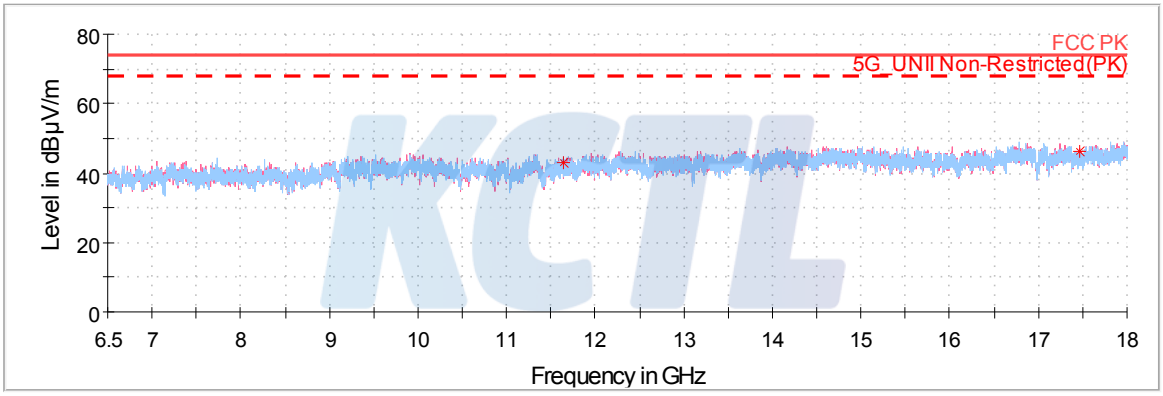
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓



Horizontal/Vertical for 18 ㎓ ~ 40 ㎓

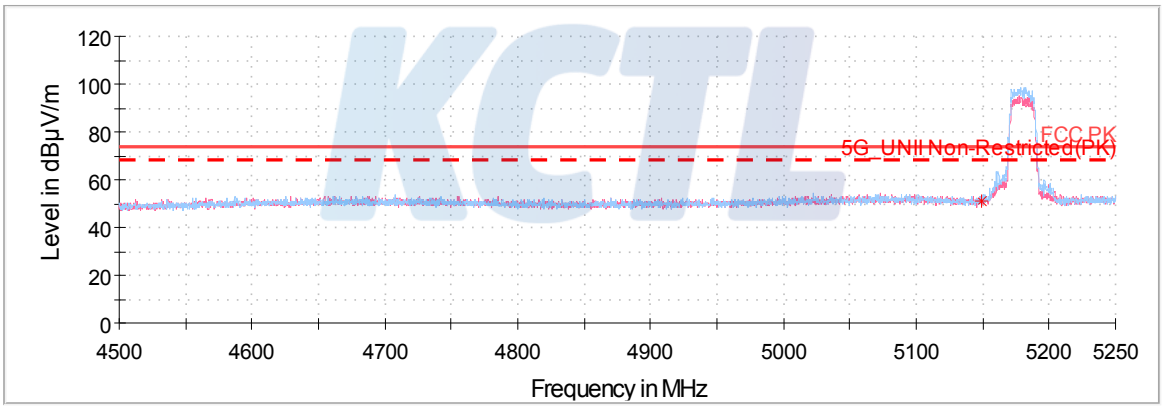
ANT1

802.11n HT20 UNII-1

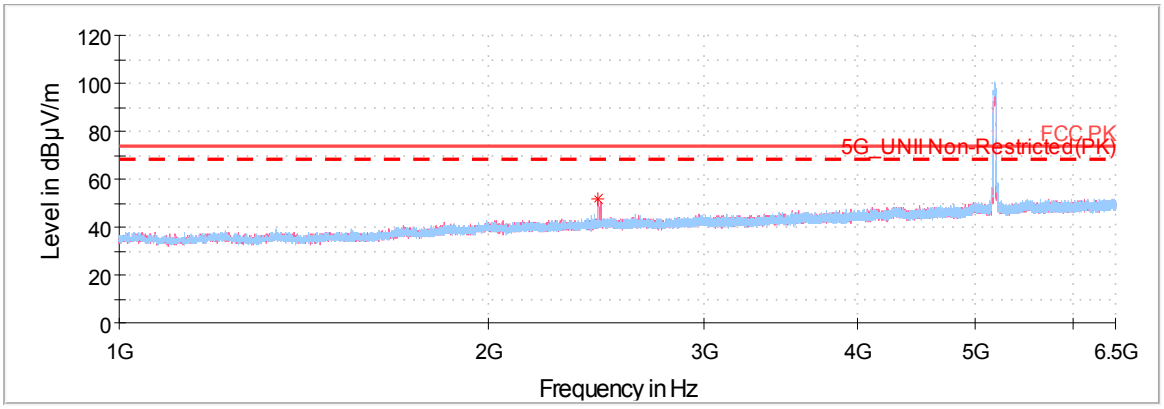
Lowest Channel (5 180 ㎒)

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
2 460.59	V	55.30	32.07	-35.64	-	51.73	68.20	16.47
5 149.75[1)]	H	45.28	34.08	-28.13	-	51.23	74.00	22.77
10 359.69	H	58.78	37.32	-52.5	-	43.60	68.20	24.60
15 542.23[1)]	V	54.74	40.02	-48.82	-	45.94	74.00	28.06
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

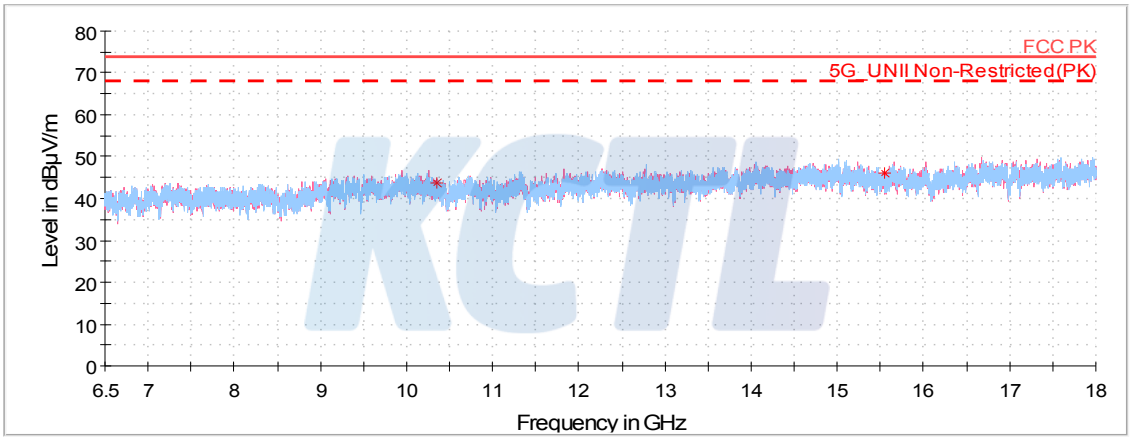
Horizontal/Vertical for Band-edge



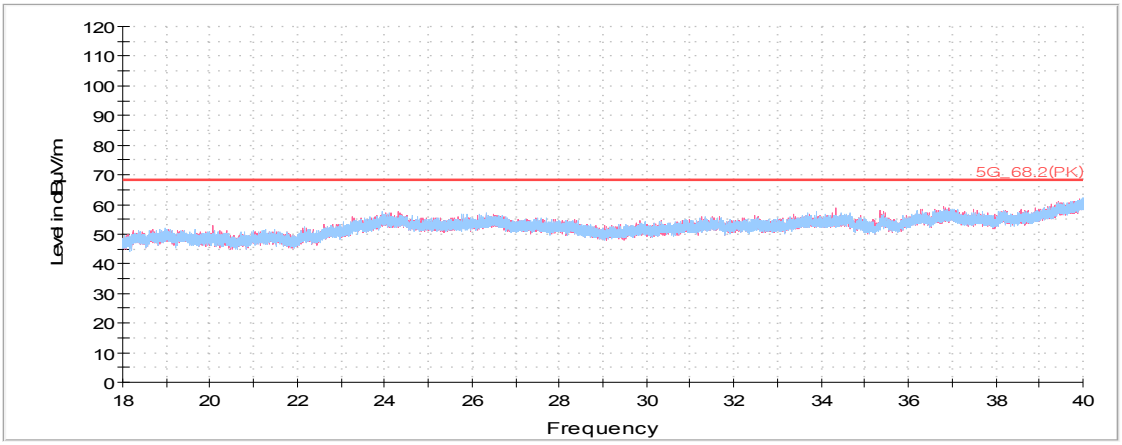
Horizontal/Vertical for 1 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓



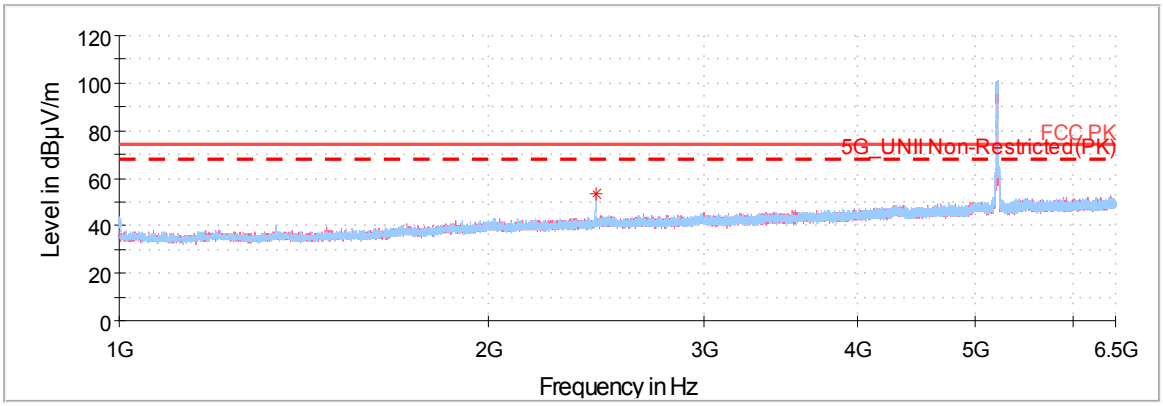
Horizontal/Vertical for 18 ㎓ ~ 40 ㎓



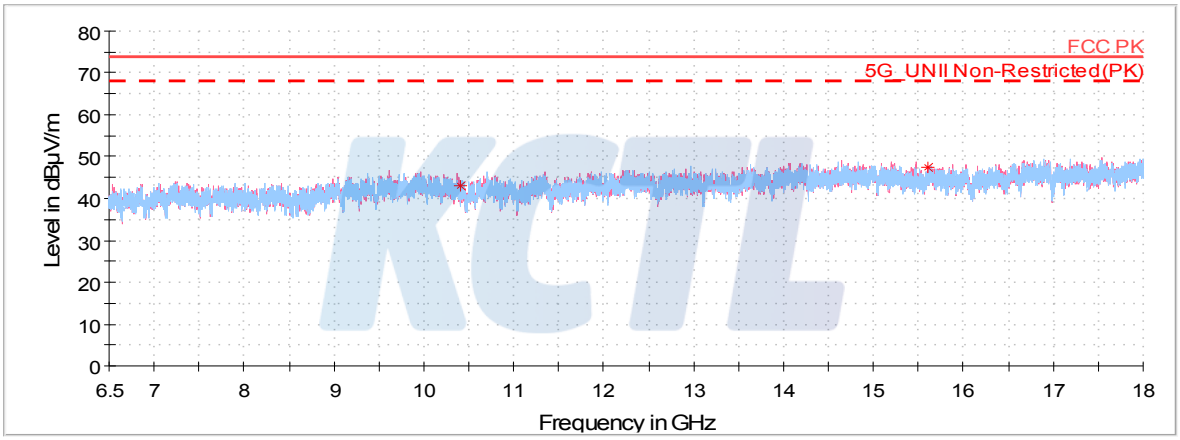
Middle Channel (5 200 ㎒)

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
2 446.84	H	56.79	32.06	-35.71	-	53.14	68.20	15.06
10 401.73	V	58.23	37.34	-52.57	-	43.00	68.20	25.20
15 605.84[1)]	V	56.24	40.04	-48.93	-	47.35	74.00	26.65
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

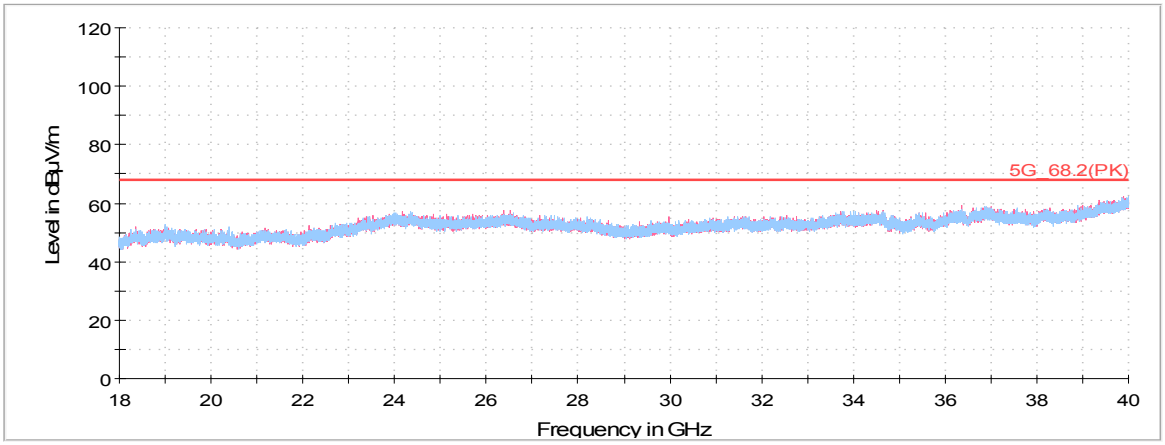
Horizontal/Vertical for 1 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓



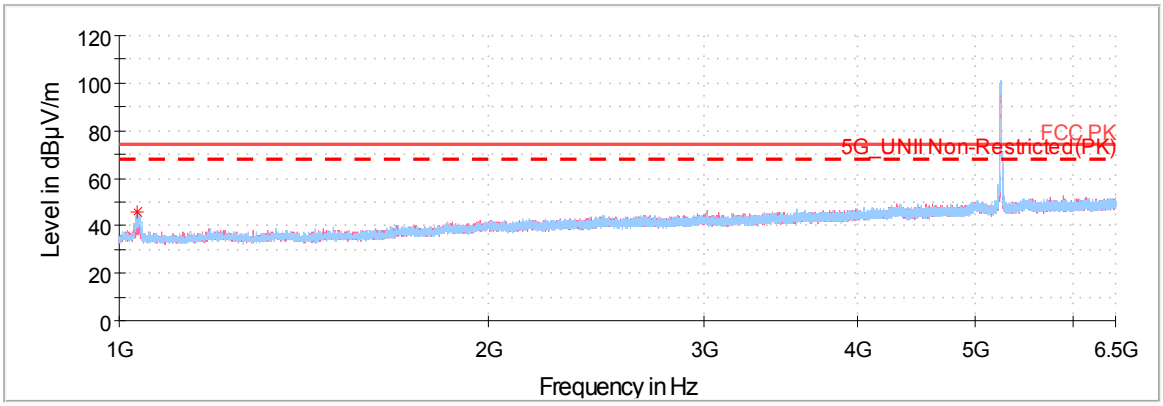
Horizontal/Vertical for 18 ㎓ ~ 40 ㎓



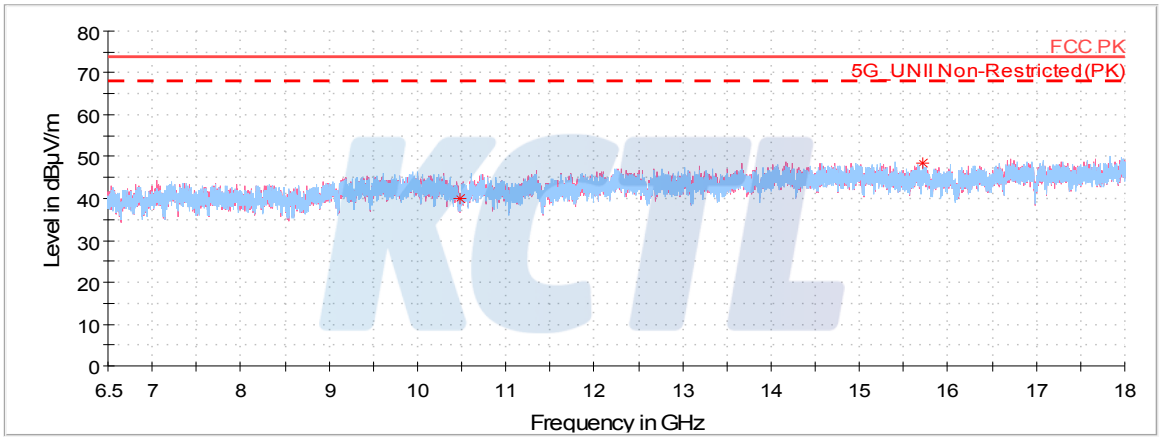
Highest Channel (5 240 ㎒)

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
10 480.08	V	55.21	37.39	-52.69	-	39.91	68.20	28.29
15 723.72[1)]	H	57.53	40.09	-49.13	-	48.49	74.00	25.51
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

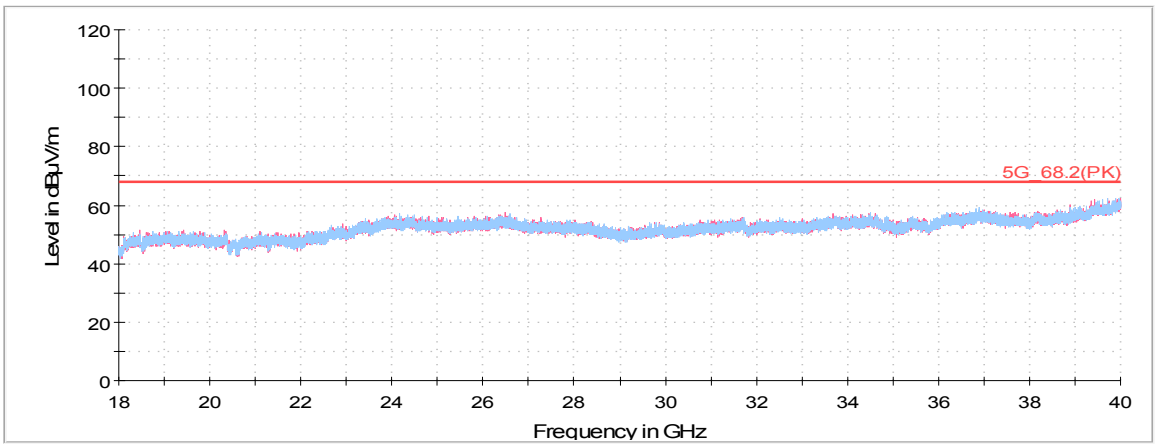
Horizontal/Vertical for 1 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓



Horizontal/Vertical for 18 ㎓ ~ 40 ㎓

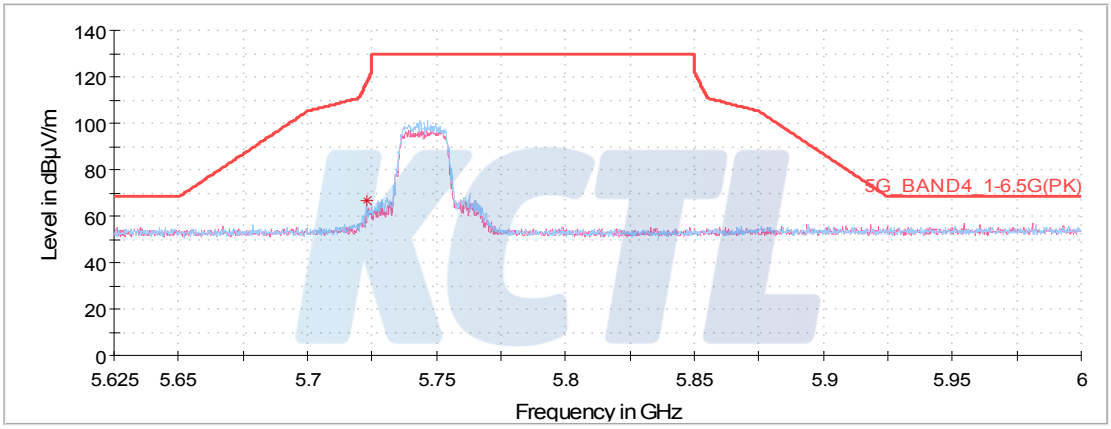


802.11n HT20 UNII-3

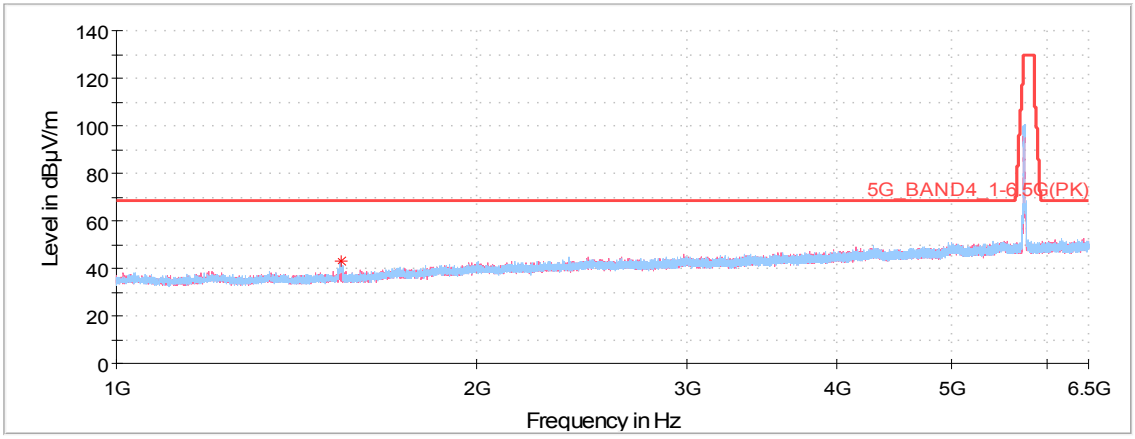
Lowest Channel (5 745 ㎒)

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 722.78	H	59.10	34.77	-27.29	-	66.58	117.14	50.56
11 490.64[1)]	V	55.37	38.19	-51.5	-	42.06	74.00	31.94
17 235.25	V	53.84	41.79	-48.63	-	47.00	68.20	21.20
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

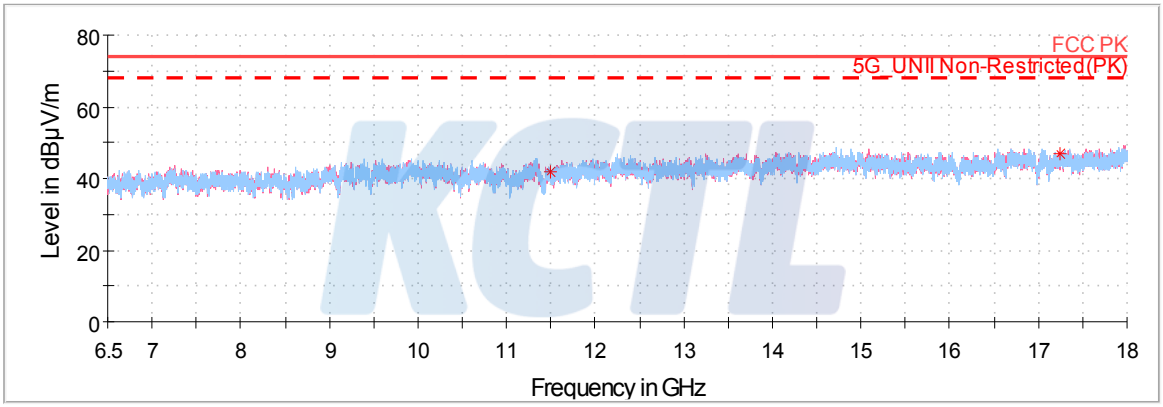
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓



Horizontal/Vertical for 18 ㎓ ~ 40 ㎓

Middle Channel (5 785 ㎒)

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
11 569.70[1)]	H	56.37	38.28	-51.43	-	43.22	74.00	30.78
17 357.80	H	54.19	41.84	-48.65	-	47.38	68.20	20.82
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

KCTL