



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-SRF0073-B Page (1) of (48)				
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 HDMI (Transmitter) / ANYSYNC-4KTH 4. Manufacturer and Country of Origin : RNware Co., Ltd. / Korea 5. FCC ID : 2ASNV-ANYSYNC-4KTH 6. Date of Test : 2019-05-01 to 2019-05-23 7. Test Standards : FCC Part 15 Subpart E, 15.407 8. Test Results : Refer to the test result in the test report					
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%; vertical-align: middle; padding: 5px;">Affirmation</td> <td style="width: 40%; padding: 5px;"> Tested by Name : Myeonghwa Jang (Signature) </td> <td style="width: 40%; padding: 5px;"> Technical Manager Name : Seungyong Kim (Signature) </td> </tr> </table> 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.			Affirmation	Tested by Name : Myeonghwa Jang (Signature)	Technical Manager Name : Seungyong Kim (Signature)
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Report revision history

Date	Revision	Page No
2019-05-27	Initial report	-
2019-06-03	Updated	4, 5, 6 21~23
2019-06-10	Updated accessory information and note 1	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
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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 HDMI (Transmitter)
Model : ANYSYNC-4KTH
Derivative model : ANYSYNC-WUTH
Frequency range : WIFI(802.11n HT20)_5 180 MHz ~ 5 240 MHz (UNII 1)
5 745 MHz ~ 5 825 MHz (UNII 3)
Modulation technique : OFDM
Number of channels : WIFI(802.11n HT20)_4 ch (UNII 1)
5 ch (UNII 3)
Power source : DC 3.7 V
Antenna specification : External - WiFi PCB Substrate Antenna
Antenna gain : 5 150 MHz ~ 5 250 MHz: 4.00 dBi
5 725 MHz ~ 5 850 MHz: 3.98 dBi
Software version : 19.3.25
Hardware version : REV.5
Test device serial No. : N/A
Operation temperature : 0 °C ~ 40 °C

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
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 512 MB x 2EA → DDR4 256 MB x 2EA)

2.3. Frequency/channel operations

This device contains the following capabilities:
 802.11n HT20

UNII-1

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

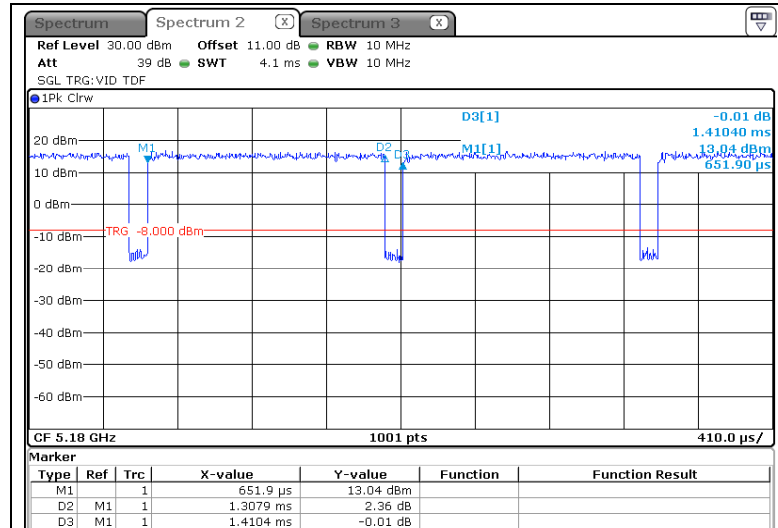
UNII-3

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

Table 2.3.1. 802.11n HT20 mode

2.4. Duty Cycle Correction Factor

- 802.11n HT20



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

Note₂) : DCCF = $10 \log(1 / x) = 10 \log(1/0.95) = 0.33 \text{ dB}$, $x = 1.31/1.41 = 0.93$

Note₃) : 802.11n HT20 is a continuous transmission (duty cycle $\leq 95 \%$)

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 FI type(external antenna) on board.
- The E.U.T Complies with the requirement of §15.203, §15.407

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. 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 or 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

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 (MHz)	Factor(dB)	Frequency (MHz)	Factor(dB)
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

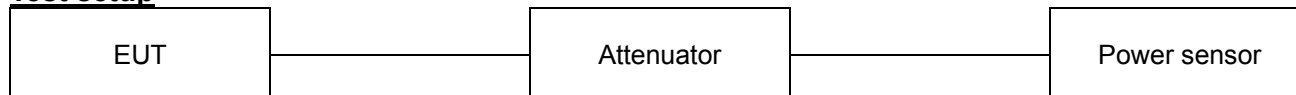
Note.

Offset(dB) = RF cable loss(dB) + Attenuator(dB) + EUT cable loss(dB)

7. Test results

7.1. Maximum conducted output power

Test setup



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

Test mode	Band	Frequency(MHz)	Measured output power			Limit(dBm)
			Reading(dBm)	Duty Factor(dB)	Result(dBm)	
802.11n HT20	UNII-1	5 180	6.23	0.33	6.56	24.00
		5 200	6.32	0.33	6.65	
		5 240	6.58	0.33	6.90	
	UNII-3	5 745	5.80	0.33	6.12	30.00
		5 785	5.45	0.33	5.78	
		5 825	6.07	0.33	6.40	

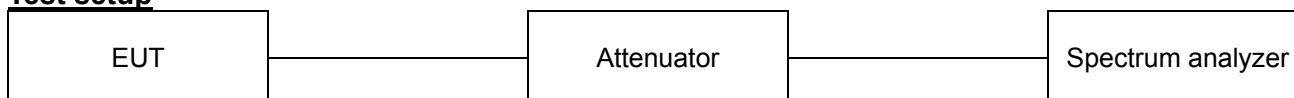
Note.

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

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7.2. Maximum Power Spectral Density

Test setup



Limit

According to §15.407(a)

Band	EUT category		Limit
UNII-1		Outdoor access point	17 dBm/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 be reduced 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 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 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of RBWs less than 1 MHz, 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 $RBW \geq 1/T$, where T is defined in II.B.I.a).
- b) Set $VBW \geq 3 RBW$.
- c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10 \log (500 \text{ kHz} / RBW)$ 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 $10 \log (1 \text{ MHz} / RBW)$ 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.

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Test results

UNII-1

Test mode	Frequency(MHz)	Peak Power Spectral Density			Limit (dBm/MHz)
		Reading(dBm)	Duty Factor (dB)	Result ¹⁾ (dBm)	
802.11n HT20	5 180	-3.61	0.33	-3.28	11.00
	5 200	-3.89	0.33	-3.56	
	5 240	-2.75	0.33	-2.42	

UNII-3

Test mode	Frequency(MHz)	Peak Power Spectral Density			Limit (dBm/500kHz)
		Reading(dBm)	Duty Factor (dB)	Result ¹⁾ (dBm)	
802.11n HT20	5 745	-6.46	0.33	-6.13	30.00
	5 785	-7.5	0.33	-7.17	
	5 825	-6.84	0.33	-6.51	

Note.

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

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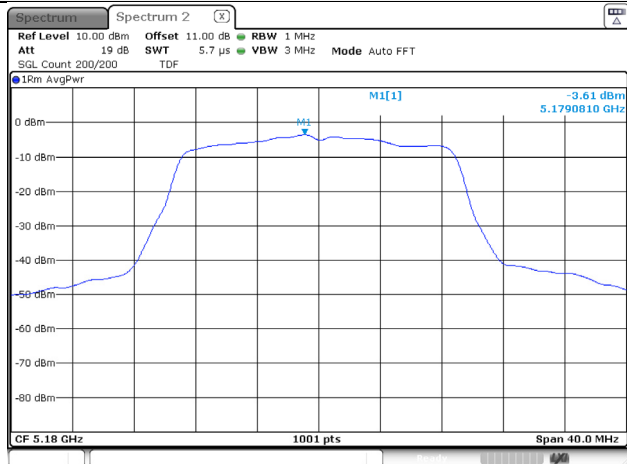
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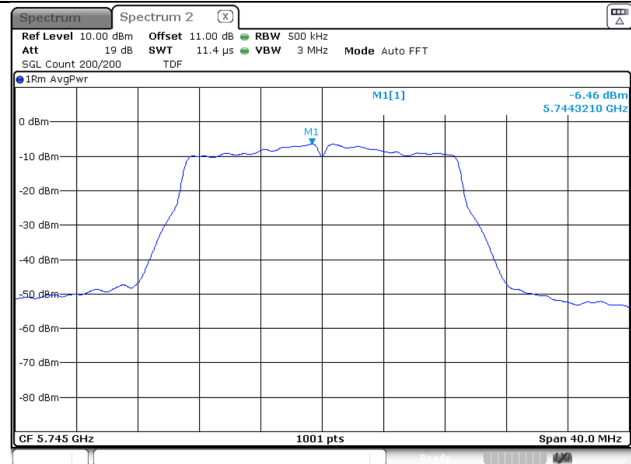


802.11n HT20

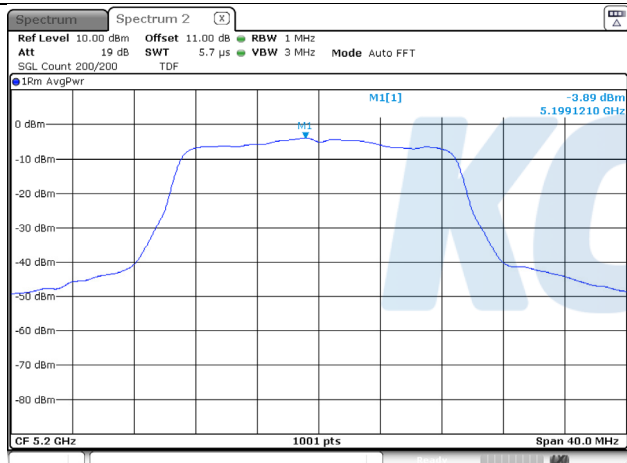
UNII-1



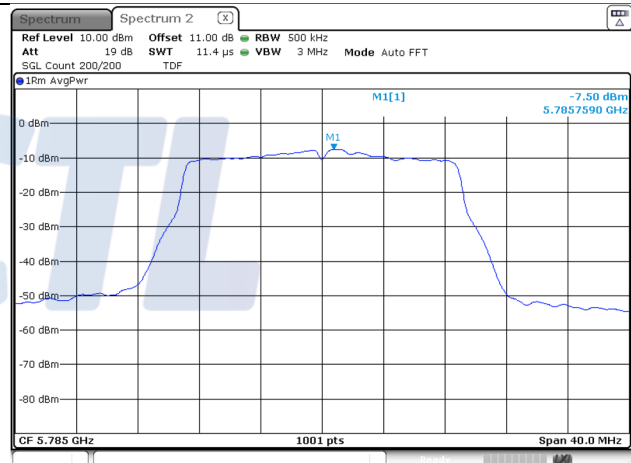
UNII-3



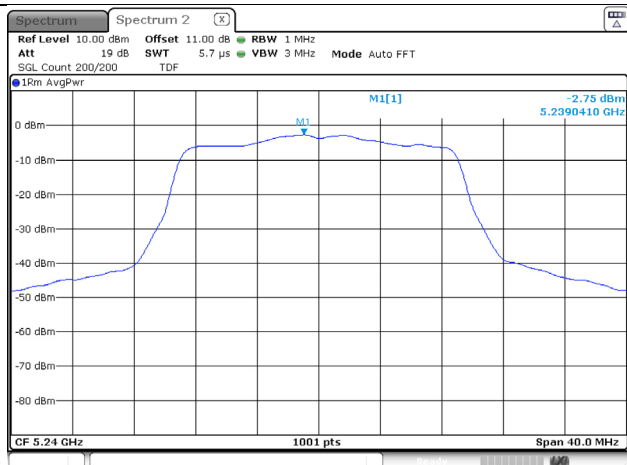
5 180 MHz



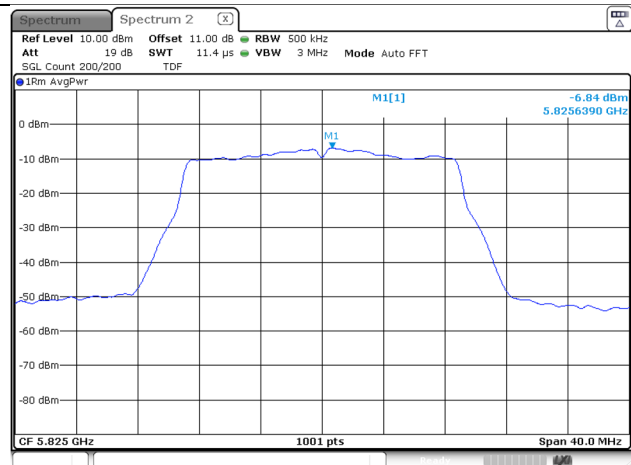
5 745 MHz



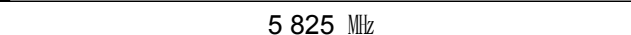
5 200 MHz



5 785 MHz



5 240 MHz



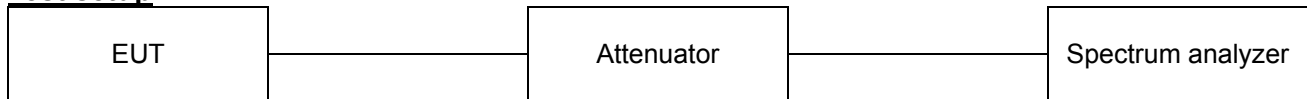
5 825 MHz

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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 $\geq 3 \times$ 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.

Test results

26 dB bandwidth(MHz)

Test mode	Frequency(MHz)	26 dB bandwidth(MHz)
802.11n HT20_UNII-1	5 180	27.41
	5 200	27.17
	5 240	23.70

99 % bandwidth(MHz)

Test mode	Frequency(MHz)	99 % bandwidth(MHz)
802.11n HT20_UNII-1	5 240	18.22

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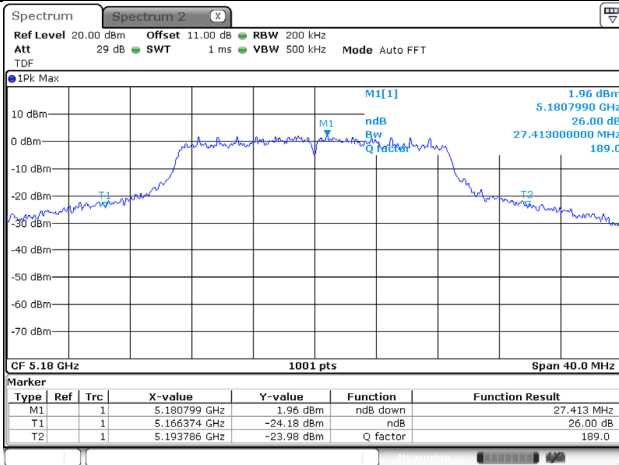
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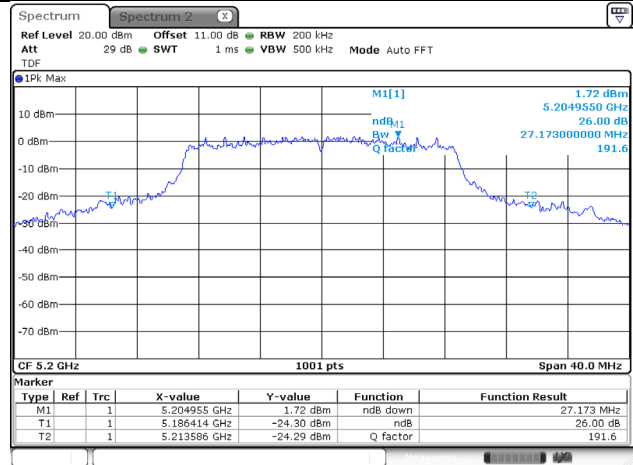
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26 dB bandwidth(MHz)

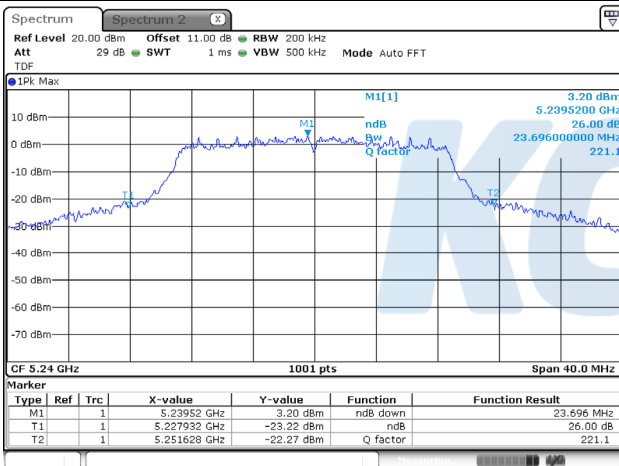
UNII-1



5 180 MHz



5 200 MHz



5 240 MHz

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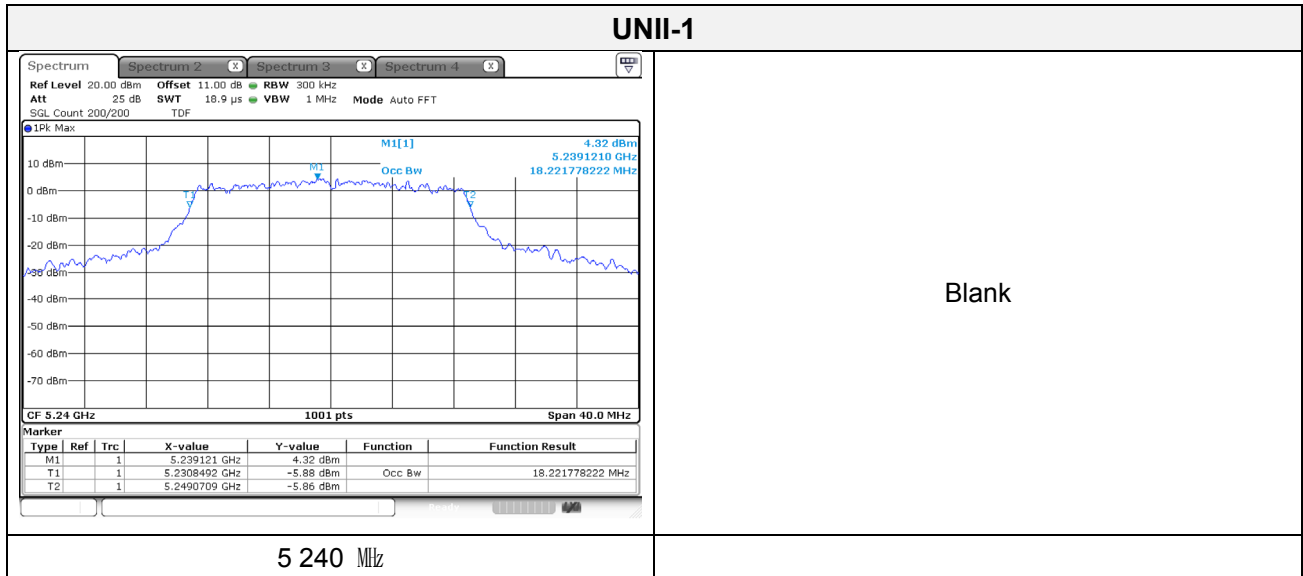
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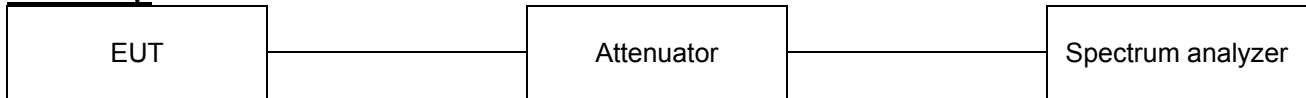
99 % bandwidth(MHz)



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7.4. 6 dB Bandwidth

Test setup



Limit

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

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

Test mode	Frequency (MHz)	Measured Bandwidth (MHz)
11n HT20	5 745	17.10
	5 785	17.54
	5 825	17.54

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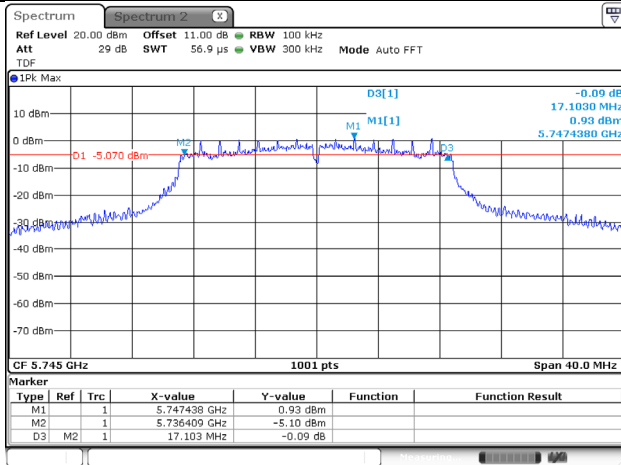
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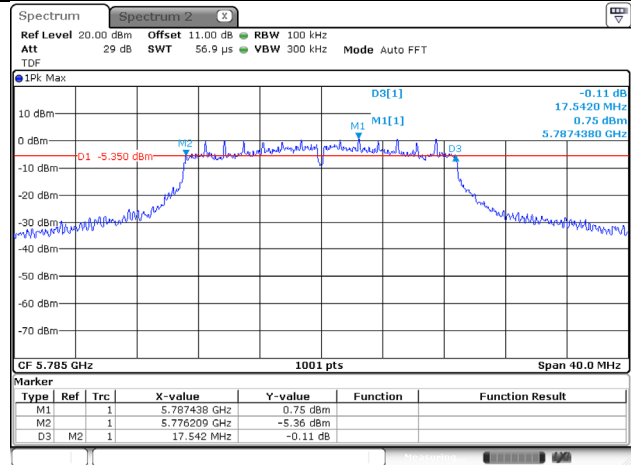
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6 dB bandwidth

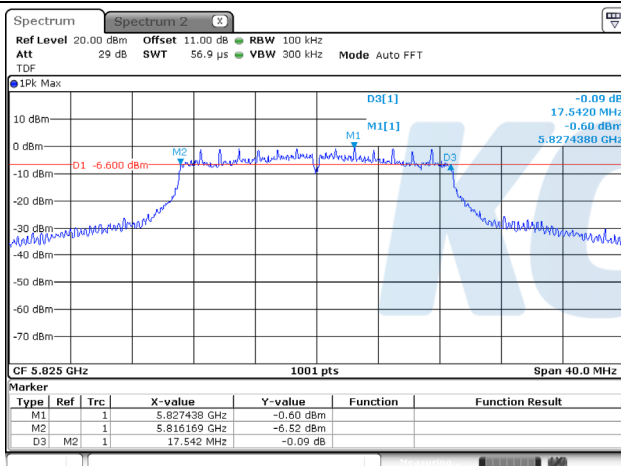
802.11n HT20



5 745 MHz



5 785 MHz

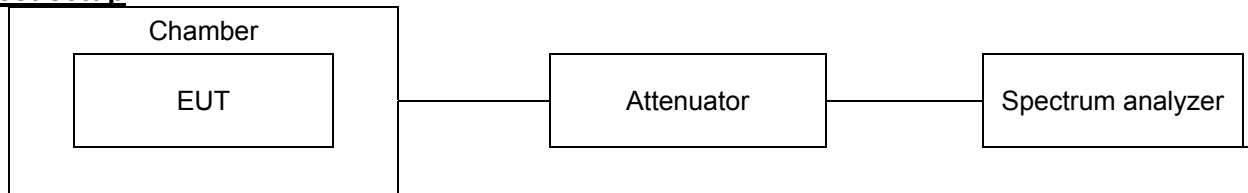


5 825 MHz

Blank

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	TEMP	Maintaining time	Measure frequency	Frequency deviation	Deviation
[%]	[V]	[°C]		[Hz]	[Hz]	[%]
100	3.70	20	Startup	5179 970 429	-295 71.00	-0.000 57
			2 minutes	5179 967 133	-328 67.00	-0.000 63
			5 minutes	5179 966 483	-335 17.00	-0.000 65
			10 minutes	5179 966 034	-339 66.00	-0.000 66
		-20	Startup	5180 017 263	172 63.00	0.000 33
			2 minutes	5180 020 968	209 68.00	0.000 40
			5 minutes	5180 021 402	214 02.00	0.000 41
			10 minutes	5180 021 517	215 17.00	0.000 42
		-10	Startup	5180 011 320	113 20.00	0.000 22
			2 minutes	5180 011 175	111 75.00	0.000 22
			5 minutes	5180 011 117	111 17.00	0.000 21
			10 minutes	5180 011 175	111 75.00	0.000 22
		0	Startup	5179 965 935	-340 65.00	-0.000 66
			2 minutes	5179 964 786	-352 14.00	-0.000 68
			5 minutes	5179 964 536	-354 64.00	-0.000 68
			10 minutes	5179 964 486	-355 14.00	-0.000 69
		10	Startup	5179 967 714	-322 86.00	-0.000 62
			2 minutes	5179 964 967	-350 33.00	-0.000 68
			5 minutes	5179 964 567	-354 33.00	-0.000 68
			10 minutes	5179 964 417	-355 83.00	-0.000 69
		25	Startup	5179 964 667	-353 33.00	-0.000 68
			2 minutes	5179 963 318	-366 82.00	-0.000 71
			5 minutes	5179 963 218	-367 82.00	-0.000 71
			10 minutes	5179 963 618	-363 82.00	-0.000 70
		30	Startup	5179 960 471	-395 29.00	-0.000 76
			2 minutes	5179 959 522	-404 78.00	-0.000 78
			5 minutes	5179 961 870	-381 30.00	-0.000 74
			10 minutes	5179 961 920	-380 80.00	-0.000 74
85	3.15	20	Startup	5179 977 673	-223 27.00	-0.000 43
			2 minutes	5179 973 227	-267 73.00	-0.000 52
			5 minutes	5179 970 230	-297 70.00	-0.000 57
			10 minutes	5179 969 031	-309 69.00	-0.000 60
115	4.26	20	Startup	5179 977 173	-228 27.00	-0.000 44
			2 minutes	5179 967 682	-323 18.00	-0.000 62
			5 minutes	5179 967 283	-327 17.00	-0.000 63
			10 minutes	5179 966 933	-330 67.00	-0.000 64

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Test mode : UNII-3

Frequency(Hz) : 5 745 000 000

Voltage [%]	Voltage [V]	TEMP [°C]	Maintaining time	Measure frequency [Hz]	Frequency deviation [Hz]	Deviation [%]
100	3.70	20	Startup	5744 998 956	-104 4.00	-0.000 02
			2 minutes	5744 998 783	-121 7.00	-0.000 02
			5 minutes	5744 998 812	-118 8.00	-0.000 02
			10 minutes	5744 998 696	-130 4.00	-0.000 02
		0	Startup	5745 023 992	239 92.00	0.000 42
			2 minutes	5745 024 107	241 07.00	0.000 42
			5 minutes	5745 023 992	239 92.00	0.000 42
			10 minutes	5745 024 107	241 07.00	0.000 42
		10	Startup	5745 011 835	118 35.00	0.000 21
			2 minutes	5745 011 922	119 22.00	0.000 21
			5 minutes	5745 011 778	117 78.00	0.000 21
			10 minutes	5745 011 575	115 75.00	0.000 20
		25	Startup	5744 993 978	-602 2.00	-0.000 10
			2 minutes	5744 989 608	-103 92.00	-0.000 18
			5 minutes	5744 989 347	-106 53.00	-0.000 19
			10 minutes	5744 989 260	-107 40.00	-0.000 19
		30	Startup	5744 982 517	-174 83.00	-0.000 30
			2 minutes	5744 982 401	-175 99.00	-0.000 31
			5 minutes	5744 982 025	-179 75.00	-0.000 31
			10 minutes	5744 981 880	-181 20.00	-0.000 32
		40	Startup	5744 972 994	-270 06.00	-0.000 47
			2 minutes	5744 971 894	-281 06.00	-0.000 49
			5 minutes	5744 970 678	-293 22.00	-0.000 51
			10 minutes	5744 970 071	-299 29.00	-0.000 52
		50	Startup	5744 964 050	-359 50.00	-0.000 63
			2 minutes	5744 963 906	-360 94.00	-0.000 63
			5 minutes	5744 963 906	-360 94.00	-0.000 63
			10 minutes	5744 963 877	-361 23.00	-0.000 63
85	3.15	20	Startup	5744 985 440	-145 60.00	-0.000 25
			2 minutes	5744 983 038	-169 62.00	-0.000 30
			5 minutes	5744 981 562	-184 38.00	-0.000 32
			10 minutes	5744 981 185	-188 15.00	-0.000 33
115	4.26	20	Startup	5744 978 465	-215 35.00	-0.000 37
			2 minutes	5744 978 899	-211 01.00	-0.000 37
			5 minutes	5744 978 234	-217 66.00	-0.000 38
			10 minutes	5744 978 494	-215 06.00	-0.000 37

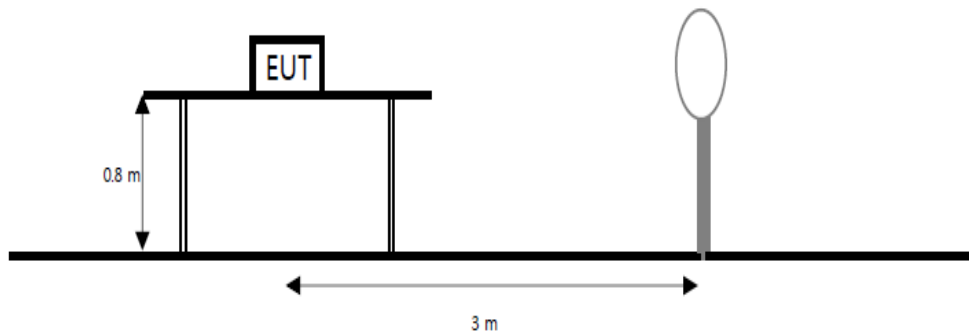
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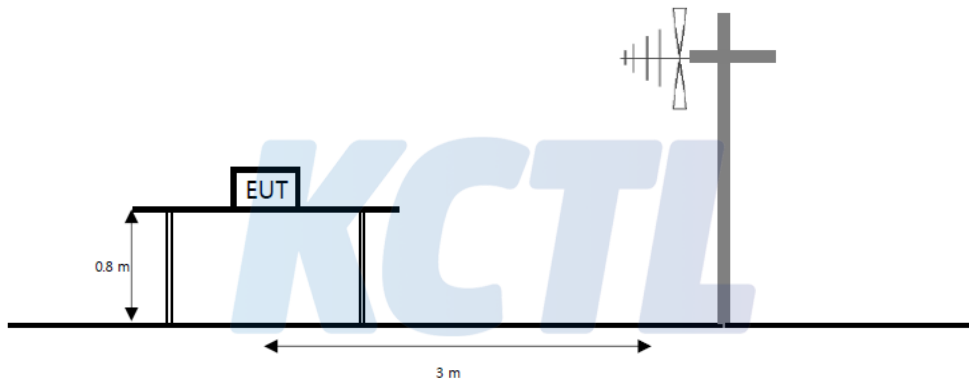
7.6. Spurious Emission, Band Edge and Restricted bands

Test setup

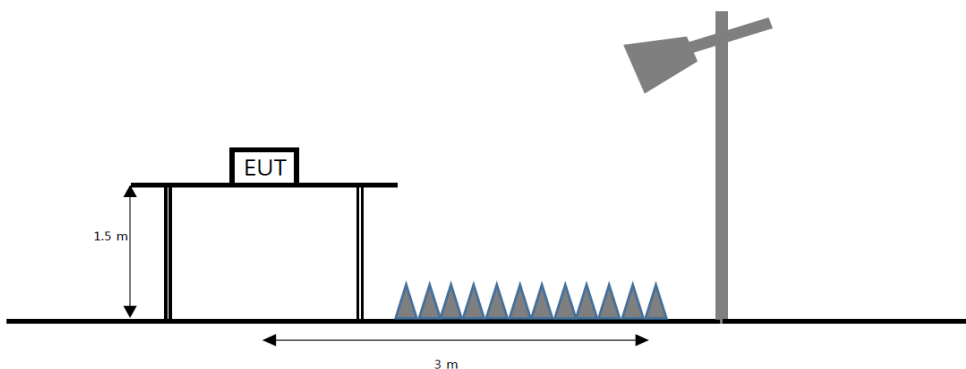
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions



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



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz 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 ($\mu V/m$)	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., Section 15.231 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	2 483.5 - 2 500	17.7 - 21.4
8.376 25 - 8.386 75	25	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 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 5.725-5.85 GHz band: All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz 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 $\geq$ (3 $\times$ 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 kHz to 150 kHz	200 Hz to 300 Hz
0.15 MHz to 30 MHz	9 kHz to 10 kHz
30 MHz to 1 000 MHz	100 kHz to 120 kHz
> 1 000 MHz	1 MHz

Average field strength measurements**Trace averaging with continuous EUT transmission at full power**

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

1. RBW = 1 MHz (unless otherwise specified).
2. VBW $\geq$ (3 $\times$ RBW).
3. Detector = RMS (power averaging), if $[\text{span} / (\# \text{ of points in sweep})] \leq (\text{RBW} / 2)$. 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 dB 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 ($D \geq 98\%$) cannot be achieved and the duty cycle is constant (duty cycle variations are less than $\pm 2\%$), 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 MHz (unless otherwise specified).
4. VBW $\geq [3 \times \text{RBW}]$.
5. Detector = RMS (power averaging), if $[\text{span} / (\# \text{ of points in sweep})] \leq (\text{RBW} / 2)$. 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 ($D \geq 98\%$) rather than turning ON and OFF 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 ($\geq 1/T$) 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. $F_d = 40 \log(D_m/D_s)$
 $f \geq 30$ MHz, 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
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.

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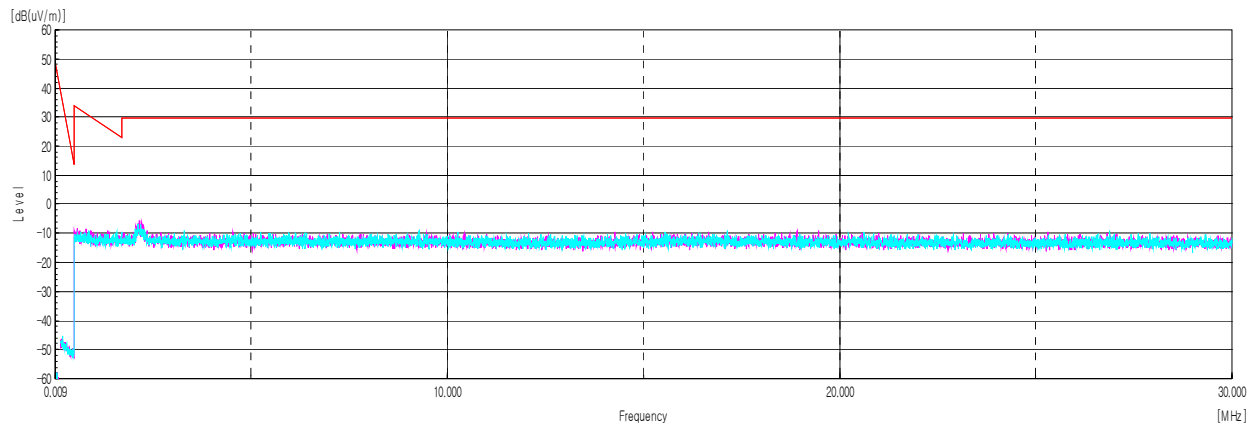
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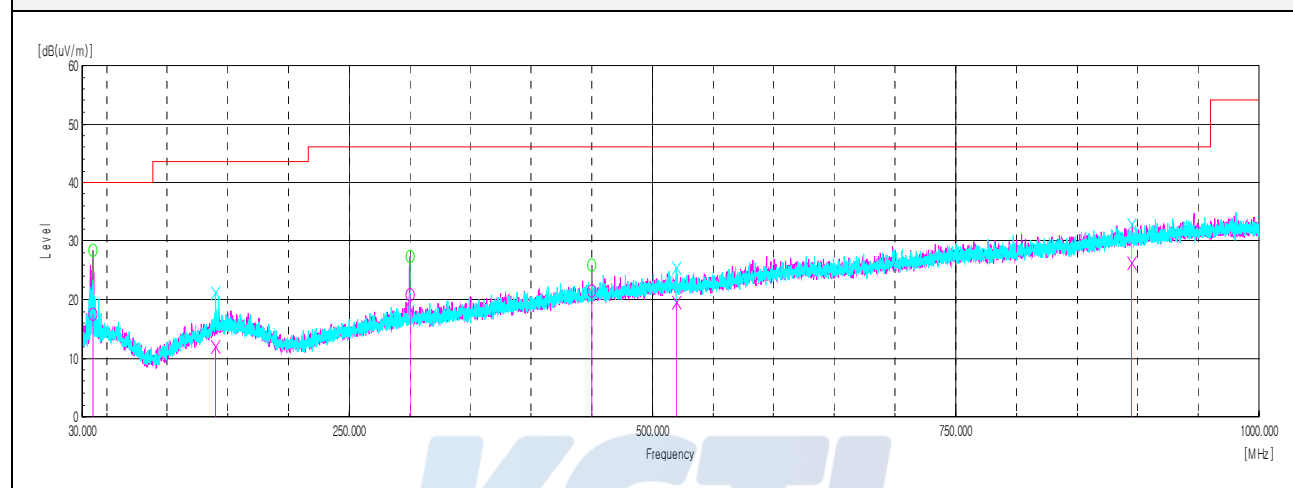
KCTL**Test results (Below 30 MHz) – Worst case: 802.11n HT20_UNII-1 Highest frequency**

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

Horizontal/Vertical**KCTL**

Test results (Below 1 000 MHz) – Worst case: 802.11n HT20_UNII-1 Highest frequency

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data								
895.12	V	21.70	29.25	-24.51	-	26.44	46.00	19.56

Horizontal/Vertical

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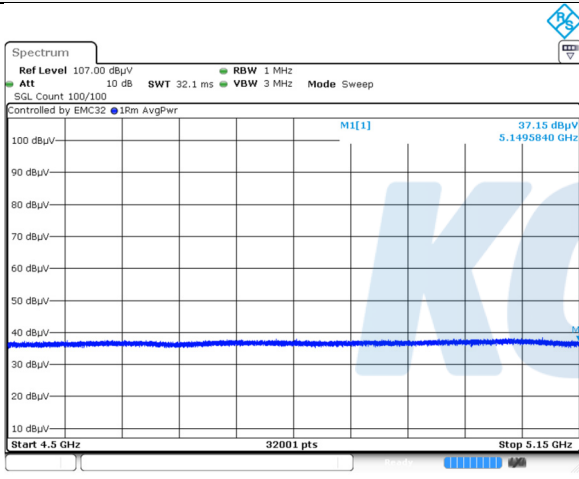
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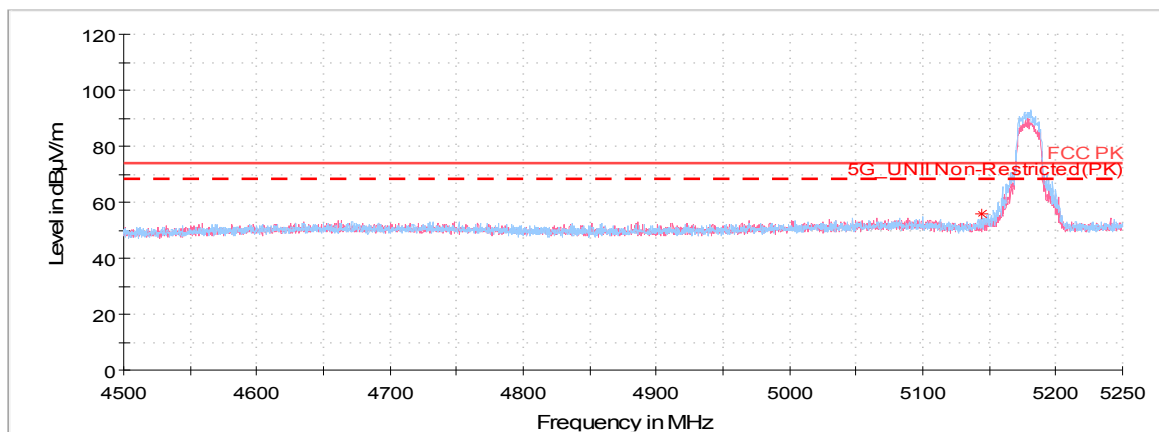
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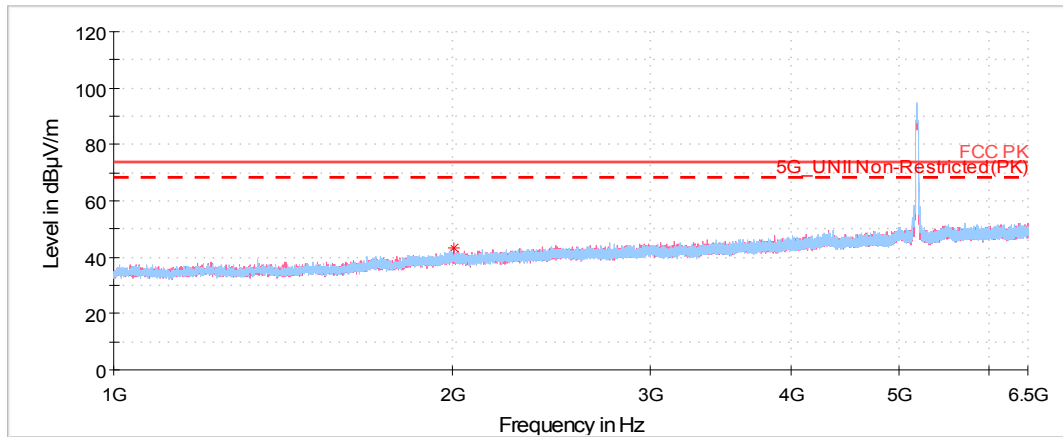
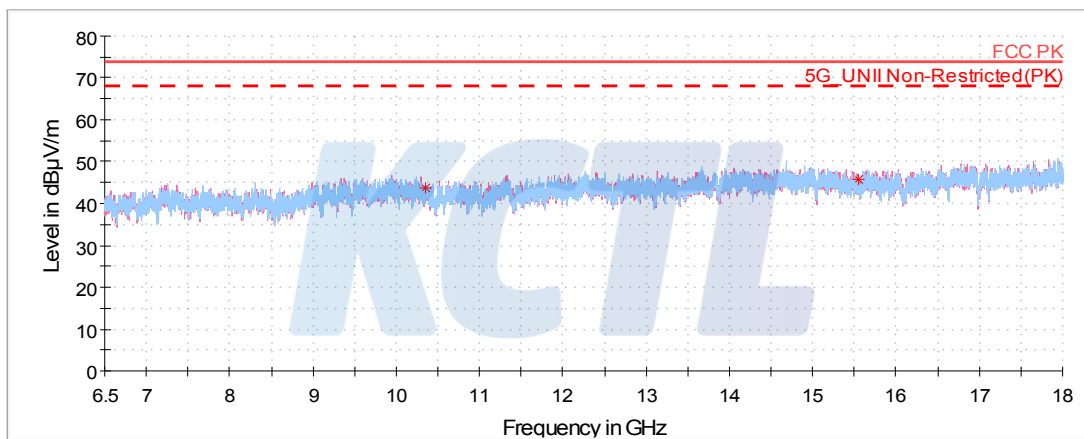
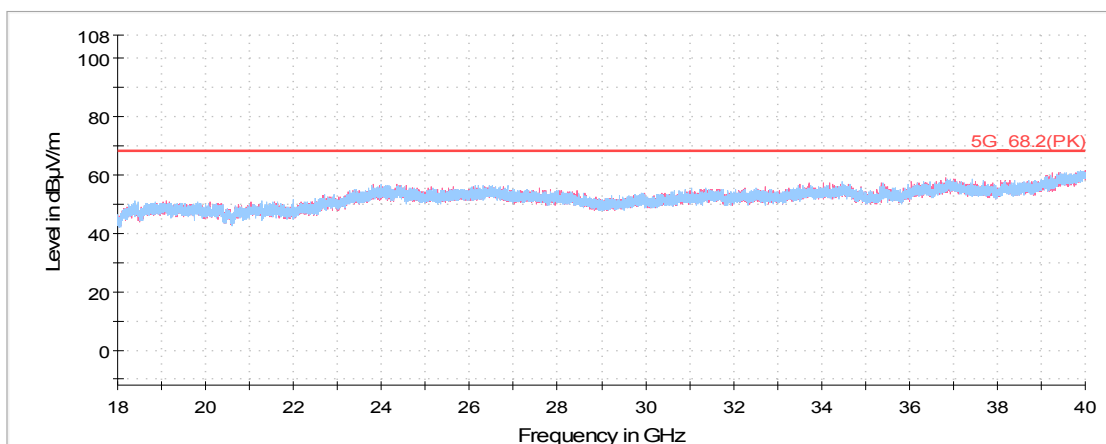
**Test results (Above 1 000 MHz)****802.11n HT20 UNII-1****Lowest Channel (5 180 MHz)**

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
10 358.97	H	59.02	37.32	-52.5	-	43.84	68.20	24.36
15 540.44 ¹⁾	H	54.60	40.02	-48.81	-	45.81	74.00	28.19
Average Data								
5 149.58 ¹⁾	H	37.15	34.08	-28.13	0.33	43.43	54.00	10.57

Horizontal/Vertical for Average data

Blank

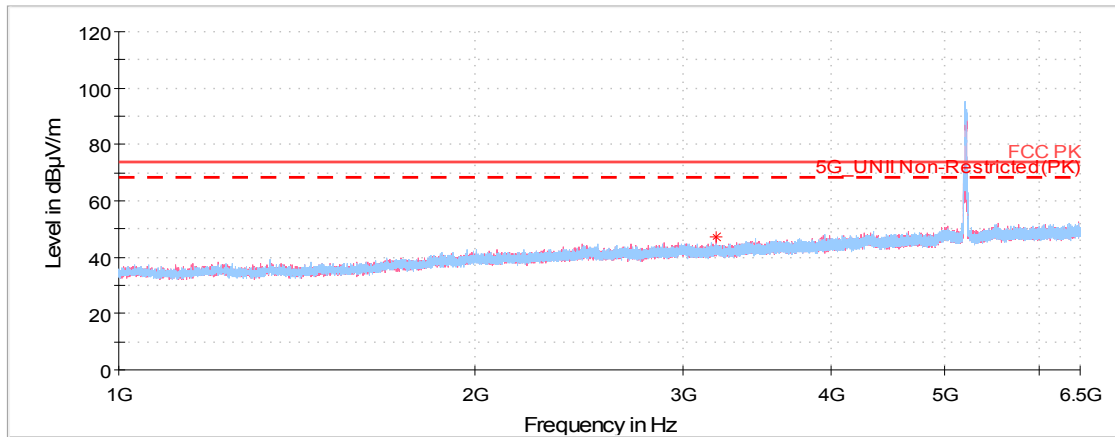
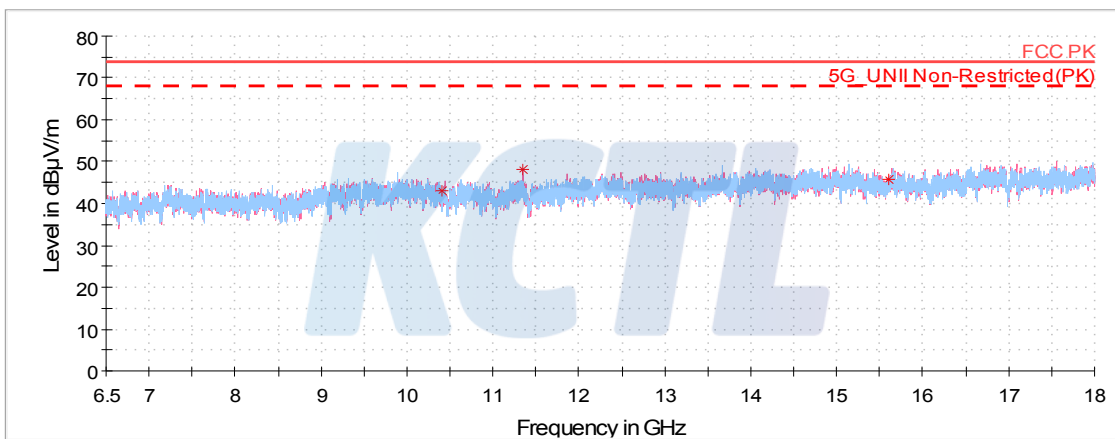
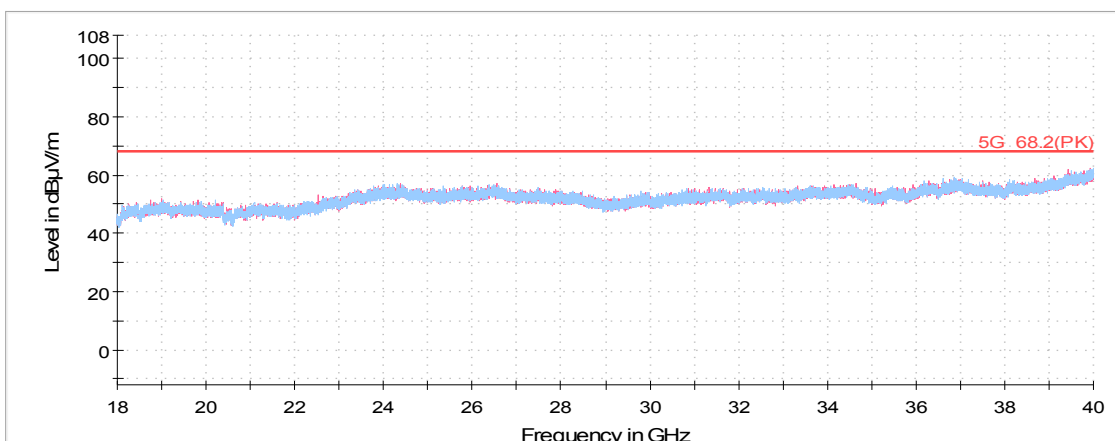
Horizontal/Vertical for Band-edge

Horizontal/Vertical for 1 GHz ~ 6.5 GHz**Horizontal/Vertical for 6.5 GHz ~ 18 GHz****Horizontal/Vertical for 18 GHz ~ 40 GHz**

Middle Channel (5 200 MHz)

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
10 399.58	H	58.19	37.34	-52.56	-	42.97	68.20	25.23
15 602.61 ¹⁾	H	54.80	40.04	-48.92	-	45.92	74.00	28.08
Average Data								
No spurious emissions were detected within 20 dB of the limit.								

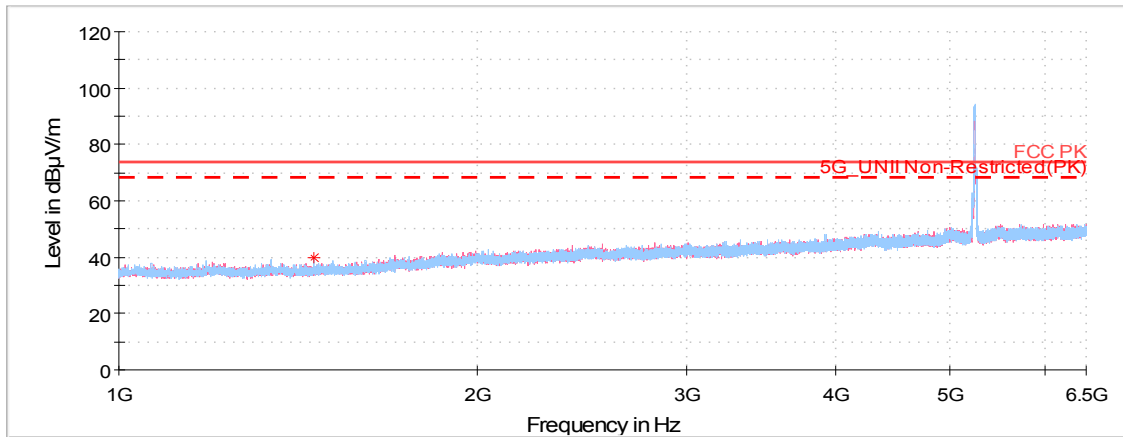
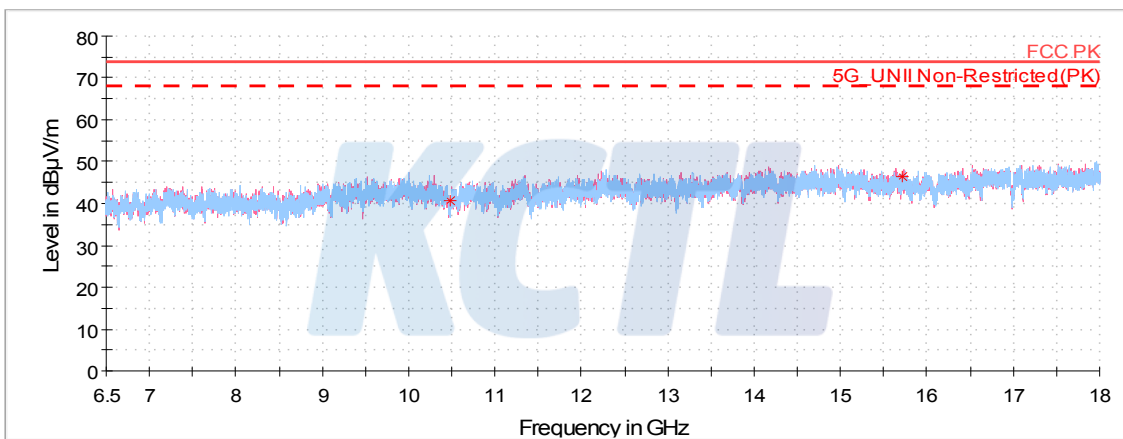
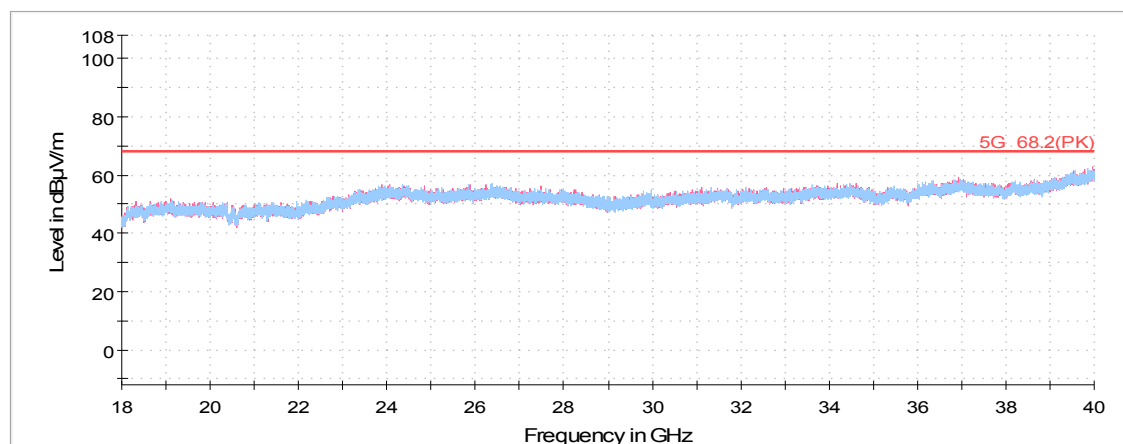


Horizontal/Vertical for 1 GHz ~ 6.5 GHz**Horizontal/Vertical for 6.5 GHz ~ 18 GHz****Horizontal/Vertical for 18 GHz ~ 40 GHz**

Highest Channel (5 240 MHz)

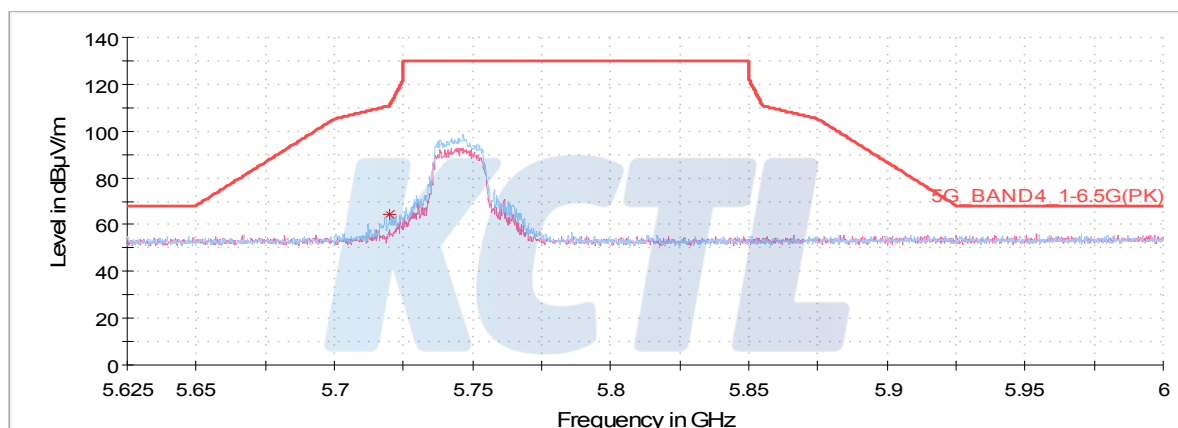
Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μ V))	(dB)	(dB)	(dB)	(dB(μ V/m))	(dB(μ V/m))	(dB)
Peak data								
10 480.08	H	55.99	37.39	-52.69	-	40.69	68.20	27.51
15 722.28 ¹⁾	H	55.56	40.09	-49.13	-	46.52	74.00	27.48
Average Data								
No spurious emissions were detected within 20 dB of the limit.								

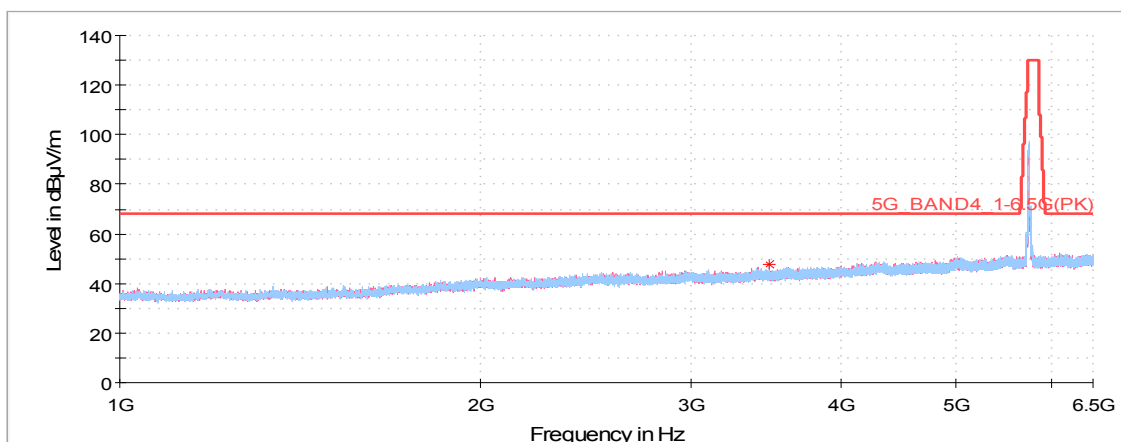
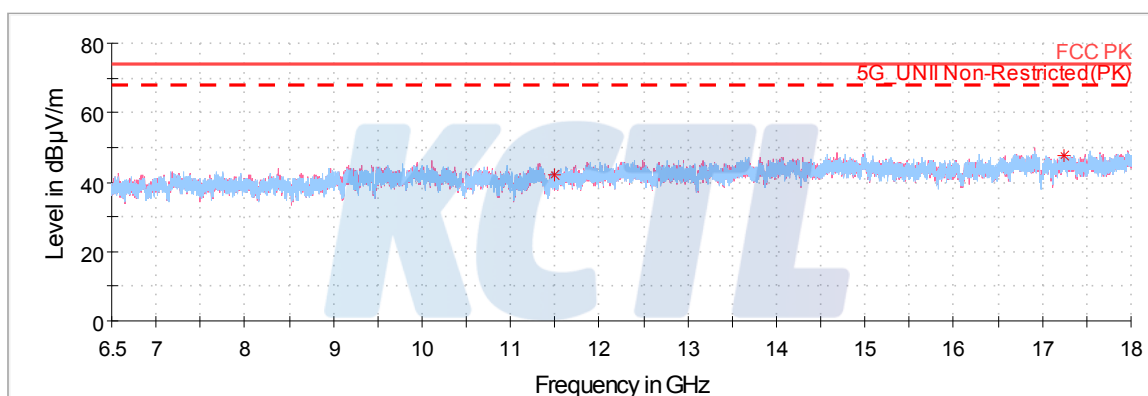
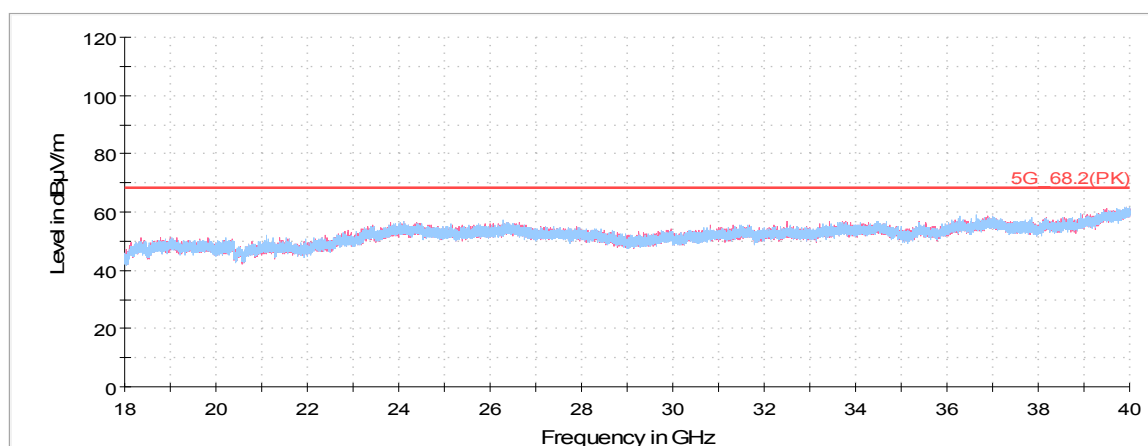


Horizontal/Vertical for 1 GHz ~ 6.5 GHz**Horizontal/Vertical for 6.5 GHz ~ 18 GHz****Horizontal/Vertical for 18 GHz ~ 40 GHz**

802.11n HT20 UNII-3**Lowest Channel (5 745 MHz)**

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μ V))	(dB)	(dB)	(dB)	(dB(μ V/m))	(dB(μ V/m))	(dB)
Peak data								
5 720.03	H	56.90	34.76	-27.3	-	64.36	110.87	46.51
11 492.08 ¹⁾	H	55.41	38.19	-51.49	-	42.11	74.00	31.89
17 235.61	H	54.56	41.79	-48.63	-	47.72	68.20	20.48
Average Data								
No spurious emissions were detected within 20 dB of the limit.								

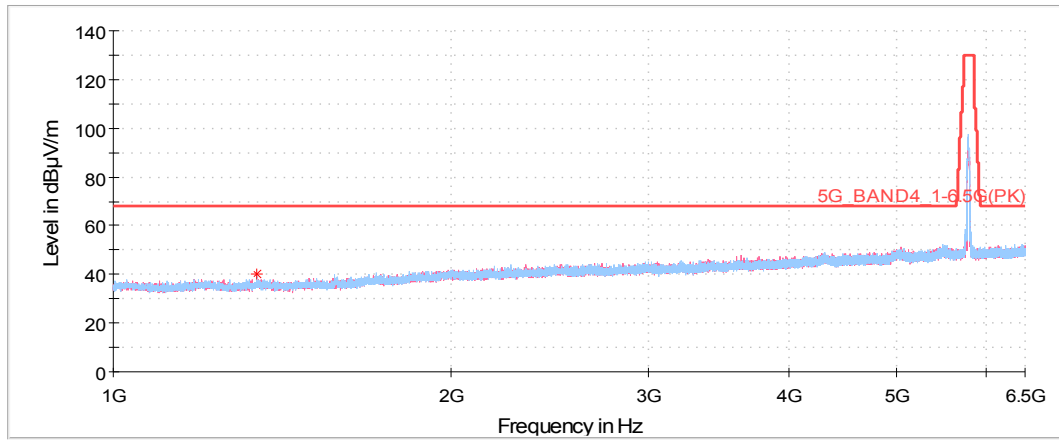
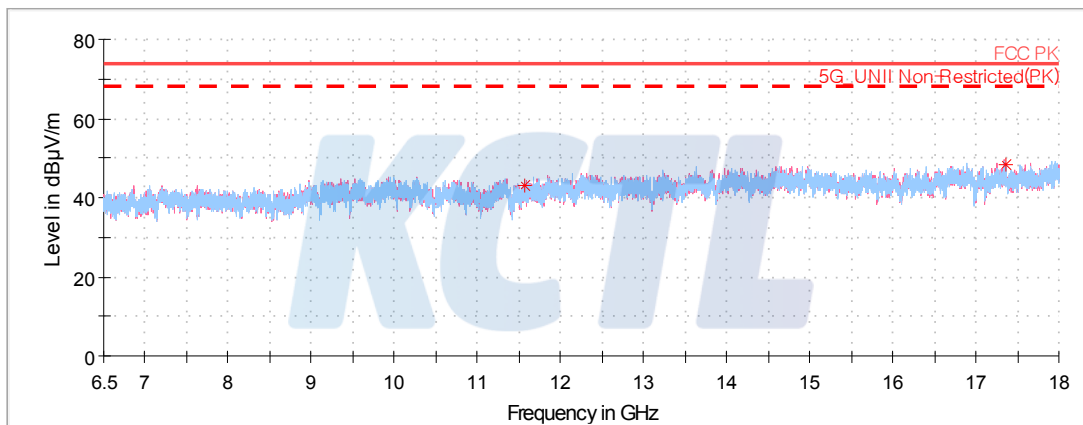
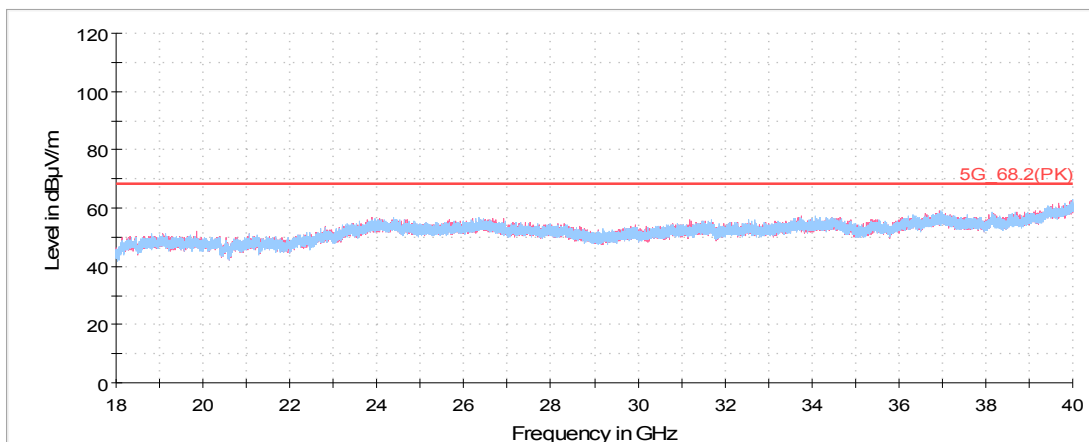
Horizontal/Vertical for Band-edge

Horizontal/Vertical for 1 GHz ~ 6.5 GHz**Horizontal/Vertical for 6.5 GHz ~ 18 GHz****Horizontal/Vertical for 18 GHz ~ 40 GHz**

Middle Channel (5 785 MHz)

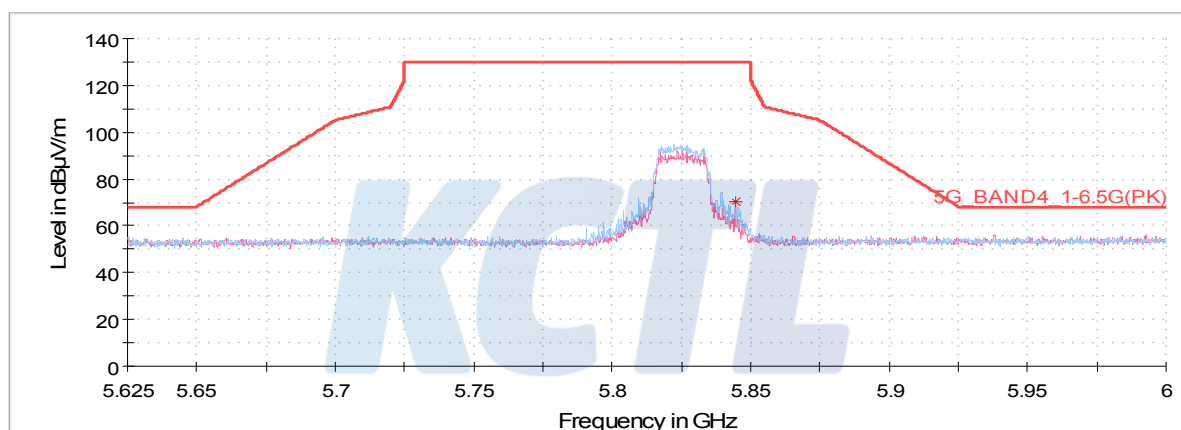
Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
11 569.34 ¹⁾	V	56.41	38.28	-51.43	-	43.26	74.00	30.74
17 355.64	V	55.36	41.84	-48.65	-	48.55	68.20	19.65
Average Data								
No spurious emissions were detected within 20 dB of the limit.								

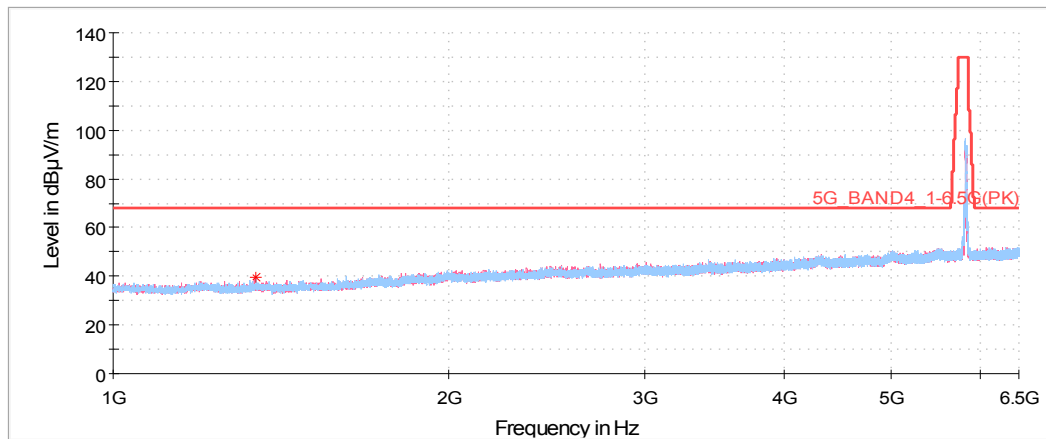
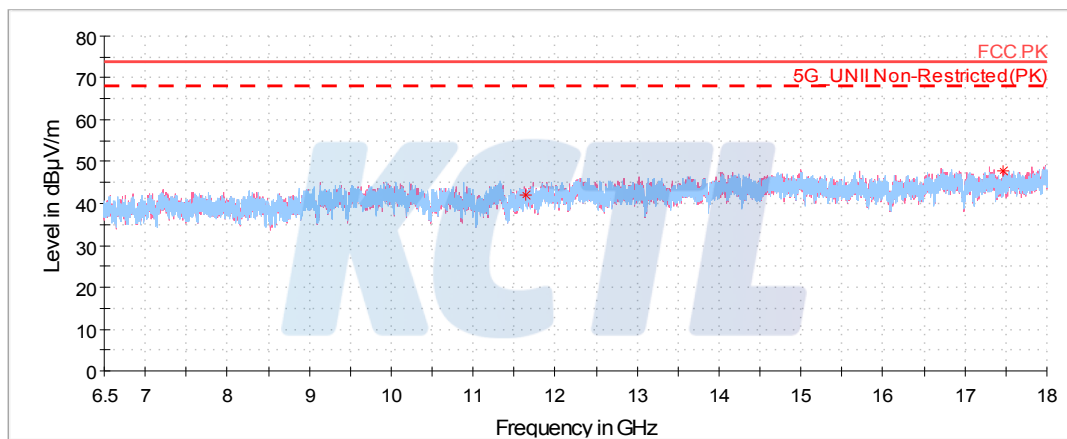
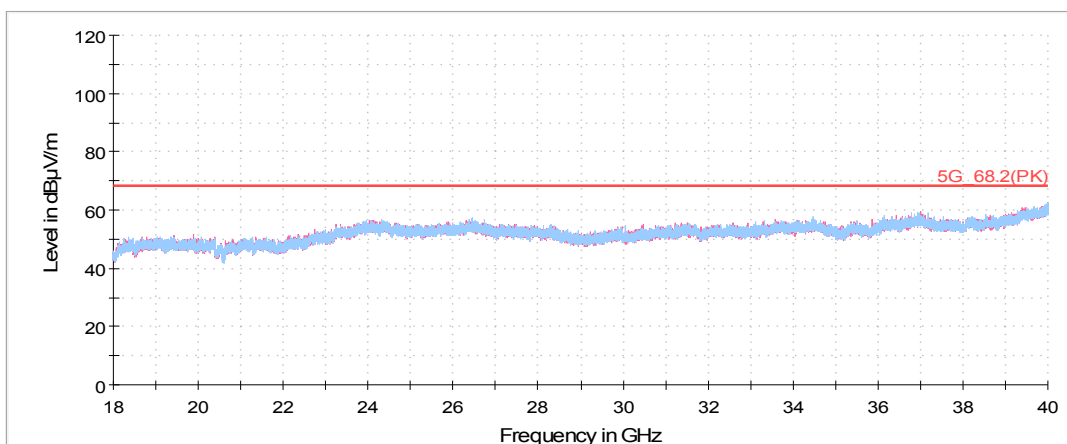


Horizontal/Vertical for 1 GHz ~ 6.5 GHz**Horizontal/Vertical for 6.5 GHz ~ 18 GHz****Horizontal/Vertical for 18 GHz ~ 40 GHz**

Highest Channel (5 825 MHz)

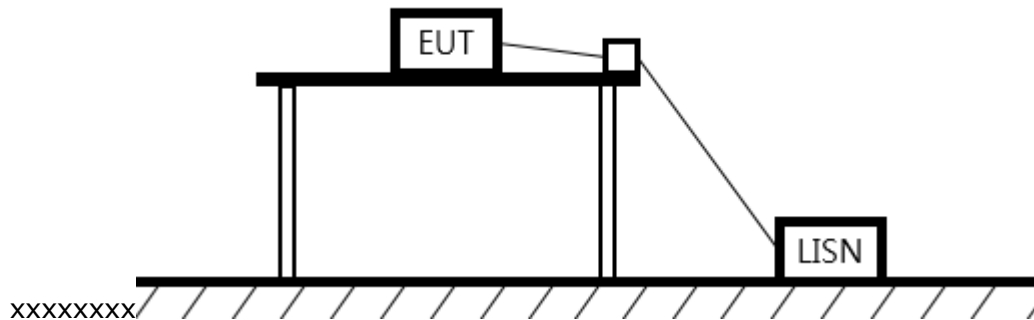
Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μ V))	(dB)	(dB)	(dB)	(dB(μ V/m))	(dB(μ V/m))	(dB)
Peak data								
1 343.75 ¹⁾	H	48.19	28.03	-36.77	-	39.45	74.00	34.55
5 850.14	H	48.53	34.92	-27.17	-	56.28	121.88	65.60
11 649.84 ¹⁾	H	55.16	38.38	-51.38	-	42.16	74.00	31.84
17 471.72	V	54.66	41.89	-48.67	-	47.88	68.20	20.32
Average Data								
No spurious emissions were detected within 20 dB of the limit.								

Horizontal/Vertical for Band-edge

Horizontal/Vertical for 1 GHz ~ 6.5 GHz**Horizontal/Vertical for 6.5 GHz ~ 18 GHz****Horizontal/Vertical for 18 GHz ~ 40 GHz**

7.7. AC Conducted emission

Test setup



Limit

According to 15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted limit (dB μ V/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

Measurement procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50 Ω /50 μ H LISN, which is an input transducer to a spectrum analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment in the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to peak amplitude within a bandwidth of 10 kHz or to quasi-peak and average within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

KCTL Inc.

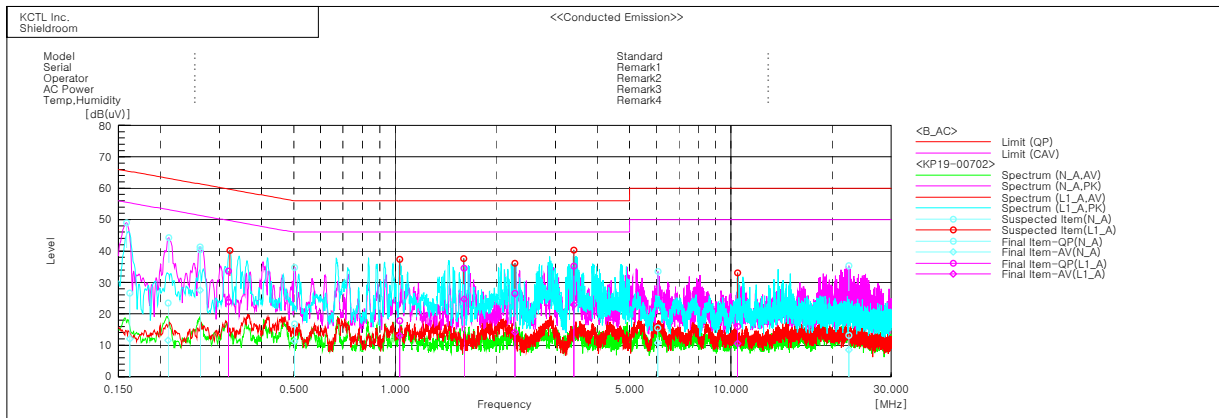
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

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KR19-SRF0073-B

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Test results



Final Result

--- N_A Phase ---									
No.	Frequency	Reading QP	Reading CAV	c.f	Result QP	Result CAV	Limit QP	Limit AV	Margin
	[MHz]	[dB(uV)]	[dB(uV)]	[dB]	[dB(uV)]	[dB(uV)]	[dB(uV)]	[dB(uV)]	QP CAV
1	0.16226	16.5	1.9	10.1	26.6	12.0	65.3	55.3	38.7 43.3
2	0.21113	13.5	1.6	9.9	23.4	11.5	63.2	53.2	39.8 41.7
3	0.26273	30.6	17.7	9.8	40.4	27.5	61.3	51.3	20.9 23.8
4	0.50173	6.7	1.3	10.0	16.7	11.3	56.0	46.0	39.3 34.7
5	6.06049	5.6	0.8	10.0	15.6	10.8	60.0	50.0	44.4 39.2
6	22.44435	2.0	-2.7	11.1	13.1	8.4	60.0	50.0	46.9 41.6

--- L1_A Phase ---									
No.	Frequency	Reading QP	Reading CAV	c.f	Result QP	Result CAV	Limit QP	Limit AV	Margin
	[MHz]	[dB(uV)]	[dB(uV)]	[dB]	[dB(uV)]	[dB(uV)]	[dB(uV)]	[dB(uV)]	QP CAV
1	0.31919	23.8	14.0	9.8	33.6	23.8	59.7	49.7	26.1 25.9
2	1.0324	7.9	3.2	9.9	17.8	13.1	56.0	46.0	38.2 32.9
3	1.6042	24.8	14.9	9.8	34.6	24.7	56.0	46.0	21.4 21.3
4	2.27451	16.7	4.3	9.8	26.5	14.1	56.0	46.0	29.5 31.9
5	3.40413	25.3	13.0	9.9	35.2	22.9	56.0	46.0	20.8 23.1
6	10.48579	5.7	0.2	10.3	16.0	10.5	60.0	50.0	44.0 39.5

8. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Spectrum Analyzer	R & S	FSV30	100914	19.09.10
Spectrum Analyzer	R & S	FSV40	100988	20.01.04
ATTENUATOR	Wideband Power Sensor	NRP-Z81	102398	20.01.25
ATTENUATOR	HP	8491A	29738	20.01.04
EMI TEST RECEIVER	R & S	ESCI	100732	19.08.23
Bi-Log Antenna	SCHWARZBECK	VULB 9168	583	21.05.04
Amplifier	SONOMA INSTRUMENT	310N	284608	19.08.23
COAXIAL FIXED ATTENUATOR	Agilent	8491B-003	2708A18758	20.05.04
Horn antenna	ETS.lindgren	3116	00086635	20.05.09*
Horn antenna	ETS.lindgren	3117	161225	20.05.22
AMPLIFIER	L-3 Narda-MITEQ	AMF-7D-01001800-22-10P	2003683	20.02.21
AMPLIFIER	L-3 Narda-MITEQ	JS44-18004000-33-8P	2000997	19.08.02
AMPLIFIER	L-3 Narda-MITEQ	AFS5-00101800-25-S-5	2054571	20.02.21
Broadband PreAmplifier	SCHWARZBECK	BBV9718	216	19.08.01
LOOP Antenna	R & S	HFH2-Z2	100355	20.08.24
Antenna Mast	Innco Systems	MA4640-XP-ET	-	-
Turn Table	Innco Systems	DT2000	79	-
Antenna Mast	Innco Systems	MA4000-EP	303	-
Turn Table	Innco Systems	DT2000	79	-
TWO-LINE V - NETWORK	R & S	ENV216	101584	20.04.05
EMI TEST RECEIVER	R & S	ESCI	101408	19.08.23
Highpass Filter	WT	WT-A1699-HS	WT160411002	20.05.14*
Vector Signal Generator	R & S	SMBV100A	257566	20.01.04
Signal Generator	R & S	SMR40	100007	20.05.13
Cable Assembly	RadiAll	2301761768000PJ	1724.659	-
Cable Assembly	gigalane	RG-400	-	-
Cable Assembly	HUER+SUHNER	SUCOFLEX 104	MY4342/4	-

*The equipment was used after finished calibration.

End of test report