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

1. Client

- Name : SELVAS Healthcare,Inc.
- Address : 174 Gajung-ro, Yuseong-gu Daejeon South Korea
- Date of Receipt : 2018-03-20

2. Use of Report : -

3. Name of Product and Model : BrailleSense Polaris MINI / H520B

4. Manufacturer and Country of Origin : SELVAS Healthcare,Inc. / Korea

5. FCC ID : 2AL4DH520B

6. Date of Test : 2018-05-01 to 2018-05-08

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 : Euijung Kim (Signature)	Technical Manager Name : Jongha Choi (Signature)

2018-06-20

KCTL Inc.

REPORT REVISION HISTORY

Date	Revision	Page No
2018-05-10	Originally issued	-
2018-06-20	Added emission mask results	40 ~ 42

[Contents]

1. Client information

Applicant:	SELVAS Healthcare,Inc.
Address:	174 Gajung-ro, Yuseong-gu Daejeon South Korea
Telephone number:	+82 42 864 4460
Contact person:	Hyeondong Jeong / flynn.h.jeong@selvas.com

Manufacturer:	SELVAS Healthcare,Inc.
Address:	155, Sinseong-ro, Yuseong-gu, Daejeon, Republic of Korea

2. Laboratory information

Address

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea

Telephone Number: +82 31 285 0894

Facsimile Number: +82 505 299 8311

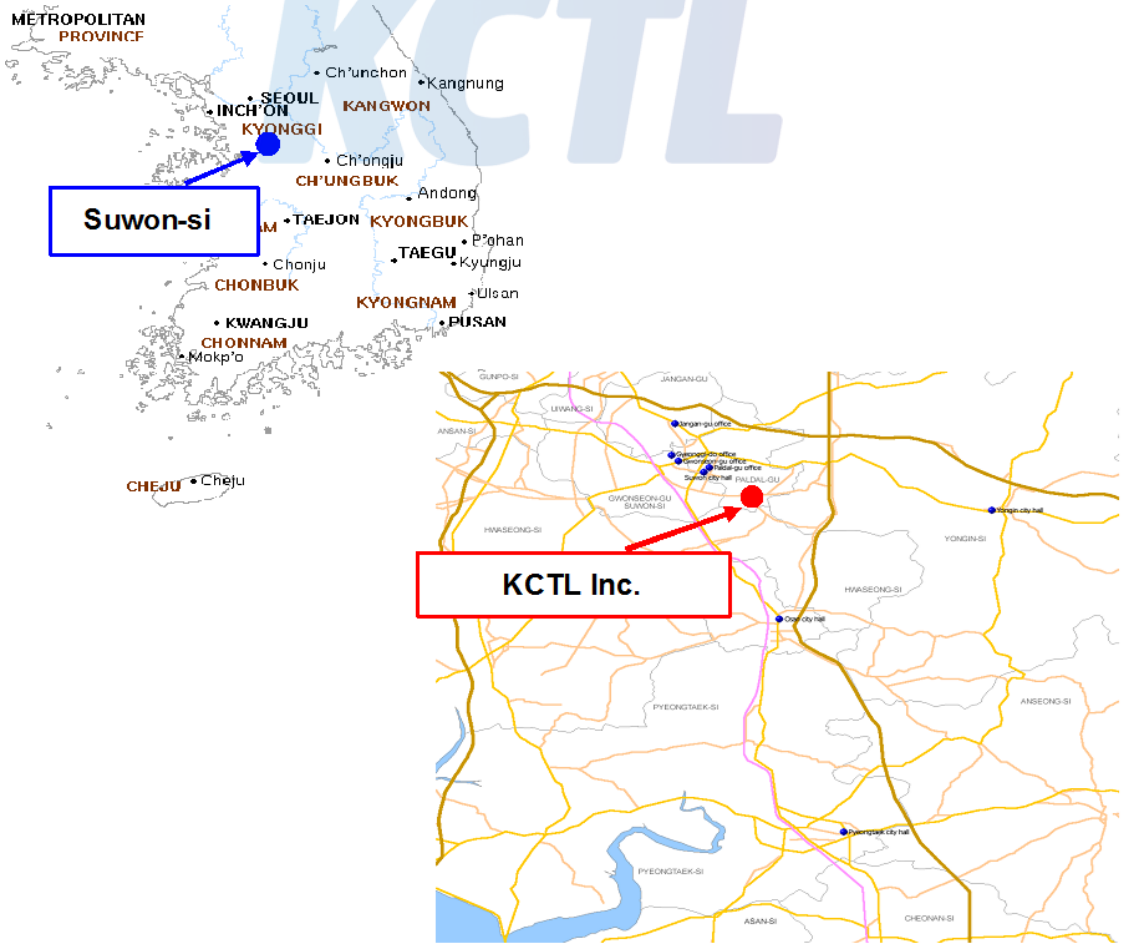
FCC Site Designation No: KR0040, FCC Site Registration No: 687132

VCCI Registration No. : R-3327, G-198, C-3706, T-1849

Industry Canada Registration No. : 8035A-2

KOLAS NO.: KT231

SITE MAP



3. Description of E.U.T.

3.1 Basic description

Applicant	SELVAS Healthcare,Inc.
Address of Applicant	174 Gajung-ro, Yuseong-gu Daejeon South Korea
Manufacturer	SELVAS Healthcare,Inc.
Address of Manufacturer	155, Sinseong-ro, Yuseong-gu, Daejeon, Republic of Korea
Type of equipment	BrailleSense Polaris MINI
Basic Model	H520B
Serial number	N/A

3.2 General description

Frequency Range	2 412 ㎒ ~ 2 462 ㎒ (802.11b/g/n HT20) 2 422 ㎒ ~ 2 452 ㎒ (802.11n HT40) 5 180 ㎒ ~ 5 240 ㎒ (802.11ac VHT20) 5 745 ㎒ ~ 5 825 ㎒ (802.11ac VHT20) 2 402 ㎒ ~ 2 480 ㎒ (Bluetooth, Bluetooth Low Energy)
Type of Modulation	802.11b : DSSS, 802.11g/n/ac : OFDM, Bluetooth : GFSK, π/4DQPSK, 8DPSK Bluetooth Low Energy : GFSK
The number of channels	2.4 ㎓: 11 ch (802.11b/g/n HT20), 7 ch (802.11n HT40), 79 ch (Bluetooth), 40 ch (Bluetooth Low Energy) 5 ㎓: 5 150 ㎒ Band: 4 (802.11ac VHT20) 5 725 ㎒ Band: 5 (802.11ac VHT20)
Type of Antenna	FPCB Antenna
Antenna Gain	2.4 ㎓: -0.97 ㏈i (WiFi) 2.45 ㏈i (Bluetooth, Bluetooth Low Energy) 5 ㎓: 1.99 ㏈i (5 150 ㎒ ~ 5 250 ㎒) -0.49 ㏈i (5 725 ㎒ ~ 5 850 ㎒)

Transmit Power	7.21 dBm
Power supply	DC 3.70 V
Product SW/HW version	V0.3 / 5.32.15.25468
Radio SW/HW version	V5.32.01 / V6.1
Test SW Version	Dut labtool 2.0.0.89
RF power setting in TEST SW	9 (5 150 ㎒ Band), 15 (5 725 ㎒ Band)

Note : The above EUT information was declared by the manufacturer.

3.3 Test frequency

- 802.11ac VHT20

Frequency	Band 1	Band 4
Lowest frequency	5 180 ㎒	5 745 ㎒
Middle frequency	5 200 ㎒	5 785 ㎒
Highest frequency	5 240 ㎒	5 825 ㎒

3.4 Test Voltage

Mode	Voltage
Nominal Voltage	DC 3.70 V

4. Summary of test results

4.1 Standards & results

FCC Rule	Parameter	Report Section	Test Result
15.203 15.407(a)(1)(2)(3)	Antenna Requirement	5.1	C
15.407(a)(1)(2)	Maximum Conducted Output Power	5.2	C
15.403(i), 15.407(e)	Bandwidth Measurement	5.3	C
15.407(a)(1)(2)(5)	Peak Power Spectral Density	5.4	C
15.205(a), 15.209(a), 15.407(b)(1), 15.407(b)(2), 15.407(b)(3) 15.407(b)(4)(i)	Spurious Emission, Band Edge and Restricted bands	5.5	C
15.407(g)	Frequency Stability	5.6	C
15.207(a)	Conducted Emissions	5.7	C
Note: C = Complies, NC = Not Complies, NT = Not Tested, NA = Not Applicable			

4.2 Uncertainty

Measurement Item	Expanded Uncertainty U = *k*Uc (*k* = 2)	
Conducted RF power	1.42 dB	
Conducted Spurious Emissions	1.58 dB	
Radiated Spurious Emissions	30 ㎒ ~ 300 ㎒:	+4.94 dB, -5.06 dB
		+4.93 dB, -5.05 dB
	300 ㎒ ~ 1 000 ㎒:	+4.97 dB, -5.08 dB
		+4.84 dB, -4.96 dB
	1 ㎓ ~ 25 ㎓:	+6.03 dB, -6.05 dB
Conducted Emissions	9 ㎑ ~ 150 ㎑:	3.75 dB
	150 ㎑ ~ 30 ㎒:	3.36 dB

5. Test results

5.1 Antenna Requirement

5.1.1 Regulation

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.
And according to §15.407(a)(1)(2)(3), If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.1.2 Result

-Complied

The transmitter has permanently attached FPCB Antenna (internal antenna) on board.

5.2 Maximum Conducted Output Power

5.2.1 Regulation

According to §15.407(a) (1) (ii) For an indoor access point operating in the band 5.15-5.25 ㎓, the maximumConducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 ㏈i. In addition, the maximum power spectral density shall not exceed 17 ㏈m in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 ㏈i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i.

According to §15.407(a) (2) For the 5.25-5.35 ㎓ and 5.47-5.725 ㎓ bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 ㎽ or 11 ㏈m + 10 log B, where B is the 26 ㏈ emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 ㏈m in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 ㏈i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in ㏈that the directional gain of the antenna exceeds 6 ㏈i.

According to §15.407(a) (3) For the band 5.725-5.85 ㎓, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 ㏈m in any 500-㎑ band. If transmitting antennas of directional gain greater than 6 ㏈i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 ㏈i without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

5.2.2 Measurement Procedure

These test measurement settings are specified in section C of 789033 D02 General UNII Test Procedures.

5.2.2.1 Method SA-1 (trace averaging with the EUT transmitting at full power throughout each sweep):

(i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.

(ii) Set RBW = 1 MHz.

(iii) Set VBW ≥ 3 MHz.

(iv) Number of points in sweep ≥ 2 × span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

(v) Sweep time = auto.

(vi) Detector = power averaging (rms), if available. Otherwise, use sample detector mode.

(vii) If transmit duty cycle < 98%, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98%, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run.”

(viii) Trace average at least 100 traces in power averaging (rms) mode.

(ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument’s band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.

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

(i) Measure the duty cycle, x, of the transmitter output signal as described in section II.B.

(ii) Set span to encompass the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.

(iii) Set RBW = 1 MHz.

(iv) Set VBW ≥ 3 MHz.

(v) Number of points in sweep ≥ 2 × span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

(vi) Sweep time = auto.

(vii) Detector = power averaging (rms), if available. Otherwise, use sample detector mode.

(viii) Do not use sweep triggering. Allow the sweep to “free run.”

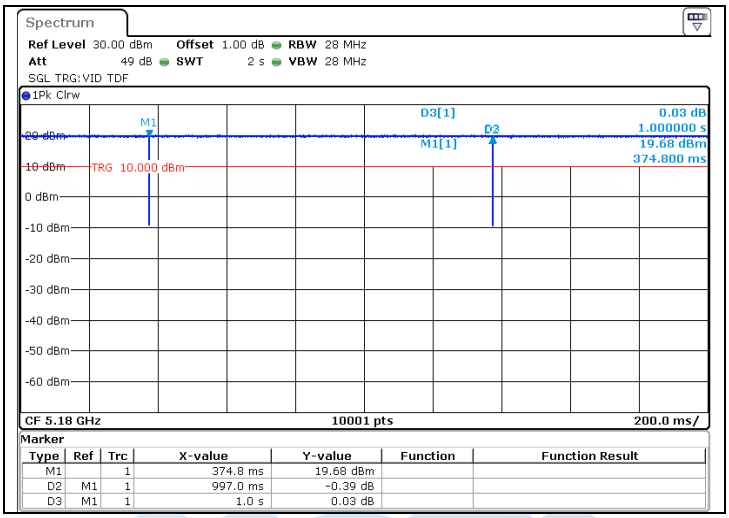
(ix) Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed to ensure that the average accurately represents the true average over the on and off periods of the transmitter.

(x) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument’s band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.

(xi) Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10 log (1/0.25) = 6 dB if the duty cycle is 25 %.

- Duty Cycle Correction Factor

- 802.11ac VHT20



Note1) : period : 1 000 ms, On time : 997 ms
Note2) : DCCF = 10 log(1 / x) = 10 log(1 / 0.997) = 0.01, x = 0.997
Note3) : 802.11ac mode is a continuous transmission (duty cycle >=98 %)"

5.2.3 Test Result

-Complied

- 5 150 Band

-802.11ac VHT20

Channel	Frequency [㎒]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	5 180	7.20	0.01	7.21	30.00	22.79
Middle	5 200	6.64	0.01	6.65	30.00	23.35
Highest	5 240	6.04	0.01	6.05	30.00	23.95

- 5 725 Band

-802.11ac VHT20

Channel	Frequency [㎒]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	5 745	1.70	0.01	1.71	30.00	28.29
Middle	5 785	1.26	0.01	1.27	30.00	28.73
Highest	5 825	2.27	0.01	2.28	30.00	27.72

Note 1 : D.C.C.F(Duty cycle correction factor) = 10log(1/x), x = 0.997
Note 2 : Result = Average power + D.C.C.F

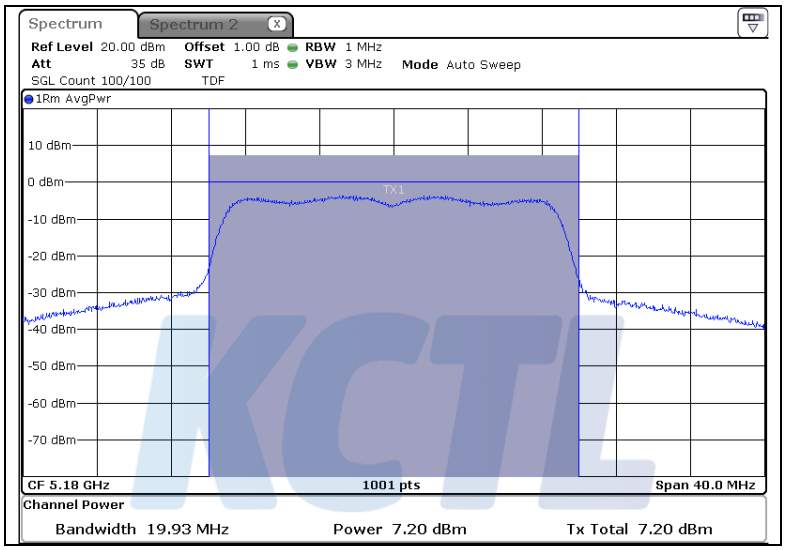
5.2.4 Test Plot

Figure 1. Conducted Output Power

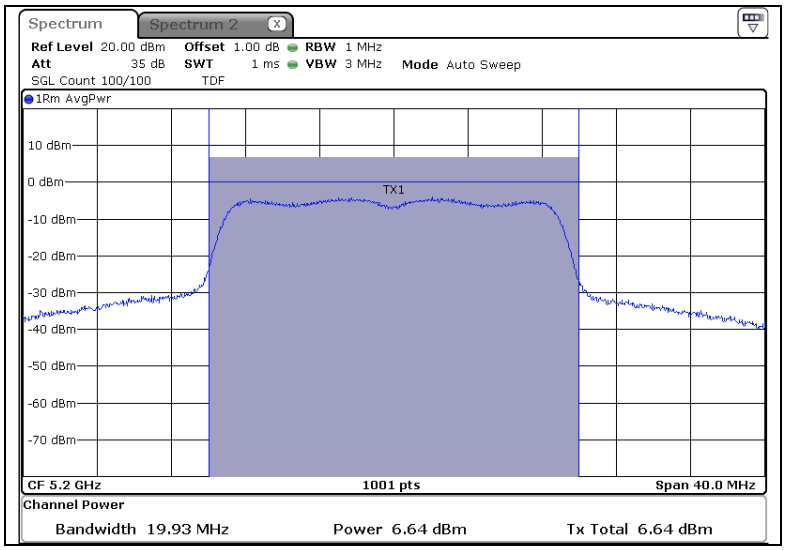
- 5 150 Band

-802.11ac VHT20

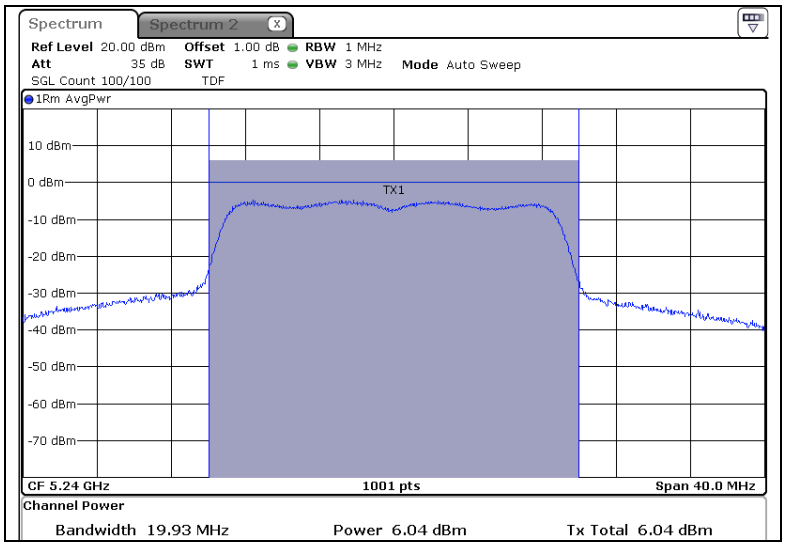
Lowest Channel (5 180 ㎒)



Middle Channel (5 200 ㎒)



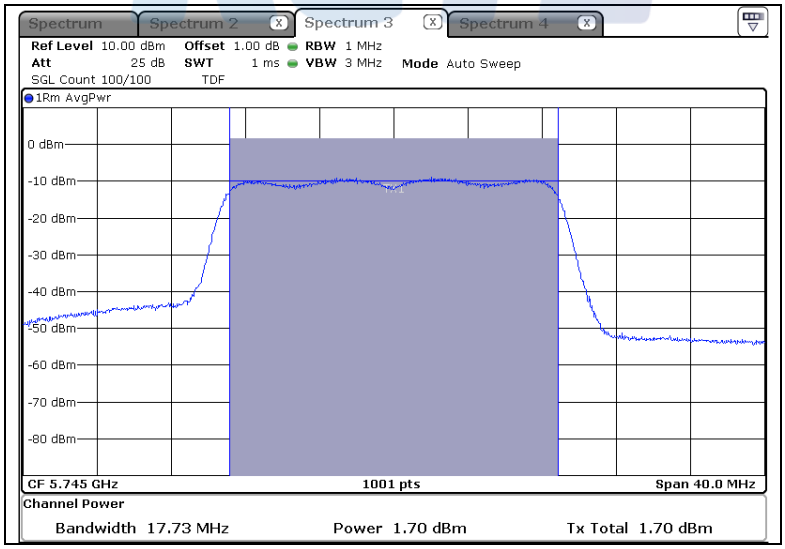
Highest Channel (5 240 ㎒)



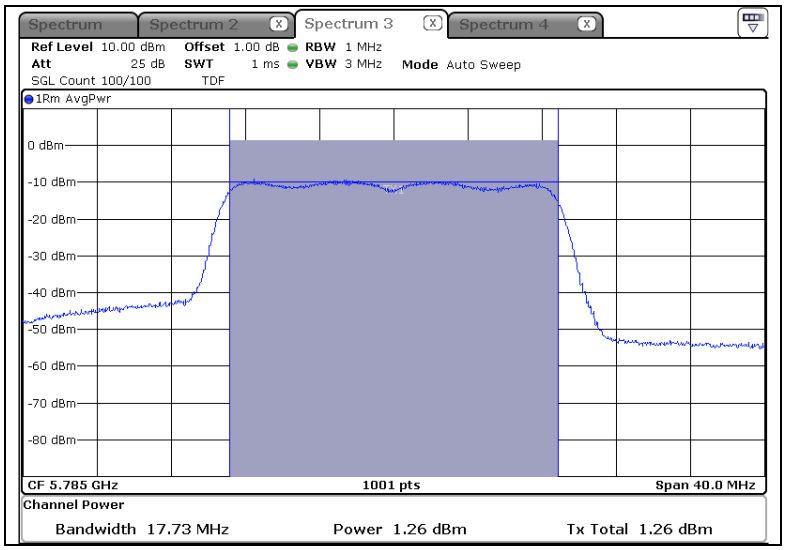
- 5 725 Band

-802.11ac VHT20

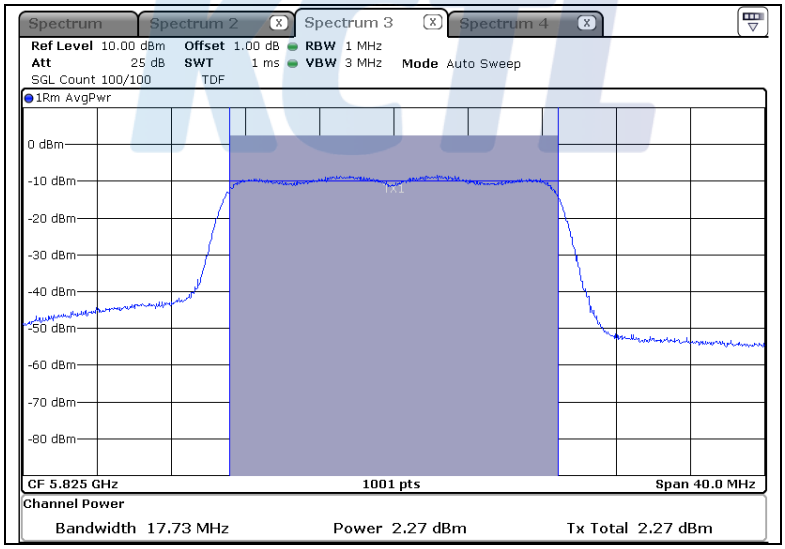
Lowest Channel (5 745 ㎒)



Middle Channel (5 785 ㎒)



Highest Channel (5 825 ㎒)



5.3 Bandwidth Measurement

5.3.1 Regulation

According to §15.403,(i) Emission bandwidth. For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 ㏈ down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

According to §15.407,(e) Within the 5.725-5.85 ㎓ band, the minimum 6 ㏈ bandwidth of U-NII devices shall be at least 500 ㎑.

5.3.2 Measurement Procedure

1.Emission Bandwidth (EBW)

a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 ㏈ down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeatmeasurement as needed until the RBW/EBW ratio is approximately 1%.

2.Minimum Emission Bandwidth for the band 5.725 - 5.85 ㎓

Section 15.407(e) specifies the minimum 6 ㏈ emission bandwidth of at least 500 ㎑ for theband 5.715-5.85 ㎓. The following procedure shall be used for measuring this bandwidth:

a) Set RBW = 100 ㎑.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associatedwith the two outermost amplitude points (upper and lower frequencies) that are attenuated by6 ㏈ relative to the maximum level measured in the fundamental emission.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

5.3.3 Test Result

-Complied

- 5 150 Band

- 802.11ac VHT20

Channel	Frequency [㎒]	26 ㏈ Bandwidth [㎒]	Min. Limit [㎒]	OBW [㎒]
Lowest	5 180	19.93	0.50	17.78
Middle	5 200	19.93	0.50	17.78
Highest	5 240	19.93	0.50	17.78

- 5 725 Band

- 802.11ac VHT20

Channel	Frequency [㎒]	6 ㏈ Bandwidth [㎒]	Min. Limit [㎒]	OBW [㎒]
Lowest	5 745	17.73	0.50	17.73
Middle	5 785	17.73	0.50	17.73
Highest	5 825	17.73	0.50	17.73

5.3.4 Test Plot

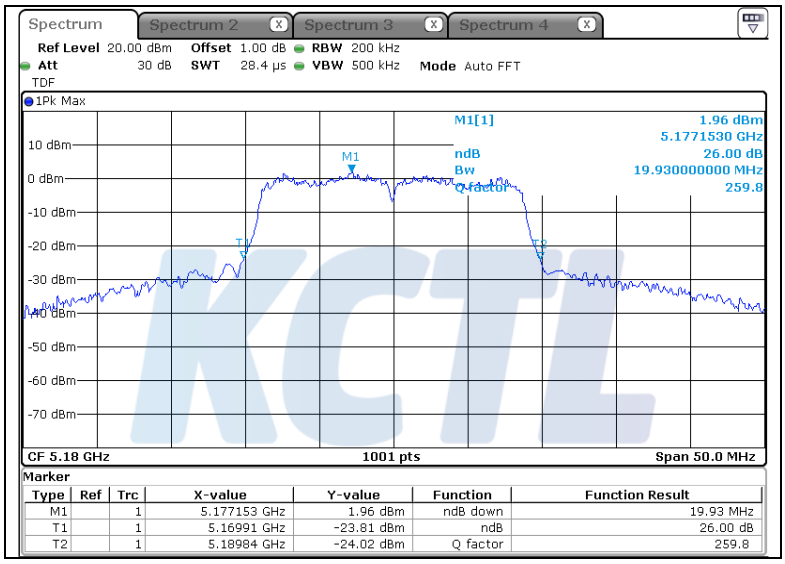
Figure 2. Plot of Bandwidth Measurement

- 5 150 Band

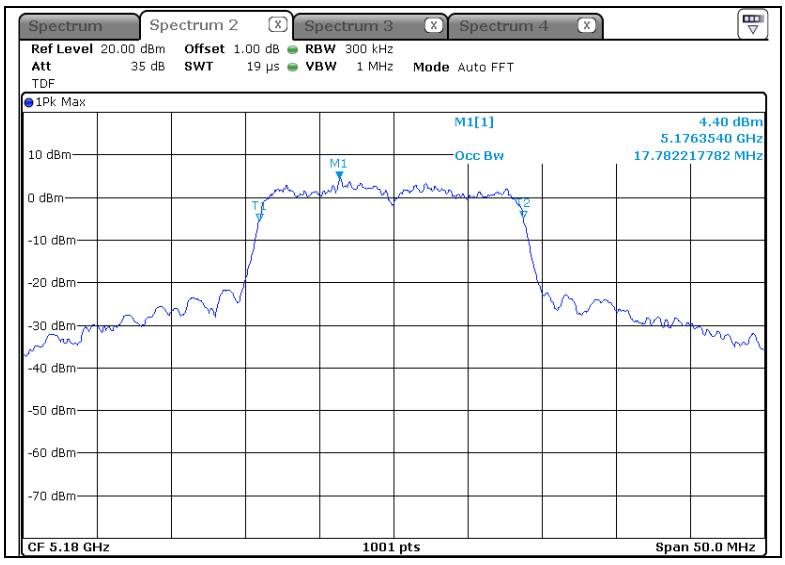
- 802.11ac VHT20

- 5 180 ㎒

EBW

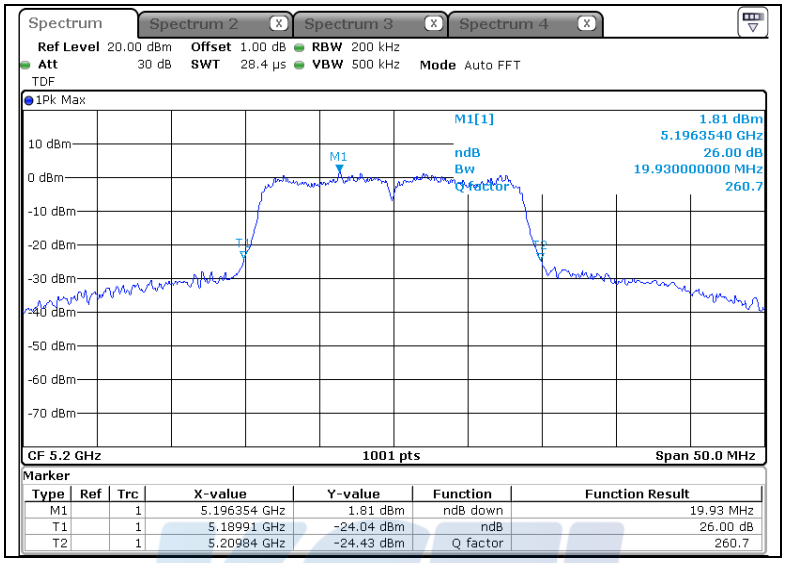


OBW

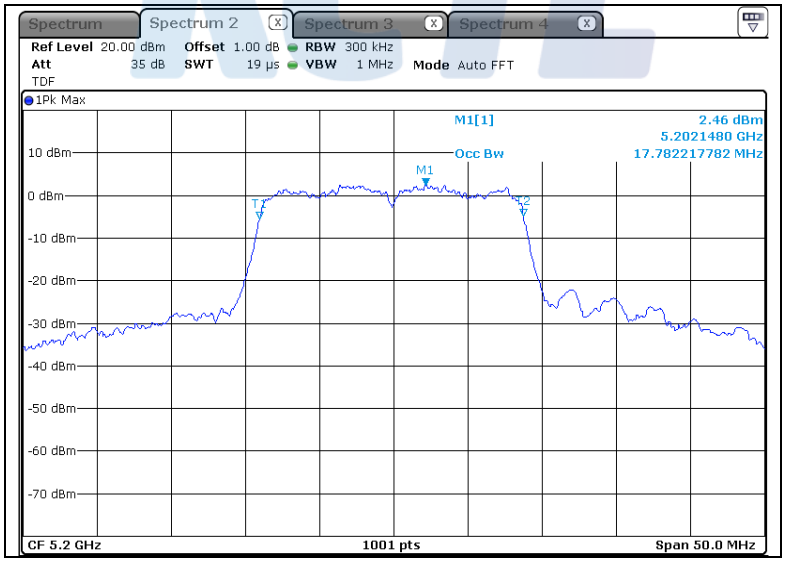


- 5 200 ㎒

EBW

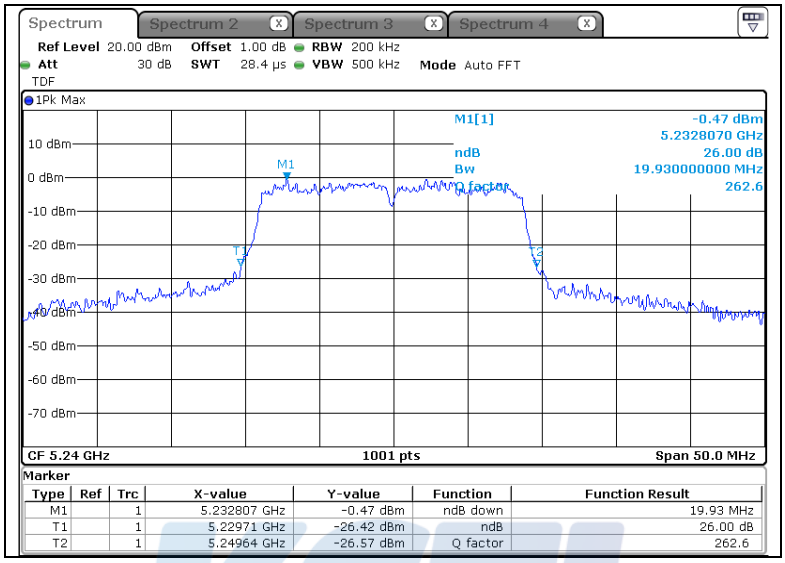

Spectrum
Spectrum 2
Spectrum 3
Spectrum 4
Ref Level 20.00 dBm Offset 1.00 dB RBW 200 kHz
Att 30 dB SWT 28.4 µs VBW 500 kHz Mode Auto FFT
TDF
1Pk Max
M1[1]
1.81 dBm
5.1963540 GHz
ndB 26.00 dB
Bw 19.930000000 MHz
Q factor 260.7
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 5.2 GHz
1001 pts
Span 50.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 5.196354 GHz 1.81 dBm ndB down 19.93 MHz
T1 1 5.18991 GHz -24.04 dBm ndB 26.00 dB
T2 1 5.20984 GHz -24.43 dBm Q factor 260.7

OBW


Spectrum
Spectrum 2
Spectrum 3
Spectrum 4
Ref Level 20.00 dBm Offset 1.00 dB RBW 300 kHz
Att 35 dB SWT 19 µs VBW 1 MHz Mode Auto FFT
TDF
1Pk Max
M1[1]
2.46 dBm
5.2021480 GHz
Occ Bw 17.782217782 MHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 5.2 GHz
1001 pts
Span 50.0 MHz

- 5 240 ㎒

EBW


Spectrum
Spectrum 2
Spectrum 3
Spectrum 4
Ref Level 20.00 dBm Offset 1.00 dB RBW 200 kHz
Att 30 dB SWT 28.4 µs VBW 500 kHz Mode Auto FFT
TDF
1Pk Max
M1[1]
-0.47 dBm
5.2328070 GHz
ndB 26.00 dB
Bw 19.930000000 MHz
Q factor 262.6
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 5.24 GHz
1001 pts
Span 50.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 5.232807 GHz -0.47 dBm ndB down 19.93 MHz
T1 1 5.22971 GHz -26.42 dBm ndB 26.00 dB
T2 1 5.24964 GHz -26.57 dBm Q factor 262.6

OBW

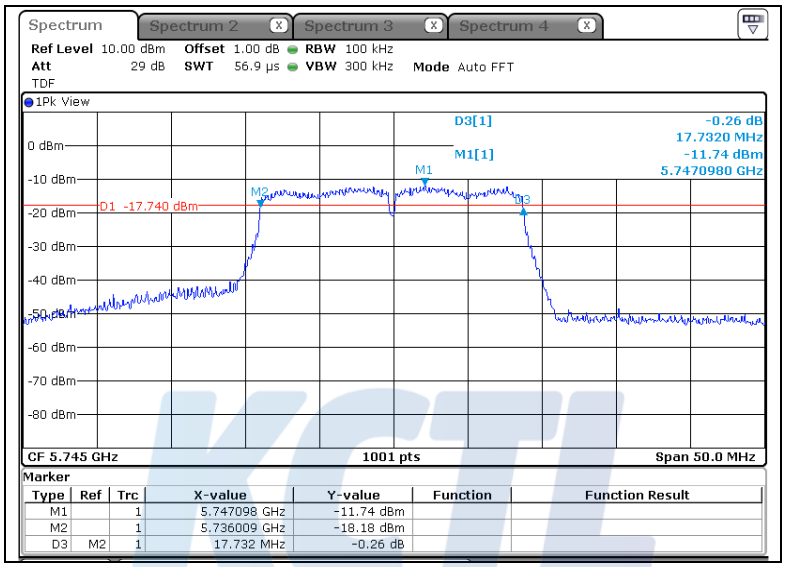

Spectrum
Spectrum 2
Spectrum 3
Spectrum 4
Ref Level 20.00 dBm Offset 1.00 dB RBW 300 kHz
Att 35 dB SWT 19 µs VBW 1 MHz Mode Auto FFT
TDF
1Pk Max
M1[1]
2.30 dBm
5.2419980 GHz
Occ Bw 17.782217782 MHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 5.24 GHz
1001 pts
Span 50.0 MHz

- 5 725 Band

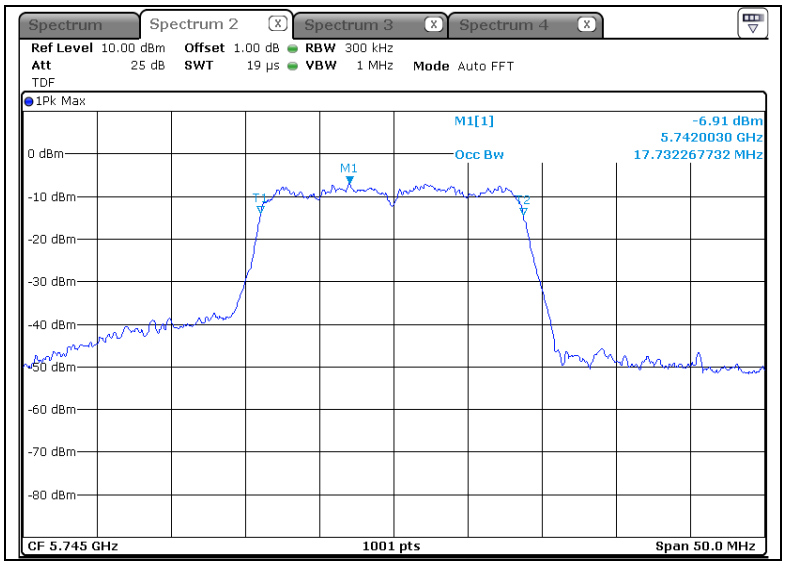
- 802.11ac VHT20

- 5 745 ㎒

EBW

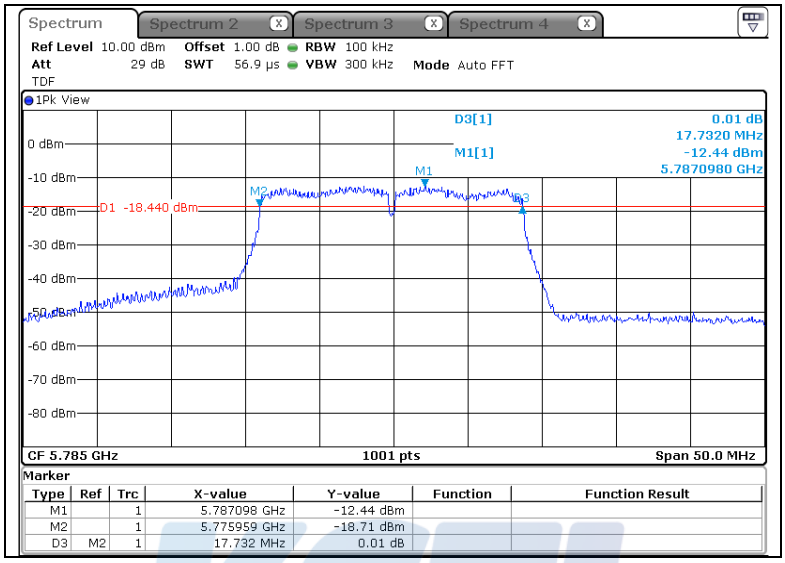


OBW

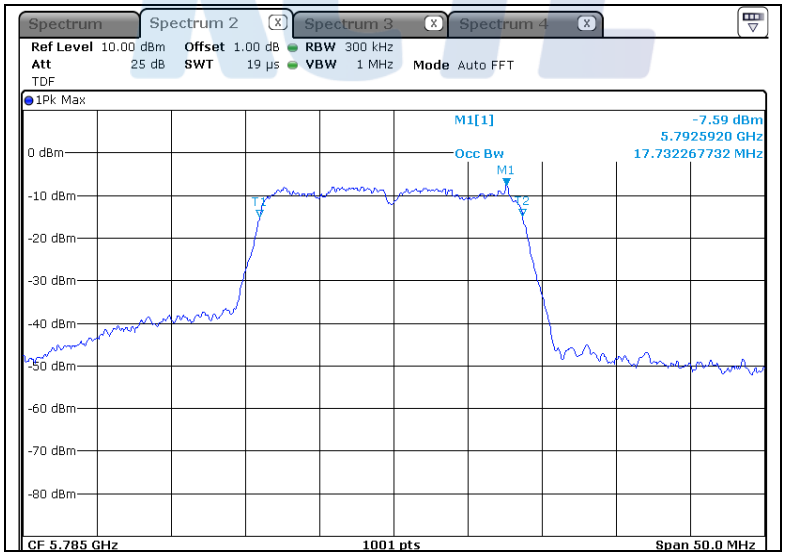


- 5 785 ㎒

EBW

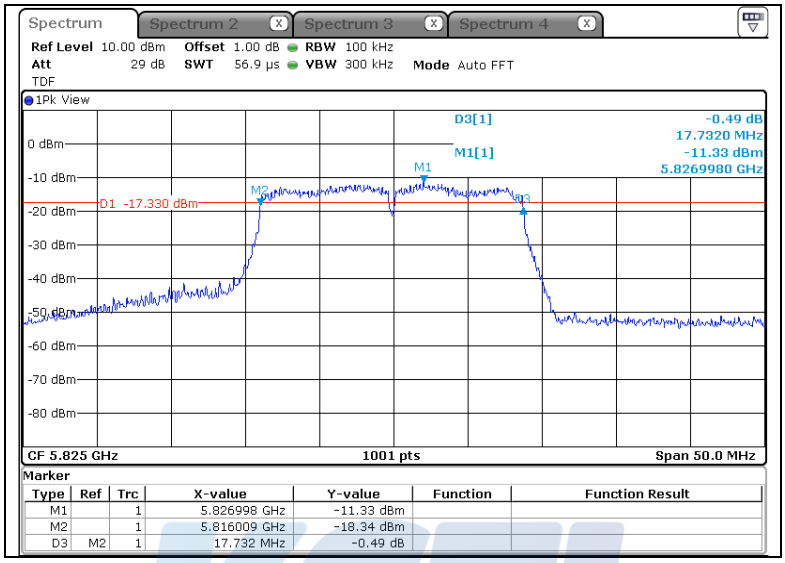

Spectrum
Spectrum 2
Spectrum 3
Spectrum 4
Ref Level 10.00 dBm Offset 1.00 dB RBW 100 kHz
Att 29 dB SWT 56.9 µs VBW 300 kHz Mode Auto FFT
TDF
1Pk View
D3[1] 0.01 dB
17.7320 MHz
M1[1] -12.44 dBm
5.7870980 GHz
D1 -18.440 dBm
CF 5.785 GHz
1001 pts
Span 50.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 5.787098 GHz -12.44 dBm
M2 1 5.775959 GHz -18.71 dBm
D3 M2 1 17.732 MHz 0.01 dB

OBW

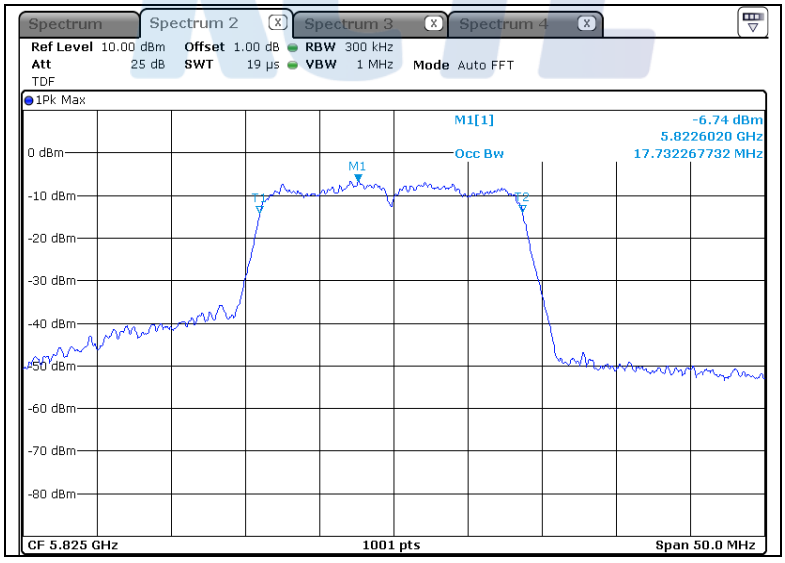

Spectrum
Spectrum 2
Spectrum 3
Spectrum 4
Ref Level 10.00 dBm Offset 1.00 dB RBW 300 kHz
Att 25 dB SWT 19 µs VBW 1 MHz Mode Auto FFT
TDF
1Pk Max
M1[1] -7.59 dBm
5.7925920 GHz
Occ Bw 17.732267732 MHz
CF 5.785 GHz
1001 pts
Span 50.0 MHz

- 5 825 ㎒

EBW


Spectrum
Spectrum 2
Spectrum 3
Spectrum 4
Ref Level 10.00 dBm Offset 1.00 dB RBW 100 kHz
Att 29 dB SWT 56.9 µs VBW 300 kHz Mode Auto FFT
TDF
1Pk View
D3[1] -0.49 dB
17.7320 MHz
M1[1] -11.33 dBm
5.8269980 GHz
D1 -17.330 dBm
CF 5.825 GHz
1001 pts
Span 50.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 5.826998 GHz -11.33 dBm
M2 1 5.816009 GHz -18.34 dBm
D3 M2 1 17.732 MHz -0.49 dB

OBW


Spectrum
Spectrum 2
Spectrum 3
Spectrum 4
Ref Level 10.00 dBm Offset 1.00 dB RBW 300 kHz
Att 25 dB SWT 19 µs VBW 1 MHz Mode Auto FFT
TDF
1Pk Max
M1[1] -6.74 dBm
5.8226020 GHz
Occ Bw 17.732267732 MHz
CF 5.825 GHz
1001 pts
Span 50.0 MHz

5.4 Peak Power Spectral Density

5.4.1 Regulation

According to §15.407(a) (1) (ii) For an indoor access point operating in the band 5.15-5.25 ㎓, the maximumConducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 ㏈i. In addition, the maximum power spectral density shall not exceed 17 ㏈m in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 ㏈i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i.

According to §15.407(a) (2) For the 5.25-5.35 ㎓ and 5.47-5.725 ㎓ bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 ㎽ or 11 ㏈m + 10 log B, where B is the 26 ㏈ emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 ㏈m in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 ㏈i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in ㏈that the directional gain of the antenna exceeds 6 ㏈i.

According to §15.407(a) (3) For the band 5.725-5.85 ㎓, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 ㏈m in any 500-㎑ band. If transmitting antennas of directional gain greater than 6 ㏈i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 ㏈i without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

5.4.2 Measurement Procedure

These test measurement settings are specified in section F of 789033 D02 General UNII Test Procedures New Rules v01.

5.4.2.1 Maximum power spectral density (PSD)

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section 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. Use the peak search function on the instrument to find the peak of the spectrum and record its value.

3. Make the following 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 step II.E.2.g)(viii), add 1 ㏈ to the final result to compensate for the difference between linear averaging and power averaging.
4. The result is the Maximum PSD over 1 ㎒ reference bandwidth.

5. For devices operating in the bands 5.15-5.25 ㎓, 5.25-5.35 ㎓, and 5.47-5.725 ㎓, the above procedures make use of 1 ㎒ RBW to satisfy directly the 1 ㎒ reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 ㎓, the rules specify a measurement bandwidth of 500 ㎑. Many spectrum analyzers do not have 500 ㎑ RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 ㎒, or 500 ㎑, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 ㎒, or 500 ㎑). If measurements are performed using a reduced resolution bandwidth (< 1 ㎒, or < 500 ㎑) and integrated over 1 ㎒, or 500 ㎑ bandwidth, the following adjustments to the procedures apply: a) Set RBW ≥ 1/T, where T is defined in section II.B.l.a).
c) Set VBW ≥ 3 RBW.
d) If measurement bandwidth of Maximum PSD is specified in 500 ㎑, add 10log(500㎑/RBW) to the measured result, whereas RBW (< 500 ㎑) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
e) If measurement bandwidth of Maximum PSD is specified in 1 ㎒, add 10log(1㎒/RBW) to the measured result, whereas RBW (< 1 ㎒) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
f) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 ㎑ for the sections 5.c) and 5.d) above, since RBW=100 ㎑ is available on nearly all spectrum analyzers.

5.4.3 Test Result

-Complied

- 5 150 Band

- 802.11ac VHT20

Frequency [㎒]	Measured PSD [dBm/㎒]	Duty Factor [dB]	Result [dBm/㎒]	Limit [dBm/㎒]	Margin [dB]
5 180	-4.04	0.01	-4.03	17.00	21.03
5 200	-4.81	0.01	-4.80	17.00	21.80
5 240	-5.78	0.01	-5.77	17.00	22.77

- 5 725 Band

- 802.11ac VHT20

Frequency [㎒]	Measured PSD [dBm/500㎑]	Duty Factor [dB]	Result [dBm/500㎑]	Limit [dBm/500㎑]	Margin [dB]
5 745	-12.38	0.01	-12.37	30.00	42.37
5 785	-12.48	0.01	-12.47	30.00	42.47
5 825	-11.76	0.01	-11.75	30.00	41.75

Note 1 : D.C.C.F(Duty cycle correction factor) = 10log(1/x), x = 0.997
Note 2 : Result = Measured PSD + D.C.C.F

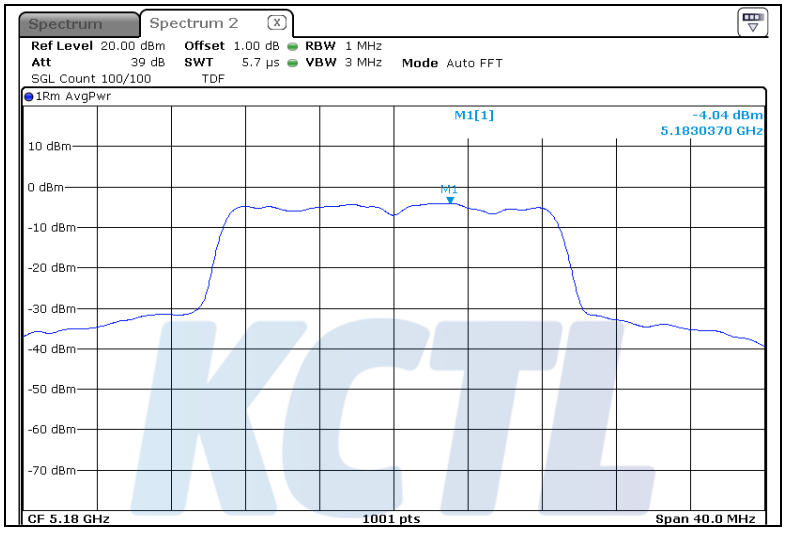
5.4.4 Test Plot

Figure 3. Plot of the Power Spectral Density

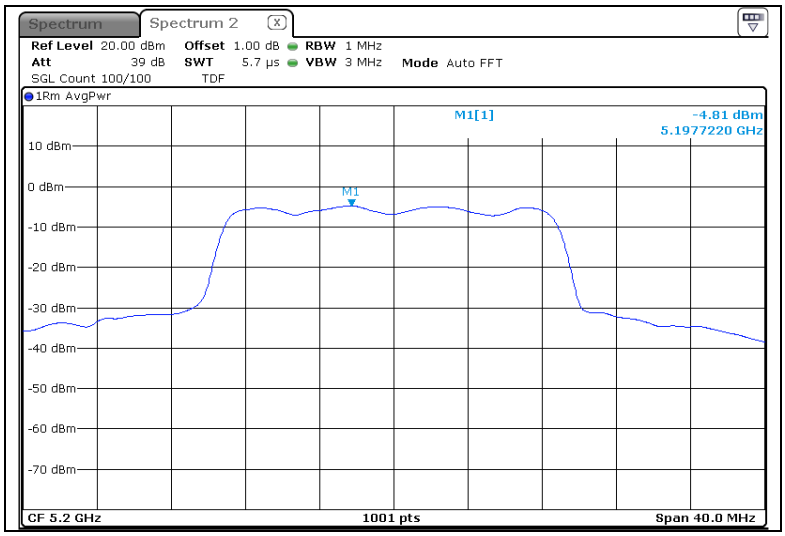
- 5 150 Band

802.11ac VHT20

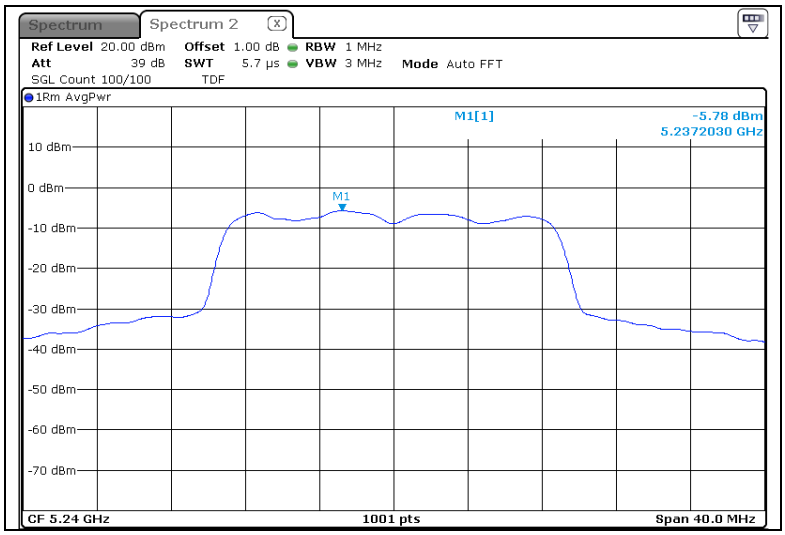
5 180 ㎒



5 200 ㎒



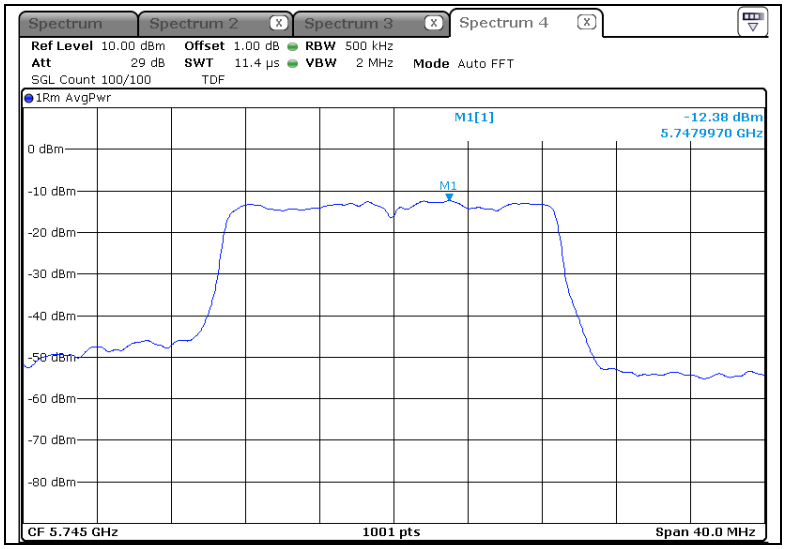
5 240 ㎒



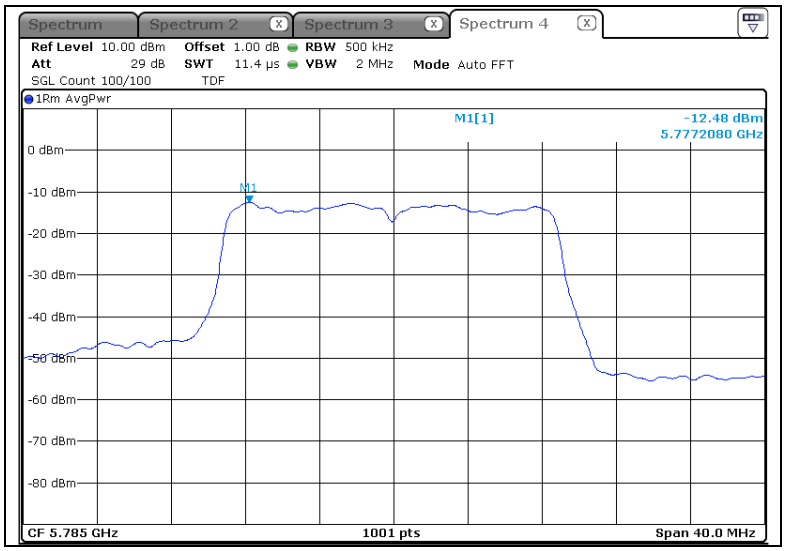
- 5 725 Band

802.11ac VHT20

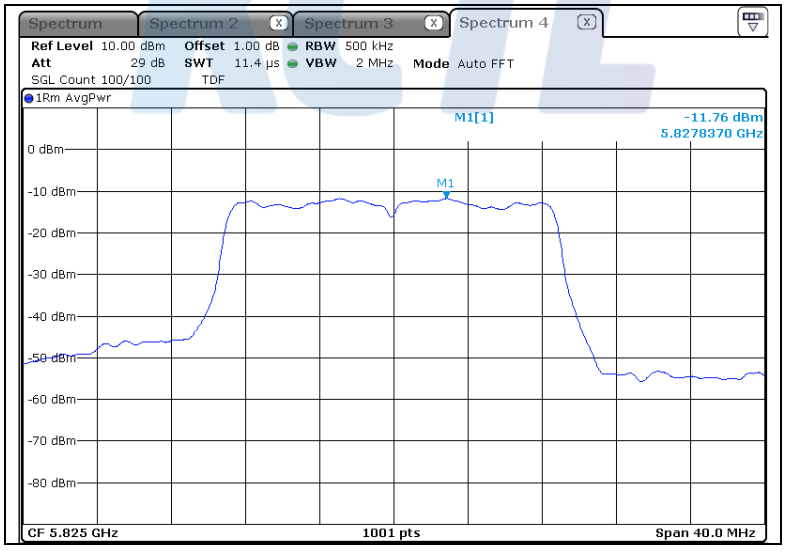
5 745 ㎒



5 785 ㎒


Spectrum
Spectrum 2
Spectrum 3
Spectrum 4
Ref Level 10.00 dBm Offset 1.00 dB RBW 500 kHz
Att 29 dB SWT 11.4 µs VBW 2 MHz Mode Auto FFT
SGL Count 100/100 TDF
1Rm AvgPwr
M1[1] -12.48 dBm
5.7772080 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
CF 5.785 GHz
1001 pts
Span 40.0 MHz

5 825 ㎒


Spectrum
Spectrum 2
Spectrum 3
Spectrum 4
Ref Level 10.00 dBm Offset 1.00 dB RBW 500 kHz
Att 29 dB SWT 11.4 µs VBW 2 MHz Mode Auto FFT
SGL Count 100/100 TDF
1Rm AvgPwr
M1[1] -11.76 dBm
5.8278370 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
CF 5.825 GHz
1001 pts
Span 40.0 MHz

5.5 Spurious Emission, Band Edge And Restricted Bands

5.5.1 Regulation

According to §15.407(b)(1) For transmitters operating in the 5.15–5.25 ㎓ band: all emissions outside of the 5.15–5.35 ㎓ band shall not exceed an EIRP of -27 dBm/㎒.

According to §15.407(b)(2) 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 dBm/㎒.

According to §15.407(b)(3) For transmitters operating in the 5.47-5.725 ㎓band: All emissions outside of the 5.47-5.725 ㎓band shall not exceed an e.i.r.p. of −27 dBm/㎒.

According to §15.407(b)(4)(i) For transmitters operating in the 5.725-5.85 ㎓ band: All emissions within the frequency range from the band edge to 10 ㎒ above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/㎒; for frequencies 10 ㎒ or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/㎒.

According to §15.407(b)(6) Unwanted emissions below 1 ㎓ must comply with the general field strength limits set forth in §15.209.

According to §15.209(a), Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall notexceed the field strength levels specified in the following table:

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

** The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1000 ㎒ are based on the average value of measured emissions.

According to §15.407(b)(7) The provisions of §15.205 apply to intentional radiators operating under this section. (8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

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

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

5.5.2 Measurement Procedure

These test measurement settings are specified in section G of 789033 D02 General UNII Test Procedures New Rules v01.
For all radiated emissions tests, measurements must correspond to the direction of maximum emission level for each measured emission (see ANSI C63.10 for guidance).

5.5.2.1 Unwanted Emission Measurement

5.5.2.1.1 1. Unwanted Emissions in the Restricted Bands

a) For all measurements, follow the requirements in section II.G.3. “General Requirements for Unwanted Emissions Measurements.”
b) At frequencies below 1 000 MHz, use the procedure described in section II.G.4. “Procedure for Unwanted Emissions Measurements Below 1 000 MHz.”
c) At frequencies above 1 000 MHz, measurements performed using the peak and average measurement procedures described in sections II.G.5. and II.G.6, respectively, must satisfy the respective peak and average limits. If all peak measurements satisfy the average limit, then average measurements are not required.
d) For conducted measurements above 1 000 MHz, EIRP shall be computed as specified in section II.G.3.b) and then field strength shall be computed as follows (see KDB Publication 412172): (i) E[dBµV/m] = EIRP[dBm] - 20 log (d[meters]) + 104.77, where E = field strength and d = distance at which field strength limit is specified in the rules; (ii) E[dBµV/m] = EIRP[dBm] + 95.2, for d = 3 meters.
e) For conducted measurements below 1 000 MHz, the field strength shall be computed as specified in d), above, and then an additional 4.7 dB shall be added as an upper bound on the field strength that would be observed on a test range with a ground plane for frequencies between 30 MHz and 1 000 MHz, or an additional 6 dB shall be added for frequencies below 30 MHz.

5.5.2.1.1 2. Unwanted Emissions that fall Outside of the Restricted Bands

a) For all measurements, follow the requirements in section II.G.3. “General Requirements for Unwanted Emissions Measurements.”

b) At frequencies below 1000 MHz, use the procedure described in section II.G.4. “Procedure for Unwanted Emissions Measurements Below 1000 MHz.”

c) At frequencies above 1000 MHz, use the procedure for maximum emissions described in section II.G.5., “Procedure for Unwanted Maximum Unwanted Emissions Measurements Above 1 000 MHz.”

(i) Section 15.407(b)(1-3) specifies the unwanted emissions limit for the U-NII-1 and 2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz. However, an out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz dBm/MHz peak emission limit.

(ii) Section 15.407(b)(4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). An alternative to the band emissions mask is specified in Section 15.407(b)(4)(ii). The alternative limits are based on the highest antenna gain specified in the filing. There are also marketing and importation restrictions for the alternative limit.

d) If radiated measurements are performed, field strength is then converted to EIRP as follows:

(i) EIRP = ((E×d)^2) / 30 where:

- E is the field strength in V/m;
- d is the measurement distance in meters;
- EIRP is the equivalent isotropically radiated power in watts.

(ii) Working in dB units, the above equation is equivalent to: EIRP[dBm] = E[dBμV/m] + 20 log (d[meters]) - 104.77

(iii) Or, if d is 3 meters: EIRP[dBm] = E[dBμV/m] - 95.2

5.5.2.2 Spurious Radiated Emissions:

1. The preliminary and final rdiated measurements were performed to determine the frequency producing the maximum emissions in at a 10m anechoic chamber. The EUT was tested at a distance 3 meters.
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360˚.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 ㎑ to 30 ㎒ using the loop antenna, and from 30 to 1 000 ㎒ using the TRILOG broadband antenna, and from
   1 000 ㎒ to 40 000 ㎒ using the horn antenna.
4. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
5. The 0.8m height is measurement for below 1 ㎓ and 1.5m is for above 1 ㎓ measurement.

Note

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 ㎑ for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 ㎓.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 ㎒ for Peak detection and frequency above 1 ㎓.

5.5.3 Test Result

-complied

1. Band-edge & Conducted Spurious Emissions was shown in figure 3.
   Note: We took the insertion loss of the cable into consideration within the measuring instrument.
2. Measured value of the Field strength of spurious Emissions (Radiated)
3. It tested x,y and z – 3 axis each, mentioned only worst case data at this report.

- Below 1 ㎓ data (Worst-case: 5 150 Band 802.11ac VHT20)

802.11ac VHT20_Lowest Channel (5 180 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor DCCF [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 30 ㎒										
4.42	9	V	41.20	1.00	-32.69	19.69	-12.00	29.20	69.50	40.30
23.53	9	H	43.10	1.45	-32.68	19.23	-12.00	31.10	69.50	38.40
Quasi-Peak DATA. Emissions below 1 ㎓										
45.04	120	V	38.49	1.37	-31.52	16.38	-13.77	24.72	40.00	15.28
120.09	120	H	51.98	2.36	-37.62	18.30	-16.96	35.02	43.50	8.48
191.99	120	H	52.01	3.05	-34.27	15.26	-15.96	36.05	43.50	7.45
203.99	120	H	48.86	3.15	-33.80	15.53	-15.12	33.74	43.50	9.76
288.26	120	H	47.50	3.79	-35.15	18.97	-12.39	35.11	46.00	10.89
300.27	120	H	49.99	3.88	-35.16	19.21	-12.07	37.92	46.00	8.08

NOTE 1. Factor = Cable loss + Amp gain + Antenna factor
NOTE 2. Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test 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.

- Above 1 ㎓ data

- 5 150 Band

802.11ac VHT20_Lowest channel (5 180 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓											
1 199.72 1)	1 000	V	52.52	2.66	-38.86	24.60	-11.60	-	40.92	74.00	33.08
1 593.51 1)	1 000	V	58.23	3.04	-38.99	26.18	-9.77	-	48.46	74.00	25.54
2 522.64	1 000	H	59.21	3.80	-38.33	28.79	-5.74	-	53.48	68.20	14.72
5 149.93 1)	1 000	H	57.67	5.57	-40.26	33.12	-1.57	-	56.09	74.00	17.91
8 982.56	1 000	V	60.79	7.59	-60.97	37.68	-15.70	-	45.09	68.20	23.11
17 271.19	1 000	H	57.66	10.55	-56.88	41.93	-4.40	-	53.26	68.20	14.94
21 966.88	1 000	V	47.05	12.10	-49.61	45.10	7.59	-	54.64	68.20	13.56
34 682.19	1 000	H	45.69	15.50	-49.60	49.90	15.80	-	61.49	68.20	6.71
Average DATA. Emissions above 1 ㎓											
1 199.72 1)	1 000	V	36.75	2.66	-38.86	24.60	-11.60	-	25.15	54.00	28.85
1 593.51 1)	1 000	V	43.70	3.04	-38.98	26.17	-9.77	-	33.93	54.00	20.07
5 149.93 1)	1 000	H	41.32	5.57	-40.26	33.12	-1.57	-	39.75	54.00	14.25

1) Restricted band.

802.11ac VHT20_Middle channel (5 200 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓											
1 597.89 1)	1 000	V	53.36	3.04	-38.96	26.20	-9.72	-	43.63	74.00	30.37
4 489.06	1 000	V	47.72	5.12	-39.99	32.64	-2.23	-	45.49	68.20	22.71
9 868.06	1 000	H	61.06	7.87	-58.66	37.87	-12.92	-	48.15	68.20	20.05
17 659.67	1 000	V	58.91	10.73	-59.56	44.26	-4.57	-	54.34	68.20	13.86
21 500.75	1 000	V	47.81	11.90	-49.39	45.00	7.51	-	55.33	68.20	12.87
34 850.63	1 000	V	46.42	15.60	-49.71	50.10	15.99	-	62.41	68.20	5.79
Average DATA. Emissions above 1 ㎓											
1 597.89 1)	1 000	V	42.20	3.04	-38.95	26.19	-9.72	-	32.48	54.00	21.52

1) Restricted band.

802.11ac VHT20_Highest channel (5 240 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓											
2 063.56	1 000	V	48.12	3.47	-38.27	27.92	-6.88	-	41.24	68.20	26.96
5 371.91 1)	1 000	V	49.00	5.71	-40.37	33.46	-1.20	-	47.81	74.00	26.19
9 625.13	1 000	V	61.93	7.79	-59.24	37.83	-13.62	-	48.31	68.20	19.89
16 549.20	1 000	V	58.42	10.29	-53.81	39.04	-4.48	-	53.93	68.20	14.27
21 680.88	1 000	V	47.69	12.00	-49.46	45.00	7.54	-	55.23	68.20	12.97
34 909.06	1 000	V	46.67	15.60	-49.65	50.10	16.05	-	62.72	68.20	5.48
Average DATA. Emissions above 1 ㎓											
5 371.91 1)	1 000	V	39.10	5.71	-40.37	33.46	-1.20	-	37.90	54.00	16.10

1) Restricted band.

- 5 745 Band

802.11ac VHT20_Lowest channel (5 745 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓											
2 441.52	1 000	V	56.12	3.74	-38.01	28.64	-5.63	-	50.49	68.20	23.51
8 968.19	1 000	V	62.03	7.58	-60.98	37.67	-15.73	-	46.30	68.20	21.90
16 549.20	1 000	V	58.52	10.29	-53.81	39.04	-4.48	-	54.04	68.20	14.16
21 913.25	1 000	H	46.67	12.10	-49.52	45.00	7.58	-	54.25	68.20	13.95
34 628.56	1 000	V	46.35	15.40	-49.56	49.90	15.74	-	62.09	68.20	6.11

802.11ac VHT20_Lowest channel (5 745 ㎒)_Emission Mask

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓											
5 664.52	1 000	V	48.20	5.89	-40.55	33.90	-0.76	-	47.44	78.94	31.50
5 706.28	1 000	H	49.79	5.92	-40.18	33.96	-0.30	-	49.49	106.96	57.47
5 717.45	1 000	H	51.26	5.92	-40.29	33.98	-0.39	-	50.87	110.09	59.22
5 724.33	1 000	H	62.00	5.93	-40.37	33.99	-0.45	-	61.56	120.67	59.11
5 853.58	1 000	V	46.34	6.01	-40.92	34.18	-0.73	-	45.61	114.04	68.43
5 863.03	1 000	H	48.12	6.01	-40.87	34.19	-0.67	-	47.45	108.55	61.10
5 874.72	1 000	H	47.99	6.02	-40.83	34.21	-0.60	-	47.39	105.28	57.88
5 907.89	1 000	V	49.65	6.04	-40.69	34.26	-0.39	-	49.26	80.86	31.60

802.11ac VHT20_Middle channel (5 785 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓											
2 438.59	1 000	V	61.75	3.74	-37.99	28.63	-5.62	-	56.13	68.20	12.07
4 482.88	1 000	H	48.42	5.12	-39.95	32.64	-2.19	-	46.23	68.20	21.97
8 925.42	1 000	V	61.92	7.56	-61.01	37.63	-15.82	-	46.10	68.20	22.10
16 741.83	1 000	V	58.41	10.34	-54.15	39.58	-4.23	-	54.18	68.20	14.02
21 532.38	1 000	V	47.59	12.00	-49.48	45.00	7.52	-	55.11	68.20	13.09
34 990.88	1 000	V	45.13	15.70	-49.76	50.20	16.14	-	61.28	68.20	6.92

802.11ac VHT20_Middle channel (5 785 ㎒)_Emission Mask

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓											
5 674.48	1 000	H	49.60	5.90	-40.43	33.91	-0.62	-	48.98	86.32	37.33
5 708.69	1 000	H	48.04	5.92	-40.20	33.96	-0.32	-	47.72	107.63	59.91
5 716.77	1 000	H	47.80	5.92	-40.28	33.98	-0.38	-	47.41	109.89	62.48
5 724.50	1 000	H	48.65	5.93	-40.37	33.99	-0.45	-	48.20	121.06	72.86
5 852.89	1 000	V	47.91	6.01	-40.92	34.18	-0.73	-	47.18	115.61	68.43
5 861.83	1 000	V	49.27	6.01	-40.88	34.19	-0.68	-	48.59	108.89	60.29
5 868.70	1 000	H	49.09	6.02	-40.85	34.20	-0.63	-	48.46	106.96	58.51
5 908.58	1 000	V	49.67	6.04	-40.69	34.26	-0.39	-	49.28	80.35	31.07

802.11ac VHT20_Highest channel (5 825 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓											
2 438.59	1 000	V	59.09	3.74	-37.99	28.63	-5.62	-	53.47	68.20	14.73
8 954.53	1 000	H	62.54	7.57	-60.98	37.65	-15.76	-	46.78	68.20	21.42
16 651.98	1 000	V	57.85	10.32	-54.00	39.33	-4.35	-	53.50	68.20	14.70
21 867.19	1 000	V	47.49	12.10	-49.53	45.00	7.57	-	55.06	68.20	13.14
34 508.25	1 000	H	46.70	15.30	-49.49	49.80	15.61	-	62.31	68.20	5.89

802.11ac VHT20_Highest channel (5 825 ㎒)_Emission Mask

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓											
5 660.91	1 000	H	48.11	5.89	-40.59	33.89	-0.81	-	47.30	76.27	28.97
5 706.80	1 000	H	48.47	5.92	-40.18	33.96	-0.30	-	48.17	107.10	58.93
5 714.70	1 000	H	48.78	5.92	-40.26	33.97	-0.37	-	48.41	109.32	60.90
5 723.47	1 000	H	47.74	5.93	-40.36	33.99	-0.44	-	47.31	118.71	71.40
5 853.41	1 000	V	47.26	6.01	-40.92	34.18	-0.73	-	46.53	114.43	67.91
5 863.38	1 000	H	48.56	6.01	-40.88	34.20	-0.67	-	47.89	108.46	60.56
5 873.52	1 000	V	48.18	6.02	-40.83	34.21	-0.60	-	47.57	105.62	58.04
5 908.23	1 000	V	50.17	6.04	-40.69	34.26	-0.39	-	49.78	80.61	30.82

5.6 Frequency Stability

5.6.1 Regulation

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

5.6.2 Measurement Procedure

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.

5.6.3 Test Result

-Complied

- 5 150 Band

-5 180 ㎒

Voltage [%]	Power [V]	Temp. [°C]	Reading Frequency [㎐]	Frequency Error [㎐]	Frequency Error [%]
100	3.70	-20	5 180 027 360	27 360	0.000 5
		-10	5 180 031 683	31 683	0.000 6
		0	5 180 026 208	26 208	0.000 5
		10	5 180 009 215	9 215	0.000 2
		20	5 179 998 824	-1 176	0.000 0
		30	5 179 972 285	-27 715	-0.000 5
		40	5 179 966 816	-33 184	-0.000 6
		50	5 179 951 841	-48 159	-0.000 9
		60	5 179 948 180	-51 820	-0.001 0
		23	5 179 966 645	-33 355	-0.000 6
85	3.15	23	5 179 967 668	-32 332	-0.000 6
115	4.26	23	5 179 965 310	-34 690	-0.000 7

- 5 725 Band

-5 745 ㎒

Voltage [%]	Power [V]	Temp. [°C]	Reading Frequency [㎐]	Frequency Error [㎐]	Frequency Error [%]
100	3.70	-20	5 745 028 451	28 451	0.000 5
		-10	5 745 028 589	28 589	0.000 5
		0	5 745 018 088	18 088	0.000 3
		10	5 745 004 711	4 711	0.000 1
		20	5 744 982 324	-17 676	-0.000 3
		30	5 744 966 709	-33 291	-0.000 6
		40	5 744 951 975	-48 025	-0.000 8
		50	5 744 945 149	-54 851	-0.001 0
		60	5 744 939 493	-60 507	-0.001 1
		23	5 744 957 671	-42 329	-0.000 7
85	3.15	23	5 744 957 718	-42 282	-0.000 7
115	4.26	23	5 744 954 046	-45 954	-0.000 8

5.7 Conducted Emission

5.7.1 Regulation

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 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50 μH/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (㎒)	Conducted limit (㏈㎶)	
	Qausi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

5.7.2 Measurement Procedure

1) The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 ㎝ in which is located 40 ㎝ 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 50Ω/50μH 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 is the system) was then performed over the frequency range of 0.15 ㎒ to 30 ㎒.

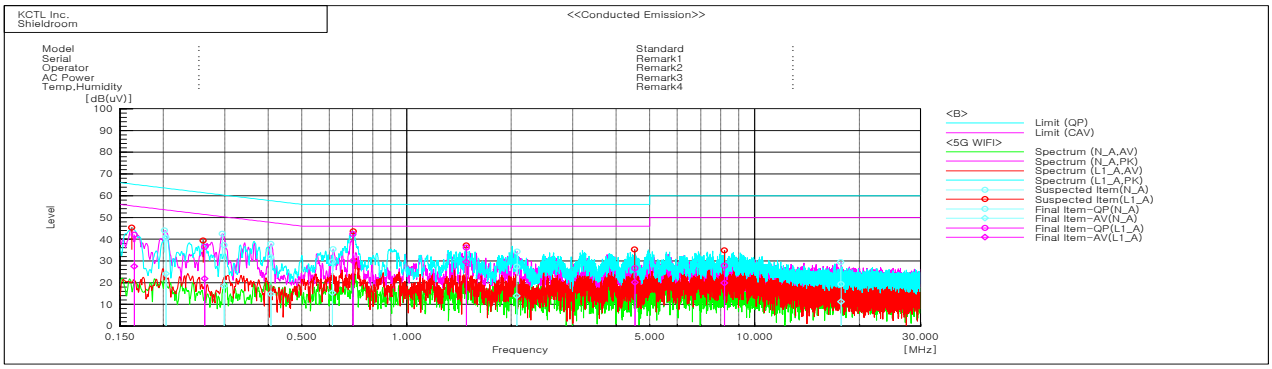
5) The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 ㎑ or to QUASI-PEAK and AVERAGE within a bandwidth of 9 ㎑. The EUT was in transmitting mode during the measurements.

5.7.3 Test Result

- Complied

Figure 4. plot of Conducted Emission

- Conducted worst-case data : 802.11ac VHT20_Lowest Chanel (5 180 ㎒)



Final Result

--- N_A Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.20322	30.8	14.1	9.9	40.7	24.0	63.5	53.5	22.8	29.5
2	0.29877	27.4	8.6	9.8	37.2	18.4	60.3	50.3	23.1	31.9
3	0.40772	21.5	4.7	10.0	31.5	14.7	57.7	47.7	26.2	33.0
4	0.61104	19.5	5.3	10.0	29.5	15.3	56.0	46.0	26.5	30.7
5	2.07486	17.1	3.7	10.1	27.2	13.8	56.0	46.0	28.8	32.2
6	17.70546	8.8	0.8	10.4	19.2	11.2	60.0	50.0	40.8	38.8

--- L1_A Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.16494	31.9	17.2	10.2	42.1	27.4	65.2	55.2	23.1	27.8
2	0.26249	26.5	12.0	9.8	36.3	21.8	61.4	51.4	25.1	29.6
3	0.70037	32.2	20.0	10.0	42.2	30.0	56.0	46.0	13.8	16.0
4	1.48507	25.9	19.2	10.2	36.1	29.4	56.0	46.0	19.9	16.6
5	4.52877	16.6	10.1	10.0	26.6	20.1	56.0	46.0	29.4	25.9
6	8.19851	17.6	9.7	10.1	27.7	19.8	60.0	50.0	32.3	30.2

6. Test equipment used for test

	Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
■	Spectrum Analyzer	R & S	FSV30	100807	18.08.01
■	Spectrum Analyzer	R & S	FSV40	100988	19.01.05
■	Wideband Power Sensor	R & S	NRP-Z81	102398	19.01.31
■	DC Power Supply	AGILENT	E3632A	MY40016393	18.12.21
■	Temp & Humid Chamber	ESPEC CORP.	SH-641	92005476	18.08.01
■	ATTENUATOR	R & S	DNF Dämpfungsglied 10 dB in N-50 Ohm	31212	18.05.15
■	EMI TEST RECEIVER	R & S	ESCI	100732	18.08.24
■	Bi-Log Antenna	SCHWARZBECK	VULB 9163	552	18.05.10
■	Amplifier	SONOMA INSTRUMENT	310N	186280	19.04.05
■	Amplifier	SONOMA INSTRUMENT	310N	284608	18.08.24
■	ATTENUATOR	Weinschel ENGINEERING	1	AE7348	18.05.15
■	Horn antenna	ETS.lindgren	3116	00086632	19.04.20
■	Horn antenna	ETS.lindgren	3117	155787	18.10.20
■	AMPLIFIER	L-3 Narda-MITEQ	AMF-7D-01001800-22-10P	2003683	18.06.12
■	AMPLIFIER	L-3 Narda-MITEQ	JS44-18004000-33-8P	2000997	18.08.09
■	LOOP Antenna	R & S	HFH2-Z2	892665/035	19.01.25
■	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	-
■	Highpass Filter	WT	WT-A1699-HS	WT160411002	18.05.15
■	Vector Signal Generator	R & S	SMBV100A	257566	19.01.05
■	Signal Generator	R & S	SMR40	100007	18.05.15
■	Cable Assembly	RadiAll	2301761768000PJ	17.30.38	-
■	Cable Assembly	gigalane	RG-400	-	-
■	Cable Assembly	HUER+SUHNER	SUCOFLEX 104	MY4342/4	-