



# TEST REPORT

<p><b>KCTL Inc.</b>                  65, Sinwon-ro, Yeongtong-gu,                  Suwon-si, Gyeonggi-do, 16677, Korea                  TEL: 82-31-285-0894 FAX: 82-505-299-8311  <a href="http://www.kctl.co.kr">www.kctl.co.kr</a></p>	<p>Report No.:                  KR17-SRF0101-B                  Page (1) of (56)</p>	
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**1. Client**

- Name : CITECH CO.,LTD.
- Address : 11F, 932, Yangjae-daero, Songpa-gu, Seoul, South Korea
- Date of Receipt : 2017-10-12

**2. Use of Report** : -

**3. Name of Product and Model** : HiFi Media Player / RS-301



**4. Manufacturer and Country of Origin** : CITECH CO.,LTD. / Korea

**5. FCC ID** : 2ANYL-RS-301

**6. Date of Test** : 2017-11-22 to 2018-01-04

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

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

<p>Affirmation</p>	<p>Tested by                    Name : Euijung Kim (Signature)</p>	<p>Technical Manager                    Name : Changmin Kim (Signature)</p>
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2018-01-04

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

**REPORT REVISION HISTORY**

Date	Revision	Page No
2017-11-27	Originally issued	-
2017-12-14	Added radiated restric band & band edge for 5725 Band	48 ~ 50
2018-01-04	Updated radiated band edge procedure and result	43 ~ 51

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## 1. Client information

**Applicant:** CITECH CO.,LTD.  
**Address:** 11F, 932, Yangjae-daero, Songpa-gu, Seoul, South Korea  
**Telephone number:** 82 2 410 9676  
**Facsimile number:** 82 2 410 9600  
**Contact person:** Yujin Kim / kyu6224@citech.kr

**Manufacturer:** CITECH CO.,LTD.  
**Address:** 11F, 932, Yangjae-daero, Songpa-gu, Seoul, South Korea

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## 2. Laboratory information

### Address

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Telephone Number: 82 31 285 0894

Facsimile Number: 82 505 299 8311

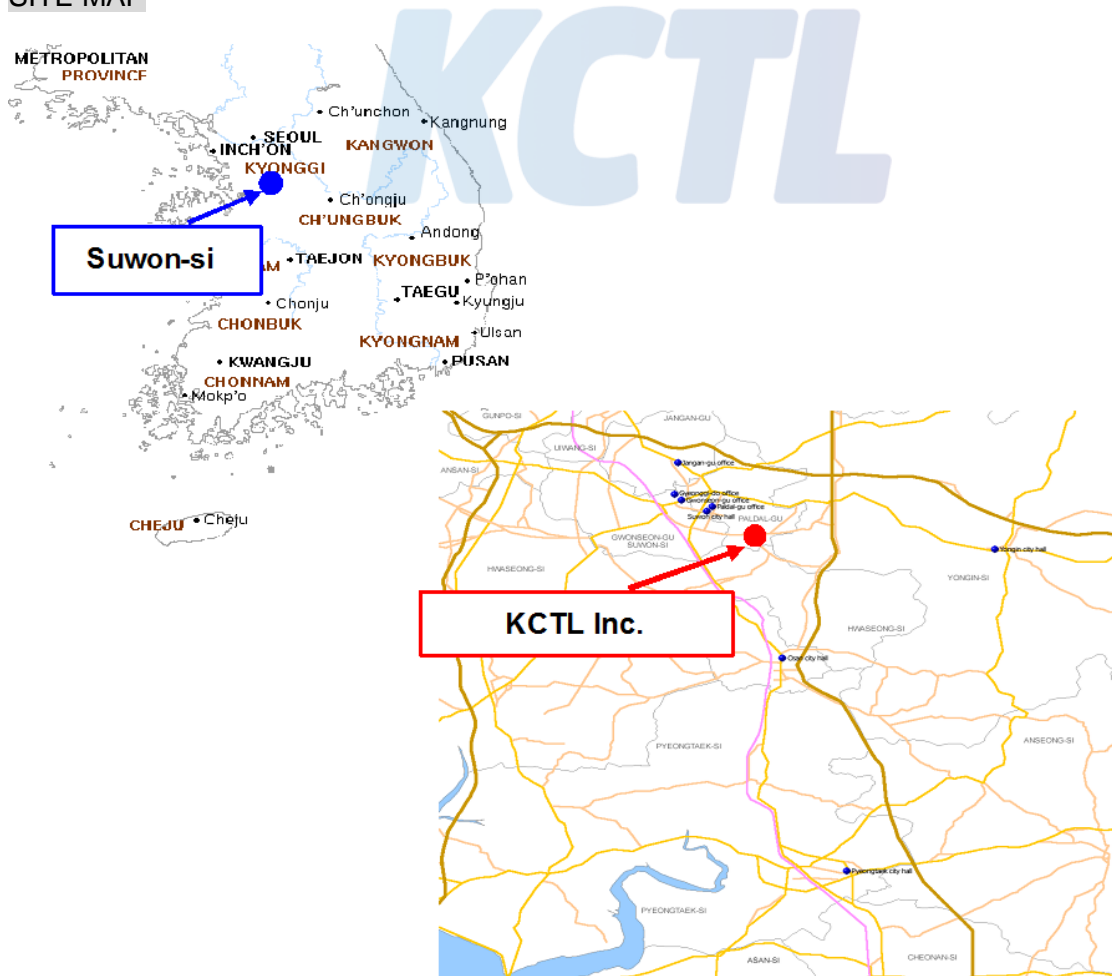
FCC Site Designation No: KR0040, FCC Site Registration No: 687132

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

Industry Canada Registration No. : 8035A

KOLAS NO.: KT231

### **SITE MAP**



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### 3. Description of E.U.T.

#### 3.1 Basic description

Applicant	CITECH CO.,LTD.
Address of Applicant	11F, 932, Yangjae-daero, Songpa-gu, Seoul, South Korea
Manufacturer	CITECH CO.,LTD.
Address of Manufacturer	11F, 932, Yangjae-daero, Songpa-gu, Seoul, South Korea
Type of equipment	HiFi Media Player
Basic Model	RS-301
Serial number	N/A

#### 3.2 General description

Frequency Range	2 412 MHz ~ 2 462 MHz (802.11b/g/n HT20) 5 180 MHz ~ 5 240 MHz (802.11a/n_HT20) 5 745 MHz ~ 5 825 MHz (802.11a/n_HT20) 2 402 MHz ~ 2 480 MHz (Bluetooth, Bluetooth Low Energy)
Type of Modulation	802.11b : DSSS, 802.11g/n_HT20 : OFDM, Bluetooth : GFSK, $\pi/4$ DQPSK, 8DPSK Bluetooth Low Energy : GFSK
The number of channels	2.4 GHz: 11 ch (802.11b/g/n HT20), 79 ch (Bluetooth), 40 ch (Bluetooth Low Energy) 5 GHz: 4 ch (Band 1: 802.11a/n_HT20) 4 ch (Band 3: 802.11a/n_HT20)
Type of Antenna	PCB Antenna
Antenna Gain	2.4 GHz: 0.75 dBi (WiFi, Bluetooth, Bluetooth Low Energy) 5 GHz: 3.52 dBi (Band 1), 3.84 dBi (Band 4)
Transmit Power	8.78 dBm
Power supply	DC 19.00 V
Product SW/HW version	Rose1.0.0.24 / REV3.00
Radio SW/HW version	KENEL3.10.0 / REV3.00
Test SW Version	Android Debug Bridge Ver 1.0.36
RF power setting in TEST SW	802.11b/g/n HT20 : -1

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

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### 3.3 Test frequency

- 802.11a/n HT20

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

### 3.4 Test Voltage

Mode	Voltage
Nominal Voltage	DC 19.00 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)	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
15.407(h)	Dynamic Frequency Selection	-	NA

Note: C = complies, NC = Not complies, NT = Not tested, NA = Not Applicable

Note: The general test methods used to test this device is ANSI C63.10:2013

### 4.2 Uncertainty

Measurement Item	Expanded Uncertainty $U = kU_c (k = 2)$	
Conducted RF power	1.44 dB	
Conducted Spurious Emissions	1.52 dB	
Radiated Spurious Emissions	30 MHz ~ 300 MHz:	+4.94 dB, -5.06 dB
		+4.93 dB, -5.05 dB
	300 MHz ~ 1 000 MHz:	+4.97 dB, -5.08 dB
+4.84 dB, -4.96 dB		
Conducted Emissions	1 GHz ~ 25 GHz:	+6.03 dB, -6.05 dB
	9 kHz ~ 150 kHz:	3.75 dB
	150 kHz ~ 30 MHz:	3.36 dB



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## 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

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

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## 5.2 Maximum Conducted Output Power

### 5.2.1 Regulation

According to §15.407(a) (1) iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to §15.407(a) (3) For the band 5.725-5.85 GHz, 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 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi 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 E of 789033 D02 General UNII Test Procedures.

### 5.2.2.1 Measurement using a Power Meter (PM)

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  $\pi$  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 section II.B.

(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%).

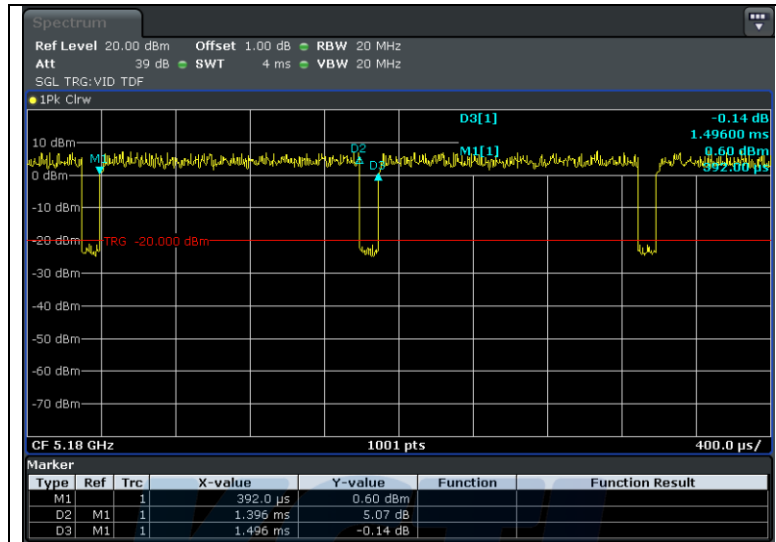
5.2.2.2 Method SA-2 (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

- (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  $\geq$  3 MHz.
- (v) Number of points in sweep  $\geq 2 \times \text{span} / \text{RBW}$ . (This ensures that bin-to-bin spacing is  $\leq \text{RBW}/2$ , 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  $10 \log (1/0.25) = 6 \text{ dB}$  if the duty cycle is 25 %.

- Duty Cycle Correction Factor

- 5 150 Band

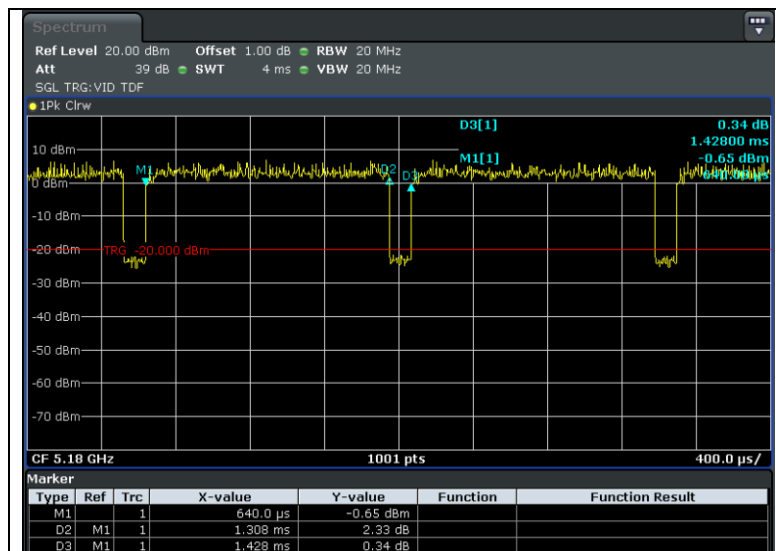
- 802.11a



Remark

- a period : 1.496 ms, on time : 1.396 ms
- DCCF =  $10 \log(1 / x) = 0.30 \text{ dB}$ ,  $x = 1.396 / 1.496 = 0.9332$  (93.32 %)

- 802.11n HT20



Remark

- a period : 1.428 ms, on time : 1.308 ms
- DCCF =  $10 \log(1 / x) = 0.38 \text{ dB}$ ,  $x = 1.308 / 1.428 = 0.916$  (91.6 %)

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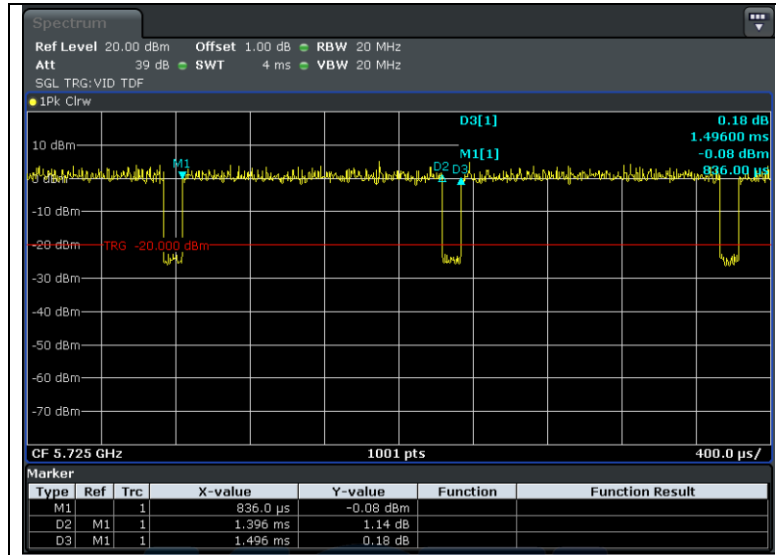
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- 5 725 Band

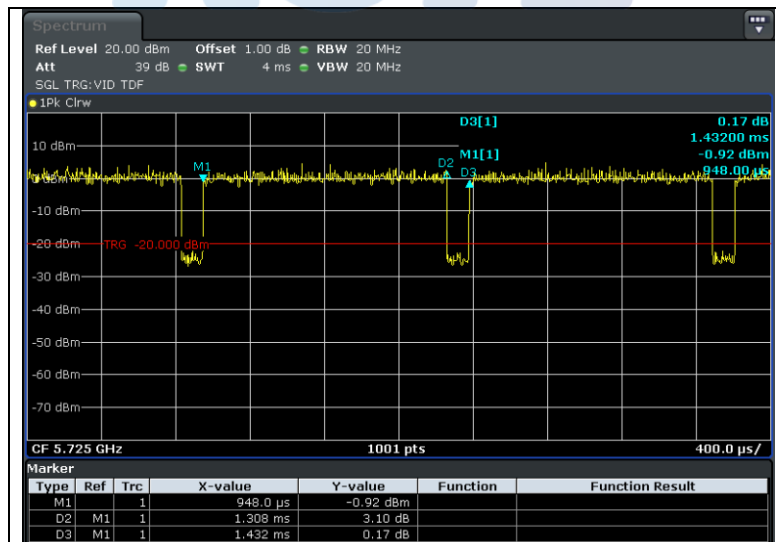
- 802.11a



### Remark

- a period : 1.496 ms, on time : 1.396 ms
- DCCF =  $10 \log(1 / x) = 0.30$  dB,  $x = 1.396 / 1.496 = 0.9332$  (93.32 %)

- 802.11n HT20



### Remark

- a period : 1.432 ms, on time : 1.308 ms
- DCCF =  $10 \log(1 / x) = 0.39$  dB,  $x = 1.308 / 1.432 = 0.9134$  (91.34 %)

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### 5.2.3 Test Result

#### -Complied

##### - 5 150 Band

##### -802.11a

Channel	Frequency [MHz]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	5 180	-1.29	0.30	-0.99	23.98	24.97
Middle	5 200	-1.05	0.30	-0.75	23.98	24.73
Highest	5 240	-1.10	0.30	-0.80	23.98	24.78

##### -802.11n HT20

Channel	Frequency [MHz]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	5 180	-2.67	0.38	-2.29	23.98	26.27
Middle	5 200	-2.48	0.38	-2.10	23.98	26.08
Highest	5 240	-2.47	0.38	-2.09	23.98	26.07

##### - 5 725 Band

##### -802.11a

Channel	Frequency [MHz]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	5 745	8.10	0.30	8.40	30.00	21.60
Middle	5 785	8.78	0.30	9.08	30.00	20.92
Highest	5 825	8.43	0.30	8.73	30.00	21.27

##### -802.11n HT20

Channel	Frequency [MHz]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	5 745	7.39	0.39	7.78	30.00	22.22
Middle	5 785	8.03	0.39	8.42	30.00	21.58
Highest	5 825	7.61	0.39	8.00	30.00	22.00

Note<sub>1</sub>) D.C.C.F = Duty cycle correction factor =  $10\log(1/\text{Duty Cycle})$

Note<sub>2</sub>) It was measured by power sensor.

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

### 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 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. 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 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW)  $\geq 3 \times$  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 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.

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



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### 5.3.3 Test Result

-Complied

- 5 150 Band

- 802.11a

Channel	Frequency [MHz]	26 dB Bandwidth [MHz]	Min. Limit [MHz]	OBW [MHz]
Lowest	5 180	18.62	-	16.42
Middle	5 200	18.70	-	16.58
Highest	5 240	18.62	-	16.50

- 802.11n HT20

Channel	Frequency [MHz]	26 dB Bandwidth [MHz]	Min. Limit [MHz]	OBW [MHz]
Lowest	5 180	19.06	-	17.54
Middle	5 200	18.94	-	17.54
Highest	5 240	19.06	-	17.46

- 5 725 Band

- 802.11a

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Min. Limit [MHz]	OBW [MHz]
Lowest	5 745	15.19	0.50	17.06
Middle	5 785	15.15	0.50	17.42
Highest	5 825	15.15	0.50	18.90

- 802.11n HT20

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Min. Limit [MHz]	OBW [MHz]
Lowest	5 745	15.23	0.50	17.66
Middle	5 785	15.11	0.50	17.66
Highest	5 825	15.19	0.50	17.90

### 5.3.4 Test Plot

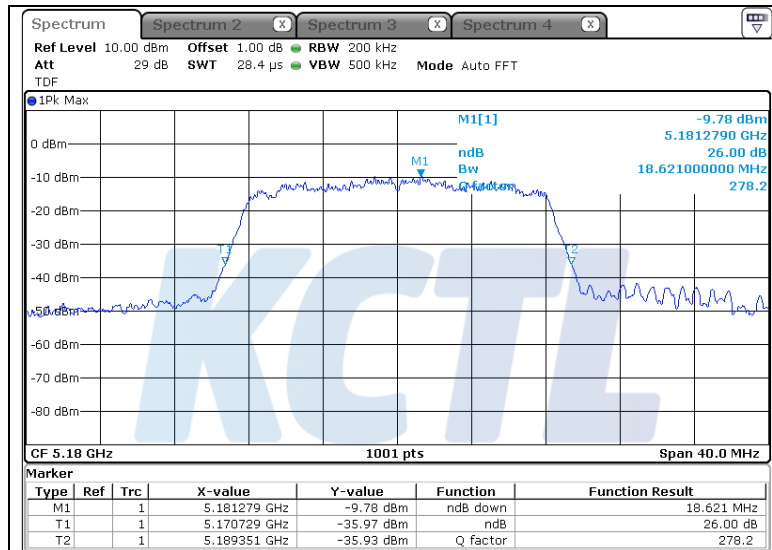
Figure 2. Plot of Bandwidth Measurement

- 5 150 Band

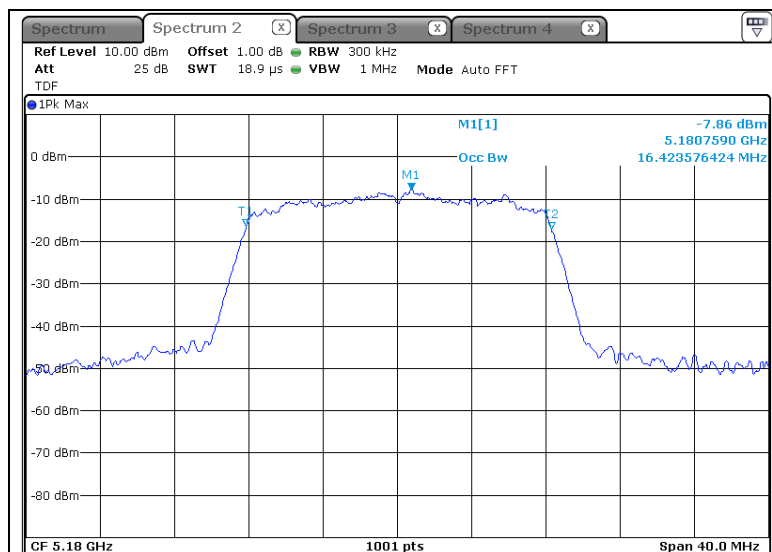
- 802.11a

- 5 180 MHz

EBW



OBW



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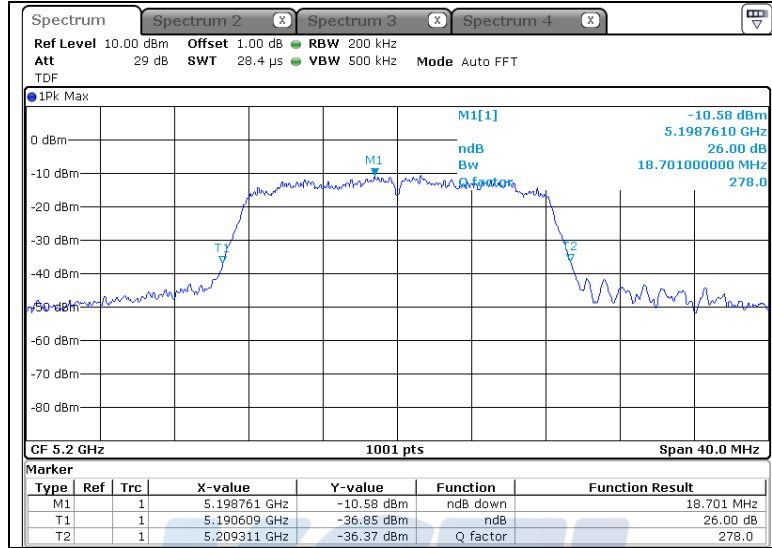
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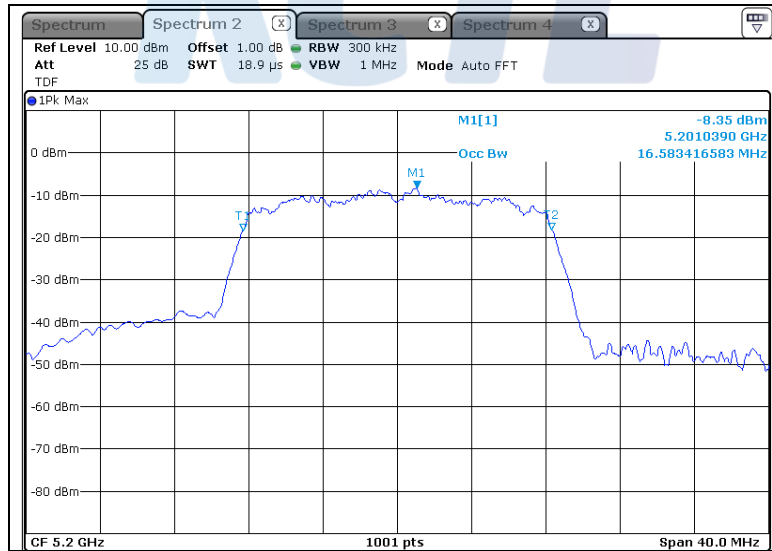


- 5 200 MHz

EBW



OBW



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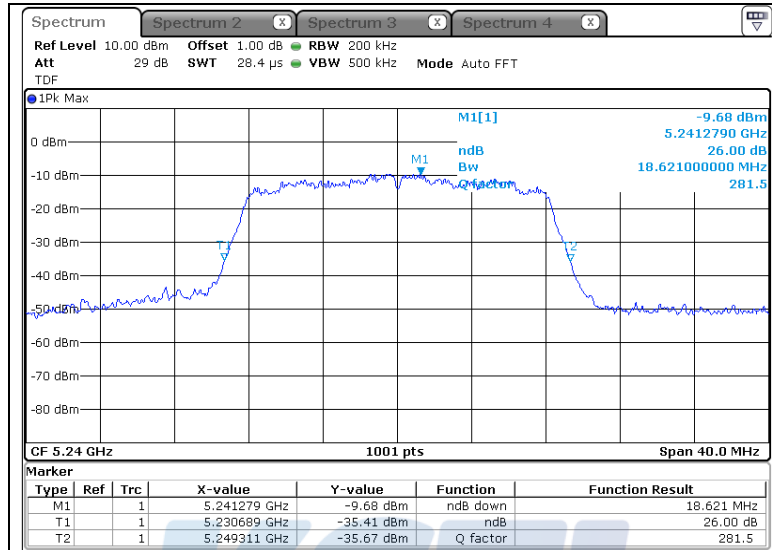
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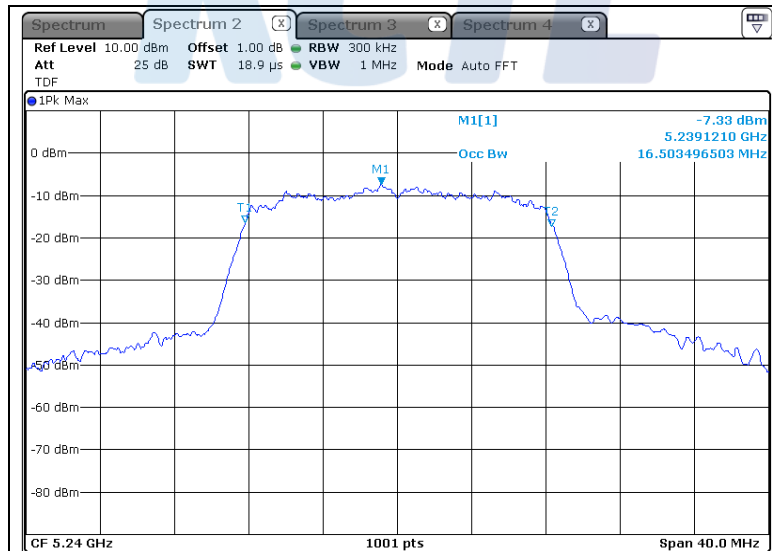


- 5 240 MHz

EBW



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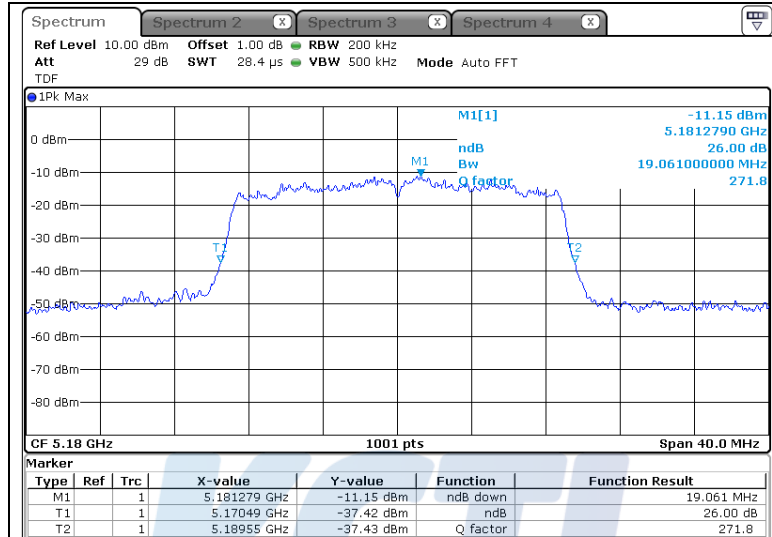
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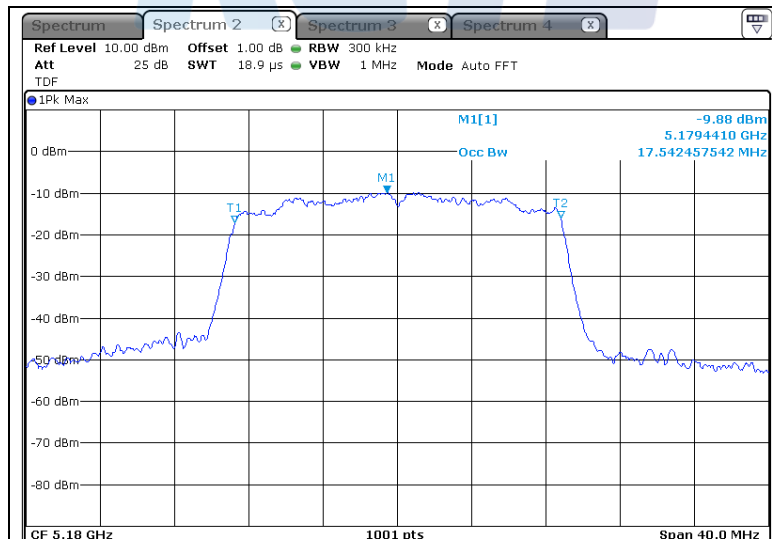
- 802.11n HT20

- 5 180 MHz

EBW



OBW



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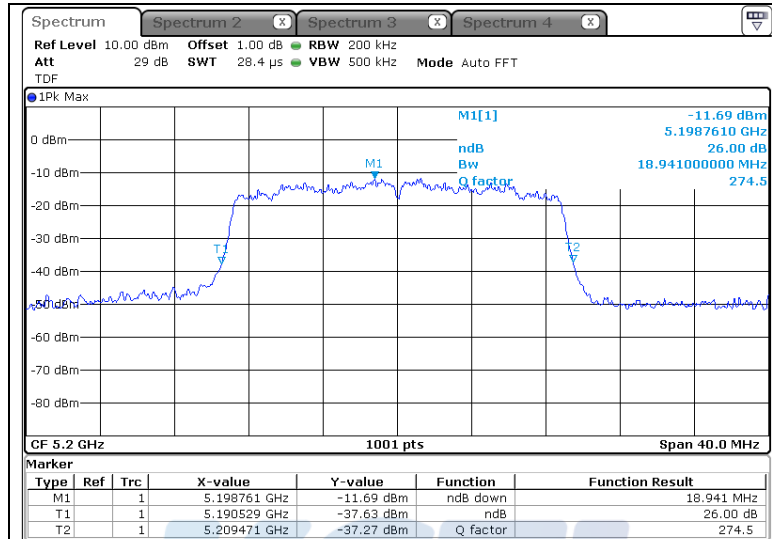
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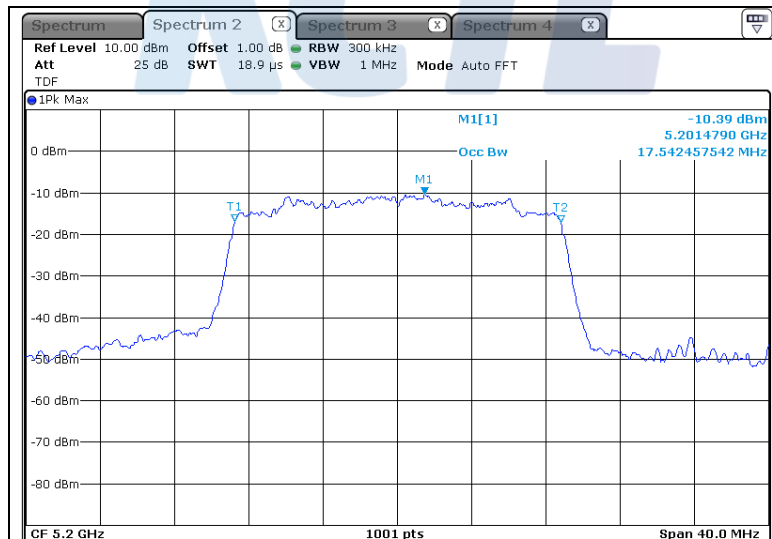


- 5 200 MHz

EBW



OBW



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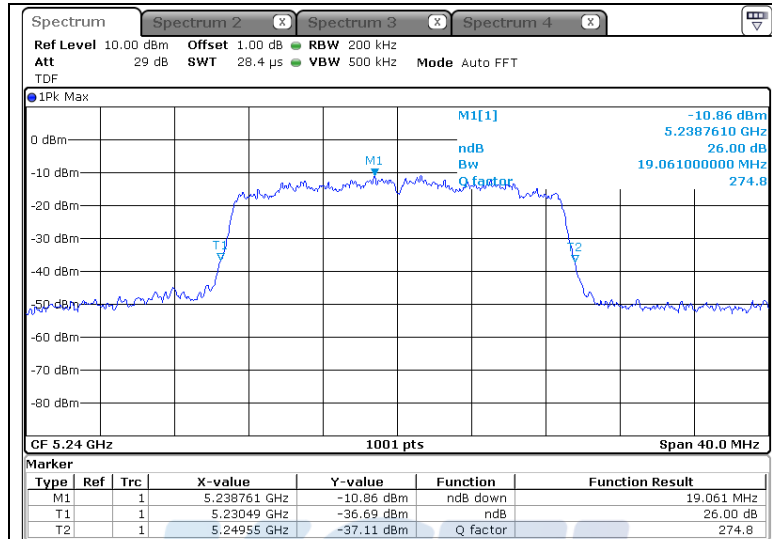
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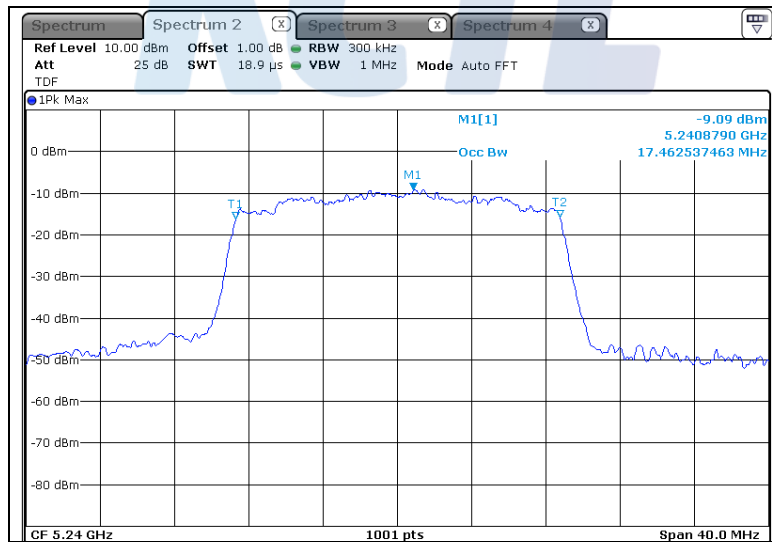


- 5 240 MHz

EBW



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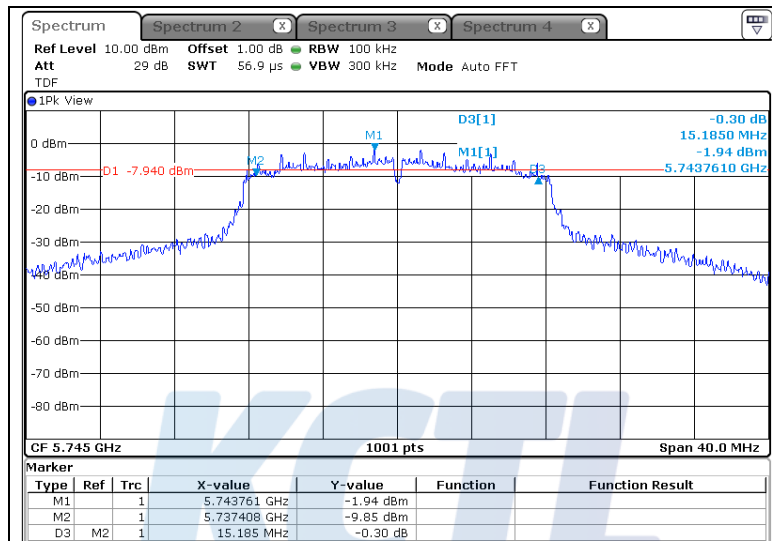


- 5 725 Band

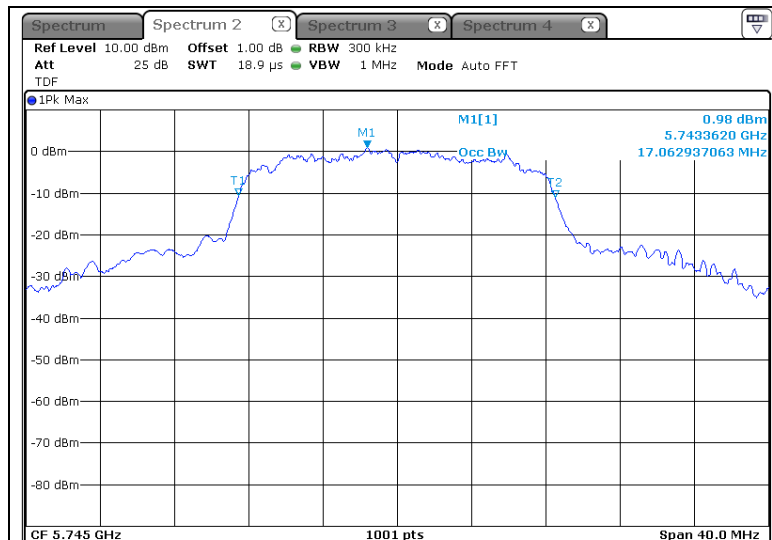
- 802.11a

- 5 745 MHz

EBW



OBW





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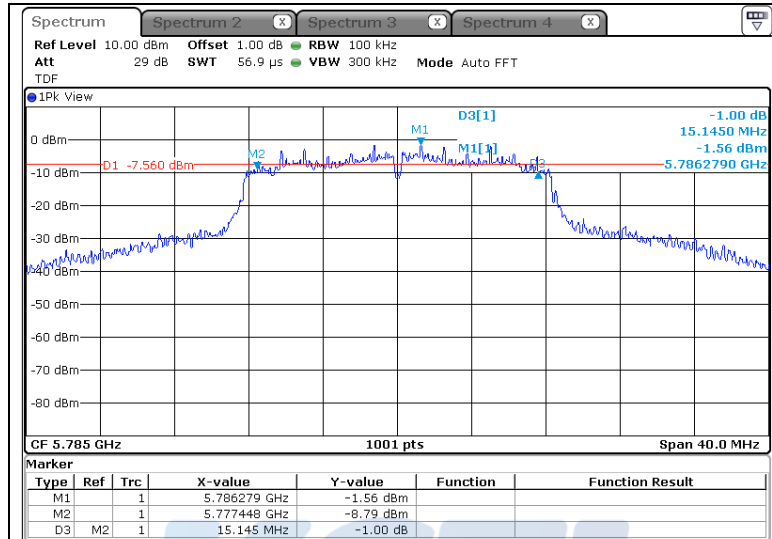
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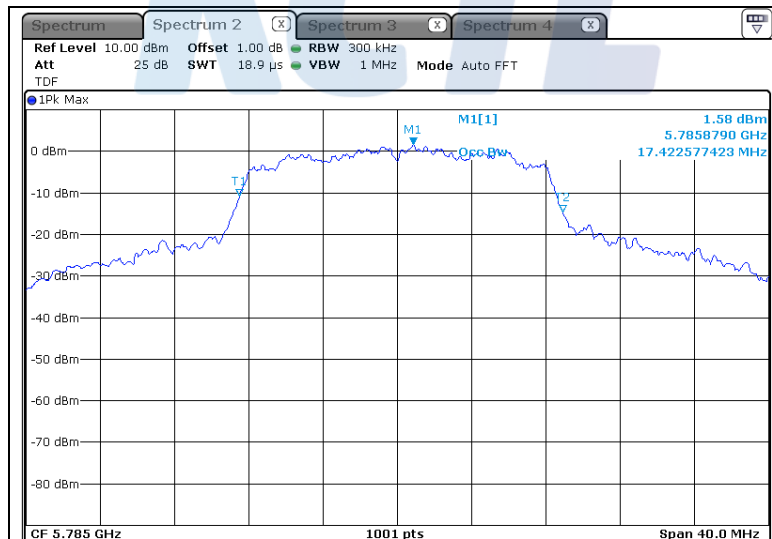


- 5 785 MHz

EBW



OBW



# KCTL Inc.

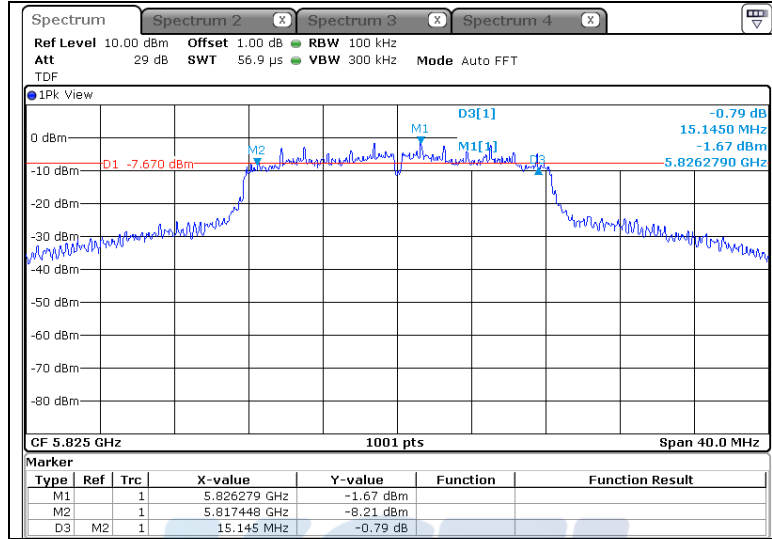
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- 5 825 MHz

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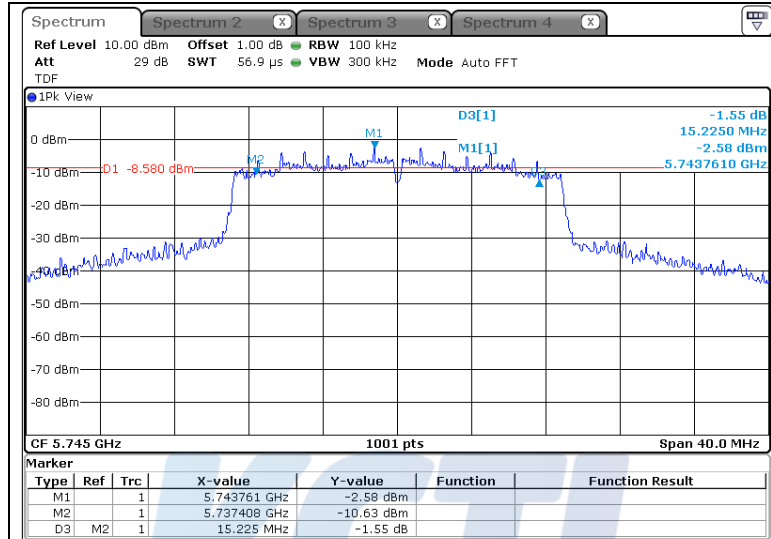
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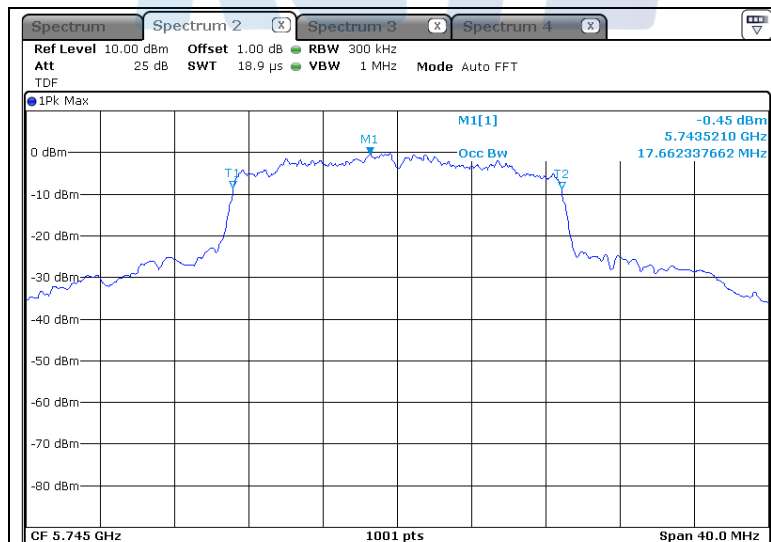
- 802.11n HT20

- 5 745 MHz

EBW



OBW



# KCTL Inc.

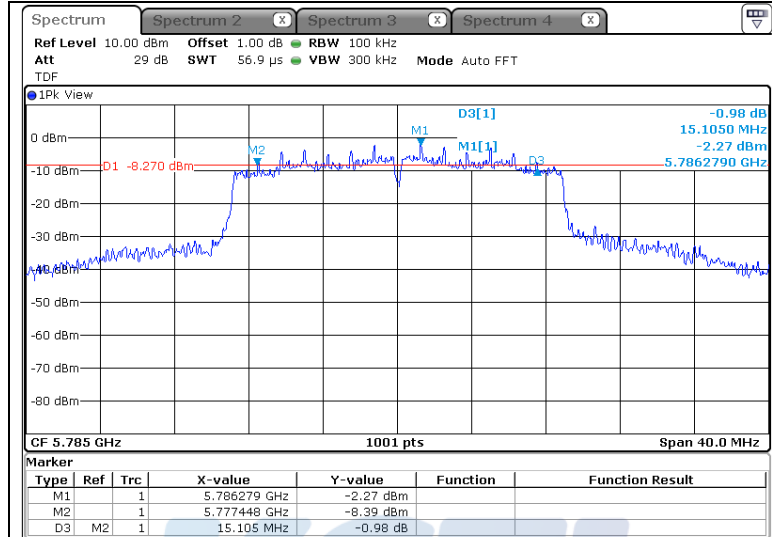
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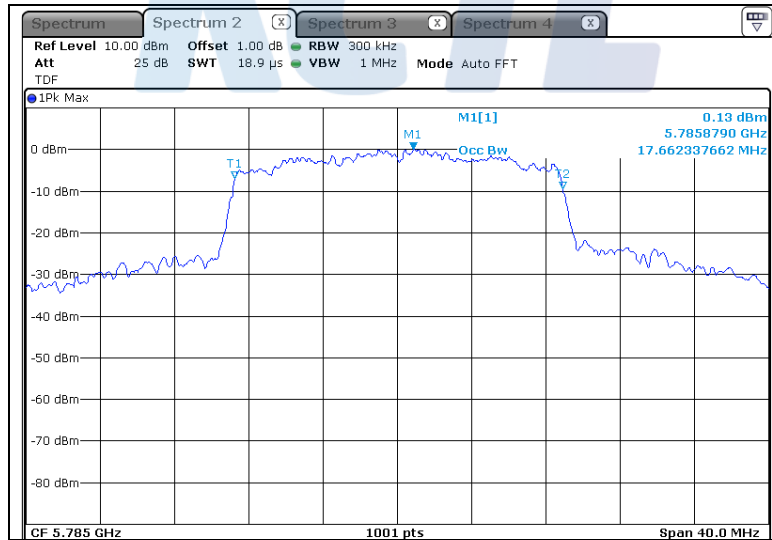


- 5 785 MHz

EBW



OBW



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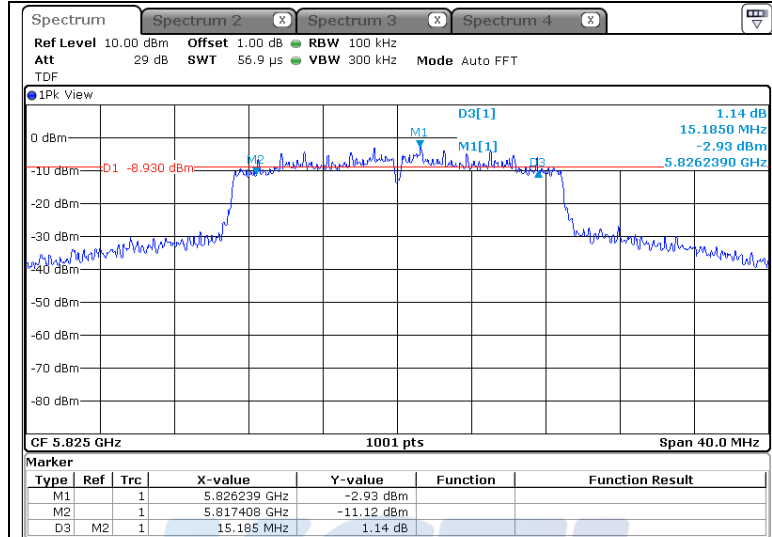
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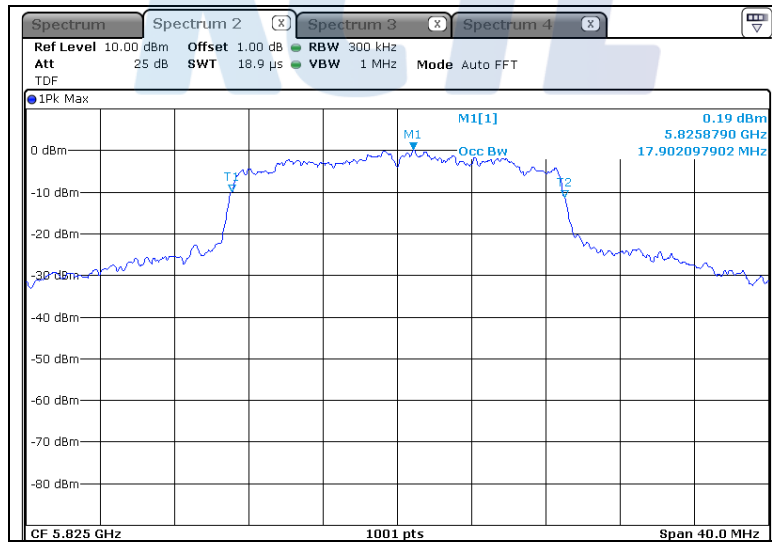


- 5 825 MHz

EBW



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## 5.4 Peak Power Spectral Density

### 5.4.1 Regulation

According to §15.407(a) (1) iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to §15.407(a) (3) For the band 5.725-5.85 GHz, 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 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi 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 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 above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 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 a 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 section II.B.I.a).
  - b) Set  $VBW \geq 3 RBW$ .
  - d) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add  $10 \log(500 \text{ kHz} / RBW)$  to the measured result, whereas  $RBW (< 500 \text{ kHz})$  is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
  - e) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add  $10 \log(1 \text{ MHz} / RBW)$  to the measured result, whereas  $RBW (< 1 \text{ MHz})$  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 kHz for the sections 5.c) and 5.d) above, since  $RBW=100 \text{ kHz}$  is available on nearly all spectrum analyzers.

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### 5.4.3 Test Result

#### -Complied

##### - 5 150 Band

##### - 802.11a

Frequency [MHz]	Result [dBm]	Duty Factor [dB]	Total result [dBm/MHz]	Limit [dBm]	Margin [dB]
5 180	-10.60	0.30	-10.30	11.00	21.30
5 200	-11.77	0.30	-11.47	11.00	22.47
5 240	-9.90	0.30	-9.60	11.00	20.60

##### - 802.11n HT20

Frequency [MHz]	Result [dBm]	Duty Factor [dB]	Total result [dBm/MHz]	Limit [dBm]	Margin [dB]
5 180	-11.95	0.38	-11.57	11.00	22.57
5 200	-12.50	0.38	-12.12	11.00	23.12
5 240	-11.50	0.38	-11.12	11.00	22.12

##### - 5 725 Band

##### - 802.11a

Frequency [MHz]	Result [dBm]	Duty Factor [dB]	Total result [dBm/MHz]	Limit [dBm]	Margin [dB]
5 745	-4.78	0.30	-4.48	30.00	34.48
5 785	-3.64	0.30	-3.34	30.00	33.34
5 825	-4.35	0.30	-4.05	30.00	34.05

##### - 802.11n HT20

Frequency [MHz]	Result [dBm]	Duty Factor [dB]	Total result [dBm/MHz]	Limit [dBm]	Margin [dB]
5 745	-5.28	0.39	-4.89	30.00	35.28
5 785	-5.48	0.39	-5.09	30.00	35.48
5 825	-5.43	0.39	-5.04	30.00	35.43

Note:

1. D.C.C.F = Duty cycle correction factor

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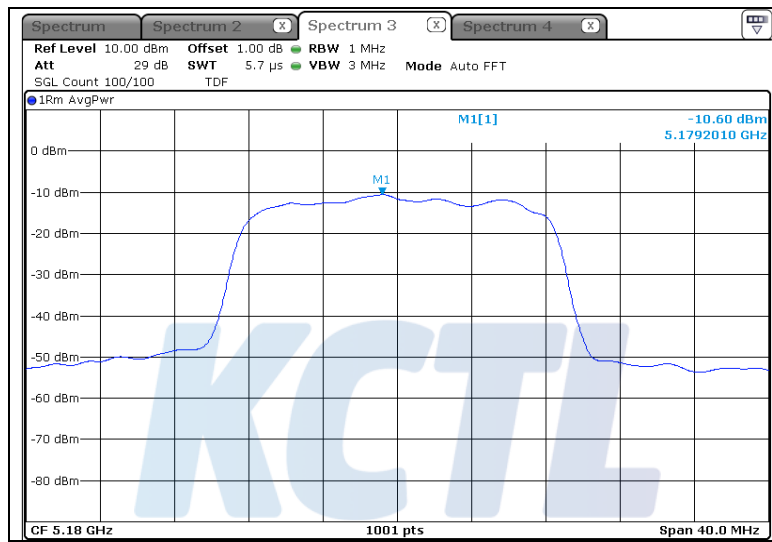
### 5.4.4 Test Plot

Figure 3. Plot of the Power Spectral Density

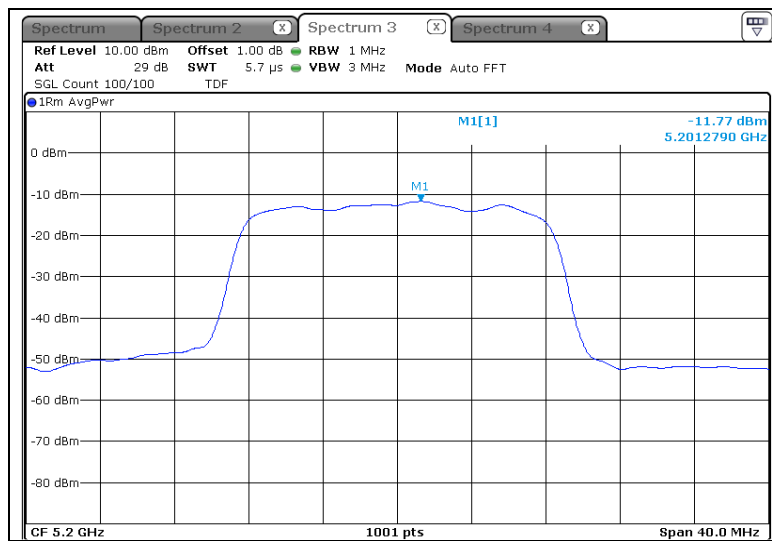
- 5 150 Band

802.11a

5 180 MHz



5 200 MHz



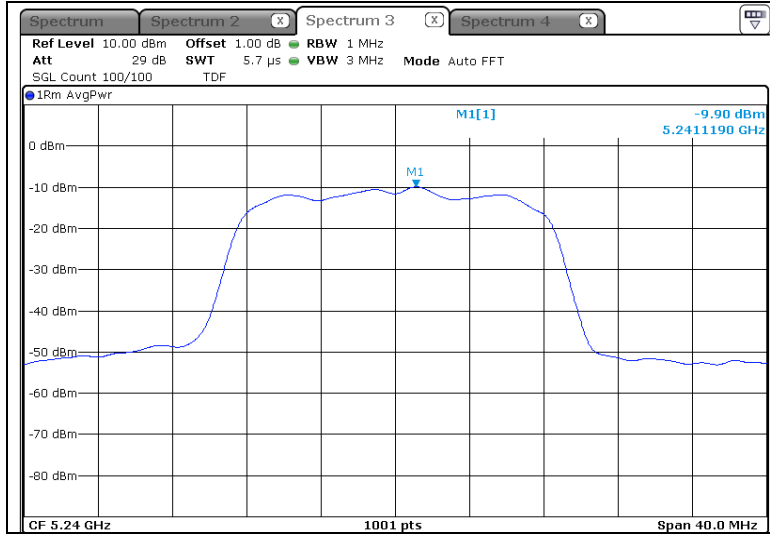
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5 240 MHz



802.11n HT20

5 180 MHz



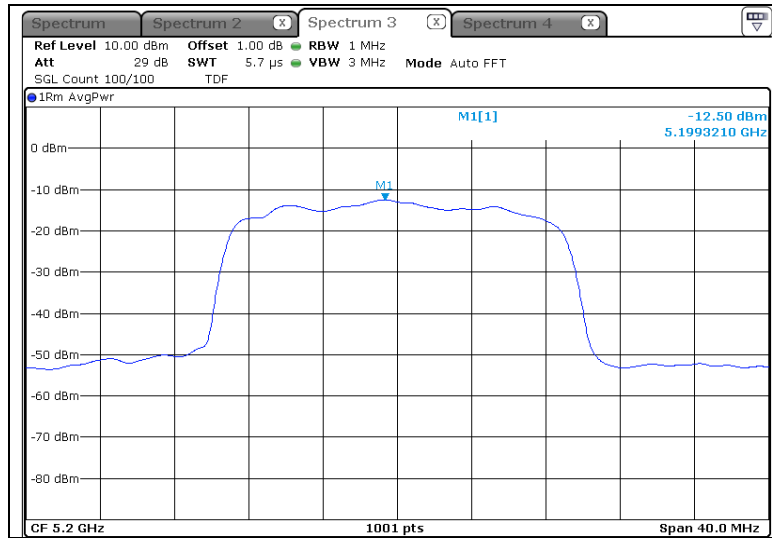
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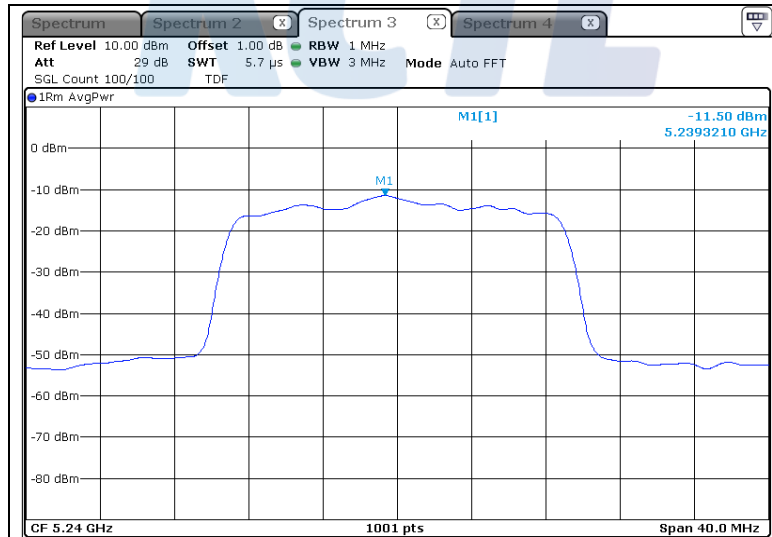
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5 200 MHz



5 240 MHz



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- 5 725 Band

802.11a

5 745 MHz



5 785 MHz



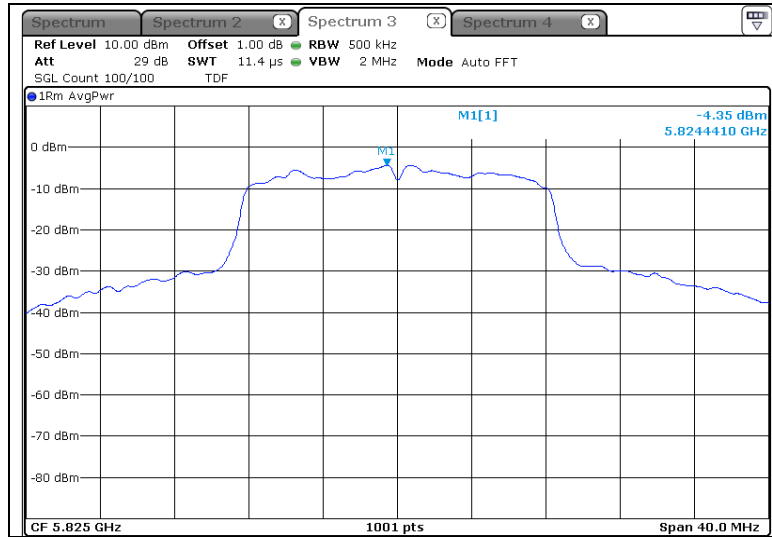
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5 825 MHz



- 802.11n HT20

5 745 MHz



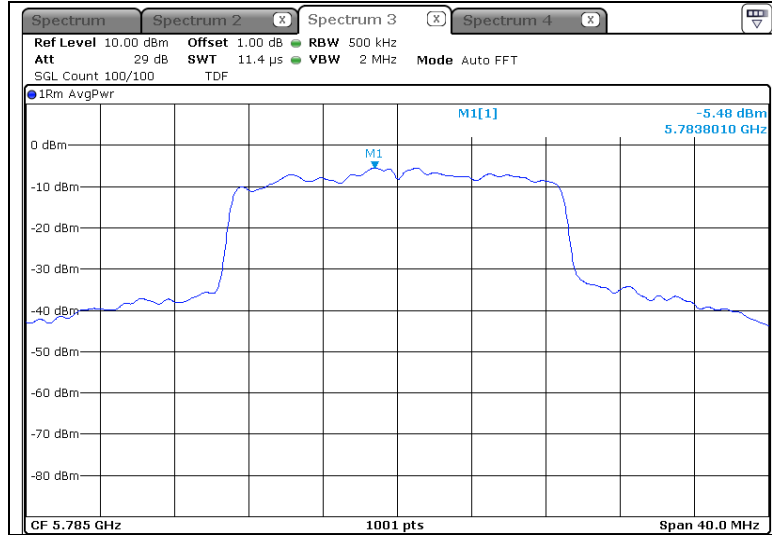
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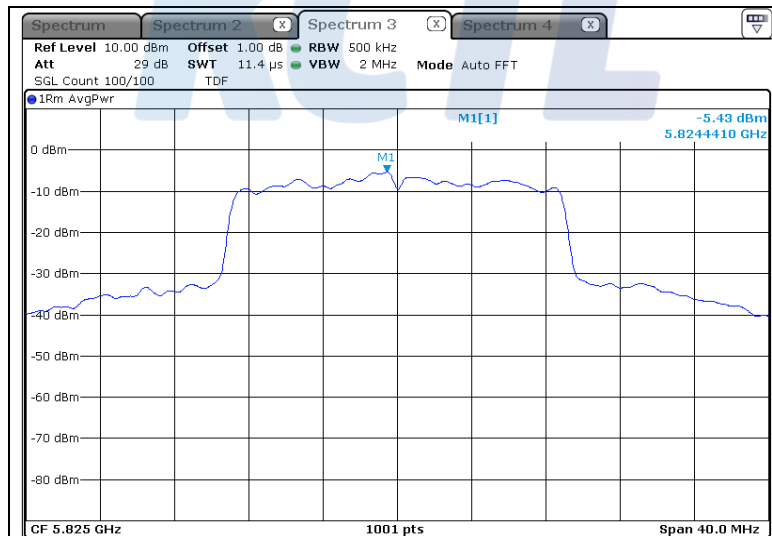
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5 785 MHz



5 825 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 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

According to §15.407(b) (2) For transmitters operating in the 5.25-5.35 GHzband: All emissions outside of the 5.15-5.35 GHzband shall not exceed an e.i.r.p. of -27 dBm/MHz.

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

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

According to §15.407(b)(6) Unwanted emissions below 1 GHz 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 not exceed the field strength levels specified in the following table:

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

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

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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 v02r01.

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. 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)  $E[\text{dB}\mu\text{V}/\text{m}] = \text{EIRP}[\text{dBm}] - 20 \log(d[\text{meters}]) + 104.77$ , where E = field strength and d = distance at which field strength limit is specified in the rules; (ii)  $E[\text{dB}\mu\text{V}/\text{m}] = \text{EIRP}[\text{dBm}] + 95.2$ , 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.

### 5.5.2.1.2. 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)  $EIRP = ((E \times d)^2) / 30$  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:  $EIRP[dBm] = E[dB\mu V/m] + 20 \log(d[meters]) - 104.77$
- (iii) Or, if d is 3 meters:  $EIRP[dBm] = E[dB\mu V/m] - 95.2$

### 5.5.2.1.3. Band edge measurements.

Unwanted band-edge emissions may be measured using either of the special band-edge measurement techniques (the marker-delta or integration methods) described in the following paragraphs. Note that the marker-delta method is primarily a radiated measurement technique that requires the 99% occupied bandwidth edge to be within 2 MHz of the authorized band edge, whereas the integration method can be used in either a radiated or conducted measurement without any special requirement with regards to the displacement of the unwanted emission(s) relative to the authorized bandwidth.

#### (i) Marker-Delta Method.

The marker-delta method, as described in ANSI C63.10, can be used to perform measurements of the radiated unwanted emissions level of emissions provided that the 99% occupied bandwidth of the fundamental is within 2 MHz of the authorized band-edge.

#### (ii) Integration Method

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

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

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

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

### 5.5.2.2 Spurious Radiated Emissions

1. The preliminary and final radiated 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 kHz to 30 MHz using the loop antenna, and from 30 to 1 000 MHz using the TRILOG broadband antenna, and from 1 000 MHz to 40 000 MHz 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 GHz and 1.5m is for above 1 GHz measurement.

#### Note

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

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### 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 GHz data (Worst-case: 5 785 Band 802.11a)

##### 802.11a\_Middle Channel (5 785 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB( $\mu$ V)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor DCCF [dB]	Result [dB( $\mu$ V/m)]	Limit [dB( $\mu$ V/m)]	Margin [dB]
<b>Quasi-Peak DATA. Emissions below 30 MHz</b>										
6.65	9	V	39.00	0.48	-32.68	19.70	-12.50	26.50	69.50	43.00
<b>Quasi-Peak DATA. Emissions below 1 GHz</b>										
44.79	120	V	46.50	1.36	-31.68	16.52	-13.80	32.70	40.00	7.30
395.93	120	V	51.60	4.54	-35.64	21.60	-9.50	42.10	46.00	3.90
500.09	120	V	47.80	5.13	-35.93	23.30	-7.50	40.30	46.00	5.70
600.00	120	V	47.30	5.72	-35.22	24.60	-4.90	42.40	46.00	3.60
700.03	120	H	43.60	6.19	-35.29	25.00	-4.10	39.50	46.00	6.50
850.01	120	H	41.90	6.81	-34.11	26.10	-1.20	40.70	46.00	5.30

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.

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**- Above 1 GHz data**

**- 5 150 Band**

**802.11a\_Lowest channel (5 180 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB( $\mu$ V)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result dB( $\mu$ V/m)	Limit dB( $\mu$ V/m)	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>											
1 979.52	1 000	V	78.19	3.41	-59.48	27.72	-28.35	-	49.83	68.20	18.37
2 460.59	1 000	H	75.90	3.75	-59.25	28.68	-26.82	-	49.08	68.20	19.12
<sup>1)</sup> 5 149.58	1 000	H	67.94	5.57	-59.64	33.12	-20.95	-	46.99	74.00	27.01
<sup>2)</sup> 5 150.00	1 000	H	64.38	5.57	-59.65	33.13	-20.95	-	43.43	74.00	30.57
5 333.83	1 000	H	76.52	5.68	-59.48	33.40	-20.40	-	56.12	68.20	12.08
6 710.59	1 000	H	62.54	5.38	-57.60	35.27	-16.95	-	45.59	68.20	22.61
16 727.81	1 000	H	59.47	11.94	-57.53	41.21	-4.38	-	55.10	68.20	13.10
21 510.38	1 000	H	46.66	11.90	-49.38	45.00	7.52	-	54.18	68.20	14.02
37 534.63	1 000	V	47.10	16.00	-48.85	46.00	13.15	-	60.24	68.20	7.96
<b>Average DATA. Emissions above 1 GHz</b>											
<sup>1)</sup> 5 149.58	1 000	H	55.76	5.57	-59.64	33.12	-20.95	0.30	35.11	54.00	18.89
<sup>2)</sup> 5 150.00	1 000	H	54.82	5.57	-59.65	33.13	-20.95	0.30	34.17	54.00	19.83

<sup>1)</sup> Restricted band.

<sup>2)</sup> Band edge.

**802.11a\_Middle channel (5 200 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB( $\mu$ V)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result dB( $\mu$ V/m)	Limit dB( $\mu$ V/m)	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>											
1 980.03	1 000	H	82.15	3.41	-59.48	27.72	-28.35	-	53.80	68.20	14.40
2 463.69	1 000	H	79.92	3.76	-59.25	28.68	-26.81	-	53.11	68.20	15.09
<sup>1)</sup> 5 360.13	1 000	H	78.93	5.70	-59.54	33.44	-20.40	-	58.53	74.00	15.47
6 659.92	1 000	H	63.87	5.44	-57.70	35.24	-17.02	-	46.84	68.20	21.36
17 480.70	1 000	H	61.65	11.97	-58.03	41.54	-4.52	-	57.13	68.20	11.07
21 967.56	1 000	H	46.67	12.10	-49.61	45.10	7.59	-	54.26	68.20	13.94
38 125.88	1 000	V	45.35	16.10	-48.05	45.70	13.75	-	59.10	68.20	9.10
<b>Average DATA. Emissions above 1 GHz</b>											
<sup>1)</sup> 5 360.13	1 000	H	55.42	5.70	-59.54	33.44	-20.40	0.30	35.32	54.00	18.68

<sup>1)</sup> Restricted band.

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**802.11a\_Highest channel (5 240 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result dB(μV/m)	Limit dB(μV/m)	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>											
1 979.86	1 000	V	80.69	3.41	-59.48	27.72	-28.35	-	52.34	68.20	15.86
2 463.69	1 000	V	83.11	3.76	-59.25	28.68	-26.81	-	56.30	68.20	11.90
<sup>2</sup> 5 350.00	1 000	H	65.13	5.69	-59.52	33.43	-20.40	-	44.73	74.00	29.27
<sup>1</sup> 5 374.73	1 000	H	72.53	5.71	-59.58	33.46	-20.41	-	52.12	74.00	21.88
6 857.94	1 000	H	63.52	5.21	-57.31	35.37	-16.73	-	46.78	68.20	21.42
16 941.64	1 000	V	60.97	11.91	-57.68	41.46	-4.31	-	56.66	68.20	11.54
21 661.63	1 000	V	47.09	12.00	-49.46	45.00	7.54	-	54.63	68.20	13.57
38 759.75	1 000	H	44.78	16.30	-46.74	45.50	15.06	-	59.84	68.20	8.36
<b>Average DATA. Emissions above 1 GHz</b>											
<sup>2</sup> 5 350.00	1 000	H	55.97	5.69	-59.52	33.43	-20.40	0.30	35.87	54.00	18.13
<sup>1</sup> 5 374.73	1 000	H	61.17	5.71	-59.58	33.46	-20.41	0.30	41.06	54.00	12.94

<sup>1</sup>) Restricted band.

<sup>2</sup>) Band edge.

**802.11n HT20\_Lowest channel (5 180 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result dB(μV/m)	Limit dB(μV/m)	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>											
2 463.34	1 000	V	78.84	3.76	-59.25	28.68	-26.81	-	52.03	68.20	16.17
<sup>1</sup> 5 098.19	1 000	H	65.44	5.53	-59.54	33.05	-20.96	-	44.48	74.00	29.52
<sup>2</sup> 5 150.00	1 000	H	64.44	5.57	-59.65	33.13	-20.95	-	43.49	74.00	30.51
6 026.66	1 000	H	74.47	6.11	-59.84	34.43	-19.30	-	55.17	68.20	13.03
6 884.53	1 000	H	62.90	5.18	-57.26	35.39	-16.69	-	46.21	68.20	21.99
16 564.30	1 000	V	62.08	11.97	-57.42	41.02	-4.43	-	57.65	68.20	10.55
24 050.69	1 000	V	46.55	12.80	-48.56	45.00	9.24	-	55.78	68.20	12.42
36 853.31	1 000	H	46.65	15.90	-49.70	46.80	13.00	-	59.66	68.20	8.54
<b>Average DATA. Emissions above 1 GHz</b>											
<sup>1</sup> 5 098.19	1 000	H	56.44	5.53	-59.54	33.05	-20.96	0.38	35.86	54.00	18.14
<sup>2</sup> 5 150.00	1 000	H	54.75	5.57	-59.65	33.13	-20.95	0.38	34.18	54.00	19.82

<sup>1</sup>) Restricted band.

<sup>2</sup>) Band edge.

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**802.11n HT20\_Middle channel (5 200 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB( $\mu$ V)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result dB( $\mu$ V/m)	Limit dB( $\mu$ V/m)	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>											
1 980.20	1 000	V	80.49	3.41	-59.48	27.72	-28.35	-	52.15	68.20	16.05
<sup>1)</sup> 5 352.39	1 000	H	74.30	5.69	-59.52	33.43	-20.40	-	53.89	74.00	20.11
6 041.09	1 000	V	72.43	6.12	-59.84	34.45	-19.27	-	53.16	68.20	15.04
8 668.83	1 000	H	67.30	6.73	-58.95	35.93	-16.29	-	51.01	68.20	17.19
17 129.23	1 000	H	61.34	11.92	-57.80	41.53	-4.35	-	56.99	68.20	11.21
21 884.38	1 000	H	46.90	12.10	-49.52	45.00	7.58	-	54.48	68.20	13.72
38 064.69	1 000	V	45.69	16.10	-48.18	45.70	13.62	-	59.31	68.20	8.89
<b>Average DATA. Emissions above 1 GHz</b>											
<sup>1)</sup> 5 352.39	1 000	H	61.15	5.69	-59.52	33.43	-20.40	0.38	41.13	54.00	12.87

<sup>1)</sup> Restricted band.

**802.11n HT20\_Highest channel (5 240 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB( $\mu$ V)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result dB( $\mu$ V/m)	Limit dB( $\mu$ V/m)	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>											
<sup>2)</sup> 5 350.00	1 000	H	64.94	5.69	-59.52	33.43	-20.40	-	44.54	74.00	29.46
<sup>1)</sup> 5 373.53	1 000	H	74.43	5.71	-59.58	33.46	-20.41	-	54.02	74.00	19.98
6 060.17	1 000	V	83.05	6.13	-59.85	34.48	-19.24	-	63.82	68.20	4.38
8 663.08	1 000	H	67.29	6.72	-58.95	35.93	-16.30	-	50.99	68.20	17.21
16 254.52	1 000	H	62.02	12.02	-57.74	40.65	-5.07	-	56.95	68.20	11.25
24 120.13	1 000	H	46.07	12.80	-48.57	45.10	9.33	-	55.40	68.20	12.80
39 560.00	1 000	H	42.59	16.60	-44.86	45.90	17.64	-	60.23	68.20	7.97
<b>Average DATA. Emissions above 1 GHz</b>											
<sup>2)</sup> 5 350.00	1 000	H	55.84	5.69	-59.52	33.43	-20.40	0.38	35.82	54.00	18.18
<sup>1)</sup> 5 373.53	1 000	H	60.12	5.71	-59.58	33.46	-20.41	0.38	40.09	54.00	13.91

<sup>1)</sup> Restricted band.

<sup>2)</sup> Band edge.



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- 5 725 Band

**802.11a\_Lowest channel (5 745 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB( $\mu$ V)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result [dB( $\mu$ V/m)]	Limit [dB( $\mu$ V/m)]	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>											
1 980.03	1 000	V	79.41	3.41	-59.48	27.72	-28.35	-	51.06	68.20	17.14
2 459.22	1 000	H	80.72	3.75	-59.25	28.67	-26.83	-	53.89	68.20	14.31
<sup>1)</sup> 4 893.31	1 000	V	82.07	5.40	-59.73	32.85	-21.48	-	60.59	68.20	7.61
5 723.64	1 000	H	86.04	5.93	-59.58	33.99	-19.66	-	66.38	119.10	52.72
<sup>2)</sup> 5 725.00	1 000	H	78.17	5.93	-59.59	33.99	-19.67	-	58.50	133.99	75.49
6 960.72	1 000	H	65.61	5.09	-57.11	35.44	-16.58	-	49.03	68.20	19.17
16 574.00	1 000	H	61.39	11.97	-57.42	41.03	-4.42	-	56.97	68.20	11.23
25 617.50	1 000	V	44.12	13.30	-46.90	45.50	11.90	-	56.02	68.20	12.18
38 264.75	1 000	H	42.36	16.20	-47.76	45.60	14.04	-	56.40	68.20	11.80
<b>Average DATA. Emissions above 1 GHz</b>											
<sup>1)</sup> 4 893.31	1 000	V	63.61	5.40	-59.73	32.85	-21.48	0.30	42.43	54.00	11.57

<sup>1)</sup> Restricted band.

<sup>2)</sup> Band edge.

**802.11a\_Middle channel (5 785 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB( $\mu$ V)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result [dB( $\mu$ V/m)]	Limit [dB( $\mu$ V/m)]	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>											
1 980.38	1 000	H	77.96	3.41	-59.48	27.72	-28.35	-	49.62	68.20	18.58
2 460.25	1 000	V	81.51	3.75	-59.24	28.67	-26.82	-	54.68	68.20	13.52
6 846.08	1 000	V	63.42	5.22	-57.33	35.36	-16.75	-	46.67	68.20	21.53
16 710.56	1 000	V	58.71	11.95	-57.52	41.19	-4.38	-	54.33	68.20	13.87
21 913.94	1 000	V	45.63	12.10	-49.50	45.00	7.60	-	53.23	68.20	14.97
38 237.25	1 000	V	44.88	16.20	-47.82	45.60	13.98	-	58.86	68.20	9.34

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**802.11a\_Highest channel (5 825 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>											
1 980.20	1 000	V	82.98	3.41	-59.48	27.72	-28.35	-	54.63	68.20	13.57
<sup>1)</sup> 5 850.00	1 000	H	75.91	6.01	-59.84	34.18	-19.65	-	56.26	133.99	77.73
5 852.89	1 000	H	83.93	6.01	-59.82	34.18	-19.63	-	64.30	115.61	51.31
5 985.23	1 000	H	78.81	6.09	-59.81	34.38	-19.34	-	59.47	68.20	8.73
7 888.27	1 000	V	65.23	5.98	-58.83	35.81	-17.04	-	48.19	68.20	20.01
16 749.38	1 000	H	61.28	11.94	-57.54	41.23	-4.37	-	56.91	68.20	11.29
25 526.75	1 000	V	42.45	13.30	-47.10	45.50	11.70	-	54.15	68.20	14.05
38 033.06	1 000	V	45.50	16.10	-48.24	45.70	13.56	-	59.06	68.20	9.14

<sup>1)</sup> Band edge.

**802.11n HT20\_Lowest channel (5 745 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>											
1 980.03	1 000	H	82.26	3.41	-59.48	27.72	-28.35	-	53.91	68.20	14.29
<sup>1)</sup> 4 896.75	1 000	H	81.56	5.40	-59.72	32.85	-21.47	-	60.09	68.20	8.11
5 724.84	1 000	H	84.80	5.93	-59.59	33.99	-19.67	-	65.13	121.84	56.71
<sup>2)</sup> 5 725.00	1 000	H	76.65	5.93	-59.59	33.99	-19.67	-	56.98	133.99	77.01
6 908.25	1 000	V	65.08	5.15	-57.22	35.41	-16.66	-	48.43	68.20	19.77
17 565.88	1 000	H	60.75	11.98	-58.08	41.54	-4.56	-	56.20	68.20	12.00
25 325.31	1 000	V	44.29	13.10	-47.30	45.40	11.20	-	55.49	68.20	12.71
37 921.69	1 000	V	44.11	16.10	-48.47	45.80	13.43	-	57.54	68.20	10.66
<b>Average DATA. Emissions above 1 GHz</b>											
<sup>1)</sup> 4 896.75	1 000	H	62.32	5.40	-59.72	32.85	-21.47	0.39	41.24	54.00	12.76

<sup>1)</sup> Restricted band.

<sup>2)</sup> Band edge.

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**802.11n HT20\_Middle channel (5 785 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB( $\mu$ V)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result dB( $\mu$ V/m)	Limit dB( $\mu$ V/m)	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>											
1 594.52	1 000	V	79.55	3.04	-60.74	26.18	-31.52	-	48.04	68.20	20.16
1 989.66	1 000	V	77.41	3.42	-59.45	27.76	-28.27	-	49.14	68.20	19.06
2 458.19	1 000	V	81.06	3.75	-59.25	28.67	-26.83	-	54.22	68.20	13.98
7 192.52	1 000	H	65.23	5.24	-57.72	35.54	-16.94	-	48.28	68.20	19.92
16 857.19	1 000	V	58.61	11.92	-57.62	41.36	-4.34	-	54.28	68.20	13.92
21 548.88	1 000	V	45.58	12.00	-49.50	45.00	7.50	-	53.08	68.20	15.12
38 378.19	1 000	V	42.25	16.20	-47.53	45.60	14.27	-	56.52	68.20	11.68

**802.11n HT20\_Highest channel (5 825 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB( $\mu$ V)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result dB( $\mu$ V/m)	Limit dB( $\mu$ V/m)	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>											
<sup>1)</sup> 1 049.84	1 000	H	75.56	2.51	-59.82	24.00	-33.31	-	42.25	74.00	31.75
<sup>1)</sup> 1 188.20	1 000	V	77.74	2.65	-60.65	24.55	-33.45	-	44.29	74.00	29.71
1 979.69	1 000	V	79.10	3.41	-59.48	27.72	-28.35	-	50.75	68.20	17.45
<sup>1)</sup> 2 772.55	1 000	H	73.27	3.98	-59.67	29.27	-26.42	-	46.85	74.00	27.15
<sup>2)</sup> 5 850.00	1 000	H	74.49	6.01	-59.84	34.18	-19.65	-	54.84	133.99	79.15
5 850.66	1 000	H	71.96	6.01	-59.84	34.18	-19.65	-	52.32	120.70	68.38
7 828.61	1 000	V	62.39	5.92	-58.83	35.78	-17.13	-	45.26	68.20	22.94
17 306.05	1 000	H	60.80	11.95	-57.93	41.54	-4.44	-	56.36	68.20	11.84
21 869.94	1 000	V	45.70	12.10	-49.50	45.00	7.60	-	53.30	68.20	14.90
38 209.06	1 000	V	42.24	16.20	-47.88	45.60	13.92	-	56.16	68.20	12.04
<b>Average DATA. Emissions above 1 GHz</b>											
<sup>1)</sup> 1 049.84	1 000	H	65.87	2.51	-59.82	24.00	-33.31	0.39	32.95	54.00	21.05
<sup>1)</sup> 1 188.20	1 000	V	66.38	2.65	-60.65	24.55	-33.45	0.39	33.32	54.00	20.68
<sup>1)</sup> 2 772.55	1 000	H	64.75	3.98	-59.67	29.27	-26.42	0.39	38.72	54.00	15.28

<sup>1)</sup> Restricted band.

<sup>2)</sup> Band edge.

## 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.

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### 5.6.3 Test Result

-Complied

- 5 150 Band

-5 180 MHz

Voltage [%]	Power [V]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [%]
100	19.00	-20	5 180 008 697	8 697	0.000 2
		-10	5 180 013 933	13 933	0.000 3
		0	5 180 025 136	25 136	0.000 5
		10	5 180 026 625	26 625	0.000 5
		20	5 180 024 062	24 062	0.000 5
		30	5 180 019 898	19 898	0.000 4
		40	5 180 014 701	14 701	0.000 3
		50	5 180 013 028	13 028	0.000 3
		60	5 180 019 416	19 416	0.000 4
		23	5 180 017 787	17 787	0.000 3
85	16.15	23	5 180 017 415	17 415	0.000 3
115	21.85	23	5 180 017 302	17 302	0.000 3

- 5 745 Band

-5 725 MHz

Voltage [%]	Power [V]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [%]
100	19.00	-20	5 745 010 898	10 898	0.000 2
		-10	5 745 016 939	16 939	0.000 3
		0	5 745 027 622	27 622	0.000 5
		10	5 745 029 549	29 549	0.000 5
		20	5 745 027 028	27 028	0.000 5
		30	5 745 020 991	20 991	0.000 4
		40	5 745 016 672	16 672	0.000 3
		50	5 745 014 410	14 410	0.000 3
		60	5 745 019 129	19 129	0.000 3
		23	5 745 017 794	17 794	0.000 3
85	16.15	23	5 745 017 664	17 664	0.000 3
115	21.85	23	5 745 017 370	17 370	0.000 3

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## 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 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50  $\Omega$  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 (MHz)	Conducted limit (dB $\mu$ V)	
	Quasi-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 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 $\Omega$ /50 $\mu$ 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 is 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.

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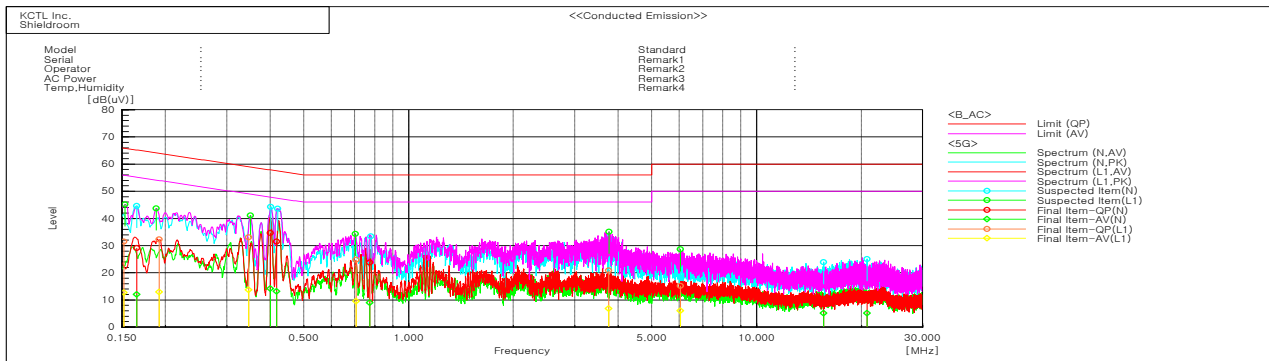


## 5.7.3 Test Result

- Complied

Figure 4. plot of Conducted Emission

- Conducted worst-case data : 802.11a\_Middle Chanel (5 785 MHz)



### Final Result

--- N 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	0.16533	19.0	1.8	10.1	29.1	11.9	65.2	55.2	36.1	43.3
2	0.4005	24.8	4.3	9.8	34.6	14.1	57.8	47.8	23.2	33.7
3	0.41693	21.6	3.4	9.8	31.4	13.2	57.5	47.5	26.1	34.3
4	0.77378	14.0	-0.8	9.8	23.8	9.0	56.0	46.0	32.2	37.0
5	15.57965	0.2	-4.9	10.0	10.2	5.1	60.0	50.0	49.8	44.9
6	20.76675	0.2	-4.9	10.0	10.2	5.1	60.0	50.0	49.8	44.9

--- L1 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	0.15171	21.6	2.9	9.8	31.4	12.7	65.9	55.9	34.5	43.2
2	0.19203	22.3	2.9	10.0	32.3	12.9	63.9	53.9	31.6	41.0
3	0.34704	23.3	4.0	9.7	33.0	13.7	59.0	49.0	26.0	35.3
4	0.70631	14.9	-0.3	9.8	24.7	9.5	56.0	46.0	31.3	36.5
5	3.75779	11.0	-3.0	9.8	20.8	6.8	56.0	46.0	35.2	39.2
6	6.03555	5.3	-3.9	9.9	15.2	6.0	60.0	50.0	44.8	44.0

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## 6. Test equipment used for test

	Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
■	Spectrum Analyzer	R & S	FSV40	100988	18.01.06
■	Spectrum Analyzer	R & S	FSV30	100810	18.08.01
■	DC Power Supply	Agilent	E3632A	MY40007371	18.07.06
■	Wideband Power Sensor	R & S	NRP-Z81	102398	18.01.31
■	ATTENUATOR	R & S	DNF Dämpfungsglied 10 dB inN-50 Ohm	0004	18.05.15
■	ATTENUATOR	HP	8491A	16861	18.04.06
■	EMI TEST RECEIVER	R & S	ESCI	100732	18.08.24
■	TWO-LINE V-NETWORK	R & S	ENV216	101358	18.08.01
■	Bi-Log Antenna	SCHWARZBECK	VULB 9163	552	18.05.10
■	Amplifier	SONOMA INSTRUMENT	310N	186280	18.04.06
■	Amplifier	SONOMA INSTRUMENT	310N	284608	18.08.24
■	ATTENUATOR	HP	8491B	22891	18.08.05
■	Horn antenna	ETS.lindgren	3116	00086635	18.04.25
■	Horn antenna	ETS.lindgren	3117	155787	19.10.20
■	AMPLIFIER	L-3 Narda-MITEQ	AMF-7D-0100 1800-22-10P	2003683	18.06.12
■	AMPLIFIER	L-3 Narda-MITEQ	JS44-18004000- 33-8P	2000997	18.08.09
■	LOOP Antenna	R & S	HFH2-Z2	100355	18.03.03
■	Antenna Mast	MATURO	AM4.0	079/3440509	-
■	Turn Table	MATURO	CO2000-SOFT	-	-
■	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	18.01.06
■	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	-
■	Temp & Humid Chamber	ESPEC CORP.	SH-641	92005476	18.08.01

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