

TEST REPORT

KCTL Inc. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 443-390, Korea TEL: 82 70 5008 1021 FAX: 82 505 299 8311	Report No.: KCTL16-SFR0017 Page(1) / (48) Pages	KCTL http://www.kctl.co.kr
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1. Applicant

Name: SM Instruments Inc.
Address: 20, Yuseong-daero 1184beon-gil, Yuseong-gu, Daejeon
34109, Korea

2. Sample Description:

FCC ID: 2AF6N-S205W
Type of equipment: Wireless Portable Sound Camera
Basic Model: SeeSV-S205W

3. Date of Test: March 14 ~ March 17, 2016

4. Test standard used: FCC Part 15 Subpart E 15.407

5. Test Results

Test Item: Refer to page 7
Result: Refer to page 8 ~ page 47
Measurement Uncertainty: Refer to page 7

This result shown in this report refer only to the sample(s) tested unless otherwise stated.

Affirmation	Tested by  Name: KI DONG, LEE	Technical Manager  Name: CHANG MIN, KIM
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2016. 03. 21

KCTL Inc. Testing Laboratory

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1. Client information

Applicant: SM Instruments Inc.
Address: 20,Yuseong-daero 1184beon-gil, Yuseong-gu, Daejeon 34109, Korea
Telephone number: +82-42-861-7004
Facsimile number: +82-42-861-7008
Contact person: Hyun Hee Kim / hhkim@smins.co.kr

Manufacturer: SM Instruments Inc.
Address: 20,Yuseong-daero 1184beon-gil, Yuseong-gu, Daejeon 34109, Korea

2. Laboratory information

Address

KCTL Inc.

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

Telephone Number: 82-70-5008-1016 Facsimile Number: 82-505-299-8311

Certificate

KOLAS No.: KT231

FCC Site Designation No.: KR0040

FCC Site Registration No.: 687132

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

IC Site Registration No.: 8035A-2

SITE MAP



3. Description of E.U.T.

3.1 Basic description

Applicant	SM Instruments Inc.
Address of Applicant	20,Yuseong-daero 1184beon-gil, Yuseong-gu, Daejeon 34109, Korea
Manufacturer	SM Instruments Inc.
Address of Manufacturer	20,Yuseong-daero 1184beon-gil, Yuseong-gu, Daejeon 34109, Korea
Type of equipment	Wireless Portable Sound Camera
Basic Model	SeeSV-S205W
Serial number	N/A

3.2 General description

Frequency Range	2 422 MHz ~ 2 452 MHz (802.11n_HT40), 5 190 MHz ~ 5 230 MHz (802.11n_HT40), 5 755 MHz ~ 5 795 MHz (802.11n_HT40)
Type of Modulation	OFDM (802.11n_HT40)
Number of Channels	2.4 GHz: 7 ch (802.11n_HT40), 5.0 GHz: 5 150 MHz Band: 2 ch (802.11n_HT40), 5 725 MHz Band: 2 ch (802.11n_HT40)
Type of Antenna	PCB Antenna (ANT 1,2,3)*
Antenna Gain	2.4 GHz: 3 dBi, 5.0 GHz: 5 dBi (5 150 MHz Band, 5 725 MHz Band)
Transmit Power	15.94 dBm
Power supply	DC 12 V(Battery), DC 24V(Adaptor)
Product SW/HW version	1.0
Radio SW/HW version	1.0
Test SW Version	CPT2_v1031
RF power setting in TEST SW	10

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

* Antenna #1,2,3 are being used simultaneously(MIMO) at Tx only.

3.3 Test frequency

* 802.11n_HT40

Frequency	Band 1	Band 4
Lowest frequency	5 190 MHz	5 755 MHz
Middle frequency	-	-
Highest frequency	5 230 MHz	5 795 MHz

3.4 Test Voltage

Mode	Voltage	
Norminal Voltage	DC 12 V	DC 24 V

3.5 Duty Factor

Frequency [MHz]	Duty cycle [dB]	Duty cycle factor [dB]
5 190	98.36	0.07
5 230	98.36	0.07
5 755	98.36	0.07
5 795	98.36	0.07

* Duty cycle factor= $10\log(1/\text{Duty cycle})$

4. Summary of test results

4.1 Standards & results

FCC Rule Reference	IC Rule Reference	Parameter	Report Section	Test Result
15.203 15.407(a)(1)(2)(3)	N/A	Antenna Requirement	5.1	C
15.403(i), 15.407(e)	4.6	Bandwidth Measurement	5.2	C
15.407(a)(1)(2)	4.8	Maximum Conducted Output Power	5.3	C
15.407(a)(1)(2)(5)	N/A	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)	4.9	Spurious Emission, Band Edge and Restricted bands	5.6	C
15.407(g)	4.7	Frequency Stability	5.7	C
15.207(a)	N/A	Conducted Emissions	5.8	C
15.407(h)	N/A	Dynamic Frequency Selection	5.9	N/A ₁₎
Note: C = complies NC = Not complies NT = Not tested NA = Not Applicable N/A ₁₎ : This device uses only WiFi 5G Band 1 & 4.				

* 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

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 an integral PCB antenna.

The total directional peak gain of the antenna exceeds 6.0 dBi

	5 150 MHz Band	5 725 MHz Band
ANT 1	5.0 dBi	5.0 dBi
ANT 2	5.0 dBi	5.0 dBi
ANT 3	5.0 dBi	5.0 dBi

According to KDB 662911 D01 Multiple Transmitter Output v02r01

- Directional gain = $G_{ANT} + \text{Array Gain}$, where Array Gain is as follows.

For power spectral density (PSD) measurements on all devices,

$$\text{Array Gain} = 10 \log(\text{NANT}/\text{NSS}) \text{ dB}$$

5 150 MHz band

$$\text{3Tx mimo Total gain} = 9.77 \text{ dBi (individual gain(5.00 dBi) + Array gain(4.77 dBi))}$$

5 725 MHz band

$$\text{3Tx mimo Total gain} = 9.77 \text{ dBi (individual gain(5.00 dBi) + Array gain(4.77 dBi))}$$

* It was calculated by the most highest antenna gain.

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 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 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 f) of section C of 789033 D02 General UNII Test Procedures.

5.2.2.1 Method PM (Measurement using an RF average power meter):

- (i) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.
 - The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
 - At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
 - The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
- (ii) If the transmitter does not transmit continuously, measure the duty cycle, x , of the transmitter output signal as described in 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 percent).

5.2.4 Test Result

-Complied

* 802.11n_HT40_Band 1_MIMO(ANT 1+2+3)_DC 12 V

Frequency [MHz]	Result [dBm]	Duty Factor [dBm]	Total result [dBm]	Limit [dBm]	Margin [dBm]
5 190	15.43	0.07	15.50	20.23	4.73
5 230	15.87	0.07	15.94	20.23	4.29

* 802.11n_HT40_Band 1_MIMO(ANT 1+2+3)_DC 24 V

Frequency [MHz]	Result [dBm]	Duty Factor [dBm]	Total result [dBm]	Limit [dBm]	Margin [dBm]
5 190	15.36	0.07	15.43	20.23	4.80
5 230	15.27	0.07	15.34	20.23	4.89

* 802.11n_HT40_Band 4_MIMO(ANT 1+2+3)_DC 12 V

Frequency [MHz]	Result [dBm]	Duty Factor [dBm]	Total result [dBm]	Limit [dBm]	Margin [dBm]
5 755	15.42	0.07	15.49	26.23	10.74
5 795	14.76	0.07	14.83	26.23	11.40

* 802.11n_HT40_Band 4_MIMO(ANT 1+2+3)_DC 24 V

Frequency [MHz]	Result [dBm]	Duty Factor [dBm]	Total result [dBm]	Limit [dBm]	Margin [dBm]
5 755	14.89	0.07	14.96	26.23	11.27
5 795	14.69	0.07	14.76	26.23	11.47

NOTE:

1. Since the directional gain of Internal Antenna declared by the manufacturer ($G_{ANT}=9.77$ dBi), exceeds 6.0 dBi, we need to reduce the output power.
2. We took the insertion loss of the cable loss into consideration within the measuring instrument.

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.

5.3.3 Test Result

-Complied

*** 802.11n_HT40_Band 1_MIMO(ANT 1+2+3)_DC 12 V**

Frequency [MHz]	26 dB Bandwidth	OBW
5 190	45.87	36.36
5 230	44.52	36.76

*** 802.11n_HT40_Band 1_MIMO(ANT 1+2+3)_DC 24 V**

Frequency [MHz]	26 dB Bandwidth	OBW
5 190	44.84	36.52
5 230	45.48	36.76

*** 802.11n_HT40_Band 4_MIMO(ANT 1+2+3)_DC 12 V**

Frequency [MHz]	6 dB Bandwidth	OBW
5 755	43.72	36.28
5 795	44.04	36.36

*** 802.11n_HT40_Band 4_MIMO(ANT 1+2+3)_DC 24 V**

Frequency [MHz]	6 dB Bandwidth	OBW
5 755	44.20	36.28
5 795	43.88	36.36

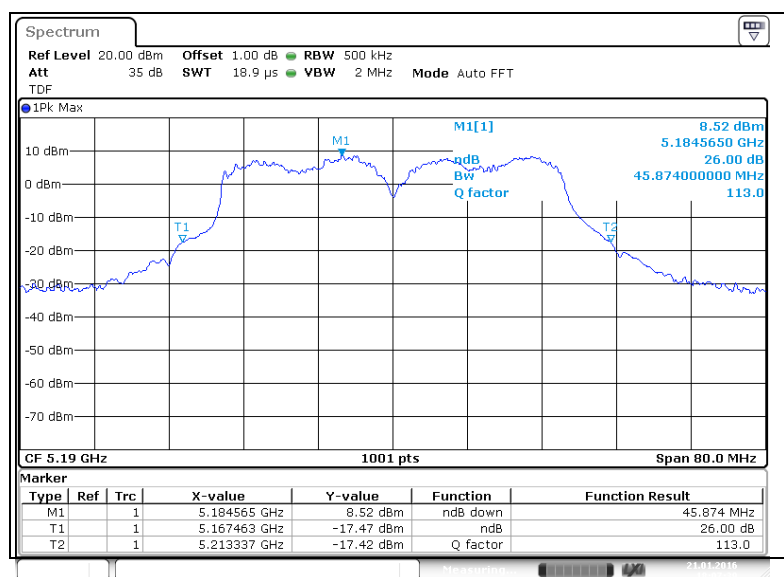
5.3.4 Test Plot

Figure 1. Bandwidth Measurement

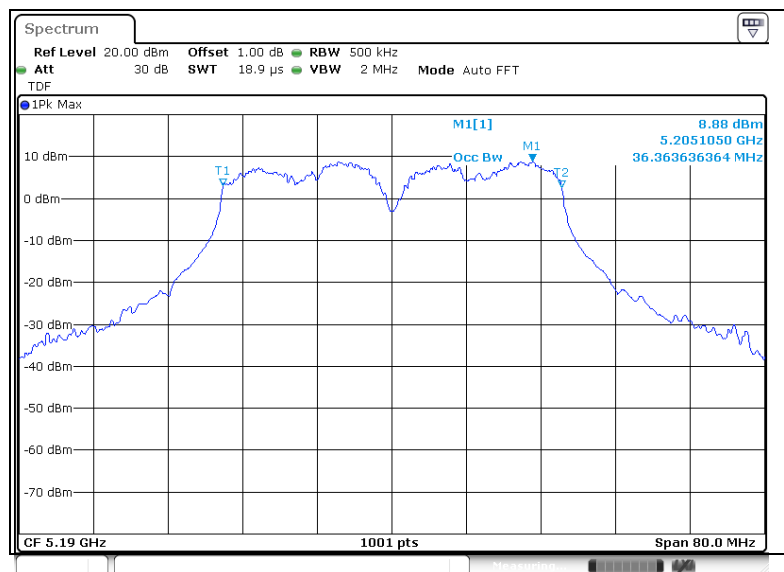
* 802.11n HT40_DC 12 V

-5 190 MHz

EBW

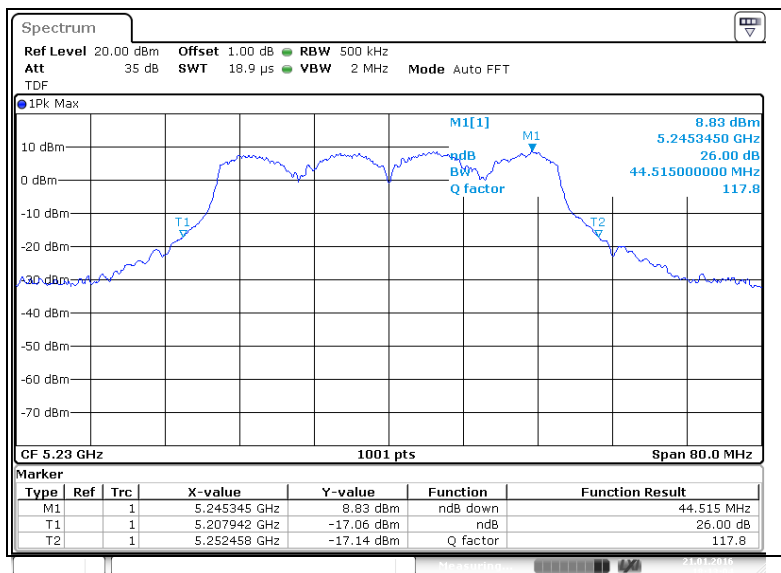


OBW

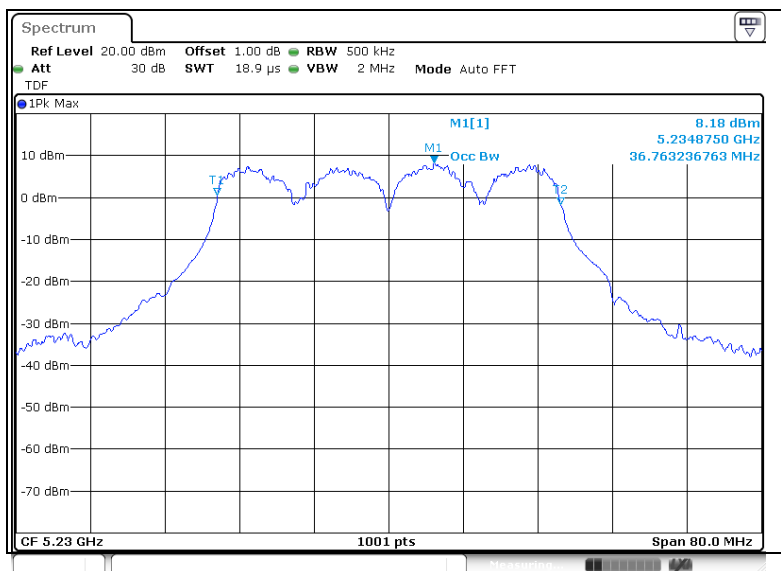


-5 230 MHz

EBW

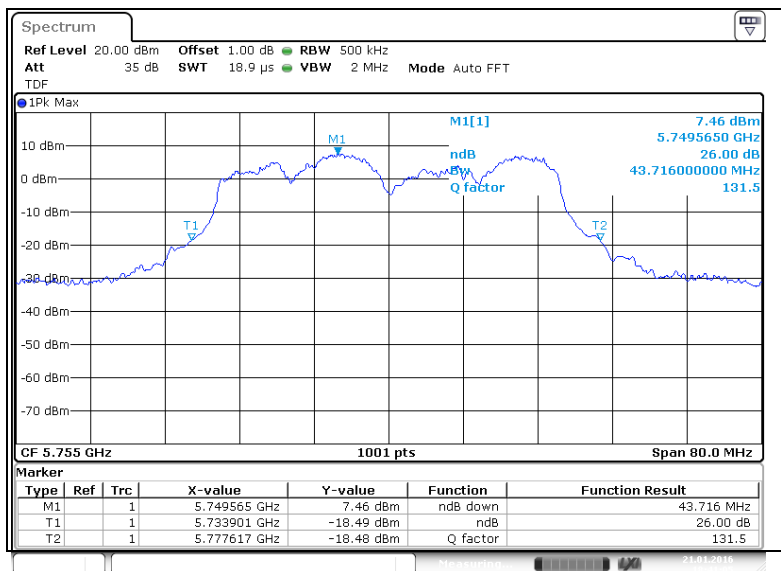


OBW

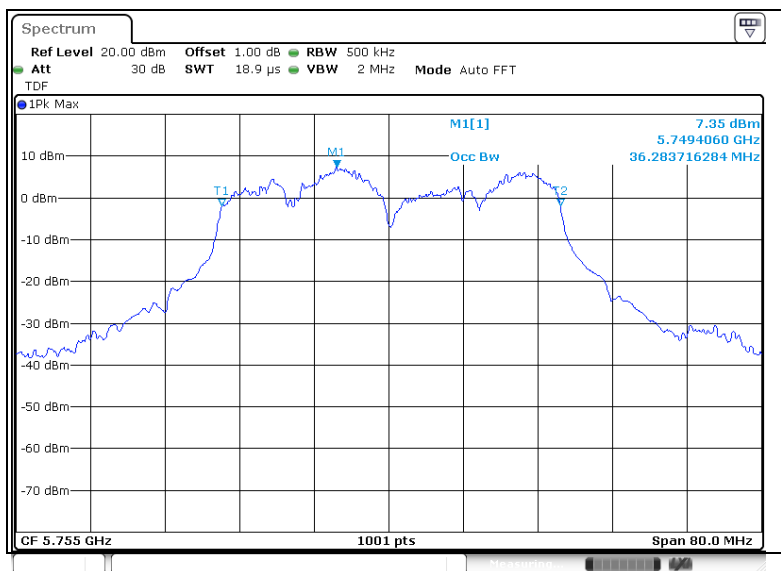


-5 755 MHz

EBW

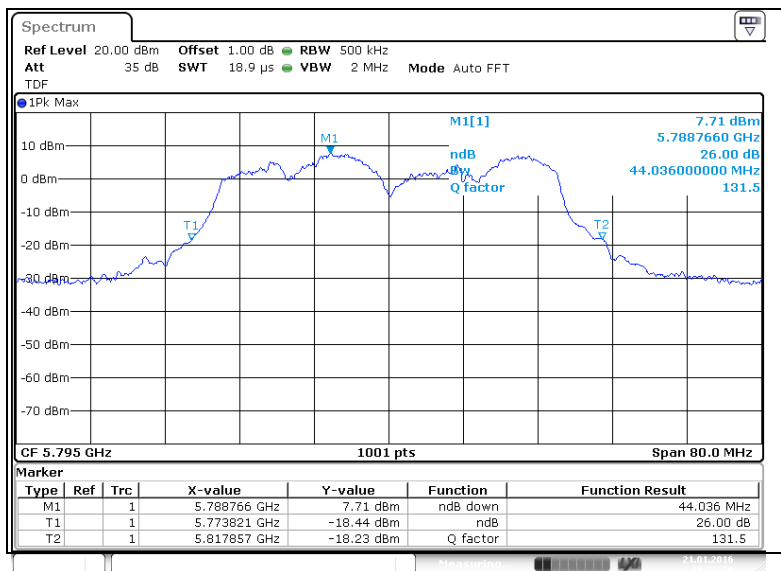


OBW

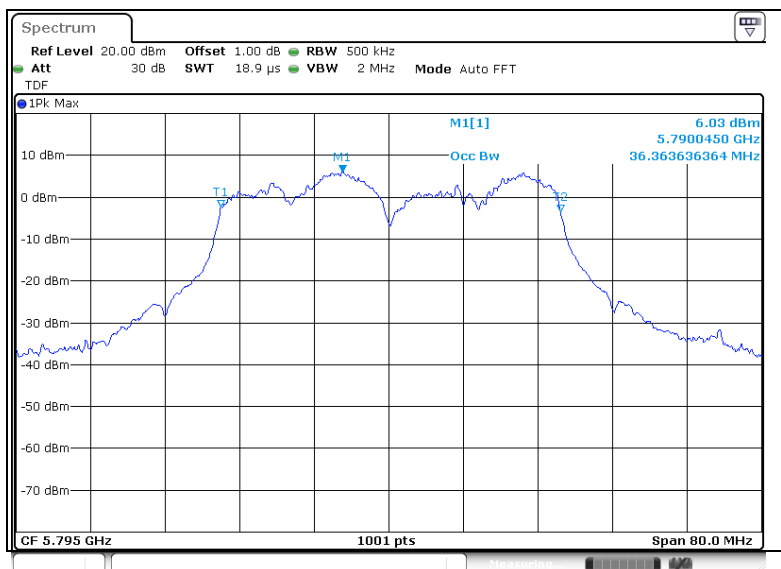


-5 795 MHz

EBW



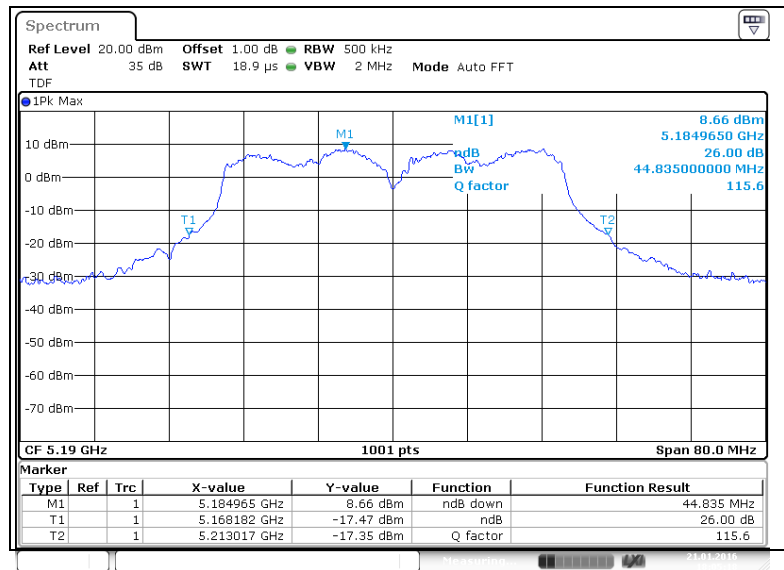
OBW



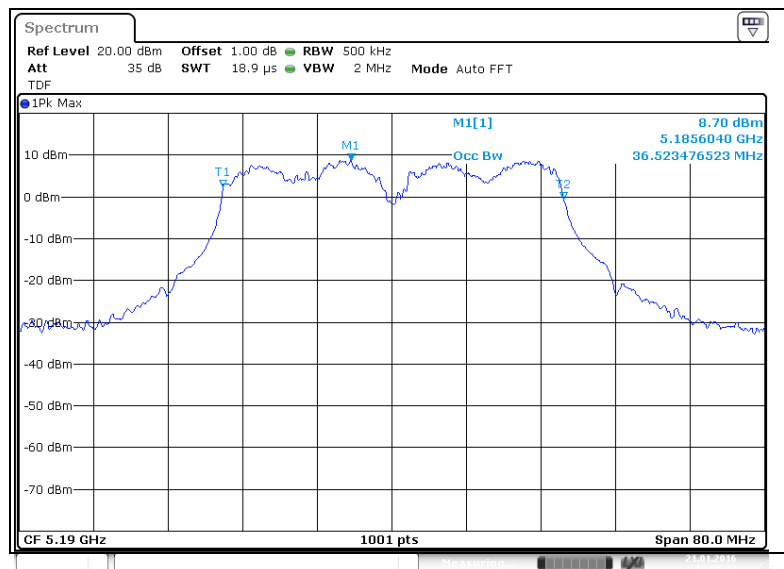
* 802.11n HT40_DC 24 V

-5 190 MHz

EBW

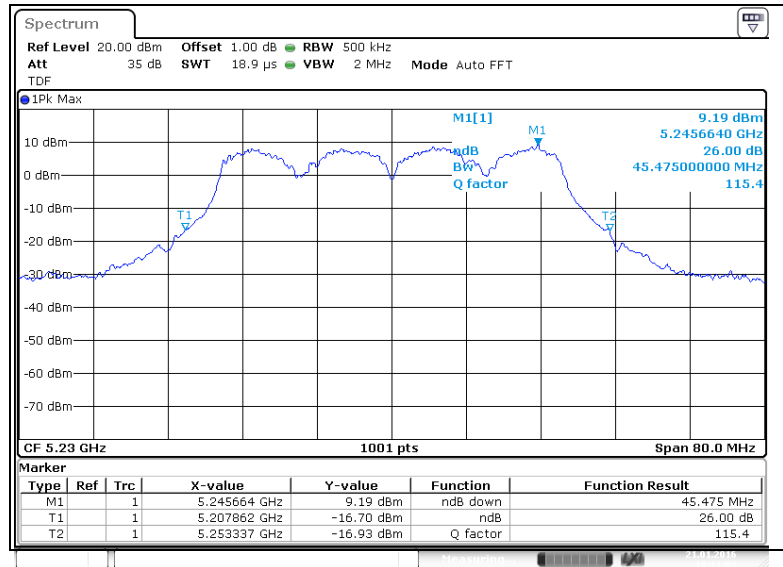


OBW

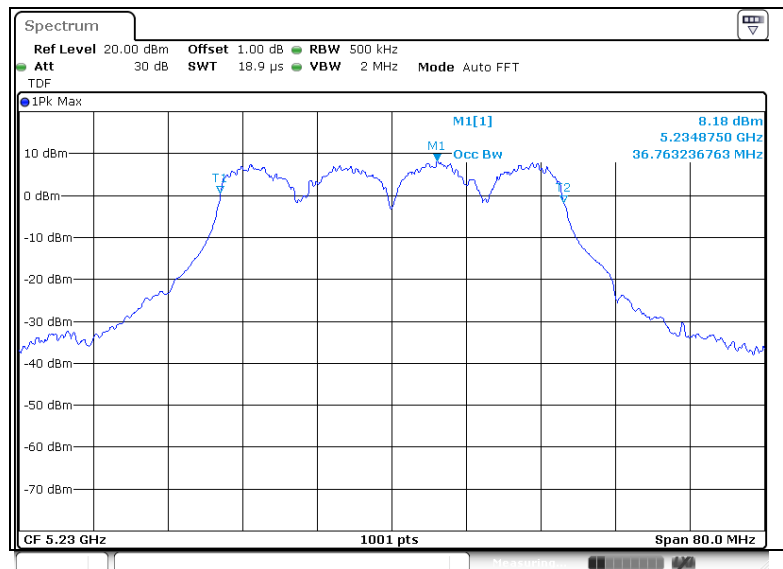


-5 230 MHz

EBW

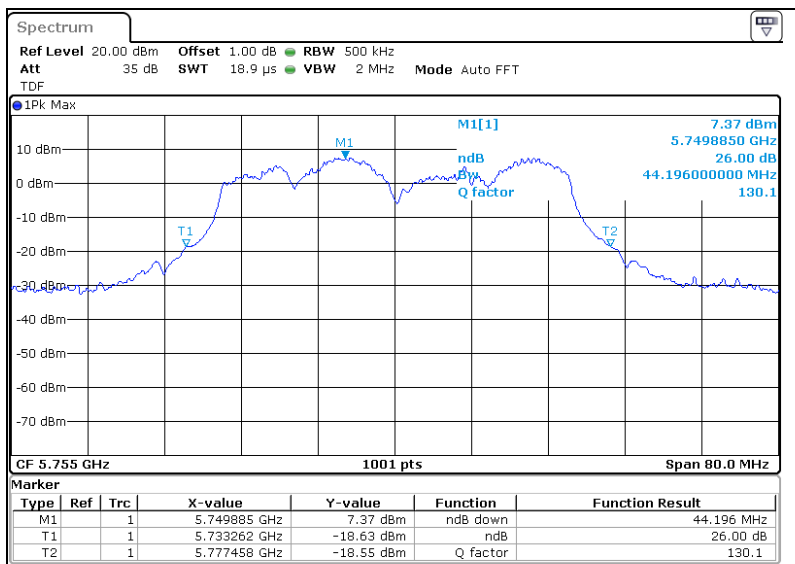


OBW

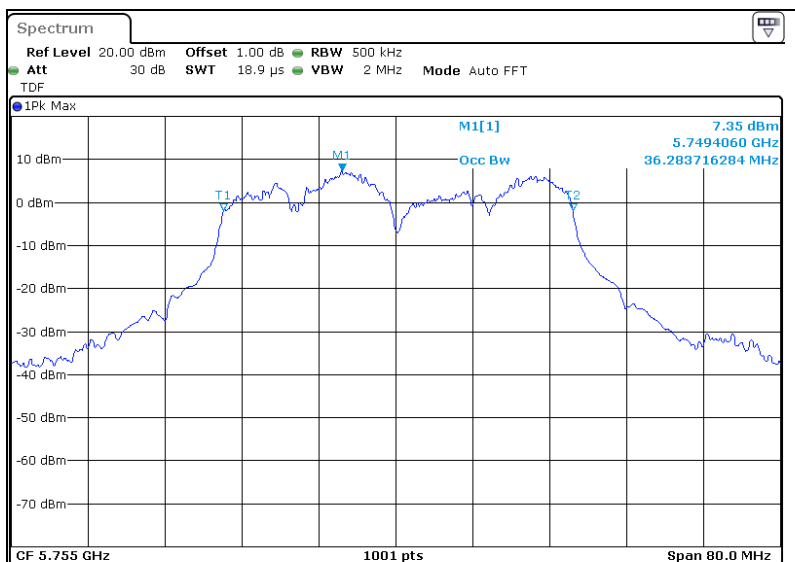


-5 755 MHz

EBW

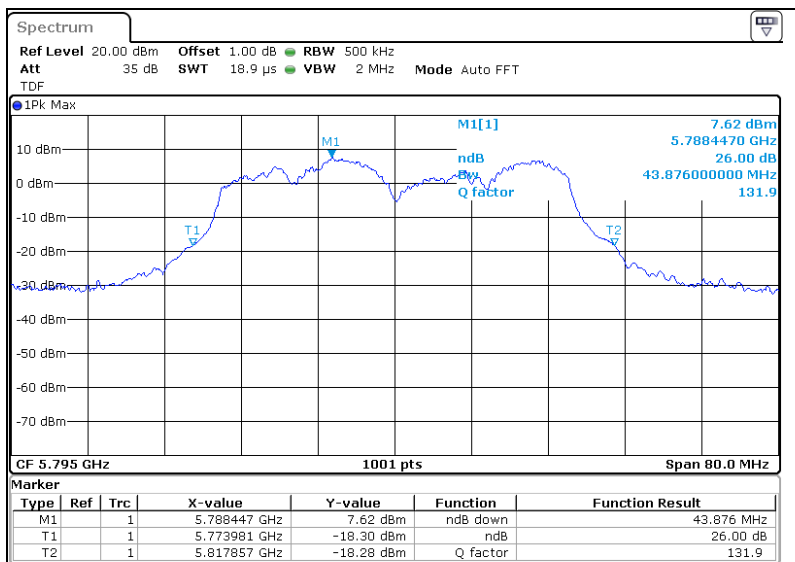


OBW

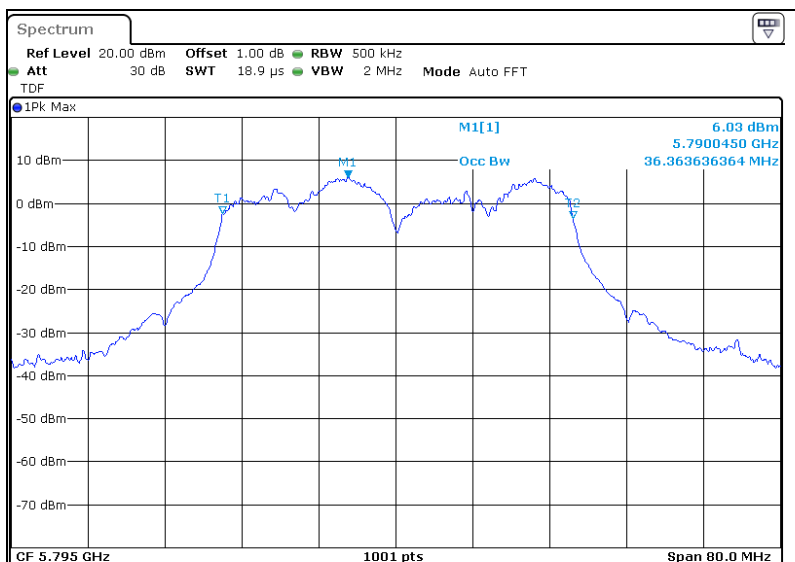


-5 795 MHz

EBW



OBW



5.4 Peak Power Spectral Density

5.4.1 Regulation

According to §15.407 (a)(1)(ii) the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.

According to §15.407(a)(3) 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, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.4.2 Measurement Procedure

These test measurement settings are specified in section E 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 $VBW \geq 3 RBW$.
- c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10\log(500\text{kHz}/RBW)$ to the measured result, whereas $RBW (< 500 \text{ kHz})$ is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
- d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add $10\log(1\text{MHz}/RBW)$ to the measured result, whereas $RBW (< 1 \text{ MHz})$ is the reduced resolution bandwidth of spectrum analyzer set during measurement.
- e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

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

5.4.3 Test Result

-Complied

*** 802.11n_HT40_Band 1_MIMO(ANT 1+2+3)_DC 12 V**

Frequency [MHz]	Reading [dBm]	Duty Factor [dB]	Total result [dBm]	Limit [dBm]	Margin [dB]
5 190	4.24	0.07	4.31	11.00	6.69
5 230	4.11	0.07	4.18	11.00	6.82

*** 802.11n_HT40_Band 1_MIMO(ANT 1+2+3)_DC 24 V**

Frequency [MHz]	Reading [dBm]	Duty Factor [dB]	Total result [dBm]	Limit [dBm]	Margin [dB]
5 190	4.18	0.07	4.25	11.00	6.75
5 230	4.03	0.07	4.10	11.00	6.90

*** 802.11n_HT40_Band 4_MIMO(ANT 1+2+3)_DC 12 V**

Frequency [MHz]	Reading [dBm]	Duty Factor [dB]	Total result [dBm]	Limit [dBm]	Margin [dB]
5 755	0.63	0.07	0.70	30.00	29.30
5 795	0.22	0.07	0.29	30.00	29.71

*** 802.11n_HT40_Band 4_MIMO(ANT 1+2+3)_DC 24 V**

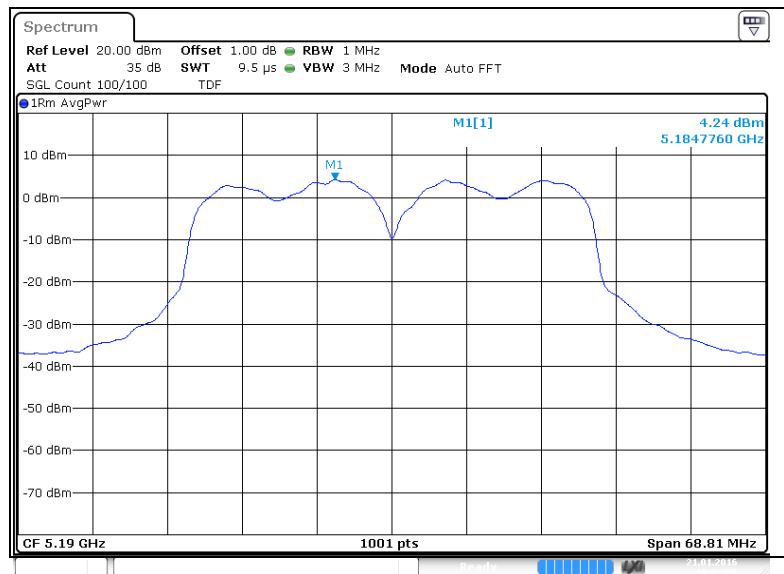
Frequency [MHz]	Reading [dBm]	Duty Factor [dB]	Total result [dBm]	Limit [dBm]	Margin [dB]
5 755	0.69	0.07	0.76	30.00	29.24
5 795	-0.10	0.07	-0.03	30.00	30.03

5.4.4 Test Plot

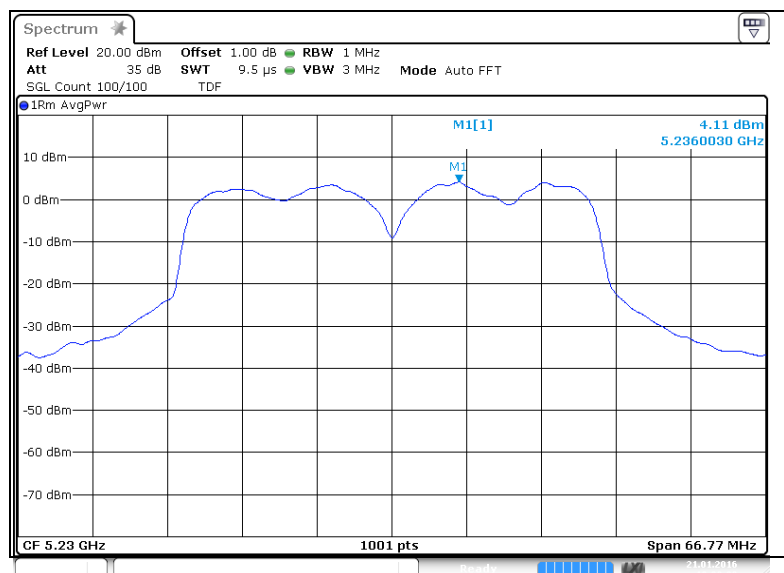
Figure 2. Plot of the Peak Power Spectral Density (Conducted)

* DC 12 V

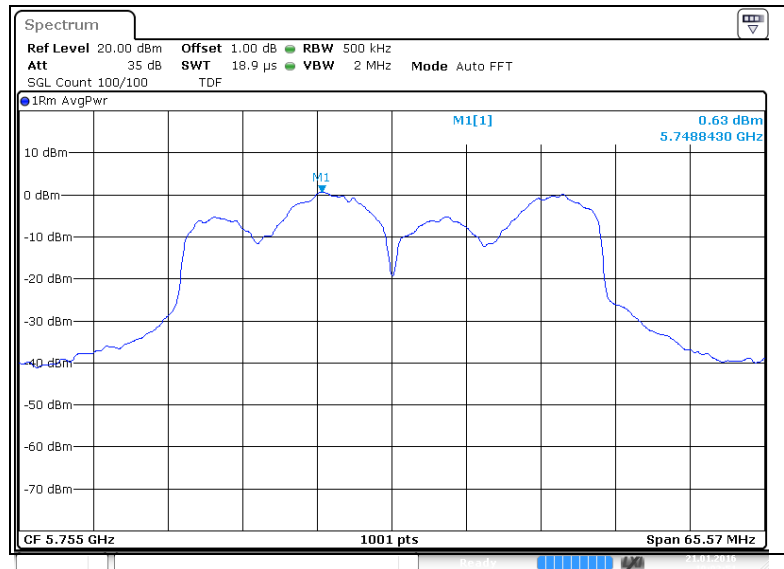
- 5 190 MHz



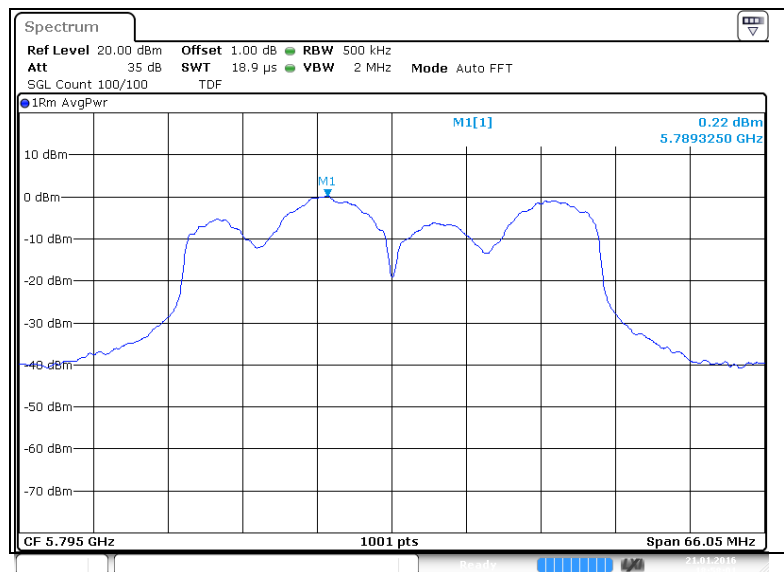
- 5 230 MHz



- 5 755 MHz

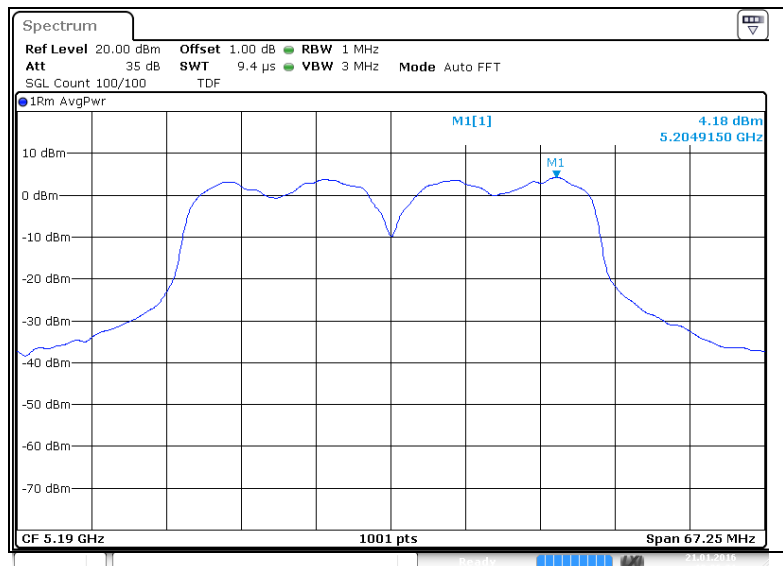


- 5 795 MHz

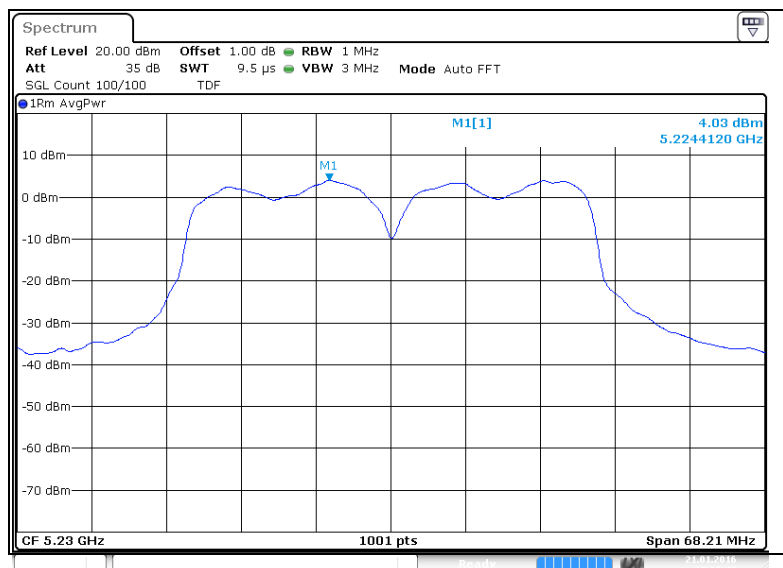


* DC 24 V

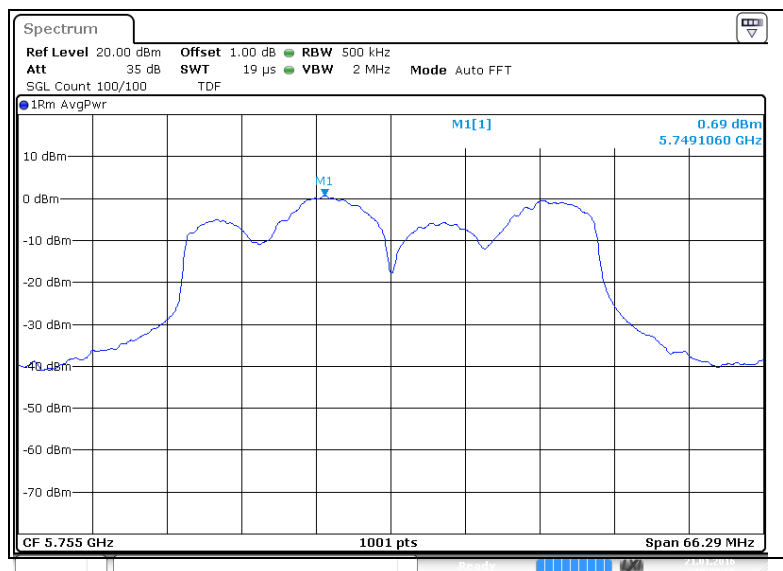
- 5 190 MHz



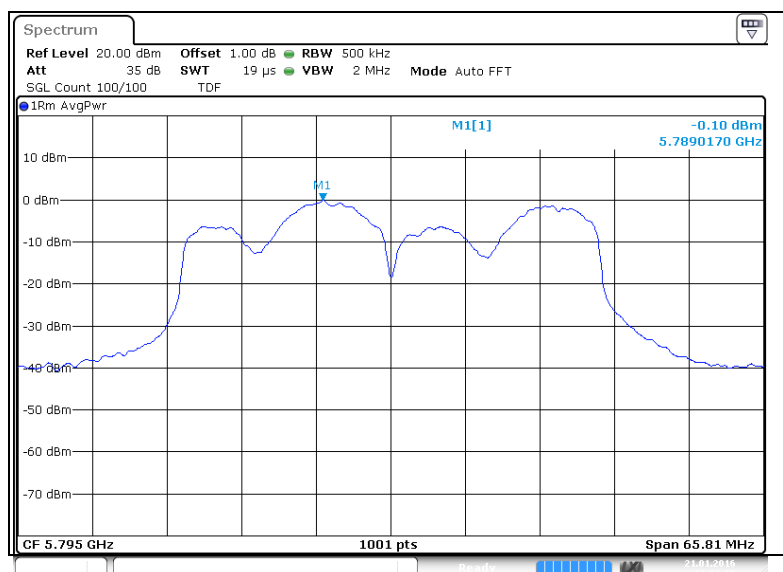
- 5 230 MHz



- 5 755 MHz



- 5 795 MHz



5.6 Spurious Emission, Band Edge And Restricted Bands

5.6.1 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) (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	2400/F(kHz)	300
0.490 -1.705	24000/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.

5.6.2 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).

5.6.2.1 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 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, 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 1000 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) $E[\text{dB}\mu\text{V/m}] = \text{EIRP}[\text{dBm}] - 20 \log(d[\text{meters}]) + 104.77$, where E = field strength and d = distance at which field strength limit is specified in the rules;
 - (ii) $E[\text{dB}\mu\text{V/m}] = \text{EIRP}[\text{dBm}] + 95.2$, for $d = 3$ meters.
- e) For conducted measurements below 1000 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 1000 MHz, or an additional 6 dB shall be added for frequencies below 30 MHz.

(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 1000 MHz”.

As specified in § 15.407(b), emissions above 1000 MHz that are outside of the restricted bands are subject to a maximum emission limit of -27 dBm/MHz (or -17 dBm/MHz as specified in § 15.407(b)(4)).

However, an out-of-band emission that complies with both the peak and average limits of § 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz maximum emission limit.

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

- (i) $\text{EIRP} = ((E \cdot d)^2) / 30$

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:

$$\text{EIRP}[\text{dBm}] = E[\text{dB}\mu\text{V/m}] + 20 \log(d[\text{meters}]) - 104.77$$

- (iii) Or, if d is 3 meters:

$$\text{EIRP}[\text{dBm}] = E[\text{dB}\mu\text{V/m}] - 95.2$$

(3) General Requirements for Unwanted Emissions Measurements

The following requirements apply to all unwanted emissions measurements, both in and outside of the restricted bands:

a) EUT Duty Cycle

(i) The EUT shall be configured or modified to transmit continuously except as stated in (ii), below. The intent is to test at 100 percent duty cycle; however a small reduction in duty cycle (to no lower than 98 percent) is permitted if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.

(ii) If continuous transmission (or at least 98 percent duty cycle) cannot be achieved due to hardware limitations of the EUT (e.g., overheating), the following additions to the measurement and reporting procedures are required:

- The EUT shall be configured to operate at the maximum achievable duty cycle.
- Measure the duty cycle, x , of the transmitter output signal as described in section II.B.
- Adjustments to measurement procedures (e.g., increasing test time and number of traces averaged) shall be performed as described in the procedures below.
- The test report shall include the following additional information:
 - The reason for the duty cycle limitation.
 - The duty cycle achieved for testing and the associated transmit duration and interval between transmissions.
 - The sweep time and the amount of time used for trace stabilization during max-hold measurements for maximum

e) mission measurements.

(iii) Reduction of the measured emission amplitude levels to account for operational duty cycle is not permitted. Compliance is based on emission levels occurring during transmission – not on an average across on and off times of the transmitter.

b) Radiated versus Conducted Measurements.

The unwanted emission limits in both the restricted and non-restricted bands are based on radiated measurements; however, as an alternative, antenna-port conducted measurements in conjunction with cabinet emissions tests will be permitted to demonstrate compliance provided that the following steps are performed:

(i) Cabinet emissions measurements. A radiated test shall be performed to ensure that cabinet emissions are below the emission limits. For the cabinet-emission measurements the antenna may be replaced by a termination matching the nominal impedance of the antenna.

(ii) Impedance matching. Conducted tests shall be performed using equipment that matches the nominal impedance of the antenna assembly used with the EUT.

(iii) EIRP calculation. A value representative of an upper bound on out-of-band antenna gain (in dBi) shall be added to the measured antenna-port conducted emission power to compute EIRP within the specified measurement bandwidth. (For emissions in the restricted bands, additional calculations are required to convert EIRP to field strength at the specified distance.) The upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands or 2 dBi, whichever is greater.³ However, for devices that operate in multiple bands using the same transmit antenna, the highest gain of the antenna within the operating band nearest to the out-of-band frequency being measured may be used in lieu of the overall highest gain when measuring emissions at frequencies within 20 percent of the absolute frequency at the nearest edge of that band, but in no case shall a value less than 2 dBi be selected.

(iv) EIRP adjustments for multiple outputs. For devices with multiple outputs occupying the same or overlapping frequency ranges in the same band (e.g., MIMO or beamforming devices), compute the total EIRP as follows:

- Compute EIRP for each output, as described in (iii), above.
- Follow the procedures specified in KDB Publication 662911 for summing emissions across the outputs or adjusting emission levels measured on individual outputs by $10 \log(NANT)$, where $NANT$ is the number of outputs.
- Add the array gain term specified in KDB Publication 662911 for out-of-band and spurious signals.⁴

c) Direction of maximum emission.

For all radiated emissions tests, measurements shall correspond to the direction of maximum emission level for each measured emission (see ANSI C63.10 for guidance).

d) 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 below. 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 section II.G.5., “Procedures for Unwanted Maximum Emissions Measurements above 1000 MHz”, except for the following changes:

- Set RBW = 100 kHz
- Set VBW $\geq 3 \cdot$ 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 section II.G.6., “Procedures for Average Unwanted Emissions Measurements above 1000 MHz”, except for the following changes:

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

(4) Procedure for Unwanted Emissions Measurements below 1000 MHz

- a) Follow the requirements in section II.G.3., “General Requirements for Unwanted Emissions Measurements”.
- b) Compliance shall be demonstrated using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

(5) Procedure for Unwanted Maximum Emissions Measurements above 1000 MHz

- a) Follow the requirements in section II.G.3., “General Requirements for Unwanted Emissions Measurements”.
- b) Maximum emission levels are measured by setting the analyzer as follows:

- (i) RBW = 1 MHz.
- (ii) VBW ≥ 3 MHz.
- (iii) Detector = Peak.
- (iv) Sweep time = auto.
- (v) Trace mode = max hold.
- (vi) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle. For example, at 50 percent duty cycle, the measurement time will increase by a factor of two relative to measurement time for continuous transmission.

(6) Procedures for Average Unwanted Emissions Measurements above 1000 MHz

- a) Follow the requirements in section II.G.3., “General Requirements for Unwanted Emissions Measurements”.
- b) Average emission levels shall be measured using one of the following two methods.
- c) Method AD (Average Detection): Primary method

- (i) RBW = 1 MHz.
 - (ii) VBW \geq 3 MHz.
 - (iii) Detector = RMS, if span/(# of points in sweep) \leq RBW/2. Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, the detector mode shall be set to peak.
 - (iv) Averaging type = power (i.e., RMS)
As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.
 - (v) Sweep time = auto.
 - (vi) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, the number of traces shall be increased by a factor of 1/x, where x is the duty cycle. For example, with 50 percent duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100 percent duty cycle—rather than turning on and off with the transmit cycle, at least 100 traces shall be averaged.)
 - (vii) If tests are performed with the EUT transmitting at a duty cycle less than 98 percent, a correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
 - If power averaging (RMS) mode was used in step (iv) above, the correction factor is $10 \log(1/x)$, where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 3 dB must be added to the measured emission levels.
 - If linear voltage averaging mode was used in step (iv) above, the correction factor is $20 \log(1/x)$, where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 6 dB must be added to the measured emission levels.
 - If a specific emission is demonstrated to be continuous (100 percent duty cycle) rather than turning on and off with the transmit cycle, no duty cycle correction is required for that emission.
- d) Method VB (Averaging using reduced video bandwidth): Alternative method.
- (i) RBW = 1 MHz.
 - (ii) Video bandwidth.
 - If the EUT is configured to transmit with duty cycle \geq 98 percent, set VBW \leq RBW/100 (i.e., 10 kHz) but not less than 10 Hz.
 - If the EUT duty cycle is $<$ 98 percent, set VBW \geq 1/T, where T is defined in section II.B.1.a).
 - (iii) Video bandwidth mode or display mode
 - The instrument shall be set to ensure that video filtering is applied in the power domain. Typically, this requires setting the detector mode to RMS and setting the Average-VBW Type to Power (RMS).
 - As an alternative, the analyzer may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some analyzers require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to “Voltage” regardless of the display mode.
 - (iv) Detector = Peak.
 - (v) Sweep time = auto.
 - (vi) Trace mode = max hold.
 - (vii) Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98 percent duty cycle. For lower duty cycles, increase the minimum number of traces by a factor of 1/x, where x is the duty cycle. For example, use at least 200 traces if the duty cycle is 25 percent. (If a specific emission is demonstrated to be continuous—i.e., 100 percent duty cycle—rather than turning on and off with the transmit cycle, at least 50 traces shall be averaged.)

5.6.2.2 Spurious Radiated Emissions:

1. The preliminary and final radiated measurements were performed to determine the frequency producing the maximum emissions in at a 10m semi-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 1000 MHz using the Bi-Log 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.

- Sample calculation

The field strength is calculated adding the antenna Factor, cable loss and, Antenna pad adding, subtracting the amplifier gain from the measured reading.

The sample calculation is as follow:

$$\text{Result} = \text{M.R} + \text{C.F}(\text{A.F} + \text{C.L} + 3 \text{ dB Att} - \text{A.G})$$

M.R = Meter Reading

C.F = Correction Factor

A.F = Antenna Factor

C.L = Cable Loss

A.G = Amplifier Gain

3 dB Att = 3 dB Attenuator

If M.R is 30 dB, A.F 12 dB, C.L 5 dB, 3 dB, A.G 35 dB

The result is Peak and Quasi-peak: $30 + 12 + 5 + 3 - 35 = 15 \text{ dB}(\mu\text{V/m})$

5.6.3 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: 5 150 Mhz Band)

802.11n_HT40_MIMO(ANT 1+2+3)_5 230 Mhz_DC 12 V

Frequency [Mhz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 30 Mhz (3m Distance)							
Below 30.00	Not Detected	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 GHz							
47.70	1 000	V	48.70	-13.30	35.40	40.00	4.60
153.07	1 000	V	48.50	-13.80	34.70	43.50	8.80
624.97	1 000	V	45.50	-2.50	43.00	46.00	3.00
Above 700.00	Not Detected	-	-	-	-	-	-

802.11n_HT40_MIMO(ANT 1+2+3)_5 190 Mhz_DC 24 V

Frequency [Mhz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 30 Mhz (3m Distance)							
Below 30.00	Not Detected	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 GHz							
45.76	1 000	V	45.90	-13.20	32.70	40.00	7.30
153.31	1 000	V	45.10	-13.80	31.30	43.50	12.20
624.97	1 000	V	46.60	-2.50	44.10	46.00	1.90
Above 700.00	Not Detected	-	-	-	-	-	-

* 1 GHz ~ 40 GHz data_Band 1_DC 12 V

802.11n_HT40_MIMO(ANT 1+2+3)_5 190 MHz

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz							
*4 799.81	1 000	V	42.30	8.40	50.70	74.00	23.30
8 042.44	1 000	H	34.30	12.30	46.60	74.00	27.40
8 555.62	1 000	V	34.50	12.30	46.80	74.00	27.20
15 935.75	1 000	H	38.00	11.40	49.40	74.00	24.60
39 384.00	1 000	H	44.80	6.40	51.20	74.00	22.80
35 910.75	1 000	V	40.70	10.70	51.40	74.00	22.60
Above 36 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz							
*4 799.81	1 000	V	31.20	8.40	39.60	54.00	14.40
8 042.44	1 000	H	28.10	12.30	40.40	54.00	13.60
8 555.62	1 000	V	28.30	12.30	40.60	54.00	13.40
15 935.75	1 000	H	31.80	11.40	43.20	54.00	10.80
39 384.00	1 000	H	38.20	6.40	44.60	54.00	9.40
35 910.75	1 000	V	34.30	10.70	45.00	54.00	9.00
Above 36 000.00	Not Detected	-	-	-	-	-	-

* This Asterisk means restricted band.

802.11n_HT40_MIMO(ANT 1+2+3)_5 230 MHz

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz							
*5 431.63	1 000	H	42.20	8.40	50.60	74.00	23.40
10 622.75	1 000	V	34.90	12.70	47.60	74.00	26.40
12 255.75	1 000	H	34.10	12.80	46.90	74.00	27.10
15 104.87	1 000	H	36.60	11.70	48.30	74.00	25.70
39 477.50	1 000	H	44.80	6.50	51.30	74.00	22.70
35 883.25	1 000	V	41.10	10.70	51.80	74.00	22.20
Above 36 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz							
*5 431.63	1 000	H	31.50	8.40	39.90	54.00	14.10
10 622.75	1 000	V	28.30	12.70	41.00	54.00	13.00
12 255.75	1 000	H	28.10	12.80	40.90	54.00	13.10
15 104.87	1 000	H	29.70	11.70	41.40	54.00	12.60
39 477.50	1 000	H	38.10	6.50	44.60	54.00	9.40
35 883.25	1 000	V	35.30	10.70	46.00	54.00	8.00
Above 36 000.00	Not Detected	-	-	-	-	-	-

* This Asterisk means restricted band.

* 1 GHz ~ 40 GHz data_Band 4_DC 12 V

802.11_HT40_MIMO(ANT 1+2+3)_5 755 MHz

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μ V)]	Factor [dB]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz							
#5 721.75	1 000	V	42.50	10.00	52.50	78.20	25.70
10 599.75	1 000	H	35.20	12.70	47.90	74.00	26.10
15 283.12	1 000	V	37.00	11.30	48.30	74.00	25.70
16 562.50	1 000	V	36.20	12.70	48.90	74.00	25.10
35 921.75	1 000	H	40.40	10.70	51.10	74.00	22.90
27 988.00	1 000	V	37.00	12.30	49.30	74.00	24.70
Above 28 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz							
10 599.75	1 000	H	29.10	12.70	41.80	54.00	12.20
15 283.12	1 000	V	30.80	11.30	42.10	54.00	11.90
16 562.50	1 000	V	29.60	12.70	42.30	54.00	11.70
35 921.75	1 000	H	33.70	10.70	44.40	54.00	9.60
27 988.00	1 000	V	30.40	12.30	42.70	54.00	11.30
Above 28 000.00	Not Detected	-	-	-	-	-	-

This Hash means out of band.

802.11n_HT40_MIMO(ANT 1+2+3)_5 795 MHz

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μ V)]	Factor [dB]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz							
#5 857.88	1 000	H	41.60	10.20	51.80	78.20	26.40
7 816.75	1 000	V	33.40	12.00	45.40	74.00	28.60
10 609.81	1 000	H	34.50	12.70	47.20	74.00	26.80
15 846.62	1 000	H	37.20	11.30	48.50	74.00	25.50
39 455.50	1 000	H	44.80	6.50	51.30	74.00	22.70
31 037.75	1 000	V	38.60	12.00	50.60	74.00	23.40
Above 32 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz							
7 816.75	1 000	V	27.70	12.00	39.70	54.00	14.30
10 609.81	1 000	H	26.30	12.70	39.00	54.00	15.00
15 846.62	1 000	H	31.10	11.30	42.40	54.00	11.60
39 455.50	1 000	H	38.20	6.50	44.70	54.00	9.30
31 037.75	1 000	V	32.40	12.00	44.40	54.00	9.60
Above 32 000.00	Not Detected	-	-	-	-	-	-

This Hash means out of band.

* 1 GHz ~ 40 GHz data_Band 1_DC 24 V

802.11n_HT40_MIMO(ANT 1+2+3)_5 190 MHz

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz							
*5 052.81	1 000	H	43.00	8.70	51.70	74.00	22.30
10 606.94	1 000	H	34.80	12.70	47.50	74.00	26.50
14 925.19	1 000	V	36.70	11.50	48.20	74.00	25.80
16 657.37	1 000	H	37.10	12.60	49.70	74.00	24.30
20 112.00	1 000	H	38.80	10.90	49.70	74.00	24.30
36 672.50	1 000	V	41.10	9.80	50.90	74.00	23.10
Above 37 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz							
*5 052.81	1 000	H	31.70	8.70	40.40	54.00	13.60
10 606.94	1 000	H	28.60	12.70	41.30	54.00	12.70
14 925.19	1 000	V	30.10	11.50	41.60	54.00	12.40
16 657.37	1 000	H	30.90	12.60	43.50	54.00	10.50
20 112.00	1 000	H	31.90	10.90	42.80	54.00	11.20
36 672.50	1 000	V	34.20	9.80	44.00	54.00	10.00
Above 37 000.00	Not Detected	-	-	-	-	-	-

* This Asterisk means restricted band.

802.11n_HT40_MIMO(ANT 1+2+3)_5 230 MHz

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μ V)]	Factor [dB]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz							
*5 406.88	1 000	H	42.00	8.40	50.40	74.00	23.60
7 841.19	1 000	V	33.20	12.10	45.30	74.00	28.70
10 562.37	1 000	H	34.30	12.70	47.00	74.00	27.00
14 987.00	1 000	V	37.20	11.70	48.90	74.00	25.10
34 230.50	1 000	V	39.40	11.70	51.10	74.00	22.90
39 414.25	1 000	H	45.20	6.40	51.60	74.00	22.40
Above 40 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz							
*5 406.88	1 000	H	31.50	8.40	39.90	54.00	14.10
7 841.19	1 000	V	27.00	12.10	39.10	54.00	14.90
10 562.37	1 000	H	28.30	12.70	41.00	54.00	13.00
14 987.00	1 000	V	30.90	11.70	42.60	54.00	11.40
34 230.50	1 000	V	32.60	11.70	44.30	54.00	9.70
39 414.25	1 000	H	38.40	6.40	44.80	54.00	9.20
Above 40 000.00	Not Detected	-	-	-	-	-	-

* This Asterisk means restricted band.

* 1 GHz ~ 40 GHz data_Band 4_DC 24 V

802.11_HT40_MIMO(ANT 1+2+3)_5 755 MHz

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz							
#5 724.50	1 000	H	41.60	10.00	51.60	78.20	26.60
7 799.50	1 000	H	33.80	12.00	45.80	74.00	28.20
12 531.75	1 000	V	34.80	12.30	47.10	74.00	26.90
16 664.56	1 000	H	35.80	12.60	48.40	74.00	25.60
39 472.00	1 000	H	45.40	6.50	51.90	74.00	22.10
34 090.25	1 000	V	39.90	11.70	51.60	74.00	22.40
Above 35 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz							
7 799.50	1 000	H	27.60	12.00	39.60	54.00	14.40
12 531.75	1 000	V	28.90	12.30	41.20	54.00	12.80
16 664.56	1 000	H	29.30	12.60	41.90	54.00	12.10
39 472.00	1 000	H	38.10	6.50	44.60	54.00	9.40
34 090.25	1 000	V	33.30	11.70	45.00	54.00	9.00
Above 35 000.00	Not Detected	-	-	-	-	-	-

This Hash means out of band.

802.11n_HT40_MIMO(ANT 1+2+3)_5 795 MHz

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μ V)]	Factor [dB]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz							
#5 854.44	1 000	H	42.30	10.20	52.50	78.20	25.70
7 818.19	1 000	V	33.80	12.00	45.80	74.00	28.20
15 033.00	1 000	H	37.20	11.70	48.90	74.00	25.10
16 604.19	1 000	V	36.10	12.70	48.80	74.00	25.20
20 263.25	1 000	V	37.70	11.30	49.00	74.00	25.00
30 537.25	1 000	H	37.90	12.00	49.90	74.00	24.10
Above 31 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz							
7 818.19	1 000	V	27.90	12.00	39.90	54.00	14.10
15 033.00	1 000	H	30.40	11.70	42.10	54.00	11.90
16 604.19	1 000	V	29.80	12.70	42.50	54.00	11.50
20 263.25	1 000	V	31.40	11.30	42.70	54.00	11.30
30 537.25	1 000	H	32.10	12.00	44.10	54.00	9.90
Above 31 000.00	Not Detected	-	-	-	-	-	-

This Hash means out of band.

5.7 Frequency Stability

5.7.1 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.

5.7.2 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.

5.7.3 Test Result

- Complied

* DC 12 V

- 5 190 MHz

Voltage (%)	Power (V _{DC})	Temp. (°C)	Reading Frequency (Hz)	Frequency Error (Hz)	Frequency Error (%)
100	12.0	-20	5 190 096 000	96 000	0.001 8
100		-10	5 190 079 500	79 500	0.001 5
100		0	5 190 044 000	44 000	0.000 8
100		10	5 190 040 000	40 000	0.000 8
100		20	5 190 040 000	40 000	0.000 8
100		30	5 190 030 000	30 000	0.000 6
100		40	5 190 080 000	80 000	0.001 5
100		50	5 190 079 500	79 500	0.001 5
100		60	5 190 079 500	79 500	0.001 5
100		Normal	5 189 960 000	-40 000	-0.000 8
85	10.2	Normal	5 189 920 000	-80 000	-0.001 5
115	13.8	Normal	5 189 960 000	-40 000	-0.000 8

- 5 755 MHz

Voltage (%)	Power (V _{DC})	Temp. (°C)	Reading Frequency (Hz)	Frequency Error (Hz)	Frequency Error (%)
100	12.0	-20	5 755 080 000	80 000	0.001 4
100		-10	5 755 079 500	79 500	0.001 4
100		0	5 755 040 000	40 000	0.000 7
100		10	5 754 952 000	-48 000	-0.000 8
100		20	5 754 948 000	-52 000	-0.000 9
100		30	5 755 039 500	39 500	0.000 7
100		40	5 755 040 000	40 000	0.000 7
100		50	5 755 080 000	80 000	0.001 4
100		60	5 755 092 000	92 000	0.001 6
100		Normal	5 754 960 000	-40 000	-0.000 7
85	10.2	Normal	5 754 920 500	-79 500	-0.001 4
115	13.8	Normal	5 754 920 000	-80 000	-0.001 4

*** DC 24 V**

- 5 190 MHz

Voltage (%)	Power (V _{DC})	Temp. (°C)	Reading Frequency (Hz)	Frequency Error (Hz)	Frequency Error (%)
100	24.0	-20	5 189 924 000	-76 000	-0.001 5
100		-10	5 189 928 000	-72 000	-0.001 4
100		0	5 189 972 000	-28 000	-0.000 5
100		10	5 190 012 000	12 000	0.000 2
100		20	5 190 028 000	28 000	0.000 5
100		30	5 190 040 000	40 000	0.000 8
100		40	5 190 048 000	48 000	0.000 9
100		50	5 190 076 000	76 000	0.001 5
100		60	5 190 080 000	80 000	0.001 5
100		Normal	5 189 940 000	-60 000	-0.001 2
85	20.4	Normal	5 189 928 000	-72 000	-0.001 4
115	27.6	Normal	5 189 932 000	-68 000	-0.001 3

- 5 755 MHz

Voltage (%)	Power (V _{DC})	Temp. (°C)	Reading Frequency (Hz)	Frequency Error (Hz)	Frequency Error (%)
100	24.0	-20	5 755 080 000	80 000	0.001 4
100		-10	5 755 071 950	71 950	0.001 3
100		0	5 755 012 000	12 000	0.000 2
100		10	5 754 988 000	-12 000	-0.000 2
100		20	5 755 015 950	15 950	0.000 3
100		30	5 755 028 000	28 000	0.000 5
100		40	5 755 076 000	76 000	0.001 3
100		50	5 755 072 000	72 000	0.001 3
100		60	5 755 084 000	84 000	0.001 5
100		Normal	5 754 948 000	-52 000	-0.000 9
85	20.4	Normal	5 754 960 000	-40 000	-0.000 7
115	27.6	Normal	5 754 964 000	-36 000	-0.000 6

5.8 Conducted Emission

5.8.1 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 µH/50 ohms 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 (dBµV)	
	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.

5.8.2 Measurement Procedure

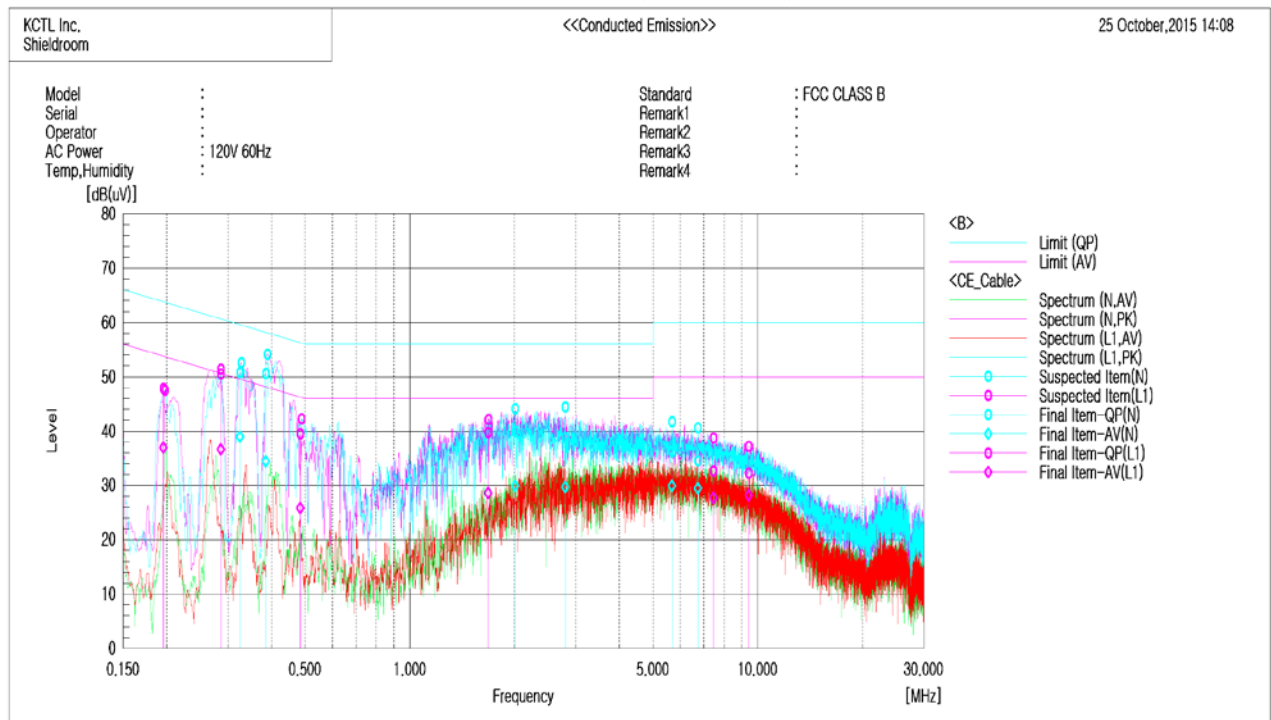
1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50µH LISN, which is 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 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.

5.8.3 Test Result

- Complied

Figure 4. plot of Conducted Emission

*Conducted worst-case data : 802.11n_HT40_MIMO(ANT 1+2+3) 5 230 MHz



Final Result

— N Phase —

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading CAV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result CAV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin CAV [dB]
1	0.32539	41.1	29.2	9.7	50.8	38.9	59.6	49.6	8.8	10.7
2	0.38626	40.7	24.6	9.9	50.6	34.5	58.1	48.1	7.5	13.6
3	2.00773	30.3	20.2	9.7	40.0	29.9	56.0	46.0	16.0	16.1
4	2.79919	29.1	20.0	9.7	38.8	29.7	56.0	46.0	17.2	16.3
5	5.6757	26.5	20.3	9.7	36.2	30.0	60.0	50.0	23.8	20.0
6	6.73377	24.9	19.8	9.7	34.6	29.5	60.0	50.0	25.4	20.5

— L1 Phase —

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading CAV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result CAV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin CAV [dB]
1	0.196	37.9	27.1	9.9	47.8	37.0	63.8	53.8	16.0	16.8
2	0.28687	41.7	26.9	9.7	51.4	36.6	60.6	50.6	9.2	14.0
3	0.4846	29.6	16.0	9.9	39.5	25.9	56.3	46.3	16.8	20.4
4	1.68017	30.0	18.9	9.7	39.7	28.6	56.0	46.0	16.3	17.4
5	7.46878	22.8	17.9	9.8	32.6	27.7	60.0	50.0	27.4	22.3
6	9.42546	22.4	18.3	9.8	32.2	28.1	60.0	50.0	27.8	21.9

6. Test equipment used for test

	Description	Manufacturer	Model No.	Serial No.	Next Cal Date.
■	Spectrum Analyzer	R&S	FSV30	100807	16.09.02
■	Spectrum Analyzer	R&S	FSV40	100988	17.01.07
■	Wideband Power Sensor	R&S	NRP-Z81	100677	17.01.08
■	Test Receiver	ESR	ESR	101078	16.09.02
■	Bi-Log Antenna	SCHWARZBECK	VULB 9163	552	16.07.10
■	Amplifier	SONOMA INSTRUMENT	310N	344922	16.09.02
■	Attenuator	SCHWARZBECK	DGA9552N	BU2404	16.06.16
■	Horn Antenna	ETS.lindgren	3117	155787	16.11.25
■	Broadband Preamplifier	SCHWARZBECK	BBV9718	216	16.11.11
■	Loop Antenna	R&S	HFH2-Z2	861971003	17.03.03
■	Antenna Mast	MATURO	AM4.0	079/3440509	-
■	Turn Table	MATURO	CO2000-SOFT	-	-
■	Horn Antenna	ETS.lindgren	3116	86635	16.04.29
■	Broadband Preamplifier	SCHWARZBECK	BBV9721	2	16.05.19
■	Vector Signal Generator	R&S	SMBV100A	257566	17.01.07
■	Highpass Filter	Wainwright Instruments GmbH	WHKX6.5/18G-8SS	2	16.06.15
■	Power Divider	Aeroflex/Weinschel, Inc	1594	671	17.01.12
■	50Ω Termination	-	50 Ω	R5	16.11.05
■	Temp & Humid Chamber	ESPEC CORP.	SH-661	92004048	17.01.26
■	DC Power Supply	Agilent	E3632A	MY40008800	16.12.09
■	3 dB Attenuator	HP	8491B	22981	16.09.01
■	Antenna Mast	Innco Systems	MA4000-EP	303	-
■	Turn Table	Innco Systems	DT2000S-1t	79	-