

Shenzhen Thousandshores Technology Co., Ltd.

TEST REPORT

SCOPE OF WORK

EMC TESTING—ACS1

REPORT NUMBER

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FCC WIFI 5G

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TEST REPORT

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Intertek Report No: 240229015GZU-003
FCC ID: 2ALNA-FITCTRL

Test standards

47 CFR PART 15 Subpart E: 2023 section 15.407

Sample Description

Product : Control Display-ACS1
Model No. : ACS1
Electrical Rating : Adapter input 5V/2A
Serial No. : Not Labeled
Date Received : 29 February 2024
Date Test Conducted : 03 January 2025-13 January 2025

Prepared and Checked By



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TEST REPORT
1.0 TEST RESULT SUMMARY

Test Item	Test Requirement	Test Method	Result
Antenna Requirement	FCC PART 15 C clause 15.203	FCC PART 15 C clause 15.247 (c) and clause 15.203	PASS
26 dB Bandwidth / 99% Occupied Bandwidth	FCC PART 15 E clause 15.407(a)	FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04, Clause C&D	PASS
6 dB Bandwidth	FCC PART 15 E clause 15.407(e) Only for band IV	FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04, Clause C	PASS
Maximum Conducted Output Power	FCC PART 15 E clause 15.407(a)	FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04, Clause E	PASS
Maximum Peak Power Spectral Density	FCC PART 15 E clause 15.407(a)	FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04, Clause F	PASS
Radiated spurious emission	FCC PART 15 E clause 15.407(b)	FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04, Clause G	PASS
Band Edge	FCC PART 15 E clause 15.407(b)	FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04, Clause G	PASS
Conducted Emissions at Mains Terminals	FCC PART 15 E section 15.207	ANSI C63.10: Clause 6.2	PASS
Remark: N/A: not applicable. Refer to the relative section for the details. EUT: In this whole report EUT means Equipment Under Test. Tx: In this whole report Tx (or tx) means Transmitter. Rx: In this whole report Rx (or rx) means Receiver. RF: In this whole report RF means Radio Frequency. ANSI C63.10: the detail version is ANSI C63.10:2013 in the whole report			

TEST REPORT

2.0 General Description

2.1 Product Description

Operating Frequency:	Band IV 5725 MHz to 5850MHz 802.11a/n(HT20,HT40)
Type of Modulation:	802.11a: OFDM (BPSK/QPSK/16QAM/64QAM) 802.11n: OFDM (BPSK/QPSK/16QAM/64QAM)
Transmit Data Rate:	802.11a :6/9/12/18/24/36/48/54 Mbps 802.11n(HT20): MCS0: 7.2Mbps, MCS1:14.2Mbps, MCS2:21.7Mbps, MCS3:28.9Mbps, MCS4:43.3Mbps, MCS5:57.8Mbps, MCS6:65.0Mbps, MCS7:72.2Mbps 802.11n(HT40): MCS0:15Mbps, MCS1:30Mbps, MCS2:45Mbps, MCS3:60Mbps, MCS4:90Mbps, MCS5:120Mbps, MCS6:135Mbps, MCS7:150Mbps
Number of Channels	Band IV 5725MHz to 5850MHz 5 Channels for 802.11a/n(HT20) 2 Channels for 802.11n(HT40)
Channel Separation:	20 MHz
Antenna Type	FPC antenna
Antenna gain:	0.78 dBi
Function:	Control Display-ACS1 with 5 GHz WIFI
EUT Power Supply:	120V/60Hz
channels and frequencies list:	Band IV 5725 MHz to 5850 MHz For 802.11a/an (HT20)/an (HT20): test frequencies are lowest channel 149: 5745 MHz, middle channel 157: 5785 MHz and highest channel 165: 5825 MHz For 802.11n(HT40): test frequencies are lowest channel 151: 5755 MHz and highest channel 159: 5795 MHz

For WIFI a(20)/WIFI n(HT 20):

Band IV(5725MHz-5850MHz)	
Channel	Frequency (MHz)
149	5745
153	5765
157	5785
161	5805
165	5825

TEST REPORT

For WIFI n(HT 40):

Band IV(5725MHz-5850MHz)	
Channel	Frequency (MHz)
151	5755
159	5795

2.2 Related Submittal(s) Grants

This is an application for certification of:

Unlicensed National Information Infrastructure Devices (WIFI transmitter portion).

DTS- Part 15 Digital Transmission Systems (WIFI transmitter portion).

2.3 Test Methodology

The EUT was performed according to the procedures in FCC Part 15 E, Section15.203, 15.207, 15.209, 15.407 and ANSI C63.4:2014, method of measurement: reference to FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04.

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.10:2013. Radiated emission measurement was performed in semi-anechoic chamber and conducted emission measurement was performed in shield room. For radiated emission measurement, preliminary scans and final tests were performed in the semi-anechoic chamber to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise.

2.4 Test Facility

All tests were performed at:

Intertek Testing Services Shenzhen Ltd. Guangzhou Branch

Room102/104, No 203, KeZhu Road, Science City, GETDD Guangzhou, China

Except Conducted Emissions was performed at:

Room101/301/401/102/202/302/402/502/602/702/802, No. 7-2, Caipin Road, Huangpu District, Guangzhou, Guangdong, China

A2LA Certificate Number 0078.10

TEST REPORT

Intertek Testing Services Shenzhen Ltd. Guangzhou Branch is accredited by A2LA and Listed in FCC website. FCC accredited test labs may perform both Certification testing under Parts 15 and 18 and Declaration of Conformity testing.

3.0 System Test Configuration

3.1 Justification

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, AC power line was manipulated to produce worst case emissions. It was powered by AC 120V/60Hz supply.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. The spurious emissions more than 20 dB below the permissible value are not reported.

For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in the following table:

Frequency range of radiated emission measurements

Lowest frequency generated in the device	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified

Number of fundamental frequencies to be tested in EUT transmit band

Frequency range in which device operates	Number of frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

TEST REPORT

3.2 EUT Exercising Software

Description	Manufacturer	Model No.	SN/Version	Supplied by
For fixing frequency	---	AmebaD_mptoo I	2V2	Applicant

3.3 Special Accessories

No special accessories used.

3.4 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	20 dB Bandwidth	2.31%
	6dB Bandwidth	
	99% Bandwidth	
2	Carrier Frequencies Separated	2.31%
3	Dwell Time	1.19%
4	Maximum Peak Conducted Output Power	1.98 dB
5	Peak Power Spectral Density	1.98 dB
6	Out of Band Conducted Emissions	1.98 dB
7	Band edges measurement	1.98 dB
8	Radiated Emissions	3.64 dB (9 kHz-30 MHz)
		4.26 dB (30 MHz-1 GHz)
		4.96 dB (1 GHz-18 GHz)
		5.16 dB (18 GHz-40 GHz)
9	Conducted Emissions at Mains Terminals	2.23 dB
10	Temperature	0.81 °C
11	Humidity	1.73%
12	Time	1.19%

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT.

Measurement uncertainty is calculated in accordance with ETSI TR 100 028-2001.

The measurement uncertainty is given with a confidence of 95%, k=2.

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

Uncertainty and Compliance – Unless the standard specifically states that measured values are to be extended by the measurement uncertainty in determining compliance, all compliance determinations are based on the actual measured value

TEST REPORT**3.5 Equipment Modification**

Any modifications installed previous to testing by Shenzhen Thousandshores Technology Co., Ltd. will be incorporated in each production model sold / leased in the United States.

No modifications were installed by Intertek Testing Services Shenzhen Ltd. Guangzhou Branch.

3.6 Support Equipment List and Description

This product was tested with corresponding support equipment as below:

Cable

Description	Model No.	Connector type	Cable length/type	Supplied by
Antenna cable	RF-01	SMA	0.2 m(shielded)	Intertek

Support equipment

Description	Model No.	Rating	Supplied by
NoteBook	Latitude 5420	100-240VAC,50/60Hz	Intertek
Adaptor	MDY-11-EX	100-240VAC,50/60Hz	Intertek

Remark:

After the frequency was fixed, Notebook and Fix board were removed out of the Chamber before test.

TEST REPORT

4.0 Measurement Results

4.1 Antenna Requirement

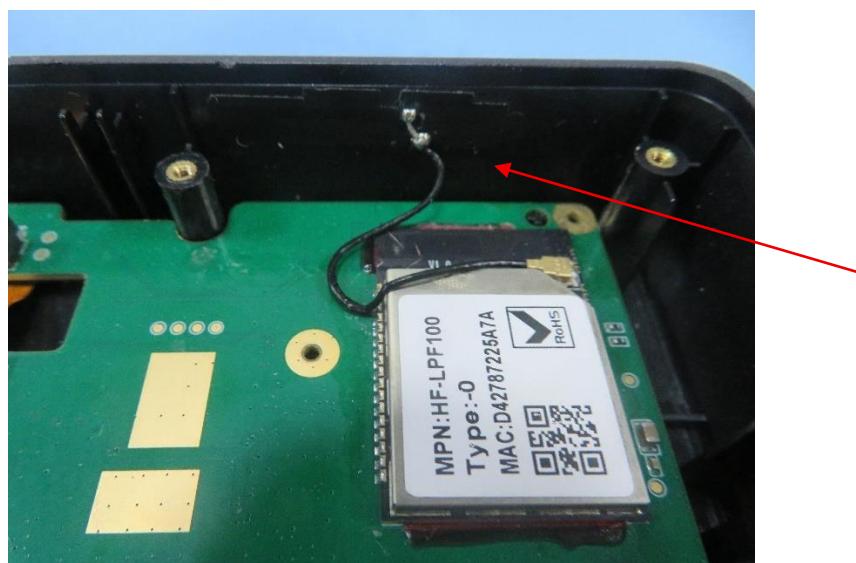
Standard requirement:

15.203 requirement:

For intentional device. 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.

EUT Antenna

The antenna is an integral antenna and no consideration of replacement. The best case gain
of the antenna is 0.78 dBi.



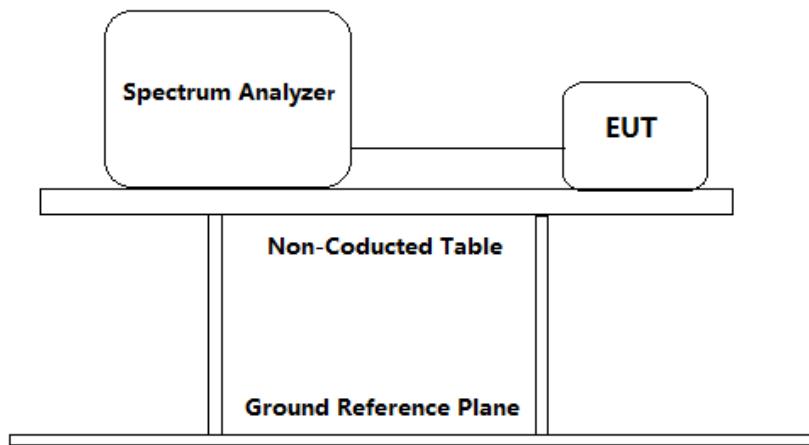
TEST REPORT**4.2 Duty Cycle**

Test Requirement: FCC KDB 789033 D02 General UNII Test Procedures New
Rules v01r04,Clause B

Test Method: FCC KDB 789033 D02 General UNII Test Procedures New
Rules v01r04,Clause B

Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Test Configuration:

**Test Procedure:**

1. Remove the antenna from the EUT and then connect a low attention attenuation RF cable (cable loss =1 dB, with 10dB attenuator) from the antenna port to the spectrum.
2. Set the spectrum analyser:
 - a) Set RBW $\geq 1\text{MHz}$
 - b) Set the VBW $\geq [3 \times \text{RBW}]$
 - c) Detector =peak
 - d) Span = Zero span
 - e) Sweep time = 100ms
 - f) Trace mode = Free run
3. Repeat until all the test status is investigated.
4. Report the worst case.

Used Test Equipment List

Spectrum Analyzer. Refer to Clause 5 Test Equipment List for details.

TEST REPORT

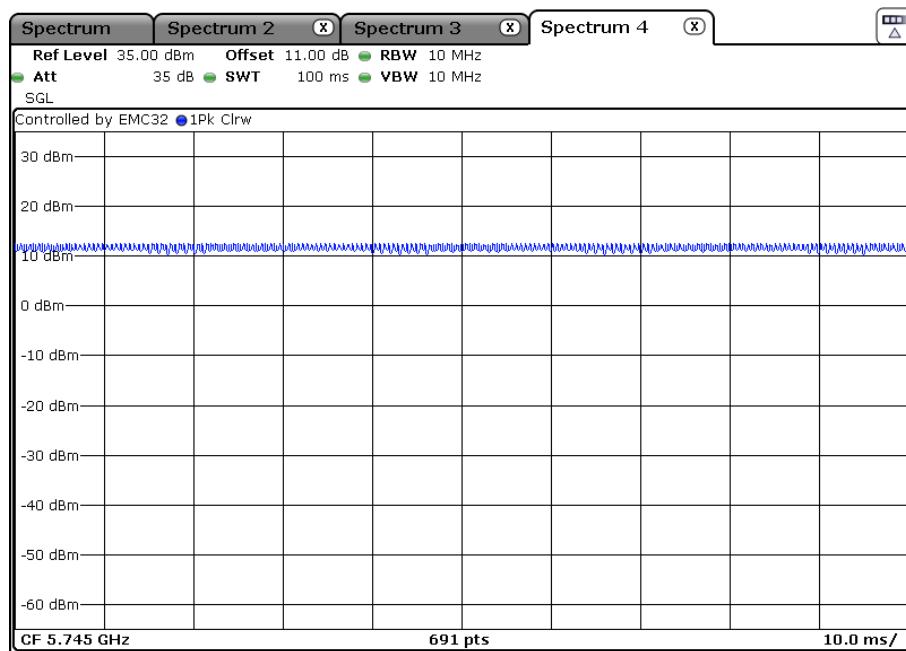
Test result:

Channel No.	Frequency (MHz)	Mode	On time (ms)	Period (ms)	Duty Cycle (%)
149	5745	802.11a(20)	100	100	100
149	5745	802.11n (HT20)	100	100	100
151	5755	802.11n (HT40)	100	100	100

Result plot as follows:

802.11a(20)

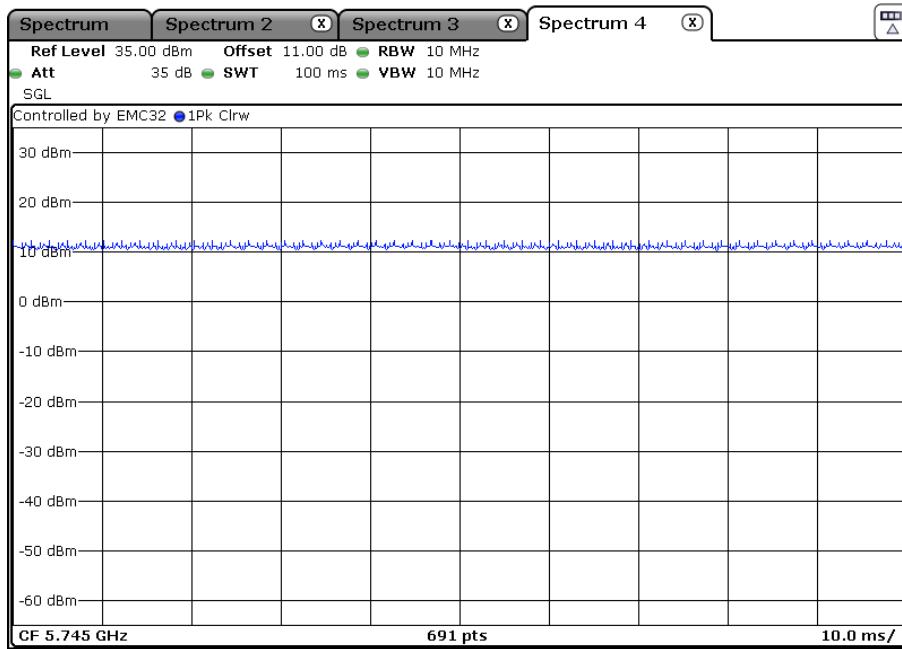
Channel 149: 5745 MHz:



TEST REPORT

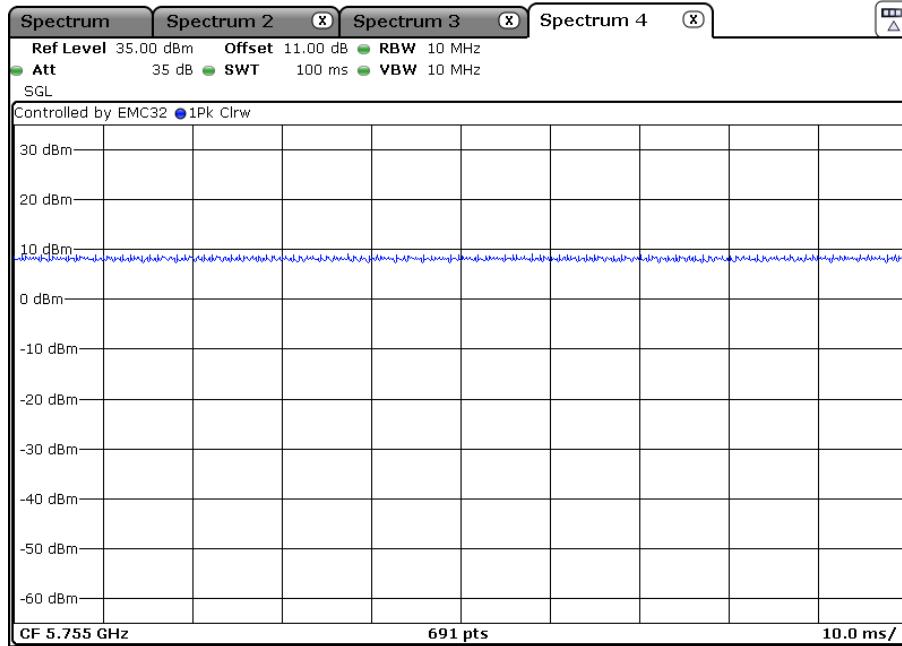
802.11n(HT20)

Channel 149: 5745 MHz:



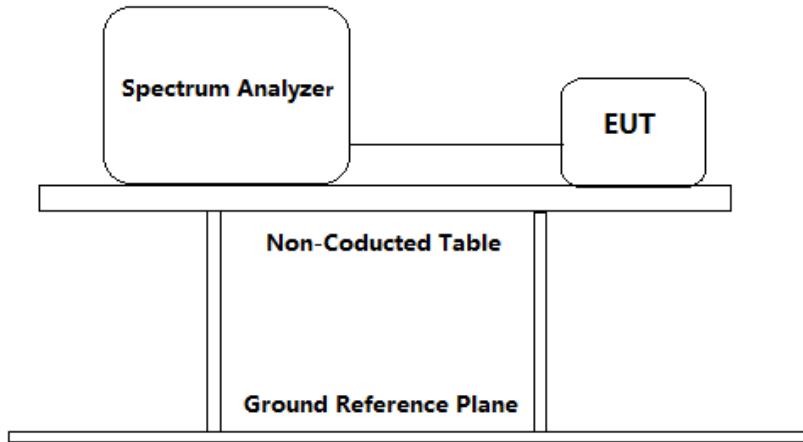
802.11n(HT40)

Channel 151: 5755 MHz:



TEST REPORT**4.3 26 dB Bandwidth**

Test Requirement: FCC PART 15 E clause 15.407(a)
Test Method: FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04, Clause C&D
Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.
Test Configuration:

**Test Procedure:**

1. Remove the antenna from the EUT and then connect a low attention attenuation RF cable (cable loss =1 dB, with 10dB attenuator) from the antenna port to the spectrum.
2. Set the spectrum analyzer:
 - a) Set the RBW = approximately 1% of the emission bandwidth.
 - b) Set the VBW $\geq [3 \times \text{RBW}]$.
 - c) Detector = peak.
 - d) Trace mode = max hold.
 - e) Sweep = auto couple.
 - f) Allow trace to fully 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 26 dB relative to the maximum level measured in the fundamental emission.
3. Repeat until all the test status is investigated.

TEST REPORT

4. Report the worst case.

Used Test Equipment List

Spectrum Analyzer. Refer to Clause 5 Test Equipment List for details.

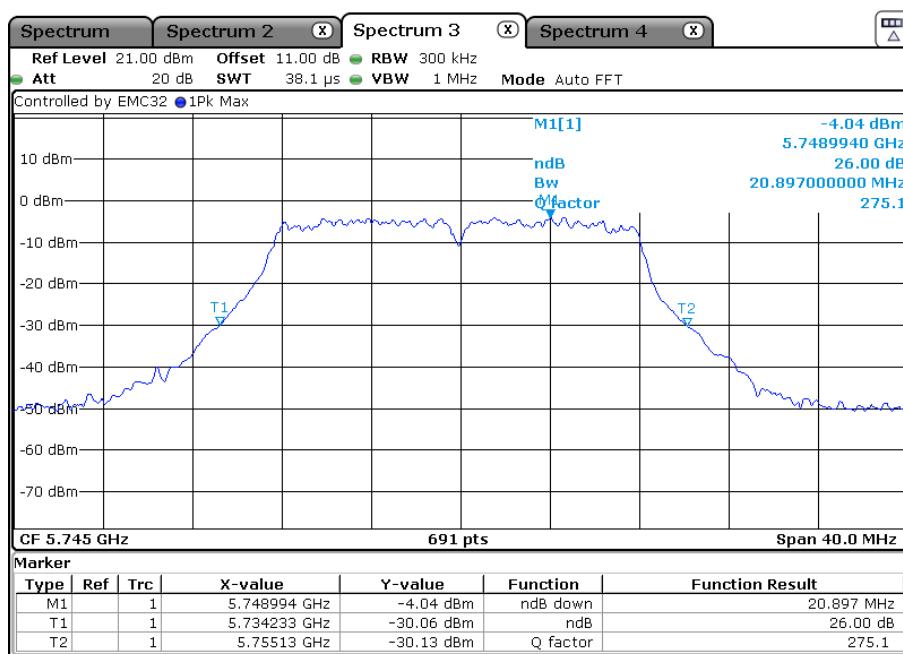
Channel No.	Frequency (MHz)	Mode	Data Rate	26dB Bandwidth (MHz)
149	5745	802.11a(20)	6 Mbps	20.9
157	5785		6 Mbps	21.1
165	5825		6 Mbps	21.2
149	5745	802.11n (HT20)	7.2 Mbps	22.0
157	5785		7.2 Mbps	21.4
165	5825		7.2 Mbps	21.5
151	5755	802.11n (HT40)	15 Mbps	39.0
159	5795		15 Mbps	39.0

Test result: The unit does meet the FCC requirements.

Result plot as follows:

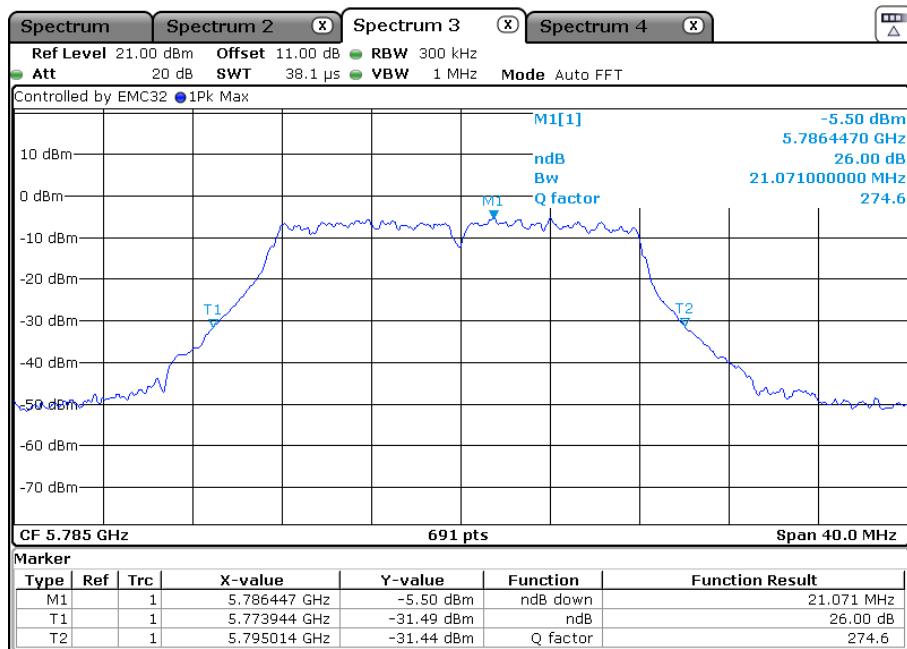
802.11a(20) mode

Channel 149: 5745 MHz:

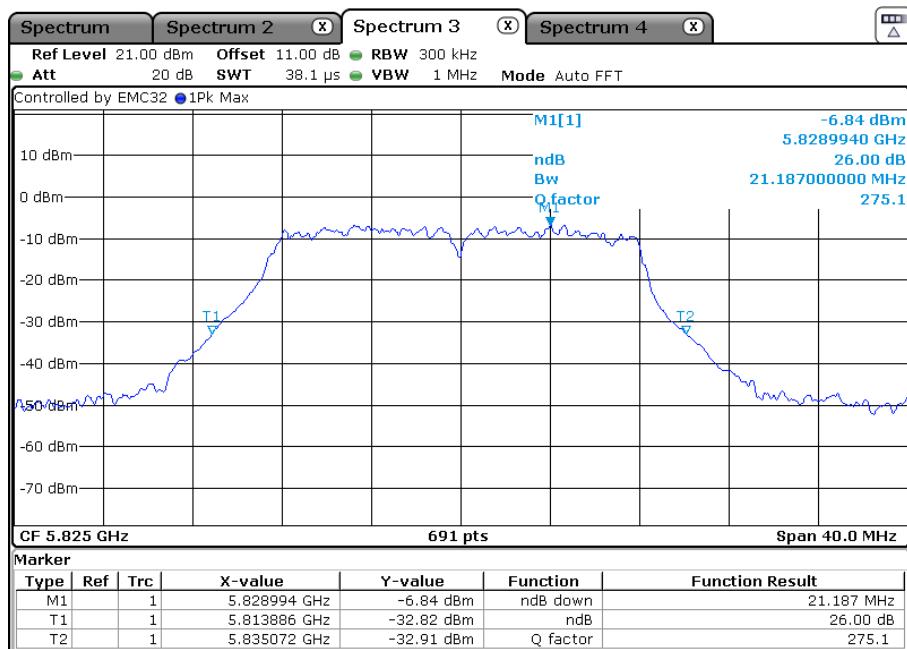


TEST REPORT

Channel 157: 5785 MHz:



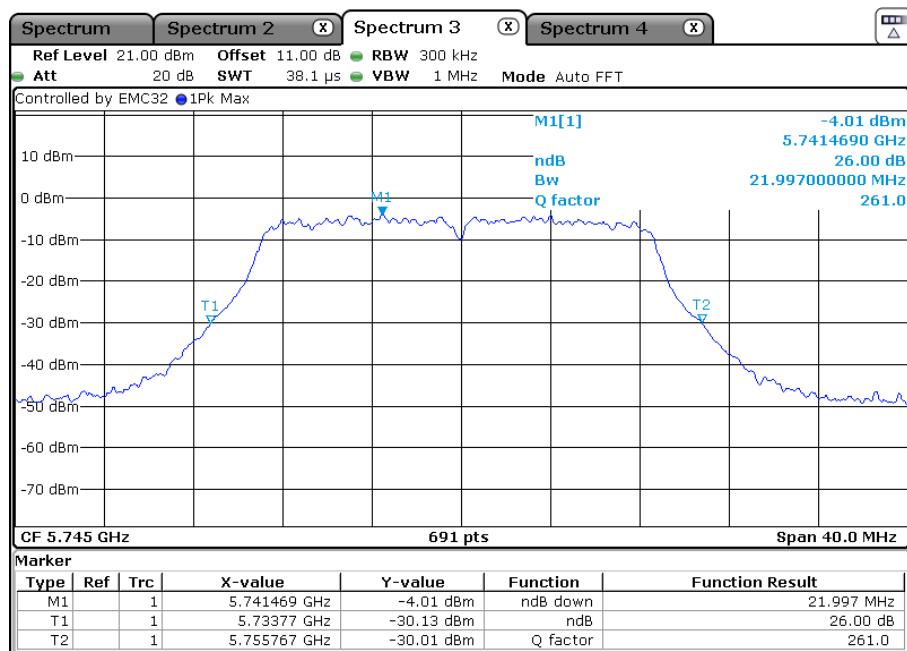
Channel 165: 5825 MHz:



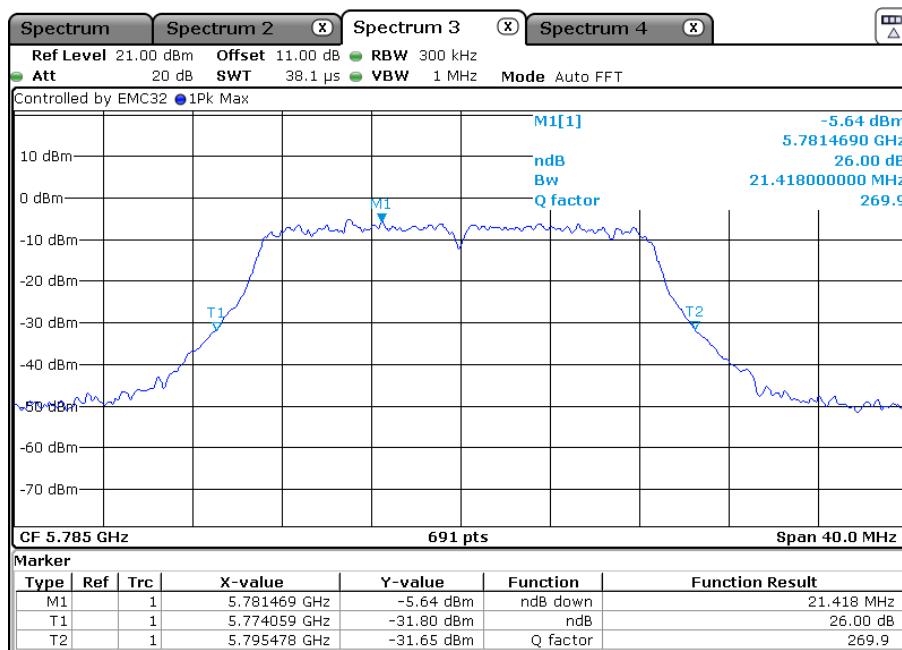
TEST REPORT

802.11n(HT 20)

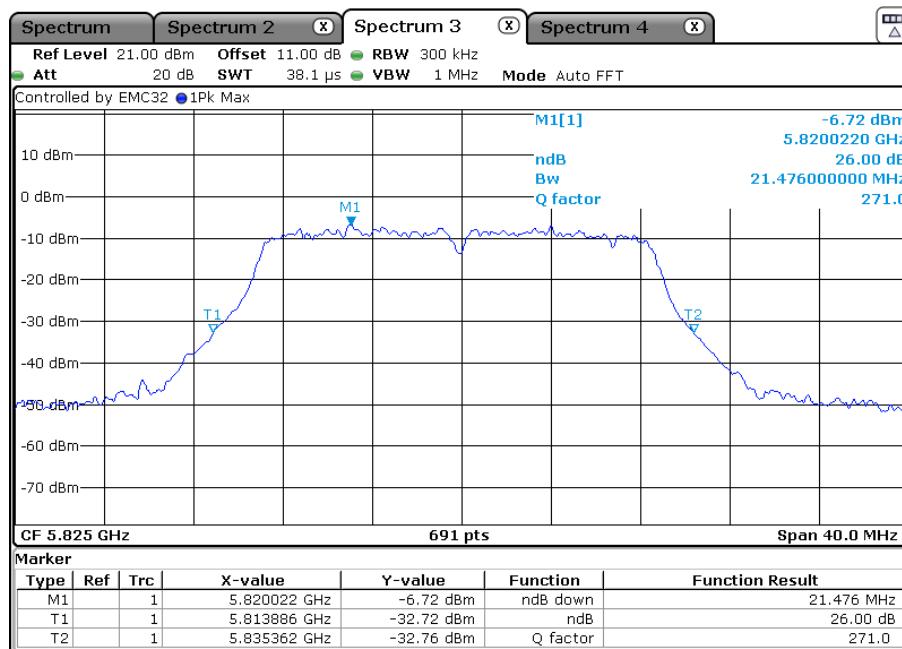
Channel 149: 5745 MHz:



Channel 157: 5785 MHz:

TEST REPORT


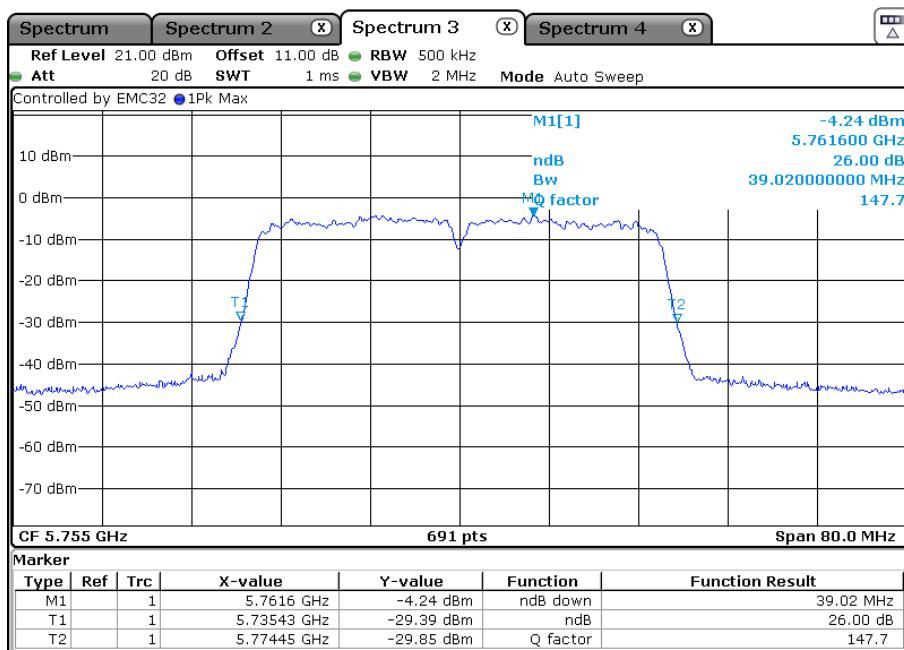
Channel 165: 5825 MHz:



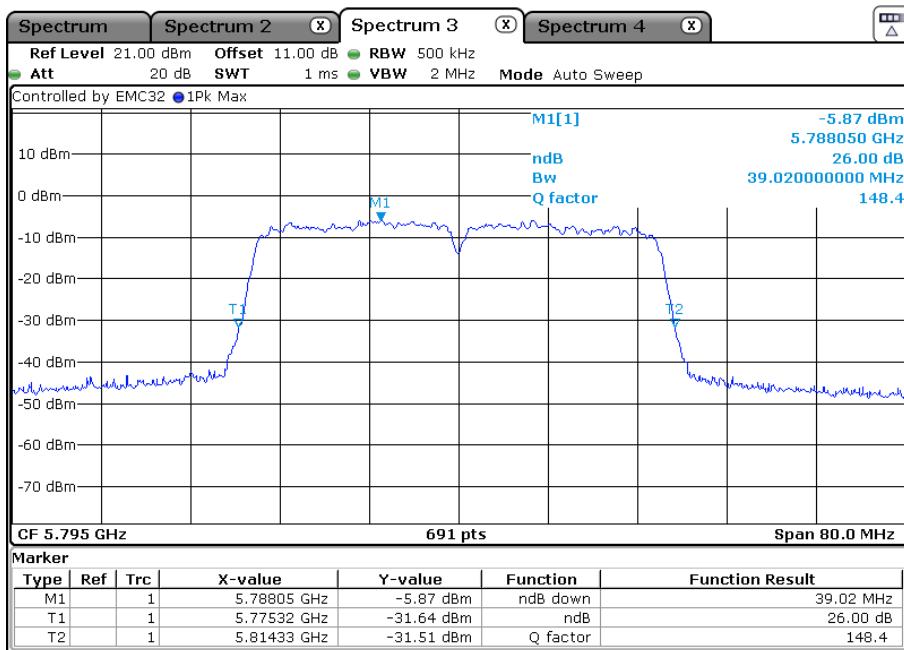
802.11n(HT 40)

Channel 151: 5755 MHz:

TEST REPORT



Channel 159: 5795 MHz:



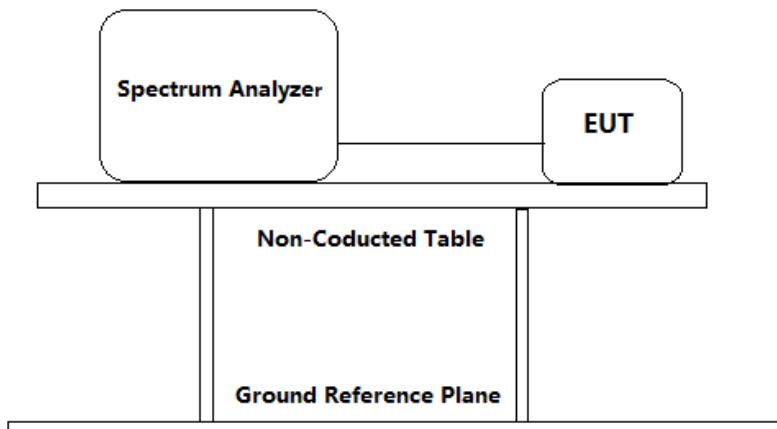
TEST REPORT**4.4 6 dB Bandwidth**

Test Requirement: FCC PART 15 E clause 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.

Test Method: FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04, Clause C

Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attention attenuation RF cable(cable loss =1 dB, with 10dB attenuator) from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer:
 - a) Set RBW = 100 kHz.
 - b) Set VBW $\geq [3 \times \text{RBW}]$
 - 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.
 - h) Span=2*BW~5*BW.
3. Repeat until all the test status is investigated.
4. Report the worst case.

TEST REPORT

Used Test Equipment List

Spectrum Analyzer. Refer to Clause 5 Test Equipment List for details.

Test result:

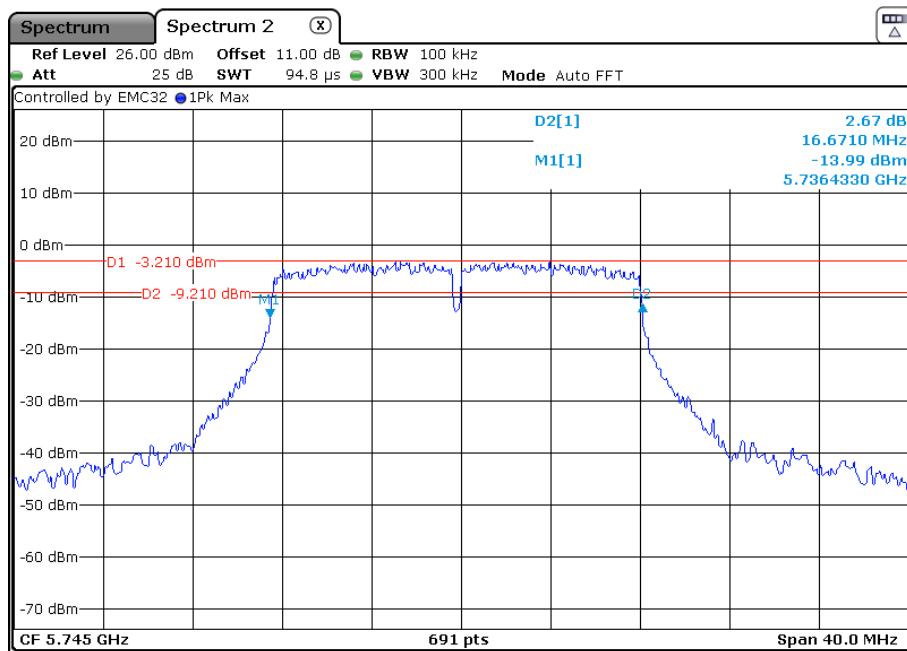
Channel No.	Frequency (MHz)	Mode	Data Rate	6dB bandwidth (MHz)	Limit	Result
149	5745	802.11a(20)	6 Mbps	16.671	$\geq 500\text{kHz}$	Pass
157	5785		6 Mbps	16.556		Pass
165	5825		6 Mbps	16.614		Pass
149	5745	802.11n (HT20)	7.2 Mbps	17.771	$\geq 500\text{kHz}$	Pass
157	5785		7.2 Mbps	17.771		Pass
165	5825		7.2 Mbps	17.771		Pass
151	5755	802.11n (HT40)	15 Mbps	36.470	$\geq 500\text{kHz}$	Pass
159	5795		15 Mbps	36.350		Pass

Test result: The unit does meet the FCC requirements

Result plot as follows:

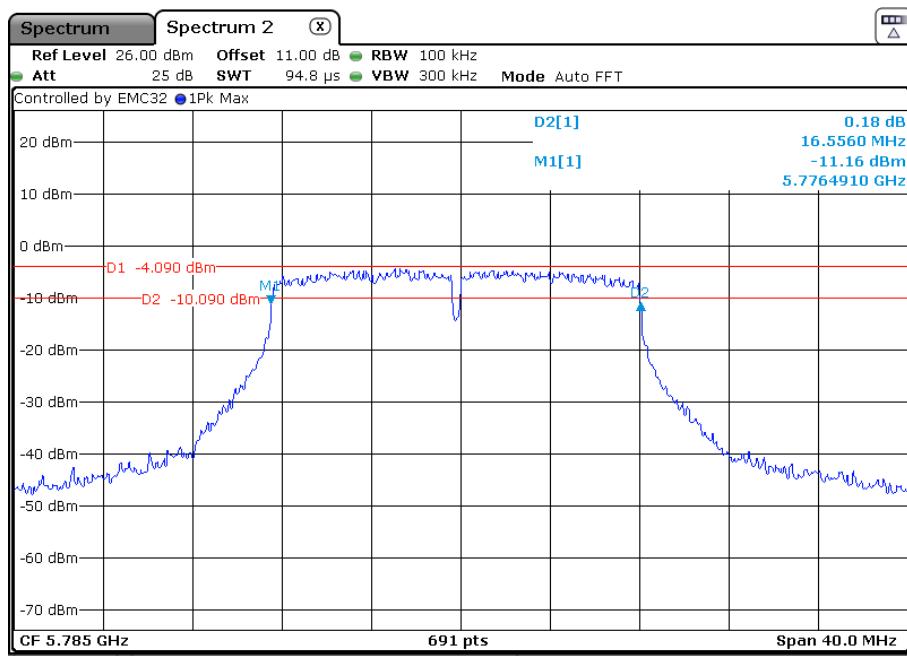
802.11a(20) mode

Channel 149: 5745 MHz:

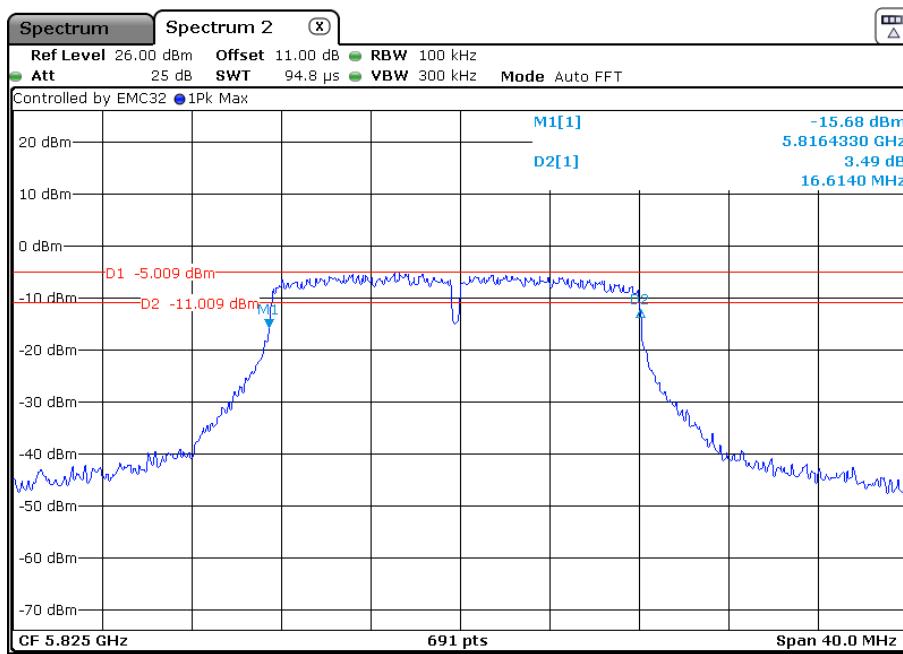


TEST REPORT

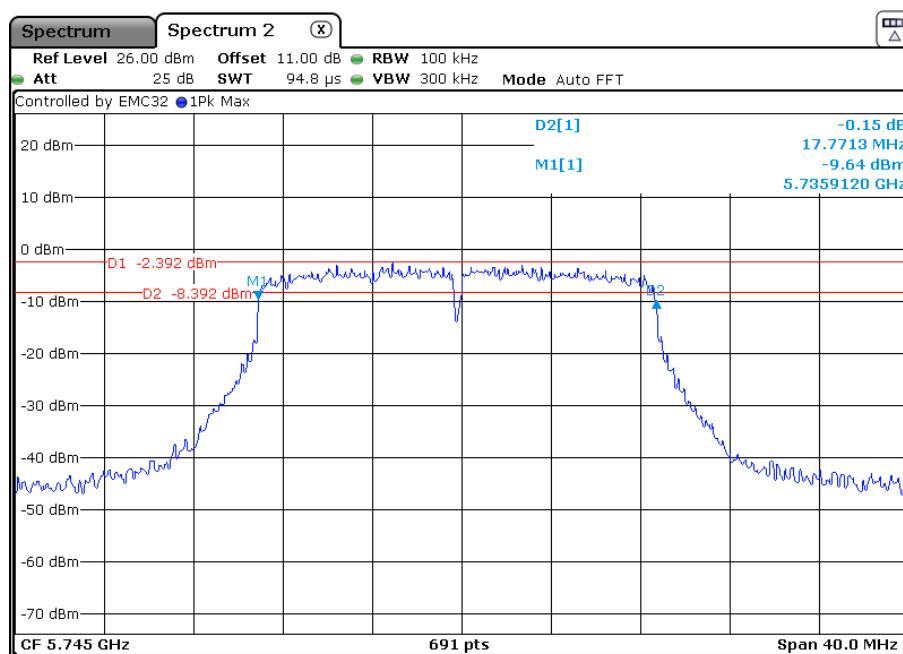
Channel 157: 5785 MHz:



Channel 165: 5825 MHz:

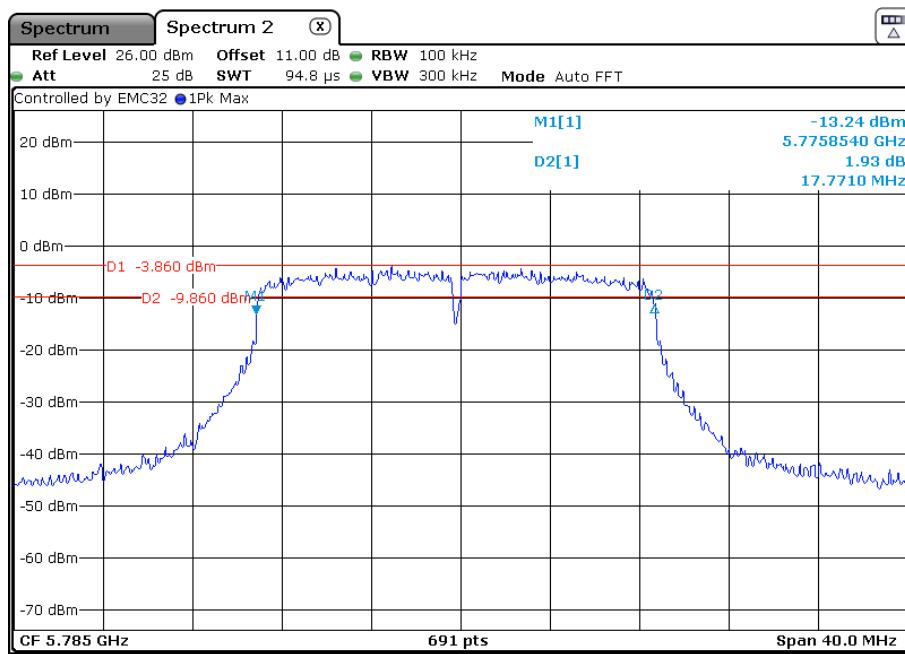
TEST REPORT


802.11n(HT 20)
 Channel 149: 5745 MHz:

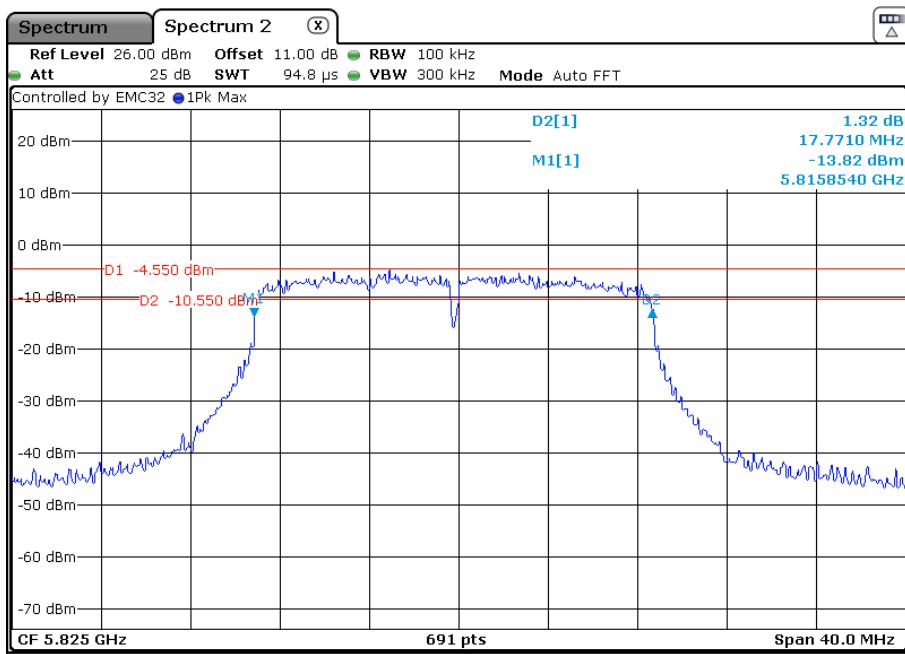


Channel 157: 5785 MHz:

TEST REPORT



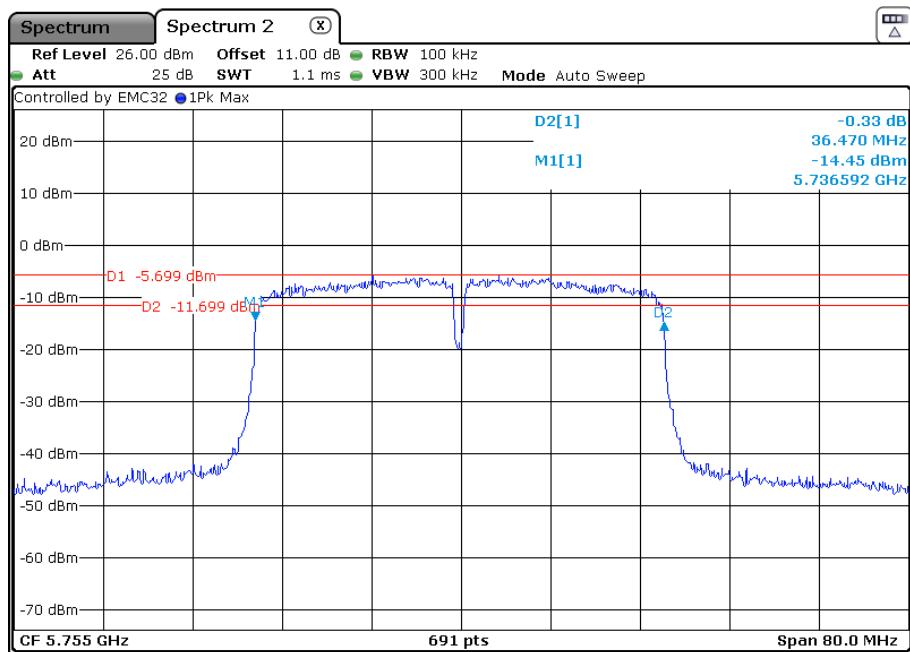
Channel 165: 5825 MHz:



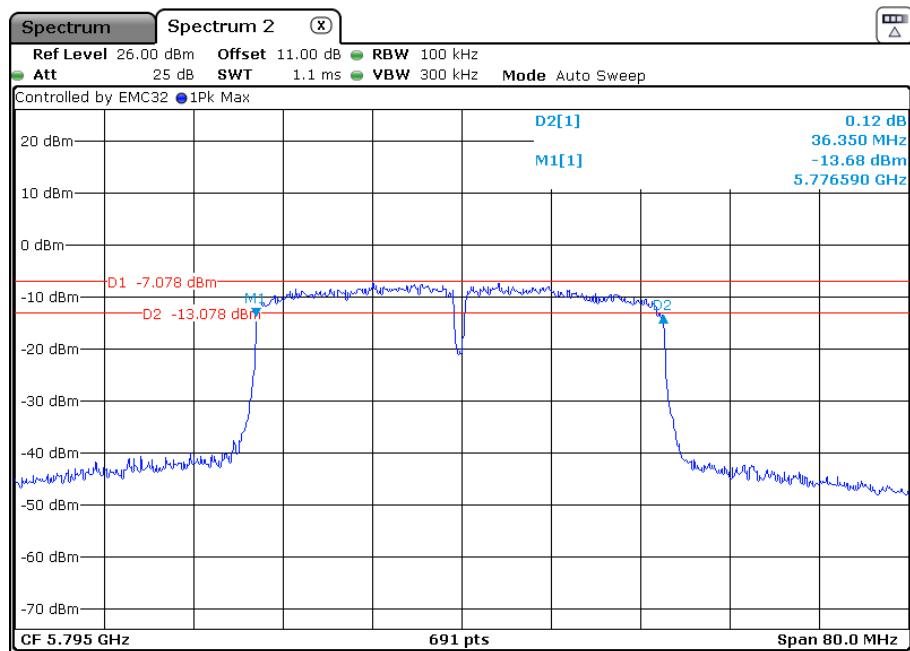
TEST REPORT

802.11n(HT 40)

Channel 151: 5755 MHz:

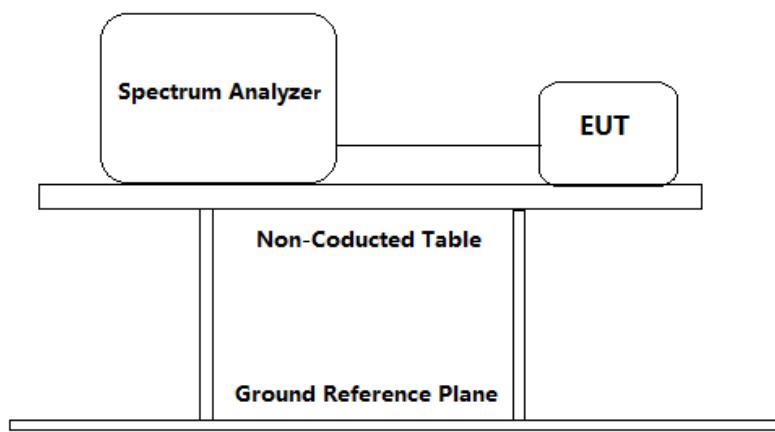


Channel 159: 5795 MHz:



TEST REPORT**4.5 Maximum Conducted Output Power**

Test Requirement: FCC Part 15 E clause 15.407(a)
Test Method: FCC KDB 789033 D02 General UNII Test Procedures New Rules
v01r04,Clause E
Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
Following channel(s) was (were) selected for the final test as listed below.
Test Configuration:

**Test Procedure:**

1. Remove the antenna from the EUT and then connect a low RF cable (cable loss =1 dB, with 10dB attenuator) from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer:
 - a) Set the RBW = 1 MHz.
 - b) Set the VBW \geq [3 \times RBW].
 - c) Set the span \geq 26 dB Bandwidth.
 - d) Detector = RMS.
 - e) Sweep time = auto couple.
 - f) Trace mode = max hold.
 - g) Allow trace to fully stabilize.
 - h) Use the instrument's band/channel power measurement function with the band limits set equal to the 26 dB Bandwidth.
3. Repeat until all the test status is investigated.
4. Report the worst case.

Used Test Equipment List

Power Senor. Refer to Clause 5 Test Equipment List for details.

TEST REPORT

Test result: Data Rate selection

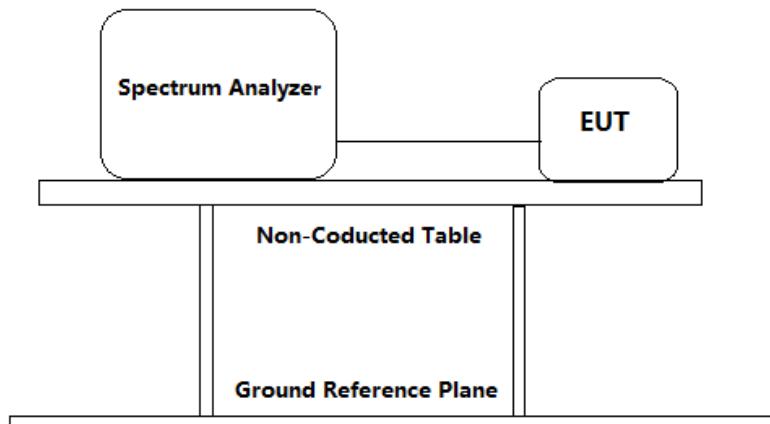
Test result:

Channel No.	Frequency (MHz)	Mode	Data Rate	Maximum Conducted output power (dBm)	Limit dBm	Result
149	5745	802.11a(20)	6Mbps	12.9	30	Pass
157	5785		6Mbps	11.2		Pass
165	5825		6Mbps	10.2		Pass
149	5745	802.11n (HT20)	7.2Mbps	12.9	30	Pass
157	5785		7.2Mbps	11.2		Pass
165	5825		7.2Mbps	10.2		Pass
151	5755	802.11n (HT40)	15Mbps	13.3	30	Pass
159	5795		15Mbps	11.2		Pass

Remark: The measured power in the table has considered the compensation of duty cycle.
 The unit does meet the FCC requirements.

4.6 Maximum Peak Power Spectral Density

Test Requirement: FCC Part 15 E clause 15.407(a)
 Test Method: FCC KDB 789033 D02 General UNII Test Procedures New Rules
 v01r04,Clause F
 Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
 Following channel(s) was (were) selected for the final test as listed below.
 Test Configuration:

TEST REPORT**Test Procedure:**

1. Remove the antenna from the EUT and then connect a low attention attenuation RF cable (cable loss = 1 dB, with 10dB attenuator) from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer:
For Band I (5150MHz-5250MHz)
 - a) Set the RBW = 1MHz.
 - b) Set the VBW $\geq [3 \times \text{RBW}]$.
 - c) Set the span ≥ 26 dB Bandwidth
 - d) Detector = peak
 - e) Sweep time = auto couple.
 - f) Trace mode = max hold.
 - g) Allow trace to fully stabilize.
 - i) Use the peak marker function to determine the maximum amplitude level within the RBW.

For Band IV (5725MHz-5850MHz)

- a) Set the RBW = 500kHz.
- b) Set the VBW $\geq [3 \times \text{RBW}]$.
- c) Set the span ≥ 26 dB Bandwidth.
- d) Detector = peak
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the RBW. Measure the Power Spectral Density of the test frequency with special test status.
3. Measure the Power Spectral Density of the test frequency with special test status.
4. Repeat until all the test status is investigated.
5. Report the worst case.

TEST REPORT

Used Test Equipment List

Spectrum Analyzer. Refer to Clause 5 Test Equipment List for details.

Channel No.	Frequency (MHz)	Mode	Data Rate	Maximum Power Spectral Density (dBm/500kHz)	Limit	Result
149	5745	802.11a(20)	6Mbps	7.91	30dBm/500kHz	Pass
157	5785		6Mbps	6.25		Pass
165	5825		6Mbps	4.62		Pass
149	5745	802.11n (HT20)	7.2Mbps	7.42	30dBm/500kHz	Pass
157	5785		7.2Mbps	6.21		Pass
165	5825		7.2Mbps	4.83		Pass
151	5755	802.11n (HT40)	15Mbps	4.77	30dBm/500kHz	Pass
159	5795		15Mbps	3.36		Pass

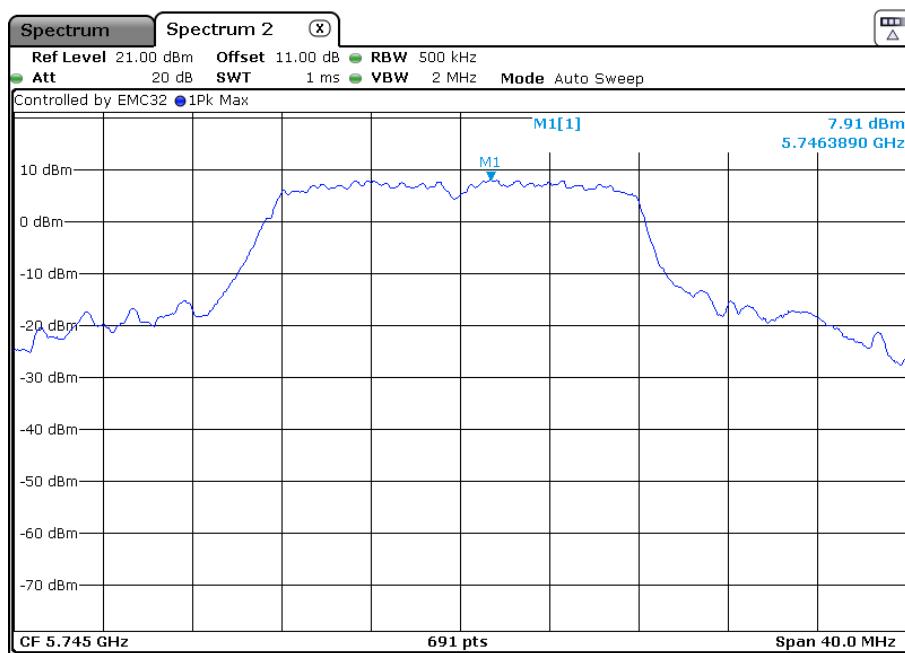
Test result: Level = Read Level + Cable Loss.

The unit does meet the FCC requirements

Result plot as follows:

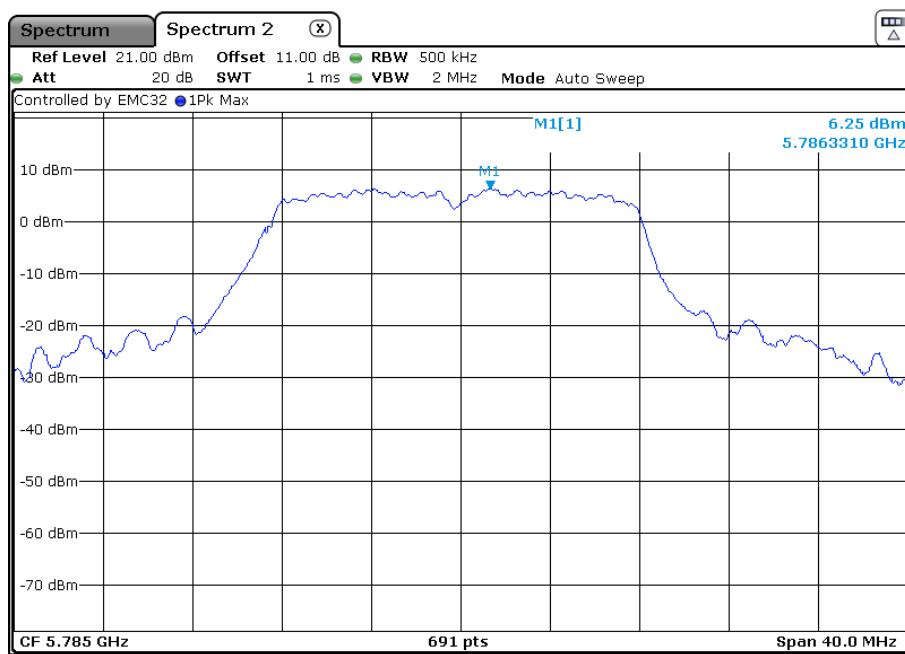
802.11a(20) mode

Channel 149: 5745 MHz:

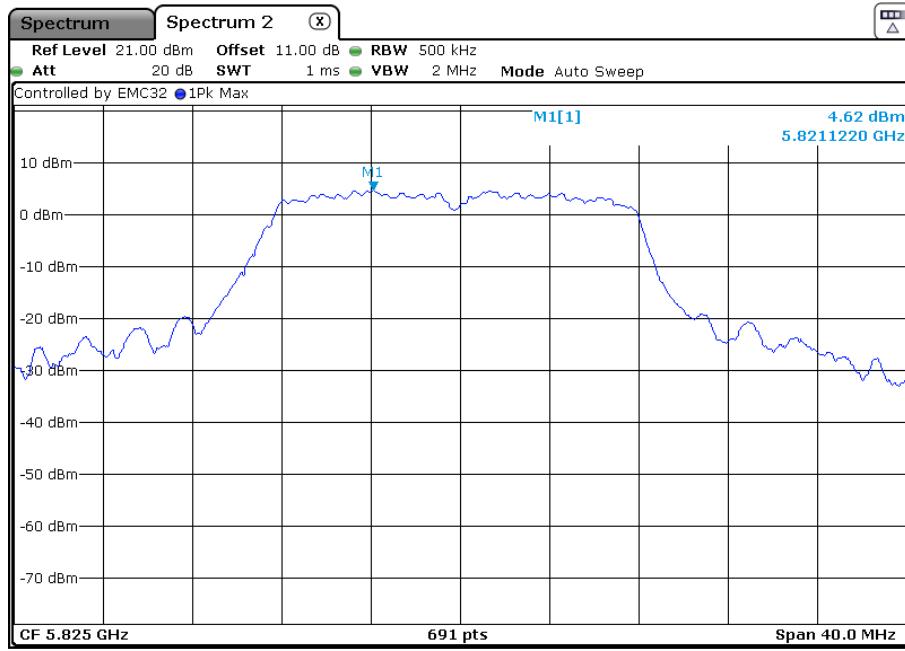


Channel 157: 5785 MHz:

TEST REPORT



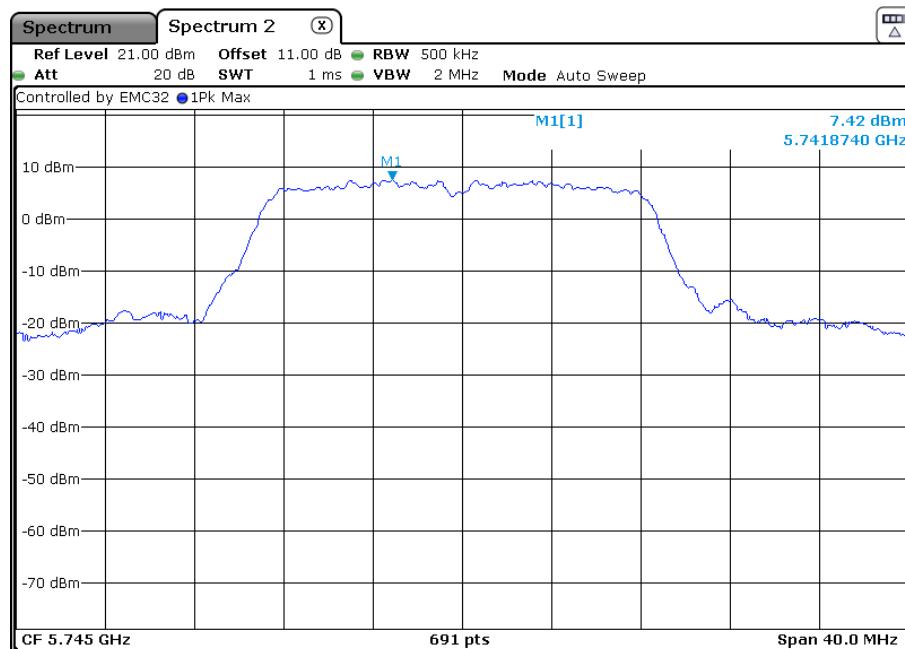
Channel 165: 5825 MHz:



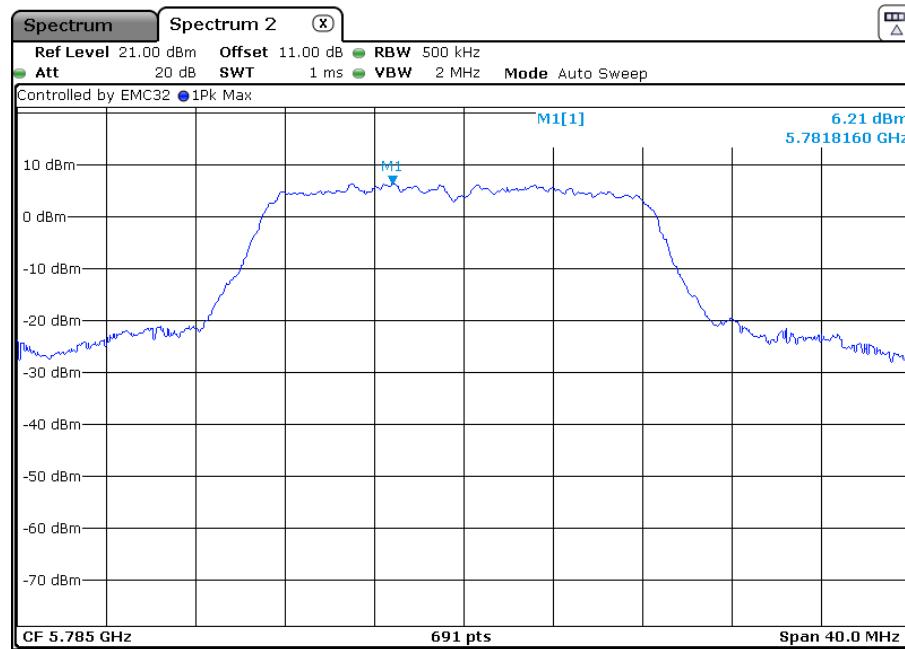
802.11n(HT 20)

TEST REPORT

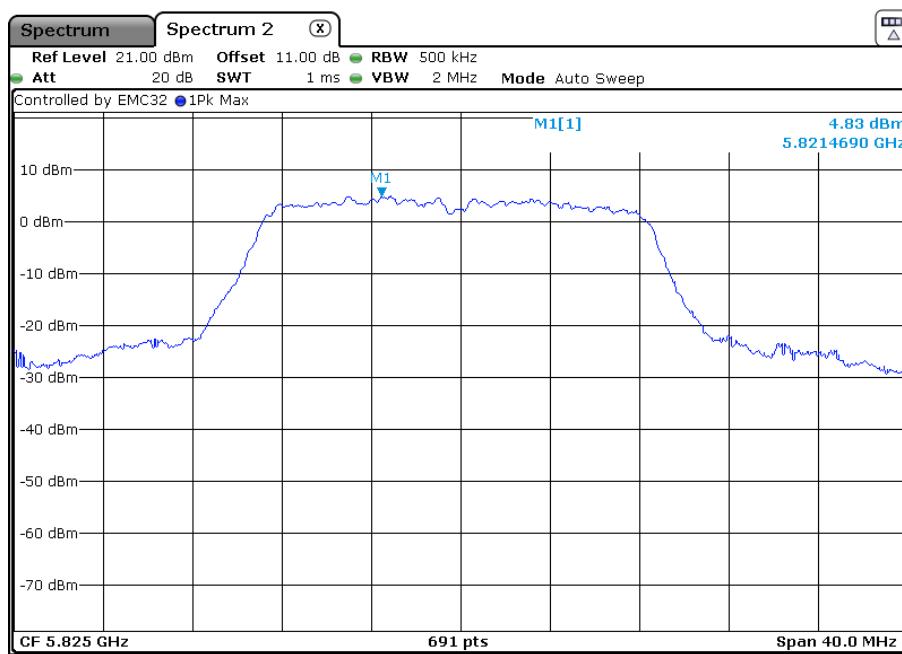
Channel 149: 5745 MHz:



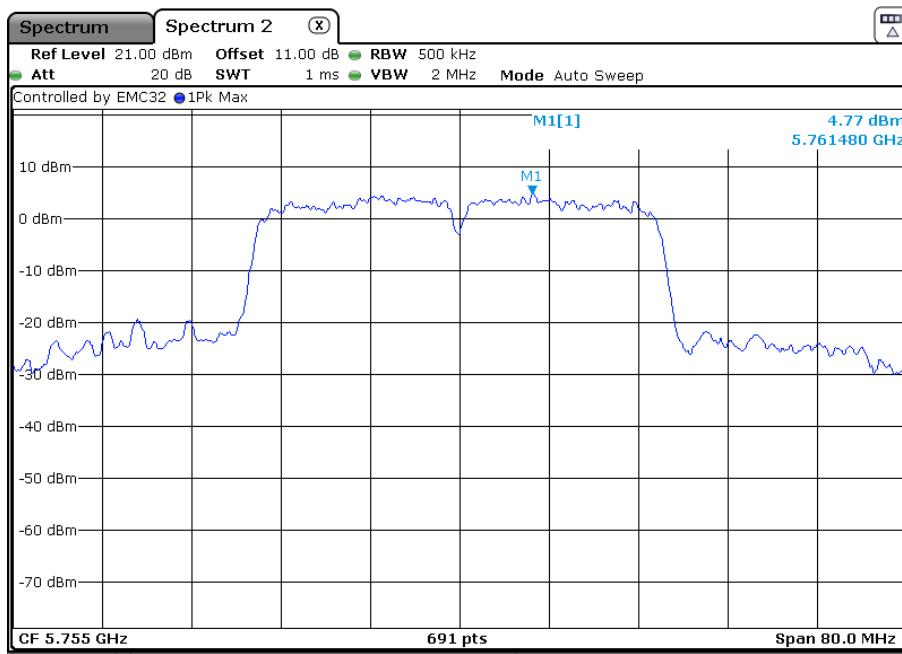
Channel 157: 5785 MHz:



Channel 165: 5825 MHz:

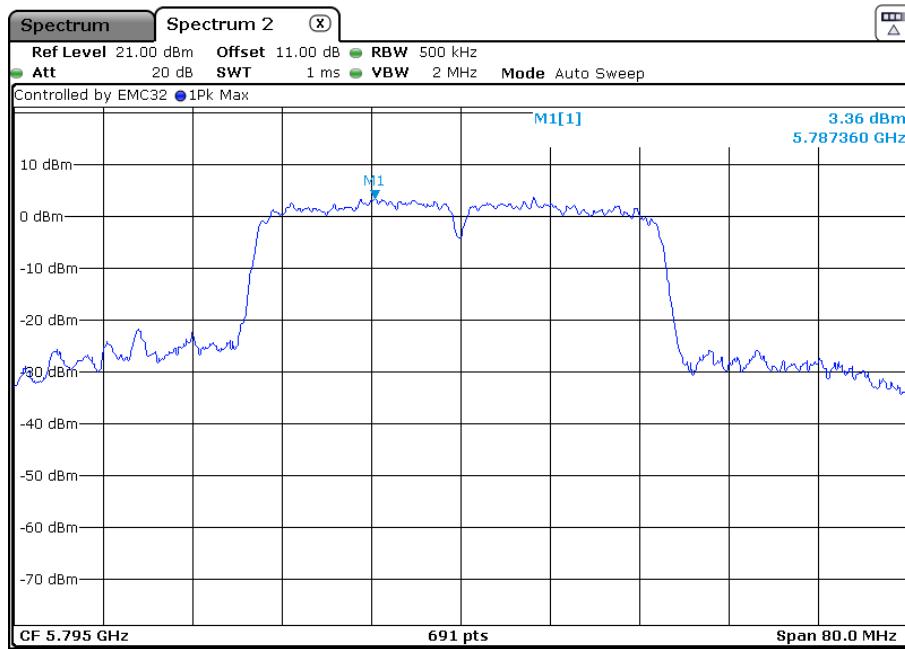
TEST REPORT

802.11n(HT 40)

Channel 151: 5755 MHz:



Channel 159: 5795 MHz:

TEST REPORT



4.7 Radiated Spurious Emissions

Test Requirement:	FCC Part 15 E clause 15.407(b)
	In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method:	FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04, Clause G
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.
Test site:	Measurement Distance: 3m (Semi-Anechoic Chamber)
Limit:	40.0 dB μ V/m between 30MHz & 88MHz; 43.5 dB μ V/m between 88MHz & 216MHz; 46.0 dB μ V/m between 216MHz & 960MHz; 54.0 dB μ V/m above 960MHz.
Detector:	For Peak and Quasi-Peak value: RBW =

TEST REPORT

1 MHz for $f \geq 1$ GHz,
 200 Hz for 9 kHz to 150 kHz
 9 kHz for 150 kHz to 30 MHz
 120 kHz for 30 MHz to 1GHz
 $VBW \geq RBW$
 Sweep = auto
 Detector function = peak for $f \geq 1$ GHz, QP for $f < 1$ GHz
 Trace = max hold

For AV value:
 $RBW = 1$ MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz
 $VBW = 10$ Hz
 Sweep = auto
 Trace = max hold

Field Strength Calculation:

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below:

$$FS = RA + AF + CF - AG + PD + AV$$

$$FS = RA + \text{Correct Factor} + AV$$

$$FS = \text{Field Strength in } dB\mu V/m$$

$$RA = \text{Receiver Amplitude (including preamplifier) in } dB\mu V$$

$$AF = \text{Antenna Factor in dB}$$

$$CF = \text{Cable Attenuation Factor in dB}$$

$$AG = \text{Amplifier Gain in dB}$$

$$PD = \text{Pulse Desensitization in dB}$$

$$AV = \text{Average Factor in } -dB$$

$$\text{Correct Factor} = AF + CF - AG + PD$$

Where:

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

$$FS = RA + AF + CF - AG + PD + AV$$

Assume a receiver reading of 62.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dB μ V/m.

$$RA = 62.0 \text{ dB}\mu V$$

$$AF = 7.4 \text{ dB}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$PD = 0 \text{ dB}$$

$$AV = -10 \text{ dB}$$

$$\text{Correct Factor} = 7.4 + 1.6 - 29.0 + 0 = -20 \text{ dB}$$

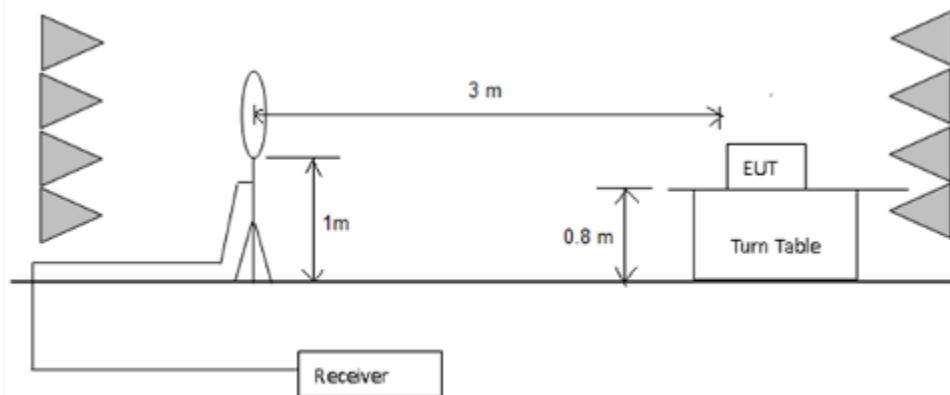
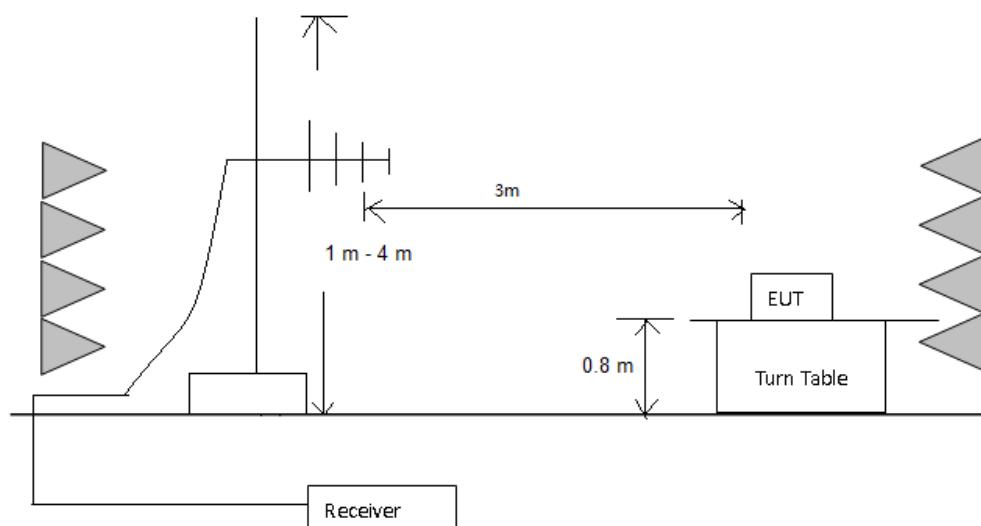
TEST REPORT

$$FS = 62 + (-20) + (-10) = 32 \text{ dB}\mu\text{V/m}$$

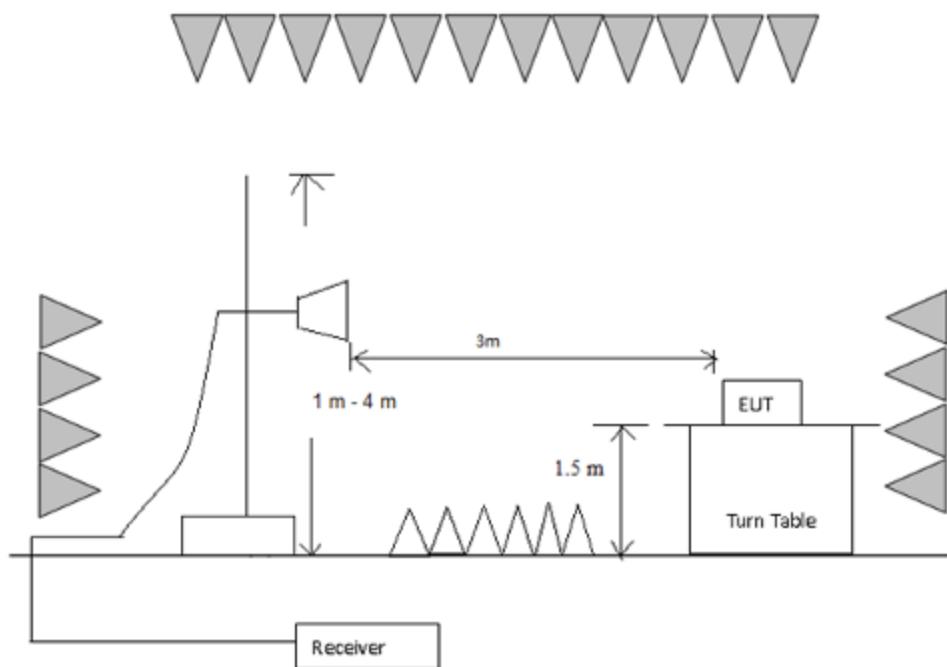
Section 15.205 Restricted bands of operation.

(a) Except as shown in paragraph (d) of this section. Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
10.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	
13.36 - 13.41	322 - 335.4		

TEST REPORT**Test Configuration:****1) 9 kHz to 30 MHz emissions:****2) 30 MHz to 1 GHz emissions:****3) 1 GHz to 40 GHz emissions:**

TEST REPORT



Test Procedure:

Test site with RF absorbing material covering the ground plane that met the site validation criterion called out in CISPR 16-1-4:2010 was used to perform radiated emission test above 1 GHz.

The receiver was scanned from 9 kHz to 25 GHz. When an emission was found, the table was rotated to produce the maximum signal strength. An initial pre-scan was performed for in peak detection mode using the receiver. The EUT was measured for both the Horizontal and Vertical polarities and performed a pre-test three orthogonal planes. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. The worst case emissions were reported.

Used Test Equipment List:

3m Semi-Anechoic Chamber, EMI Test Receiver (9 kHz~7 GHz), Signal and Spectrum Analyzer (10 Hz~40 GHz), Loop antenna (9 kHz-30 MHz). TRILOG Super Broadband test Antenna(30 MHz-3 GHz) (RX), Double-Ridged Waveguide Horn Antenna (800 MHz-18 GHz)(RX) and High Frequency Antenna & preamplifier(18 GHz~26.5 GHz) (RX). Refer to Clause 5 Test Equipment List for details.

9 kHz~30 MHz Field Strength of Unwanted Emissions for Quasi-Peak Measurement

The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

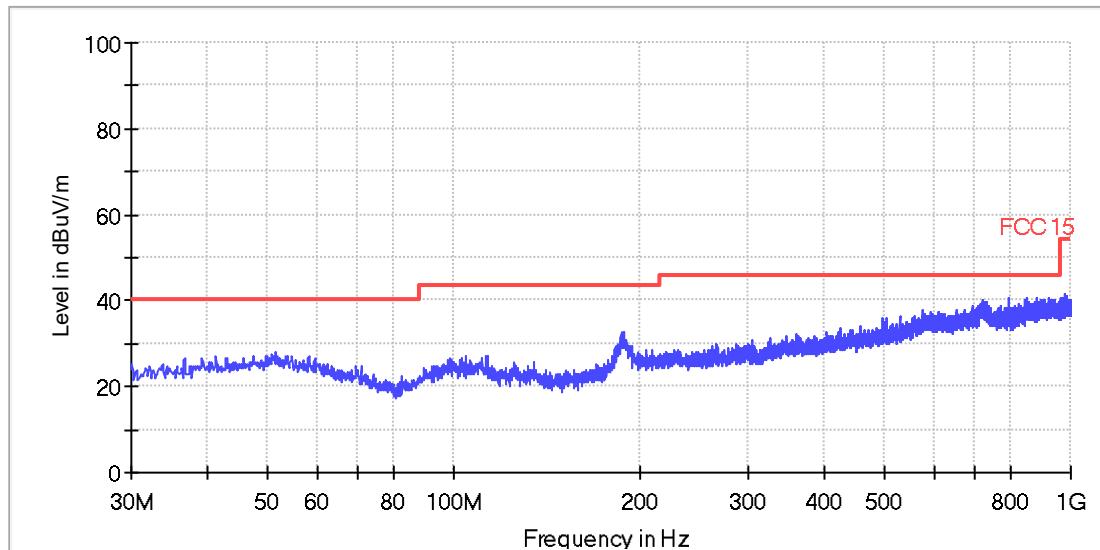
30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement.

Pretest on all channel for each mode of the brand I and brand IV.

The below data test on mode WIFI an (HT20) channel 149: 5745MHz was the worst case of all test record.

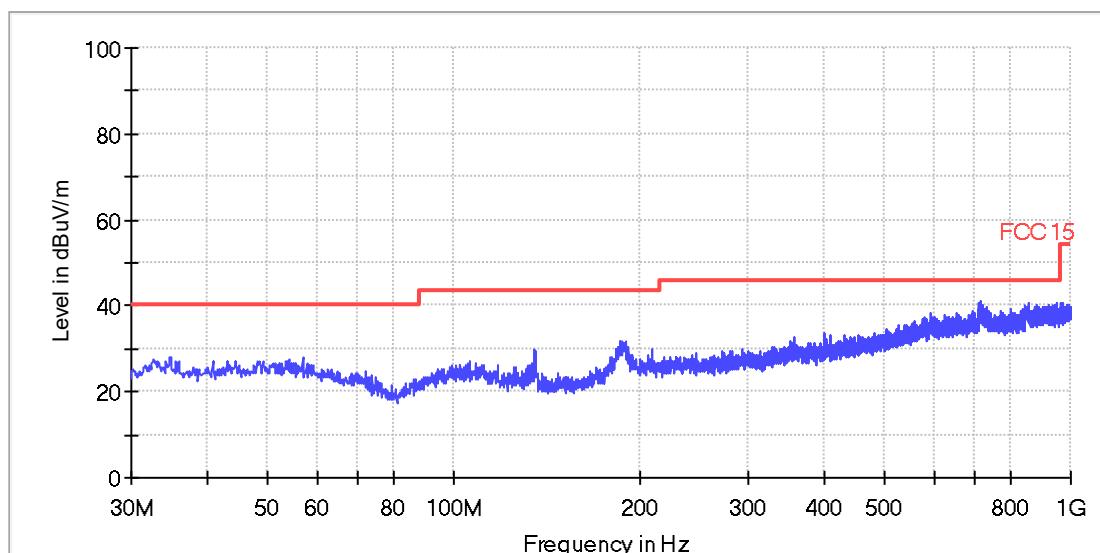
TEST REPORT

Horizontal:



All emission levels are more than 6dB below the limit.

Vertical:



TEST REPORT

All emission levels are more than 6dB below the limit.

1~40 GHz Radiated Emissions.

802.11a(20) mode

Channel 149: 5745 MHz:

PK Measurement:

Frequency (MHz)	PK Reading Level (dB μ V)	Correction factors (dB/m)	PK Emission Level (dB μ V/m)	PK Limit (dB μ V/m)	Antenna polarization
9884.6	41.6	6.2	47.8	68.2	H
10906.8	41.4	6.7	48.1	74	V

Remark: When Peak emission level was below AV limit, the AV emission level did not be recorded.

Channel 157: 5785 MHz:

PK Measurement:

Frequency (MHz)	PK Reading Level (dB μ V)	Correction factors (dB/m)	PK Emission Level (dB μ V/m)	PK Limit (dB μ V/m)	Antenna polarization
9578.6	42.4	5.0	47.4	68.2	H
12630.1	41.6	7.2	48.8	74	V

Remark: When Peak emission level was below AV limit, the AV emission level did not be recorded.

Channel 165: 5825 MHz:

PK Measurement:

Frequency (MHz)	PK Reading Level (dB μ V)	Correction factors (dB/m)	PK Emission Level (dB μ V/m)	PK Limit (dB μ V/m)	Antenna polarization
1099.9	62.7	-14.0	48.7	74	H
9296.0	42.7	4.6	47.3	68.2	V

Remark: When Peak emission level was below AV limit, the AV emission level did not be recorded.

802.11n(HT 20)

TEST REPORT

Channel 149: 5745 MHz:

PK Measurement:

Frequency (MHz)	PK Reading Level (dB μ V)	Correction factors (dB/m)	PK Emission Level (dB μ V/m)	PK Limit (dB μ V/m)	Antenna polarization
9884.6	41.6	6.2	47.8	68.2	H
10906.8	41.4	6.7	48.1	74	V

Remark: When Peak emission level was below AV limit, the AV emission level did not be recorded.

Channel 157: 5785 MHz:

PK Measurement:

Frequency (MHz)	PK Reading Level (dB μ V)	Correction factors (dB/m)	PK Emission Level (dB μ V/m)	PK Limit (dB μ V/m)	Antenna polarization
9578.6	42.4	5.0	47.4	68.2	H
12630.1	41.6	7.2	48.8	74	V

Remark: When Peak emission level was below AV limit, the AV emission level did not be recorded.

Channel 165: 5825 MHz:

PK Measurement:

Frequency (MHz)	PK Reading Level (dB μ V)	Correction factors (dB/m)	PK Emission Level (dB μ V/m)	PK Limit (dB μ V/m)	Antenna polarization
1099.9	62.7	-14.0	48.7	74	H
9269	42.7	4.6	47.3	68.2	V

Remark: When Peak emission level was below AV limit, the AV emission level did not be recorded.

802.11n(HT 40)

Channel 151: 5755 MHz:

PK Measurement:

Frequency (MHz)	PK Reading Level (dB μ V)	Correction factors (dB/m)	PK Emission Level (dB μ V/m)	PK Limit (dB μ V/m)	Antenna polarization
13660.8	41.4	8.8	50.2	74	H
9058.0	42.6	4.6	47.2	74	V

Remark: When Peak emission level was below AV limit, the AV emission level did not be

TEST REPORT

recorded.

Channel 159: 5795 MHz:

PK Measurement:

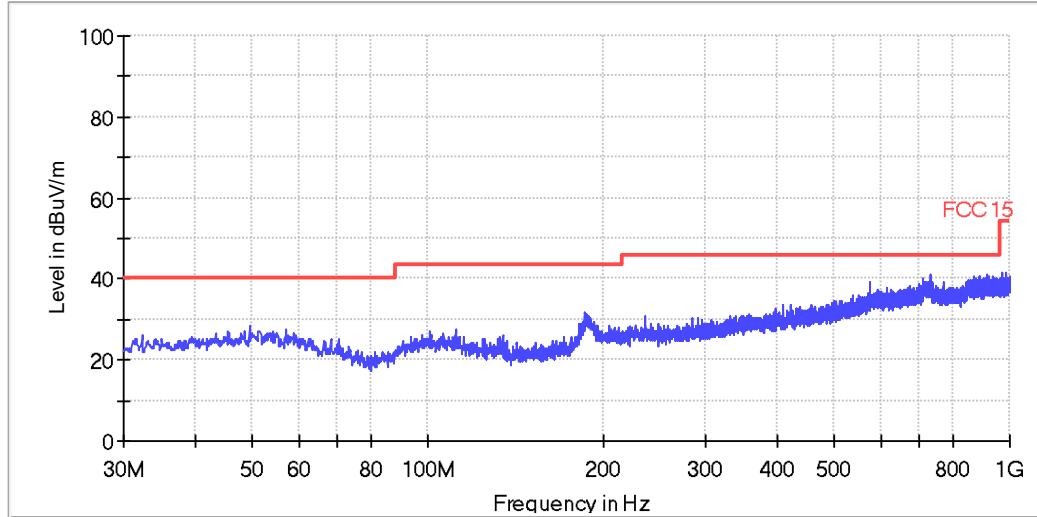
Frequency (MHz)	PK Reading Level (dB μ V)	Correction factors (dB/m)	PK Emission Level (dB μ V/m)	PK Limit (dB μ V/m)	Antenna polarization
13116.8	41.2	7.8	49.0	68.2	H
9602.0	42.5	5.1	47.6	68.2	V

Remark: When Peak emission level was below AV limit, the AV emission level did not be recorded.

Test in WIFI/BLE module and BLE module continuous transmission status 9 kHz~30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report. 30 MHz~1 GHz Spurious Emissions.

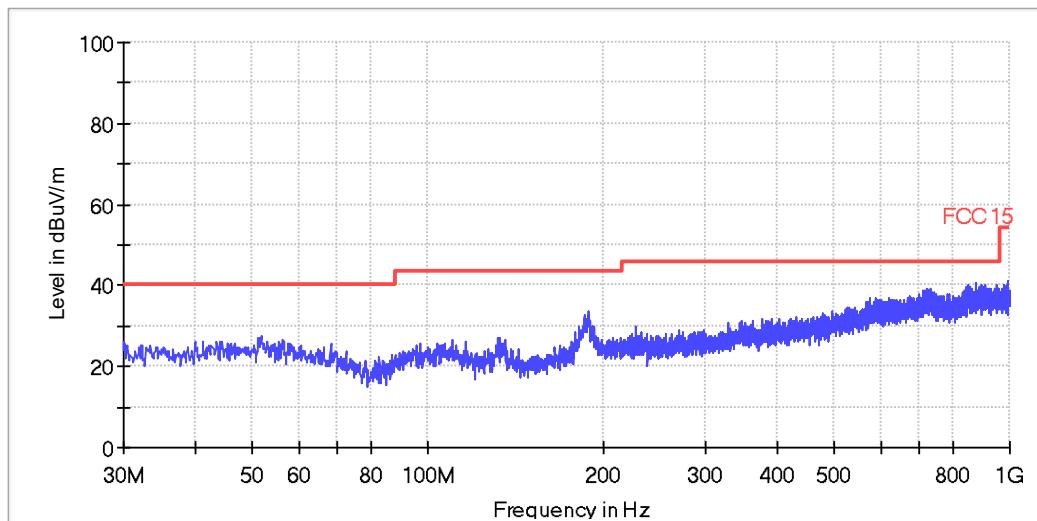
Quasi-Peak Measurement

Horizontal



All emission levels are more than 6 dB below the limit.

Vertical

TEST REPORT


All emission levels are more than 6 dB below the limit.

1GHz-25GHz Radiated Emissions
PK Measurement:

Frequency (MHz)	PK Reading Level (dBuV)	Correction factors (dB)	PK Emission Level (dB μ V/m)	PK Limit (dB μ V/m)	Antenna polarization
4803.8	49.0	-0.4	48.6	74	H
4803.8	48.4	-0.4	48.0	74	V

AV Measurement:

Frequency (MHz)	PK Reading Level (dBuV)	Correction factors (dB)	PK Emission Level (dB μ V/m)	PK Limit (dB μ V/m)	Antenna polarization
4803.8	-	-0.4	-	54	H
4803.8	-	-0.4	-	54	V

Remark: When Peak emission level was below AV limit, the AV emission level did not be recorded.

The field strength is calculated by adding the Antenna Factor. Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading + Antenna Factor + Cable Loss - Preamplifier Factor.

As shown in Section, for frequencies above 1000 MHz. the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

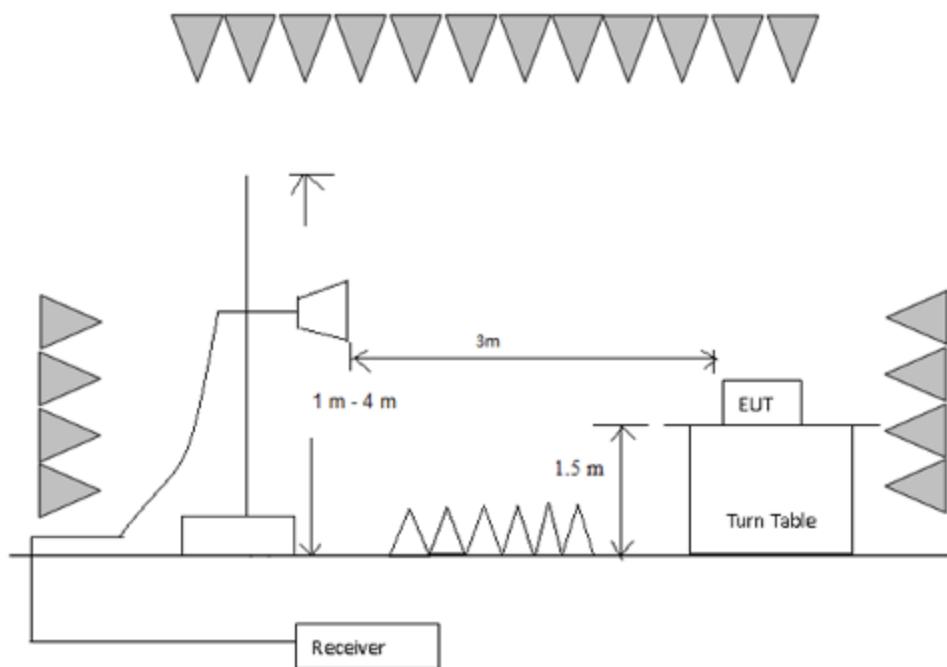
No any other emissions level which are attenuated less than 20dB below the limit.

TEST REPORT

4.8 Band Edges Requirement

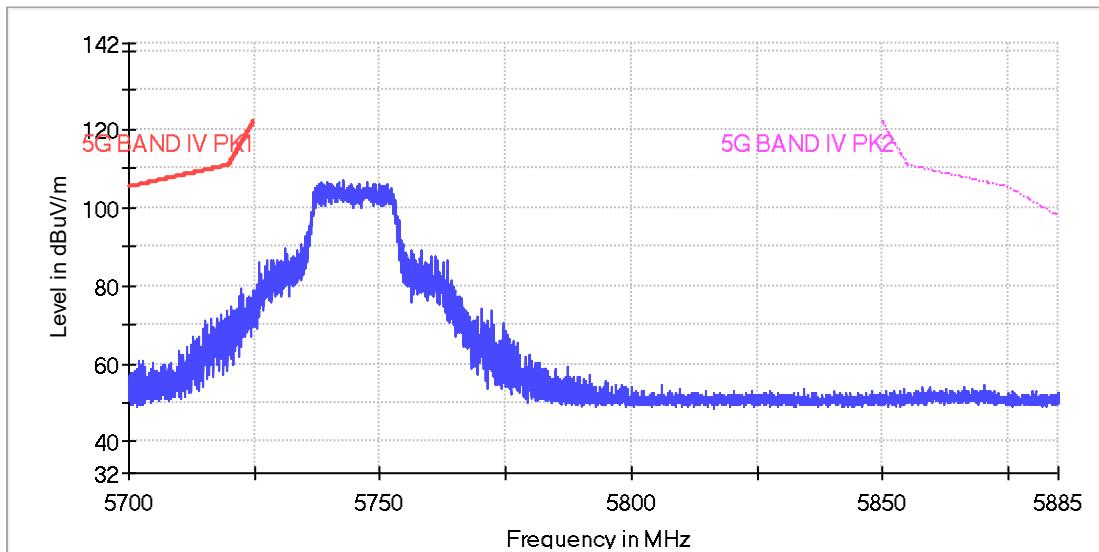
Test Requirement:	FCC Part 15 E clause 15.407(b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits.
Test Method:	FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01, Clause G
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.
Test site:	Measurement Distance: 3m (Semi-Anechoic Chamber)
Limit:	For transmitters operating in the 5.725–5.85 GHz band: All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
Test Configuration:	
4) 1 GHz to 40 GHz emissions:	

TEST REPORT



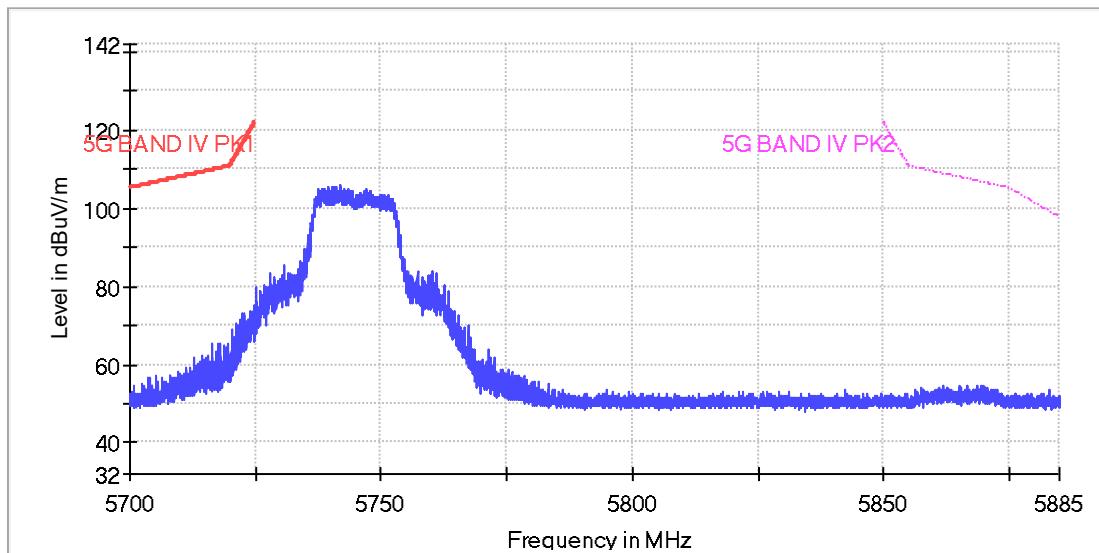
802.11a(20) mode
Channel 149: 5745 MHz:

Horizontal



Vertical

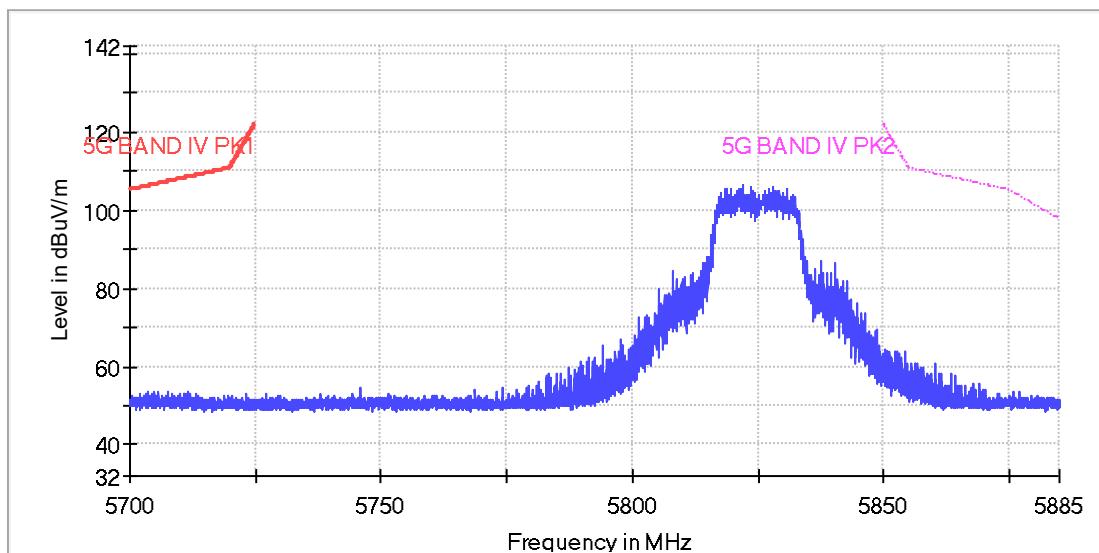
TEST REPORT



All emission levels are more than 6 dB below the limit.

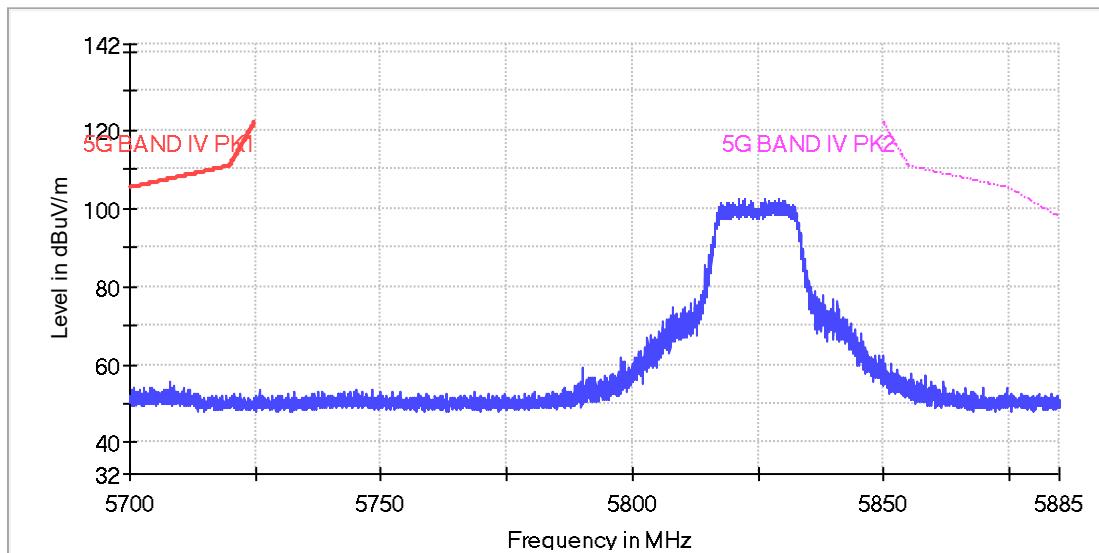
Channel 165: 5825 MHz:

Horizontal



Vertical

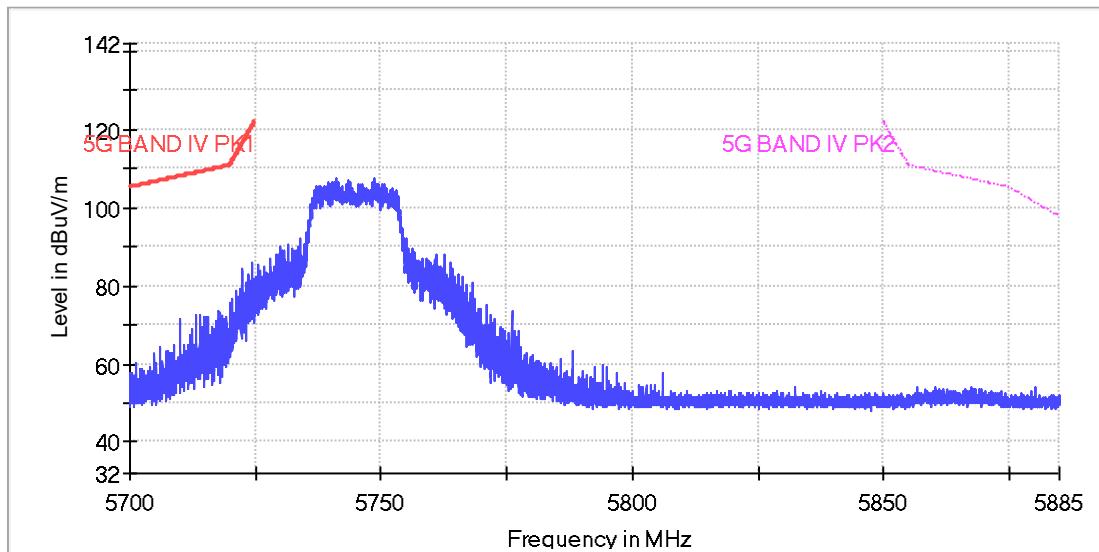
TEST REPORT



All emission levels are more than 6 dB below the limit.

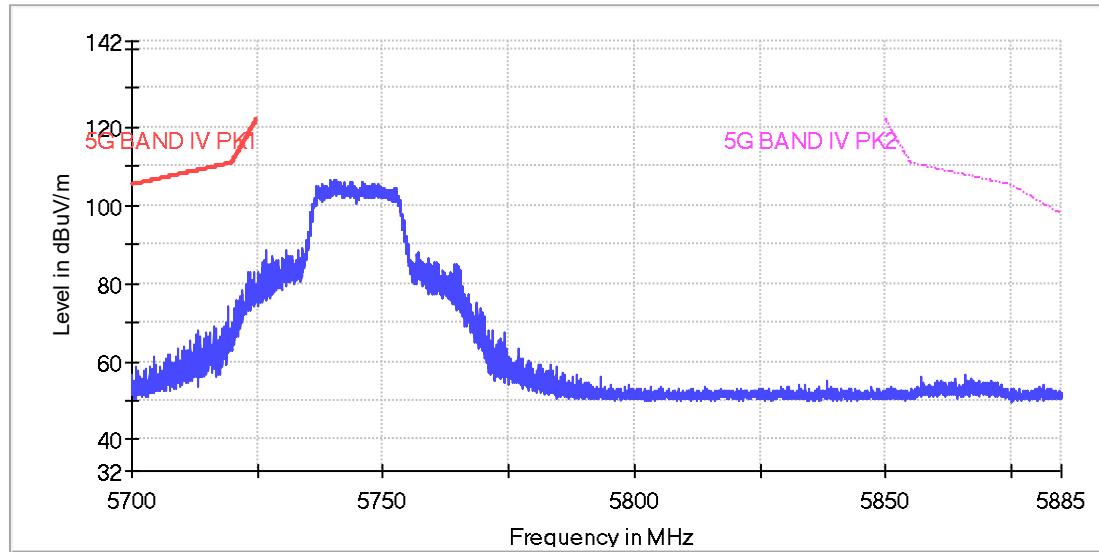
802.11n(HT 20)
Channel 149: 5745 MHz:

Horizontal



Vertical

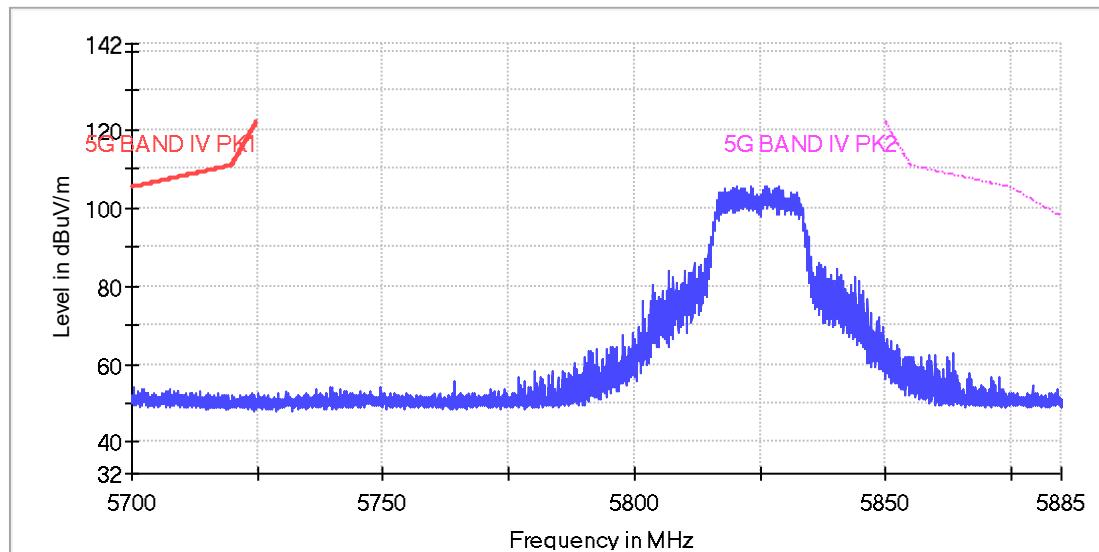
TEST REPORT



All emission levels are more than 6 dB below the limit.

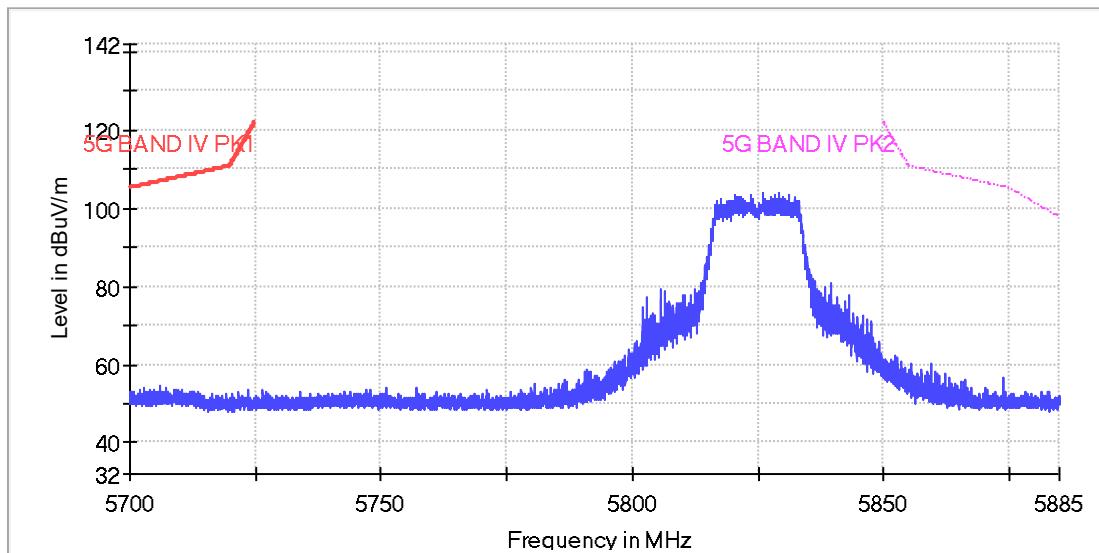
Channel 165: 5825 MHz:

Horizontal



Vertical

TEST REPORT

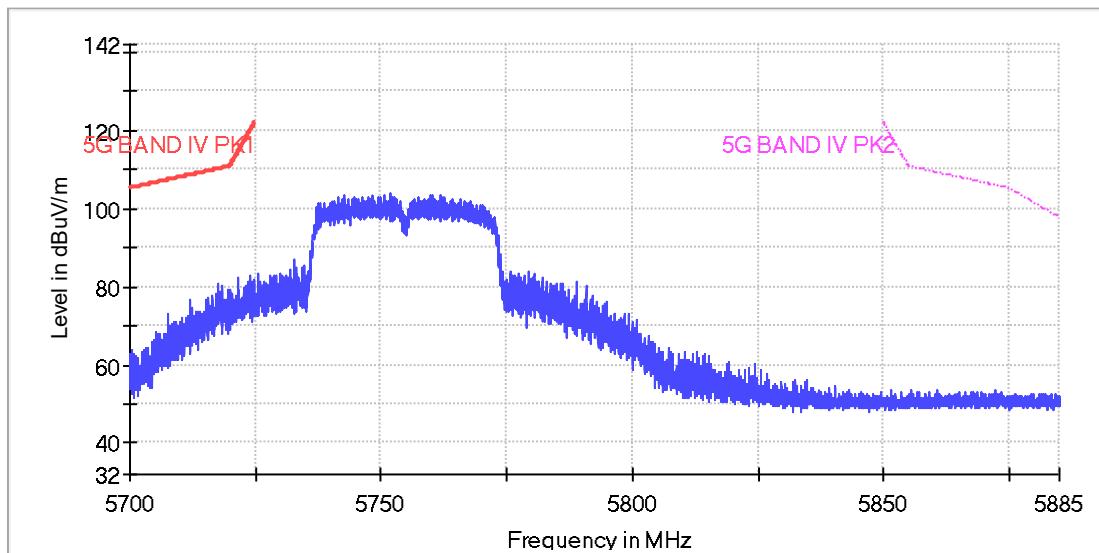


All emission levels are more than 6 dB below the limit.

802.11n(HT 40)

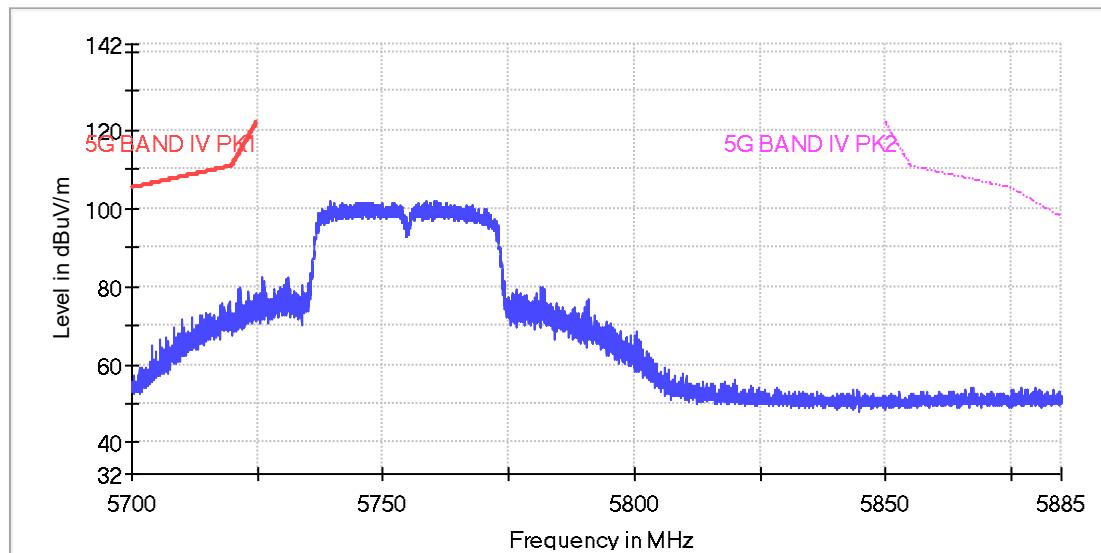
Channel 151: 5755 MHz:

Horizontal



Vertical

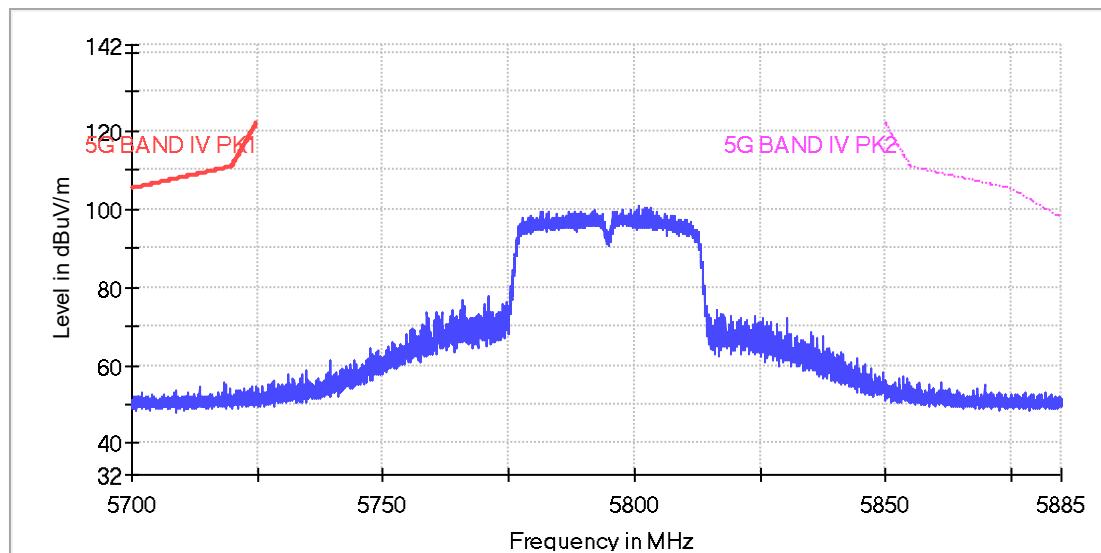
TEST REPORT



All emission levels are more than 6 dB below the limit.

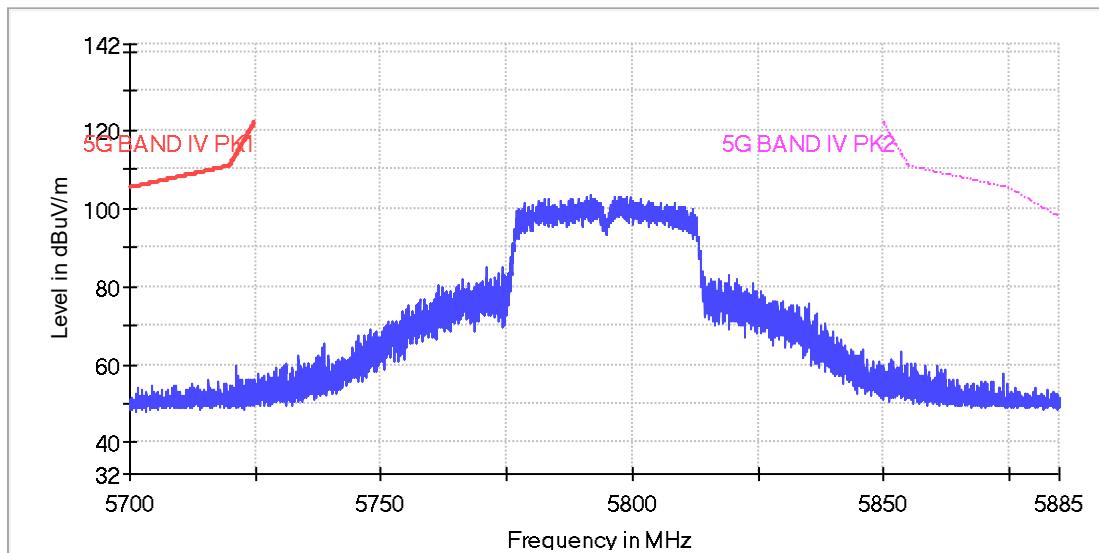
Channel 159: 5795 MHz:

Horizontal



Vertical

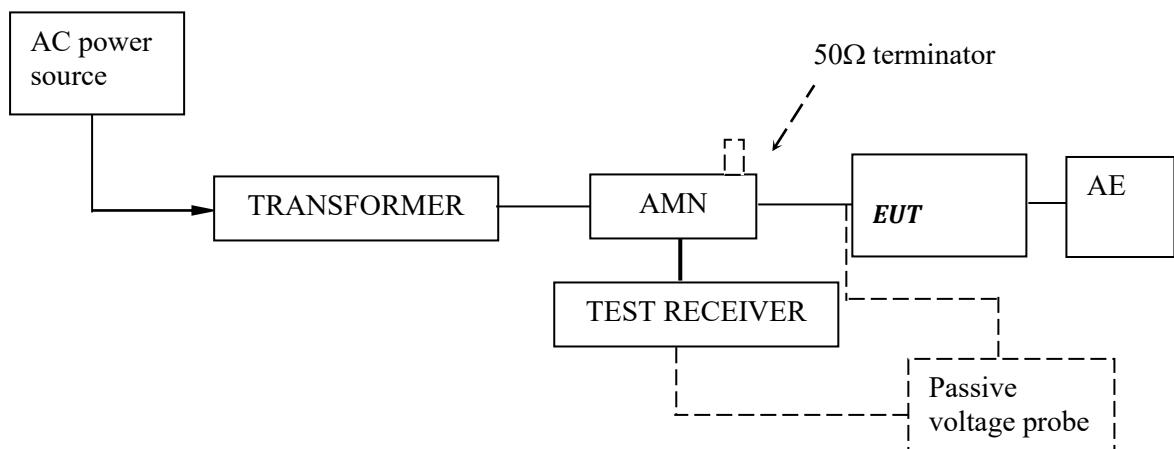
TEST REPORT



All emission levels are more than 6 dB below the limit.

4.10 Conducted Emission Test

Test Configuration:



TEST REPORT

Test Setup and Procedure:

Test was performed according to ANSI C63.10 Clause 6.2. The EUT was set to achieve the maximum emission level. The mains terminal disturbance voltage was measured with the EUT in a shielded room. The EUT was connected to AC power source through an Artificial Mains Network which provides a 50Ω linear impedance Artificial hand is used if appropriate (for handheld apparatus). The load/control terminal disturbance voltage was measured with passive voltage probe if appropriate.

The table-top EUT was placed on a 0.8m high non-metallic table above earthed ground plane (Ground Reference Plane). And for floor standing EUT, was placed on a 0.1m high non-metallic supported on GRP. The EUT keeps a distance of at least 0.8m from any other of the metallic surface. The Artificial Mains Network is situated at a distance of 0.8m from the EUT.

During the test, mains lead of EUT excess 0.8m was folded back and forth parallel to the lead so as to form a horizontal bundle with a length between 0.3m and 0.4m

The bandwidth of test receiver was set at 9 kHz. The frequency range from 150 kHz to 30MHz was checked.

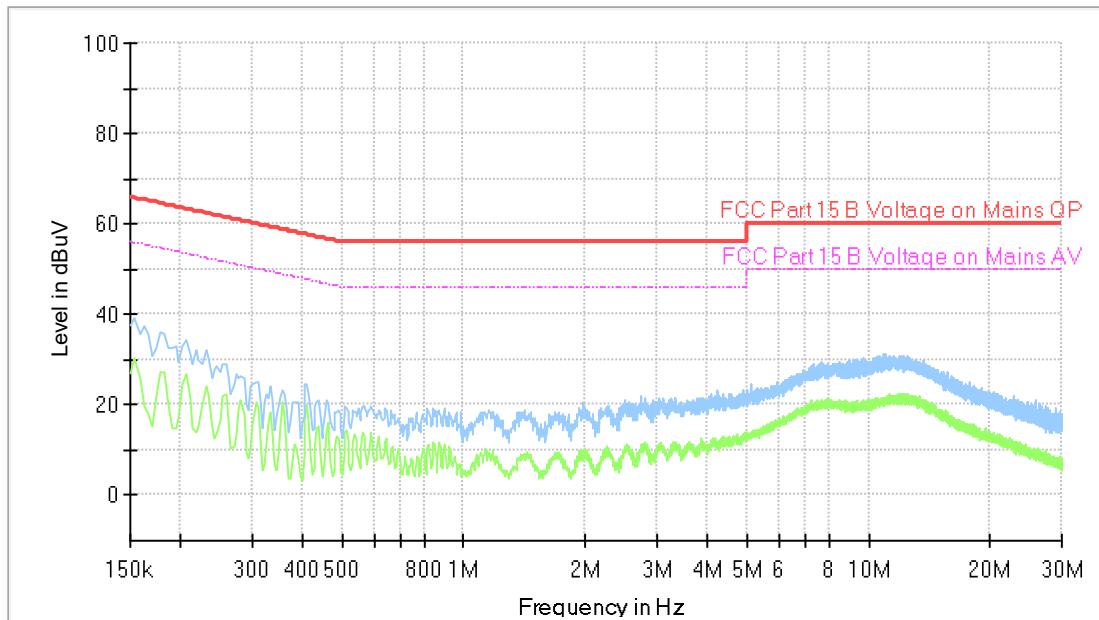
Test Data and Curve

At main terminal: Pass

Tested Wire: Live

Operation Mode: transmitting mode

Full Spectrum



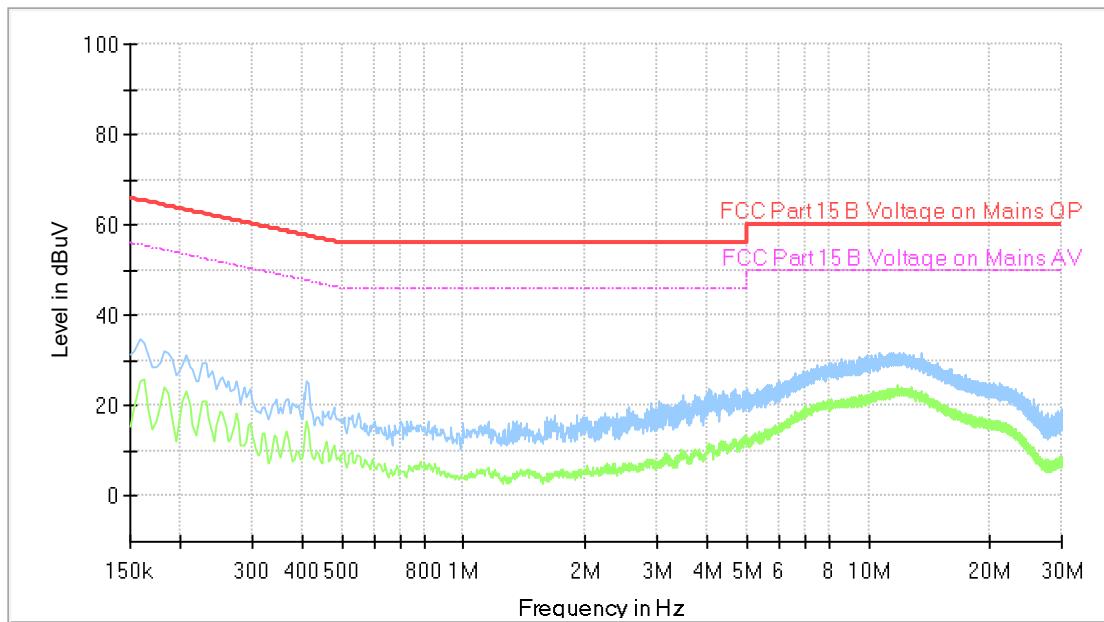
All emission levels are more than 10 dB below the limit.

TEST REPORT

Tested Wire: Neutral

Operation Mode: transmitting mode

Full Spectrum



All emission levels are more than 10 dB below the limit.

TEST REPORT

5.0 Test Equipment List

Radiated Emission/Radio					
Equipment No.	Equipment	Model	Manufacturer	Cal. Due date (YYYY-MM-DD)	Calibration Interval
EM030-04	3m Semi-Anechoic Chamber	9×6×6 m ³	ETS-LINDGREN	2025-04-09	1Y
EM031-02	EMI Test Receiver (9 kHz~7 GHz)	R&S ESR7	R&S	2025-11-10	1Y
EM031-03	Signal and Spectrum Analyzer (10 Hz~40 GHz)	R&S FSV40	R&S	2025-11-10	1Y
EM011-04	Loop antenna (9 kHz-30 MHz)	HFH2-Z2	R&S	2025-07-07	1Y
EM033-01	TRILOG Super Broadband test Antenna(30 MHz-3 GHz) (RX)	VULB 9163	SCHWARZBECK	2025-12-08	1Y
EM033-02	Double-Ridged Waveguide Horn Antenna (800 MHz-18 GHz)(RX)	R&S HF907	R&S	2025-07-02	1Y
EM033-03	High Frequency Antenna & preamplifier(18 GHz~26.5 GHz) (RX)	R&S SCU-26	R&S	2025-04-22	1Y
EM033-04	High Frequency Antenna & preamplifier (26 GHz-40 GHz)	R&S SCU-40	R&S	2025-04-22	1Y
EM031-02-01	Coaxial cable(9 kHz-1 GHz)	N/A	R&S	2025-04-09	1Y
EM033-02-02	Coaxial cable(1 GHz-18 GHz)	N/A	R&S	2025-04-09	1Y
EM033-04-02	Coaxial cable(18 GHz~40 GHz)	N/A	R&S	2025-04-25	1Y
EM031-01	Signal Generator (9 kHz~6 GHz)	SMB100A	R&S	2025-03-17	1Y
EM040-01	Band Reject/Notch Filter	WRHVF	Wainwright	N/A	1Y
EM040-02	Band Reject/Notch Filter	WRCGV	Wainwright	N/A	1Y
EM040-03	Band Reject/Notch Filter	WRCGV	Wainwright	N/A	1Y
EM022-03	2.45 GHz Filter	BRM50702	Micro-Tronics	2025-05-15	1Y
SA016-29	Climatic Test Chamber	MHU-80L	JIANQIAO	2026-01-05	1Y
EM046-05	Power meter	NPR6A	R&S	2025-04-22	1Y
EM046-06	Power meter	NPR6A	R&S	2025-05-09	1Y
EM045-01-01	EMC32 software (RE/RS)	V10.01.00	R&S	N/A	N/A
EM045-01-10	10dB Attenuator	N/A	R&S	2025-12-24	1Y

Conducted Disturbance-Mains Terminal (2)

Equipment No.	Equipment	Model	Manufacturer	Cal. Due date	Calibration
				(DD-MM-YYYY)	Interval
EM031-04	EMI receiver	ESR3	R&S	05/01/2026	1Y
EM006-06	LISN	ENV216	R&S	01/09/2025	1Y
SA047-111	Digital Temperature-Humidity Recorder	RS210	YIJIE	20/10/2025	1Y
EM004-03	EMC shield Room	8m×4m×3m	Zhongyu	05/01/2026	1Y

*****End of the test report*****