



FCC TEST REPORT

**Test report
On Behalf of
Shenzhen Feasycom Technology Co.,LTD
For
Bluetooth and Wi-Fi combo module
Model No.: FSC-BW236**

FCC ID: 2AMWOFSC-BW236

Prepared for : Shenzhen Feasycom Technology Co.,LTD
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Date of Test: Oct. 26, 2020 -- Nov. 04, 2020

Date of Report: Nov. 04, 2020

Report Number: HK2010293163-3E

**TEST RESULT CERTIFICATION**

Applicant's name.....: Shenzhen Feasycom Technology Co.,LTD
Address.....: Room 2004A, 20th Floor, Huichao Technology Building, Jinhai Road, Xixiang, Baoan District, Shenzhen, China 518102
Manufacture's Name.....: Shenzhen Feasycom Technology Co.,LTD
Address.....: Room 2004A, 20th Floor, Huichao Technology Building, Jinhai Road, Xixiang, Baoan District, Shenzhen, China 518102
Product description
Trade Mark.....: Feasycom
Product name.....: Bluetooth and Wi-Fi combo module
Model and/or type reference.: FSC-BW236
Standards.....: FCC 47 CFR Part 15 Subpart E

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Date of Test..... :
Date (s) of performance of tests.....: Oct. 26, 2020 -- Nov. 04, 2020
Date of Issue.....: Nov. 04, 2020
Test Result.....: Pass

Testing Engineer :

(Gary Qian)

Technical Manager :

(Eden Hu)

Authorized Signatory :

(Jason Zhou)



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1 GENERAL INFORMATION

1.1 TEST RESULTS

Requirement	CFR 47 Section	Result
Antenna requirement	§15.203	PASS
AC Power Line Conducted Emission	§15.207	PASS
Maximum Conducted Output Power	§15.407(a)	PASS
26dB Emission Bandwidth& 99% Occupied Bandwidth	§15.407(a)	PASS
6 dB bandwidth	15.407 (e)	PASS
Power Spectral Density	§15.407(a)	PASS
Band edge	§15.407(b)	PASS
Radiated Emission	§15.407(b)	PASS
Frequency Stability	§15.407(g)	PASS

Note: 1. PASS: Test item meets the requirement.

2. Fail: Test item does not meet the requirement.

3. N/A: Test case does not apply to the test object.

4. The test result judgment is decided by the limit of test standard.

1.2 TEST FACILITY

Test Firm : Shenzhen HUAKE Testing Technology Co., Ltd.

Address 1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China

1.3 MEASUREMENT EQUIPMENT USED

The measuring equipment, which was utilized in performing the tests documented here in, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

Conducted Emissions Test Site					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum analyzer	Agilent	N9020A	HKE-048	2019-12-26	2020-12-25
Spectrum analyzer	R&S	FSP40	HKE-025	2019-12-26	2020-12-25
Power meter	Agilent	E4419B	HKE-085	2019-12-26	2020-12-25
Power Sensor	Agilent	E9300A	HKE-086	2019-12-26	2020-12-25
Power SPLITTER	Mini-Circuits	ZN2PD-9G	HKE-125	N.C.R	N.C.R
programmable power	Agilent	E3634A	HKE-091	N.C.R	N.C.R
Temperature and humidity	Boyang	HTC-1	HKE-079	2019-12-26	2020-12-25



977 Chamber					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum analyzer	Agilent	N9020A	HKE-048	2019-12-26	2020-12-25
Spectrum analyzer	R&S	FSP40	HKE-025	2019-12-26	2020-12-25
Spectrum analyzer	Agilent	N9020A	HKE-089	2019-12-26	2020-12-25
Receiver	R&S	ESCI 7	HKE-010	2019-12-26	2020-12-25
Preamplifier	EMCI	EMC051845SE	HKE-015	2019-12-26	2020-12-25
Preamplifier	Agilent	83051A	HKE-016	2019-12-26	2020-12-25
Broadband antenna	Schwarzbeck	VULB 9163	HKE-012	2019-12-26	2020-12-25
Horn antenna	Schwarzbeck	9120D	HKE-013	2019-12-26	2020-12-25
Loop antenna	Schwarzbeck	FMZB 1519 B	HKE-014	2019-12-26	2020-12-25
High gain antenna	Schwarzbeck	LB-180400KF	HKE-054	2019-12-26	2020-12-25
Position controller	Taiwan MF	MF7802	HKE-011	N.C.R	N.C.R
Antenna tower	Taiwan MF	CTERG23	HKE-120	N.C.R	N.C.R
Controller	Taiwan MF	CT100	HKE-121	N.C.R	N.C.R
Test Software			EZ-EMC		

Conducted Emission					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Receiver	R&S	ESCI 7	HKE-010	2019-12-26	2020-12-25
LISN	R&S	ENV216	HKE-002	2019-12-26	2020-12-25
LISN	ENV216	R&S	HKE-059	2019-12-26	2020-12-25
ISN	Schwarzbeck	ISN CAT5 8158	HKE-062	2019-12-26	2020-12-25
Test Software	EZ-EMC				

Remark: Each piece of equipment is scheduled for calibration once a year.



1.4 Measurement Uncertainty

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with TR 100 028-1 [2] and shall correspond to an expansion factor(coverage factor) $k = 1,96$ or $k = 2$ (which provide confidence levels of respectively 95% and 95,45% in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

Table 6 is based on such expansion factors.

Table6:Maximummeasurementuncertainty

Parameter	UNCERTAINTY
Radio frequency	$\pm 0.8 \times 10^{-7}$
RF power, conducted	0.2054
Maximum frequency deviation: -within 300Hz and 6 kHz of audio frequency -within 6 kHz and 25 kHz of audio frequency	1.3%
	0.65 dB
Adjacent channel power	0.2054
Conducted spurious emission of transmitter, valid up to 6 GHz	0.2892
Conducted emission of receivers	+1.2/-1.1 dB
Radiated emission of transmitter, valid up to 6 GHz	± 3.94 dB
Radiated emission of receiver, valid up to 6 GHz	± 3.94 dB
RF level uncertainty for a given BER	± 0.3 dB
Temperature	0.1979
Humidity	± 1 %



2 GENERAL DESCRIPTION

2.1 EUT DESCRIPTION

Product Name:	Bluetooth and WIFI combo module			
Model/Type reference:	FSC-BW236			
Serial Model:	/			
Trade Mark:	Feasycom			
FCC ID	2AMWOFSC-BW236			
Hardware Version:	V1.2			
Software Version:	V2.2			
Frequency Range :	Band	Mode	Operation frequency	Channels
	BAND I UNII-I	IEEE802.11a	5180-5240MHz	4
		IEEE802.11acHT20	5180-5240MHz	4
		IEEE802.11ac HT40	5190-5230MHz	2
	BAND III UNII-3	IEEE802.11 a	5745-5825 MHz	5
		IEEE802.11 acHT20	5745-5825 MHz	5
		IEEE802.11 acHT40	5755-5795 MHz	2
Modulation Technology:	OFDM			
Antenna Type:	PCB Antenna			
Antenna Gain:	0dBi			
Power Source:	DC 3.3V from test board(5.0V)			

Note: This report only shows band1/3 test data

The product only support 802.11a/ac mode

Data Rate(s) Tested: Use the maximum rate: 54Mbit/s

Frequency of Channels (20MHz BW)

Band 1		Band 3	
CH.	Frequency (MHz)	CH.	Frequency (MHz)
36	5180	149	5745
40	5200	153	5765
44	5220	157	5785
48	5240	161	5805
		165	5825

Frequency of Channels (40MHz BW)

Band 1		Band 3	
CH.	Frequency (MHz)	CH.	Frequency (MHz)
38	5190	151	5755
46	5230	159	5795

Worst Case Configuration: ANT1 transmitting both 2.4GHz mode and 5GHz mode

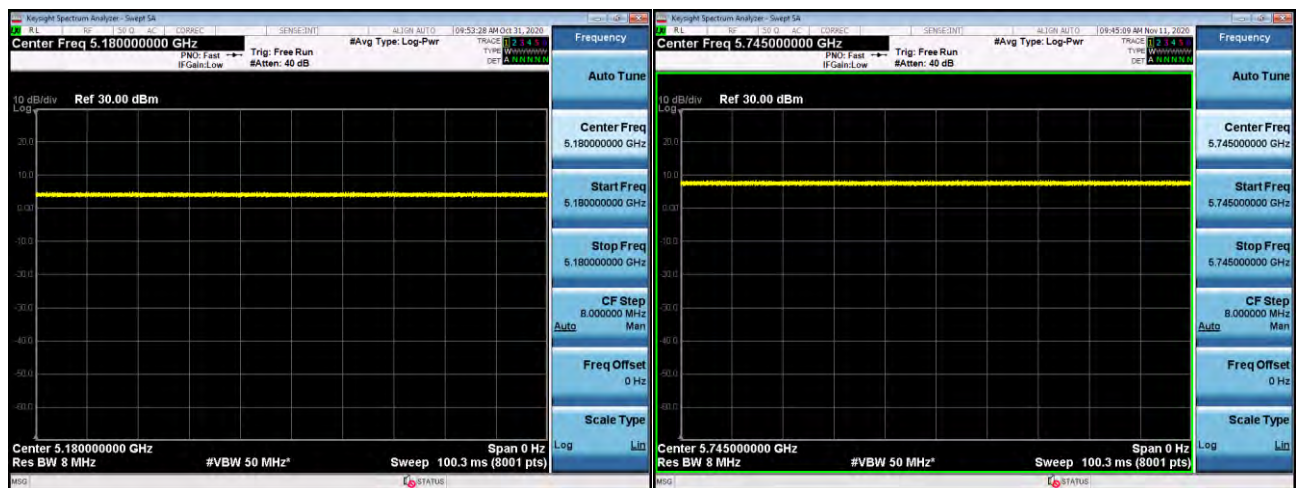


Description	5 GHz Emission
Antenna	ANT1
Channel	36
Operating Frequency (MHz)	5180
Data Rate (Mbps)	54
Mode	BAND 1

2.2 Duty Cycles

5GHz NII operation is possible in 20MHz channel bandwidths. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz, and detector = peak per the guidance of Section B)2)b) of ANSI C63.10-2013 and KDB 789033 D02 v02r01. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Duty Cycles(%)	
Mode	ANT1
Band 1-A(HT20)	100%
Band 3-A(HT20)	100%



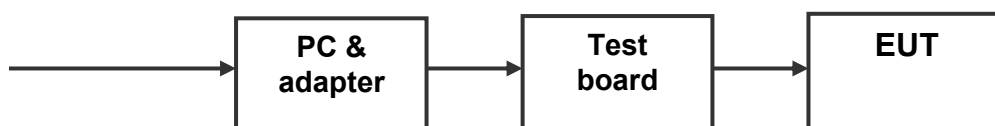
2.3 EUT CONFIGURATION

The EUT configuration for testing is installed for RF field strength measurement to meet the Commissions requirement, and is operated in a manner intended to generate the maximum emission in a continuous normal application.

The EUT is operated in the engineering mode to fix the Tx frequency for the purposes of measurement. According to its specifications, the EUT must comply with the requirements of Section 15.407 under the FCC Rules Part 15 Subpart E.

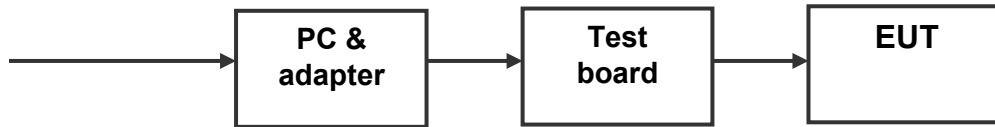
2.4 DESCRIPTION OF TEST SETUP

Operation of EUT during conducted testing:





Operation of EUT during Radiation and Above 1GHz Radiation testing:



NOTE: DC 3.3V(EUT) from test board(5.0V)

2.5 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turn table, which is positioned at 0.8 m above the ground plane. According to the requirements in Section 13.3 of ANSI C63.10:2013, the conducted emission from the EUT is measured in the frequency range between 0.15MHz and 30MHz, using the CISPR Quasi-Peak detector mode.

Radiated Emissions

Under 1GHz: The EUT is placed on a turn table, which is 0.8m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.10:2013.

Above 1GHz: The EUT is placed on a turn table, which is 1.5m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.10:2013.

2.6 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

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 0.495 - 0.505 ⁽¹⁾ 2.1735 - 2.1905 4.125 - 4.128 4.17725 - 4.17775 4.20725 - 4.20775 6.215 - 6.218 6.26775 - 6.26825 6.31175 - 6.31225 8.291 - 8.294 8.362 - 8.366 8.37625 - 8.38675 8.41425 -	16.42 - 16.423 16.69475 - 16.69525 16.80425 - 16.80475 25.50 - 25.67 37.50 - 38.25 73.00 - 74.60 74.80 - 75.20 108.00 - 121.94 123 - 138	399.9 - 410 608 - 614 960.0 - 1240 1300 - 1427 1435.0 - 1626.5 1645.5 - 1646.5 1660 - 1710 1718.8 - 1722.2 2200 - 2300 2310 - 2390 2483.5 - 2500.0 2655 - 2900 3260 - 3267	4.50 - 5.15 5.35 - 5.46 7.25 - 7.75 8.025 - 8.500 9.0 - 9.2 9.3 - 9.5 10.6 - 12.7 13.25 - 13.4 14.47 - 14.5 15.35 - 16.2 17.7 - 21.4 22.01 - 23.12 23.6 - 24.0 31.2 - 31.8 36.43 - 36.5 ⁽²⁾
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¹ Until February 1, 1999, this restricted band shall be 0.490-0.510MHz.

² Above 38.6

Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

2.7 DESCRIPTION OF TEST MODES

Description	Modulation Technology
26dB Bandwidth and 99% bandwidth	OFDM
Maximum conducted output power	OFDM
Band edges measurement	OFDM
Peak Power Spectral Density	OFDM
Radiated undesirable emission	OFDM
Power line conducted emission	OFDM

2.8 ANTENNA DESCRIPTION

an intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached or an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section”

- * the antenna of this EUT is a unique (PCB antenna for WiFi).
- * the EUT complies with the requirement of 15.203.

WIFI ANTENNA





3.SETUP OF EQUIPMENT UNDER TEST

3.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

3.2 SUPPORT EQUIPMENT

Description	Information	Manufacturer	Remark	Certificate
Computer	Model: TP00067A	DELL	Provide by lab	ID
PC Adapter	MODEL:PW25T12A1 INPUT1100-240V AC 50/60Hz OUTPUT:12V 6A	DELL	Provide by lab	SDOC

Remark:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.



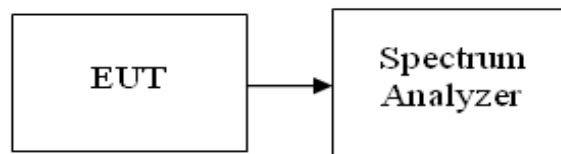
4 TEST REQUIREMENTS AND RESULTS

4.1 26 DB EMISSION BANDWIDTH

LIMIT

According to §15.403(i), 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. Compliance with the emissions limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

TEST CONFIGURATION



TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low-loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzers RBW = approximately 1% of the emission bandwidth, VBW > RBW, Detector = Peak, Span > 26 dB bandwidth, and Sweep = auto, Trace mode = max hold.
4. 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%.
5. Repeat until all the rest channels were investigated.

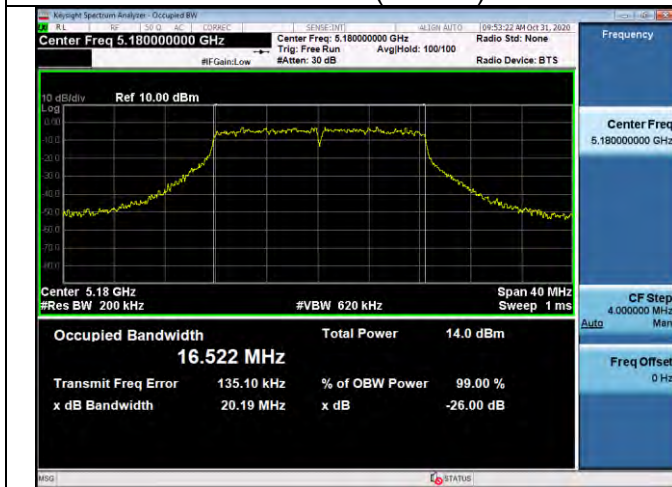
TEST RESULTS

BAND	802.11 Mode	Channel No.	Frequency [MHz]	26dB Bandwidth [MHz]	99%dB Bandwidth [MHz]
BAND 1	a (20MHz)	36	5180	20.19	16.522
		40	5200	20.37	16.519
		48	5240	20.15	16.525
	ac (20MHz)	36	5180	20.44	17.591
		40	5200	20.12	17.577
		48	5240	20.25	17.646
	ac(40MHz)	38	5190	38.49	35.821
		46	5230	38.28	35.887

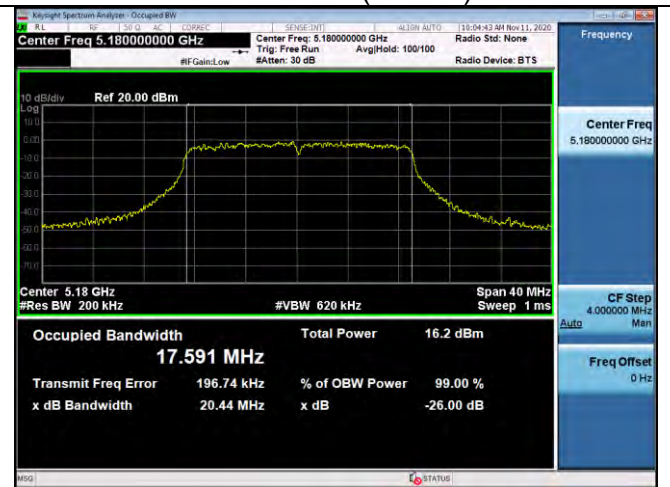


Test plots as follows:

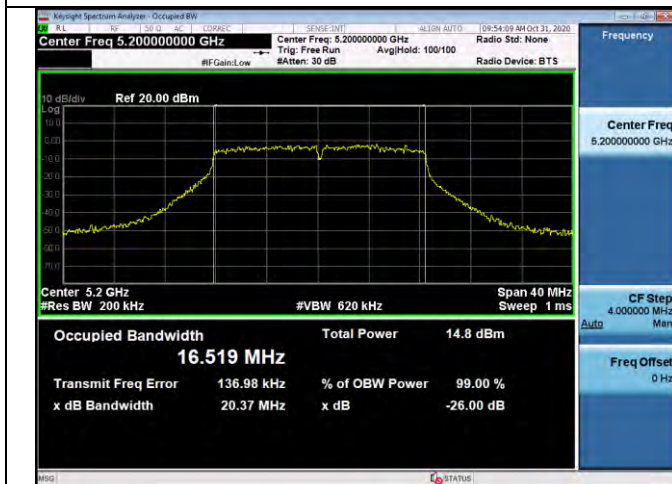
Band 1-- a (20MHz)



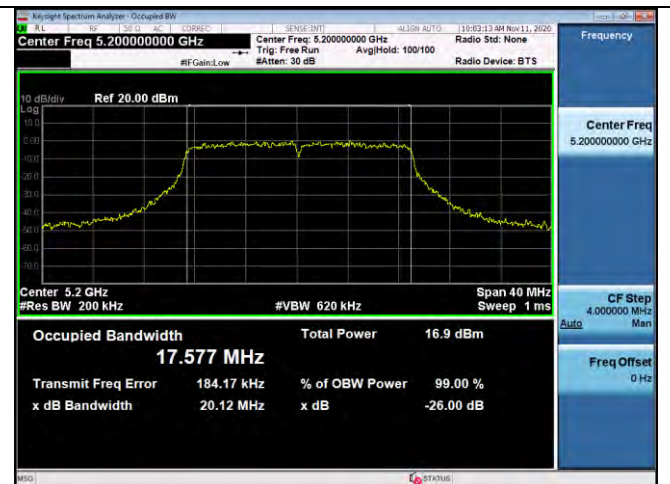
Band 1-- ac (20MHz)



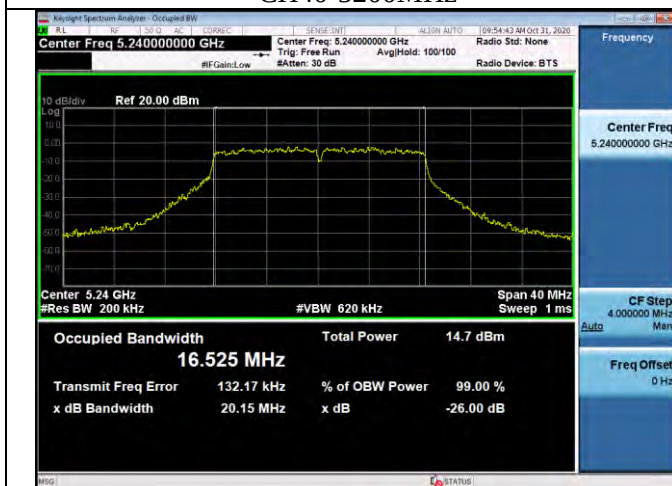
CH36-5180MHz



CH36-5180MHz



CH40-5200MHz



CH40-5200MHz

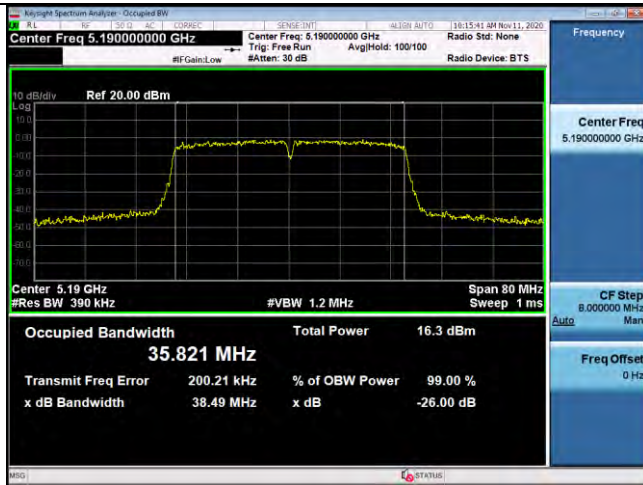


CH48-5240MHz

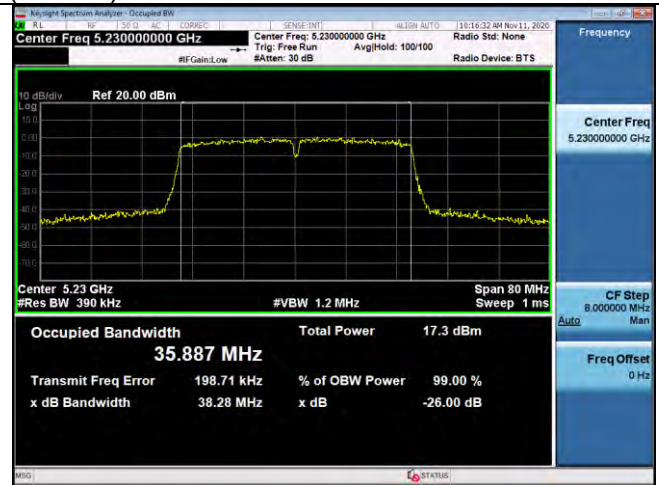
CH48-5240MHz



Band 1-- ac (40MHz)



CH38-5190MHz

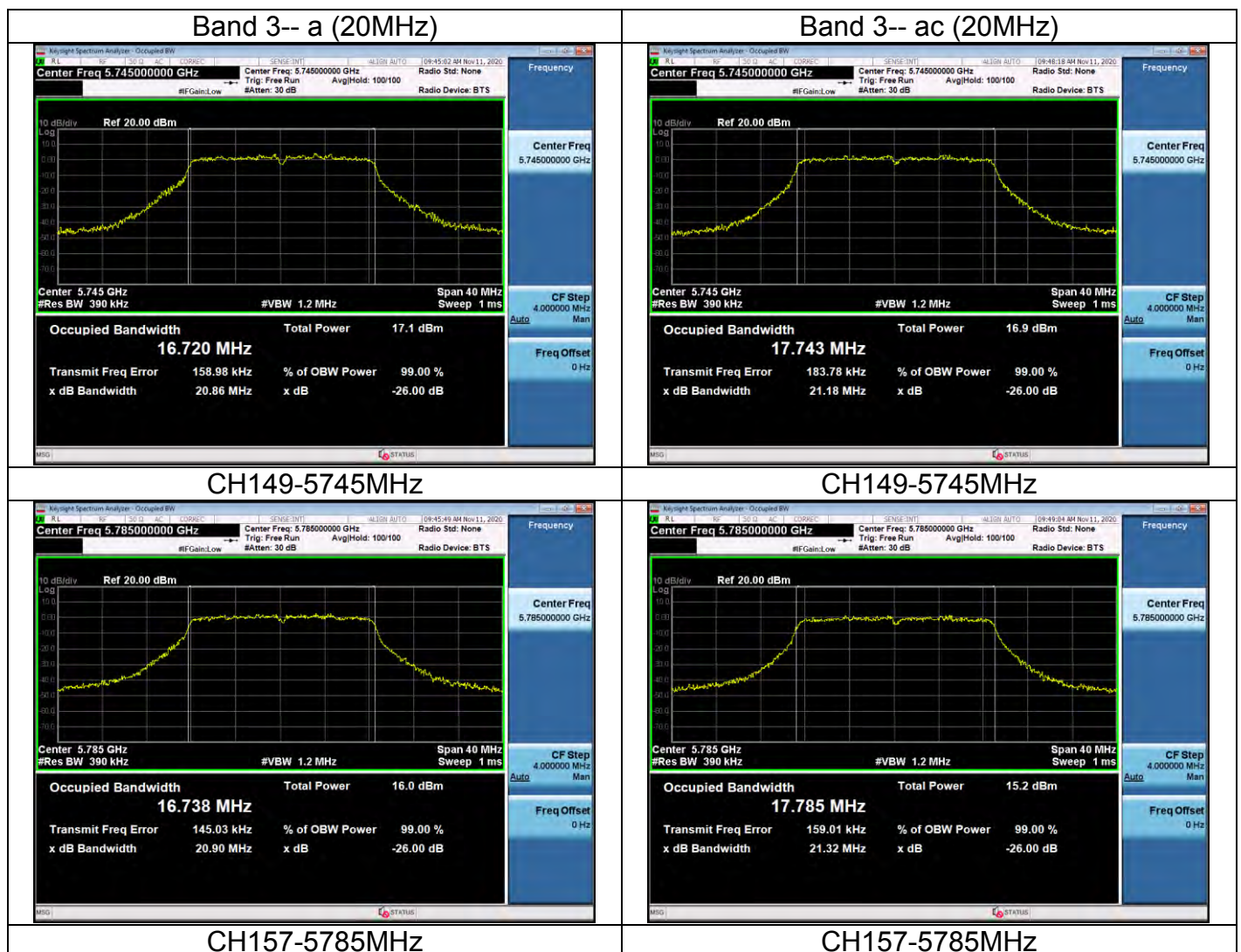


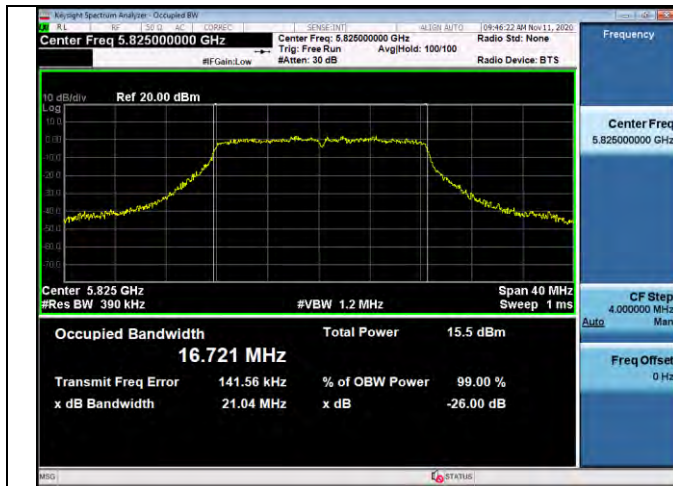
CH46-5230MHz



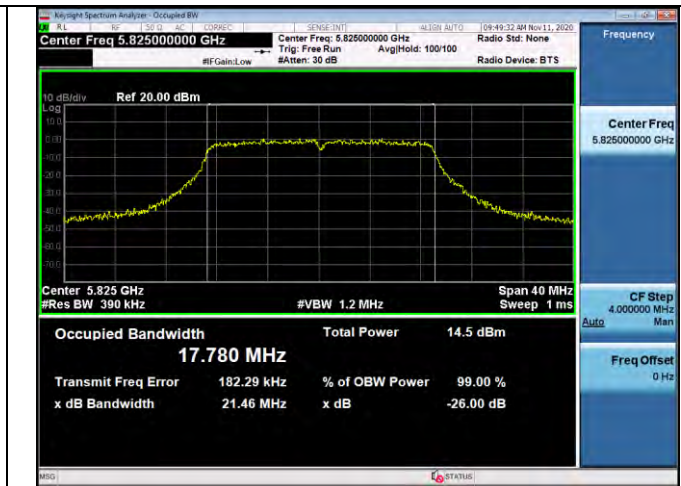
BAND	802.11 Mode	Channel No.	Frequency [MHz]	99%dB Bandwidth [MHz]
BAND 3	a (20MHz)	149	5745	16.720
		157	5785	16.738
		165	5825	16.721
	ac (20MHz)	149	5745	17.743
		157	5785	17.785
		165	5825	17.780
	ac(40MHz)	151	5755	35.910
		159	5795	35.938

Test plots as follows:



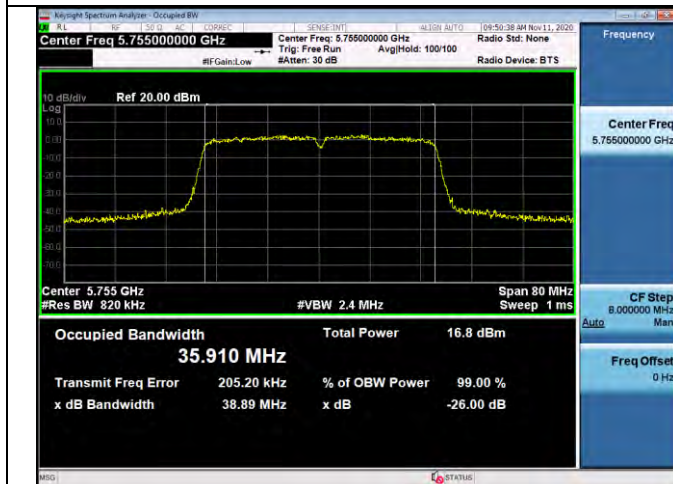


CH165-5825MHz

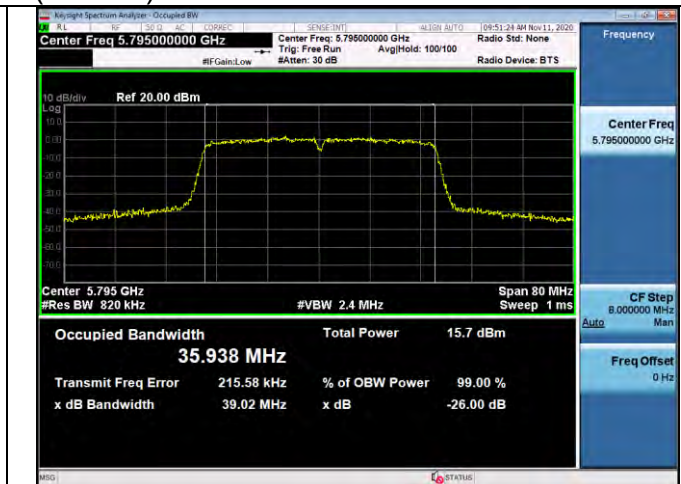


CH165-5825MHz

Band 3-- ac (40MHz)



CH151-5755MHz



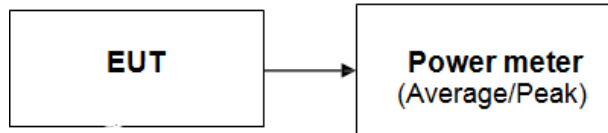
CH159-5795MHz



4.2 -6dB Bandwidth

In the 5.725 – 5.850GHz band, the 6dB bandwidth must be ≥ 500 kHz.

TEST CONFIGURATION



The EUT was connected to a spectrum analyzer through a 50Ω RF cable.

TEST PROCEDURE

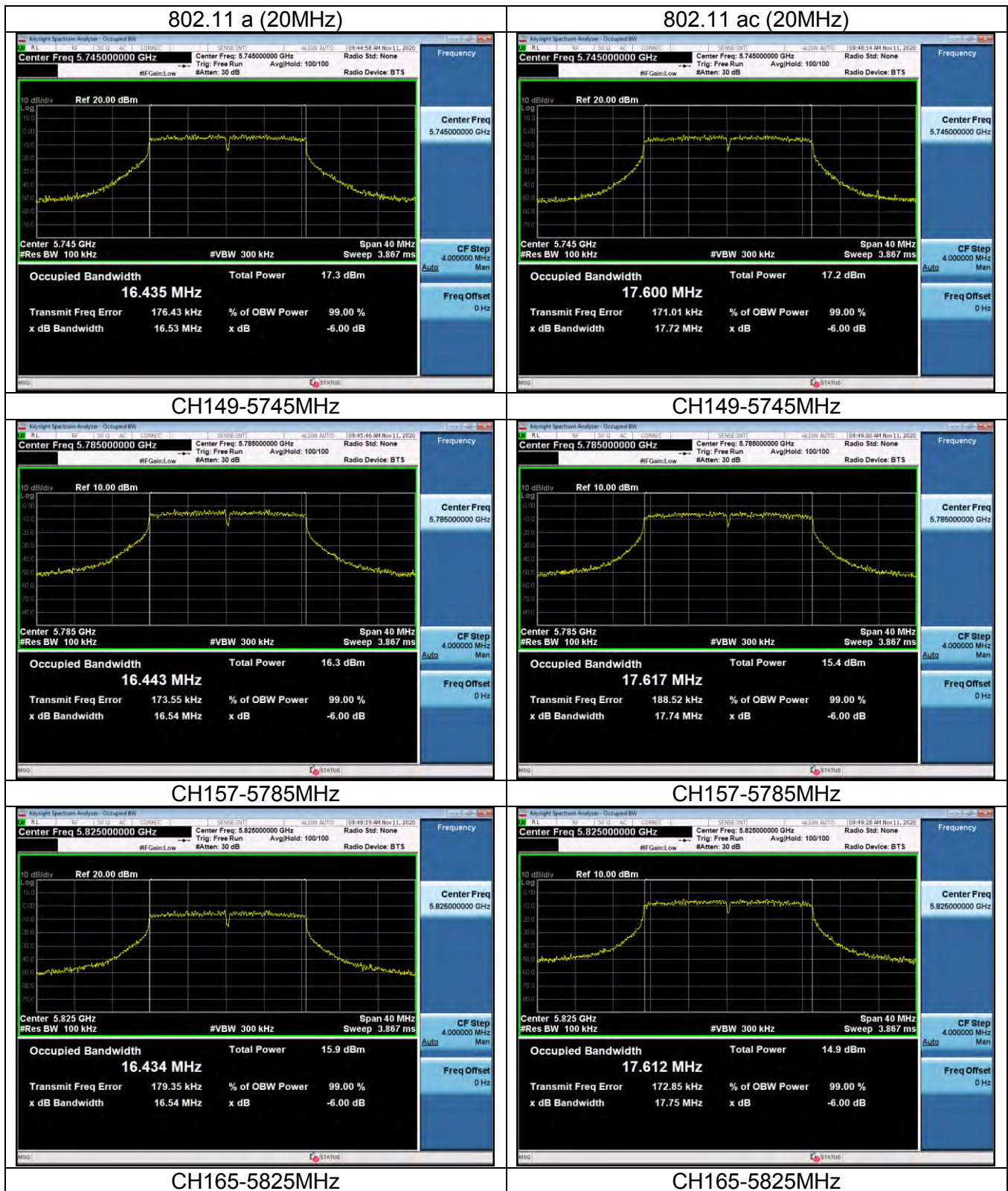
1. KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section C
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Make the measurement with the spectrum analyzer's resolution bandwidth RBW = 1% EBW, VBW $\geq$ 3RBW, In order to make an accurate measurement.
4. Measure and record the results in the test report.

TEST RESULTS

BAND	802.11 Mode	Channel No.	Frequency [MHz]	-6db Bandwidth [MHz]
BAND 3	a (20MHz)	149	5745	16.53
		157	5785	16.54
		165	5825	16.54
	ac (20MHz)	149	5745	17.72
		157	5785	17.74
		165	5825	17.75
	ac(40MHz)	151	5755	36.41
		159	5795	36.41
Limit	≥ 500 kHz			
Result	PASS			



Test plots as follows:

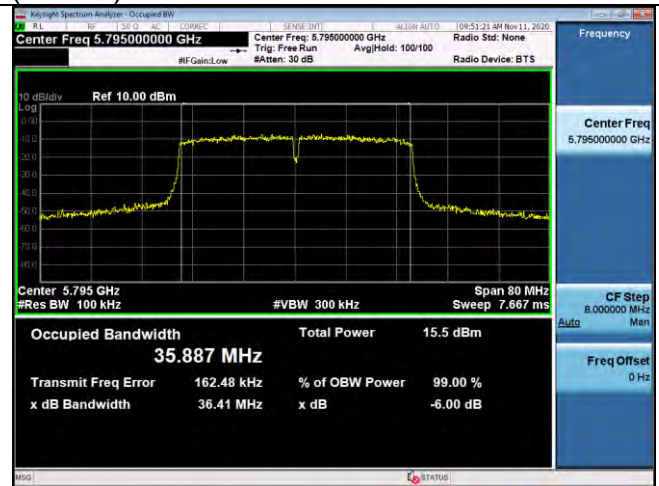




802.11 ac (40MHz)



CH151-5755 MHz



CH159-5795 MHz



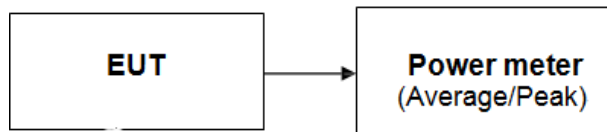
4.3 MAXIMUM CONDUCTED OUTPUT POWER

LIMIT

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

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.

TEST CONFIGURATION



The EUT was connected to a spectrum analyzer through a 50Ω RF cable.

TEST PROCEDURE

The testing follows Method PM of FCC KDB789033 D02 General UNII Test Procedures New Rules v02r01.

Method PM (Measurement using an RF peak power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.

TEST RESULTS

BAND	802.11 Mode	Channel No.	Frequency [MHz]	Conducted Power [dBm]	Limit [dBm]
BAND 1	a (20MHz)	36	5180	7.585	23.98
		40	5200	8.288	23.98
		48	5240	8.415	23.98
	ac (20MHz)	36	5180	7.760	23.98
		40	5200	8.448	23.98



		48	5240	8.941	23.98
	ac(40MHz)	38	5190	8.623	23.98
		46	5230	8.704	23.98

BAND	802.11 Mode	Channel No.	Frequency [MHz]	Conducted Power [dBm]	Limit [dBm]
BAND 3	a (20MHz)	149	5745	10.670	30.00
		157	5785	9.606	30.00
		165	5825	9.130	30.00
	ac (20MHz)	149	5745	9.487	30.00
		157	5785	8.796	30.00
		165	5825	8.203	30.00
	ac(40MHz)	151	5755	9.708	30.00
		159	5795	8.545	30.00



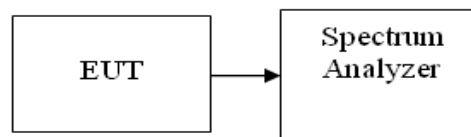
4.4 POWER SPECTRAL DENSITY

LIMIT

For client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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.

TEST CONFIGURATION



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 1MHz, VBW = 3MHz, Span must be greater than 26dB bandwidth, adjust as necessary, Sweep = auto, Detector RMS
3. Record the max. reading.

TEST RESULTS

BAND	802.11 Mode	Channel No.	Frequency [MHz]	Measured Power Spectral Density [dBm/MHz]	Power Spectral Density Limit [dBm/MHz]
BAND 1	a (20MHz)	36	5180	5.872	11
		40	5200	6.545	11
		48	5240	6.541	11
	ac (20MHz)	36	5180	6.640	11
		40	5200	7.502	11
		48	5240	7.913	11
	ac(40MHz)	38	5190	4.135	11
		46	5230	4.873	11

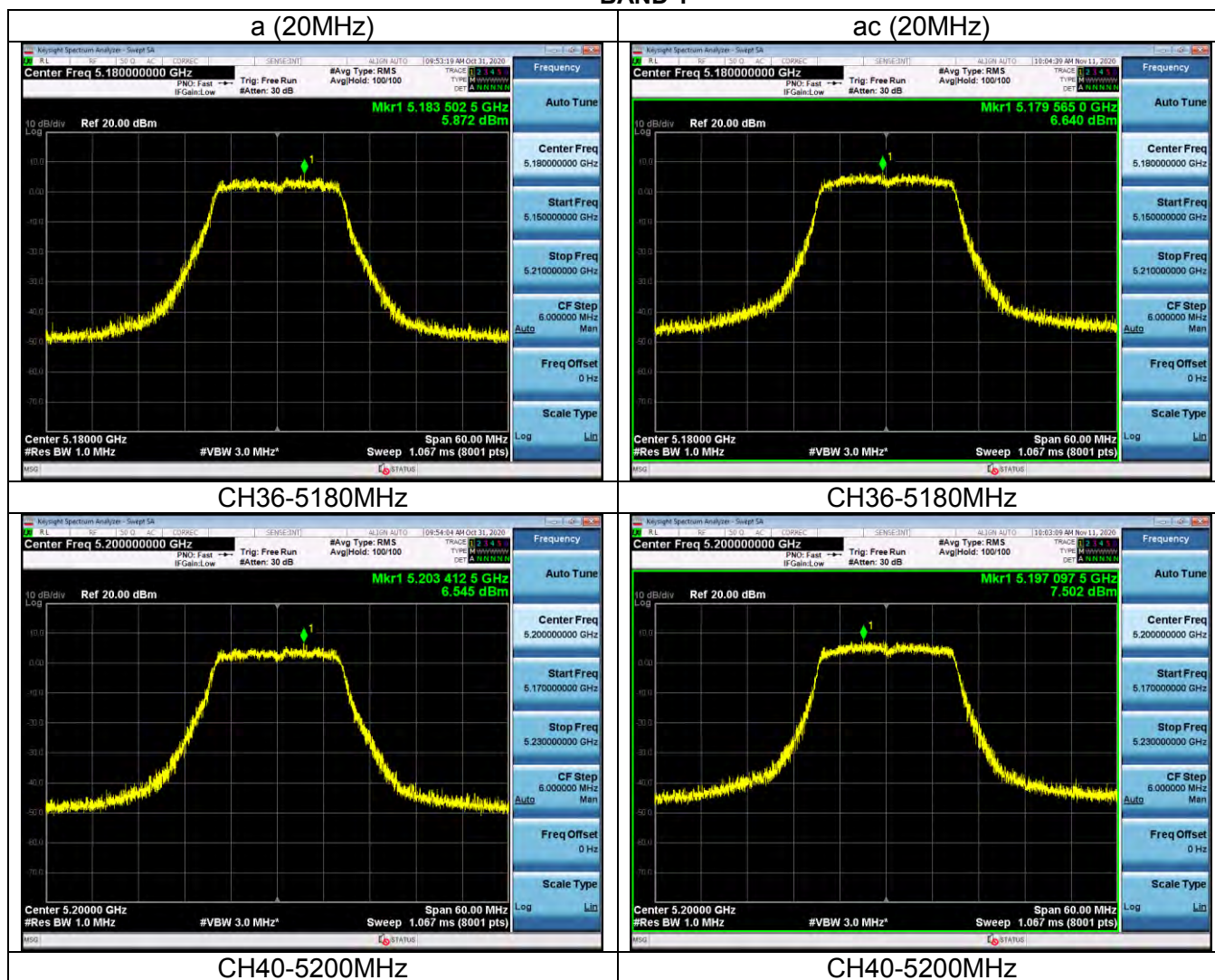


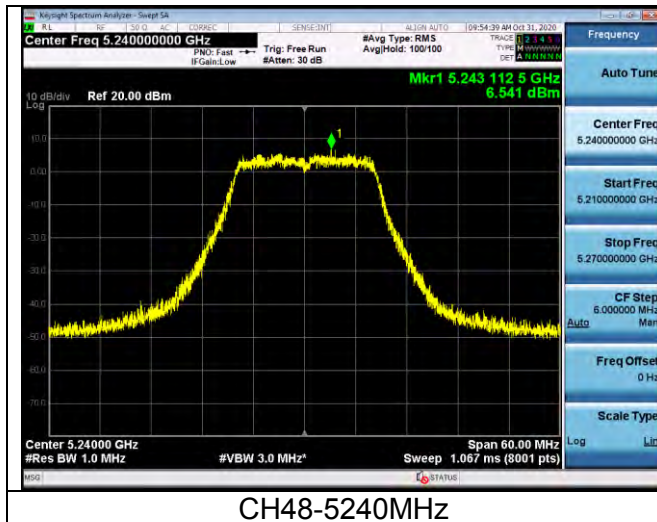
BAND	802.11 Mode	Channel No.	Frequency [MHz]	Measured PSD[dBm/510KHz]	Covert PSD [dBm/500KHz]	Limit [dBm/500KHz]
BAND 3	a (20MHz)	149	5745	5.471	5.385	30
		157	5785	3.537	3.451	30
		165	5825	3.582	3.496	30
	ac (20MHz)	149	5745	4.511	4.425	30
		157	5785	2.996	2.910	30
		165	5825	2.374	2.288	30
	ac (40MHz)	151	5755	0.196	0.110	30
		159	5795	0.134	0.048	30

Note: Covert PSD [dBm/500KHz]= PSD[dBm/510KHz]+10*log(500/510)

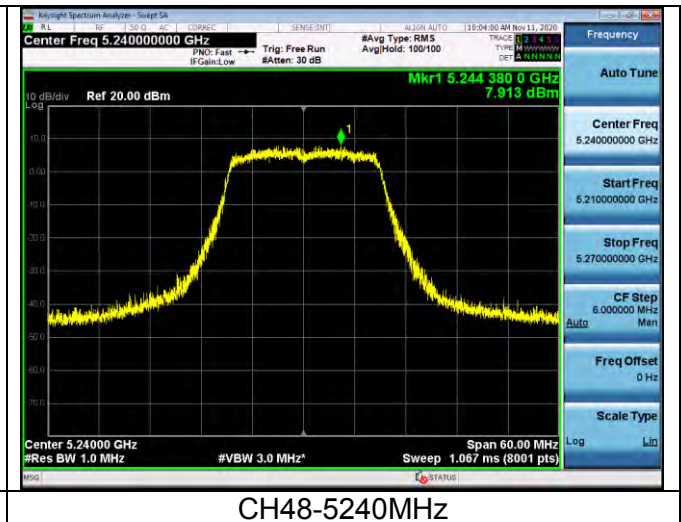
Test plots as follows:

BAND 1



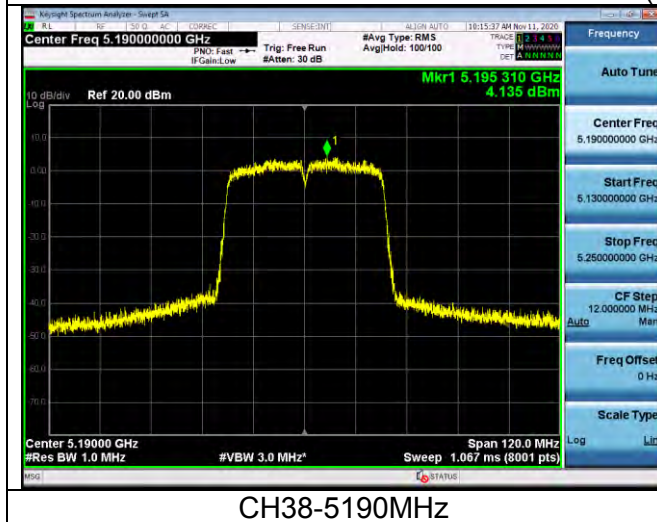


CH48-5240MHz

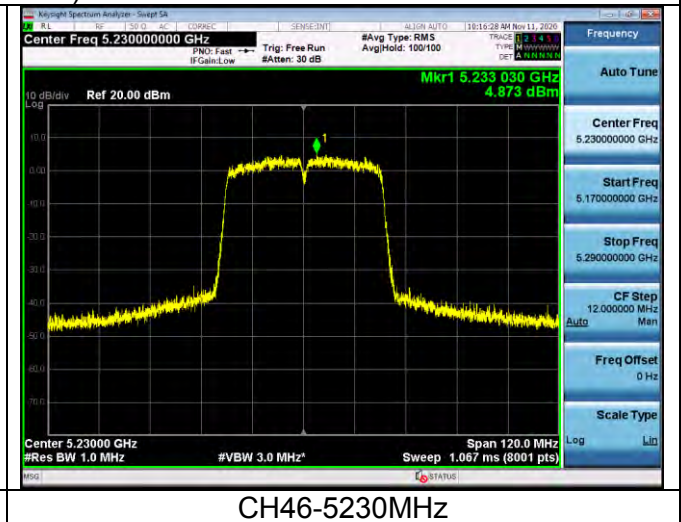


CH48-5240MHz

ac (40MHz)



CH38-5190MHz

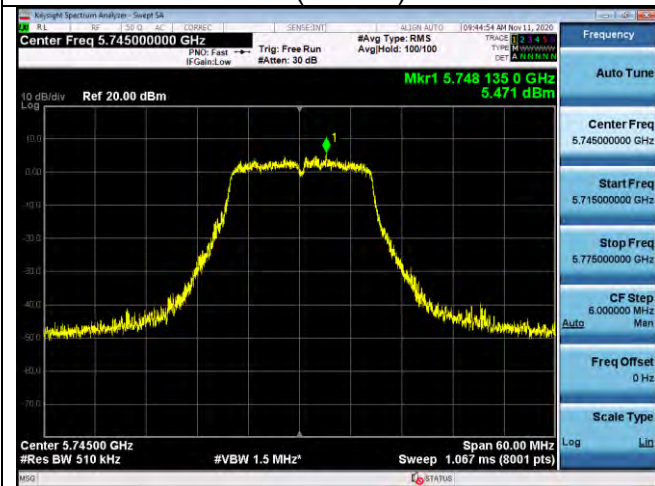


CH46-5230MHz



BAND 3

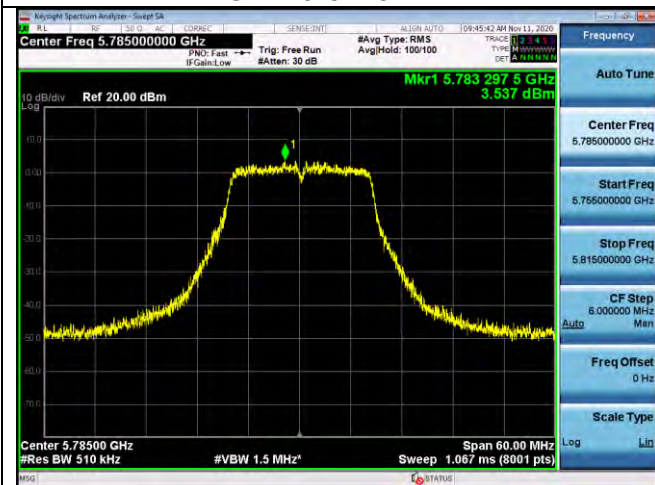
a (20MHz)



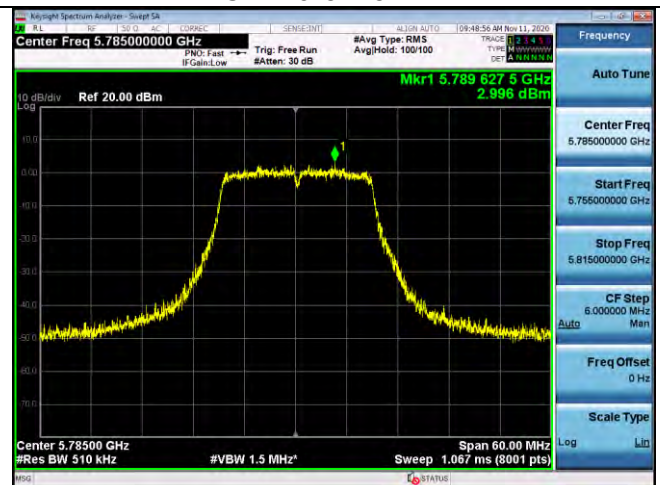
ac (20MHz)



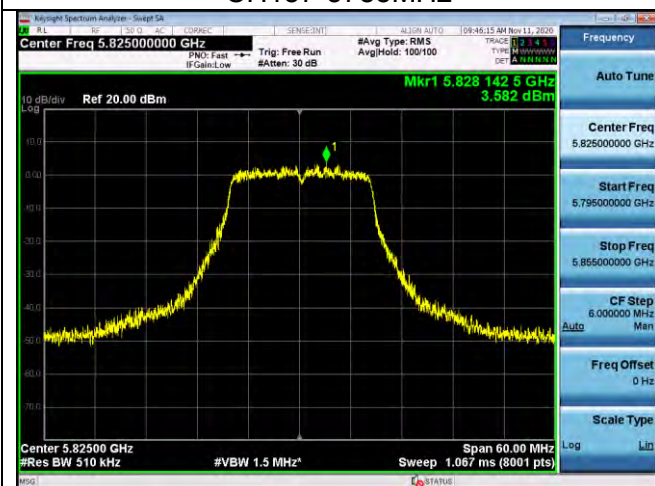
CH149-5745MHz



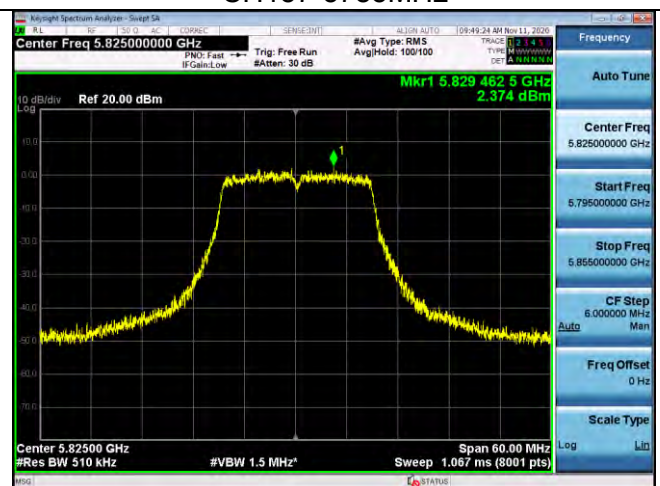
CH149-5745MHz



CH157-5785MHz



CH157-5785MHz



CH65-5825MHz



CH65-5825MHz

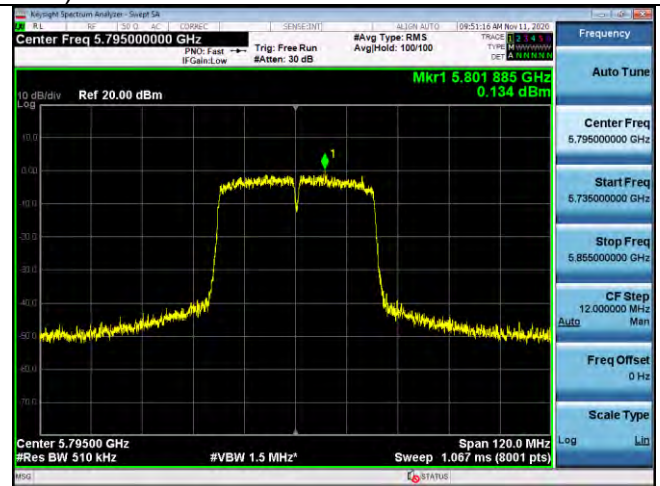




ac (40MHz)



CH151-5755MHz



CH159-5795MHz

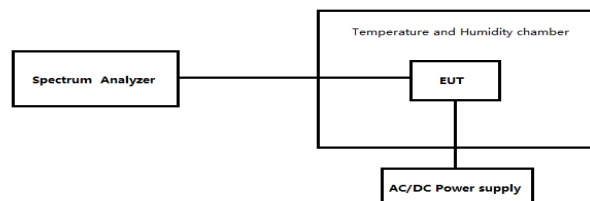


4.5 FREQUENCY STABILITY MEASUREMENT

LIMIT

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 user's manual.

TEST CONFIGURATION



TEST PROCEDURE

1. To ensure emission at the band edge is maintained within the authorized band, those values shall be measured by radiation emissions at upper and lower frequency points, and finally compensated by frequency deviation as procedures below.
2. The EUT was operated at the maximum output power, and connected to the spectrum analyzer, which is set to maximum hold function and peak detector. The peak value of the power envelope was measured and noted. The upper and lower frequency points were respectively measured relatively 10dB lower than the measured peak value.
3. The frequency deviation was calculated by adding the upper frequency point and the lower frequency point divided by two. Those detailed values of frequency deviation are provided in table below.

TEST RESULTS

The report only shows the test results in the worst test mode:

MODE	CH.	FRE.
802.11a(HT20)	36	5180
802.11a(HT20)	48	5240



802.11a(HT20)-CH36

Temperature (°C)	Voltage (V)	Freq.(MHz)	Center Frequency (MHz)	Frequency Deviation (MHz)	Frequency Stability (ppm)
25	V _{min}	5180	5180.031	0.031	6.045
25	V _{max}	5180	5180.021	0.021	4.046
25	V _{nor}	5180	5180.027	0.027	5.154
-10	V _{nor}	5180	5180.011	0.011	2.070
40	V _{nor}	5180	5180.030	0.030	5.785

ANT1-- 802.11a(HT20)-CH48

Temperature (°C)	Voltage (V)	Freq.(MHz)	Center Frequency (MHz)	Frequency Deviation (MHz)	Frequency Stability (ppm)
25	V _{min}	5260	5240.011	0.011	2.186
25	V _{max}	5260	5240.007	0.007	1.332
25	V _{nor}	5260	5240.034	0.034	6.405
-10	V _{nor}	5260	5240.033	0.033	6.204
40	V _{nor}	5260	5240.026	0.026	4.968



4.6 RADIATED UNDESIRABLE EMISSION

LIMIT

Radiated emissions from 9 kHz to 25 GHz were measured according to the methods defined in ANSI C63.10-2013. The EUT was placed above the ground plane, 0.8 meter for frequency below

1 GHz and 1.5 meter for frequency above 1 GHz. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions.

1. For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27 dBm/MHz.

For transmitters operating in the 5250-5350 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band must meet all applicable technical requirements for operation in the 5150-5250 MHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5150-5250 MHz band.

For transmitters operating in the 5470-5600 MHz and 5650-5725 MHz band: all emissions outside of the 5470-5600 MHz and 5650-5725 MHz band shall not exceed an EIRP of -27 dBm/MHz.

2. KDB789033v02r01G)2)c) As specified in 15.407(b), emissions above 1000 MHz that are outside of the restricted bands are subject to a peak 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 average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.
3. 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.
4. 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:

FREQUENCIES(MHz)	FIELD STRENGTH (microvolt/meter)	MEASUREMENT DISTANCE(meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Remark: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

5. In the emission table above, the tighter limit applies at the band edges.

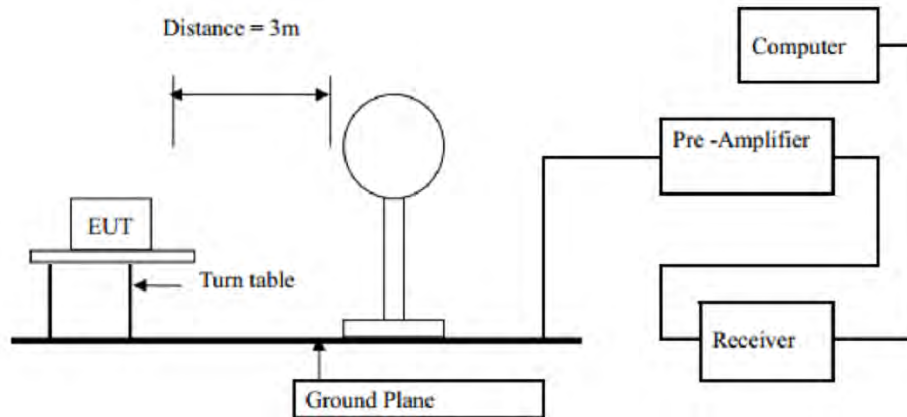
Frequency (MHz)	Field Strength(μV/m at 3-meter)	Field Strength(dBμV/m at 3-meter)
30-88	100	40



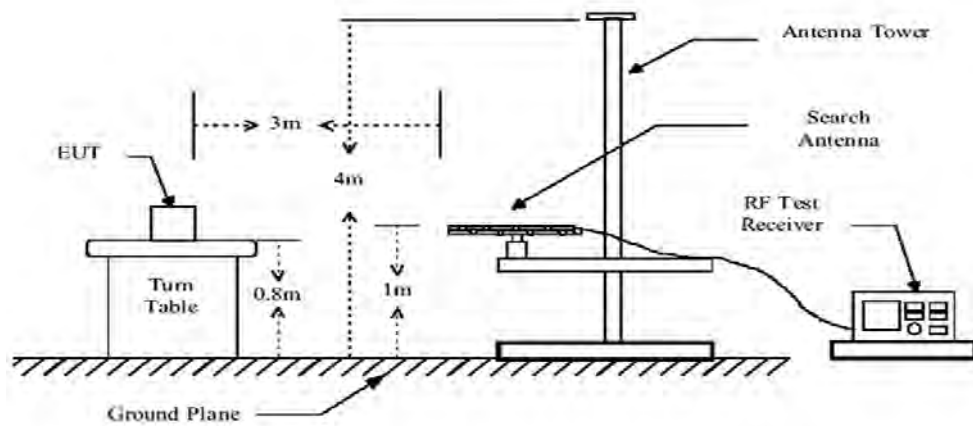
88-216	150	43.5
216-960	200	46
Above 960	500	54

Test Configuration

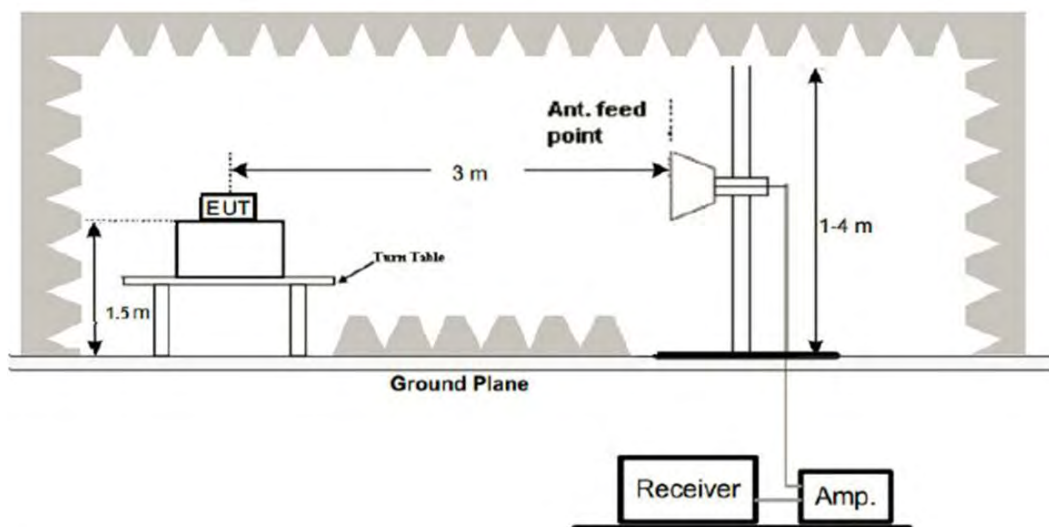
Below 30MHz



Below 1GHz



Above 1 GHz





TESTPROCEDURE

1. The EUT is placed on a turntable above ground plane, which is 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz.
2. The turntable shall be rotated for 360degrees to determine the position of maximum emission level.
3. EUTisset3mawayfromthereceivingantenna,whichisvariedfrom1mto4mtofindoutthehighest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

Below 1GHz:

RBW=100kHz/ VBW=300kHz / Sweep=AUTO

Above 1GHz:

(a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

(b) AVERAGE: RBW=1MHz / Sweep=AUTO

VBW=10Hz,whenduty cycle is no less than 98 percent.

VBW $\geq 1/T$, when duty cycle is less than 98 percent, where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

7. Repeat above procedures until the measurements for all frequencies are complete.

TES TRESULTS

Harmonics and Spurious Emissions

Frequency Range (9 kHz-30MHz)

Frequency (MHz)	Level@3m (dB μ V/m)	Limit@3m (dB μ V/m)
--	--	--
--	--	--
--	--	--
--	--	--

Note: 1. Emission Level=Reading+ Cable loss-Antenna factor-Amp factor

2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement



Test Results

All the test modes completed for test. only the worst result of 802.11a at 5240MHz was reported as below:

radiated emission 30MHz – 1Ghz:

Horizontal



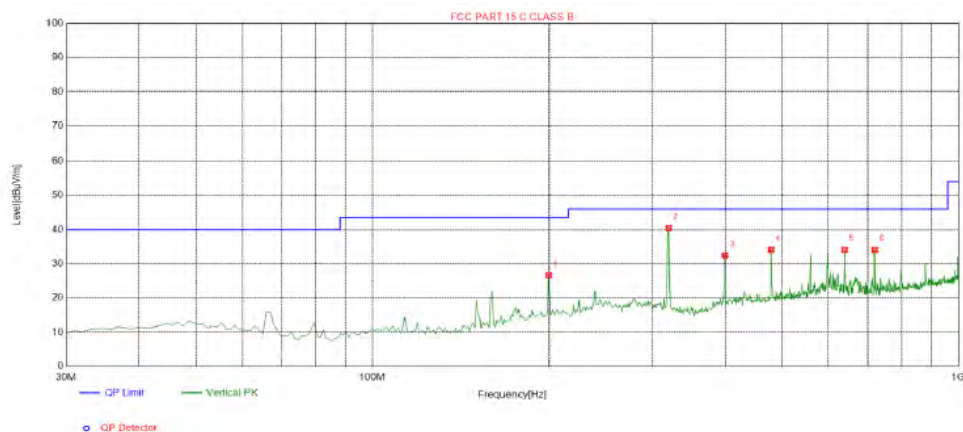
Suspected List

Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	320.3203	-12.08	63.32	51.24	46.00	-5.24	100	335	Horizontal
2	399.9399	-10.41	52.18	41.77	46.00	4.23	100	165	Horizontal
3	479.5596	-8.44	50.89	42.45	46.00	3.55	100	165	Horizontal
4	639.7698	-5.65	45.04	39.39	46.00	6.61	100	307	Horizontal
5	799.9800	-3.12	42.76	39.64	46.00	6.36	100	1	Horizontal
6	879.5996	-2.07	43.23	41.16	46.00	4.84	100	104	Horizontal

Remark: Margin = Limit – Level
Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
Level=Test receiver reading + correction factor



Vertical



Suspected List

Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	199.9199	-15.07	41.69	26.62	43.50	16.88	100	216	Vertical
2	320.3203	-12.08	52.55	40.47	46.00	5.53	100	73	Vertical
3	399.9399	-10.41	42.85	32.44	46.00	13.56	100	124	Vertical
4	479.5596	-8.44	42.55	34.11	46.00	11.89	100	140	Vertical
5	639.7698	-5.65	39.72	34.07	46.00	11.93	100	245	Vertical
6	720.3604	-4.70	38.78	34.08	46.00	11.92	100	79	Vertical

Remark: Margin = Limit – Level

Correction Factor= Antenna Factor + Cable loss – Pre-amplifier

Level=Test receiver reading + correction factor

Above 1 GHz

Note: The test results only show the worst results of mode 802.11a(HT20) for BAND1

TEST BAND	BW	TEST CH.	TEST FRE.(MHz)
BAND I	20	36	5180
		40	5200
		48	5240

BAND I

Operation Mode: Tx / IEEE 802.11a(HT20) Low Channel

Horizontal

[illegible]

Vertical

[illegible]

Operation Mode: Tx / IEEE 802.11a(HT20) Mid Channel

Horizontal

[illegible]

Vertical

[illegible]

Operation Mode: Tx / IEEE 802.11a(HT20) High Channel

Horizontal

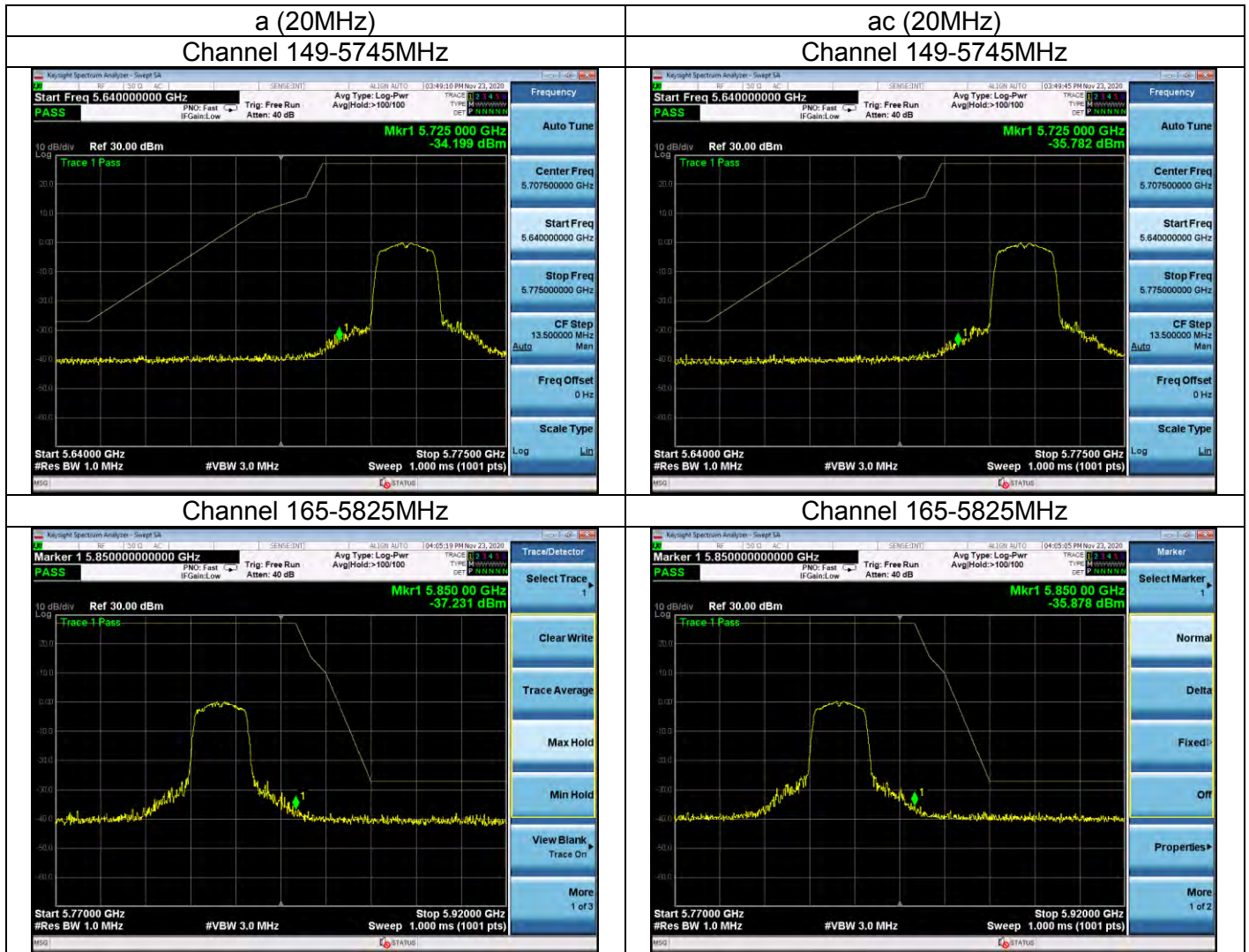
[illegible]

Vertical

[illegible]



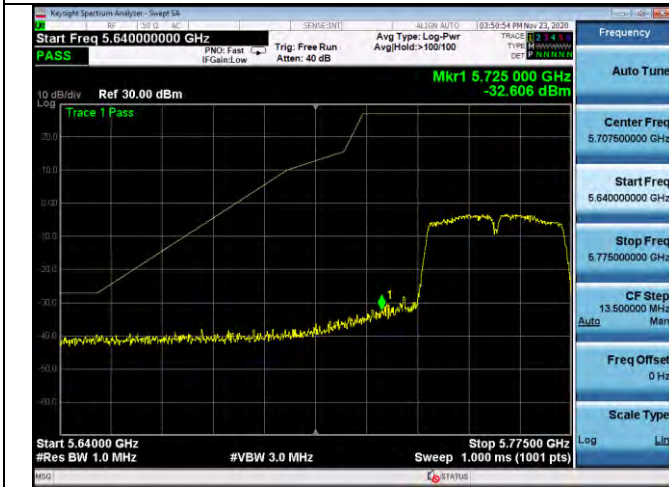
BAND 3:





ac(40MHz)

Channel 151-5755MHz



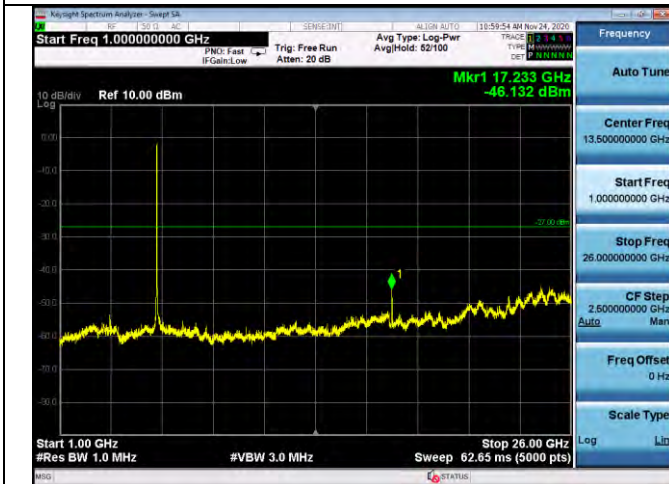
Channel 159-5795MHz



out-of-band emission:

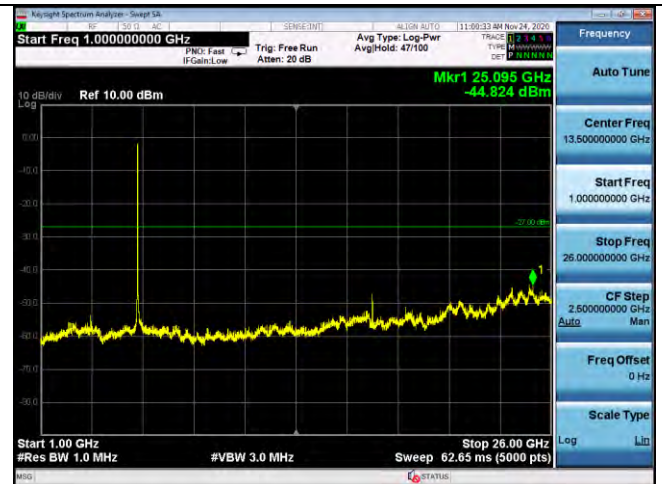
a (20MHz)

Channel 149-5745MHz

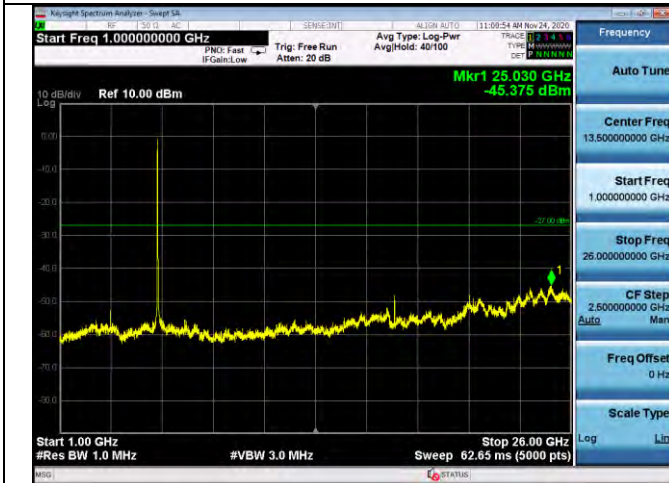


ac (20MHz)

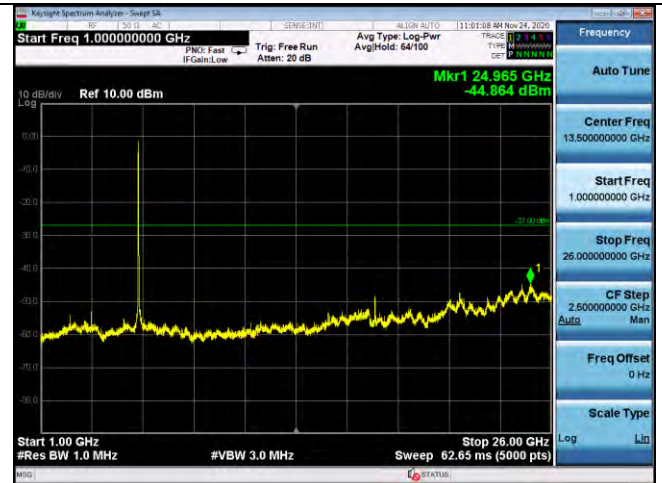
Channel 149-5745MHz



Channel 157-5785MHz

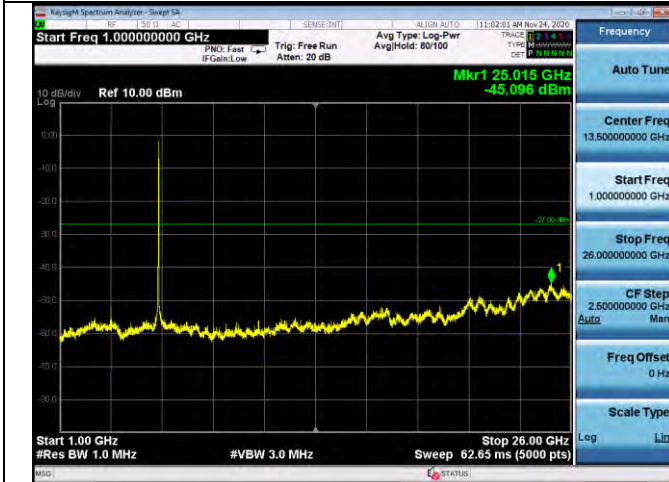


Channel 157-5785MHz

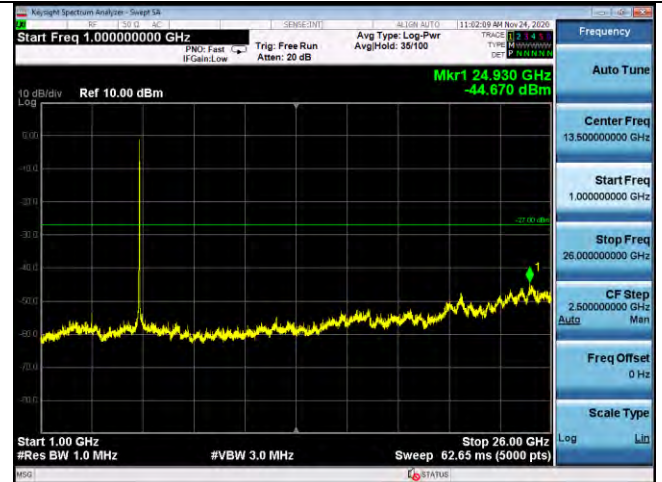




Channel 165-5825MHz

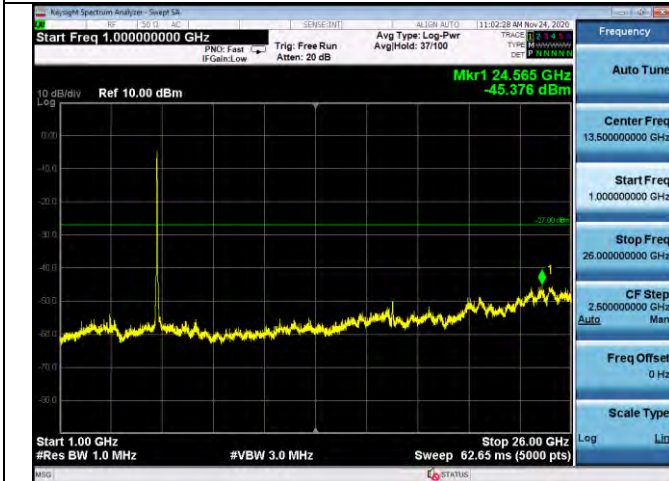


Channel 165-5825MHz

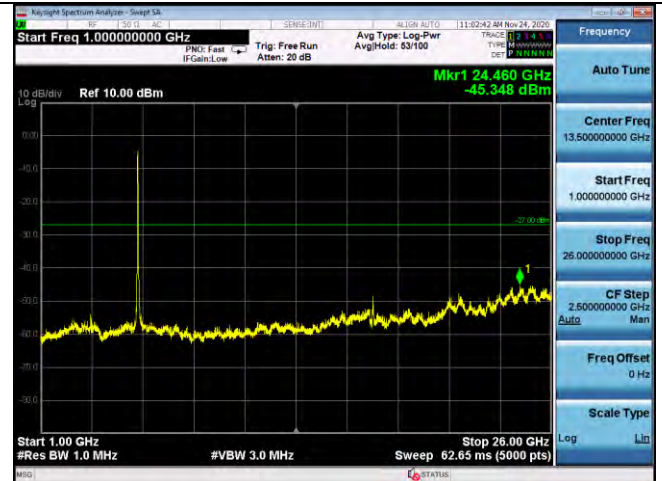


ac(40MHz)

Channel 151-5755MHz



Channel 159-5795MHz



Radiated Band Edge Test:

Operation Mode: BAND I--802.11a20 Mode - CH Low

Horizontal

Frequency	Reading	Factor	Emission level	Limits	Margin	Detector type
(MHz)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
5150	57.36	-2.49	54.87	74	-19.13	PK
5150	/	-2.49	/	54	/	AV
Remark: Factor= Antenna Factor + Cable loss – Pre-amplifier						

Vertical:

Frequency	Reading	Factor	Emission level	Limits	Margin	Detector type
(MHz)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
5150	58.48	-2.49	55.99	74	-18.01	PK
5150	/	-2.49	/	54	/	AV
Remark: Factor= Antenna Factor + Cable loss – Pre-amplifier						

Operation Mode: BAND I-- 802.11a20 Mode - CH High

Horizontal

Frequency	Reading	Factor	Emission level	Limits	Margin	Detector type
(MHz)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
5350	60.99	-2.49	58.50	74	-15.50	PK
5350	/	-2.49	/	54	/	AV
Remark: Factor= Antenna Factor + Cable loss – Pre-amplifier						

Vertical:

Frequency	Reading	Factor	Emission level	Limits	Margin	Detector type
(MHz)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
5350	57.20	-2.49	54.71	74	-19.29	PK
5350	/	-2.49	/	54	/	AV
Remark: Factor= Antenna Factor + Cable loss – Pre-amplifier						



4.7 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 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 Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

* *Decreases with the logarithm of the frequency.*

TEST CONFIGURATION

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

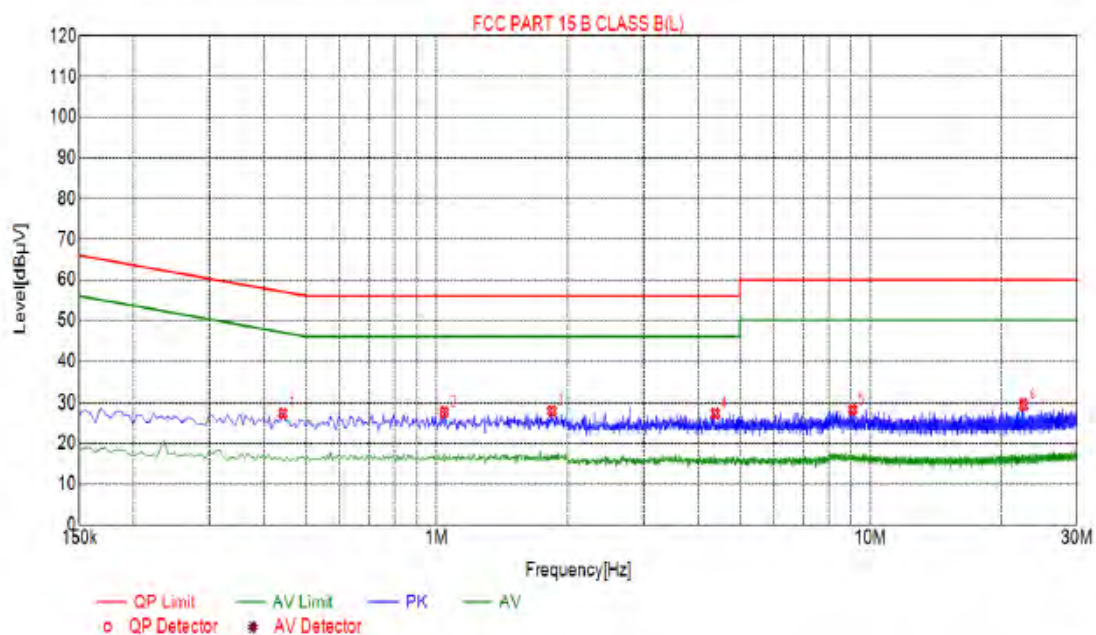
TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.



TestData

Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)

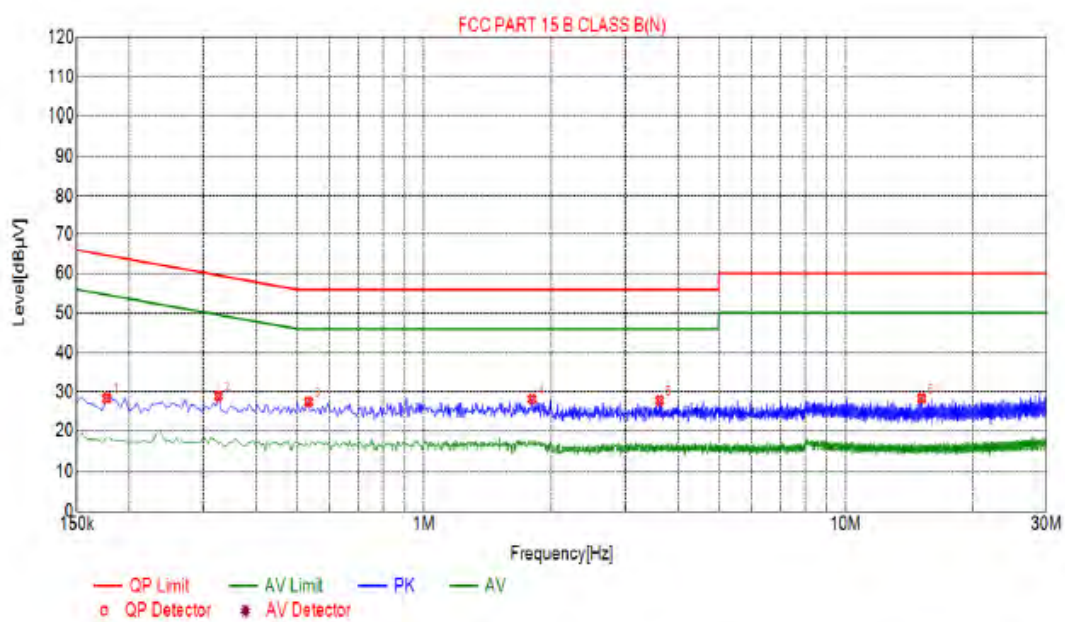


Suspected List								
NO.	Freq. [MHz]	Level [dBμV]	Factor [dB]	Limit [dBμV]	Margin [dB]	Reading [dBμV]	Detector	Type
1	0.4425	27.54	10.05	57.01	29.47	17.49	PK	L
2	1.0410	27.89	10.07	56.00	28.11	17.82	PK	L
3	1.8420	28.11	10.14	56.00	27.89	17.97	PK	L
4	4.3890	27.55	10.25	56.00	28.45	17.30	PK	L
5	9.0870	28.43	10.11	60.00	31.57	18.32	PK	L
6	22.5195	29.47	10.17	60.00	30.53	19.30	PK	L

Remark: Margin = Limit – Level

Correction factor = Cable lose + LISN insertion loss

Level=Test receiver reading + correction factor



Suspected List

NO.	Freq. [MHz]	Level [dBμV]	Factor [dB]	Limit [dBμV]	Margin [dB]	Reading [dBμV]	Detector	Type
1	0.1770	28.43	10.05	64.63	36.20	18.38	PK	N
2	0.3255	28.94	10.05	59.57	30.63	18.89	PK	N
3	0.5325	27.46	10.05	56.00	28.54	17.41	PK	N
4	1.8060	28.17	10.14	56.00	27.83	18.03	PK	N
5	3.6240	27.87	10.25	56.00	28.13	17.62	PK	N
6	15.1620	28.37	9.96	60.00	31.63	18.41	PK	N

Remark: Margin = Limit – Level

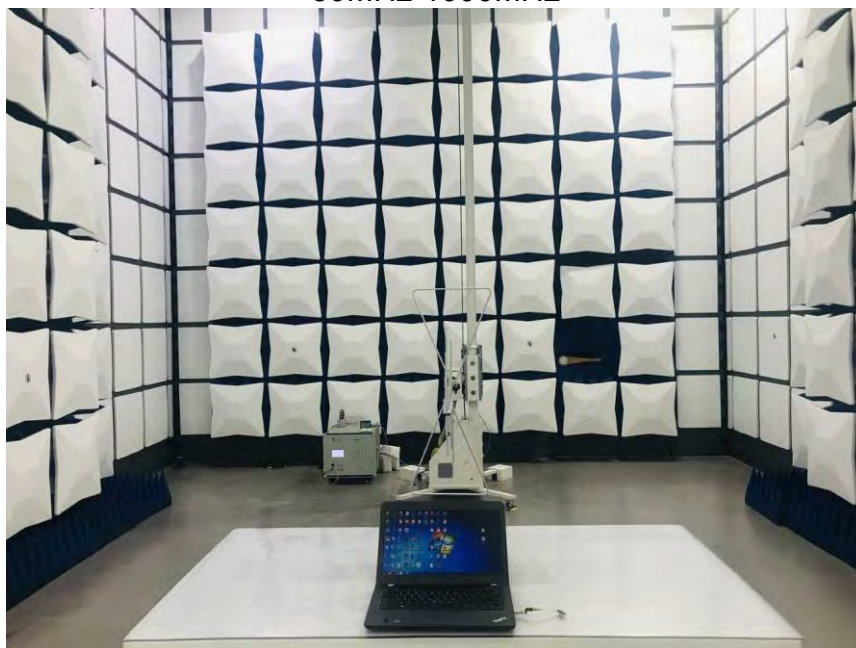
Correction factor = Cable lose + LISN insertion loss

Level=Test receiver reading + correction factor



7 Photographs of Test Setup

30MHz-1000MHz

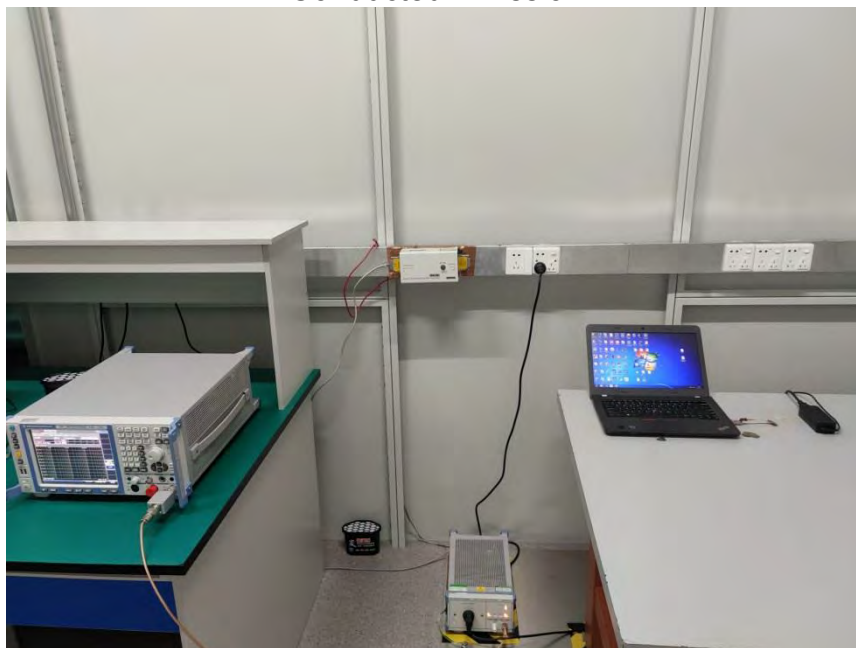


Above 1000MHz





Conducted Emission





8 PHOTOS OF THE EUT

Please refer to the report No.: HK2010293163-1E

*****END OF REPORT*****