

RF Test Report

Applicant : ADDON Technology

Product Type : Hybrid wireless multiple connected conference

Trade Name : Tutti Studio

Model Number : iCube A2 Tutti Matti

Test Specification : FCC 47 CFR PART 15 SUBPART E
ANSI C63.10:2013

Receive Date : May 02, 2018

Test Period : Jun. 01 ~ Jul. 02, 2018

Issue Date : Jul. 02, 2018

Issue by

A Test Lab Techno Corp.
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Taiwan Accreditation Foundation accreditation number: 1330
Test Firm MRA designation number: TW0010

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Revision History

Rev.	Issue Date	Revisions	Revised By
00	Jun. 22, 2018	Initial Issue	Nina Lin
01	Jul. 02, 2018	Revised report information	Nina Lin

Verification of Compliance

Issued Date: Jul. 02, 2018

Applicant : ADDON Technology
Product Type : Hybrid wireless multiple connected conference
Trade Name : Tutti Studio
Model Number : iCube A2 Tutti Matti
FCC ID : Z2HMATTI-8
EUT Rated Voltage : DC18V, 2A
Test Voltage : 120 Vac / 60 Hz
13.32Vdc, 14.80Vdc, 16.28Vdc
Applicable Standard : FCC 47 CFR PART 15 SUBPART E
ANSI C63.10:2013
Test Result : Complied
Performing Lab. : A Test Lab Techno Corp.

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<http://www.atl-lab.com.tw/e-index.htm>



A Test Lab Techno Corp. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by A Test Lab Techno Corp. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Approved By :

Jet Lu

(Manager)

(Jet Lu)

Reviewed By :

Eric Ou Yang

(Testing Engineer)

(Eric Ou Yang)

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1 General Information

1.1. Summary of Test Result

Standard	Item	Result	Remark
FCC			
15.407(b)(6) 15.207	AC Power Conducted Emission	PASS	---
15.407(b) 15.205 / 15.209	Transmitter Radiated Emissions	PASS	---
15.407(a)	Maximum Conducted Output Power	PASS	---
15.407(e)	6dB RF Bandwidth	PASS	----
15.407(a)	Maximum Power Spectral Density	PASS	---
15.407(g)	Frequency Stability	PASS	---
15.407(c)	Automatically discontinue transmission	PASS	---
15.407(a) 15.203	Antenna Requirement	PASS	---

The test results of this report relate only to the tested sample(s) identified in this report. Manufacturer or whom it may concern should recognize the pass or fail of the test result.

1.2. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty (dB)
Conducted Emission	9kHz ~ 150KHz	2.7
	150kHz ~ 30MHz	2.7
Radiated Emission	9kHz ~ 30MHz	1.7
	30MHz ~ 1000MHz	5.7
	1000MHz ~ 18000MHz	5.5
	18000MHz ~ 26500MHz	4.8
	26500MHz ~ 40000MHz	4.8
Conducted Output Power		+0.27 dB / -0.28 dB
RF Bandwidth		4.96%
Power Spectral Density		+0.71 dB / -0.77 dB
Frequency Stability		+ 2.212 x 10 ⁻⁷ % / - 2.170 x 10 ⁻⁷
Duty Cycle		1.06%
Time Occupancy		1.40%

2 EUT Description

Applicant	ADDON Technology 1F., No.11, Lane 206, Sec. 1, Da An Road Taipei City Taiwan		
Manufacturer	Shenzhen Opures Technology Co., Ltd Room 206, No.535 Buiding, Bagua 2nd road , Futian District,Shenzhen City, China		
Product Type	Hybrid wireless multiple connected conference		
Trade Name	Tutti Studio		
Model No.	iCube A2 Tutti Matti		
FCC ID	Z2HMATTI-8		
Frequency Range	5736MHz – 5814MHz		
Modulation Type	QPSK		
Equipment Type	Client devices		
Antenna information	ANT	Type	Max. Gain (dBi)
	ANT0/ANT1	PCB Antenna	3.2
Antenna Delivery	Reference section 3.1		
Frequency stability specification	± 20 ppm		
Operate Temp. Range	-5 ~ +40 °C		

Channel List

CH	Frequency (MHz)
00	5736
01	5762
02	5814

Frequency Range	RF Output Power (W)
5736MHz – 5814MHz	0.006

Equipment Type		
Outdoor access point	point-to-point	---
	point-to-multipoint	---
Indoor access point		---
Fixed point-to-point access points		---
Client devices		V

3 Test Methodology

3.1. Mode of Operation

Decision of Test ATL has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: Transmit mode
Mode 2: Continuous TX mode

Software used to control the EUT for staying in continuous transmitting mode was programmed.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in normal link mode only.

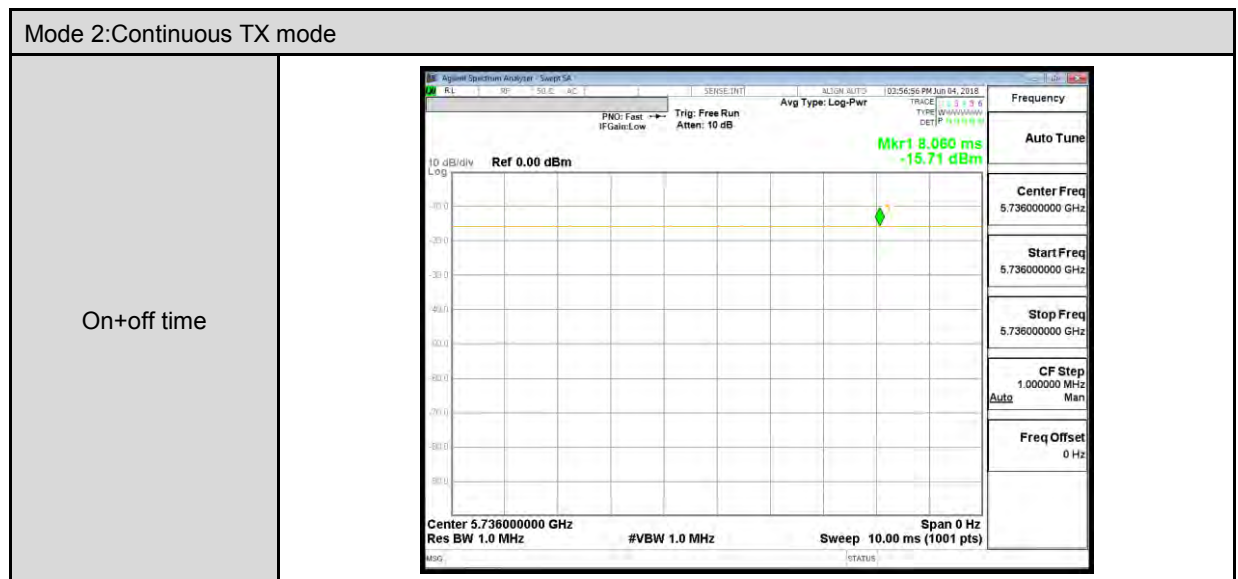
Note : Power worst case is ANT-0.

Test Mode	Antenna Delivery
Mode 2	1TX (Diversity)

Duty cycle

Test Mode	Frequency (MHz)	on time (ms)	on+off time (ms)	Duty cycle	Duty Factor (dB)	1/T Minimum VBW (kHz)
Mode 2	5736.0	1.000	1.000	1.000	0.000	0.010

Duty Cycle Graphs





3.2. EUT Exercise Software

The EUT is operated in the engineering mode to fix the TX frequency for the purposes of measurement.

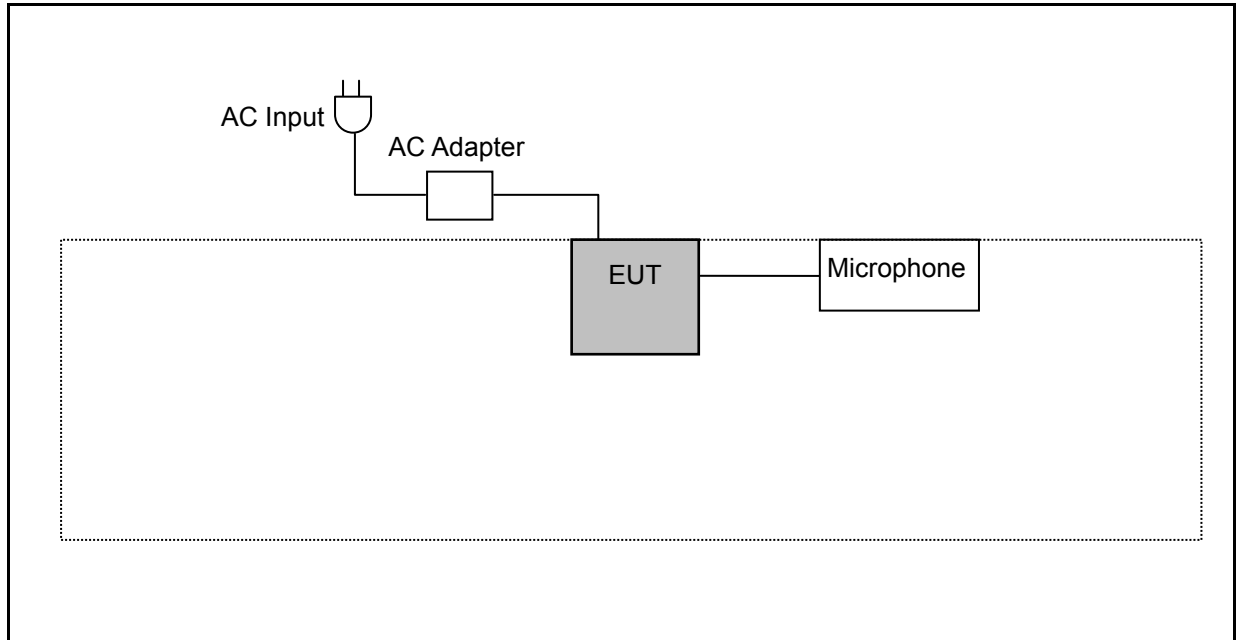
According to its specifications, the EUT must comply with the requirements of Section 15.407 under the FCC Rules Part 15 Subpart E.

1.	Setup the EUT shown on "Configuration of Test System Details"
2.	Turn on the power of all equipment.
3.	Turn on TX function.
4.	EUT run test program.

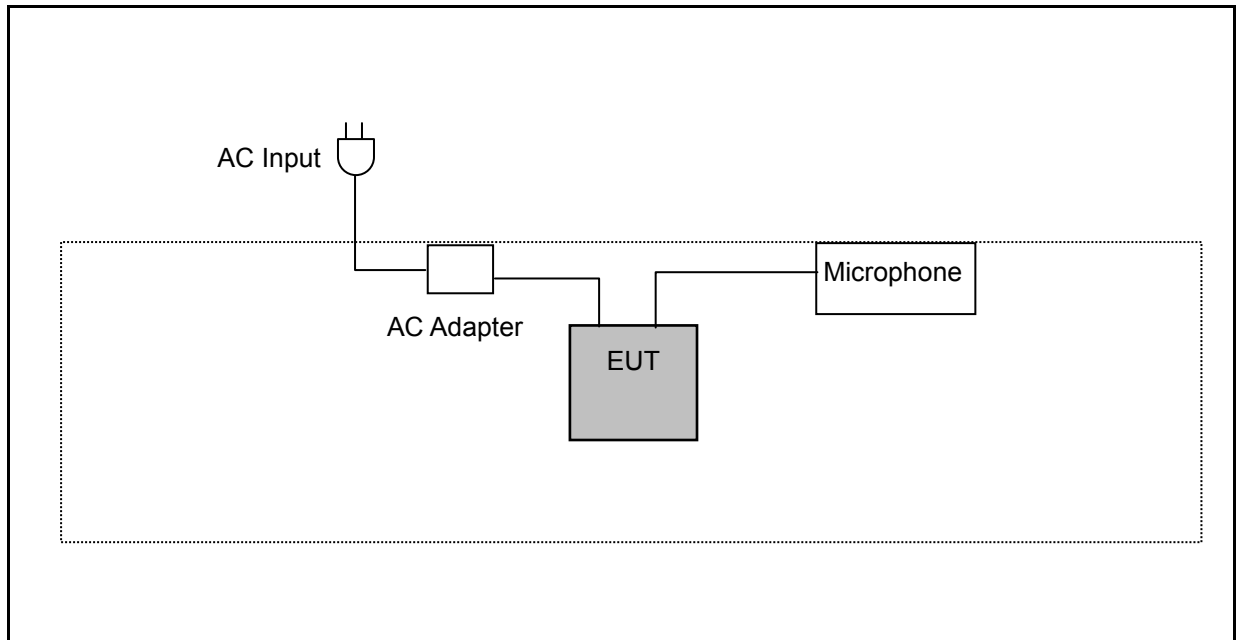
Measurement Software	
1	EZ-EMC Ver. ATL-03A1-1
2	EZ-EMC Ver ATL-ITC-3A1-1

3.3. Configuration of Test System Details

Conducted Emission



Radiated Emissions



Devices Description					
	Product	Manufacturer	Model Number	Serial Number	Power Cord
(1)	---	---	---	---	---

3.4. Test Instruments

For Conducted Emission

Test Period: Jun. 01, 2018

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Next Cal. Date	Cal. Period
Test Receiver	R&S	ESCI	100367	05/21/2018	05/20/2019	1 year
LISN	R&S	ENV216	101040	04/11/2018	04/10/2019	1 year
LISN	R&S	ENV216	101041	03/23/2018	03/22/2019	1 year

For Radiated Emissions

Test Period: Jun. 01 ~ Jun. 04, 2018

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Next Cal. Date	Cal. Period
EXA Signal Analyzer	Keysight	N9010A	MY52221312	01/15/2018	01/14/2019	1 year
Amplifier	Agilent	8449B	3008A02237	10/16/2017	10/15/2018	1 year
Amplifier	Agilent	8447D	2944A11119	01/10/2018	01/09/2019	1 year
Broadband Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB 9168	416	10/26/2017	10/25/2018	1 year
Horn Antenna (1~18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	9120D-550	06/20/2017	06/19/2018	1 year
Horn Antenna	ETS	3116	86467	09/19/2017	09/18/2018	1 year
RF Cable	EMCI	EMC104-N-N-60 00	TE01-1	02/20/2018	02/19/2019	1 year
Microwave Cable	EMCI	EMC104-SM-SM -13000	170814	10/31/2017	10/30/2018	1 year
Microwave Cable	EMCI	EMC102-KM-KM -14000	151001	02/20/2018	02/19/2019	1 year

For Conducted

Test Period: Jun. 04 ~ Jul. 02, 2018

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Next Cal. Date	Cal. Period
Power Sensor	Anritsu	MA2411B	1126022	01/15/2018	01/14/2019	1 year
Power Meter	Anritsu	ML2495A	1135009	10/16/2017	10/15/2018	1 year
Spectrum Analyzer (3Hz~50GHz)	Agilent	N9030A	MY53120541	01/02/2018	01/01/2019	1 year
Microwave Cable	EMCI	EMC102-SM-SM1 500	001	11/22/2017	11/21/2018	1 year



3.5. Test Site Environment

Items	Required (IEC 60068-1)	Actual
Temperature (°C)	15-35	26
Humidity (%RH)	25-75	60
Barometric pressure (mbar)	860-1060	950

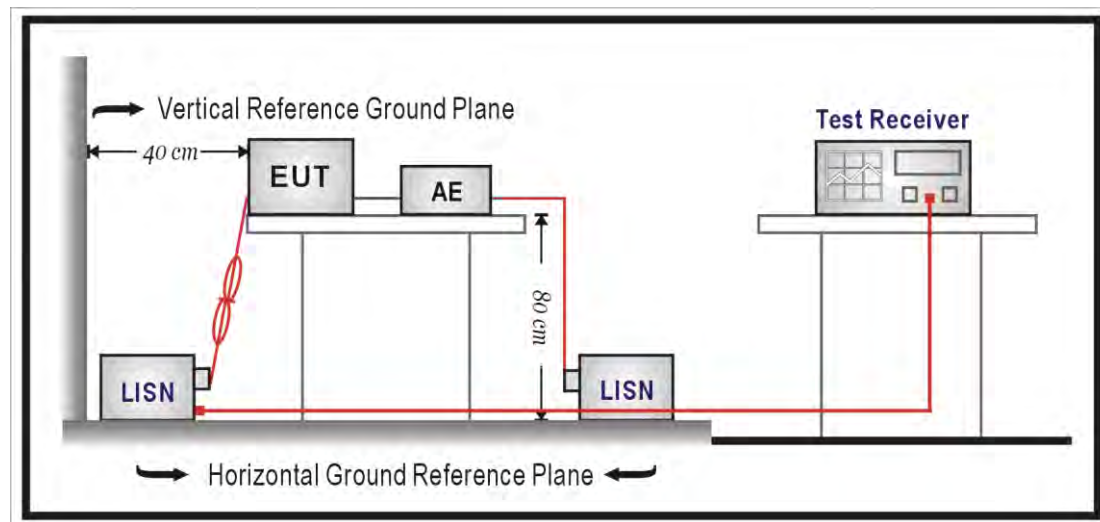
4 Measurement Procedure

4.1. AC Power Conducted Emission Measurement

■ Limit

Frequency (MHz)	Quasi-peak	Average
0.15 - 0.5	66 to 56	56 to 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

■ Test Setup



■ Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a $50\Omega // 50\mu\text{H}$ coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a $50\Omega // 50\mu\text{H}$ coupling impedance with 50ohm termination.

Tabletop device shall be placed on a non-conducting platform, of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The wall of screened room shall be located 40cm to the rear of the EUT. Other surfaces of tabletop or floor standing EUT shall be at least 80cm from any other ground conducting surface including one or more LISNs. For floor-standing device shall be placed under the EUT with a 12mm insulating material.

Conducted emissions were investigated over the frequency range from 0.15 MHz to 30 MHz using a resolution bandwidth of 9 kHz. The equipment under test (EUT) shall be meet the limits in section 4.1, as applicable, including the average limit and the quasi-peak limit when using respectively, an average detector and quasi-peak detector measured in accordance with the methods described of related standard. When all of peak value were complied with quasi-peak and average limit from 150kHz to 30MHz then quasi-peak and average measurement was unnecessary.

The AMN shall be placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane for AMNs mounted on top of the ground reference plane. This distance is between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment shall be at least 0,8 m from the AMN. If the mains power cable is longer than 1m then the cable shall be folded back and forth at the centre of the lead to form a bundle no longer than 0.4m. All of interconnecting cables that hang closer than 40cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long. All of EUT and AE shall be separate place more than 0.1m. All 50 Ω ports of the LISN shall be resistively terminated into 50 Ω loads when not connected to the measuring instrument.

If the reading of the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 s at each measurement frequency; the higher reading shall be recorded with the exception of any brief isolated high reading which shall be ignored.

4.2. Transmitter Radiated Emissions Measurement

■ Limit

(1) 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:

(a) 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 e.i.r.p. of -27 dBm/MHz.

(b) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

(c) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

(d) For transmitters operating in the 5.725-5.85 GHz band:

(i) 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.

(2) Limits of Radiated Emission Measurement

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

Frequency Range (MHz)	Field Strength (microvolts/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	10	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

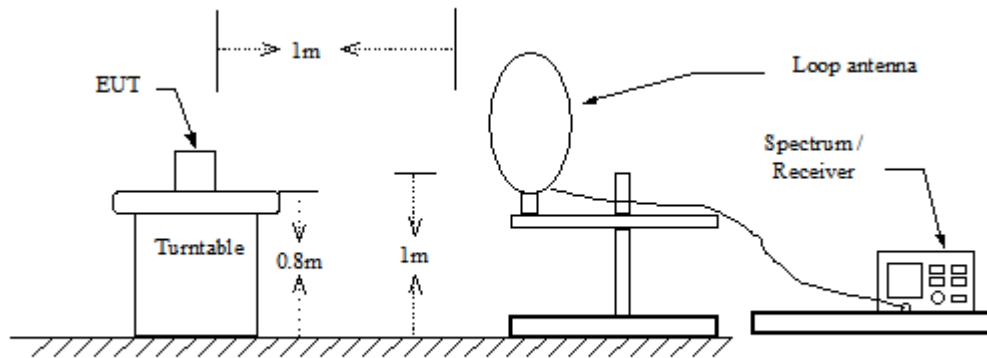
Note: 1. The lower limit shall apply at the transition frequencies.

2. Emission level (dBuV/m) = 20 log Emission level (uV/m).

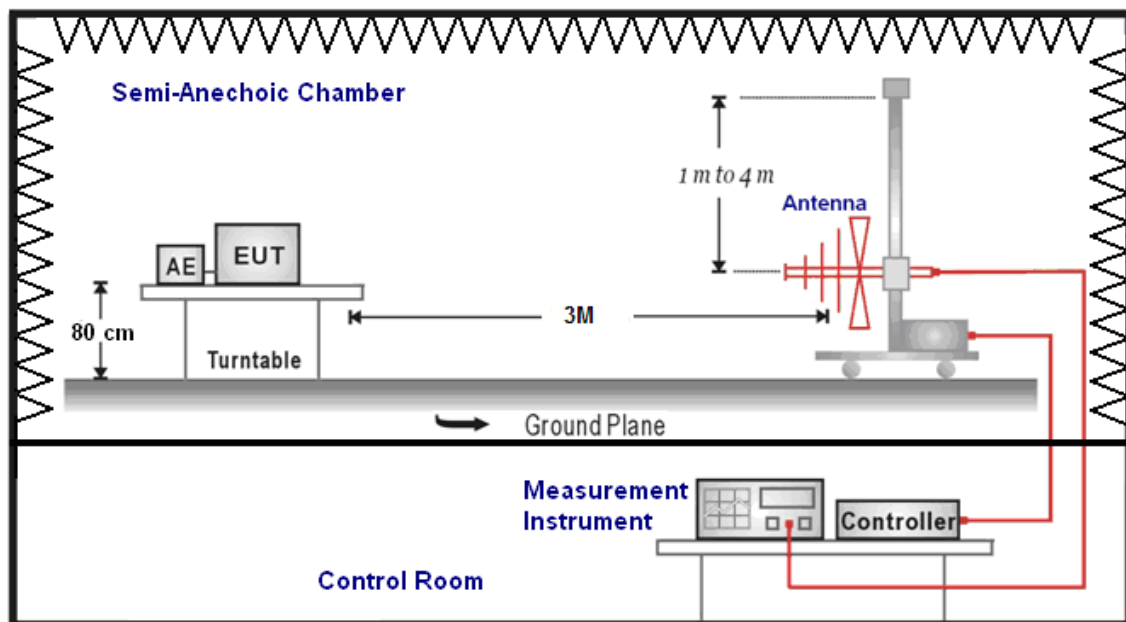
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

■ Setup

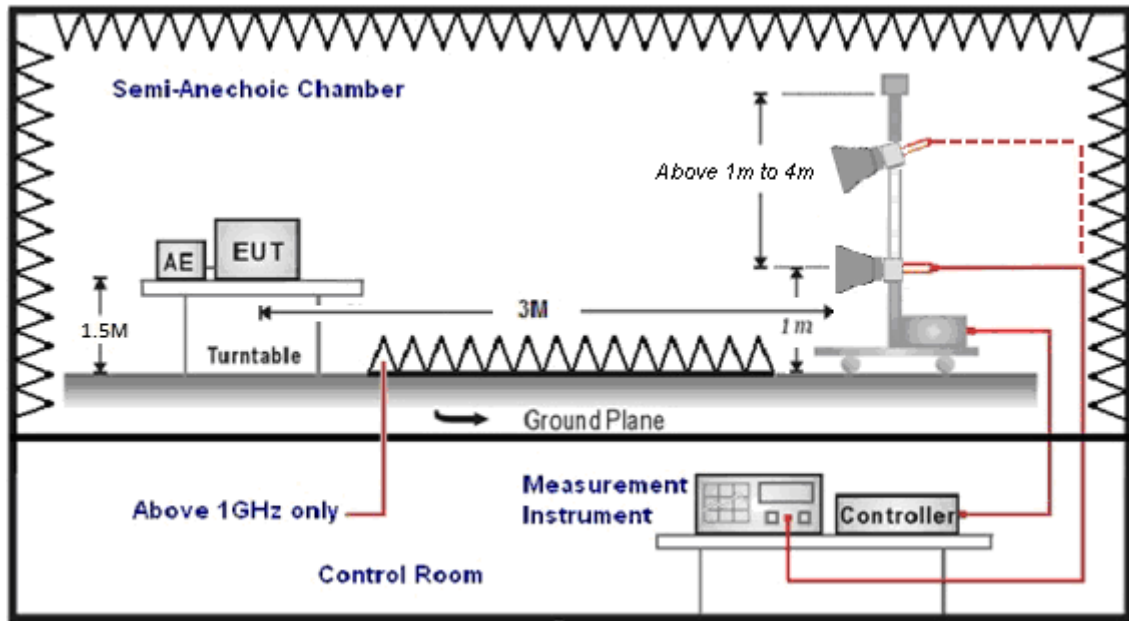
9kHz ~ 30MHz



30MHz ~ 1GHz



Above 1GHz



■ Test Procedure

Final radiation measurements were made on a three-meter, Semi Anechoic Chamber. The EUT system was placed on a nonconductive turntable which is 0.8 or 1.5 meters height (below 1GHz use 0.8m turntable / above 1GHz use 1.5m turntable), top surface 1.0 x 1.5 meter. The spectrum was examined from 250 MHz to 2.5 GHz in order to cover the whole spectrum below 10th harmonic which could generate from the EUT. During the test, EUT was set to transmit continuously & Measurements spectrum range from 9 kHz to 40 GHz is investigated.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For restricted measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 3 MHz for peak measurements and 10 Hz for average measurements when Duty cycle > 0.98 / 1/T for average measurements when Duty cycle < 0.98.

For out of band measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 3 MHz for peak measurements.

A nonconductive material surrounded the EUT to supporting the EUT for standing on three orthogonal planes. At each condition, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization.

SCHWARZBECK MESS-ELEKTRONIK Trilog-Broadband Antenna at 3 Meter and the ETS-Lindgren Double-Ridged Waveguide Horn antenna Schwarzbeck Mess-Elektronik Broadband Horn Antenna was used in frequencies 1 – 40 GHz at a distance of 3 meter. The antenna at an angle toward the source of the emission. All test results were extrapolated to equivalent signal at 3 meters utilizing an inverse linear distance extrapolation Factor (20dB/decade).

For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. No post – detector video filters were used in the test.

The spectrum analyzer's 6 dB bandwidth was set to 1 MHz, and the analyzer was operated in the peak detection mode, for frequencies both below and up 1 GHz. The average levels were obtained by subtracting the duty cycle correction factor from the peak readings.

The following procedures were used to convert the emission levels measured in decibels referenced to 1 microvolt (dBuV) into field intensity in micro volts per meter (uV/m).

The actual field intensity in decibels referenced to 1 microvolt in to field intensity in micro volts per meter (dBuV/m).

The actual field is intensity in referenced to 1 microvolt per meter (dBuV/m) is determined by algebraically adding the measured reading in dBuV, the antenna factor (dB), and cable loss (dB) and Subtracting the gain of preamplifier (dB) is auto calculate in spectrum analyzer.

$$(1) \text{ Amplitude (dBuV/m) = FI (dBuV) + AF (dBuV) + CL (dBuV) - Gain (dB)}$$

FI= Reading of the field intensity.

AF= Antenna factor.

CL= Cable loss.

P.S Amplitude is auto calculate in spectrum analyzer.

$$(2) \text{ Actual Amplitude (dBuV/m) = Amplitude (dBuV) - Dis(dB)}$$

The FCC specified emission limits were calculated according the EUT operating frequency and by following linear interpolation equations:

(a) For fundamental frequency : Transmitter Output < +30dBm

(b) For spurious frequency : Spurious emission limits = fundamental emission limit /10

Measuring Instruments and setting

The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000MHz
Stop Frequency	40GHz
RBW/VBW(Emission in restricted band)	1MHz / 3MHz for Peak 1MHz / (1/T) for Average
RBW/VBW(Emission in non-restricted band)	1MHz / 3MHz for Peak

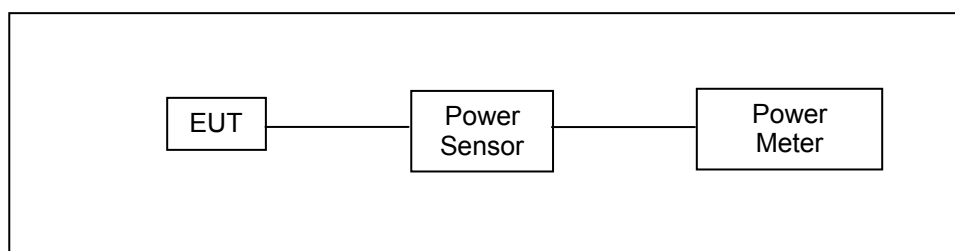
4.3. Maximum Conducted Output Power Measurement

■ Limit

Frequency Range (MHz)	FCC Maximum Conducted Output Power Limit
	Client
5.725 ~ 5.850 GHz	The lesser of 1W (30dBm)

According FCC KDB 662911 D01 v02r01 – for power measurements on IEEE802.11 devices,

■ Test Setup



■ Test Procedure

The test is performed in accordance with KDB789033: D02 General UNII Test Procedures New Rules v02r01, Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices

Section (E) Maximum Conducted Output Power

3. Measurement using a Power Meter (PM)

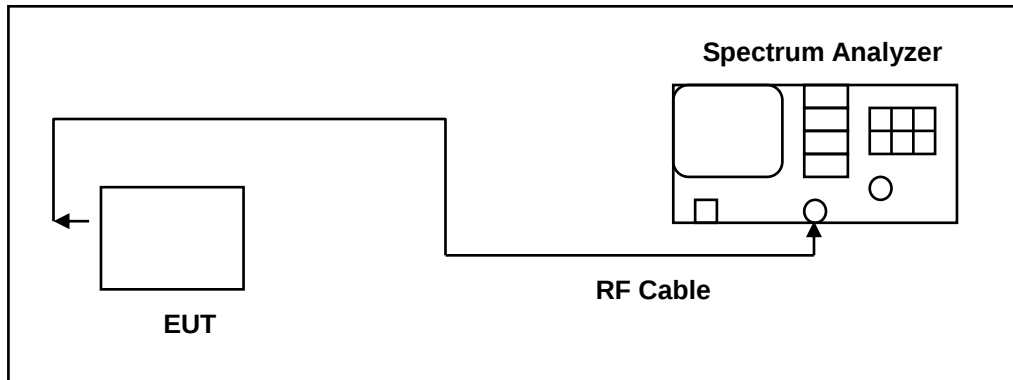
b) Method PM-G (Measurement using a gated RF average power meter)

4.4. 6dB RF Bandwidth Measurement

■ Limit

Systems using digital modulation techniques may operate in the 5725~5850MHz bands. The minimum 6 dB band-width shall be at least 500 kHz.

■ Test Setup



■ Test Procedure

The EUT tested to UNII test procedure of KDB789033 D02 v02r01 for compliance to FCC 47CFR 15.407 requirements.

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A peak output reading was taken, a DISPLAY line was drawn 6 dB lower than peak level. The 6 dB bandwidth was determined from where the channel output spectrum intersected the display line.

The test was performed at 3 channels.

4.5. Maximum Power Spectral Density Measurement

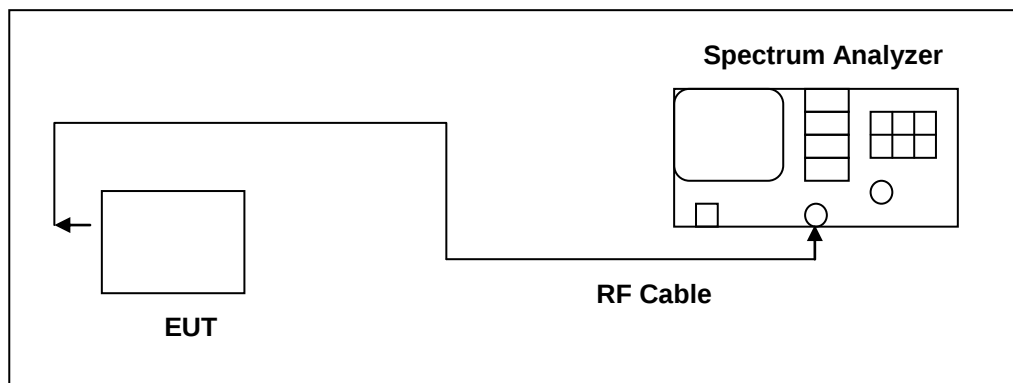
■ Limit

Conducted power spectral density

Frequency Range (MHz)	FCC Limit
	Client
5.725 ~ 5.850 GHz	30 dBm/500KHz

According FCC KDB 662911 D01 v02r01 – for power spectral density measurements on IEEE802.11 devices,

■ Test Setup



**■ Test Procedure**

The test is performed in accordance with KDB789033: D02 General UNII Test Procedures New Rules v02r01, Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E.

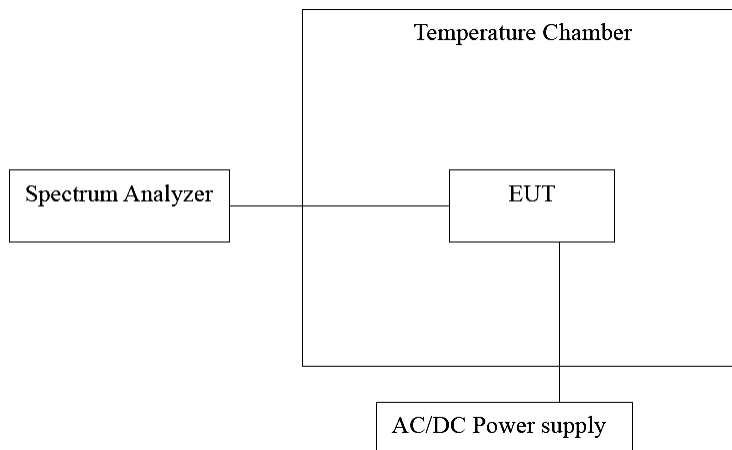
Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	Encompass the entire emissions bandwidth (EBW) of the signal
RBW	1 MHz (5725 ~ 5850MHz use 100 kHz)
VBW	3 MHz (5725 ~ 5850MHz use 300 kHz)
Detector	RMS
Trace	AVERAGE
Sweep Time	Auto
Trace Average	100 times
Note: If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10\log(500\text{kHz}/100\text{kHz})$ to the measured result.	

4.6. Frequency Stability Measurement

■ Limit

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.

■ Test Setup



■ Test Procedure

1. The EUT was placed inside the environmental test chamber and powered by nominal AC/DC voltage.
2. Turn the EUT on and couple its output to a spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.



4.7. Automatically discontinue transmission

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signalling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization a description of how this requirement is met.

■ Declare

While the EUT is not transmitting any information, the EUT can automatically discontinue transmission and become standby mode for power saving.

The EUT can detect the controlling signal of ACK message transmitting from remote device and verify whether it shall resend or discontinue transmission.

4.8. Antenna Requirement

■ Limit

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.

And According to 15.407 (a), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

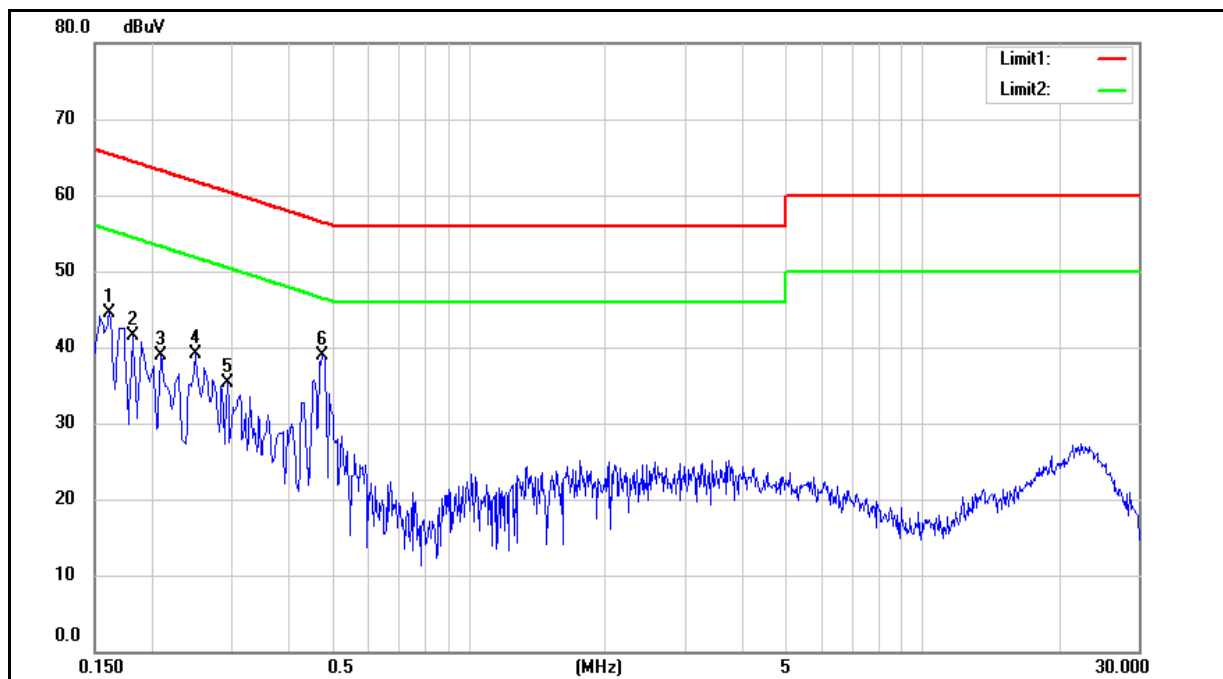
■ Antenna Connector Construction

See section 2 – antenna information.

5 Test Results

5.1. AC Power Conducted Emission Measurement

Standard:	FCC Part 15.407	Line:	L1
Test item:	Conducted Emission	Power:	AC 120V/60Hz
Test Mode:	Mode 1	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Description:			

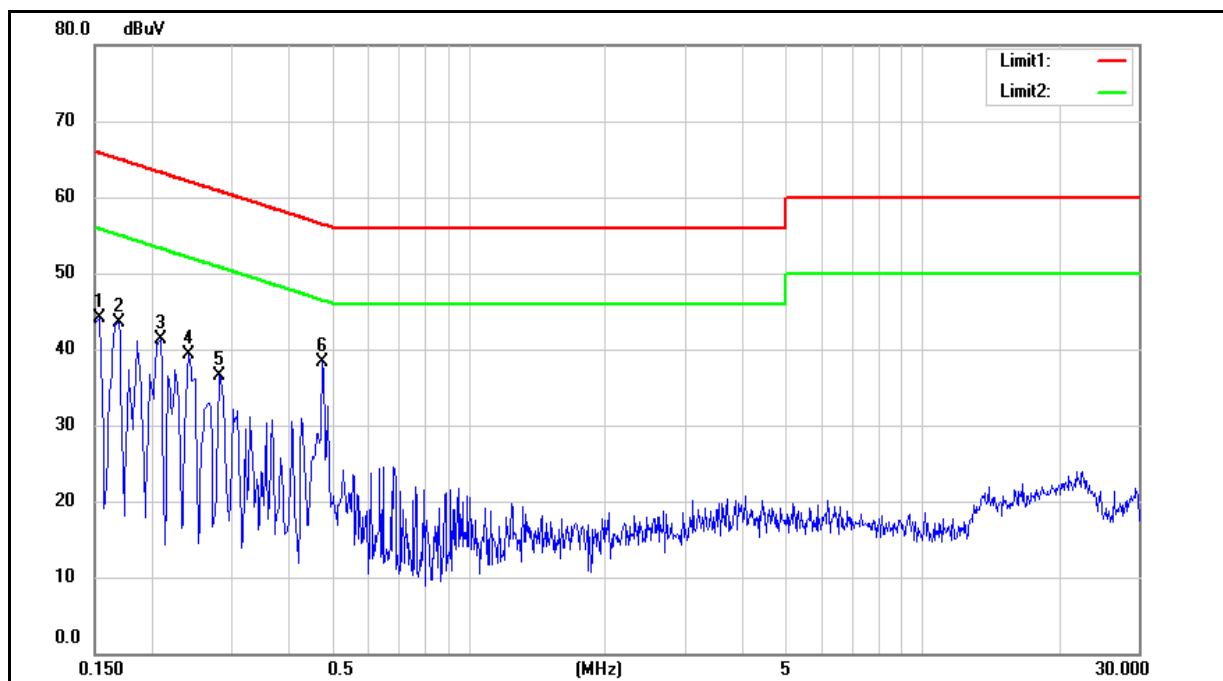


No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.1620	30.33	10.44	9.67	40.00	20.11	65.36	55.36	-25.36	-35.25	Pass
2	0.1820	29.52	10.76	9.67	39.19	20.43	64.39	54.39	-25.20	-33.96	Pass
3	0.2100	26.08	9.76	9.68	35.76	19.44	63.21	53.21	-27.45	-33.77	Pass
4	0.2500	25.07	7.97	9.69	34.76	17.66	61.76	51.76	-27.00	-34.10	Pass
5	0.2940	21.21	7.22	9.69	30.90	16.91	60.41	50.41	-29.51	-33.50	Pass
6	0.4780	28.39	20.27	9.68	38.07	29.95	56.37	46.37	-18.30	-16.42	Pass

Note: 1. Result = Correction factor + Reading

2. Correction factor = Antenna Factor + Cable loss – Pre-Amplifier gain.

Standard:	FCC Part 15.407	Line:	N
Test item:	Conducted Emission	Power:	AC 120V/60Hz
Test Mode:	Mode 1	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Description:			



No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.1540	32.40	11.45	9.68	42.08	21.13	65.78	55.78	-23.70	-34.65	Pass
2	0.1700	30.91	10.06	9.69	40.60	19.75	64.96	54.96	-24.36	-35.21	Pass
3	0.2100	26.17	7.20	9.69	35.86	16.89	63.21	53.21	-27.35	-36.32	Pass
4	0.2420	25.71	5.17	9.69	35.40	14.86	62.03	52.03	-26.63	-37.17	Pass
5	0.2820	23.27	5.03	9.71	32.98	14.74	60.76	50.76	-27.78	-36.02	Pass
6	0.4780	25.12	14.92	9.70	34.82	24.62	56.37	46.37	-21.55	-21.75	Pass

Note: 1. Result = Correction factor + Reading

2. Correction factor = Antenna Factor + Cable loss – Pre-Amplifier gain.



5.2. Transmitter Radiated Emissions Measurement

Below 1GHz

Standard:		FCC Part 15.407		Test Distance:		3m	
Test item:		Harmonic		Power:		AC 120V/60Hz	
Test Mode:		Mode 1		Temp.(°C)/Hum.(%RH):		26(°C)/60%RH	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
245.3400	53.21	-12.32	40.89	46.00	-5.11	QP	H
294.8100	53.71	-10.38	43.33	46.00	-2.67	QP	H
344.2800	48.76	-9.24	39.52	46.00	-6.48	QP	H
392.7800	50.93	-7.37	43.56	46.00	-2.44	QP	H
442.2500	44.64	-6.37	38.27	46.00	-7.73	QP	H
491.7200	39.70	-5.29	34.41	46.00	-11.59	QP	H
245.3400	49.10	-12.32	36.78	46.00	-9.22	QP	V
392.7800	47.04	-7.37	39.67	46.00	-6.33	QP	V
442.2500	44.04	-6.37	37.67	46.00	-8.33	QP	V
491.7200	41.20	-5.29	35.91	46.00	-10.09	QP	V
540.2200	39.53	-5.25	34.28	46.00	-11.72	QP	V
589.6900	43.41	-3.52	39.89	46.00	-6.11	QP	V

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

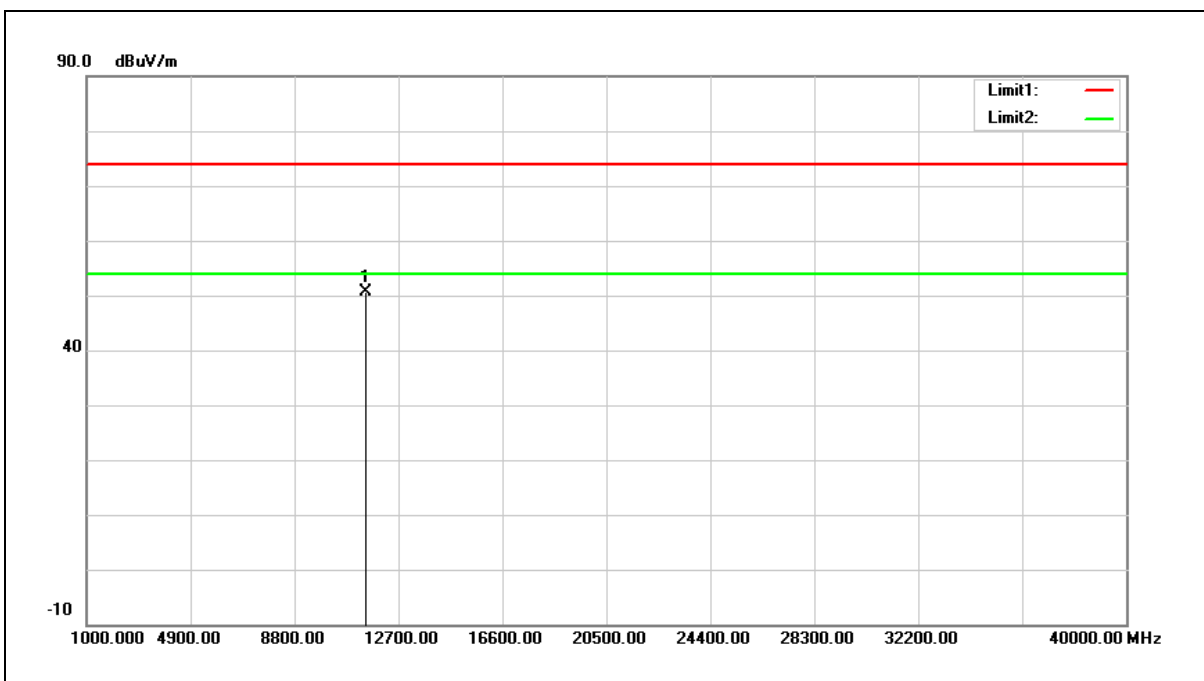
2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.



Above 1GHz

Standard:	FCC Part 15.407	Test Distance:	3m
Test item:	Harmonic	Power:	AC 120V/60Hz
Frequency:	5736MHz	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



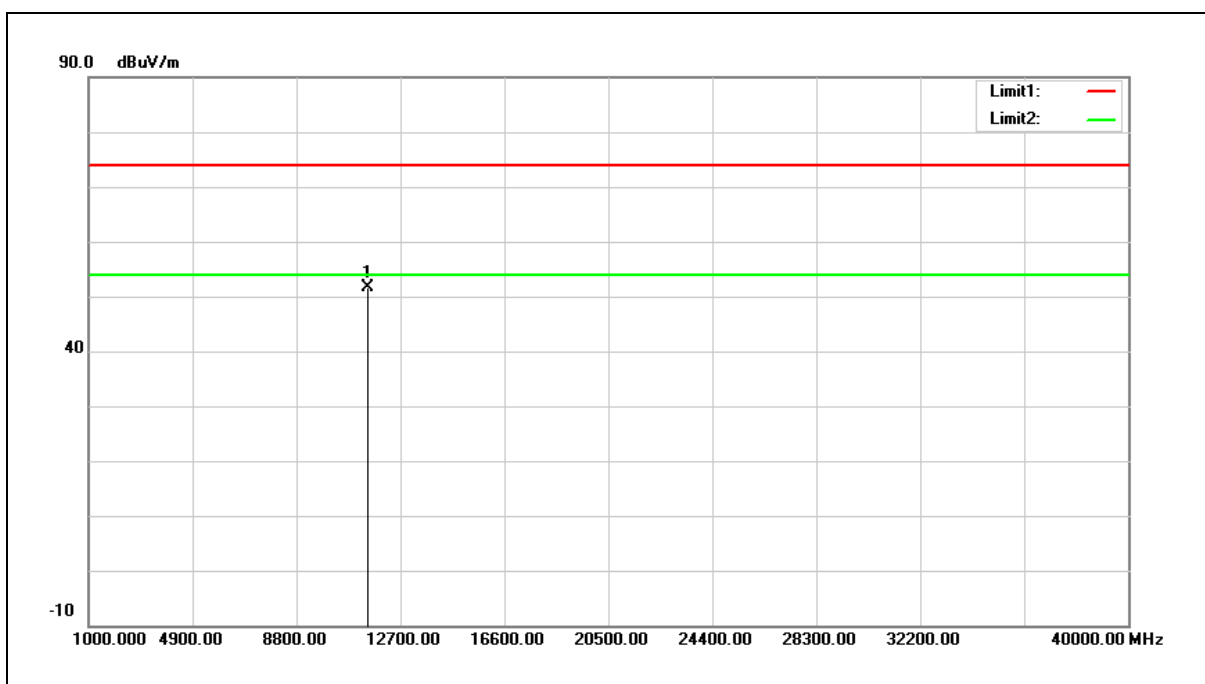
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	11472.000	43.72	7.00	50.72	74.00	-23.28	peak

Note: 1. Result (dBuV/m) = Correct Factor (dB/m) + Reading (dBuV).

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.407	Test Distance:	3m
Test item:	Harmonic	Power:	AC 120V/60Hz
Frequency:	5736MHz	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	Mode 2		
Ant.Polar.:	Vertical		



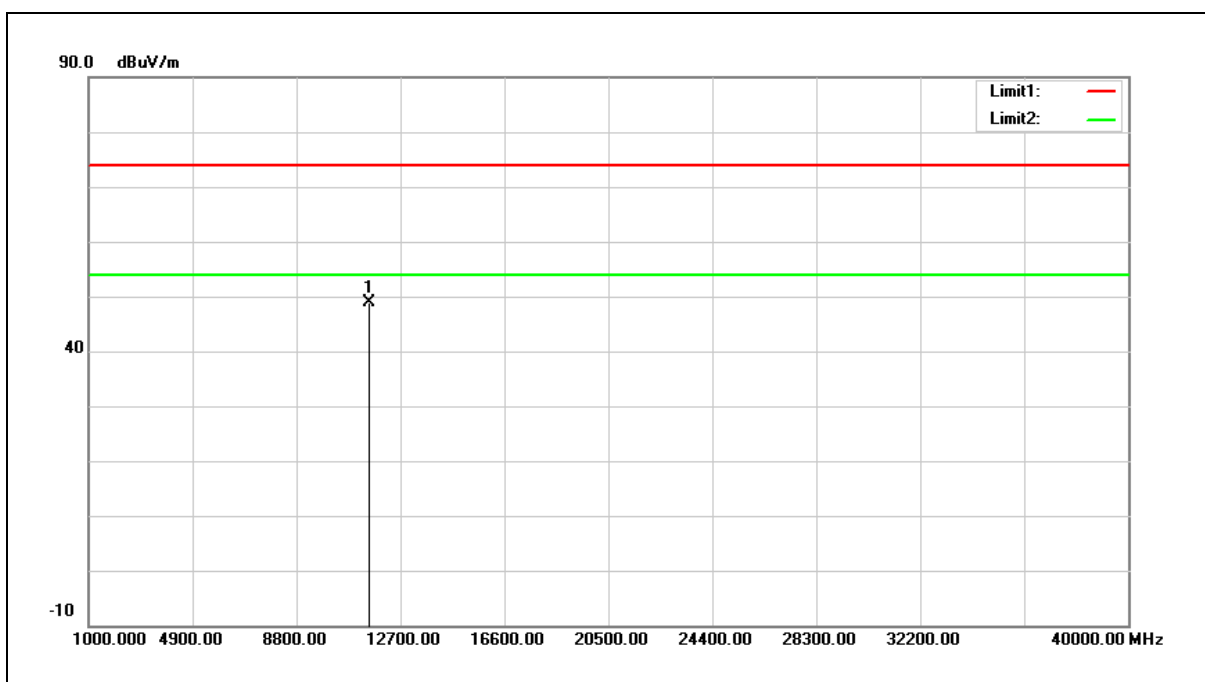
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	11472.000	44.73	7.00	51.73	74.00	-22.27	peak

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.407	Test Distance:	3m
Test item:	Harmonic	Power:	AC 120V/60Hz
Frequency:	5762MHz	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



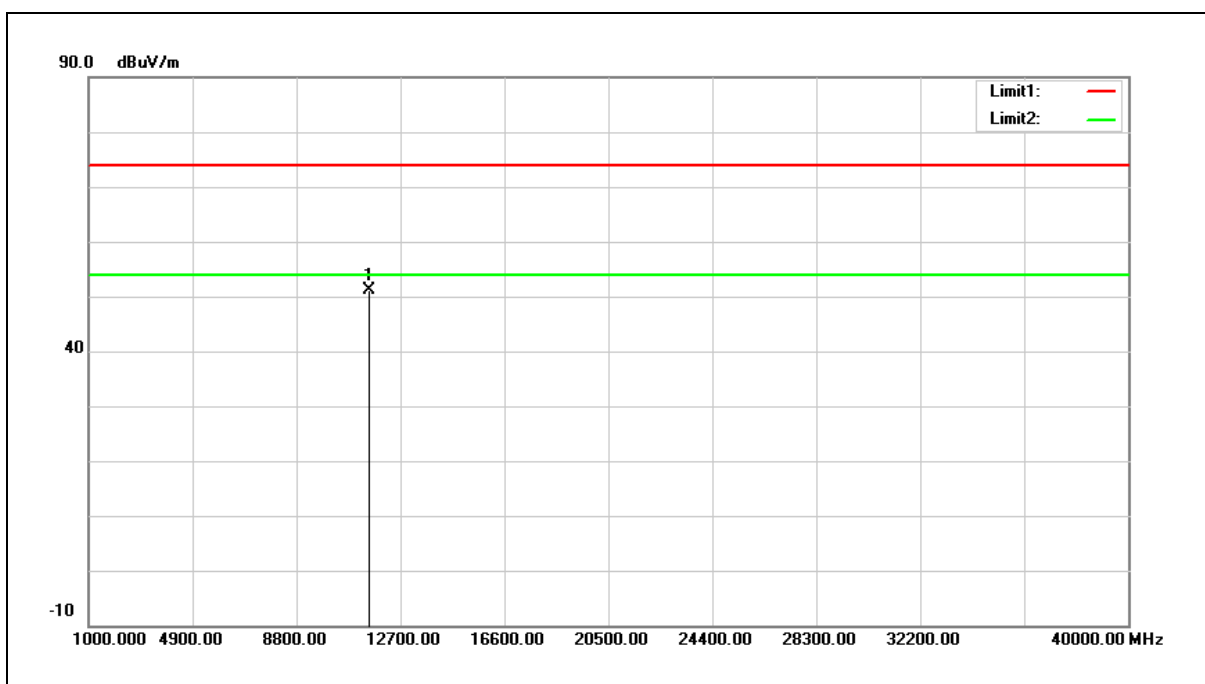
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	11524.000	41.99	6.99	48.98	74.00	-25.02	peak

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.407	Test Distance:	3m
Test item:	Harmonic	Power:	AC 120V/60Hz
Frequency:	5762MHz	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	Mode 2		
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	11524.000	44.04	6.99	51.03	74.00	-22.97	peak

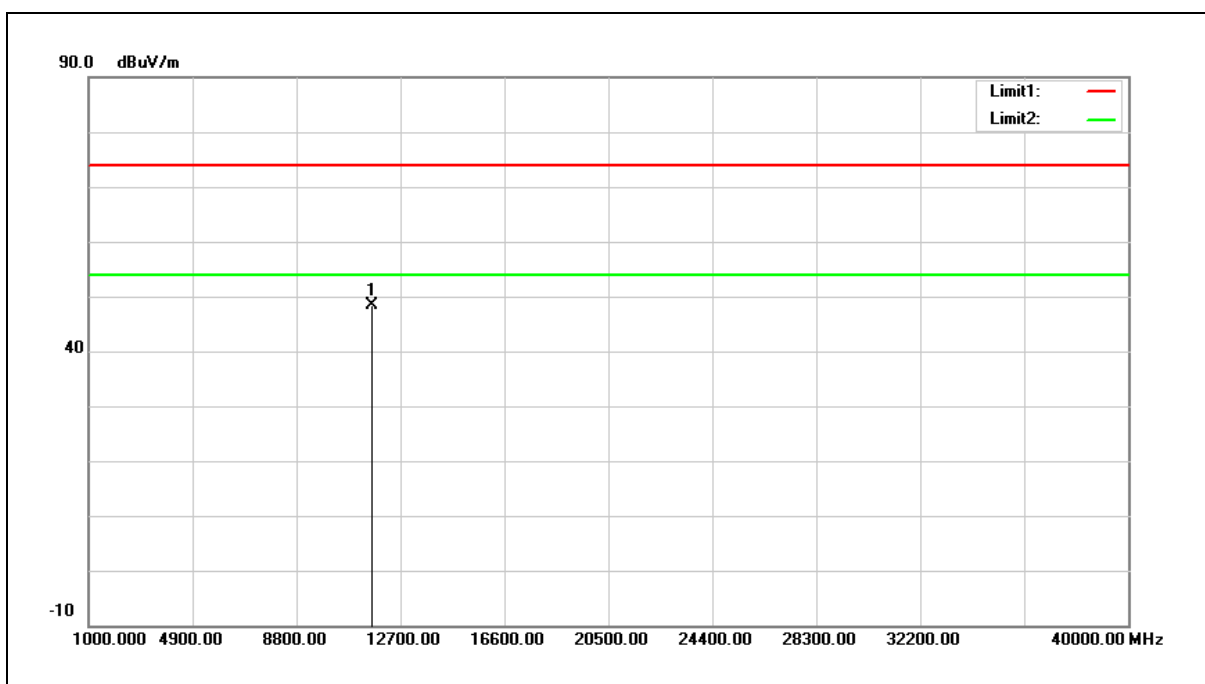
Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.



Standard:	FCC Part 15.407	Test Distance:	3m
Test item:	Harmonic	Power:	AC 120V/60Hz
Frequency:	5814MHz	Temp.(°C)/Hum. (%RH):	26(°C)/60%RH
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



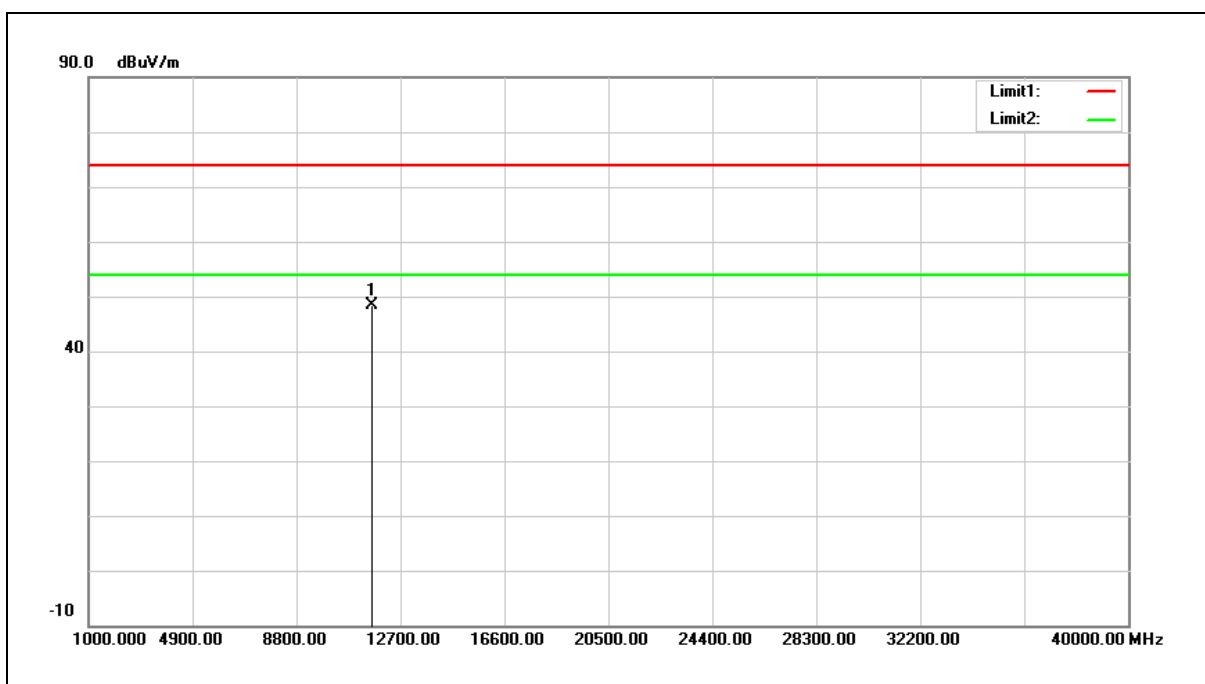
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	11628.000	41.23	7.09	48.32	74.00	-25.68	peak

Note: 1. Result (dBuV/m) = Correct Factor (dB/m) + Reading (dBuV).

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.407	Test Distance:	3m
Test item:	Harmonic	Power:	AC 120V/60Hz
Frequency:	5814MHz	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	Mode 2		
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	11628.000	41.17	7.09	48.26	74.00	-25.74	peak

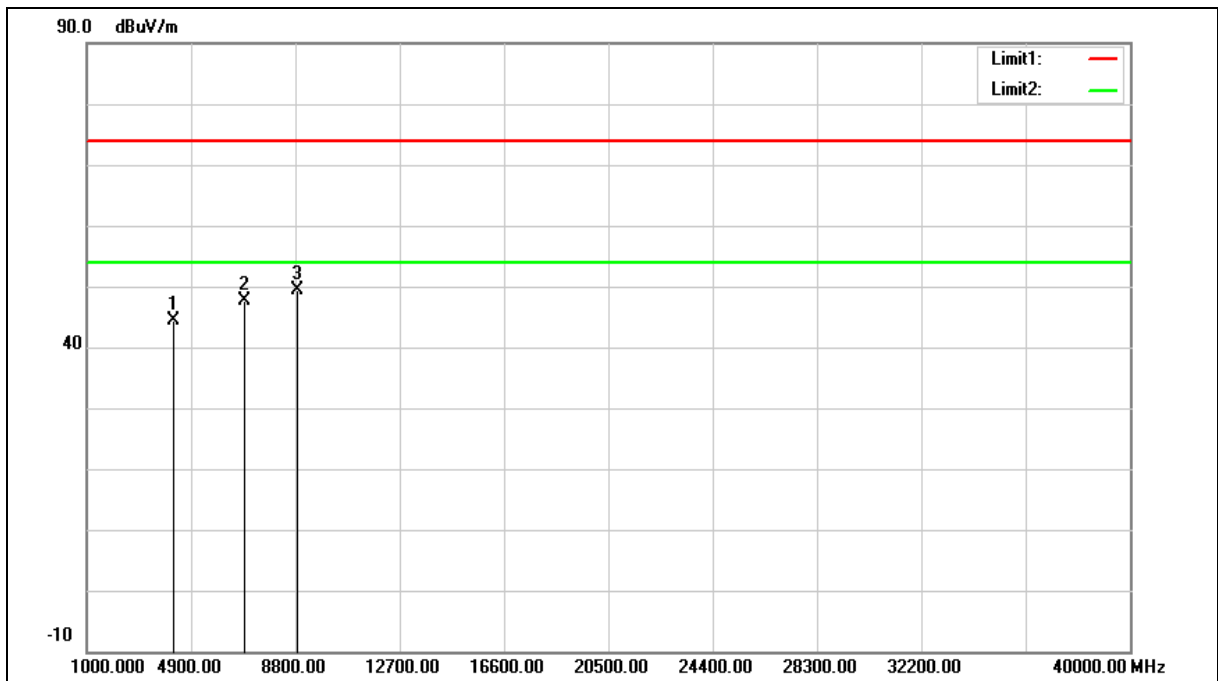
Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.



Standard:	FCC Part 15.407	Test Distance:	3m
Test item:	Harmonic	Power:	AC 120V/60Hz
Test Mode:	Simultaneous Transmitting (5G DSSS+BT)	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Ant.Polar.:	Horizontal		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4230.000	49.44	-5.05	44.39	74.00	-29.61	peak
2	6865.000	48.75	-1.06	47.69	74.00	-26.31	peak
3	8854.000	45.86	3.44	49.30	74.00	-24.70	peak

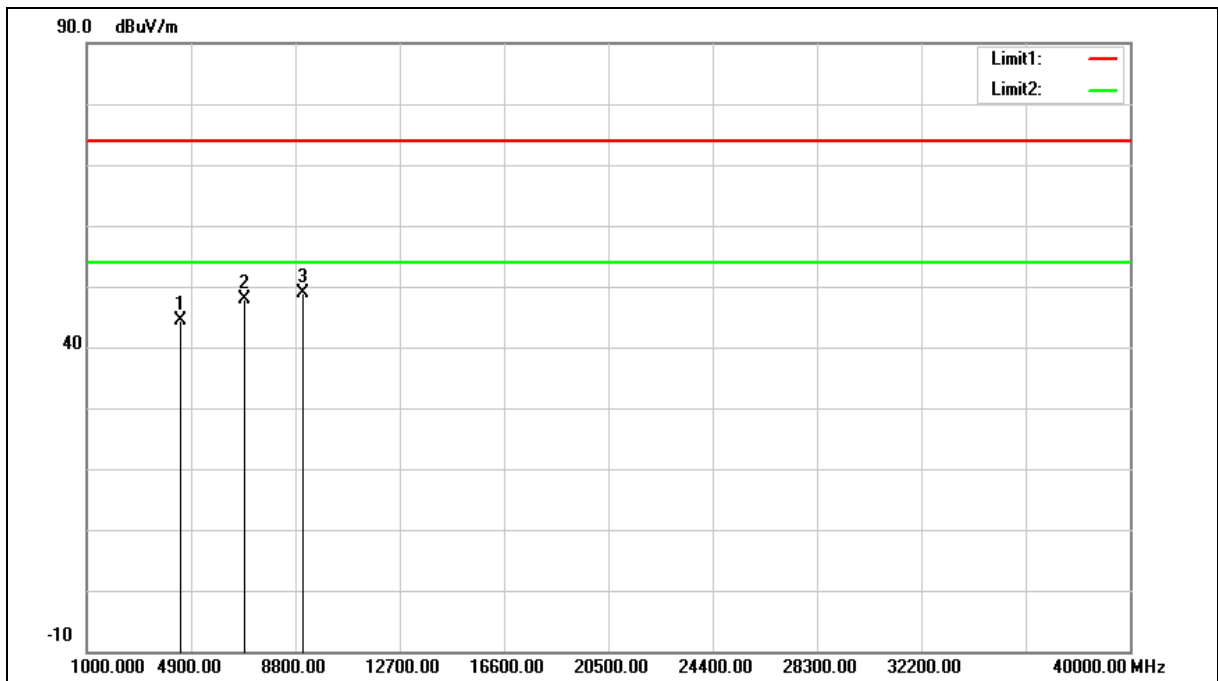
Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.



Standard:	FCC Part 15.407	Test Distance:	3m
Test item:	Harmonic	Power:	AC 120V/60Hz
Test Mode:	Simultaneous Transmitting (5G DSSS+BT)	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4485.000	49.23	-4.73	44.50	74.00	-29.50	peak
2	6882.000	48.79	-1.03	47.76	74.00	-26.24	peak
3	9041.000	44.85	4.05	48.90	74.00	-25.10	peak

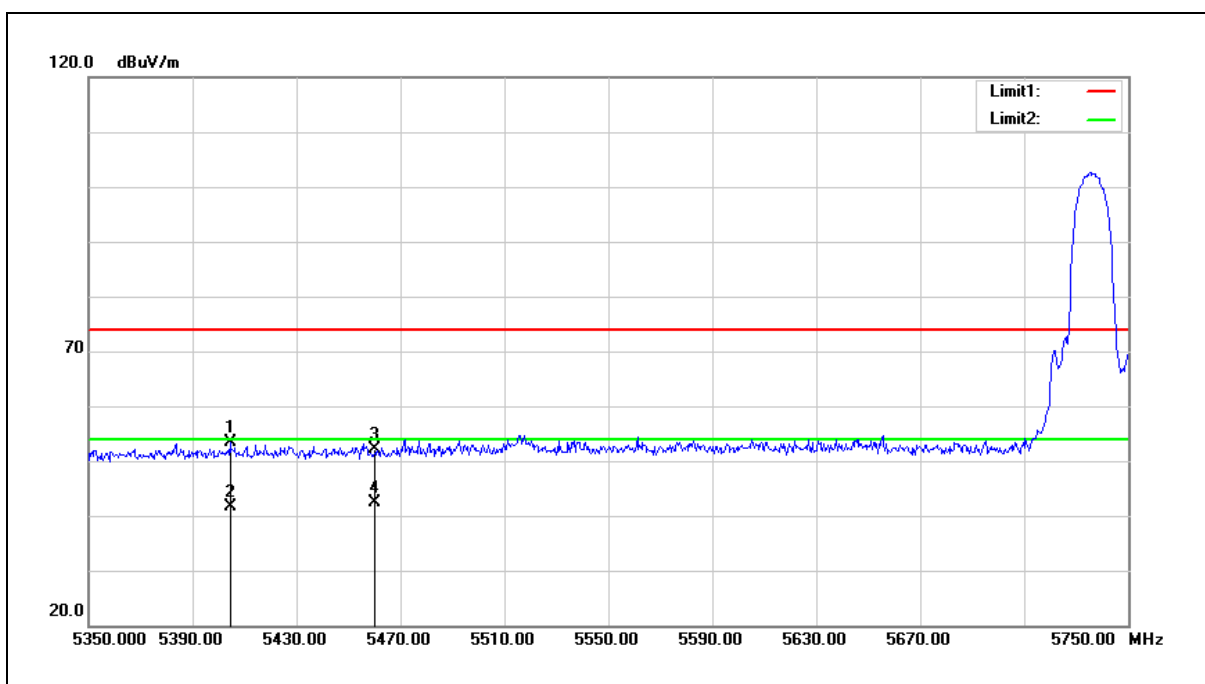
Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Band Edge

Standard:	FCC Part 15.407	Test Distance:	3m
Test item:	Band edge	Power:	AC 120V/60Hz
Frequency:	5736MHz	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



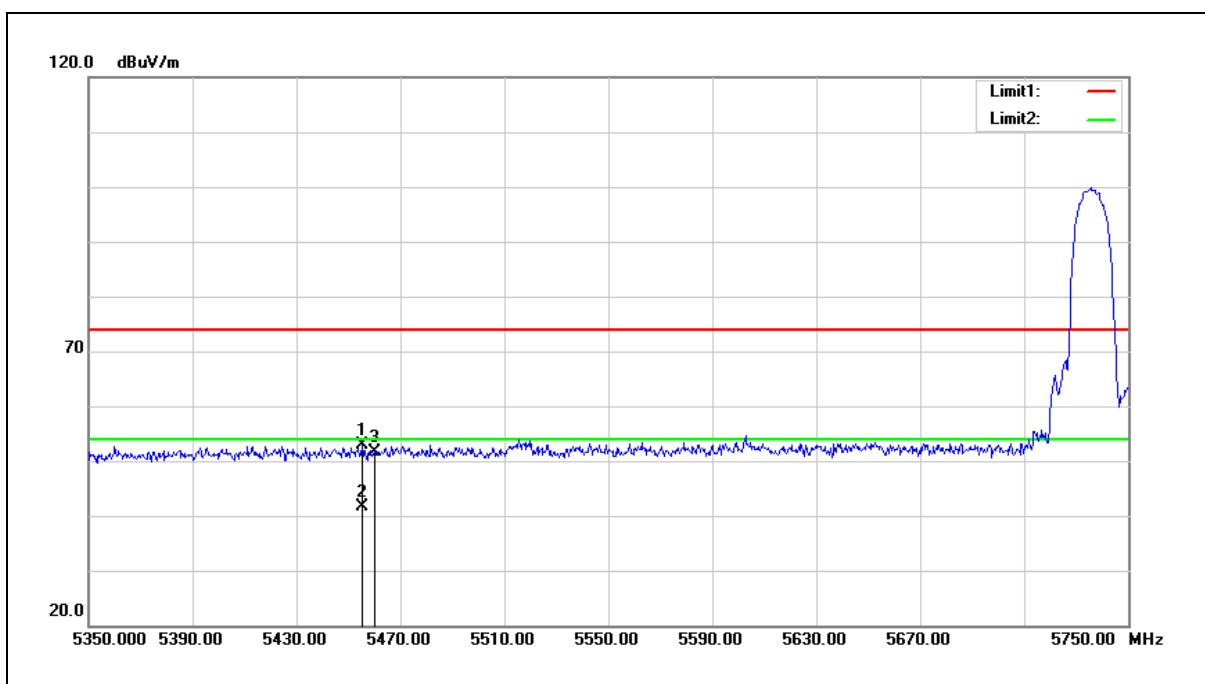
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5404.400	56.94	-3.54	53.40	74.00	-20.60	peak
2	5404.400	45.14	-3.54	41.60	54.00	-12.40	AVG
3	5460.000	55.61	-3.46	52.15	74.00	-21.85	peak
4	5460.000	45.72	-3.46	42.26	54.00	-11.74	AVG

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.407	Test Distance:	3m
Test item:	Band edge	Power:	AC 120V/60Hz
Frequency:	5736MHz	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	Mode 2		
Ant.Polar.:	Vertical		



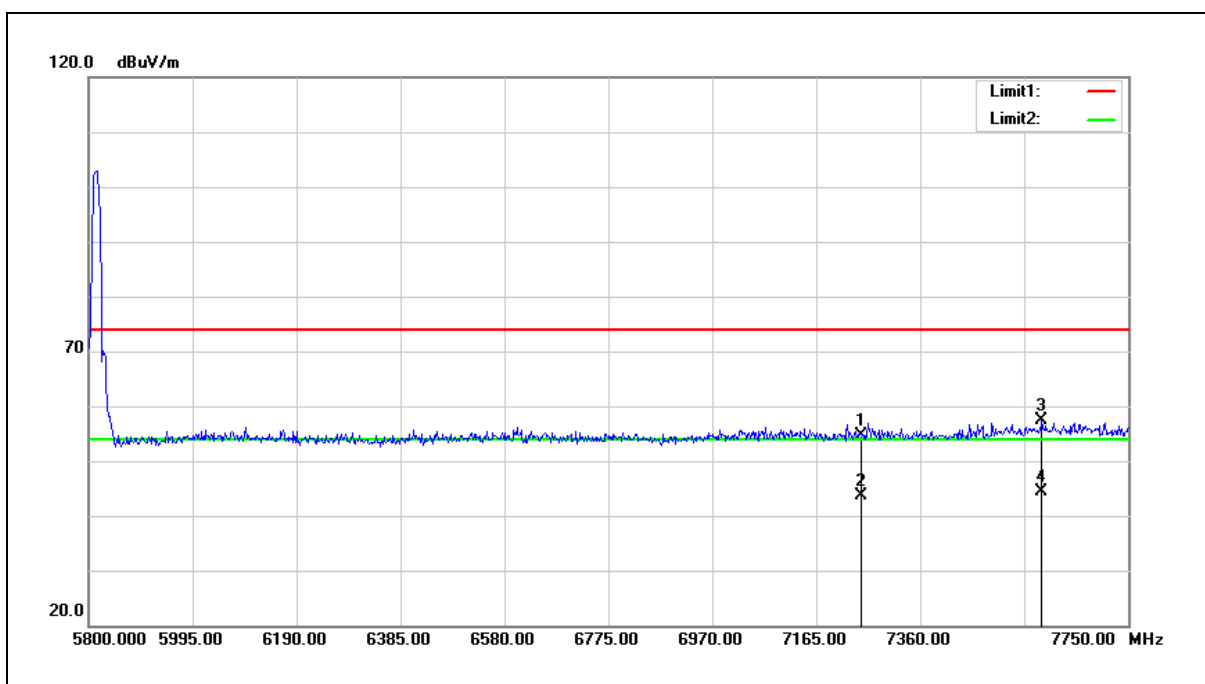
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5455.200	56.29	-3.48	52.81	74.00	-21.19	peak
2	5455.200	45.14	-3.48	41.66	54.00	-12.34	AVG
3	5460.000	55.03	-3.46	51.57	74.00	-22.43	peak

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.407	Test Distance:	3m
Test item:	Band edge	Power:	AC 120V/60Hz
Frequency:	5814MHz	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



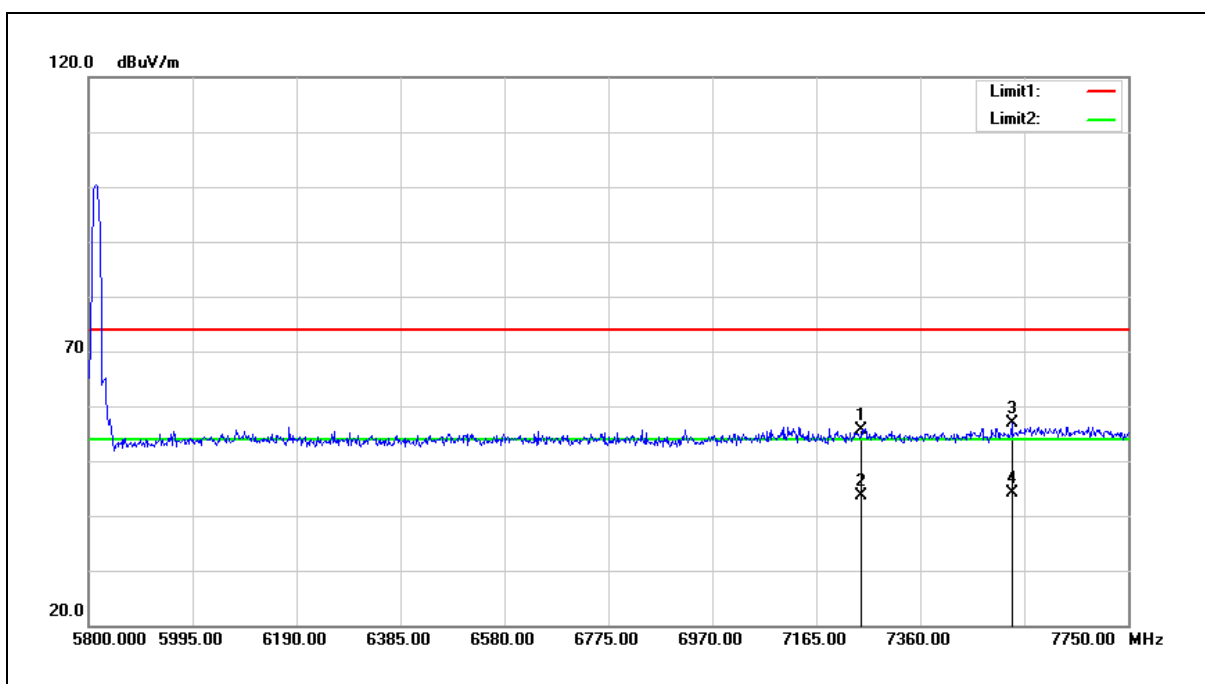
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	7250.000	55.11	-0.39	54.72	74.00	-19.28	peak
2	7250.000	43.91	-0.39	43.52	54.00	-10.48	AVG
3	7588.150	57.03	0.23	57.26	74.00	-16.74	peak
4	7588.150	44.15	0.23	44.38	54.00	-9.62	AVG

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.407	Test Distance:	3m
Test item:	Band edge	Power:	AC 120V/60Hz
Frequency:	5814MHz	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	Mode 2		
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	7250.000	56.08	-0.39	55.69	74.00	-18.31	peak
2	7250.000	43.94	-0.39	43.55	54.00	-10.45	AVG
3	7531.600	56.81	0.17	56.98	74.00	-17.02	peak
4	7531.600	43.96	0.17	44.13	54.00	-9.87	AVG

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.



5.3. Maximum Conducted Output Power Measurement

Test Mode	Mode 2:Continuous TX mode				
Frequency (MHz)	ANT-0		ANT-1		FCC Limit (dBm)
	(dBm)	(W)	(dBm)	(W)	
5736	4.31	0.003	3.58	0.002	≤ 30
5762	4.54	0.003	3.43	0.002	
5814	7.62	0.006	7.07	0.005	

Note 1: The relevant measured result has the offset with cable loss already.

5.4. 6dB RF Bandwidth Measurement

Test Mode	Mode 2:Continuous TX mode	
Frequency (MHz)	ANT-0	Limit (kHz)
5736	9855	> 500
5762	9855	> 500
5814	11090	> 500



Mode 2:Continuous TX mode_ANT-0

5736 MHz

Agilent Spectrum Analyzer - Occupied BW

Center Freq: 5.73600000 GHz
 Trig: Free Run
 #Atten: 10 dB
 Avg/Hold: >10/10
 Radio Std: None
 Radio Device: BTS

10 dB/div Ref 10.00 dBm

Center 5.736 GHz
 #Res BW 100 kHz
 #VBW 300 kHz
 Span 30 MHz
 Sweep 2.933 ms

Occupied Bandwidth: 13.957 MHz
 Total Power: 5.72 dBm
 Transmit Freq Error: 178.81 kHz
 x dB Bandwidth: 9.855 MHz
 OBW Power: 99.00 %
 x dB: -6.00 dB

Frequency: 5.73600000 GHz
 CF Step: 3.000000 MHz
 Freq Offset: 0 Hz

5762 MHz

Agilent Spectrum Analyzer - Occupied BW

Center Freq: 5.76200000 GHz
 Trig: Free Run
 #Atten: 10 dB
 Avg/Hold: >10/10
 Radio Std: None
 Radio Device: BTS

10 dB/div Ref 10.00 dBm

Center 5.762 GHz
 #Res BW 100 kHz
 #VBW 300 kHz
 Span 30 MHz
 Sweep 2.933 ms

Occupied Bandwidth: 13.961 MHz
 Total Power: 6.74 dBm
 Transmit Freq Error: 191.64 kHz
 x dB Bandwidth: 9.855 MHz
 OBW Power: 99.00 %
 x dB: -6.00 dB

Frequency: 5.76200000 GHz
 CF Step: 3.000000 MHz
 Freq Offset: 0 Hz

5814 MHz

Agilent Spectrum Analyzer - Occupied BW

Center Freq: 5.81400000 GHz
 Trig: Free Run
 #Atten: 10 dB
 Avg/Hold: >10/10
 Radio Std: None
 Radio Device: BTS

10 dB/div Ref 10.00 dBm

Center 5.814 GHz
 #Res BW 100 kHz
 #VBW 300 kHz
 Span 30 MHz
 Sweep 2.933 ms

Occupied Bandwidth: 13.958 MHz
 Total Power: 9.58 dBm
 Transmit Freq Error: 219.65 kHz
 x dB Bandwidth: 11.09 MHz
 OBW Power: 99.00 %
 x dB: -6.00 dB

Frequency: 5.81400000 GHz
 CF Step: 3.000000 MHz
 Freq Offset: 0 Hz



5.5. Maximum Power Spectral Density Measurement

Test Mode	Mode 2: IEEE 802.11a link mode			
Frequency (MHz)	ANT-0			
	Measurement (dBm/100KHz)	Duty Factor (dB)	Calculated (dBm/500KHz)	Limit (dBm/500KHz)
5736	-12.34	0.000	-5.35	< 30
5762	-11.40	0.000	-4.41	
5814	-8.53	0.000	-1.54	

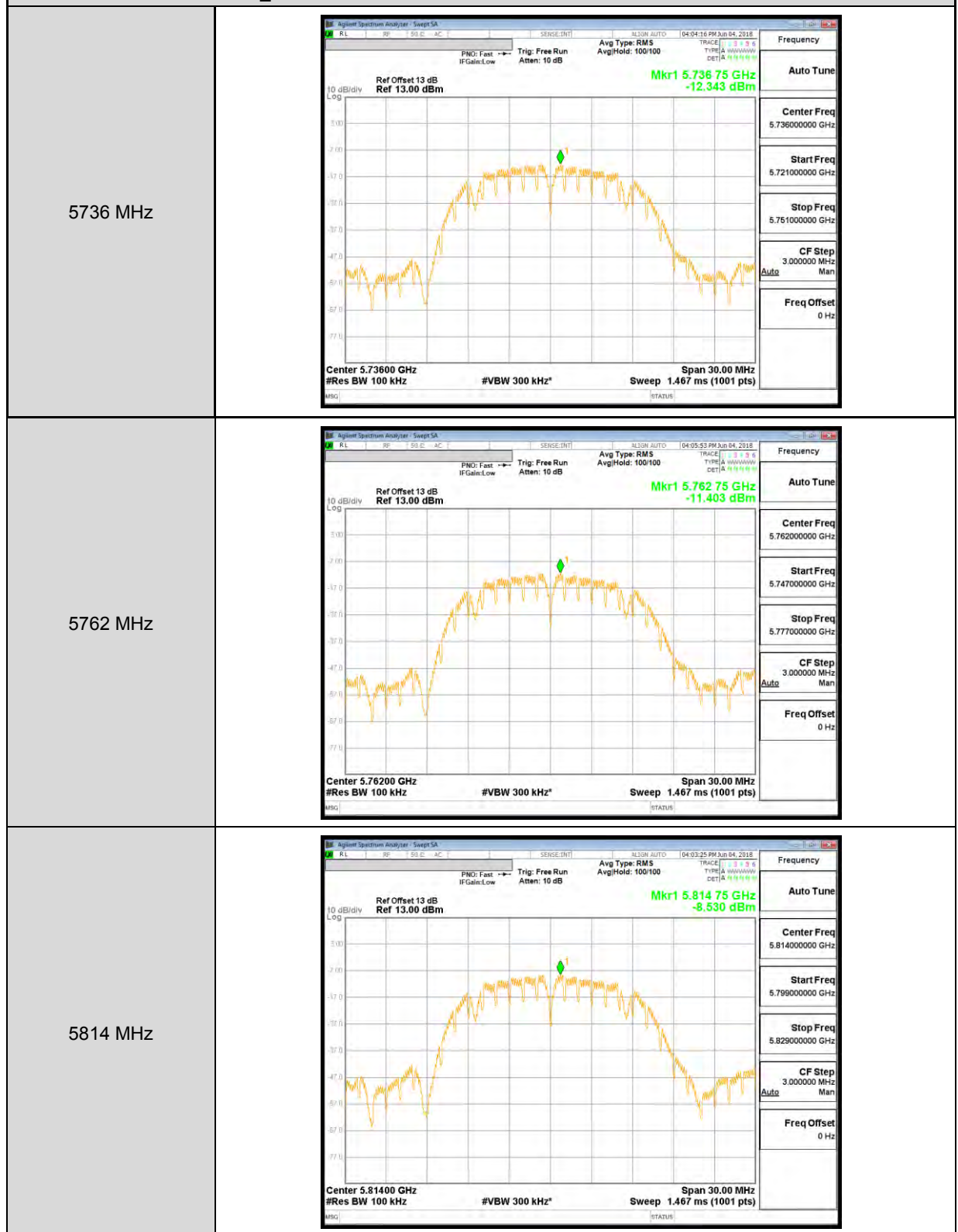
Note: Method SA-2, Power density = measured result + $10\log(1/\text{duty cycle})$ + Conversion ratio = measured result + duty factor.

Conversion ratio = $10*\log(500\text{k}/100\text{k})$



■ Test Graphs

Mode 2:Continuous TX mode_ ANT-0





5.6. Frequency Stability Measurement

Temperature Variations

Frequency	Temp. (°C)	Voltage (Vdc)	Measured Freq. (MHz)	Delta Freq. (Hz)	Tolerance (ppm)	Result (Pass/Fail)
5762 MHz	-5	14.80	5736.0157	15700	2.737	Pass
	0		5736.014	14000	2.441	Pass
	10		5736.0168	16800	2.929	Pass
	20		5736.0129	12900	2.249	Pass
	30		5736.011	11000	1.918	Pass
	40		5736.0101	10100	1.761	Pass

Voltage Variations

Frequency	Temp. (°C)	Voltage (Vdc)	Measured Freq. (MHz)	Delta Freq. (Hz)	Tolerance (ppm)	Result (Pass/Fail)
5762 MHz	20	13.32	5736.019	19000	3.312	Pass
		14.80	5736.0129	12900	2.249	Pass
		16.28	5736.006	6000	1.046	Pass

Note: The manufacturer's frequency stability specification is better than 20ppm.