

Test Report

FCC Part15 Subpart E

Product Name : ST10
Model No. : ST10
FCC ID : 2ACS5-ST10
IC : 11554B-ST10

Applicant : Yuneec Technology Co., Limited
Address : 2/F Man Shung Industrial Building, 7 Lai Yip Street, Kwun
Tong, Hong Kong

Date of Receipt : Oct. 29, 2014
Test Date : Oct. 29, 2014~ Dec. 03, 2014
Issued Date : Dec. 12, 2014
Report No. : 14B0064R-RF-CE-P14V02
Report Version : V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration of the equipment and evaluated measurement uncertainty herein.

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Test Report Certification

Issued Date : Dec. 12, 2014
Report No. : 14B0064R-RF-US-P09V01



Product Name : ST10

Applicant : Yuneec Technology Co., Limited

Address : 2/F Man Shung Industrial Building, 7 Lai Yip Street, Kwun Tong, Hong Kong

Manufacturer : Good Power Technology Co., Ltd.

Address : No.388 East Zhengwei Road, Jinxi Town, Kunshan, Jiangsu 215324, China

Model No. : ST10

FCC ID : 2ACS5-ST10

IC : 11554B-ST10

EUT Voltage : DC: 3.6V

Brand Name : Yuneec

Applicable Standard : FCC CFR Title 47 Part 15 Subpart E: 2014
ANSI C63.4: 2009; KDB 789033 D02 New Rules v01
RSS-210 Issue 8, December 2010

Test Result : Complied

Performed Location : Suzhou EMC Laboratory
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TEL: +86-512-6251-5088 / FAX: +86-512-6251-5098
FCC Registration Number: 800392; IC Lab Code: 4075B

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Laboratory Information

We, **Quietek Corporation**, are an independent EMC and safety consultancy that was established the whole facility in our laboratories. The test facility has been accredited/accepted(audited or listed) by the following related bodies in compliance with ISO 17025, EN 45001 and specified testing scope:

Taiwan R.O.C.	:	BSMI, NCC, TAF
Germany	:	TUV Rheinland
Norway	:	Nemko, DNV
USA	:	FCC
Japan	:	VCCI
China	:	CNAS

The related certificate for our laboratories about the test site and management system can be downloaded from Quietek Corporation's Web Site :<http://www.quietek.com/tw/ctg/cts/accreditations.htm>

The address and introduction of Quietek Corporation's laboratories can be founded in our Web site :
<http://www.quietek.com/>

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History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
14B0064R-RF-US-P09V01	V1.0	Initial Issued Report	Dec. 12, 2014

1. General Information

1.1. EUT Description

Product Name	ST10
Brand Name	Yuneec
Model No.	ST10
EUT Voltage	DC 3.6V
Frequency Range	802.11a: 5745~5825MHz
Channel Number	802.11a: 5
Type of Modulation	802.11a: OFDM
Data Rate	802.11a: 6/9/12/18/24/36/48/54Mbps
Channel Control	Auto
Antenna Delivery	1*Tx + 1*Rx
Peak Antenna Gain	5 dBi

802.11a(20MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
149	5745 MHz	153	5765 MHz	157	5785 MHz	161	5805 MHz
165	5825 MHz	N/A	N/A	N/A	N/A	N/A	N/A

Duty Cycle

Test Mode	Duty Cycle
802.11a	99%

1.2. Mode of Operation

Quietek 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 by 802.11a

Note:

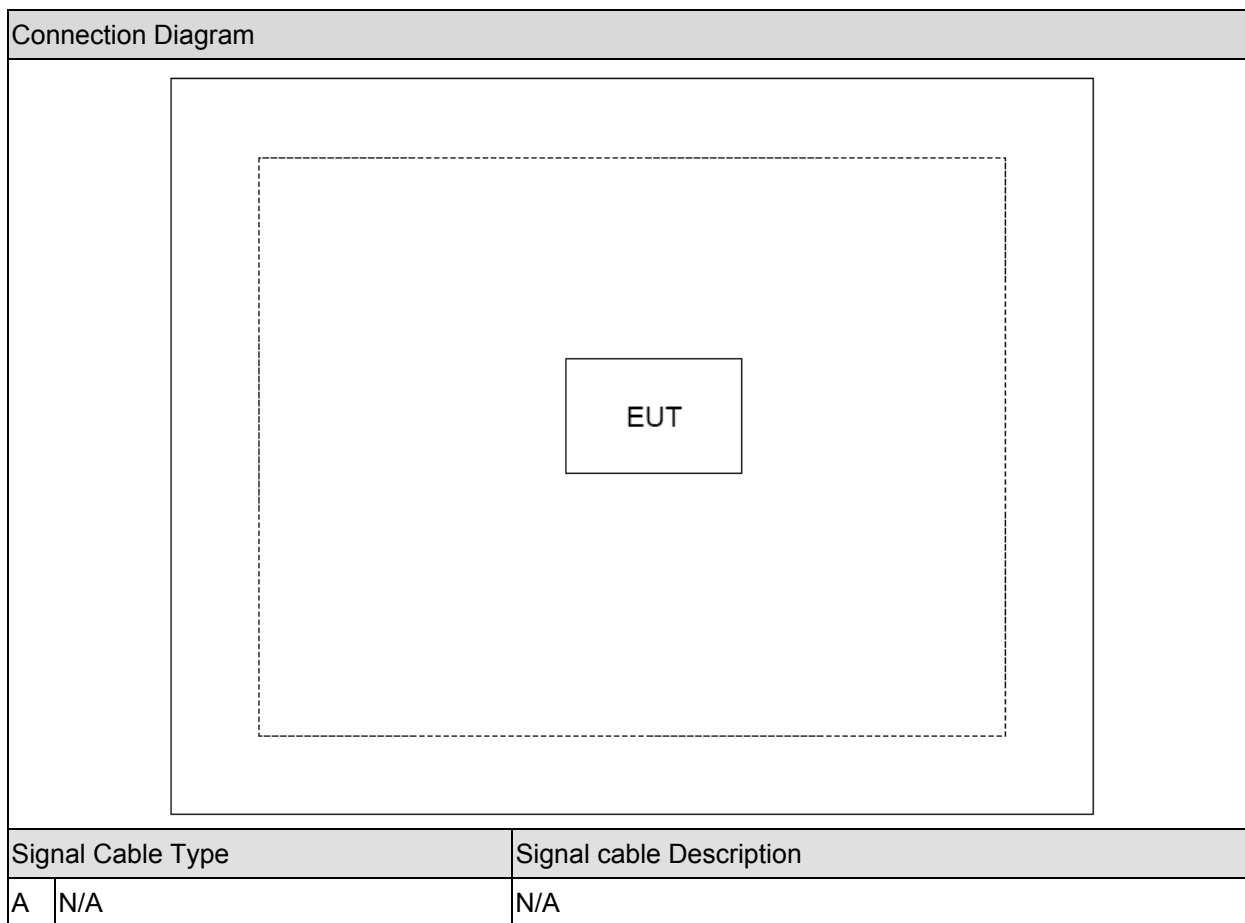
1. Regards to the frequency band operation: the lowest, middle and highest frequency of channel were selected to perform the test, then shown on this report.
2. This device is a composite device in accordance with zigbee under part 15.247 regulations. The function for zibee part was measured and made a test report that the report number is 14B0064R-RF-US-P05V01.

1.3. Tested System Details

The types for all equipments, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product		Manufacturer	Model No.	Serial No.	Power Cord
1	N/A	N/A	N/A	N/A	N/A

1.4. Configuration of Tested System



1.5. EUT Exercise Software

1	Setup the EUT and simulators as shown on above.
2	Turn on the power of equipment.
3	Set the test mode and channel, then press OK to start continue Transmit.

2. Technical Test

2.1. Summary of Test Result

- No deviations from the test standards
- Deviations from the test standards as below description:

Performed Test Item	Normative References	Test Performed	Deviation
Conducted Emission	FCC CFR Title 47 Part 15 Subpart E: 2014 Section 15.207	No	No
Radiated Emission	FCC CFR Title 47 Part 15 Subpart E: 2014 Section 15.209 RSS-210 Issue 8 December 2010 Section 2.7 Table 2 and Table 3	Yes	No
6dB&99% Occupied Bandwidth	FCC CFR Title 47 Part 15 Subpart E: 2014 Section 15.407(a)(5)&(e) RSS-210 A9.2(4)	Yes	No
Power Output	FCC CFR Title 47 Part 15 Subpart E: 2014 Section 15.407(a)(3) RSS-210 A9.2(4)	Yes	No
Peak Power Spectral Density	FCC CFR Title 47 Part 15 Subpart E: 2014 Section 15.407(a)(3) RSS-210 A9.2(4)	Yes	No
Radiated Emission Band Edge	FCC CFR Title 47 Part 15 Subpart E: 2014 Section 15.205, 15.407(b)(4) RSS-210 A9.2(4)	Yes	No
Frequency Stability	FCC CFR Title 47 Part 15 Subpart E: 2014 Section 15.407(g)	Yes	No

2.2. Test Environment

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	21
Humidity (%RH)	25-75	50
Barometric pressure (mbar)	860-1060	950-1000

3. Conducted Emission

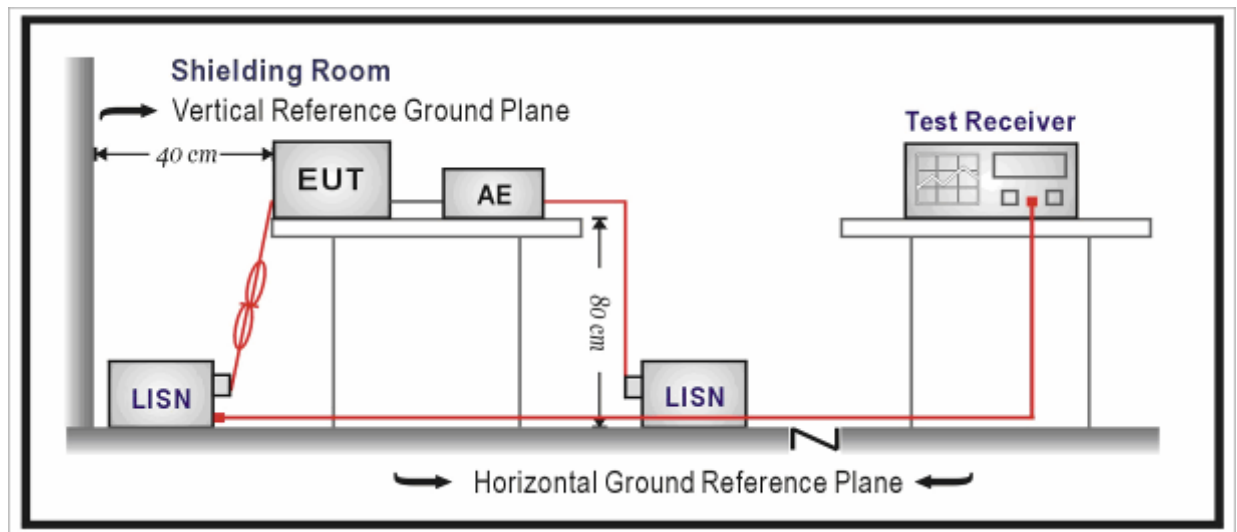
3.1. Test Equipment

Conducted Emission / TR-1

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
EMI Test Receiver	R&S	ESCI	100726	2015.03.28
Two-Line V-Network	R&S	ENV216	100043	2015.03.28
Two-Line V-Network	R&S	ENV216	100044	2015.09.16
50ohm Coaxial Switch	Anritsu	MP59B	6200464462	2015.03.01
50ohm Termination	SHX	TF2	07081401	2015.09.16
Temperature/Humidity Meter	zhicheng	ZC1-2	TR1-TH	2015.01.08

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

3.2. Test Setup



3.3. Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

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

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

3.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2009.

The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)

Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.

The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

3.5. Uncertainty

The measurement uncertainty is defined as ± 2.02 dB

3.6. Test Result

EUT is battery powered, test is not applicable.

4. Radiated Emission

4.1. Test Equipment

Radiated Emission / AC-2

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
EMI Test Receiver	R&S	ESCI	100573	2015.03.28
Loop Antenna	R&S	HFH2-Z2	833799/003	2015.11.25
Bilog Chainenna	Teseq GmbH	CBL6112D	27611	2015.10.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2015.03.01
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC2-TH	2015.01.08

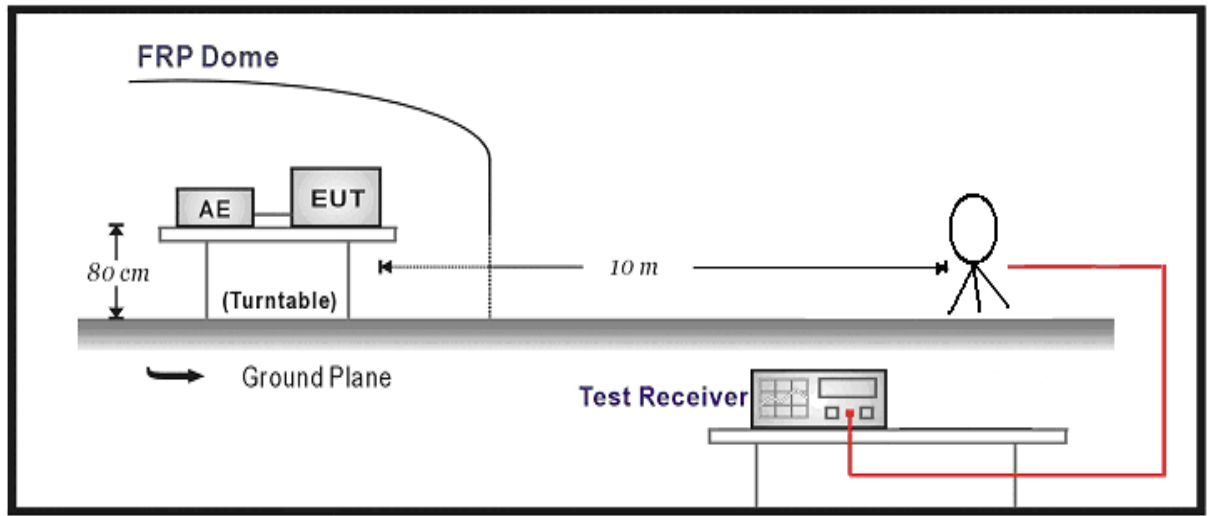
Radiated Emission / AC-5

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MY49100159	2015.03.28
Spectrum Analyzer	Agilent	E4446A	MY45300103	2015.01.07
Preamplifier	Miteq	NSP1800-25	1364185	2015.05.03
Preamplifier	QuieTek	AP-040G	CHM-0906001	2015.05.03
DRG Horn	ETS-Lindgren	3117	00123988	2015.01.07
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2016.04.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2015.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2015.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2015.03.01
EMI Receiver	Agilent	N9038A	MY51210196	2015.06.09
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC5-TH	2015.01.08

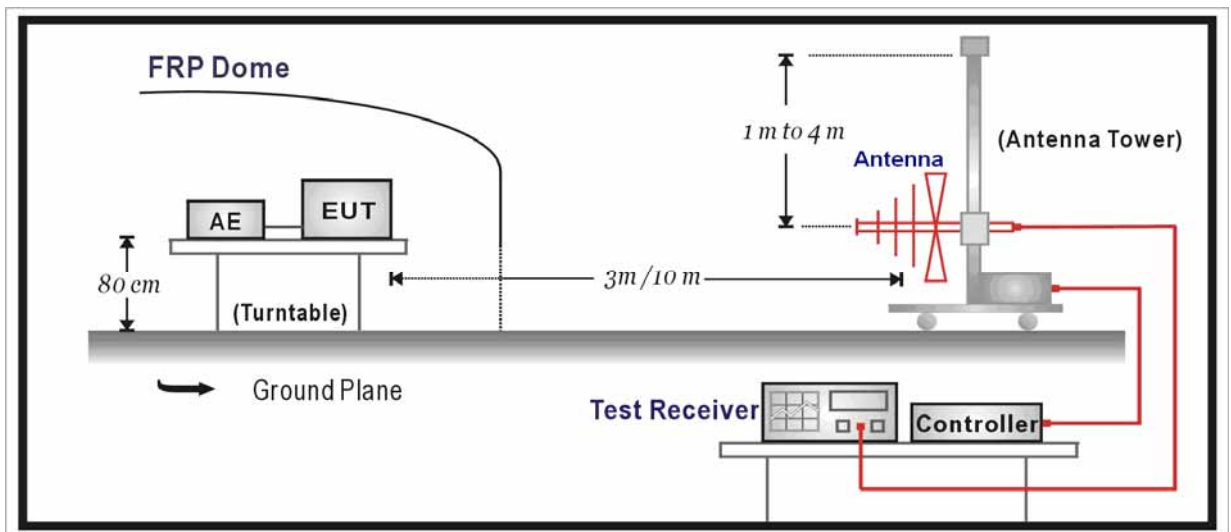
Note 1: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

4.2. Test Setup

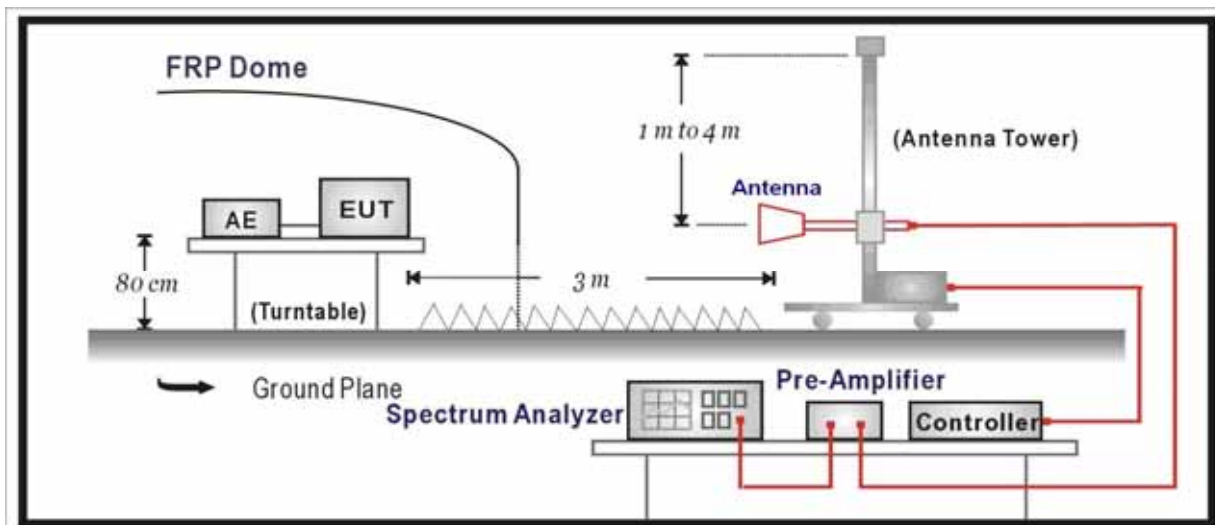
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



4.3. Limit

FCC Part 15 Subpart C Paragraph 15.209		
Frequency (MHz)	Distance (m)	Level (dBuV/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

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

Note 2: Distance refers to the distance in meters between the measuring instrument Chainenna and the closed point of any part of the device or system.

Note 3: $E \text{ field strength (dBuV/m)} = 20 \log E \text{ field strength (uV/m)}$

4.4. Test Procedure

The EUT was setup according to ANSI C63.4 2009 & KDB 789033.

The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from Chainenna to the EUT was 3 meters.

The Chainenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the Chainenna. In order to find

the maximum emission, all of the interface cables were manipulated according to ANSI C63.4:2009 on radiated measurement.

The resolution bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz.

The frequency range from 30MHz to 10th harmonic is checked.

Note: When doing emission measurement above 1GHz, the horn Chainenna will be bended down a little (as horn Chainenna has the narrow beamwidth) in order to keeping the Chainenna in the “cone of radiation” of EUT. The 3dB beamwidth is 60~10 degrees for H-plane and 90~10 degrees for E-plane.

The measurement was applied in a semi-anechoic chamber. While testing for spurious emission higher than 1GHz, if applied, the pre-amplifier would be equipped just at the output terminal of the antenna.

The EUT and simulators were placed on a 0.8m high wooden turntable above the horizontal metal ground plane. The turn table rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1meter to 4 meters to find out the maximum emission level.

The EUT was tested according to KDB 789033D02 Section II G.4/5/6, for the average unwanted emission measurements above 1GHz, use KDB 789033D02 Section II G. 6(c) Method AD (Average Detection).

The radiated emission was measured using the Spectrum Analyzer with the resolutions bandwidth & method set as:

RBW = 100kHz, VBW = 300kHz, Detector: CISPR QP (30MHz~1GHz)

RBW = 1MHz, VBW = 3MHz, Detector: Peak (>1GHz for PK)

RBW = 1MHz, VBW = 3MHz, Detector: RMS

Use power average type, perform a trace average of at least 100 traces. (>1GHz for AV)

4.5. Uncertainty

The measurement uncertainty above 1G is defined as ± 3.9 dB
 below 1G is defined as ± 3.8 dB

4.6. Test Result

Mode1: Transmit by 802.11a

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
149	H	11489.0	26.8	13.5	40.3	54(Note3)	-13.7	PK
	H	11497.5	33.8	13.6	47.4	54(Note3)	-6.6	PK
	V	17235.0	26.6	18.8	45.4	54(Note3)	-8.6	PK
	V	17235.0	27.1	18.8	45.9	54(Note3)	-8.1	PK
157	H	11565.5	26.9	13.8	40.7	54(Note3)	-13.3	PK
	H	11582.5	35.4	13.9	49.3	54(Note3)	-4.7	PK
	V	17354.0	29.8	19.1	48.9	54(Note3)	-5.1	PK
	V	17371.0	29.2	19.1	48.3	54(Note3)	-5.7	PK
165	H	11659.0	25.0	14.2	39.2	54(Note3)	-14.8	PK
	H	11659.0	32.1	14.2	46.3	54(Note3)	-7.7	PK
	V	17464.5	25.0	19.5	44.5	54(Note3)	-9.5	PK
	V	17473.0	25.3	19.5	44.8	54(Note3)	-9.2	PK

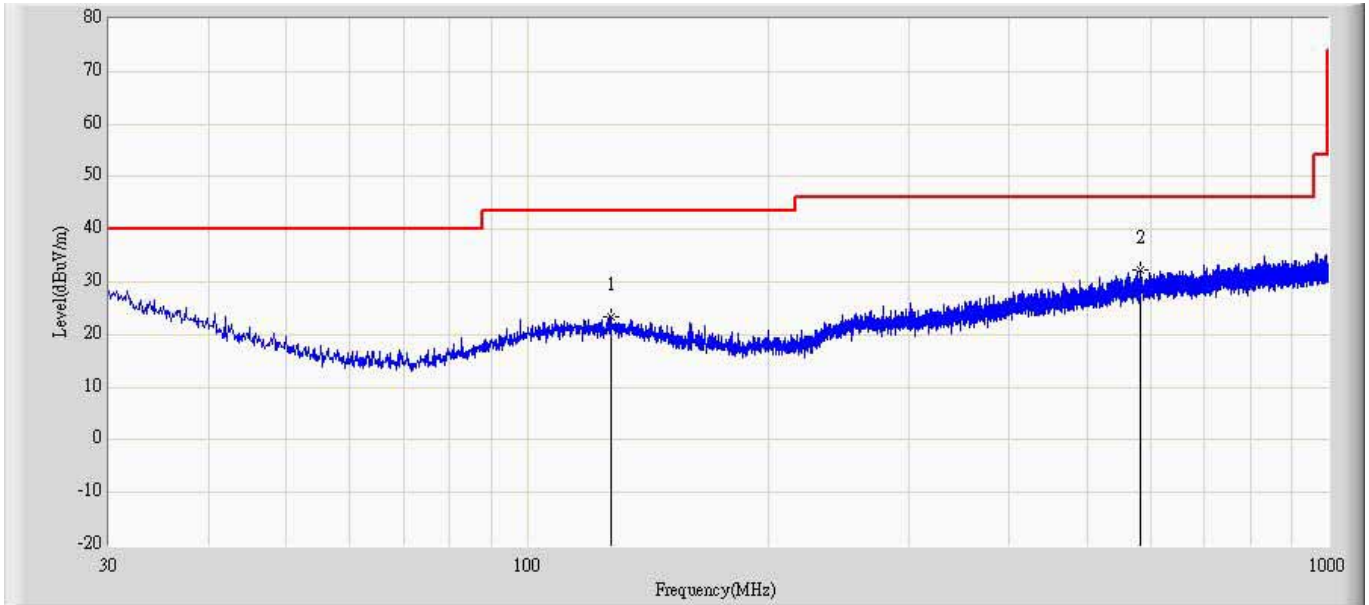
Note: 1. Measure Level = Reading Level + Factor.

2. The test trace is same as the ambient noise (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

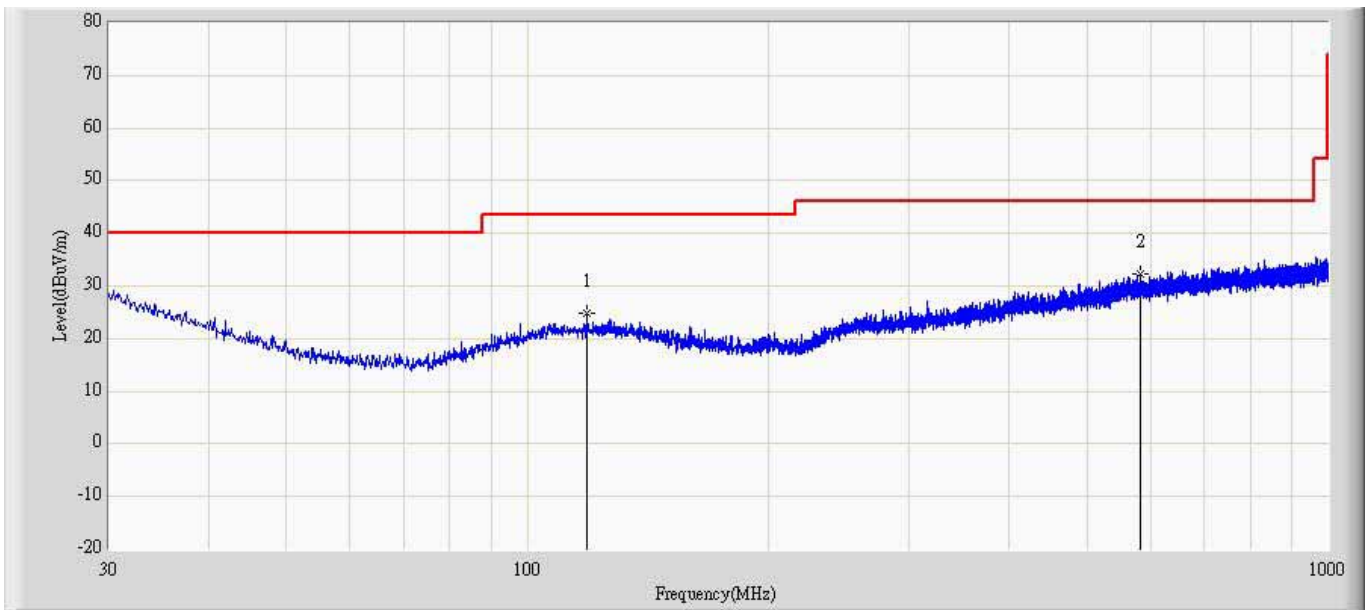
The worst case of Radiated Emission below 1GHz:

Site: AC2	Time: 2014/12/03 - 09:31
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: CBL6112D_27611(30-1000MHz)	Polarity: Horizontal
EUT: ST10	Power: AC 120V/60Hz
Note: Mode1: Transmit at channel 149 by 802.11a	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		127.364	23.457	4.774	-20.043	43.500	18.683	QP
2	*	583.870	32.381	5.471	-13.619	46.000	26.910	QP

Site: AC2	Time: 2014/12/03 - 09:32
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: CBL6112D_27611(30-1000MHz)	Polarity: Vertical
EUT: ST10	Power: AC 120V/60Hz
Note: Mode1: Transmit at channel 149 by 802.11a	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		118.512	24.839	6.087	-18.661	43.500	18.752	QP
2	*	583.870	32.381	5.471	-13.619	46.000	26.910	QP

5. Occupied Bandwidth

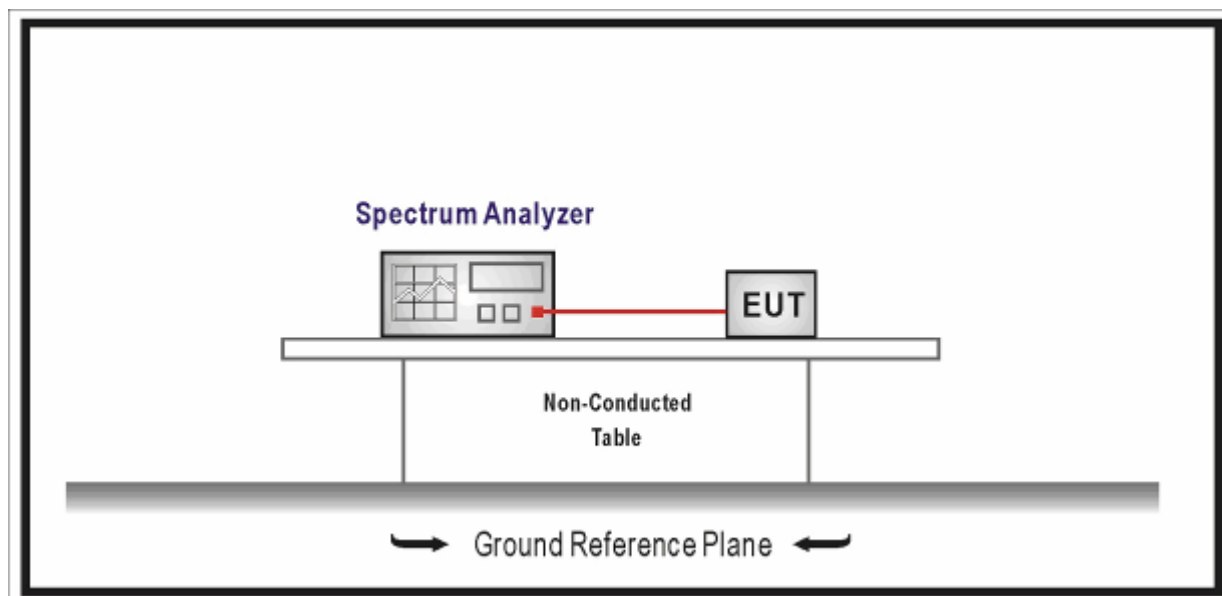
5.1. Test Equipment

Occupied Bandwidth / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2015.01.07
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2015.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

5.2. Test Setup



5.3. Limit

According to 15.407(e)

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

5.4. Test Procedure

The EUT was tested according to KDB 789033 Section II C2&D for compliance to FCC 47CFR 15.407 requirements.

Emission Bandwidth

- Use a RBW = approximately 1% of the emission bandwidth.
- Set the VBW > RBW
- Detector = Peak.
- Trace mode = max hold.
- Measure the maximum width of the emission that is 26 dB down from the peak 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%.

99% Occupied Bandwidth

- Set center frequency to the nominal EUT channel center frequency.
- Set span = 1.5 times to 5.0 times the OBW.
- Set RBW = 1 % to 5 % of the OBW.
- Set VBW $\geq 3 \cdot$ RBW.
- Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
- Use the 99 % power bandwidth function of the instrument (if available).
- If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

5.5. Uncertainty

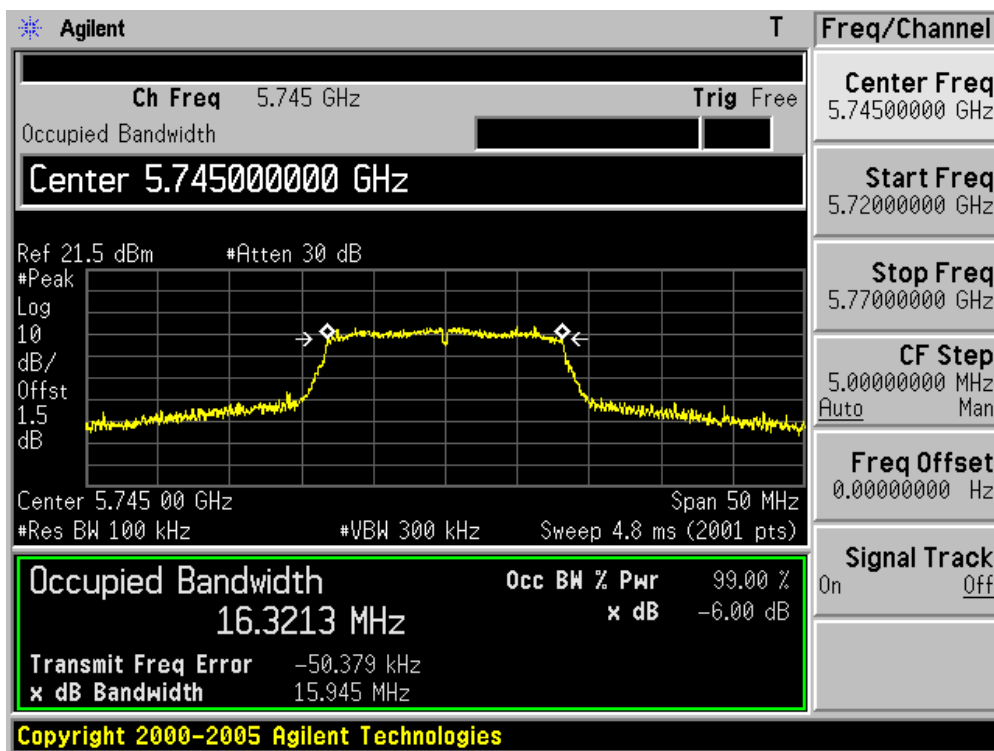
The measurement uncertainty is defined as ± 1 kHz

5.6. Test Result

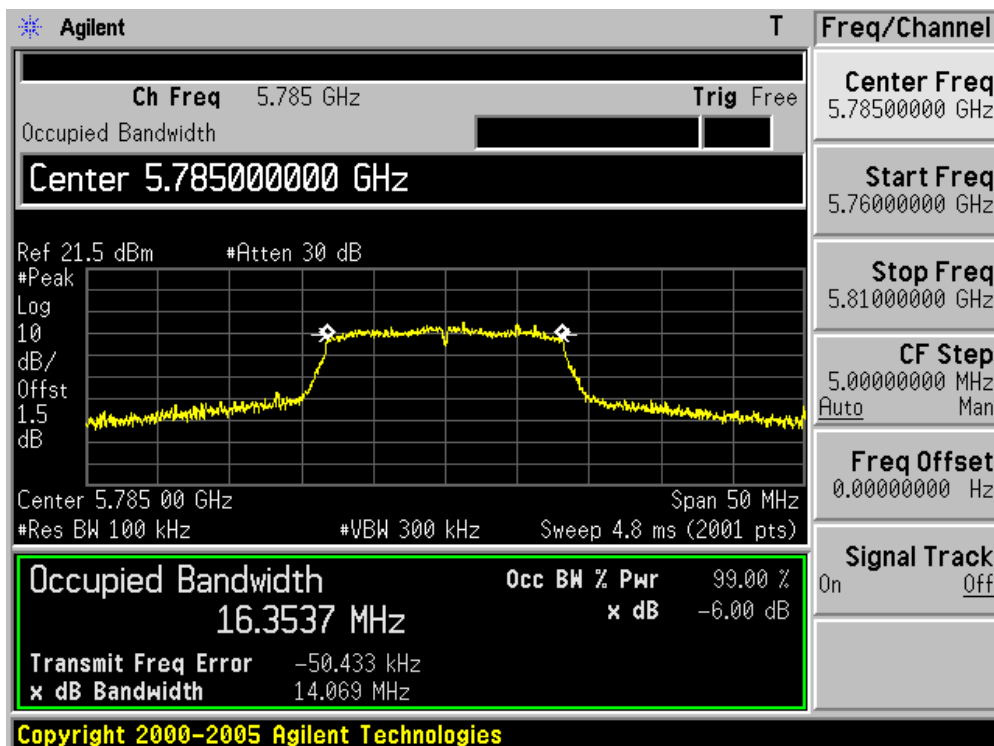
Product	:	ST10
Test Item	:	6dB & 99% Occupied Bandwidth
Test Mode	:	Mode 1: Transmit by 802.11a

Channel No.	Frequency (MHz)	6dB Bandwidth (kHz)	99% Bandwidth (kHz)	Limit (kHz)	Result
149	5745	15945.0	16321.3	>500	Pass
157	5785	14069.0	16353.7	>500	Pass
165	5825	14362.0	16297.7	>500	Pass

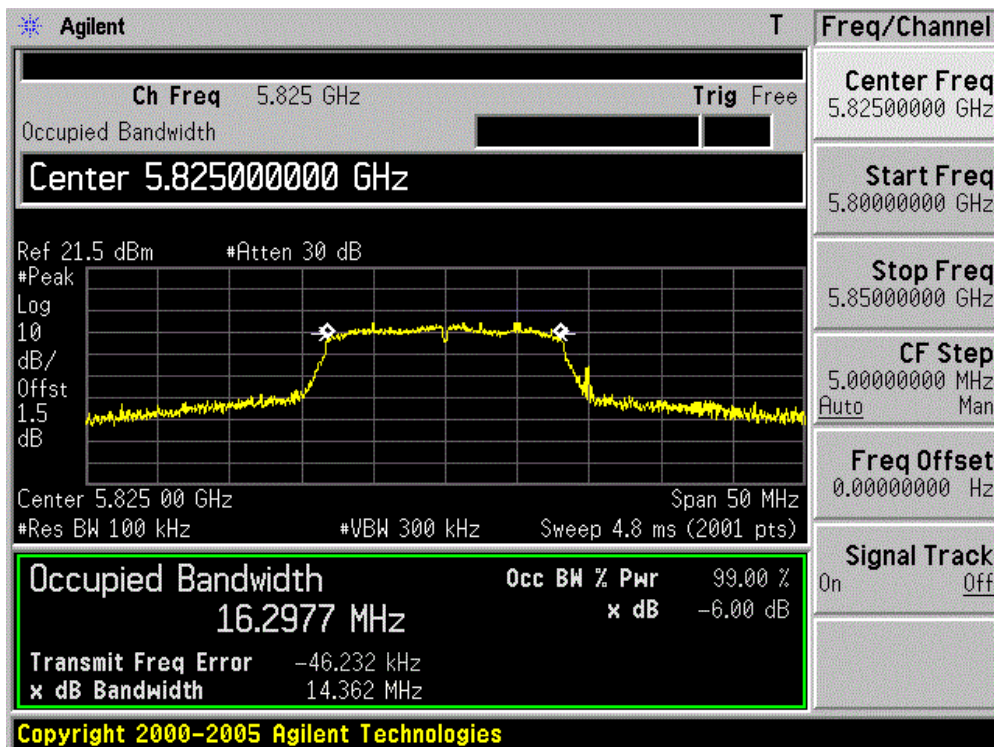
Channel 149 (5745MHz)



Channel 157 (5785MHz)



Channel 165 (5825MHz)



6. Power Output

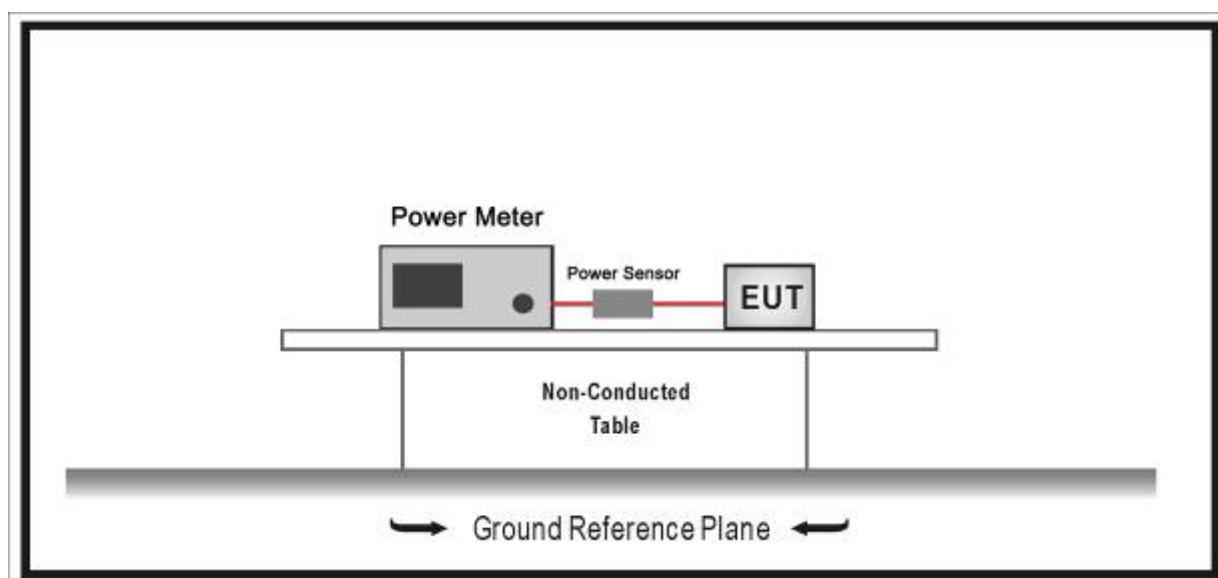
6.1. Test Equipment

Power Output / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2015.01.07
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2015.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

6.2. Test Setup



6.3. Limit

According to 15.407(a)(3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. 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

According to 15.407(a)(4)

The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.

According to RSS-210 A9.2(4)

The maximum conducted output power shall not exceed 1.0 W or $17 + 10 \log_{10} B$, dBm, whichever power is less. The maximum e.i.r.p. shall not exceed 4.0 W or $23 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.

6.4. Test Procedure

The EUT was tested according to KDB 789033 Section II E3(a) for compliance to FCC 47CFR 15.407 requirements.

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

(i) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

- The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
- At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
- The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

(ii) If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section II.B.

(iii) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.

(iv) Adjust the measurement in dBm by adding $10 \log(1/x)$ where x is the duty cycle (e.g., $10 \log(1/0.25)$ if the duty cycle is 25 percent).

Use the wideband power meter to test RMS power and record the result.

6.5. Uncertainty

The measurement uncertainty is defined as ± 1.27 dB

6.6. Test Result

Power output test was verified over all data rates 6/9/12/18/24/36/48/54Mbps, and the 6Mbps was the worst case and data was recorded in the result.

Product	: ST10
Test Item	: Power Output
Test Site	: TR-8
Test Mode	: Mode 1: Transmit by 802.11a

Output Power Results For FCC

Channel No.	Frequency (MHz)	Meas Power (dBm)	Power Limit(dBm)	Power Margin(dBm)	Result
149	5745	11.09	30.00	-18.77	Pass
157	5785	11.27	30.00	-18.68	Pass
165	5825	11.41	30.00	-19.02	Pass

Output Power Results For IC

Limit :

Channel No.	Frequency (MHz)	99% Occupied Bandwidth (MHz)	Power Limit of 17 + 10 log ₁₀ B (dBm)	Power limit of 1W (dBm)	e.i.r.p Limit of 23 + 10 log ₁₀ B (dBm)	Power limit of 4W (dBm)
149	5745	16.3213	29.13	30	35.13	36
157	5785	16.3537	29.14	30	35.14	36
165	5825	16.2977	29.12	30	35.12	36

Channel No.	Frequency (MHz)	Meas. Power (dBm)	IC Power Limit (dBm)	e.i.r.p Power (dBm)	IC e.i.r.p Limit(dBm)	Result
149	5745	11.09	29.13	16.09	35.13	Pass
157	5785	11.27	29.14	16.27	35.14	Pass
165	5825	11.41	29.12	16.41	35.12	Pass

Note: e.i.r.p Power = Meas. Power + Antenna gain.

7. Peak Power Spectral Density

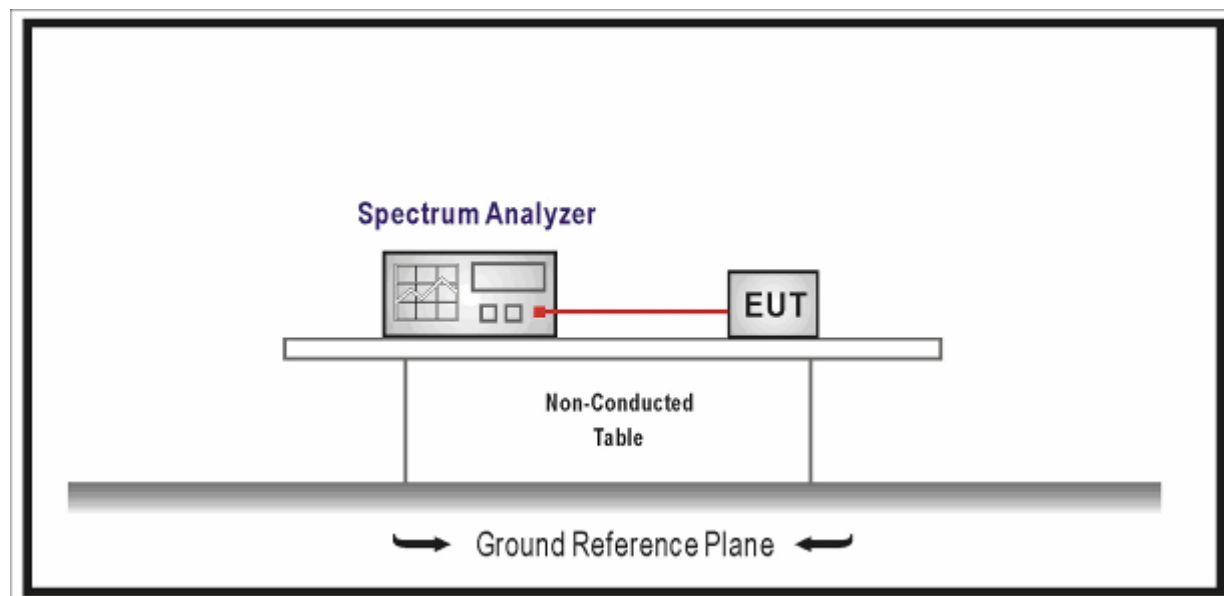
7.1. Test Equipment

Peak Power Spectral Density / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2015.01.07
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2015.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

7.2. Test Setup



7.3. Limit

According to 15.407(a)(3)

In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

According to RSS-210 A9.2(4)

The power spectral density shall not exceed 17 dBm in any 1.0 MHz band.

7.4. Test Procedure

According to KDB 789033D02: section F

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method.
2. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
3. The result is the Maximum PSD over 1 MHz reference bandwidth.

7.5. Uncertainty

The measurement uncertainty is defined as ± 1.27 dB

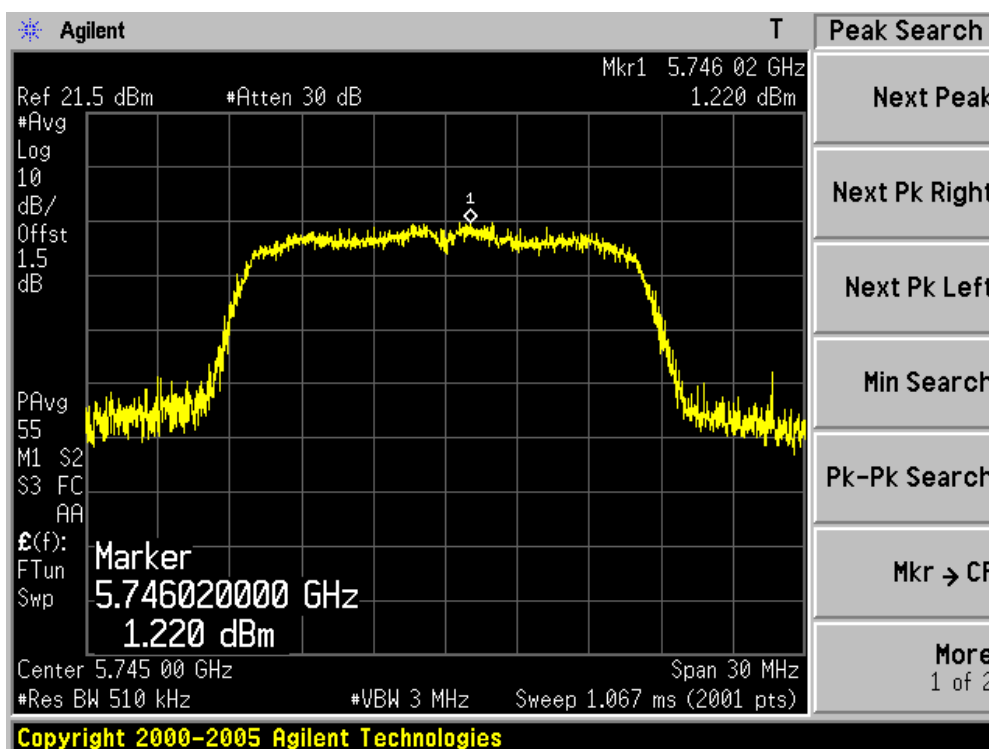
7.6. Test Result

Product	:	ST10
Test Item	:	Peak Power Spectral Density
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmit by 802.11a

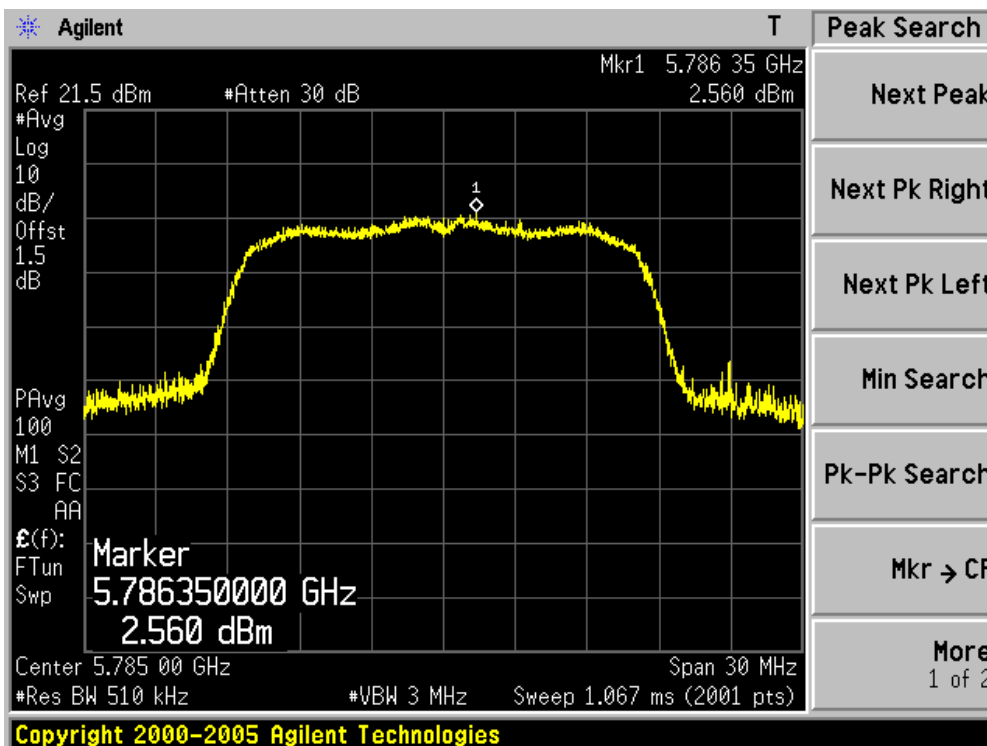
For FCC part

Channel No.	Frequency (MHz)	Measurement PPSD (dBm/500kHz)	Total PPSD (dBm/500kHz)	Limit (dBm/500kHz)	Result
149	5745	1.220	1.220	30	Pass
157	5785	2.560	2.560	30	Pass
165	5825	2.238	2.238	30	Pass

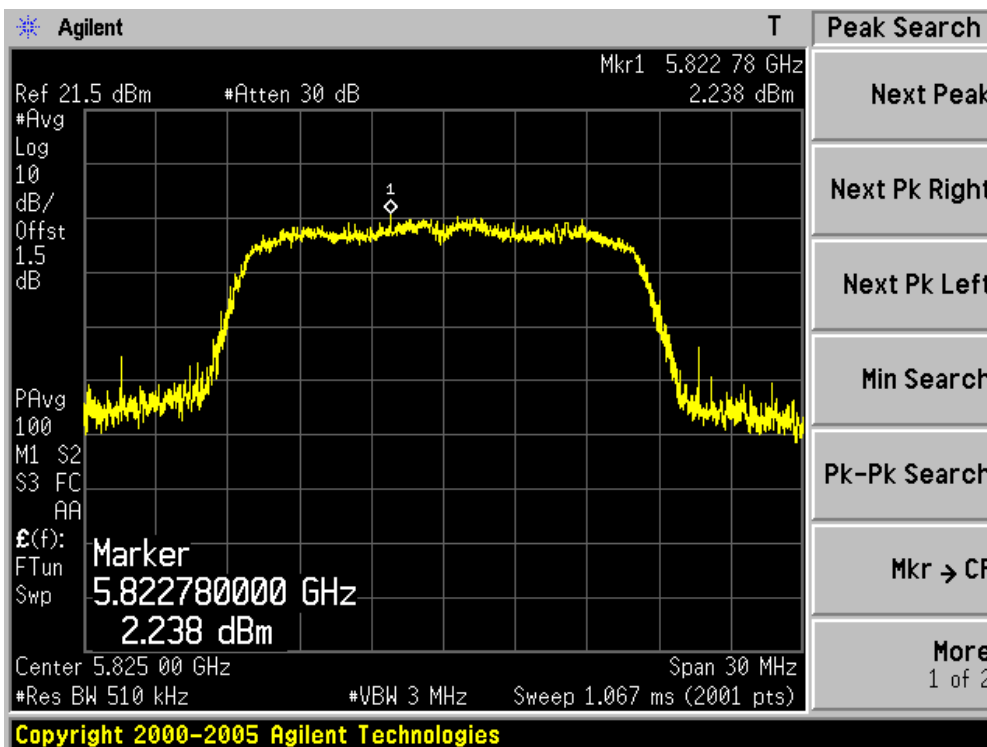
Channel 149 (5745MHz)



Channel 157 (5785MHz)



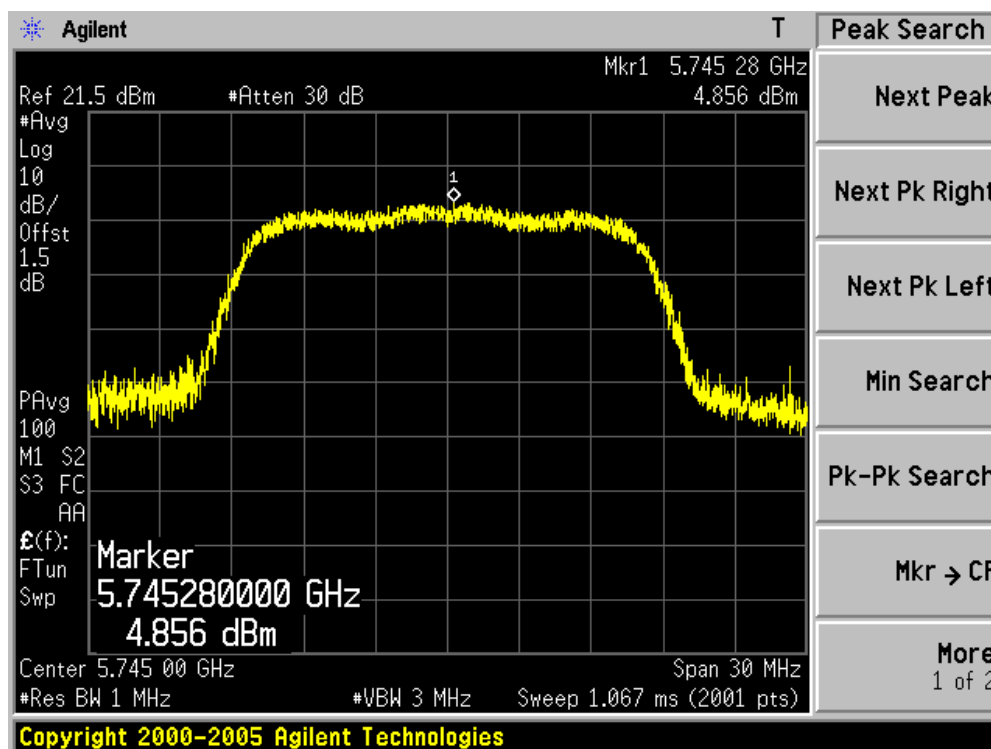
Channel 165 (5825MHz)



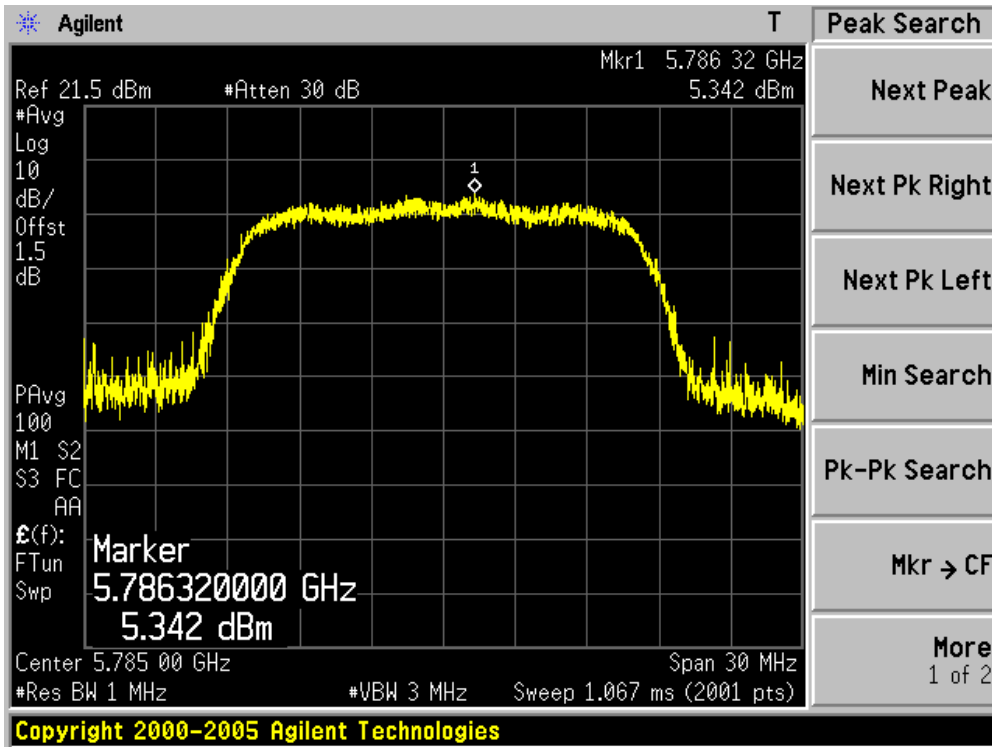
For IC part

Channel No.	Frequency (MHz)	Measurement PPSD (dBm/1MHz)	Total PPSD (dBm/1MHz)	Limit (dBm/1MHz)	Result
149	5745	4.856	4.856	17	Pass
157	5785	5.342	5.342	17	Pass
165	5825	6.550	6.550	17	Pass

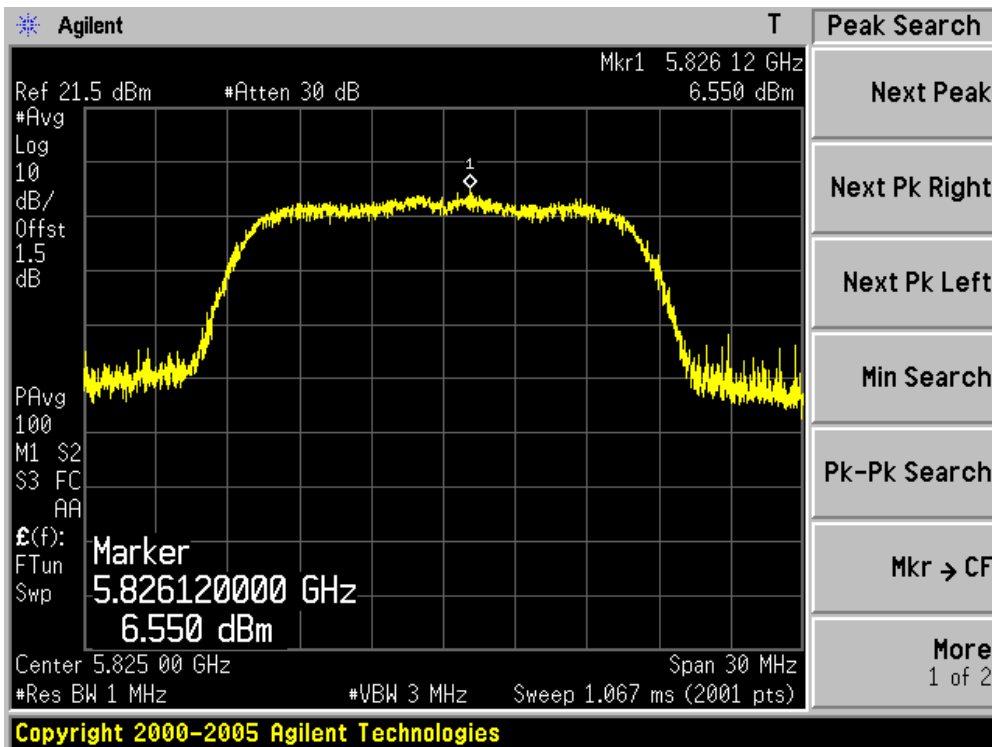
Channel 149 (5745MHz)



Channel 157 (5785MHz)



Channel 165 (5825MHz)



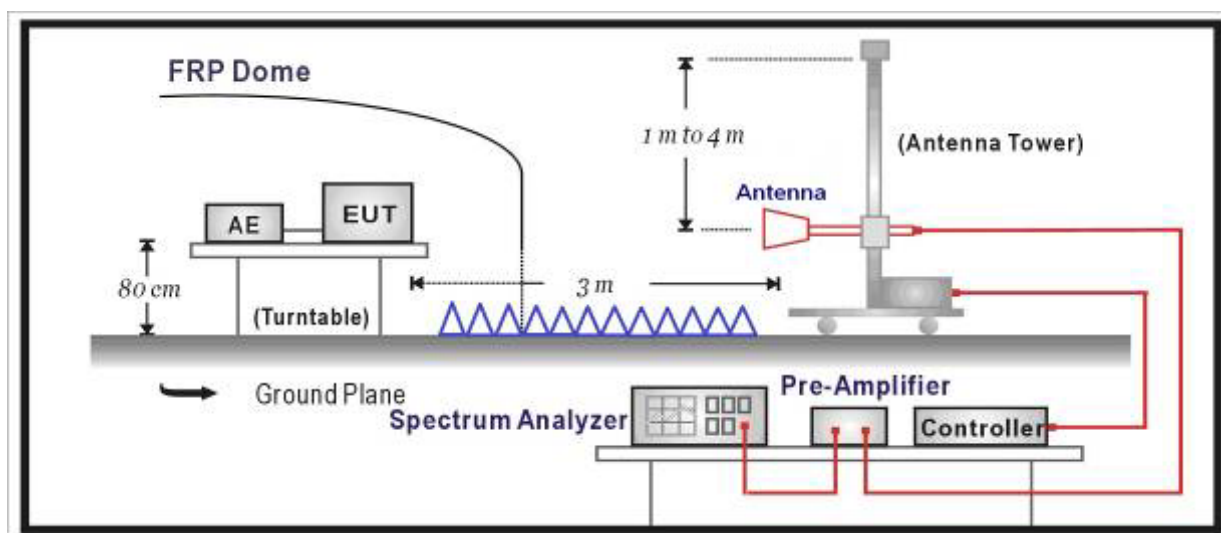
8. Radiated Emission Band Edge

8.1. Test Equipment

☒ Radiated Emission Band Edge / AC-5

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MY49100159	2015.03.28
Preamplifier	Miteq	NSP1800-25	1364185	2015.05.03
Preamplifier	QuieTek	AP-040G	CHM-0906001	2015.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2015.10.15
DRG Horn	ETS-Lindgren	3117	00123988	2015.01.07
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2016.04.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2015.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2015.03.01
EMI Receiver	Agilent	N9038A	MY51210196	2015.06.09
Temperature/Humidity Meter	Zhichen	ZC1-2	AC5-TH	2015.01.08

8.2. Test Setup



8.3. Limit

For 15.205 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a).

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 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 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)

For 15.407(b) & RSS-210 A9.2(4) requirement:

- For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

Operating Frequency Band (MHz)	EIRP Limit (dBm/MHz)	Equivalent Field Strength at 3m (dBuV/m)
5150 - 5250	-27	68.3
5250 - 5350	-27	68.3
5470 - 5725	-27	68.3
5725 - 5825	-27 [Note(1)]	68.3
	-17 [Note(2)]	78.3

Note(1): Outside the frequency range 5715 - 5835MHz.

Note(2): Within the frequency range from the band edge to 10MHz below or above the band edge, 5715 – 5725MHz and 5825 - 5835MHz.

8.4. Test Procedure

The EUT was tested according to KDB 789033 for compliance to FCC 47CFR 15.407 requirements.

The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4: 2009 on radiated measurement.

Note: When doing emission measurement above 1GHz, the horn Chainenna will be bended down a little (as horn Chainenna has the narrow beamwidth) in order to keeping the Chainenna in the “cone of radiation” of EUT. The 3dB beamwidth is 10~60 degrees for H-plane and 10~90 degrees for E-plane.

According to KDB 789033 D02: section G3 d) (ii)

(ii) Integration Method

- For maximum emissions measurements, follow the procedures described in section II.G.5., “Procedures for Unwanted Maximum Emissions Measurements above 1000 MHz”, except for the following changes:
 - Set RBW = 100 kHz
 - Set VBW $\geq 3 \cdot$ RBW
 - Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured. CAUTION: You must ensure that the spectrum analyzer or EMI receiver is set for peak-detection and max-hold for this measurement.
- For average emissions measurements, follow the procedures described in section II.G.6., “Procedures for Average Unwanted Emissions Measurements above 1000 MHz”, except for the following changes:
 - Set RBW = 100 kHz
 - Set VBW $\geq 3 \cdot$ RBW
 - Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured.

8.5. Uncertainty

The measurement uncertainty above 1GHz is defined as ± 3.9 dB

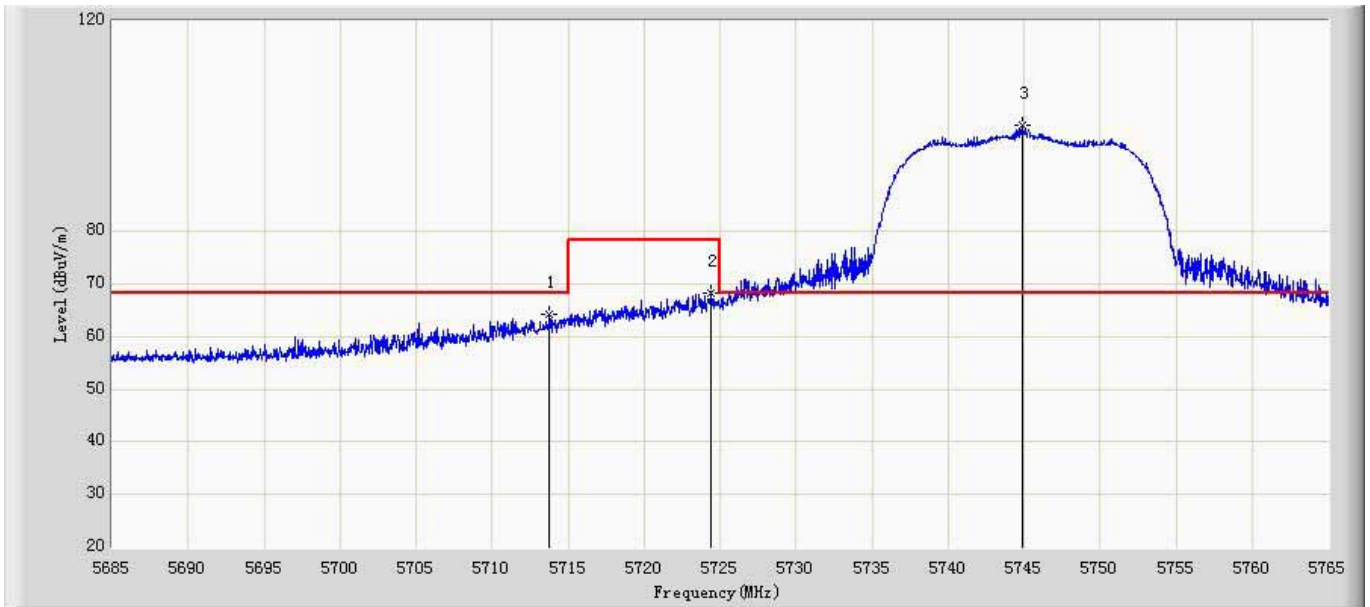
8.6. Test Result

For band edge points:

Peak detector: RBW = 100kHz, VBW = 300kHz, detector = Peak, sweep time = auto;
power integration across 1MHz.

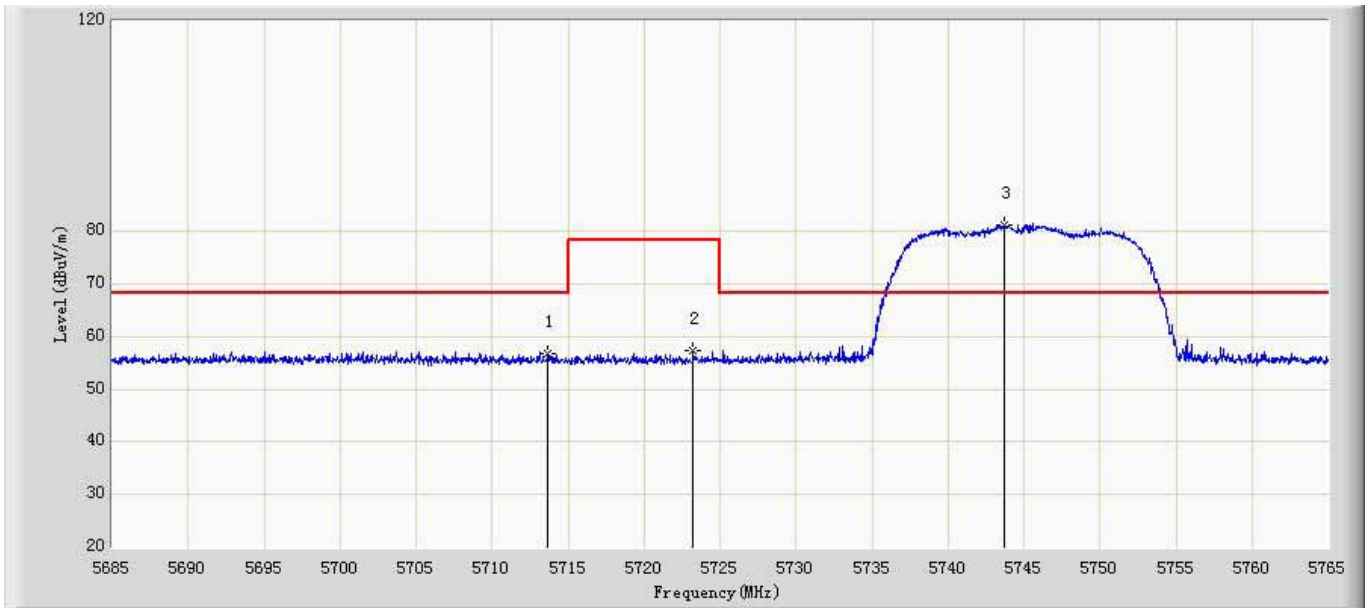
Average detector: RBW = 100kHz, VBW = 300kHz, detector = RMS, sweep time = auto.

Site: AC5	Time: 2014/11/27 - 11:17
Limit: FCC-15.407 new	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: ST10	Power: AC 120V/60Hz
Note: Mode1: Transmit at channel 5745MHz	



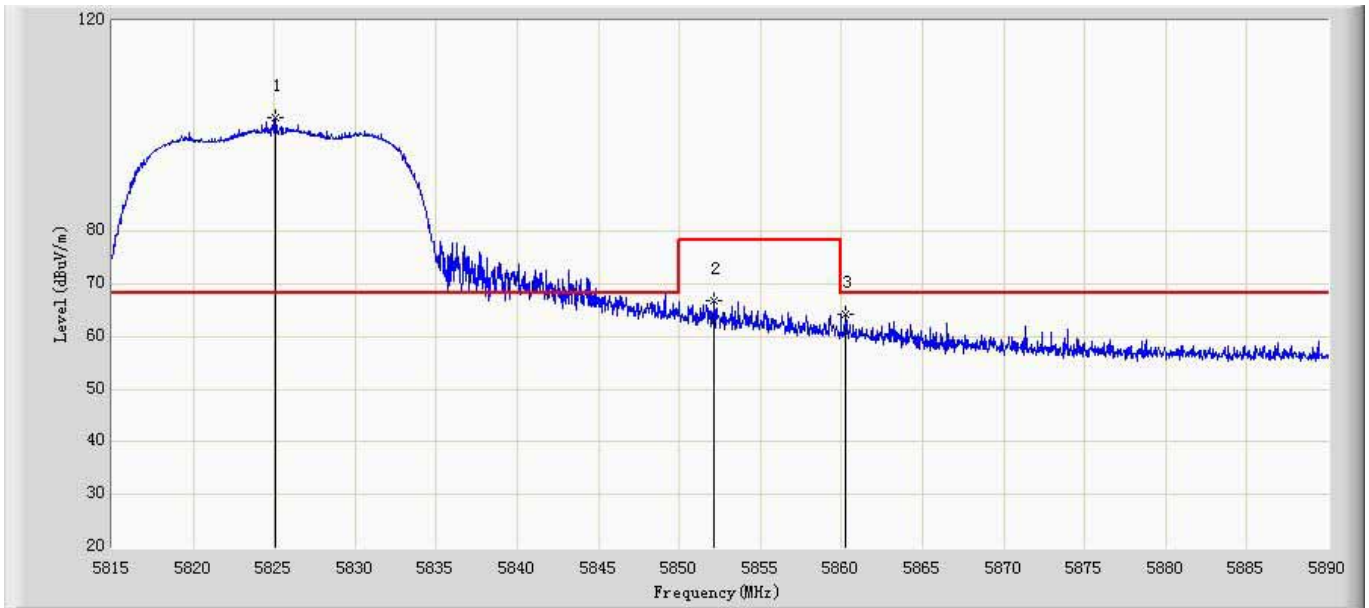
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		5713.800	64.163	22.634	-4.137	68.300	41.529	PK
2		5724.400	68.352	26.810	-9.948	78.300	41.542	PK
3	*	5744.920	100.042	58.477	N/A	N/A	41.565	PK

Site: AC5	Time: 2014/11/27 - 11:21
Limit: FCC-15.407 new	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: ST10	Power: AC 120V/60Hz
Note: Mode1: Transmit at channel 5745MHz	



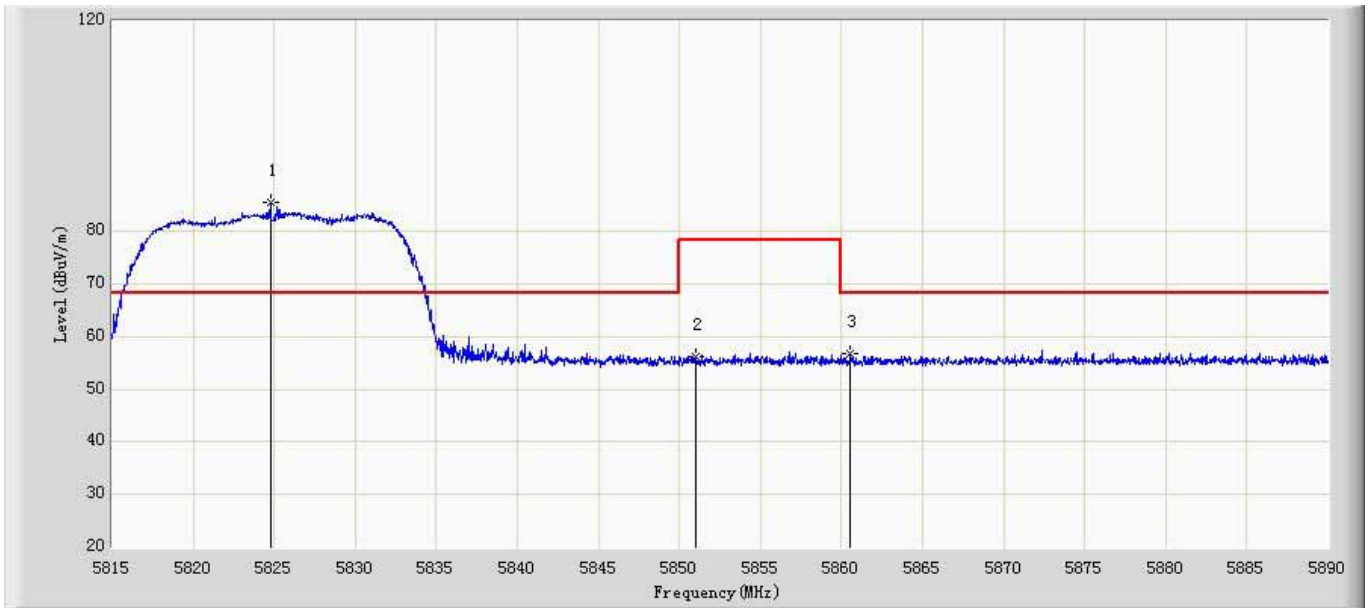
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		5713.680	56.853	15.325	-11.447	68.300	41.529	PK
2		5723.240	57.232	15.691	-21.068	78.300	41.541	PK
3	*	5743.680	81.195	39.632	N/A	N/A	41.563	PK

Site: AC5	Time: 2014/11/27 - 11:26
Limit: FCC-15.407 new	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: ST10	Power: AC 120V/60Hz
Note: Mode1: Transmit at channel 5825MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	5825.087	101.747	59.993	N/A	N/A	41.754	PK
2		5852.163	66.943	25.112	-11.357	78.300	41.831	PK
3		5860.225	64.240	22.387	-4.060	68.300	41.852	PK

Site: AC5	Time: 2014/11/27 - 11:31
Limit: FCC-15.407 new	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: ST10	Power: AC 120V/60Hz
Note: Mode1: Transmit at channel 5825MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	5824.750	85.590	43.837	N/A	N/A	41.754	PK
2		5850.962	56.254	14.426	-22.046	78.300	41.828	PK
3		5860.562	56.749	14.895	-11.551	68.300	41.854	PK

9. Frequency Stability

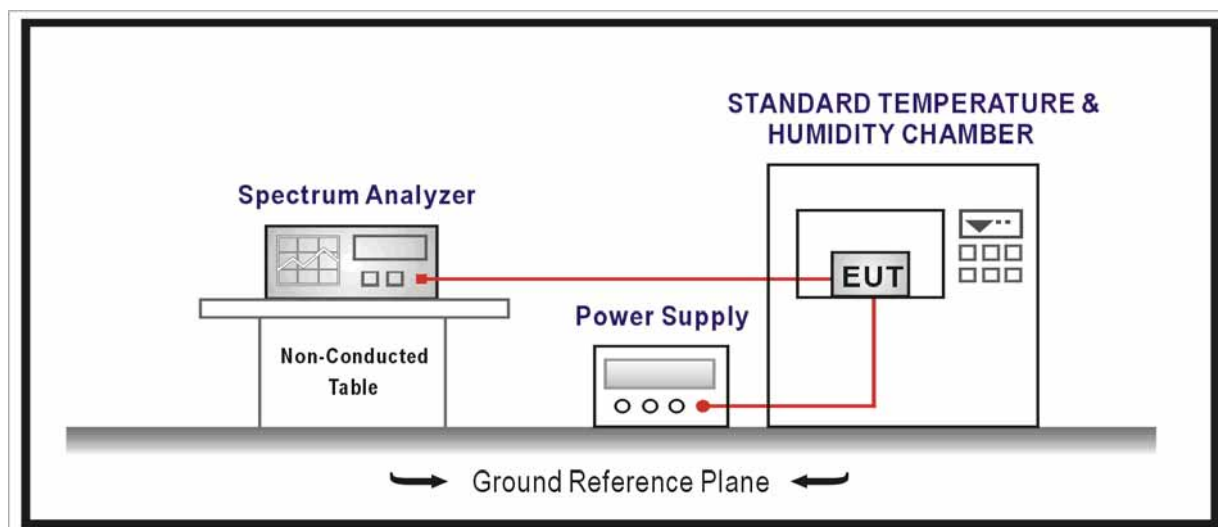
9.1. Test Equipment

Frequency Stability / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2015.01.07
AC Power Supply	IDRC	CF-500TP	979422	2015.09.16
DC Power Supply	IDRC	CD-035-020PR	977272	2015.09.16
Programmable Temperature & Humidity Chamber	Gaoyu	TH-1P-B	WIT-05121302	2015.01.07
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2015.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

9.2. Test Setup



9.3. Limit

Manufactures 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.

9.4. Test Procedure

Frequency Stability Under Temperature Variations:

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to highest. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C decreased per stage until the lowest temperature reached.

Frequency Stability Under Voltage Variations:

Set chamber temperature to 20°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation ($\pm 15\%$) and endpoint, record the maximum frequency change.

9.5. Uncertainty

The measurement uncertainty is defined as ± 100 Hz

9.6. Test Result

Product	:	ST10
Test Item	:	Frequency Stability
Test Site	:	TR-8
Test Mode	:	Carrier Transmit

Operating Frequency	Temp (°C)	Voltage (DC)	Frequency Tolerance (ppm)				
			0 minutes		2 minutes		
			Operation Frequency(M Hz)	Measure Level(ppm)	Operation Frequency(M Hz)	Measure Level(ppm)	
149	0	4.2	5745.016	2.785	5745.015	2.611	
		3.6	5745.015	2.611	5745.014	2.437	
		3.0	5745.014	2.437	5745.014	2.437	
	10	4.2	5745.018	3.133	5745.018	3.133	
		3.6	5745.016	2.785	5745.017	2.959	
		3.0	5745.016	2.785	5745.016	2.785	
	20	4.2	5745.015	2.611	5745.016	2.785	
		3.6	5745.018	3.133	5745.018	3.133	
		3.0	5745.014	2.437	5745.014	2.437	
	30	4.2	5745.016	2.785	5745.015	2.611	
		3.6	5745.016	2.785	5745.016	2.785	
		3.0	5745.020	3.481	5745.020	3.481	
	40	4.2	5745.022	3.829	5745.022	3.829	
		3.6	5745.018	3.133	5745.016	2.785	
		3.0	5745.018	3.133	5745.018	3.133	
	157	0	4.2	5785.017	2.959	5785.017	2.959
			3.6	5785.014	2.437	5785.014	2.437
			3.0	5785.016	2.785	5785.016	2.785
10		4.2	5785.018	3.133	5785.018	3.133	
		3.6	5785.017	2.959	5785.017	2.959	
		3.0	5785.016	2.785	5785.020	3.481	
20		4.2	5785.018	3.133	5785.017	2.959	
		3.6	5785.014	2.437	5785.018	3.133	
		3.0	5785.019	3.307	5785.018	3.133	
30		4.2	5785.018	3.133	5785.017	2.959	
		3.6	5785.018	3.133	5785.016	2.785	
		3.0	5785.020	3.481	5785.019	3.307	

	40	4.2	5785.018	3.133	5785.017	2.959
		3.6	5785.017	2.959	5785.019	3.307
		3.0	5785.019	3.307	5785.015	2.611
165	0	4.2	5825.021	3.655	5825.020	3.481
		3.6	5825.016	2.785	5825.018	3.133
		3.0	5825.015	2.611	5825.014	2.437
	10	4.2	5825.017	2.959	5825.020	3.481
		3.6	5825.016	2.785	5825.017	2.959
		3.0	5825.014	2.437	5825.017	2.959
	20	4.2	5825.019	3.307	5825.017	2.959
		3.6	5825.022	3.829	5825.019	3.307
		3.0	5825.016	2.785	5825.017	2.959
	30	4.2	5825.016	2.785	5825.014	2.437
		3.6	5825.018	3.133	5825.019	3.307
		3.0	5825.020	3.481	5825.018	3.133
	40	4.2	5825.019	3.307	5825.017	2.959
		3.6	5825.015	2.611	5825.017	2.959
		3.0	5825.019	3.307	5825.018	3.133

Operating Frequency	Temp (°C)	Voltage (AC)	Frequency Tolerance (ppm)			
			5 minutes		10 minutes	
			Operation Frequency(M Hz)	Measure Level(ppm)	Operation Frequency(M Hz)	Measure Level(ppm)
149	0	4.2	5745.015	2.611	5745.013	2.263
		3.6	5745.017	2.959	5745.015	2.611
		3.0	5745.012	2.089	5745.014	2.437
	10	4.2	5745.020	3.481	5745.015	2.611
		3.6	5745.019	3.307	5745.018	3.133
		3.0	5745.014	2.437	5745.017	2.959
	20	4.2	5745.014	2.437	5745.014	2.437
		3.6	5745.019	3.307	5745.019	3.307
		3.0	5745.012	2.089	5745.015	2.611
	30	4.2	5745.015	2.611	5745.014	2.437
		3.6	5745.018	3.133	5745.017	2.959
		3.0	5745.019	3.307	5745.020	3.481
	40	4.2	5745.021	3.655	5745.020	3.481

		3.6	5745.018	3.133	5745.017	2.959
		3.0	5745.017	2.959	5745.019	3.307
157	0	4.2	5785.016	2.785	5785.015	2.611
		3.6	5785.015	2.611	5785.015	2.611
		3.0	5785.015	2.611	5785.017	2.959
	10	4.2	5785.017	2.959	5785.016	2.785
		3.6	5785.019	3.307	5785.018	3.133
		3.0	5785.015	2.611	5785.016	2.785
	20	4.2	5785.017	2.959	5785.016	2.785
		3.6	5785.016	2.785	5785.015	2.611
		3.0	5785.018	3.133	5785.020	3.481
	30	4.2	5785.017	2.959	5785.016	2.785
		3.6	5785.015	2.611	5785.015	2.611
		3.0	5785.019	3.307	5785.021	3.655
	40	4.2	5785.017	2.959	5785.018	3.133
		3.6	5785.019	3.307	5785.018	3.133
		3.0	5785.015	2.611	5785.017	2.959
165	0	4.2	5825.020	3.481	5825.019	3.307
		3.6	5825.018	3.133	5825.017	2.959
		3.0	5825.016	2.785	5825.016	2.785
	10	4.2	5825.016	2.785	5825.015	2.611
		3.6	5825.018	3.133	5825.017	2.959
		3.0	5825.013	2.263	5825.015	2.611
	20	4.2	5825.018	3.133	5825.017	2.959
		3.6	5825.020	3.481	5825.019	3.307
		3.0	5825.015	2.611	5825.017	2.959
	30	4.2	5825.015	2.611	5825.018	3.133
		3.6	5825.020	3.481	5825.019	3.307
		3.0	5825.016	2.785	5825.018	3.133
	40	4.2	5825.018	3.133	5825.017	2.959
		3.6	5825.017	2.959	5825.019	3.307
		3.0	5825.022	3.829	5825.020	3.481

10. Receiver Spurious Emission for Industry Canada RSS-Gen Requirement

10.1. Test Equipment

Radiated Emission / AC-2

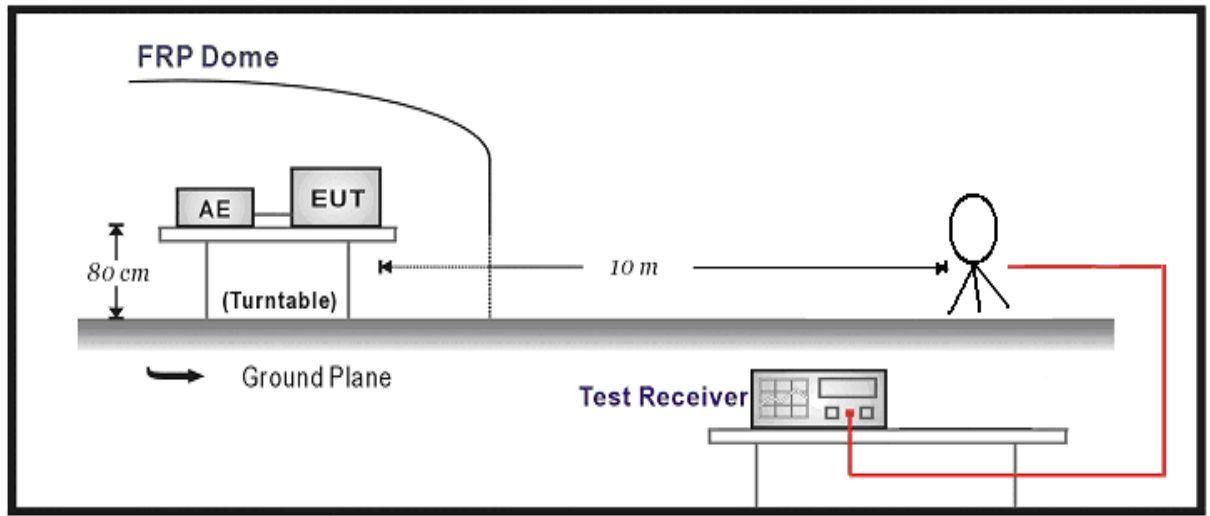
Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
EMI Test Receiver	R&S	ESCI	100573	2015.03.28
Loop Antenna	R&S	HFH2-Z2	833799/003	2015.11.25
Bilog Chainenna	Teseq GmbH	CBL6112D	27611	2015.10.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2015.03.01
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC2-TH	2015.01.08

Radiated Emission / AC-5

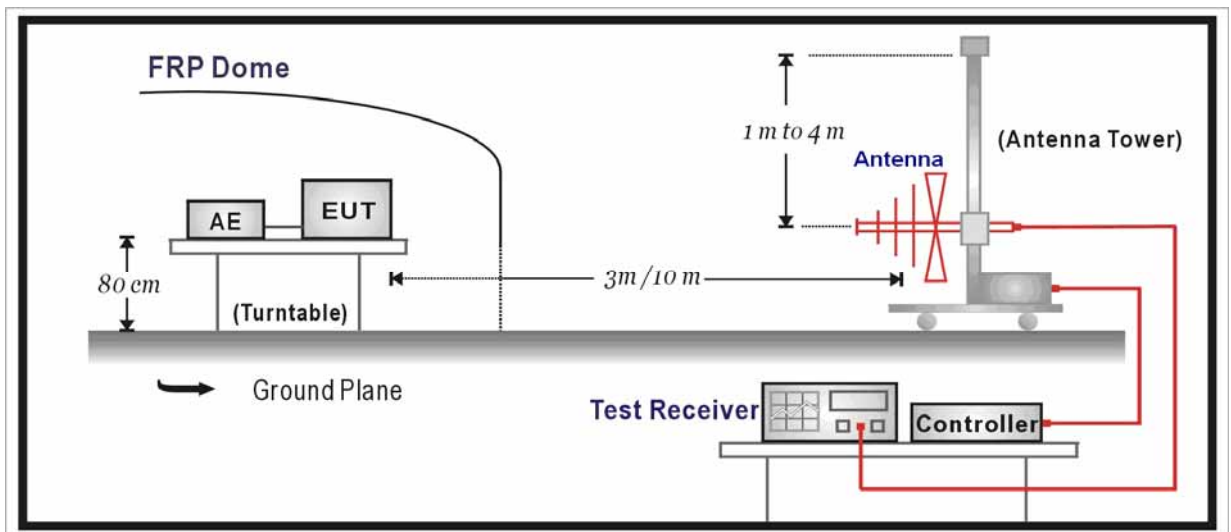
Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MY49100159	2015.03.28
Spectrum Analyzer	Agilent	E4446A	MY45300103	2015.05.12
Preamplifier	Miteq	NSP1800-25	1364185	2015.05.03
Preamplifier	QuieTek	AP-040G	CHM-0906001	2015.05.03
DRG Horn	ETS-Lindgren	3117	00123988	2015.10.15
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2015.01.07
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2016.04.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2015.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2015.03.01
EMI Receiver	Agilent	N9038A	MY51210196	2015.06.09
Temperature/Humidity Meter	Zhichen	ZC1-2	AC5-TH	2015.01.08

10.2. Test Setup

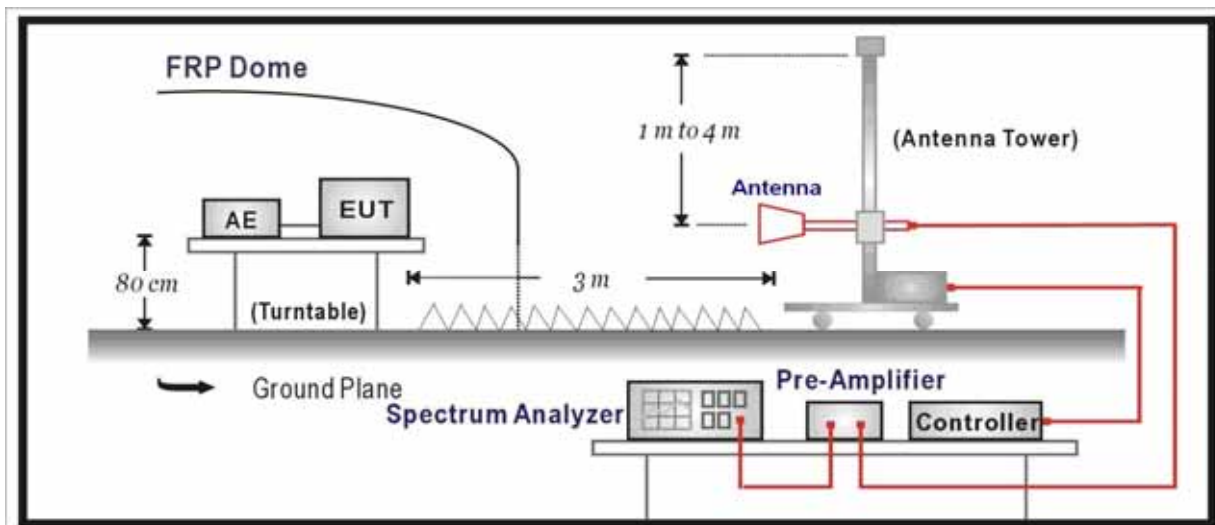
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



10.3. Limit

FCC Part 15 Subpart B Paragraph 15.109		
Frequency (MHz)	Distance (m)	Level (dBuV/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

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

Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

Note 3: E field strength (dBuV/m) = 20 log E field strength (uV/m)

10.4. Test Procedure

According to ANSI C63.10: 2009.

The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the

maximum emission, all of the interface cables were manipulated according to ANSI C63.4: 2009 on radiated measurement.

The resolution bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz.

The frequency range from 9kHz to 10th harmonic is checked.

Note: When doing emission measurement above 1GHz, the horn antenna will be bended down a little (as horn antenna has the narrow beamwidth) in order to keeping the antenna in the "cone of radiation" of EUT. The 3dB beamwidth is 60~10 degrees for H-plane and 90~10 degrees for E-plane.

10.5. Uncertainty

The measurement uncertainty above 1GHz is defined as ± 3.9 dB
below 1GHz is defined as ± 3.8 dB

10.6. Test Result

All of the test result shown indicates the worst case, and spectrum analyzer parameters setting as shown below:

Peak detector: RBW = 1MHz, VBW = 3MHz, sweep time = 200ms;

Average detector: RBW = 1MHz, VBW = 10Hz, sweep time = auto.

Measure Level = Reading Level + Cable Loss + Antenna Factor - Preamplifier Gain

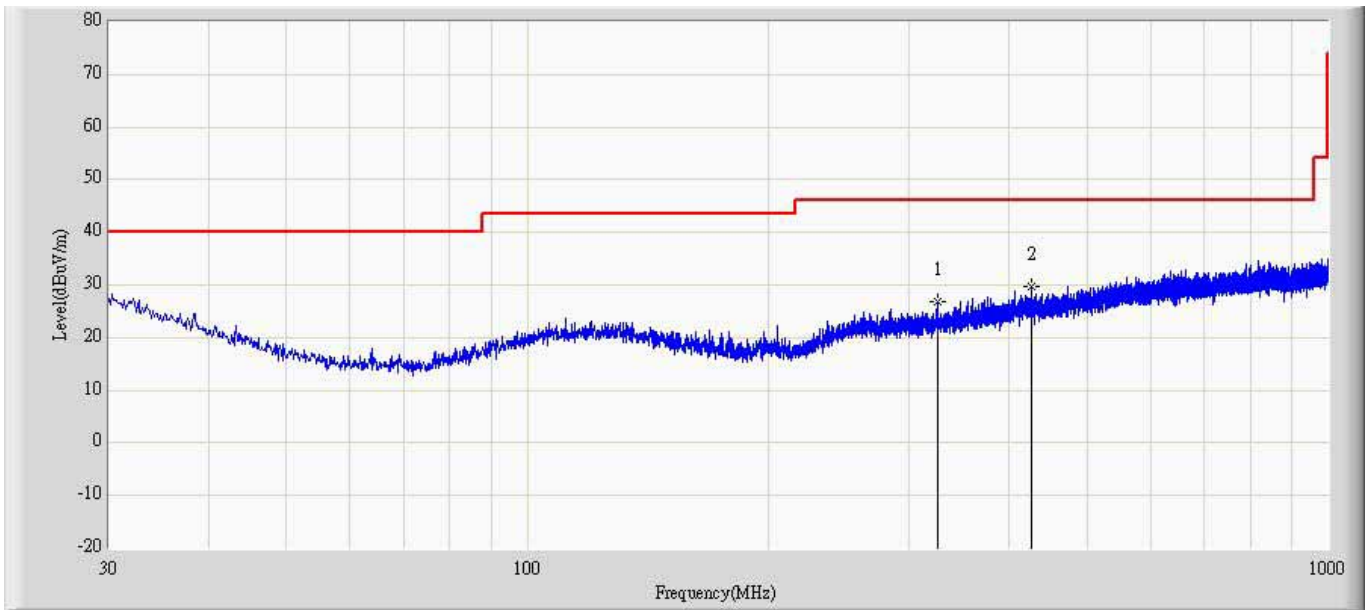
Mode 1: Receive

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
149	H	2683.0	40.3	0.0	40.3	54(Note)	-13.7	PK
	H	3227.0	38.7	1.4	40.1	54(Note)	-13.9	PK
	V	3584.0	38.0	2.1	40.1	54(Note)	-13.9	PK
	V	4264.0	31.8	4.2	36.0	54(Note)	-18.0	PK
157	H	4799.5	30.0	6.7	36.7	54(Note)	-17.3	PK
	H	5394.5	27.3	8.1	35.4	54(Note)	-18.6	PK
	V	5896.0	27.4	8.7	36.1	54(Note)	-17.9	PK
	V	6380.5	26.5	8.8	35.3	54(Note)	-18.7	PK
165	H	2173.0	40.3	-1.5	38.8	54(Note)	-15.2	PK
	H	2496.0	39.6	-0.4	39.2	54(Note)	-14.8	PK
	V	2997.5	39.4	0.5	39.9	54(Note)	-14.1	PK
	V	3439.5	38.5	1.9	40.4	54(Note)	-13.6	PK

Note: This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

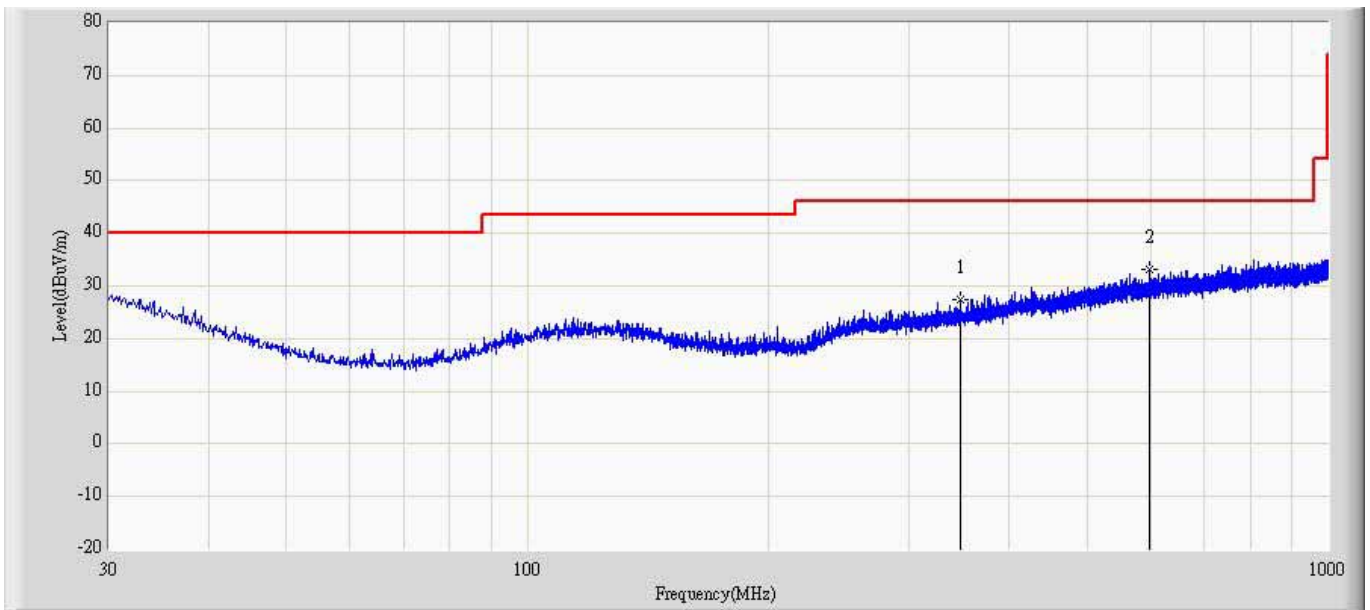
The worst case of Radiated Emission below 1GHz:

Site: AC2	Time: 2014/12/03 - 09:32
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: CBL6112D_27611(30-1000MHz)	Polarity: Horizontal
EUT: ST10	Power: AC 120V/60Hz
Note: Mode1: Receive at channel 149 by 802.11a	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		324.880	26.780	5.400	-19.220	46.000	21.380	QP
2	*	426.003	29.667	5.257	-16.333	46.000	24.410	QP

Site: AC2	Time: 2014/12/03 - 09:33
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: CBL6112D_27611(30-1000MHz)	Polarity: Vertical
EUT: ST10	Power: AC 120V/60Hz
Note: Mode1: Receive at channel 149 by 802.11a	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		346.948	27.432	5.432	-18.568	46.000	22.000	QP
2	*	599.633	33.081	6.199	-12.919	46.000	26.882	QP

————— The End —————