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FCC RADIO TEST REPORT

Applicant's company	Electronwheel, Inc.
Applicant Address	16935 W Bernardo Drive Suite 103, San Diego, CA 92127
FCC ID	2ANKG-PEDAL-01
Manufacturer's company	Tri Star Group
Manufacturer Address	11F, International Shipping & Finance Ctr 720 Pudong Ave. Shanghai, China 200120

Product Name	PEDALING SENSOR
Brand Name	ELECTRON WHEEL
Model Name	PEDAL-01
Test Rule Part(s)	47 CFR FCC Part 15 Subpart C § 15.249
Test Freq. Range	2400 ~ 2483.5MHz
Received Date	Aug. 29, 2017
Final Test Date	Sep. 06, 2017
Submission Type	Original Equipment

Statement

The test result in this report refers exclusively to the presented test model / sample.

Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.

The measurements and test results shown in this test report were made in accordance with the procedures and found in compliance with the limit given in **ANSI C63.10-2013** and **47 CFR FCC Part 15 Subpart C**.

The test equipment used to perform the test is calibrated and traceable to NML/ROC.



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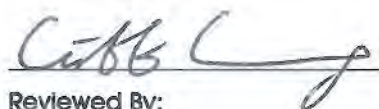
History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR782349	Rev. 01	Initial issue of report	Oct. 20, 2017

1. VERIFICATION OF COMPLIANCE

Product Name : PEDALING SENSOR
Brand Name : ELECTRON WHEEL
Model Name : PEDAL-01
Applicant : Electronwheel, Inc.
Test Rule Part(s) : 47 CFR FCC Part 15 Subpart C § 15.249

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Aug. 29, 2017 would like to declare that the tested sample has been evaluated and found to be in compliance with the tested rule parts. The data recorded as well as the test configuration specified is true and accurate for showing the sample's EMC nature.



Reviewed By:

Cliff Chang

SPORTON INTERNATIONAL INC.

2. SUMMARY OF THE TEST RESULT

Applied Standard: 47 CFR FCC Part 15 Subpart C			
Part	Rule Section	Description of Test	Result
4.1	15.207	AC Power Line Conducted Emissions	Complies
4.2	15.249(a)	Field Strength of Fundamental Emissions	Complies
4.3	15.215(c)	20dB Spectrum Bandwidth	Complies
4.4	15.249(a)/(d)	Radiated Emissions	Complies
4.5	15.249(d)	Band Edge Emissions	Complies
4.6	15.203	Antenna Requirements	Complies

3. GENERAL INFORMATION

3.1. Product Details

Items	Description
Power Type	From power adapter or internal lithium battery
Modulation	FSK
Frequency Range	2400 ~ 2483.5MHz
Operation Frequency Range	2405 ~ 2480MHz
Channel Number	10
Channel Bandwidth (99%)	0.31 MHz
Max. Field Strength	88.10 dBuV/m at 3m (Average)
Carrier Frequencies	Please refer to section 3.3
Antenna	Antenna Type: Printed Antenna (Without any antenna connector) Antenna Gain: 3.27 dBi

3.2. Accessories

Power	Brand	Model No.	Rating	Remark
Adapter	SINO-AMERICAN	SA103K-05	INPUT: 100-240VAC, 50-60Hz, 0.1A OUTPUT: 5VDC, 0.6A, 3W	With cable: Non-shielded, 1m (for EUT use only)
Internal lithium battery	RPC	IP601834	300mAHR	-
Other				
Power cable*1: Non-shielded, 1.8m (for adapter 2 use only)				

3.3. Table for Carrier Frequencies

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
2400 ~ 2483.5MHz	1	2405 MHz	6	2430 MHz
	2	2410 MHz	7	2435 MHz
	3	2415 MHz	8	2440 MHz
	4	2420 MHz	9	2460 MHz
	5	2425 MHz	10	2480 MHz

3.4. Table for Test Modes

The following table is a list of the test modes shown in this test report.

Test Items	Mode	Channel	Antenna
AC Power Line Conducted Emissions	Normal Link	-	-
Field Strength of Fundamental Emissions 20dB Spectrum Bandwidth	CTX	1/8/10	1
Radiated Emissions 30MHz ~ 1GHz	Normal Link	-	-
Radiated Emissions 1GHz~10 th Harmonic	CTX	1/8/10	1
Band Edge Emissions	CTX	1/8/10	1

Note: CTX=continuously transmitting

The following test modes were performed for all tests:

The following table is a list of the test modes shown in this test report.

AC Power Line Conducted Emissions	
Test Mode	Description
1	Normal Link - EUT with charging mode

Radiated Emissions 30MHz ~ 1GHz	
Test Mode	Description
1	Normal Link - 26" Electron Wheel + EUT in Y axis
2	Normal Link - 26" Electron Wheel + EUT in X axis
Mode 1 has been evaluated to be the worst case among Mode 1~2, thus measurement for Mode 3~5 will follow this same test mode.	
3	Normal Link - 28" Electron Wheel + EUT in Y axis
4	Normal Link - 26" Electron Wheel + EUT in Y axis with charging mode
5	Normal Link - 28" Electron Wheel + EUT in Y axis with charging mode
Mode 4 generated the worst test result, so it was recorded in this report.	

Radiated Emissions 1GHz~10 th Harmonic and Band Edge Emissions	
Test Mode	Description
1	CTX - EUT in Y axis
2	CTX - EUT in X axis
Mode 1 has been evaluated to be the worst case after evaluating. Consequently, measurement will follow this same test mode.	

3.5. Table for Testing Locations

Test Site Location					
Address:	No.8, Lane 724, Bo-ai St., Jhubei City, Hsinchu County 302, Taiwan, R.O.C.				
TEL:	886-3-656-9065				
FAX:	886-3-656-9085				
Test Site No.	Site Category	Location	FCC Designation No.	IC File No.	VCCI Reg. No
03CH01-CB	SAC	Hsin Chu	TW0006	IC 4086D	-
CO01-CB	Conduction	Hsin Chu	TW0006	IC 4086D	-
TH01-CB	OVEN Room	Hsin Chu	-	-	-

Open Area Test Site (OATS); Semi Anechoic Chamber (SAC); Fully Anechoic Chamber (FAC).

3.6. Table for Supporting Units

For Test Site No: CO01-CB: N/A

For Test Site No: 03CH01-CB (below 1GHz)

Support Unit	Brand	Model	FCC ID
Test Fixture	TranzX	TRAINER	N/A
26" Electron Wheel	ELECTRON WHEEL	E-WHEEL-04	QOQBLE113
28" Electron Wheel	ELECTRON WHEEL	E-WHEEL-05	QOQBLE113

For Test Site No: 03CH01-CB (above 1GHz) and TH01-CB

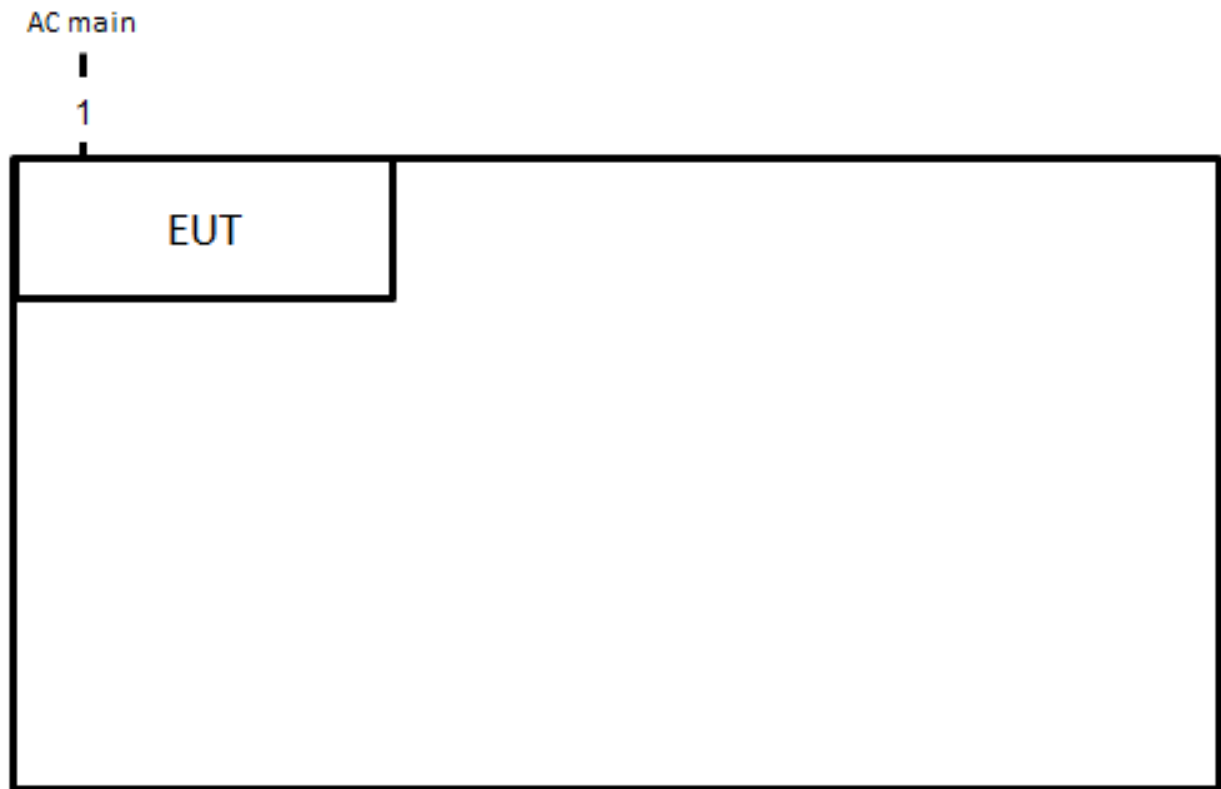
Support Unit	Brand	Model	FCC ID
Test Fixture	AMICCOM	EK7196	N/A
Notebook	DELL	E4300	DoC

3.7. Duty Cycle

On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
1.000	1.000	100.00%	0.00	0.01

3.8. Test Configurations

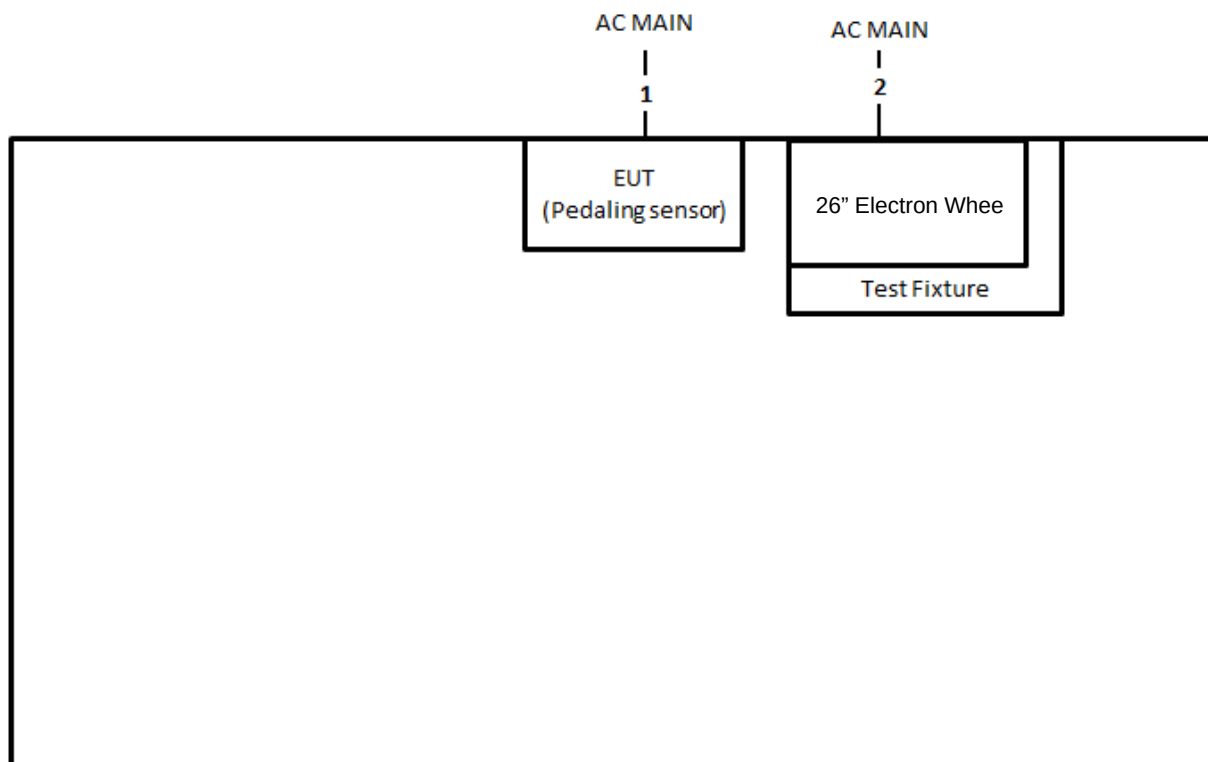
3.8.1. AC Power Line Conduction Emissions Test Configuration



Item	Connection	Shielded	Length
1	Power cable	No	1m

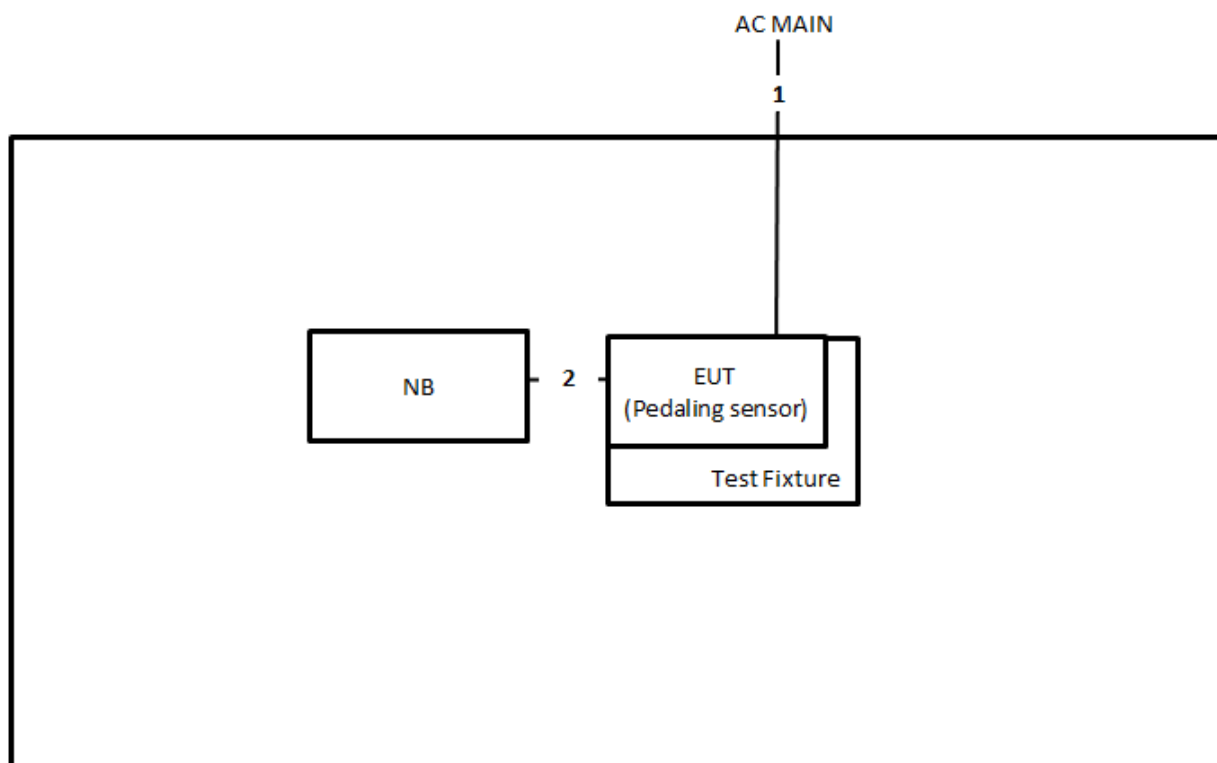
3.8.2. Radiation Emissions Test Configuration

Test Configuration: 30MHz~1GHz



Item	Connection	Shielded	Length
1	Power cable	No	1m
2	Power cable	No	2.8m

Test Configuration: Above 1GHz



Item	Connection	Shielded	Length
1	Power cable	No	1 m
2	USB cable	No	2.5m

4. TEST RESULT

4.1. AC Power Line Conducted Emissions Measurement

4.1.1. Limit

For this product which is designed to be connected to the 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 below limits table.

Frequency (MHz)	QP Limit (dBuV)	AV Limit (dBuV)
0.15~0.5	66~56	56~46
0.5~5	56	46
5~30	60	50

4.1.2. Measuring Instruments and Setting

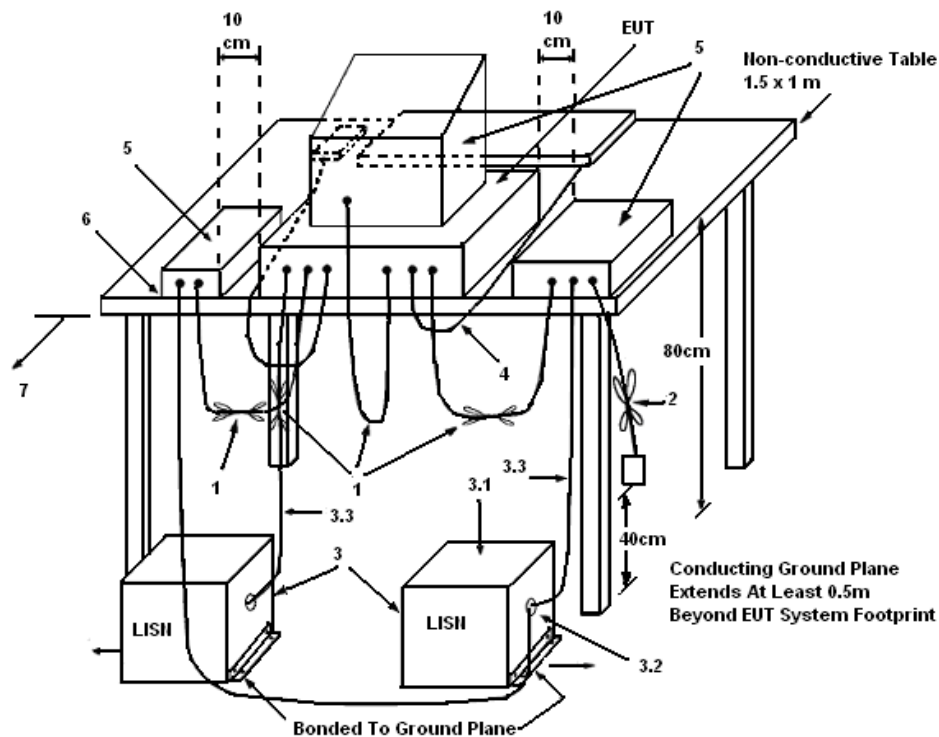
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

4.1.3. Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT or host of EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT or host of EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connected to the other LISNs. The LISN should provide 50uH/50ohms coupling impedance.
4. The frequency range from 150 kHz to 30 MHz was searched.
5. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. The measurement has to be done between each power line and ground at the power terminal.

4.1.4. Test Setup Layout



LEGEND:

- (1) Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- (2) I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- (3) EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω . LISN can be placed on top of, or immediately beneath, reference ground plane.
- (3.1) All other equipment powered from additional LISN(s).
- (3.2) Multiple outlet strip can be used for multiple power cords of non-EUT equipment.
- (3.3) LISN at least 80 cm from nearest part of EUT chassis.
- (4) Cables of hand-operated devices, such as keyboards, mice, etc., shall be placed as for normal use.
- (5) Non-EUT components of EUT system being tested.
- (6) Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.
- (7) Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane.

4.1.5. Test Deviation

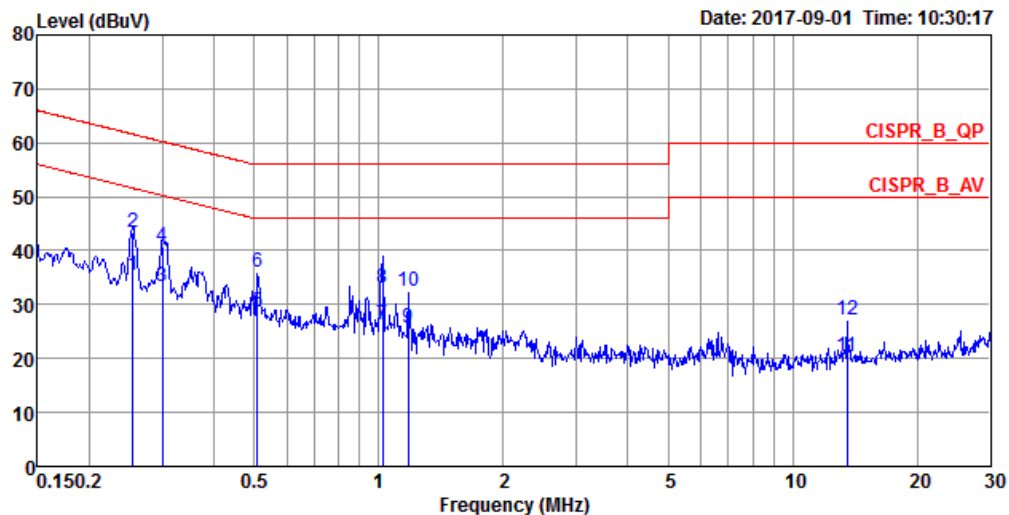
There is no deviation with the original standard.

4.1.6. EUT Operation during Test

The EUT was placed on the test table and programmed in normal function.

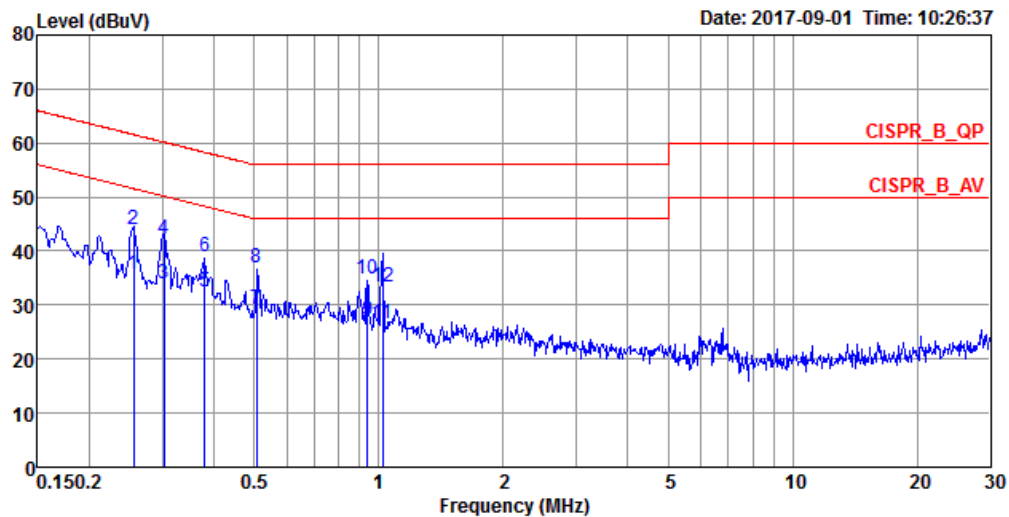
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	25°C	Humidity	64%
Test Engineer	Wei Liu	Phase	Line
Configuration	Normal Link	Test Mode	Mode 1



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.2548	35.41	-16.19	51.60	25.40	9.92	0.09	Average	LINE
2	0.2548	43.34	-18.26	61.60	33.33	9.92	0.09	QP	LINE
3	0.3003	33.30	-16.94	50.24	23.31	9.93	0.06	Average	LINE
4	0.3003	40.81	-19.43	60.24	30.82	9.93	0.06	QP	LINE
5	0.5101	28.75	-17.25	46.00	18.74	9.95	0.06	Average	LINE
6	0.5101	35.89	-20.11	56.00	25.88	9.95	0.06	QP	LINE
7	1.0211	26.19	-19.81	46.00	16.04	9.96	0.19	Average	LINE
8	1.0211	33.05	-22.95	56.00	22.90	9.96	0.19	QP	LINE
9	1.1781	25.66	-20.34	46.00	15.51	9.96	0.19	Average	LINE
10	1.1781	32.40	-23.60	56.00	22.25	9.96	0.19	QP	LINE
11	13.5509	20.38	-29.62	50.00	10.00	10.20	0.18	Average	LINE
12	13.5509	27.13	-32.87	60.00	16.75	10.20	0.18	QP	LINE

Temperature	25°C	Humidity	64%
Test Engineer	Wei Liu	Phase	Neutral
Configuration	Normal Link	Test Mode	Mode 1



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.2562	35.80	-15.76	51.56	25.63	10.08	0.09	Average	NEUTRAL
2	0.2562	43.87	-17.69	61.56	33.70	10.08	0.09	QP	NEUTRAL
3	0.3035	34.05	-16.10	50.15	23.84	10.15	0.06	Average	NEUTRAL
4	0.3035	42.12	-18.03	60.15	31.91	10.15	0.06	QP	NEUTRAL
5	0.3791	32.39	-15.91	48.30	22.15	10.22	0.02	Average	NEUTRAL
6	0.3791	38.98	-19.32	58.30	28.74	10.22	0.02	QP	NEUTRAL
7	0.5074	29.12	-16.88	46.00	18.84	10.22	0.06	Average	NEUTRAL
8	0.5074	36.95	-19.05	56.00	26.67	10.22	0.06	QP	NEUTRAL
9	0.9381	27.19	-18.81	46.00	16.94	10.07	0.18	Average	NEUTRAL
10	0.9381	34.80	-21.20	56.00	24.55	10.07	0.18	QP	NEUTRAL
11	1.0211	26.60	-19.40	46.00	16.36	10.05	0.19	Average	NEUTRAL
12	1.0211	33.32	-22.68	56.00	23.08	10.05	0.19	QP	NEUTRAL

Note:

Level = Read Level + LISN Factor + Cable Loss.

4.2. Field Strength of Fundamental Emissions Measurement

4.2.1. Limit

The field strength of fundamental emissions within these bands specified at a distance of 3 meters (measurement instrumentation employing an average detector) shall comply with the following table.

Frequency Band (MHz)	Fundamental Emissions Limit (dBuV/m) at 3m
2400-2483.5	94 (Average)
	114 (Peak)

4.2.2. Measuring Instruments and Setting

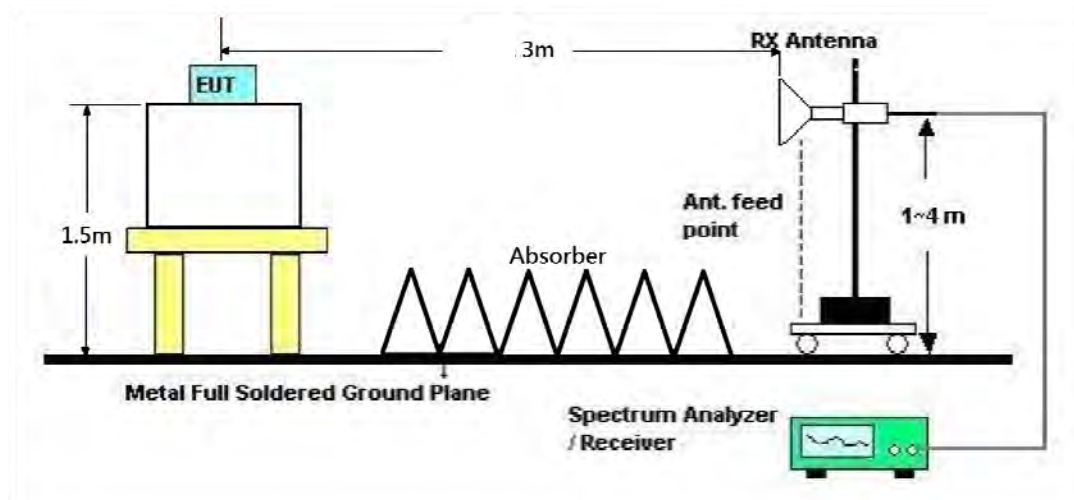
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Power Meter Parameter	Setting
RBW	1 MHz Peak / 3MHz Peak
VBW	1 MHz Peak / 1/T Average
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

4.2.3. Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. For Fundamental emissions, use 1MHz VBW and 3MHz RBW for peak reading. Then 1MHz RBW and 1/T VBW for average reading in spectrum analyzer.
6. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

4.2.4. Test Setup Layout



4.2.5. Test Deviation

There is no deviation with the original standard.

4.2.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.2.7. Test Result of Field Strength of Fundamental Emissions

Temperature	22°C	Humidity	54%
Test Engineer	Jay Luo, Mason Chen, Paul Chen	Configurations	Channel 1, 8, 10
Test Date	Sep. 06, 2017		

Channel 1

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2404.80	88.10	94.00	-5.90	56.15	3.70	28.25	0.00	101	153	Average	VERTICAL
2	2404.80	88.67	114.00	-25.33	56.72	3.70	28.25	0.00	101	153	Peak	VERTICAL

Channel 8

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2439.60	82.41	94.00	-11.59	50.37	3.73	28.31	0.00	101	156	Average	VERTICAL
2	2439.60	83.02	114.00	-30.98	50.98	3.73	28.31	0.00	101	156	Peak	VERTICAL

Channel 10

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2479.80	78.72	94.00	-15.28	46.60	3.76	28.36	0.00	116	118	Average	HORIZONTAL
2	2479.80	79.45	114.00	-34.55	47.33	3.76	28.36	0.00	116	118	Peak	HORIZONTAL

Note:

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

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

4.3. 20dB Spectrum Bandwidth Measurement

4.3.1. Limit

Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emissions in the specific band (2400 ~ 2483.5MHz).

4.3.2. Measuring Instruments and Setting

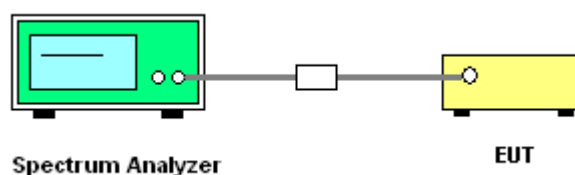
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> 20dB Bandwidth
RBW	100 kHz
VBW	100 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

4.3.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
2. The resolution bandwidth of 100 kHz and the video bandwidth of 100 kHz were used.
3. Measured the spectrum width with power higher than 6dB below carrier.

4.3.4. Test Setup Layout



4.3.5. Test Deviation

There is no deviation with the original standard.

4.3.6. EUT Operation during Test

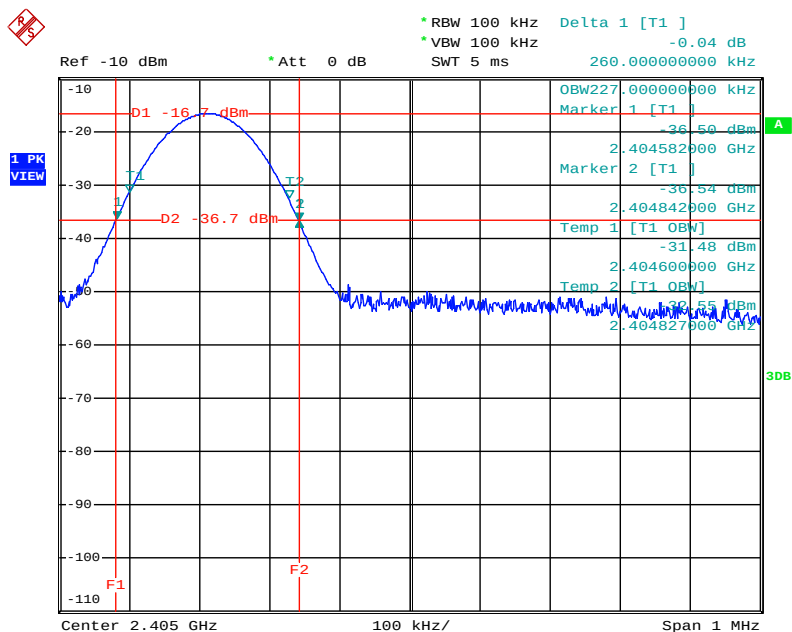
The EUT was programmed to be in continuously transmitting mode.

4.3.7. Test Result of 20dB Spectrum Bandwidth

Temperature	22°C	Humidity	54%
Test Engineer	Eddie Weng	Configurations	Channel 1/8/10

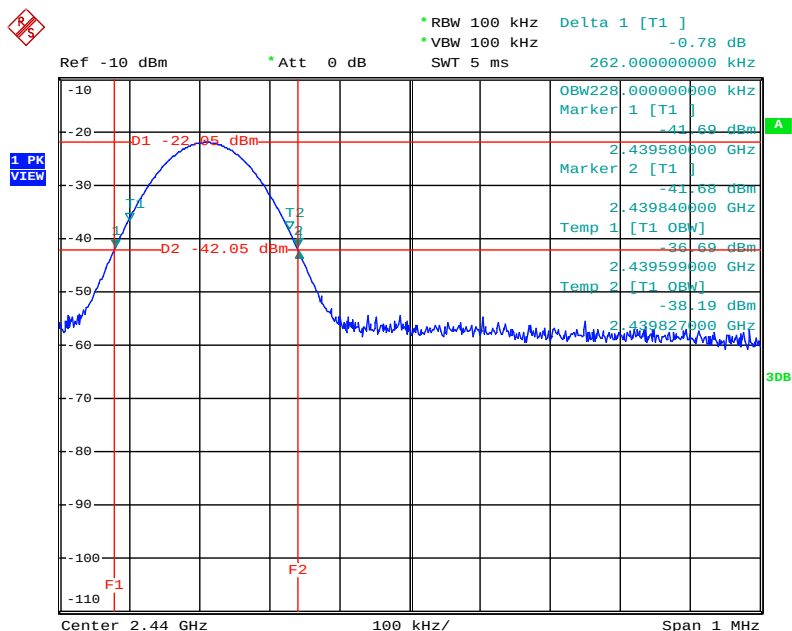
Frequency	20dB BW (MHz)	99% OBW (MHz)	Frequency range (MHz) $f_L > 2400\text{MHz}$	Frequency range (MHz) $f_H < 2483.5\text{MHz}$	Test Result
2405 MHz	0.26	0.23	2404.6000	-	Complies
2440 MHz	0.26	0.23	-	-	Complies
2480 MHz	0.28	0.31	-	2479.8870	Complies

20 dB / 99% Bandwidth Plot on 2405 MHz



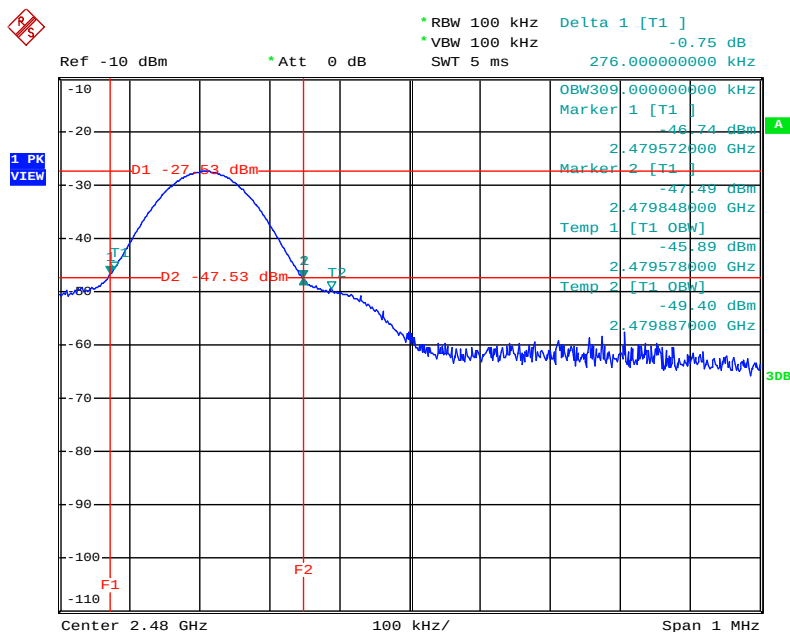
Date: 6.SEP.2017 22:46:10

20 dB / 99% Bandwidth Plot on 2440 MHz



Date: 6.SEP.2017 22:43:53

20 dB / 99% Bandwidth Plot on 2480 MHz



Date: 6.SEP.2017 23:53:11

4.4. Radiated Emissions Measurement

4.4.1. Limit

Harmonic emissions limits comply with below 54 dBuV/m at 3m. Other emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or comply with the radiated emissions limits specified in section 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/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

4.4.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1 000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW (Emission in restricted band)	1 MHz / 3MHz for Peak, 1 MHz / 1/T for Average
RBW / VBW (Emission in non-restricted band)	100kHz/300kHz for Peak

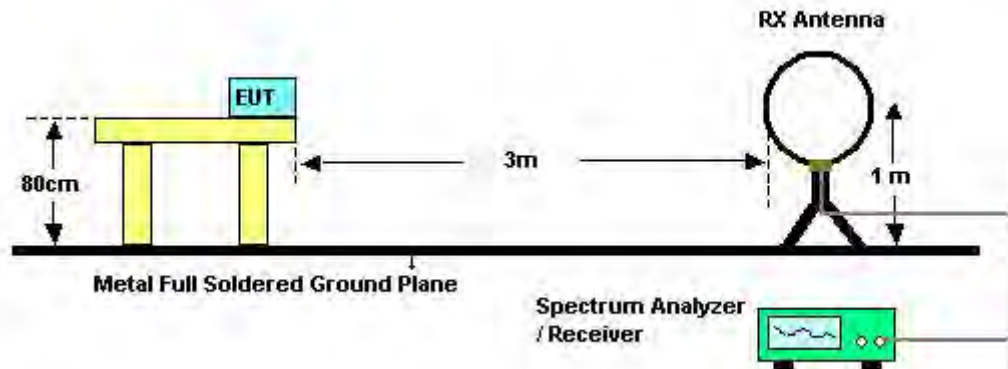
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.4.3. Test Procedures

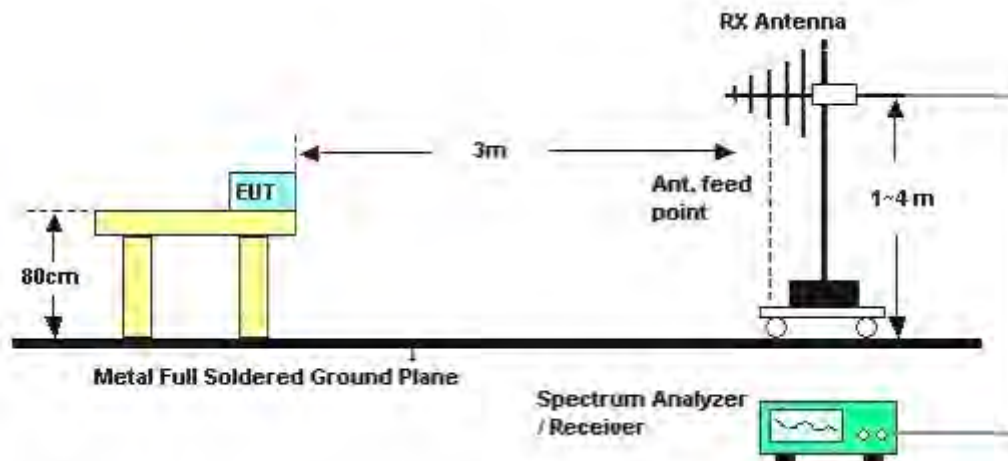
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and 3MHz RBW for peak reading. Then 1MHz RBW and 1/T VBW for average reading in spectrum analyzer.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions 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.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High – Low scan is not required in this case.

4.4.4. Test Setup Layout

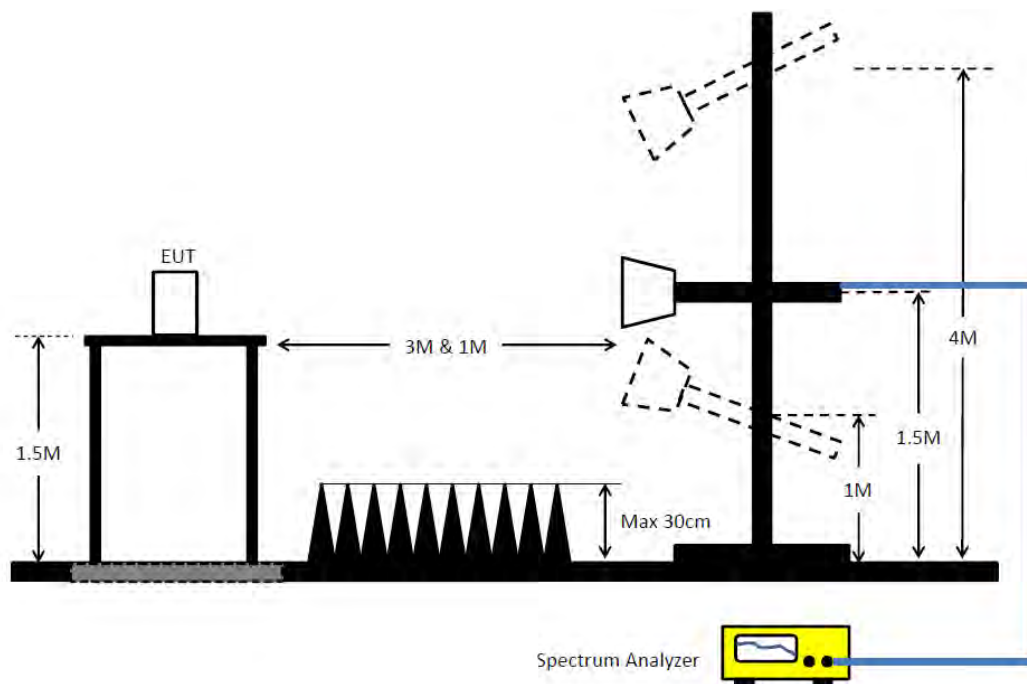
For Radiated Emissions: 9kHz ~30MHz



For Radiated Emissions: 30MHz~1GHz



For Radiated Emissions: Above 1GHz



4.4.5. Test Deviation

There is no deviation with the original standard.

4.4.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.4.7. Results of Radiated Emissions (9kHz~30MHz)

Temperature	22°C	Humidity	54%
Test Engineer	Jay Luo, Mason Chen, Paul Chen	Configurations	Normal Link
Test Date	Aug. 31, 2017	Test Mode	Mode 4

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

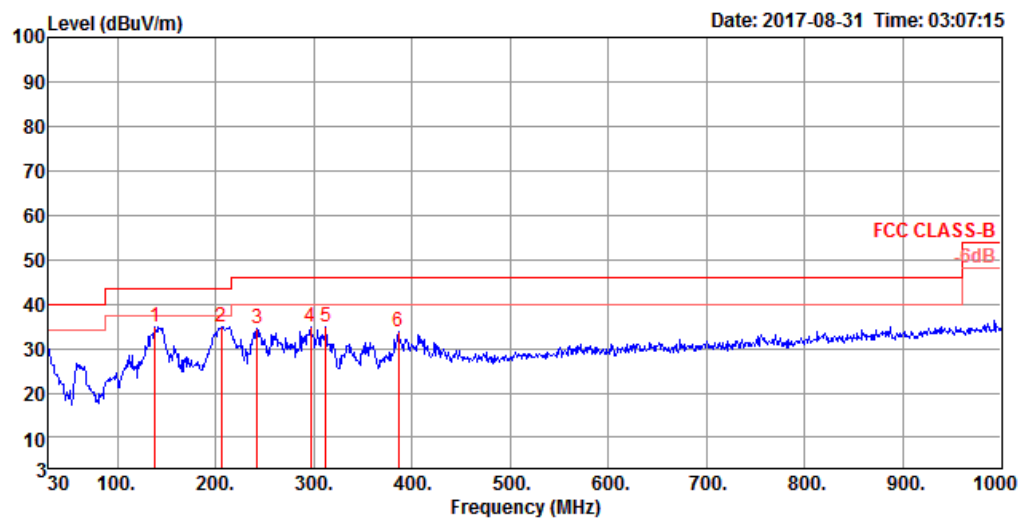
Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

4.4.8. Results of Radiated Emissions (30MHz~1GHz)

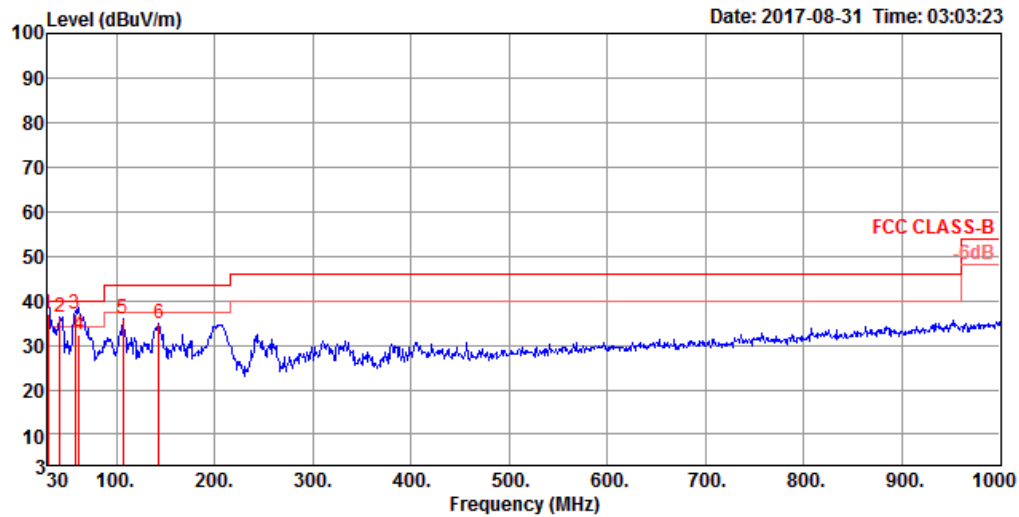
Temperature	22°C	Humidity	54%
Test Engineer	Jay Luo, Mason Chen, Paul Chen	Configurations	Normal Link
Test Mode	Mode 4		

Horizontal



	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	138.64	34.88	43.50	-8.62	48.09	1.36	17.78	32.35	150	211 Peak	HORIZONTAL
2	205.57	34.90	43.50	-8.60	49.19	1.66	16.36	32.31	150	240 Peak	HORIZONTAL
3	242.43	34.62	46.00	-11.38	46.91	1.80	18.20	32.29	150	260 Peak	HORIZONTAL
4	296.75	34.80	46.00	-11.20	45.44	1.99	19.64	32.27	100	98 Peak	HORIZONTAL
5	312.27	34.88	46.00	-11.12	45.06	2.04	20.05	32.27	100	110 Peak	HORIZONTAL
6	385.99	33.79	46.00	-12.21	41.74	2.28	22.06	32.29	100	62 Peak	HORIZONTAL

Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Preamp Factor	Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	30.00	36.95	40.00	-3.05	43.15	0.63	25.60	32.43	100	205	QP	VERTICAL
2	42.61	36.19	40.00	-3.81	49.54	0.75	18.32	32.42	100	147	Peak	VERTICAL
3	58.13	36.84	40.00	-3.16	55.31	0.88	13.06	32.41	100	118	Peak	VERTICAL
4	62.01	32.47	40.00	-7.53	51.30	0.90	12.68	32.41	200	74	QP	VERTICAL
5	106.63	36.05	43.50	-7.45	49.37	1.20	17.85	32.37	100	252	Peak	VERTICAL
6	143.49	34.81	43.50	-8.69	48.35	1.38	17.42	32.34	100	288	Peak	VERTICAL

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

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

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

4.4.9. Results for Radiated Emissions (1GHz~10th Harmonic)

Temperature	22°C	Humidity	54%
Test Engineer	Jay Luo, Mason Chen, Paul Chen	Configurations	Channel 1
Test Date	Sep. 06, 2017		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4809.38	50.21	74.00	-23.79	45.53	6.26	33.35	34.93	222	58	Peak	HORIZONTAL
2	4809.42	45.05	54.00	-8.95	40.37	6.26	33.35	34.93	222	58	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4809.42	52.93	54.00	-1.07	48.25	6.26	33.35	34.93	220	336	Average	VERTICAL
2	4809.44	55.23	74.00	-18.77	50.55	6.26	33.35	34.93	220	336	Peak	VERTICAL

Temperature	22°C	Humidity	54%
Test Engineer	Jay Luo, Mason Chen, Paul Chen	Configurations	Channel 8
Test Date	Sep. 06, 2017		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamplifier Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4879.37	50.44	74.00	-23.56	45.62	6.24	33.51	34.93	109	59	Peak	HORIZONTAL
2	4879.42	44.30	54.00	-9.70	39.48	6.24	33.51	34.93	109	59	Average	HORIZONTAL
3	7319.11	47.15	54.00	-6.85	38.34	7.61	36.40	35.20	185	49	Average	HORIZONTAL
4	7319.13	53.23	74.00	-20.77	44.42	7.61	36.40	35.20	185	49	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamplifier Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4879.42	52.24	54.00	-1.76	47.42	6.24	33.51	34.93	191	339	Average	VERTICAL
2	4879.44	55.40	74.00	-18.60	50.58	6.24	33.51	34.93	191	339	Peak	VERTICAL
3	7319.10	42.71	54.00	-11.29	33.90	7.61	36.40	35.20	177	23	Average	VERTICAL
4	7319.37	51.57	74.00	-22.43	42.76	7.61	36.40	35.20	177	23	Peak	VERTICAL

Temperature	22°C	Humidity	54%
Test Engineer	Jay Luo, Mason Chen, Paul Chen	Configurations	Channel 10
Test Date	Sep. 06, 2017		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4959.40	45.18	54.00	-8.82	40.18	6.22	33.70	34.92	210	68	Average	HORIZONTAL
2	4959.44	51.14	74.00	-22.86	46.14	6.22	33.70	34.92	210	68	Peak	HORIZONTAL
3	7439.11	43.27	54.00	-10.73	34.30	7.52	36.65	35.20	175	47	Average	HORIZONTAL
4	7439.34	52.09	74.00	-21.91	43.12	7.52	36.65	35.20	175	47	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4959.38	55.86	74.00	-18.14	50.86	6.22	33.70	34.92	221	0	Peak	VERTICAL
2	4959.43	53.64	54.00	-0.36	48.64	6.22	33.70	34.92	221	0	Average	VERTICAL
3	7439.09	51.06	74.00	-22.94	42.09	7.52	36.65	35.20	101	344	Peak	VERTICAL
4	7439.10	42.14	54.00	-11.86	33.17	7.52	36.65	35.20	101	344	Average	VERTICAL

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

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

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

4.5. Band Edge Emissions Measurement

4.5.1. Limit

Band edge emissions radiated outside of the specified frequency bands shall be attenuated by at least 50 dB below the level of the fundamental or comply with the radiated emissions limits specified in section 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/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

4.5.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	100 MHz
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1 MHz / 1/T for Average
RBW / VBW (Emission in non-restricted band)	100kHz/300kHz for Peak

4.5.3. Test Procedures

The test procedure is the same as section 4.4.3.

4.5.4. Test Setup Layout

This test setup layout is the same as that shown in section 4.4.4.

4.5.5. Test Deviation

There is no deviation with the original standard.

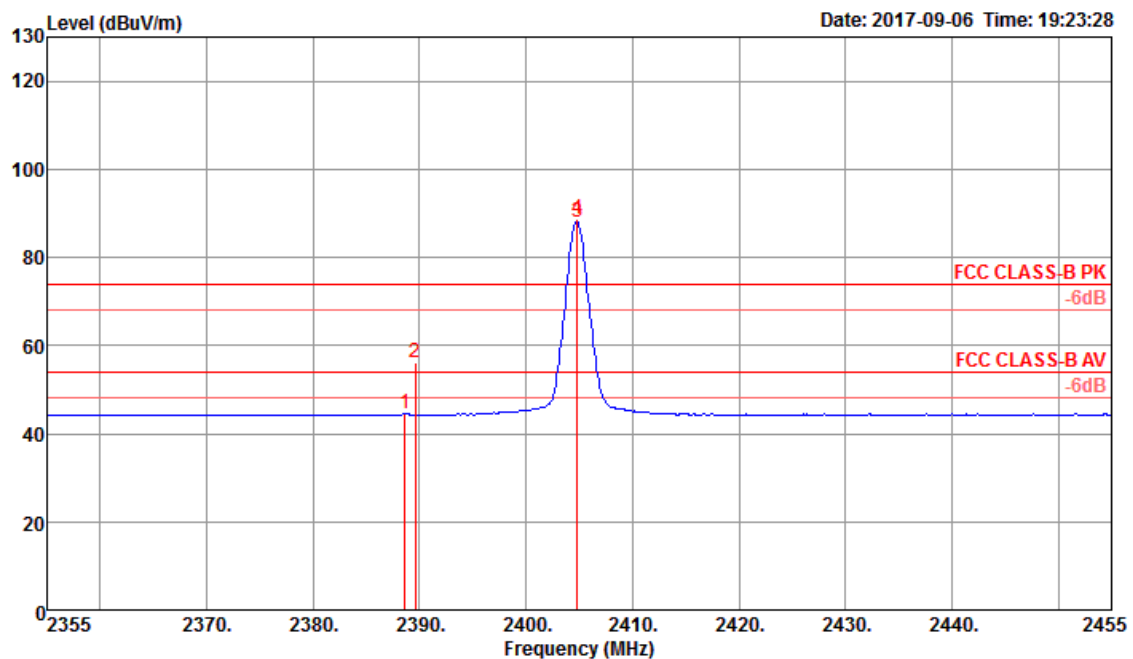
4.5.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.5.7. Test Result of Band Edge and Fundamental Emissions

Temperature	22°C	Humidity	54%
Test Engineer	Jay Luo, Mason Chen, Paul Chen	Configurations	Channel 1, 8, 10

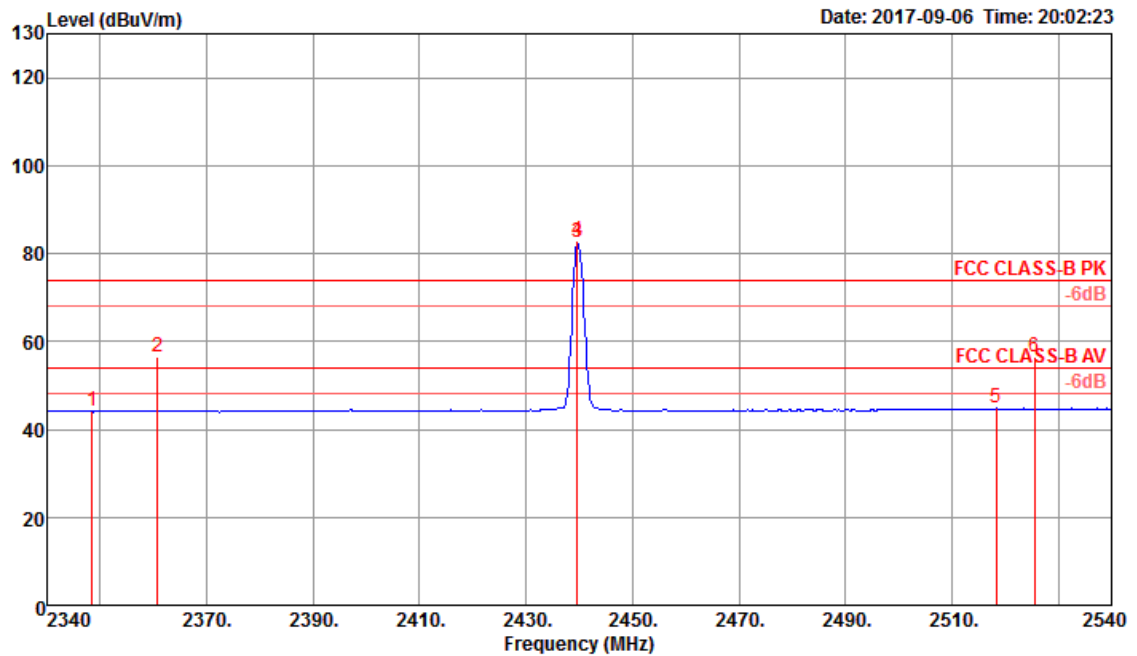
Channel 1



	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	2388.60	44.44	54.00	-9.56	12.54	3.69	28.21	0.00	101	153 Average	VERTICAL
2	2389.60	56.03	74.00	-17.97	24.13	3.69	28.21	0.00	101	153 Peak	VERTICAL
3 @	2404.80	88.10			56.15	3.70	28.25	0.00	101	153 Average	VERTICAL
4 @	2404.80	88.67			56.72	3.70	28.25	0.00	101	153 Peak	VERTICAL

Item 3, 4 are the fundamental frequency at 2405 MHz.

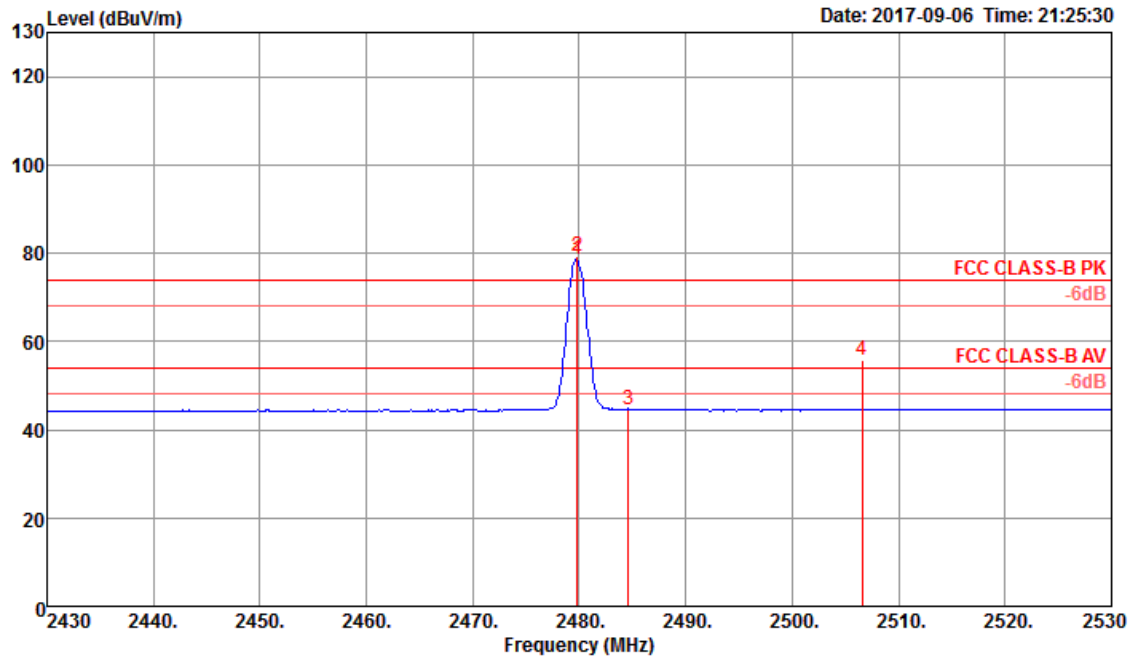
Channel 8



	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	2348.40	44.30	54.00	-9.70	12.51	3.65	28.14	0.00	101	156 Average	VERTICAL
2	2360.80	56.54	74.00	-17.46	24.71	3.66	28.17	0.00	101	156 Peak	VERTICAL
3 @	2439.60	82.41			50.37	3.73	28.31	0.00	101	156 Average	VERTICAL
4 @	2439.60	83.02			50.98	3.73	28.31	0.00	101	156 Peak	VERTICAL
5	2518.40	44.86	54.00	-9.14	12.57	3.80	28.49	0.00	101	156 Average	VERTICAL
6	2525.60	56.62	74.00	-17.38	24.31	3.80	28.51	0.00	101	156 Peak	VERTICAL

Item 3, 4 are the fundamental frequency at 2440 MHz.

Channel 10



	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1 @	2479.80	78.63			46.51	3.76	28.36	0.00	117	119 Average	VERTICAL
2 @	2479.80	79.34			47.22	3.76	28.36	0.00	117	119 Peak	VERTICAL
3	2484.60	44.71	54.00	-9.29	12.56	3.77	28.38	0.00	117	119 Average	VERTICAL
4	2506.60	55.87	74.00	-18.13	23.65	3.79	28.43	0.00	117	119 Peak	VERTICAL

Item 1, 2 are the fundamental frequency at 2480 MHz.

Note:

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

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

4.6. Antenna Requirements

4.6.1. Limit

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

4.6.2. Antenna Connector Construction

Please refer to section 3.1 in this test report, antenna connector complied with the requirements.

5. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.45GHz	Jan. 23, 2017	Jan. 22, 2018	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Dec. 14, 2016	Dec. 13, 2017	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Dec. 21, 2016	Dec. 20, 2017	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150kHz ~ 30MHz	May 23, 2017	May 22, 2018	Conduction (CO01-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	N.C.R.	Conduction (CO01-CB)
BILOG ANTENNA with 6dB Attenuator	TESEQ & EMCI	CBL6112D & N-6-06	37880 & AT-N0609	20MHz ~ 2GHz	Aug. 30, 2017	Aug. 29, 2018	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Nov. 10, 2016	Nov. 09, 2017	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 05, 2017	Jul. 04, 2018	Radiation (03CH01-CB)
Pre-Amplifier	EMCI	EMC330N	980332	20MHz ~ 3GHz	May 02, 2017	May 01, 2018	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 16, 2017	Jan. 15, 2018	Radiation (03CH01-CB)
Pre-Amplifier	MITEQ	TTA1840-35-HG	1864479	18GHz ~ 40GHz	Jul. 10, 2017	Jul. 09, 2018	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Nov. 22, 2016	Nov. 21, 2017	Radiation (03CH01-CB)
EMI Test	R&S	ESCS	100355	9kHz ~ 2.75GHz	May 06, 2017	May 05, 2018	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-16+17	N/A	30 MHz ~ 1 GHz	Oct. 24, 2016	Oct. 23, 2017	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Oct. 24, 2016	Oct. 23, 2017	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16+17	N/A	1 GHz ~ 18 GHz	Oct. 24, 2016	Oct. 23, 2017	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#1	N/A	18GHz ~ 40 GHz	Oct. 24, 2016	Oct. 23, 2017	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#2	N/A	18GHz ~ 40 GHz	Oct. 24, 2016	Oct. 23, 2017	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 16, 2016*	Mar. 15, 2018*	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Nov. 22, 2016	Nov. 21, 2017	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-6	1 GHz ~ 26.5 GHz	Oct. 24, 2016	Oct. 23, 2017	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-7	1 GHz ~ 26.5 GHz	Oct. 24, 2016	Oct. 23, 2017	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-8	1 GHz ~ 26.5 GHz	Oct. 24, 2016	Oct. 23, 2017	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-9	1 GHz ~ 26.5 GHz	Oct. 24, 2016	Oct. 23, 2017	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz ~ 26.5 GHz	Oct. 24, 2016	Oct. 23, 2017	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 22, 2016	Nov. 21, 2017	Conducted (TH01-CB)

Note: Calibration Interval of instruments listed above is one year.

*** Calibration Interval of instruments listed above is two years.

N.C.R. means Non-Calibration required.

6. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	3.2 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	3.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.7 dB	Confidence levels of 95%