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FCC RADIO TEST REPORT

Applicant's company	**AirTies Wireless Networks**
Applicant Address	Gülbahar Mah. Avni Dilligil Sok. Celik Is Merkezi No 5 mecidiyekoy ISTANBUL, 34394 Turkey
FCC ID	**Z3WAIR7405**
Manufacturer's company	**Karel Elektronik**
Manufacturer Address	Organize Sanayi Bölgesi Gazneliler Caddesi No:10 06935 Sincan Ankara/Turkey

Product Name	HD IP Set-Top Box with Wireless
Brand Name	AirTies
Model No.	Air 7405
Test Rule Part(s)	47 CFR FCC Part 15 Subpart C § 15.249
Test Freq. Range	2400 ~ 2483.5MHz
Received Date	Jun. 30, 2015
Final Test Date	Dec. 22, 2015
Submission Type	Original Equipment

Statement

Test result included is only for the IEEE 802.15.4 ZigBee RF4CE of the product.

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.

Testing Laboratory
1190

Table of Contents

History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR570157AC	Rev. 01	Initial issue of report	Dec. 28, 2015

1. VERIFICATION OF COMPLIANCE

Product Name	:	HD IP Set-Top Box with Wireless
Brand Name	:	AirTies
Model Name	:	Air 7405
Applicant	:	AirTies Wireless Networks
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 Jun. 30, 2015 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:
Sam Chen
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**	**Under Limit**
4.1	15.207	AC Power Line Conducted Emissions	Complies	11.89 dB
4.2	15.249(a)	Field Strength of Fundamental Emissions	Complies	8.74 dB
4.3	15.215(c)	20dB Spectrum Bandwidth	Complies	-
4.4	15.249(a)/(d)	Radiated Emissions	Complies	3.25 dB
4.5	15.249(d)	Band Edge Emissions	Complies	11.02 dB
4.6	15.203	Antenna Requirements	Complies	-

3. GENERAL INFORMATION

3.1. Product Details

Items	Description
Power Type	From power adapter
Modulation	O-QPSK
Data Rate	250kbps
Frequency Range	2400 ~ 2483.5MHz
Channel Number	11
Channel Band Width (99%)	2.40 MHz
Max. Field Strength	85.26 dBuV/m at 3m (Average)
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

3.2. Accessories

Power	Brand	Model No.	Rating
Adapter	MOSO	MSA-C2000IC5.0-12W-US	Input: 100-240Vac, 50/60Hz, 0.5A max. Output: 5.0Vdc, 2A
Others			
RJ-45 cable*1: Non-shielded, 1.5m			
HDMI cable*1: Shielded, 1.5m			
Scart cable*1: Non-shielded, 1.2m			
Remote controller*1			

3.3. Table for Filed Antenna

Ant.	Brand	Model No.	Antenna Type	Connector	Gain (dBi)		Remark
					2.4GHz	5GHz	
1	-	-	Printed Antenna	N/A	3.0	3.6	WLAN
2	-	-	Printed Antenna	N/A	3.0	3.6	
Ant.	**Brand**	**Model No.**	**Antenna Type**	**Connector**	**Gain (dBi)**		**Remark**
					2.4GHz		
3	-	-	Printed Antenna	N/A	0		ZigBee
4	-	-	Printed Antenna	N/A	0		RF4CE

Note: The EUT has four antennas.

For WLAN Function

For IEEE 802.11a/b/g mode (1TX/1RX):

Only Ant. 1 can be used as transmitting/receiving antenna.

For IEEE 802.11n/ac mode (2TX/2RX):

Ant. 1 and Ant. 2 can be used as transmitting/receiving antenna.

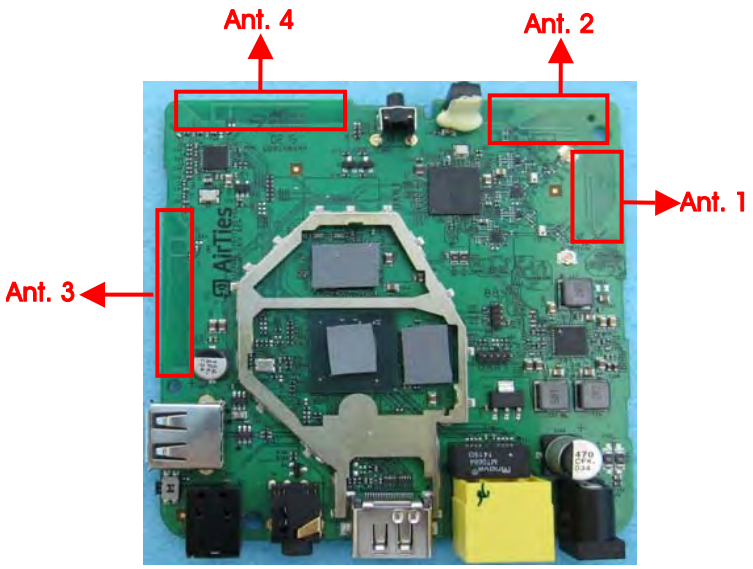
Ant. 1 and Ant. 2 could transmit/receive simultaneously.

For ZigBee RF4CE function (1TX/1RX)

The EUT supports the antenna with TX and RX diversity functions.

Both Ant. 3 and Ant. 4 support transmit and receive functions, but only one of them will be used at one time.

The Ant. 3 generated the worst case, so it was selected to test and record in the report.



3.4. Table for Carrier Frequencies

Frequency Band	Channel No.	Frequency
2400 ~ 2483.5MHz	15	2425 MHz
	16	2430 MHz
	:	:
	19	2445 MHz
	20	2450 MHz
	21	2455 MHz
	:	:
	24	2470 MHz
	25	2475 MHz

3.5. Table for Test Modes

Investigation has been done on all the possible configurations for searching the worst cases. 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	15/20/25	3
Radiated Emissions 30MHz ~ 1GHz	Normal Link	-	-
Radiated Emissions 1GHz~10th Harmonic	CTX	15/20/25	3
Band Edge Emissions	CTX	15/20/25	3

Note: 1. The EUT can only be used at Z axis position.

2. All the specification of test configurations and test modes were based on customer's request.

The following test modes were performed for all tests:

For Radiated Emission below 1GHz test:

Mode 1. 2.4GHz WLAN function

Mode 2. 5GHz WLAN function

Mode 1 is the worst case, so it was selected to record in this test report.

3.6. 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 Reg. No.**	**IC File No.**
03CH01-CB	SAC	Hsin Chu	262045	IC 4086D
CO02-CB	Conduction	Hsin Chu	262045	IC 4086D
TH01-CB	OVEN Room	Hsin Chu	-	-

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

3.7. Table for Supporting Units

For Test Site No: CO02-CB_

Support Unit	Brand	Model	FCC ID
NB	DELL	E6430	DoC
Flash disk	Silicon Power	I-Series	DoC
SD card	Apacer	SD card	N/A
TV	SONY	KLV-32U300A	DoC

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

Support Unit	Brand	Model	FCC ID
NB*2	DELL	E4300	DoC
SD card	Apacer	SD card	N/A
Flash disk	Silicon Power	I-Series	DoC
Wireless ac AP	Netgear	R6300V2	PY313200227
HDMI box	Gefen	AF1208127396	N/A

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

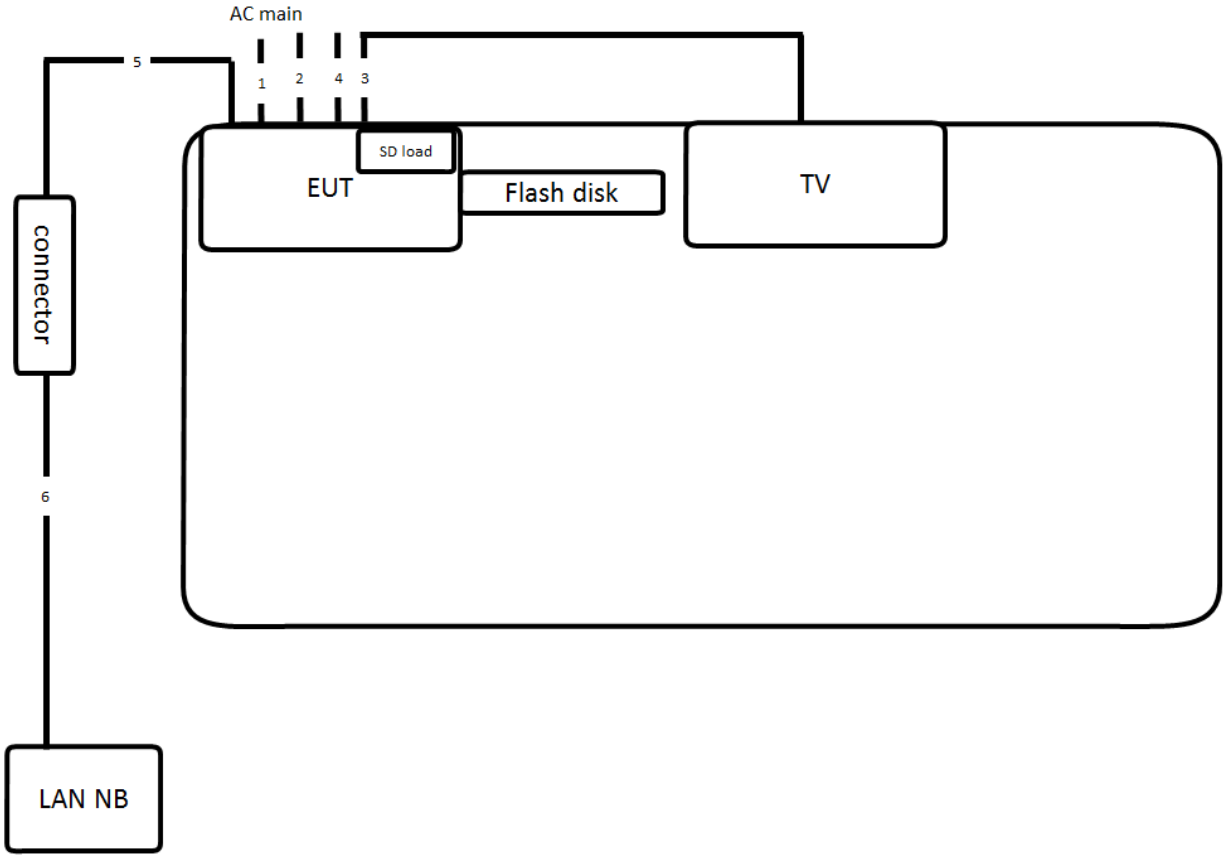
Support Unit	Brand	Model	FCC ID
NB	DELL	E4300	DoC

3.8. Duty Cycle

On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
0.760	3.240	23.46	6.30	1.32

3.9. Test Configurations

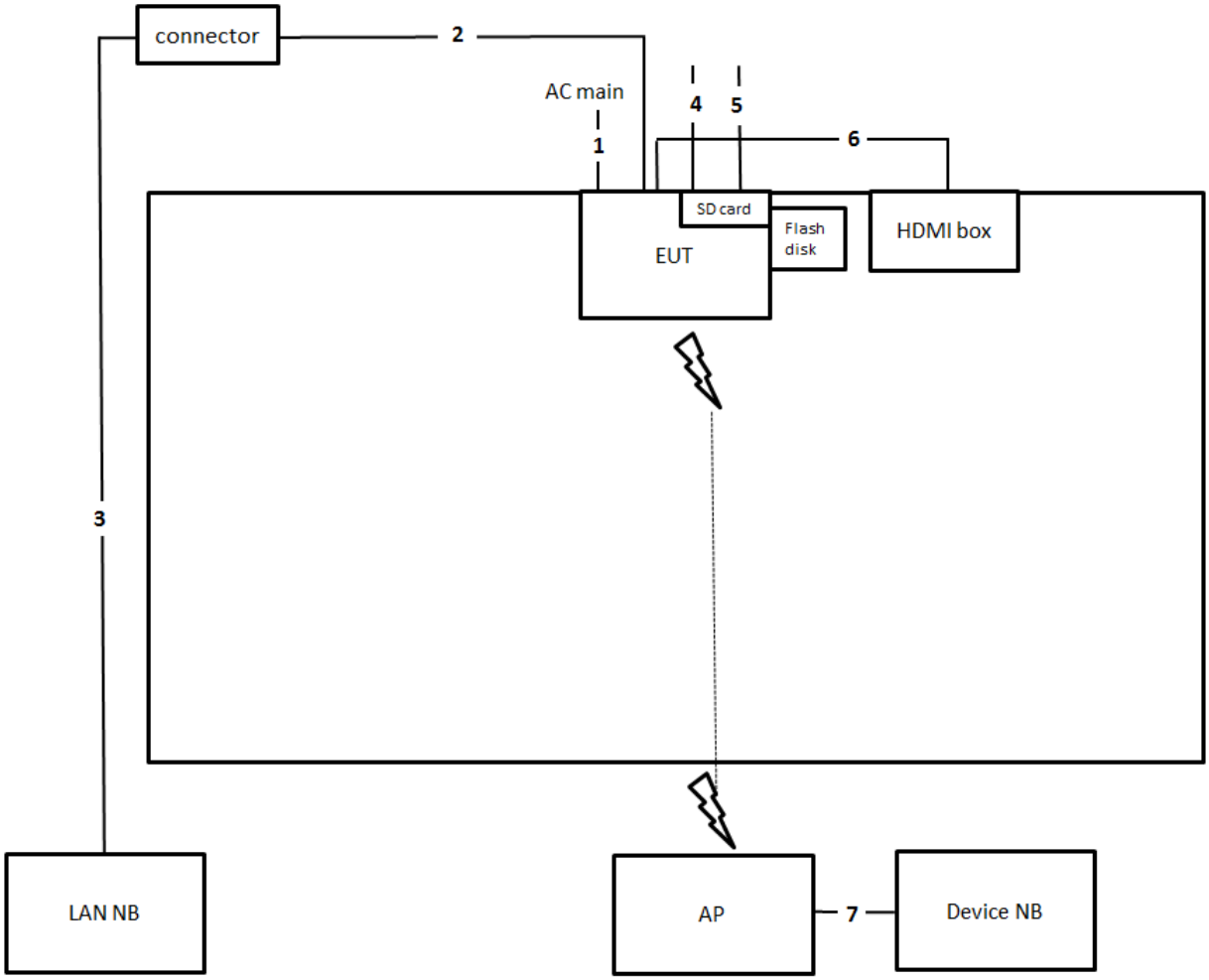
3.9.1. AC Power Line Conduction Emissions Test Configuration



Item	Connection	Shielded	Length
1	Power cable	No	1.5m
2	Scart cable	No	1.2m
3	HDMI cable	Yes	1.5m
4	Fiber cable	No	1m
5	RJ-45 cable	No	1.5m
6	RJ-45 cable	No	10m

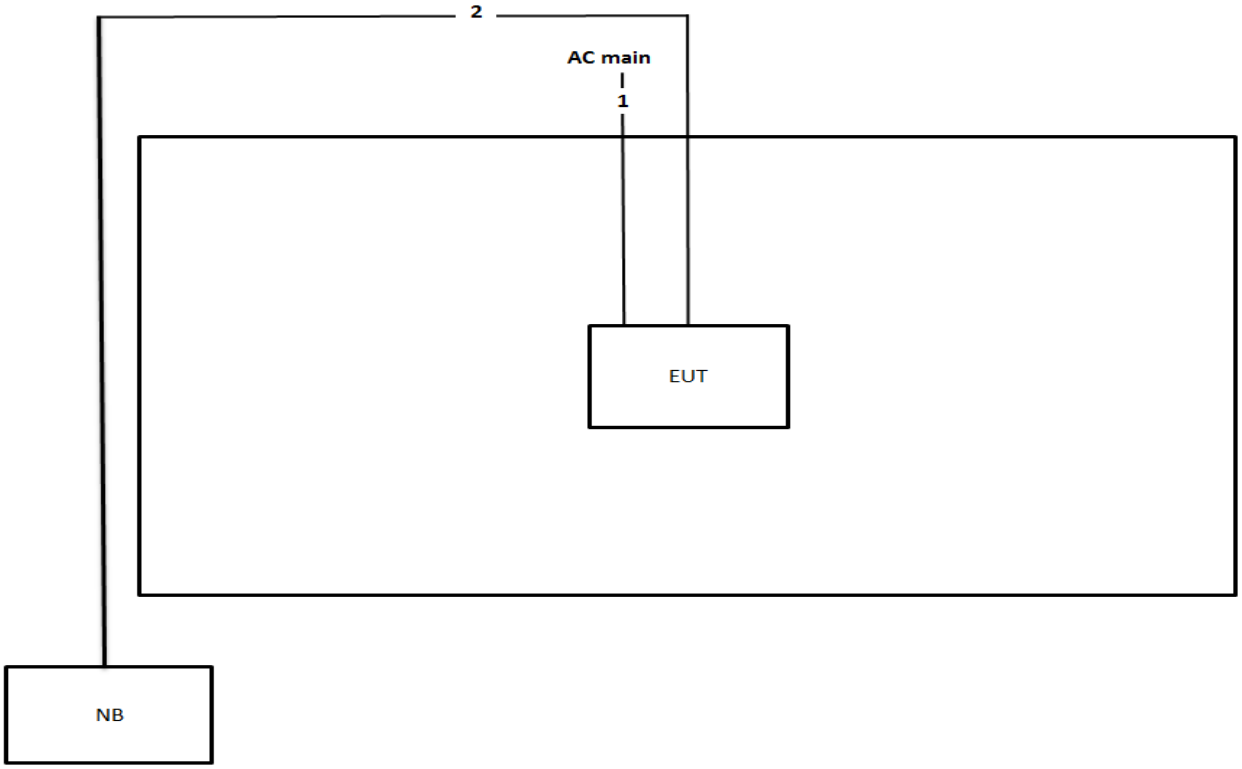
3.9.2. Radiation Emissions Test Configuration

Test Configuration: 30MHz~1GHz



Item	Connection	Shielded	Length
1	Power cable	No	1.5m
2	RJ-45 cable	No	1.5m
3	RJ-45 cable	No	10m
4	Scart cable	No	1.2m
5	Fiber cable	No	1m
6	HDMI cable	Yes	1.5m
7	RJ-45 cable	No	1.5m

Test Configuration: above 1GHz



Item	Connection	Shielded	Length
1	Power cable	No	1.5m
2	RJ-45 cable	No	10m

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

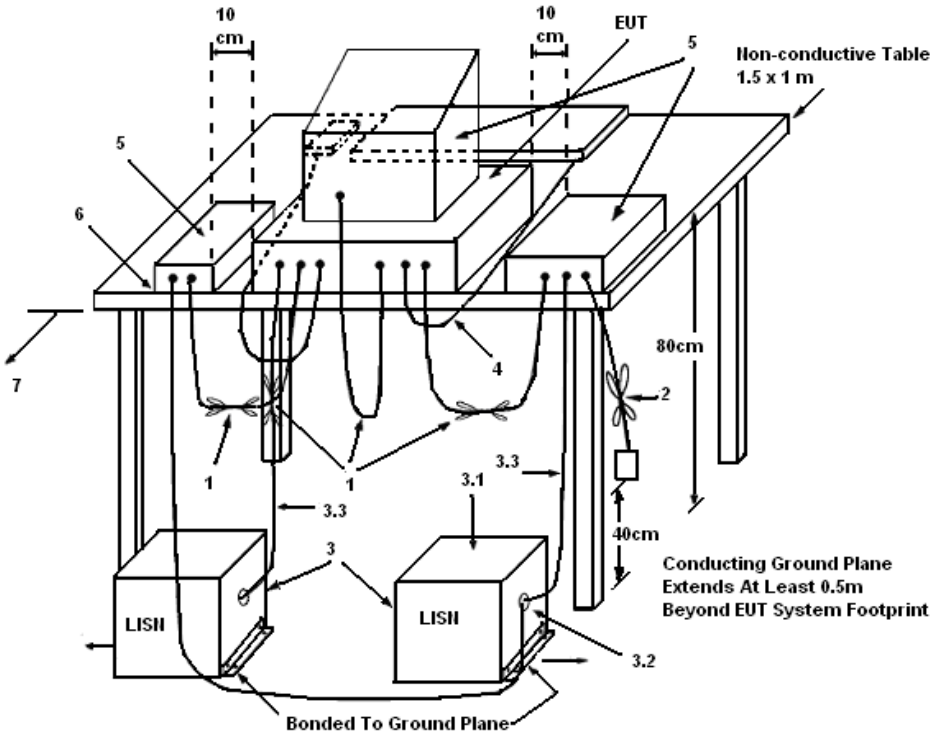
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

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

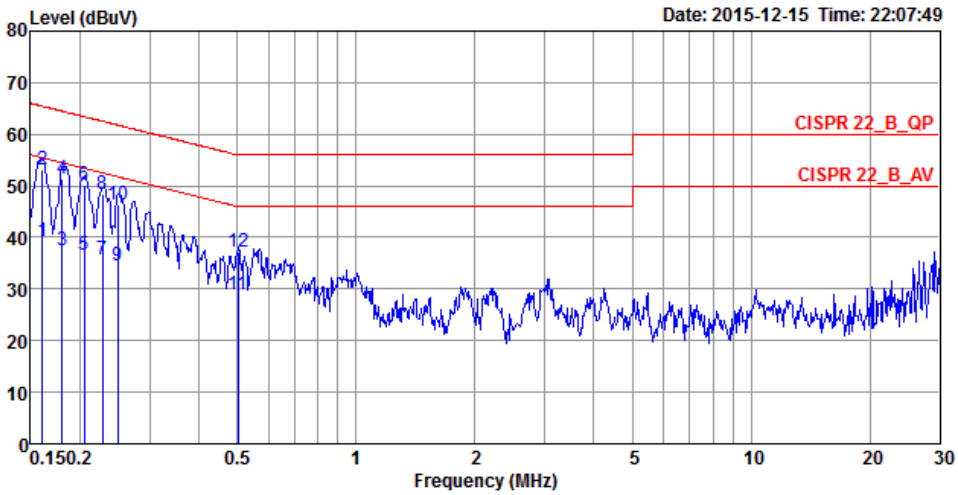
There is no deviation with the original standard.

4.1.6. EUT Operation during Test

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

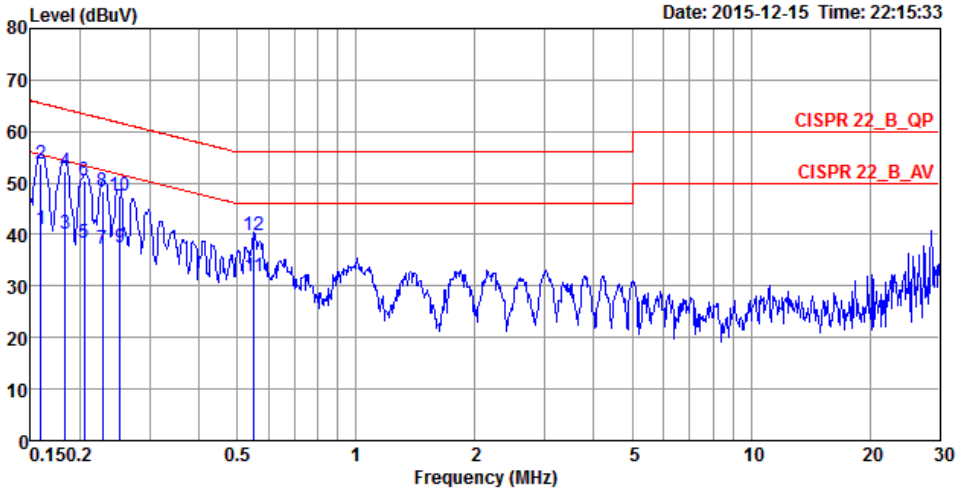
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	22°C	Humidity	60%
Test Engineer	Deven Huang	Phase	Line
Configuration	Normal Link		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB		
1	0.1607	39.12	-16.31	55.43	29.00	9.96	Average	LINE
2	0.1607	53.25	-12.18	65.43	43.13	9.96	QP	LINE
3	0.1806	37.38	-17.08	54.46	27.25	9.95	Average	LINE
4	0.1806	51.51	-12.95	64.46	41.38	9.95	QP	LINE
5	0.2050	36.62	-16.78	53.40	26.49	9.95	Average	LINE
6	0.2050	50.18	-13.22	63.40	40.05	9.95	QP	LINE
7	0.2280	35.58	-16.94	52.52	25.44	9.96	Average	LINE
8	0.2280	48.41	-14.11	62.52	38.27	9.96	QP	LINE
9	0.2495	34.48	-17.30	51.78	24.32	9.97	Average	LINE
10	0.2495	46.35	-15.43	61.78	36.19	9.97	QP	LINE
11	0.5020	29.04	-16.96	46.00	18.82	10.02	Average	LINE
12	0.5020	37.08	-18.92	56.00	26.86	10.02	QP	LINE

Temperature	22°C	Humidity	60%
Test Engineer	Deven Huang	Phase	Neutral
Configuration	Normal Link		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB		
1	0.1590	41.01	-14.51	55.52	30.89	9.96	Average	NEUTRAL
2	0.1590	53.63	-11.89	65.52	43.51	9.96	QP	NEUTRAL
3	0.1835	40.16	-14.17	54.33	30.02	9.96	Average	NEUTRAL
4	0.1835	52.35	-11.98	64.33	42.21	9.96	QP	NEUTRAL
5	0.2050	38.40	-15.00	53.40	28.26	9.96	Average	NEUTRAL
6	0.2050	50.46	-12.94	63.40	40.32	9.96	QP	NEUTRAL
7	0.2280	37.23	-15.29	52.52	27.09	9.96	Average	NEUTRAL
8	0.2280	48.55	-13.97	62.52	38.41	9.96	QP	NEUTRAL
9	0.2521	37.57	-14.12	51.69	27.42	9.96	Average	NEUTRAL
10	0.2521	47.46	-14.23	61.69	37.31	9.96	QP	NEUTRAL
11	0.5523	31.89	-14.11	46.00	21.72	9.97	Average	NEUTRAL
12	0.5523	39.83	-16.17	56.00	29.66	9.97	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

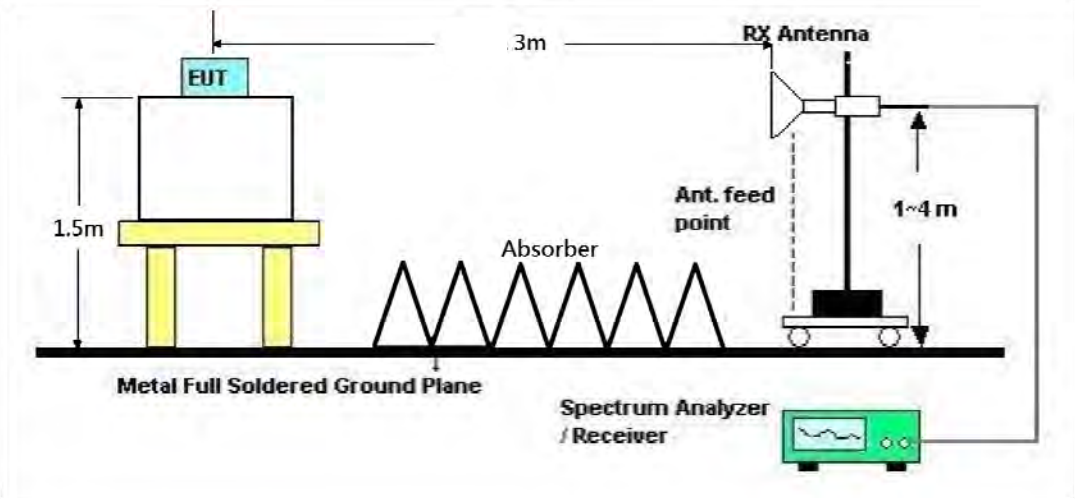
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

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 1.5 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. 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	24℃	Humidity	41%
Test Engineer	Paul Chen	Configurations	Channel 15/20/25
Test Date	Dec. 10, 2015		

Channel 15

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	2425.20	97.20	114.00	-16.80	65.34	3.88	27.98	0.00	324	332	Peak	HORIZONTAL
2	2425.20	84.61	94.00	-9.39	52.75	3.88	27.98	0.00	324	332	Average	HORIZONTAL

Channel 20

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	2449.60	96.35	114.00	-17.65	64.51	3.89	27.95	0.00	333	327	Peak	HORIZONTAL
2	2449.60	83.76	94.00	-10.24	51.92	3.89	27.95	0.00	333	327	Average	HORIZONTAL

Channel 25

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	2474.60	97.85	114.00	-16.15	66.01	3.91	27.93	0.00	310	143	Peak	HORIZONTAL
2	2474.60	85.26	94.00	-8.74	53.42	3.91	27.93	0.00	310	143	Average	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

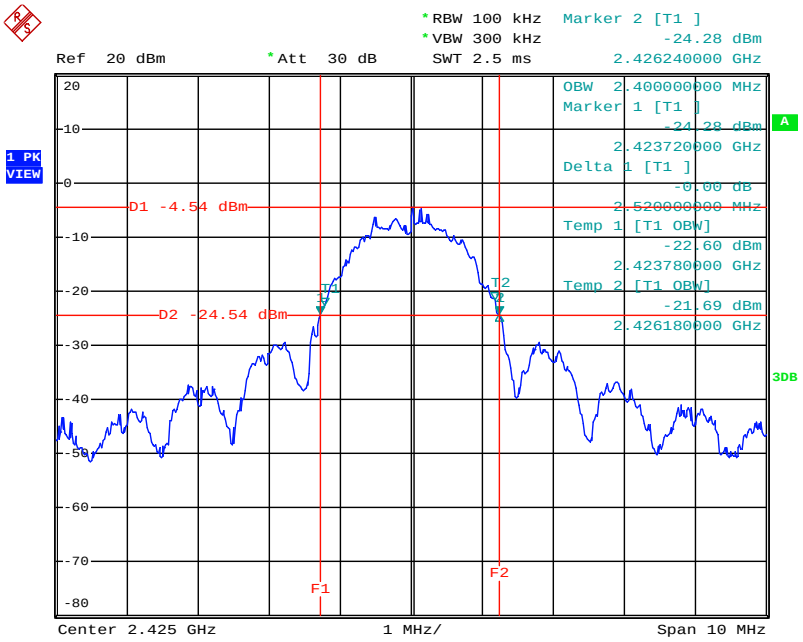
The EUT was programmed to be in continuously transmitting mode.

4.3.7. Test Result of 20dB Spectrum Bandwidth

Temperature	24°C	Humidity	60%
Test Engineer	Clemens Fang	Configurations	Channel 15/20/25

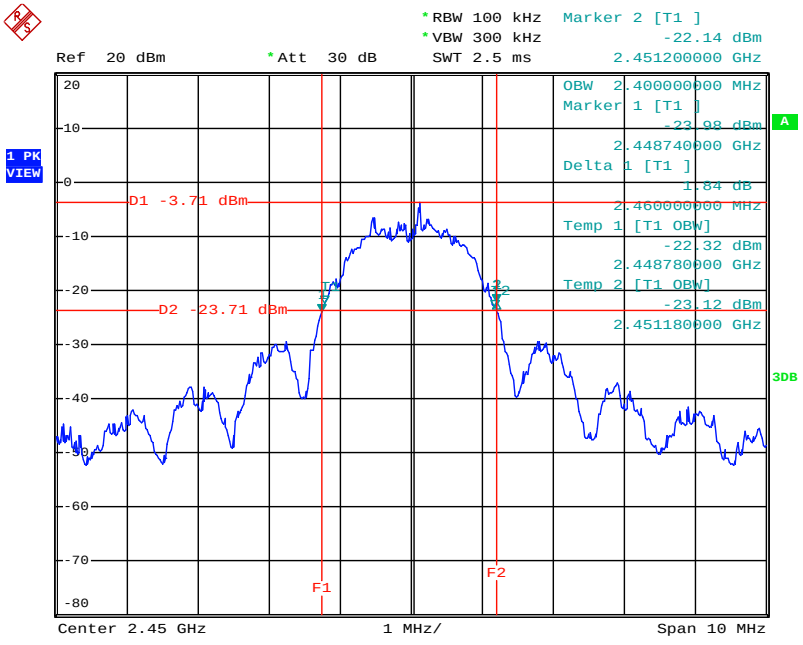
Frequency	20dB BW (MHz)	99% OBW (MHz)	Frequency range (MHz) f_L > 2400MHz	Frequency range (MHz) f_H < 2483.5MHz	Test Result
2425 MHz	2.52	2.40	2423.7200	-	Complies
2450 MHz	2.46	2.40	-	-	Complies
2475 MHz	2.44	2.34	-	2476.2200	Complies

20 dB / 99% Bandwidth Plot on 2425 MHz



Date: 22.DEC.2015 19:52:59

20 dB / 99% Bandwidth Plot on 2450 MHz



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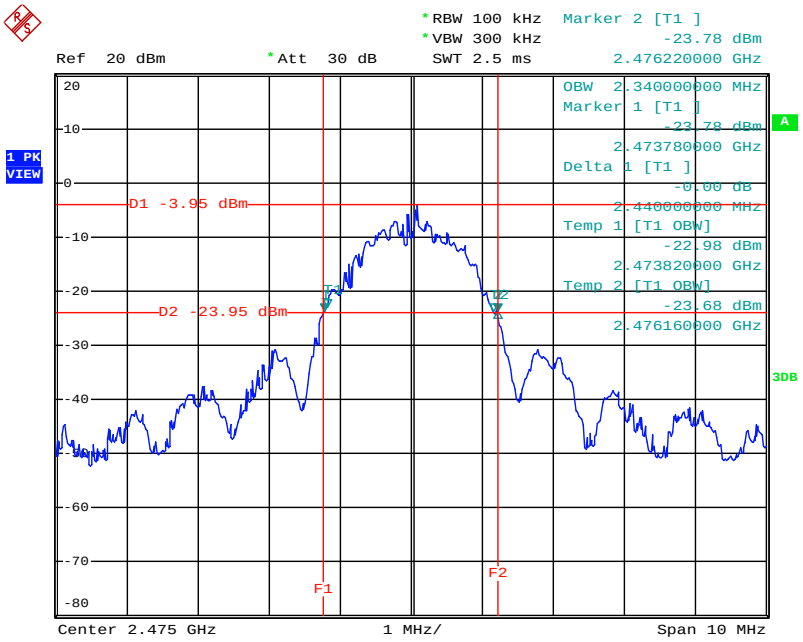
20 dB / 99% Bandwidth Plot on 2475 MHz



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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	1000 MHz
Stop Frequency	10th carrier harmonic
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

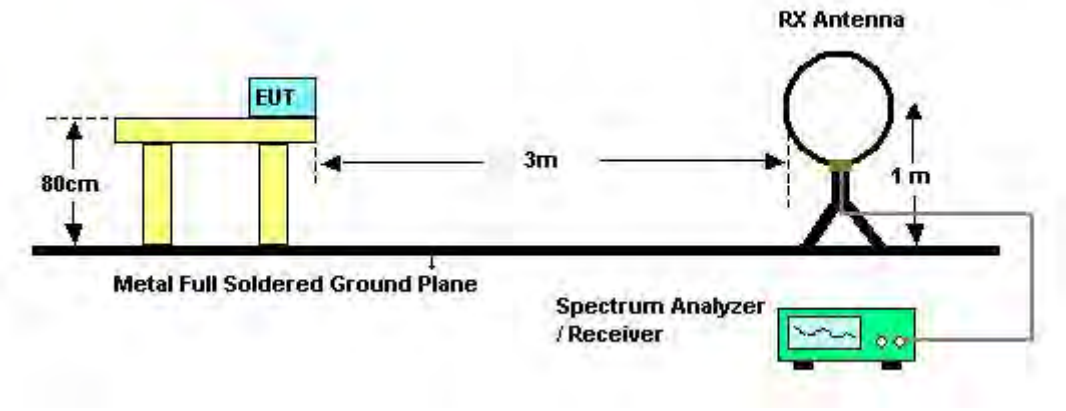
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.4.3. Test Procedures

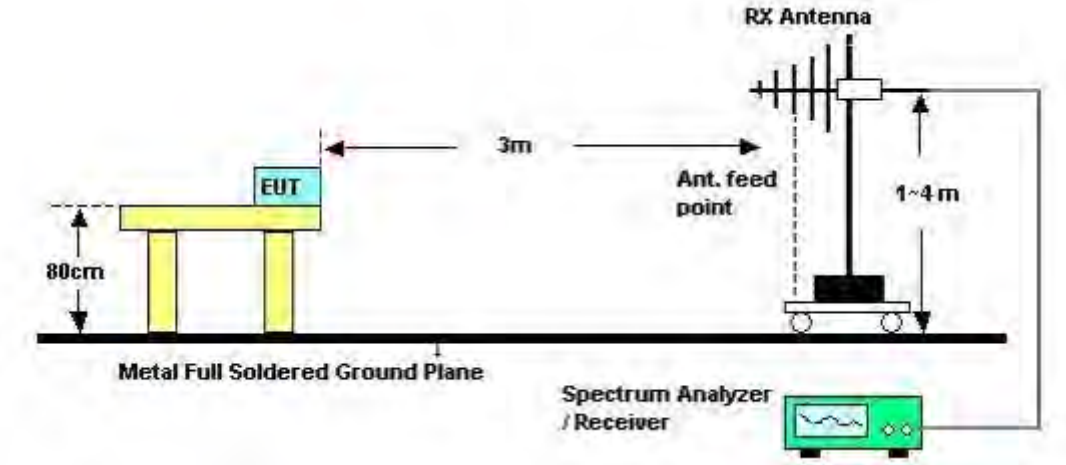
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting 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

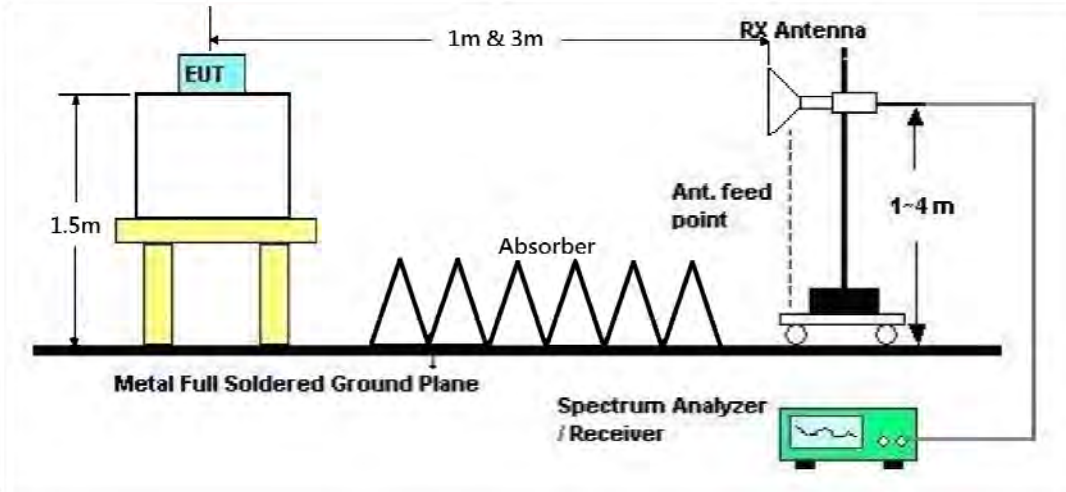
For Radiated Emissions: 9kHz ~30MHz



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	24°C	Humidity	41%
Test Engineer	Paul Chen	Configurations	Normal Link
Test Date	Dec. 18, 2015	Test Mode	Mode 1

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.

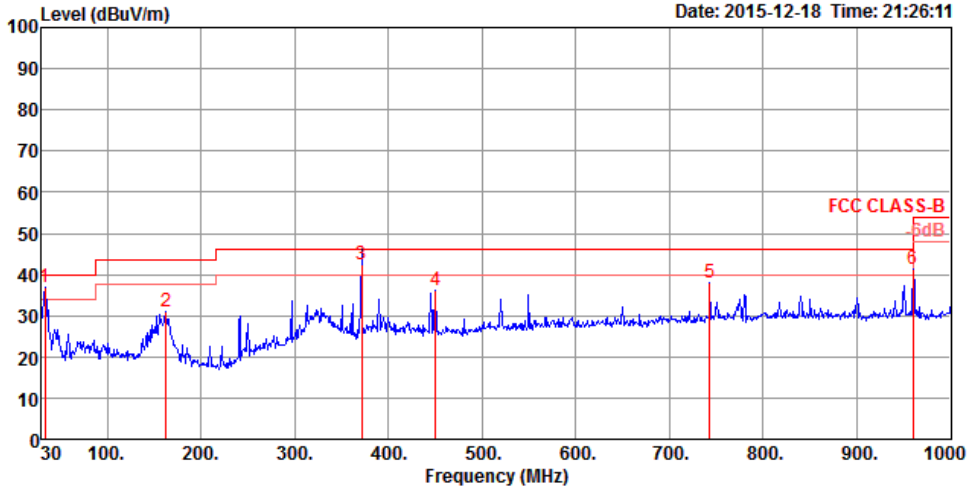
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

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

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

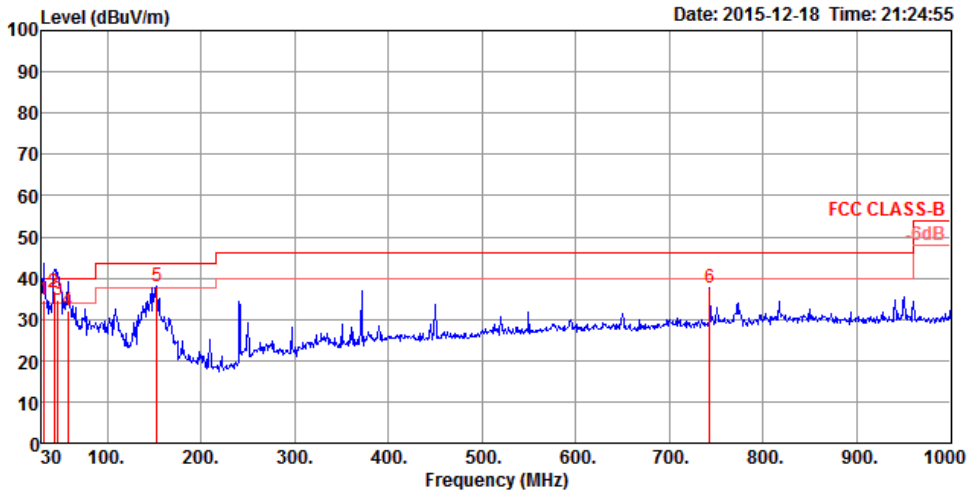
Temperature	24°C	Humidity	41%
Test Engineer	Paul Chen	Configurations	Normal Link
Test Mode	Mode 1		

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	33.88	36.75	40.00	-3.25	50.93	0.51	17.71	32.40	100	225	Peak	HORIZONTAL
2	162.89	30.86	43.50	-12.64	51.46	1.09	10.66	32.35	200	185	Peak	HORIZONTAL
3	371.44	42.25	46.00	-3.75	56.98	1.66	15.93	32.32	100	213	QP	HORIZONTAL
4	450.01	36.05	46.00	-9.95	49.25	1.84	17.30	32.34	100	267	Peak	HORIZONTAL
5	742.95	38.07	46.00	-7.93	47.71	2.36	20.31	32.31	150	193	Peak	HORIZONTAL
6	960.23	41.35	54.00	-12.65	47.91	2.69	21.94	31.19	200	40	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	31.94	34.85	40.00	-5.15	47.88	0.50	18.87	32.40	100	220	QP	VERTICAL
2	43.58	36.43	40.00	-3.57	56.14	0.58	12.12	32.41	100	165	QP	VERTICAL
3	47.46	34.62	40.00	-5.38	56.22	0.61	10.20	32.41	100	352	QP	VERTICAL
4	58.13	32.02	40.00	-7.98	56.55	0.68	7.20	32.41	100	214	QP	VERTICAL
5	153.19	37.90	43.50	-5.60	58.06	1.06	11.13	32.35	100	131	Peak	VERTICAL
6	742.95	37.71	46.00	-8.29	47.35	2.36	20.31	32.31	150	166	Peak	VERTICAL

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB 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	24°C	Humidity	41%
Test Engineer	Paul Chen	Configurations	Channel 15
Test Date	Dec. 10, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4849.00	54.43	74.00	-19.57	49.96	6.12	32.86	34.51	160	299	Peak	HORIZONTAL
2	4849.00	41.84	54.00	-12.16	37.37	6.12	32.86	34.51	160	299	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4849.03	56.84	74.00	-17.16	52.37	6.12	32.86	34.51	234	323	Peak	VERTICAL
2	4849.03	44.25	54.00	-9.75	39.78	6.12	32.86	34.51	234	323	Average	VERTICAL

Temperature	24°C	Humidity	41%
Test Engineer	Paul Chen	Configurations	Channel 20
Test Date	Dec. 10, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4899.26	55.11	74.00	-18.89	50.66	6.00	32.95	34.50	162	320	Peak	HORIZONTAL
2	4899.26	42.52	54.00	-11.48	38.07	6.00	32.95	34.50	162	320	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4901.00	57.37	74.00	-16.63	52.92	6.00	32.95	34.50	240	350	Peak	VERTICAL
2	4901.00	44.78	54.00	-9.22	40.33	6.00	32.95	34.50	240	350	Average	VERTICAL

Temperature	24°C	Humidity	41%
Test Engineer	Paul Chen	Configurations	Channel 25
Test Date	Dec. 10, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4949.08	55.89	74.00	-18.11	51.45	5.91	33.01	34.48	267	124	Peak	HORIZONTAL
2	4949.08	43.30	54.00	-10.70	38.86	5.91	33.01	34.48	267	124	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4949.40	57.03	74.00	-16.97	52.59	5.91	33.01	34.48	61	100	Peak	VERTICAL
2	4949.40	44.44	54.00	-9.56	40.00	5.91	33.01	34.48	61	100	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	24°C	Humidity	41%
Test Engineer	Paul Chen	Configurations	Channel 15, 20, 25
Test Date	Dec. 10, 2015		

Channel 15

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	2390.00	54.82	74.00	-19.18	22.95	3.85	28.02	0.00	223	342	Peak	VERTICAL
2	2390.00	42.23	54.00	-11.77	10.36	3.85	28.02	0.00	223	342	Average	VERTICAL
3	2424.60	95.60			63.74	3.87	27.99	0.00	223	342	Peak	VERTICAL
4	2424.60	83.01			51.15	3.87	27.99	0.00	223	342	Average	VERTICAL

Item 3, 4 are the fundamental frequency at 2425 MHz.

Channel 20

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	2390.00	55.06	74.00	-18.94	23.19	3.85	28.02	0.00	234	330	Peak	VERTICAL
2	2390.00	42.47	54.00	-11.53	10.60	3.85	28.02	0.00	234	330	Average	VERTICAL
3	2449.60	94.13			62.29	3.89	27.95	0.00	234	330	Peak	VERTICAL
4	2449.60	81.54			49.70	3.89	27.95	0.00	234	330	Average	VERTICAL
5	2483.50	55.57	74.00	-18.43	23.73	3.92	27.92	0.00	234	330	Peak	VERTICAL
6	2483.50	42.98	54.00	-11.02	11.14	3.92	27.92	0.00	234	330	Average	VERTICAL

Item 3, 4 are the fundamental frequency at 2450 MHz.

Channel 25

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	2474.60	97.85			66.01	3.91	27.93	0.00	310	143	Peak	HORIZONTAL
2	2474.60	85.26			53.42	3.91	27.93	0.00	310	143	Average	HORIZONTAL
3	2483.50	55.56	74.00	-18.44	23.72	3.92	27.92	0.00	310	143	Peak	HORIZONTAL
4	2483.50	42.97	54.00	-11.03	11.13	3.92	27.92	0.00	310	143	Average	HORIZONTAL

Item 1, 2 are the fundamental frequency at 2475 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 3.3 in this test report, antenna connector complied with the requirements.

5. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
LISN	Schwarzbeck	NSLK 8127	8127650	9kHz ~ 30MHz	Nov. 16, 2015	Conduction (CO02-CB)
LISN	Schwarzbeck	NSLK 8127	8127478	9kHz ~ 30MHz	Nov. 13, 2015	Conduction (CO02-CB)
EMI Receiver	Agilent	N9038A	MY52260140	9kHz ~ 8.4GHz	Jan. 13, 2015	Conduction (CO02-CB)
COND Cable	Woken	Cable	01	0.15MHz ~ 30MHz	Dec. 01, 2015	Conduction (CO02-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	Conduction (CO02-CB)
Pulse Limiter	Schwarzbeck	VTSD 9561F	9561-F073	9kHz ~ 30MHz	Sep. 30, 2015	Conduction (CO02-CB)
BILOG ANTENNA	Schaffner	CBL6112D	37880	20MHz ~ 2GHz	Sep. 03, 2015	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Oct. 22, 2015	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 21, 2015	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Feb. 24, 2015	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 12, 2015	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	923365	26GHz ~ 40GHz	Feb.10, 2015	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Oct. 27, 2015	Radiation (03CH01-CB)
EMI Receiver	Agilent	N9038A	MY52260123	9kHz ~ 8.4GHz	Jan. 21, 2015	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-1	N/A	30 MHz ~ 1 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-17	N/A	1 GHz ~ 18 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-1	N/A	18GHz ~ 40 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-2	N/A	18GHz ~ 40 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 12, 2015*	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSV40	100979	9kHz~40GHz	Dec. 09, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-7	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-8	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-9	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-6	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 02, 2015	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%