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FCC RADIO TEST REPORT

Applicant's company	**Greenwave Systems Pte. Ltd.**
Applicant Address	41 Science Park Road, #03-01, The Gemini Science Park II, Singapore 117610 Singapore
FCC ID	**Z3M-GNT1J1B1**
Manufacturer's company	**Greenwave Systems Pte. Ltd.**
Manufacturer Address	41 Science Park Road, #03-01, The Gemini Science Park II, Singapore 117610 Singapore

Product Name	Wireless Smart Plug
Brand Name	Greenwave Systems
Model No.	NT1J1-B1XY-BB ; where X – Cosmetic variant, 0~9, A~Z ; Y – Colour , 0 ~ 9 ; B- Brand, 0~9, A~Z
Test Rule	47 CFR FCC Part 15 Subpart C § 15.247
Test Freq. Range	2405~ 2480MHz
Received Date	Jun. 06, 2014
Final Test Date	Jul. 14, 2014
Submission Type	Original Equipment

Statement

Test result included is only for the IEEE 802.15.4 ZigBee 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 C63.10-2009**, **47 CFR FCC Part 15 Subpart C** and **KDB 558074 D01 v03r02**.

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

TAF
Testing Laboratory
1190

Table of Contents

History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR461606	Rev. 01	Initial issue of report	Sep. 11, 2014

Certificate No.: CB10307189

1. CERTIFICATE OF COMPLIANCE

Product Name	:	Wireless Smart Plug
Brand Name	:	Greenwave Systems
Model No.	:	NT1J1-B1XY-BB; where X – Cosmetic variant, 0~9, A~Z ; Y – Colour , 0 ~ 9 ; B- Brand, 0~9, A~Z
Applicant	:	Greenwave Systems Pte. Ltd.
Test Rule Part(s)	:	47 CFR FCC Part 15 Subpart C § 15.247

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Jun. 06, 2014 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.

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	1.10 dB
4.2	15.247(b)(3)	Maximum Conducted Output Power	Complies	28.55 dB
4.3	15.247(e)	Power Spectral Density	Complies	18.63 dB
4.4	15.247(a)(2)	6dB Spectrum Bandwidth	Complies	-
4.5	15.247(d)	Radiated Emissions	Complies	3.31 dB
4.6	15.247(d)	Band Edge Emissions	Complies	0.20 dB
4.7	15.203	Antenna Requirements	Complies	-

3. GENERAL INFORMATION

3.1. Product Details

Items	Description
Power Type	From Internal Power Supply
Modulation	DSSS (O-QPSK)
Data Rate (Mbps)	DSSS (250kbps)
Frequency Range	2405～ 2480MHz
Channel Number	16
Channel Band Width (99%)	2.31 MHz
Maximum Conducted Output Power	1.45 dBm
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

3.2. Accessories

N/A

3.3. Table for Filed Antenna

Ant.	Brand	P/N	Antenna Type	Connector	Gain (dBi) (Include cable loss)	Cable loss
1	WNC	48EAAB0D.SGA.X02	PCB Antenna	Murata	4.87	0.2

3.4. Table for Carrier Frequencies

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
2405 ～ 2480MHz	11	2405 MHz	19	2445 MHz
	12	2410 MHz	20	2450 MHz
	13	2415 MHz	21	2455 MHz
	14	2420 MHz	22	2460 MHz
	15	2425 MHz	23	2465 MHz
	16	2430 MHz	24	2470 MHz
	17	2435 MHz	25	2475 MHz
	18	2440 MHz	26	2480 MHz

3.5. Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. 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	Data Rate	Channel	Antenna
AC Power Line Conducted Emissions	Normal Link	-	-	-
Maximum Conducted Output Power	TX Mode	250 kbps	11/18/26	-
Power Spectral Density 6dB Spectrum Bandwidth	TX Mode	250 kbps	11/18/26	-
Radiated Emissions 9kHz~1GHz	Normal Link	-	-	-
Radiated Emissions 1GHz~10th Harmonic	TX Mode	250 kbps	11/18/26	1
Band Edge Emissions	TX Mode	250 kbps	11/18/26	1

The following test modes were performed for all tests:

For Conducted Emission test:

Mode 1. Normal Link

For Radiated Emission below 1GHz test:

Mode 1: Place EUT in X axis

Mode 2: Place EUT in Y axis

Mode 3: Place EUT in Z axis

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

For Radiated Emission above 1GHz test:

The EUT was performed at X axis, Y axis and Z axis position for Radiated emission above 1GHz test, and the worst case was found at X axis. So the measurement will follow this same test configuration.

Mode 1: Place EUT in X axis

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
CO01-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: 03CH01-CB

For Radiated Emission below 1GHz test:

Support Unit	Brand	Model	FCC ID
Tablet PC	Samsung	SM-T110	N/A
Device (Wireless AP)	greenWAVE	UBW1J1-1A01-GR	N/A
Table lamp	Pro'sKit	MA-1003MA	N/A

For Radiated Emission above 1GHz test:

Support Unit	Brand	Model	FCC ID
Notebook	DELL	M1330	DoC

For Test Site No: CO01-CB

Support Unit	Brand	Model	FCC ID
Tablet PC	Samsung	SM-T110	N/A
Device (Wireless AP)	greenWAVE	UBW1J1-1A01-GR	N/A
Table lamp	Pro'sKit	MA-1003MA	N/A

For Test Site No: TH01-CB

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E6430	DoC

3.8. Table for Parameters of Test Software Setting

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Power Parameters of IEEE 802.15.4 ZigBee

Test Software Version	hypertrm		
Frequency	2405 MHz	2440 MHz	2480 MHz
IEEE 802.15.4 ZigBee	3	3	3

3.9. EUT Operation during Test

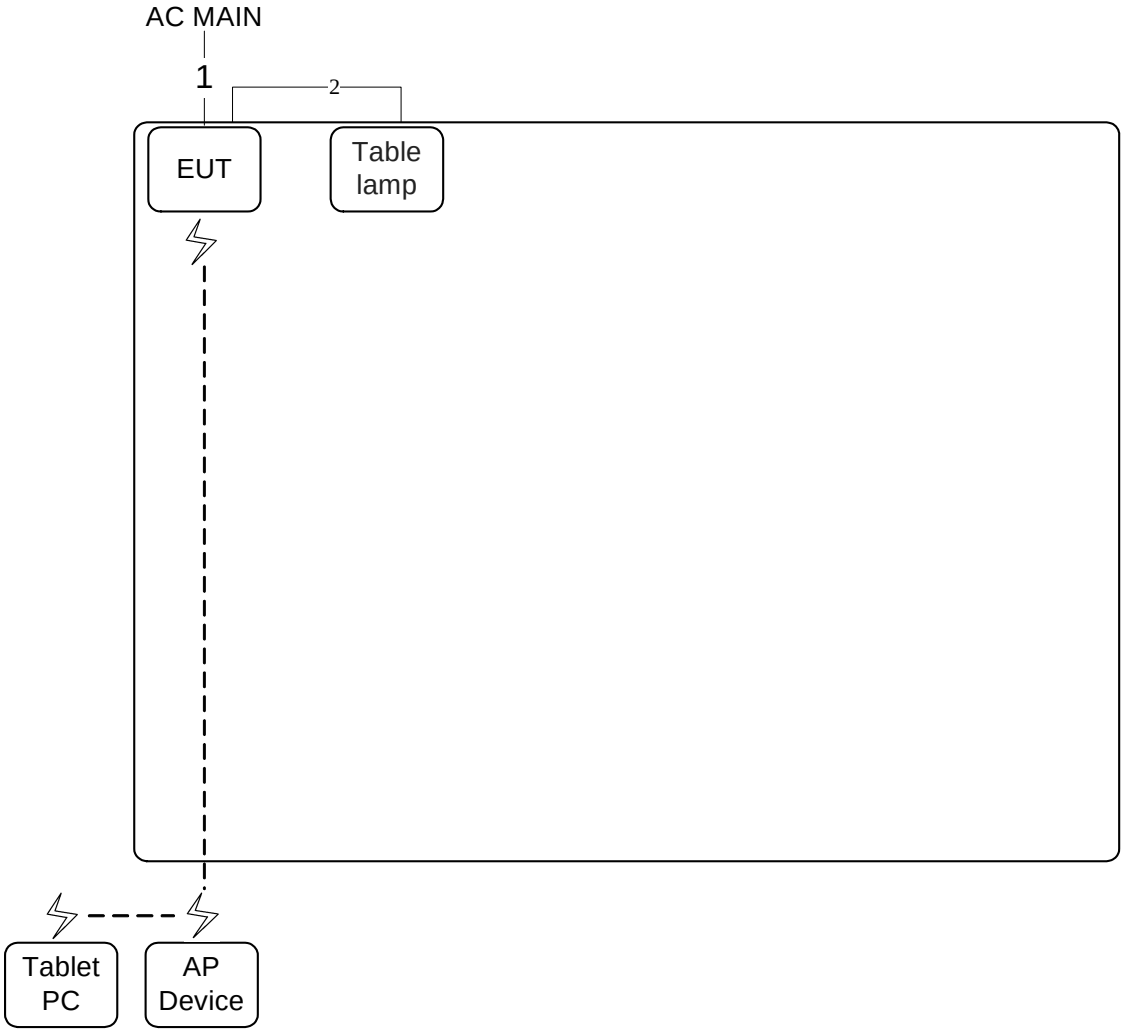
The EUT was programmed to be in continuously transmitting mode.

3.10. Duty Cycle

On Time(ms)	On+Off Time(ms)	Duty Cycle(%)	1/T Minimum VBW (kHz)
1.000	1.000	100	0..01

3.11. Test Configurations

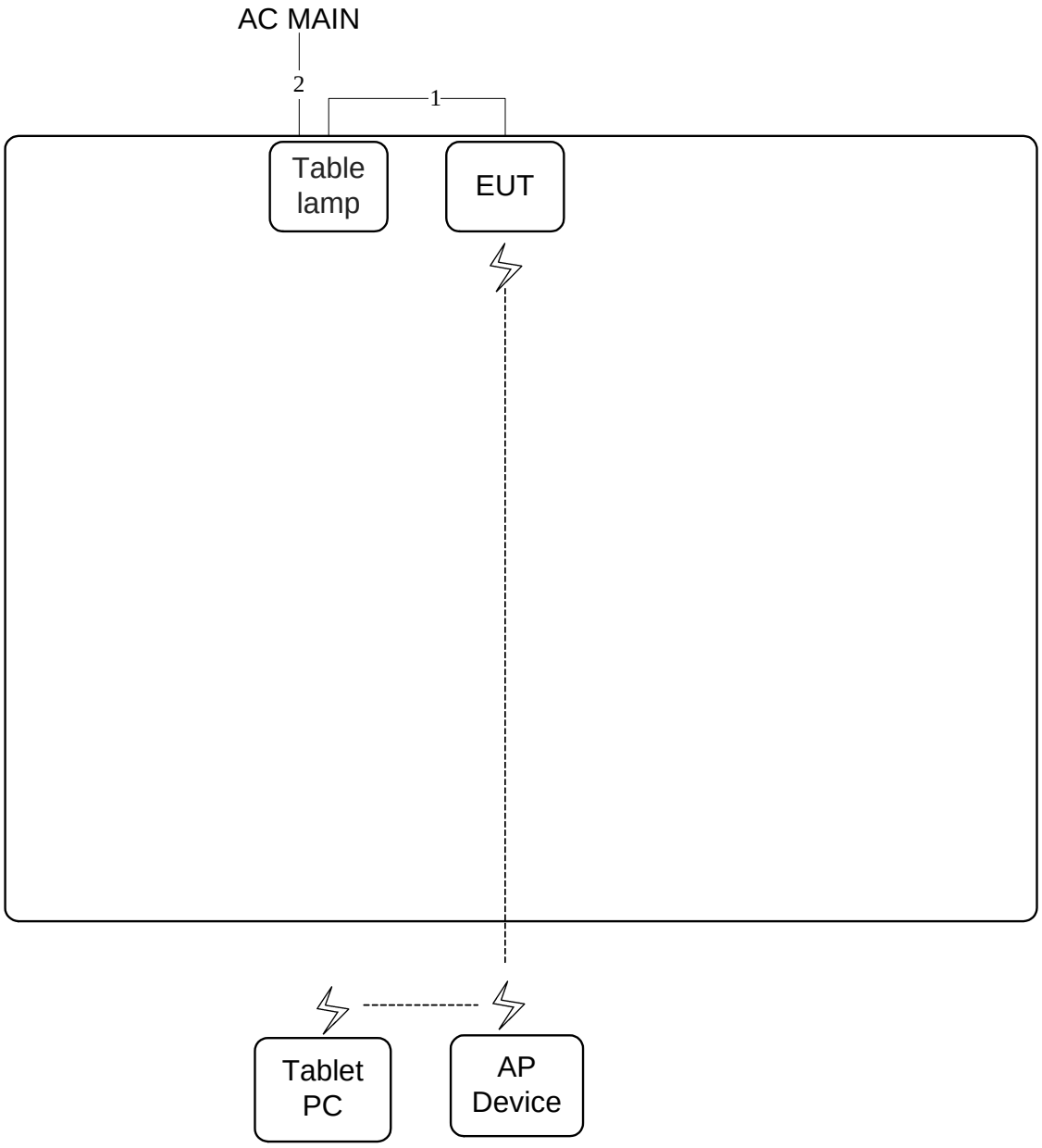
3.11.1. AC Power Line Conduction Emissions Test Configuration



Item	Connection	Shielded	Length(m)
1	Power cable	No	0.8m
2	Power cable	No	1.5m

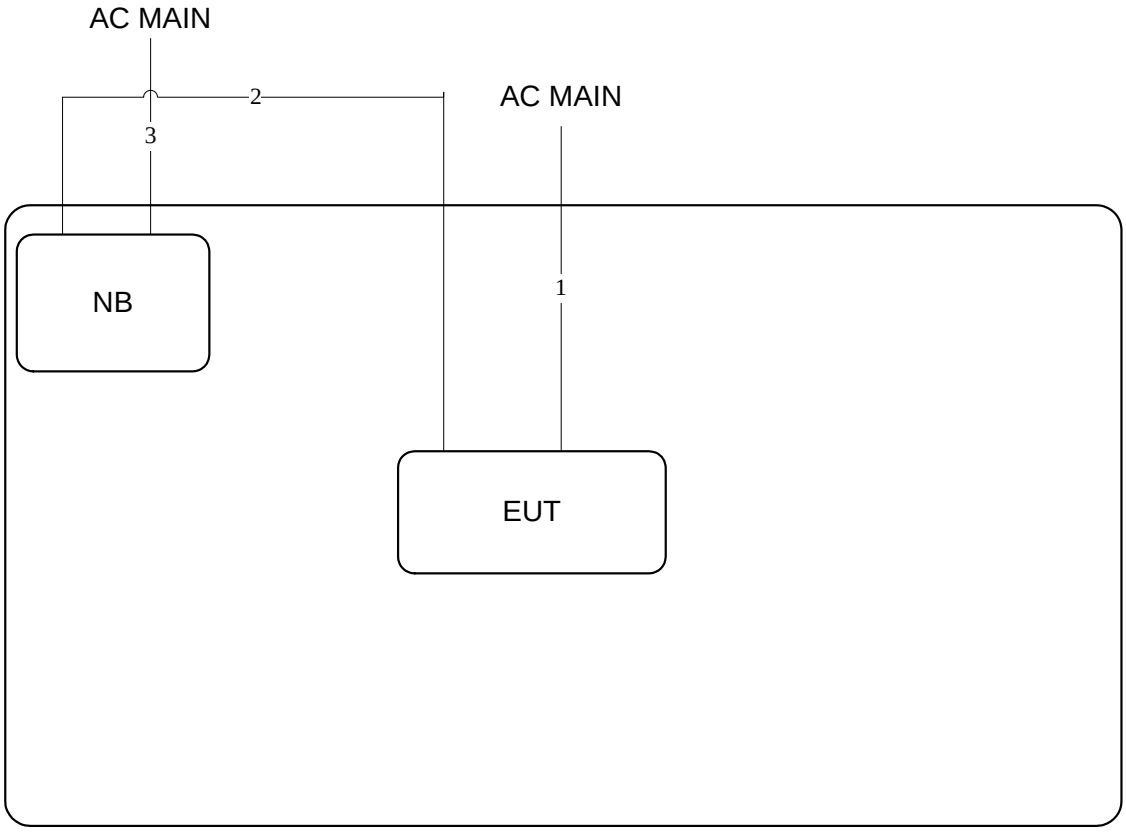
3.11.2. Radiation Emissions Test Configuration

Test Configuration: 30MHz~1GHz



Item	Connection	Shielded	Length(m)
1	Power cable	No	1.5m
2	Power cable	No	0.8m

Test Configuration: Above 1GHz



Item	Connection	Shielded	Length(m)
1	Power cable	No	1m
2	USB cable	Yes	2m
3	Power cable	No	2.6m

4. TEST RESULT

4.1. AC Power Line Conducted Emissions Measurement

4.1.1. Limit

For a Low-power Radio-frequency Device 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

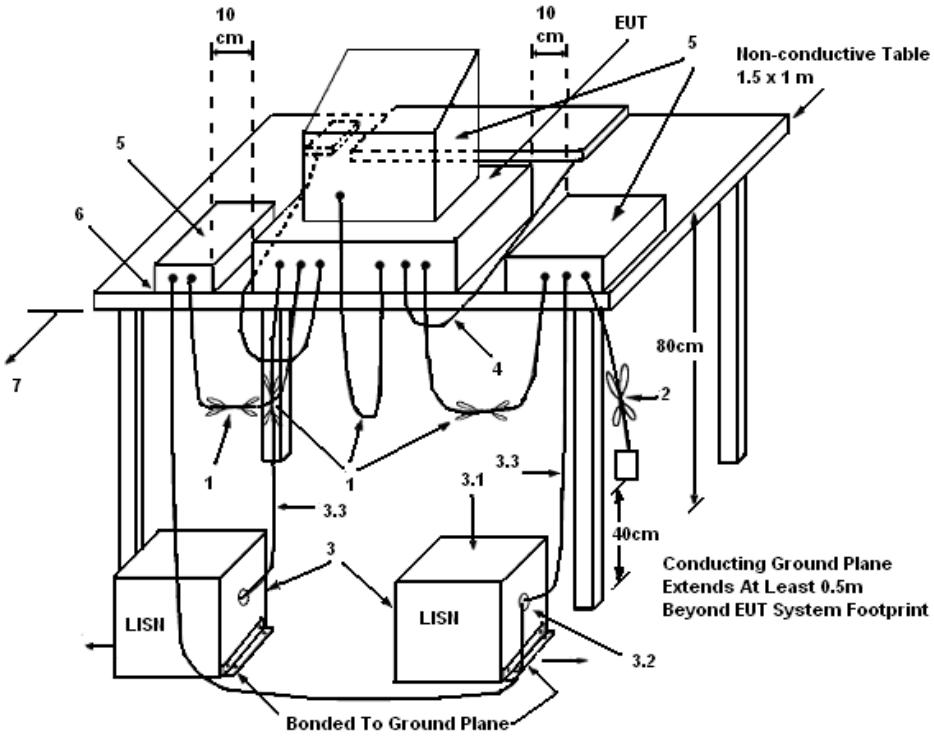
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

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

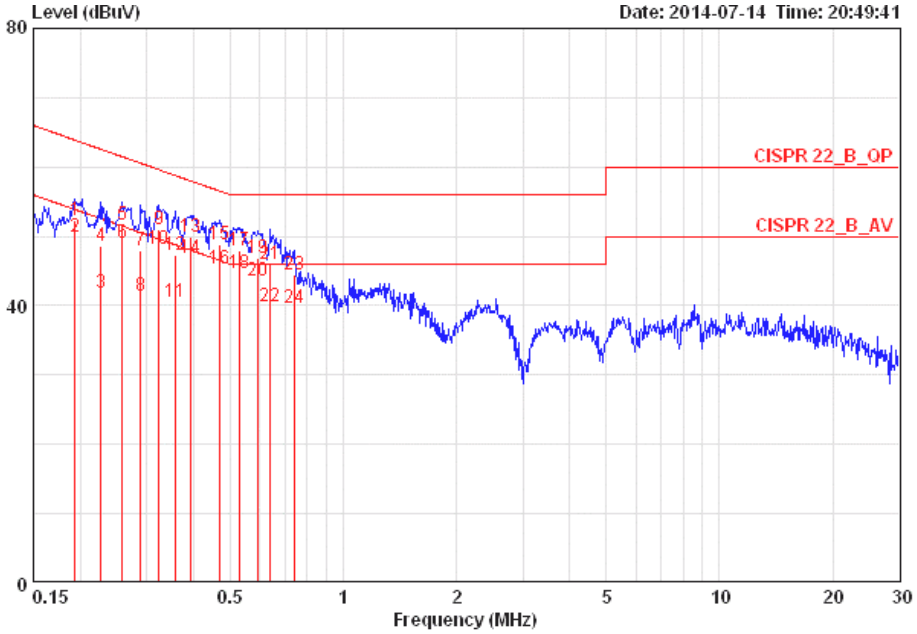
There is no deviation with the original standard.

4.1.6. EUT Operation during Test

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

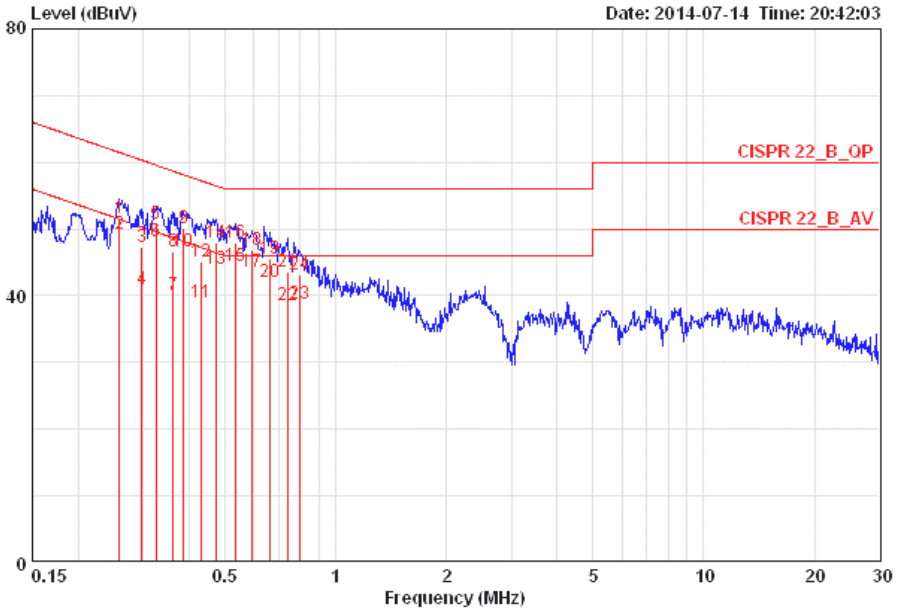
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	25°C	Humidity	55%
Test Engineer	Hank Yang	Phase	Line
Configuration	Normal Link		



	Freq	Level	Over Limit	Limit Line	LISN Factor	Read Level	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dB	dBuV	dB		
1	0.19344	52.24	-11.64	63.89	0.10	51.98	0.16	LINE	QP
2	0.19344	49.99	-3.89	53.89	0.10	49.73	0.16	LINE	AVERAGE
3	0.22676	41.83	-10.74	52.57	0.10	41.56	0.17	LINE	AVERAGE
4	0.22676	48.51	-14.06	62.57	0.10	48.24	0.17	LINE	QP
5	0.25888	51.61	-9.86	61.47	0.10	51.34	0.17	LINE	QP
6	0.25888	49.02	-2.45	51.47	0.10	48.75	0.17	LINE	AVERAGE
7	0.28935	47.87	-12.67	60.54	0.10	47.60	0.17	LINE	QP
8	0.28935	41.31	-9.23	50.54	0.10	41.04	0.17	LINE	AVERAGE
9	0.32340	50.97	-8.65	59.62	0.10	50.69	0.18	LINE	QP
10	0.32340	48.21	-1.41	49.62	0.10	47.93	0.18	LINE	AVERAGE
11	0.35765	40.59	-8.20	48.78	0.10	40.31	0.18	LINE	AVERAGE
12	0.35765	47.34	-11.45	58.78	0.10	47.06	0.18	LINE	QP
13	0.39344	50.02	-7.97	57.99	0.10	49.74	0.18	LINE	QP
14 @	0.39344	46.89	-1.10	47.99	0.10	46.61	0.18	LINE	AVERAGE
15	0.47110	48.74	-7.76	56.49	0.11	48.45	0.18	LINE	QP
16 @	0.47110	45.29	-1.21	46.49	0.11	45.00	0.18	LINE	AVERAGE
17	0.52934	47.90	-8.10	56.00	0.11	47.60	0.19	LINE	QP
18 @	0.52934	44.71	-1.29	46.00	0.11	44.41	0.19	LINE	AVERAGE
19	0.59478	46.85	-9.15	56.00	0.11	46.55	0.19	LINE	QP
20	0.59478	43.50	-2.50	46.00	0.11	43.20	0.19	LINE	AVERAGE
21	0.64058	46.10	-9.90	56.00	0.12	45.79	0.19	LINE	QP
22	0.64058	39.88	-6.12	46.00	0.12	39.57	0.19	LINE	AVERAGE
23	0.73910	44.41	-11.59	56.00	0.12	44.10	0.19	LINE	QP
24	0.73910	39.58	-6.42	46.00	0.12	39.27	0.19	LINE	AVERAGE

Temperature	25°C	Humidity	55%
Test Engineer	Hank Yang	Phase	Neutral
Configuration	Normal Link		



	Freq	Level	Over Limit	Limit Line	LISN Factor	Read Level	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dB	dBuV	dB		
1	0.25888	51.70	-9.77	61.47	0.09	51.44	0.17	NEUTRAL	QP
2	0.25888	49.20	-2.27	51.47	0.09	48.94	0.17	NEUTRAL	AVERAGE
3	0.29712	47.39	-12.93	60.32	0.09	47.13	0.17	NEUTRAL	QP
4	0.29712	41.05	-9.27	50.32	0.09	40.79	0.17	NEUTRAL	AVERAGE
5	0.32512	50.90	-8.68	59.57	0.09	50.63	0.18	NEUTRAL	QP
6 @	0.32512	48.27	-1.31	49.57	0.09	48.00	0.18	NEUTRAL	AVERAGE
7	0.36146	40.04	-8.66	48.69	0.09	39.77	0.18	NEUTRAL	AVERAGE
8	0.36146	46.59	-12.11	58.69	0.09	46.32	0.18	NEUTRAL	QP
9	0.38724	50.12	-8.00	58.12	0.09	49.85	0.18	NEUTRAL	QP
10	0.38724	46.72	-1.40	48.12	0.09	46.45	0.18	NEUTRAL	AVERAGE
11	0.43052	39.02	-8.22	47.24	0.09	38.75	0.18	NEUTRAL	AVERAGE
12	0.43052	45.15	-12.09	57.24	0.09	44.88	0.18	NEUTRAL	QP
13	0.47360	44.02	-2.43	46.45	0.10	43.74	0.18	NEUTRAL	AVERAGE
14	0.47360	47.89	-8.56	56.45	0.10	47.61	0.18	NEUTRAL	QP
15	0.53215	44.49	-1.51	46.00	0.10	44.20	0.19	NEUTRAL	AVERAGE
16	0.53215	47.97	-8.03	56.00	0.10	47.68	0.19	NEUTRAL	QP
17	0.59478	43.49	-2.51	46.00	0.10	43.20	0.19	NEUTRAL	AVERAGE
18	0.59478	46.82	-9.18	56.00	0.10	46.53	0.19	NEUTRAL	QP
19	0.66127	45.56	-10.44	56.00	0.11	45.26	0.19	NEUTRAL	QP
20	0.66127	41.99	-4.01	46.00	0.11	41.69	0.19	NEUTRAL	AVERAGE
21	0.74302	43.58	-12.42	56.00	0.11	43.28	0.19	NEUTRAL	QP
22	0.74302	38.48	-7.52	46.00	0.11	38.18	0.19	NEUTRAL	AVERAGE
23	0.80023	38.87	-7.13	46.00	0.11	38.56	0.20	NEUTRAL	AVERAGE
24	0.80023	43.18	-12.82	56.00	0.11	42.87	0.20	NEUTRAL	QP

Note:

Level = Read Level + LISN Factor + Cable Loss.

4.2. Maximum Conducted Output Power Measurement

4.2.1. Limit

For systems using digital modulation in the 2400-2483.5MHz, the limit for output power is 30dBm. The limited has to be reduced by the amount in dB that the gain of the antenna exceed 6dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

4.2.2. Measuring Instruments and Setting

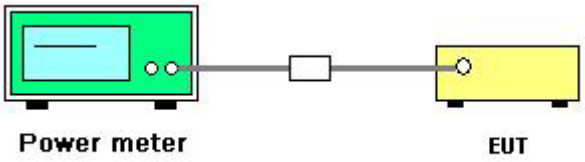
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

Power Meter Parameter	Setting
Bandwidth	50MHz bandwidth is greater than the EUT emission bandwidth
Detector	Average

4.2.3. Test Procedures

1. Test procedures refer KDB 558074 D01 v03r02 section 9.2.3.2.
2. This procedure provides an alternative for determining the RMS output power using a broadband RF average power meter with a thermocouple detector.

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 Maximum Conducted Output Power

Temperature	24°C	Humidity	60%
Test Engineer	Benson Peng	Configurations	802.15.4 Zigbee
Test Date	Jul. 09, 2014		

Configuration IEEE 802.15.4 Zigbee

Channel	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
11	2405 MHz	1.45	30.00	Complies
18	2440 MHz	0.90	30.00	Complies
26	2480 MHz	0.63	30.00	Complies

4.3. Power Spectral Density Measurement

4.3.1. Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

4.3.2. Measuring Instruments and Setting

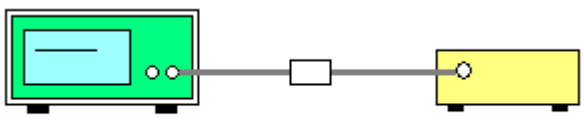
Please refer to section 5 of equipments list in this report. The following table is the setting of Spectrum Analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	5-30 % greater than the DTS channel bandwidth.
RBW	3 kHz ≤ RBW ≤ 100kHz
VBW	≥ 3 x RBW
Detector	Peak
Trace	Max Hold
Sweep Time	Auto couple

4.3.3. Test Procedures

1. Test was performed in accordance with KDB 558074 D01 v03r02 for Performing Compliance Measurements on Digital Transmission Systems (DTS) - section 10.2 Method PKPSD (peak PSD).
2. Use this procedure when the maximum conducted output power in the fundamental emission is used to demonstrate compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.
3. Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW (use of a greater number of measurement points than this minimum requirement is recommended).
4. Use the peak marker function to determine the maximum level in any 3 kHz band segment within the fundamental EBW.
5. The resulting PSD level must be ≤ 8 dBm.

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 Power Spectral Density

Temperature	24°C	Humidity	60%
Test Engineer	Benson Peng	Configurations	802.15.4 Zigbee

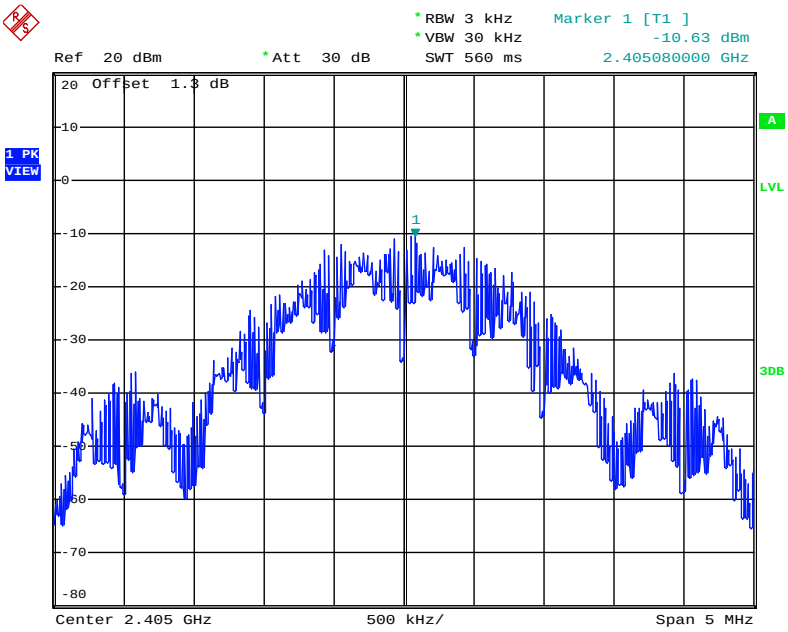
Configuration IEEE 802.15.4 Zigbee

Frequency	Power Density (dBm/3kHz)	Power Density Limit (dBm/3kHz)	Result
2405 MHz	-10.63	8.00	Complies
2440 MHz	-11.38	8.00	Complies
2480 MHz	-11.67	8.00	Complies

Note: All the test values were listed in the report.

For plots, only the channel with worse result was shown.

Power Density Plot on Configuration 802.15.4 Zigbee / 2405 MHz



4.4. 6dB Spectrum Bandwidth Measurement

4.4.1. Limit

For digital modulation systems, the minimum 6dB bandwidth shall be at least 500 kHz.

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.

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> 6dB Bandwidth
RBW	100kHz
VBW	≥ 3 x RBW
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

4.4.3. Test Procedures

For Radiated 6dB Bandwidth Measurement:

1. The transmitter was radiated to the spectrum analyzer in peak hold mode.
2. Test was performed in accordance with KDB 558074 D01 v03r02 for Performing Compliance Measurements on Digital Transmission Systems (DTS) - section 8.0 DTS bandwidth=> 8.1 Option 1.
3. Measured the spectrum width with power higher than 6dB below carrier.

4.4.4. Test Setup Layout

For Radiated 6dB Bandwidth Measurement:

This test setup layout is the same as that shown in section 4.5.4.

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. Test Result of 6dB Spectrum Bandwidth

Temperature	24°C	Humidity	60%
Test Engineer	Benson Peng	Configurations	802.15.4 Zigbee

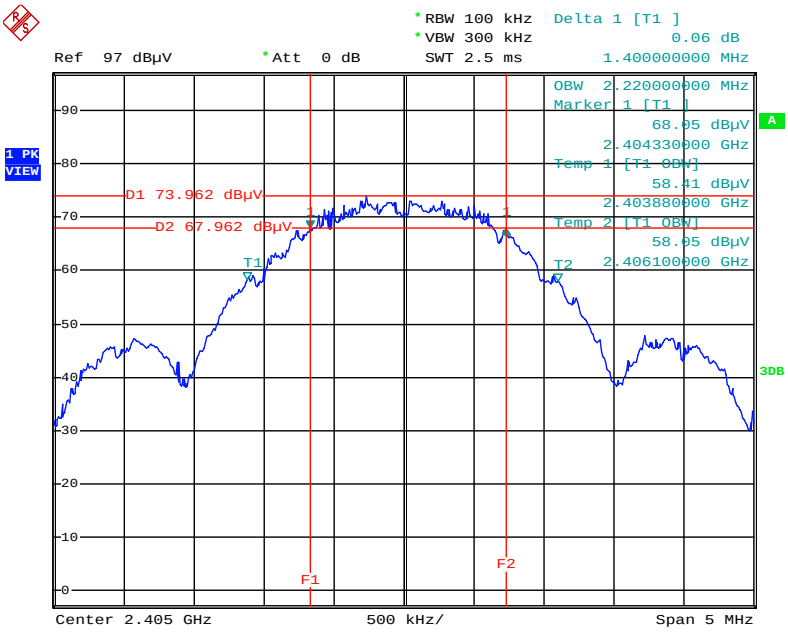
Configuration 802.15.4 Zigbee

Channel	Frequency	6dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Min. Limit (kHz)	Test Result
11	2405 MHz	1.40	2.22	500.00	Complies
18	2440 MHz	1.48	2.26	500.00	Complies
26	2480 MHz	1.57	2.31	500.00	Complies

Note: All the test values were listed in the report.

For plots, only the channel with worse result was shown.

6 dB Bandwidth Plot on Configuration 802.15.4 Zigbee / 2405 MHz



Date: 9.JUL.2014 19:28:55

4.5. Radiated Emissions Measurement

4.5.1. Limit

30dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 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 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, Please refer to section 3.10 for Average
RBW / VBW (Emission in non-restricted band)	100kHz / 300kHz for peak

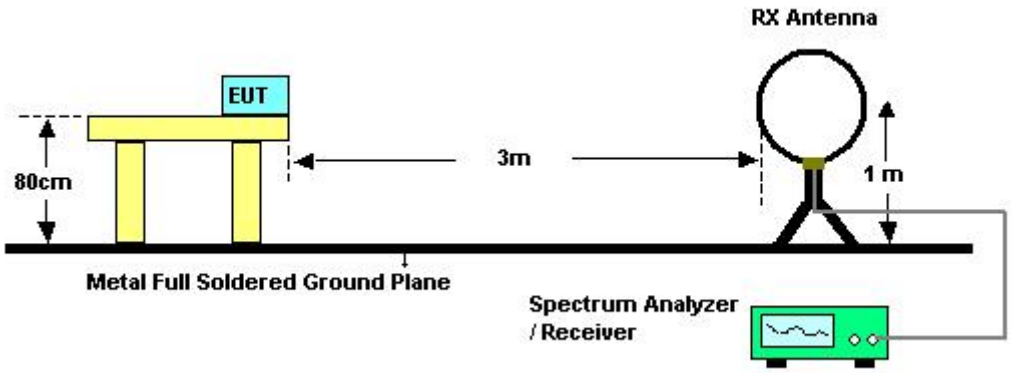
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.5.3. Test Procedures

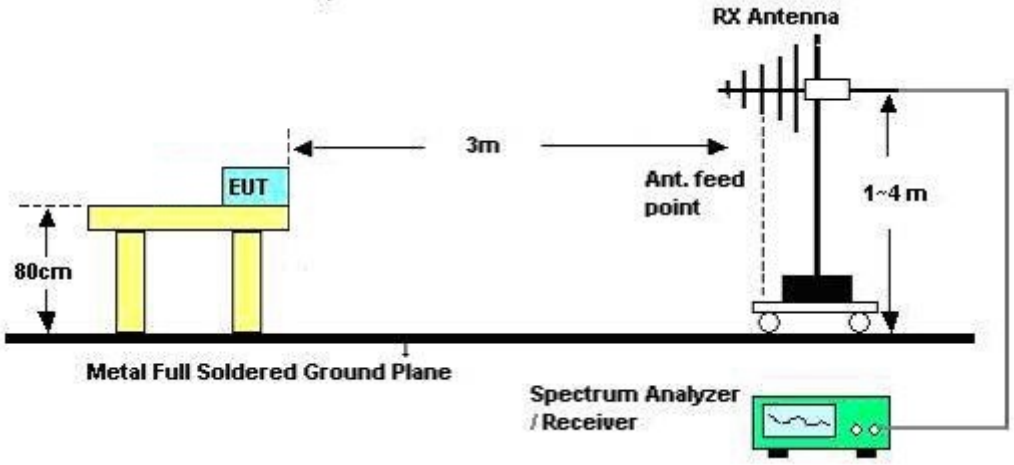
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting 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. 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 10Hz VBW for average reading in spectrum analyzer.
7. 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.
8. 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.
9. 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.

4.5.4. Test Setup Layout

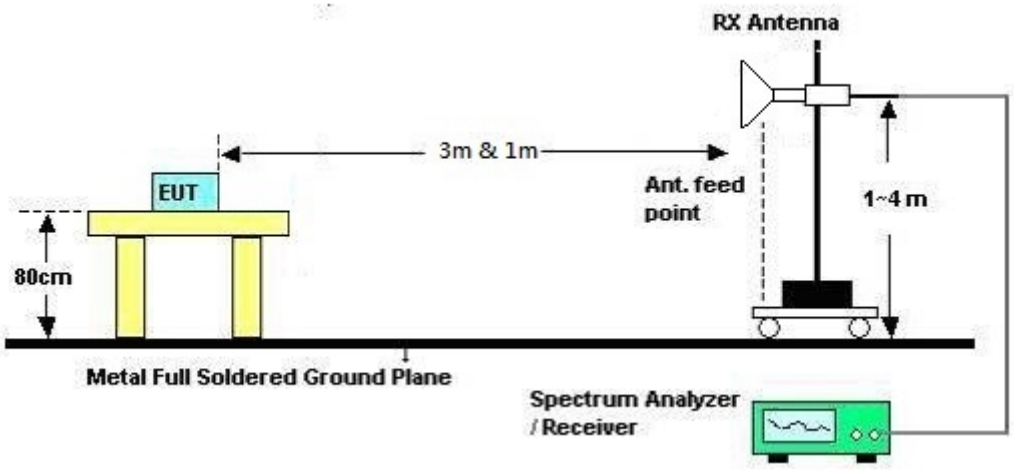
For Radiated Emissions: 9kHz ~30MHz



For Radiated Emissions: 30MHz~1GHz



For Radiated Emissions: Above 1GHz



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

Temperature	26°C	Humidity	68%
Test Engineer	YC Chen	Configurations	Normal Link
Test Date	Jul. 12, 2014	Test Mode	Mode 1

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

Note:

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

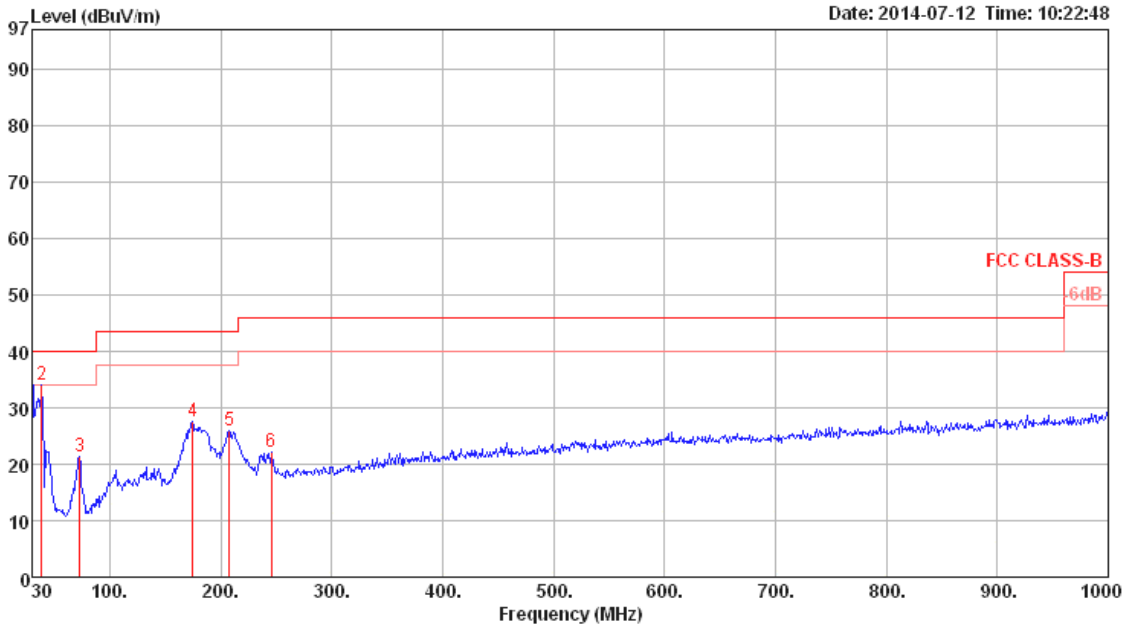
Distance extrapolation factor = 40 log (specific distance / test distance) (Db);

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

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

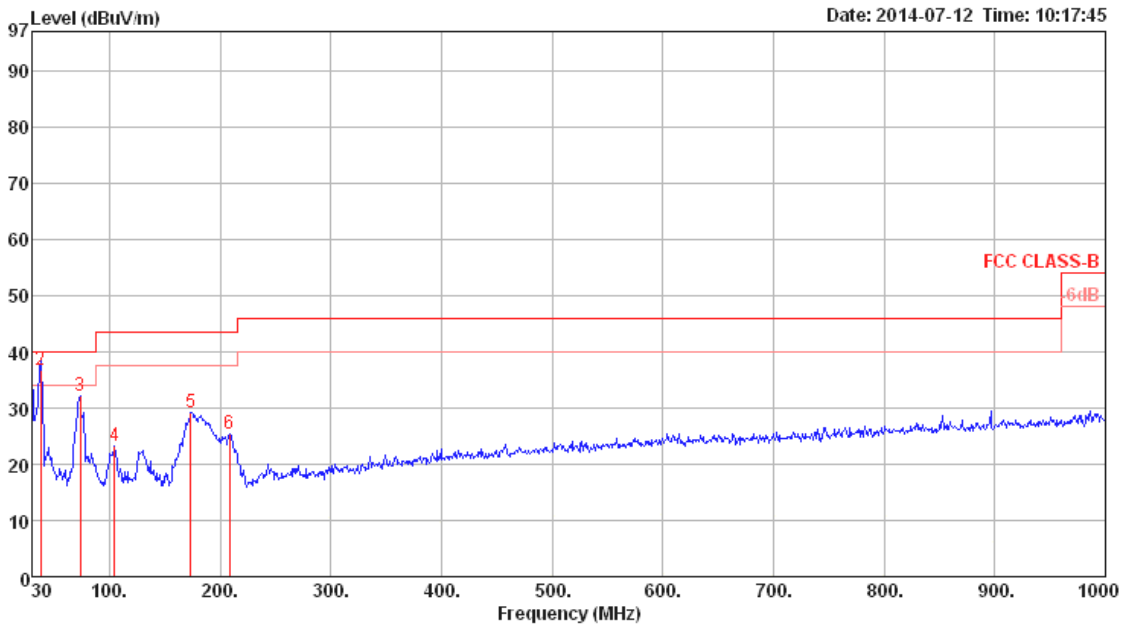
Temperature	26°C	Humidity	68%
Test Engineer	YC Chen	Configurations	Normal Link
Test Mode	Mode 1		

Horizontal



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	30.00	35.21	40.00	-4.79	43.64	0.61	18.76	27.80	Peak	100	0	HORIZONTAL
2	38.73	34.14	40.00	-5.86	47.57	0.67	13.70	27.80	Peak	100	0	HORIZONTAL
3	72.68	21.45	40.00	-18.55	41.43	0.95	6.78	27.71	Peak	100	0	HORIZONTAL
4	174.53	27.57	43.50	-15.93	40.16	1.52	13.12	27.23	Peak	100	0	HORIZONTAL
5	207.51	25.98	43.50	-17.52	41.76	1.68	9.62	27.08	Peak	100	0	HORIZONTAL
6	245.34	22.16	46.00	-23.84	34.99	1.77	12.41	27.01	Peak	100	0	HORIZONTAL

Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	30.00	33.10	40.00	-6.90	41.53	0.61	18.76	27.80	Peak	400	0	VERTICAL
2	37.76	36.69	40.00	-3.31	49.51	0.68	14.30	27.80	QP	400	0	VERTICAL
3	73.65	32.29	40.00	-7.71	52.23	0.94	6.83	27.71	Peak	400	0	VERTICAL
4	104.69	23.15	43.50	-20.35	38.16	1.20	11.36	27.57	Peak	400	0	VERTICAL
5	173.56	29.19	43.50	-14.31	41.86	1.51	13.05	27.23	Peak	400	0	VERTICAL
6	208.48	25.31	43.50	-18.19	41.02	1.68	9.69	27.08	Peak	400	0	VERTICAL

Note:

The amplitude of spurious emissions that 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.

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

Temperature	26°C	Humidity	68%
Test Engineer	YC Chen	Configurations	802.15.4 Zigbee CH 11
Test Date	Jul. 04, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	T/Pos	A/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		deg	cm	
1	4808.94	61.14	74.00	-12.86	59.01	4.20	32.52	34.59	Peak	325	129	HORIZONTAL
2	4808.99	50.66	54.00	-3.34	48.53	4.20	32.52	34.59	Average	325	129	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	T/Pos	A/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		deg	cm	
1	4808.94	53.79	74.00	-20.21	51.66	4.20	32.52	34.59	Peak	36	123	VERTICAL
2	4808.97	43.40	54.00	-10.60	41.27	4.20	32.52	34.59	Average	36	123	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	YC Chen	Configurations	802.15.4 Zigbee CH 18
Test Date	Jul. 04, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	T/Pos	A/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		deg	cm	
1	4878.97	45.97	54.00	-8.03	43.66	4.22	32.66	34.57	Average	338	114	HORIZONTAL
2	4881.03	56.04	74.00	-17.96	53.73	4.22	32.66	34.57	Peak	338	114	HORIZONTAL
3	7318.54	55.15	74.00	-18.85	47.54	5.35	37.09	34.83	Peak	45	129	HORIZONTAL
4	7321.20	44.18	54.00	-9.82	36.57	5.35	37.09	34.83	Average	45	129	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	T/Pos	A/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		deg	cm	
1	4878.97	39.99	54.00	-14.01	37.68	4.22	32.66	34.57	Average	45	174	VERTICAL
2	4880.93	50.61	74.00	-23.39	48.30	4.22	32.66	34.57	Peak	45	174	VERTICAL
3	7318.64	55.05	74.00	-18.95	47.44	5.35	37.09	34.83	Peak	347	101	VERTICAL
4	7318.69	44.08	54.00	-9.92	36.47	5.35	37.09	34.83	Average	347	101	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	YC Chen	Configurations	802.15.4 Zigbee CH 26
Test Date	Jul. 04, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	T/Pos	A/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		deg	cm	
1	4958.94	55.01	74.00	-18.99	52.49	4.23	32.83	34.54	Peak	315	125	HORIZONTAL
2	4960.95	44.85	54.00	-9.15	42.33	4.23	32.83	34.54	Average	315	125	HORIZONTAL
3	7438.45	53.46	74.00	-20.54	45.70	5.37	37.24	34.85	Peak	39	117	HORIZONTAL
4	7438.67	43.56	54.00	-10.44	35.80	5.37	37.24	34.85	Average	39	117	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	T/Pos	A/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		deg	cm	
1	4960.88	49.05	74.00	-24.95	46.53	4.23	32.83	34.54	Peak	123	128	VERTICAL
2	4960.93	38.63	54.00	-15.37	36.11	4.23	32.83	34.54	Average	123	128	VERTICAL
3	7438.61	43.59	54.00	-10.41	35.83	5.37	37.24	34.85	Average	21	108	VERTICAL
4	7441.38	54.14	74.00	-19.86	46.38	5.37	37.24	34.85	Peak	21	108	VERTICAL

Note:

The amplitude of spurious emissions that 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.

4.6. Emissions Measurement

4.6.1. Limit

30dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 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

4.6.2. 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, Please refer to section 3.10 for Average
RBW / VBW (30dBc in any 100 kHz bandwidth emission)	100 kHz / 300 kHz for Peak

4.6.3. Test Procedures

For Radiated band edges Measurement:

1. The test procedure is the same as section 4.5.3, only the frequency range investigated is limited to 100MHz around band edges.

For Radiated Out of Band Emission Measurement:

1. Test was performed in accordance with KDB 558074 D01 v03r02 for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 10.1 Unwanted Emissions into Non-Restricted Frequency Bands Measurement Procedure.
2. The radiated emission test is performed on each TX port of operating mode without summing or adding 10log (N) since the limit is relative emission limit.
   Only worst data of each operating mode is presented.

4.6.4. Test Setup Layout

For Radiated band edges Measurement:

This test setup layout is the same as that shown in section 4.5.4.

For Radiated Out of Band Emission Measurement:

This test setup layout is the same as that shown in section 4.5.4.

4.6.5. Test Deviation

There is no deviation with the original standard.

4.6.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.6.7. Test Result of Band Edge and Fundamental Emissions

Temperature	26°C	Humidity	68%
Test Engineer	YC Chen	Configurations	802.15.4 Zigbee CH 11, 18, 26
Test Date	Jul. 04, 2014		

Channel 11

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	T/Pos	A/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		deg	cm	
1	2389.04	56.62	74.00	-17.38	25.79	2.91	27.92	0.00	Peak	83	100	VERTICAL
2	2390.00	45.44	54.00	-8.56	14.61	2.91	27.92	0.00	Average	83	100	VERTICAL
3	2405.00	94.27			63.45	2.92	27.90	0.00	Average	83	100	VERTICAL
4	2405.64	98.25			67.43	2.92	27.90	0.00	Peak	83	100	VERTICAL

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

Channel 18

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	T/Pos	A/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		deg	cm	
1	2390.00	52.37	74.00	-21.63	21.54	2.91	27.92	0.00	Peak	35	100	VERTICAL
2	2390.00	42.08	54.00	-11.92	11.25	2.91	27.92	0.00	Average	35	100	VERTICAL
3	2440.00	93.58			62.78	2.94	27.86	0.00	Average	35	100	VERTICAL
4	2440.40	97.60			66.80	2.94	27.86	0.00	Peak	35	100	VERTICAL
5	2483.50	52.71	74.00	-21.29	21.93	2.96	27.82	0.00	Peak	35	100	VERTICAL
6	2483.50	42.02	54.00	-11.98	11.24	2.96	27.82	0.00	Average	35	100	VERTICAL

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

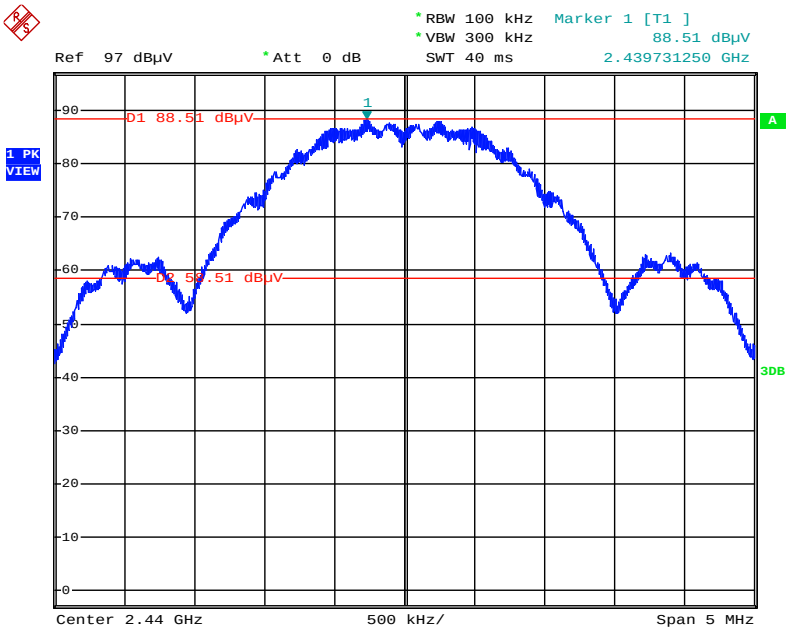
Channel 26

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	T/Pos	A/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		deg	cm	
1	2479.52	96.90			66.12	2.96	27.82	0.00	Peak	82	100	VERTICAL
2	2480.00	92.59			61.81	2.96	27.82	0.00	Average	82	100	VERTICAL
3	2483.50	64.57	74.00	-9.43	33.79	2.96	27.82	0.00	Peak	82	100	VERTICAL
4	2483.50	53.80	54.00	-0.20	23.02	2.96	27.82	0.00	Average	82	100	VERTICAL

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

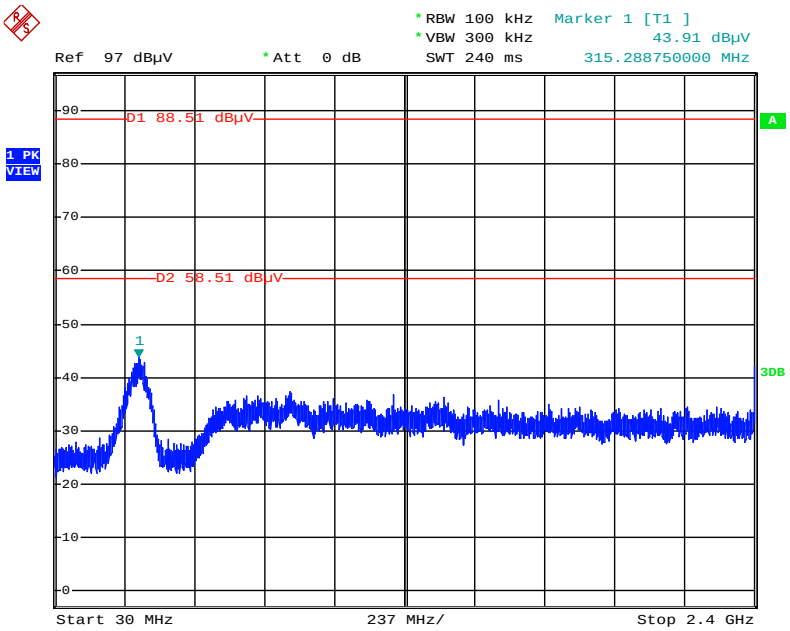
For Emission not in Restricted Band

Plot on Configuration 802.15.4 Zigbee / Reference Level



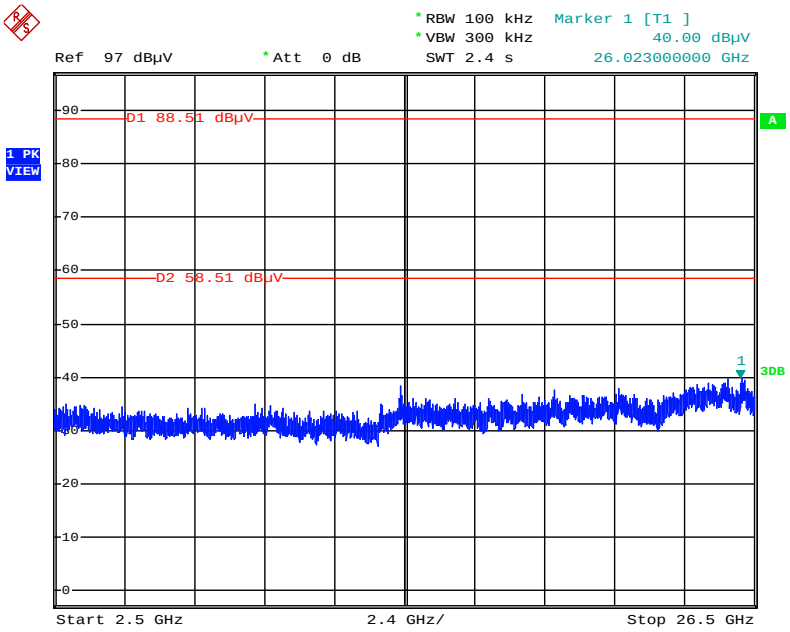
Date: 9.JUL.2014 22:56:02

Plot on Configuration 802.15.4 Zigbee / CH 11 / 30MHz~2400MHz (down 30dBc)



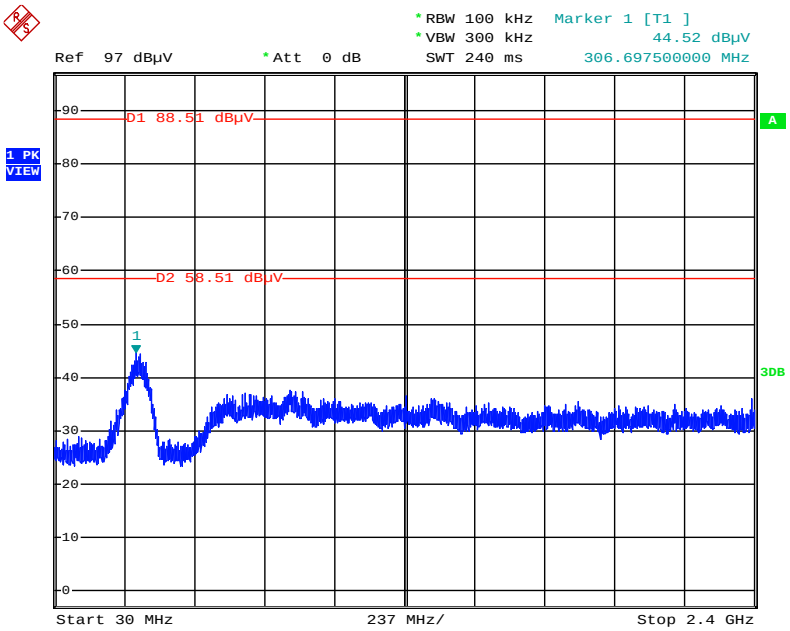
Date: 9.JUL.2014 22:57:08

Plot on Configuration 802.15.4 Zigbee / CH 11 / 2500MHz~26500MHz (down 30dBc)



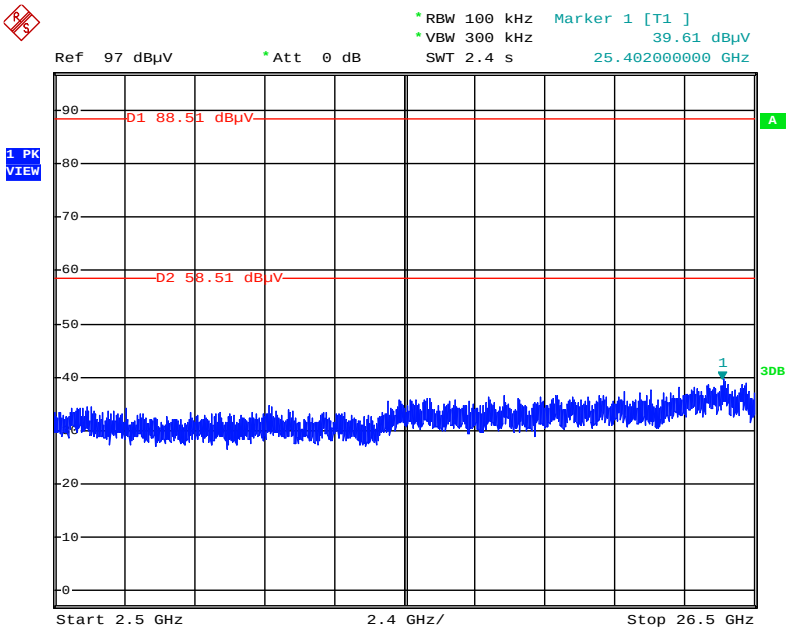
Date: 9.JUL.2014 22:58:06

Plot on Configuration 802.15.4 Zigbee / CH 26 / 30MHz~2400MHz (down 30dBc)



Date: 9.JUL.2014 23:00:14

Plot on Configuration 802.15.4 Zigbee / CH 26 / 2500MHz~26500MHz (down 30dBc)



Date: 9.JUL.2014 23:00:38

4.7. Antenna Requirements

4.7.1. 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.

4.7.2. 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
EMI Test Receiver	R&S	ESCS 30	100355	9 kHz ~ 2.75 GHz	Apr. 23, 2014	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150 kHz ~ 100 MHz	Nov. 23, 2013	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127478	9kHz ~ 30MHz	Nov. 11, 2013	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150 kHz ~ 30 MHz	Dec. 04, 2013	Conduction (CO01-CB)
Software	Audix	E3	5.410e	-	N.C.R.	Conduction (CO01-CB)
BILOG ANTENNA	Schaffner	CBL6112B	2928	30MHz ~ 2GHz	Dec. 27, 2013	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9 kHz - 30 MHz	Nov. 05, 2012*	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz~18GHz	Nov. 01, 2013	Radiation (03CH01-CB)
Horn Antenna	SCHWARZBEAK	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Dec. 17, 2013	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Nov. 12, 2013	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Dec. 16, 2013	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	923365	26GHz ~ 40GHz	Oct. 23, 2013	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSP40	100019	9kHz~40GHz	Dec. 02, 2013	Radiation (03CH01-CB)
EMI Test Receiver	Agilent	N9038A	MY52260123	9kHz ~ 8GHz	Dec. 12, 2013	Radiation (03CH01-CB)
Turn Table	INN CO	CO 2000	N/A	0 ~ 360 degree	N.C.R.	Radiation (03CH01-CB)
Antenna Mast	INN CO	CO2000	N/A	1 m - 4 m	N.C.R.	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-1	N/A	30 MHz - 1 GHz	Nov. 17, 2013	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-1	N/A	1 GHz – 26.5 GHz	Nov. 17, 2013	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-2	N/A	1 GHz – 26.5 GHz	Nov. 17, 2013	Radiation (03CH01-CB)
Signal analyzer	R&S	FSV40	100979	9kHz~40GHz	Nov. 29, 2013	Conducted (TH01-CB)
RF Power Divider	Woken	2 Way	0120A02056002D	2GHz ~ 18GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Power Divider	Woken	3 Way	MDC2366	2GHz ~ 18GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Power Divider	Woken	4 Way	0120A04056002D	2GHz ~ 18GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-7	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-8	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-9	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
RF Cable-high	Woken	High Cable-10	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-11	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)
Power Sensor	Anritsu	MA2411B	0917223	300MHz~40GHz	Sep. 18, 2013	Conducted (TH01-CB)
Power Meter	Anritsu	ML2495A	1035008	300MHz~40GHz	Sep. 18, 2013	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)	2.4 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%