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FCC RADIO TEST REPORT

Applicant's company	**SunPower Corporation**
Applicant Address	1414 Harbour Way South, Richmond, CA 94804, USA
FCC ID	**YAW513407**
Manufacturer's company (1)	**ZyXEL Communications Corp.**
Manufacturer Address	No.6, Chuangxin 2nd Rd., Baoshan Township, Hsinchu County 308, Taiwan (R.O.C.)
Manufacturer's company (2)	**MitraStar Technology Corporation**
Manufacturer Address	No. 6, Innovation Rd II, Hsinchu Science Park, Hsinchu 30076, Taiwan

Product Name	SunPower Monitoring System with PVS5c
Brand Name	SUNPOWER
Model No.	PVS5c
Test Rule	47 CFR FCC Part 15 Subpart C § 15.247
Test Freq. Range	2400~2483.5 MHz
Received Date	Oct. 16, 2015
Final Test Date	Nov. 19, 2015
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 C63.10-2013**, **47 CFR FCC Part 15 Subpart C** and **KDB558074 D01 v03r03**.

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

Testing Laboratory
1190

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History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR5O1212AB	Rev. 01	Initial issue of report	Dec. 01, 2015

1. VERIFICATION OF COMPLIANCE

Product Name	:	SunPower Monitoring System with PVS5c
Brand Name	:	SUNPOWER
Model No.	:	PVS5c
Applicant	:	SunPower Corporation
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 Oct. 16, 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.

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	17.52 dB
4.2	15.247(b)(3)	Maximum Conducted Output Power	Complies	8.11 dB
4.3	15.247(e)	Power Spectral Density	Complies	1.54 dB
4.4	15.247(a)(2)	6dB Spectrum Bandwidth	Complies	-
4.5	15.247(d)	Radiated Emissions	Complies	0.09 dB
4.6	15.247(d)	Band Edge Emissions	Complies	0.08 dB
4.7	15.203	Antenna Requirements	Complies	-

3. GENERAL INFORMATION

3.1. Product Details

Items	Description
Power Type	Internal power supply
Modulation	DSSS (O-QPSK)
Data Rate (Mbps)	DSSS (250kbps)
Frequency Range	2400~2483.5 MHz
Channel Number	15
Channel Band Width (99%)	For Zigbee module 1: 2.64 MHz For Zigbee module 2: 2.66 MHz
Maximum Conducted Output Power	For Zigbee module 1: 21.89 dBm For Zigbee module 2: 21.79 dBm
Carrier Frequencies	Please refer to section 3.6
Antenna	Please refer to section 3.5

3.2. Accessories

Description	
Power cord	2.0 meter, non-shielded, w/o ferrite core

3.3. Table for Zigbee Module

The EUT has two Zigbee modules and their information in the following table:

Brand Name	Model No.	Remark
Ember	EM357	Zigbee module 1
Ember	EM357	Zigbee module 2

3.4. Table for WWAN Module

The EUT has two WWAN modules and their information in the following table:

Brand Name	Model No.	FCC ID	Bands	Remark
Telit	HE910-D	RI7HE910	GSM 850 GSM 1900 WCDMA Band 2 WCDMA Band 4 WCDMA Band 5	WWAN module 1
QUECTEL	UC20GA-128-NCH-STD	XMR201312UC20	WCDMA Band 2 WCDMA Band 5	WWAN module 2

3.5. Table for Filed Antenna

Ant.	Brand	Model Name	Hong Lin P/N	Type	Connector	Gain (dBi)
1	Hong Lin	IGW-2220OUZ-A2 Zigbee-1	290-10333	PCB	I-PEX	2.02
2	Hong Lin	IGW-2220OUZ-A2 Zigbee-2	290-10334	PCB	I-PEX	2.89

Note: The EUT has two antennas for Zigbee function.

For Zigbee module 1 (1TX, 1RX):

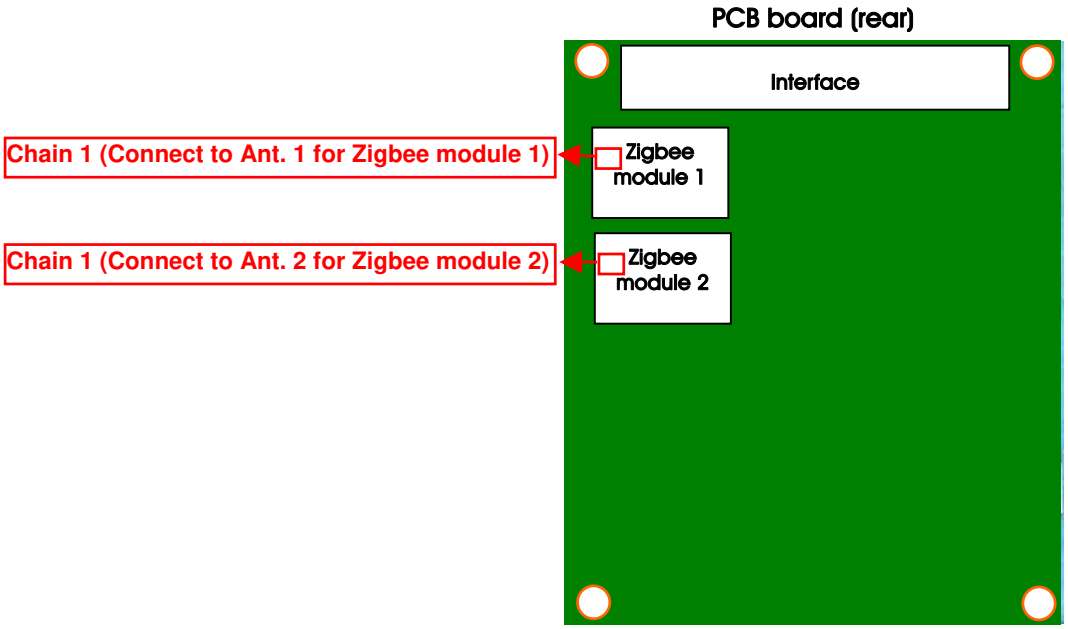
Only Ant. 1 can be use as transmitting/receiving antenna.

Only Chain 1 can be used as transmitting/receiving functions.

For Zigbee module 2 (1TX, 1RX):

Only Ant. 2 can be use as transmitting/receiving antenna.

Only Chain 1 can be used as transmitting/receiving functions.



3.6. Table for Carrier Frequencies

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
2400~2483.5 MHz	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	-	-

3.7. 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	Chain
AC Power Line Conducted Emissions	CTX	-	-	-
Maximum Conducted Output Power	TX Mode	250 kbps	11/18/25	1
Power Spectral Density 6dB Spectrum Bandwidth	TX Mode	250 kbps	11/18/25	1
Radiated Emissions 9kHz~1GHz	CTX	-	-	-
Radiated Emissions 1GHz~10th Harmonic	TX Mode	250 kbps	11/18/25	1
Band Edge Emissions	TX Mode	250 kbps	11/18/25	1

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

2. All the specification of test configurations and test modes has been defined as the user usage.

The following test modes were performed for all tests:

For Co-location MPE test:

The EUT could be applied with 2.4GHz WLAN function, ZigBee function and WWAN function; therefore Co-location Maximum Permissible Exposure (Please refer to FA5O1212) test is added for simultaneously transmit between 2.4GHz WLAN function, ZigBee function and WWAN function.

The transmit simultaneously mode:

1. 2.4GHz WLAN + ZigBee (Zigbee module 1) + ZigBee (Zigbee module 2) + WCDMA (WWAN module 1)
2. 2.4GHz WLAN + ZigBee (Zigbee module 1) + ZigBee (Zigbee module 2) + WCDMA (WWAN module 2)

3.8. 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).

3.9. Table for Supporting Units

For Test Site No: 03CH01-CB and TH01-CB

Support Unit	Brand	Model	FCC ID
NB	DELL	E4300	DoC

For Test Site No: CO01-CB

Support Unit	Brand	Model	FCC ID
NB	DELL	E6430	DoC
NB	DELL	E6430	DoC
NB	DELL	E6430	DoC
SIM Card	R&S	NA	N/A
Flash disk	Transcend	JetFlash-700	DoC
Flash disk	Transcend	JetFlash-700	DoC

3.10. 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

For Zigbee module 1:

Test Software Version	DOS		
Frequency	2405 MHz	2440 MHz	2475 MHz
IEEE 802.15.4 ZigBee	0	-5	-9

For Zigbee module 2:

Test Software Version	DOS		
Frequency	2405 MHz	2440 MHz	2475 MHz
IEEE 802.15.4 ZigBee	0	-2	-5

3.11. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

3.12. Duty Cycle

For Zigbee module 1:

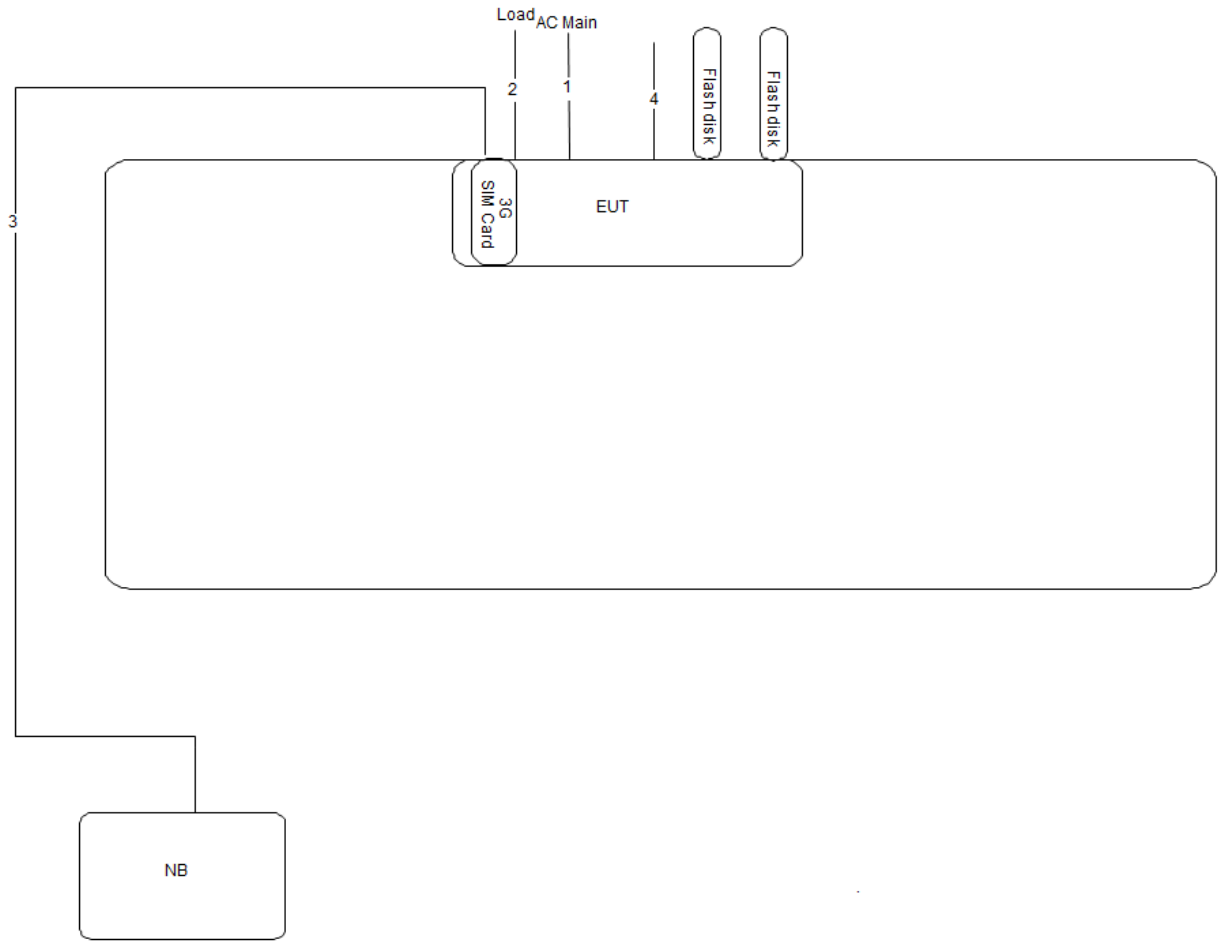
On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
1	1	100.00	0.00	0.01

For Zigbee module 2:

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

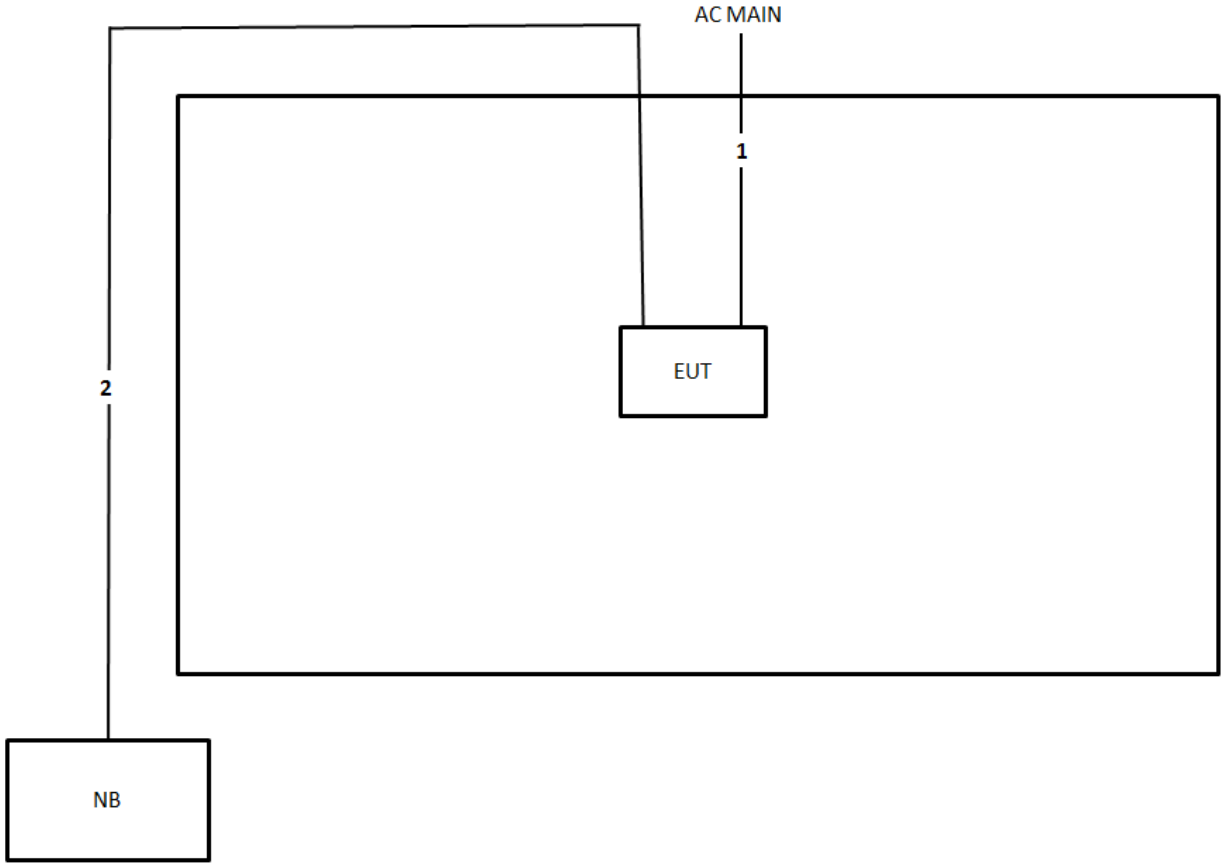
3.13. Test Configurations

3.13.1. AC Power Line Conduction Emissions Test Configuration



Item	Connection	Shielded	Length
1	Power cord	No	2m
2	RJ-45 cable	No	1.5m
3	RJ-45 cable	No	10m
4	RS-485 cable*3	No	3m

3.13.2. Radiation Emissions Test Configuration



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

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

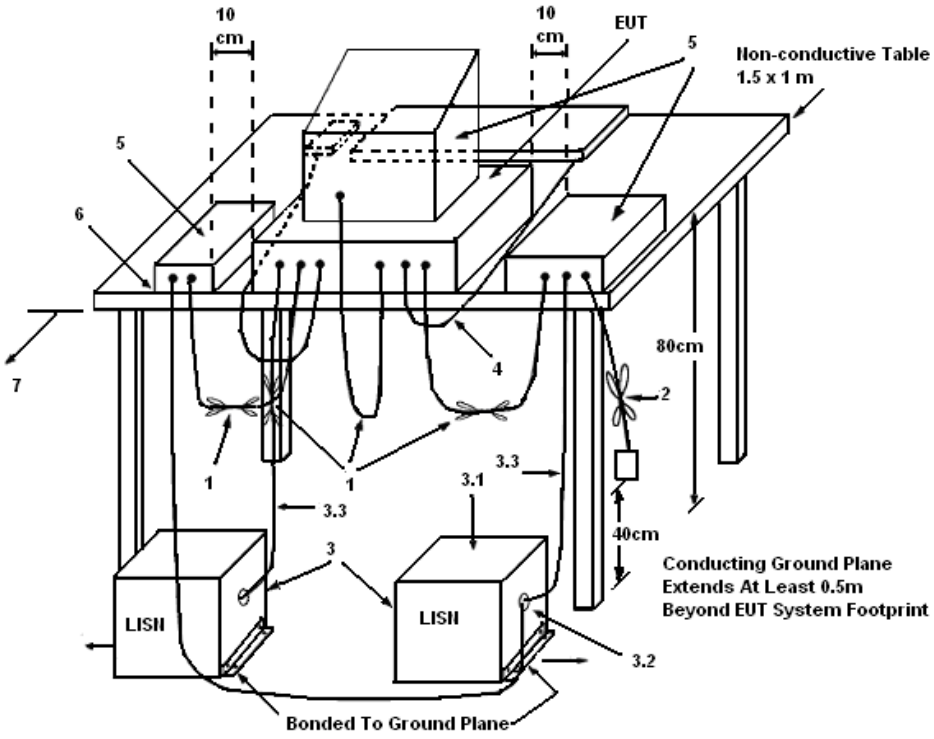
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

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

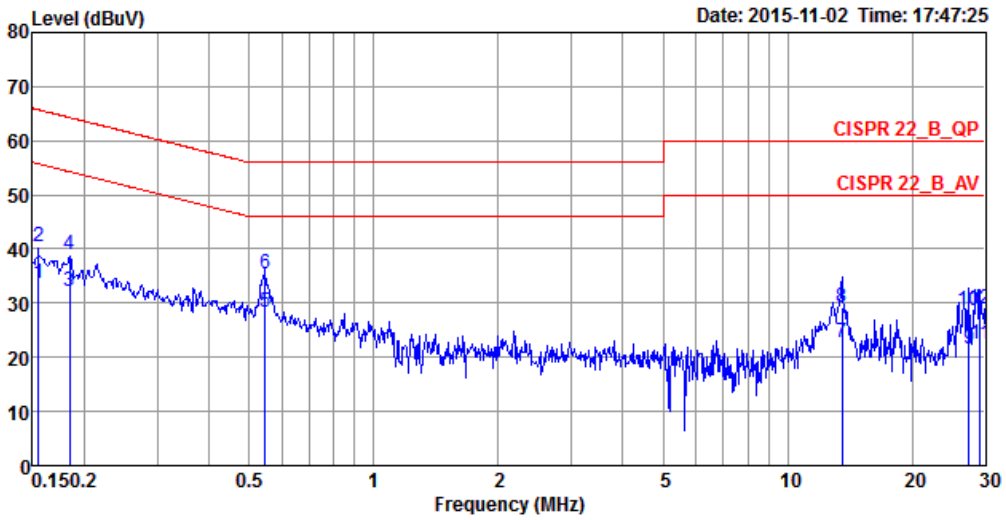
There is no deviation with the original standard.

4.1.6. EUT Operation during Test

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

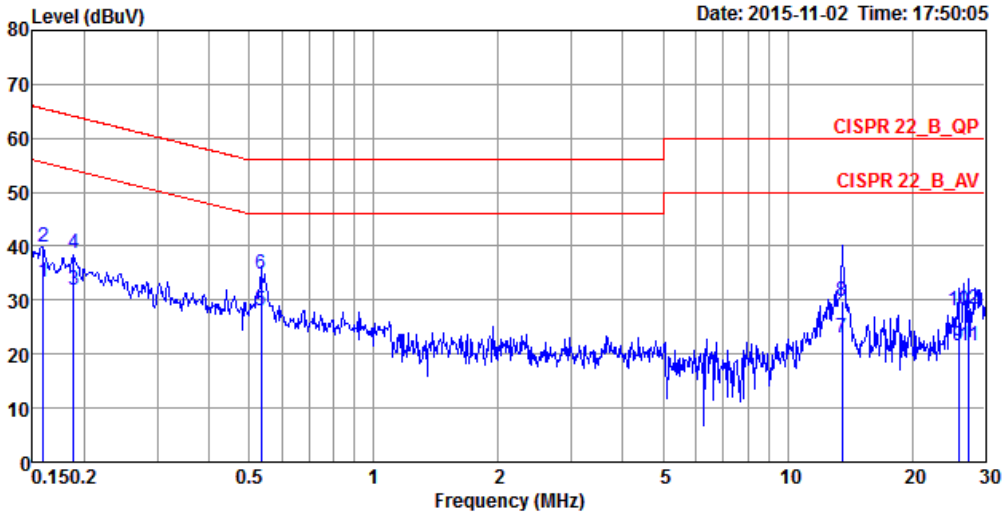
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	23°C	Humidity	62%
Test Engineer	Ryo Fan	Phase	Line
Configuration	CTX		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.1548	33.72	-22.02	55.74	23.57	9.98	0.17	Average	LINE
2	0.1548	40.35	-25.39	65.74	30.20	9.98	0.17	QP	LINE
3	0.1844	32.24	-22.04	54.28	22.08	9.97	0.19	Average	LINE
4	0.1844	38.91	-25.37	64.28	28.75	9.97	0.19	QP	LINE
5	0.5464	28.48	-17.52	46.00	18.30	9.98	0.20	Average	LINE
6	0.5464	35.34	-20.66	56.00	25.16	9.98	0.20	QP	LINE
7	13.5509	22.67	-27.33	50.00	12.00	10.25	0.42	Average	LINE
8	13.5509	29.15	-30.85	60.00	18.48	10.25	0.42	QP	LINE
9	27.4160	21.52	-28.48	50.00	10.65	10.32	0.55	Average	LINE
10	27.4160	28.56	-31.44	60.00	17.69	10.32	0.55	QP	LINE
11	29.2157	22.42	-27.58	50.00	11.52	10.33	0.57	Average	LINE
12	29.2157	29.03	-30.97	60.00	18.13	10.33	0.57	QP	LINE

Temperature	23°C	Humidity	62%
Test Engineer	Ryo Fan	Phase	Neutral
Configuration	CTX		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.1590	33.26	-22.26	55.52	23.11	9.98	0.17	Average	NEUTRAL
2	0.1590	39.99	-25.53	65.52	29.84	9.98	0.17	QP	NEUTRAL
3	0.1884	31.92	-22.19	54.11	21.76	9.97	0.19	Average	NEUTRAL
4	0.1884	38.68	-25.43	64.11	28.52	9.97	0.19	QP	NEUTRAL
5	0.5350	28.16	-17.84	46.00	17.96	10.00	0.20	Average	NEUTRAL
6	0.5350	34.86	-21.14	56.00	24.66	10.00	0.20	QP	NEUTRAL
7	13.5509	23.17	-26.83	50.00	12.53	10.22	0.42	Average	NEUTRAL
8	13.5509	29.84	-30.16	60.00	19.20	10.22	0.42	QP	NEUTRAL
9	25.8638	21.45	-28.55	50.00	10.58	10.34	0.53	Average	NEUTRAL
10	25.8638	28.18	-31.82	60.00	17.31	10.34	0.53	QP	NEUTRAL
11	27.4160	21.63	-28.37	50.00	10.73	10.35	0.55	Average	NEUTRAL
12	27.4160	28.31	-31.69	60.00	17.41	10.35	0.55	QP	NEUTRAL

Note:

Level = Read Level + LISN Factor + Cable Loss.

4.2. Maximum Conducted Output Power Measurement

4.2.1. Limit

The limit for output power is 30dBm.

4.2.2. Measuring Instruments and Setting

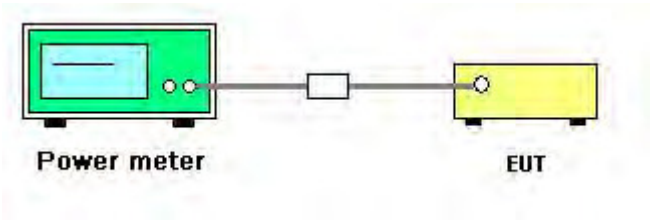
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

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 KDB558074 D01 v03r03 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	25°C	Humidity	45%
Test Engineer	Eddie Weng	Configurations	802.15.4 Zigbee
Test Date	Nov. 13, 2015		

Configuration IEEE 802.15.4 Zigbee

For Zigbee module 1:

Channel	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
11	2405 MHz	21.89	30.00	Complies
18	2440 MHz	19.67	30.00	Complies
25	2475 MHz	14.22	30.00	Complies

For Zigbee module 2:

Channel	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
11	2405 MHz	21.79	30.00	Complies
18	2440 MHz	20.76	30.00	Complies
25	2475 MHz	16.51	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

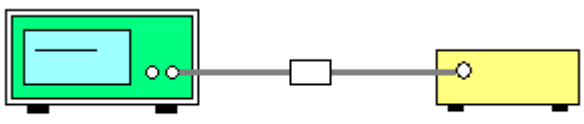
Please refer to section 5 of equipments list in this report. The following table is the setting of Spectrum Analyzer.

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 KDB558074 D01 v03r03 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	25°C	Humidity	45%
Test Engineer	Eddie Weng	Configurations	802.15.4 Zigbee

Configuration IEEE 802.15.4 Zigbee

For Zigbee module 1:

Frequency	Power Density (dBm/3kHz)	Power Density Limit (dBm/3kHz)	Result
2405 MHz	6.46	8.00	Complies
2440 MHz	4.92	8.00	Complies
2475 MHz	-0.88	8.00	Complies

For Zigbee module 2:

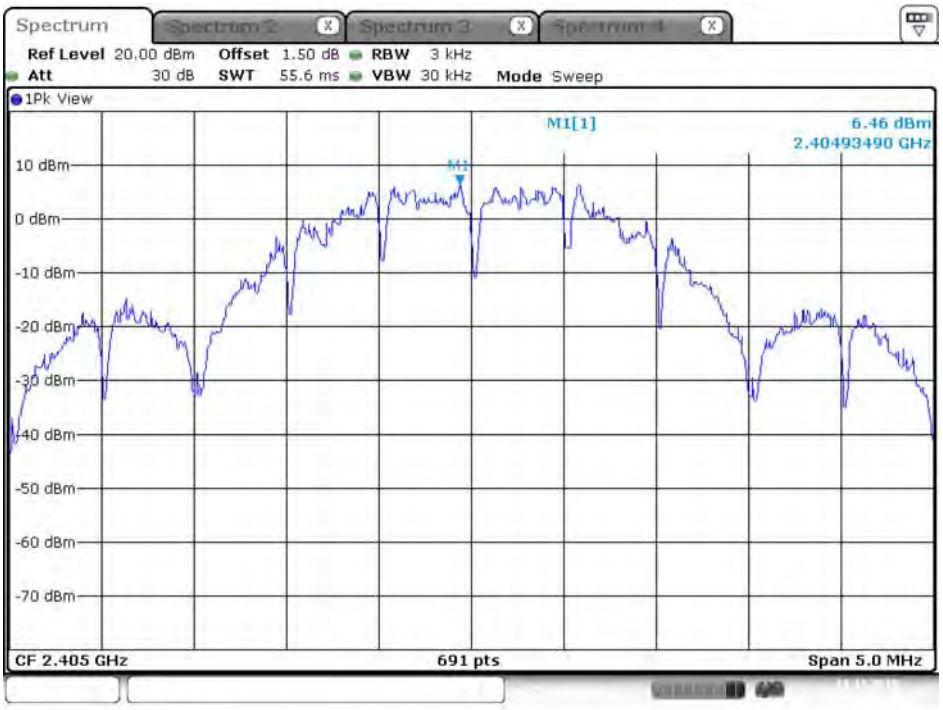
Frequency	Power Density (dBm/3kHz)	Power Density Limit (dBm/3kHz)	Result
2405 MHz	6.11	8.00	Complies
2440 MHz	5.65	8.00	Complies
2475 MHz	1.90	8.00	Complies

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

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

For Zigbee module 1:

Power Density Plot on Configuration 802.15.4 Zigbee / 2405 MHz



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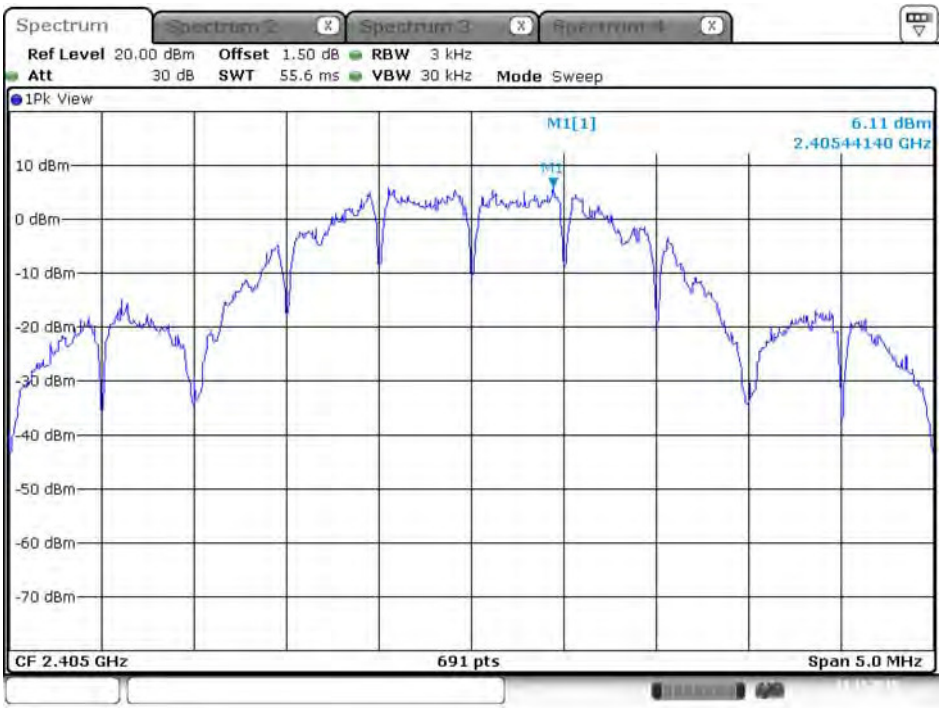
For Zigbee module 2:

Power Density Plot on Configuration 802.15.4 Zigbee / 2405 MHz



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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.

6dB Spectrum Bandwidth	
Spectrum Parameters	**Setting**
Attenuation	Auto
Span Frequency	> 6dB Bandwidth
RBW	100kHz
VBW	≥ 3 x RBW
Detector	Peak
Trace	Max Hold
Sweep Time	Auto
99% Occupied Bandwidth	
Spectrum Parameters	**Setting**
Span	1.5 times to 5.0 times the OBW
RBW	1 % to 5 % of the OBW
VBW	≥ 3 x RBW
Detector	Peak
Trace	Max Hold

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 KDB558074 D01 v03r03 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	25℃	Humidity	45%
Test Engineer	Eddie Weng	Configurations	802.15.4 Zigbee

Configuration 802.15.4 Zigbee

For Zigbee module 1:

Channel	Frequency	6dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Min. Limit (kHz)	Test Result
11	2405 MHz	1.18	2.57	500.00	Complies
18	2440 MHz	1.16	2.47	500.00	Complies
25	2475 MHz	1.59	2.64	500.00	Complies

For Zigbee module 2:

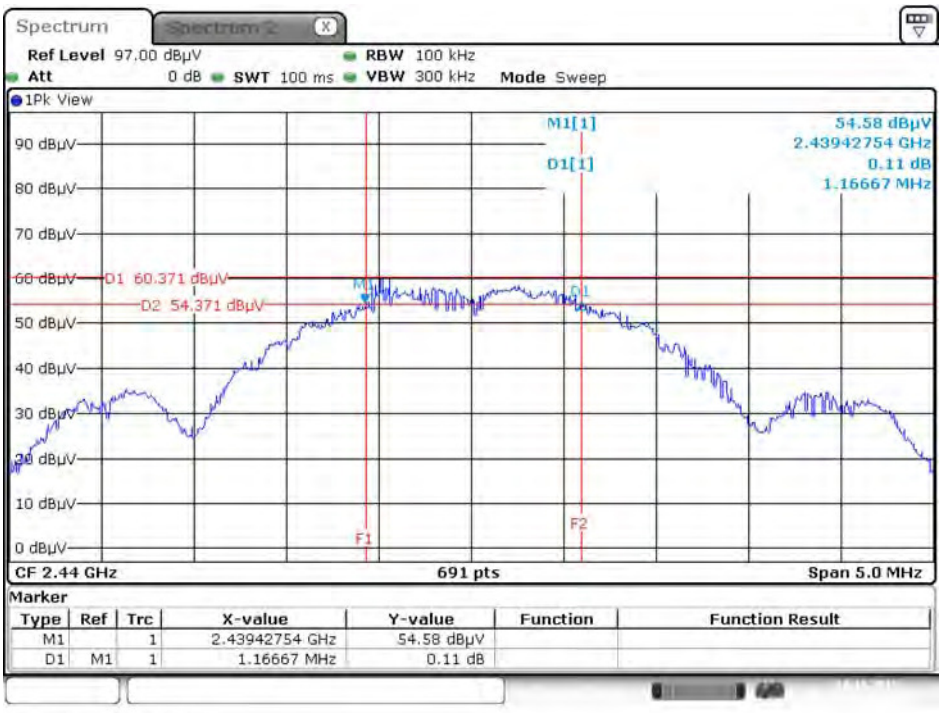
Channel	Frequency	6dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Min. Limit (kHz)	Test Result
11	2405 MHz	1.18	2.56	500.00	Complies
18	2440 MHz	1.18	2.51	500.00	Complies
25	2475 MHz	1.58	2.66	500.00	Complies

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

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

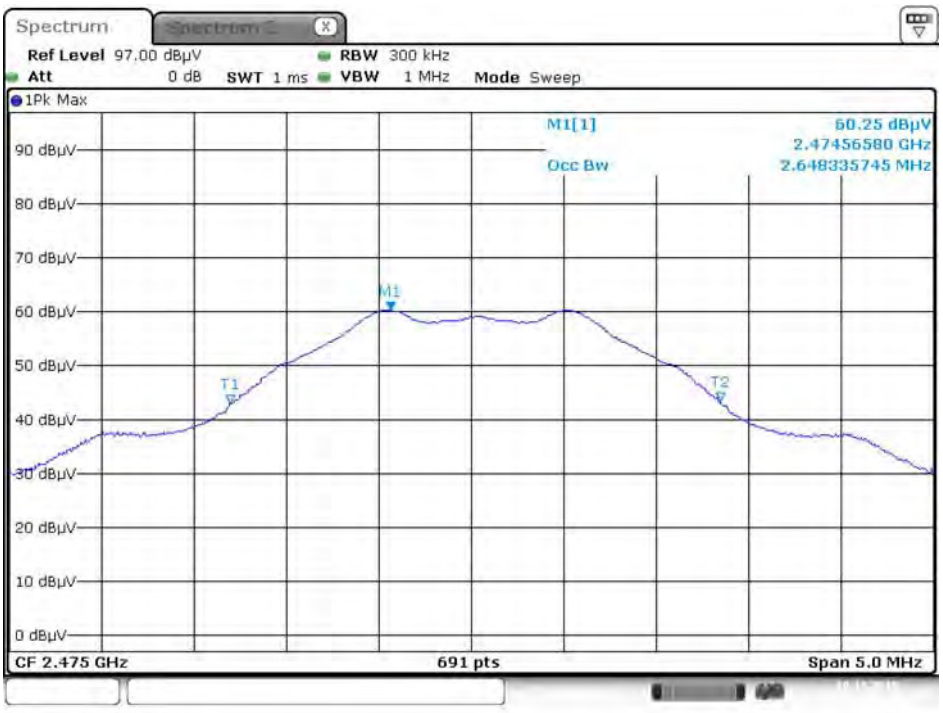
For Zigbee module 1:

6 dB Bandwidth Plot on Configuration 802.15.4 Zigbee / 2440 MHz



Date: 19.NOV.2015 18:58:38

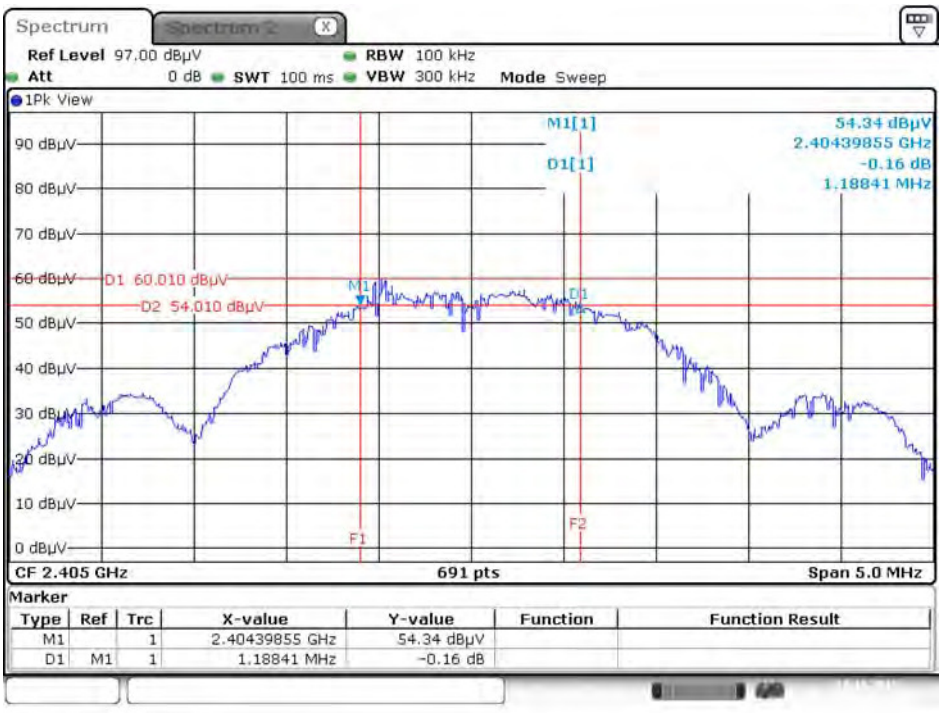
99% Occupied Bandwidth Plot on Configuration 802.15.4 Zigbee / 2475 MHz



Date: 19.NOV.2015 19:03:28

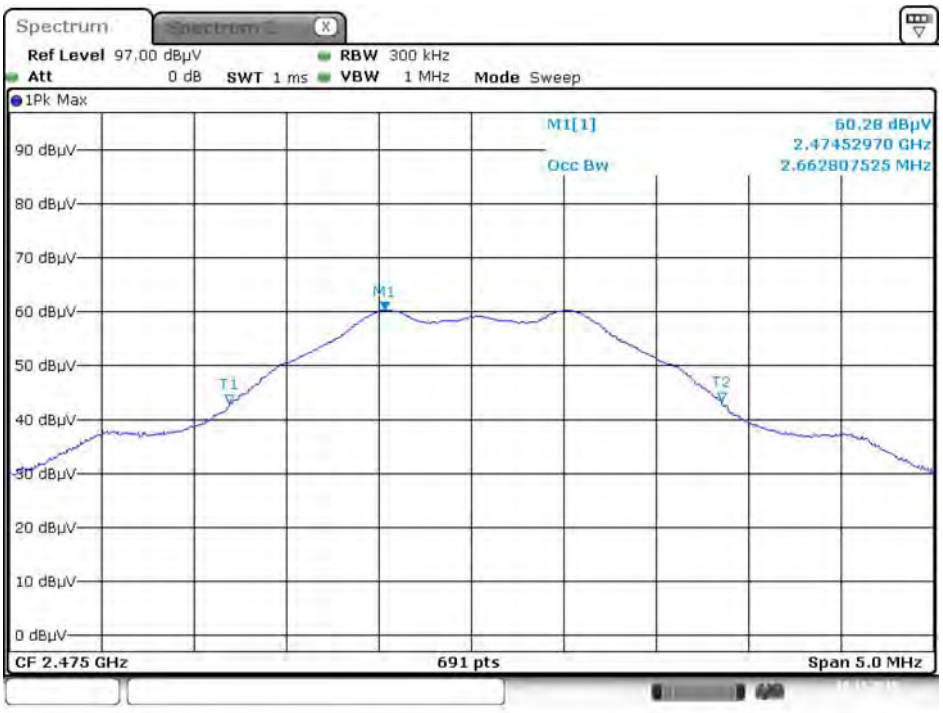
For Zigbee module 2:

6 dB Bandwidth Plot on Configuration 802.15.4 Zigbee / 2405 MHz



Date: 19.NOV.2015 19:01:34

99% Occupied Bandwidth Plot on Configuration 802.15.4 Zigbee / 2475 MHz



Date: 19.NOV.2015 19:03:34

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, 1MHz / 1/T for Average
RBW / VBW (Emission in non-restricted band)	100kHz / 300kHz for peak

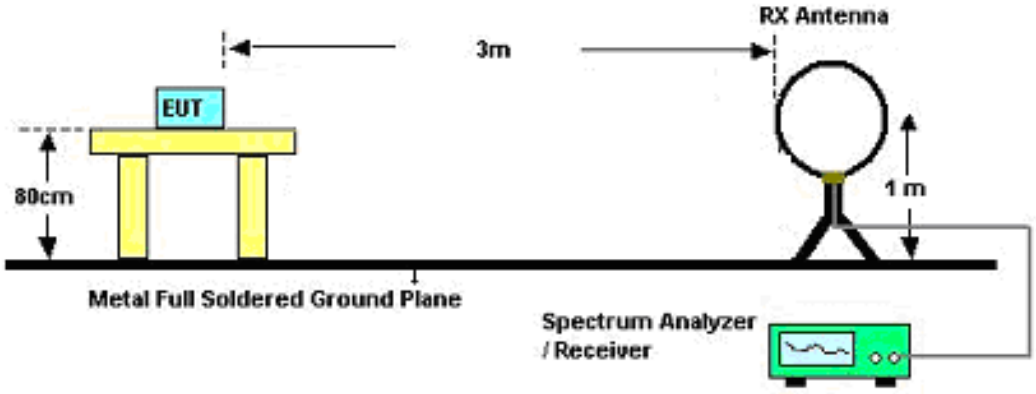
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.5.3. Test Procedures

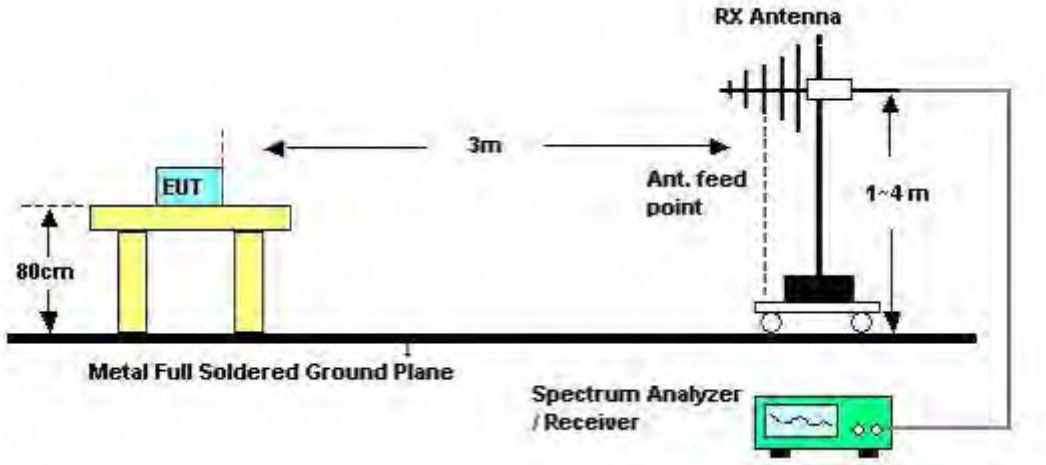
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 1m & 3m far away from the turntable.
2. Power on the EUT and all the supporting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

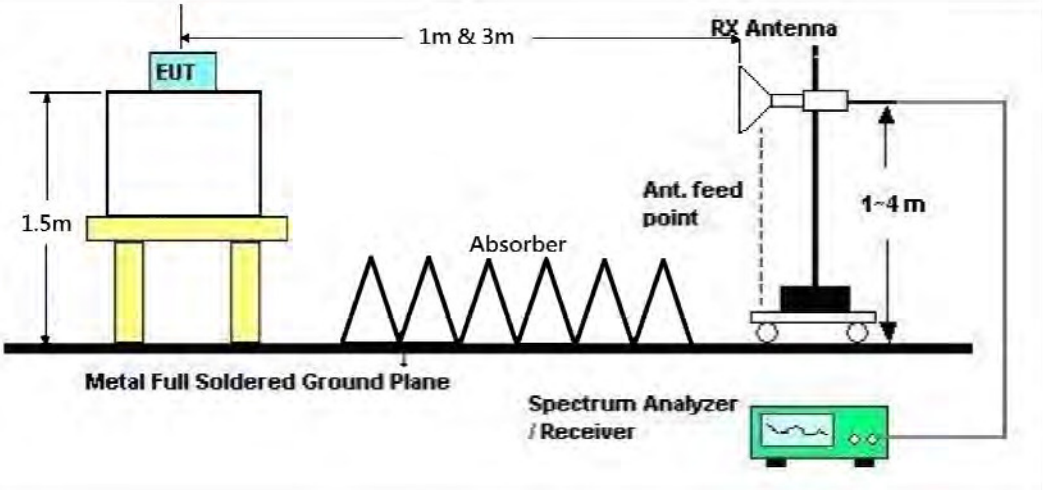
For Radiated Emissions: 9kHz ~30MHz



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	25°C	Humidity	55%
Test Engineer	Stim Song	Configurations	CTX
Test Date	Nov. 13, 2015		

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.

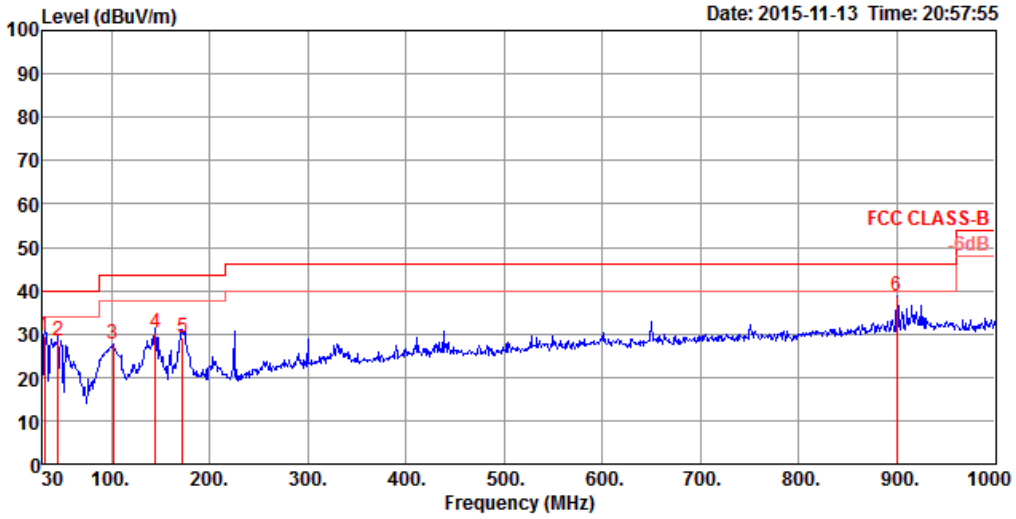
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

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

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

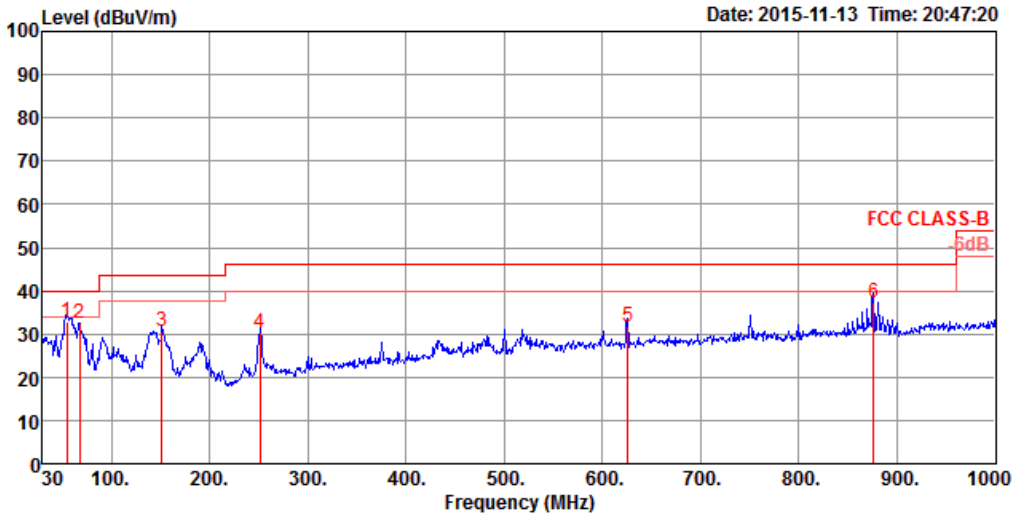
Temperature	25°C	Humidity	55%
Test Engineer	Stim Song	Configurations	CTX

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	31.94	29.42	40.00	-10.58	42.45	0.50	18.87	32.40	100	154	QP	HORIZONTAL
2	45.52	28.56	40.00	-11.44	49.29	0.60	11.08	32.41	150	60	QP	HORIZONTAL
3	101.78	27.86	43.50	-15.64	47.78	0.87	11.60	32.39	200	222	QP	HORIZONTAL
4	144.46	30.31	43.50	-13.19	49.90	1.03	11.74	32.36	100	226	QP	HORIZONTAL
5	172.59	29.07	43.50	-14.43	50.10	1.13	10.18	32.34	150	293	QP	HORIZONTAL
6	900.09	38.67	46.00	-7.33	46.24	2.57	21.60	31.74	200	234	QP	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	54.25	32.80	40.00	-7.20	56.49	0.64	8.08	32.41	100	238	QP	VERTICAL
2	67.83	32.39	40.00	-7.61	57.36	0.71	6.72	32.40	100	255	QP	VERTICAL
3	151.25	30.69	43.50	-12.81	50.75	1.05	11.24	32.35	100	298	QP	VERTICAL
4	251.16	30.35	46.00	-15.65	48.23	1.34	13.08	32.30	125	314	QP	VERTICAL
5	625.58	31.65	46.00	-14.35	42.48	2.16	19.41	32.40	100	21	QP	VERTICAL
6	875.84	37.42	46.00	-8.58	45.28	2.55	21.45	31.86	150	113	QP	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.

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

Temperature	25℃	Humidity	55%
Test Engineer	Stim Song	Configurations	802.15.4 Zigbee CH 11
Test Date	Oct. 27, 2015	Test Module	Zigbee module 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	4809.02	60.40	74.00	-13.60	54.28	6.13	33.08	33.09	210	198	Peak	HORIZONTAL
2	4810.98	49.99	54.00	-4.01	43.87	6.13	33.08	33.09	210	198	Average	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	4810.94	41.32	54.00	-12.68	35.20	6.13	33.08	33.09	175	249	Average	VERTICAL
2	4811.00	52.72	74.00	-21.28	46.60	6.13	33.08	33.09	175	249	Peak	VERTICAL

Temperature	25℃	Humidity	55%
Test Engineer	Stim Song	Configurations	802.15.4 Zigbee CH 18
Test Date	Oct. 27, 2015	Test Module	Zigbee module 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	4879.00	57.74	74.00	-16.26	51.51	6.08	33.23	33.08	197	212	Peak	HORIZONTAL
2	4879.06	48.19	54.00	-5.81	41.96	6.08	33.23	33.08	197	212	Average	HORIZONTAL
3	7318.50	62.67	74.00	-11.33	51.72	8.30	36.12	33.47	177	117	Peak	HORIZONTAL
4	7318.60	51.55	54.00	-2.45	40.60	8.30	36.12	33.47	177	117	Average	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	4878.76	52.65	74.00	-21.35	46.42	6.08	33.23	33.08	137	212	Peak	VERTICAL
2	4879.04	41.73	54.00	-12.27	35.50	6.08	33.23	33.08	137	212	Average	VERTICAL
3	7318.32	57.44	74.00	-16.56	46.49	8.30	36.12	33.47	268	143	Peak	VERTICAL
4	7321.70	44.78	54.00	-9.22	33.83	8.30	36.12	33.47	268	143	Average	VERTICAL

Temperature	25℃	Humidity	55%
Test Engineer	Stim Song	Configurations	802.15.4 Zigbee CH 25
Test Date	Oct. 27, 2015	Test Module	Zigbee module 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	4949.28	41.91	54.00	-12.09	35.54	6.04	33.39	33.06	167	337	Average	HORIZONTAL
2	4951.10	52.76	74.00	-21.24	46.39	6.04	33.39	33.06	167	337	Peak	HORIZONTAL
3	7426.42	49.20	54.00	-4.80	37.95	8.39	36.35	33.49	167	110	Average	HORIZONTAL
4	7426.60	61.58	74.00	-12.42	50.33	8.39	36.35	33.49	167	110	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	4950.92	51.88	74.00	-22.12	45.51	6.04	33.39	33.06	233	170	Peak	VERTICAL
2	4951.00	41.43	54.00	-12.57	35.06	6.04	33.39	33.06	233	170	Average	VERTICAL
3	7426.36	45.73	54.00	-8.27	34.48	8.39	36.35	33.49	238	181	Average	VERTICAL
4	7426.38	56.55	74.00	-17.45	45.30	8.39	36.35	33.49	238	181	Peak	VERTICAL

Temperature	25°C	Humidity	55%
Test Engineer	Stim Song	Configurations	802.15.4 Zigbee CH 11
Test Date	Oct. 27, 2015	Test Module	Zigbee module 2

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	4809.02	57.80	74.00	-16.20	51.68	6.13	33.08	33.09	236	198	Peak	HORIZONTAL
2	4809.08	46.75	54.00	-7.25	40.63	6.13	33.08	33.09	236	198	Average	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	4809.12	54.12	74.00	-19.88	48.00	6.13	33.08	33.09	234	131	Peak	VERTICAL
2	4809.14	43.03	54.00	-10.97	36.91	6.13	33.08	33.09	234	131	Average	VERTICAL

Temperature	25℃	Humidity	55%
Test Engineer	Stim Song	Configurations	802.15.4 Zigbee CH 18
Test Date	Oct. 27, 2015	Test Module	Zigbee module 2

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	4879.02	43.96	54.00	-10.04	37.73	6.08	33.23	33.08	295	204	Average	HORIZONTAL
2	4879.02	54.41	74.00	-19.59	48.18	6.08	33.23	33.08	295	204	Peak	HORIZONTAL
3	7321.44	53.91	54.00	-0.09	42.96	8.30	36.12	33.47	280	130	Average	HORIZONTAL
4	7321.54	64.03	74.00	-9.97	53.08	8.30	36.12	33.47	280	130	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	4878.98	54.83	74.00	-19.17	48.60	6.08	33.23	33.08	295	207	Peak	VERTICAL
2	4879.08	43.65	54.00	-10.35	37.42	6.08	33.23	33.08	295	207	Average	VERTICAL
3	7318.50	64.69	74.00	-9.31	53.74	8.30	36.12	33.47	254	132	Peak	VERTICAL
4	7318.64	53.46	54.00	-0.54	42.51	8.30	36.12	33.47	254	132	Average	VERTICAL

Temperature	25℃	Humidity	55%
Test Engineer	Stim Song	Configurations	802.15.4 Zigbee CH 25
Test Date	Oct. 27, 2015	Test Module	Zigbee module 2

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	4949.16	55.11	74.00	-18.89	48.74	6.04	33.39	33.06	215	345	Peak	HORIZONTAL
2	4951.08	45.28	54.00	-8.72	38.91	6.04	33.39	33.06	215	345	Average	HORIZONTAL
3	7426.32	51.54	54.00	-2.46	40.29	8.39	36.35	33.49	244	125	Average	HORIZONTAL
4	7426.70	63.53	74.00	-10.47	52.28	8.39	36.35	33.49	244	125	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	4949.04	41.63	54.00	-12.37	35.26	6.04	33.39	33.06	175	168	Average	VERTICAL
2	4950.82	52.88	74.00	-21.12	46.51	6.04	33.39	33.06	175	168	Peak	VERTICAL
3	7423.66	47.87	54.00	-6.13	36.62	8.39	36.35	33.49	296	144	Average	VERTICAL
4	7426.90	58.74	74.00	-15.26	47.49	8.39	36.35	33.49	296	144	Peak	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, 1MHz / 1/T 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.

For Radiated Out of Band Emission Measurement:

1. Test was performed in accordance with KDB558074 D01 v03r03 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.

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	25℃	Humidity	55%
Test Engineer	Stim Song	Configurations	802.15.4 Zigbee CH 11, 18, 25
Test Date	Oct. 27, 2015	Test Module	Zigbee module 1

Channel 11

	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	2389.40	63.14	74.00	-10.86	30.46	4.37	28.31	0.00	259	244	Peak	HORIZONTAL
2	2390.00	53.51	54.00	-0.49	20.79	4.41	28.31	0.00	259	244	Average	HORIZONTAL
3	2405.00	115.57			82.82	4.41	28.34	0.00	259	244	Average	HORIZONTAL
4	2405.60	120.09			87.34	4.41	28.34	0.00	259	244	Peak	HORIZONTAL

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	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2382.80	56.52	74.00	-17.48	23.87	4.37	28.28	0.00	265	87	Peak	HORIZONTAL
2	2390.00	45.72	54.00	-8.28	13.00	4.41	28.31	0.00	265	87	Average	HORIZONTAL
3	2440.00	113.72			80.87	4.44	28.41	0.00	265	87	Average	HORIZONTAL
4	2440.40	117.62			84.77	4.44	28.41	0.00	265	87	Peak	HORIZONTAL
5	2493.60	57.10	74.00	-16.90	24.05	4.55	28.50	0.00	265	87	Peak	HORIZONTAL
6	2496.80	46.11	54.00	-7.89	13.06	4.55	28.50	0.00	265	87	Average	HORIZONTAL

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

Channel 25

	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	2474.60	112.15			79.17	4.51	28.47	0.00	248	267	Peak	HORIZONTAL
2	2475.00	107.74			74.76	4.51	28.47	0.00	248	267	Average	HORIZONTAL
3	2483.50	53.92	54.00	-0.08	20.94	4.51	28.47	0.00	248	267	Average	HORIZONTAL
4	2483.50	64.93	74.00	-9.07	31.95	4.51	28.47	0.00	248	267	Peak	HORIZONTAL

Item 1, 2 are the fundamental frequency at 2475 MHz.

Temperature	25℃	Humidity	55%
Test Engineer	Stim Song	Configurations	802.15.4 Zigbee CH 11, 18, 25
Test Date	Oct. 27, 2015	Test Module	Zigbee module 2

Channel 11

	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	2389.60	62.97	74.00	-11.03	30.29	4.37	28.31	0.00	173	0	Peak	HORIZONTAL
2	2390.00	53.32	54.00	-0.68	20.60	4.41	28.31	0.00	173	0	Average	HORIZONTAL
3	2404.60	119.72			86.97	4.41	28.34	0.00	173	0	Peak	HORIZONTAL
4	2405.00	115.28			82.53	4.41	28.34	0.00	173	0	Average	HORIZONTAL

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	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2383.60	45.59	54.00	-8.41	12.94	4.37	28.28	0.00	174	142	Average	VERTICAL
2	2389.20	57.56	74.00	-16.44	24.88	4.37	28.31	0.00	174	142	Peak	VERTICAL
3	2440.00	100.94			68.09	4.44	28.41	0.00	174	142	Average	VERTICAL
4	2440.40	105.31			72.46	4.44	28.41	0.00	174	142	Peak	VERTICAL
5	2494.00	57.37	74.00	-16.63	24.32	4.55	28.50	0.00	174	142	Peak	VERTICAL
6	2500.00	46.14	54.00	-7.86	13.09	4.55	28.50	0.00	174	142	Average	VERTICAL

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

Channel 25

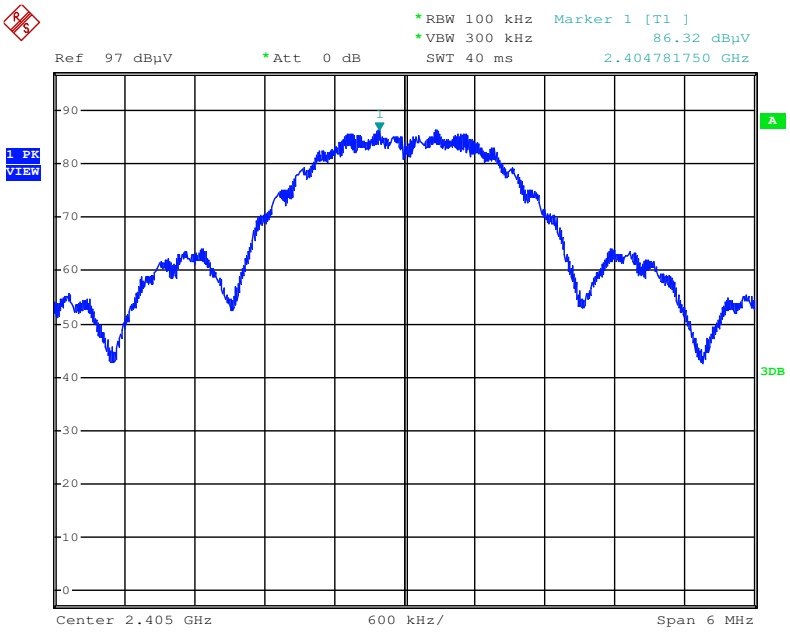
	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2474.60	111.57			78.59	4.51	28.47	0.00	218	0	Peak	HORIZONTAL
2	2475.00	107.14			74.16	4.51	28.47	0.00	218	0	Average	HORIZONTAL
3	2484.00	53.13	54.00	-0.87	20.15	4.51	28.47	0.00	218	0	Average	HORIZONTAL
4	2484.00	63.23	74.00	-10.77	30.25	4.51	28.47	0.00	218	0	Peak	HORIZONTAL

Item 1, 2 are the fundamental frequency at 2475 MHz.

For Emission not in Restricted Band

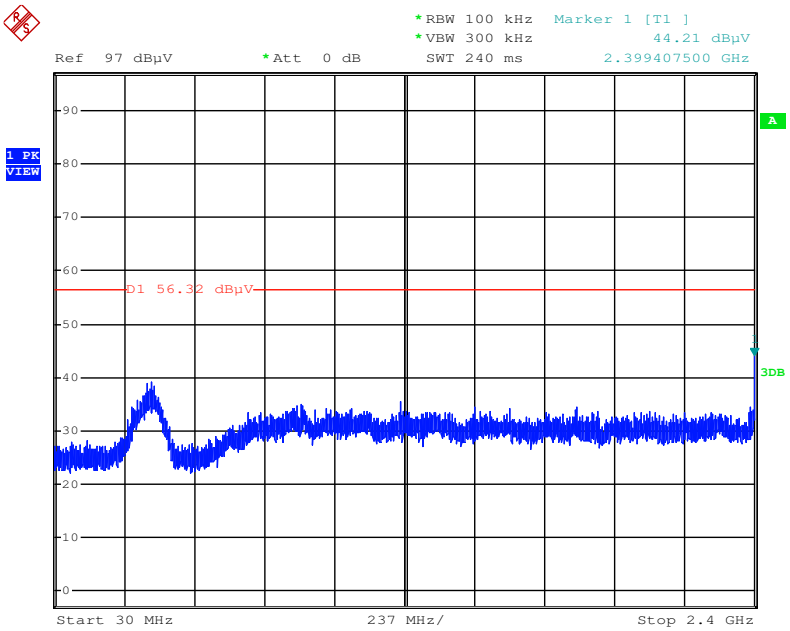
For Zigbee module 1:

Plot on Configuration 802.15.4 Zigbee / Reference Level



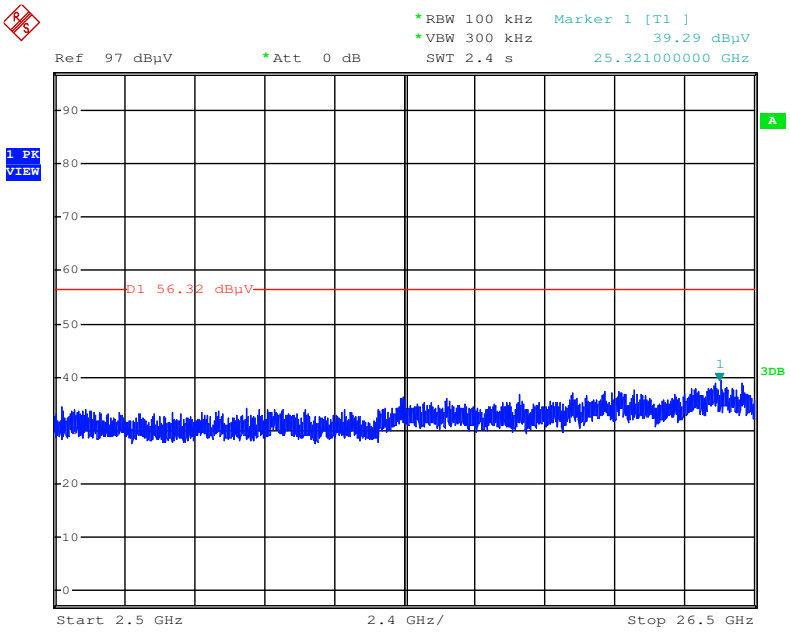
Date: 27.OCT.2015 16:39:05

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



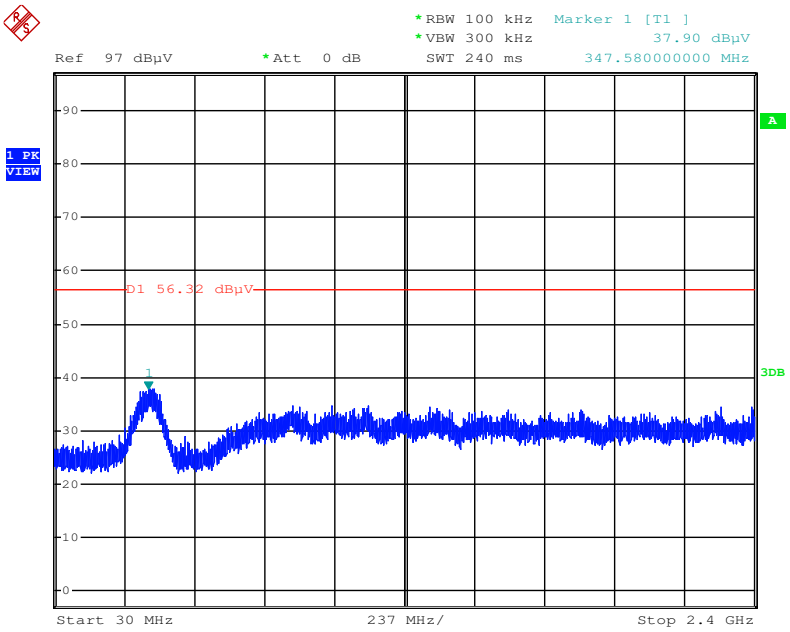
Date: 27.OCT.2015 16:40:07

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



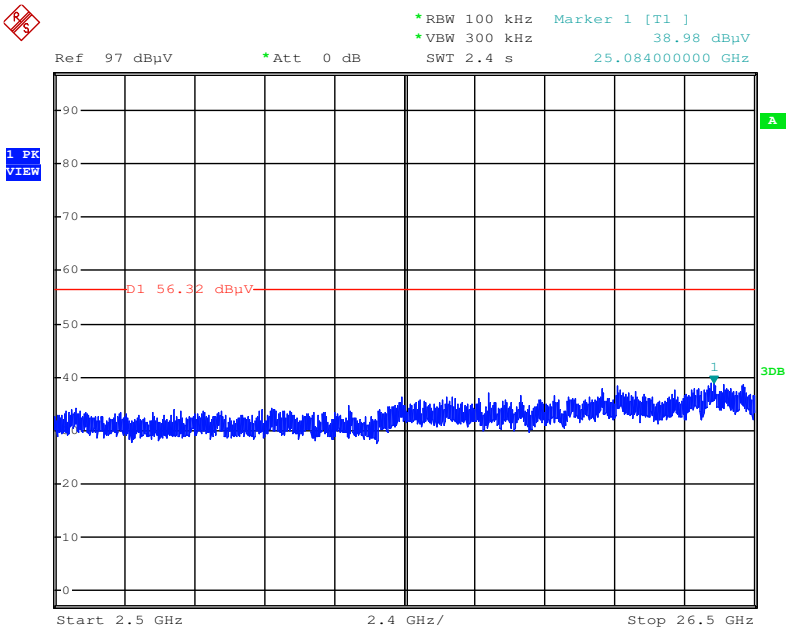
Date: 27.OCT.2015 16:41:30

Plot on Configuration 802.15.4 Zigbee / CH 25 / 30MHz~2400MHz (down 30dBc)



Date: 27.OCT.2015 16:44:12

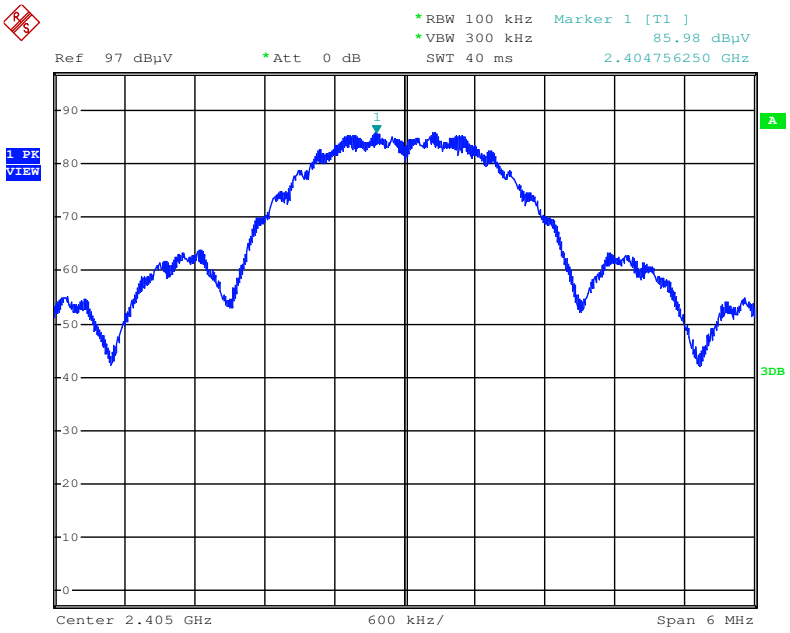
Plot on Configuration 802.15.4 Zigbee / CH 25 / 2500MHz~26500MHz (down 30dBc)



Date: 27.OCT.2015 16:43:43

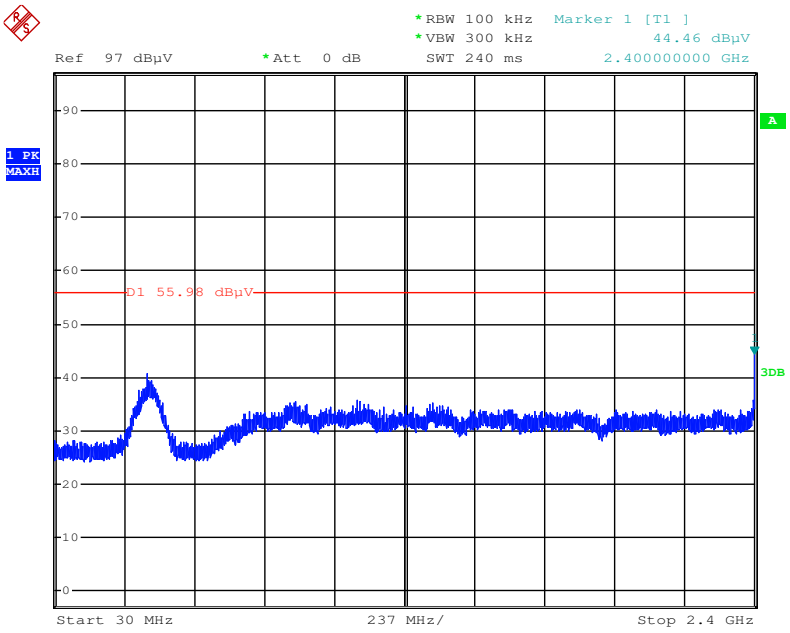
For Zigbee module 2:

Plot on Configuration 802.15.4 Zigbee / Reference Level



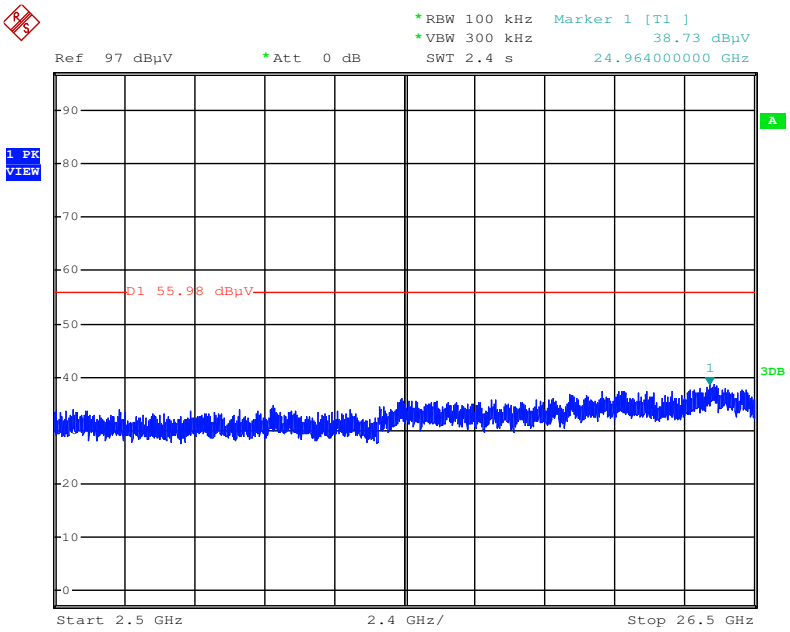
Date: 27.OCT.2015 16:47:14

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



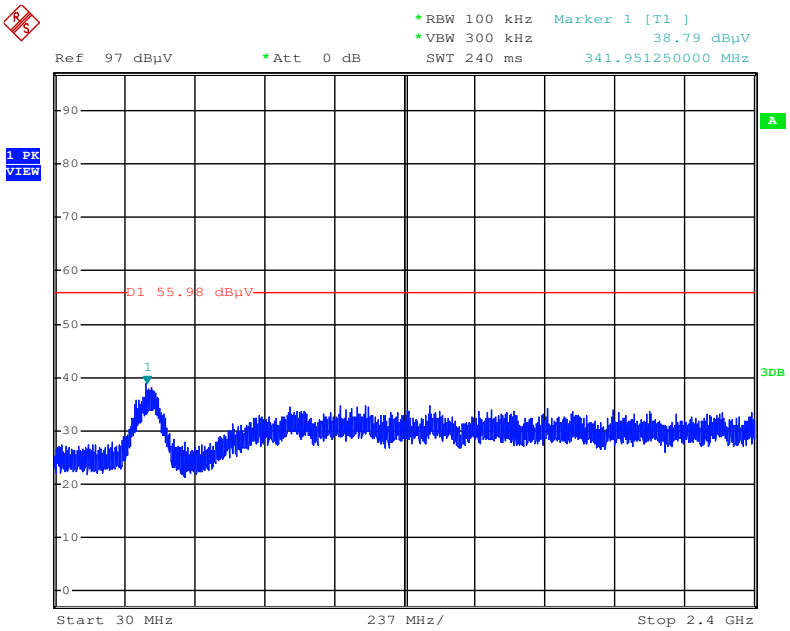
Date: 27.OCT.2015 16:49:04

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



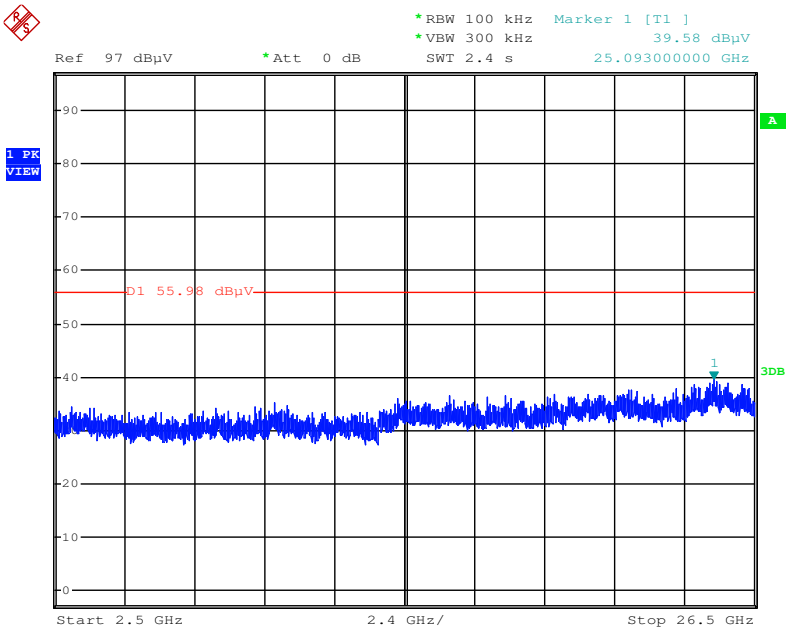
Date: 27.OCT.2015 16:49:37

Plot on Configuration 802.15.4 Zigbee / CH 25 / 30MHz~2400MHz (down 30dBc)



Date: 27.OCT.2015 16:50:57

Plot on Configuration 802.15.4 Zigbee / CH 25 / 2500MHz~26500MHz (down 30dBc)



Date: 27.OCT.2015 16:50:30

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
LISN	Schwarzbeck	NSLK 8127	8127650	9kHz ~ 30MHz	Nov. 17, 2014	Conduction (CO02-CB)
LISN	Schwarzbeck	NSLK 8127	8127478	9kHz ~ 30MHz	Nov. 17, 2014	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, 2014	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	22021	20MHz ~ 2GHz	May 06, 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	Nov. 25, 2014	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Nov. 06, 2014	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. 15, 2014	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-1	N/A	1 GHz ~ 40 GHz	Nov. 15, 2014	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-2	N/A	1 GHz ~ 40 GHz	Nov. 15, 2014	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. 12, 2014	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%