

FCC 15.247& RSS-247 2.4 GHz Report

for

LG Electronics Inc.

**222, LG-ro, Jinwi-myeon, Pyeongtaek-si,
Gyeonggi-do, 451-713 Korea**

Product Name : ZigBee Connector
Brand : LG
Model Name : 9ZS52055DA
FCC ID : BEJ9ZS52055DA
IC : 2703H-9ZS52055DA

**Prepared by: : AUDIX Technology Corporation,
EMC Department**



TABLE OF CONTENTS

Description	Page
TEST REPORT CERTIFICATION	4
1. REPORT HISTORY.....	5
2. SUMMARY OF TEST RESULTS	6
3. GENERAL INFORMATION	7
3.1. Description of EUT	7
3.2. EUT Specifications Assessed in Current Report	7
3.3. Test Configuration	8
3.4. Tested Supporting System List	9
3.5. Setup Configuration	9
3.6. Operating Condition of EUT	9
3.7. Description of Test Facility	9
3.8. Measurement Uncertainty	10
4. MEASUREMENT EQUIPMENT LIST	11
4.1. Conducted Emission Measurement	11
4.2. Radiated Emission Measurement	11
4.3. RF Conducted Measurement	11
5. CONDUCTED EMISSION MEASUREMENT	12
5.1. Block Diagram of Test Setup	12
5.2. Power Line Conducted Emission Limit	12
5.3. Test Procedure	12
5.4. Conducted Emission Measurement Results	13
6. RADIATED EMISSION MEASUREMENT	15
6.1. Block Diagram of Test Setup	15
6.2. Radiated Emission Limits	16
6.3. Test Procedure	17
6.4. Measurement Result Explanation	18
6.5. Test Results	18
7. 6dB BANDWIDTH MEASUREMENT	28
7.1. Block Diagram of Test Setup	28
7.2. Specification Limits	28
7.3. Test Procedure	28
7.4. Test Results	28
8. MAXIMUM PEAK OUTPUT POWER MEASUREMENT	29
8.1. Block Diagram of Test Setup	29
8.2. Specification Limits	29
8.3. Test Procedure	29
8.4. Test Results	29
9. EMISSION LIMITATIONS MEASUREMENT	30
9.1. Block Diagram of Test Setup	30
9.2. Specification Limits	30
9.3. Test Procedure	30
9.4. Test Results	31
10. POWER SPECTRAL DENSITY	32
10.1. Block Diagram of Test Setup	32

AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City 244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

10.2. Specification Limits	32
10.3. Test Procedure	32
10.4. Test Results.....	32
11. DEVIATION TO TEST SPECIFICATIONS.....	33

APPENDIX A TEST PLOTS

APPENDIX B TEST PHOTOGRAPHS

TEST REPORT CERTIFICATION

Applicant : LG Electronics Inc.
Manufacturer : LG Electronics Inc.
Factory : OHSUNG ELECTRONICS CO., LTD.
Product Name : ZigBee Connector
Model No. : 9ZS52055DA
Serial No. : N/A
Brand Name : LG
Power Supply : DC 5V

Applicable Standards:

47 CFR FCC Part 15 Subpart C: 2016
RSS-Gen (Issue 4), November 2014
RSS-247 (Issue 1), May 2015
ANSI C63.10:2013
KDB 558074 D01 DTS Meas Guidance v03r05

AUDIX Technology Corp. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report. **AUDIX Technology Corp.** does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

Date of Test: 2016. 12. 30 ~ 2017. 01. 20

Date of Report: 2017. 01. 20

Producer: Sabrina Wang
(Sabrina Wang/Administrator)

Signatory: Ben Cheng
(Ben Cheng/Manager)

1. REPORT HISTORY

Revision	Date	Revision Summary	Report Number
0	2017. 01. 20	Original Report.	EM-F170005

2. SUMMARY OF TEST RESULTS

Rule		Description	Results
FCC	IC		
15.207	RSS-Gen §8.8	Conducted Emission	PASS
15.247(d)/ 15.205	RSS-Gen §8.9 RSS-247 §5.5	Radiated Band Edge and Radiated Spurious Emission	PASS
15.247(a)(2)	RSS-247 §5.2(1)	6dB Bandwidth	PASS
15.247(b)(3)	RSS-247 §5.4(4)	Maximum Peak Output	PASS
15.247(d)	RSS-247 §5.5	Conducted Band Edges and Conducted Spurious Emission	PASS
15.247 (e)	RSS-247 §5.2(2)	Peak Power Spectral Density	PASS
15.203	----	Antenna Requirement	PASS

3. GENERAL INFORMATION

3.1. Description of EUT

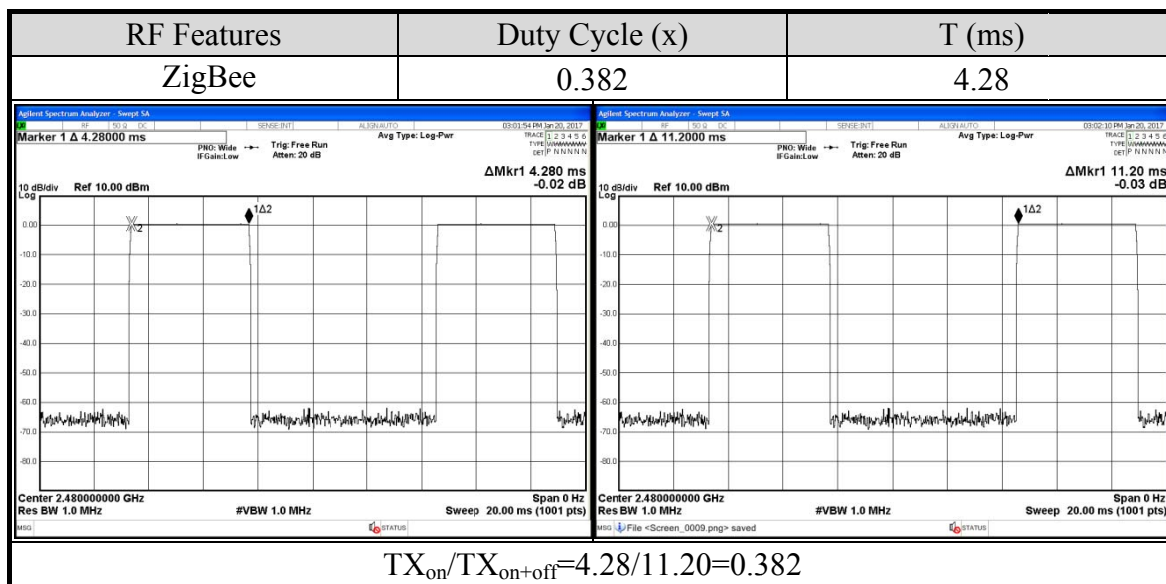
Product	ZigBee Connector
Model Number	9ZS52055DA
Serial Number	N/A
Brand	LG
Applicant	LG Electronics Inc. 222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do, 451-713 Korea
Manufacturer	LG Electronics Inc. 222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do, 451-713 Korea
Factory	OHSUNG ELECTRONICS CO., LTD. 335-4, Sanho-Daero, Gumi-si, Gyeongsangbuk-do, Rep. of Korea.
RF Features	ZigBee (IEEE 802.15.4)
Antenna Type/Gain	Internal PCB Antenna, Gain: 0.5 dBi
Date of Receipt of Sample	2016. 12. 27

3.2. EUT Specifications Assessed in Current Report

Mode	Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (Mbps)
ZigBee (IEEE 802.15.4)	2405-2480	16	DSSS (O-QPSK)	0.25

Channel List			
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
11	2405	19	2445
12	2410	20	2450
13	2415	21	2455
14	2420	22	2460
15	2425	23	2465
16	2430	24	2470
17	2435	25	2475
18	2440	26	2480

3.3. Test Configuration



AC Conduction	
Test Case	Normal operation

Item		Test Channel
Radiated Test Case	Radiated Band Edge	11/25/26
	Radiated Spurious Emission (30MHz-1GHz) ^{Note1}	11
	Radiated Spurious Emission (Above 1GHz) ^{Note1}	11/18/26
Conducted Test Case	6dB Bandwidth	11/18/26
	Peak Power Spectral Density	11/18/26
	Peak Output Power	11/18/26
	Band Edge	11/18/26
	Spurious Emission	11/18/26

Note 1:

☐ Mobile Device

☒ Portable Device, and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow:

☒ Lie ☐ Side ☐ Stand

Note 2: Low, mid, and high channels were measured, only the worst channel of each modulation was presented in this report.

3.4. Tested Supporting System List

3.4.1. Support Peripheral Unit

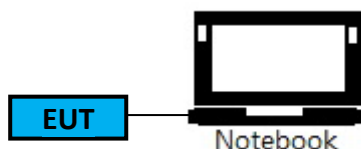
No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	Notebook PC	acer	MS2362	N/A	PPD-AAR5B225
2.	USB Hub (For Radiated Side, Stand axis used)	TP-Link	TP-12100801	N/A	N/A

3.4.2. Cable Lists

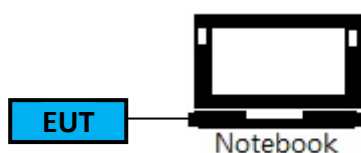
No.	Cable Description Of The Above Support Units
1.	Adapter: Chicony, M/N CPA09-A065N1, DC Cord: Shielded, Undetachable, 1.8m, Bonded a ferrite core AC Power Cord: Unshielded, Detachable, 1.8m
2.	USB Cable: Unshielded, Detachable, 0.5m (For Radiated Side, Stand axis used)

3.5. Setup Configuration

3.5.1. EUT Configuration for Power Line and Radiated Emission



3.5.2. EUT Configuration for Conducted Test Items



3.6. Operating Condition of EUT

Test program “Tera Term” is used for enabling EUT RF function under continues transmitting and choosing data rate/ channel.

3.7. Description of Test Facility

Test Firm Name	:	AUDIX Technology Corporation EMC Department No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan
Test Location & Facility	:	No. 7 Shielded Room No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan Semi-Anechoic Chamber No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan IC Test Site Registration No.: 5183B-1 Renewal on September 17, 2014 Fully Anechoic Chamber No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan IC Test Site Registration No.: 5183B-4 Renewal on August 31, 2015
NVLAP Lab. Code	:	200077-0
TAF Accreditation No	:	1724
FCC OET Designation	:	TW1004 & TW1090

3.8. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty
Conduction Test	150kHz~30MHz	±3.5dB
Radiation Test (Distance: 3m)	30MHz~1000MHz	± 3.68dB
	Above 1GHz	± 5.82dB

Remark : Uncertainty = $k_{u_c}(y)$

Test Item	Uncertainty
6dB Bandwidth	± 0.05kHz
Maximum peak output power	± 0.33dB
Power spectral density	± 0.13dB
Conducted Emission Limitations	± 0.13dB

4. MEASUREMENT EQUIPMENT LIST

4.1. Conducted Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Test Receiver	R&S	ESR3	101774	2016. 02. 04	1 Year
2.	A.M.N.	R&S	ESH2-Z5	100366	2016. 07. 27	1 Year
3.	L.I.S.N.	Kyoritsu	KNW-407	8-1539-3	2016. 01. 21	1 Year
4.	Pulse Limiter	R&S	ESH3-Z2	101495	2016. 01. 17	1 Year
5.	Test Software	Audix	e3	V.120619C	N.C.R.	N.C.R.

4.2. Radiated Emission Measurement

4.2.1. Frequency Range 9kHz~1000MHz (Semi-Anechoic Chamber)

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2016. 09. 19	1 Year
2.	Test Receiver	R & S	ESCS30	100338	2016. 06. 22	1 Year
3.	Amplifier	HP	8447D	2944A06305	2016. 02. 23	1 Year
4.	Bilog Antenna	CHASE	CBL6112D	33821	2016. 01. 30	1 Year
5.	Loop Antenna	R&S	HFH2-Z2	891847/27	2016. 12. 23	1 Year
6.	Test Software	Audix	e3	V.120619C	N.C.R.	N.C.R.

4.2.2. Frequency Range Above 1GHz (Fully Anechoic Chamber)

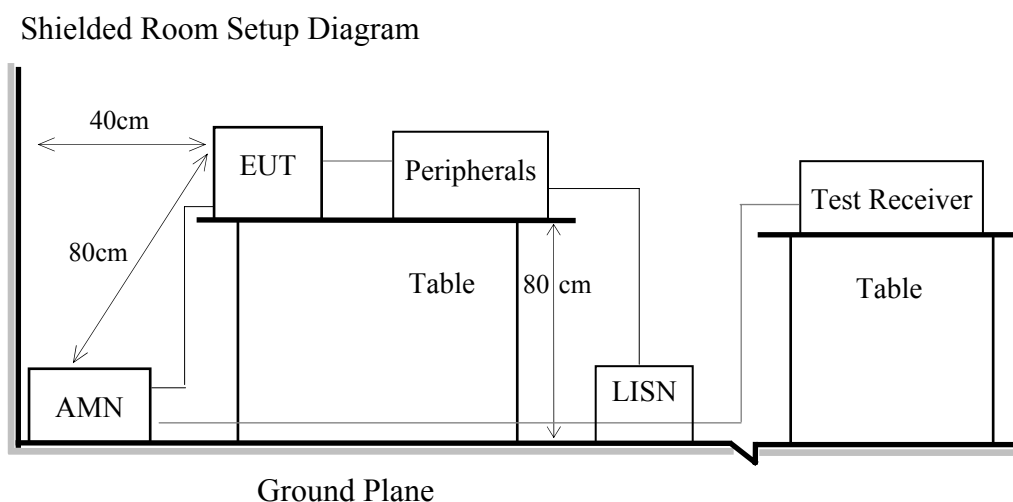
Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	E4446A	US44300366	2016. 08. 19	1 Year
2.	Amplifier	Agilent	8449B	3008A02678	2016. 03. 04	1 Year
3.	2.4GHz Notch Filter	K&L	7NSL10-2441.5E130.5-00	1	2016. 07. 27	1 Year
4.	Horn Antenna	ETS-Lindgren	3117	00135902	2016. 03. 05	1 Year
5.	Horn Antenna	EMCO	3116	2653	2016. 10. 24	1 Year
6.	Test Software	Audix	e3	V.6.110601	N.C.R.	N.C.R.

4.3. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9030A-526	MY53310269	2016. 01. 02	1 Year
	Spectrum Analyzer	Agilent	N9030A-526	MY53310269	2017. 01. 03	1 Year
2.	Power Meter	Anritsu	ML2495A	1145008	2016. 10. 27	1 Year
3.	Power Sensor	Anritsu	MA2411B	1126096	2016. 10. 27	1 Year

5. CONDUCTED EMISSION MEASUREMENT

5.1. Block Diagram of Test Setup



5.2. Power Line Conducted Emission Limit

Frequency	Conducted Limit	
	Quasi-Peak Level	Average Level
150kHz ~ 500kHz	66 ~ 56 dB μ V	56 ~ 46 dB μ V
500kHz ~ 5MHz	56 dB μ V	46 dB μ V
5MHz ~ 30MHz	60 dB μ V	50 dB μ V

Remark 1.: If the average limit is met when using a Quasi-Peak detector, the measurement using the average detector is not required.

2.: The lower limit applies to the band edges.

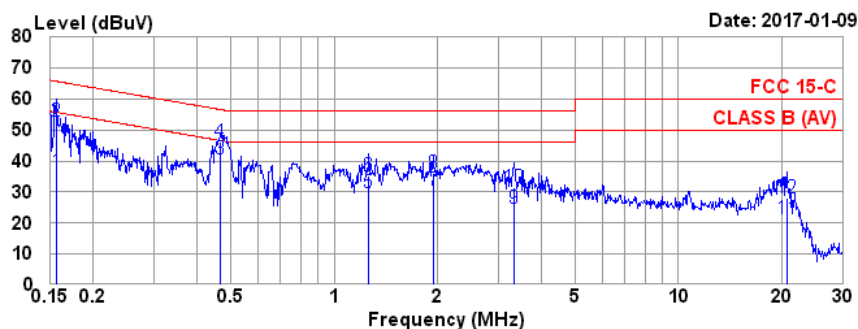
5.3. Test Procedure

- 5.3.1. To set up the EUT as indicated in ANSI C 63.10. The EUT was placed on the table which has 80 cm height to the ground and 40 cm distance to the conducting wall.
- 5.3.2. Power supplier of the EUT was connected to the AC mains through an Artificial Mains Network (A.M.N.).
- 5.3.3. The AC power supplies to all peripheral devices must be provided through line impedance stabilization network (L.I.S.N.)
- 5.3.4. Checking frequency range from 150 kHz to 30 MHz and record the emission which does not have 20 dB below limit.

5.4. Conducted Emission Measurement Results

PASSED.

Test Date	2017/01/09	Temp./Hum.	23°C/48%
Test Voltage	AC 120V, 60Hz (via Notebook PC)		



Site no. : No.7 Shielded Room Data no. : 2
Condition : ESH2-Z5 366(ADAPTER) Phase : NEUTRAL
Limit : FCC 15-C
Env. / Ins. : 23°C / 48% ESR3 (1774) Engineer : Nick Du
EUT : 9Z552055DA
Power Rating : 120Vac/60Hz
Test Mode : Operating

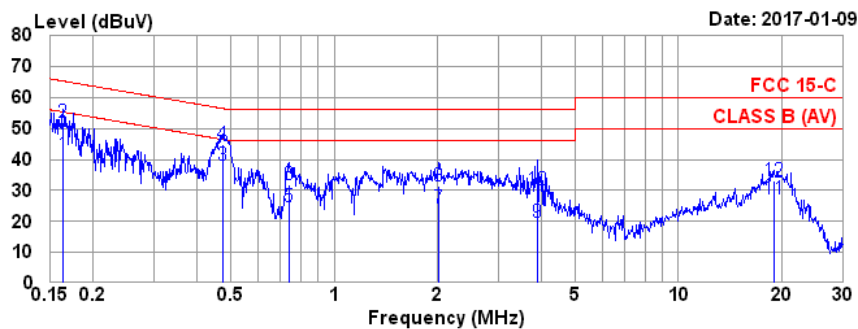
	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.156	0.19	0.03	9.85	26.51	36.58	55.69	19.11	Average
2	0.156	0.19	0.03	9.85	42.74	52.81	65.69	12.88	QP
3	0.469	0.20	0.04	9.85	30.75	40.84	46.54	5.70	Average
4	0.469	0.20	0.04	9.85	35.94	46.03	56.54	10.51	QP
5	1.262	0.23	0.07	9.92	19.73	29.95	46.00	16.05	Average
6	1.262	0.23	0.07	9.92	24.94	35.16	56.00	20.84	QP
7	1.939	0.25	0.07	9.96	20.22	30.50	46.00	15.50	Average
8	1.939	0.25	0.07	9.96	25.59	35.87	56.00	20.13	QP
9	3.328	0.30	0.10	9.90	14.58	24.88	46.00	21.12	Average
10	3.328	0.30	0.10	9.90	21.13	31.43	56.00	24.57	QP
11	20.594	0.98	0.25	9.94	10.17	21.34	50.00	28.66	Average
12	20.594	0.98	0.25	9.94	16.77	27.94	60.00	32.06	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.

AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

Test Date	2017/01/09	Temp./Hum.	23°C/48%
Test Voltage	AC 120V, 60Hz (via Notebook PC)		



Site no. : No.7 Shielded Room Data no. : 1
Condition : ESH2-Z5 366(ADAPTER) Phase : LINE
Limit : FCC 15-C
Env. / Ins. : 23°C / 48% ESR3 (1774) Engineer : Nick Du
EUT : 9ZS52055DA
Power Rating : 120Vac/60Hz
Test Mode : Operating

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.163	0.17	0.03	9.85	31.33	41.38	55.30	13.92	Average
2	0.163	0.17	0.03	9.85	41.82	51.87	65.30	13.43	QP
3	0.474	0.19	0.04	9.85	27.94	38.02	46.45	8.43	Average
4	0.474	0.19	0.04	9.85	34.87	44.95	56.45	11.50	QP
5	0.743	0.20	0.05	9.88	14.46	24.59	46.00	21.41	Average
6	0.743	0.20	0.05	9.88	21.81	31.94	56.00	24.06	QP
7	2.012	0.25	0.07	9.96	13.84	24.12	46.00	21.88	Average
8	2.012	0.25	0.07	9.96	20.96	31.24	56.00	24.76	QP
9	3.901	0.33	0.11	9.89	9.34	19.67	46.00	26.33	Average
10	3.901	0.33	0.11	9.89	19.99	30.32	56.00	25.68	QP
11	18.920	1.07	0.24	9.92	15.92	27.15	50.00	22.85	Average
12	18.920	1.07	0.24	9.92	21.87	33.10	60.00	26.90	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.

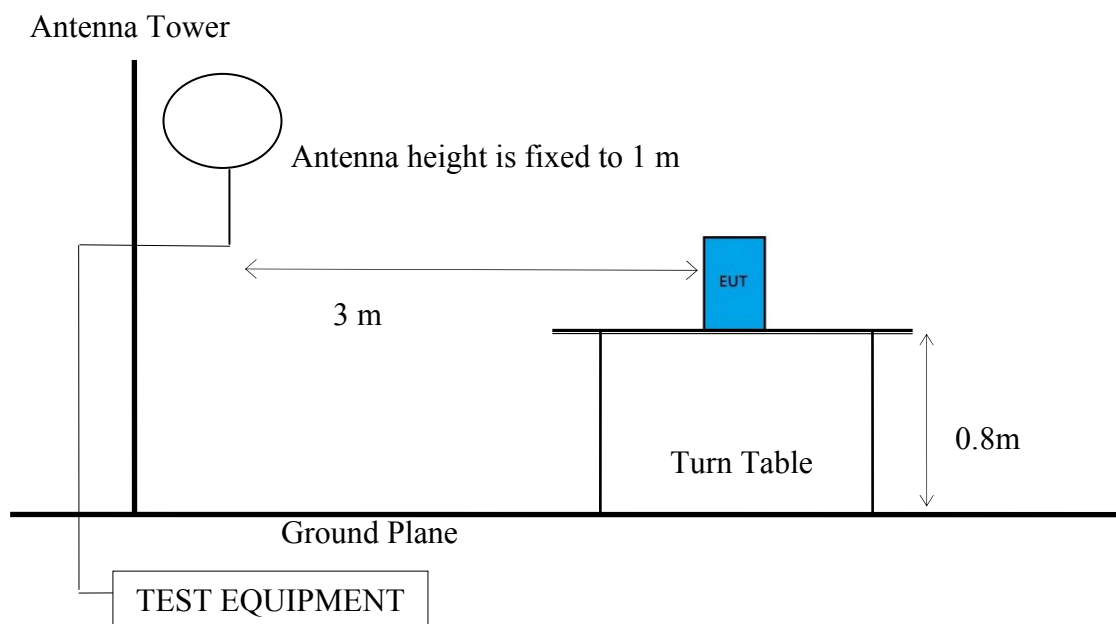
6. RADIATED EMISSION MEASUREMENT

6.1. Block Diagram of Test Setup

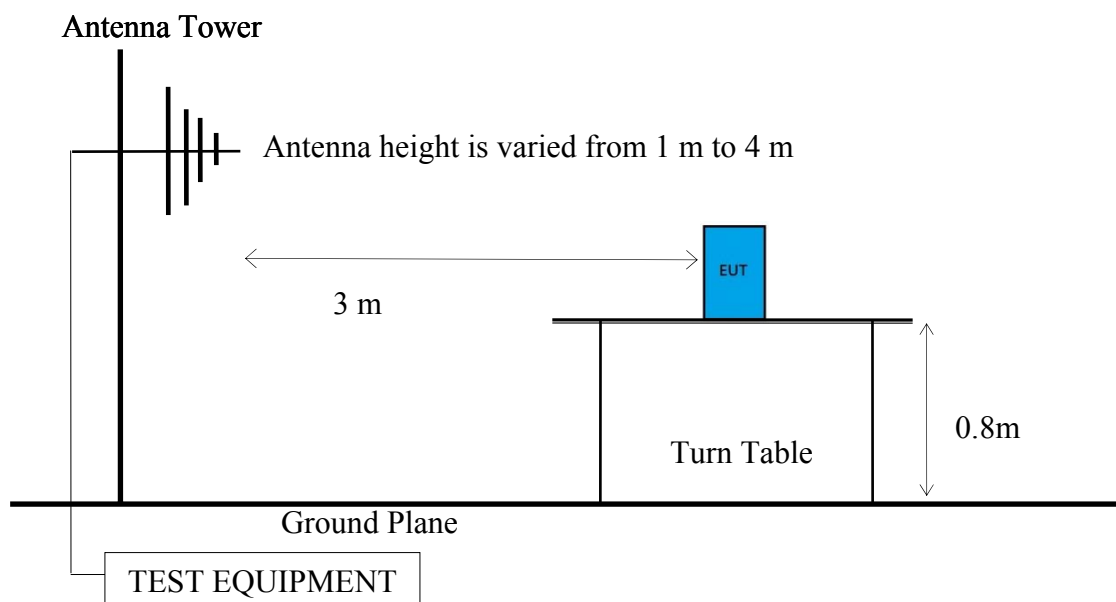
6.1.1. Block Diagram of connection between EUT and simulators

Indicated as section 3.5

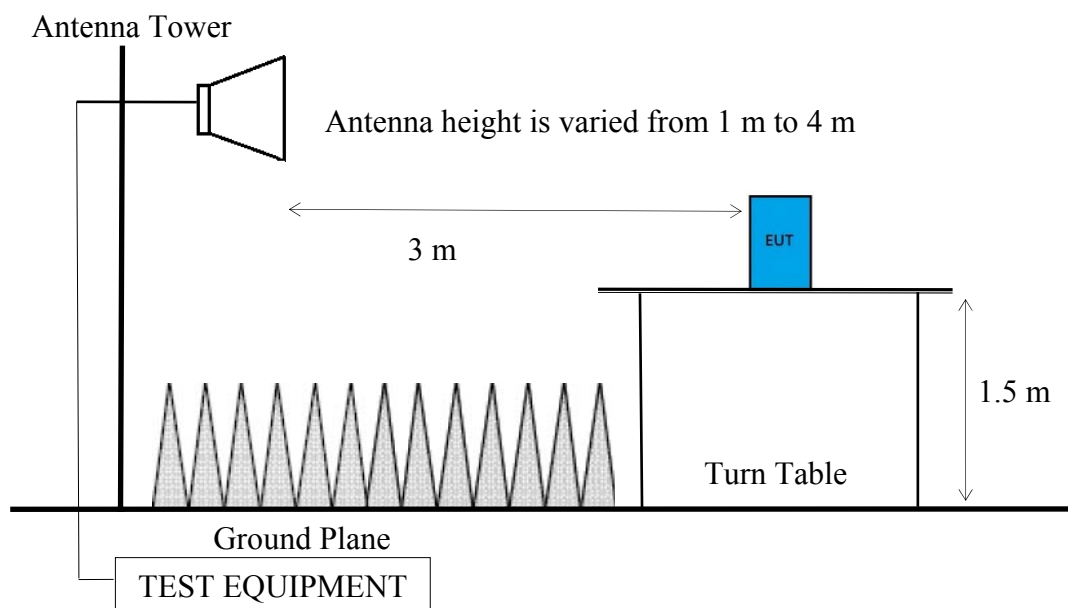
6.1.2. Semi Anechoic Chamber (3m) Setup Diagram for 9kHz-30MHz



6.1.3. Semi Anechoic Chamber (3m) Setup Diagram for 30-1000 MHz



6.1.4. Fully Anechoic Chamber (3m) Setup Diagram for above 1GHz



6.2. Radiated Emission Limits

In any 100kHz bandwidth outside the frequency band, the radio frequency power produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205/RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified as below.

Frequency (MHz)	Distance (m)	Limits	
		dB μ V/m	μ V/m
0.009 - 0.490	300	67.6	2400/kHz
0.490 - 1.705	30	87.6	24000/kHz
1.705 - 30	30	29.5	30
30 - 88	3	40.0	100
88- 216	3	43.5	150
216- 960	3	46.0	200
Above 960	3	54.0	500
Above 1000	3	74.0 dB μ V/m (Peak) 54.0 dB μ V/m (Average)	

Remark : (1) dB μ V/m = 20 log (μ V/m)

- (2) The tighter limit applies to the edge between two frequency bands.
- (3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
- (4) Fundamental and emission fall within operation band are exempted from this section.
- (5) Pursuant to ANSI C63.10: 6.6.4.3, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

6.3. Test Procedure

Frequency Range 9kHz~30MHz:

The EUT setup on the turn table which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

(1) RBW = 9kHz with peak and average detector.

(2) Detector: average and peak (9kHz-490kHz)

Q.P. (490kHz-30MHz)

Frequency Range 30MHz ~ 40GHz:

The EUT setup on the turn find table which has 80 cm (for 30-1000 MHz) and 1.5m (for above 1GHz) height to the ground. The turn table rotated 360 degrees and antenna varied from 1 m to 4 m to find the maximum emission level. Both horizontal and vertical polarization are required. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

Frequency below 1 GHz:

Spectrum Analyzer is used for pre-testing with following setting:

(1) RBW = 120KHz

(2) VBW $\geq 3 \times$ RBW.

(3) Detector = Peak.

(4) Sweep time = auto.

(5) Trace mode = max hold.

(6) Allow sweeps to continue until the trace stabilizes.

(7) When peak-detected value is lower than limit that the measurement using the Q.P. detector is not required. Otherwise using Q.P. for finally measurement.

Frequency above 1GHz to 10th harmonic:

Peak Detector:

(1) RBW = 1MHz

(2) VBW $\geq 3 \times$ RBW.

(3) Detector = Peak.

(4) Sweep time = auto.

(5) Trace mode = max hold.

(6) Allow sweeps to continue until the trace stabilizes.

(7) When peak-detected value is lower than limit that the measurement using the average detector is not required. Otherwise using average for finally measurement.

Average Detector:**■ Option 1:**

(1) RBW = 1MHz

(2) VBW $\geq 1/T$.N/A: $1/T$ is not implemented when duty cycle presented in section 3.5 is $\geq 98\%$.

(1) Detector = Peak.

(2) Sweep time = auto.

(3) Trace mode = max hold.

(4) Allow sweeps to continue until the trace stabilizes.

□ Option 2:

Average Emission Level = Peak Emission Level + D.C.C.F.

6.4. Measurement Result Explanation**■** Peak Emission Level = Antenna Factor + Cable Loss + Meter Reading**■** Average Emission Level = Antenna Factor + Cable Loss + Meter Reading**□** Average Emission Level = Peak Emission Level + DCCFDuty Cycle Correction Factor (DCCF) = $20\log(TX_{on}/TX_{on+off})$ presented in section 3.3**□** ERP = Peak Emission Level - 95.2dB - 2.14dB**6.5. Test Results****PASSED.**

Test Date	2017/01/09	Temp./Hum.	25°C/56%
Test Voltage	DC 5V (via Notebook PC)		

6.5.1. Emissions within Restricted Frequency Bands

6.5.1.1. Frequency 9kHz~30MHz

The emissions (9kHz~30MHz) not reported for there is no emission be found.

6.5.1.2. Frequency Below 1 GHz

Worse mode as representative.

Mode	ZigBee	Frequency	TX 2405MHz
------	--------	-----------	------------

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
166.77	15.91	3.00	10.92	29.83	43.50	13.67	Peak
335.55	20.95	4.80	14.91	40.66	46.00	5.34	Peak
395.69	22.64	5.51	10.01	38.16	46.00	7.84	QP
623.64	24.97	6.83	4.24	36.04	46.00	9.96	Peak
815.70	26.64	7.70	11.06	45.40	46.00	0.60	Peak
875.84	27.00	8.04	7.70	42.74	46.00	3.26	QP

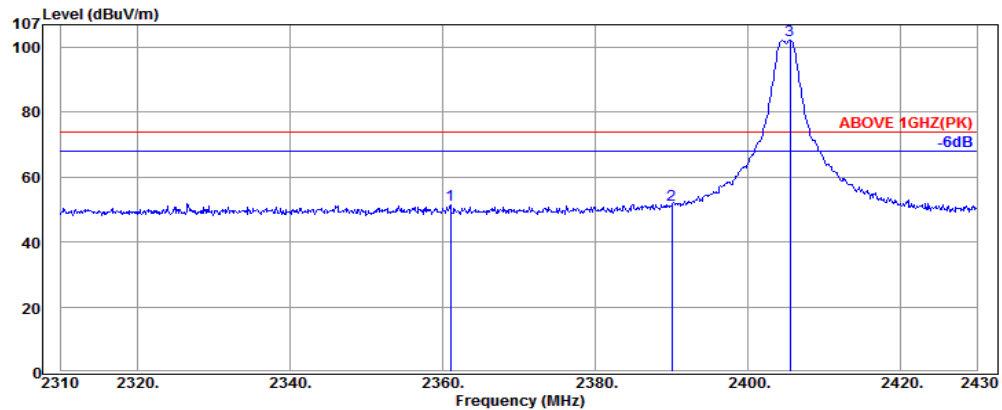
Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
107.60	17.85	2.36	10.00	30.21	43.50	13.29	Peak
304.51	19.93	4.37	6.41	30.71	46.00	15.29	Peak
384.05	22.32	5.38	8.94	36.64	46.00	9.36	Peak
576.11	24.52	6.68	6.37	37.57	46.00	8.43	Peak
815.70	26.64	7.70	9.25	43.59	46.00	2.41	Peak
852.56	26.88	7.92	7.34	42.14	46.00	3.86	Peak

6.5.2. Frequency Above 1 GHz to 10th harmonics

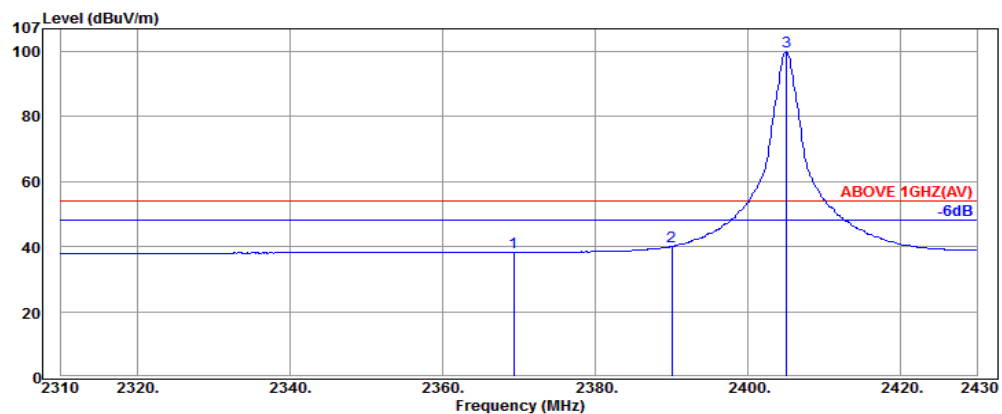
Band Edge:

Mode	ZigBee	Frequency	TX 2405MHz
------	--------	-----------	------------



Antenna at Horizontal Polarization

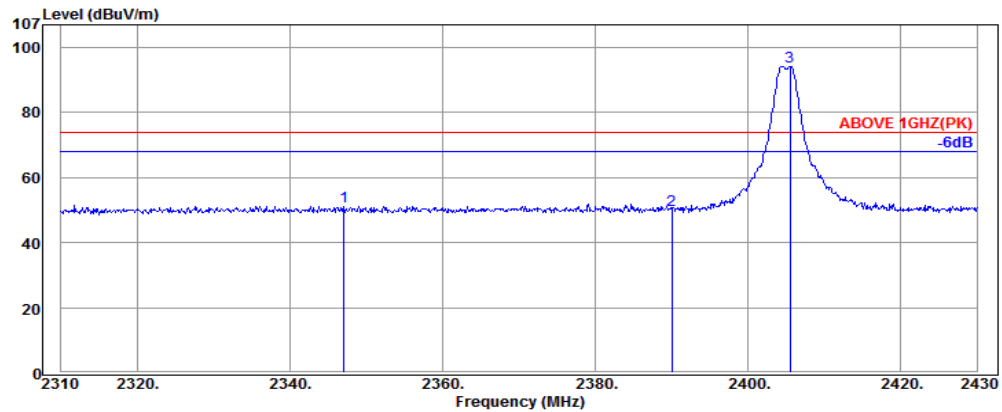
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2361.00	32.11	6.04	13.44	51.59	74.00	22.41	Peak
2390.04	32.16	6.08	13.25	51.49	74.00	22.51	Peak
2405.52	32.18	6.10	63.91	102.19	---	---	Peak



Antenna at Horizontal Polarization

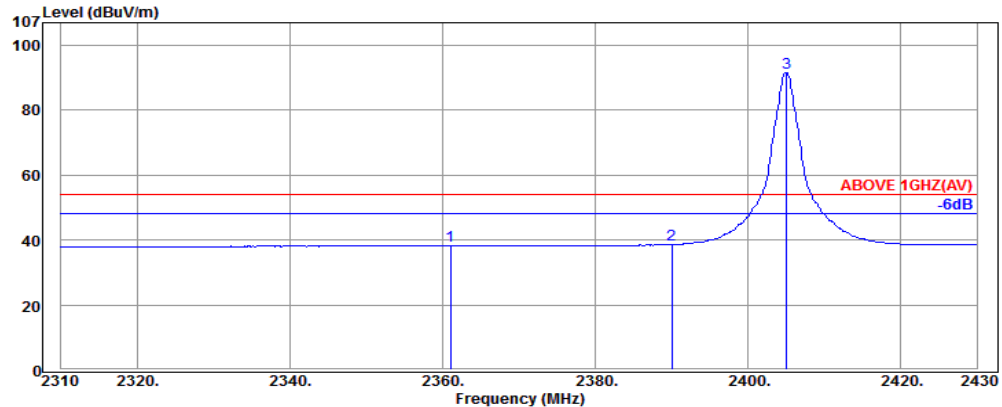
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2369.28	32.13	6.05	0.09	38.27	54.00	15.73	Average
2390.04	32.16	6.08	1.80	40.04	54.00	13.96	Average
2405.04	32.18	6.10	61.55	99.83	---	---	Average

Mode	ZigBee	Frequency	TX 2405MHz
------	--------	-----------	------------



Antenna at Vertical Polarization

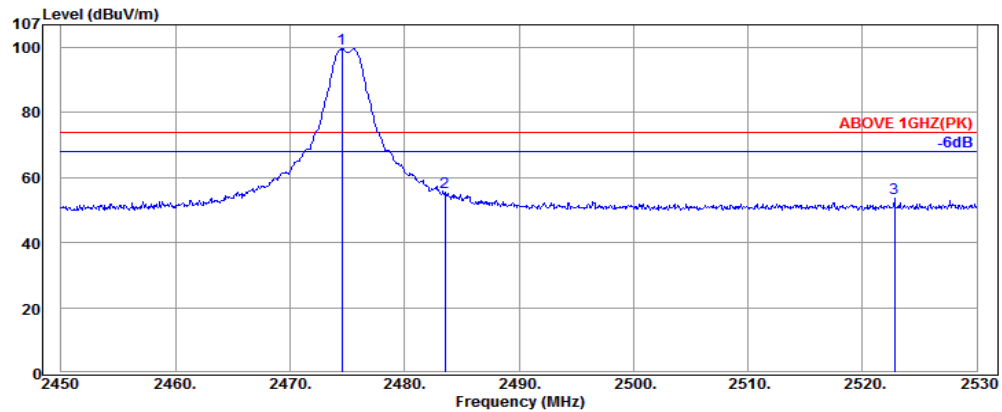
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	imits (dBμV/m)	Margin (dB)	Detector
2347.08	32.08	6.02	13.05	51.15	74.00	22.85	Peak
2390.04	32.16	6.08	11.88	50.12	74.00	23.88	Peak
2405.52	32.18	6.10	56.00	94.28	---	---	Peak



Antenna at Vertical Polarization

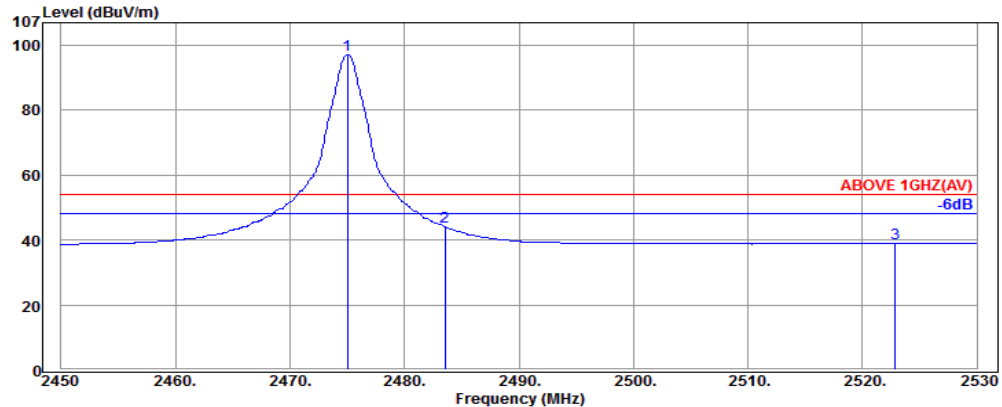
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	imits (dBμV/m)	Margin (dB)	Detector
2361.00	32.11	6.04	0.09	38.24	54.00	15.76	Average
2390.04	32.16	6.08	0.40	38.64	54.00	15.36	Average
2405.04	32.18	6.10	53.42	91.70	---	---	Average

Mode	ZigBee	Frequency	TX 2475MHz
------	--------	-----------	------------



Antenna at Horizontal Polarization

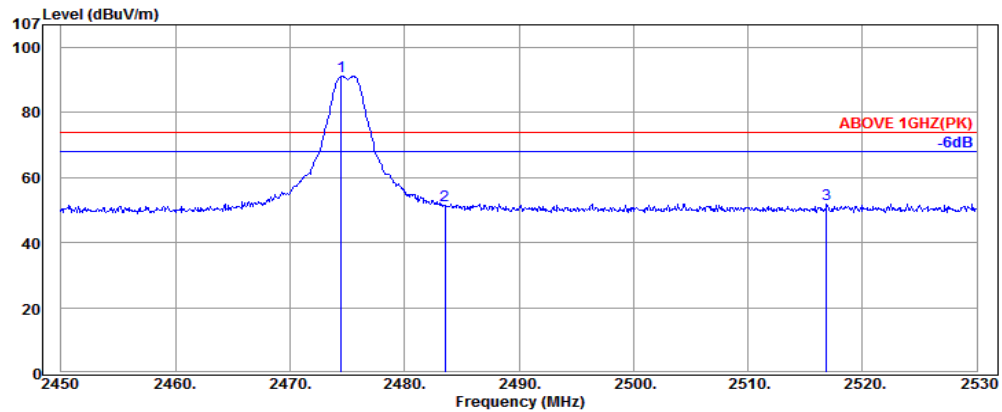
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2474.56	32.28	6.17	61.07	99.52	---	---	Peak
2483.52	32.28	6.19	17.06	55.53	74.00	18.47	Peak
2522.80	32.34	6.23	15.06	53.63	74.00	20.37	Peak



Antenna at Horizontal Polarization

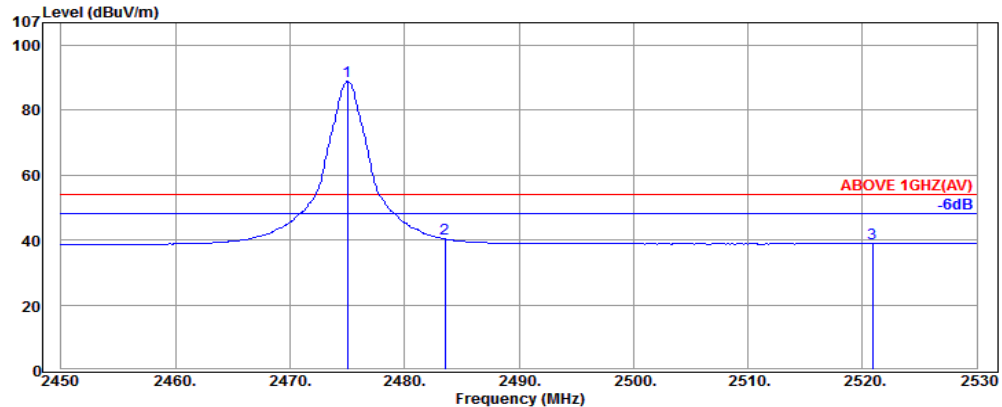
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2475.04	32.28	6.18	58.73	97.19	---	---	Average
2483.52	32.28	6.19	5.50	43.97	54.00	10.03	Average
2522.88	32.34	6.23	0.37	38.94	54.00	15.06	Average

Mode	ZigBee	Frequency	TX 2475MHz
------	--------	-----------	------------



Antenna at Vertical Polarization

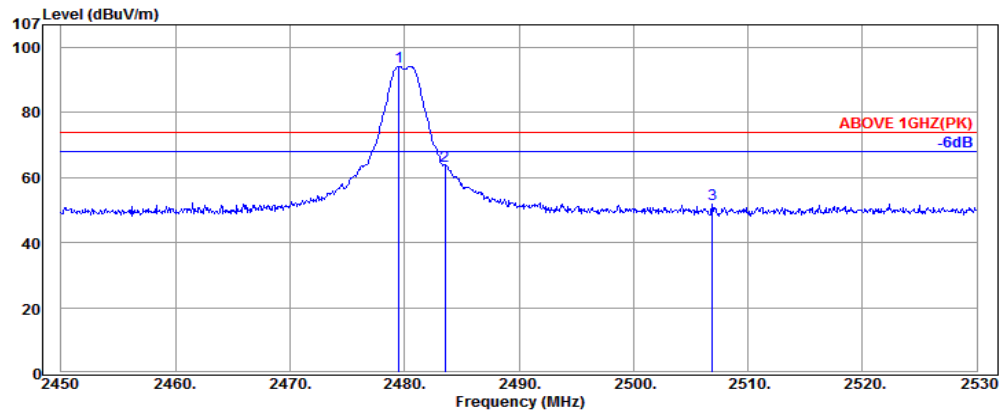
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	imits (dBμV/m)	Margin (dB)	Detector
2474.48	32.28	6.17	52.71	91.16	---	---	Peak
2483.52	32.28	6.19	12.85	51.32	74.00	22.68	Peak
2516.88	32.32	6.23	13.47	52.02	74.00	21.98	Peak



Antenna at Vertical Polarization

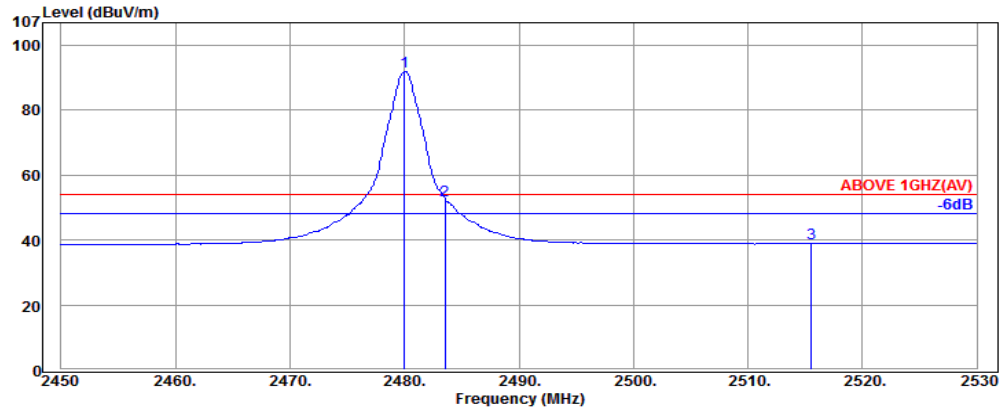
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	imits (dBμV/m)	Margin (dB)	Detector
2475.04	32.28	6.18	50.37	88.83	---	---	Average
2483.52	32.28	6.19	1.83	40.30	54.00	13.70	Average
2520.88	32.32	6.23	0.34	38.89	54.00	15.11	Average

Mode	ZigBee	Frequency	TX 2480MHz
------	--------	-----------	------------



Antenna at Horizontal Polarization

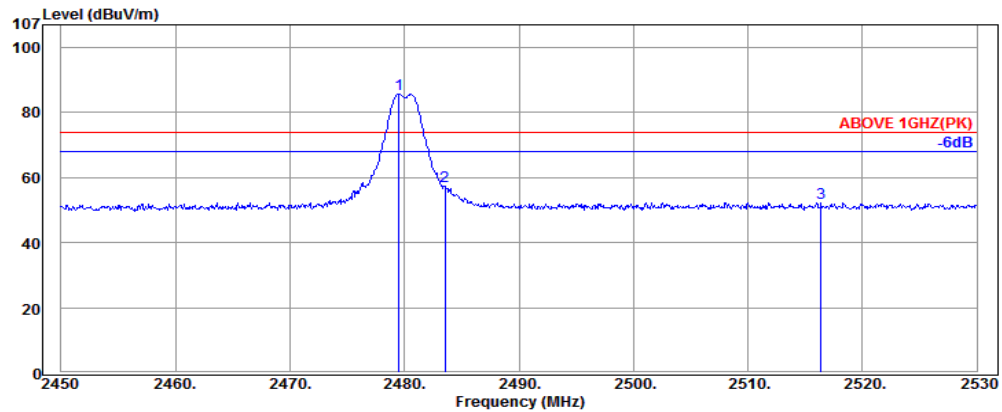
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2479.52	32.28	6.18	55.77	94.23	---	---	Peak
2483.52	32.28	6.19	25.12	63.59	74.00	10.41	Peak
2506.88	32.32	6.21	13.31	51.84	74.00	22.16	Peak



Antenna at Horizontal Polarization

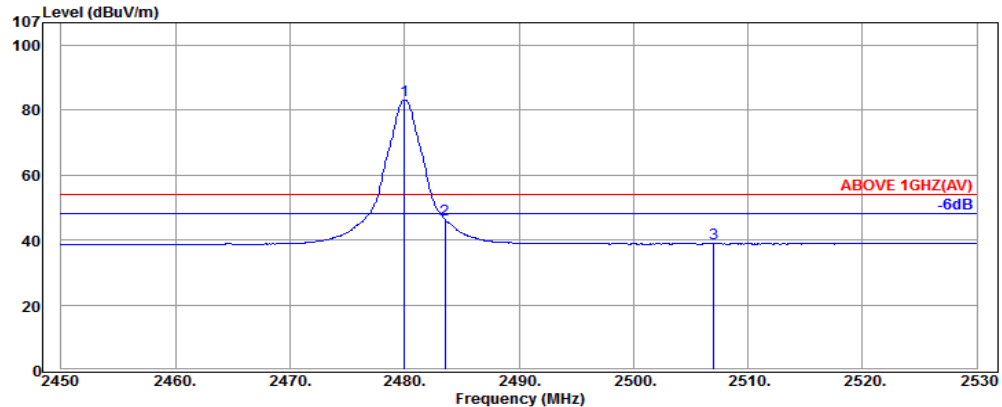
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2480.00	32.28	6.18	53.47	91.93	---	---	Average
2483.52	32.28	6.19	13.90	52.37	54.00	1.63	Average
2515.52	32.32	6.22	0.38	38.92	54.00	15.08	Average

Mode	ZigBee	Frequency	TX 2480MHz
------	--------	-----------	------------



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	imits (dBμV/m)	Margin (dB)	Detector
2479.52	32.28	6.18	47.14	85.60	---	---	Peak
2483.52	32.28	6.19	19.02	57.49	74.00	16.51	Peak
2516.40	32.32	6.23	13.76	52.31	74.00	21.69	Peak



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	imits (dBμV/m)	Margin (dB)	Detector
2480.00	32.28	6.18	44.78	83.24	---	---	Average
2483.52	32.28	6.19	7.87	46.34	54.00	7.66	Average
2507.04	32.32	6.21	0.34	38.87	54.00	15.13	Average

6.5.3. Emissions outside the frequency band:

The emissions (up to 25GHz) not reported for there is no emission be found.

Mode	ZigBee	Frequency	TX 2405MHz
------	--------	-----------	------------

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4810.00	34.22	8.87	9.30	52.39	54.00	1.61	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4810.00	34.22	8.87	8.82	51.91	54.00	2.09	Peak

Mode	ZigBee	Frequency	TX 2440MHz
------	--------	-----------	------------

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4880.00	34.25	9.14	6.72	50.11	54.00	3.89	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4880.00	34.25	9.14	7.09	50.48	54.00	3.52	Peak

Mode	ZigBee	Frequency	TX 2480MHz
------	--------	-----------	------------

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4960.00	34.29	9.40	7.12	50.81	54.00	3.19	Peak

Antenna at Vertical Polarization

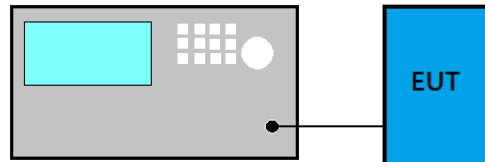
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4960.00	34.29	9.40	8.04	51.73	54.00	2.27	Peak

6.5.4. Emissions in Non-restricted Frequency Bands

Pursuant to KDB 558074 D01 v03r05 that emission levels below the 15.209/RSS-Gen Section 8.9 table 4 general radiated emissions limits is not required.

7. 6dB BANDWIDTH MEASUREMENT

7.1. Block Diagram of Test Setup



7.2. Specification Limits

The minimum 6dB bandwidth shall be at least 500kHz.

7.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r05:

■ Option 2

- (1) Set RBW = 100 kHz.
- (2) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Trace mode = max hold.
- (5) Sweep = auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -6 dB to record the final bandwidth.

7.4. Test Results

Please refer to Appendix A

8. MAXIMUM PEAK OUTPUT POWER MEASUREMENT

8.1. Block Diagram of Test Setup



8.2. Specification Limits

The Limits of maximum Peak Output Power for digital modulation in 2400-2483.5MHz is : 1Watt. (30dBm), and E.I.R.P.: 4Watt (36dBm)

8.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r05:

☒ **PKPM1 Peak power meter method:**

EUT is connected to power sensor and record the maximum output power.

☐ **Method AVGPM (Measurement using an RF average power meter):**

EUT is connected to power sensor and record the maximum average output power and duty cycle factor is added when duty cycle presented in section 3.5 is < 98%.

☐ **Method AVGSA-2 (Spectrum channel power)**

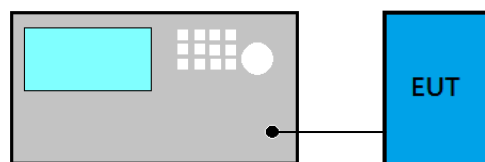
- (1) Set span to at least 1.5 times the OBW
- (2) Set RBW = 1 -5% of OBW
- (3) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- (4) Detector = RMS.
- (5) Trace mode = trace average at least 100 traces
- (6) Sweep = auto couple.
- (7) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges.
- (8) Duty cycle factor is added when duty cycle presented in section 3.5 is < 98%.

8.4. Test Results

Please refer to Appendix A

9. EMISSION LIMITATIONS MEASUREMENT

9.1. Block Diagram of Test Setup



9.2. Specification Limits

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a)/RSS-Gen Section 8.9 table 4 is not required. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205(a)/RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified in Section 15.209(a)/RSS-Gen Section 8.9 table 4 (See Section 15.205(c)).

9.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r05:

■ Reference Level

- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: 100 kHz.
- (4) Set the VBW $\geq 3 \times$ RBW.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize to find the max PSD as reference level.

■ Emission Level Measurement

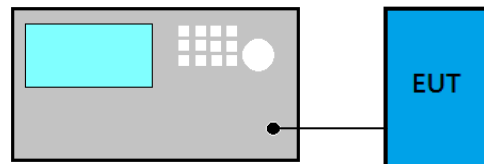
- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: 100 kHz.
- (4) Set the VBW $\geq 3 \times$ RBW.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize to find the max level.

9.4. Test Results

Please refer to Appendix A

10. POWER SPECTRAL DENSITY

10.1. Block Diagram of Test Setup



10.2. Specification Limits

The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band.

10.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r05:

☒ Method PKPSD (peak PSD)

- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- (4) Set the VBW $\geq 3 \times \text{RBW}$.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize.
- (9) Use the peak marker function to determine the maximum amplitude level.
- (10) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

☐ Method AVGPSD-2

- (1) Using peak PSD procedure step 1 to step 4.
- (2) Detector = RMS detector
- (3) Sweep time = auto couple
- (4) Trace mode = trace averaging over a minimum of 100 traces
- (5) Use the peak marker function to determine the maximum amplitude level.
- (6) Duty cycle factor is added when duty cycle presented in section 3.5 $< 98\%$.
- (7) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

10.4. Test Results

Please refer to Appendix A

11.DEVIATION TO TEST SPECIFICATIONS

【NONE】



AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City 244, Taiwan

APPENDIX A

Tel: +886 2 26099301
Fax: +886 2 26099303

APPENDIX A

TEST PLOTS

(Model: 9ZS52055DA)

TABLE OF CONTENTS

A.1 6dB BANDWIDTH MEASUREMENT	2
A.1.1 6dB Bandwidth Result.....	2
A.1.2 Measurement Plots	3
A.2 MAXIMUM PEAK OUTPUT POWER MEASUREMENT	4
A.2.1 Peak Output Power	4
A.3 EMISSION LIMITATIONS MEASUREMENT	5
A.4 POWER SPECTRAL DENSITY	8
A.4.1 Power Spectral Density Result	8
A.4.2 Measurement Plots	9

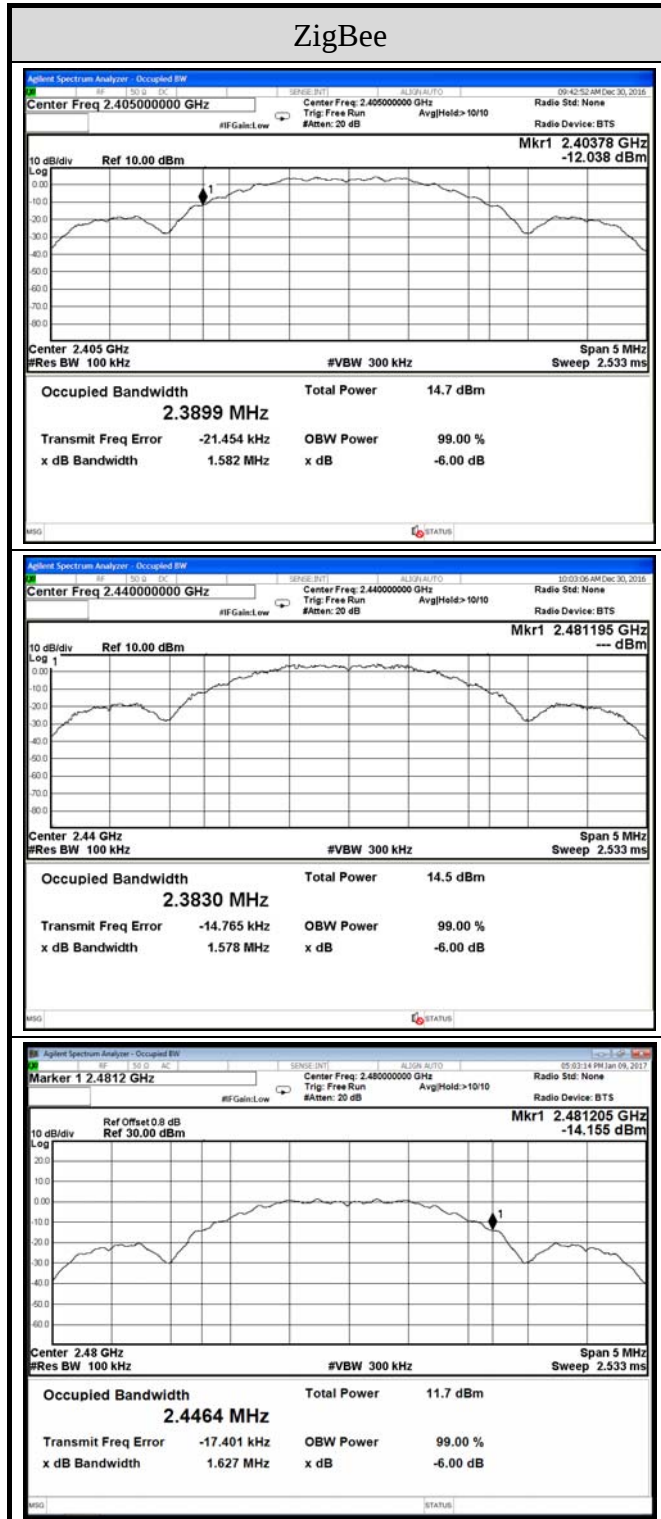
A.1 6dB BANDWIDTH MEASUREMENT

Test Date	2016/12/30 ~ 2017/01/09	Temp./Hum.	23~24°C/57~59%
Cable Loss	0.8dB	Test Voltage	DC 5V (via Notebook PC)

A.1.1 6dB Bandwidth Result

Modulation Type	Centre Frequency (MHz)	6 dB Bandwidth (MHz)	Limit
ZigBee	2405	1.582	>500kHz
	2440	1.578	
	2480	1.627	

A.1.2 Measurement Plots



A.2 MAXIMUM PEAK OUTPUT POWER MEASUREMENT

Test Date	2016/12/30 ~ 2017/01/09	Temp./Hum.	23~24°C/57~59%
Cable Loss	0.8dB	Test Voltage	DC 5V (via Notebook PC)

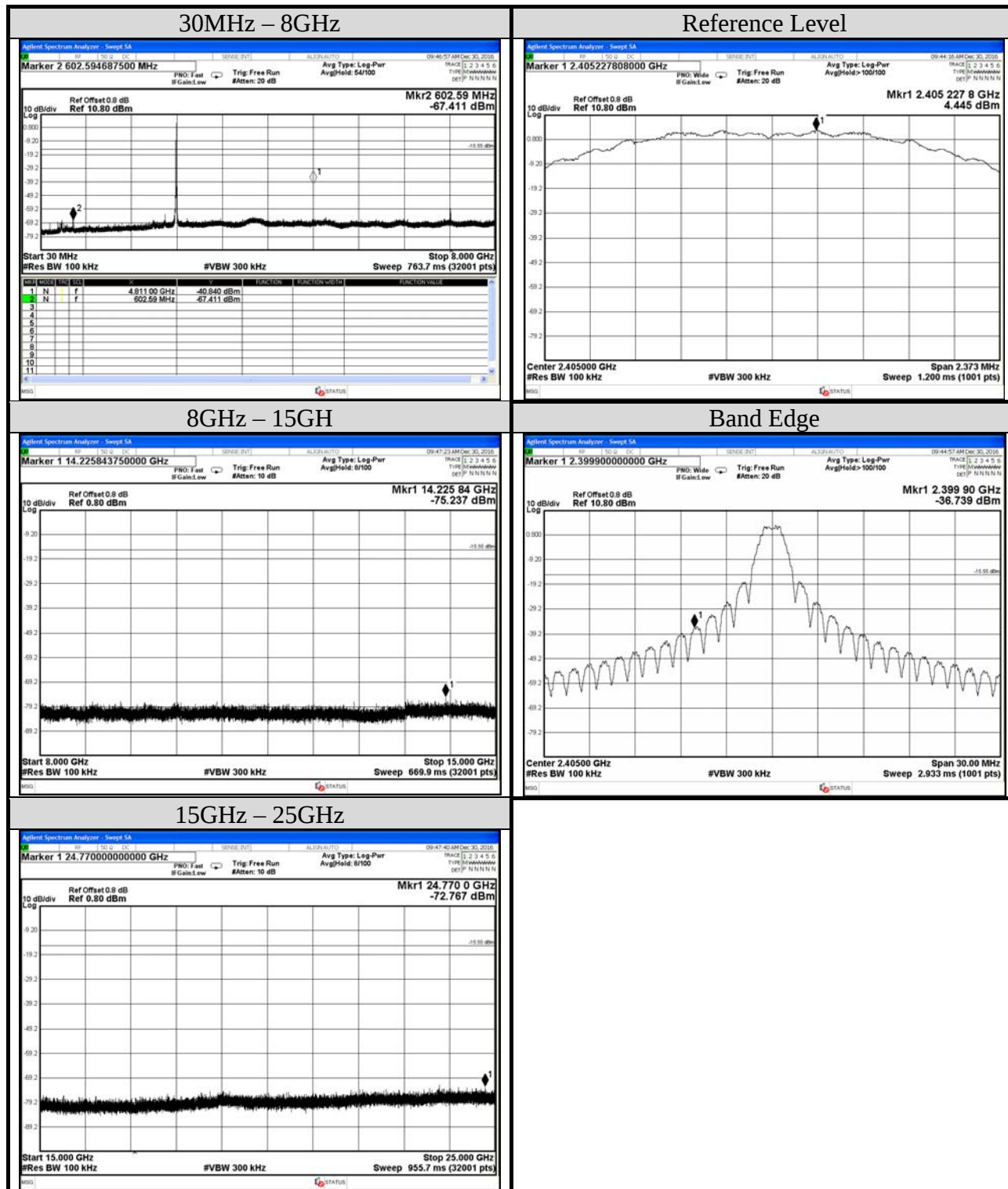
A.2.1 Peak Output Power

Mode	Centre Frequency (MHz)	Peak Output Power		Limit
		(dBm)	(W)	
ZigBee	2405	8.87	0.007709	< 30 dBm (1 W)
	2410	8.86	0.007691	
	2415	8.81	0.007603	
	2420	8.78	0.007551	
	2425	8.73	0.007464	
	2430	8.65	0.007328	
	2435	8.60	0.007244	
	2440	8.51	0.007096	
	2445	8.43	0.006966	
	2450	8.35	0.006839	
	2455	8.24	0.006668	
	2460	8.13	0.006501	
	2465	8.04	0.006368	
	2470	7.93	0.006209	
	2475	7.80	0.006026	
	2480	3.40	0.002188	

Note: The results have been included cable loss.

A.3 EMISSION LIMITATIONS MEASUREMENT

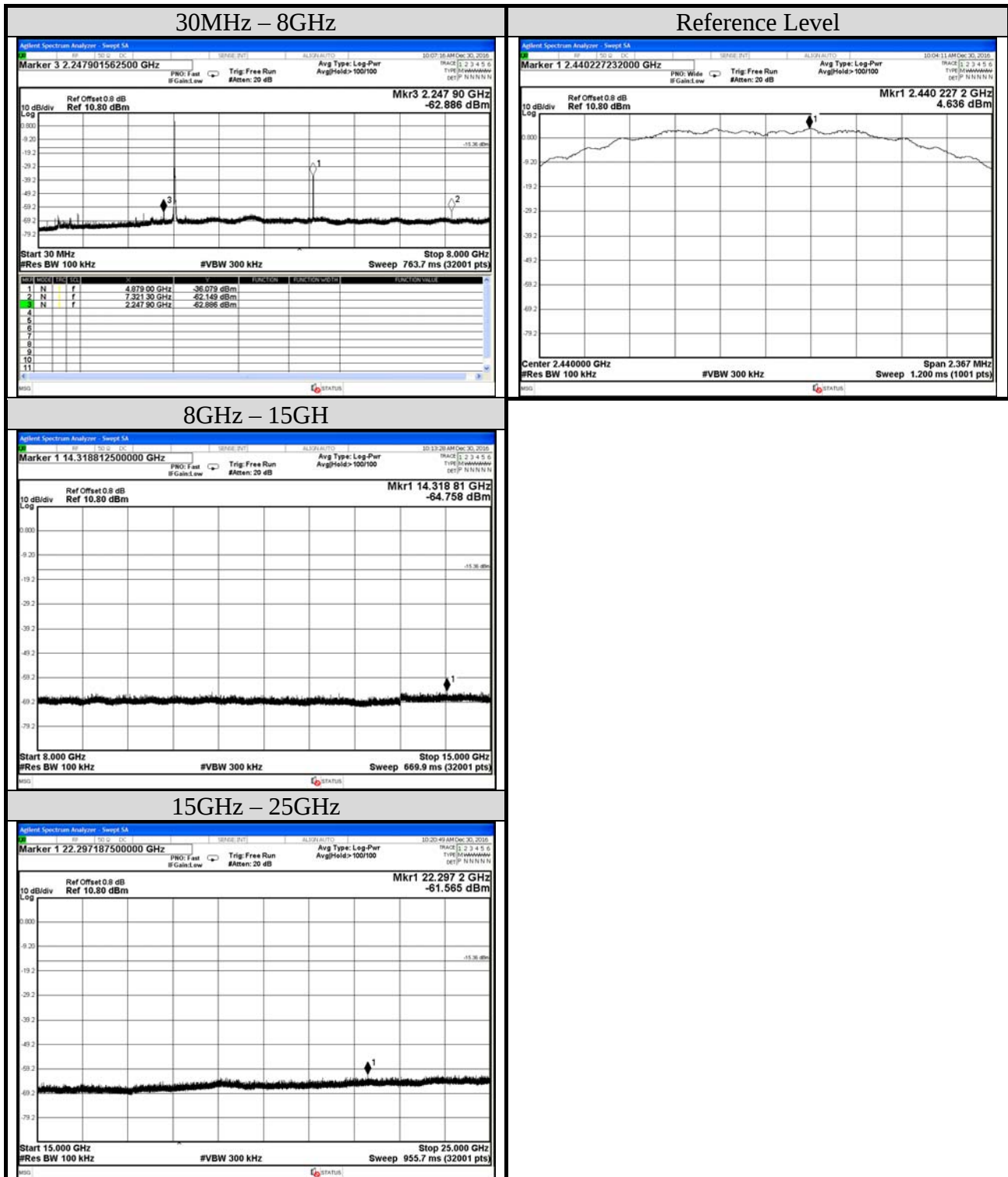
Test Date	2016/12/30	Temp./Hum.	23°C/59%
Cable Loss	0.8dB	Test Voltage	DC 5V (via Notebook PC)
Mode	ZigBee	Frequency	TX 2405MHz



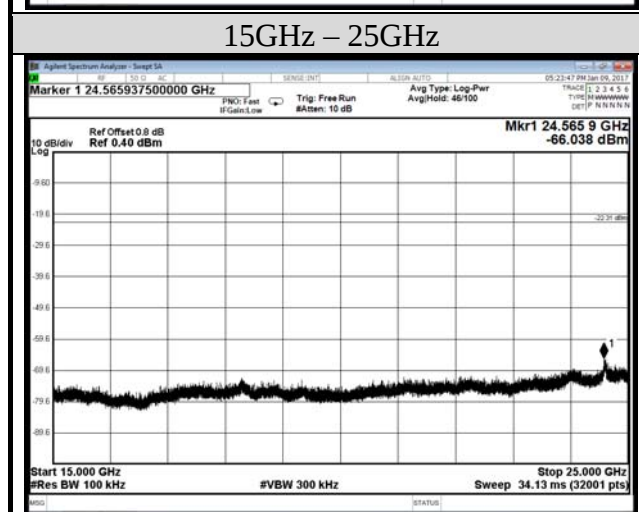
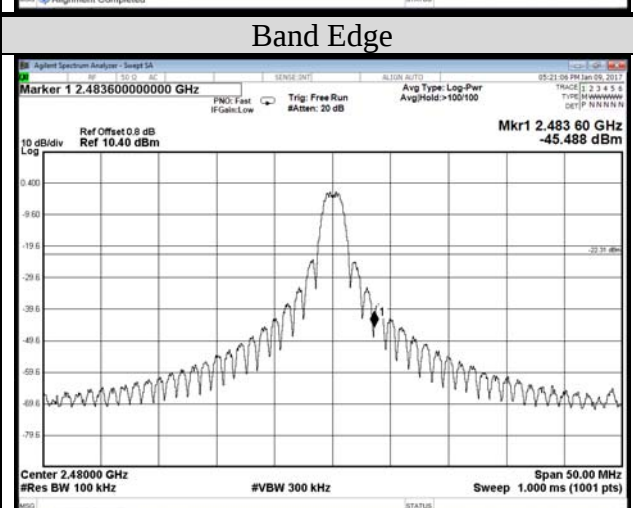
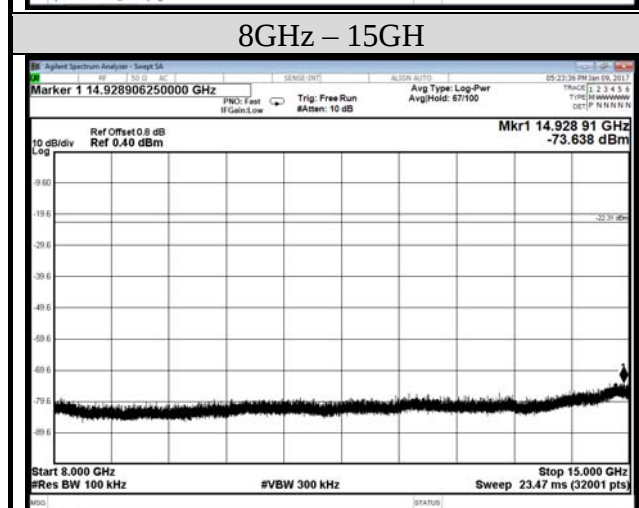
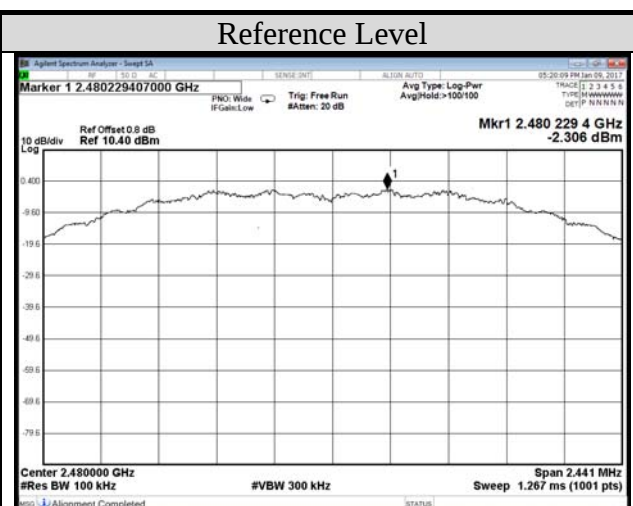
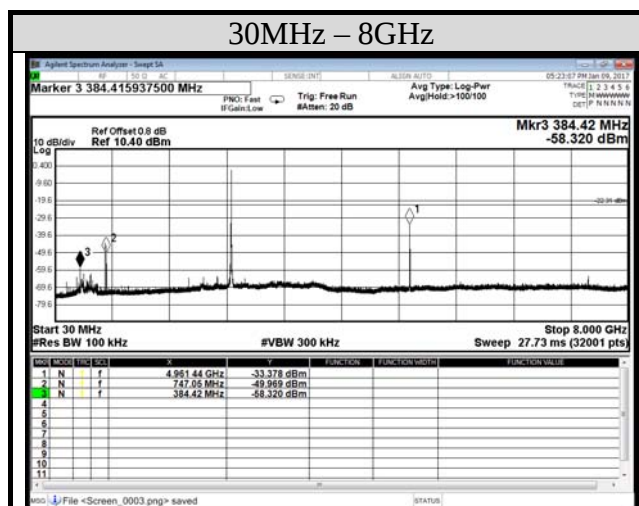
AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City 244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

Test Date	2016/12/30	Temp./Hum.	23°C/59%
Cable Loss	0.8dB	Test Voltage	DC 5V (via Notebook PC)
Mode	ZigBee	Frequency	TX 2440MHz



Test Date	2017/01/09	Temp./Hum.	24°C/57%
Cable Loss	0.8dB	Test Voltage	DC 5V (via Notebook PC)
Mode	ZigBee	Frequency	TX 2480MHz



A.4 POWER SPECTRAL DENSITY

Test Date	2016/12/30 ~ 2017/01/09	Temp./Hum.	23~24°C/57~59%
Cable Loss	0.8dB	Test Voltage	DC 5V (via Notebook PC)

A.4.1 Power Spectral Density Result

Modulation Type	Centre Frequency (MHz)	Power Spectral Density (dBm)	Limit
ZigBee	2405	4.445	< 8 dBm/3kHz
	2440	4.636	
	2480	-2.306	

Note: All results have been included cable loss and Simultaneous Factor.

A.4.2 Measurement Plots

