AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
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FCC 15.247
2.4 GHz Report

for

LG Electronics Inc.

1, Gwanak-ro, Gwanak-gu, Seoul, 151-919, Rep. of Korea

Brand	**:**	**LG**
Product Name	**:**	**Wireless Motion Sensor**
Model Name	**:**	**9SD441TVDA**
FCC ID	**:**	**BEJ9SD441TVDA**

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TEST REPORT CERTIFICATION

Applicant	:	LG Electronics Inc.
Manufacture	:	LG Electronics Inc.
Factory	:	OHSUNG ELECTRONICS Co., Ltd.
Product Name	:	Wireless Motion Sensor
Model No.	:	9SD441TVDA
Serial No.	:	N/A
Brand	:	LG
Power Supply	:	DC 3.3V (Via test jig powered by USB)

Applicable Standards:

FCC Rules and Regulations Part 15 Subpart C, Oct. 2014
ANSI C63.4:2003
KDB 558074 D01 DTS Meas Guidance v03r02

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: 2015. 03. 14 ~ 25 Date of Report: 2015. 03. 25

Producer : (Tina Huang/Administrator)

Signatory: (Ben Cheng/Manager)

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1. REPORT HISTORY

Revision	Date	Revision Summary	Report Number
0	2015. 03. 25	Original Report.	EM-F150158

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2. SUMMARY OF TEST RESULTS

Rule	Description	Results
15.207	Conducted Emission	**PASS**
15.247(d)/15.205	Radiated Band Edge and Radiated Spurious Emission	**PASS**
15.247(a)	6dB Bandwidth	**PASS**
15.247(b)	Maximum Peak Output	**PASS**
15.247(d)	Conducted Band Edges and Conducted Spurious Emission	**PASS**
15.247 (e)	Power Spectral Density	**PASS**
15.203	Antenna Requirement	**PASS**

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3. GENERAL INFORMATION

3.1. Description of EUT

Product	Wireless Motion Sensor
Model Number	9SD441TVDA
Serial Number	N/A
Brand Name	LG
Applicant	LG Electronics Inc. 1, Gwanak-ro, Gwanak-gu, Seoul, 151-919, Rep. of Korea
Manufacture	LG Electronics Inc. 1, Gwanak-ro, Gwanak-gu, Seoul, 151-919, Rep. of Korea
Factory	OHSUNG ELECTRONICS Co., Ltd. 181, Gongdan-dong, Gumi-si, Gyeongsangbuk-do, Korea
RF Features	ZigBee (IEEE 802.15.4)
Transmit Type	1T1R
Cable	Non-Shielded, Detachable, 1.2m
Date of Receipt of Sample	2015. 03. 06

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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			
ZigBee (IEEE 802.15.4)			
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. Antenna Information

Antenna Part Number	Manufacture	Antenna Type	Frequency	Max Gain (dBi)
---	---	PCB Printed Antenna	2405-2480MHz	-0.33

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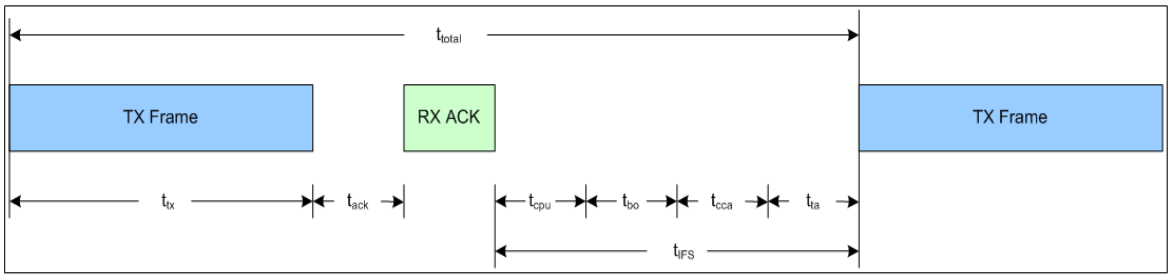
3.4. Test Configuration

Duty Cycle of EUT

IEEE 802.15.4-2003 MAC Constants		
maxBE	5	IEEE 802.15.4 specifies 5, ZigBee specifies 8
a Max Frame Response Time	1220	symbols
a Max Frame Retries	3	
a Unit Back off Period	20	symbols
mac Ack Wait Duration	54	symbols
mac Batt Life Ext Periods	6	Backoff periods
mac Max CSMA Back offs	4	
mac Min BE	3	IEEE 802.15.4 specifies 3, ZigBee specifies 5
a Min LIFS Period	40	symbols
a Min SIFS Period	12	symbols
a Min CAP Length	440	symbols
NB	0	
CW	2	
BE	3	



MAC-Level Calculation (SIFS)

Short Frame Scenario:	
1) TX Frame	Assume Frame is Data Frame
2) Wait for ACK	
3) RX ACK	
4) CPU Processing of ACK	
5) Wait for Back off	
6) Repeat 1)	

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MAC-Level Calculation (SIFS)

Short Frame Scenario:		
1) TX Frame	Assume Frame is Data Frame	Assume Frame is Data Frame
2) Wait for ACK		
3) RX ACK		
4) CPU Processing of ACK		
5) Wait for Back off		
6) Repeat 1)		

Short Inter Frame Spacing (Slotted w/ ACK)		
Short Frame	18	bytes
Data Frame Payload	18	bytes
ACK Frame	5	bytes
tack	12	sym
SIFS	12	sym
Back off Period	20	sym
Maximum Back off	7	
Back off Required	2	
Back off Time	70	sym

Transmit Time		
TX Time (Packet)	0.000768	
Total TX Time (sec)	0.000768	

NOT Transmit time (RX or Idle)		
Wait for ACK (tack)	0.000192	
RX Time (ACK)	0.000352	
Back off Time (tbo)	0.00112	(Backoff Time * Backoff Period)
CPU Processing (tcpu)	0.0002	(0.2ms average on EM2xx running EmberZNet)
CCA Assessment (tcca)	0.000128	(averaged over 8 symbols in RX Mode)
Turn Around Time (RX to TX)	0.000192	(After CCA, Radio turns over to TX in 12 symbols)
Total Off Time (sec)	0.002184	

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Total Time (ttotal)	0.002952
Number of periods in 100ms Window	33.87533875
Worse Case (100ms window)	
TX Frame 15 times	0.01152
RX or IDLE 15 Times	0.03276
Sum	0.04428

Duty Cycle correction= 20*log[0.01152/(0.01152+0.03276)]= -11.34dB

AC Conduction	
Test Case	Normal operation

Item		Mode	Data Rate	Test Channel
Radiated Test Case	Radiated Band Edge	ZigBee	0.25 Mbps	11/26
	Radiated Spurious Emission	ZigBee	0.25 Mbps	11/18/26
Conducted Test Case	6dB Bandwidth	ZigBee	0.25 Mbps	11/18/26
	Peak Power Spectral Density	ZigBee	0.25 Mbps	11/18/26
	Peak Output Power	ZigBee	0.25 Mbps	11/18/26
	Band Edge	ZigBee	0.25 Mbps	11/18/26
	Spurious Emission	ZigBee	0.25 Mbps	11/18/26

3.5. Tested Supporting System List

3.5.1. Support Peripheral Unit

No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	Notebook PC	acer	MS2362	N/A	PPD-AAR5B225
2.	Test Jig	N/A	N/A	N/A	N/A

3.5.2. Cable Lists

No.	Cable Description Of The Above Support Units
1.	USB Cable: Shielded, Detachable, 1.8m Adapter: Chicony, M/N CPA09-A065N1, DC Cord: Shielded, Undetachable, 1.8m Bonded a ferrite core AC Power Cord: Non-Shielded, Detachable, 1.8m
2.	BUS Cable: Non-Shielded, Detachable, 0.1m

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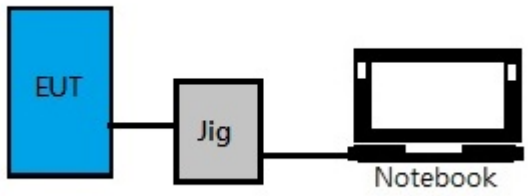
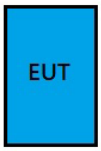
3.6. Setup Configuration

3.6.1. EUT Configuration for Power Line and Radiated Emission



3.6.2. EUT Configuration for Conducted Test Items



3.7. Operating Condition of EUT

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

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3.8. 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. 8 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 May 11, 2012 File on Federal Communication Commission Registration Number: 90993
NVLAP Lab. Code	:	200077-0
TAF Accreditation No	:	1724

3.9. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty
Conduction Test	150kHz~30MHz	±3.5dB
Radiation Test (Distance: 3m)	30MHz~1000MHz	± 5.3dB
	Above 1GHz	± 4.8dB

Remark：Uncertainty = $ku_c(y)$

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

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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	2015. 02. 06	1 Year
2.	A.M.N.	R&S	ENV4200	100169	2014. 05. 06	1 Year
3.	L.I.S.N.	Kyoritsu	KNW-407	8-855-9	2014. 12. 26	1 Year
4.	Pulse Limiter	R&S	ESH3-Z2	100354	2015. 01. 17	1 Year

4.2. Radiated Emission Measurement

4.2.1. Frequency Range 30MHz~1000MHz

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A-503	MY52220119	2014. 06. 25	1 Year
2.	Test Receiver	R & S	ESCS30	100338	2014. 06. 24	1 Year
3.	Amplifier	HP	8447D	2944A06305	2015. 02. 12	1 Year
4.	Bilog Antenna	TESEQ	CBL6112D	33821	2014. 08. 02	1 Year

4.2.2. Frequency Range 30MHz~1000MHz

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9030A-544	US51350140	2014. 06. 25	1 Year
2.	Test Receiver	R & S	ESCS30	100338	2014. 06. 24	1 Year
3.	Amplifier	Agilent	8449B	3008A02676	2015. 02. 11	1 Year
4.	2.4GHz Notch Filter	K&L	7NSL10-2441.5E130.5-00	1	2014. 06. 12	1 Year
5.	3G High Pass Filter	Microware Circuits	H3G018G1	484796	2014. 06. 12	1 Year
6.	Horn Antenna	EMCO	3115	9609-4927	2014. 06. 17	1 Year
7.	Horn Antenna	EMCO	3116	2653	2014. 10. 10	1 Year

4.3. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9030A-526	MY53310269	2014. 09. 19	1 Year
2.	Power Meter	Anritsu	ML2495A	1145008	2014. 10. 17	1 Year
3.	Power Sensor	Anritsu	MA2411B	1126096	2014. 10. 17	1 Year

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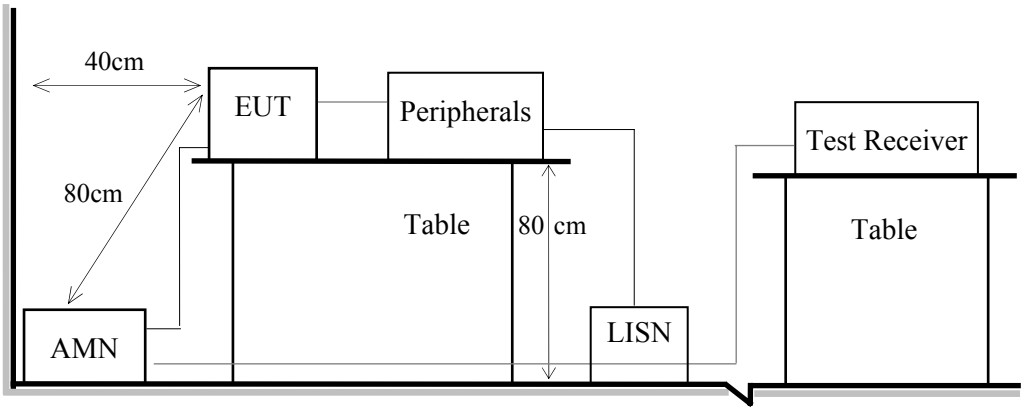
5. CONDUCTED EMISSION MEASUREMET

5.1. Block Diagram of Test Setup

Shielded Room Setup Diagram



Ground Plane

5.2. Power Line Conducted Emission Limit

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

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.

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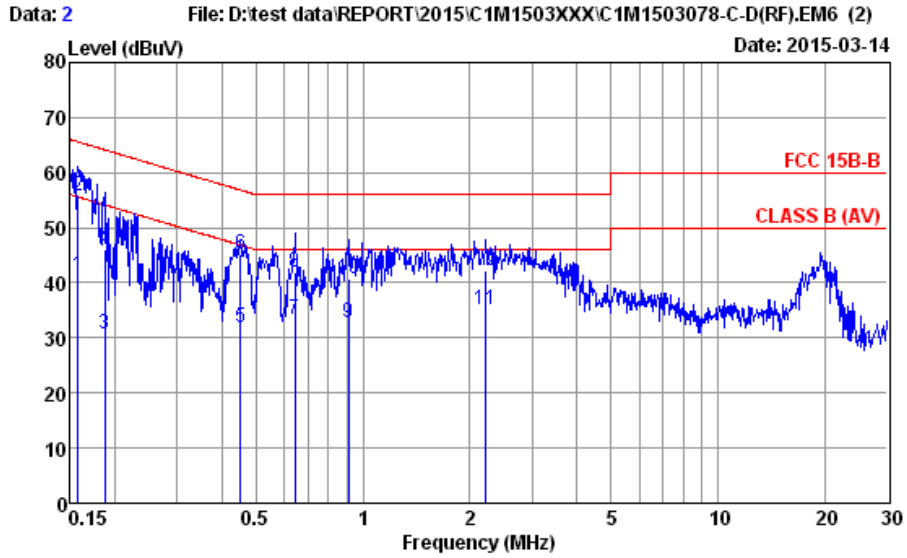
5.4. Conducted Emission Measurement Results

PASSED.

Test Date	2015/03/14	Temp./Hum.	26℃/50%
Test Voltage	DC 3.3V		




```
Site no.      : No.8 Shielded Room          Data no.   : 2
Condition     : ENV4200 100169              Phase      : NEUTRAL
Limit         : FCC 15B-B
Env. / Ins.   : 26°C / 50% ESR3 (1774)      Engineer   : Ken Yang
EUT           : 9SD441TVDA
Power Rating  : DC3.3V
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	0.157	10.66	0.03	9.87	20.92	41.48	55.60	14.12	Average
2	0.157	10.66	0.03	9.87	35.26	55.82	65.60	9.78	QP
3	0.187	10.61	0.03	9.87	10.27	30.78	54.15	23.37	Average
4	0.187	10.61	0.03	9.87	25.52	46.03	64.15	18.12	QP
5	0.452	10.47	0.03	9.88	11.48	31.86	46.85	14.99	Average
6	0.452	10.47	0.03	9.88	24.80	45.18	56.85	11.67	QP
7	0.644	10.46	0.04	9.88	13.08	33.46	46.00	12.54	Average
8	0.644	10.46	0.04	9.88	21.45	41.83	56.00	14.17	QP
9	0.909	10.45	0.05	9.87	12.27	32.64	46.00	13.36	Average
10	0.909	10.45	0.05	9.87	20.50	40.87	56.00	15.13	QP
11	2.213	10.50	0.09	9.87	14.62	35.08	46.00	10.92	Average
12	2.213	10.50	0.09	9.87	21.86	42.32	56.00	13.68	QP

```
Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
         2. If the average limit is met when useing a quasi-peak detector,
            the EUT shall be deemed to meet both limits and measurement
            with average detector is unnecessary.
```

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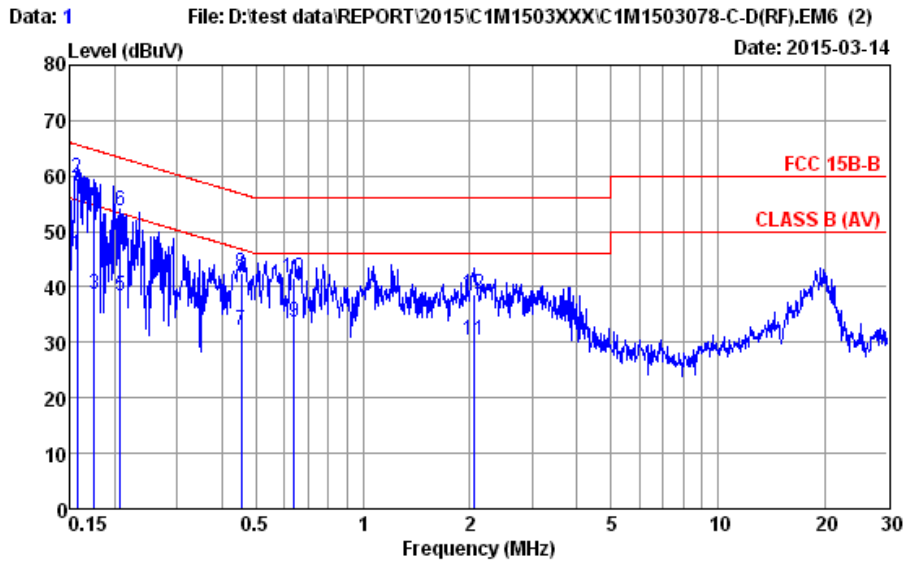

Site no. : No.8 Shielded Room
Data no. : 1
Condition : ENV4200 100169
Phase : LINE
Limit : FCC 15B-B
Env. / Ins. : 26°C / 50% ESR3 (1774)
Engineer : Ken Yang
EUT : 9SD441TVDA
Power Rating : DC3.3V
Test Mode : Operating

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBµV)	Emission Level (dBµV)	Limits (dBµV)	Margin (dB)	Remark
1	0.156	10.65	0.03	9.87	25.30	45.85	55.65	9.80	Average
2	0.156	10.65	0.03	9.87	39.00	59.55	65.65	6.10	QP
3	0.175	10.63	0.03	9.87	18.07	38.60	54.72	16.12	Average
4	0.175	10.63	0.03	9.87	34.79	55.32	64.72	9.40	QP
5	0.207	10.59	0.03	9.87	17.74	38.23	53.32	15.09	Average
6	0.207	10.59	0.03	9.87	33.19	53.68	63.32	9.64	QP
7	0.454	10.48	0.03	9.88	11.66	32.05	46.80	14.75	Average
8	0.454	10.48	0.03	9.88	22.14	42.53	56.80	14.27	QP
9	0.641	10.47	0.04	9.88	13.29	33.68	46.00	12.32	Average
10	0.641	10.47	0.04	9.88	21.18	41.57	56.00	14.43	QP
11	2.055	10.50	0.08	9.87	9.81	30.26	46.00	15.74	Average
12	2.055	10.50	0.08	9.87	18.08	38.53	56.00	17.47	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
2. If the average limit is met when useing a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

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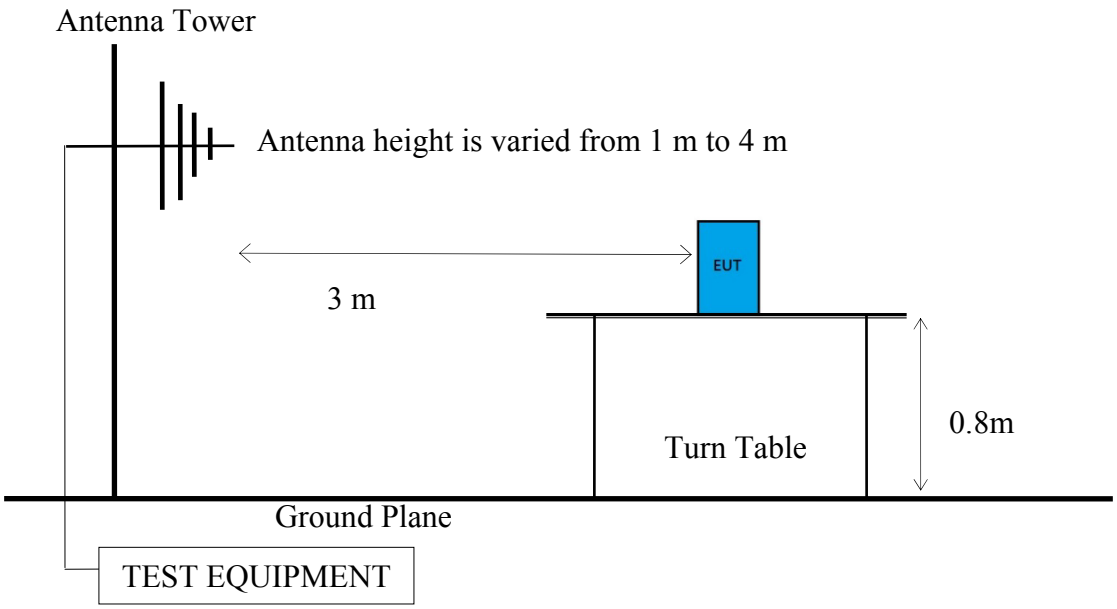
6. RADIATED EMISSION MEASUREMENT

6.1. Block Diagram of Test Setup

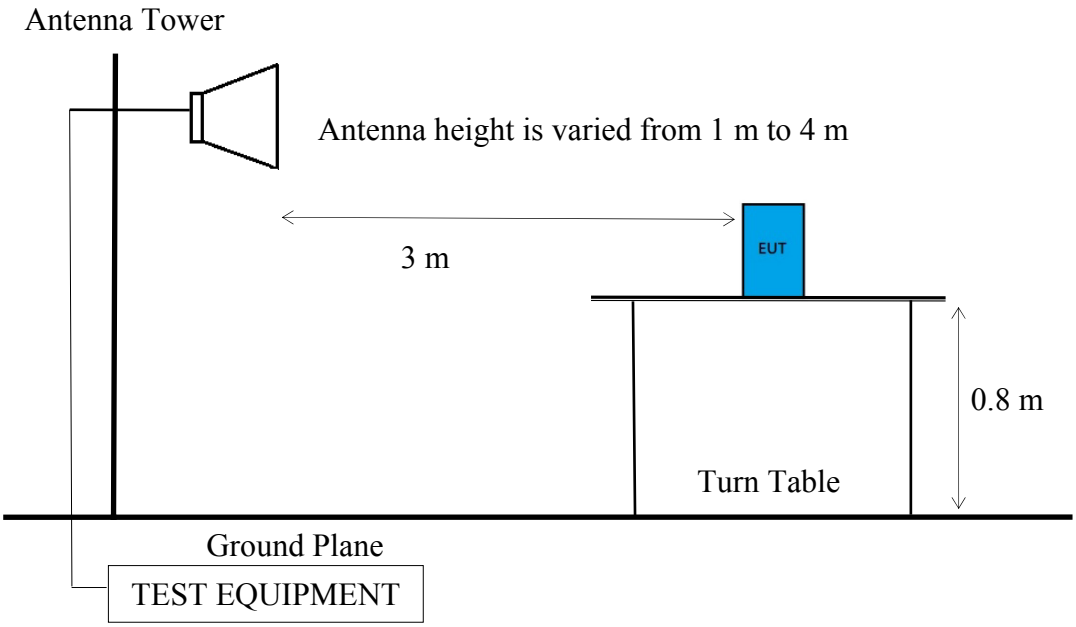
6.1.1. Block Diagram of EUT

Indicated as section 3.6

6.1.2. Setup Diagram for 30-1000 MHz



6.1.3. Semi-Anechoic Chamber (3m) Setup Diagram for above 1GHz



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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, must also comply with the radiated emission limits specified as below.

Frequency (MHz)	Distance (m)	Field Strengths Limits	
		μV/m	dBμV/m
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
Above 960	3	500	54.0
Above 1000	3	74.0 dBμV/m (Peak) 54.0 dBμV/m (Average)	

Remark：(1) dBμV/m = 20 log (μV/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

The EUT setup on the turn find table which has 80 cm 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, RSS-Gen and RSS-210 regulation.

Frequency below 1 GHz:
Spectrum Analyzer is used for pre-testing with following setting:
(1) RBW = 120KHz
(2) VBW ≥ 3 x 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.

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Frequency above 1GHz to 10th harmonic:

Peak Detector:

(1) RBW = 1MHz
(2) VBW ≥ 3 x 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.

6.4. Measurement Result Explanation

Peak Emission Level=Antenna Factor + Cable Loss + Meter Reading
Average Emission Level= Peak Emission Level+ DCCF
Duty Cycle Correction Factor (DCCF)= 20log (TX_{on}/TX_{on+off}) presented in section 3.4

6.5. Test Results

PASSED.

Test Date	2015/03/23	Temp./Hum.	23℃/38%
Test Voltage	DC 3.3V		

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6.5.1. Emissions within Restricted Frequency Bands

6.5.1.1. Frequency Below 1 GHz

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
275.41	12.78	4.50	25.42	42.70	46.00	3.30	Peak
299.66	13.12	4.65	24.84	42.61	46.00	3.39	Peak
500.45	16.98	6.44	19.02	42.44	46.00	3.56	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
299.66	13.12	4.65	17.93	35.70	46.00	10.30	Peak
500.45	16.98	6.44	16.77	40.19	46.00	5.81	Peak
800.18	20.02	7.16	7.16	34.34	46.00	11.66	Peak

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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
299.66	13.12	4.65	24.50	42.27	46.00	3.73	Peak
500.45	16.98	6.44	19.52	42.94	46.00	3.06	Peak
800.18	20.02	7.16	9.70	36.88	46.00	9.12	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
125.06	12.01	3.41	18.10	33.52	43.50	9.98	Peak
299.66	13.12	4.65	18.39	36.16	46.00	9.84	Peak
500.45	16.98	6.44	16.71	40.13	46.00	5.87	Peak

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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
250.19	12.40	4.33	25.66	42.39	46.00	3.61	Peak
275.41	12.78	4.50	25.40	42.68	46.00	3.32	Peak
500.45	16.98	6.44	19.35	42.77	46.00	3.23	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
299.66	13.12	4.65	17.95	35.72	46.00	10.28	Peak
500.45	16.98	6.44	16.35	39.77	46.00	6.23	Peak
912.70	20.65	7.62	5.23	33.50	46.00	12.50	Peak

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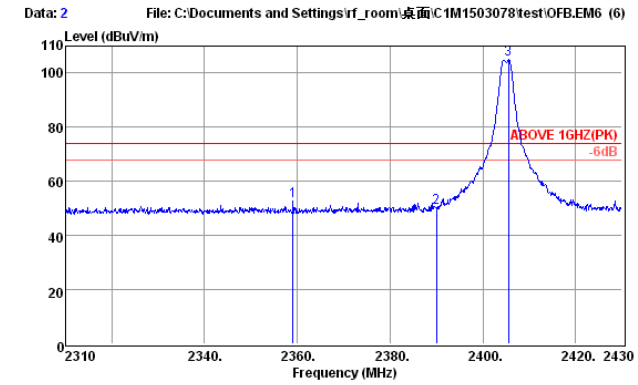
6.5.1.2. Frequency Above 1 GHz to 10th harmonics

Band Edge:



Site no. : Audix NO.1 3m Chamber Data no. : 2
Dis. / Ant. : 3m 3115(4927) Ant. pol. : HORIZONTAL
Limit : ABOVE 1GHZ(PK)
Env. / Ins. : 23*C/38% N9010A Engineer : An
EUT : 9SD441TVDA
Power Rating : DC 3.3V
Test Mode : Tx2405MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1	2359.08	28.17	5.19	19.56	52.92	74.00	21.08	Peak
2	2390.04	28.20	5.24	16.82	50.26	74.00	23.74	Peak
3	2405.52	28.22	5.26	71.44	104.92	74.00	-30.92	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Peak Level (dB/m)	DCCF (dB)	Average Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)
2359.08	52.92	-11.34	41.58	54.00	12.42
2390.04	50.26	-11.34	38.92	54.00	15.08

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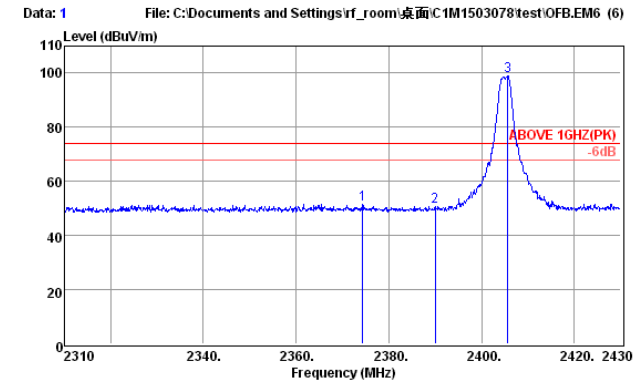

Site no. : Audix NO.1 3m Chamber Data no. : 1
Dis. / Ant. : 3m 3115(4927) Ant. pol. : VERTICAL
Limit : ABOVE 1GHZ(PK)
Env. / Ins. : 23*C/38% N9010A Engineer : An
EUT : 9SD441TVDA
Power Rating : DC 3.3V
Test Mode : Tx2405MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1	2374.32	28.18	5.22	18.20	51.60	74.00	22.40	Peak
2	2390.04	28.20	5.24	17.15	50.59	74.00	23.41	Peak
3	2405.64	28.22	5.26	65.55	99.03	74.00	-25.03	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

Antenna at Vertical Polarization

Emission Frequency (MHz)	Peak Level (dB/m)	DCCF (dB)	Average Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)
2374.32	51.60	-11.34	40.26	54.00	13.74
2390.04	50.59	-11.34	39.25	54.00	14.75

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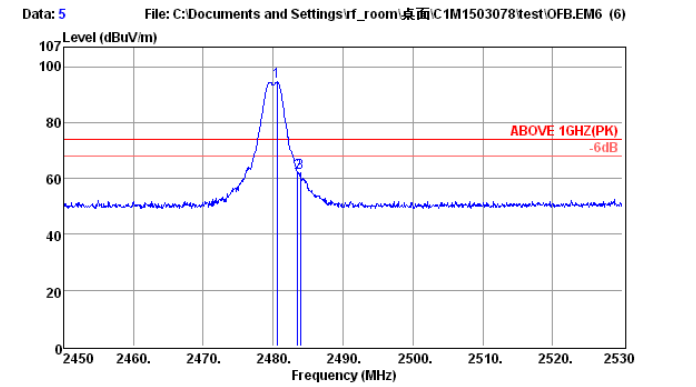

Site no. : Audix NO.1 3m Chamber Data no. : 5
Dis. / Ant. : 3m 3115(4927) Ant. pol. : HORIZONTAL
Limit : ABOVE 1GHZ(PK)
Env. / Ins. : 23*C/38% N9010A Engineer : An
EUT : 9SD441TVDA
Power Rating : DC 3.3V
Test Mode : Tx2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1	2480.56	28.28	5.86	60.86	94.50	74.00	-20.50	Peak
2	2483.52	28.29	5.87	28.36	62.02	74.00	11.98	Peak
3	2483.92	28.29	5.87	28.36	62.02	74.00	11.98	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Peak Level (dB/m)	DCCF (dB)	Average Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)
2483.52	62.02	-11.34	50.68	54.00	3.32
2483.92	62.02	-11.34	50.68	54.00	3.32

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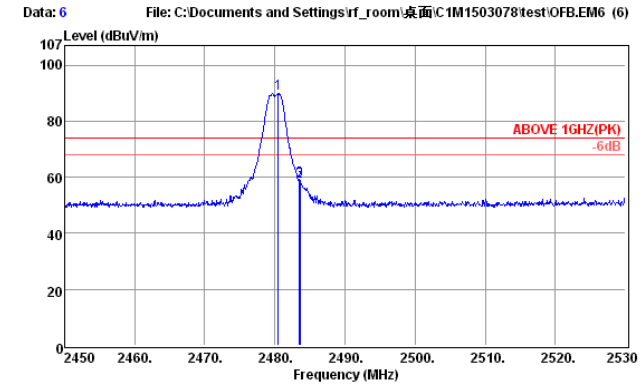

Site no. : Audix NO.1 3m Chamber Data no. : 6
Dis. / Ant. : 3m 3115(4927) Ant. pol. : VERTICAL
Limit : ABOVE 1GHZ(PK)
Env. / Ins. : 23*C/38% N9010A Engineer : An
EUT : 9SD441TVDA
Power Rating : DC 3.3V
Test Mode : Tx2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1	2480.48	28.28	5.36	56.26	89.90	74.00	-15.90	Peak
2	2483.52	28.29	5.37	24.73	58.39	74.00	15.61	Peak
3	2483.60	28.29	5.37	25.19	58.85	74.00	15.15	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

Antenna at Vertical Polarization

Emission Frequency (MHz)	Peak Level (dB/m)	DCCF (dB)	Average Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)
2483.52	58.39	-11.34	47.05	54.00	6.95
2483.60	58.85	-11.34	47.51	54.00	6.49

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Emissions outside the frequency band:

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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
4811.50	32.78	8.09	13.20	54.07	74.00	19.93	Peak

Emission Frequency (MHz)	Peak Level (dB/m)	DCCF (dB)	Average Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)
4811.50	54.07	-11.34	42.73	54.00	11.27

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
4811.50	32.78	8.09	21.10	61.97	74.00	12.03	Peak

Emission Frequency (MHz)	Peak Level (dB/m)	DCCF (dB)	Average Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)
4811.50	61.97	-11.34	50.63	54.00	3.37

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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
4882.00	32.91	8.17	12.25	53.33	74.00	20.67	Peak

Emission Frequency (MHz)	Peak Level (dB/m)	DCCF (dB)	Average Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)
4882.00	53.33	-11.34	41.99	54.00	12.01

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
4882.00	32.91	8.17	17.68	58.76	74.00	15.24	Peak

Emission Frequency (MHz)	Peak Level (dB/m)	DCCF (dB)	Average Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)
4882.00	58.76	-11.34	47.42	54.00	6.58

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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
4861.50	33.03	8.26	8.34	49.63	74.00	24.37	Peak

Emission Frequency (MHz)	Peak Level (dB/m)	DCCF (dB)	Average Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)
4861.50	49.63	-11.34	38.29	54.00	15.71

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
4958.50	33.03	8.24	14.64	55.91	74.00	18.09	Peak

Emission Frequency (MHz)	Peak Level (dB/m)	DCCF (dB)	Average Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)
4858.50	55.91	-11.34	44.57	54.00	9.43

6.5.2. Emissions in Non-restricted Frequency Bands

Pursuant to KDB 558074 D01 v03r02 that emission levels below the 15.209 general radiated emissions limits is not required.

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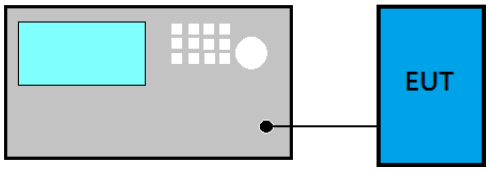
7. 6dB BANDWIDTH MEASUREMENT

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 v03r02:

■ Option 2

(1) Set RBW = 100 kHz.
(2) Set the video bandwidth (VBW) ≥ 3 × 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.

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7.4. Test Results

Test Date	2015/03/23	Temp./Hum.	24℃/41%
Cable Loss	0.5dB	Test Voltage	DC 3.3V

7.4.1. 6dB Bandwidth Result

Modulation Type	Centre Frequency (MHz)	6 dB Bandwidth (MHz)
ZigBee	2405	1.240
	2440	1.254
	2480	1.231

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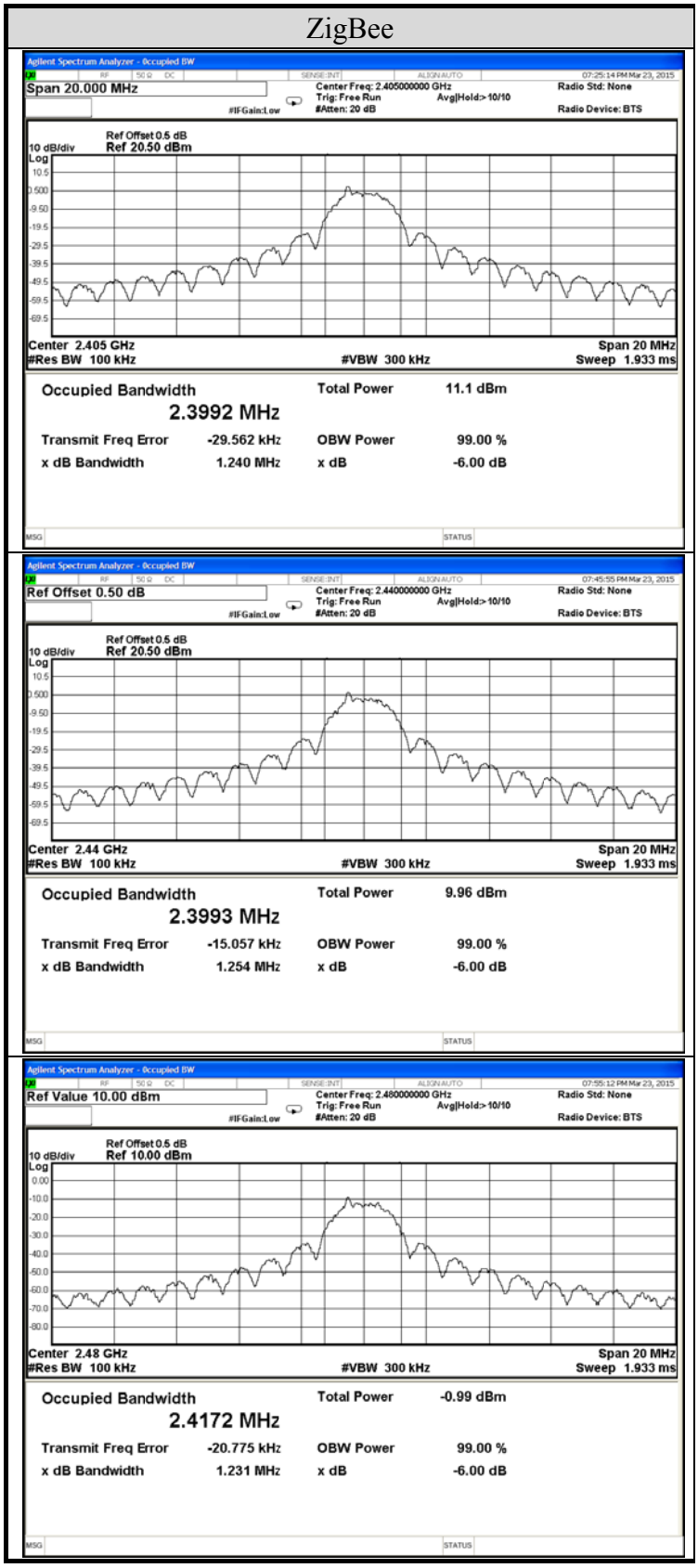
7.4.2. Measurement Plots

ZigBee



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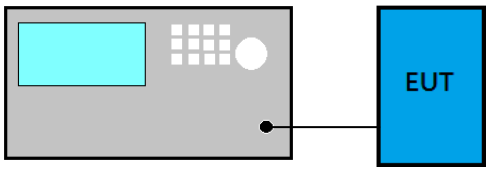
8. MAXIMUM PEAK OUTPUT POWER MEASUREMENT

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)

8.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r02:

☐**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 3.5.1 is < 98%.

■**RBW≥DTS bandwidth**

(1) Set span to at least 3 times the OBW
(2) Set RBW ≥ OBW
(3) Set the video bandwidth (VBW) ≥ 3 × RBW.
(4) Detector = Peak
(5) Trace mode = max hold
(6) Sweep = auto couple.
(7) To find the peak amplitude level.

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8.4. Test Results

Test Date	2015/03/25	Temp./Hum.	25℃/40%
Cable Loss	0.5dB	Test Voltage	DC 3.3V

8.4.1. Peak Output Power

Modulation Type	Centre Frequency (MHz)	Peak Output Power		Limit
		(dBm)	(W)	
ZigBee	2405	6.607	0.0046	< 30 dBm (1 W)
	2440	6.781	0.0048	
	2480	-2.306	0.0006	

Note: The results have been included cable loss.

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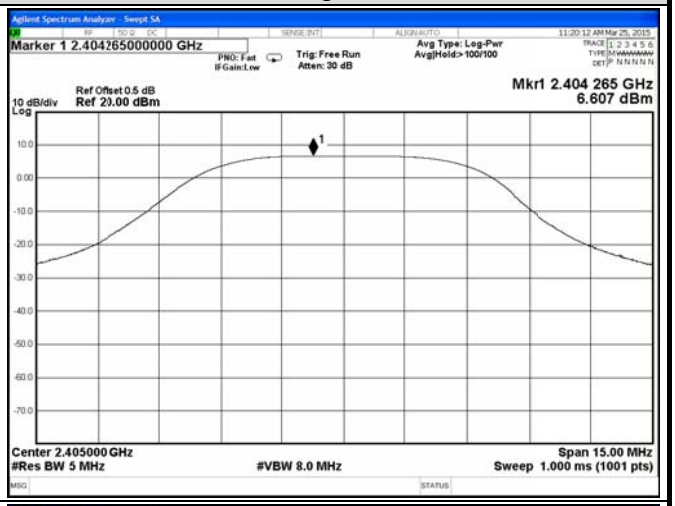
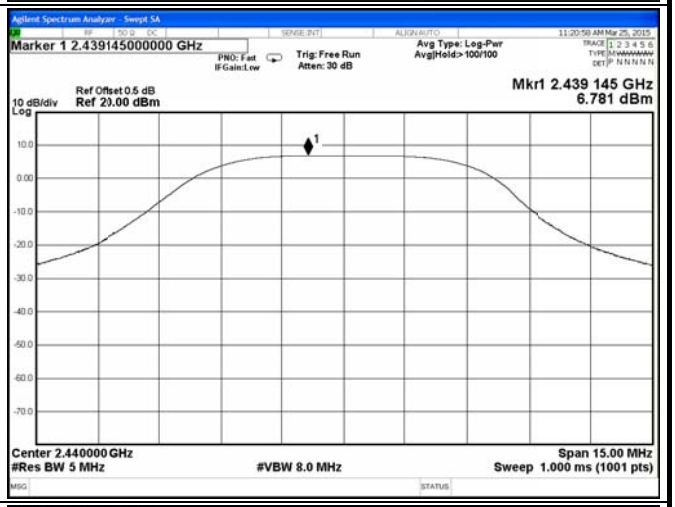
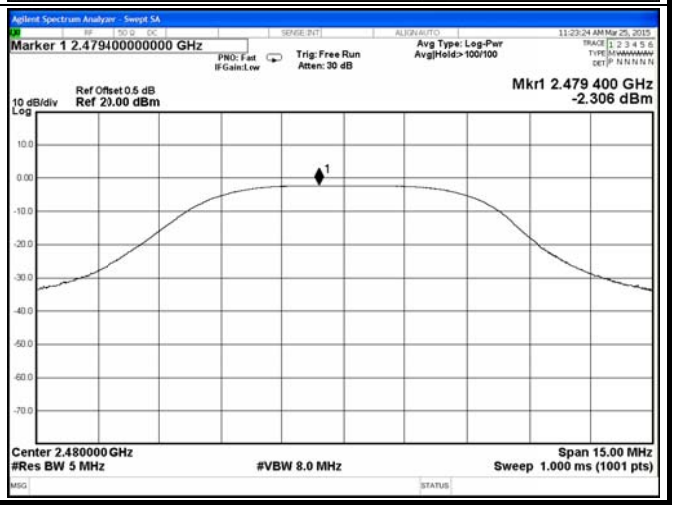
8.4.2. Measurement Plots

ZigBee
Peak Output Power







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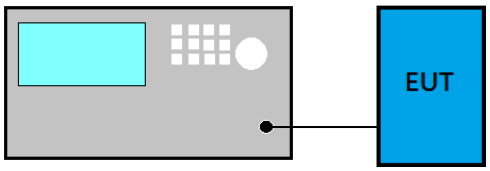
9. EMISSION LIMITATIONS MEASUREMENT

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) is not required. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (See Section 15.205(c)).(※This test result attaching to §4.6.1.2 and §4.6.2.2)

9.3. Test Procedure

The RF output of EUT was connected to the spectrum analyzer. The bandwidth of the fundamental frequency was measure by spectrum analyzer with 100kHz RBW and 300kHz VBW.

The measurement guideline was according to 558074 D01 v03r02.

The measurement guideline was according to RSS-Gen.

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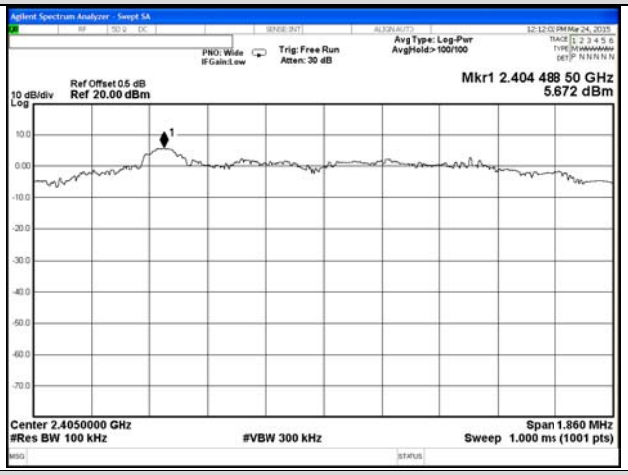
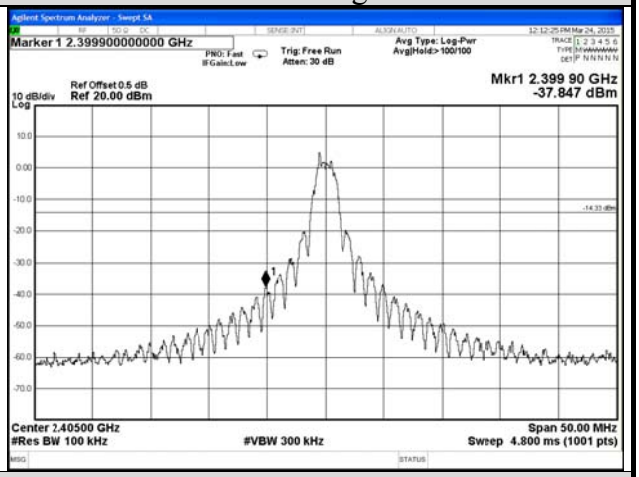
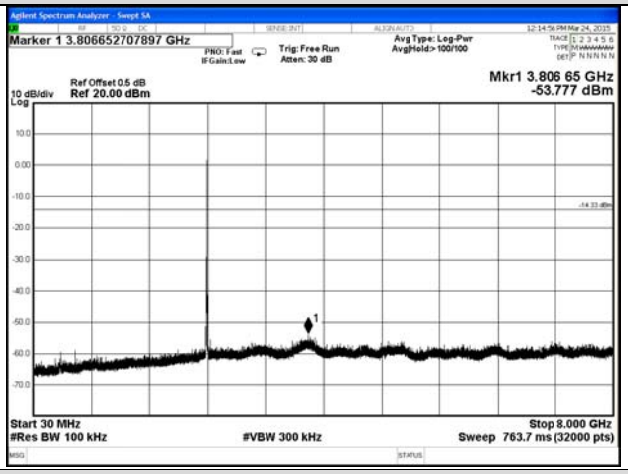
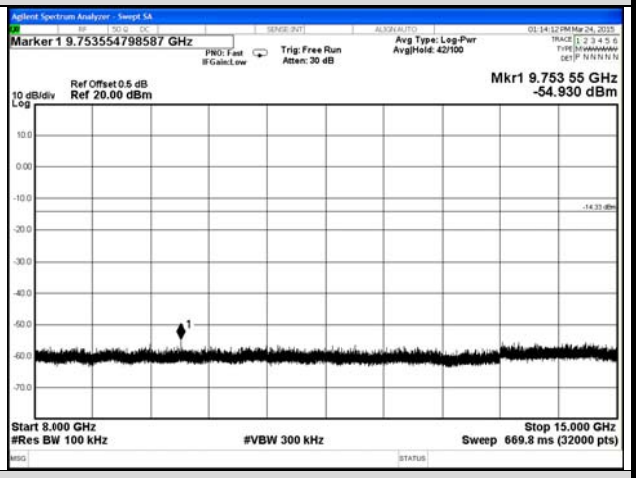
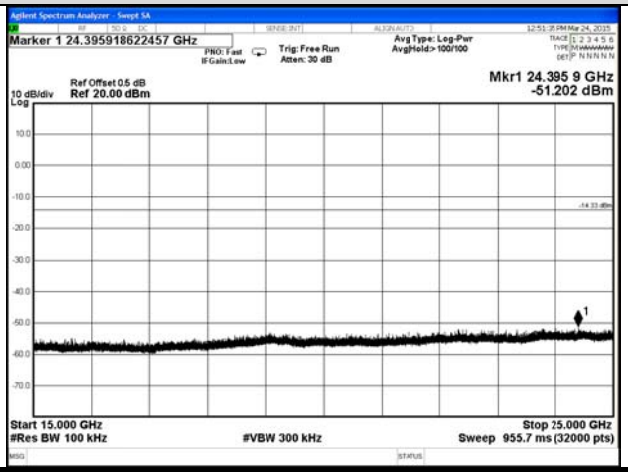
9.4. Test Results

Test Date	2015/03/24	Temp./Hum.	25℃/40%
Mode	ZigBee	Frequency	TX 2405MHz
Cable Loss	0.5dB	Test Voltage	DC 3.3V

Reference Level	Band Edge
	
30MHz – 8GHz	**8GHz – 15GHz**
	
15GHz – 25GHz	
	

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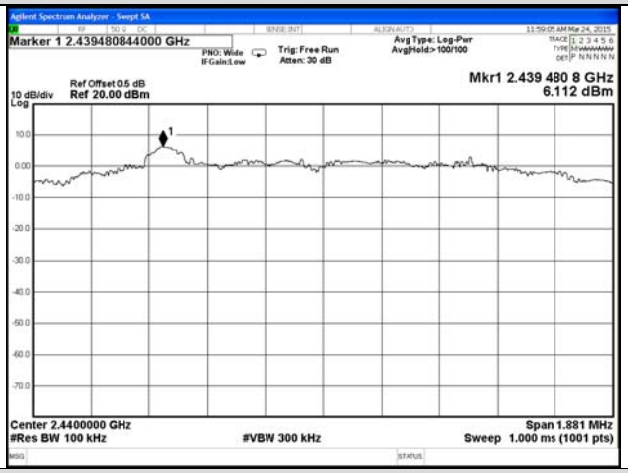
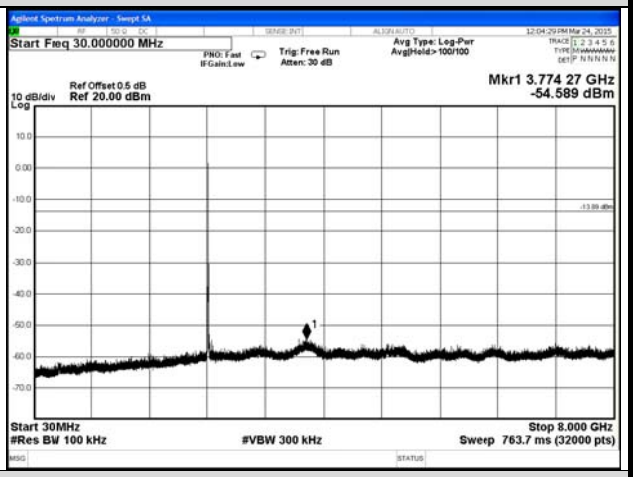
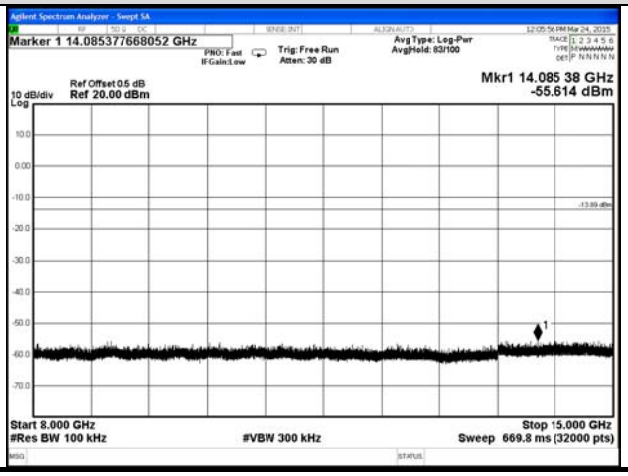
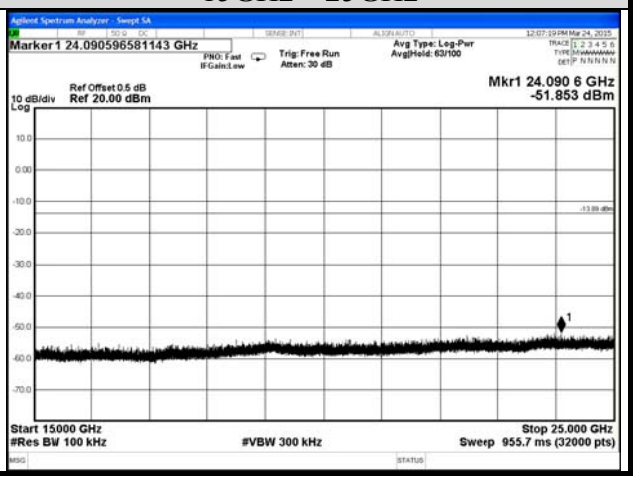
Test Date	2015/03/24	Temp./Hum.	25℃/40%
Mode	ZigBee	Frequency	TX 2440MHz
Cable Loss	---	Test Voltage	DC 3.3V

Reference Level	30MHz – 8GHz
	
8GHz – 15GHz	**15GHz – 25GHz**
	

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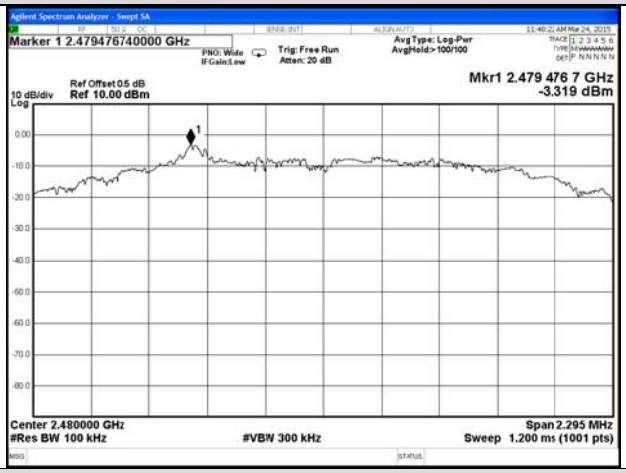
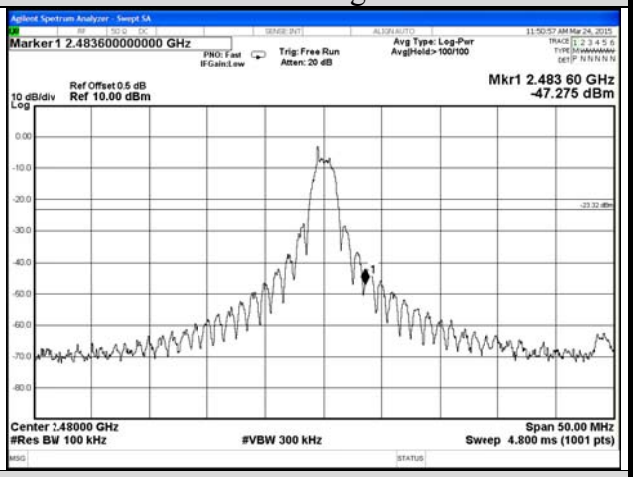
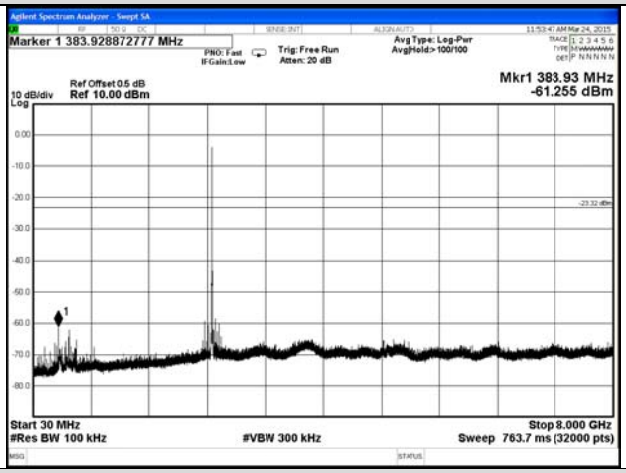
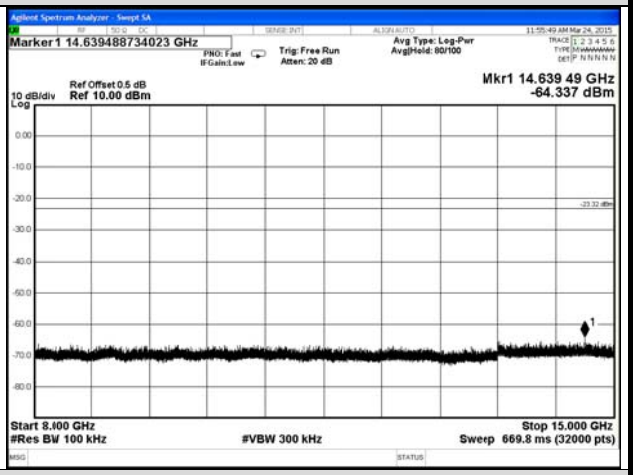
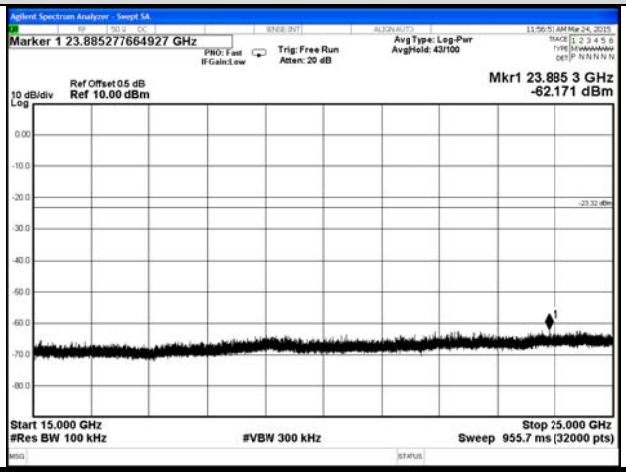
Test Date	2015/03/24	Temp./Hum.	25℃/40%
Mode	ZigBee	Frequency	TX 2480MHz
Cable Loss	---	Test Voltage	DC 3.3V

Reference Level	Band Edge
	
30MHz – 8GHz	8GHz – 15GHz
	
15GHz – 25GHz	
	

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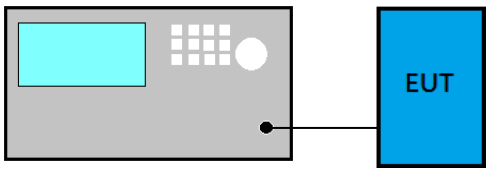
10. POWER SPECTRAL DENSITY

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 v03r02:

☐**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 kHz ≤ RBW ≤ 100 kHz.
(4) Set the VBW ≥ 3 × 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 3.5.1. < 98%.
(7) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

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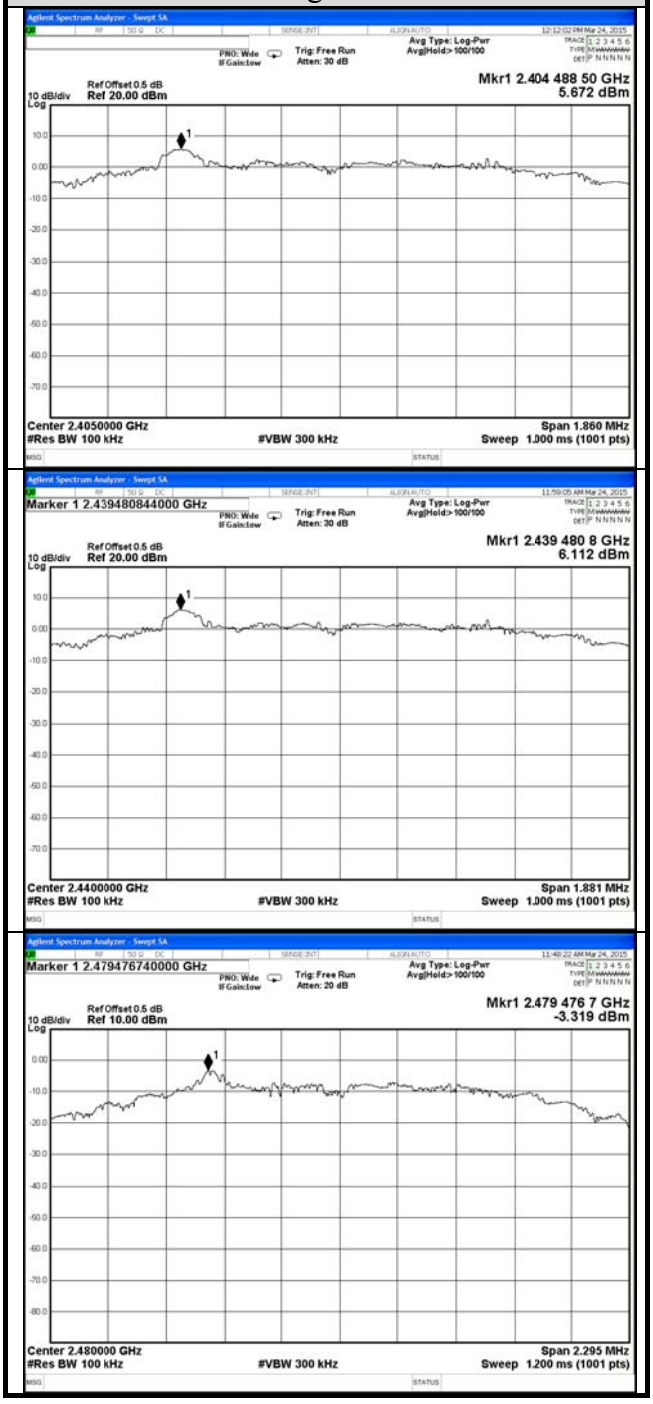
10.4. Test Results

Test Date	2014/10/14	Temp./Hum.	25℃/54%
Cable Loss	0.5dB	Test Voltage	DC 3.7V

ZigBee



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11. DEVIATION TO TEST SPECIFICATIONS

【NONE】