

FCC 15.247
(Class II Permissive Change)
2.4 GHz Report
for

LG Electronics Inc.

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

Brand : LG
Product Name : Wireless Multi Sensor
Model Name : 9SDA81VVDA
FCC ID : BEJ9SD751TVDA

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APPENDIX A TEST PHOTOGRAPHS

TEST REPORT CERTIFICATION (Class II Permissive Change)

Applicant : LG Electronics Inc.
Manufacture : LG Electronics Inc.
Factory : OHSUNG ELECTRONICS CO., LTD
Product Name : Wireless Multi Sensor
Model No. : 9SDA81VVDA
Serial No. : N/A
Brand : LG
Power Supply : DC 3.3V (Via test jig powered by USB)

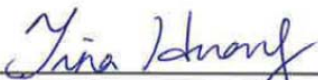
Applicable Standards:

FCC Rules and Regulations Part 15 Subpart C, Oct. 2014
ANSI C63.10:2013
KDB 558074 D01 DTS Meas Guidance v03r03

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. 07. 23 ~ 28

Date of Report: 2015. 07. 29

Producer: 
(Tina Huang/Administrator)

Signatory: 
(Ben Cheng/Manager)

1. REPORT HISTORY

Revision	Date	Revision Summary	Report Number
0	2014. 05. 16	Original Report.	EM-F140293
Rev. A	2015. 03. 11	1. To add new model "9SDA81TVDA" for different appearance type and construction. 2. To update FCC 47 CFR Part 15 Subpart C Standard from version Oct. 2013 to Oct. 2014. 3. Supplementary test data are recorded in report number EM-F150110.	EM-F150110
Rev. B	2015. 07. 29	1. To add new model 9SDA81VVDA for different case and PCB size and to added daylight sensor and chip items (R.C) on PCB board. 2. Supplementary test data are recorded in this report.	EM-F150436

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(b)	Maximum Peak Output	PASS
Remark: To add new model 9SDA81VVDA for different case, change PCB size and added daylight sensor and chip items (R.C) on PCB board, above test items were criticized and reconfirmed to comply with FCC requirement.		

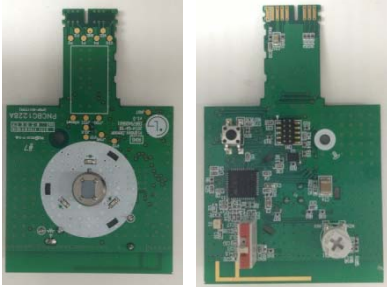
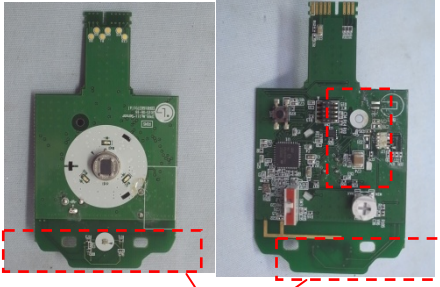
3. GENERAL INFORMATION

3.1. Description of EUT

Product	Wireless Multi Sensor
Model Number	9SDA81VVDA
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. 335-4, Sanho-daero, Gumi-si, Gyeongsangbuk-do, Korea
RF Features	ZigBee (IEEE 802.15.4)
Transmit Type	1T1R
Device Category	☐ Outdoor Access Point ☐ Fixed point-to-point Access Point ☐ Indoor Access Point ☒ Mobile and Portable client device
Date of Receipt of Sample	2015. 07. 17

Information for Class II Change Permissive:

1. The EUT is an addition version with original FCC ID: BEJ9SD751TVDA.
2. The difference with original report as following list.

Item	Original	Class II Change Permissive
Model	9SD751TVDA (Wireless Motion Sensor)	9SDA81VVDA (Wireless Multi Sensor)
PCB Board		
	 (1)Added daylight sensor and chip items(R,C) around it. (2)Changed PCB size due to a daylight sensor Daylight sensor	
Case		
	 Made a hole on the top case and inserted lens for daylight sensing.	

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

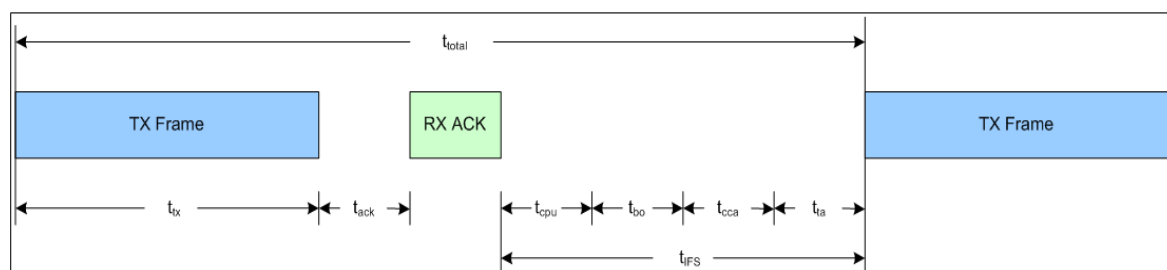
3.3. Antenna Information

Antenna Part Number	Manufacture	Antenna Type	Frequency	Max Gain
PNCBC1228A	OHSUNG	PCB	2405-2480MHz	0.9073dBi

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)	

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	

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= $20 \cdot \log[0.01152/(0.01152+0.03276)] = -11.34\text{dB}$

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 (30MHz-1GHz) ^{Note1}	ZigBee	0.25 Mbps	11/18/26
	Radiated Spurious Emission (Above 1GHz) ^{Note1}	ZigBee	0.25 Mbps	18
Conducted Test Case	Peak Output Power	ZigBee	0.25 Mbps	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

3.5. Tested Supporting System List

3.5.1. Support Peripheral Unit

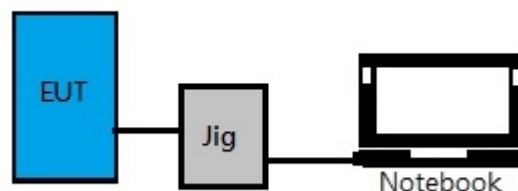
No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	Notebook PC	acer	MS2362	N/A	PPD-AAR5B225
2.	Test Jig	N/A	N/A	N/A	N/A

3.5.2. Cable Lists

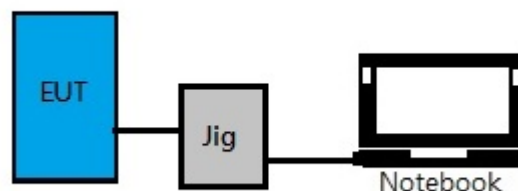
No.	Cable Description Of The Above Support Units
1.	LAN Cable: Shielded, Detachable, 1.0m USB Cable: Shielded, Detachable, 1.8m Adapter: Chicony, M/N CPA09-A065N1, DC Cord: Shielded, Undetachable, 1.8m, Bonded a ferrite core AC Power Cord: Unshielded, Detachable, 1.8m
2.	BUS Cable: Unshielded, Detachable, 0.1m

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.

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. 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 May 06, 2015 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~300MHz	± 3.64dB
	300MHz~1000MHz	± 4.07dB
	Above 1GHz	± 2.94dB

Remark : Uncertainty = $ku_c(y)$

Test Item	Uncertainty
Maximum peak output power	± 0.33dB

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	ESCI	101276	2015. 04. 04	1 Year
2.	A.M.N.	R&S	ESH2-Z5	100366	2015. 03. 11	1 Year
3.	L.I.S.N.	Kyoritsu	KNW-407	8-881-13	2015. 01. 14	1 Year
4.	Pulse Limiter	R&S	ESH3-Z2	101495	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-526	MY53400071	2014. 09. 15	1 Year
2.	Test Receiver	R & S	ESCS30	100338	2015. 06. 24	1 Year
3.	Amplifier	HP	8447D	2944A06305	2015. 02. 12	1 Year
4.	Bilog Antenna	TESEQ	CBL6112D	33821	2015. 02. 27	1 Year

4.2.2. Frequency Range 30MHz~1000MHz

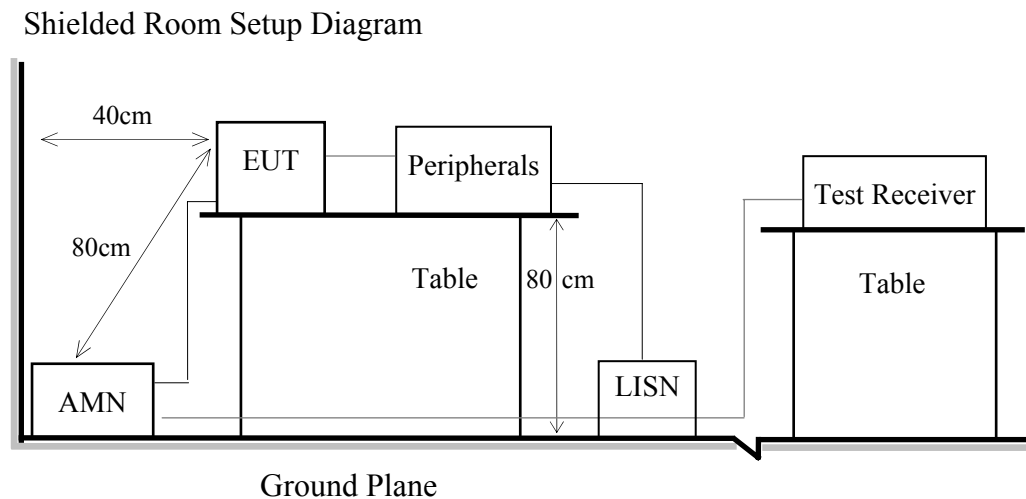
Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2014. 09. 15	1 Year
2.	Test Receiver	R & S	ESCS30	100338	2015. 06. 24	1 Year
3.	Amplifier	Agilent	8449B	3008A02676	2015. 02. 11	1 Year
4.	2.4GHz Notch Filter	K&L	7NSL10-244 1.5E130.5-0 0	1	2015. 07. 22	1 Year
5.	3G High Pass Filter	Microwave Circuits	H3G018G1	484796	2014. 08. 25	1 Year
6.	Double-Ridged Waveguide Horn	ETS-Lindgren	3115	00114104	2015. 04. 07	1 Year
7.	Horn Antenna	EMCO	3116	2653	2014. 10. 14	1 Year

4.3. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9030A-544	US51350140	2014. 07. 24	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.

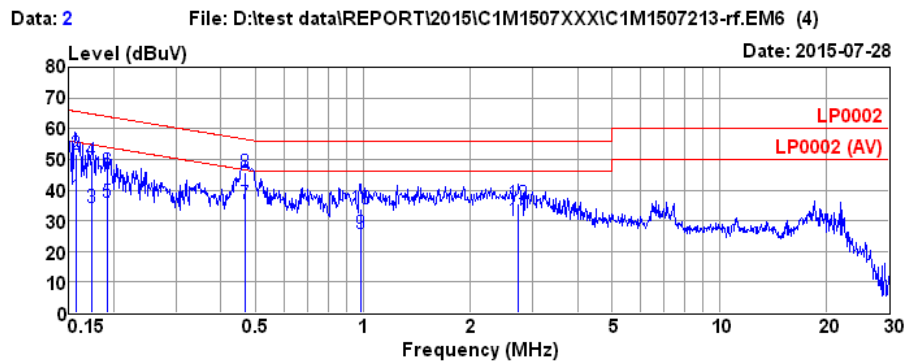
5.3. Test Procedure

- 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.

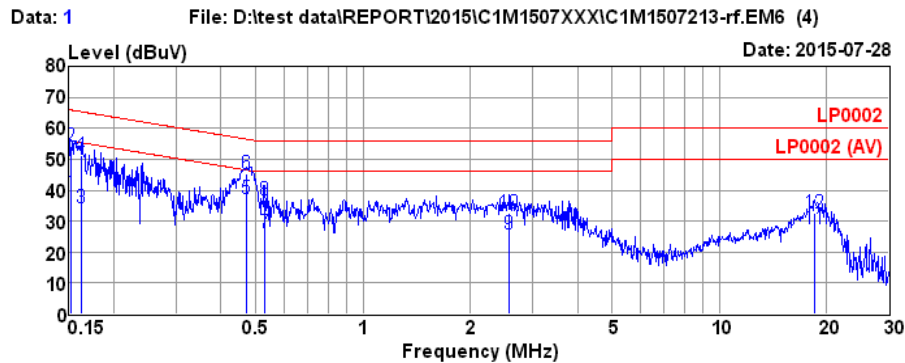
Test Date	2015/07/28	Temp./Hum.	27°C/62%
Test Voltage	DC 3.3V (Via test jig powered by USB)		



Site no. : No.7 Shielded Room Data no. : 2
Condition : ESH2-Z5 366 Phase : NEUTRAL
Limit : LP0002
Env. / Ins. : 27°C / 62% ESCI (1276) Engineer : Ken Yang
EUT : 9SDA81VVDA
Power Rating : DC 3.3V (Via test jig powered by USB)
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	0.11	0.03	9.85	27.75	37.74	55.60	17.86	Average
2	0.157	0.11	0.03	9.85	41.85	51.84	65.60	13.76	QP
3	0.173	0.11	0.03	9.85	24.33	34.32	54.81	20.49	Average
4	0.173	0.11	0.03	9.85	39.37	49.36	64.81	15.45	QP
5	0.192	0.12	0.03	9.85	25.89	35.89	53.93	18.04	Average
6	0.192	0.12	0.03	9.85	36.35	46.35	63.93	17.58	QP
7	0.469	0.14	0.03	9.86	25.50	35.53	46.54	11.01	Average
8	0.469	0.14	0.03	9.86	35.79	45.82	56.54	10.72	QP
9	0.989	0.16	0.05	9.85	15.63	25.69	46.00	20.31	Average
10	0.989	0.16	0.05	9.85	23.75	33.81	56.00	22.19	QP
11	2.736	0.22	0.07	9.86	19.87	30.02	46.00	15.98	Average
12	2.736	0.22	0.07	9.86	25.62	35.77	56.00	20.23	QP

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



Site no. : No.7 Shielded Room Data no. : 1
Condition : ESH2-Z5 366 Phase : LINE
Limit : LP0002
Env. / Ins. : 27°C / 62% ESCI (1276) Engineer : Ken Yang
EUT : 9SDA81VVDA
Power Rating : DC 3.3V (Via test jig powered by USB)
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	0.152	0.11	0.03	9.85	28.78	38.77	55.91	17.14	Average
2	0.152	0.11	0.03	9.85	44.36	54.35	65.91	11.56	QP
3	0.162	0.11	0.03	9.85	24.39	34.38	55.38	21.00	Average
4	0.162	0.11	0.03	9.85	41.43	51.42	65.38	13.96	QP
5	0.471	0.13	0.03	9.86	27.44	37.46	46.49	9.03	Average
6	0.471	0.13	0.03	9.86	35.11	45.13	56.49	11.36	QP
7	0.532	0.13	0.03	9.86	16.11	26.13	46.00	19.87	Average
8	0.532	0.13	0.03	9.86	26.99	37.01	56.00	18.99	QP
9	2.581	0.20	0.07	9.86	15.89	26.02	46.00	19.98	Average
10	2.581	0.20	0.07	9.86	22.33	32.46	56.00	23.54	QP
11	18.524	0.64	0.20	9.94	16.87	27.65	50.00	22.35	Average
12	18.524	0.64	0.20	9.94	21.75	32.53	60.00	27.47	QP

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

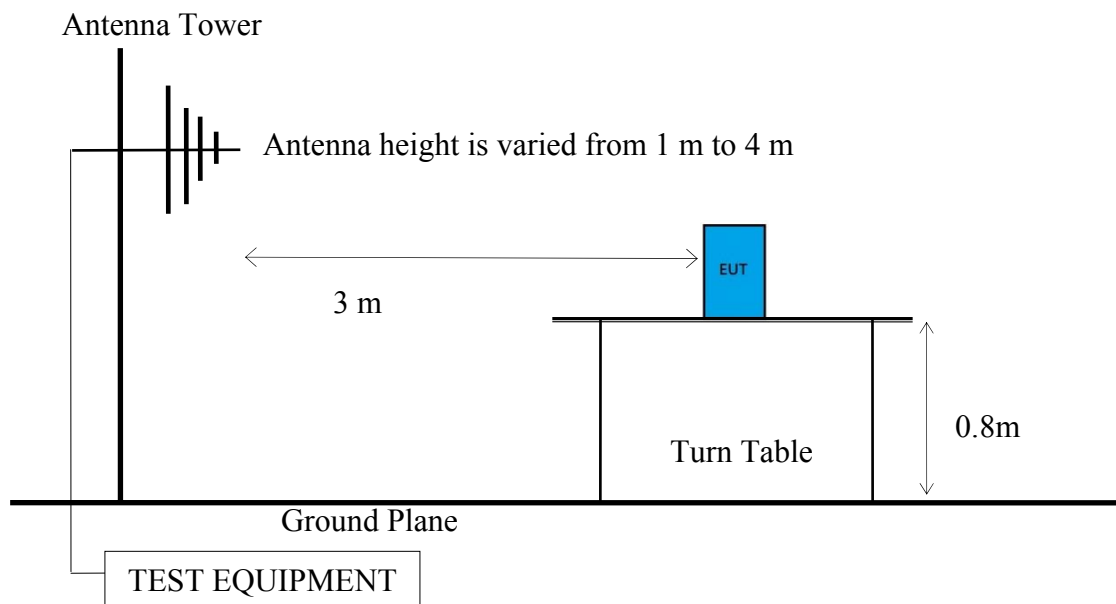
6. RADIATED EMISSION MEASUREMENT

6.1. Block Diagram of Test Setup

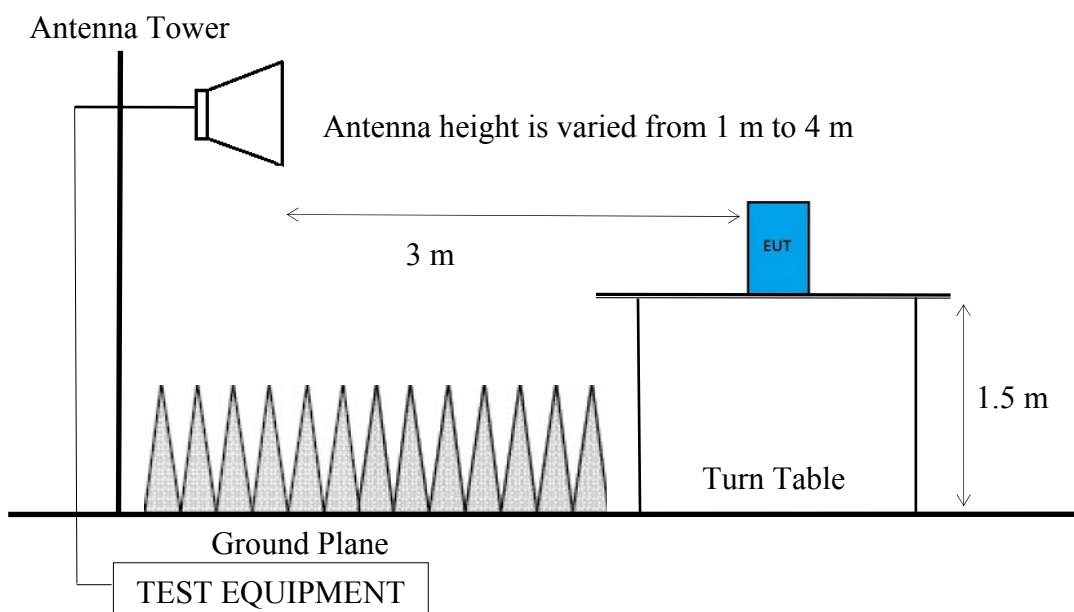
6.1.1. Block Diagram of EUT

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



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	
		$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$
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 $\text{dB}\mu\text{V/m}$ (Peak) 54.0 $\text{dB}\mu\text{V/m}$ (Average)	

Remark : (1) $\text{dB}\mu\text{V/m} = 20 \log (\mu\text{V/m})$

- (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

The EUT setup on the turn table which has 1.5m 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 Measurement:

☐ **Option 1:**

- (1) RBW = 1 MHz
- (2) VBW = 1/T
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) 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 + DCCF

Duty Cycle Correction Factor (DCCF) = $20\log(TX_{on}/TX_{on+off})$ presented in section 3.4

☐ EPR = Peak Emission Level - 95.2dB - 2.14dBi

6.5. Test Results

PASSED.

Test Date	2015/07/23	Temp./Hum.	23°C/41%
Test Voltage	DC 3.3V (Via test jig powered by USB)		

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
125.06	12.01	3.41	24.86	40.28	43.50	3.22	Peak
299.66	13.12	4.65	24.62	42.39	46.00	3.61	Peak
499.48	16.95	6.44	18.26	41.65	46.00	4.35	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	21.23	36.65	43.50	6.85	Peak
250.19	12.40	4.33	23.41	40.14	46.00	5.86	Peak
500.45	16.98	6.44	18.30	41.72	46.00	4.28	Peak

Mode	ZigBee	Frequency	TX 2440MHz
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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
125.06	12.01	3.41	24.60	40.02	43.50	3.48	Peak
299.66	13.12	4.65	24.67	42.44	46.00	3.56	Peak
499.48	16.95	6.44	18.41	41.80	46.00	4.20	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	21.25	36.67	43.50	6.83	Peak
250.19	12.40	4.33	24.17	40.90	46.00	5.10	Peak
500.45	16.98	6.44	18.62	42.04	46.00	3.96	Peak

Mode	ZigBee	Frequency	TX 2480MHz
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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
150.28	10.51	3.61	25.18	39.30	43.50	4.20	Peak
250.19	12.40	4.33	24.87	41.60	46.00	4.40	Peak
499.48	16.95	6.44	16.51	39.90	46.00	6.10	Peak

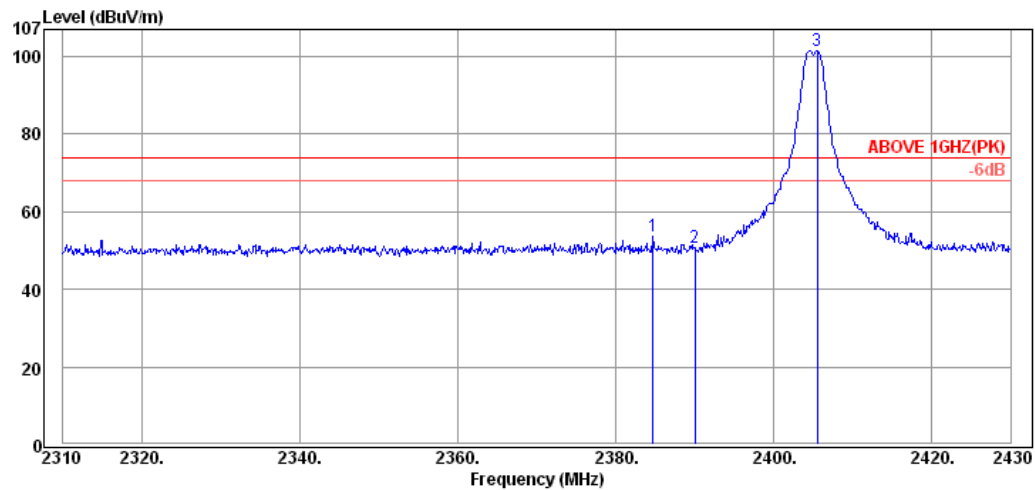
Antenna at Vertical Polarization

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	21.59	37.01	43.50	6.49	Peak
250.19	12.40	4.33	23.71	40.44	46.00	5.56	Peak
500.45	16.98	6.44	18.49	41.91	46.00	4.09	Peak

6.5.1.2. Frequency Above 1 GHz to 10th harmonics

Band Edge:

Mode	ZigBee	Frequency	TX 2405MHz
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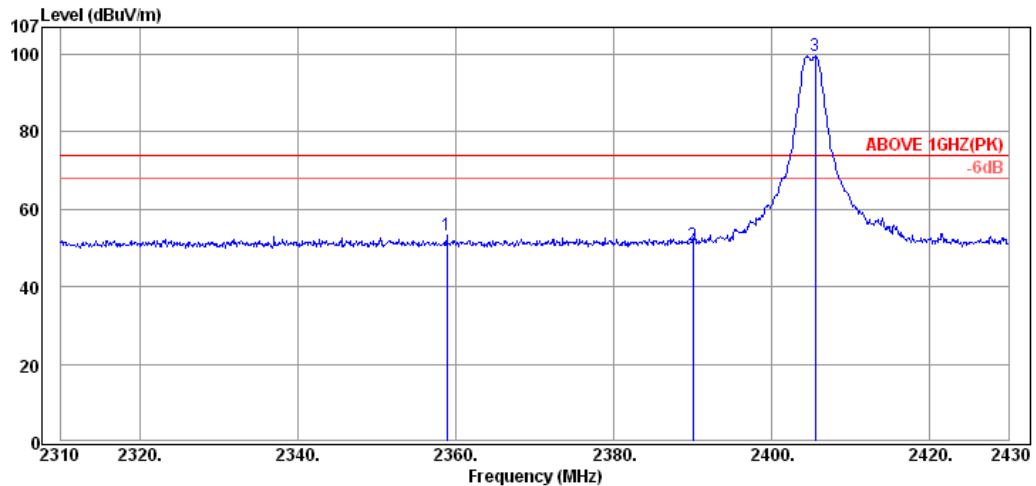
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2384.76	28.40	5.23	20.20	53.83	74.00	20.17	Peak
2390.04	28.40	5.24	17.07	50.71	74.00	23.29	Peak
2405.52	28.42	5.26	67.72	101.40	---	---	Peak

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Peak Emission Level (dB/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2384.76	53.83	-11.34	42.49	54.00	11.51	Average
2390.04	50.71	-11.34	39.37	54.00	14.63	Average

Mode	ZigBee	Frequency	TX 2405MHz
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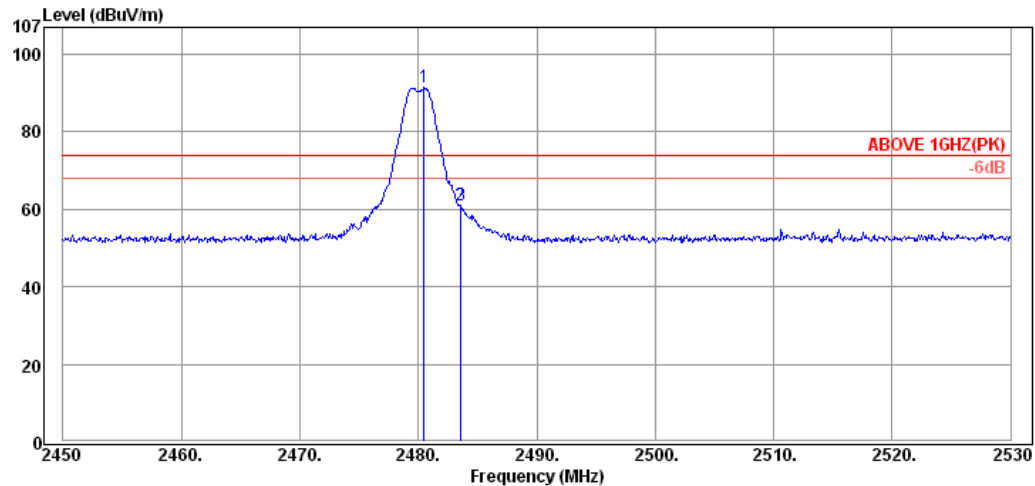
Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2358.84	28.37	5.19	19.82	53.38	74.00	20.62	Peak
2390.04	28.40	5.24	17.20	50.84	74.00	23.16	Peak
2405.52	28.42	5.26	65.87	99.55	---	---	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Peak Emission Level (dB/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2358.84	53.38	-11.34	42.04	54.00	11.96	Average
2390.04	50.84	-11.34	39.50	54.00	14.50	Average

Mode	ZigBee	Frequency	TX 2480MHz
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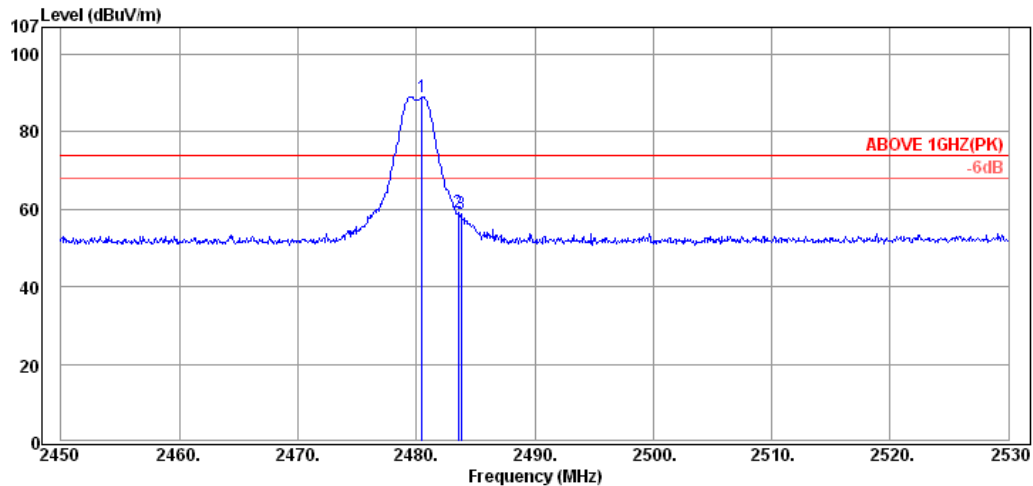
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2480.48	28.48	5.36	57.56	91.40	---	---	Peak
2483.52	28.49	5.37	27.07	60.93	74.00	13.07	Peak
2483.60	28.49	5.37	27.22	61.08	74.00	12.92	Peak

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Peak Emission Level (dB/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2483.52	60.93	-11.34	49.59	54.00	4.41	Average
2483.60	61.08	-11.34	49.74	54.00	4.26	Average

Mode	ZigBee	Frequency	TX 2480MHz
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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
2480.48	28.48	5.36	55.18	89.02	---	---	Peak
2483.52	28.49	5.37	25.23	59.09	74.00	14.91	Peak
2483.76	28.49	5.37	24.79	58.65	74.00	15.35	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Peak Emission Level (dB/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2483.52	59.09	-11.34	47.75	54.00	6.25	Average
2483.76	58.65	-11.34	47.31	54.00	6.69	Average

6.5.2. Emissions outside the frequency band:

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

Mode	ZigBee	Frequency	TX 2405MHz
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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
4808.50	32.98	8.09	11.71	52.78	74.00	21.22	Peak

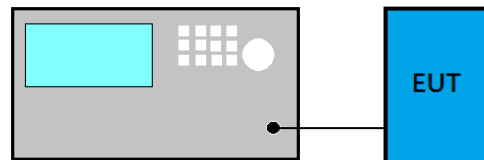
Emission Frequency (MHz)	Peak Emission Level (dB/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4808.50	52.78	-11.34	41.44	54.00	12.56	Average

6.5.3. Emissions in Non-restricted Frequency Bands

Pursuant to KDB 558074 D01 v03r03 that emission levels below the 15.209 general radiated emissions limits is not required.

7. MAXIMUM PEAK OUTPUT POWER MEASUREMENT

7.1. Block Diagram of Test Setup



7.2. Specification Limits

The Limits of maximum Peak Output Power for digital modulation in 2400-2483.5MHz is : 1Watt. (30dBm)

7.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r03:

☐ **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 $RBW \geq OBW$
- (3) Set the video bandwidth (VBW) $\geq 3 \times RBW$.
- (4) Detector = Peak
- (5) Trace mode = max hold
- (6) Sweep = auto couple.
- (7) To find the peak amplitude level.

7.4. Test Results

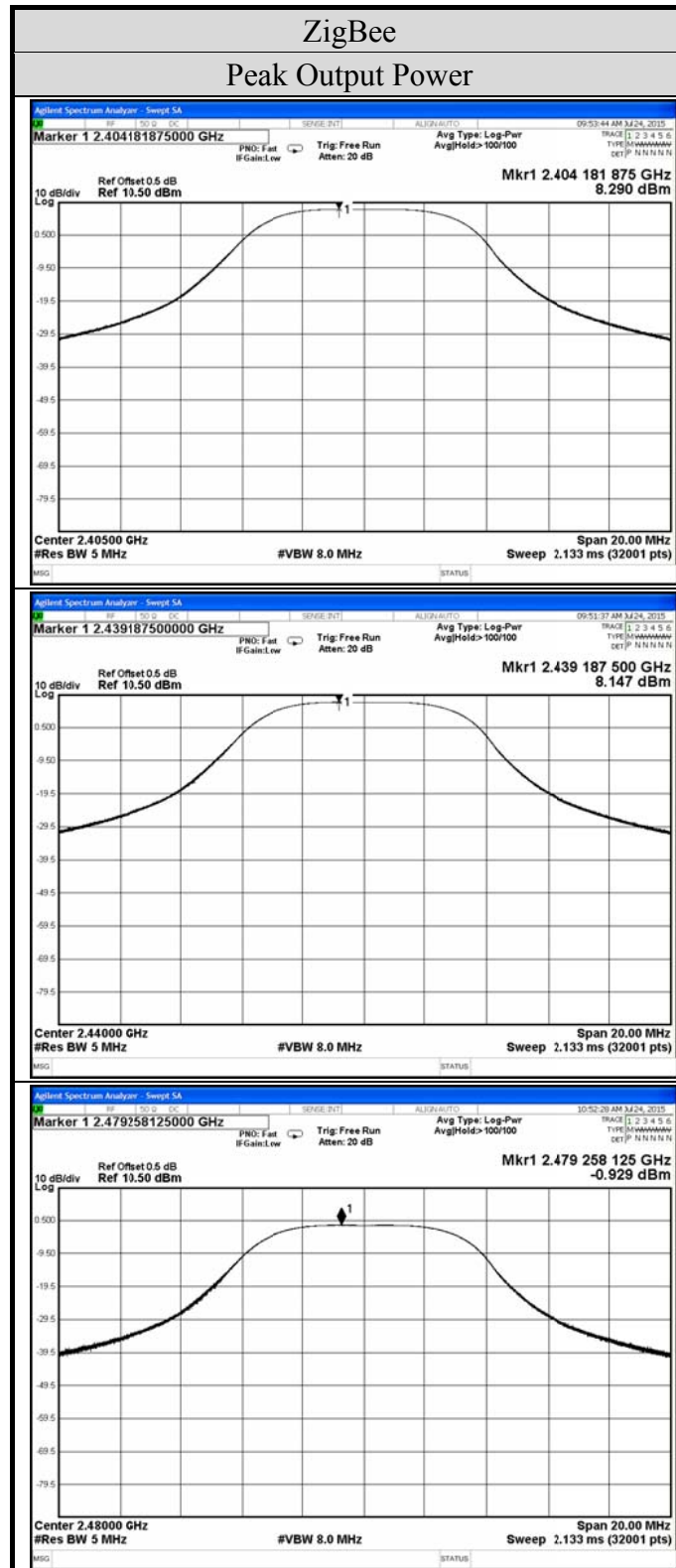
Test Date	2015/07/24	Temp./Hum.	24°C/40%
Cable Loss	0.5dB	Test Voltage	DC 3.3V (Via test jig powered by USB)

7.4.1. Peak Output Power

Modulation Type	Centre Frequency (MHz)	Peak Output Power		Limit
		(dBm)	(W)	
ZigBee	2405	8.290	0.006745	< 30 dBm (1 W)
	2440	8.147	0.006527	
	2480	-0.929	0.000807	

Note: The results have been included cable loss.

7.4.2. Peak Measurement Plots



8. DEVIATION TO TEST SPECIFICATIONS

【NONE】