Shenzhen Asia Test Technology Co., Ltd.
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FCC RF Test Report

Product Type	:	WiFi/Zigbee Gateway
Report No	:	ATT-2015SZ0229145F-2
Applicant	:	Sensing TeK Co., Ltd.
Address	:	4F-1,No.62,Chen Gung 5 st., ChuBei City, Hsinchu county Taiwan 302
Trade Name	:	N/A
Model Number	:	GWZ2100
List Model	:	N/A
Test Specification	:	FCC 47 CFR PART 15 SUBPART C: Oct., 2013 ANSI C63.10:2009 KD558074 D01 DTS Meas Guidance v03r02
Receive Date	:	15 Feb,2015
Test Period	:	16 Feb ,2015 to 11 Mar , 2015
Issue Date	:	12 Mar , 2015

Issue by

Shenzhen Asia Test Technology Co.,Ltd.

7 / F, Xinwei Building, Gushu Village, Xixiang Town, Baoan District, Shenzhen, China.

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Verification of Compliance

Issued Date: 12/03/2015

Product Type	:	WiFi/Zigbee Gateway
Applicant	:	Sensing TeK Co., Ltd.
Address	:	4F-1,No.62,Chen Gung 5 st., ChuBei City, Hsinchu county Taiwan 302
Manufacturer	:	Sensing TeK Co., Ltd.
Address	:	4F-1,No.62,Chen Gung 5 st., ChuBei City, Hsinchu county Taiwan 302
Trade Name	:	N/A
Model Number	:	GWZ2100
List Mode		N/A
FCC ID	:	WMXGWZ2100
EUT Rated Voltage	:	DC 12.0V From Adapter By AC 120V
Adapter :	:	Model:AU1121206u Input:AC 100-240V 50/60Hz 0.5A Output :DC 12V 1A
Applicable Standard	:	FCC 47 CFR PART 15 SUBPART C: Oct., 2013 ANSI C63.10:2009 KD558074 D01 DTS Meas Guidance v03r02
Test Result	:	Complied
Performing Lab.	:	Shenzhen Asia Test Technology Co.,Ltd. 7 / F, Xinwei Building, Gushu Village, Xixiang Town, Baoan District, Shenzhen, China

The EUT described above is tested by Shenzhen Asia Test Technology Co.,Ltd. EMC Laboratory to determine the maximum emissions from the EUT. Shenzhen Asia Test Technology Co.,Ltd. EMC Laboratory assumed full responsibility for the accuracy of the test results. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2003) and the energy emitted by the sample EUT tested as described in this report is in compliance with FCC Rules Part 15.207, 15.209 and 15.247.

The test results of this report relate only to the tested sample identified in this report.

Approved By	:	Seal-Chen	Reviewed By	:	
(Testing Engineer)		(Seal Chen)	(Manager)		(Jackie Deng)

CONTENT

1. General Information

1.1 Applied Standard

Applied Rules: FCC 47 CFR PART 15 SUBPART C: Oct., 2013

Test Method: KD558074 D01 DTS Meas Guidance v03r02

1.2 Test Location

TestLocation1: Shenzhen Asia Test Technology Co.,Ltd.

Address: 7 / F, Xinwei Building, Gushu Village, Xixiang Town, Baoan District, Shenzhen, China

FCC Registration No.: 348715

1.3 Test Environment Condition

Ambient Temperature: 19.5to 25°C
Ambient Relative Humidity: 40 to 55 %
Atmospheric Pressure: Not applicable

2. Test Summary

Test Item	FCC Part No.	Requirements	Verdict
DTS (6 dB) Bandwidth	15.247(a)(2)	≥ 500 kHz.	PASS
Maximum Peak Conducted Output Power	15.247(b)(3)	For directional gain:< 30dBm – (G[dBi] –6 [dB]),peak; Otherwise :< 30dBm, peak.	PASS
Maximum Power Spectral Density Level	15.247(e)	For directional gain :< 8dBm/3 kHz – (G[dBi] –6[dB]), peak. Otherwise :< 8dBm/3 kHz, peak.	PASS
Band Edges Compliance	15.247(d)	< -20dBr/100 kHz if total Peak power ≤power limit.	PASS
Unwanted Emissions into Non-Restricted Frequency Bands	15.247(d)	< -20dBr/100 kHz if total peak power ≤power limit.	PASS
Unwanted Emissions into Restricted Frequency Bands (Conducted)	15.247(d) 15.209	< -20dBr/100 kHz if total peak power ≤power limit.	PASS
Unwanted Emissions into Restricted Frequency Bands (Radiated)	15.247(d) 15.209	FCC Part 15.209 field strength limit;	PASS
AC Power Line Conducted Emissions	15.207	FCC Part 15.207 conducted limit;	PASS

3. Description of the Equipment under Test (EUT)

3.1 General Description

Product	WiFi/Zigbee Gateway	
Trade Name	N/A	
Model Number	GWZ2100	
Applicant	Sensing TeK Co., Ltd. 4F-1,No.62,Chen Gung 5 st., ChuBei City, Hsinchu county Taiwan 302	
Manufacturer	Sensing TeK Co., Ltd. 4F-1,No.62,Chen Gung 5 st., ChuBei City, Hsinchu county Taiwan 302	
FCC ID	WMXGWZ2100	
Mode	Frequency (MHz)	Modulation
IEEE 802.15	2405 ~ 2480	OQPSK (DSSS)
Antenna Delivery	1*Tx + 1*Rx	
Type of Antenna	Internal	
Antenna Gain (dBi)	3.0 dBi	

NOTE: Only ZigBee test data included in this report.

3.2 Test Modes

NOTE: ZigBee test mode was selected to perform tests. The manufacturer provide special test software to control TX duty cycle >98% for TX test.

3.3 EUT Configurations

3.3.1 General Configurations

The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

3.3.2 Customized Configurations

ZigBee Frequency List

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

Test Frequency

Test Mode	RF Ch.	TX Channel NO.	TX Freq. [MHz]	RX Freq. [MHz]
ZigBee	L	CH 11	2405MHz	2405MHz
	M	CH 18	2440MHz	2440MHz
	H	CH 26	2480MHz	2480MHz

3.4 Test Environments

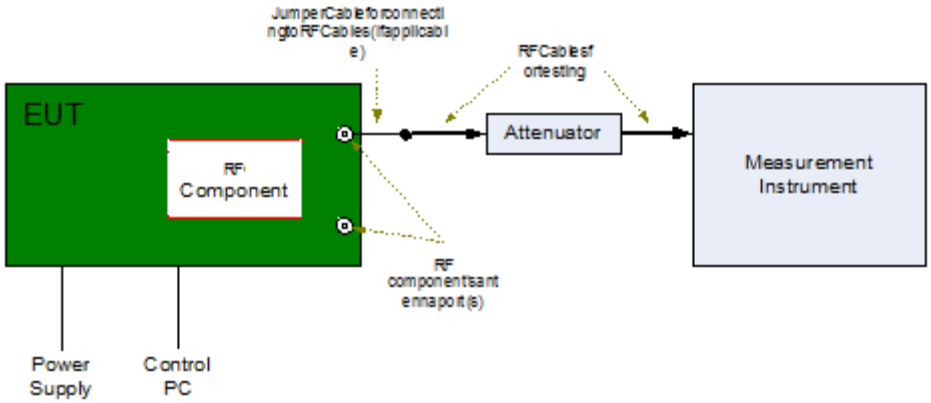
NOTE: The values used in the test report maybe stringent than the declared.

Environment Parameter	Selected Values During Tests		
NTNV	Temperature	Voltage	Relative Humidity
	Ambient	AC 120V/60Hz	Ambient

3.5 Test Setups

3.5.1 Test Setup 1

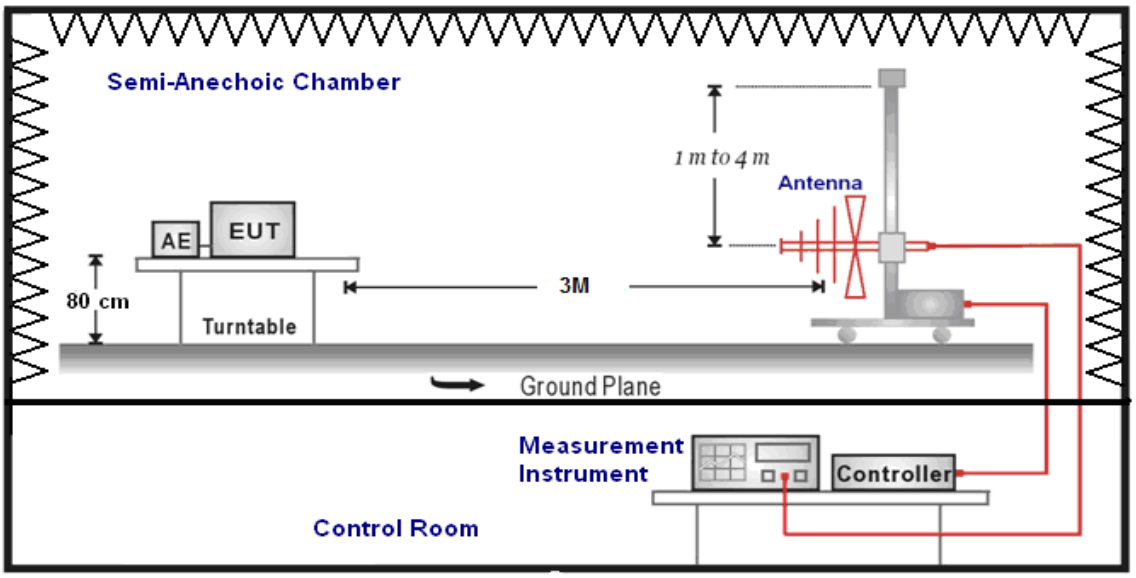
The Zigbee component's antenna ports(s) of the EUT are connected to the measurement instrument per an appropriate attenuator. The EUT is controlled by PC/software to emit the specified signals for the purpose of measurements.



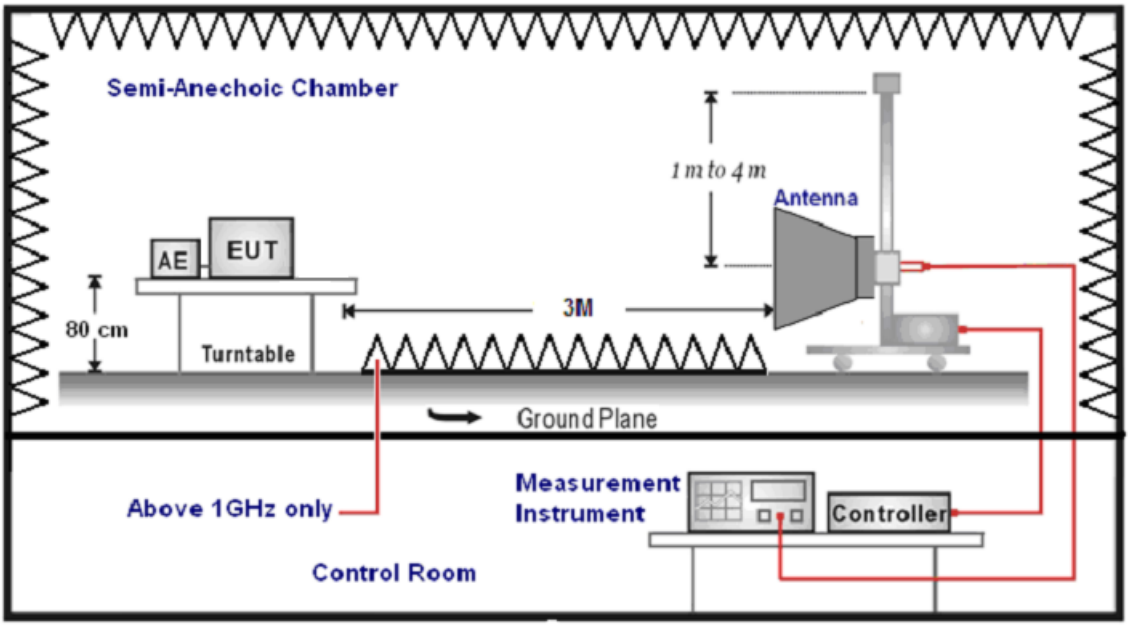
3.5.2 Test Setup 2

The test sites anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSIC63.4. The test distance is 3m.The setup is according to ANSI C63.4 and CAN/CSA-CEI/IEC CISPR 22.

The maximal emission value is acquired by adjusting the antenna height, polarization and turntable azimuth. Normally, the height range of antenna is 1m to 4m, the azimuth range of turntable is 0° to 360°,and the receive antenna has two polarizations Vertical (V) and Horizontal (H).



(Below1 GHz)

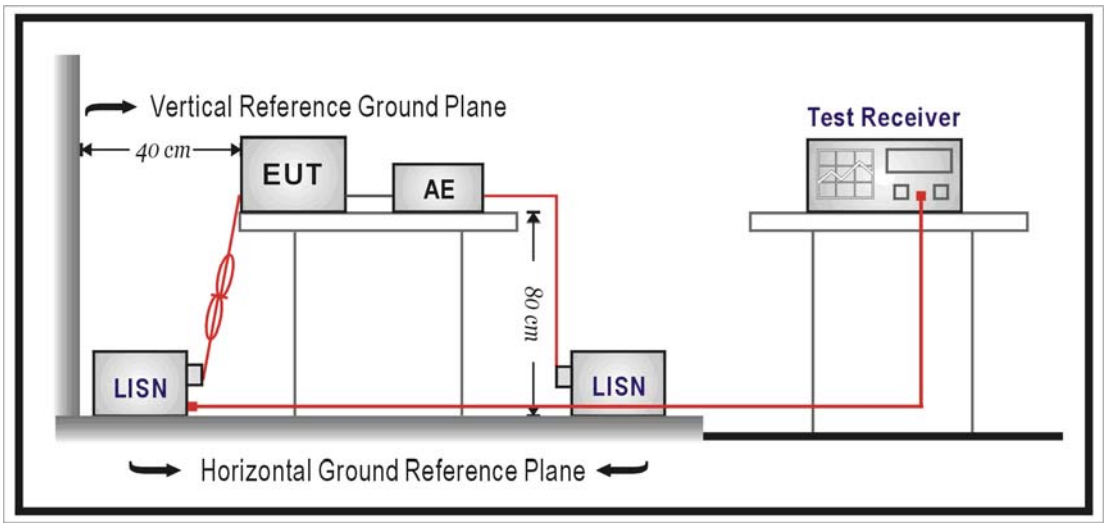


(Above 1GHz)

3.5.3 Test Setup 3

The mains cable of the EUT (maybe per AC/DC Adapter) must be connected to LISN. The LISN shall be placed 0.8 m from the boundary of EUT and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance is between the closest points of the LISN and the EUT. All other units of the EUT and associated equipment shall be least 0.8m from the LISN.

Ground connections, where required for safety purposes, shall be connected to the reference ground point of the LISN and, where not otherwise provided or specified by the manufacturer, shall be of same length as the mains cable and run parallel to the mains connection at a separation distance of not more than0.1 m.



3.6 Test Conditions

Test Case	Test Conditions	
	Configuration	Description
DTS (6 dB) Bandwidth	Measurement Method	FCC KDB 558074 §8.1 Option2.
	Test Environment	NTNV
	Test Setup	Test Setup 1
	EUT Configuration	CH11, CH18, CH26
Maximum Peak Conducted Output Power	Measurement Method	FCC KDB 558074§9.1.2
	Test Environment	NTNV
	Test Setup	Test Setup 1
	EUT Configuration	CH11, CH18, CH26
Maximum Power Spectral Density Level	Measurement Method	FCC KDB 558074 §10.2 (peak PSD).
	Test Environment	NTNV
	Test Setup	Test Setup 1
	EUT Configuration	CH11, CH18, CH26
Unwanted Emissions into Non-Restricted Frequency Bands	Measurement Method	FCC KDB 558074§11.0
	Test Environment	NTNV
	Test Setup	Test Setup 1
	EUT Configuration	CH11, CH18, CH26
Unwanted Emissions into Restricted Frequency Bands (Conducted)	Measurement Method	FCC KDB 558074§12.2, Conducted (antenna-port).
	Test Environment	NTNV
	Test Setup	Test Setup 1
	EUT Configuration	CH11, CH26
Unwanted Emissions into Restricted	Measurement Method	FCC KDB 558074§12.1, Radiated (cabinet/case emissions with Impedance matching for antenna-port).
	Test Environment	NTNV
	Test Setup	Test Setup 2
	EUT Configuration	CH11, CH26
AC Power Line Conducted Emissions	Measurement Method	AC mains conducted.
	Test Environment	NTNV
	Test Setup	Test Setup 3
	EUT Configuration	CH11 (Worst Conf.)

Note: For Radiated Emissions, By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “X axis” position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

4. Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements and is documented in the Shenzhen Asia Test Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for General Testing & Inspection laboratory is reported:

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.65 dB	(1)
Transmitter power Radiated	2.33 dB	(1)
Conducted spurious emission 9KHz-40 GHz	1.62 dB	(1)
Radiated spurious emission 9KHz-40 GHz	2.20 dB	(1)
Conducted Emission 9KHz-30MHz	3.50 dB	(1)
Radiated Emission 30~1000MHz	4.50 dB	(1)
Radiated Emission 1~18GHz	4.60 dB	(1)
Radiated Emission 18-40GHz	5.12 dB	(1)
Occupied Bandwidth	---------	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

5. Main Test Instruments

NO	Equipment Name	Model	Serial Number	Manufacturer	Cal DUE Date	Cal Period
1	Spectrum Analyzer	E4402B	MY1542588	Agilent	2015-07-30	1 year
2	Spectrum Analyzer	FSP40	100378	R&S	2015-12-20	1 year
3	Test Receiver	ESCI	100701	R&S	2015-07-30	1 year
4	Test Receiver	ESCI	100702	R&S	2015-07-30	1 year
5	LISN	ESH2-Z5	100196	R&S	2015-12-20	1 year
6	Horn Antenna	EM-AH-10180	2011071402	EM	2015-05-29	1 year
7	Horn Ant	BBHA 9170	9170-181	Schwarz beck	2015-05-29	1 year
8	Loop Antenna	HLA6120	35779	TESEQ	2015-05-29	1 year
9	EMI-Antenna	3160-09	00118383	ETS-Lindgren	2015-09-05	1 year
10	Power Mete	ML2487B	110553	Anritsu	2015-07-10	1 year
11	Power Sensor	MA2411B	100345	Anritsu	2015-07-10	1 year
12	RF cable 1	MXHS83QE3000	1420354	MURATA	2015-07-10	1 year

6. Test Conditions and Results

6.1 AC Power Conducted Emission

TEST PROCEDURE

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2009.
2. Support equipment, if needed, was placed as per ANSI C63.10-2009
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2009
4. The EUT received DC12V power from the adapter, the adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.

AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following：

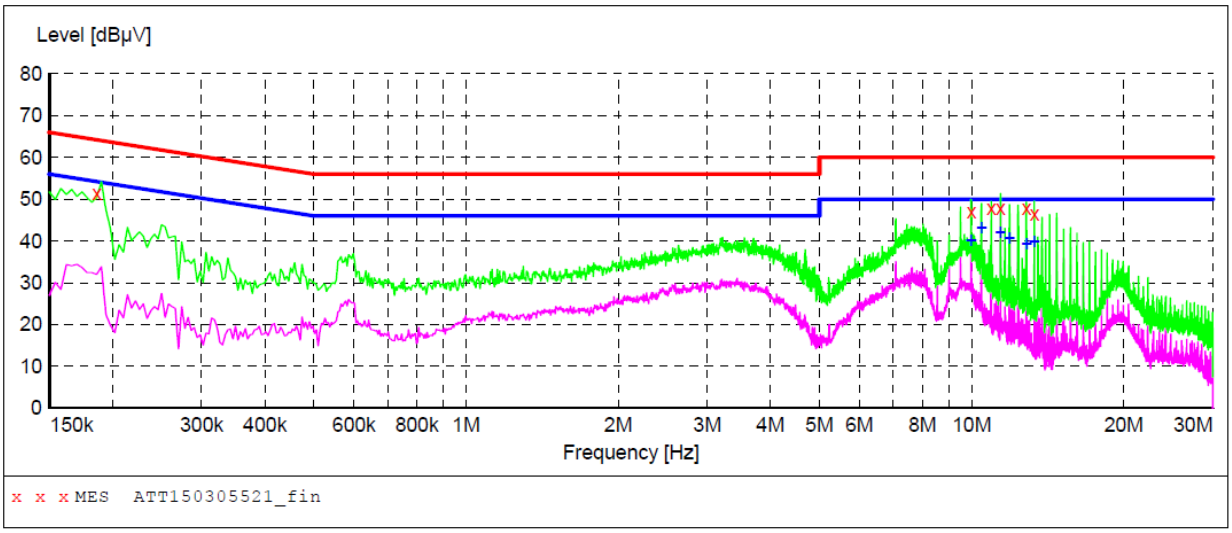
Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

TEST RESULTS

Test condition:	Normal	Channel:	CH11	Polarity:	L/N

SCAN TABLE: "Voltage (9K-30M)FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "ATT150305521_fin"

3/05/2015 7:23PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.186000	51.40	12.1	64	12.8	QP	L1	GND
9.986000	47.00	10.7	60	13.0	QP	N	GND
10.934000	47.70	10.7	60	12.3	QP	L1	GND
11.406000	47.80	10.7	60	12.2	QP	L1	GND
12.834000	47.80	10.7	60	12.2	QP	N	GND
13.314000	46.50	10.8	60	13.5	QP	N	GND

MEASUREMENT RESULT: "ATT150305521_fin2"

3/05/2015 7:23PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
9.982000	40.20	10.7	50	9.8	AV	L1	GND
10.462000	43.20	10.7	50	6.8	AV	N	GND
11.410000	42.00	10.7	50	8.0	AV	L1	GND
11.886000	40.70	10.7	50	9.3	AV	L1	GND
12.842000	39.40	10.7	50	10.6	AV	N	GND
13.314000	39.90	10.8	50	10.1	AV	N	GND

6.2 Radiated Emissions

TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9 KHz to 25GHz.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.

The frequency spectrum above 1 GHz for Transmitter was investigated. All emission not reported are much lower than the prescribed limits. Set the RBW=1MHz, VBW=3MHz for Peak Detector while the RBW=1MHz, VBW=10Hz for Average Detector, Readings are both peak and average values.

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	300	20log(2400/F(KHz))+80	2400/F(KHz)
0.49-1.705	30	20log(24000/F(KHz))+40	24000/F(KHz)
1.705-30	30	20log(30)+40	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

TEST RESULTS

Remark:

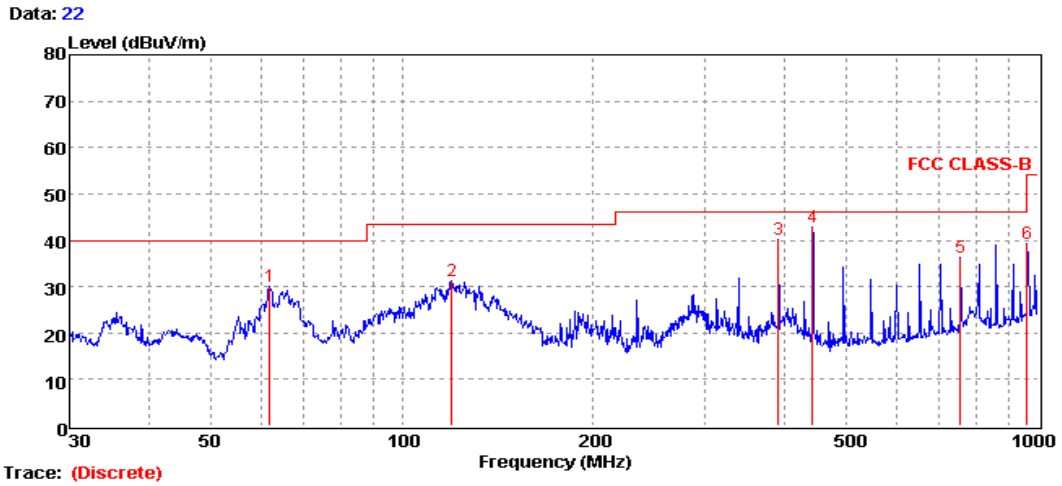
1. The radiated measurement is performed at channel (low/mid/high) and recorded worst datum at low channel for below 1GHz measurement.
2. ULTRA-BROADBAND ANTENNA for the radiation emission test below 1G.
3. HORN ANTENNA for the radiation emission test above 1G.
4. We tested X, Y, Z Axis, and recorded the worst case at the X Axis.

For 9 KHz to 30MHz

Frequency (MHz)	Corrected Reading (dBuV/m)@3m	FCC Limit (dBuV/m) @3m	Margin (dB)	Detector	Result
0.15	54.49	104.08	49.59	QP	PASS
1.56	43.69	63.74	20.05	QP	PASS
20.36	55.47	69.54	14.07	QP	PASS
23.26	48.25	69.54	21.29	QP	PASS

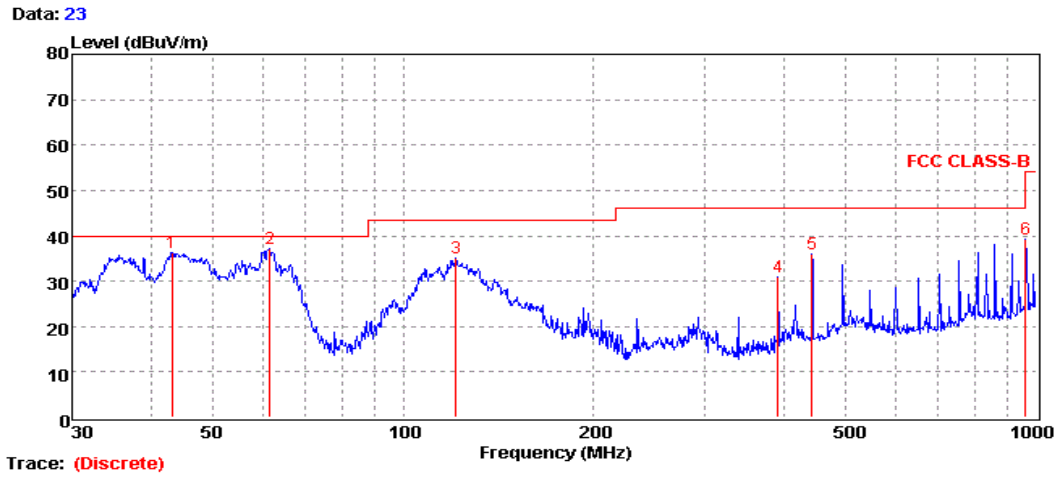
For 30MHz to 1000MHz

Horizontal



Mark	Frequency MHz	Level dBuV/m	Factor dB/m	Reading dBuV	Limit dBuV/m	Margin dB	Polarization	Detector
1	62.00	30.11	-20.06	50.17	40.00	9.89	HORIZONTAL	Peak
2	119.86	31.09	-18.67	49.76	43.50	12.41	HORIZONTAL	Peak
3	390.72	40.07	-13.57	53.64	46.00	5.93	HORIZONTAL	Peak
4	441.74	42.71	-12.52	55.23	46.00	3.29	HORIZONTAL	Peak
5	755.39	36.20	-8.21	44.41	46.00	9.80	HORIZONTAL	Peak
6	962.16	39.32	-4.50	43.82	54.00	14.68	HORIZONTAL	Peak

Vertical



Mark	Frequency MHz	Level dBuV/m	Factor dB/m	Reading dBuV	Limit dBuV/m	Margin dB	Polarization	Detector
1	43.20	36.25	-13.52	49.77	40.00	3.75	VERTICAL	Peak
2	61.56	37.11	-20.06	57.17	40.00	2.89	VERTICAL	Peak
3	121.12	35.02	-18.69	53.71	43.50	8.48	VERTICAL	Peak
4	390.72	30.92	-13.57	44.49	46.00	15.08	VERTICAL	Peak
5	441.74	36.03	-12.52	48.55	46.00	9.97	VERTICAL	Peak
6	962.16	39.14	-4.50	43.64	54.00	14.86	VERTICAL	Peak

For 1GHz to 25GHz

Frequency(MHz):				2405			Polarity:			HORIZONTAL		
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	4810.00	56.25	PK	74	17.75	1.00	45	54.11	31.65	6.89	36.40	2.14
1	4810.00	42.48	AV	54	11.52	1.00	45	40.34	31.65	6.89	36.40	2.14
2	7215.00	48.26	PK	74	25.74	1.00	110	37.93	37.10	8.58	35.35	10.33
2	7215.00	--	AV	54	--	--	--	--	--	--	--	--

Frequency(MHz):				2405			Polarity:			VERTICAL		
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	4810.00	57.26	PK	74	16.74	1.00	120	55.12	31.65	6.89	36.40	2.14
1	4810.00	43.69	AV	54	10.31	1.00	120	41.55	31.65	6.89	36.40	2.14
2	7215.00	49.25	PK	74	24.75	1.00	135	38.92	37.10	8.58	35.35	10.33
2	7215.00	--	AV	54	--	--	--	--	--	--	--	--

Frequency(MHz):				2440			Polarity:			HORIZONTAL		
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	4880.00	56.36	PK	74.00	17.64	1.00	110	54.96	30.47	7.49	36.56	1.40
1	4880.00	42.50	AV	54.00	11.50	1.00	110	41.10	30.47	7.49	36.56	1.40
2	7320.00	48.33	PK	74.00	25.67	1.00	185	37.42	37.65	8.56	35.30	10.91
2	7320.00	--	AV	54.00	--	--	--	--	--	--	--	--

Frequency(MHz):				2440			Polarity:			VERTICAL		
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	4880.00	57.39	PK	74.00	16.61	1.00	115	55.99	30.47	7.49	36.56	1.40
1	4880.00	43.64	AV	54.00	10.36	1.00	115	42.24	30.47	7.49	36.56	1.40
2	7320.00	48.96	PK	74.00	25.04	1.00	70	38.05	37.65	8.56	35.30	10.91
2	7320.00	--	AV	54.00	--	--	--	--	--	--	--	--

Frequency(MHz):				2480			Polarity:			HORIZONTAL		
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	4960.00	56.35	PK	74.00	17.65	1.00	130	53.29	31.55	7.79	36.28	3.06
1	4960.00	42.87	AV	54.00	11.13	1.00	130	39.81	31.55	7.79	36.28	3.06
2	7440.00	47.98	PK	74.00	26.02	1.00	120	36.25	38.36	8.70	35.33	11.73
2	7440.00	--	AV	54.00	--	--	--	--	--	--	--	--

Frequency(MHz):				2480			Polarity:			VERTICAL		
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	4960.00	57.47	PK	74.00	16.53	1.00	100	54.41	31.55	7.79	36.28	3.06
1	4960.00	42.47	AV	54.00	11.53	1.00	100	39.41	31.55	7.79	36.28	3.06
2	7440.00	48.69	PK	74.00	25.31	1.00	15	36.96	38.36	8.70	35.33	11.73
2	7440.00	--	AV	54.00	--	--	--	--	--	--	--	--

REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

6.3 Maximum Peak Output Power

TEST PROCEDURE

According to KDB558074 D01 DTS Mea Guidance v03r02 9.1.2 PKPM1 Peak power meter method “The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.”

LIMIT

The Maximum Peak Output Power Measurement is 30dBm.

TEST RESULTS

Type	Channel	Total Output power(dBm)	Limit (dBm)	Result
Zigbee	11	-1.357	30.00	Pass
	18	-1.547		
	26	0.047		

6.4 Power Spectral Density

TEST PROCEDURE

According to KDB 558074 D01 V03 Method PKPSD (peak PSD) this procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

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 within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

LIMIT

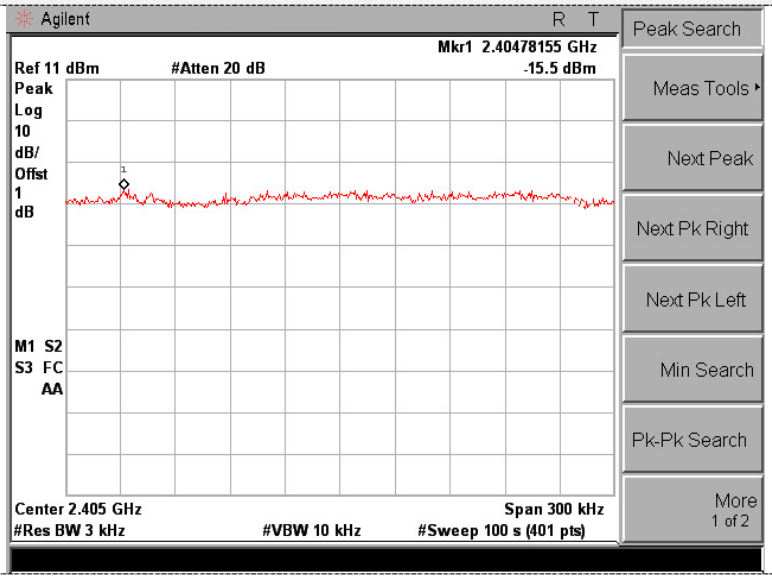
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

TEST RESULTS

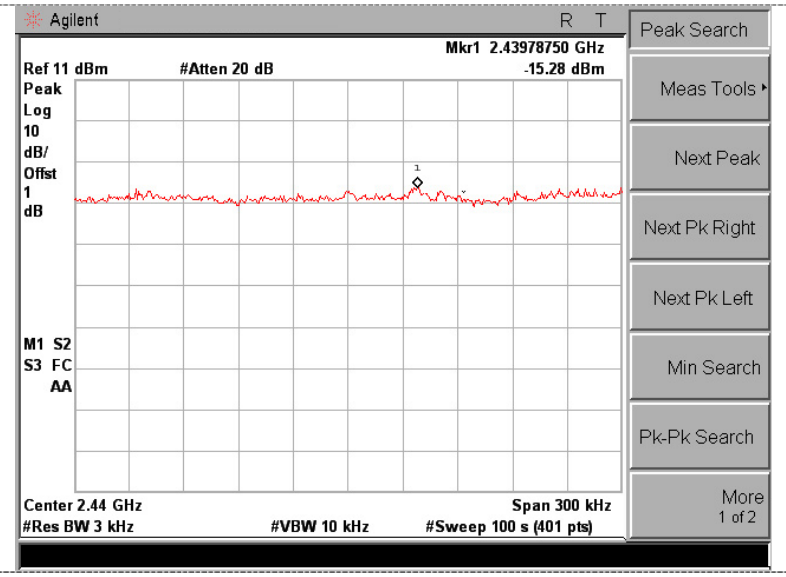
Type	Channel	Total Power Spectral Density (dBm/3KHz)	Limit (dBm/3KHz)	Result
Zigbee	11	-15.50	8.00	Pass
	18	-15.28		
	26	-14.03		

Test plots as fellow:

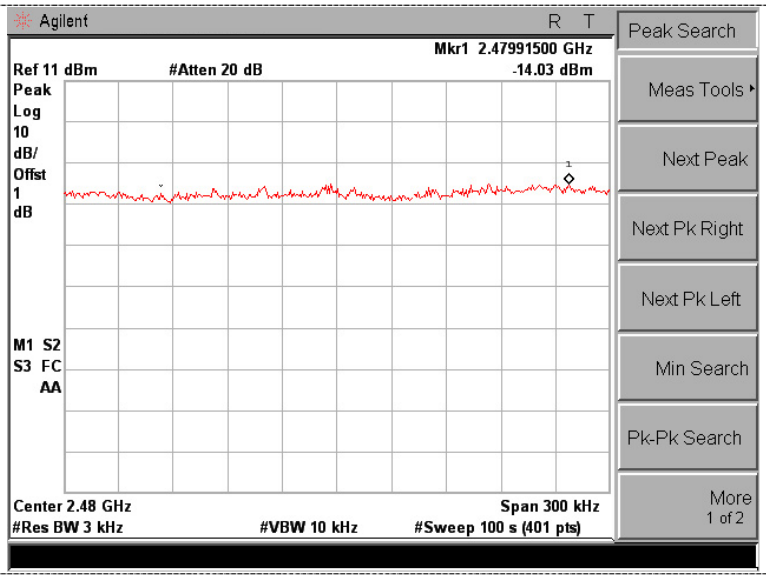
Zigbee



CH11



CH18



CH26

6.5 Band Edge Compliance of RF Emission

TEST REQUIREMENT

In any 100 kHz 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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

Test Procedure tor conducted method

1. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a spectrum analyzer
2. Turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set spectrum analyzer RBW =100 kHz and VBW=300 kHz
4. Use spectrum analyzer Maxhold function to allow trace to fully stabilize
5. Marker the highest point which fall into restricted frequency bands
6. Repeat above procedures until all measured frequencies were complete.

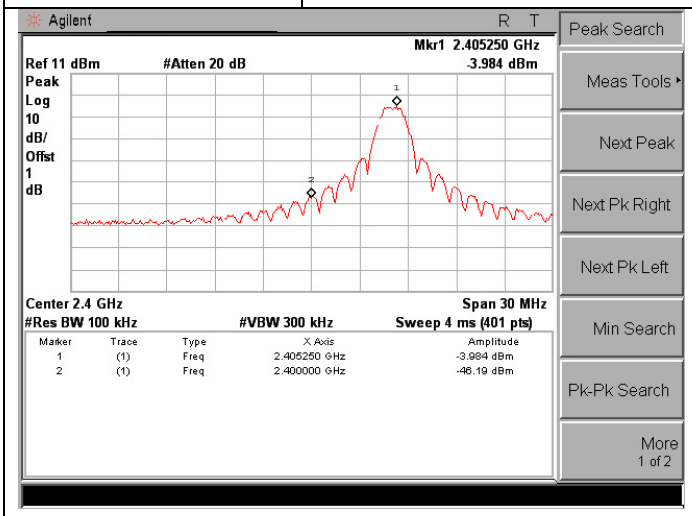
Test Procedure tor radiated method

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel
7. Test the EUT in the lowest channel, the highest channel
8. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.
9. Repeat above procedures until all frequencies measured was complete.

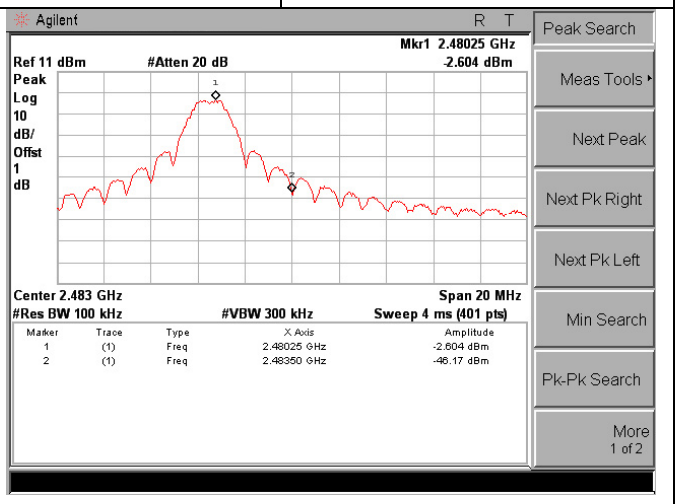
Test Results

A. Conducted measurements

Zigbee			
Frequency (MHz)	**Delta Peak to Band emission (dBc)**	**Limit (dBc)**	**Verdict**
2400.00	42.21	20	PASS
2483.50	43.57	20	PASS



CH 11



CH 26

B. Radiated measurements

Frequency(MHz):			**2405**			**Polarity:**			**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2390.00	64.25	PK	74.00	9.75	1.00	100	69.56	27.49	3.32	36.12	-5.31
2390.00	43.65	AV	54.00	10.35	1.00	100	48.96	27.49	3.32	36.12	-5.31
Frequency(MHz):			**2405**			**Polarity:**			**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2390.00	65.62	PK	74.00	8.38	1.00	55	70.93	27.49	3.32	36.12	-5.31
2390.00	42.45	AV	54.00	11.55	1.00	55	47.76	27.49	3.32	36.12	-5.31
Frequency(MHz):			**2480**			**Polarity:**			**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.50	67.84	PK	74.00	6.16	1.00	185	73.56	27.45	3.38	36.55	-5.72
2483.50	45.62	AV	54.00	8.38	1.00	185	51.34	27.45	3.38	36.55	-5.72
Frequency(MHz):			**2480**			**Polarity:**			**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.50	66.99	PK	74.00	7.01	1.00	130	72.71	27.45	3.38	36.55	-5.72
2483.50	45.32	AV	54.00	8.68	1.00	130	51.04	27.45	3.38	36.55	-5.72

6.6 Spurious RF Conducted Emission

TEST PROCEDURE

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2009 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100 kHz and VBW= 300 KHz to measure the peak field strength, and measure frequency range from 9 KHz to 26.5GHz.

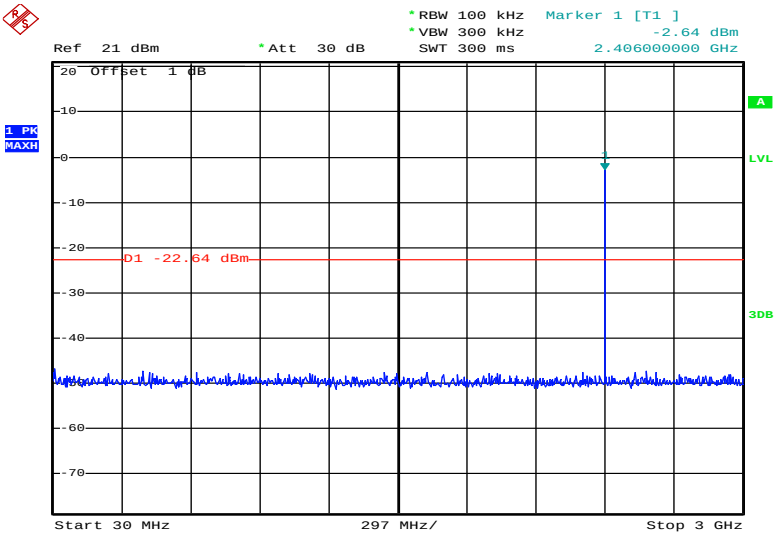
LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

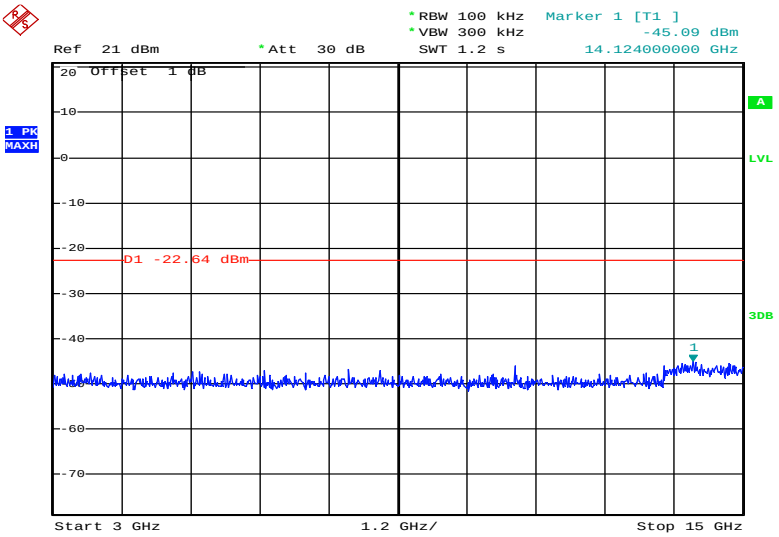
TEST RESULTS

Remark: The measurement frequency range is from 9 KHz to the 10^{th} harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions measurement data.
The spurious emissions of the 9 kHz to 30MHz are Background and lower than Limit, so we don’t recorded it.

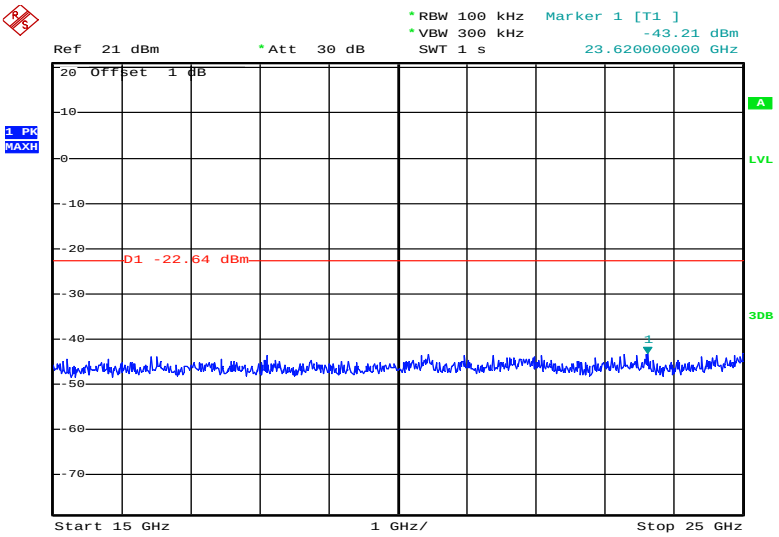
Test Mode:	Zigbee	Test channel :	CH 11



30MHz~3GHz

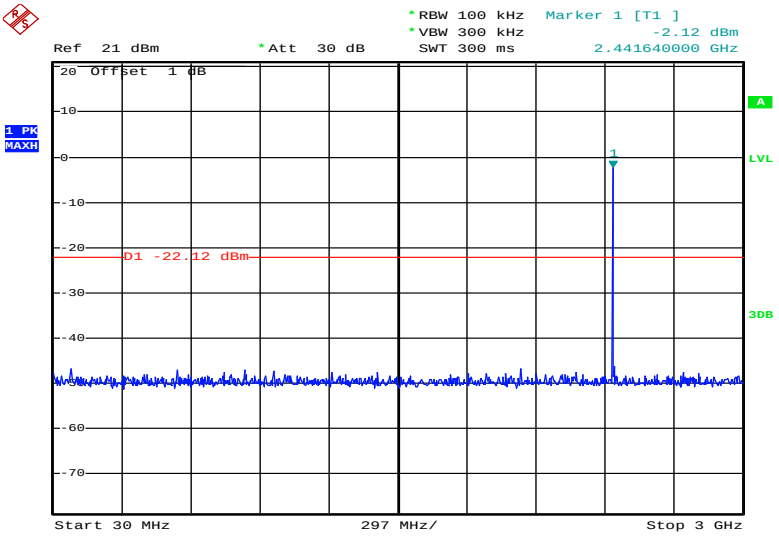


3GHz~15GHz

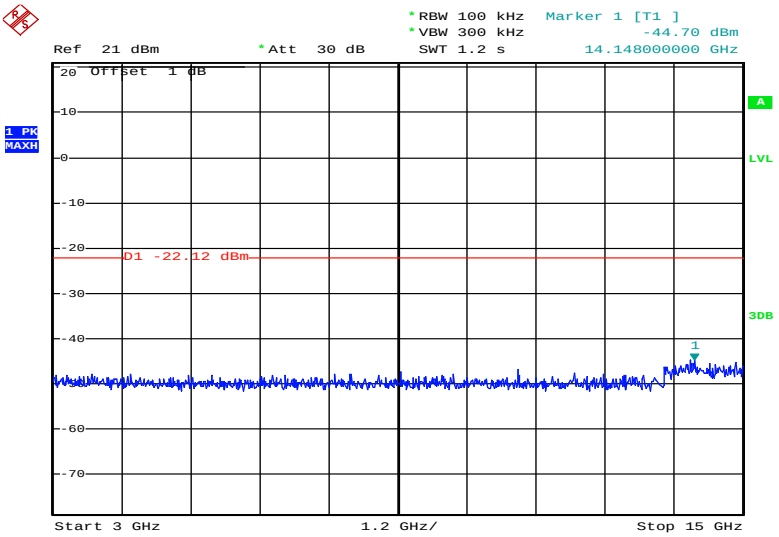


15GHz~25GHz

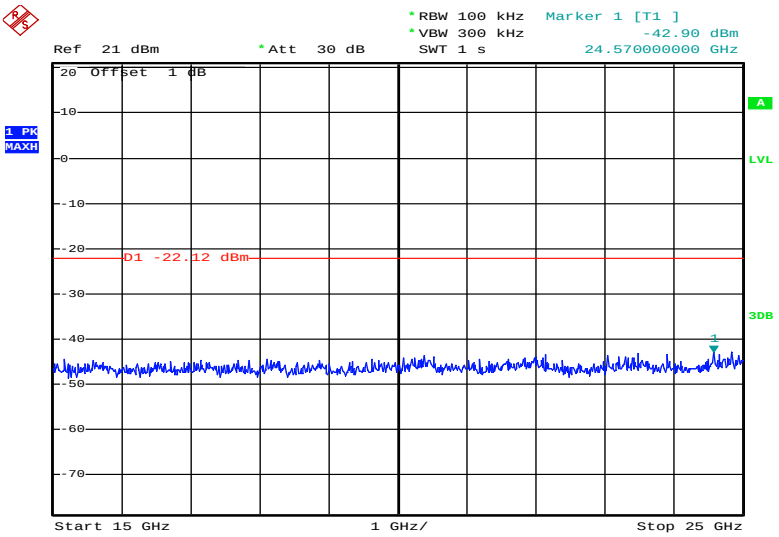
Test Mode:	Zigbee	Test channel :	CH 18



30MHz~3GHz

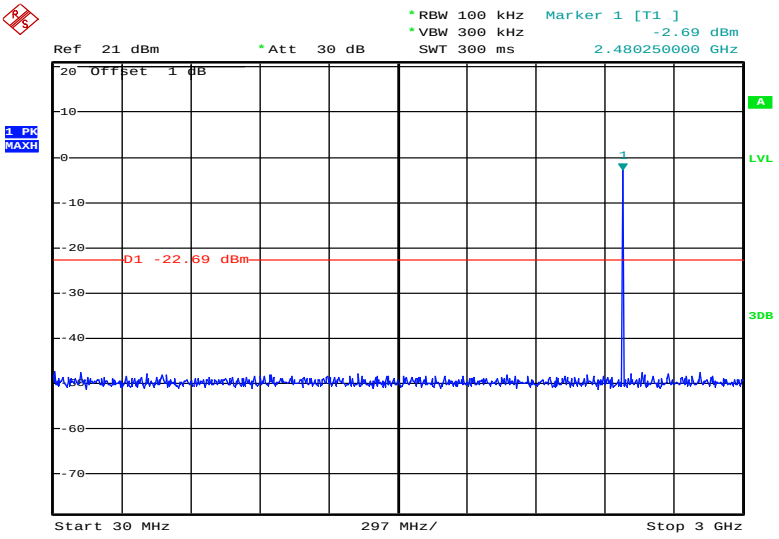


3GHz~15GHz

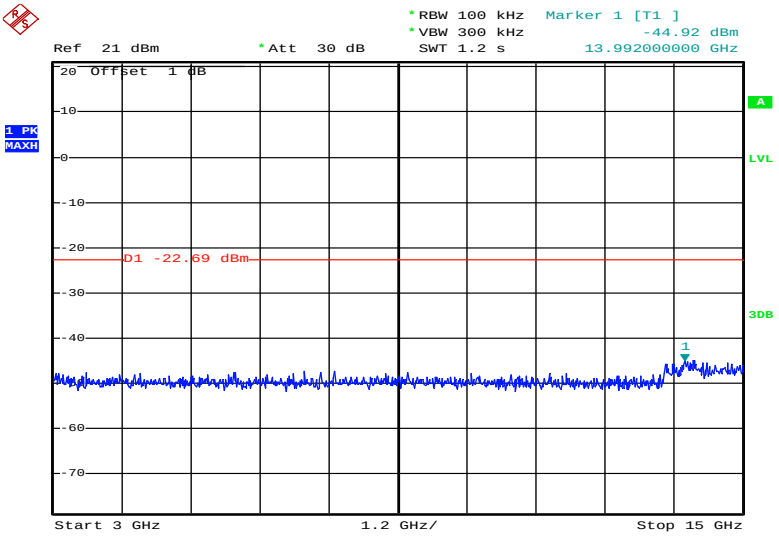


15GHz~25GHz

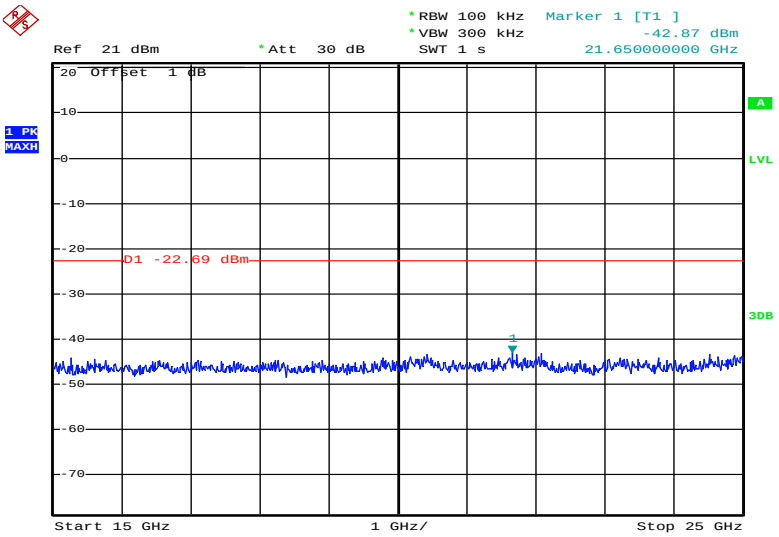
Test Mode:	Zigbee	Test channel :	CH 26



30MHz~3GHz



3GHz~15GHz



15GHz~25GHz

6.7 6dB Bandwidth

TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with100 KHz RBW and 300KHz VBW.
The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.
According to KDB558074 D01 V03 for one of the following procedures may be used to determine the modulated DTS device signal bandwidth.
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. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

LIMIT

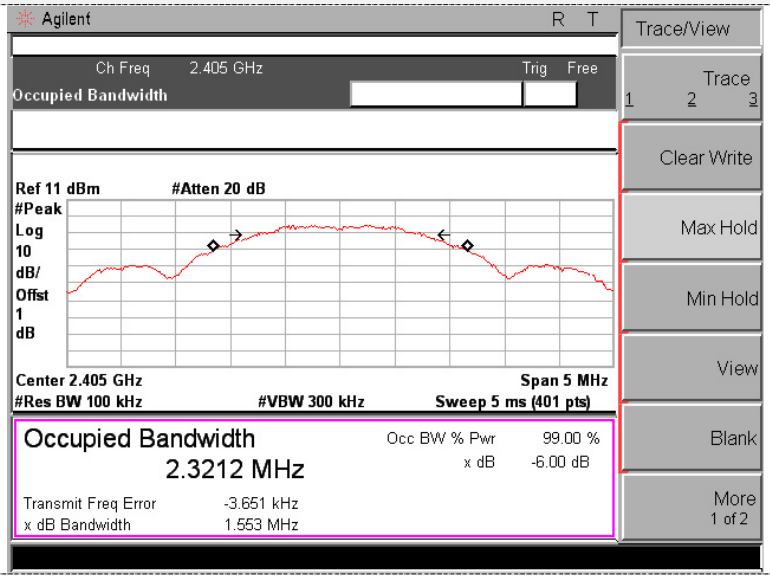
For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

TEST RESULTS

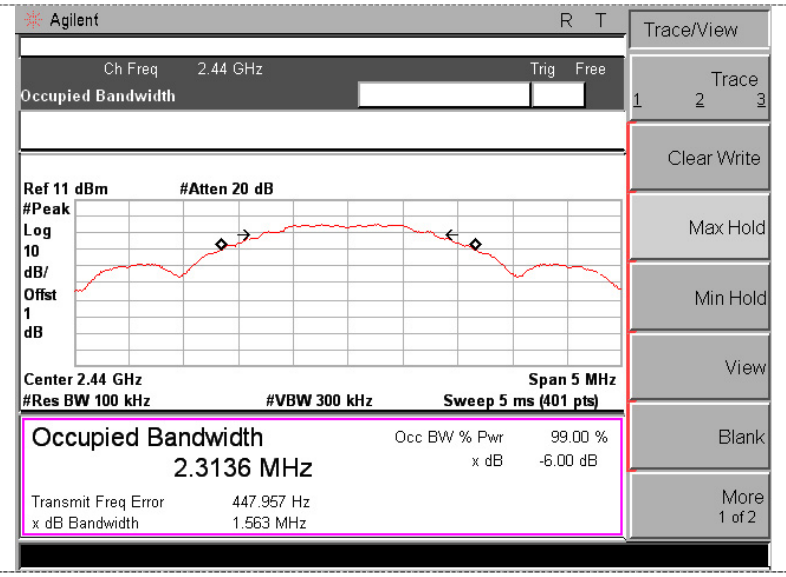
Type	Channel	Bandwidth (MHz)	Limit (KHz)	Result
ZigBee	11	1.5530	≥500	Pass
	18	1.5630		
	26	1.5330		

Test plots as fellow:

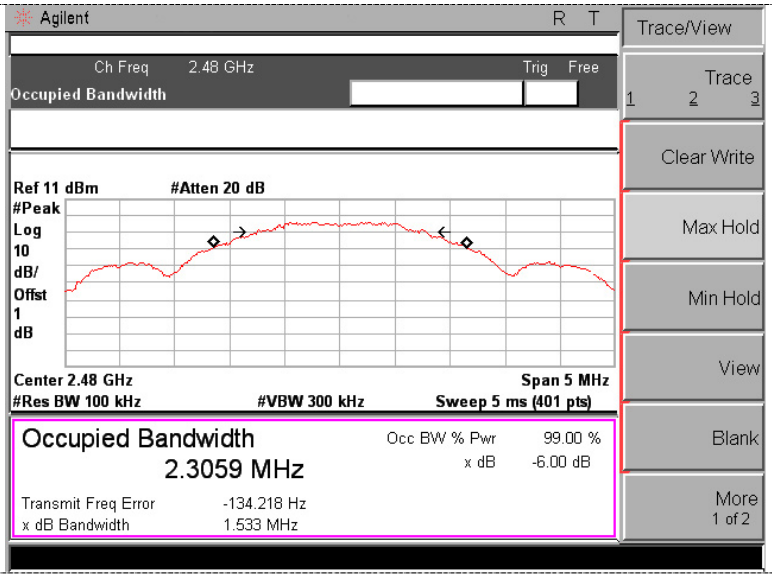
Zigbee



CH 11



CH 18



CH 26

6.8 Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Refer to statement below for compliance

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction

The device use a High-gain External Directional Antenna and the maximum antenna gain was 3.00 dBi.

END