



## Test Report

Product Name	Industrial ZigBee module
Model No	NPort Z3150 ZigBee Module
FCC ID.	SLEZ2150

Applicant	Moxa Inc.
Address	Fl.4. No.135. Lane 235, Baoqiao Rd. Xindian Dist, New Taipei City, Taiwan.

Date of Receipt	July 21, 2011
Issue Date	Aug. 15, 2011
Report No.	117349R-RFUSP28V01
Report Version	V1.0

The test results relate only to the samples tested.

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# Test Report Certification

Issue Date: Aug. 15, 2011

Report No.: 117349R-RFUSP28V01


**Accredited by NIST (NVLAP)**

NVLAP Lab Code: 200533-0

Product Name	Industrial ZigBee module	
Applicant	Moxa Inc.	
Address	Fl.4. No.135. Lane 235, Baoqiao Rd. Xindian Dist, New Taipei City, Taiwan.	
Manufacturer	Moxa Inc.	
Model No.	NPort Z3150 ZigBee Module	
EUT Rated Voltage	DC 3.3V	
EUT Test Voltage	AC 120V/ 60Hz	
Trade Name	Moxa	
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2010 ANSI C63.4: 2009	 <small>NVLAP Lab Code: 200533-0</small>
Test Result	Complied	

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# TABLE OF CONTENTS

Description	Page
<b>1. GENERAL INFORMATION .....</b>	<b>5</b>
1.1. EUT Description.....	5
1.2. Operational Description .....	7
1.3. Tested System Details.....	8
1.4. Configuration of Tested System .....	8
1.5. EUT Exercise Software .....	9
1.6. Test Facility .....	10
<b>2. Conducted Emission.....</b>	<b>11</b>
2.1. Test Equipment.....	11
2.2. Test Setup .....	11
2.3. Limits .....	12
2.4. Test Procedure .....	12
2.5. Uncertainty .....	12
2.6. Test Result of Conducted Emission.....	13
<b>3. Peak Power Output .....</b>	<b>15</b>
3.1. Test Equipment.....	15
3.2. Test Setup .....	15
3.3. Limits .....	15
3.4. Test Procedure .....	15
3.5. Uncertainty .....	15
3.6. Test Result of Peak Power Output.....	16
<b>4. Radiated Emission.....</b>	<b>17</b>
4.1. Test Equipment.....	17
4.2. Test Setup .....	18
4.3. Limits .....	19
4.4. Test Procedure .....	19
4.5. Uncertainty .....	19
4.6. Test Result of Radiated Emission.....	20
<b>5. RF antenna conducted test.....</b>	<b>24</b>
5.1. Test Equipment.....	24
5.2. Test Setup .....	24
5.3. Limits .....	24
5.4. Test Procedure .....	25
5.5. Uncertainty .....	25
5.6. Test Result of RF antenna conducted test.....	26
<b>6. Band Edge .....</b>	<b>32</b>
6.1. Test Equipment.....	32
6.2. Test Setup .....	33
6.3. Limits .....	33
6.4. Test Procedure .....	34
6.5. Uncertainty .....	34
6.6. Test Result of Band Edge .....	35

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<b>7.</b>	<b>Occupied Bandwidth.....</b>	<b>39</b>
7.1.	Test Equipment.....	39
7.2.	Test Setup .....	39
7.3.	Limits .....	39
7.4.	Test Procedure .....	39
7.5.	Uncertainty .....	39
7.6.	Test Result of Occupied Bandwidth .....	40
<b>8.</b>	<b>Power Density .....</b>	<b>43</b>
8.1.	Test Equipment.....	43
8.2.	Test Setup .....	43
8.3.	Limits .....	43
8.4.	Test Procedure .....	43
8.5.	Uncertainty .....	43
8.6.	Test Result of Power Density .....	44
<b>9.</b>	<b>EMI Reduction Method During Compliance Testing .....</b>	<b>47</b>

Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs

## 1. GENERAL INFORMATION

### 1.1. EUT Description

Product Name	Industrial ZigBee module
Trade Name	Moxa
Model No.	NPort Z3150 ZigBee Module
FCC ID.	SLEZ2150
Frequency Range	2405~2475MHz
Channel Separation	5 MHz
Channel Number	15
Type of Modulation	OQPSK
Antenna Type	Dipole
Antenna Gain	Refer to the table “Antenna List”
Channel Control	Auto
Module Version	V1.0
Contain Host Equipment	MOXA/ Nport Z2150

#### Antenna List

No.	Manufacturer	Part No.	Peak Gain
1	KINSON	6602D03081	2.9dBi for 2.4 GHz

Note: The antenna of EUT is conform to FCC 15.203

Center Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 01:	2405MHz	Channel 02:	2410MHz	Channel 03:	2415 MHz	Channel 04:	2420 MHz
Channel 05:	2425MHz	Channel 06:	2430MHz	Channel 07:	2435 MHz	Channel 08:	2440 MHz
Channel 09:	2445 MHz	Channel 10:	2450 MHz	Channel 11:	2455 MHz	Channel 12:	2460 MHz
Channel 13:	2465MHz	Channel 14:	2470 MHz	Channel 15:	2475 MHz		

## Note:

1. The EUT is a Industrial ZigBee module.
2. The device is applied for modular approval.
3. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
4. These tests are conducted on a sample for the purpose of demonstrating compliance of 2.4GHz transmitter with Part 15 Subpart C Paragraph 15.247 of spread spectrum devices
5. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

## 1.2. Operational Description

The EUT is a Industrial ZigBee module, The Number of the channels is 15 in 2405~2475MHz, The device adapts the OQPSK modulation, The Antenna is Dipole Antenna.

IEEE Std 802.15.4 defines the physical layer (PHY) and medium access control (MAC) sublayer specifications for low-data-rate wireless connectivity with fixed, portable, and moving devices with no battery or very limited battery consumption requirements typically operating in the personal operating space (POS) of 10 m.

ZigBee applications include:

- Home and office automation
- Industrial automation
- Medical monitoring
- Low-power sensors
- HVAC control
- Plus many other control and monitoring uses

Test Mode:	Mode 1: Transmit
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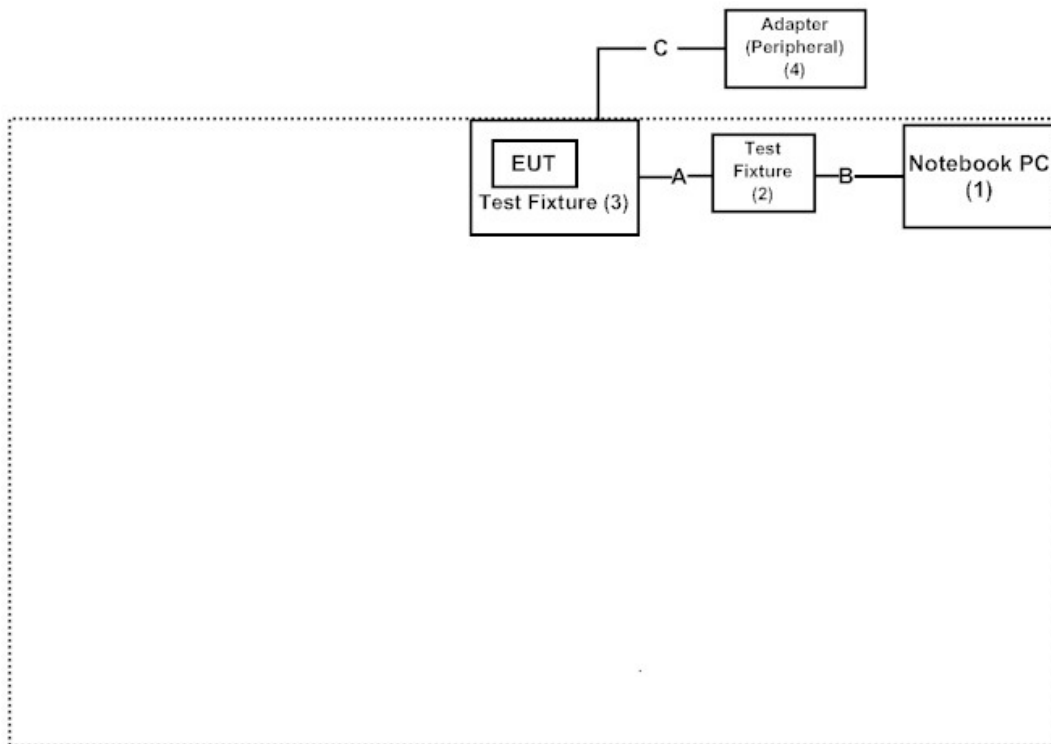
### 1.3. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1 Notebook PC	DELL	PPT	N/A	Non-Shielded, 0.8m
2 Test Fixture	MOXA	N/A	N/A	N/A
3 Test Fixture	MOXA	N/A	N/A	Non-Shielded, 1.6m
4 Adapter (for Fixture)	BNG	3A-066WP12	N/A	N/A

Signal Cable Type	Signal cable Description
A Signal Cable	Non-Shielded, 0.2m
B USB Cable	Shielded, 1.6m
C Power cable	Non-Shielded, 1.6m

### 1.4. Configuration of Tested System





## 1.5. EUT Exercise Software

- (1) Setup the EUT as shown in section 1.4.
- (2) Execute “CC2530.exe” on the Notebook.
- (3) Configure the test mode, the test channel to start the continuous transmit
- (4) Verify that the EUT works properly.

**1.6. Test Facility**

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from Quietek Corporation's Web Site : <http://tw.quietek.com/tw/emc/accreditations/accreditations.htm>

The address and introduction of Quietek Corporation's laboratories can be founded in our Web site : <http://www.quietek.com/>

Site Description: File on  
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 FCC Engineering Laboratory  
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Accreditation on NVLAP  
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FCC Accreditation Number: TW1014



## 2. Conducted Emission

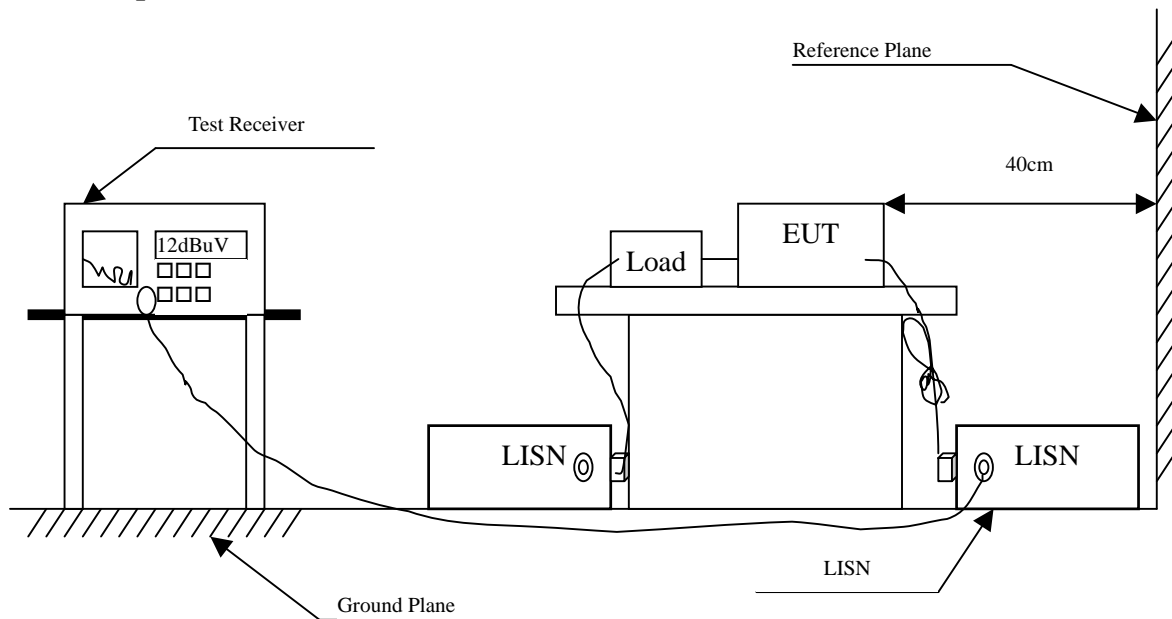
### 2.1. Test Equipment

The following test equipment are used during the conducted emission test:

Item	Instrument	Manufacturer	Type No./Serial No	Last Cal.	Remark
1	Test Receiver	R & S	ESCS 30/825442/17	May, 2011	
2	L.I.S.N.	R & S	ESH3-Z5/825016/6	May, 2011	EUT
3	L.I.S.N.	Kyoritsu	KNW-407/8-1420-3	May, 2011	Peripherals
4	Pulse Limiter	R & S	ESH3-Z2	May, 2011	
5	No.1 Shielded Room			N/A	

Note: All instruments are calibrated every one year.

### 2.2. Test Setup



**2.3. Limits**

<b>FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit</b>		
Frequency MHz	Limits	
	QP	AVG
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

**2.4. Test Procedure**

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2009 on conducted measurement.

Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

**2.5. Uncertainty**

± 2.26 dB

## 2.6. Test Result of Conducted Emission

Product : Industrial ZigBee module  
 Test Item : Conducted Emission Test  
 Power Line : Line 1  
 Test Mode : Mode 1: Transmit

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV	Margin dB	Limit dBuV
<b>Line 1</b>					
<b>Quasi-Peak</b>					
0.369	9.650	24.560	34.210	-25.533	59.743
0.560	9.640	34.100	43.740	-12.260	56.000
0.873	9.668	28.940	38.608	-17.392	56.000
1.060	9.670	26.640	36.310	-19.690	56.000
3.447	9.690	18.560	28.250	-27.750	56.000
11.345	9.850	20.680	30.530	-29.470	60.000
<b>Average</b>					
0.369	9.650	11.980	21.630	-28.113	49.743
0.560	9.640	22.870	32.510	-13.490	46.000
0.873	9.668	14.380	24.048	-21.952	46.000
1.060	9.670	13.600	23.270	-22.730	46.000
3.447	9.690	7.580	17.270	-28.730	46.000
11.345	9.850	8.500	18.350	-31.650	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. "■" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : Industrial ZigBee module  
 Test Item : Conducted Emission Test  
 Power Line : Line 2  
 Test Mode : Mode 1: Transmit

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV	Margin dB	Limit dBuV
<b>Line 2</b>					
<b>Quasi-Peak</b>					
0.502	9.640	34.580	44.220	-11.780	56.000
0.548	9.640	35.540	45.180	-10.820	56.000
0.689	9.650	32.040	41.690	-14.310	56.000
0.896	9.670	29.780	39.450	-16.550	56.000
1.377	9.670	22.960	32.630	-23.370	56.000
11.349	9.860	28.880	38.740	-21.260	60.000
<b>Average</b>					
0.502	9.640	21.180	30.820	-15.180	46.000
0.548	9.640	21.670	31.310	-14.690	46.000
0.689	9.650	23.020	32.670	-13.330	46.000
0.896	9.670	16.900	26.570	-19.430	46.000
1.377	9.670	10.250	19.920	-26.080	46.000
11.349	9.860	14.850	24.710	-25.290	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. "■" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

### 3. Peak Power Output

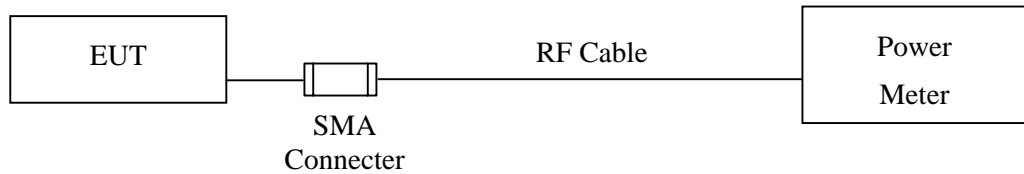
#### 3.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Power Meter	Anritsu	ML2495A/6K00003357	May, 2011
X	Power Sensor	Anritsu	MA2411B/0738448	Jun, 2011

Note: 1. All instruments are calibrated every one year.  
 2. The test instruments marked by “X” are used to measure the final test results.

#### 3.2. Test Setup

Conducted Measurement



#### 3.3. Limits

The maximum peak power shall be less 1 Watt.

#### 3.4. Test Procedure

The EUT was tested according to DTS test procedure of Mar. 2005 KDB558074 for compliance to FCC 47CFR 15.247 requirements.

#### 3.5. Uncertainty

± 1.27 dB

### 3.6. Test Result of Peak Power Output

Product : Industrial ZigBee module  
Test Item : Peak Power Output Data  
Test Site : No.3 OATS  
Test Mode : Mode 1: Transmit

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
01	2405	2.85	<30dBm	Pass
08	2440	2.60	<30dBm	Pass
15	2475	2.35	<30dBm	Pass

Note: Peak Power Output Value =Reading value on peak power meter + cable loss



## 4. Radiated Emission

### 4.1. Test Equipment

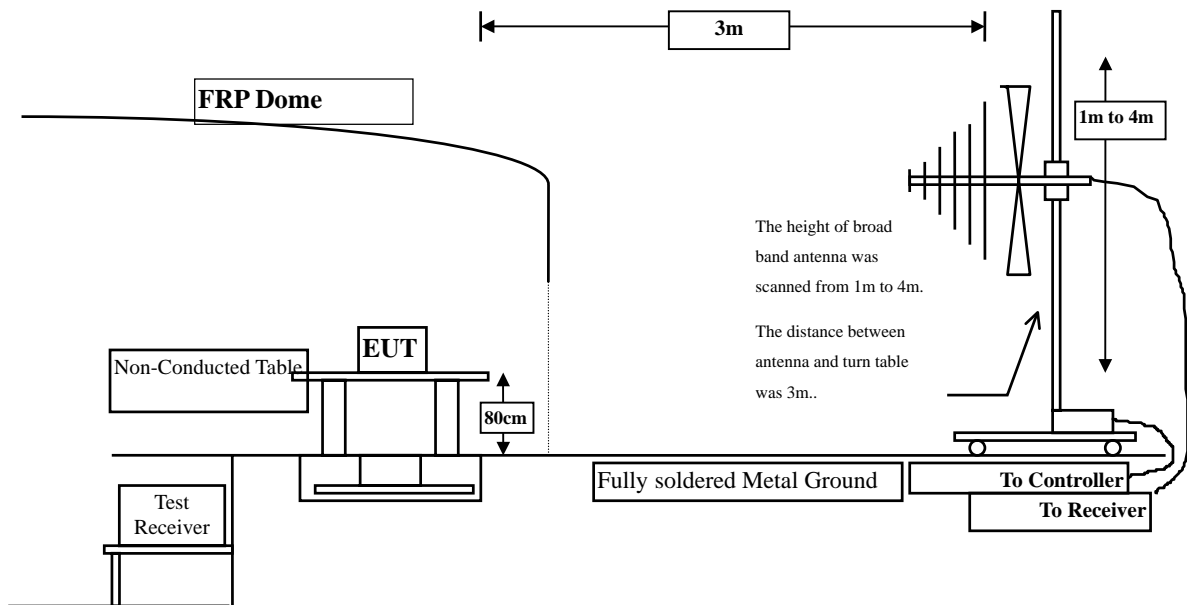
The following test equipment are used during the radiated emission test:

Test Site		Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☒ Site # 3	X	Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2010
	X	Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2010
	X	Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2011
	X	Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2011
	X	Pre-Amplifier	QTK	AP-180C / CHM_0906076	Sep., 2010
	X	Pre-Amplifier	MITEQ	AMF-4D-180400-45-6P/ 925975	Mar, 2011
	X	Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2011
	X	Test Receiver	R & S	ESCS 30/ 825442/018	Sep., 2010
	X	Coaxial Cable	Quietek	QTK-CABLE/ CAB5	Feb., 2011
	X	Controller	Quietek	QTK-CONTROLLER/ CTRL3	N/A
	X	Coaxial Switch	Anritsu	MP59B/6200265729	N/A

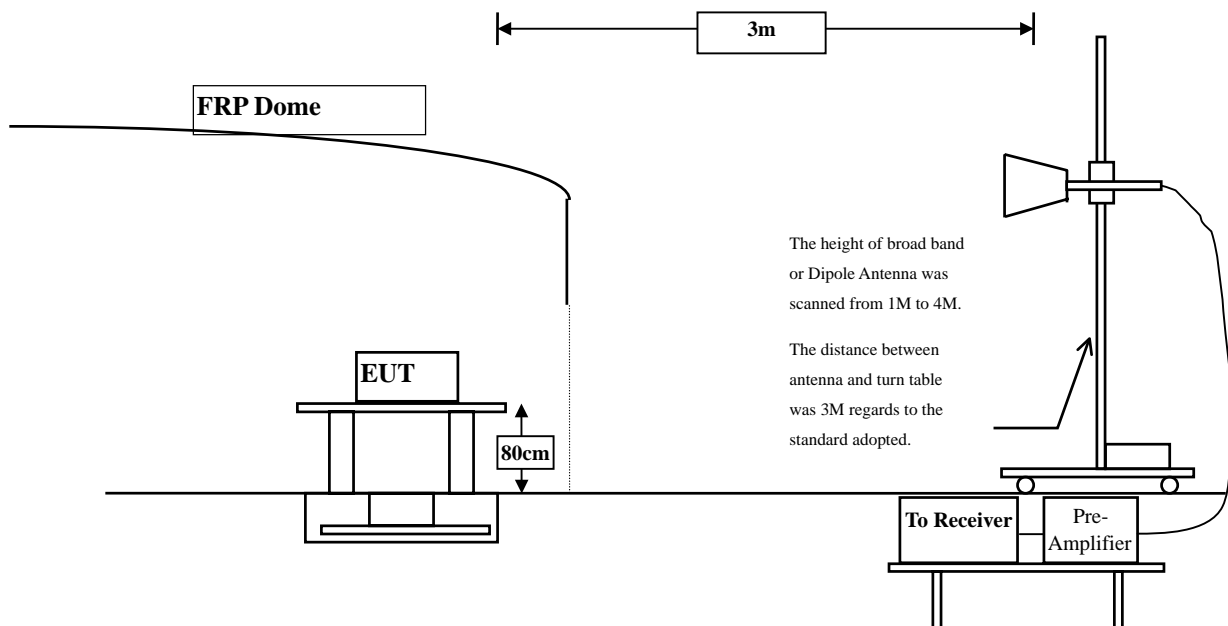
- Note:
1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
  2. The test instruments marked with "X" are used to measure the final test results.

## 4.2. Test Setup

### Radiated Emission Below 1GHz



### Radiated Emission Above 1GHz



### 4.3. Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

<b>FCC Part 15 Subpart C Paragraph 15.209(a) Limits</b>		
Frequency MHz	uV/m @3m	dBuV/m@3m
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Remarks: E field strength (dBuV/m) = 20 log E field strength (uV/m)

### 4.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2009 and tested according to DTS test procedure of Mar. 2005 KDB558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned between 1 meter and 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4:2009 on radiated measurement.

The resolution bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz.

Radiated emission measurements below 1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.

The worst radiated emission is measured in the Open Area Test Site on the Final Measurement. The measurement frequency range from 30MHz - 10th Harmonic of fundamental was investigated.

### 4.5. Uncertainty

± 3.9 dB above 1GHz

± 3.8 dB below 1GHz

#### 4.6. Test Result of Radiated Emission

Product : Industrial ZigBee module  
 Test Item : Harmonic Radiated Emission Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit (2405Hz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
<b>Horizontal</b>					
<b>Peak Detector:</b>					
4810.000	0.532	41.450	41.982	-32.018	74.000
7215.000	7.411	44.990	52.401	-21.599	74.000
9620.000	8.282	38.860	47.142	-26.858	74.000
<b>Average Detector:</b>					
--					
<b>Vertical</b>					
<b>Peak Detector:</b>					
4810.000	0.927	52.190	53.117	-20.883	74.000
7215.000	7.895	50.650	58.545	-15.455	74.000
9620.000	8.760	39.440	48.200	-25.800	74.000
<b>Average Detector:</b>					
7215.000	7.895	41.880	49.775	-4.225	54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Industrial ZigBee module  
 Test Item : Harmonic Radiated Emission Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit (2440Hz)

Frequency MHz	Correct Factor dB	Reading Level dBUV	Measurement Level dBUV/m	Margin dB	Limit dBUV/m
<b>Horizontal</b>					
<b>Peak Detector:</b>					
4880.000	0.038	43.130	43.168	-30.832	74.000
7320.000	7.699	45.600	53.299	-20.701	74.000
9760.000	7.665	38.040	45.705	-28.295	74.000
<b>Average Detector:</b>					
--					
<b>Vertical</b>					
<b>Peak Detector:</b>					
4880.000	0.499	53.110	53.609	-20.391	74.000
7320.000	8.303	48.330	56.633	-17.367	74.000
9760.000	8.299	38.370	46.670	-27.330	74.000
<b>Average Detector:</b>					
7320.000	8.303	38.670	46.973	-7.027	54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Industrial ZigBee module  
 Test Item : Harmonic Radiated Emission Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit (2475z)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
<b>Horizontal</b>					
<b>Peak Detector:</b>					
4950.000	0.483	41.560	42.043	-31.957	74.000
7425.000	8.496	39.660	48.156	-25.844	74.000
9900.000	8.163	39.090	47.252	-26.748	74.000
<b>Average Detector:</b>					
--					
<b>Vertical</b>					
<b>Peak Detector:</b>					
4950.000	1.243	52.440	53.683	-20.317	74.000
7425.000	9.225	46.800	56.026	-17.974	74.000
9900.000	9.202	38.550	47.751	-26.249	74.000
<b>Average Detector:</b>					
7425.000	9.225	36.730	45.956	-8.044	54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Industrial ZigBee module  
 Test Item : General Radiated Emission Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit (2440Hz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
<b>Horizontal</b>					
35.832	1.644	29.899	31.543	-8.457	40.000
64.990	-12.263	46.045	33.782	-6.218	40.000
309.920	-7.756	41.290	33.533	-12.467	46.000
442.104	-1.650	29.378	27.728	-18.272	46.000
523.747	-0.213	32.718	32.504	-13.496	46.000
856.152	3.041	24.133	27.174	-18.826	46.000
<b>Vertical</b>					
37.776	-7.872	38.500	30.628	-9.372	40.000
66.934	-13.872	50.120	36.247	-3.753	40.000
84.829	-10.943	42.440	31.497	-8.503	40.000
121.363	-10.255	43.785	33.530	-9.970	43.500
309.920	-8.991	36.464	27.473	-18.527	46.000
531.523	-1.859	34.899	33.040	-12.960	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

**5. RF antenna conducted test**

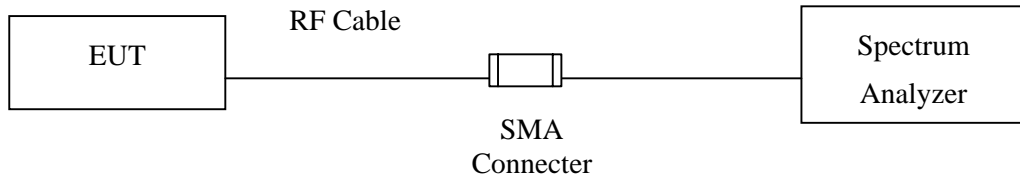
**5.1. Test Equipment**

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2011
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2011
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2011

- Note:
1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
  2. The test instruments marked with “X” are used to measure the final test results.

**5.2. Test Setup**

**RF antenna Conducted Measurement:**



**5.3. Limits**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the 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)).



#### 5.4. Test Procedure

The EUT was tested according to DTS test procedure of Mar. 2005 KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 100 kHz, Set VBW > RBW, scan up through 10th harmonic.

#### 5.5. Uncertainty

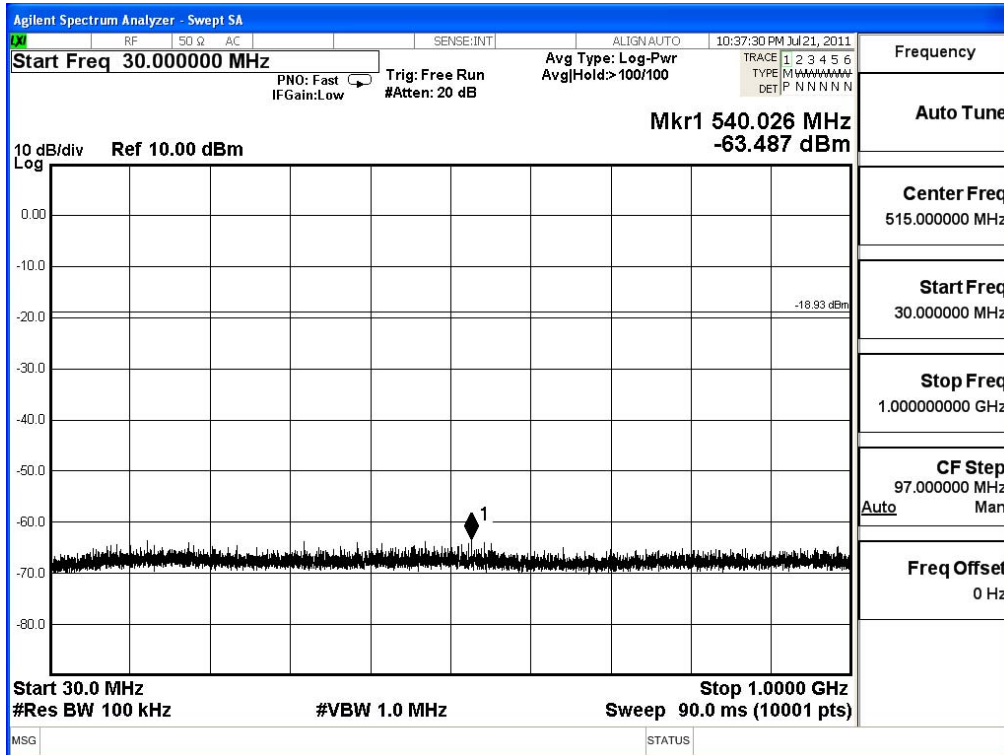
The measurement uncertainty

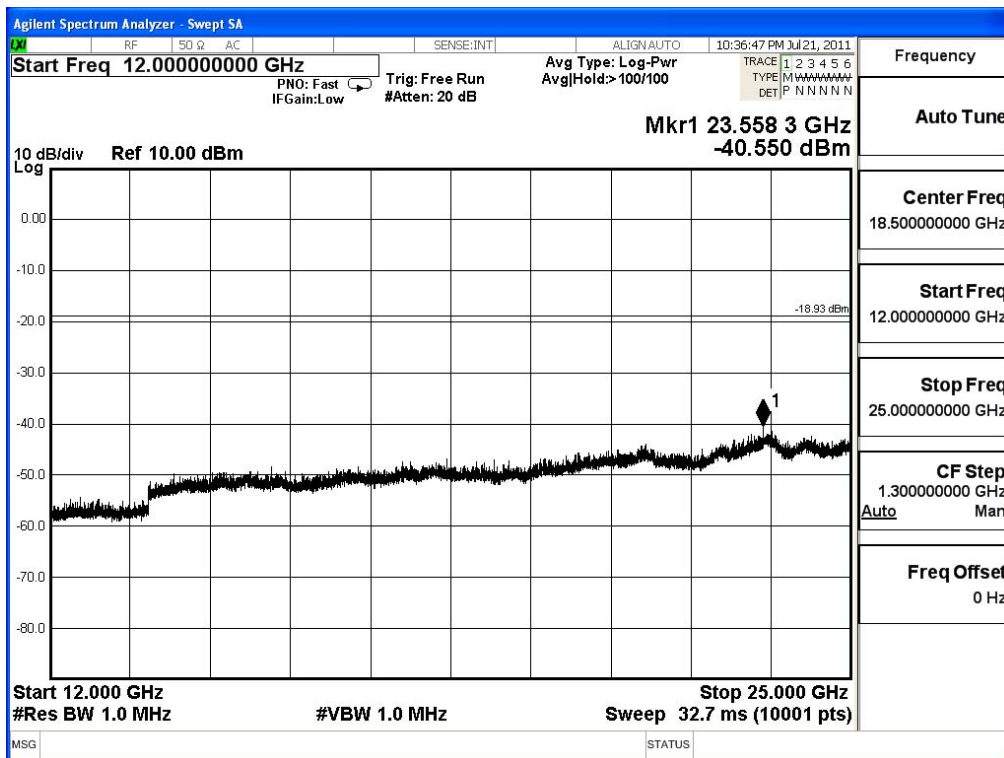
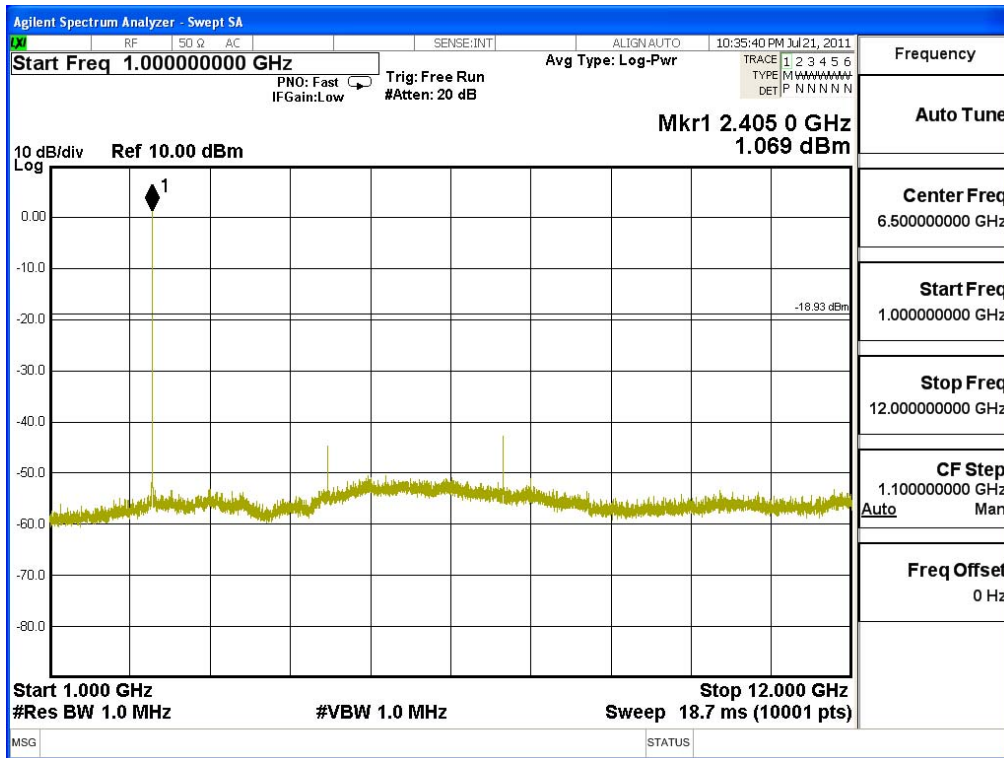
Conducted is defined as  $\pm 1.27\text{dB}$

**5.6. Test Result of RF antenna conducted test**

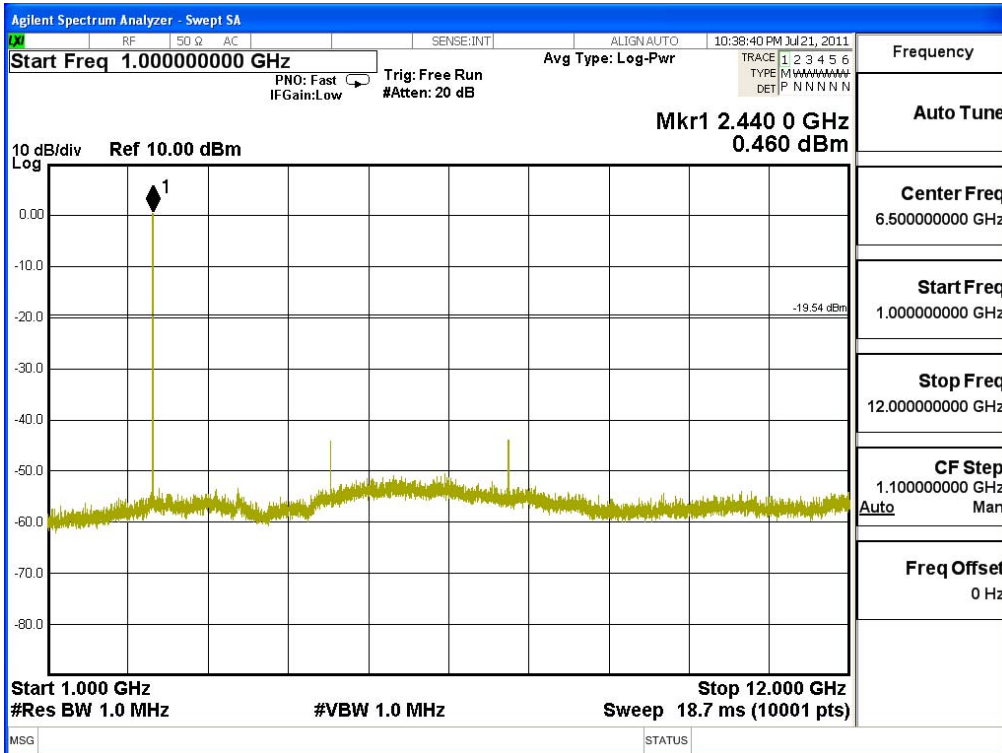
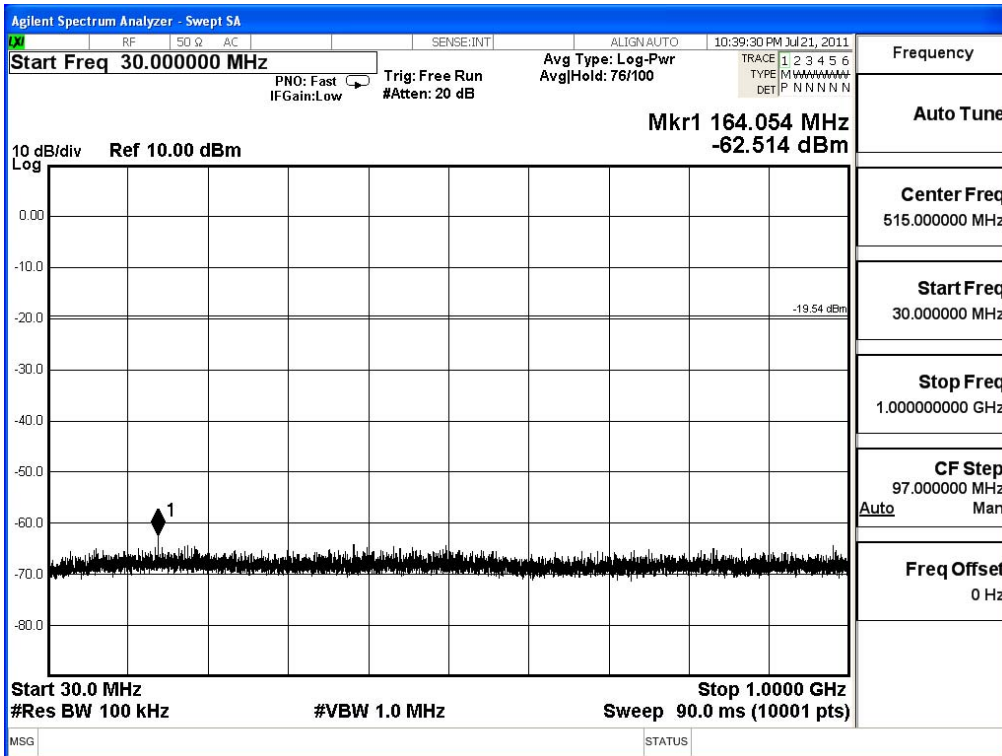
Product : Industrial ZigBee module  
 Test Item : RF antenna conducted test  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit

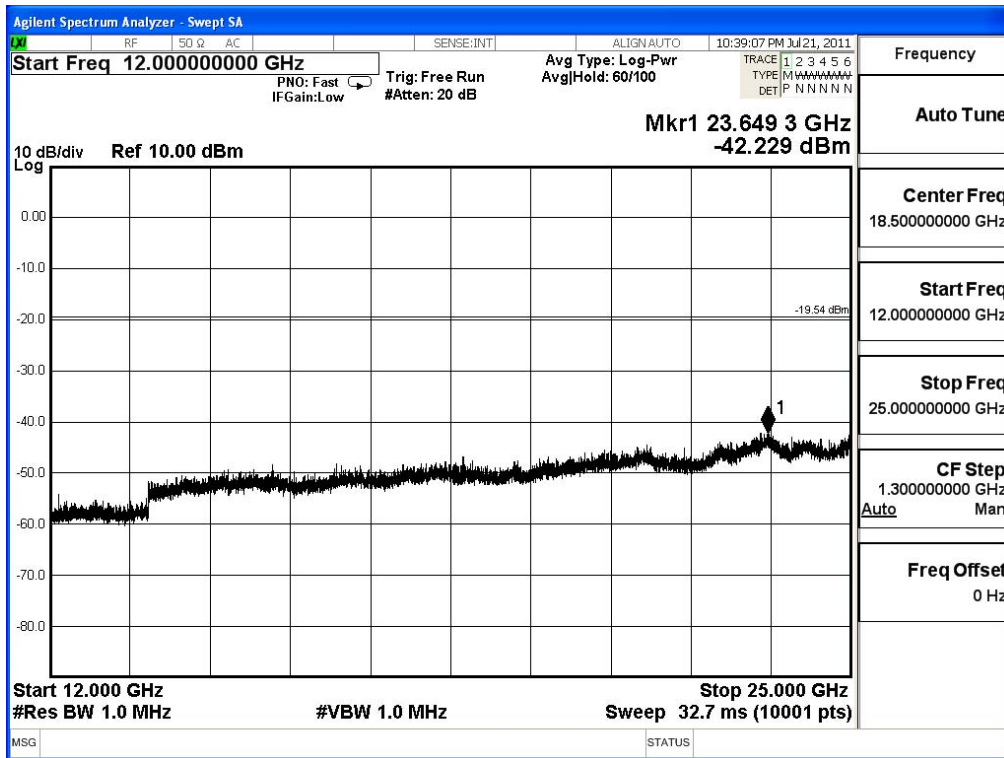
**Channel 01(2405Hz)**



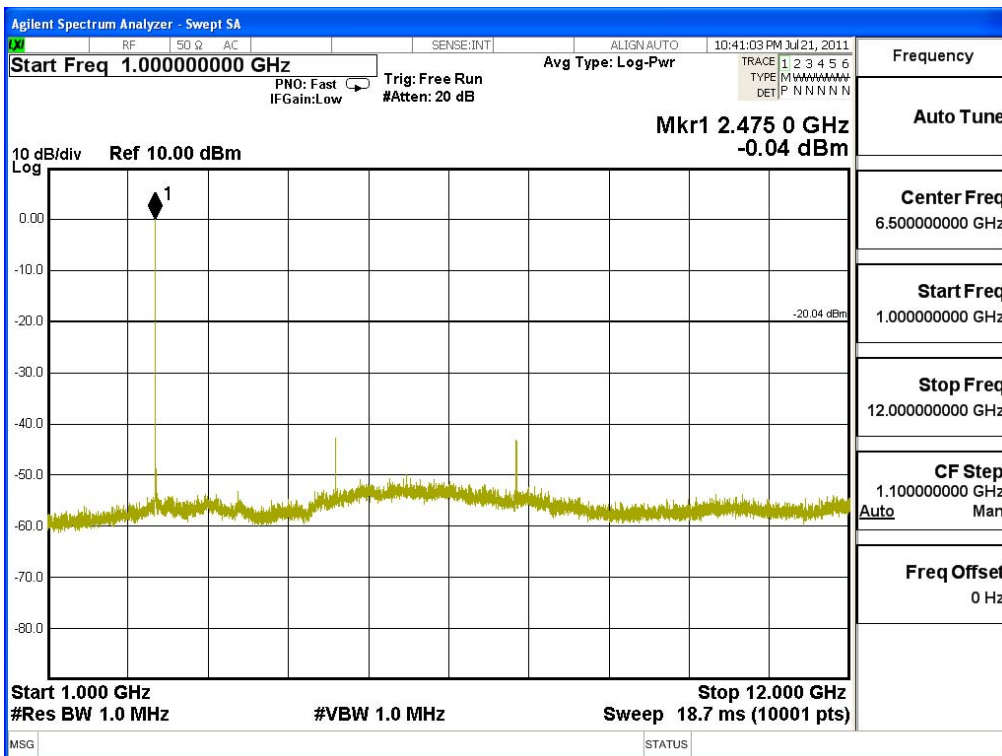
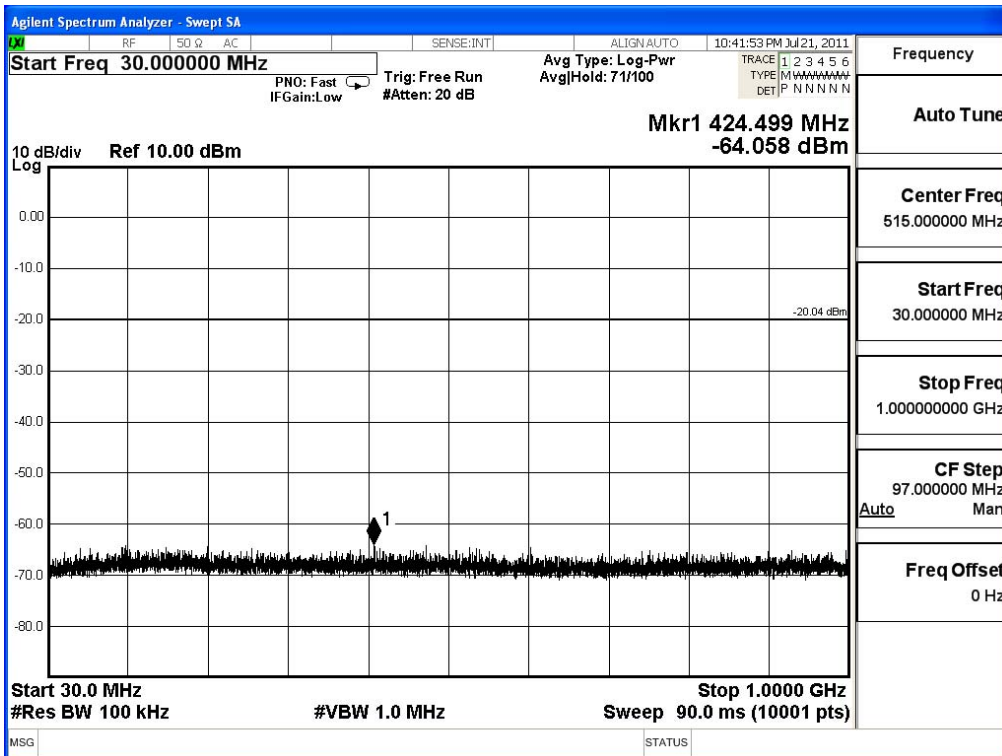


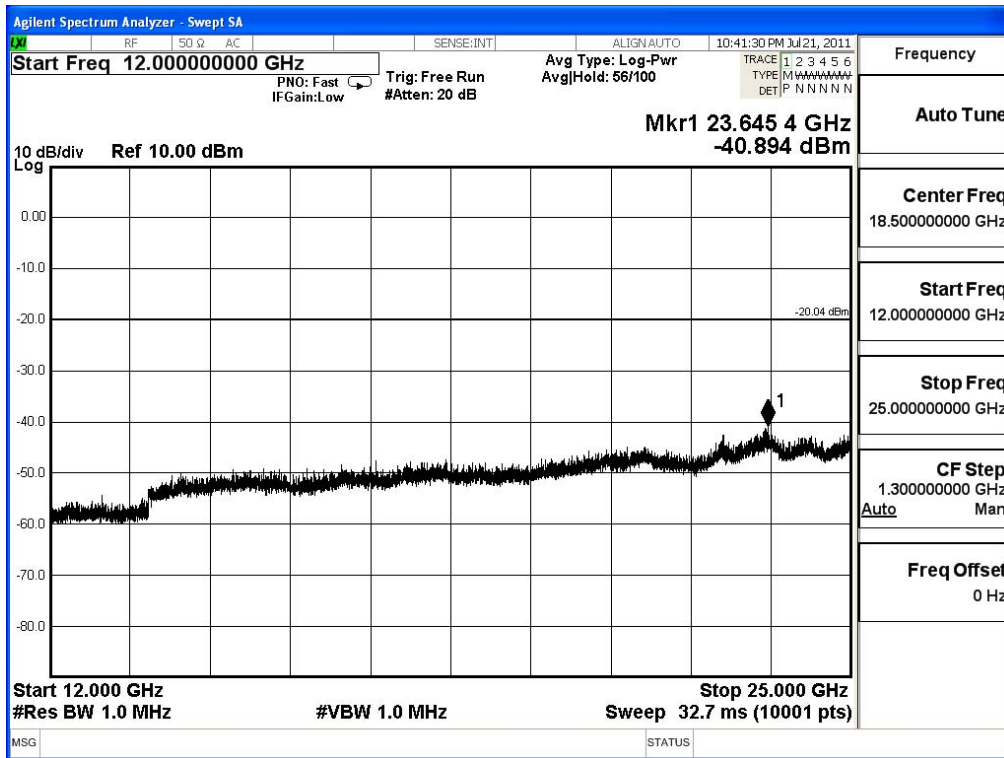
**Channel 08 (2440MHz)**





**Channel 15 (2475MHz)**





## 6. Band Edge

### 6.1. Test Equipment

#### RF Conducted Measurement

The following test equipments are used during the band edge tests:

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2011
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2011
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2011

Note:

1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with "X" are used to measure the final test results.

#### RF Radiated Measurement:

The following test equipments are used during the band edge tests:

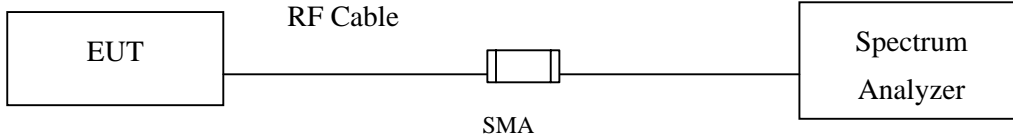
Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.	
☒ Site # 3		Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2010
	X	Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2010
		Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2011
		Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2011
	X	Pre-Amplifier	QTK	AP-180C / CHM_0906076	Sep., 2010
		Pre-Amplifier	MITEQ	AMF-4D-180400-45-6P/ 925975	Mar, 2011
	X	Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2011
		Test Receiver	R & S	ESCS 30/ 825442/018	Sep., 2010
	X	Coaxial Cable	Quietek	QTK-CABLE/ CAB5	Feb., 2011
	X	Controller	Quietek	QTK-CONTROLLER/ CTRL3	N/A
	X	Coaxial Switch	Anritsu	MP59B/6200265729	N/A

- Note:
1. All instruments are calibrated every one year.
  2. The test instruments marked by "X" are used to measure the final test results.

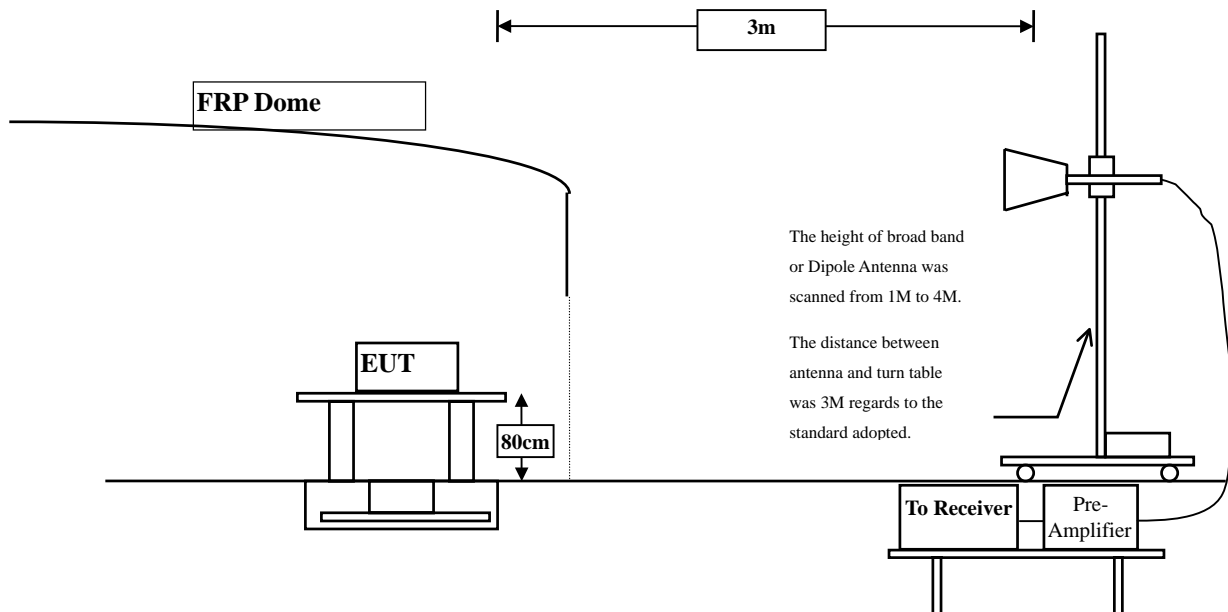


## 6.2. Test Setup

### RF Conducted Measurement



### RF Radiated Measurement:



## 6.3. Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

#### **6.4. Test Procedure**

The EUT was setup according to ANSI C63.4, 2009 and tested according to DTS test procedure of Mar. 2005 KDB558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4:2009 on radiated measurement.

#### **6.5. Uncertainty**

± 3.9 dB above 1GHz

± 3.8 dB below 1GHz

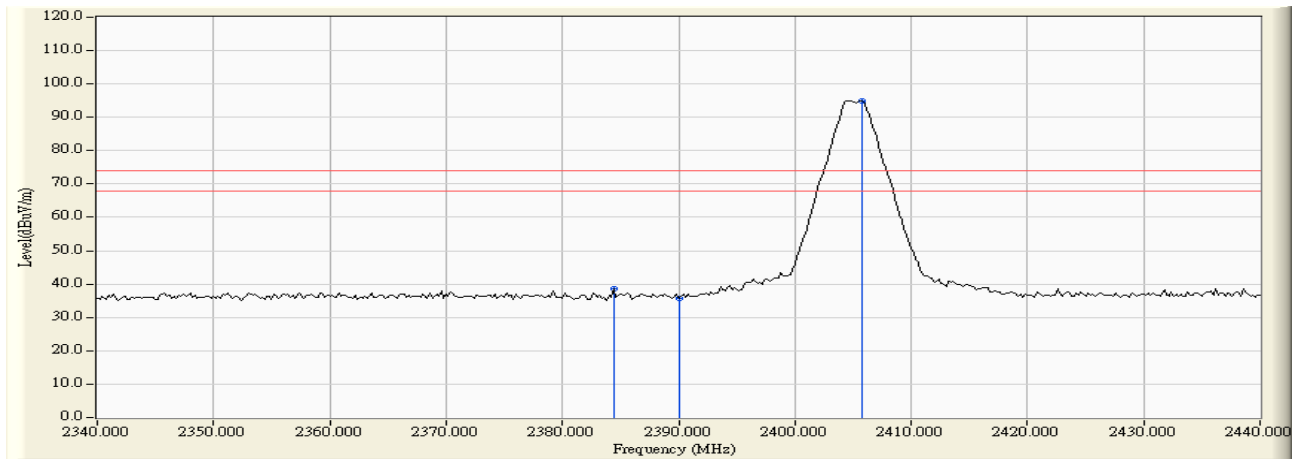
**6.6. Test Result of Band Edge**

Product : Industrial ZigBee module  
 Test Item : Band Edge Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit

**RF Radiated Measurement (Horizontal):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Result
01 (Peak)	2384.400	-1.153	39.608	38.455	-35.545	74.000	Pass
01 (Peak)	2390.000	30.415	36.985	35.854	-38.146	74.000	Pass
01 (Peak)	2405.800	30.503	96.014	94.963	--	--	--

**Figure Channel 01: Horizontal (Peak)**



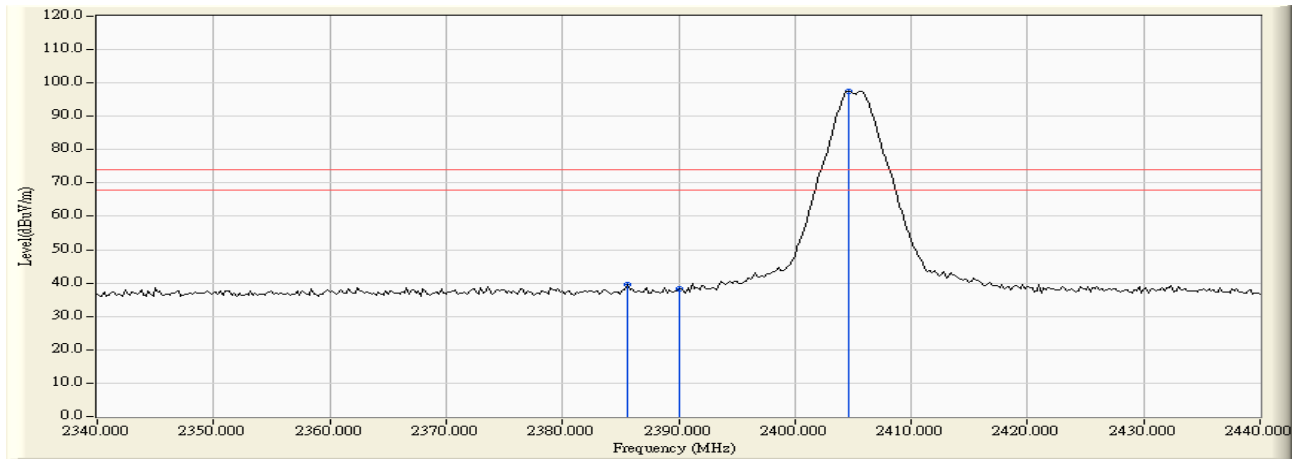
Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

Product : Industrial ZigBee module  
 Test Item : Band Edge Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit

**RF Radiated Measurement (Vertical):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Result
01 (Peak)	2385.600	-1.704	41.412	39.708	-34.292	74.000	Pass
01 (Peak)	2390.000	-1.725	40.034	38.309	-35.691	74.000	Pass
01 (Peak)	2404.600	-1.723	99.250	97.527	--	--	--

**Figure Channel 01: Vertical (Peak)**



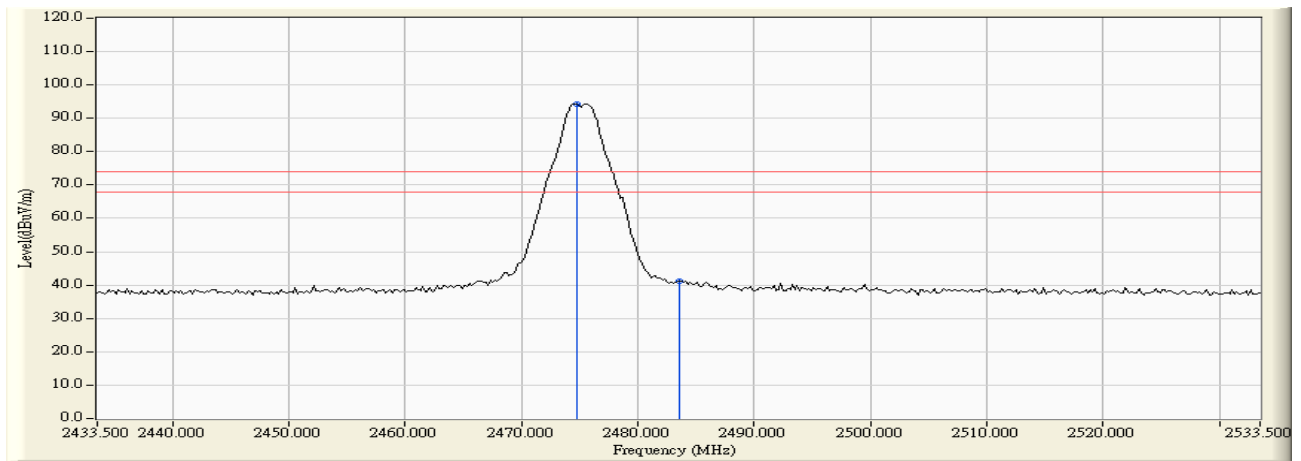
Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

Product : Industrial ZigBee module  
 Test Item : Band Edge Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit

**RF Radiated Measurement (Horizontal):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Result
15 (Peak)	2474.700	-0.615	94.924	94.310	--	--	--
15 (Peak)	2483.500	-0.558	41.870	41.312	-32.688	74.000	Pass

**Figure Channel 15: Horizontal (Peak)**



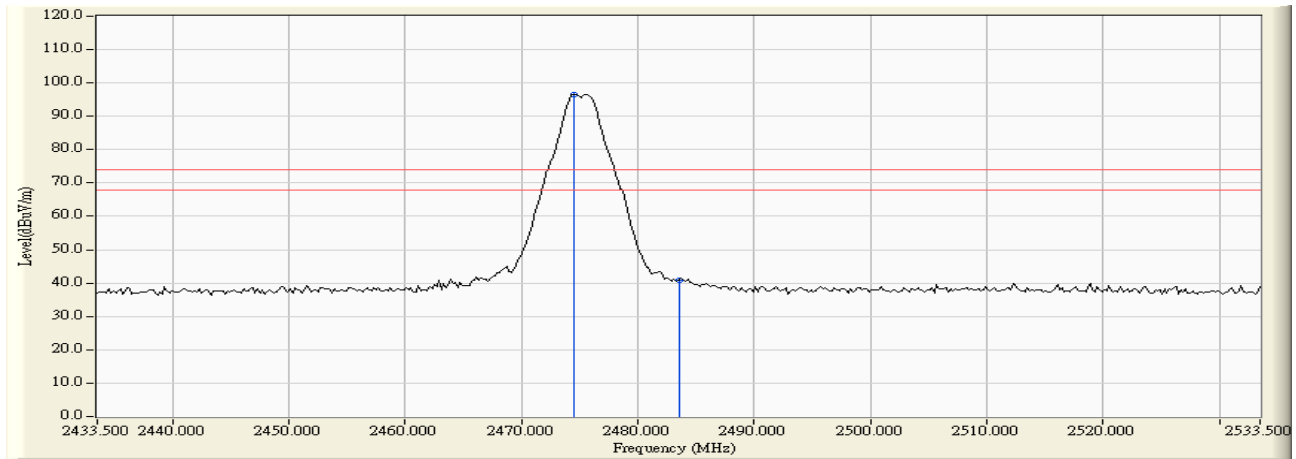
Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

Product : Industrial ZigBee module  
 Test Item : Band Edge Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit

**RF Radiated Measurement (Vertical):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Result
15 (Peak)	2474.500	-1.355	97.913	96.558	--	--	--
15 (Peak)	2483.500	-1.305	42.269	40.964	-33.036	74.000	Pass

**Figure Channel 78: Vertical (Peak)**



Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

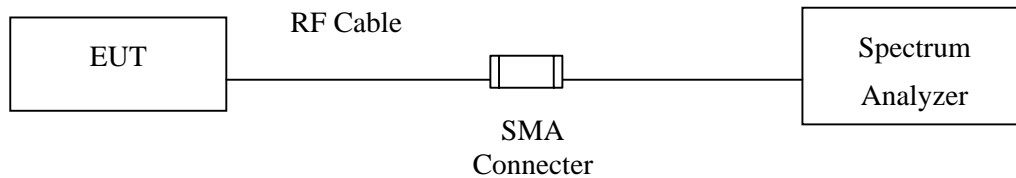
## 7. Occupied Bandwidth

### 7.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2011
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2011
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2011

- Note:
1. All instruments are calibrated every one year.
  2. The test instruments marked by "X" are used to measure the final test results.

### 7.2. Test Setup



### 7.3. Limits

The minimum bandwidth shall be at least 500 kHz.

### 7.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2009; tested according to DTS test procedure of Mar. 2005 KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 100 kHz, Span greater than RBW.

### 7.5. Uncertainty

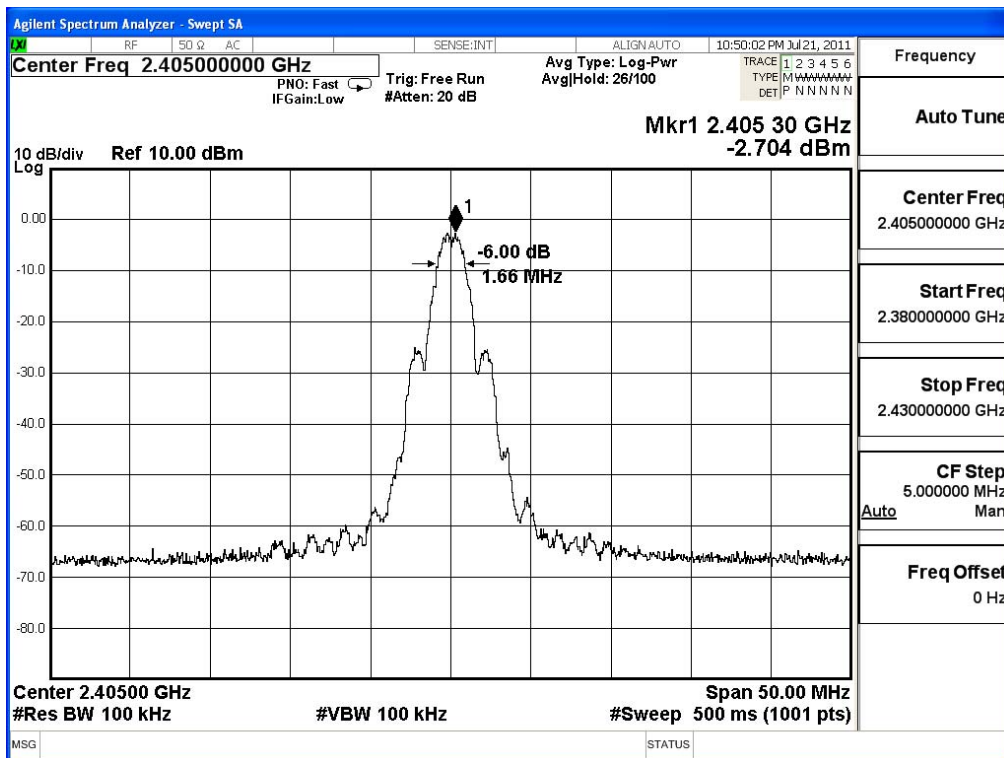
$\pm 150\text{Hz}$

### 7.6. Test Result of Occupied Bandwidth

Product : Industrial ZigBee module  
 Test Item : Occupied Bandwidth Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit (2405MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
01	2405.00	1660	>500	Pass

Figure Channel 01:

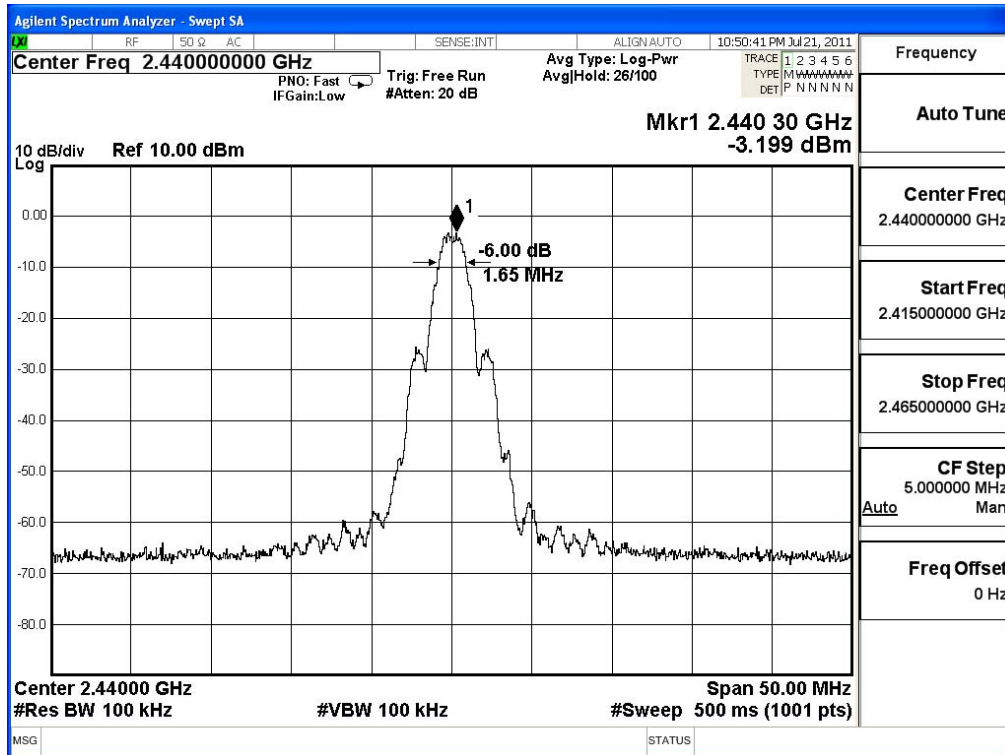




Product : Industrial ZigBee module  
 Test Item : Occupied Bandwidth Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit (2440MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
08	2440.00	1650	>500	Pass

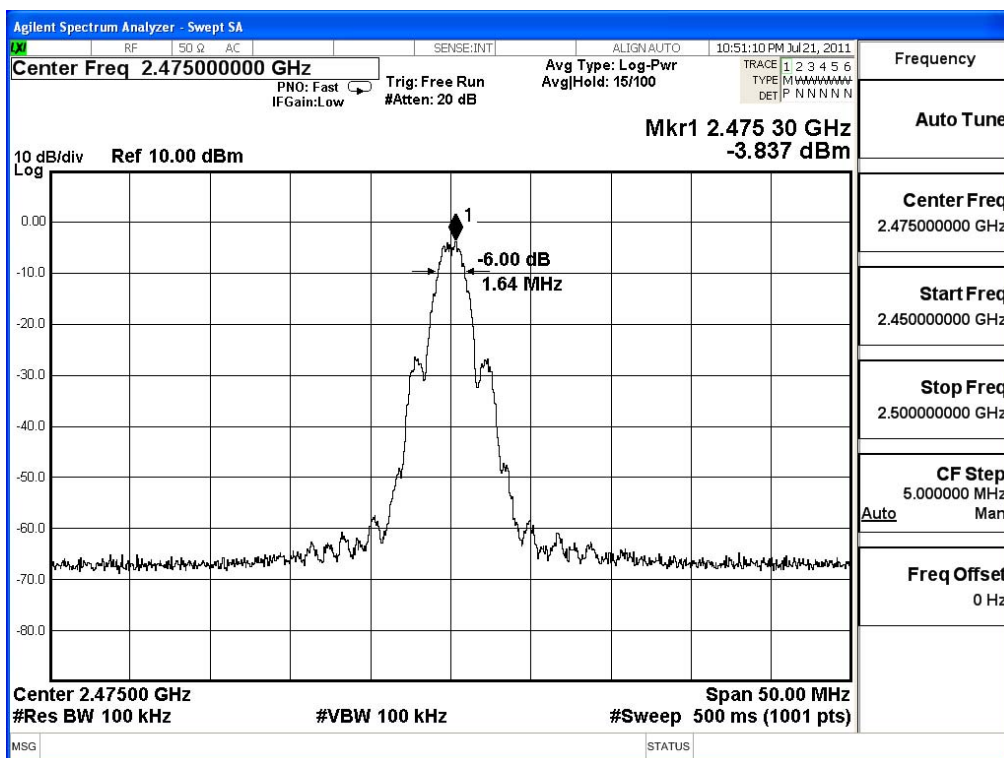
**Figure Channel 08:**



Product : Industrial ZigBee module  
 Test Item : Occupied Bandwidth Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit (2475MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
15	2475.00	1640	>500	Pass

**Figure Channel 15:**



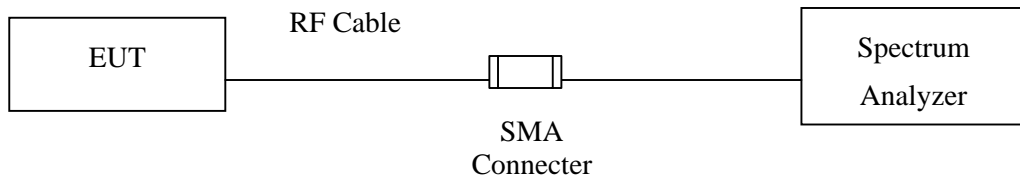
**8. Power Density**

**8.1. Test Equipment**

Equipment	Manufacturer	Model No./Serial No.	Last Cal.
Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2011
Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2011
X Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2011

Note: 1. All equipments are calibrated every one year.  
 2. The test instruments marked by “X” are used to measure the final test results.

**8.2. Test Setup**



**8.3. Limits**

The transmitted power density averaged over any 1 second interval shall not be greater +8dBm in any 3kHz bandwidth.

**8.4. Test Procedure**

The EUT was setup according to ANSI C63.4, 2009; tested according to DTS test procedure of Mar. 2005 KDB558074 for compliance to FCC 47CFR 15.247 requirements.  
 Set RBW= 3 kHz, VBW=10KHz, Sweep time=(SPAN/3KHz), detector=Peak detector

**8.5. Uncertainty**

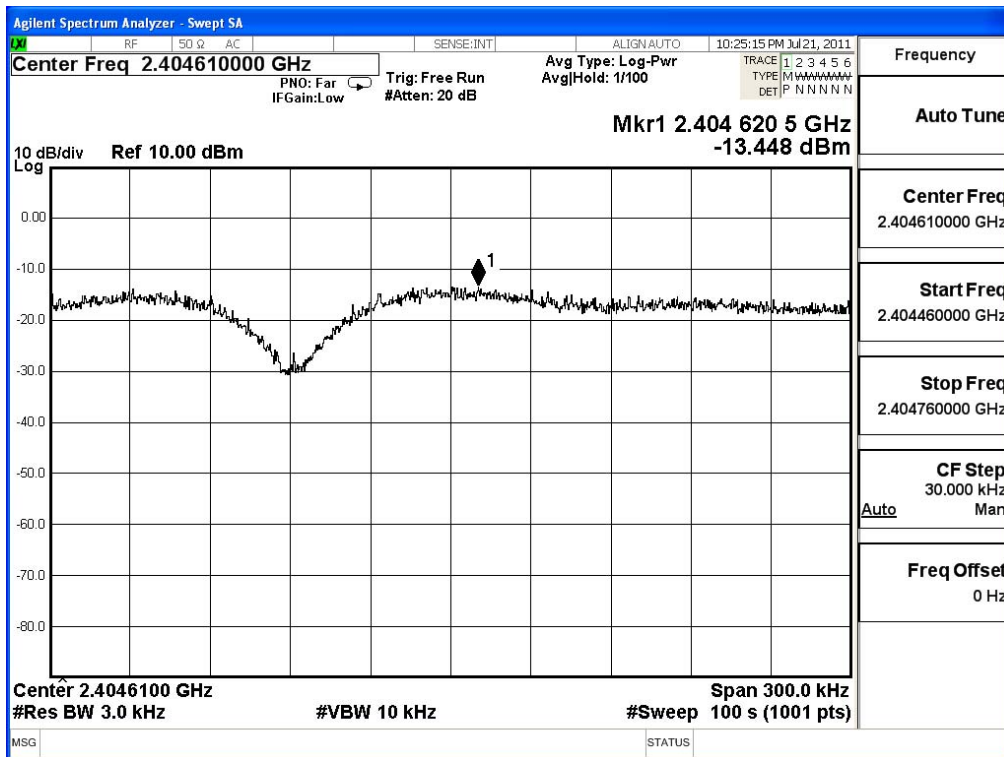
± 1.27 dB

### 8.6. Test Result of Power Density

Product : Industrial ZigBee module  
 Test Item : Power Density Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit(2405MHz)

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
01	2405.00	-13.448	< 8dBm	Pass

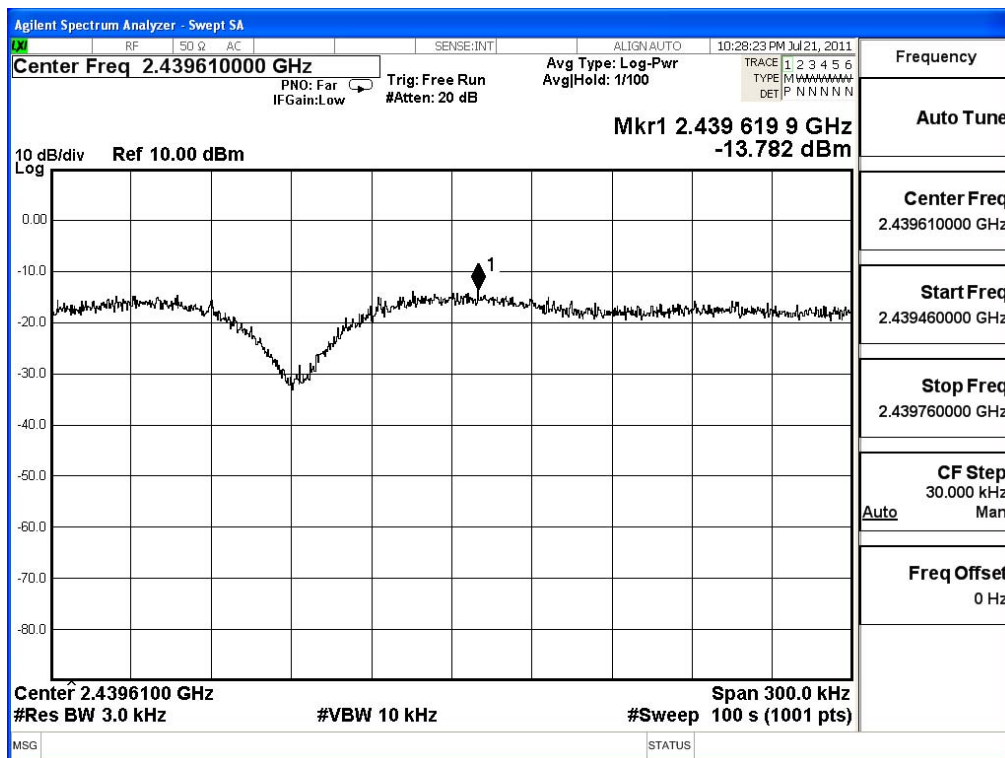
**Figure Channel 01:**



Product : Industrial ZigBee module  
 Test Item : Power Density Data  
 Test Site : No.3OATS  
 Test Mode : Mode 1: Transmit (2440MHz)

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
08	2440.00	-13.782	< 8dBm	Pass

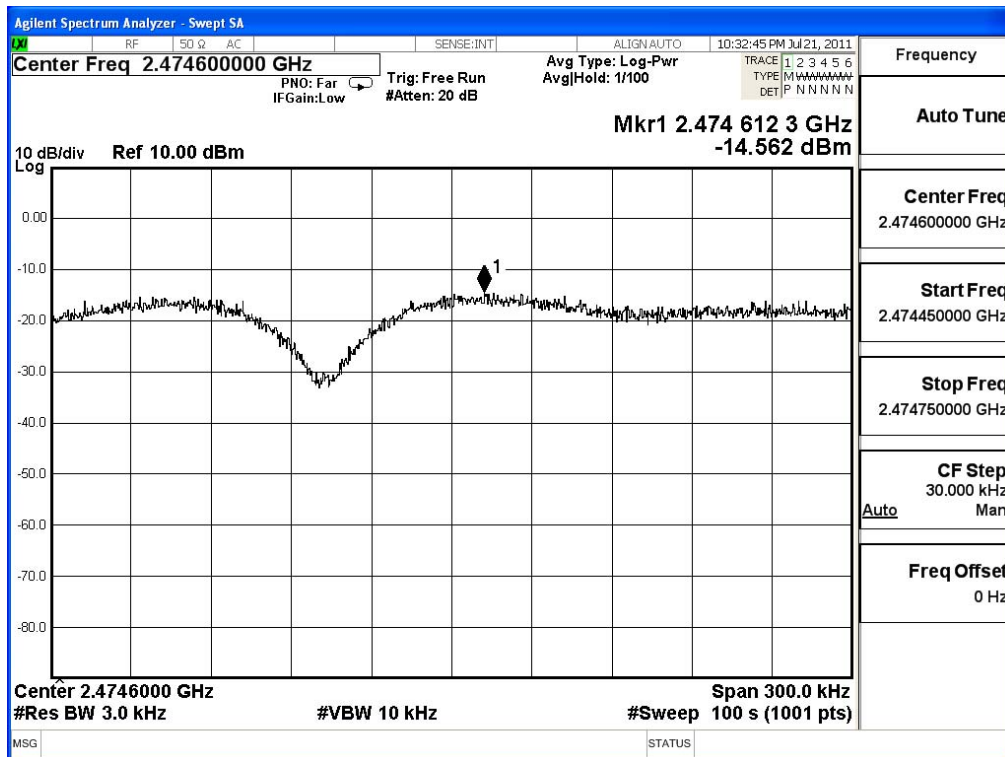
**Figure Channel 08:**



Product : Industrial ZigBee module  
 Test Item : Power Density Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit (2475MHz)

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
15	2475.00	-14.562	< 8dBm	Pass

**Figure Channel 15:**



## 9. EMI Reduction Method During Compliance Testing

No modification was made during testing.

## Attachment 1: EUT Test Photographs



## Attachment 2: EUT Detailed Photographs