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## TEST REPORT

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Report No.: SRTC2010-H024-E0025

Product Name: 2.4GHz Wireless Module

Product Model: SIA2420

Applicant: Shenyang Institute of Automation Chinese  
Academy of Sciences

Manufacture: Shenyang Institute of Automation Chinese  
Academy of Sciences

Specification: 47CFR Part 15 July 10, 2008, Subpart C

FCC ID: YZIWIA-SIA2420

The State Radio\_monitoring\_center Testing Center (SRTC)

No.80 Beilishi Road Xicheng District Beijing, China

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## 1. General information

### 1.1 Notes of the test report

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The test results relate only to individual items of the samples which have been tested.

### 1.2 Information about the testing laboratory

Company: The State Radio\_monitoring\_center Testing Center (SRTC)  
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City: Beijing  
Country or Region: China  
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Email: wangjf@srrc.org.cn / wangjunfeng@srtc.org.cn

### 1.3 Applicant's details

Company: Shenyang Institute of Automation Chinese  
Academy of Sciences  
Address: 114 Nanta Street, Shenhe District, Shenyang, China  
City: Shenyang  
Country or Region: China  
Grantee Code: YZI  
Contacted person: Zhao Xuefeng  
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Fax: 86-024-23970013  
Email: xuefeng@sia.cn

### 1.4 Manufacturer's details

Company: Shenyang Institute of Automation Chinese  
Academy of Sciences  
Address: 114 Nanta Street, Shenhe District, Shenyang, China  
City: Shenyang  
Country or Region: China  
Contacted person: Zhao Xuefeng  
Tel: 86-024-23970700  
Fax: 86-024-23970013  
Email: xuefeng@sia.cn

## 1.5 Application details

Date of receipt of test sample: 27<sup>th</sup> Aug 2010

Date of test: 27<sup>th</sup> Aug 2010 to 30<sup>th</sup> Dec 2010

## 1.6 Reference specification

47CFR Part 15, July 10, 2008, Subpart C

## 1.7 Information of EUT

### 1.7.1 General information

Name of EUT	2.4GHz Wireless Module
FCC ID	YZIWIA-SIA2420
Frequency range	2.4000GHz~2.4835GHz
Number of channel	16
Modulation type	O-QPSK
Duplex mode	TDD
Channel spacing	5MHz
Data rate	250kbps
Antenna type	External
Power Supply	DC power
Rated Power Supply Voltage	3.3V

### 1.7.2 EUT details

Name	Model	Serial Number
2.4GHz Wireless Module	SIA2420	0X2400000100000007


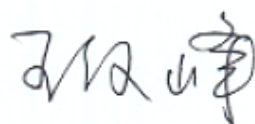
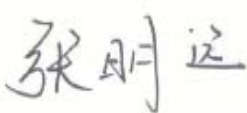
### 1.7.3 Auxiliary equipment details

N/A

## 2. Test information:

### 2.1 Summary of the test results

No.	Test case	FCC reference	Verdict
1	Occupied Bandwidth	15.247(a) (1)	Pass
2	Peak Power Output	15.247(a) (1)	Pass
3	Transmitter Power Spectral Density	15.247 (e)	Pass
3	Spurious RF Conducted Emissions	15.247(d)	Pass
4	Spurious Radiated Emissions	15.247(d),15.35(b), 15.209	Pass
5	Band Edge Compliance	15.247(d)	Pass

<b>This Test Report Is Issued By:</b> <b>Mr. Song Qizhu, Director of the test lab</b> 	<b>Checked By:</b> <b>Mr. Wang Junfeng, Deputy director of the test lab</b> 
<b>Tested By:</b> <b>Mr. Zhang Mingyuan, Test engineer</b> 	<b>Issued date:</b>  <b>2010.12.30</b>

## 2.2 Test result

### 2.2.1 Occupied Bandwidth-§15.247(a) (2)

#### 2.2.1.1 Ambient condition

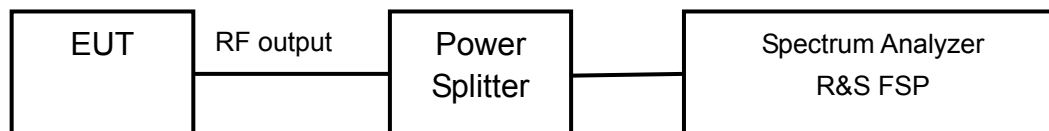
Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

#### 2.2.1.2 Test Description

The Equipment Under Test (EUT) was setup in a shielded room to perform the occupied bandwidth measurements.

The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.

The results recorded were measured with the modulation which produces the worst-case (widest) occupied bandwidth.



#### 2.2.1.3 Test limit

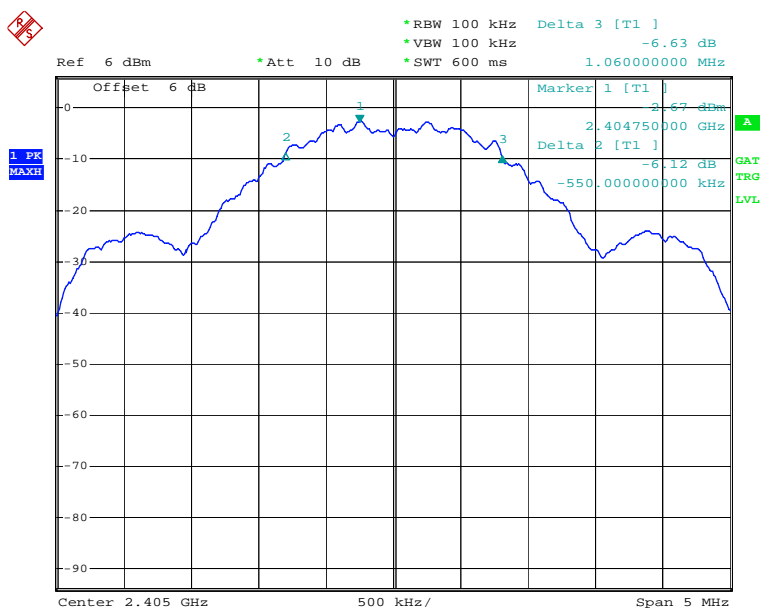
FCC Part 15, Subpart C, §15.247 (a) (2)

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500kHz.

## 2.2.1.4 Test result

Modulation type: O-QPSK

Carrier frequency (MHz)	Channel No.	6 dB bandwidth(KHz)
2405	1	1610
2440	8	1610
2475	15	1610



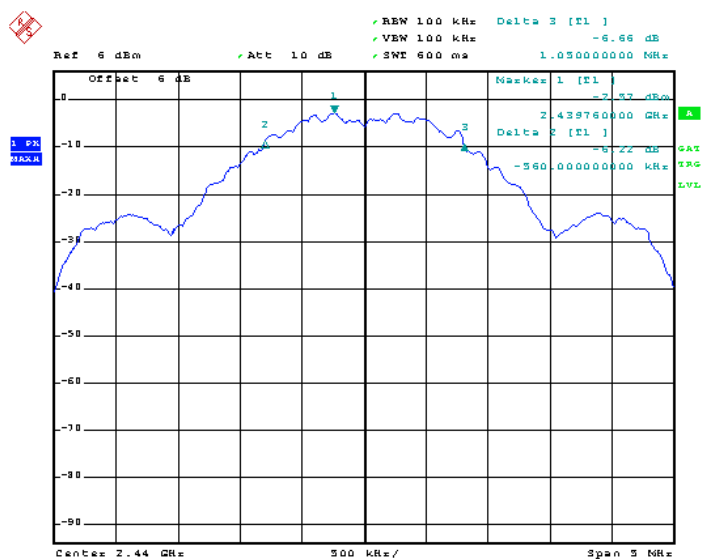
Date: 29.DEC.2010 15:12:48

Carrier frequency (MHz): 2405

Channel No.:1

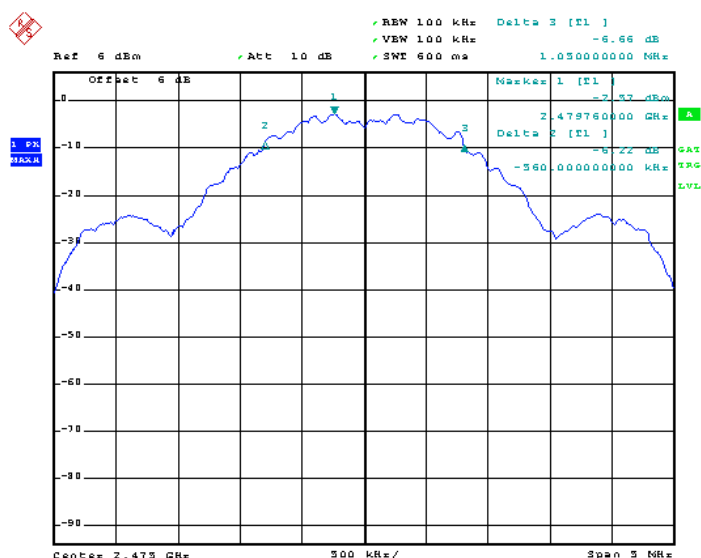
Modulation type: O-QPSK





Date: 29.DEC.2010 15:14:38

Carrier frequency (MHz): 2440  
Channel No.:8  
Modulation type: O-QPSK



Date: 29.DEC.2010 15:15:05

Carrier frequency (MHz): 2475  
Channel No.:15  
Modulation type: O-QPSK

## 2.2.2 Peak power output-§15.247(a) (1)

### 2.2.2.1 Ambient condition:

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

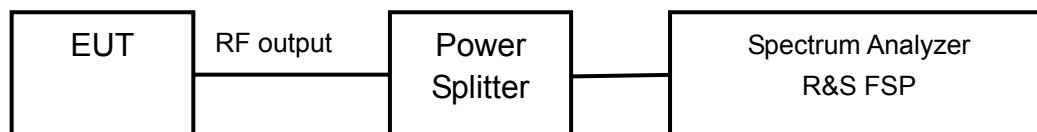
### 2.2.2.2 Test Description

The Equipment Under Test (EUT) was set up in a shielded room to perform the output power measurements.

The results recorded were measured with the modulation which produces the worst-case (highest) output power.

The resolution bandwidth for measuring the output power was 1 MHz.

The reference level of the spectrum analyzer was set higher than the output power of the EUT.



### 2.2.2.3 Test limit

Used conversion factor: Limit (dBm) = 10 log (Limit (W)/1mW)

==> Maximum Output Power: 30 dBm

#### 2.2.2.4 Test result:

Offset=antenna gain+ the insertion loss of the power splitter+ cable loss  
=0.00+10.00+2.00=12.00dB

Modulation type: O-QPSK

Note:

The EIRP measurement was performed using the peak conducted power measurement in conjunction with the maximum declared antenna gain (6dBi).

Carrier frequency (MHz)	Channel No	Output Power (dBm)
2405	1	19.05
2440	8	19.27
2475	15	19.46

## 2.2.3 Transmitter Power Spectral Density- §15.247 (e)

### 2.2.3.1 Ambient condition:

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

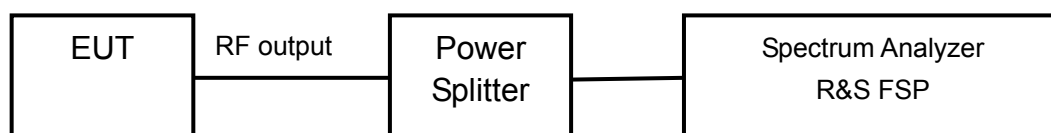
### 2.2.3.2 Test Description

The Equipment Under Test (EUT) was set up in a shielded room to perform the Power Spectral Density measurements.

The resolution bandwidth for measuring the output power was 3kHz.

The trace set to max hold

The span is set to 2MHz



### 2.2.3.3 Test limit

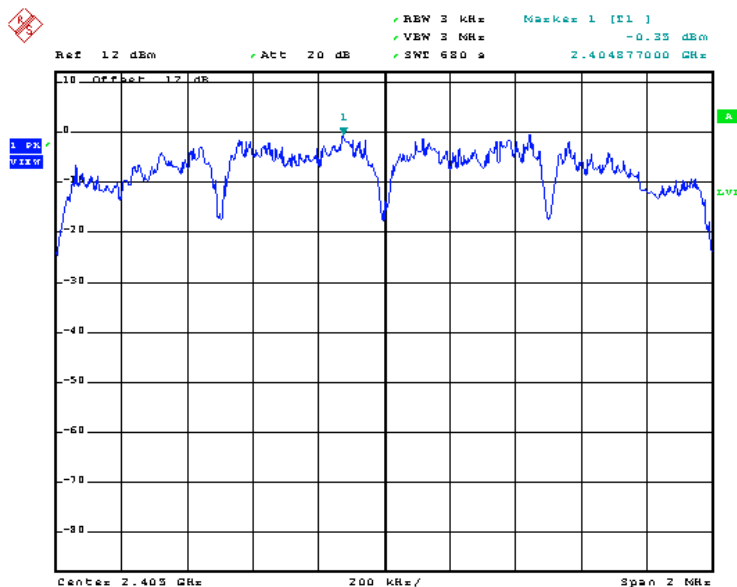
FCC Part 15, Subpart C, §15.247 (e)

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. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

### 2.2.3.4 Test result:

Modulation type: O-QPSK

Carrier frequency (MHz)	Channel No	Power Density
2405	1	-0.35
2440	8	-0.25
2475	15	-0.68

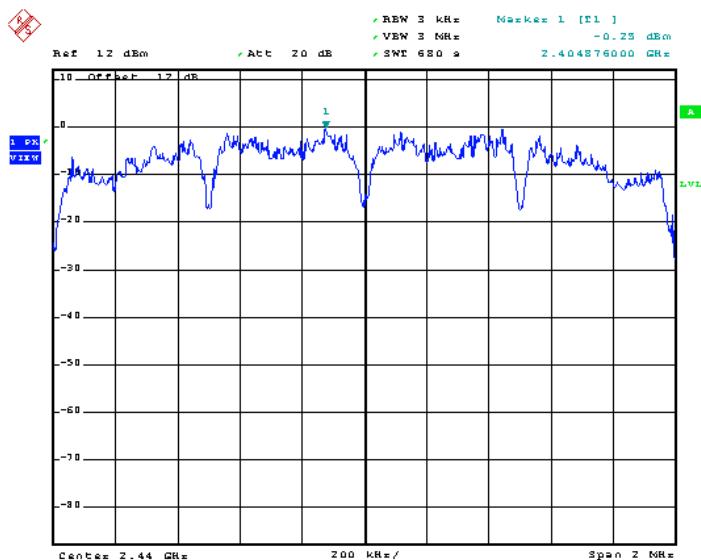


Date: 30.DEC.2010 12:26:39

Carrier frequency (MHz): 2405

Channel No.1

Modulation type: O-QPSK

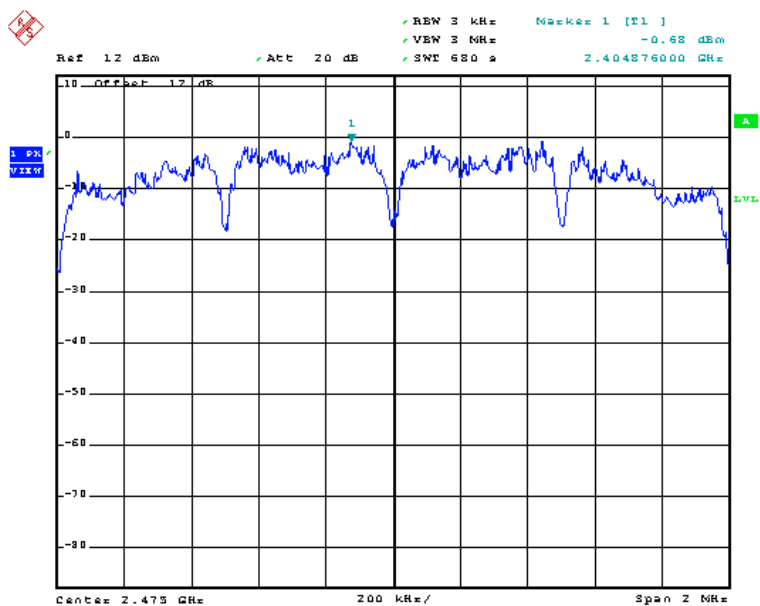


Date: 30.DEC.2010 13:12:28

Carrier frequency (MHz): 2440

Channel No.8

Modulation type: O-QPSK



Date: 30.DEC.2010 14:17:55

Carrier frequency (MHz): 2475  
Channel No.15  
Modulation type: O-QPSK

## 2.2.4 Spurious RF conducted emissions-§15.247(d)

### 2.2.4.1 Ambient condition:

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

### 2.2.4.2 Test Description

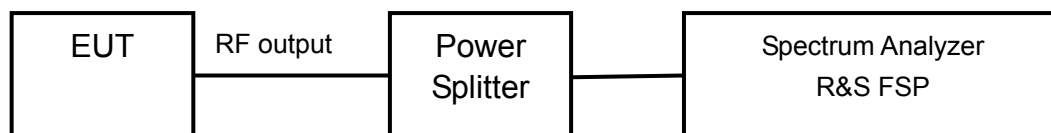
The Equipment Under Test (EUT) was set up in a shielded room to perform the spurious emissions measurements.

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.

Analyzer settings:

- Detector: Peak-Maxhold
- Frequency range: 30 ~25000 MHz
- Resolution Bandwidth (RBW): 100 kHz
- Video Bandwidth (VBW): 300 kHz

The reference value for the measurement of the spurious RF conducted emissions is determined during the test “band edge compliance” (cf. chapter 4.5). This value is used to calculate the 20 dBc limit.



### 2.2.4.3 Test limit

FCC Part 15, Subpart C, §15.247 (d)

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.

#### 2.2.4.4 Test result

Carrier frequency (MHz): 2405

Channel No.:1

Modulation type: O-QPSK

Frequency MHz	Corrected measurement value dBm	Reference value dBm	Limit dBm	Delta to limit dB
---	---	---	---	---
---	---	---	---	---

Carrier frequency (MHz): 2440

Channel No.:8

Modulation type: O-QPSK

Frequency MHz	Corrected measurement value dBm	Reference value dBm	Limit dBm	Delta to limit dB
---	---	---	---	---
---	---	---	---	---

Carrier frequency (MHz): 2475

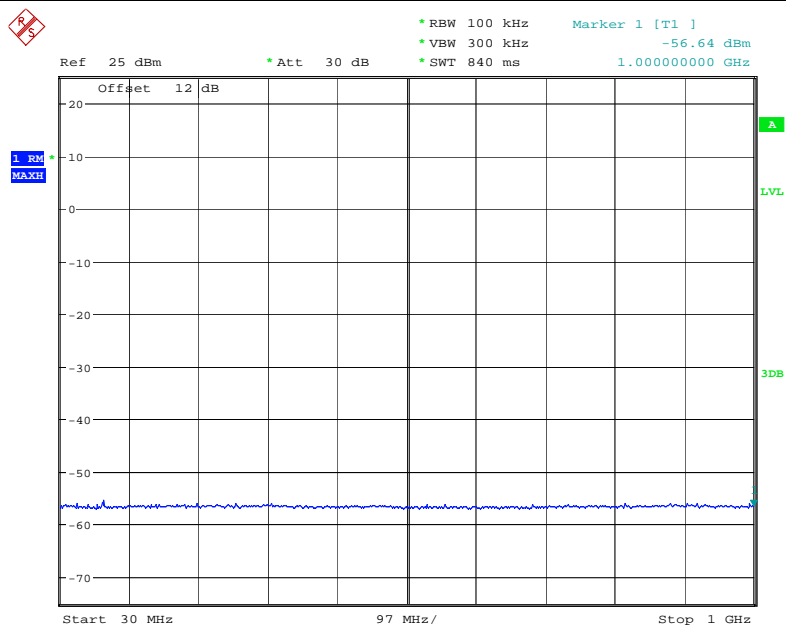
Channel No.:15

Modulation type: O-QPSK

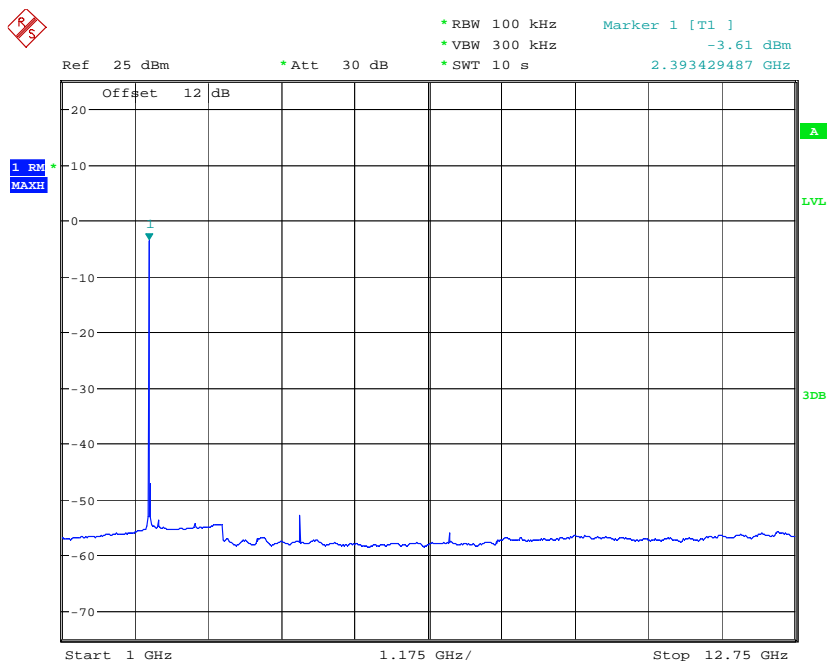
Frequency MHz	Corrected measurement value dBm	Reference value dBm	Limit dBm	Delta to limit dB
---	---	---	---	---
---	---	---	---	---

Note: The Reference value see 2.2.5 Band edge compliance

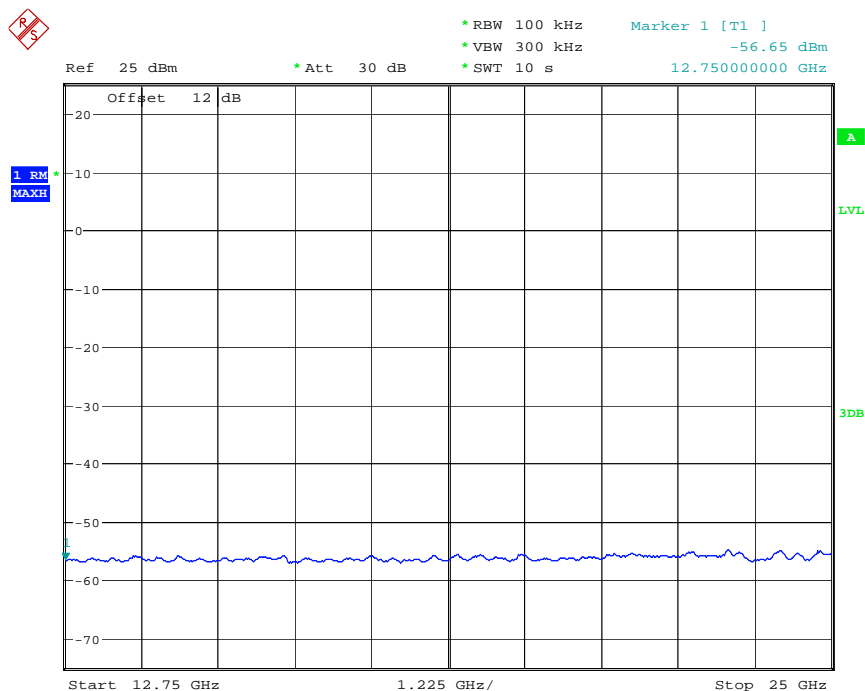




Date: 4.AUG.2010 18:11:11



Date: 4.AUG.2010 18:11:39

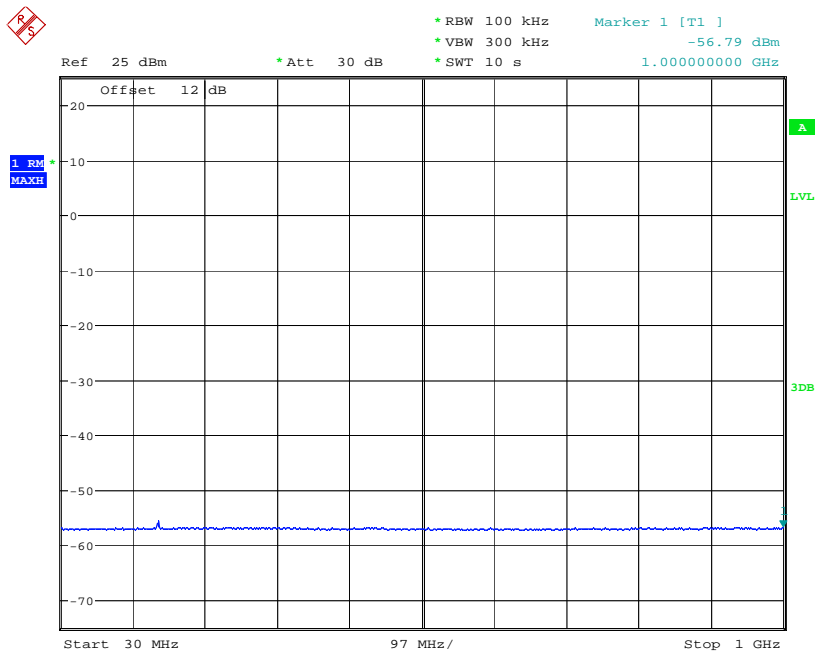


Date: 4.AUG.2010 18:11:58

Carrier frequency (MHz): 2405

Channel No.:1

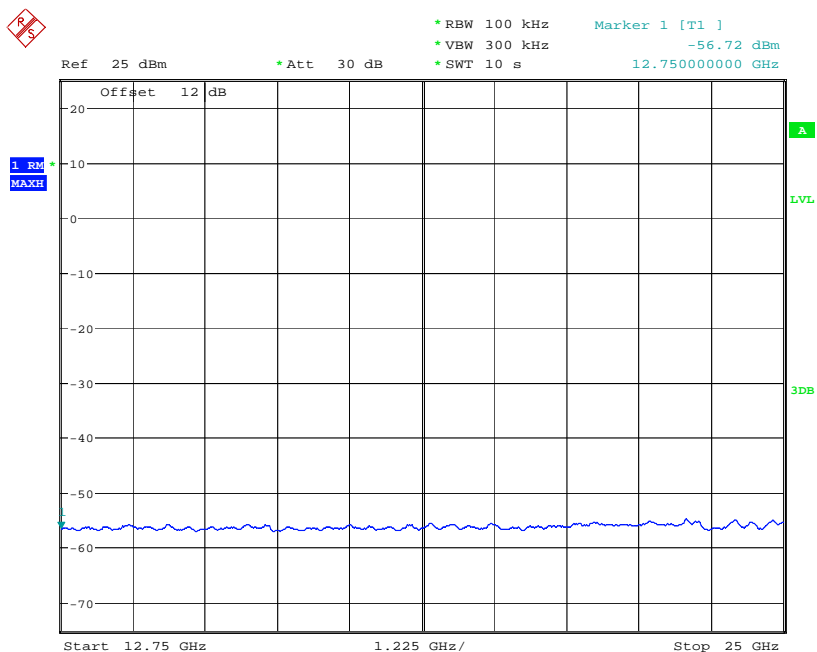
Modulation type: O-QPSK



Date: 4.AUG.2010 18:12:35

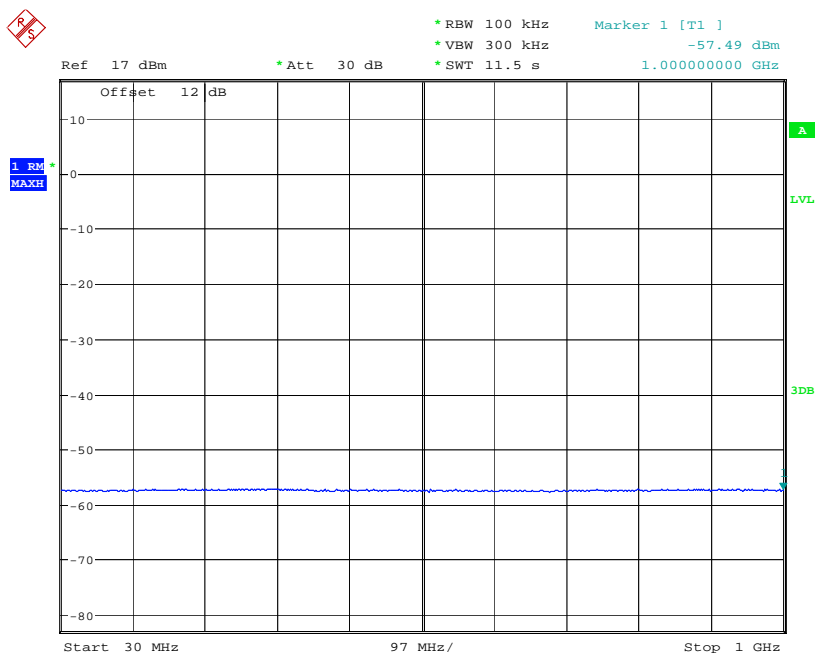


Date: 4.AUG.2010 18:12:57

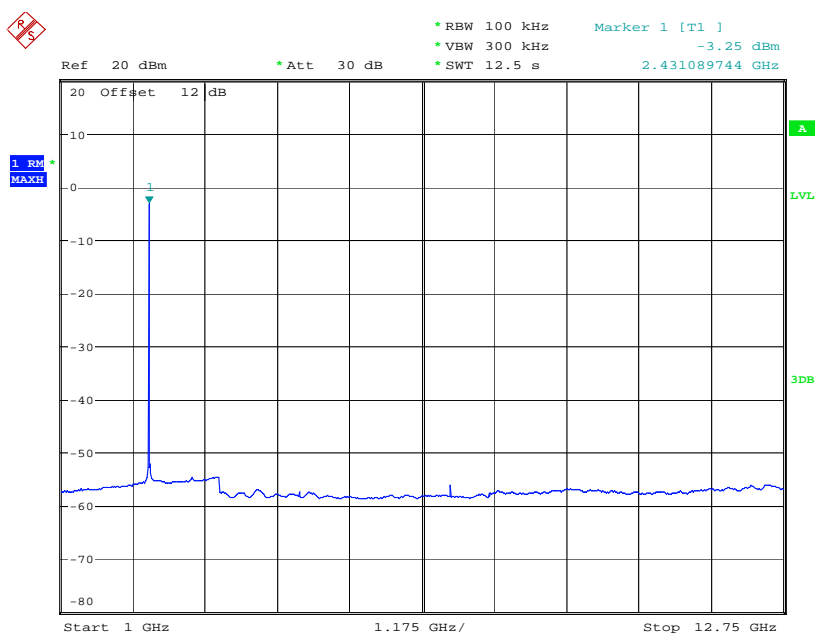


Date: 4.AUG.2010 18:13:24

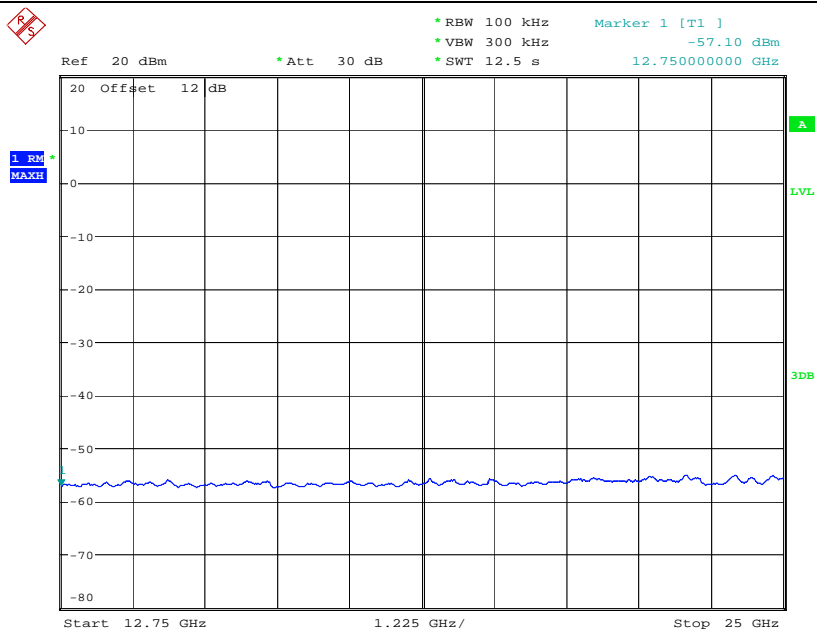
Carrier frequency (MHz): 2440  
Channel No.:8  
Modulation type: O-QPSK



Date: 26.AUG.2010 10:53:13



Date: 26.AUG.2010 10:54:04



Date: 26.AUG.2010 10:54:30

Carrier frequency (MHz): 2475  
Channel No.:15  
Modulation type: O-QPSK

## 2.2.5 Spurious radiated emissions-§15.247(d),§15.35(b),§15.209

### 2.2.5.1 Ambient condition

Temperature	Relative humidity	Pressure
20°C	35%	101.4kPa

### 2.2.5.2 Test Description

The test set-up was made in accordance to the general provisions of ANSI C 63.4-2003.

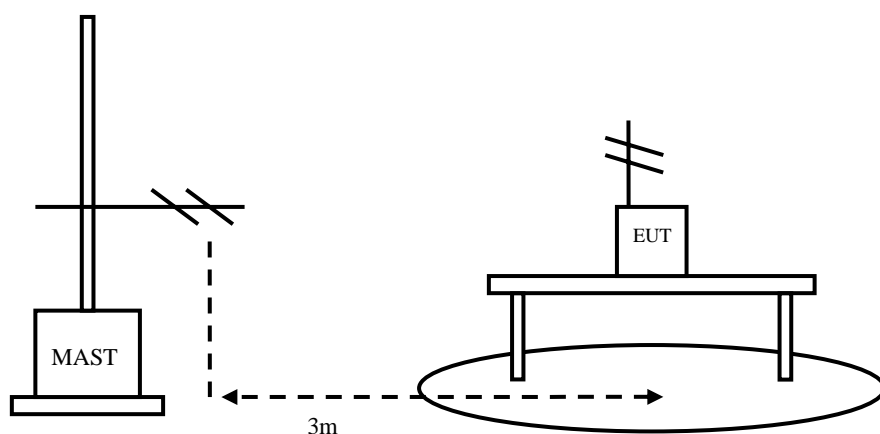
The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna.

The radiated emissions measurements were made in a typical installation configuration.

Then start the test software ES-K1. Sweep the whole frequency band through the range from 30MHz to 1GHz or above, using receive log period antenna HL562 or Ridge horn antenna HF906.

During the test, the height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turn table shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna.

The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing.



### 2.2.5.3 Test limit

FCC Part 15, Subpart C, §15.247 (d)

... 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)).

FCC Part 15, Subpart C, §15.209, Radiated Emission Limits

Frequency Range (MHz)	Class B Limit (dBμV/m)
30 – 88	40.0
88 – 216	43.5
216 – 960	46.0
above 960	54.0

§15.35(b)

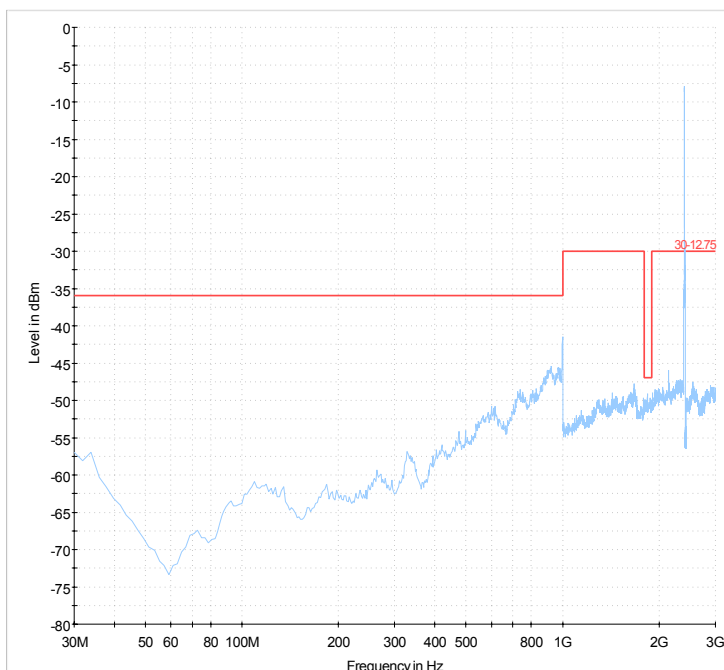
..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

Used conversion factor:  $\text{Limit (dB}\mu\text{V/m)} = 20 \log (\text{Limit } (\mu\text{V/m})/1\mu\text{V/m})$

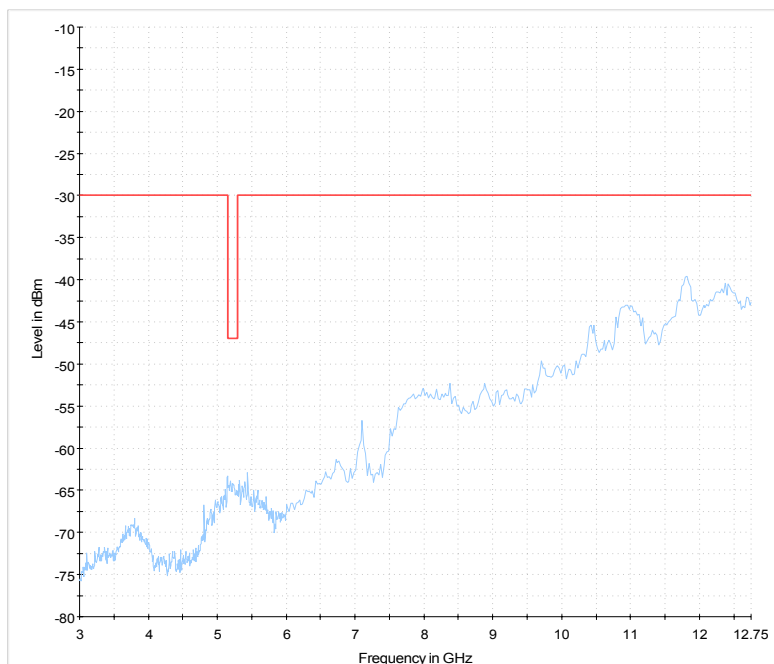
### 2.2.5.4 Test result

Carrier frequency (MHz): 2441

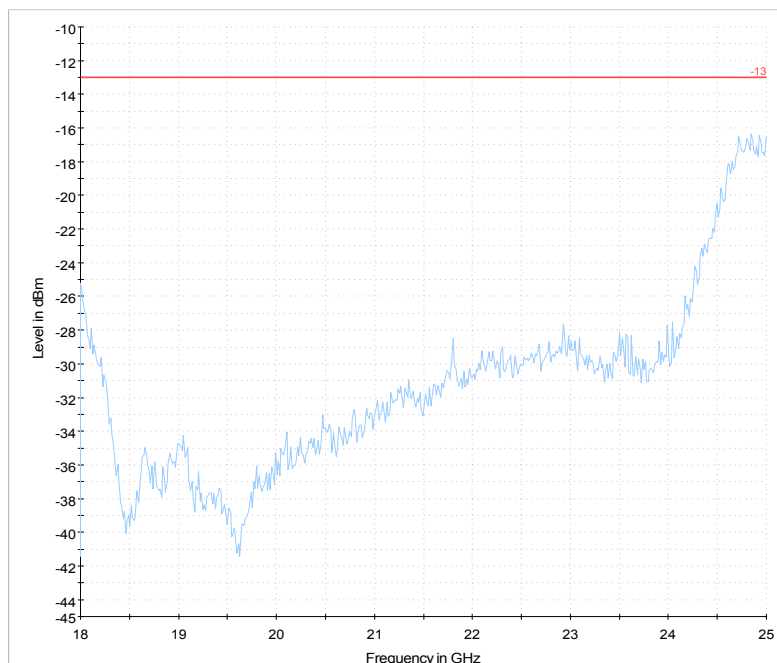
Channel No.:39



Frequency Range: 30MHz -3GHz



Frequency Range: 1GHz -12.75GHz  
Detector: Av mode and PK mode  
Modulation type: O-QPSK



Frequency Range: 18GHz-25GHz  
Detector: Av mode and PK mode  
Modulation type: O-QPSK



## 2.2.6 Band edge compliance-§15.247(d)

### 2.2.6.1 Ambient condition

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

### 2.2.6.2 Test Description

The Equipment Under Test (EUT) was set up in a shielded room to perform the spurious emissions measurements.

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.

For the first measurement the EUT is set to transmit on the lowest channel (2405 MHz). The lower band edge is 2400 MHz.

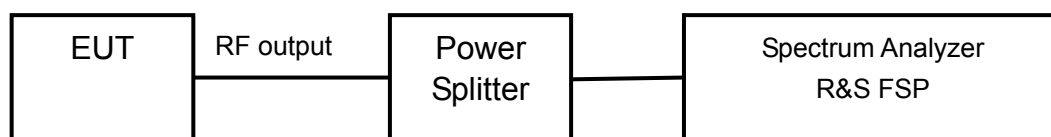
Analyzer settings:

- Detector: Peak
- RBW= 100 kHz
- VBW= 300 kHz

For the second measurement the EUT is set to transmit on the highest channel (2475MHz). The higher band edge is 2483.5 MHz.

Analyzer settings:

- Detector: Peak
- RBW= 100 kHz
- VBW= 300 kHz



### 2.2.6.3 Test limit

FCC Part 15.247 (d)

“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.

#### 2.2.6.4 Test result

Carrier frequency (MHz): 2405

Channel No.:1

Modulation type: O-QPSK

Frequency MHz	Measured value dBm	Reference value dBm	Limit dBm	Delta to limit dB
2400	-50.58	6.96	-13.04	-37.54

Carrier frequency (MHz): 2475

Channel No.:15

Modulation type: O-QPSK

Frequency MHz	Measured value dBm	Reference value dBm	Limit dBm	Delta to limit dB
2483.5	-31.66	9.26	-10.74	20.92

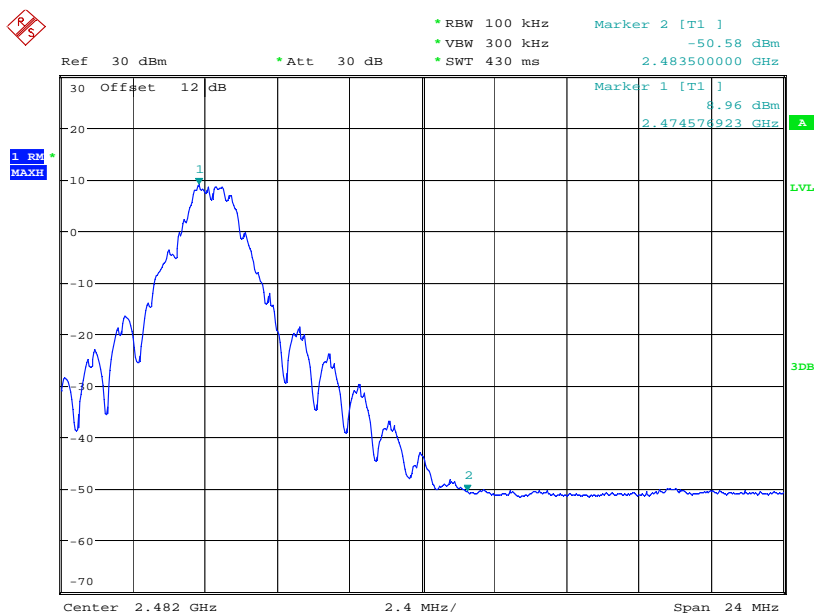


Date: 5.AUG.2010 11:01:52

Carrier frequency (MHz): 2405

Channel No.:1

Modulation type: O-QPSK

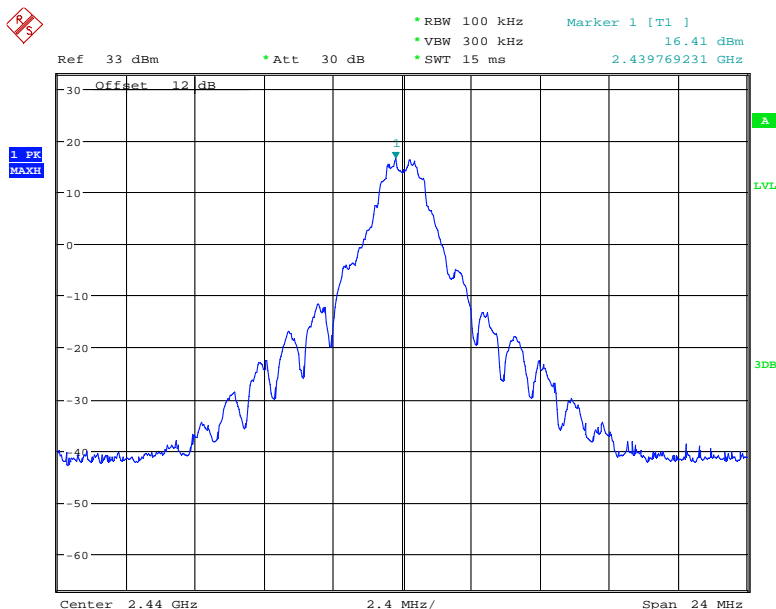


Date: 5.AUG.2010 11:03:40

Carrier frequency (MHz): 2475

Channel No.:15

Modulation type: O-QPSK



Date: 26.AUG.2010 10:56:38

Carrier frequency (MHz): 2440

Channel No.:8

Modulation type: O-QPSK

### 2.3. List of test equipment

No.	Name/Model	Manufacturer	S/N	Calibration Date
1	Bluetooth Test Set Anritsu MT8852B	Anritsu	6K 00005827	Aug. 2010
2	R&S FSP Spectrum Analyzer	R&S	100118	Aug. 2010
3	1506A Power Splitter	Weinschel	MN154	Aug. 2010
4	9.080m×5.255m×3.525m Shielding room	FRANKONIA	-----	Aug. 2010
5	ESI 40 EMI test receiver	R&S	100015	Aug. 2010
6	SMR 20 Signal generator	R&S	100086	Aug. 2010
7	CMU 200 Radio tester	R&S	100313	Aug. 2010
8	12.65m*8.03m*7.50m Fully-Anechoic Chamber	FRANKONIA	-----	Aug. 2010
9	HL562 Ultra log test antenna	R&S	100016	Aug. 2010
10	HF 906 Double-Ridged Waveguide Horn Antenna	R&S	100030	Aug. 2010
11	HF 906 Double-Ridged Waveguide Horn Antenna	R&S	100029	Aug. 2010
12	PS2000 Turn Table	FRANKONIA	-----	Aug. 2010
13	MA260 Antenna Master	FRANKONIA	-----	Aug. 2010
14	ES-K1EMI test software	R&S	-----	-----
15	HL562 Receive antenna	R&S	100167	Aug. 2010