

<b>Prüfbericht - Nr.:</b>		<b>15053322 001</b>	<b>Seite 1 von 54</b>		
<i>Test Report No.:</i>					
<b>Auftraggeber:</b> <i>Client:</i>		<b>Shanghai HuaTuo Satellite Navigation Technology Ltd.</b> Floor 2, Buliding 35, NO 680 guiping road ,shanghai, 200233, China			
<b>Gegenstand der Prüfung:</b> <i>Test Item:</i>		<b>Geodetic GNSS Receiver</b>			
<b>Bezeichnung:</b> <i>Identification:</i>		<b>X900</b>	<b>Serien-Nr.:</b> <i>Serial No.:</i>		
<b>Wareneingangs-Nr.:</b> <i>Receipt No.:</i>		<b>153189567</b>	<b>Eingangsdatum:</b> <i>Date of Receipt:</i>		
<b>Prüfört:</b> <i>Testing Location:</i>		<b>TÜV Rheinland (Shanghai) Co., Ltd.</b> Building 177, No. 777 Guangzhong Road West, Shanghai 200072, P.R. China			
<b>Prüfgrundlage:</b> <i>Test Specification:</i>		<b>FCC 47 CFR Part 15, Subpart C, Section 15.247 (October 1, 2009)</b> ANSI C63.4-2003 Public Notice DA 00-705: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems (March 30, 2000)			
<b>Prüfergebnis:</b> <i>Test Result:</i>		<b>Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n).</b> <i>The test item passed the test specification(s).</i>			
<b>Prüflaboratorium:</b> <i>Testing Laboratory:</i>		<b>TÜV Rheinland (Shanghai) Co., Ltd.</b> 10-15/F, Huatsing Building, No.88, Lane 777, Guangzhong Road West, Shanghai 200072, P.R. China			
<b>geprüft/ tested by:</b>		<b>kontrolliert/ reviewed by:</b>			
2012-07-03	Shi Li / Inspector	2012-07-06	Rene' Charton / Reviewer		
<b>Datum</b> <i>Date</i>	<b>Name/Stellung</b> <i>Name/Position</i>	<b>Unterschrift</b> <i>Signature</i>	<b>Datum</b> <i>Date</i>	<b>Name/Stellung</b> <i>Name/Position</i>	<b>Unterschrift</b> <i>Signature</i>
<b>Sonstiges / Other Aspects:</b>					
<b>Abkürzungen:</b> P(pass) = entspricht Prüfgrundlage F(fail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet			<b>Abbreviations:</b> P(pass) = passed F(fail) = failed N/A = not applicable N/T = not tested		
<b>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</b> <i>This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.</i>					

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## TEST SUMMARY

**3.2.1 VOLTAGE REQUIREMENTS, FCC 15.31(E)**

RESULT: PASS

**3.2.2 ANTENNA REQUIREMENTS, FCC 15.203, FCC 15.204**

RESULT: PASS

**5.1.1 CONDUCTED OUTPUT POWER, FCC 15.247(B)(1)**

RESULT: PASS

**5.1.2 CARRIER FREQUENCY SEPARATION, FCC 15.247(A)(1)**

RESULT: PASS

**5.1.3 20dB BANDWIDTH, FCC 15.247(A)(1)****5.1.4 NUMBER OF HOPPING FREQUENCIES, FCC 15.247(A)(1)(III)**

RESULT: PASS

**5.1.5 AVERAGE TIME OF OCCUPANCY, FCC 15.247(A)(1)(III)**

RESULT: PASS

**5.1.6 CONDUCTED SPURIOUS EMISSION, FCC 15.247(D)**

RESULT: PASS

**5.1.7 BAND EDGE COMPLIANCE OF RF CONDUCTED EMISSION, FCC 15.247(D)**

RESULT: PASS

**6.1.1 BAND EDGE RADIATED EMISSION, FCC 15.205, FCC 15.209, FCC 15.247(D)**

RESULT: Pass

**6.1.2 RADIATED SPURIOUS EMISSION OF TRANSMITTER, FCC 15.205, FCC 15.209, FCC 15.247(D)**

RESULT: PASS

**6.2.1 RADIATED SPURIOUS EMISSION OF BLUETOOTH RECEIVER, FCC 15.109**

RESULT: PASS

**6.2.2 RADIATED SPURIOUS EMISSION OF LAND MOBILE RECEIVER, FCC 15.109**

RESULT: PASS

**6.2.3 RADIATED SPURIOUS EMISSION OF GPS RECEIVER, FCC 15.109**

RESULT: PASS

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## 1. General Remarks

### 1.1 Complementary Materials

All attachments are integral parts of this test report.

## 2. Test Sites

### 2.1 Test Facilities

Lab.1:TÜV Rheinland (Shanghai) Co., Ltd.  
10-15/F, Huatsing Building, No.88, Lane 777, West Guangzhong Road, Zhabei District  
Shanghai 200072, P.R. China

Lab.2: Quietek Technology (Suzhou)Co.,Ltd.  
No.99 Hongye Rd., Suzhou Industrial Park Loufeng Hi-Tech Development  
Zone., Suzhou, China

The used test equipment is in accordance with CISPR 16 for measurement of radio interference.

The Federal Communications Commission has reviewed the technical characteristics of the radiated and conducted emission facility, and has found these test facilities to be in compliance with the requirements of section 2.948 of the FCC rules. The description of the test facility is listed under FCC registration number 657274.

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## 2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Lab.1:

Equipment	Model	Serial no.	Cal. due date
Spectrum analyzer	FSP30	100192	21.05.2013

Lab.2:

Equipment	Model	Serial no.	Cal. due date
Spectrum analyzer	Agilent	N9010A	18.04.2013
EMI Test Receiver	R&S	ESCI	18.04.2013
Bilog Antenna	Teseq GmbH	CBL6112D	18.10.2012
Broad-band Horn Antenna	Schwarzbeck	BBHA9120 D	11.06.2013
Preamplifier	Preamplifier	AP-180C	03.05.2013
Coaxial cable	Huber+Suhner	SUCOFLEX 106	02.03.2013
Temperature/Humidity Meter	Zhicheng	ZC1-2	10.01.2013

## 2.3 Measurement Uncertainty

Table 2: Emission Measurement Uncertainty

Measurement Type	Frequency	Uncertainty
Antenna Port Conducted Emission	< 1GHz	±0.39dB
	> 1GHz	±0.68dB
Radiated Emission	30MHz - 1GHz	±5.34dB
	> 1GHz	±5.40dB

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### 3. General Product Information

#### 3.1 Product Function and Intended Use

The EUT (Equipment Under Test) is a Geodetic GNSS Receiver: for the use of field data collection and storage by receiving the GPS Signal from satellites. For the further information, refer to the user's manual.

#### 3.2 System Details

Radio standard:	Bluetooth, GPS Receiver, Land mobile Receiver
Specified output power:	Bluetooth:-3dbm;
Antenna gain:	Bluetooth:2 dBi
Antenna type:	Bluetooth, and GPS Receiver: Internal antenna, Land Mobile Receiver: External antenna,
Frequency range:	2402 – 2480MHz for Bluetooth, 450~470MHz for Land mobile Receiver;
Number of channels:	L1=1575.42Mhz, L2:1227.6Mhz for GPS Receiver;
Channel spacing:	79 for Bluetooth
Modulation type:	1MHz for Bluetooth, 12.5KHZ for FM radio Receiver
Rated voltage:	GFSK, $\pi/4$ -DQPSK or 8DPSK for Bluetooth, FM for Land mobile receiver,
Protection class:	Supplied by Li-Ion Battery that can be recharged in external charger, or alternatively by car battery.
Test voltage:	III
Remark:	3.3V for Bluetooth and GPS receiver, a fully charged Li-Ion batteries were used for Land Mobile Receiver
	It also contain a Certified GPRS module with the FCC ID:N7NQ2687. We don't test for this module.

##### 3.2.1 Voltage Requirements, FCC 15.31(e)

RESULT:

PASS

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All the tests were performed using 3.3V for Bluetooth and GPS receiver, Battery voltage(7.4~18VDC) for Land Mobile Receiver. Hence it complies with the power supply requirements.

### 3.2.2 Antenna Requirements, FCC 15.203, FCC 15.204

**RESULT:****PASS**

The EUT has an internal antenna which is not user accessible. Hence it complies with the requirements.

## 3.3 Independent Operation Modes

The EUT was tested on a stand-alone basis (only attached to the test jig) and the test system was configured in a typical fashion (as a customer would normally use it).

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.4:2003. Testing was performed at the lowest operating frequency (2402MHz), at the operating frequency in the middle of the specified frequency band (2441MHz) and at the highest operating frequency (2480MHz) with different modulation types.

The basic operation modes are:

- A. EUT transmits (TX mode), with full power, at lowest channel (2402MHz), a continuous modulated signal streaming with 50% duty cycle.
- B. EUT transmits (TX mode), with full power, at middle channel (2441MHz), a continuous modulated signal streaming with 50% duty cycle.
- C. EUT transmits (TX mode), with full power, at highest channel (2480MHz), a continuous modulated signal streaming with 50% duty cycle.
- D. EUT receives (RX mode), at lowest channel (2441MHz), continuously.
- E. EUT receives (RX mode), at middle channel (2441MHz), continuously.
- F. EUT receives (RX mode), at highest channel (2441MHz), continuously.
- G. EUT transmits on pseudo-random sequence on all channels (hopping mode).
- H. EUT receive at GPS receiver mode;
- I. EUT receive at Land mobile receiver mode(461.05Mhz)

## 3.4 Clock Frequencies

The highest clock frequency generated by the EUT is 12 MHz.

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### 3.5 Noise Suppressing Parts

Refer to schematics and internal photos.

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## 4. Test Set-up and Operation Modes

### 4.1 Test Methodology

The test methodology used is based on the requirements of 47 CFR Part 15, Sections 15.31, 15.33, 15.35, 15.205, 15.207, 15.209 and Public Notice DA 00-705.

The test methods, which have been used, are based on ANSI C63.4-2003 .

For details, see under each test item.

### 4.2 Physical Configuration for Testing

The EUT was designed to get into related working mode with the control of a laptop computer through RS232 interface.

Notes:

Two test samples were available. One for antenna port conducted measurements and the other one for radiated measurements.

For antenna conducted measurements, the antenna was replaced by a 50Ω antenna connector.

For more details, refer to section: Photographs of the Test Set-Up.

### 4.3 Test Operation and Test Software

Software used for testing: CSR Tool for 2.4 Version supplied by Client.

This software was running on the laptop computer connected to the EUT by RS232. It was used to enable the test operation modes listed in section 3.3 as appropriate.

### 4.4 Special Accessories and Auxiliary Equipment

NA

### 4.5 Countermeasures to achieve EMC Compliance

No additional measures were employed to achieve compliance.

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## 5. Test Results of Conducted Measurements at Antenna Port

### 5.1 Transmitter Parameters

#### 5.1.1 Conducted Output Power, FCC 15.247(b)(1)

RESULT:

PASS

Date of testing: 2012-04-23

Ambient temperature: 20°C

Relative humidity: 39.6%

Atmospheric pressure: 101.5hPa

Requirements:

For frequency hopping systems operating in the 2400-2483.5MHz band employing at least 75 non-overlapping hopping channels, the maximum peak output power shall be 1W (30dBm). For other hopping systems operating in the 2400-2483.5MHz band, the maximum peak output power shall be 0.125W (21dBm).

Test procedure:

ANSI C63.4-2003 and Public Notice DA 00-705.

The maximum peak output power (conducted) was measured at the antenna connector with a spectrum analyzer. The analyzer resolution bandwidth was set to 3MHz and the video bandwidth to 10MHz. The final measurement takes into account the loss generated by all the involved cables.

Table 3: Conducted Output Power, Mode A (2402MHz)

Data Rate [Mbps]	Reading [dBm]	Correction Factor [dB]	RBW [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
1	-3.75	0.63	3	-3.75	21	24.75
2	-5.82	0.63	3	-5.82	21	26.82
3	-5.67	0.63	3	-5.67	21	26.67

Notes: Cable loss was included in reading as offset.

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Page 12 of 54**Table 4: Conducted Output Power, Mode B (2441MHz)**

Data Rate [Mbps]	Reading [dBm]	Correction Factor [dB]	RBW [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
1	-3.40	0.63	3	-3.40	21	24.40
2	-5.57	0.63	3	-5.57	21	26.57
3	-5.39	0.63	3	-5.39	21	26.39

Notes: Cable loss was included in reading as offset.

**Table 5: Conducted Output Power, Mode C (2480MHz)**

Data Rate [Mbps]	Reading [dBm]	Correction Factor [dB]	RBW [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
1	-2.57	0.69	3	-2.57	21	23.57
2	-4.80	0.69	3	-4.80	21	25.80
3	-4.65	0.69	3	-4.65	21	25.65

Notes: Cable loss was included in reading as offset.

Remark:

The above results show that the worst case output power is found at the data rate of 1Mbps. Therefore, all the other measurements for the evaluation of the radio properties of the EUT have been performed using this data rate.

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### **5.1.2 Carrier Frequency Separation, FCC 15.247(a)(1)**

#### **RESULT:**

**PASS**

Date of testing: 2012-04-23

Ambient temperature: 20°C

Relative humidity: 39.6%

Atmospheric pressure: 101.5hPa

#### **Requirements:**

Frequency hopping systems operating in the 2400-2483.5MHz band shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater. In case of an output power less than 125mW, the frequency hopping system may have channels separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

#### **Test procedure:**

ANSI C63.4-2003 and Public Notice DA 00-705.

A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth was set to 30kHz and the video bandwidth to 100kHz. The Delta Marker function was used to determine the separation between the peaks of two adjacent channels.

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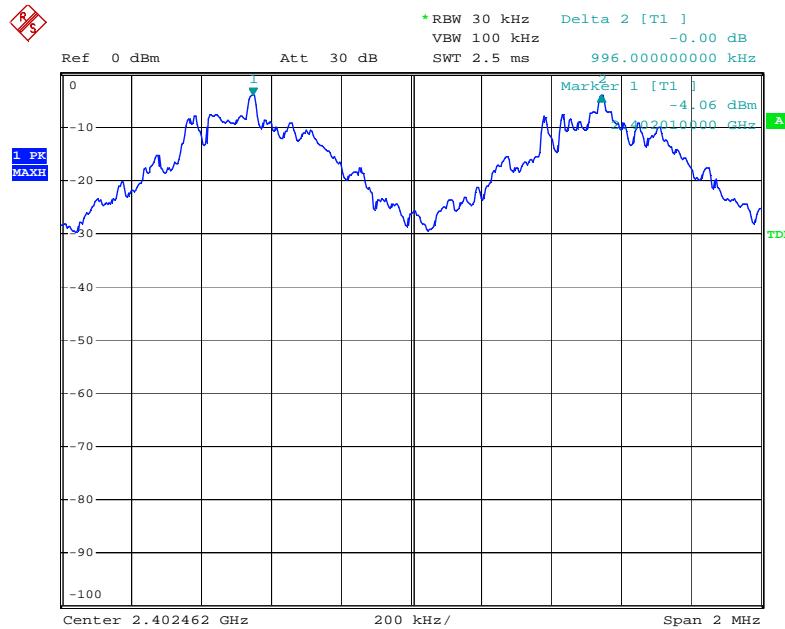
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Table 6: Carrier Frequency Separation

Channel	Channel Separation [kHz]	Limit [kHz]	20dB Bandwidth [kHz](EDR)	20dB Bandwidth [kHz](GFSK)
Low	996	842.7	1264	848
Middle	996	842.7	1264	848
High	996	842.7	1264	862

Notes: Limit = 20dB bandwidth \* 2/3 since it is greater than 25kHz and the output power is less than 125mW.

Figure 1: Carrier Frequency Separation-Low Channel



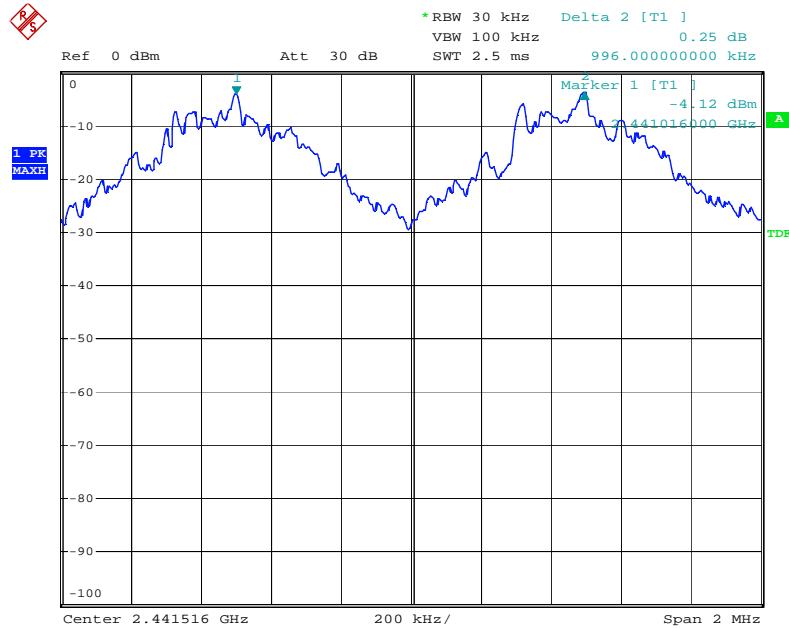
Date: 23.APR.2012 09:31:35

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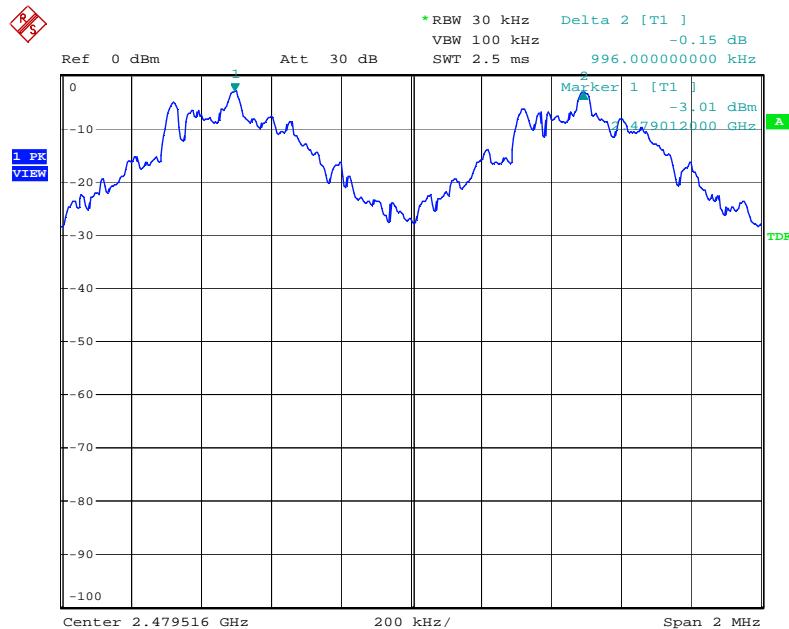
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Figure 2: Carrier Frequency Separation-Middle Channel



Date: 23.APR.2012 09:34:10

Figure 3: Carrier Frequency Separation-High Channel



Date: 23.APR.2012 09:37:14

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### **5.1.3 20dB Bandwidth, FCC 15.247(a)(1)**

Date of testing: 2012-04-23

Ambient temperature: 20°C

Relative humidity: 39.6%

Atmospheric pressure: 101.5hPa

#### Requirements:

For frequency hopping systems operating in the 2400-2483.5MHz band, no bandwidth limit is specified. Test data is provided for reference.

#### Test procedure:

ANSI C63.4-2003 and Public Notice DA 00-705.

A spectrum analyzer was connected to the antenna port of the EUT. The spectrum analyzer resolution bandwidth was set to 30kHz, the video bandwidth to 100kHz and the span to 2MHz.

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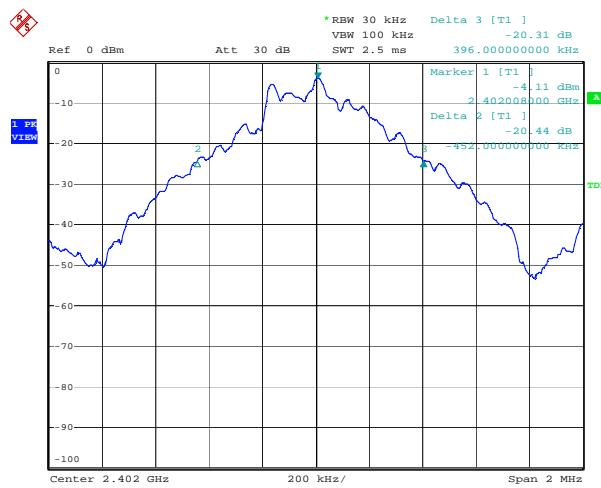
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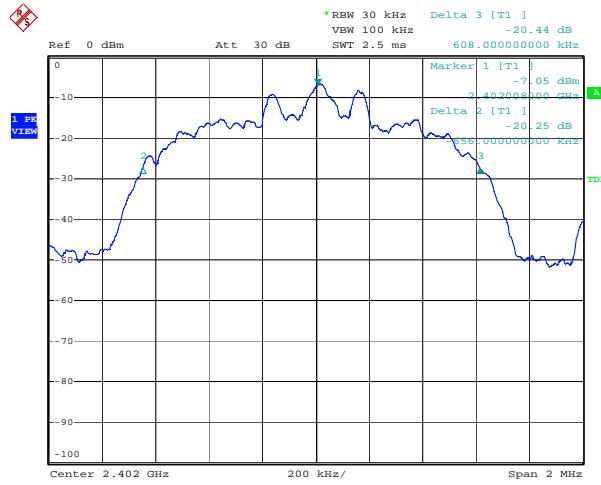
Table 7: 20dB Bandwidth

Operating Frequency [MHz]	20dB Bandwidth [kHz](EDR)	20dB Bandwidth [kHz](GFSK)
2402	1264	848
2441	1264	848
2480	1264	862

Figure 4: 20dB Bandwidth, Mode A (2402MHz)



Date: 23.APR.2012 09:44:21



Date: 23.APR.2012 09:48:31

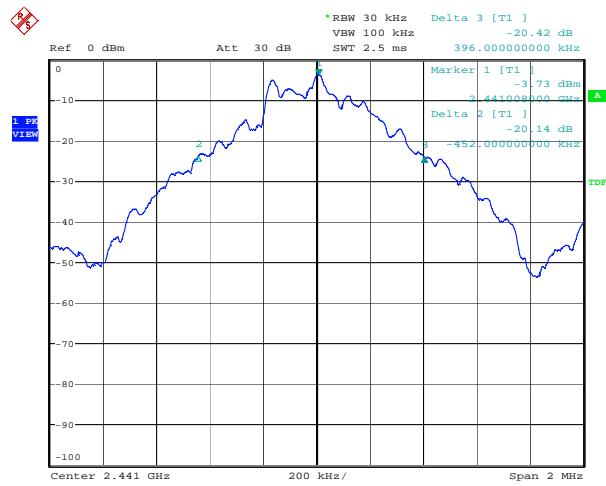
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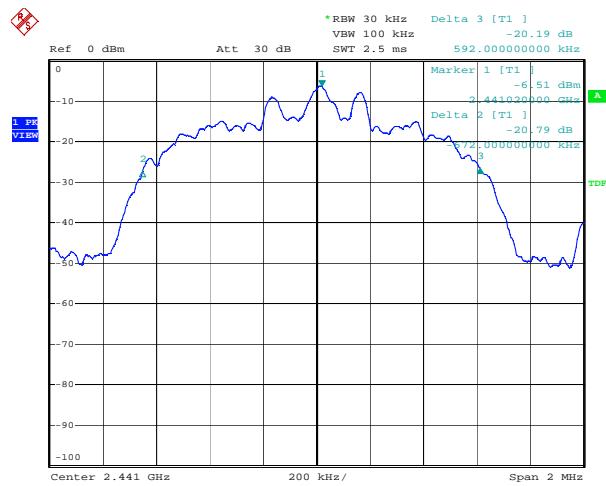
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**Figure 5: 20dB Bandwidth, Mode B (2441MHz)**



Date: 23.APR.2012 09:42:20



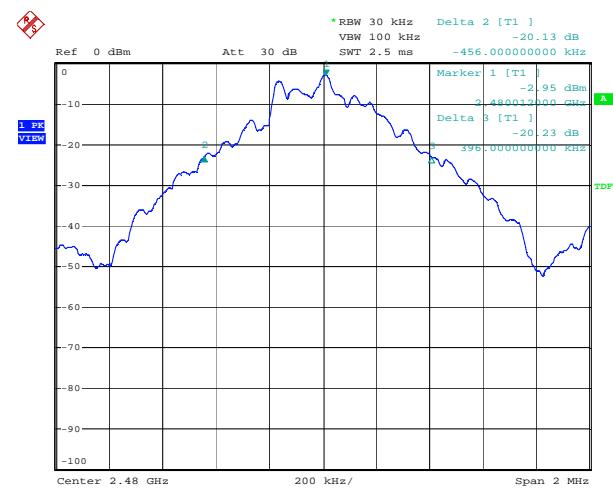
Date: 23.APR.2012 09:49:57

Prüfbericht - Nr.:  
Test Report No.:

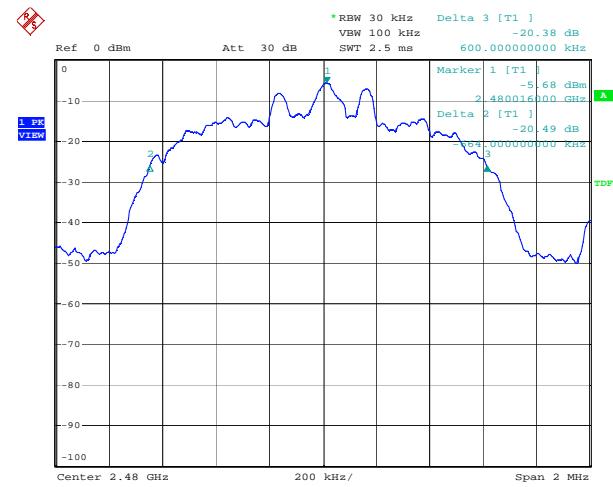
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Figure 6: 20dB Bandwidth, Mode C (2480MHz)



Date: 23.APR.2012 09:46:44



Date: 23.APR.2012 09:51:28

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### 5.1.4 Number of Hopping Frequencies, FCC 15.247(a)(1)(iii)

#### RESULT:

Pass

Date of testing: 2012-04-24

Ambient temperature: 20°C

Relative humidity: 39.6%

Atmospheric pressure: 101.5hPa

#### Requirements:

Frequency hopping systems operating in the 2400-2483.5MHz band shall use at least 15 channels.

#### Test procedure:

ANSI C63.4-2003 and Public Notice DA 00-705.

A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth was set to 300kHz and video bandwidth was set to 1MHz. The spectrum was broken in three plots to show all the hopping frequencies.

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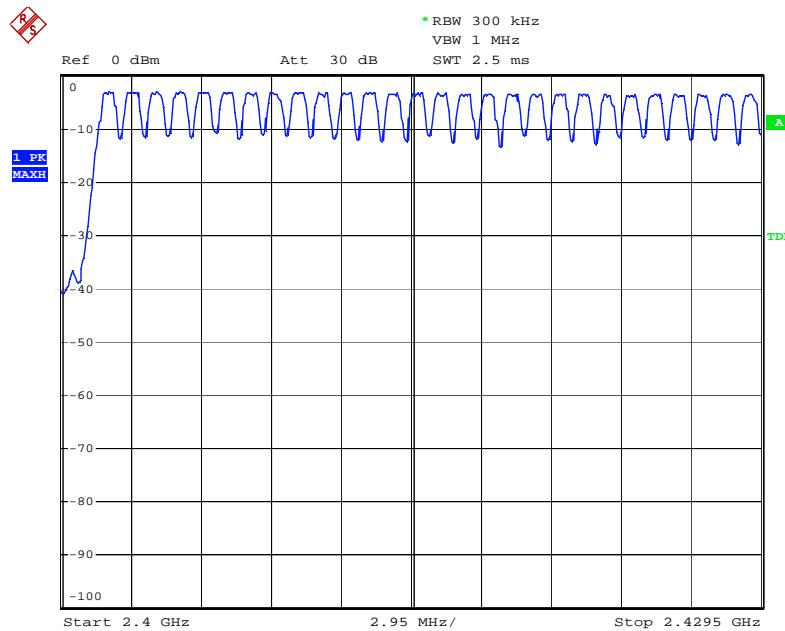
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Table 8: Number of Hopping Frequencies

Number of Hopping Frequencies	Limit
79	15

Figure 7: Hopping Frequencies up to 2429.5MHz, Mode G (Hopping)



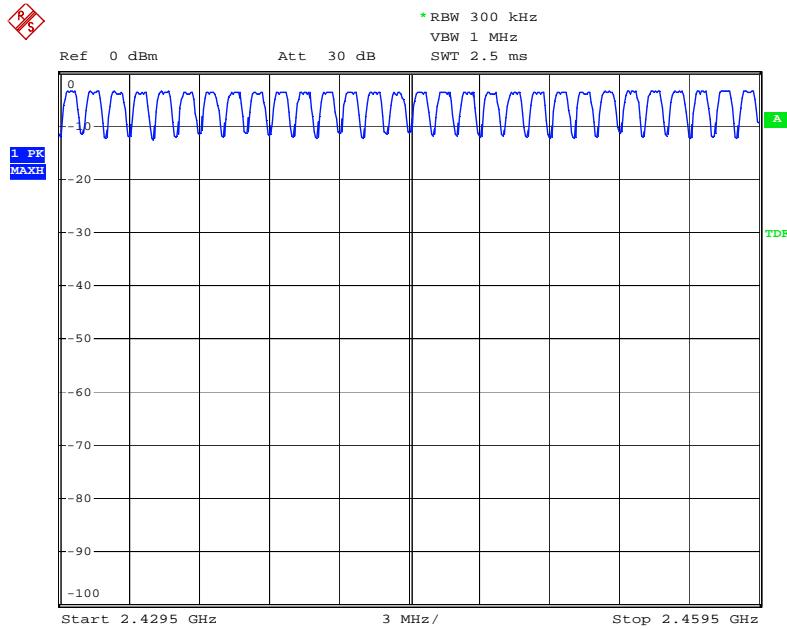
Date: 24.APR.2012 15:38:30

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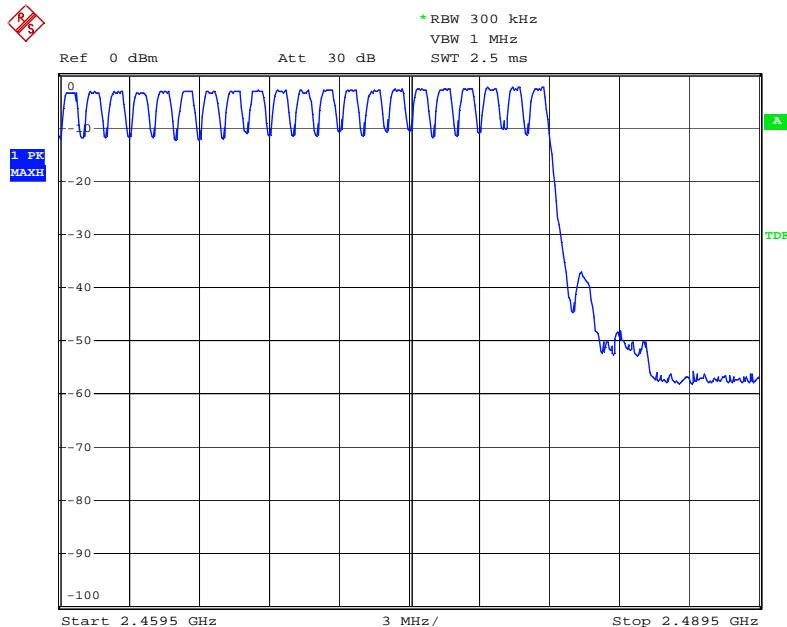
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Figure 8: Hopping Frequencies up to 2459.5MHz, Mode G (Hopping)



Date: 24.APR.2012 15:40:10

Figure 9: Hopping Frequencies up to 2489.5MHz, Mode G (Hopping)



Date: 24.APR.2012 15:41:33

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### 5.1.5 Average Time of Occupancy, FCC 15.247(a)(1)(iii)

#### RESULT:

**PASS**

Date of testing: 2012-4-23

Ambient temperature: 20°C

Relative humidity: 39.6%

Atmospheric pressure: 101.5hPa

#### Requirements:

For frequency hopping systems operating in the 2400-2483.5MHz band, the average time of occupancy on any channel shall not be greater than 0.4s within a period of 0.4s multiplied by the number of hopping channels employed.

#### Test procedure:

ANSI C63.4-2003 and Public Notice DA 00-705.

A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth and video bandwidth were set to 1MHz. The average time of occupancy was obtained by measuring first the dwell time of a single packet with the Delta Marker function using a zero span centered on a hopping channel and by counting then the number of hops per channel in a 31.6s period (0.4s times the number of hopping channels).

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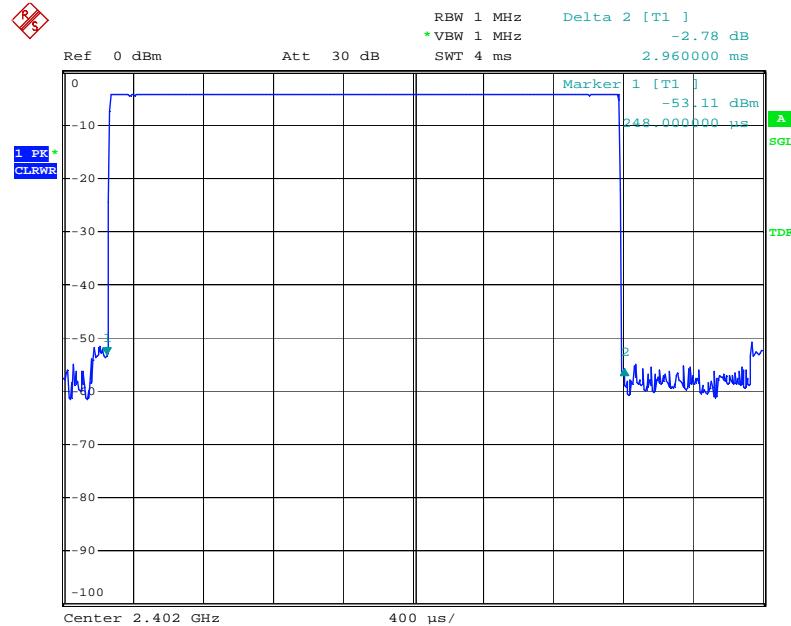
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Table 9: Average Time of Occupancy

Channel	Packet Type	Packet Duration [ms]	Number of Hops per Channel in a 31.6s Period	Average Time of Occupancy [ms]	Limit [ms]
Low	DH5	2.96	106.81	316.16	400
	2-DH5	2.968	106.81	317.01	400
	3-DH5	2.968	106.81	317.01	400
Mid	DH5	2.96	106.81	316.16	400
	2-DH5	2.968	106.81	317.01	400
	3-DH5	2.968	106.81	317.01	400
High	DH5	2.96	106.81	316.16	400
	2-DH5	2.968	106.81	317.01	400
	3-DH5	2.968	106.81	317.01	400

Notes: Average time of occupancy = Packet duration \* Number of hops per channel in a 31.6s period

Figure 10: Dwell Time, Mode G (Hopping), DH5, Low channel



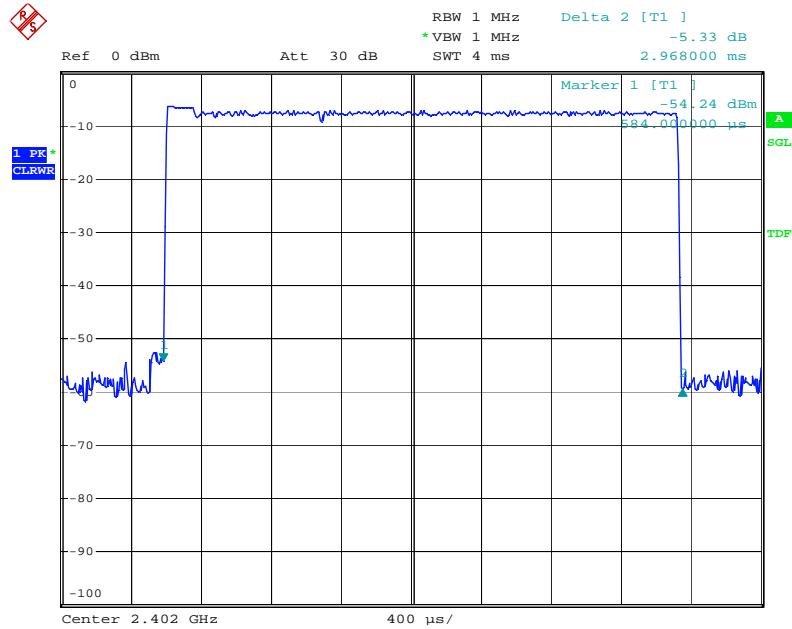
Date: 23.APR.2012 10:32:09

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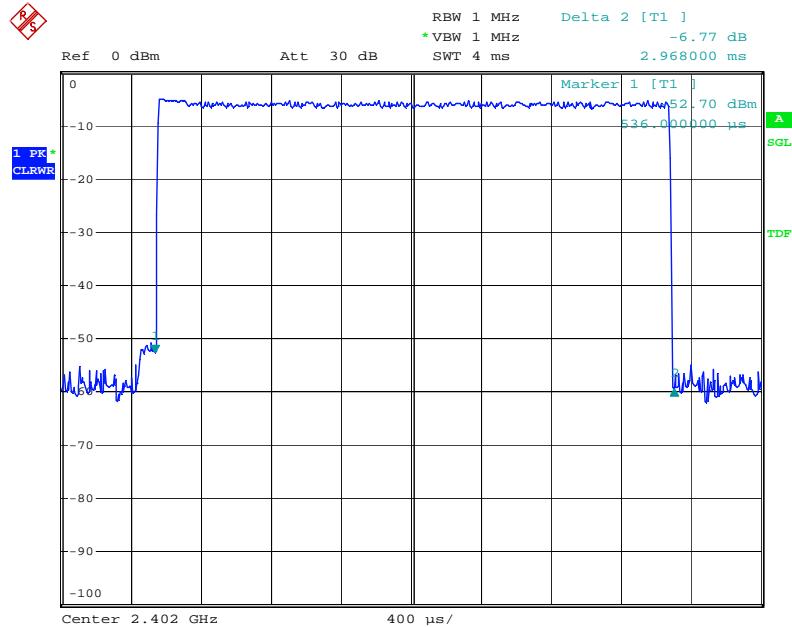
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Figure 11: Dwell Time, Mode G (Hopping), 2-DH5, Low channel



Date: 23.APR.2012 10:47:32

Figure 12: Dwell Time, Mode G (Hopping), 3-DH5, Low channel



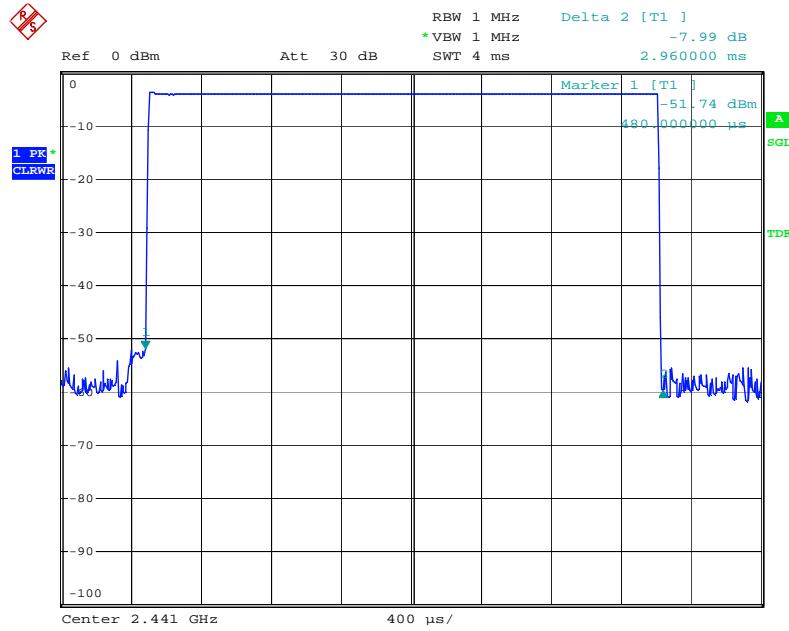
Date: 23.APR.2012 10:35:24

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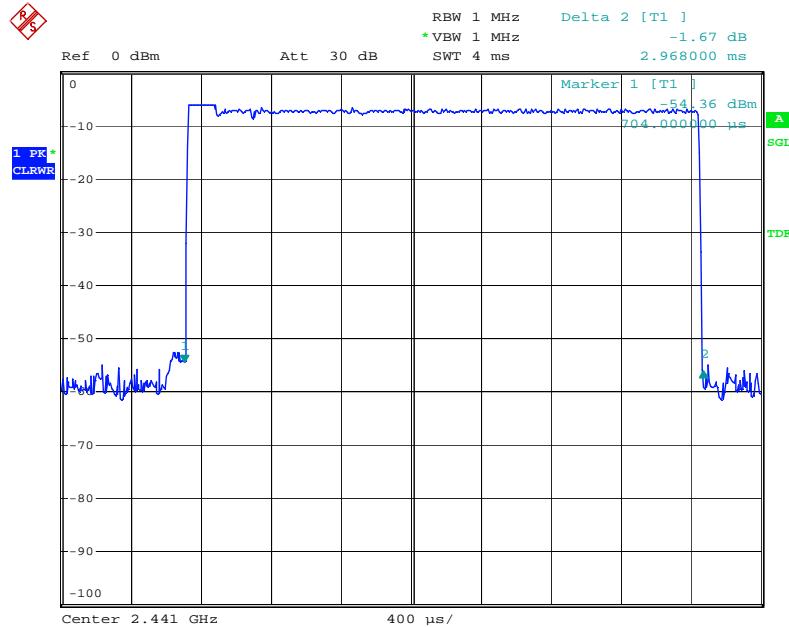
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Figure 13: Dwell Time, Mode G(Hopping), DH5, Mid channel



Date: 23.APR.2012 10:33:09

Figure 14: Dwell Time, Mode G (Hopping), 2-DH5, Mid channel



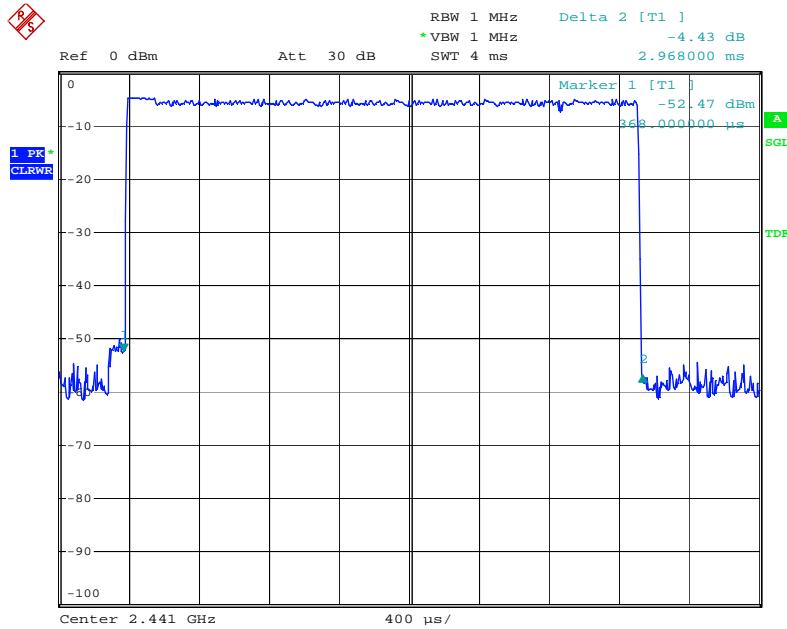
Date: 23.APR.2012 10:28:37

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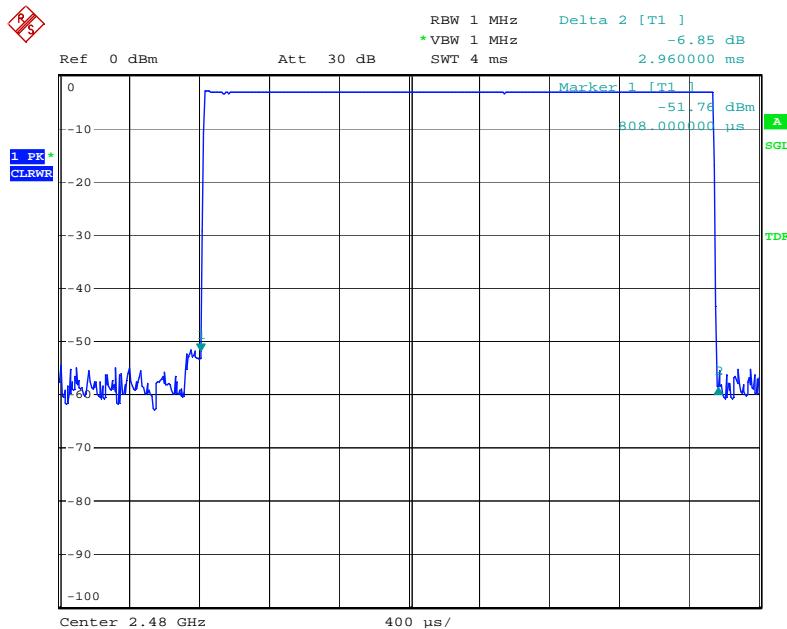
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Figure 15: Dwell Time, Mode G (Hopping), 3-DH5, Mid channel



Date: 23.APR.2012 10:36:34

Figure 16: Dwell Time, Mode G(Hopping), DH5, High channel



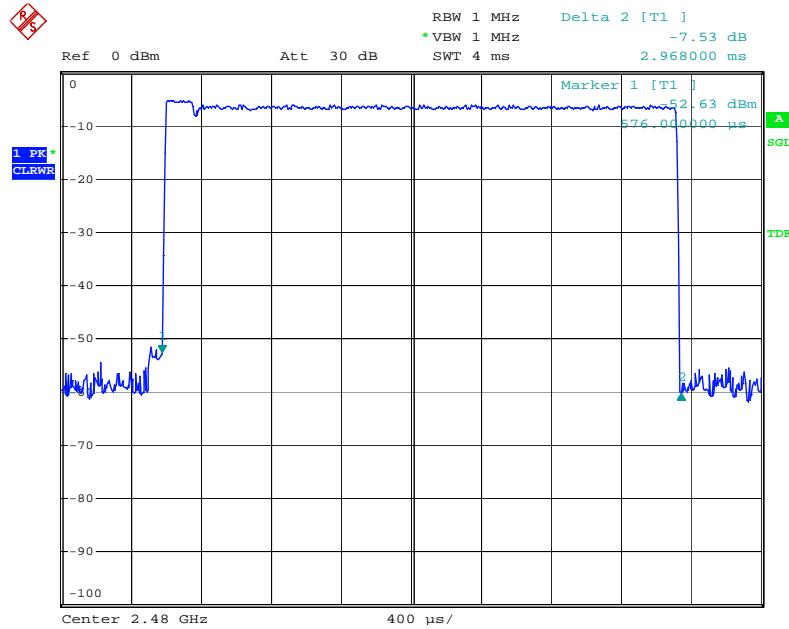
Date: 23.APR.2012 10:34:13

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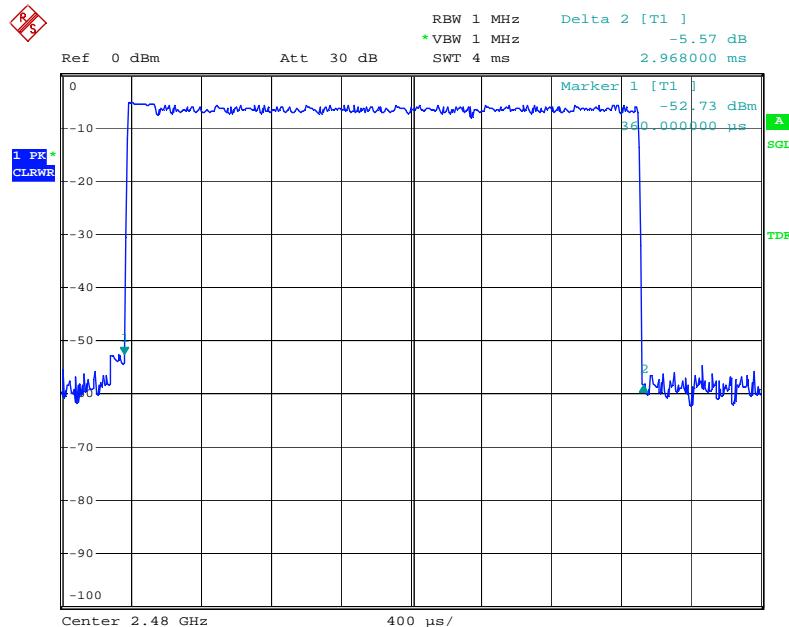
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Figure 17: Dwell Time, Mode G (Hopping), 2-DH5, High channel



Date: 23.APR.2012 10:30:14

Figure 18: Dwell Time, Mode G (Hopping), 3- DH5, High channel



Date: 23.APR.2012 10:37:35

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### 5.1.6 Conducted Spurious Emission, FCC 15.247(d)

#### RESULT:

**PASS**

Date of testing: 2012-04-23

Ambient temperature: 20°C

Relative humidity: 39.6%

Atmospheric pressure: 101.5hPa

#### Requirements:

In any 100kHz bandwidth outside the frequency band, the RF power shall be at least 20dB below that of the maximum in-band 100kHz emission.

#### Test procedure:

ANSI C63.4-2003 and Public Notice DA 00-705.

A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth was set to 100kHz. For each channel investigated, the in-band and out-of-band emission measurements were performed. The out-of-band emissions were measured from 30MHz to 25GHz (10<sup>th</sup> harmonics).

The final measurement takes into account the loss generated by all the involved cables.

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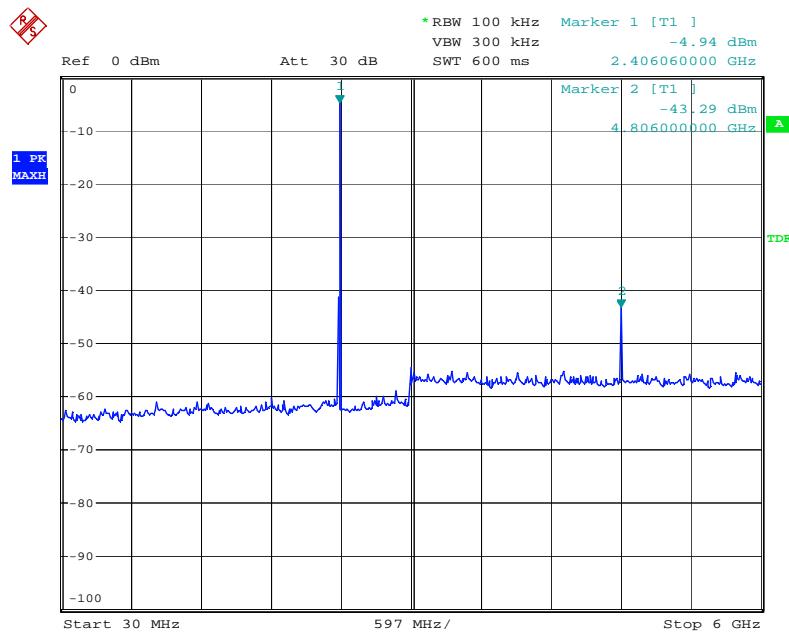
Table 10: Conducted Spurious Emission, Mode A (2402MHz)

Frequency [MHz]	Reading [dBm]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
4806	-43.29	-43.29	-24.94	18.35
24316	-37.84	-37.84	-24.94	12.90
2406.06	-4.94	-4.94	NA	NA

Notes: Cable loss was included in reading as offset.

Limit = Reading of fundamental + Correction factor – 20dB

Figure 19: Conducted Spurious Emission, 30MHz – 6GHz, Mode A (2402MHz)



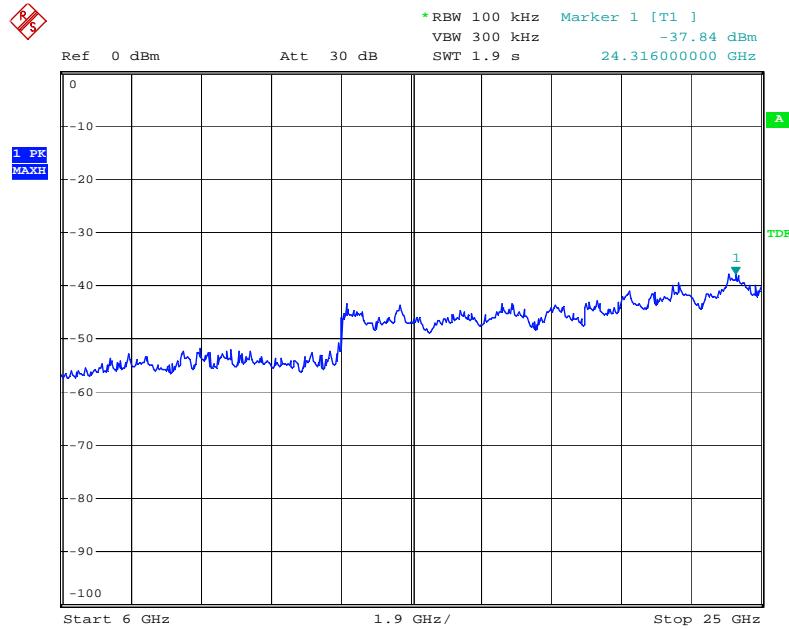
Date: 23.APR.2012 09:19:54

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Figure 20: Conducted Spurious Emission, 6 – 25GHz, Mode A (2402MHz)



Date: 23.APR.2012 09:20:38

Table 11: Conducted Spurious Emission, Mode B (2441MHz)

Frequency [MHz]	Reading [dBm]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
4889.58	-36.34	-36.34	-24.51	11.83
24392	-37.11	-37.11	-24.51	12.6
2441.88	-4.51	-4.51	NA	N/A

Notes: Cable loss was included in reading as offset.

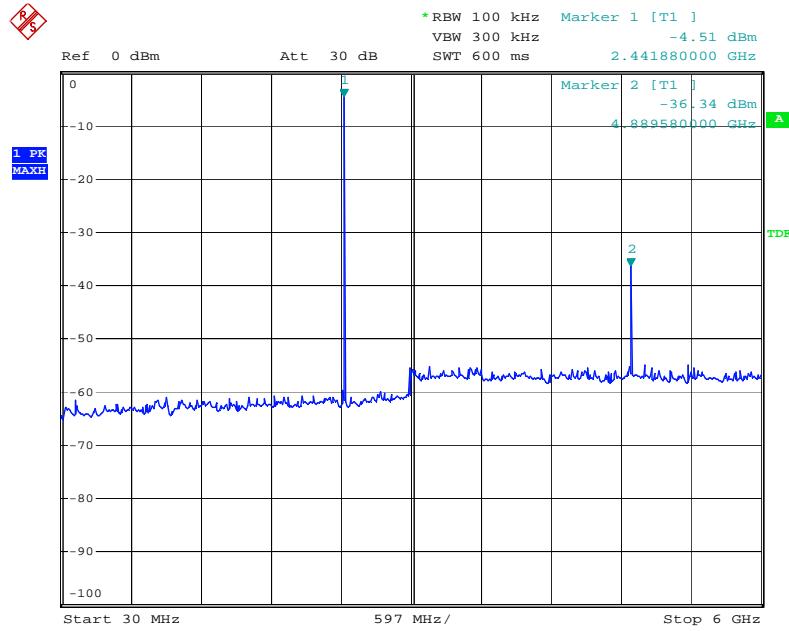
Limit = Reading of fundamental + Correction factor – 20dB

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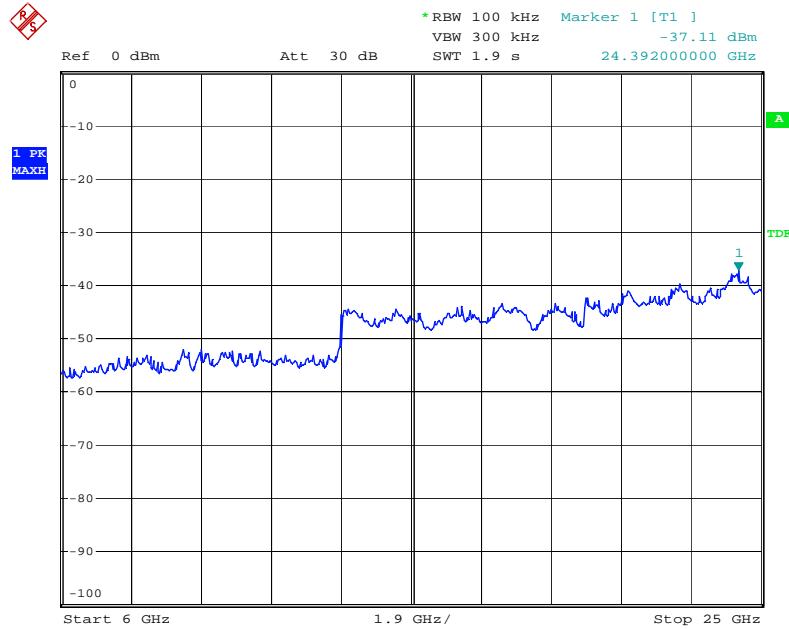
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Figure 21: Conducted Spurious Emission, 30MHz – 6GHz, Mode B (2441MHz)



Date: 23.APR.2012 09:21:41

Figure 22: Conducted Spurious Emission, 6 – 25GHz, Mode B (2441MHz)



Date: 23.APR.2012 10:02:27

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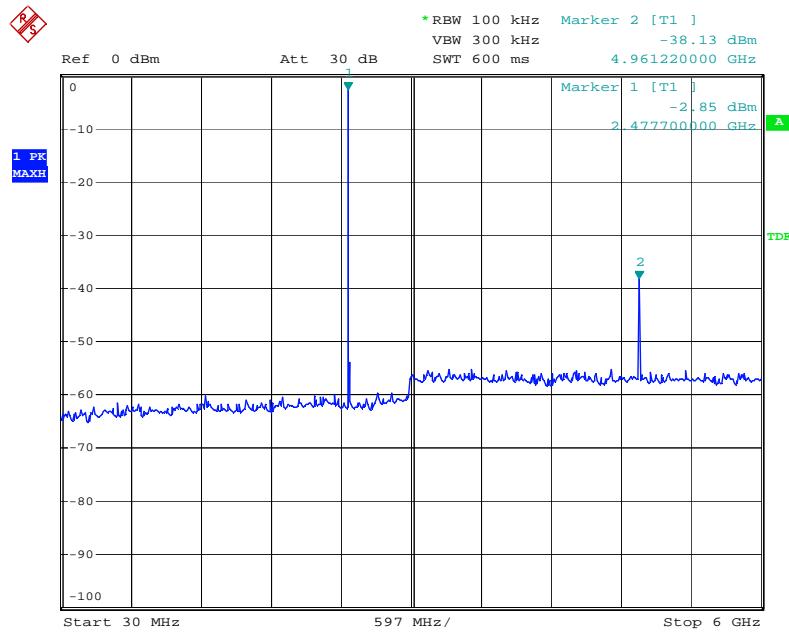
Table 12: Conducted Spurious Emission, Mode C (2480MHz)

Frequency [MHz]	Reading [dBm]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
4961.22	-38.13	-38.13	-22.85	15.28
24164	-38.10	-38.10	-22.85	15.25
2477.7	-2.85	-2.85	N/A	N/A

Notes: Cable loss was included in reading as offset.

Limit = Reading of fundamental + Correction factor – 20dB

Figure 23: Conducted Spurious Emission, 30MHz – 6GHz, Mode C (2480MHz)



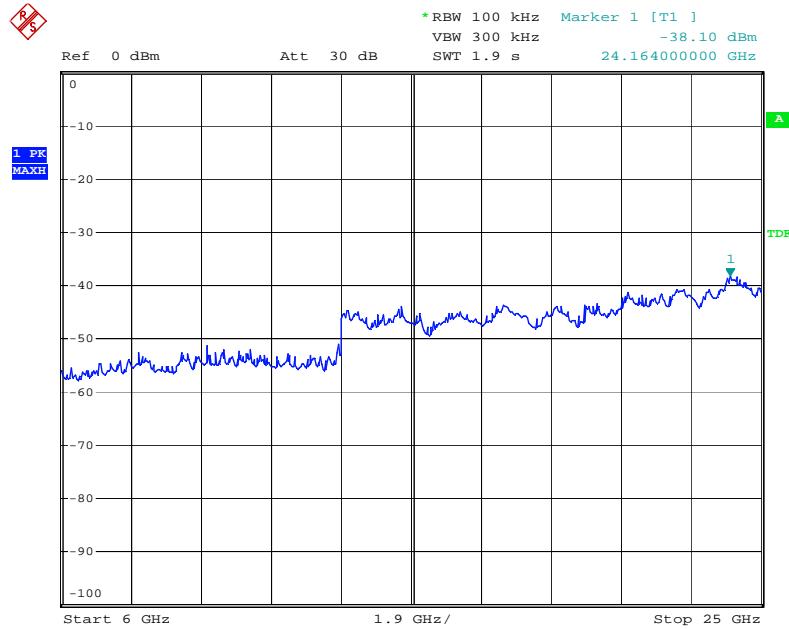
Date: 23.APR.2012 09:23:39

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Figure 24: Conducted Spurious Emission, 6 – 25GHz, Mode C (2480MHz)



Date: 23.APR.2012 09:24:17

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### **5.1.7 Band Edge Compliance of RF Conducted Emission, FCC 15.247(d)**

#### **RESULT:**

**PASS**

Date of testing: 2012-04-23

Ambient temperature: 20°C

Relative humidity: 39.6%

Atmospheric pressure: 101.5hPa

#### Requirements:

In any 100kHz bandwidth outside the frequency band, the RF power shall be at least 20dB below that of the maximum in-band 100kHz emission.

#### Test procedure:

ANSI C63.4-2003 and Public Notice DA 00-705.

A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth was set to 100kHz and video bandwidth was set to 300kHz. Allow the trace to stabilize. Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.

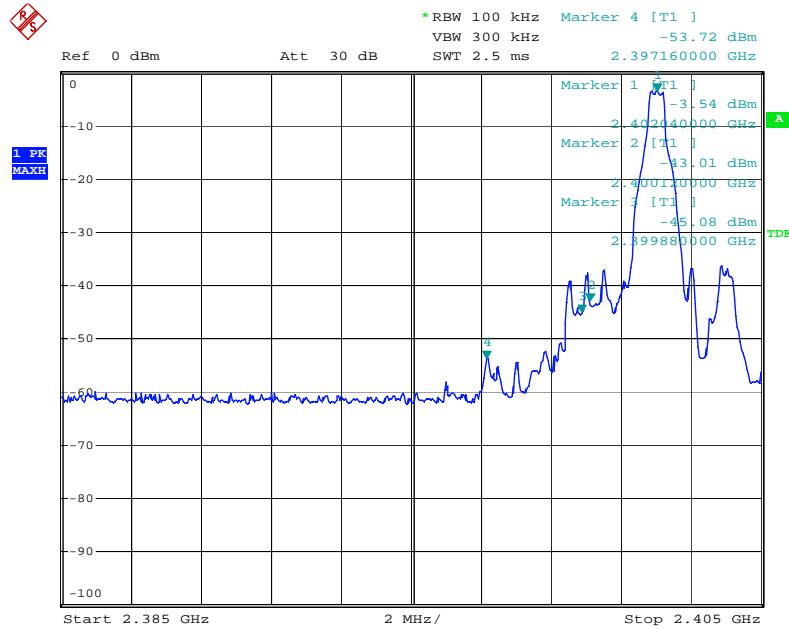
The final measurement takes into account the loss generated by all the involved cables.

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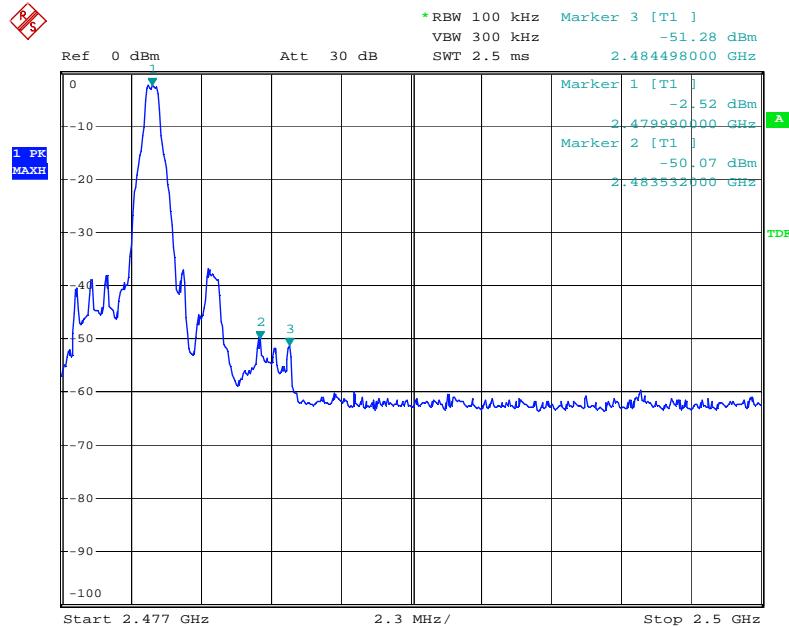
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Figure 25: Lower Band Edge Conducted, Hopping Disenabled



Date: 23.APR.2012 10:56:03

Figure 26: Upper Band Edge Conducted, Hopping Disenabled



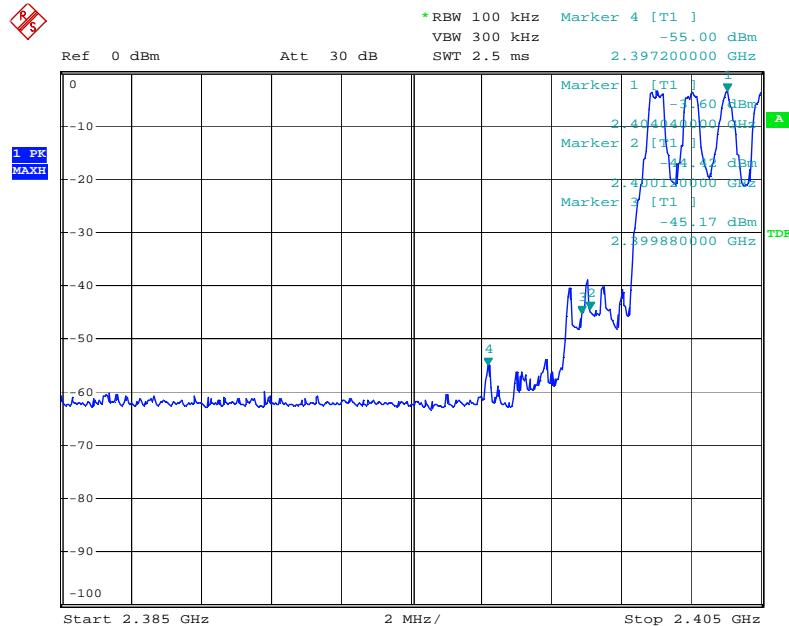
Date: 23.APR.2012 10:57:29

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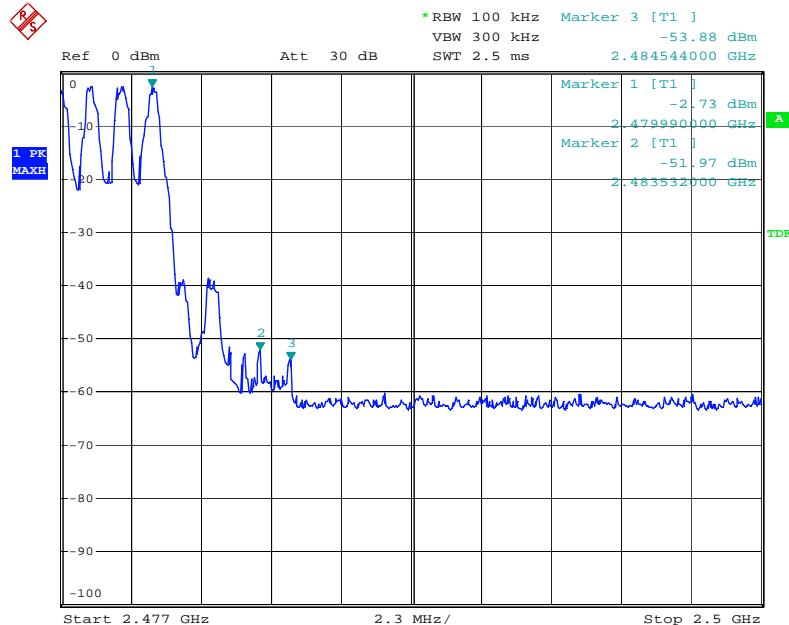
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Figure 27: Lower Band Edge Conducted, Hopping Enabled



Date: 23.APR.2012 10:59:24

Figure 28: Upper Band Edge Conducted, Hopping Enabled



Date: 23.APR.2012 11:00:50

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## 6. Test Results of Radiated Measurements

### 6.1 Transmitter Parameters

#### 6.1.1 Band Edge Radiated Emission, FCC 15.205, FCC 15.209, FCC 15.247(d)

RESULT:

Pass

Date of testing: 2012-06-28

Ambient temperature: 23.5°C

Relative humidity: 45%

Atmospheric pressure: 101.5hPa

Measurement distance: 3m

Kind of test site: Semi Anechoic Chamber

Requirements:

Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a) ,and must comply with the radiated emission limits specified in FCC 15.209(a) .

Test procedure:

ANSI C63.4-2003, RSS-Gen 4.9 and Public Notice DA 00-705.

The EUT was placed on a nonconductive turntable 0.8m above the ground plane. Measurements were made at 3m distance. The EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level.

Measurements were taken using both horizontal and vertical antenna polarization. The rotation through the three orthogonal axes is normally not needed for equipment that is not hand-held or body-worn. The EUT was pretested in floor-standing condition and in the table position and the worst case condition was table position which was used for the final measurements.

Measurements were performed using a spectrum analyzer with a suitable span to encompass the peak of the fundamental and using the following settings: Peak: RBW & VBW = 1MHz, Average: RBW = 1MHz, VBW = 10Hz.

The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

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Table 13: Band Edge Radiated Emission

Operating Frequency [MHz]	EUT / Antenna Orient.	Average Value [dB $\mu$ V/m]	Peak Value [dB $\mu$ V/m]	Average Limit [dB $\mu$ V/m]	Peak Limit [dB $\mu$ V/m]	Average Margin [dB]	Peak Margin [dB]
2389.800	X/H	48.976	62.669	54	74	5.024	11.331
2399.898	X/H	51.467	68.408	54	74	2.533	5.592
2389.880	X/V	49.024	63.543	54	74	4.976	10.457
2399.898	X/V	50.534	68.661	54	74	3.466	5.339
2483.469	X/H	48.603	61.368	54	74	5.397	12.632
2483.469	X/V	48.621	61.501	54	74	5.379	12.499

Notes: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.

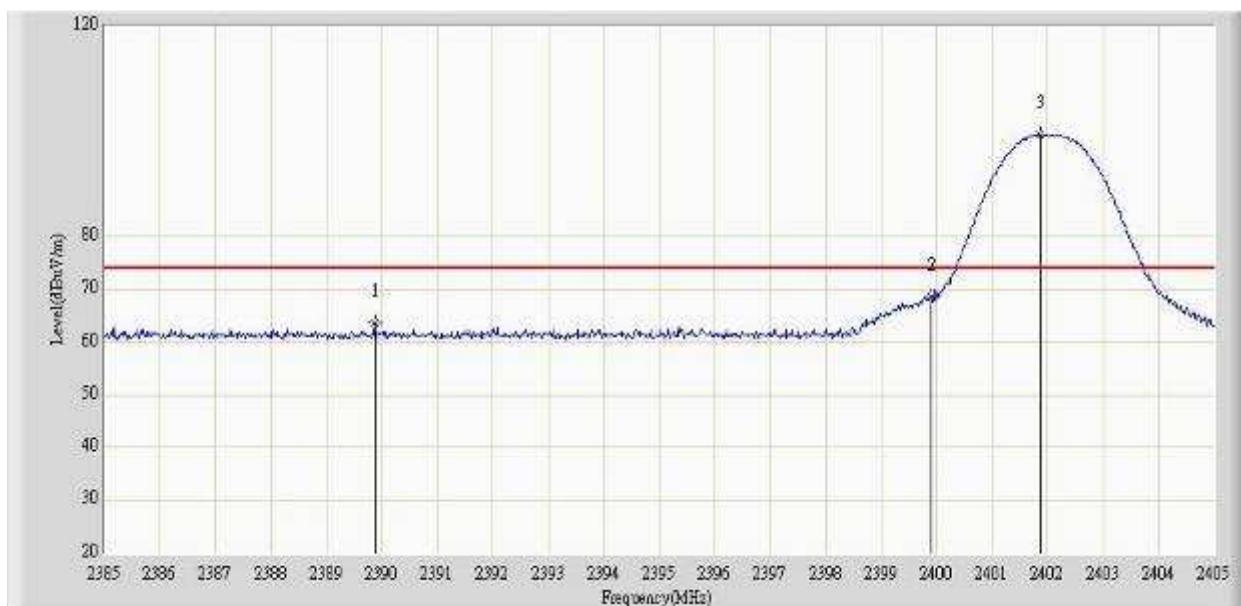
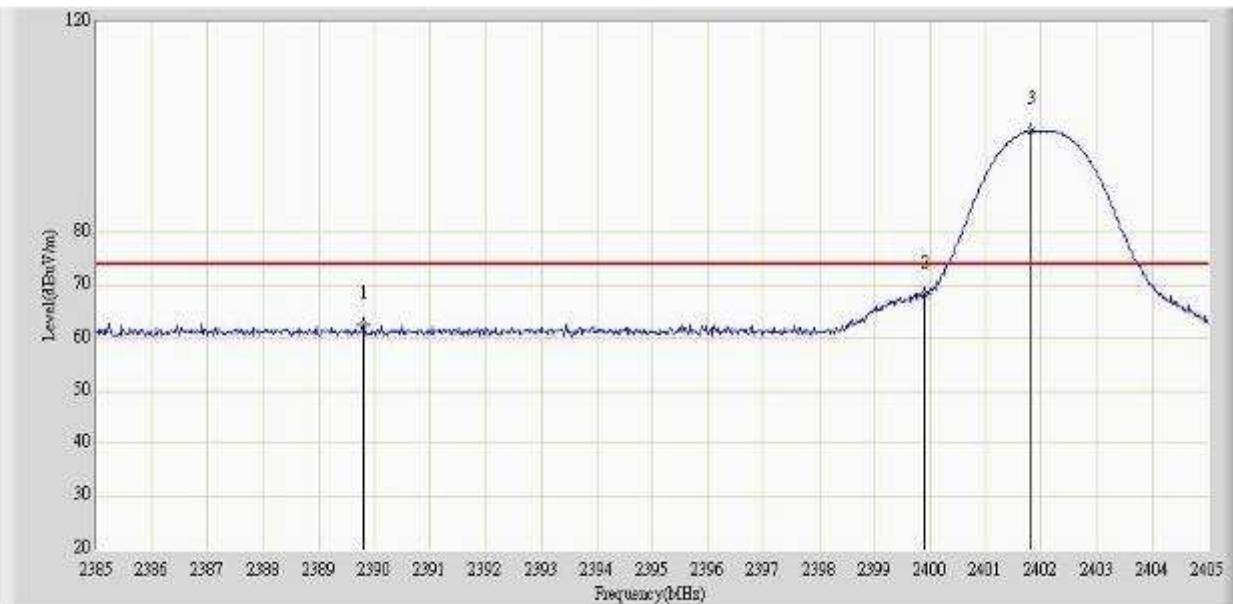
Average limit in dB $\mu$ V/m is calculated as follows: Average limit = 20 x log(500uV/m).Peak limit in dB $\mu$ V/m is calculated as follows: Peak limit = Average limit + 20dB.

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Figure 29: Band Edge Radiated Emission, Spectral Diagram, Mode A (2402MHz)



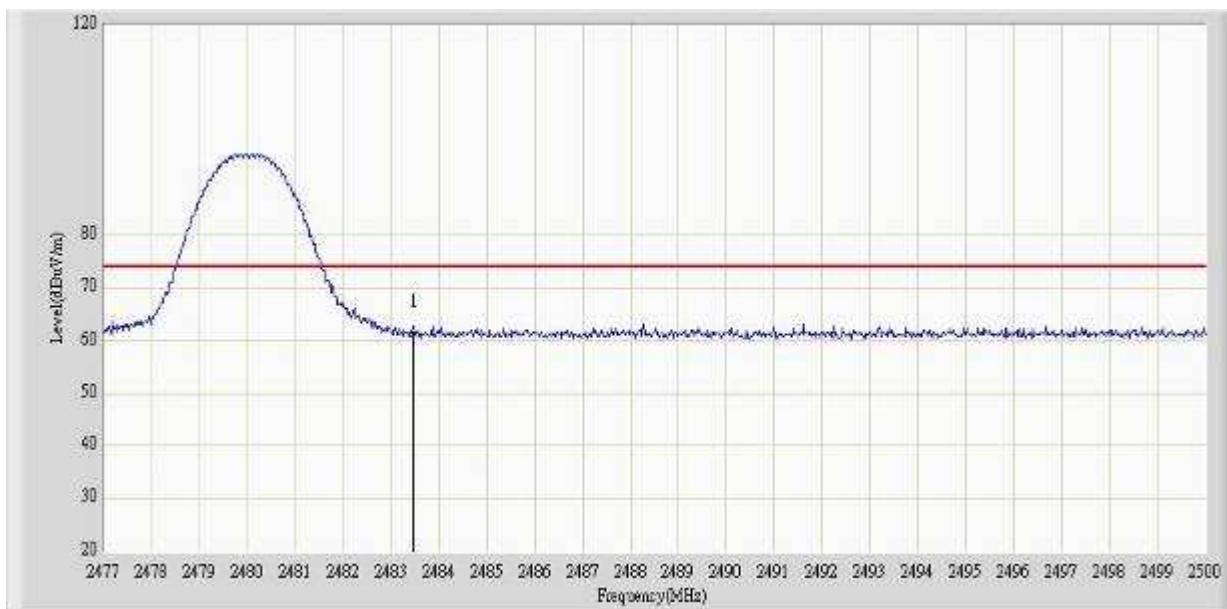
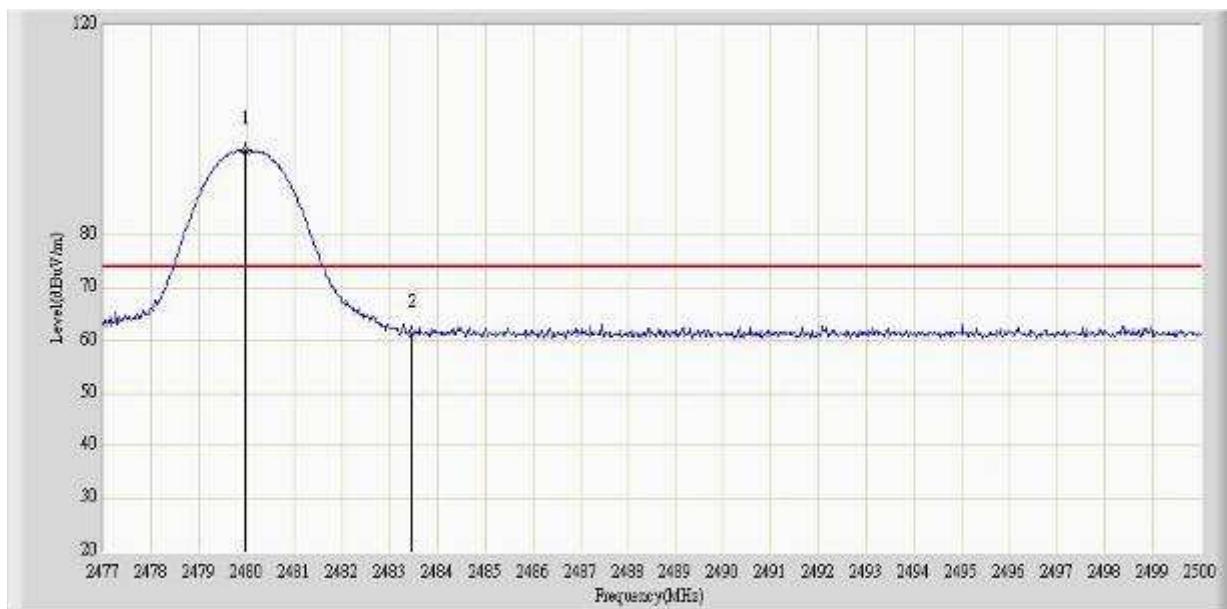
Note: The upper diagram shows the vertical peak value and the lower diagram shows the horizontal value.

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Figure 30: Band Edge Radiated Emission, Spectral Diagram, Mode C (2480MHz)



Note: The upper diagram shows the vertical peak value and the lower diagram shows the horizontal value.

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### **6.1.2 Radiated Spurious Emission of Transmitter, FCC 15.205, FCC 15.209, FCC 15.247(d)**

#### **RESULT:**

**PASS**

Date of testing: 2012-06-28

Ambient temperature: 23.5°C

Relative humidity: 45%

Atmospheric pressure: 101.5hPa

Frequency range: 30MHz – 25GHz

Measurement distance: 3m

Kind of test site: Semi Anechoic Chamber

#### Requirements:

Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a) ,must comply with the radiated emission limits specified in FCC 15.209(a) .

#### Test procedure:

ANSI C63.4-2003 and Public Notice DA 00-705.

The EUT was placed on a nonconductive turntable 0.8m above the ground plane. Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The EUT was pretested in floor-standing condition and in the table position and the worst case condition was table position which was used for the final measurements. The rotation through the three orthogonal axes is normally not needed for equipment that is not hand-held or body-worn.

The spectrum was examined from 30MHz to the 10th harmonic of the highest fundamental transmitter frequency (25GHz). Final radiated emission measurements were made at 3m distance.

At each frequency where a spurious emission was found, the EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations.

For frequencies between 30MHz and 1GHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1GHz, measurements were performed using the following settings: Peak: RBW & VBW = 1MHz, Average: RBW = 1MHz, VBW = 10Hz.

The highest emission amplitudes relative to the appropriate limit were recorded in this report. Emissions other than those mentioned are small or not detectable.

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Seite 43 von 54  
Page 43 of 54**Table 14: Radiated Emission, Average and Peak Data, 1 – 25GHz, Horizontal and Vertical Antenna Orientations, Mode A (2402MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Level AV [dB $\mu$ V/m]	Level PK [dB $\mu$ V/m]	Limit AV [dB $\mu$ V/m]	Limit PK [dB $\mu$ V/m]	Margin AV [dB]	Margin PK [dB]
4808.000	X/H	29.386	43.415	54	74	24.614	30.585
4808.000	X/V	31.537	42.909	54	74	22.463	31.091

Note: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.

**Table 15: Radiated Emission, Average and Peak Data, 1 – 25GHz, Horizontal and Vertical Antenna Orientations, Mode B (2441MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Level AV [dB $\mu$ V/m]	Level PK [dB $\mu$ V/m]	Limit AV [dB $\mu$ V/m]	Limit PK [dB $\mu$ V/m]	Margin AV [dB]	Margin PK [dB]
4876	X/H	31.118	41.758	54	74	22.882	32.242
4876	X/V	31.777	49.537	54	74	22.223	24.463

Note: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.

**Table 16: Radiated Emission, Average and Peak Data, 1 – 25GHz, Horizontal and Vertical Antenna Orientations, Mode B (2441MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Level AV [dB $\mu$ V/m]	Level PK [dB $\mu$ V/m]	Limit AV [dB $\mu$ V/m]	Limit PK [dB $\mu$ V/m]	Margin AV [dB]	Margin PK [dB]
4961.000	X/H	34.087	44.087	54	74	19.913	29.913
4961.000	X/V	29.854	46.149	54	74	24.146	27.851

Note: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.

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## 6.2 Receiver Parameters

### 6.2.1 Radiated Spurious Emission of Bluetooth Receiver, FCC 15.109

#### RESULT:

PASS

Date of testing: 2012-06-28

Ambient temperature: 23.5°C

Relative humidity: 45%

Atmospheric pressure: 101.5hPa

Frequency range: 30MHz – 12.5GHz

Measurement distance: 3m

Kind of test site: Semi Anechoic Chamber

#### Requirements:

The emissions from the unintentional radiator shall not exceed the field strength specified in 15.109(a).

#### Test procedure:

ANSI C63.4-2003.

The EUT was placed on a nonconductive turntable 0.8m above the ground plane. Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The EUT was pretested in floor-standing condition and in the table position and the worst case condition was table position which was used for the final measurements. The rotation through the three orthogonal axes is normally not needed for equipment that is not hand-held or body-worn.

The spectrum was examined from 30MHz to the 5th harmonic of the highest fundamental operation frequency (12.5GHz). Final radiated emission measurements were made at 3m distance.

Measurements were taken using both horizontal and vertical antenna polarizations.

For frequencies between 30MHz and 1GHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1GHz, measurements were performed using the following settings: Peak: RBW & VBW = 1MHz, Average: RBW = 1MHz, VBW = 10Hz.

The highest emission amplitudes relative to the appropriate limit were recorded in this report. No spurious emission was found in the range 30MHz – 12500MHz.

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Page 45 of 54**6.2.2 Radiated Spurious Emission of Land mobile Receiver, FCC  
15.109****RESULT:****PASS**

Date of testing: 2012-06-28

Ambient temperature: 23.5°C

Relative humidity: 45%

Atmospheric pressure: 101.5hPa

The frequency to tuned: 461.05Mhz

Frequency range: 30MHz – 3GHz

Measurement distance: 3m

Kind of test site: Semi Anechoic Chamber

## Requirements:

The emissions from the unintentional radiator shall not exceed the field strength specified in 15.109(a).

## Test procedure:

ANSI C63.4-2003.

The EUT was placed on a nonconductive turntable 0.8m above the ground plane. Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The EUT was pretested in floor-standing condition and in the table position and the worst case condition was table position which was used for the final measurements. The rotation through the three orthogonal axes is normally not needed for equipment that is not hand-held or body-worn.

The spectrum was examined from 30MHz to the 5th harmonic of the highest fundamental operation frequency (3GHz). Final radiated emission measurements were made at 3m distance.

Measurements were taken using both horizontal and vertical antenna polarizations.

For frequencies between 30MHz and 1GHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1GHz, measurements were performed using the following settings: Peak: RBW & VBW = 1MHz, Average: RBW = 1MHz, VBW = 10Hz.

The highest emission amplitudes relative to the appropriate limit were recorded in this report. No spurious emission was found in the range 1GHZ~3GHZ;

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Page 46 of 54**Table 17: Radiated Emission, Peak Data, 30 – 1000MHz, Horizontal and Vertical Antenna Orientations, Mode I(Land mobile receiver:461.05Mhz)**

Freq. [MHz]	EUT / Antenna Orientation	Level PK [dB $\mu$ V/m]	Limit PK [dB $\mu$ V/m]	Margin PK [dB]
121.786	X/H	36.247	43.5	7.253
179.986	X/H	30.537	43.5	12.963
343.310	X/H	31.654	46.0	14.346
416.060	X/H	35.995	46.0	10.005
824.551	X/V	39.186	46.0	6.814

Note: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values

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Page 47 of 54**6.2.3 Radiated Spurious Emission of GPS Receiver, FCC 15.109****RESULT:****PASS**

Date of testing: 2012-06-28

Ambient temperature: 23.5°C

Relative humidity: 45%

Atmospheric pressure: 101.5hPa

Frequency range: 30MHz – 8GHz

Measurement distance: 3m

Kind of test site: Semi Anechoic Chamber

**Requirements:**

The emissions from the unintentional radiator shall not exceed the field strength specified in 15.109(a).

**Test procedure:**

ANSI C63.4-2003.

The EUT was placed on a nonconductive turntable 0.8m above the ground plane. Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The EUT was pretested in floor-standing condition and in the table position and the worst case condition was table position which was used for the final measurements. The rotation through the three orthogonal axes is normally not needed for equipment that is not hand-held or body-worn.

The spectrum was examined from 30MHz to the 5th harmonic of the highest fundamental operation frequency (8GHz). Final radiated emission measurements were made at 3m distance.

Measurements were taken using both horizontal and vertical antenna polarizations.

For frequencies between 30MHz and 1GHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1GHz, measurements were performed using the following settings: Peak: RBW & VBW = 1MHz, Average: RBW = 1MHz, VBW = 10Hz.

The highest emission amplitudes relative to the appropriate limit were recorded in this report. No spurious emission was found in the range 30MHz – 1000MHz.

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Seite 48 von 54  
Page 48 of 54**Table 18: Radiated Emission, Average and Peak Data, 1 – 8GHz, Horizontal and Vertical Antenna Orientations, Mode H(GPS receiver)**

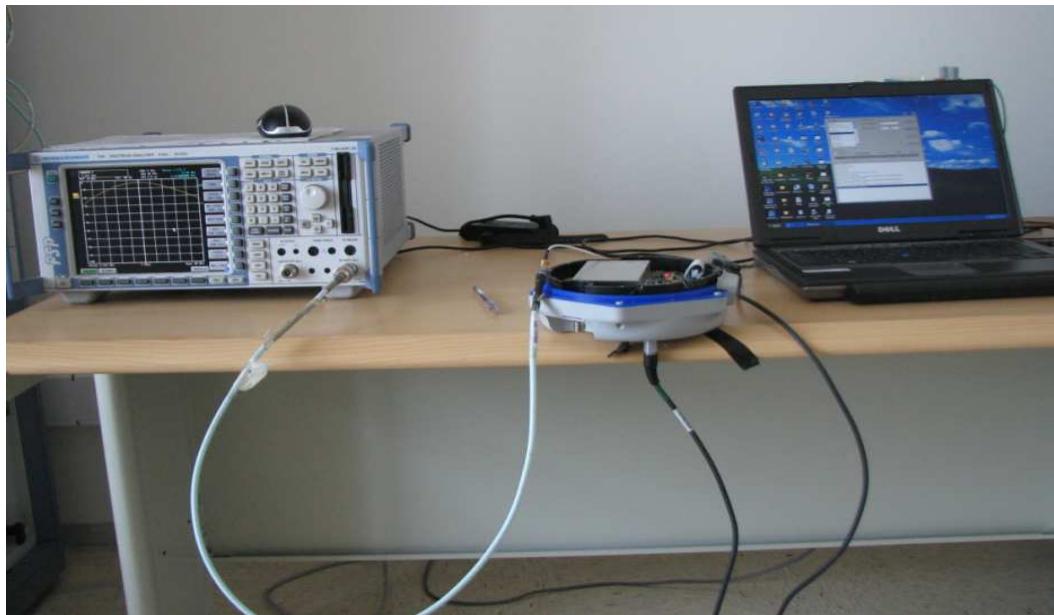
Freq. [MHz]	EUT / Antenna Orientation	Level AV [dB $\mu$ V/m]	Level PK [dB $\mu$ V/m]	Limit AV [dB $\mu$ V/m]	Limit PK [dB $\mu$ V/m]	Margin AV [dB]	Margin PK [dB]
1248.500	X/H	No peak found	33.060	54	74	NA	40.940
1605.500	X/H	No peak found	37.697	54	74	NA	36.303
1665.000	X/H	No peak found	39.712	54	74	NA	34.288
1612.500	X/V	No peak found	38.127	54	74	NA	35.873
1665.000	X/V	No peak found	44.080	54	74	NA	29.920

Note: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values

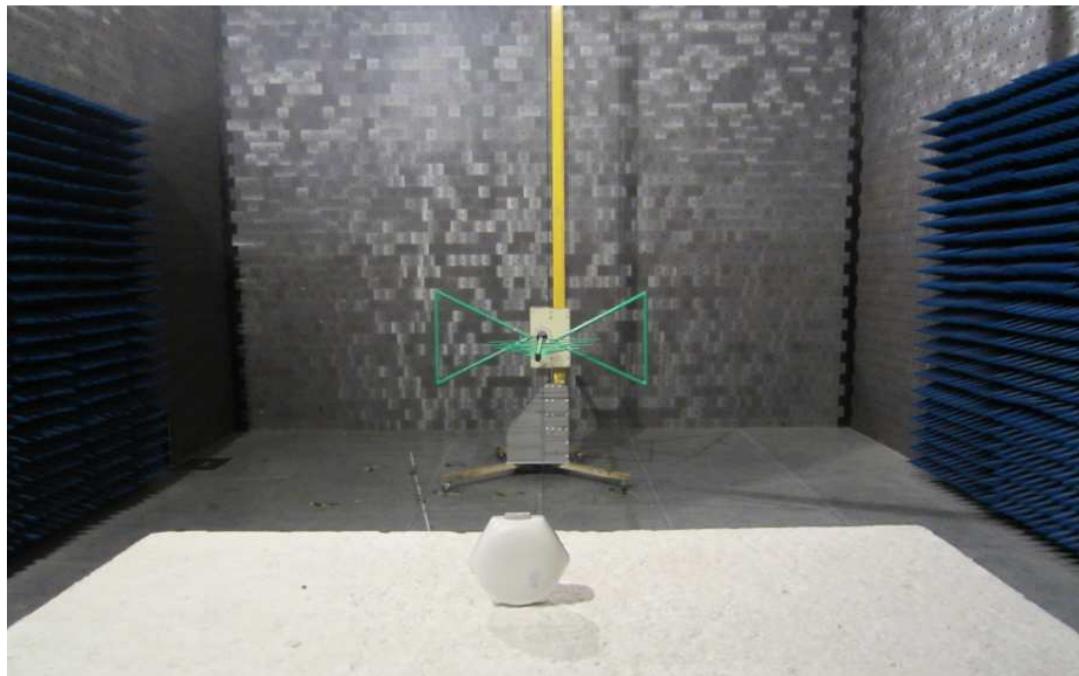
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## 7. Photographs of the Test Setup

**Photograph 1: Set-up for Conducted Emission at Antenna Port**



**Photograph 2: Set-up for Radiated Emission of Bluetooth, 30MHz-1000MHz**



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**Photograph 3: Set-up for Radiated Emission of Bluetooth, 1G-18GHz**



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Photograph 4: Set-up for Radiated Emission Land mobile Receiver,  
30MHZ~3GHZ;

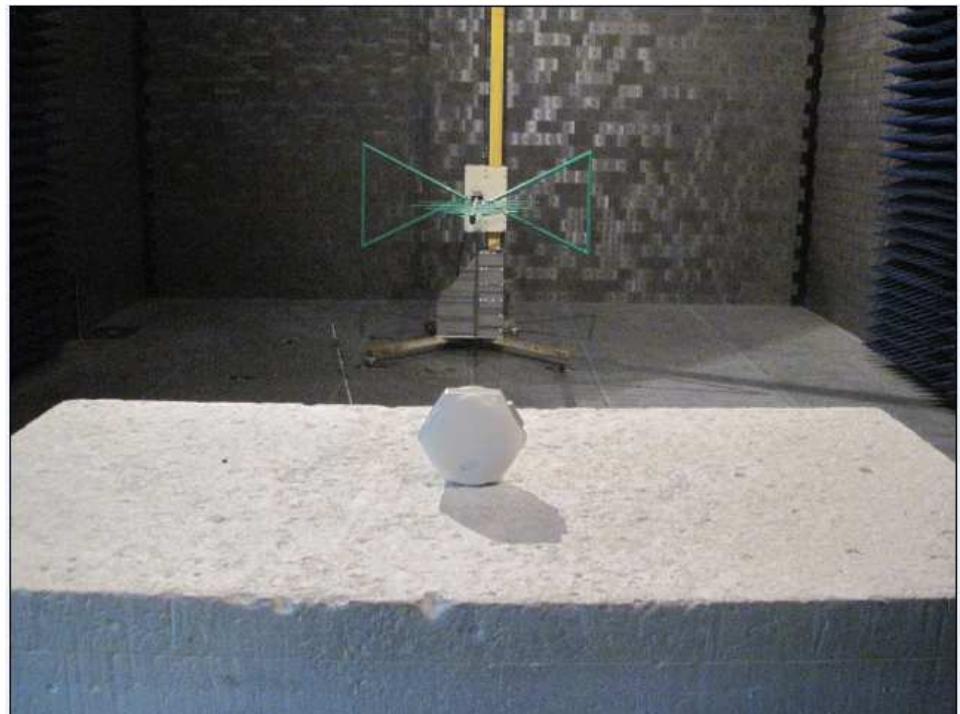


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**Photograph 5: Set-up for Radiated Emission GPS Receiver, 30MHZ~8GHZ;**



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