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<i>Test Report No.:</i>				
Auftraggeber: <i>Client:</i>	Amp'ed RF(Tianjin) Technology Co., Ltd. 1879 LUNDY Ave, Suite 138, San Jose, C95131,USA			
Gegenstand der Prüfung: <i>Test Item:</i>	Bluetooth Module			
Bezeichnung: BT24 <i>Identification:</i> FCC ID:X3ZBTMOD6	Serien-Nr.: <i>Serial No.:</i>	Engineering sample		
Wareneingangs-Nr.: 154014766 <i>Receipt No.:</i>	Eingangsdatum: <i>Date of Receipt:</i>	2012-12-13		
Prüfört: <i>Testing Location:</i>	TÜV Rheinland (Shanghai) Co., Ltd. Building 2, No. 777 Guangzhong Road West, Shanghai 200072, P.R. China			
Prüfgrundlage: <i>Test Specification:</i>	FCC 47 CFR Part 15, Subpart C, Section 15.247 (October 1, 2009) ANSI C63.4-2003 Public Notice DA 00-705: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems (March 30, 2000) RSS-210 (Issue 8): 2010 RSS-Gen (Issue 3): 2010			
Prüfergebnis: <i>Test Result:</i>	Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n). The test item passed the test specification(s).			
Prüflaboratorium: <i>Testing Laboratory:</i>	TÜV Rheinland (Shanghai) Co., Ltd. TÜV Rheinland (Shanghai) Co., Ltd., No. 177, Lane 777, West Guangzhong Road, Shanghai 200072, P.R.China			
geprüft/ tested by:	kontrolliert/ reviewed by:			
2012-12-13 Shi Li / Inspector 	2012-12-13 Jesse Huang/ Reviewer 			
Datum Name/Stellung Unterschrift <i>Date</i> <i>Name/Position</i> <i>Signature</i>	Datum Name/Stellung Unterschrift <i>Date</i> <i>Name/Position</i> <i>Signature</i>			
Sonstiges / Other Aspects:				
<table style="width:100%; border:none;"> <tr> <td style="width:50%; border:none;">Abkürzungen: P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet</td> <td style="width:50%; border:none;">Abbreviations: P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested</td> </tr> </table>			Abkürzungen: P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet	Abbreviations: P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested
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<p>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. 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.</p>				
<p>TÜV Rheinland (Shanghai) Co., Ltd., No. 177, Lane 777, West Guangzhong Road, Shanghai 200072, P.R.China · Tel.: +86 21 6108 1188 · Fax: +86 21 6108 1099 · Mail: service@de.tuv.com · Web: www.tuv.com</p>				

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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 AND RSS-GEN 7.1.4

RESULT: PASS

5.1.1 CONDUCTED OUTPUT POWER, FCC 15.247(B)(1) AND RSS-210 A8.4(2)

RESULT: PASS

5.1.2 CARRIER FREQUENCY SEPARATION, FCC 15.247(A)(1) AND RSS-210 A8.1(B)

RESULT: PASS

5.1.3 20dB BANDWIDTH, FCC 15.247(A)(1) AND RSS-210 A8.1(A)

5.1.4 99% BANDWIDTH, RSS-GEN 4.6.1

5.1.5 NUMBER OF HOPPING FREQUENCIES, FCC 15.247(A)(1)(III) AND RSS-210 A8.1(D)

RESULT: PASS

5.1.6 AVERAGE TIME OF OCCUPANCY, FCC 15.247(A)(1)(III) AND RSS-210 A8.1(D)

RESULT: PASS

5.1.7 CONDUCTED SPURIOUS EMISSION, FCC 15.247(D) AND RSS-210 A8.5

RESULT: PASS

5.1.8 BAND EDGE COMPLIANCE OF RF CONDUCTED EMISSION, FCC 15.247(D) AND RSS-210 A8.5

RESULT: PASS

6.1.1 BAND EDGE RADIATED EMISSION, FCC 15.205, FCC 15.209, FCC 15.247(D), RSS-210 2.2, RSS-210 2.6 AND RSS-210 A8.5

RESULT: Pass

6.1.2 RADIATED SPURIOUS EMISSION OF TRANSMITTER, FCC 15.205, FCC 15.209, FCC 15.247(D), RSS-210 2.2, RSS-210 2.6 AND RSS-210 A8.5

RESULT: PASS

6.2.1 RADIATED SPURIOUS EMISSION OF RECEIVER, FCC 15.109, RSS-210 2.2, RSS-210 2.6, RSS-210 A8.5, RSS-GEN 7.2.3.2

RESULT: PASS

6.3.1 AC POWER LINE CONDUCTED EMISSION, FCC 15.207 AND RSS-GEN7.2.2

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

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

The Industry Canada has reviewed the technical characteristics of the radiated and conducted emission facility, and has found these test facilities to be in compliance. The description of the test facility is listed under chambers filing number 2932F-1.

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2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Equipment	Model	Serial no.	Cal. due date
3m modified semi-anechoic chamber	SAC	N/A	10.12.2014
EMI test receiver	ESCI	100280	08.11.2013
broadband antenna	BTA-H	040005H	28.07.2013
Spectrum analyzer	FSP30	100192	21.07.2013
Broadband coaxial preamplifier	BBV 9718	9718-012	04.07.2014
Double ridged broadband horn antenna	BBHA 9120 D	9120D-433	15.05.2013

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 Bluetooth module.

3.2 System Details

Radio standard:	Bluetooth
Specified output power:	6.24dBm
Antenna gain:	1.48dBi
Antenna type:	Internal antenna
Antenna mounting type:	Printed
Antenna cable length:	N/A
Frequency range:	2402 – 2480MHz
Number of channels:	79
Channel spacing:	1MHz
Modulation type:	GFSK, $\pi/4$ -DQPSK or 8DPSK
Rated voltage:	3.3V
Protection class:	III
Test voltage:	3.3V

3.2.1 Voltage Requirements, FCC 15.31(e)

RESULT:

PASS

All the tests were performed using steady DC 3.3V. Hence it complies with the power supply requirements.

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3.2.2 Antenna Requirements, FCC 15.203, FCC 15.204 and RSS-Gen 7.1.4

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.

Each mode basic operation in (GFSK; $\pi/4$ -DQPSK ;8DPSK) :

- A. EUT transmits (TX mode), with full power, at lowest channel (2402MHz), a continuous modulated signal streaming with 100% duty cycle.
- B. EUT transmits (TX mode), with full power, at middle channel (2441MHz), a continuous modulated signal streaming with 100% duty cycle.
- C. EUT transmits (TX mode), with full power, at highest channel (2480MHz), a continuous modulated signal streaming with 100% 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).

3.4 Clock Frequencies

The highest clock frequency generated by the EUT is 26 MHz.

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 and RSS-Gen (Issue 3).

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 RS 232 interface.

Notes:

One test sample was available. Both for antennas conducted measurements and 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: A-COM2 115200 Baud –Amp'ed RF Firmware Test tool -4.2 by client.

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

4.4 Special Accessories and Auxiliary Equipment

The product has been tested together with a power adapter (supply power for the module).

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4.5 Countermeasures to achieve EMC Compliance

No additional measures were employed to achieve compliance.

5. Test Results of Conducted Measurements at Antenna Port

5.1 Transmitter Parameters

5.1.1 Conducted Output Power, FCC 15.247(b)(1) and RSS-210 A8.4(2)

RESULT: **PASS**

Date of testing: 2012-12-7

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, RSS-Gen 4.8 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]
1	5.64	0.63	3	5.64	21
2	5.70	0.63	3	5.70	21
3	5.61	0.69	3	5.61	21

Notes: Cable loss was included in reading as offset.

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Table 4: Conducted Output Power, Mode B (2441MHz)

Data Rate [Mbps]	Reading [dBm]	Correction Factor [dB]	RBW [MHz]	Output Power [dBm]	Limit [dBm]
1	5.89	0.63	3	5.89	21
2	5.92	0.63	3	5.92	21
3	5.92	0.69	3	5.92	21

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]
1	6.09	0.63	3	6.09	21
2	6.24	0.63	3	6.24	21
3	6.12	0.69	3	6.12	21

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 2Mbps. 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) and RSS-210 A8.1(b)

RESULT:

PASS

Date of testing: 2012-12-10

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.

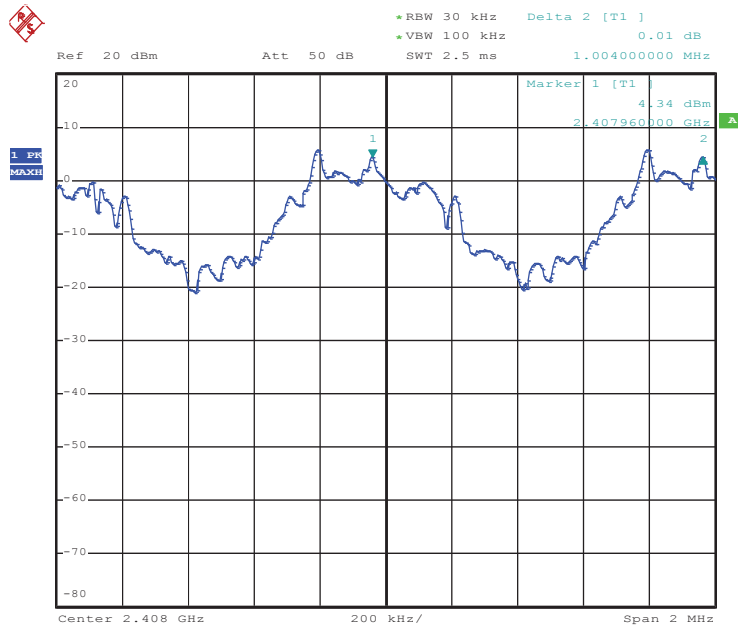
A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth was set to 30kHz and the video bandwidth to 100kHz. The Delta Marker function was used to determine the separation between the peaks of two adjacent channels.

Table 6: Carrier Frequency Separation

Channel	Channel Separation [kHz]	20dB Bandwidth [kHz](8DPSK)	Limit [kHz]
Low	1004	1110	688.0
Middle	1008	1104	685.4
High	1000	1104	685.4

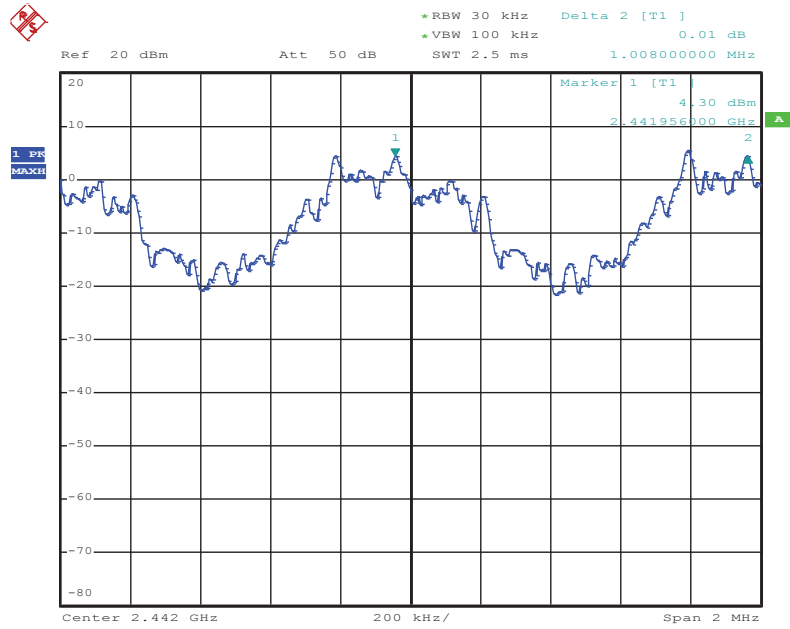
Notes: Limit = 20dB bandwidth * 2/3 since it is greater than 25kHz and the output power is less than 125mW.

Figure 1: Carrier Frequency Separation-Low Channel



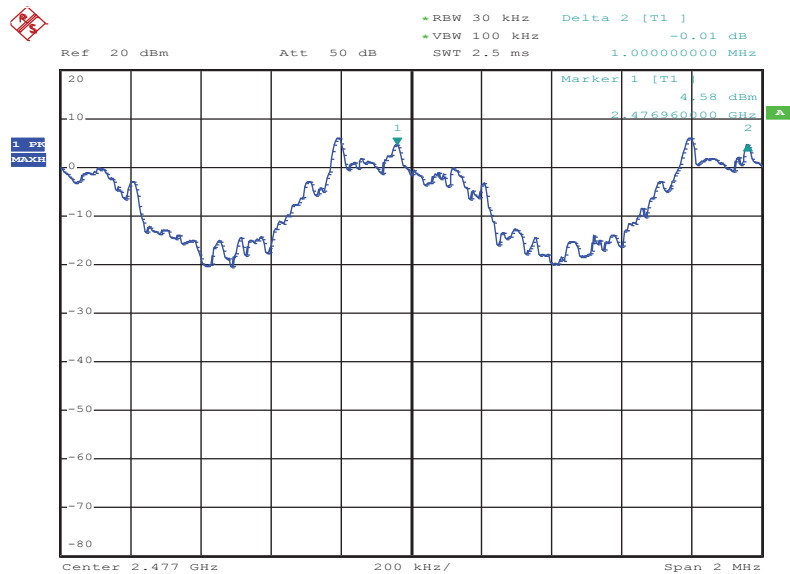
Date: 10.DEC.2012 16:19:33

Figure 2: Carrier Frequency Separation-Middle Channel



Date: 10.DEC.2012 15:37:40

Figure 3: Carrier Frequency Separation-High Channel



Date: 10.DEC.2012 15:44:37

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5.1.3 20dB Bandwidth, FCC 15.247(a)(1) and RSS-210 A8.1(a)

Date of testing: 2012-12-10

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:

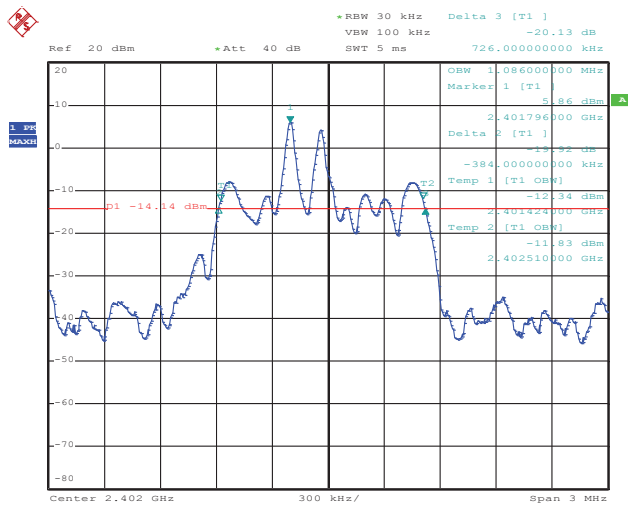
ANSI C63.4-2003, RSS-Gen 4.6.2 and Public Notice DA 00-705.

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 3MHz. GFSK, $\pi/4$ -DQPSK and 8DPSK are test, only the worst case data listing.

Table 7: 20dB Bandwidth

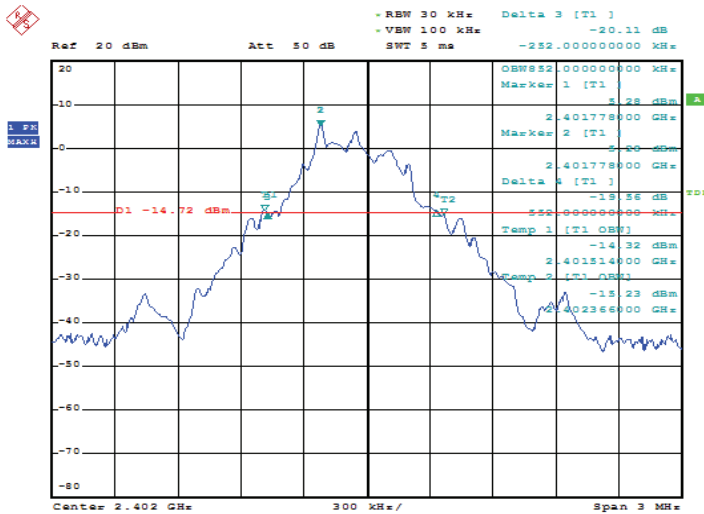
Operating Frequency [MHz]	20dB Bandwidth [kHz](8DPSK)	20dB Bandwidth [kHz](GFSK)
2402	1110	0.804
2441	1104	0.798
2480	1104	0.804

Figure 4: 20dB Bandwidth, Mode A (2402MHz 8DPSK and GFSK)



Date: 10.DEC.2012 17:33:29

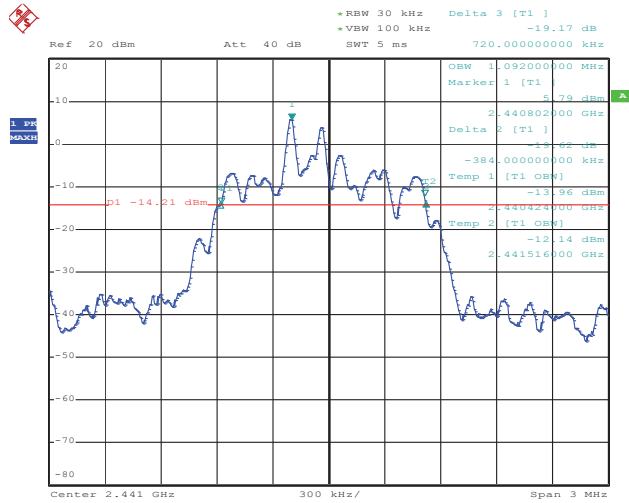
2402MHz 8DPSK



Date: 12.DEC.2012 12:47:27

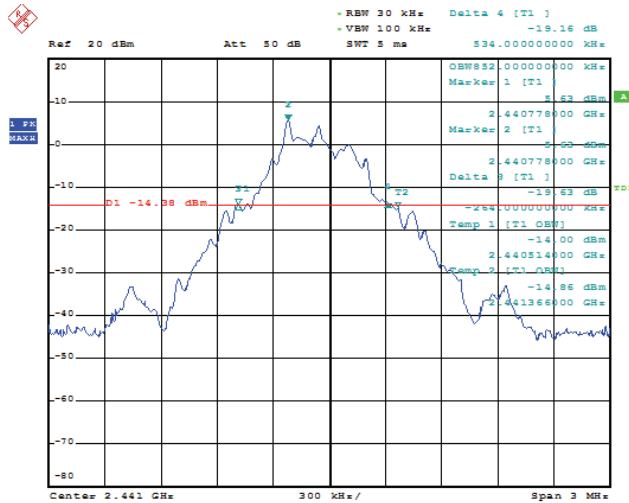
2402MHz GFSK

Figure 5: 20dB Bandwidth, Mode B (2441MHz 8DPSK and GFSK)



Date: 7.DEC.2012 15:28:02

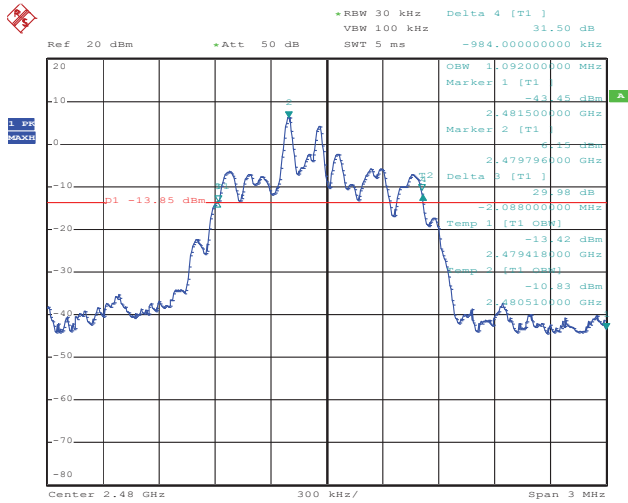
2441MHz 8DPSK



Date: 12.DEC.2012 12:51:08

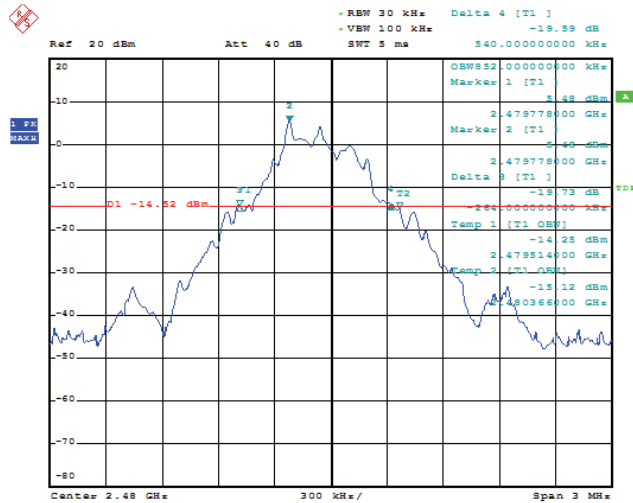
2441MHz GFSK

Figure 6: 20dB Bandwidth, Mode C (2480MHz 8DPSK and GFSK)



Date: 10.DEC.2012 17:52:45

2480MHz 8DPSK



Date: 12.DEC.2012 12:54:12

2480MHz GFSK

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5.1.4 99% Bandwidth, RSS-Gen 4.6.1

Date of testing: 2012-12-10

Ambient temperature: 20°C

Relative humidity: 39.6%

Atmospheric pressure: 101.5hPa

Requirements:

The 99% bandwidth shall be reported according to RSS-Gen 4.6.1.

Test procedure:

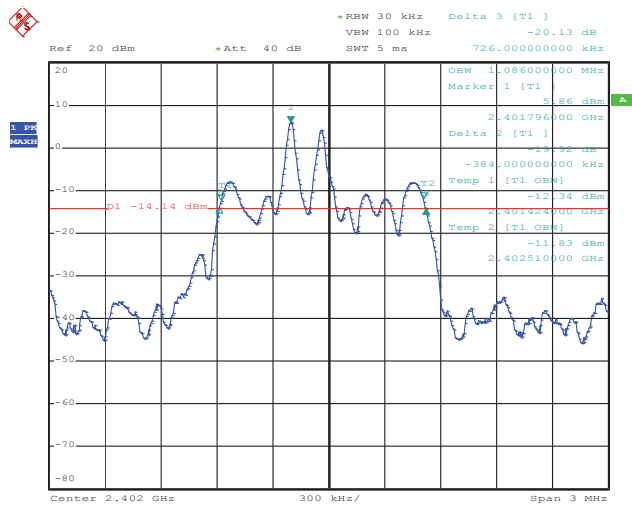
RSS-Gen 4.6.1.

A spectrum analyzer was connected to the antenna port of the EUT. The spectrum analyzer resolution bandwidth was set to 1% of the span (2MHz). The 99% bandwidth was measured by using the OBW function of the analyzer with a 99% coverage setting.

Table 8: 99% Bandwidth

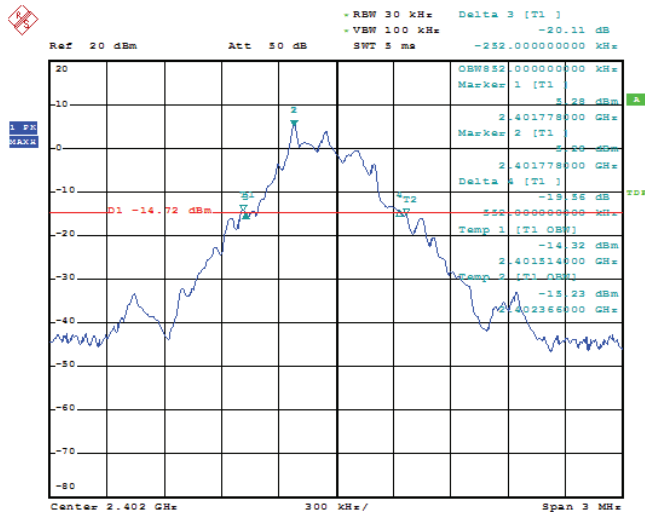
Operating Frequency [MHz]	99% Bandwidth [MHz](8DPSK)	99% Bandwidth [MHz](GFSK)
2402	1.086	0.852
2441	1.092	0.852
2480	1.092	0.852

Figure 7: 99% Bandwidth, Mode A (2402MHz 8DPSK and GFSK)



Date: 10.DEC.2012 17:33:29

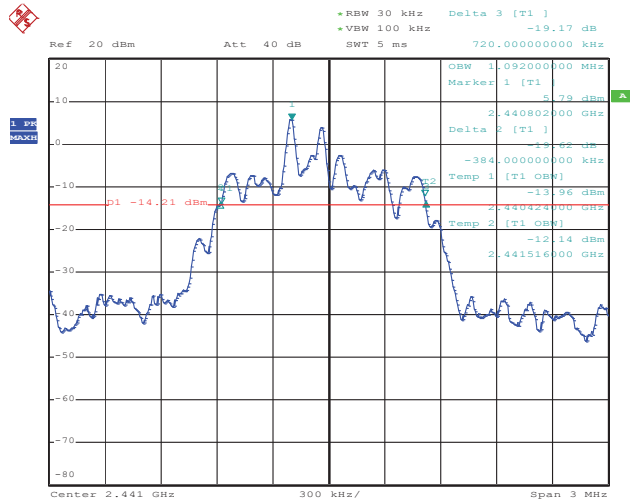
2402MHz 8DPSK



Date: 12.DEC.2012 12:47:27

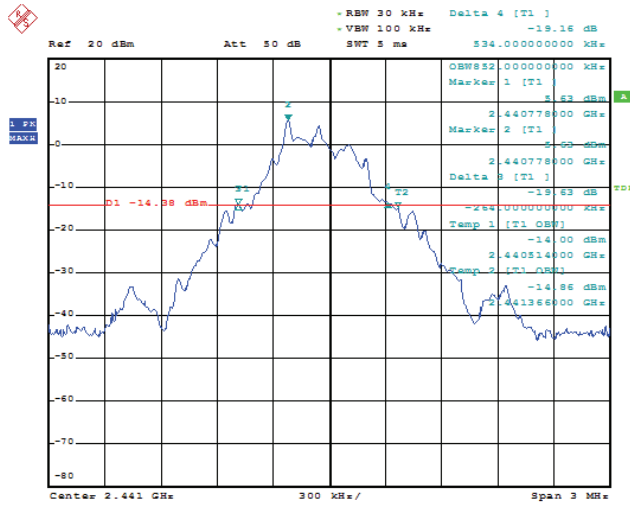
2402MHz GFSK

Figure 8: 99% Bandwidth, Mode B (2441MHz 8DPSK and GFSK)



Date: 7.DEC.2012 15:28:02

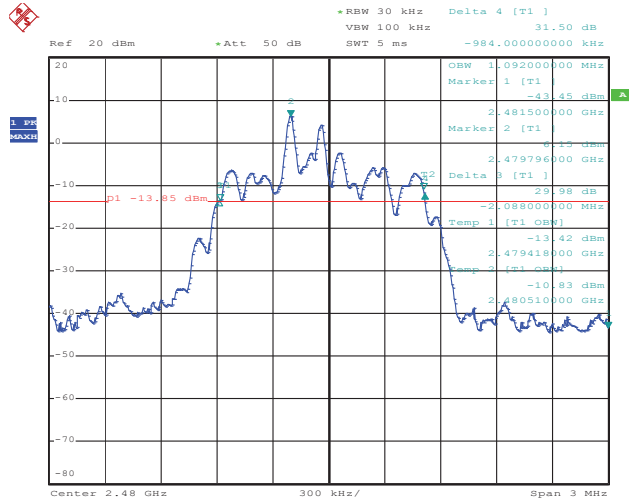
2441MHz 8DPSK



Date: 12.DEC.2012 12:51:08

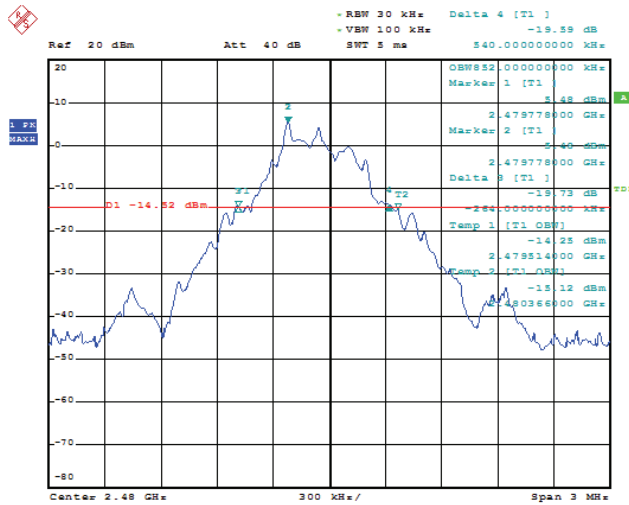
2441MHz GFSK

Figure 9: 99% Bandwidth, Mode C (2480MHz 8DPSK and GFSK)



Date: 10.DEC.2012 17:52:45

2480MHz 8DPSK



Date: 12.DEC.2012 12:54:12

2480MHz GFSK

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5.1.5 Number of Hopping Frequencies, FCC 15.247(a)(1)(iii) and RSS-210 A8.1(d)

RESULT:

PASS

Date of testing: 2012-12-10

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.

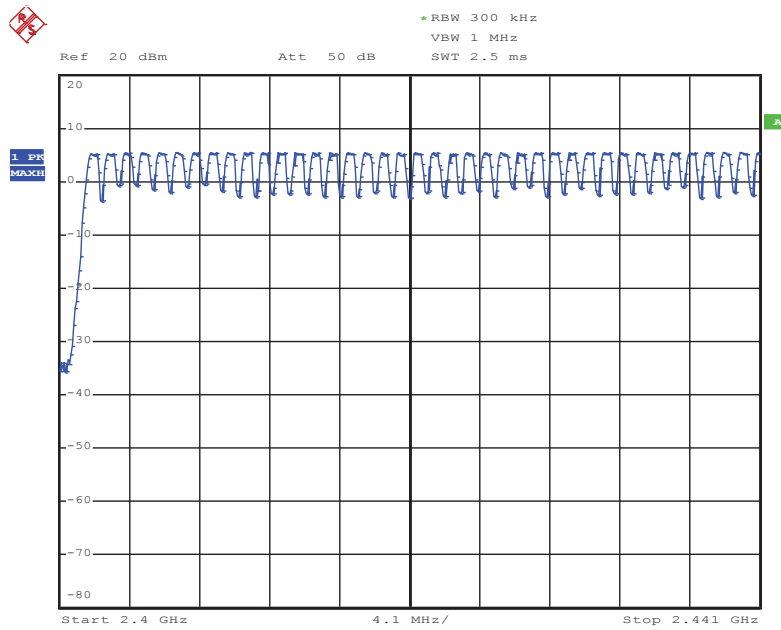
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Table 9: Number of Hopping Frequencies

Number of Hopping Frequencies	Limit
79	15

Figure 10: Hopping Frequencies up to 2429.5MHz, Mode G (Hopping)

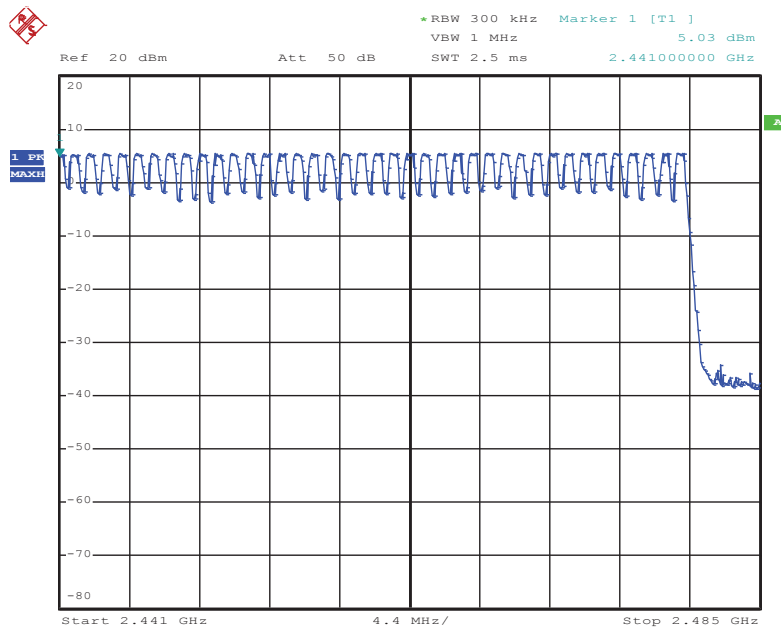


Date: 10.DEC.2012 14:48:02

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Figure 11: Hopping Frequencies up to 2459.5MHz, Mode G (Hopping)



Date: 10.DEC.2012 14:50:03

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5.1.6 Average Time of Occupancy, FCC 15.247(a)(1)(iii) and RSS-210 A8.1(d)

RESULT:

PASS

Date of testing: 2012-12-13

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.

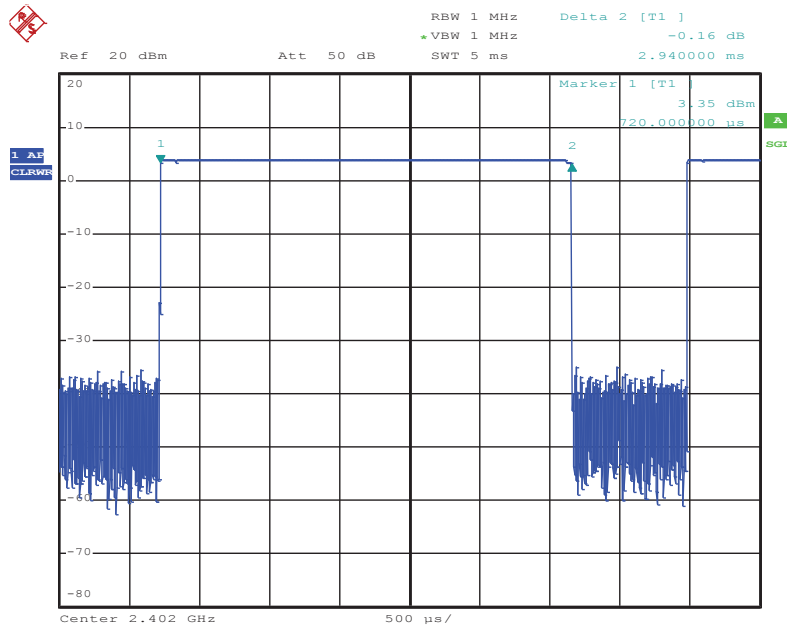
A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth and video bandwidth were set to 1MHz. The average time of occupancy was obtained by measuring first the dwell time of a single packet with the Delta Marker function using a zero span centered on a hopping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

Table 10: 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	2M-DH5	2.94	106.81	314.02	400
Mid	2M-DH5	2.96	106.81	316.15	400
High	2M-DH5	2.95	106.81	315.08	400

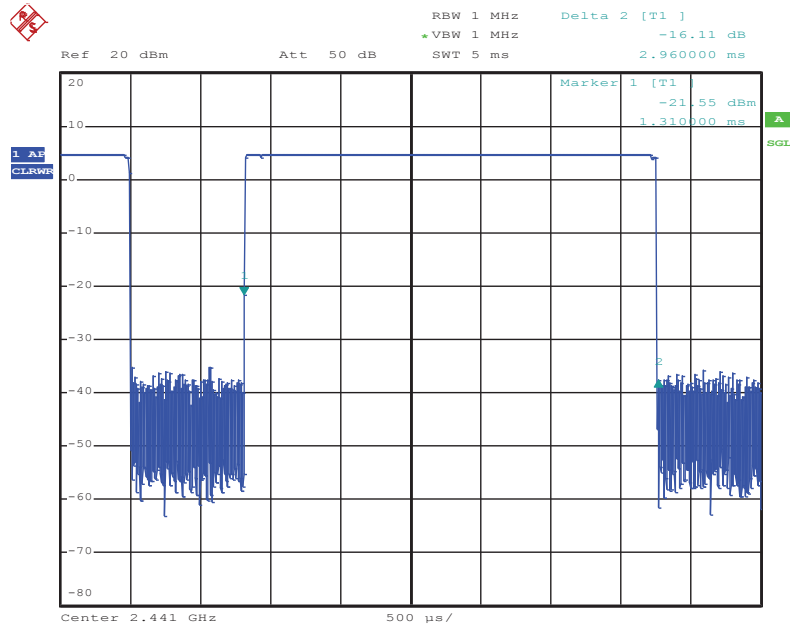
Notes: Average time of occupancy = Packet duration * Number of hops per channel in a 31.6s period

Figure 12: Dwell Time, Mode G (Hopping), 2M-DH5, Low channel



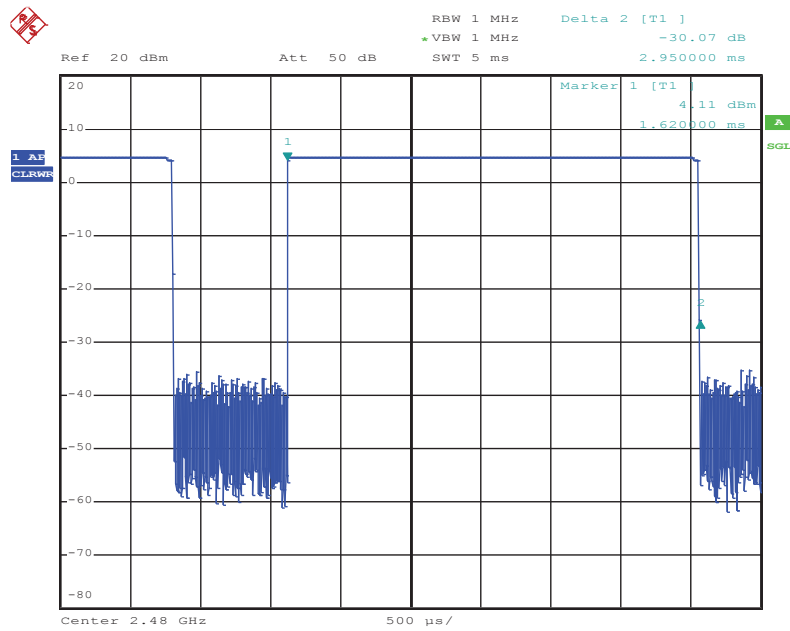
Date: 13.DEC.2012 10:32:00

Figure 13: Dwell Time, Mode G(Hopping), 2M-DH5, Mid channel



Date: 13.DEC.2012 10:34:28

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



Date: 13.DEC.2012 10:36:22

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5.1.7 Conducted Spurious Emission, FCC 15.247(d) and RSS-210 A8.5

RESULT: **PASS**

Date of testing: 2012-12-10

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, RSS-Gen 4.9 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 (10th harmonics).

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

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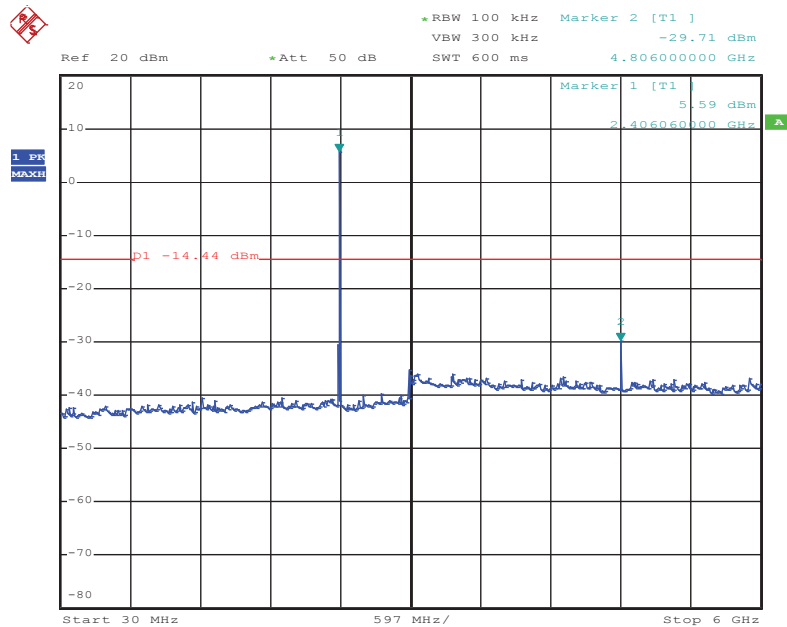
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Table 11: Conducted Spurious Emission, Mode A (2402MHz)

Frequency [MHz]	Reading [dBm]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
7200	-22.65	-22.65	-14.44	8.21
4806	-29.71	-29.71	-14.44	15.27
2406.06	5.59	5.59	N/A	N/A

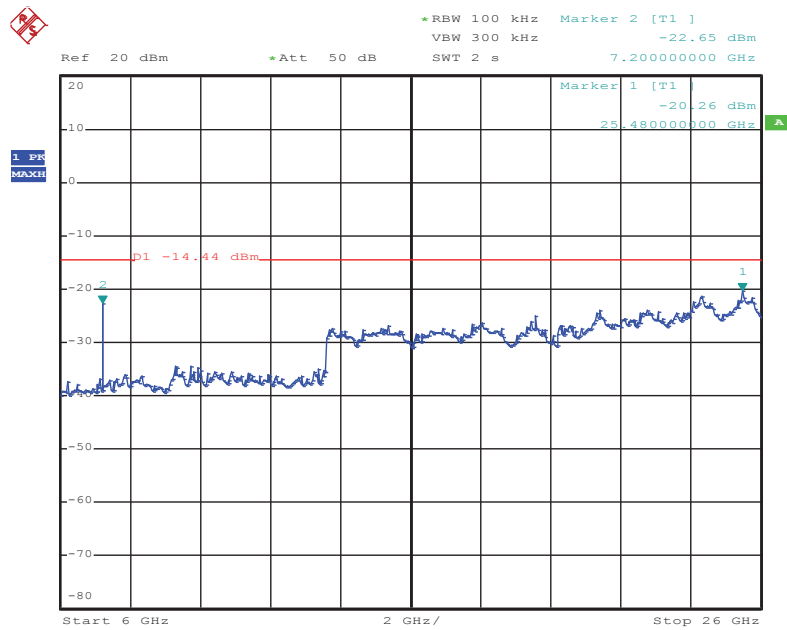
Notes: Cable loss was included in reading as offset.
Limit = Reading of fundamental + Correction factor – 20dB

Figure 15: Conducted Spurious Emission, 30MHz – 6GHz, Mode A (2402MHz)



Date: 10.DEC.2012 17:37:04

Figure 16: Conducted Spurious Emission, 6 – 26GHz, Mode A (2402MHz)



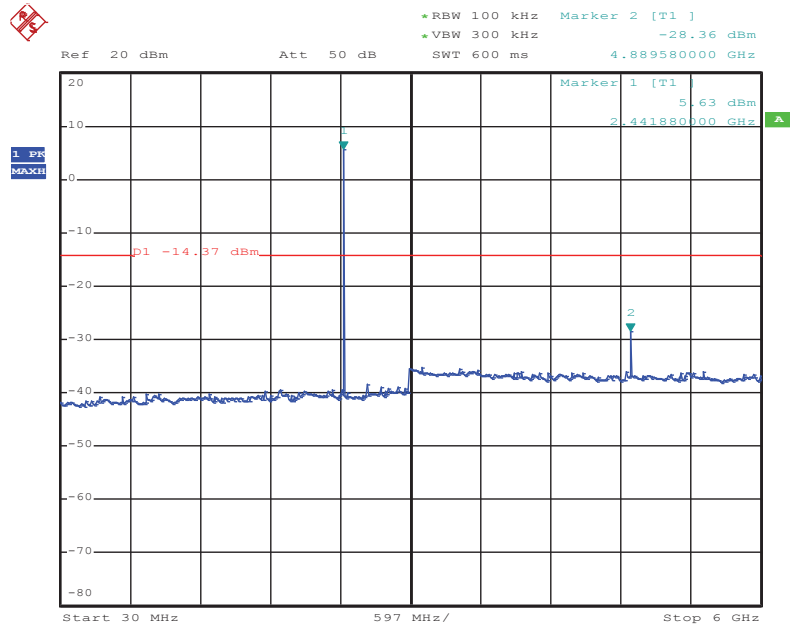
Date: 10.DEC.2012 17:38:00

Table 12: Conducted Spurious Emission, Mode B (2441MHz)

Frequency [MHz]	Reading [dBm]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
22680	-21.72	-21.72	-14.37	7.35
7320	-25.21	-25.21	-14.37	10.84
4889.5	-28.36	-28.36	-14.37	13.99
2441.88	5.63	5.63	NA	N/A

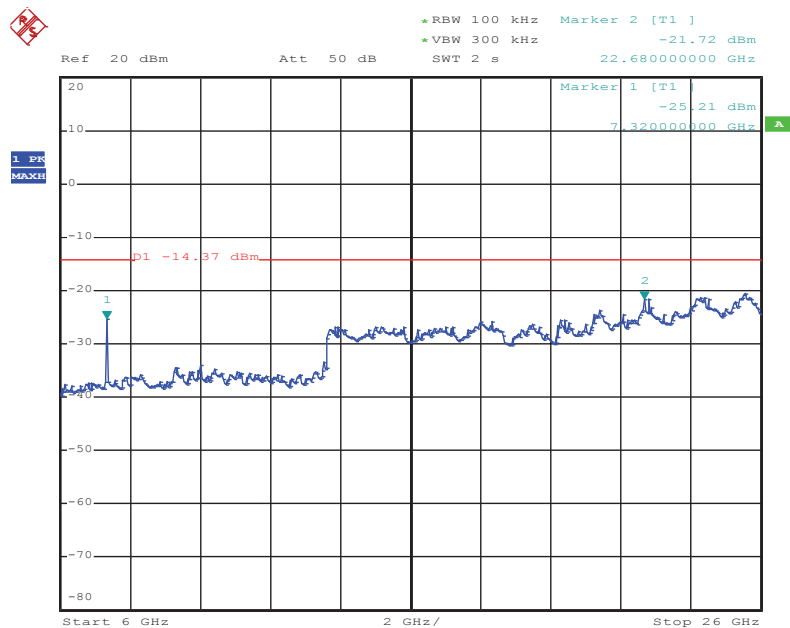
Notes: Cable loss was included in reading as offset.
Limit = Reading of fundamental + Correction factor – 20dB

Figure 17: Conducted Spurious Emission, 30MHz – 6GHz, Mode B (2441MHz)



Date: 7.DEC.2012 17:22:51

Figure 18: Conducted Spurious Emission, 6 – 26GHz, Mode B (2441MHz)



Date: 7.DEC.2012 17:25:18

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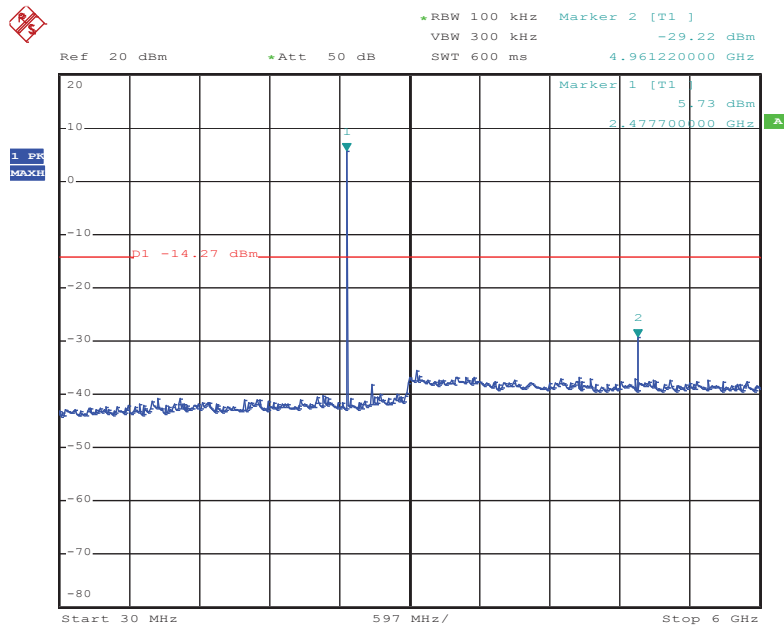
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Table 13: Conducted Spurious Emission, Mode C (2480MHz)

Frequency [MHz]	Reading [dBm]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
4961.2	-29.22	-29.22	-14.27	14.95
2477.7	5.73	5.73	N/A	N/A

Notes: Cable loss was included in reading as offset.
Limit = Reading of fundamental + Correction factor – 20dB

Figure 19: Conducted Spurious Emission, 30MHz – 6GHz, Mode C (2480MHz)

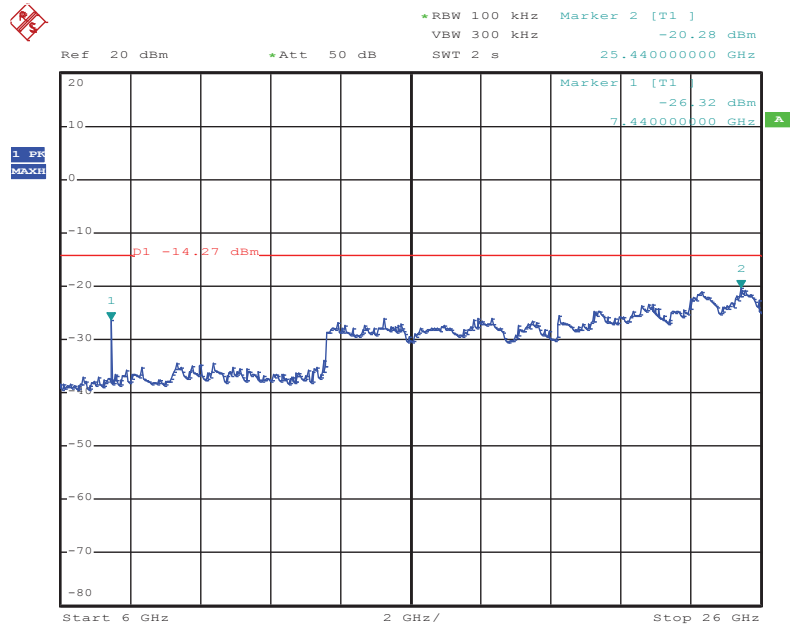


Date: 10.DEC.2012 17:43:27

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Figure 20: Conducted Spurious Emission, 6 – 25GHz, Mode C (2480MHz)



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5.1.8 Band Edge Compliance of RF Conducted Emission, FCC 15.247(d) and RSS-210 A8.5

RESULT:

PASS

Date of testing: 2012-12-11

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.

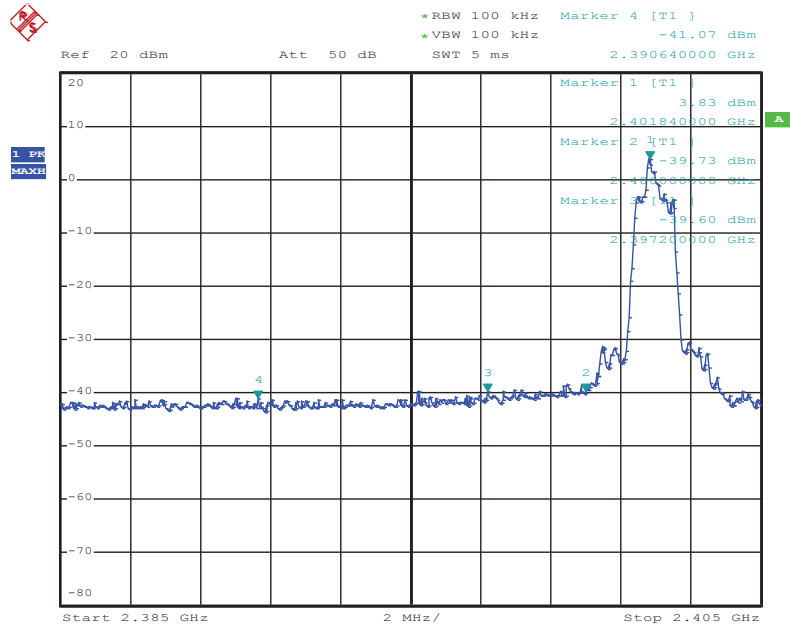
Test procedure:

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.

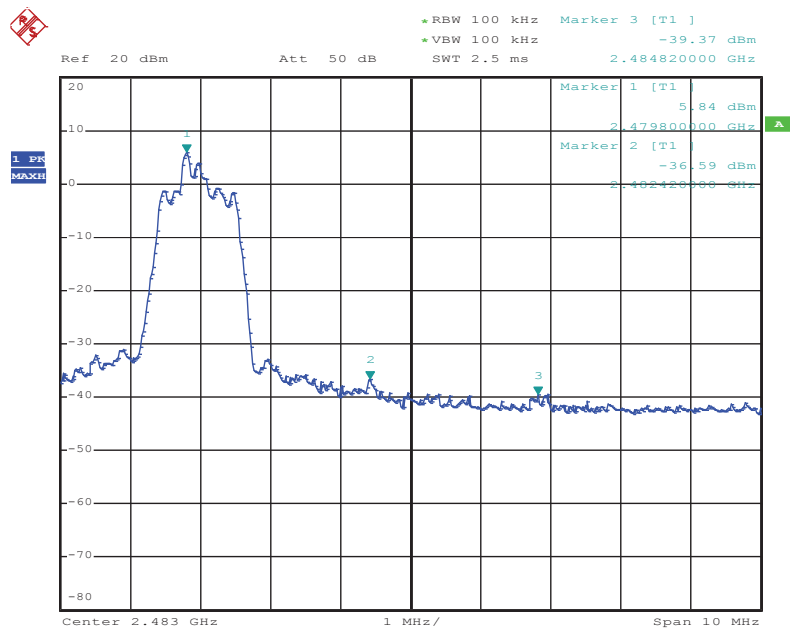
The final measurement takes into account the loss generated by all the involved cables.

Figure 21: Lower Band Edge Conducted, Hopping Disabled



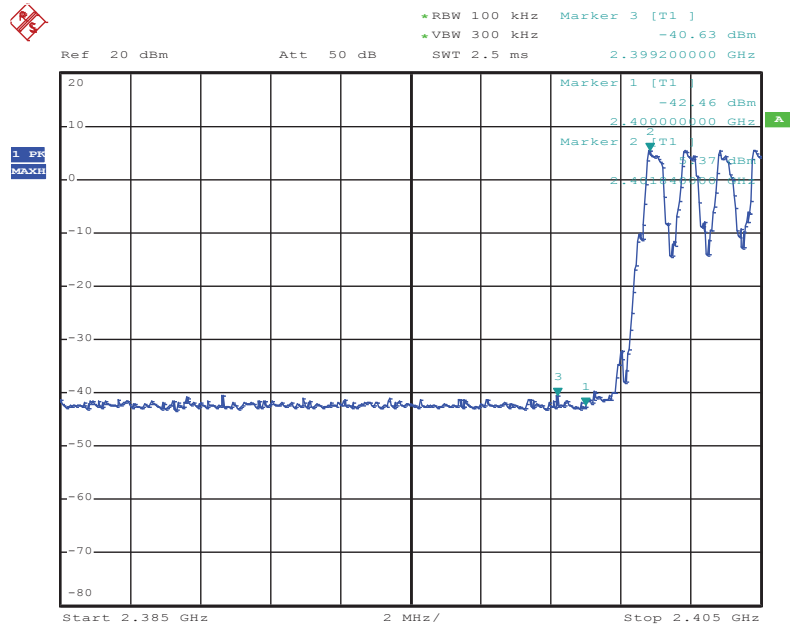
Date: 11.DEC.2012 16:30:27

Figure 22: Upper Band Edge Conducted, Hopping Disabled



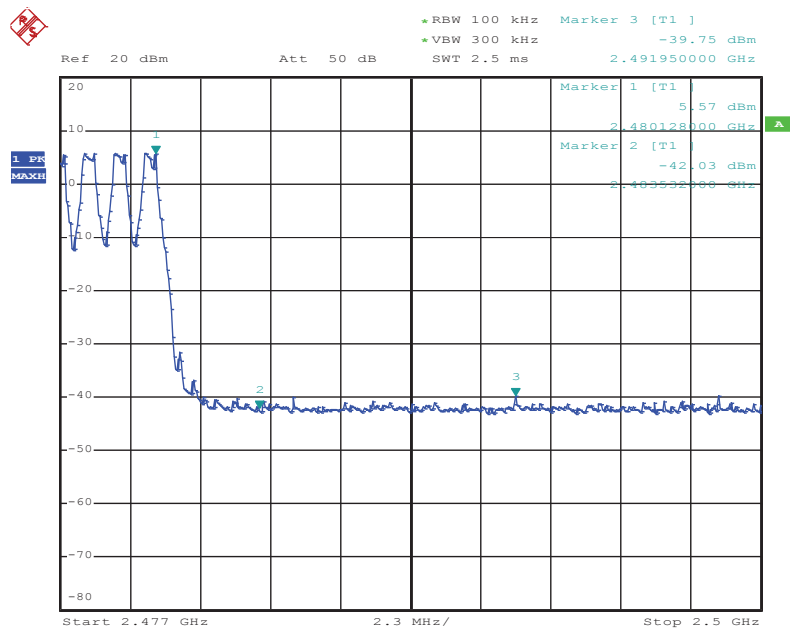
Date: 7.DEC.2012 14:03:32

Figure 23: Lower Band Edge Conducted, Hopping Enabled



Date: 10.DEC.2012 15:17:47

Figure 24: Upper Band Edge Conducted, Hopping Enabled



Date: 10.DEC.2012 15:25:30

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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), RSS-210 2.2, RSS-210 2.6 and RSS-210 A8.5

RESULT:

Pass

Date of testing: 2012-12-07

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 RSS-210 2.7 (Table 1), must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-210 2.7 (Table 2 and 3).

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.

Table 14: Band Edge Radiated Emission

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Horizontal	2390.000	57.097	26.382	-16.903	74.000	30.715	PK
2	Horizontal	2399.898	62.586	31.876	-11.414	74.000	30.710	PK
3	Horizontal	2401.780	98.988	68.278	N/A	N/A	30.710	PK

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Horizontal	2390.000	43.520	12.805	-10.480	54.000	30.715	AV
2	Horizontal	2399.898	50.316	19.606	-3.684	54.000	30.710	AV
3	Horizontal	2401.780	98.801	68.091	N/A	N/A	30.710	AV

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Vertical	2390.000	57.377	26.662	-16.623	74.000	30.715	PK
2	Vertical	2399.898	60.327	29.617	-13.673	74.000	30.710	PK
3	Vertical	2401.800	96.165	65.455	N/A	N/A	30.710	PK

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Vertical	2390.000	43.453	12.738	-10.547	54.000	30.715	AV
2	Vertical	2399.898	48.269	17.559	-5.731	54.000	30.710	AV
3	Vertical	2401.840	95.818	65.108	N/A	N/A	30.710	AV

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Horizontal	2479.806	97.614	66.884	N/A	N/A	30.730	PK
2	Horizontal	2483.500	60.172	29.442	-13.828	74.000	30.730	PK
3	Horizontal	2484.900	58.712	27.982	-15.288	74.000	30.730	PK

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Horizontal	2479.829	97.552	66.822	N/A	N/A	30.730	AV
2	Horizontal	2483.500	46.988	16.258	-7.012	54.000	30.730	AV
3	Horizontal	2484.900	45.528	14.798	-8.472	54.000	30.730	AV

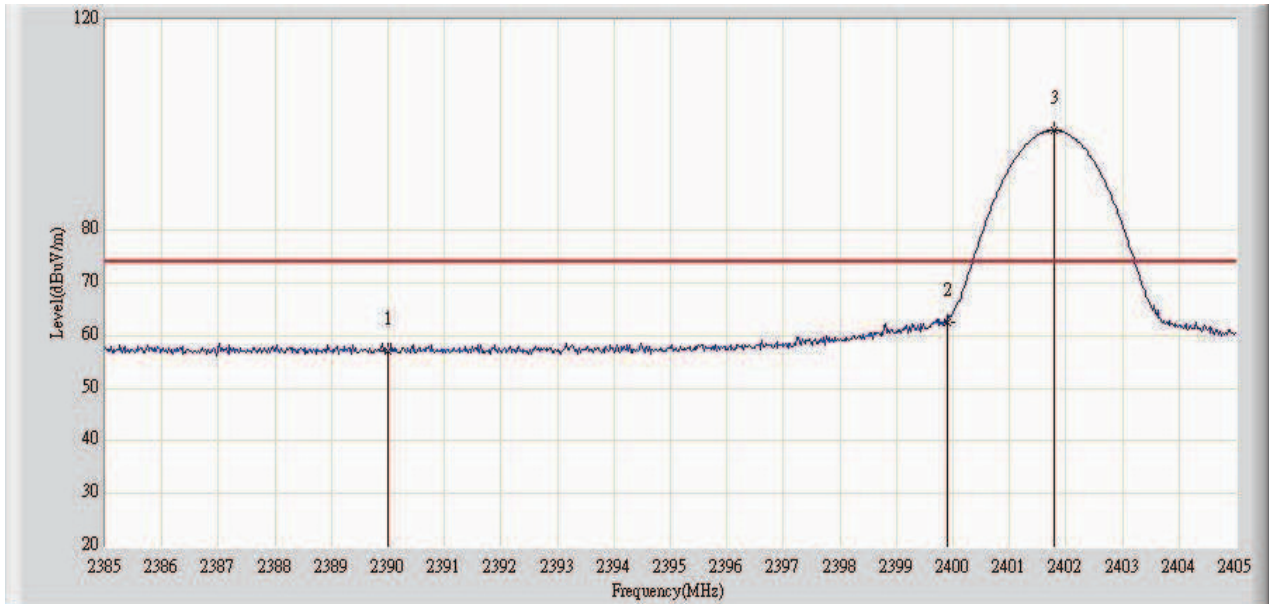
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Vertical	2479.806	94.894	64.164	N/A	N/A	30.730	PK
2	Vertical	2483.500	59.250	28.520	-14.750	74.000	30.730	PK
3	Vertical	2484.900	58.002	27.272	-15.998	74.000	30.730	PK

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Vertical	2479.875	94.757	64.027	N/A	N/A	30.730	AV
2	Vertical	2483.500	46.135	15.405	-7.865	54.000	30.730	AV
3	Vertical	2484.900	44.943	14.213	-9.057	54.000	30.730	AV

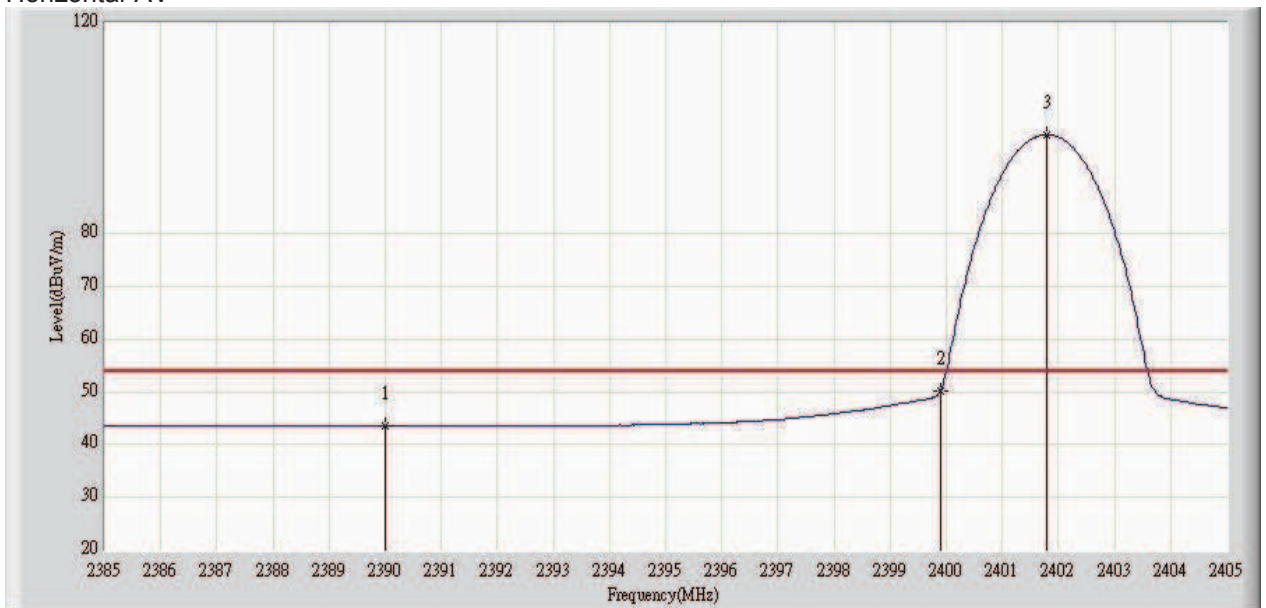
Notes: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.
Average limit in dBuV/m is calculated as follows: Average limit = 20 x log(500uV/m).
Peak limit in dBuV/m is calculated as follows: Peak limit = Average limit + 20dB.

Figure 25: Band Edge Radiated Emission, Spectral Diagram, Mode A (2402MHz)

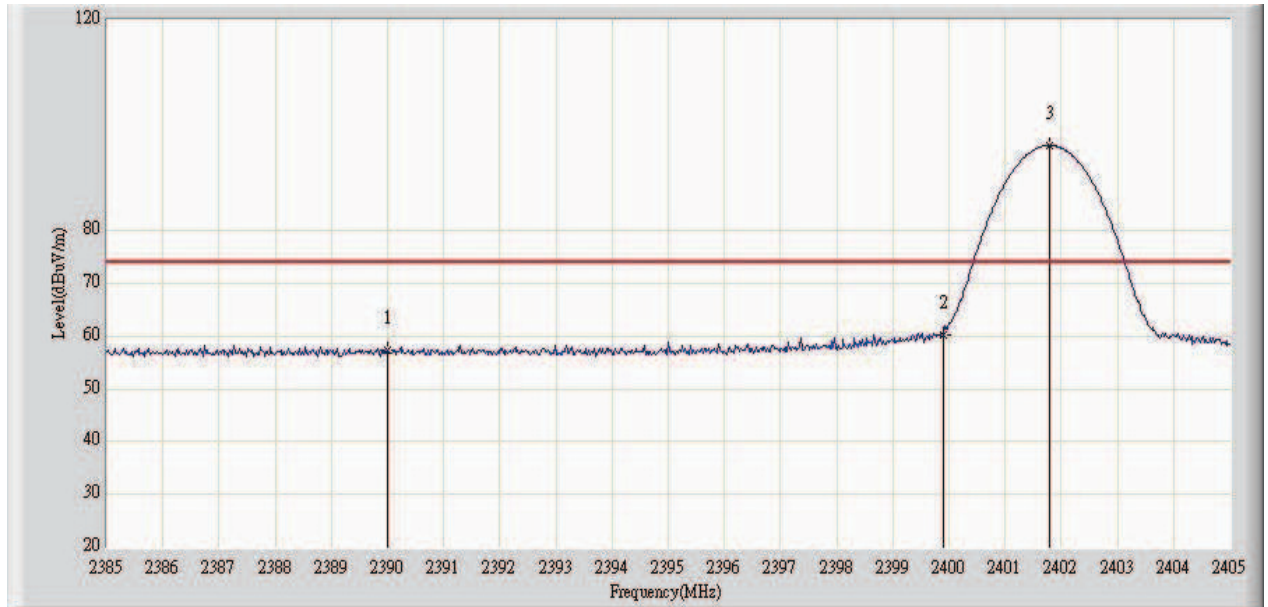
Horizontal-PK



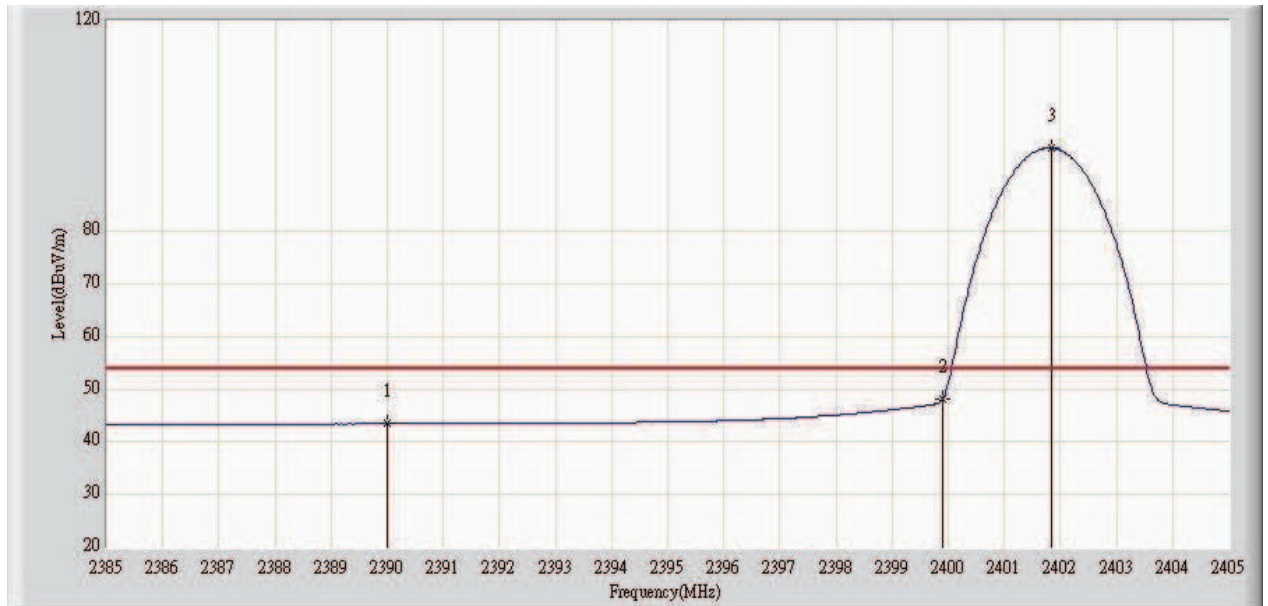
Horizontal-AV



Vertical-PK



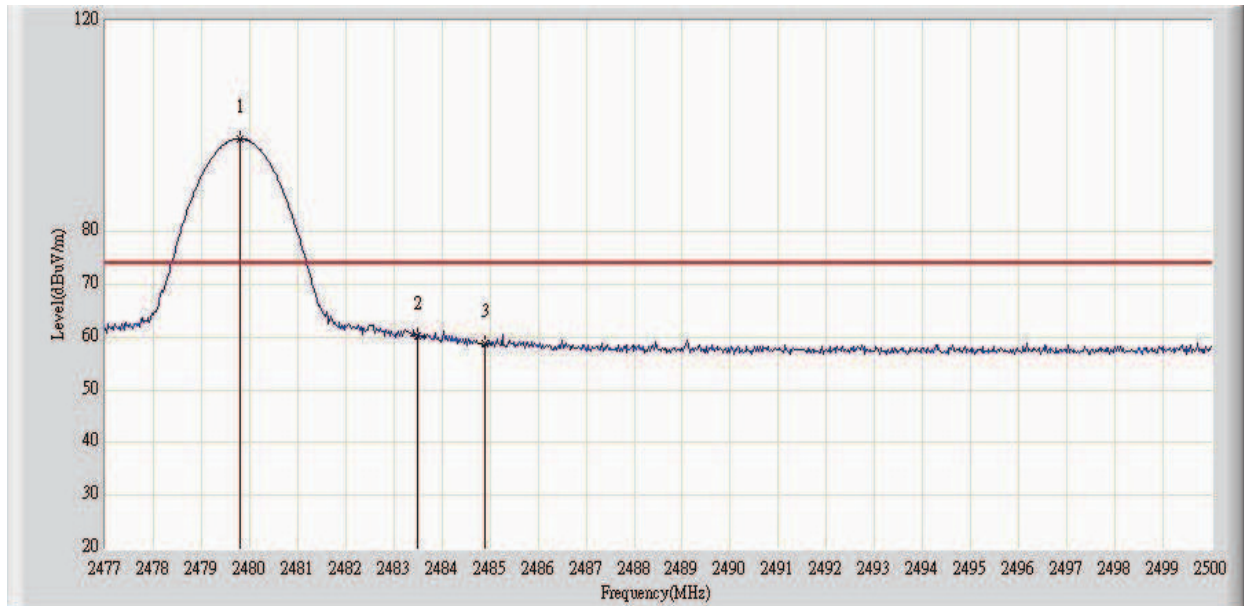
Vertical-AV



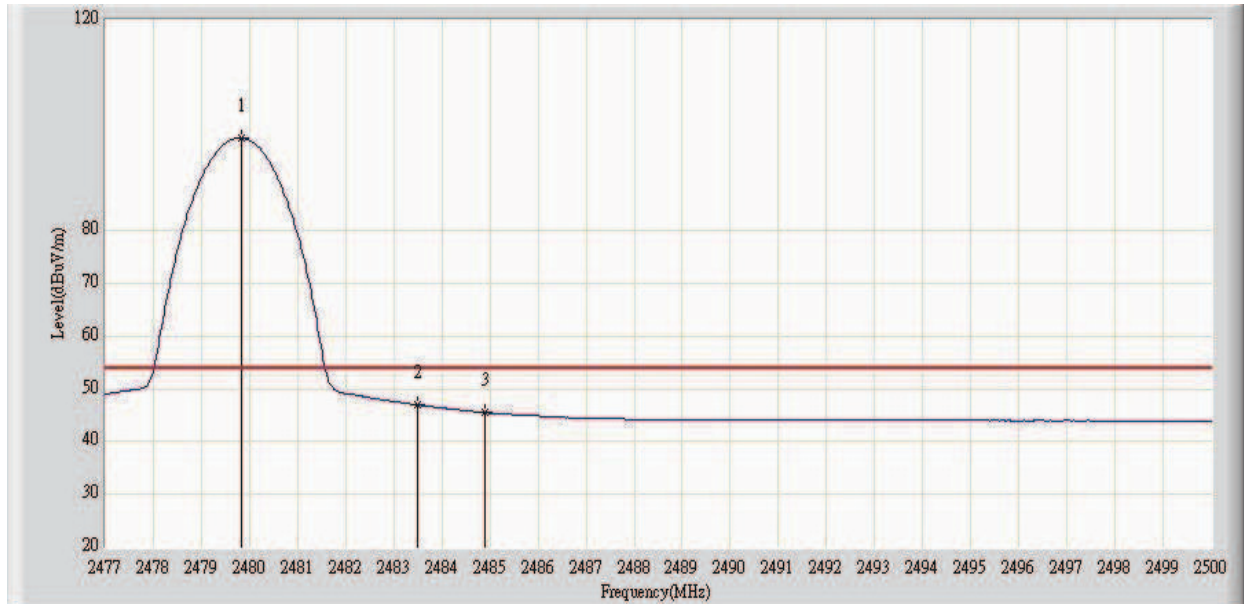
Note: The upper diagram shows the vertical peak value and the lower diagram shows the horizontal value.

Figure 26: Band Edge Radiated Emission, Spectral Diagram, Mode C (2480MHz)

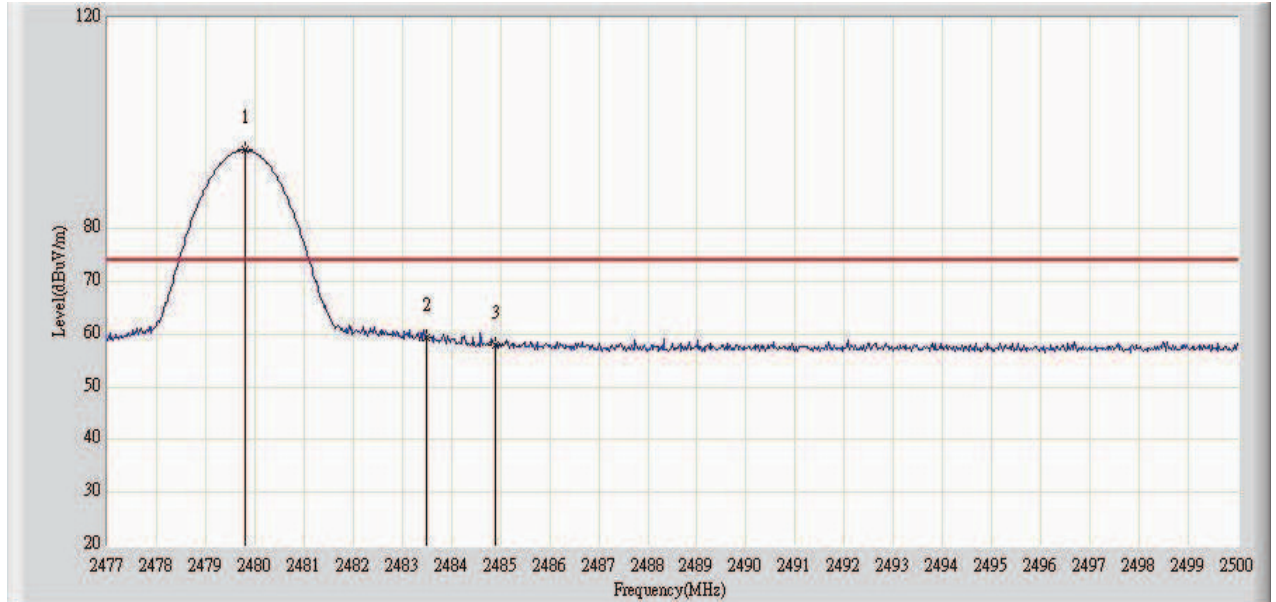
Horizontal-PK



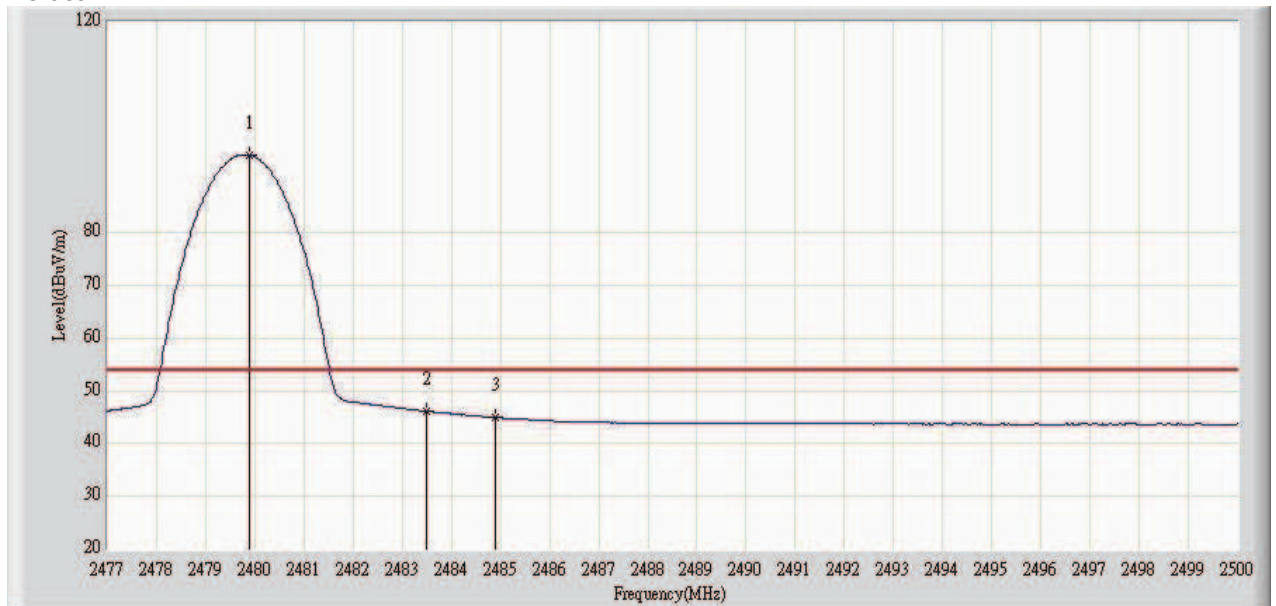
Horizontal-AV



Vertical -PK



Vertical -AV



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), RSS-210 2.2, RSS-210 2.6 and RSS-210 A8.5

RESULT: **PASS**

Date of testing:	2012-11-26
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) and RSS-210 2.7 (Table 1), must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-210 2.7 (Table 2 and 3).

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. 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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Table 15: Radiated Emission, Average and Peak Data, 1 – 25GHz, Horizontal and Vertical Antenna Orientations, Mode A (2402MHz)

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Horizontal	7205.000	52.978	56.028	-21.022	74.000	-3.050	PK
2	Vertical	7205.000	54.785	57.835	-19.215	74.000	-3.050	PK
3	Vertical	7205.330	52.892	55.941	-1.108	54.000	-3.049	AV

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)

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Horizontal	7323.000	50.087	52.781	-23.913	74.000	-2.694	PK
2	Vertical	7324.000	52.918	55.608	-21.082	74.000	-2.690	PK
3	Vertical	-	-	-	-	-	-	-

Table 17: Radiated Emission, Average and Peak Data, 1 – 25GHz, Horizontal and Vertical Antenna Orientations, Mode B (2441MHz)

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Horizontal	7440.000	48.376	50.695	-25.624	74.000	-2.318	PK
2	Vertical	4961.000	46.862	57.802	-27.138	74.000	-10.940	PK
3	Vertical	7443.000	50.854	53.164	-23.146	74.000	-2.310	PK

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 Receiver, FCC 15.109, RSS-210 2.2, RSS-210 2.6, RSS-210 A8.5, RSS-Gen 7.2.3.2

RESULT:

PASS

Date of testing:	2012-11-26
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) and RSS-210 Table 2 (and RSS-Gen Table 1).

Test procedure:

ANSI C63.4-2003 and RSS-Gen 4.10.

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. emission in mode D, E, F . all signals found in the pre-testing were more than 20 dB below the limit .

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6.3 Test Results of AC Power Line Conducted Measurements

6.3.1 AC Power Line Conducted Emission, FCC 15.207 and RSS-Gen7.2.2

RESULT: **PASS**

Date of testing: 2012-11-26

Ambient temperature: 23.5°C

Relative humidity: 45%

Atmospheric pressure: 101.5hPa

Frequency range: 0.15MHz –30MHz

Measurement distance: N/A

Kind of test site: Shielded Room

Requirements:

The AC power line conducted emission on any frequency within the band 150 kHz to 30MHz shall not exceed the limits specified in FCC 15.207 and RSS-Gen 7.2.2.

Test procedure:

ANSI C63.4-2003.

The EUT was placed on a wooden table raised 80cm above the reference ground plane. A vertical conducting plane of the screened room was located 40cm to the rear of the EUT. The AC adapter of the EUT was connected to a Line Impedance Stabilization Network (LISN).

The physical arrangement of the test system and associated cabling was varied to determine the effect on the EUT's emissions in amplitude and frequency in order to ensure that maximum emission amplitudes were attained.

The measurements were performed with the receiver operating in the CISPR quasipeak and average detection modes.

No disturbances found or not detectable.

Prüfbericht - Nr.: 15057486 001
Test Report No.:

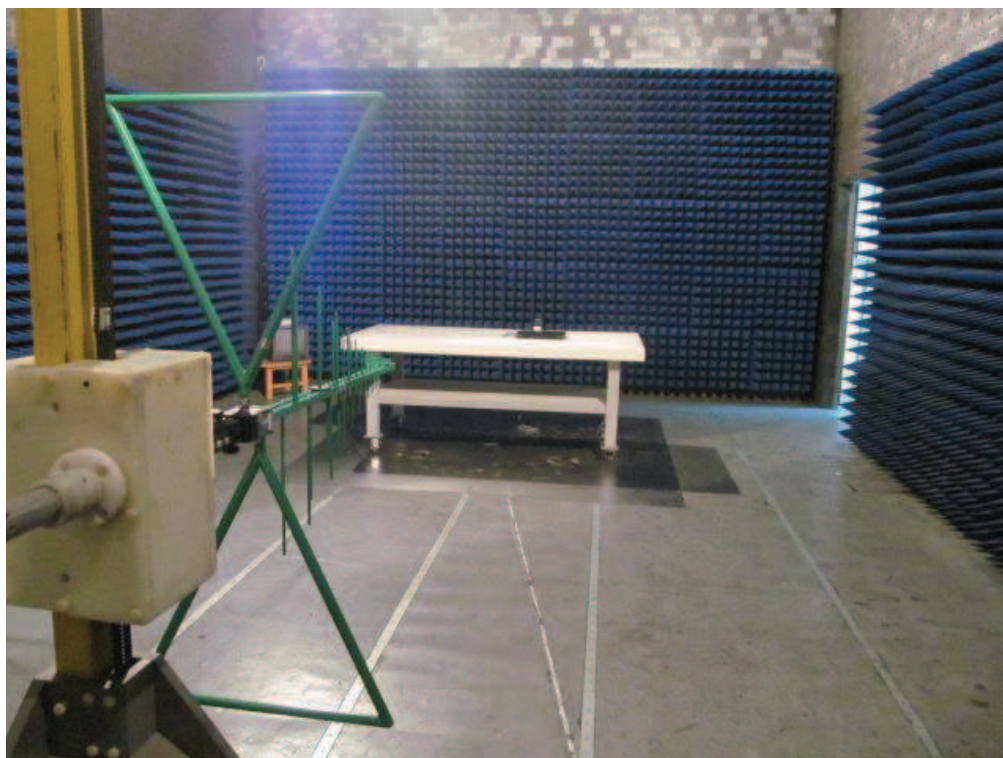
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7. Photographs of the Test Setup

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



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



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