Produkte
Products

TÜVRheinland®

Prüfbericht - Nr.: 15059842 001

Test Report No.:

Auftraggeber: *Client:*	**Cambridge Executive Limited** St John's Innovation Centre Cowley road Cambridge CB4 0WS
Gegenstand der Prüfung: *Test item:*	**Bluetooth Module 4.0 dual mode**
Bezeichnung: *Identification:*	**BC127 ;BC127-A;BC127-Cxx** **FCC ID :SSSBC127-X**
Serien-Nr.: *Serial No.:*	**N/A**
Wareneingangs-Nr.: *Receipt No.:*	**154021705**
Eingangsdatum: *Date of receipt:*	**2013-3-1**
Zustand des Prüfgegenstandes bei Anlieferung: *Condition of test item at delivery:*	**Test sample(s) is/are not damaged and suitable for testing.**
Prüfort: *Testing location:*	• **TÜV Rheinland (Shanghai) Co., Ltd.** • **QuieTek Technology(Suzhou)Co., Ltd.** **(Detailed address refer to clause 2.1)**
Prüfgrundlage: *Test specification:*	**FCC 47 CFR Part 15, Subpart C, § 15.247** **ANSI C63.4-2009** **ANSI C63.10-2009** **KDB 558074 D01 DTS Meas Guidance v02** **Public Notice DA 00-705：Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems (March 30, 2000)**
Prüfergebnis: *Test Result:*	**Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n).** *The test item passed the test specification(s).*
Prüflaboratorium: *Testing Laboratory:*	**TÜV Rheinland (Shanghai) Co., Ltd.** Building 2, No. 777 Guangzhong Road West, Shanghai 200072, P.R. China

geprüft/ *tested by:*

2013-04-05	Shili / Inspector	shi li
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

kontrolliert/ *reviewed by:*

2013-04-05	Jesse Huang / Reviewer	Jesse Huang
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

Sonstiges/ *Other Aspects:*

Abkürzungen:				*Abbreviations:*			
	P(ass)	=	*entspricht Prüfgrundlage*		*P(ass)*	=	*passed*
	F(ail)	=	*entspricht nicht Prüfgrundlage*		*F(ail)*	=	*failed*
	N/A	=	*nicht anwendbar*		*N/A*	=	*not applicable*
	N/T	=	*nicht getestet*		*N/T*	=	*not tested*

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)& (3) 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 AND 6DB&99% BANDWIDTH, FCC 15.247(A)(1)& (2) AND RSS-210 A8.2(A)

5.1.4 NUMBER OF HOPPING FREQUENCIES, FCC 15.247(A)(1)(III) AND RSS-210 A8.1(D)
RESULT: *PASS*

5.1.5 AVERAGE TIME OF OCCUPANCY, FCC 15.247(A)(1)(III) AND RSS-210 A8.1(D)
RESULT: *PASS*

5.1.6 POWER SPECTRAL DENSITY (PSD), FCC 15.247(E) AND RSS-210 A8.2
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*

CONTENTS

1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report.

2. Test Sites

2.1 Test Facilities

QuieTek Technology(Suzhou)Co.,Ltd.
No.99 Hongye RD.Suzhou Industnal 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 800392.

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 4075B.

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

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 4.0 dual mode
Max output power:	7.11dBm
Antenna gain:	0dBi
Antenna type:	Ceramic antenna
Antenna cable length:	N/A
Frequency range:	2402 – 2480MHz
EDR Number of channels：	79
BLE Number of channels:	40
EDR Channel spacing:	1MHz
BLE Channel spacing:	2MHz
Modulation type:	EDR （GFSK; π/4-DQPSK ;8DPSK）BLE（GFSK）
Rated voltage:	3.3V
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.

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 C63.4:2009.

Bluetooth BDR and EDR mode :
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.

Bluetooth LE 4.0 mode:
Testing was performed at the lowest operating frequency (2402MHz), at the operating frequency in the middle of the specified frequency band (2442MHz) and at the highest operating frequency (2480MHz) with different modulation types.

Bluetooth BDR and EDR mode basic operation in (GFSK; π/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 (2402MHz), continuously.
E. EUT receives (RX mode), at middle channel (2441MHz), continuously.
F. EUT receives (RX mode), at highest channel (2480MHz), continuously.

EUT transmits on pseudo-random sequence on all channels (hopping mode).

Bluetooth 4.0 BLE mode basic operation in :

G. EUT transmits (TX mode), with full power, at lowest channel (2402MHz), a continuous modulated signal streaming with 100% duty cycle.
H. EUT transmits (TX mode), with full power, at middle channel (2442MHz), a continuous modulated signal streaming with 100% duty cycle.
I. EUT transmits (TX mode), with full power, at highest channel (2480MHz), a continuous modulated signal streaming with 100% duty cycle.
J. EUT receives (RX mode), at lowest channel (2402MHz), continuously.
K. EUT receives (RX mode), at middle channel (2442MHz), continuously.
L. EUT receives (RX mode), at highest channel (2480MHz), continuously.

3.4 Noise Suppressing Parts

Refer to schematics and internal photos.

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

The test methods, which have been used, are based on ANSI C63.10-2009 and KDB 558074 D01 DTS Meas Guidance v02 and Public Notice DA 00-705 and ANSI C63.4-2009

For details, see under each test item.
Note : Bluetooth 4.0 BLE is following KDB 558074 D01 DTS Meas Guidance v02
Bluetooth 4.0 BDR and EDR is following Public Notice DA 00-705

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:
Two test sample was available:

For antennas conducted measurements with 50Ω connector and radiated measurements.more details, refer to section: Photographs of the Test Set-Up.

4.3 Test Operation and Test Software

Software used for testing: CSR Bluetest 3 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 PCB Development kit (Control the module).

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)& (3) and RSS-210 A8.4(2)

RESULT: **PASS**

Date of testing: 2013-3-5

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 C63.10-2009, RSS-Gen 4.8 and KDB 558074 D01 DTS Meas Guidance v02

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	0.83	0.63	3	0.83	21
2	0.82	0.63	3	0.82	21
3	0.79	0.69	3	0.79	21

Table 4: Conducted Output Power, Mode B (2442MHz)

Data Rate [Mbps]	Reading [dBm]	Correction Factor [dB]	RBW [MHz]	Output Power [dBm]	Limit [dBm]
1	3.58	0.63	3	3.58	21
2	3.43	0.63	3	3.43	21
3	3.56	0.69	3	3.56	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	1.28	0.63	3	1.28	21
2	1.19	0.63	3	1.19	21
3	1.26	0.69	3	1.26	21

Table 6: Conducted Output Power, Mode G (2402MHz)

Reading [dBm]	Correction Factor [dB]	RBW [MHz]	Output Power [dBm]	Limit [dBm]
5.69	0.63	3	5.69	30

Notes: Cable loss was included in reading as offset.

Table 7: Conducted Output Power, Mode H (2442MHz)

Reading [dBm]	Correction Factor [dB]	RBW [MHz]	Output Power [dBm]	Limit [dBm]
7.11	0.63	3	7.11	30

Notes: Cable loss was included in reading as offset.

Table 8: Conducted Output Power, Mode I (2480MHz)

Reading [dBm]	Correction Factor [dB]	RBW [MHz]	Output Power [dBm]	Limit [dBm]
6.15	0.63	3	6.15	30

Notes: Cable loss was included in reading as offset.

Remark:

The above results show that the BDR and EDR worst case output power is found at the data rate of 1Mbps. And the BLE worst case output power is Middle channel.

5.1.2 Carrier Frequency Separation, FCC 15.247(a)(1) and RSS-210 A8.1(b)

RESULT: **PASS**

Date of testing: 2013-3-5

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 C63.4-2009 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 9: Carrier Frequency Separation

Channel	Channel Separation [kHz]	20dB Bandwidth [kHz](8DPSK)	Limit [kHz]
Low	1002	1216	810.6
Middle	1004	1212	808
High	1001	1196	797.3

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

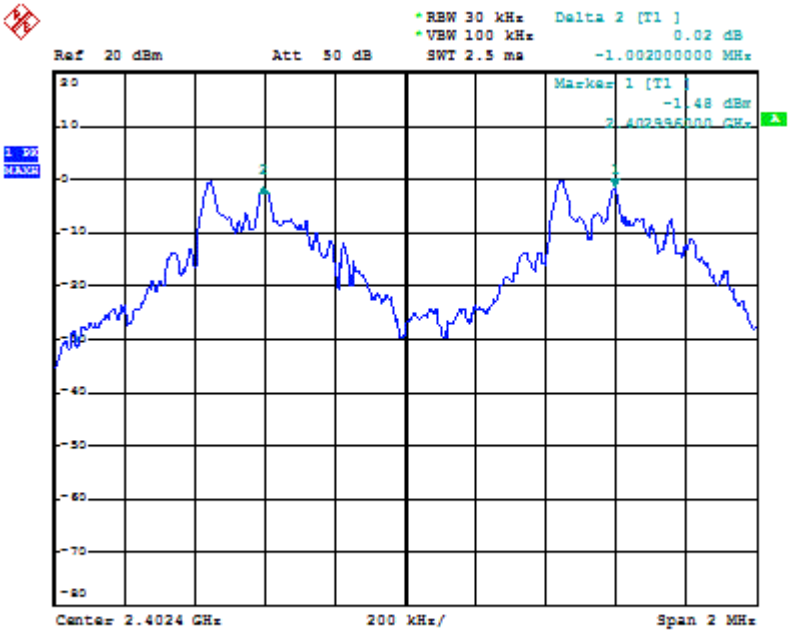


Figure 2: Carrier Frequency Separation-Middle Channel

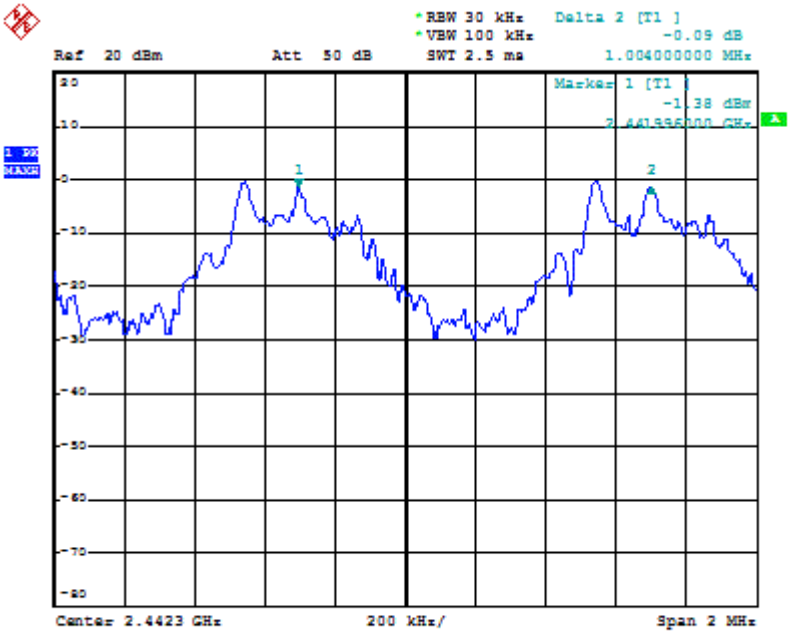
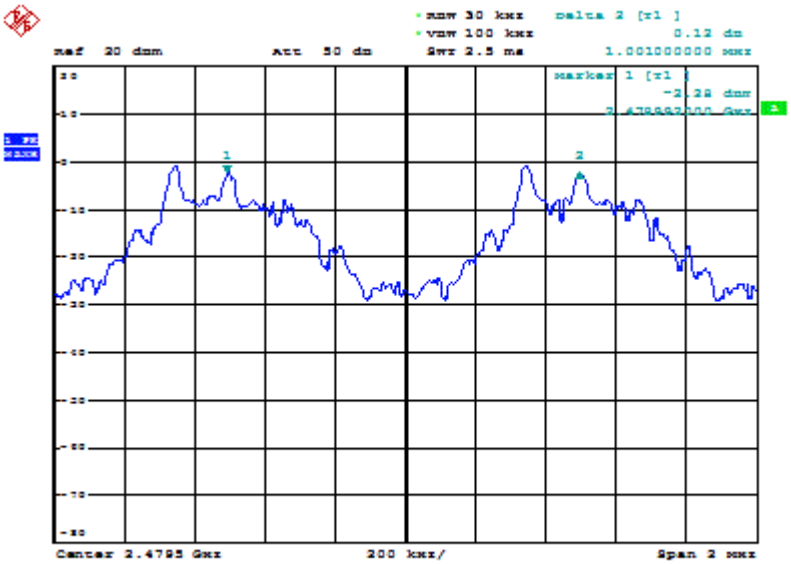


Figure 3: Carrier Frequency Separation-High Channel



5.1.3 20dB Bandwidth and 6dB&99% Bandwidth, FCC 15.247(a)(1)& (2) and RSS-210 A8.2(a)

Date of testing:	2013-3-5
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 C63.10-2009, RSS-Gen 4.6.2 and KDB 558074 D01 DTS Meas Guidance v02

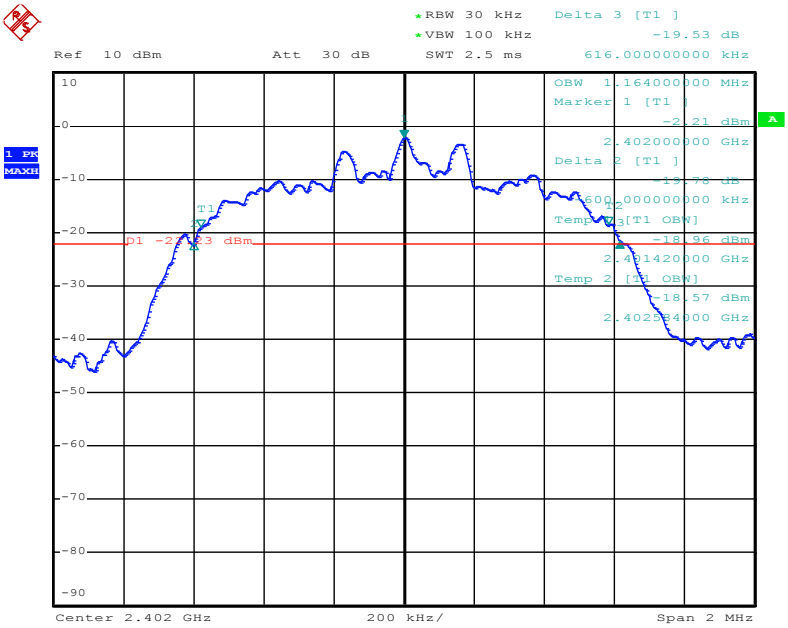
Public Notice DA 00-705.

A spectrum analyzer was connected to the antenna port of the EUT. The spectrum analyzer resolution bandwidth was set to 100kHz, the video bandwidth to 300kHz and the span to 2MHz.

Table 10: 20dB &99% Bandwidth（bluetoooth 4.0 BDR and EDR）

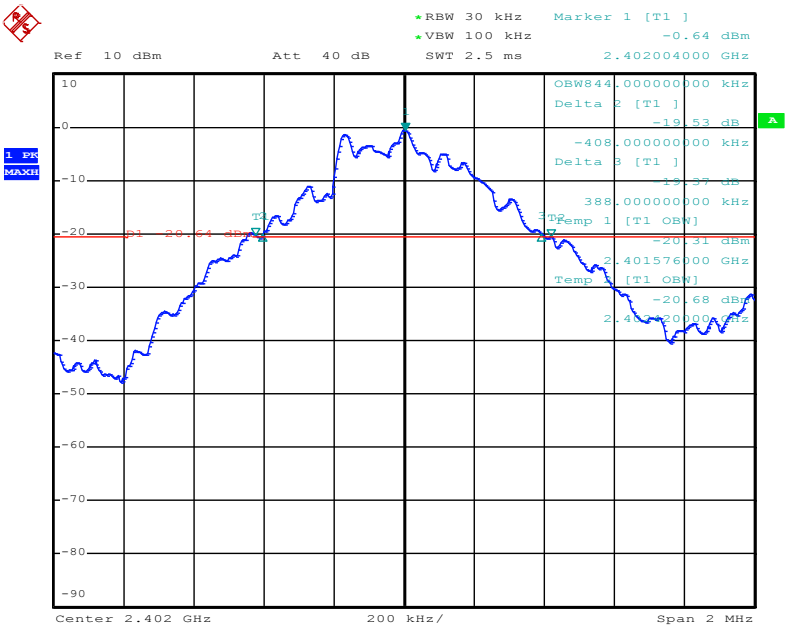
Operating Frequency [MHz]	20dB Bandwidth [kHz](8DPSK)	20dB Bandwidth [kHz](GFSK)	99% Bandwidth [kHz](8DPSK)	99% Bandwidth [kHz](GFSK)
2402	1216	796	1164	844
2441	1212	844	1168	844
2480	1196	828	1128	848

Figure 4: 20dB &99% Bandwidth, Mode A (2402MHz 8DPSK and GFSK)



Date: 4.MAR.2013 13:00:42

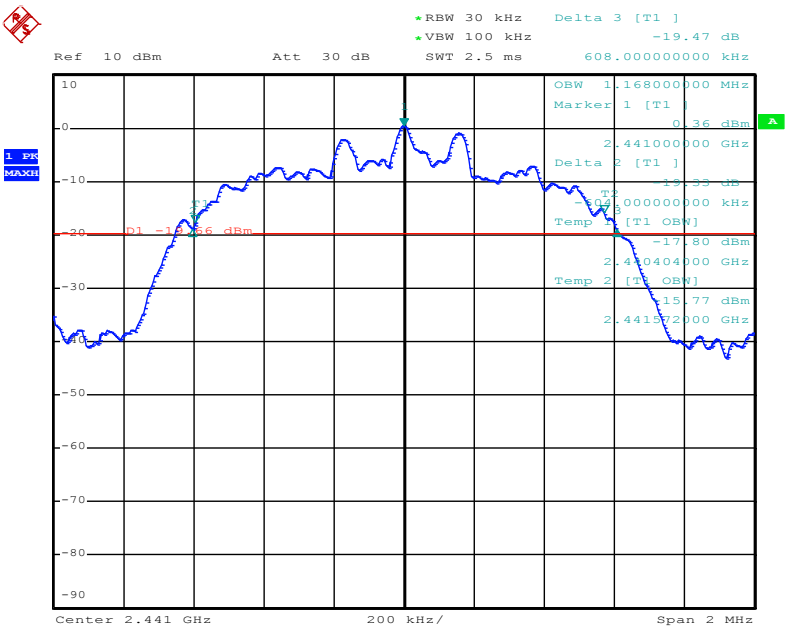
8DPSK



Date: 4.MAR.2013 12:51:02

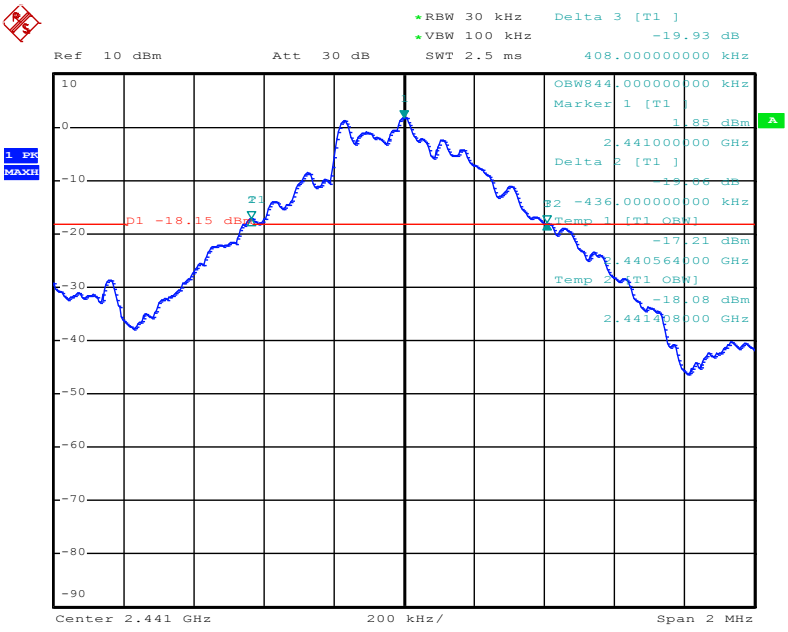
GFSK

Figure 5: 20dB Bandwidth, Mode B (2442MHz 8DPSK and GFSK)



Date: 4.MAR.2013 12:59:11

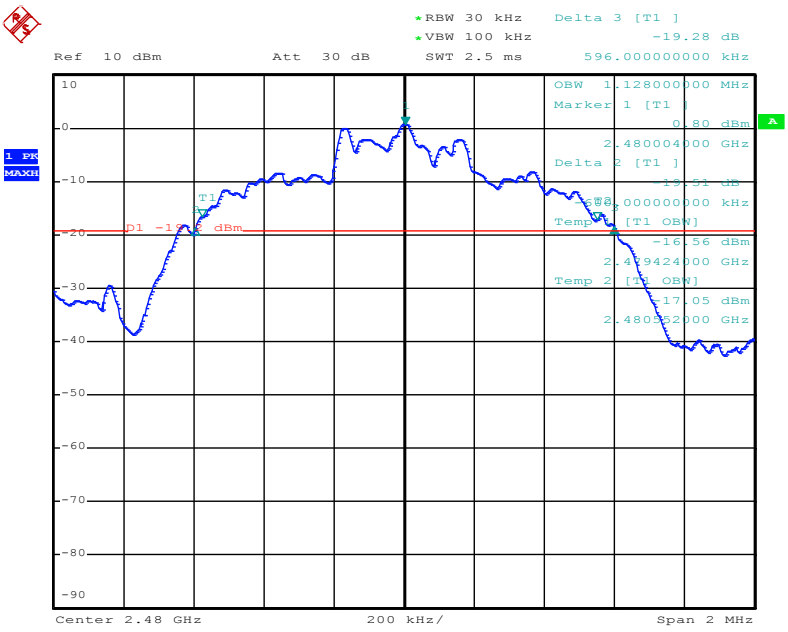
8DPSK



Date: 4.MAR.2013 12:53:39

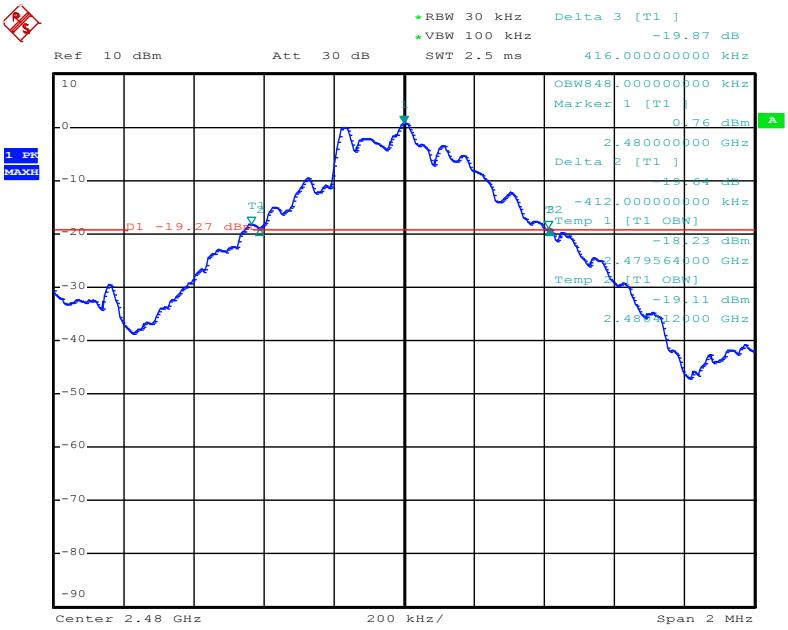
GFSK

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



Date: 4.MAR.2013 12:57:42

8DPSK



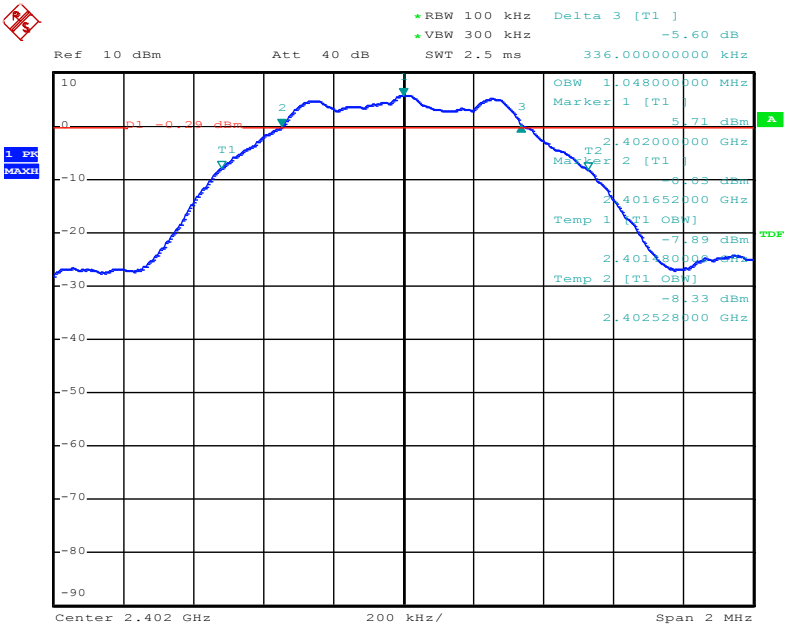
Date: 4.MAR.2013 12:55:43

GFSK

Table 11: 6dB&99% Bandwidth（Bluetooth 4.0 BLE）

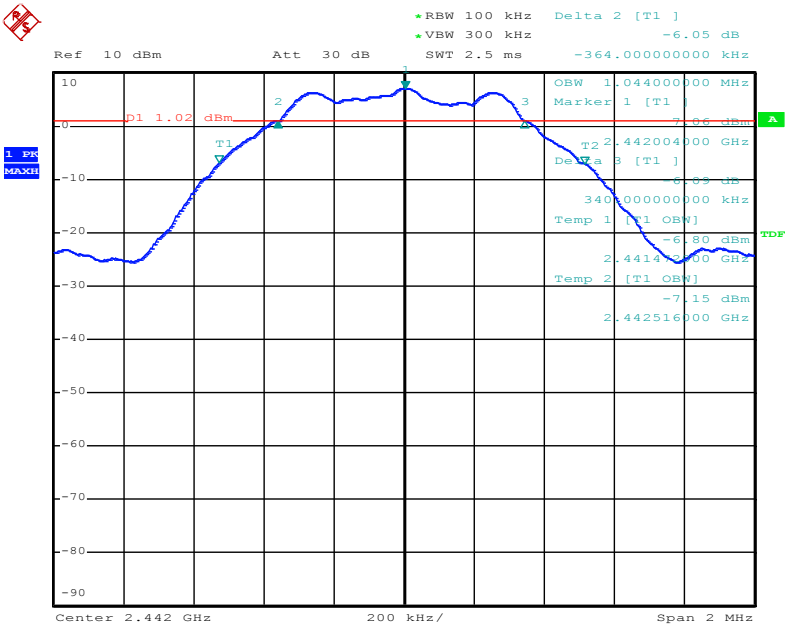
Operating Frequency [MHz]	99%dB Bandwidth[KHz]	6dB Bandwidth[KHz] limit 500KHz
2402	1048	684
2442	1044	704
2480	1044	720

Figure 7: 6dB &99%Bandwidth, Mode G



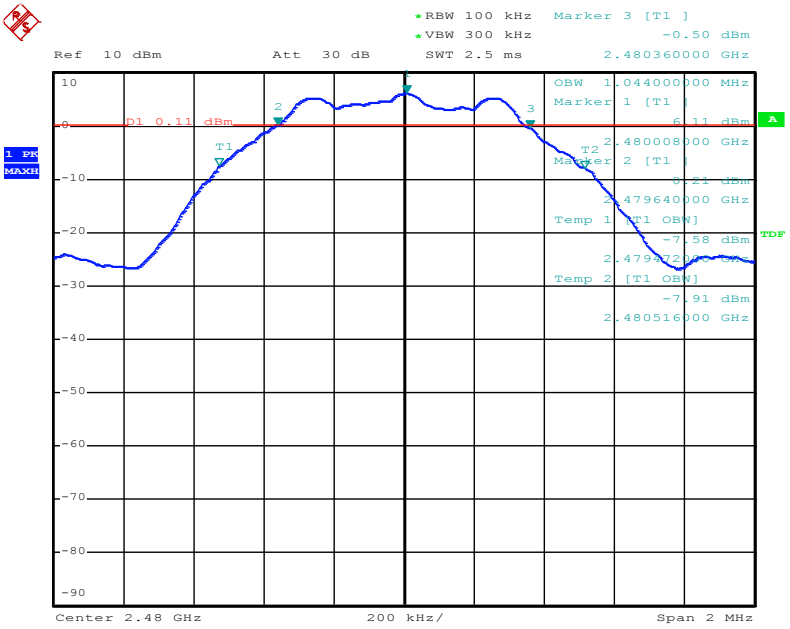
Date: 15.MAR.2013 15:10:34

Figure 8: 6dB &99%Bandwidth, Mode H



Date: 15.MAR.2013 15:12:49

Figure 9: 6dB &99%Bandwidth, Mode I



Date: 15.MAR.2013 15:14:57

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

RESULT: **PASS**

Date of testing:	2013-3-5
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:

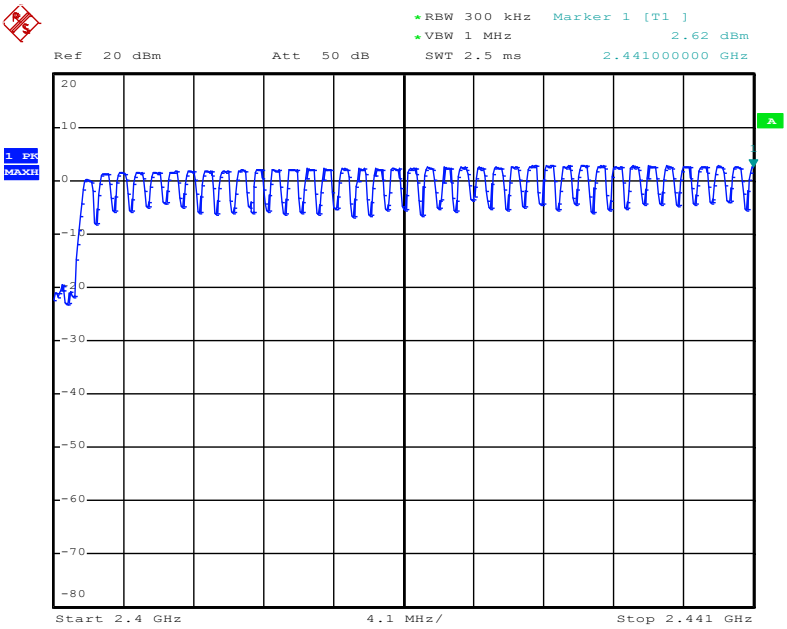
ANSI C63.4-2009 and Public Notice DA 00-705.

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.

Table 12: Number of Hopping Frequencies

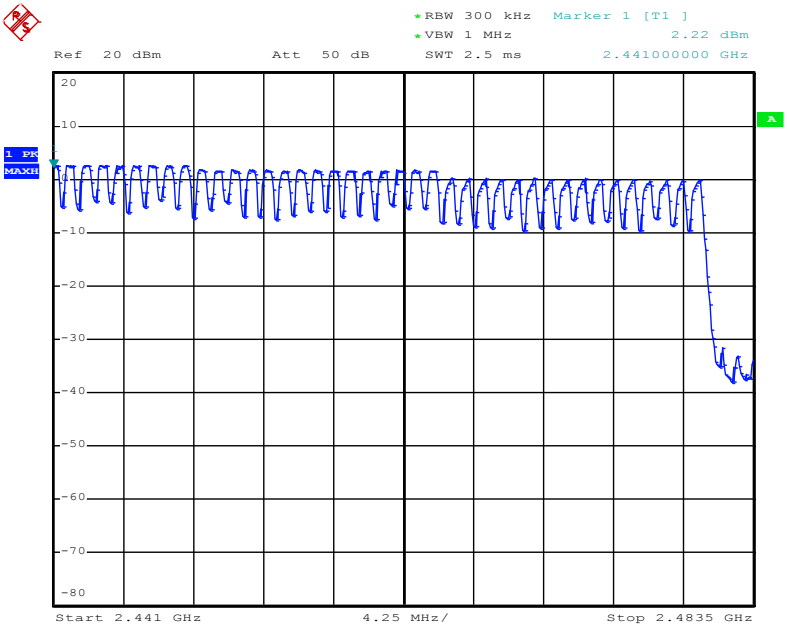
Number of Hopping Frequencies	Limit
79	15

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



Date: 5.MAR.2013 17:31:34

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



Date: 5.MAR.2013 17:32:49

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

RESULT: **PASS**

Date of testing: 2013-3-4

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 C63.4-2009 and Public Notice DA 00-705.

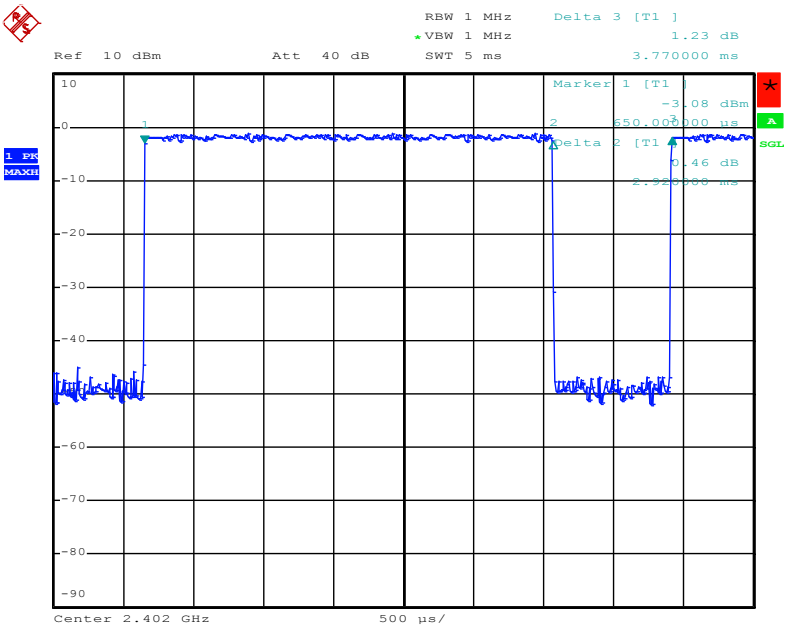
A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth and video bandwidth were set to 1MHz. The average time of occupancy was obtained by measuring first the dwell time of a single packet with the Delta Marker function using a zero span centered on a hopping 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 13: 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	1M-DH5	2.92	106.81	311.88	400
Mid	1M-DH5	2.92	106.81	311.88	400
High	1M-DH5	2.91	106.81	310.81	400

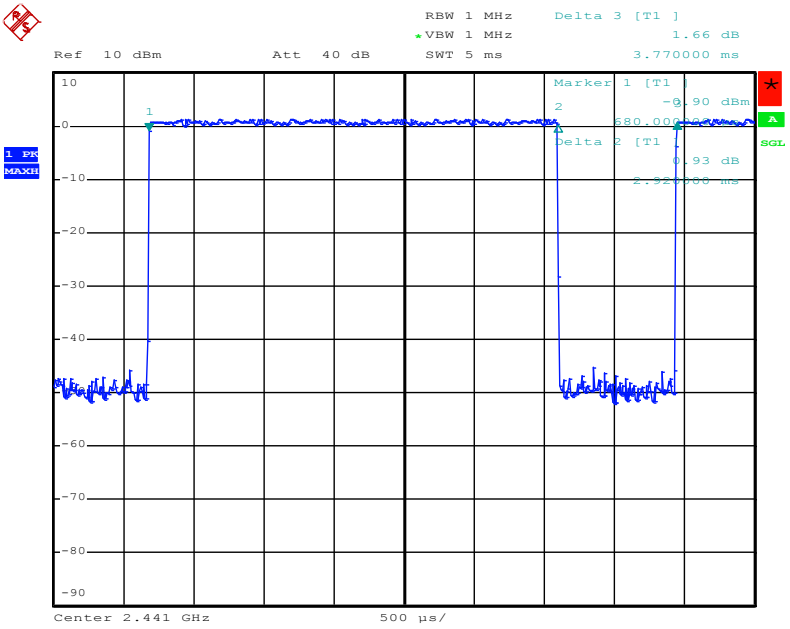
Notes: Average time of occupancy = Packet duration * Number of hops per channel in a 31.6s period

Figure 12: Dwell Time, Mode (Hopping), 1M-DH5, Low channel



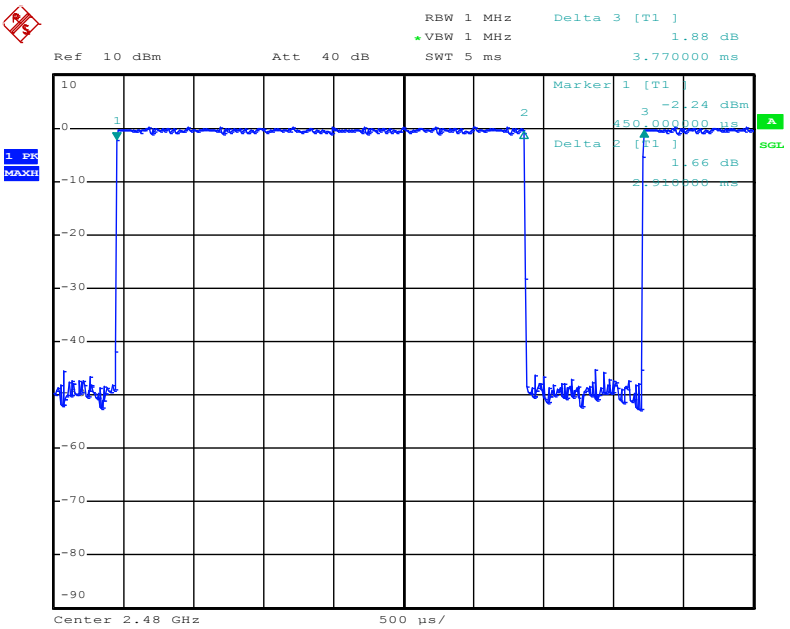
Date: 4.MAR.2013 13:04:15

Figure 13: Dwell Time, Mode (Hopping), 1M-DH5, Mid channel



Date: 4.MAR.2013 13:05:28

Figure 14: Dwell Time, Mode (Hopping), 1M-DH5, High channel



Date: 4.MAR.2013 13:06:25

5.1.6 Power Spectral Density (PSD), FCC 15.247(e) and RSS-210 A8.2

RESULT: **PASS**

Date of testing: 2013-3-5

Ambient temperature: 20°C
Relative humidity: 39.6%
Atmospheric pressure: 101.5hPa

Requirements:

According to FCC section 15.247(e) and RSS-A8.2(b), the same method of determining the conducted output power shall be used to determine the power spectral density. If a peak output power is measured, then a peak power spectral density measurement is required. If an average output power is measured, then an average power spectral density measurement should be used.

Test procedure:

KDB 558074 D01 DTS Meas Guidance v02

A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth was set to 100kHz.

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

Table 14: Power spectral density

Frequency [MHz]	Reading [dBm/100KHz]	PSD [dBm/3KHz]	Limit [dBm/3kHz]
Low	5.76	-9.44	8
Middle	7.06	-8.14	8
High	6.19	-9.01	8
Correction factor=10log(3KHZ/100KHz)=-15.2dBm			

Figure 15: Power spectral density, Mode G

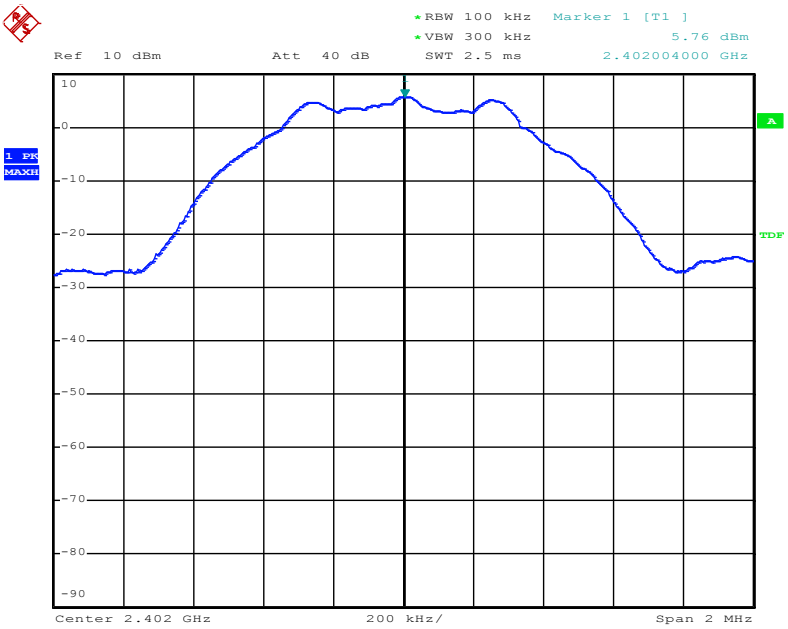
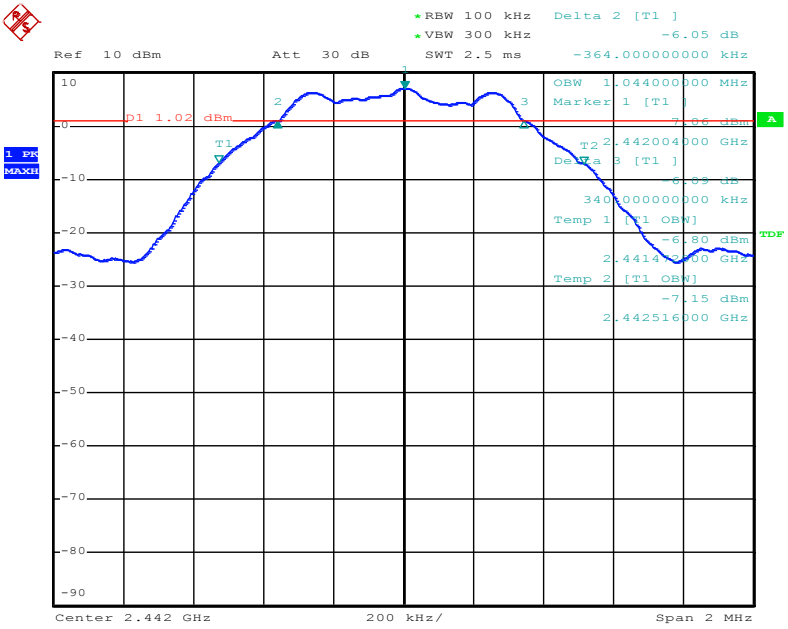
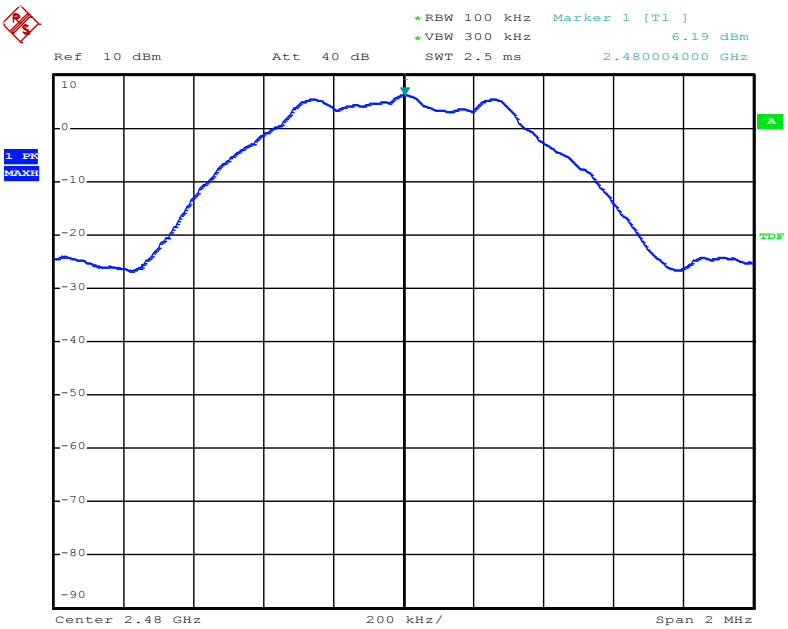


Figure 16: Power spectral density, Mode H



Date: 15.MAR.2013 15:12:49

Figure 17: Power spectral density, Mode I



Date: 15.MAR.2013 15:19:43

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

RESULT: **PASS**

Date of testing: 2013-3-5

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 C63.10-2009, RSS-Gen 4.9 and KDB 558074 D01 DTS Meas Guidance v02

Public Notice DA 00-705.

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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 26GHz (10^{th} harmonics).

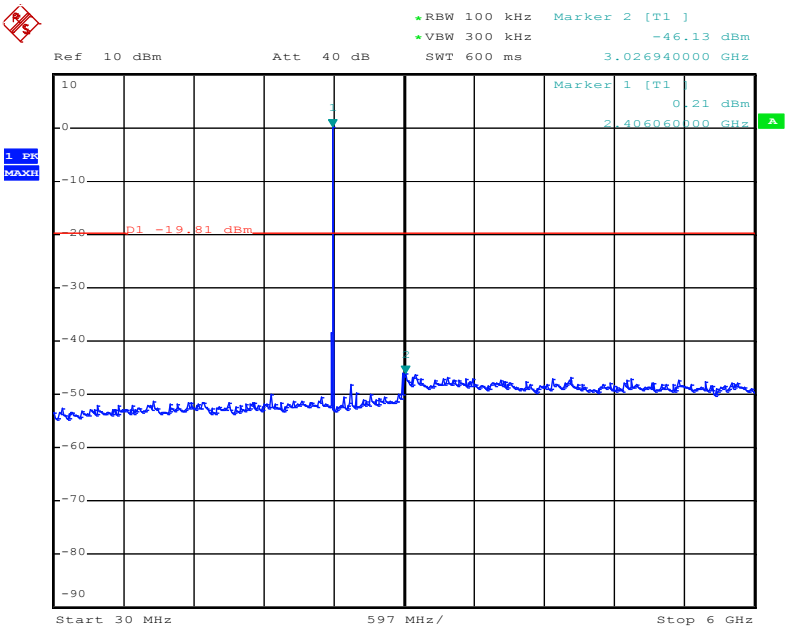
The final measurement takes into account the loss generated by all the involved cables.

Table 15: Conducted Spurious Emission, Mode A

Frequency [MHz]	Reading [dBm]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
25480	-31.26	-20.96	-19.81	11.45
N/A	N/A	N/A	-19.81	N/A
2402	0.21	0.21	N/A	N/A

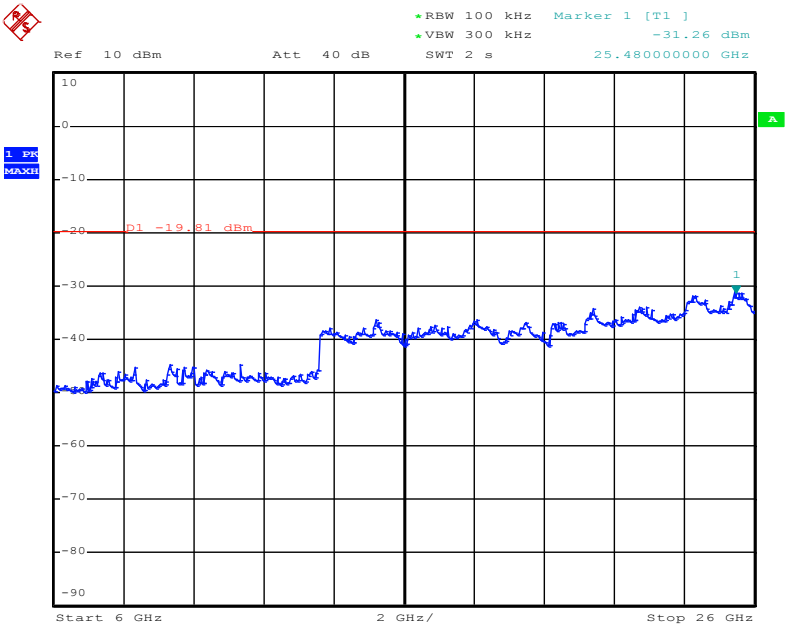
Notes: Cable loss was included in reading as offset.
Limit = Reading of fundamental + Correction factor – 20dB

Figure 18: Conducted Spurious Emission, 30MHz – 6GHz, Mode A



Date: 4.MAR.2013 13:20:19

Figure 19: Conducted Spurious Emission, 6 – 26GHz, Mode A



Date: 4.MAR.2013 13:20:59

Table 16: Conducted Spurious Emission, Mode B

Frequency [MHz]	Reading [dBm]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
25440	-31.01	-31.01	-19.03	11.98
3134	-46.25	-46.25	-19.03	27.22
2441	0.97	0.97	NA	N/A

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

Figure 20: Conducted Spurious Emission, 30MHz – 6GHz, Mode B

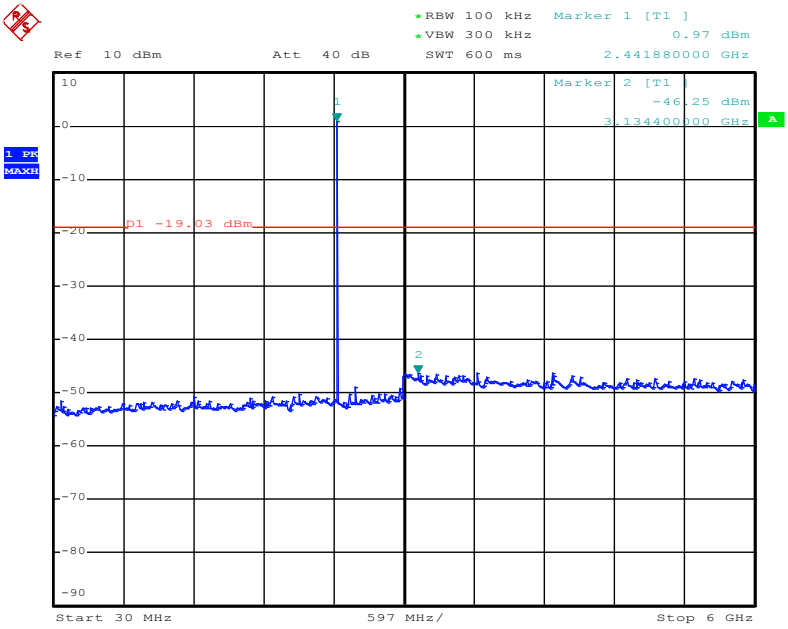


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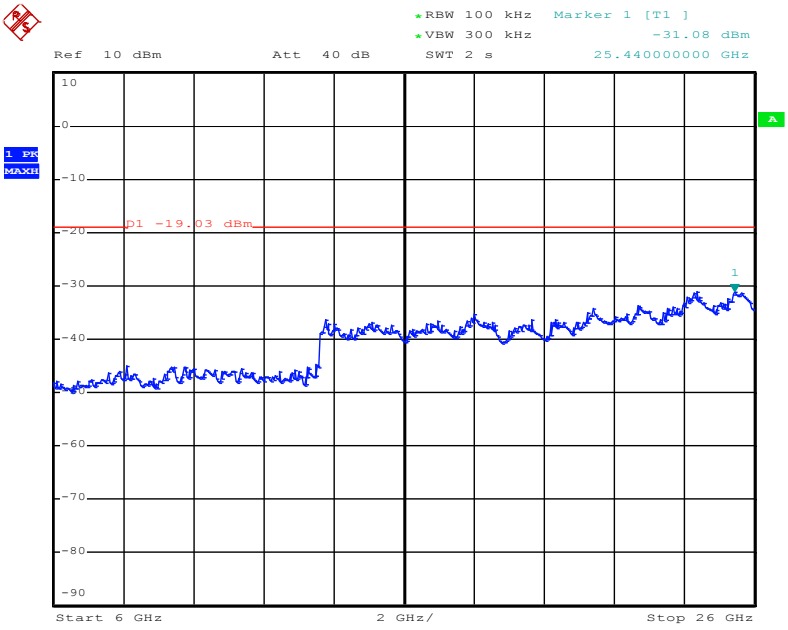
Figure 21: Conducted Spurious Emission, 6 – 26GHz, Mode B



Date: 4.MAR.2013 13:15:48

Table 17: Conducted Spurious Emission, Mode C

Frequency [MHz]	Reading [dBm]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
25440	-31.11	-31.11	-19.98	11.13
4292	-46.97	-46.97	-19.98	26.99
2480	0.02	0.02	N/A	N/A

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

Figure 22: Conducted Spurious Emission, 30MHz – 6GHz, Mode C

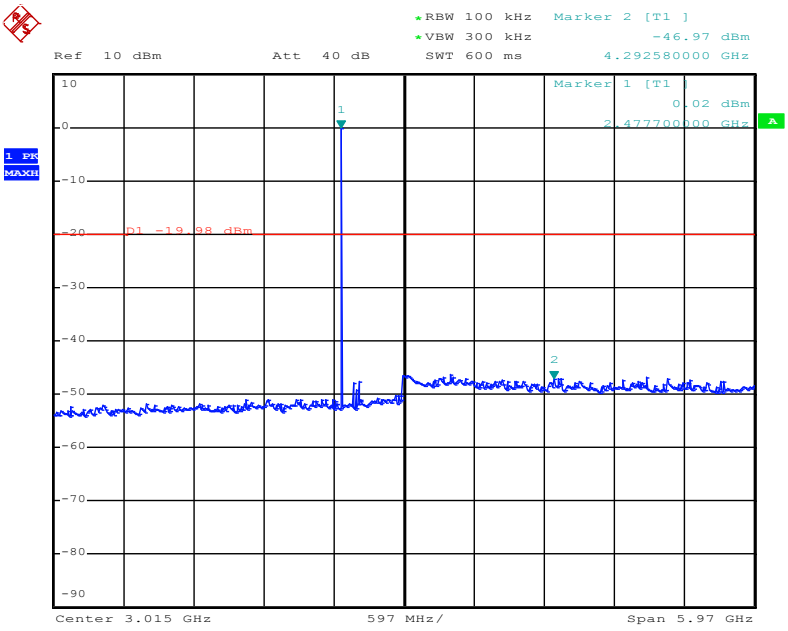


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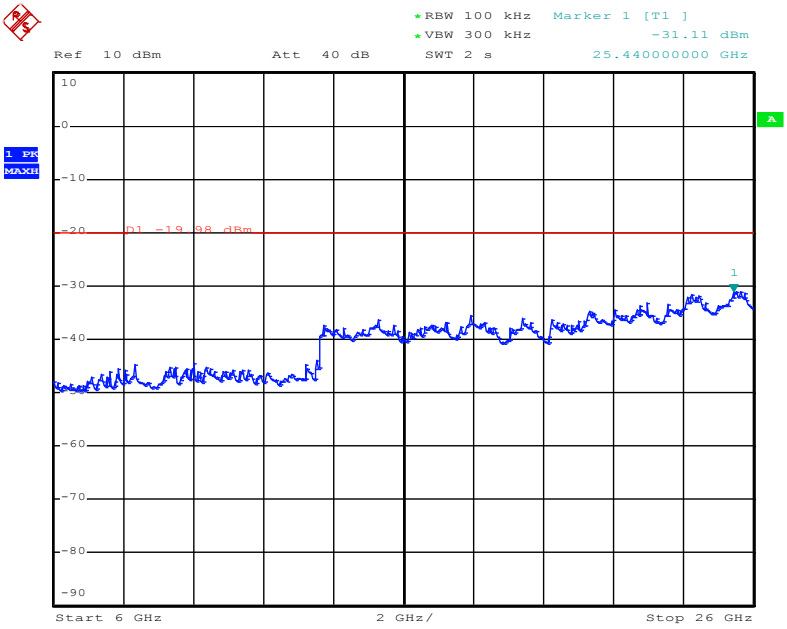
Figure 23: Conducted Spurious Emission, 6 – 26GHz, Mode C



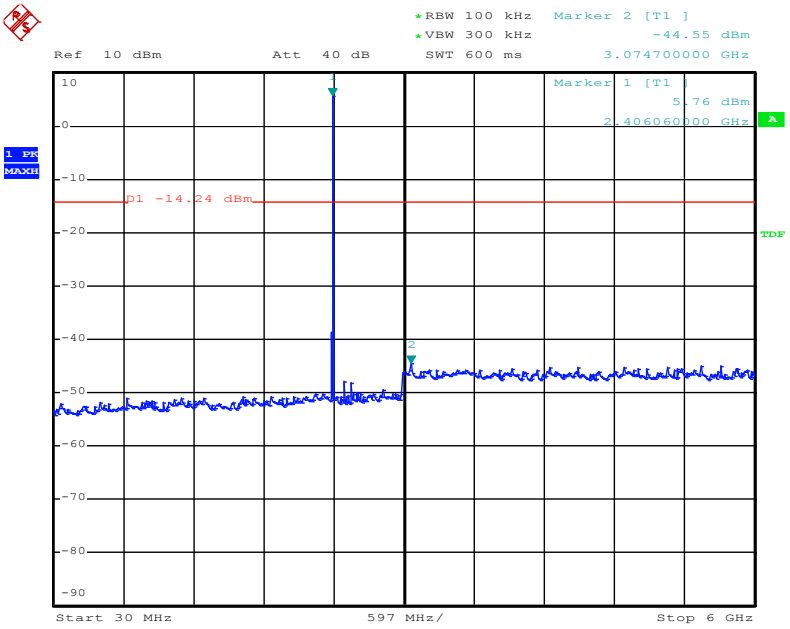
Date: 4.MAR.2013 13:10:35

Table 18: Conducted Spurious Emission, Mode G

Frequency [MHz]	Reading [dBm]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
25560	-31.03	-31.03	-14.24	16.79
3074	-44.55	-44.55	-14.24	30.31
2402	5.76	5.76	N/A	N/A

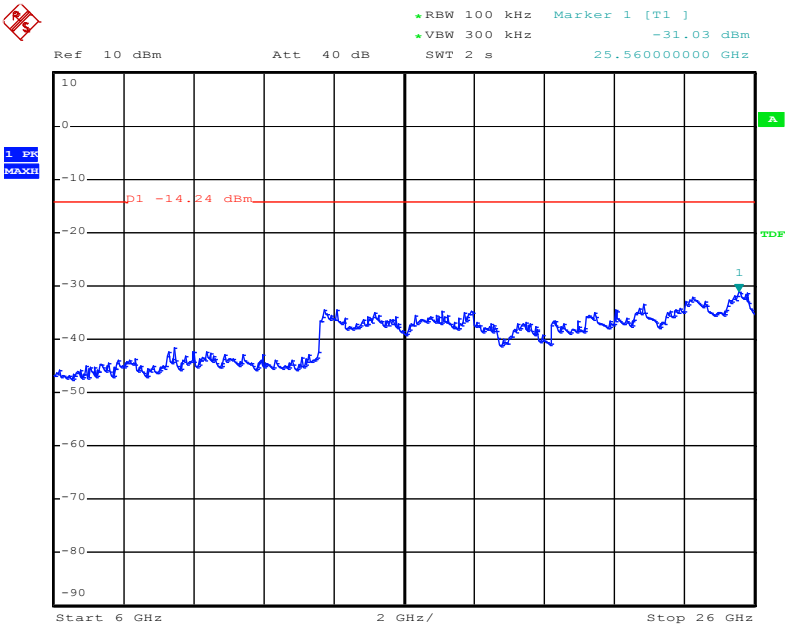
Notes: Cable loss was included in reading as offset.
Limit = Reading of fundamental + Correction factor – 20dB

Figure 24: Conducted Spurious Emission, 30MHz – 6GHz, Mode G



Date: 15.MAR.2013 15:22:50

Figure 25: Conducted Spurious Emission, 6 – 26GHz, Mode G



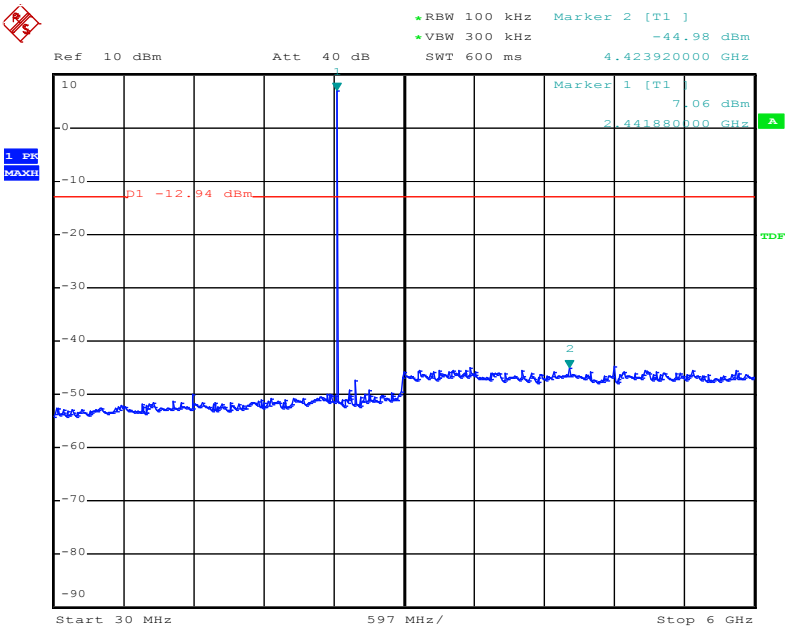
Date: 15.MAR.2013 15:23:33

Table 19: Conducted Spurious Emission, Mode H

Frequency [MHz]	Reading [dBm]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
25480	-30.88	-30.88	-12.94	17.94
4423	-44.98	-44.98	-12.94	32.04
2442	7.06	7.06	NA	N/A

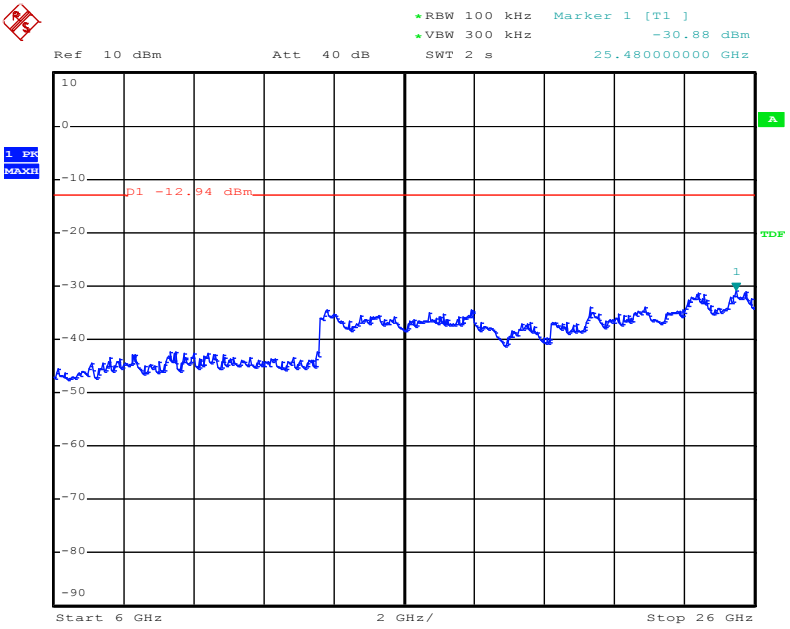
Notes: Cable loss was included in reading as offset.
Limit = Reading of fundamental + Correction factor – 20dB

Figure 26: Conducted Spurious Emission, 30MHz – 6GHz, Mode H



Date: 15.MAR.2013 15:25:16

Figure 27: Conducted Spurious Emission, 6 – 26GHz, Mode H



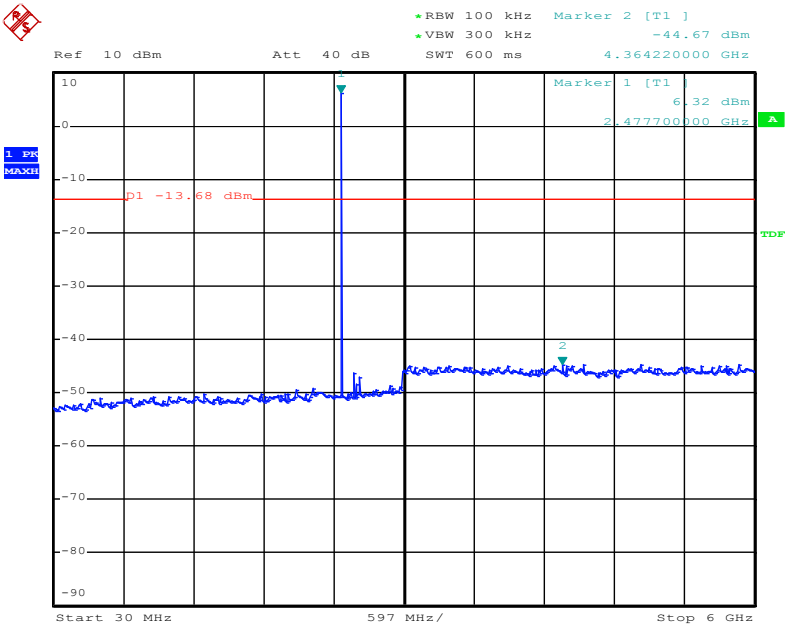
Date: 15.MAR.2013 15:26:08

Table 20: Conducted Spurious Emission, Mode I

Frequency [MHz]	Reading [dBm]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
25680	-31.42	-31.42	-13.68	17.74
4364	-44.67	-44.67	-13.68	30.99
2480	6.32	6.32	N/A	N/A

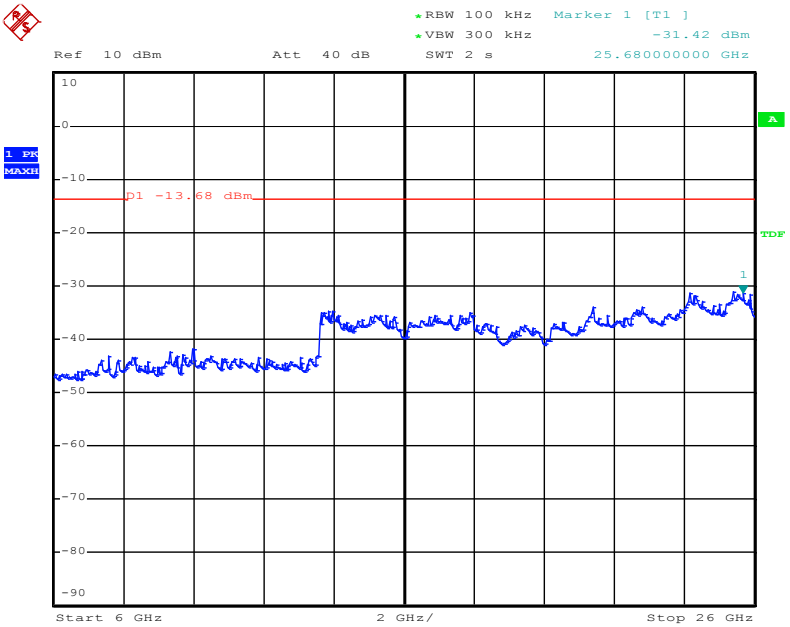
Notes: Cable loss was included in reading as offset.
Limit = Reading of fundamental + Correction factor – 20dB

Figure 28: Conducted Spurious Emission, 30MHz – 6GHz, Mode I



Date: 15.MAR.2013 15:36:43

Figure 29: Conducted Spurious Emission, 6 – 26GHz, Mode I



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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: 2013-3-5

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 C63.10-2009 and KDB 558074 D01 DTS Meas Guidance v02 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 30: Lower Band Edge Conducted Mode A

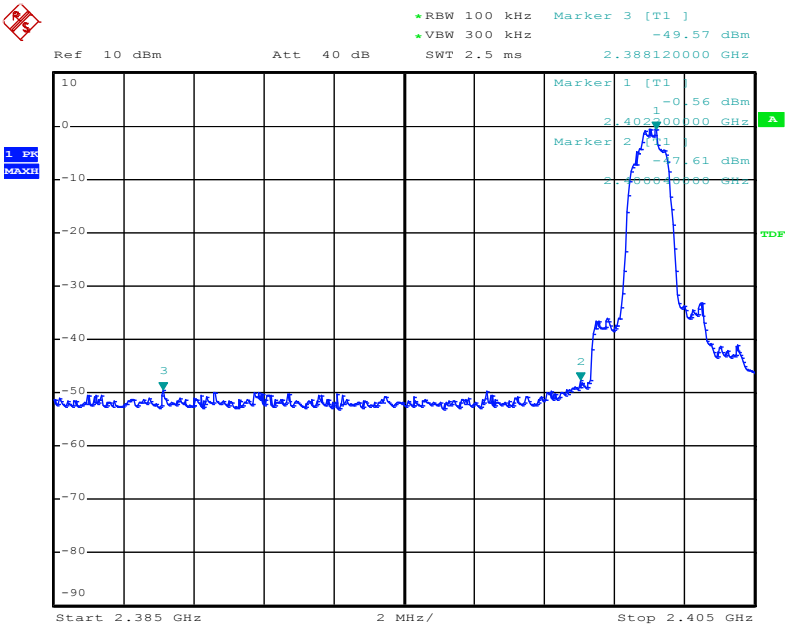

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Figure 31: Upper Band Edge Conducted Mode C

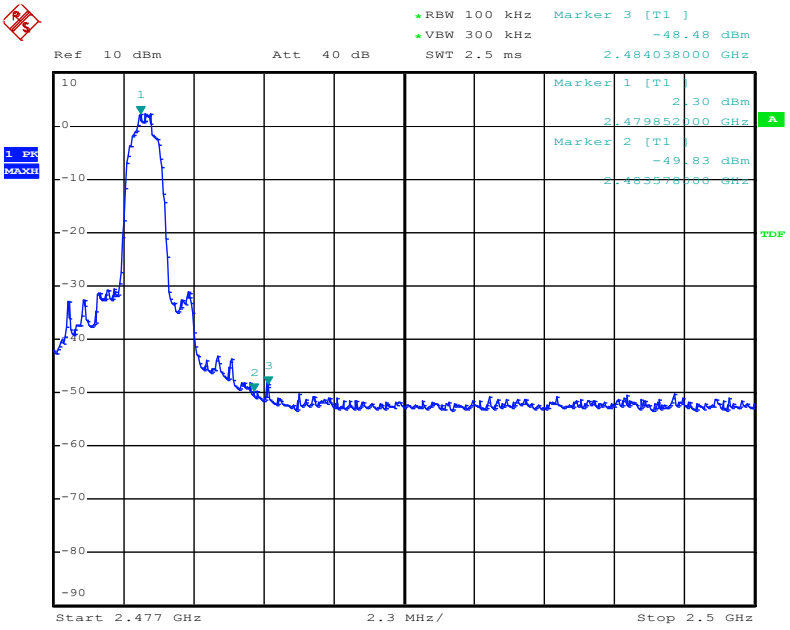

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Figure 32: Lower Band Edge Conducted Mode A(Hopping)

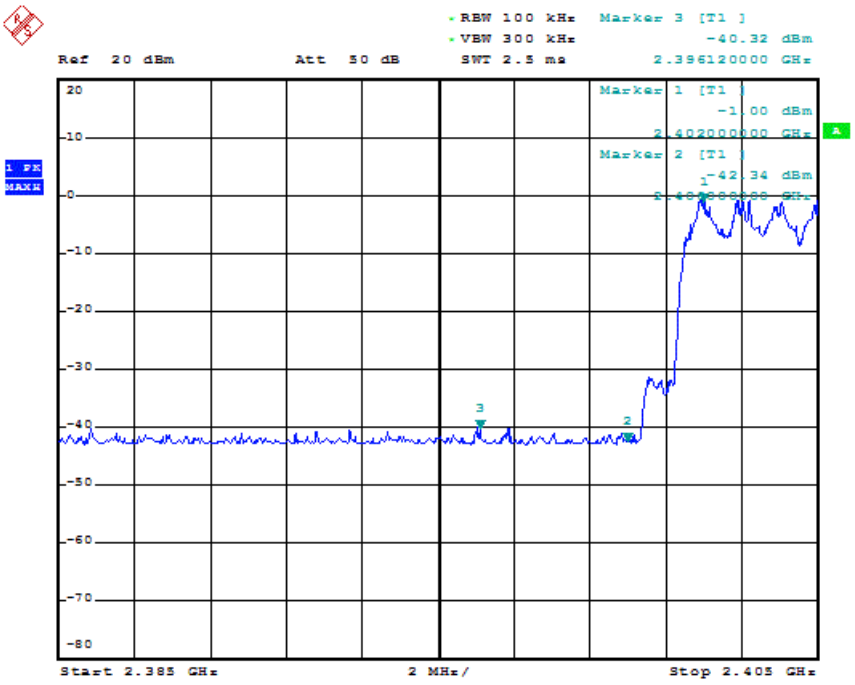
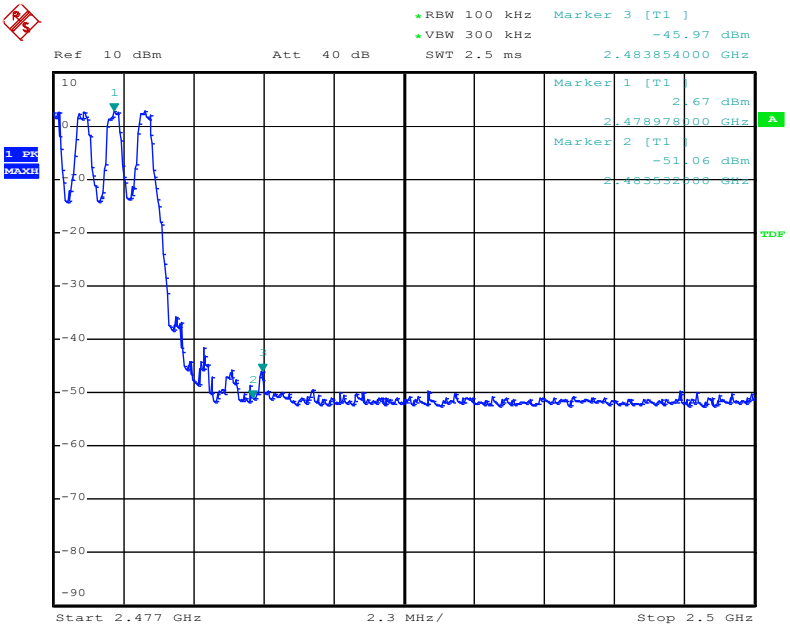


Figure 33: Lower Band Edge Conducted Mode C(Hopping)



Date: 15.MAR.2013 15:50:32

Figure 34: Lower Band Edge Conducted Mode G

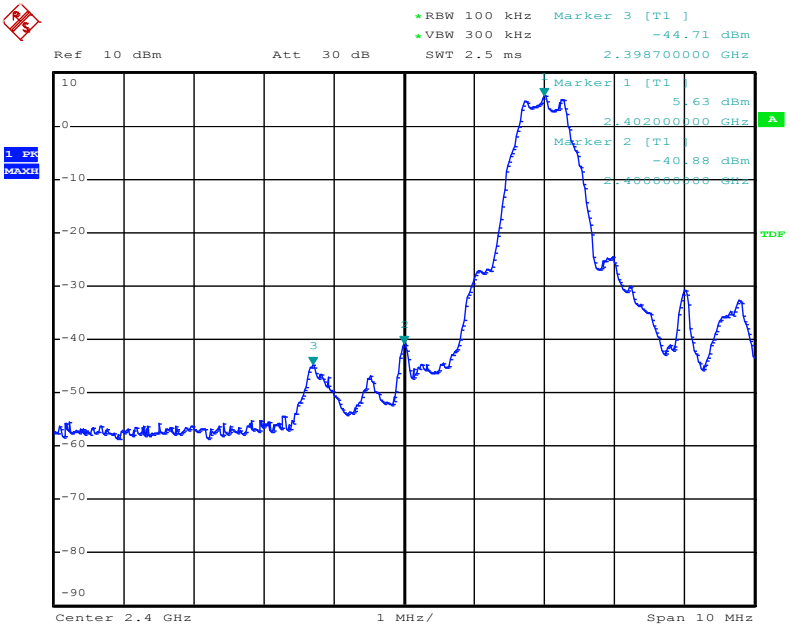


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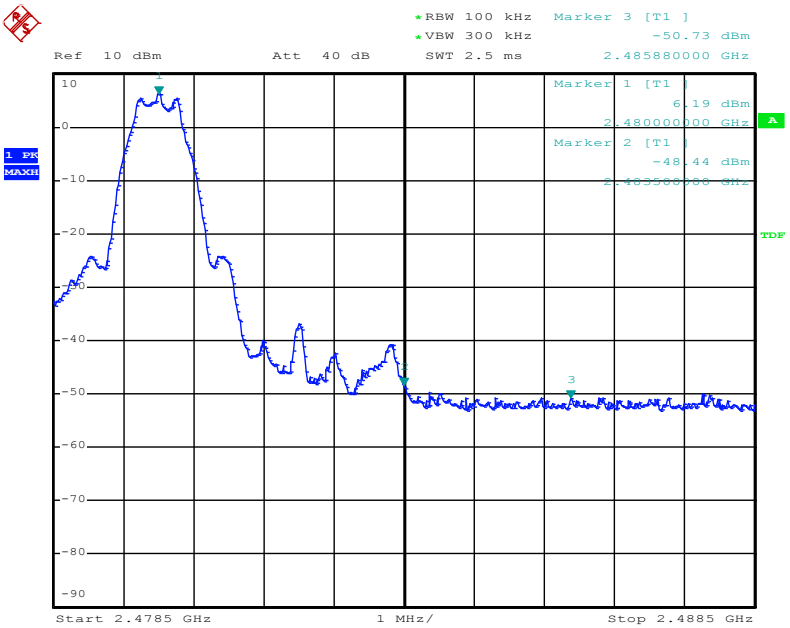
Figure 35: Lower Band Edge Conducted Mode I



Date: 15.MAR.2013 15:18:35

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:	2013-3-5
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 C63.10-2009, RSS-Gen 4.9 and KDB 558074 D01 DTS Meas Guidance v02 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 21: 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	60.907	25.466	-13.093	74.000	35.442	PK
2	Horizontal	2399.898	61.048	25.525	-12.952	74.000	35.522	PK
3	Horizontal	2402.214	81.214	45.672	N/A	N/A	35.542	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	47.783	12.342	-6.217	54.000	35.442	AV
2	Horizontal	2399.898	48.193	12.670	-5.807	54.000	35.522	AV
3	Horizontal	2401.885	73.017	37.478	N/A	N/A	35.539	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	61.237	26.456	-12.763	74.000	34.782	PK
2	Vertical	2399.898	60.488	25.665	-13.512	74.000	34.823	PK
3	Vertical	2402.026	80.765	45.933	N/A	N/A	34.832	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	47.129	12.348	-6.871	54.000	34.782	AV
2	Vertical	2399.898	47.537	12.714	-6.463	54.000	34.823	AV
3	Vertical	2401.744	72.082	37.251	N/A	N/A	34.831	AV

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Horizontal	2479.848	85.769	49.582	N/A	N/A	36.186	PK
2	Horizontal	2483.500	62.576	26.359	-11.424	74.000	36.217	PK
3	Horizontal	2484.900	62.615	26.386	-11.385	74.000	36.228	PK

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Horizontal	2479.881	75.849	39.662	N/A	N/A	36.188	AV
2	Horizontal	2483.500	48.897	12.680	-5.103	54.000	36.217	AV
3	Horizontal	2484.900	48.776	12.547	-5.224	54.000	36.228	AV

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Vertical	2479.782	84.783	49.616	N/A	N/A	35.167	PK
2	Vertical	2483.500	61.712	26.529	-12.288	74.000	35.183	PK
3	Vertical	2484.900	61.070	25.881	-12.930	74.000	35.189	PK

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Vertical	2479.914	75.812	40.644	N/A	N/A	35.168	AV
2	Vertical	2483.500	47.860	12.677	-6.140	54.000	35.183	AV
3	Vertical	2484.900	47.812	12.623	-6.188	54.000	35.189	AV

Table 22: Band Edge Radiated Emission (BLE)

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Horizontal	2390.000	61.125	25.684	-12.875	74.000	35.442	PK
2	Horizontal	2399.898	61.208	25.685	-12.792	74.000	35.522	PK
3	Horizontal	2402.073	84.820	49.280	N/A	N/A	35.541	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	47.719	12.278	-6.281	54.000	35.442	AV
2	Horizontal	2399.898	48.031	12.508	-5.969	54.000	35.522	AV
3	Horizontal	2402.026	70.659	35.119	N/A	N/A	35.540	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	61.093	26.312	-12.907	74.000	34.782	PK
2	Vertical	2399.898	60.711	25.888	-13.289	74.000	34.823	PK
3	Vertical	2402.120	85.413	50.581	N/A	N/A	34.833	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	47.211	12.430	-6.789	54.000	34.782	AV
2	Vertical	2399.898	47.522	12.699	-6.478	54.000	34.823	AV
3	Vertical	2402.026	70.970	36.138	N/A	N/A	34.832	AV

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Horizontal	2479.947	87.973	51.785	N/A	N/A	36.188	PK
2	Horizontal	2483.500	62.322	26.105	-11.678	74.000	36.217	PK
3	Horizontal	2484.900	62.234	26.005	-11.766	74.000	36.228	PK

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Horizontal	2479.980	73.412	37.224	N/A	N/A	36.188	AV
2	Horizontal	2483.500	48.977	12.760	-5.023	54.000	36.217	AV
3	Horizontal	2484.900	48.843	12.614	-5.157	54.000	36.228	AV

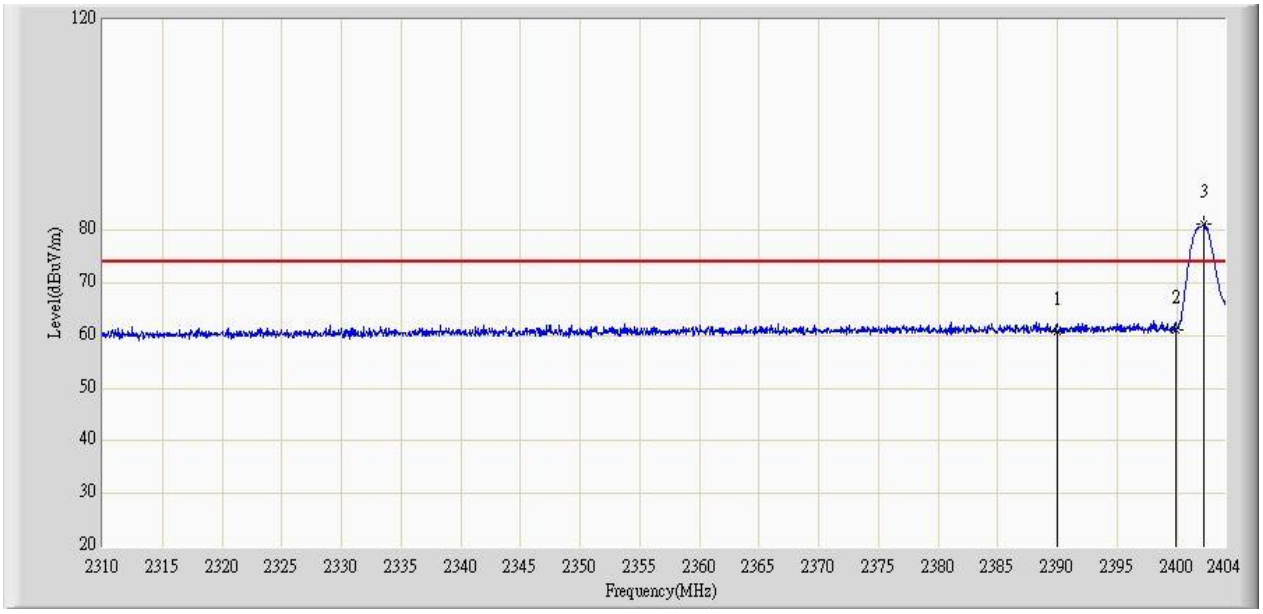
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Vertical	2479.980	84.924	49.756	N/A	N/A	35.169	PK
2	Vertical	2483.500	60.879	25.696	-13.121	74.000	35.183	PK
3	Vertical	2484.900	61.097	25.908	-12.903	74.000	35.189	PK

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Vertical	2479.980	70.598	35.430	N/A	N/A	35.169	AV
2	Vertical	2483.500	47.913	12.730	-6.087	54.000	35.183	AV
3	Vertical	2484.900	47.774	12.585	-6.226	54.000	35.189	AV

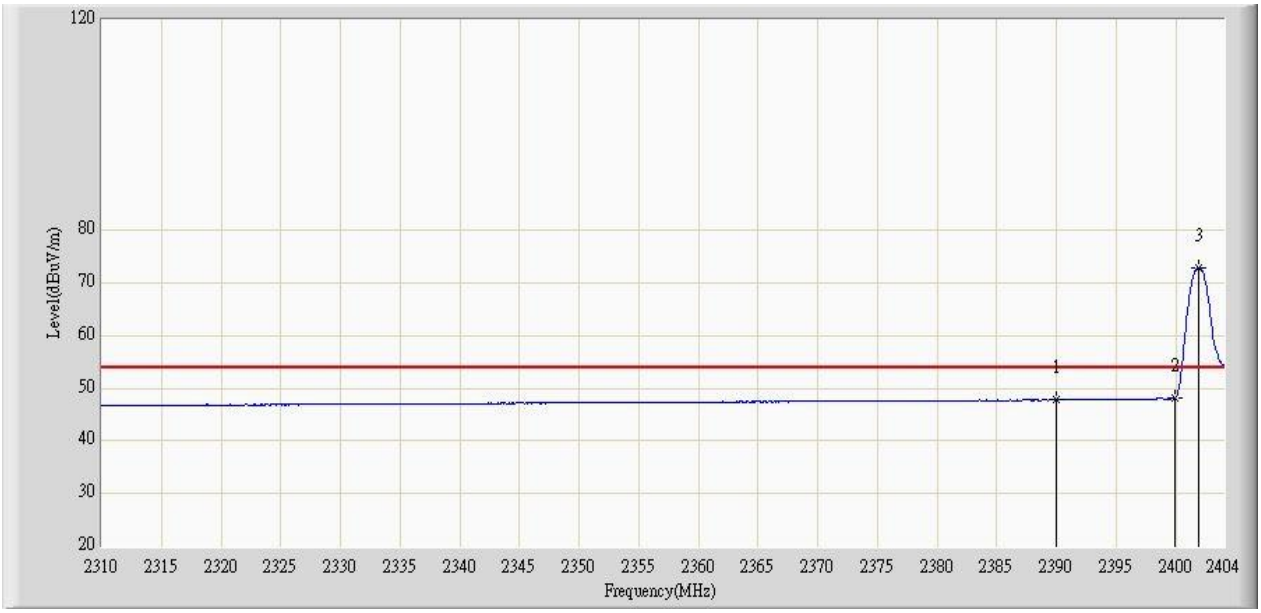
Notes: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.
Average limit in dBuV/m is calculated as follows: Average limit = 20 x log(500uV/m).
Peak limit in dBuV/m is calculated as follows: Peak limit = Average limit + 20dB.

Figure 36: Band Edge Radiated Emission, Spectral Diagram, Mode A (2402MHz)

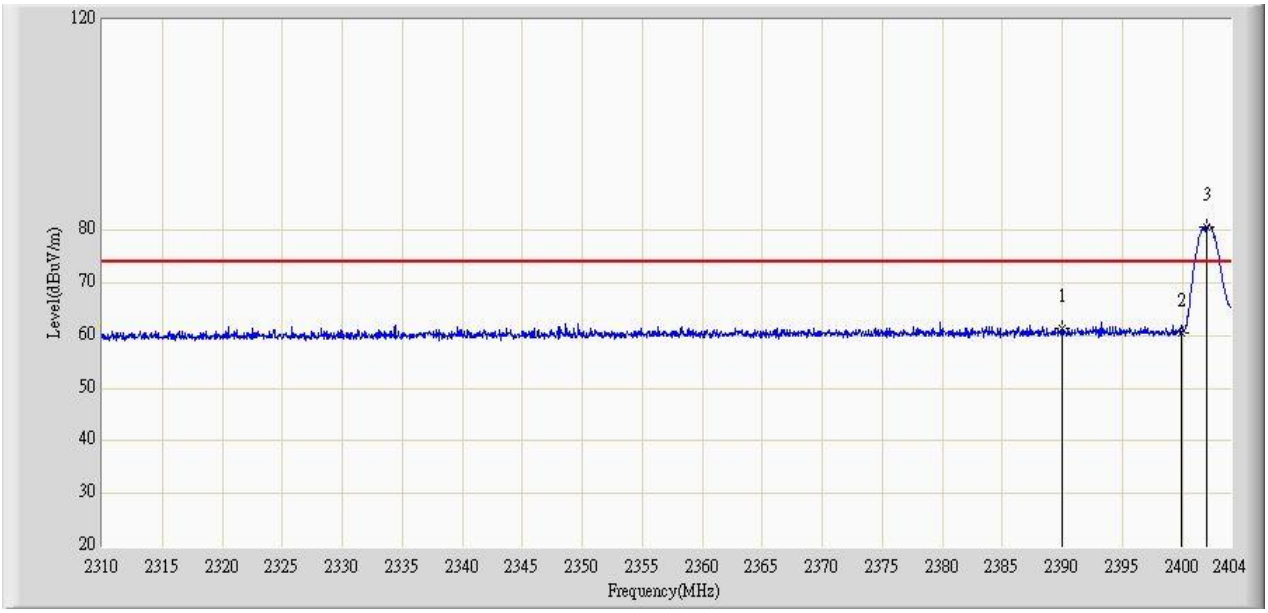
Horizontal-PK



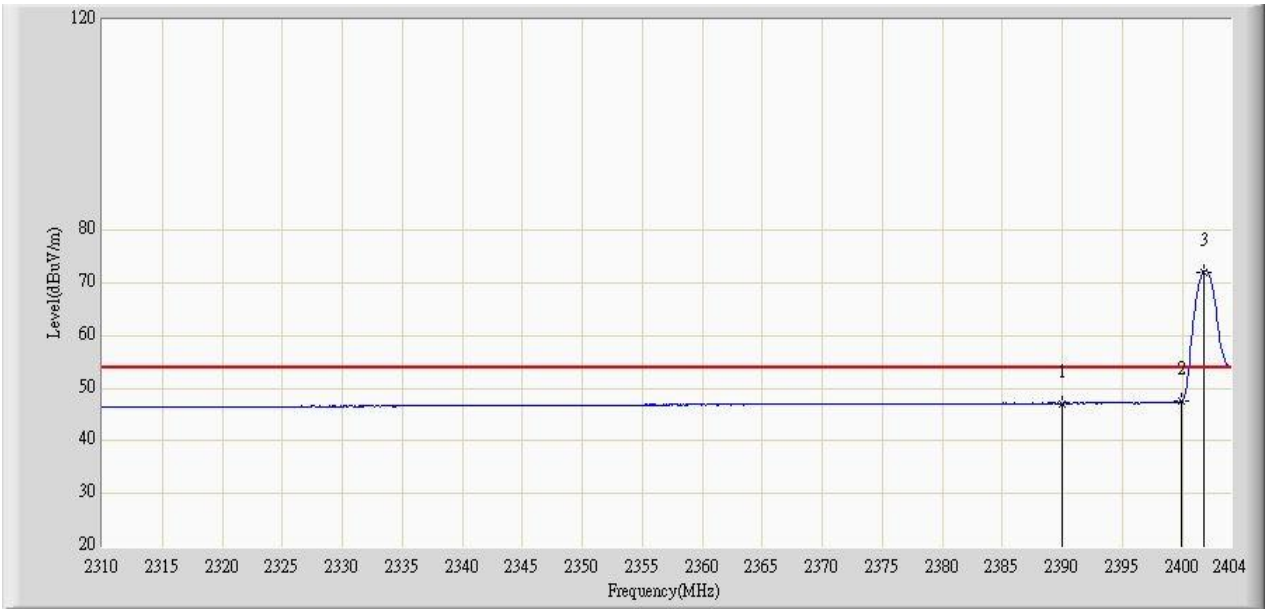
Horizontal-AV



Vertical-PK



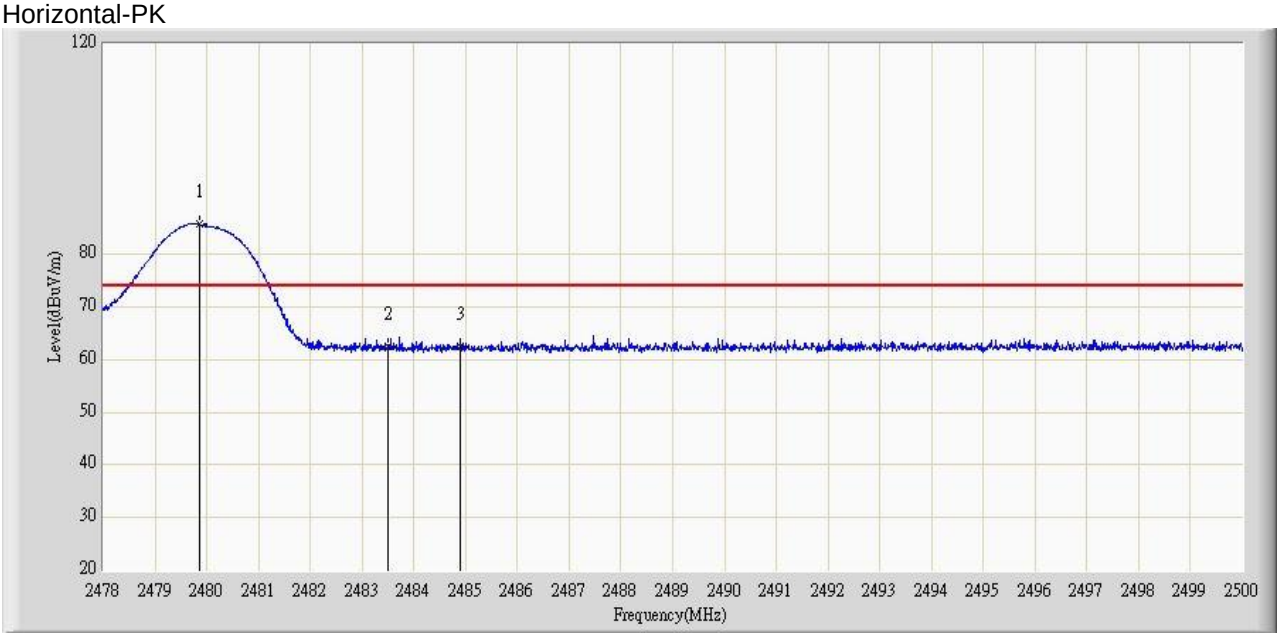
Vertical-AV



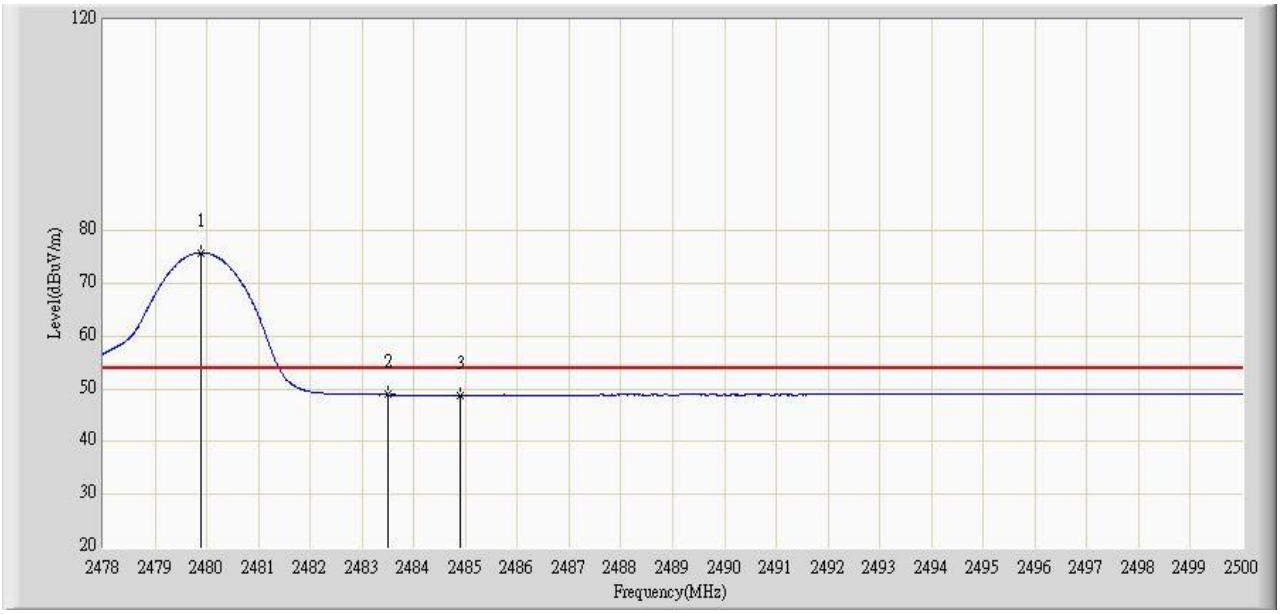
Note: The upper diagram shows the vertical peak value and the lower diagram shows the horizontal value.

Figure 37: Band Edge Radiated Emission, Spectral Diagram, Mode C (2402MHz)

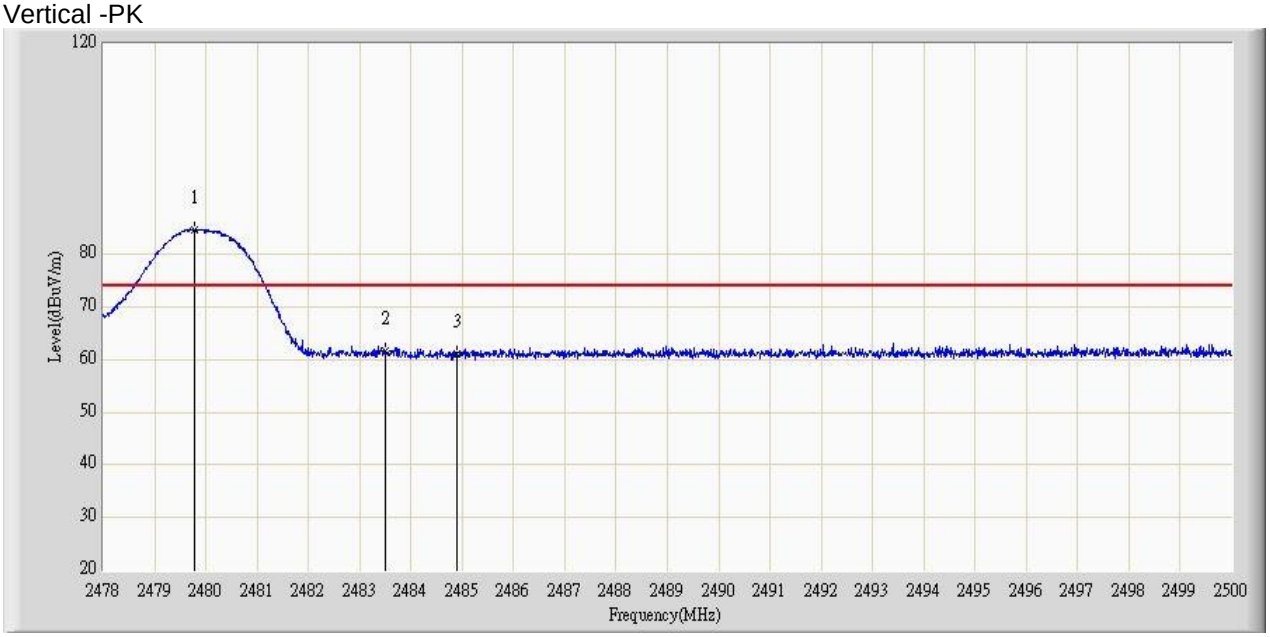
Horizontal-PK



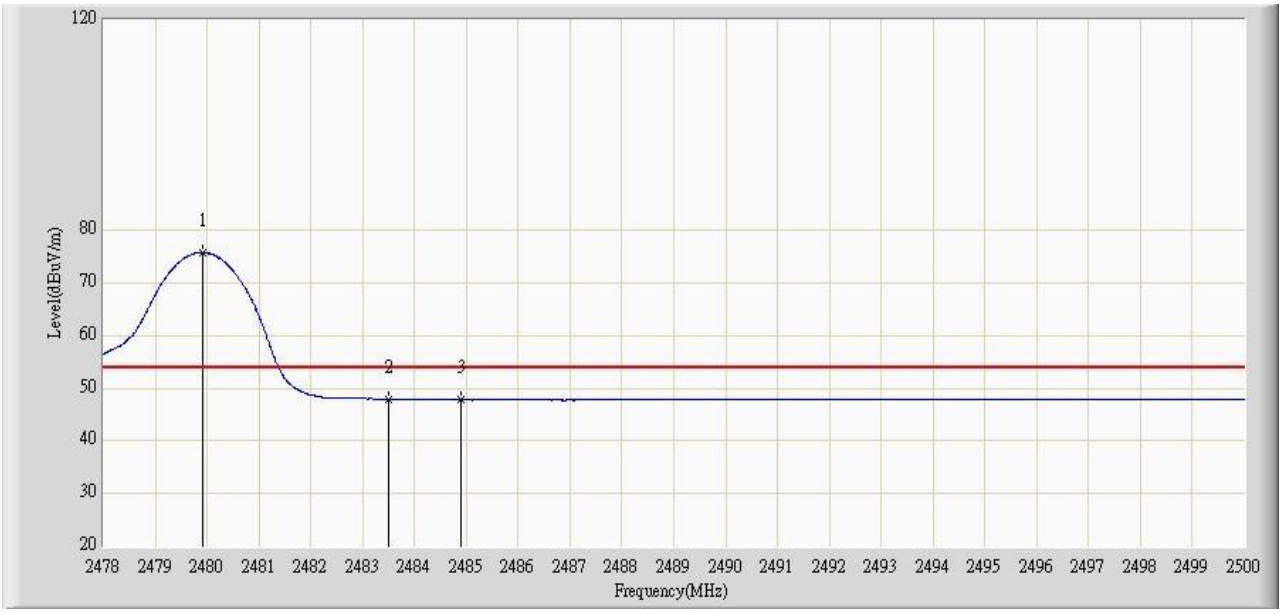
Horizontal-AV



Vertical -PK



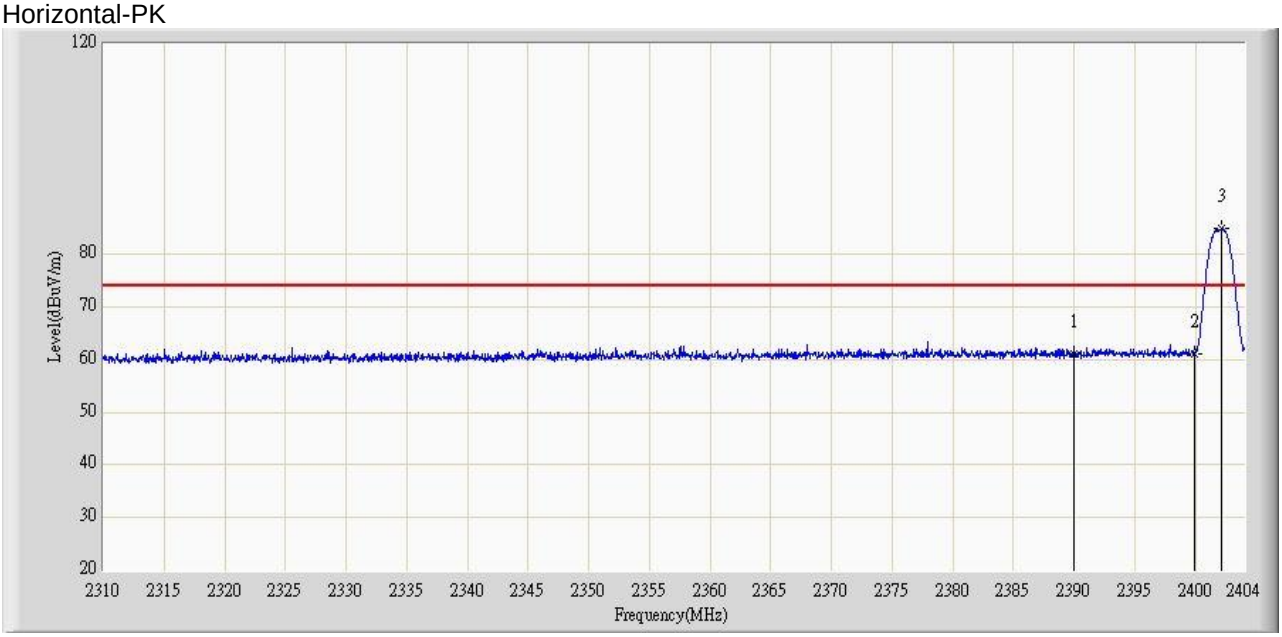
Vertical -AV



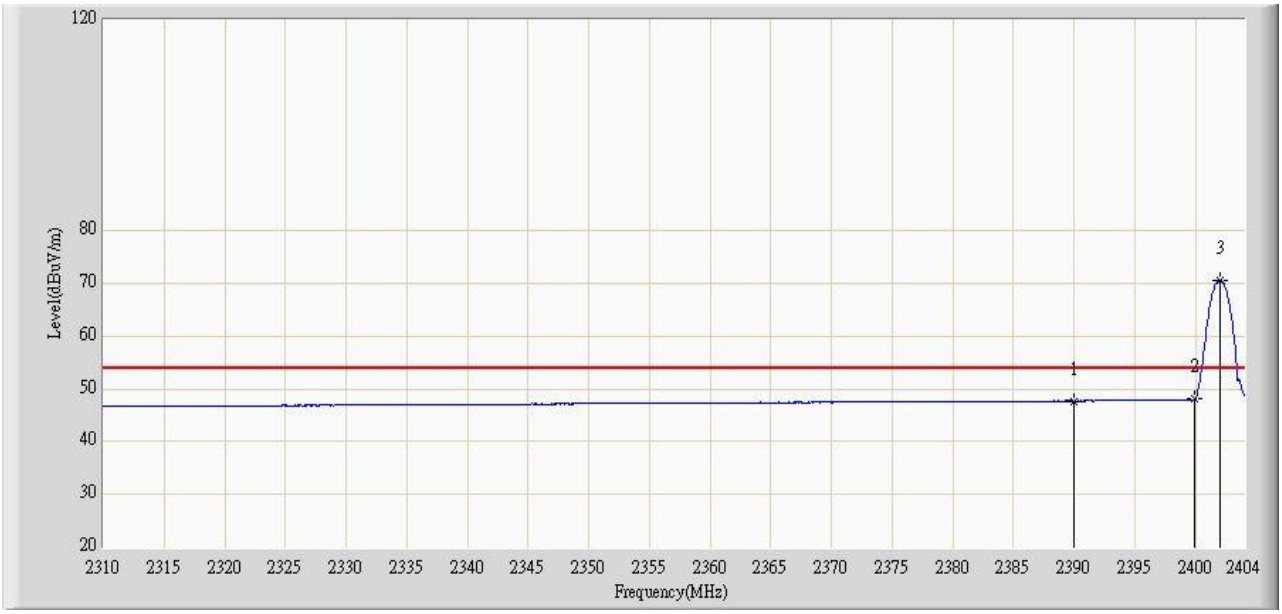
Note: The upper diagram shows the vertical peak value and the lower diagram shows the horizontal value.

Figure 38: Band Edge Radiated Emission, Spectral Diagram, Mode G (2402MHz)

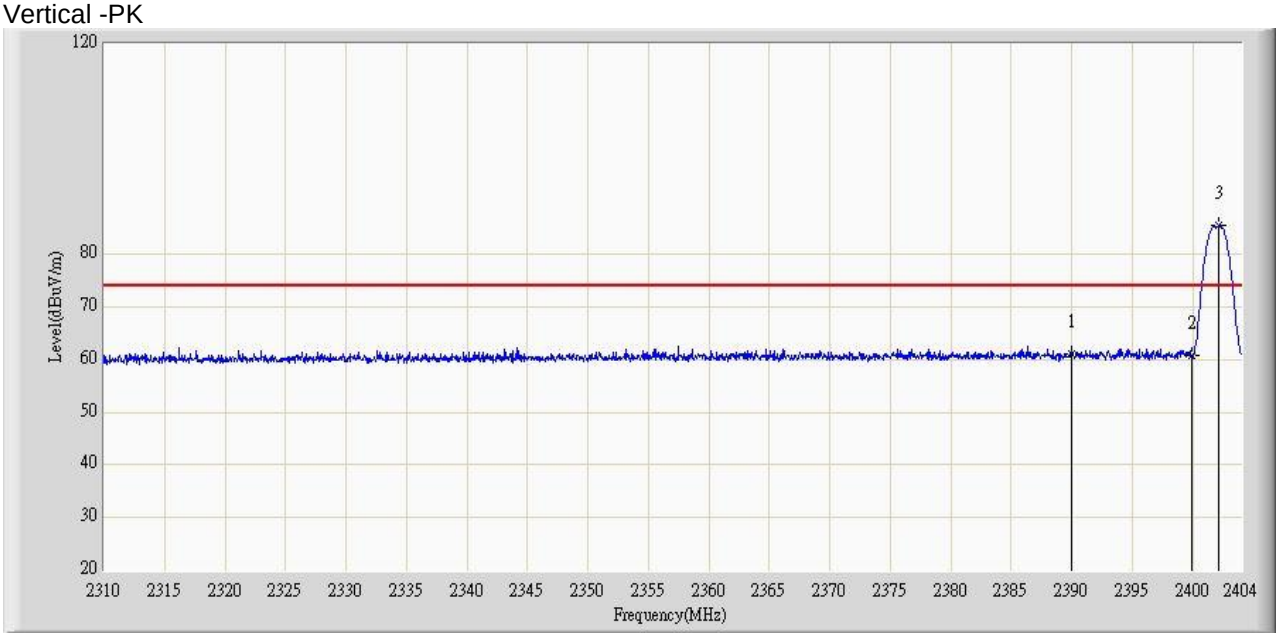
Horizontal-PK



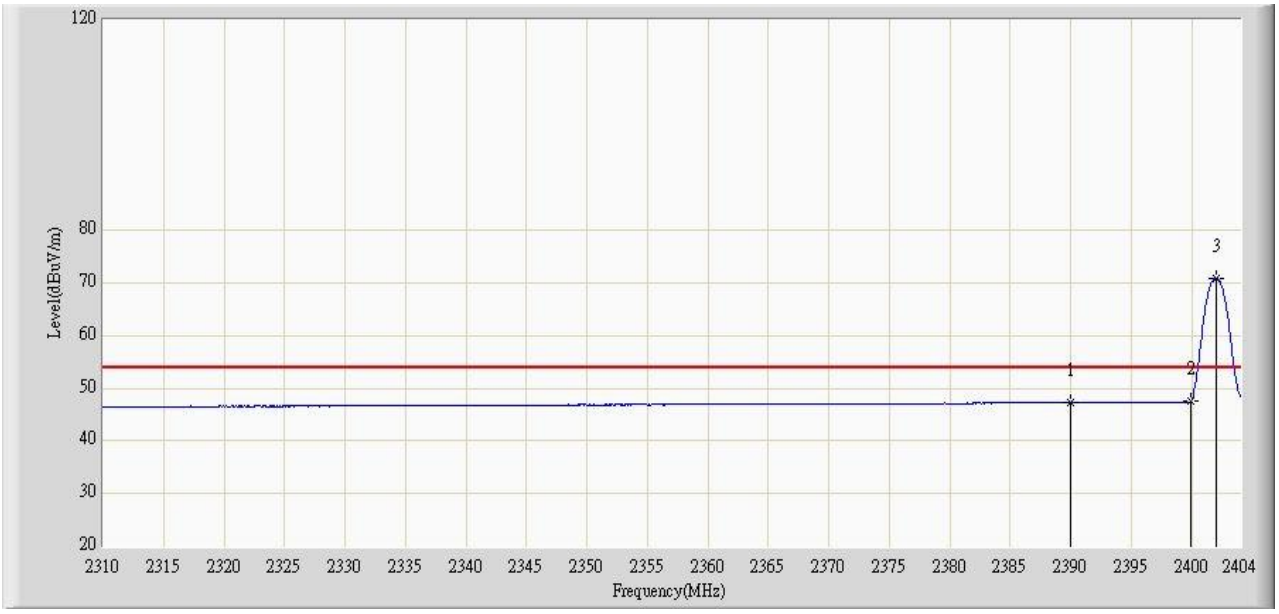
Horizontal-AV



Vertical -PK



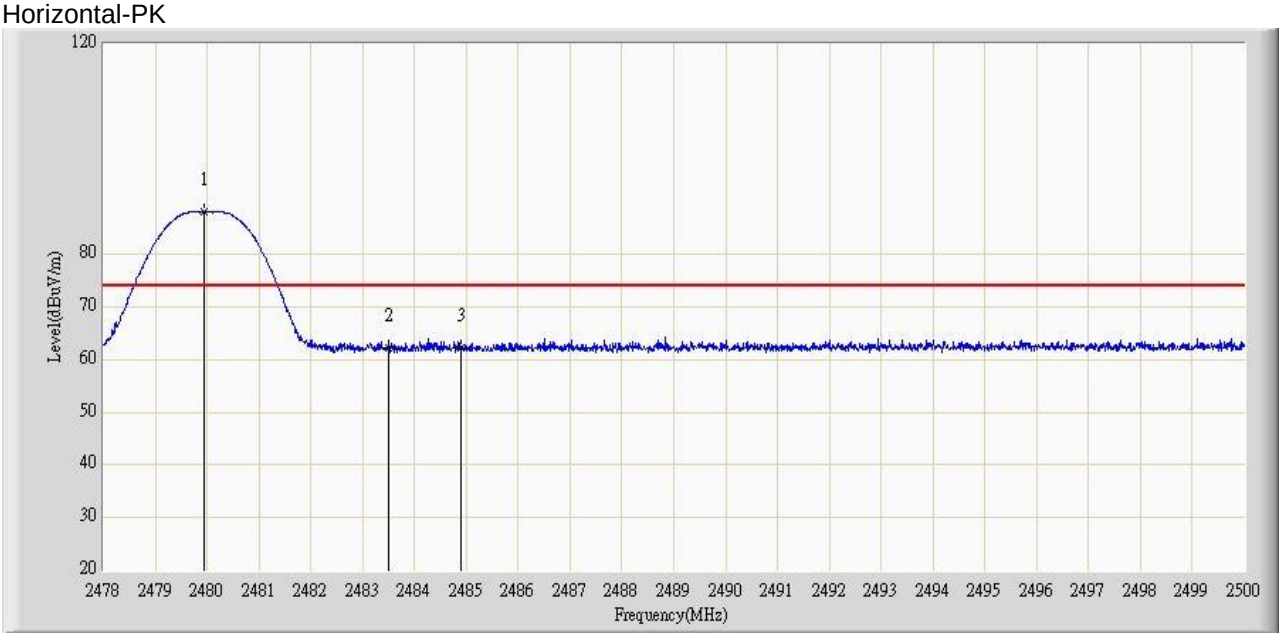
Vertical -AV



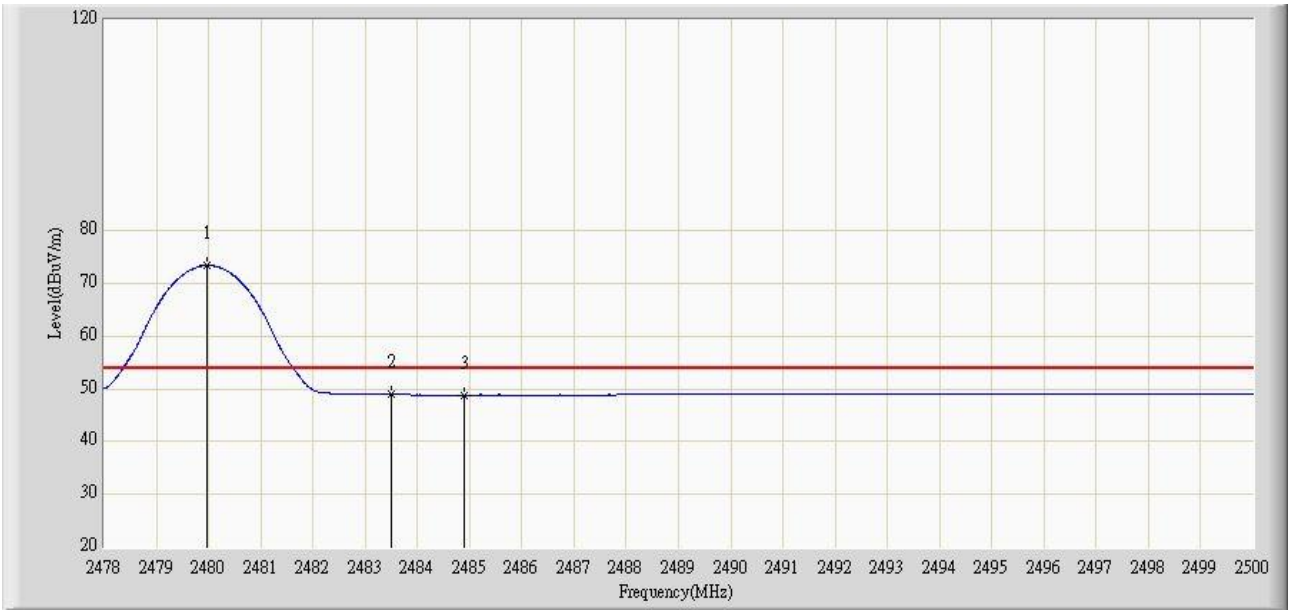
Note: The upper diagram shows the vertical peak value and the lower diagram shows the horizontal value.

Figure 39: Band Edge Radiated Emission, Spectral Diagram, Mode I (2402MHz)

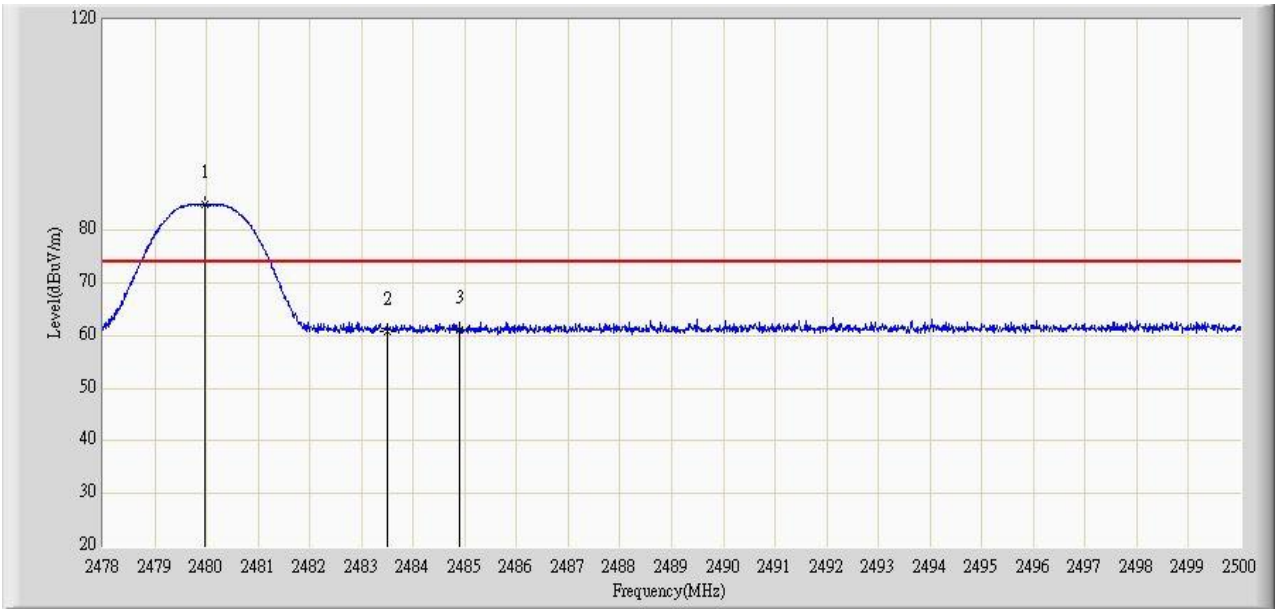
Horizontal-PK



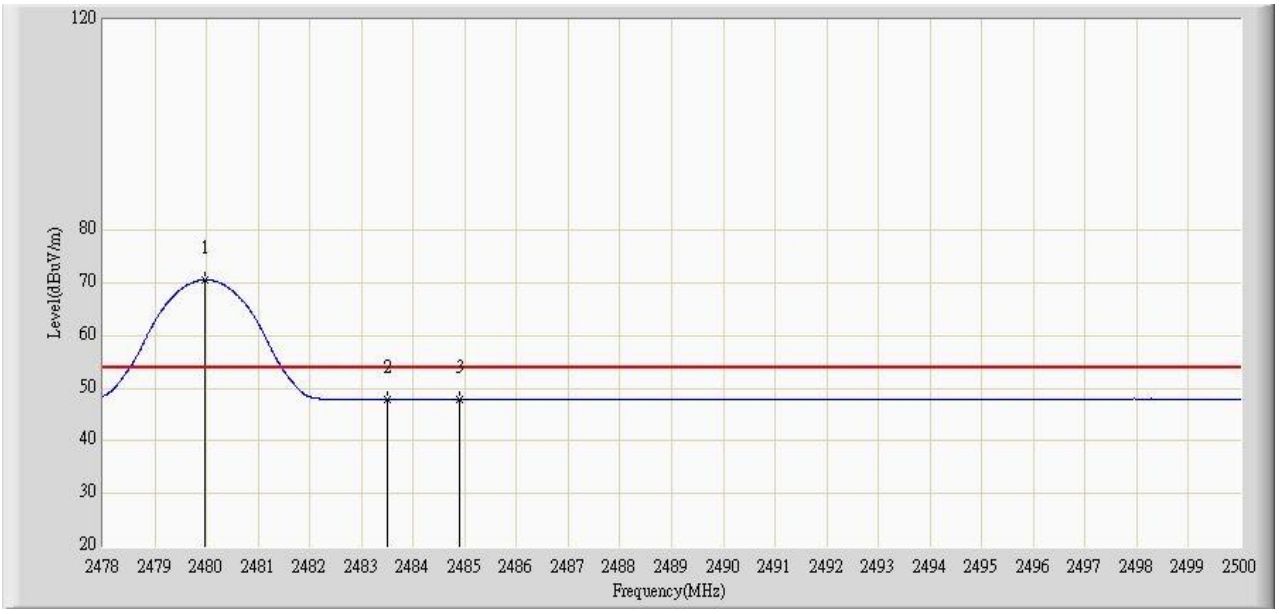
Horizontal-AV



Vertical -PK



Vertical -AV



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

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:	2013-3-22
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 C63.10-2009, RSS-Gen 4.9 and KDB 558074 D01 DTS Meas Guidance v02 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.

Table 23: 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	4808.000	56.569	65.055	-17.431	74.000	-8.486	PK
2	Vertical	4799.500	59.162	67.758	-14.838	74.000	-8.595	PK

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

Table 24: Radiated Emission, Average and Peak Data, 1 – 25GHz, Horizontal and Vertical Antenna Orientations, Mode B (2442MHz)

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Horizontal	4884.500	58.448	66.980	-15.552	74.000	-8.533	PK
2	Vertical	4884.500	60.477	68.994	-13.523	74.000	-8.518	PK

Table 25:Radiated Emission, Average and Peak Data, 1 – 25GHz, Horizontal and Vertical Antenna Orientations, Mode C (2442MHz)

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Horizontal	4961.000	52.625	61.234	-21.375	74.000	-8.609	PK
2	Vertical	4961.000	59.065	67.536	-14.935	74.000	-8.471	PK

Table 26: Radiated Emission, Average and Peak Data, 1 – 25GHz, Horizontal and Vertical Antenna Orientations, Mode G (2402MHz)

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Horizontal	4536.000	45.231	53.892	-28.769	74.000	-8.661	PK
2	Vertical	4493.500	46.285	55.246	-27.715	74.000	-8.961	PK

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

Table 27: Radiated Emission, Average and Peak Data, 1 – 25GHz, Horizontal and Vertical Antenna Orientations, Mode H (2442MHz)

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Horizontal	4527.500	45.544	54.212	-28.456	74.000	-8.668	PK
2	Vertical	4128.000	44.841	54.214	-29.159	74.000	-9.373	PK

Table 28:Radiated Emission, Average and Peak Data, 1 – 25GHz, Horizontal and Vertical Antenna Orientations, Mode I (2442MHz)

No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	Horizontal	6516.500	48.843	54.288	-25.157	74.000	-5.445	PK
2	Vertical	5309.500	46.267	54.529	-27.733	74.000	-8.263	PK

Note: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values. Above 18 GHz emission far below limit

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:	2013-3-22
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 C63.4-2009 and RSS-Gen 4.10.

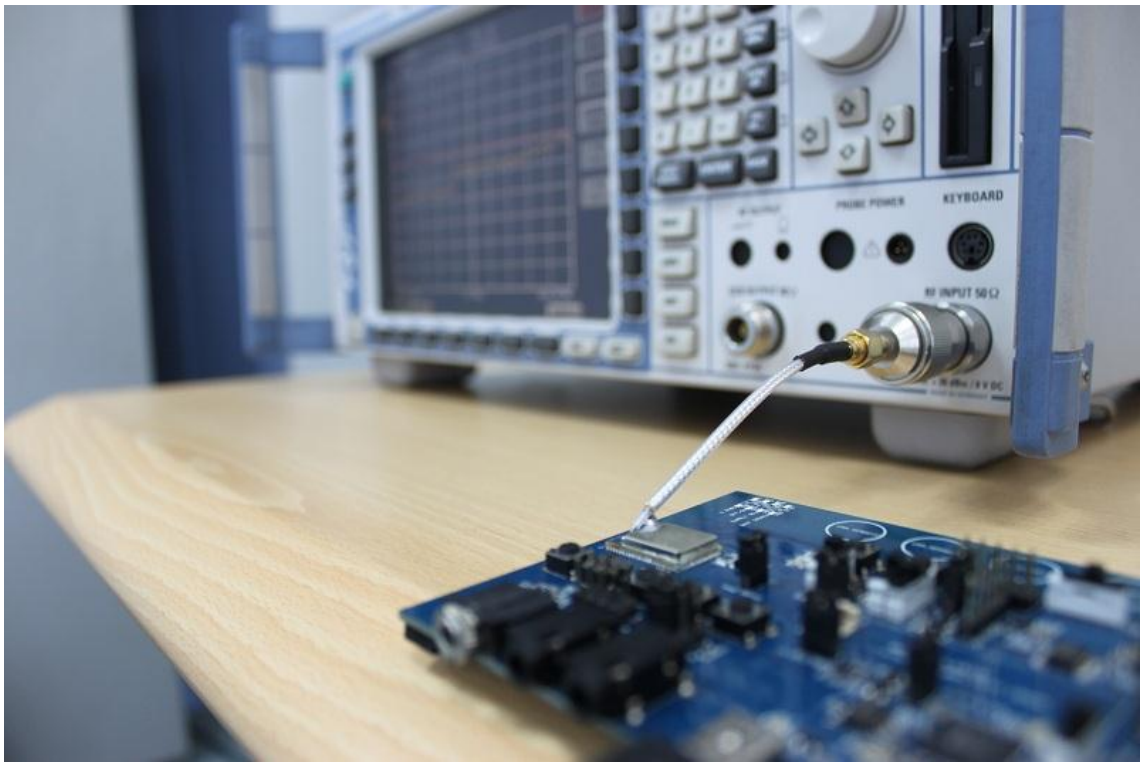
The EUT was placed on a nonconductive turntable 0.8m above the ground plane. Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The EUT was pretested in floor-standing condition and in the table position and the worst case condition 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.

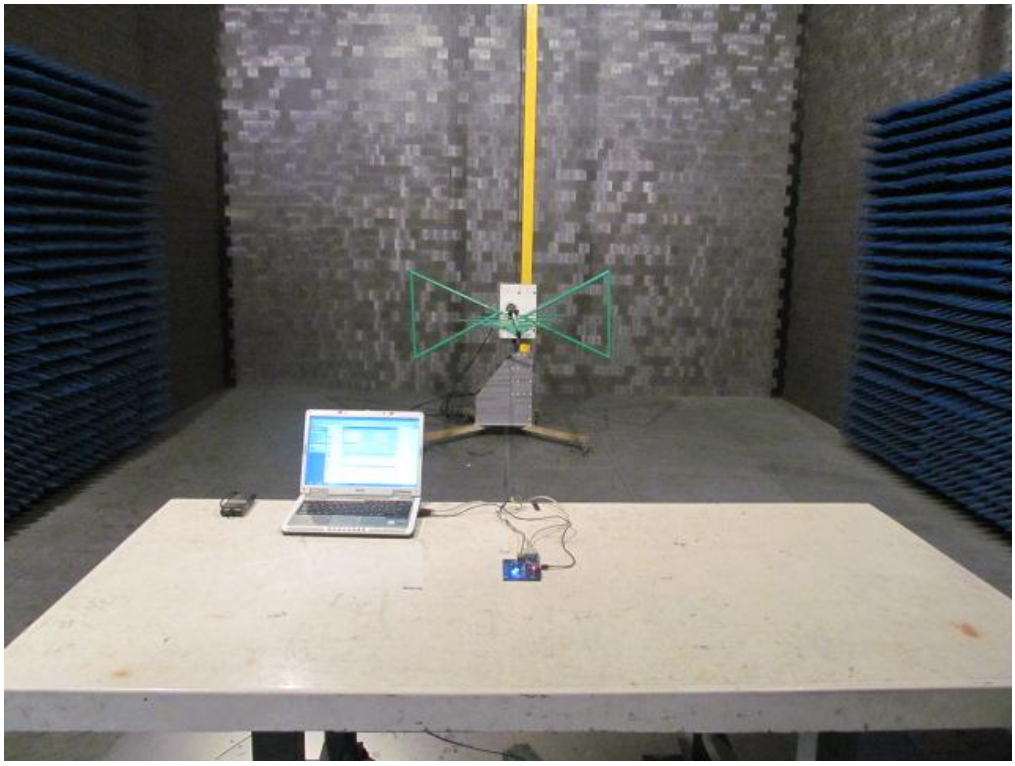
For frequencies between 30MHz and 1GHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1GHz, measurements were performed using the following settings: Peak: RBW & VBW = 1MHz, Average: RBW = 1MHz, VBW = 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 ,J,K,L. all signals found in the pre-testing were more than 20 dB below the limit .

7. Photographs of the Test Setup

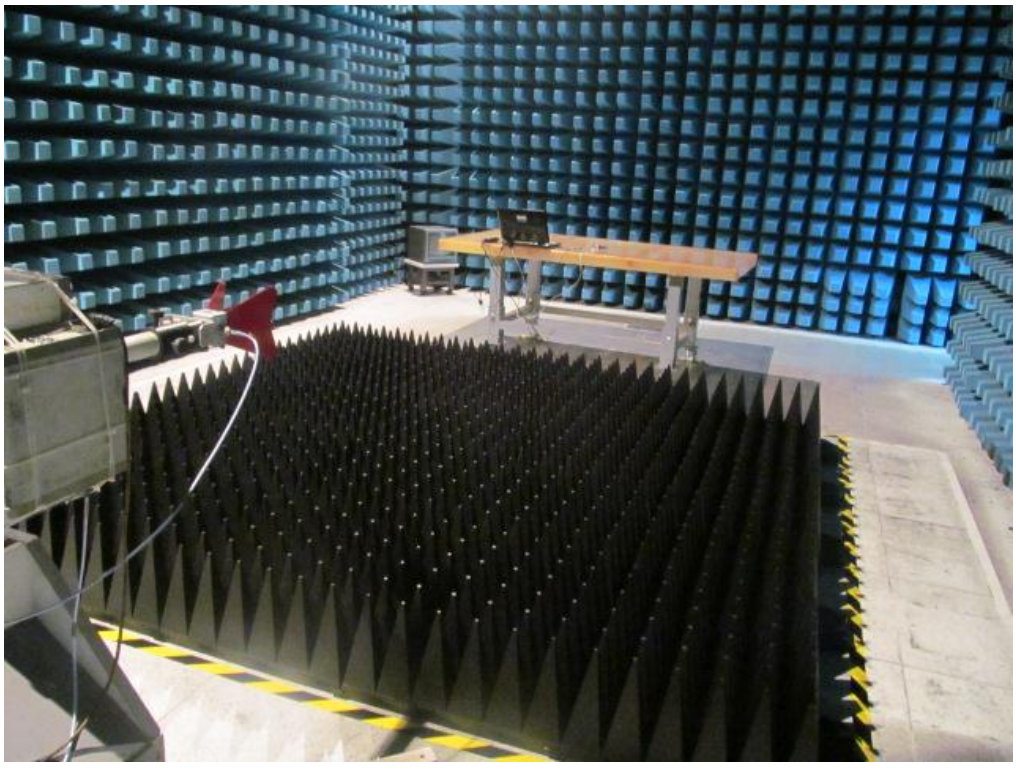
Photograph 1: Set-up for Conducted RF test at Antenna Port



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



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



8. List of Tables

9. List of Figures

10. List of Photographs