

Produkte
Products

Prüfbericht - Nr.: 12607877 001		Seite 1 von 76 Page 1 of 76
<i>Test Report No.:</i>		
Auftraggeber: <i>Client:</i>	Victor Company of Japan Ltd 3-12, Moriya-cho, Kanagawa-ku, Yokohama 221, Japan	
Gegenstand der Prüfung: <i>Test Item:</i>	Bluetooth Adaptor	
Bezeichnung: <i>Identification:</i>	KS-BTA100	Serien-Nr.: <i>Serial No.:</i> Engineering Sample
Wareneingangs-Nr.: <i>Receipt No.:</i>	PT0214005001-1 PT0214005001-2	Eingangsdatum: <i>Date of Receipt:</i> 2010-11-05 2010-11-08
Prüfört: <i>Testing Location:</i>	TÜV Rheinland Japan Ltd. - Global Technology Assessment Center 4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan	
Prüfgrundlage: <i>Test Specification:</i>	FCC 47 CFR Part 15, Subpart B (October 1, 2009) 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 7): 2007 RSS-Gen (Issue 2): 2007	
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 Japan Ltd. - Global Technology Assessment Center 4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan	
geprüft/ tested by:	kontrolliert/ reviewed by:	
2010-11-24 T. Cheung / Inspector	2010-11-24 K. Goto / Reviewer	
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>
Sonstiges / Other Aspects:		
This test report deals with the transmitter and receiver of the tested product. Digital interface portion is excluded to evaluate separately as the vehicular device.		
Abkürzungen:	P(ass) = entspricht Prüfgrundlage F(all) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet	Abbreviations: P(ass) = passed F(all) = failed N/A = not applicable N/T = not tested
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.		

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

**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

**7.1.1 AC POWER LINE CONDUCTED EMISSION OF TRANSMITTER, FCC 15.207 AND RSS-
GEN 7.2.2**

RESULT: N/A

**7.2.1 AC POWER LINE CONDUCTED EMISSION OF RECEIVER, FCC 15.107 AND RSS-GEN
7.2.2**

RESULT: N/A

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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 Japan Ltd. - Global Technology Assessment Center
4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan

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 299054.

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 OATS filing number 3466B.

The test facility is accredited by VLAC (member of ILAC) under number VLAC-017 according to ISO/IEC 17025:2005.



TÜV Rheinland Japan Ltd. is accredited by the Federal Communications Commission as a Conformity Assessment Body under Designation Number JP0017 and Test Firm Registration Number 386498.

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Kind of Equipment	Manufacturer	Model Name	Serial Number	Equipment ID	Calibrated until
For Antenna Port Conducted Emission					
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2010-12
RF Power Meter	Agilent	N1911A	MY451017 37	RF-0393	2010-11
RF Peak Power Sensor	Agilent	N1921A	MY452422 28	RF-0394	2010-11
DC Power Supply	Peak Tech	2250	H0060	BT-8013	N/A
True RMS Multimeter	Fluke	87V	93760364	TL-9108	2011-09
For Radiated Emission					
Receiver	Rohde & Schwarz	ESU 8	100025	RF-0020	2011-02
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2010-12
RF Selector (10m)	Toyo Corporation	NS4900	0703-182	RF-0029	2011-05
3dB Attenuator 50Ohm	Tamagawa Electronics Co., Ltd.	CFA-01	-	RF-0265	2011-05
Low Noise Pre-Amplifier	TSJ	MLA-10K01-B01-35	1370750	RF-0253	2011-05
Microwave Pre-Amplifier, 1-8GHz	Toyo Corporation	TPA0108-40	0634	RF-0052	2011-05
Band Reject Filter	Nitsuki	NF-49BT	027	RF-0131	2011-05
Trilog Antenna, 30-1000MHz	Schwarzbeck	VULB9168	0245	RF-0019	2011-05
Horn Antenna, 1-10GHz	Schwarzbeck	BBHA9120B	419	RF-0050	2011-05
Horn Antenna with Pre-Amplifier, 2-18GHz	Toyo Corporation	HAP06-18W	00000025	RF-0065	2011-05
Horn Antenna with Pre-Amplifier, 18-26.5GHz	Toyo Corporation	HAP18-26N	00000010	RF-0070	2011-05
DC Power Supply	Hewlett Packard	6653A	3640A0310 5	Y3-0504	2011-08

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	±4.7dB
	> 1GHz	±4.5dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT (Equipment Under Test) KS-BTA100 is an Bluetooth Adaptor intended to operate with vehicle audio device and to communicate with cellular phone(s) as hand free.

3.2 System Details

Radio standard:	Bluetooth Version 2.1 + EDR (Class 1) HFP, A2DP and AVRCP support class2 BT device.
Specified output power:	Max. 6.0dBm
Antenna gain:	0.73dBi (Peak), 0.60dBi (Average)
Antenna type:	Printed inverted-F antenna
Antenna mounting type:	Printed on PCB
Frequency range:	2402 – 2480MHz
Number of channels:	79
Channel spacing:	1MHz
Modulation type:	FHSS coupled with GFSK, $\pi/4$ -DQPSK and 8DPSK
FCC classification:	DSS (Spread Spectrum Transmitter)
IC classification:	Bluetooth Device
Emission designator:	837KFXD (GFSK) and 1M17GXD ($\pi/4$ -DQPSK & 8DPSK)
Rated voltage:	DC11-18V
Rated current:	Max. 60mA
Protection class:	III
Environment:	Vehicle use
Test voltage:	DC 14.4V
HW version:	1000
Mech version:	1000
SW version:	5005

Table 3: Interfaces present on the EUT

No.	Interface	Cable Length for Testing, Shielding	Interface Classification
1.	DC Power	2.9m, un-shielded	DC input power port
2.	GND	2.9m, un-shielded	Ground port
3.	Control	2.9m, un-shielded	Signal port
4.	Audio	2.9m, un-shielded	Signal port

3.2.1 Voltage Requirements, FCC 15.31(e)

RESULT: **PASS**

The EUT has an internal voltage regulator to supply the RF circuit. 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 a PCB printed antenna which is permanently attached. Hence it complies with the requirements.

3.3 Independent Operation Modes

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).

The basic operation modes are:

- A. EUT transmits (TX mode), with full power, at lowest channel (2402MHz), continuously.
- B. EUT transmits (TX mode), with full power, at middle channel (2441MHz), continuously.
- C. EUT transmits (TX mode), with full power, at highest channel (2480MHz), continuously.
- D. EUT receives (RX mode), at middle channel (2441MHz), continuously.
- E. EUT transmits on pseudo-random sequence on all channels (hopping mode), continuously.

3.4 Clock Frequencies

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

3.5 Noise Suppressing Parts

Refer to schematics.

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 2).

For details, see under each test item.

4.2 Physical Configuration for Testing

Figure 1: Test setup of RF Conducted test

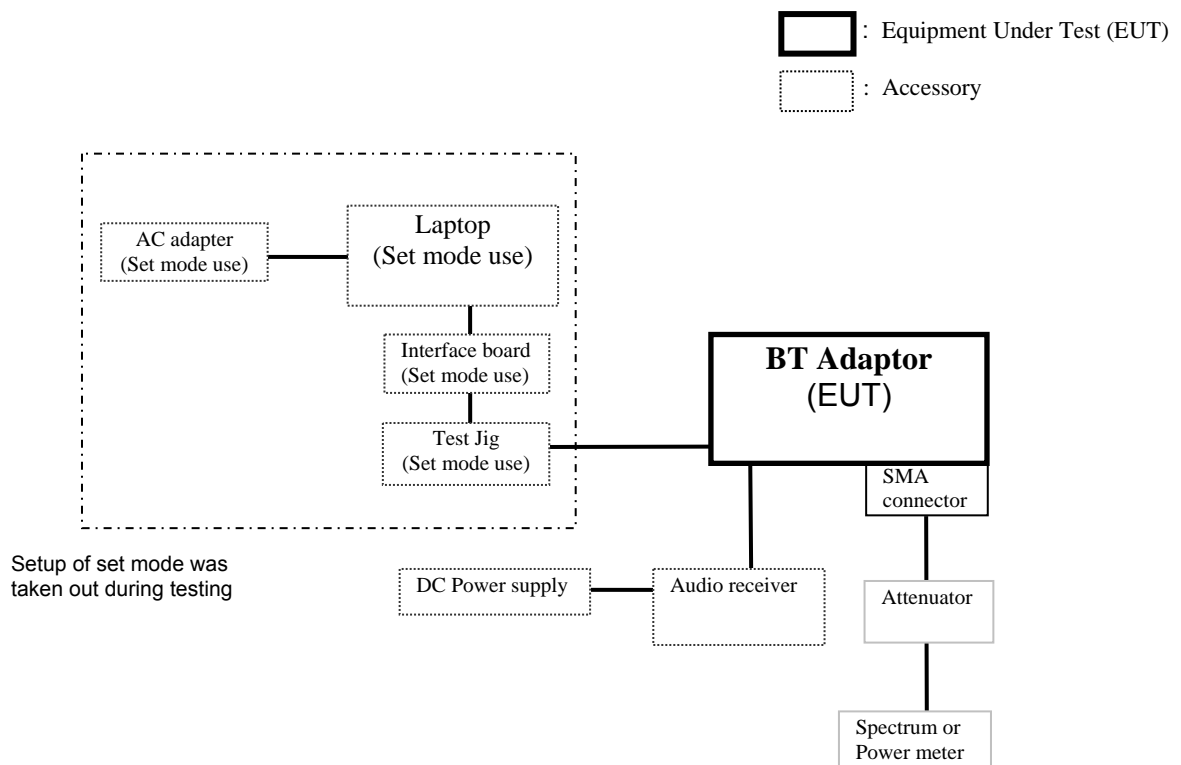
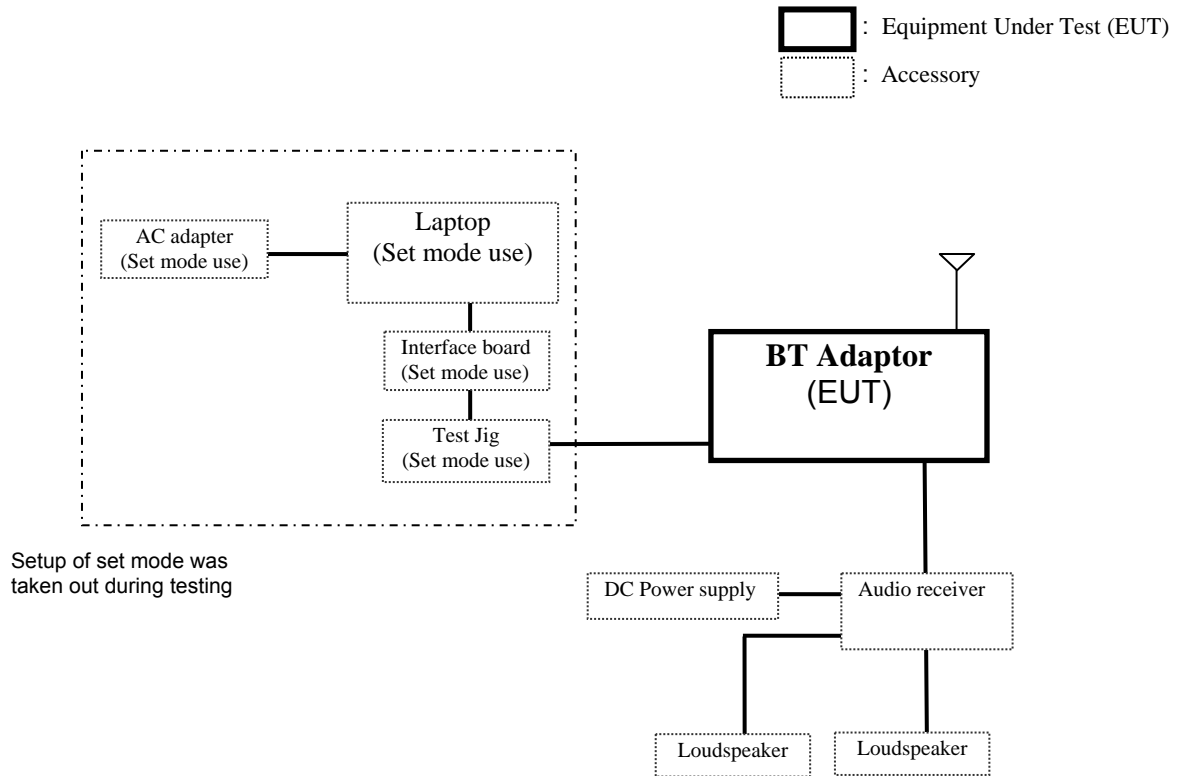


Figure 2: Test setup of Radiated testing



Two test samples were available. Sample receipt No. PT0214005001-1 was tested for RF conducted test with SMA connector (figure 1) and sample receipt No. PT0214005001-2 was tested for radiated measurements (figure 2).

The power cables of the Adaptor and DC power supply are not shown in the figures.
For more details, refer to section: Photographs of the Test Set-Up

4.3 Test Operation and Test Software

A software Bluetest3 of CSR BlueSuite Version 2.2 was used for testing.

The software was running on the external PC setting continuous radio communication of the EUT with selected operation mode, frequency channel, packet type, packet size. It was used to enable on the EUT the test operation mode specified in section 3.3. The PC was disconnected after setting.

4.4 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

1. Product: Laptop Computer
Manufacturer: IBM
Model: ThinkPad x 41
Rated Voltage: DC 16V
Input Current: 3.5A
Frequency: -
Serial Number: 11S91P9283Z1Z9VB5970FG

2. Product: AC adaptor of Laptop Computer
Manufacturer: IBM
Model: 02K6810
Rated Voltage: AC100-240V
Input Current: 1.5A
Frequency: 50-60Hz
Serial Number: 11S02K6810Z1Z3BJ59G1JH

3. Product: Audio Receiver
Manufacturer: JVC
Model: KD-R320
Rated Voltage: N/A
Input Current: N/A
Frequency: -
Serial Number: Prototype

4. Product: Speaker x2 (4ohm)
Manufacturer: KENWOOD
Model: KFC-C162
Serial Number: N/A

5. Product: Interface Board
Manufacturer: Hosiden

6. Product: Test Jig
Manufacturer: Hosiden

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: 2010-11-08

Ambient temperature: 24°C

Relative humidity: 40%

Atmospheric pressure: 1008hPa

Requirements:

For frequency hopping systems operating in the 2400-2483.5MHz band employing at least 75 non-overlapping hopping channels and hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 dB bandwidth of the hopping channel, whichever is greater, the maximum peak output power shall be 1W (30dBm).

Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125mW (20.97dBm).

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 power meter. The final measurement takes into account the loss generated by all the involved cables, including the short cable provided by the EUT manufacturer to support the SMA antenna connector.

The measurement was performed at all the available modulations and data rates in order to identify the one producing the highest output power for each of the GFSK and $\pi/4$ -DQPSK and 8DPSK radios.

Table 4: Conducted Output Power, Mode A (2402MHz)

Data Rate-Modulation	Reading [dBm]	Correction Factor [dB]	Output Power [dBm]	Output Power [mW]	Limit [dBm]	Limit [mW]	Margin [dB]
DH1-1	2.92	2.04	4.96	3.14	30.00	1000	25.04
DH1-2	2.59	2.04	4.63	2.91	20.97	125	16.34
DH1-3	2.83	2.04	4.87	3.07	20.97	125	16.10
DH3-1	2.90	2.04	4.94	3.12	30.00	1000	25.06
DH3-2	2.61	2.04	4.65	2.92	20.97	125	16.32
DH3-3	2.70	2.04	4.74	2.98	20.97	125	16.23
DH5-1	2.86	2.04	4.90	3.09	30.00	1000	25.10
DH5-2	2.63	2.04	4.67	2.93	20.97	125	16.30
DH5-3	2.87	2.04	4.91	3.10	20.97	125	16.06

Notes: Output power = Reading + Correction factor
 Correction factor = Total cable loss
 $mW = 10^{(dBm/10)}$
 $dBm = 10 \times \log(mW)$

Table 5: Conducted Output Power, Mode B (2441MHz)

Data Rate-Modulation	Reading [dBm]	Correction Factor [dB]	Output Power [dBm]	Output Power [mW]	Limit [dBm]	Limit [mW]	Margin [dB]
DH1-1	2.93	2.05	4.98	3.15	30.00	1000	25.02
DH1-2	2.60	2.05	4.65	2.92	20.97	125	16.32
DH1-3	2.90	2.05	4.95	3.13	20.97	125	16.02
DH3-1	2.93	2.05	4.98	3.15	30.00	1000	25.02
DH3-2	2.68	2.05	4.73	2.97	20.97	125	16.24
DH3-3	2.92	2.05	4.97	3.14	20.97	125	16.00
DH5-1	2.93	2.05	4.98	3.15	30.00	1000	25.02
DH5-2	2.61	2.05	4.66	2.93	20.97	125	16.31
DH5-3	2.92	2.05	4.97	3.14	20.97	125	16.00

Notes: Output power = Reading + Correction factor
 Correction factor = Total cable loss
 $mW = 10^{(dBm/10)}$
 $dBm = 10 \times \log(mW)$

Table 6: Conducted Output Power, Mode C (2480MHz)

Data Rate-Modulation	Reading [dBm]	Correction Factor [dB]	Output Power [dBm]	Output Power [mW]	Limit [dBm]	Limit [mW]	Margin [dB]
DH1-1	3.08	2.05	5.13	3.26	30.00	1000	24.87
DH1-2	2.60	2.05	4.65	2.92	20.97	125	16.32
DH1-3	2.94	2.05	4.99	3.16	20.97	125	15.98
DH3-1	3.03	2.05	5.08	3.22	30.00	1000	24.92
DH3-2	2.67	2.05	4.72	2.97	20.97	125	16.25
DH3-3	2.93	2.05	4.98	3.15	20.97	125	15.99
DH5-1	3.03	2.05	5.08	3.22	30.00	1000	24.92
DH5-2	2.68	2.05	4.73	2.97	20.97	125	16.24
DH5-3	3.00	2.05	5.05	3.20	20.97	125	15.92

Grey shading area shows the highest power in the corresponding modulation.

Notes: Output power = Reading + Correction factor

Correction factor = Total cable loss

mW = $10^{(dBm/10)}$

dBm = $10 \times \log(mW)$

Remark:

Since the hopping channel carrier frequencies separated more than the 20 dB bandwidth of the hopping channel in GFSK, the limit of maximum peak output power shall be 1W (30dBm). On the other hand, the hopping channel carrier frequencies cannot be greater than 20dB bandwidth but still more than two-thirds of the 20 dB bandwidth of the hopping channel. Therefore, the limit of maximum peak output power shall be 125mW in $\pi/4$ -DQPSK and 8DPSK. For the details, please refer to section 5.1.2.

The above results show that the highest output power is found at the data rate of DH1 in GFSK and DH5 in $\pi/4$ -DQPSK/8DPSK. Therefore, all the other measurements for the evaluation of the radio properties of the EUT have been performed using these data rates.

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

RESULT:

PASS

Date of testing: 2010-11-09

Ambient temperature: 24°C

Relative humidity: 20%

Atmospheric pressure: 994hPa

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.

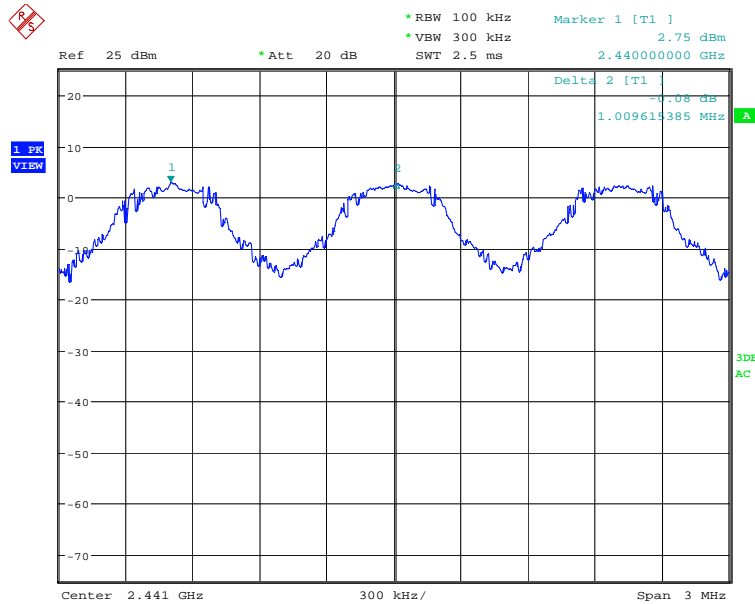
A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth was set to 100kHz and the video bandwidth to 300kHz. The Delta Marker function was used to determine the separation between the peaks of two adjacent channels.

Table 7: Carrier Frequency Separation

Modulation	Channel Separation [kHz]	Maximum 20dB Bandwidth [kHz]	Limit [kHz]
GFSK	1001	875.00	875.00
8DPSK	1000	1288.46	858.97

Notes: For GFSK: Limit = 20dB bandwidth since it is greater than 125kHz.
 For 8DPSK: Limit = 20dB bandwidth * 2/3 since it is greater than 125kHz and the output power is less than 125mW.

Figure 3: Carrier Frequency Separation, GFSK



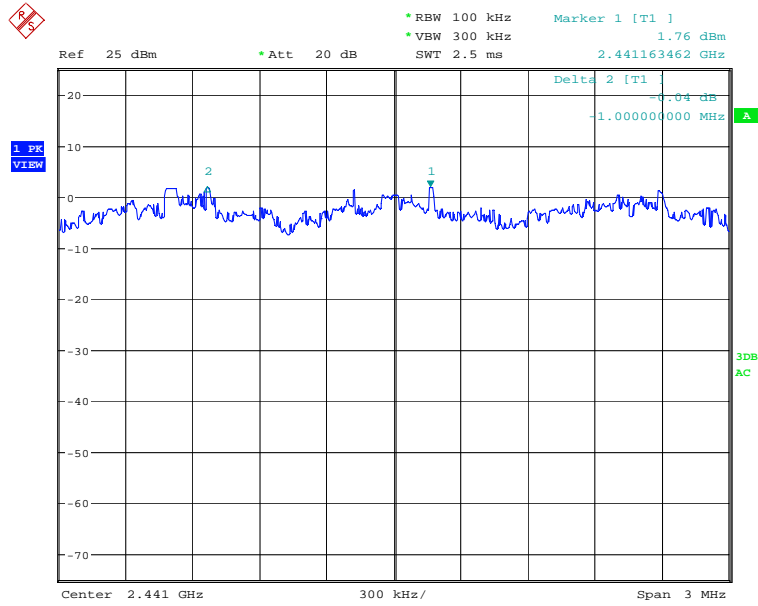
Hopping Channel DH5-1
 Date: 9.NOV.2010 18:53:47

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Figure 4: Carrier Frequency Separation, 8DPSK



Hopping Channel DH5-3 b
Date: 9.NOV.2010 19:00:21

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

Date of testing: 2010-11-09

Ambient temperature: 24°C

Relative humidity: 20%

Atmospheric pressure: 994hPa

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:

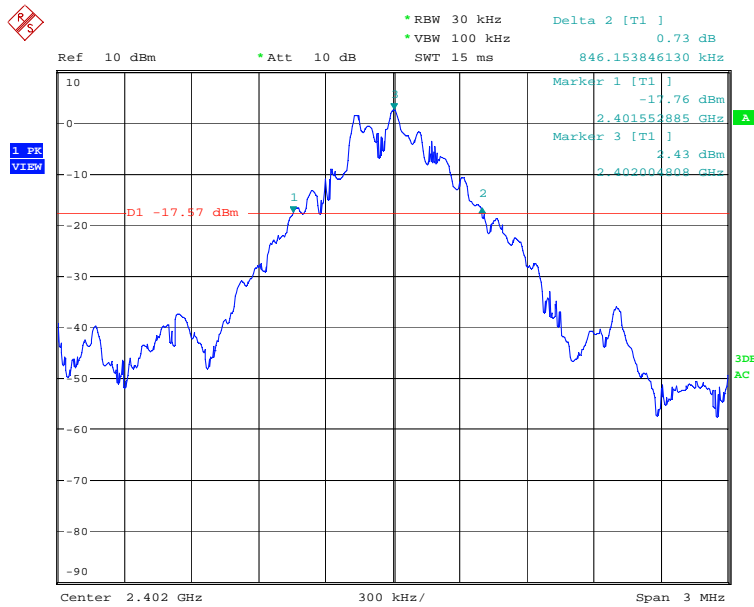
ANSI C63.4-2003, RSS-Gen 4.6.2 and Public Notice DA 00-705.

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.

Table 8: 20dB Bandwidth

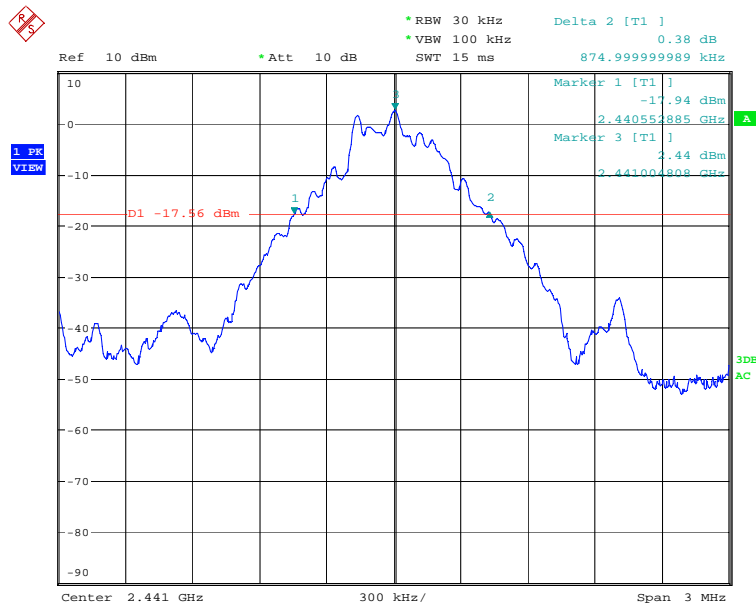
Modulation	Operating Frequency [MHz]	20dB Bandwidth [kHz]
GFSK	2402	846.15
GFSK	2441	875.00
GFSK	2480	846.15
8DPSK	2402	1283.65
8DPSK	2441	1283.65
8DPSK	2480	1288.46

Figure 5: 20dB Bandwidth, Mode A (2402MHz), GFSK



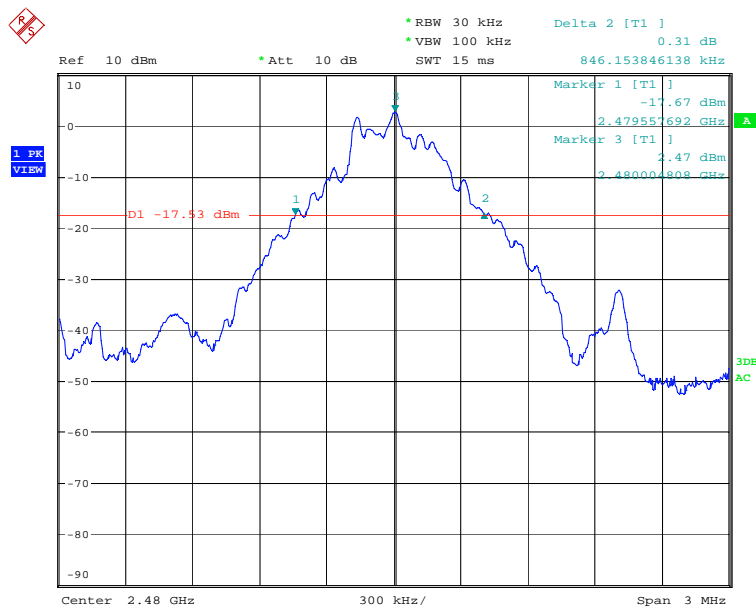
20dB Bandwidth 2402MHz DH1-1
 Date: 9.NOV.2010 18:02:28

Figure 6: 20dB Bandwidth, Mode B (2441MHz), GFSK



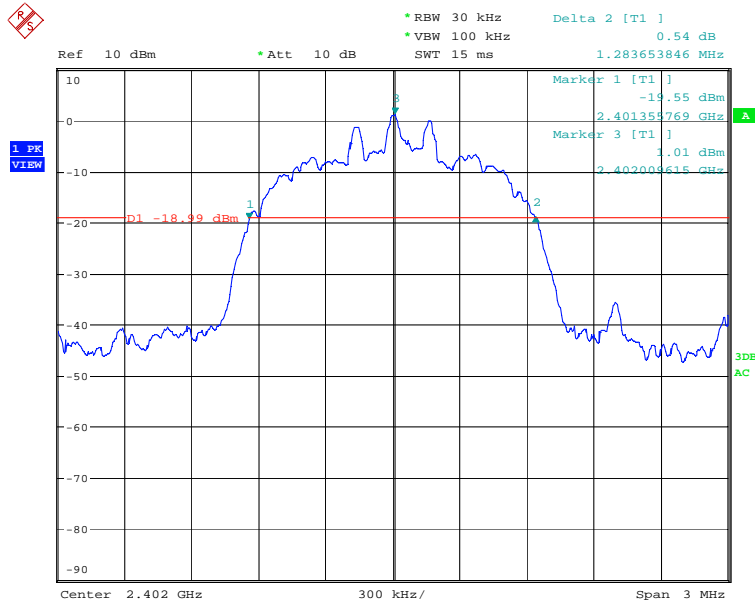
20dB Bandwidth 2441MHz DH1-1
Date: 9.NOV.2010 18:05:45

Figure 7: 20dB Bandwidth, Mode C (2480MHz), GFSK



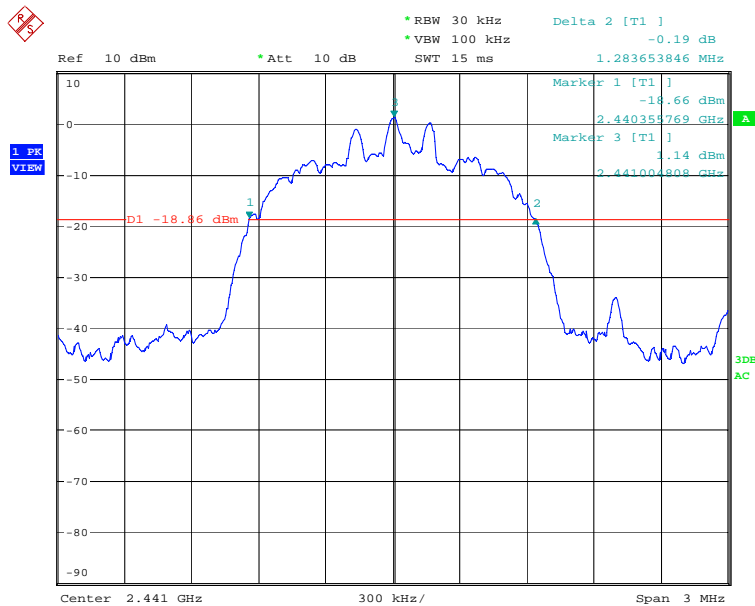
20dB Bandwidth 2480MHz DH1-1
Date: 9.NOV.2010 18:07:57

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



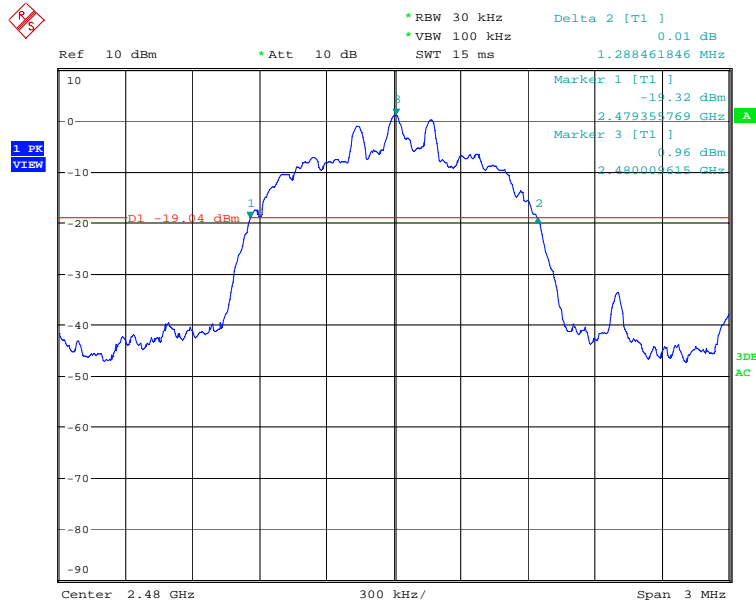
20dB Bandwidth 2402MHz DH5-3
Date: 9.NOV.2010 18:17:06

Figure 9: 20dB Bandwidth, Mode B (2441MHz), 8DPSK



20dB Bandwidth 2441MHz DH5-3
Date: 9.NOV.2010 18:14:48

Figure 10: 20dB Bandwidth, Mode C (2480MHz), 8DPSK



20dB Bandwidth 2480MHz DH5-3
Date: 9.NOV.2010 18:11:29

5.1.4 99% Bandwidth, RSS-Gen 4.6.1

Date of testing: 2010-11-09

Ambient temperature: 24°C

Relative humidity: 20%

Atmospheric pressure: 994hPa

Requirements:

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

Test procedure:

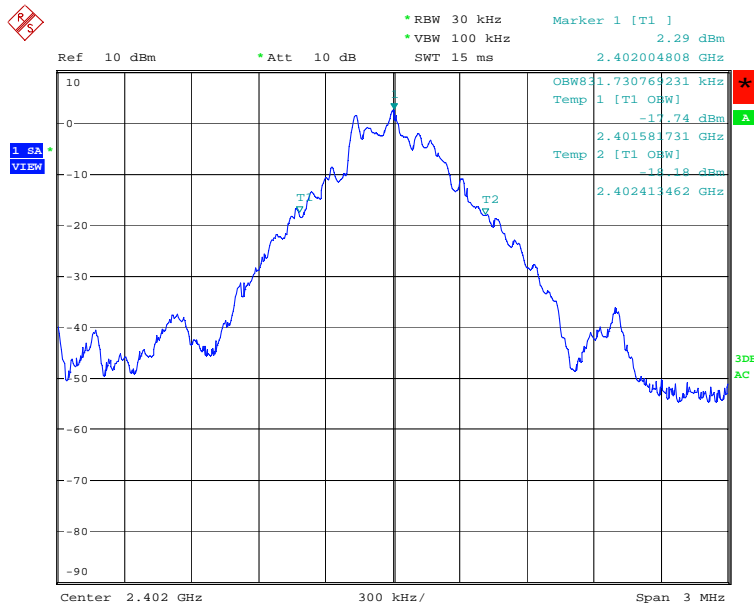
RSS-Gen 4.6.1.

A spectrum analyzer was connected to the antenna port of the EUT. The spectrum analyzer resolution bandwidth was set to 1% of the span (3MHz). The 99% bandwidth was measured by using the OBW function of the analyzer with a 99% coverage setting.

Table 9: 99% Bandwidth

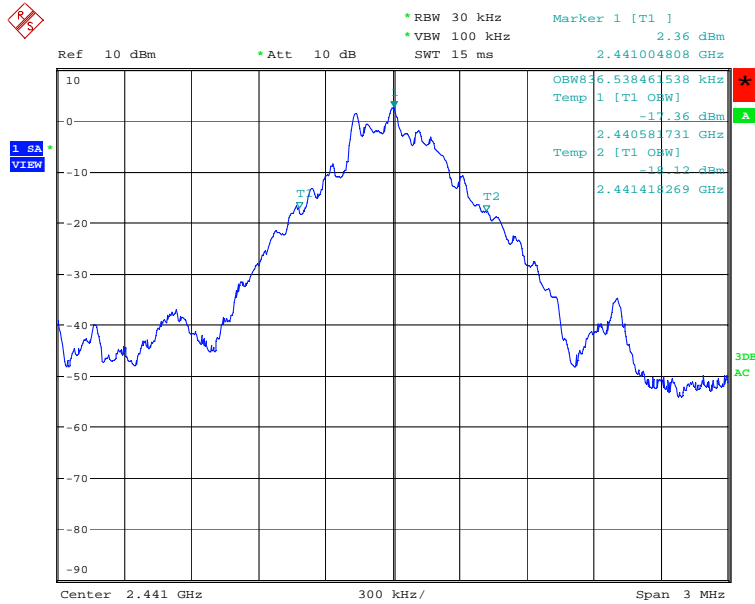
Modulation	Operating Frequency [MHz]	99% Bandwidth [kHz]
GFSK	2402	831.73
GFSK	2441	836.54
GFSK	2480	836.54
8DPSK	2402	1168.27
8DPSK	2441	1168.27
8DPSK	2480	1168.27

Figure 11: 99% Bandwidth, Mode A (2402MHz), GFSK



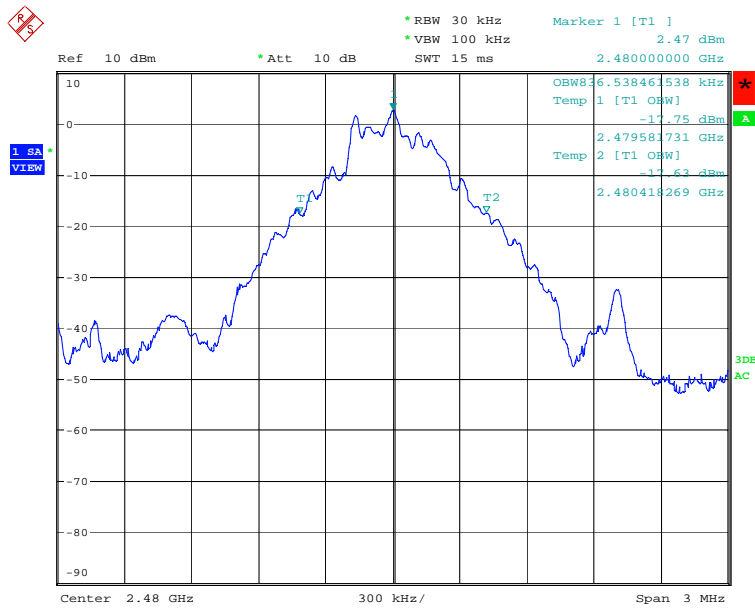
99% Bandwidth 2402MHz DH1-1
 Date: 9.NOV.2010 18:24:30

Figure 12: 99% Bandwidth, Mode B (2441MHz), GFSK



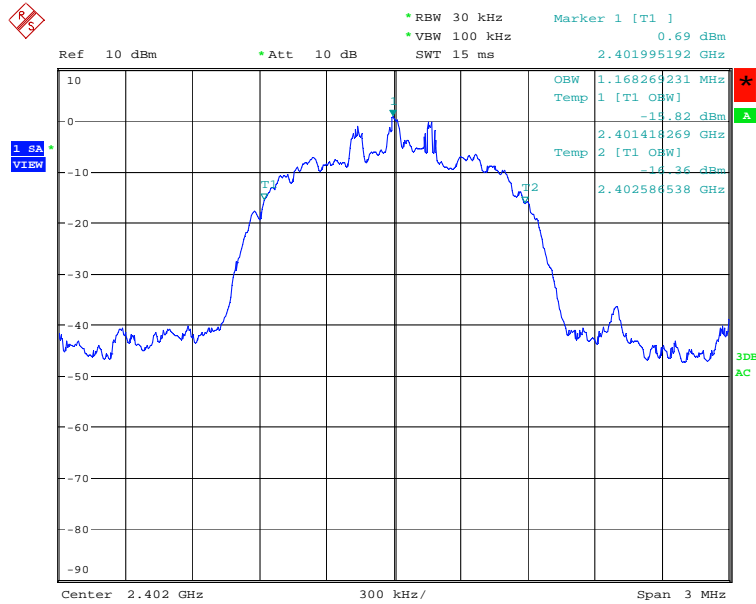
99% Bandwidth 2441MHz DH1-1
 Date: 9.NOV.2010 18:27:14

Figure 13: 99% Bandwidth, Mode C (2480MHz), GFSK



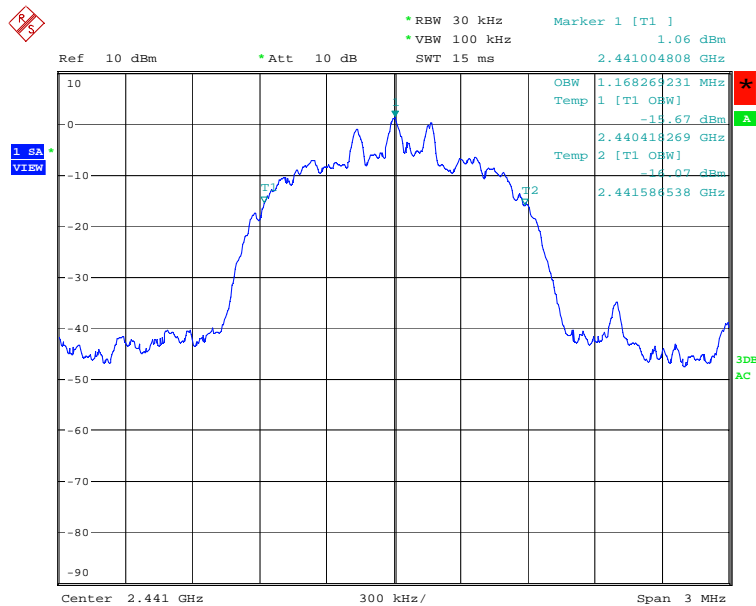
99% Bandwidth 2480MHz DH1-1
 Date: 9.NOV.2010 18:29:19

Figure 14: 99% Bandwidth, Mode A (2402MHz), 8DPSK



99% Bandwidth 2402MHz DH5-3
 Date: 9.NOV.2010 18:34:42

Figure 15: 99% Bandwidth, Mode B (2441MHz), 8DPSK



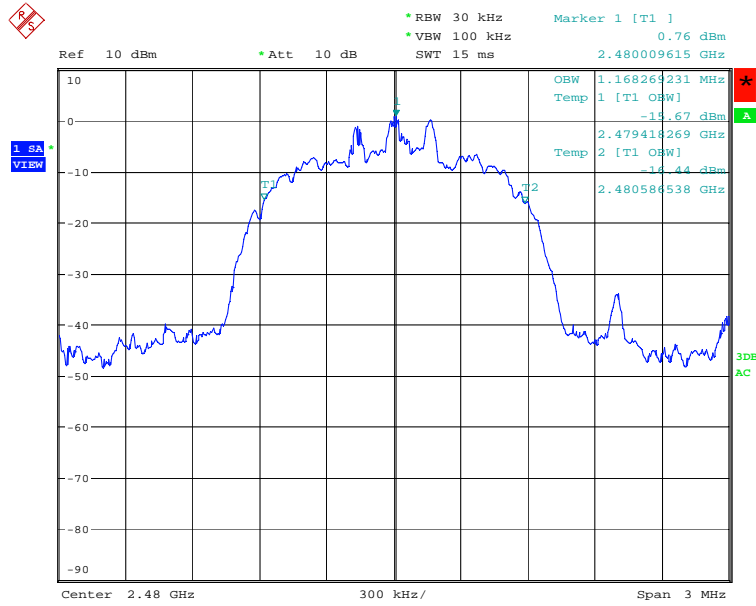
99% Bandwidth 2441MHz DH5-3
 Date: 9.NOV.2010 18:33:11

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Figure 16: 99% Bandwidth, Mode C (2480MHz), 8DPSK



99% Bandwidth 2480MHz DH5-3
Date: 9.NOV.2010 18:31:33

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

RESULT:

PASS

Date of testing: 2010-11-09

Ambient temperature: 24°C

Relative humidity: 20%

Atmospheric pressure: 994hPa

Requirements:

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

Test procedure:

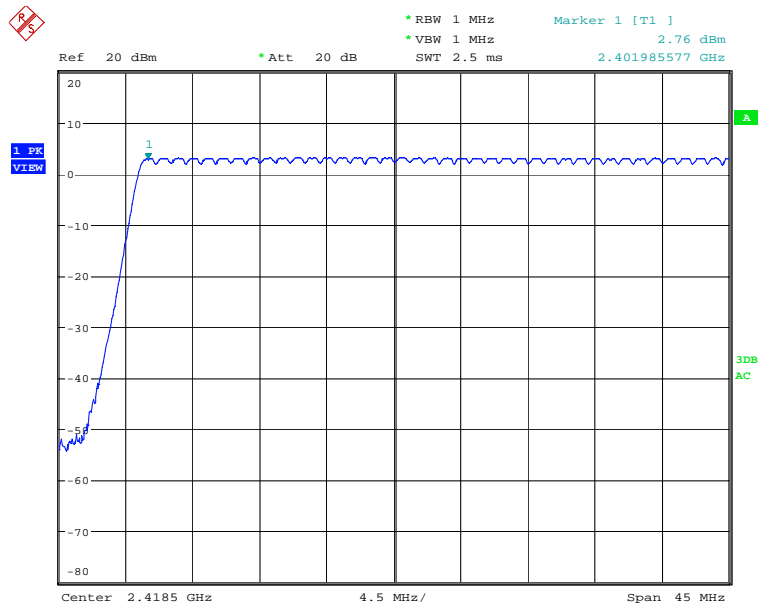
ANSI C63.4-2003 and Public Notice DA 00-705.

A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth and video bandwidth were set to 1MHz. The spectrum was broken in two plots having each a 45MHz span to show all the hopping frequencies.

Table 10: Number of Hopping Frequencies

Number of Hopping Frequencies	Limit
79	15

Figure 17: Hopping Frequencies up to 2441MHz, Mode E (Hopping)



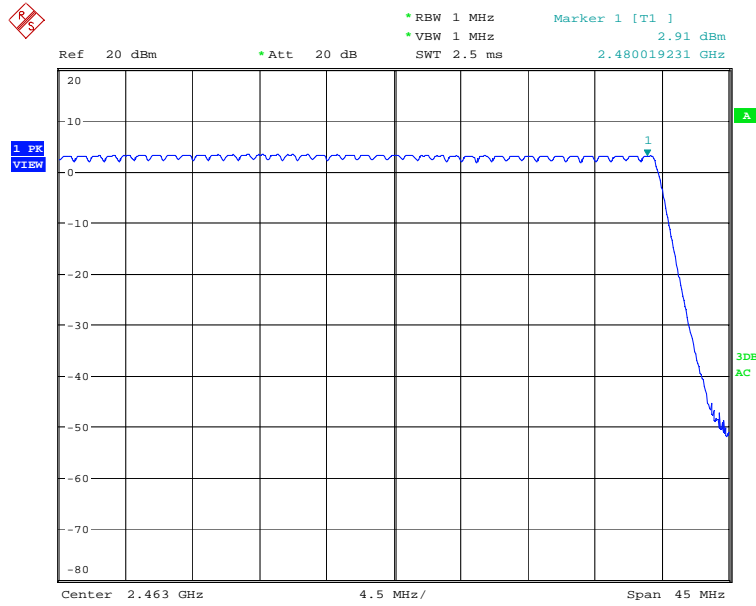
Hopping Sequence Lower DH5-1
 Date: 9.NOV.2010 17:37:16

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Figure 18: Hopping Frequencies above 2441MHz, Mode E (Hopping)



Hopping Sequence Upper DH5-1
Date: 9.NOV.2010 17:38:41

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

RESULT:

PASS

Date of testing: 2010-11-09

Ambient temperature: 24°C

Relative humidity: 20%

Atmospheric pressure: 994hPa

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.

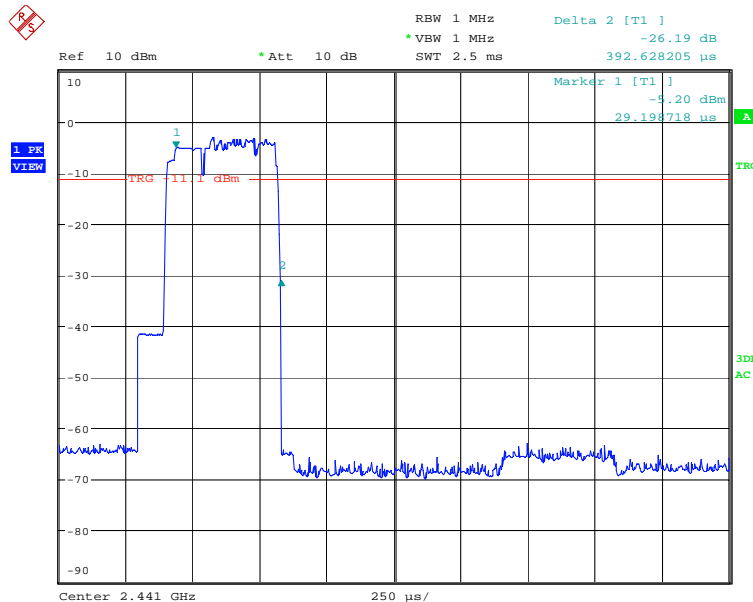
A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth and video bandwidth were set to 1MHz. The average time of occupancy was obtained by measuring first the dwell time of a single packet with the Delta Marker function using a zero span centered on a hopping 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 11: Average Time of Occupancy

Packet Type	Packet Duration [ms]	Number of Hops per Channel in a 31.6s Period	Average Time of Occupancy [ms]	Limit [ms]
DH1	0.393	320	125.76	400
DH3	1.667	160	266.72	400
DH5	3.069	106.67	327.37	400

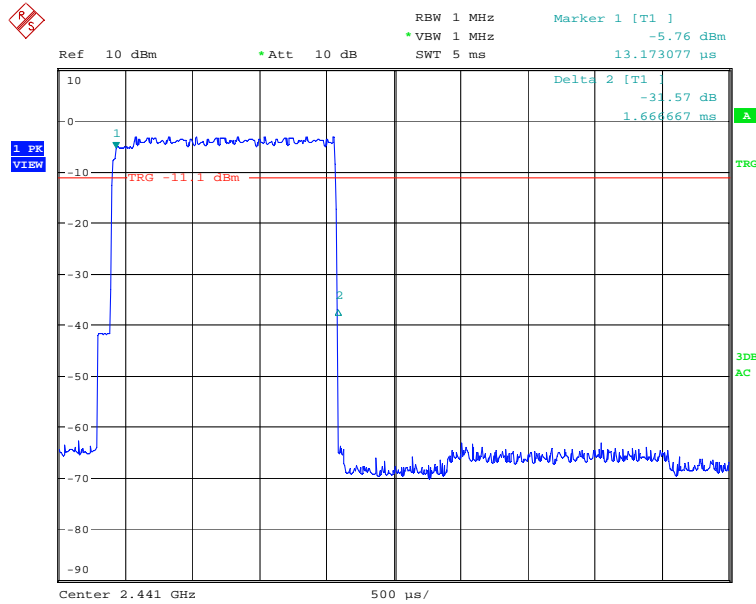
Notes: DH1 Packet type permits maximum $1600 / 79 / 2 = 10.13$ hops per second in each channel (1 time slot for Tx and 1 time slot for Rx). The number of hops within 31.6 sec. = 320 hops in each channel
 DH3 Packet type permits maximum $1600 / 79 / 4 = 5.06$ hops per second in each channel (3 time slot for Tx and 1 time slot for Rx). The number of hops within 31.6 sec. = 160 hops in each channel
 DH5 Packet type permits maximum $1600 / 79 / 6 = 3.38$ hops per second in each channel (5 time slot for Tx and 1 time slot for Rx). The number of hops within 31.6 sec. = 106.67 hops in each channel
 Average time of occupancy = Packet duration * Number of hops per channel in a 31.6s period

Figure 19: Dwell Time, Mode E (Hopping), DH1



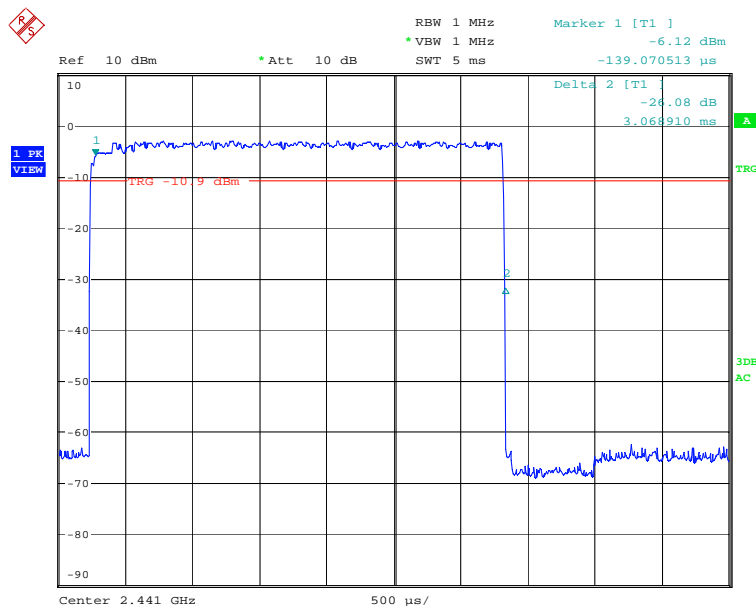
Dwell Time DH1-3
 Date: 9.NOV.2010 16:57:18

Figure 20: Dwell Time, Mode E (Hopping), DH3



Dwell Time DH3-3
Date: 9.NOV.2010 17:03:55

Dwell Time, Mode E (Hopping), DH5



Dwell Time DH5-2
Date: 9.NOV.2010 17:07:56

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

RESULT:

PASS

Date of testing: 2010-11-09

Ambient temperature: 24°C

Relative humidity: 20%

Atmospheric pressure: 994hPa

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 worst case was found at the data rate of DH1 in GFSK Therefore, the final measurement was reported accordingly.

The final measurement takes into account the loss generated by all the involved cables, including the short cable provided by the EUT manufacturer to support the SMA antenna connector.

Table 12: Conducted Spurious Emission, Mode A (2402MHz)

Frequency [MHz]	Reading [dBm]	Correction Factor [dB]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
Fundamental	3.97	1.54	5.51	N/A	N/A
3321.2	-51.34	1.84	-49.50	-14.49	35.02
926.5	-51.68	0.93	-50.75	-14.49	36.27
4804.0	-43.73	2.24	-41.49	-14.49	27.01
7675.4	-50.80	2.85	-47.95	-14.49	33.47
9328.7	-52.15	3.20	-48.95	-14.49	34.47
10372.5	-51.14	3.40	-47.74	-14.49	33.25
12092.4	-51.60	3.60	-48.00	-14.49	33.51
15725.7	-51.60	4.21	-47.39	-14.49	32.90
17934.4	-51.52	4.45	-47.07	-14.49	32.59
18298.9	-51.55	4.51	-47.04	-14.49	32.56
20269.3	-51.79	4.70	-47.09	-14.49	32.60
22417.2	-51.68	5.08	-46.60	-14.49	32.11
24519.8	-51.45	5.54	-45.91	-14.49	31.42

Notes: Limit = Reading of fundamental + Correction factor – 20dB
 Emission level = Reading (included RF SMA cable loss of EUT side) + Correction factor
 Correction factor = Total cable loss of the measuring cable

Figure 21: Conducted Spurious Emission, 30MHz – 2GHz, Mode A (2402MHz)

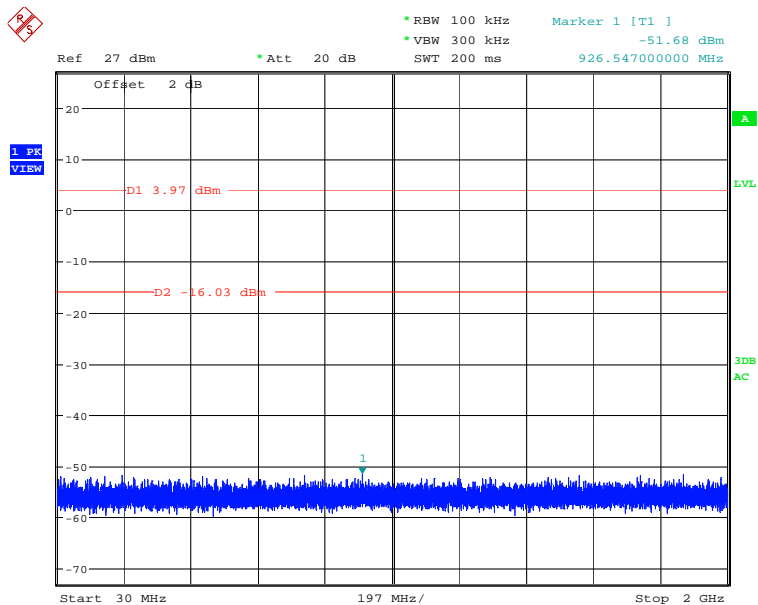
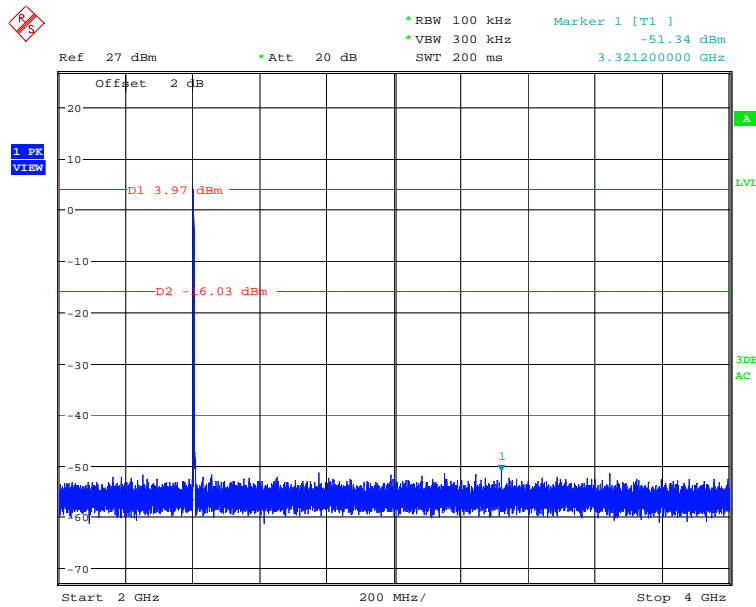
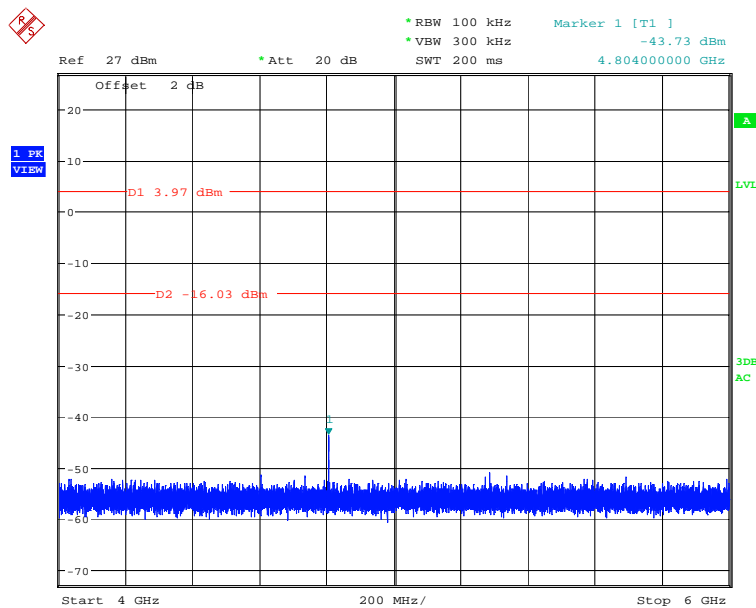


Figure 22: Conducted Spurious Emission, 2 – 4GHz, Mode A (2402MHz)



Spurious Emission 2402MHz DH1-1 2GHz-4GHz
Date: 9.NOV.2010 19:35:18

Figure 23: Conducted Spurious Emission, 4 – 6GHz, Mode A (2402MHz)



Spurious Emission 2402MHz DH1-1 4GHz-6GHz
Date: 9.NOV.2010 19:38:43

Figure 24: Conducted Spurious Emission, 6 – 8GHz, Mode A (2402MHz)

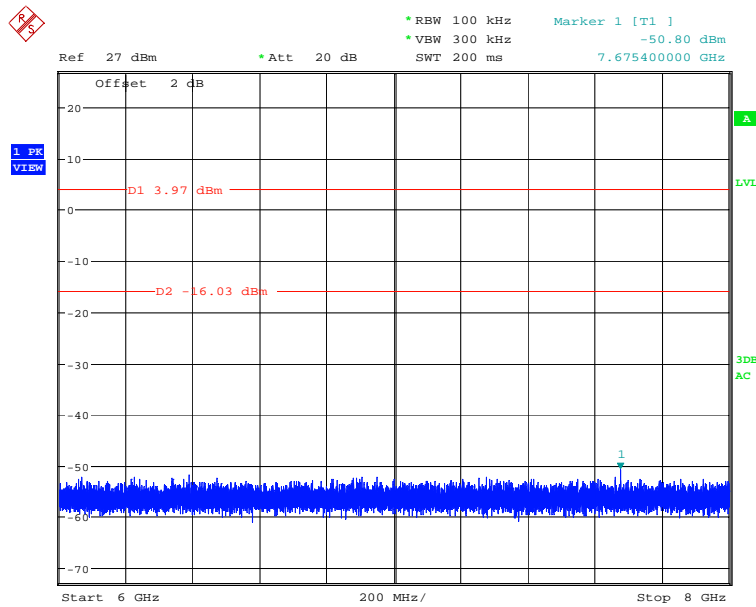


Figure 25: Conducted Spurious Emission, 8 – 10GHz, Mode A (2402MHz)

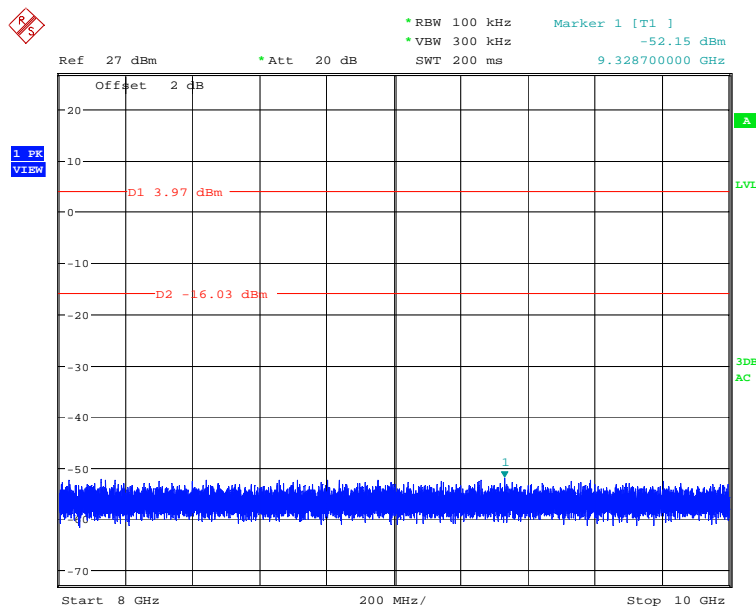
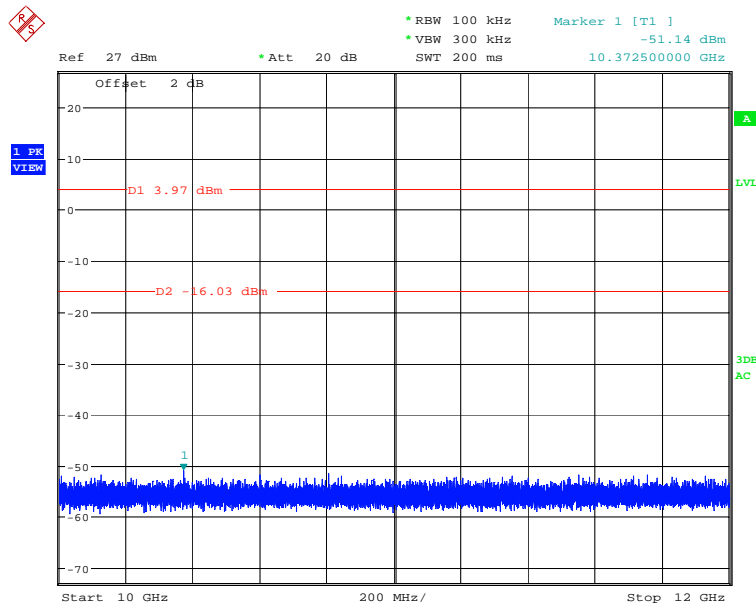
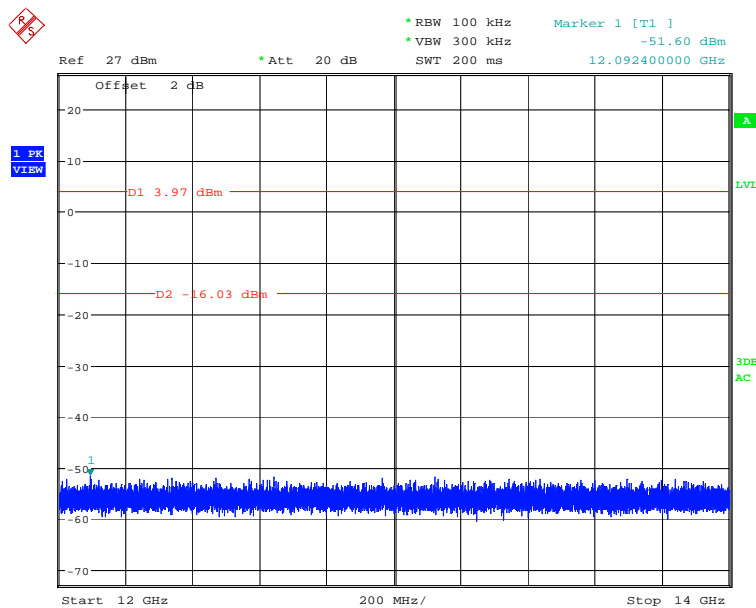


Figure 26: Conducted Spurious Emission, 10 – 12GHz, Mode A (2402MHz)



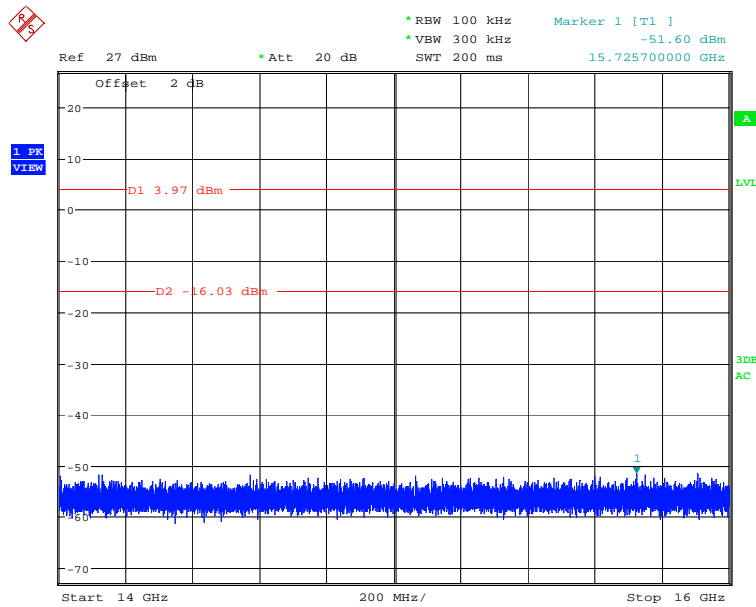
Spurious Emission 2402MHz DH1-1 10GHz-12GHz
Date: 9.NOV.2010 19:42:31

Figure 27: Conducted Spurious Emission, 12 – 14GHz, Mode A (2402MHz)



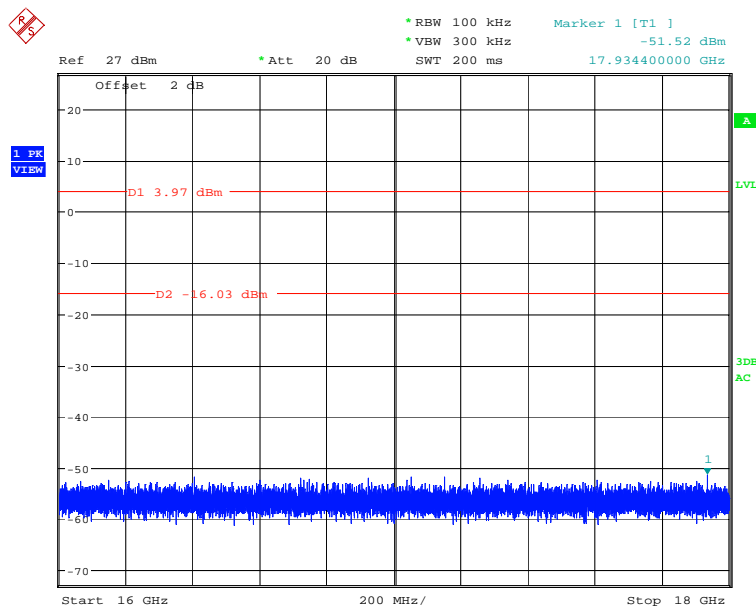
Spurious Emission 2402MHz DH1-1 12GHz-14GHz
Date: 9.NOV.2010 19:43:53

Figure 28: Conducted Spurious Emission, 14 – 16GHz, Mode A (2402MHz)



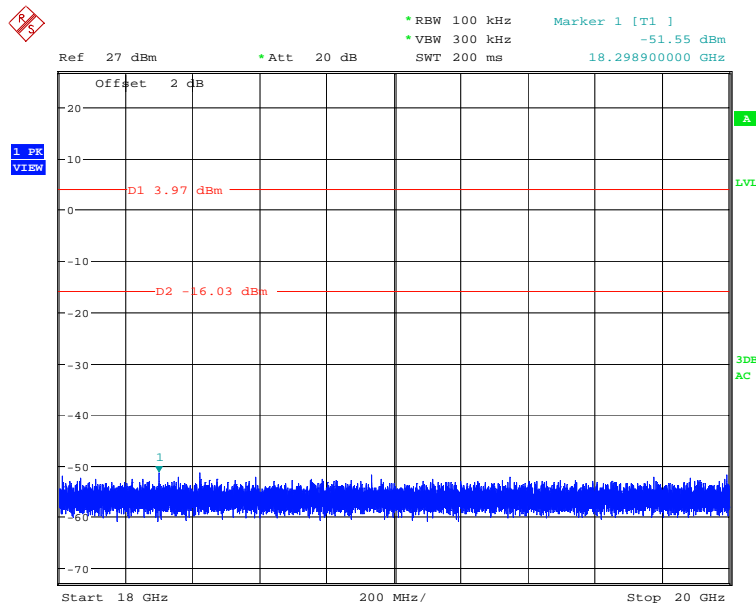
Spurious Emission 2402MHz DH1-1 14GHz-16GHz
Date: 9.NOV.2010 19:45:12

Figure 29: Conducted Spurious Emission, 16 – 18GHz, Mode A (2402MHz)



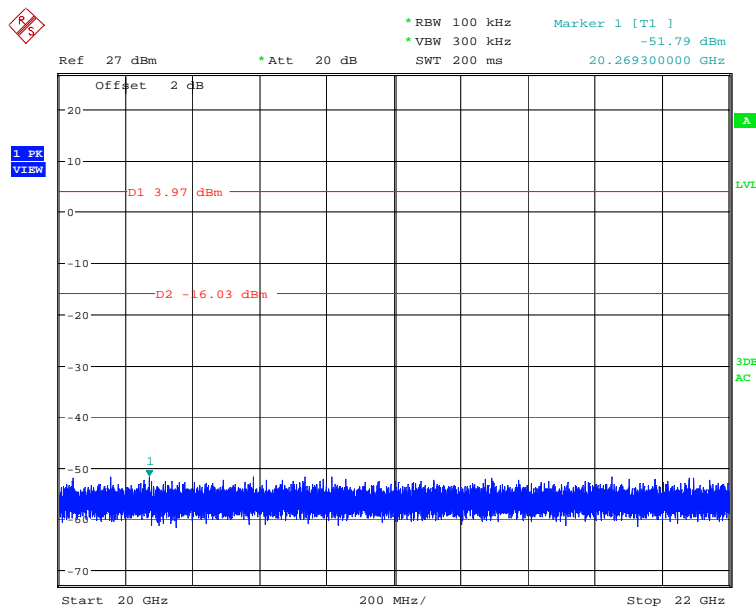
Spurious Emission 2402MHz DH1-1 16GHz-18GHz
Date: 9.NOV.2010 19:46:24

Figure 30: Conducted Spurious Emission, 18 – 20GHz, Mode A (2402MHz)



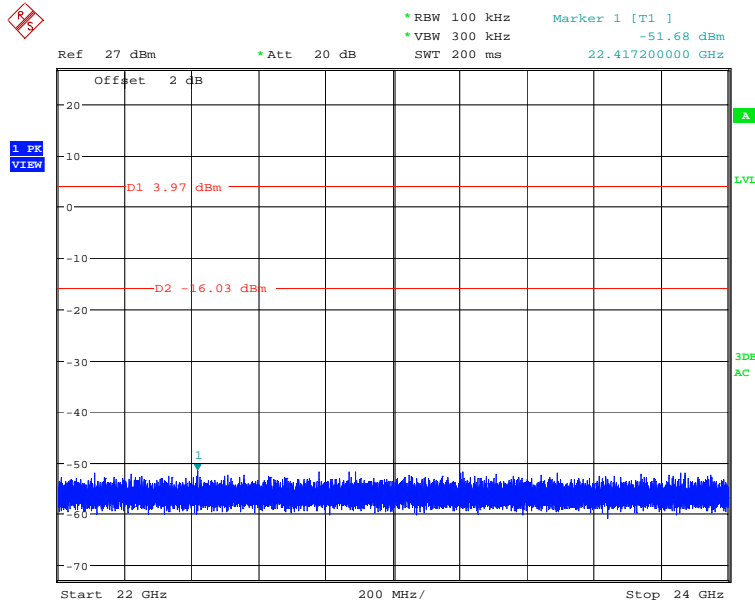
Spurious Emission 2402MHz DH1-1 18GHz-20GHz
Date: 9.NOV.2010 19:47:53

Figure 31: Conducted Spurious Emission, 20 – 22GHz, Mode A (2402MHz)



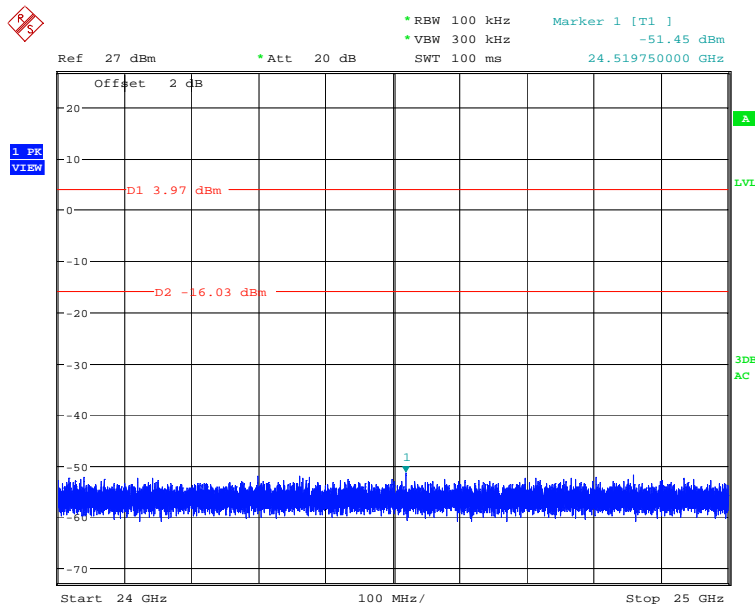
Spurious Emission 2402MHz DH1-1 20GHz-22GHz
Date: 9.NOV.2010 19:49:08

Figure 32: Conducted Spurious Emission, 22 – 24GHz, Mode A (2402MHz)



Spurious Emission 2402MHz DH1-1 22GHz-24GHz
Date: 9.NOV.2010 19:50:19

Figure 33: Conducted Spurious Emission, 24 – 25GHz, Mode A (2402MHz)



Spurious Emission 2402MHz DH1-1 24GHz-25GHz
Date: 9.NOV.2010 19:51:46

Table 13: Conducted Spurious Emission, Mode B (2441MHz)

Frequency [MHz]	Reading [dBm]	Correction Factor [dB]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
Fundamental	4.82	1.55	6.37	N/A	N/A
2067.2	-51.87	1.38	-50.49	-13.63	36.86
977.4	-51.45	0.92	-50.53	-13.63	36.90
4882.0	-44.58	2.30	-42.28	-13.63	28.66
7752.4	-51.34	2.95	-48.39	-13.63	34.76
8722.9	-51.55	3.19	-48.36	-13.63	34.73
10185.5	-51.26	3.37	-47.89	-13.63	34.26
13823.0	-51.52	4.03	-47.49	-13.63	33.86
15289.7	-51.26	4.18	-47.08	-13.63	33.45
16954.7	-51.42	4.42	-47.00	-13.63	33.38
19839.4	-51.87	4.71	-47.16	-13.63	33.54
20070.3	-51.34	4.72	-46.62	-13.63	32.99
22230.1	-51.52	5.04	-46.48	-13.63	32.86
23433.6	-51.42	5.27	-46.15	-13.63	32.52

Notes: Limit = Reading of fundamental + Correction factor – 20dB
 Emission level = Reading (included RF SMA cable loss of EUT side) + Correction factor
 Correction factor = Total cable loss of the measuring cable

Figure 34: Conducted Spurious Emission, 30MHz – 2GHz, Mode B (2441MHz)

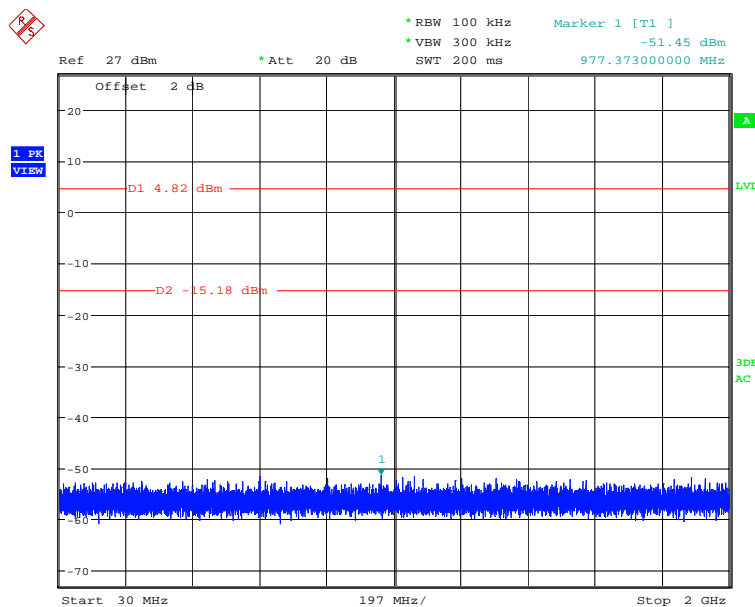
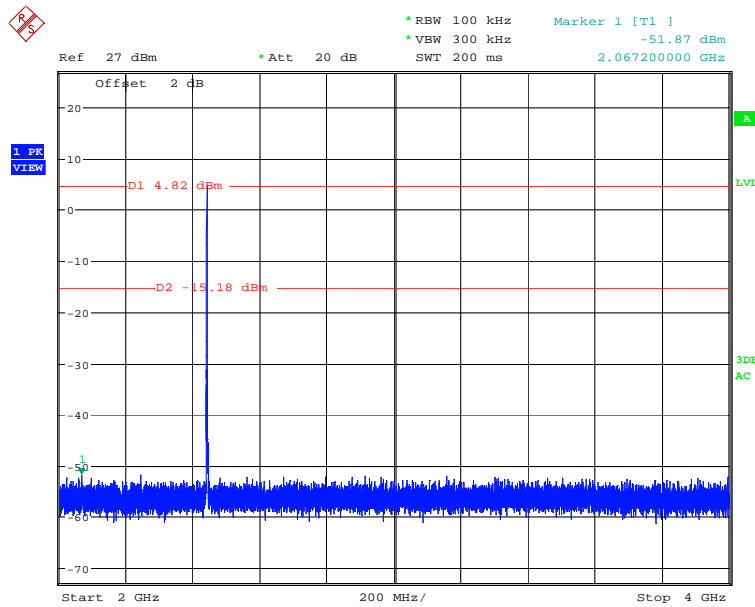
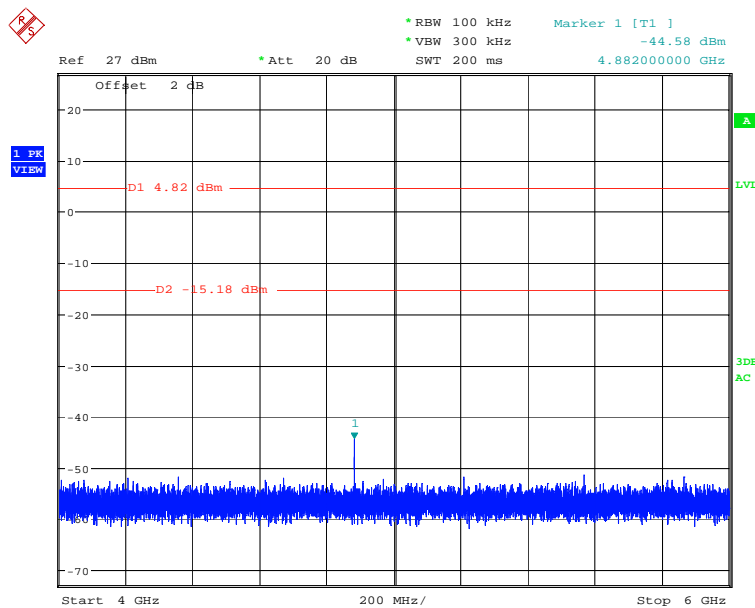


Figure 35: Conducted Spurious Emission, 2 – 4GHz, Mode B (2441MHz)



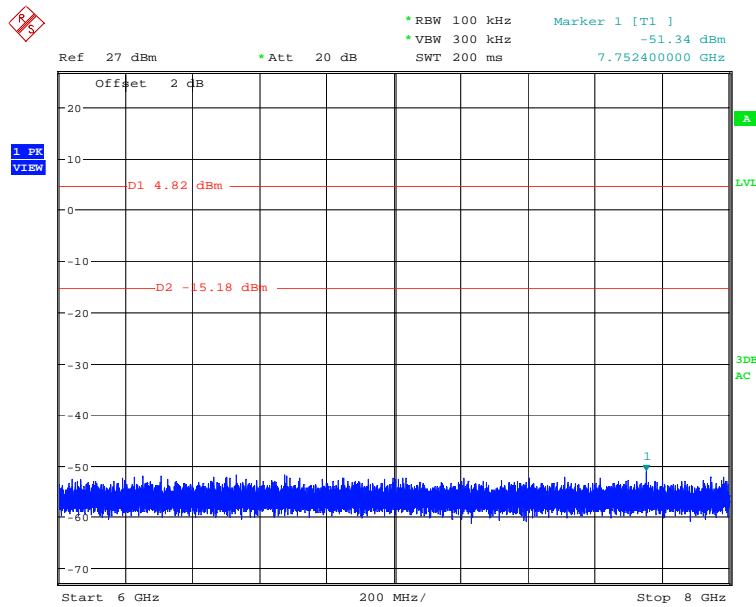
Spurious Emission 2441MHz DH1-1 2GHz-4GHz
Date: 9.NOV.2010 19:55:14

Figure 36: Conducted Spurious Emission, 4 – 6GHz, Mode B (2441MHz)



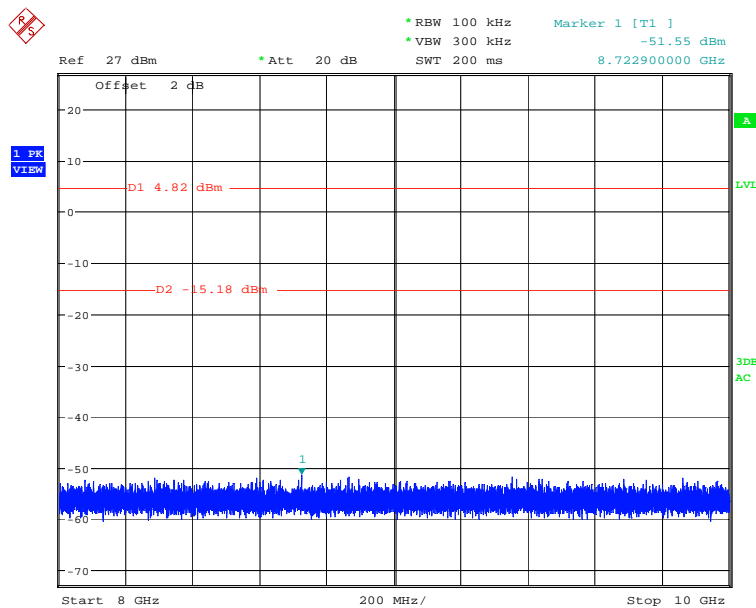
Spurious Emission 2441MHz DH1-1 4GHz-6GHz
Date: 9.NOV.2010 19:57:39

Figure 37: Conducted Spurious Emission, 6 – 8GHz, Mode B (2441MHz)



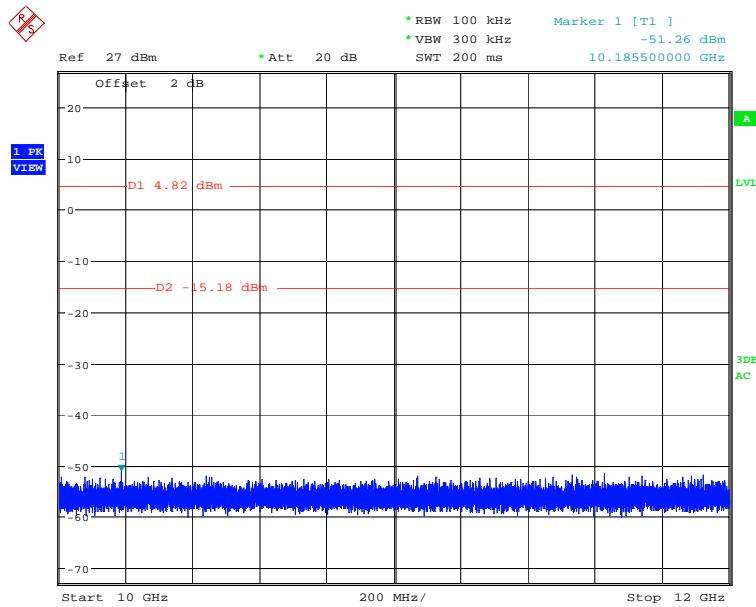
Spurious Emission 2441MHz DH1-1 6GHz-8GHz
Date: 9.NOV.2010 19:59:00

Figure 38: Conducted Spurious Emission, 8 – 10GHz, Mode B (2441MHz)



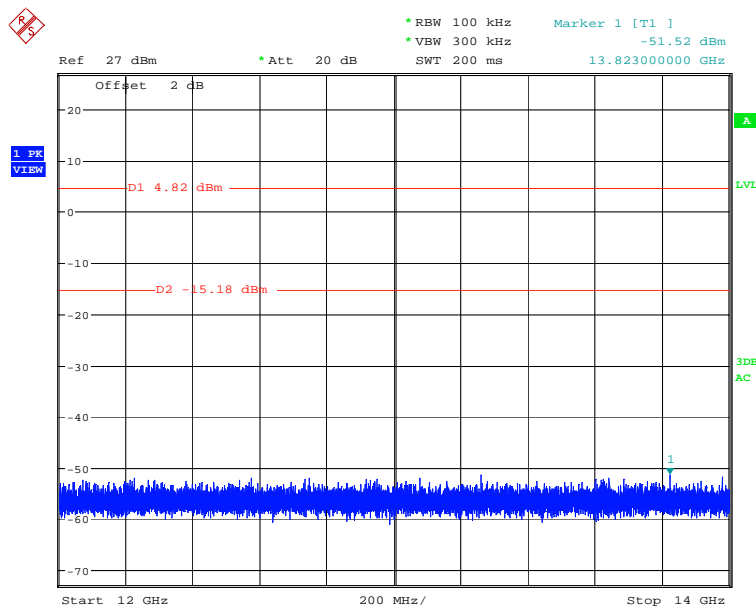
Spurious Emission 2441MHz DH1-1 8GHz-10GHz
Date: 9.NOV.2010 20:00:11

Figure 39: Conducted Spurious Emission, 10 – 12GHz, Mode B (2441MHz)



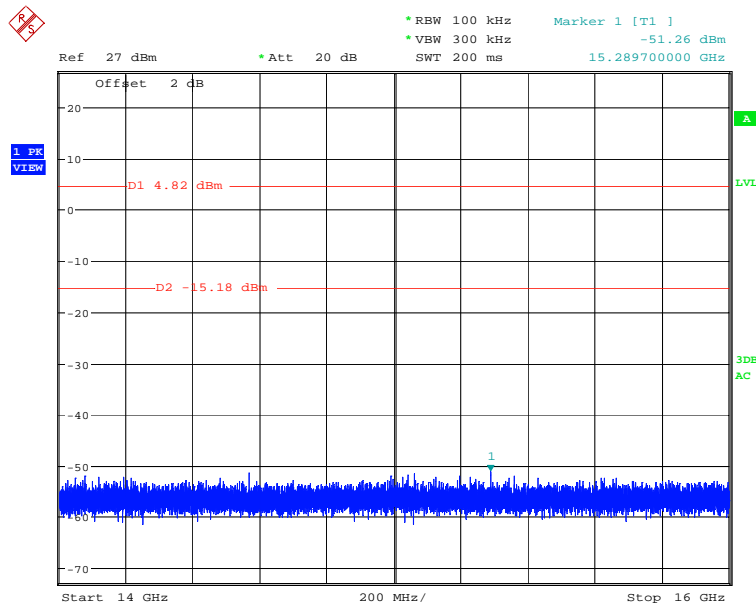
Spurious Emission 2441MHz DH1-1 10GHz-12GHz
Date: 9.NOV.2010 20:01:29

Figure 40: Conducted Spurious Emission, 12 – 14GHz, Mode B (2441MHz)



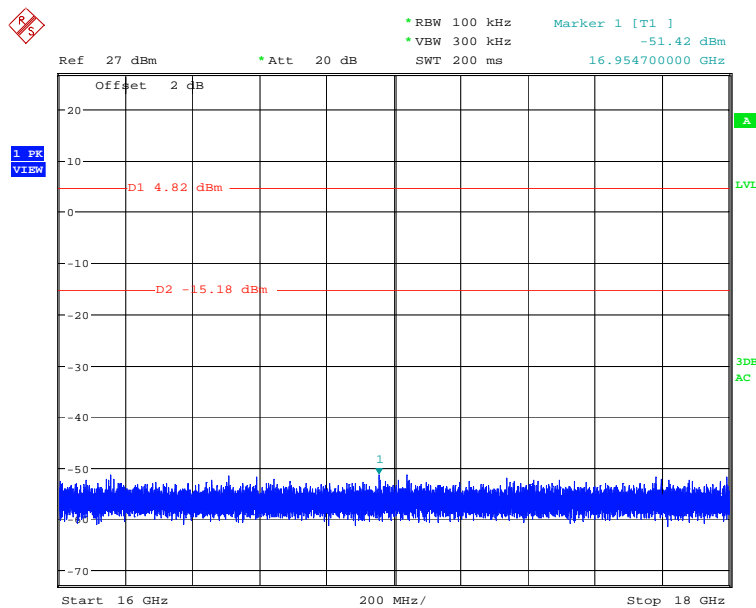
Spurious Emission 2441MHz DH1-1 12GHz-14GHz
Date: 9.NOV.2010 20:02:45

Figure 41: Conducted Spurious Emission, 14 – 16GHz, Mode B (2441MHz)



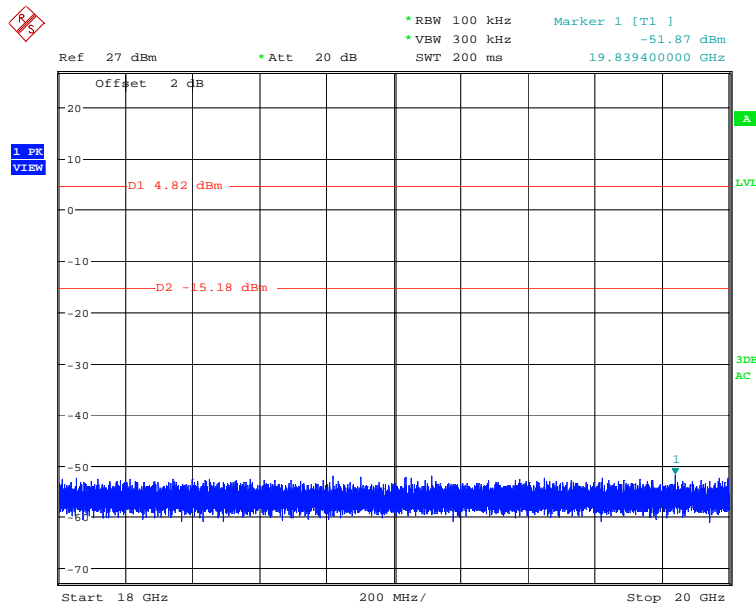
Spurious Emission 2441MHz DH1-1 14GHz-16GHz
Date: 9.NOV.2010 20:03:58

Figure 42: Conducted Spurious Emission, 16 – 18GHz, Mode B (2441MHz)



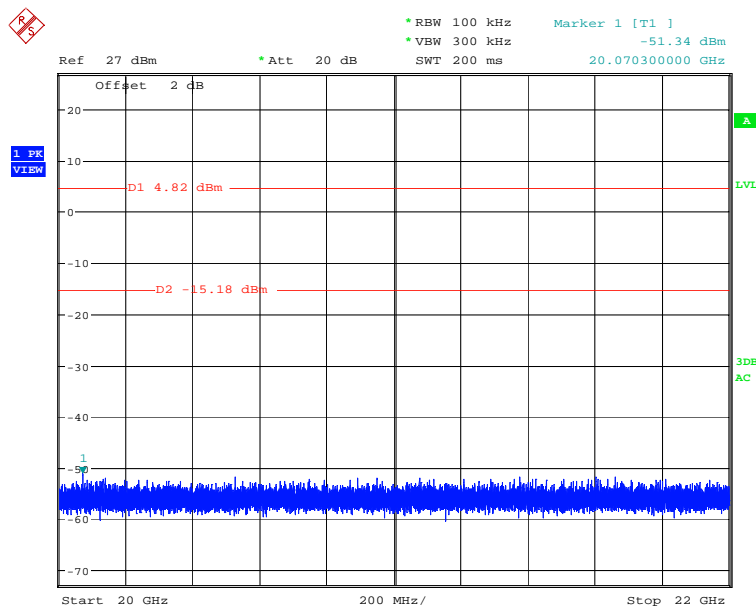
Spurious Emission 2441MHz DH1-1 16GHz-18GHz
Date: 9.NOV.2010 20:05:10

Figure 43: Conducted Spurious Emission, 18 – 20GHz, Mode B (2441MHz)



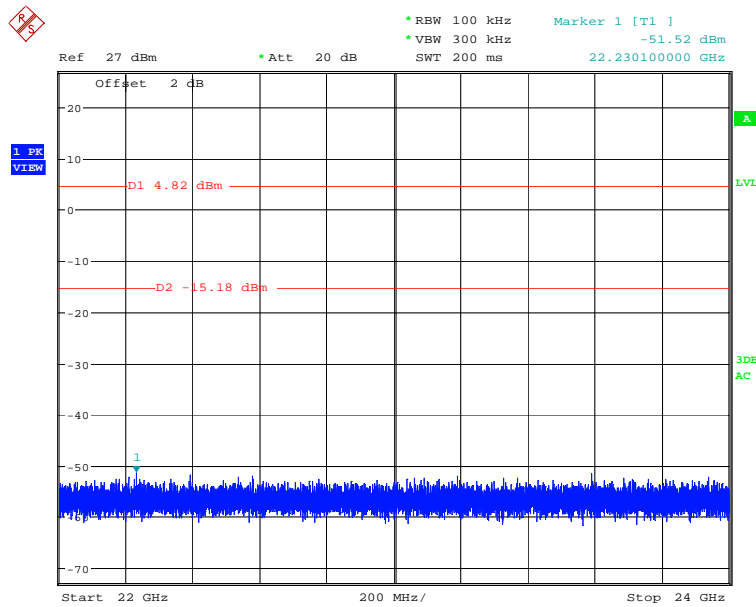
Spurious Emission 2441MHz DH1-1 18GHz-20GHz
Date: 9.NOV.2010 20:06:23

Figure 44: Conducted Spurious Emission, 20 – 22GHz, Mode B (2441MHz)



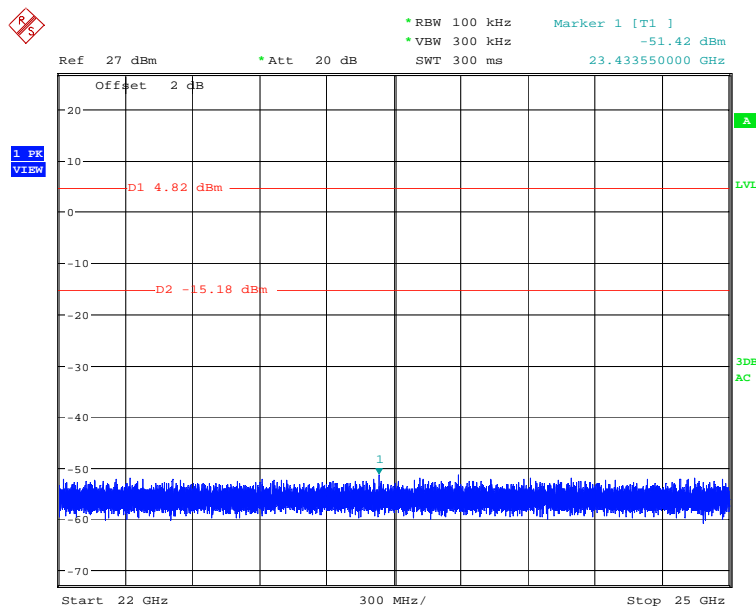
Spurious Emission 2441MHz DH1-1 20GHz-22GHz
Date: 9.NOV.2010 20:07:40

Figure 45: Conducted Spurious Emission, 22 – 24GHz, Mode B (2441MHz)



Spurious Emission 2441MHz DH1-1 22GHz-24GHz
Date: 9.NOV.2010 20:08:50

Figure 46: Conducted Spurious Emission, 24 – 25GHz, Mode B (2441MHz)



Spurious Emission 2441MHz DH1-1 24GHz-25GHz
Date: 9.NOV.2010 20:10:13

Table 14: Conducted Spurious Emission, Mode C (2480MHz)

Frequency [MHz]	Reading [dBm]	Correction Factor [dB]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
Fundamental	4.23	1.55	5.78	N/A	N/A
3040.2	-51.04	1.77	-49.27	-14.22	35.06
1595.4	-51.74	1.26	-50.48	-14.22	36.26
4960.3	-44.01	2.21	-41.80	-14.22	27.58
7043.5	-51.42	2.79	-48.63	-14.22	34.41
9565.6	-51.52	3.21	-48.31	-14.22	34.09
10186.9	-51.60	3.37	-48.23	-14.22	34.01
12110.9	-51.48	3.67	-47.81	-14.22	33.59
15681.2	-51.90	4.20	-47.70	-14.22	33.48
17113.2	-51.48	4.36	-47.12	-14.22	32.90
18477.6	-50.32	4.54	-45.78	-14.22	31.56
21510.9	-51.71	4.98	-46.73	-14.22	32.52
22441.1	-50.84	4.98	-45.86	-14.22	31.65
24934.0	-51.55	5.46	-46.09	-14.22	31.87

Notes: Limit = Reading of fundamental + Correction factor – 20dB
 Emission level = Reading (included RF SMA cable loss of EUT side) + Correction factor
 Correction factor = Total cable loss of the measuring cable

Figure 47: Conducted Spurious Emission, 30MHz – 2GHz, Mode C (2480MHz)

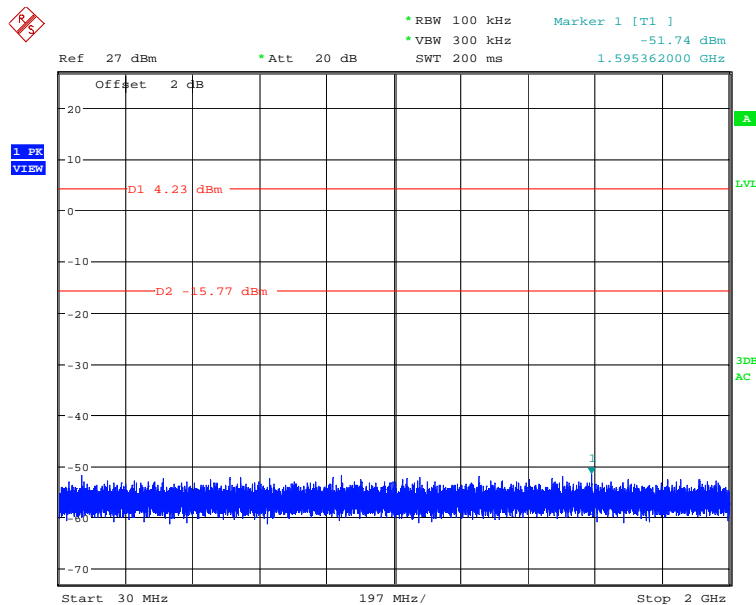
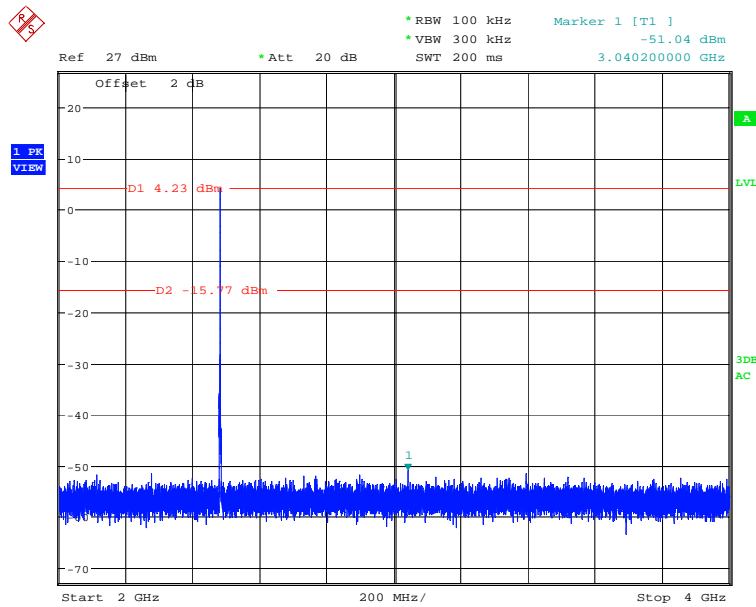
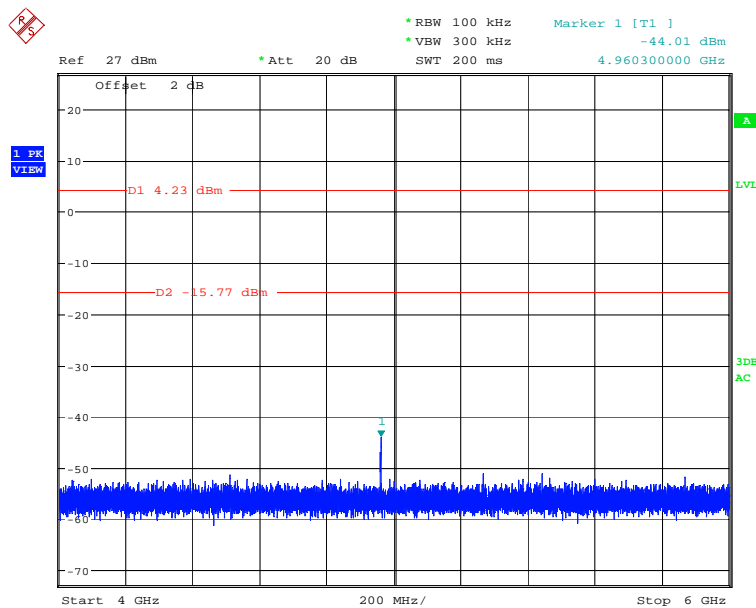


Figure 48: Conducted Spurious Emission, 2 – 4GHz, Mode C (2480MHz)



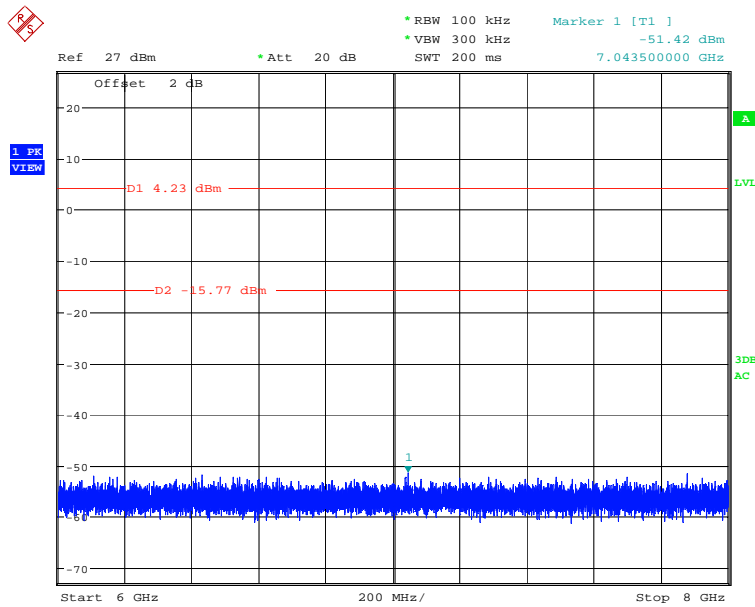
Spurious Emission 2480MHz DH1-1 2GHz-4GHz
Date: 9.NOV.2010 20:12:53

Figure 49: Conducted Spurious Emission, 4 – 6GHz, Mode C (2480MHz)



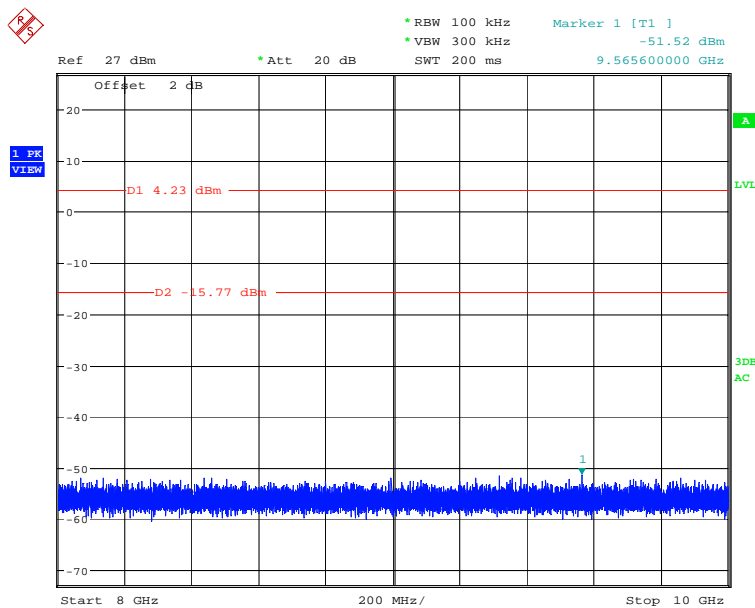
Spurious Emission 2480MHz DH1-1 4GHz-6GHz
Date: 9.NOV.2010 20:15:14

Figure 50: Conducted Spurious Emission, 6 – 8GHz, Mode C (2480MHz)



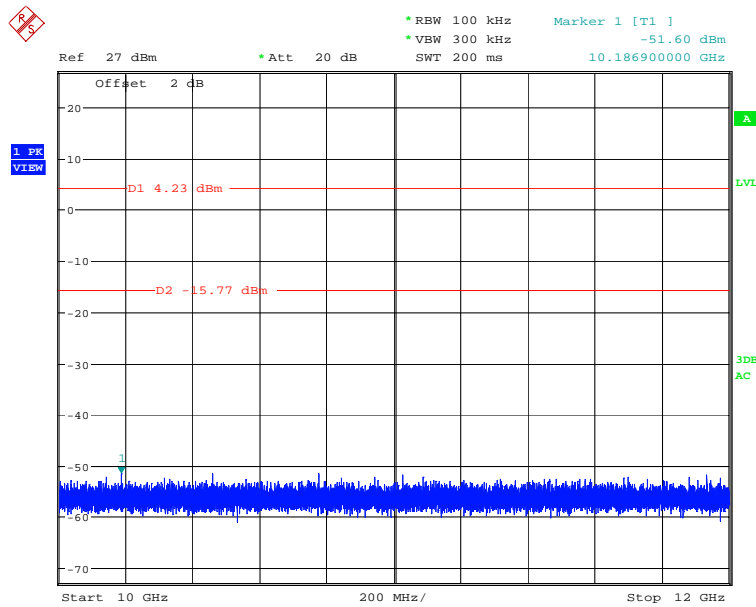
Spurious Emission 2480MHz DH1-1 6GHz-8GHz
Date: 9.NOV.2010 20:16:18

Figure 51: Conducted Spurious Emission, 8 – 10GHz, Mode C (2480MHz)



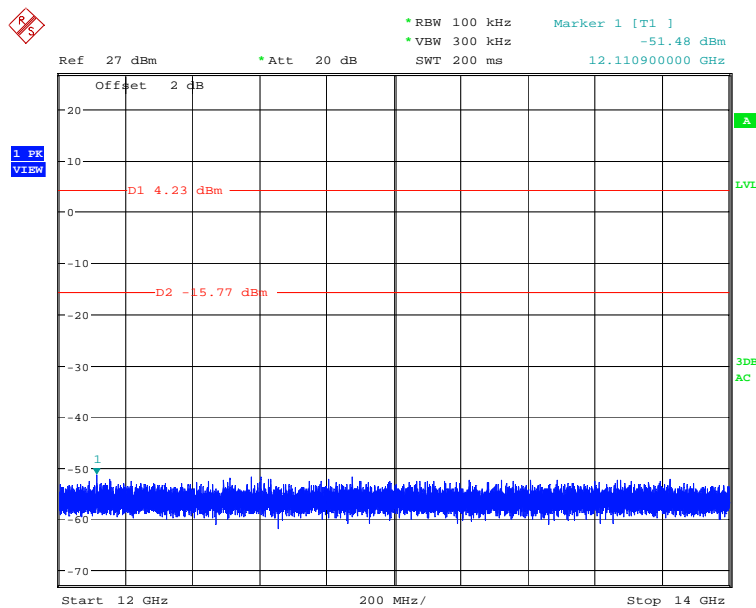
Spurious Emission 2480MHz DH1-1 8GHz-10GHz
Date: 9.NOV.2010 20:17:35

Figure 52: Conducted Spurious Emission, 10 – 12GHz, Mode C (2480MHz)



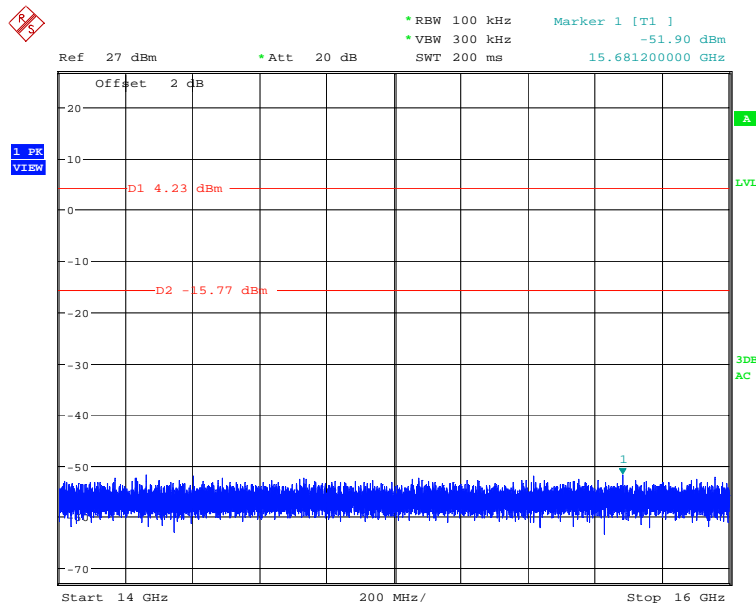
Spurious Emission 2480MHz DH1-1 10GHz-12GHz
Date: 9.NOV.2010 20:18:39

Figure 53: Conducted Spurious Emission, 12 – 14GHz, Mode C (2480MHz)



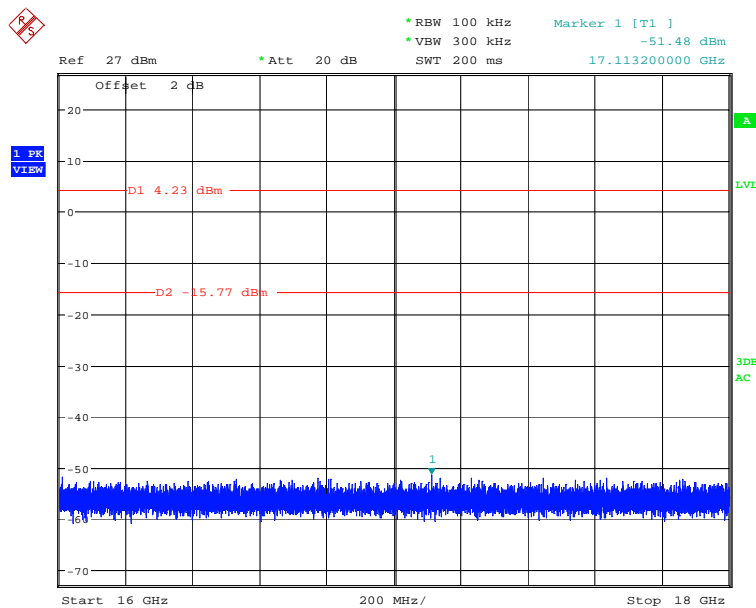
Spurious Emission 2480MHz DH1-1 12GHz-14GHz
Date: 9.NOV.2010 20:19:38

Figure 54: Conducted Spurious Emission, 14 – 16GHz, Mode C (2480MHz)



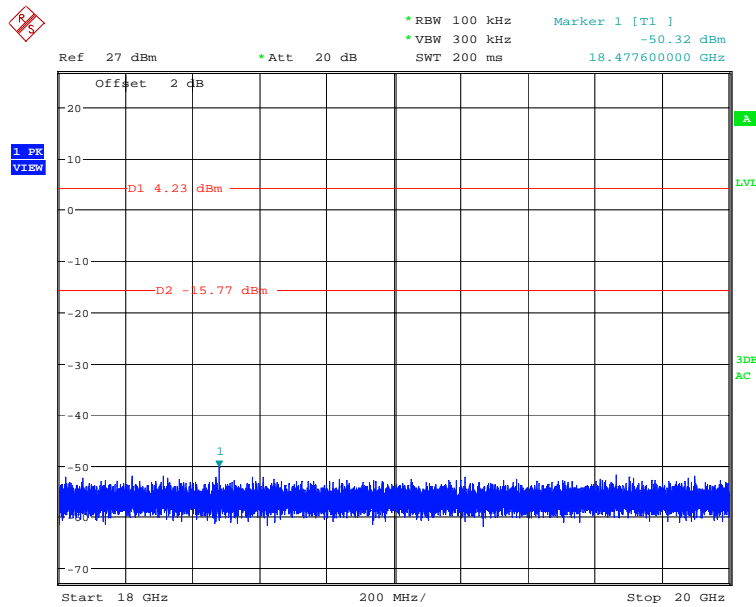
Spurious Emission 2480MHz DH1-1 14GHz-16GHz
Date: 9.NOV.2010 20:20:42

Figure 55: Conducted Spurious Emission, 16 – 18GHz, Mode C (2480MHz)



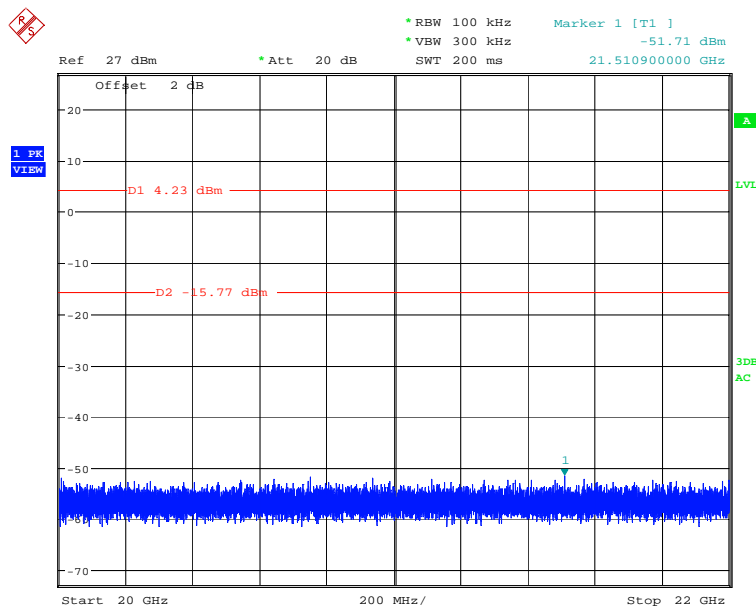
Spurious Emission 2480MHz DH1-1 16GHz-18GHz
Date: 9.NOV.2010 20:21:48

Figure 56: Conducted Spurious Emission, 18 – 20GHz, Mode C (2480MHz)



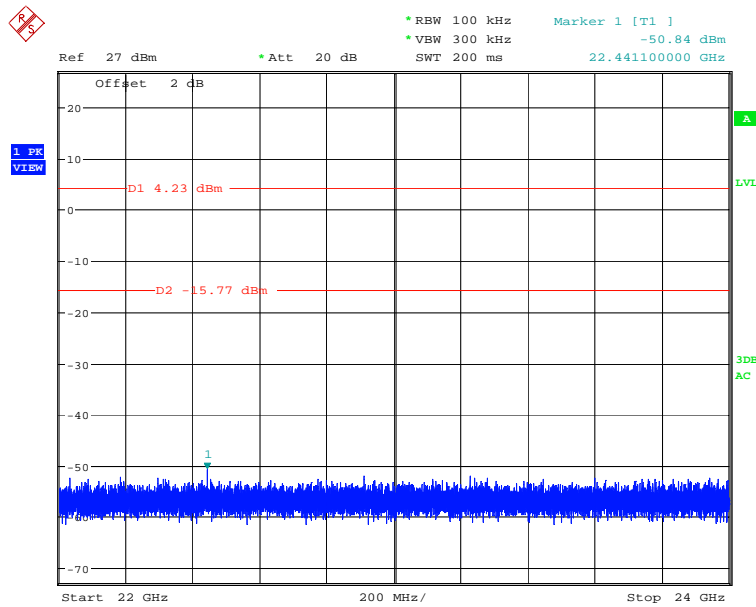
Spurious Emission 2480MHz DH1-1 18GHz-20GHz
Date: 9.NOV.2010 20:23:01

Figure 57: Conducted Spurious Emission, 20 – 22GHz, Mode C (2480MHz)



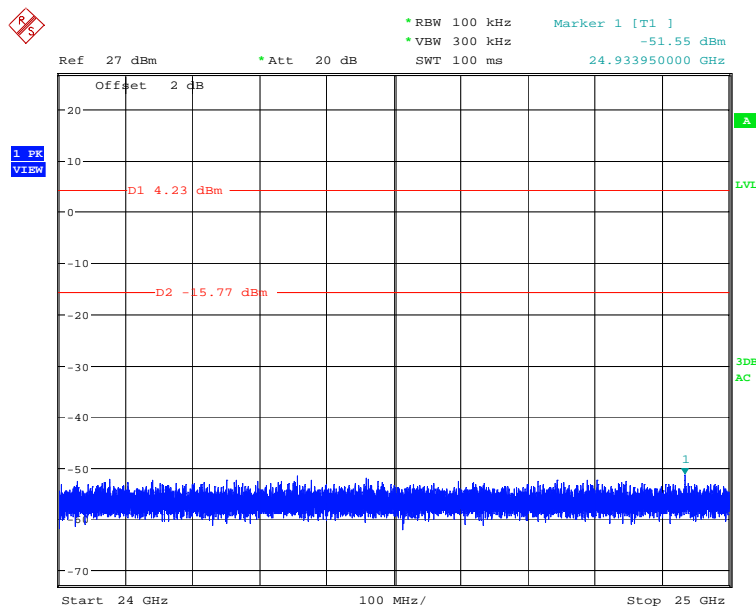
Spurious Emission 2480MHz DH1-1 20GHz-22GHz
Date: 9.NOV.2010 20:24:11

Figure 58: Conducted Spurious Emission, 22 – 24GHz, Mode C (2480MHz)



Spurious Emission 2480MHz DH1-1 22GHz-24GHz
Date: 9.NOV.2010 20:25:04

Figure 59: Conducted Spurious Emission, 24 – 25GHz, Mode C (2480MHz)



Spurious Emission 2480MHz DH1-1 24GHz-25GHz
Date: 9.NOV.2010 20:26:20

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: 2010-11-10

Ambient temperature: 23°C

Relative humidity: 29%

Atmospheric pressure: 1004hPa

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 polarizations for 3 EUT orientations (X, Y and Z).

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.

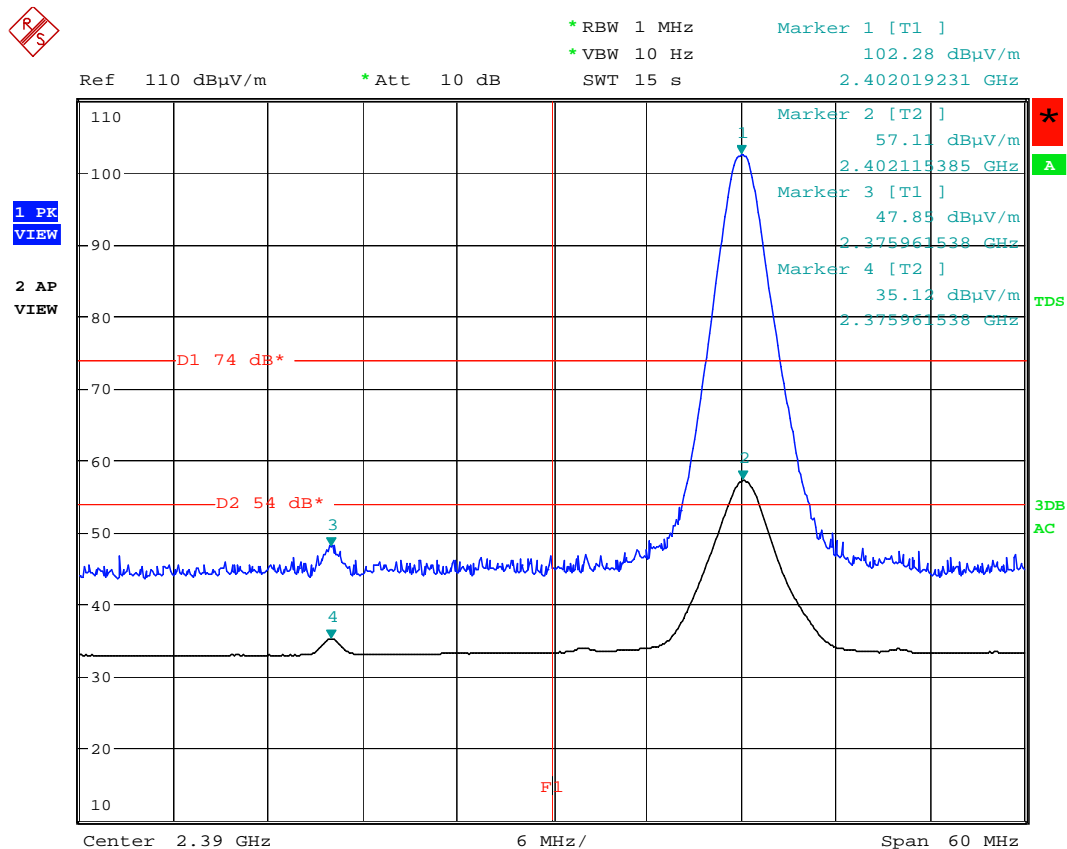
The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Table 15: Band Edge Radiated Emission, GFSK

Operating Frequency [MHz]	EUT / Antenna Orient.	Average Value [dBµV/m]	Peak Value [dBµV/m]	Average Limit [dBµV/m]	Peak Limit [dBµV/m]	Average Margin [dB]	Peak Margin [dB]
2402	Z / V	35.12	47.85	54.00	74.00	18.88	26.15
2480	Z / V	39.50	57.59	54.00	74.00	14.50	16.41

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.

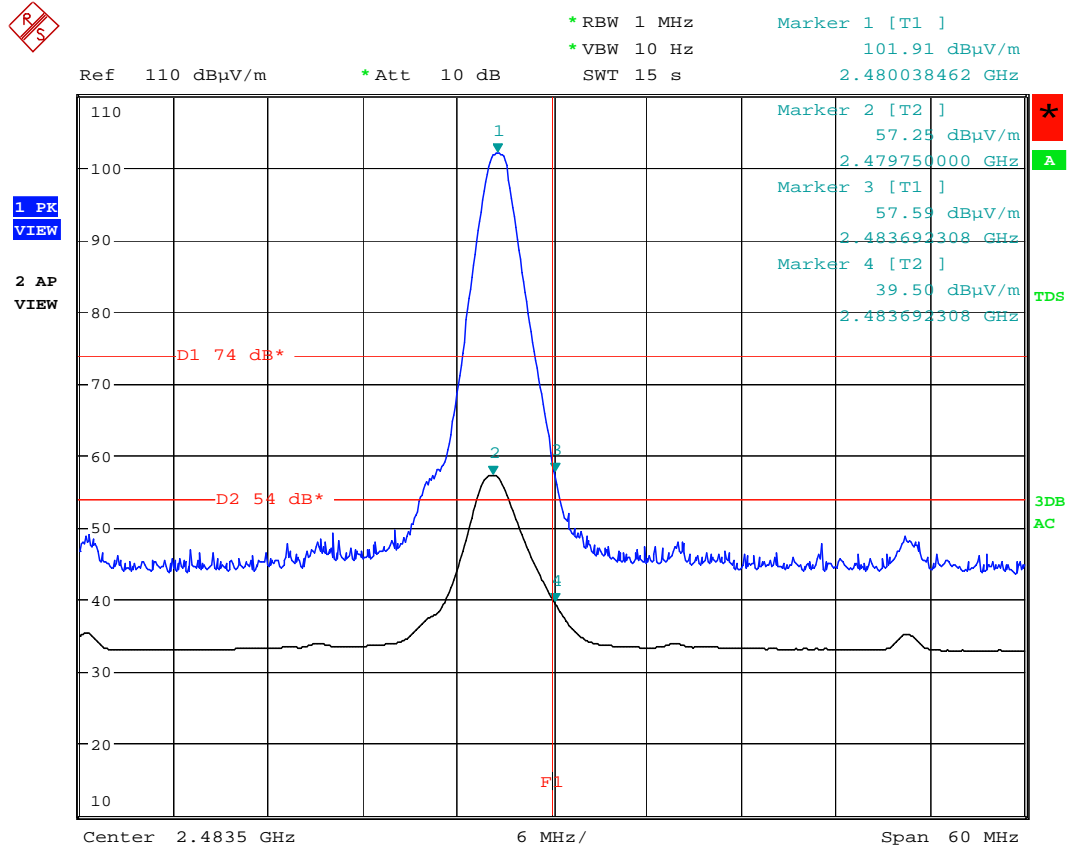
Figure 60: Band Edge Radiated Emission, Spectral Diagram, Mode A (2402MHz), GFSK



Band Edge, DH1-1, Vert, Mode: A, Pos.: Z
 Date: 10.NOV.2010 19:24:01

Note: The upper trace shows the peak value and the lower trace shows the average value.

Figure 61: Band Edge Radiated Emission, Spectral Diagram, Mode C (2480MHz), GFSK



Band Edge, DH1-1, Vert, Mode: C, Pos.: Z

Date: 10.NOV.2010 19:38:48

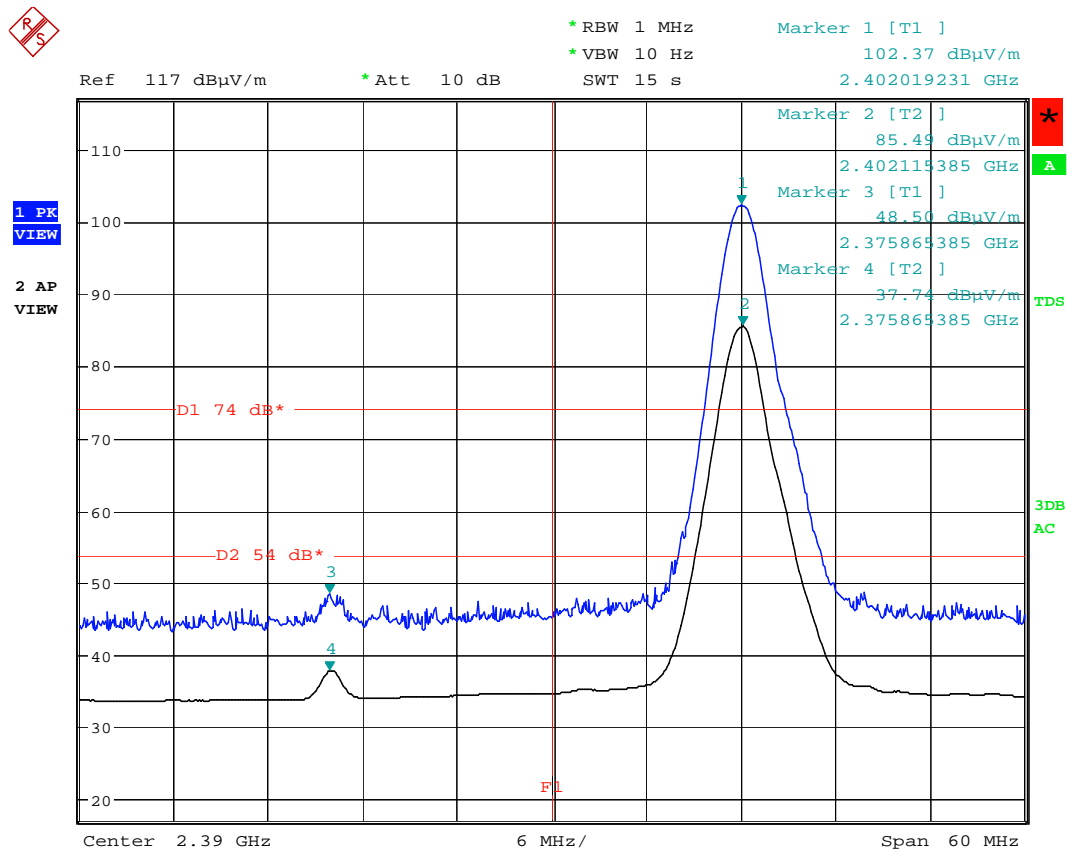
Note: The upper trace shows the peak value and the lower trace shows the average value.

Table 16: Band Edge Radiated Emission, 8DPSK

Operating Frequency [MHz]	EUT / Antenna Orient.	Average Value [dBµV/m]	Peak Value [dBµV/m]	Average Limit [dBµV/m]	Peak Limit [dBµV/m]	Average Margin [dB]	Peak Margin [dB]
2402	Z / V	37.74	48.50	54.00	74.00	16.26	25.50
2480	X / V	42.58	51.11	54.00	74.00	11.42	22.89

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.

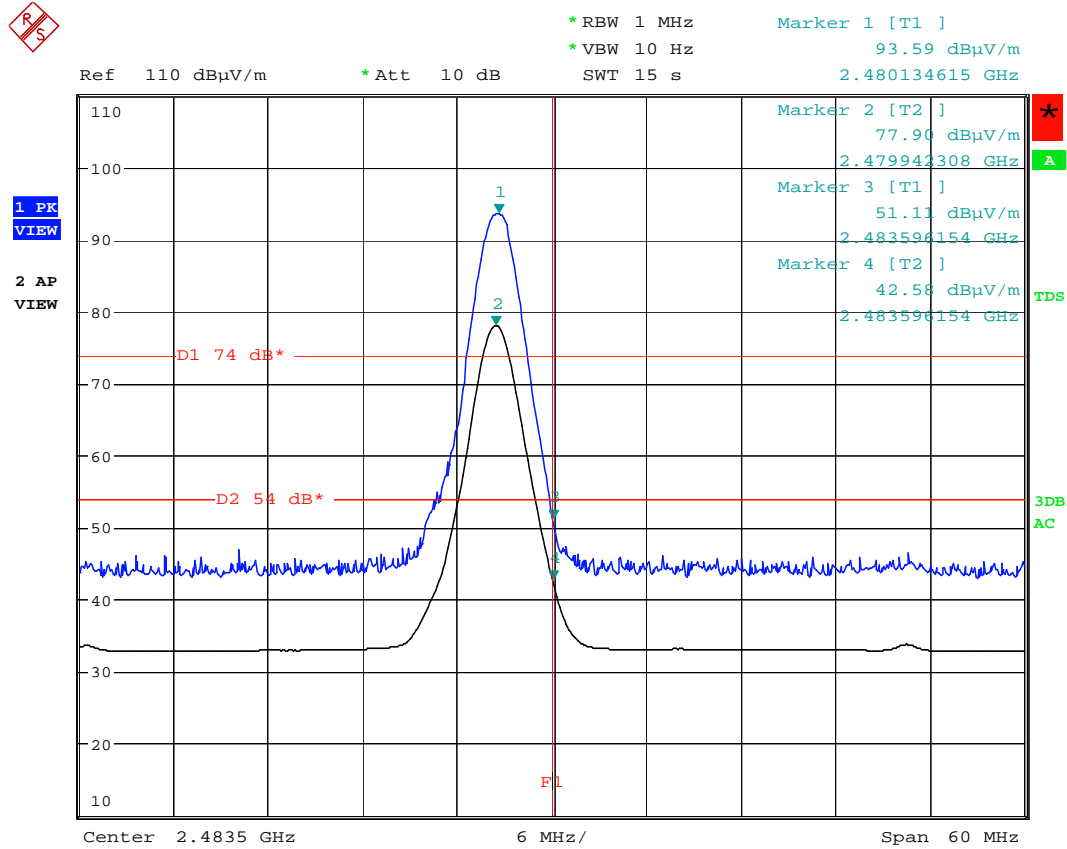
Figure 62: Band Edge Radiated Emission, Spectral Diagram, Mode A (2402MHz), 8DPSK



Band Edge, DH5-3, Vert, Mode: A, Pos.: Z
 Date: 10.NOV.2010 18:20:06

Note: The upper trace shows the peak value and the lower trace shows the average value.

Figure 63: Band Edge Radiated Emission, Spectral Diagram, Mode C (2480MHz), 8DPSK



Band Edge, DH5-3, Vert, Mode: C, Pos.: X

Date: 10.NOV.2010 19:08:22

Note: The upper trace shows the peak value and the lower trace shows the average 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: 2010-11-10, 2010-11-11, 2010-11-12

Ambient temperature: 23,23,23°C

Relative humidity: 29,26,31%

Atmospheric pressure: 1004,1014,1015hPa

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 physical arrangement of the test system, the associated cabling and the EUT orientation (X, Y, Z) were varied in order to ensure that maximum emission amplitudes were attained.

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 worst case was found at the data rate of DH1 in GFSK Therefore, the final measurement was reported accordingly.

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 17: Radiated Emission, Quasi Peak Data, 30MHz – 1GHz, Horizontal and Vertical Antenna Orientations, Mode A (2402MHz)

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Height [cm]	Angle [°]
80.408	Z / H	51.0	-27.0	24.0	40.0	16.0	359	353
509.440	Z / H	46.1	-15.3	30.8	46.0	15.2	166	87
44.971	Z / V	43.7	-23.3	20.4	40.0	19.6	103	184
138.035	Z / V	52.3	-23.1	29.2	43.5	14.3	101	215
611.314	Z / V	42.4	-12.8	29.6	46.0	16.4	100	359
679.223	Z / V	43.1	-12.2	30.9	46.0	15.1	172	159

Note: Level QP = Reading QP + Factor

Table 18: Radiated Emission, Average and Peak Data, 1 – 25GHz, Horizontal and Vertical Antenna Orientations, Mode A (2402MHz)

Freq. [MHz]	EUT / Antenna P	Reading AV [dB(µV)]	Reading PK [dB(µV)]	Factor [dB(1/m)]	Level AV [dB(µV/m)]	Level PK [dB(µV/m)]	Limit AV / PK [dB(µV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
7205.972	Z / H	42.6	57.5	-4.8	37.8	52.7	54.0 / 74.0	16.2	21.3	102	209
13977.821	Z / H	38.5	52.4	-6.7	31.8	45.7	54.0 / 74.0	22.2	28.3	180	73
17825.094	Z / H	37.4	51.1	-4.8	32.6	46.3	54.0 / 74.0	21.4	27.7	127	34
1172.964	Z / V	61.5	63.6	-15.3	46.2	48.3	54.0 / 74.0	7.8	25.7	100	167
4803.949	Z / V	45.3	63.9	-9.5	35.8	54.4	54.0 / 74.0	18.2	19.6	101	195
7206.006	Z / V	42.6	57.3	-4.8	37.8	52.5	54.0 / 74.0	16.2	21.5	100	26
9608.011	Z / V	39.0	53.0	-8.8	30.2	44.2	54.0 / 74.0	23.8	29.8	148	192
12485.890	Z / V	37.0	51.0	-6.4	30.6	44.6	54.0 / 74.0	23.4	29.4	143	349
15894.518	Z / V	37.3	51.1	-5.2	32.1	45.9	54.0 / 74.0	21.9	28.1	199	326

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

Table 19: Radiated Emission, Quasi Peak Data, 30MHz – 1GHz, Horizontal and Vertical Antenna Orientations, Mode B (2441MHz)

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Height [cm]	Angle [°]
80.407	X / H	49.7	-27.0	22.7	40.0	17.3	347	351
509.423	X / H	48.0	-15.3	32.7	46.0	13.3	167	89
138.033	X / V	53.5	-23.1	30.4	43.5	13.1	100	203
594.330	X / V	43.0	-13.1	29.9	46.0	16.1	101	1
645.266	X / V	42.3	-12.5	29.8	46.0	16.2	104	318

Note: Level QP = Reading QP + Factor

Table 20: Radiated Emission, Average and Peak Data, 1 – 25GHz, Horizontal and Vertical Antenna Orientations, Mode B (2441MHz)

Freq. [MHz]	EUT / Antenna P	Reading AV [dB(µV)]	Reading PK [dB(µV)]	Factor [dB(1/m)]	Level AV [dB(µV/m)]	Level PK [dB(µV/m)]	Limit AV / PK [dB(µV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
7322.906	Z / H	39.6	53.1	-4.6	35.0	48.5	54.0 / 74.0	19.0	25.5	123	232
14955.16	Z / H	37.9	51.7	-6.0	31.9	45.7	54.0 / 74.0	22.1	28.3	161	308
17881.58	Z / H	37.2	52.1	-4.6	32.6	47.5	54.0 / 74.0	21.4	26.5	197	277
1172.962	Z / V	61.2	63.2	-15.3	45.9	47.9	54.0 / 74.0	8.1	26.1	103	170
4881.939	Z / V	45.2	63.5	-9.2	36.0	54.3	54.0 / 74.0	18.0	19.7	100	191
10689.37	Z / V	36.0	49.9	-5.4	30.6	44.5	54.0 / 74.0	23.4	29.5	177	18
13663.65	Z / V	37.7	52.6	-6.0	31.7	46.6	54.0 / 74.0	22.3	27.4	101	145
15578.17	Z / V	37.9	51.8	-4.8	33.1	47.0	54.0 / 74.0	20.9	27	181	144

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

Table 21: Radiated Emission, Quasi Peak Data, 30MHz – 1GHz, Horizontal and Vertical Antenna Orientations, Mode C (2480MHz)

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Height [cm]	Angle [°]
80.407	Y / H	50.2	-27.0	23.2	40.0	16.8	358	351
509.420	Y / H	47.4	-15.3	32.1	46.0	13.9	162	101
138.036	Y / V	52.7	-23.1	29.6	43.5	13.9	102	191
594.340	Y / V	42.0	-13.1	28.9	46.0	17.1	103	11
679.230	Y / V	42.6	-12.2	30.4	46.0	15.6	100	147

Note: Level QP = Reading QP + Factor

Table 22: Radiated Emission, Average and Peak Data, 1 – 25GHz, Horizontal and Vertical Antenna Orientations, Mode C (2480MHz)

Freq. [MHz]	EUT / Antenna P	Reading AV [dB(µV)]	Reading PK [dB(µV)]	Factor [dB(1/m)]	Level AV [dB(µV/m)]	Level PK [dB(µV/m)]	Limit AV / PK [dB(µV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
2927.287	Y / H	37.7	52.2	-11.6	26.1	40.5	54.0 / 74.0	27.9	33.5	128	258
3305.242	Y / H	40.9	53.8	-10.9	30.0	42.9	54.0 / 74.0	24.0	31.1	102	153
3841.278	Y / H	38.3	51.9	-10.2	28.1	41.7	54.0 / 74.0	25.9	32.3	172	342
4407.192	Y / H	38.1	52.3	-9.9	28.2	42.4	54.0 / 74.0	25.8	31.6	119	130
4959.927	Y / H	46.3	65.8	-8.9	37.4	56.9	54.0 / 74.0	16.6	17.1	106	228
6615.308	Y / H	37.6	51.7	-5.9	31.7	45.8	54.0 / 74.0	22.3	28.2	194	57
7387.825	Y / H	37.8	52.1	-4.6	33.2	47.5	54.0 / 74.0	20.8	26.5	129	266
12619.5	Z / H	36.7	51.3	-5.4	31.3	45.9	54.0 / 74.0	22.7	28.1	197	211
14119.07	Z / H	37.9	51.7	-5.5	32.4	46.1	54.0 / 74.0	21.6	27.9	197	129
1172.963	Y / V	62.1	64.0	-15.3	46.8	48.7	54.0 / 74.0	7.2	25.3	100	175
2454.05	Y / V	40.9	55.4	-13.3	27.6	42.1	54.0 / 74.0	26.4	31.9	195	73
3582.587	Y / V	38.0	51.9	-9.9	28.1	42.0	54.0 / 74.0	25.9	32.0	107	203
3843.332	Y / V	38.4	52.1	-10.2	28.2	41.9	54.0 / 74.0	25.8	32.1	135	30
4960.004	Y / V	43.9	59.8	-8.9	35.0	50.9	54.0 / 74.0	19.0	23.1	114	254
11991.03	Z / V	36.8	51.0	-5.1	31.7	45.9	54.0 / 74.0	22.3	28.1	185	29
15042.46	Z / V	38.2	51.9	-5.8	32.4	46.1	54.0 / 74.0	21.6	27.9	195	317
16746.94	Z / V	37.7	51.8	-5.9	31.8	45.9	54.0 / 74.0	22.2	28.1	195	47

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

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: 2010-11-10, 2010-11-11, 2010-11-12

Ambient temperature: 23,23,23°C

Relative humidity: 29,26,31%

Atmospheric pressure: 1004,1014,1015hPa

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 physical arrangement of the test system, the associated cabling and the EUT orientation (X, Y, Z) were varied in order to ensure that maximum emission amplitudes were attained.

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.

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 worst case was found at the data rate of DH1 in GFSK Therefore, the final measurement was reported accordingly.

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, Quasi Peak Data, 30MHz – 1GHz, Horizontal and Vertical Antenna Orientations, Mode D (Receive at 2441MHz)

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Height [cm]	Angle [°]
87.434	Z / H	48.1	-27.2	20.9	40.0	19.1	399	157
509.430	Z / H	48.0	-15.3	32.7	46.0	13.3	166	96
543.387	Z / H	42.4	-14.4	28.0	46.0	18.0	100	167
138.043	Z / V	48.4	-23.1	25.3	43.5	18.2	100	178
611.307	Z / V	43.6	-12.8	30.8	46.0	15.2	100	353
679.241	Z / V	42.8	-12.2	30.6	46.0	15.4	101	151

Note: Level QP = Reading QP + Factor

Table 24: Radiated Emission, Average and Peak Data, 1 – 13.5GHz, Horizontal and Vertical Antenna Orientations, Mode D (Receive at 2441MHz)

Freq. [MHz]	EUT / Antenna P	Reading AV [dB(µV)]	Reading PK [dB(µV)]	Factor [dB(1/m)]	Level AV [dB(µV/m)]	Level PK [dB(µV/m)]	Limit AV / PK [dB(µV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
7314.67	Y / H	38.3	52.8	-4.6	33.7	48.2	54.0 / 74.0	20.3	25.8	148	321
7494.435	Y / H	37.4	51.9	-4.2	33.2	47.7	54.0 / 74.0	20.8	26.3	173	351
1176.556	Y / V	60.2	62.5	-15.3	44.9	47.2	54.0 / 74.0	9.1	26.8	103	162
7722.054	Y / V	37.2	51.3	-3.4	33.8	47.9	54.0 / 74.0	20.2	26.1	198	11
7920.111	Y / V	37.5	51.8	-2.9	34.6	49.0	54.0 / 74.0	19.4	25.0	169	205

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

7. Test Results of AC Power Line Conducted Measurements

7.1 Transmitter Parameters

7.1.1 AC Power Line Conducted Emission of Transmitter, FCC 15.207 and RSS-Gen 7.2.2

RESULT: N/A

Frequency range: 0.15 – 30MHz

Note: The EUT is connected with vehicular accessory which is powered by vehicular battery, therefore the test is not applicable.

7.2 Receiver Parameters

7.2.1 AC Power Line Conducted Emission of Receiver, FCC 15.107 and RSS-Gen 7.2.2

RESULT: N/A

Frequency range: 0.15 – 30MHz

Note: The EUT is connected with vehicular accessory which is powered by vehicular battery, therefore the test is not applicable.

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