TEST REPORT

For

Bluetooth Module

In conformity with

FCC CFR 47 Part15 / RSS-210, RSS-Gen

Model: BU-1

FCC ID/ IC Certification No.: K660F434X10 / 511B-0F434X10

Test Item: Bluetooth Module

Report No: RY705Y29R1

Issue Date: 29 May 2007

Prepared for

Vertex Standard Co., Ltd.
4-8-8 Nakameguro, Meguro-ku, Tokyo, 153-8644 Japan

Prepared by

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Table of contents

1 General information

1.1 Product description

Test item	: Bluetooth Module
Manufacturer	: Vertex Standard Co., Ltd.
Address	: 4-8-8 Nakameguro, Meguro-ku, Tokyo, 153-8644 Japan
Model	: BU-1
FCC ID	: K660F434X10
IC Certification No.	: 511B-0F434X10
Classification	: Certification
Serial numbers	: None
Fundamental / Operated Frequency	: 12 MHz, Tx/Rx Freq.(2402 - 2480 MHz)
RF Output Power	: -2.51dBm(measured at the antenna terminal)
Antenna Gain	: 1.9 dBi(Nominal Maximum Value)
Receipt date of EUT	: 25 April 2007
Nominal power souse voltages	: DC 5V (from AC Adaptor, Model:S-8302A by Kaga Component)

1.2 Test(s) performed/ Summary of test result

Test specification(s)	: FCC CFR 47. Part 15 / RSS-210 Issue 6, RSS-Gen Issue 1
Test method(s)	: ANSI C63.4: 2003
Test(s) started	: 11 May 2007
Test(s) completed	: 18 May 2007
Purpose of test(s)	: Grant for Certification of FCC / IC
Summary of test result	: Complied

Note: The above judgment is only based on the measurement data and it does not include the measurement uncertainty. Accordingly, the statement below is applied to the test result.
The EUT complies with the limit required in the standard in case that the margin is not less than the measurement uncertainty in the Laboratory.
Compliance of the EUT is more probable than non-compliance is case that the margin is less than the measurement uncertainty in the Laboratory.

Test engineer : Y. Nakajima

Reviewer : T. Ikegami

1.3 Test facility

The Federal Communications Commission has reviewed the technical characteristics of the test facilities at RF Technologies Ltd., located in 472, Nippa-cho, Kohoku-ku, Yokohama, 223-0057, Japan, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948, per October 23, 2000.
The description of the test facilities has been filed under registration number 879401 at the Office of the Federal Communications Commission. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.
The list of all public test facilities is available on the Internet at http://www.fcc.gov.

Registered by Voluntary Control Council for Interference by Information Technology Equipment (VCCI).
Each registered facility number is as follows;
Test site (Anechoic chamber 3m) R-2393
Test site (Shielded room) C-2617

1.4 Measurement uncertainty

The treatment of uncertainty is based on the general matters on the definition of uncertainty in “Guide to the expression of uncertainty in measurement (GUM)” published by ISO. The Lab’s uncertainty is determined by referring UKAS Publication LAB34: 2002 “The Expression of Uncertainty in EMC Testing” and CISPR16-4-2: 2003 “Uncertainty in EMC Measurements”.
The uncertainty of the measurement result in the level of confidence of approximately 95% (k=2) is as follows;

Conducted emission: ± 3.5 dB (10 kHz – 150 kHz), ± 3.6 dB (150 kHz – 30 MHz)
Radiated emission (9 kHz - 30MHz): ± 3.2 dB
Radiated emission (30MHz - 1000MHz): ± 4.6 dB
Radiated emission (above 1000MHz): ± 4.6 dB

1.5 Summary of test results

1.5.1 Table of test summary

Requirement of;	Section in FCC15	Section in RSS210/ RSS-Gen	Result	Section in this report
1.5.1 Occupied Bandwidth (20 dB)	15.247(a)(1)	A8.1(1)	Complied	2.1
1.5.2 Hopping Carrier Frequency Separation	15.247(a)(1)	A8.1(2)	Complied	2.2
1.5.3 Number of Hopping Channel	15.247(a)(1)(iii)	A8.1(4)	Complied	2.3
1.5.4 Average Time of Occupancy	15.247(a)(1)(iii)	A8.1(4)	Complied	2.4
1.5.5 Peak Output Power	15.247(a)(1)	A8.4(2)	Complied	2.5
1.5.6 Peak Power Spectral Density	15.247(f)	A8.3(2)	Complied	2.6
1.5.7 Conducted Spurious Emissions	15.247(d)	A8.5	Complied	2.7
1.5.8 Transmitter Radiated Spurious Emissions	15.205(b)/15.209	A8.5	Complied	2.8
1.5.9 Transmitter AC Power Line Conducted Emissions	15.207	RSS-Gen 7.2.2	Complied	2.9
1.5.10 Receiver Radiated Spurious Emissions	15.109	RSS-Gen 6	Complied	2.10
1.5.11 Receiver AC Power Line Conducted Emissions	15.107	RSS-Gen 7.2.2	Complied	2.11
1.5.12 Maximum Permissible Exposure (Exposure of Humans to RF Fields)	15.247(i)/ 1.1307(b)(1)	RSS-Gen 5.5/ RSS-102	Complied	2.12

1.5.2 Conclution of warst-case and operationg mode

The EUT has three type of modulation (GFSK, π/4DQPSK and 8DPSK). Each maximum output power as followings:

Modulation Type	Output power (dBm)	Output power (mW)	Symbol Rate
GFSK (2480MHz)	-2.51	0.561	1Mbps
π/4DQPSK (2480MHz)	-2.67	0.541	2Mbps
8DPSK (2480MHz)	-2.54	0..557	3Mbps

Therefore all applicable requirements were tested to the two type of higher output power modulation (GFSK and 8DPSK) at upper channel (2480 MHz).
The field strength of spurious emission was measured in three orthogonal EUT positions (X-axis, Y-axis and Z-axis). The axis defined in the photographs in clause 3.1 in this report.

1.6 Setup of equipment under test (EUT)

1.6.1 Test configuration of EUT

Equipment(s) under test:

	Item	Manufacturer	Model No.	Serial No.	FCC ID/ IC Certification No.
A	Bluetooth Module	Vertex Standard Co., Ltd.	BU-1	None	K660F434X10/ 511B-0F434X10

Support Equipment(s):

	Item	Manufacturer	Model No.	Serial No.	FCC ID
B	AC Adaptor	Kaga Componemts	S-8302A	None	N/A
C	Test Kit	-	-	-	N/A
D	Personal Computer	DELL	TS30T	0007524T-12961-99P-0698	DoC
E	AC Adaptor	Delta Electronics, Inc.	ADP-60NH	NPW0441009729	N/A

Connected cable(s):

No.	Item	Identification (Manu.e.t.c)	Shielded YES / NO	Ferrite Core YES / NO	Connector Type Shielded YES / NO	Length (m)
1	Control cable	-	No	No	No	0.2
2	DC power cable	-	Yes	No	Yes	1.9
3	RS232C cable	SANWA SUPPLY	Yers	No	Yes	2.0
4	DC power cable	WORLD TECH	Yes	Yes	Yes	1.8
5	AC power cable	TAIKO	No	No	No	2.0

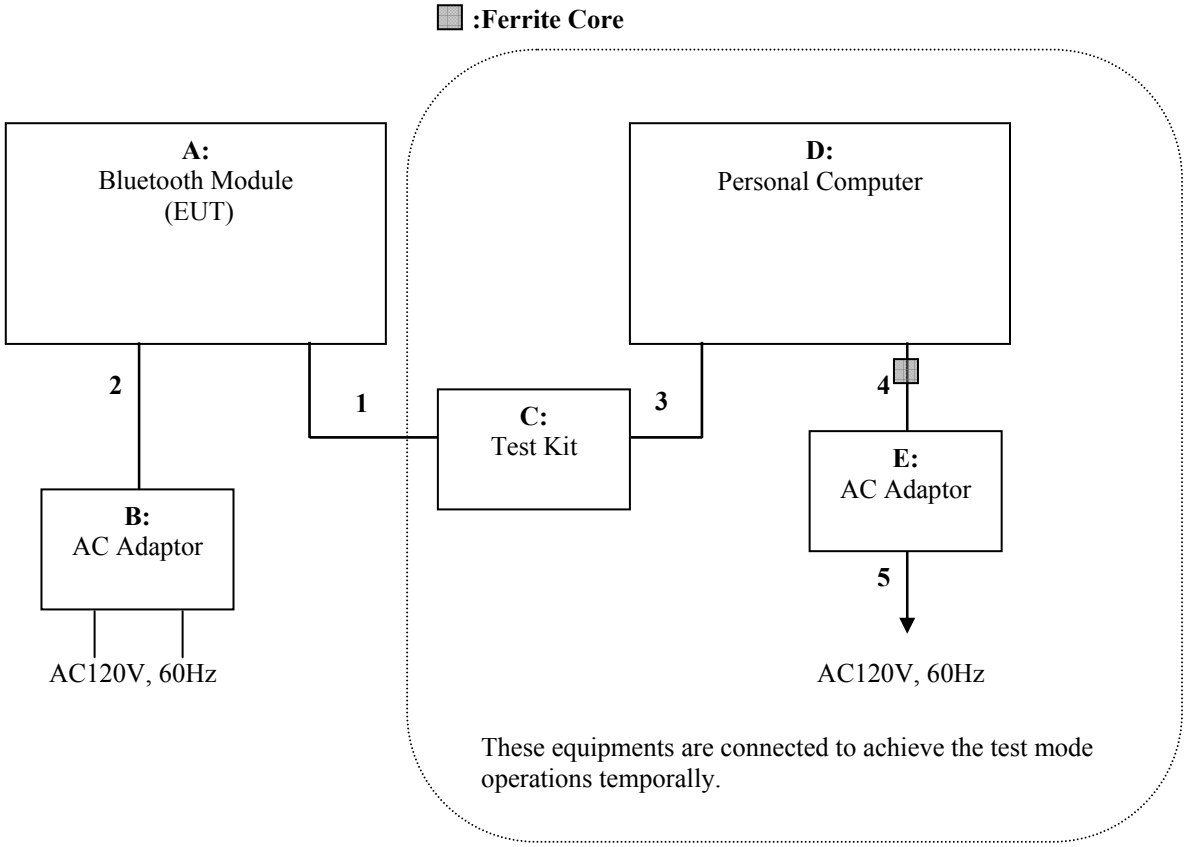
1.6.2 Operating condition:

Operating mode:

The EUT was tested under the following test mode prepared by the applicant;:

(1-1) GFSK Modulation, continuous transmission with PRBS9 modulation at hopping off (2402MHz)
(1-2) GFSK Modulation, continuous transmission with PRBS9 modulation at hopping off (2441MHz)
(1-3) GFSK Modulation, continuous transmission with PRBS9 modulation at hopping off (2480MHz)
(1-4) GFSK Modulation, continuous transmission with PRBS9 modulation at hopping on
(2-1) 8DPSK Modulation, continuous transmission with PRBS9 modulation at hopping off (2402MHz)
(2-2) 8DPSK Modulation, continuous transmission with PRBS9 modulation at hopping off (2441MHz)
(2-3) 8DPSK Modulation, continuous transmission with PRBS9 modulation at hopping off (2480MHz)
(2-4) 8DPSK Modulation, continuous transmission with PRBS9 modulation at hopping on
(3-1) Continuous receiving

1.6.3 Setup diagram of tested system:



1.7 Equipment modifications

No modifications have been made to the equipment in order to achieve compliance with the applicable standards described in clause 1.2.

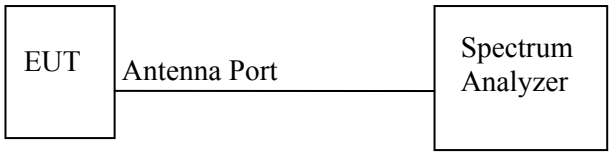
1.8 Deviation from the standard

No deviations from the standards described in clause 1.2.

2 Test procedure and test data

2.1 Occupied Bandwidth (20 dB)

Test setup
Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



Test procedure
Measurement procedures were implemented according to the method of ANSI C63.4: 2003 clauses 13.1.7.
The EUT antenna port connected to the spectrum analyzer. The RBW is set to 1% to 3% of the measured 20dB bandwidth. The VBW is set to 3 times of the RBW. The sweep time is coupled appropriate.

Limitation
There are no limitations. The measurement value is used to calculation of the limitation of the channel separation and the emission designator.

Test equipment used (refer to List of utilized test equipment)

SA06					

Test results – Reporting purpose .

Transmission Channel	Transmission Frequency	Operation Mode	
		GFSK	8DPSK
		20dB Bandwidth (kHz)	
Low (0ch)	2402	920	1,210
Middle (39ch)	2441	920	1,210
High (78ch)	2480	920	1,210

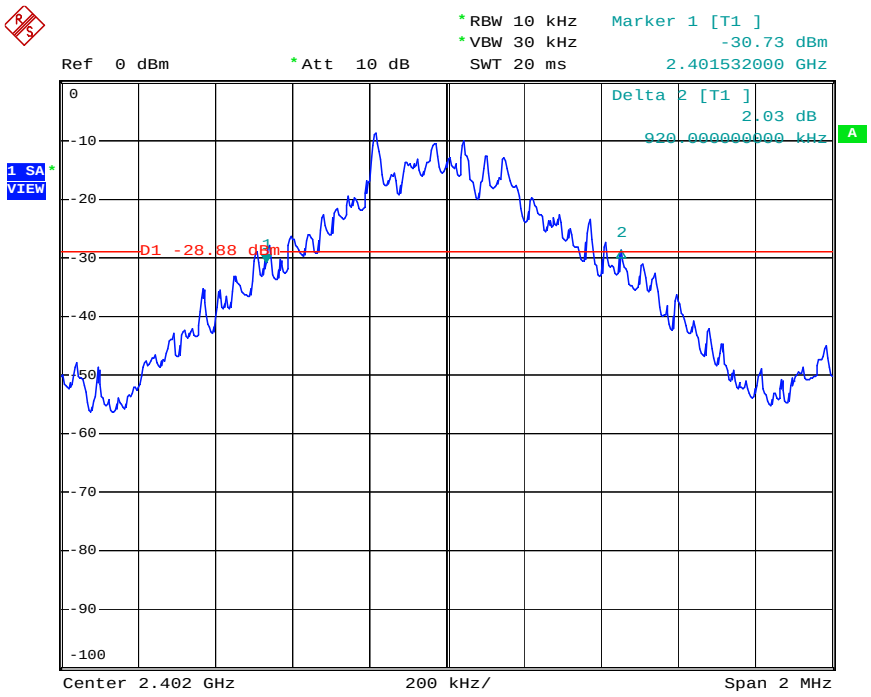
Test Data

Tested Date: May 15, 2007

Temperature: 24 ˚C
Humidity: 38 %
Atmos. Press: 1008 hPa

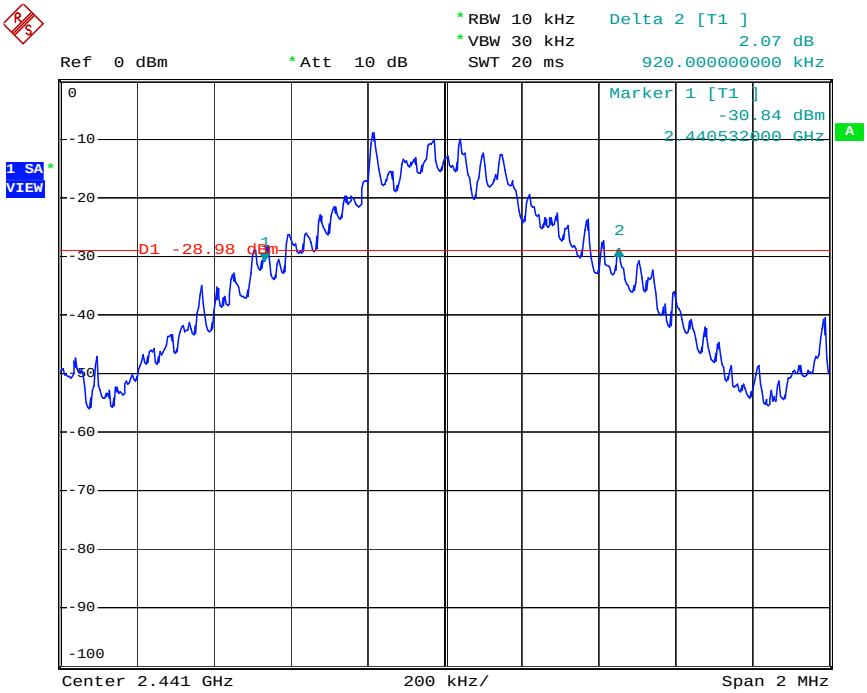
2.1.1 Operating Mode: GFSK

Low (CH:0) 2402MHz



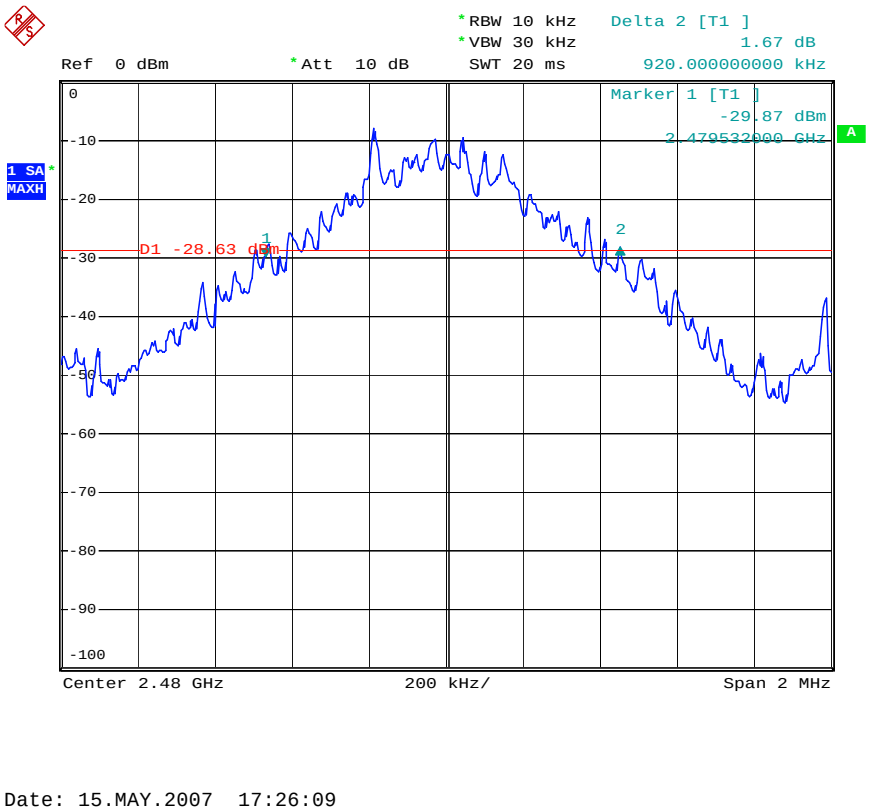
Date: 15.MAY.2007 17:05:43

Middle (CH: 39) 2441MHz



Date: 15.MAY.2007 17:20:07

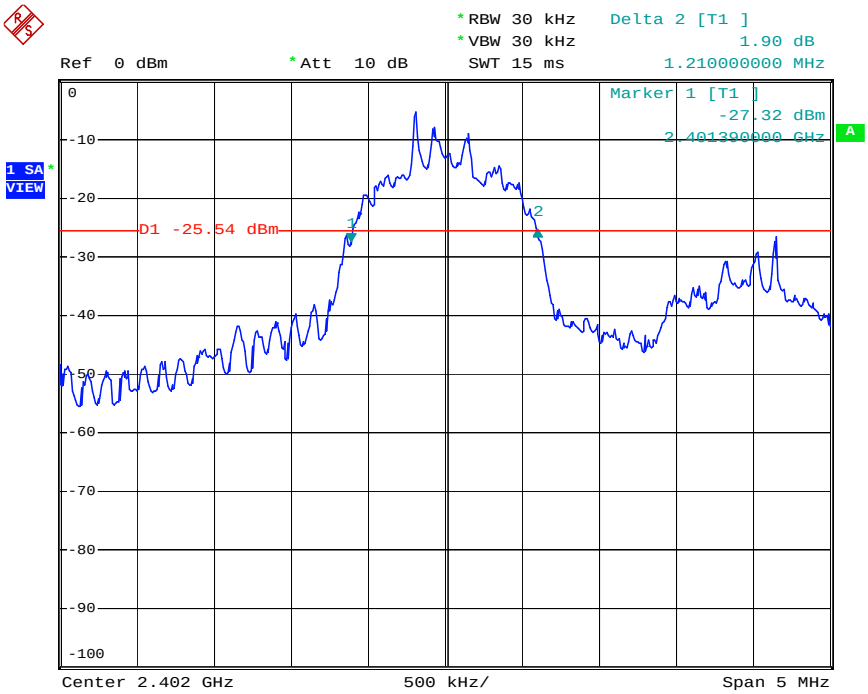
High (CH: 78) 2480MHz



Date: 15.MAY.2007 17:26:09

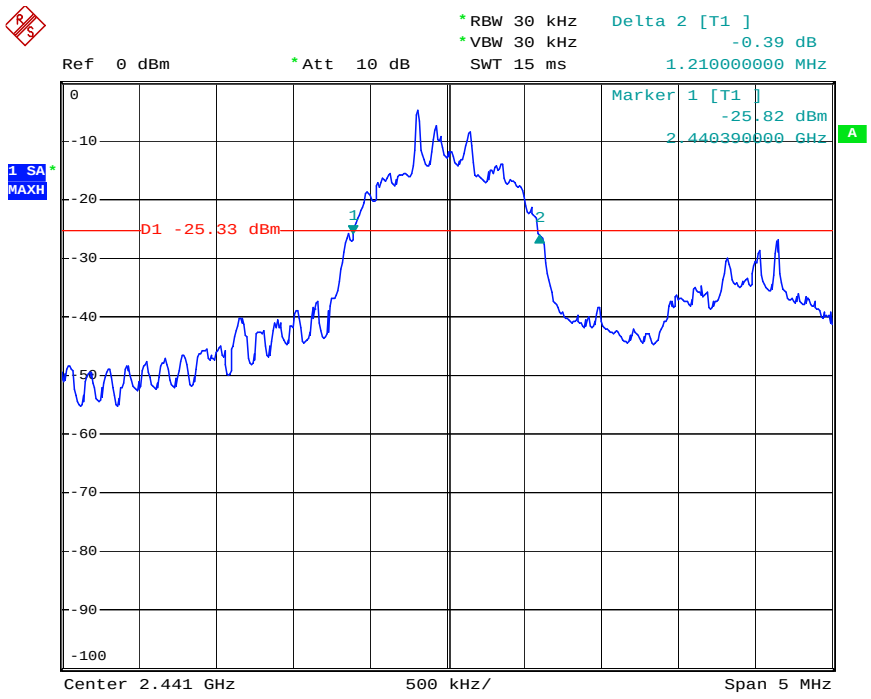
2.1.2 Operating Mode: 8DPSK

Low (CH:0) 2402MHz



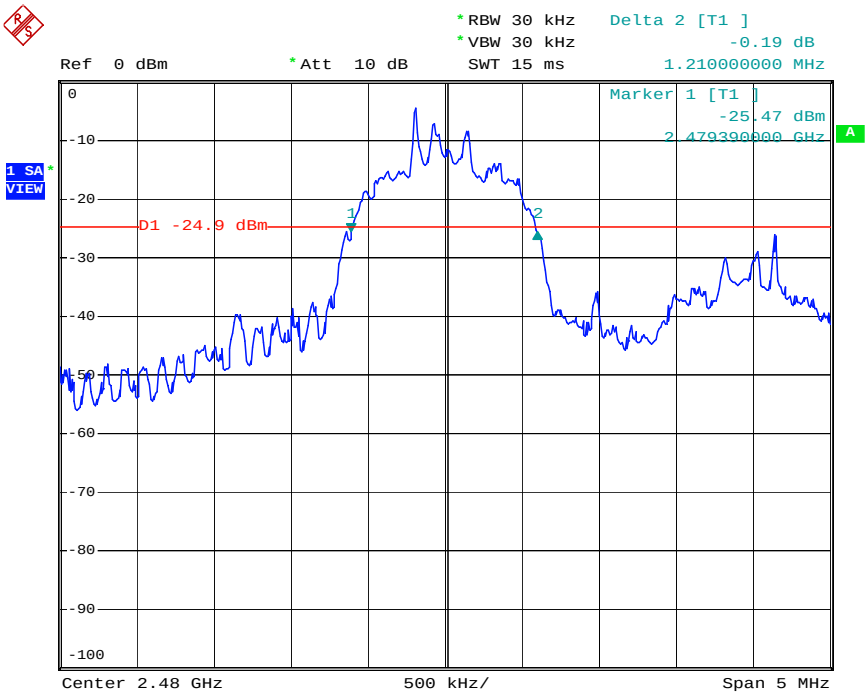
Date: 15.MAY.2007 17:36:22

Middle (CH: 39) 2441MHz



Date: 15.MAY.2007 17:44:21

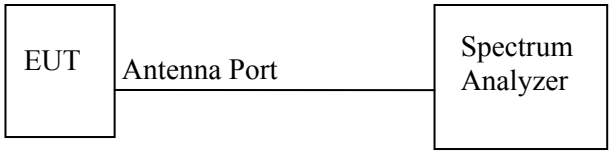
High (CH: 78) 2480MHz



Date: 15.MAY.2007 17:47:25

2.2 Hopping Carrier Frequency Separation

Test setup
Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



Test procedure
The EUT antenna port connected to the spectrum analyzer. The RBW is set to 300kHz. The VBW is set to appropriate in order to read carrier frequency separation. The sweep time is coupled appropriate.

Limitation
15.247(a)(1) 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 125 mW.
Therefore limitation value is grater than 613.4 kHz for GFSK and 680 kHz for 8DPSK.

Test equipment used (refer to List of utilized test equipment)

SA06					

Test results – comply with the limitation.

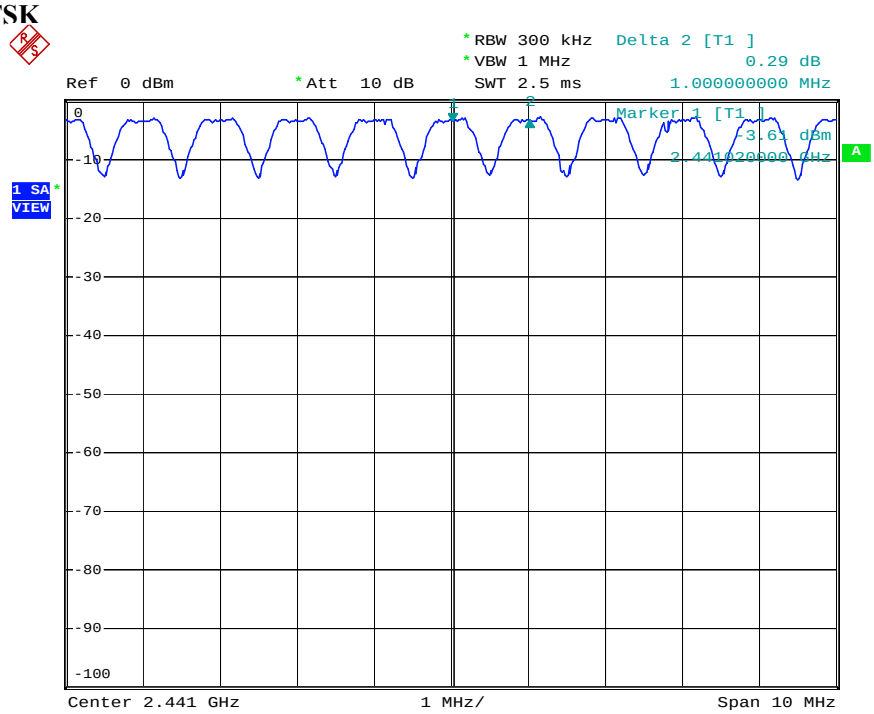
Measured Channel	Measured Frequency (MHz)	Operation Mode	
		GFSK	8DPSK
		Frequency Separation (MHz)	
Middle (39ch)	2441	1.0	1.0

Test Data

Tested Date: May 16, 2007

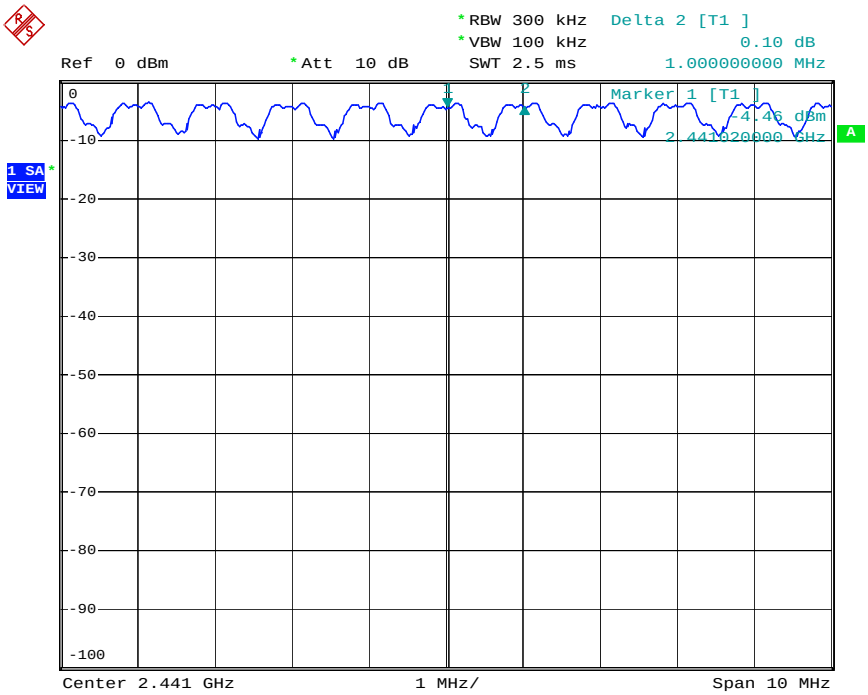
Temperature: 23 ˚C
Humidity: 42 %
Atmos. Press: 1010 hPa

2.2.1 Operating Mode: GFSK



Date: 16.MAY.2007 12:01:14

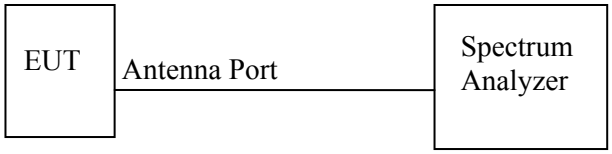
2.2.2 Operating Mode: 8DPSK



Date: 16.MAY.2007 12:07:43

2.3 Number of Hopping Channel

Test setup
Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



Test procedure
The EUT antenna port connected to the spectrum analyzer. The RBW is set to 300 kHz. The VBW is set to appropriate in order to read carrier frequency. The sweep time is coupled appropriate. The span is set to cover the authorized band. The analyzer is set to MAX HOLD. The EUT is hopping operation.

Limitation
15.247(a)(1)(iii) (iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

Test equipment used (refer to List of utilized test equipment)

SA06					

Test results – Comply with the limitation

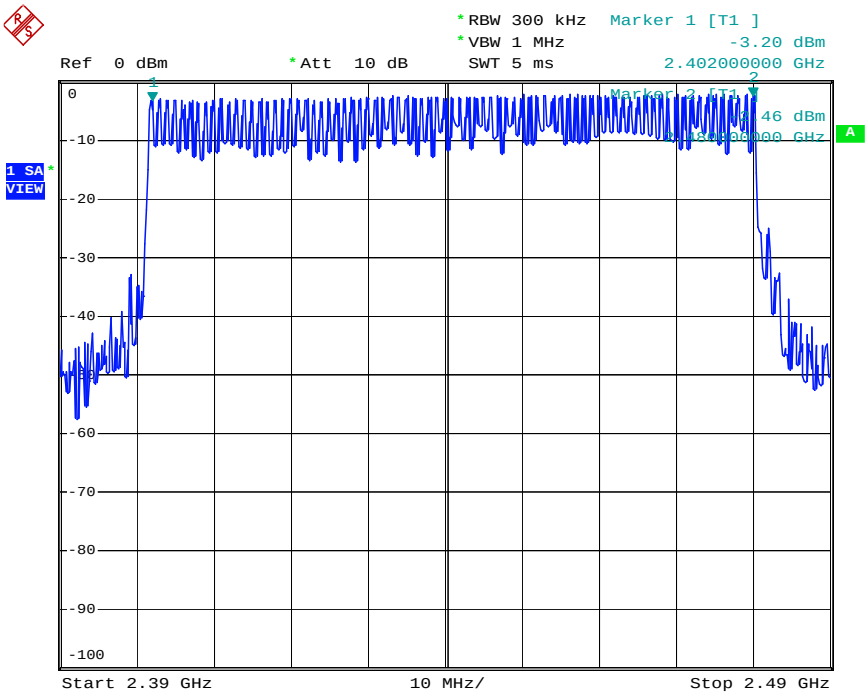
Operation Mode	
GFSK	8DPSK
79	79

Test Data

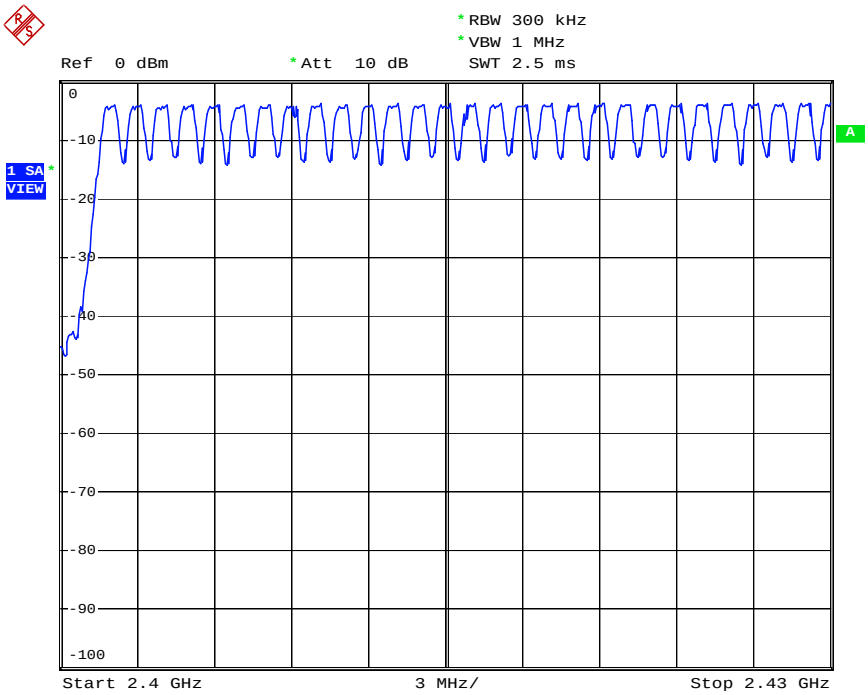
Tested Date: May 16, 2007

Temperature: 23 ˚C
Humidity: 42 %
Atmos. Press: 1010 hPa

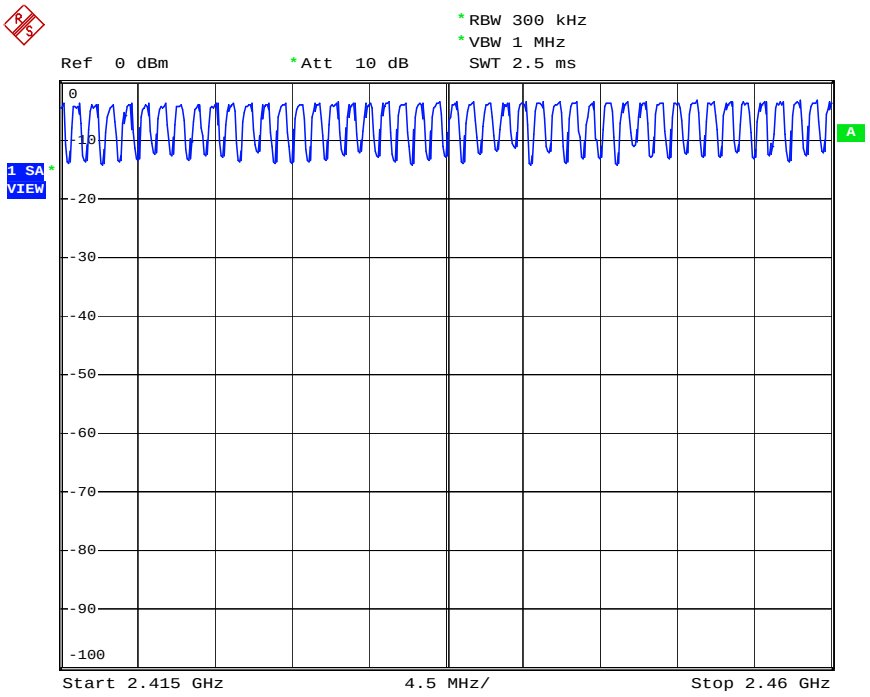
2.3.1 Operating Mode: GFSK



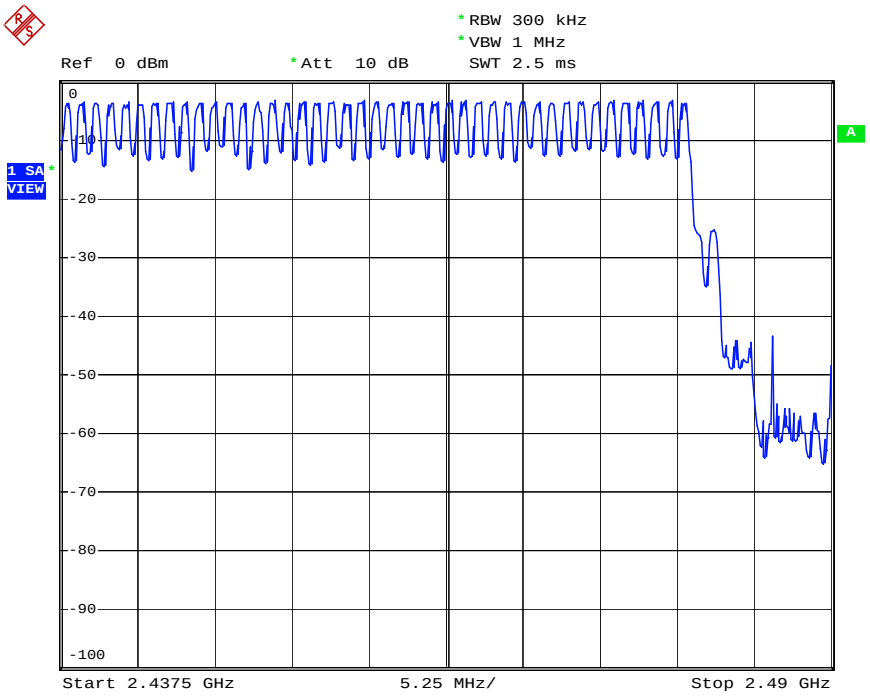
Date: 16.MAY.2007 10:06:45



Date: 16.MAY.2007 10:16:46

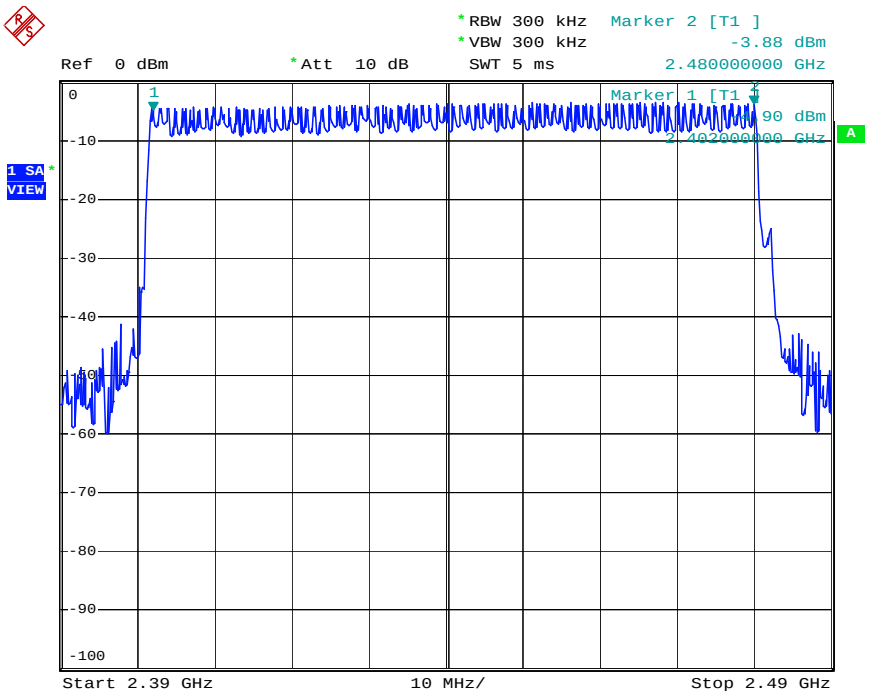


Date: 16.MAY.2007 10:17:58

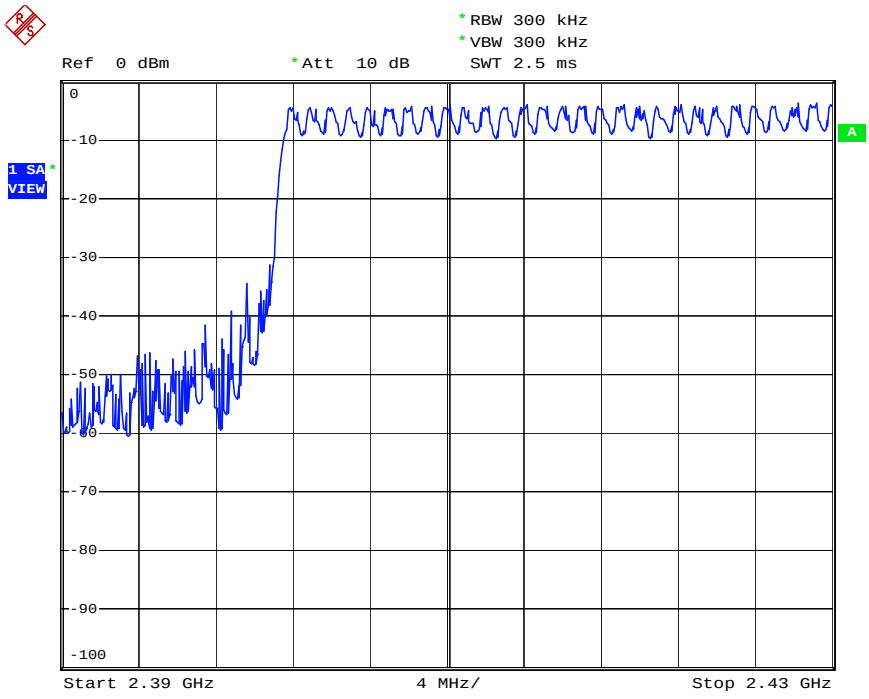


Date: 16.MAY.2007 10:19:32

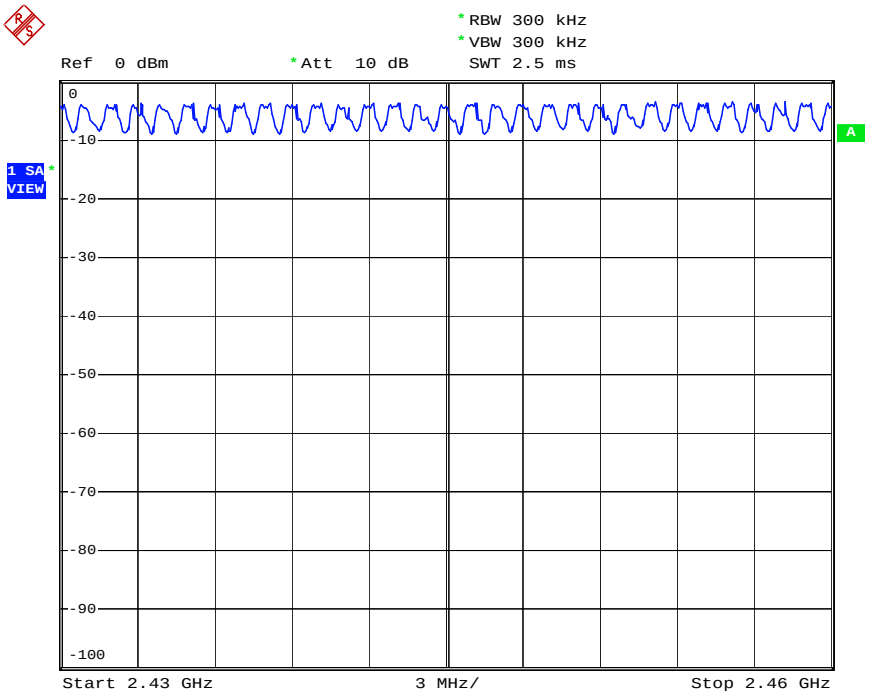
2.3.2 Operating Mode: 8DPSK



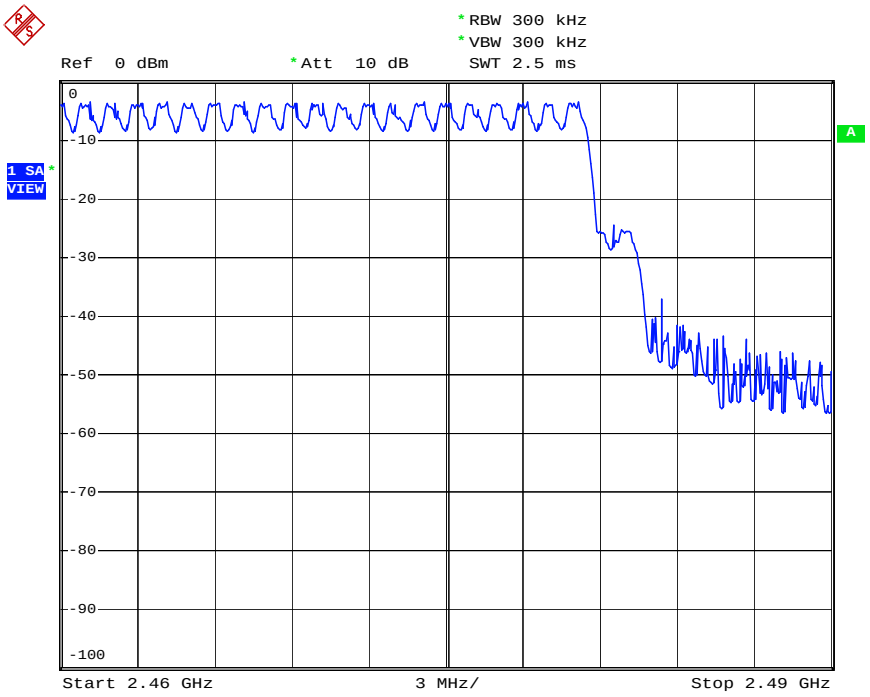
Date: 16.MAY.2007 10:33:51



Date: 16.MAY.2007 10:39:25



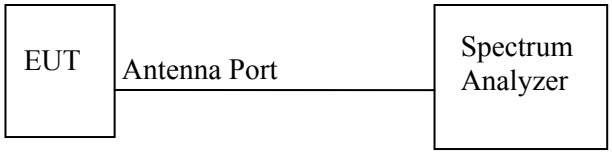
Date: 16.MAY.2007 10:48:21



Date: 16.MAY.2007 10:57:42

2.4 Average Time of Occupancy

Test setup
Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



Test procedure
The EUT antenna port connected to the spectrum analyzer. The RBW is set to 300 kHz. The VBW is set to appropriate in order to read the plus duration. The sweep time is coupled appropriate. The span is set to 0 MHz and single sweep with video triggered. The EUT is hopping operation.
The average time of occupancy within the 31.6 seconds (79 channels * 0.4) is calculated as follows in accordance with Bluetooth formula;
In case of DH1: (average time of occupancy) = (pulse width) * (1600 / 2) / 79 * 31.6
In case of DH3: (average time of occupancy) = (pulse width) * (1600 / 4) / 79 * 31.6
In case of DH5: (average time of occupancy) = (pulse width) * (1600 / 6) / 79 * 31.6

Limitation
15.247(a)(1)(iii) The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Test equipment used (refer to List of utilized test equipment)

SA06					

Test results – comply with the limitation.

Operation Mode	Transmission Packet Type	Pulse width (msec)	Time of occupancy (msec)
GFSK	DH1	0.432	138.24
	DH3	1.688	270.08
	DH5	2.960	315.73
8DPSK	DH1	0.444	142.08
	DH3	1.696	271.36
	DH5	2.960	315.73

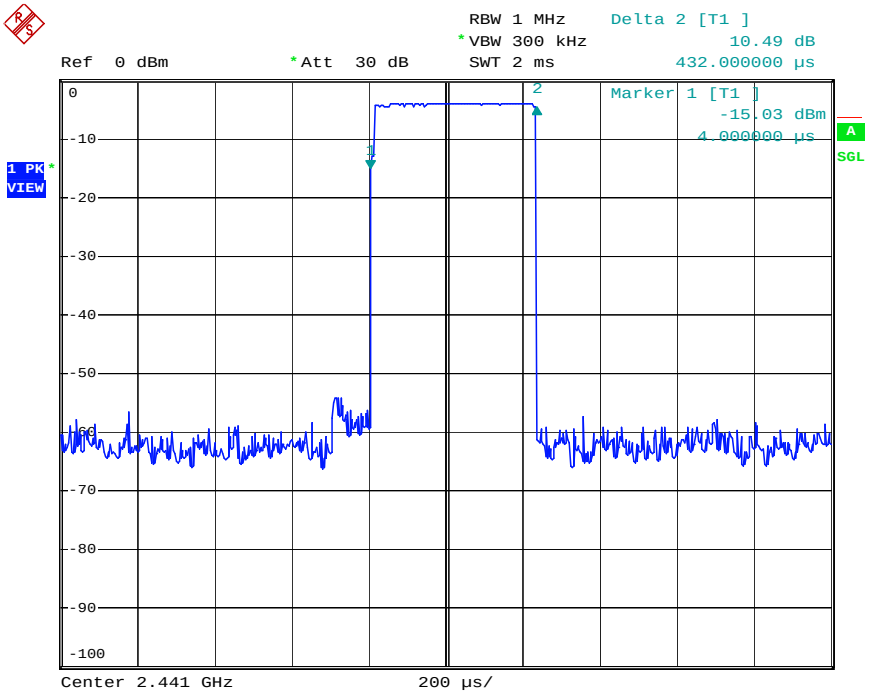
Test Data

Tested Date: May 16, 2007

Temperature: 23 ˚C
Humidity: 42 %
Atmos. Press: 1010 hPa

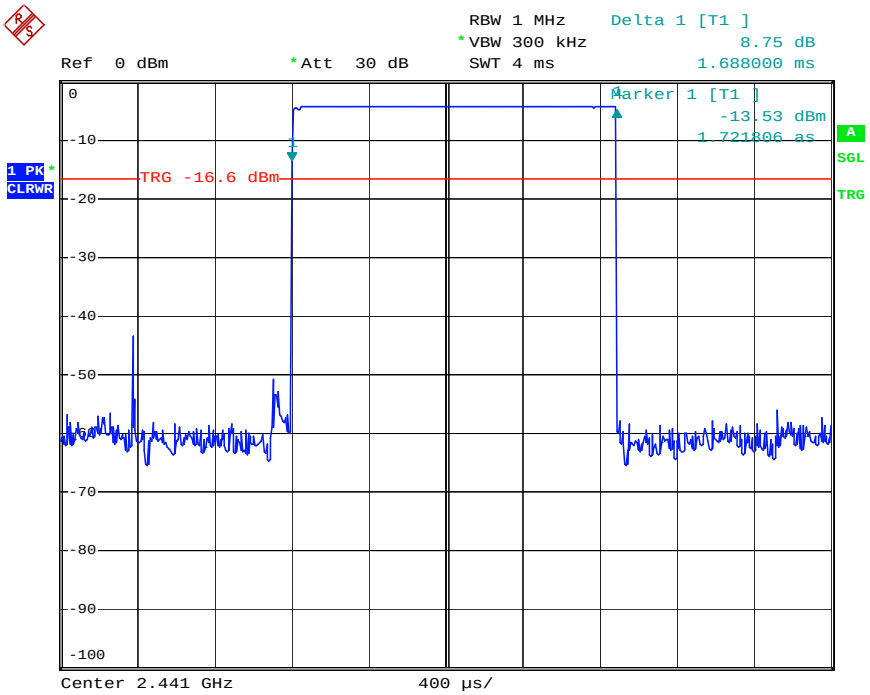
2.4.1 Operating Mode: GFSK

DH1 Packet



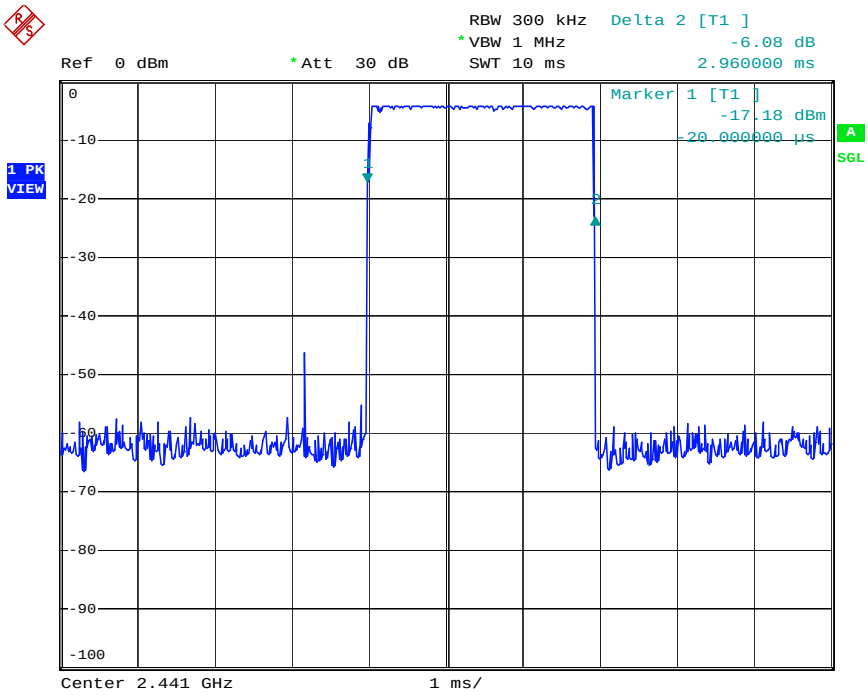
Date: 16.MAY.2007 16:43:12

DH3 Packet



Date: 16.MAY.2007 17:01:51

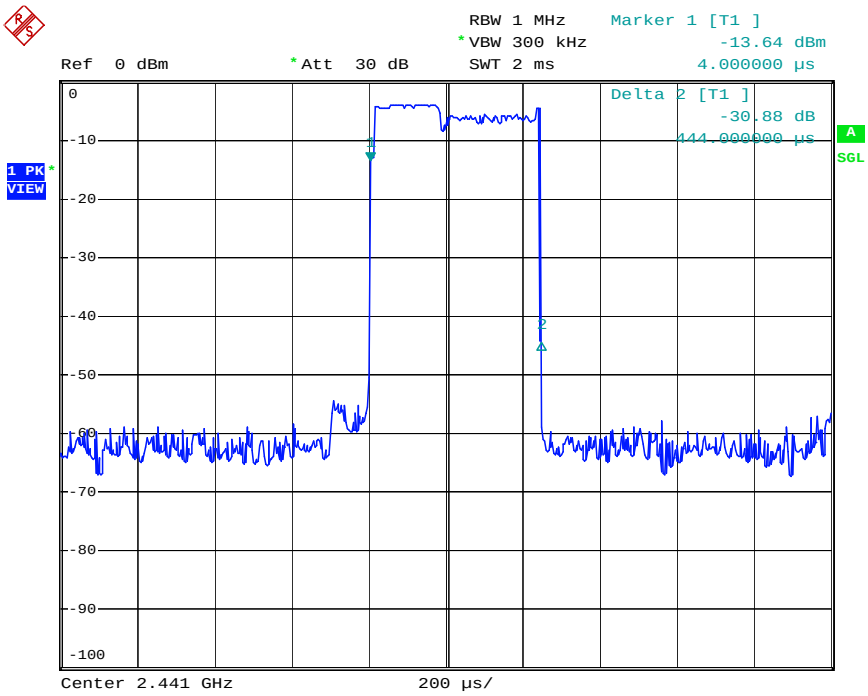
DH5 Packet



Date: 16.MAY.2007 17:20:42

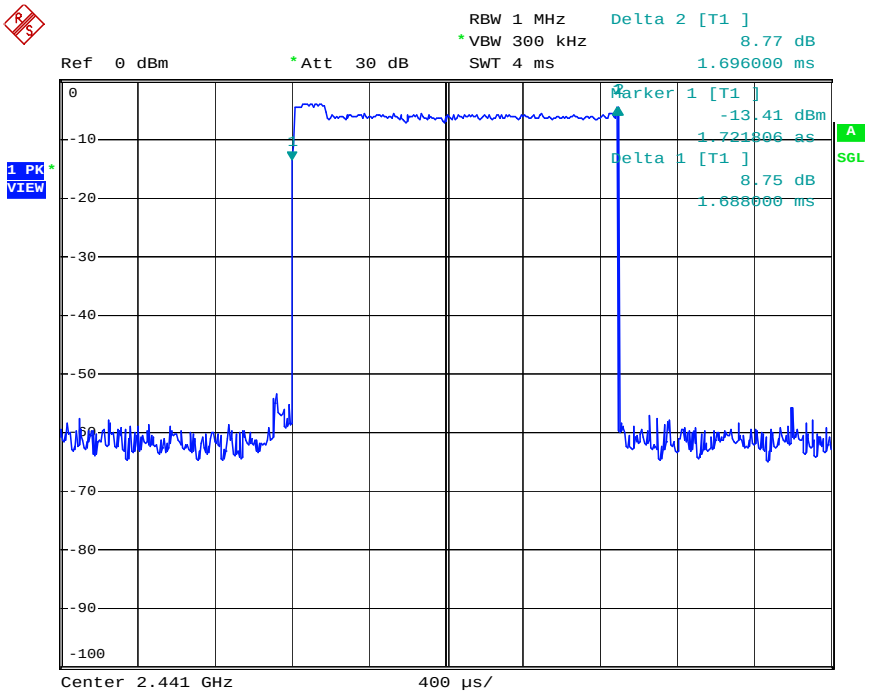
2.4.2 Operating Mode: 8DPSK

DH1



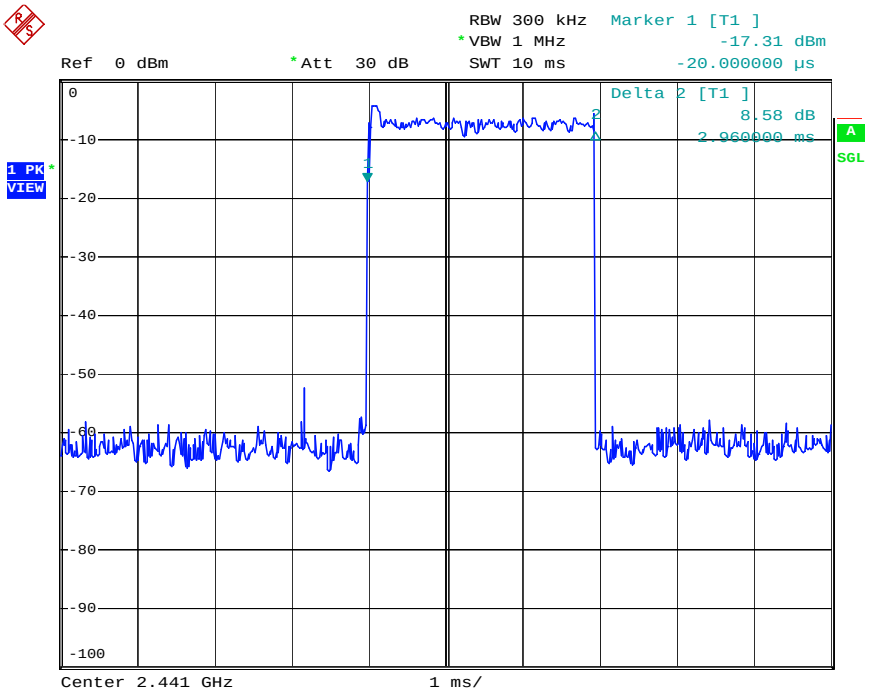
Date: 16.MAY.2007 17:26:06

DH3 Packet



Date: 16.MAY.2007 17:29:25

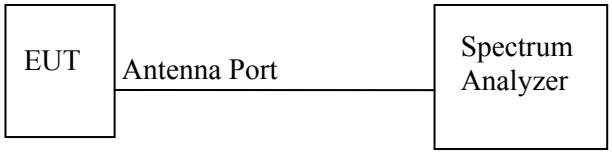
DH5 Packet



Date: 16.MAY.2007 17:31:29

2.5 Peak Output Power

Test setup
Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



Test procedure
The EUT antenna port connected to the spectrum analyzer. The RBW is set to the greater than 20dB bandwidth. The VBW is set to three times of RBW. The sweep time is coupled appropriate. The span is set to cover the carrier output spectrum. The analyzer is set to MAX HOLD. The EUT is set measured transmission channel under hopping off mode.
The correction factor is set to the spectrum analyzer in order to correct of the connected cable loss.

Limitation
15.247(a)(1) 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 125 mW(21dBm).

Test equipment used (refer to List of utilized test equipment)

SA06					

Test results – comply with the limitation.

Operation Mode	Transmission Channel(Frequency:MHz)	Output power (dBm)	Output power (mW)
GFSK	Low (2402)	-3.14	0.485
	Middle (2441)	-2.69	0.538
	High (2480)	-2.51	0.561
8DPSK	Low (2402)	-3.39	0.458
	Middle (2441)	-2.82	0.522
	High (2480)	-2.54	0.557

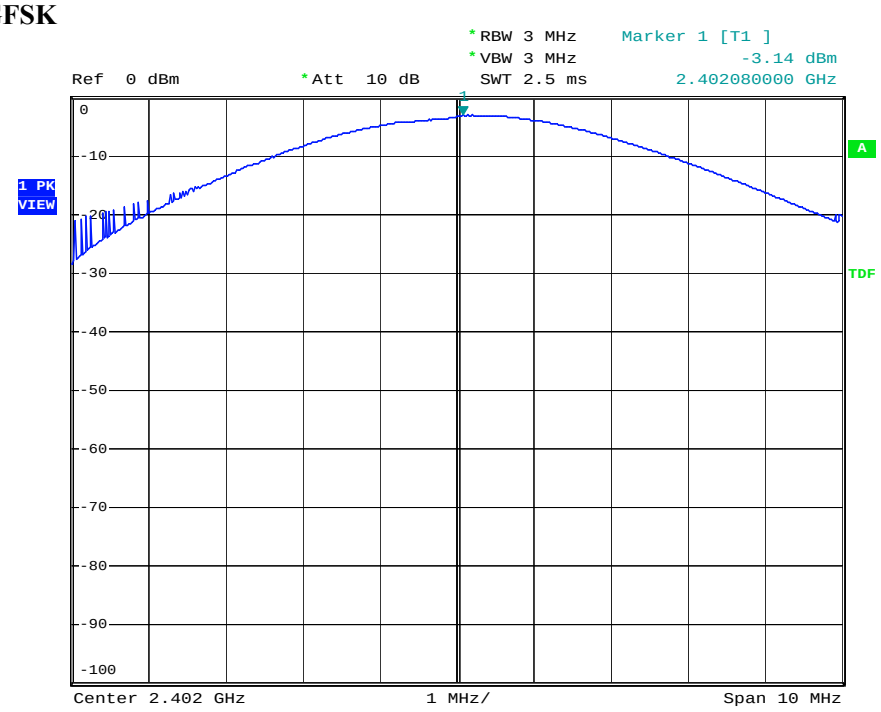
Test Data

Tested Date: May 17, 2007

Temperature: 22 ˚C
Humidity: 44 %
Atmos. Press: 1006 hPa

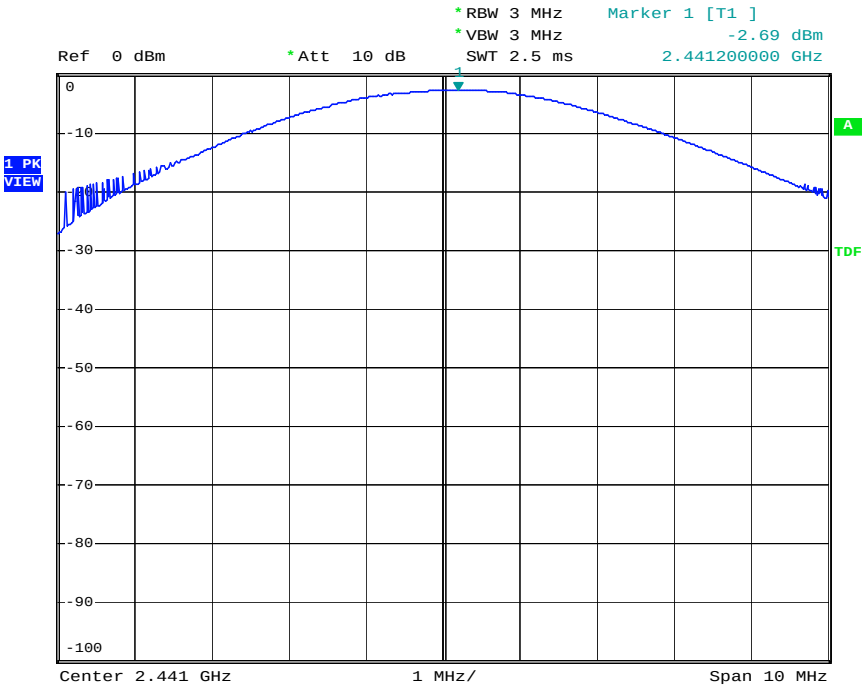
2.5.1 Operating Mode: GFSK

Low (CH:0) 2402MHz



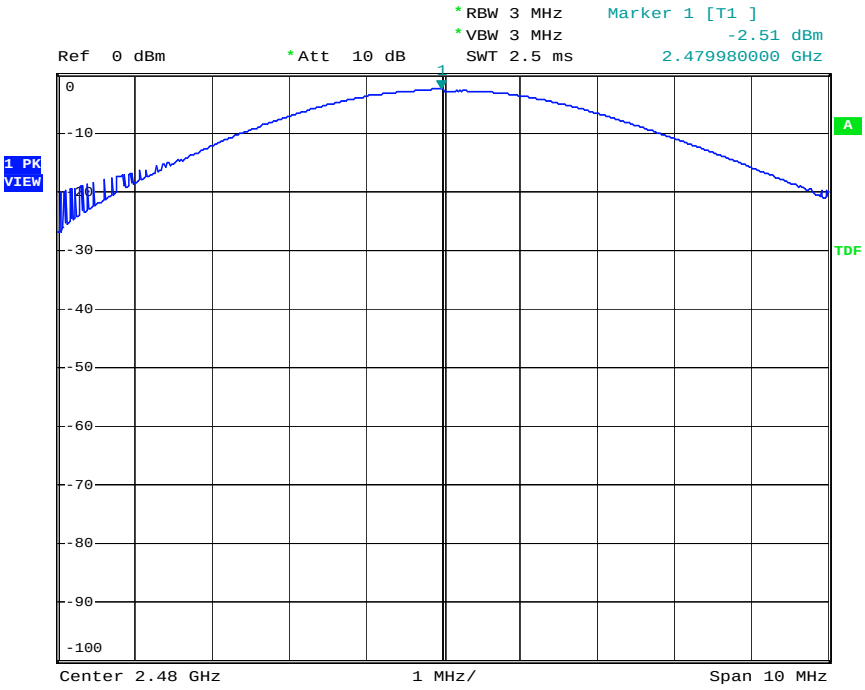
Date: 17.MAY.2007 11:16:57

Middle (CH: 39) 2441MHz



Date: 17.MAY.2007 11:18:06

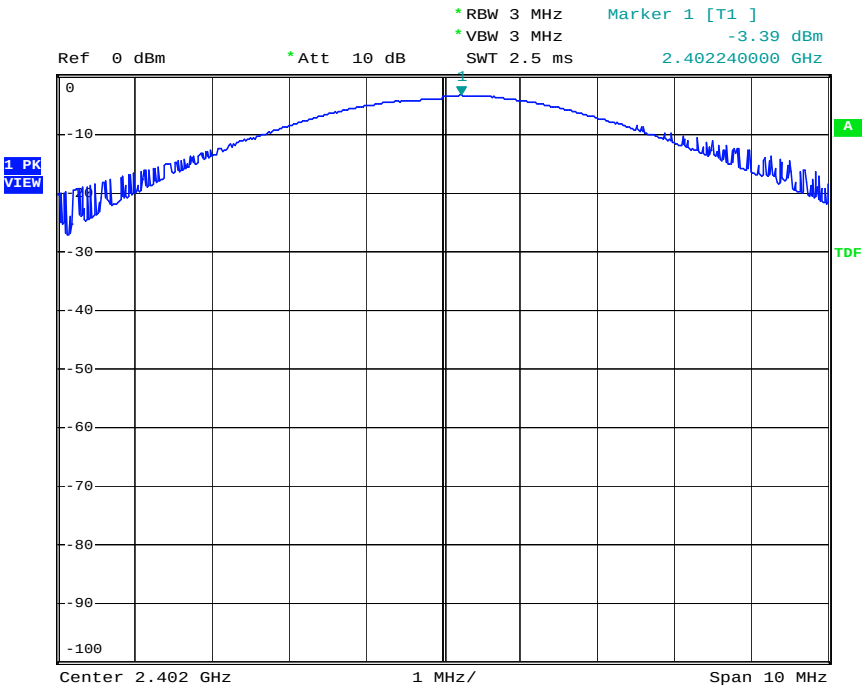
High (CH: 78) 2480MHz



Date: 17.MAY.2007 11:19:35

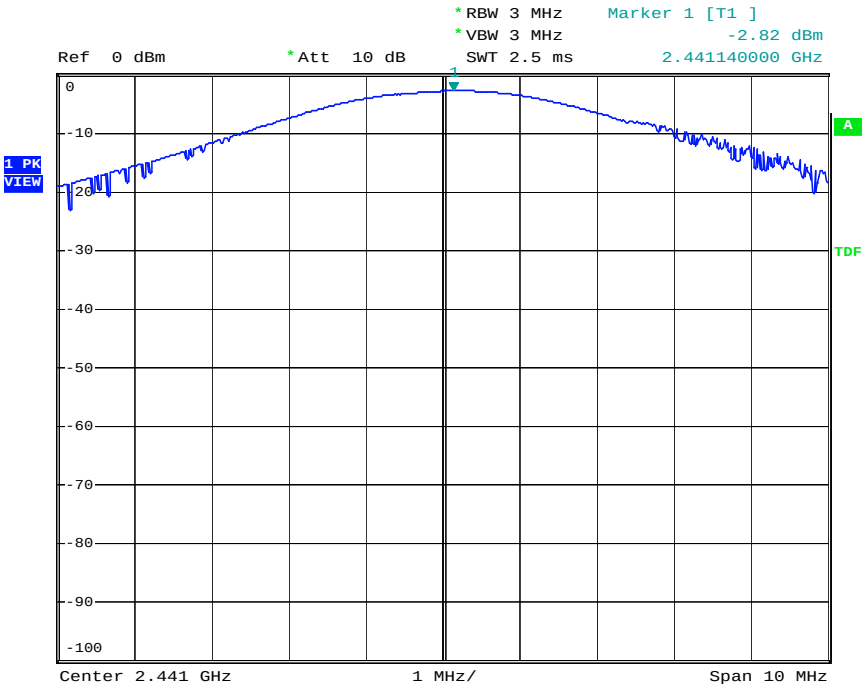
2.5.2 Operating Mode: 8DPSK

Low (CH:0) 2402MHz



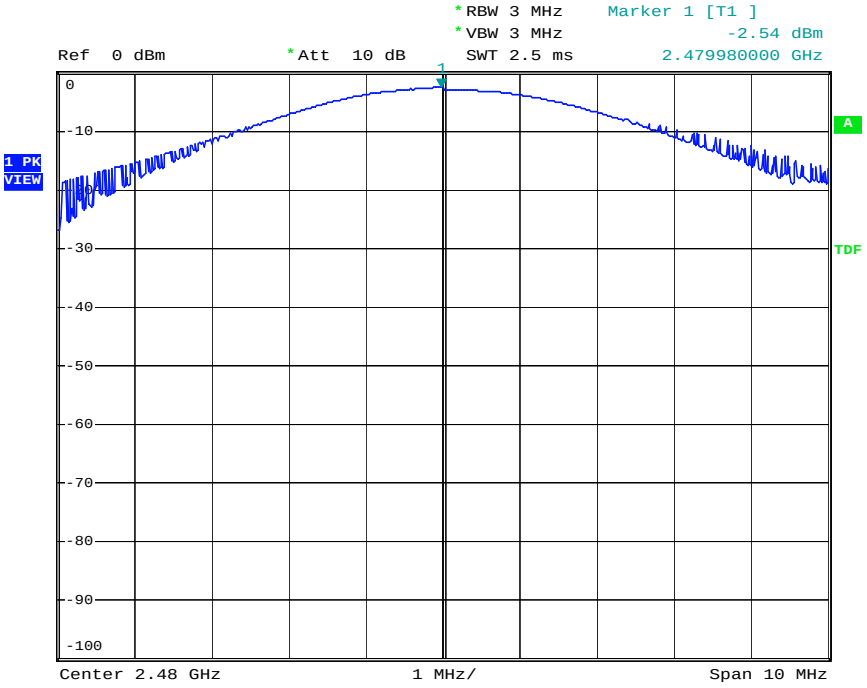
Date: 17.MAY.2007 11:29:34

Middle (CH: 39) 2441MHz



Date: 17.MAY.2007 11:30:45

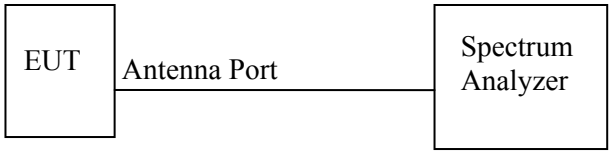
High (CH: 78) 2480MHz



Date: 17.MAY.2007 11:31:38

2.6 Peak Power Spectral Density

Test setup
Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



Test procedure
The EUT antenna port connected to the spectrum analyzer. The RBW is set to 3 kHz. The VBW is set to 10 kHz.
The sweep time is set to 100 seconds. The span is set to cover the carrier output spectrum.
The EUT is set measured transmission channel under hopping off mode.
The correction factor is set to the spectrum analyzer in order to correct of the connected cable loss.

Limitation
15.247(f) the digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section. The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test equipment used (refer to List of utilized test equipment)

SA06					

Test results – comply with the limitation.

Operation Mode	Transmission Channel(Frequency:MHz)	PPSD (dBm)
GFSK	Low (2402)	-14.96
	Middle (2441)	-13.64
	High (2480)	-13.65
8DPSK	Low (2402)	-14.59
	Middle (2441)	-13.93
	High (2480)	-14.03

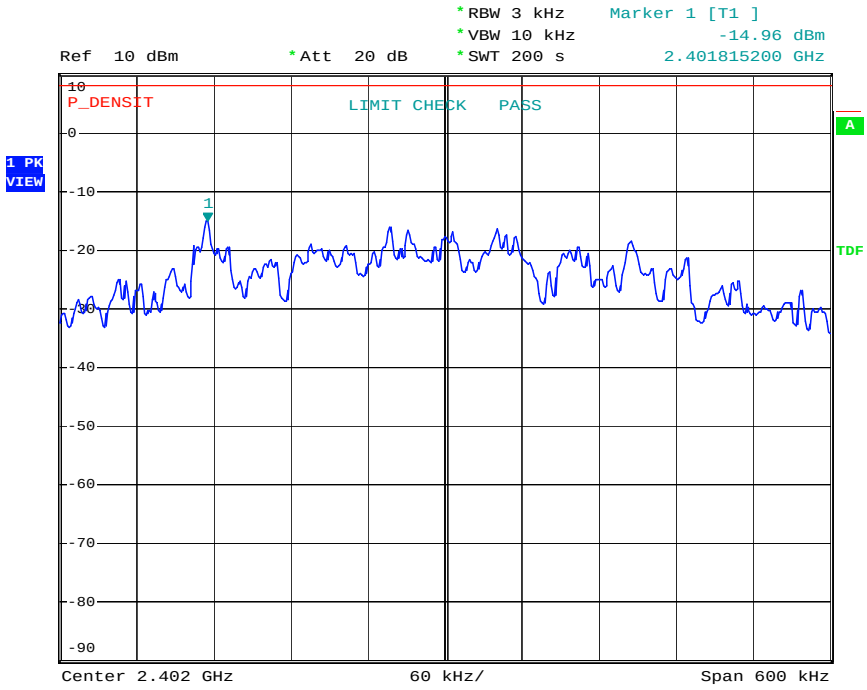
Test Data

Tested Date: May 16 2007

Temperature: 24 ˚C
Humidity: 38 %
Atmos. Press: 1008 hPa

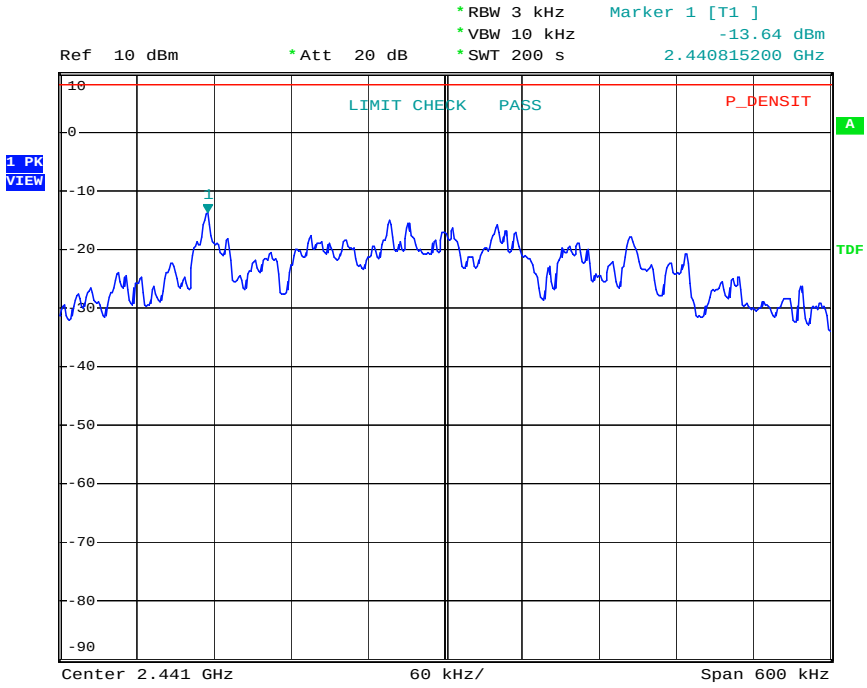
2.6.1 Operating Mode: GFSK

Low (CH:0) 2402MHz



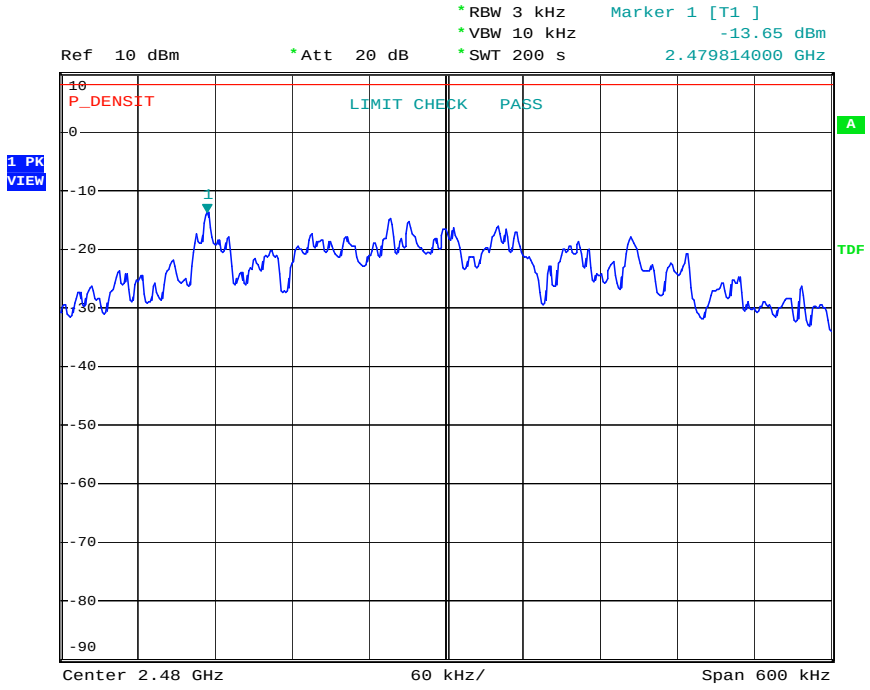
Date: 16.MAY.2007 18:04:37

Middle (CH: 39) 2441MHz



Date: 16.MAY.2007 18:09:55

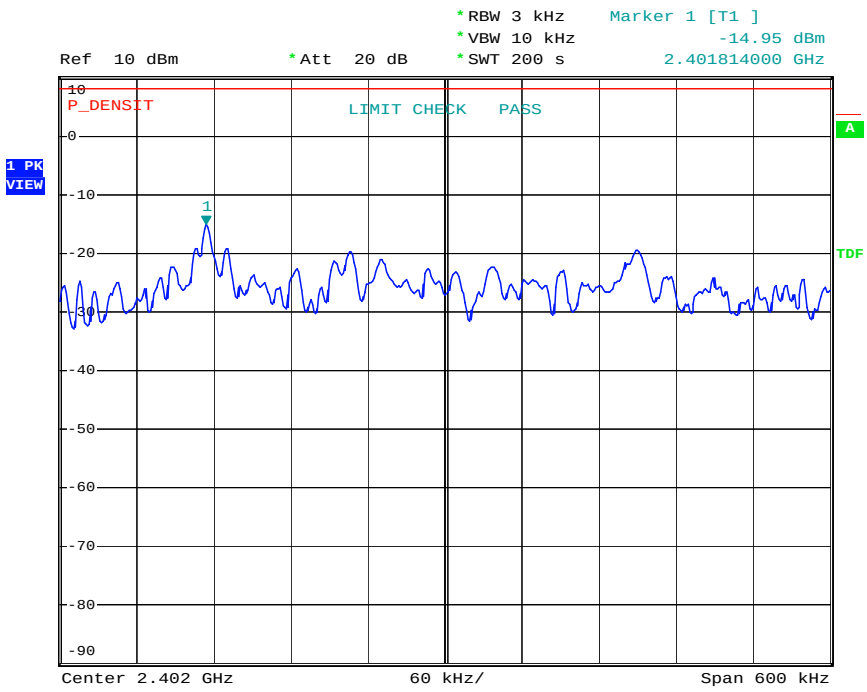
High (CH: 78) 2480MHz



Date: 16.MAY.2007 18:14:22

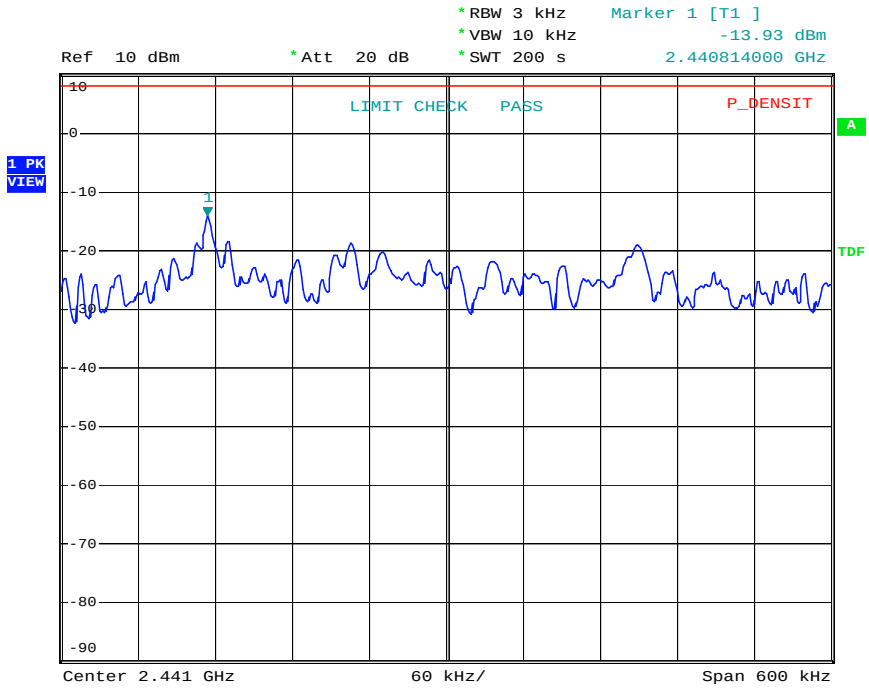
2.6.2 Operating Mode: 8DPSK

Low (CH:0) 2402MHz



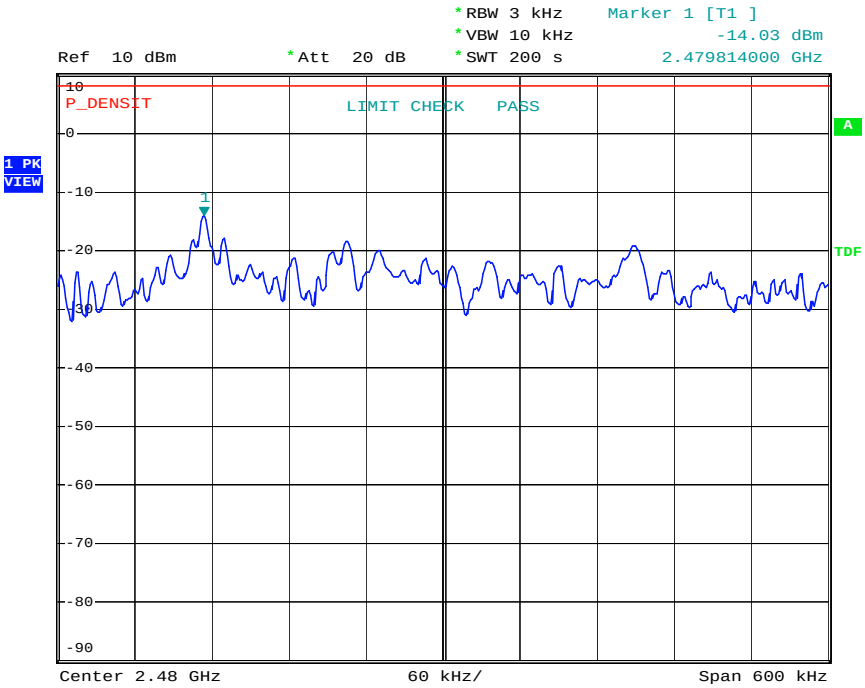
Date: 16.MAY.2007 18:21:41

Middle (CH: 39) 2441MHz



Date: 16.MAY.2007 18:26:25

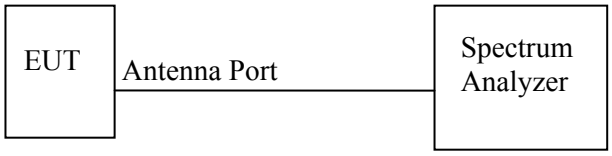
High (CH: 78) 2480MHz



Date: 16.MAY.2007 18:31:38

2.7 Conducted Spurious Emissions (Antenna Port)

Test setup
Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



Test procedure
The EUT antenna port connected to the spectrum analyzer. The RBW is set to 100 kHz. The VBW is set to 300 kHz.
The sweep time is set to the coupled. The spectrum is cheated from 30 MHz to 26 GHz.
The EUT is set measured transmission channel under hopping off mode.

Limitation
15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test equipment used (refer to List of utilized test equipment)

SA06					

Test results – comply with the limitation.
There is no conducted spurious emissions grater than the noise floor.

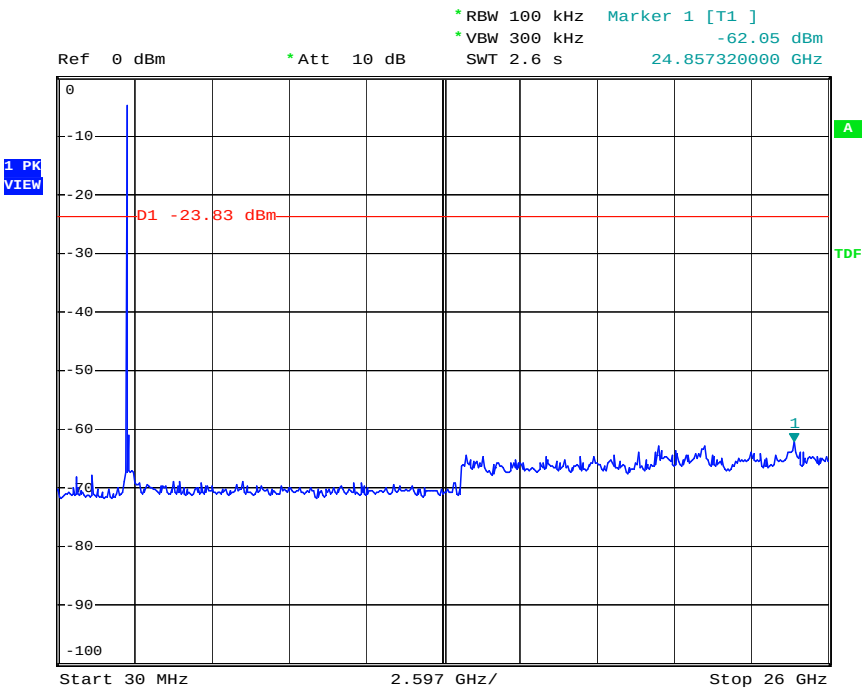
Test Data
Tested Date: May 17 2007

Temperature: 22 ˚C
Humidity: 44 %
Atmos. Press: 1006 hPa

2.7.1 Operating Mode: GFSK

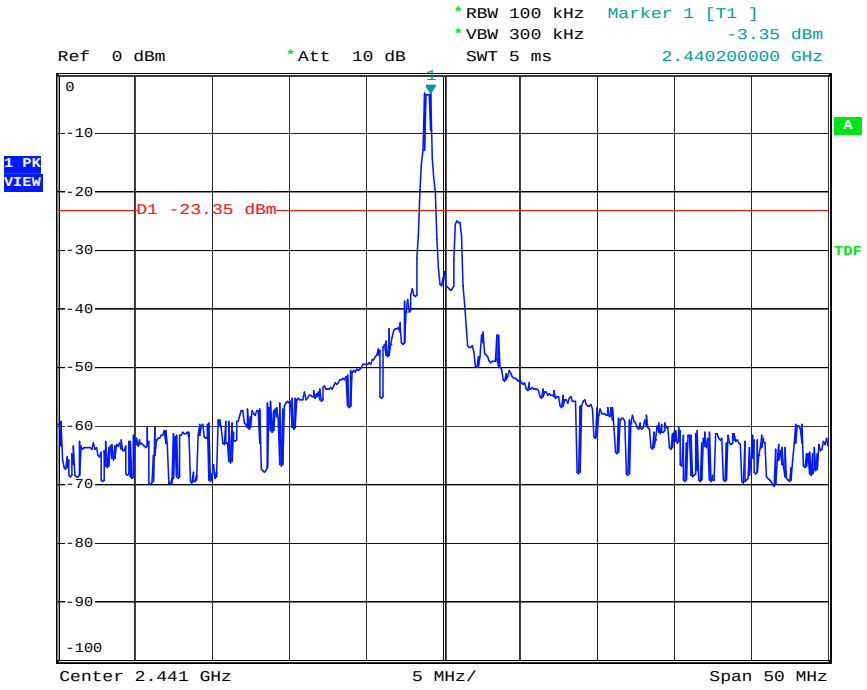
Low (CH:0) 2402MHz

Date: 17.MAY.2007 11:34:29

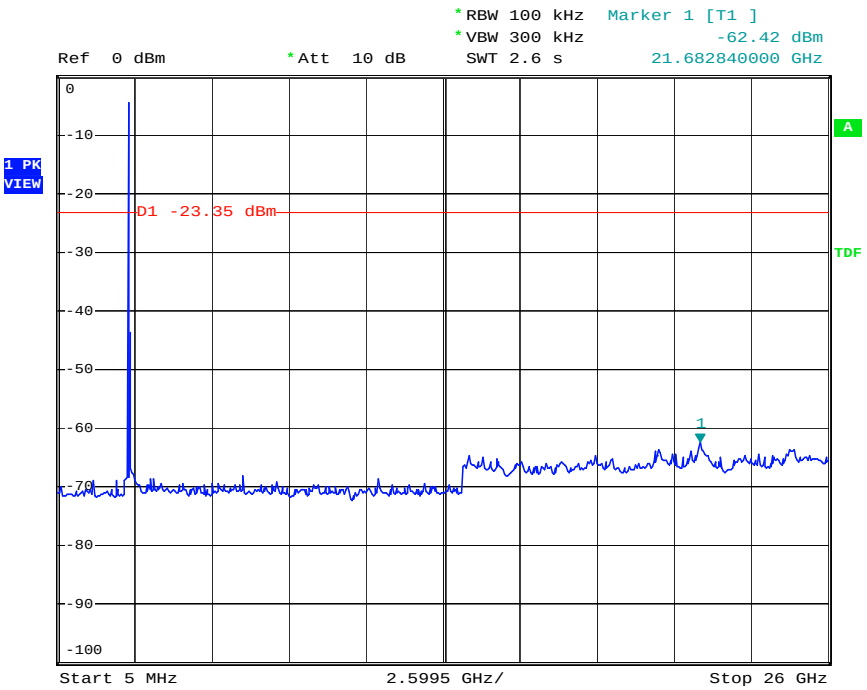


Date: 17.MAY.2007 11:35:44

Middle (CH: 39) 2441MHz

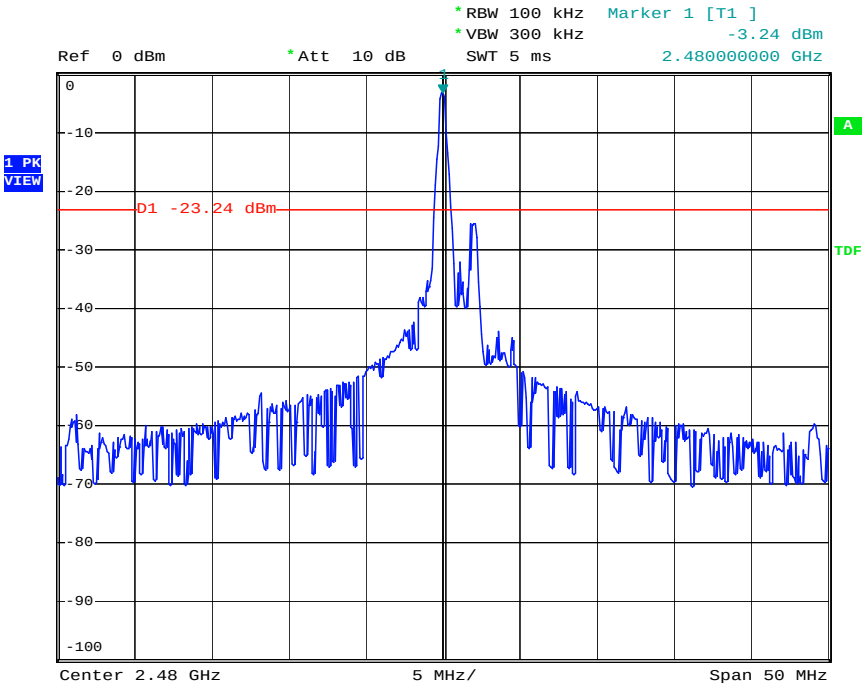


Date: 17.MAY.2007 11:37:06

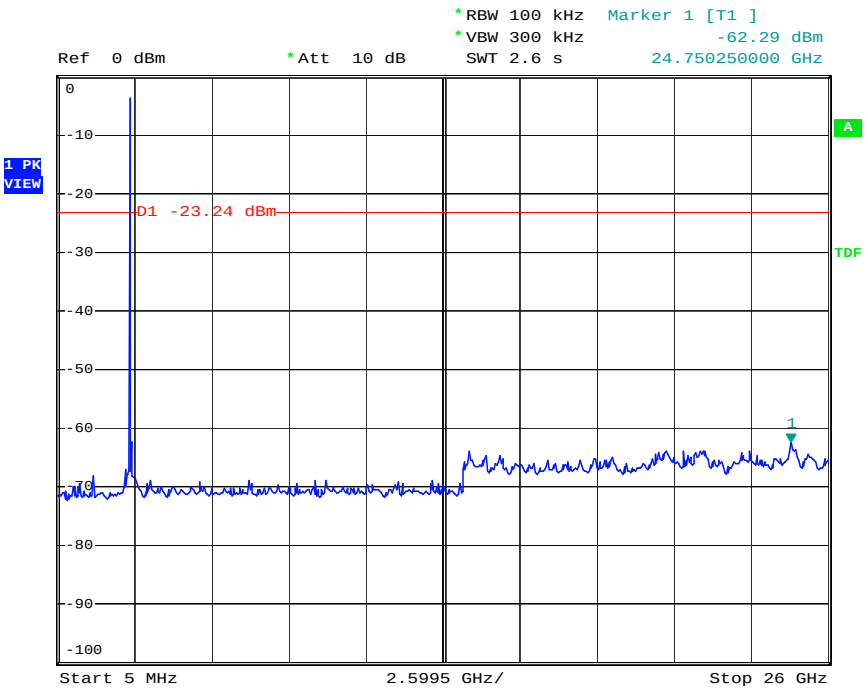


Date: 17.MAY.2007 11:38:06

High (CH: 78) 2480MHz



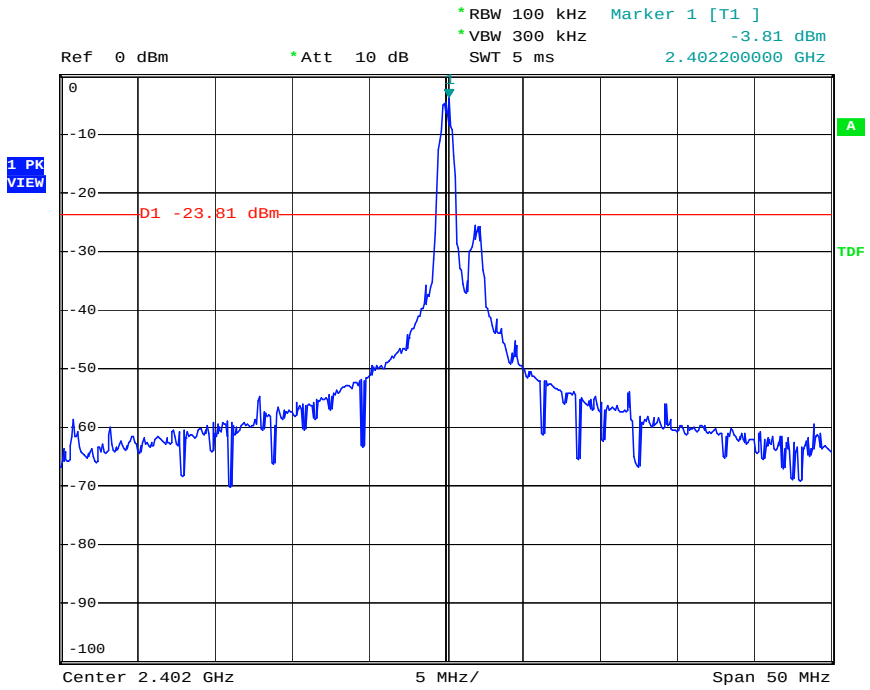
Date: 17.MAY.2007 11:39:08



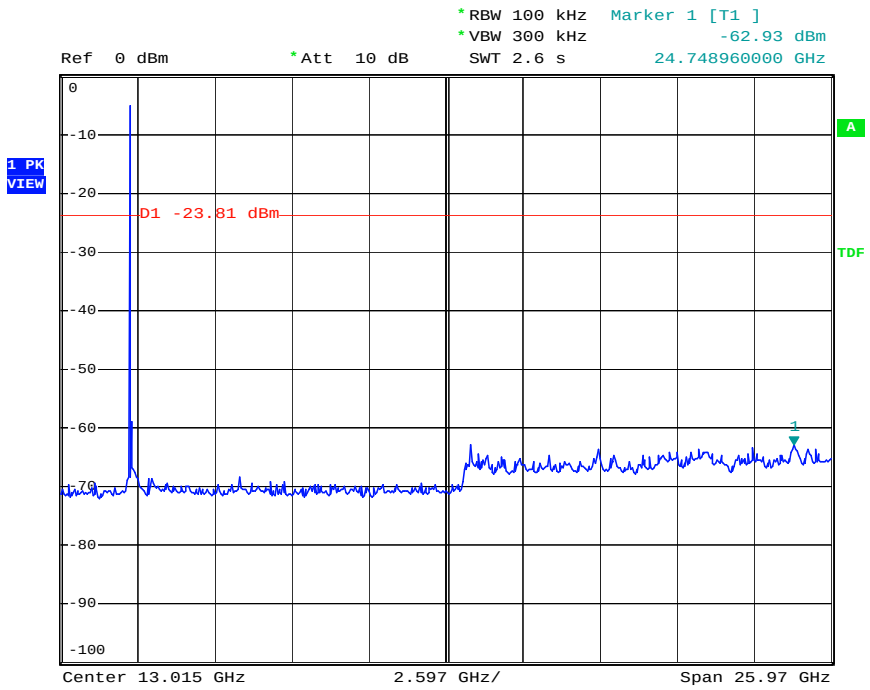
Date: 17.MAY.2007 11:40:02

2.7.2 Operating Mode: 8DPSK

Low (CH:0) 2402MHz

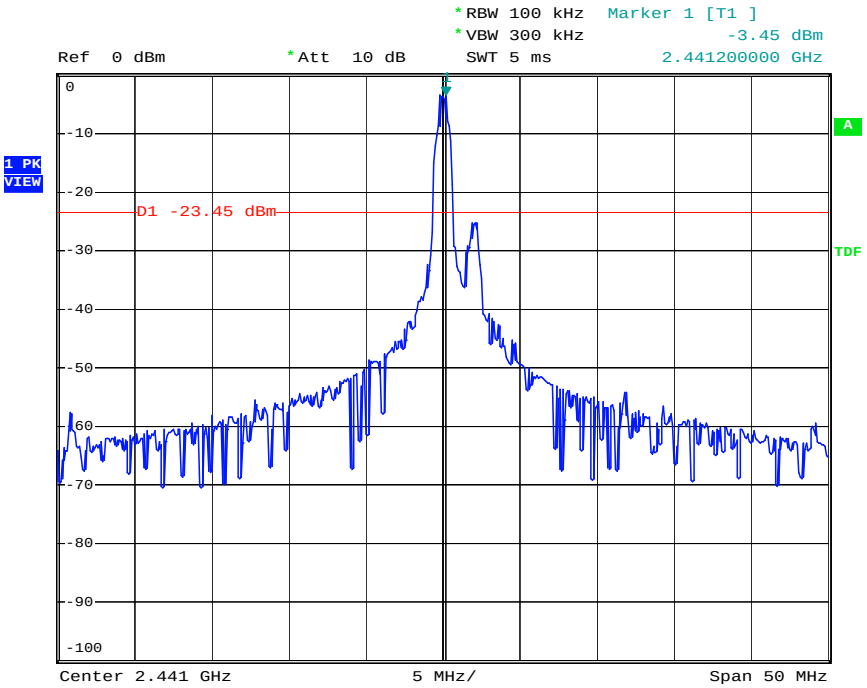


Date: 17.MAY.2007 11:41:32

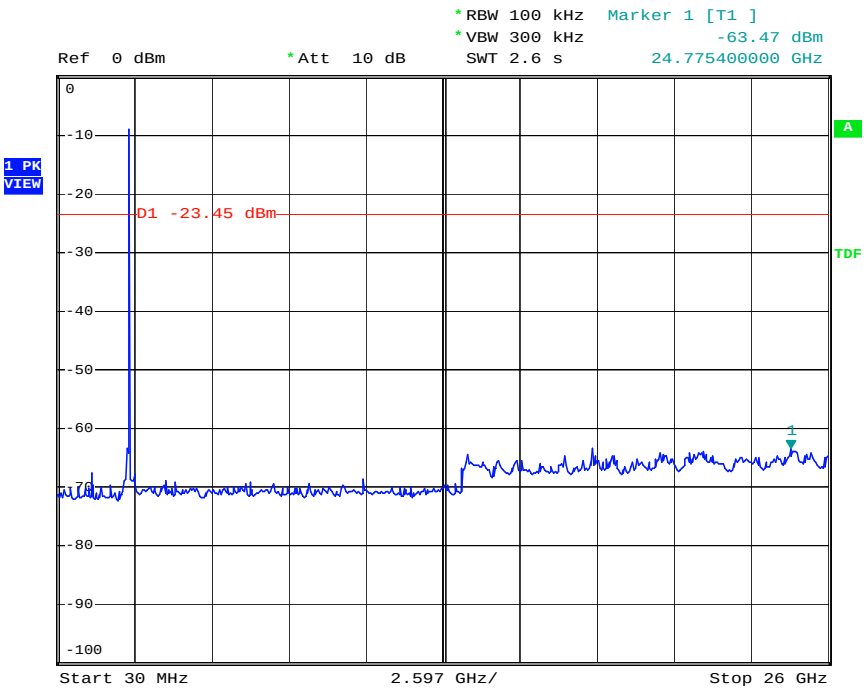


Date: 17.MAY.2007 11:55:31

Middle (CH: 39) 2441MHz

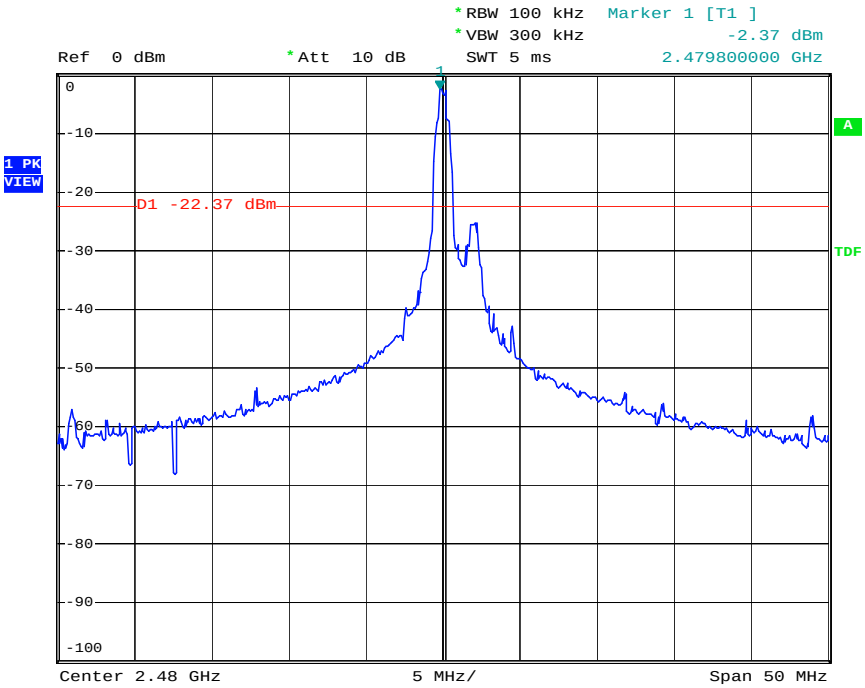


Date: 17.MAY.2007 11:42:46

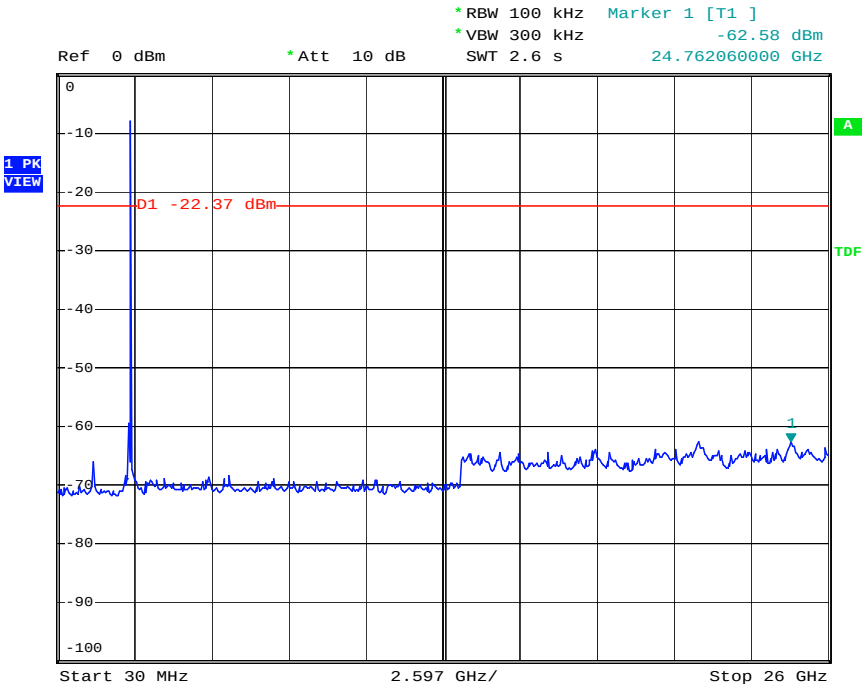


Date: 17.MAY.2007 11:43:39

High (CH: 78) 2480MHz



Date: 18.MAY.2007 09:10:42

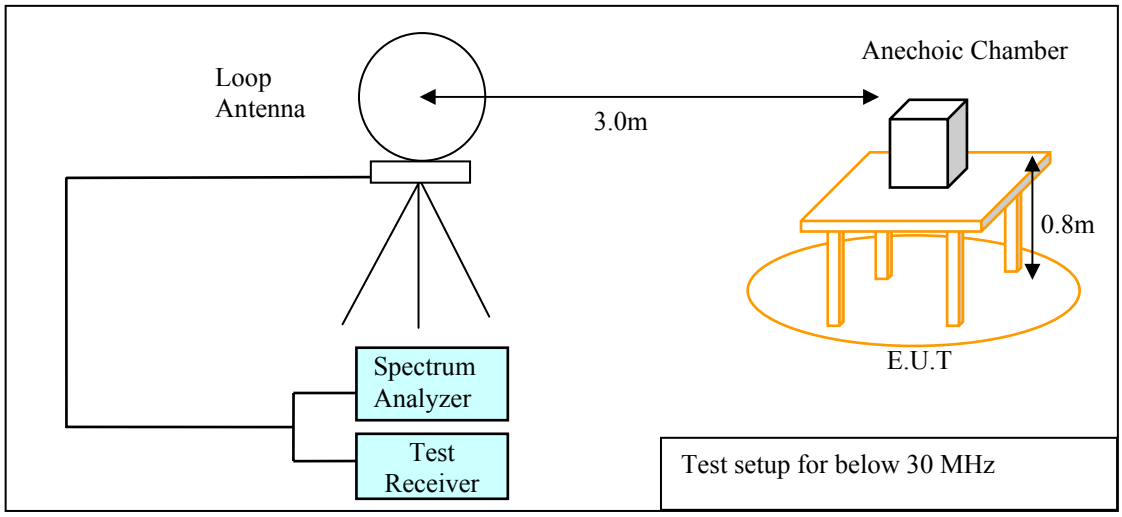


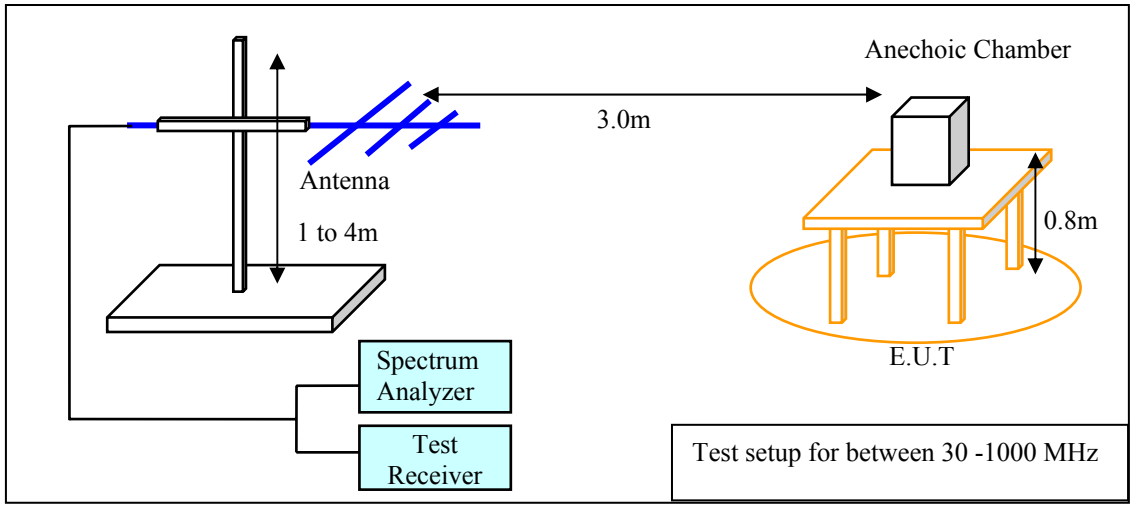
Date: 18.MAY.2007 09:12:30

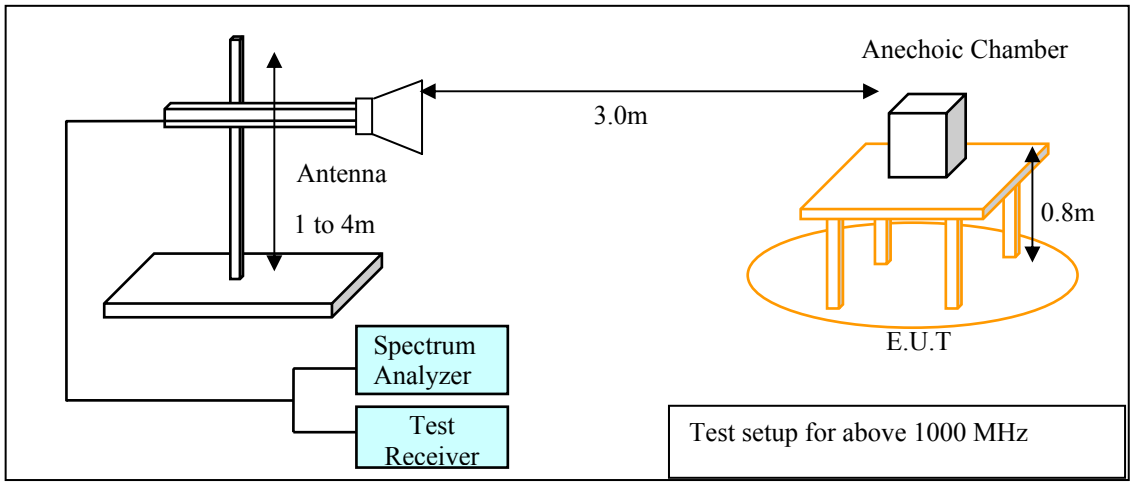
2.8 Transmitter Radiated spurious emissions

Test setup

Test setup was implemented according to the method of ANSI C63.4: 2003 clause 6 "General requirements for EUT equipment arrangements and operation", clause 8.2 and Annex H.3 "Radiated emission measurements setup".







Test procedure

Measurement procedures were implemented according to the method of ANSI C63.4: 2003 clauses 8.2.
The EUT is place on a non-conducted table which is 0.8m height from a ground plane and the measurement antenna to EUT distance is 3 meters. The turn table is rotated for 360 degrees to determine the maximum emission level.
In the frequency range of 9 kHz to 30 MHz, a calibrated loop antenna was positioned with its plane vertical at the distance 3m from the EUT with an extrapolation of corrected distance factor and rotated about its vertical axis for maximum response at each azimuth about the EUT. For certain applications, the loop antenna also needs to be positioned horizontally. The center of the loop shall be 1 m above the ground.
In the frequency above 30 MHz, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.
EUT is placed at three different orientations (X, Y and Z axis) in order to find the worst orientation.
The spectrum analyzer and receiver is set to the followings;

Below 30 MHz: RBW=10 kHz, VBW= 30 kHz, final measurement is carried out receiver RBW=9 kHz QP
Between 30 - 1000 MHz: RBW=100 kHz, VBW= 300 kHz, final measurement is carried out receiver RBW=120 kHz QP
Above 1000 MHz: Peak measurement- RBW=1 MHz, VBW= 1 MHz
Average measurement – RBW=1 MHz, VBW=10 Hz

Applicable rule and limitation

§15.205 restricted bands of operation

Except as shown in paragraph 15.205 (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.490 - 0.510	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(1)

15.205(b) except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

15.209(a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30.0	30	30
30 – 88	100	3
88 –216	150	3
216 – 960	200	3
Above 960	500	3

In the emission table above, the tighter limit applies at the band edges.
The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission.
The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz.
Radiated emission limits in the above bands are based on measurements employing an average detector.

Test results - Complied with requirement.

Test Data

2.8.1 Below 30 MHz

Test equipment used (refer to List of utilized test equipment)

LP01	CL11	SA06	TR04	

Tested Date: May 11 2007

Temperature: 21 ˚C
Humidity: 52 %
Atmos. Press: 1002 hPa

Operation Mode	**Result**
GFSK Worst case configuration	There is no spurious emissions grater than noise floor.
8DPSK Worst case configuration	There is no spurious emissions grater than noise floor.

Note: The lowest oscillator in the EUT is 12 MHz, therefore the spectrum was checked from the below 12 MHz. The noise floor is about 30dBuV/m at 3 meters (-10dBuV/m at 30 meters).

2.8.2 Between 30 – 1000 MHz

Test equipment used (refer to List of utilized test equipment)

BA03	CL11	PR03	SA06	TR04

Tested Date: May 11 2007

Temperature: 21 ˚C
Humidity: 52 %
Atmos. Press: 1002 hPa

2.8.2.1 Operating Mode: GFSK Worst case configuration

No.	Frequency [MHz]	Reading [dBuV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna Plariozation
1	42.35	50.8	10.5	4.1	29.8	35.6	40.0	4.4	Vert.
2	57.38	57.5	5.9	4.3	29.8	37.9	40.0	2.1	Vert.
3	58.83	44.3	5.8	4.3	29.8	24.6	40.0	15.4	Hori.
4	84.89	52.0	7.2	4.6	29.8	34.0	40.0	6.0	Vert.
5	104.32	47.1	10.1	4.8	29.7	32.3	43.5	11.2	Hori.
6	144.43	49.6	10.5	5.1	29.7	35.5	43.5	8.0	Hori.
7	150.61	42.0	10.5	5.2	29.7	28.0	43.5	15.5	Vert.

Calculation method

The Correction Factors and RESULT are calculated as followings.

Correction Factor (dB) = FACTOR (dB/m) + LOSS (dB) – GAIN (dB)

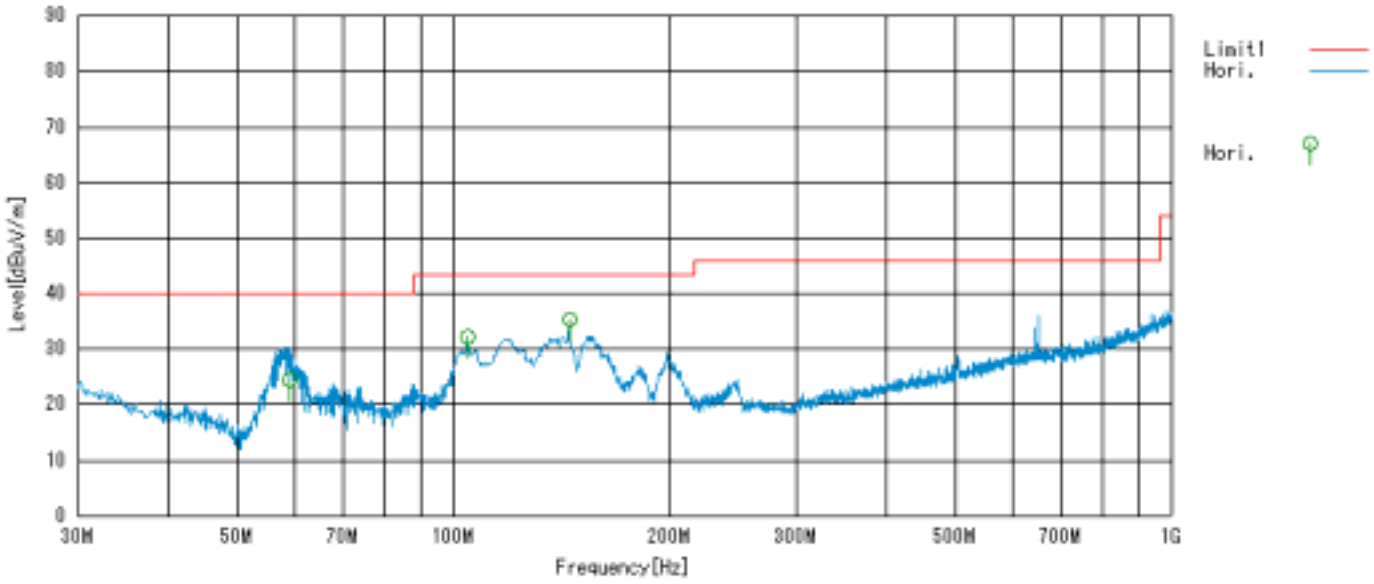
RESULT (dBμV/m) = READING (dBμV) + Correction Factor (dB/m)

Sample calculation at 57.38 MHz vertical result as follow:

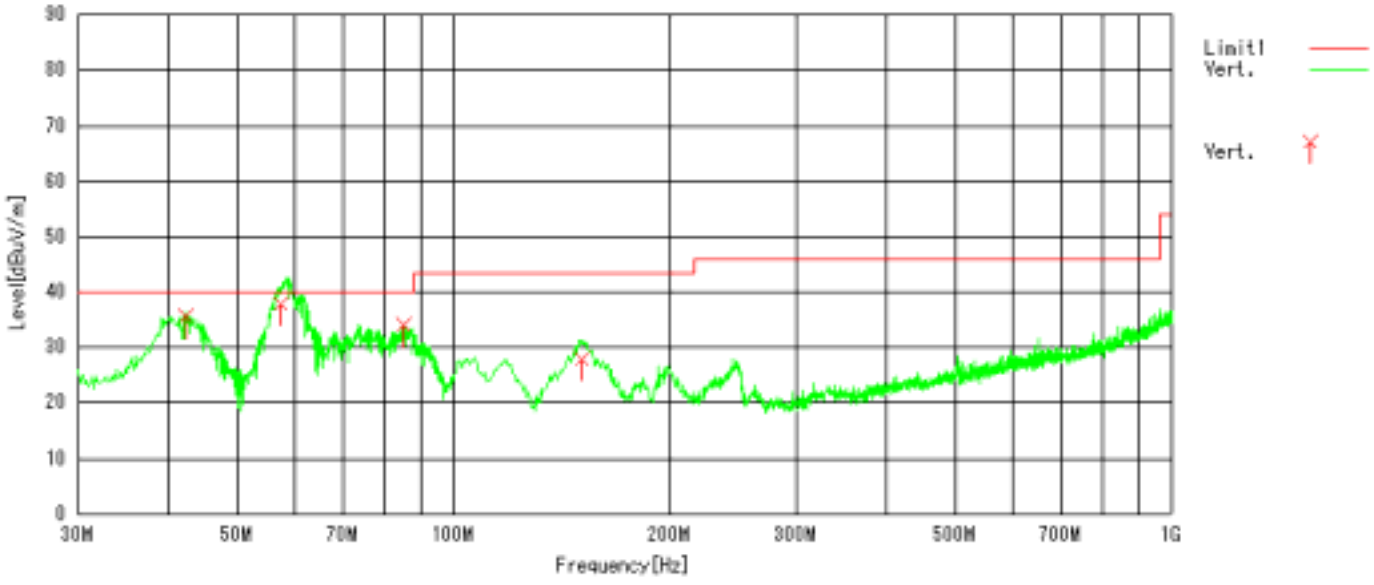
Result (dBuV/m) = Reading + C.F = 57.5 + 5.9 + 4.3 -29.8 = 37.9
Margin = Limit – Result = 40.0 – 37.9 = 2.1 (dBuV/m)

Graphical express of test result (30MHz-1000MHz)

Antenna polarization: Horizontal



Antenna polarization: Vertical



2.8.2.2 Operating Mode: 8DPSK Worst case configuration

No.	Frequency [MHz]	Reading [dBuV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna Plariozation
1	40.14	44.9	12.0	4.1	29.8	31.2	40.0	8.8	Vert.
2	63.35	47.9	5.7	4.4	29.8	28.2	40.0	11.8	Hori.
3	63.37	55.4	5.7	4.4	29.8	35.7	40.0	4.3	Vert.
4	87.37	51.8	7.7	4.6	29.7	34.4	40.0	5.6	Vert.
5	100.72	48.1	9.9	4.7	29.7	33.0	43.5	10.5	Vert.
6	103.63	46.2	10.1	4.8	29.7	31.4	43.5	12.1	Hori.
7	147.07	50.5	10.5	5.2	29.7	36.5	43.5	7.0	Hori.
8	147.62	42.7	10.5	5.2	29.7	28.7	43.5	14.8	Vert.
9	224.33	39.0	11.0	5.7	29.6	26.1	46.0	19.9	Vert.

Calculation method

The Correction Factors and RESULT are calculated as followings.

Correction Factor = FACTOR + LOSS – GAIN
(dB) (dB/m) (dB) (dB)

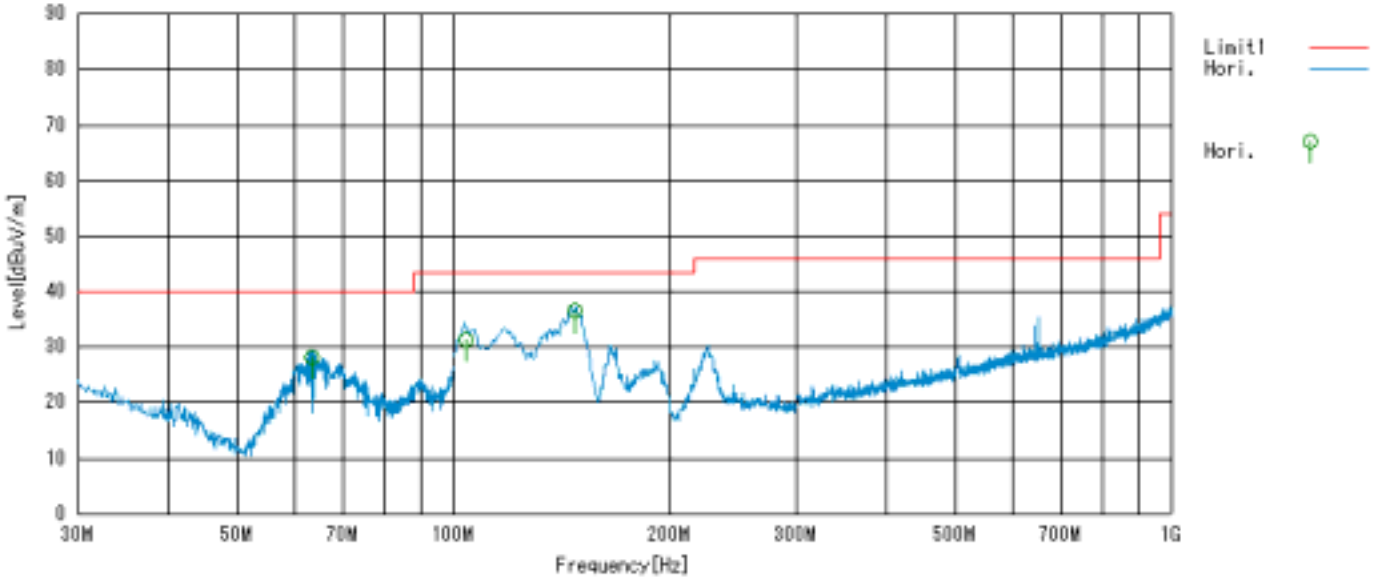
RESULT =READING+ Correction Factor
(dBµV/m) (dBµV) (dB/m)

Sample calculation at 63.37 MHz vertical result as follow:

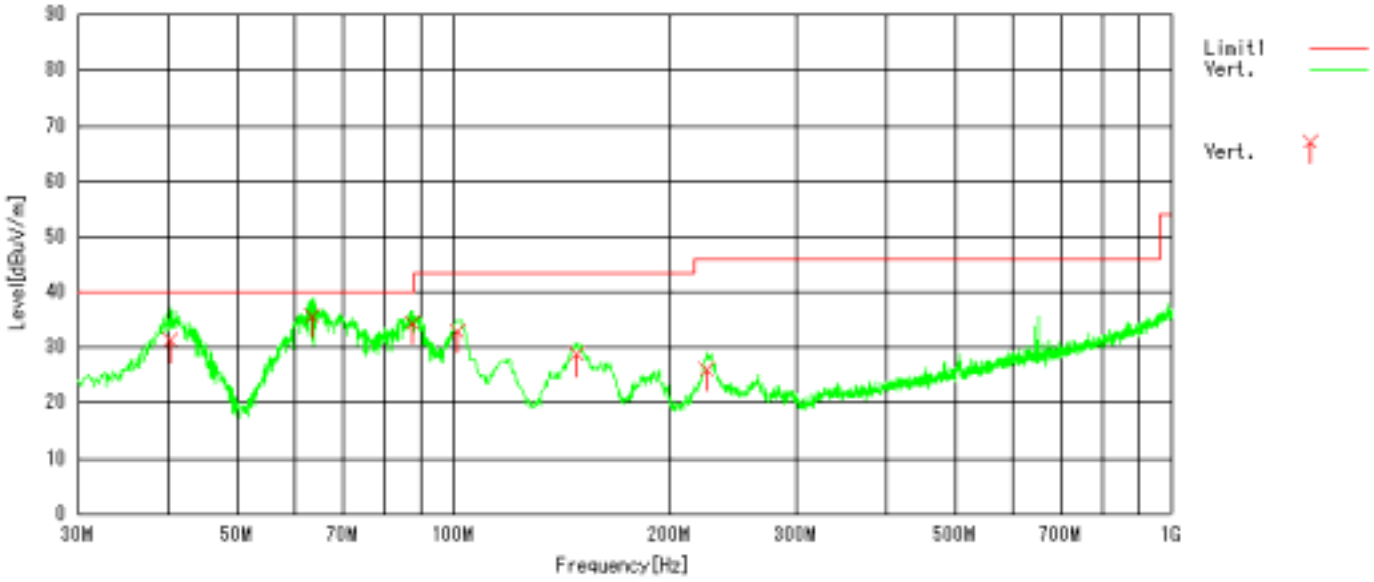
Result (dBuV/m) = Reading + C.F = 55.4 + 5.7 + 4.4 -29.8 = 35.7
Margin = Limit – Result = 40.0 – 37.9 = 2.1 (dBuV/m)

Graphical express of test result (30MHz-1000MHz)

Antenna polarization: Horizontal



Antenna polarization: Vertical



2.8.3 Above 1000 MHz

Test equipment used (refer to List of utilized test equipment)

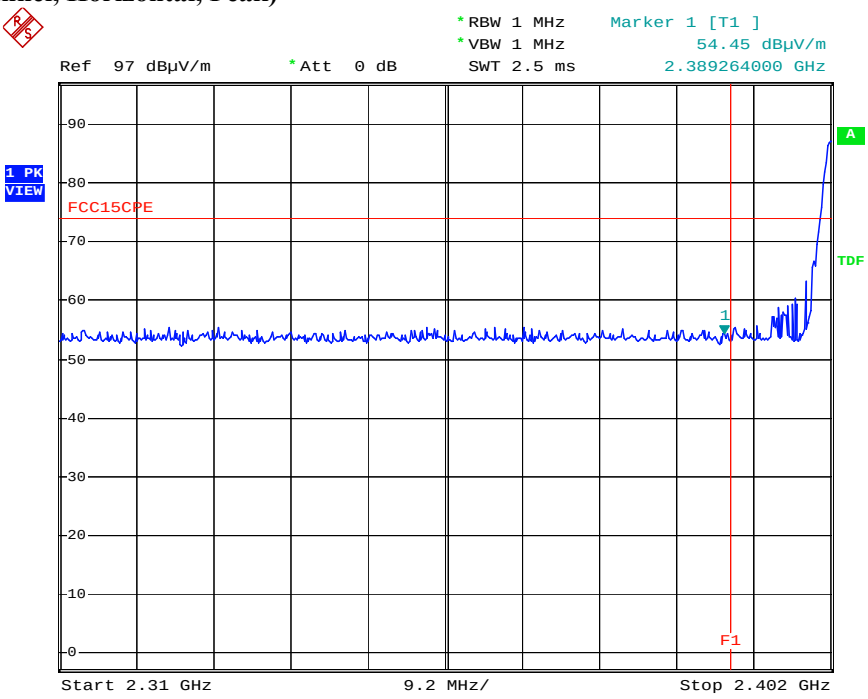
BRF1	HPF1	PR04	SH01	SA06	CL21	CL22	DH02

Tested Date: May 15 2007

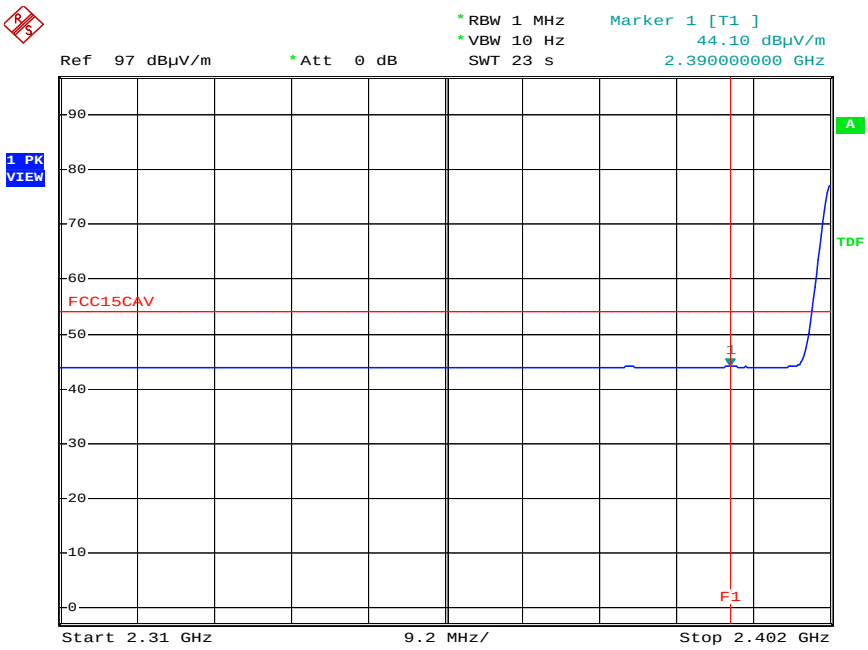
Temperature: 24 ˚C
Humidity: 38 %
Atmos. Press: 1008 hPa

2.8.3.1 Operating Mode: GFSK

Restricted Band Edge (Low channel, Horizontal, Peak)

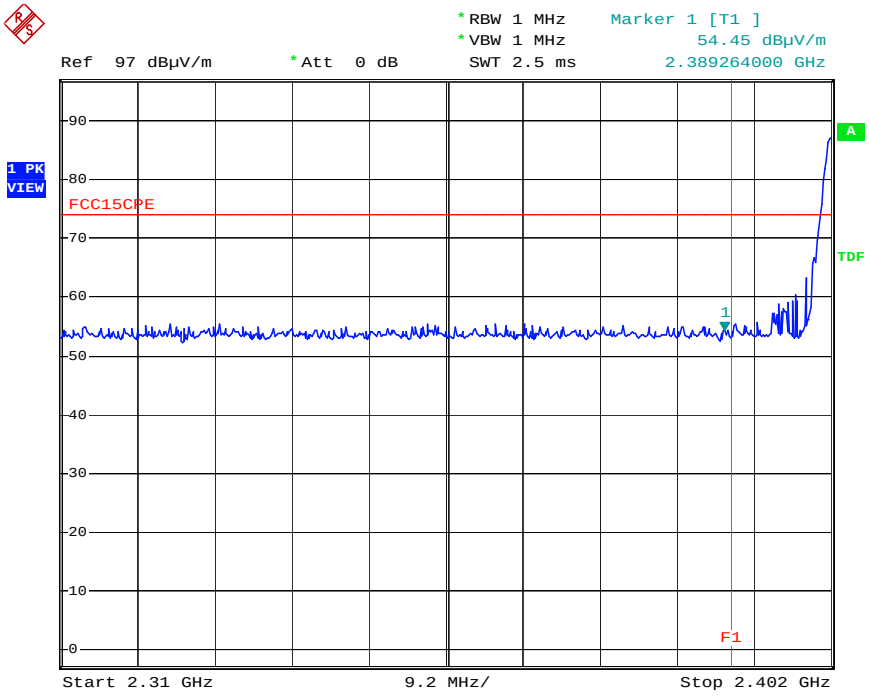


Restricted Band Edge (Low channel, Horizontal, Average)



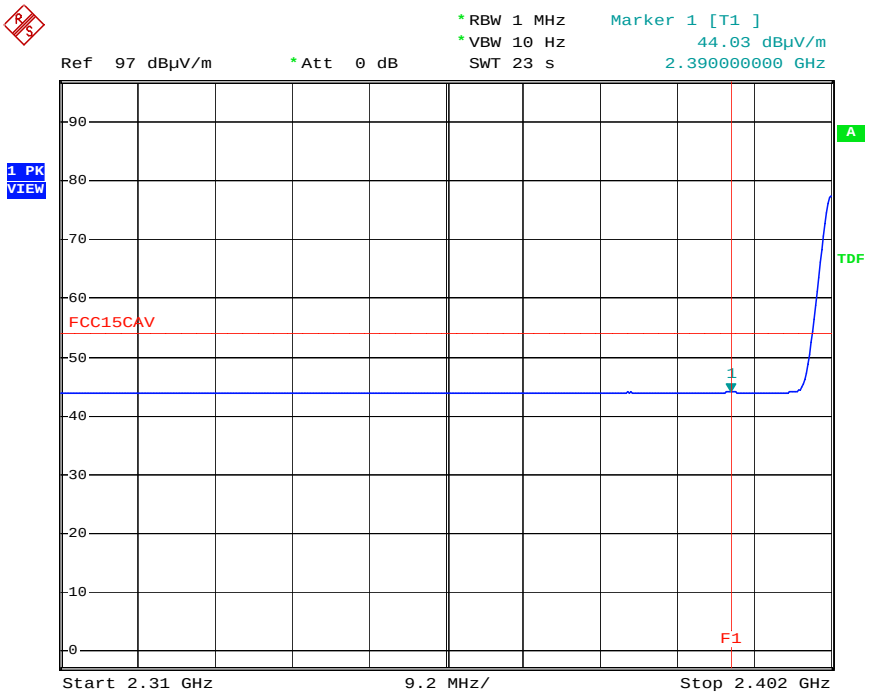
Date: 15.MAY.2007 12:13:03

Restricted Band Edge (Low channel, Vertical, Peak)



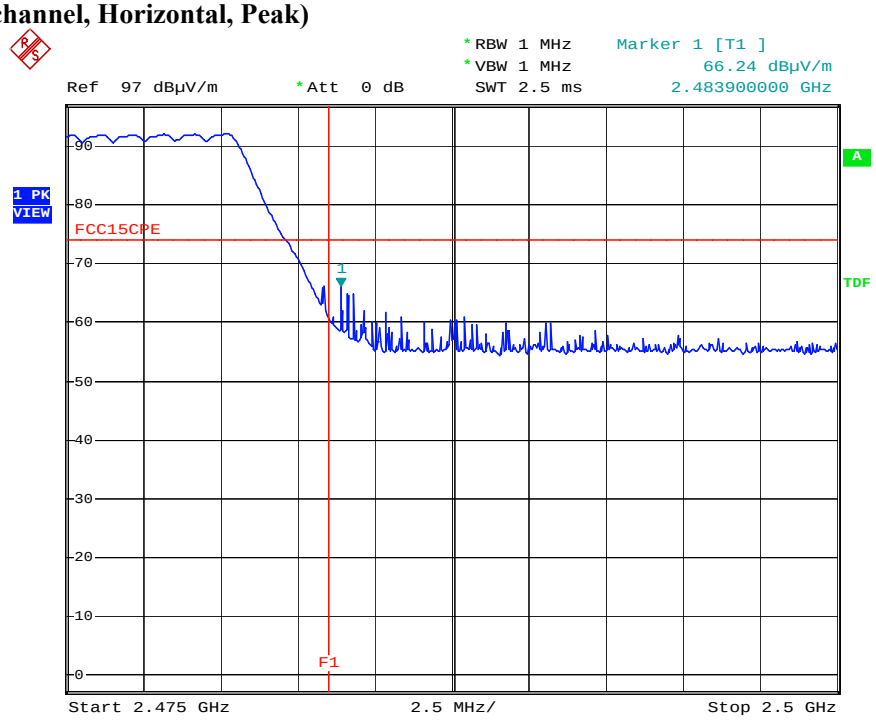
Date: 15.MAY.2007 13:39:41

Restricted Band Edge (Low channel, Vertical, Average)



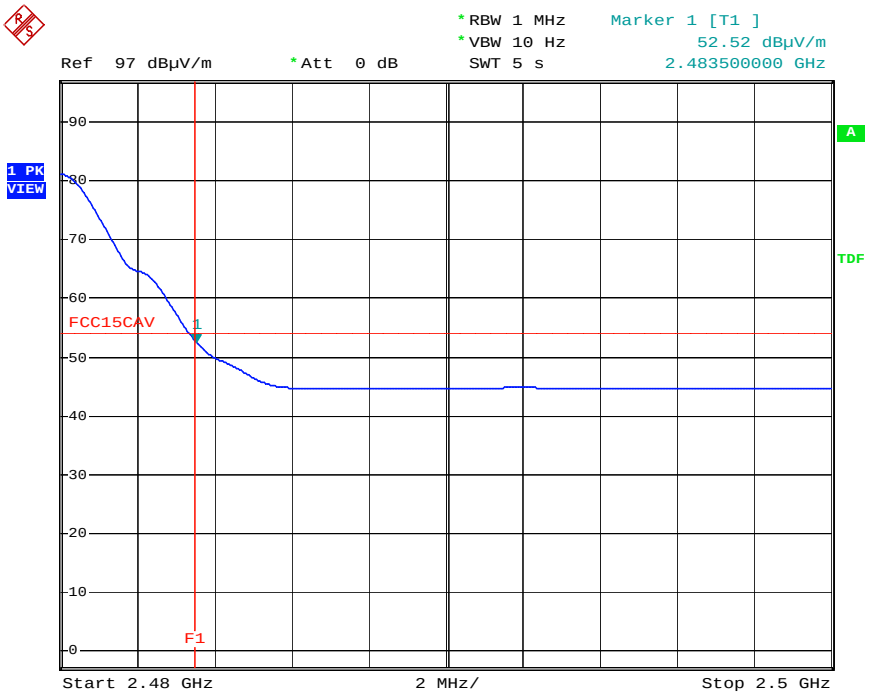
Date: 15.MAY.2007 13:42:05

Restricted Band Edge (High channel, Horizontal, Peak)



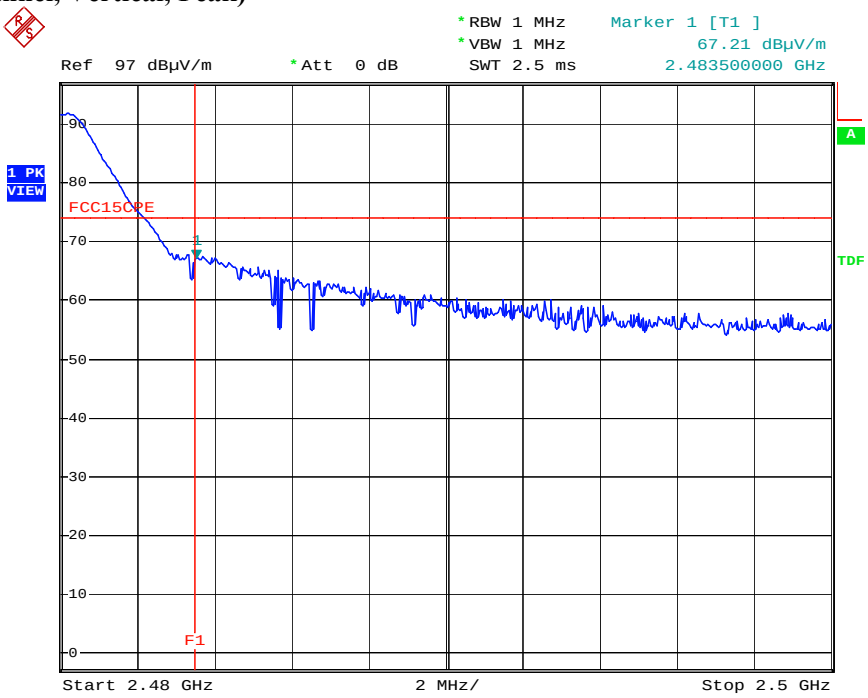
Date: 15.MAY.2007 12:03:43

Restricted Band Edge (High channel, Horizontal, Average)



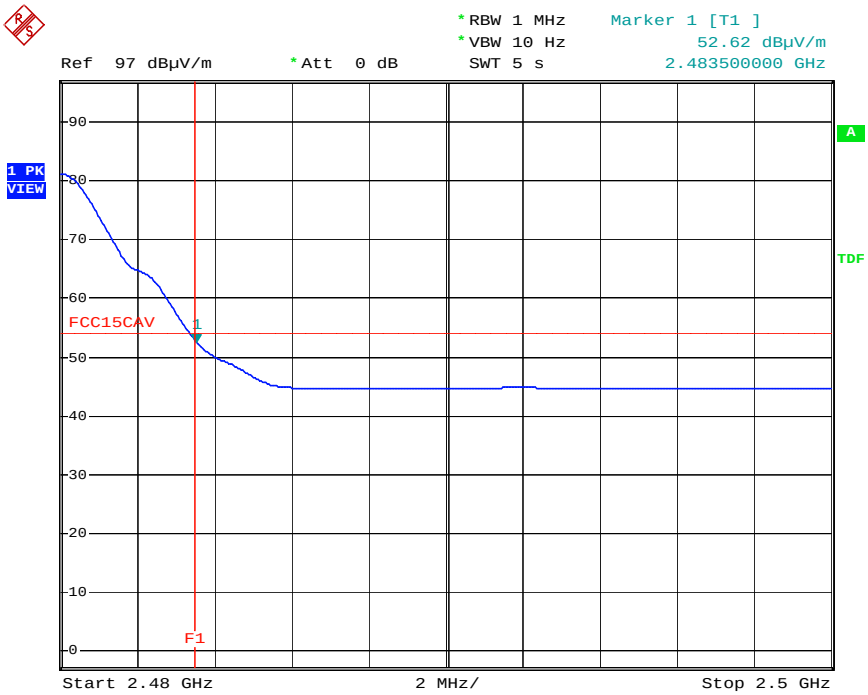
Date: 18.MAY.2007 09:42:10

Restricted Band Edge (High channel, Vertical, Peak)



Date: 15.MAY.2007 13:51:50

Restricted Band Edge (High channel, Vertical, Average)



Date: 15.MAY.2007 13:53:35

Harmonics and Spurious Emission above 1000 MHz

There is no spurious emissions greeter than noise floor. The noise floor is listed below;

TX CH (MHz)	Freq. (MHz)	Cable Loss (dB)	Antenna Factor (dB)	Meter Reading(dBuV) Ave. Horiz.	Ave. Vert.	Peak Horiz.	Peak Vert.	Limit(dBuV) Ave.	Peak	Result (dBuV/m) Ave	Peak	Margin (dB) Ave.	Peak	Pol.
0ch	4804.0	-25.9	33.1	< 33.0	< 33.0	< 45.0	< 45.0	54.0	74.0	< 40.2	< 52.2	> 13.8	> 21.8	-
2402	7206.0	-25.5	36.9	< 34.0	< 34.0	< 47.0	< 47.0	54.0	74.0	< 45.4	< 58.4	> 8.6	> 15.6	-
	9608.0	-22.4	37.6	< 34.0	< 34.0	< 47.0	< 47.0	54.0	74.0	< 49.2	< 62.2	> 4.8	> 11.8	-
39ch	4882.0	-25.7	33.5	< 33.0	< 33.0	< 45.0	< 45.0	54.0	74.0	< 40.8	< 52.8	> 13.2	> 21.2	-
2441	7323.0	-25.9	36.9	< 34.0	< 34.0	< 47.0	< 47.0	54.0	74.0	< 45.6	< 58.6	> 8.4	> 15.4	-
	9764.0	-22.2	37.5	< 34.0	< 34.0	< 47.0	< 47.0	54.0	74.0	< 49.3	< 62.3	> 4.7	> 11.7	-
78ch	4960.0	-25.6	33.8	< 33.0	< 33.0	< 45.0	< 45.0	54.0	74.0	< 41.2	< 53.2	> 12.8	> 20.8	-
2480	7440.0	-25.2	36.7	< 34.0	< 34.0	< 47.0	< 47.0	54.0	74.0	< 45.5	< 58.5	> 8.5	> 15.5	-
	9920.0	-21.8	37.5	< 34.0	< 34.0	< 47.0	< 47.0	54.0	74.0	< 49.7	< 62.7	> 4.3	> 11.3	-

Calculation method

The RESULT is calculated as followings.

RESULT = READING + Antenna Factor + Cable Loss
(dBµV/m) (dBµV) (dB/m) (dB)

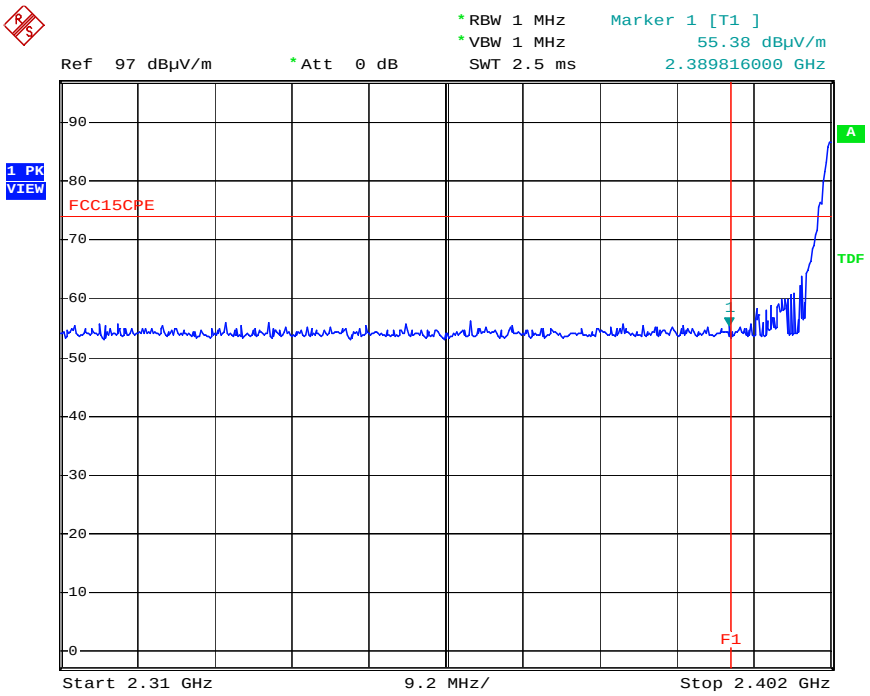
The Cable loss include amplifier gain

Sample calculation at 4804 MHz result as follow:

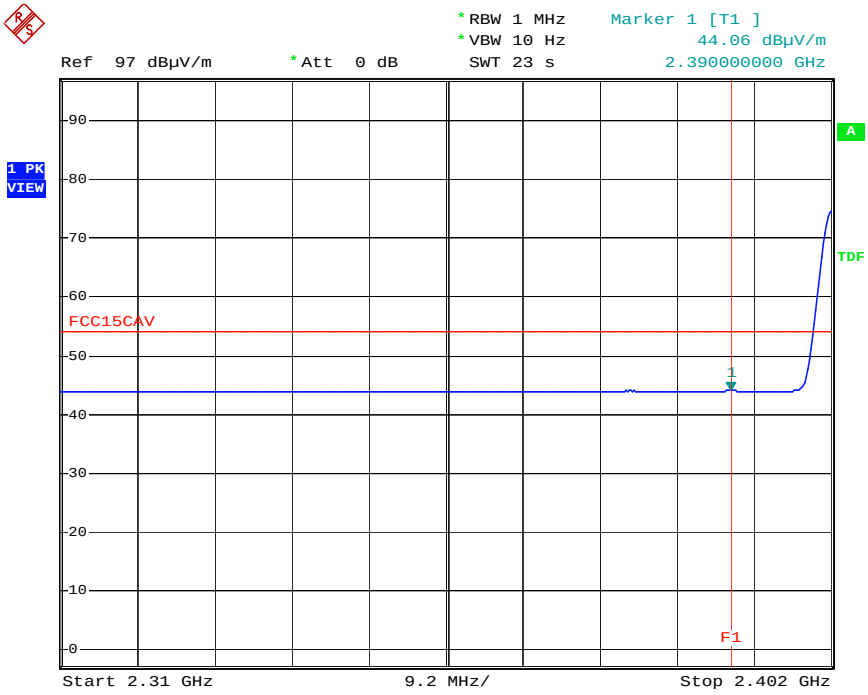
Result (dBuV/m) = Reading + Antenna Factor + Cable Loss = 33.0 + 33.1 – 25.9 = 40.2
Margin = Limit – Result = 54.0 – 40.2 = 13.8 (dBuV/m)

2.8.3.2 Operating Mode: 8DPSK

Restricted Band Edge (Low channel, Horizontal, Peak)

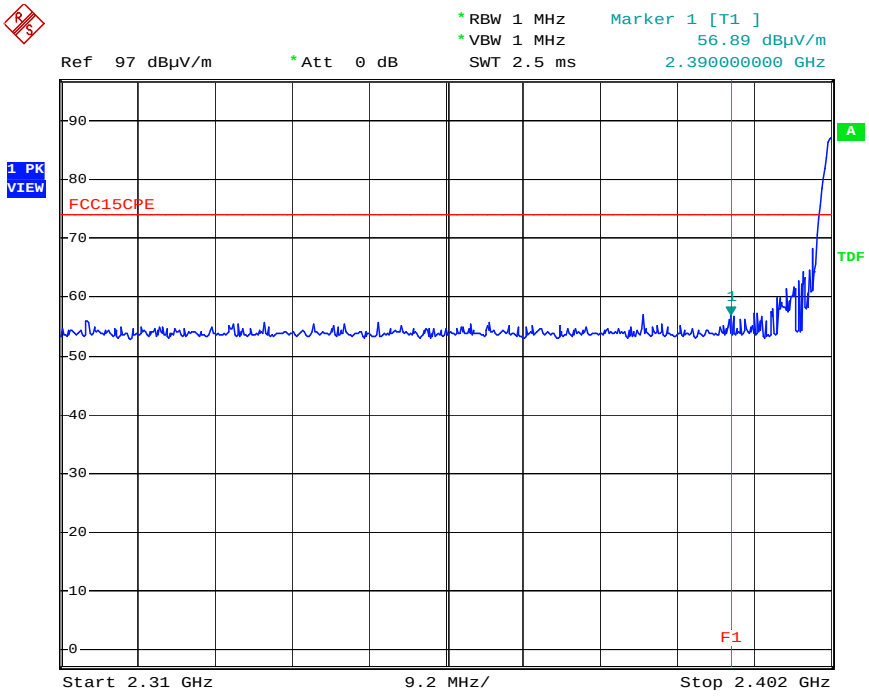


Restricted Band Edge (Low channel, Horizontal, Average)



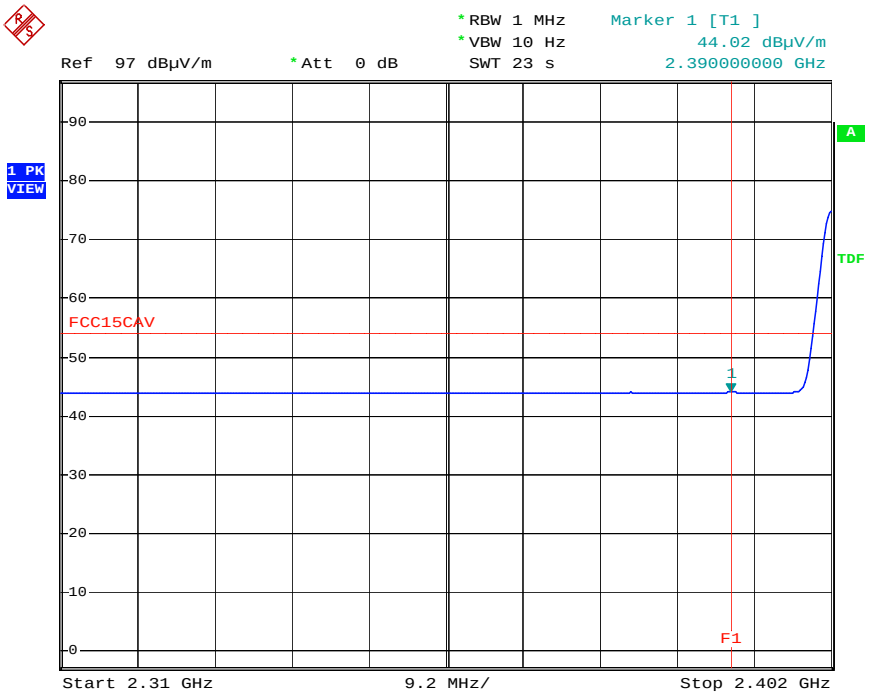
Date: 15.MAY.2007 12:16:31

Restricted Band Edge (Low channel, Vertical, Peak)



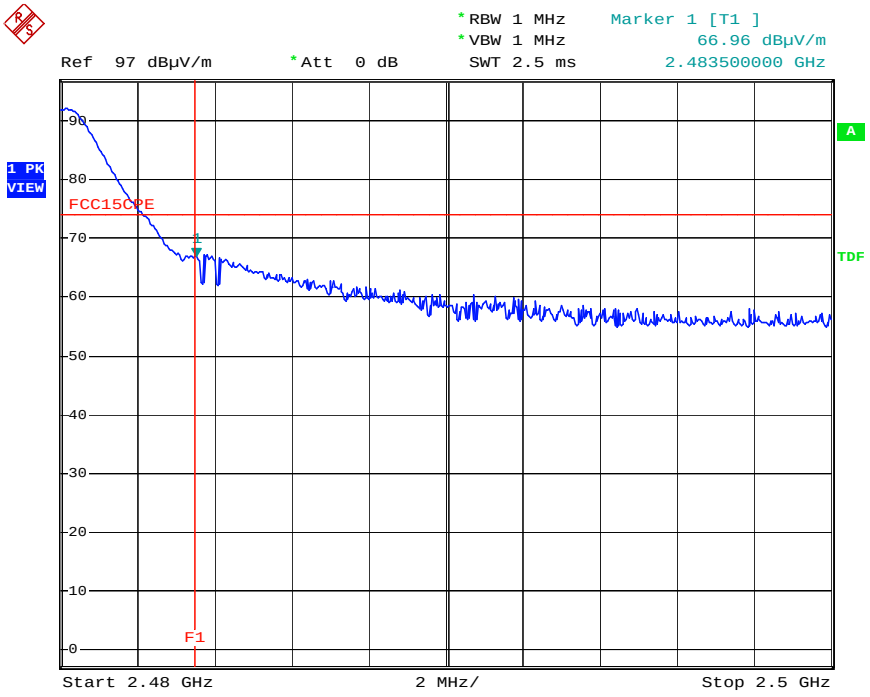
Date: 15.MAY.2007 13:45:26

Restricted Band Edge (Low channel, Vertical, Average)



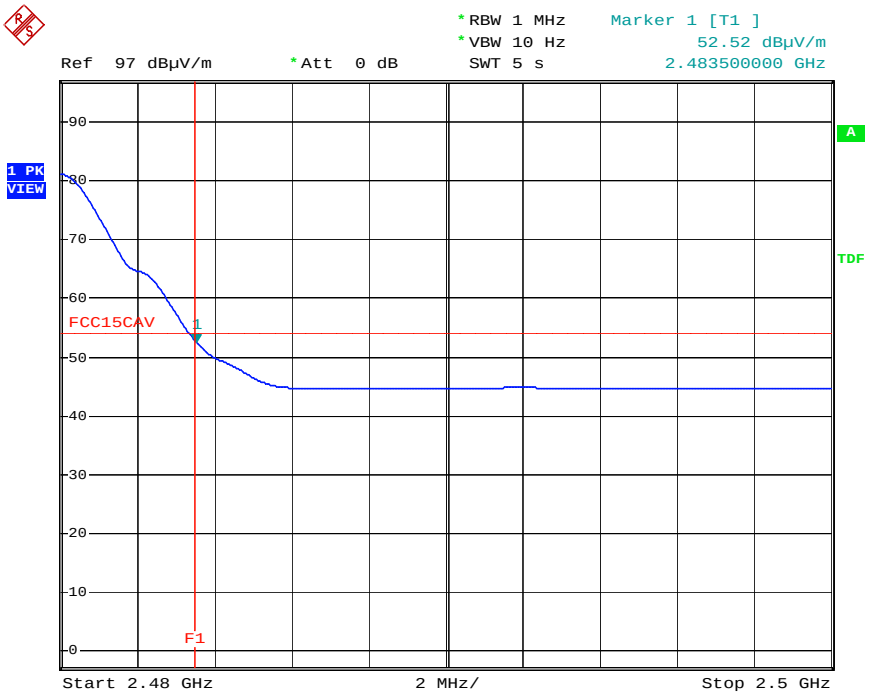
Date: 15.MAY.2007 13:47:33

Restricted Band Edge (High channel, Horizontal, Peak)



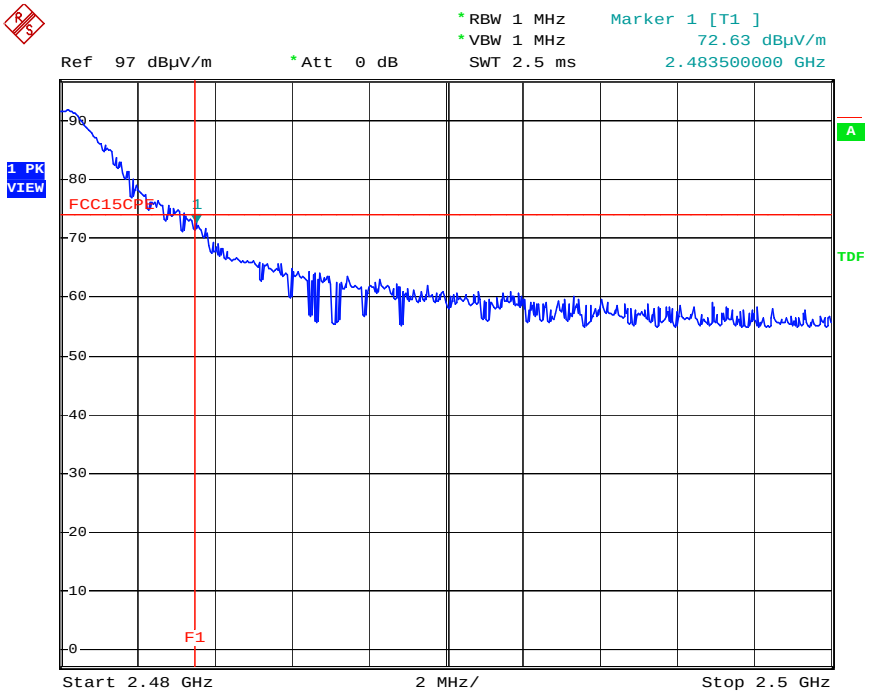
Date: 15.MAY.2007 12:23:18

Restricted Band Edge (High channel, Horizontal, Average)



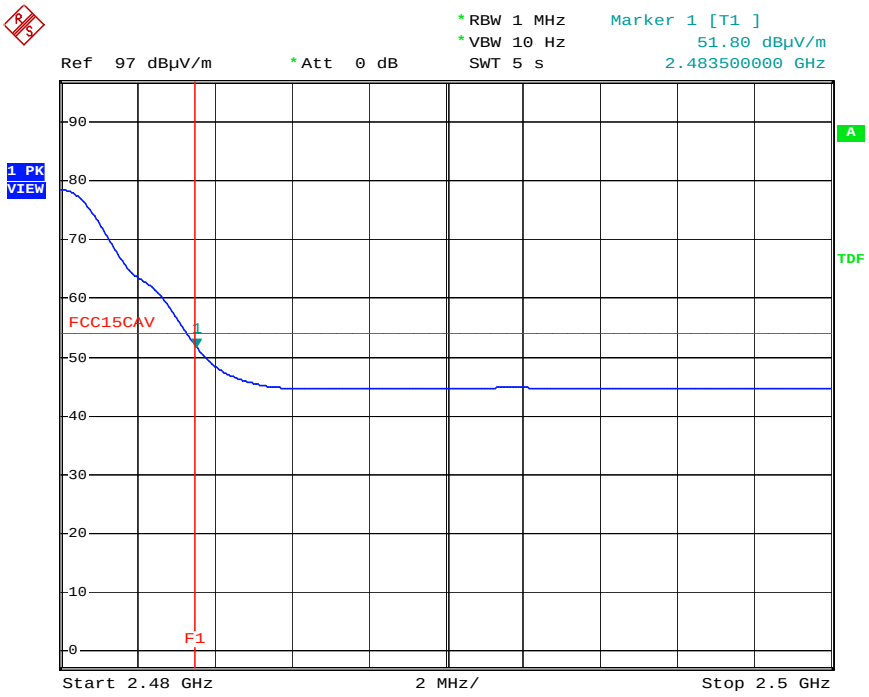
Date: 15.MAY.2007 12:25:51

Restricted Band Edge (High channel, Vertical, Peak)



Date: 15.MAY.2007 13:56:42

Restricted Band Edge (High channel, Vertical, Average)



Date: 15.MAY.2007 13:58:00

Harmonics and Spurious Emission above 1000 MHz

There is no spurious emissions greeter than noise floor. The noise floor is listed below;

TX CH (MHz)	Freq. (MHz)	Cable Loss (dB)	Antenna Factor (dB)	Meter Reading(dBuV) Ave. Horiz.	Ave. Vert.	Peak Horiz.	Peak Vert.	Limit(dBuV) Ave.	Peak	Result (dBuV/m) Ave	Peak	Margin (dB) Ave.	Peak	Pol.
0ch	4804.0	-25.9	33.1	< 33.0	< 33.0	< 45.0	< 45.0	54.0	74.0	< 40.2	< 52.2	> 13.8	> 21.8	-
2402	7206.0	-25.5	36.9	< 34.0	< 34.0	< 47.0	< 47.0	54.0	74.0	< 45.4	< 58.4	> 8.6	> 15.6	-
	9608.0	-22.4	37.6	< 34.0	< 34.0	< 47.0	< 47.0	54.0	74.0	< 49.2	< 62.2	> 4.8	> 11.8	-
39ch	4882.0	-25.7	33.5	< 33.0	< 33.0	< 45.0	< 45.0	54.0	74.0	< 40.8	< 52.8	> 13.2	> 21.2	-
2441	7323.0	-25.9	36.9	< 34.0	< 34.0	< 47.0	< 47.0	54.0	74.0	< 45.6	< 58.6	> 8.4	> 15.4	-
	9764.0	-22.2	37.5	< 34.0	< 34.0	< 47.0	< 47.0	54.0	74.0	< 49.3	< 62.3	> 4.7	> 11.7	-
78ch	4960.0	-25.6	33.8	< 33.0	< 33.0	< 45.0	< 45.0	54.0	74.0	< 41.2	< 53.2	> 12.8	> 20.8	-
2480	7440.0	-25.2	36.7	< 34.0	< 34.0	< 47.0	< 47.0	54.0	74.0	< 45.5	< 58.5	> 8.5	> 15.5	-
	9920.0	-21.8	37.5	< 34.0	< 34.0	< 47.0	< 47.0	54.0	74.0	< 49.7	< 62.7	> 4.3	> 11.3	-

Calculation method

The RESULT is calculated as followings.

RESULT = READING + Antenna Factor + Cable Loss
(dBµV/m) (dBµV) (dB/m) (dB)

The Cable loss include amplifier gain

Sample calculation at 4804 MHz result as follow:

Result (dBuV/m) = Reading + Antenna Factor + Cable Loss = 33.0 + 33.1 – 25.9 = 40.2
Margin = Limit – Result = 54.0 – 40.2 = 13.8 (dBuV/m)

2.9 Transmitter AC power line conducted emissions

Test setup
Test setup was implemented according to the method of ANSI C63.4: 2003 clause 6 “General requirements for EUT equipment arrangements and operation” and Annex H.1 “AC power line conducted emission measurements setup”.

Test procedure
Measurement procedures were implemented according to the method of ANSI C63.4: 2003 clauses 7, clause 13.1.3 and Annex H.2 “AC power line conducted emission measurements”.
Exploratory measurements were used the spectrum analyzer to identify the frequency of the emission that has the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable positions, and with a typical system equipment configuration and arrangement.
Final ac power line conducted emission measurements were performed based on the exploratory tests.
The EUT cable configuration and arrangement and mode of operation that produced the emission with the highest amplitude relative to the limit are selected for the final measurement.
When the measurement value is grater than average limitation the average detection measurements were performed.

Applicable rule and limitation

§15.207 (a) AC powerline conducted limits

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.
The lower limit applies at the band edges.

Test equipment used (refer to List of utilized test equipment)

TR04	PL01	LN06 for EUT	LN05 for AE	SA06	CL11

Test results - Complied with requirement.

Test Data

Tested Date: May 11 2007

Temperature: 24 ˚C
Humidity: 38 %
Atmos. Press: 1008 hPa

2.9.1 Operating Mode: GFSK(Worst case configuration)

No.	Frequency [MHz]	Reading		C.F. [dB]	Result		Limit		Margin		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.298	31.9	29.6	0.3	32.2	29.9	60.3	50.3	28.1	20.4	N
2	0.695	37.5	35.0	0.2	37.7	35.2	56.0	46.0	18.3	10.8	N
3	0.893	30.2	28.3	0.3	30.5	28.6	56.0	46.0	25.5	17.4	N
4	0.994	30.3	28.4	0.3	30.6	28.7	56.0	46.0	25.4	17.3	N
5	12.610	39.9	35.7	0.7	40.6	36.4	60.0	50.0	19.4	13.6	N
6	0.297	31.8	24.7	0.3	32.1	25.0	60.3	50.3	28.2	25.3	L
7	0.695	36.0	34.0	0.2	36.2	34.2	56.0	46.0	19.8	11.8	L
8	0.894	27.6	25.5	0.3	27.9	25.8	56.0	46.0	28.1	20.2	L
9	0.994	27.1	25.4	0.3	27.4	25.7	56.0	46.0	28.6	20.3	L
10	13.308	35.8	30.0	0.8	36.6	30.8	60.0	50.0	23.4	19.2	L
11	16.583	38.0	32.9	0.9	38.9	33.8	60.0	50.0	21.1	16.2	L

The power line conducted emission voltage is calculated by adding the LISN factor and Cable loss attenuation from the measured reading. The calculation is as follows:

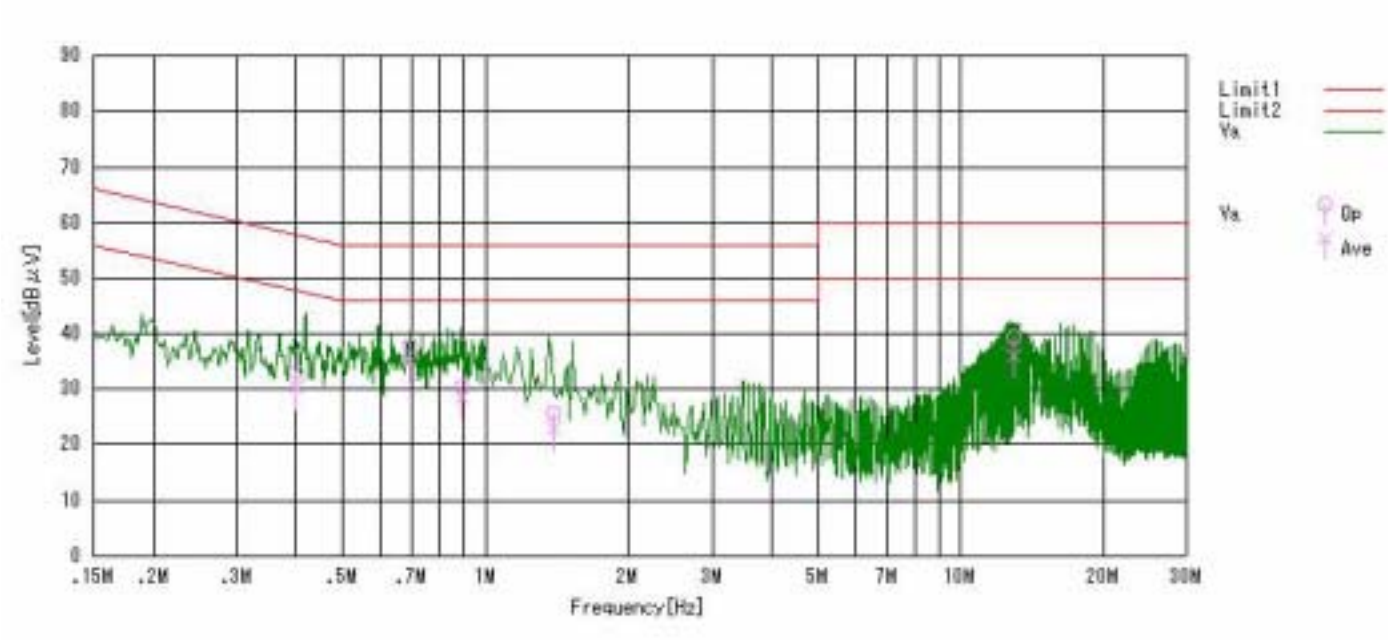
Result = Reading + C. F
where C.F = LISN Factor + Cable Loss [dB]

Sample calculation at 0.695MHz Ave. result as follow:

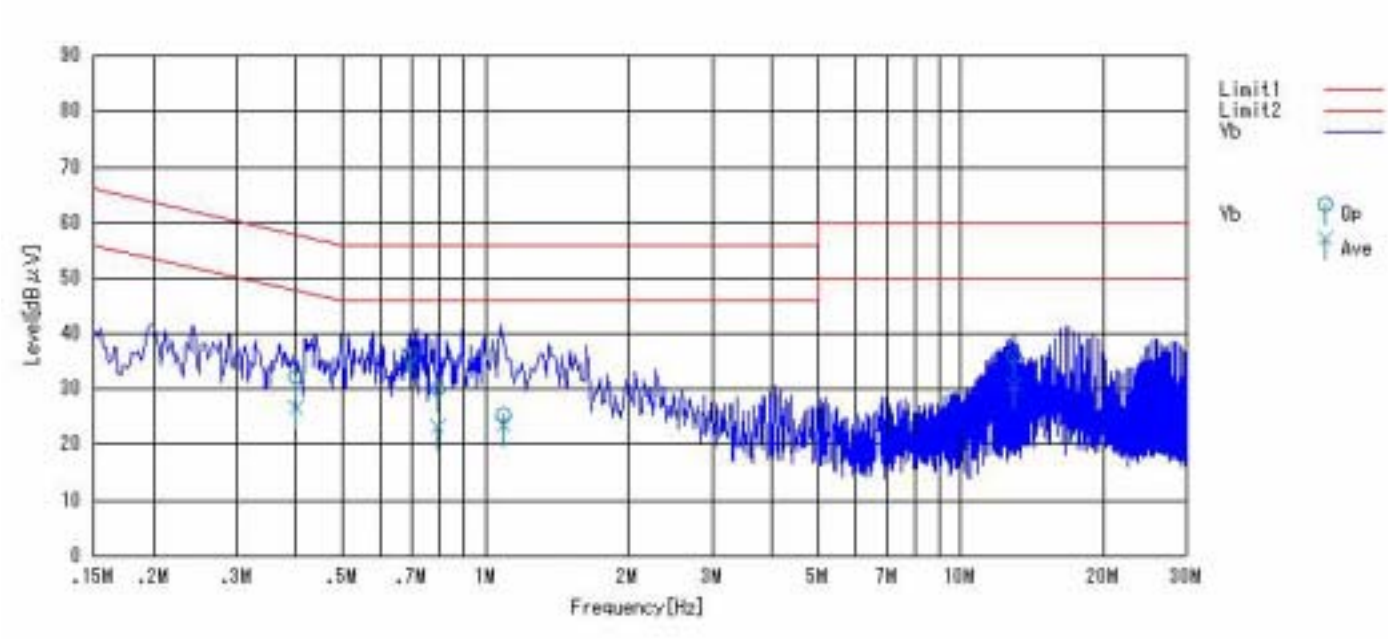
Result (dBuV) = Reading + C.F = 35.0 + 0.2 = 35.2(dBuV)
Margin = Limit – Result = 46.0 – 35.2 = 10.8 (dBuV)

Graphical express of test result (0.15 MHz-30MHz)

AC Power line conducted emission. (Phase N)



AC Power line conducted emission. (Phase L)



2.9.2 Operating Mode: 8DPSK (Worst case configuration)

No.	Frequency [MHz]	Reading		C.F. [dB]	Result		Limit		Margin		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.397	33.1	30.1	0.2	33.3	30.3	57.9	47.9	24.6	17.6	N
2	0.696	37.5	35.0	0.2	37.7	35.2	56.0	46.0	18.3	10.8	N
3	0.895	30.2	28.3	0.3	30.5	28.6	56.0	46.0	25.5	17.4	N
4	1.391	25.3	22.5	0.3	25.6	22.8	56.0	46.0	30.4	23.2	N
5	12.917	38.6	35.3	0.8	39.4	36.1	60.0	50.0	20.6	13.9	N
6	0.398	31.9	26.4	0.2	32.1	26.6	57.9	47.9	25.8	21.3	L
7	0.695	36.0	33.9	0.2	36.2	34.1	56.0	46.0	19.8	11.9	L
8	0.795	29.7	22.8	0.3	30.0	23.1	56.0	46.0	26.0	22.9	L
9	1.091	25.2	23.3	0.3	25.5	23.6	56.0	46.0	30.5	22.4	L
10	12.916	35.1	29.8	0.8	35.9	30.6	60.0	50.0	24.1	19.4	L

The power line conducted emission voltage is calculated by adding the LISN factor and Cable loss attenuation from the measured reading. The calculation is as follows:

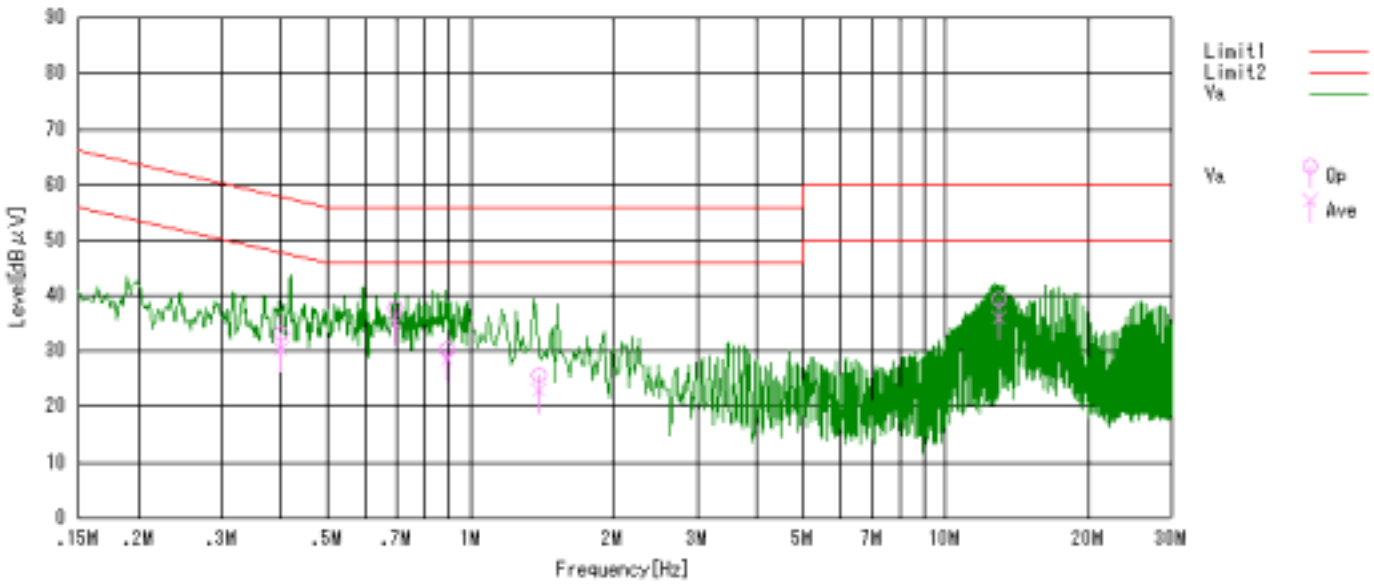
Result = Reading + C. F
where C.F = LISN Factor + Cable Loss [dB]

Sample calculation at 0.696MHz Ave. result as follow:

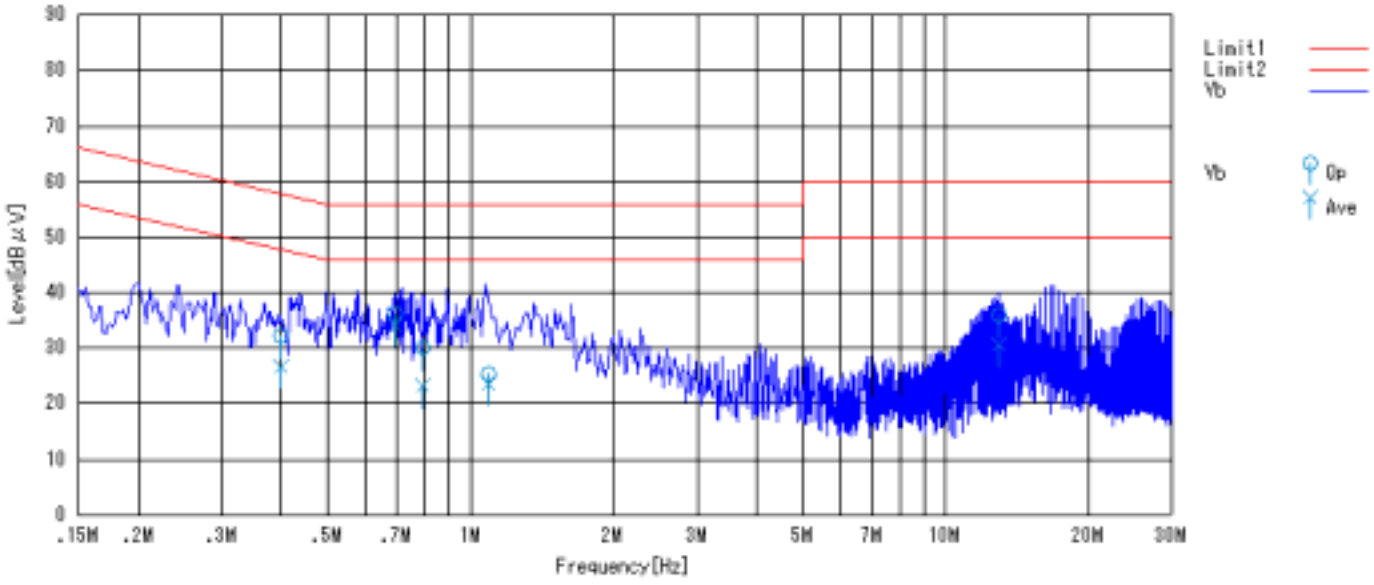
Result (dBuV) = Reading + C.F = 35.0 + 0.2 = 35.2(dBuV)
Margin = Limit – Result = 46.0 – 35.2 = 10.8 (dBuV)

Graphical express of test result (0.15 MHz-30MHz)

AC Power line conducted emission. (Phase N)



AC Power line conducted emission.. (Phase L)



2.10 Receiver Radiated spurious emissions

Test setup - Same as clause 2.8

Test procedure - Same as clause 2.8

Applicable rule and limitation at 3m
§15.109 radiated emission limitation

Frequency (MHz)	Measurement Distance (m)	Field Strength (uV/m)	Field Strength (dBuV/m)
30 – 88	3	100	40.0
88 –216	3	150	43.5
216 – 960	3	200	46.0
Above 960	3	500	54.0

In the emission table above, the tighter limit applies at the band edges.
The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector.

Test results - Complied with requirement.

2.10.1 Between 30 – 1000 MHz

Test equipment used (refer to List of utilized test equipment)

BA03	CL11	PR03	SA06	TR04

Test Data

Tested Date: May 15 2007

Temperature: 24 ˚C
Humidity: 38 %
Atmos. Press: 1008 hPa

Operating Mode: Continuous Reception (Worst case configuration)

No.	Frequency [MHz]	Reading [dBuV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna Plariozation
1	42.37	50.3	10.5	4.1	29.8	35.1	40.0	4.9	Vert.
2	61.61	57.1	5.7	4.4	29.7	37.5	40.0	2.5	Vert.
3	61.62	48.6	5.7	4.4	29.7	29.0	40.0	11.0	Hori.
4	87.37	53.8	7.7	4.6	29.7	36.4	40.0	3.6	Vert.
5	104.30	48.1	10.1	4.8	29.7	33.3	43.5	10.2	Hori.
6	104.96	47.8	10.2	4.8	29.7	33.1	43.5	10.4	Vert.
7	155.97	37.5	10.4	5.2	29.6	23.5	43.5	20.0	Hori.

Calculation method

The Correction Factors and RESULT are calculated as followings.

Correction Factor = FACTOR + LOSS – GAIN
(dB/m) (dB/m) (dB) (dB)

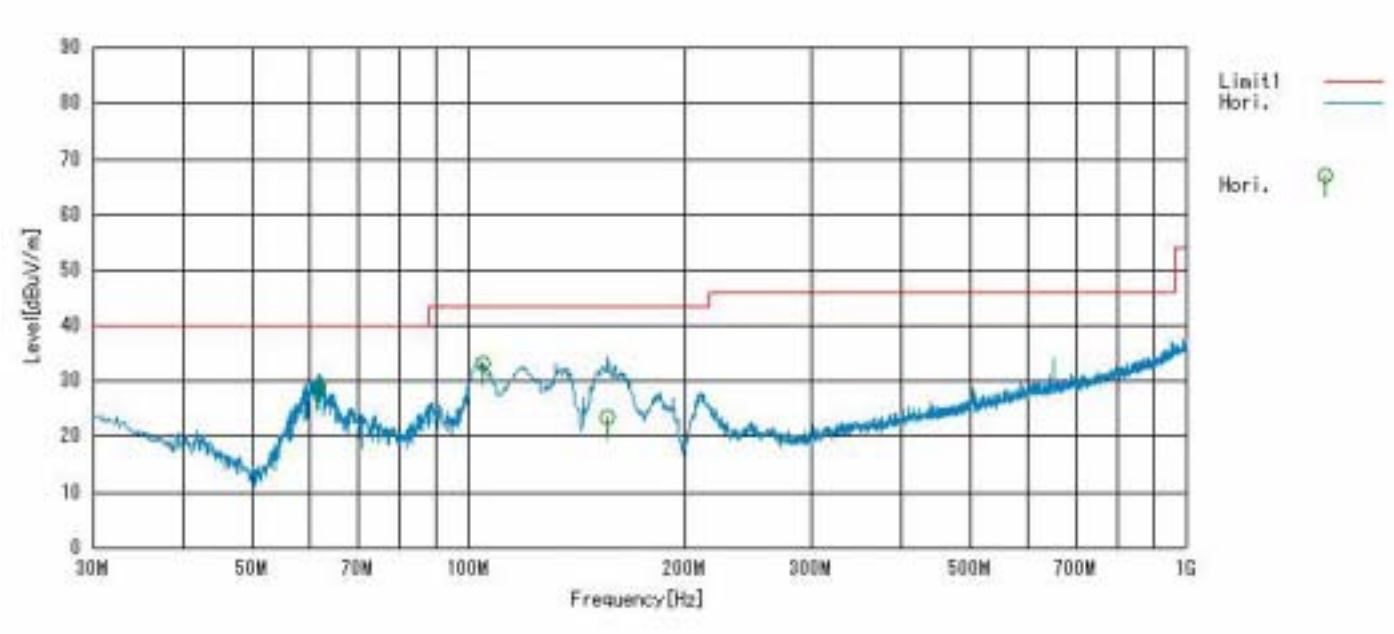
RESULT =READING+ Correction Factor
(dBµV/m) (dBµV) (dB/m)

Sample calculation at 61.61MHz vertical result as follow:

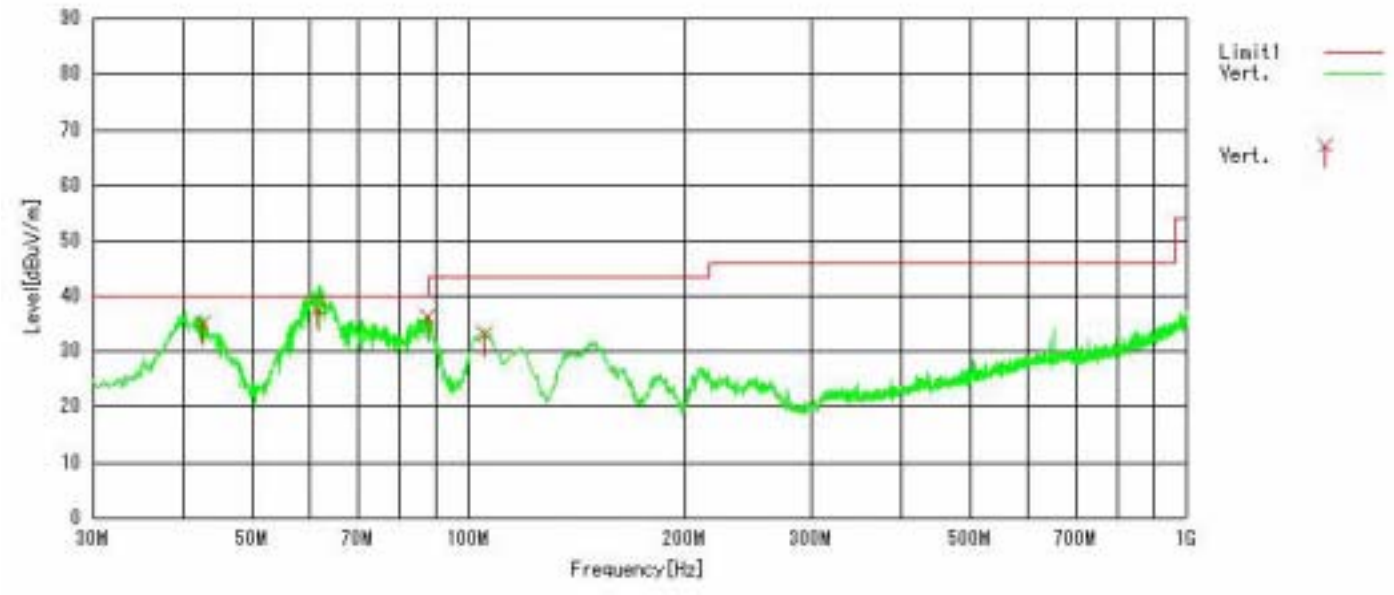
Result (dBuV/m) = Reading + C.F = 57.1 + 5.7 + 4.4 -29.7 = 37.5
Margin = Limit – Result = 40.0 – 37.5 = 2.5 (dBuV/m)

Graphical express of test result (30MHz-1000MHz)

Antenna polarization: Horizontal



Antenna polarization: Vertical



2.10.2 Above 1000 MHz

Test equipment used (refer to List of utilized test equipment)

PR04	SH01	SA06	CL21	CL22	DH02		

Tested Date: May 15 2007

Temperature: 24 ˚C
Humidity: 38 %
Atmos. Press: 1008 hPa

Operating Mode: Continuous Reception (Worst case configuration)

There are no spurious emissions other than listed below;

Freq.	Cable Loss	Antenna Factor	Meter Reading(dBuV) Ave.		Peak		Limit(dBuV)		Result (dBuV/m)		Margin (dB)		Pol.
(MHz)	(dB)	(dB)	Horiz.	Vert.	Horiz.	Vert.	Ave.	Peak	Ave	Peak	Ave.	Peak	
1248.2	-26.7	24.4	36.30	37.00	52.20	55.20	54.0	74.0	34.7	52.9	19.3	21.1	V
1597.0	-26.9	24.9	34.80	35.20	49.80	51.70	54.0	74.0	33.2	49.7	20.8	24.3	V

Calculation method

The RESULT is calculated as followings.

RESULT = READING + Antenna Factor + Cable Loss
(dBµV/m) (dBµV) (dB/m) (dB)

The Cable loss include amplifier gain

Sample calculation at 1248.2 MHz result as follow:

Result (dBuV/m) = Reading + Antenna Factor + Cable Loss = 37.0 + 24.4 – 26.7 = 34.7
Margin = Limit – Result = 54.0 – 34.7 = 19.3 (dBuV/m)

2.11 Receiver AC power line conducted emissions

Test setup - Same as clause 2.9

Test procedure - Same as clause 2.9

Applicable rule and limitation

§15.107 (a) AC power line conducted limits

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.
The lower limit applies at the band edges.

Test equipment used (refer to List of utilized test equipment)

TR04	PL01	LN06 for EUT	LN05 for AE	SA06	CL11

Test results - Complied with requirement.

Test Data

Tested Date: May 11 2007

Temperature: 24 ˚C
Humidity: 38 %
Atmos. Press: 1008 hPa

Operating Mode: Continuous Reception (Worst case configuration)

No.	Frequency [MHz]	Reading		C.F. [dB]	Result		Limit		Margin		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	QP [dBuV]	QP [dBuV]	QP [dBuV]	QP [dBuV]	QP [dBuV]	
1	0.397	33.4	30.3	0.2	33.6	30.5	57.9	47.9	24.3	17.4	N
2	0.696	37.5	35.6	0.2	37.7	35.8	56.0	46.0	18.3	10.2	N
3	0.895	30.0	28.6	0.3	30.3	28.9	56.0	46.0	25.7	17.1	N
4	1.292	22.9	22.4	0.3	23.2	22.7	56.0	46.0	32.8	23.3	N
5	12.718	38.8	38.2	0.7	39.5	38.9	60.0	50.0	20.5	11.1	N
6	0.398	31.9	26.4	0.2	32.1	26.6	57.9	47.9	25.8	21.3	L
7	0.695	36.0	33.9	0.2	36.2	34.1	56.0	46.0	19.8	11.9	L
8	0.795	29.7	22.8	0.3	30.0	23.1	56.0	46.0	26.0	22.9	L
9	1.091	25.2	23.3	0.3	25.5	23.6	56.0	46.0	30.5	22.4	L
	12.716	38.1	37.7	0.7	38.8	38.4	60.0	50.0	21.2	11.6	L

The power line conducted emission voltage is calculated by adding the LISN factor and Cable loss attenuation from the measured reading. The calculation is as follows:

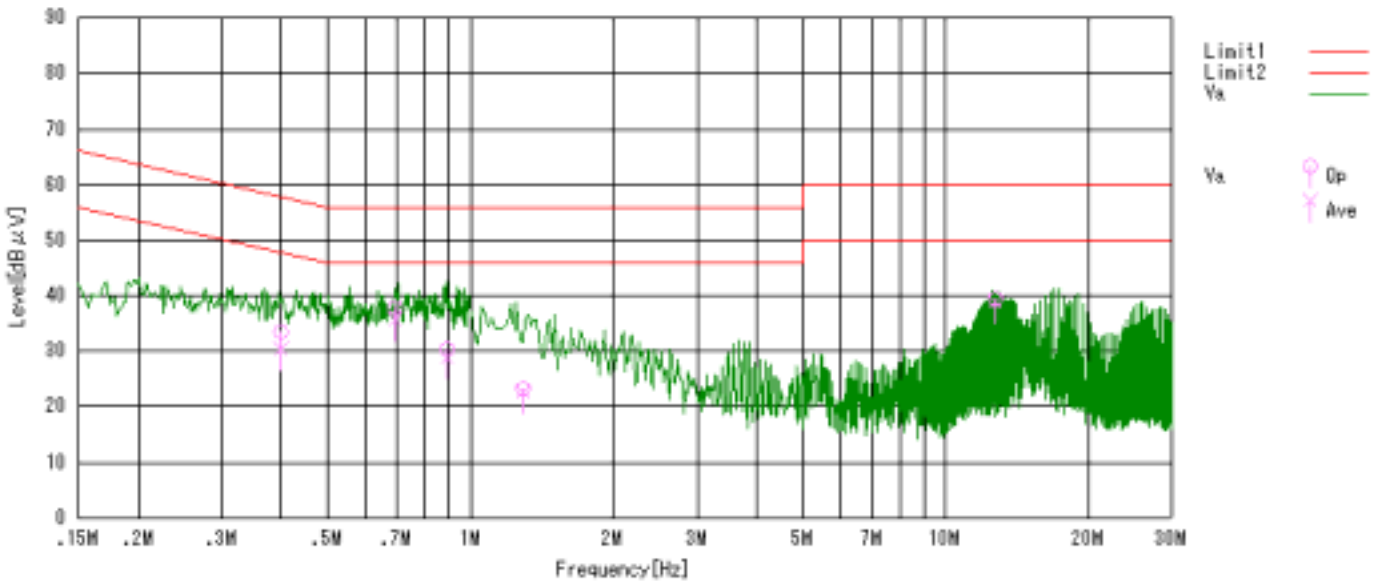
Result = Reading + C. F
where C.F = LISN Factor + Cable Loss [dB]

Sample calculation at 0.696MHz Ave. result as follow:

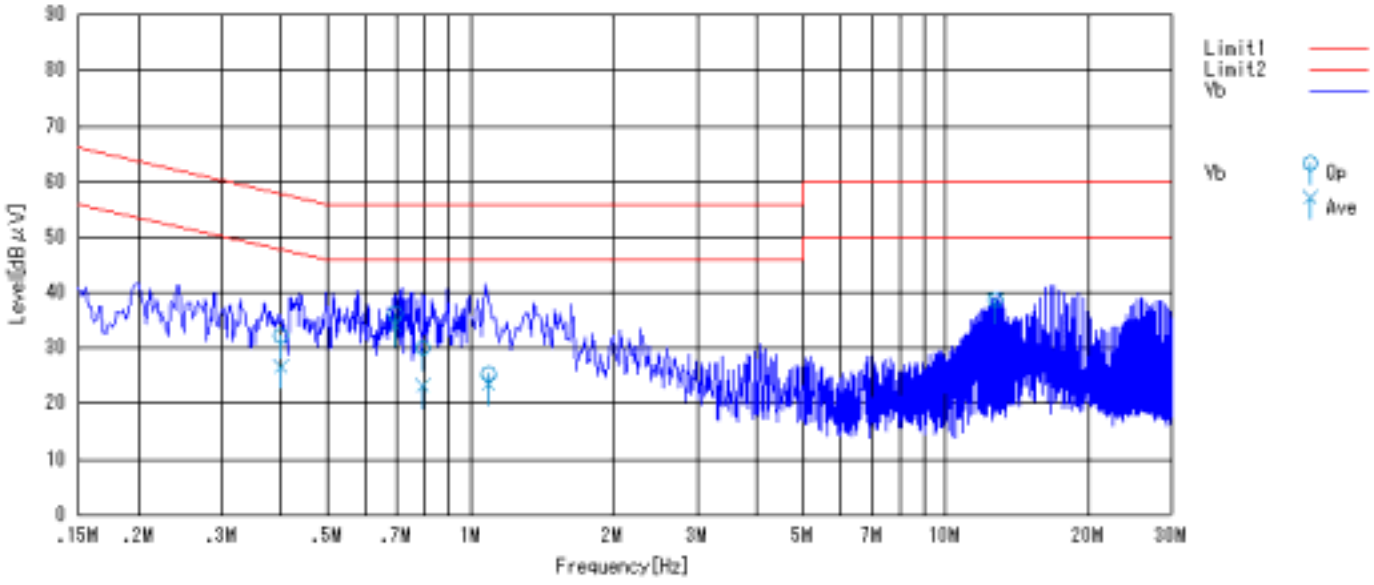
Result (dBuV) = Reading + C.F = 35.6 + 0.2 = 35.8(dBuV)
Margin = Limit – Result = 46.0 – 35.8 = 10.2 (dBuV)

Graphical express of test result (0.15 MHz-30MHz)

AC Power line conducted emission. (Phase N)



AC Power line conducted emission. (Phase L)



2.12 Maximum Permissible Exposure (Exposure of Humans to RF Fields)

Limitation

15.247(i) systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.
See 1.1307(b) (1) of this Chapter.
1.1310 The criteria of "General Population/ Uncontrolled Exposure" listed in the below table shall be used to evaluated the environmental impact of human exposure to radio-frequency radiation as specified in 1.1307(b), except in the case of portable devices which shall be evaluated according to the previsions of 2.1093 of this chapter.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	$(180/f^2)$*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

f = frequency in MHz *Plane-wave equivalent power density

NOTE 2: ***General population/uncontrolled*** exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

The MPE distance calculations:

The Maximum Permissible Exposure (MPE) distance between the EUT's antenna and human body is calculated in accordance with FCC OET Bulletin 65 and Safety Code 6 of IC.
The MPE distance where the exposure level reaches the permitted exposure level can be calculated as bellow;

$$S = P * G / 4\pi R^2$$

Rearranging terms to calculate the MPE Distance

$$R = (P * G / 4\pi S)^{1/2}$$

Where:

R = MPE Distance in cm
P = Power in dBm (0.561 mW, Refer to page 5 in this report)
G = Antenna Gain in numeric
(1.549 = 1.9dBi, Max. Antenna Gain, Refer to the submitted antenna spec.)
S = Power Density Limit in mW/cm2
(1.0 mW/cm2, Max. permissible exposure limit above)

Then MPE Distance is 0.263 cm.

Test results - Complied with requirement.

4 List of utilized test equipment/ calibration

RFT ID No.	Kind of Equipment and Precision	Manufacturer	Model No.	Serial Number	Calibration Date	Calibrated until
BA03	Bilogical Antenna	CAHSE	CBL6111	1309	2006/5/21	2007/5/20
BRF1	Band Reject Filter (2000MHz)		BRF2000-06	VT0001	2007/4/24	2008/4/22
CL11	Antenna Cable	RFT	-	-	2006/6/7	2007/6/6
DC01	Directional Coupler	KRYTAR	1850	77202	2007/4/24	2008/4/22
HPF1	High Pass Filter (3500MHz)	TOKIMEC	TF323DCA	603	2007/4/24	2008/4/22
LN02	LISN (3ph 32A)	SCHWARZBECK	NSLK8128	8128-212	2007/2/2	2008/2/1
LN05	LISN	Kyoritsu	KNW-407	8-1773-2	2006/5/24	2007/5/23
LN06	LISN	Kyoritsu	KNW-407	8-1773-3	2006/5/24	2007/5/23
LN08	LISN (5uF)	SCHWARZBECK	NNBM8125	8126A-9262	2006/9/4	2007/9/3
LP01	Loop Antenna	EMCO	6502	3436	2007/1/16	2008/1/15
MA01	Active Monopole Antenna	SCHWARZBECK	VAMP9243	9438	2007/2/8	2008/2/7
PL01	Pulse Limiter	PMM	PL-01	0000J10109	2007/1/30	2008/1/29
PR03	Pre. Amplifier	Anritsu	HM648A	M41984	2006/5/24	2007/5/23
PR04	Pre. Amplifier (1-26G)	RFT	LNP126	060208-01	2007/2/6	2008/2/5
PR08	Pre. Amplifier	Sonoma Instrument	315	263504	2007/2/23	2008/2/22
SA06	Spectrum Analyzer (F/W: 3.60 SP1)	Rohde & Schwarz	FSP40	100071	2006/11/13	2007/11/12
SH01	Standard Horn Antenna (18-26G)	A.H. Systems	SAS-572	208	2006/5/3	2008/5/1
SH02	Standard Horn Antenna (18-26G)	A.H. Systems	SAS-572	209	2006/5/3	2008/5/1
SH03	Standard Horn Antenna (26-40G)	A.H. Systems	SAS-573	150	2006/5/3	2008/5/1
SH04	Standard Horn Antenna (26-40G)	A.H. Systems	SAS-573	151	2006/5/3	2008/5/1
TL01	Transient Limiter	Agilent Technologies	11947A	3107A04000	2006/11/6	2007/11/5
CL21	RF Cable(0.5m)	Suhner	-	-	2007/5/14	2008/5/13
CL22	RF Cable(4m)	Suhner	-	-	2007/5/14	2008/5/13
TR04	Test Receiver (F/W : 3.82 SP1)	Rohde & Schwarz	ESCI	100447	2006/9/27	2007/9/26

RFT ID No.	Kind of Equipment and Precision	Manufacturer	Model No.	Serial Number	Calibration Date	Calibrated until
AT05	Attenuator 3dB 50W	Weinschel	45-3-33	LC530	2007/2/5	2008/2/4
AT12	Attenuator 6dB 30W	FUJISOKU	FAT-530A	63454	2007/2/5	2008/2/4
AT14	Attenuator	JFW	50HF-003N	—	2007/4/25	2008/4/23
AT15	Attenuator	JFW	50HF-006N	—	2007/4/25	2008/4/23
AT20	Attenuator	JFW	50HF-010N	—	2007/3/16	2008/3/14
AT21	Attenuator 6dB 5W 18GHz	Weinschel	WA2-6-34	A1020	2007/3/9	2008/3/7
AT22	Attenuator 6dB 5W 18GHz	Weinschel	WA2-6-34	A1021	2007/3/9	2008/3/7
AT23	Attenuator 6dB 5W 18GHz	Weinschel	WA2-6-34	A1022	2007/3/9	2008/3/7
AT24	Attenuator 6dB 5W 18GHz	Weinschel	WA2-6-34	A1023	2007/3/9	2008/3/7
AT25	Attenuator 6dB 5W 18GHz	Weinschel	WA2-6-34	A1024	2007/3/9	2008/3/7
AT26	Attenuator 6dB 5W 18GHz	Weinschel	WA2-6-34	A1025	2007/3/9	2008/3/7
AT27	Attenuator 10dB 5W 18GHz	Weinschel	WA2-10-34	A1026	2007/3/9	2008/3/7
AT28	Attenuator 10dB 5W 18GHz	Weinschel	WA2-10-34	A1027	2007/3/9	2008/3/7
AT29	Attenuator 10dB 5W 18GHz	Weinschel	WA2-10-34	A1028	2007/3/9	2008/3/7
AT30	Attenuator 20dB 5W 18GHz	Weinschel	WA2-20-34	A1029	2007/3/9	2008/3/7
AT31	Attenuator 20dB 5W 18GHz	Weinschel	WA2-20-34	A1030	2007/3/9	2008/3/7
AT32	Attenuator 20dB 5W 18GHz	Weinschel	WA2-20-34	A1031	2007/3/9	2008/3/7
DH01	DRG Horn Antenna	A.H. Systems	SAS-571	785	2006/2/6	2008/2/5
DH02	DRG Horn Antenna	A.H. Systems	SAS-200/571	239	2007/4/20	2008/4/18
PM01	Power Meter	Rohde & Schwarz	NRVS	100055	2007/1/29	2008/1/28
PU01	Power Meter Insertion Unit	Rohde & Schwarz	URV5-Z4	100055	2007/1/29	2008/1/28
RC02	Radio communication tester (F/W : V4.10)	Rohde & Schwarz	CMU200	105097	2006/9/14	2007/9/13
SG01	Signal Generator	Rohde & Schwarz	SML03	100325	2007/2/2	2008/2/1
SG05	Signal Generator	Rohde & Schwarz	SMR20	100905	2006/10/17	2007/10/16
TA02	Dummy Load	Mini-Circuits	DL-30N	-	2007/2/23	2008/2/22
TA03	Dummy Load	Mini-Circuits	DL-30N	-	2007/2/23	2008/2/22
TA04	Dummy Load (4GHz, 50W)	Weinschel	WA1423-4	A462	2007/3/9	2008/3/7
TA05	Dummy Load (4GHz, 50W)	Weinschel	WA1423-4	A463	2007/3/9	2008/3/7
TC01	Temperature Chamber	ESPEC	SH-641	92000964	2007/4/23	2008/4/21

RFT ID No.	Kind of Equipment and Precision	Manufacturer	Model No.	Serial Number	Calibration Date	Calibrated until
AC51	AC power supply	TAKASAGO	AA2000D	506960030014	not applicable	not applicable
AC52	AC power supply	KIKUSUI	PCR6000W		not applicable	not applicable
AF51	Active Filter	NF corp.	DV-04	434339	not applicable	not applicable
BC51	Burst Clamp	SCHAFFNER	CDN8015	21369	not applicable	not applicable
CG51	Comb Generator	tsj	TG-C2	TGC2-0009	not applicable	not applicable
CG52	Comb Generator	tsj	TG-R2	TGR2-0009	not applicable	not applicable
CJ51	CDN Calibration JIG 1	RFT	-	-	not applicable	not applicable
CJ52	CDN Calibration JIG 2	RFT	-	-	not applicable	not applicable
CJ53	EM clamp Calibration JIG 1	RFT	-	-	not applicable	not applicable
CJ54	EM clamp Calibration JIG 2	RFT	-	-	not applicable	not applicable
DC51	DC power supply	KIKUSUI	PMC18-3A	DF002941	not applicable	not applicable
DC52	DC power supply	KIKUSUI			not applicable	not applicable
LP05	Test Loop Antenna	Panasonic	VQ-085C	0O2800A122	not applicable	not applicable
MP51	Microphone	G.R.A.S	26AK + 12AK	50941 + 58712	not applicable	not applicable
MS51	Mouth Simulator	G.R.A.S	44AA	52222	not applicable	not applicable
TS51	TEMSEL	KYORITSU	KTC-5055	8S-688-6	not applicable	not applicable

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.