ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Bluetooth USB Dongle

MODEL No.: BT-410D

BRAND NAME: KINGENE

FCC ID: QYDBT410D01

REPORT NO: 030008-RF-ID

ISSUE DATE: Apr. 08, 2003

Prepared for

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VERIFICATION OF COMPLIANCE

Applicant:	KINGENE Technology Corporation 7F, No. 144, Minchuan E. Rd. Sec. 3, Taipei, Taiwan, R.O.C.
Equipment Under Test:	Bluetooth USB Dongle
BRAND NAME:	KINGENE
MODEL No.:	BT-410D
Model Difference:	N/A
Serial Number:	N/A
File Number:	030008-RF-ID
Date of test:	Jan 16 ~ Jan. 28, 2003

We hereby certify that:

The above equipment was tested by C&C Laboratory Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2001) and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.

The test results of this report relate only to the tested sample identified in this report.

Approved By

Vincent Su / RF Dept. Vice Manager
C&C Laboratory Co., Ltd

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1. GENERAL INFORMATION

1.1 Product Description

The KINGENE Technology Corporation Model: BT-410D (referred to as the EUT in this report) is a Bluetooth USB Dongle.

The EUT is compliance with Bluetooth Standard.

A major technical descriptions of EUT is described as following:

A). Operation Frequency: 2402 – 2480MHz 79 channels

B). Rated output power: -4.99 dBm

C). Modulation type: Frequency Hopping Sequence Spread Spectrum (FHSS)

D). Antenna Designation: Ceramic Antenna, -1dBi, Non-User Replaceable (Fixed)

E). Power Supply: 5Vdc from USB port of PC

F). Receiver type: Super heterodyne

1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: QYDBT410D01 filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. The composite system (receiver) is compliance with Subpart B is authorized under a Doc procedure.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 (1992). Radiated testing was performed at an antenna to EUT distance 3 meters.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the address of C&C Laboratory, Co., Ltd. No. 81-1, 210 Lane, Pa-de 2nd Road, Lu-Chu Hsiang, Taoyuan, Taiwan, R.O.C.. The Open Area Test Sites and the Line Conducted labs are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 1992 and CISPR 22/EN 55022 requirements.

1.5 Special Accessories

Not available for this EUT intended for grant.

1.6 Equipment Modifications

Not available for this EUT intended for grant.

2. SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The EUT (Transmitter) was operated in the engineering mode to fix the Tx frequency which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4-1992.Conducted emissions from the EUT measured in the **frequency range between 0.15 MHz and 30MHz** using **CISPR Quasi-Peak and Average detector mode**.

2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4-1992.

2.4 Configuration of Tested System

Fig. 2-1 Configuration of Tested System

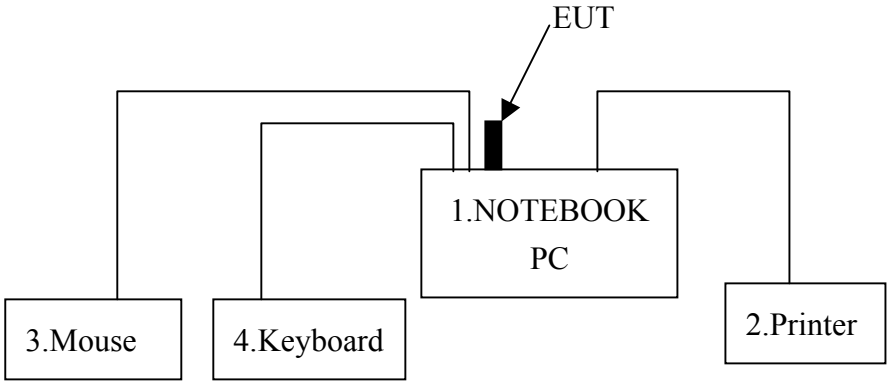


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	Note
1	Notebook	LEO	M285	DoC	1A25B37A002110	
2	Printer	EPSON	P1114A	DoC	CAQY004717	
3	USB-Mouse	ACER	M-BB48	DoC	LZE2250259	
4	PS2-Keyboard	COMPAQ	M-S34	DZL211029	113907-068	

Note:

(1) Unless otherwise marked as ※ in『Remark』column, Neutron consigns the support equipment to the tested system.
(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	Conducted Emission	Compliant
§15.247(b)	Peak Output Power	Compliant
§15.247(a)(1)(ii)	20dB Bandwidth	Compliant
§15.247(c)	100 KHz Bandwidth Of Frequency Band Edges	Compliant
§15.209(a) (f)	Spurious Emission	Compliant
§15.247(a)(1)	Frequency Separation	Compliant
§15.247(a)(1)(ii)	Number of hopping frequency	Compliant
§15.247(a)(1)(ii)	Time of Occupancy	Compliant
§15.247	Peak Power Density	Compliant
§15.203	Antenna Requirement	Compliant
§1.1310	RF Exposure	Compliant

4. DESCRIPTION OF TEST MODES

The EUT (Bluetooth USB Dongle) has been tested under operating condition.
Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
Channel low (2402MHz)、mid (2441MHz) and high (2480MHz) with highest data rate are chosen for full testing.

5. CONDUCTED EMISSION TEST

5.1 Standard Applicable

According to §15.207. frequency within 150KHz to 30MHz shall not exceed

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	**Average**
0.15 to 0.50	**66 to 56**	**56 to 46**
0.50 to 5	**56**	**46**
5 to 30	**60**	**50**
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

5.2 EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4-1992.
2. The EUT was plug-in the host PC via USB port. The host PC system was placed on the center of the back edge on the test table. The peripherals like modem, monitor printer, K/B, and mouse were placed on the side of the host PC system. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The keyboard was placed directly in the front of the monitor, flushed with the front tabletop. The mouse was placed next to the Keyboard, flushed with the back of keyboard.
4. The spacing between the peripherals was 10 centimeters.
5. External I/O cables were draped along the edge of the test table and bundle when necessary.
6. The host PC system was connected with 110Vac/60Hz power source.

5.3 Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

5.4 Measurement Equipment Used:

Conducted Emission Test Site # 4					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
EMI Test Receiver	R&S	ESHS30	828144/003	08/08/2002	08/07/2003
LISN	R&S	ESH2-Z5	843285/010	12/16/2002	12/15/2003
LISN	EMCO	3825/2	9003-1628	07/26/2002	07/25/2003
Spectrum Analyzer	ADVANTEST	R3261A	91720031	N/A	N/A
2X2 WIRE ISN	R&S	ENY22	100020	06/20/2002	06/19/2003
FOUR WIRE ISN	R&S	ENY41	100006	06/20/2002	06/19/2003

5.5 Measurement Result

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

LINE CONDUCTED TEST

Model Number:BT-410D **Tested by:** Robin Chen

Test Mode: normal operating **Detector Function:** Quasi-Peak

Temperature: 20^0C **Humidity:**60%RH

(The chart below shows the highest readings taken from the final data)

FREQ MHz	Q.P. Raw dBuV	AVG Raw dBuV	Q.P. Limit dBuV	AVG Limit dBuV	Q.P. Margin dB	AVG Margin dB	NOTE
0.153	58.00	44.50	65.84	55.84	-7.84	-11.34	L1
0.221	50.00	---	62.78	52.78	-12.78	---	L1
0.681	44.40	---	56.00	46.00	-11.60	---	L1
0.716	45.20	39.55	56.00	46.00	-10.80	-6.45	L1
0.844	43.20	---	56.00	46.00	-12.80	---	L1
0.991	42.80	---	56.00	46.00	-13.20	---	L1
0.153	58.00	42.50	65.84	55.84	-7.84	-13.34	L2
0.222	53.20	41.30	62.74	52.74	-9.54	-11.44	L2
0.307	49.40	42.33	60.05	50.05	-10.65	-7.72	L2
0.689	45.60	38.12	56.00	46.00	-10.40	-7.88	L2
0.718	46.00	39.25	56.00	46.00	-10.00	-6.75	L2
0.895	43.80	---	56.00	46.00	-12.20	---	L2

Remark：

(1) Measuring frequencies from 0.15 MHz to 30MHz。

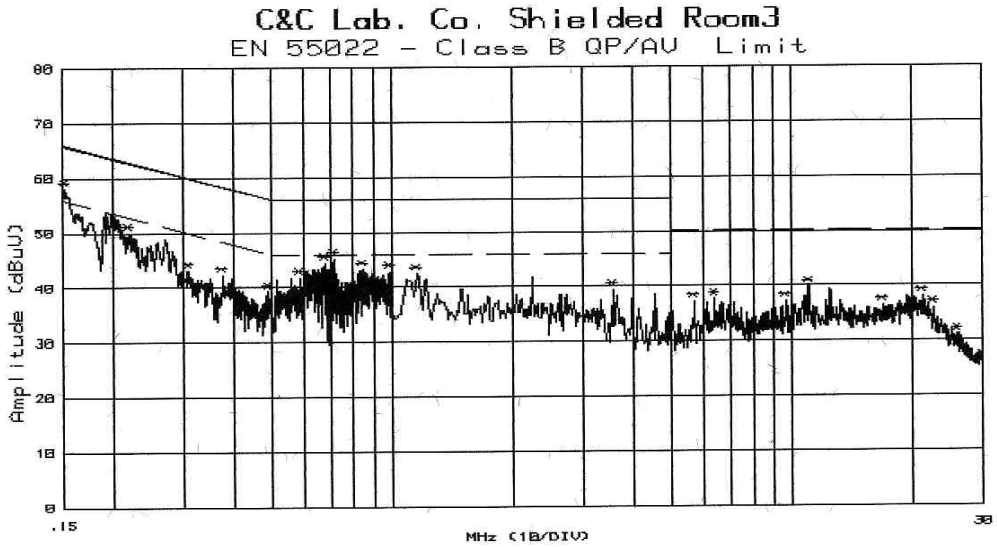
(2) The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Qusia-Peak detector and Average detector.

(3) "---" denotes the emission level was or more than 2dB below the Average limit, so no re-check anymore.

(4) The IF bandwidth of SPA between 0.15MHz to 30MHz was 10KHz;
The IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9KHz;

(5) L1 = Line One (Hot side) / L2 = Line Two (Neutral side)

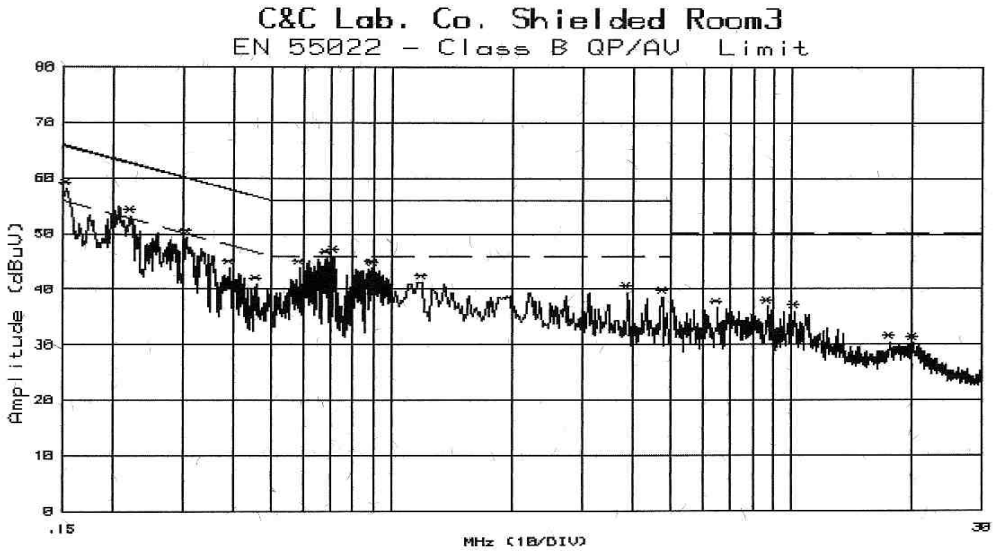
Conducted Emission Test Plot



Customer:1
Model :BT-410D
Mode :
Reading :Peak(R3261C SPA)
Remark :110V

File#: 1145
Humd.:60 (%)
Port :L1

Date :14 Feb 2003 19:38:02
Temp. :20 (C)
Tested by:Robin



Customer:1
Model :BT-410D
Mode :
Reading :Peak(R3261C SPA)
Remark :110V

File#: 1146
Humd.:60 (%)
Port :L2

Date :14 Feb 2003 19:40:31
Temp. :20 (C)
Tested by:Robin

6. PEAK OUTPUT POWER MEASUREMENT

6.1 Standard Applicable

According to §15.247(b)(2), for direct sequence systems, the maximum peak output power of the intentional radiator shall not exceed 1 Watt.

6.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (Channel power function, RBW, VBW = 1MHz)
3. Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

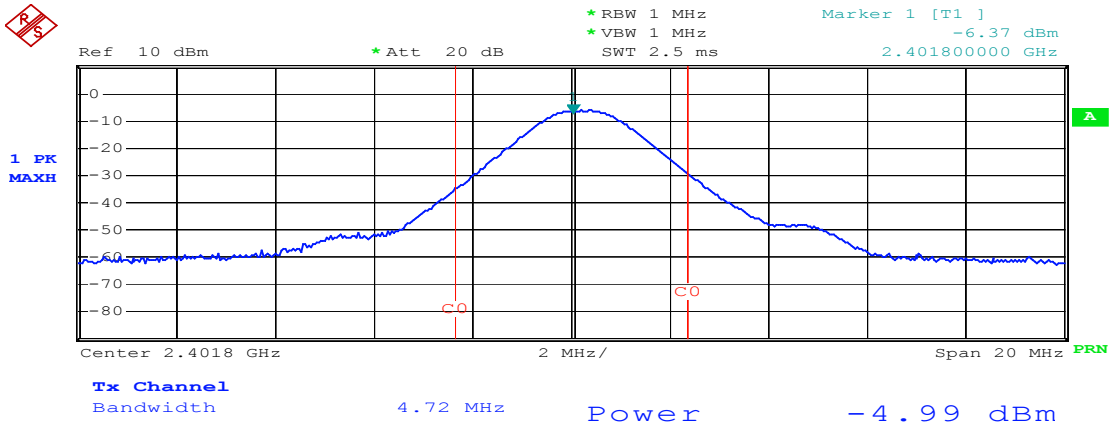
6.3 Measurement Result

CH	Frequency (MHz)	Reading Power	Cabble Loss	Output Power dBm	Output Power W	Limit (W)
LOW	2402.00	-4.99	0.60	-4.39	0.00036	1
MID	2441.00	-6.64	0.60	-6.04	0.00025	1
HIGH	2480.00	-8.96	0.60	-8.36	0.00015	1

6.4 Measurement Equipment Used:

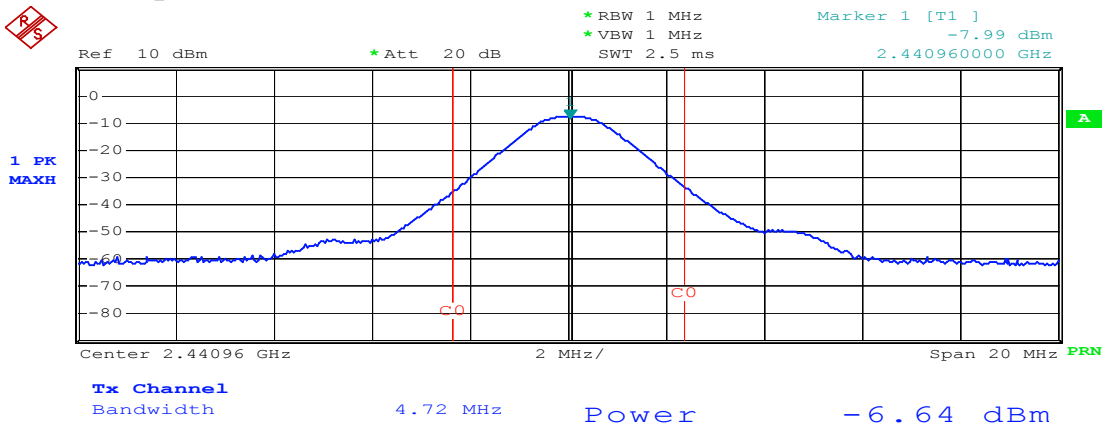
EQUIPMENT TYPE	MFR	Model No.	Serial No.	LAST CAL.	Cal. Due.
Power Meter	HP	436A	2709A29027	03/16/2003	03/15/2004
Power Sensor	HP	8481A	2702A61366	03/16/2003	03/15/2004
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/23/2002	07/22/2003
low loss cable	Huber + Suhner	Sucoflex 104	N/A	N/A	N/A

Peak Power Output Data Plot (CH Low)



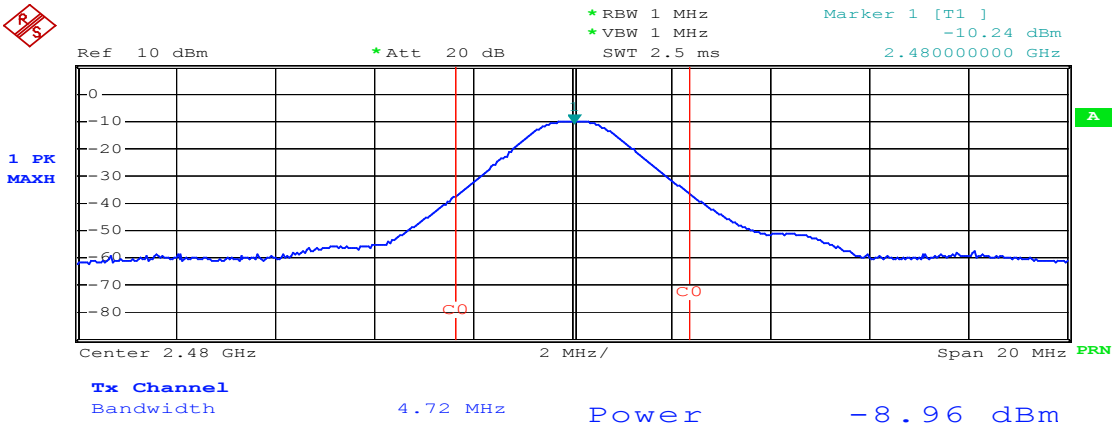
Date: 17.JAN.2003 07:03:33

Peak Power Output Data Plot (CH Mid)



Date: 17.JAN.2003 06:59:37

Peak Power Output Data Plot (CH High)



Date: 17.JAN.2003 06:58:36

7. 20dB BAND WIDTH

7.1 Standard Applicable

According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz and 5725MHz – 5850MHz bands. The Maximum 20dB bandwidth of the hopping channel is 1MHz.

7.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=10KHz (1 % of Bandwidth.), Span= 2MHz, Sweep=auto
4. Mark the peak frequency and –20dB (upper and lower) frequency.
5. Repeat above procedures until all frequency measured were complete.

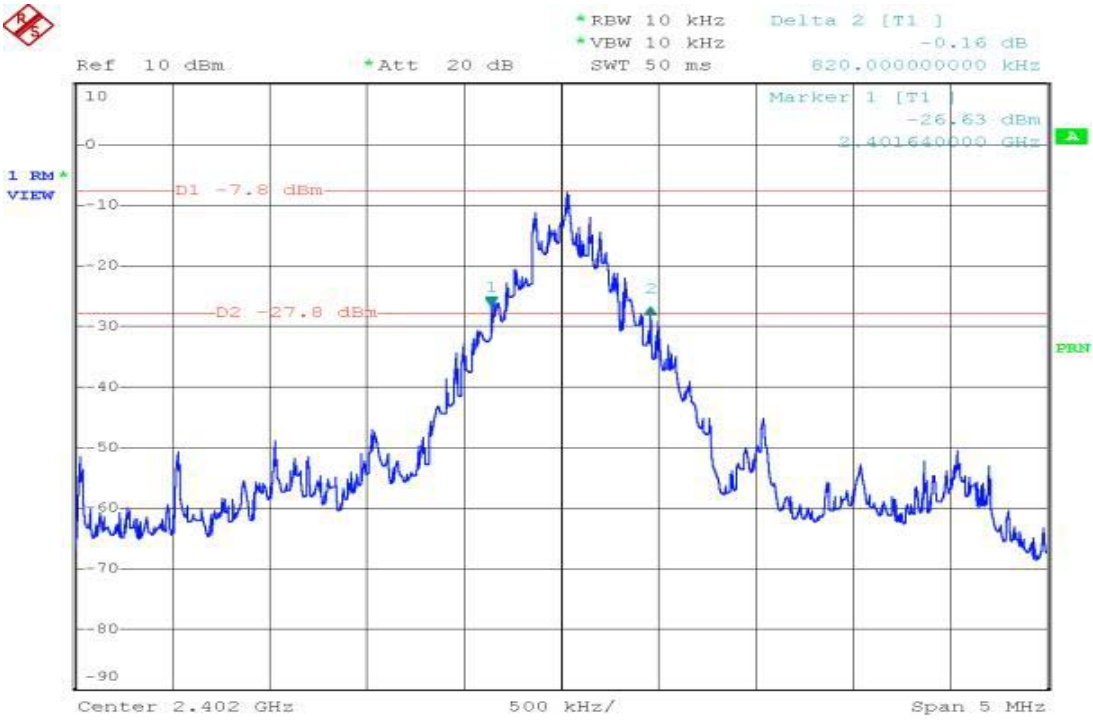
7.3 Measurement Result

CH	Bandwidth (MHz)	Bandwidth Limit (MHz)	Result
Lower	0.82	1	PASS
Mid	0.82	1	PASS
Higher	0.82	1	PASS

7.4 Measurement Equipment Used:

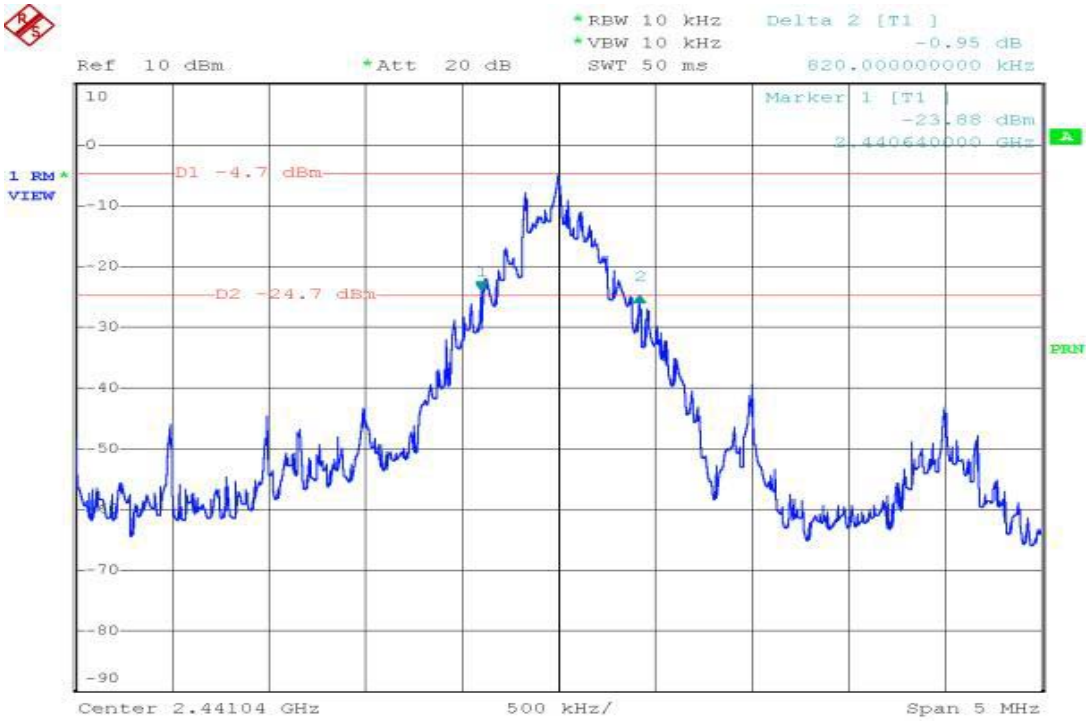
EQUIPMENT TYPE	MFR	Model No.	Serial No.	LAST CAL.	Cal. Due.
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/23/2002	07/22/2003
low loss cable	Huber + Suhner	Sucoflex 104	N/A	N/A	N/A

20dB Band Width Test Data CH-Low



Date: 8.JAN.2003 10:13:33

20dB Band Width Test Data CH-Mid



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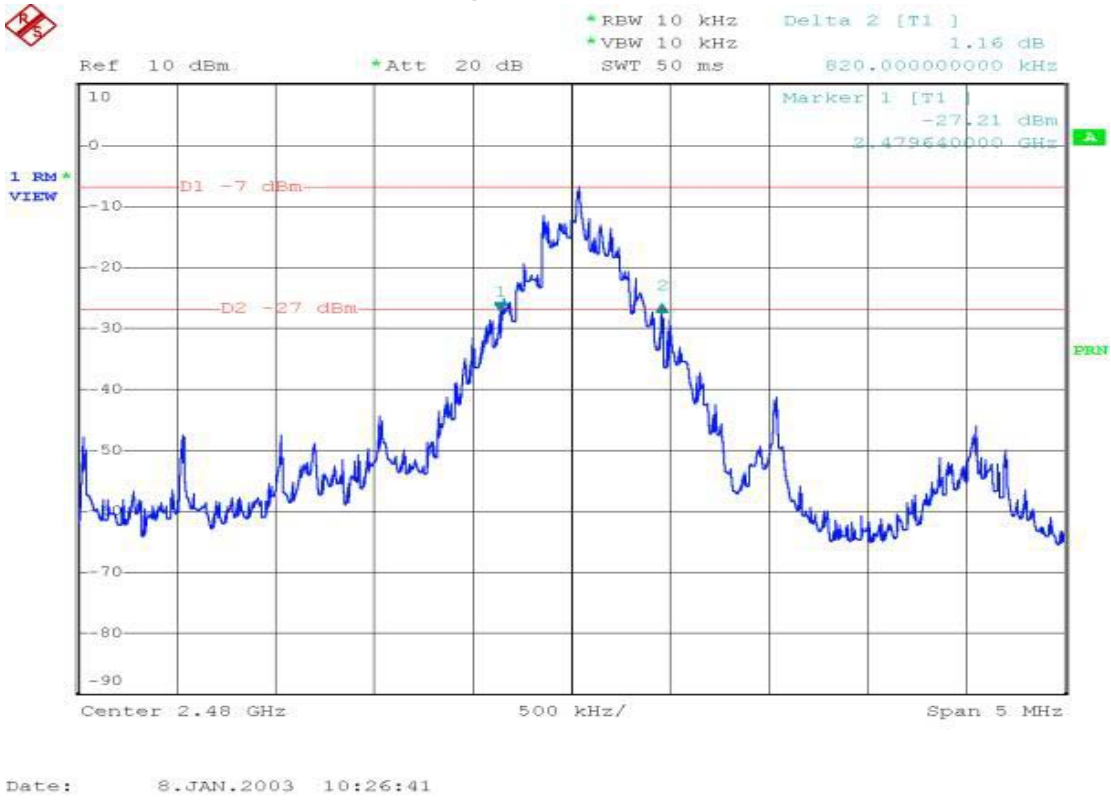
20dB Band Width Test Data CH-High



8. 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT

8.1 Standard Applicable

According to §15.247(c), in any 100 KHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in15.209(a).

8.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=100KHz, Span=30MHz, Sweep = auto
5. Mark Peak, 2.390GHz and 2.488GHz and record the max. level.
6. Repeat above procedures until all frequency measured were complete.

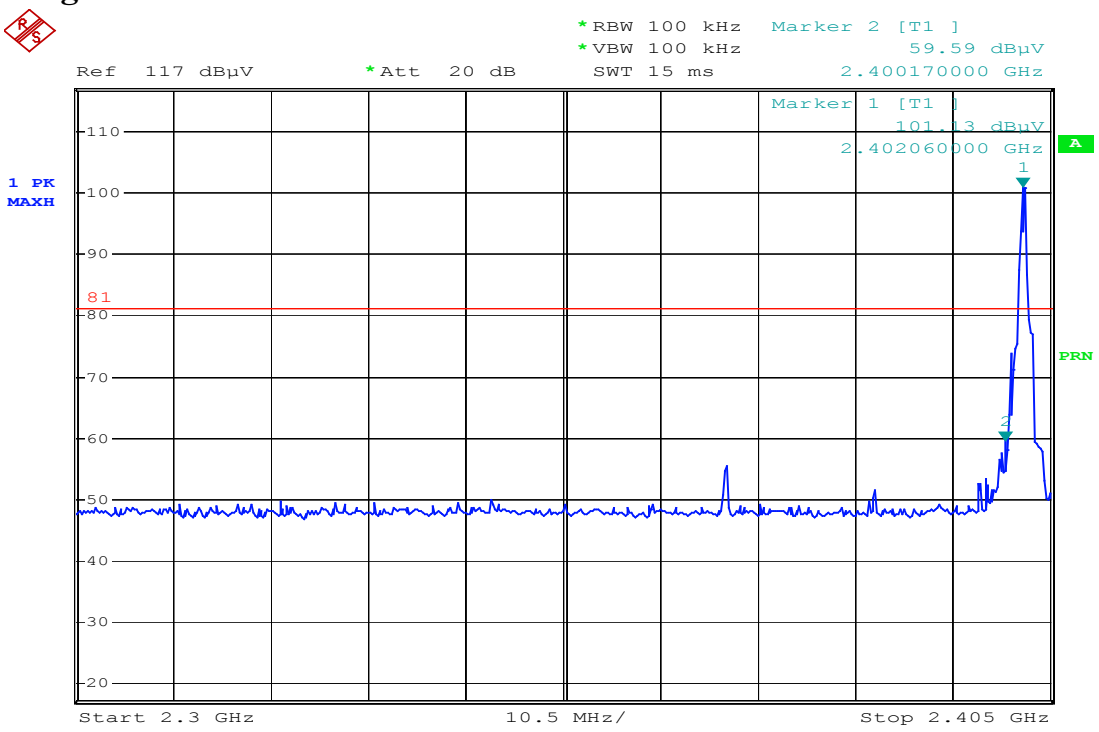
8.3 Measurement Result

Refer to attach spectrum analyzer data chart.

8.4 Measurement Equipment Used:

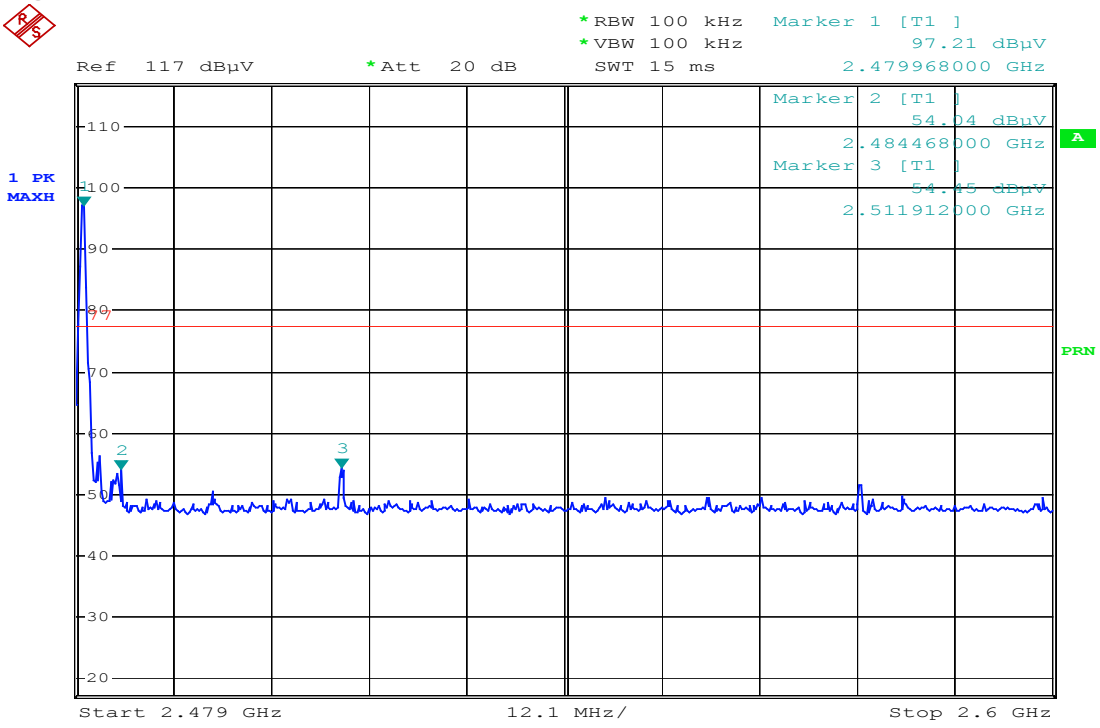
EQUIPMENT TYPE	MFR	Model No.	Serial No.	LAST CAL.	Cal. Due.
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/23/2002	07/22/2003
low loss cable	Huber + Suhner	Sucoflex 104	N/A	N/A	N/A

Band Edges Test Data CH-Low



Date: 17.JAN.2003 07:11:23

Band Edges Test Data CH-Low



Date: 17.JAN.2003 07:15:37

9. SPURIOUS RADIATED EMISSION TEST

9.1 Standard Applicable

According to §15.247(c), all other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). And according to §15.33(a)(1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

9.2 EUT Setup

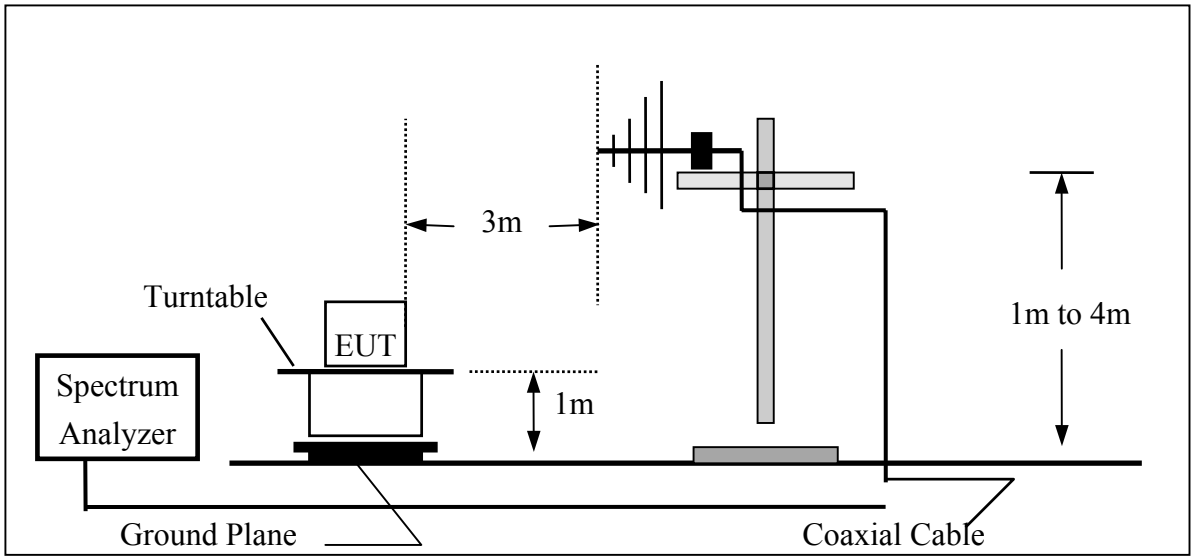
1. The radiated emission tests were performed in the 3 meter open-test site, using the setup in accordance with the ANSI C63.4-1992.
2. The EUT was put in the front of the test table. The host PC system was placed on the center of the back edge on the test table. The peripherals like modem, monitor printer, K/B, and mouse were placed on the side of the host PC system. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The keyboard was placed directly in the front of the monitor, flushed with the front tabletop. The mouse was placed next to the Keyboard, flushed with the back of keyboard.
4. The spacing between the peripherals was 10 centimeters.
5. External I/O cables were draped along the edge of the test table and bundle when necessary.
6. The host PC system was connected with 110Vac/60Hz power source.

9.3 Measurement Procedure

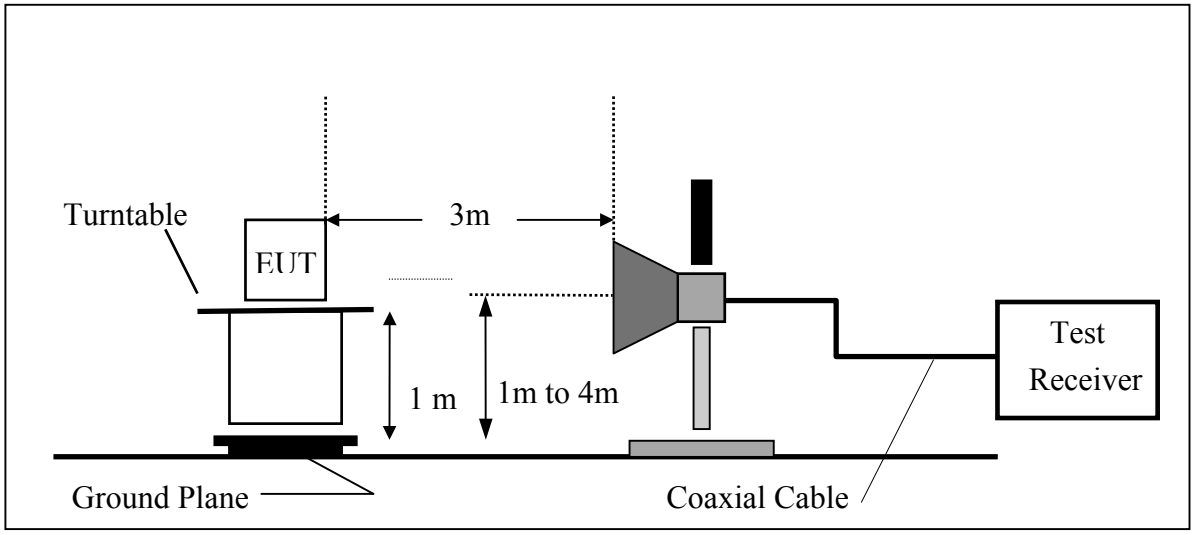
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until all frequency measured were complete.

9.4 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-UP Frequency Over 1 GHz



9.5 Measurement Equipment Used:

Open Area Test Site # 3					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Spectrum Analyzer	ADVANTEST	R3261A	N/A	03/19/2003	03/18/2004
EMI Test Receiver	R&S	ESVS20	838804/004	01/05/2003	01/04/2004
Pre-Amplifier	HP	8447D	2944A09173	03/04/2003	03/03/2004
Bilog Antenna	SCHWAZBECK	VULB9163	145	07/06/2002	07/05/2003
Turn Table	EMCO	2081-1.21	9709-1885	N.C.R	N.C.R
Antenna Tower	EMCO	2075-2	9707-2060	N.C.R	N.C.R
Controller	EMCO	2090	9709-1256	N.C.R	N.C.R
RF Switch	ANRITSU	MP59B	M53867	N.C.R	N.C.R
Site NSA	C&C	N/A	N/A	09/07/2002	09/06/2003
Horn antenna	Schwarzbeck	BBHA 9120	D210	2/24/2003	2/23/2004
Loop Antenna	EMCO	6502	2356	7/11/2002	7/10/2003
Pre-Amplifier	HP	8449B	3008B00965	10/01/2002	10/02/2003

9.6 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

9.7 Measurement Result

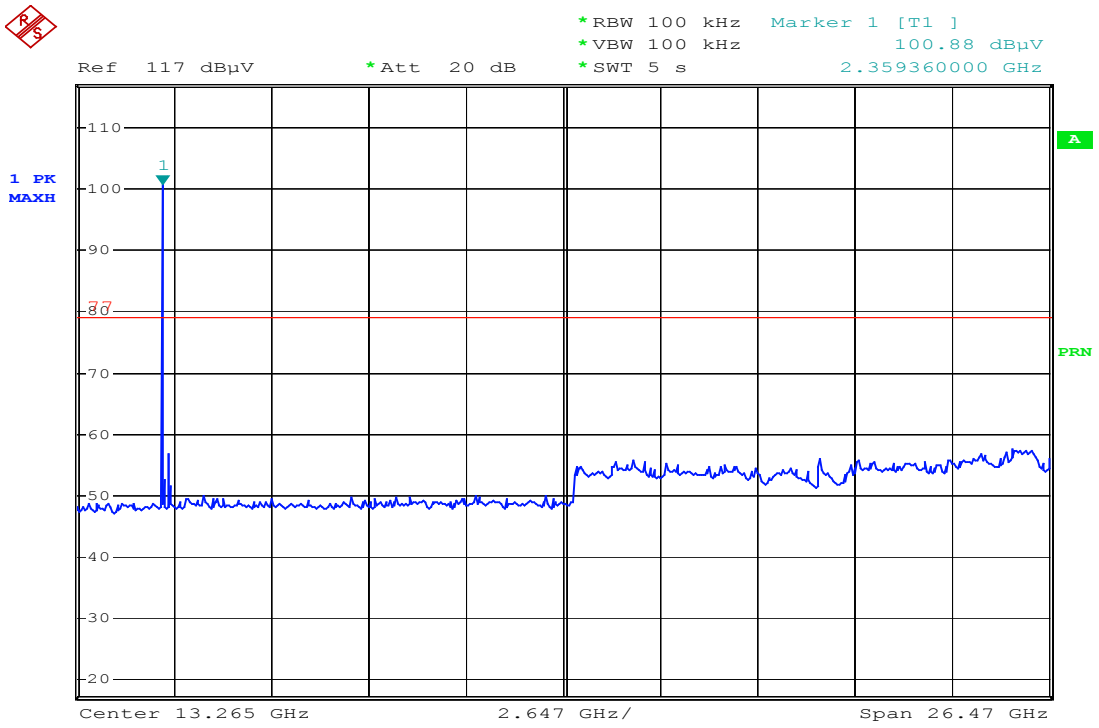
Refer to attach tabular data sheets.

NOTE:

The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 100kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.

Conducted Spurious Emission Measurement Result

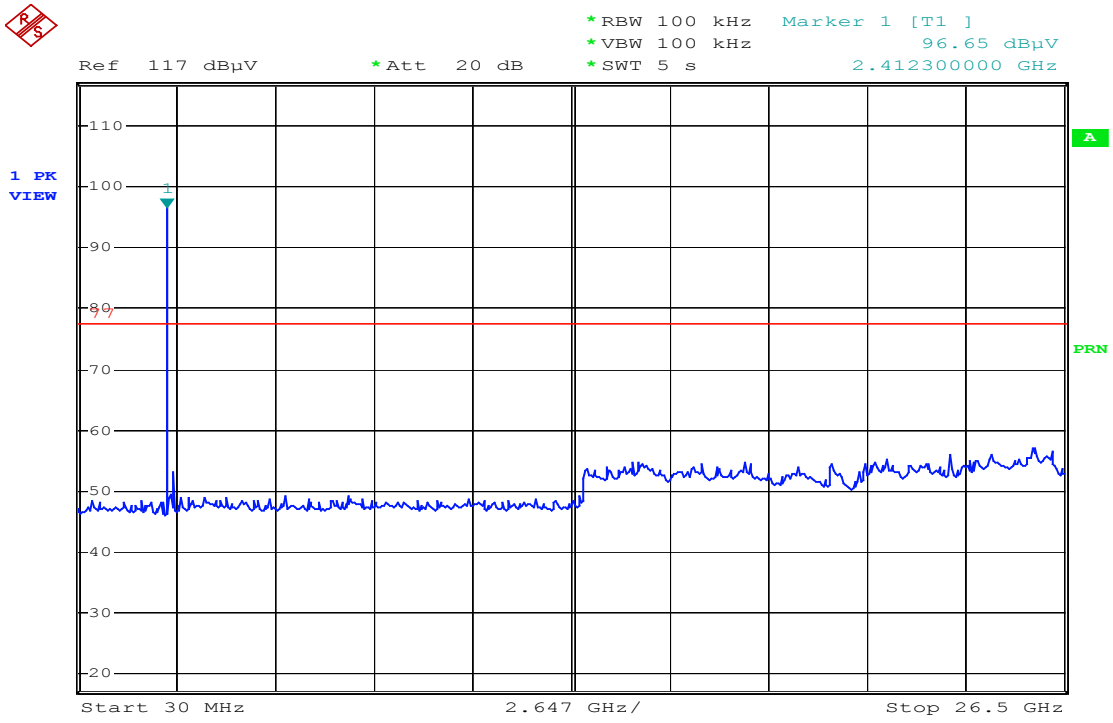
Ch Low



Date: 17.JAN.2003 07:27:49

Conducted Spurious Emission Measurement Result

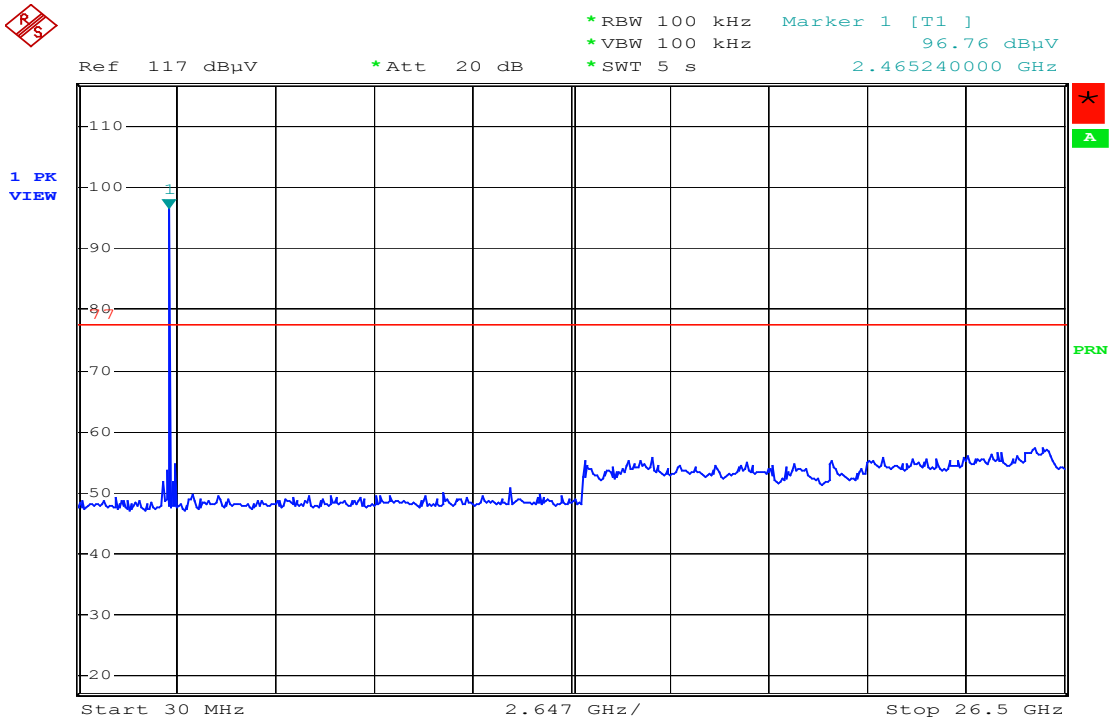
Ch Mid



Date: 17.JAN.2003 07:23:16

Conducted Spurious Emission Measurement Result

Ch High



Date: 17.JAN.2003 07:20:22

9.8 Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode :TX CH Low
Fundamental Frequency :2402MHz
Temperature :20 ℃
Humidity :65 %

Test Date :Jan. 17, 2003
Test By :Robin
Pol :Ver./Hor

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Ant./CL/ Amp. CF(dB)	Actual FS (dBuV/m)	Limit3m (dBuV/m)	Safe Margin (dB)
240.15	V	Peak	17.88	15.92	33.8	46.00	-12.20
252.30	V	Peak	21.04	16.25	37.29	46.00	-8.71
399.17	V	Peak	15.53	20.68	36.21	46.00	-9.79
431.83	V	Peak	13.9	20.37	34.27	46.00	-11.73
797.00	V	Peak	8.26	26.12	34.38	46.00	-11.62
928.83	V	Peak	8.78	28.56	37.34	46.00	-8.66
195.15	H	Peak	11.01	13.82	24.83	43.50	-18.67
252.30	H	Peak	10.88	15.17	26.05	46.00	-19.95
399.17	H	Peak	10.36	20.68	31.04	46.00	-14.96
431.83	H	Peak	11.23	20.37	31.6	46.00	-14.40
468.00	H	Peak	11.39	21.01	32.4	46.00	-13.60
798.17	H	Peak	7.77	26.13	33.9	46.00	-12.10

Remark：

(1) Measuring frequencies from 30 MHz to the 1GHz。

(2) Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/AV detector mode.

(3) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(4) The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.

Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode	:TX CH Mid	Test Date	:Jan. 17, 2003
Fundamental Frequency	:2441MHz	Test By	:Robin
Temperature	:20 ℃	Pol	:Ver./Hor
Humidity	:65 %		

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Ant./CL/ Amp. CF(dB)	Actual FS (dBuV/m)	Limit3m (dBuV/m)	Safe Margin (dB)
252.30	V	Peak	19.54	14.83	34.37	46.00	-11.63
325.67	V	Peak	18.11	17.37	35.48	46.00	-10.52
399.17	V	Peak	16.7	20.68	37.38	46.00	-8.62
431.83	V	Peak	14.9	20.37	35.27	46.00	-10.73
541.50	V	Peak	12.42	23.98	36.4	46.00	-9.60
801.67	V	Peak	13.25	26.18	39.43	46.00	-6.57
399.17	H	Peak	11.7	20.68	32.38	46.00	-13.62
433.00	H	Peak	11.13	20.36	31.49	46.00	-14.51
468.00	H	Peak	11.06	21.01	32.07	46.00	-13.93
528.67	H	Peak	10.34	23.52	33.86	46.00	-12.14
541.50	H	Peak	7.75	23.98	31.73	46.00	-14.27
795.83	H	Peak	8.25	26.12	34.37	46.00	-11.63

Remark：

(1) Measuring frequencies from 30 MHz to the 1GHz。

(2) Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/AV detector mode.

(3) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(4) The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.

Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode	:TX CH High	Test Date	:Jan. 17, 2003
Fundamental Frequency	:2480MHz	Test By	:Robin
Temperature	:20 ℃	Pol	:Ver./Hor
Humidity	:65 %		

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Ant./CL/ Amp. CF(dB)	Actual FS (dBuV/m)	Limit3m (dBuV/m)	Safe Margin (dB)
252.30	V	Peak	20.71	16.25	36.96	46.00	-9.04
325.67	V	Peak	18.11	17.37	35.48	46.00	-10.52
399.17	V	Peak	17.03	20.68	37.71	46.00	-8.29
433.00	V	Peak	14.63	20.36	34.99	46.00	-11.01
541.50	V	Peak	11.92	23.98	35.9	46.00	-10.10
797.00	V	Peak	13.43	26.12	39.55	46.00	-6.45
398.00	H	Peak	9.88	20.61	30.49	46.00	-15.51
431.83	H	Peak	11.40	20.37	31.77	46.00	-14.23
528.67	H	Peak	9.67	23.52	33.19	46.00	-12.81
532.17	H	Peak	7.94	23.65	31.59	46.00	-14.41
541.50	H	Peak	7.25	23.98	31.23	46.00	-14.77
797.00	H	Peak	7.60	26.12	33.72	46.00	-12.28

Remark：

(1) Measuring frequencies from 30 MHz to the 1GHz。

(2) Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/AV detector mode.

(3) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(4) The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	:TX CH Low	Test Date	:Jan. 17, 2003
Fundamental Frequency	:2402MHz	Test By	:Robin
Temperature	:20 ℃	Pol	:Ver
Humidity	:65%		

Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Ant./CL CF(dB)	Actual FS Peak (dBuV/m)	Actual FS AV (dBuV/m)	Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	
1196.67	58.34		-10.65	47.69		74.00	54.00	-6.31	Peak
1456.67	53.67		-9.66	44.01		74.00	54.00	-9.99	Peak
1593.33	52.67		-8.98	43.69		74.00	54.00	-10.31	Peak
1993.33	50.67		-8.01	42.66		74.00	54.00	-11.34	Peak
2123.30	50.34		-7.48	42.86		74.00	54.00	-11.14	Peak
4805.34	----		----	----		----	----	----	
7208.01	----		----	----		----	----	----	
9610.68	----		----	----		----	----	----	
12013.35	----		----	----		----	----	----	
14416.02	----		----	----		----	----	----	
16818.69	----		----	----		----	----	----	
19221.36	----		----	----		----	----	----	
21624.03	----		----	----		----	----	----	
24026.70	----		----	----		----	----	----	

Remark：

(1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency。

(2) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column。

(4) Spectrum PK Setting: 1GHz - 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time = 200 ms.

(5) Spectrum Average Setting: 1GHz – 26GHz, RBW=1MHz, VBW=10Hz, Sweep time = 200ms

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	:TX CH Low	Test Date	:Jan. 17, 2003
Fundamental Frequency	:2402MHz	Test By	:Robin
Temperature	:20 ℃	Pol	:Hor
Humidity	:65%		

Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Ant./CL CF(dB)	Actual FS Peak (dBuV/m)	Actual FS AV (dBuV/m)	Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	
1060.0	51.17		-11.55	39.62		74.00	54.00	-14.38	Peak
1193.3	53.17		-10.67	42.50		74.00	54.00	-11.50	Peak
1463.3	53.50		-9.62	43.88		74.00	54.00	-10.12	Peak
1593.3	49.84		-8.98	40.86		74.00	54.00	-13.14	Peak
4805.4	----								
7205.7	----								
9607.6	----								
12009.5	----								
14411.4	----								
16813.3	----								
19215.2	----								
21617.1	----								
24019.0	----								

(1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency。

(2) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column。

(4) Spectrum PK Setting: 1GHz - 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time = 200 ms.

(5) Spectrum Average Setting: 1GHz – 26GHz, RBW=1MHz, VBW=10Hz, Sweep time = 200ms

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	:TX CH Mid	Test Date	:Jan. 17, 2003
Fundamental Frequency	:2441MHz	Test By	:Robin
Temperature	:20 ℃	Pol	:Ver.
Humidity	:65%		

Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Ant./CL CF(dB)	Actual FS Peak (dBuV/m)	Actual FS AV (dBuV/m)	Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	
1063.3	51.67		-11.53	40.14		74.00	54.00	-13.86	Peak
1196.7	59.67		-10.65	49.02		74.00	54.00	-4.98	Peak
1460.0	53.34		-9.64	43.70		74.00	54.00	-10.30	Peak
1590.0	50.34		-9.00	41.34		74.00	54.00	-12.66	Peak
1990.0	49.34		-8.02	41.32		74.00	54.00	-12.68	Peak
2123.3	50.17		-7.48	42.69		74.00	54.00	-11.31	Peak
4883.3	----		----	----		----	----	----	
7325.0	----		----	----		----	----	----	
9766.7	----		----	----		----	----	----	
12208.4	----		----	----		----	----	----	
14650.0	----		----	----		----	----	----	
17091.7	----		----	----		----	----	----	
19533.4	----		----	----		----	----	----	
21975.0	----		----	----		----	----	----	
24416.7	----		----	----		----	----	----	

Remark：

(1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency。

(2) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column。

(4) Spectrum PK Setting: 1GHz - 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time = 200 ms.

(5) Spectrum Average Setting: 1GHz – 26GHz, RBW=1MHz, VBW=10Hz, Sweep time = 200ms

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	:TX CH Mid	Test Date	:Jan. 17, 2003
Fundamental Frequency	:2441MHz	Test By	:Robin
Temperature	:20 ℃	Pol	:Hor
Humidity	:65%		

Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Ant./CL CF(dB)	Actual FS Peak (dBuV/m)	Actual FS AV (dBuV/m)	Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	
1060.0	50.67		-11.55	39.12		74.00	54.00	-14.88	Peak
1196.7	55.84		-10.65	45.19		74.00	54.00	-8.81	Peak
1460.0	52.17		-9.64	42.53		74.00	54.00	-11.47	Peak
1593.3	50.34		-8.98	41.36		74.00	54.00	-12.64	Peak
2393.3	49.50		-6.38	43.12		74.00	54.00	-10.88	Peak
4882.0	----		----	----		----	----	----	
7323.0	----		----	----		----	----	----	
9764.0	----		----	----		----	----	----	
12205.0	----		----	----		----	----	----	
14646.0	----		----	----		----	----	----	
17087.0	----		----	----		----	----	----	
19528.0	----		----	----		----	----	----	
21969.0	----		----	----		----	----	----	
24410.0	----		----	----		----	----	----	

Remark：

(1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency。

(2) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column。

(4) Spectrum PK Setting: 1GHz - 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time = 200 ms.

(5) Spectrum Average Setting: 1GHz – 26GHz, RBW=1MHz, VBW=10Hz, Sweep time = 200ms

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	:TX CH High	Test Date	:Jan. 17, 2003
Fundamental Frequency	:2480MHz	Test By	:Robin
Temperature	:20 ℃	Pol	:Ver
Humidity	:65%		

Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Ant./CL CF(dB)	Actual FS Peak (dBuV/m)	Actual FS AV (dBuV/m)	Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	
1196.7	60.67		-10.65	50.02		74.00	54.00	-3.98	Peak
1463.3	54.17		-9.62	44.55		74.00	54.00	-9.45	Peak
1593.3	51.17		-8.98	42.19		74.00	54.00	-11.81	Peak
1856.7	49.00		-8.44	40.56		74.00	54.00	-13.44	Peak
1993.3	50.34		-8.01	42.33		74.00	54.00	-11.67	Peak
2120.0	50.00		-7.49	42.51		74.00	54.00	-11.49	Peak
4960.0	----		----	----		----	----	----	
7440.0	----		----	----		----	----	----	
9920.0	----		----	----		----	----	----	
12400.0	----		----	----		----	----	----	
14880.0	----		----	----		----	----	----	
17360.0	----		----	----		----	----	----	
19840.0	----		----	----		----	----	----	
22320.0	----		----	----		----	----	----	
24800.0	----		----	----		----	----	----	

Remark：

(1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency。

(2) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column。

(4) Spectrum PK Setting: 1GHz - 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time = 200 ms.

(5) Spectrum Average Setting: 1GHz – 26GHz, RBW=1MHz, VBW=10Hz, Sweep time = 200ms

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	:TX CH High	Test Date	:Jan. 17, 2003
Fundamental Frequency	:2480MHz	Test By	:Robin
Temperature	:20 ℃	Pol	:Hor
Humidity	:65%		

Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Ant./CL CF(dB)	Actual FS Peak (dBuV/m)	Actual FS AV (dBuV/m)	Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	
1063.3	51.34		-11.53	39.81		74.00	54.00	-14.19	Peak
1133.3	50.34		-11.06	39.28		74.00	54.00	-14.72	Peak
1196.7	55.34		-10.65	44.69		74.00	54.00	-9.31	Peak
1463.3	52.17		-9.62	42.55		74.00	54.00	-11.45	Peak
1593.3	50.00		-8.98	41.02		74.00	54.00	-12.98	Peak
4960.0	----		----	----		----	----	----	
7440.0	----		----	----		----	----	----	
9920.0	----		----	----		----	----	----	
12400.0	----		----	----		----	----	----	
14880.0	----		----	----		----	----	----	
17360.0	----		----	----		----	----	----	
19840.0	----		----	----		----	----	----	
22320.0	----		----	----		----	----	----	
24800.0	----		----	----		----	----	----	

Remark：

(1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency。

(2) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column。

(4) Spectrum PK Setting: 1GHz - 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time = 200 ms.

(5) Spectrum Average Setting: 1GHz – 26GHz, RBW=1MHz, VBW=10Hz, Sweep time = 200ms

10. FREQUENCY SEPARATION

10.1 Standard Applicable

According to §15.247(a), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 20dB bandwidth of the hopping channel, whichever is greater.

10.2 9.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = middle of hopping channel .
4. Set the spectrum analyzer as RBW,VBW=3KHz, Adjust Span to 3.0 MHz, Sweep = auto.
5. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

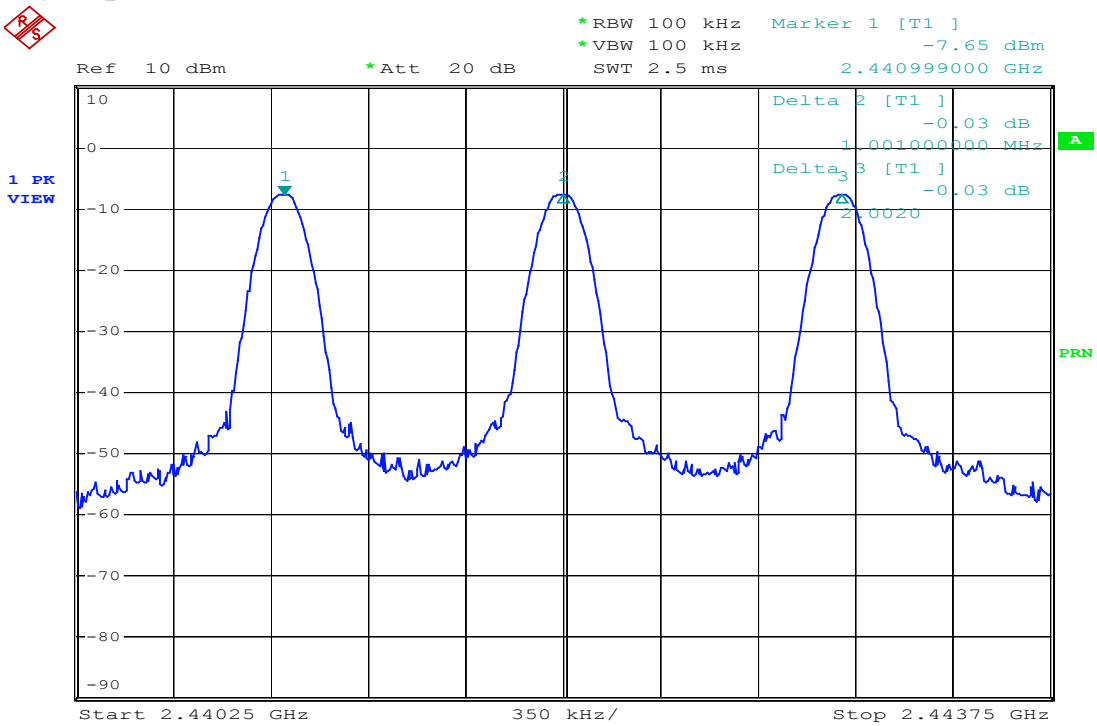
10.3 Measurement Result

Channel separation	Limit	Result
MHz	kHz	
1	>=25	PASS

10.4 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	Model No.	Serial No.	LAST CAL.	Cal. Due.
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/23/2002	07/22/2003
low loss cable	Huber + Suhner	Sucoflex 104	N/A	N/A	N/A

Frequency Separation Test Data



11. NUMBER OF HOPPING FREQUENCY

11.1 Standard Applicable

According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz and 5725MHz – 5850MHz bands shall use at least 75 hopping frequencies.

11.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set spectrum analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
4. Set the spectrum analyzer as RBW,VBW=100KHz,
5. Max hold, view and count how many channel in the band.

11.3 Measurement Result

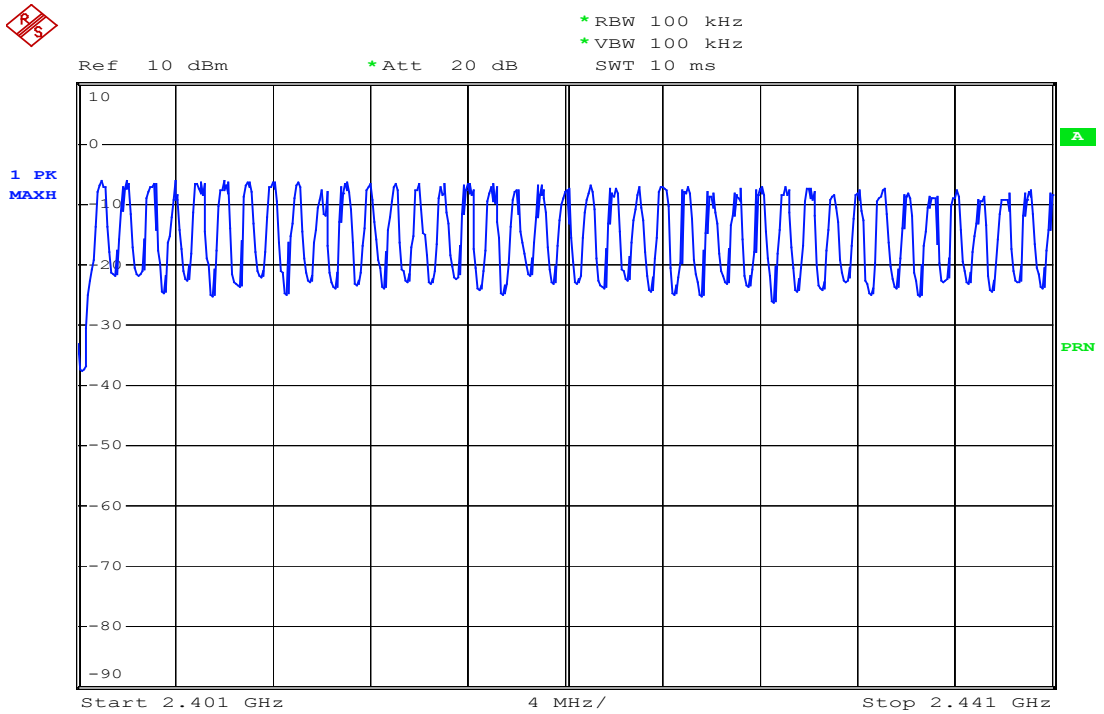
Total no of hopping channel	Limit (CH)	Measurement result (CH)	Result
	75	79	PASS

11.4 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	Model No.	Serial No.	LAST CAL.	Cal. Due.
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/23/2002	07/22/2003
low loss cable	Huber + Suhner	Sucoflex 104	N/A	N/A	N/A

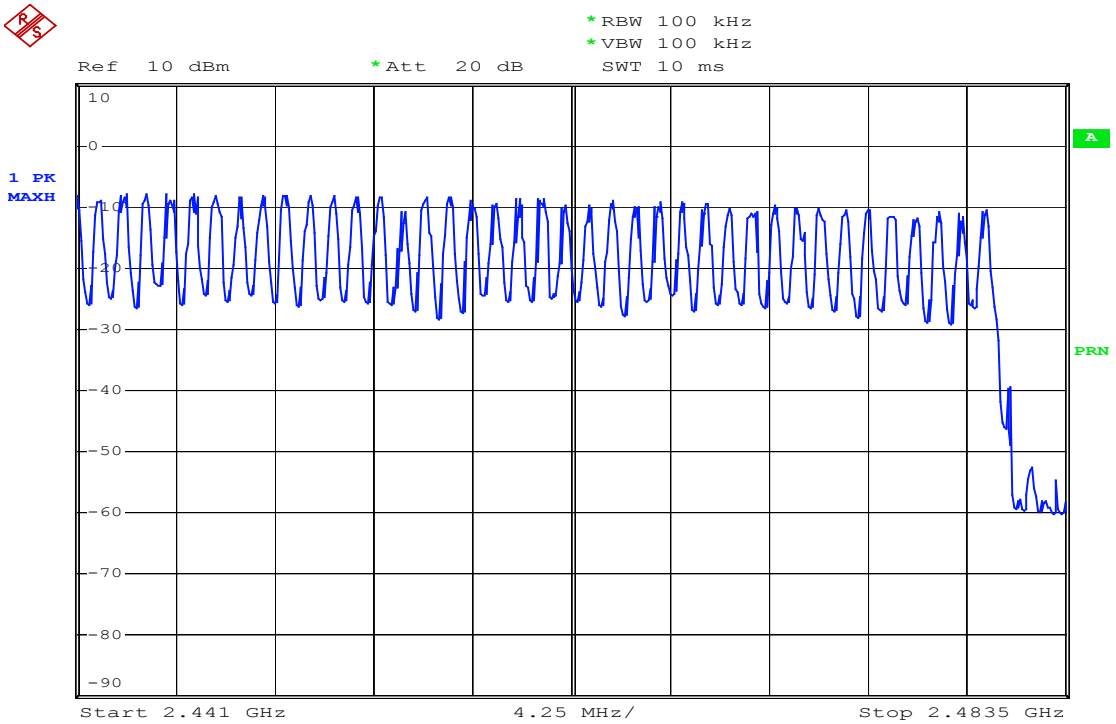
Channel Number

2.401GHz – 2.441GHz



Date: 17.JAN.2003 10:49:45

2.441 GHz – 2.4835GHz



Date: 17.JAN.2003 10:51:18

12. TIME OF OCCUPANCY (DWELL TIME)

12.1 Standard Applicable

According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz and 5725MHz – 5850MHz bands. The average time of occupancy on any frequency shall not greater than 0.4 s within a 30s period.

12.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW,VBW=100KHz, Span = 0Hz , Adjust Sweep = 30s.
5. Repeat above procedures until all frequency measured were complete.

12.3 Measurement Result

A period time = 0.4 (ms) * 79 = 31.6 (s)

CH Low: 0.36 (ms) * 1600/79 * 31.6=230.4 (ms)

CH Mid: 0.36 (ms) * 1600/79 * 31.6=230.4 (ms)

CH High: 0.36 (ms) * 1600/79 * 31.6=230.4 (ms)

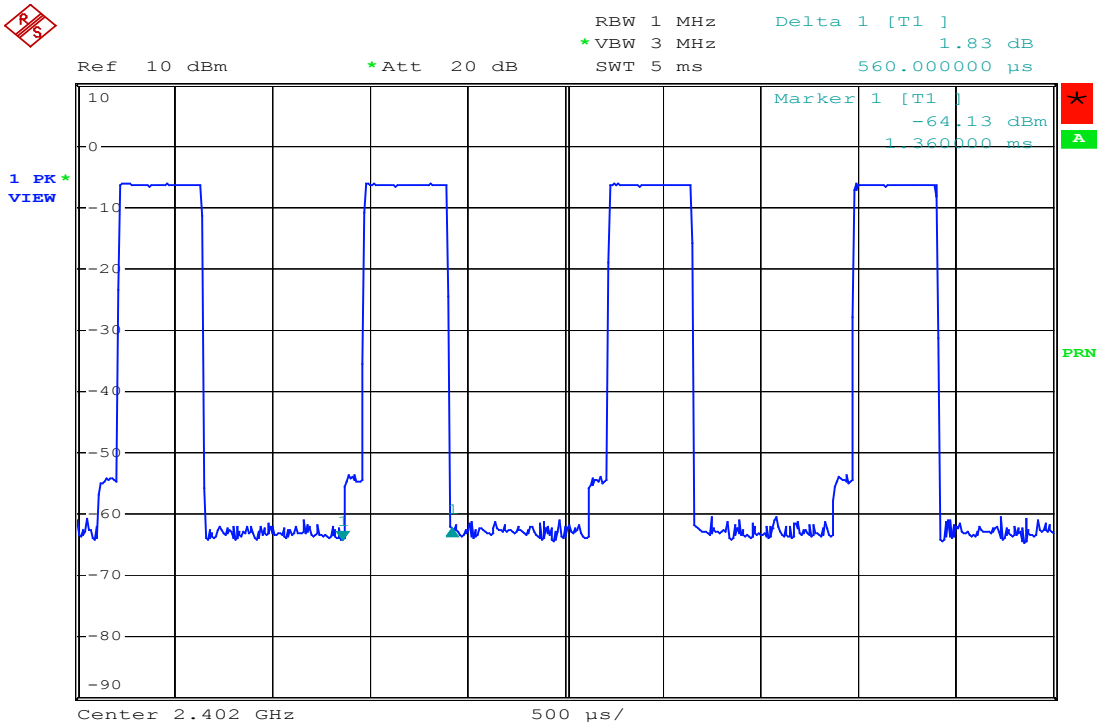
CH	Pulse Time (ms)	Total of Dwell Time (ms)	Period time (ms)	Limit (ms)
Low	0.36	230.40	31.60	400.00
Mid	0.36	230.40	31.60	400.00
High	0.36	230.40	31.60	400.00

12.4 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	Model No.	Serial No.	LAST CAL.	Cal. Due.
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/23/2002	07/22/2003
low loss cable	Huber + Suhner	Sucoflex 104	N/A	N/A	N/A

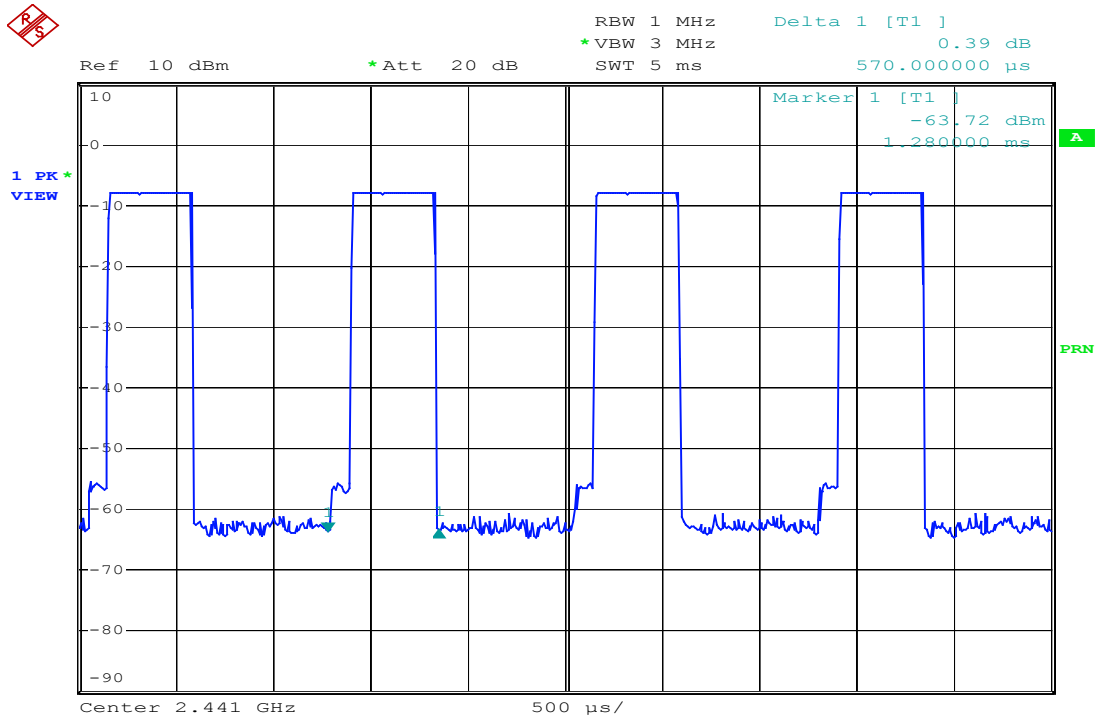
Dwell Time Test Data

CH LOW



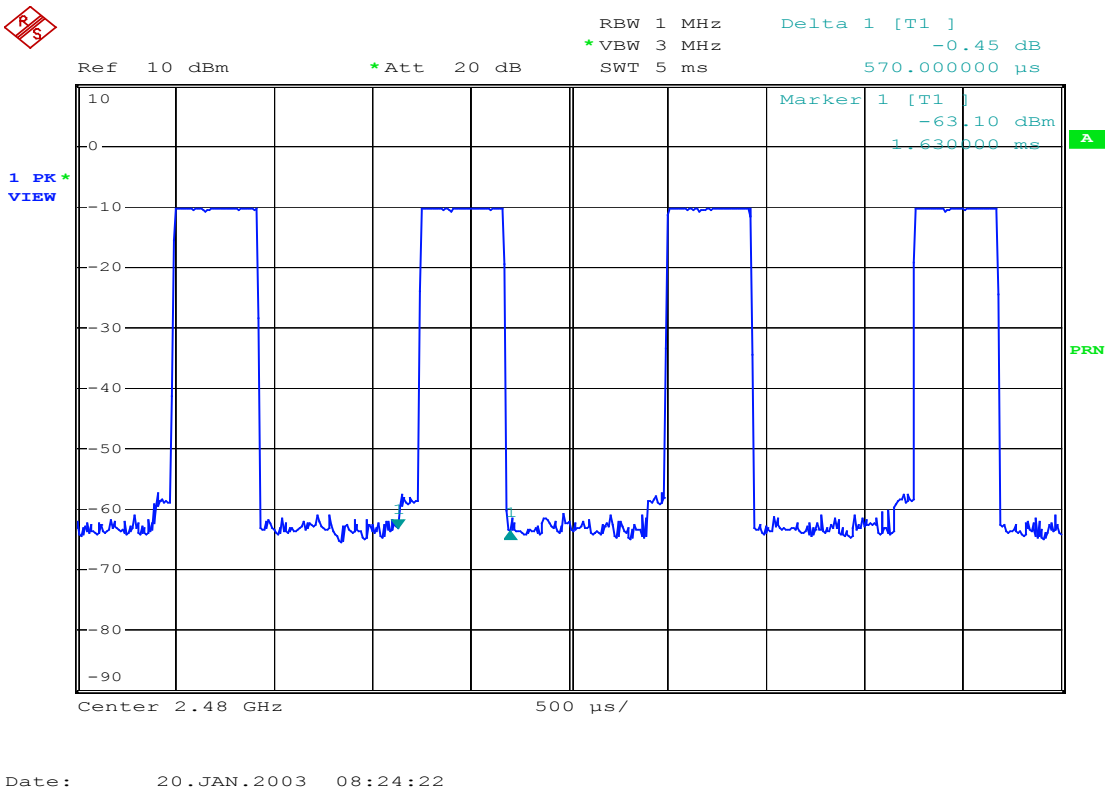
Date: 20.JAN.2003 08:20:20

CH MID



Date: 20.JAN.2003 08:23:21

CH HIGH



Date: 20.JAN.2003 08:24:22

13. Peak Power Spectral Density

13.1 Standard Applicable

According to §15.247(d), for direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3kHz band during any time interval of continuous transmission.

13.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 3KHz, VBW = 3KHz, Span = 300KHz, Sweep=100s
4. Record the max. reading.
5. Repeat above procedures until all frequency measured were complete.

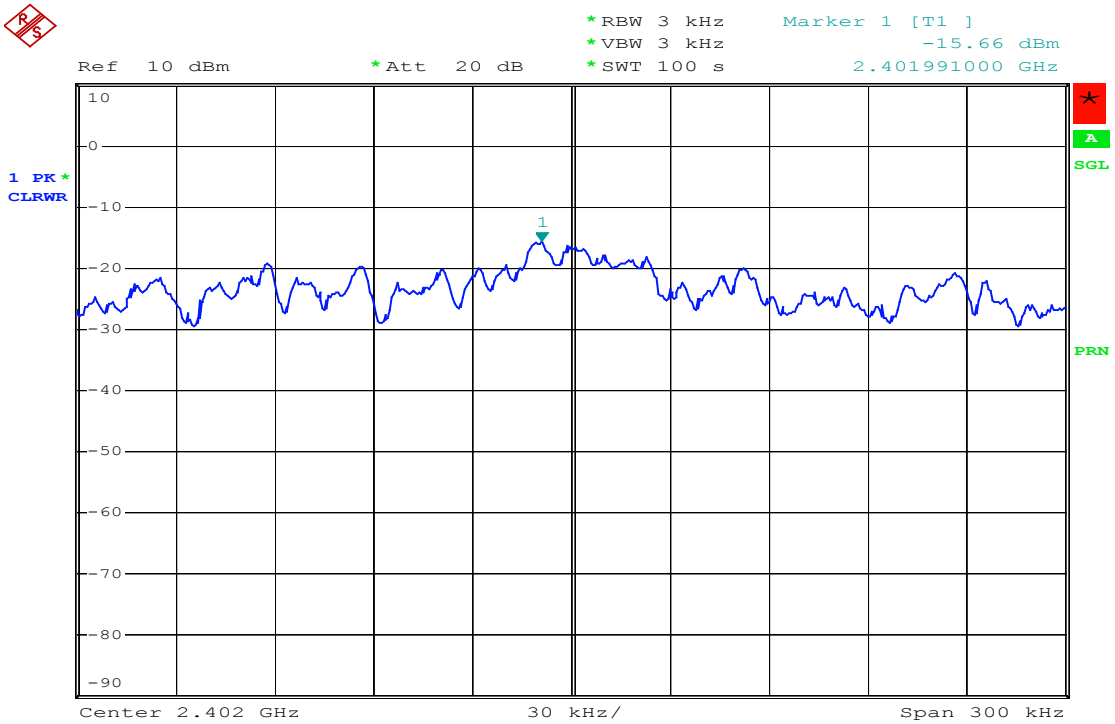
13.3 Measurement Result

CH	RF Power Density Reading (dBm)	Cable loss (dB)	RF Power Density Level (dBm)	Maximum Limit (dBm)
Low	-15.66	0.60	-15.06	8
Mid	-17.32	0.60	-16.72	8
High	-19.90	0.60	-19.30	8

13.4 Measurement Equipment Used:

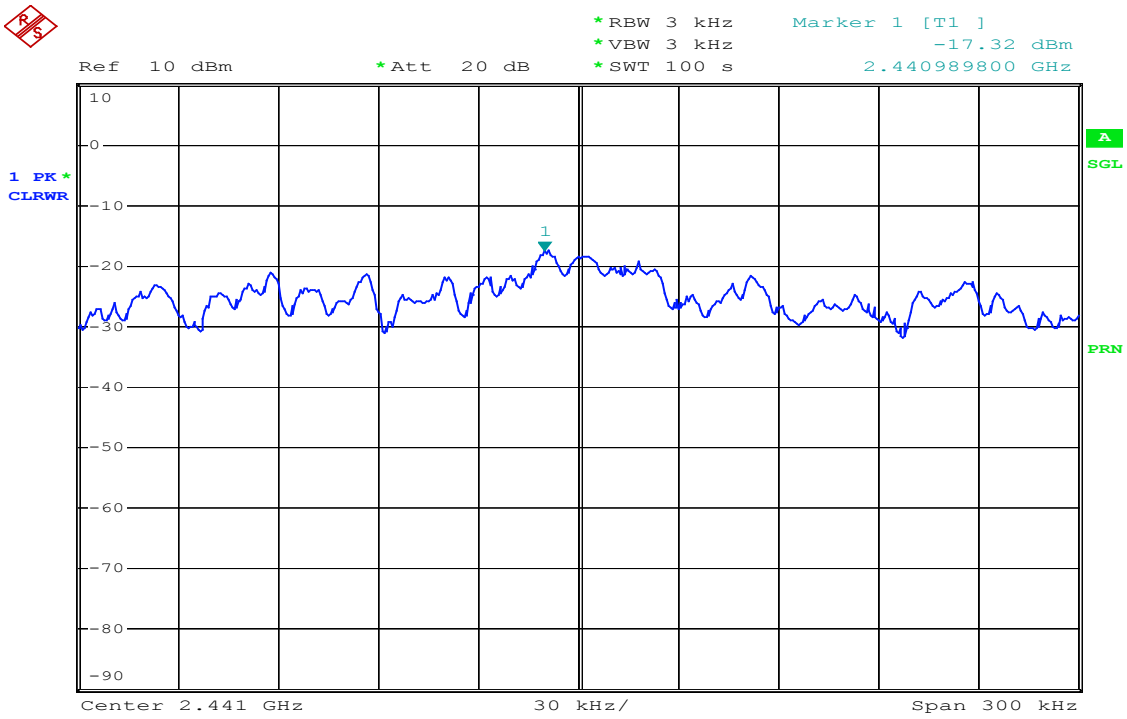
EQUIPMENT TYPE	MFR	Model No.	Serial No.	LAST CAL.	Cal. Due.
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/23/2002	07/22/2003
Plotter	HP	7475A	2938A29027	N/A	N/A
Low loss cable	Huber + Suhner	Sucoflex 104	N/A	N/A	N/A

Power Spectral Density Test Plot (CH-Low)



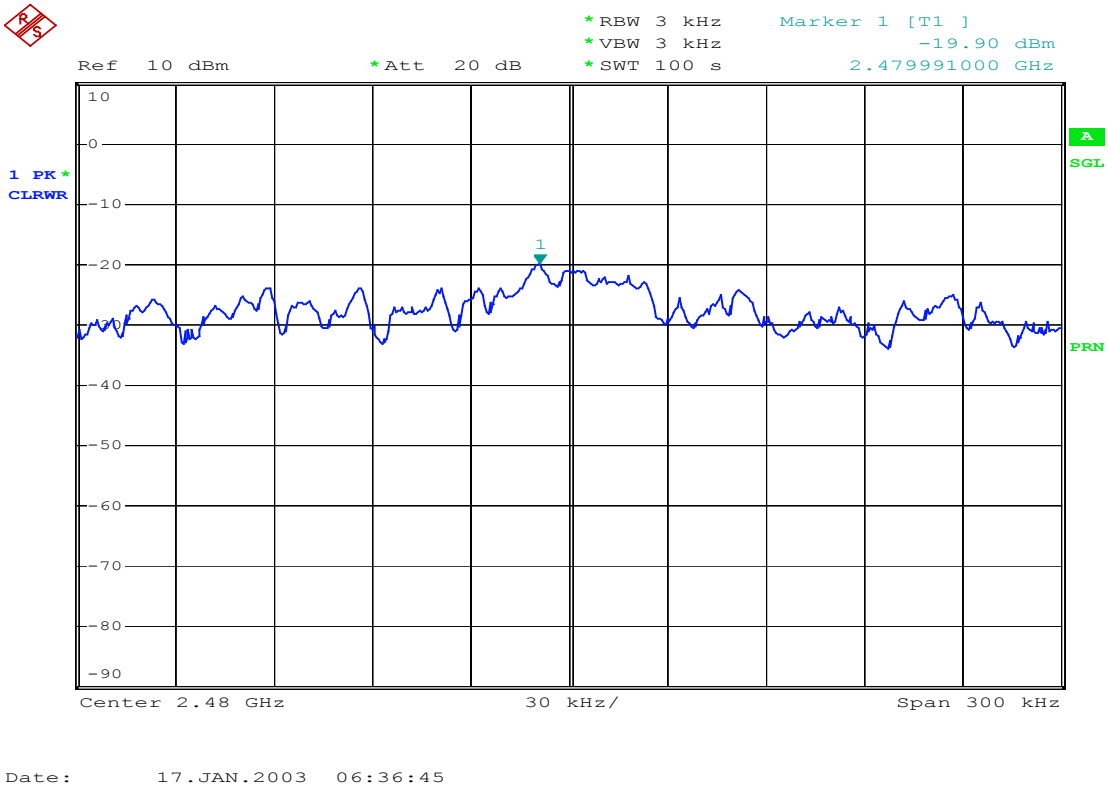
Date: 17.JAN.2003 04:09:57

Power Spectral Density Test Plot (CH-Mid)



Date: 17.JAN.2003 04:20:07

Power Spectral Density Test Plot (CH-High)



14. ANTENNA REQUIREMENT

14.1 Standard Applicable

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

And according to §15.246(1), if transmitting antennas of directional gain greater than 6dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

14.2 Antenna Connected Construction

The directional gins of antenna used for transmitting is -1 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

15. RF EXPOSURE

15.1 Standard Applicable

According to §15.247(b)(4) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This device is classed as a portable device

The Max. output power is –4.39dBm(0.568mW) at 2402MHz, which is lower than general population low threshold 60/F(60/2.480=24.19mW), The SAR is not required.