

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

*OF*

**USB Dongle**

**MODEL No.: BUS002**

**BRAND NAME: BLUEGINIE**

**FCC ID: EUNBUS002**

**REPORT NO: 020097-RF-ID**

**ISSUE DATE: Dec. 04, 2002**

*Prepared for*

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Neihu, Taipei, Taiwan, 114**

*Prepared by*

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## VERIFICATION OF COMPLIANCE

**Applicant:** First International Computer, Inc.  
No. 300, Yang Guang St.,  
Neihu, Taipei, Taiwan, 114

**Equipment Under Test:** USB Dongle

**BRAND NAME:** BLUEGINIE

**MODEL No.:** BUS002

**Serial Number:** N/A

**File Number:** 020097-RF-ID

**Date of test:** Nov. 25 ~ Dec. 2, 2002

### 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 (1992) 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*

A handwritten signature in cursive script that reads 'Vincent Su'.

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



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## 1. GENERAL INFORMATION

### 1.1 Product Description

The First International Computer, Inc. Model: BUS002 (referred to as the EUT in this report) is a USB Bluetooth transceiver.

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

C). Antenna Designation: Non-User Replaceable (Fixed)

D). Power Supply: 5Vdc via USB port of PC.

E). Receiver type: Super heterodyne

### 1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: EUNBUS002 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 2<sup>nd</sup> 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

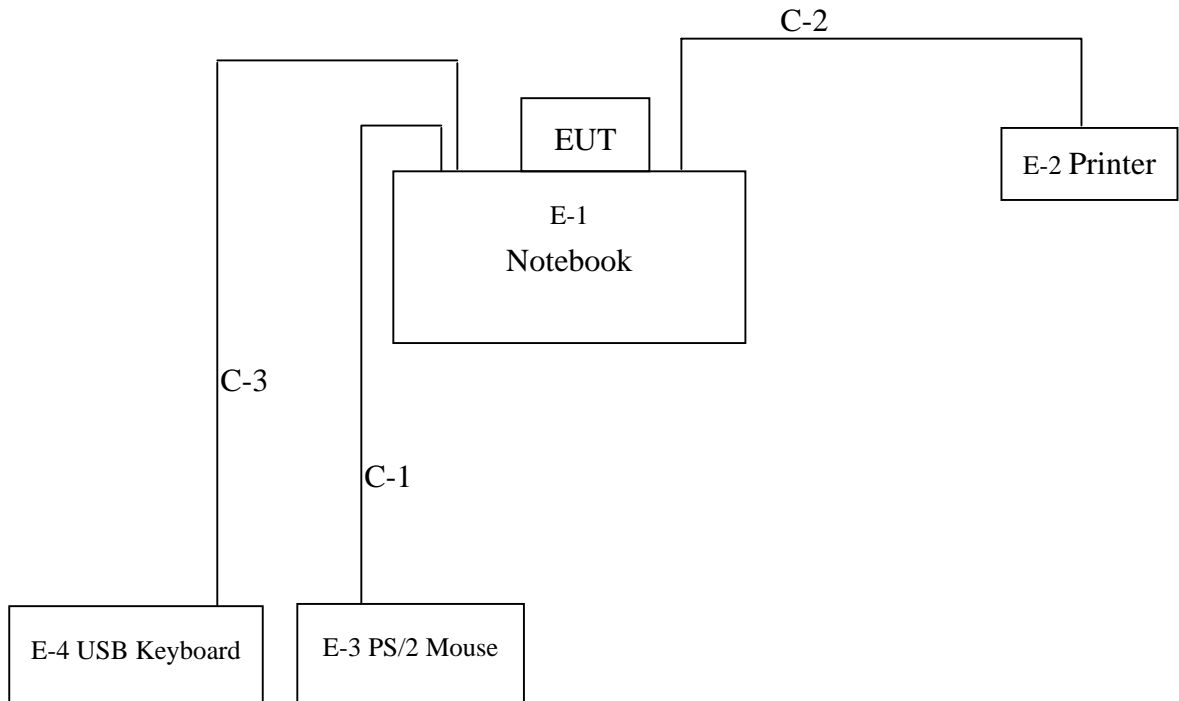


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	Note
E-1	Notebook	KDS	Valiant 6380i Ptd	DOC	SPL 0529800024	
E-2	PRINTER	HP	2225C	DOC	<b>3137S01428</b>	
E-3	PS2 MOUSE	COMPAQ	M-S34	DZL211029	113907-068	
E-4	USB- KEYBORAD	WINIC	FDA-4251	DOC	FDKB84100149	

Table 2-2 Information of Interface Cable

Item	I/O Cable	Device Connected	Shielded Type	Ferrite Core	Detachable/ Permanently	Length	Note
C-1	Mouse Cable	PC-Mouse	Yes	No	Permanently attached on Mouse	180cm	
C-2	Centronics Cable	PC-Printer	Yes	No	Part of Printer, Detachable	200cm	
C-3	Keyboard Cable	PC-Keyboard	Yes	No	Permanently attached on Keyboard	200cm	

## 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

<b>FCC Rules</b>	<b>Description Of Test</b>	<b>Result</b>
§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 (USB Dongle) has been tested under engineering mode which was used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low (2402MHz), mid (2441MHz) and high (2480MHz) with 741k highest data rate are chosen for 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 # 3					
EQUIPMENT TYPE	MFR	MODEL NO.	SERIAL NO.	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCS30	847793/012	12/19/2001	12/18/2002
LISN	R&S	ESH2-Z5	843285/010	12/10/2001	12/09/2002
LISN	EMCO	3825/2	9003-1628	07/26/2002	07/25/2003
Spectrum Analyzer	ADVANTEST	R3261C	71720533	08/06/2002	08/05/2003
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:** BUS002

**Tested by:** Robin Chen

**Test Mode:** TX + RX Normal Operating

**Detector Function:** Quasi-Peak

**Temperature:** 25<sup>0</sup>C

**Humidity:** 65%RH

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

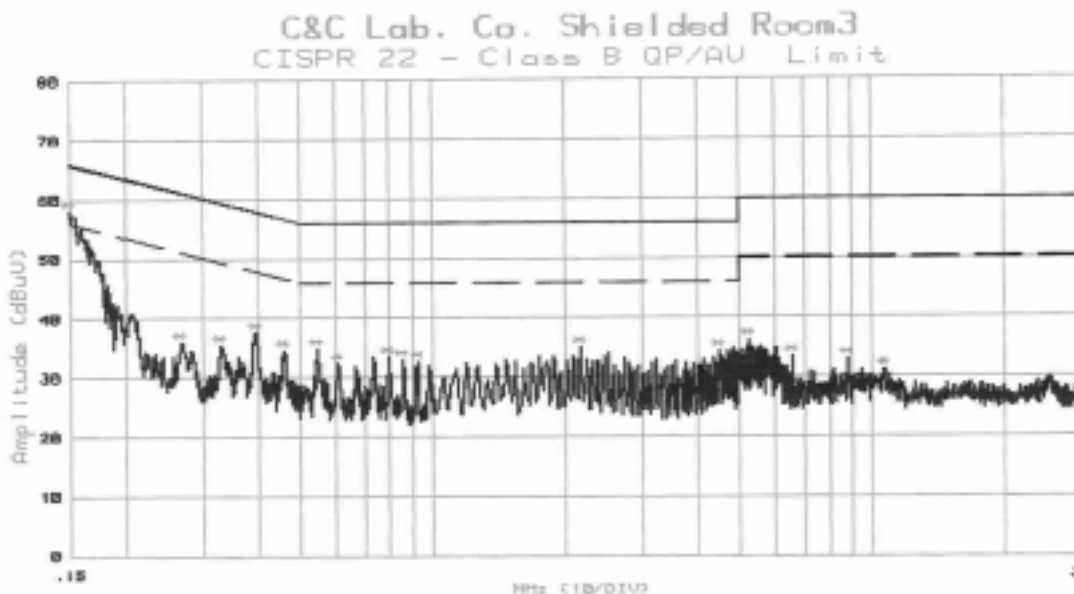
FREQ MHz	Q.P. Raw dBuV	AVG Raw dBuV	Q.P. Limit dBuV	AVG Limit dBuV	Q.P. Margin dB	AVG Margin dB	NOTE
0.150	48.60	---	66.00	56.00	-17.40	---	L1
0.269	36.00	---	61.15	51.15	-25.15	---	L1
0.331	35.40	---	59.43	49.43	-24.03	---	L1
0.397	37.60	---	57.92	47.92	-20.32	---	L1
0.461	34.60	---	56.68	46.68	-22.08	---	L1
0.549	34.80	---	56.00	46.00	-21.20	---	L1
0.152	48.50	---	65.89	55.89	-17.39	---	L2
0.272	35.20	---	61.06	51.06	-25.86	---	L2
0.334	36.20	---	59.35	49.35	-23.15	---	L2
0.403	37.80	---	57.79	47.79	-19.99	---	L2
0.463	34.00	---	56.64	46.64	-22.64	---	L2
0.554	37.40	---	56.00	46.00	-18.60	---	L2

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

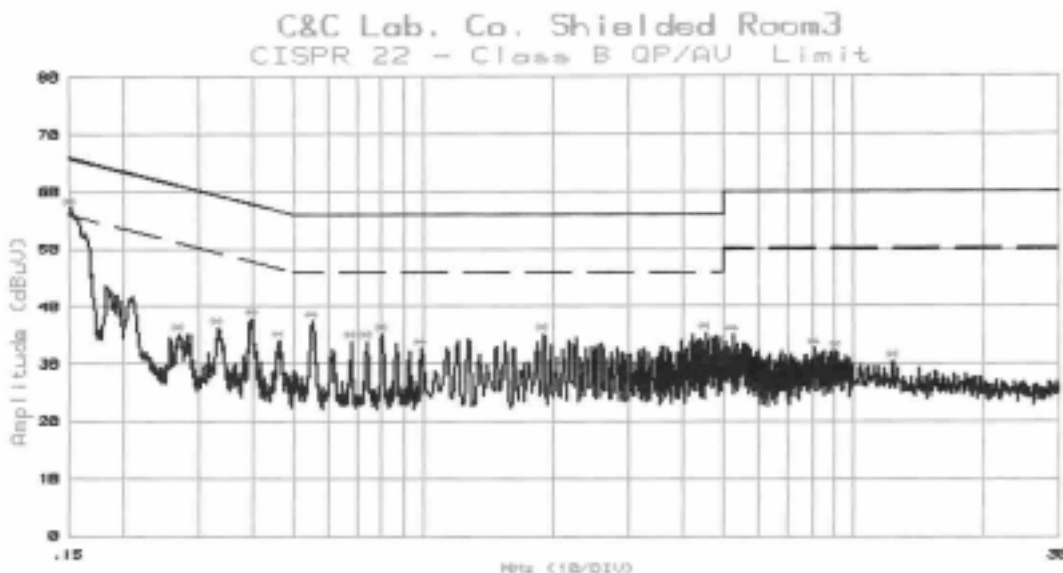
**\*\*NOTE: “---” denotes the emission level was or more than 2dB below the Average limit, so no re-check anymore.**



### Conducted Emission Test Plot



Customer:1                      File#: 70                      Date : 2 Dec 2002 09:00:30  
Model :1                          Humd.:65 (%)                  Temp. :25 (C)  
Mode :                            Port :L1                        Tested by:jean  
Reading :Peak(R3261C SPA)



Customer:1                      File#: 72                      Date : 2 Dec 2002 09:07:39  
Model :1                          Humd.:65 (%)                  Temp. :25 (C)  
Mode :                            Port :L2                        Tested by:jean  
Reading :Peak(R3261C SPA)  
Remark :

## 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

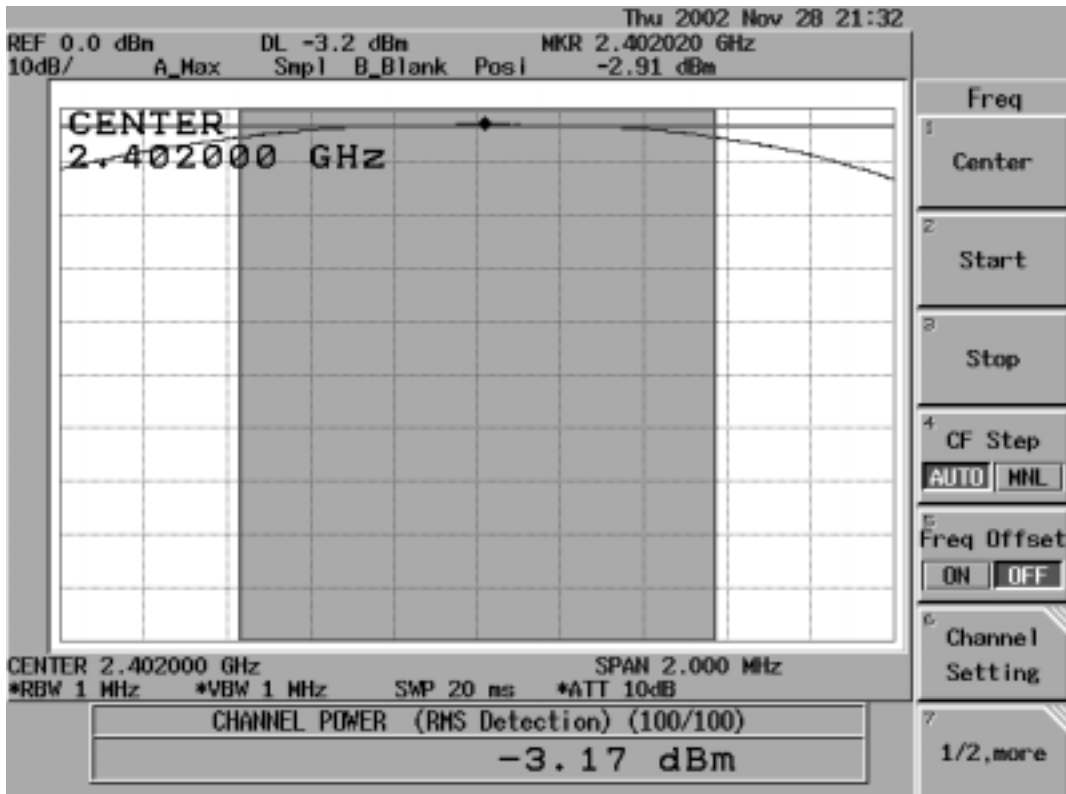
CH	Frequency (MHz)	Reading Power	Cable Loss	Output Power dBm	Output Power W	Limit (W)
LOWER	2402.00	-3.17	0.50	-2.67	0.00054	1
MID	2441.00	-2.30	0.50	-1.80	0.00066	1
HIGHER	2480.00	-1.87	0.50	-1.37	0.00073	1

### 6.4 Measurement Equipment Used:

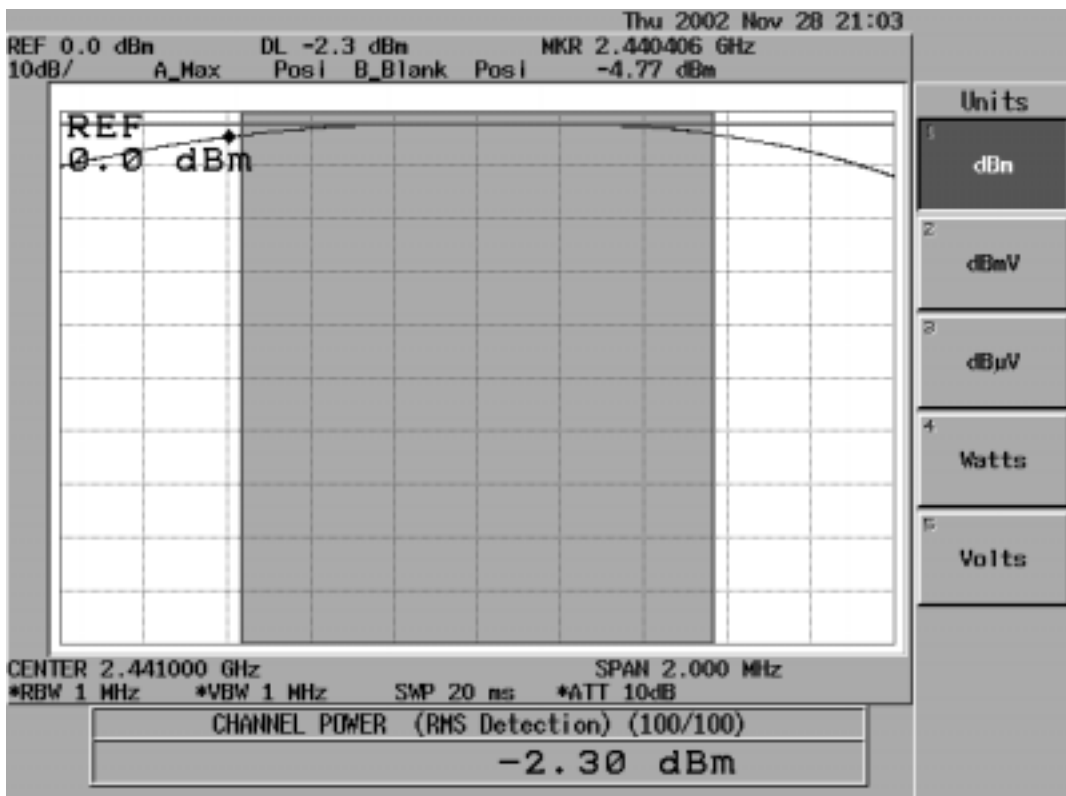
EQUIPMENT TYPE	MFR	Model No.	Serial No.	LAST CAL.	Cal. Due.
Spectrum Analyzer	Advantest	R3182	110600647	11/16/2002	11/15/2003
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/23/2002	07/22/2003
low loss cable	Huber + Suhner	Sucoflex 104	N/A	N/A	N/A



### Peak Power Output Data Plot (CH Low)

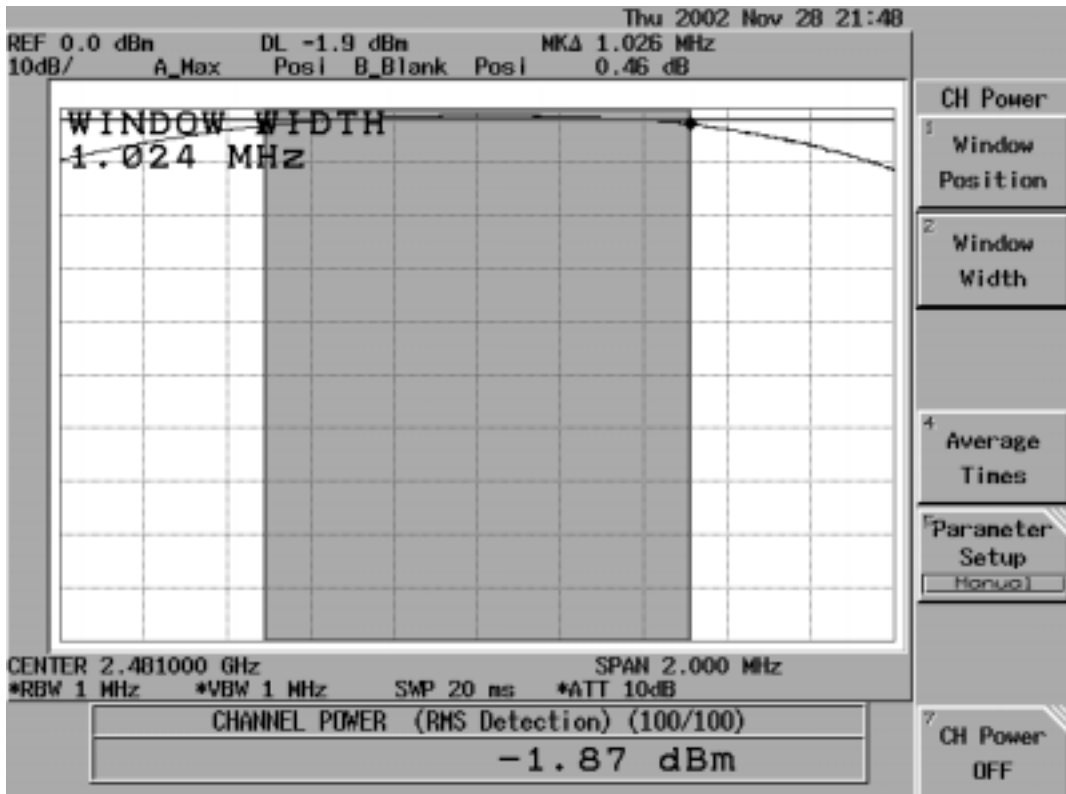


### Peak Power Output Data Plot (CH Mid)





### Peak Power Output Data Plot (CH High)





## 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	0.912	1	PASS
Mid	0.882	1	PASS
Higher	0.874	1	PASS

### 7.4 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	Model No.	Serial No.	LAST CAL.	Cal. Due.
Spectrum Analyzer	Advantest	R3182	110600647	11/16/2002	11/15/2003
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



### 20dB Band Width Test Data CH-Mid



### 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 is 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 in 15.209(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, Start = 2.3857GHz, Stop = 2.406GHz or Start = 2.4751GHz, Stop = 2.495GHz,Sweep = auto.
5. Mark Peak ,2.4GHz and 2.4835GHz and record the max. level.
6. Repeat above procedures until all frequency measured were complete.

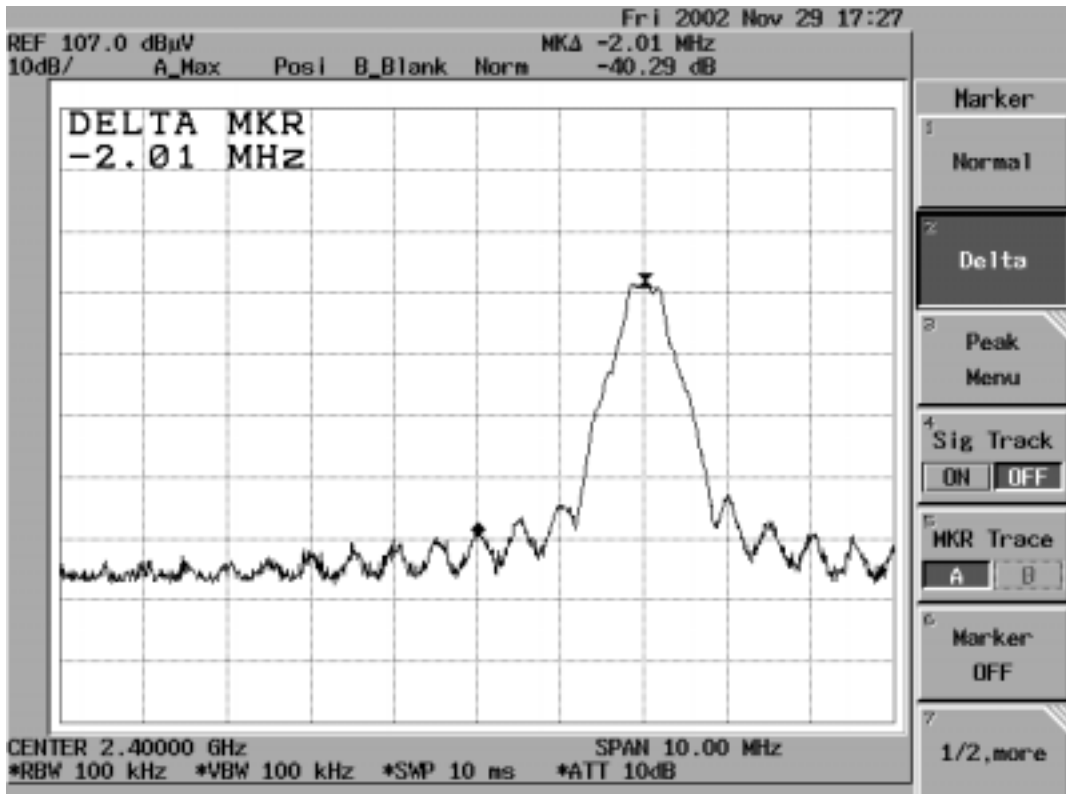
### 8.3 Measurement Result

Refer to attach spectrum analyzer data chart.

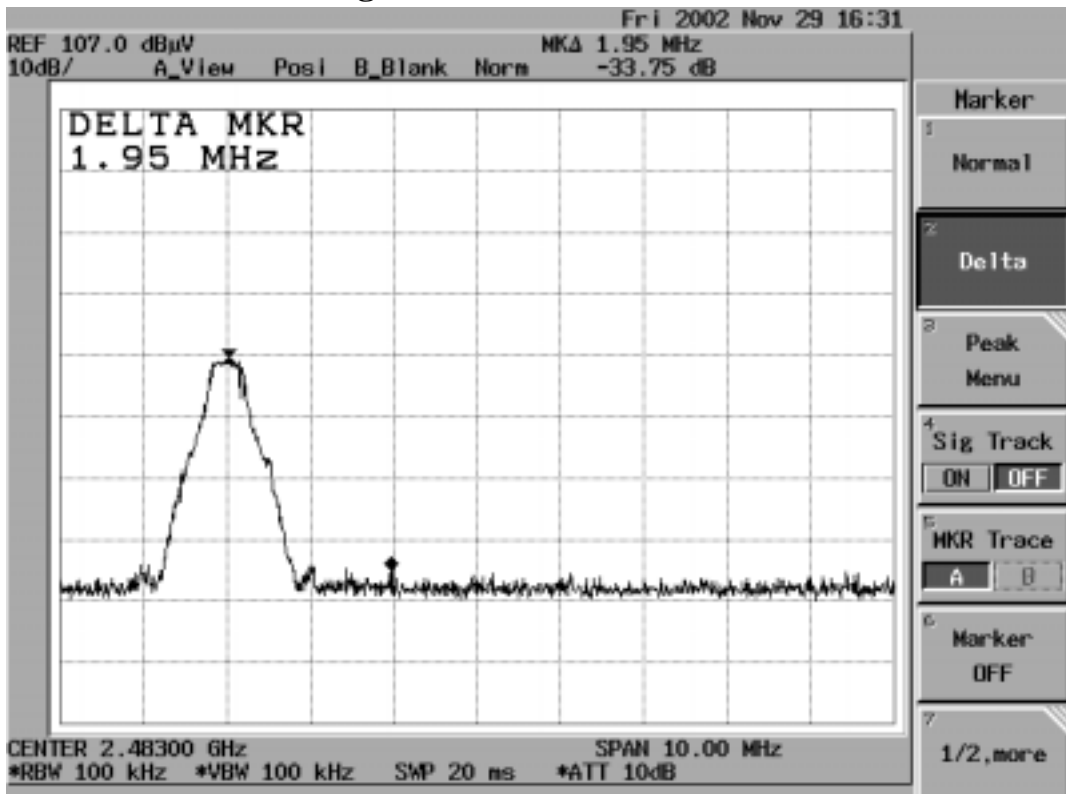
### 8.4 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	Model No.	Serial No.	LAST CAL.	Cal. Due.
Spectrum Analyzer	Advantest	R3182	110600647	11/16/2002	11/15/2003
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

### Out of Band Test Data CH-Low



### Out of Band Test Data CH-High



## 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

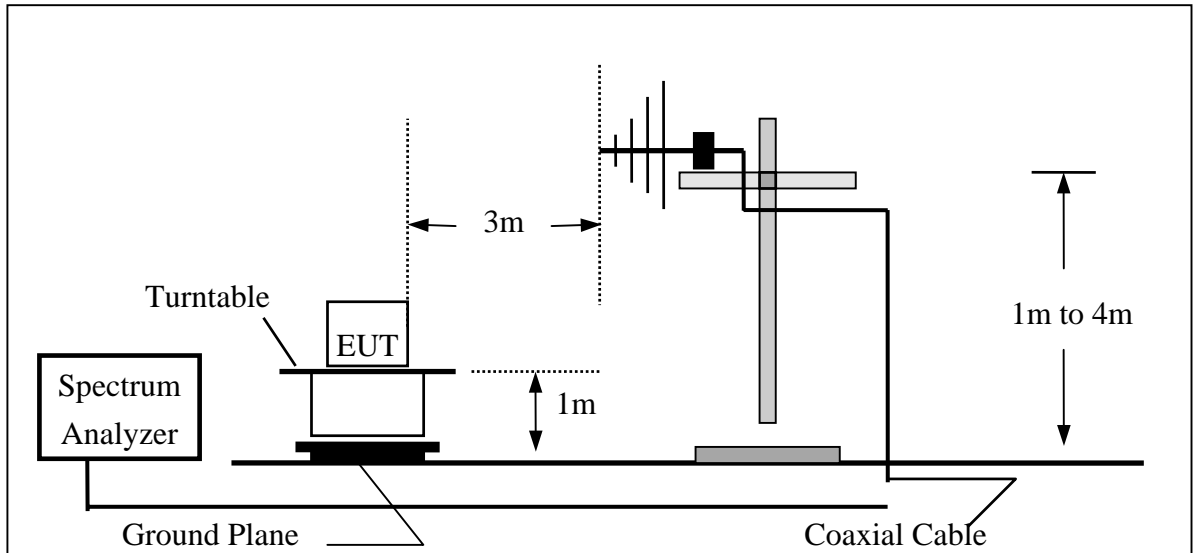
1. The radiated emission tests were performed in the 3 meter open-test site, using the setup in accordance with the ANSI C63.4-1992.
2. The EUT was put in the front of the test table. The host PC system was placed on the center of the back edge on the test table. The peripherals like modem, monitor printer, 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

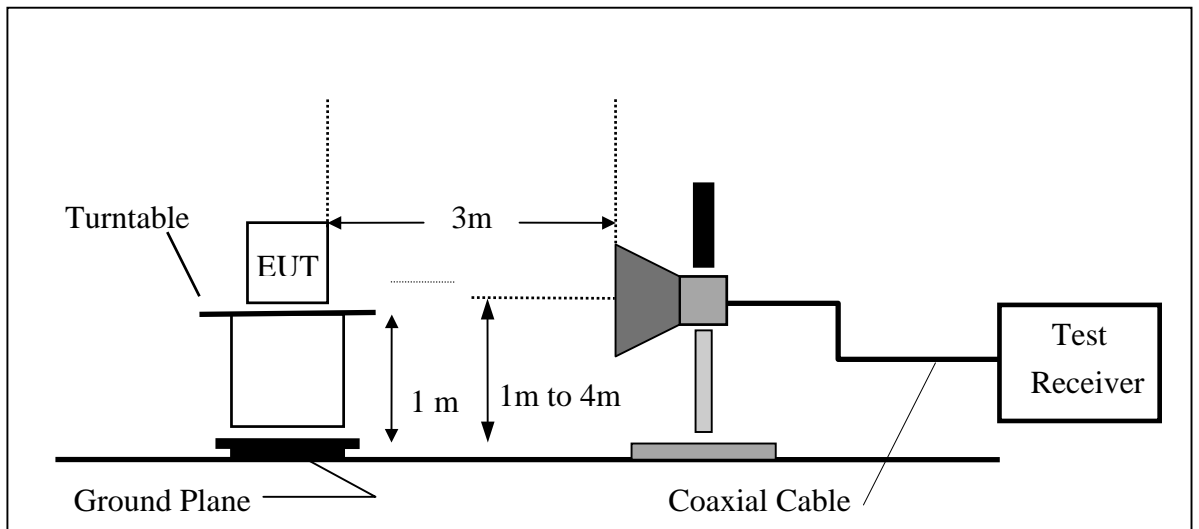
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was 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	03/19/2002	03/18/2003
Spectrum Analyzer	Advantest	R3182	110600647	11/16/2002	11/15/2003
Spectrum Analyzer	ROHDE & SCHWARZ	FSP30	100112	06/29/2002	06/28/2003
EMI Test Receiver	R&S	ESVS20	838804/004	01/05/2002	01/04/2003
Pre-Amplifier	HP	8447D	2944A09173	03/04/2002	03/03/2003
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	11/17/2002	11/16/2003
Horn antenna	Schwarzbeck	BBHA 9120	D210	2/24/2002	2/23/2003
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.

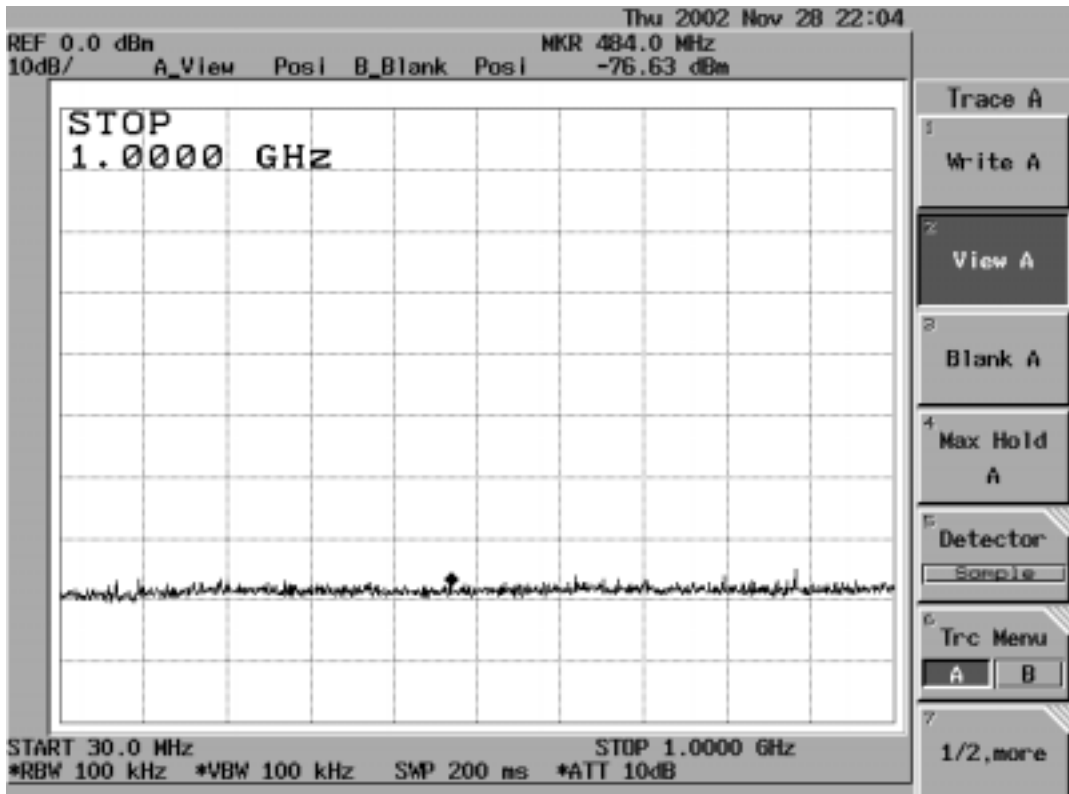
**NOTE:**

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.

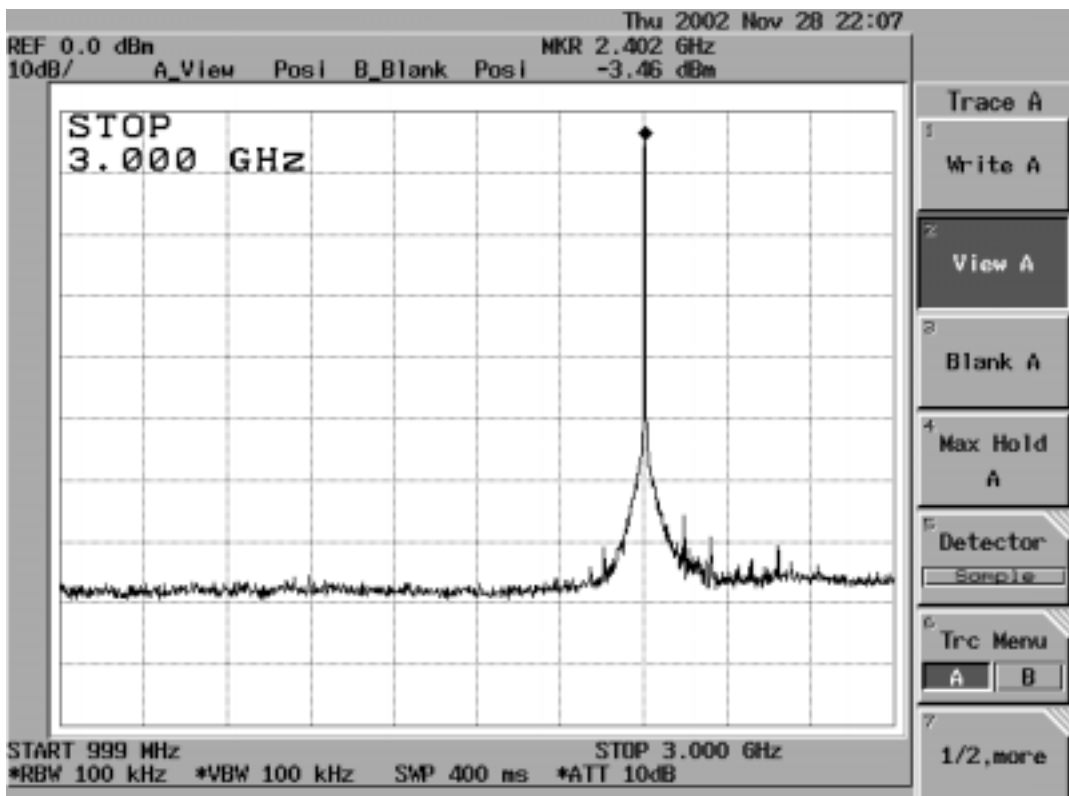


# Conducted Spurious Emission Measurement Result

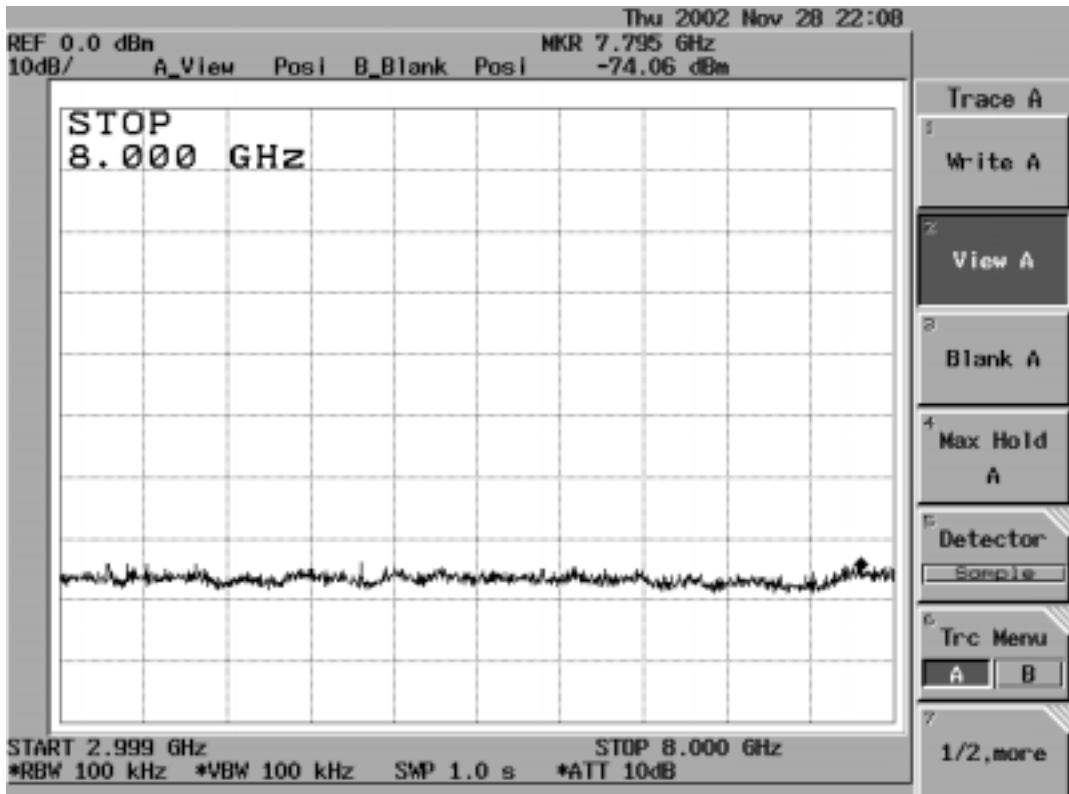
## CH Low 30MHz – 1GHz



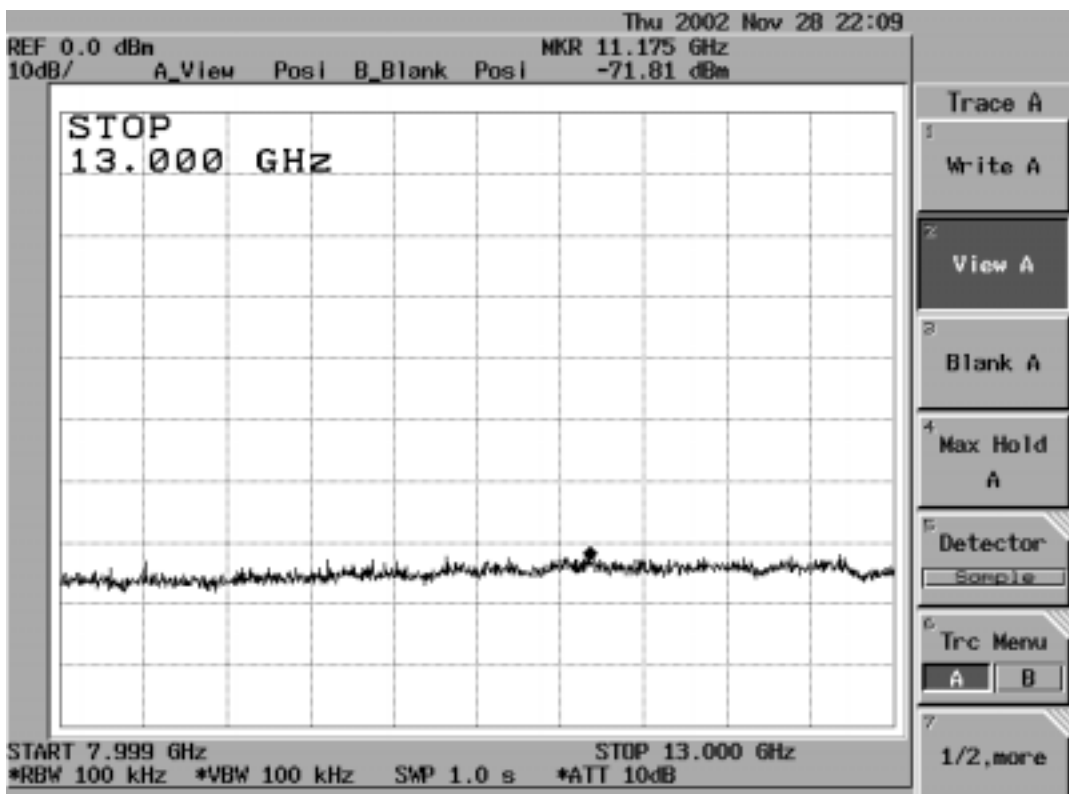
## CH Low 1GHz- 3GHz



### CH Low 3GHz – 8GHz

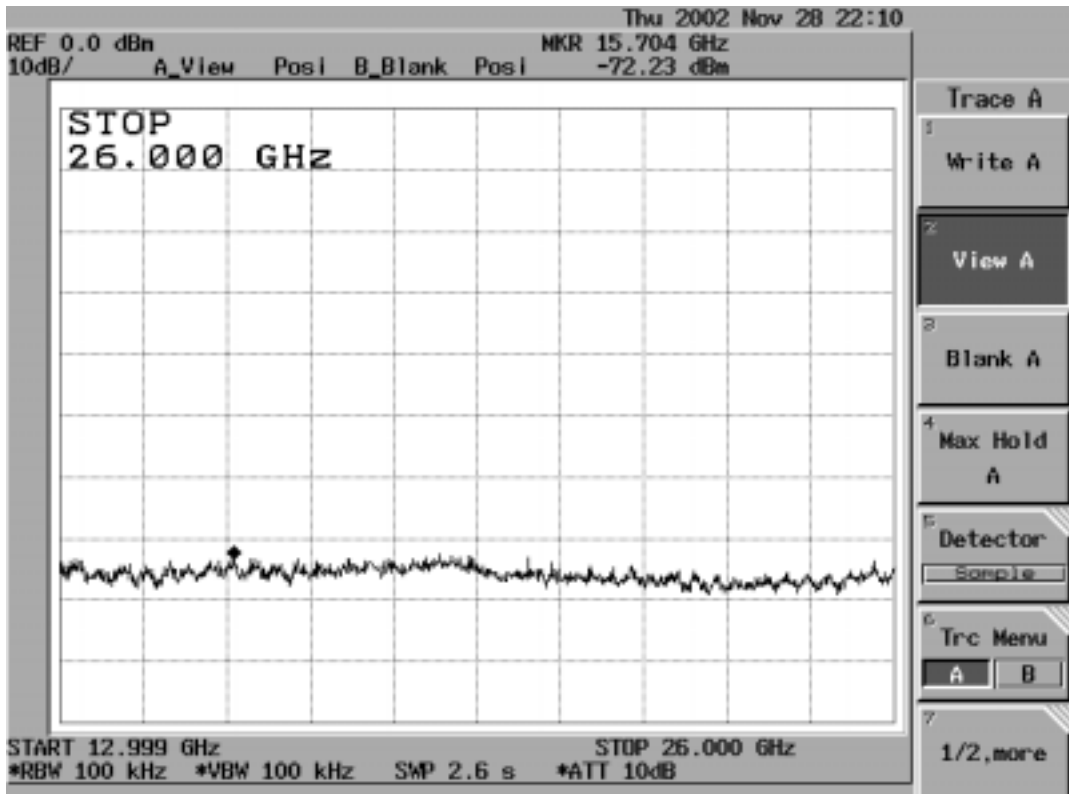


### CH Low 8GHz- 13GHz

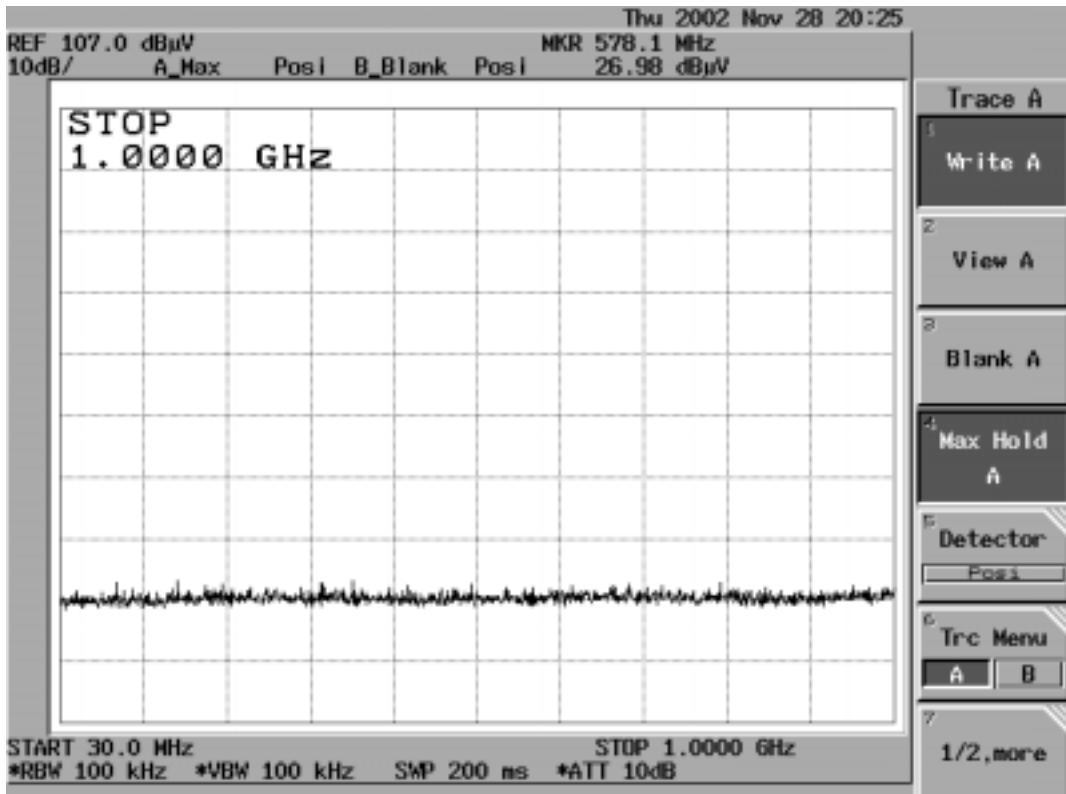




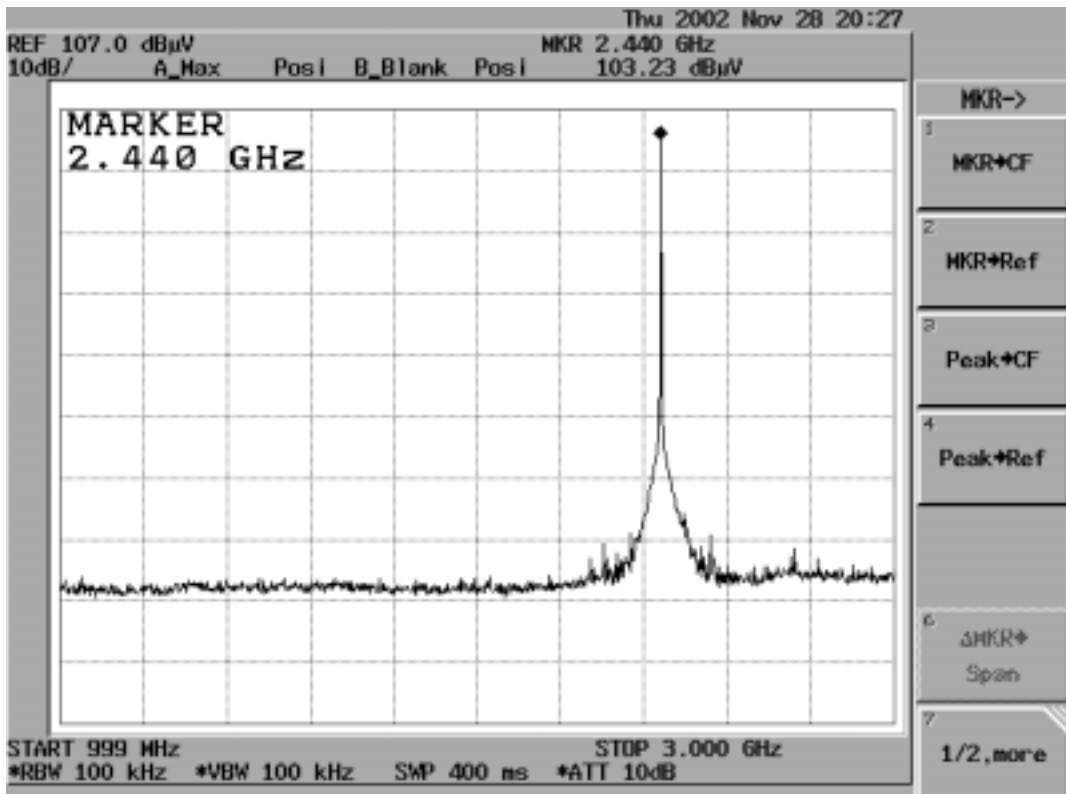
### CH Low 13GHz – 26GHz



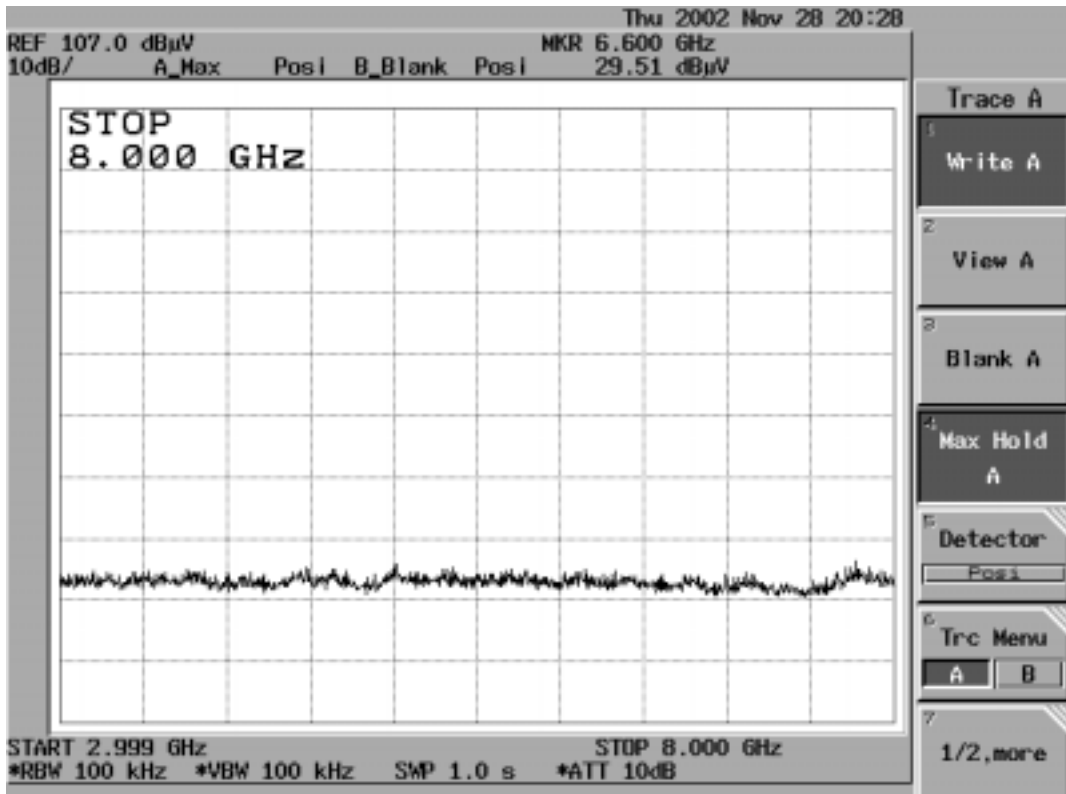
### CH Mid 30MHz – 1GHz



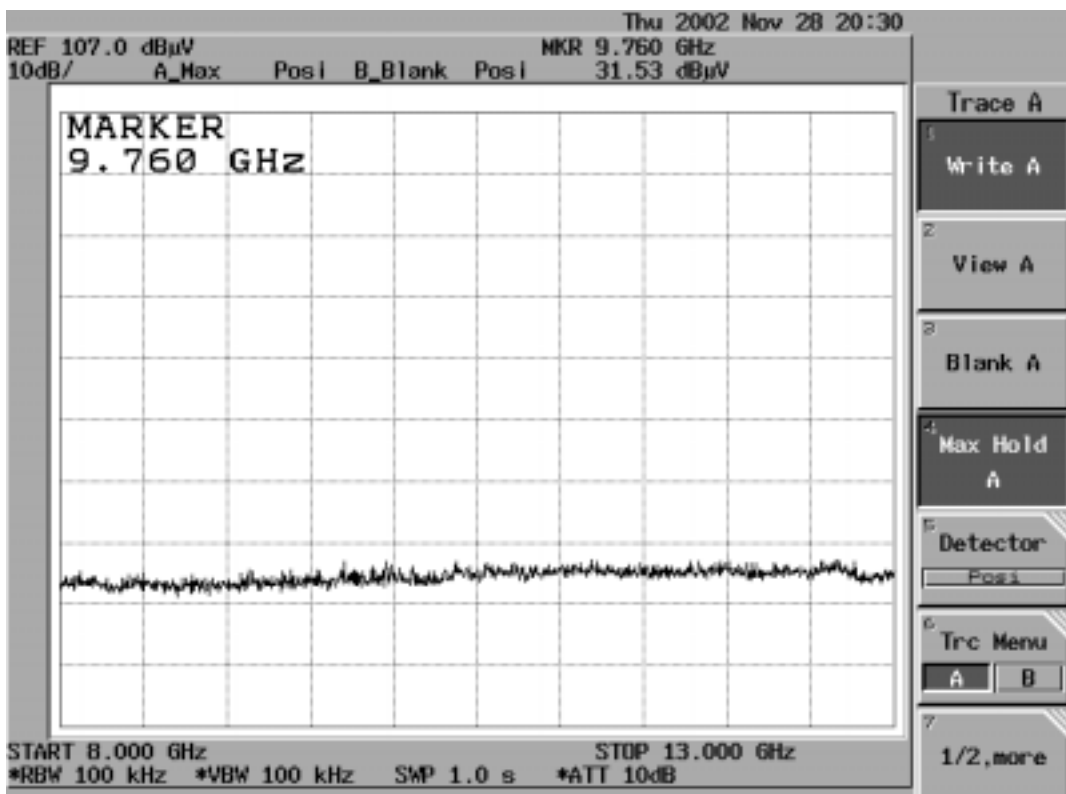
### CH Mid 1GHz- 3GHz



### CH Mid 3GHz – 8GHz

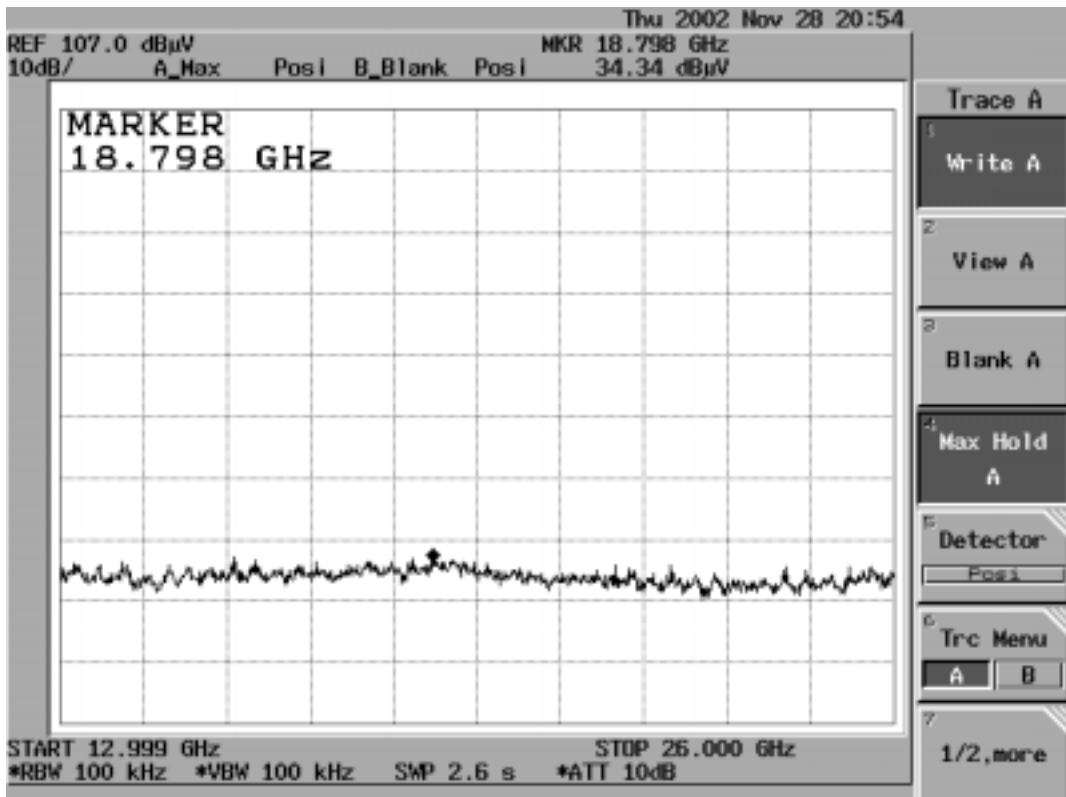


### CH Mid 8GHz- 13GHz

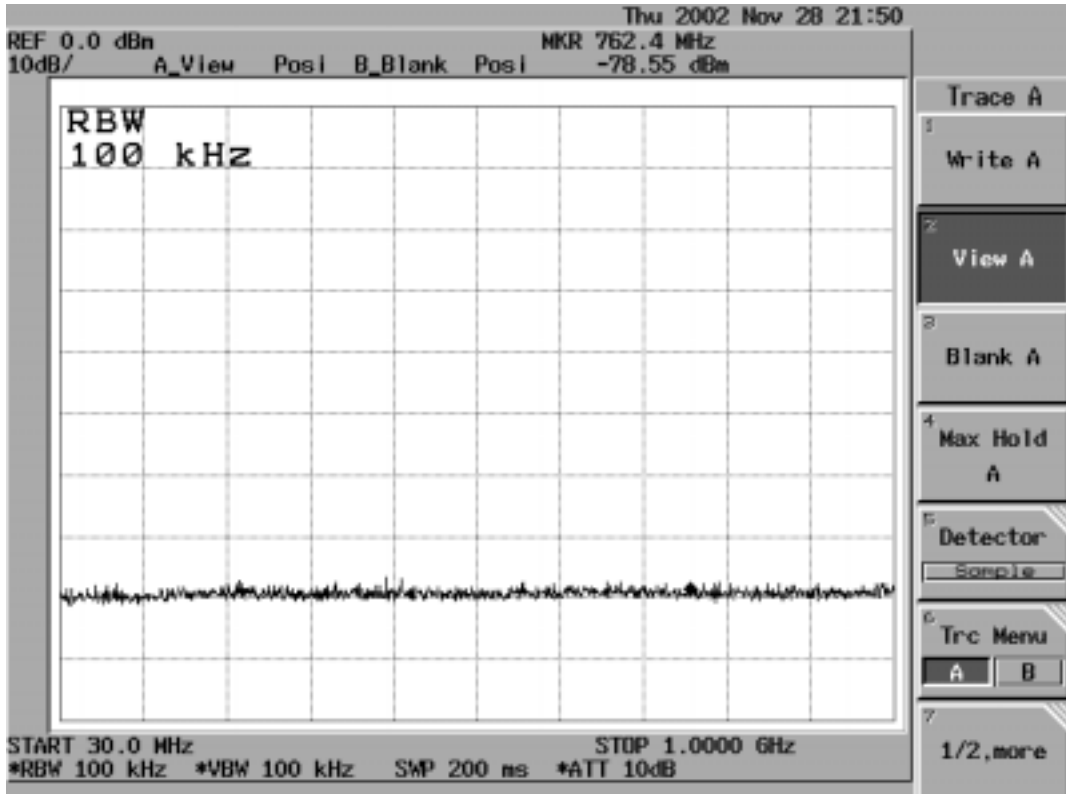




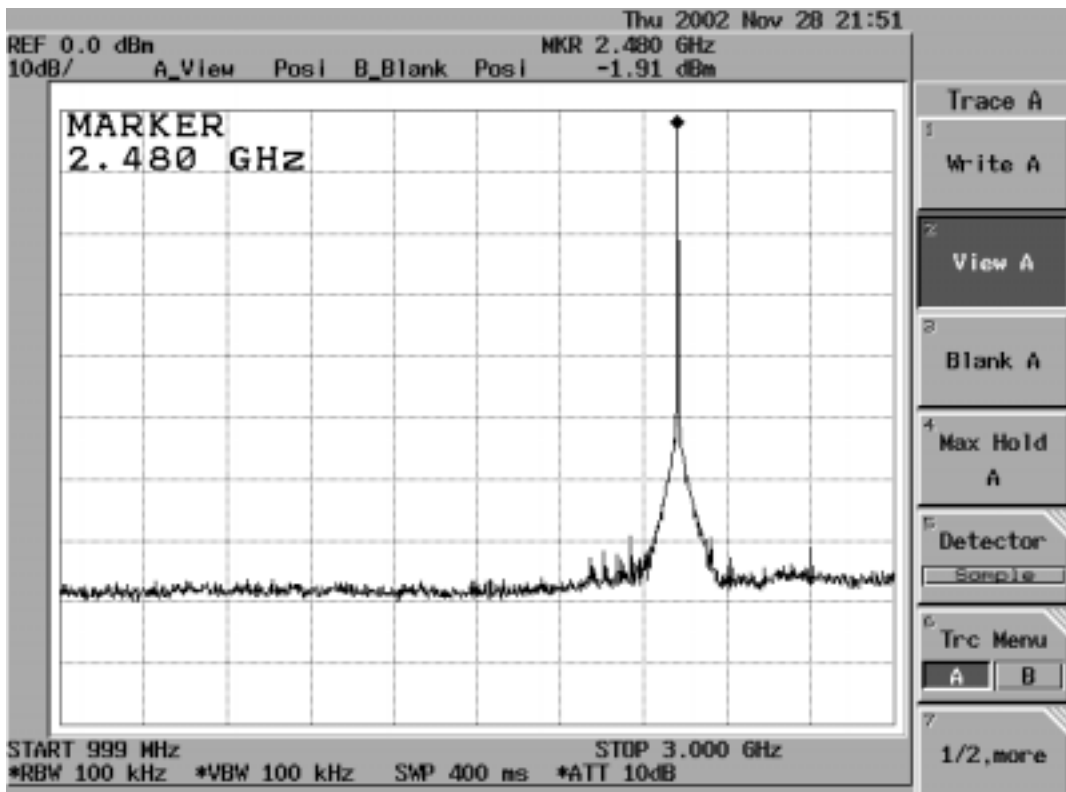
### CH Mid 13GHz – 26GHz



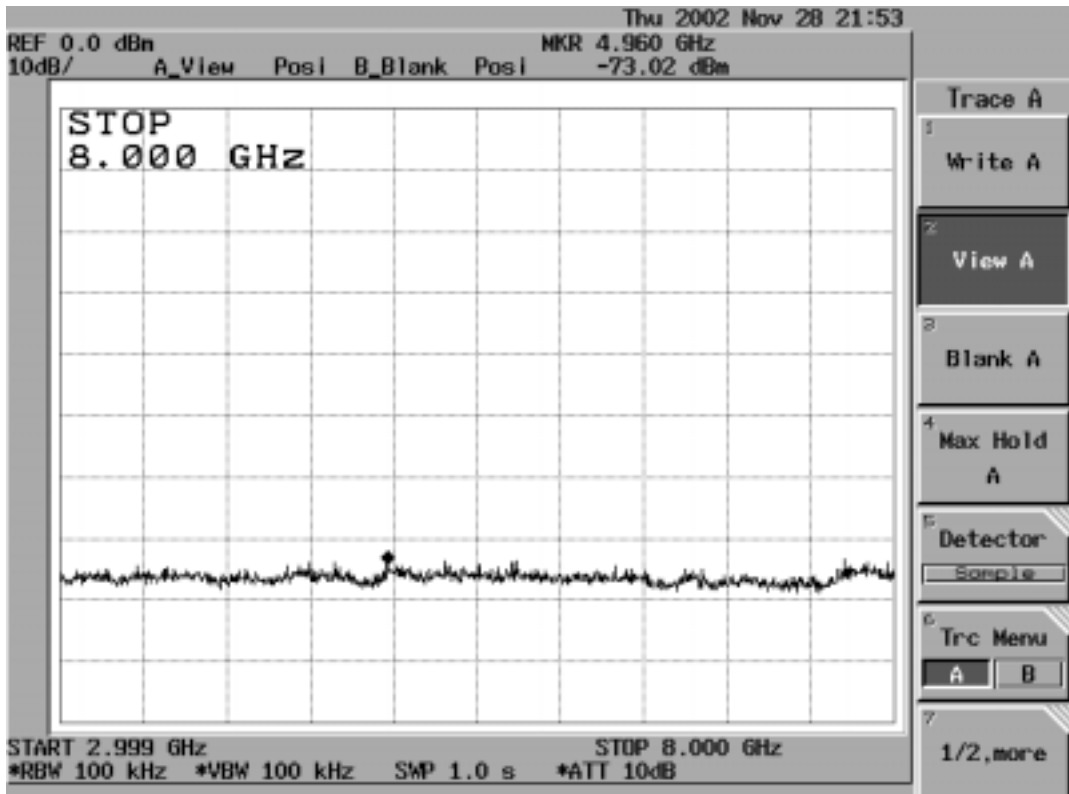
### CH High 30MHz – 1GHz



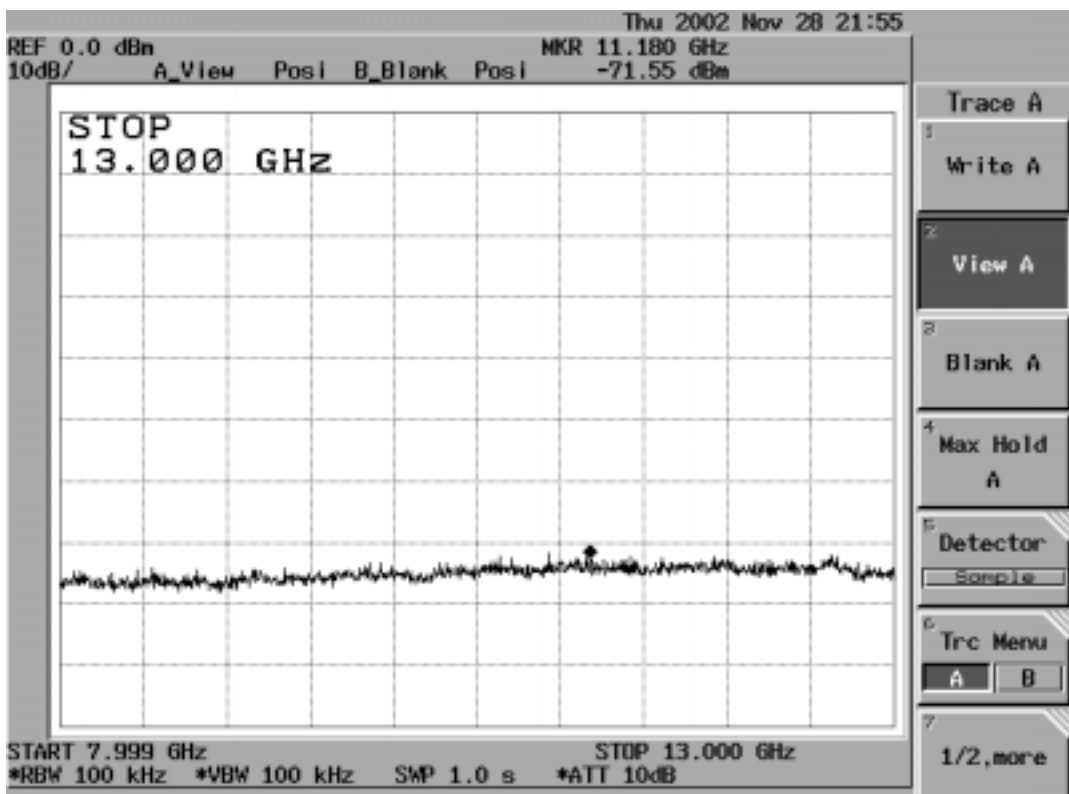
### CH High 1GHz- 3GHz



### CH High 3GHz – 8GHz



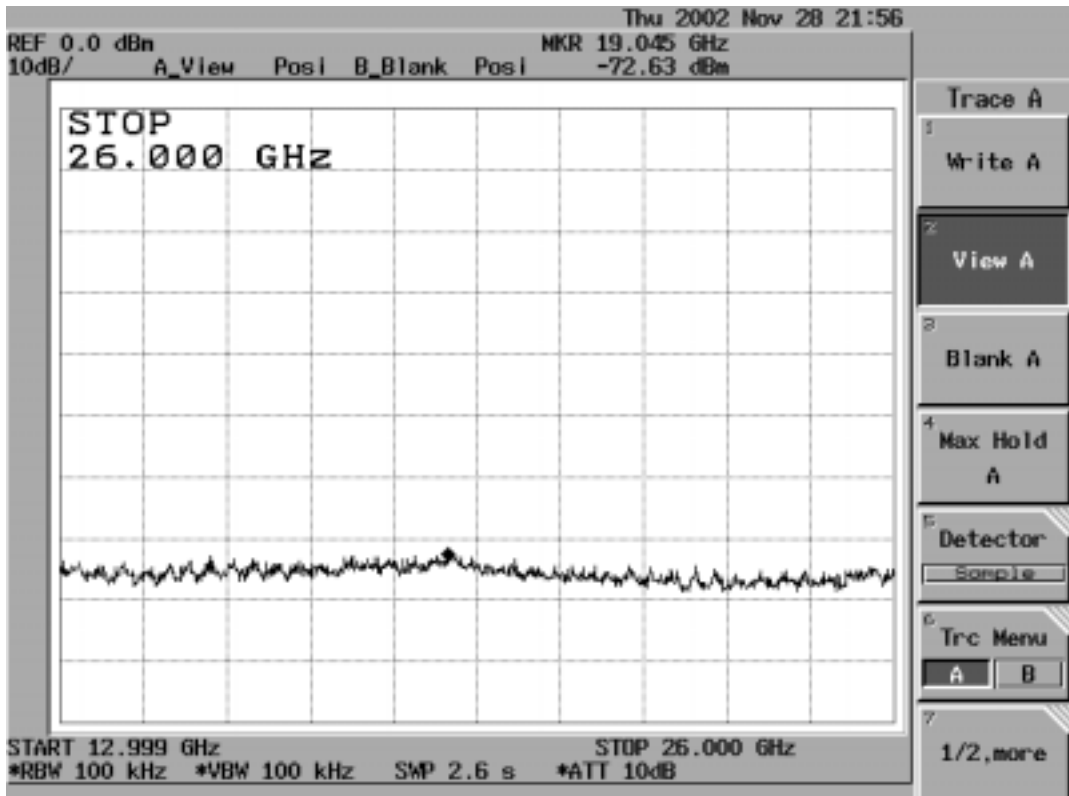
### CH High 8GHz- 13GHz







### CH High 13GHz – 26GHz



**Radiated Spurious Emission Measurement Result (below 1GHz)**

Operation Mode: TX CH Low Mode  
 Fundamental Frequency: 2402MHz  
 Temperature : 23  
 Humidity : 65 %

Test Date : Nov. 26, 2002  
 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)
229.80	V	Peak	17.87	15.51	33.38	46.00	-12.62
398.00	V	Peak	21.3	16.05	37.35	46.00	-8.65
596.80	V	Peak	10.72	25.3	36.02	46.00	-9.98
715.80	V	Peak	10.08	25.8	35.88	46.00	-10.12
731.20	V	Peak	9.83	25.84	35.67	46.00	-10.33
931.40	V	Peak	8.65	28.6	37.25	46.00	-8.75
280.56	H	Peak	16.62	15.93	32.55	46.00	-13.45
398.00	H	Peak	19.41	20.61	40.02	46.00	-5.98
463.80	H	Peak	10.78	20.82	31.6	46.00	-14.40
479.20	H	Peak	12.53	21.54	34.07	46.00	-11.93
666.80	H	Peak	8.76	25.18	33.94	46.00	-12.06
734.00	H	Peak	9.18	25.84	35.02	46.00	-10.98

## 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 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 Mode  
 Fundamental Frequency: 2442MHz  
 Temperature : 23  
 Humidity : 65 %

Test Date : Nov. 26, 2002  
 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)
196.86	V	Peak	17.54	14.61	32.15	43.50	-11.35
232.50	V	Peak	21.02	15.62	36.64	46.00	-9.36
396.60	V	Peak	14.46	20.54	35	46.00	-11.00
729.80	V	Peak	11.38	25.84	37.22	46.00	-8.78
748.00	V	Peak	10.53	25.88	36.41	46.00	-9.59
928.60	V	Peak	9.14	28.56	37.7	46.00	-8.30
246.00	H	Peak	16.14	16.15	32.29	46.00	-13.71
396.60	H	Peak	19.12	19.12	20.54	46.00	-25.46
431.60	H	Peak	11.87	11.87	20.37	46.00	-25.63
463.80	H	Peak	12.5	11.45	20.82	46.00	-25.18
479.20	H	Peak	10.93	12.98	21.54	46.00	-24.46
734.00	H	Peak	11.21	9.97	25.84	46.00	-20.16

## 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 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 Mode  
 Fundamental Frequency: 2480MHz  
 Temperature : 23  
 Humidity : 65 %

Test Date : Nov. 26, 2002  
 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)
195.78	V	Peak	15.76	14.5	30.26	43.50	-13.24
396.60	V	Peak	16.53	20.54	37.07	46.00	-8.93
463.80	V	Peak	14.64	20.82	35.46	46.00	-10.54
596.80	V	Peak	11.16	25.3	36.46	46.00	-9.54
662.60	V	Peak	9.87	25.1	34.97	46.00	-11.03
731.20	V	Peak	10.29	25.84	36.13	46.00	-9.87
200.10	H	Peak	11.63	14.92	26.55	43.50	-16.95
396.60	H	Peak	20.37	20.54	40.91	46.00	-5.09
433.00	H	Peak	13.67	20.36	34.03	46.00	-11.97
463.80	H	Peak	13.91	20.82	34.73	46.00	-11.27
662.60	H	Peak	8.93	25.1	34.03	46.00	-11.97
732.60	H	Peak	8.91	25.84	34.75	46.00	-11.25

**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 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.



**Measurement Result (above 1GHz)**

Operation Mode: TX Mode  
 Fundamental Frequency: CH Low  
 Temperature : 30  
 Humidity : 55%

Test Date : 11/26/2002  
 Test By: Robin  
 Pol: VERTICAL

Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Ant./CL CF(dB)	Actual FS		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	
				Peak (dBuV/m)	AV (dBuV/m)				
1196.0	53.50		-10.53	42.97		74.00	54.00	-11.03	Peak
1464.0	54.47		-9.60	44.87		74.00	54.00	-9.13	Peak
1596.0	51.46		-8.89	42.57		74.00	54.00	-11.43	Peak
1732.0	54.63		-8.53	46.10		74.00	54.00	-7.90	Peak
1864.0	54.10		-8.13	45.97		74.00	54.00	-8.03	Peak
2268.0	49.08		-6.58	42.50		74.00	54.00	-11.50	Peak
4804	49.00		-0.15	48.85		74.00	54.00	-5.15	Peak
7206	--					74.00	54.00		
9608	--					74.00	54.00		
12010	--					74.00	54.00		
14412	--					74.00	54.00		
16814	--					74.00	54.00		
19216	--					74.00	54.00		
21618	--					74.00	54.00		
24020	--					74.00	54.00		

Remark :

- (1) Measuring frequencies from 1 GHz 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 Setting 1GHz- 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time= 200 ms.



Operation Mode: TX Mode  
 Fundamental Frequency: CH Low  
 Temperature : 30  
 Humidity : 55%

Test Date : 11/26/2002  
 Test By: Robin  
 Pol: HORIZONTAL

Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Ant./CL CF(dB)	Actual FS		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)
				Peak (dBuV/m)	AV (dBuV/m)			
1132.0	53.20		-10.92	42.28		74.00	54.00	-11.72 Peak
1260.0	50.05		-10.36	39.69		74.00	54.00	-14.31 Peak
1592.0	49.13		-8.91	40.22		74.00	54.00	-13.78 Peak
1860.0	50.69		-8.14	42.55		74.00	54.00	-11.45 Peak
1996.0	48.34		-7.61	40.73		74.00	54.00	-13.27 Peak
2132.0	50.47		-7.10	43.37		74.00	54.00	-10.63 Peak
4804	--					74.00	54.00	
7206	--					74.00	54.00	
9608	--					74.00	54.00	
12010	--					74.00	54.00	
14412	--					74.00	54.00	
16814	--					74.00	54.00	
19216	--					74.00	54.00	
21618	--					74.00	54.00	
24020	--					74.00	54.00	

Remark :

- (1) Measuring frequencies from 1 GHz 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 Setting 1GHz- 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time= 200 ms.



Operation Mode: TX Mode  
 Fundamental Frequency: CH Mid  
 Temperature : 30  
 Humidity : 55%

Test Date : 11/26/2002  
 Test By: Robin  
 Pol: VERTICAL

Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Ant./CL CF(dB)	Actual FS		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	
				Peak (dBuV/m)	AV (dBuV/m)				
1128.0	53.60		-10.94	42.66		74.00	54.00	-11.34	Peak
1196.0	53.23		-10.53	42.70		74.00	54.00	-11.30	Peak
1328.0	50.38		-10.18	40.20		74.00	54.00	-13.80	Peak
1464.0	55.16		-9.60	45.56		74.00	54.00	-8.44	Peak
1596.0	50.40		-8.89	41.51		74.00	54.00	-12.49	Peak
1728.0	53.69		-8.54	45.15		74.00	54.00	-8.85	Peak
1988.0	51.42		-7.64	43.78		74.00	54.00	-10.22	Peak
4882	49.00		0.01	49.01		74.00	54.00	-4.99	Peak
7323	--					74.00	54.00		
9764	--					74.00	54.00		
12205	--					74.00	54.00		
14646	--					74.00	54.00		
17087	--					74.00	54.00		
19528	--					74.00	54.00		
21969	--					74.00	54.00		
24410	--					74.00	54.00		

Remark :

- (1) Measuring frequencies from 1 GHz 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 Setting 1GHz- 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time= 200 ms.



Operation Mode: TX Mode  
 Fundamental Frequency: CH Mid  
 Temperature : 30  
 Humidity : 55%

Test Date : 11/26/2002  
 Test By: Robin  
 Pol: HORIZONTAL

Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Ant./CL CF(dB)	Actual FS		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)
				Peak (dBuV/m)	AV (dBuV/m)			
1260.0	51.64		-10.36	41.28		74.00	54.00	-12.72 Peak
1332.0	49.55		-10.16	39.39		74.00	54.00	-14.61 Peak
1592.0	49.78		-8.91	40.87		74.00	54.00	-13.13 Peak
1860.0	51.72		-8.14	43.58		74.00	54.00	-10.42 Peak
2132.0	50.37		-7.10	43.27		74.00	54.00	-10.73 Peak
2260.0	48.11		-6.61	41.50		74.00	54.00	-12.50 Peak
4882	--					74.00	54.00	
7323	--					74.00	54.00	
9764	--					74.00	54.00	
12205	--					74.00	54.00	
14646	--					74.00	54.00	
17087	--					74.00	54.00	
19528	--					74.00	54.00	
21969	--					74.00	54.00	
24410	--					74.00	54.00	

Remark :

- (1) Measuring frequencies from 1 GHz 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 Setting 1GHz- 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time= 200 ms.





Operation Mode: TX Mode  
 Fundamental Frequency: CH High  
 Temperature : 30  
 Humidity : 55%

Test Date : 11/26/2002  
 Test By: Robin  
 Pol: VERTICAL

Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Ant./CL CF(dB)	Actual FS		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	
				Peak (dBuV/m)	AV (dBuV/m)				
1096.0	51.84		-11.14	40.70		74.00	54.00	-13.30	Peak
1328.0	52.26		-10.18	42.08		74.00	54.00	-11.92	Peak
1596.0	51.43		-8.89	42.54		74.00	54.00	-11.46	Peak
1860.0	56.01		-8.14	47.87		74.00	54.00	-6.13	Peak
4960	47.00		0.18	47.18		74.00	54.00	-6.82	Peak
7440	--					74.00	54.00		
9920	--					74.00	54.00		
12400	--					74.00	54.00		
14880	--					74.00	54.00		
17360	--					74.00	54.00		
19840	--					74.00	54.00		
22320	--					74.00	54.00		
24800	--					74.00	54.00		

Remark :

- (1) Measuring frequencies from 1 GHz 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 Setting 1GHz- 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time= 200 ms.



Operation Mode: TX Mode  
 Fundamental Frequency: CH High  
 Temperature : 30  
 Humidity : 55%

Test Date : 11/26/2002  
 Test By: Robin  
 Pol: HORIZONTAL

Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Ant./CL CF(dB)	Actual FS		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)
				Peak (dBuV/m)	AV (dBuV/m)			
1196.0	53.42		-10.53	42.89		74.00	54.00	-11.11
1332.0	51.26		-10.16	41.10		74.00	54.00	-12.90
1464.0	53.03		-9.60	43.43		74.00	54.00	-10.57
1592.0	50.14		-8.91	41.23		74.00	54.00	-12.77
1860.0	51.79		-8.14	43.65		74.00	54.00	-10.35
2124.0	50.48		-7.13	43.35		74.00	54.00	-10.65
4960	--					74.00	54.00	
7440	--					74.00	54.00	
9920	--					74.00	54.00	
12400	--					74.00	54.00	
14880	--					74.00	54.00	
17360	--					74.00	54.00	
19840	--					74.00	54.00	
22320	--					74.00	54.00	
24800	--					74.00	54.00	

Remark :

- (1) Measuring frequencies from 1 GHz 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 Setting 1GHz- 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time= 200 ms.

## 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 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=100KHz, Adjust Span to 3.5 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	
1.03	$\geq 25 / 20$ dB Bandwidth	PASS

### 10.4 Measurement Equipment Used:

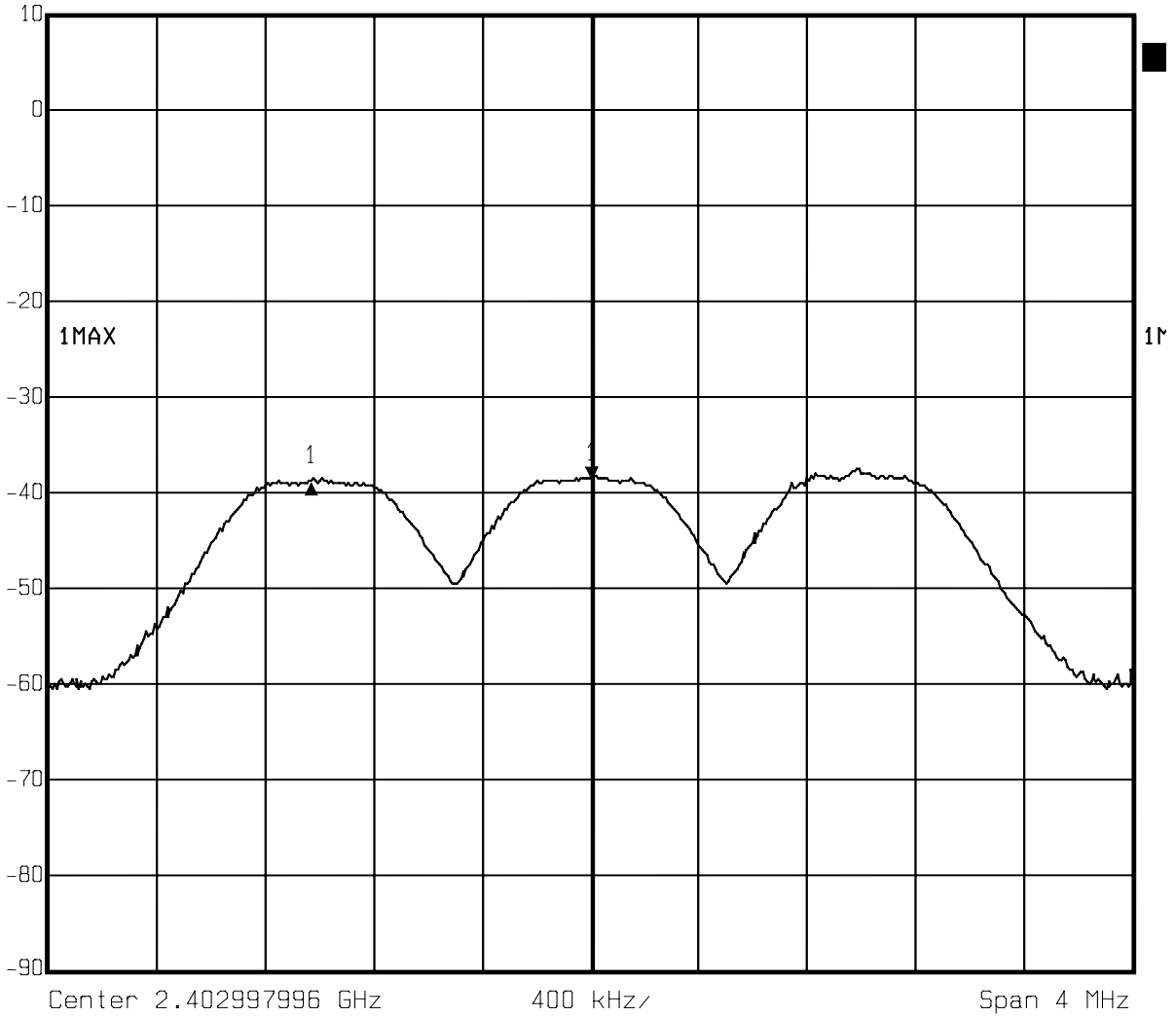
EQUIPMENT TYPE	MFR	Model No.	Serial No.	LAST CAL.	Cal. Due.
Spectrum Analyzer	Advantest	R3182	110600647	11/16/2002	11/15/2003
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/23/2002	07/22/2003
low loss cable	Huber + Suhner	Sucoflex 104	N/A	N/A	N/A



### Frequency Separation Test Data



Delta 1 [T1]	RBW	300 kHz	RF Att	30 dB
Ref Lvl	-0.26 dB	VBW	100 kHz	
10 dBm	-1.03006012 MHz	SWT	35 ms	Unit dBm



Date: 29.NOV.2002 14:08:53

## 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

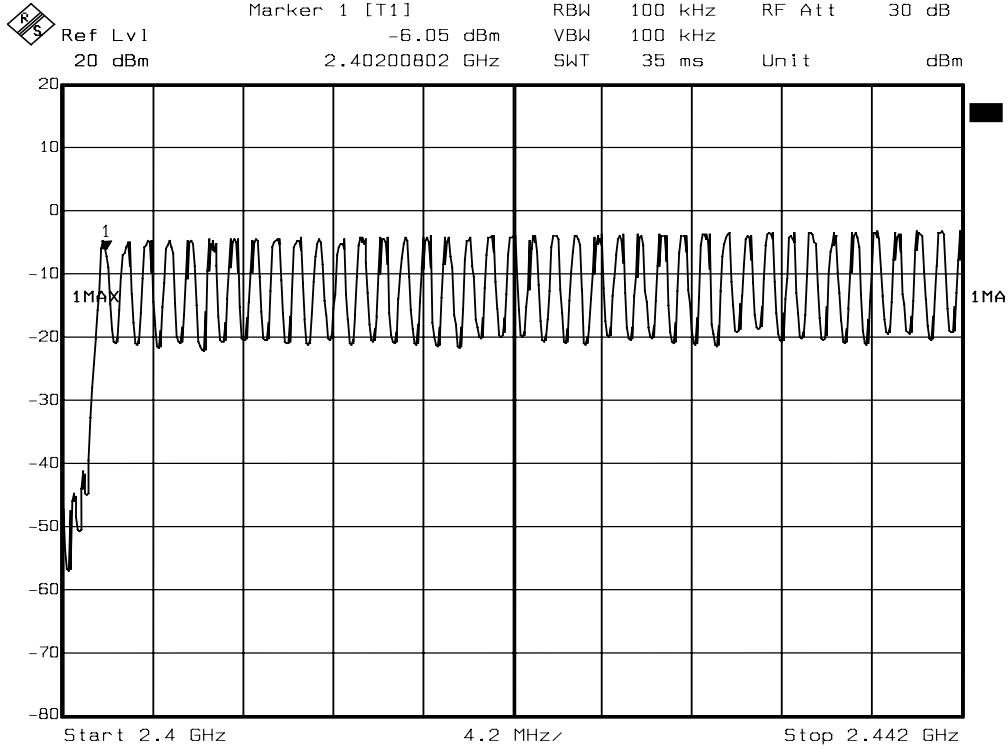
### 11.4 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	Model No.	Serial No.	LAST CAL.	Cal. Due.
Spectrum Analyzer	Advantest	R3182	110600647	11/16/2002	11/15/2003
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



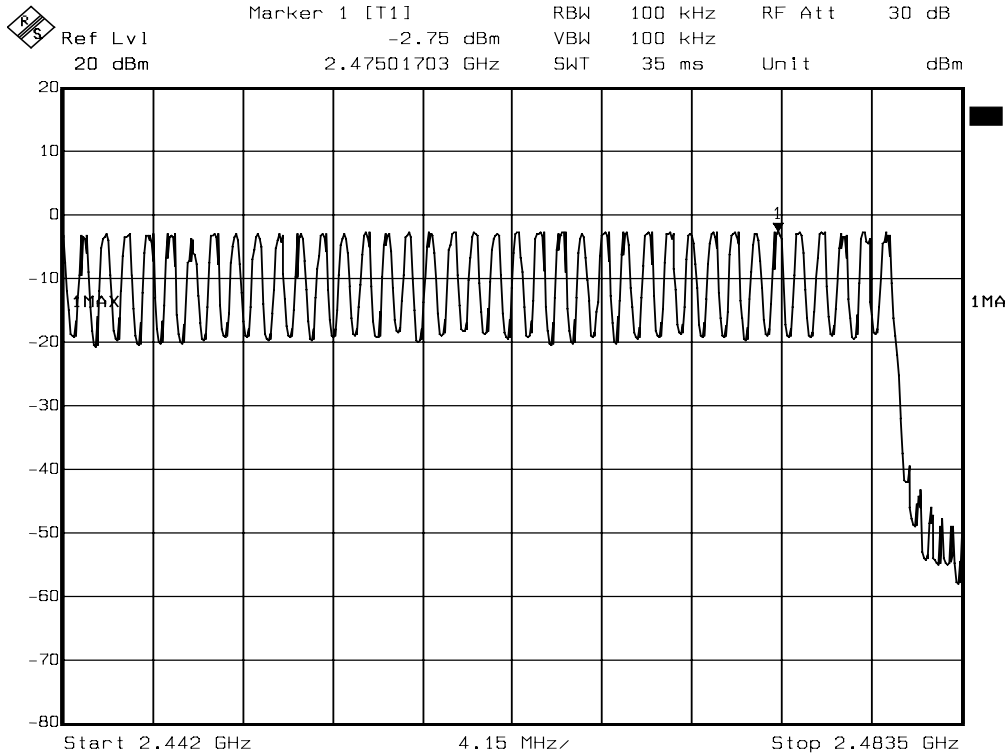
### Channel Number

#### 2.4 GHz – 2.442GHz



Date: 29.NOV.2002 11:14:42

#### 2.442 GHz – 2.483GHz



Date: 29.NOV.2002 11:20:59

## 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=1MHz, Span = 0Hz , Adjust Sweep = 30s.
5. Repeat above procedures until all frequency measured were complete.

### 12.3 Measurement Result

A period time = 0.400 (ms) \* 79 = 31.6 (s)

CH Low:: 0.40 (ms) \* 1600/79 \* 31.6=256 (ms)

CH Mid:: 0.40 (ms) \* 1600/79 \* 31.6=256 (ms)

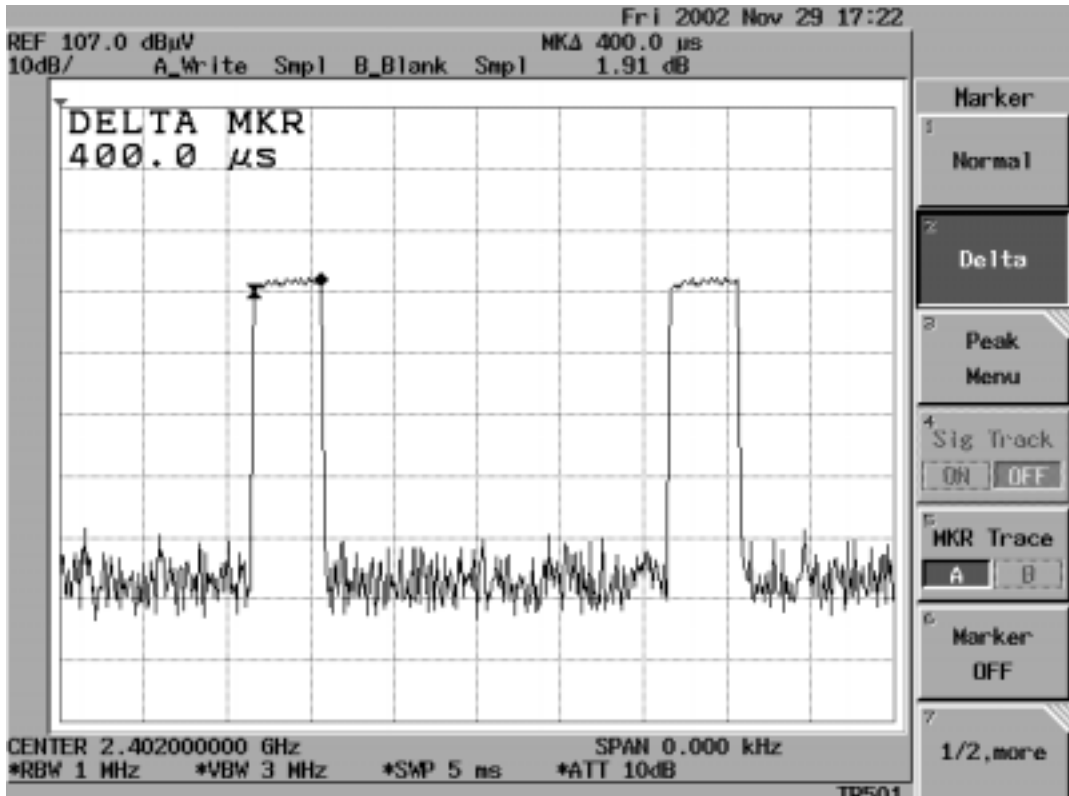
CH High: 0.39 (ms) \* 1600/79 \* 31.6=249.6 (ms)

CH	Pulse Time ms	Total of Dwell Time (ms)	Period time (ms)	Limit (ms)
Low	0.40	256.00	31.60	400.00
Mid	0.40	256.00	31.60	400.00
High	0.39	249.60	31.60	400.00

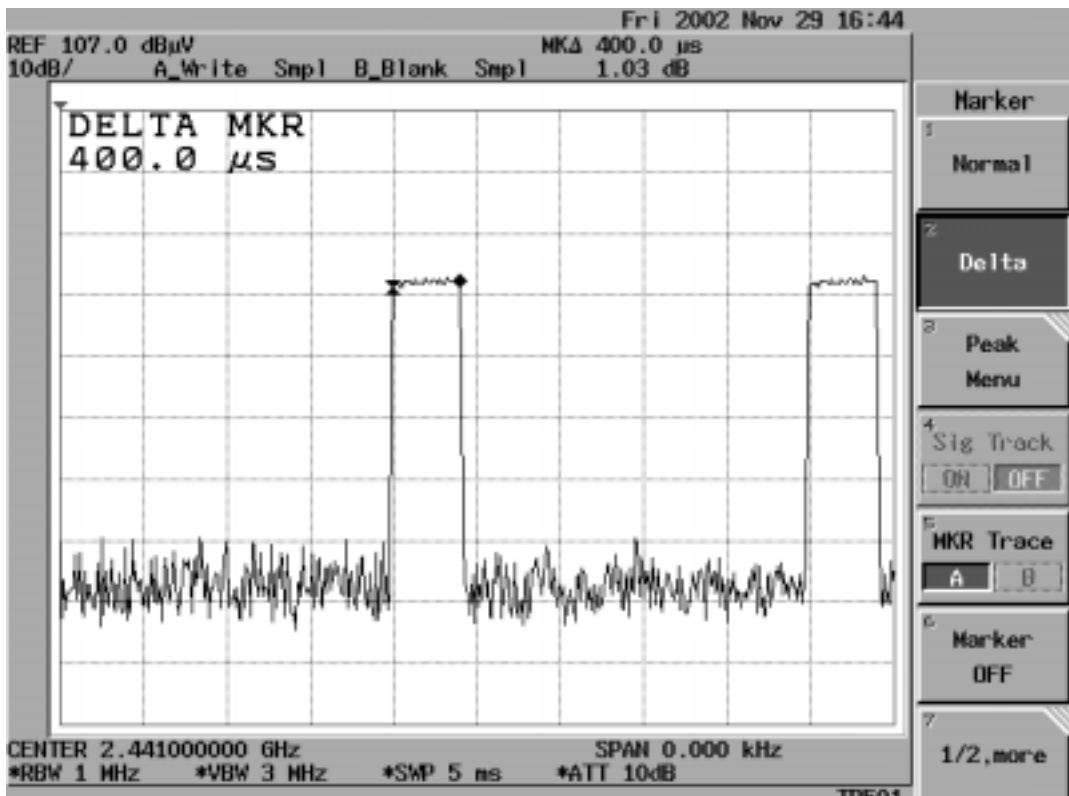
### 12.4 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	Model No.	Serial No.	LAST CAL.	Cal. Due.
Spectrum Analyzer	Advantest	R3182	110600647	11/16/2002	11/15/2003
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



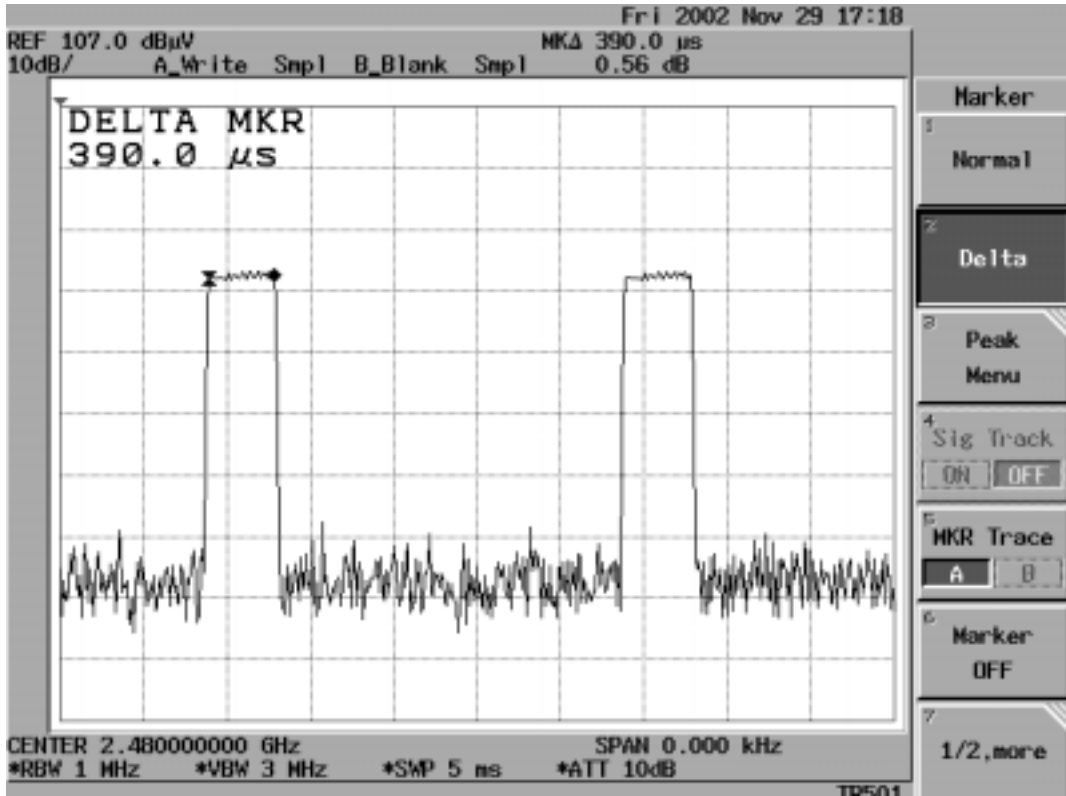
### Dwell Time Test Data Ch Low







### Dwell Time Test Data Ch High



### 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

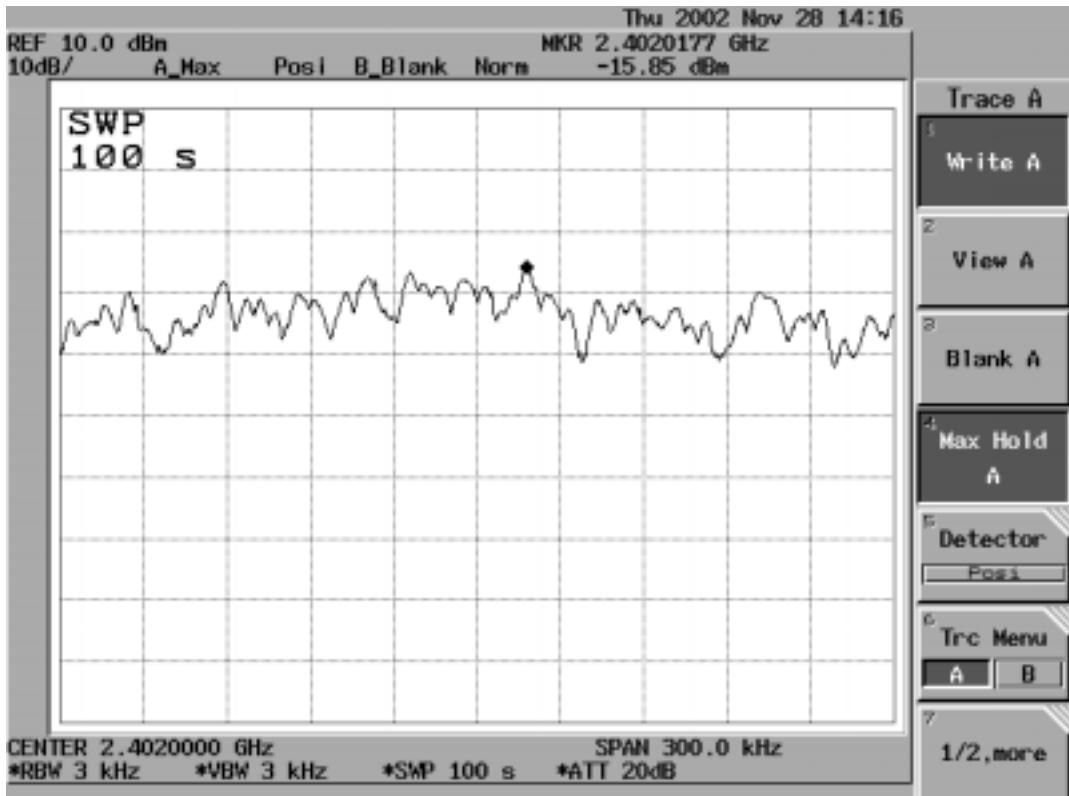
CH	RF Power Density Reading (dBm)	Cable loss (dB)	RF Power Density Level (dBm)	Maximum Limit (dBm)
Low	-15.85	0.50	-15.35	8
Mid	-14.59	0.50	-14.09	8
High	-23.41	0.50	-22.91	8

#### 13.4 Measurement Equipment Used:

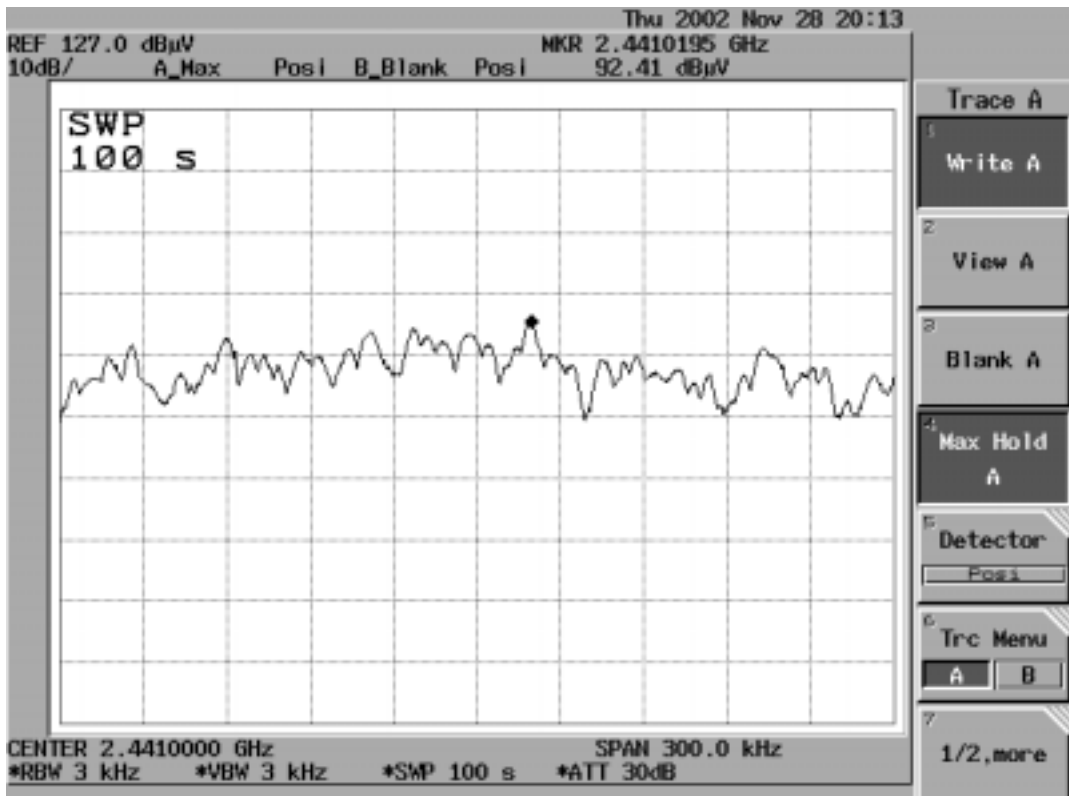
EQUIPMENT TYPE	MFR	Model No.	Serial No.	LAST CAL.	Cal. Due.
Spectrum Analyzer	Advantest	R3182	110600647	11/16/2002	11/15/2003
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/23/2002	07/22/2003
low loss cable	Huber + Suhner	Sucoflex 104	N/A	N/A	N/A



### Power Spectral Density Test Plot (CH-Low)

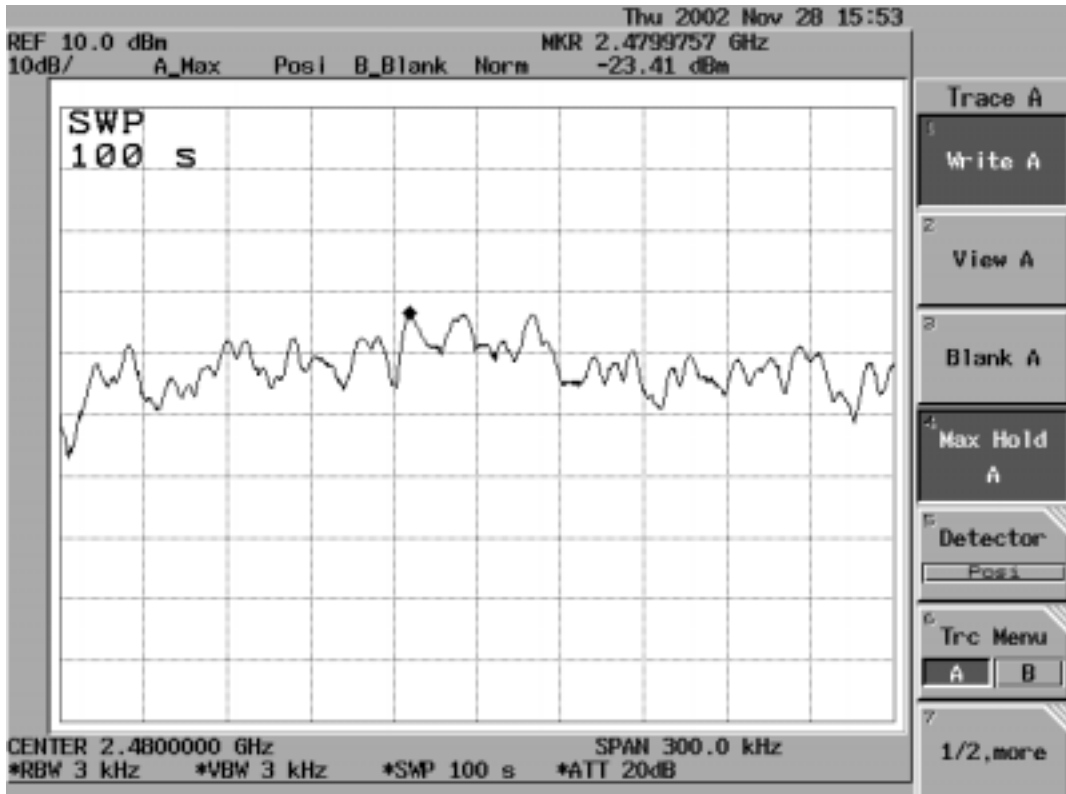


### Power Spectral Density Test Plot (CH-Mid)





### 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 gains of antenna used for transmitting is  $< 2$  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.

According to §1.1310 and §2.1093 RF exposure is calculated.

Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-15000	/	/	1.0	30

F = frequency in MHz

\* = Plane-wave equipment power density



**MPE Prediction**

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{P \cdot G}{4 \cdot R^2}$$

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal: -1.37(dBm)

Maximum peak output power at antenna input terminal: 0.72945 (mW)

Antenna gain (typical): < 2 (dBi)

Maximum antenna gain: 1.584 (numeric)

Prediction distance: 3 (cm)

Prediction frequency: 2480 (MHz)

MPE limit for uncontrolled exposure at prediction frequency:

1 (mW/cm<sup>2</sup>)

Power density at predication frequency at 3 (cm) distance is

0.01022746mW/cm<sup>2</sup>

S	P	P	G	G	R
mW/cm <sup>2</sup>	mW	dBm	dBi	(numeric)	cm
0.010227461	0.72945751	-1.37	2	1.584893	3

**15.2 Measurement Result**

The predicted power density level at 3 cm is 0.010227 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2480MHz.