TEST REPORT

Equipment Under Test	:	Bluetooth GPS
Model No.	:	Clip-On BT GPS
Applicant	:	Fortuna Electronic Corp
Address of Applicant	:	3F, No.9, Sec. 1, ChangAn East Road, Taipei, Taiwan, R.O.C.

Standards:

FCC Part 15 subpart C

In the configuration tested, the EUT complied with the standards specified above.

Remarks:

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS Taiwan E&E Services or testing done by SGS Taiwan E&E Services in connection with distribution or use of the product described in this report must be approved by SGS Taiwan E&E Services in writing.

Tested by	:	**Alex Hsieh**	**Testing Date** :	**Sep. 08, 2003**
Approved by	:	**Robert Chang**	**Issue Date** :	**Sep. 09, 2003**

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1. General Information

1.1 Testing Laboratory

SGS Taiwan Ltd. (FCC Registration number: 573967)
1F, No. 134, Wukung Road, Wuku industrial zone
Taipei county , Taiwan , R.O.C.
Telephone : +886-2-2299-3279
Fax : +886-2-2298-2698
Internet : http://www.sgs.com.tw

1.2 Details of Applicant

Applicant : Fortuna Electronic Corp
Address of Applicant : 3F,No.9,Sec. 1,ChangAn East Road, Taipei, Taiwan, R.O.C.
Contact : Vincent Chen
Telephone : +886-2-25818373 ext. 280

1.3 Description of EUT(s)

1	Product name	Bluetooth GPS
2	Product ID	Clip-On BT GPS
3	Supply Voltage	DC 3.7V
4	Antenna Gain	0 dbi
5	Carrier Frequency	2402MHz to 2480MHz
6	Modulation Method	GFSK,1Mbps,0.5BT Gaussian
7	Hopping	1600hops/sec, 1MHz channel space
8	Operation Temperature	-20 to +55 degree
9	Compliant	Bluetooth Specification Ver1.1

1.4 Operation Procedure

The Bluetooth is a FHSS system, and the output power and operating frequency are NOT End-user adjustable. Applicant offer a engineering software “BlueSuite” installed on PC to control the EUT. Setting of the software parameters are set as default. Operating frequency are set as testing required. The output power is set as Ext=255, Int=60 (at max. power). Inside the BlueSuite software, there is a BlueTest to control EUT hopping on or off. We select “Txdata1” (which modulated by pseudo-random sequence)and assign the transmit channel(as below). When the EUT is required to transmit in hopping on mode. We select “Txdata2”

The lowest operating frequency within Bluetooth specification is 2402Mhz, and highest operating frequency is 2480Mhz. So the frequency above are used as the lowest and highest frequency in the testing, and the middle frequency is set as 2441Mhz.

1.5 Testing Method

The testing standard follows CFR 47, Part 15.247 and ANSI C63.4 1992, and measurement method according to Public Notice DA00-705 (March 2000).

The Testing procedure is as following:
a. The EUT was connected to PC via RS232 and placed on the top of a rotating table 0.8 meters above the ground at a 3m chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna.
c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 300 Hz for Average detection (AV) at frequency above 1GHz.
4. During the Output power testing, the manufacturer attach a test fixture which is a short cable that replace the antenna. So we use conducted method to measure the power. Hence the EIRP is the output power plus the antenna gain in dBi. Due to cable loss, the real value will equal to measured value(show on the instrument) add cable loss.

2.Summary of Results

subclause	Parameter to be measures	Verdict	Page
15.209	Radiated emission Limits, general requirement	*PASS*	8
15.247(a)(1)	Channel Spacing	*PASS*	15
15.247(a)(1)(ii)	20db bandwidth / No. of channels	*PASS*	16
15.247(a)(1)(ii)	Average Time of Occupancy	*PASS*	21
15.247(b)(1)	Peak Output power	*PASS*	25
15.247(c)	Band-Edge Emission	*PASS*	28
15.247(c)	Spurious Emission under 25Ghz	*PASS*	30

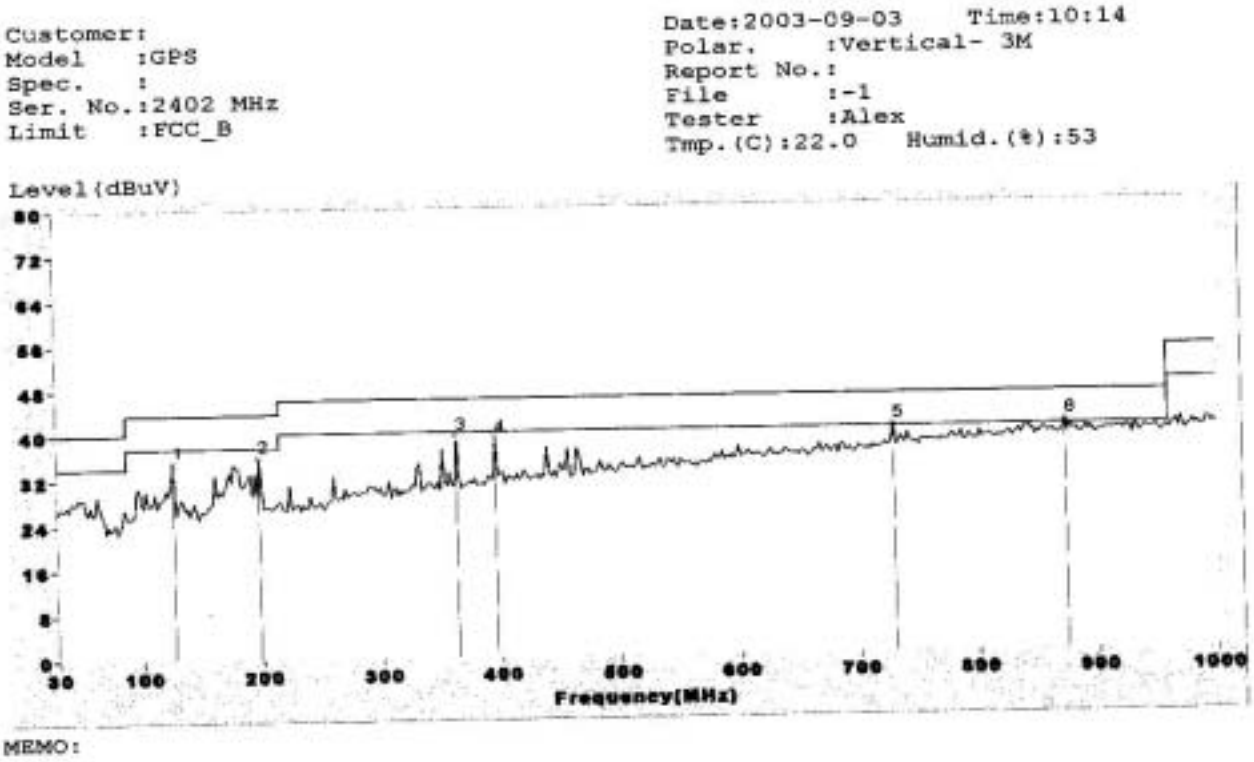
3. Instruments List

Instrument	Model	Serial number	Calibration date
Desktop PC	HP Pavillion 723D	N/A	N/A
Spectrum Analyzer	Agilent E7405A	US40240202	Jun 02, 2003
Spectrum Analyzer	R&S FSP 40	100034	Mar. 27, 2003
Antenna	Schwarzbeck BBHA9170A	184/185	Jul. 04, 2003
Antenna	Schwarzbeck BBHA9120A	309/320	Feb 24, 2003
Antenna	Schwarzbeck VULB9163	152	Jul. 07, 2003
Signal generator	R&S SMR 40	100210	Feb. 11, 2003
EMC Analyzer	HP 8594EM	3624A00203	Dec. 13, 2002
EMI Test Receiver	R&S ESCS 30	828985/004	Oct. 11, 2002
Transient Limiter	HP 11947A	3107A02062	Jul. 22, 2003
L.I.S.N	Rolf-Heine NNB-2/16Z	99012	Oct. 08, 2002

4. Measurements

4.1 Radiated emission Limits, general requirement SUBCLAUSE 15.209

1. Transmit at 2402Mhz, The Spectrum setting : RBW=120Khz , VBW=120Khz, **Vertical**



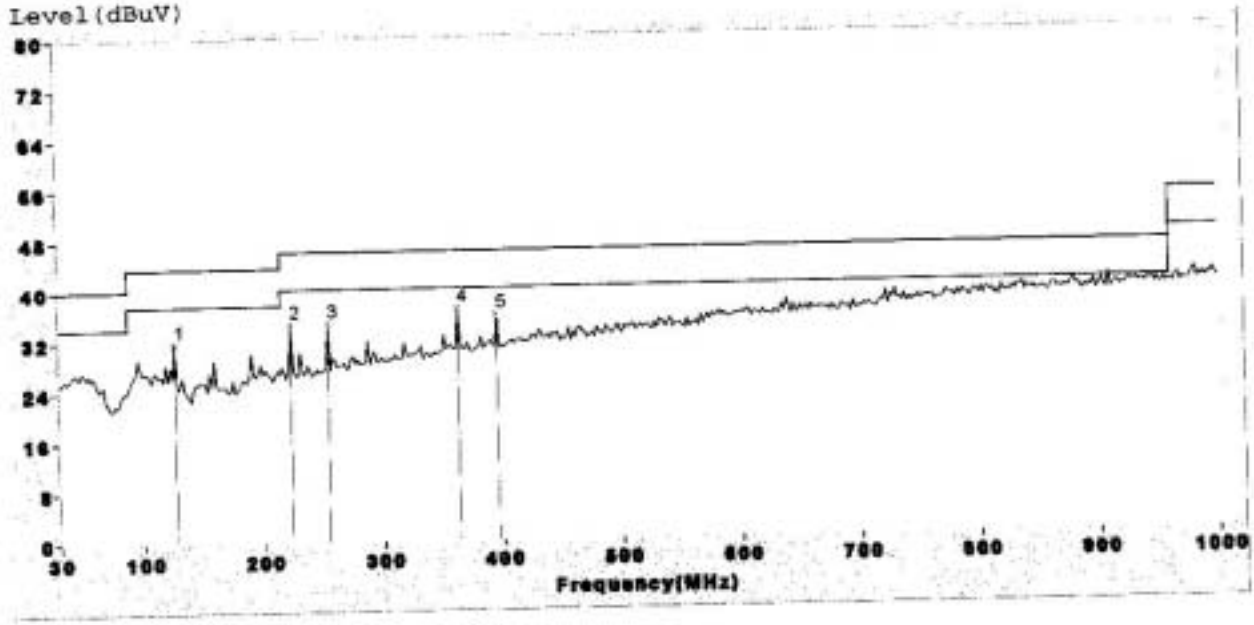
	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Factor	Other Factor
	MHz	dB	dB	dB	dB	dB	dB	dB
1	127.00	35.08	-8.42	43.50	26.01	8.27	0.81	0.00
2	198.78	35.94	-7.56	43.50	24.65	10.31	0.99	0.00
3	363.68	39.39	-6.61	46.00	22.97	14.95	1.47	0.00
4	396.66	38.92	-7.08	46.00	21.79	15.54	1.59	0.00
! 5	730.34	40.30	-5.70	46.00	17.44	20.57	2.29	0.00
! 6	873.90	40.71	-5.29	46.00	16.14	22.03	2.54	0.00

Freq	Level	Over Limit	Read Level	Antenna Factor	Cable Factor
873.90	40.71	-5.29	16.14	22.03	2.54
730.34	40.30	-5.70	17.44	20.57	2.29

2. Transmit at 2402Mhz, The Spectrum setting : RBW=120Khz , VBW=120Khz, **Horizontal**

Customer:
Model :GPS
Spec. :
Ser. No.:2402 MHz
Limit :FCC_B

Date:2003-09-03 Time:10:13
Polar. :Horizontal- 3M
Report No.:
File :-1
Tester :Alex
Tmp.(C):22.0 Humid.(%):53



MEMO:

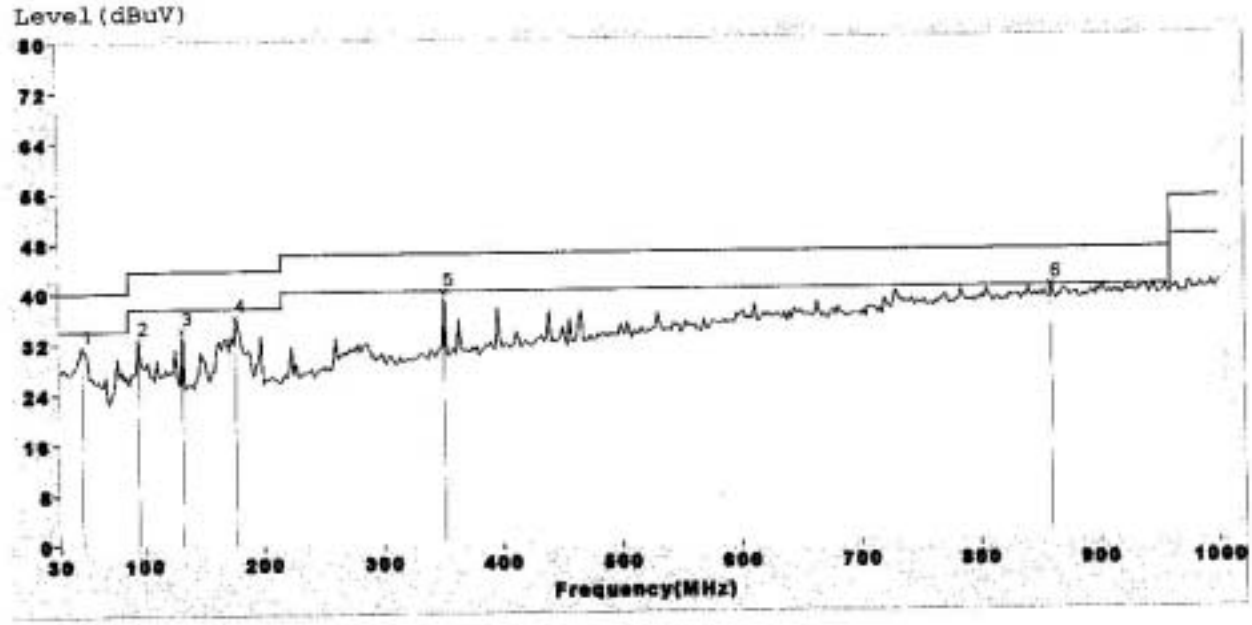
	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Factor	Other Factor
	MHz	dB	dB	dB	dB	dB	dB	dB
1	127.00	31.69	-11.81	43.50	22.61	8.27	0.81	0.00
2	224.00	34.58	-11.42	46.00	22.24	11.30	1.05	0.00
3	255.04	34.68	-11.32	46.00	21.35	12.20	1.13	0.00
4	363.68	36.83	-9.17	46.00	20.41	14.95	1.47	0.00
5	396.66	35.76	-10.24	46.00	18.63	15.54	1.59	0.00

Freq	Level	Over Limit	Read Level	Antenna Factor	Cable Factor
363.68	36.83	-9.17	20.41	14.95	1.47
396.66	35.76	-10.24	18.63	15.54	1.59

3. Transmit at 2441Mhz, The Spectrum setting : RBW=120Khz , VBW=120Khz, **Vertical**

Customer:
Model :GPS
Spec. :
Ser. No.:2441 MHz
Limit :FCC_B

Date:2003-09-03 Time:10:50
Polar. :Vertical- 3M
Report No.:
File :-1
Tester :Alex
Tmp.(C):22.0 Humid.(%):53



MEMO:

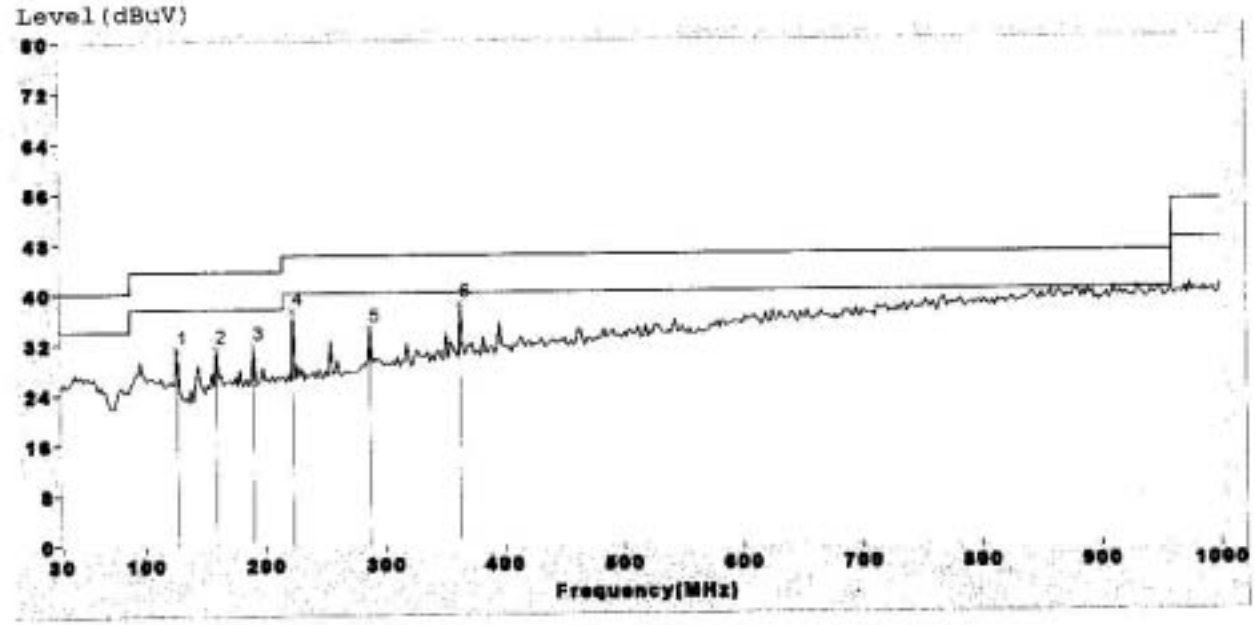
		Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Factor	Other Factor
		MHz	dB	dB	dB	dB	dB	dB	dB
	1	49.40	31.42	-8.58	40.00	18.87	12.03	0.52	0.00
	2	95.96	32.55	-10.95	43.50	20.18	11.64	0.73	0.00
	3	132.82	34.14	-9.36	43.50	25.62	7.70	0.82	0.00
	4	177.44	36.07	-7.43	43.50	26.09	9.04	0.93	0.00
	5	352.04	39.84	-6.16	46.00	23.65	14.76	1.43	0.00
!	6	860.32	40.15	-5.85	46.00	15.80	21.83	2.52	0.00

Freq	Level	Over Limit	Read Level	Antenna Factor	Cable Factor
860.32	40.15	-5.85	15.80	21.83	2.52
352.04	39.84	-6.16	23.65	14.76	1.43

4. Transmit at 2441Mhz, The Spectrum setting : RBW=120Khz , VBW=120Khz,**Horizontal**

Customer:
Model :GPS
Spec. :
Ser. No.:2441 MHz
Limit :FCC_B

Date:2003-09-03 Time:10:49
Polar. :Horizontal- 3M
Report No.:
File :-1
Tester :Alex
Tmp.(C):22.0 Humid.(%):53



MEMO:

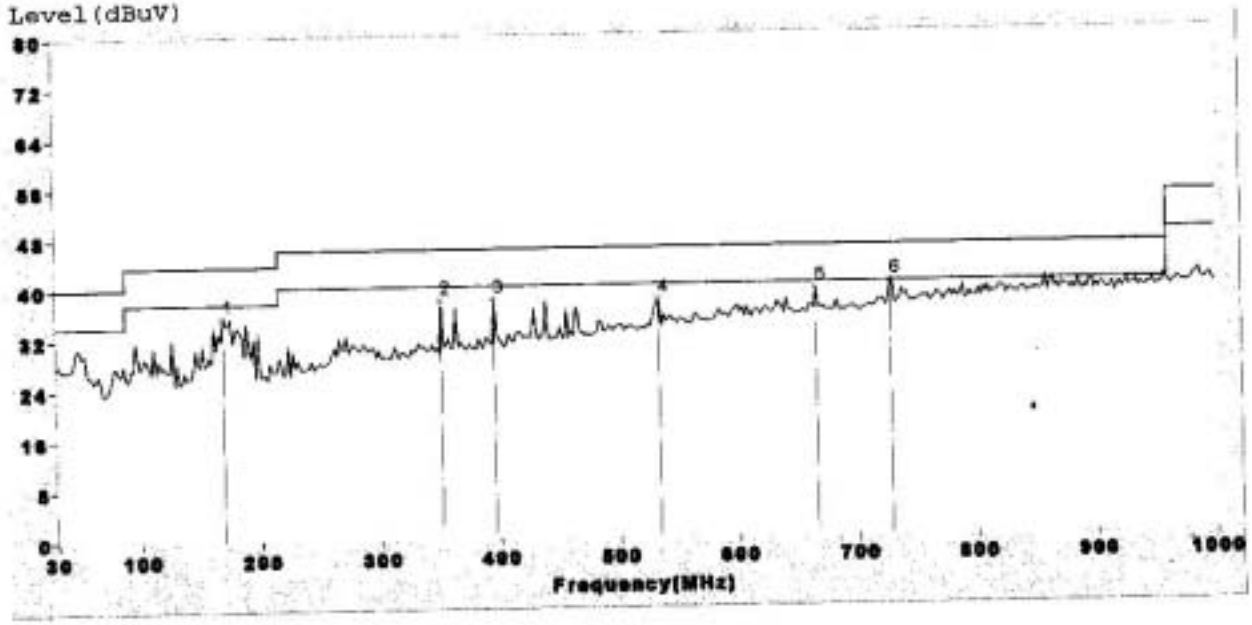
	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Factor	Other Factor
	MHz	dB	dB	dB	dB	dB	dB	dB
1	127.00	31.26	-12.24	43.50	22.18	8.27	0.81	0.00
2	159.98	31.34	-12.16	43.50	22.42	8.03	0.89	0.00
3	191.02	31.73	-11.77	43.50	20.54	10.22	0.97	0.00
4	224.00	37.22	-8.78	46.00	24.87	11.30	1.05	0.00
5	288.02	34.46	-11.54	46.00	20.10	13.15	1.21	0.00
6	363.68	38.25	-7.75	46.00	21.83	14.95	1.47	0.00

Freq	Level	Over Limit	Read Level	Antenna Factor	Cable Factor
363.68	38.25	-7.75	27.83	14.95	1.47
224.00	37.22	-8.78	24.87	11.30	1.05

5. Transmit at 2480Mhz, The Spectrum setting : RBW=120Khz , VBW=120Khz, **Vertical**

Customer:
Model :GPS
Spec. :
Ser. No.:2480 MHz
Limit :FCC_B

Date:2003-09-03 Time:10:53
Polar. :Vertical- 3M
Report No.:
File :-1
Tester :Alex
Tmp.(C):22.0 Humid.(%):53



MEMO:

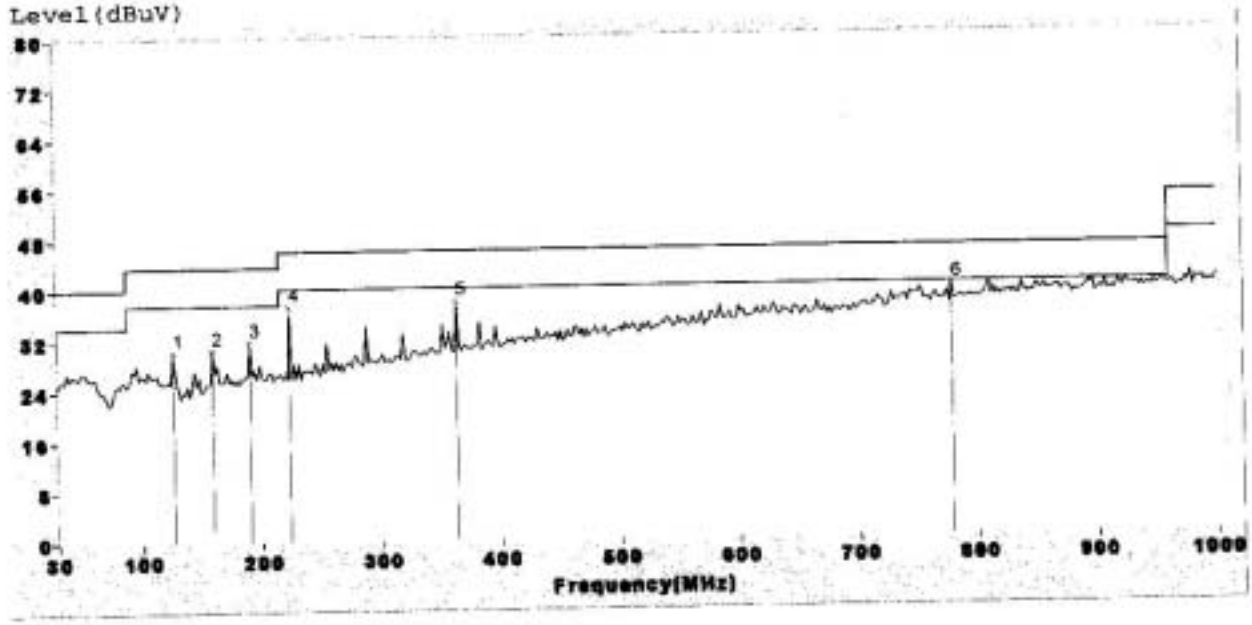
	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Factor	Other Factor
	MHz	dB	dB	dB	dB	dB	dB	dB
1	169.68	35.43	-8.07	43.50	26.09	8.43	0.91	0.00
2	352.04	37.86	-8.14	46.00	21.67	14.76	1.43	0.00
3	396.66	37.98	-8.02	46.00	20.85	15.54	1.59	0.00
4	534.40	37.62	-8.38	46.00	17.91	17.78	1.93	0.00
5	666.32	39.06	-6.94	46.00	17.26	19.63	2.18	0.00
! 6	728.40	40.01	-5.99	46.00	17.23	20.50	2.28	0.00

Freq	Level	Over Limit	Read Level	Antenna Factor	Cable Factor
728.40	40.01	-5.99	17.23	20.50	2.28
666.32	39.06	-6.94	17.26	19.63	2.18

6. Transmit at 2480Mhz, The Spectrum setting : RBW=120Khz , VBW=120Khz,**Horizontal**

Customer:
Model :GPS
Spec. :
Ser. No.:2480 MHz
Limit :FCC_B

Date:2003-09-03 Time:10:52
Polar. :Horizontal- 3M
Report No.:
File :-1
Tester :Alex
Tmp.(C):22.0 Humid.(%):53



MEMO:

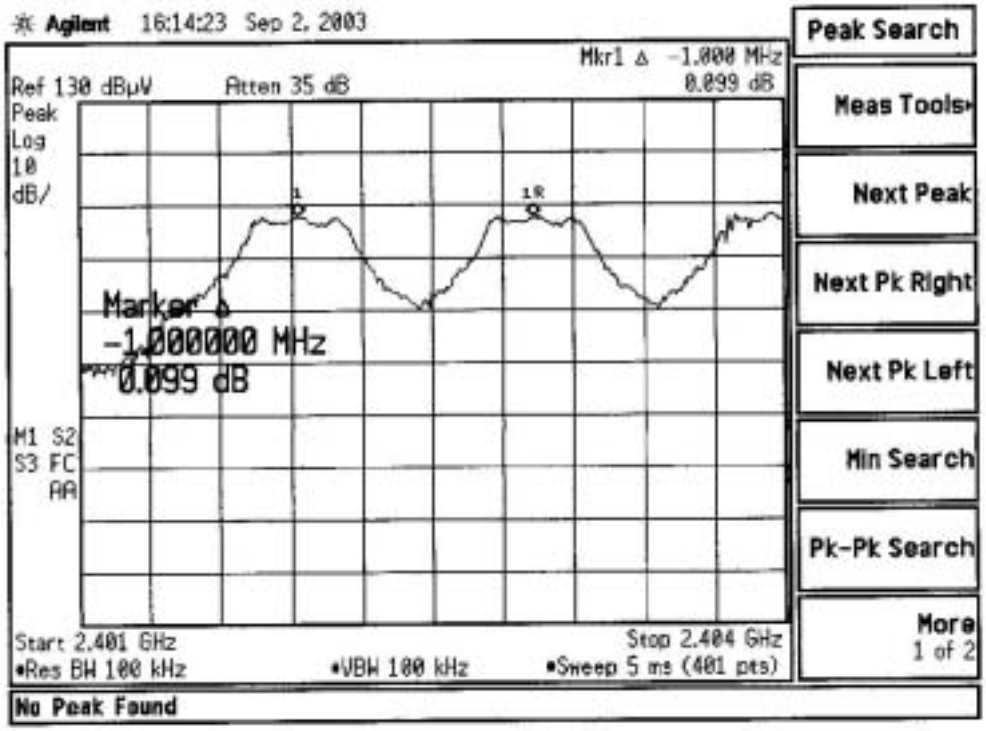
	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Factor	Other Factor
	MHz	dB	dB	dB	dB	dB	dB	dB
1	127.00	30.23	-13.27	43.50	21.15	8.27	0.81	0.00
2	159.98	30.37	-13.13	43.50	21.45	8.03	0.89	0.00
3	191.02	31.71	-11.79	43.50	20.52	10.22	0.97	0.00
4	224.00	37.24	-8.76	46.00	24.89	11.30	1.05	0.00
5	363.68	37.86	-8.14	46.00	21.44	14.95	1.47	0.00
6	778.84	39.58	-6.42	46.00	16.18	21.00	2.39	0.00

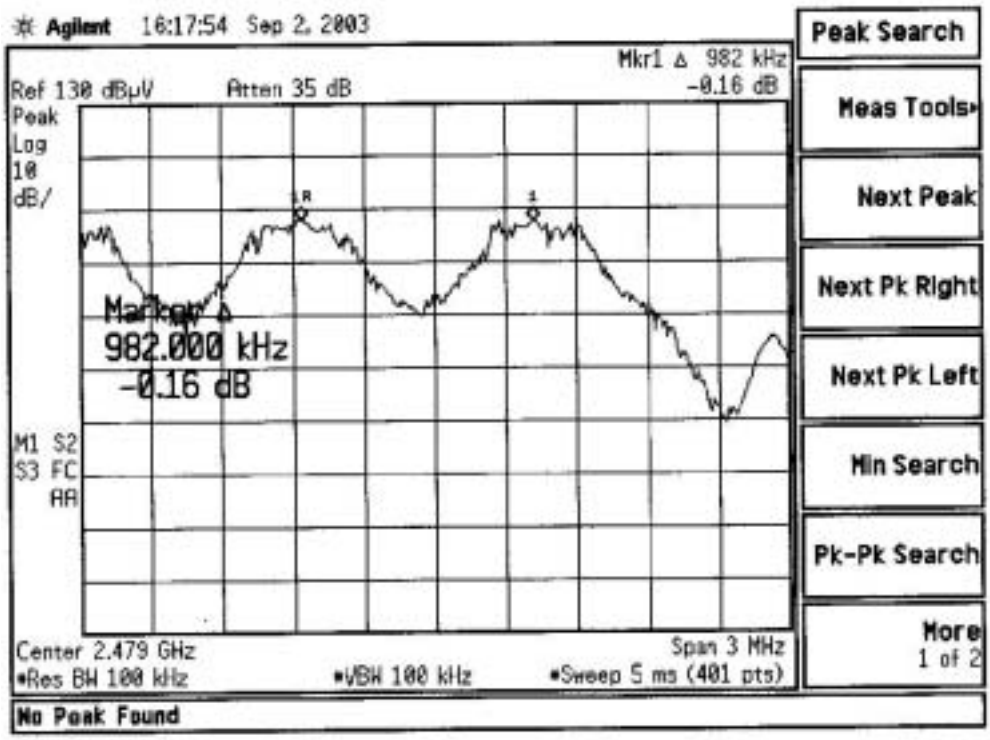
Freq	Level	Over Limit	Read Level	Antenna Factor	Cable Factor
778.84	39.58	-6.42	16.18	21.00	2.39
363.68	37.86	-8.14	21.44	14.95	1.47

4.2.1 Limits

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
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

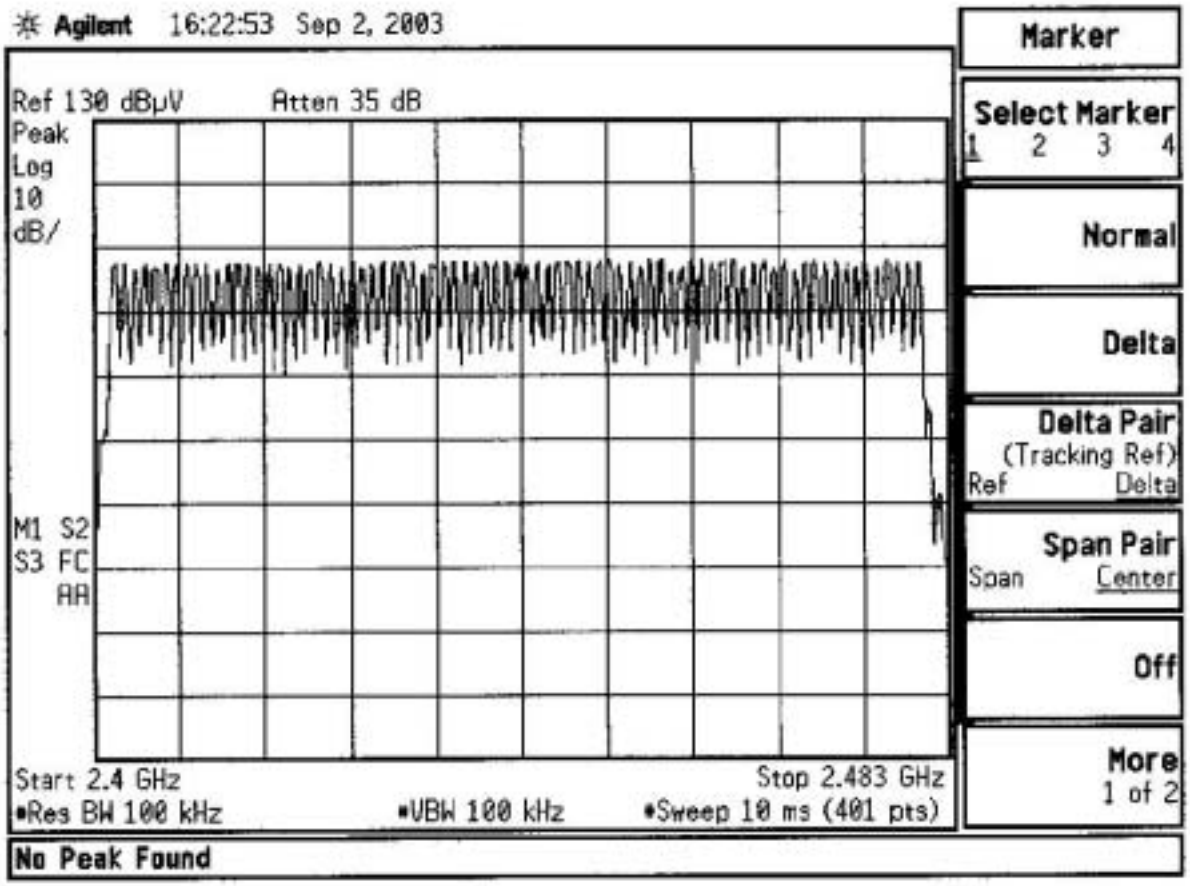
4.2 Channel Spacing SUBCLAUSE15.247(a)(1)





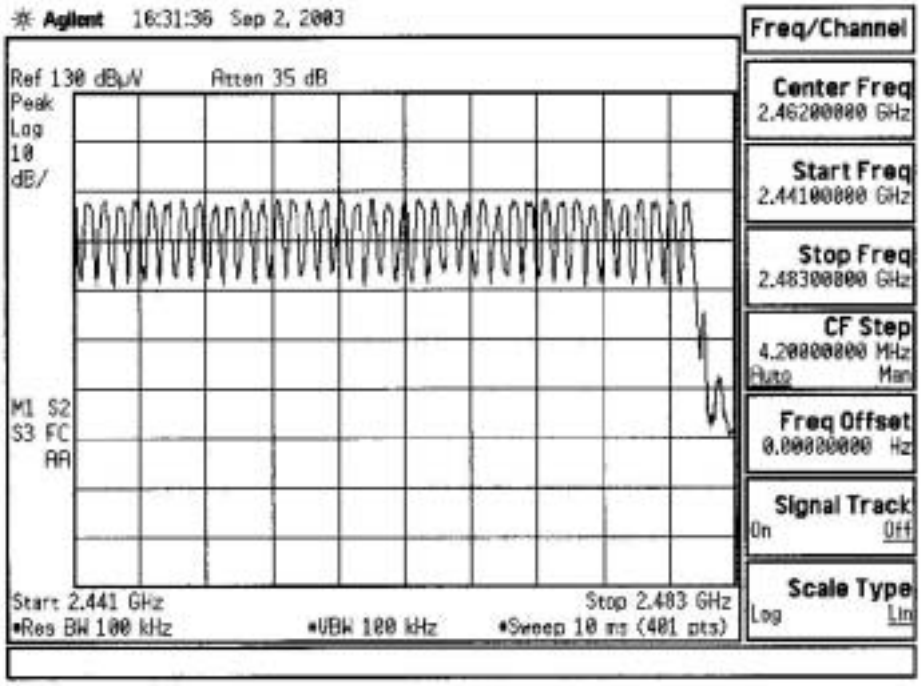
4.3 No. of carrier frequency / 20db Bandwidth

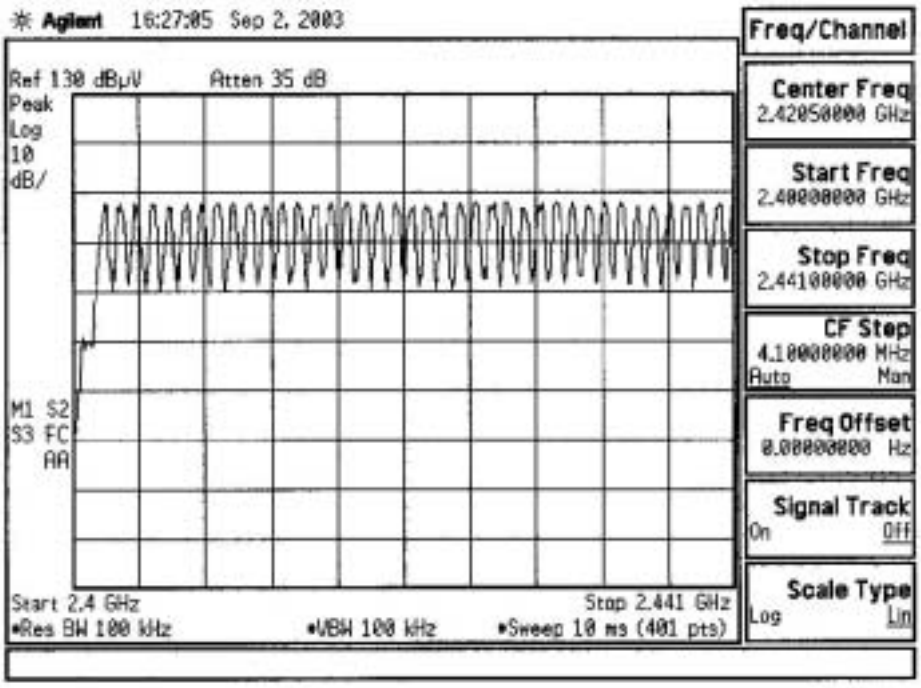
SUBCLAUSE15.247(a)(1)(ii)



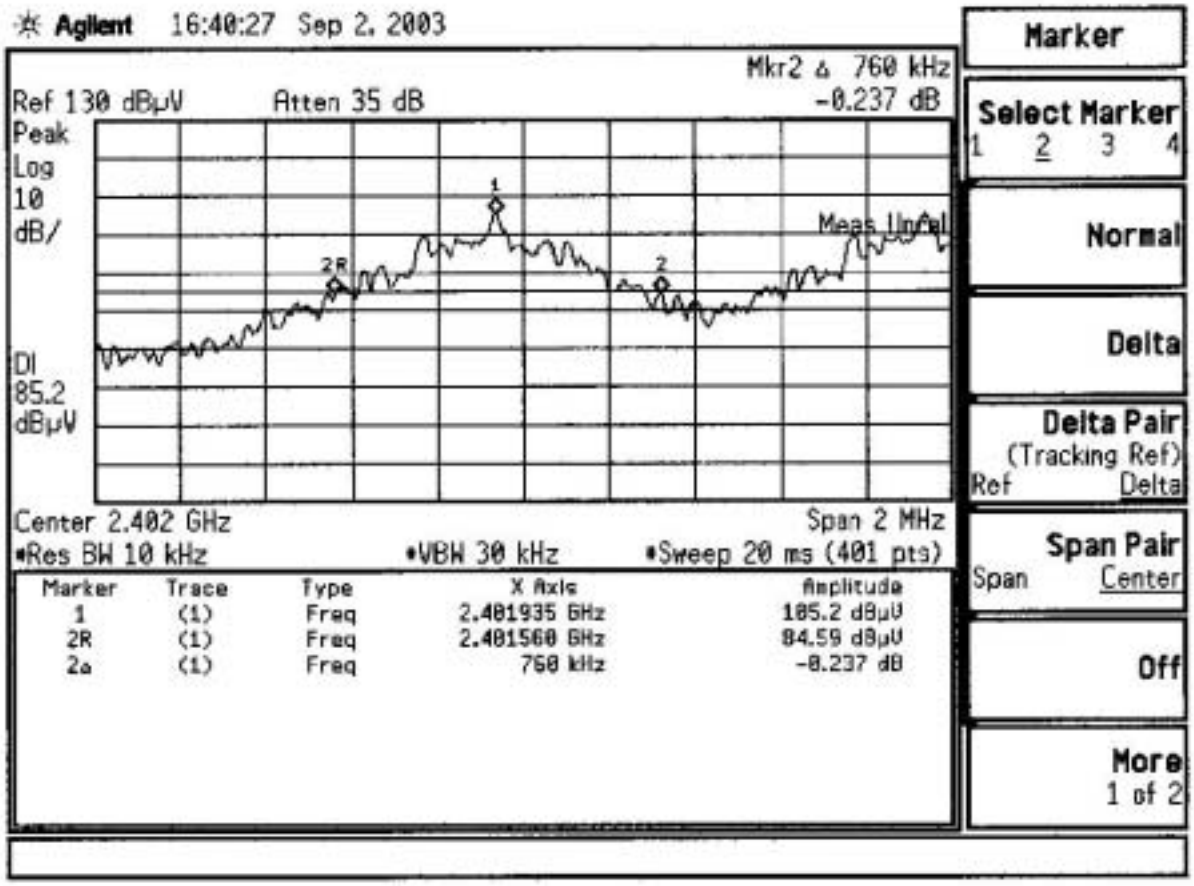
Number of channels = 79

Split the whole frequency band into two.

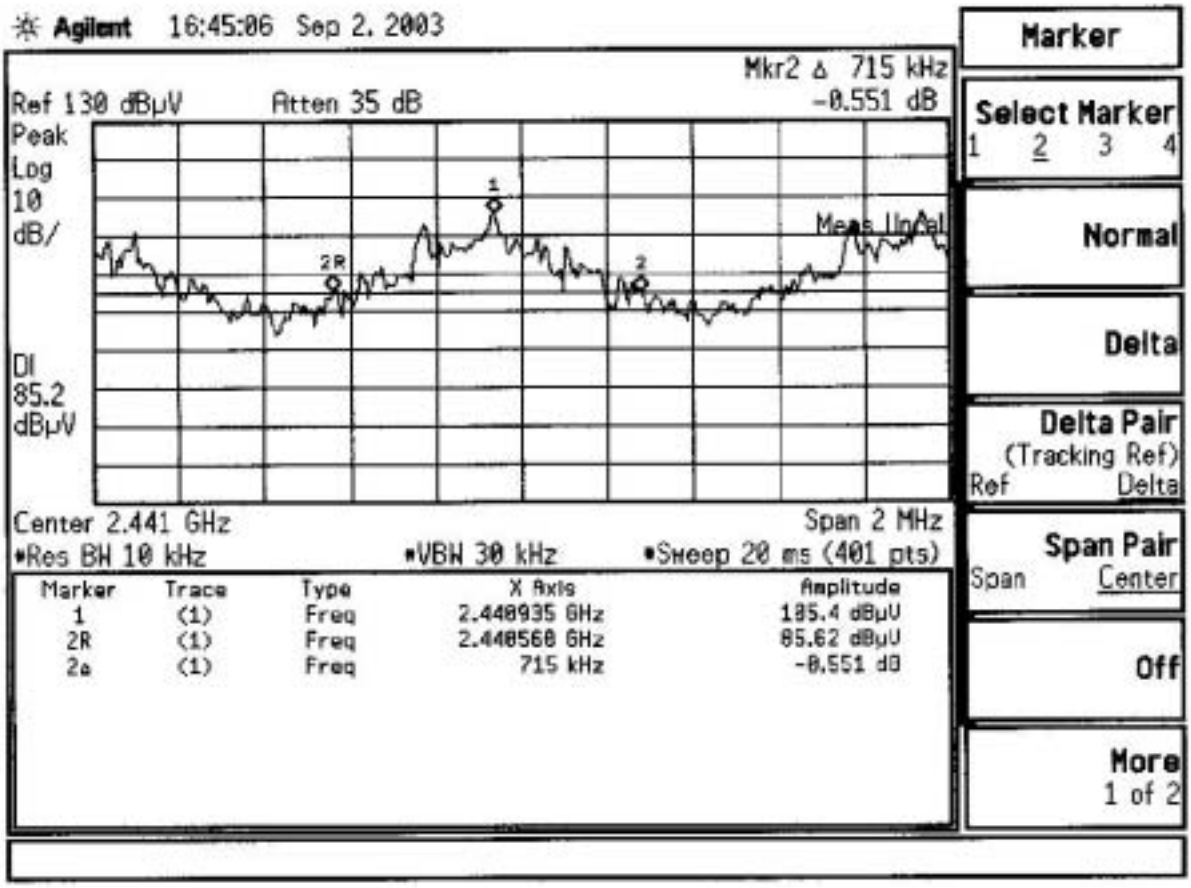




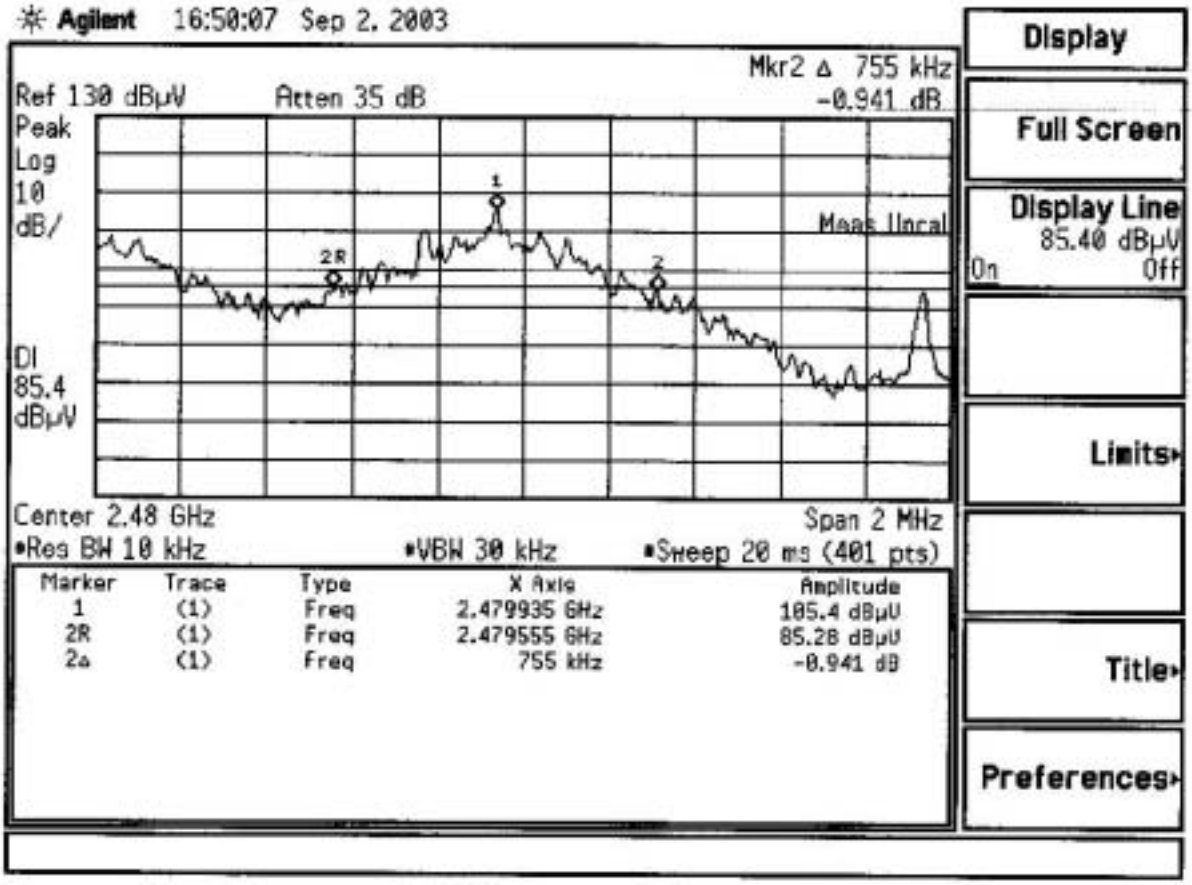
20dB bandwidth at lowest (2402Mhz), middle(2441Mhz), highest channel(2480Mhz)



Channel bandwidth = 760 KHZ

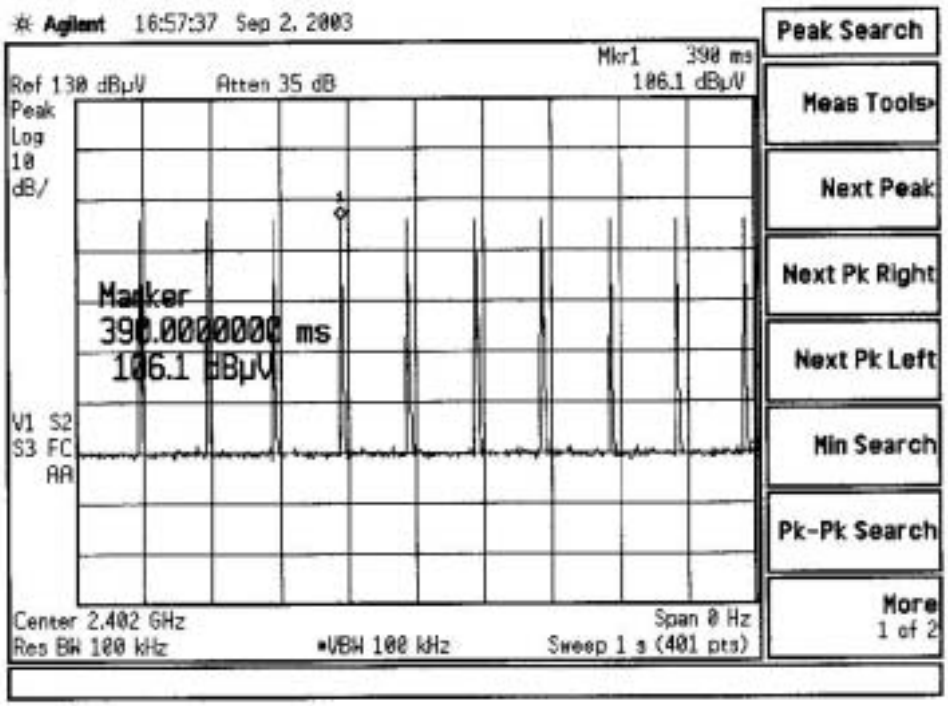


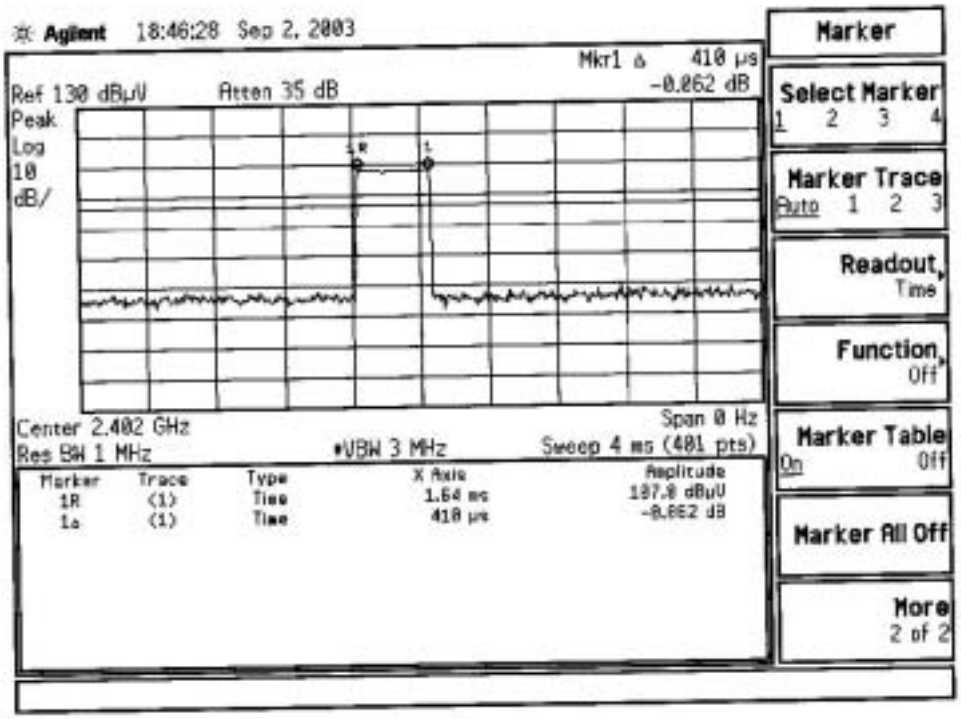
Channel bandwidth =715 KHZ

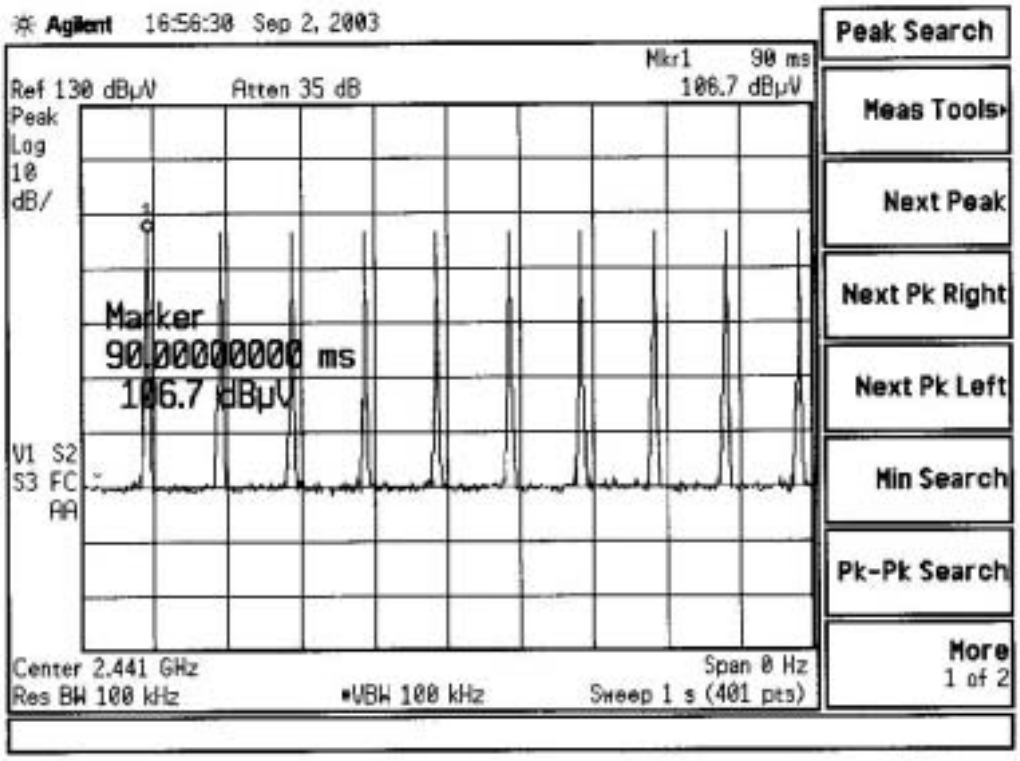


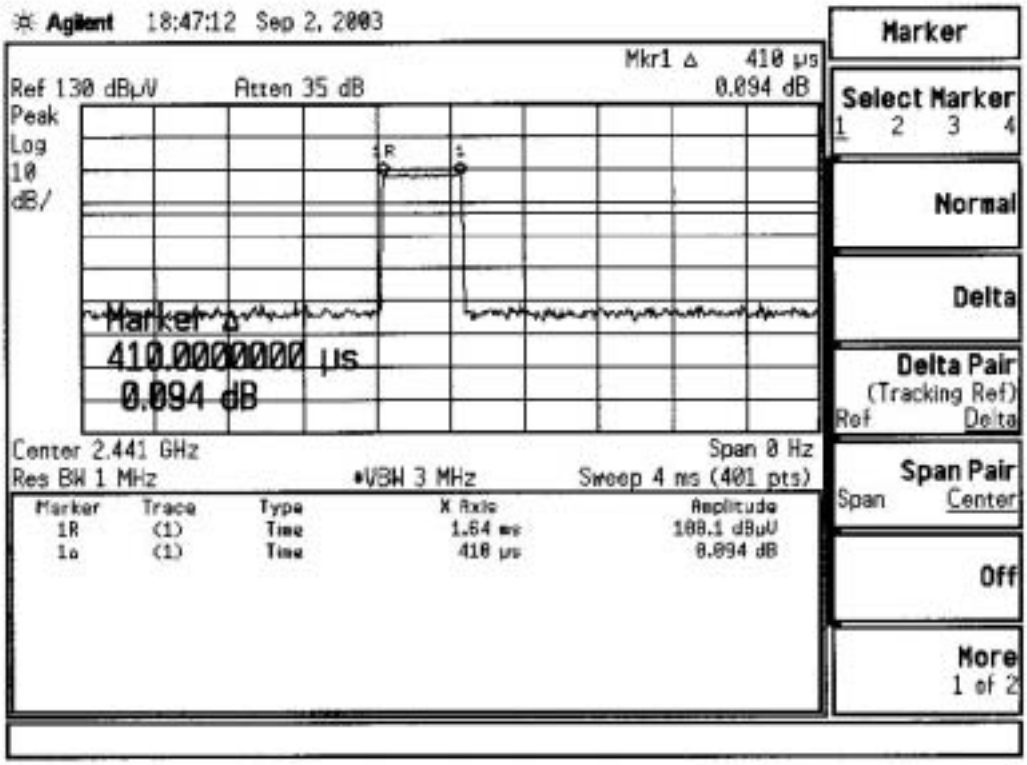
Channel bandwidth =755 KHZ

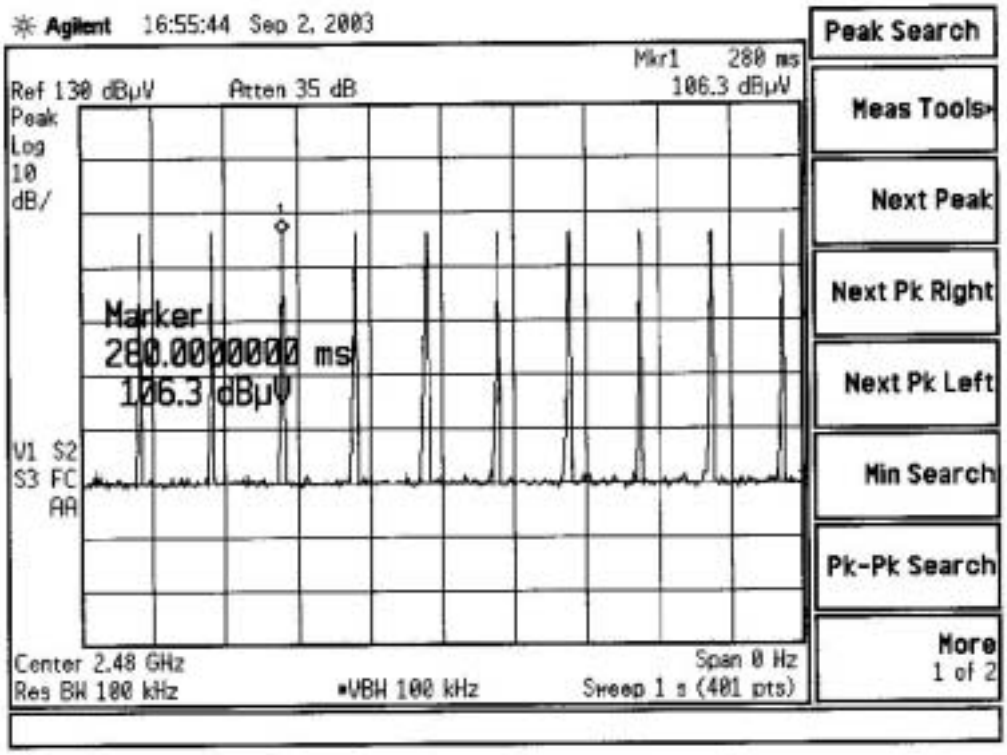
4.4 Average Time of Occupancy SUBCLAUSE15.247(a)(1)(ii)

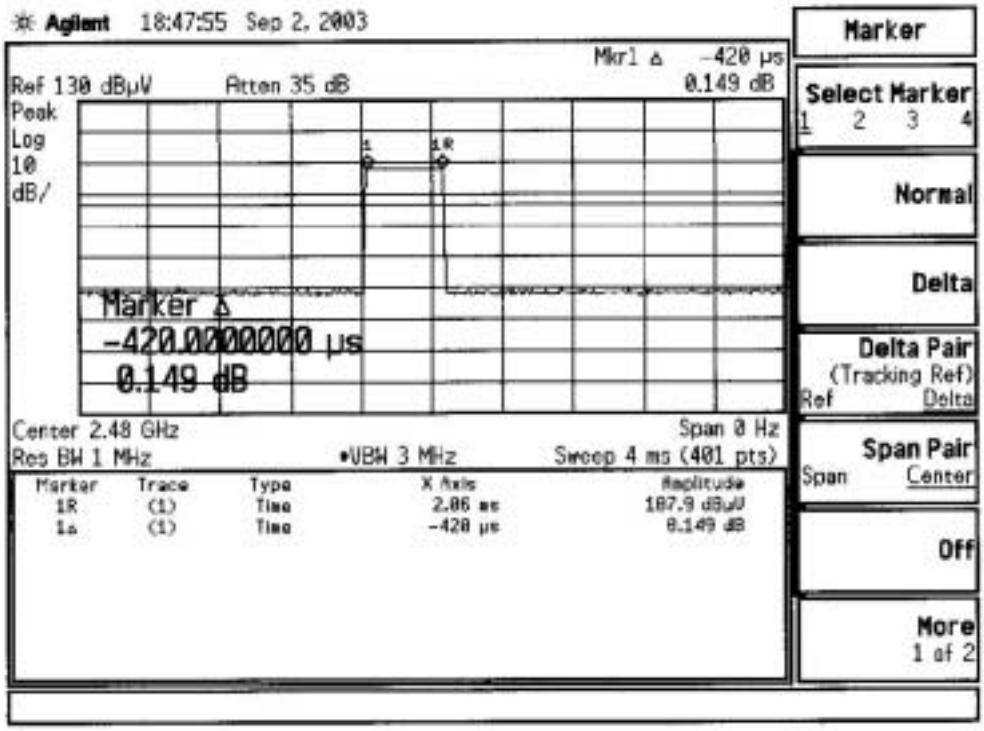





Agilent 16:56:30 Sep 2, 2003
Mkr1 90 ms
106.7 dBµV
Ref 130 dBµV
Atten 35 dB
Peak
Log
10
dB/
Marker
90.00000000 ms
106.7 dBµV
V1 S2
S3 FC
AA
Center 2.441 GHz
Res BW 100 kHz
#VBW 100 kHz
Span 0 Hz
Sweep 1 s (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2


Agilent 18:47:12 Sep 2, 2003
Mkr1 Δ 410 µs
0.094 dB
Ref 130 dBµV
Atten 35 dB
Peak
Log
10
dB/
Marker Δ
410.0000000 µs
0.094 dB
Center 2.441 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 4 ms (401 pts)
Marker Trace Type X Axis Amplitude
1R (1) Time 1.64 ms 108.1 dBµV
1Δ (1) Time 410 µs 0.094 dB
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2


Agilent 16:55:44 Sep 2, 2003
Mkr1 280 ms
106.3 dBµV
Ref 130 dBµV
Atten 35 dB
Peak
Log
10
dB/
Marker
280.0000000 ms
106.3 dBµV
V1 S2
S3 FC
AA
Center 2.48 GHz
Res BW 100 kHz
#VBW 100 kHz
Span 0 Hz
Sweep 1 s (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2


Agilent 18:47:55 Sep 2, 2003
Mkr1 Δ -420 µs
0.149 dB
Ref 130 dBµV
Atten 35 dB
Peak
Log
10
dB/
Marker Δ
-420.0000000 µs
0.149 dB
Center 2.48 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 4 ms (401 pts)
Marker Trace Type X Axis Amplitude
1R (1) Time 2.06 ms 107.9 dBµV
1Δ (1) Time -420 µs 0.149 dB
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

4.5.1 calculation

At channel 2402 (410 μ Sec), 2441(410 μ Sec)and 2480Mhz(420 μ Sec), there are 10 bursts in 1 sec. Time period of each burst is 420 μ Sec(worst case). So the occupancy time within 30 second is 420 x 10 x 30 = 126000 μ Sec = 126 mSec = 0.126 Sec.

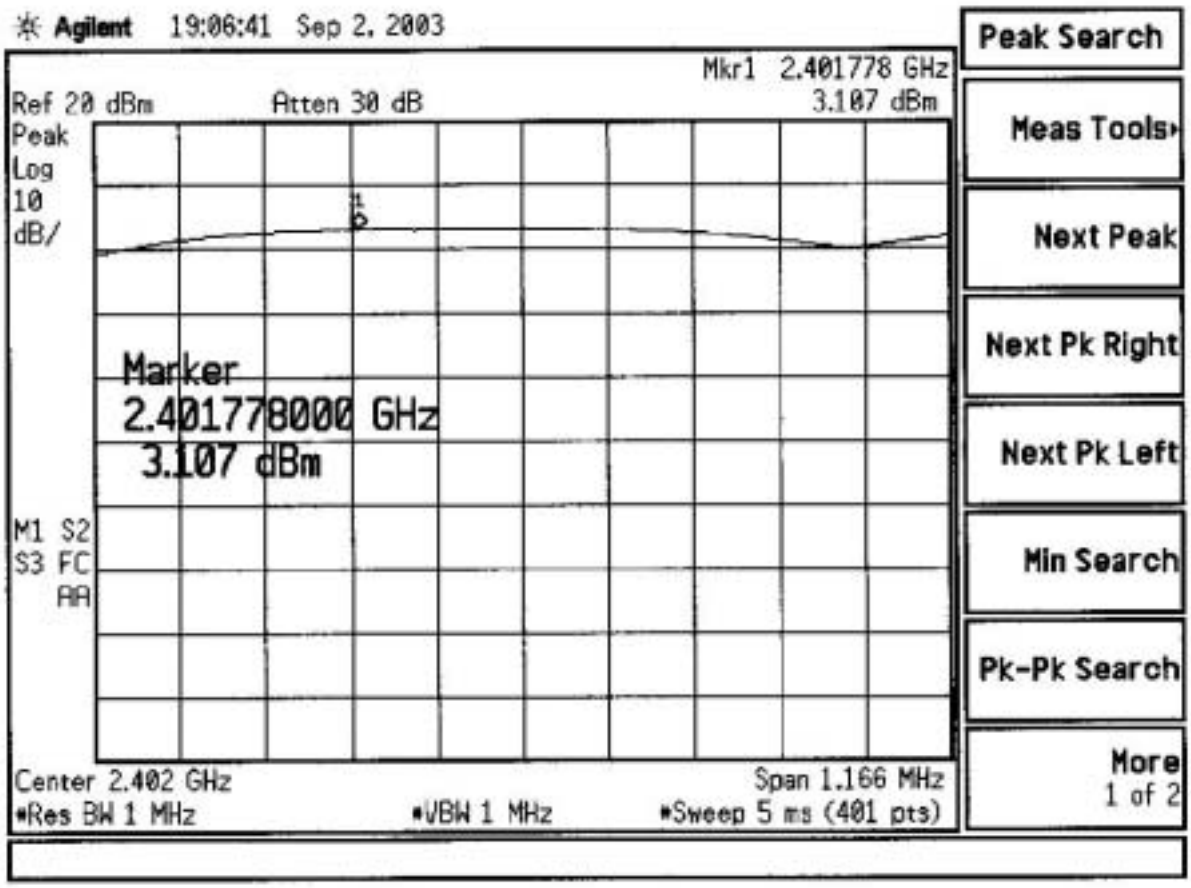
4.5.2 Limits

The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

The EUT comply with the requirement in Sec 15.247(a)(1) that use at least 75 hopping frequencies. The maximum 20dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

4.5 Peak output Power SUBCLAUSE15.247(b)(1)

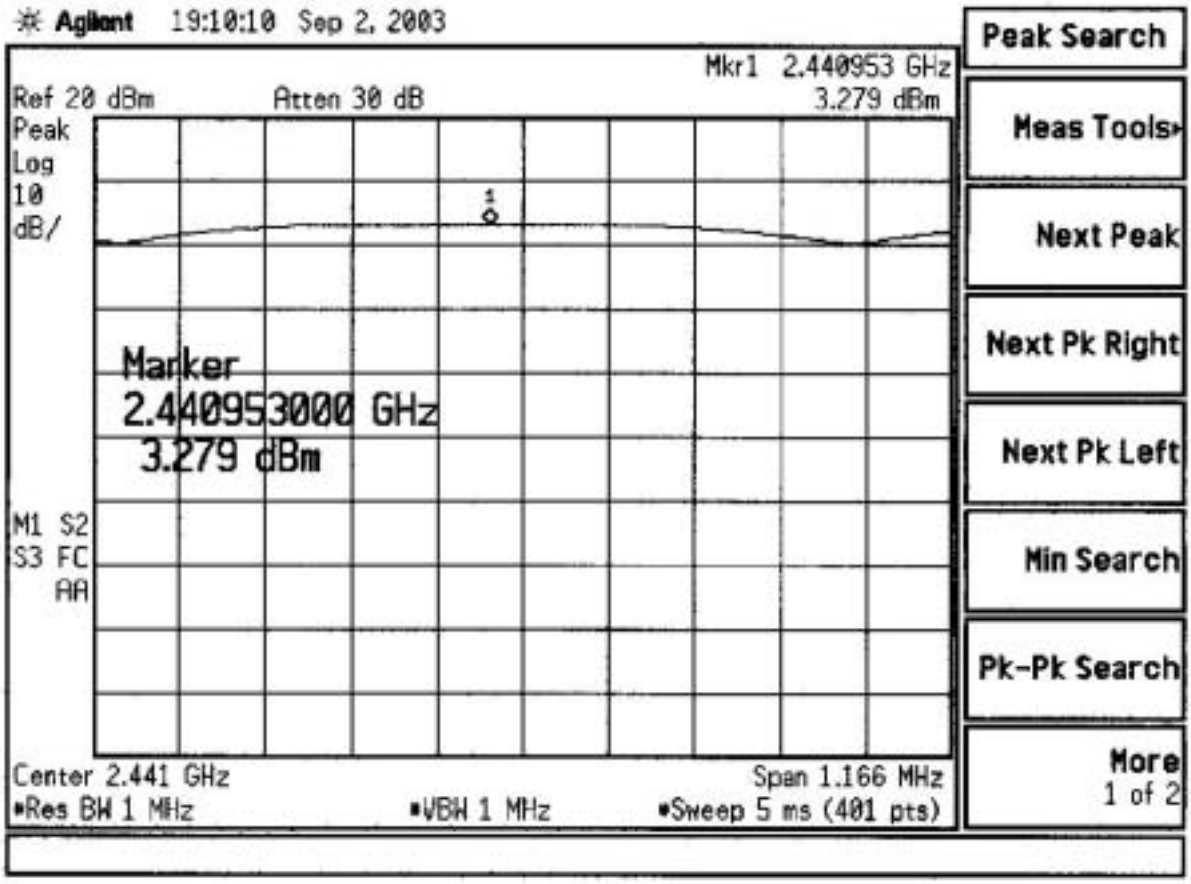
Transmitter transmit at lowest channel (2402Mhz)



The Power (ERP) = Output power + cable loss + antenna gain

= 3.107 dbm + 1.7 db+ 0 dBi = 4.8 dbm

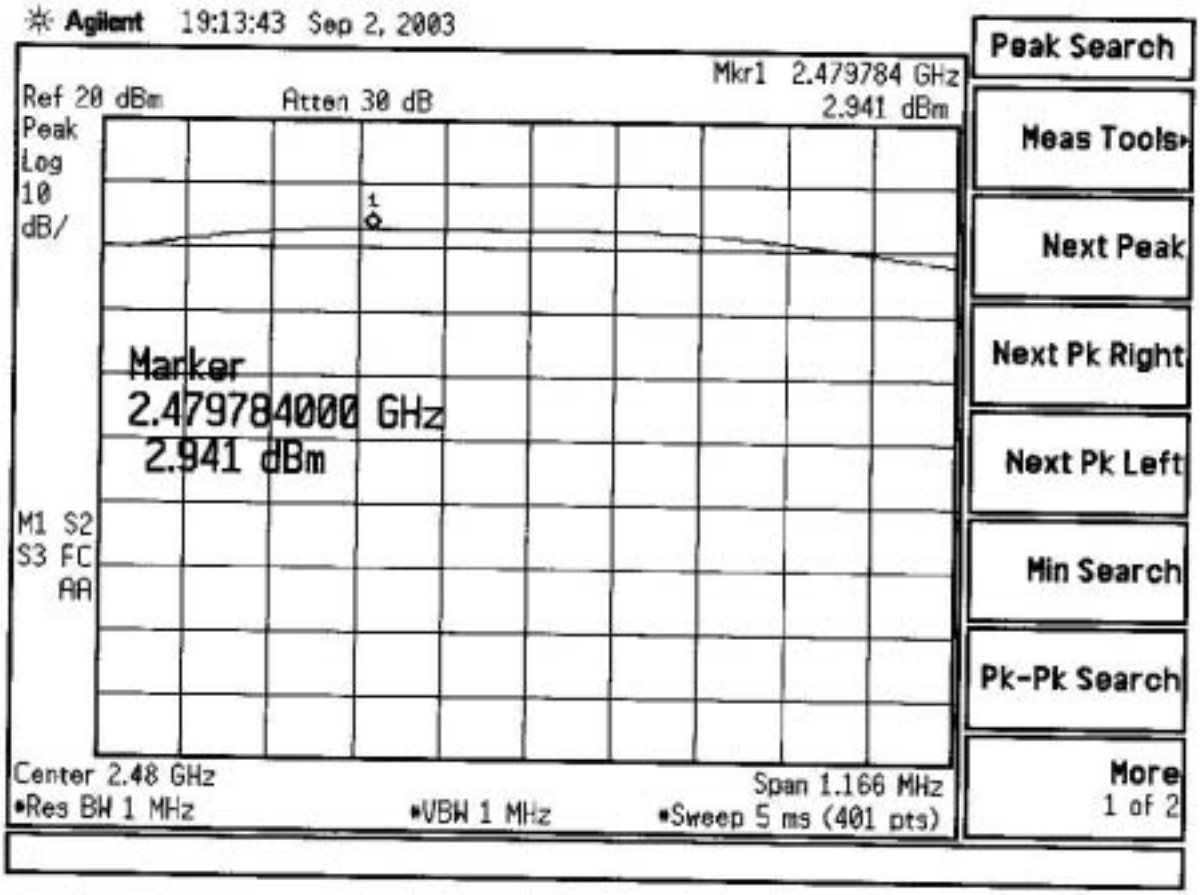
Transmitter transmit at middle channel (2441Mhz)



The Power (ERP) = Output power + cable loss + antenna gain

= 3.279 dbm +1.7 db+ 0 dBi = 4.979 dbm

Transmitter transmit at highest channel (2480Mhz)



The Power (ERP) = Output power + cable loss + antenna gain

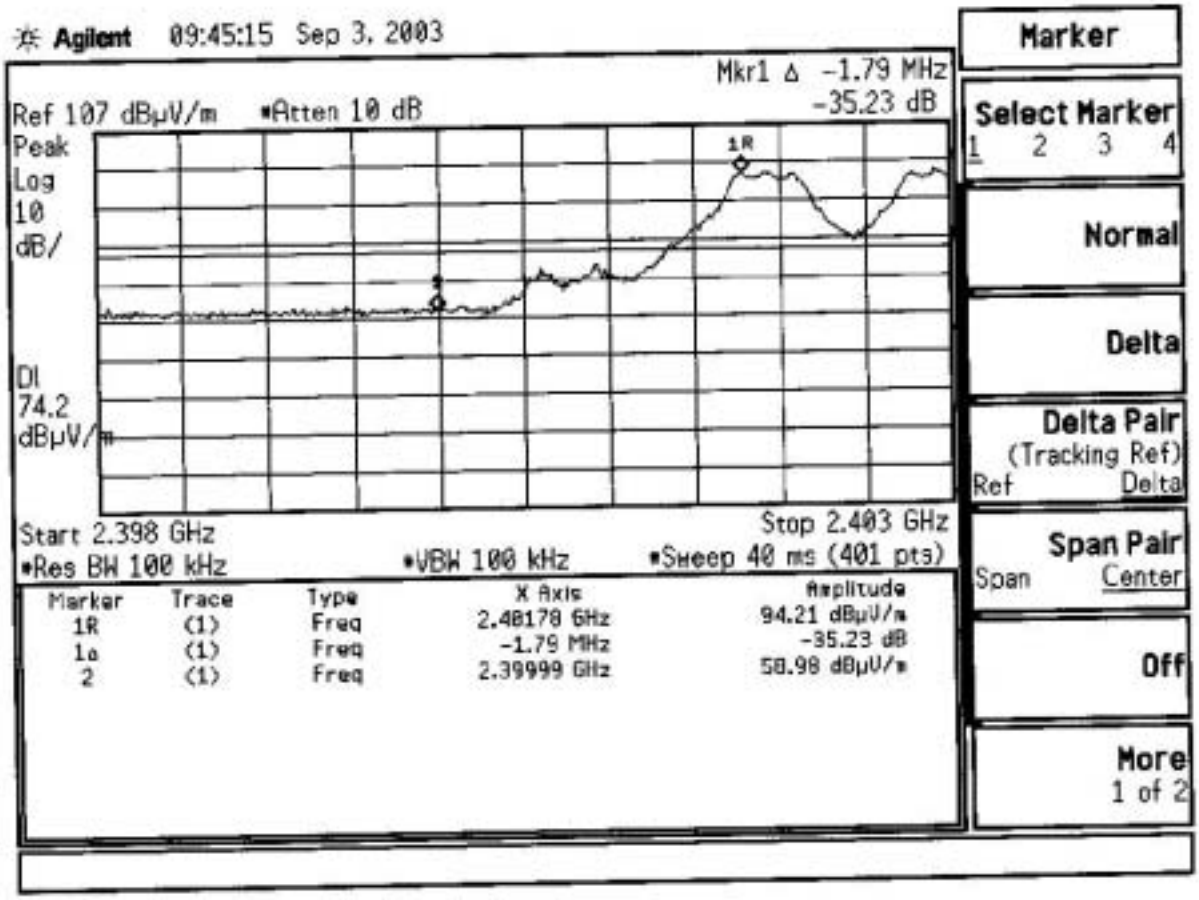
= 2.941 dbm +1.7 db+ 0 dBi = 4.641 dbm

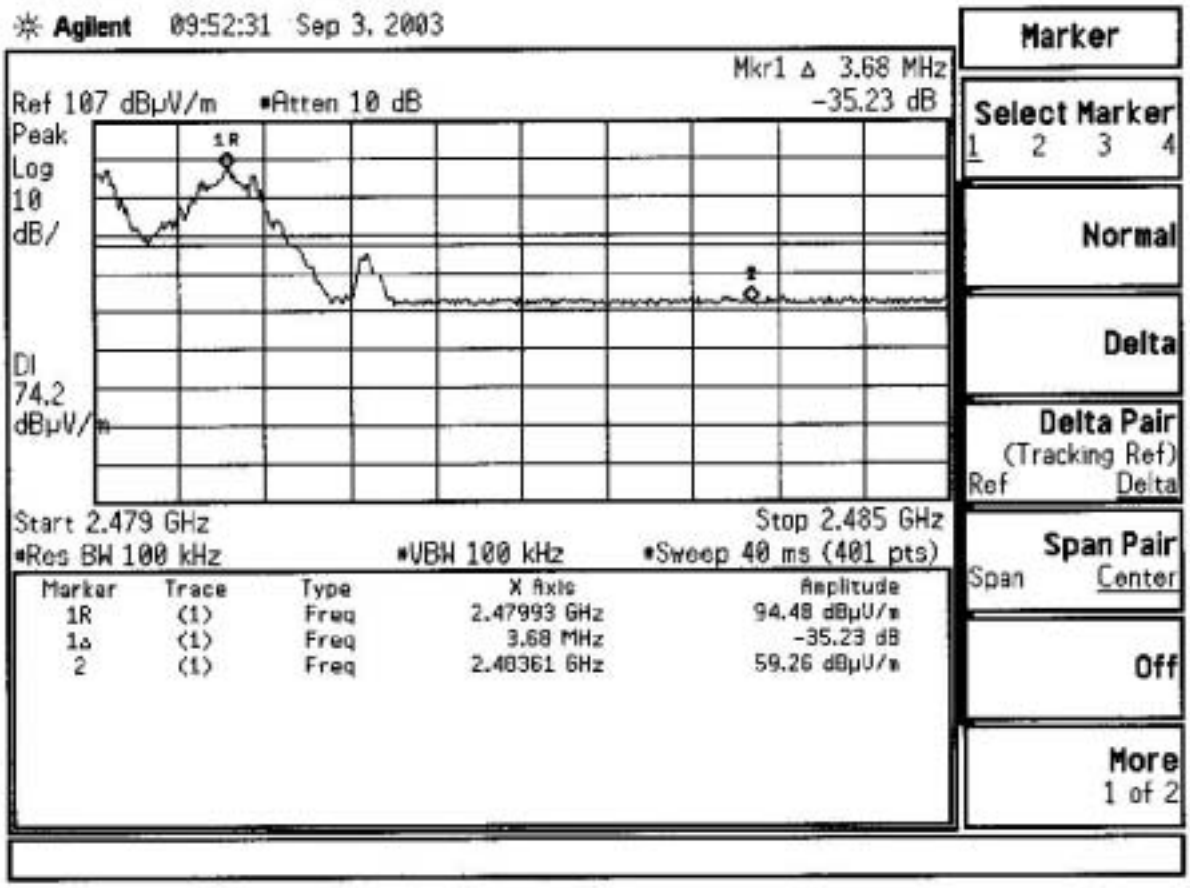
So the max power happens at 2441Mhz , which equals to 4.979 dbm = 6.9 mW

Limits:

For frequency hopping systems operating in the 2400-2483.5 MHz band employing At least 75 hopping channels, all frequency hopping systems in the 5725-5850MHZ Band, and all direct sequence systems: 1 Watt.

4.6 Band Edge emission SUBCLAUSE15.247(c)





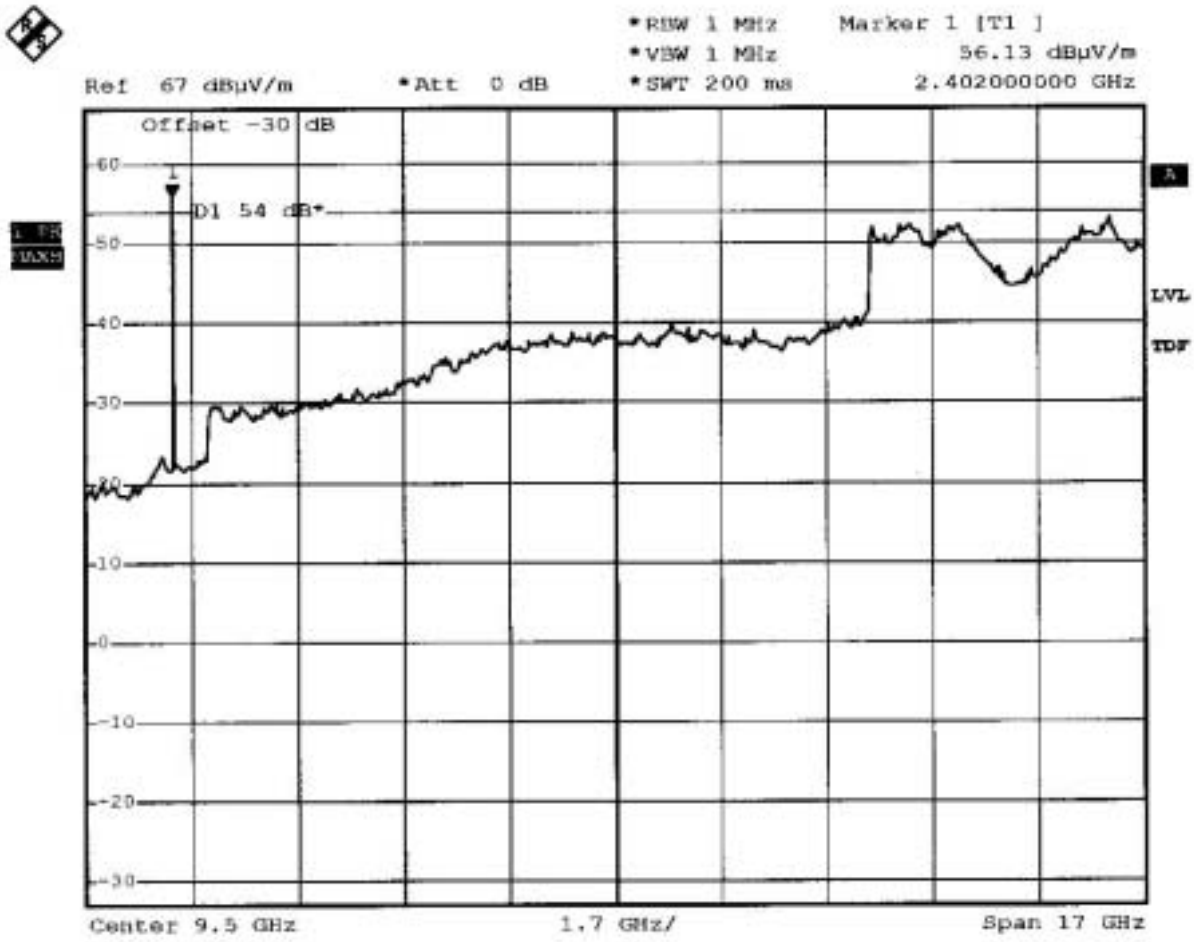
	Lower bandedge	Upper bandedge
Bandedge difference from main channel	**35.23 db**	**35.23 db**

4.7.1 Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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, and it must comply with the limit in 15.209.

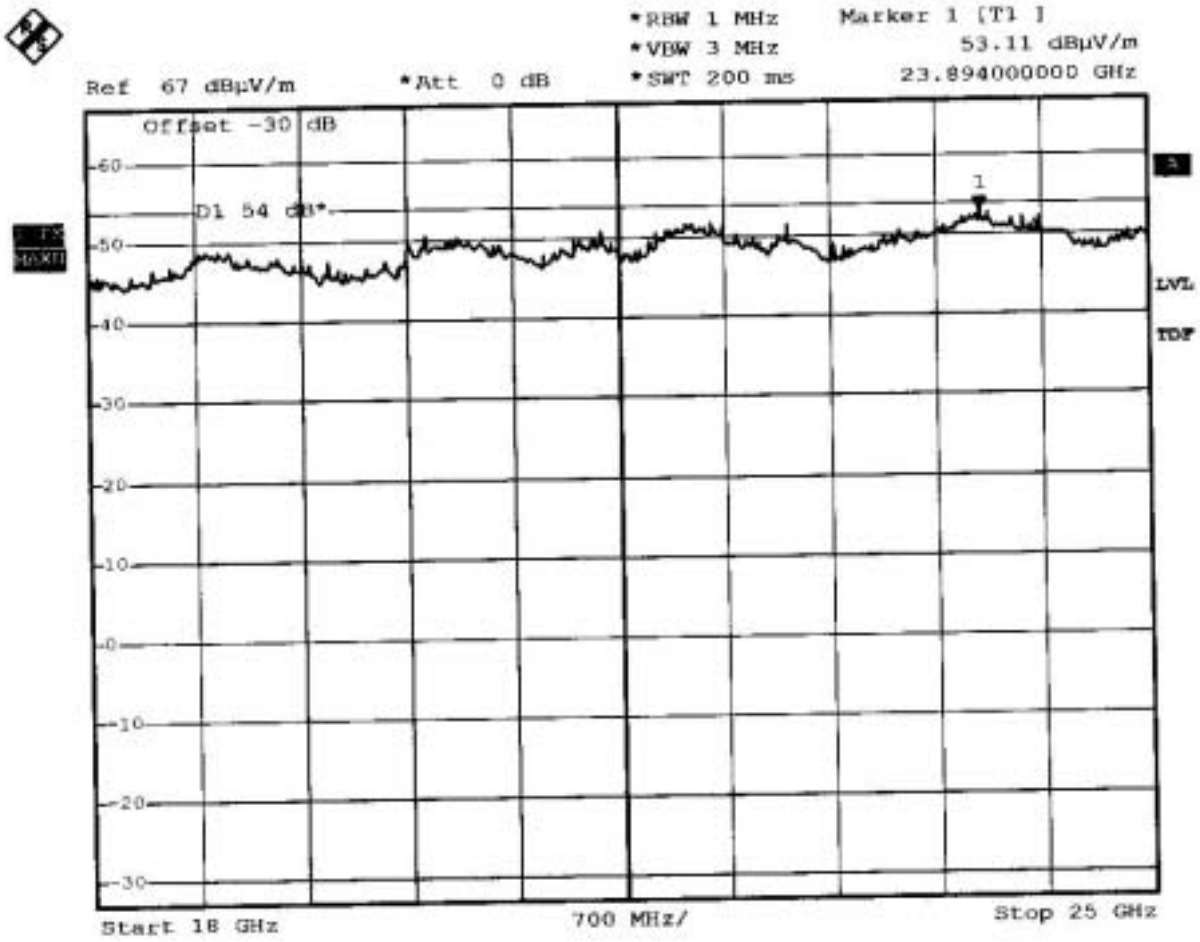
4.7 Spurious Emission under 25Ghz (from 1Ghz) SUBCLAUSE15.247(c)

1. Transmit at 2402Mhz
1Ghz – 18Ghz , Vertical



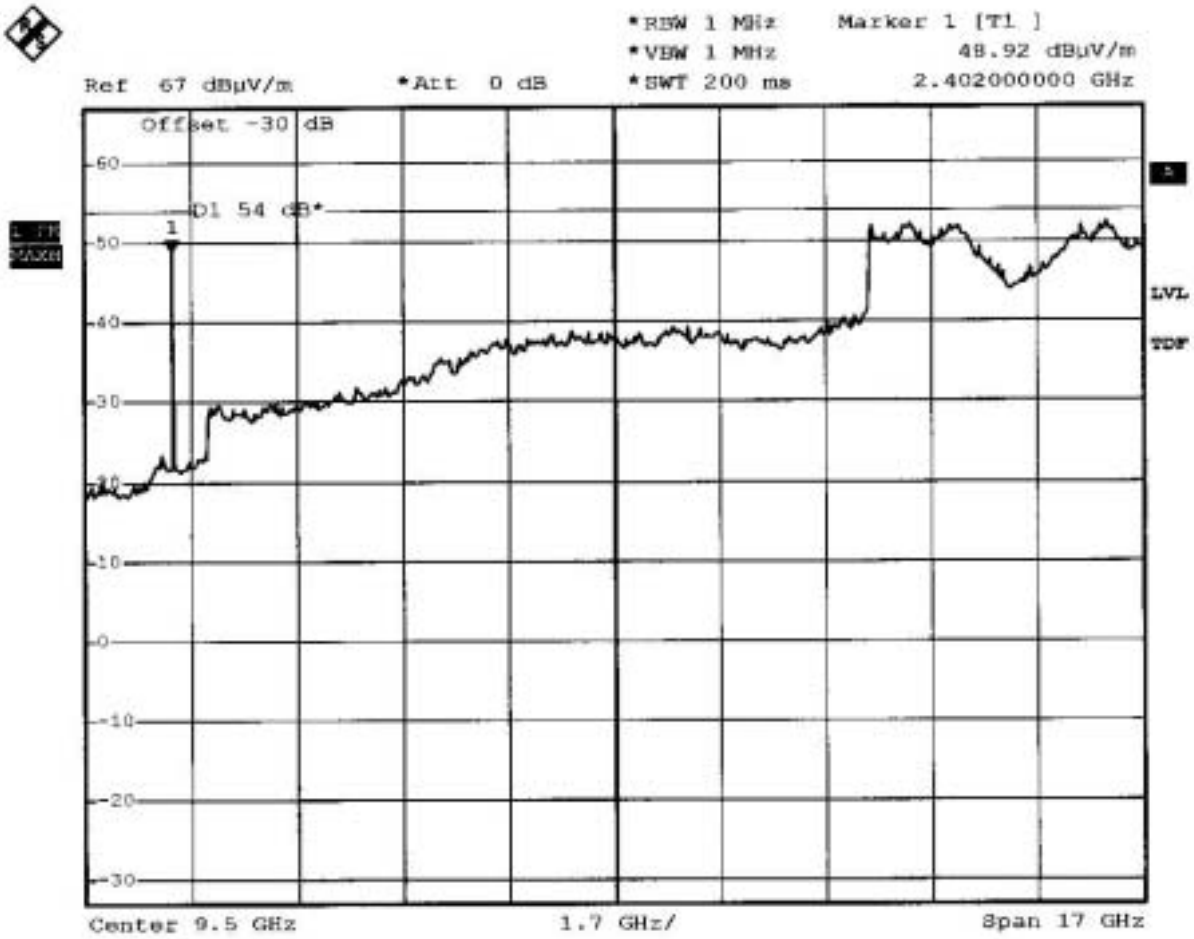
Date: 2.SEP.2003 15:24:50

18Ghz – 25Ghz , Vertical



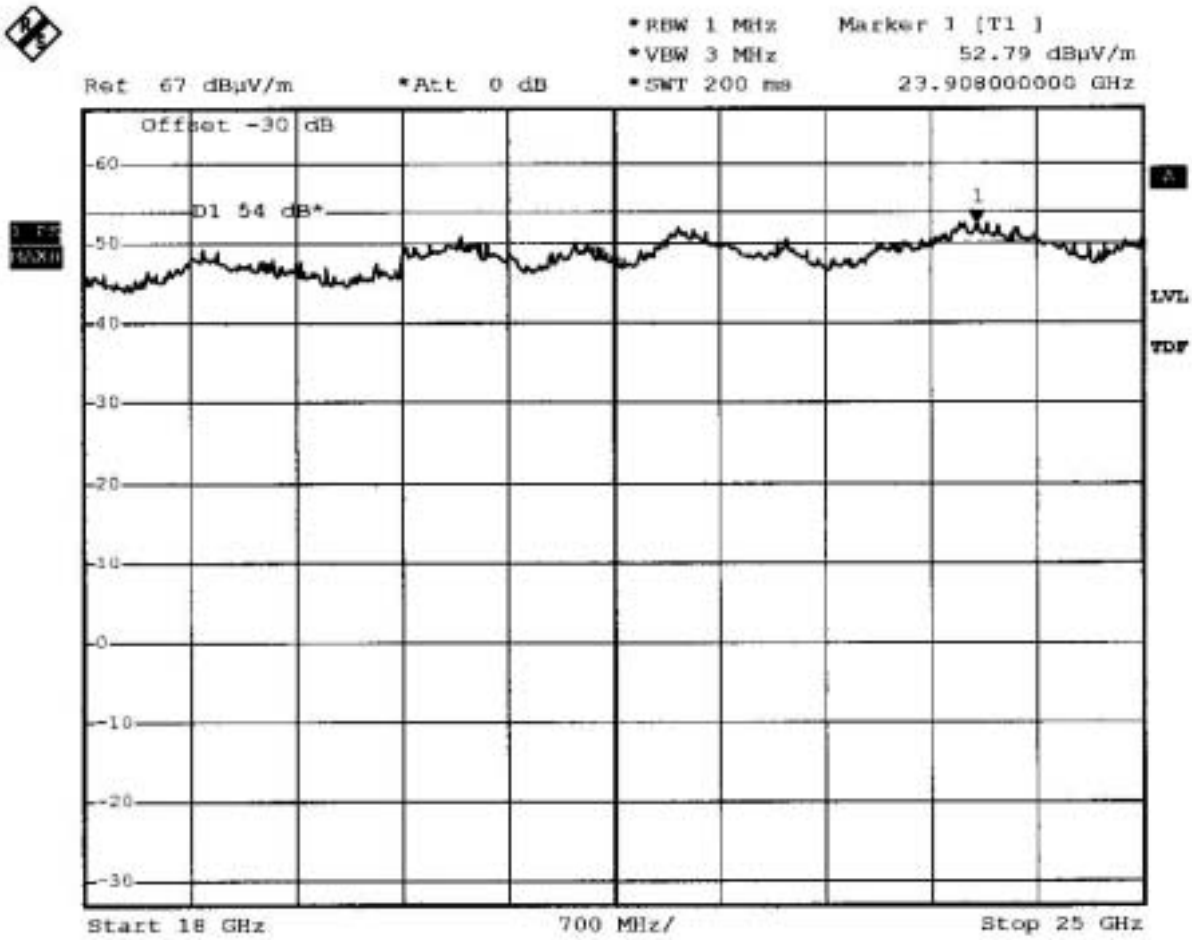
Date: 3.SEP.2003 18:29:17

1Ghz – 18Ghz , Horizontal

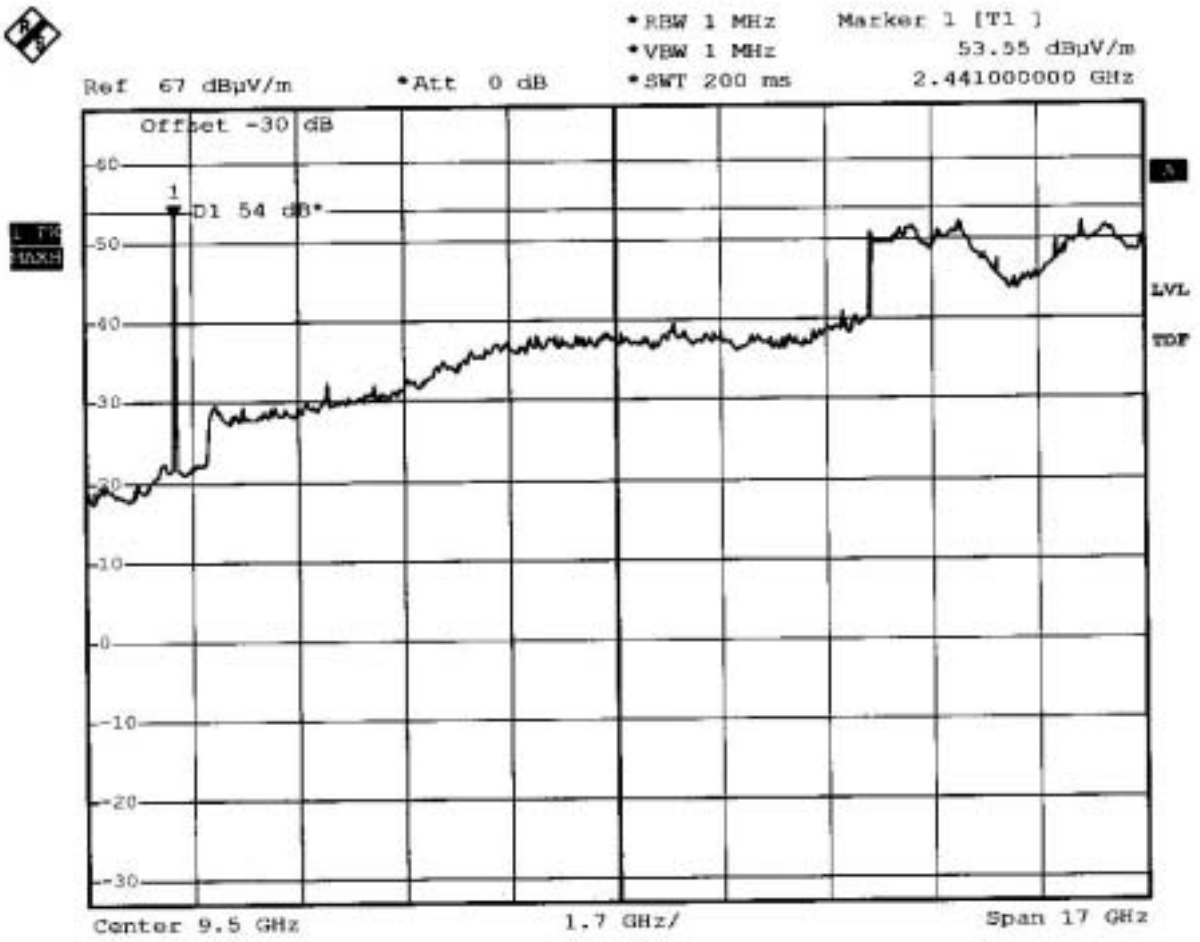


Date: 2.SEP.2003 15:23:21

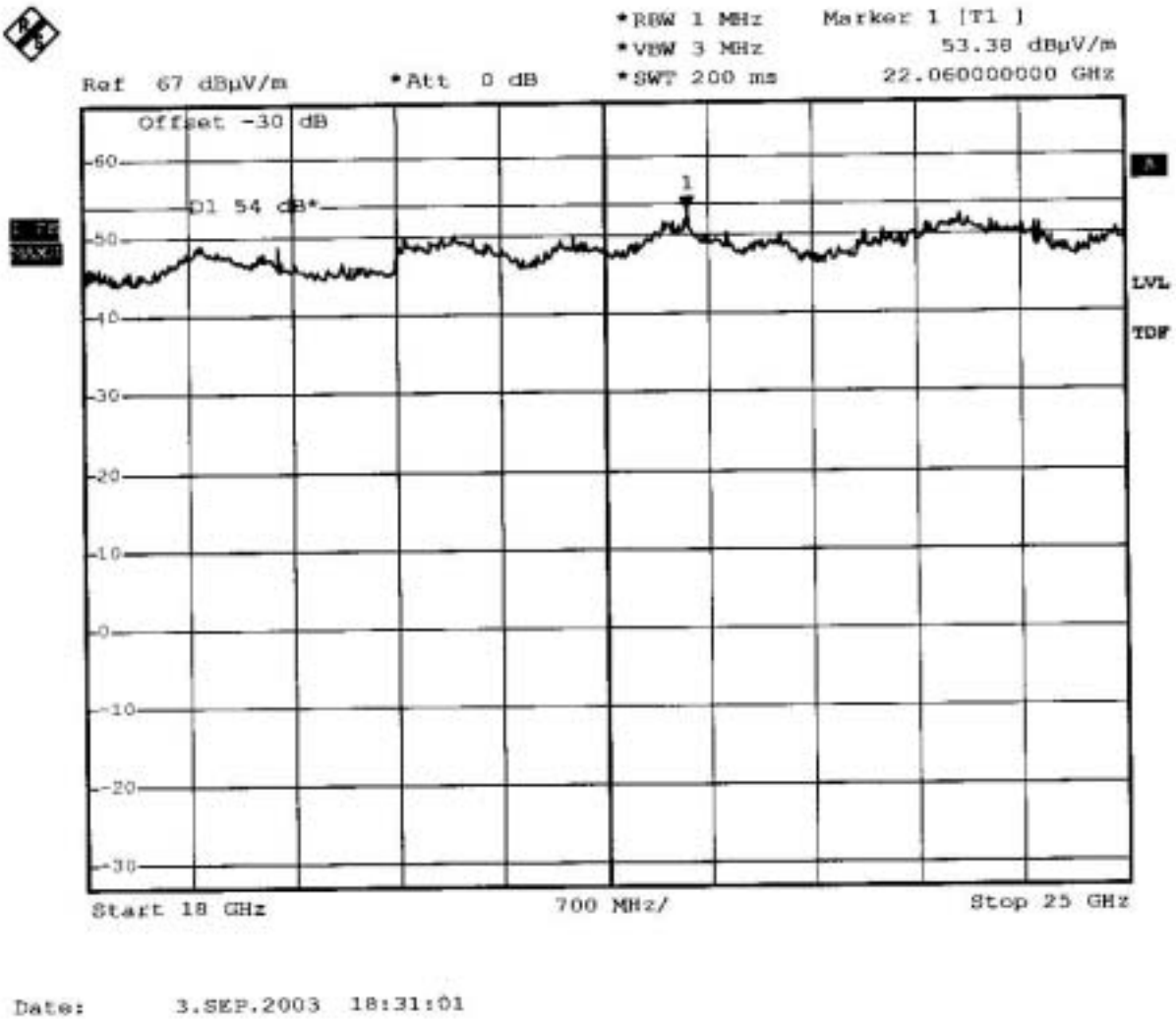
18Ghz – 25Ghz , Horizontal



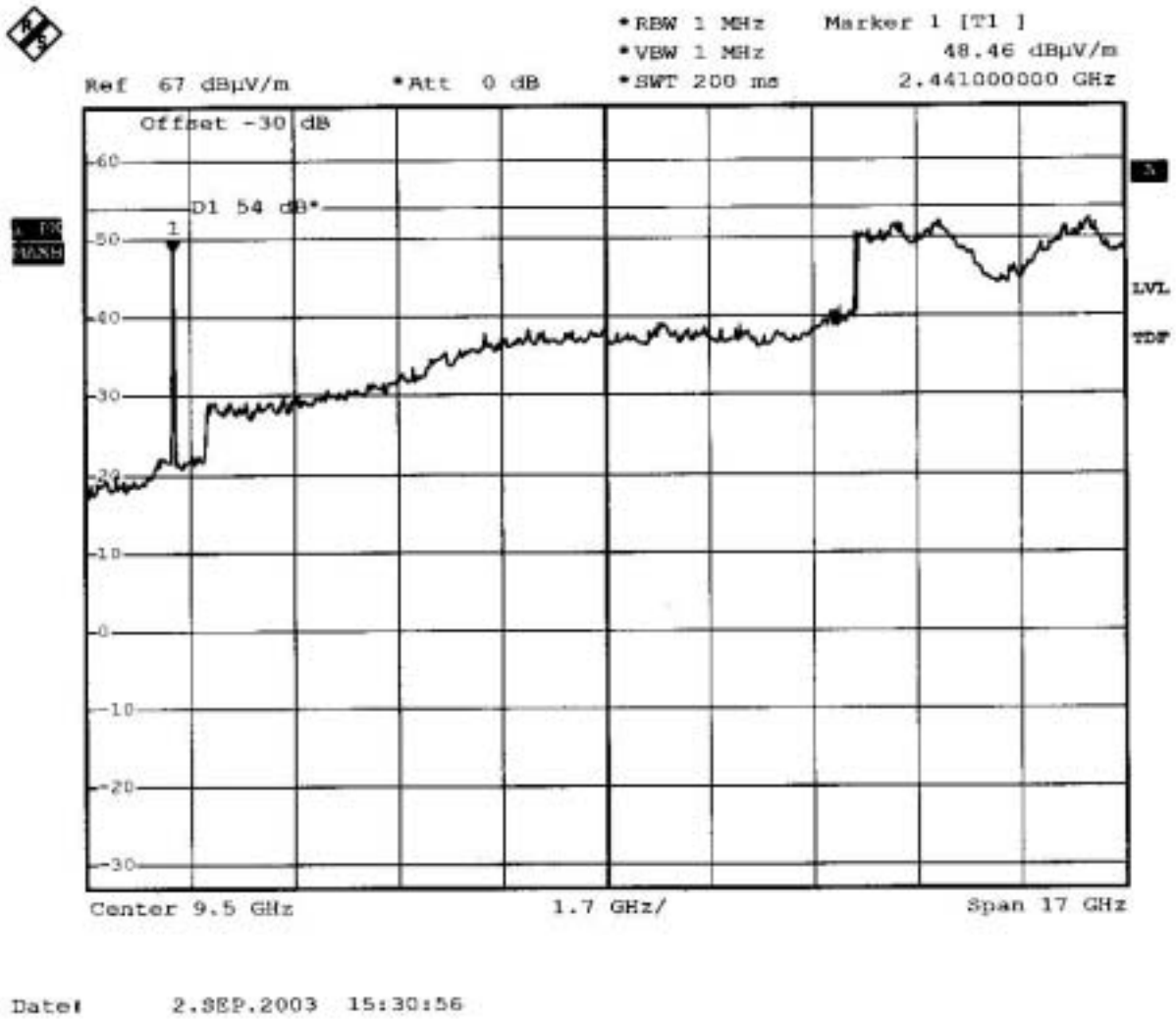
2. Transmit at 2441Mhz
1Ghz – 18Ghz , Vertical



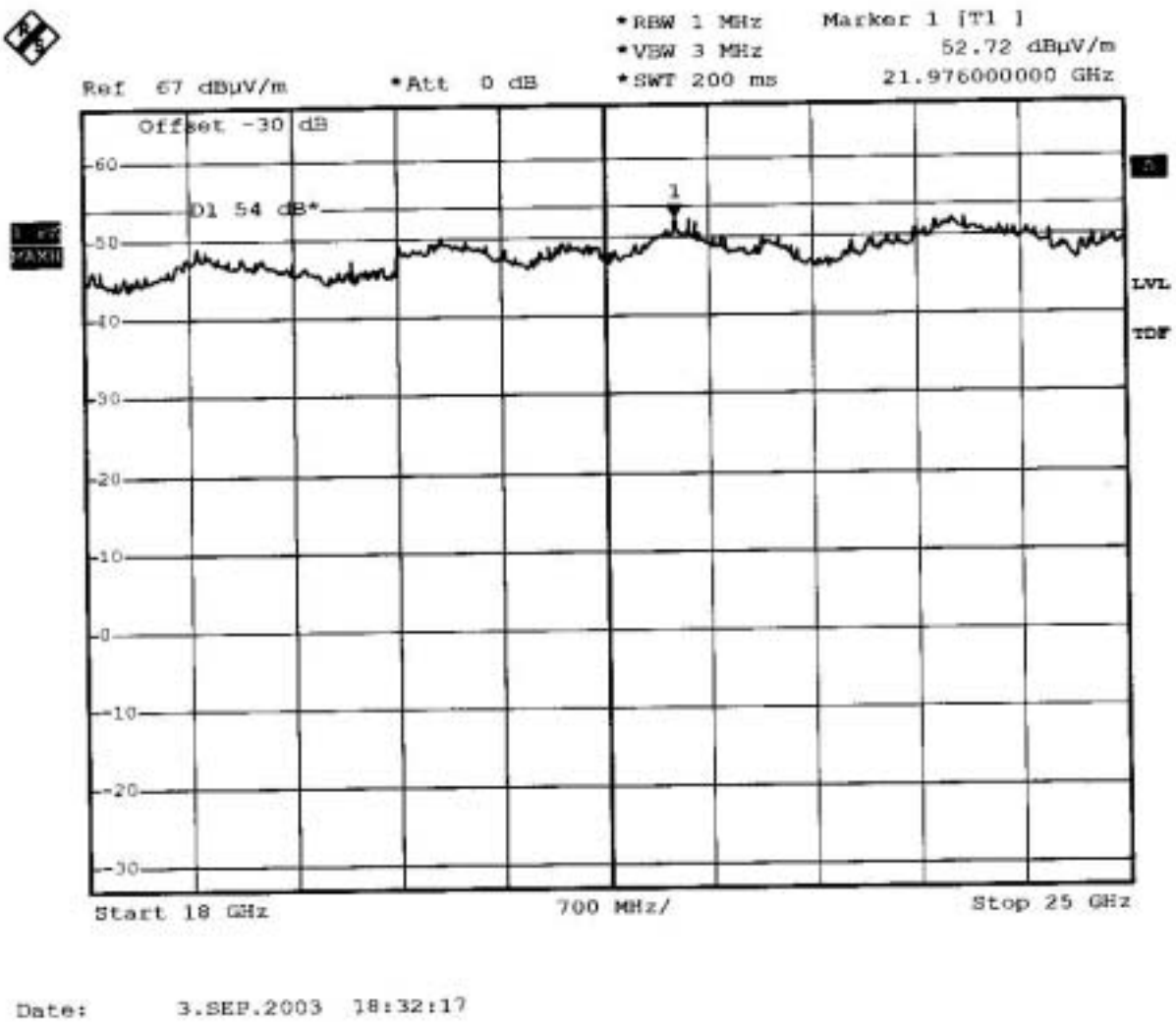
18Ghz – 25Ghz , Vertical



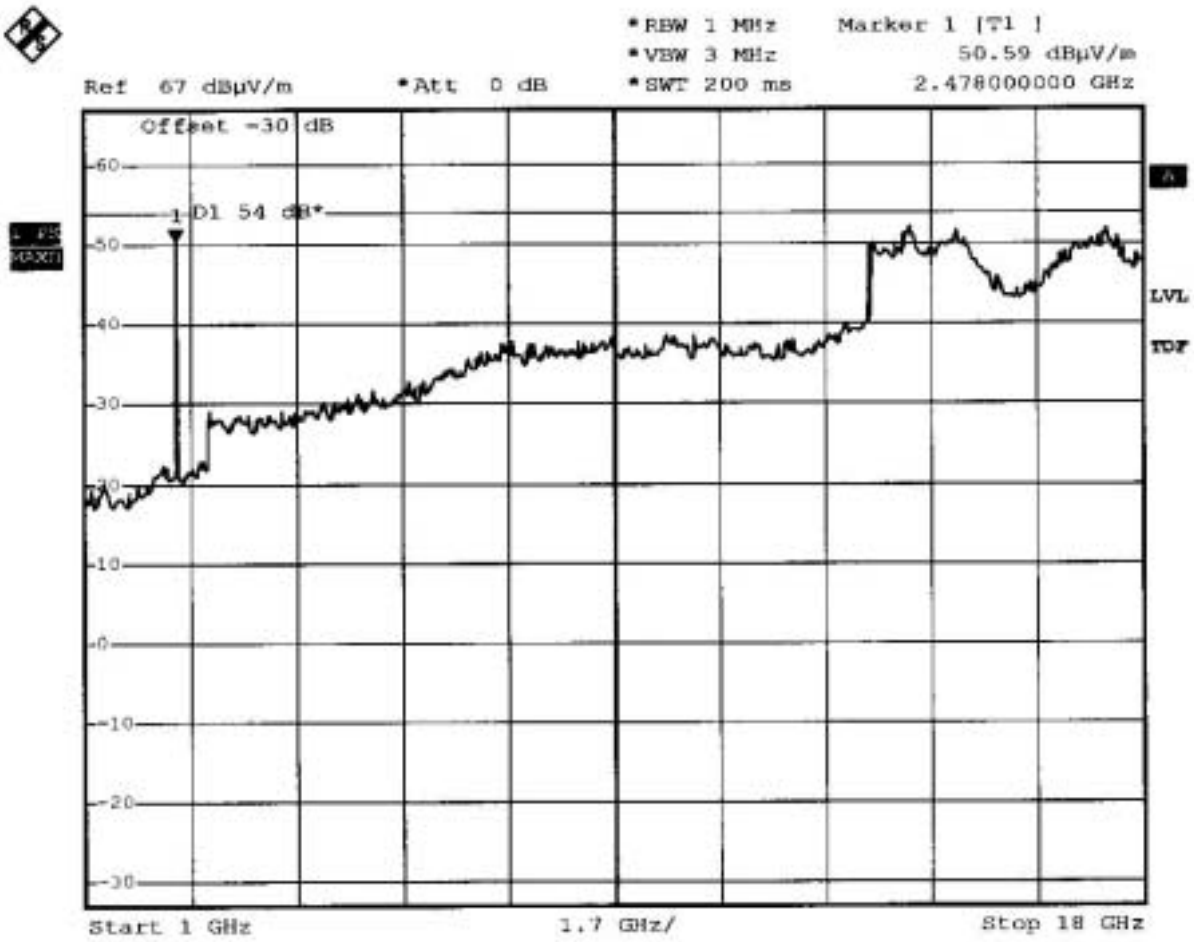
1Ghz – 18Ghz , Horizontal



18Ghz – 25Ghz , Horizontal

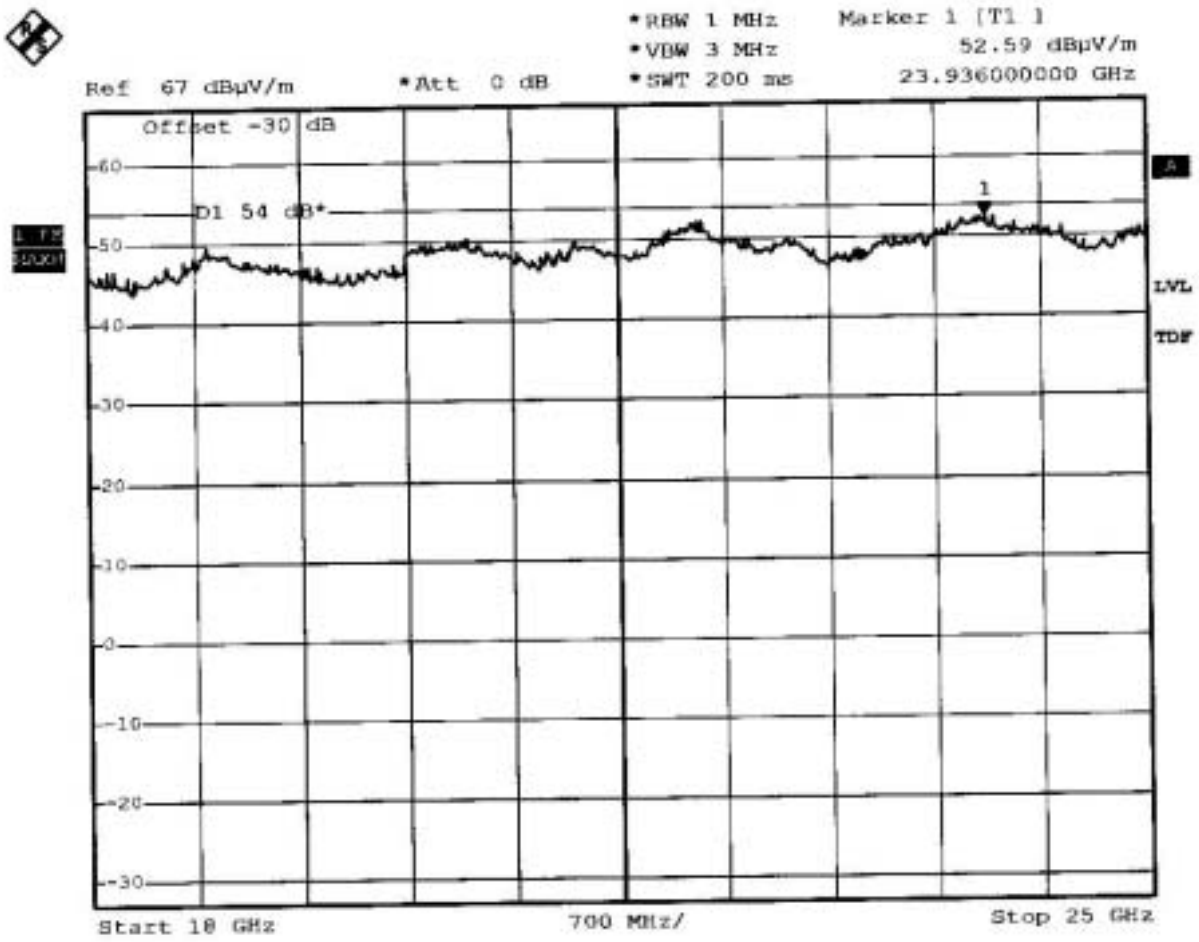


3. Transmit at 2480Mhz
1Ghz – 18Ghz , Vertical



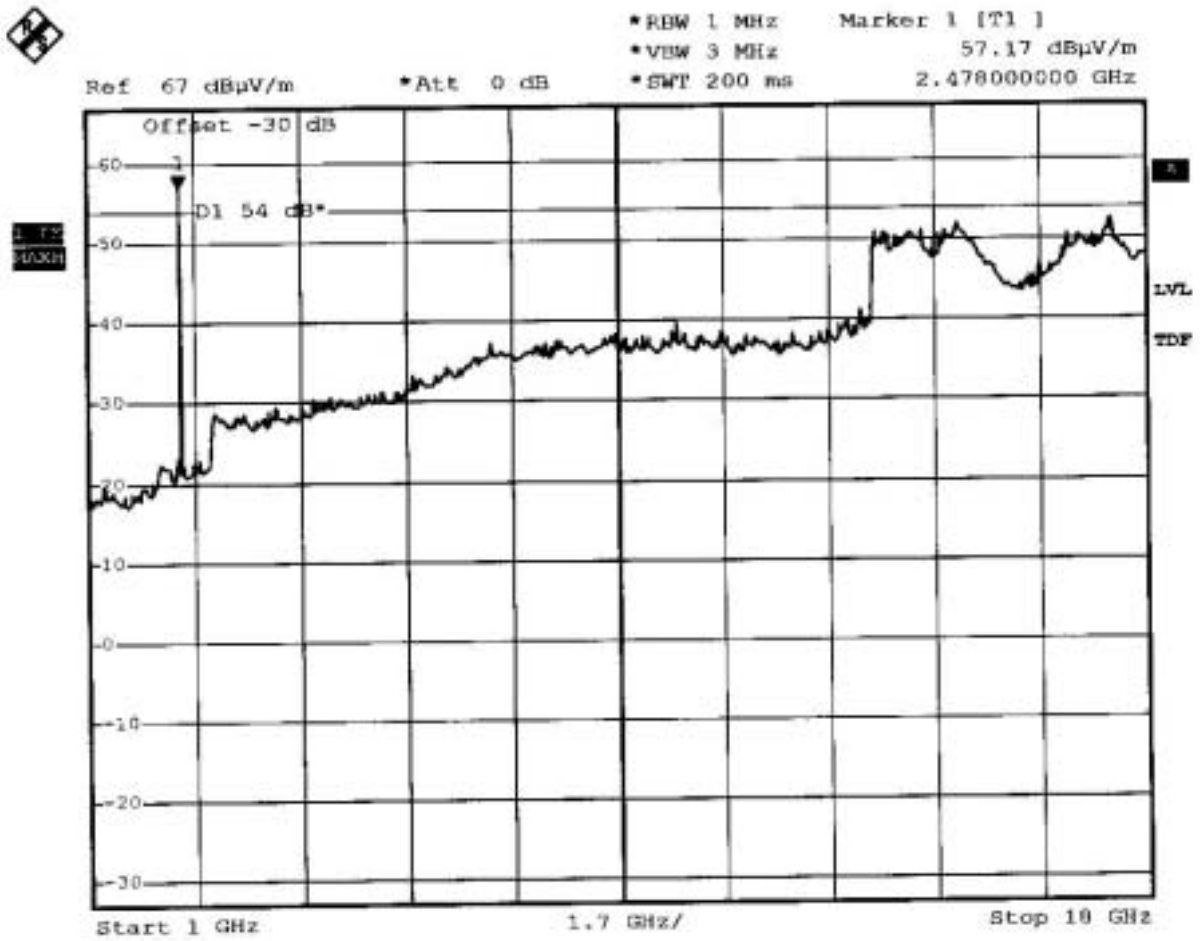
Date: 3.SEP.2003 18:27:53

18Ghz – 25Ghz , Vertical



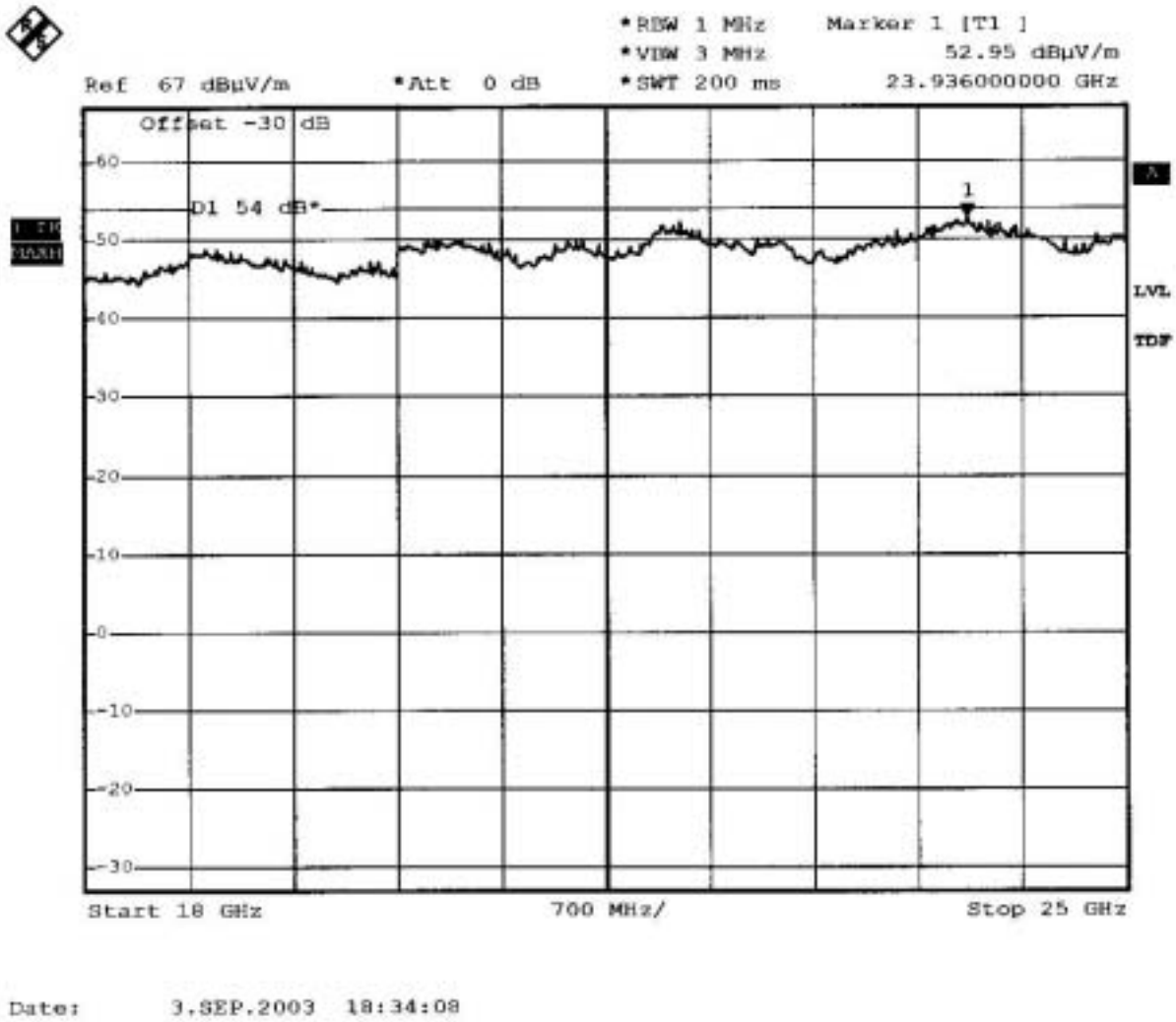
Date: 3.SEP.2003 18:33:05

1Ghz – 18Ghz , Horizontal



Date: 3.SEP.2003 18:26:20

18Ghz – 25Ghz , Horizontal



APPENDIX: Photographs of Test Setup

(The Photos are saved separately)

APPENDIX : Photographs of EUT

Internal Photos

(The Photos are saved separately)

External Photos

(The Photos are saved separately)