

TEST REPORT

Equipment Under Test : GST Class 2 Bluetooth Headset
Model No. : GL2BHS82

Applicant : Global Sun Technology Inc.
Address of Applicant : No 13. Tung Yuan Rd., Jung Li Industrial Park Jung Li
City ,Taoyuan Hsien,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 **Date** : Aug. 12, 2003

Approved by : Robert Chang **Date** : Aug 13, 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 : Global Sun Technology Inc.
Address of Applicant: No 13. Tung Yuan Rd.,Jung Li Industrial
 Park Jung Li City ,Taoyuan Hsien,Taiwan ,
 R.O.C.
 Contact: Jane Lee
 Telephone: +886-2-85227155 ext.63110

1.3 Description of EUT(s)

| | | |
|----|-----------------------|----------------------------------|
| 1 | Product name | GST Class 2 Bluetooth Headset |
| 2 | Product ID | GL2BHS82 |
| 3 | Supply Voltage | DC 3.7V |
| 4 | Antenna Gain | 1.9 dBi |
| 5 | Carrier Frequency | 2402MHz to 2480MHz |
| 6 | Modulation Method | GFSK,1Mbps,0.5BT Gaussian |
| 7 | Hopping | 1600hops/sec, 1MHz channel space |
| 8 | Output Interface | USB |
| 9 | Operation Temperature | -20 to +55 degree |
| 10 | 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=55 (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 plug in the USB port of PC 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.

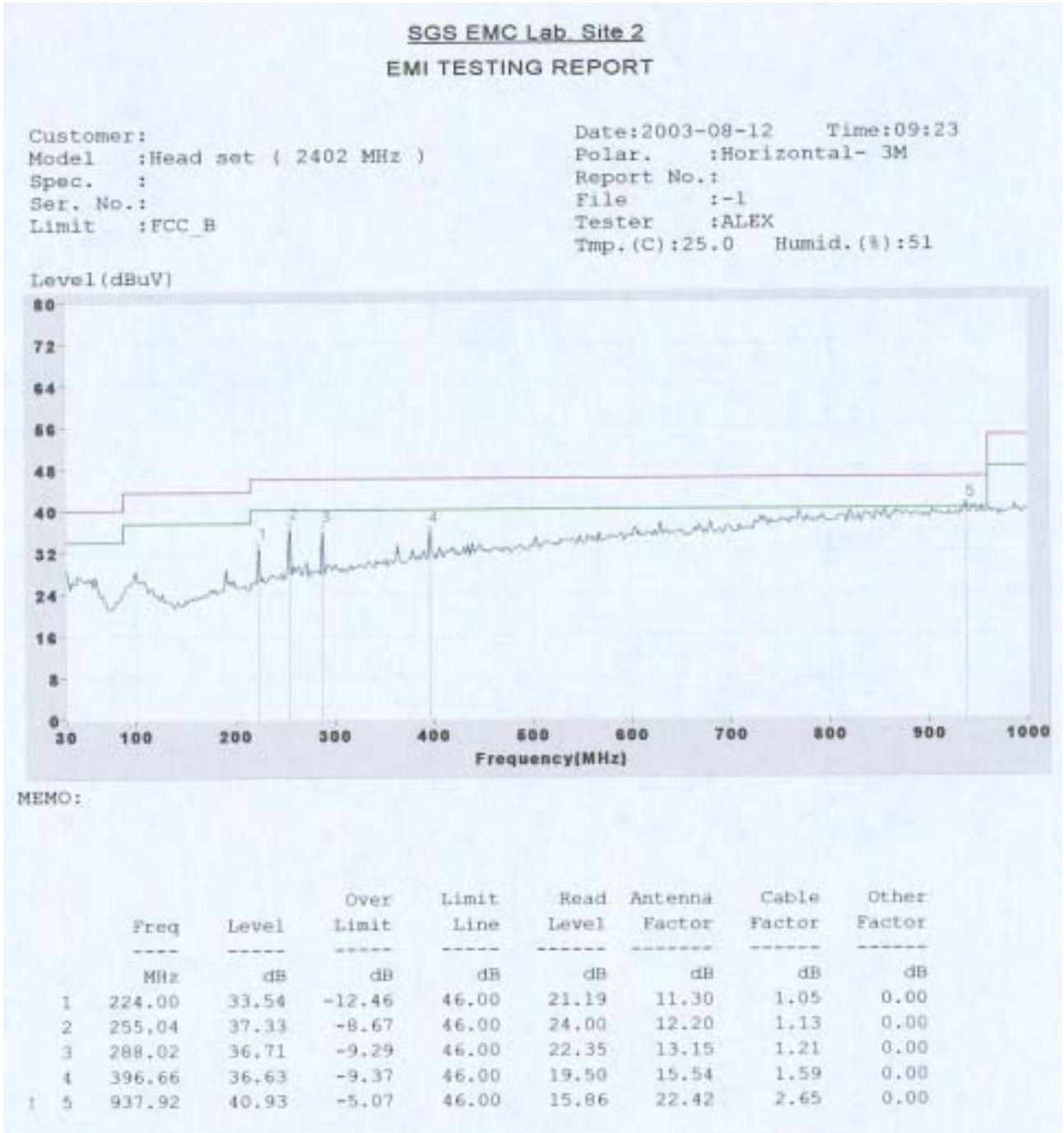
2.Summary of Results

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

3. Instruments List

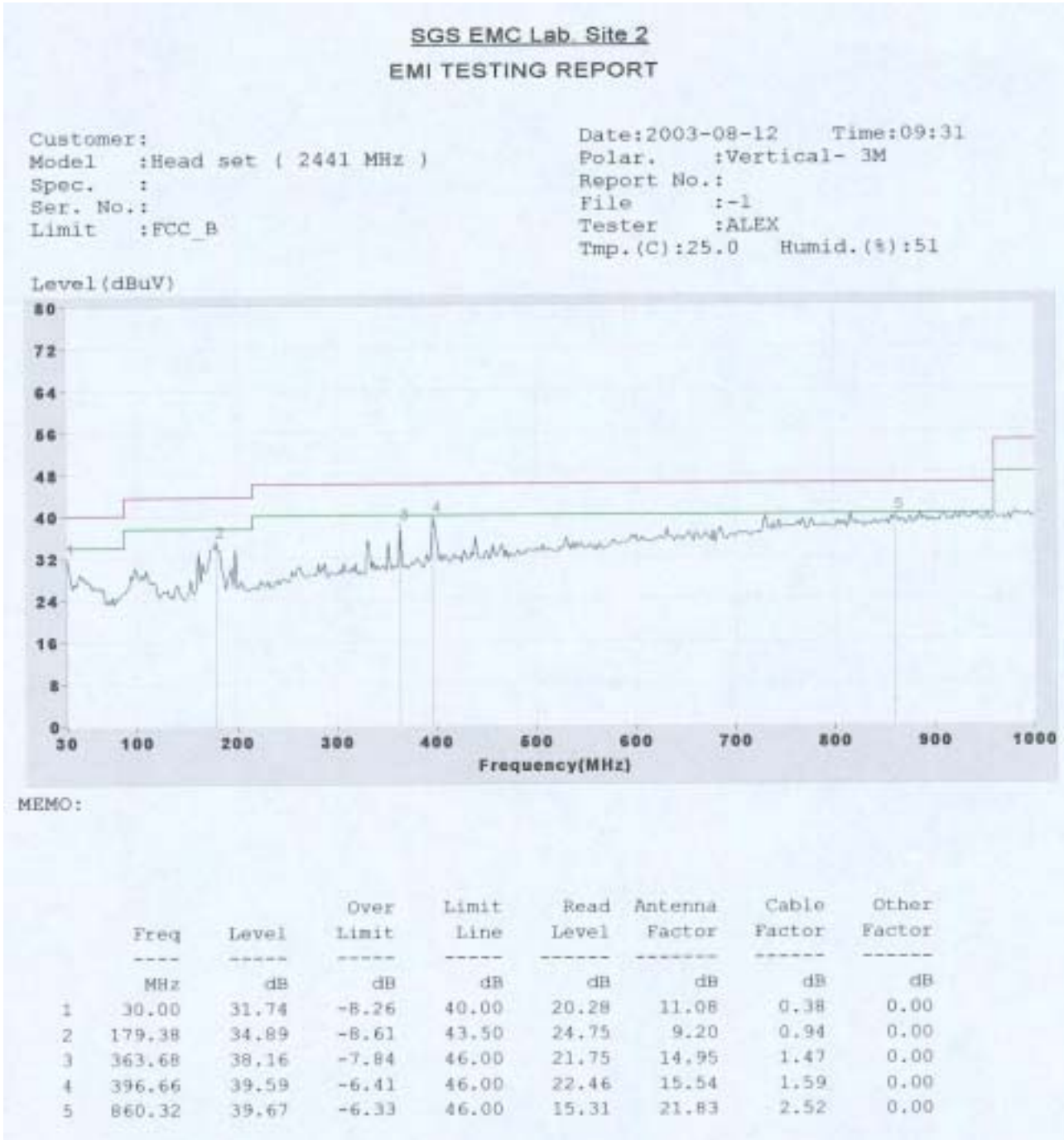
| Instrument | Model | Serial number | Calibration date |
|--------------------------|----------------------------------|----------------------|-------------------------|
| Desktop PC | HP Pavillion 723D | N/A | N/A |
| Spectrum Analyzer | Agilent E7405A | US40240202 | Jun 02, 2003 |
| Spectrum Analyzer | 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 |

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



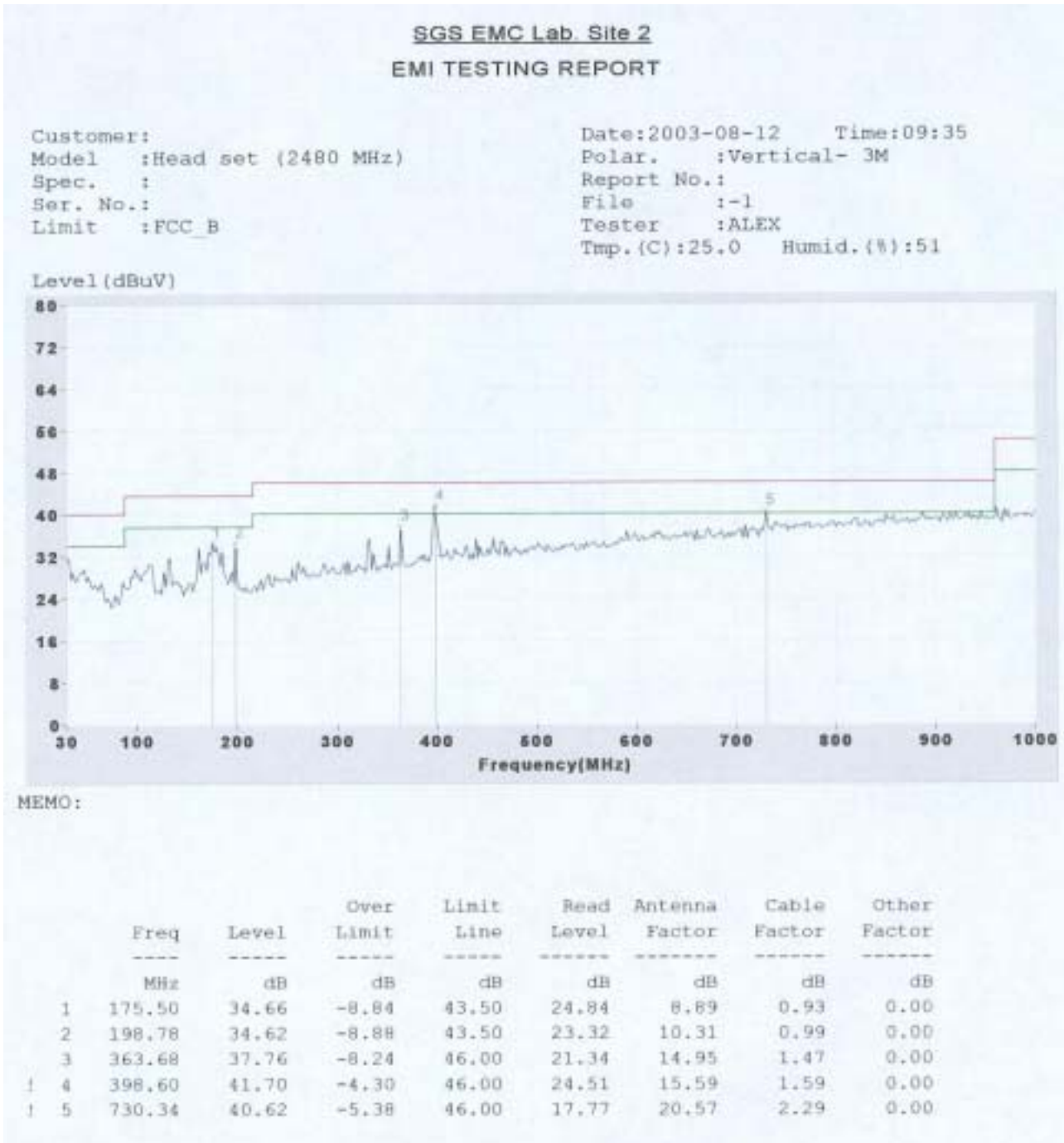
| Freq | Level | Over Limit | Read Level | Antenna Factor | Cable Factor |
|--------|-------|------------|------------|----------------|--------------|
| 937.92 | 40.93 | -5.07 | 15.86 | 22.42 | 2.65 |
| 255.04 | 37.33 | -8.67 | 24.00 | 12.20 | 1.13 |

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



| Freq | Level | Over Limit | Read Level | Antenna Factor | Cable Factor |
|--------|-------|------------|------------|----------------|--------------|
| 860.32 | 39.67 | -6.33 | 15.31 | 21.83 | 2.52 |
| 396.66 | 39.59 | -6.41 | 22.46 | 15.54 | 1.59 |

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



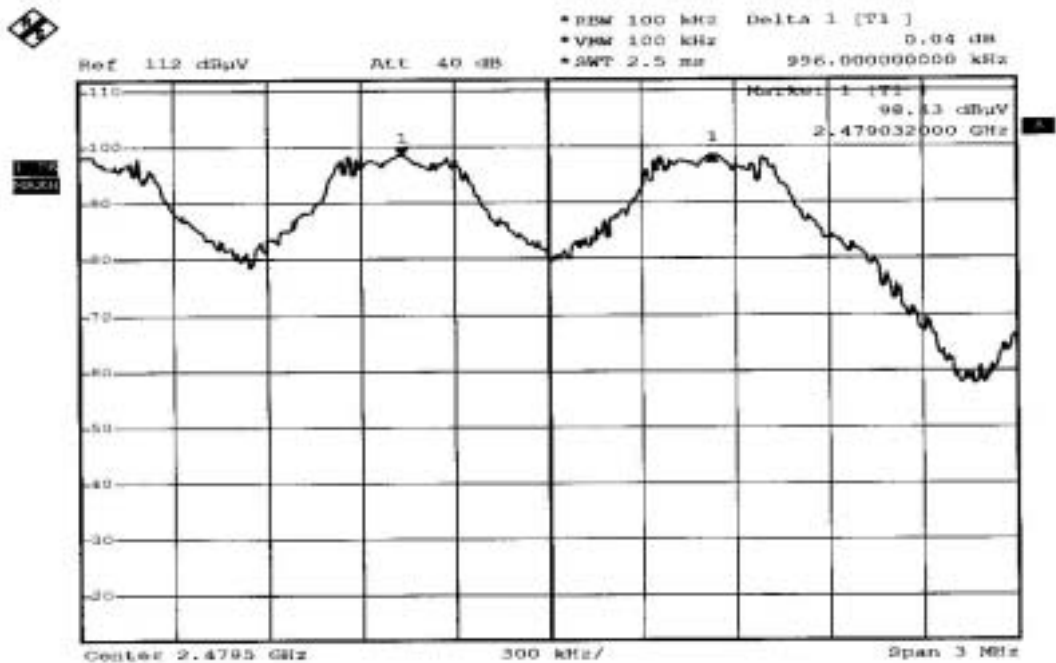
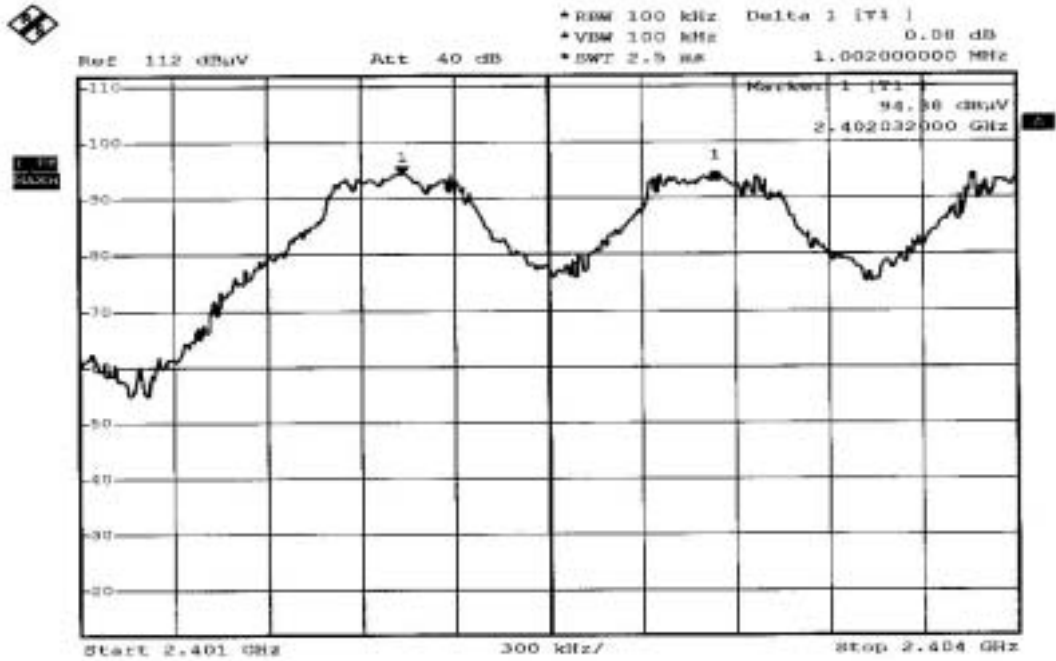
| Freq | Level | Over Limit | Read Level | Antenna Factor | Cable Factor |
|--------|-------|------------|------------|----------------|--------------|
| 730.34 | 40.81 | -5.19 | 17.96 | 20.57 | 2.29 |
| 396.66 | 39.27 | -6.73 | 22.14 | 15.54 | 1.59 |

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 |

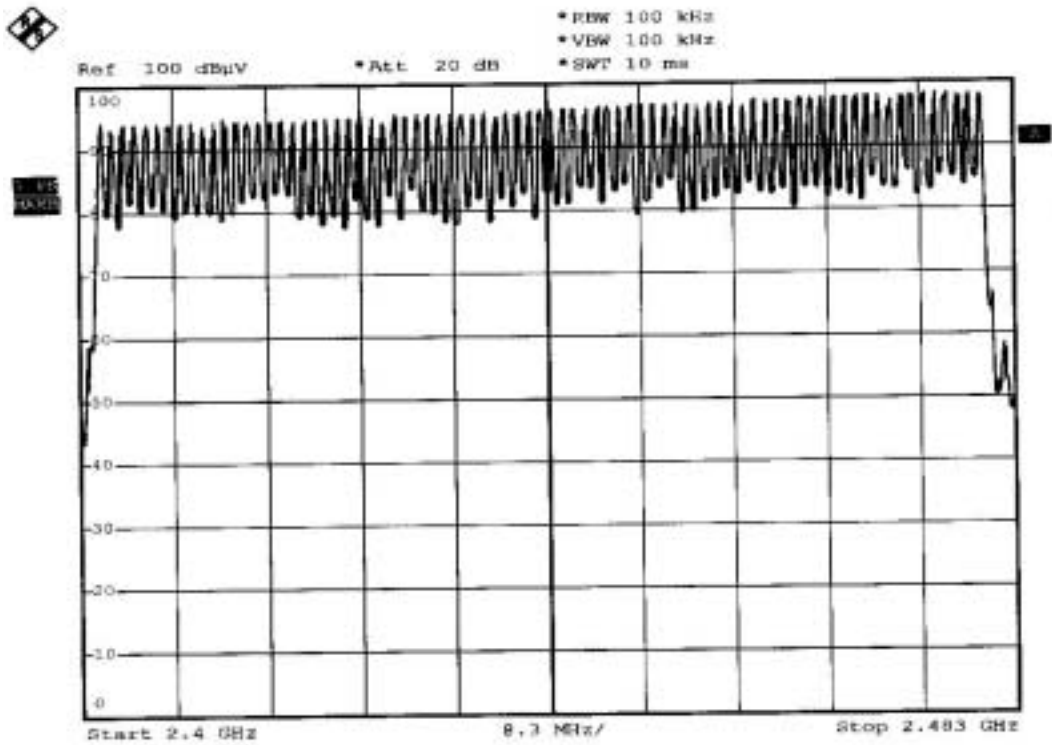
4.2 Channel Spacing

SUBCLAUSE 15.247(a)(1)



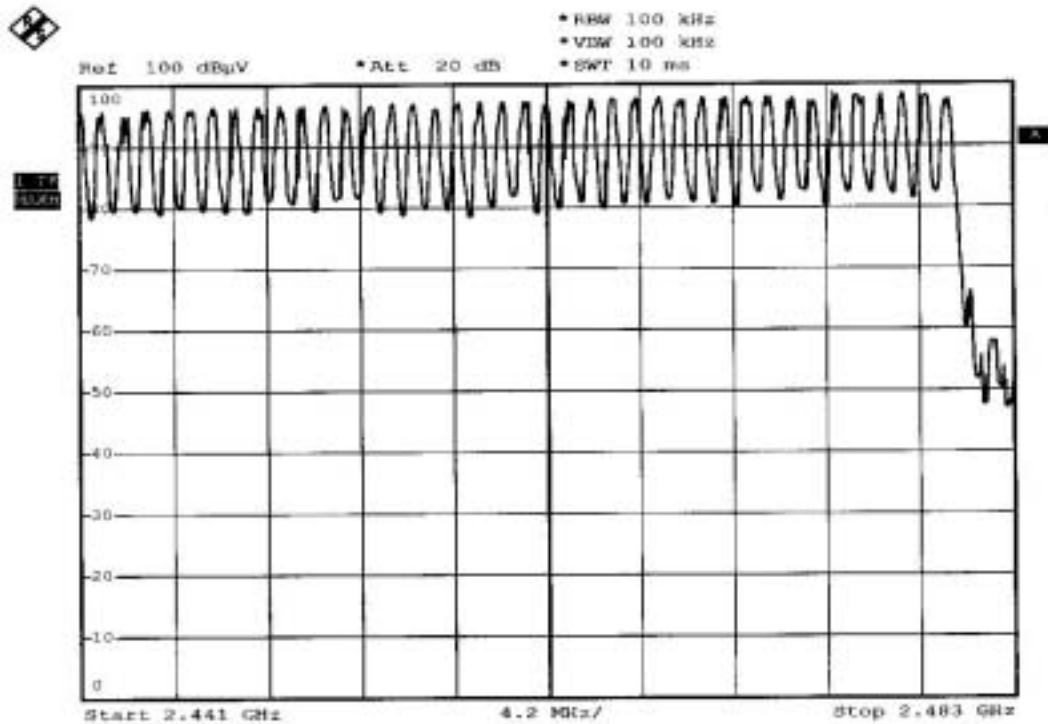
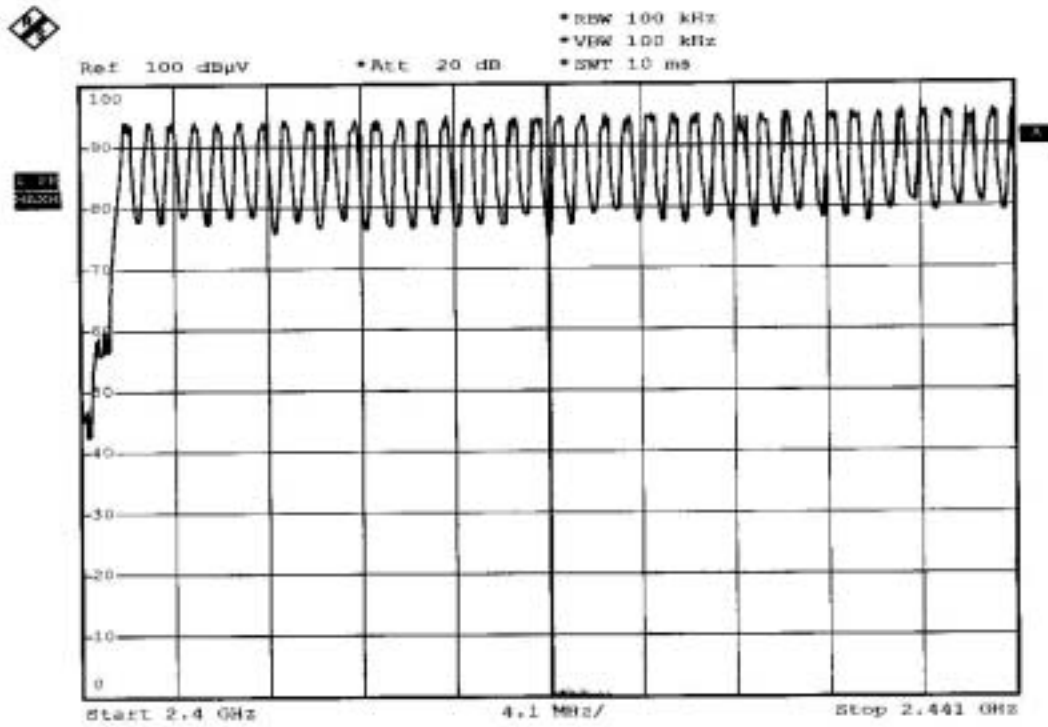
4.3 No. of carrier frequency / 20db Bandwidth

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

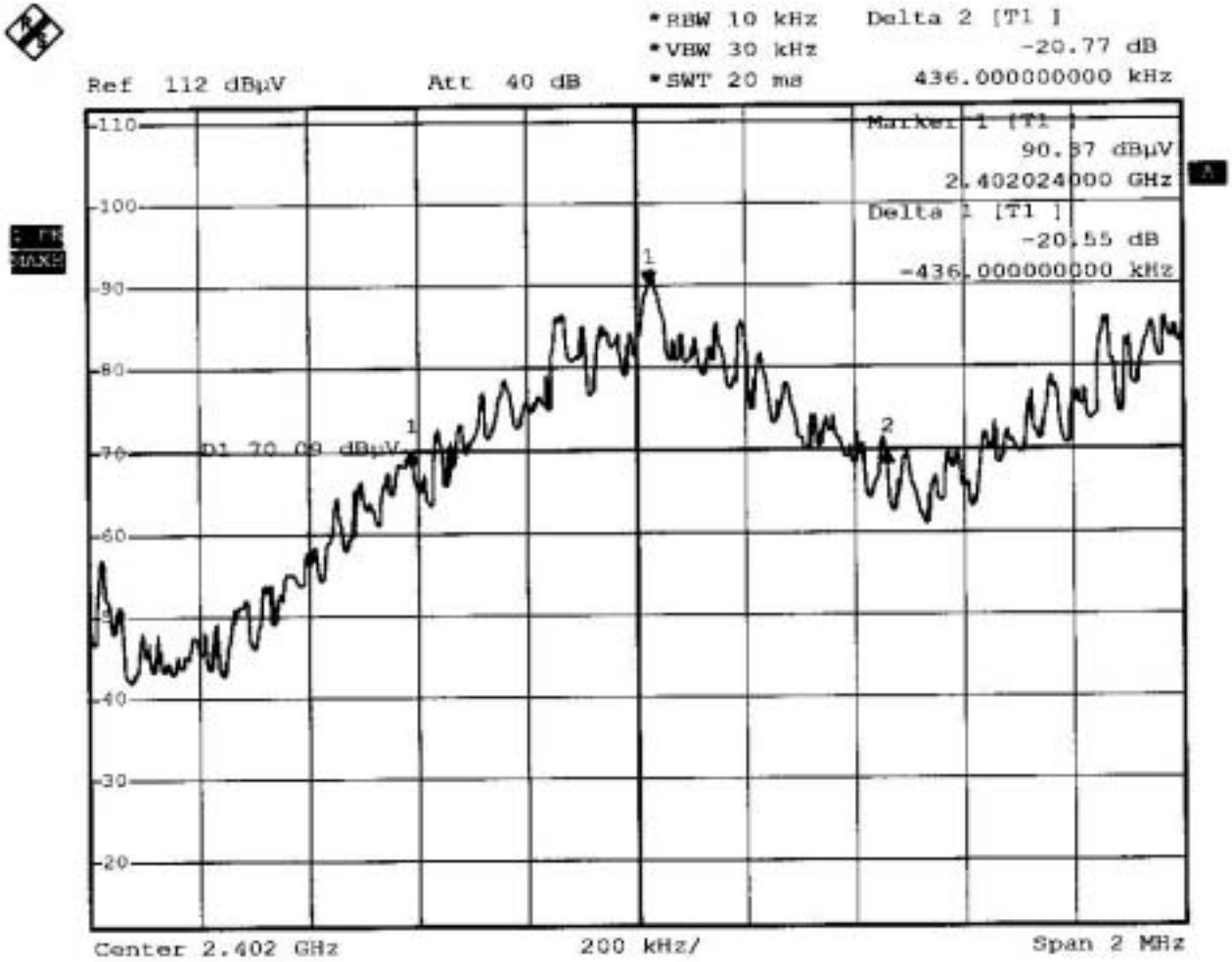


Number of channels = 79

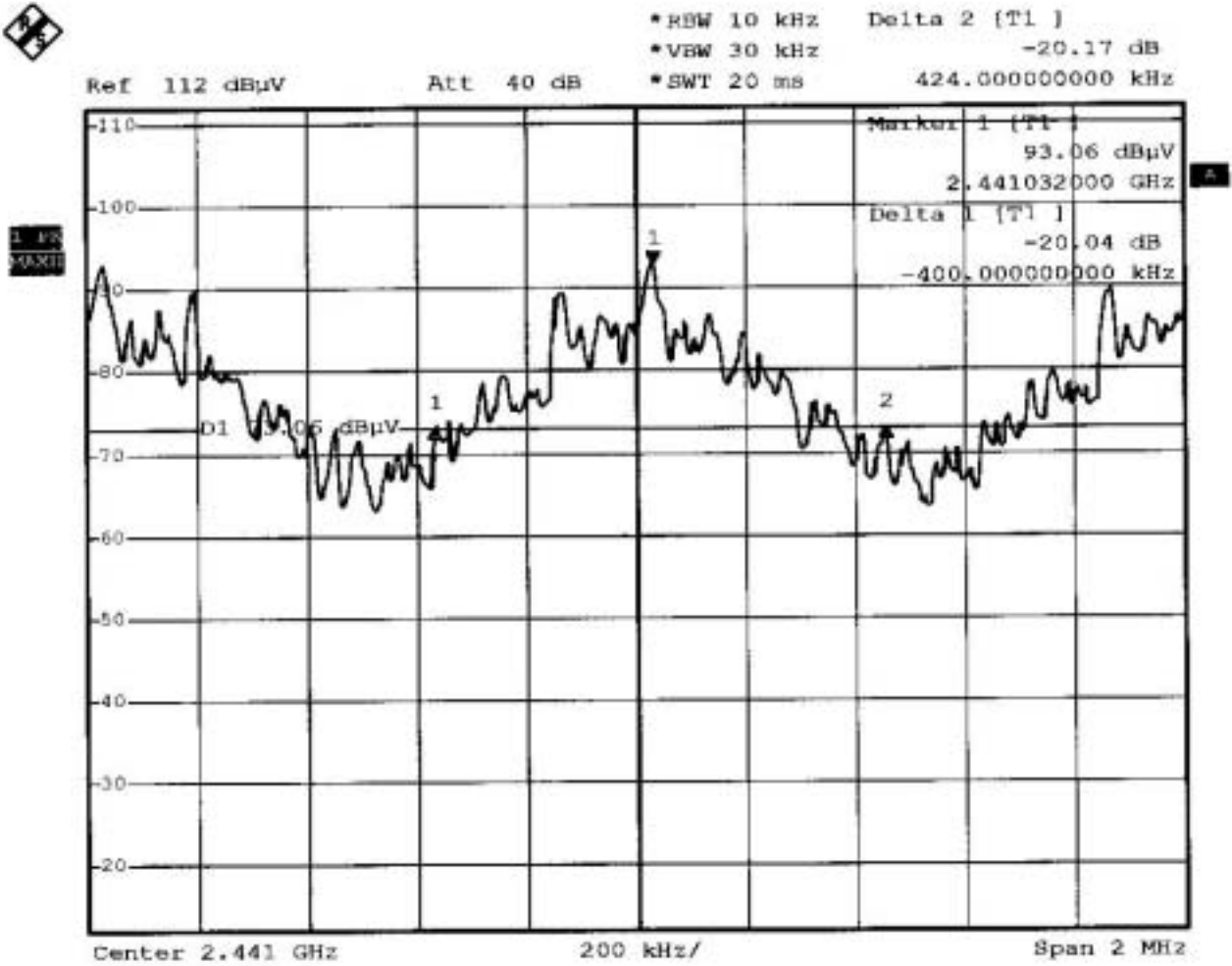
Split the whole frequency band into two.



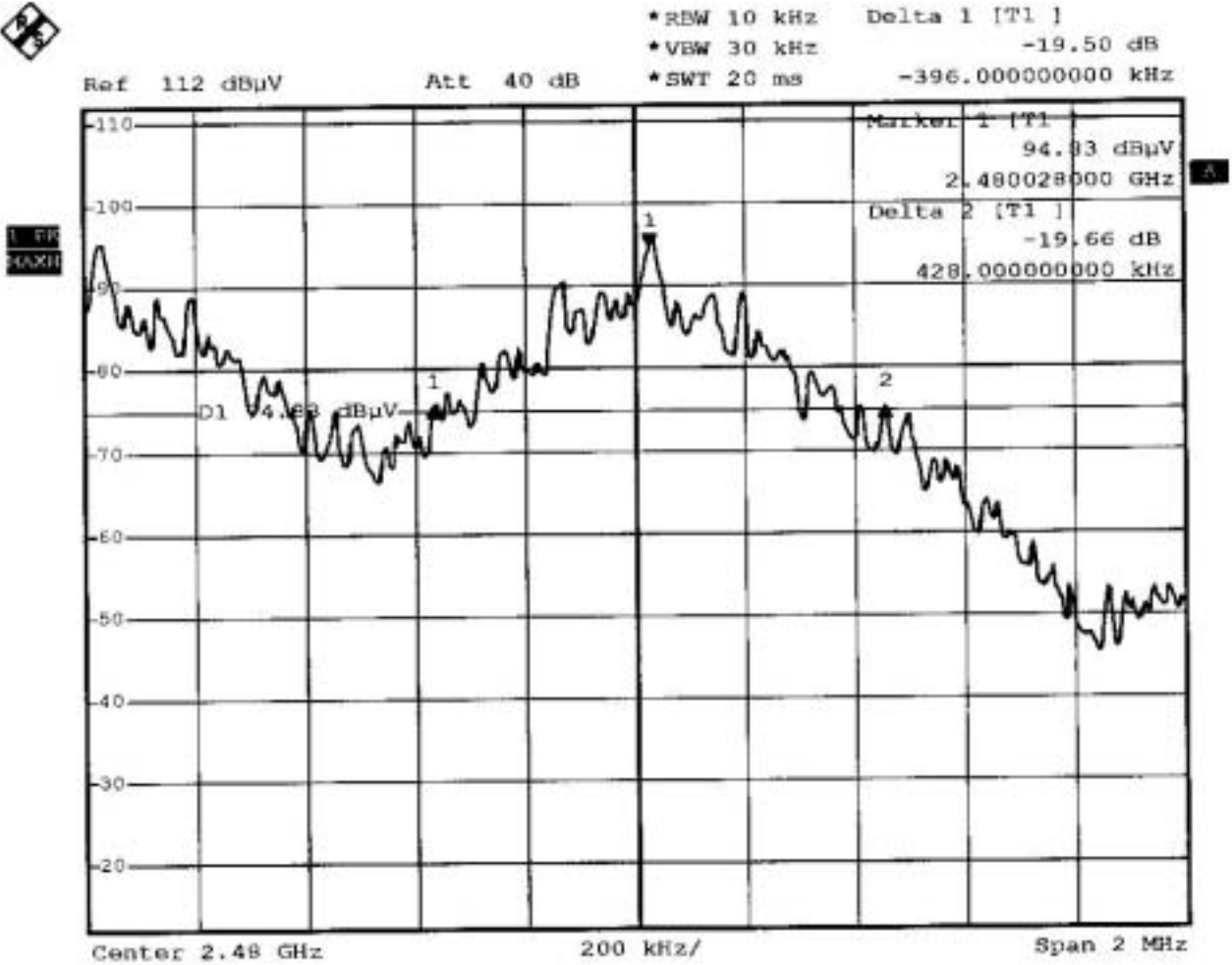
20dB bandwidth at lowest (2402Mhz), middle(2441Mhz), highest channel(2480Mhz)



Channel bandwidth = 872 KHZ



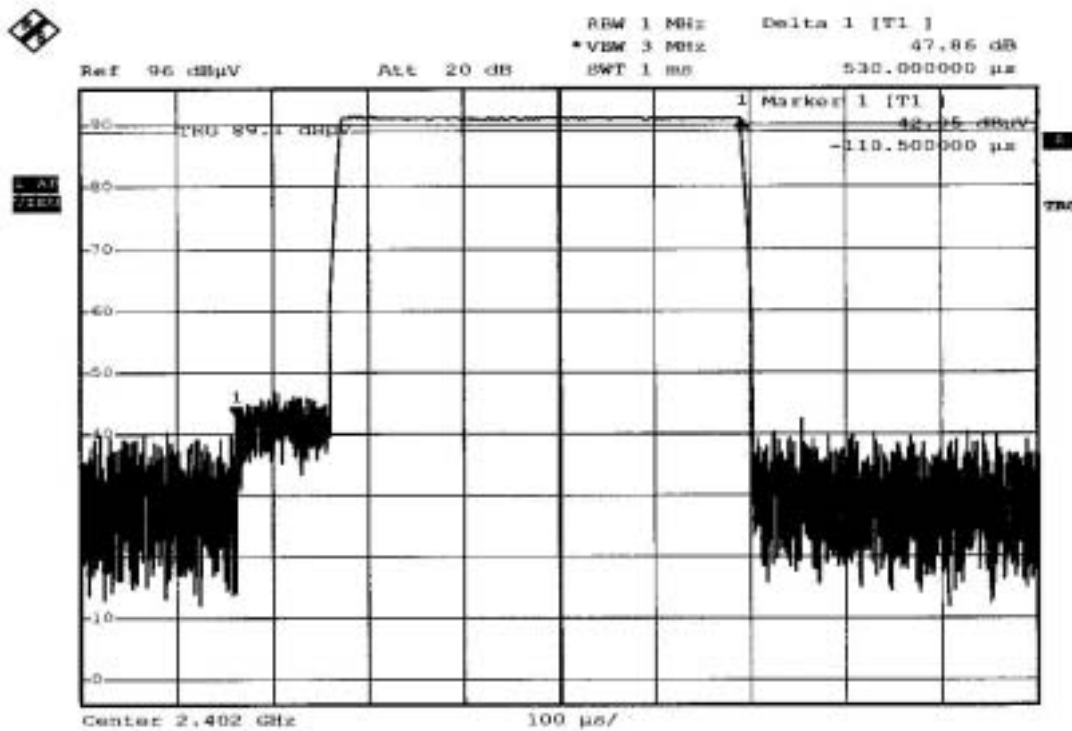
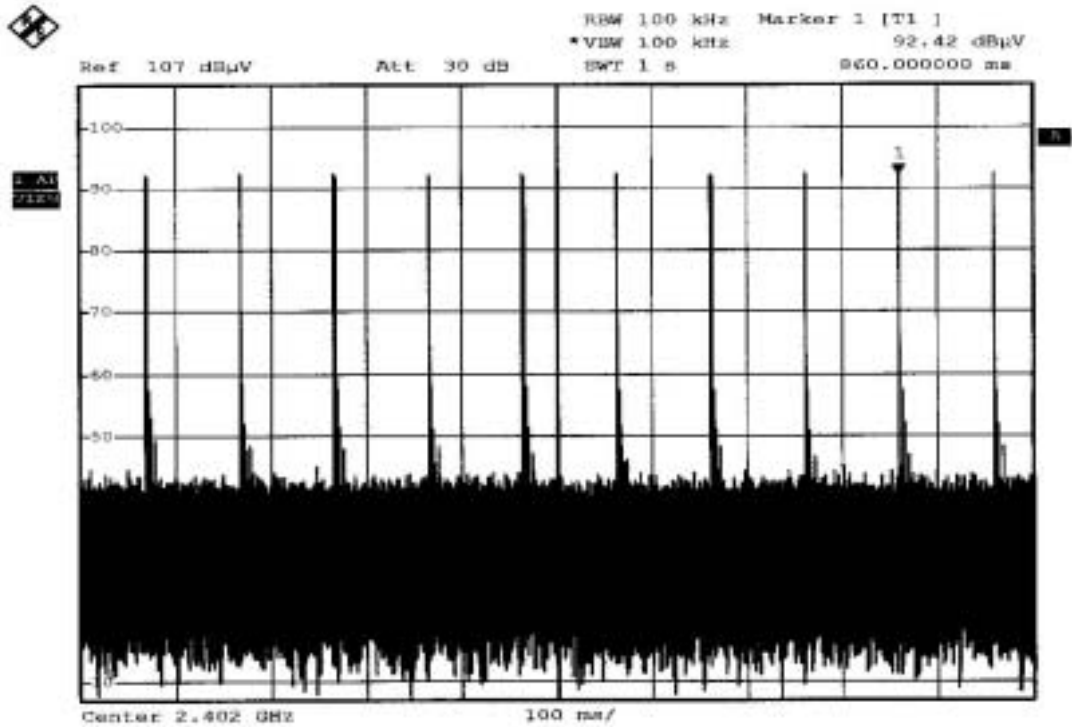
Channel bandwidth = 824 KHZ

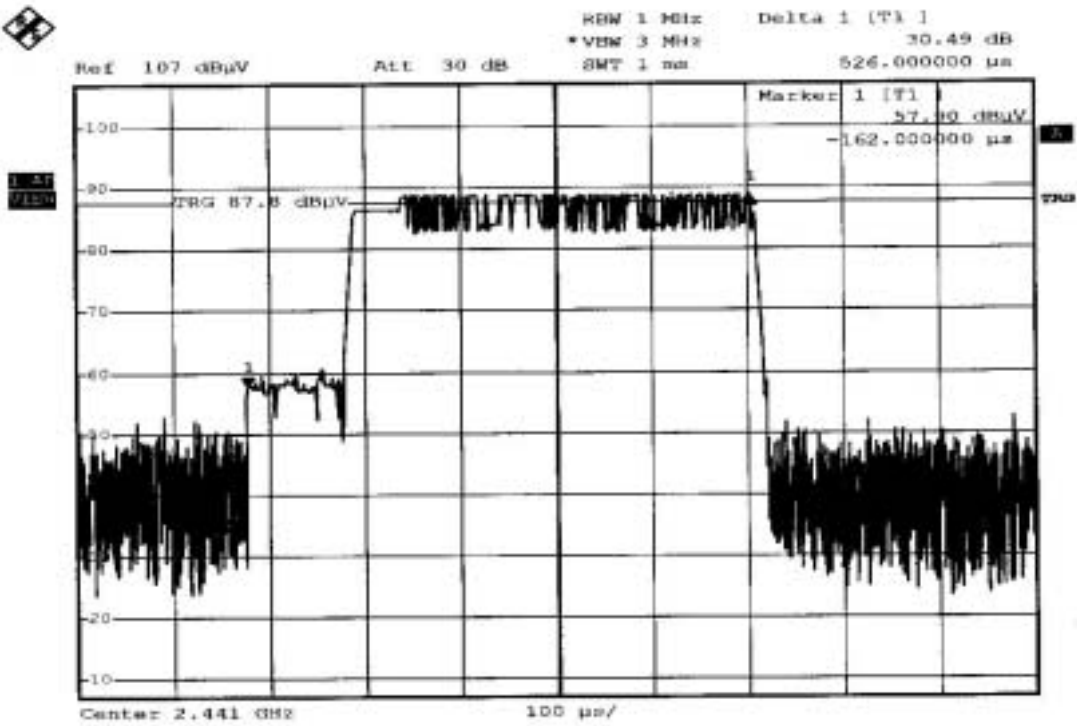
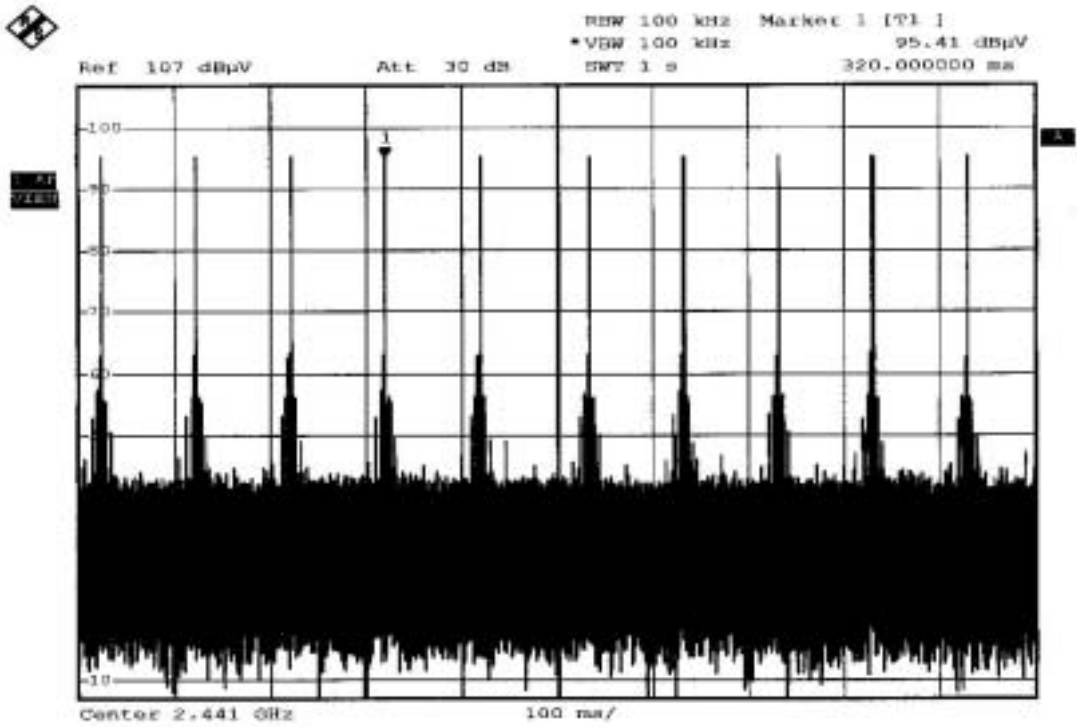


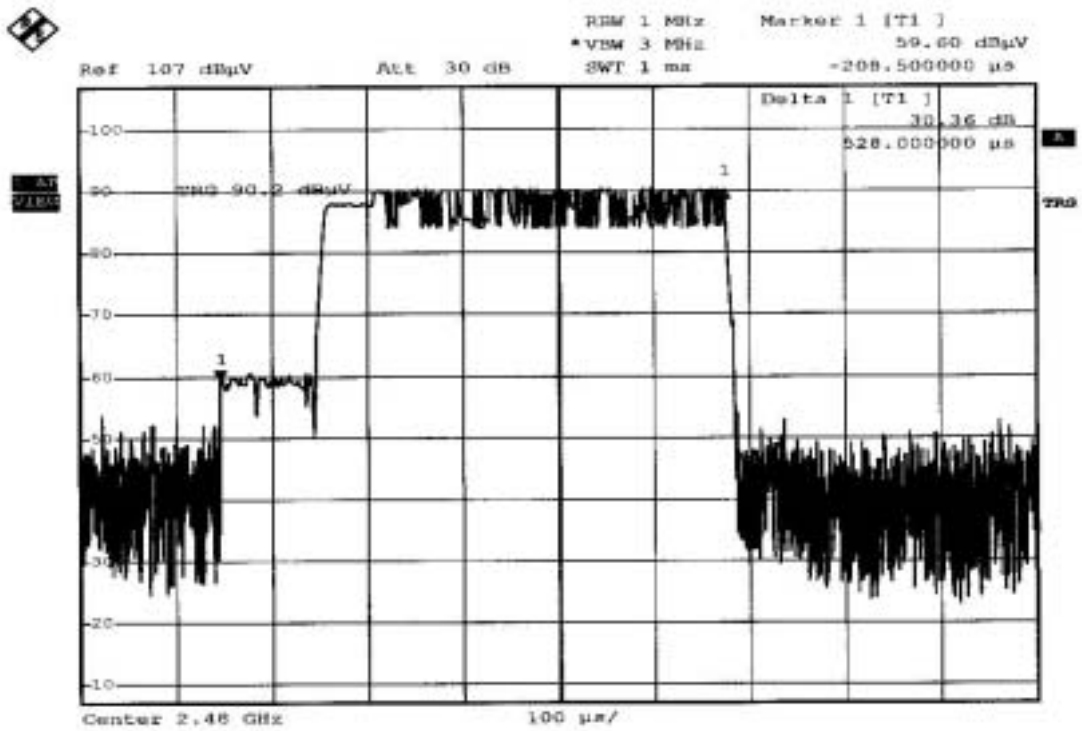
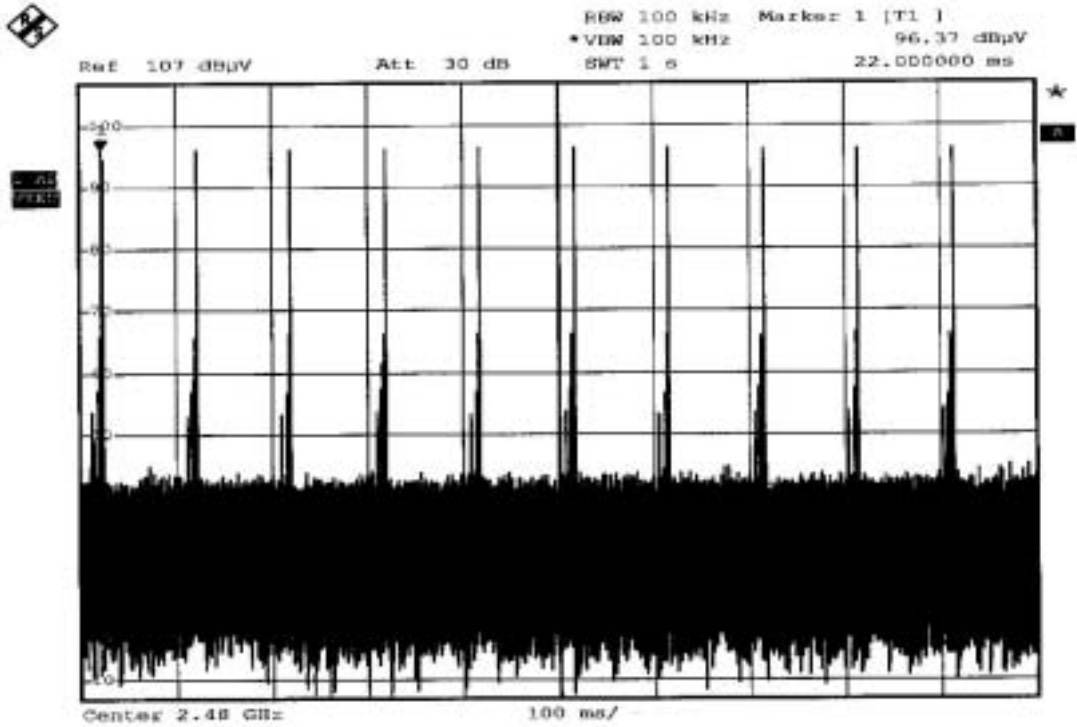
Channel bandwidth = 825 KHZ

4.4 Average Time of Occupancy

SUBCLAUSE 15.247(a)(1)(ii)







4.5.1 calculation

At channel 2402 (530 μ Sec), 2441(526 μ Sec)and 2480Mhz(528 μ Sec), there are 10 bursts in 1 sec. Time period of each burst is 530 μ Sec(worst case). So the occupancy time within 30 second is $530 \times 10 \times 30 = 159000 \mu$ Sec = 159 mSec = 0.159 Sec.

4.5.2 Limits

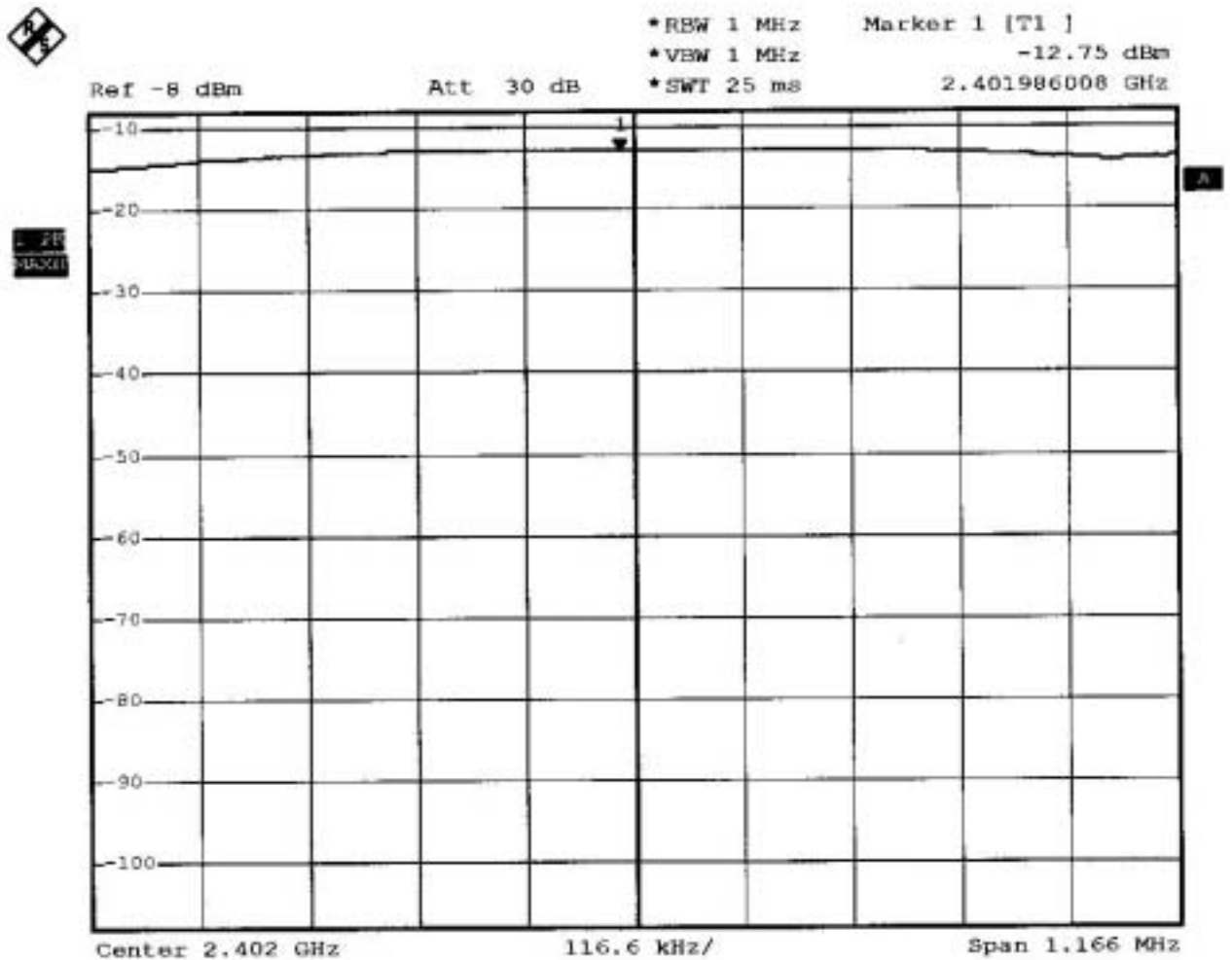
The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

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

SUBCLAUSE 15.247(b)(1)

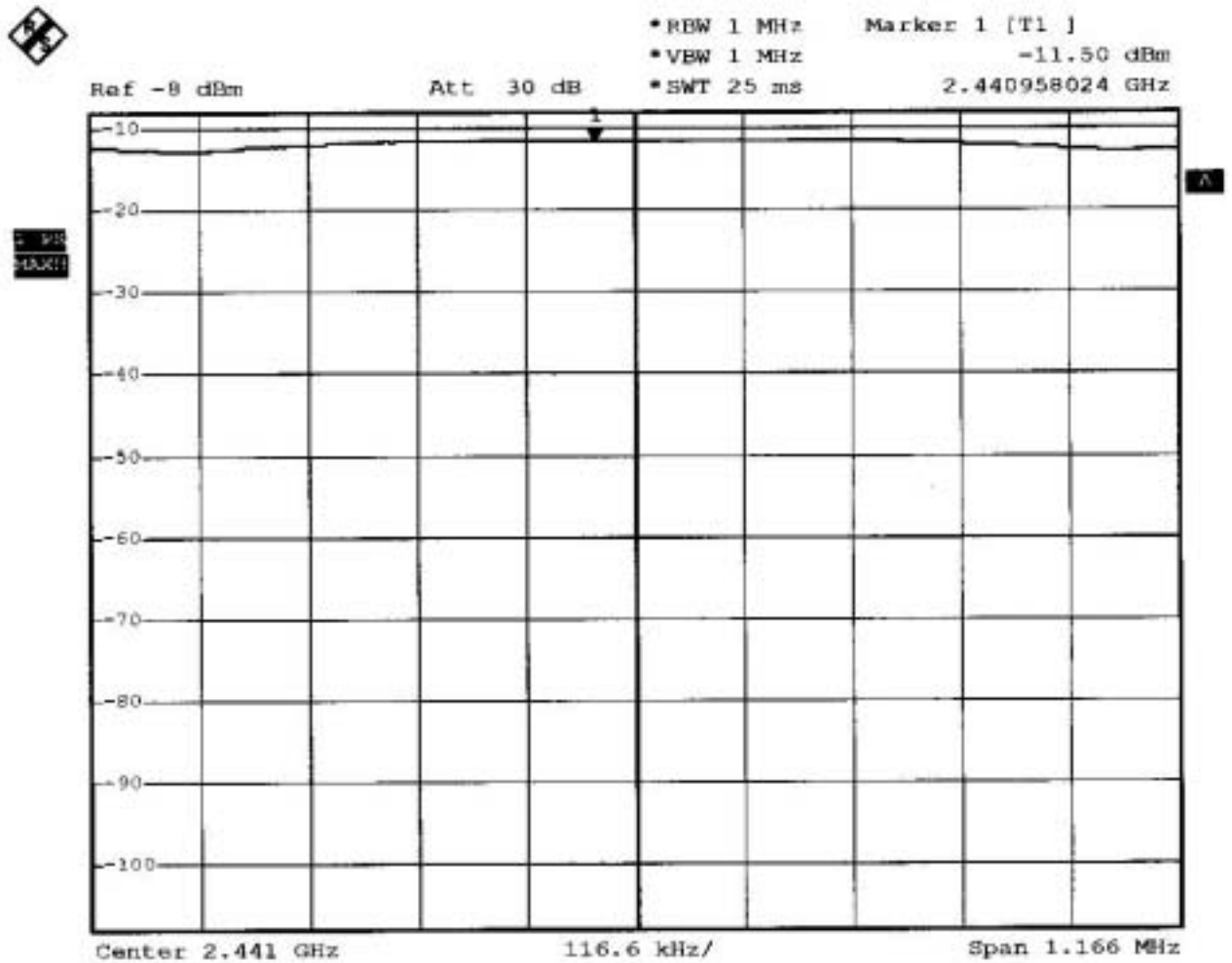
Transmitter transmit at lowest channel (2402Mhz)



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

$$= -12.75 \text{ dbm} + 7.4 \text{ db} + 1.9 \text{ dBi} = -3.45 \text{ dbm}$$

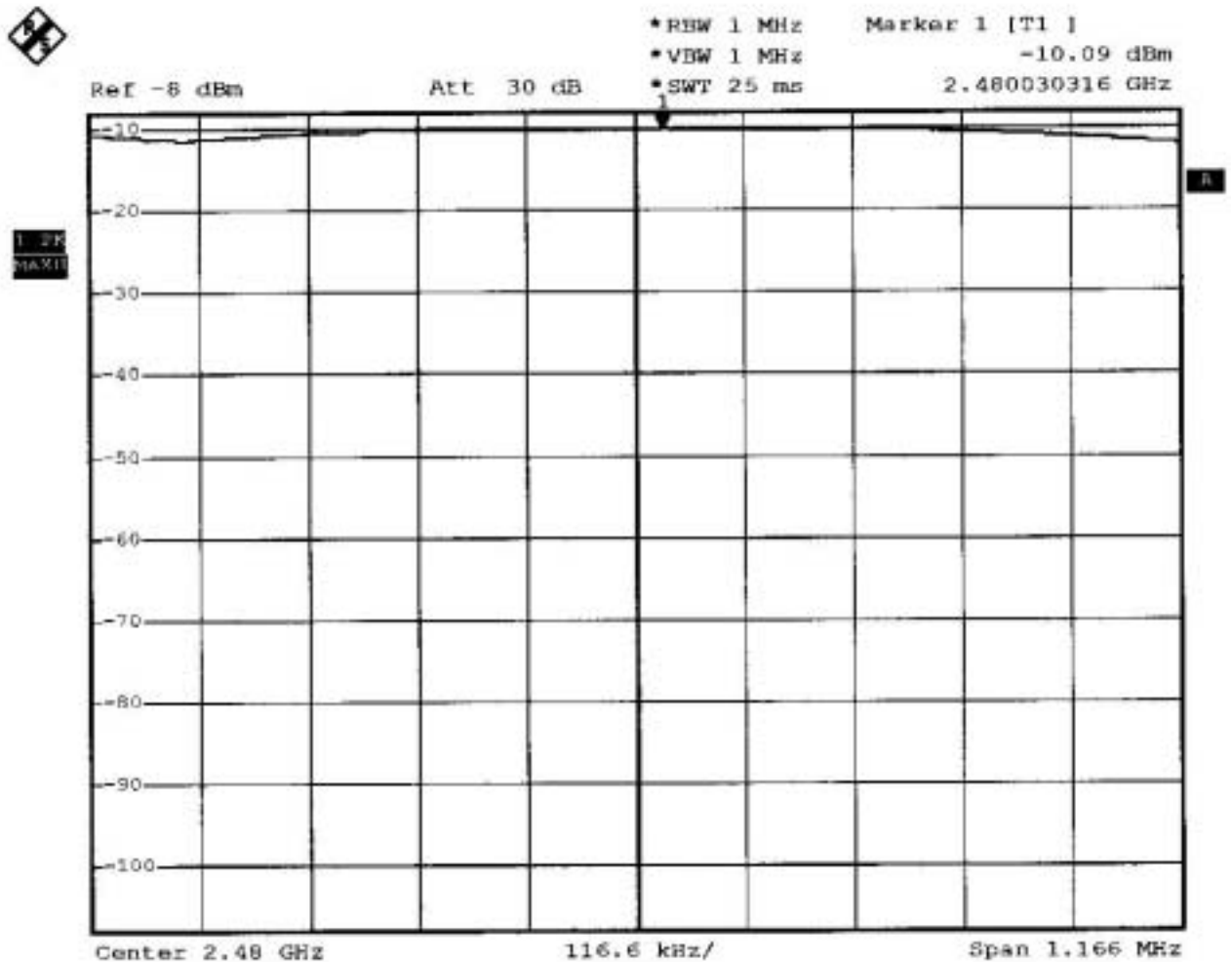
Transmitter transmit at middle channel (2441Mhz)



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

$$= -11.50 \text{ dbm} + 7.4 \text{ db} + 1.9 \text{ dBi} = -2.2 \text{ dbm}$$

Transmitter transmit at highest channel (2480Mhz)



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

$$= -10.09 \text{ dbm} + 7.4 \text{ db} + 1.9 \text{ dBi} = -0.79 \text{ dbm}$$

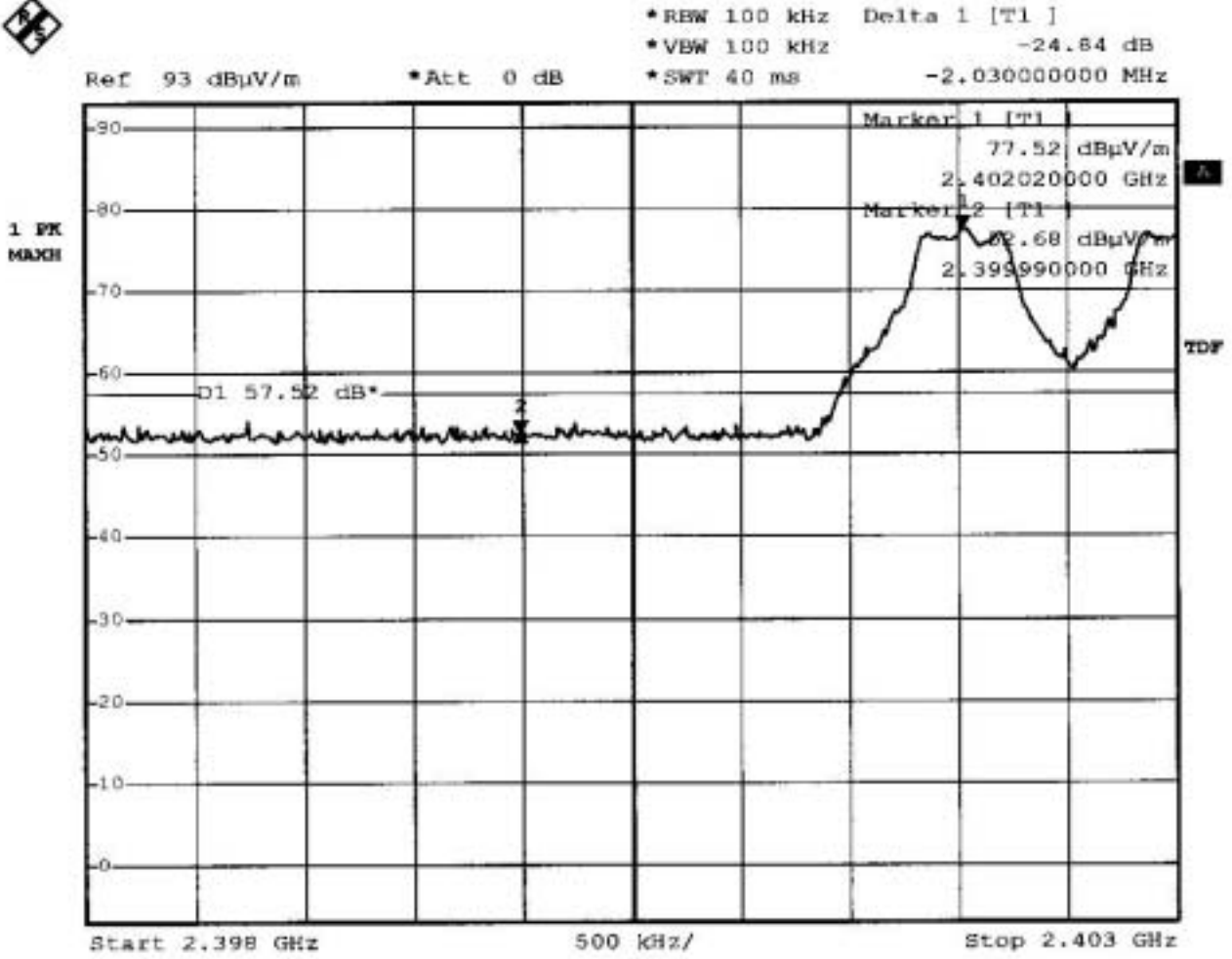
So the max power happens at 2480Mhz , which equals to $-0.79 \text{ dbm} = 0.83 \text{ mW}$

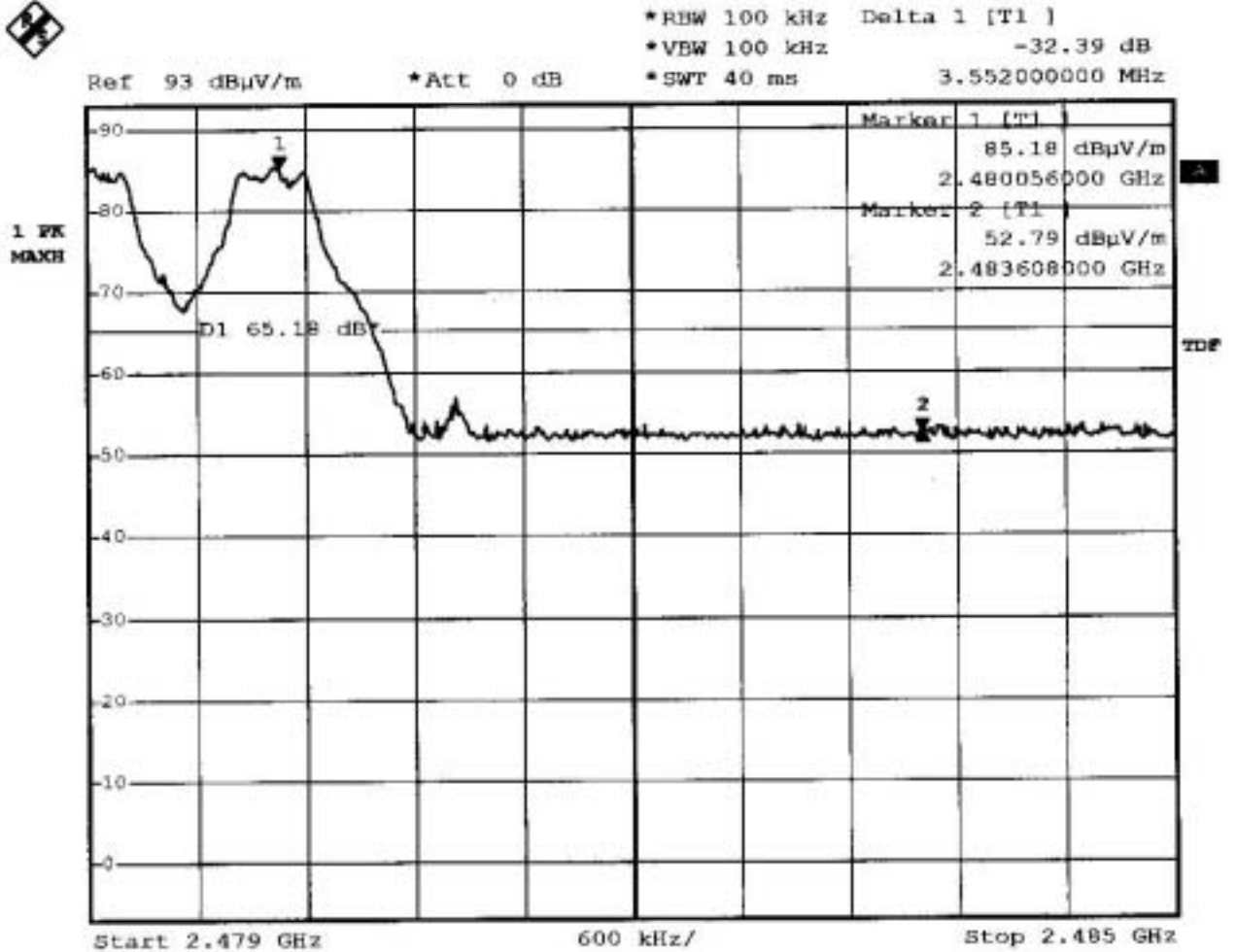
Limits:

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)





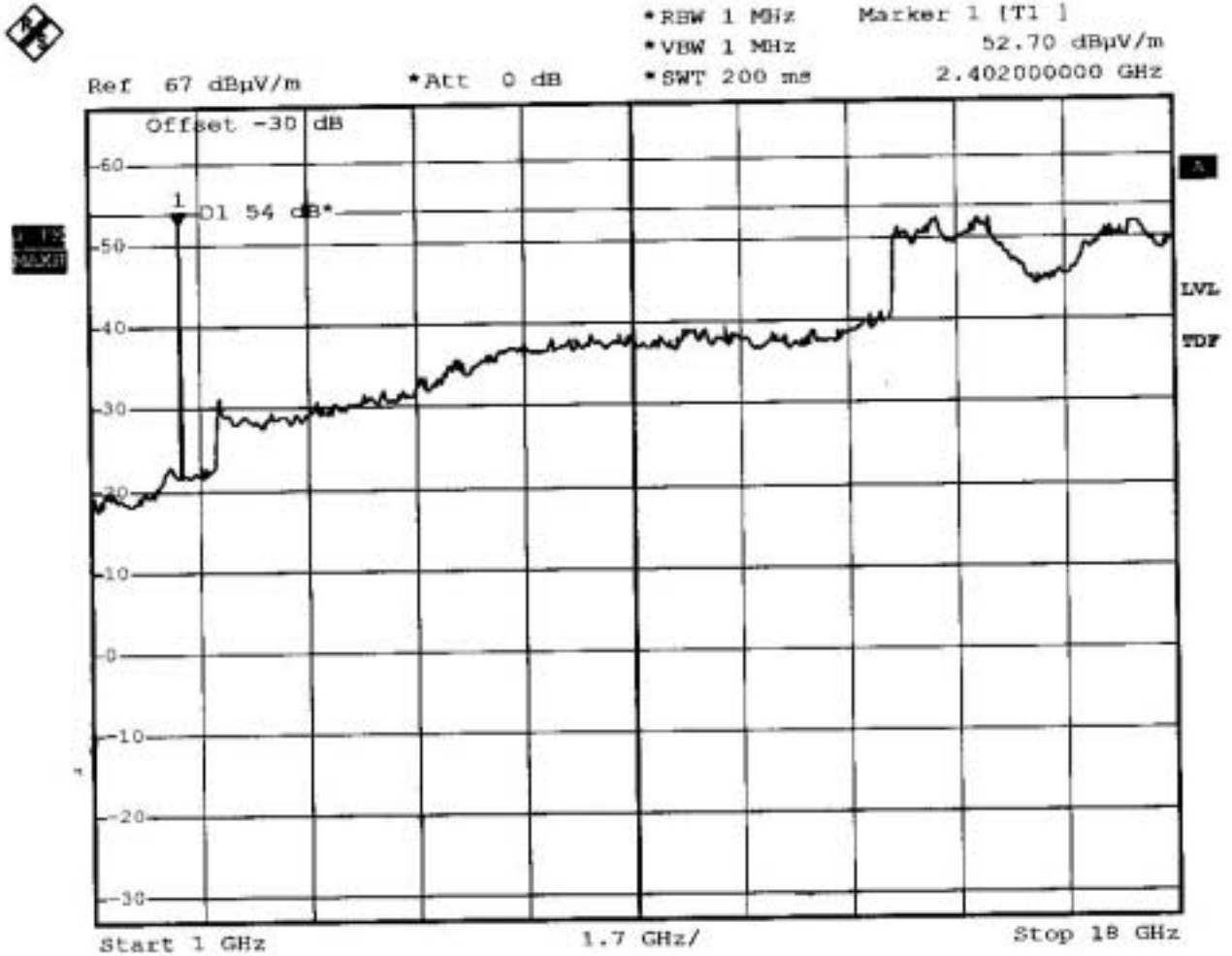
| | Lower bandedge | Upper bandedge |
|--|-----------------|-----------------|
| Bandedge difference from main channel | 24.84 db | 32.39 db |

4.7.1 Limits

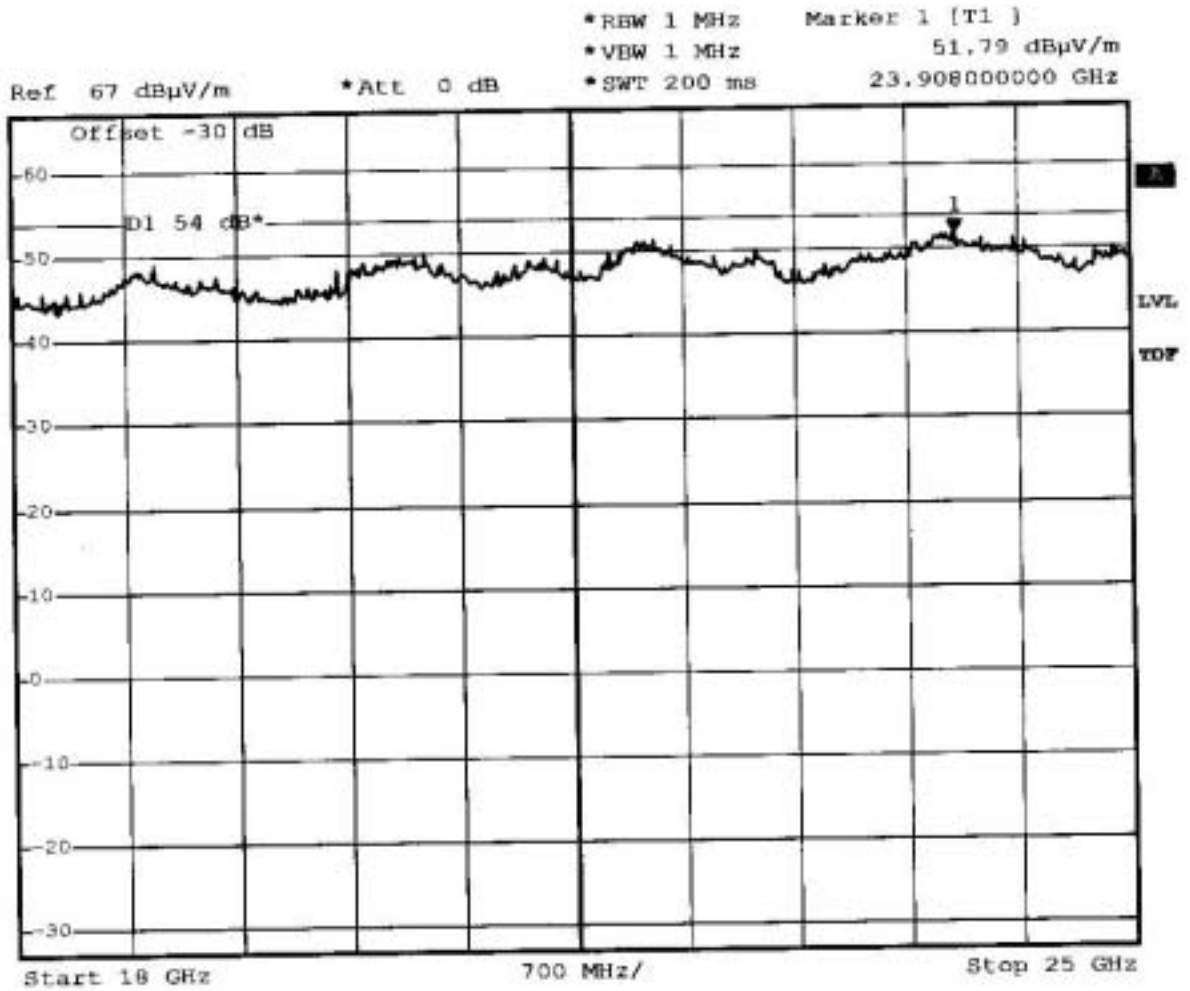
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, and it must comply with the limit in 15.209.

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

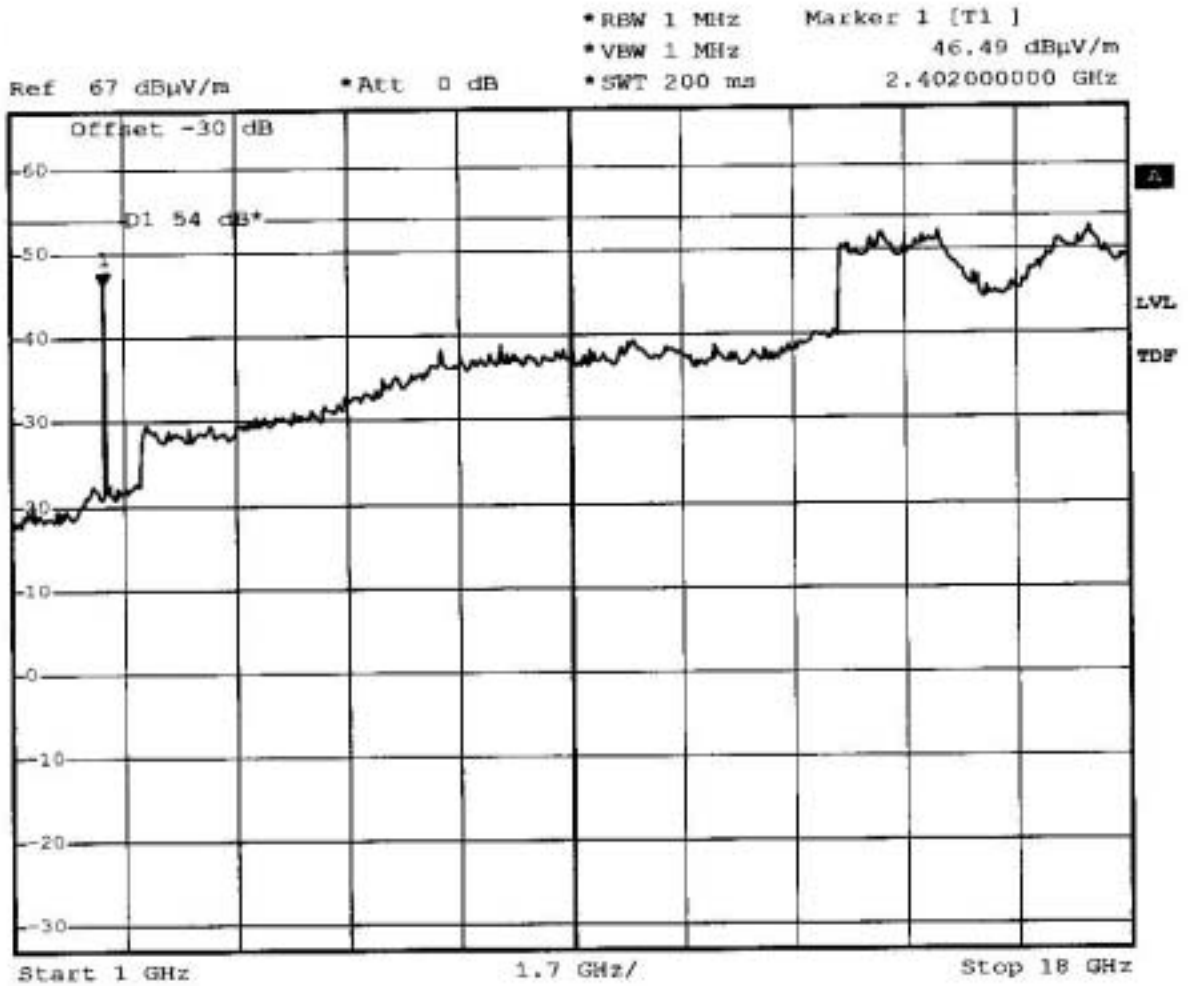
1. Transmit at 2402Mhz
1Ghz – 18Ghz , Vertical



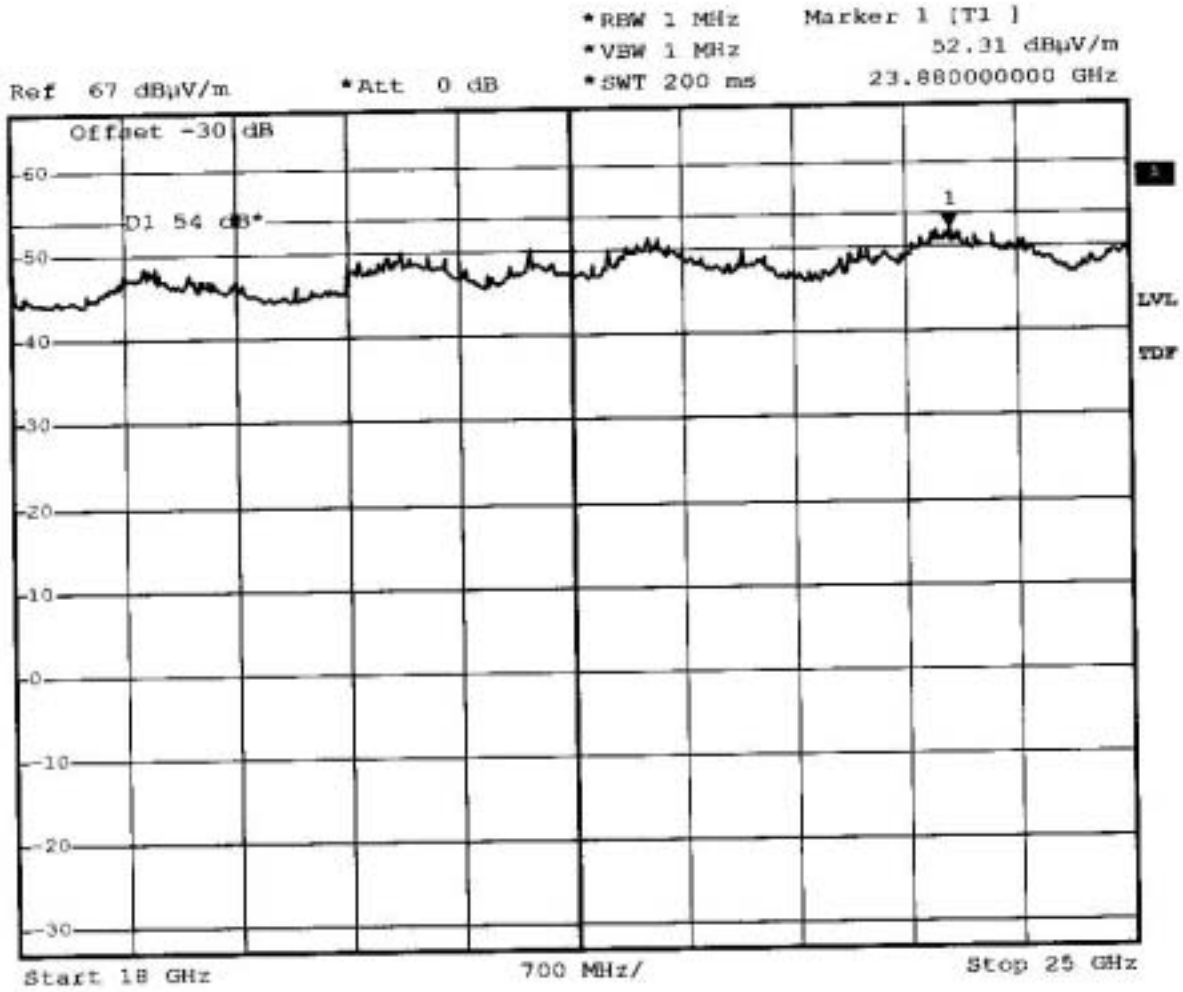
18GHz – 25GHz , Vertical



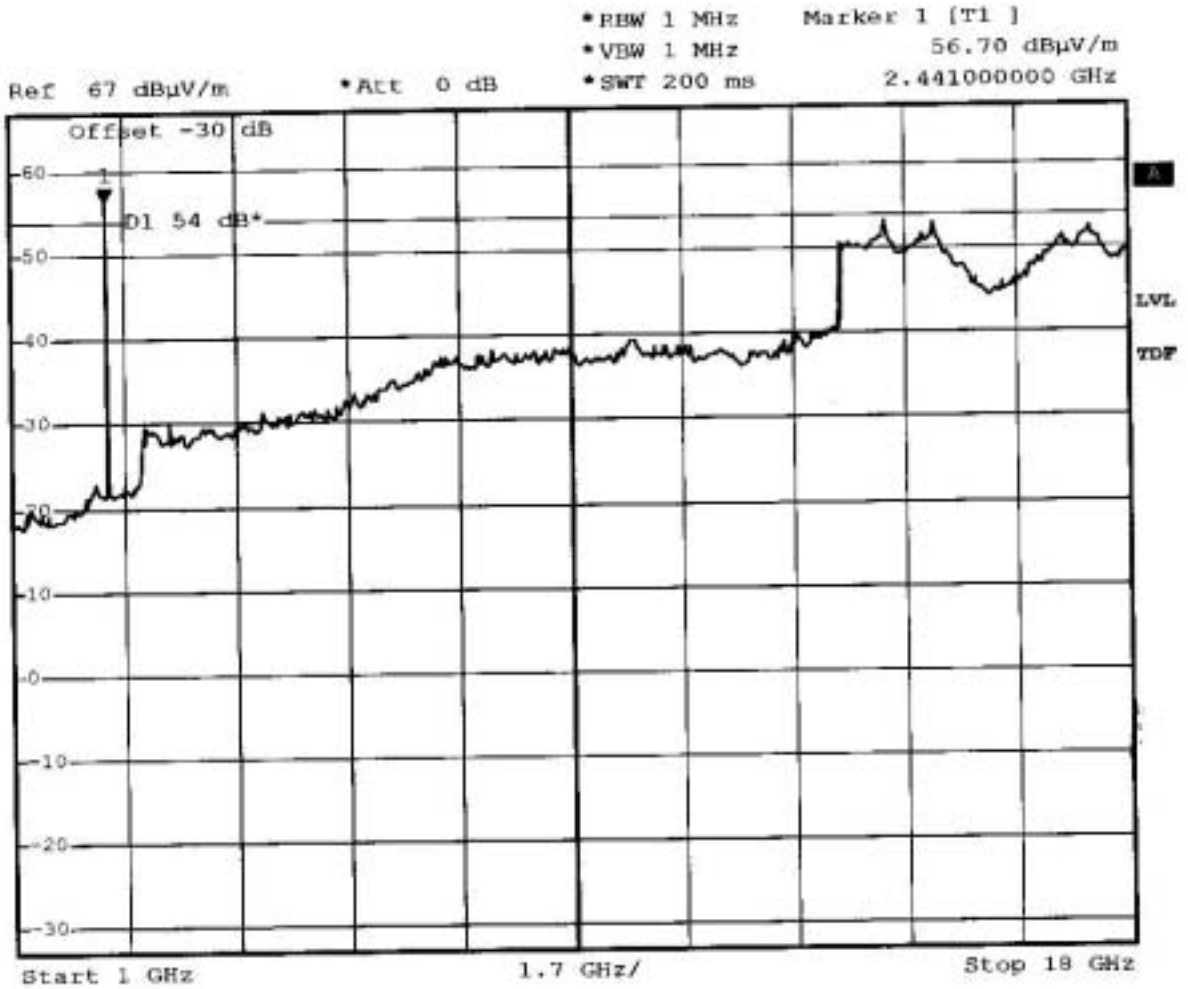
1GHz – 18GHz , Horizontal



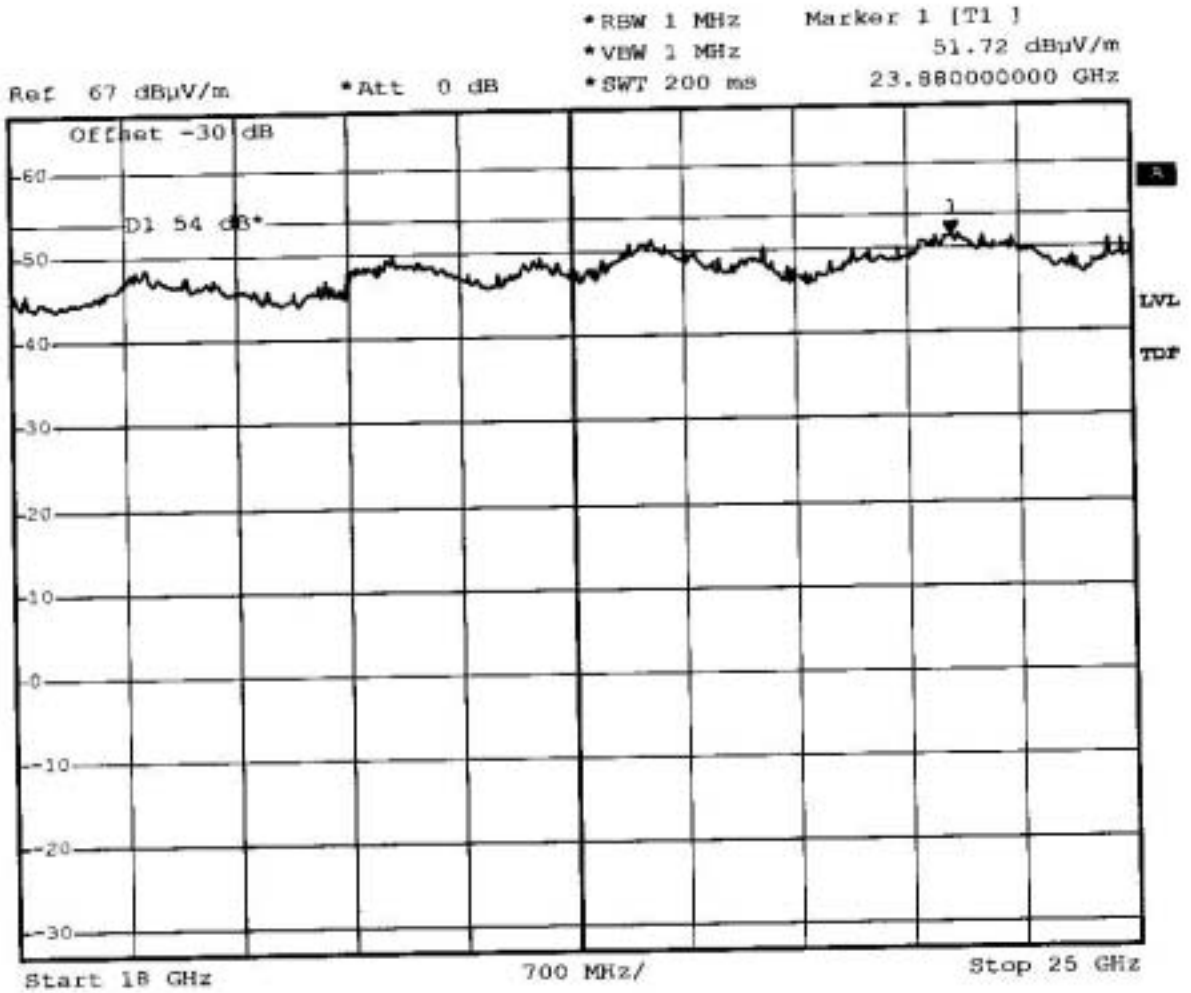
18GHz – 25GHz , Horizontal



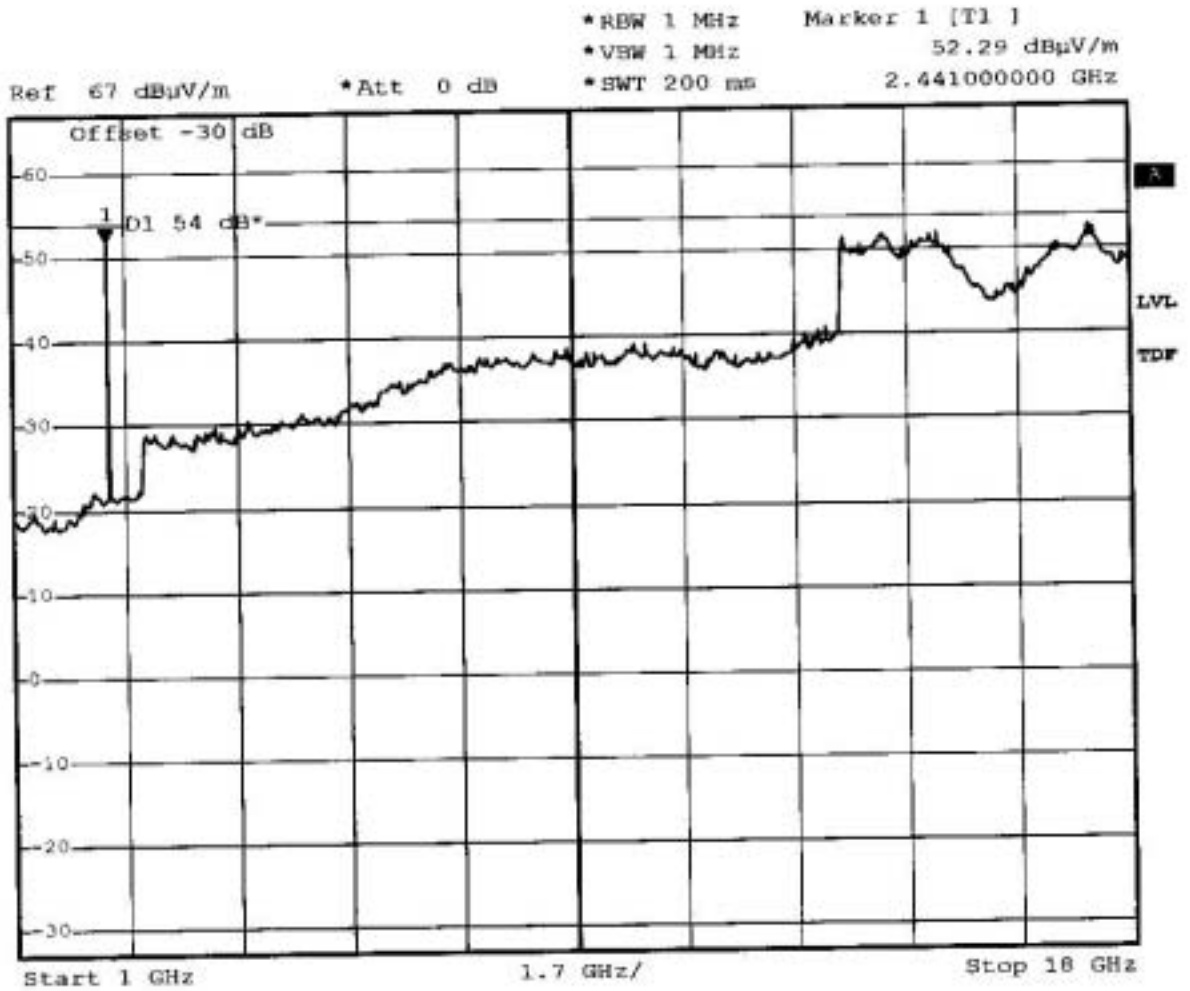
2. Transmit at 2441Mhz 1Ghz – 18Ghz , Vertical



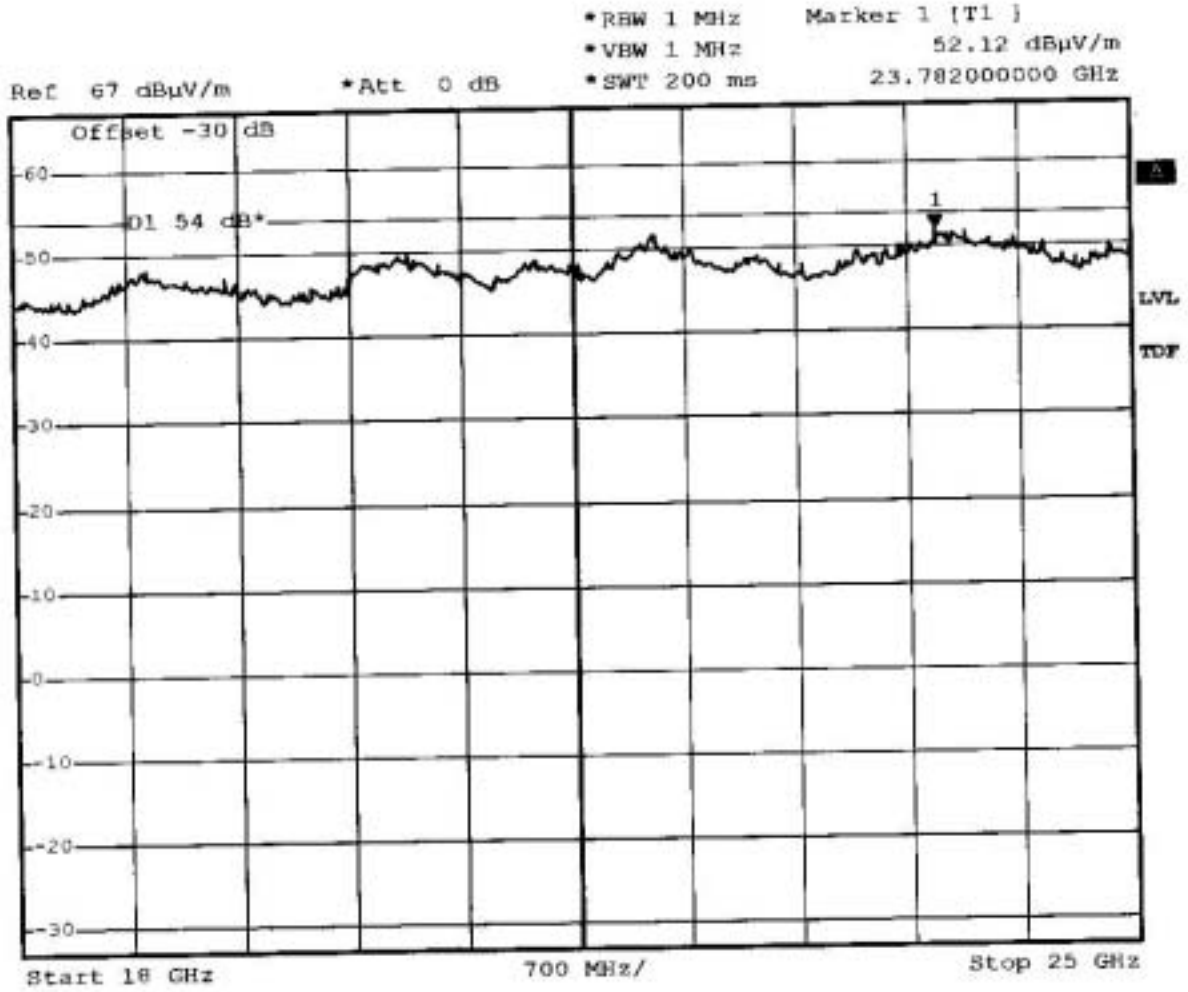
18GHz – 25GHz , Vertical



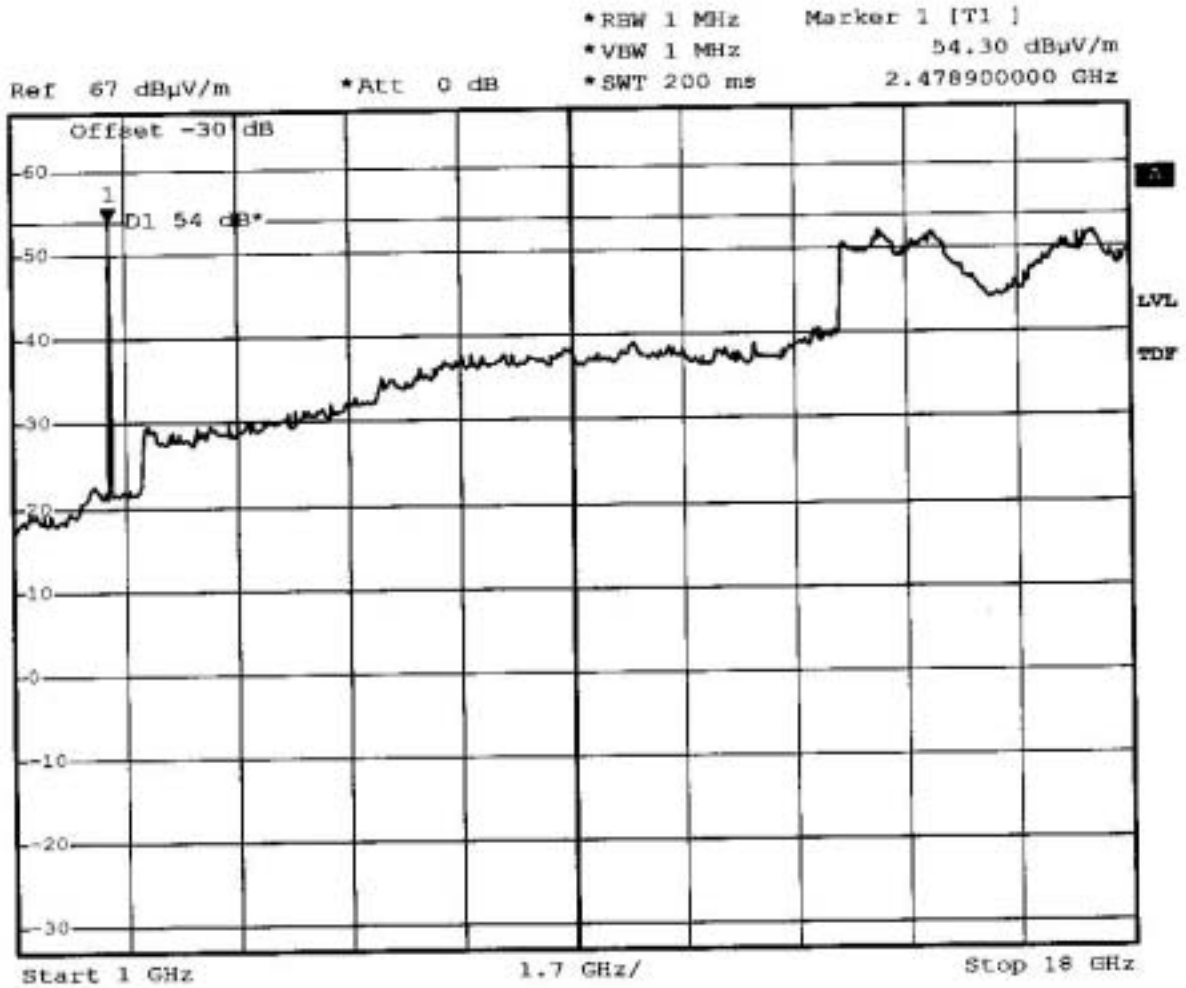
1Ghz – 18Ghz , Horizontal



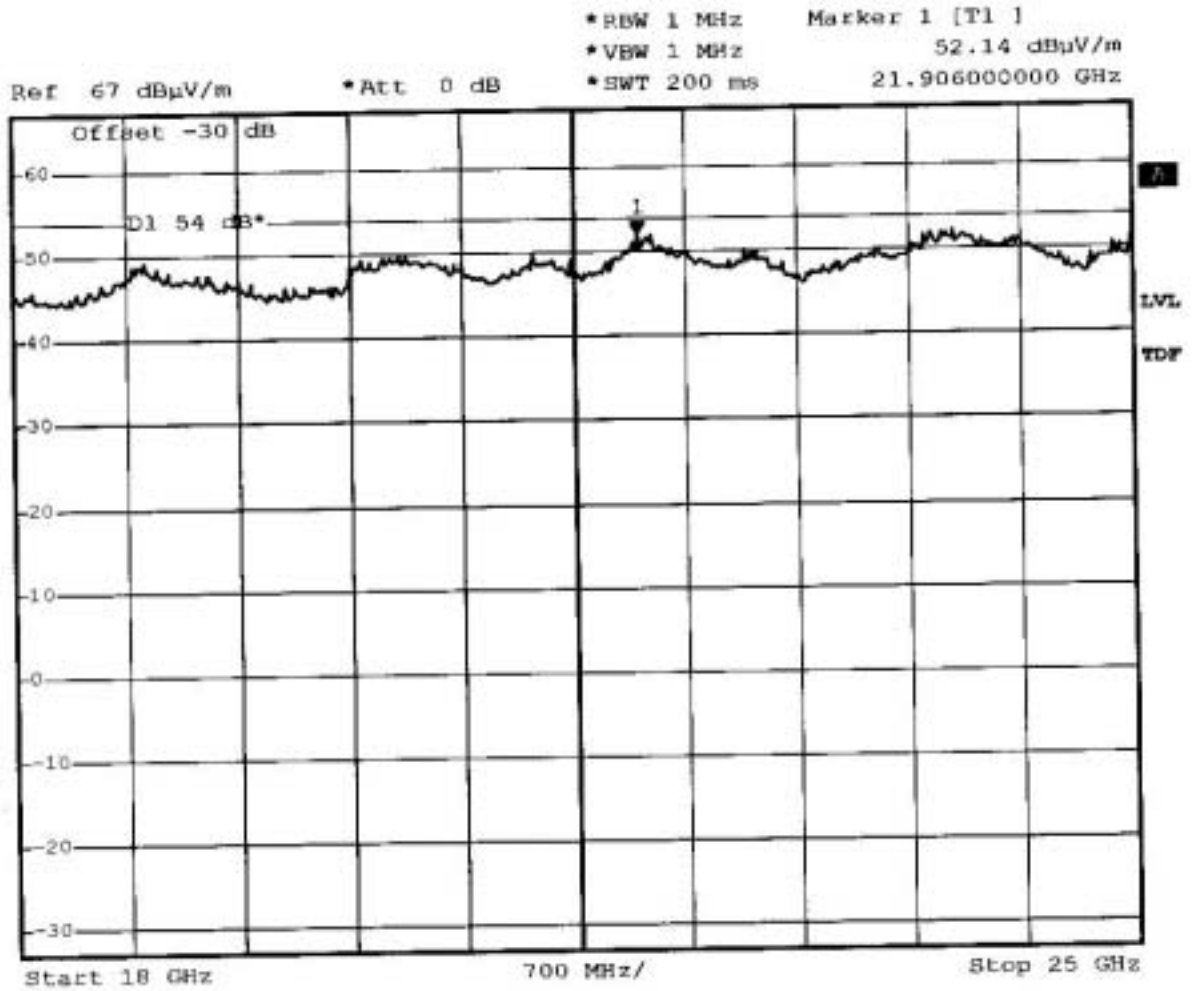
18GHz – 25GHz , Horizontal



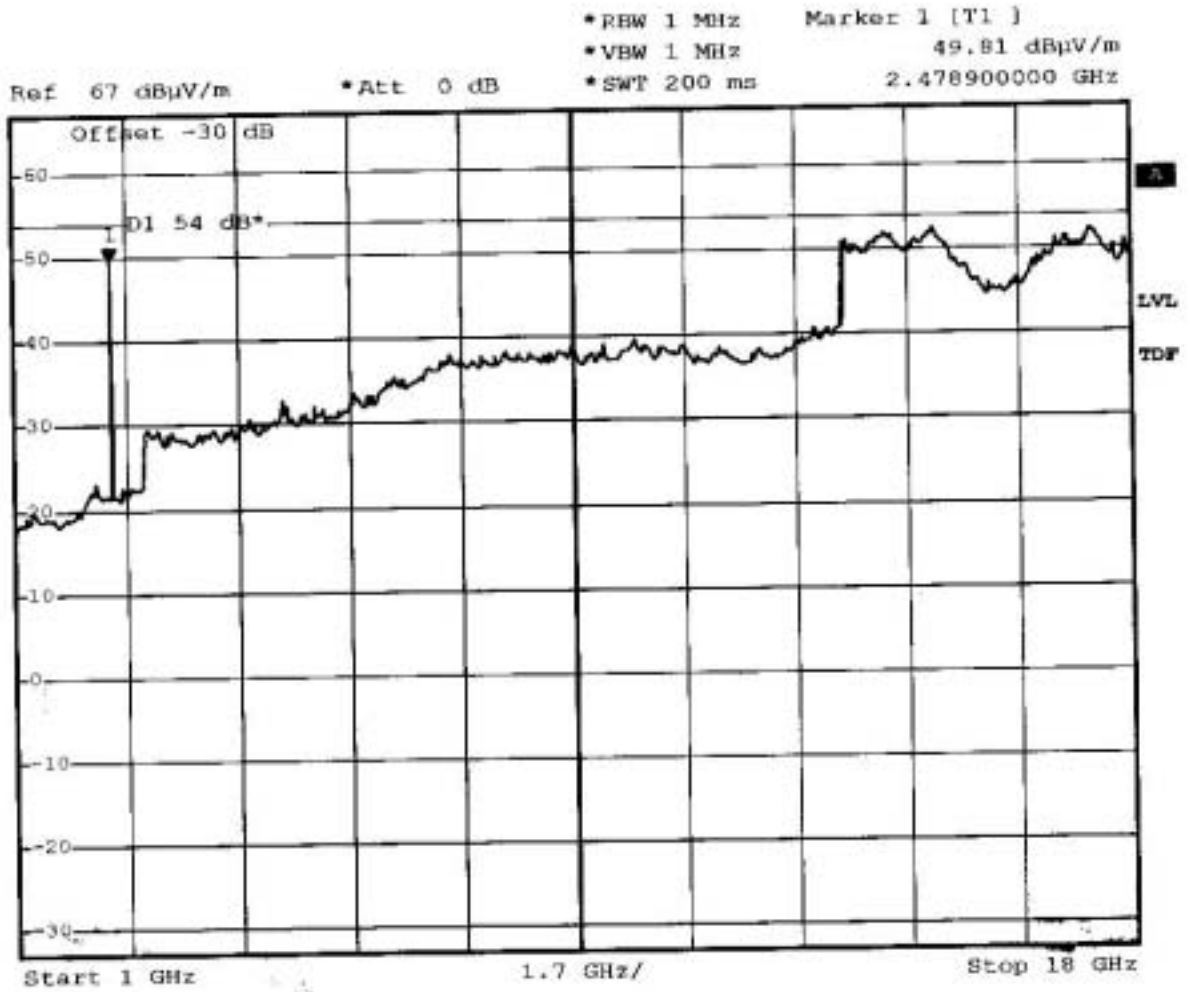
3. Transmit at 2480Mhz 1Ghz – 18Ghz , Vertical



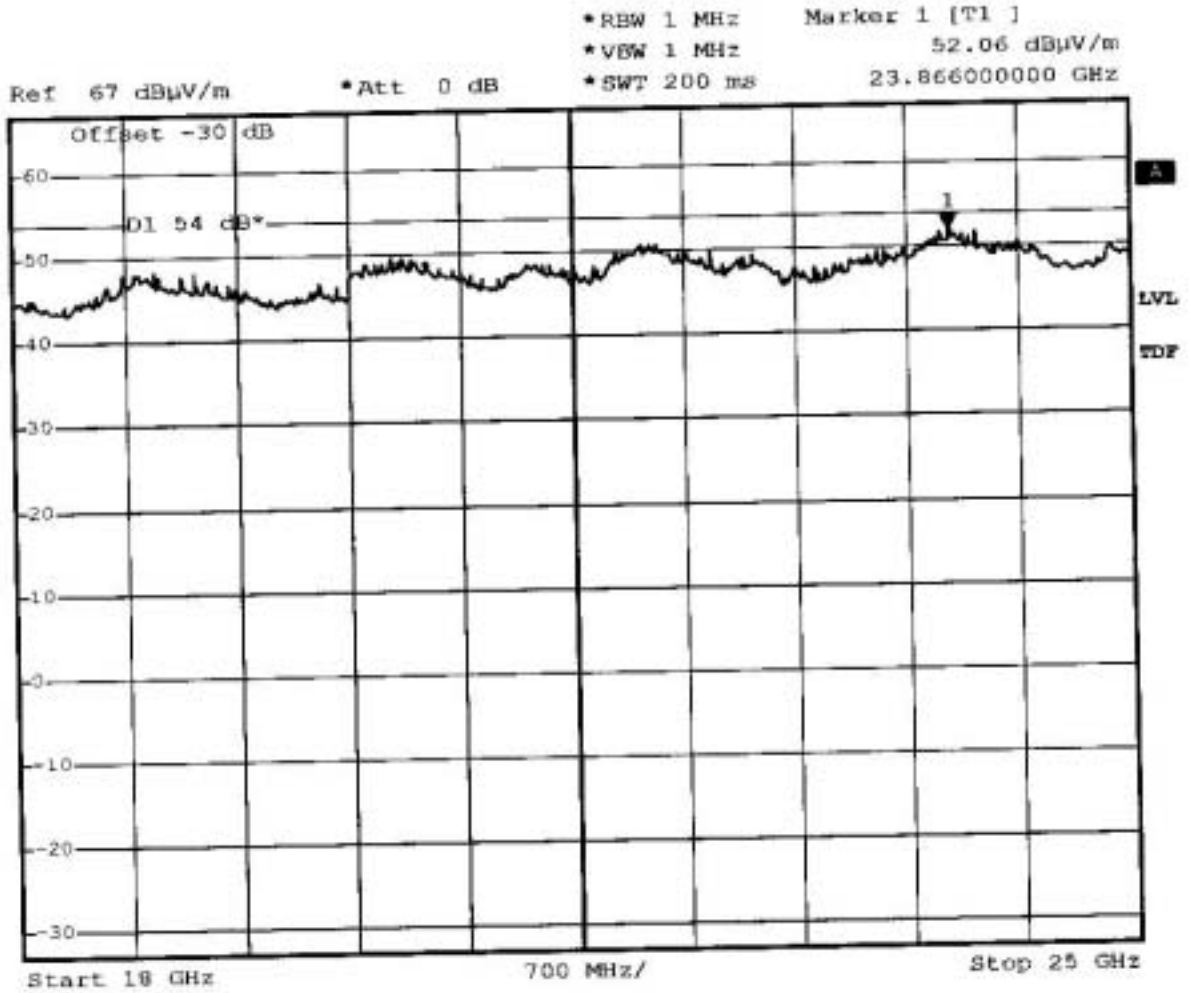
18GHz – 25GHz , Vertical



1Ghz – 18Ghz , Horizontal



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)