

## 11 Number of Hopping Channels

### 11.1 Standard Applicable

According to 15.247(b)(1), for frequency hopping systems, operating in the 2400-2483.5MHz band employing at least 75 hopping channels

### 11.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 5. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set EUT to hopping operating mode and set spectrum analyzer maximum to measure the number of hopping channels.

### 11.3 Measurement Equipment

| Equipment         | Manufacturer    | Model No. | Next Cal. Due |
|-------------------|-----------------|-----------|---------------|
| Plotter           | Hewlett-Packard | 7440A     | N/A           |
| Spectrum Analyzer | Hewlett-Packard | 8564EC    | 09/10/2003    |

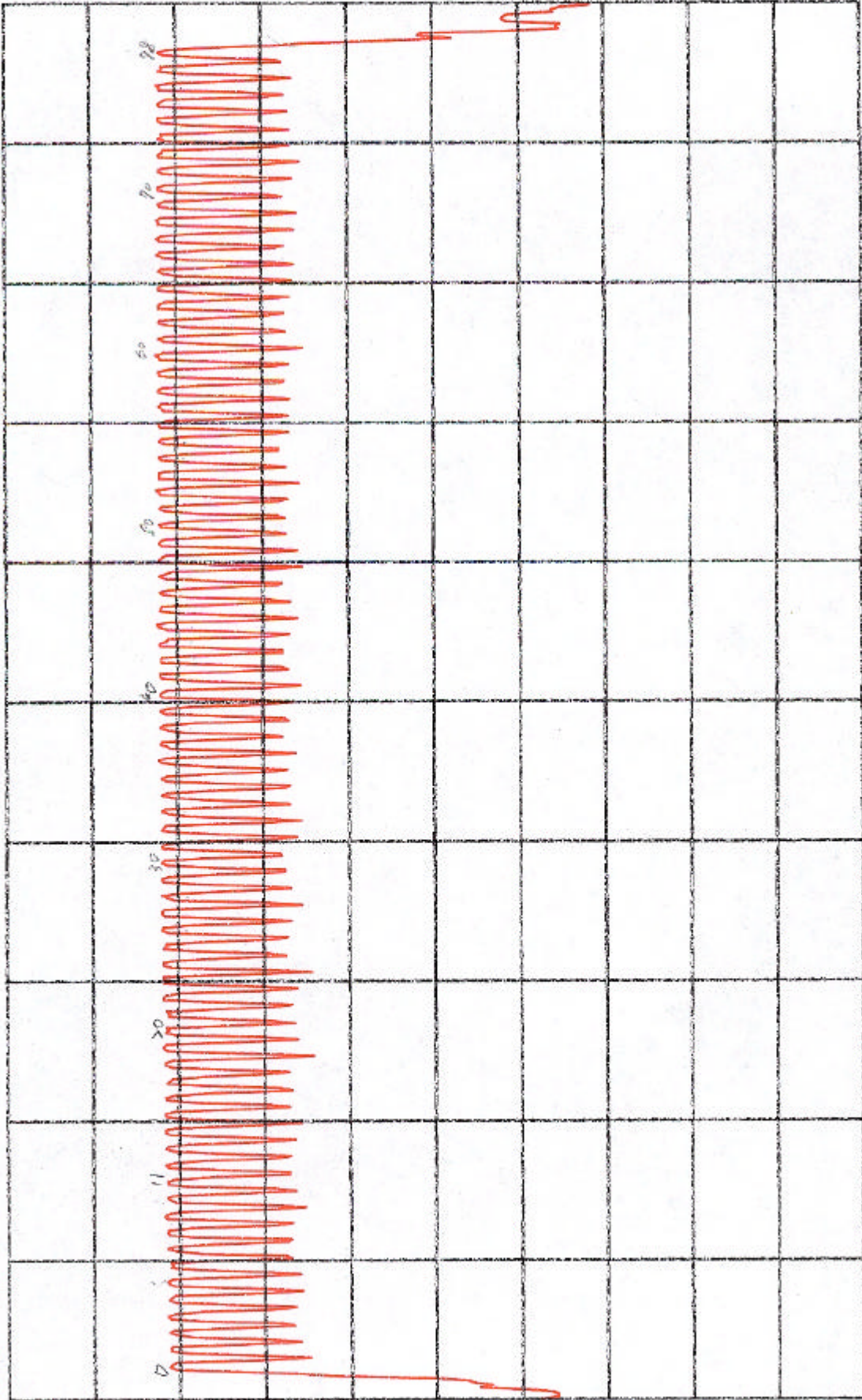
### 11.4 Measurement Data

Test Date : Mar. 26, 2003      Temperature : 22°C      Humidity: 60 %

Number of hopping channels = 79 channels

**Note: Please see Appendix 4 for plotted datas**

ATTEN 30dB  
PL 20.0dBm  
10dB/



START 2.400000GHZ STOP 2.483500GHZ  
\*RBW 100KHZ \*VBW 300KHZ SWP 50.0ms

## 12 Channel Carrier Frequencies Separation

### 12.1 Standard Applicable

According to 15.247(a)(1), the frequency hopping system shall have hopping channel carrier frequencies separated by minimum of 25kHz or the 20dB bandwidth of hopping channel, whichever is greater.

### 12.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 5. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measurement frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set spectrum analyzer maximum hold to measure channel carrier frequency , then adjust channel carrier frequency to adjacent channel.
4. Repeat above procedure until all measured frequencies were complete.

### 12.3 Measurement Equipment

| Equipment         | Manufacturer    | Model No. | Next Cal. Due |
|-------------------|-----------------|-----------|---------------|
| Plotter           | Hewlett-Packard | 7550A     | N/A           |
| Spectrum Analyzer | Hewlett-Packard | 8564EC    | 09/10/2003    |

### 12.4 Measurement Data

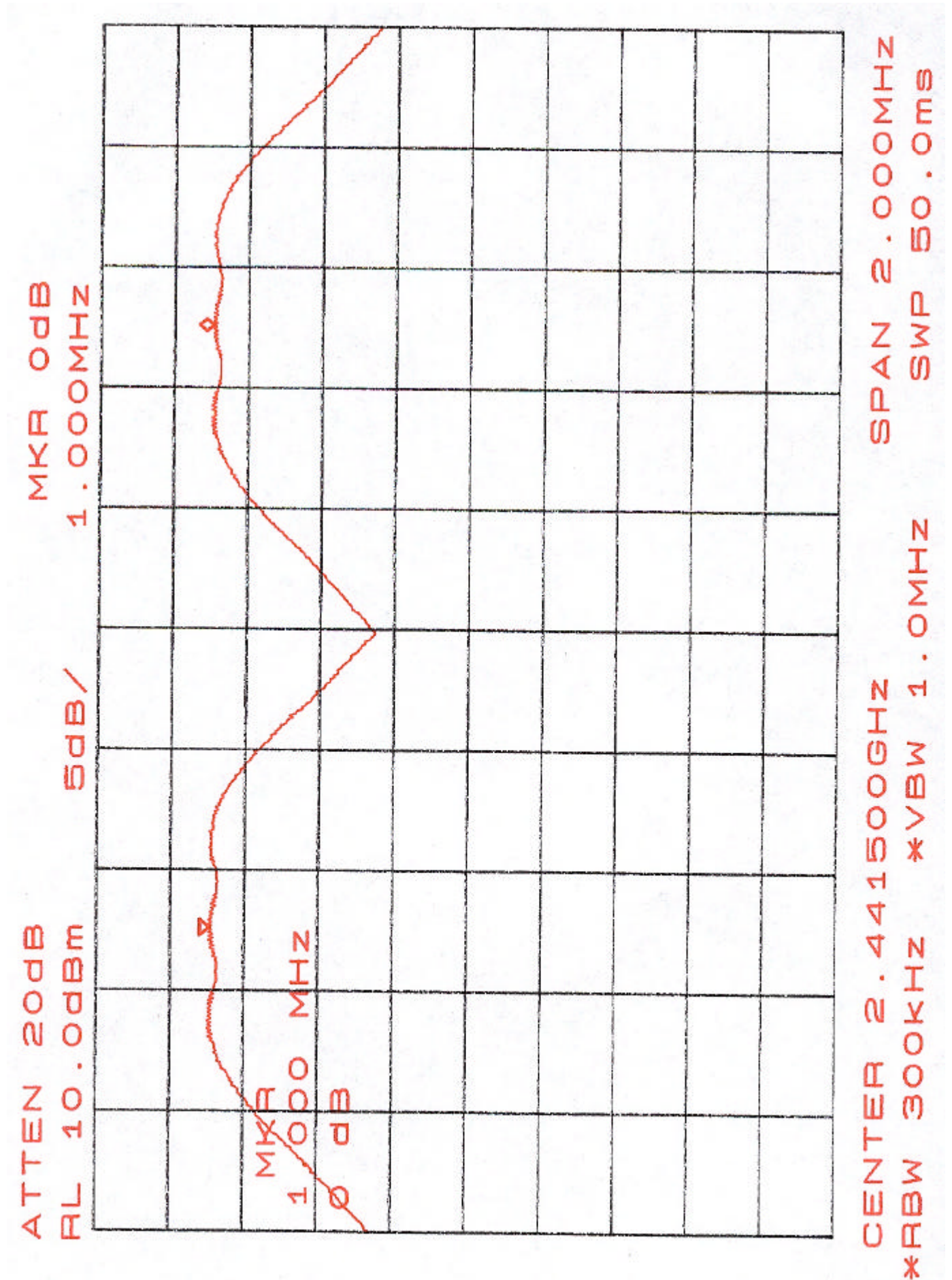
Test Date : Mar. 26, 2003

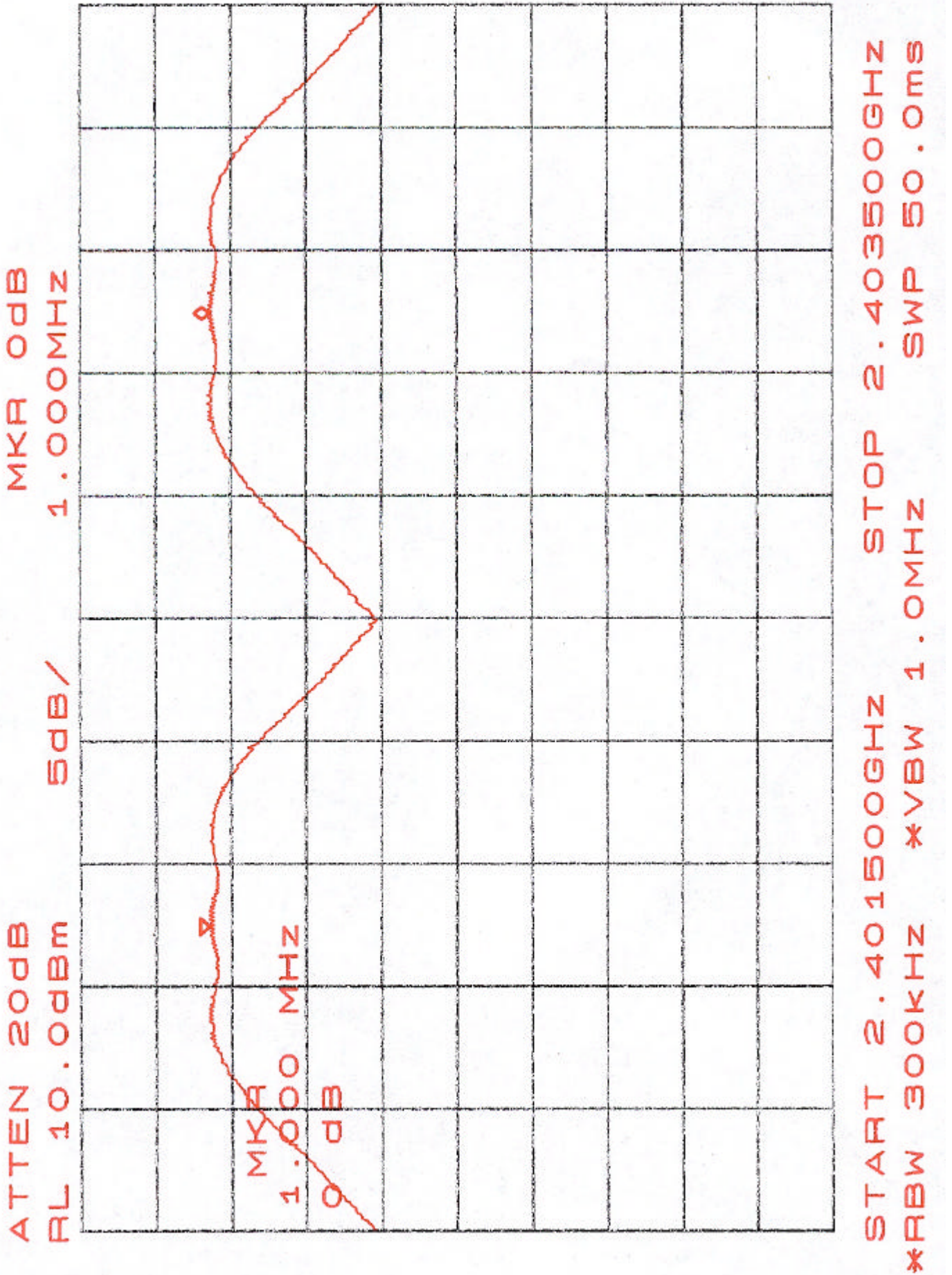
Temperature : 22°C

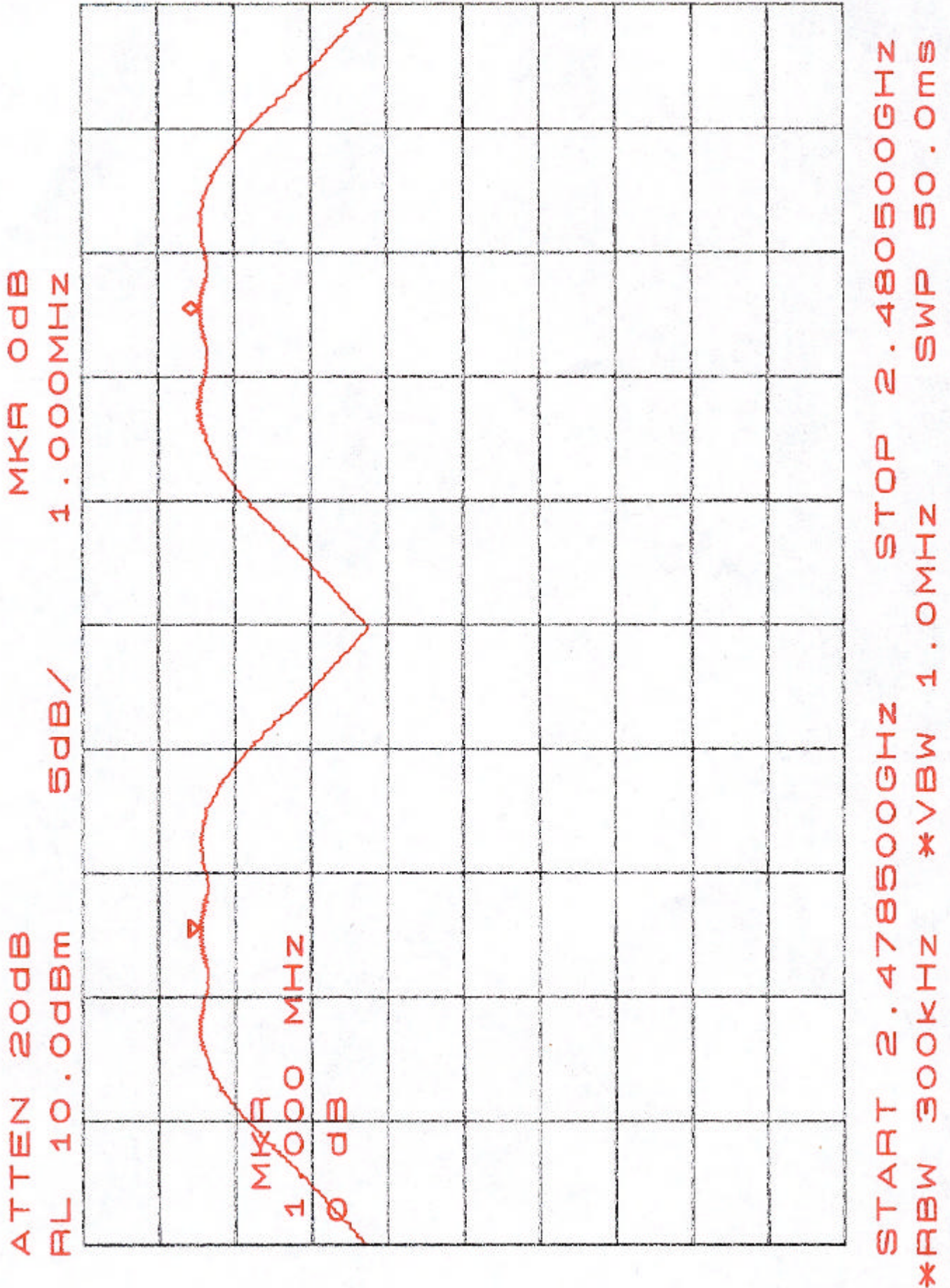
Humidity: 60 %

- a) 2402MHz channel separation is 1MHz
- b) 2441MHz channel separation is 1MHz
- c) 2480MHz channel separation is 1MHz

**Note: Please see Appendix 5 for plotted datas**







## 13 Dwell Time

### 13.1 Standard Applicable

According to 15.247(a)(1)(iii), frequency hopping system in the 2400-2483.5MHz band employing at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 second multiplied by the number of hopping channels employed.

### 13.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 5.

### 13.3 Measurement Equipment

| Equipment         | Manufacturer    | Model No. | Next Cal. Due |
|-------------------|-----------------|-----------|---------------|
| Plotter           | Hewlett-Packard | 7550A     | N/A           |
| Spectrum Analyzer | Hewlett-Packard | 8564EC    | 09/10/2003    |

### 13.4 Measurement Data

Test Date : Mar. 26, 2003

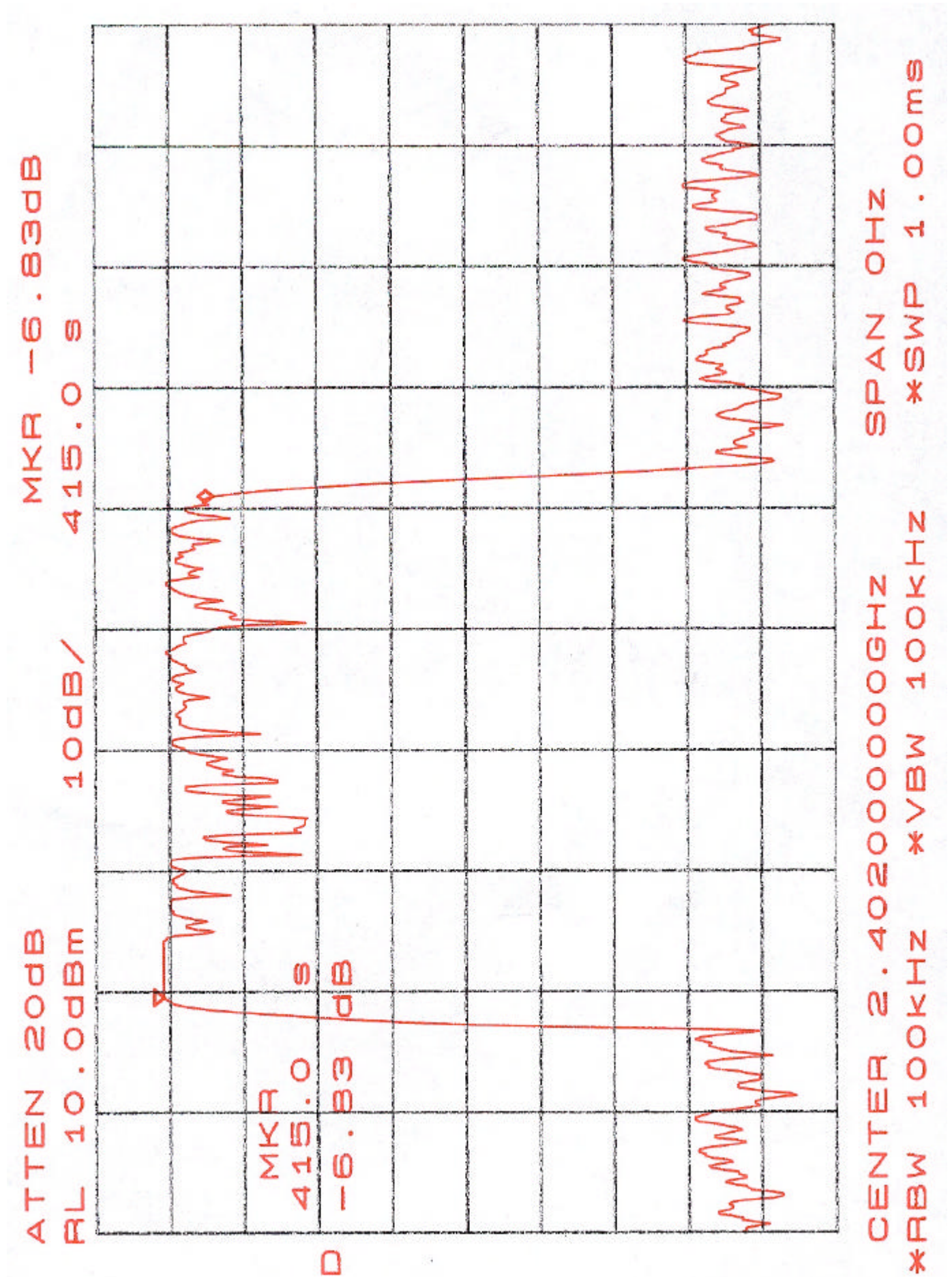
Temperature : 22°C

Humidity: 60 %

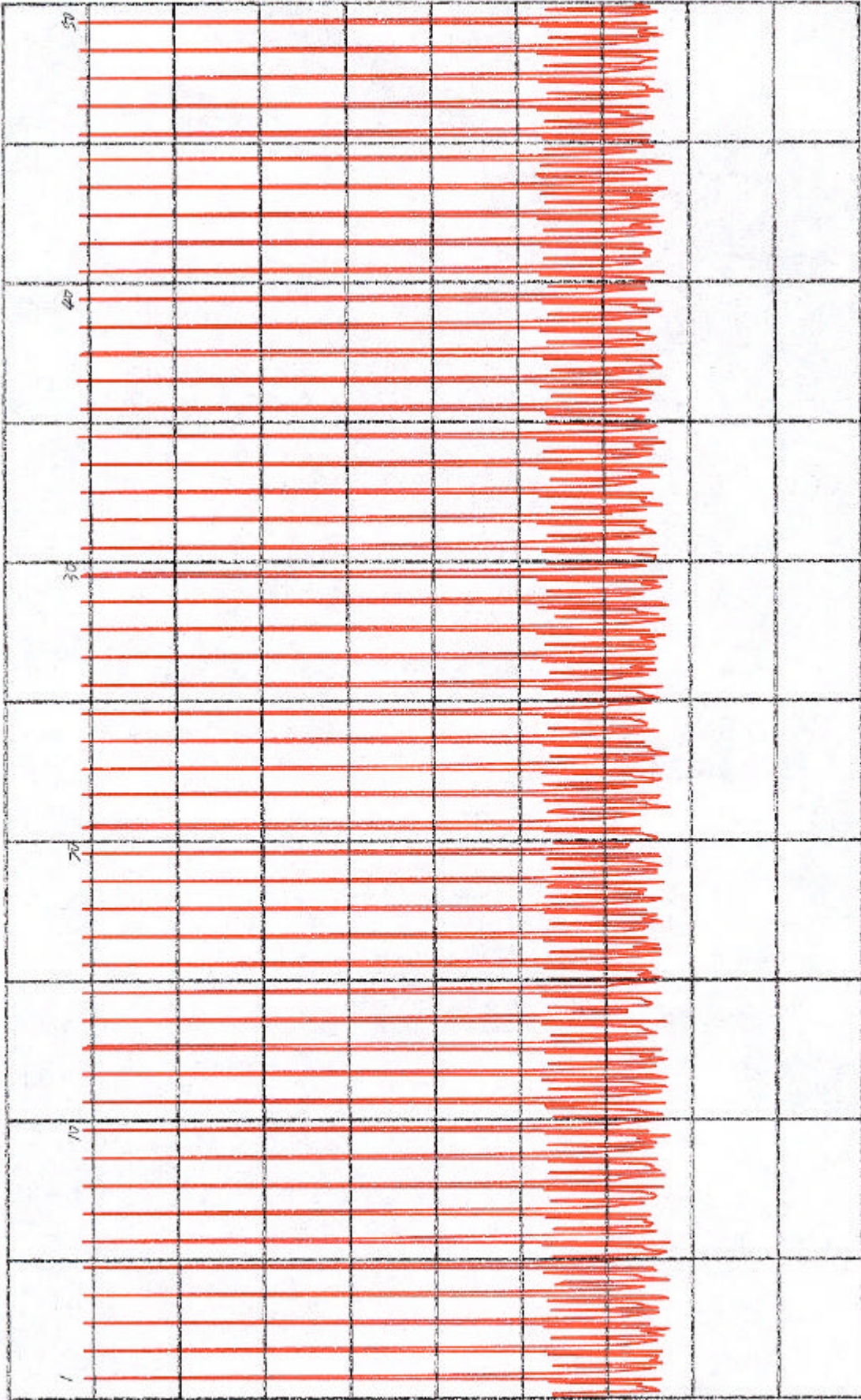
Test period=0.4(second/channel)× 79 channel=31.6sec

- a) 2402MHz dwell time=  $0.4150\text{ms} \times \frac{50}{5} \times 31.6 = 131.14\text{ms}$
- b) 2441MHz dwell time=  $0.4150\text{ms} \times \frac{51}{5} \times 31.6 = 133.76\text{ms}$
- c) 2480MHz dwell time=  $0.4150\text{ms} \times \frac{50}{5} \times 31.6 = 131.14\text{ms}$

**Note:** Please see Appendix 6 for plotted datas

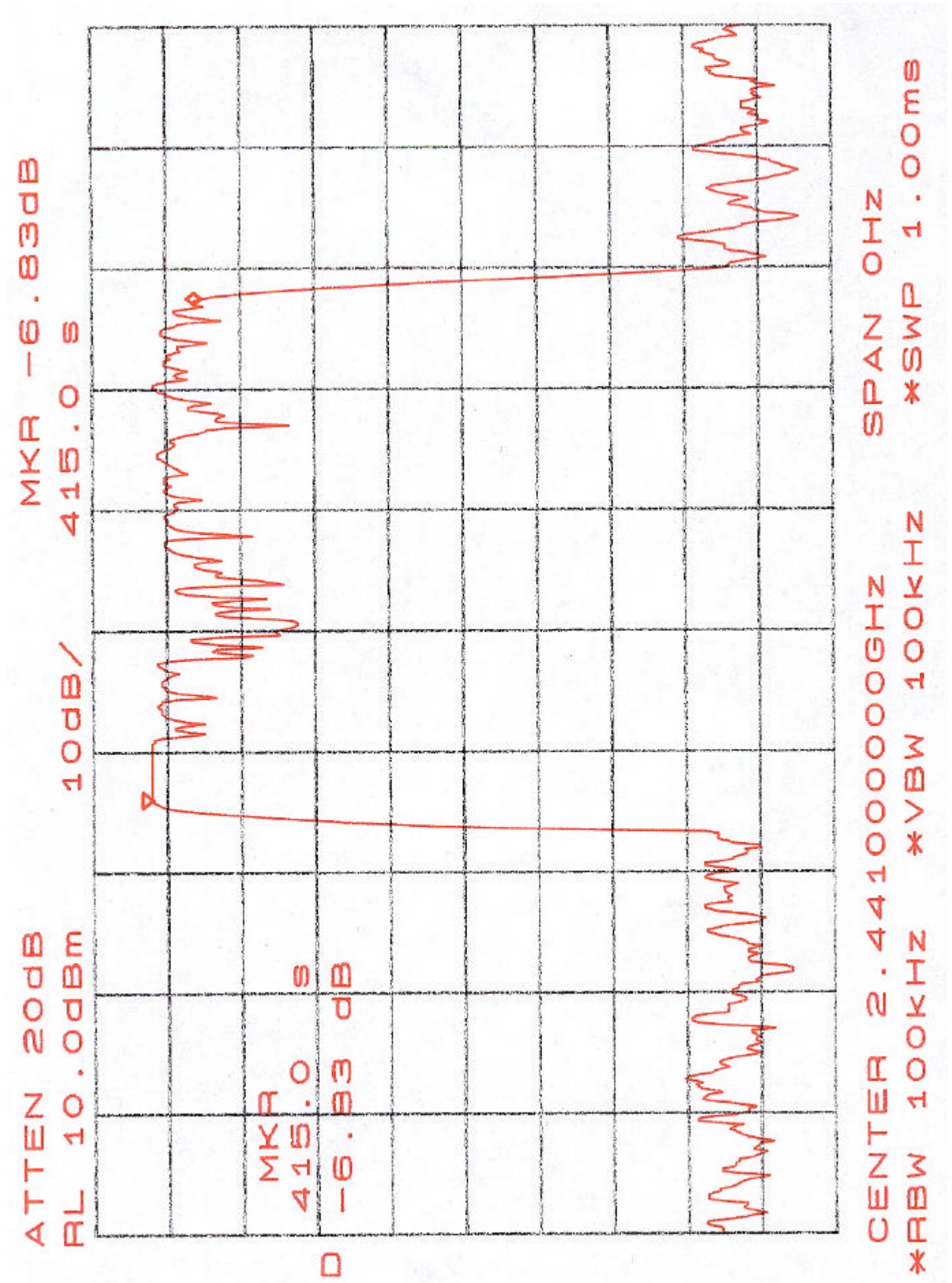


ATTEN 20dB  
RL 10.0dBm  
10dB/

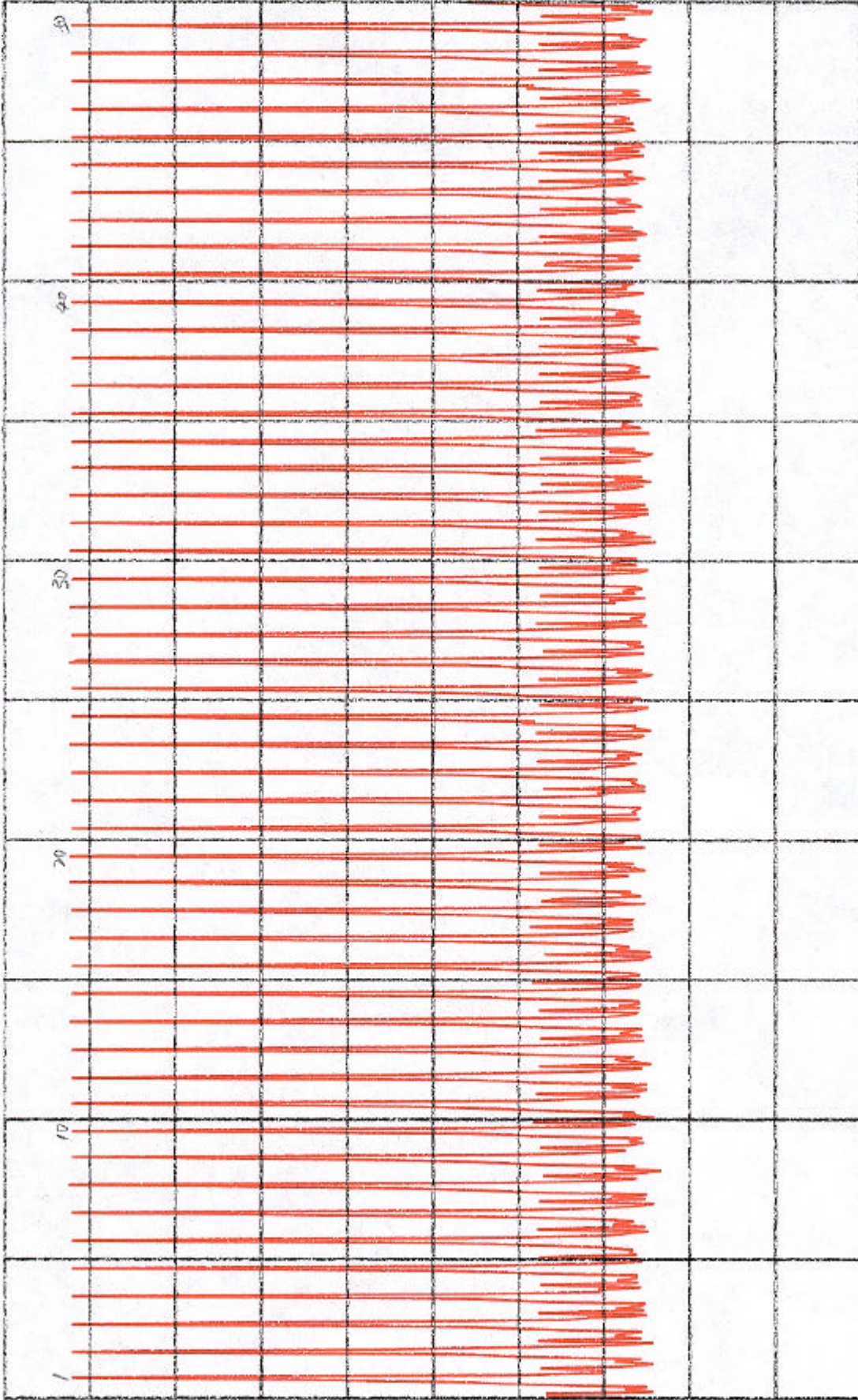


D

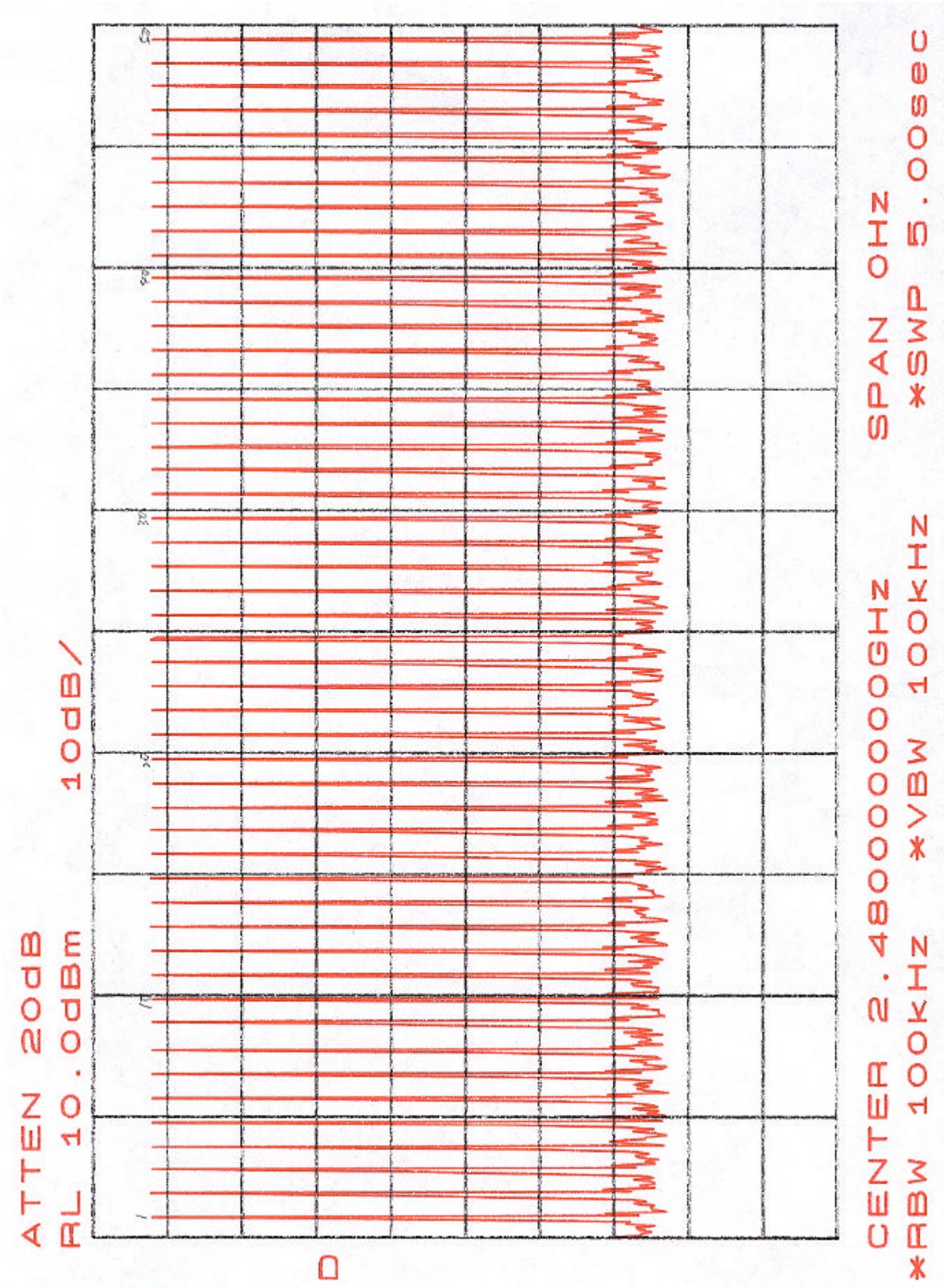
CENTER 2.402000000GHZ  
\*RBW 100KHZ  
SPAN 0HZ  
\*VBW 100KHZ  
\*SWP 5.00SEC



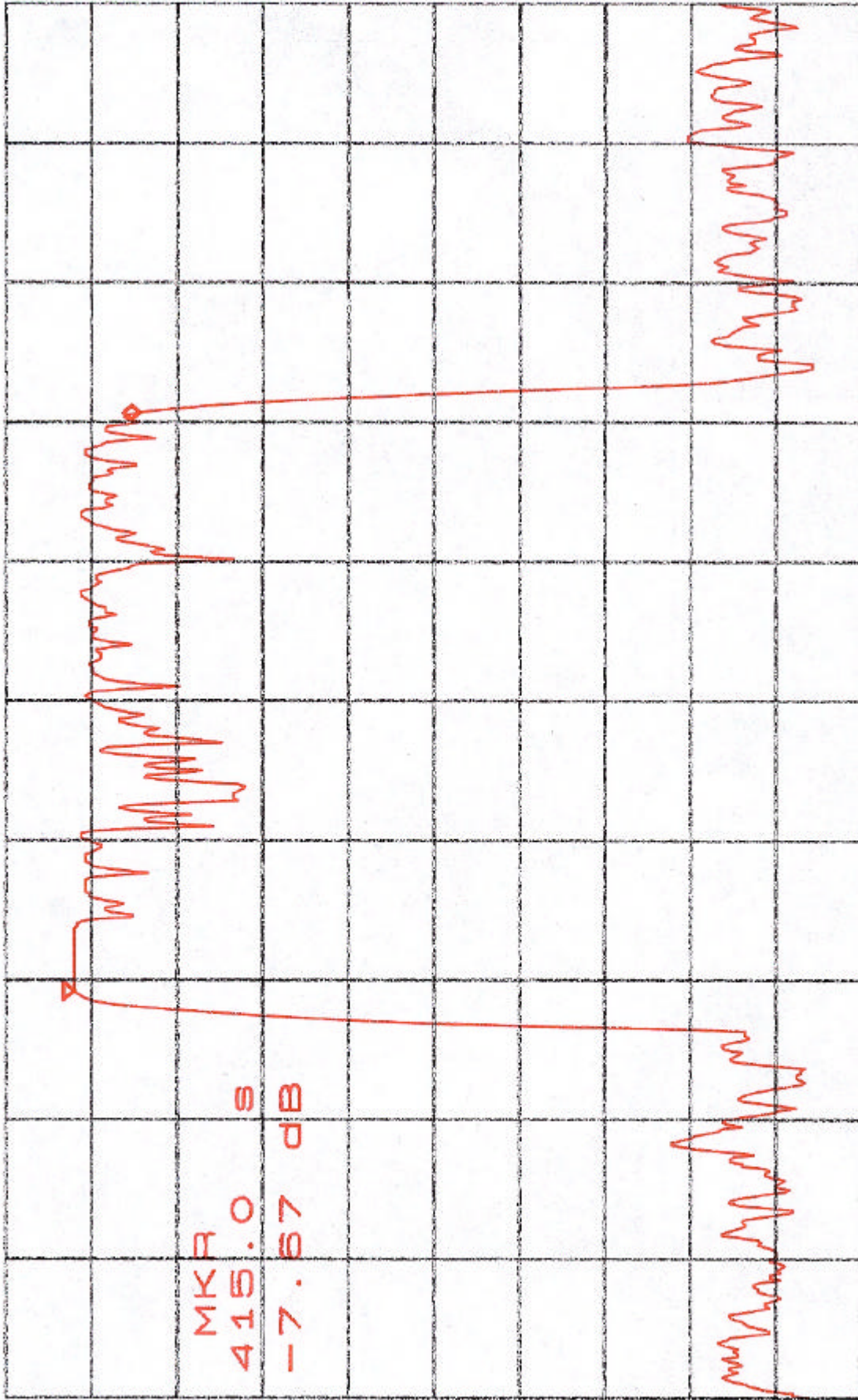
ATTEN 20dB  
RL 10.0dBm  
10dB/



CENTER 2.441000000GHZ  
\*RBW 100KHZ  
\*VBW 100KHZ  
SPAN 0HZ  
\*SWP 5.00SEC



ATTEN 20dB MKR -7.67dB  
RL 10.0dBm 415.0 S



CENTER 2.480000000GHZ SPAN 0HZ  
\*RBW 100KHZ \*VBW 100KHZ \*SWP 1.00ms

## 14 RF Exposure Evaluation

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency radiation as specified in 1.1307(b) LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

| Frequency Range (MHz)                                    | Electric Field Strength(V/m) | Magnetic Field Strength(A/m) | Power Density(nW/cm <sup>2</sup> ) | Average Time (Minutes) |
|----------------------------------------------------------|------------------------------|------------------------------|------------------------------------|------------------------|
| (A) Limits for Occupational/control Exposures            |                              |                              |                                    |                        |
| 300-1500                                                 | --                           | --                           | F/300                              | 6                      |
| 1500-100,000                                             | --                           | --                           | 5                                  | 6                      |
| (B) Limits for General Population/Uncontrolled Exposures |                              |                              |                                    |                        |
| 300-1500                                                 | --                           | --                           | F/300                              | 6                      |
| 1500-100,000                                             | --                           | --                           | 1                                  | 30                     |

F=Frequency in MHz

### 14.1 Friis Formula

Friis transmission formula:  $P_d = (P_{out} * G) / (4 * \pi * r^2)$

Where

$P_d$ =power density in mW/cm<sup>2</sup>

$P_{out}$ =output power to antenna in mW

G=gain of antenna in linear scale

$\pi$ =3.1416

R=distance between observation point and center of the radiator in cm

$P_d$  is the limit of MPE, 1 mW/cm<sup>2</sup>. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

### 14.2 EUT Operation condition

A software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

### 14.3 Test Result of RF Exposure Evaluation

Test Date : Mar. 26, 2003      Temperature : 22°C      Humidity: 60 %

Product: Epox Bluetooth Printer Adapter

Test Item: RF Exposure Evaluation Data

Test site: No. 2 chamber

Test Mode: Normal Operation

#### 14.3.1 Antenna Gain

Antenna Gain: The maximum Gain is 1.5 dBi.

#### 14.3.2 Output Power Into Antenna & RF Exposure Evaluation Distance

| Channel | Channel Frequency<br>(MHz) | Output Power to Antenna<br>(dBm) | Minimum allowable Distance<br>®From Skin(cm) |
|---------|----------------------------|----------------------------------|----------------------------------------------|
| 01      | 2402                       | +1.00                            | 0.37                                         |
| 40      | 2441                       | +0.00                            | 0.36                                         |
| 79      | 2480                       | +0.00                            | 0.29                                         |

The distance r (4<sup>th</sup> column) calculated from the Friis transmission formula is far shorter than 20 cm separation requirement. So, RF exposure limit warning or SAR test are not required.