FCC Part 15
EMI TEST REPORT

of

E.U.T. : i-Key

FCC ID. : M6DIKEYPENDANTTX

MODEL : i-Key Pendant

Working Frequency : 433.920MHz

for

APPLICANT : HORNG WOEI ELECTRONIC CO., LTD.
ADDRESS : No.30-29, Wan Ho Rd. Sec.1, Taichung 408, Taiwan R.O.C.

Test Performed by

ELECTRONICS TESTING CENTER, TAIWAN
NO. 34, LIN 5, DING FU TSUN, LINKOU HSIANG
TAIPEI HSIEN, TAIWAN, R.O.C.

Tel:(02)26023052 Fax:(02)26010910
http://www.etc.org.tw ; e-mail : etcemi@seed.net.tw

Report Number : ET92R-06-046-03

TEST REPORT CERTIFICATION

Applicant : HORNG WOEI ELECTRONIC CO., LTD.
No.30-29, Wan Ho Rd. Sec.1, Taichung 408, Taiwan R.O.C.

Manufacturer : HORNG WOEI ELECTRONIC CO., LTD.
No.30-29, Wan Ho Rd. Sec.1, Taichung 408, Taiwan R.O.C.

Description of EUT :

a) Type of EUT	: i-Key
b) Trade Name	: Horng Woei
c) Model No.	: i-Key Pendant
d) FCC ID	: M6DIKEYPENDANTTX
e) Working Frequency	: 433.920MHz
f) Power Supply	: DC12V

Regulation Applied : FCC Rules and Regulations Part 15 Subpart C (2002)

I HEREBY CERTIFY THAT; The data shown in this report were made in accordance with the procedures given in ANSI C63.4 and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

Note : 1. The results of the testing report relate only to the items tested.
2. The testing report shall not be reproduced except in full, without the written approval of ETC.

Issued Date : Jul. 16, 2003

Test Engineer : Eric Chen
(Eric Chen)

Approve & Authorized Signer : Will Yauo
Will Yauo, Manager
EMC Dept. II of ELECTRONICS
TESTING CENTER, TAIWAN

Table of Contents Page

1. GENERAL INFORMATION 1

1.1 PRODUCT DESCRIPTION 1
1.2 CHARACTERISTICS OF DEVICE: 1
1.3 TEST METHODOLOGY 1
1.4 TEST FACILITY 1

2. DEFINITION AND LIMITS 2

2.1 DEFINITION 2
2.2 RESTRICTED BANDS OF OPERATION 2
2.3 LIMITATION 2
2.4 LABELING REQUIREMENT 4
2.5 USER INFORMATION 4

3 SYSTEM TEST CONFIGURATION 5

3.1 JUSTIFICATION 5
3.2 DEVICES FOR TESTED SYSTEM 5

4. RADIATED EMISSION MEASUREMENT 6

4.1 APPLICABLE STANDARD 6
4.2 MEASUREMENT PROCEDURE 6
4.3 TEST DATA 8
4.3.1 Tx Fundamental and Harmonics 8
4.3.2 Other Emissions 9
4.4 FIELD STRENGTH CALCULATION 10
4.5 ACTIVATE TIME 10
4.6 CALCULATION OF DUTY FACTOR 10
4.7 RADIATED TEST EQUIPMENT 11
4.8 MEASURING INSTRUMENT SETUP 11
4.9 RADIATED MEASUREMENT PHOTOS 12

5. BANDWIDTH OF EMISSION 13

5.1 APPLICABLE STANDARD PLOT GRAPHIC OF BANDWIDTH 13
5.2 BANDWIDTH TEST EQUIPMENT 13
5.3 PLOT GRAPHIC OF BANDWIDTH 13

6. CONDUCTED EMISSION MEASUREMENT 14

6.1 DESCRIPTION 14

7 ANTENNA REQUIREMENT 15

7.1 STANDARD APPLICABLE 15
7.2 ANTENNA CONSTRUCTION 15

APPENDIX 1 : PLOTTED DATA FOR DUTY FACTOR 16

APPENDIX 2 : PLOTTED DATA FOR BANDWIDTH 21

1. GENERAL INFORMATION

1.1 Product Description

a) Type of EUT	: i-Key
b) Trade Name	: Horng Woei
c) Model No.	: i-Key Pendant
d) FCC ID	: M6DIKEYPENDANTTX
e) Working Frequency	: 433.920MHz
f) Power Supply	: DC12V

1.2 Characteristics of Device:

1. The frequcncy is 433.92MHZ(SAW).
2. The transmission is by IR, Do not need to open the casing that we can encode it. (Including programmer and transmitter).
3. Receiver has waterproof , transmitter has water resistant.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in chapter 13 of ANSI C63.4.

The Transmitter under test was operated continuously in its normal operating mode for the purpose of the measurements. In order to secure the continuous operation of the device under test, rewiring in the circuit was done by the manufacturer so as to affect its intended operation.

The receiving antenna polarized horizontally was varied from 1 to 4 meters and the wooden turntable was rotated through 360 degrees to obtain the highest reading on the field strength meter or on the display of the spectrum analyzer. And also, each emission was to be maximized by changing the orientation of the Transmitter under test.

In order to determining the average value during one pulse train of the radiated power generated from the Transmitter under test, the encoded wave form in the time domain was used.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the roof top of Building at No.34, Lin 5, Ding Fu Tsun, Linkou Hsiang, Taipei Hsien, Taiwan, R.O.C.

This site has been fully described in a report submitted to your office, and accepted in a letter dated Feb. 10, 2000.

2. DEFINITION AND LIMITS

2.1 Definition

Intentional radiator:
A device that intentionally generates and emits radio frequency energy by radiation or induction.

2.2 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.15
0.495 - 0.505 **	16.69475 - 16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425 - 16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475 - 156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

Remark "**" : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

2.3 Limitation

(1) Conducted Emission Limits:

Except for Class A digital devices, for equpment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50ì H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency MHz	Quasi Peak dB µV	Average dB µV
0.15 - 0.5	66-56*	56-46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

* Decreases with the logarithm of the frequency

(2) Radiated Emission Limits :

According to 15.231,Periodic operation in the band 40.66-40.70 MHz and above 70 MHz, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Frequency Band (MHz)	Field strength of Fundamental (uV/m)	Field strength of Spurious (uV/m)
40.66-40.70	2250	225
70-130	1250	125
130-174	*1,250 to 3,750	*125 to 375
174-260	3750	375
260-470	*3,750 to 12,500	*375 to 1250
Above 470	12500	1250

* Linear interpolations.

According to 15.235, the field strength of emissions from intentional radiators operated under these frequency bands shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental	
	µV/meter	dBµV/meter
49.82 - 49.90	10000	80

Field strength limits are at the distance of 3 meters, emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209,as following table:

Other Frequencies (MHz)	Field Strength of Fundamental	
	µV/meter	dBµV/meter
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

(3) Limit of transmission time

a) A manually operated Transmitter shall employ a switch that will automatically deactivate the Transmitter (Transmitter) within not more than 5 seconds of being released.

b) A Transmitter activated automatically shall cease transmission within 5 seconds after activation.

2.4 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device :

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

2.5 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

3 SYSTEM TEST CONFIGURATION

3.1 Justification

All measurement were intentional to maximum the emissions from EUT by varying the connection cables, therefore, the test result is sure to meet the applicable requirement.

3.2 Devices for Tested System

Device	Manufacture	Model / FCC ID.	Description
i-Key*	HORNG WOEI ELECTRONIC CO., LTD.	i-Key Pendant M6DIKEYPENDANTTX	----

Remark "*" means equipment under test.

4. RADIATED EMISSION MEASUREMENT

4.1 Applicable Standard

For periodic operation intentional radiator, the radiated emission shall comply with § 15.231(b).

4.2 Measurement Procedure

A. Preliminary Measurement For Portable Devices

For portable devices, he following procedure was performed to determine the maximum emission axis of EUT:

1. With the receiving antenna is H polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
2. With the receiving antenna is V polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
3. Compare the results derived from above two steps. So, the axis of maximum emission from EUT was determined and the configuration was used to perform the final measurement.

B. Final Measurement

1. Setup the configuration per figure 1 and 2 for frequencies measured below and above 1 GHz respectively. Turn on EUT and make sure that it is in normal function.

2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.

3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.

4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0° to 360° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.

5. Repeat step 4 until all frequencies need to be measured were complete.

6. Repeat step 5 with search antenna in vertical polarized orientations.

7. Check the three frequencies of highest emission with varying the placement of cables (if any) associated with EUT to obtain the worse case and record the result.

Figure 1 : Frequencies measured below 1 GHz configuration

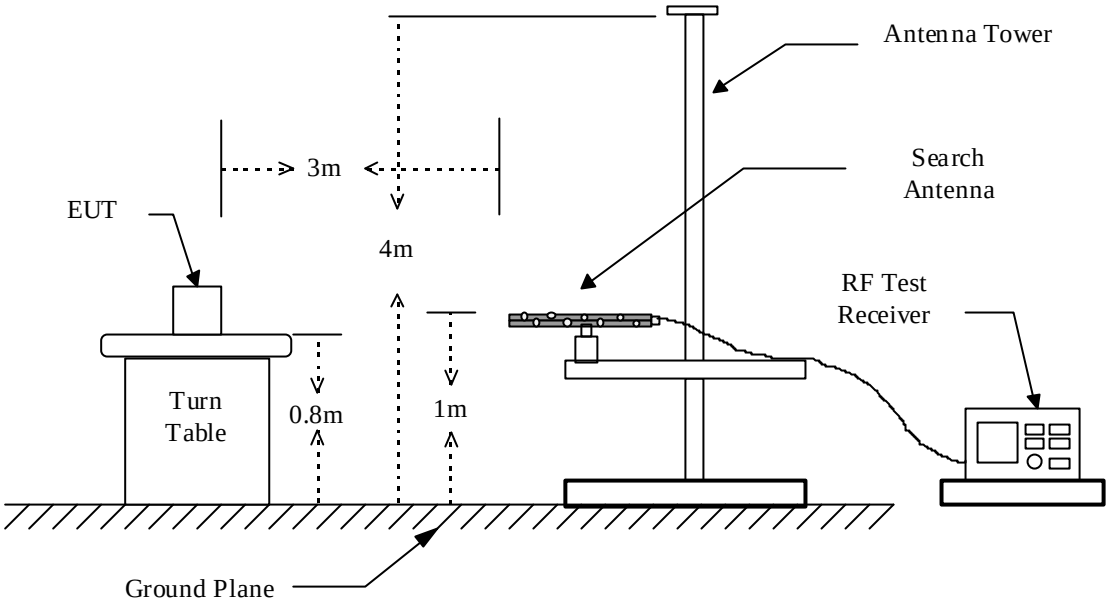
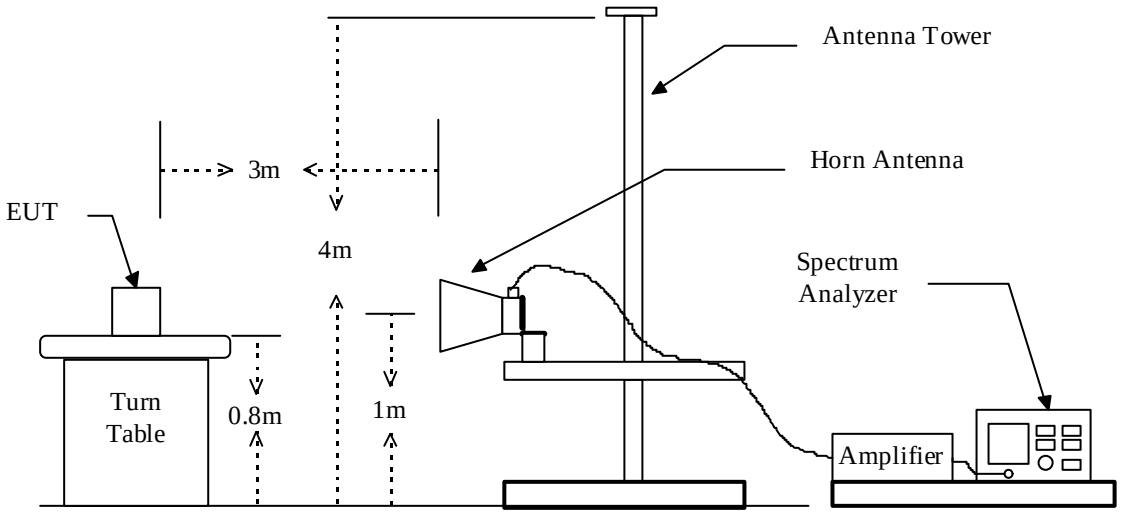


Figure 2 : Frequencies measured above 1 GHz configuration



4.3 Test Data

4.3.1 Tx Fundamental and Harmonics

Operation Mode : Working

Test Date : Jun. 16, 2003 Temperature : 25 ℃ Humidity: 65 %

Frequency (MHz)	Peak Reading (dBuV) H	V	Factor (dB) C	D	Result @3m (dBuV/m) Peak	Ave.	Limit @3m (dBuV/m) Peak	Ave.	Margin (dB)	Table Degree (Deg.)	Ant. High (m)
433.911	95.1	96.2	-5.5	-12.6	90.7	78.1	100.8	80.8	-2.7	60	1.4
867.829	69.5	69.7	2.3	-12.6	72.0	59.4	80.8	60.8	-1.4	120	1.4
*1301.700	71.3	71.7	-8.4	-12.6	63.3	50.7	74.0	54.0	-3.3	60	1.0
1735.700	55.7	63.0	-6.1	-12.6	56.9	44.3	80.8	60.8	-16.5	120	1.2
2169.600	---	48.8	-4.0	-12.6	44.8	32.2	80.8	60.8	-28.6	120	1.0
2603.600	---	47.2	-2.4	-12.6	44.8	32.2	80.8	60.8	-28.6	60	1.0
3037.600	---	---	-1.1	-12.6	---	---	80.8	60.8	---	---	---
3471.600	---	---	-0.1	-12.6	---	---	80.8	60.8	---	---	---
*3905.600	---	---	1.6	-12.6	---	---	74.0	54.0	---	---	---
*4339.600	---	---	2.0	-12.6	---	---	74.0	54.0	---	---	---

Note :

1. *Factor C means "corrected", and that includes antenna factor, cable loss, amplifier gain (if any). And Factor D means "Duty", that is for calculating the average value and derived from section 3.6 in this test report.*
2. *Peak Result = Reading + C. Factor*
   Ave. Result = Peak Value + D Factor
3. *"*" means the frequency fall in the restricted frequency band, and the limit of emission is referred to FCC class B*
4. *The limit for spurious emissions refers to FCC §15.231.*
5. *The expanded uncertainty of the radiated emission tests is 3.53 dB.*

If the measured frequencies fall in the restricted frequency band, the limit employed is § 15.209 general requirement when frequencies are below or equal to 1 GHz. And the measuring instrument is set to quasi peak detector function, no duty factor applied.

4.3.2 Other Emissions

Operation Mode : Transmitting

Test Date : Jun. 16, 2003 Temperature : 25 ℃ Humidity: 65 %

Frequency (MHz)	Ant-Pol H/V	Meter Reading (dBuV)	Corrected Factor (dB)	Result @3m (dBuV/m)	Limit @3m (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (m)
201.180	V	39.0	-7.0	32.0	43.5	-11.5	110	1.0
259.500	H	32.9	-3.9	29.0	46.0	-17.0	270	2.0
279.210	H	33.2	-2.8	30.4	46.0	-15.6	265	1.5
776.700	H	34.6	-0.2	34.4	46.0	-11.6	270	2.0
816.598	V	33.8	1.2	35.0	46.0	-11.0	115	1.0
839.000	V	33.5	1.9	35.4	46.0	-10.6	110	1.0

Note :

1. Remark "---" means that the emissions level is too low to be measured.
2. The expanded uncertainty of the radiated emission tests is 3.53 dB.

4.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

Peak = Reading + Corrected Factor

where

Corr. Factor = Antenna Factor + Cable Factor - Amplifier Gain (if any)

And the average value is

Average = Peak Value + Duty Factor

Note : If the measured frequencies are fall in the restricted frequency band, the limit employed must be quasi peak value when frequencies are below or equal to 1 GHz. And the measuring instrument is set to quasi peak detector function.

4.5 Activate Time

This EUT is operated manually. It ceases transmission within 5 seconds after been released.

4.6 Calculation of Duty Factor

The duty factor is calculated with following formula:

$$20\log\frac{Total\ Duty}{Period\ of\ Pulse\ Train}$$

433.911 MHz

$$20\log\frac{(0.729x22)+(12x0.24)ms}{80.9ms}=-12.6dB$$

Note : Please see appendix 1 for Plotted Data

4.7 Radiated Test Equipment

Equipment	Manufacturer	Model No.	Next Cal. Date
Spectrum Analyzer	Hewlett-Packard	8568B	10/14/2004
Pre-selector	Hewlett-Packard	85685A	01/10/2004
Quasi Peak Detector	Hewlett-Packard	85650A	01/10/2004
Spectrum Analyzer	Hewlett-Packard	8564E	04/14/2004
RF Test Receiver	Rohde & Schwarz	ESVS 30	08/06/2003
Horn Antenna	EMCO	3115	08/08/2003
Log periodic Antenna	EMCO	3146	11/04/2003
Biconical Antenna	EMCO	3110B	11/04/2003
Preamplifier	Hewlett-Packard	8449B	05/29/2004
Preamplifier	Hewlett-Packard	8447D	01/04/2004

4.8 Measuring Instrument Setup

Explanation of measuring instrument setup in frequency band measured is as following :

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	RF Test Receiver	Quasi-Peak	120 kHz	N/A
	Spectrum Analyzer	Peak	100 kHz	100 kHz
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	300 Hz

4.9 Radiated Measurement Photos

Please see Exhibit F-Test Setup Photos

5. BANDWIDTH OF EMISSION

5.1 Applicable Standard Plot Graphic of Bandwidth

Per FCC rule §15.231(c), the permitted emission bandwidth is no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz.

5.2 Bandwidth Test Equipment

Equipment	Manufacturer	Model No.	Next Cal. Date
EMI Test Receiver	Rohde and Schwarz	ESBI	05/25/2004
Plotter	Hewlett-Packard	7550A	N/A

5.3 Plot Graphic of Bandwidth

The emission bandwidth limit for this transmitter is

433.920 MHz×0.25%＝1084. 8 KHz
20 dB bandwidth = 39.5 KHz
Test Result: 39.5KHz ＜ 1084.8 KHz.

Note : Please see appendix 2 for Plotted Data

6. CONDUCTED EMISSION MEASUREMENT

6.1 Description

This EUT is excused from investigation of conducted emission, for it is powered by DC 12V battery only. According to § 15.207 (d), measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.

7 ANTENNA REQUIREMENT

7.1 Standard Applicable

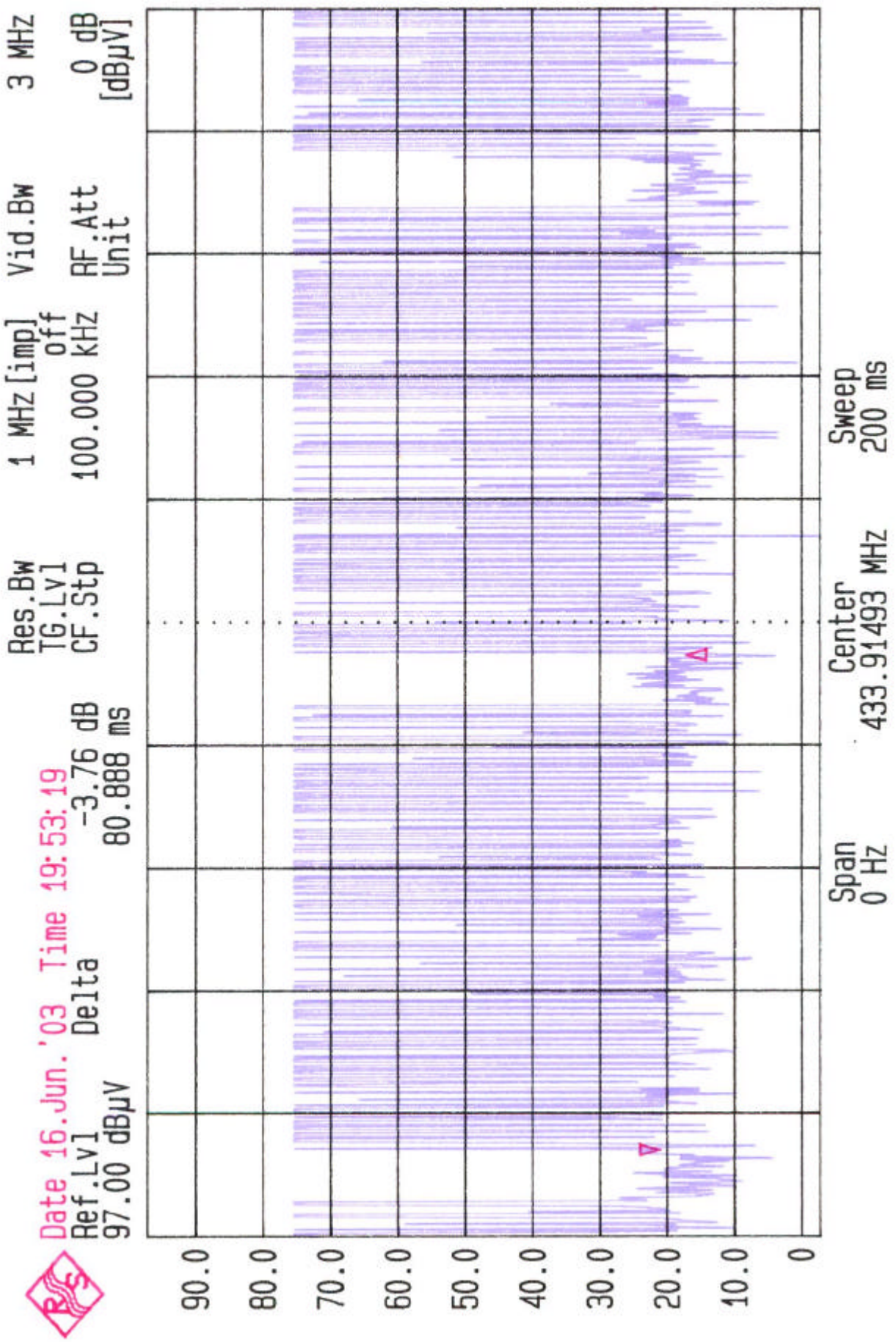
According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

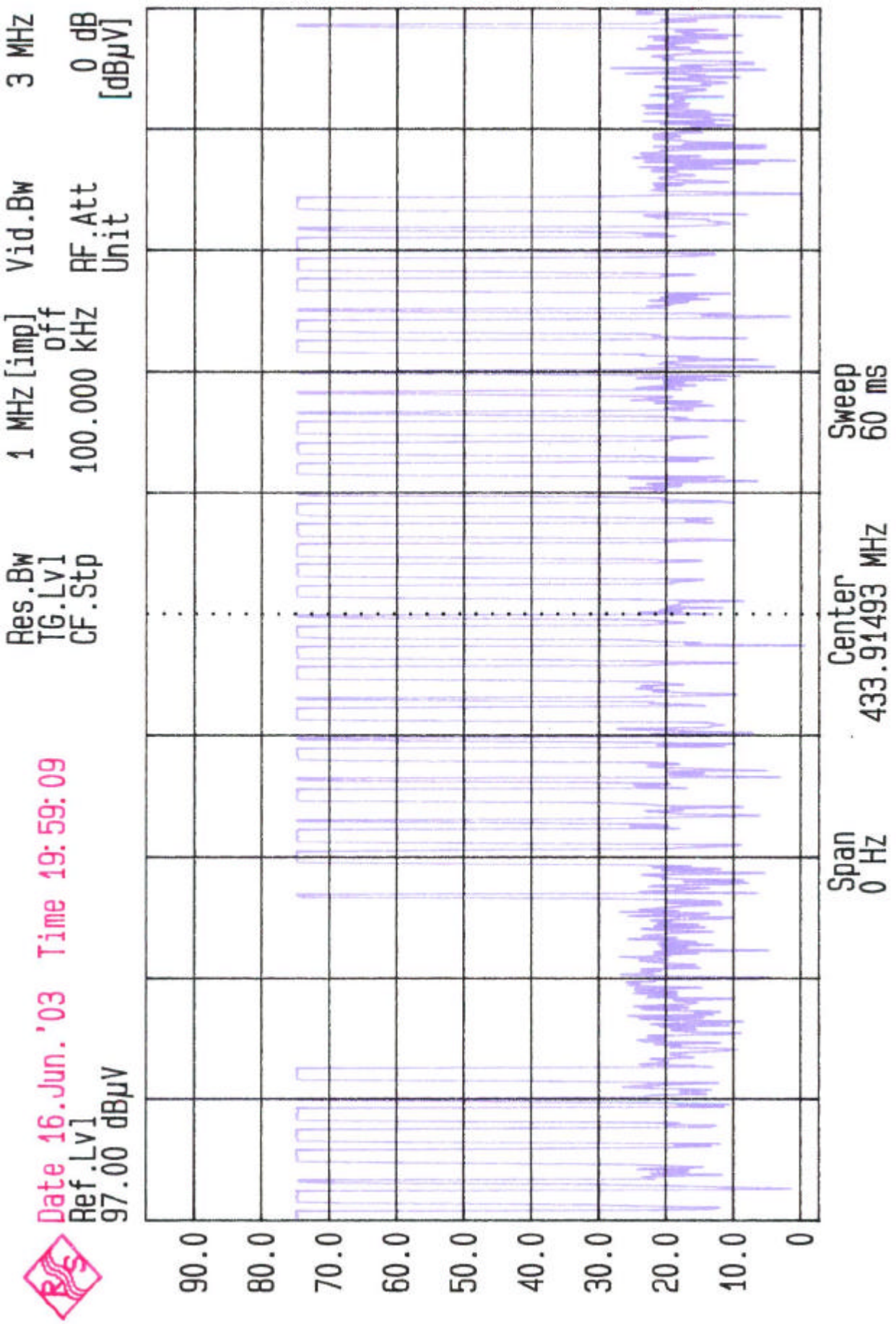
7.2 Antenna Construction

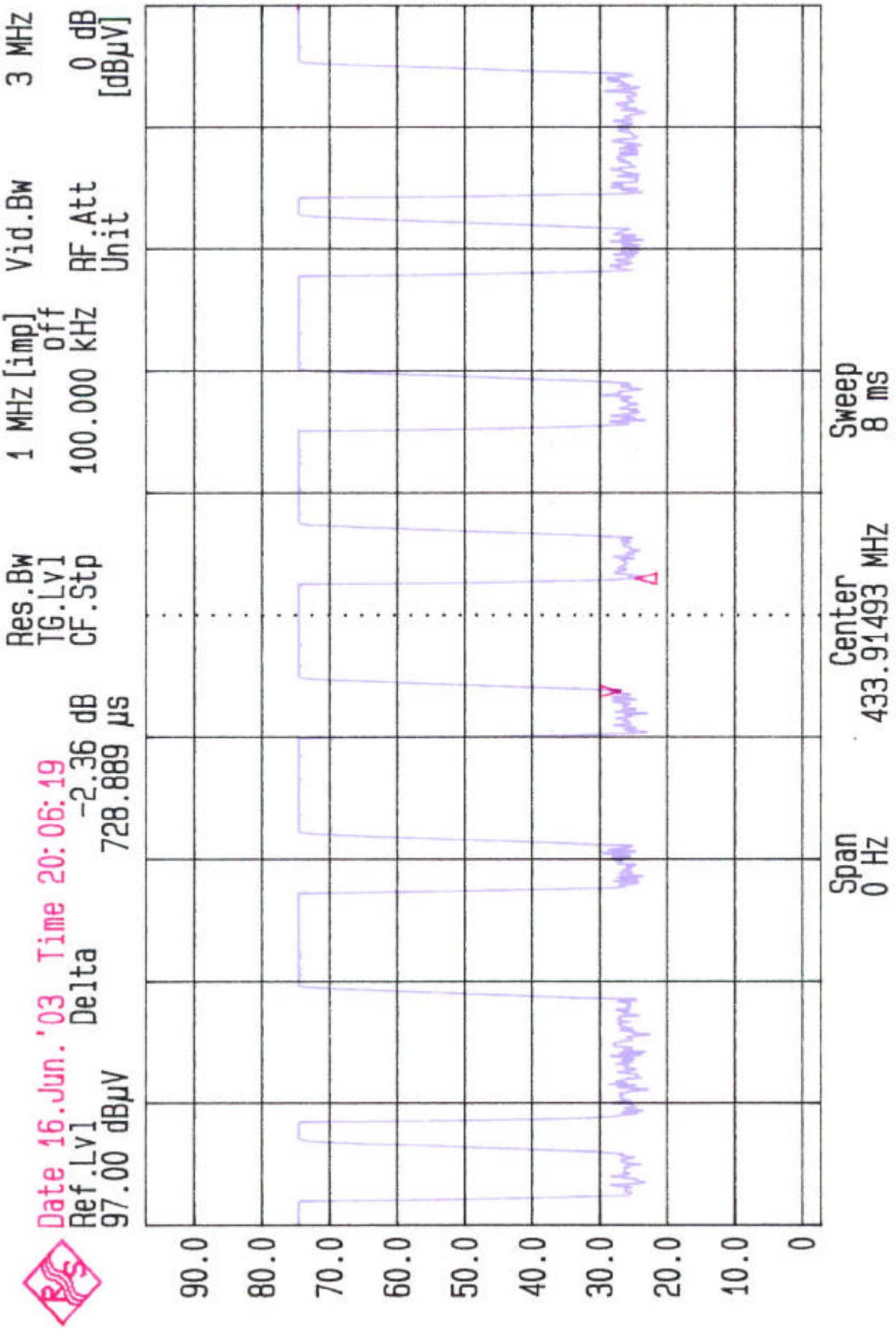
The antenna is permanently mounted on RF Board, no consideration of replacement.

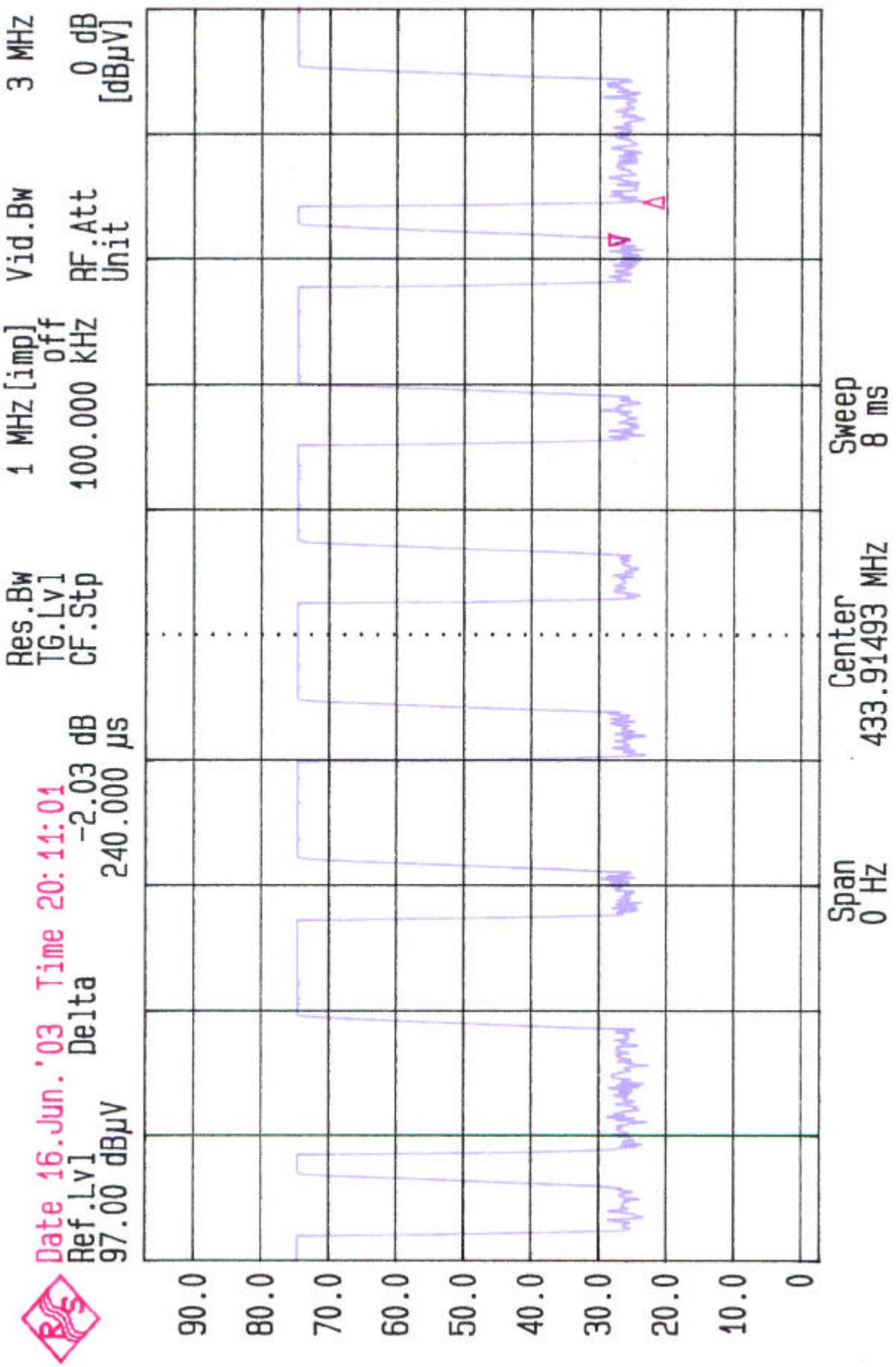
Please see photos submitted in Exhibit B.

APPENDIX 1 : PLOTTED DATA FOR DUTY FACTOR

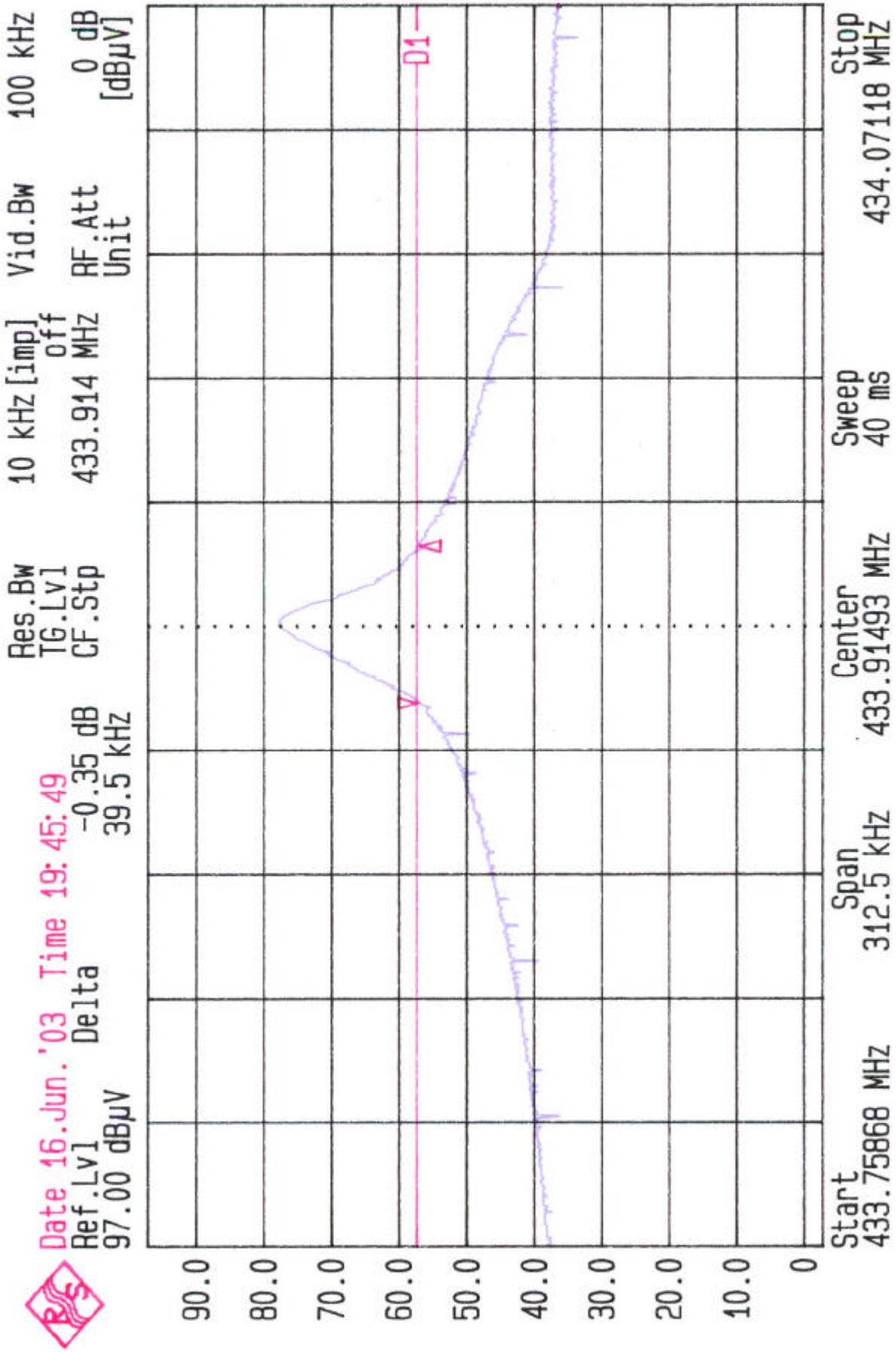

Date 16.Jun.'03 Time 19:53:19
Ref.Lvl
97.00 dBµV
Delta
-3.76 dB
80.888 ms
Res.Bw
TG.Lvl
CF.Stp
1 MHz [imp]
off
100.000 kHz
Vid.Bw
RF.Att
Unit
3 MHz
0 dB
[dBµV]
Span
0 Hz
Center
433.91493 MHz
Sweep
200 ms
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0


Date 16.Jun.'03 Time 19:59:09
Ref.Lvl
97.00 dBµV
Res.Bw 1 MHz [imp]
TG.Lvl off
CF.Stp 100.000 kHz
Vid.Bw 3 MHz
RF.Att 0 dB
Unit [dBµV]
Span
0 Hz
Center
433.91493 MHz
Sweep
60 ms
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0


Date 16.Jun.'03 Time 20:06:19
Ref.Lvl
97.00 dBµV
Delta
-2.36 dB
728.889 µs
Res.Bw
TG.Lvl
CF.Stp
1 MHz [imp]
off
100.000 kHz
Vid.Bw
RF.Att
Unit
3 MHz
0 dB
[dBµV]
Span
0 Hz
Center
433.91493 MHz
Sweep
8 ms
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0


Date 16.Jun.'03 Time 20:11:01
Ref.Lvl
97.00 dBµV
Delta
-2.03 dB
240.000 µs
Res.Bw
TG.Lvl
CF.Stp
1 MHz [imp]
off
100.000 kHz
Vid.Bw
RF.Att
Unit
3 MHz
0 dB
[dBµV]
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
Span
0 Hz
Center
433.91493 MHz
Sweep
8 ms

APPENDIX 2 : PLOTTED DATA FOR BANDWIDTH


Date 16.Jun.'03 Time 19:45:49
Ref.Lvl
97.00 dBµV
Delta
-0.35 dB
39.5 kHz
Res.Bw
TG.Lvl
CF.Stp
10 kHz [imp]
off
433.914 MHz
Vid.Bw
RF.Att
Unit
100 kHz
0 dB
[dBµV]
D1
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
Start
433.75868 MHz
Span
312.5 kHz
Center
433.91493 MHz
Sweep
40 ms
Stop
434.07118 MHz