

EXHIBIT D

CKC TEST REPORT



CERTIFICATION TEST REPORT
FOR THE
TIMING DEVICE, PHOTO-RECEIVER
FCC PART 15 SUBPART C
COMPLIANCE

DATE OF ISSUE: AUGUST 18, 1998

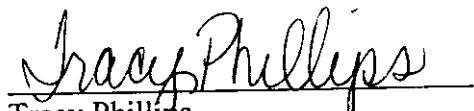
PREPARED FOR:

FarmTek, Inc.
5113 Heritage
Sachse, TX 75048

P.O. No: Check #8155
W.O. No: 68,604

Report No: FC98-022

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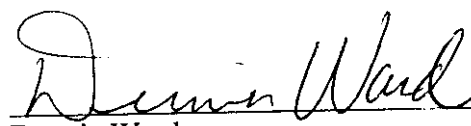

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Date of test: July 29-31, 1998

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ADMINISTRATIVE INFORMATION

DATE OF TEST: July 29-31, 1998

PURPOSE OF TEST: To demonstrate the compliance of the Timing Device, Photo-Receiver, with the requirements for FCC Part 15 Subpart C devices.

MANUFACTURER: FarmTek, Inc.
5113 Heritage
Sachse, TX 75048

REPRESENTATIVE: Mike Douglas

TEST LOCATION: CKC Laboratories, Inc.
5473A Clouds Rest
Mariposa, CA 95338

TEST PERSONNEL: Skip Doyle

TEST METHOD: ANSI C63.4 1992

FREQUENCY RANGE TESTED: 30 MHz - 10 GHz

EQUIPMENT UNDER TEST: Timing Device
Manuf: FarmTek, Inc.
Model: Photo-Receiver
Serial: 20000029807
FCC ID: NWNMI050-2RB

SUMMARY OF RESULTS

The FarmTek, Inc. Timing Device, Photo-Receiver, was tested in accordance with ANSI C63.4 1992 for compliance with FCC Part 15 Subpart C.

As received, the above equipment was found to be fully compliant with the limits of FCC Part 15 Subpart C. The results in this report apply only to the items tested, as identified herein.

EQUIPMENT UNDER TEST (EUT) DESCRIPTION

Electronic timer for track events (RF receiving unit) with remote photo-sensors for automatic start/stop (RF transmitting unit).

MEASUREMENT UNCERTAINTY

Associated with data in this report is a ± 4 dB measurement uncertainty.

EUT OPERATING FREQUENCY

The EUT was operating at 903.3 MHz – 921.3 MHz.

TEMPERATURE AND HUMIDITY DURING TESTING

The temperature during testing was within $+15^{\circ}\text{C}$ and $+35^{\circ}\text{C}$.
The relative humidity was between 20% and 75%.

PERIPHERAL DEVICES

The EUT was not tested with peripheral devices.

REPORT OF MEASUREMENTS

The following Tables 1 and 2 report the highest emissions levels recorded during the tests performed on the Timing Device, Photo-Receiver. The data sheets from which these tables were compiled are contained in Appendix B.

Table 1: Six Highest Fundamental Emission Levels

FREQUENCY MHz	METER READING dBμV	CORRECTION FACTORS				CORRECTED READING dBμV/m	SPEC LIMIT dBμV/m	MARGIN dB	NOTES
		Ant dB	Amp dB	Cable dB	Dist dB				
903.449	85.1	23.7	-27.5	6.2		87.2	93.9	-6.7	V
903.453	80.6	23.4	-27.5	6.2		82.7	93.9	-11.2	H
909.447	83.9	23.4	-27.4	6.3		86.2	93.9	-7.7	V
909.461	80.7	23.4	-27.4	6.3		83.0	93.9	-10.9	H
921.450	85.3	23.6	-27.4	6.3		87.8	93.9	-6.1	V
921.452	81.3	23.6	-27.4	6.3		83.8	93.9	-10.1	H

Test Method: ANSI C63.4 1992
Spec Limit : 15.249 (a)
Test Distance: 3 Meters

NOTES: H = Horizontal Polarization
V = Vertical Polarization
N = No Polarization
D = Dipole Reading
Q = Quasi Peak Reading
A = Average Reading

COMMENTS: EUT is a Photo Receiver/Transmitter with three channels of operation. Frequencies are: channel 0 = 903.3MHz, channel 3 = 909.3MHz and channel 7 = 921.3MHz. EUT uses a 9V battery and is continuously transmitting a modulated signal. Maximized emissions of fundamentals per FCC 15.249(a) after attenuation by the customer.

Table 2: Six Highest Radiated Emission Levels (30MHz-10GHz)

FREQUENCY MHz	METER READING dBμV	CORRECTION FACTORS				CORRECTED READING dBμV/m	SPEC LIMIT dBμV/m	MARGIN dB	NOTES
		Ant dB	Amp dB	Cable dB	Dist dB				
1806.600	28.0	26.6	-35.8	6.9		25.7	54.0	-28.3	V
1818.600	30.2	26.7	-35.8	6.9		28.0	54.0	-26.0	V
1842.600	27.9	26.8	-35.7	7.0		26.0	54.0	-28.0	V
3613.200	28.1	33.0	-33.9	12.7		39.9	54.0	-14.1	V
3637.200	27.9	33.0	-33.9	12.8		39.8	54.0	-14.2	V
3685.200	28.0	33.1	-33.8	12.8		40.1	54.0	-13.9	V

Test Method: ANSI C63.4 1992
Spec Limit : 15.249(c)/15.209
Test Distance: 3 Meters

NOTES: H = Horizontal Polarization
V = Vertical Polarization
N = No Polarization
D = Dipole Reading
Q = Quasi Peak Reading
A = Average Reading

COMMENTS: EUT is a Photo Receiver/Transmitter with three channels of operation. Frequencies are: channel 0 = 903.3MHz, channel 3 = 909.3MHz and channel 7 = 921.3MHz. EUT uses a 9V battery and is continuously transmitting a modulated signal. Maximized emissions per FCC 15.249(c) 30 - 10000MHz except fundamentals (on MAX5.DAT). No signals detected from EUT, these readings are grass levels taken at harmonics of the fundamental transmitter frequencies.

TABLE A

LIST OF TEST EQUIPMENT

1. Spectrum Analyzer, Hewlett Packard, Model No. 85662A, S/N 2403A08241.
2. Preamp, Hewlett Packard, Model No. 8447D, S/N -1937A02604.
3. Quasi-Peak Adapter, Hewlett Packard, Model No. 85650A, S/N 2811A01267.
4. Biconical Antenna, A & H Systems, Model No. SAS-200/542, S/N 156.
5. Log Periodic Antenna, A & H Systems, Model No. SAS-200/512, S/N 154.
6. Magnetic Loop Antenna, EMCO, Model No. 6502, S/N 1074.
7. Horn Antenna, EMCO, Model No. 3115, S/N 4683.
8. LISN (FCC), Solar Electronics, S/N 855996, 992.
9. LISN, Solar Electronics, S/N 8144793, 474.
10. Test software, EMI Test 2.91.

EUT SETUP

The equipment under test (EUT) listed was setup in a manner that represented their normal use. Any special conditions required for the EUT to operate normally are identified in the comments that accompany Tables 1 for fundamental emissions and Table 2 for radiated emissions.

During radiated emissions testing, the EUT was mounted on a nonconductive, rotating table 80 cm above the conductive grid. The nonconductive table dimensions were 1 meter by 1.5 meters. This configuration is typical for radiated emissions testing of table top devices.

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed in Table A were used to collect the radiated emissions data for the Timing Device, Photo-Receiver. For radiated measurements below 300 MHz, the biconical antenna was used. For frequencies from 300 to 1000 MHz, the log periodic antenna was used. For frequencies above 1000 MHz, the horn antenna was used. All antennas were located at a distance of 3 meters from the edge of the EUT. Conducted emissions tests required the use of the FCC type LISN's.

The HP spectrum analyzer was used for all measurements. Table B shows the analyzer bandwidth settings that were used in designated frequency bands. For conducted emissions, a reference level of 100 dB μ V and a vertical scale size of 10 dB per division were used. A 10 dB external attenuator was also used during conducted tests, with internal offset correction in the analyzer. During radiated testing, the measurements were made with 0 dB of attenuation, a reference level of 97 dB μ V, and a vertical scale of 10 dB per division.

TABLE B : ANALYZER BANDWIDTH SETTINGS PER FREQUENCY RANGE

TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	10 GHz	1 MHz

SPECTRUM ANALYZER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in Tables 1 and 2 indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "Peak" mode. Whenever a "Quasi-Peak" or "Average" reading is listed as one of the six highest readings, this is indicated as a "Q" or an "A" in Table 1 or Table 2. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data for the Timing Device, Photo-Receiver.

Peak

In this mode, the Spectrum Analyzer or test engineer recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature of the analyzer called "peak hold," the analyzer had the ability to measure transients or low duty cycle transient emission peak levels. In this mode the analyzer made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

When the true peak values exceeded or were within 2 dB of the specification limit, quasi-peak measurements were taken using the HP 85650A Quasi-Peak Adapter for the HP 8568B Spectrum Analyzer. The detailed procedure for making quasi peak measurements contained in the HP Quasi-Peak Adapter manual were followed.

Average

When the frequencies exceed 1 GHz, average measurements may be made using the spectrum analyzer. To make these measurements, the test engineer reduces the video bandwidth on the analyzer until the modulation of the signal is filtered out. At this point the analyzer is set into the linear mode and the scan time is reduced.

TEST METHODS

The emissions data of the Timing Device, Photo-Receiver, was taken with the HP Spectrum Analyzer. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the "Sample Calculations". The corrected data was then compared to the FCC Part 15, Subpart C, Section 15.249 emissions limits to determine compliance.

Preliminary and final measurements were taken in order to better ensure that all emissions from the EUT were found and maximized.

Radiated Emissions Testing

During the preliminary radiated scan, the EUT was powered up and operating in its defined FCC test mode. The frequency range of 30 MHz - 88 MHz was then scanned with the biconical antenna located about 1.5 meter above the ground plane in the vertical configuration. During this scan, the turntable was rotated and all peaks which were at or near the limit were recorded. The frequency range of 100 - 300 MHz was scanned with the biconical antenna in the same manner, and the peaks recorded. Lastly, a scan of the FM band from 88 - 110 MHz was made, using a reduced resolution bandwidth and a reduced frequency span. The biconical antenna was changed to the horizontal polarity and the above steps were repeated. After changing to the log periodic antenna in the horizontal configuration, the frequency range of 300 - 1000 MHz was scanned. The log periodic antenna was changed to the vertical polarity and the frequency range of 300 - 1000 MHz was again scanned. The horn antenna was used to scan for frequencies above 1000 MHz. Care was taken to ensure that no frequencies were missed within the FM and TV bands. An analysis was performed to determine if the signals that were at or near the limit were caused by an ambient transmission. If unable to determine by analysis, the equipment was powered down to make the final determination if the EUT was the source of the emission.

For the final radiated scan, the equipment was again positioned facing the antenna. A thorough scan of all frequencies was manually made using a small frequency span, rotating the turntable as needed. Comparison with the previously recorded measurements was then made.

Using the peak readings from both scans as a guide, the test engineer then maximized the readings with respect to the table rotation and antenna height. Maximizing of the EUT was achieved by monitoring the spectrum analyzer on a closed circuit television monitor while the EUT was being moved and rearranged on the EUT table for maximum emissions. Photographs showing the final worst case configuration of the EUT are contained in Appendix A.

TRANSMITTER CHARACTERISTICS

Occupied Bandwidth Measurements

The fundamental frequency was kept within the permitted band 902 – 928 MHz. Refer to Appendix B for the occupied bandwidth plots.

Power Output FCC Part 15.249 (a)

The maximum ERP of this transmitter was measured to be (87.0 dB μ V/m in a 50 Ω system) when measured at a test distance of three meters. This measurement was made with the EUT's integral antenna, for there is no provision for connecting an external antenna.

SAMPLE CALCULATIONS

The basic spectrum analyzer reading was converted using correction factors as shown in the six highest emissions readings in Tables 1 and 2. For radiated emissions in dB μ V/m, the spectrum analyzer reading in dB μ V was corrected by using the following formula:

$$\begin{aligned}
 &\text{Meter reading (dB}\mu\text{V)} \\
 &+ \text{Antenna Factor (dB)} \\
 &+ \text{Cable Loss (dB)} \\
 &- \text{Distance Correction (dB)} \\
 &- \text{Pre-amplifier Gain (dB)} \\
 &= \text{Corrected Reading (dB}\mu\text{V/m)}
 \end{aligned}$$

This reading was then compared to the applicable specification limit to determine compliance.

A typical data sheet will display the following in column format:

#	Freq MHz	Rdng dB μ V	Barn	Pre Amp.	Bicon	Horn	Log s	Dist	Corr dB μ V/m	Spec	Margin	Polar
---	-------------	--------------------	------	-------------	-------	------	-------	------	----------------------	------	--------	-------

means reading number

Freq MHz is the frequency in MHz of the obtained reading.

Rdng dB μ V is the reading obtained on the spectrum analyzer in dB μ V.

PreAmp. is short for the preamplifier factor or gain in dB.

Bicon is the biconical antenna factor in dB.

Log is the log periodic antenna factor in dB.

Horn is the horn antenna factor in dB.

Barn is the cable loss in dB of the coaxial cable on the OATS.

Dist is the distance factor (in dB). It is used when testing at a different test distance than the one stated in the spec.

Corr dB μ V/m is the corrected reading which is now in dB μ V/m (field strength).

Spec is the specification limit (dB) stated in the agency's regulations.

Margin is the closeness to the specified limit in dB; + is over and - is under the limit.

Polar is the Polarity of the antenna with respect to earth.

APPENDIX A

INFORMATION ABOUT THE EQUIPMENT UNDER TEST

INFORMATION ABOUT THE EQUIPMENT UNDER TEST

Test Software/Firmware:
CRT was displaying:
Power Supply Manufacturer:
Power Supply Part Number:
AC Line Filter Manufacturer:
AC Line Filter Part Number:

The EUT has no power cord.

I/O PORTS

Type	#

CRYSTAL OSCILLATORS

Type	Freq. In MHz
Microprocessor	4.0

PRINTED CIRCUIT BOARDS

Function	Model & Rev	Clocks, MHz	Layers	Location
Photo-Rcvr (RF xmit)	PC030, Rev B	4.0	2	Photo Rcvr

REQUIRED EUT CHANGES TO COMPLY:

None.

APPENDIX B
MEASUREMENT DATA SHEETS

Test Location: CKC Laboratories, Inc. • 5473A Clouds Rest Rd, Barn • Mariposa, CA 95338 • (800)-500-4EMC

Customer: FarmTek, Date: Jul-30-98
 Specification: FCC 15.249 (a) Time: 11:10
 Test Type: Radiated Scan Sequence#: 5
 Equipment: Transmitter
 Manufacturer: FarmTek, Tested By: Skip Doyle
 Model: Photo-Receiver
 S/N: 20000029807

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Transmitter	FarmTek,	Photo-Receiver	20000029807

Support Devices:

Function	Manufacturer	Model #	S/N
None			

Test Conditions / Notes:

EUT is a Photo Receiver/Transmitter with three channels of operation. Frequencies are: channel 0 = 903.3, channel 3 = 909.3MHz and channel 7 = 921.3MHz. EUT uses a 9V battery and is continuously transmitting a modulated signal. Maximized emissions of fundamentals per FCC 15.249(a) after attenuation by the customer.

Measurement Data: Sorted by Margin Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	Barn dB	Pream dB	Log S dB	Dist dB	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar
1	921.450	85.3	+6.3	-27.4	+23.6	+0.0	87.8	93.9	-6.1	Vert
2	903.449	85.1	+6.2	-27.5	+23.4	+0.0	87.2	93.9	-6.7	Vert
3	909.447	83.9	+6.3	-27.4	+23.4	+0.0	86.2	93.9	-7.7	Vert
4	921.452	81.3	+6.3	-27.4	+23.6	+0.0	83.8	93.9	-10.1	Horiz
5	909.461	80.7	+6.3	-27.4	+23.4	+0.0	83.0	93.9	-10.9	Horiz
6	903.453	80.6	+6.2	-27.5	+23.4	+0.0	82.7	93.9	-11.2	Horiz

Test Location: CKC Laboratories, Inc. • 5473A Clouds Rest Rd, Barn • Mariposa, CA 95338 • (800)-500-4EMC

Customer: FarmTek,
Specification: FCC 15.249(C) / 15.209
Test Type: Radiated Scan
Equipment: Transmitter
Manufacturer: FarmTek,
Model: Photo-Receiver
S/N: 20000029807

Date: Aug-12-98
Time: 09:03
Sequence#: 10

Tested By: Skip Doyle

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Transmitter	FarmTek,	Photo-Receiver	20000029807

Support Devices:

Function	Manufacturer	Model #	S/N
None			

Test Conditions / Notes:

EUT is a Photo Receiver/Transmitter with three channels of operation. Frequencies are: channel 0 = 903.3MHz, channel 3 = 909.3MHz and channel 7 = 921.3MHz. EUT uses a 9V battery and is continuously transmitting a modulated signal. Maximized emissions per FCC 15.249(c) 30 - 1000MHz except fundamentals (on MAX5.DAT). No signals detected from EUT except fund. freqs.

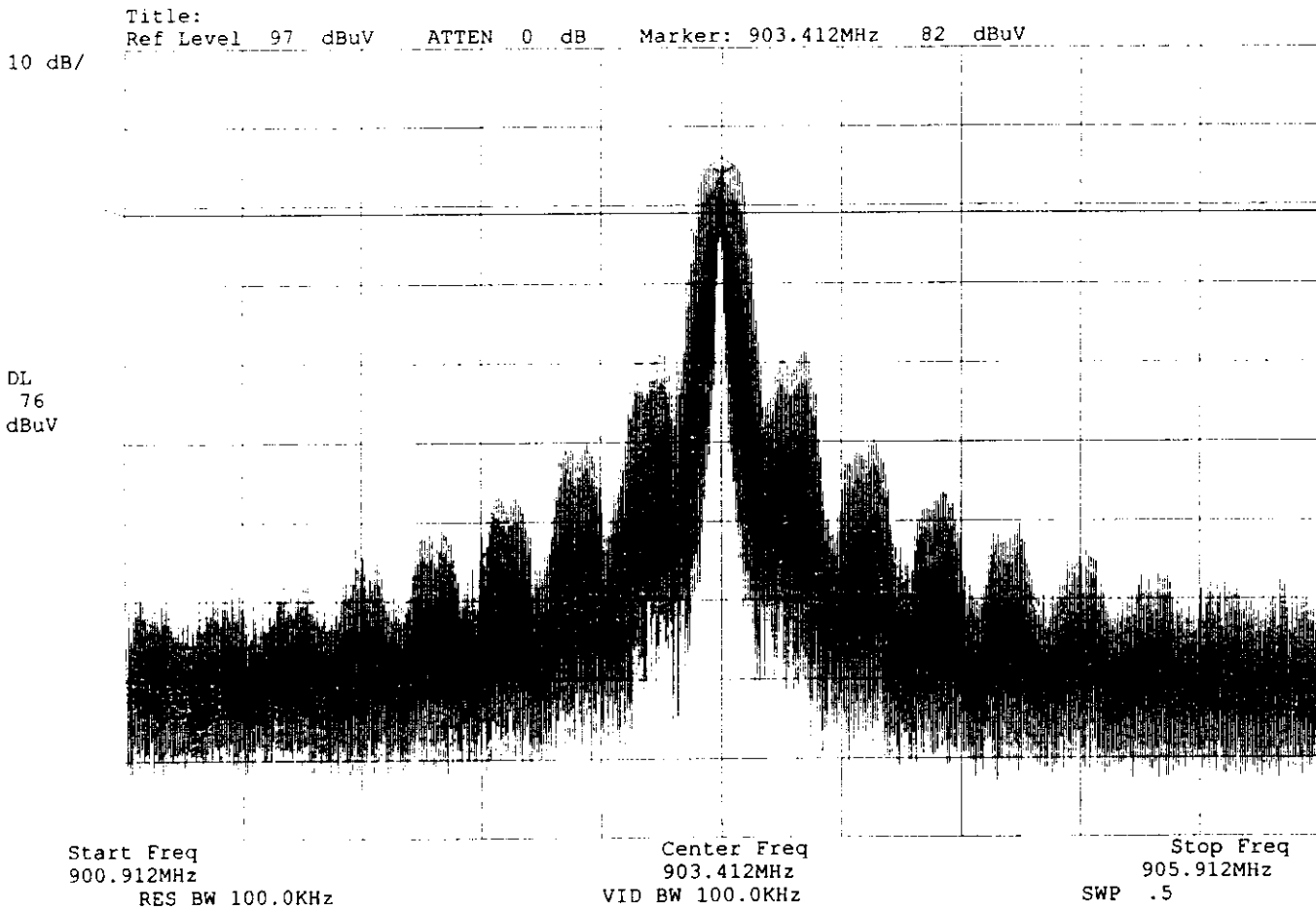
Measurement Data:

Sorted by Margin

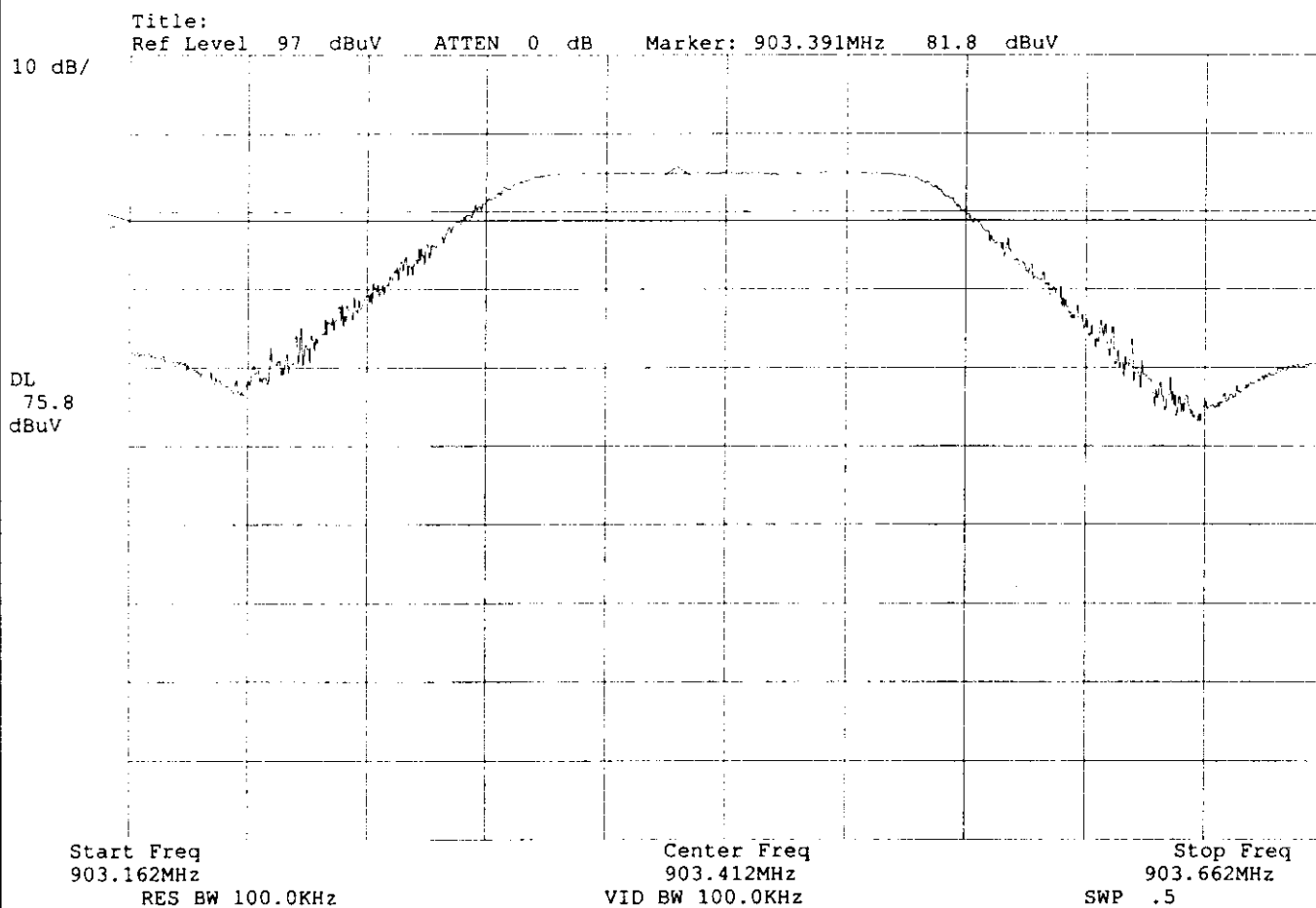
Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	Horn dB	PreAm dB	Barn dB	Dist dB	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar
1	3685.200	28.0	+33.1	-33.8	+12.8	+0.0	40.1	54.0	-13.9	Vert
2	3613.200	28.1	+33.0	-33.9	+12.7	+0.0	39.9	54.0	-14.1	Vert
3	3637.200	27.9	+33.0	-33.9	+12.8	+0.0	39.8	54.0	-14.2	Vert
4	1818.600	30.2	+26.7	-35.8	+6.9	+0.0	28.0	54.0	-26.0	Vert
5	1842.600	27.9	+26.8	-35.7	+7.0	+0.0	26.0	54.0	-28.0	Vert
6	1806.600	28.0	+26.6	-35.8	+6.9	+0.0	25.7	54.0	-28.3	Vert

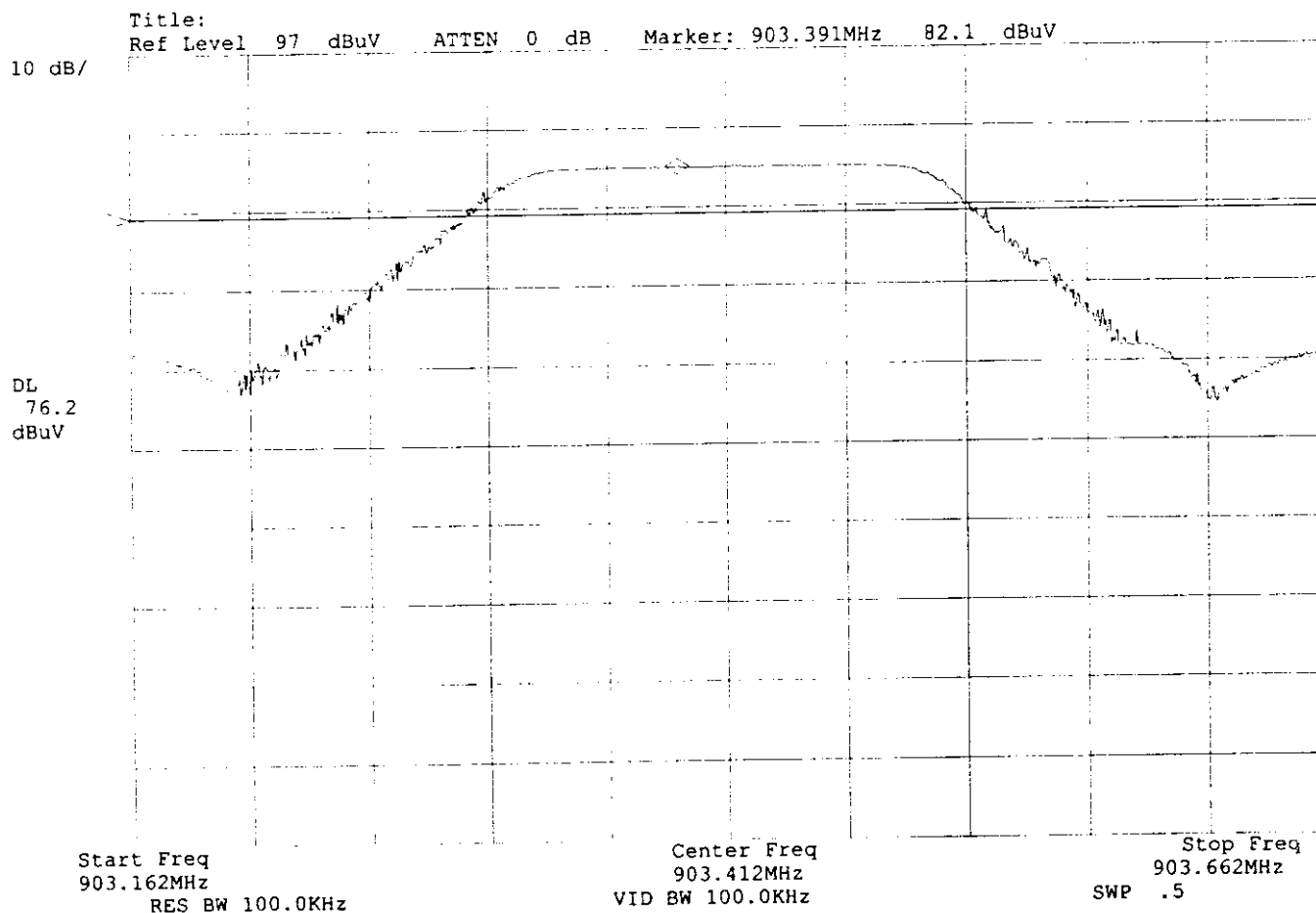
Occupied Bandwidth Plot



Occupied Bandwidth Plot



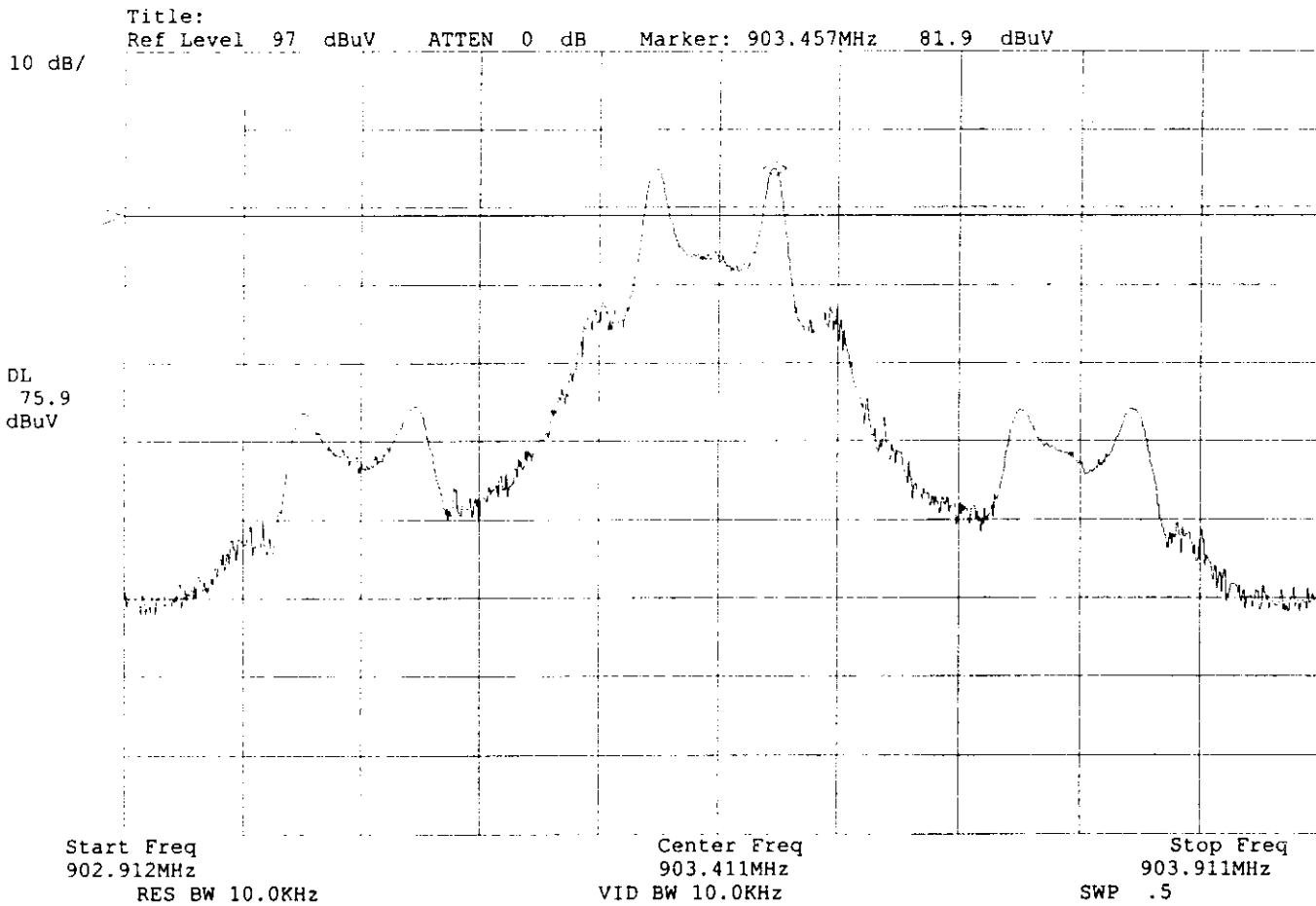
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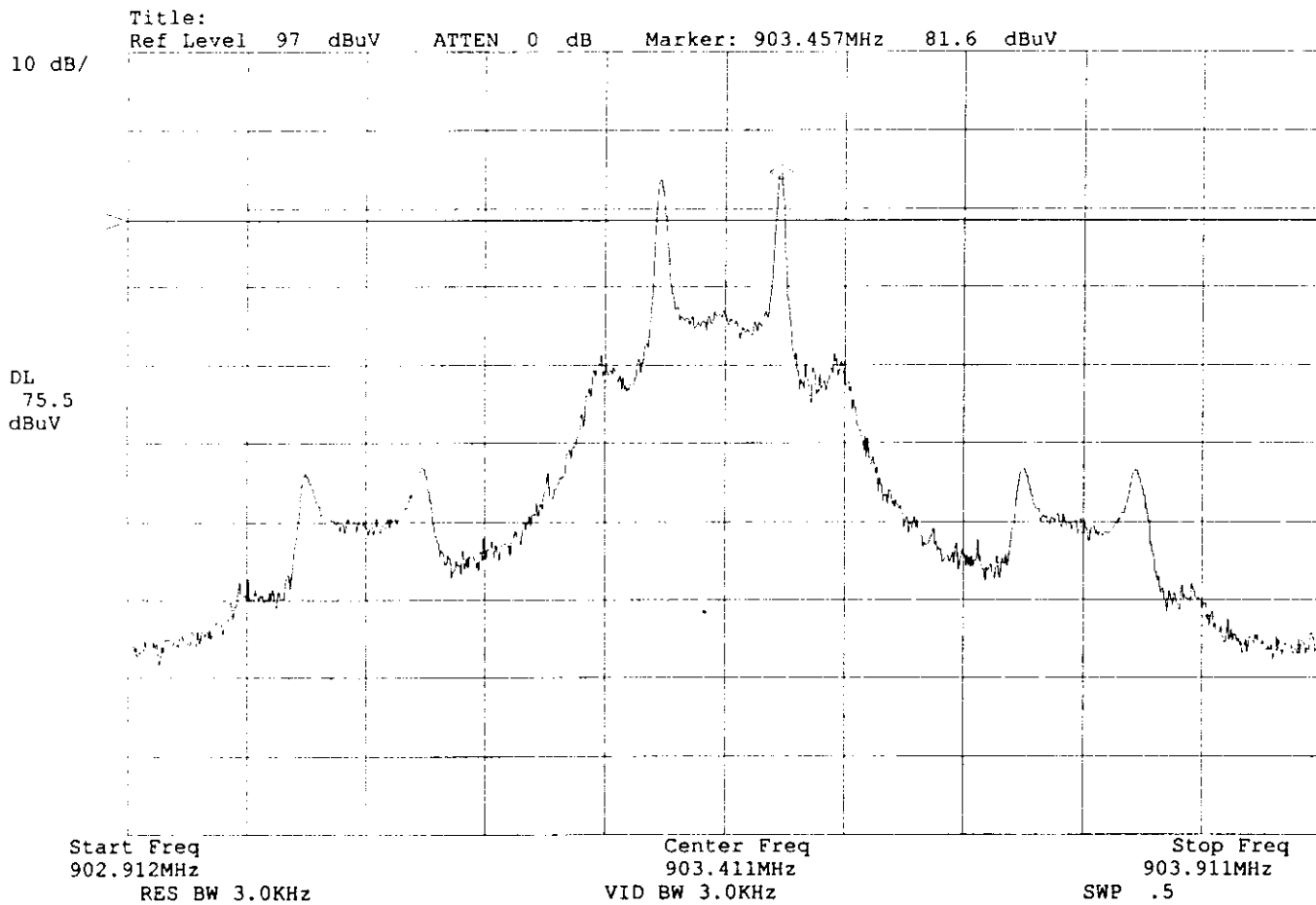


Testing the Future
LABORATORIES, INC.

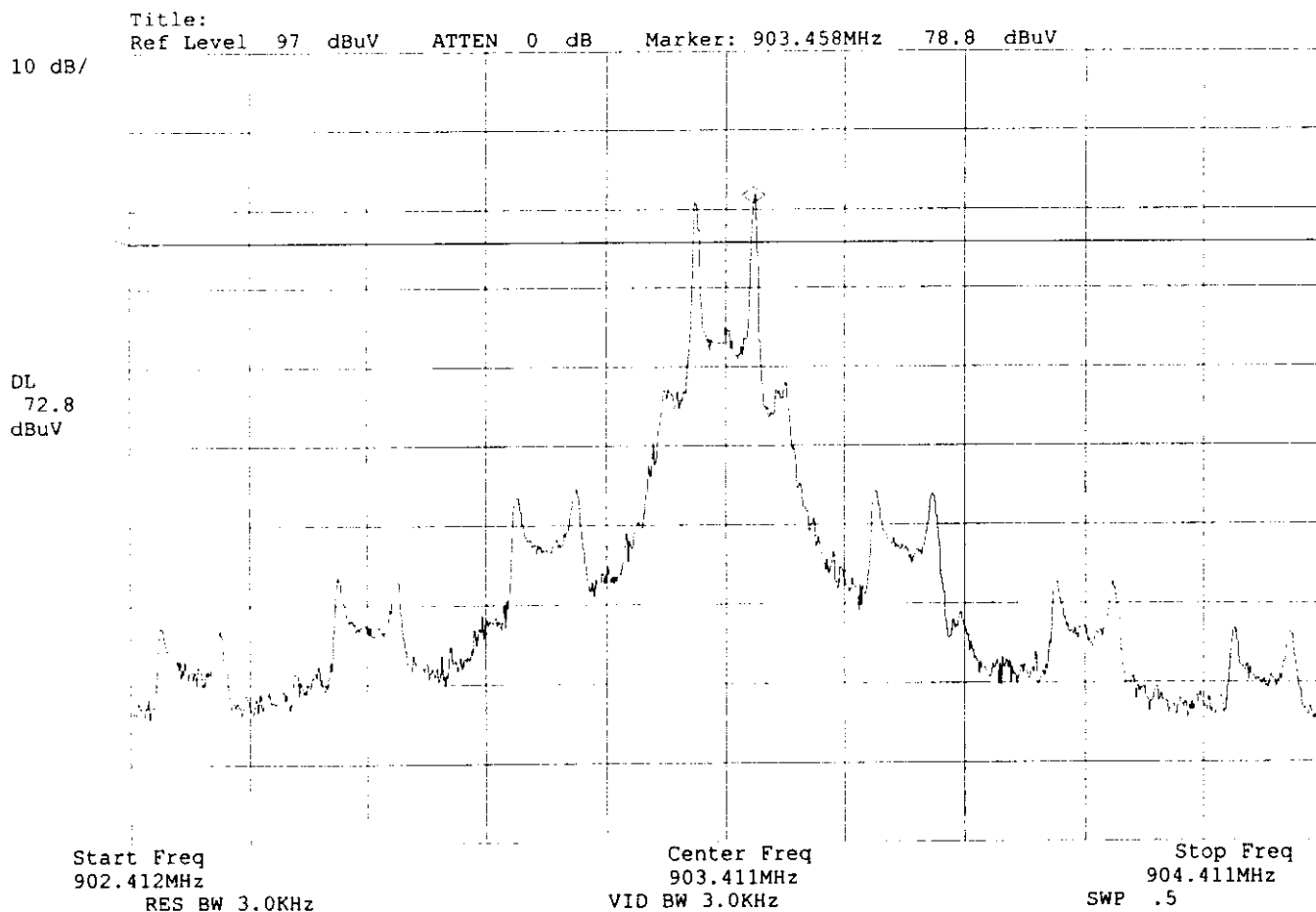
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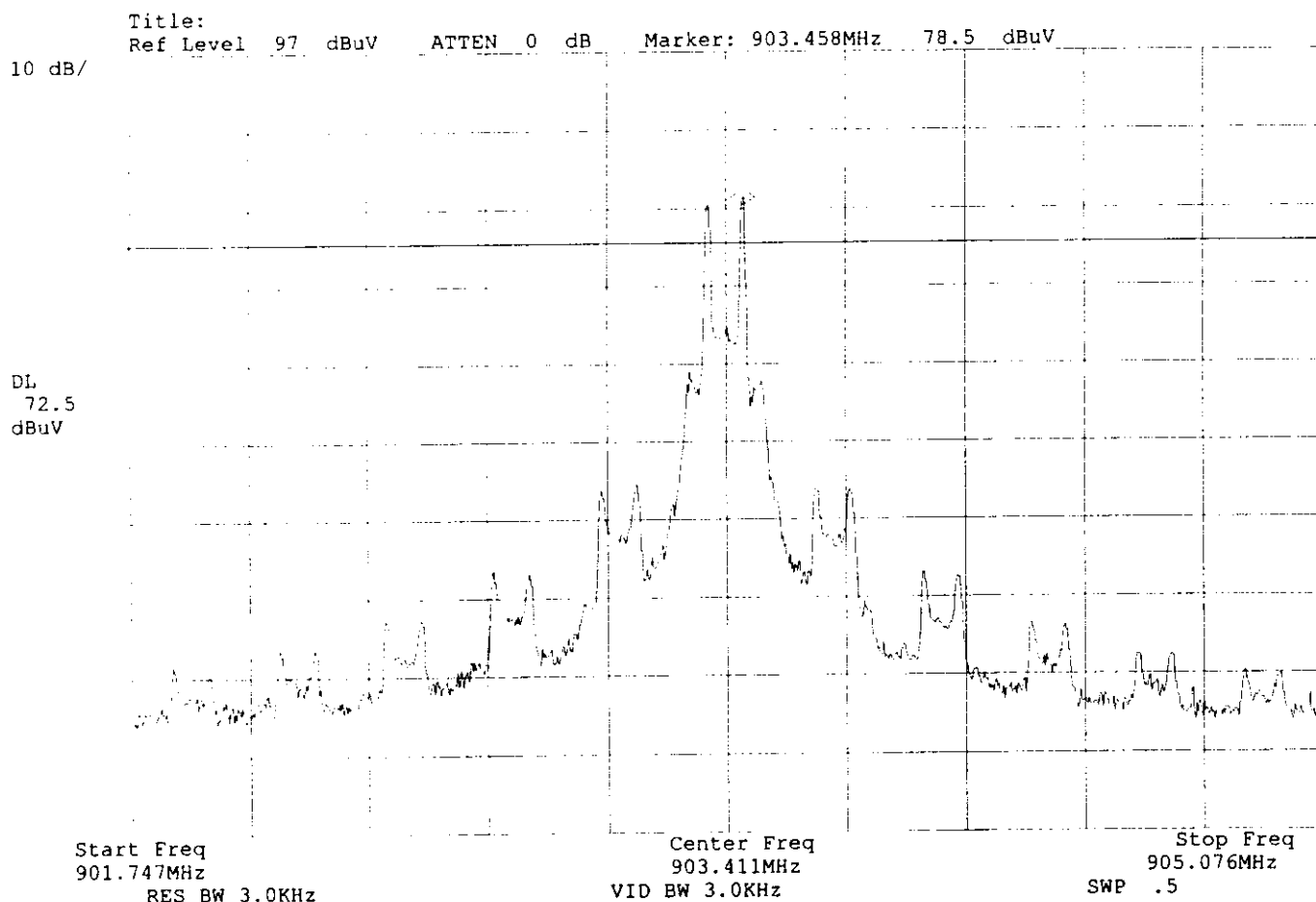
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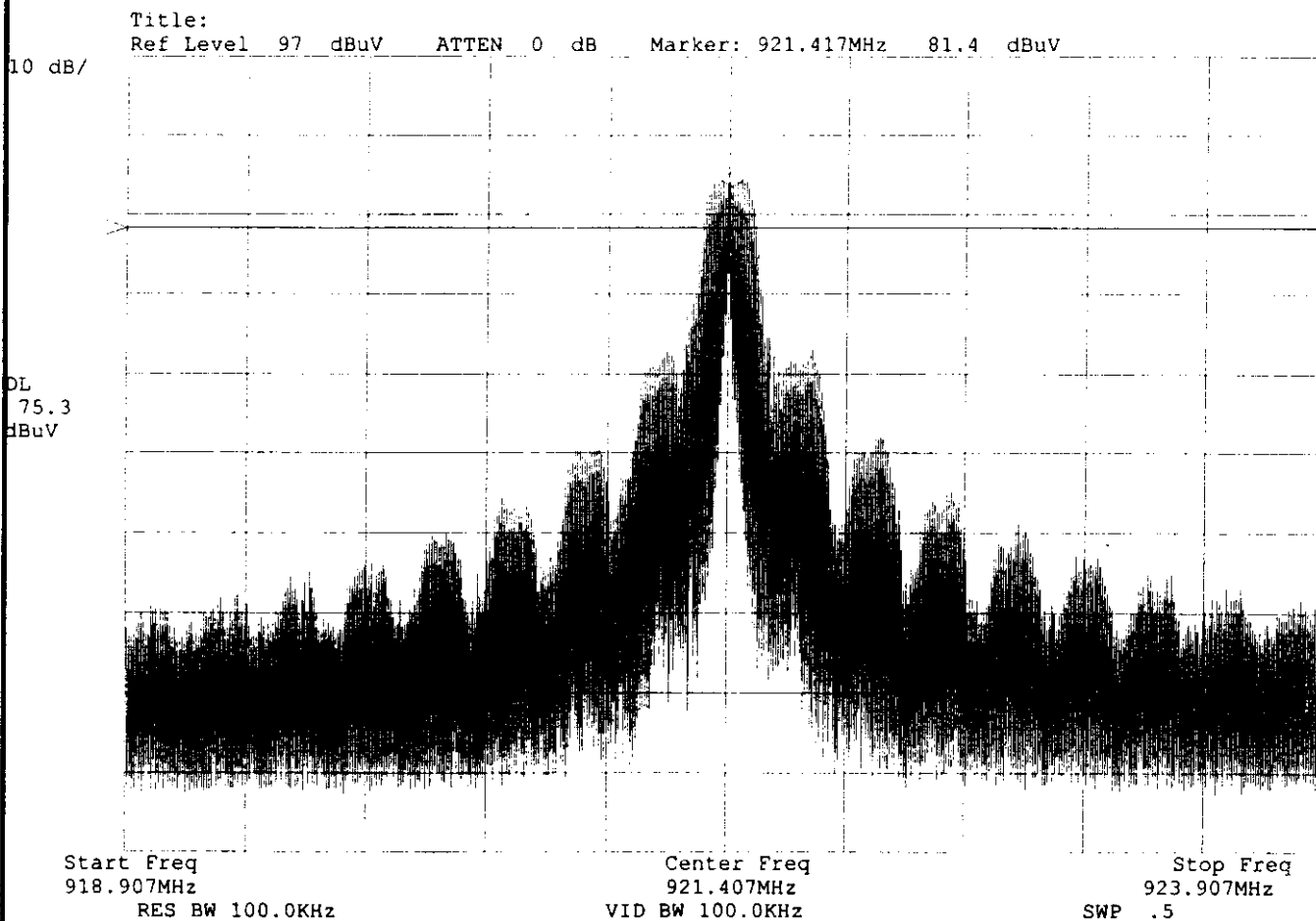
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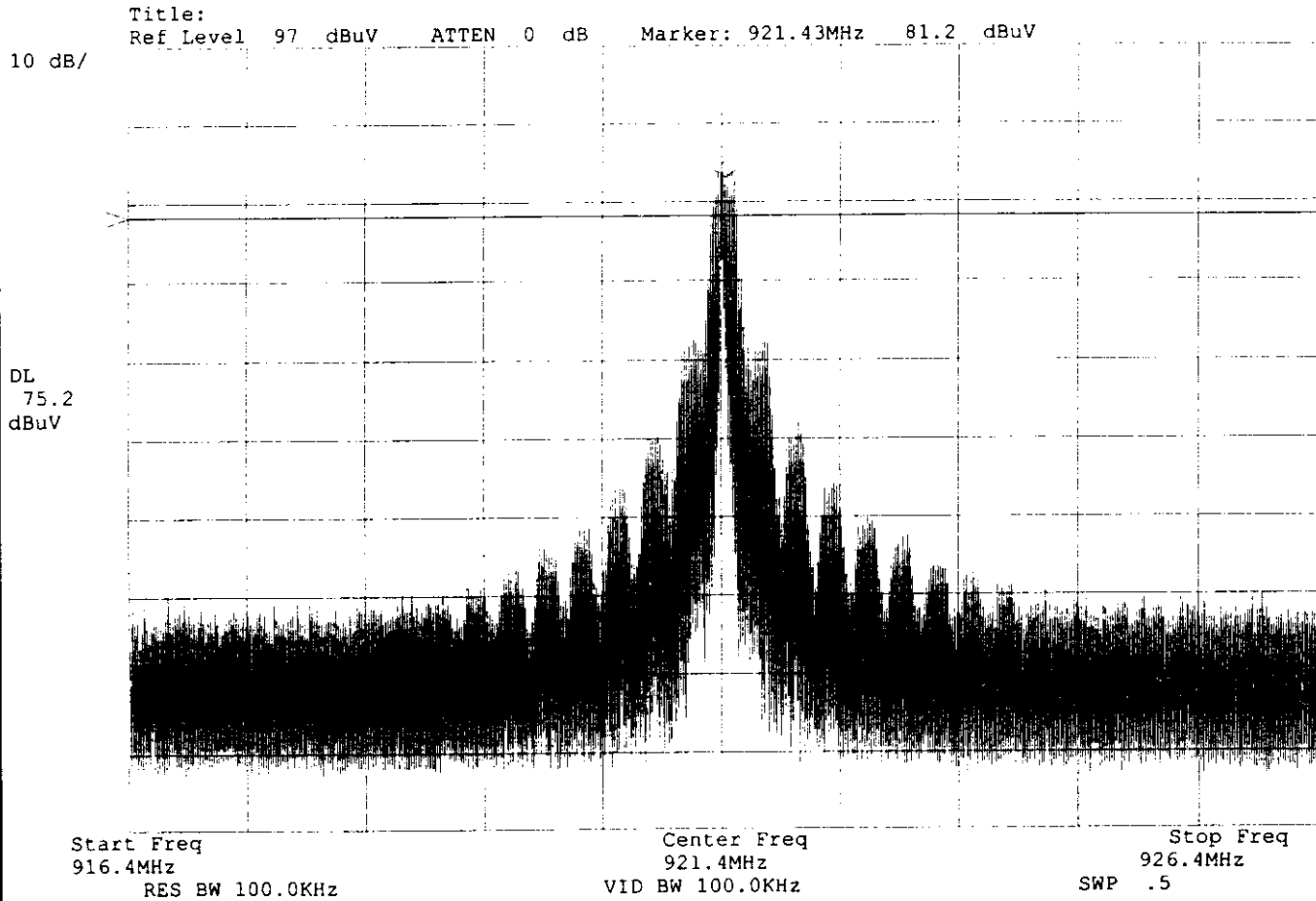
Occupied Bandwidth Plot



Occupied Bandwidth Plot



Occupied Bandwidth Plot

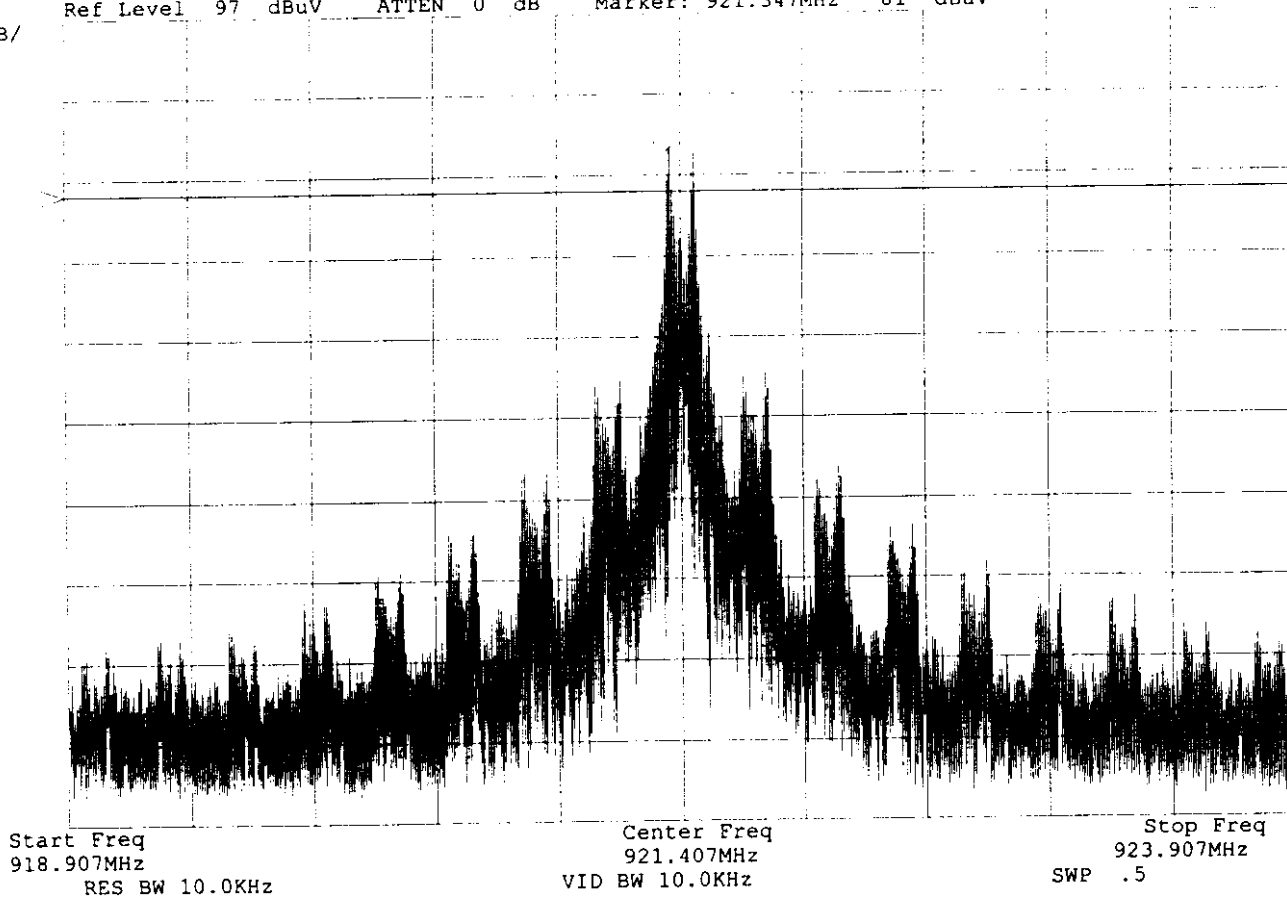


Occupied Bandwidth Plot

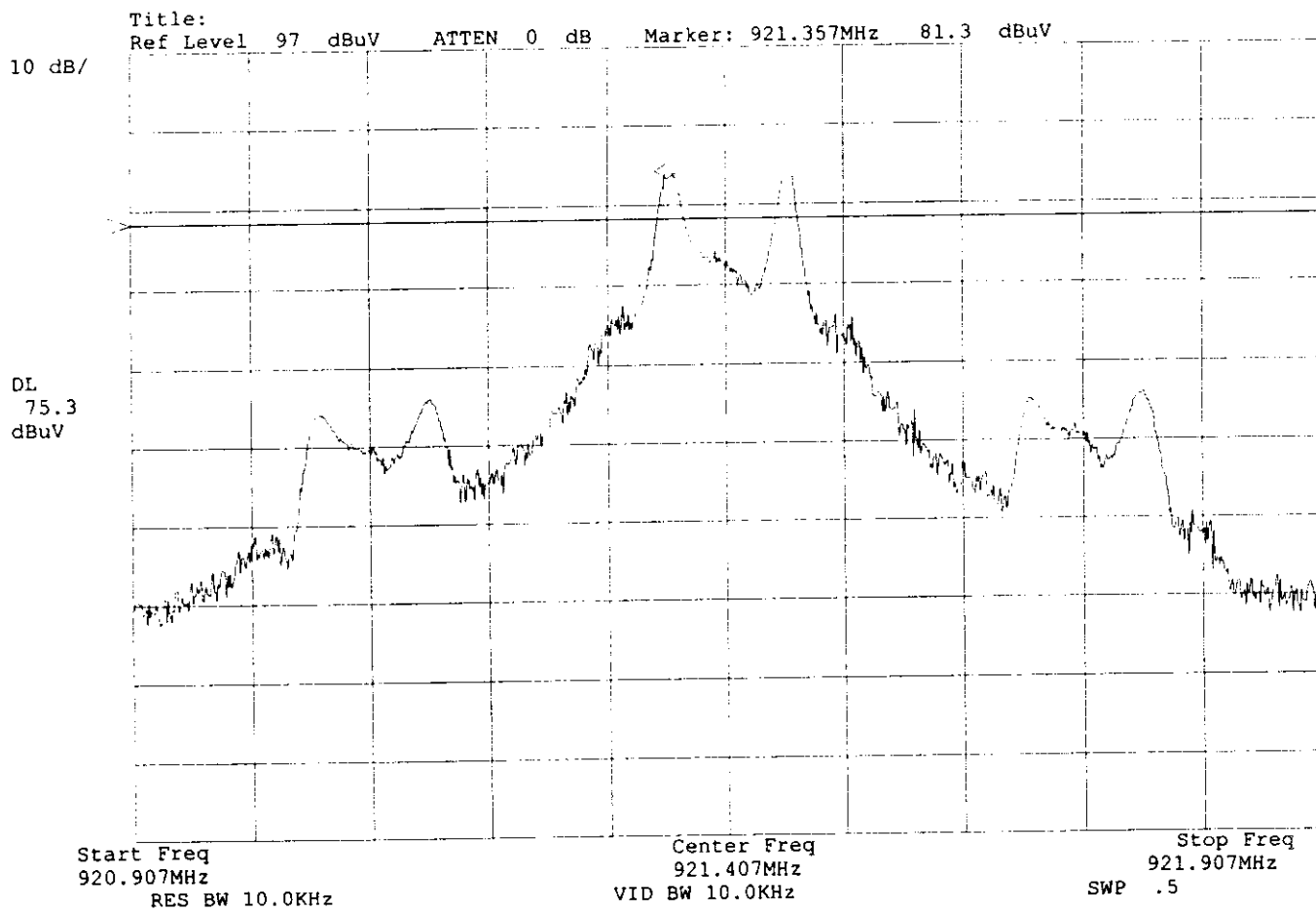
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10 dB/

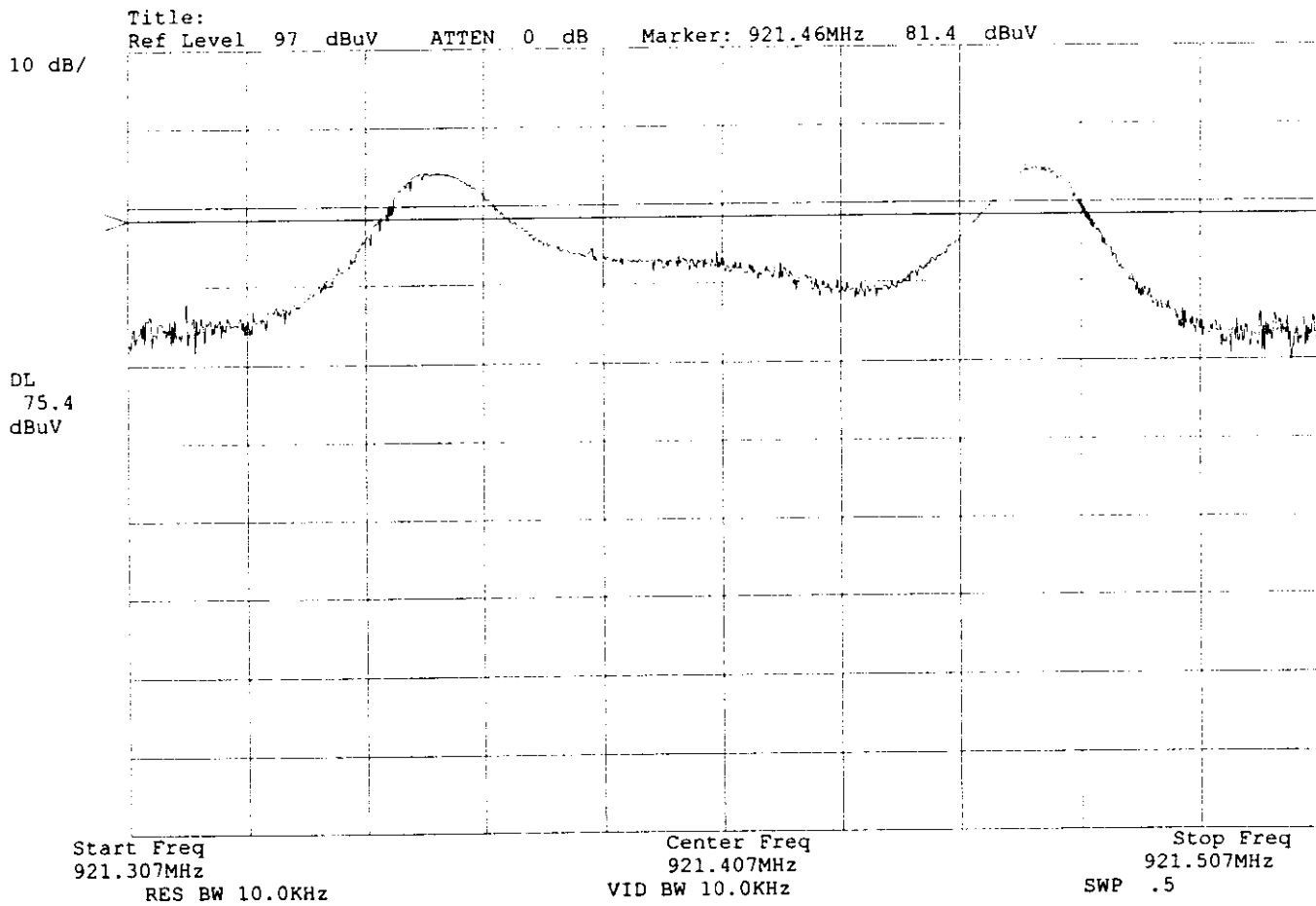
PL
 75
 dBuV



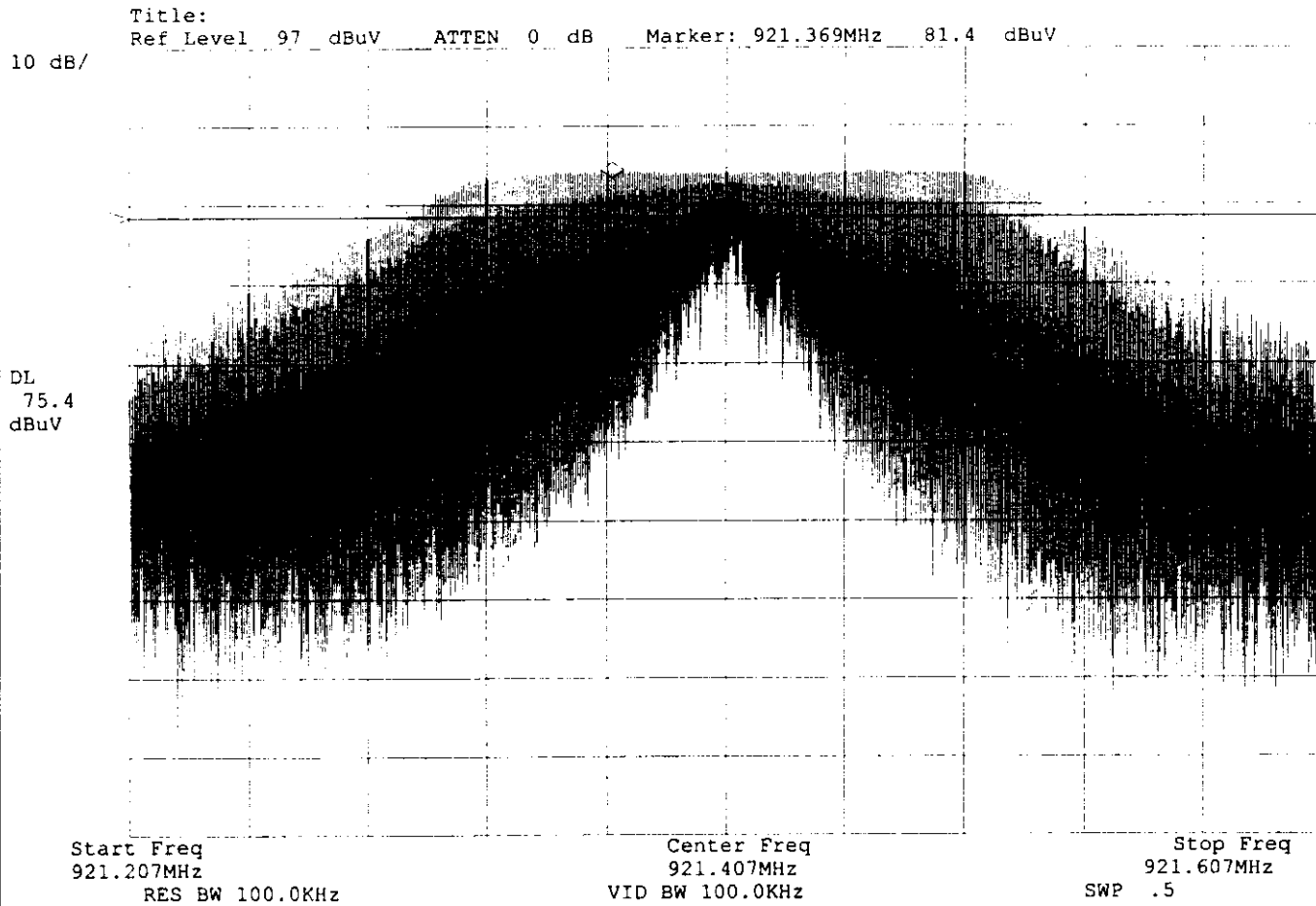
Occupied Bandwidth Plot



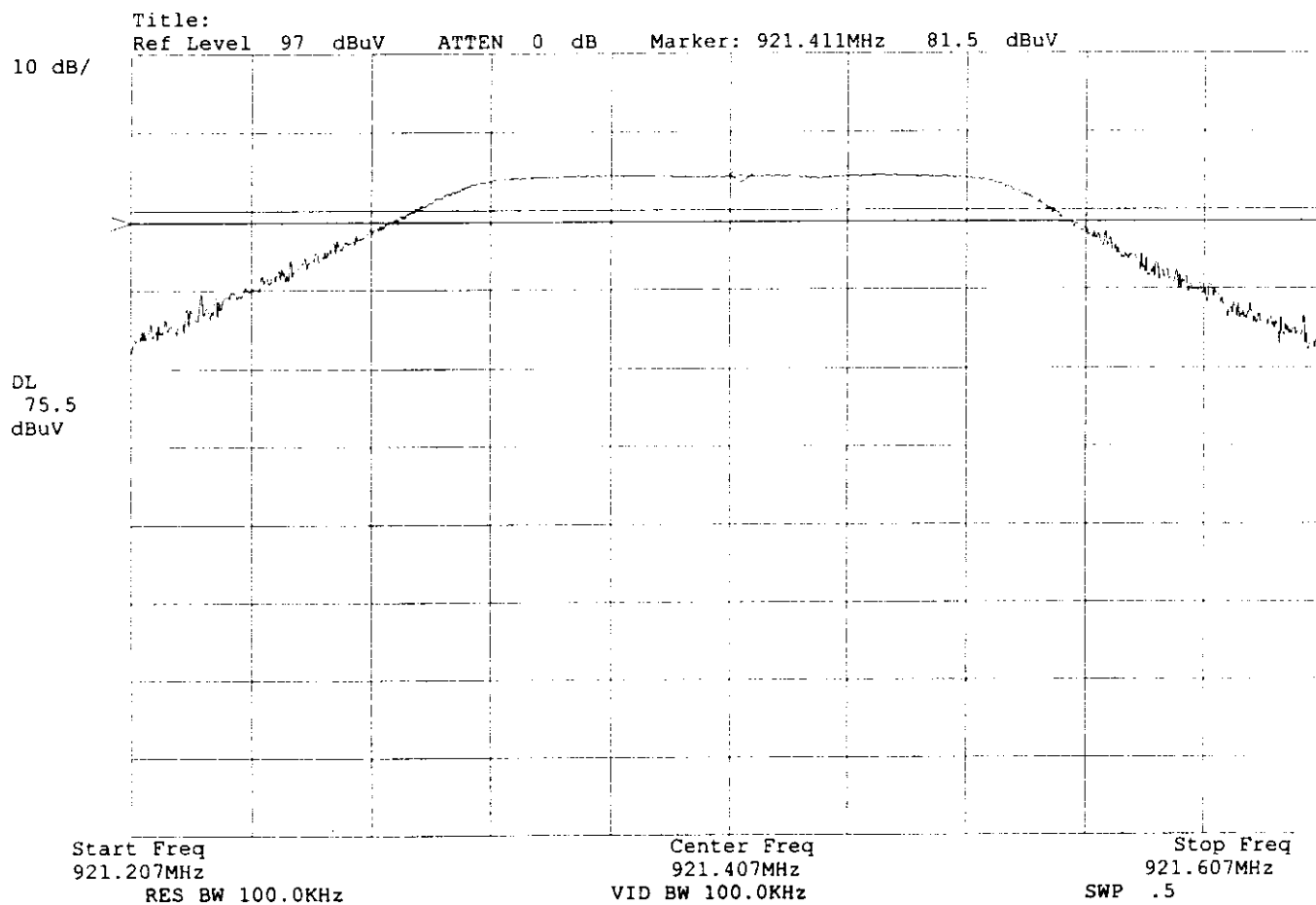
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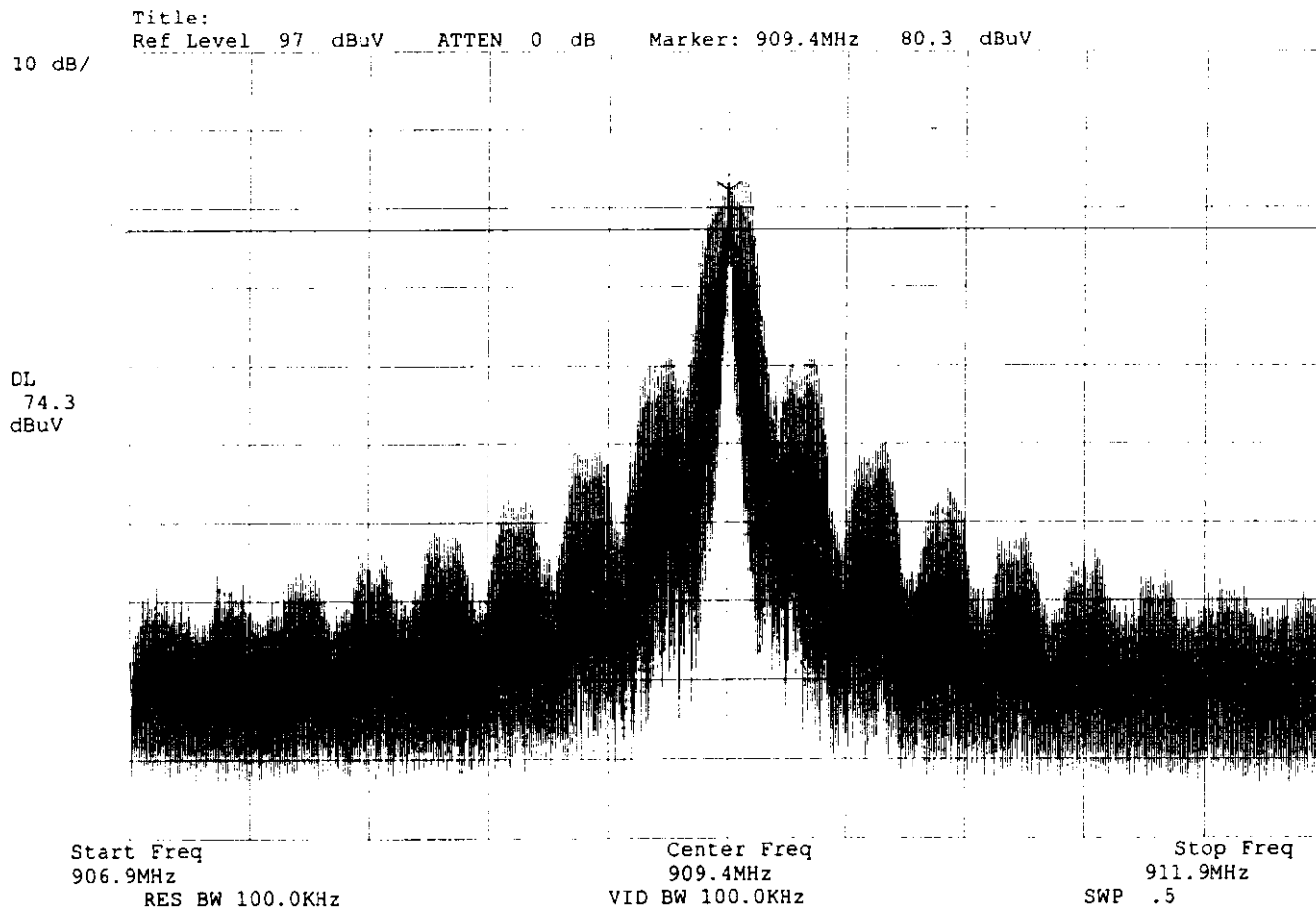
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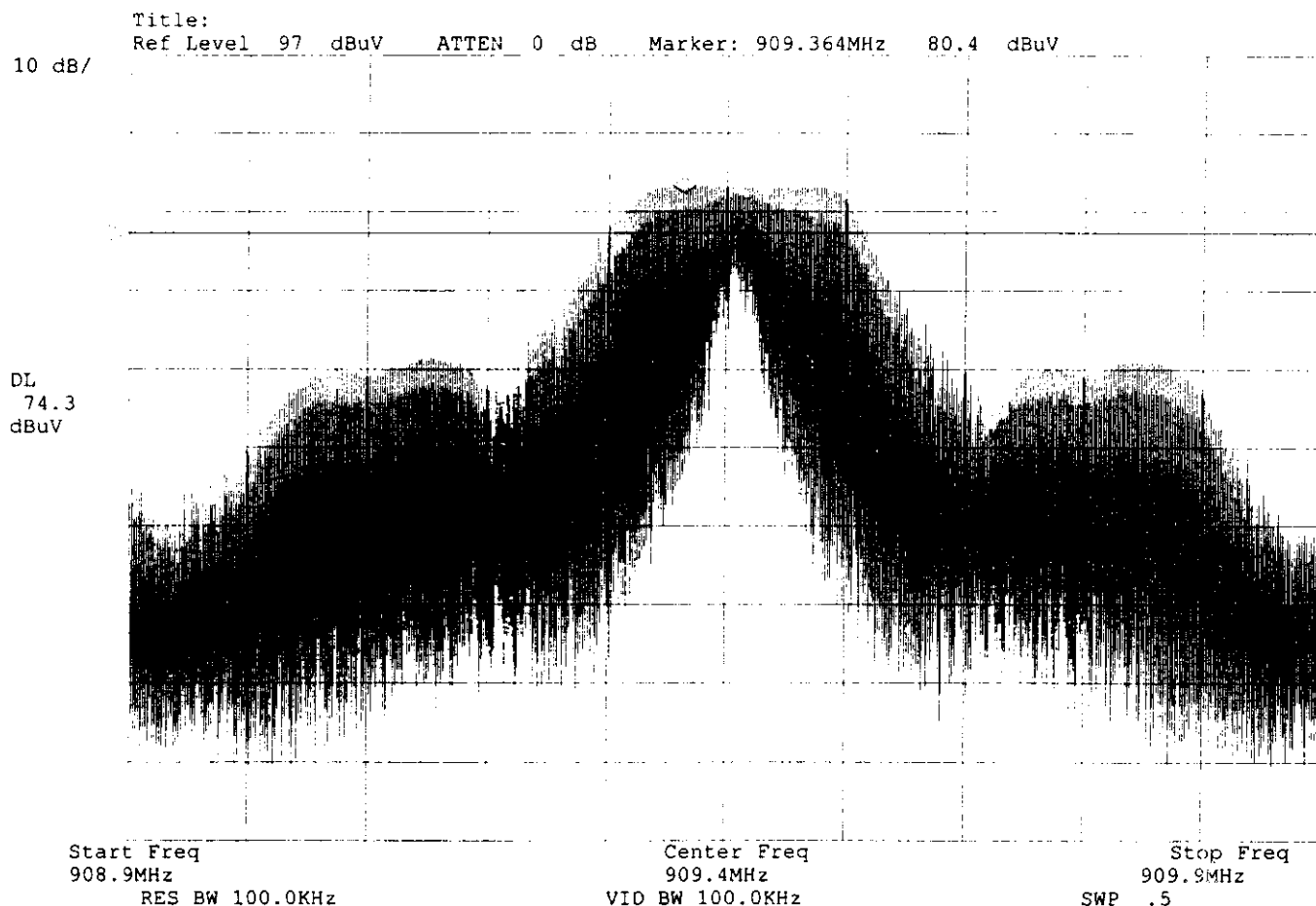
Occupied Bandwidth Plot



Occupied Bandwidth Plot



Occupied Bandwidth Plot



Occupied Bandwidth Plot

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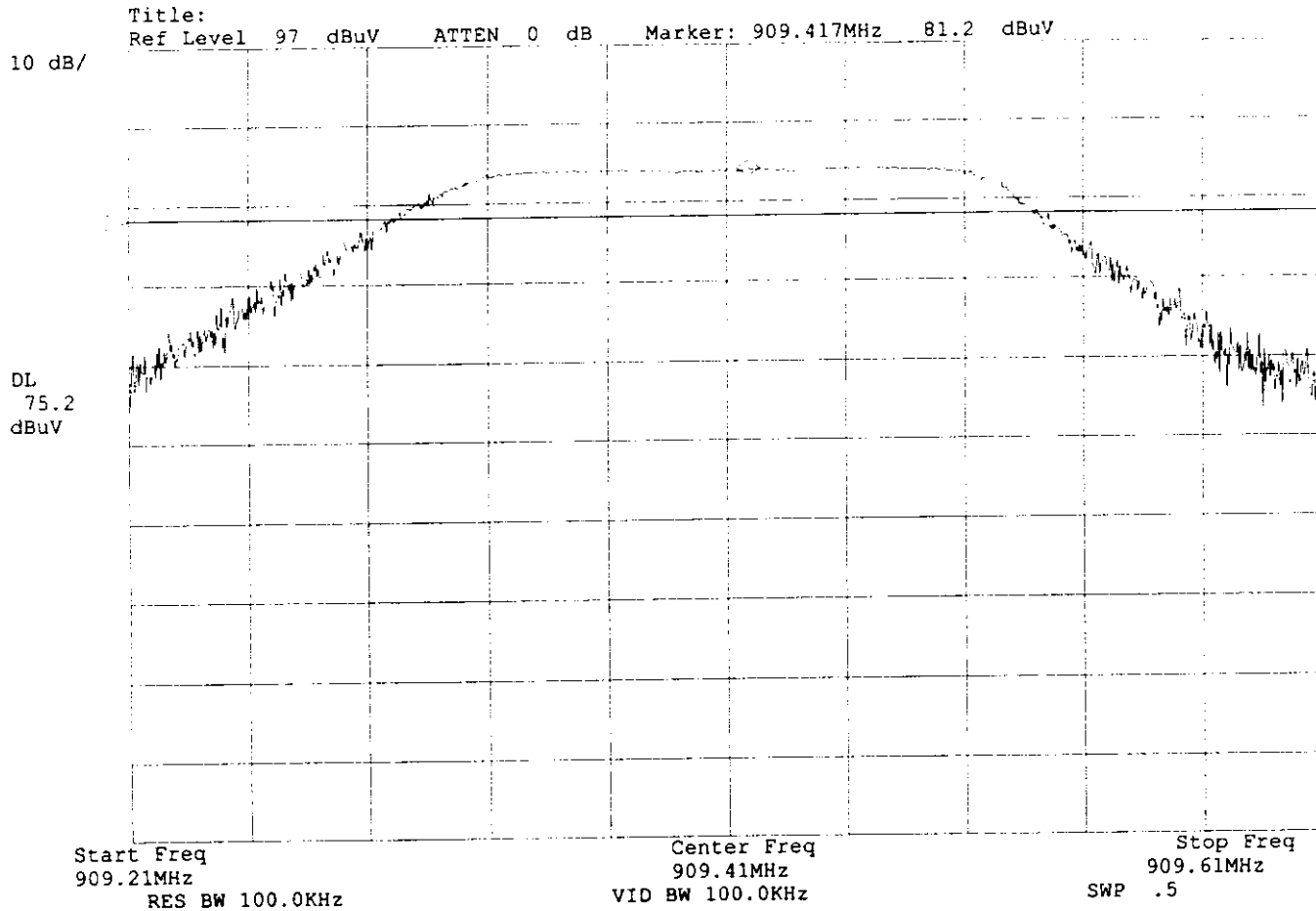
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10 dB/

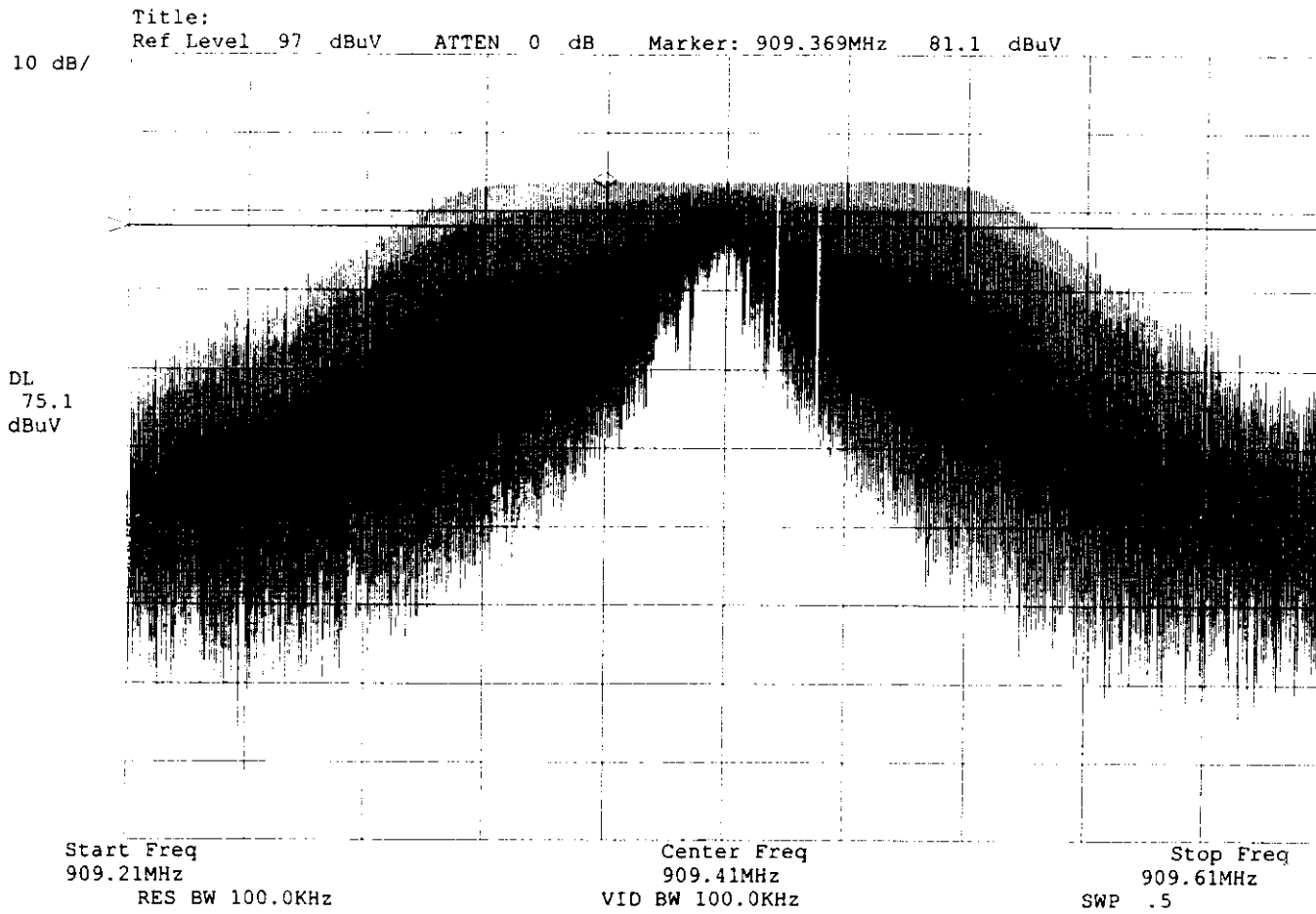
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dBuV

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RES BW 10.0KHz VID BW 10.0KHz SWP .5

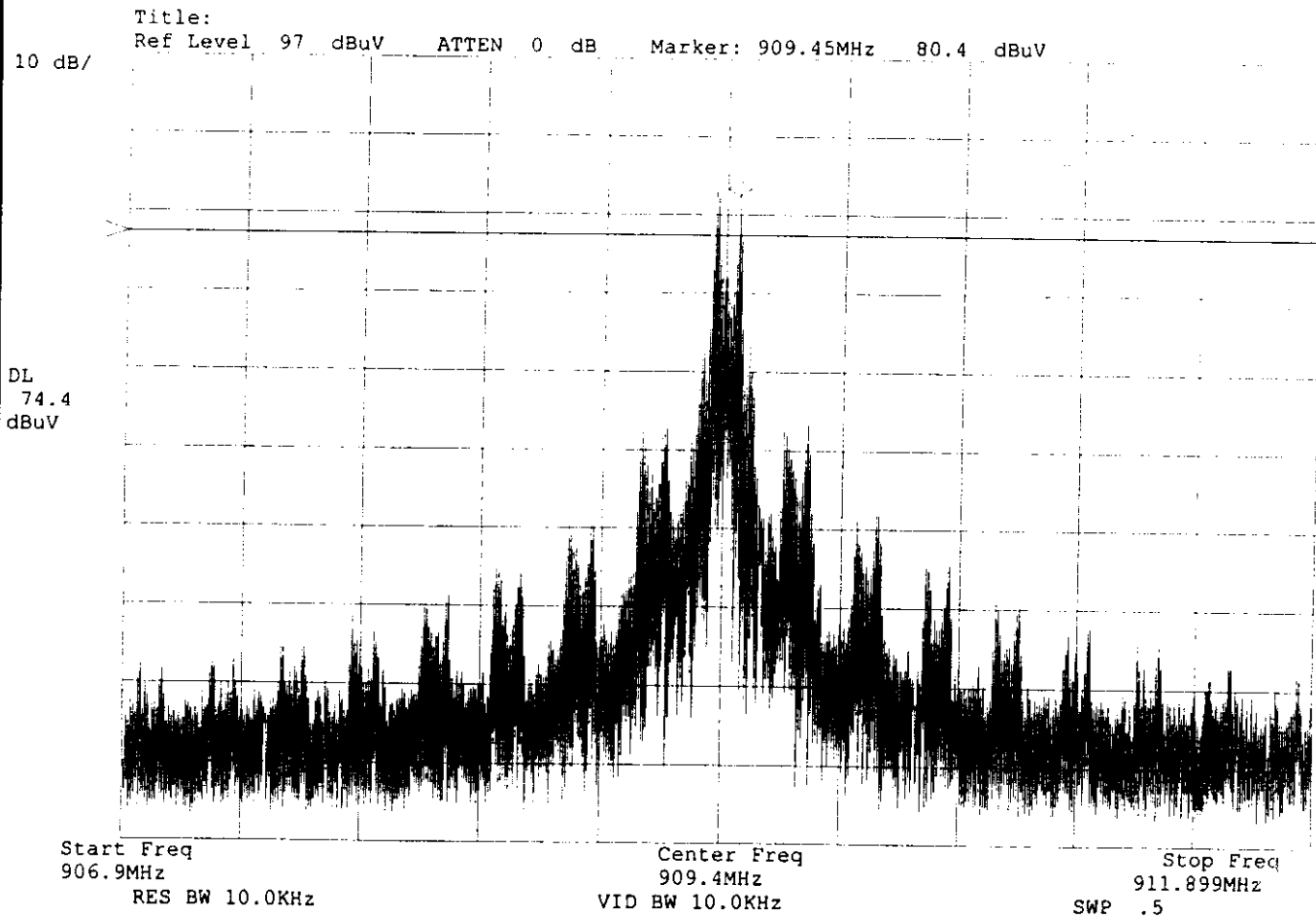
Occupied Bandwidth Plot



Occupied Bandwidth Plot



Occupied Bandwidth Plot



Occupied Bandwidth Plot

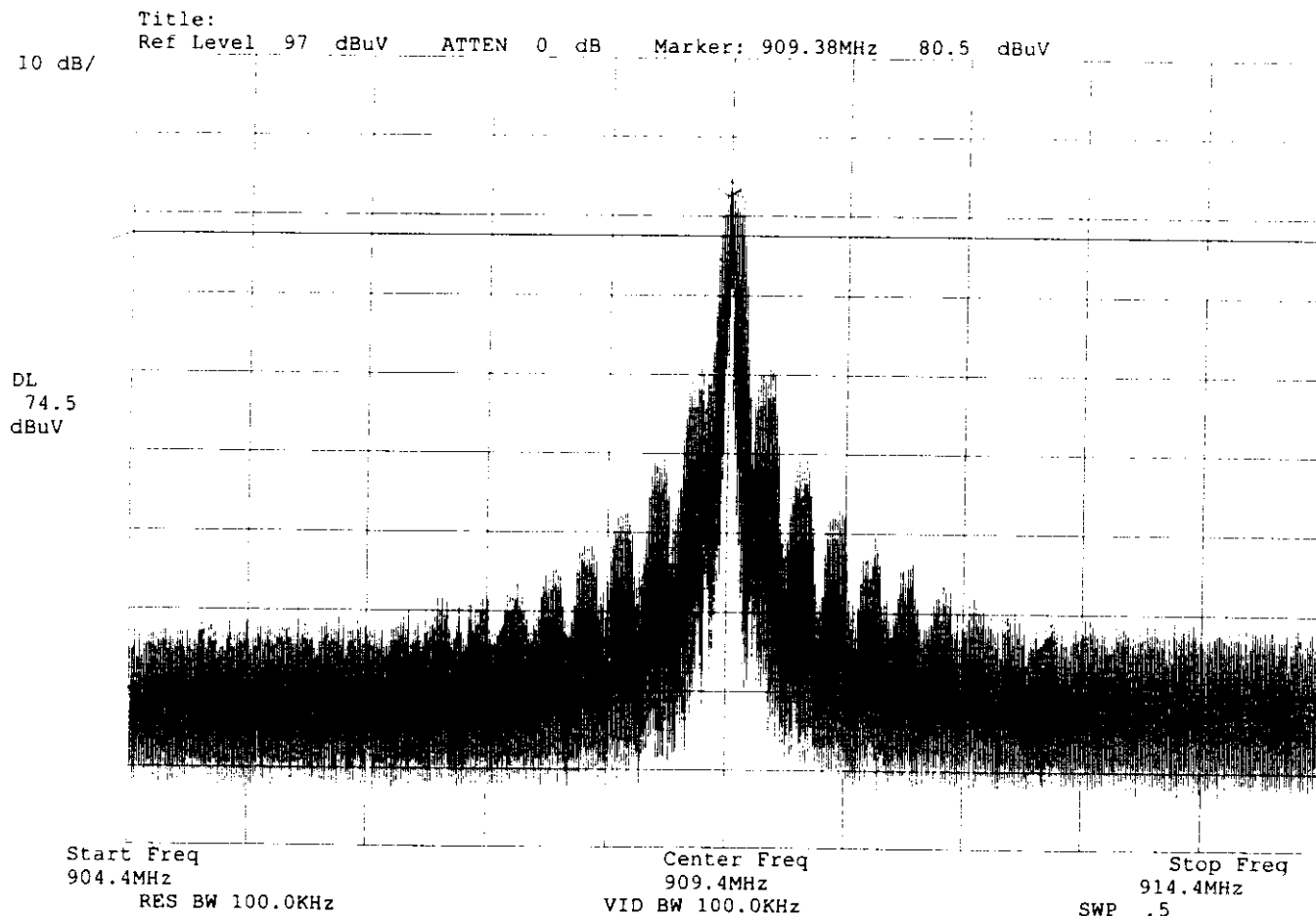


EXHIBIT E
SYSTEM MANUAL