

APPLICATION FOR FCC CERTIFICATION

Acer NeWeb Corporation

Spread Spectrum Radio

Model: Warplink 2402

FCC ID: NKRWARPLINK02

LTO# J99009659

Number of Pages: 30 pp. + Supporting Data and Documents

Date of Report: May 29, 1999

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Acer Advanced Labs. FHSS, FCC ID:

Date of Test: May 24-28, 1999

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1.0 Summary of Tests

Acer NeWeb Corporation - Model No.: Warplink 2402

FCC ID: NKRWARPLINK02

TEST	REFERENCE	RESULTS
Max. Output power	15.247(b)(3)	Pass
20 dB Bandwidth	15.247(a)(1)	Pass
Min. Channel Separation	15.247(a)(1)	Pass
Min. Hopping Channels	15.247(a)(1)	Pass
Average Channel Occupancy Time	15.47(a)(1)	Pass
Out of Band Antenna Conducted Emission	15.247(c)	Pass
Out of Band Radiated Emission	15.247(c)	Not Applicable
Radiated Emission in Restricted Bands	15.247(c), 15.209(a)	Pass
AC Conducted Emission	15.207	Pass
Radiated Emission from Digital Part	15.109	Pass
Radiated Emission from Receiver L.O.	15.109	Not Applicable
Antenna Requirement	15.203	Pass

EMC Site Mgr.: _____
David Chernomordik

Date: _____

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2.0 General Description

2.1 Product Description

The Model is a spread spectrum radio.

Overview of the EUT

Applicant	Acer NeWeb Corporation
Trade Name & Model No.	Model No.Warplink 2402
FCC Identifier	NKRWARPLINK02
Use of Product	
Manufacturer & Model of Spread Spectrum Module	
Type of Transmission	Frequency Hopping
Rated RF Output (mW)	60
Frequency Range (MHz)	2402 - 2480
Number of Channel(s)	79
Antenna(s) & Gain	0 dBi
Processing Gain Measurements	N/A
Antenna Requirement	[]The EUT uses a permanently connected antenna. [x] The antenna is affixed to the EUT using a unique connector which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector. [] The EUT requires professional installation (attach supporting documentation if using this option).
Manufacturer name & address	

2.2 Related Submittal(s) Grants

None.

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2.3 Test Methodology

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4 (1992).

Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Data Sheet**" of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at Menlo Park, CA. This test facility and site measurement data have been fully placed on file with the FCC.

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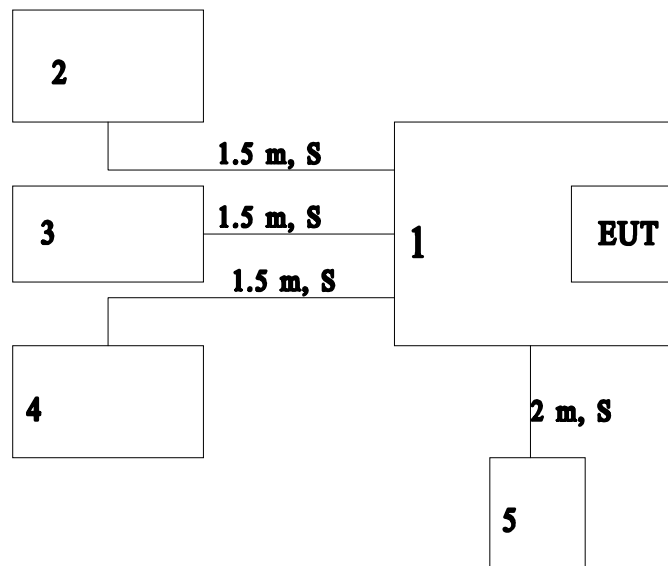
Date of Test: May 24-28, 1999

3.0 System Test Configuration

3.1 Support Equipment

Item	Description	Model	Serial No.	FCC ID
1	Acer Laptop Computer	500	9195B050583900523 M	DoC
2	Dell Monitor	01428- HS	02922CV22495	GWGPM04E1X
3	HP Printer	2225C+	2921S45711	DSI6X42225
4	Hayes Modem	07- 00038	A00715003231	BFI90907-00038A
5	HP Mouse	C3751B	LZA71404352	DZL211029

3.2 Block Diagram of Test Setup



<p>* = EUT</p> <p>** = No ferrites on video cable</p>	<p>S = Shielded;</p> <p>= With Ferrite</p> <p>U = Unshielded</p>	<p>F</p>
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3.3 Justification

For emission testing, the equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). During testing, all cables were manipulated to produce worst case emissions.

For radiated emission measurements, the EUT is attached to a cardboard box (if necessary) and placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT is wired to transmit full power.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use.

3.5 Mode of Operation During Test

For radiated emission measurements, the EUT were setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing.

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3.6 Modifications Required for Compliance

The following modifications were installed during compliance testing in order to bring the product into compliance (Please note that this list does not include changes made specifically by Symbol Technologies Inc. prior to compliance testing):

No modifications were made to the EUT by Intertek Testing Services.

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4.0 Measurement Results

4.1 Maximum Conducted Output Power at Antenna Terminals , FCC Ref: 15.247(b):

With the hopping function turned OFF:

[] The antenna port of the EUT was connected to the input of a power meter. Power was read directly and cable loss correction was added to the reading to obtain power at the EUT antenna terminals.

[X] The antenna port of the EUT was connected to the input of a spectrum analyzer. The analyzer was set for maximum RES BW and power was read directly in dBm.

For antennas with gains of 6 dBi or less , maximum allowed transmitter output is 1 watt (+30 dBm).

For antennas with gains greater than 6 dBi, transmitter output level must be decreased by an amount equal to $(\text{GAIN} - 6)/3$ dBm.

Frequency (MHz)	Output in dBm	Output in mWatt
2402	17.0	50.1
2442	17.6	57.5
2480	17.6	57.5

Cable loss: 0.7 dB External Attenuation: 0 dB

Cable loss, external attenuation: [x] included in OFFSET function

[] added to SA raw reading

EUT Transmitting Antenna Gain (0 dBi) +17.6 dBm max. output level =17.6 dBm (36 dBm or less)

Please refer to the attached plots for details:

Plot 4.1a: Low Channel Output Power

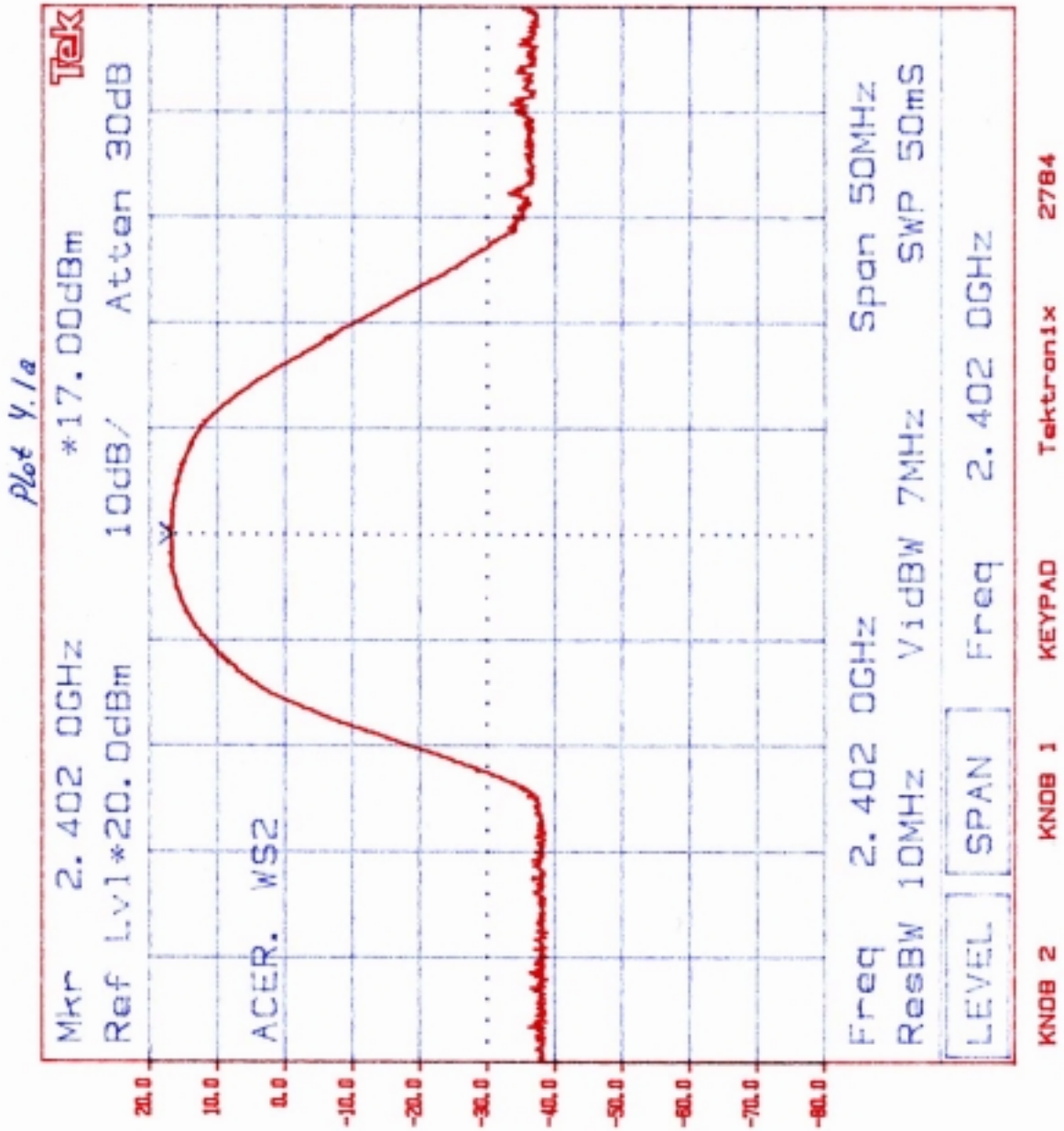
Plot 4.1b: Middle Channel Output Power

Plot 4.1c: High Channel Output Power

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Acer Advanced Labs. FHSS, FCC ID:

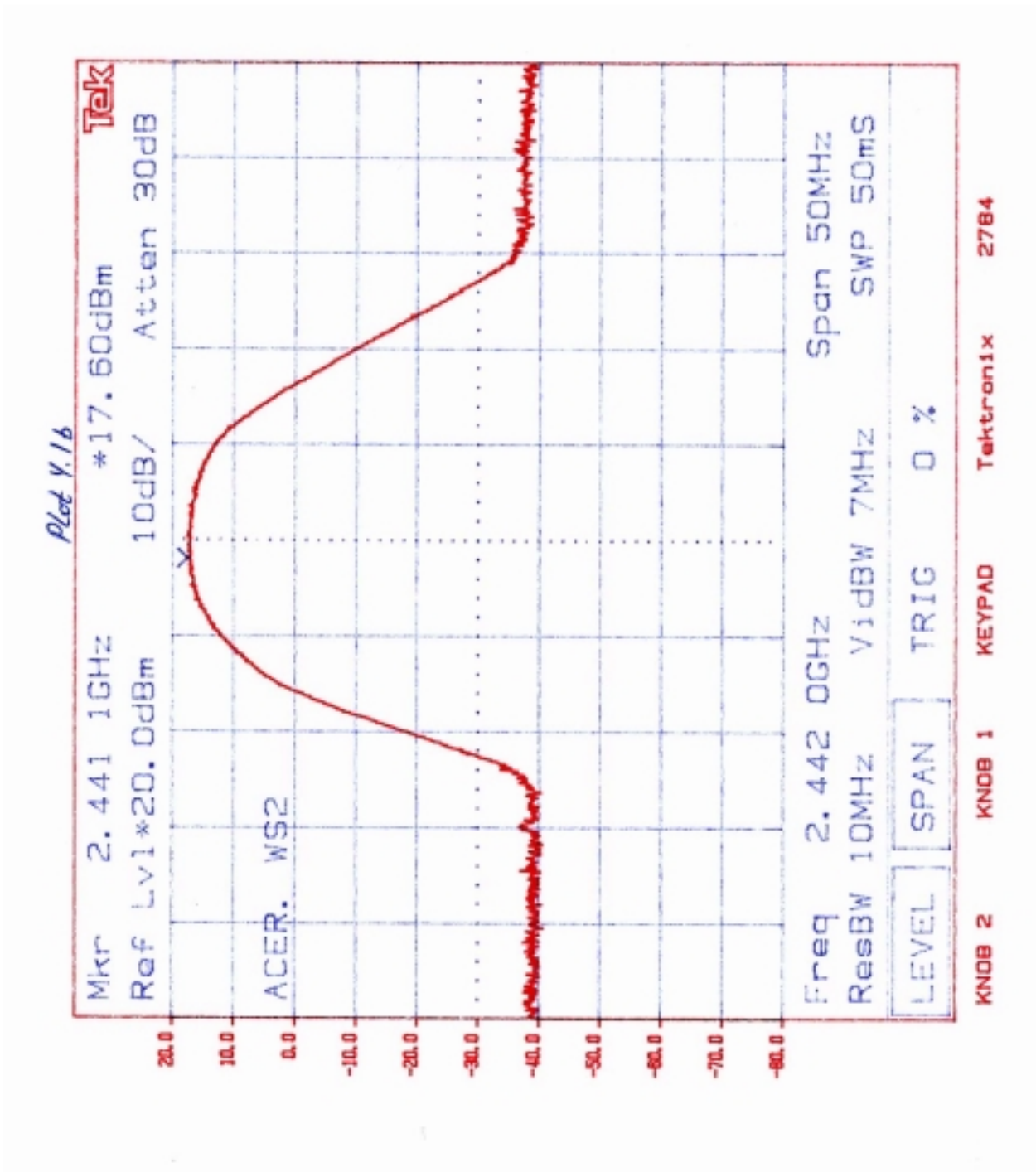
Date of Test: May 24-28, 1999



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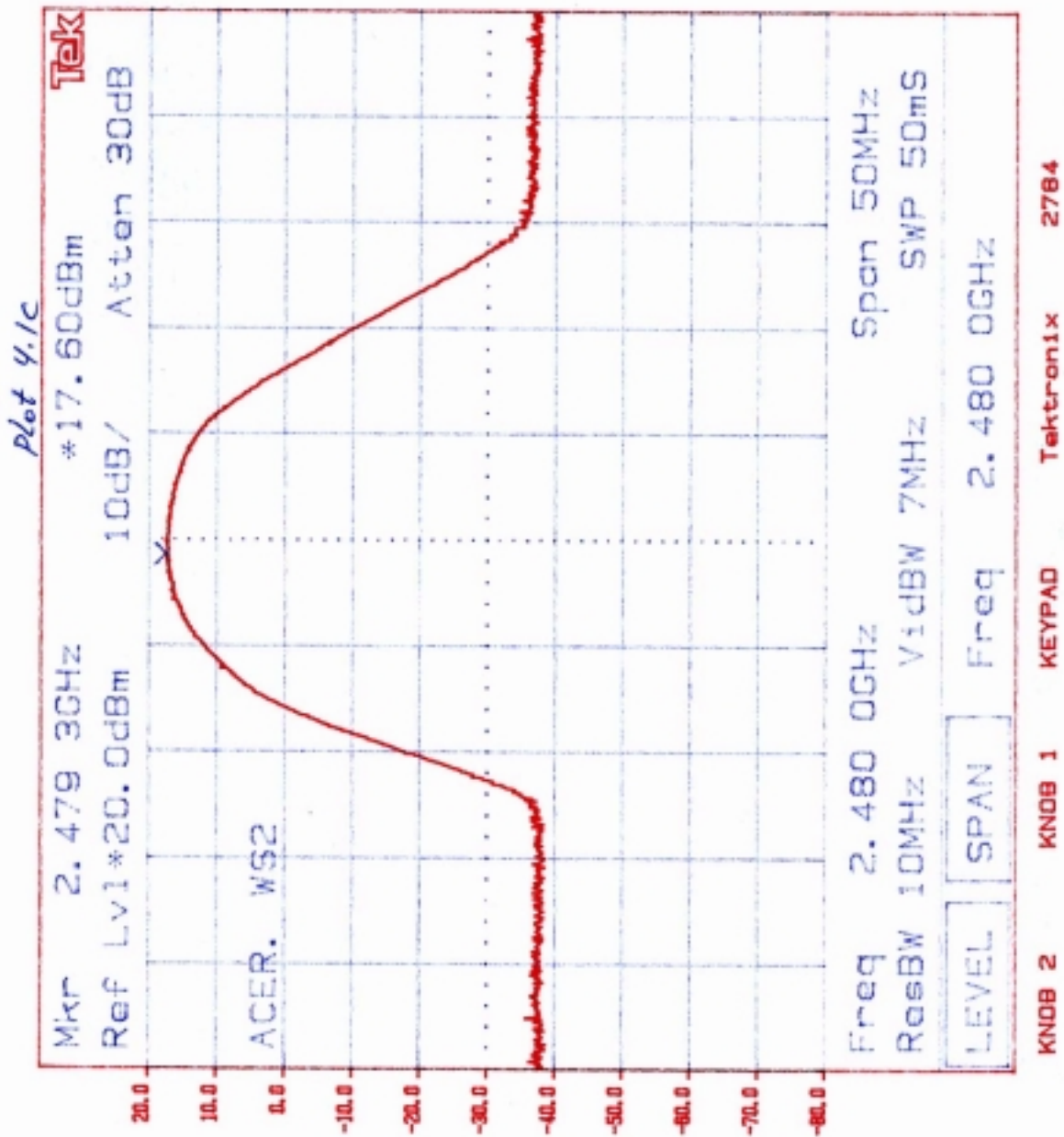
Date of Test: May 24-28, 1999



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4.2 Hopping Channel 20 dB RF Bandwidth, FCC Ref: 15.247(a)(1)

Test results:

Channel (Frequency, MHz)	20 dB Bandwidth (kHz)
Low, 2402	825
Middle, 2442	815
High, 2480	860

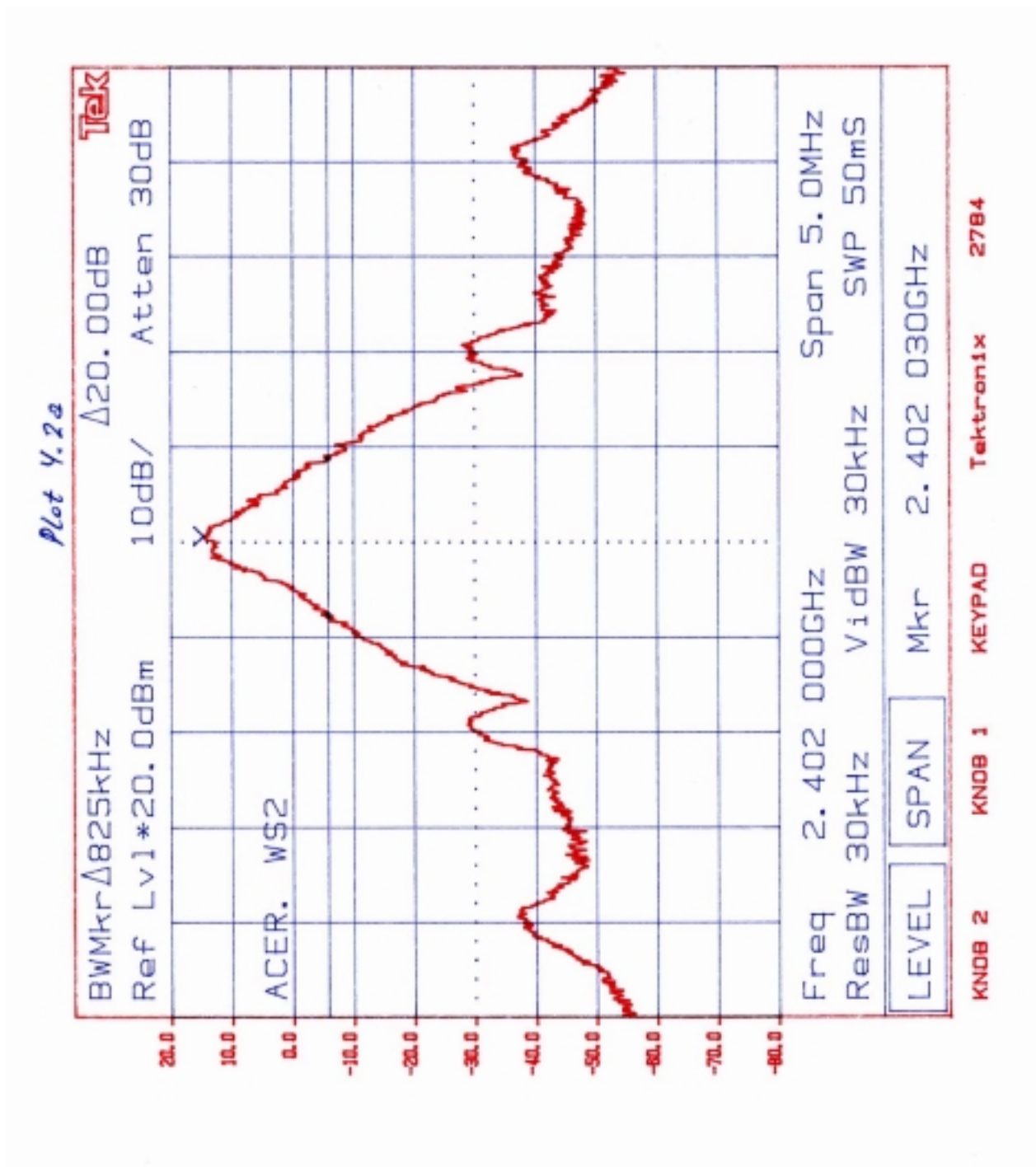
Please refer to the attached plots for details:

Plot 4.2a - 4.2c

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Acer Advanced Labs. FHSS, FCC ID:

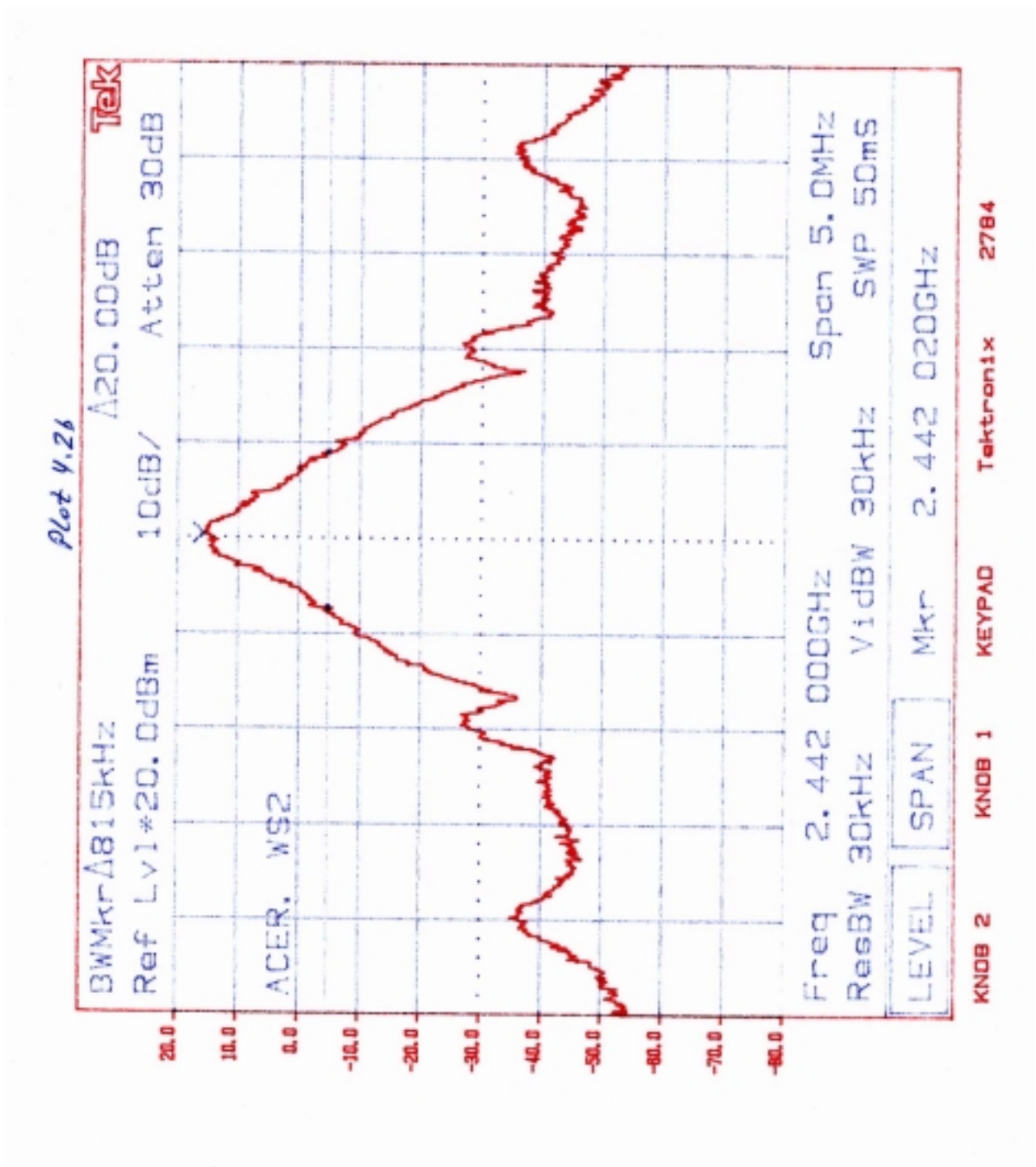
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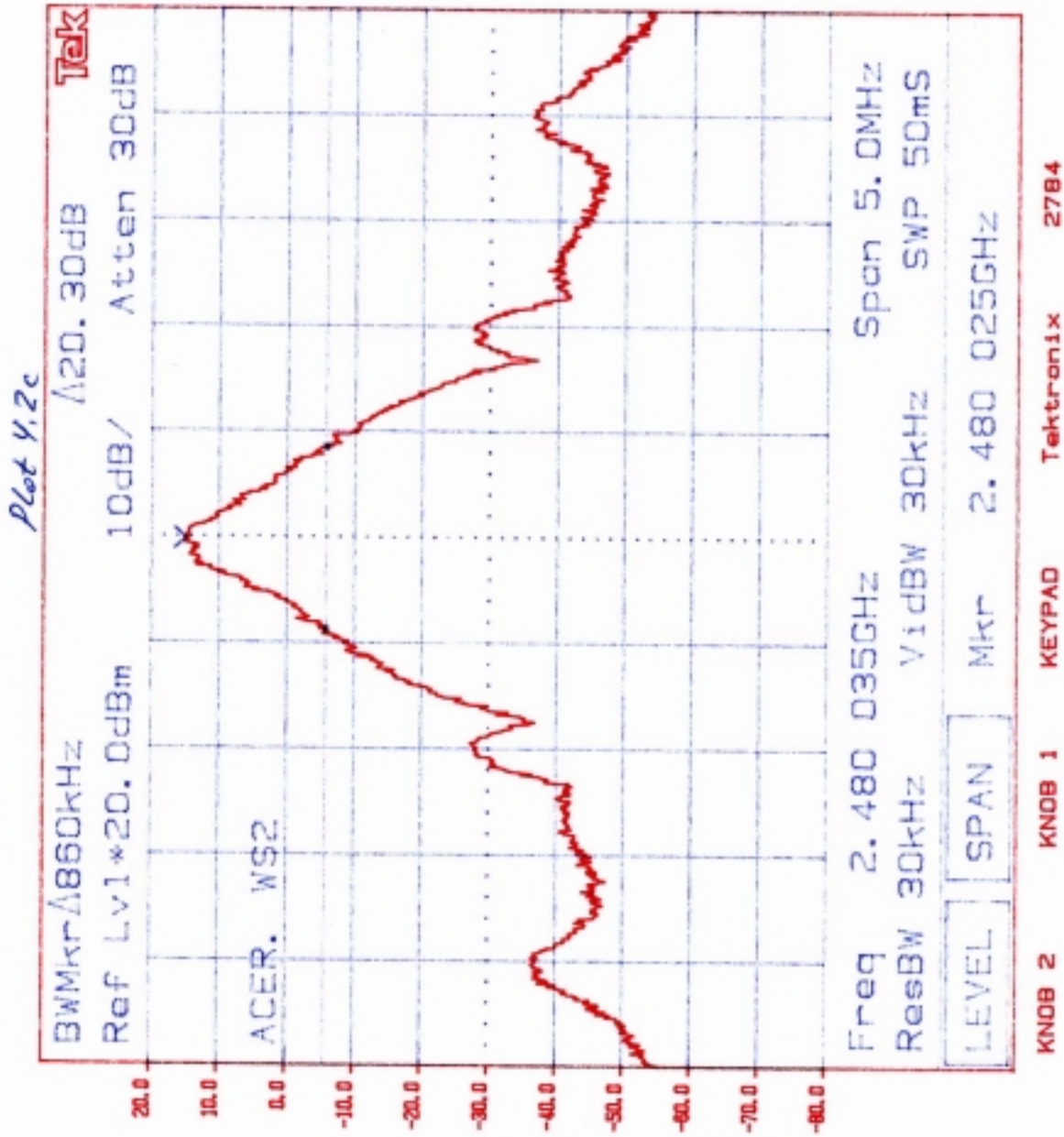
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Acer Advanced Labs. FHSS, FCC ID:

Date of Test: May 24-28, 1999



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Acer Advanced Labs. FHSS, FCC ID:

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4.3 Minimum Hopping Channel Carrier Frequency Separation, FCC Ref: 15.247(a)(1)

Using the DELTA MARKER function of the analyzer, the frequency separation between two adjacent channels was measured and compared against the limit.

[X] 20 dB bandwidth of hopping channel

Please refer to the plots 4.4a - 4.4d in section 4.4 for the test result.

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4.4 Minimum Number of Hopping Frequencies, FCC Ref: 15.247(a)(1)(i&ii)

The RF passband of the EUT was divided into 4 approximately equal bands. With the analyzer set to MAX HOLD readings were taken for 2 - 3 minutes in each band. The channel peaks so recorded were added together, and the total number compared to the minimum number of channels required in the regulation.

No. of hopping channels	79
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Minimum Requirements:

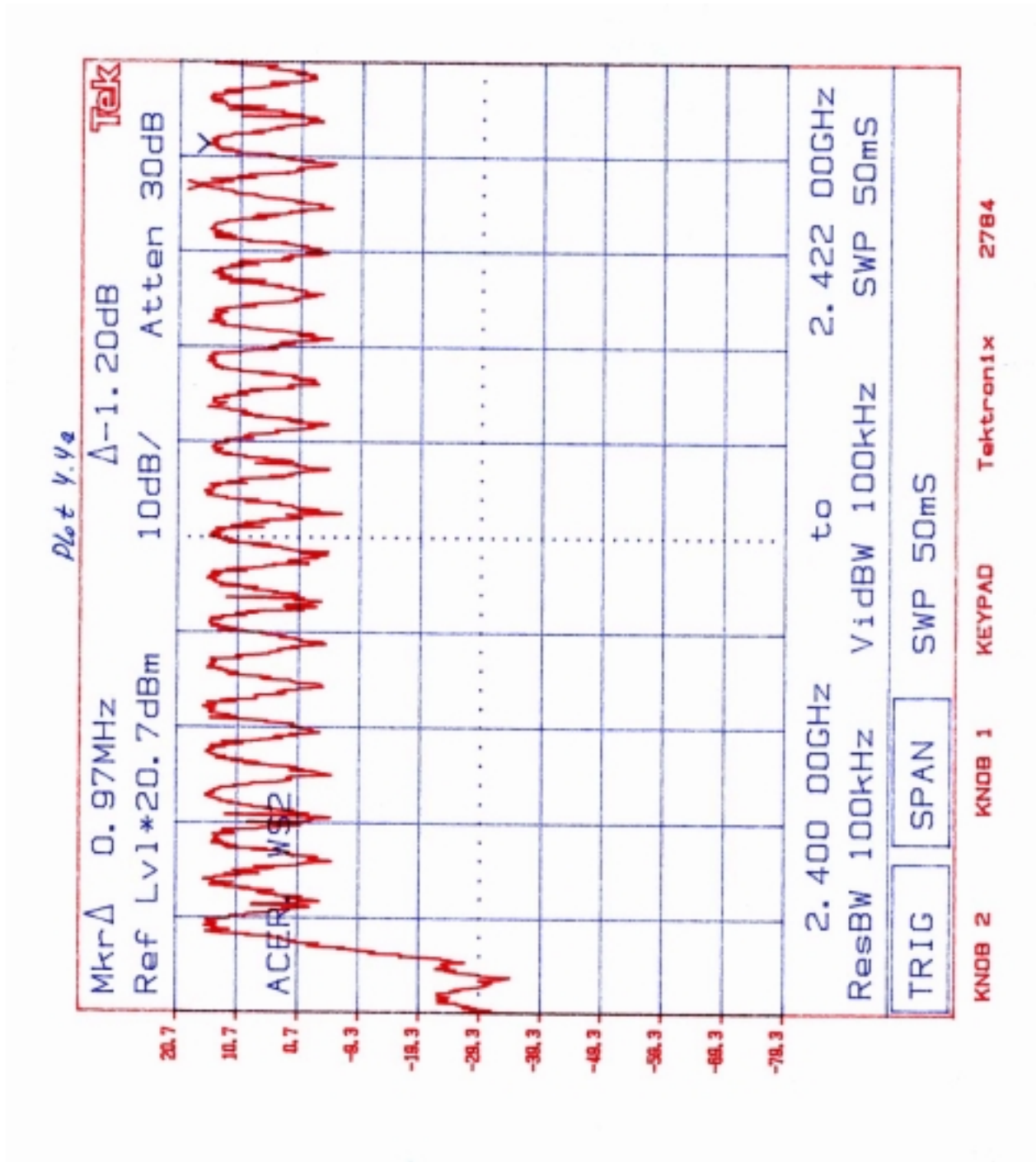
at least 50 channels for 902 - 928 MHz band;
at least 75 channels for 2400 - 2483.5 and 5725 - 5850 MHz
systems

Refer to the plots 4.4a - 4.4d.

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Acer Advanced Labs. FHSS, FCC ID:

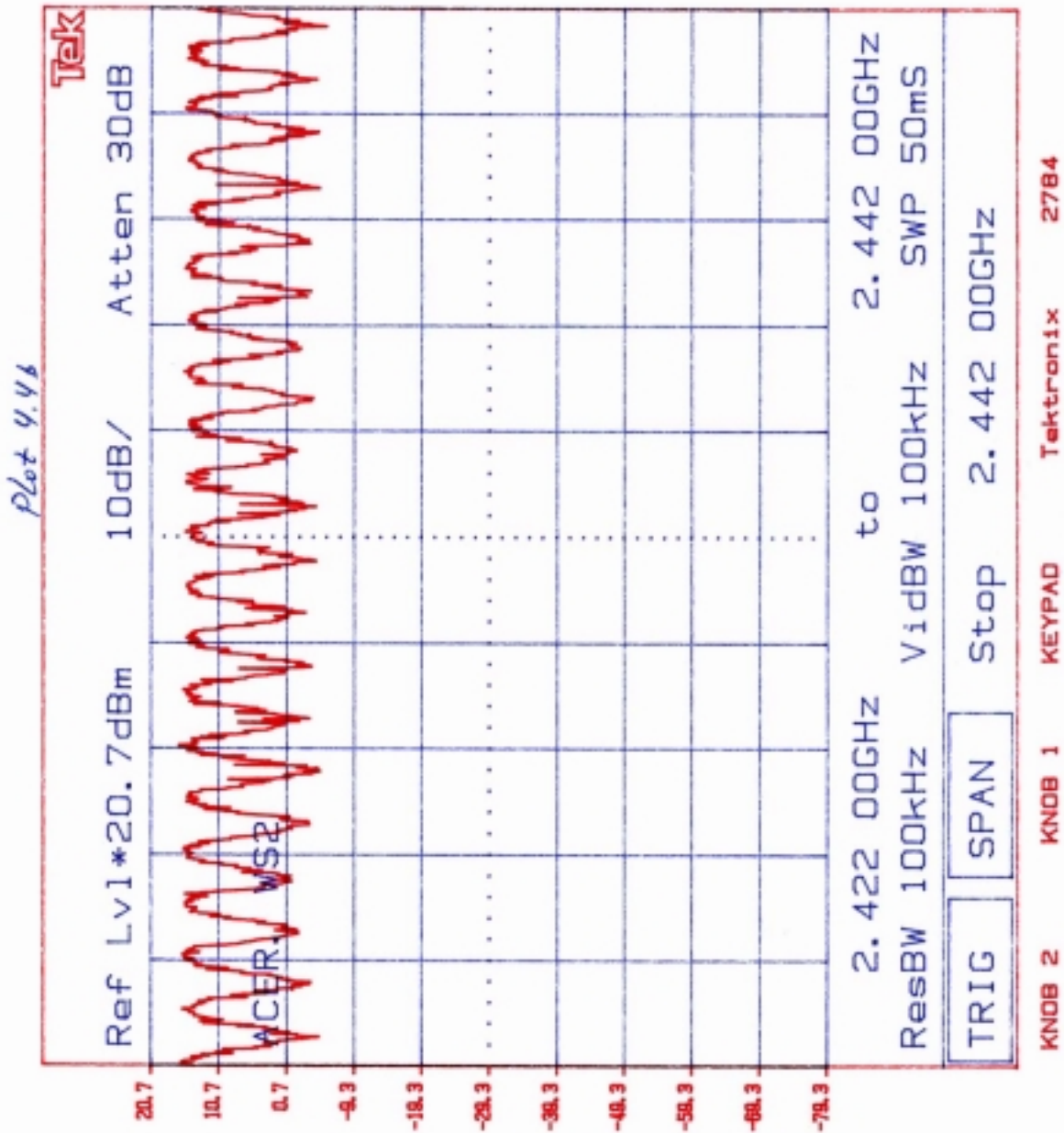
Date of Test: May 24-28, 1999

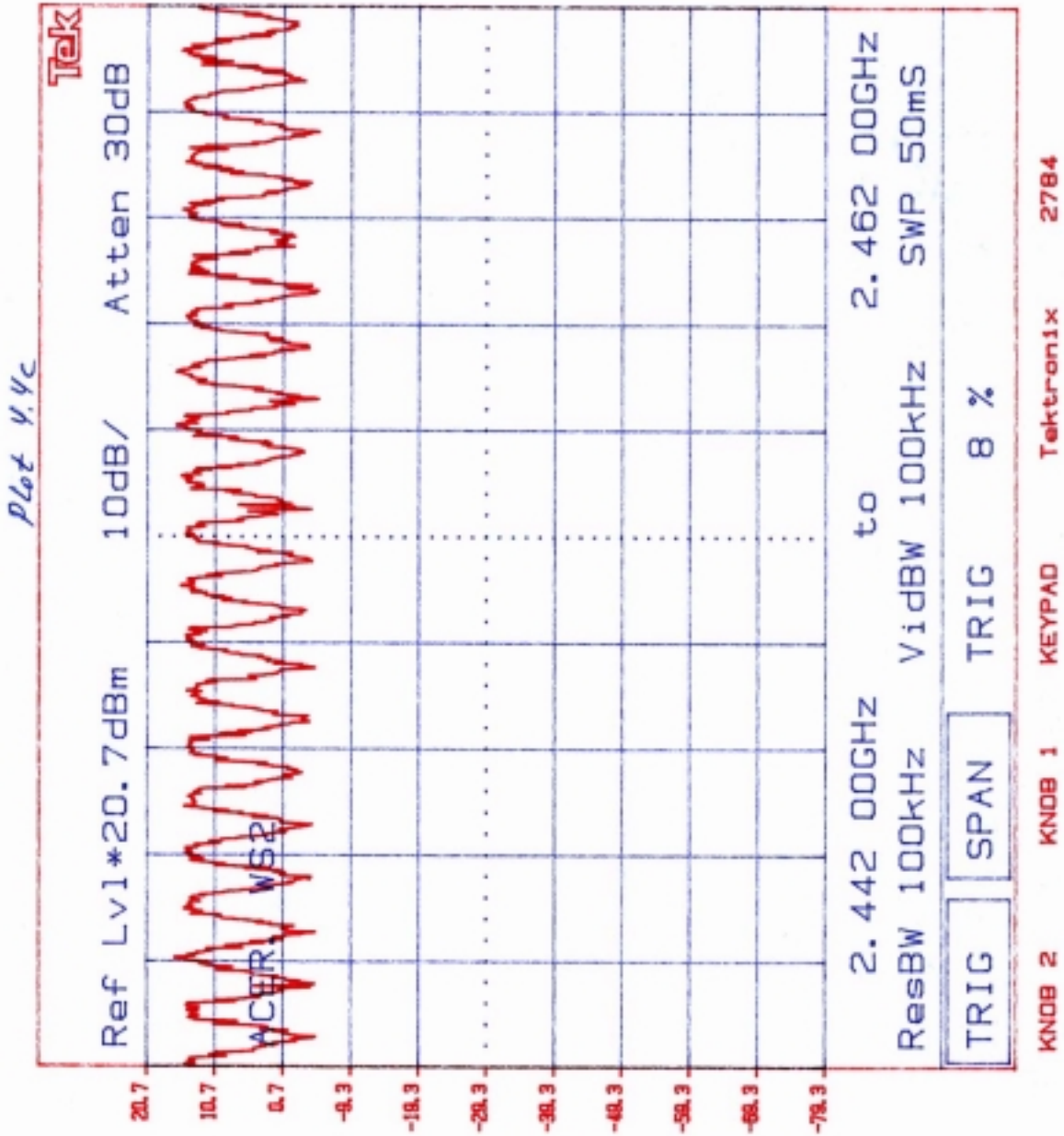


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Acer Advanced Labs. FHSS, FCC ID:

Date of Test: May 24-28, 1999

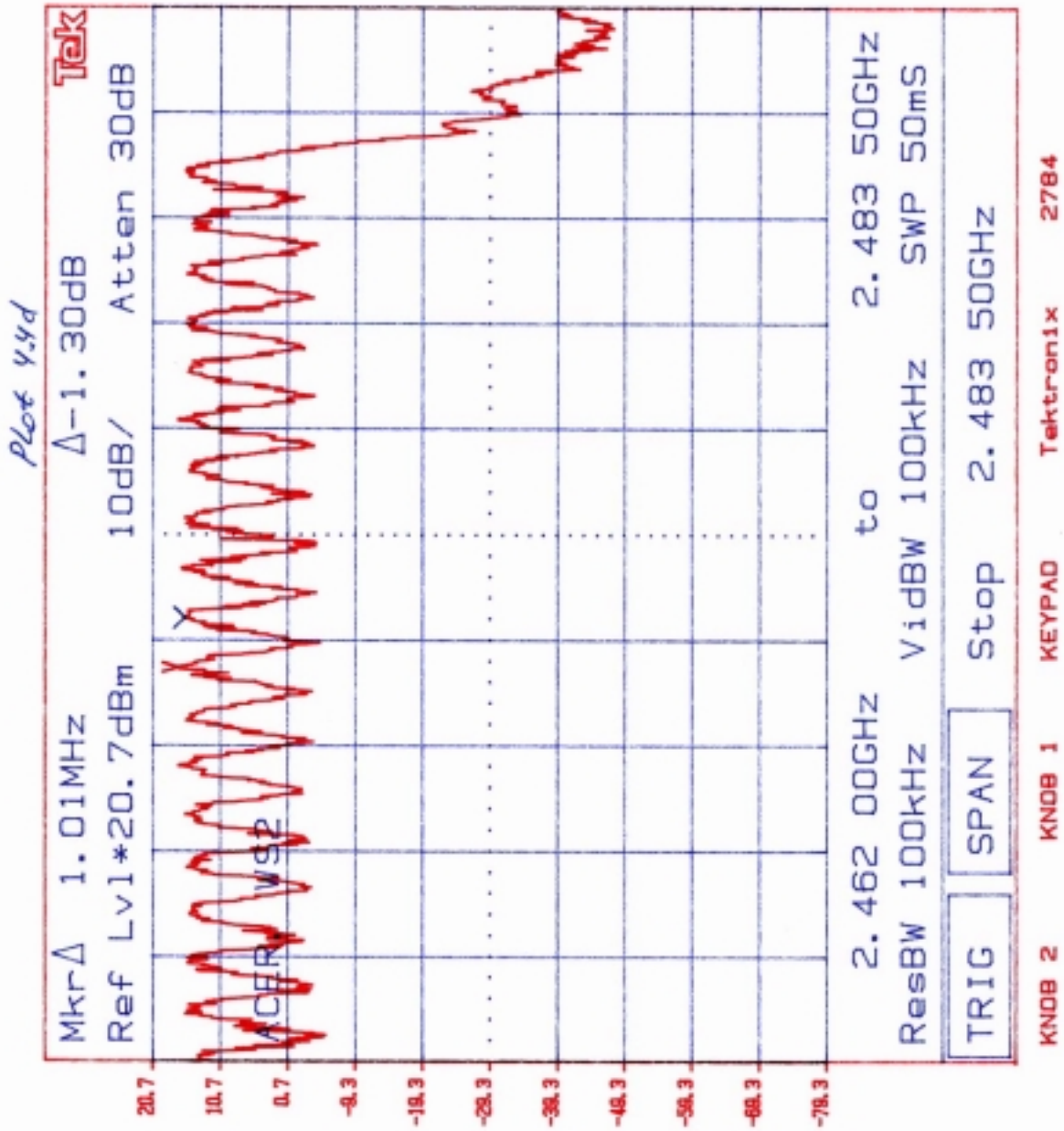




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4.5 Average Channel Occupancy Time, FCC Ref: 15.247(a)(1)(i&ii)

The spectrum analyzer center frequency was set to one of the known hopping channels. The SWEEP was set to 0.4 second, the SPAN was set to ZERO SPAN, and the TRIGGER was set to VIDEO. The time duration of the transmission so captured was measured with the MARKER DELTA function.

The sweep was then set to the time required by the regulation (20 seconds for 902-928 MHz devices, 30 seconds for all other bands).

The analyzer was set to SINGLE SWEEP, the total ON time was added and compared against the limit (0.4 seconds).

The Average time is equal $75H5=375$ ms.

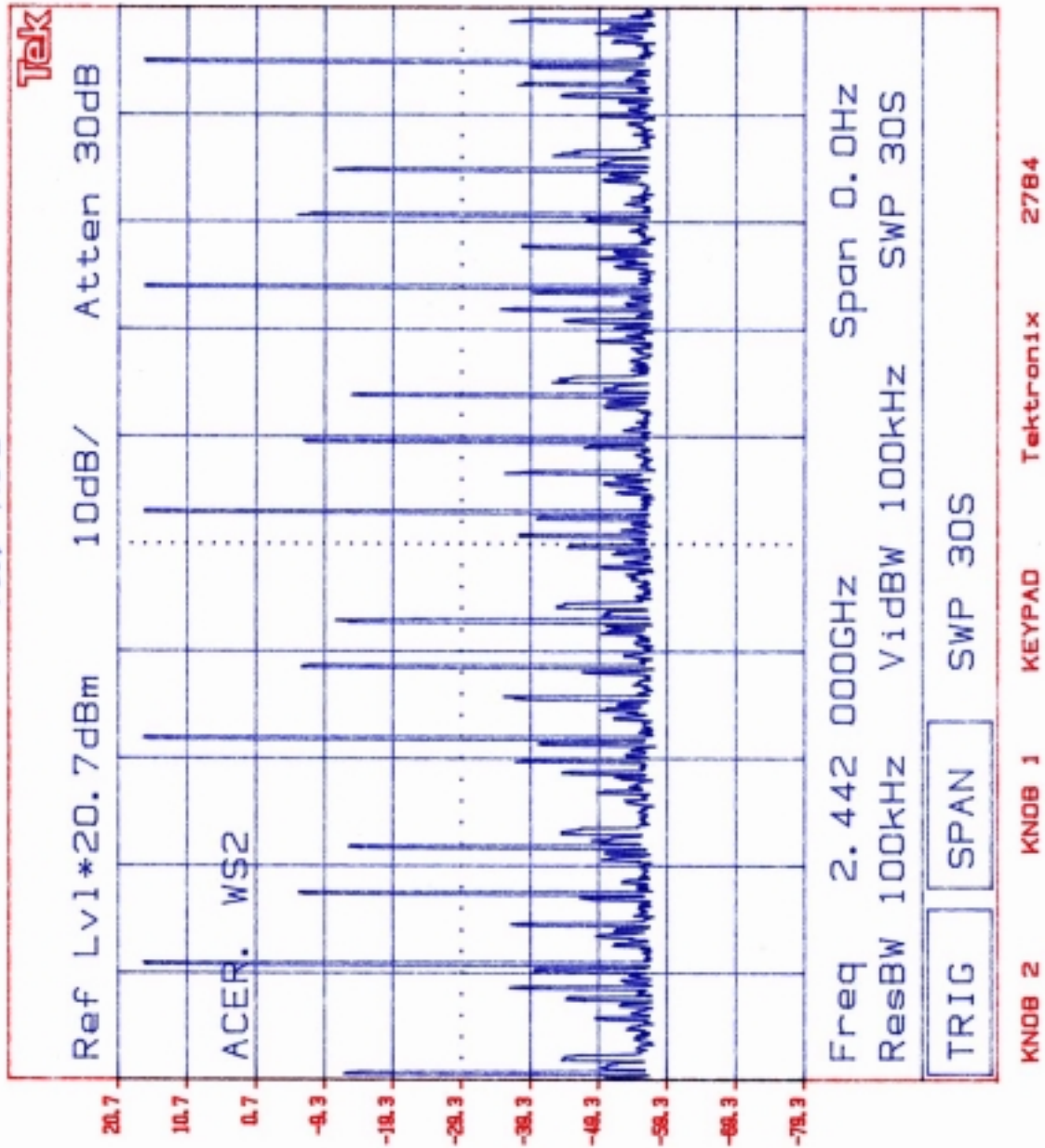
Refer to the plots 4.5a - 4.5b for details.

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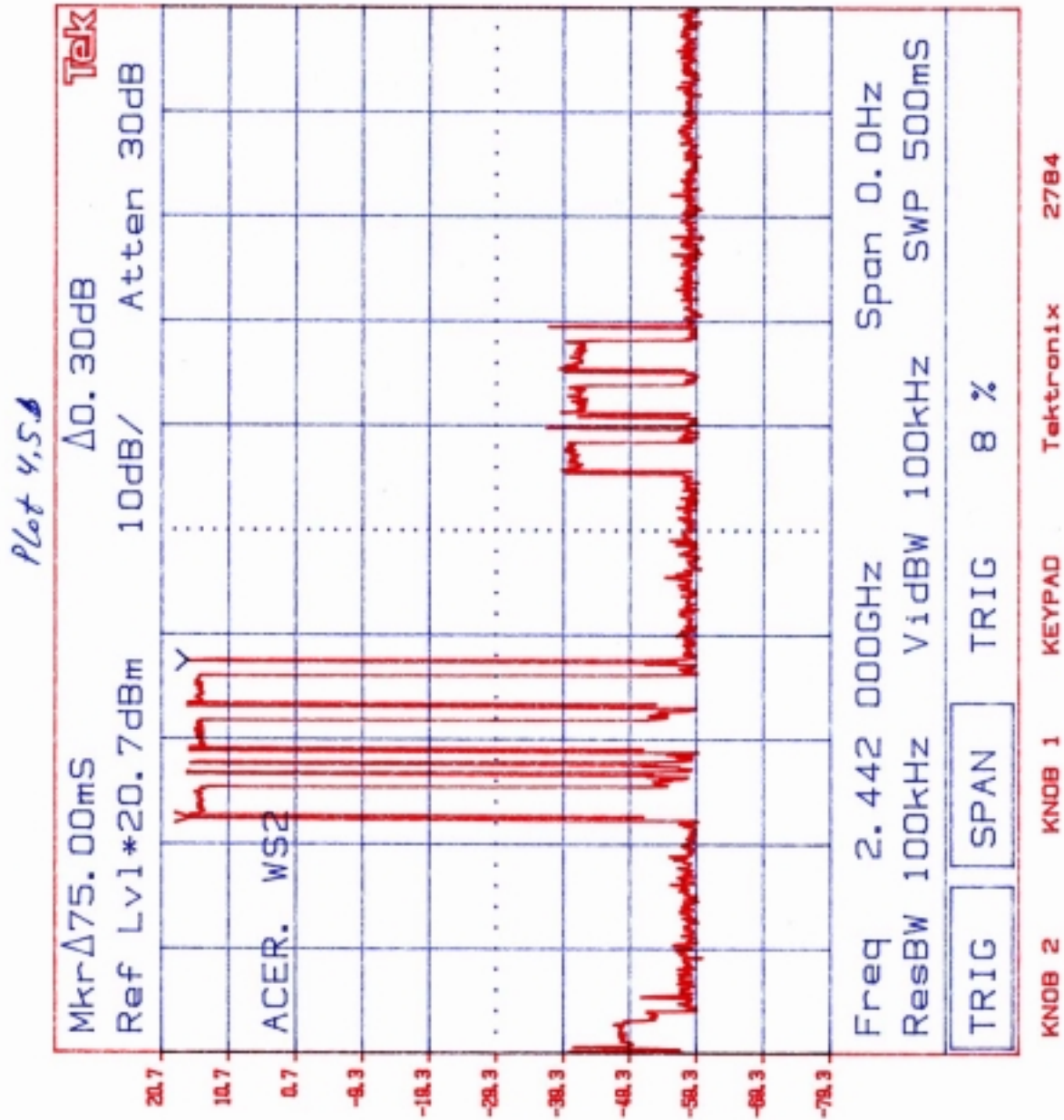
Plot 4.5a



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4.6 Out of Band Conducted Emissions, FCC Ref: 15.247(c)

For EUT antenna conducted output frequencies from 1 MHz to the 10th harmonic of the transmitter operating frequency (or 40 GHz, whichever is lower):

In any 100 kHz bandwidth outside the EUT passband, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, or else shall meet the general limits for radiated emissions at frequencies outside the passband, whichever results in lower attenuation.

All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the passband.

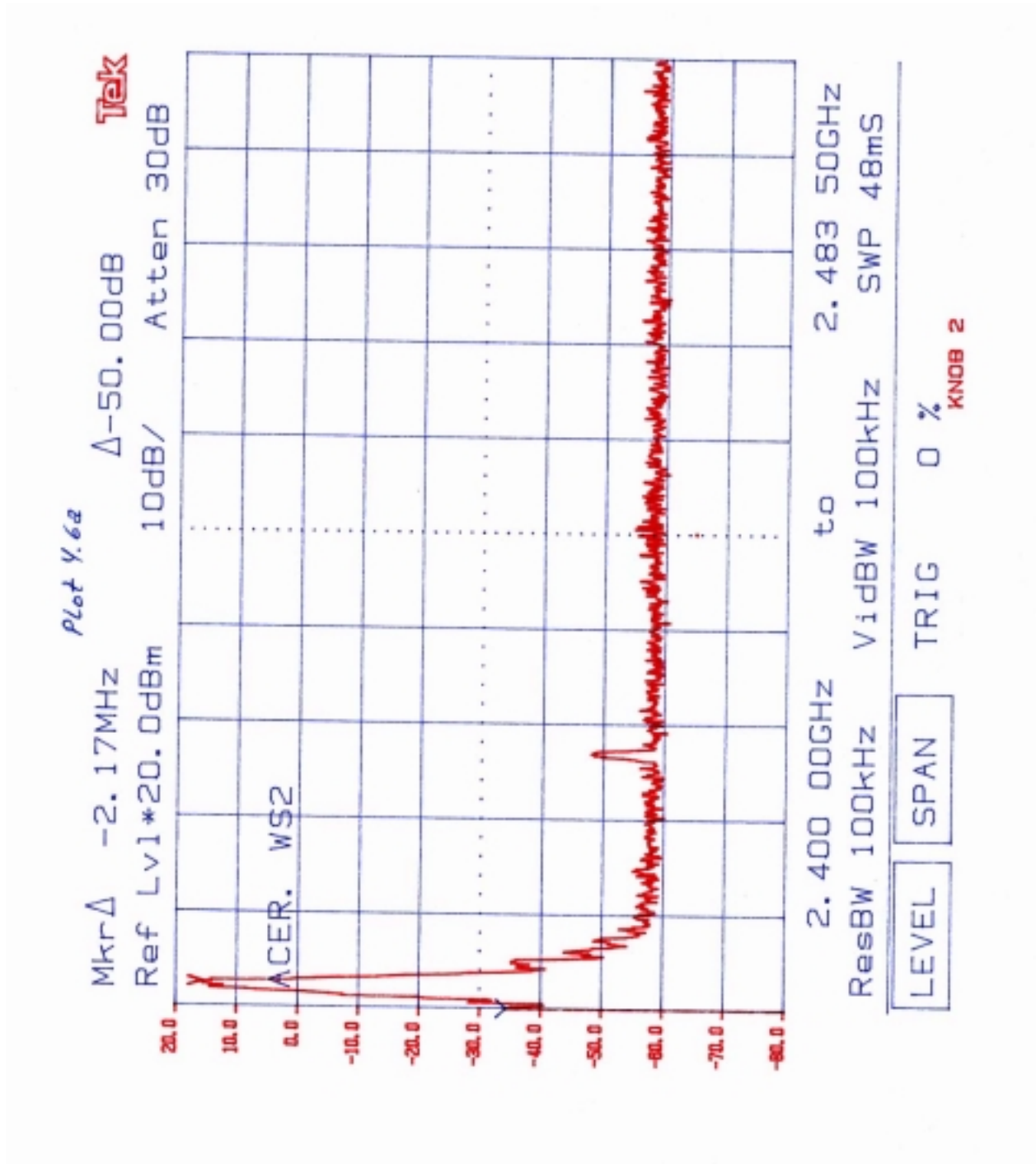
Please refer to the plots for details:

Low Channel	Plots 4.6a - 4.6f
Middle Channel	Plots 4.6g - 4.6l
High Channel	Plots 4.6m - 4.6s

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Acer Advanced Labs. FHSS, FCC ID:

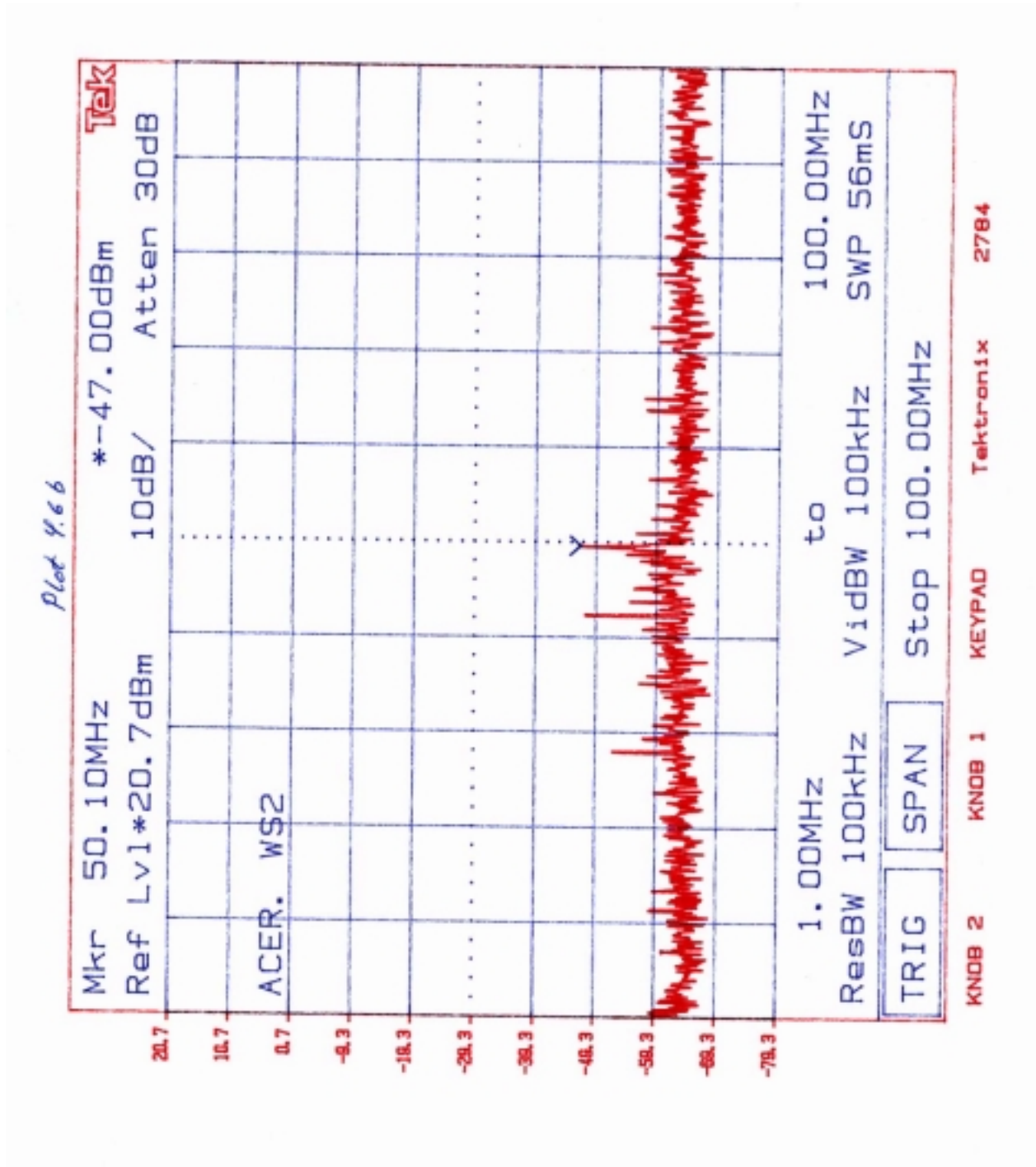
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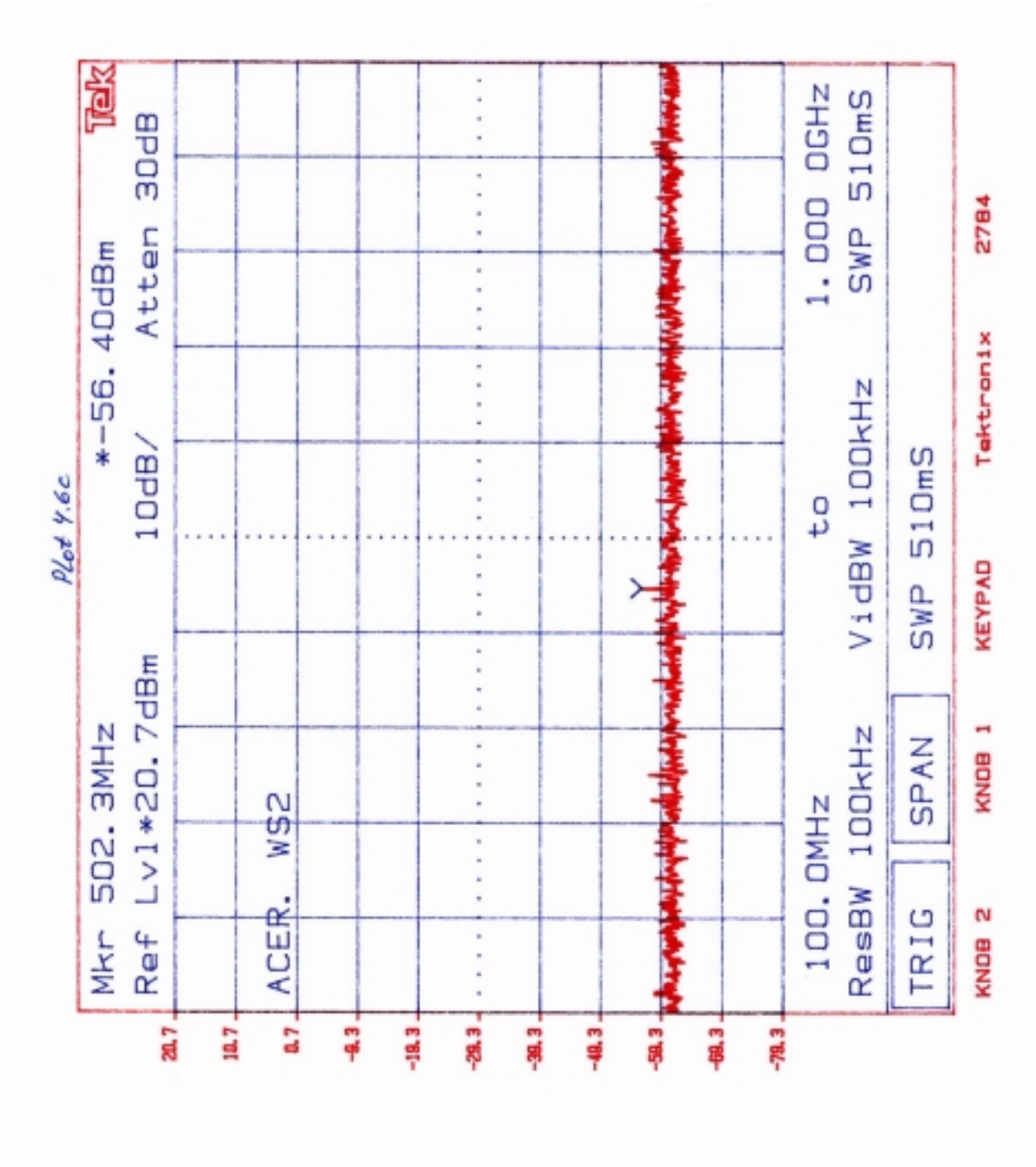
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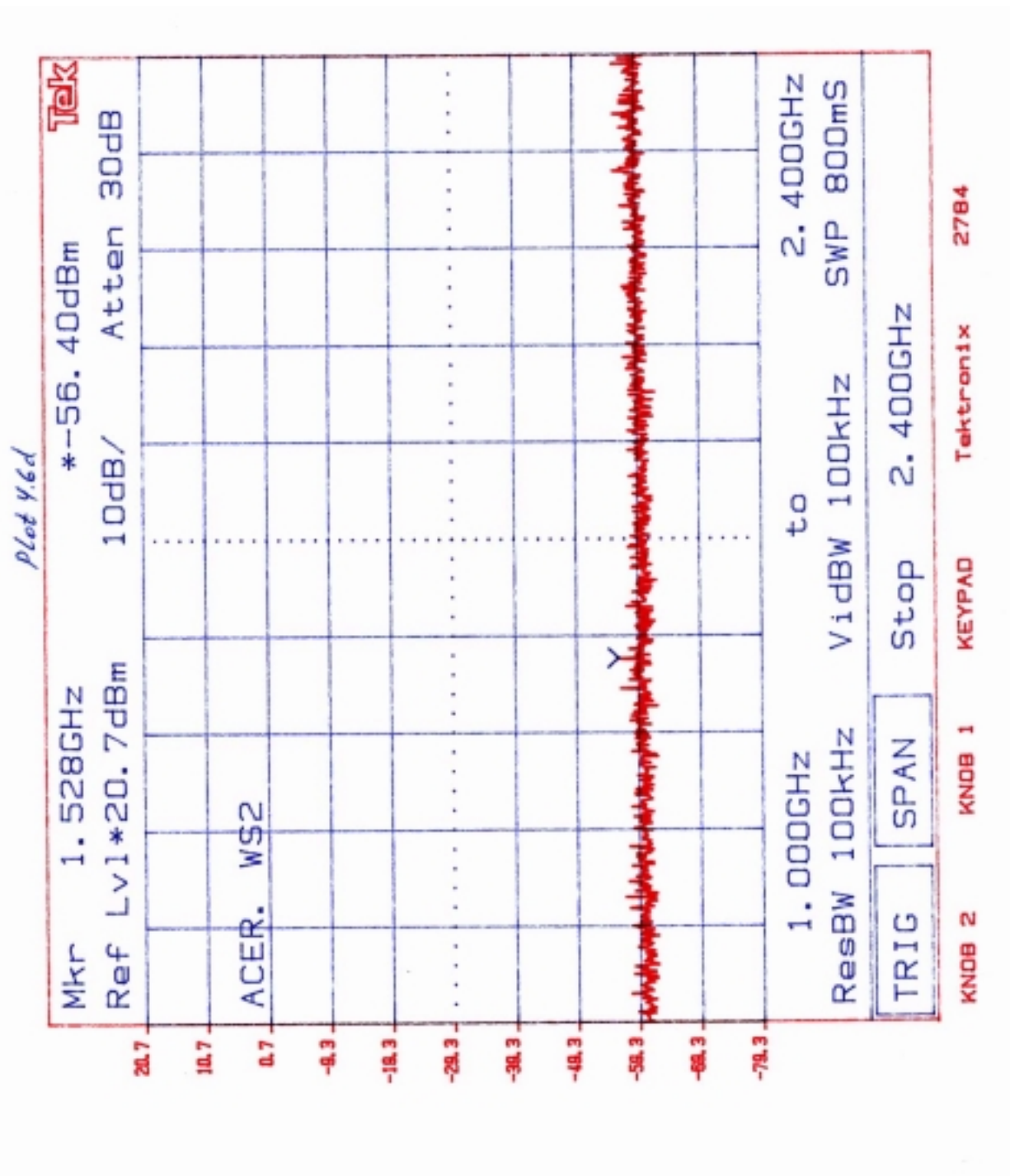
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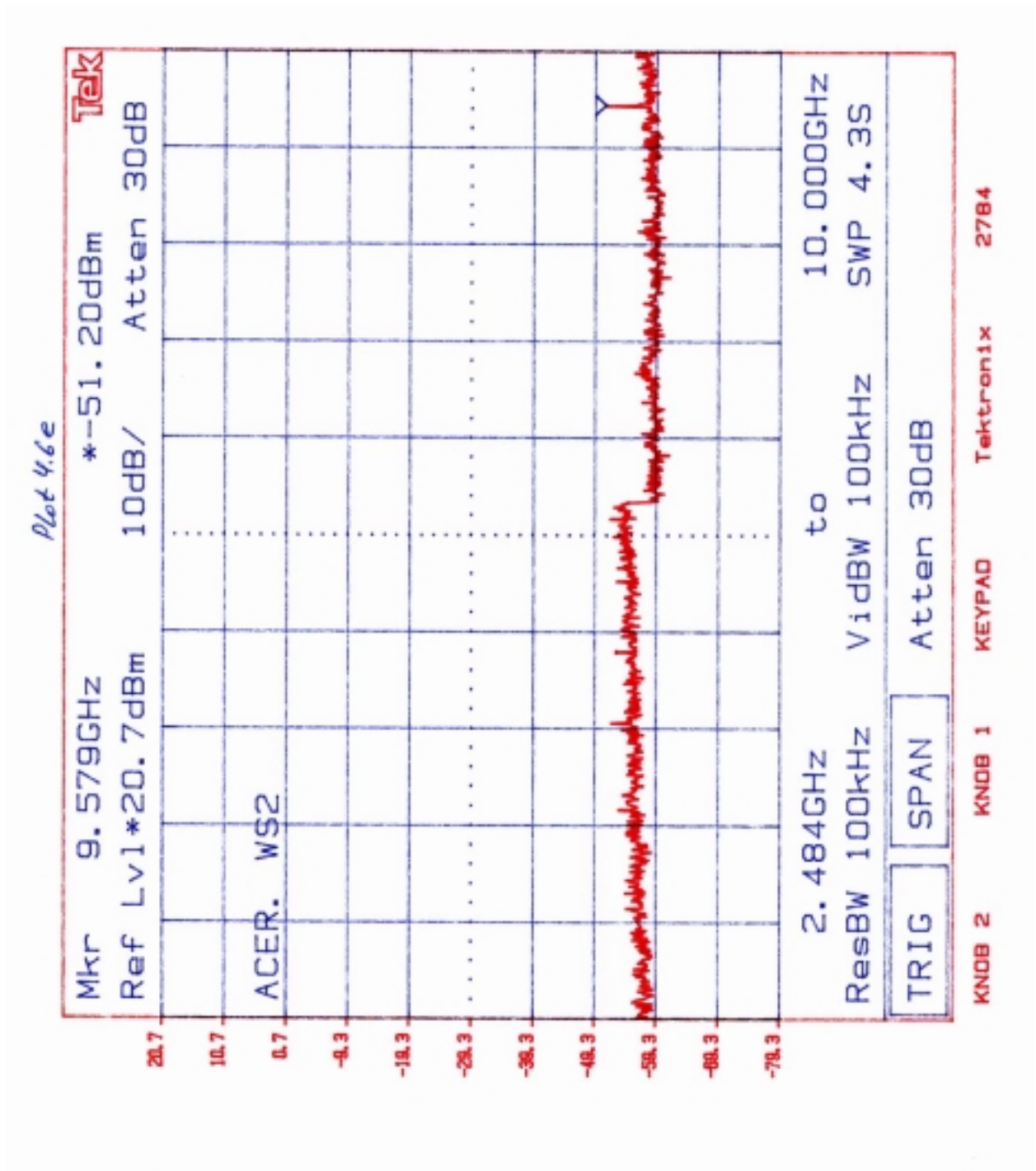
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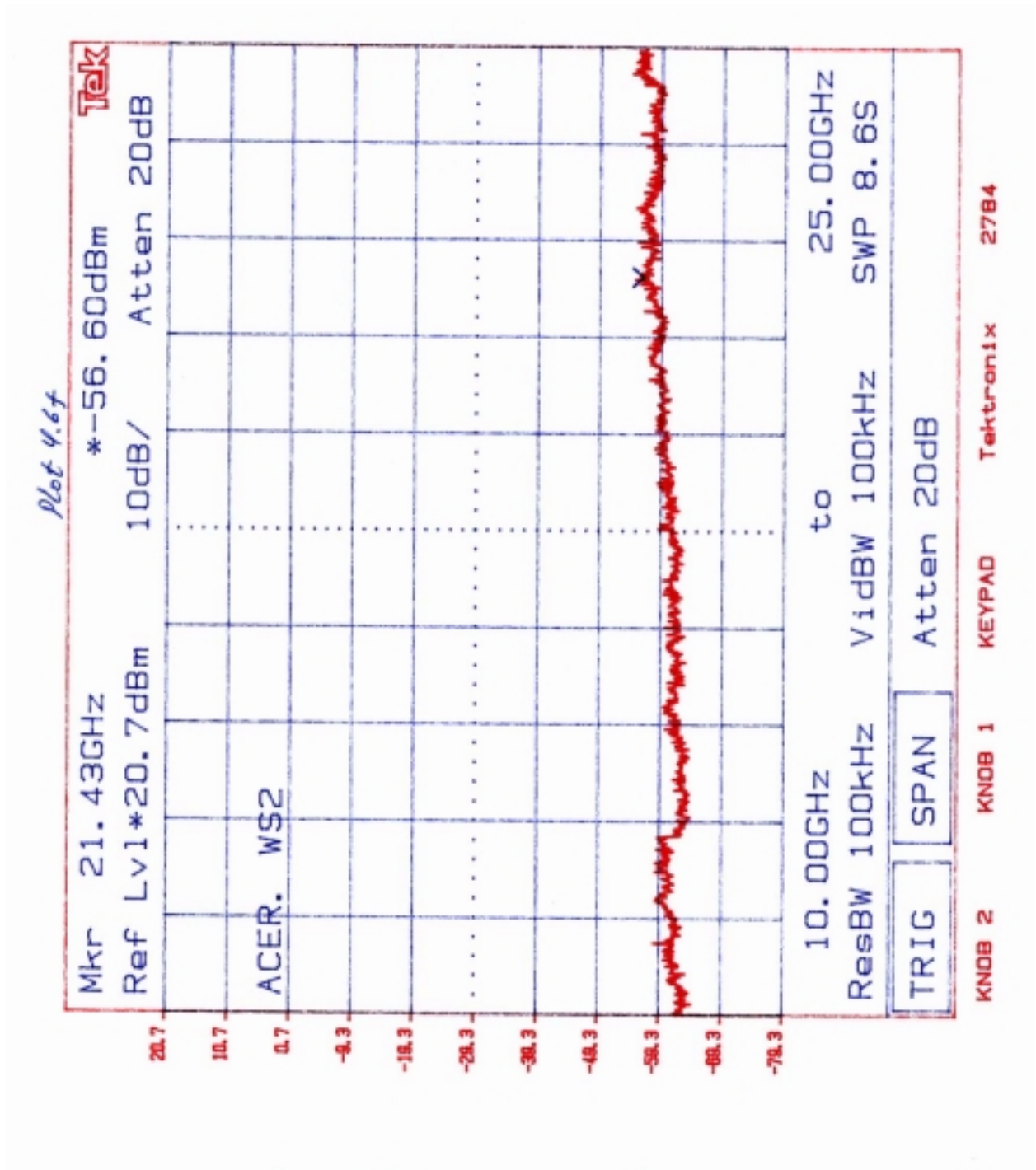
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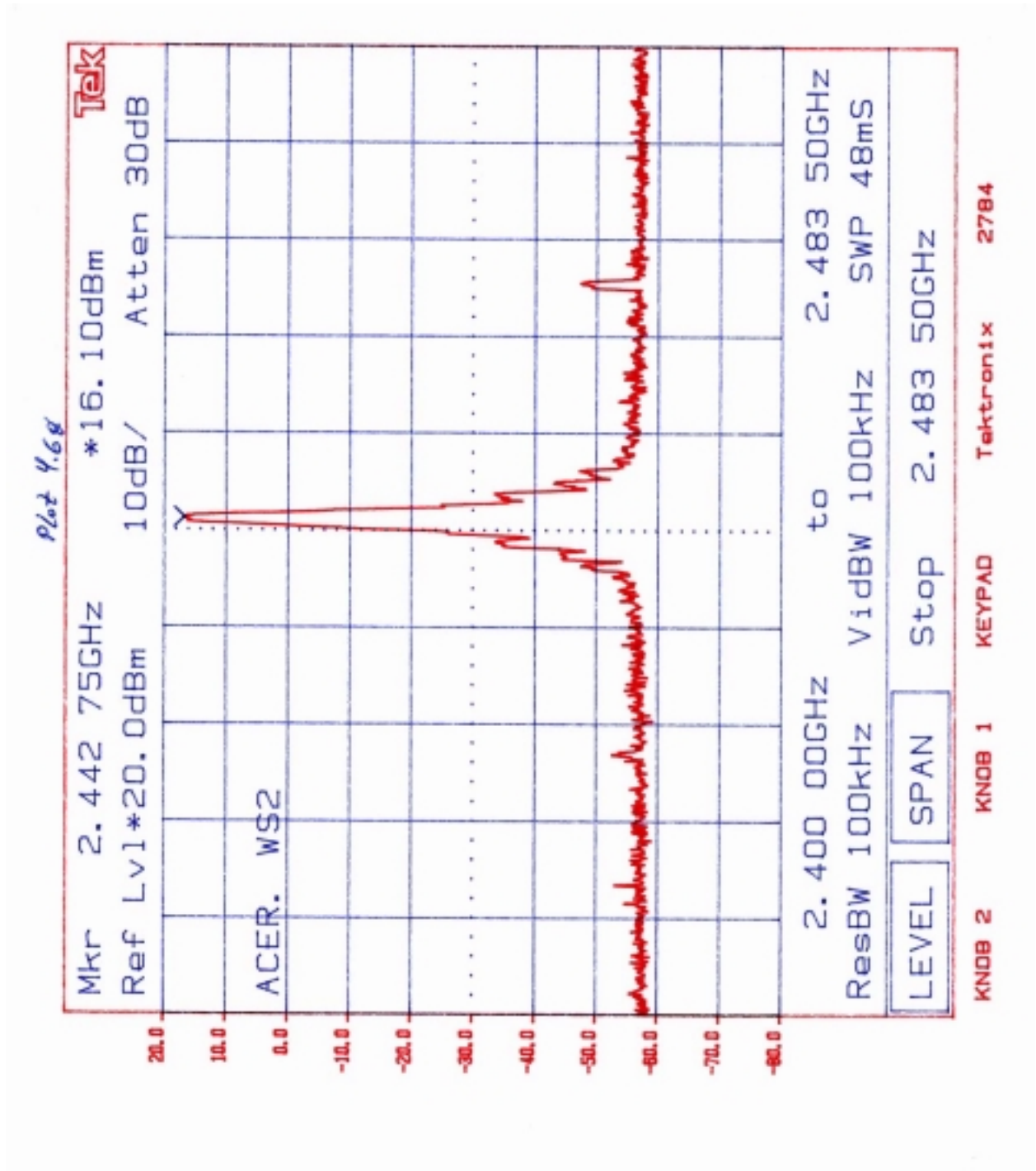
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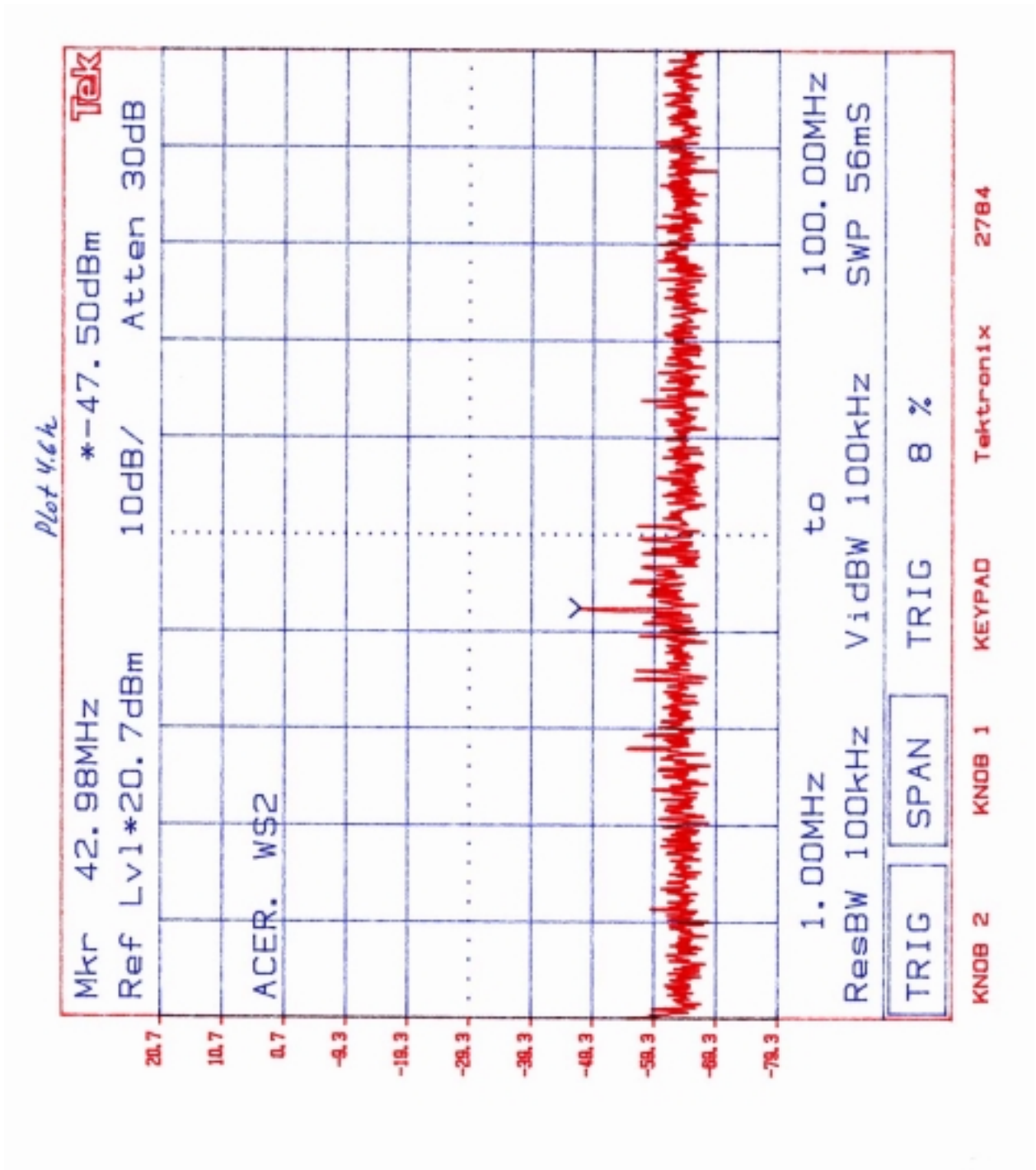
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Acer Advanced Labs. FHSS, FCC ID:

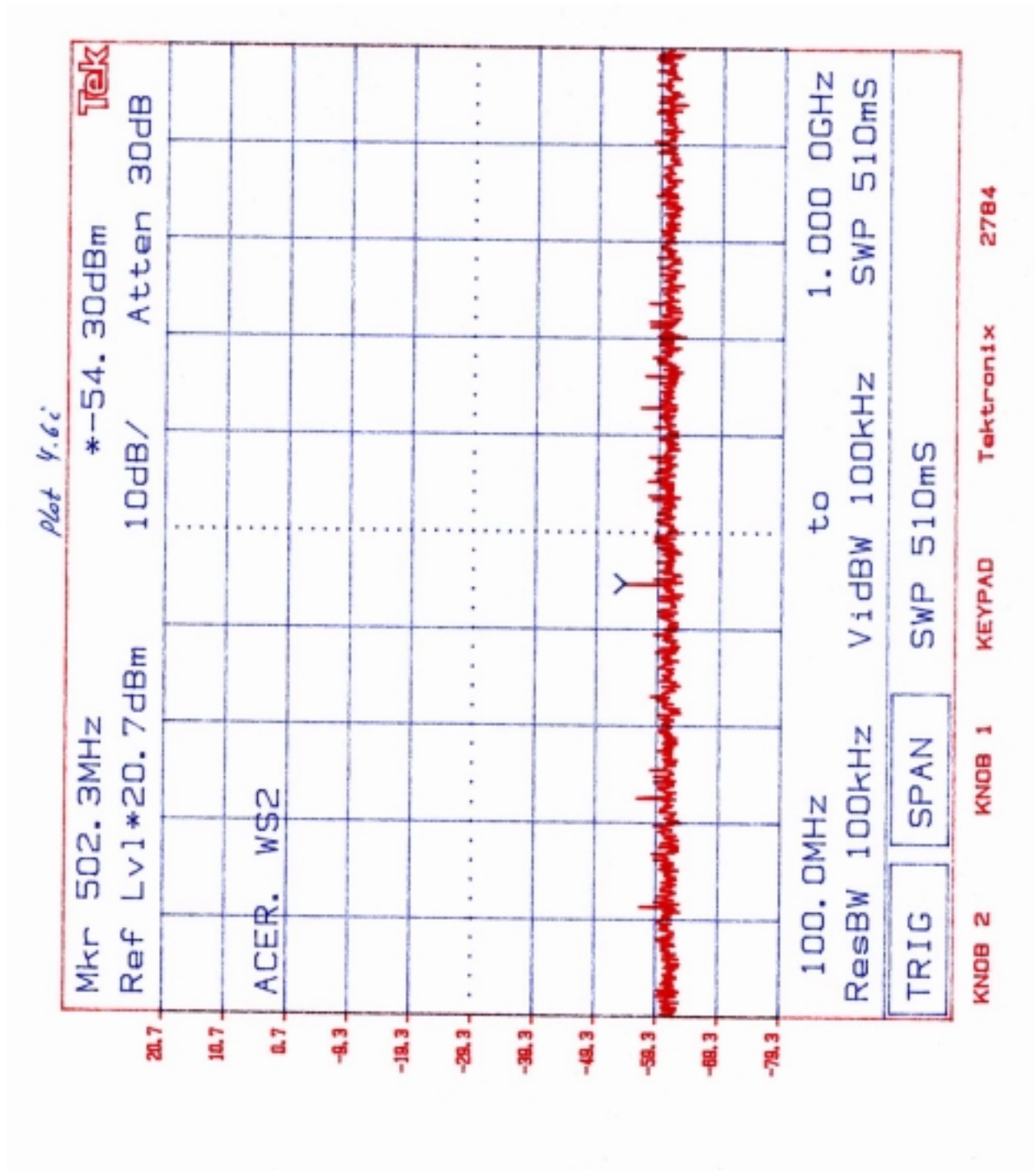
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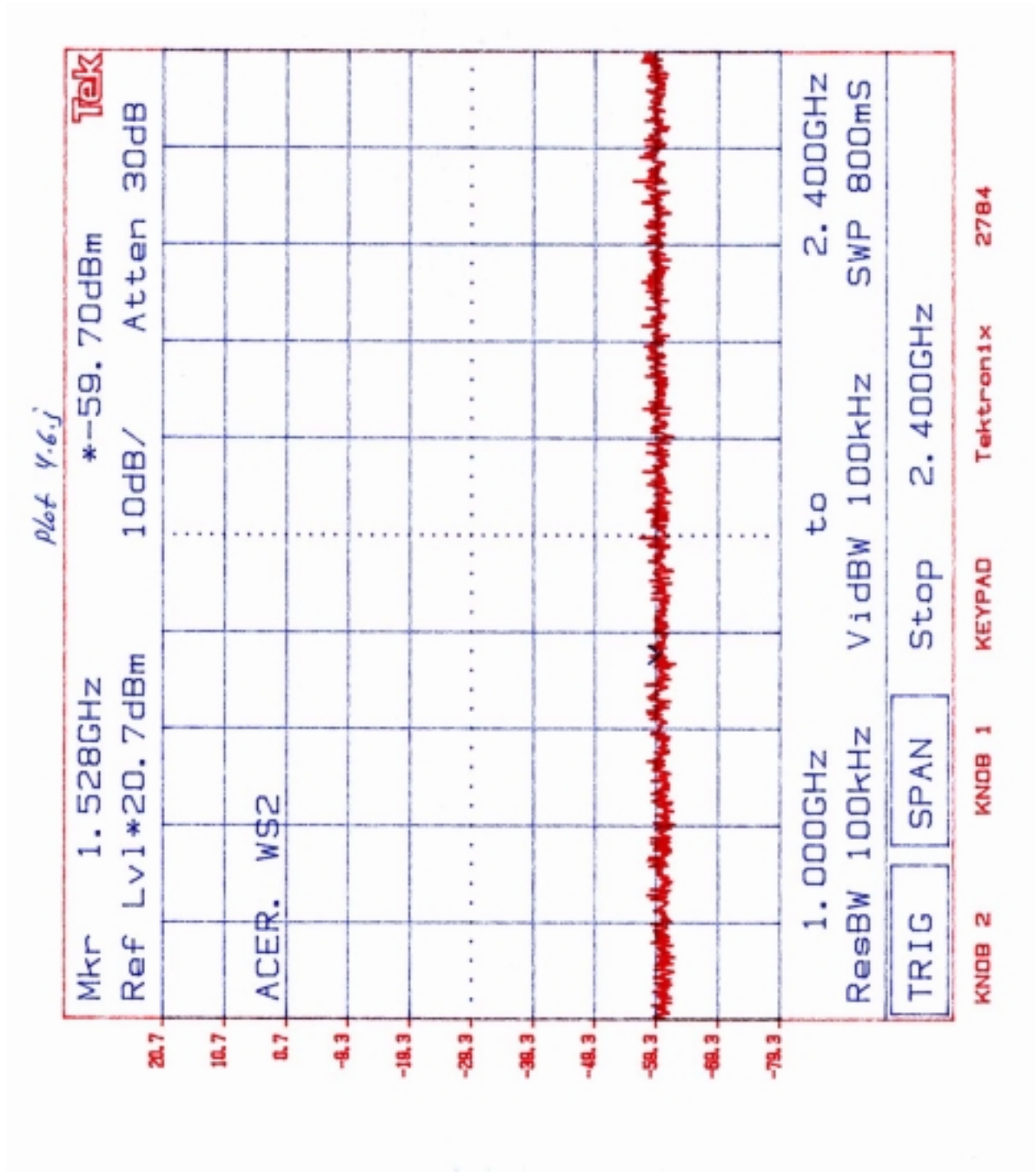
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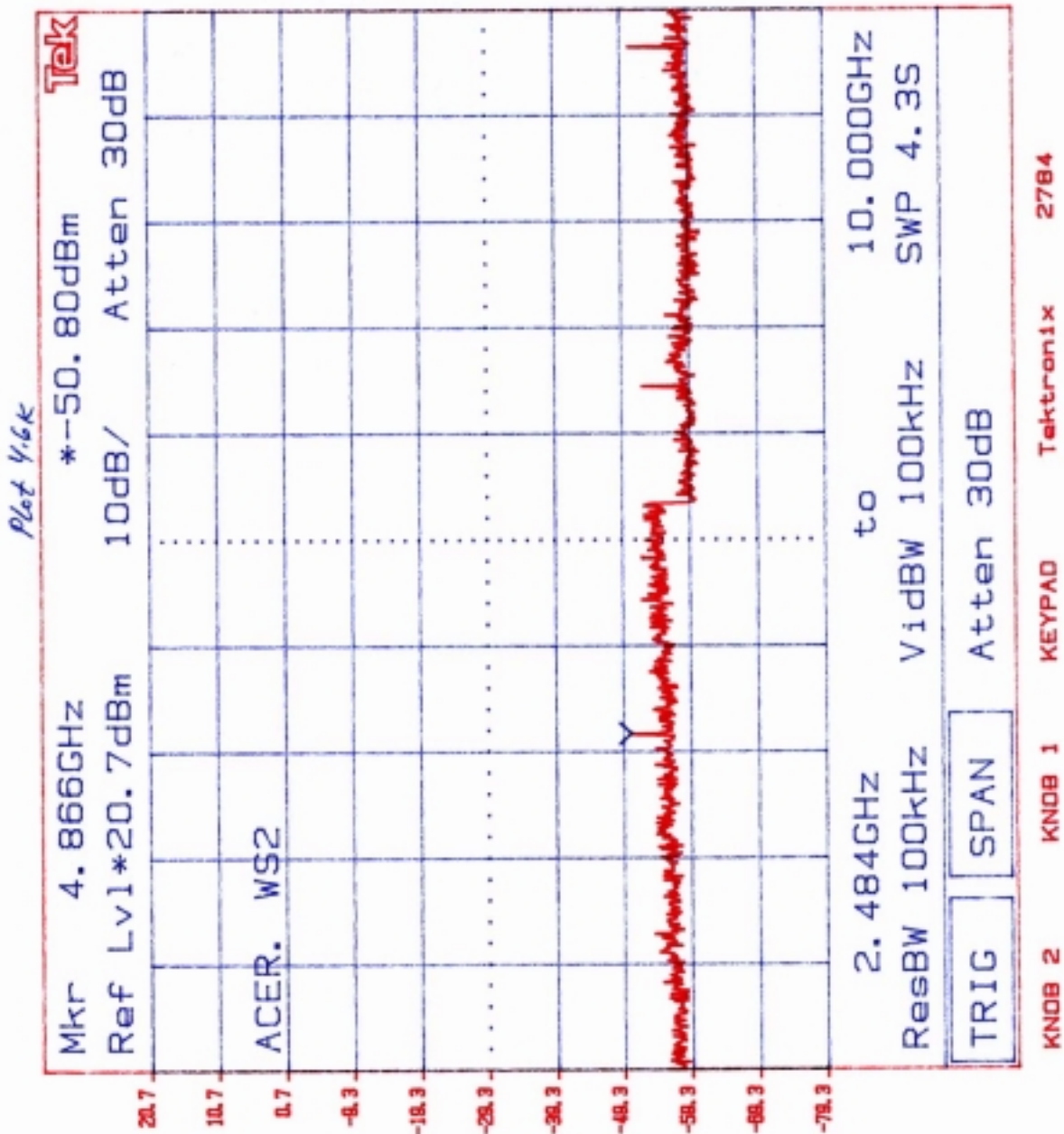
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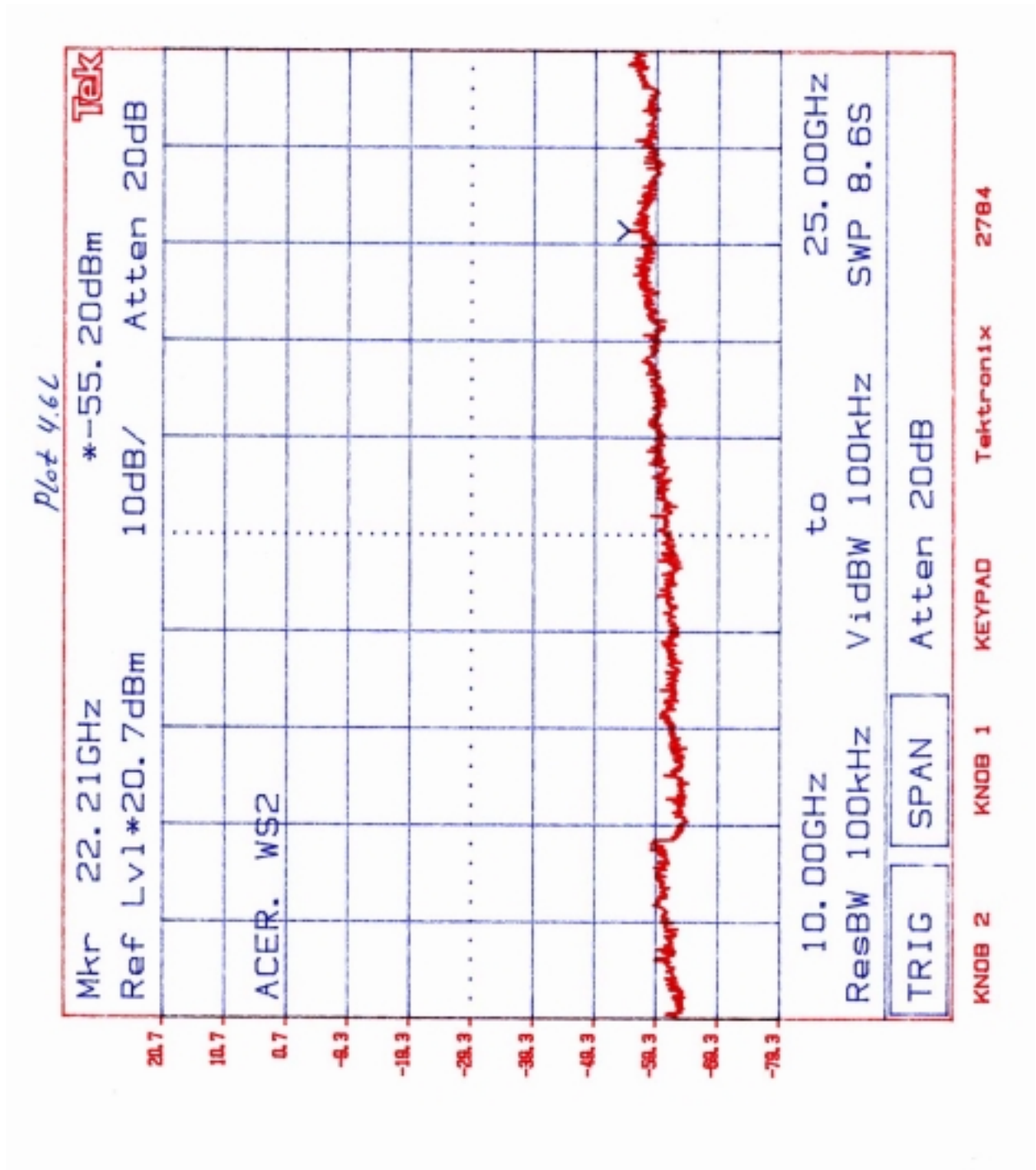
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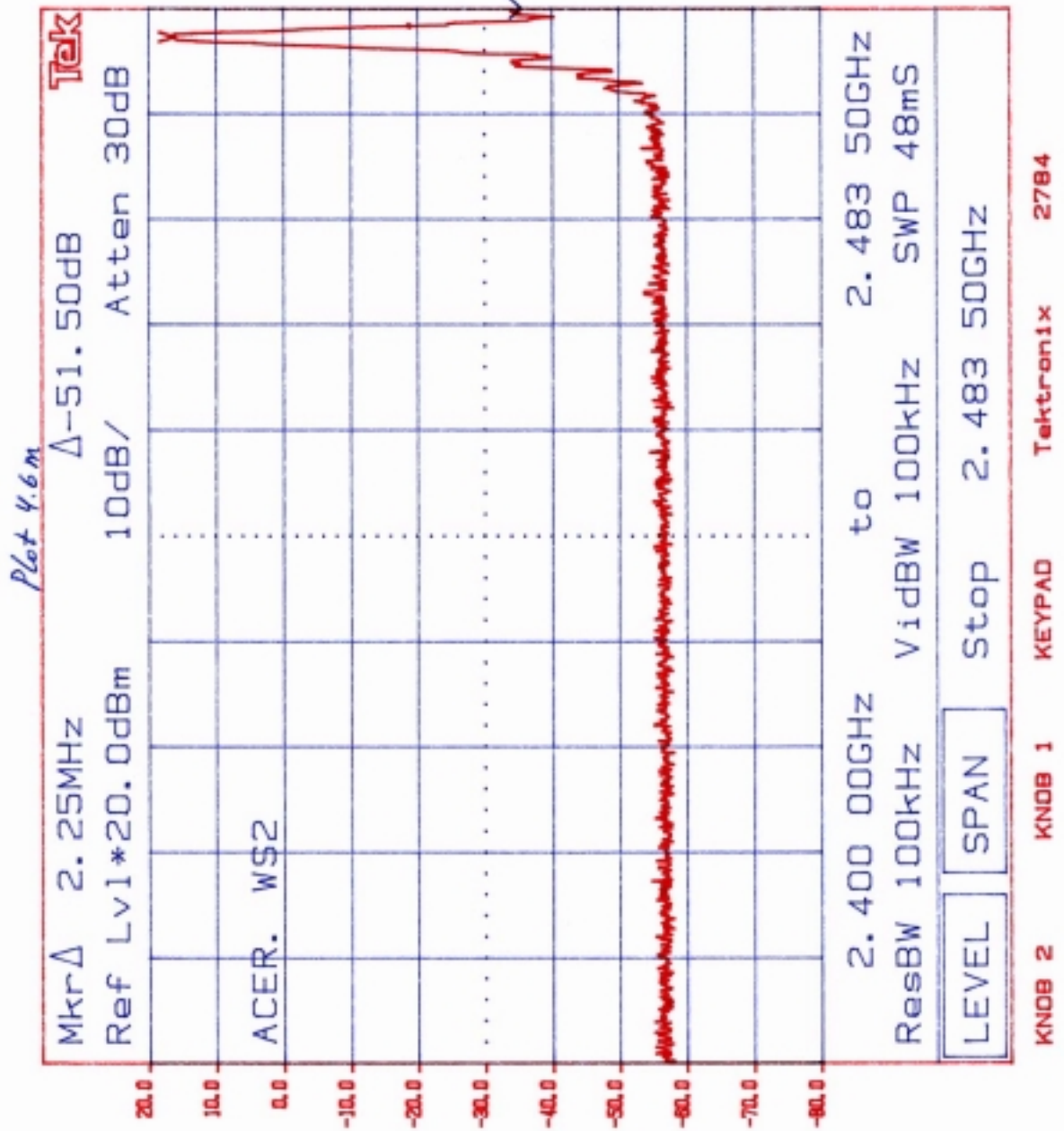
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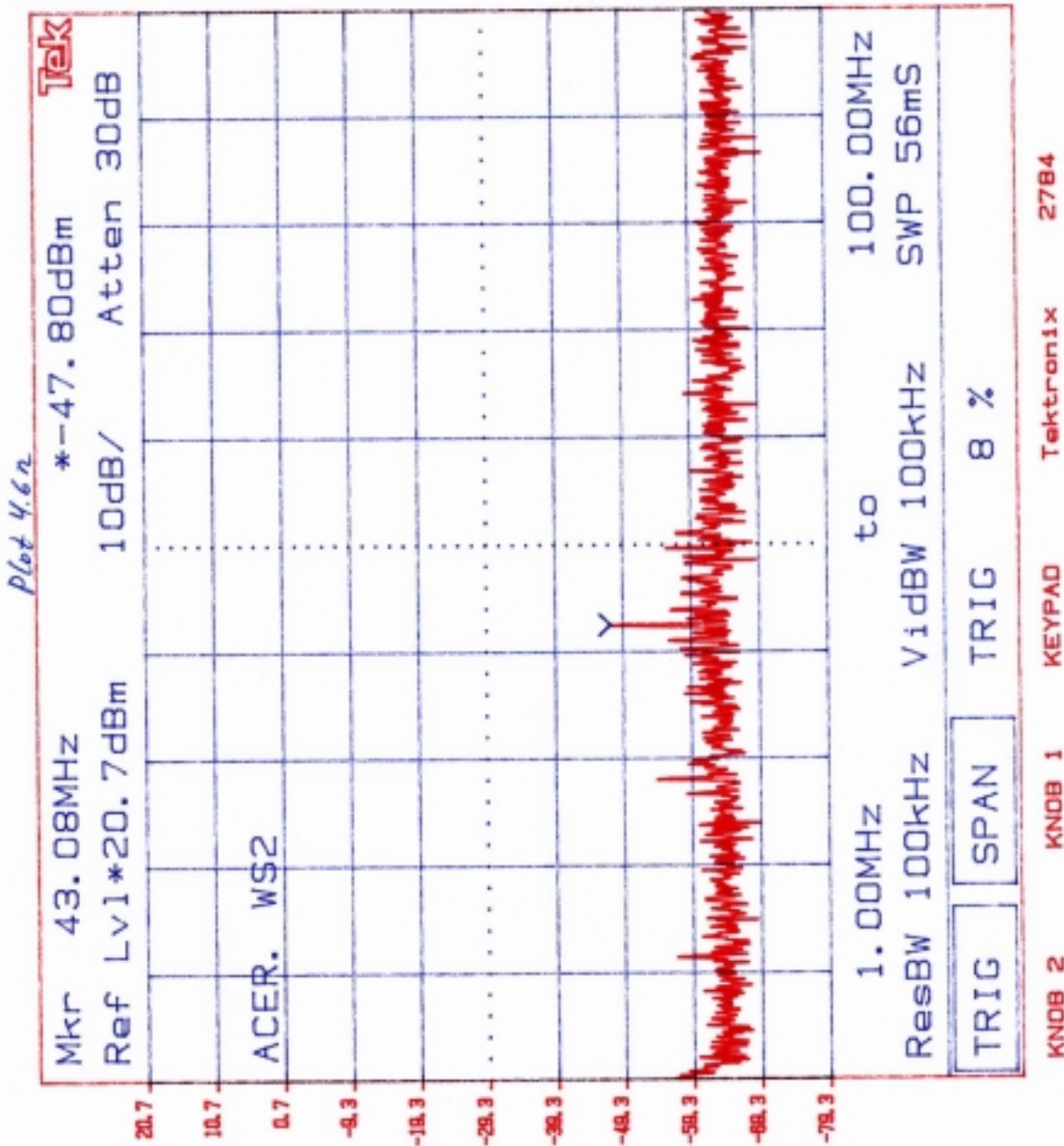
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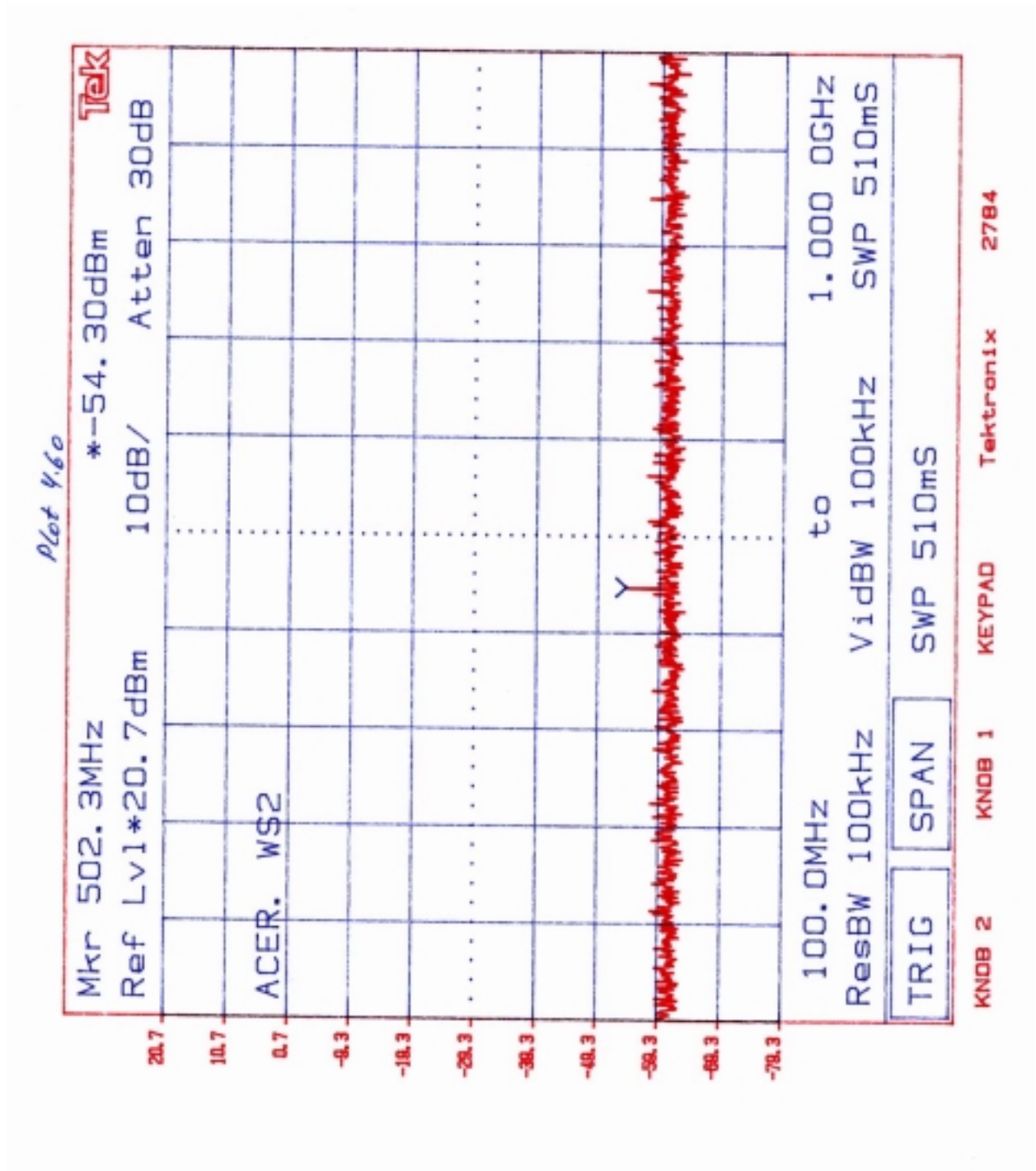
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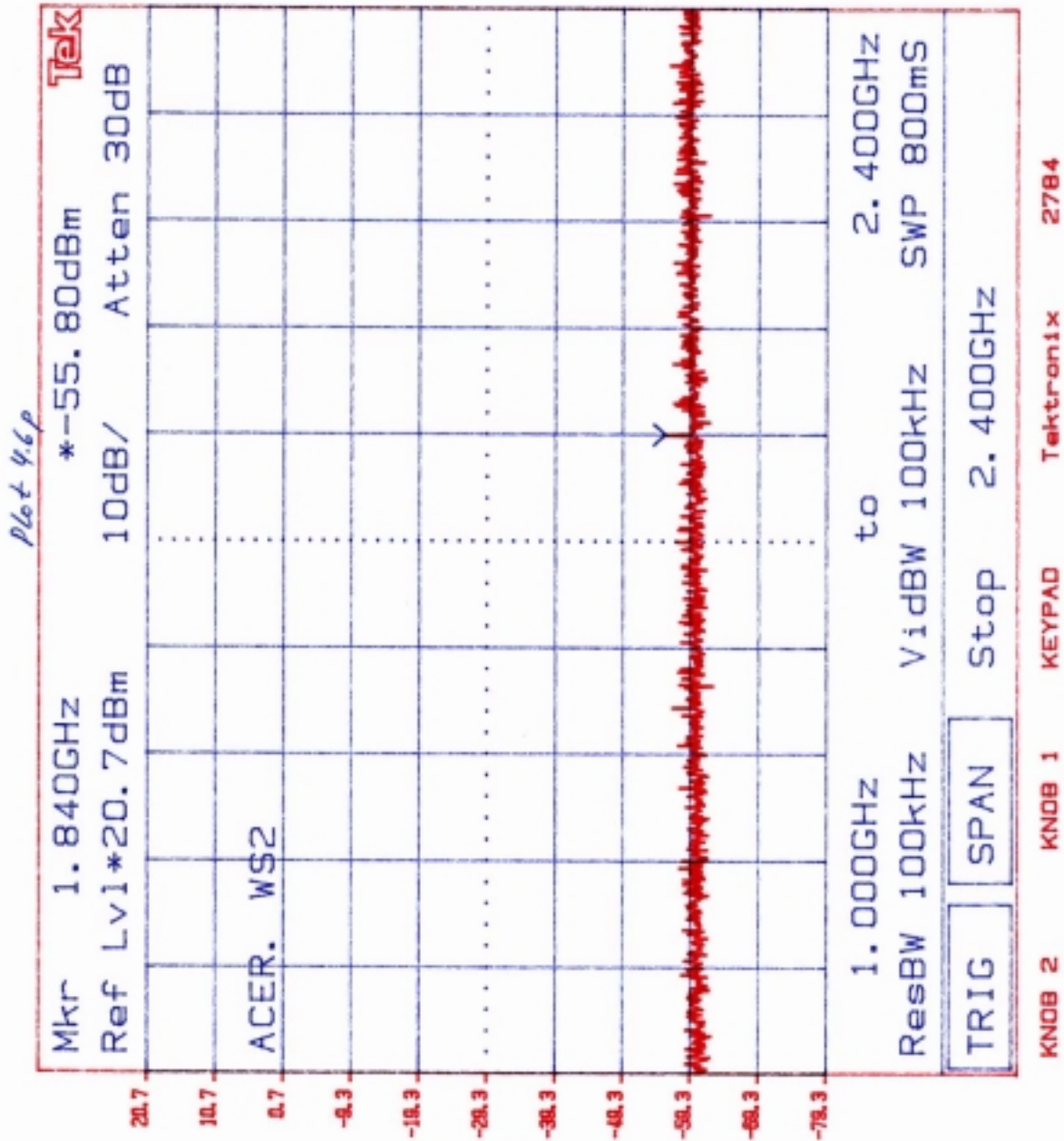
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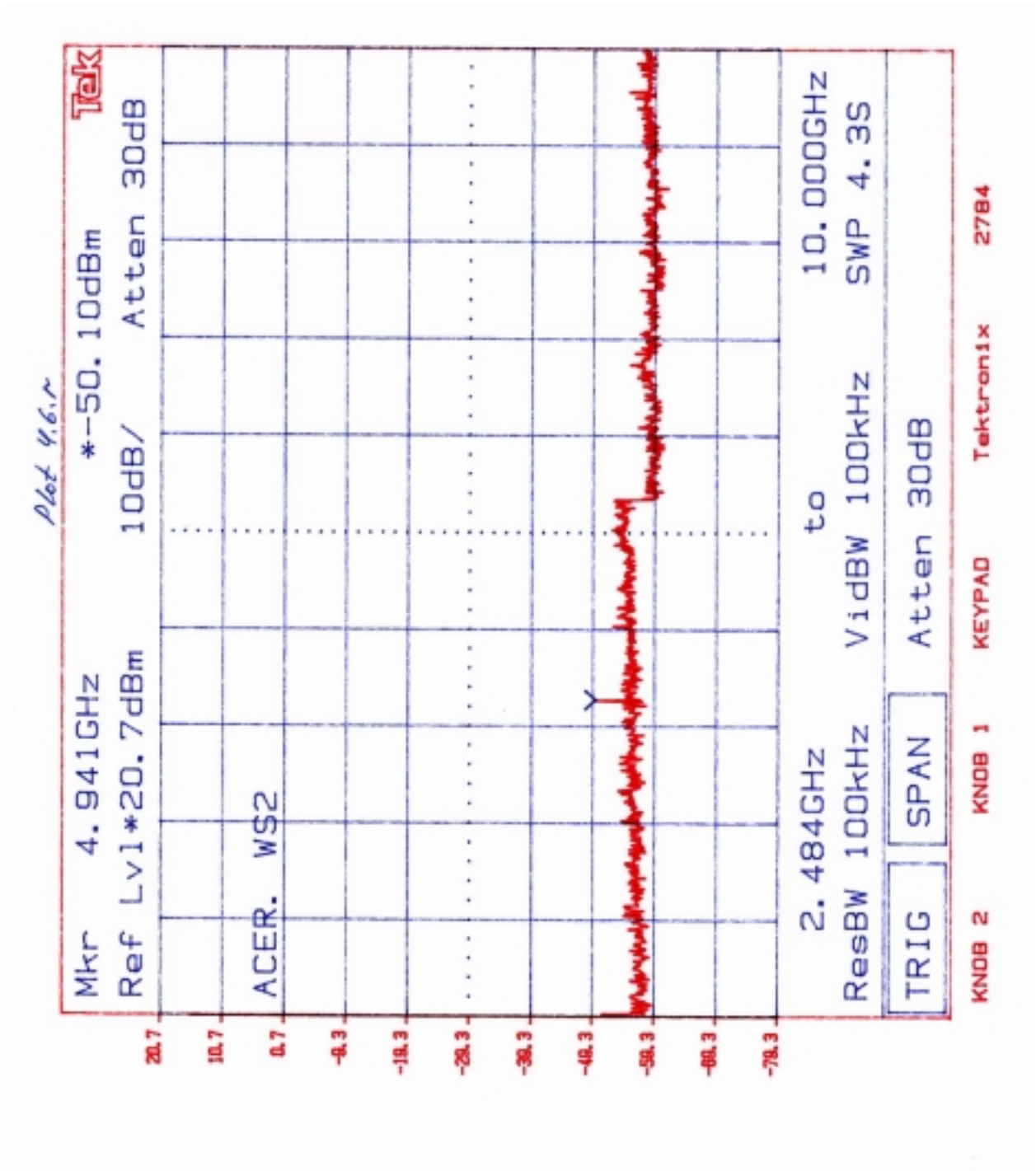
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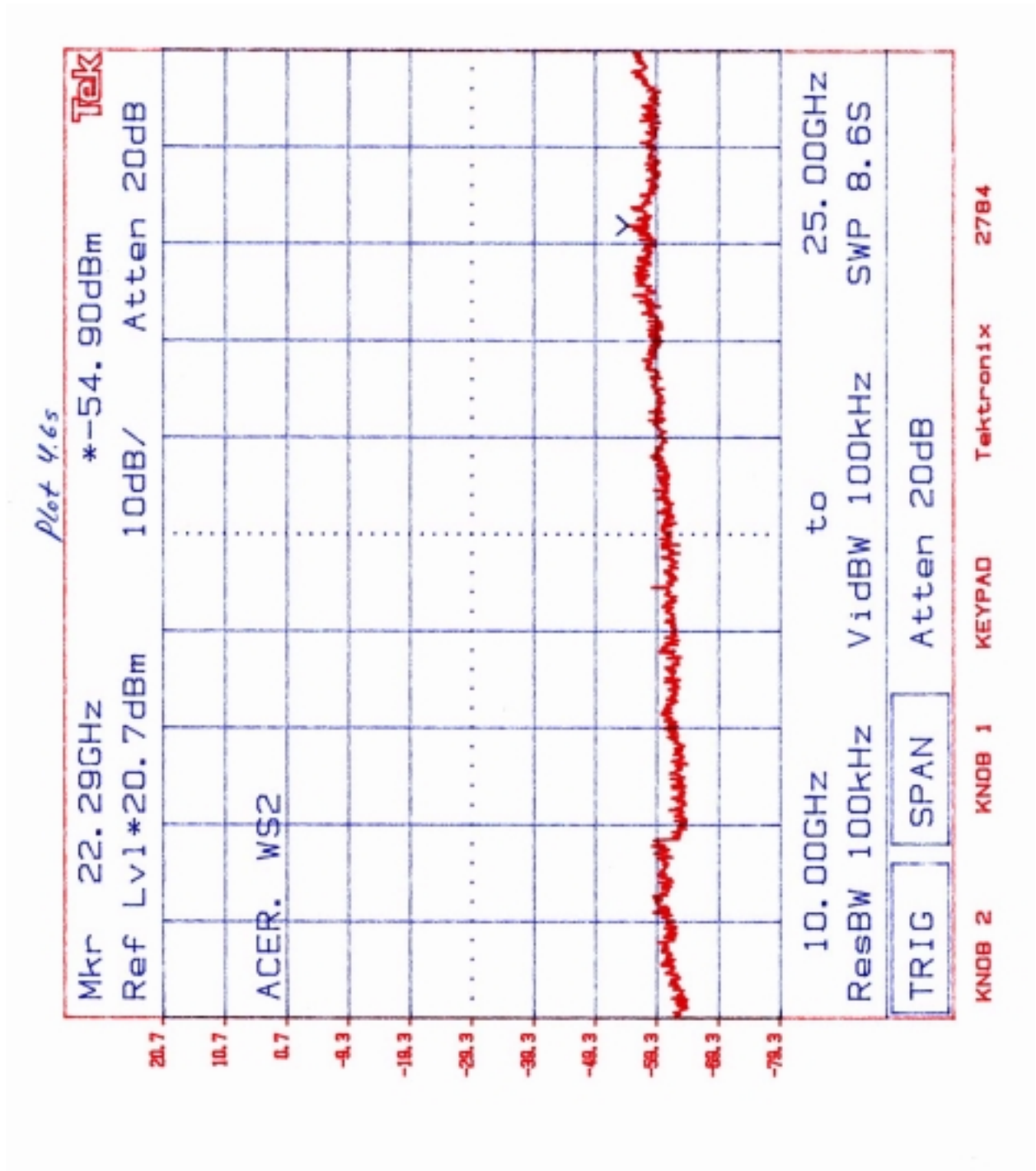
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4.7 Out of Band Radiated Emissions (for emissions in § 4.6 above that are less than 26 dB below carrier), FCC Ref: 15.247(c)

For out of band emissions that are close to or that exceed the 20 dB attenuation requirement described in the specification, radiated measurements were performed at a 3 m separation distance to determine whether these emissions complied with the general radiated emission requirement.

Test results are attached.

Not required, all emissions more than 26 dB below fundamental

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4.8 Transmitter Radiated Emissions in Restricted Bands, FCC Ref: 15.247(c),

Radiated emission measurements were performed from 30 MHz to 25000 MHz. Analyzer resolution is 100 kHz or greater for frequencies from 30 MHz to 1000 MHz and 1 MHz for frequencies above 1000 MHz.

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included. All measurements were performed with peak detection and average detection (above 1 GHz) unless otherwise specified.

On the following pages, the emissions on the harmonics frequencies, the limits, and the margin of compliance are presented. These tests were made when the transmitter is in full radiated power.

The additional test was performed to show compliance with the requirement at the band-edge frequency 2483.5 MHz and up to 2500 MHz and at 2390.0 MHz and down to 2310 MHz.

The transmitter was set up to transmit at the highest channel 2480 MHz. Then the field strength (E_0) was measured at 2480 MHz. The spectrum analyzer with resolution bandwidth 1 MHz was connected to the antenna terminal of the transmitter. The marker was set up at 2483.5 MHz and Δ (delta) between 2480 MHz and 2483.5 MHz was measured (see plots # 4.8a, 4.8b). The field strength at 2483.5 MHz was calculated as $E_0 - \Delta$.

The transmitter was set up to transmit at the Lowest channel 2402 MHz. Then the field strength (E_1) was measured at 2402 MHz. The spectrum analyzer with resolution bandwidth 1 MHz was connected to the antenna terminal of the transmitter. The marker was set up at 2390 MHz and Δ (delta) between 2402 MHz and 2390 MHz was measured (see plot # 4.8c, 4.8d). The field strength at 2390 MHz was calculated as $E_1 - \Delta$.

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Freq. MHz	Detect or P/A	Reading dB(uV)	Antenna Factor dB(1/m)	Preamp dB	Cable Loss dB	Field Strength dB(uV/m)	Limit dB(uV/m)	Margin dB
2480	A	81.3	30.5	0	2.3	114.1	-	-

2480 2480.5	R P	82.0	30.5	0	2.3	45.4.8*	54.0	-9.0
2483.5	P	-	-	-	-	45.7 *	74.0	-28.3
2500	A	-	-	-	-	47.1 **	54.0	-6.9
2402	A	78.4	30.5	0	2.3	111.2	-	-
2402	P	79.0	30.5	0	2.3	111.8	-	-
2390	A	-	-	-	-	38.6 ***	54.0	-15.4
2390	P	-	-	-	-	39.2 ***	74.0	-34.8
2382	A	-	-	-	-	41.9 ****	54.0	-12.1

* from plot # 4.8a

** from plot # 4.8b

*** from plot # 4.8c

****from plot # 4.8d

For transmitters with hopping channel ON times < 100 msec, DUTY CYCLE CORRECTION is permitted for emissions above 1000 MHZ:

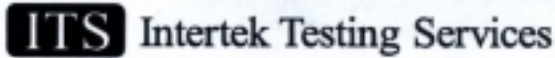
The Duty Cycle was calculated from the data presented on plots 4.8e, 4.8f as follows

$$DC = 20 \log (12.8H^4/100) = -5.8 \text{ dB}$$

Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

Date of Test: May 24-28, 1999



Radiated Emissions Test Data

Company: Acer	Model #: WS(2)	Standard:	FCC § 15.247 (R.B.)
EUT: 2.4 GHz FHSS	S/N #:	Limits:	11
Project #:	Test Date: 5/27/99	Test Distance:	3 meters
Test Mode: Xmit 2402 MHz	Engineer: David C.	Duty Relaxation:	0 dB

Number:	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
	8	7	17	8	12	10	12	0	0	0
Model:	EMCO 3115	EM LPA-25	EMCO 3160	CDL P100 0	ALO 400	AFT16355	Gm_M+L	None	None	None

Frequency	Reading	Detector	Ant #	Amp #	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(µV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dB(µV/m)	dB(µV/m)	dB
4804	41.9	Peak	8	8	H	34.0	28.1	3.2	0.0	51.0	74.0	-23.0
4804	38.0	Ave.	8	8	H	34.0	28.1	3.2	0.0	47.1	54.0	-6.9
7306	40.7	Peak	8	8	H	36.8	28.0	4.3	0.0	53.8	74.0	-20.2
7306	31.7	Ave.	8	8	H	36.8	28.0	4.3	0.0	44.8	54.0	-9.2
12010	43.7	Peak	8	10	H	44.1	39.1	5.9	0.0	54.6	74.0	-19.5
12010	31.9	Ave.	8	10	H	44.1	39.1	5.9	0.0	42.8	54.0	-11.3
19216	42.5*	Peak	17	12	H	40.2	7.1	23.3	-9.5	57.0	74.0	-17.0
19216	30.8*	Ave.	17	12	H	40.2	7.1	23.3	-9.5	45.3	54.0	-8.7
21618	43.4*	Peak	17	12	H	40.3	7.5	24.0	-9.5	57.7	74.0	-16.3
21618	33.8*	Ave.	17	12	H	40.3	7.5	24.0	-9.5	47.9	54.0	-6.1

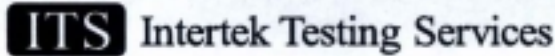
* Noise Floor with RBW = 300 kHz

Notes:	a) D.C.F.: Distance Correction Factor
	b) Insert. Loss (dB) = Cable A + Cable B + Cable C.
	c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).
	d) Negative signs (-) in Margin column signify levels below the limits.

Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

Date of Test: May 24-28, 1999



Radiated Emissions Test Data

Company: Acer	Model #: WS(2)	Standard:	FCC § 15.247 (R.B.)
EUT: 2.4 GHz FHSS	S/N #:	Limits:	11
Project #:	Test Date: 5/27/99	Test Distance:	3 meters
Test Mode: Xmit 2442 MHz	Engineer: David C.	Duty Relaxation:	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	8	7	17	8	12	10	12	0	0	0
Model:	EMCO 3115	EM LPA-25	EMCO 3160	CDL P100 0	ALO 400	AFT16505	GM_M+L	None	None	None

Frequency	Reading	Detector	Ant #	Amp #	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(µV)	Pk/Avg			H/V	dB(1m)	dB	dB	dB	dB(µV/m)	dB(µV/m)	dB
4884	41.1	Peak	8	8	H	34.0	28.1	3.2	0.0	50.2	74.0	-23.8
4884	36.1	Ave.	8	8	H	34.0	28.1	3.2	0.0	45.2	54.0	-8.8
7326	43.1	Peak	8	8	H	36.8	28.0	4.3	0.0	56.2	74.0	-17.8
7326	36.8	Ave.	8	8	H	36.8	28.0	4.3	0.0	49.9	54.0	-4.1
12210	43.7	Peak	8	10	H	44.1	39.1	5.9	0.0	54.6	74.0	-19.5
12210	31.9	Ave.	8	10	H	44.1	39.1	5.9	0.0	42.8	54.0	-11.3
19536	42.5*	Peak	17	12	H	40.2	7.1	23.3	-9.5	57.0	74.0	-17.0
19536	30.8*	Ave.	17	12	H	40.2	7.1	23.3	-9.5	45.3	54.0	-8.7
21978	43.4*	Peak	17	12	H	40.3	7.5	24.0	-9.5	57.7	74.0	-16.3
21978	33.6*	Ave.	17	12	H	40.3	7.5	24.0	-9.5	47.9	54.0	-6.1

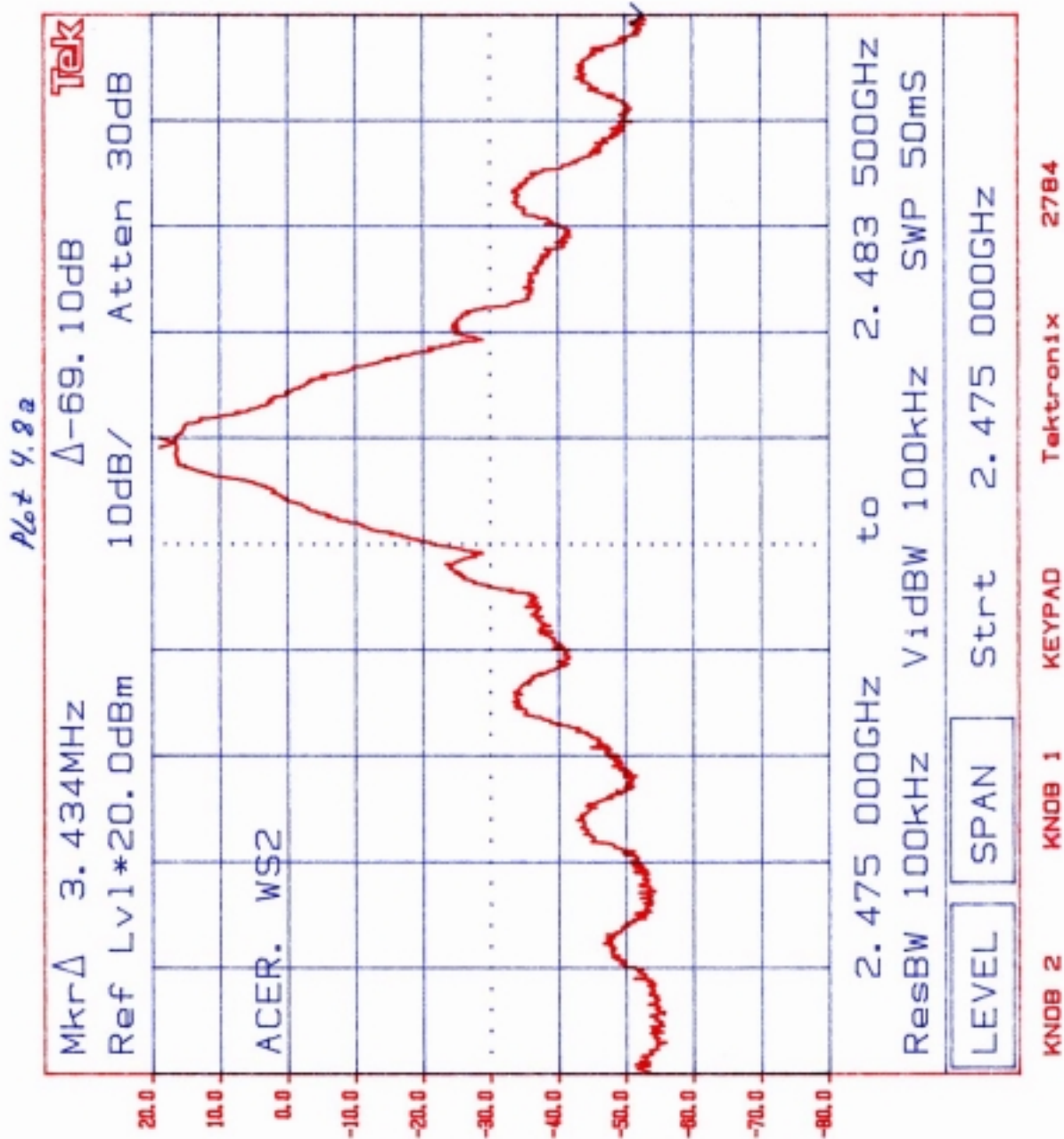
* Noise Floor with RBW = 300 kHz

Notes:	a) D.C.F.: Distance Correction Factor b) Insert. Loss (dB) = Cable A + Cable B + Cable C. c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only). d) Negative signs (-) in Margin column signify levels below the limits.
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Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

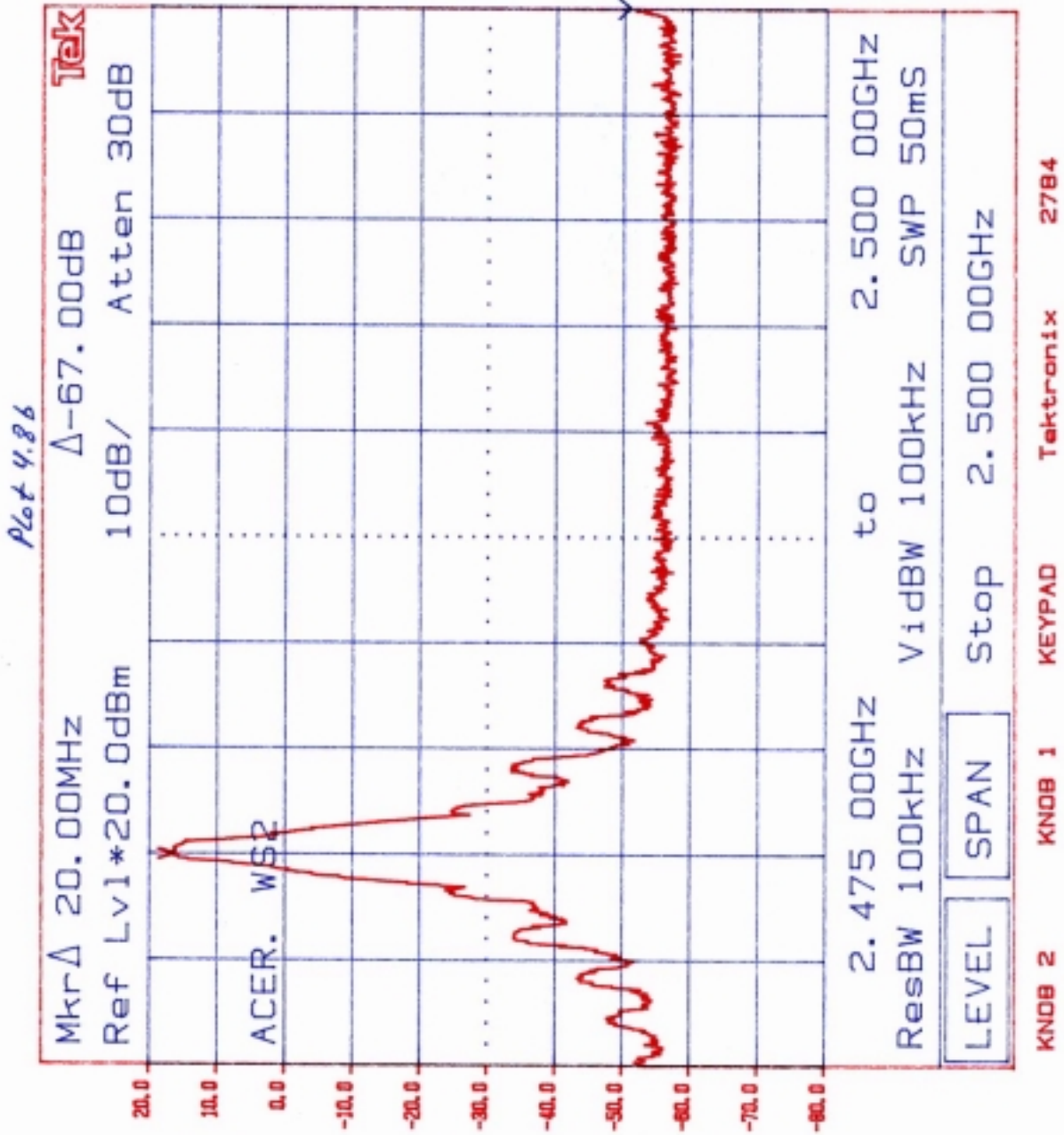
Date of Test: May 24-28, 1999



Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

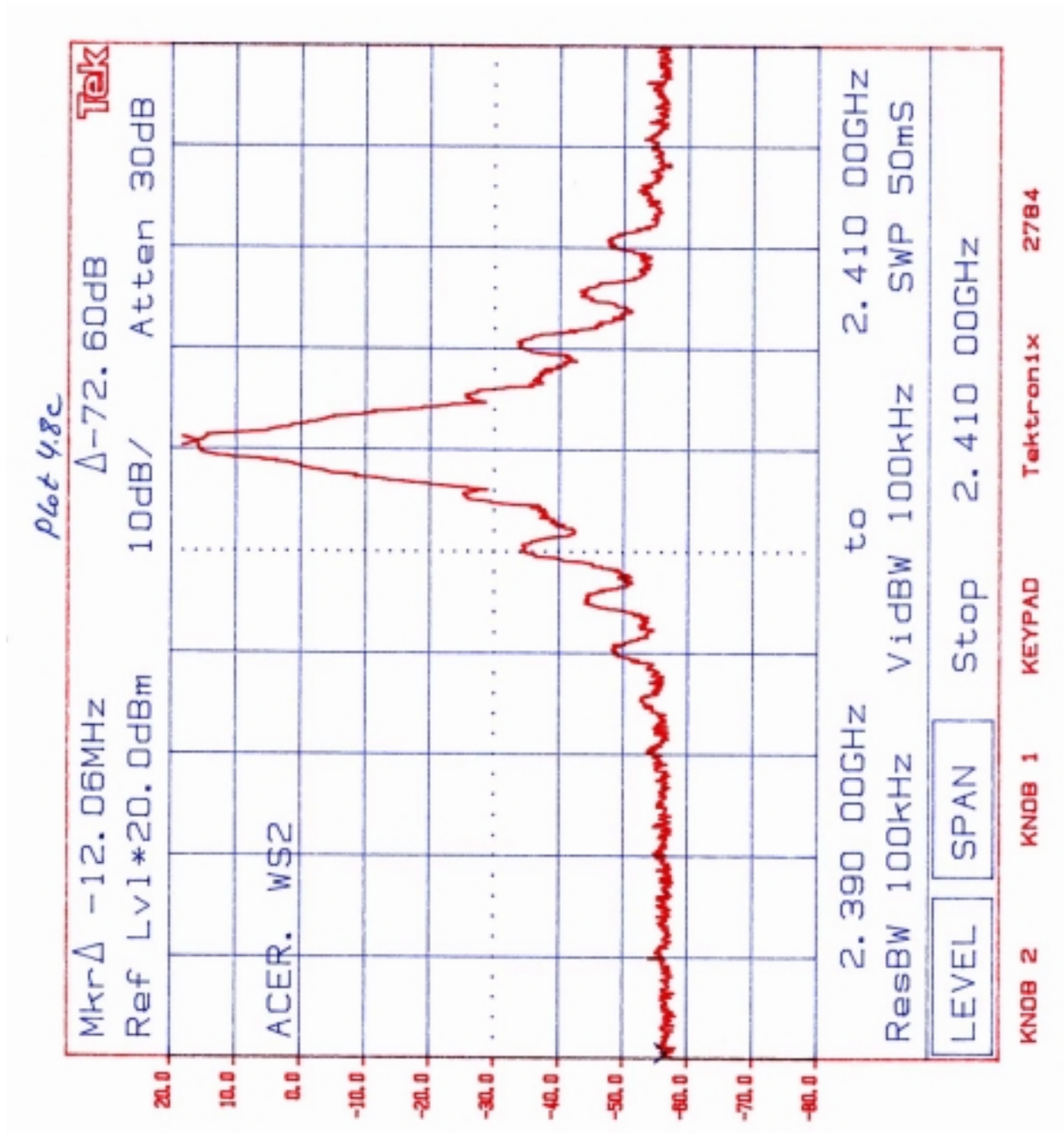
Date of Test: May 24-28, 1999



Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

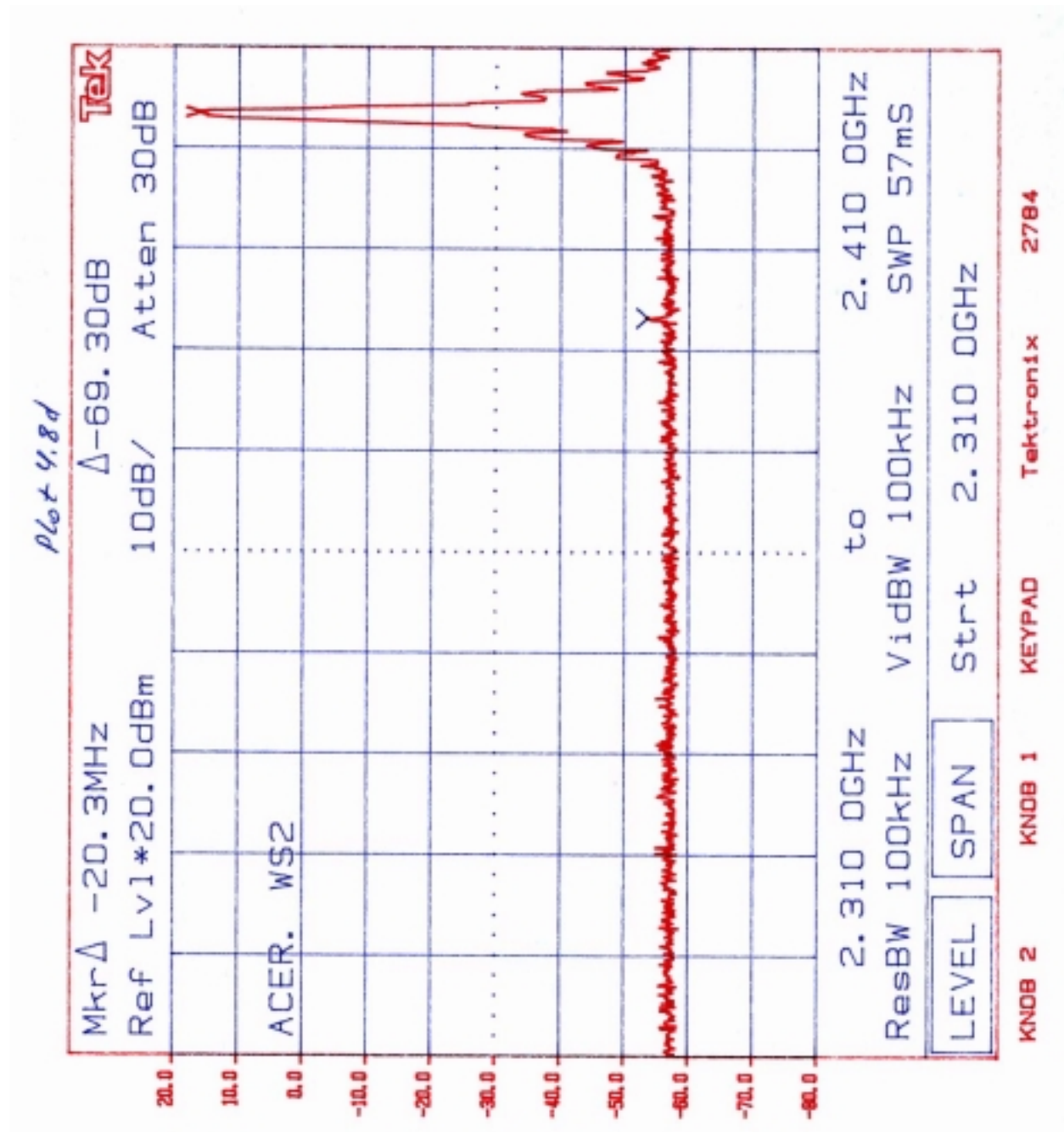
Date of Test: May 24-28, 1999



Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

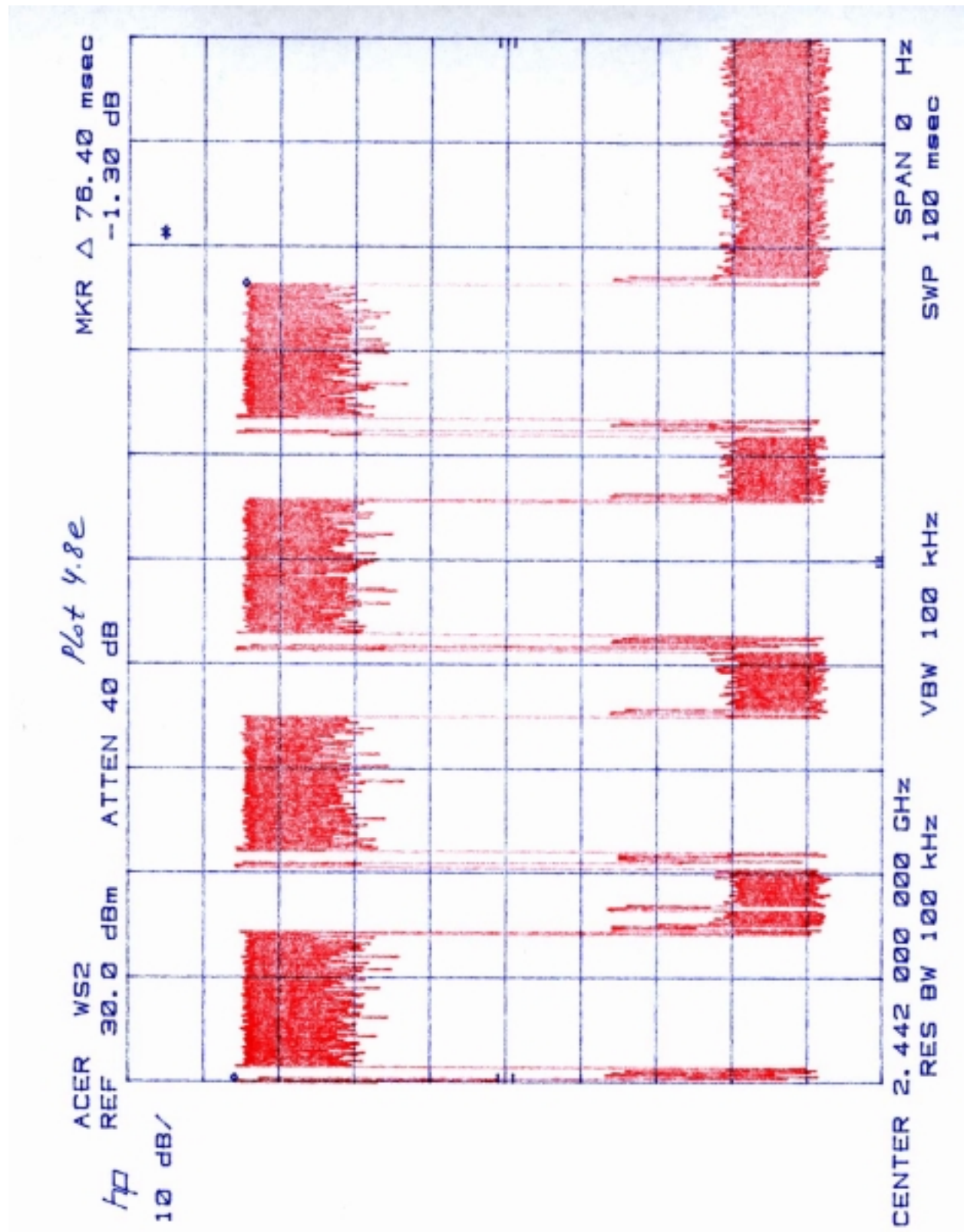
Date of Test: May 24-28, 1999



Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

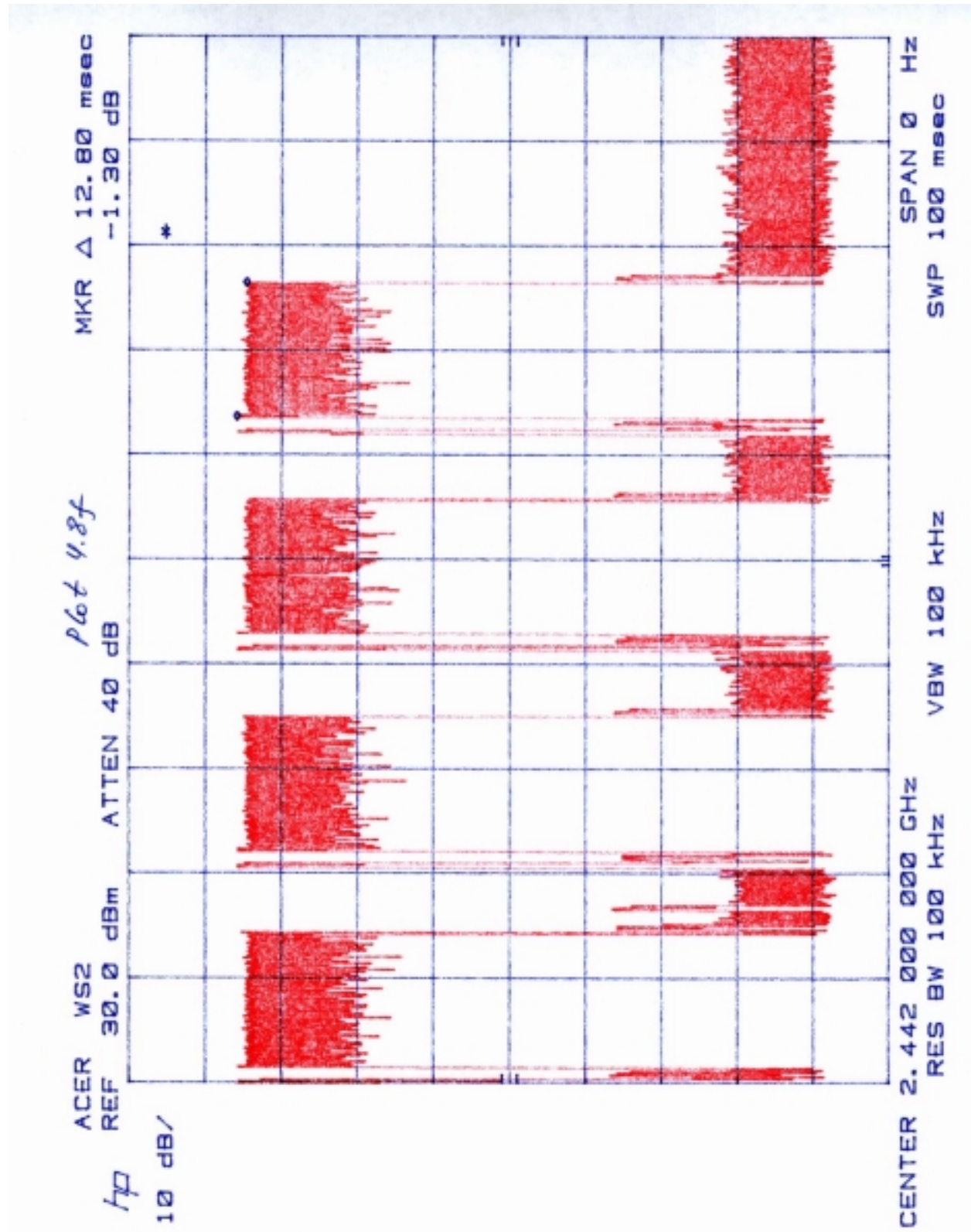
Date of Test: May 24-28, 1999



Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

Date of Test: May 24-28, 1999

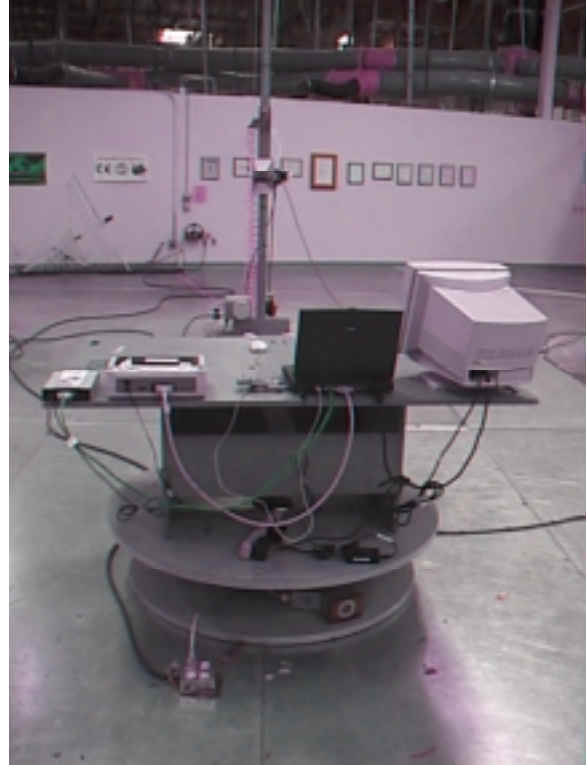
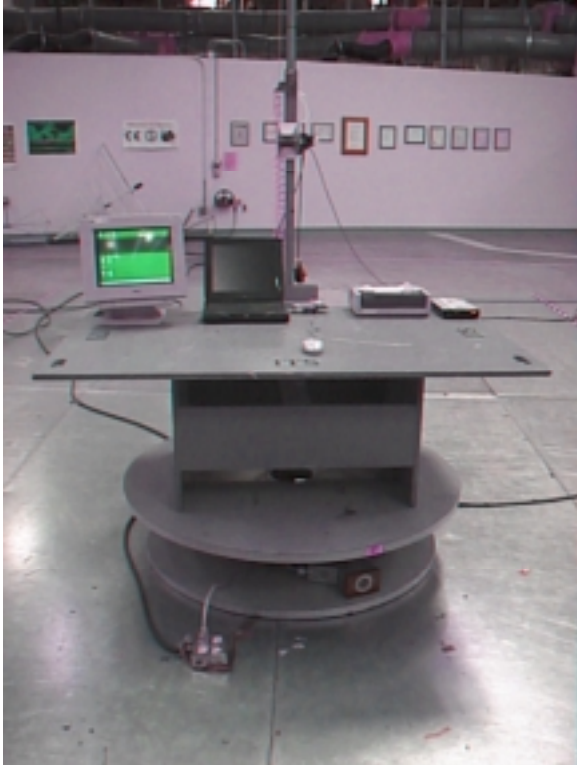


Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

Date of Test: May 24-28, 1999

4.9 Radiated Emission Configuration Photographs



4.10 Radiated Emissions from Digital Section of Transceiver, FCC Ref: 15.109

Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

Date of Test: May 24-28, 1999

Test results are presented in a ADoC≡report.

Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

Date of Test: May 24-28, 1999

4.11 Radiated Emissions from Receiver Section of Transceiver
(L.O. Radiation), FCC Ref: 15.109, 15.111

Not required - EUT operation above
960 MHz only

Not Applicable - EUT is transmitter only

Not performed; exempt until June 1999

Test results are attached

4.12 AC Line Conducted Emission, FCC Rule 15.207:

Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

Date of Test: May 24-28, 1999

Test results are presented in a ADoC≡report.

Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

Date of Test: May 24-28, 1999

5.0 Equipment Photographs

Photographs of the EUT are attached.

Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

Date of Test: May 24-28, 1999

6.0 Product Labelling

6.1 Label Artwork

6.2 Label Location

See attached pages.

Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

Date of Test: May 24-28, 1999

7.0 Technical Specifications

7.1 Circuit Diagram

See attached page.

Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

Date of Test: May 24-28, 1999

7.2 Block Diagram

See attached page.

Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

Date of Test: May 24-28, 1999

7.3 Antenna gain and Mounting Information

See attached pages.

Intertek Testing Services - Menlo Park

Acer Advanced Labs. FHSS, FCC ID:

Date of Test: May 24-28, 1999

8.0 Instruction Manual

Attached is a preliminary copy of the Instruction Manual.

Please note that the required FCC Information to the User can be found on Page _____ of this manual.

This manual will be provided to the end-user with each unit sold/leased in the United States.