FCC CERTIFICATION TEST REPORT

for

Adtran, Inc.
901 Explorer Boulevard
Huntsville, AL 35806

FCC ID: HDCTRC582TR1

Rack Mount

August 8, 2000

WLL PROJECT #: 5896X

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STATEMENT OF QUALIFICATIONS

for

Steven Koster

Washington Laboratories, Ltd.

I am a NARTE-Accredited EMC Test Laboratory Engineer with over nineteen years of electronics experience, the last ten years being directly involved in EMI testing. I am qualified to perform EMC testing to the methods described in this test report. The measurements taken within this report are accurate within my ability to perform the tests and within the tolerance of the measuring instrumentation.

By: _____
Steven Koster
Compliance Engineer

Date: January 1, 2000

FCC CERTIFICATION TEST REPORT

for

FCC ID: HDCTRC582TR1

1.0 Introduction

This report has been prepared on behalf of Adtran, Inc. to support the attached Application for Equipment Authorization. The test and application are submitted for an Intentional Radiator under Part 15.247 of the FCC Rules and Regulations. The Equipment Under Test was the Adtran Inc. TRACER 2xT1 Rackmount, 5.8 GHz Direct Sequence Spread Spectrum transmitter.

All measurements herein were performed according to the 1992 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and field Strength Instrumentation. Calibration checks are made periodically to verify proper performance of the measuring instrumentation.

All measurements are performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

All results reported herein relate only to the equipment tested. The measurement uncertainty of the data contained herein is ±2.3 dB. Refer to Appendix A for Statement of Measurement Uncertainty. This report shall not be used to claim product endorsement by NVLAP or any agency of the US Government.

1.1 Summary

The Adtran, Inc. TRACER 2xT1 (Rack Mount) DSSS complies with the limits for an Intentional Radiator under Part 15.247 of the FCC Rules and Regulations.

2.0 Description of Equipment Under Test (EUT)

The Adtran, Inc. TRACER 2xT1 (Rack Mount) DSSS (EUT) is a 5.8 GHz DSSS transmitter that provides dual T1 transport by microwave link. Each end of the TRACER link is composed of two units; the baseband processor (BBP) and the radio frequency converter (RFC). Both the RFC and BBP are housed in a 1U (1.75”), 19” rack mountable package.

Two configurations of the TRACER 2xT1 RFC are available; the rack mountable unit as described in this report, and a Mast Mount unit (separate certification, FCC ID: HDCTRC582TM1). The two RFC configurations are identical in circuitry and operation. The only difference between the units is the external housing. This report concerns the testing and results of the rack mountable configuration. The 5.8 GHz TRACER operates on Plan A, Tx = 5747 MHz, Rx = 5827 MHz or Plan B, Tx = 5827 MHz, Rx = 5747 MHz.

Two DS1/DSX1 (T1) interfaces are provided on the rear of the BBP. The DS1/DSX1 interface provides connections up to 1800 meters from T1 equipment. A single coaxial cable connects the BBP to the RFC and another connects the RFC to the antenna. In addition to the DS1/DSX1 interface, the TRACER has the following I/O ports:

RS232 port for configuration and diagnostic

Terminal Strip for two sets of alarm contacts

The TRACER is powered via 48VDC provided by an external power adapter; Adtran Model: 1360DSK24VL1.

The EUT was evaluated with the following antenna types:

- Directional Flat Panel Antenna; Gabriel Electronics, Inc.; Model DFPD2-52; Gain: 28dBi
- Standard Plane Polarized Parabolic Dish Antenna; Gabriel Electronics, Inc.; Model SSP2-52B; Gain: 28.5dBi

3.0 Test Configuration

To complete the test configuration required by the FCC, the transmitter was tested in a typical setup for the equipment as in normal installation. Both the BBP and RFC were placed on the test table and the antenna was mounted to a post attached to the test table. All testing was performed at 120VAC.

	I/O Ports	I/O Cables
BBP:	RS 232	1 meter cable, shielded, unterminated
	(2) DS1/DSX-1 Interfaces, RJ-48C	2 meter cable, non-shielded, EUT to termination
	(2) RJ-45 (management ports)	2 meter, non-shielded, unterminated
	N-Type connector (IF Port)	1 meter, shielded coax, BBP to RFC
	MAJ & MIN (Alarm Outputs)	1 meter 6-wires, non-shielded, unterminated
RFC:	N-Type (IF Port)	1 meter, shielded coax, BBP to RFC
	N-Type (RF Port)	1 meter, shielded coax, RFC to Antenna

3.1 Testing Algorithm

The transmitter was set to continuously transmit for testing. During testing, cables were manipulated to ensure worst case emissions.

Worst case emissions are recorded in the data tables.

3.2 Conducted Emissions Testing

The EUT was placed on an 80 cm high 1 x 1.5 m non-conductive table above a ground plane. Power to the EUT was provided through a Solar Corporation 50 Ω/50 µH Line Impedance Stabilization Network bonded to a 3 x 2 meter ground plane. The LISN has its AC input supplied from a filtered AC power source. Power and data cables were moved about to obtain maximum emissions.

The 50 Ω output of the LISN was connected to the input of the spectrum analyzer and the emissions in the frequency range of 450 kHz to 30 MHz was measured. The detector function was set to quasi-peak or peak, as appropriate, and the resolution bandwidth during testing was at least 9 kHz, with all post-detector filtering no less than 10 times the resolution bandwidth.

Data is recorded in Table 1.

Table 1
FCC 15.247 Conducted Emissions Data

CLIENT: Adtran
MODEL NO: TRACER, 5.8 GHz DSSS Unit, Rackmount
DATE: 8/3/00
BY: S. Lavorata
JOB #: 5775x

LINE 1 - NEUTRAL

Frequency MHz	Voltage (PEAK) dBuV	Voltage uV	FCC Limit uV	Margin dB
0.578	41.0	112.2	250	-7.0
0.760	42.2	128.8	250	-5.8
3.87	43.1	142.9	250	-4.9
9.98	42.8	138.0	250	-5.2
19.50	45.5	188.4	250	-2.5
24.72	44.0	158.5	250	-4.0

LINE 2 - PHASE

Frequency MHz	Voltage (PEAK) dBuV	Voltage uV	FCC Limit uV	Margin dB
0.72	43.2	144.5	250	-4.8
4.21	43.6	151.4	250	-4.4
10.60	44.3	164.1	250	-3.7
19.43	45.0	177.8	250	-3.0
19.63	42.3	130.3	250	-5.7
23.71	43.4	147.9	250	-4.6

3.3 Transmitter Spurious Emissions Testing

Part 15.247(c) specifies spurious emission requirements for direct sequence spread spectrum transmitters. To show compliance with these requirements, the following three tests were performed:

1. Conducted Spurious Emissions using a direct connection to the RF Output (antenna port) to show 20 dBc.

2. Radiated emissions test to determine compliance with the requirements for emissions that fall within the restricted bands listed in 15.205. Both antennas listed in section 2.0 were tested.

3.3.1 Radiated Emissions Testing

The EUT was placed on an 80 cm high 1 x 1.5 meters non-conductive motorized turntable for radiated testing on a 3 meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Biconilog and standard gain horn broadband antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured.

The output from the antenna was connected, via a preselector or preamplifier, to the input of the spectrum analyzer. The detector function was set to quasi-peak for frequencies below 1000 MHz and peak or average for frequencies above 1000 MHz. For frequencies below 1000 MHz, the measurement bandwidth on the spectrum analyzer system was set to at least 120 kHz, with all post-detector filtering no less than 10 times the measurement bandwidth. For average measurements on frequencies above 1000 MHz, the resolution bandwidth on the spectrum analyzer system was set to 1 MHz and the video bandwidth on the spectrum analyzer system was set to 10 Hz.

3.3.2 Radiated Data Reduction and Reporting

To convert the raw spectrum analyzer radiated data into a form that can be compared with the FCC limits, it is necessary to account for various calibration factors that are supplied with the antennas and other measurement accessories. These factors are grouped into a composite antenna factor (AFc) and are supplied in the AFc column of Table 2. The AFc in dB/m is algebraically added to the Spectrum Analyzer Voltage in dbµV to obtain the Radiated Electric Field in dBµV/m. This level is then compared with the FCC limit.

Example:

Spectrum Analyzer Voltage: VdBµV

Composite Antenna Factor: AFcdB/m

Electric Field: EdBµV/m = VdBµV + AFcdB/m

To convert to linear units: Eµ V/m = antilog (EdBµV/m/20)

Average and Peak data for radiated emissions detected within the restricted bands are recorded in Table 2A for the Flat Panel Antenna and in Table 2B for the Parabolic Dish Antenna.

Table 2A: Flat Panel Antenna
FCC 15.247(c) 3M Radiated Emissions Data
Restricted Band Spurious Emissions

CLIENT: Adtran
MODEL NO: TRACER 5.8 GHz DSSS Unit, Rackmount, Plan B
DATE: June 2, 2000
BY: S. Lavorata
JOB #: 5896X
Tx Frequency: 5.827 GHz
Antenna: Flat Panel, Model DFPD2-52; Gain: 28dBi

Frequency	Polarity	Azimuth	Ant Height	SA Level (QP)	AFc	E-Field	E-Field	Limit	Margin
MHz	H/V	Degree	m	dBuV	dB/m	dBuV/m	uV/m	uV/m	dB
252.10	H	0.00	1.5	18.4	14.5	32.9	44.0	200.0	-13.1
252.10	V	0.00	1.0	13.7	14.5	28.2	25.6	200.0	-17.8

Measurements Above 1 GHz (Restricted Bands)

Frequency	Polarity	Azimuth	Ant Height	SA Level (AVG)	AFc	E-Field	E-Field	Limit	Margin
MHz	H/V	Degree	m	dBuV	dB/m	dBuV/m	uV/m	uV/m	dB
1008.94	V	315.00	1.3	48.7	-12.7	36.0	63.0	500.0	-18.0
1050.00	V	22.50	1.0	39.8	-12.3	27.5	23.6	500.0	-26.5
1059.08	V	225.00	1.0	49.2	-12.3	36.9	70.4	500.0	-17.0
1412.24	V	180.00	1.0	32.4	-9.5	22.9	14.0	500.0	-31.1
1512.57	V	180.00	1.0	33.4	-8.8	24.6	16.9	500.0	-29.4
1719.79	V	180.00	1.0	30.8	-7.6	23.2	14.4	500.0	-30.8
1722.18	V	180.00	1.0	31.1	-7.6	23.5	15.0	500.0	-30.5
4888.30	V	0.00	1.0	24.4	-2.5	21.9	12.5	500.0	-32.0
7475.00	V	0.00	1.0	38.7	2.2	40.9	110.9	500.0	-13.1
7475.00	H	0.00	1.0	39.1	2.2	41.3	116.1	500.0	-12.7
11654.20	V	0.00	1.0	35.0	5.2	40.2	102.0	500.0	-13.8
11654.20	H	0.00	1.0	35.2	5.2	40.4	104.4	500.0	-13.6

Table 2A (Continued)
FCC 15.247(c) 3M Radiated Emissions Data
Restricted Band Spurious Emissions

CLIENT: Adtran
MODEL NO: TRACER 5.8 GHz DSSS Unit, Rackmount, Plan B
DATE: June 2, 2000
BY: S. Lavorata
JOB #: 5896X
Tx Frequency: 5.827 GHz
Antenna: Flat Panel, Model DFPD2-52; Gain: 28dBi

Peak Measurements Above 1 GHz (Restricted Bands)

Frequency MHz	Polarity H/V	Azimuth Degree	Ant Height m	SA Level (Peak) dBuV	AFc dB/m	E-Field dBuV/m	E-Field uV/m	Limit uV/m	Margin dB	
1008.94	V	315.00	1.3	58.8	-12.7	46.1	201.5	5000.0	-27.9	
1050.00	V	22.50	1.0	45.3	-12.3	33.0	44.5	5000.0	-41.0	
1059.08	V	225.00	1.0	57.0	-12.3	44.7	172.8	5000.0	-29.2	
1412.24	V	180.00	1.0	49.7	-9.5	40.2	102.3	5000.0	-33.8	
1512.57	V	180.00	1.0	55.2	-8.8	46.4	207.8	5000.0	-27.6	
1719.79	V	180.00	1.0	66.5	-7.6	58.9	879.1	5000.0	-15.1	
1722.18	V	180.00	1.0	68.4	-7.6	60.8	1095.7	5000.0	-13.2	
4888.30	V	0.00	1.0	38.1	-2.5	35.6	60.5	5000.0	-38.3	
7475.00	V	0.00	1.0	49.0	2.2	51.2	363.1	5000.0	-22.8	Amb
7475.00	H	0.00	1.0	49.3	2.2	51.5	375.8	5000.0	-22.5	Amb
11654.20	V	0.00	1.0	46.5	5.2	51.7	383.5	5000.0	-22.3	Amb
11654.20	H	0.00	1.0	46.5	5.2	51.7	383.5	5000.0	-22.3	Amb
17482.08	V	0.00	1.0	47.3	10.9	58.2	810.2	5000.0	-15.8	Amb
17482.08	H	0.00	1.0	47.3	10.9	58.2	810.2	5000.0	-15.8	Amb
23310.00	V	0.00	1.0	18.6	40.5	59.1	901.6	5000.0	-14.9	Amb
23310.00	H	0.00	1.0	18.6	40.5	59.1	901.6	5000.0	-14.9	Amb

Table 2B: Parabolic Dish Antenna
FCC 15.247(c) 3M Radiated Emissions Data
Restricted Band Spurious Emissions

CLIENT: Adtran
MODEL NO: TRACER 5.8 GHz DSSS Unit, Rackmount, Plan B
DATE: June 2, 2000
BY: S. Lavorata
JOB #: 5896X
Tx Frequency: 5.827 GHz
Antenna: Parabolic Dish, Model SSP2-52B; Gain: 28.5dBi

Frequency MHz	Polarity H/V	Azimuth Degree	Ant Height m	SA Level (QP) dBuV	AFc dB/m	E-Field dBuV/m	E-Field uV/m	Limit uV/m	Margin dB	
252.10	H	0.00	1.5	17.4	14.5	31.9	39.2	200.0	-14.1	
252.10	V	0.00	1.0	13.5	14.5	28.0	25.0	200.0	-18.0	

Measurements Above 1 GHz (Restricted Bands)

Frequency MHz	Polarity H/V	Azimuth Degree	Ant Height m	SA Level (AVG) dBuV	AFc dB/m	E-Field dBuV/m	E-Field uV/m	Limit uV/m	Margin dB	
1008.94	V	315.00	1.3	47.4	-12.7	34.7	54.2	500.0	-19.3	
1050.00	V	22.50	1.0	38.6	-12.3	26.3	20.6	500.0	-27.7	
1059.08	V	225.00	1.0	50.2	-12.3	37.9	79.0	500.0	-16.0	
1512.57	V	180.00	1.0	35.2	-8.8	26.4	20.8	500.0	-27.6	
1719.79	V	180.00	1.0	31.2	-7.6	23.6	15.1	500.0	-30.4	
1722.18	V	180.00	1.0	30.8	-7.6	23.2	14.4	500.0	-30.8	
7475.00	V	0.00	1.0	39.0	2.2	41.2	114.8	500.0	-12.8	Amb
7475.00	H	0.00	1.0	39.0	2.2	41.2	114.8	500.0	-12.8	Amb
11654.20	V	0.00	1.0	34.7	5.2	39.9	98.6	500.0	-14.1	Amb
11654.20	H	0.00	1.0	34.9	5.2	40.1	100.9	500.0	-13.9	Amb

Table 2B (Continued)
FCC 15.247(c) 3M Radiated Emissions Data
Restricted Band Spurious Emissions

CLIENT: Adtran
MODEL NO: TRACER 5.8 GHz DSSS Unit, Rackmount, Plan B
DATE: June 2, 2000
BY: S. Lavorata
JOB #: 5896X
Tx Frequency: 5.827 GHz
Antenna: Parabolic Dish, Model SSP2-52B; Gain: 28.5dBi

Peak Measurements Above 1 GHz (Restricted Bands)

Frequency MHz	Polarity H/V	Azimuth Degree	Ant Height m	SA Level (Peak) dBuV	AFc dB/m	E-Field dBuV/m	E-Field uV/m	Limit uV/m	Margin dB	
1008.94	V	315.00	1.3	56.9	-12.7	44.2	161.9	5000.0	-29.8	
1059.08	V	225.00	1.0	58.1	-12.3	45.8	196.1	5000.0	-28.1	
1512.57	V	180.00	1.0	46.7	-8.8	37.9	78.1	5000.0	-36.1	
1719.79	V	180.00	1.0	63.4	-7.6	55.8	615.2	5000.0	-18.2	
1722.18	V	180.00	1.0	66.8	-7.6	59.2	911.4	5000.0	-14.8	
7475.00	V	0.00	1.0	49.6	2.2	51.8	389.0	5000.0	-22.2	Amb
7475.00	H	0.00	1.0	49.0	2.2	51.2	363.1	5000.0	-22.8	Amb
11654.20	V	0.00	1.0	46.0	5.2	51.2	362.0	5000.0	-22.8	Amb
11654.20	H	0.00	1.0	46.0	5.2	51.2	362.0	5000.0	-22.8	Amb
17482.08	V	0.00	1.0	46.8	10.9	57.7	764.9	5000.0	-16.3	Amb
17482.08	H	0.00	1.0	46.8	10.9	57.7	764.9	5000.0	-16.3	Amb
23310.00	V	0.00	1.0	18.2	40.5	58.7	861.0	5000.0	-15.3	Amb
23310.00	H	0.00	1.0	18.2	40.5	58.7	861.0	5000.0	-15.3	Amb

3.4 Conducted Spurious Emissions Testing

For the Conducted Spurious Emissions testing, the EUT antenna was removed and the cable was connected directly into a spectrum analyzer through a 10 dB attenuator up to 18 GHz and through a 20 dB directional coupler from 18 GHz to 40 GHz. An offset was programmed into the spectrum analyzer to compensate for the loss of the external attenuator or directional coupler. The spectrum analyzer resolution bandwidth was set to 100 kHz and the video bandwidth was set to 1 MHz. The amplitude of the EUT carrier frequency was measured to determine the emissions limit (20 dB below the carrier frequency amplitude). Then all of the emissions outside of the allocated frequency band were scanned up to the tenth harmonic of the carrier.

Spectrum analyzer plots of the spurious emissions from 30MHz up to 40GHz are in Exhibit 1.

3.5 Carrier Bandwidth Testing

The EUT antenna was removed and connected directly into the spectrum analyzer input with a short length of coaxial cable. The analyzer resolution bandwidth was set to 100 kHz and the video bandwidth was set to 1 MHz. The highest peak of the carrier was centered on the analyzer display. An external attenuator was used to confirm that the transmitter input was not overloading the spectrum analyzer input. The 6dB bandwidth of the modulated carrier was measured and verified to be at least 500kHz. The actual measured 6dB bandwidth measured is 22.08MHz for Frequency Plan A and 21.75MHz for Frequency Plan B.

Spectrum analyzer plot of the 6dB bandwidth is located in Exhibit 2.

3.6 Power Output Testing

The EUT antenna was removed and connected directly into the spectrum analyzer input with a short length of coaxial cable. The analyzer resolution and video bandwidths were set to 5 MHz and 3 MHz respectively. The highest peak of the carrier was centered on the analyzer display. An external attenuator was used to confirm that the transmitter input was not overloading the spectrum analyzer input. The peak power in dBm was measured and compared to the FCC limit.

The measured peak output power was 19.93 dBm at 5748.35 MHz for Frequency Plan A and 20.07 dBm at 5829.6 MHz for Frequency Plan B.

3.7 Power Spectral Density

In accordance with 15.247(d), the peak power spectral density conducted from the intentional radiator shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

The EUT antenna was removed and connected directly into the spectrum analyzer input with a short length of coaxial cable. The spectrum analyzer was tuned to the center of the carrier frequency and the peak of the emission was located. This emission peak was then zoomed in on for performing the Power Spectral Density measurement. Once the peak emission was detected the analyzer resolution bandwidth was set to 3 kHz with a span of 300kHz and a sweep time of 100 seconds. The highest peak measurement for Frequency Plan A was –8.4dBm and the highest peak measurement for Frequency Plan B was –6.9dBm.

Exhibit 3 contains the plots of the Power Spectral Density measurement.

Table 3: System Under Test

FCC ID: HDCTRC582TR1

EUT:	Adtran, Inc. Rackmount 5.8 GHz TRACER 2xT1 DSSS Part Numbers: 4280TRC582TR1A (Plan A), 4280TRC582TR1B (Plan B) FCC ID: HDCTRC582TR1
Power Supply:	Adtran, Inc. P/N: 1360DSK24VL1

Table 4: Interface Cables Used

Shielded and non-shielded I/O cables were used throughout the system under test.

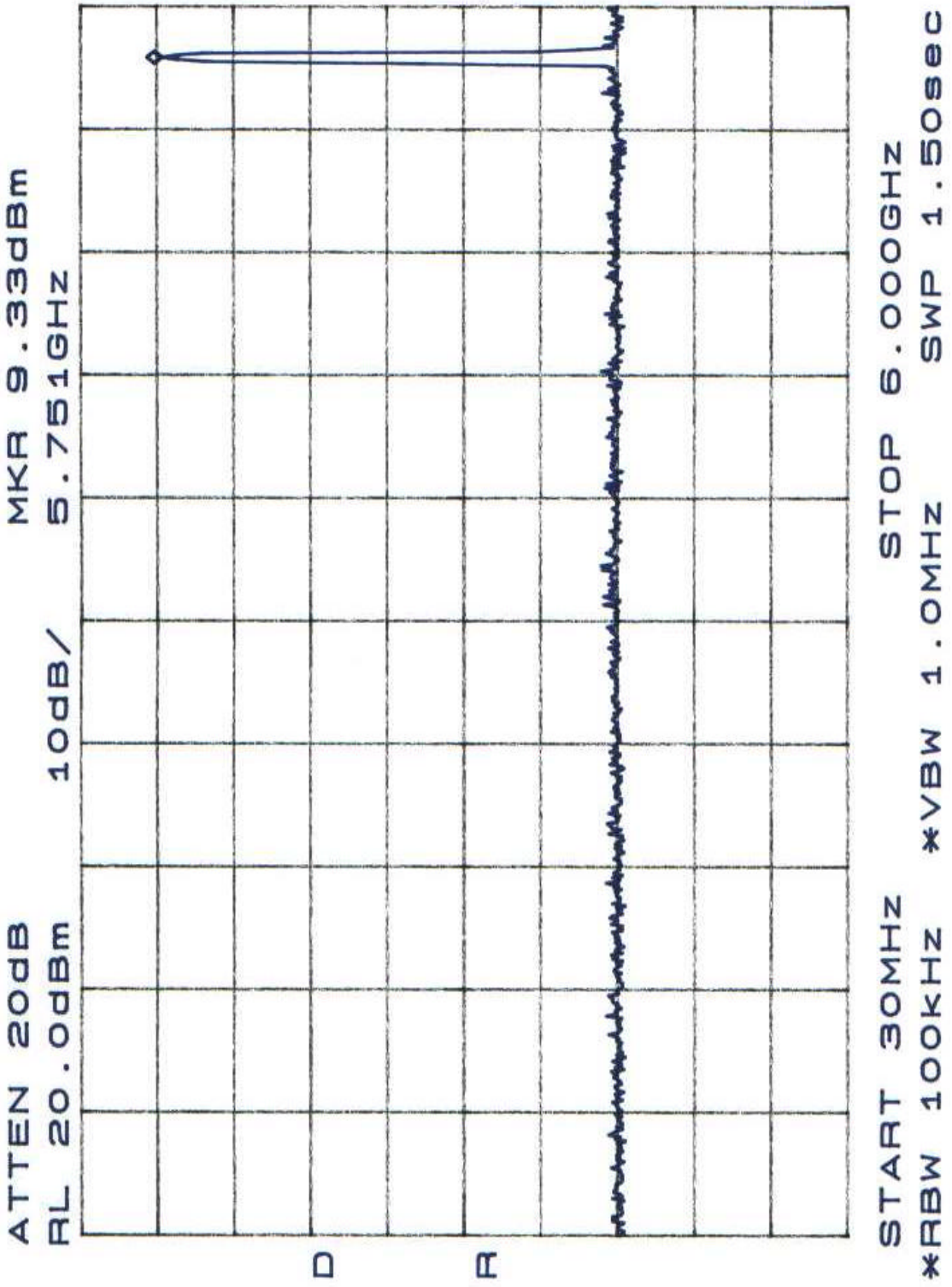
The EUT was powered via a non-shielded AC power cord.

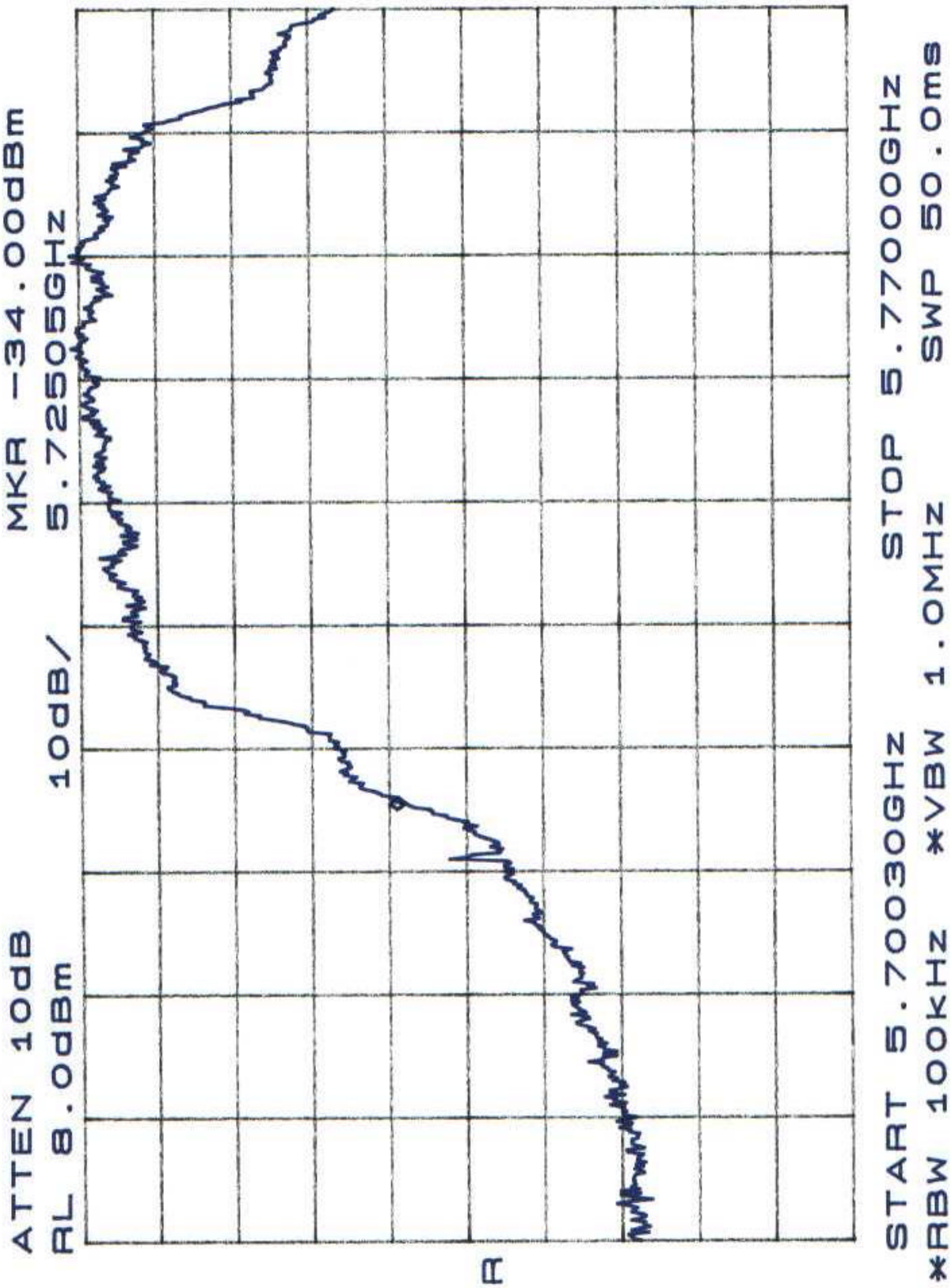
Table 5: Measurement Equipment Used

The following equipment is used to perform measurements:

Hewlett-Packard Spectrum Analyzer: HP8564E
Hewlett-Packard Spectrum Analyzer: HP8568B
Hewlett-Packard Spectrum Analyzer: HP8593A
Hewlett-Packard Quasi-Peak Adapter: HP85650A
Hewlett-Packard Preselector: HP85685A
Hewlett-Packard Preamplifier: HP8449B
Narda Horn Antenna: Model 638
Narda Horn Antenna: Model V637
Narda Directional Coupler: Model 4018-20
Antenna Research Associates, Inc. Biconical Log Periodic Antenna: LPB-2520A (Site 2)
Antenna Research Associates, Inc. Horn Antenna: DRG-118/A
Solar 50 Ω/50 µH Line Impedance Stabilization Network: 8012-50-R-24-BNC
Solar 50 Ω/50 µH Line Impedance Stabilization Network: 8028-50-TS-24-BNC
AH Systems, Inc. Portable Antenna Mast: AMS-4 (Site 2)
AH Systems, Inc. Motorized Turntable (Site 2)
RG-214 semi-rigid coaxial cable
RG-223 double-shielded coaxial cable

Exhibit 1. Spurious Emissions at the Antenna Terminal Plots
Frequency Plan A

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RL 8.0dBm
10dB/
MKR -34.00dBm
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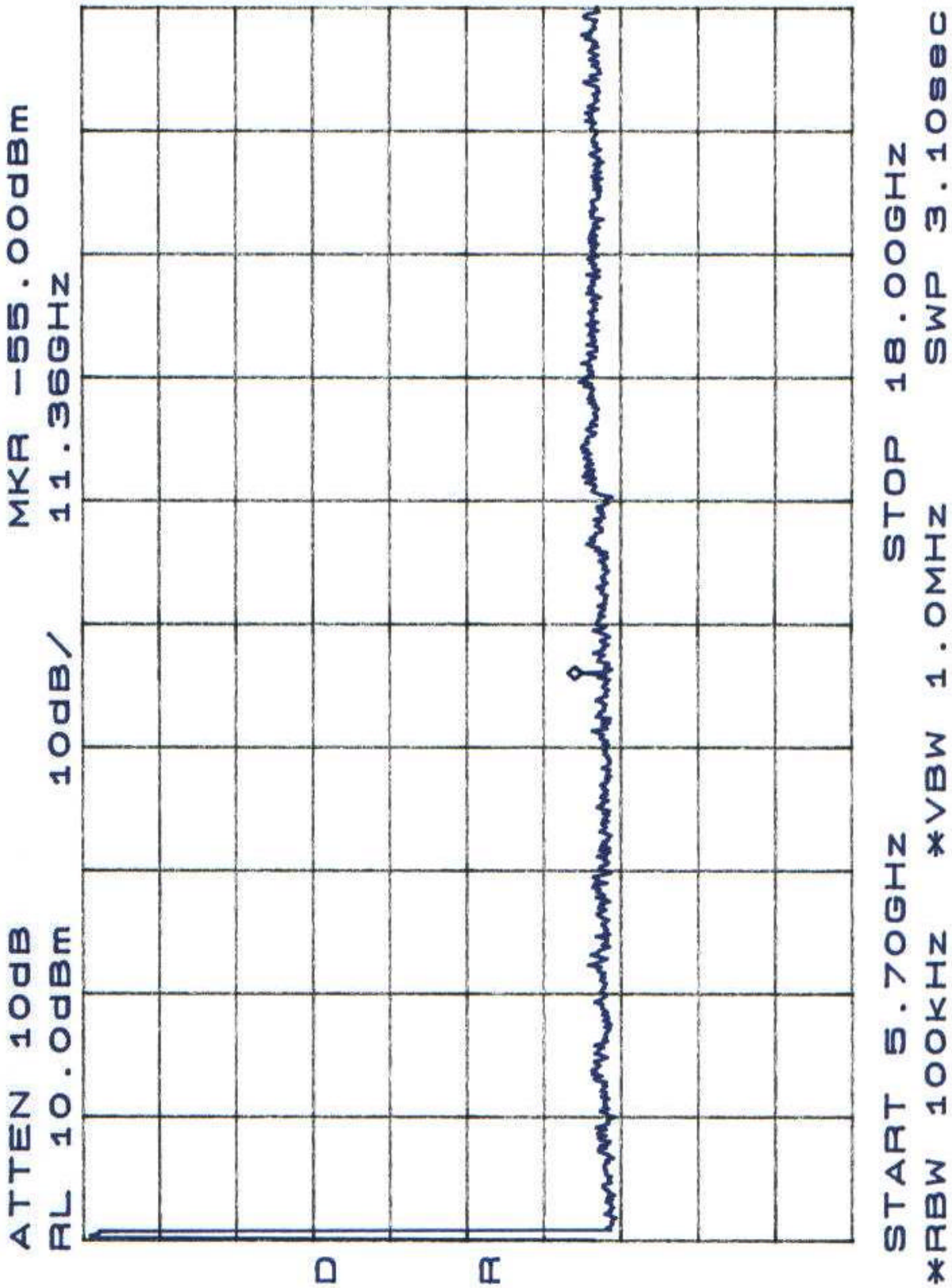
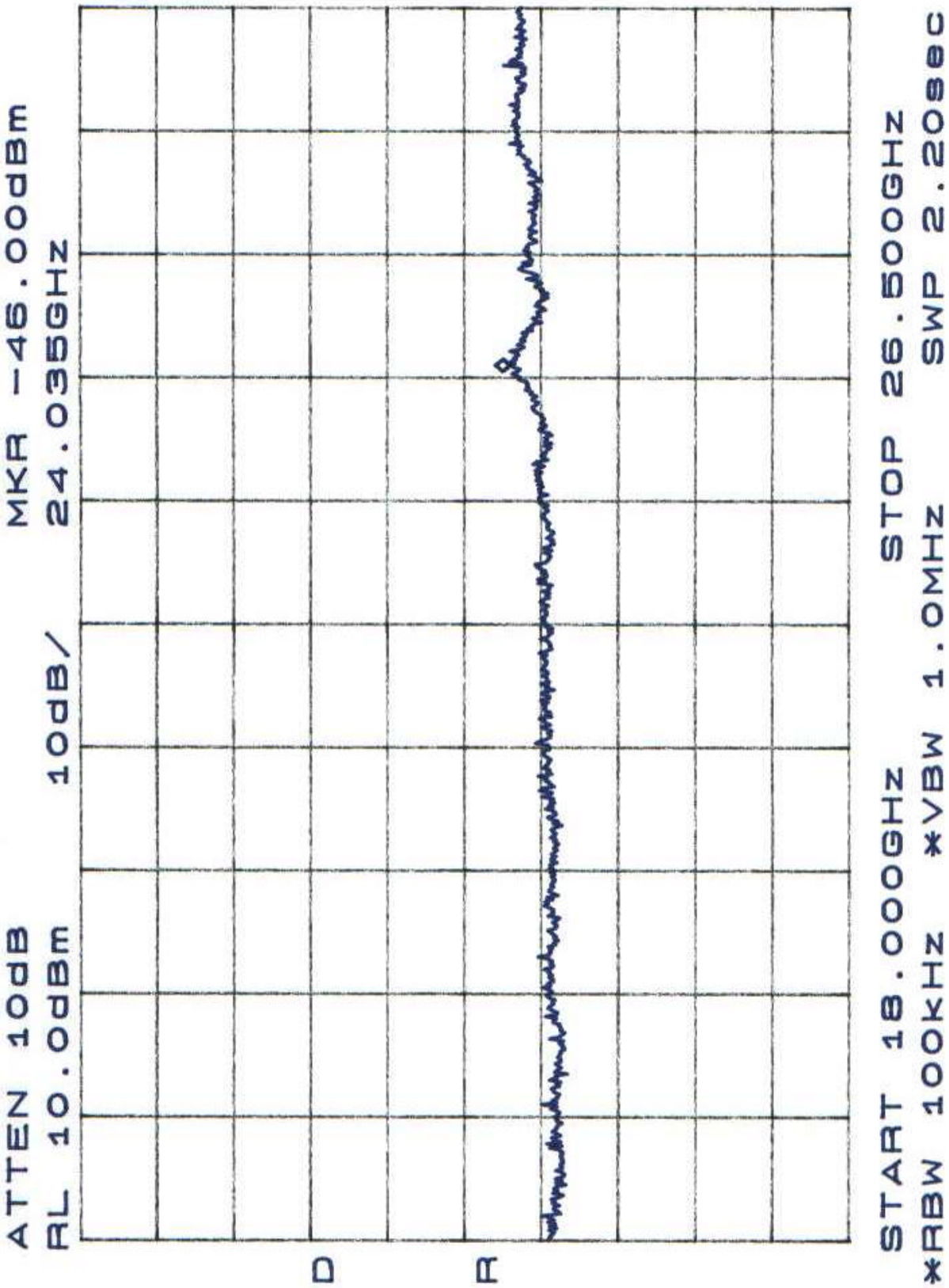
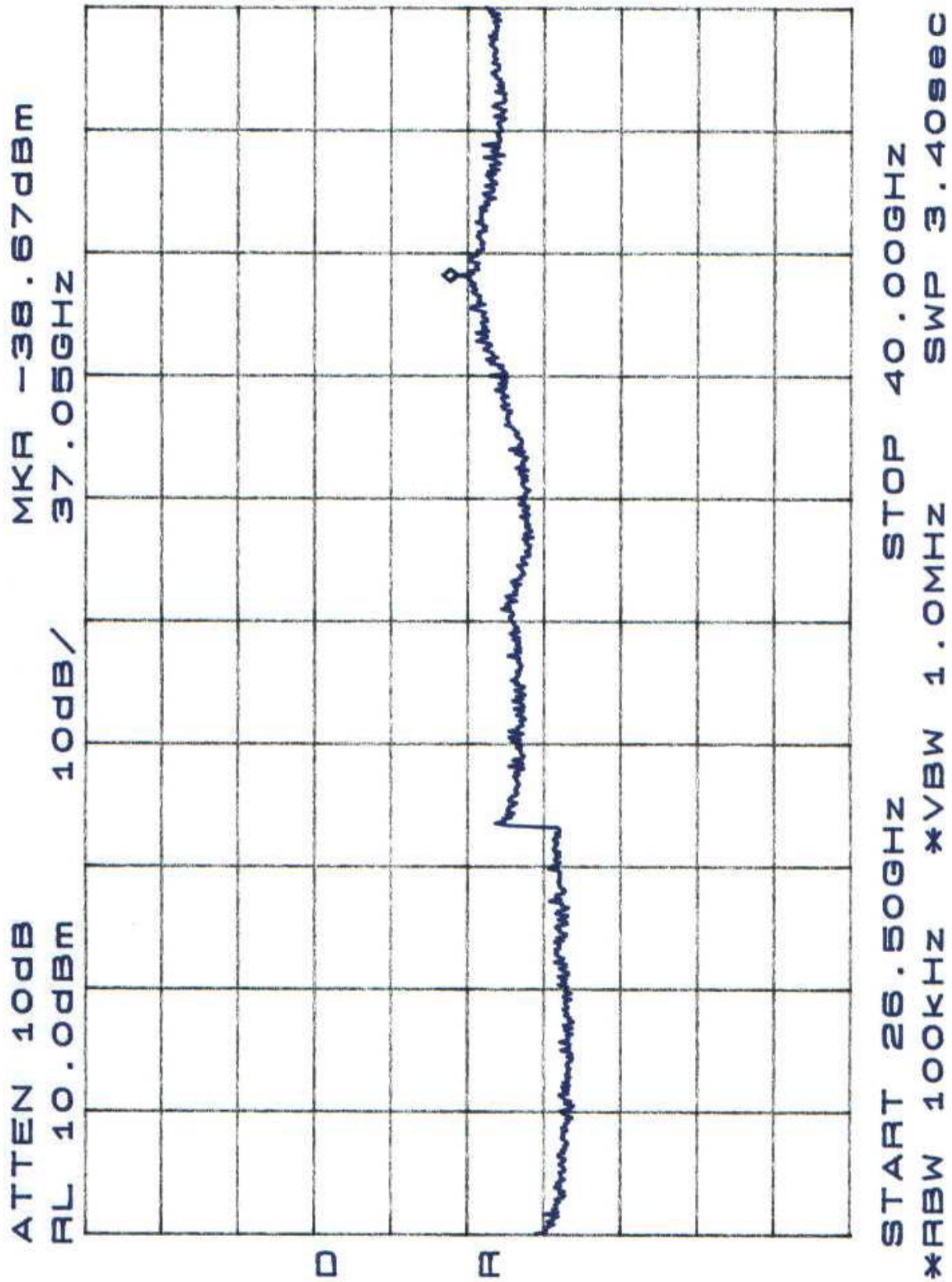
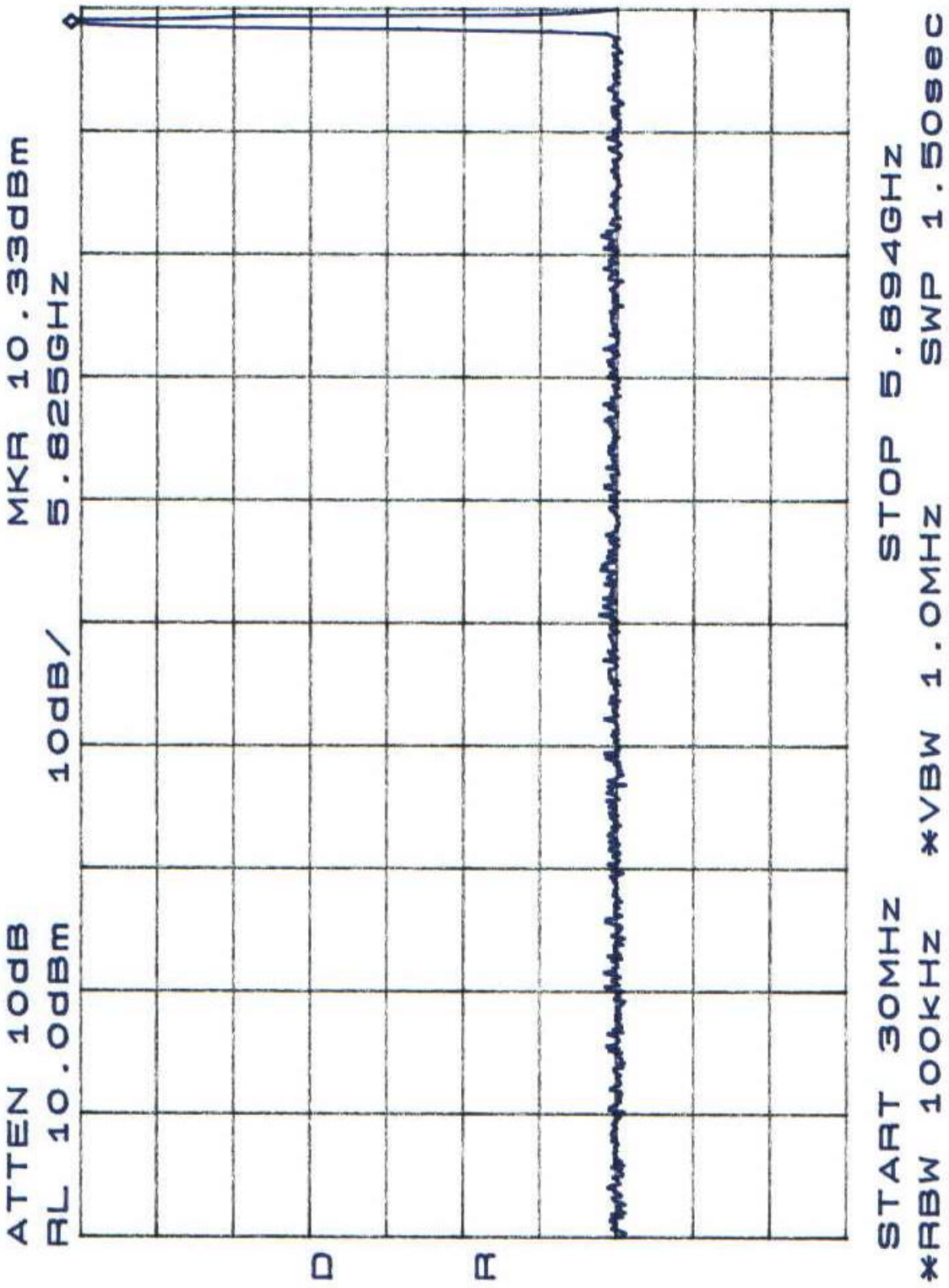
START 5.70030GHz
*RBW 100KHz
*VBW 1.0MHz
STOP 5.77000GHz
SWP 50.0ms
R

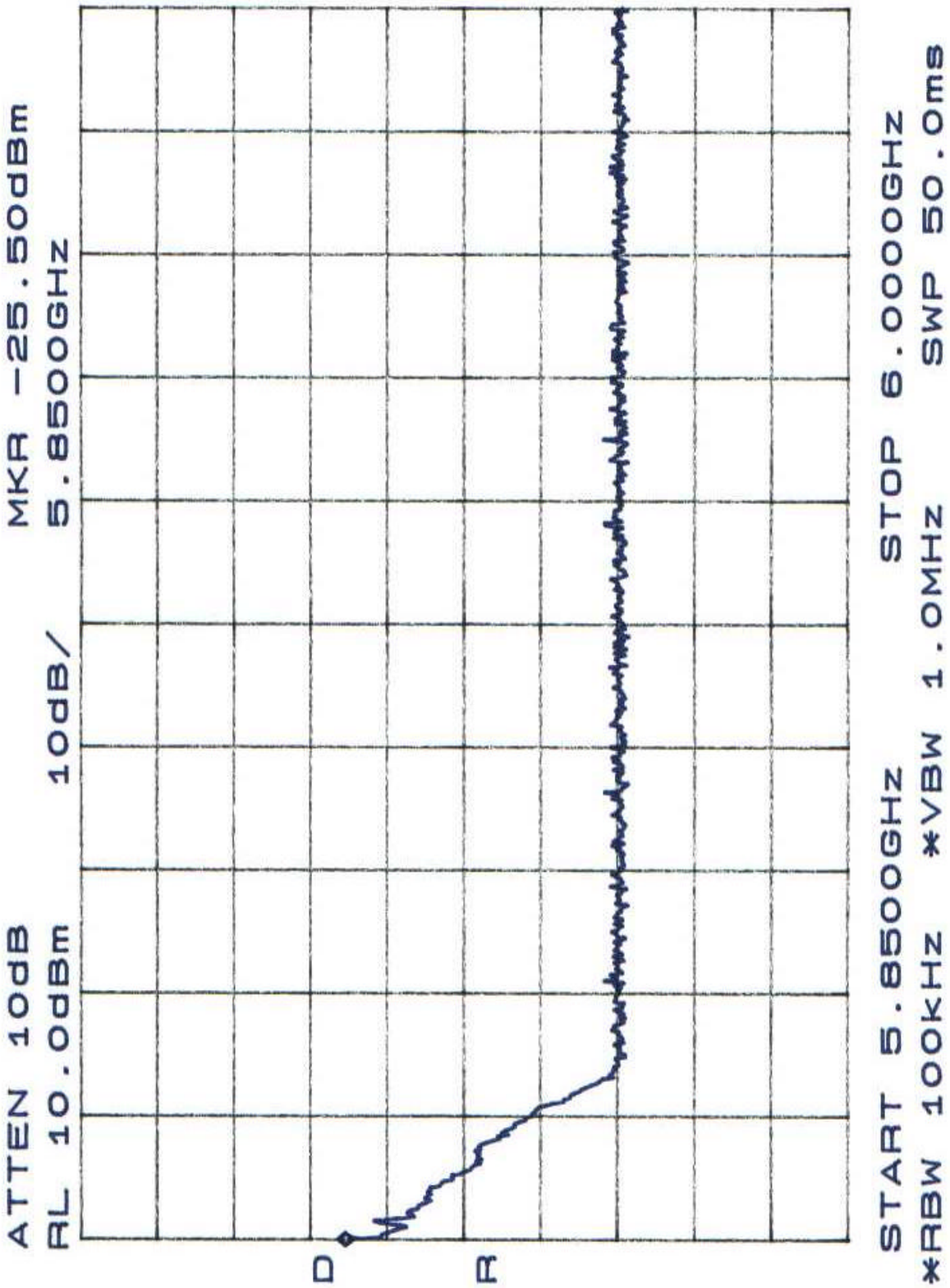

ATTEN 10dB
RL 10.0dBm
10dB/
MKR -55.00dBm
11.36GHz
START 5.70GHz
*RBW 100KHz
*VBW 1.0MHz
STOP 18.00GHz
SWP 3.10sec
D
R

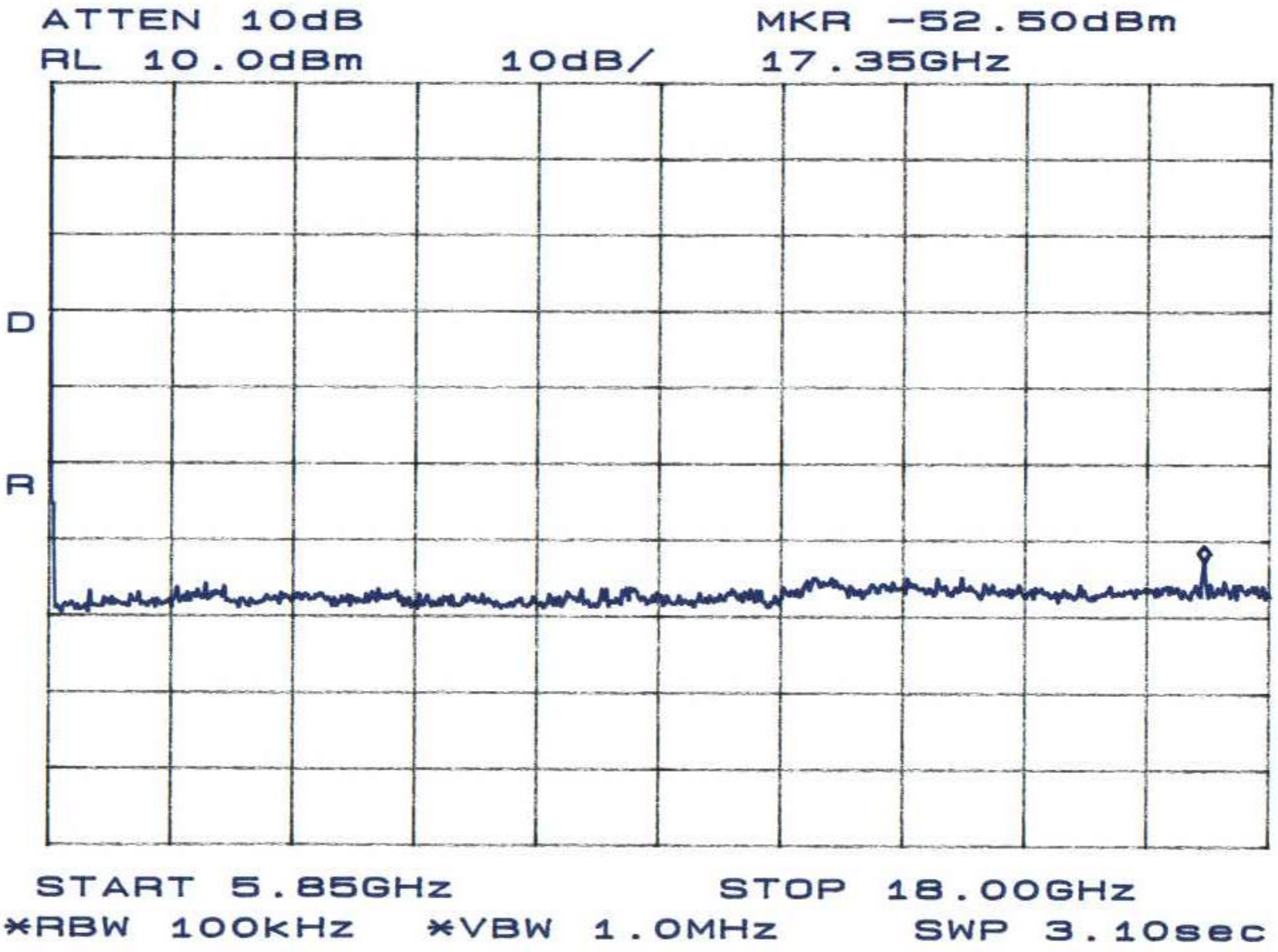

ATTEN 10dB
RL 10.0dBm
10dB/
MKR -46.00dBm
24.035GHz
D
R
START 18.000GHz
*RBW 100KHz
*VBW 1.0MHz
STOP 26.500GHz
SWP 2.20sec

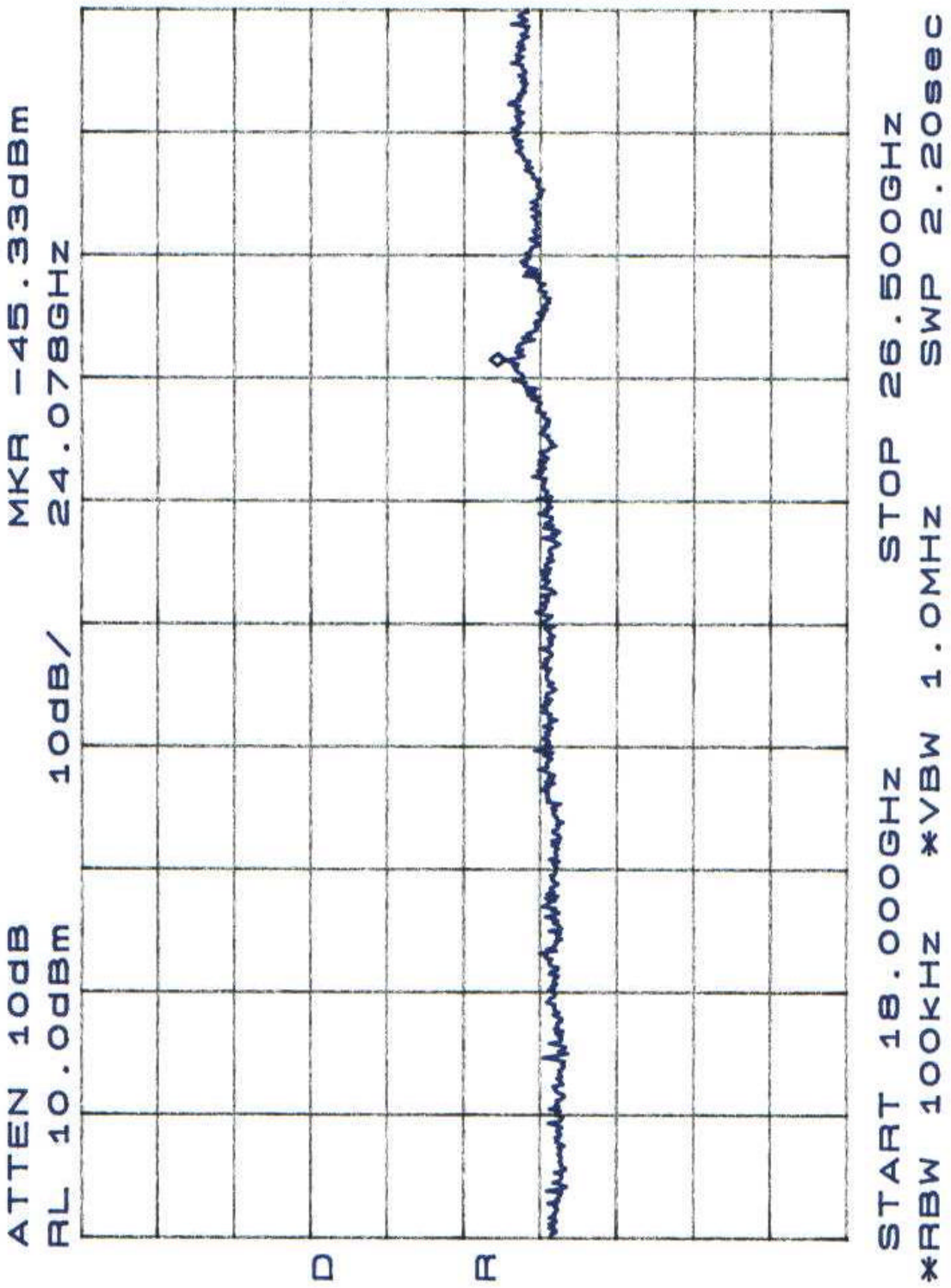

ATTEN 10dB
RL 10.0dBm
10dB/
MKR -38.67dBm
37.05GHz
START 26.50GHz
*RBW 100kHz
*VBW 1.0MHz
STOP 40.00GHz
SWP 3.40sec

Frequency Plan B




ATTEN 10dB
RL 10.0dBm
10dB/
MKR -25.50dBm
5.8500GHz
START 5.8500GHz
*RBW 100KHz
*VBW 1.0MHz
STOP 6.0000GHz
SWP 50.0ms
D
R


ATTEN 10dB
MKR -52.50dBm
RL 10.0dBm
10dB/
17.35GHz
D
R
START 5.85GHz
STOP 18.00GHz
*RBW 100kHz
*VBW 1.0MHz
SWP 3.10sec


ATTEN 10dB
RL 10.0dBm
10dB/
MKR -45.33dBm
24.078GHz
D
R
START 18.000GHz
*RBW 100KHz
*VBW 1.0MHz
STOP 26.500GHz
SWP 2.20sec

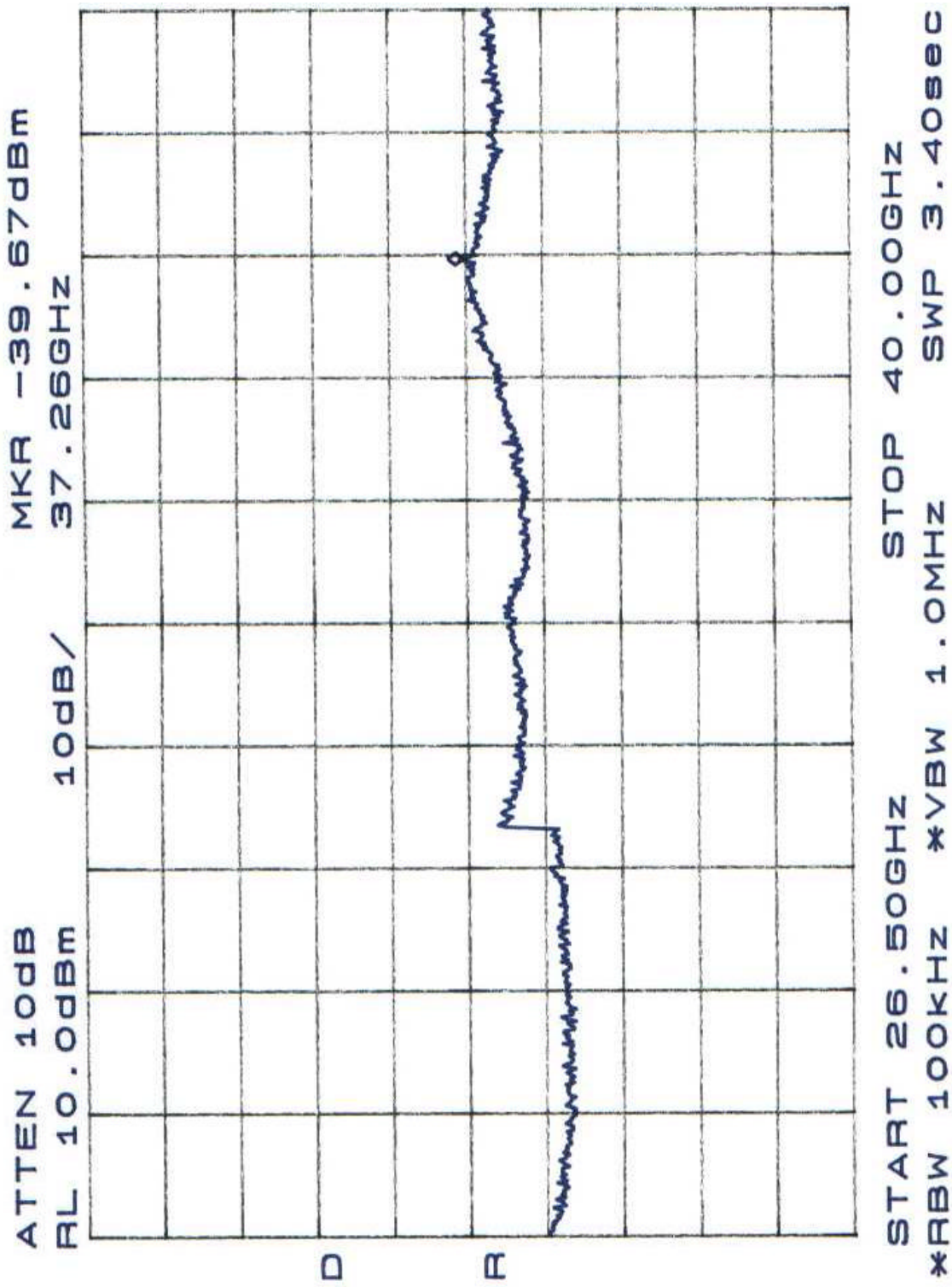
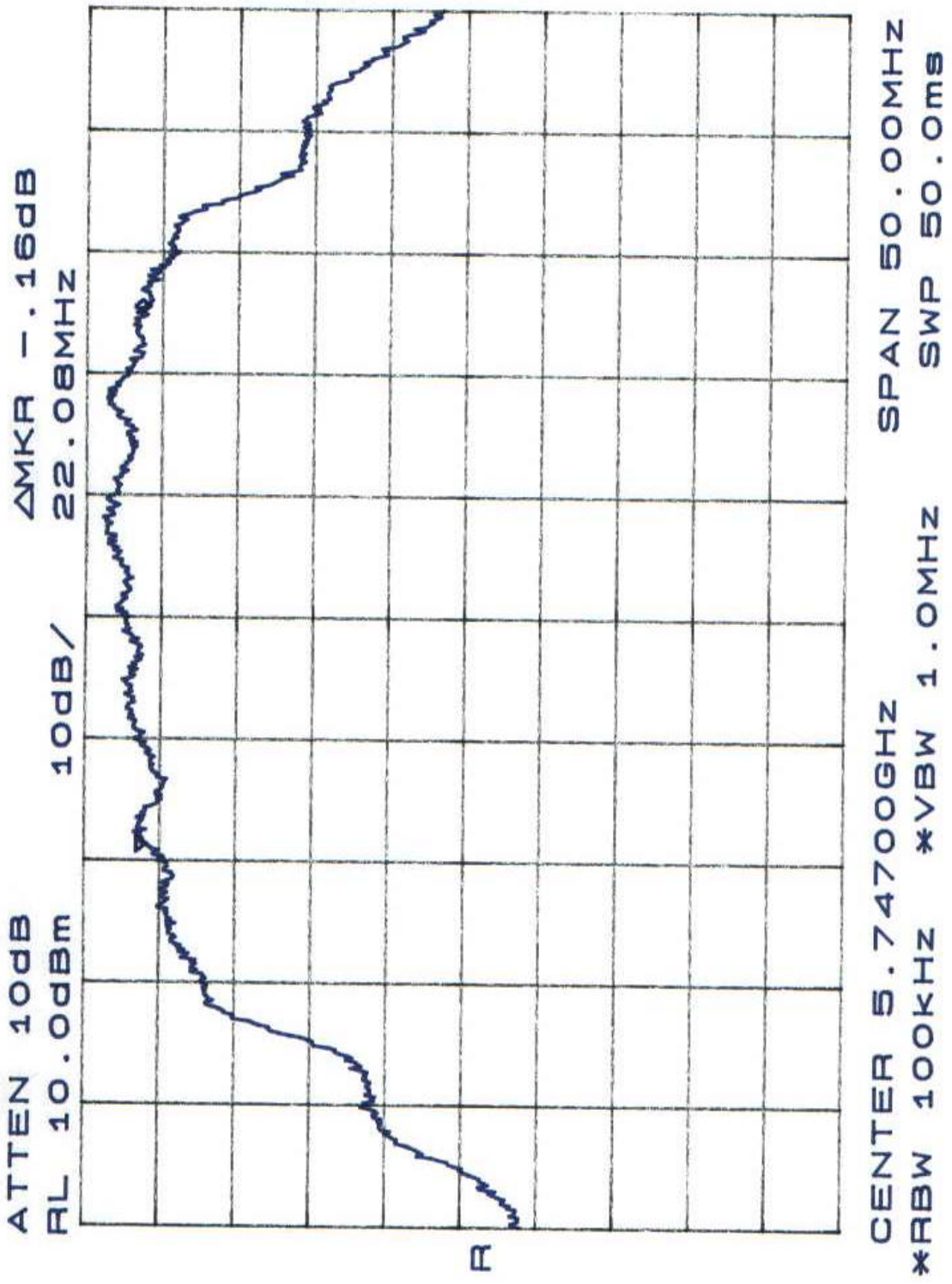

ATTEN 10dB
RL 10.0dBm
10dB/
MKR -39.67dBm
37.26GHz
START 26.50GHz
*RBW 100kHz
*VBW 1.0MHz
STOP 40.00GHz
SWP 3.40sec
D
R

Exhibit 2. 6dB Bandwidth Plot
Frequency Plan A



Frequency Plan B

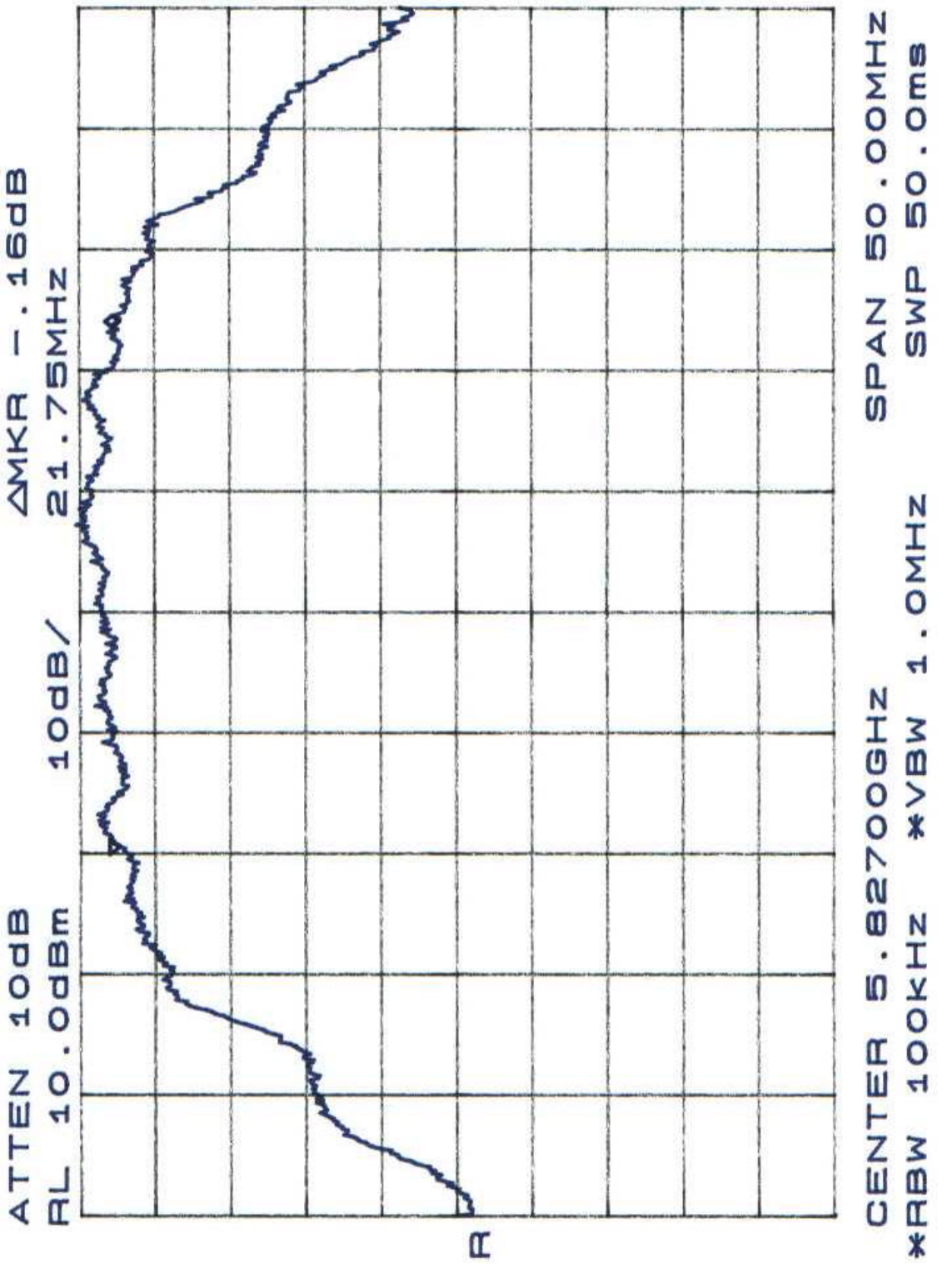
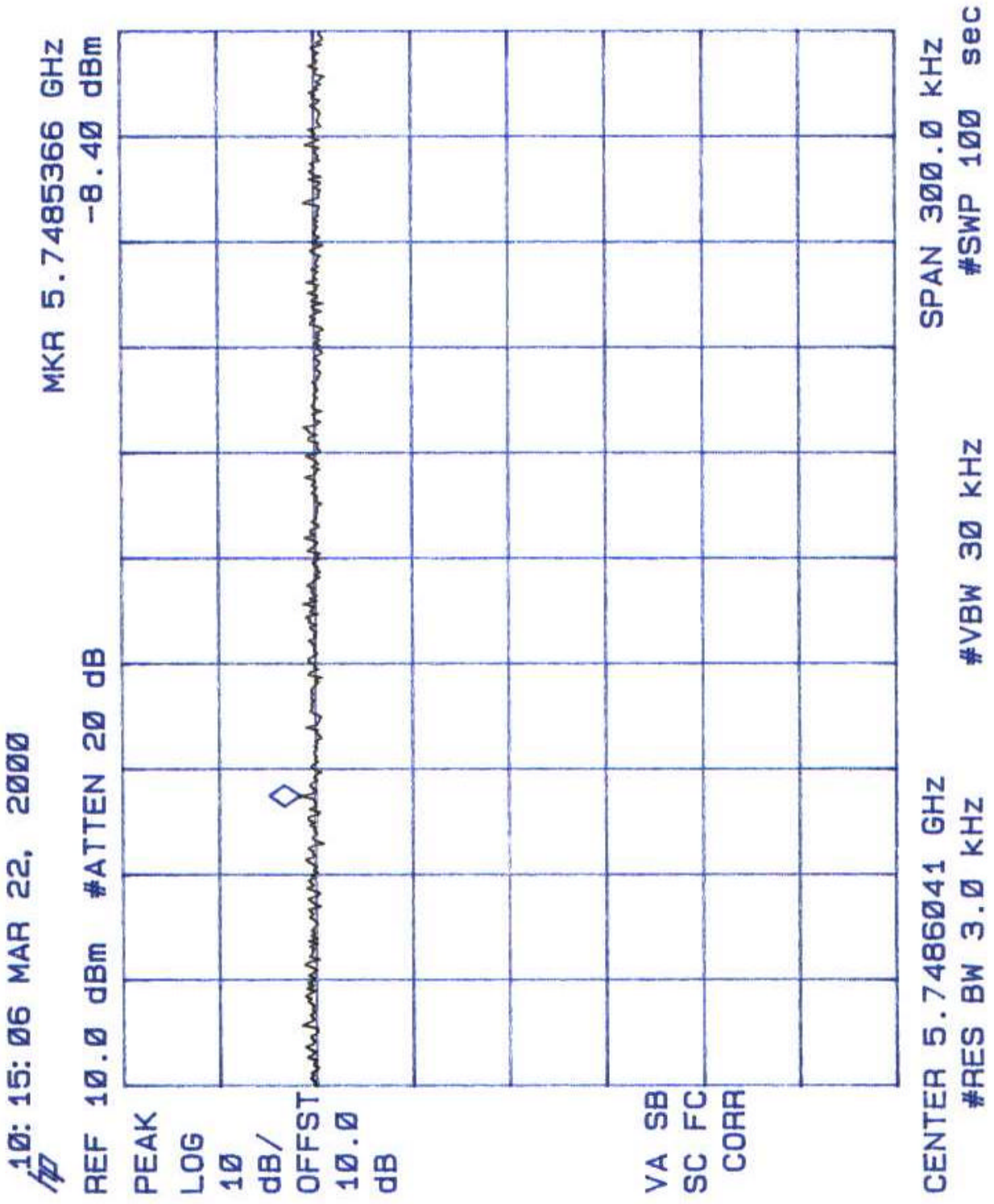
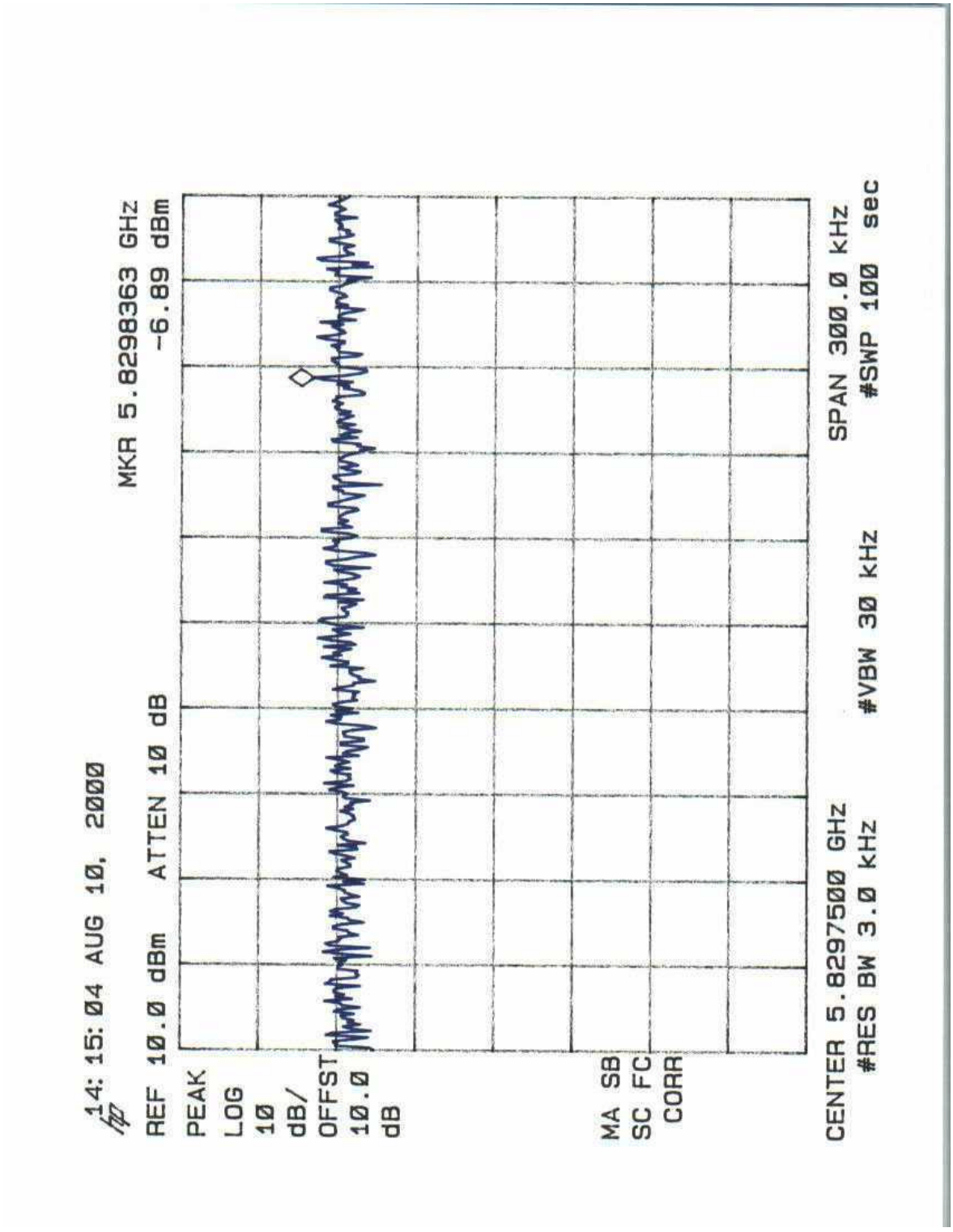


Exhibit 3: Power Spectral Density
Frequency Plan A



Frequency Plan B



Appendix A

Statement of Measurement Uncertainty

For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ±2.3 dB. This has been calculated for a *worst-case situation* (radiated emissions measurements performed on an open area test site).

The following measurement uncertainty calculation is provided:

$$\text{Total Uncertainty} = (A^2 + B^2 + C^2)^{1/2}/(n-1)$$

where:

A = Antenna calibration uncertainty, in dB = 2 dB

B = Spectrum Analyzer uncertainty, in dB = 1 dB

C = Site uncertainty, in dB = 4 dB

n = number of factors in uncertainty calculation = 3

Thus, Total Uncertainty = $0.5\ (2^2 + 1^2 + 4^2)^{1/2}$ = ±2.3 dB.