FCC CERTIFICATION TEST REPORT

for

Lamson & Sessions

25701 Science Park Drive
Beachwood, OH 44122

FCC ID: DE4RC3901T

September 15, 2000

WLL PROJECT #: 5720X

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STATEMENT OF QUALIFICATIONS

for

Chad M. Beattie

Washington Laboratories, Ltd.

I am a NARTE-Accredited EMC Test Laboratory Engineer with an Associates in Electronic Systems Technology. I have nine years of electronics experience, the last five 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: __________________________

Chad M. Beattie
Compliance Engineer

Date: September 15, 2000

FCC CERTIFICATION TEST REPORT

for

FCC ID: DE4RC3901T

1.0 Introduction

This report has been prepared on behalf of Lamson & Sessions to support the attached Application for Equipment Authorization. The test and application are submitted for a Periodic Intentional Radiator under Part 15.231 of the FCC Rules and Regulations. The Equipment Under Test was the Lamson & Sessions Libra RC3901T.

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 Lamson & Sessions Libra RC3901T complies with the limits for a Periodic Intentional Radiator under Part 15.231 of the FCC Rules and Regulations.

2.0 Description of Equipment Under Test (EUT)

The Lamson & Sessions Libra RC3901T (EUT) is a battery-powered 433 MHz door chime transmitter. The RC3901T transmitter is used in conjunction with the Lamson & Sessions RC3923R Door Chime receiver. When the operation button is pressed, the unit sends a signal to the chime receiver which activates a user selectable announcement chime. The RC3901T ceases transmission immediately after releasing the button.

2.1 On-board Oscillators

The Lamson & Sessions Libra RC3901T contains the following oscillators: 6.78 MHz

3.0 Test Configuration

To complete the test configuration required by the FCC, the transmitter was tested in all three orthogonal planes. All testing was done at 3 VDC.

3.1 Testing Algorithm

The transmitter was turned on and constantly transmitting. Worst case emissions are recorded in the data tables.

3.2 Conducted Emissions Testing

The EUT is battery-powered, so conducted emissions testing was not performed.

3.3 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. Biconical and log periodic 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. The peripherals were placed on the table in accordance with ANSI C63.4-1992. 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 a preamplifier, to the input of the spectrum analyzer. The detector function was set to quasi-peak or peak, as appropriate. The measurement bandwidth on the spectrum analyzer system was set to at least 120 kHz (1 MHz for measurements above 1 GHz), with all post-detector filtering no less than 10 times the measurement bandwidth.

3.3.1 Radiated Data Reduction and Reporting

To convert the raw spectrum analyzer radiated data into a level 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 1. The AFc in dB/m and AFd (duty cycle factor) in dB (see Exhibit 1) are 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 limit.

Example:

Spectrum Analyzer Voltage: VdBμV

Composite Antenna Factor: AFcdB/m

Duty Cycle Factor: AF_ddB

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

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

Data is recorded in Table 1.

Table 1: FCC 15.231 3-Meter Radiated Emissions Data-Site 2

CLIENT: Lamson & Sessions
MODEL NO: RC3901T
TYPE/PART: 15.231
DATE(s): 9/1/00
BY: Chad M. Beattie
JOB #: 5720RFFCC
Tx Frequency: 433 MHz

Frequency MHz	Polarity H/V	Azimuth Degree	Antenna Height m	SA Level (Peak) dBuV	AFc dB/m	Afd dB/m	E-Field dBuV/m	E-Field uV/m	Limit uV/m	Margin dB	
433.91	H	135.00	3.0	58.4	19.4	0.0	77.8	7745.3	10993.8	-3.0	
433.91	V	270.00	1.5	60.0	19.4	0.0	79.4	9311.9	10993.8	-1.4	
867.83	H	180.00	1.3	9.7	13.2	0.0	22.9	14.0	1099.4	-37.9	
867.83	V	135.00	1.5	15.2	27.5	0.0	42.7	136.7	1099.4	-18.1	
1301.60	H	180.00	1.0	52.8	-10.3	-4.9	37.6	76.0	500.0	-16.4	
1301.60	V	270.00	1.0	56.7	-10.3	-4.9	41.5	119.1	500.0	-12.5	
1735.66	H	0.00	1.0	45.4	-7.5	-4.9	33.0	44.5	1099.4	-27.9	amb
1735.66	V	0.00	1.0	52.5	-7.5	-4.9	40.1	100.8	1099.4	-20.8	amb
2169.72	H	180.00	1.0	53.6	-5.8	-4.9	42.9	139.4	1099.4	-17.9	
2169.72	V	90.00	1.0	46.7	-5.8	-4.9	36.0	63.0	1099.4	-24.8	
2603.61	V	0.00	1.0	46.5	-5.1	-4.9	36.5	67.1	1099.4	-24.3	amb
2603.61	H	0.00	1.0	47.7	-5.1	-4.9	37.7	77.1	1099.4	-23.1	
3037.55	H	0.00	1.0	45.4	-4.4	-4.9	36.1	63.6	1099.4	-24.7	amb
3037.55	V	0.00	1.0	45.5	-4.4	-4.9	36.2	64.4	1099.4	-24.6	amb
3471.49	H	0.00	1.0	46.2	-3.9	-4.9	37.4	74.3	1099.4	-23.4	amb
3471.49	V	0.00	1.0	46.0	-3.9	-4.9	37.2	72.7	1099.4	-23.6	amb
3905.44	H	0.00	1.0	45.9	-3.4	-4.9	37.6	76.0	500.0	-16.4	amb
3905.44	V	0.00	1.0	44.8	-3.4	-4.9	36.5	66.9	500.0	-17.5	amb
4339.43	H	180.00	1.0	45.5	-3.0	-4.9	37.6	76.3	500.0	-16.3	amb
4339.43	V	0.00	1.0	45.4	-3.0	-4.9	37.5	75.4	500.0	-16.4	amb

Table 1 (Cont'd.): FCC 15.231 3-Meter Radiated Emissions Data-Site 2

CLIENT: Lamson & Sessions
MODEL NO: RC3901T
TYPE/PART: 15.231
DATE(s): 9/1/00
BY: Chad M. Beattie
JOB #: 5720RFFCC
Tx Frequency: 433 MHz

Peak Measurements Above 1GHz

Frequency MHz	Polarity H/V	Azimuth Degree	Antenna Height m	SA Level (QP) dBuV	AFc dB/m	E-Field dBuV/m	E-Field uV/m	Limit uV/m	Margin dB
1301.60	H	180.00	1.0	52.8	-10.3	42.5	133.6	5000.0	-31.5
1301.60	V	270.00	1.0	56.7	-10.3	46.4	209.4	5000.0	-27.6
1735.66	H	0.00	1.0	45.4	-7.5	37.9	78.2	5000.0	-36.1
1735.66	V	0.00	1.0	52.5	-7.5	45.0	177.2	5000.0	-29.0
2169.72	H	180.00	1.0	53.6	-5.8	47.8	245.1	5000.0	-26.2
2169.72	V	90.00	1.0	46.7	-5.8	40.9	110.7	5000.0	-33.1
2603.61	V	0.00	1.0	46.5	-5.1	41.4	118.0	5000.0	-32.5
2603.61	H	0.00	1.0	47.7	-5.1	42.6	135.5	5000.0	-31.3
3037.55	H	0.00	1.0	45.4	-4.4	41.0	111.9	5000.0	-33.0
3037.55	V	0.00	1.0	45.5	-4.4	41.1	113.2	5000.0	-32.9
3471.49	H	0.00	1.0	46.2	-3.9	42.3	130.7	5000.0	-31.7
3471.49	V	0.00	1.0	46.0	-3.9	42.1	127.7	5000.0	-31.9
3905.44	H	0.00	1.0	45.9	-3.4	42.5	133.5	5000.0	-31.5
3905.44	V	0.00	1.0	44.8	-3.4	41.4	117.6	5000.0	-32.6
4339.43	H	180.00	1.0	45.5	-3.0	42.5	134.1	5000.0	-31.4
4339.43	V	0.00	1.0	45.4	-3.0	42.4	132.5	5000.0	-31.5

Table 2: System Under Test

FCC ID: DE4RC3901T

EUT: Lamson & Sessions Model: RC3901T
FCC ID: DE4RC3901T

Table 3: Interface Cables Used

The Libra RC3901T is a stand-alone battery operated unit with no external cables or interfaces.

Table 4: 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
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

DUTY CYCLE CALCULATIONS

The following page shows spectrum analyzer plots of the transmitter coding. The following calculations show the worst case 100 ms duty cycle correction used for calculating the average level of the carrier, harmonics, and emissions.

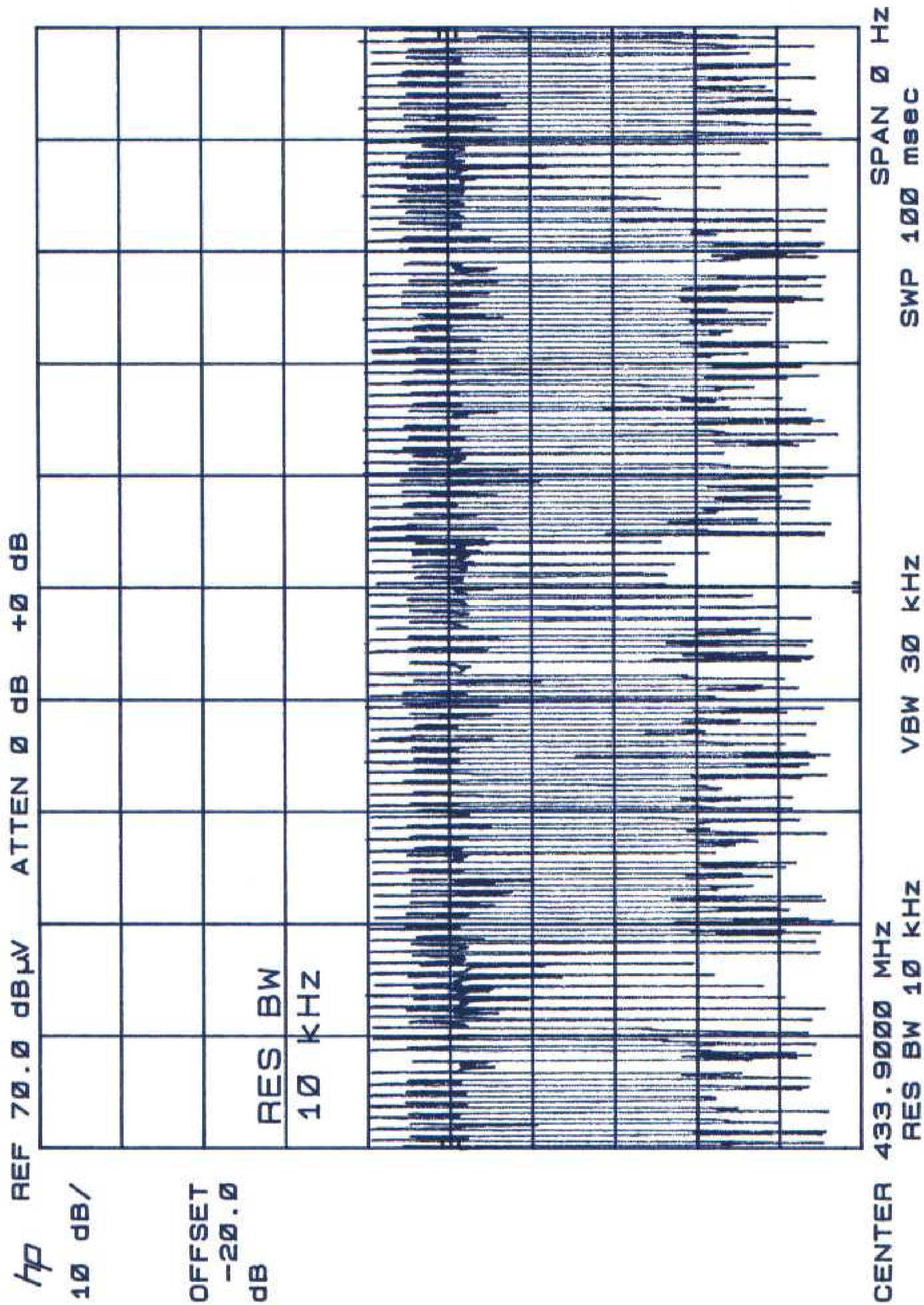
Plot 1 shows that the transmitter has a pulse train period of 36 ms and consists of 3 widths of pulses. The pulse widths are measured on Plots 2, 3 and 4. From these plots, the following duty cycle correction factor is calculated.

ON TIME PER PULSE TRAIN:

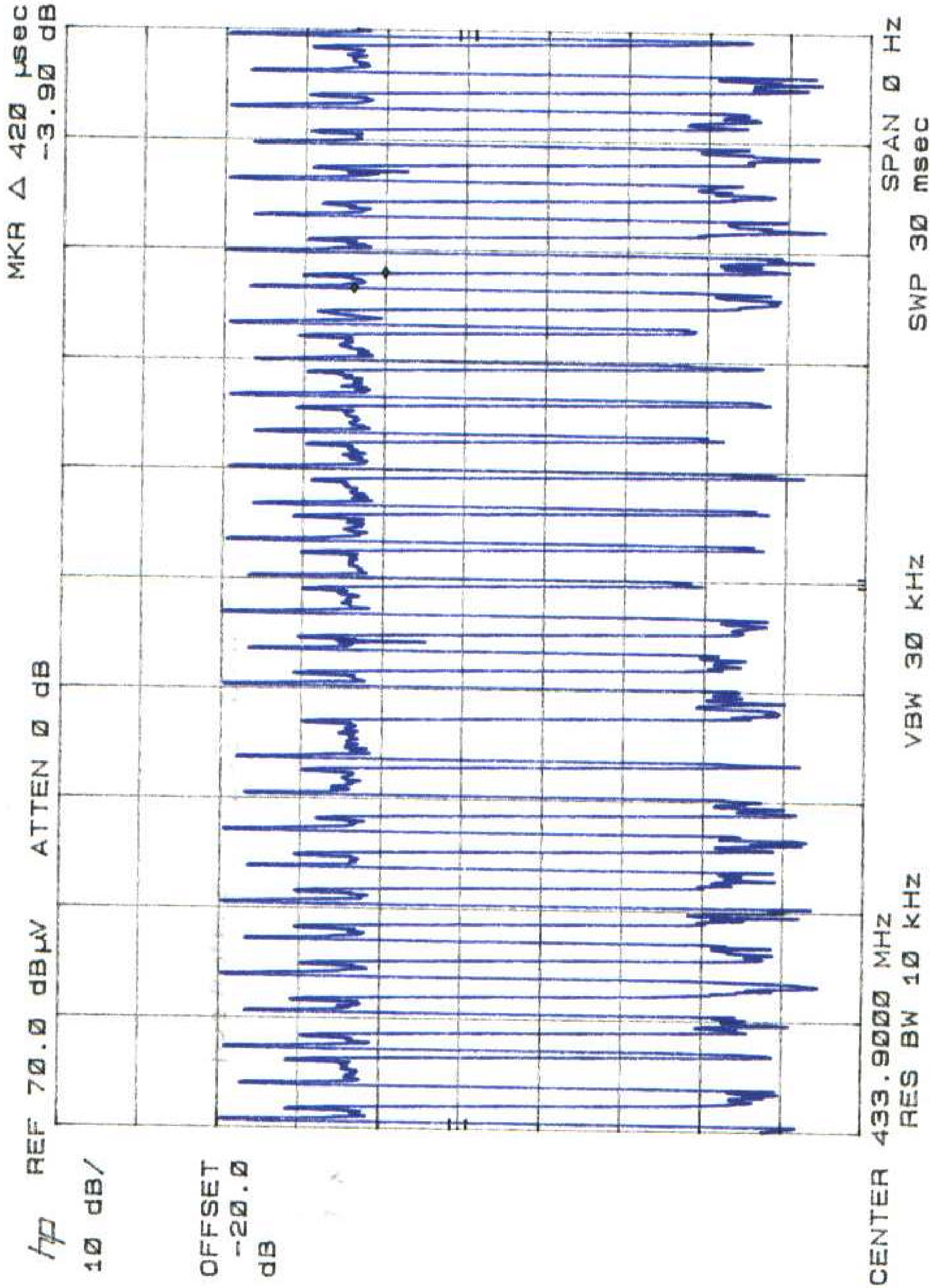
(21 x 420 us) + (13 x 810 us) + (1 x 1.08 ms) = 20.43 ms ON TIME per 36 ms Pulse Train

= 20.43 ms/36 ms = 0.5675 Duty Cycle
= 56.75% Duty Cycle
= -4.9 dB AFd

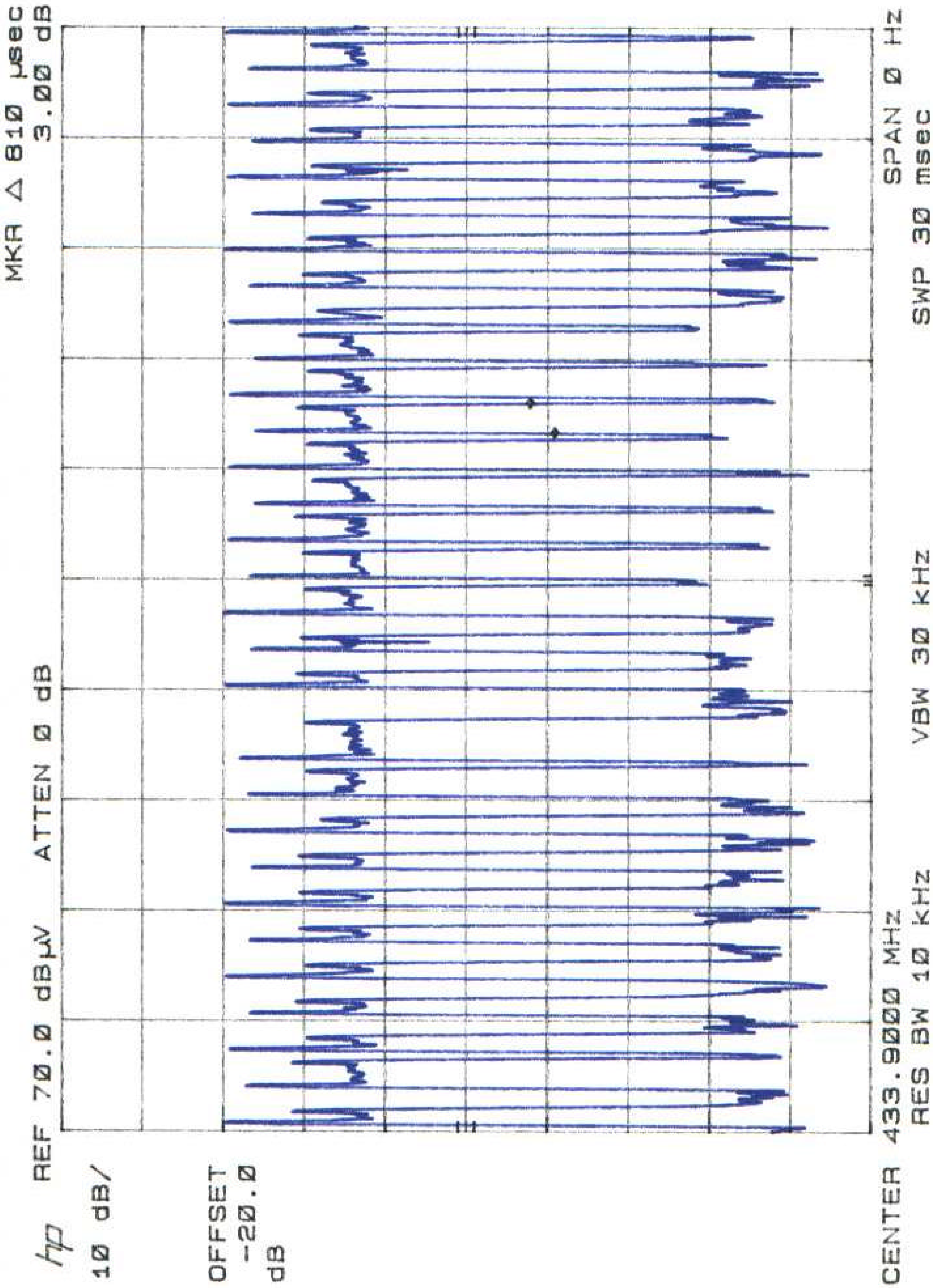
Duty Cycle Plot 1



Duty Cycle Plot 2



Duty Cycle Plot 3



Duty Cycle Plot 4

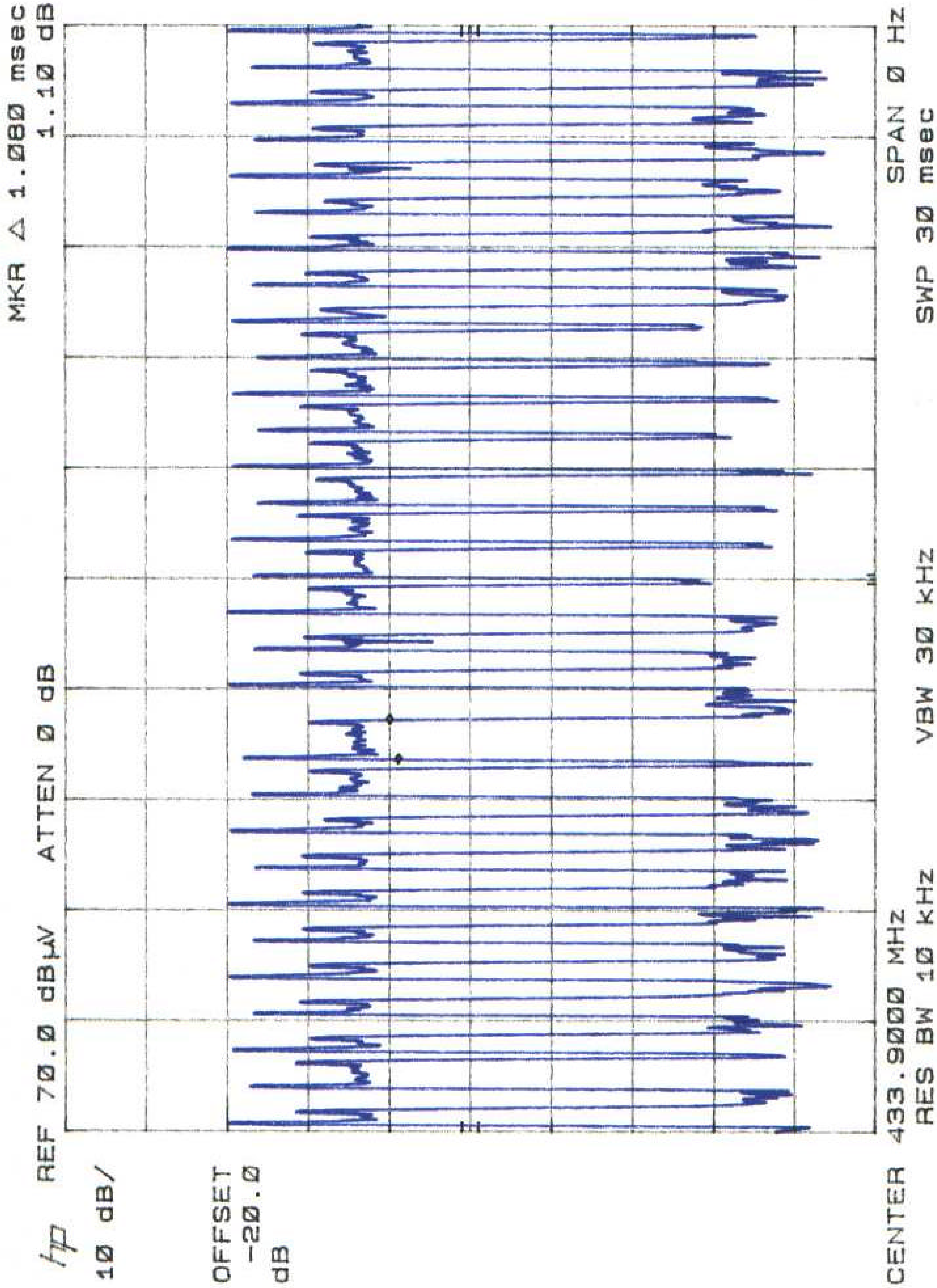


EXHIBIT 2

CARRIER BANDWIDTH DATA

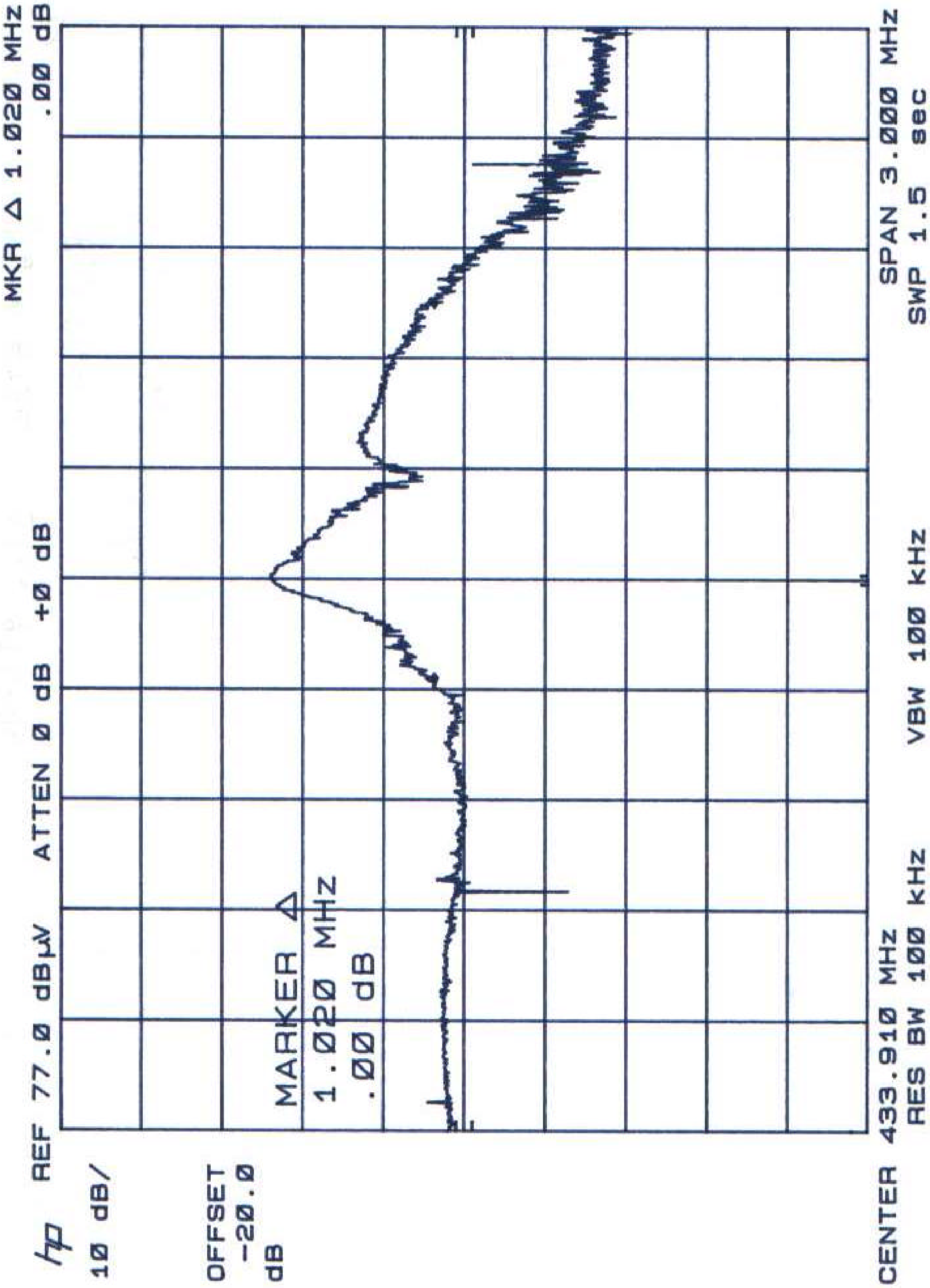
The 20 dB modulated bandwidth shall be no wider than 0.25% of the center frequency.

Bandwidth Limit = Carrier Frequency x .0025

Bandwidth Limit = 433.91 MHz x .0025 = 1.0848 MHz

Measured EUT Bandwidth = 1.02 MHz

Bandwidth Plot



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 = $0.5\,(2^2 + 1^2 + 4^2)^{1/2} = \pm 2.3$ dB.