FCC CERTIFICATION TEST REPORT

for

Connaught Electronics Ltd.

IDA Industrial Estate
Dunmore Road, Tuam
Co. Galway, Ireland

FCC ID: LQN1821

January 31, 2000

WLL PROJECT #: 5553X

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STATEMENT OF QUALIFICATIONS

for

Herbert W. Meadows

Washington Laboratories, Ltd.

I hold a Bachelor of Science in Electronics Engineering Technology. I have over three years of EMI testing experience and nine years of RF and microwave testing experience. 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:

Herbert W. Meadows
Compliance Engineer

Date: January 31, 2000

CEL

nsai

Connaught Electronics Ltd.

IDA INDUSTRIAL ESTATE,
DUNMORE ROAD, TUAM,
CO. GALWAY, IRELAND.

Telephone: 093-25128
Fax: 093-25133

03.11.1999

Chief, Authorizations Branch
Federal Communications Commission
7435 Oakland Mills Road
Columbia, MD 21046

RE: LETTER OF AGENCY

This letter is to serve notice that Washington Laboratories, Ltd is hereby authorized to act on our behalf in connection with the Application for Equipment Authorization attached herewith.

We certify that we are not subject to denial of federal benefits, that includes FCC benefits, pursuant to Section 5301 of the Anti-Drug Abuse ACT of 1988, U.S.C. 862. Further, no party, as defined in 47 CFR 1.2002(b), to the application is subject to denial of federal benefits, that includes FCC benefits.

Sincerely

Aiden Heeran
Export Manager

FCC CERTIFICATION TEST REPORT

for

FCC ID: LQN1821

1.0   Introduction

This report has been prepared on behalf of Connaught Electronics Ltd. 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 Range Rover Remote Keyless Entry RF 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 Connaught Electronics Ltd. Range Rover RF Transmitter 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 Connaught Electronics Ltd. Range Rover RF Transmitter (EUT) is a 315MHz low power transmitter keyfob that is used as a wireless remote control for vehicle keyless entry systems. The battery powered transmitter is manually operated and used with the Connaught STAR Rx 1821 Receiver and was tested under the FCC DOC program. The unit stops transmitting as soon as the button is released.

2.1   On-board Oscillators

The Connaught Electronics Ltd. Range Rover RF Transmitter contains a 4.7547MHz oscillator and 10.7MHz SAW oscillator.

3.0   Test Configuration

To complete the test configuration required by the FCC, the transmitter was tested in all three orthogonal planes.

3.1   Testing Algorithm

The transmitter was turned on and constantly transmitting. The system was tested in all three orthogonal planes. Worst case emissions are recorded in the data tables.

3.2   Conducted Emissions Testing

Conducted emissions testing was not performed as the unit is DC powered.

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 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, 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 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 1. 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: EμV/m = antilog (EdBμV/m/20)

Data is recorded in Table 1.

Table 1

FCC 15.231 3M Radiated Emissions Data – Site 2

CLIENT: Connaught Electronics Ltd.
FCC ID: LQN1821
DATE: 12/9/99
BY: Herb Meadows
JOB #:   5553X

FREQ	POL	Azimuth	Ant Height	SA LEVEL (QP)	Correction Factor	AFc	E-FIELD	E-FIELD	LIMIT	MRGN
MHz	H/V	Degree	m	dBuV	dB	dB/m	dBuV/m	uV/m	uV/m	dB
315.00	H	180.00	1.0	55.9	-13.9	16.5	58.5	840.2	6041.7	-17.1
315.00	V	90.00	1.0	39.7	-13.9	16.5	42.3	130.1	6041.7	-33.3
630.00	H	0.00	1.0	36.9	-13.9	24.1	47.1	226.8	604.2	-8.5
630.00	V	90.00	1.0	22.4	-13.9	24.1	32.6	42.7	604.2	-23.0
945.00	H	180.00	1.0	27.0	-13.9	28.8	41.9	124.5	604.2	-13.7
945.00	V	90.00	1.0	17.0	-13.9	28.8	31.9	39.4	604.2	-23.7

Average Measurements Above 1 GHz:

FREQ	POL	Azimuth	Ant Height	SA LEVEL (PEAK)	AFd	AFc	E-FIELD	E-FIELD	LIMIT	MRGN
MHz	H/V	Degree	m	dBuV	dB/m	dB/m	dBuV/m	uV/m	uV/m	dB
1260.00	H	225.00	1.0	62.6	-13.9	-10.6	38.1	80.4	604.2	-17.5
1260.00	V	90.00	1.0	57.3	-13.9	-10.6	32.8	43.7	604.2	-22.8
1575.00	H	90.00	1.0	71.7	-13.9	-8.5	49.3	291.7	500.0	-4.7
1575.00	V	0.00	1.0	70.3	-13.9	-8.5	47.9	248.3	500.0	-6.1
1890.30	H	270.00	1.0	63.4	-13.9	-6.7	42.8	138.0	604.2	-12.8
1890.30	V	225.00	1.0	58.2	-13.9	-6.7	37.6	75.9	604.2	-18.0
2205.30	V	270.00	1.0	58.3	-13.9	-5.7	38.7	86.1	500.0	-15.3
2205.30	H	270.00	1.0	66.2	-13.9	-5.7	46.6	213.8	500.0	-7.4
2520.20	V	225.00	1.0	53.1	-13.9	-5.2	34.0	50.1	500.0	-20.0
2520.20	H	180.00	1.0	61.0	-13.9	-5.2	41.9	124.5	500.0	-12.1
2835.20	V	225.00	1.0	62.4	-13.9	-4.7	43.8	154.9	500.0	-10.2
2835.20	H	270.00	1.0	60.3	-13.9	-4.7	41.7	121.6	500.0	-12.3
3150.40	V	225.00	1.0	67.3	-13.9	-4.3	49.1	285.1	604.2	-6.5
3150.40	H	135.00	1.0	70.5	-13.9	-4.3	52.3	412.1	604.2	-3.3

Table 1 (Cont'd.)

FCC 15.231 3M Radiated Emissions Data – Site 2

Peak Measurements Above 1GHz

FREQ MHz	POL 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	MRGN dB
1260.00	H	225.00	1.0	62.6	-9.1	53.5	470.9	5000.0	-20.5
1260.00	V	90.00	1.0	57.3	-9.1	48.2	255.8	5000.0	-25.8
1575.00	H	90.00	1.0	71.7	-6.7	65.0	1784.6	5000.0	-8.9
1575.00	V	0.00	1.0	70.3	-6.7	63.6	1518.9	5000.0	-10.3
1890.30	H	270.00	1.0	63.4	-4.6	58.8	866.1	5000.0	-15.2
1890.30	V	225.00	1.0	58.2	-4.6	53.6	476.0	5000.0	-20.4
2205.30	V	270.00	1.0	58.3	-3.4	54.9	554.2	5000.0	-19.1
2205.30	H	270.00	1.0	66.2	-3.4	62.8	1376.1	5000.0	-11.2
2520.20	V	225.00	1.0	53.1	-2.6	50.5	333.3	5000.0	-23.5
2520.20	H	180.00	1.0	61.0	-2.6	58.4	827.5	5000.0	-15.6
2835.20	V	225.00	1.0	62.4	-2.0	60.4	1052.7	5000.0	-13.5
2835.20	H	270.00	1.0	60.3	-2.0	58.3	826.6	5000.0	-15.6
3150.40	V	225.00	1.0	67.3	-1.6	65.7	1927.5	5000.0	-8.3
3150.40	H	135.00	1.0	70.5	-1.6	68.9	2786.1	5000.0	-5.1

Table 2

<u>System Under Test</u>

FCC ID: LQN1821

_____

EUT: Connaught Electronics Ltd. Range Rover Remote Keyless Entry RF Transmitter; M/N:
                        CEL 6078; S/N: PCB Marked 018080
                        FCC ID: LQN1821

Table 3

<u>Interface Cables Used</u>

The EUT is battery powered and has no I/O cables.
                        _____

Table 4

<u>Measurement Equipment Used</u>

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 a spectrum analyzer plot 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.

ON TIME PER 100 ms:

(25 x 810 us) = 20.25 ms ON TIME PER 100 ms

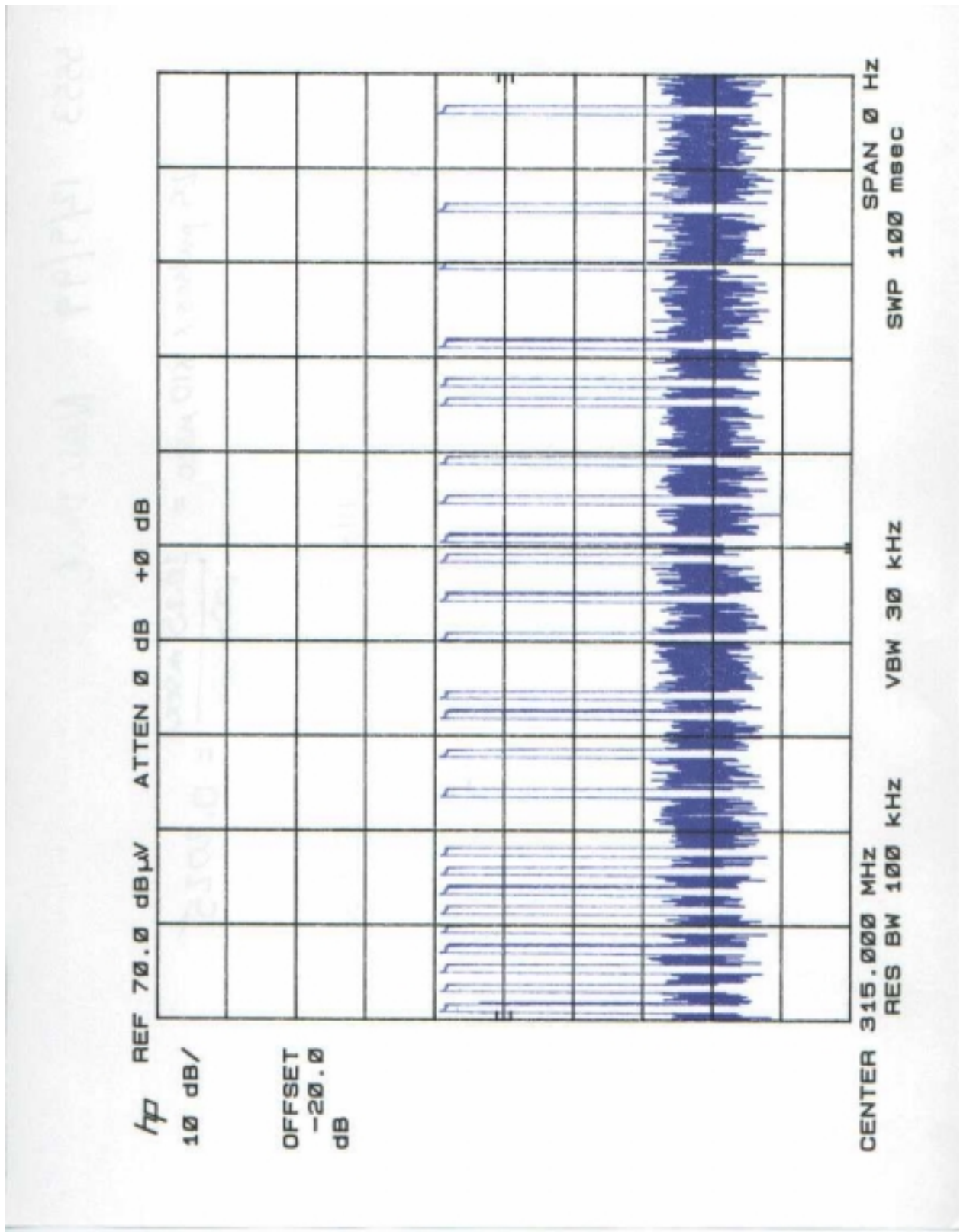> **= 20.25% DUTY CYCLE**
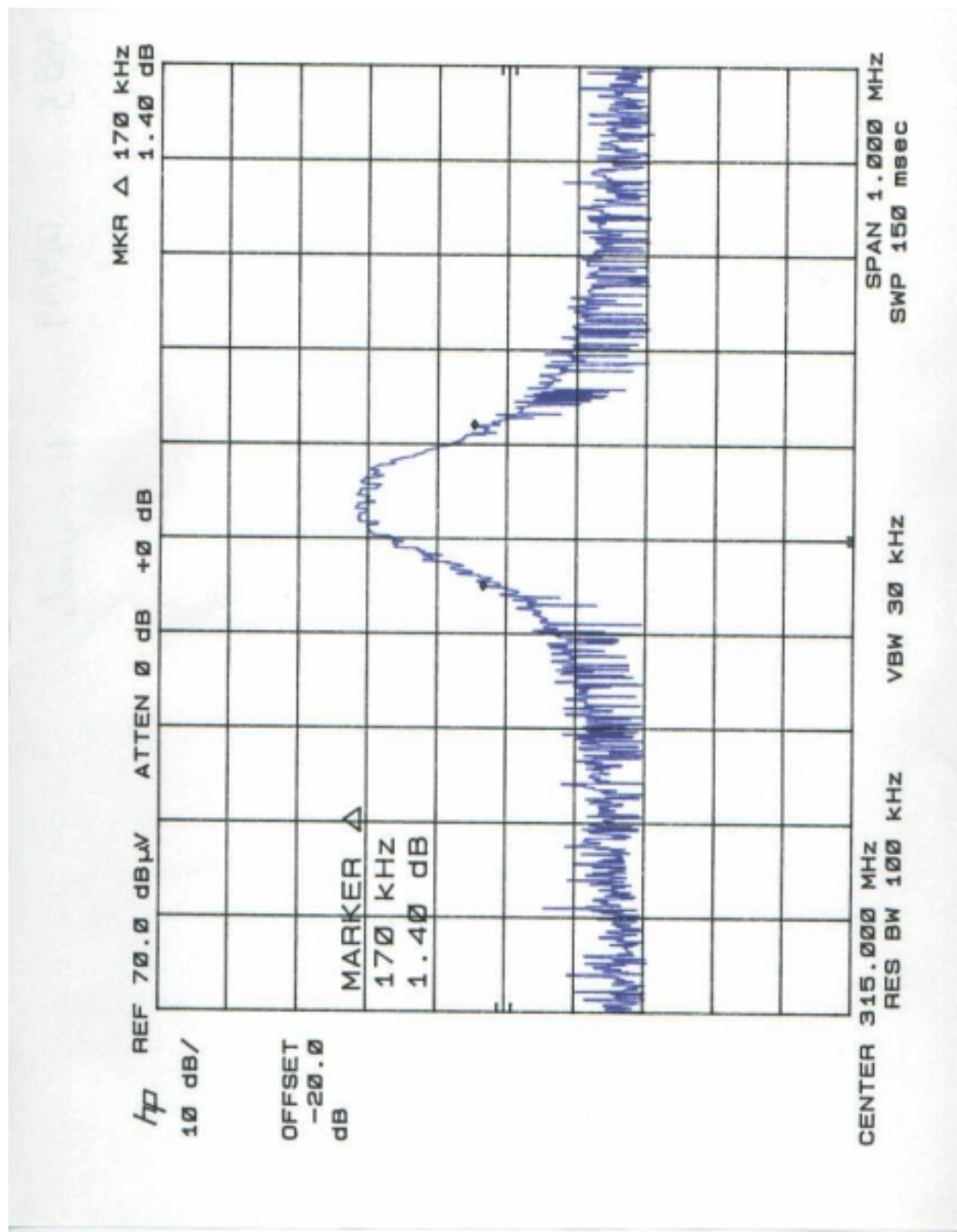> **= -13.9 dB**

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 = 315 MHz x .0025 = 787.5 kHz

Measured EUT Bandwidth = 170 kHz

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:

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

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.