# FCC CERTIFICATION TEST REPORT

for

Lamson & Sessions
25701 Science Park Drive
Beachwood, OH 44122

## FCC ID: NA2HS3600T

October 21, 1999

**WLL PROJECT #: 4885X**

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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
Herbert W. Meadows
Compliance Engineer

Date: October 21, 1999

# FCC CERTIFICATION TEST REPORT

for

## FCC ID: NA2HS3600T

## 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 HS3600T Low Power 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

After the implementation of the modification listed in Appendix B, the Lamson & Sessions Model complies with the limits for a Periodic Intentional Radiator under FCC Part 15.231.

## 2.0 Description of Equipment Under Test (EUT)

The Lamson & Sessions Model (EUT) is a low power transmitter that contains a PIR motion sensor for use as part of a security system. The battery powered transmitter is used with a receiver, M/N: HS3600R which is approved under the FCC DOC program. The transmitter is activated via the motion sensor and the unit stops transmitting within 5 seconds after activation.

### 2.1 On-board Oscillators

The Lamson & Sessions Model contains a 305 MHz SAW oscillator.

## 3.0 Test Configuration

To complete the test configuration required by the FCC, the transmitter was tested in all three orthogonal planes. The EUT was powered via four AA batteries.

### 3.1 Testing Algorithm

The transmitter was turned on and set to continuously transmit. 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 EUT is battery 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: Lamson & Sessions
FCC ID: NA2HS3600T
DATE: 9/23/99
BY: Herb Meadows
JOB #: 4885X

| FREQ MHz | POL H/V | Azimuth Degree | Ant Height m | SA LEVEL (QP) dBuV | Duty Cycle Correction dB | AFc dB/m | E-Field dBuV/m | E-Field uV/m | Limit uV/m | Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| 304.30 | V | 45.00 | 1.0 | 55.0 | -14.6 | 16.2 | 56.5 | 671.9 | 5595.8 | -18.4 |
| 304.30 | H | 225.00 | 1.0 | 64.4 | -14.6 | 16.2 | 65.9 | 1982.8 | 5595.8 | -9.0 |
| 608.65 | V | 225.00 | 1.0 | 40.7 | -14.6 | 23.7 | 49.8 | 307.6 | 559.5 | -5.2 |
| 608.65 | H | 0.00 | 1.0 | 38.7 | -14.6 | 23.7 | 47.8 | 244.4 | 559.5 | -7.2 |
| 912.85 | V | 270.00 | 1.0 | 31.7 | -14.6 | 28.3 | 45.4 | 185.8 | 559.5 | -9.6 |
| 912.85 | H | 180.00 | 1.0 | 34.5 | -14.6 | 28.3 | 48.2 | 256.5 | 559.5 | -6.8 |
| 1219.57 | V | 90.00 | 1.0 | 73.1 | -14.6 | -10.9 | 47.6 | 239.9 | 500.0 | -6.4 |
| 1219.57 | H | 180.00 | 1.0 | 76.4 | -14.6 | -10.9 | 50.9 | 350.8 | 500.0 | -3.1 |
| 1521.16 | V | 135.00 | 1.0 | 72.7 | -14.6 | -8.8 | 49.3 | 291.7 | 500.0 | -4.7 |
| 1521.16 | H | 180.00 | 1.0 | 69.1 | -14.6 | -8.8 | 45.7 | 192.8 | 500.0 | -8.3 |
| 1825.96 | V | 90.00 | 1.0 | 63.0 | -14.6 | -7.1 | 41.3 | 116.1 | 559.5 | -13.7 |
| 1825.96 | H | 180.00 | 1.0 | 67.4 | -14.6 | -7.1 | 45.7 | 192.8 | 559.5 | -9.3 |
| 2130.03 | V | 180.00 | 1.0 | 57.8 | -14.6 | -5.9 | 37.3 | 73.3 | 559.5 | -17.7 |
| 2130.03 | H | 315.00 | 1.0 | 56.6 | -14.6 | -5.9 | 36.1 | 63.8 | 559.5 | -18.9 |
| 2434.63 | V | 90.00 | 1.0 | 59.8 | -14.6 | -5.3 | 39.9 | 98.9 | 559.5 | -15.1 |
| 2434.63 | H | 180.00 | 1.0 | 60.6 | -14.6 | -5.3 | 40.7 | 108.4 | 559.5 | -14.3 |
| 2739.03 | V | 90.00 | 1.0 | 57.3 | -14.6 | -4.9 | 37.8 | 77.6 | 500.0 | -16.2 |
| 2739.03 | H | 225.00 | 1.0 | 54.7 | -14.6 | -4.9 | 35.2 | 57.5 | 500.0 | -18.8 |
| 3043.28 | V | 90.00 | 1.0 | 51.7 | -14.6 | -4.4 | 32.7 | 43.2 | 559.5 | -22.3 |
| 3043.28 | H | 0.00 | 1.0 | 52.9 | -14.6 | -4.4 | 33.9 | 49.5 | 559.5 | -21.1 |

## Table 2

System Under Test

FCC ID: NA2HS3600T

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EUT: Lamson & Sessions Low Power Transmitter; M/N: HS3600T; S/N: N/A; FCC ID: NA2HS3600T

## Table 3

Interface Cables Used

The EUT was powered via four AA batteries. The EUT contains no I/O cables.

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## Table 4

Measurement Equipment Used

The following equipment is used to perform measurements:

Hewlett-Packard Spectrum Analyzer: HP 8568B

Hewlett-Packard Quasi-Peak Adapter: HP 85650A

Hewlett-Packard Preselector: HP 85685A

Hewlett-Packard Spectrum Analyzer: HP 8593A

Antenna Research Associates, Inc. Biconical Log Periodic Antenna: LPB-2520A (Site 2)

Antenna Research Associates, Inc. Standard Gain 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

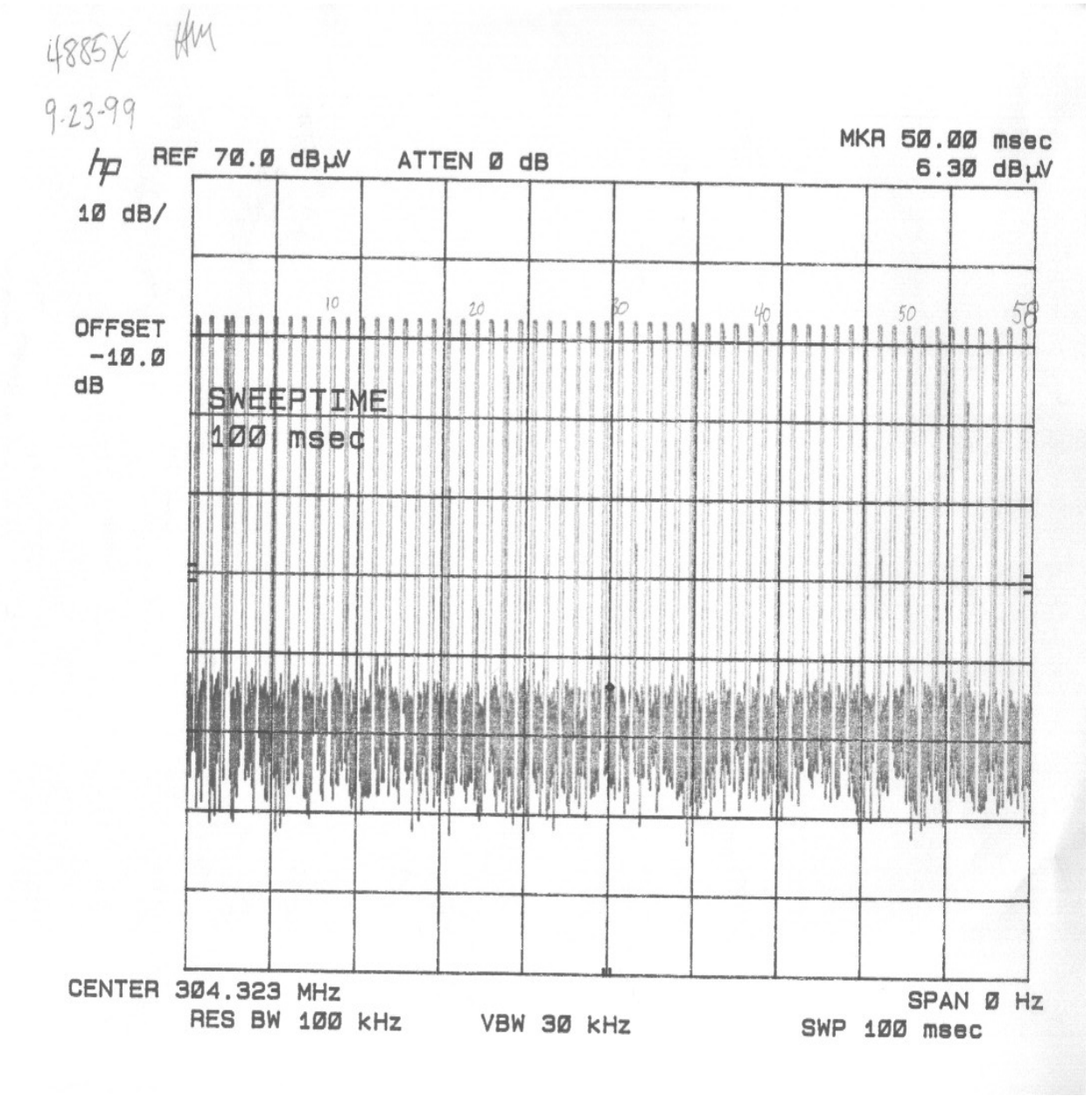
## DUTY CYCLE CALCULATIONS

**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:**

**(58 x 320 us) = 18.6 ms ON TIME PER 100 ms**

**= 18.6% DUTY CYCLE**
**= -14.6 dB**


4885X HM
9-23-99
REF 70.0 dBµV
ATTEN 0 dB
MKR 50.00 msec
6.30 dBµV
10 dB/
OFFSET
-10.0
dB
SWEEPTIME
100 msec
CENTER 304.323 MHz
RES BW 100 kHz
VBW 30 kHz
SPAN 0 Hz
SWP 100 msec

# EXHIBIT 2

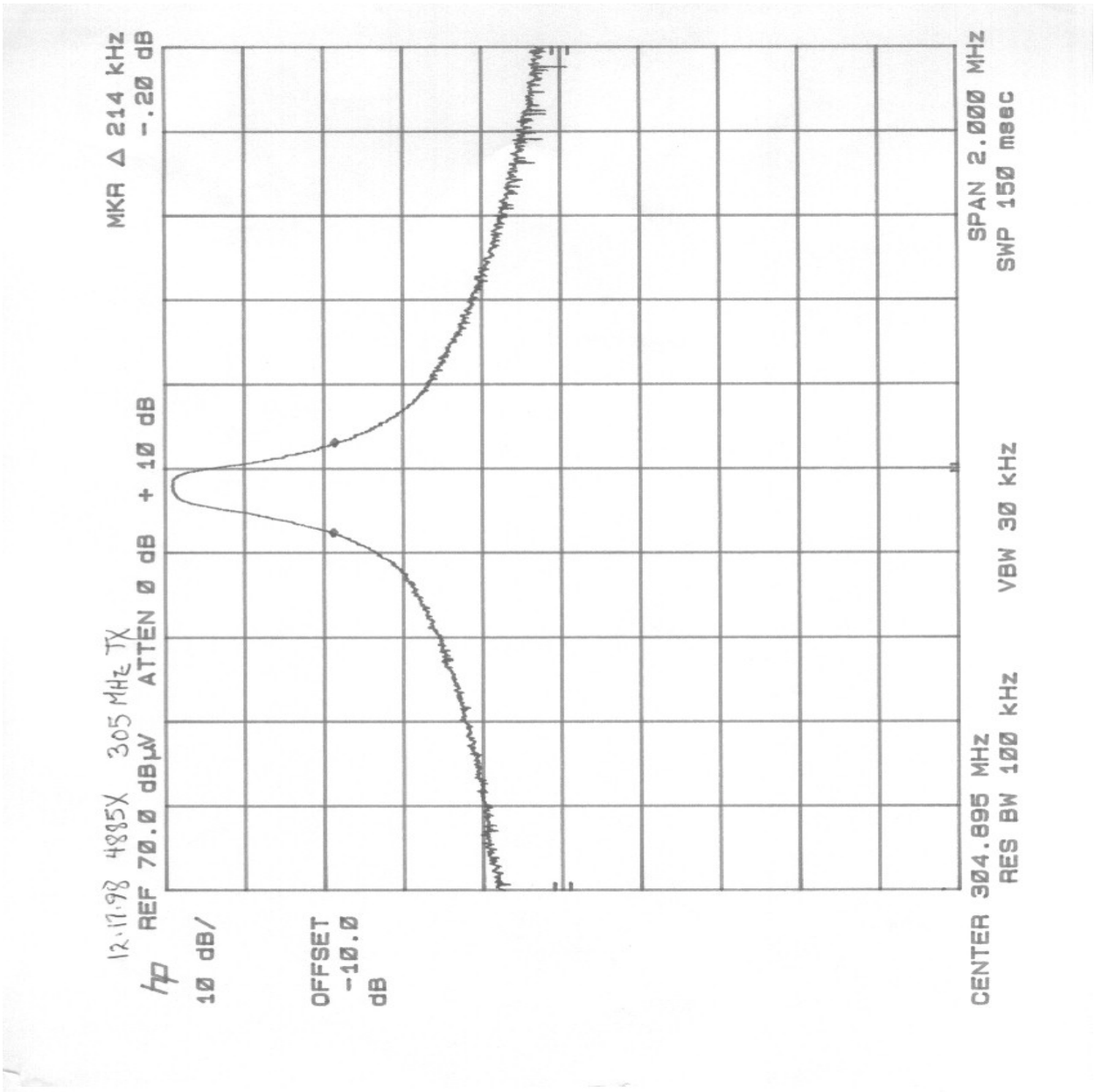
## CARRIER BANDWIDTH DATA

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

**Bandwidth Limit = Carrier Frequency x .0025**

**Bandwidth Limit = 305 MHz x .0025 = 762.5 kHz**

**Measured EUT Bandwidth = 214 kHz**


12.17.98 4885X 305 MHz TX
MKR Δ 214 kHz
-.20 dB
REF 70.0 dBµV
ATTEN 0 dB
+ 10 dB
10 dB/
OFFSET
-10.0
dB
CENTER 304.895 MHz
RES BW 100 kHz
VBW 30 kHz
SPAN 2.000 MHz
SWP 150 msec

## 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

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

## Appendix B

## Modifications

The following modifications, in addition to the production modifications, were made to the Lamson & Sessions HS3600T Transmitter (FCC ID:  NA2HS3600T) in order for it to comply with the radiated emissions requirements:

1. Replaced R25 120 ohm resistor.