



FOUNTAIN TECHNOLOGIES, INC.

COMPLIANCE LABORATORY

50 Randolph Rd.  
Somerset, NJ 08873

Tel: (732) 560-9010  
Fax: (732) 560-9173

## ELECTROMAGNETIC EMISSION COMPLIANCE REPORT of

WIRELESS OUTDOOR LIGHT CONTROL TRANSMITTER

MODEL: HW2190T

FCC ID: NA2HW2190-T

November 24, 1998

This report concerns (check one): Original grant  Class II change   
Equipment type: Periodic Operation Intentional Radiator

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes  no   
If yes, defer until: \_\_\_\_\_ (date)

Company agrees to notify the Commission by \_\_\_\_\_ (date)  
of the intended date of announcement of the product so that the grant can be  
issued on that date.

Transition Rules Request per 15.37? yes  no   
If no, assumed Part 15, Subpart B for unintentional radiators - the new 47 CFR  
[10-1-90 Edition] provision.

Report prepared for:  
Report prepared by:  
Report number:

LAMSON&SESSIONS CO.  
Fountain Compliance Lab  
0048-981120-1



The test result in this report IS supported and covered by the NVLAP accreditation

## Table of Contents

<b>Report Cover Page .....</b>	<b>1</b>
<b>Table of Contents .....</b>	<b>2</b>
<b>Figures .....</b>	<b>3</b>
<b>1. GENERAL INFORMATION .....</b>	<b>4</b>
<b>1.1 Verification of Compliance.....</b>	<b>4</b>
<b>1.2 Equipment Modifications .....</b>	<b>5</b>
<b>1.3 Product Information .....</b>	<b>6</b>
<b>1.4 Test Methodology .....</b>	<b>6</b>
<b>1.5 Test Facility.....</b>	<b>6</b>
<b>1.6 Test Equipment .....</b>	<b>6</b>
<b>1.7 Statement of the Document Use .....</b>	<b>7</b>
<b>2. PRODUCT LABELING .....</b>	<b>8</b>
<b>3. SYSTEM TEST CONFIGURATION .....</b>	<b>9</b>
<b>3.1 Justification.....</b>	<b>9</b>
<b>3.2 Special Accessories .....</b>	<b>9</b>
<b>3.3 Configuration of Tested System.....</b>	<b>9</b>
<b>4. SYSTEM SCHEMATICS .....</b>	<b>12</b>
<b>5. RADIATED EMISSION DATA .....</b>	<b>13</b>
<b>5.1 Field Strength Calculation.....</b>	<b>13</b>
<b>5.2 Test Methods and Conditions .....</b>	<b>13</b>
<b>5.3 Test Data .....</b>	<b>13</b>
<b>5.4 Occupied Bandwidth.....</b>	<b>15</b>
<b>6. PHOTOS OF TESTED EUT.....</b>	<b>20</b>

## Figures

<b>Figure 2.1 FCC ID Label .....</b>	<b>8</b>
<b>Figure 2.2 Location of Label on Back of the EUT .....</b>	<b>8</b>
<b>Figure 3.1 Radiated Test Setup, Position 1 .....</b>	<b>10</b>
<b>Figure 3.2 Radiated Test Setup, Position 2 .....</b>	<b>10</b>
<b>Figure 3.3 Radiated Test Setup, Position 3 .....</b>	<b>11</b>
<b>Figure 4.1 EUT Schematics .....</b>	<b>12</b>
<b>Figure 5.1 Pulse Train Timing .....</b>	<b>16</b>
<b>Figure 5.2 Short Pulse Timing .....</b>	<b>17</b>
<b>Figure 5.3 Long Pulse Timing .....</b>	<b>18</b>
<b>Figure 5.4 Occupied Bandwidth .....</b>	<b>19</b>
<b>Figure 6.1 Top View .....</b>	<b>21</b>
<b>Figure 6.2 Bottom View .....</b>	<b>22</b>
<b>Figure 6.3 Component Side .....</b>	<b>23</b>
<b>Figure 6.4 Foil Side.....</b>	<b>24</b>

## 1. GENERAL INFORMATION

### 1.1 Verification of Compliance

EUT: **WIRELESS OUTDOOR LIGHT CONTROL TRANSMITTER**  
 Model: **HW2190T**  
 Applicant: **LAMSON&SESSIONS CO.**  
 Test Type: **CERTIFICATION**  
 Result: **PASS**  
 Tested by: **FOUNTAIN COMPLIANCE LABORATORY**  
 Test Date: **11-23-98**  
 Report Number: **0048-981120-1**

The above equipment was tested by Fountain Technologies, Inc. Compliance Laboratory for compliance with the requirement set forth in the FCC rules and regulations Part 15, subpart C. This said equipment in the configuration described in the report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

The estimated uncertainty of the test result is given as following. The method of uncertainty calculation is provided in Fountain Compliance Lab. Doc. No. 0048-01-01.

	Prob. Dist.	Uncertainty(dB)	Uncertainty(dB)	Uncertainty(dB)
		30-1000MHz	1-6.5GHz	Conducted
Combined Std. Uncertainty $u_c$	norm.	$\pm 2.36$	$\pm 2.99$	$\pm 1.83$



Wei Li  
 Lab Manager  
 Fountain Compliance Lab  
 Fountain Technologies, Inc.

Date: Nov. 25, 1998

## **1.2 Equipment Modifications**

To achieve compliance to Class B levels, the following change(s) were made in **WIRELESS OUTDOOR LIGHT CONTROL TRANSMITTER**, model: **HW2190T** by Fountain Compliance Laboratory during compliance testing:

1. Added a 180 ohms SMT resister between the collector of transmitter and variable capacitor.

This modified product was used as EUT for final EMC test and report. The above modifications will be implemented in each production unit sold under the FCC Number: **NA2HW2190-T**.

### 1.3 Product Information

#### System Configuration

ITEM	DESCRIPTION	FCC ID	CABLE
Product	WIRELESS OUTDOOR LIGHT CONTROL <sup>(1)</sup>	NA2HW2190-T	
Housing	PLASTICS		
Power Supply	BATTERY		
Clock/OSC Freq.	312.1MHz		
Device Type	Periodic Operation		

(1) EUT submitted for grant.

### 1.4 Test Methodology

Radiated tests were performed according to the procedures in ANSI C63.4-1992 at an antenna to EUT distance of 3 meters.

### 1.5 Test Facility

The open area test site and conducted measurement facility used to collect the radiated and conducted data are located at 50 Randolph Road, Somerset, New Jersey. This site has been accepted by FCC to perform measurements under Part 15 or 18 in a letter dated May 19, 1997 (Refer to: 31040/PRV 1300F2). The NVLAP Lab code for accreditation of FCC EMC Test Method is: 200101-0.

### 1.6 Test Equipment

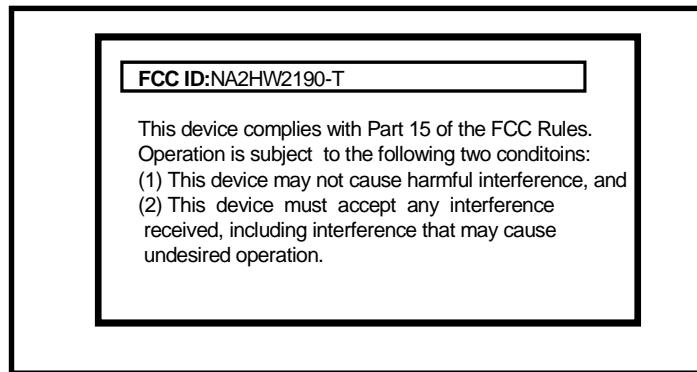
Manufacture	Model	Serial No.	Description	Last Cal dd/mm/yy	Cal Due dd/mm/yy
Hewlett-Packard	HP8546A	3625A00341	EMI Receiver	17/11/98	17/11/99
Fischer Custom	LISN-2	900-4-009	Line Impedance Stabilization Networks	01/04/98	01/04/99
EMCO	3115	4945	Double Ridge Guide Horn Antenna	21/10/98	21/10/99
ARA	BCD-235/B	172	30-200MHz Biconical Antenna	19/05/98	19/05/99
EMCO	3146	9008-2860	200-1000MHz Log-Periodic Antenna	30/04/98	30/04/99

All Test Equipment Used are Calibrated Traceable to NIST Standards.

### **1.7 Statement for the Document Use**

This report shall not be reproduced except in full, without the written approval of the laboratory. And this report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

## 2. PRODUCT LABELING



**Figure 2.1 FCC ID Label**



**Figure 2.2 Location of Label on Back of the EUT**

### **3. SYSTEM TEST CONFIGURATION**

#### **3.1 Justification**

The system was configured for testing in a typical fashion (as a customer would normally use it). And its antenna was permanently attached to the EUT (Made on the PCB).

This manually operated transmitter will deactivate immediately after releasing the “OFF” or “ON” switch button.

Testing was performed in “ON” mode. It is the worst case.

#### **3.2 Special Accessories**

N/A

#### **3.3 Configuration of Tested System**

Figure 3.1 and Figure 3.3 illustrate this system, which is tested standing along.



**Figure 3.1 Radiated Test Setup, Position 1**

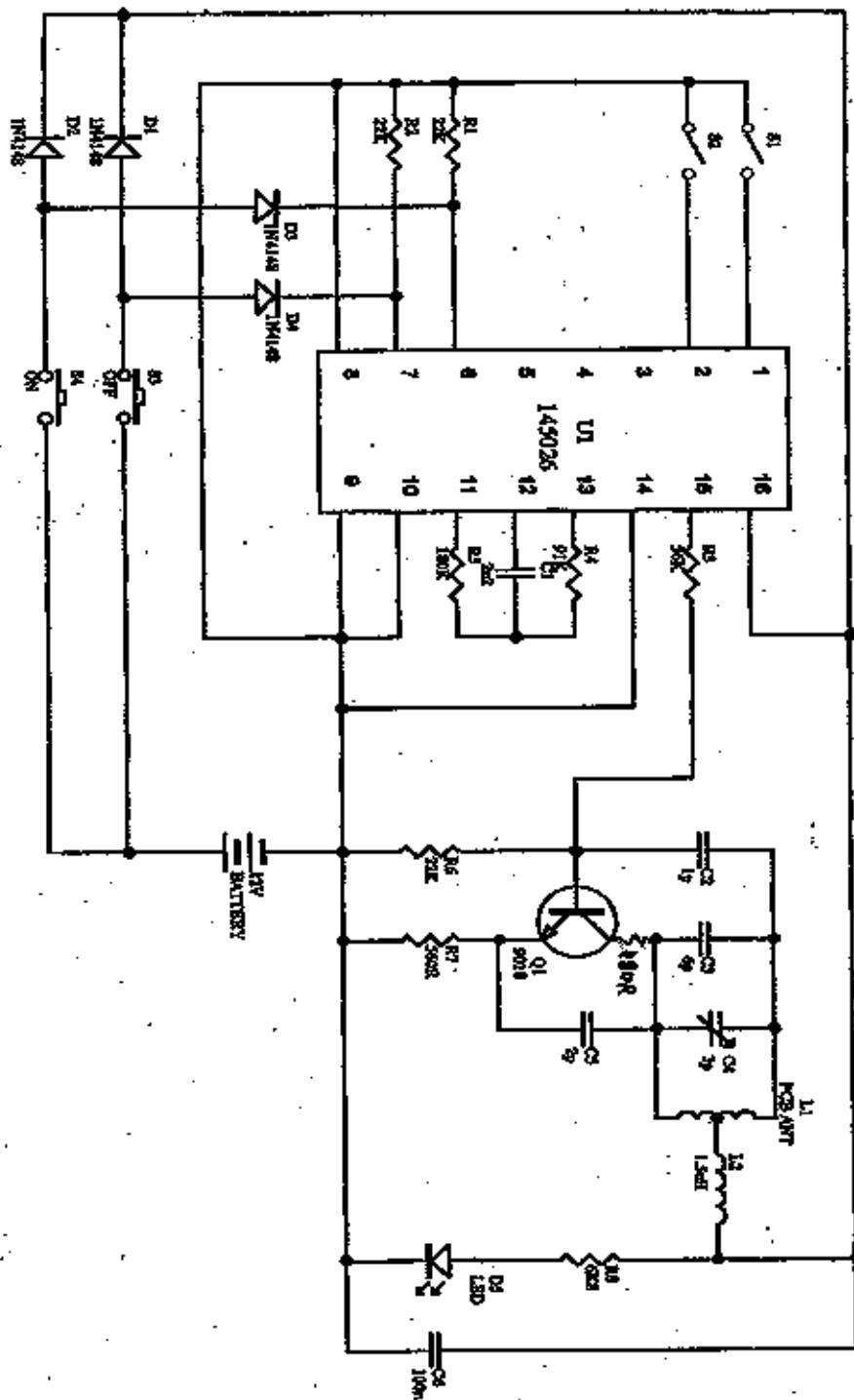


**Figure 3.2 Radiated Test Setup, Position 2**



**Figure 3.3 Radiated Test Setup, Position 3**

## 4. SYSTEM SCHEMATICS



## Figure 4.1 System Schematics

## 5. RADIATED EMISSION DATA

### 5.1 Field Strength Calculation

The corrected field strength is automatically calculated by EMI Receiver using following:

$$FS = RA - AF - CF - AG$$

where FS: Corrected Field Strength in dB $\mu$ V/m

RA: Amplitude of EMI Receiver before correction in dB $\mu$ V

AF: Antenna Factor in dB/m

CF: Cable Attenuation Factor in dB

AG: Built-in Preamplifier Gain in dB (Stored in receiver as part of the calibration data)

The pulse train timing plots are showed in Figure 5.1, 5.2 and 5.3. The total time for each **pulse train** is 43.1ms, the **long pulse** is 1.59ms, and **short pulse** is 0.22ms. The maximum setting for high voltage is 7 long pulses and 11 short pulses.

$$(0.22 \times 11 + 1.59 \times 7) / 43.1 = 0.31438515 = -10.0 \text{dB}$$

The maximum average field strength should be **0.314** of the peak field strength measured. So we use peak value minus **10dB** as calculated maximum average field strength.

### 5.2 Test Methods and Conditions

The EUT exercise program was loaded during the radiated emission test. The initial step in collecting radiated data is a EMI Receiver scan of the measurement range 30MHz - 5GHz using peak detector. IF bandwidth is 120kHz and video bandwidth is 300kHz for measuring 30MHz-1GHz. Both bandwidth are 1MHz for above 1GHz measurement.

### 5.3 Test Data

The following data lists the significant emission frequencies, polarity and position, peak reading of the EMI Receiver, calculated average reading, the FCC limit, and the difference between the peak reading and the limit. Explanation of the correction and calculation are given in section 5.1.

Test Personnel:

Tester Signature: 

Date: 11-23-1998

Typed/Printed Name: David Tu

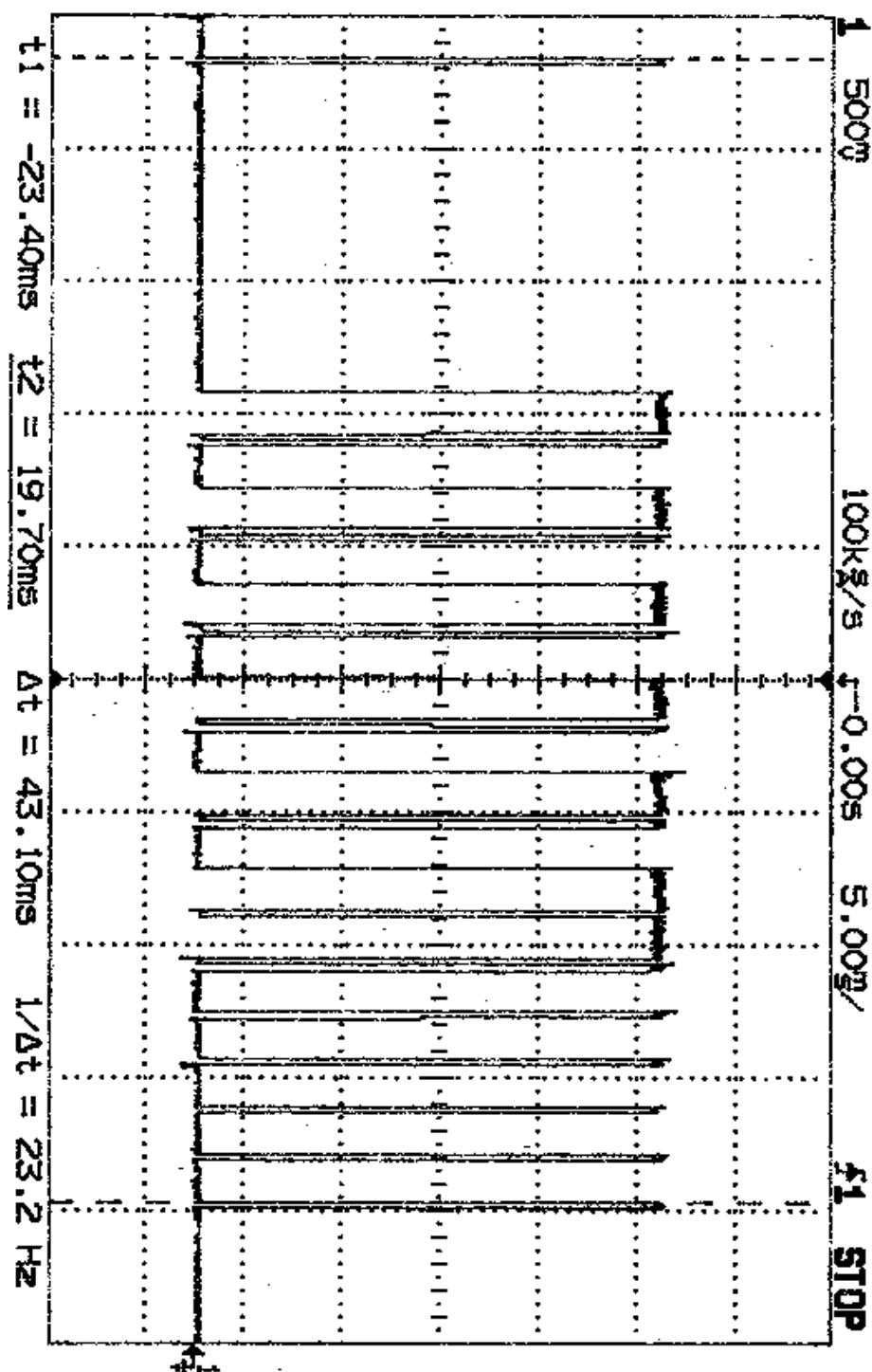
## Radiated Test Data

Frequency (MHz)	Polarity [H or V], Position (X,Y,Z)	Height (m)	Azimuth (Degree)	Peak Reading (dB $\mu$ V/m)	Calculated Average Reading (dB $\mu$ V/m)	FCC 3m Limit (dB $\mu$ V/m)	Difference from limit (dB)
312.1	H,X	1.0	267	71.3	61.3	75.5 <sup>(3)</sup>	-14.2
624.3	H,X	1.23	212	59.7	49.7	55.5 <sup>(4)</sup>	-5.8
936.2	H,X	1.0	100	57.9	47.9	55.5 <sup>(4)</sup>	-7.6
312.1	V,X	1.48	155	58.3	48.3	75.5 <sup>(3)</sup>	-27.2
624.3	V,X	1.86	169	50.8	40.8	55.5 <sup>(4)</sup>	-14.7
936.2	V,X	1.04	274	51.8	41.8	55.5 <sup>(4)</sup>	-13.7
1248.6	V,X	1.0	281	52.2	42.2	55.5 <sup>(4)</sup>	-13.3
1562.0	V,X	1.0	110	51.7	41.7	54.0 <sup>(2)</sup>	-12.3
312.1	H,Y	2.0	281	65.7	55.7	75.5 <sup>(3)</sup>	-19.8
624.3	H,Y	1.35	117	57.1	47.1	55.5 <sup>(4)</sup>	-8.4
936.2	H,Y	2.04	216	56.5	46.5	55.5 <sup>(4)</sup>	-9.0
1248.6	H,Y	1.0	291	56.0	46.0	55.5 <sup>(4)</sup>	-9.5
1562.0	H,Y	1.0	197	52.7	42.7	54.0 <sup>(2)</sup>	-11.3
312.1	V,Y	1.84	173	69.7	59.7	75.5 <sup>(3)</sup>	-15.8
624.3	V,Y	1.0	182	57.1	47.1	55.5 <sup>(4)</sup>	-8.4
936.2	V,Y	1.53	000	59.0	49.0	55.5 <sup>(4)</sup>	-6.5
1248.6	V,Y	1.0	076	53.0	43.0	55.5 <sup>(4)</sup>	-12.5
312.1	H,Z	2.38	000	61.1	51.1	75.5 <sup>(3)</sup>	-24.4
624.3	H,Z	1.84	173	53.7	43.7	55.5 <sup>(4)</sup>	-11.8
936.2	H,Z	1.84	214	58.0	48.0	55.5 <sup>(4)</sup>	-7.5
1248.6	H,Z	1.0	268	57.5	47.5	55.5 <sup>(4)</sup>	-8.0
1562.0	H,Z	1.04	145	52.7	42.7	54.0 <sup>(2)</sup>	-11.3
312.1	V,Z	1.87	187	67.6	57.6	75.5 <sup>(3)</sup>	-17.9
624.3	V,Z	1.0	1.0	61.9	51.9	55.5 <sup>(4)</sup>	-3.6
936.2	V,Z	1.18	1.18	60.7	50.7	55.5 <sup>(4)</sup>	-4.8

- (1) See Figure 3.1, 3.2 and 3.3 for definition of position 1, 2, 3.
- (2) Restricted band.
- (3) Fundamental limit is 3750-12500 microvolts/meter linear interpolations.
- (4) Spurious limit is 375-1250 microvolts/meter linear interpolations.

## 5.4 Occupied Bandwidth

The bandwidth of the emission shall be no wider than 0.25% of the center frequency, in this case, 0.78MHz. Bandwidth is determined at the points 20dB down from the modulated carrier. Figure 5.4 shows the occupied bandwidth plot.

**Figure 5.1 Pulse Train Timing**

## Figure 5.2 Short Pulse Timing

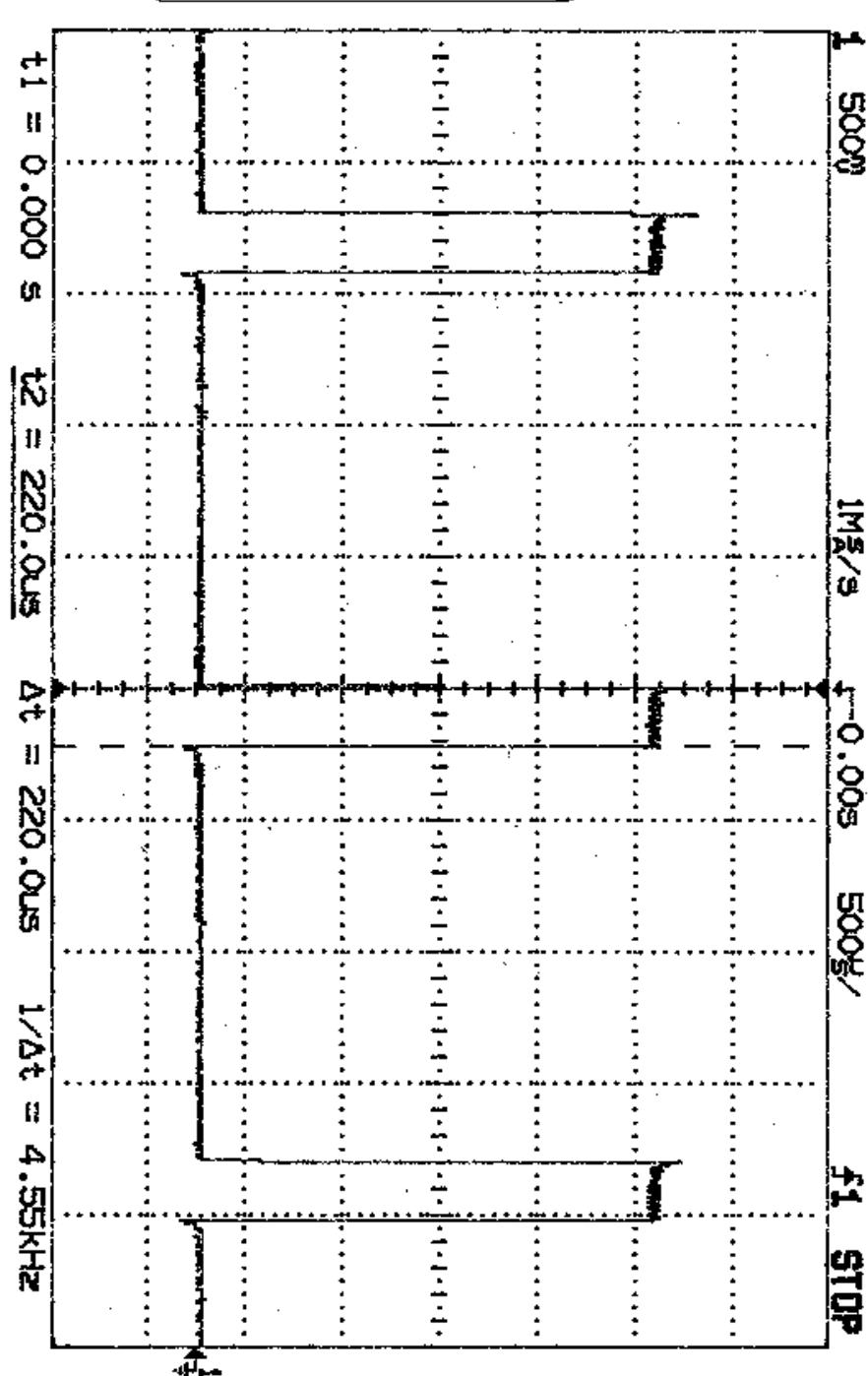


Figure 5.3 Long Pulse Timing

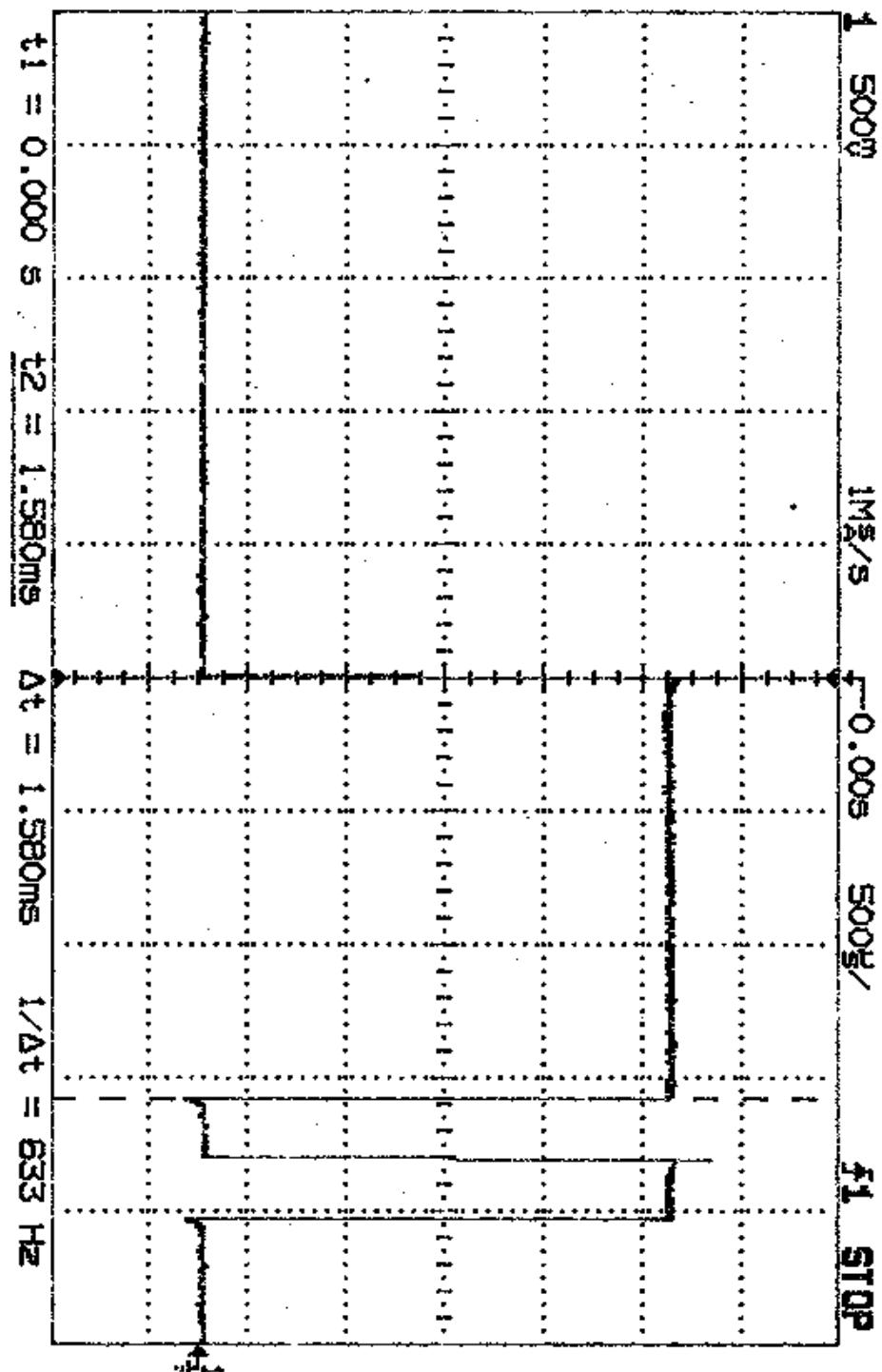
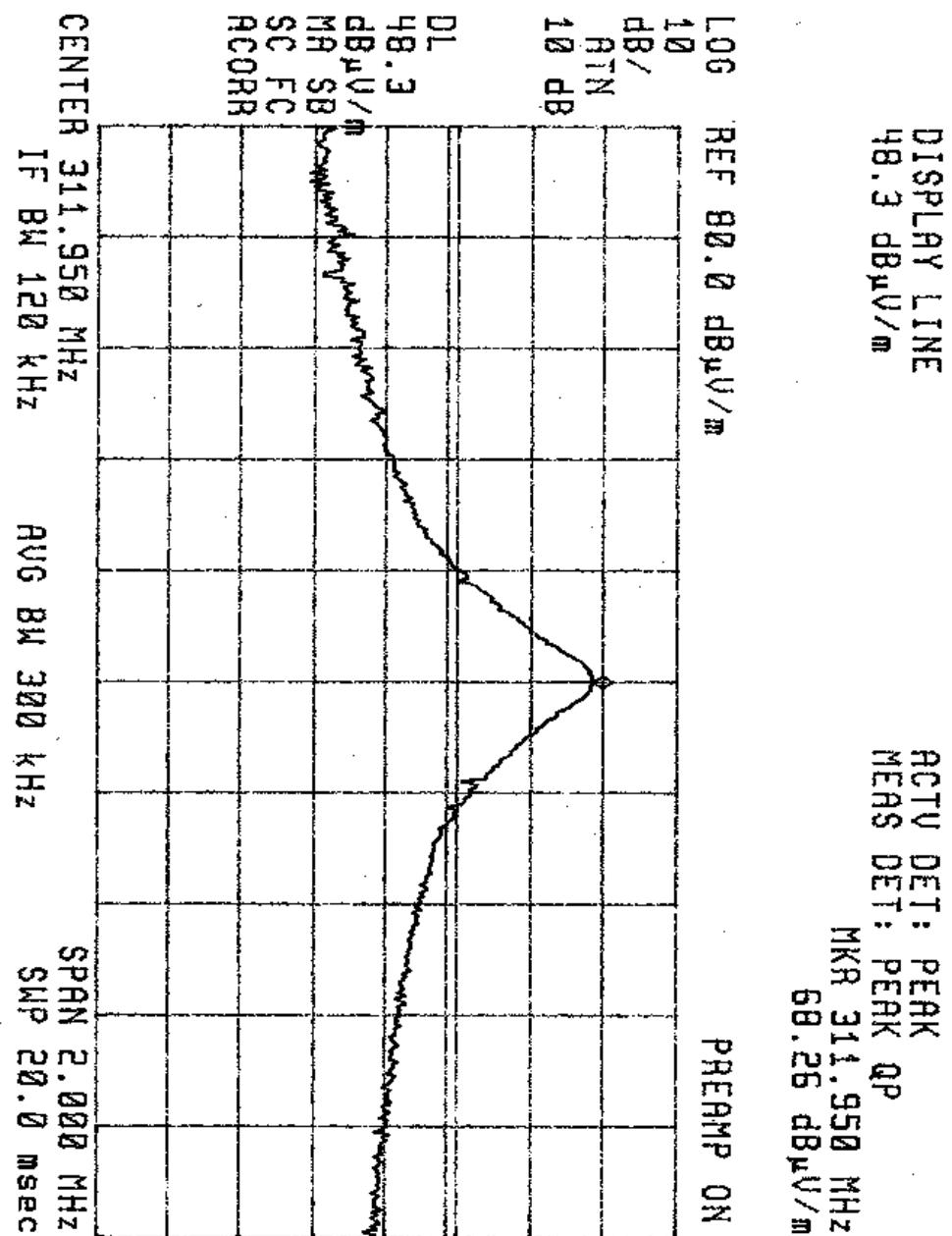


Figure 5.4 Occupied Bandwidth



## **6. PHOTOS OF TESTED EUT**

The following photos show the inside details of the EUT.