



**Certelecum Laboratories Inc.**

*Safety - EMI - Telecom - ISO Guide 25*

**ENGINEERING TEST REPORT**

**ON:  
THE DIGITAL SECURITY CONTROLS  
"WLS-915 ALARM TRANSMITTER"**

**FCC ID: F5398SS15**

**IN ACCORDANCE WITH:  
FCC PART 15, SUBPART C  
DIRECT SEQUESTNCE TRANSMITTERS  
902 - 928 MHz**

**PROJECT NO.: 7DI160-54C**

**TESTED FOR:**

DIGITAL SECURITY CONROLS LTD.  
1645 FLINT ROAD  
DOWNSVIEW, ONTARIO M3J 2J6

**TESTED BY:**

CERTELECOM LABORATORIES INC.  
3325 RIVER ROAD, R.R. 5  
OTTAWA, ONTARIO K1V 1H2



**NVLAP LAB CODE: 100351-0**

**JANUARY 1998**

**This document contains 38 pages including this one.**

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**This report applies only to the items tested.**

*EQUIPMENT: The Digital Security Controls "WLS-915 Alarm Transmitter"*  
*FCC ID: F5398SS15*

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*EQUIPMENT: The Digital Security Controls "WLS-915 Alarm Transmitter"*  
*FCC ID: F5398SS15*

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*EQUIPMENT: The Digital Security Controls "WLS-915 Alarm Transmitter"*  
*FCC ID: F5398SS15*

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**Section 1. Summary Of Test Results**

Manufacturer: Digital Security Controls

Model No.: WLS-915

Serial No.: None

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15, Subpart C, Paragraph 15.247 for Direct Sequence Spread Spectrum devices.

☒ New Submission

☒ Production Unit

☐ Class II Permissive Change

☐ Pre-Production Unit

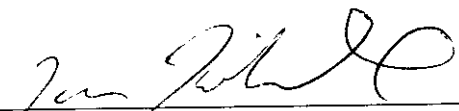
☐ Family Listing

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.


THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST  
SPECIFICATIONS HAVE BEEN MADE.  
See " Summary of Test Data".

**NVLAP**

**NVLAP LAB CODE: 100351-0**

TESTED BY:   
Tom Tidwell, Senior Technologist

DATE: 9 APR. 1998

APPROVED BY:   
W. Waterhouse, RF Engineering Lab Manager

DATE: 13th April 1998

*EQUIPMENT: The Digital Security Controls "WLS-915 Alarm Transmitter"**FCC ID: F5398SS15***Summary Of Test Data**

| NAME OF TEST                              | PARA. NO.     | SPEC.               | MEAS.          | RESULT   |
|---|---------------|---------------------|----------------|----------|
| Powerline Conducted Emissions             | 15.207 (a)    | 48 dB $\mu$ V       | N/A            | N/A      |
| Occupied Bandwidth                        | 15.247 (a)(2) | $\geq 500$ kHz      | 765 kHz        | Complies |
| Peak Power Output                         | 15.247 (b)    | 1 watt              | 0.18 W         | Complies |
| Spurious Emissions<br>(Antenna Conducted) | 15.247 (c)    | -20 dBc             | N/A            | N/A      |
| Spurious Emissions<br>(Radiated)          | 15.247 (c)    | Table<br>15.209 (a) | 51dB $\mu$ V/m | Complies |
| Transmitter Power Density                 | 15.247 (d)    | $\leq +8$ dBm       | -2.5 dBm       | Complies |
| Processing Gain                           | 15.247 (e)    | $\geq 10$ dB        | 13.7 dB        | Complies |

**Footnotes For N/A's:**

- (1) Powerline Conducted Emissions were not performed since the E.U.T. is battery powered.
- (2) Antenna Conducted Spurious Emissions were not performed since the E.U.T. has an integral antenna.

**Test Conditions:**            Temperature: 23 °C  
                                 Humidity: 20 %

*EQUIPMENT: The Digital Security Controls "WLS-915 Alarm Transmitter"**FCC ID: F5398SS15*

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**Section 2. General Equipment Specification****Transmitter**

|   |                          |
|---|--------------------------|
| <b>Power Input:</b>                               | 12 Vdc Battery           |
| <b>Frequency Range:</b>                           | 924 MHz (Fixed)          |
| <b>Turnable Bands:</b>                            | Not Applicable           |
| <b>6 dB Bandwidth:</b>                            | 765 kHz                  |
| <b>Type of Modulation</b>                         | FSK                      |
| <b>Data Rate:</b>                                 | 9600 bps                 |
| <b>Internal / External Data Source:</b>           | Not Applicable           |
| <b>Emissions Designator:</b>                      | F1D                      |
| <b>Output Impedance:</b>                          | Not Applicable           |
| <b>RF Power Output (Rated):</b>                   | 20 mW                    |
| <b>Duty Cycle:</b>                                | -18 dB (20 Log 12.4/100) |
| <b>Channel Spacing:</b>                           | Not Applicable           |
| <b>Operator Selection of Operating Frequency:</b> | Not Applicable           |
| <b>Power Output Adjustment Capability:</b>        | Not Applicable           |

*EQUIPMENT: The Digital Security Controls "WLS-915 Alarm Transmitter"*  
*FCC ID: F5398SS15*

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**Receiver**

**Frequency Range:**

**Turnable Bands:**

**LO:**

**1<sup>st</sup> IF:**

**2<sup>nd</sup> IF:**

**Bandwidth:**

**Type of Modulation:**

**Operator Selection of Operating Frequency**

**NOT APPLICABLE**

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FCC PART 15, SUBPART C  
DIRECT SEQUENCE TRANSMITTERS  
PROJECT NO.: 7DI160-54C

*EQUIPMENT: The Digital Security Controls "WLS-915 Alarm Transmitter"*  
*FCC ID: F5398SS15*

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**Description of Modification for Modification Filing**

**Family List Rational**

**NOT APPLICABLE**



*EQUIPMENT: The Digital Security Controls "WLS-915 Alarm Transmitter"*

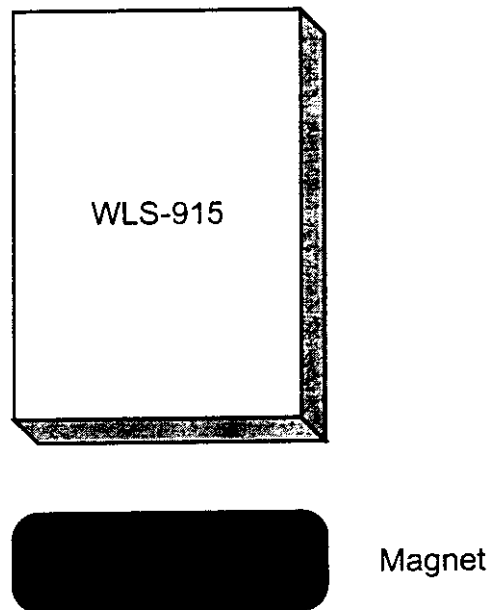
FCC ID: F5398SS15

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### **Theory of Operation**

The E.U.T. is a magnetic switch activate transmitter designed to operate with the WLS-900 alarm system. The WLS-915 is a door contact transmitter.

### **System Diagram**



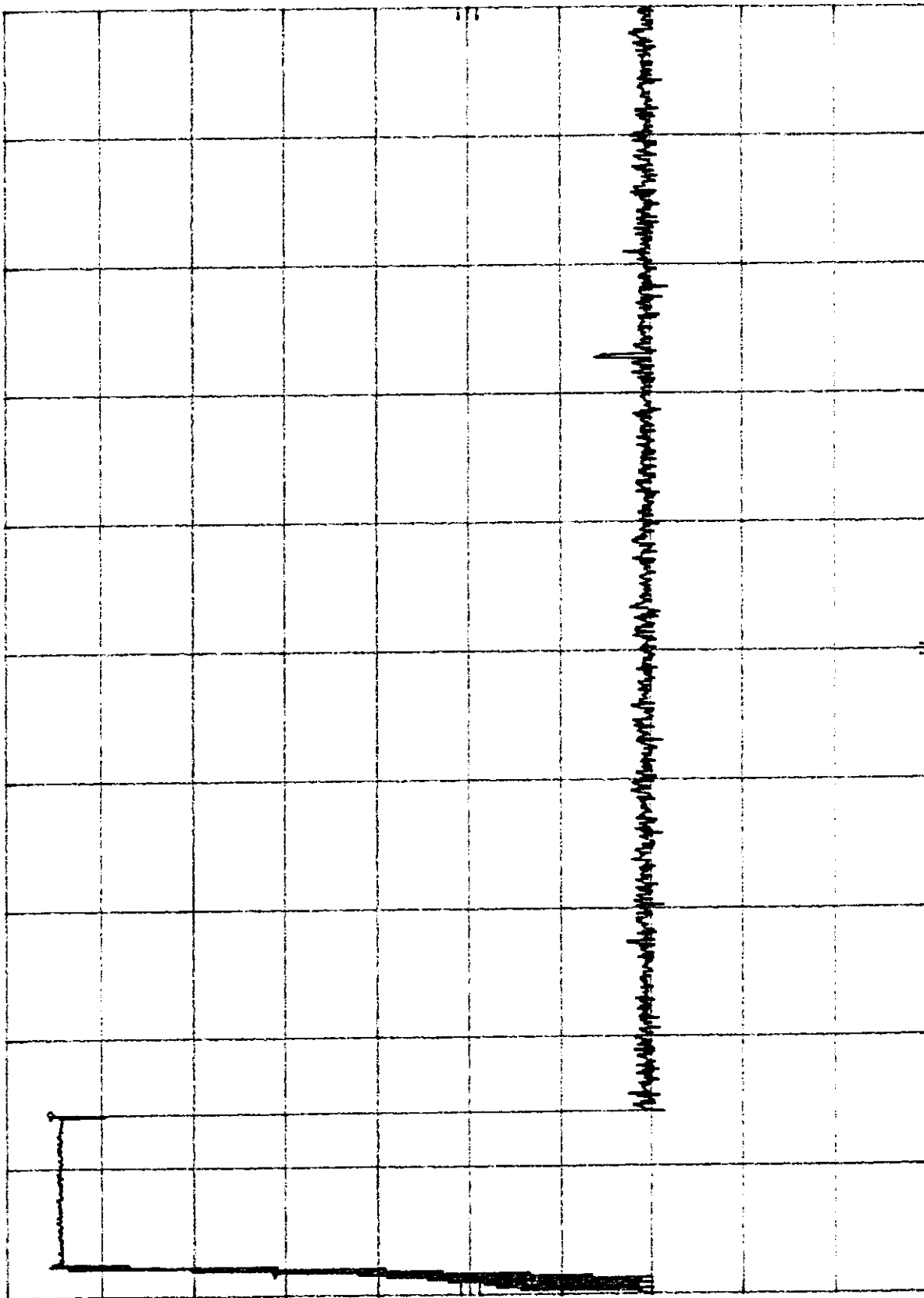
MKR  $\Delta$  12.40 msec  
24.20 dB

ATTEN 10 dB

REF 0.0 dBm

HP

10 dB/



SPAN 0 Hz  
SWP 100 msec

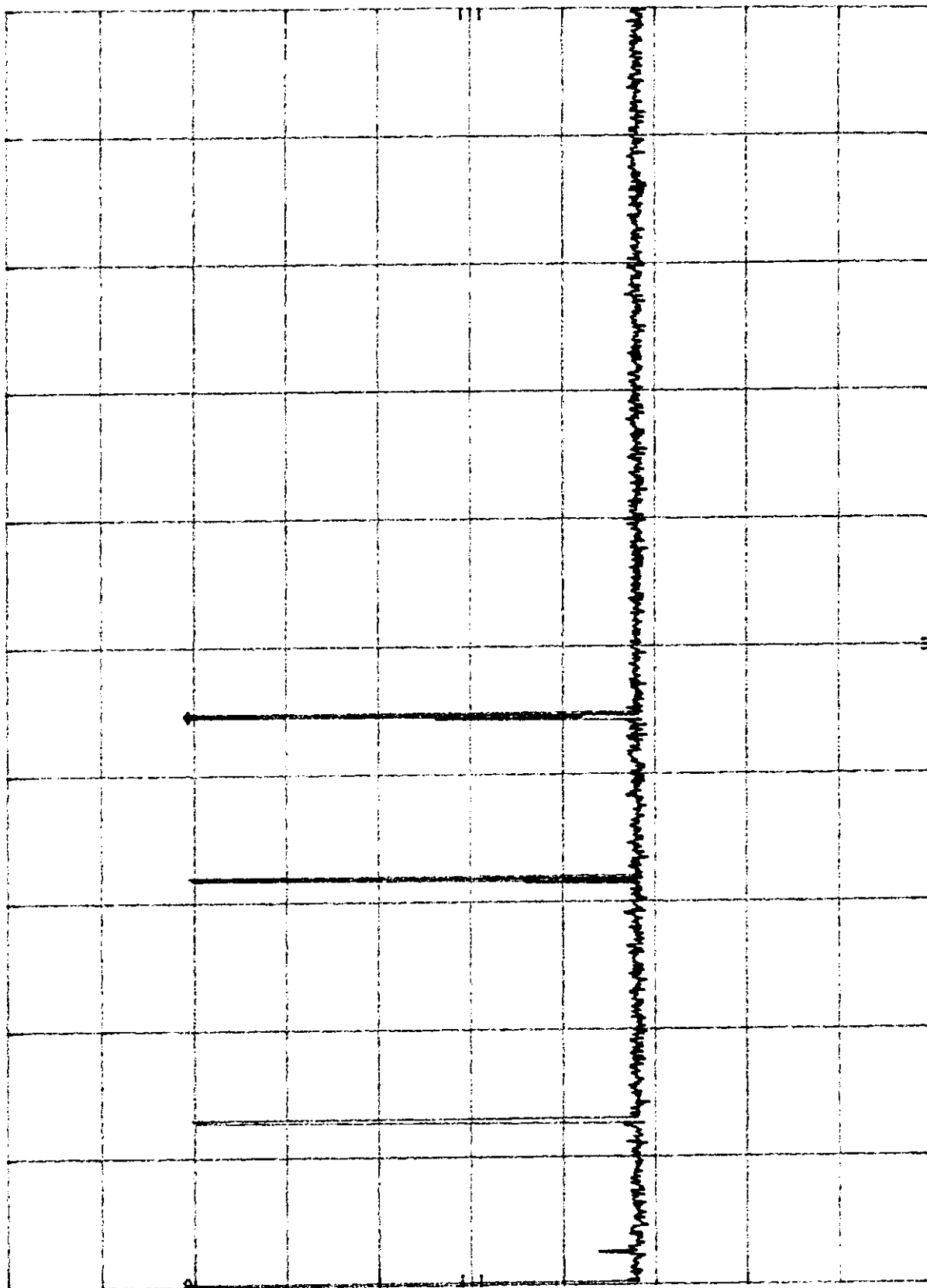
VBW 3 MHz

CENTER 924.000 000 MHz  
RES BW 1 MHz

MKR  $\Delta$  2.230 sec  
-0.10 dB

hp REF 0.0 dBm ATTN 10 dB

10 dB/



SPAN 0 Hz  
SWP 5.00 sec

VBW 3 MHz

CENTER 924.000 000 MHz  
RES BW 1 MHz

*EQUIPMENT: The Digital Security Controls "WLS-915 Alarm Transmitter"*  
*FCC ID: F5398SS15*

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**Section 3. Powerline Conducted Emissions**

|   |                      |
|---|----------------------|
| NAME OF TEST: Powerline Conducted Emissions | PARA. NO.: 15.207(a) |
| TESTED BY:                                  | DATE:                |

**Test Results:** Complies. See attached graph.

**Measurement Data:** See attached graph.

**NOT APPLICABLE**

*EQUIPMENT: The Digital Security Controls "WLS-915 Alarm Transmitter"*

*FCC ID: F5398SS15*

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**Section 4.        Occupied Bandwidth**

|                                  |                         |
|----------------------------------|-------------------------|
| NAME OF TEST: Occupied Bandwidth | PARA. NO.: 15.247(a)(2) |
| TESTED BY: Tom Tidwell           | DATE: February 16, 1998 |

**Test Results:**                Complies. The 6 dB bandwidth is 0.765 MHz.  
See attached graph.

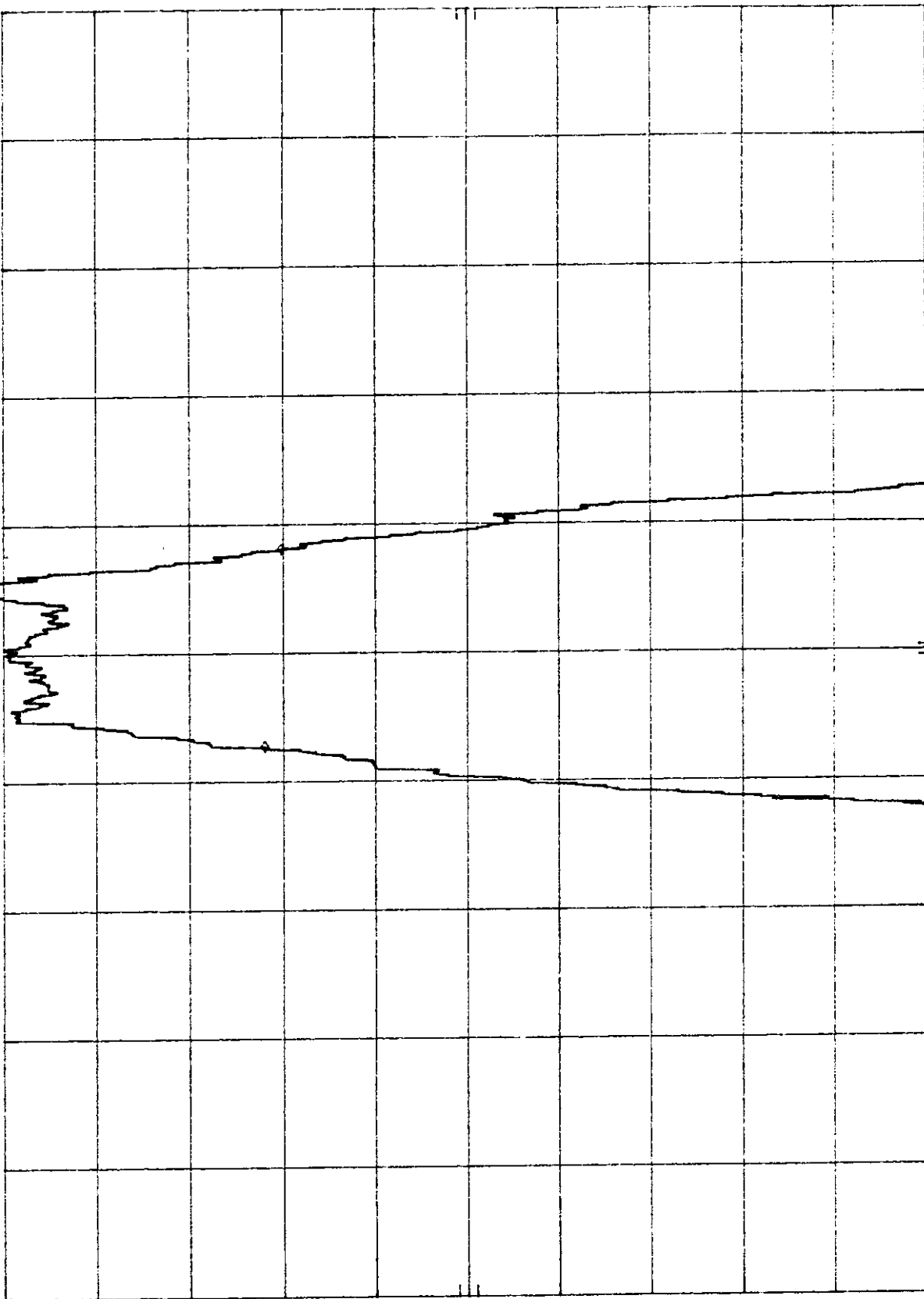
**Measurement Data:**        See attached graph.

MKR  $\Delta$  765 kHz  
-0.36 dB

ATTEN 10 dB

REF -17.3 dBm

hp  
2 dB/



SPAN 5.00 MHz  
SWP 20.0 msec

VBW 300 kHz

CENTER 924.00 MHz  
RES BW 100 kHz

EQUIPMENT: *The Digital Security Controls "WLS-915 Alarm Transmitter"*  
FCC ID: *F5398SS15*

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**Section 5. Peak Power Output**

|                                 |                        |
|---------------------------------|------------------------|
| NAME OF TEST: Peak Power Output | PARA. NO.: 15.247 (b)  |
| TESTED BY: Tom Tidwell          | DATE: January 19, 1998 |

**Test Results:** Complies. The maximum peak power output of the transmitter is 0.018 watts

**Measurement Data:** Detachable antenna? ☐ Yes ☒ No  
If yes, state the type of non-standard connector used at the antenna port:

Directional Gain of Antenna: 0 dBi or 1 Numeric.

Peak Power Output: 0.018 watts.

Field Strength: 107.7 dB $\mu$ V/m @ 3m or 0.243 V/m @ 3m.

FCC ID: F5398SS15

[illegible]

( ) Denotes failing emission level.



*EQUIPMENT: The Digital Security Controls "WLS-915 Alarm Transmitter"*

*FCC ID: F5398SS15*

**Section 6. Spurious Emissions (Antenna Conducted)**

NAME OF TEST: Spurious Emissions (Antenna Conducted) PARA. NO.: 15.247(c)

TESTED BY:

DATE:

**Test Results:**

Complies. The worst-case emission level is \_\_\_\_\_ dBm at  
\_\_\_\_\_ MHz. This is \_\_\_\_\_ dB above / below the specification  
limit.

**Measurement Data:**

See attached graphs.

**NOT APPLICABLE**

*EQUIPMENT: The Digital Security Controls "WLS-915 Alarm Transmitter"*  
*FCC ID: F5398SS15*

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**Section 7. Spurious Emissions (Radiated)**

|   |                        |
|---|------------------------|
| NAME OF TEST: Spurious Emissions (Radiated) | PARA. NO.: 15.247(c)   |
| TESTED BY: Tom Tidwell                      | DATE: January 19, 1998 |

**Test Results:** Complies. The worst-case emission level is 51.0 dB $\mu$ V/m @ 3m at 3696 MHz. This is 3.0 dB below the specification limit.

**Measurement Data:** See attached graphs.

FCC ID: F5398SS15

[illegible]

B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole

\* Re-measured using dipole antenna.

\*\* Includes cable loss when amplifier is not used.

\*\*\* Includes cable loss.

( ) Denotes failing emission level.

### Test Data - Radiated Emissions (AVERAGE)

[illegible]

Notes:

B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole

\* Re-measured using dipole antenna.

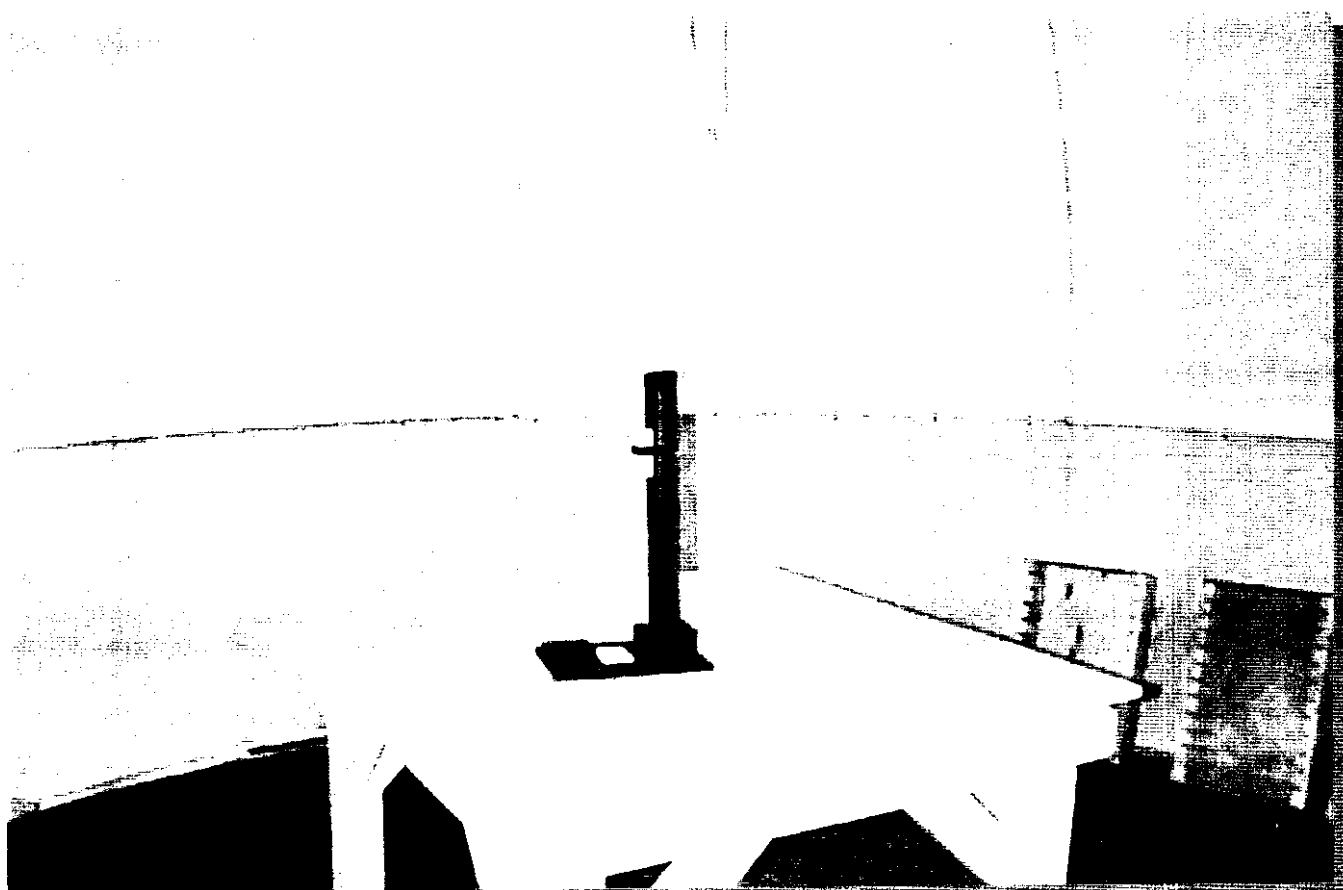
\*\* Includes cable loss when amplifier is not used.

\*\*\* Includes cable loss.

( ) Denotes failing emission level.

## RADIATED PHOTOGRAPHS

### FRONT VIEW



*EQUIPMENT: The Digital Security Controls "WLS-915 Alarm Transmitter"*

*FCC ID: F5398SS15*

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**Section 8. Transmitter Power Density**

NAME OF TEST: Transmitter Power Density

PARA. NO.: 15.247(d)

TESTED BY: Tom Tidwell

DATE: January 19, 1998

**Test Results:** Complies.

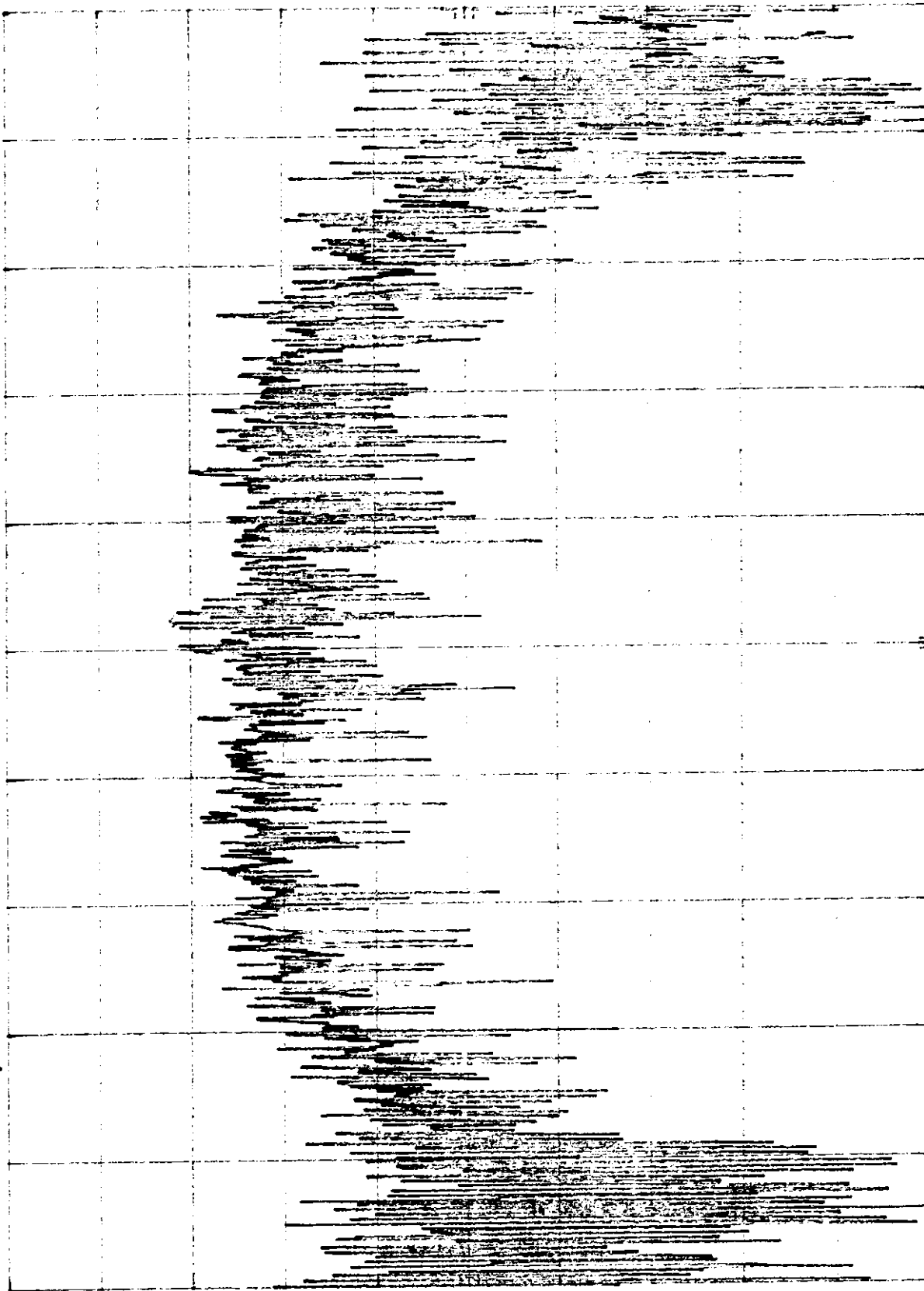
**Measurement Data:** See attached graphs.

Received Signal: 58 dB $\mu$ V  
Antenna Factor: 34.7 dB  
Field Strength: 92.7 dB $\mu$ V/m @ 3 m.  
Field Strength: 0.043152 V/m  
E.I.R.P.: 0.558626 mW  
E.I.R.P.: -2.5 dBm

MKR 924.033 MHz  
57.95 dBμV

hp REF 67.0 dBμV ATTN 10 dB

5 dB/



SPAN 1.50 MHz  
SWP 500 sec

VBW 10 kHz

CENTER 924.00 MHz  
RES BW 3 kHz

*EQUIPMENT: The Digital Security Controls "WLS-915 Alarm Transmitter"**FCC ID: F5398SS15*

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**Section 9. Processing Gain**

|                               |                        |
|-------------------------------|------------------------|
| NAME OF TEST: Processing Gain | PARA. NO.: 15.247(e)   |
| TESTED BY: Tom Tidwell        | DATE: January 19, 1998 |

**Test Results:** Complies. The processing gain of the system is 13.7 dB.

**Measurement Data:** See attached data.

BER:  $2.5 \times 10^{-1}$   
S/N<sub>out</sub>: 1.42 dB  
J/S Ratio: 10.3 dB  
L<sub>sys</sub>: 2 dB

$$10.3 \text{ dB} + 1.42 \text{ dB} + 2 \text{ dB} = 13.7 \text{ dB}$$

*Measured with WLS 920 Receiver*



*EQUIPMENT: The Digital Security Controls "WLS-915 Alarm Transmitter"**FCC ID: F5398SS15***Processing Gain Data**

| Frequency (MHz) | Jamming Signal Level (dBm) | Transmitter Signal Level (dBm) | Jamming Margin (dB) | Processing Gain (Gp) | 25% Ignored |
|-----------------|----------------------------|--------------------------------|---------------------|----------------------|-------------|
| 923.25          | -4.7                       | -20                            | 15.3                | 18.7                 |             |
| 923.30          | -6.3                       | -20                            | 13.7                | 17.1                 |             |
| 923.35          | -7.2                       | -20                            | 12.8                | 16.2                 |             |
| 923.40          | -6.1                       | -20                            | 13.9                | 17.3                 |             |
| 923.45          | -8.3                       | -20                            | 11.7                | 15.1                 |             |
| 923.50          | -7.5                       | -20                            | 12.5                | 15.9                 |             |
| 923.55          | -9.7                       | -20                            | 10.3                | 13.7                 |             |
| 923.60          | -6.4                       | -20                            | 13.6                | 17.0                 |             |
| 923.65          | -7.3                       | -20                            | 12.7                | 16.1                 |             |
| 923.70          | -6.0                       | -20                            | 14.0                | 17.4                 |             |
| 923.75          | -5.7                       | -20                            | 14.3                | 17.7                 |             |
| 923.80          | -8.1                       | -20                            | 11.9                | 15.3                 |             |
| 923.85          | -9.3                       | -20                            | 10.7                | 14.1                 |             |
| 923.90          | -7.0                       | -20                            | 13.0                | 16.4                 |             |
| 923.95          | -10.5                      | -20                            | 9.5                 | 12.9                 | x           |
| 924.00          | -14.2                      | -20                            | 5.8                 | 9.2                  | x           |
| 924.05          | -15.6                      | -20                            | 4.4                 | 6.8                  | x           |
| 924.10          | -13.0                      | -20                            | 7.0                 | 10.4                 | x           |
| 924.15          | -10.0                      | -20                            | 10.0                | 13.4                 | x           |
| 924.20          | -9.7                       | -20                            | 10.3                | 13.7                 | x           |
| 924.25          | -11.3                      | -20                            | 8.7                 | 12.1                 | x           |
| 924.30          | -10.9                      | -20                            | 9.1                 | 12.5                 | x           |
| 924.35          | -9.6                       | -20                            | 10.4                | 13.8                 |             |
| 924.40          | -7.0                       | -20                            | 13.0                | 16.4                 |             |
| 924.45          | -7.2                       | -20                            | 12.8                | 16.2                 |             |
| 924.50          | -6.8                       | -20                            | 13.2                | 16.6                 |             |
| 924.55          | -7.4                       | -20                            | 12.6                | 16.0                 |             |
| 924.60          | -6.4                       | -20                            | 13.6                | 17.0                 |             |
| 924.65          | -6.0                       | -20                            | 14.0                | 17.4                 |             |
| 924.70          | -7.3                       | -20                            | 12.7                | 16.1                 |             |
| 924.75          | -5.0                       | -20                            | 15.0                | 18.4                 |             |

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FCC PART 15, SUBPART C  
DIRECT SEQUENCE TRANSMITTERS  
PROJECT NO.: 7DI160-54C

*EQUIPMENT: The Digital Security Controls "WLS-915 Alarm Transmitter"*  
*FCC ID: F5398SS15*

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**Additional Data**

**NOT APPLICABLE**

*EQUIPMENT: The Digital Security Controls "WLS-915 Alarm Transmitter"**FCC ID: F5398SS15***Section 10. Test Equipment List**

| CAL CYCLE | EQUIPMENT                   | MANUFACTURER    | MODEL     | SERIAL     | LAST CAL.   | NEXT CAL.   |  |
|-----------|-----------------------------|-----------------|-----------|------------|-------------|-------------|--|
| 1 Year    | Spectrum Analyzer           | Hewlett Packard | 8565E     | FA000981   | May 9/97    | May 9/98    |  |
|           | Plotter                     | Hewlett Packard | 7470A     | 2308A30807 | NCR         | NCR         |  |
| 1 Year    | Quasi-peak adapter-1        | Hewlett-Packard | 85650A    | 2043A00302 | Sept. 30/97 | Sept. 30/98 |  |
| 1 Year    | Spectrum Analyzer-2         | Hewlett Packard | 8566B     | 1950A00400 | Oct. 3/97   | April 3/98  |  |
| 1 Year    | Spectrum Analyzer Display-2 | Hewlett Packard | 85662A    | 1950A01177 | Oct. 3/97   | April 3/98  |  |
| 1 Year    | Quasi Peak Adaptor-2        | Hewlett Packard | 85650A    | 2251A00620 | Oct. 3/98   | April. 3/98 |  |
| 1 Year    | Multimeter                  | Fluke           | 29        | 67902059   | June 1/97   | Jun 1/98    |  |
| 1 Year    | RF Millivoltmeter           | Rohde & Schwarz | URV5      | FA000420   | July 23/97  | July 23/98  |  |
| 1 Year    | Insertion Unit              | Rohde & Schwarz | URV5-Z4   | FA000905   | July 23/97  | July 23/98  |  |
| 2 Year    | Horn Antenna                | EMCO #2         | 3115      | 4336       | Oct. 30/97  | Oct. 30/99  |  |
| 1 Year    | Dipole Antenna Set          | EMCO            | 3121C     | 1029       | Oct. 28/97  | Oct. 28/98  |  |
|           | 50 $\Omega$ Termination     | Wiltron         | 26N50     | 605248     | N/A         | N/A         |  |
| 1 Year    | 50 ohm Combiner Pad         | Mini Circuits   | ZFC-3-4   | 922603     | Dec. 5/97   | Dec. 5/98   |  |
| 1 Year    | Low Noise Amplifier         | Avantek         | AWT-8035  | 1005       | Oct. 24/97  | Oct. 24/98  |  |
| 1 Year    | Low Noise Amplifier         | DBS Microwave   | DWT-13035 | 9623       | Oct. 24/97  | Oct. 24/98  |  |

NA: Not Applicable

NCR: No Cal Required

*EQUIPMENT:*  
*FCC ID: F5398SS15*

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**ANNEX A**  
**TEST METHODOLOGIES**

*EQUIPMENT:*

*FCC ID: F5398SS15*

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|   |                      |
|---|----------------------|
| NAME OF TEST: Powerline Conducted Emissions | PARA. NO.: 15.207(a) |
|---|----------------------|

**Test Conditions:**

Standard Temperature and Humidity  
Standard Test Voltage

**Minimum Standard:**

The R.F. that is conducted back onto the AC power line on any frequency within the band 0.45 to 30 MHz shall not exceed 250 $\mu$ V (48 dB $\mu$ V) across 50 ohms.

*EQUIPMENT:**FCC ID: F5398SS15*

NAME OF TEST: Occupied Bandwidth

PARA. NO.: 15.247(a)(2)

**Test Conditions:**

Standard Temperature and Humidity

Standard Test Voltage

**Minimum Standard:**

The minimum bandwidth shall be at least 500 kHz.

**Method Of Measurement:**

The spectrum analyzer is set as follows:

RBW: 100 kHz

VBW: 100 kHz

Span: &gt;RBW

LOG dB/div.: 2 dB

Sweep: Auto

Number of channels tested:

| <b>Tuning Range</b> | <b>Number Of Channels Tested</b> | <b>Channel Location In Band</b> |
|---------------------|----------------------------------|---------------------------------|
| 1 MHz or Less       | 1                                | Middle                          |
| 1 to 10 MHz         | 2                                | Top And Bottom                  |
| More Than 10 MHz    | 3                                | Top, Middle, Bottom             |

EQUIPMENT:

FCC ID: F5398SS15

NAME OF TEST: Peak Power Output

PARA. NO.: 15.247(b)

**Test Conditions:** Standard Temperature and Humidity  
Standard Test Voltage

**Minimum Standard:** The maximum peak power output shall not exceed 1 watt.  
If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**Direct Measurement Method For Detachable Antennas:**

If the antenna is detachable, a peak power meter is used to measure the power output with the transmitter operating into a 50 ohm load.

**Calculation Of EIRP For Integral Antenna:**

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation  $GP/4\pi R^2 = E^2/120\pi$  and proceeding as follows:

$$P = \frac{E^2 R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

The RBW of the spectrum analyzer shall be set to a value greater than the measured 6 dB occupied bandwidth of the E.U.T.

Number of channels tested:

| Tuning Range     | Number Of Channels Tested | Channel Location In Band |
|------------------|---------------------------|--------------------------|
| 1 MHz or Less    | 1                         | Middle                   |
| 1 to 10 MHz      | 2                         | Top And Bottom           |
| More Than 10 MHz | 3                         | Top, Middle, Bottom      |

EQUIPMENT:

FCC ID: F5398SS15

NAME OF TEST: Spurious Emissions at Antenna Terminal

PARA. NO.: 15.247(c)

**Test Conditions:**Standard Temperature and Humidity  
Standard Test Voltage**Minimum Standard:**

In any 100kHz bandwidth outside the 902 - 928 MHz bands emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

| Frequency (MHz) | Field Strength ( $\mu\text{V/m}$ @ 3m) | Field Strength (dB @ 3m) |
|-----------------|--|--------------------------|
| 30 - 88         | 100                                    | 40.0                     |
| 88 - 216        | 150                                    | 43.5                     |
| 216 - 960       | 200                                    | 46.0                     |
| Above 960       | 500                                    | 54.0                     |

*The spectrum was searched to the 10<sup>th</sup> harmonic.*

**Method Of Measurement:****Upper Band Edge**

RBW: At least 1% of span/div.

VBW: &gt;RBW

Span: As necessary to display any spurious at band edge.

Sweep: Auto

Center Frequency: 928 MHz

Marker: Peak of fundamental emission

Marker  $\Delta$ : Peak of highest spurious level above 928 MHz**Lower Band Edge**

RBW: At least 1% of span/div.

VBW: &gt;RBW

Span: As necessary to display any spurious at band edge.

Sweep: Auto

Center Frequency: 902 MHz

Marker: Peak of fundamental emission

Marker  $\Delta$ : Peak of highest spurious level below 902 MHz**30 MHz - 10th Harmonic Plot**

RBW: 100 kHz

VBW: 300 kHz

Sweep: Auto

Display line: -20 dBc

Number of channels tested:

| Tuning Range     | Number Of Channels Tested | Channel Location In Band |
|------------------|---------------------------|--------------------------|
| 1 MHz or Less    | 1                         | Middle                   |
| 1 to 10 MHz      | 2                         | Top And Bottom           |
| More Than 10 MHz | 3                         | Top, Middle, Bottom      |



EQUIPMENT:  
FCC ID: F5398SS15

NAME OF TEST: Radiated Spurious Emissions

PARA. NO.: 15.247(c)

Test Conditions: Standard Temperature and Humidity  
Standard Test VoltageMinimum Standard: In any 100kHz bandwidth outside the 902 - 928 MHz bands emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. *Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:*

| Frequency (MHz) | Field Strength ( $\mu\text{V/m}$ @ 3m) | Field Strength (dB @ 3m) |
|-----------------|--|--------------------------|
| 30 - 88         | 100                                    | 40.0                     |
| 88 - 216        | 150                                    | 43.5                     |
| 216 - 960       | 200                                    | 46.0                     |
| Above 960       | 500                                    | 54.0                     |

*The spectrum was searched to the 10<sup>th</sup> harmonic.***15.205 Restricted Bands**

| MHz               | MHz                 | MHz           | GHz         |
|-------------------|---------------------|---------------|-------------|
| 0.09-0.11         | 16.42-16.423        | 399.9-410     | 4.5-5.25    |
| 0.495-0.505       | 16.69475-16.69525   | 608-614       | 5.35-5.46   |
| 2.1735-2.1905     | 16.80425-16.80475   | 960-1240      | 7.25-7.75   |
| 4.125-4.128       | 25.5-25.67          | 1300-1427     | 8.025-8.5   |
| 4.17725-4.17775   | 37.5-38.25          | 1435-1626.5   | 9.0-9.2     |
| 4.20725-4.20775   | 73-74.6             | 1645.5-1646.5 | 9.3-9.5     |
| 6.125-6.218       | 74.8-75.2           | 1660-1710     | 10.6-12.7   |
| 6.26775-6.26825   | 108-121.94          | 1718.8-1722.2 | 13.25-13.4  |
| 6.31175-6.31225   | 123-138             | 2200-2300     | 14.47-14.5  |
| 8.291-8.294       | 149.9-150.05        | 2310-2390     | 15.35-16.2  |
| 8.362-8.366       | 156.52475-156.52525 | 2483.5-2500   | 17.7-21.4   |
| 8.37625-8.38675   | 156.7-156.9         | 2655-2900     | 22.01-23.12 |
| 8.41425-8.41475   | 162.0125-167.17     | 3260-3267     | 23.6-24.0   |
| 12.29-12.293      | 167.72-173.2        | 3332-3339     | 31.2-31.8   |
| 12.51975-12.52025 | 240-285             | 3345.8-3358   | 36.43-36.5  |
| 12.57675-12.57725 | 322-335.4           | 3600-4400     | Above 38.6  |
| 13.36-13.41       | 1718                |               |             |

Number of channels tested:

| Tuning Range     | Number Of Channels Tested | Channel Location In Band |
|------------------|---------------------------|--------------------------|
| 1 MHz or Less    | 1                         | Middle                   |
| 1 to 10 MHz      | 2                         | Top And Bottom           |
| More Than 10 MHz | 3                         | Top, Middle, Bottom      |

EQUIPMENT:

FCC ID: F5398SS15

|   |                      |
|---|----------------------|
| NAME OF TEST: Transmitter Power Density | PARA. NO.: 15.247(d) |
|---|----------------------|

**Test Conditions:** Standard Temperature and Humidity  
Standard Test Voltage

**Minimum Standard:** The transmitted power density averaged over any 1 second interval shall not be greater than +8 dBm in any 3 kHz bandwidth.

**Method Of Measurement:** The spectrum analyzer is set as follows:

RBW: 3 kHz

VBW: &gt;3 kHz

Span: =&gt; measured 6 dB bandwidth

Sweep: Span(kHz)/3 (i.e. for a span of 1.5 MHz the sweep rate is 1500/3 = 500 sec.

LOG dB/div.: 2 dB

**Note:** For devices with spectrum line spacing  $\leq 3$  kHz, the RBW of the analyzer is reduced until the spectral lines are resolved. The measurement data is normalized to 3 kHz by summing the power of all the individual spectral lines within a 3 kHz band in linear power units.

#### **For Devices With Integral Antenna:**

For devices with non-detachable antennas, the received field strength is peaked and the spectrum analyzer is set as above. The peak emission level is then measured and converted to a field strength by adding the appropriate antenna factor and cable loss. This field strength is then converted to an equivalent isotropic radiated power using the same method as described for Peak Power output.

Number of channels tested:

| Tuning Range     | Number Of Channels Tested | Channel Location In Band |
|------------------|---------------------------|--------------------------|
| 1 MHz or Less    | 1                         | Middle                   |
| 1 to 10 MHz      | 2                         | Top And Bottom           |
| More Than 10 MHz | 3                         | Top, Middle, Bottom      |

EQUIPMENT:  
FCC ID: F5398SS15

NAME OF TEST: Processing Gain

PARA. NO.: 15.247(e)

**Test Conditions:** Standard Temperature and Humidity  
Standard Test Voltage

**Minimum Standard:** The processing gain shall be at least 10 dB.

**Method Of Measurement:** The CW jamming margin method was used to determine the processing gain. A CW signal generator is stepped across the passband of the receiver in 50 kHz increments. At each point the signal generator level required to obtain the recommended bit error rate is recorded. The jammer to signal ratio (J/S) is then calculated. The worst 20% of the J/S points is discarded. The lowest remaining J/S ratio is used to calculate the processing gain.

#### Calculation Of Processing Gain:

The processing gain was determined by measuring the jamming margin of the E.U.T. and using the following formula:

$$\text{Jamming Margin} = G_p - (S/N)_{\text{out}} - L_{\text{sys}}$$

For a receiver using non-coherent detection the value  $(S/N)_{\text{out}}$  is calculated using the formula:

$P_e = (1/2)\text{EXP}\{-E/2N_o\}$  where  $P_e$  is the probability of error (minimum Bit Error Rate required for proper operation).

$E/N_o$  is  $(S/N)_{\text{out}}$

for example, for a bit error rate of  $10^{-4}$  a S/N ratio of 12.3 dB is required.

$L_{\text{sys}}$  (system losses) is assumed to be 2 dB.

$$\text{Therefore } G_p = M_j + (S/N)_{\text{out}} + L_{\text{sys}}$$

Measurement performed at 915 MHz.

*EQUIPMENT:*

*FCC ID: F5398SS15*

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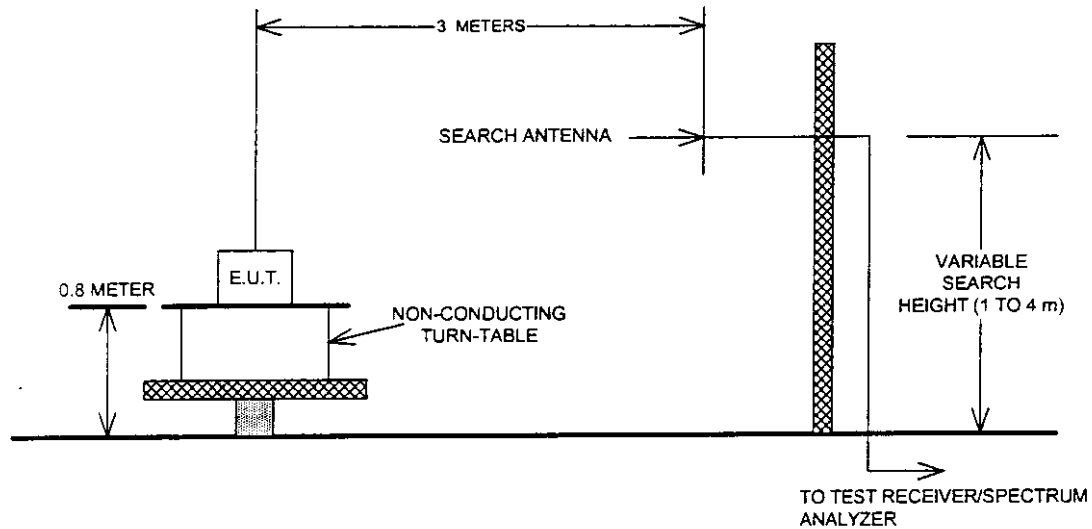
**ANNEX B**

**BLOCK DIAGRAMS**

**EQUIPMENT:**

FCC ID: F5398SS15

**Test Site For Radiated Emissions**



**Below 1 GHz**

Peak detector.

RBW = 100 kHz

**Above 1 GHz For Peak Emission Levels**

Peak detector

RBW = 1 MHz

VBW = >RBW

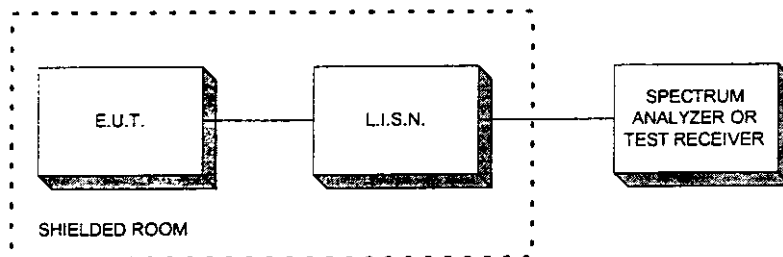
**Above 1 GHz For Average Emission Levels**

Peak detector

RBW = 1 MHz

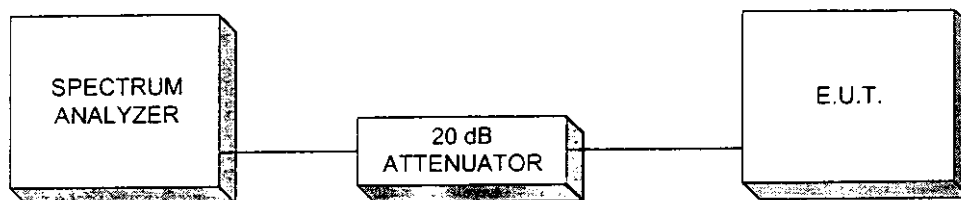
VBW = 10 Hz

**Conducted Emissions**

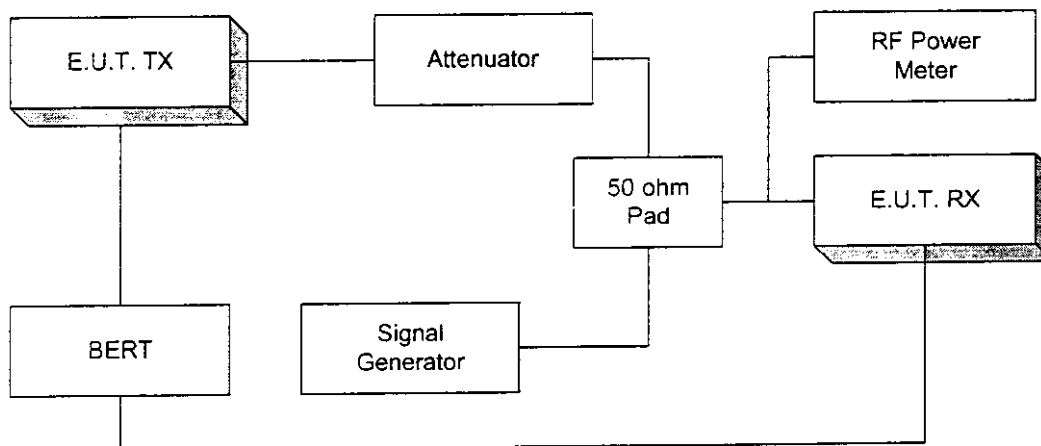


*EQUIPMENT:**FCC ID: F5398SS15*

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**Transmitter Power Density & Peak Power At Antenna Terminals**

If the E.U.T. has an integral (non-detachable) antenna, the above test is performed as a radiated measurement and the result is reported as EIRP.

**Processing Gain**

NOTE: This is a typical setup. The setup may vary slightly since many devices have BER test functions built into the device.