

KTL Test Report:

8R01212

Applicant:

Digital Security Controls Ltd.
1645 Flint Road
Downsview, Ontario
M3J 2J6

**Equipment Under Test:
(E.U.T.)**

Motion Sensor With 900 MHz Spread
Spectrum Transmitter

FCC ID:

F5398SS14

In Accordance With:

FCC Part 15, Subpart C
Direct Sequence Transmitters 902 - 928 MHz

Tested By:

KTL Ottawa Inc.
3325 River Road, R.R. 5
Ottawa, Ontario K1V 1H2

Authorized By:



T. Tidwell, Laboratory Manager

Date:

23 March, 1999

Total Number of Pages:

37

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
FCC ID: F5398SS14

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EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
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EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
FCC ID: F5398SS14

Section 1. Summary Of Test Results

Manufacturer: Digital Security Controls Ltd.
Model No.: WLS 914
Serial No.: FCC (A6) FIRST
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
- Equipment Code
- Family Listing

D S S

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 LAB CODE: 100351-0

TESTED BY: Kevin Carr DATE: 22 March 99
Kevin Carr, Technologist

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EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
FCC ID: F5398SS14

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
Powerline Conducted Emissions	15.207 (a)	48 dB μ V	N/A	N/A
Occupied Bandwidth	15.247 (a)(2)	\geq 500 kHz	893 kHz	Complies
Peak Power Output	15.247 (b)	1 watt	0.0146W	Complies
Spurious Emissions (Antenna Conducted)	15.247 (c)	-20 dBc	N/A	N/A
Spurious Emissions (Radiated)	15.247 (c)	Table 15.209 (a)	Table	Complies
Transmitter Power Density	15.247 (d)	\leq +8 dBm	-0.62 dBm	Complies
Processing Gain	15.247 (e)	\geq 10 dB	Customer Supplied	Complies

Footnotes For N/A's:

Test Conditions:

Indoor Temperature: 21 °C
 Humidity: 13 %

Outdoor Temperature: 5 °C
 Humidity: 13 %

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
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Section 2. General Equipment Specification

Transmitter

Power Input:		6 Vdc
Frequency Range:		924 MHz (fixed)
Tunable Bands:		1
6 dB Bandwidth:		893 kHz
Type of Modulation		Direct Sequence Spread Spectrum
Data Rate:		
Internal / External Data Source:		
Emissions Designator:		
Output Impedance:		Not Applicable
RF Power Output (Rated):	Single:	14.6 mW (11.64 dBm)
Duty Cycle:		-18.42 dB
Channel Spacing:		Not Applicable
Operator Selection of Operating Frequency:		No User Adjustment
Power Output Adjustment Capability:		No User Adjustment

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EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
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Receiver

Frequency Range:

Turnable Bands:

LO:

1st IF:

2nd 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.: 8R01212

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
FCC ID: F5398SS14

Description of Modification for Modification Filing

NOT APPLICABLE

Family List Rational

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
FCC ID: F5398SS14

Theory of Operation

The E.U.T. is a wireless motion sensor. It transmits at 924 MHz and utilizes spread spectrum technology. The device is powered via batteries.

System Diagram

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FCC PART 15, SUBPART C
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EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
FCC ID: F5398SS14

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: Motion Sensor with 900 MHz Spread Spectrum Transmitter
FCC ID: F5398SS14

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(2)
TESTED BY: Kevin Carr	DATE: February 4, 1999

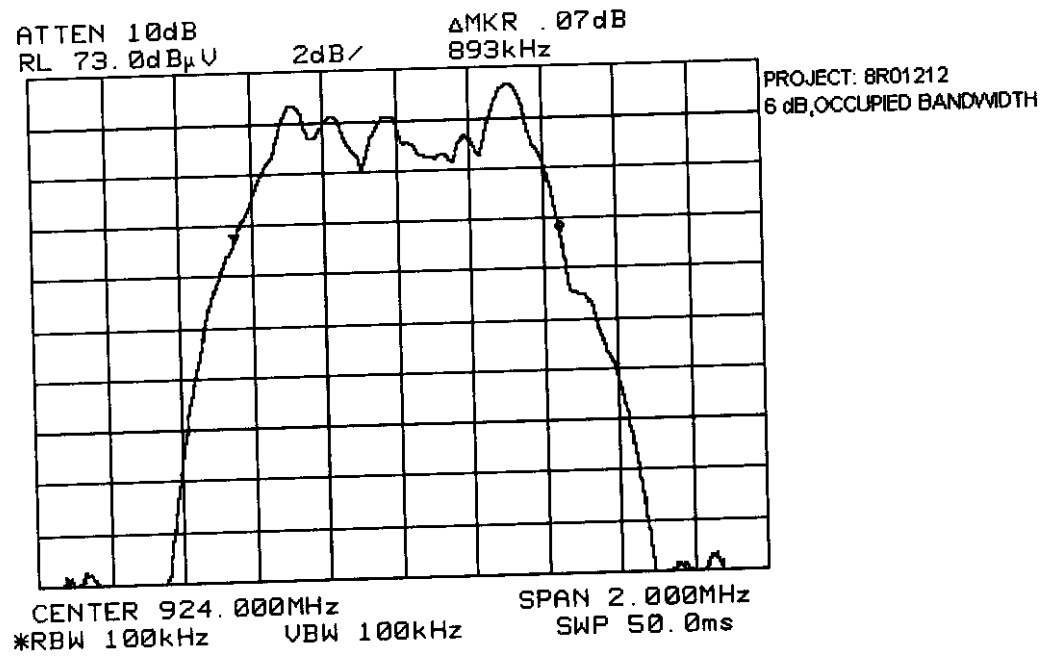
Test Results: Complies. The 6 dB bandwidth is 0.893 MHz.
See attached graph.

Measurement Data: See attached graph.

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FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
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EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
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EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
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Section 5. Peak Power Output

NAME OF TEST: Peak Power Output	PARA. NO.: 15.247 (b)
TESTED BY: Kevin Carr	DATE: February 4, 1999

Test Results: Complies. The maximum peak power output of the transmitter is 0.0146 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 0 Numeric.
Peak Power Output: 0.0146 watts.
Field Strength: 108.4 dB μ V/m @ 3m or 0.263 V/m @ 3m.

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
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Peak Power Output

Test Distance (meters) : 3		Range: A Tower		Receiver: ESVP		RBW(kHz): 120		Detector: CISPR, Q-Peak			
Freq. (MHz)	Ant. *	Pol. (V/H)	Ant. HGT. (m)	Table (deg.)	RCVD Signal (dBµV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Dist. Corr. (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
923.8	E/D4	V			73.3	35.1			108.4	108.4	0
924.3	E/D4	H			63.6	35.1			98.7	108.4	9.7

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.

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
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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 _____ limit.

Measurement Data: See attached graphs.

NOT APPLICABLE

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
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Section 7. Spurious Emissions (Radiated)

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.247(c)
TESTED BY: Kevin Carr	DATE: February 4, 1999

Test Results: Complies. The worst-case emission level is 41.9 dB μ V/m @ 3m at 2772.51 MHz. This is 12.1 dB below the specification limit.

Measurement Data: See attached graphs.

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
 FCC ID: F5398SS14

Test Data - Radiated Emissions (PEAK)

Test Distance (meters) : 3		Range: A Tower		Receiver: Other		RBW (kHz): 120		VBW (kHz):		Detector: Q-Peak	
Freq. (MHz)	Ant. *	Pol. (V/H)	Ant. HGT. (m)	Table (deg.)	RCVD Signal (dBµV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Duty Cycle Corr.	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
923.8	E/D4	V			73.3	35.1			108.4	108.4	0.0
924.3	E/D4	H			63.6	35.1			98.7	108.4	9.7
1848.21	Hrn2	V			85.1	30.2	-44.5		70.8	88.4	17.6
1848.21	Hrn2	H			84.8	30.2	-44.5		70.5	88.4	17.9
2772.51	Hrn2	V			68.0	32.0	-45.0		55.0	74.0	19.0
2772.51	Hrn2	H			73.4	32.0	-45.0		60.4	74.0	13.6
3695.0	Hrn2	V			67.0	35.6	-42.3		60.3	74.0	13.7
3695.0	Hrn2	H			65.8	35.6	-42.3		59.1	74.0	14.9
4620.0	Hrn2	V			53.4	37.7	-43.6		47.5	74.0	26.5
4620.0	Hrn2	H			55.8	37.7	-43.6		49.9	74.0	24.1
5542.0	Hrn2	V			47.5	40.3	-43.4		44.4	74.0	29.6
5542.0	Hrn2	H			48.3	40.3	-43.4		45.2	74.0	28.8

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.

No further emissions detected, noise floor was at least 20 dB from the limit.

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
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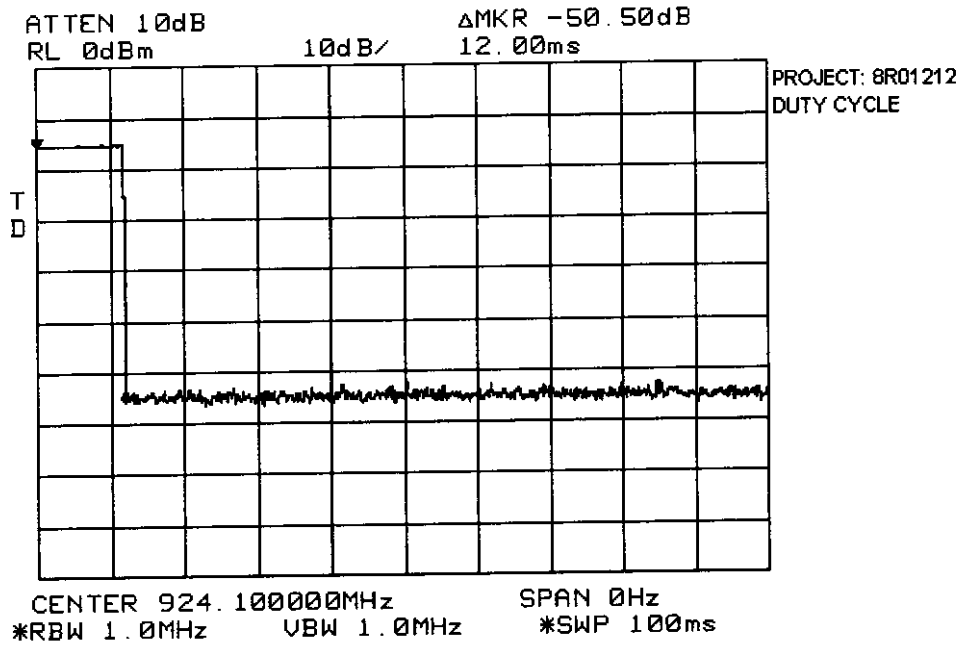
Vest Data - Radiated Emissions (AVERAGE)

Test Distance (meters) :		Range:		Receiver:		RBW (kHz):		VBW (kHz):		Detector:	
Freq. (MHz)	Ant. *	Pol. (V/H)	Ant. HGT. (m)	Table (deg.)	RCVD Signal (dBµV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Distance Corr.	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2772.51	Hrn2	V			68.0	32.0	-45.0	-18.42	36.5	54.0	17.5
2772.51	Hrn2	H			73.4	32.0	-45.0	-18.42	41.9	54.0	12.1
3695.0	Hrn2	V			67.0	35.6	-42.3	-18.42	41.8	54.0	12.2
3695.0	Hrn2	H			65.8	35.6	-42.3	-18.42	40.6	54.0	13.4
4620.0	Hrn2	V			53.4	37.7	-43.6	-18.42	29.0	54.0	25.0
4620.0	Hrn2	H			55.8	37.7	-43.6	-18.42	31.4	54.0	22.6

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.

No further emissions detected, noise floor was at least 20 dB from the limit.

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
FCC ID: F5398SS14



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Section 8. Transmitter Power Density

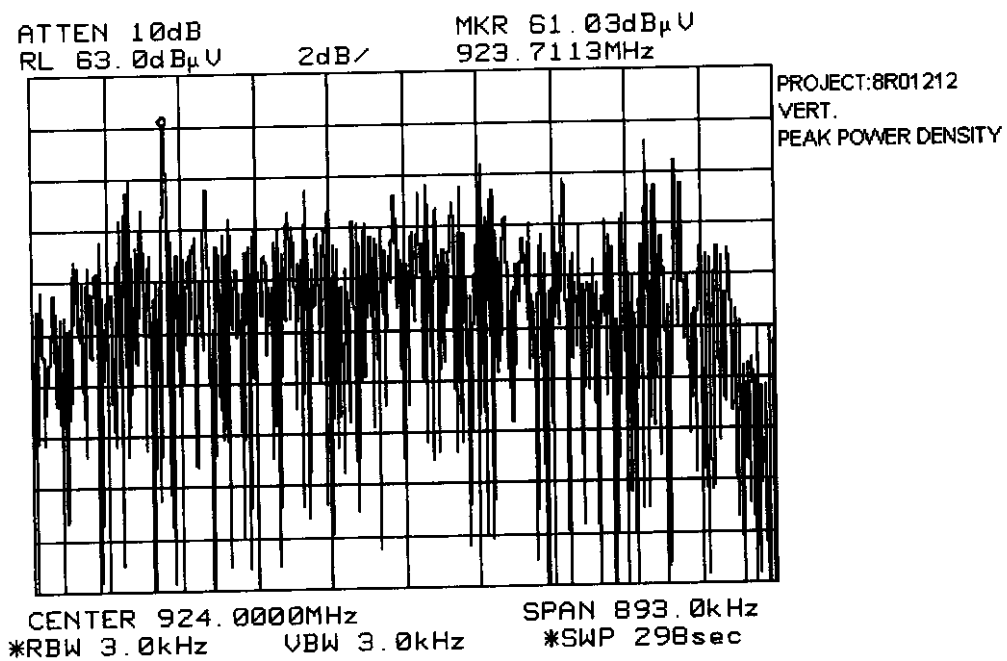
NAME OF TEST: Transmitter Power Density	PARA. NO.: 15.247(d)
TESTED BY: Kevin Carr	DATE: February 4, 1999

Test Results: Complies.

Measurement Data: See attached graphs.

Received Signal: 61.03 dB μ V @ 3m
Antenna Factor: 35.1 dB
Field Strength: 96.13 dB μ V @ 3m
Field Strength: 0.064047 V @ 3m
E.I.R.P.: 0.867 mW
E.I.R.P.: -0.62 dBm

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
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Section 9. Processing Gain

NAME OF TEST: Processing Gain	PARA. NO.: 15.247(e)
TESTED BY: Customer Supplied	DATE: March 22, 1999

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

Measurement Data: See attached data.

- BER:
- S/N_{out} :
- J/S Ratio: 10.3 dB
- L_{sys} : 2.0 dB
- Data Rate: 10 Kbits/sec or 100 μ s/bit
- PN Rate: 902 Kbits/sec or 1.1 μ s/bit

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
 FCC ID: F5398SS14

Processing Gain Data

Frequency (MHz)	Jamming Signal Level (dBm)	Transmitter Signal Level (dBm)	Jamming Margin (dB)	Processing Gain (Gp)	20% Ignored
923.25	-4.7	-20.0	15.3	18.7	
923.30	-6.3	-20.0	13.7	17.1	
923.35	-7.2	-20.0	12.8	16.2	
923.40	-6.1	-20.0	13.9	17.3	
923.45	-8.3	-20.0	11.7	15.1	
923.50	-7.5	-20.0	12.5	15.9	
923.55	-9.7	-20.0	10.3	13.7	
923.60	-6.4	-20.0	13.6	17.0	
923.65	-7.3	-20.0	12.7	16.1	
923.70	-6.0	-20.0	14.0	17.4	
923.75	-5.7	-20.0	14.3	17.7	
923.80	-8.1	-20.0	11.9	15.3	
923.85	-9.3	-20.0	10.7	14.1	
923.90	-7.0	-20.0	13.0	16.4	
923.95	-10.5	-20.0	9.5	12.9	*
924.00	-14.2	-20.0	5.8	9.2	*
924.05	-15.6	-20.0	4.4	7.8	*
924.10	-13.0	-20.0	7.0	10.4	*
924.15	-10.0	-20.0	10.0	13.4	*
924.20	-9.7	-20.0	10.3	13.7	*
924.25	-11.3	-20.0	8.7	12.1	*
924.30	-10.9	-20.0	9.1	12.5	*
924.35	-9.6	-20.0	10.4	13.8	
924.40	-7.0	-20.0	13.0	16.4	
924.45	-7.2	-20.0	12.8	16.2	
924.50	-6.8	-20.0	13.2	16.6	
924.55	-7.4	-20.0	12.6	16.0	
924.60	-6.4	-20.0	13.6	17.0	
924.65	-6.0	-20.0	14.0	17.4	
924.70	-7.3	-20.0	12.7	16.1	
924.75	-5.0	-20.0	15.0	18.4	

Worst case Gp of remaining 80% = 13.7 dB

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FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
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Additional Data

NOT APPLICABLE

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
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Section 10. Test Equipment List

CAL CYCLE	EQUIPMENT	MANUFACTURER	MODEL	SERIAL	LAST CAL.	NEXT CAL.	
1 Year	Spectrum Analyzer	Hewlett Packard	8565E	FA000981	May 20/98	May 20/99	
1 Year	Receiver	Rohde & Schwarz	ESVP	892661/014	Mar. 31/98	Mar. 31/99	
2 Year	Horn Antenna	EMCO #2	3115	4336	Oct. 30/97	Oct. 30/99	
1 Year	Log Periodic Antenna	EMCO	LPA-25	1141	July 27/98	July 27/99	
1 Year	Dipole Antenna Set	EMCO	3121C	1029	Nov. 18/98	Nov. 18/99	
1 Year	Digital Storage Oscilloscope	Tektronix	TDS544A	B012005	July 23/98	July 23/99	

NA: Not Applicable
NCR: No Cal Required

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
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ANNEX A
TEST METHODOLOGIES

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
FCC ID: F5398SS14

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
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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 μ V (48 dB μ V) across 50 ohms.

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
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NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(2)
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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: >RBW
- LOG dB/div.: 2 dB
- Sweep: Auto

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: Motion Sensor with 900 MHz Spread Spectrum Transmitter
FCC ID: F5398SS14

NAME OF TEST: Peak Power Output	PARA. NO.: 15.247(b)
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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:

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: Motion Sensor with 900 MHz Spread Spectrum Transmitter
FCC ID: F5398SS14

NAME OF TEST: Spurious Emissions at Antenna Terminal	PARA. NO.: 15.247(c)
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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 10th harmonic.

Method Of Measurement:

Upper Band Edge

RBW: At least 1% of span/div.
 VBW: >RBW
 Span: As necessary to display any spurious at band edge.
 Sweep: Auto
 Center Frequency: 928 MHz
 Marker: Peak of fundamental emission
 Marker Δ : Peak of highest spurious level above 928 MHz

Lower Band Edge

RBW: At least 1% of span/div.
 VBW: >RBW
 Span: As necessary to display any spurious at band edge.
 Sweep: Auto
 Center Frequency: 902 MHz
 Marker: Peak of fundamental emission
 Marker Δ : 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: Motion Sensor with 900 MHz Spread Spectrum Transmitter
FCC ID: F5398SS14

NAME OF TEST: Radiated Spurious Emissions	PARA. NO.: 15.247(c)
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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 (µV/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 10th 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: Motion Sensor with 900 MHz Spread Spectrum Transmitter
FCC ID: F5398SS14

NAME OF TEST: Transmitter Power Density	PARA. NO.: 15.247(d)
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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: >3 kHz
- Span: => 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: Motion Sensor with 900 MHz Spread Spectrum Transmitter
FCC ID: F5398SS14

NAME OF TEST: Processing Gain	PARA. NO.: 15.247(e)
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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_{sys} (system losses) is assumed to be 2 dB.

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

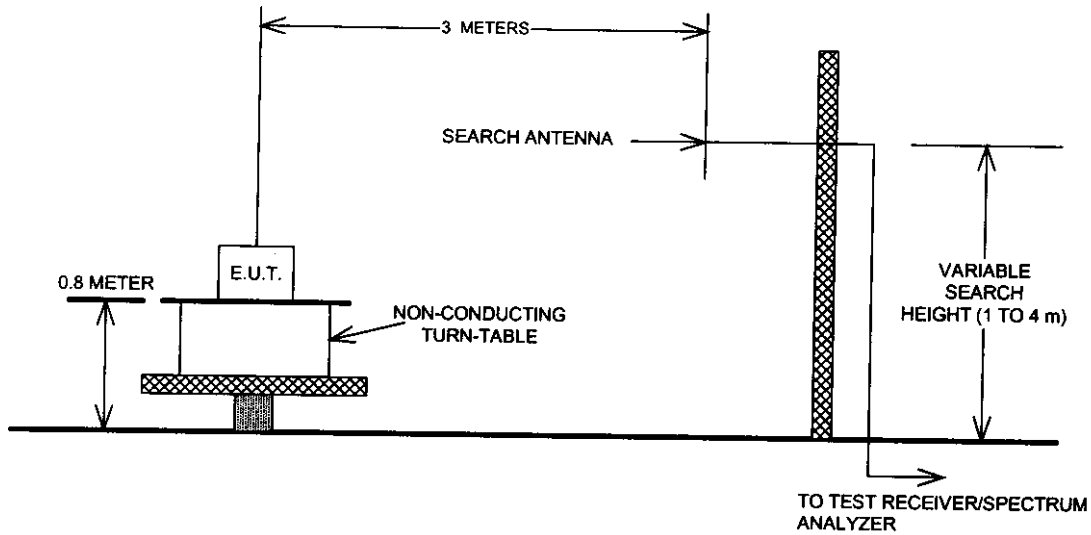
Measurement performed at 915 MHz.

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
FCC ID: F53985514

ANNEX B
BLOCK DIAGRAMS

EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
FCC ID: F53985514

Test Site For Radiated Emissions



Below 1 GHz

Peak detector.
RBW = 100 kHz

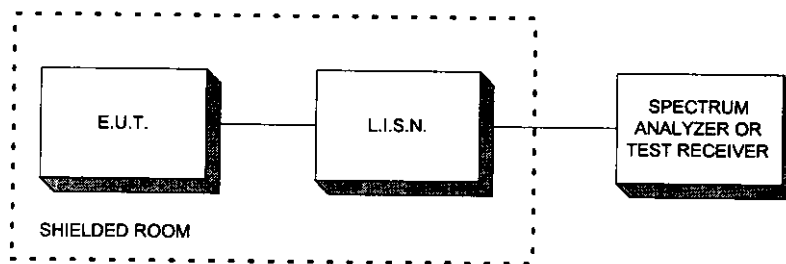
Above 1 GHz For Peak Emission Levels

Peak detector
RBW = 1 MHz
VBW = >RBW

Above 1 GHz For Average Emission Levels

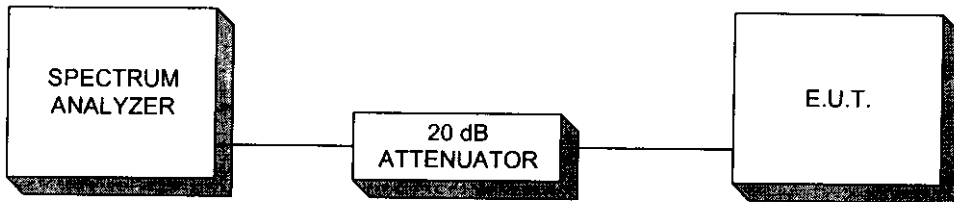
Peak detector
RBW = 1 MHz
VBW = 10 Hz

Conducted Emissions



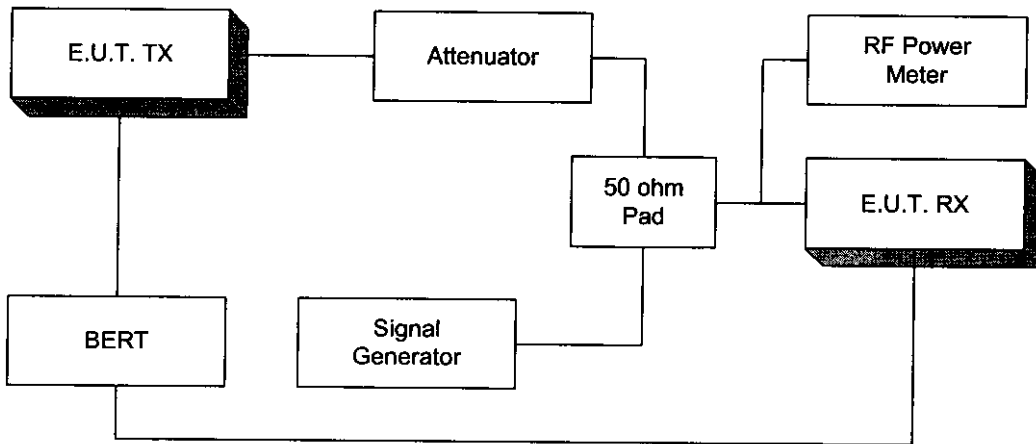
EQUIPMENT: Motion Sensor with 900 MHz Spread Spectrum Transmitter
FCC ID: F53985514

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.