

Nemko Test Report: 3L0064RUS1

Applicant: Telenexus
1909 N. Glenville Drive, Ste. 200
Richardson, TX 75081

Equipment Under Test: LRP915HR-CLD
(E.U.T.)

In Accordance With: **FCC Part 15, Subpart C, 15.247**
Frequency Hopping Transmitters

Tested By: Nemko Dallas Inc.
802 N. Kealy
Lewisville, Texas 75057-3136

Authorized By: 
David Light, Resource Manager

Date: 9/30/03

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FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

Section 1. Summary of Test Results

Manufacturer: Telenexus

Model No.: LRP915HR-CLD

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 Part 15, Subpart C, Paragraph 15.247 for Frequency Hopping Spread Spectrum devices. Radiated tests were conducted in accordance with ANSI C63.4-1992. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.



New Submission



Production Unit



Class II Permissive Change



Pre-Production Unit

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. NONE
See "Summary of Test Data".



NVLAP LAB CODE: 100426-0

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	RESULT
Powerline Conducted Emissions	15.207(a)	48 dB μ V	Complies
Channel Separation	15.247(a)(1)	Greater of 25 kHz or 20 dB Bandwidth	Complies
Pseudorandom Hopping Algorithm	15.247(a)(1)		Complies
Time of Occupancy	15.247(a)(1)(ii)	\leq 0.4 sec in 30 sec	Complies
20 dB Occupied Bandwidth	15.247(a)(1)	\leq 1 MHz	Complies
Peak Power Output	15.247(b)	1 Watt	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	-20 dBc	N/A
Spurious Emissions (Radiated)	15.247(c)	Table 15.209(a)	Complies

Footnotes:

The device has an integral antenna.

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

Section 2. Equipment Under Test (E.U.T.)

General Equipment Information

Frequency Band: 902.75 to 927.25 MHz

Number of Channels: 50

Channel Spacing: 500 kHz

User Frequency Adjustment: Software controlled

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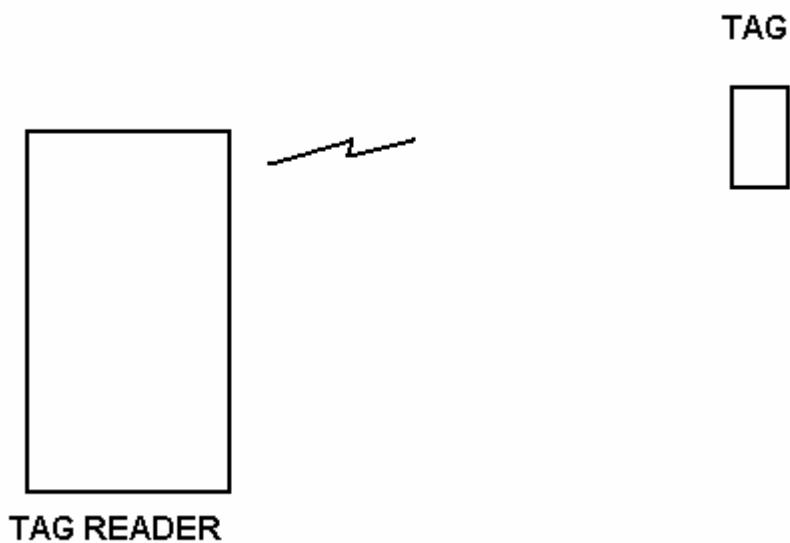
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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER
EQUIPMENT: LRP915HR-CLD REPORT NO.: 3L0064RUS1

Description of EUT

The device is a handheld RFID tag reader.

System Diagram



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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

Section 3. Powerline Conducted Emissions

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

Test Results: Complies.

Measurement Data: See attached data.

Measurement +/- 0.7 dB
Uncertainty: _____

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER
EQUIPMENT: LRP915HR-CLD **REPORT NO.: 3L0064RUS1**

Test Data – Powerline Conducted Emissions



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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

Test Setup Photos – Powerline Conducted Emissions



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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

Section 4. Channel Separation

NAME OF TEST: Channel Separation	PARA. NO.: 15.247(a)(1)(i)
TESTED BY: David Light	DATE: 3/26/03

Test Results: Complies.

Measurement Data: See 20 dB BW plot

Measured 20 dB bandwidth: 223 kHz
Channel Separation: 500 kHz

Measurement Uncertainty: $\pm 1.7\text{dB}$
 1×10^{-7} ppm

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD REPORT NO.: 3L0064RUS1

Test Data – Channel Separation

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Data Plot		Channel Separation	
Page <u>1</u> of 1			
Job No.:	3L0064	Date:	3/26/2003
Specification:	15.247	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%):	40
E.U.T.:	RFID READER		
Configuration:	TX		
Sample Number:	1		
Location:	Lab 1	RBW:	30 kHz
Detector Type:	Peak	VBW:	30 kHz
		Measurement	Distance: NA m
Test Equipment Used			
Antenna:	802	Directional Coupler:	
Pre-Amp:		Cable #1:	1484
Filter:		Cable #2:	
Receiver:	1464	Cable #3:	
Attenuator #1		Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty: +/-1.7 dB			
Notes:	CHANNEL SEPARATION = 500 kHz		

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

Section 5. Time of Occupancy

NAME OF TEST: Time of Occupancy	PARA. NO.: 15.247(a)(1)(i)
TESTED BY: David Light	DATE: 3/26/03

Test Results: Complies.

Measurement Data: Refer to attached plots

Maximum Dwell Time On Any Channel: 399.6 mS in 20 Seconds

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD REPORT NO.: 3L0064RUS1

Test Plots – Time of Occupancy

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Data Plot		Time of Occupancy	
Page <u>1</u> of 3			
Job No.:	3L0064	Date:	3/26/2003
Specification:	15.247	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%):	40
E.U.T.:	RFID READER		
Configuration:	TX		
Sample Number:	1		
Location:	Lab 1	RBW:	Refer to plots
Detector Type:	Peak	VBW:	Refer to plots
		Measurement	Distance: NA m
Test Equipment Used			
Antenna:	802	Directional Coupler:	
Pre-Amp:		Cable #1:	1484
Filter:		Cable #2:	
Receiver:	1464	Cable #3:	
Attenuator #1		Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty: +/-1.7 dB			
Notes:	Time of Occupancy 30.3 mS		

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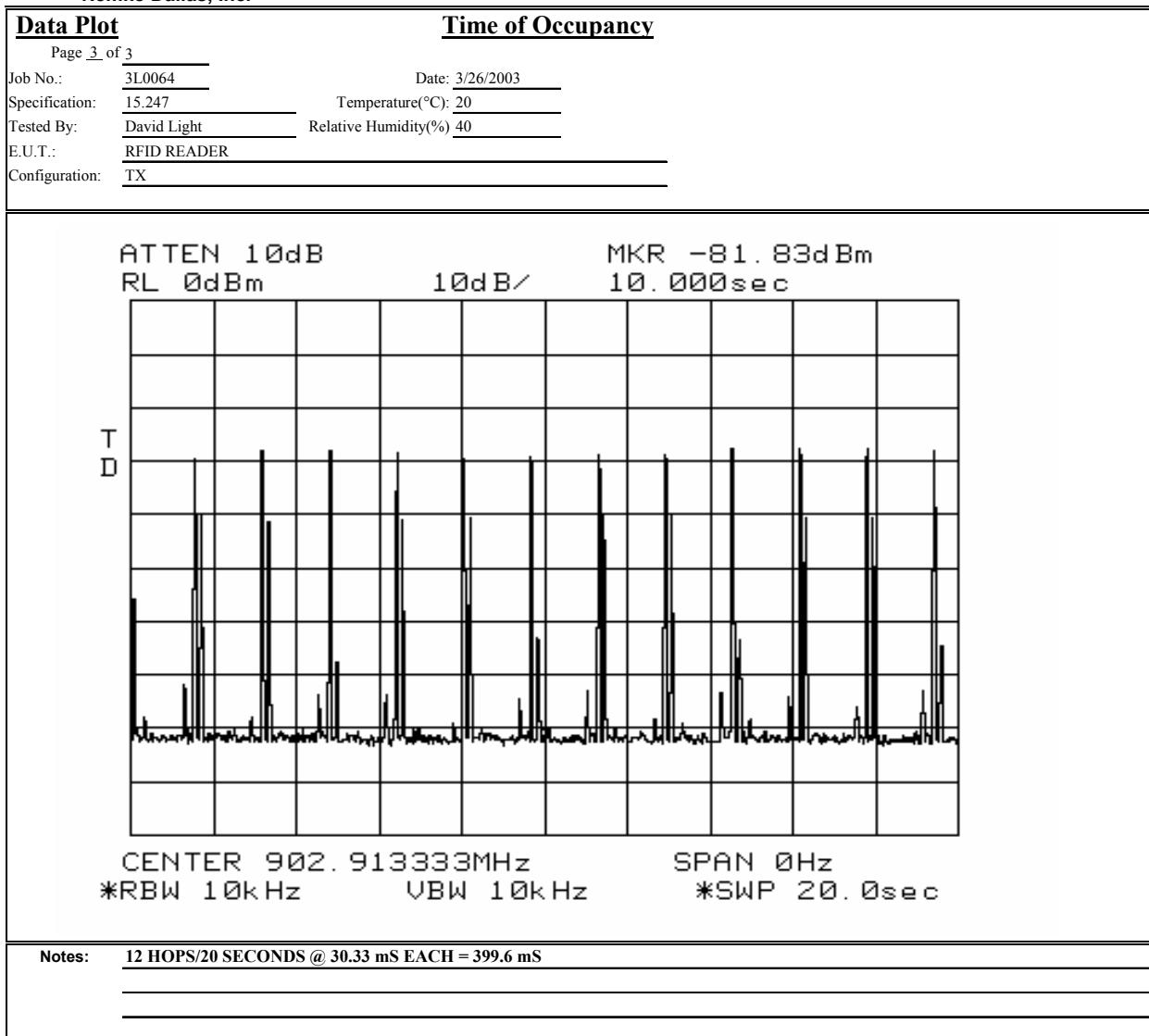
FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER
EQUIPMENT: LRP915HR-CLD REPORT NO.: 3L0064RUS1

Test Plots – Time of Occupancy



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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

Section 6. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(1)(i)
TESTED BY: David Light	DATE: 3/26/03

Test Results: Complies.

Measurement Data: See attached plots.

Measurement Uncertainty: +/- 0.7 dB
 1×10^{-7} ppm

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD REPORT NO.: 3L0064RUS1

Test Data – 20 dB Bandwidth

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Data Plot		Occupied Bandwidth	
Page <u>1</u> of 3			
Job No.:	310064	Date:	3/26/2003
Specification:	15.247	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%):	40
E.U.T.:	RFID READER		
Configuration:	TX		
Sample Number:	1		
Location:	Lab 2	RBW:	30 kHz
Detector Type:	Peak	VBW:	30 kHz
Test Equipment Used		Measurement	
Antenna:	802	Directional Coupler:	
Pre-Amp:		Cable #1:	1484
Filter:		Cable #2:	
Receiver:	1464	Cable #3:	
Attenuator #1		Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty: +/-1.7 dB			
CENTER 902.837MHz		SPAN 2.000MHz	
*RBW 30kHz		VBW 30kHz	
SWP 50.0ms			
Notes: <u>Lowest channel</u>			

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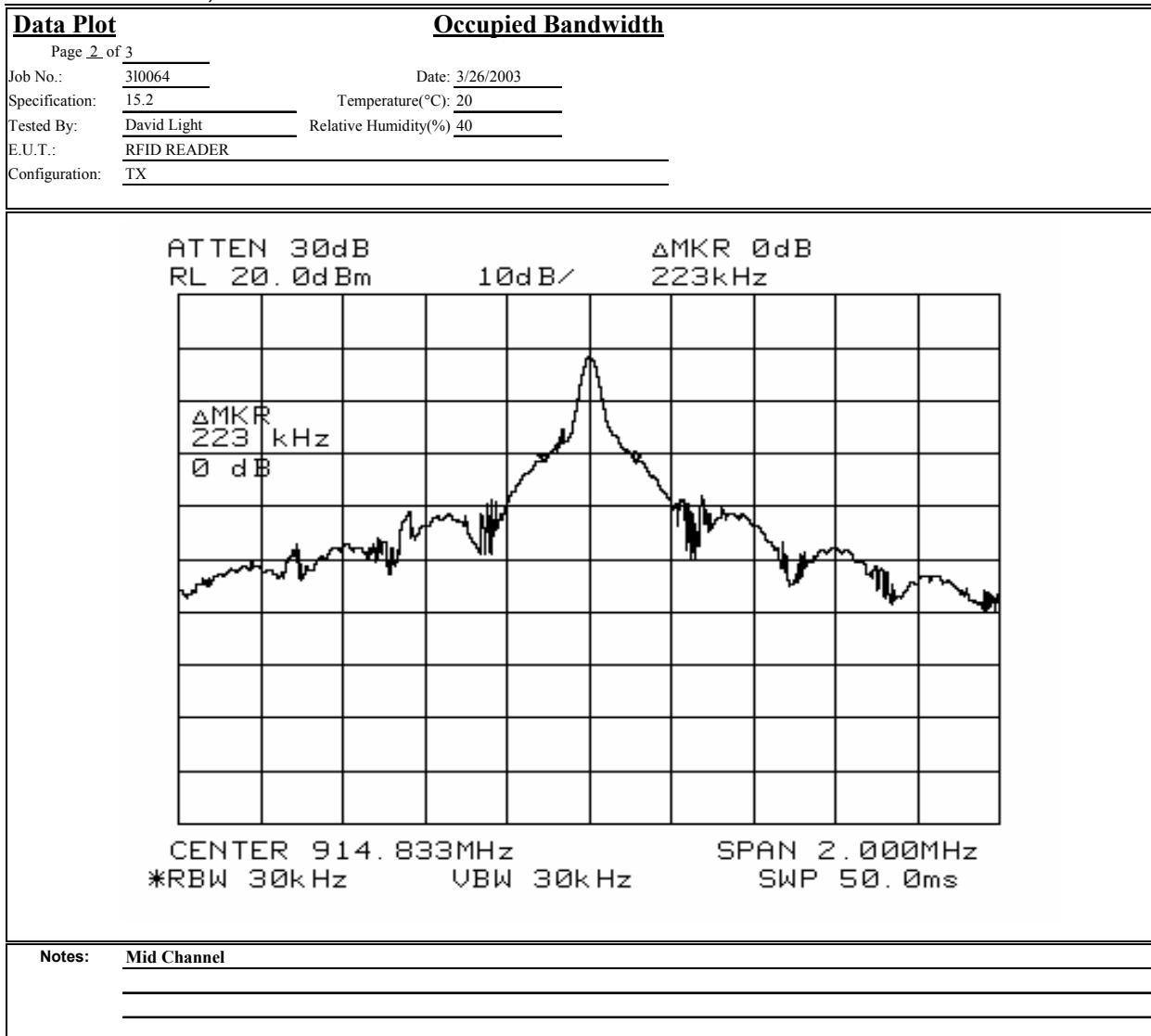
FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER
EQUIPMENT: LRP915HR-CLD REPORT NO.: 3L0064RUS1

Test Data – 20 dB Bandwidth



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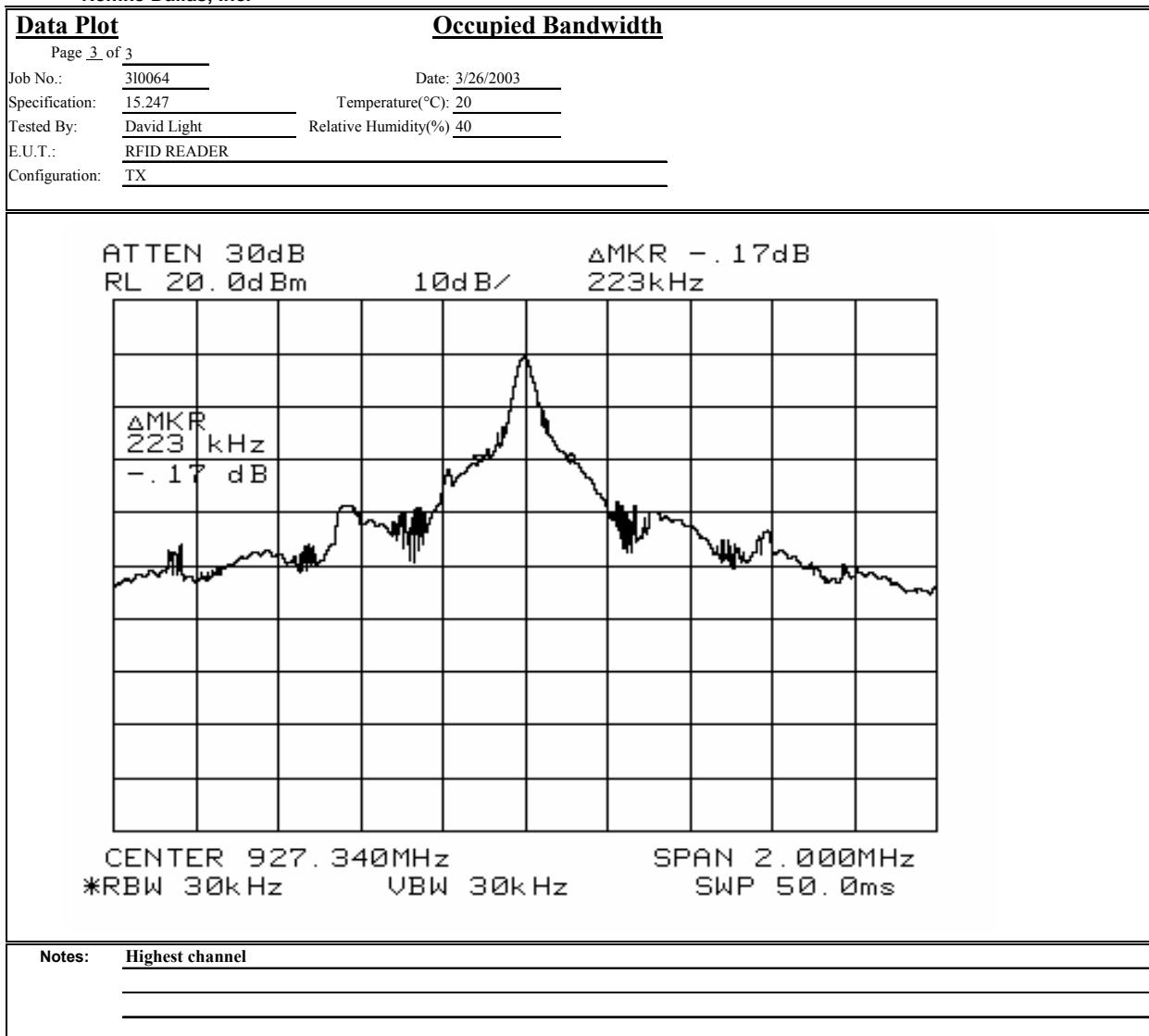
FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER
EQUIPMENT: LRP915HR-CLD REPORT NO.: 3L0064RUS1

Test Data – 20 dB Bandwidth



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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

Section 7. Number of Hopping Frequencies

NAME OF TEST: Number of Hopping Frequencies	PARA. NO.: 15.247 (a)(1)(i)
TESTED BY: David Light	DATE: 3/26/03

Test Results: Complies.

Measurement Data: See attached plots.

Measurement Uncertainty: +/- $\frac{1.7}{1 \times 10^{-7}}$ dB ppm

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FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER
EQUIPMENT: LRP915HR-CLD REPORT NO.: 3L0064RUS1

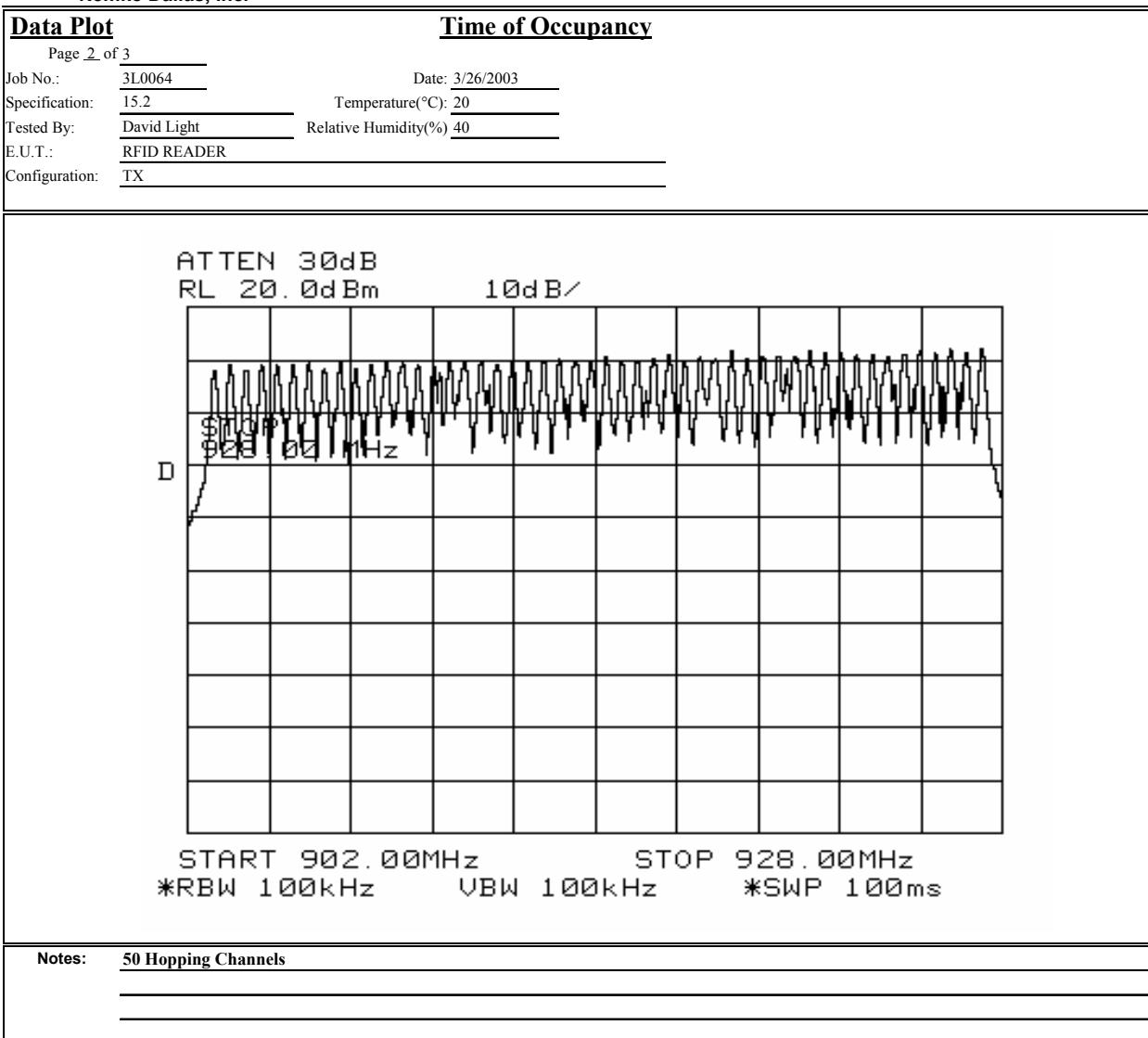
Test Plot – Number of Hopping Frequencies



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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

Section 8. Peak Power Output

NAME OF TEST: Peak Power Output	PARA. NO.: 15.247 (b)
TESTED BY: David Light	DATE: 9/30/03

Test Results: Complies.

Measurement Data: See attached plots.

Antennas: Integral Detachable antenna? Yes No

Measurement Uncertainty: +/- 0.7 dB

Nemko Dallas**FCC PART 15, SUBPART C****FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER****EQUIPMENT: LRP915HR-CLD****REPORT NO.: 3L0064RUS1****Test Data – Peak Power Output (E.I.R.P.)**

Nemko Dallas, Inc.

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EIRP Substitution Method													
Page <u>1</u> of <u>1</u>			Complete <u>X</u> Preliminary _____										
Job No.:	3L0064		Date: 9/30/03										
Specification:	15.247		Temperature(°C): 24										
Tested By:	Tom Tidwell		Relative Humidity(%) 55										
E.U.T.:	RFID READER												
Configuration:	UPRIGHT (WORST CASE)												
Sample No:	1												
Location:	AC 3		RBW: 300 kHz			Measurement							
Detector Type:	Peak		VBW: 300 kHz			Distance: 3 m							
Test Equipment Used													
Antenna:	1304		Directional Coupler:										
Pre-Amp:			Cable #1: 1484										
Filter:			Cable #2: 1485										
Receiver:	1464		Cable #3:										
Attenuator #1			Cable #4:										
Attenuator #2:			Mixer:										
Additional equipment used:													
Measurement Uncertainty: +/-1.7 dB													
Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBi)		EIRP (dBm)	EIRP (mW)	Polarity	Comments			
903.025	-16.1	29.3		0	7.1		20.3	107.98	V				
902.75	-27.3	31.0		0	7.1		10.8	12.022644	H				
914.75	-18.0	29.3		0	7.1		18.4	69.716140	V				
914.75	-20.7	31.0		0	7.1		17.4	54.954087	H				
927.25	-19.6	29.3		0	7.1		16.8	48.23	V				
927.25	-24.6	31.0		0	7.1		13.5	22.387211	H				
Notes: _____													

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FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

Section 10. Spurious Emissions (Radiated)

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.247(c)
TESTED BY: Ed McGrath	DATE: 9/30/03

Test Results: Complies.

Measurement Data: See attached table.

Duty Cycle Calculation: $20 \log_{10}(33.3/100) = 9.6 \text{ dB}$

Duty Cycle correction factor(dB) = $20 \log (\text{rf}_{\text{ON}} \text{ in ms}/100\text{ms})$

Measurement Uncertainty: $\pm \underline{1.7} \text{ dB}$

Nemko Dallas**FCC PART 15, SUBPART C****FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER****EQUIPMENT: LRP915HR-CLD****REPORT NO.: 3L0064RUS1****Test Data - Radiated Emissions**

Job No.:	3L0064	Date: 9/30/2003						
Specification:	15.247	Temperature(°C): 25						
Tested By:	ED MCGRATH	Relative Humidity(%) 45						
E.U.T.:	RFID READER							
Configuration:	TX UPRIGHT (WORST CASE)							
Sample Number:	1							
Location:	AC 3	RBW: 1 MHz						
Detector Type:	Peak/Avg	VBW: 1 MHz						
Test Equipment Used								
Antenna:	1304	Directional Coupler: #N/A						
Pre-Amp:	1016	Cable #1: 1484						
Filter:	1481	Cable #2: 1485						
Receiver:	1464	Cable #3: #N/A						
Attenuator #1	#N/A	Cable #4: #N/A						
Attenuator #2:	#N/A	Mixer: #N/A						
Measurement Uncertainty:	+/- 3.6 dB							
Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Comment
								Tx @ 902.75 MHz
2708.25	54.3	29.0	3.6	32.5	54.4	74	-19.6	Vertical Peak
2708.25	44.67	29.0	3.6	32.5	44.8	54	-9.2	Vertical Average
3611.00	50.3	30.6	3.6	31.8	52.7	54	-1.3	Vertical Peak
4513.75	51.2	32.2	4.1	31	56.5	74	-17.5	Vertical Peak
4513.75	41.57	32.2	4.1	31	46.9	54	-7.1	Vertical Average
5416.50	49.8	33.6	4.7	28.6	59.5	74	-14.5	Vertical Peak
5416.50	40.17	33.6	4.7	28.6	49.9	54	-4.1	Vertical Average
6319.25	49.5	34.7	5.2	31.6	57.8	74	-16.2	Vertical Peak
6319.25	39.87	34.7	5.2	31.6	48.2	54	-5.8	Vertical Average
7222.00	44.7	36.0	5.1	33.9	51.9	54	-2.1	Vertical Peak
8124.75	43.3	36.8	5.7	33	52.8	54	-1.2	Vertical Peak
9027.50	47	37.8	5.5	33.3	57.0	74	-17.0	Vertical Peak
9027.50	37.37	37.8	5.5	33.3	47.4	54	-6.6	Vertical Average
2705.558	56.8	29.0	3.6	32.5	56.9	74	-17.1	Horizontal Peak
2705.558	47.17	29.0	3.6	32.5	47.3	54	-6.7	Horizontal Average
3613.486	51	30.6	3.6	31.8	53.4	74	-20.6	Horizontal Peak
3613.486	41.37	30.6	3.6	31.8	43.8	54	-10.2	Horizontal Average
4511.8	52.5	32.2	4.1	31.0	57.8	74	-16.2	Horizontal Peak
4511.8	42.9	32.2	4.1	31.0	48.2	54	-5.8	Horizontal Average
5410.115	48.7	33.6	4.7	28.6	58.4	74	-15.6	Horizontal Peak
5410.115	39.1	33.6	4.7	28.6	48.8	54	-5.2	Horizontal Average
6309.0790	48.3	34.7	5.2	31.6	56.6	74	-17.4	Horizontal Peak
6309.0790	38.7	34.7	5.2	31.6	47.0	54	-7.0	Horizontal Average
7220.8670	45.3	36.0	5.1	33.9	52.5	54	-1.5	Horizontal Peak
8118.068	51.2	36.8	5.7	33.0	60.7	74	-13.3	Horizontal Peak
8118.068	41.6	36.8	5.7	33.0	51.1	54	-2.9	Horizontal Average
9022.5630	52.7	37.8	5.5	33.3	62.7	74	-11.3	Horizontal Peak
9022.5630	43.1	37.8	5.5	33.3	53.1	54	-0.9	Horizontal Average
Notes: 9.6 dB correction was used for Average readings								
If Peak reading met the Average limit, then an Average reading was not made.								

Nemko Dallas**FCC PART 15, SUBPART C****FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER****EQUIPMENT: LRP915HR-CLD****REPORT NO.: 3L0064RUS1****Test Data - Radiated Emissions**

Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Comment
Tx @ 902.75 MHz								
Vertical								
2744.25	48	29.1	3.7	32.5	48.3	74	-25.7	Peak
2744.25	38.37	29.1	3.7	32.5	38.7	54	-15.3	Average
3659.00	65	30.9	3.6	31.7	67.8	74	-6.2	Peak
3659.00	55.37	30.9	3.6	31.7	58.2	54	4.2	Average
4573.75	60.8	32.5	4.1	30.9	66.5	74	-7.5	Peak
4573.75	51.17	32.5	4.1	30.9	56.9	54	2.9	Average
5488.50	49.7	33.6	4.7	28.5	59.5	74	-14.5	Peak
5488.50	40.07	33.6	4.7	28.5	49.9	54	-4.1	Average
6403.25	48.3	34.8	5.2	31.9	56.4	74	-17.6	Peak
6403.25	38.67	34.8	5.2	31.9	46.8	54	-7.2	Average
7318.00	47	36.1	5.2	34.2	54.1	74	-19.9	Peak
7318.00	37.37	36.1	5.2	34.2	44.5	54	-9.5	Average
8232.75	46.7	37.0	5.6	33.1	56.2	74	-17.8	Peak
8232.75	37.07	37.0	5.6	33.1	46.6	54	-7.4	Average
9147.50	44.17	37.7	5.5	33.3	54.1	74	-19.9	Peak
9147.50	34.54	37.7	5.5	33.3	44.4	54	-9.6	Average
Horizontal								
2744.25	55.2	29.1	3.7	32.51	55.5	74	-18.5	Peak
2744.25	45.57	29.1	3.7	32.51	45.9	54	-8.1	Average
3659.00	54.7	30.9	3.6	31.7	57.5	74	-16.5	Peak
3659.00	45.07	30.9	3.6	31.7	47.9	54	-6.1	Average
4573.75	59.2	32.5	4.1	30.9	64.9	74	-9.1	Peak
4573.75	49.57	32.5	4.1	30.9	55.3	54	1.3	Average
5488.50	51.5	33.6	4.7	28.5	61.3	74	-12.7	Peak
5488.50	41.87	33.6	4.7	28.5	51.7	54	-2.3	Average
6403.25	48	34.8	5.2	31.9	56.1	74	-17.9	Peak
6403.25	38.37	34.8	5.2	31.9	46.5	54	-7.5	Average
7318.00	49.2	36.1	5.2	34.2	56.3	74	-17.7	Peak
7318.00	39.57	36.1	5.2	34.2	46.7	54	-7.3	Average
8232.75	47.8	37.0	5.6	33.1	57.3	74	-16.7	Peak
8232.7500	38.17	37.0	5.6	33.1	47.7	54	-6.3	Average
9147.5000	52.8	37.7	5.5	33.3	62.7	74	-11.3	Peak
9147.5	43.17	37.7	5.5	33.3	53.1	54	-0.9	Average

Test Data - Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Comment
								<u>Tx @ 902.75 MHz</u>
								Vertical
2781.50	49.8	29.3	3.7	32.5	50.3	74	-23.7	Peak
2781.50	40.17	29.3	3.7	32.5	40.7	54	-13.3	Average
3708.75	51.3	31.0	3.6	31.6	54.3	74	-19.7	Peak
3708.75	41.67	31.0	3.6	31.6	44.7	54	-9.3	Average
4636.00	50.3	32.7	4.2	30.7	56.5	74	-17.5	Peak
4636.00	40.67	32.7	4.2	30.7	46.9	54	-7.1	Average
5563.25	51	33.7	4.7	28.3	61.1	74	-12.9	Peak
5563.25	41.37	33.7	4.7	28.3	51.5	54	-2.5	Average
6490.50	47.2	34.9	5.3	32.1	55.3	74	-18.7	Peak
6490.50	37.57	34.9	5.3	32.1	45.7	54	-8.3	Average
7417.75	45.7	36.2	5.3	34.1	53.1	54	-0.9	Peak
8345.00	47.7	37.1	5.6	33.2	57.2	74	-16.8	Peak
8345.00	38.07	37.1	5.6	33.2	47.6	54	-6.4	Average
9272.25	47	37.5	5.6	33.2	56.9	74	-17.1	Peak
9272.25	37.37	37.5	5.6	33.2	47.3	54	-6.7	Average
								Horizontal
2769.25	53.8	29.3	3.7	32.5	54.3	74	-19.7	Peak
2769.25	44.17	29.3	3.7	32.5	44.7	54	-9.3	Average
3696.5	45.2	31.0	3.6	31.6	48.2	54	-5.8	Peak
4623.75	50.5	32.7	4.2	30.7	56.7	74	-17.3	Peak
4623.75	40.87	32.7	4.2	30.7	47.1	54	-6.9	Average
5551	55.33	33.7	4.7	28.3	65.4	74	-8.6	Peak
5551	42.87	33.7	4.7	28.3	53.0	54	-1.0	Average
6478.25	51	34.9	5.3	32.1	59.1	74	-14.9	Peak
6478.25	41.37	34.9	5.3	32.1	49.5	54	-4.5	Average
7405.5	48.8	36.2	5.3	34.1	56.2	74	-17.8	Peak
7405.5	39.17	36.2	5.3	34.1	46.6	54	-7.4	Average
8332.75	47.3	37.1	5.6	33.2	56.8	74	-17.2	Peak
8332.75	37.67	37.1	5.6	33.2	47.2	54	-6.8	Average
9260	49.8	37.5	5.6	33.2	59.7	74	-14.3	Peak
9260	40.17	37.5	5.6	33.2	50.1	54	-3.9	Average

Nemko Dallas

FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

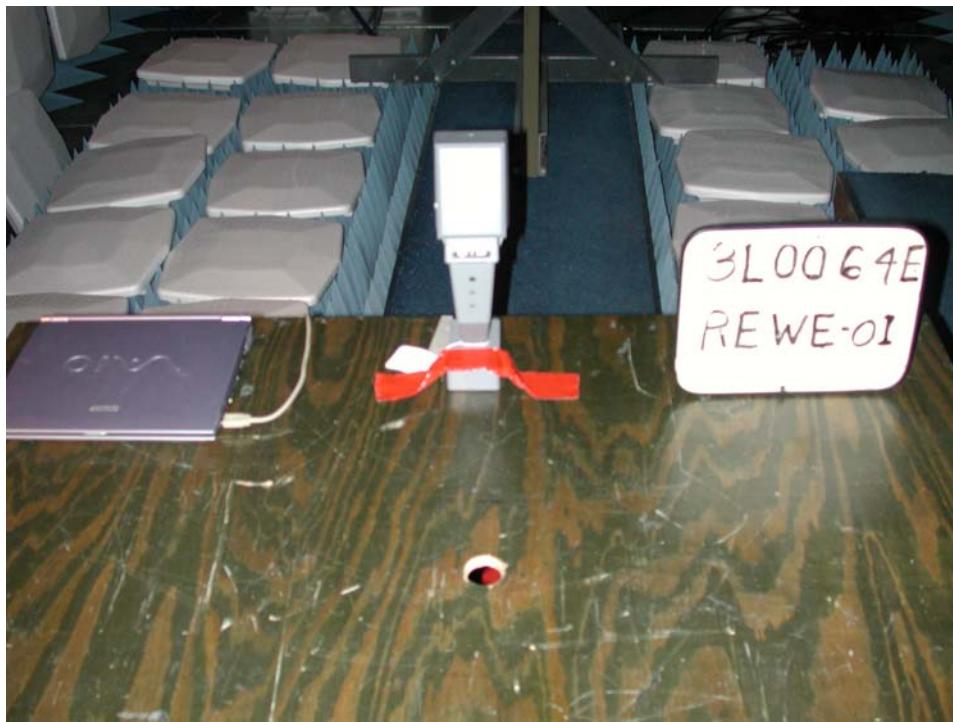
REPORT NO.: 3L0064RUS1

Radiated Photographs (Worst Case Configuration)

FRONT VIEW



REAR VIEW



Nemko Dallas**FCC PART 15, SUBPART C****FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER****EQUIPMENT: LRP915HR-CLD****REPORT NO.: 3L0064RUS1**

Section 11. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1481	Microwave Highpass Filter	K & L 3DH1-2000/T8000-0/0	4	Cal B4 Use	N/A
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	02/11/03	02/11/05
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	07/24/03	07/23/04
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	07/24/03	07/23/04
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	08/28/03	08/28/04
1034	ANTENNA,LP	A.H. SYSTEMS SAS-200/510	121	06/09/03	06/08/04
802	Near Field Probe Set	EMCO 7405	103	N/A	N/A
545	LISN	Schwarz Beck 8120	8120350	08/01/03	07/31/04
968	Filter, High pass 5khz	Solartron 7930-5.0	933124	08/08/03	08/07/04
1547	CABLE .6m	KTL RG223	N/A	09/15/03	09/14/04
1129	CABLE, 9.5m	KTL RG58	N/A	06/18/03	06/17/04
716	Receiver	Polorad ESH2	879342/005	01/03/03	01/03/04

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FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

ANNEX A - TEST DETAILS

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FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

NAME OF TEST: Powerline Conducted Emissions

PARA. NO.: 15.207(a)

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.

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FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

NAME OF TEST: Channel Separation	PARA. NO.: 15.247(a)(1)
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Minimum Standard:
channel carrier

Frequency hopping systems shall have hopping frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

NAME OF TEST: Pseudorandom Hopping Algorithm	PARA. NO.: 15.247(a)(1)
--	-------------------------

Minimum Standard:
selected from

The system shall hop to channel frequencies that are a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their transmitters and shall shift frequencies in synchronization with the transmitted signals.

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

NAME OF TEST: Time of Occupancy

PARA. NO.: 15.247(a)(1)(ii)

Minimum Standard:

Frequency Band (MHz)	20 dB Bandwidth	No. of Hopping Channels	Average Time of Occupancy
902 - 928	<250 kHz	50	=<0.4 sec. in 20 sec.
902 – 928	=>250 kHz	25	=<0.4 sec. in 10 sec.
2400 – 2483.5	-----	75	=<0.4 sec. in 30 sec.
5725 – 5850	-----	75	=<0.4 sec. in 30 sec.

Method Of Measurement:

The spectrum analyzer is set as follows:

RBW: 1 MHz

VBW: = RBW

Span: 0 Hz

LOG dB/div.: 10 dB

Sweep: Sufficient to see one hop time sequence.

Trigger: Video

The occupancy time of one hop is measured as above. The average time of occupancy is calculated over the appropriate period of time from above table (10, 20, or 30 seconds).

Avg. time of occupancy = (period from table/duration of one hop)/no. of channels multiplied by the duration of one hop.

For instance:

If a 2.4 GHz system has a measured hop duration time of 1 msec. and uses 75 channels, then the average time of occupancy would be:

$(30 \text{ sec.} / 0.001 \text{ sec.}) / 75 \text{ chan.} = 400 \times 1 \text{ msec.} = 400 \text{ msec. or } 0.4 \text{ sec. in 30 sec.}$

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FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

NAME OF TEST: Occupied Bandwidth

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

Minimum Standard:

Frequency Band (MHz)	Maximum 20 dB Bandwidth
902 - 928	500 kHz
2400 – 2483.5	1 MHz
5725 – 5850	1 MHz

Method Of Measurement:

The spectrum analyzer is set as follows:

RBW: At least 1% of span/div.

VBW: >RBW

Span: Sufficient to display 20 dB bandwidth

LOG dB/div.: 10 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

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FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD REPORT NO.: 3L0064RUS1

NAME OF TEST: Peak Power Output

PARA. NO.: 15.247(b)

Minimum Standard:

Frequency Band (MHz)	No. of Hopping Channels	Maximum Peak Power Output at Antenna Port
902 - 928	at least 50	1 watt
902 – 928	25 - 49	0.25 watts
2400 – 2483.5	75	1 watt
5725 – 5850	75	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.

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point to point operation may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceed 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operation may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

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. The dBi gain of the antenna(s) employed shall be reported.

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 20 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

Nemko Dallas**FCC PART 15, SUBPART C****FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER****EQUIPMENT: LRP915HR-CLD****REPORT NO.: 3L0064RUS1****NAME OF TEST: Spurious Emissions at Antenna
Terminals****PARA. NO.: 15.247(c)**

Minimum Standard: In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, 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 (μ 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:**30 MHz - 10th harmonic plot

RBW: 100 kHz

VBW: 300 kHz

Sweep: Auto

Display line: -20 dBc

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, 2400 MHz, or 5725 MHz

Marker: Peak of fundamental emission

Marker Δ : Peak of highest spurious level below center frequency.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, 2483.5 MHz, or 5850 MHz

Marker: Peak of fundamental emission

Marker Δ : Peak of highest spurious level above center frequency.

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

Nemko Dallas**FCC PART 15, SUBPART C****FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER****EQUIPMENT: LRP915HR-CLD****REPORT NO.: 3L0064RUS1****NAME OF TEST: Radiated Spurious Emissions****PARA. NO.: 15.247(c)**

Minimum Standard: In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, 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

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FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

ANNEX B - TEST DIAGRAMS

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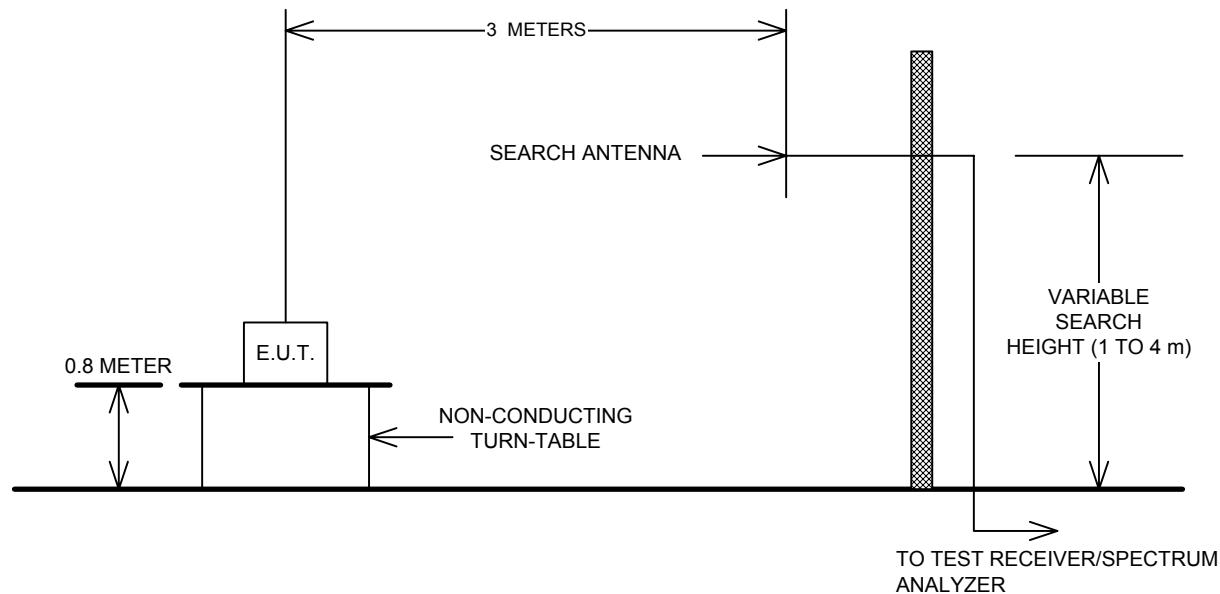
FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

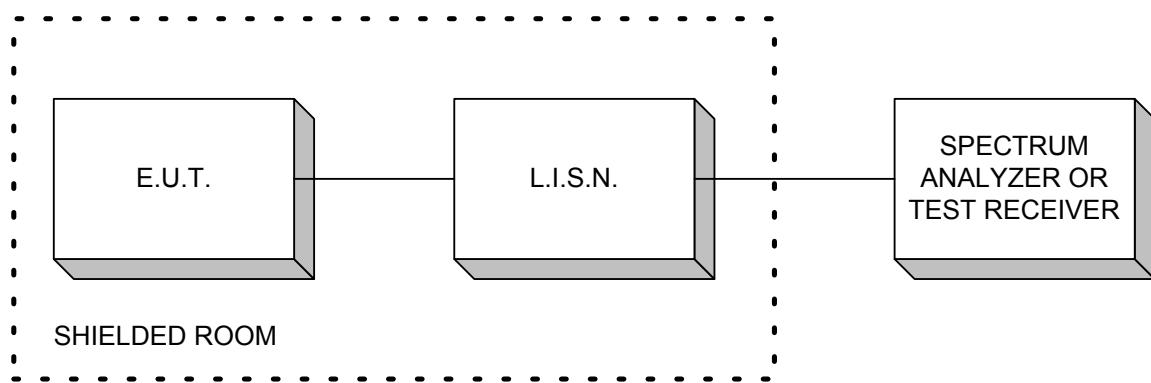
EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

Test Site For Radiated Emissions



Conducted Emissions



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FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

Peak Power At Antenna Terminals

