

**Nemko Test Report:** 4L0576RUS1Rev1

**Applicant:** LXE, Inc.  
125 Technology Parkway  
Norcross, GA 30092

**Equipment Under Test:** RFID Reader  
(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:**   
Tom Tidwell, Frontline Group Manager

**Date:** 7 Dec. 2004

**Total Number of Pages:** 39

## Table of Contents

<b>Section 1. Summary of Test Results .....</b>	<b>3</b>
<b>Section 2. Equipment Under Test (E.U.T.).....</b>	<b>5</b>
<b>Section 3. Channel Separation.....</b>	<b>7</b>
<b>Section 4. Time of Occupancy.....</b>	<b>10</b>
<b>Section 5. Occupied Bandwidth.....</b>	<b>13</b>
<b>Section 6. Peak Power Output .....</b>	<b>17</b>
<b>Section 7. Spurious Emissions (Antenna Conducted) .....</b>	<b>19</b>
<b>Section 8. Spurious Emissions (Radiated) .....</b>	<b>23</b>
<b>Section 9. Test Equipment List .....</b>	<b>28</b>
<b>ANNEX A - TEST DETAILS.....</b>	<b>29</b>
<b>ANNEX B - TEST DIAGRAMS .....</b>	<b>38</b>

**Section 1. Summary of Test Results**

Manufacturer: Sirit Corporation

Model No.: RFID Reader

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 C63.4-2001. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

<input checked="" type="checkbox"/>	New Submission	<input type="checkbox"/>	Production Unit
<input type="checkbox"/>	Class II Permissive Change	<input checked="" type="checkbox"/>	Pre-Production Unit
<input type="checkbox"/>	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. NONE****NVLAP LAB CODE: 100426-0**

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**Summary Of Test Data**

NAME OF TEST	PARA. NO.	SPEC.	RESULT
Powerline Conducted Emissions	15.207(a)	48 dB $\mu$ V	Not Tested*
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	Complies
Spurious Emissions (Radiated)	15.247(c)	Table 15.209(a)	Complies

**Footnotes:**

Powerline Conducted Emissions test was not performed. The EUT operates with battery supply.

**Section 2. Equipment Under Test (E.U.T.)****General Equipment Information**

**Frequency Band:**  902 – 928 MHz  
 2400 – 2483.5 MHz

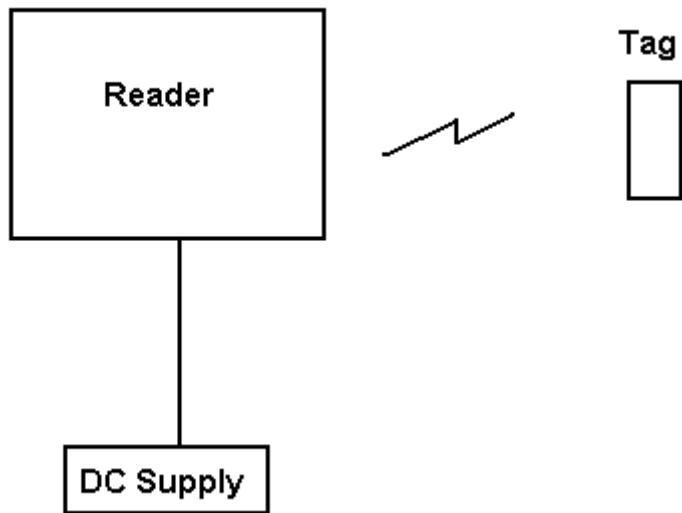
**Number of Channels:** 50

**Channel Spacing:** 500 kHz

**User Frequency Adjustment:** Software controlled

**Theory of Operation**

The EUT is a RFID reader operating in the 900 MHz band.

**System Diagram**

**Section 3. Channel Separation**

NAME OF TEST: Channel Separation

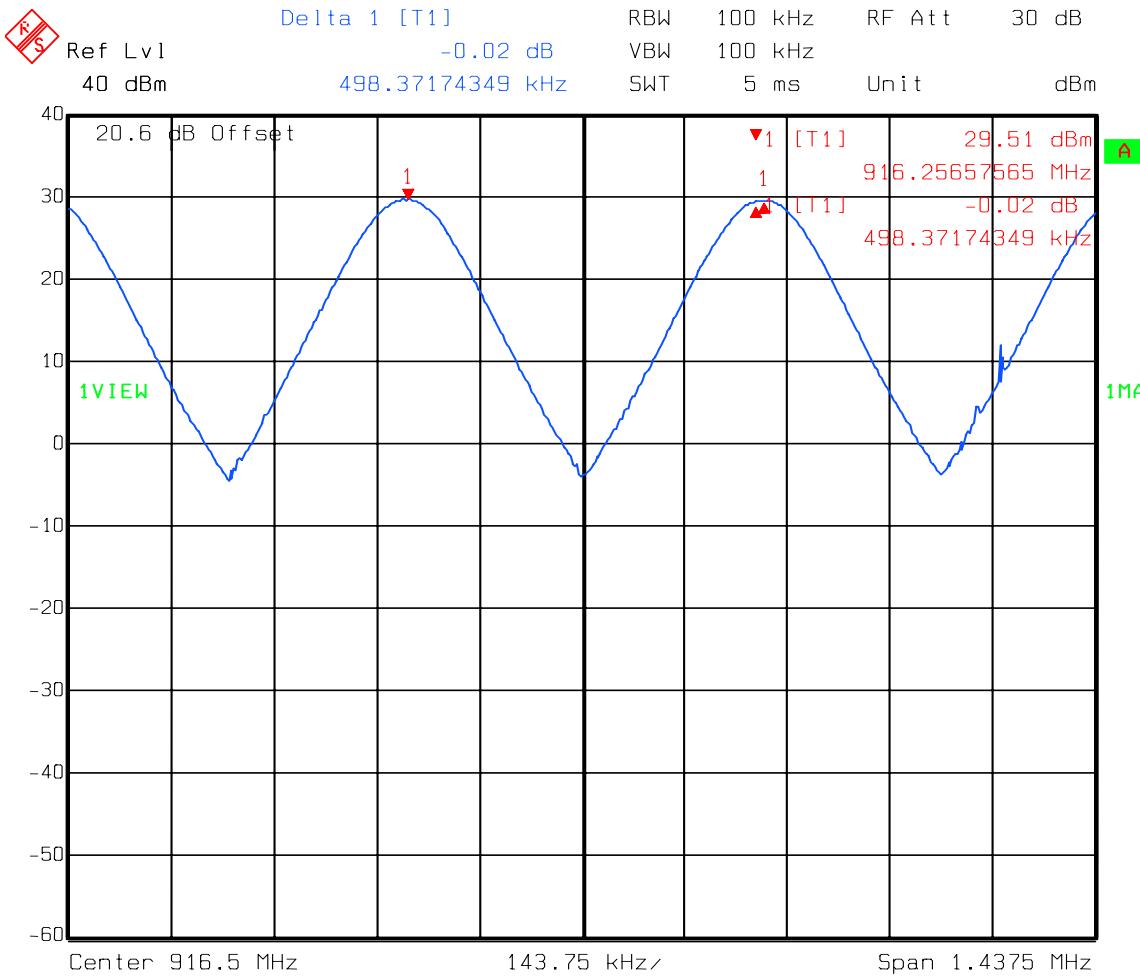
PARA. NO.: 15.247(a)(1)

TESTED BY: David Light

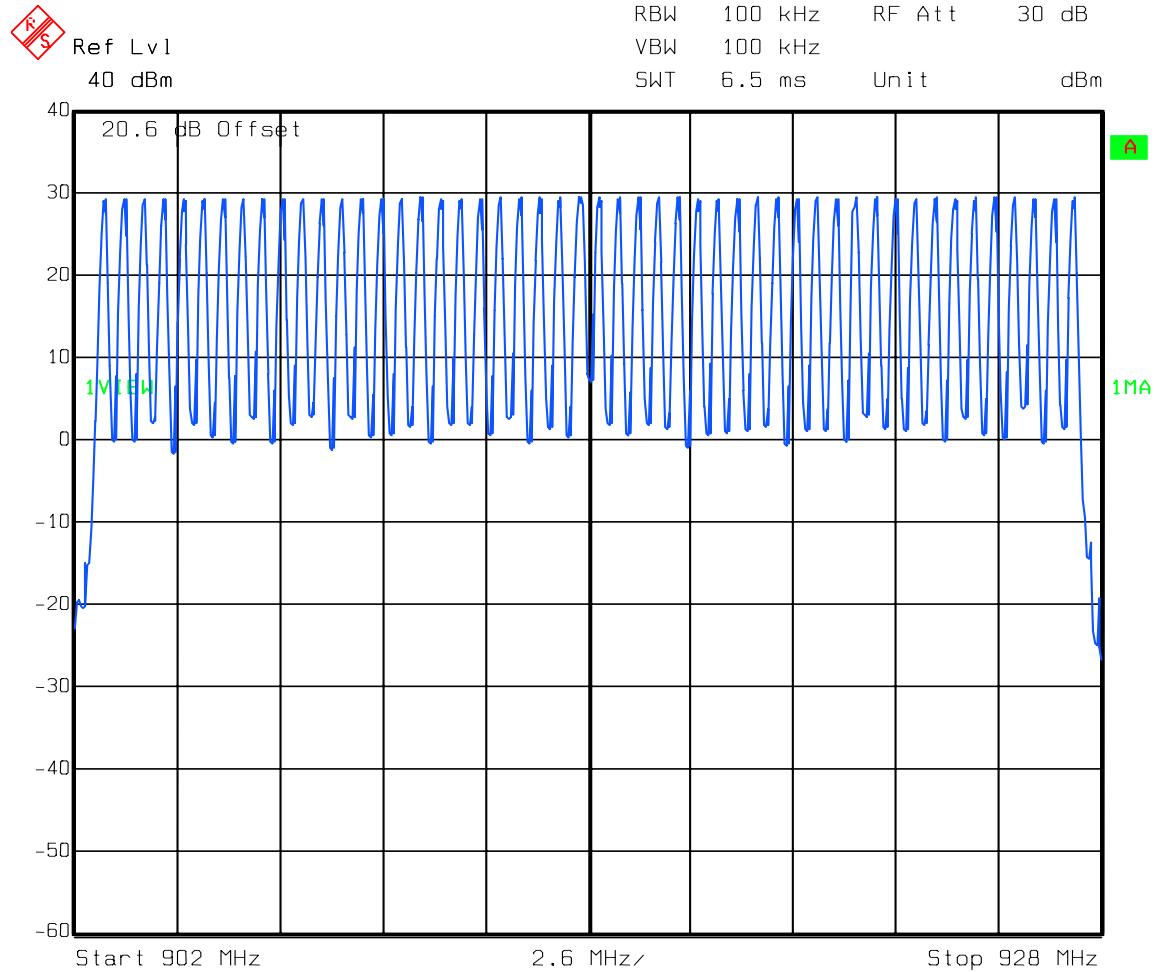
DATE: 9/21/04

**Test Results:** Complies.**Measurement Data:** See 20 dB BW plot  
Measured 20 dB bandwidth: 325 kHz  
Channel Separation: 500 kHz**Equipment Used:** 1036-1480-1484-1485**Measurement Uncertainty:** +/- 0.7 dB**Temperature:** 22 °C**Relative Humidity:** 45 %

## Test Data – Channel Separation



Date: 21.SEP.2004 09:49:57

**Number of Channels**

Date: 21.SEP.2004 09:55:31

50 Channels

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FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

*EQUIPMENT: RFID Reader*

TEST REPORT NO.:

4L0576RUS1Rev1

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## **Section 4. Time of Occupancy**

NAME OF TEST: Time of Occupancy	PARA. NO.: 15.247(a)(1)
---------------------------------	-------------------------

TESTED BY: David Light	DATE: 9/21/04
------------------------	---------------

**Test Results:** Complies.

**Measurement Data:**

Maximum Dwell Time On Any Channel: 144.3 mS in 10 seconds

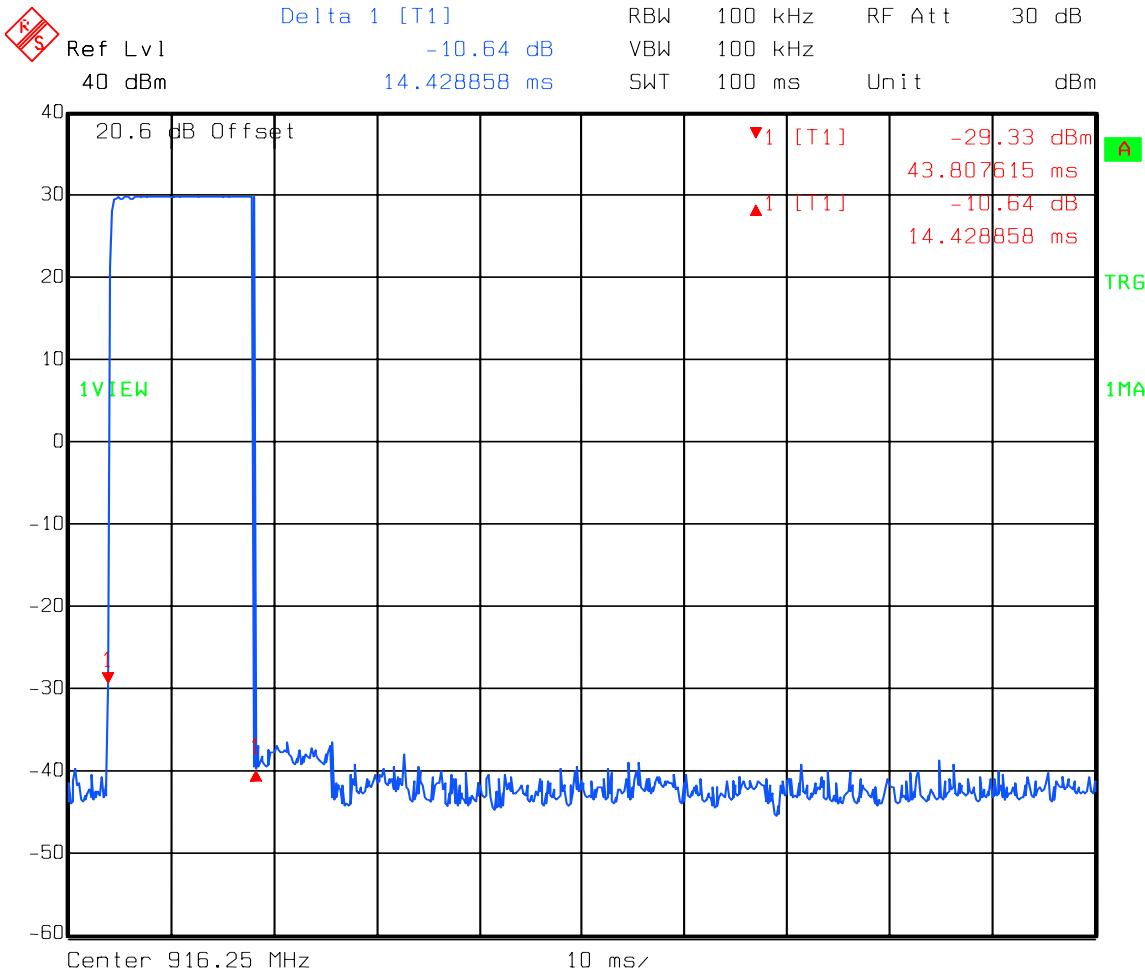
**Equipment Used:** 1036-1480-1484-1485

**Measurement Uncertainty:** +/- 0.7 dB

**Temperature:** 22 °C

**Relative Humidity:** 45 %

## Test Data – Time of Occupancy

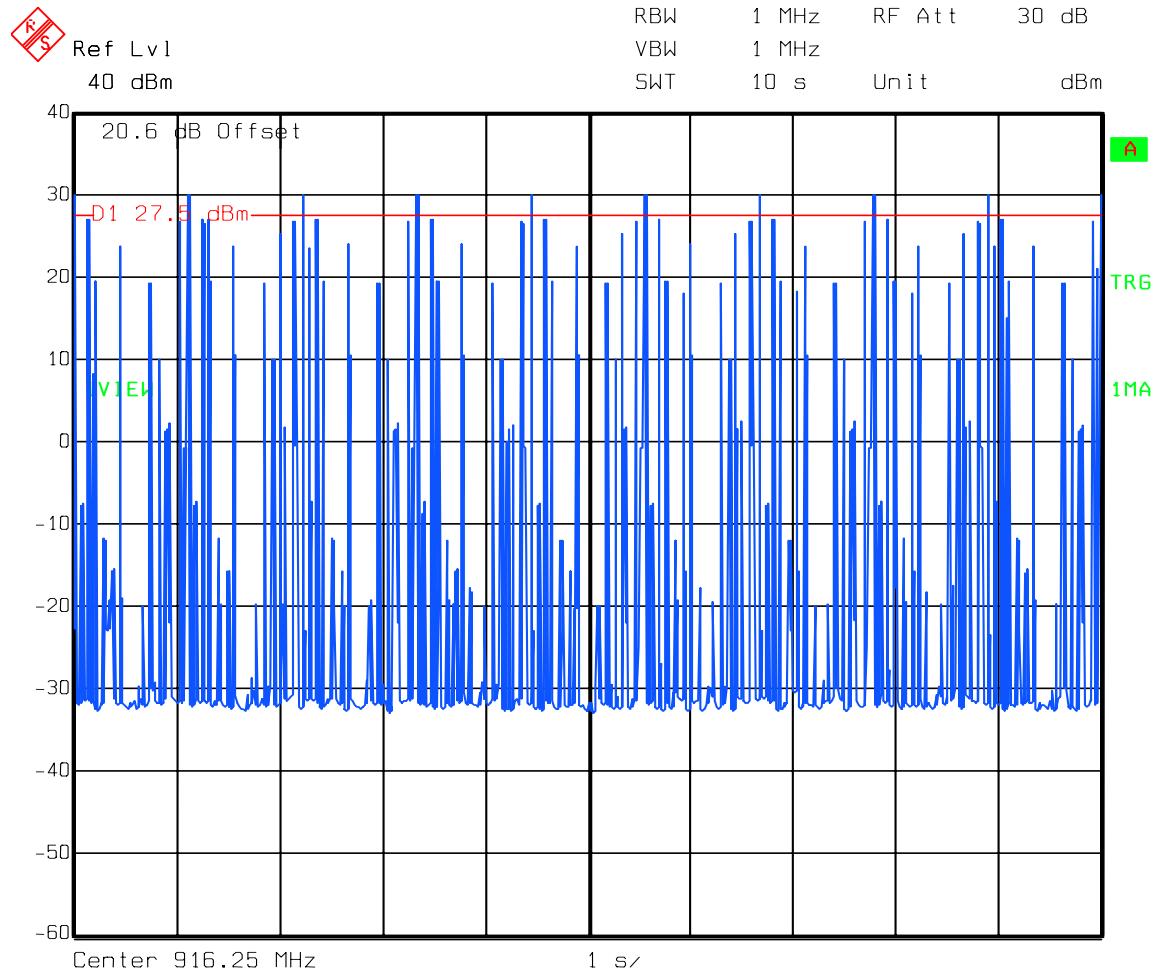


Date: 21.SEP.2004 09:52:32

On 14.4 mS in 100 mS

Duty cycle correction = -16.8 dB

## Test Data – Time of Occupancy



Date: 21.SEP.2004 10:00:42

14.43 mS per hop

10 hops in 10 seconds

144.3 mS in 10 seconds

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TEST REPORT NO.:

4L0576RUS1Rev1

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## **Section 5.        Occupied Bandwidth**

NAME OF TEST: Occupied Bandwidth

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

TESTED BY: David Light

DATE: 9/21/04

**Test Results:**        Complies.

**Measurement Data:**        See attached plots.

**Equipment Used:**        1484-1485-1036-1480

**Measurement Uncertainty:**        +/- 0.7 dB

**Temperature:**        22        °C

**Relative Humidity:**        45        %

## Nemko Dallas

## FCC PART 15, SUBPART C

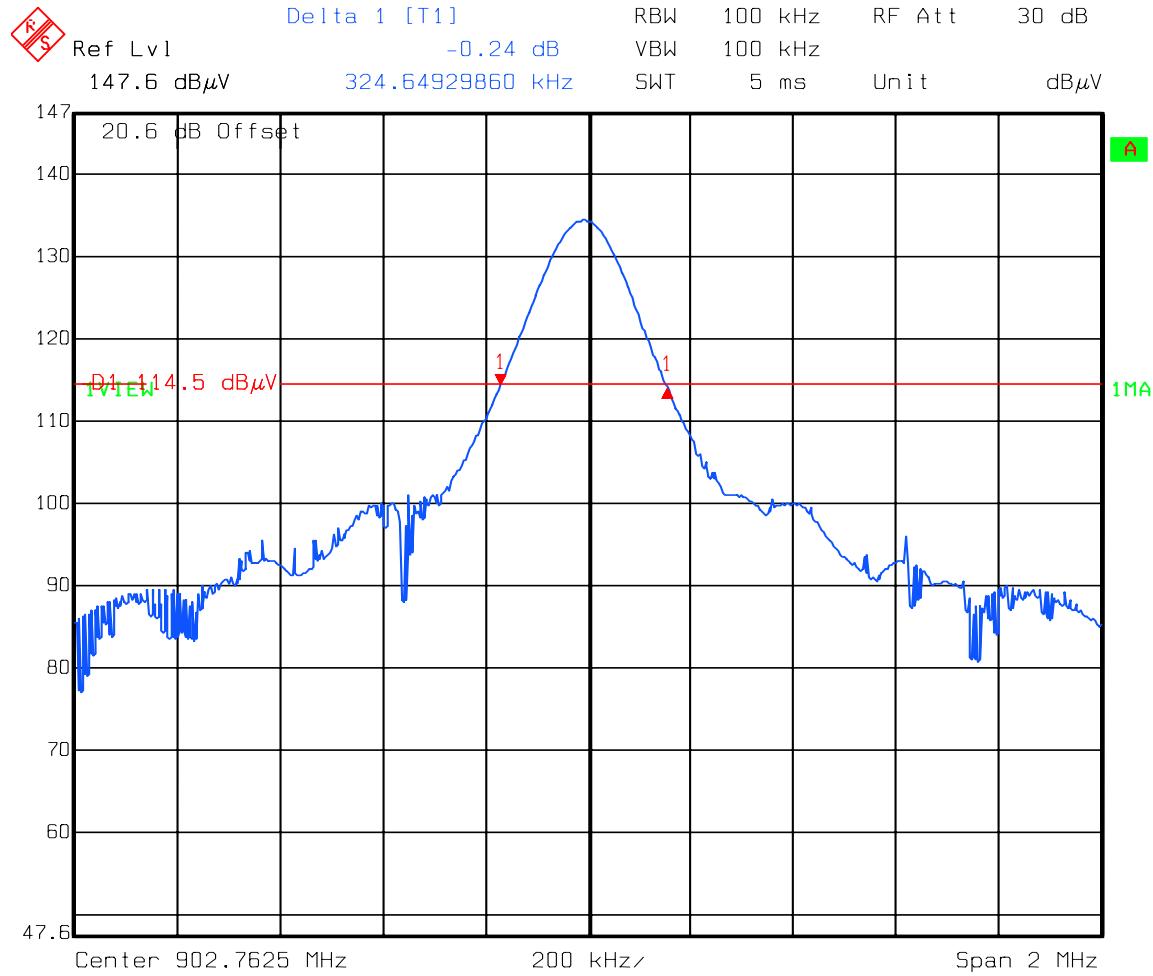
# FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

### *EQUIPMENT: RFID Reader*

## TEST REPORT NO.:

4L0576RUS1Rev1

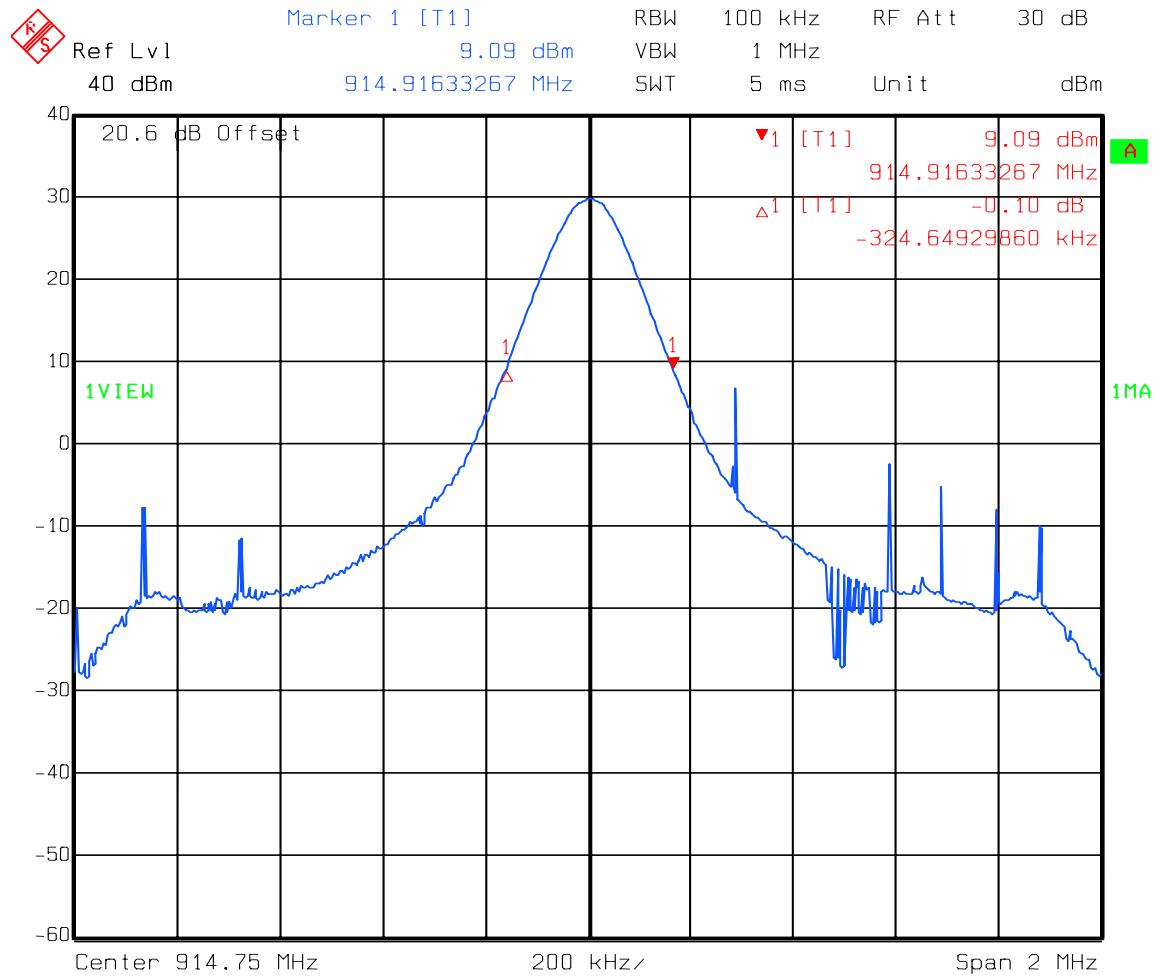
## Test Data – Occupied Bandwidth



Date: 21.SEP.2004 09:11:12

## Low Channel

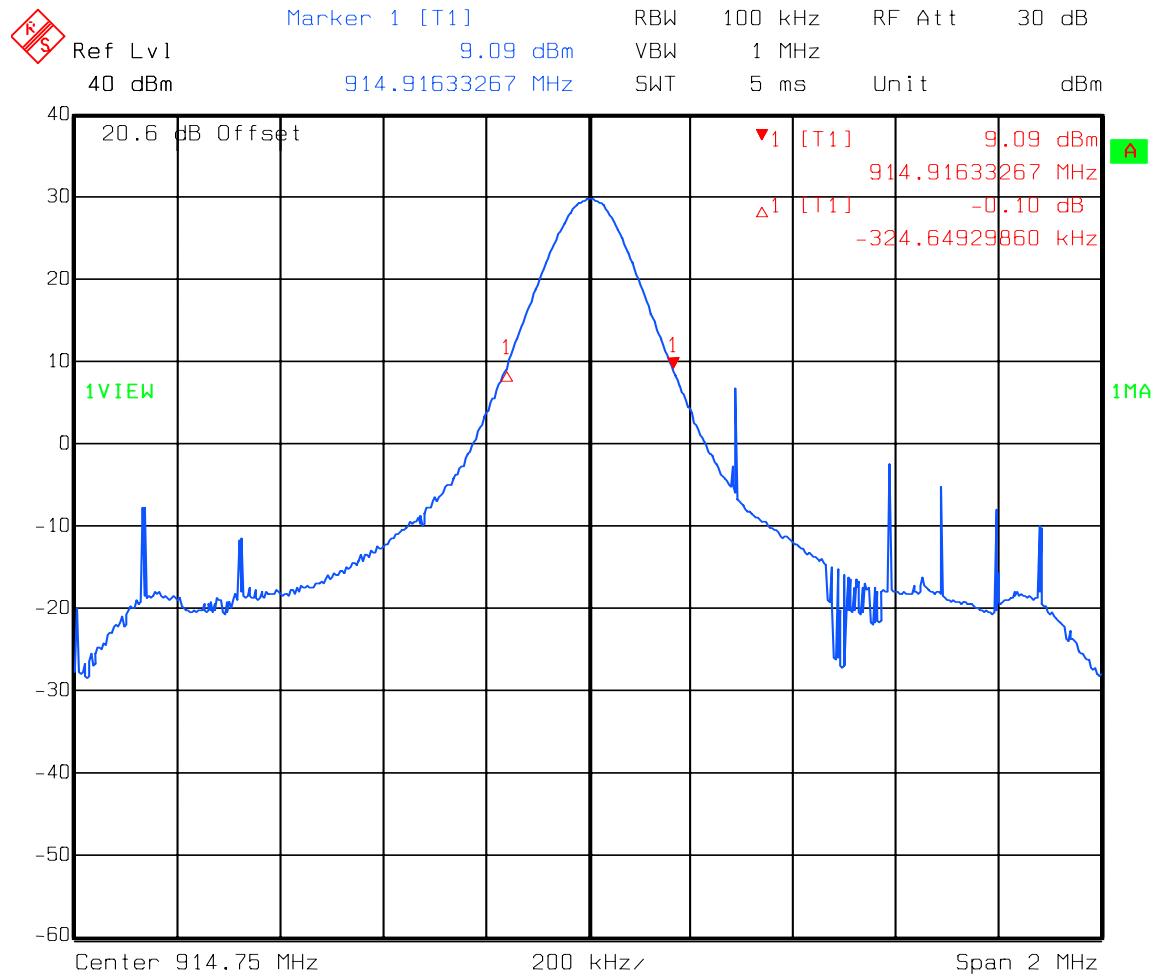
## Test Data – Occupied Bandwidth



Date: 21.SEP.2004 09:41:23

Mid Channel

## Test Data – Occupied Bandwidth



Date: 21.SEP.2004 09:41:23

High channel

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

*EQUIPMENT: RFID Reader*

TEST REPORT NO.:

4L0576RUS1Rev1

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## **Section 6. Peak Power Output**

NAME OF TEST: Peak Power Output

PARA. NO.: 15.247 (b)

TESTED BY: David Light

DATE: 11/1/04

**Test Results:** Complies.

**Measurement Data:** See attached data.

Detachable antenna?  Yes  No

If yes, state the type of non-standard connector used:

The EUT was tested at full battery voltage and run to cutoff voltage. No change in power output.

This test was done radiated as the antenna gain is unknown.

**Nemko Dallas****FCC PART 15, SUBPART C****FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER****EQUIPMENT: RFID Reader****TEST REPORT NO.:****4L0576RUS1Rev1****Test Data – Peak Power Output**

Nemko Dallas, Inc.

**Dallas Headquarters:**

802 N. Kealy

Lewisville, TX 75057

Tel: (972) 436-9600

Fax: (972) 436-2667

**EIRP Substitution Method**Page 1 of 1

Job No.:	4L0576R	Date:	11/1/04	Complete <input checked="" type="checkbox"/> X				
Specification:	15.247	Temperature(°C):	21	Preliminary <input type="checkbox"/>				
Tested By:	David Light	Relative Humidity(%)	40					
E.U.T.:	RFID READER							
Configuration:	TX FULL POWER							
Sample No:	1	RBW:	1 MHz	Measurement				
Location:	AC 3	VBW:	1 MHz	Distance: 3 m				
<b>Test Equipment Used</b>								
Antenna:	1304	Directional Coupler:						
Pre-Amp:		Cable #1:	1484					
Filter:		Cable #2:	1485					
Receiver:	1036	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
902.75	-10.2	31.0	0	7.1	27.9	616.60	H	
902.75	-17.8	29.3	0	7.1	18.6	73.00	V	
927.25	-14.1	31.0	0	7.1	24.0	251.19	H	
927.25	-22.5	29.3	0	7.1	13.9	24.74	V	
914.75	-8.5	31.0	0	7.1	29.6	912.01	H	
914.75	-18.1	29.3	0	7.1	18.3	68.13	V	
Notes: Device was tested at full battery voltage and run to battery cutoff with no change in output power.								

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FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

*EQUIPMENT: RFID Reader*

TEST REPORT NO.:

4L0576RUS1Rev1

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## **Section 7. Spurious Emissions (Antenna Conducted)**

NAME OF TEST: Spurious Emissions (Antenna Conducted)	PARA. NO.: 15.247(c)
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TESTED BY: David Light	DATE: 9/21/04
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**Test Results:** Complies.

**Measurement Data:** See attached plots.

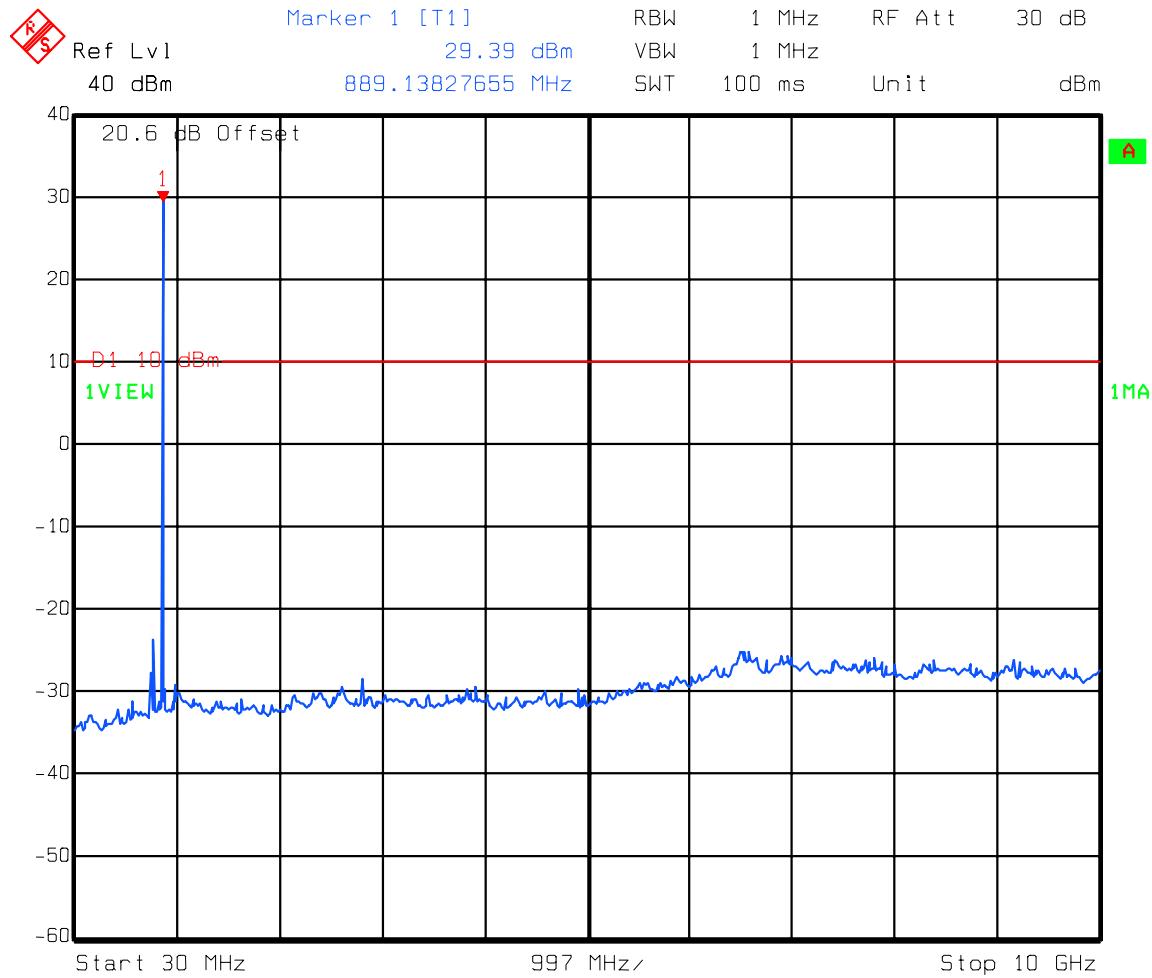
**Equipment Used:** 1036-1629

**Measurement Uncertainty:** +/- 0.7 dB

**Temperature:** 22 °C

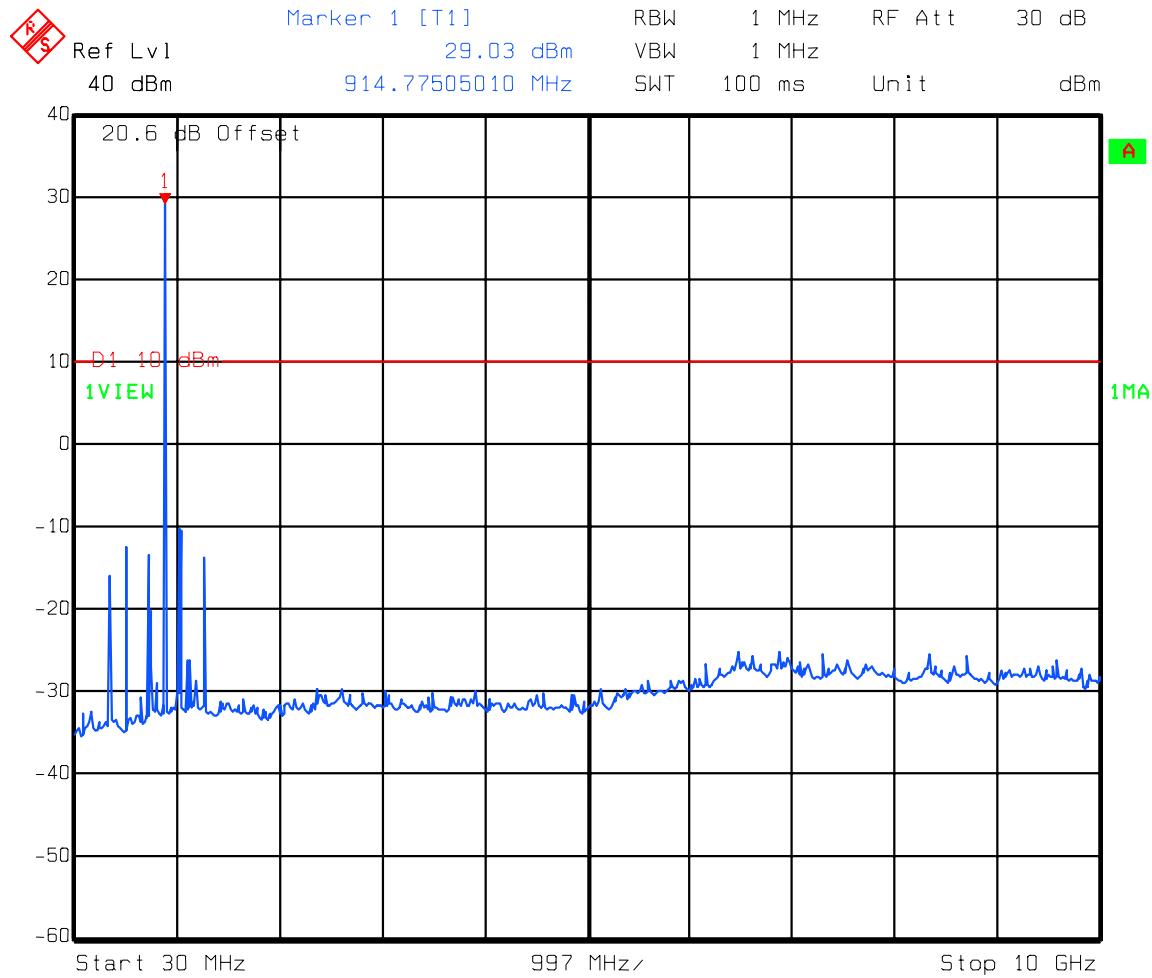
**Relative Humidity:** 45 %

## Test Data – Spurious Emissions



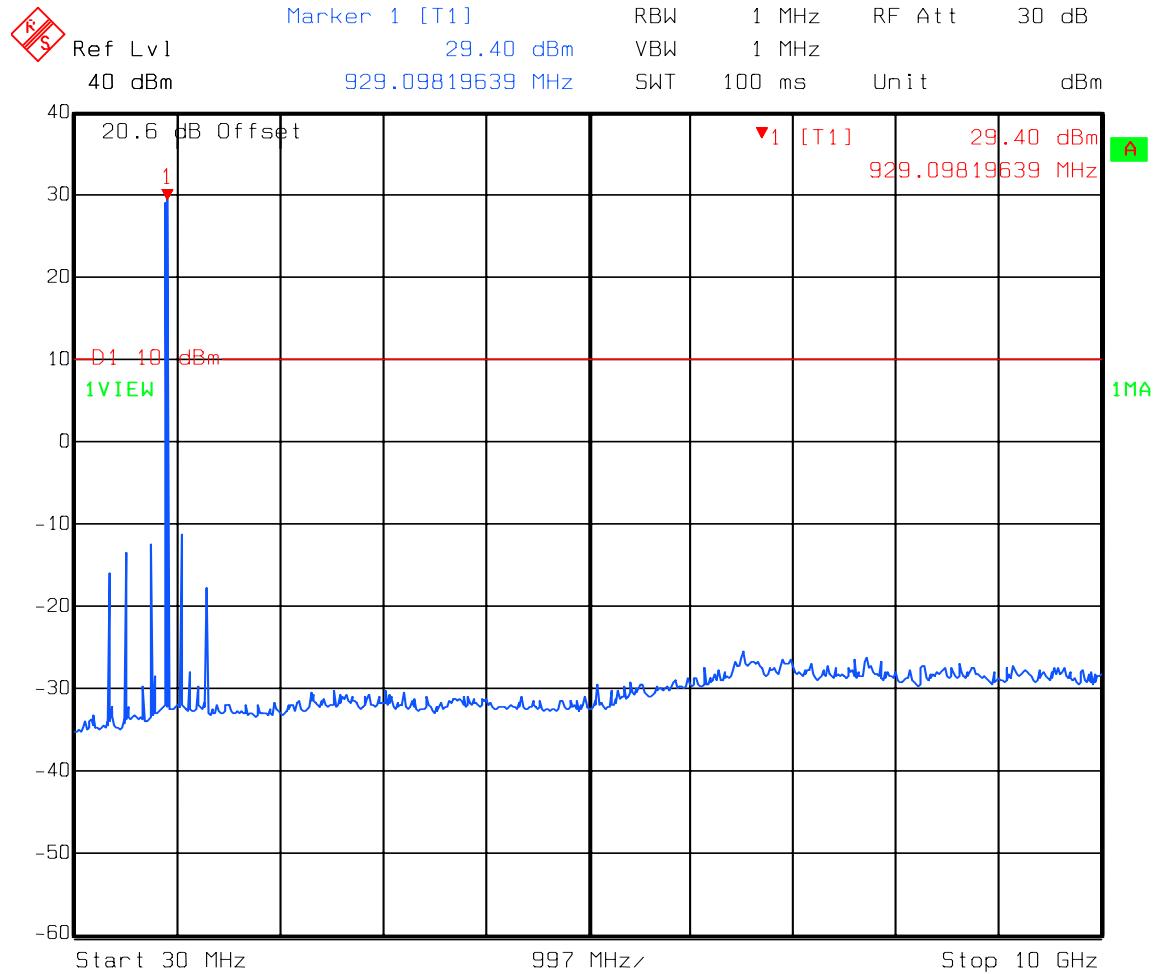
Date: 21.SEP.2004 09:30:26

## Low channel

**Test Data – Spurious Emissions**

Date: 21.SEP.2004 09:36:31

Mid channel

**Test Data – Spurious Emissions**

Date: 21.SEP.2004 09:47:51

High channel

**Nemko Dallas**

FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

*EQUIPMENT: RFID Reader*

TEST REPORT NO.:

4L0576RUS1Rev1

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## **Section 8. Spurious Emissions (Radiated)**

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.247(c)
TESTED BY: David Light	DATE: 11/1/04

**Test Results:** Complies.

**Measurement Data:** See attached table.

**Duty Cycle Calculation:**

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

On 14.4 mS in 100 mS

Duty cycle correction = -16.8 dB

**Note: The spectrum was searched from 20 MHz up to 10 GHz.**

## Test Data - Radiated Emissions

<u>Radiated Emissions</u>								
Page <u>1</u> of <u>3</u>								
Job No.:	4L0576R				Date: 11/1/2004			
Specification:	15.247/15.205				Temperature(°C): 25			
Tested By:	David Light				Relative Humidity(%): 50			
E.U.T.:	RFID READER							
Configuration:	TX							
Sample Number:	1							
Location:	AC 3				RBW: 1 MHz			
Detector Type:	Peak				VBW: 1 MHz			
Antenna:	1304				Directional Coupler: #N/A			
Pre-Amp:	1016				Cable #1: 1484			
Filter:	#N/A				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 (MHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Comment
								914.75 MHz
2744.25	58.3	29.2	3.7	32.5	58.7	74	-15.3	Peak -V
2744.25	41.5	29.2	3.7	32.5	41.9	54	-12.1	Average -V
3659.00	50.1	29.2	3.7	32.5	50.5	74	-23.5	Peak -V
3659.00	33.3	29.2	3.7	32.5	33.7	54	-20.3	Average -V
4573.75	62	32.7	4.2	30.7	68.2	74	-5.8	Peak -V
4573.75	45.2	32.7	4.2	30.7	51.4	54	-2.6	Average -V
5488.50	48	33.7	4.7	28.3	58.1	74	-15.9	Peak -V
5488.50	31.2	33.7	4.7	28.3	41.3	54	-12.7	Average -V
6403.25	46.3	34.9	5.3	31.8	54.7	74	-19.3	Peak -V
6403.25	29.5	34.9	5.3	31.8	37.9	54	-16.1	Average -V
7318.00	44.9	35.8	5.3	32.8	53.2	74	-20.8	Peak -V
7318.00	28.1	35.8	5.3	32.8	36.4	54	-17.6	Average -V
8232.75	44	37.1	5.6	33.2	53.5	74	-20.5	Peak -V
8232.75	27.2	37.1	5.6	33.2	36.7	54	-17.3	Average -V
9147.50	43.9	37.8	5.8	34	53.5	74	-20.5	Peak -V
9147.50	27.1	37.8	5.8	34	36.7	54	-17.3	Average -V
2744.25	54.3	29.2	3.7	32.5	54.7	74	-19.3	Peak -H
2744.25	37.5	29.2	3.7	32.5	37.9	54	-16.1	Average -H
3659.00	47.6	29.2	3.7	32.5	48.0	74	-26.0	Peak -H
3659.00	30.8	32.7	4.2	30.7	37.0	54	-17.0	Average -H
4573.75	59.7	32.7	4.2	30.7	65.9	74	-8.1	Peak -H
4573.75	42.9	32.7	4.2	30.7	49.1	54	-4.9	Average -H
5488.50	46.8	33.7	4.7	28.3	56.9	74	-17.1	Peak -H
5488.50	30	33.7	4.7	28.3	40.1	54	-13.9	Average -H
6403.25	44.6	34.9	5.3	31.8	53.0	74	-21.0	Peak -H
6403.25	27.8	34.9	5.3	31.8	36.2	54	-17.8	Average -H
7318.00	45	35.8	5.3	32.8	53.3	74	-20.7	Peak -H
7318.00	28.2	35.8	5.3	32.8	36.5	54	-17.5	Average -H
8232.75	42	37.1	5.6	33.2	51.5	74	-22.5	Peak -H
8232.75	25.2	37.1	5.6	33.2	34.7	54	-19.3	Average -H
9147.50	43	37.8	5.8	34.0	52.6	74	-21.4	Peak -H
9147.50	26.2	37.8	5.8	34.0	35.8	54	-18.2	Average -H
Notes: -16.8 dB Duty cycle correction included in average readings.								

## Test Data - Radiated Emissions

Radiated Spurious Emissions								
Page <u>2</u> of <u>3</u>				Continuation Page				
Job No.:				Date: 11/10/2004				
Specification:	CFR 47, Part 15			Temperature(°C): <u>25</u>				
Tested By:	#N/A			Relative Humidity(%) <u>50</u>				
E.U.T.:	RFID READER							
Configuration:	TX							
								902.75 MHz
2708.25	56.7	29.2	3.7	32.5	57.1	74	-16.9	Peak - V
2708.25	39.9	29.2	3.7	32.5	40.3	54	-13.7	Average - V
3611.00	46	29.2	3.7	32.5	46.4	74	-27.6	Peak - V
3611.00	29.2	29.2	3.7	32.5	29.6	54	-24.4	Average - V
4513.75	50.1	32.7	4.2	30.7	56.3	74	-17.7	Peak - V
4513.75	33.3	32.7	4.2	30.7	39.5	54	-14.5	Average - V
5416.50	49.6	33.7	4.7	28.3	59.7	74	-14.3	Peak - V
5416.50	32.8	33.7	4.7	28.3	42.9	54	-11.1	Average - V
6319.25	45.6	34.9	5.3	31.8	54.0	74	-20.0	Peak - V
6319.25	28.8	34.9	5.3	31.8	37.2	54	-16.8	Average - V
7222.00	47.9	35.8	5.3	32.8	56.2	74	-17.8	Peak - V
7222.00	31.1	35.8	5.3	32.8	39.4	54	-14.6	Average - V
8124.75	46.9	37.1	5.6	33.2	56.4	74	-17.6	Peak - V
8124.75	30.1	37.1	5.6	33.2	39.6	54	-14.4	Average - V
9027.50	43.5	37.8	5.8	34	53.1	74	-20.9	Peak - V
9027.50	26.7	37.8	5.8	34	36.3	54	-17.7	Average - V
2708.25	55	29.2	3.7	32.5	55.4	74	-18.6	Peak - H
2708.25	38.2	29.2	3.7	32.5	38.6	54	-15.4	Average - H
3611.00	43.7	29.2	3.7	32.5	44.1	54	-9.9	Peak - H
3611.00	26.9	32.7	4.2	30.7	33.1	74	-40.9	Average - H
4513.75	48.2	32.7	4.2	30.7	54.4	74	-19.6	Peak - H
4513.75	31.4	32.7	4.2	30.7	37.6	54	-16.4	Average - H
5416.50	48.2	33.7	4.7	28.3	58.3	74	-15.7	Peak - H
5416.50	31.4	33.7	4.7	28.3	41.5	54	-12.5	Average - H
6319.25	44.9	34.9	5.3	31.8	53.3	74	-20.7	Peak - H
6319.25	28.1	34.9	5.3	31.8	36.5	54	-17.5	Average - H
7222.00	46.3	35.8	5.3	32.8	54.6	74	-19.4	Peak - H
7222.00	29.5	35.8	5.3	32.8	37.8	54	-16.2	Average - H
8124.75	46.9	37.1	5.6	33.2	56.4	74	-17.6	Peak - H
8124.75	30.1	37.1	5.6	33.2	39.6	54	-14.4	Average - H
9027.50	45	37.8	5.8	34	54.6	74	-19.4	Peak - H
902.75	28.2	37.8	5.8	34	37.8	54	-16.2	Average - H

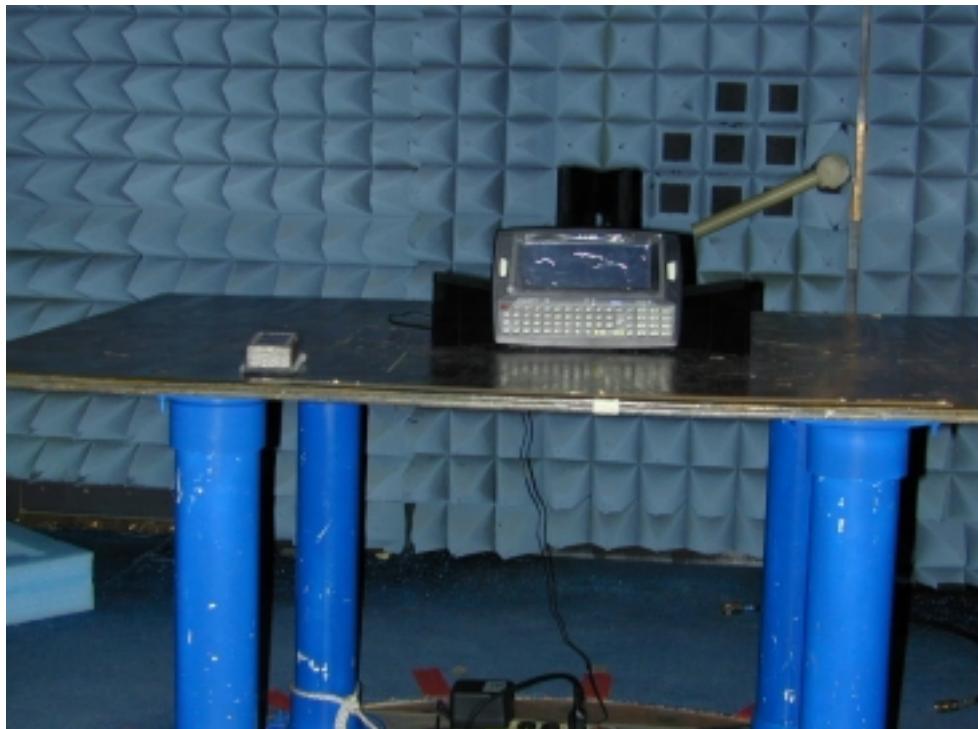
Notes: -16.8 dB Duty cycle correction included in average readings.

**Test Data - Radiated Emissions**

<u>Radiated Spurious Emissions</u>								
Page <u>3</u> of <u>3</u>				Continuation Page				
Job No.:	4L0576R			Date: 11/10/2004				
Specification:	CFR 47, Part 15			Temperature(°C): <u>25</u>				
Tested By:	#N/A			Relative Humidity(%) <u>50</u>				
E.U.T.:	RFID READER							
Configuration:	TX							
								927.25 MHz
2781.75	63.1	29.2	3.7	32.5	63.5	74	-10.5	Peak - V
2781.75	46.3	29.2	3.7	32.5	46.7	54	-7.3	Average - V
3709.00	47	29.2	3.7	32.5	47.4	74	-26.6	Peak - V
3709.00	30.2	29.2	3.7	32.5	30.6	54	-23.4	Average - V
4636.25	63	32.7	4.2	30.7	69.2	74	-4.8	Peak - V
4636.25	46.2	32.7	4.2	30.7	52.4	54	-1.6	Average - V
5563.50	46.5	33.7	4.7	28.3	56.6	74	-17.4	Peak - V
5563.50	29.7	33.7	4.7	28.3	39.8	54	-14.2	Average - V
6490.75	46.6	34.9	5.3	31.8	55.0	74	-19.0	Peak - V
6490.75	29.8	34.9	5.3	31.8	38.2	54	-15.8	Average - V
7418.00	43	35.8	5.3	32.8	51.3	74	-22.7	Peak - V
7418.00	26.2	35.8	5.3	32.8	34.5	54	-19.5	Average - V
8345.25	42.6	37.1	5.6	33.2	52.1	74	-21.9	Peak - V
8345.25	25.8	37.1	5.6	33.2	35.3	54	-18.7	Average - V
9272.50	45.7	37.8	5.8	34	55.3	74	-18.7	Peak - V
9272.50	28.9	37.8	5.8	34	38.5	54	-15.5	Average - V
2781.75	55.5	29.2	3.7	32.5	55.9	74	-18.1	Peak - H
2781.75	38.7	29.2	3.7	32.5	39.1	54	-14.9	Average - H
3709.00	45	29.2	3.7	32.5	45.4	54	-8.6	Peak - H
3709.00	28.2	32.7	4.2	30.7	34.4	74	-39.6	Average - H
4636.25	59.6	32.7	4.2	30.7	65.8	74	-8.2	Peak - H
4636.25	42.8	32.7	4.2	30.7	49.0	54	-5.0	Average - H
5563.50	45	33.7	4.7	28.3	55.1	74	-18.9	Peak - H
5563.50	28.2	33.7	4.7	28.3	38.3	54	-15.7	Average - H
6490.75	44	34.9	5.3	31.8	52.4	74	-21.6	Peak - H
6490.75	27.2	34.9	5.3	31.8	35.6	54	-18.4	Average - H
7418.00	42.5	35.8	5.3	32.8	50.8	74	-23.2	Peak - H
7418.00	25.7	35.8	5.3	32.8	34.0	54	-20.0	Average - H
8345.25	42.2	37.1	5.6	33.2	51.7	74	-22.3	Peak - H
8345.25	25.4	37.1	5.6	33.2	34.9	54	-19.1	Average - H
9272.50	44.5	37.8	5.8	34	54.1	74	-19.9	Peak - H
9272.50	27.7	37.8	5.8	34	37.3	54	-16.7	Average - H

Notes: -16.8 dB Duty cycle correction included in average readings.

**Test Setup Photos**



## Section 9. Test Equipment List

Data taken in September 04

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSE K30	830844/006	03/22/04	03/23/06
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	07/30/04	07/31/06
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	08/26/04	08/26/05
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	08/02/04	08/02/05
1480	Bilog Antenna	Schaffner-Chase CBL6111C	2572	CalNotReq	N/A
1304	HORN ANTE NNA	ELECTRO METRICS RGA-60	6151	09/22/03	09/22/05
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	11/12/04	11/12/05
1481	Microwave Highpass Filter	K & L 3DH1-2000/T8000-0/0	4	Cal B4 Use	N/A

Data taken 11/1/04

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	09/22/03	09/22/05
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	10/27/04	11/12/04*
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	08/26/04	08/26/05
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	08/02/04	08/02/05
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	07/30/04	07/31/06
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	07/23/04	07/23/05
1025	PRE AMP, 25dB	ICC LNA25	399	06/09/04	06/09/05
1983	CABLE	KTL Site A OATS	N/A	03/11/04	03/11/05
760	Antenna biconical	Electro Metrics MFC-25	477	06/22/04	06/22/05

Calibration extended based on confidence testing.

**Nemko Dallas**

FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

*EQUIPMENT: RFID Reader*

TEST REPORT NO.:

4L0576RUS1Rev1

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## **ANNEX A - TEST DETAILS**

**Nemko Dallas**

FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

*EQUIPMENT: RFID Reader*

TEST REPORT NO.:

4L0576RUS1Rev1

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

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

NAME OF TEST: Pseudorandom Hopping Algorithm	PARA. NO.: 15.247(a)(1)
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**Minimum Standard:**

The system shall hop to channel frequencies that are selected from 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.

NAME OF TEST: Time of Occupancy	PARA. NO.: 15.247(a)(1)(ii)
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**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:

$(30 \text{ sec.} / .001 \text{ sec.}) / 75 \text{ chan.} = 400 \times 1 \text{ msec.} = 400 \text{ msec. or } 0.4 \text{ sec. in 30 sec.}$

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(2)
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**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

**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

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 ( $\mu$ 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  $\Delta$ : 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  $\Delta$ : 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

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 ( $\mu$ 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**

#### 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

**Nemko Dallas**

FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

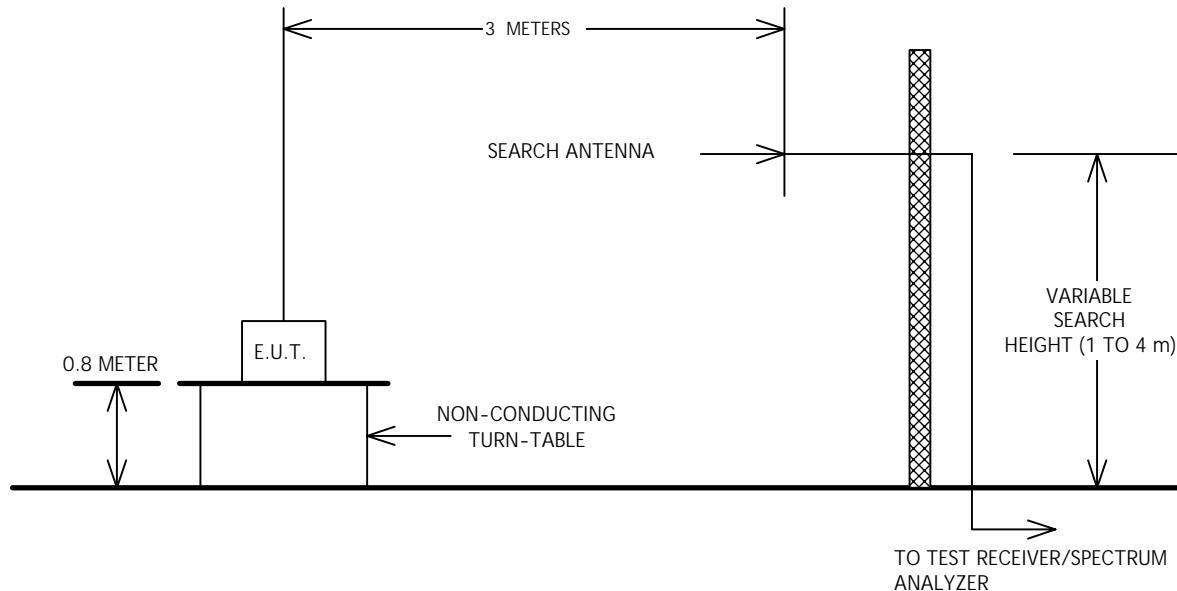
*EQUIPMENT: RFID Reader*

TEST REPORT NO.:

4L0576RUS1Rev1

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**ANNEX B - TEST DIAGRAMS**

**Test Site For Radiated Emissions****Peak Power At Antenna Terminals**