

Nemko Test Report: 3L0064RUS1

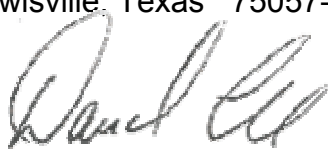
Applicant: Telenexus
1909 N. Glenville Drive, Ste. 200
Richardson, TX 75081

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:

A handwritten signature in black ink, appearing to read "David Light", is positioned above the printed name of the authorized person.

David Light, Resource Manager

Date: 9/30/03

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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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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)	≤ 0.4 sec in 30 sec	Complies
20 dB Occupied Bandwidth	15.247(a)(1)	≤ 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.

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

General Equipment Information

Frequency Band: 902.75 to 927.25 MHz

Number of Channels: 50

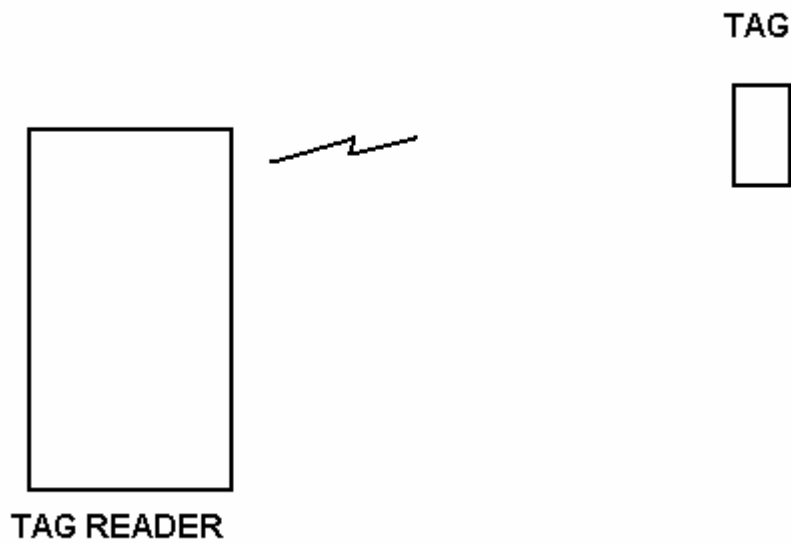
Channel Spacing: 500 kHz

User Frequency Adjustment: Software controlled

Description of EUT

The device is a handheld RFID tag reader.

System Diagram



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: _____

Test Data – Powerline Conducted Emissions



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Dallas Headquarters:

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Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Conducted Emissions

Powerline Voltage Measurement

Complete X
Preliminary

Job # : 3L0064E

Test # : CEPV-01

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of 1

Client Name : Telenexus, Inc.

EUT Name : 915 MHz Hand-held RFID Reader

EUT Model # : LRP915HR-CLD

EUT Part # : None

EUT Serial # : None

EUT Config. :	Charging
---------------	----------

Specification : CFR 47, FCC Pt. 15, Subpart B, Class A

Reference : CISPR 22:1997 Class A

Transducer # : 545

Temp. (deg. C) : 24

Date : 9/29/2003

HP Filter # : 968

Humidity (%): 31

Time : 9:30

Cable 1 #: 1547

EUT Voltage : 120

Staff : Eldon Berry

Cable 2 # : 1129

EUT Frequency : 60 Hz

Location : Lab 5

Detector 1 # : 716

Peak Bandwidth: 10kHz

Photo ID: 3L0064E CEPV-01

Detector 2 # : _____

QP Bandwidth 10kHz

Limiter # : NA

Avg. Bandwidth	10kHz
----------------	-------

[illegible]

..\EMCShare\AUTOMATE\DATASHTS\CEP Voltage Rev C.xls Document Control #EMC DS EM COND VOLT

Test Setup Photos – Powerline Conducted Emissions



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: $\pm 1.7\text{dB}$
 $1 \times 10^{-7} \text{ ppm}$

Test Data – Channel Separation



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Data Plot

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Channel Separation

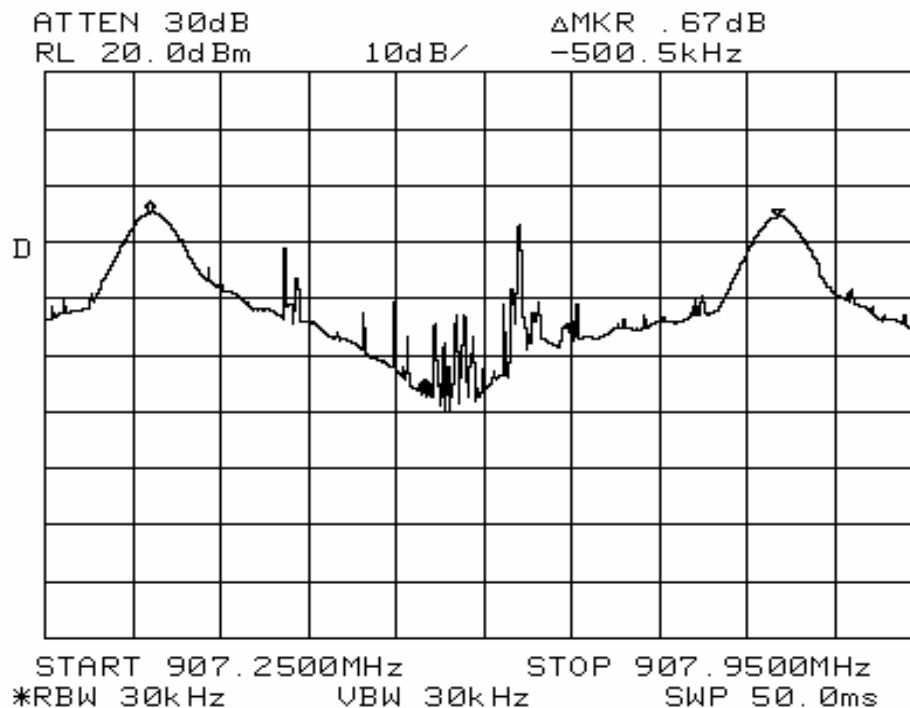
Job No.: 3L0064 Date: 3/26/2003
Specification: 15.247 Temperature(°C): 20
Tested By: David Light Relative Humidity(%): 40
E.U.T.: RFID READER
Configuration: TX
Sample Number: 1
Location: Lab 1 RBW: 30 kHz
Detector Type: Peak VBW: 30 kHz

Complete X
Preliminary: _____

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 SEPERATION = 500 kHz

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

Test Plots – Time of Occupancy



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Data Plot

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Time of Occupancy

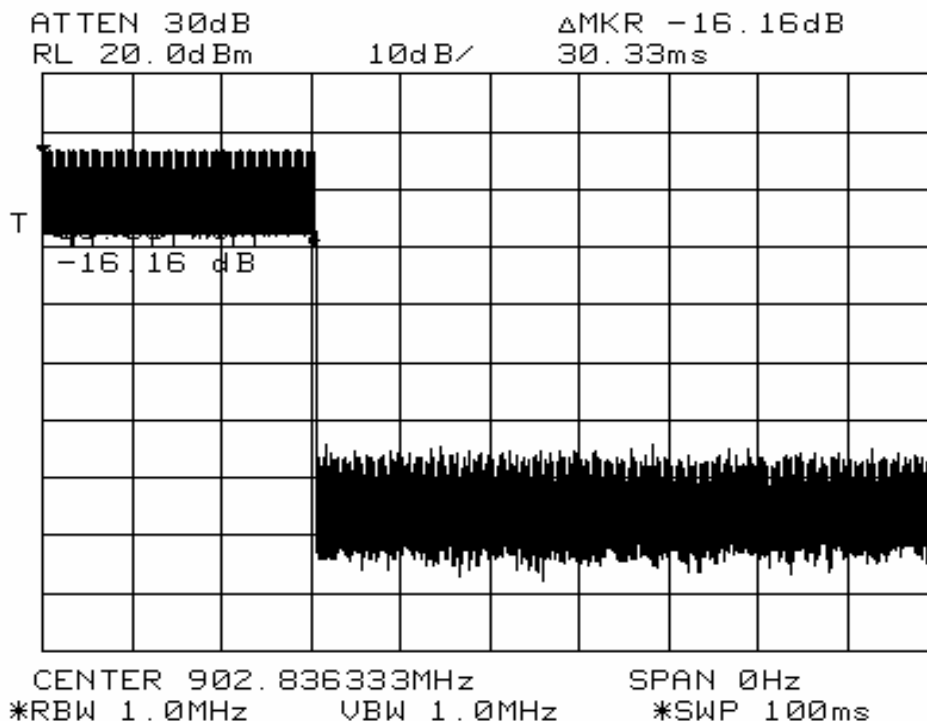
Job No.: 3L0064 Date: 3/26/2003
Specification: 15.247 Temperature(°C): 20
Tested By: David Light Relative Humidity(%): 40
E.U.T.: RFID READER
Configuration: TX
Sample Number: 1
Location: Lab 1 RBW: Refer to plots
Detector Type: Peak VBW: Refer to plots

Complete X
Preliminary: _____

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

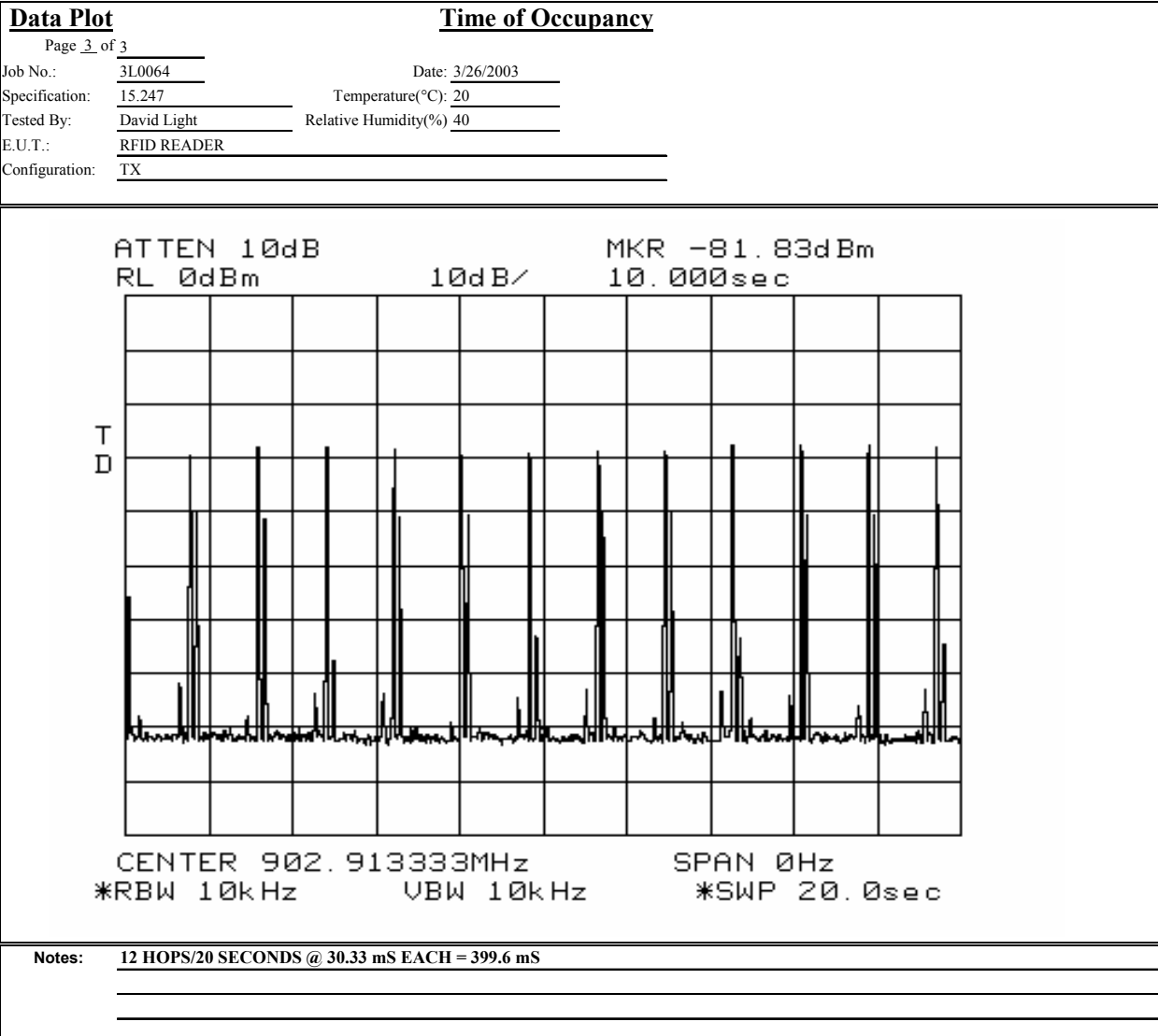
Test Plots – Time of Occupancy



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Test Results: Complies.

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

Test Data – 20 dB Bandwidth

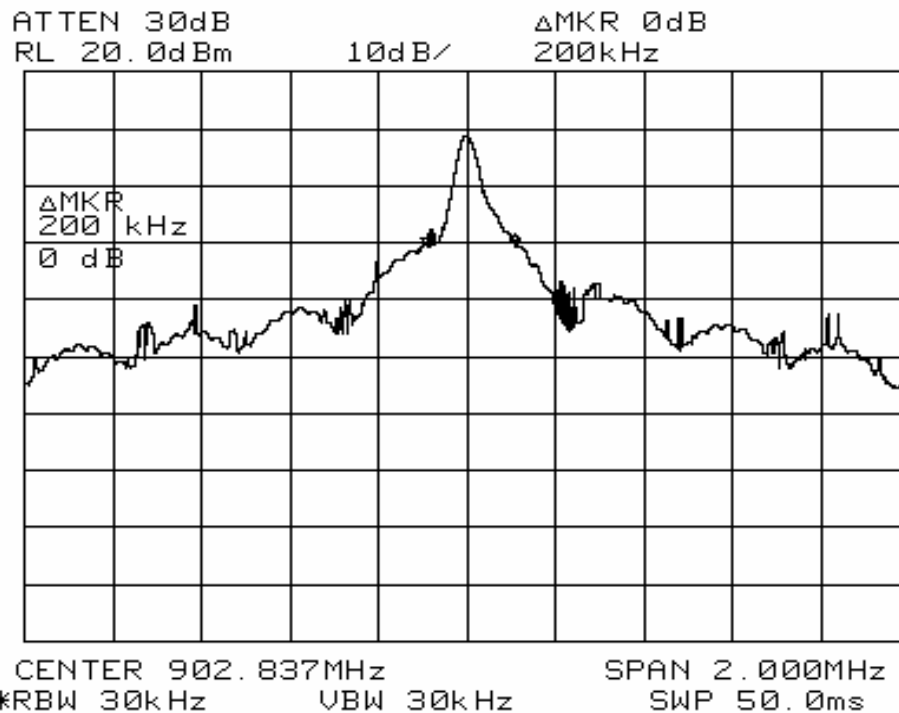


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Data Plot		Occupied Bandwidth			
Page <u>1</u> of <u>3</u>				Complete <u>X</u>	
Job No.:	310064	Date:	3/26/2003	Preliminary:	
Specification:	15.247	Temperature(°C):	20		
Tested By:	David Light	Relative Humidity(%)	40		
E.U.T.:	RFID READER				
Configuration:	TX				
Sample Number:	1				
Location:	Lab 2	RBW:	30 kHz	Measurement	
Detector Type:	Peak	VBW:	30 kHz	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: Lowest channel

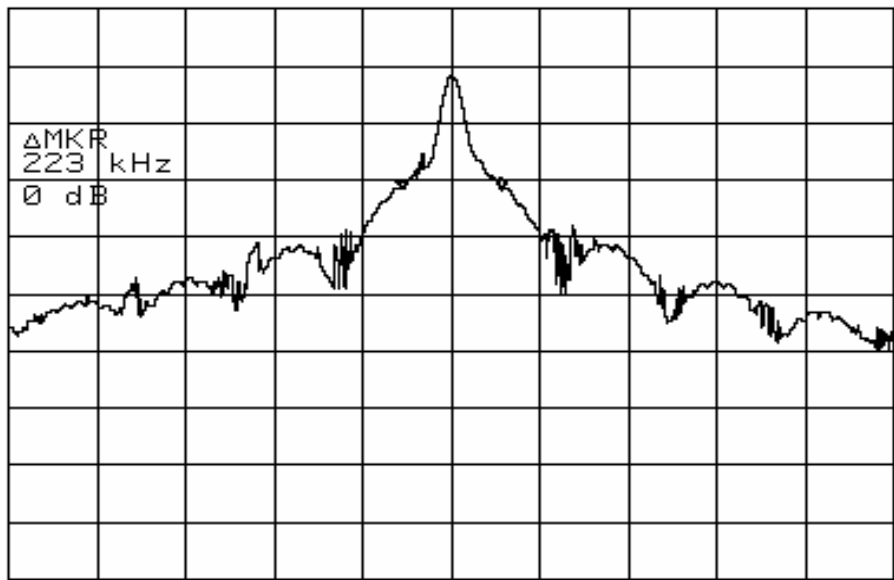
Test Data – 20 dB Bandwidth



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<u>Data Plot</u>	<u>Occupied Bandwidth</u>
Page 2 of 3 Job No.: 310064 Specification: 15.2 Tested By: David Light E.U.T.: RFID READER Configuration: TX	Date: 3/26/2003 Temperature(°C): 20 Relative Humidity(%) 40
<div style="display: flex; justify-content: space-between;"> ATTEN 30dB ΔMKR 0dB </div> <div style="display: flex; justify-content: space-between;"> RL 20.0dBm 10dB/ 223kHz </div>  <div style="display: flex; justify-content: space-between; margin-top: 10px;"> CENTER 914.833MHz SPAN 2.000MHz </div> <div style="display: flex; justify-content: space-between;"> *RBW 30kHz VBW 30kHz SWP 50.0ms </div>	
Notes: <u>Mid Channel</u>	

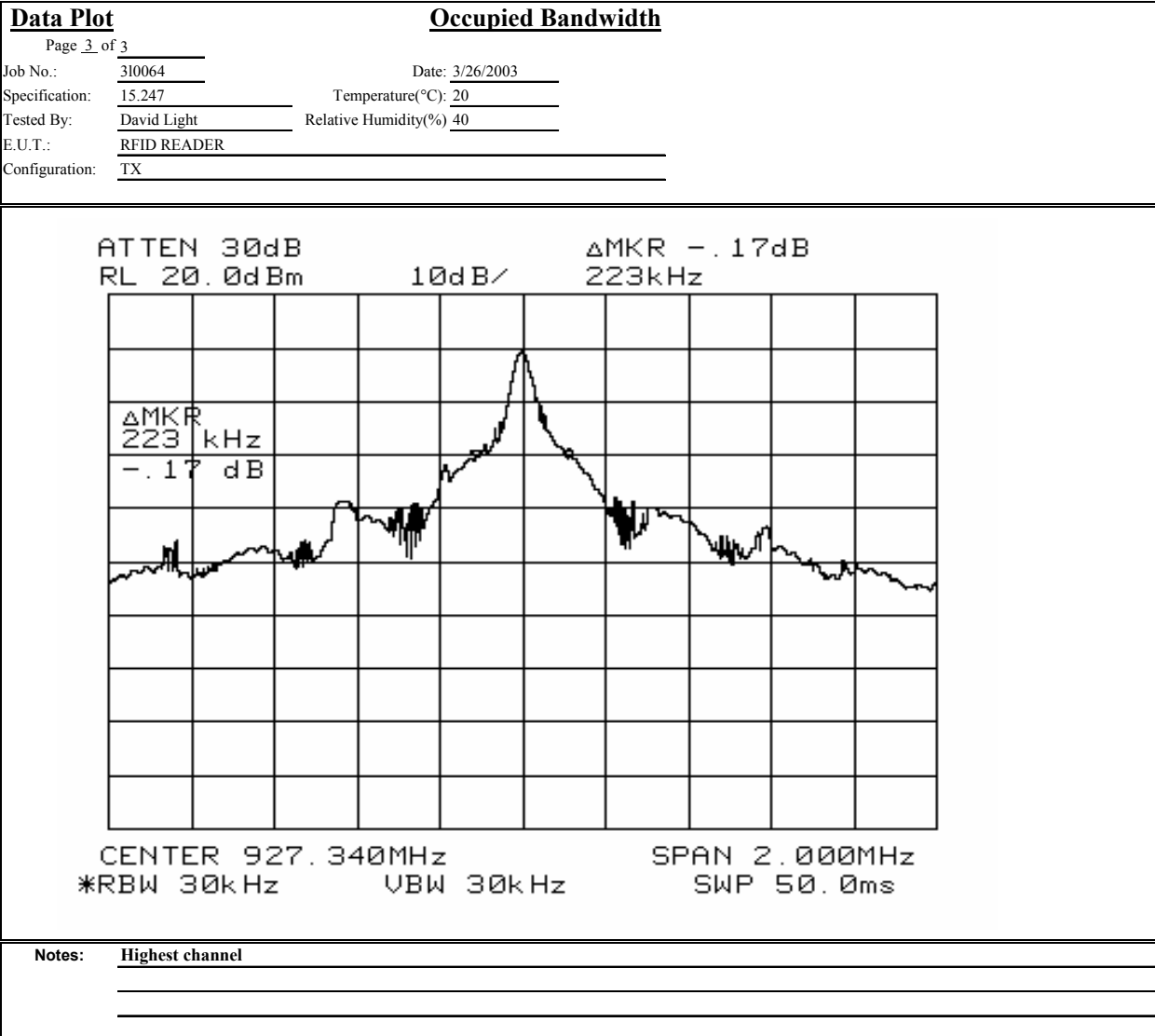
Test Data – 20 dB Bandwidth



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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

Test Plot – Number of Hopping Frequencies



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<u>Data Plot</u>	<u>Time of Occupancy</u>
Page 2 of 3	
Job No.: 3L0064	Date: 3/26/2003
Specification: 15.2	Temperature(°C): 20
Tested By: David Light	Relative Humidity(%) 40
E.U.T.: RFID READER	
Configuration: TX	

ATTEN 30dB
RL 20.0dBm 10dB/

START 902.00MHz STOP 928.00MHz
*RBW 100kHz VBW 100kHz *SWP 100ms

Notes:	50 Hopping Channels

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

Test Data – Peak Power Output (E.I.R.P.)



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EIRP Substitution Method

Page 1 of 1
 Job No.: 3L0064 Date: 9/30/03 Complete X
 Specification: 15.247 Temperature(°C): 24 Preliminary _____
 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: _____

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) = $20 \log (rf_{ON} \text{ in ms}/100\text{ms})$

Measurement Uncertainty: +/- 1.7 dB

EQUIPMENT: LRP915HR-CLD

REPORT NO.: 3L0064RUS1

Job No.:	3L0064	Date:	9/30/2003																																																																																																																																																																																																																																																																																																																																
Specification:	15.247	Temperature(°C):	25																																																																																																																																																																																																																																																																																																																																
Tested By:	ED MCGRATH	Relative Humidity(%)	45																																																																																																																																																																																																																																																																																																																																
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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																																																																																																																																																																																																																																																																																																																																		
<table border="1"> <thead> <tr> <th>Frequency (GHz)</th> <th>Meter Reading (dBuV)</th> <th>Antenna Factor (dB)</th> <th>Cable Loss (dB)</th> <th>Pre-Amp Gain (dB)</th> <th>Corrected Reading (dBuV/m)</th> <th>Limit (dBuV/m)</th> <th>Delta (dB)</th> <th>Comment</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Tx @ 902.75 MHz</td> </tr> <tr> <td>2708.25</td> <td>54.3</td> <td>29.0</td> <td>3.6</td> <td>32.5</td> <td>54.4</td> <td>74</td> <td>-19.6</td> <td>Vertical Peak</td> </tr> <tr> <td>2708.25</td> <td>44.67</td> <td>29.0</td> <td>3.6</td> <td>32.5</td> <td>44.8</td> <td>54</td> <td>-9.2</td> <td>Vertical Average</td> </tr> <tr> <td>3611.00</td> <td>50.3</td> <td>30.6</td> <td>3.6</td> <td>31.8</td> <td>52.7</td> <td>54</td> <td>-1.3</td> <td>Vertical Peak</td> </tr> <tr> <td>4513.75</td> <td>51.2</td> <td>32.2</td> <td>4.1</td> <td>31</td> <td>56.5</td> <td>74</td> <td>-17.5</td> <td>Vertical Peak</td> </tr> <tr> <td>4513.75</td> <td>41.57</td> <td>32.2</td> <td>4.1</td> <td>31</td> <td>46.9</td> <td>54</td> <td>-7.1</td> <td>Vertical Average</td> </tr> <tr> <td>5416.50</td> <td>49.8</td> <td>33.6</td> <td>4.7</td> <td>28.6</td> <td>59.5</td> <td>74</td> <td>-14.5</td> <td>Vertical Peak</td> </tr> <tr> <td>5416.50</td> <td>40.17</td> <td>33.6</td> <td>4.7</td> <td>28.6</td> <td>49.9</td> <td>54</td> <td>-4.1</td> <td>Vertical Average</td> </tr> <tr> <td>6319.25</td> <td>49.5</td> <td>34.7</td> <td>5.2</td> <td>31.6</td> <td>57.8</td> <td>74</td> <td>-16.2</td> <td>Vertical Peak</td> </tr> <tr> <td>6319.25</td> <td>39.87</td> <td>34.7</td> <td>5.2</td> <td>31.6</td> <td>48.2</td> <td>54</td> <td>-5.8</td> <td>Vertical Average</td> </tr> <tr> <td>7222.00</td> <td>44.7</td> <td>36.0</td> <td>5.1</td> <td>33.9</td> <td>51.9</td> <td>54</td> <td>-2.1</td> <td>Vertical Peak</td> </tr> <tr> <td>8124.75</td> <td>43.3</td> <td>36.8</td> <td>5.7</td> <td>33</td> <td>52.8</td> <td>54</td> <td>-1.2</td> <td>Vertical Peak</td> </tr> <tr> <td>9027.50</td> <td>47</td> <td>37.8</td> <td>5.5</td> <td>33.3</td> <td>57.0</td> <td>74</td> <td>-17.0</td> <td>Vertical Peak</td> </tr> <tr> <td>9027.50</td> <td>37.37</td> <td>37.8</td> <td>5.5</td> <td>33.3</td> <td>47.4</td> <td>54</td> <td>-6.6</td> <td>Vertical Average</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>2705.558</td> <td>56.8</td> <td>29.0</td> <td>3.6</td> <td>32.5</td> <td>56.9</td> <td>74</td> <td>-17.1</td> <td>Horizontal Peak</td> </tr> <tr> <td>2705.558</td> <td>47.17</td> <td>29.0</td> <td>3.6</td> <td>32.5</td> <td>47.3</td> <td>54</td> <td>-6.7</td> <td>Horizontal Average</td> </tr> <tr> <td>3613.486</td> <td>51</td> <td>30.6</td> <td>3.6</td> <td>31.8</td> <td>53.4</td> <td>74</td> <td>-20.6</td> <td>Horizontal Peak</td> </tr> <tr> <td>3613.486</td> <td>41.37</td> <td>30.6</td> <td>3.6</td> <td>31.8</td> <td>43.8</td> <td>54</td> <td>-10.2</td> <td>Horizontal Average</td> </tr> <tr> <td>4511.8</td> <td>52.5</td> <td>32.2</td> <td>4.1</td> <td>31.0</td> <td>57.8</td> <td>74</td> <td>-16.2</td> <td>Horizontal Peak</td> </tr> <tr> <td>4511.8</td> <td>42.9</td> <td>32.2</td> <td>4.1</td> <td>31.0</td> <td>48.2</td> <td>54</td> <td>-5.8</td> <td>Horizontal Average</td> </tr> <tr> <td>5410.115</td> <td>48.7</td> <td>33.6</td> <td>4.7</td> <td>28.6</td> <td>58.4</td> <td>74</td> <td>-15.6</td> <td>Horizontal Peak</td> </tr> <tr> <td>5410.115</td> <td>39.1</td> <td>33.6</td> <td>4.7</td> <td>28.6</td> <td>48.8</td> <td>54</td> <td>-5.2</td> <td>Horizontal Average</td> </tr> <tr> <td>6309.0790</td> <td>48.3</td> <td>34.7</td> <td>5.2</td> <td>31.6</td> <td>56.6</td> <td>74</td> <td>-17.4</td> <td>Horizontal Peak</td> </tr> <tr> <td>6309.0790</td> <td>38.7</td> <td>34.7</td> <td>5.2</td> <td>31.6</td> <td>47.0</td> <td>54</td> <td>-7.0</td> <td>Horizontal Average</td> </tr> <tr> <td>7220.8670</td> <td>45.3</td> <td>36.0</td> <td>5.1</td> <td>33.9</td> <td>52.5</td> <td>54</td> <td>-1.5</td> <td>Horizontal Peak</td> </tr> <tr> <td>8118.068</td> <td>51.2</td> <td>36.8</td> <td>5.7</td> <td>33.0</td> <td>60.7</td> <td>74</td> <td>-13.3</td> <td>Horizontal Peak</td> </tr> <tr> <td>8118.068</td> <td>41.6</td> <td>36.8</td> <td>5.7</td> <td>33.0</td> <td>51.1</td> <td>54</td> <td>-2.9</td> <td>Horizontal Average</td> </tr> <tr> <td>9022.5630</td> <td>52.7</td> <td>37.8</td> <td>5.5</td> <td>33.3</td> <td>62.7</td> <td>74</td> <td>-11.3</td> <td>Horizontal Peak</td> </tr> <tr> <td>9022.5630</td> <td>43.1</td> <td>37.8</td> <td>5.5</td> <td>33.3</td> <td>53.1</td> <td>54</td> <td>-0.9</td> <td>Horizontal Average</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="9"> Notes: 9.6 dB correction was used for Average readings If Peak reading met the Average limit, then an Average reading was not made. </td> </tr> </tbody> </table>									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.								
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																																																																																																																																																																																																																																																																																																																											
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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																																																																																																																																																																																																																																																																																																																											
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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																																																																																																																																																																																																																																																																																																																											
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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																																																																																																																																																																																																																																																																																																																											
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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
								Tx @ 902.75 MHz
								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

Radiated Photographs (Worst Case Configuration)

FRONT VIEW



REAR VIEW



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

ANNEX A - TEST DETAILS

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
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Minimum Standard:
line on any

The R.F. that is conducted back onto the AC power

frequency within the band 0.45 to 30 MHz shall not exceed
250 μ V
(48 dB μ V) across 50 ohms.

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.

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

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 sec./1.001 sec.)/75 chan. = 400 x 1 msec. = 400 msec. or 0.4 sec. in 30 sec.

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

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 ($\mu\text{V/m}$ @ 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:**

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

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 ($\mu\text{V/m}$ @ 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

15.205 Restricted Bands

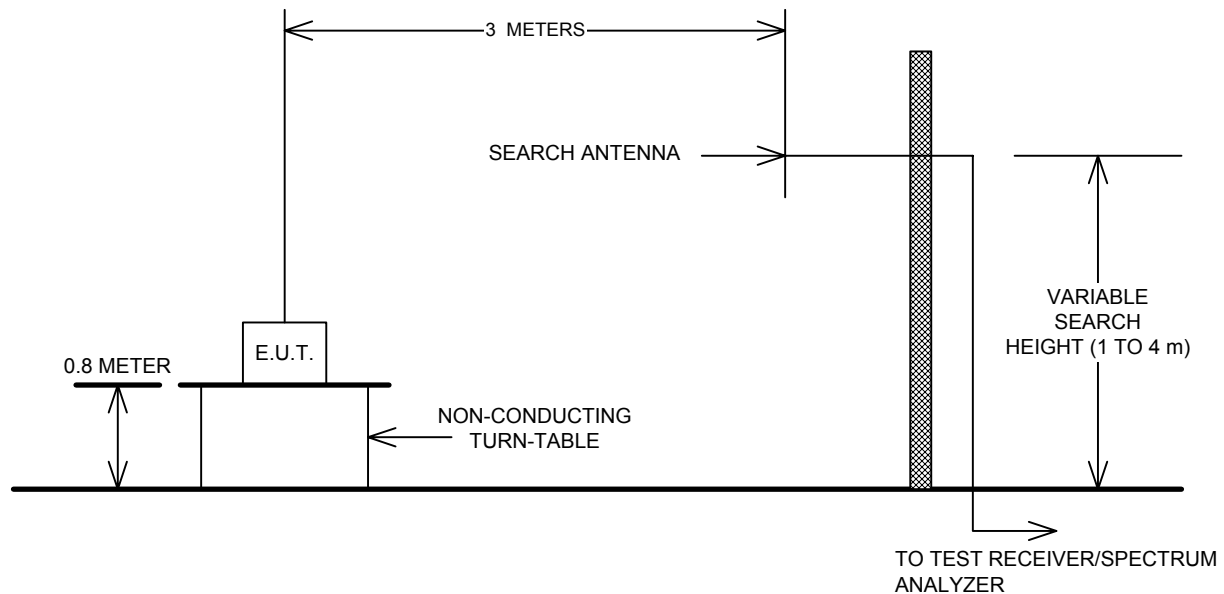
MHz	MHz	MHz	GHz
0.09-0.11	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.125-6.218	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:

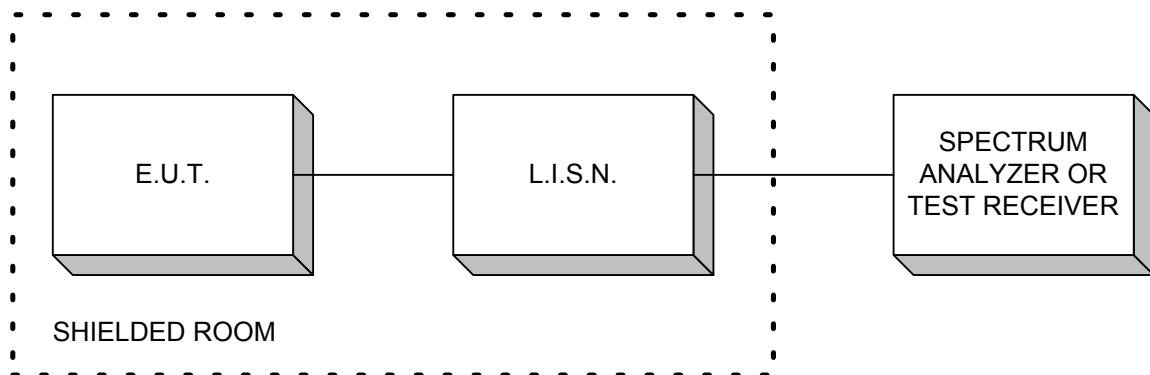
Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

ANNEX B - TEST DIAGRAMS

Test Site For Radiated Emissions



Conducted Emissions



Peak Power At Antenna Terminals

