

**Nemko Test Report:** 1L0526RUS1Rev1

**Applicant:** Andrew Corp.  
1500 N. Roosevelt  
Burlington, Iowa 52601

**Equipment Under Test:  
(E.U.T.)** Amplifier/Antenna  
Models: QD-24-0010 (50 Ohm input)  
and QD-24-0040 (75 Ohm input) with Lucent Radio  
LAN card model PC24E-H-FC (FCC ID.  
IMRWLPCE24H)

**FCC ID:** P3824GCA

**In Accordance With:** **FCC Part 15, Subpart C, 15.247**  
Direct Sequence Spread Spectrum Transmitters

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

**Authorized By:**



Tom Tidwell, RF Group Manager

**Date:** 5/18/02

**Total Number of Pages:** 44

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*EQUIPMENT:* QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC PROJECT NO.: 1L0526RUS1Rev1

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**Section 1. Summary of Test Results**

Manufacturer: Andrew Corporation

Model No.: QD-24-0010 (50 Ohm input) and QD-24-0040 (75 Ohm input) with Lucent  
Radio LAN card model PC24E-H-FC (FCC ID. IMRWLPCE24H)

Serial No.: S01

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 Direct Sequence 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.

- |                                     |                            |                                     |                     |
|-------------------------------------|----------------------------|-------------------------------------|---------------------|
| <input checked="" type="checkbox"/> | New Submission             | <input checked="" type="checkbox"/> | Production Unit     |
| <input type="checkbox"/>            | Class II Permissive Change | <input type="checkbox"/>            | 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.

See " Summary of Test Data".



**NVLAP LAB CODE: 100426-0**

TESTED BY:  Lance Walker  DATE:  11/29/01

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QD-24-0010 and QD-24-0040 with  
*EQUIPMENT:* Lucent radio model PC24E-H-FC PROJECT NO.: 1L0526RUS1Rev1

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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	Complies
Minimum 6 dB Bandwidth	15.247(a)(2)	>500 kHz	Complies
Maximum Peak Power Output	15.247(b)(1)	460.6 mW	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	-20 dBc/100kHz	Complies
Spurious Emissions (Restricted Bands)	15.247(c)	< 74 dBuV/m Peak < 54 dBuV/m Avg	Complies
Peak Power Spectral Density	15.247(d)	+8 dBm/3kHz	Complies
Processing Gain	15.247(e)	10 dB	N/A

### Footnotes:

460.6 mW is the Max Peak Power Output limit due to the system being a point to point system. The gain of the integral antenna is 16.1 dBi. In accordance with 15.247(b)(i), the peak power output to the antenna must be reduced by 1 dB for every 3 dB that the antenna gain exceeds 6 dBi for a point-to-point system.

The antenna exceeds 6 dBi by 10 dB, therefore the power output must be reduced by 4 dB below the 1 watt limit. The limit for the power fed to the antenna is thus 30 dBm - 4 dB = 26 dBm (398 mW).

Processing gain is determined by the associated radio card.

*EQUIPMENT:* QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC PROJECT NO.: 1L0526RUS1Rev1

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

### General Equipment Information

**Frequency Band:**

- 902 – 928 MHz
- 2400 – 2483.5 MHz
- 5725 – 5850 MHz

**Tuning Range:**

2412 - 2462 MHz (Channel 1 - 11)

**Channel Spacing:**

5 MHz

**User Frequency Adjustment:**

Software controlled

**Nemko Dallas**

FCC PART 15, SUBPART C  
DSSS TRANSMITTER

QD-24-0010 and QD-24-0040 with  
*EQUIPMENT:* Lucent radio model PC24E-H-FC      PROJECT NO.: 1L0526RUS1Rev1

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**Description of Modification for Modification Filing**

Not Applicable

QD-24-0010 and QD-24-0040 with

*EQUIPMENT:* Lucent radio model PC24E-H-FC PROJECT NO.: 1L0526RUS1Rev1

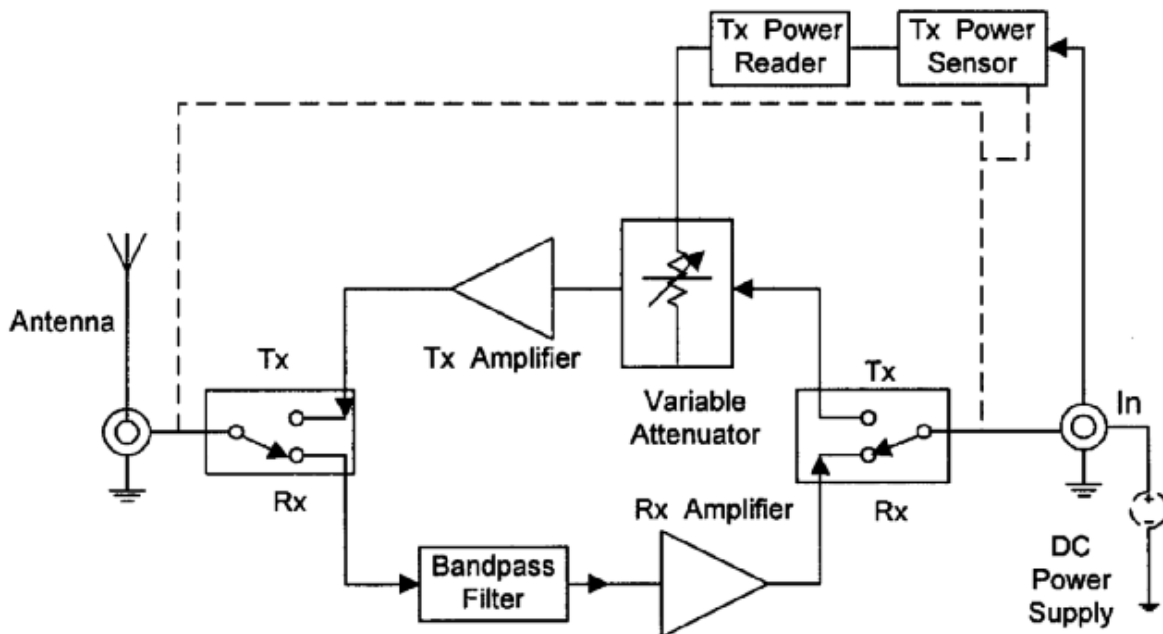
### Theory of Operation

The EUT is an integrated antenna/amplifier to be marketed, sold, and delivered with the Lucent radio LAN card model PC24E-H-FC (FCC ID. IMRWLPCE24H) for point-to-point transmission. The system is installed by qualified personnel and is distributed only through select distributors. The system is not available directly to the general public.

The transmitted signal from the wireless LAN card is fed to the integrated antenna via coaxial cable. The gain of the amplifier is automatically adjusted to maintain a constant output to the antenna of 420 mW (26.2 dBm). The EUT cannot operate with a radio LAN that does not use TDD (Time Division Duplex).

The EUT is offered with either 75 ohm input or 50 ohm input.

### System Diagram



*EQUIPMENT:* QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC      PROJECT NO.: 1L0526RUS1Rev1

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**Section 3.            Powerline Conducted Emissions**

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY: Lance Walker	DATE: 11/13/2001

**Test Results:**                      Complies.

**Measurement Uncertainty:** +/- 1.7 dB



**EQUIPMENT:** QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC

**PROJECT NO.:** 1L0526RUS1Rev1

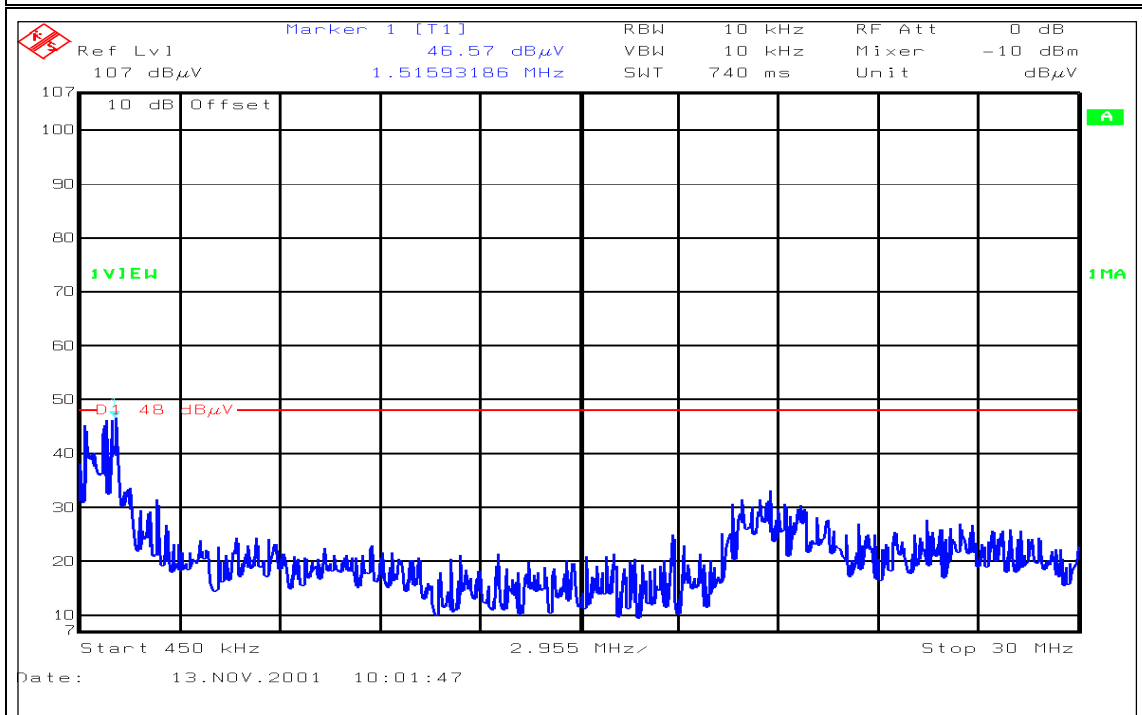
**Test Data – Powerline Conducted Emissions**



**Dallas Headquarters:**  
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Fax: (972) 436-2667

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Data Plot		Powerline Conducted			
Page 1 of 2				Complete	<u>X</u>
Job No.:	1L0526R	Date:	11/13/2001	Preliminary:	<u>        </u>
Specification:	FCC15247	Temperature(°C):	22		
Tested By:	Lance Walker	Relative Humidity(%)	50		
E.U.T.:	<u>Amp/Antenna</u>				
Configuration:	<u>Normal</u>				
Sample Number:	<u>S01</u>				
Location:			RBW: Refer to plots	Measurement	
Detector Type:			VBW: Refer to plots	Distance: <u>N/A</u> m	
<b>Test Equipment Used</b>					
Antenna:			Directional Coupler:		
Pre-Amp:			Cable #1:	<u>1534</u>	
Filter:			Cable #2:	<u>1553</u>	
Receiver:	<u>1036</u>		Cable #3:		
Attenuator #1			LISN:	<u>545</u>	
Attenuator #2:			Mixer:		
Additional equipment used:	<u>798</u>				
Measurement Uncertainty:	<u>+/-1.7 dB</u>				



**Notes:** Neutral line, measurement taken with a peak detector and limit line displaying quasipeak limit.

**EQUIPMENT:** QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC

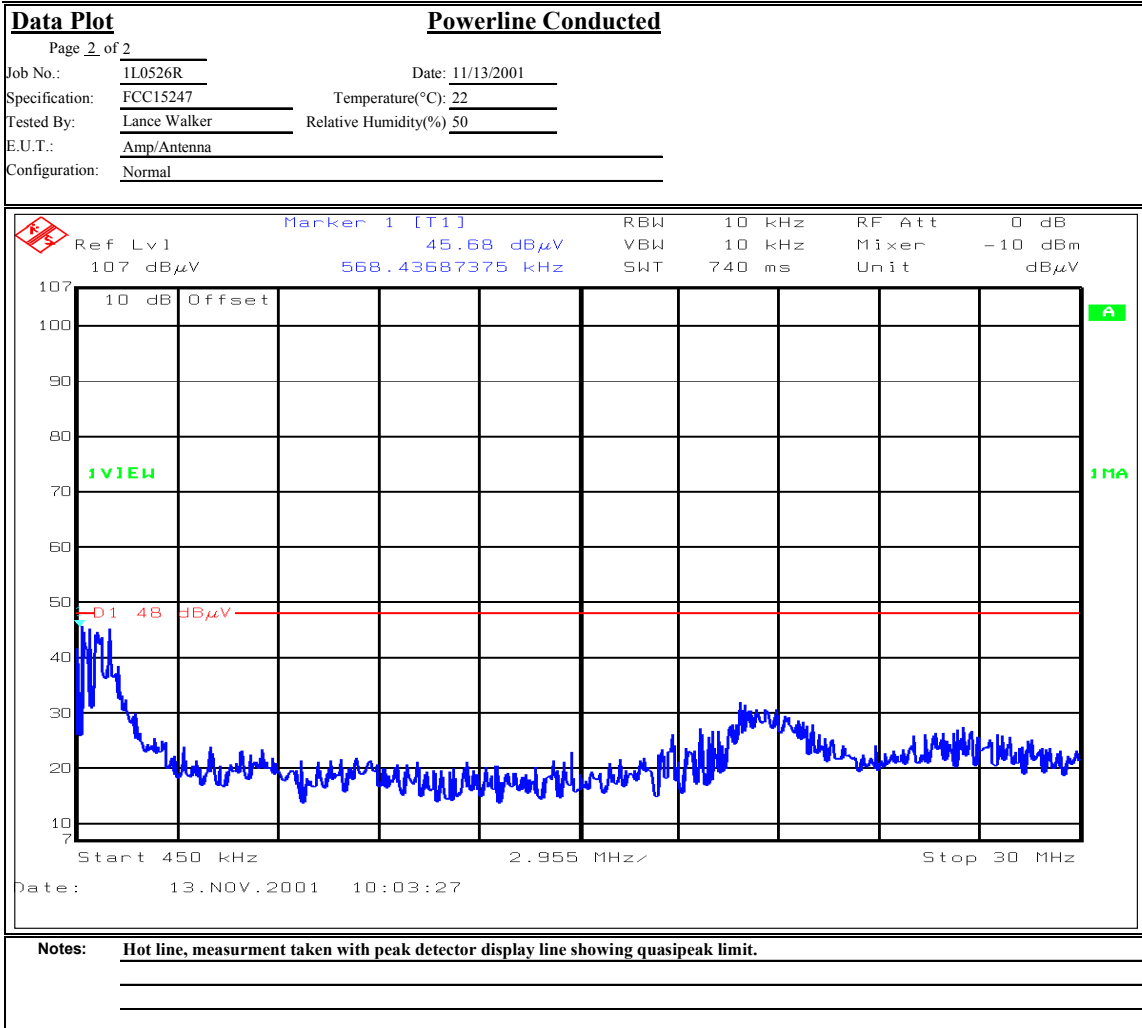
**PROJECT NO.:** 1L0526RUS1Rev1

**Test Data – Powerline Conducted Emissions**



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*EQUIPMENT:* QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC

PROJECT NO.: 1L0526RUS1Rev1

**Photos – Powerline Conducted Emissions**

Front



Side



*EQUIPMENT:* QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC      PROJECT NO.: 1L0526RUS1Rev1

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**Section 4.            Minimum 6 dB Bandwidth**

NAME OF TEST: Minimum 6 dB Bandwidth	PARA. NO.: 15.247(a)(2)
TESTED BY: Lance Walker	DATE: 10/29/2001

**Test Results:**                    Complies.

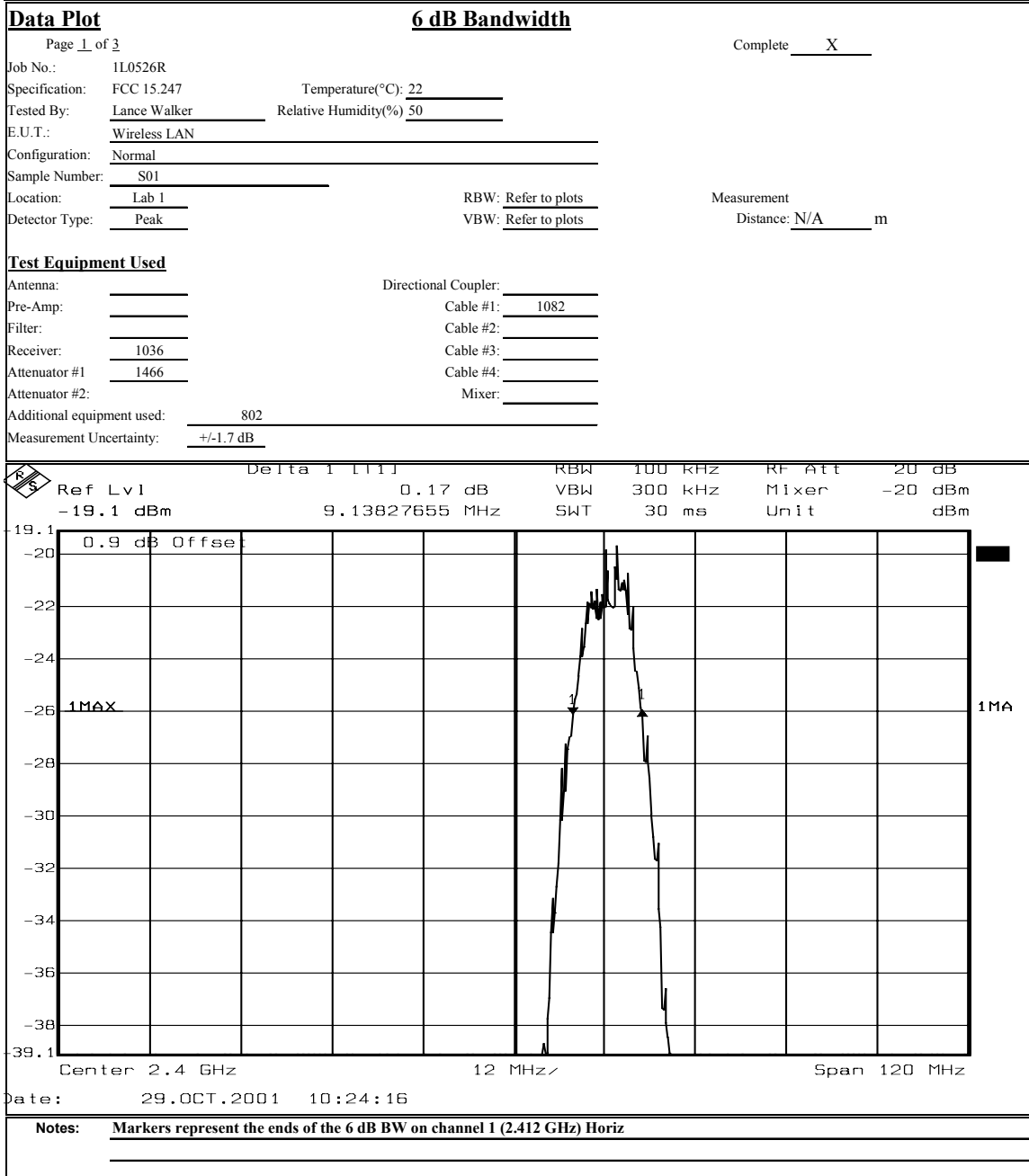
**EQUIPMENT:** QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC

**PROJECT NO.:** 1L0526RUS1Rev1



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**EQUIPMENT:** QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC

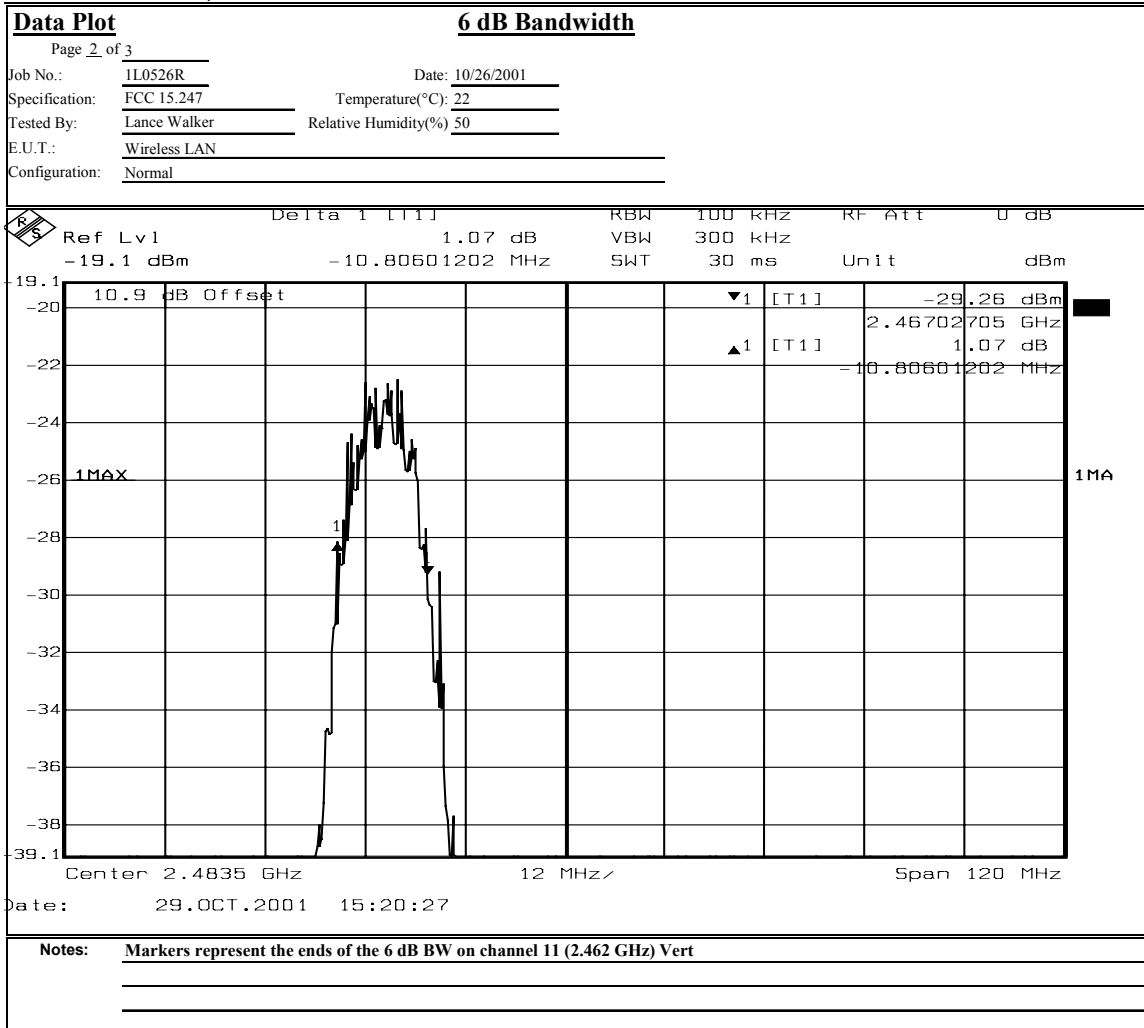
**PROJECT NO.:** 1L0526RUS1Rev1



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*EQUIPMENT:* QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC

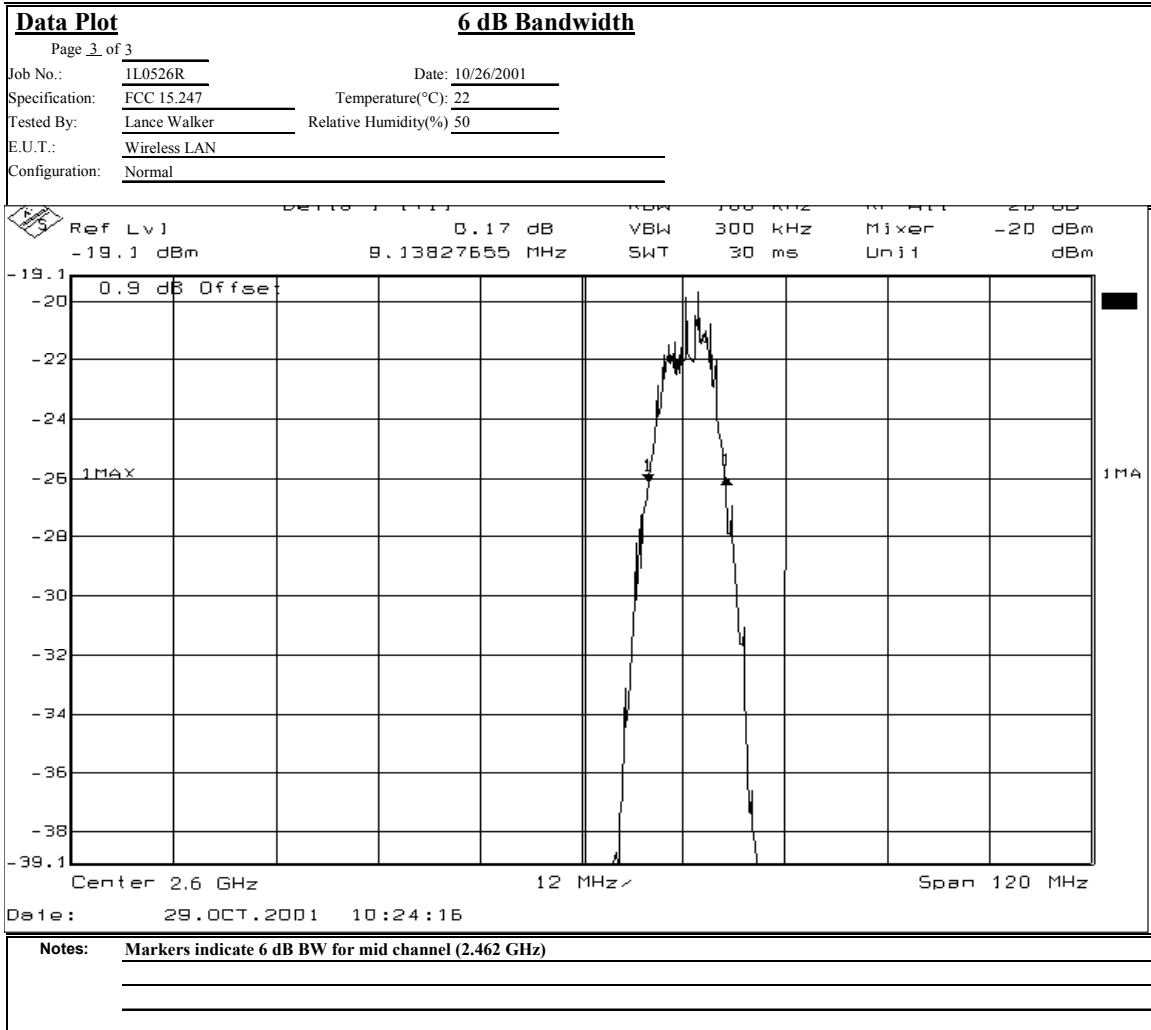
PROJECT NO.: 1L0526RUS1Rev1



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*EQUIPMENT:* QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC PROJECT NO.: 1L0526RUS1Rev1

**Section 5. Maximum Peak Output Power**

NAME OF TEST: Maximum Peak Output power	PARA. NO.: 15.247(b)(1)
TESTED BY: Lance Walker	DATE: 11/09/2001

**Test Results:** Complies.

Channel	Measurement (mW)	Converted measurement (dBm)	Limit (dBm)
1	400	26.0	26
6	385	25.9	26
11	361	25.6	26
<b>Peak power output at antenna port(dBm) 26.0 dBm</b>			

Antenna gain is 16.1 dBi so total output would be 42.1 dBm at the highest level.

Since the EUT is for point-to-point operation only, the rf output power must be reduced 1 dB for every 3 dB that the antenna exceeds 6 dBi. Therefore, the maximum rf output at the antenna port must be reduced below the 1 watt (+30 dBm) limit by:

$$(16 \text{ dBi} - 6 \text{ dBi})/3 = 4 \text{ (rounded up)}$$

The maximum allowable rf input to the antenna is therefore,

$$+30 \text{ dBm} - 4 \text{ dB} = 26 \text{ dBm (398 mW)}$$

**Measurements were made at the input of the antenna elements using a peak power meter.**



QD-24-0010 and QD-24-0040 with  
*EQUIPMENT:* Lucent radio model PC24E-H-FC PROJECT NO.: 1L0526RUS1Rev1

**Section 6. RF Exposure**

NAME OF TEST: RF Exposure	PARA. NO.: 15.247(b)(4)
TESTED BY: Lance Walker	DATE: 11/09/2001

**Test Results:** Complies.

**Prediction of MPE limit at a given distance**

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density  
P = power input to the antenna  
G = power gain of the antenna in the direction of interest relative to an isotropic radiator  
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal: 26.00 (dBm)  
 Maximum peak output power at antenna input terminal: 398.1072 (mW)  
 Antenna gain(typical): 16.1 (dBi)  
 Maximum antenna gain: 40.73803 (numeric)  
 Prediction distance: 200 (cm)  
 Prediction frequency: 2400 (MHz)  
 MPE limit for uncontrolled exposure at prediction frequency: 1 (mW/cm<sup>2</sup>)  
 Power density at prediction frequency: **0.032265** (mW/cm<sup>2</sup>)  
 Maximum allowable antenna gain: **31.0127** (dBi)

Notes: Minimum separation of 2 m between the user and the radiating element

*EQUIPMENT:* QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC      PROJECT NO.: 1L0526RUS1Rev1

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

NAME OF TEST: Spurious Emissions (conducted)	PARA. NO.: 15.247(c)
TESTED BY:	DATE:

**Test Results:**                      Complies.

**Measurement Data:**      See attached plots.

**EQUIPMENT:** QD-24-0010 and QD-24-0040 with Lucent radio model PC24E-H-FC **PROJECT NO.:** 1L0526RUS1Rev1

**Data Plot**

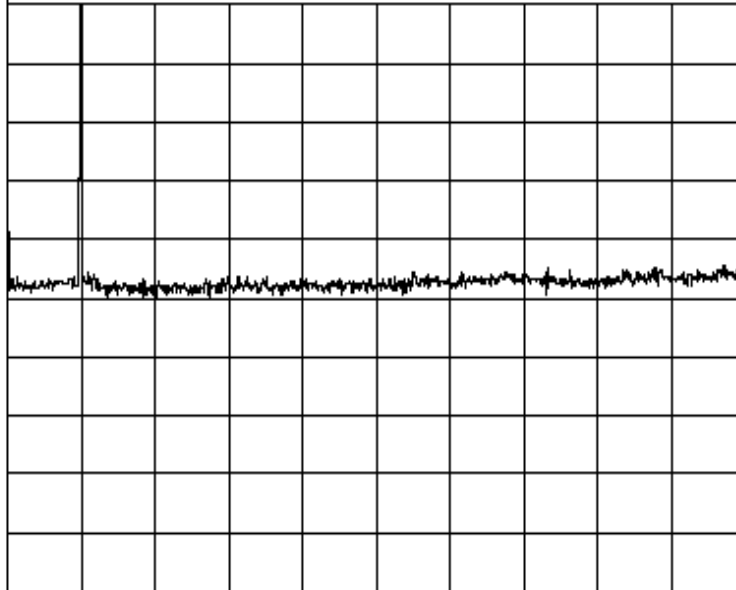
**ACSE**

Page 1 of 3  
 Job No.: 1L0526R Date: 10/29/2001 Complete X  
 Specification: FCC15247 Temperature(°C): 22 Preliminary: \_\_\_\_\_  
 Tested By: Lance Walker Relative Humidity(%): 50  
 E.U.T.: Wireless LAN  
 Configuration: Normal  
 Sample Number: S01  
 Location: Lab 1 RBW: Refer to plots Measurement  
 Detector Type: Peak VBW: Refer to plots Distance: N/A m

**Test Equipment Used**

Antenna: \_\_\_\_\_ Directional Coupler: \_\_\_\_\_  
 Pre-Amp: \_\_\_\_\_ Cable #1: 1082  
 Filter: \_\_\_\_\_ Cable #2: \_\_\_\_\_  
 Receiver: 1036 Cable #3: \_\_\_\_\_  
 Attenuator #1: \_\_\_\_\_ Cable #4: \_\_\_\_\_  
 Attenuator #2: \_\_\_\_\_ Mixer: \_\_\_\_\_  
 Additional equipment used: 0802  
 Measurement Uncertainty: +/-1.7 dB

ATTEN 10dB  
RL -25.0dBm 10dB/



Lower Channel (2.412 GHz)

START 0Hz STOP 24.00GHz  
\*RBW 100kHz VBW 100kHz SWP 6.00sec

**Notes:** 10 dB external attenuation

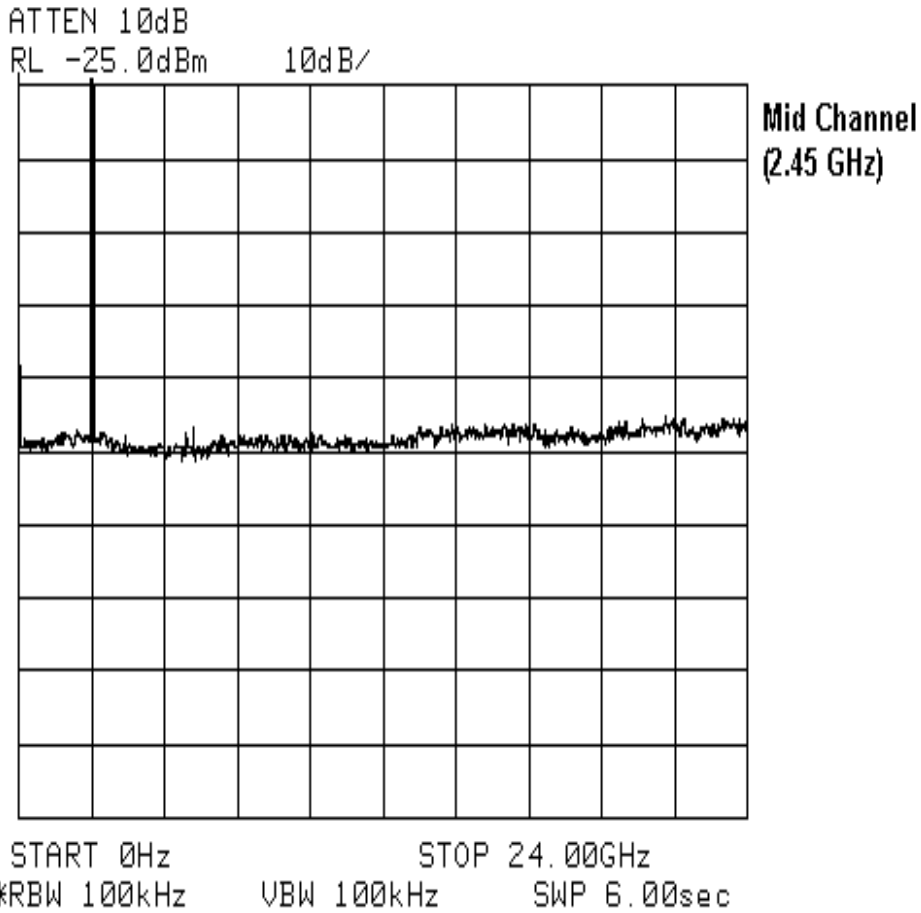
*EQUIPMENT:* QD-24-0010 and QD-24-0040 with Lucent radio model PC24E-H-FC PROJECT NO.: 1L0526RUS1Rev1

**Data Plot**

**ACSE**

Page 2 of 3

Job No.:	<u>1L0526R</u>	Date:	<u>10/29/2001</u>
Specification:	<u>FCC15247</u>	Temperature(°C):	<u>22</u>
Tested By:	<u>Lance Walker</u>	Relative Humidity(%):	<u>50</u>
E.U.T.:	<u>Wireless LAN</u>		
Configuration:	<u>Normal</u>		



Notes: Ext. attenuation 10 dB



*EQUIPMENT:* QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC PROJECT NO.: 1L0526RUS1Rev1

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**Section 8. Spurious Emissions (radiated)**

NAME OF TEST: Peak Power Output	PARA. NO.: 15.247 (c)
TESTED BY: Lance Walker	DATE: November 9, 2001

**Test Results:** Complies.

**Measurement Data:** See attached table.

**Duty Cycle Calculation:**

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

**EQUIPMENT:** QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC

**PROJECT NO.:** 1L0526RUS1Rev1



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**Radiated Emissions**

Page 1 of 2

Job No.: 1L0526R Date: 11/9/01

Specification: CFR 47, Part 15 Temperature(°C): 22

Tested By: Lance Walker Relative Humidity(%) 50

E.U.T.: Andrew Amp/Antenna

Configuration: Normal

Sample Number: S01

Location: AC 3 RBW: 1 MHz

Detector Type: Average VBW: 30 kHz

**Test Equipment Used**

Antenna: 1304 Directional Coupler: #N/A

Pre-Amp: 1016 Cable #1: 1484

Filter: 1482 Cable #2: 1485

Receiver: #N/A Cable #3: 1082

Attenuator #1: #N/A Cable #4: #N/A

Attenuator #2: #N/A Mixer: #N/A

Additional equipment used: \_\_\_\_\_

Measurement Uncertainty: +/- .7 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
4.824	41.1	33.9	4.1	33.7	45.4	54	-8.6	Ch 1 H to H
12.060	38.1	40	7.3	35.7	49.7	54	-4.3	Ch 1 H to H NF
14.472	37.4	40.4	7.1	32.7	52.2	54	-1.8	Ch 1 H to H NF
4.824	42.7	33.9	4.1	33.7	47.0	54	-7.0	Ch 1 V to H
12.060	38.1	40	7.3	35.7	49.7	54	-4.3	Ch 1 V to H NF
14.472	37.4	40.4	7.1	32.7	52.2	54	-1.8	Ch 1 V to H NF
4.824	41.9	33.9	4.1	33.7	46.2	54	-7.8	Ch 1 V to V
12.060	38.1	40	7.3	35.7	49.7	54	-4.3	Ch 1 V to V NF
14.472	37.4	40.4	7.1	32.7	52.2	54	-1.8	Ch 1 V to V NF
4.824	39.6	33.9	4.1	33.7	43.9	54	-10.1	Ch 1 H to V
12.060	38.1	40	7.3	35.7	49.7	54	-4.3	Ch 1 H to V NF
14.472	37.4	40.4	7.1	32.7	52.2	54	-1.8	Ch 1 H to V NF
4.874	46.2	33.9	4.1	33.7	50.5	54	-3.5	Ch 6 H to H
7.340	37.1	35.8	5.0	33	44.9	54	-9.1	Ch 6 H to H NF
12.185	37.7	40	7.3	35.7	49.3	54	-4.7	Ch 6 H to H NF
4.874	45.1	33.9	4.1	33.7	49.4	54	-4.6	Ch 6 H to V
7.340	37.1	35.8	5.0	33	44.9	54	-9.1	Ch 6 H to V NF
12.185	37.3	40	7.3	35.7	48.9	54	-5.1	Ch 6 H to V NF

Notes: all channels measured up to 10th harmonic no signal found above 4.8\_\_ GHz

**EQUIPMENT:** QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC

PROJECT NO.: 1L0526RUS1Rev1



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<b>Radiated Spurious Emissions</b>								
Page <u>1</u> of		<b>Continuation Page</b>						
Job No.:		Date: 11/12/01						
Specification: CFR 47, Part 15		Temperature(°F): 72						
Tested By: #N/A		Relative Humidity(%) 50						
E.U.T.:		Andrew Amp/Antenna						
Configuration:		Normal						
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
4.874	44.7	33.9	4.1	33.7	49.0	54	-5.0	Ch 6 V to V
7.340	37.1	35.8	5.0	33	44.9	54	-9.1	Ch 6 V to V NF
12.185	37.3	40	7.3	35.7	48.9	54	-5.1	Ch 6 V to V NF
4.874	44.4	33.9	4.1	33.7	48.7	54	-5.3	Ch 6 V to H
7.340	37.1	35.8	5.0	33	44.9	54	-9.1	Ch 6 V to H NF
12.185	37.3	40	7.3	35.7	48.9	54	-5.1	Ch 6 V to H NF
4.924	42.2	33.9	4.1	33.7	46.5	54	-7.5	Ch 11 H to H
7.386	37.5	35.8	5.0	33	45.3	54	-8.7	Ch 11 H to H NF
12.310	37.7	40	7.3	35.7	49.3	54	-4.7	Ch 11 H to H NF
4.924	42.5	33.9	4.1	33.7	46.8	54	-7.2	Ch 11 H to V
7.386	37.5	35.8	5.0	33	45.3	54	-8.7	Ch 11 H to V NF
12.310	37.7	40	7.3	35.7	49.3	54	-4.7	Ch 11 H to V NF
4.924	42.1	33.9	4.1	33.7	46.4	54	-7.6	Ch 11 V to V
7.386	37.5	35.8	5.0	33	45.3	54	-8.7	Ch 11 V to V NF
12.310	37.7	40	7.3	35.7	49.3	54	-4.7	Ch 11 V to V NF
4.924	39.9	33.9	4.1	33.7	44.2	54	-9.8	Ch 11 V to H
7.386	37.5	35.8	5.0	33	45.3	54	-8.7	Ch 11 V to H NF
12.310	37.7	40	7.3	35.7	49.3	54	-4.7	Ch 11 V to H NF
Notes:								



QD-24-0010 and QD-24-0040 with

EQUIPMENT: Lucent radio model PC24E-H-FC

PROJECT NO.: 1L0526RUS1Rev1

<u>Radiated Emissions</u>	
Page <u>1</u> of <u>2</u>	
Job No.: 1L0526R	Date: 5/13/02
Specification: CFR 47, Part 15	Temperature(°C): <u>22</u>
Tested By: <u>David Light</u>	Relative Humidity(%) <u>50</u>
E.U.T.: _____	Andrew Amp/Antenna
Configuration: _____	Normal
Sample Number: <u>S01</u>	
Location: <u>AC 3</u>	RBW: <u>1 MHz</u>
Detector Type: <u>Peak</u>	VBW: <u>1 MHz</u>
<u>Test Equipment Used</u>	
Antenna: <u>1304</u>	Directional Coupler: <u>#N/A</u>
Pre-Amp: <u>1016</u>	Cable #1: <u>1484</u>
Filter: <u>1482</u>	Cable #2: <u>1485</u>
Receiver: <u>#N/A</u>	Cable #3: <u>1082</u>
Attenuator #1: <u>#N/A</u>	Cable #4: <u>#N/A</u>
Attenuator #2: <u>#N/A</u>	Mixer: <u>#N/A</u>
Additional equipment used: _____	
Measurement Uncertainty: <u>+/-3.6 dB</u>	

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
4.824	47	33.9	4.1	33.7	51.3	74	-22.7	Ch 1 H to H
12.060	38.1	40	7.3	35.7	49.7	74	-24.3	Ch 1 H to H NF
14.472	37.4	40.4	7.1	32.7	52.2	74	-21.8	Ch 1 H to H NF
4.824	48.1	33.9	4.1	33.7	52.4	74	-21.6	Ch 1 V to H
12.060	38.1	40	7.3	35.7	49.7	74	-24.3	Ch 1 V to H NF
14.472	37.4	40.4	7.1	32.7	52.2	74	-21.8	Ch 1 V to H NF
4.824	47.7	33.9	4.1	33.7	52.0	74	-22.0	Ch 1 V to V
12.060	38.1	40	7.3	35.7	49.7	74	-24.3	Ch 1 V to V NF
14.472	37.4	40.4	7.1	32.7	52.2	74	-21.8	Ch 1 V to V NF
4.824	46.6	33.9	4.1	33.7	50.9	74	-23.1	Ch 1 H to V
12.060	38.1	40	7.3	35.7	49.7	74	-24.3	Ch 1 H to V NF
14.472	37.4	40.4	7.1	32.7	52.2	74	-21.8	Ch 1 H to V NF
4.874	51.7	33.9	4.1	33.7	56.0	74	-18.0	Ch 6 H to H
7.340	37.1	35.8	5.0	33	44.9	74	-29.1	Ch 6 H to H NF
12.185	37.7	40	7.3	35.7	49.3	74	-24.7	Ch 6 H to H NF
4.874	52	33.9	4.1	33.7	56.3	74	-17.7	Ch 6 H to V
7.340	37.1	35.8	5.0	33	44.9	74	-29.1	Ch 6 H to V NF
12.185	37.3	40	7.3	35.7	48.9	74	-25.1	Ch 6 H to V NF

Notes: \_\_\_\_\_

QD-24-0010 and QD-24-0040 with

EQUIPMENT:

Lucent radio model PC24E-H-FC

PROJECT NO.: 1L0526RUS1Rev1

Page <u>2</u> of <u>2</u>		<b><u>Radiated Spurious Emissions</u></b>	
Job No.:		Continuation Page	
Specification: CFR 47, Part 15		Date: 5/18/02	
Tested By: #N/A		Temperature(°F): <u>72</u>	
E.U.T.:		Relative Humidity(%) <u>50</u>	
Configuration:		Andrew Amp/Antenna	
		Normal	

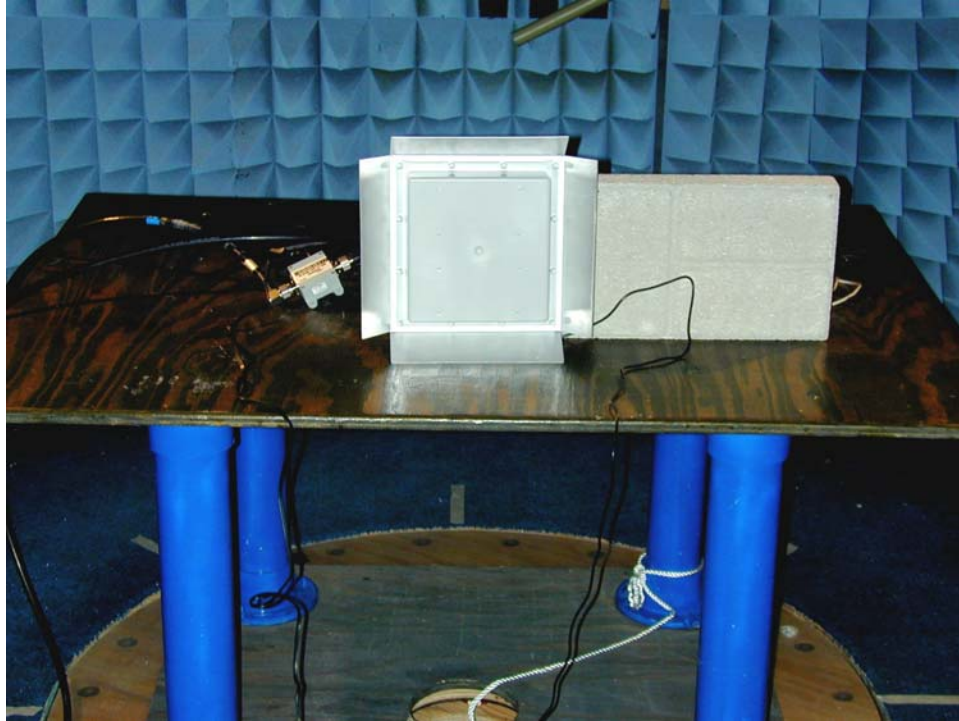
Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Comment
4.874	50.8	33.9	4.1	33.7	55.1	74	-18.9	Ch 6 V to V
7.340	37.1	35.8	5.0	33	44.9	74	-29.1	Ch 6 V to V NF
12.185	37.3	40	7.3	35.7	48.9	74	-25.1	Ch 6 V to V NF
4.874	51.1	33.9	4.1	33.7	55.4	74	-18.6	Ch 6 V to H
7.340	37.1	35.8	5.0	33	44.9	74	-29.1	Ch 6 V to H NF
12.185	37.3	40	7.3	35.7	48.9	74	-25.1	Ch 6 V to H NF
4.924	48.3	33.9	4.1	33.7	52.6	74	-21.4	Ch 11 H to H
7.386	37.5	35.8	5.0	33	45.3	74	-28.7	Ch 11 H to H NF
12.310	37.7	40	7.3	35.7	49.3	74	-24.7	Ch 11 H to H NF
4.924	48.5	33.9	4.1	33.7	52.8	74	-21.2	Ch 11 H to V
7.386	37.5	35.8	5.0	33	45.3	74	-28.7	Ch 11 H to V NF
12.310	37.7	40	7.3	35.7	49.3	74	-24.7	Ch 11 H to V NF
4.924	48.2	33.9	4.1	33.7	52.5	74	-21.5	Ch 11 V to V
7.386	37.5	35.8	5.0	33	45.3	74	-28.7	Ch 11 V to V NF
12.310	37.7	40	7.3	35.7	49.3	74	-24.7	Ch 11 V to V NF
4.924	46.1	33.9	4.1	33.7	50.4	74	-23.6	Ch 11 V to H
7.386	37.5	35.8	5.0	33	45.3	74	-28.7	Ch 11 V to H NF
12.310	37.7	40	7.3	35.7	49.3	74	-24.7	Ch 11 V to H NF
2.462	81.5	29	2.1	0	112.6		112.6	Ch 11
2.4835	33.5	29	2.1	0	64.6	74	-9.4	<b>Peak(1MHz/1MHz)</b>
2.4835	18	29	2.1	0	49.1	54	-4.9	<b>Avg. (1MHz/10Hz) NF</b>
2.437	83.2	29	2.1	0	114.3		114.3	Ch 6
2.412	81.3	29	2.1	0	112.4		112.4	Ch 1
Notes:								

*EQUIPMENT:* QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC PROJECT NO.: 1L0526RUS1Rev1

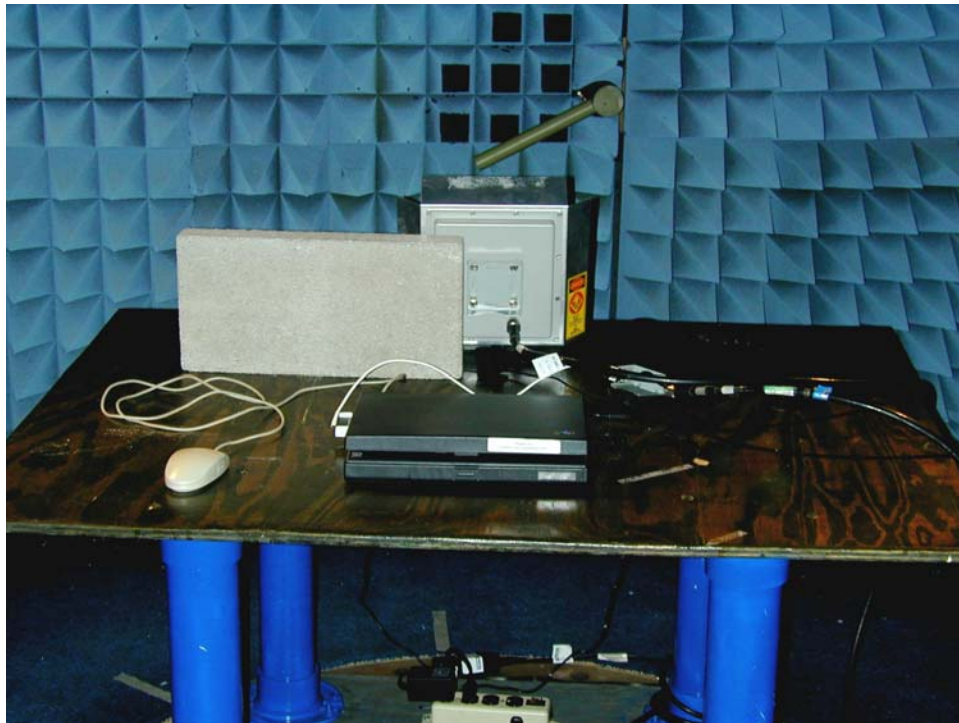
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**Radiated Photographs (Worst Case Configuration)**

Front



Back



**EQUIPMENT:** QD-24-0010 and QD-24-0040 with Lucent radio model PC24E-H-FC **PROJECT NO.:** 1L0526RUS1Rev1

**Section 9. Peak Power Spectral Density**

NAME OF TEST: Peak Power Spectral Density	PARA. NO.: 15.247(d)
TESTED BY: Lance Walker	DATE: November 12, 2001

**Test Results:** Complies.



**Dallas Headquarters:**  
802 N. Kealy  
Lewisville, TX 75057  
Tel: (972) 436-9600  
Fax: (972) 436-2667

Radiated Emissions

Page 1 of \_\_\_\_\_

Job No.: 1L0526R Date: 11/12/2001  
 Specification: CFR 47, Part 15 Temperature(°C): 22  
 Tested By: Lance Walker Relative Humidity(%): 50  
 E.U.T.: Andrew Amp/Antenna  
 Configuration: Normal with sweep of 1700 sec  
 Sample Number: S01  
 Location: AC 3 RBW: 3 KHz  
 Detector Type: Average VBW: 3 kHz

Test Equipment Used

Antenna: 1304 Directional Coupler: #N/A  
 Pre-Amp: N/A Cable #1: 1484  
 Filter: N/A Cable #2: 1485  
 Receiver: #N/A Cable #3: N/A  
 Attenuator #1: #N/A Cable #4: #N/A  
 Attenuator #2: #N/A Mixer: #N/A

Additional equipment used: \_\_\_\_\_  
 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
2.462	81.5	29	2.1	0	112.6		112.6	Ch 11
2.437	83.2	29	2.1	0	114.3		114.3	Ch 6
2.412	81.3	29	2.1	0	112.4		112.4	Ch 1
Frequency (GHz)	Formula			Limit	Measurement			
2.462	$\frac{V^2 R^2}{30(40.7)}$			8 dBm	1.275 dBm			
2.437	$\frac{V^2 R^2}{30(40.7)}$			8 dBm	2.975 dBm			
2.412	$\frac{V^2 R^2}{30(40.7)}$			8 dBm	1.075 dBm			

*EQUIPMENT:* QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC PROJECT NO.: 1L0526RUS1Rev1

## Section 10. Minimum Processing Gain

NAME OF TEST: Minimum Processing Gain	PARA. NO.: 15.247(e)
TESTED BY:	DATE:

### Test Results:

**The EUT does not have an effect on the processing gain since no modulation or IF filtering are performed within the EUT circuitry. The EUT is to be used only with the certified LAN card that has been proven to comply with this requirement (FCC ID. IMRWLPCE24H). Processing Gain data for the radio card is provided as a separate attachment.**

### Theoretical Processing Gain

#### **1 and 2 Mbps DQPSK modulation:**

For 1 and 2 Mbp/s DQPSK modulation using a fixed spreading sequence the symbol rate is 1 MSymbol/s. The symbol length is 11 chips. Each chip duration is 1/11 uS. A symbol duration is 1 uS.

The chip/symbol rate is 11.

The theoretical process gain is  $10 \cdot \text{LOG}(11) = 10 \text{ dB}$ .

#### **5.5 and 11 Mbps DQPSK CCK:**

For 5.5 and 11 Mbp/s CCK where the spreading sequence is a function of the transmitted data, the symbol rate is 8/11 MSymbol/s. The symbol length is 8 chips. Each chip duration is 1/11 uS. A symbol duration is 8/11 uS. The chip/symbol rate is 8.

The theoretical process gain is  $10 \cdot \text{LOG}(8) = 9 \text{ dB}$ . Due to the fact that only 256 code sequences out of the 65536 code sequences that are available are used, there is coding gain. Therefore the processing gain of a CCK system consists of spreading gain and coding gain together. As such a CCK system does meet the FCC requirement for a process gain of minimal 10 dB.

QD-24-0010 and QD-24-0040 with  
*EQUIPMENT:* Lucent radio model PC24E-H-FC      PROJECT NO.: 1L0526RUS1Rev1

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### Section 11. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/02/01
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	06/01/01
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	06/01/01
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	07/30/01
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	05/30/01
1482	Band Pass Filter	K & L 11SH10-4000/T12000-0/0	2	Cal B4 Use
1082	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	06/01/01
1029	PEAK POWER METER	HP 8900D	3303U0012	03/12/01
1030	PEAK POWER SENSOR	HP 84811A	2539A03573	03/12/01

**Nemko Dallas**

FCC PART 15, SUBPART C  
DSSS TRANSMITTER

*EQUIPMENT:* QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC      PROJECT NO.: 1L0526RUS1Rev1

---

## **ANNEX A - TEST DETAILS**

Nemko Dallas

FCC PART 15, SUBPART C  
DSSS TRANSMITTER

QD-24-0010 and QD-24-0040 with  
*EQUIPMENT:* Lucent radio model PC24E-H-FC      PROJECT NO.: 1L0526RUS1Rev1

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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 $\mu$ V (48 dB $\mu$ V) across 50 ohms.



**Nemko Dallas**

FCC PART 15, SUBPART C  
DSSS TRANSMITTER

QD-24-0010 and QD-24-0040 with  
EQUIPMENT: Lucent radio model PC24E-H-FC      PROJECT NO.: 1L0526RUS1Rev1

NAME OF TEST: Minimum 6 dB bandwidth	PARA. NO.: 15.247(a)(2)
--------------------------------------	-------------------------

**Minimum Standard:**      The minimum 6 dB bandwidth shall be at least 500 kHz

QD-24-0010 and QD-24-0040 with  
*EQUIPMENT:* Lucent radio model PC24E-H-FC      PROJECT NO.: 1L0526RUS1Rev1

NAME OF TEST: Maximum Peak Output Power	PARA. NO.: 15.247(b)(1)
---	-------------------------

**Minimum Standard:**      The maximum peak output power shall not exceed 1 watt.

If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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

QD-24-0010 and QD-24-0040 with  
*EQUIPMENT:* Lucent radio model PC24E-H-FC      PROJECT NO.: 1L0526RUS1Rev1

---

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

Number of channels tested:

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

Nemko Dallas

FCC PART 15, SUBPART C  
DSSS TRANSMITTER

QD-24-0010 and QD-24-0040 with  
*EQUIPMENT:* Lucent radio model PC24E-H-FC      PROJECT NO.: 1L0526RUS1Rev1

---

NAME OF TEST: RF Exposure	PARA. NO.: 15.247(b)(4)
---------------------------	-------------------------

**Minimum Standard:**      Systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines stipulated in 1.1307(b)(1) of CFR 47.

QD-24-0010 and QD-24-0040 with  
*EQUIPMENT:* Lucent radio model PC24E-H-FC PROJECT NO.: 1L0526RUS1Rev1

NAME OF TEST: Spurious Emissions(conducted)	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 IS SEARCHED TO THE 10th HARMONIC OF THE HIGHEST FREQUENCY GENERATED IN THE EUT.**

**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

QD-24-0010 and QD-24-0040 with  
*EQUIPMENT:* Lucent radio model PC24E-H-FC PROJECT NO.: 1L0526RUS1Rev1

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

QD-24-0010 and QD-24-0040 with  
*EQUIPMENT:* Lucent radio model PC24E-H-FC PROJECT NO.: 1L0526RUS1Rev1

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

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

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

- RBW: 3 kHz
- VBW: >3 kHz
- Span: => measured 6 dB bandwidth
- Sweep: Span(kHz)/3 (i.e. for a span of 1.5 MHz the sweep rate is 1500/3 = 500 sec.
- LOG dB/div.: 2 dB

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

**For Devices With Integral Antenna:**

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

Number of channels tested:

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

QD-24-0010 and QD-24-0040 with  
*EQUIPMENT:* Lucent radio model PC24E-H-FC PROJECT NO.: 1L0526RUS1Rev1

NAME OF TEST: Processing Gain	PARA. NO.: 15.247(e)
-------------------------------	----------------------

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

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

**Calculation Of Processing Gain:**

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

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

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

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

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

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

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

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

Measurement performed at a channel in the center of the operating band of the EUT.



*EQUIPMENT:* QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC      PROJECT NO.: 1L0526RUS1Rev1

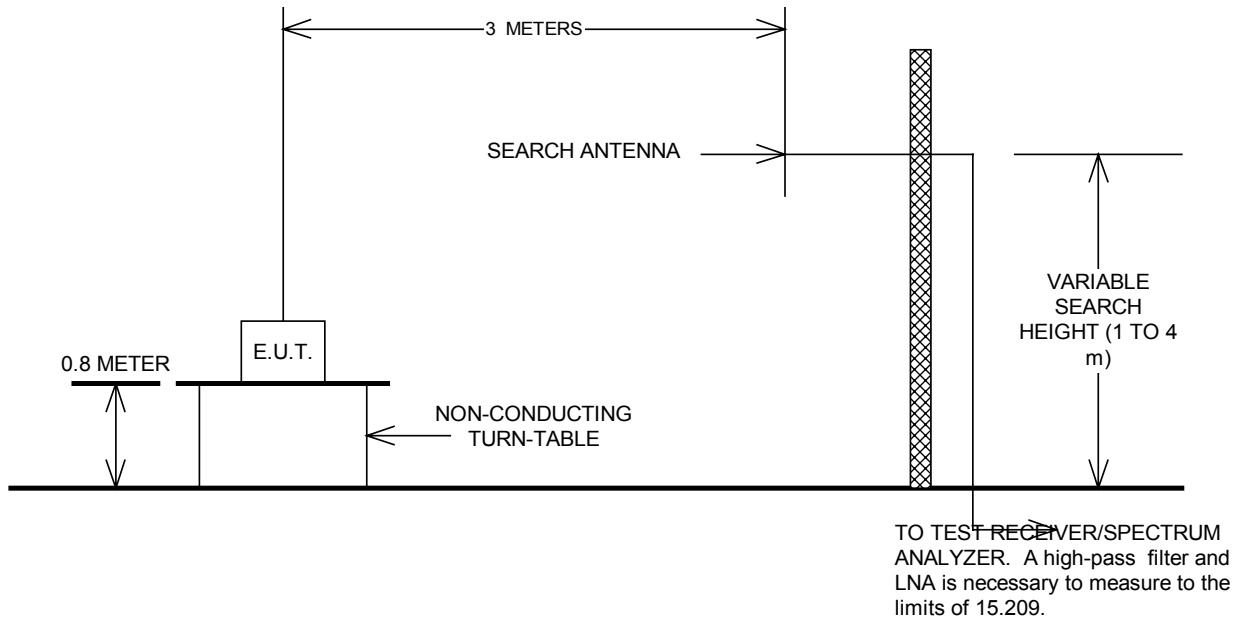
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## **ANNEX B - TEST DIAGRAMS**

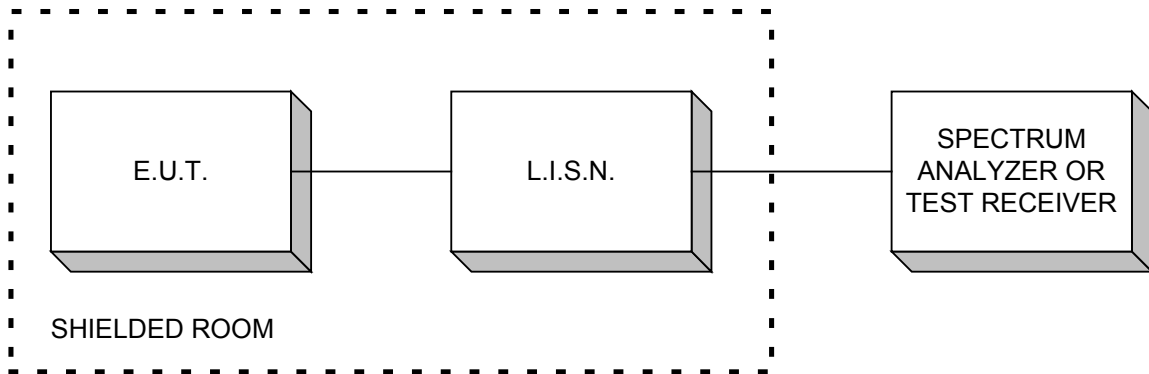
*EQUIPMENT:* QD-24-0010 and QD-24-0040 with  
Lucent radio model PC24E-H-FC

PROJECT NO.: 1L0526RUS1Rev1

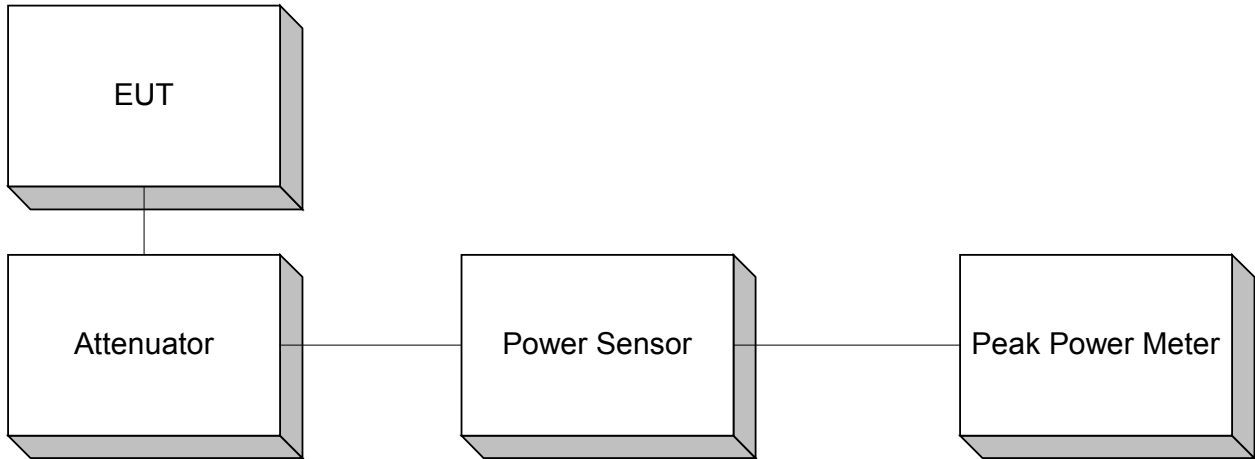
### Test Site For Radiated Emissions



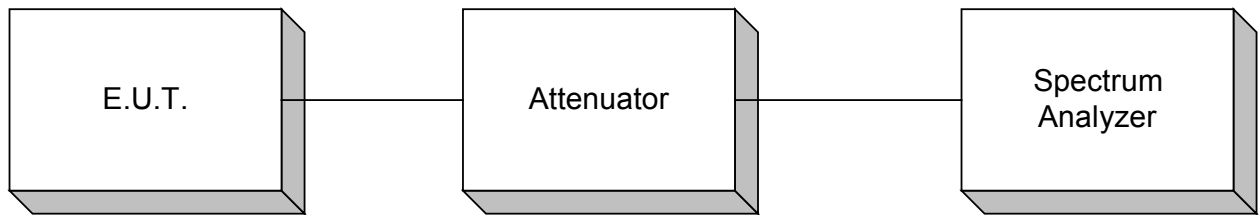
### Conducted Emissions



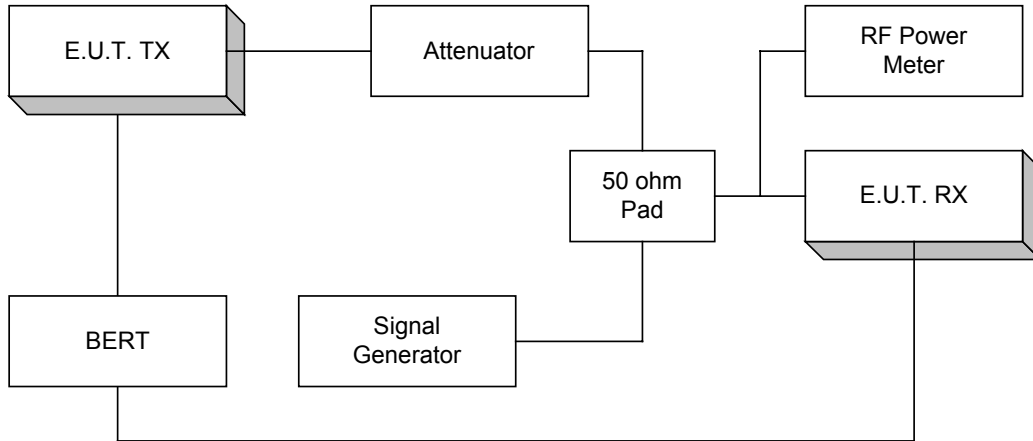
**Peak Power At Antenna Terminals**



**Minimum 6 dB Bandwidth  
Peak Power Spectral Density  
Spurious Emissions (conducted)**



**Processing Gain**



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