



**ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT  
INTENTIONAL RADIATOR CERTIFICATION TO  
FCC PART 15 SUBPART C REQUIREMENT**

*OF*

**FCC ID: IMK-HRFBRIDGE**

**SYMPHONY-HOME RF CORDLESS GATEWAY**

**REPORT NO: 00U0131-2**

**TEST DATE: APRIL 05, 2000**

*Prepared for*  
**PROXIM, INC.**  
**510 DEGUIGUE DRIVE**  
**SUNNYVALE, CA 94086, U.S.A.**

*Prepared by*  
**COMPLIANCE ENGINEERING SERVICES, INC.**  
*d.b.a*  
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**NVLAP<sup>®</sup>**  
**LAB CODE:200065-0**

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CONFIDENTIALITY PACKAGE CONTAINS:

SYMPHONY- HRF Cordless Gateway, "Schematic"

SYMPHONY- HRF Cordless Gateway, "Block Diagram"

SYMPHONY- Home RF Frequency Hopping "Theory of Operation"

Maximum Duty Cycle Analysis for Symphony-HRF Cordless Gateway

**1. VERIFICATION OF COMPLIANCE**

COMPANY NAME :        PROXIM  
                                  510 DEGUIGUE DRIVE  
                                  SUNNYVALE, CA 94086

CONTACT PERSON :        KEITH GLOVER / CFO

TELEPHONE NO        :        (408) 731-2657

EUT DESCRIPTION :        FREQUENCY HOPPING SPREAD SPECTRUM WLAN  
                                  ADAPTER

MODEL NAME        :        SYMPHONY-HOME RF CORDLESS GATEWAY

DATE TESTED        :        APRIL 05, 2000

<b>LIMITS APPLY TO: FCC PART 15 SECTION 15.247</b>	
<b>TECHNICAL LIMITS</b>	<b>TEST RESULT</b>
Radiated Emission/15.205 & 15.209	Complies
Radiated Emission/15.109	Complies
AC Line Conducted Emission	Complies
Minimum 20dB Bandwidth	Complies
RF Power Output	Complies
Minimum Number of Hopping Channels	Complies
Channel Separation	Complies
Average Time of Channel Occupancy	Complies
<p>The above equipment was tested by Compliance Engineering Services, Inc. for compliance with the requirements set forth in CFR 47 PART 15, SUBPART C. This said equipment in the configuration described in this report shows the maximum emission levels emanating from equipment are within the compliance requirements.</p>	
<hr/> THOMAS N. COKENIAS/ EMC DIRECTOR COMPLIANCE CERTIFICATION SERVICES, INC.	<hr/> DATE
<p><b>Warning :</b> This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document.</p>	

This document may be altered or revised by Compliance Certification Services personnel only, and shall be noted in the revision section of the document.

## 2. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

The product is a FHSS WLAN adapter operating in the 2.4-2.4835GHz band with a nominal TX output power of 100mW. It is a small desktop box with associated wall plug mounted 5V switching DC power supply, integral antenna inside the plastic enclosure and 10 base T port for connection to standard wired LAN. The integral antenna is permanently attached to the PCB. It has nominal gain of 0 dBi. This device can either stand alone connected to a RJ-45 LAN hub port, or be connected to the RJ-45 port of a computing device.

<b>HRF BRIDGE WLAN</b>	
Actual Frequency Range	<b>2402 - 2480 MHz</b>
Transmit Power	<b>100mW</b>
Modulation Technique	<b>FSK</b>
Radio Technique	<b>Frequency Hopping Spread Spectrum</b>
Channel Bandwidth	<b>870kHz</b>
Number of Channel	<b>75 channels</b>
Antenna Gain, dBi	<b>0 dBi</b>
Air Data Rate	<b>1.6 Mbps</b>
DC voltage	<b>5V</b>
AC Power Supply Accessory	<b>Proxim (P/N: 4000.0025)</b>
Network Cable Accessory	<b>Proxim P/N: 6001.0124 unshielded twisted pair RJ-45 cable assembly</b>

PC INTERFACE TYPE	<b>RJ-45</b>
ANTENNA CONNECTOR	<b>None, integral antenna.</b>
ANTENNA TYPE	<b>OMNIDIRECTIONAL =0.0dBi</b>

**3.    ANTENNA CONNECTION (Section 15.203)**

The SYMPHONY-HOME RF CORDLESS GATEWAY is equipped with a permanently attached integral antenna. Please refer to **ATTACHMENT#4: EUT TECHICAL DESCRIPTION**. Also, refer to **ATTACHMENT# 1: EUT PHOTOS**, which contains a picture of the antenna and its location (Photo# 5).

**4.    PSEUDORANDOM HOPPING SEQUENCE NUMBERS**

Please refer to **ATTACHMENT#6: CONFIDENTIALITY REQUEST LETTER " Symphony-Home RF Frequency Hopping Theory of Operation "** confidentiality package.

**5.    CHANNEL USAGE**

Please refer to **ATTACHMENT#6: CONFIDENTIALITY REQUEST LETTER " Symphony-Home RF Frequency Hopping Theory of Operation "** confidentiality package.

**6.    THEORY OF OPERATION**

Please refer to **ATTACHMENT#6: CONFIDENTIALITY REQUEST LETTER ""** confidentiality package.

**7.    THE COORDINATION OF FREQUENCY HOPPING SYSTEM**

Please refer to **ATTACHMENT#6: CONFIDENTIALITY REQUEST LETTER " Symphony-Home RF Frequency Hopping Theory of Operation "** confidentiality package.

**8.    RECEIVER TECHNICAL INFORMATION (Section 15.247 (a)(1))**

Please refer to **ATTACHMENT#4: SYMPHONY-HOME RF CORDLESS GATEWAY TECHICAL DESCRIPTION**.

**9.    TEST LOCATION**

All emissions tests were performed at:

Compliance Consulting Services  
561F Monterey Road  
Morgan Hill, CA 95087

CCS has site descriptions on file with the FCC for 10 and 3 meter site configurations. CCS is a NVLAP accredited facility.

Radiated emissions from the digital portion of the EUT were performed on site C, one of the 10 meter sites.

**10. SUPPORT EQUIPMENT**

DEVICE TYPE	MANUFACTURER	MODEL NAME	SERIAL NO	FCC ID
HOST PC	Dell Computer	MMS	8028F	E2KHANNIBAD
MONITOR	Dell Computer	D1728D-LS	04036A8M60-27	A3LCMG737
KEYBOARD	Del Computer	SK-1000REW	N/A	GYUR26SK
MOUSE	Dell Computer	M-S34	LZA706006595	DZI210472

**11. TEST EQUIPMENT**

EQUIPMENT TYPE	MODEL NAME	SERIAL NO	CAL DUE:
SPECTRUM ANALYZER	HP8593EM	3710A00205	5/28/00
SPECTRUM ANALYZER	HP8568B	2732A03661	12/17/00
SPECTRUM ANALYZER	HP8566B	2140A01296	12/17/00
PRE-AMP	HP8447D (P5)	2944A06550	8/10/00
MITEQ PRE-AMP	NSP2600-44	646456	1/3/01
EMOC HORN ANTENNA	3115	9001-3245	1/05/01
BICONICAL ANTENNA	EATON 94455-1	1214	8/12/00
LOG PERIODIC ANTENNA	EMCO 3146	9107-3163	8/12/00

## 12. TEST PROCEDURES AND TEST RESULTS

### ***Radiated Emissions (General Requirements)***

Test Requirement: 15.205, 15.209

#### **Measurement Equipment Used:**

HP 8593EM Spectrum Analyzer

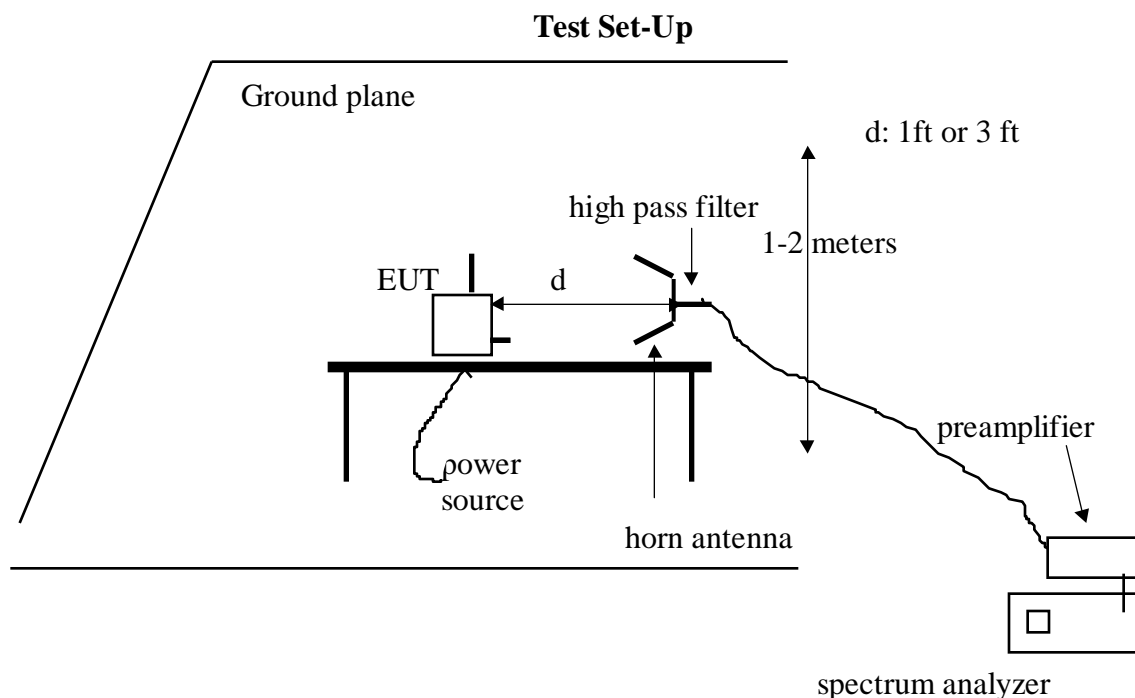
MITEQ NSP2600-44 Preamplifier, 1-26 GHz

EMCO 3115 Horn Antenna, 1-18 GHz

ARA MWH1826/B Antenna, 18-26 GHz

FLEXCO Cables, 18ft (loss: 0.85 dB/ft@ 26 GHz)

FYS Microwave: High Pass Filter 4.305 GHz



#### **Test Procedures**

1. The EUT was placed on a wooden table on the outdoor ground plane. The search antenna was placed 3 ft and 1 ft from the EUT. Measurement distance is chosen so that the noise floor of the measurement system is at least 6dB below the specification limits. The EUT frequency hopping sequence disabled and set the EUT to transmit at its lowest channel first.
  
2. The turntable was slowly rotated to locate the direction of maximum emission at each emission falling in the restricted bands of 15.205.



3. Once maximum direction was determined, the search antenna was raised and lowered in both vertical and horizontal polarizations. The maximum readings so obtained are recorded in the data listed below.

4. Steps 1 to 3 were repeated for the middle and high channel

**Test Results:**

Refer to attached spreadsheets.

**COMPLIANCE CERTIFICATION SERVICES, INC.**

Radiated Emissions  
15.205

04/06/00  
Kerwin Corpuz  
C-site (1.0 Meter)

PROXIM

2402 - 2480MHz HSSS HRF BRIDGE (M/N: 4930); FCC ID: IMK-HRFBRIDGE

f<sub>0</sub>= 2402 MHz (LOW)

F(MHz)	READING (dBuV)		AF (dB)	CL (dB)	AMP (dB)	DIST (dB)	HPF (dB)	Total (dBuV/m)		Limit (dBuV/m)		MARGIN (dB)	
	Pk	Avg						Pk	Avg	Pk	Avg	Pk	Avg
4804V	55.85	53.08	32.5	5.4	-42	-9.5	1	43.25	40.48	74	54	-30.8	-13.5
4804H	57.8	54.1	32.5	5.4	-42	-9.5	1	45.2	41.5	74	54	-28.8	-12.5
7206V	51.65	44.59	36.1	6.6	-41.43	-9.5	1	44.42	37.36	74	54	-29.6	-16.6
7206H	50.11	41.11	36.1	6.6	-41.43	-9.5	1	42.88	33.88	74	54	-31.1	-20.1
9607*	47.6	36.2	37.1	8.3	-39.4	-9.5	1	45.1	33.7	74	54	-28.9	-20.3
12009*	48.14	37.82	39	9	-40.82	-9.5	1	46.82	36.5	74	54	-27.2	-17.5
14411*	51.1	39.6	40.3	10.1	-42.3	-9.5	1	50.7	39.2	74	54	-23.3	-14.8
16813*	50.5	40.1	40.7	11.34	-44.03	-9.5	1	50.01	39.61	74	54	-24	-14.4
19215*	51	40.1	32	12.6	-44.29	-9.5	1	42.81	31.91	74	54	-31.2	-22.1
21617*	52.1	41.8	32.5	14.22	-43	-9.5	1	47.32	37.02	74	54	-26.7	-17
24019*	52.8	42	32.1	15.12	-43.95	-9.5	1	47.57	36.77	74	54	-26.4	-17.2

\* Measured noise floor (worse case vertical)

**NOTE: MEASURED HORIZONTAL (H) AND VERTICAL (V)**

**DIST:** Correction to extrapolate reading to 3m specification distance  
1M measurement distance: **-9.5dB**

**AF:** Antenna Factor

**ANTENNA:** EMCO, 3115, S/N:9001-3245 & ARA, MWH-1826/B, S/N:1013

**AMP:** Pre-amp gain

**PRE-AMP:** MITEQ, NSP2600-44, S/N:646456

**CL:** Cable loss (18ft)

**HPF:** High pass filter insertion loss (4.6GHz)                      FSY (S/N: 001)

**ANALYZER SETTINGS**

Res bw	Avg. bw
<b>PEAK(Pk): 1MHz</b>	<b>1MHz</b>
<b>AVERAGE(Avg): 1MHz</b>	<b>10Hz</b>

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**COMPLIANCE CERTIFICATION SERVICES, INC.**

Radiated Emissions  
15.205

04/06/00  
Kerwin Corpuz  
C-site (1.0 Meter)

PROXIM

2402 - 2480MHz HSSS HRF BRIDGE (M/N: 4930); FCC ID: IMK-HRFBRIDGE

f<sub>0</sub>= 2439 MHz (MID)

F(MHz)	READING (dBuV)		AF (dB)	CL (dB)	AMP (dB)	DIST (dB)	HPF	Total (dBuV/m)		LIMIT (dBuV/m)		MARGIN (dB)	
	Pk	Avg						Pk	Avg	Pk	Avg	Pk	Avg
4878V	54.58	51.2	32.5	5.4	-42	-9.5	1	41.98	38.6	74	54	-32	-15.4
4878H	53.39	49.54	32.5	5.4	-42	-9.5	1	40.79	36.94	74	54	-33.2	-17.1
7318V	50.1	41.5	36.1	6.6	-41.43	-9.5	1	42.87	34.27	74	54	-31.1	-19.7
7318H	50.6	38	36.1	6.6	-41.43	-9.5	1	43.37	30.77	74	54	-30.6	-23.2
9607*	47.6	36.2	37.1	8.3	-39.4	-9.5	1	45.1	33.7	74	54	-28.9	-20.3
12009*	48.14	37.82	39	9	-40.82	-9.5	1	46.82	36.5	74	54	-27.2	-17.5
14411*	51.1	39.6	40.3	10.1	-42.3	-9.5	1	50.7	39.2	74	54	-23.3	-14.8
16813*	50.5	40.1	40.7	11.34	-44.03	-9.5	1	50.01	39.61	74	54	-24	-14.4
19215*	51	40.1	32	12.6	-44.29	-9.5	1	42.81	31.91	74	54	-31.2	-22.1
21617*	52.1	41.8	32.5	14.22	-43	-9.5	1	47.32	37.02	74	54	-26.7	-17
24019*	52.8	42	32.1	15.12	-43.95	-9.5	1	47.57	36.77	74	54	-26.4	-17.2

\* Measured noise floor (worse case vertical)

**NOTE: MEASURED HORIZONTAL (H) AND VERTICAL (V)**

**DIST:** Correction to extrapolate reading to 3m specification distance  
1M measurement distance: **-9.5dB**

**AF:** Antenna Factor

**ANTENNA:** EMCO, 3115, S/N:9001-3245 & ARA, MWH-1826/B, S/N:1013

**AMP:** Pre-amp gain

**PRE-AMP:** MITEQ, NSP2600-44, S/N:646456

**CL:** Cable loss (18ft)

**HPF:** High pass filter insertion loss (4.6GHz)                      FSY (S/N: 001)

**ANALYZER SETTINGS**

<u>Res bw</u>	<u>Avg. bw</u>
<b>1MHz</b>	<b>1MHz</b>
<b>1MHz</b>	<b>10Hz</b>

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**COMPLIANCE CERTIFICATION SERVICES, INC.**

Radiated Emissions  
15.205

04/06/00  
Kerwin Corpuz  
C-site (1.0 Meter)

PROXIM

2402 - 2480MHz HSSS HRF BRIDGE (M/N: 4930); FCC ID: IMK-HRFBRIDGE

f<sub>0</sub>= 2480 MHz (HIGH)

F(MHz)	READING (dBuV)		AF (dB)	CL (dB)	AMP (dB)	DIST (dB)	HPF (dB)	Total (dBuV/m)		LIMIT (dBuV/m)		MARGIN (dB)	
	Pk	Avg						Pk	Avg	Pk	Avg	Pk	Avg
4959V	53	49.7	32.9	5.58	-41.76	-9.5	1	41.22	37.92	74	54	-32.8	-16.1
4959H	51	45.7	32.9	5.58	-41.76	-9.5	1	39.22	33.92	74	54	-34.8	-20.1
7439V	50.2	41.4	37	6.6	-41.43	-9.5	1	43.87	35.07	74	54	-30.1	-18.9
7439H	48.37	37.8	37	6.6	-41.43	-9.5	1	42.04	31.47	74	54	-32	-22.5
9607*	47.6	36.2	37.1	8.3	-39.4	-9.5	1	45.1	33.7	74	54	-28.9	-20.3
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19215*	51	40.1	32	12.6	-44.29	-9.5	1	42.81	31.91	74	54	-31.2	-22.1
21617*	52.1	41.8	32.5	14.22	-43	-9.5	1	47.32	37.02	74	54	-26.7	-17
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\* Measured noise floor (worse case vertical)

**NOTE: MEASURED HORIZONTAL (H) AND VERTICAL (V)**

**DIST:** Correction to extrapolate reading to 3m specification distance  
1M measurement distance: **-9.5dB**

**AF:** Antenna Factor

**ANTENNA:** EMCO, 3115, S/N:9001-3245 & ARA, MWH-1826/B, S/N:1013

**AMP:** Pre-amp gain

**PRE-AMP:** MITEQ, NSP2600-44, S/N:646456

**CL:** Cable loss (18ft)

**HPF:** High pass filter insertion loss (4.6GHz)                      FSY (S/N: 001)

**ANALYZER SETTINGS**

<u>Res bw</u>	<u>Avg. bw</u>
<b>1MHz</b>	<b>1MHz</b>
<b>1MHz</b>	<b>10Hz</b>

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## Unintentional Radiated Emissions

Test Requirement: 15.109

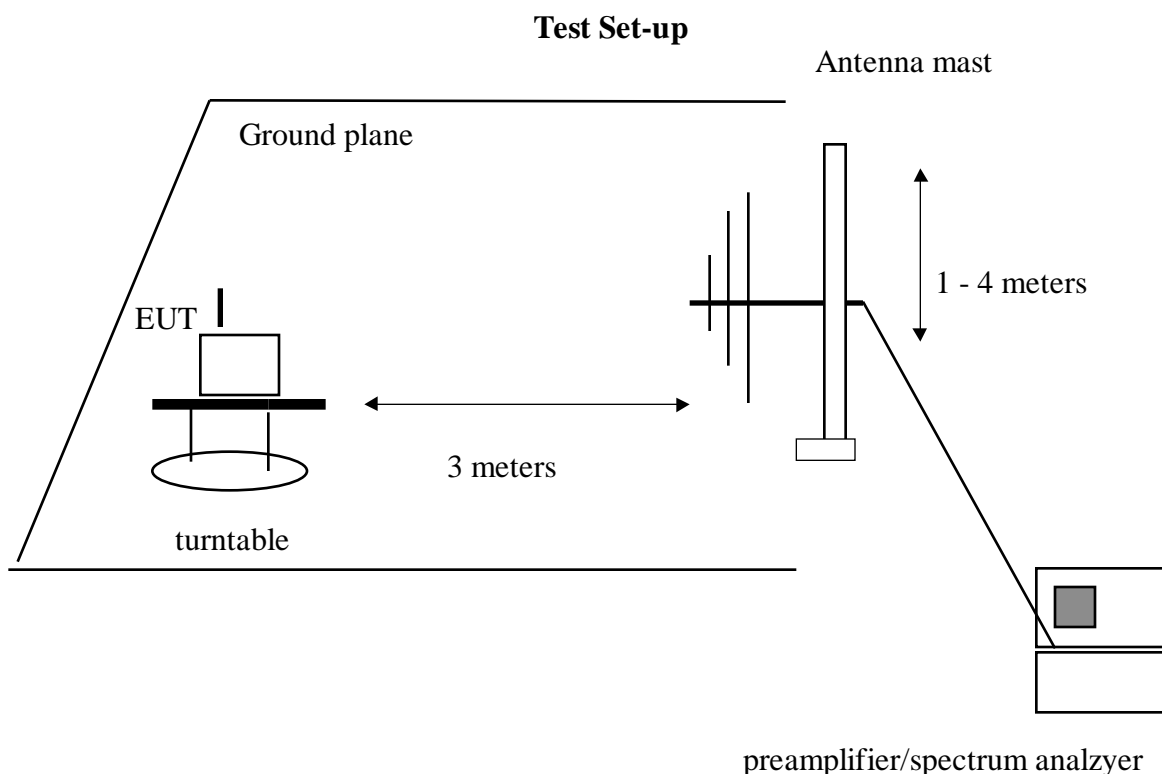
### Measurement Equipment Used:

HP 8568A Spectrum Analyzer

Eaton 94455-1 Biconical Antenna, 30 - 200 MHz

EMCO 3146 Log Periodic Antenna, 200 - 1000 MHz

HP 8447D Amplifier



### TEST PROCEDURE:

The EUT was placed on a turntable at a distance of 3 meters from a biconical or log periodic search antenna. The EUT was set to transmit. Frequency hopping sequence was enabled. The antenna was raised and lowered, the EUT rotated on the turntable, until the EUT azimuth, antenna elevation, and antenna polarity were found which yielded maximum received emission levels on the spectrum analyzer.

### Test Result:

Refer to attached tabular data sheet.

Compliance Engineering Services Inc.

Project No. : 00U0131-2  
 Report No. : 000406C1  
 Date : 04/06/2000  
 Time : 09:17  
 Test Engr : KERWIN CORPUZ

>> 3 M RADIATED EMISSION DATA <<

Company : PROXIM  
 Equipment Under Test : SYMPHONY-HRF CORDLESS GATEWAY (M/N: 4930)  
 Test Configuration : EUT ONLY  
 Type of Test : FCC CLASS B  
 Mode of Operation : SPREAD SPECTRUM HOPPING

Freq.    dBuV    PreAmp    Ant    Cable    dBuV/m    Limit    Margin    Pol    Hgt(m)    Az  
 Biconical 1214 & LP 9107-3163 ; Pre-amp = 8447D-P5 2944A06550:

Step size 20.00 MHz:

40.00	43.90	-27.48	11.67	1.07	29.16	40.00	-10.84	V	1.0	45
60.00	50.00	-27.46	6.31	1.34	30.19	40.00	-9.81	V	1.0	270
80.00	48.80	-27.34	8.83	1.46	31.75	40.00	-8.25	V	1.0	45
100.00	46.10	-27.32	11.27	1.58	31.63	43.50	-11.87	V	1.0	45
120.00	50.80	-27.24	10.72	1.74	36.02	43.50	-7.48	V	1.0	0
420.00	38.20	-27.38	15.67	3.18	29.67	46.00	-16.33	V	1.0	180
480.00	38.60	-27.74	16.96	3.41	31.23	46.00	-14.77	V	1.0	225
600.00	39.20	-27.97	18.32	3.84	33.39	46.00	-12.61	V	1.0	225
60.00	45.40	-27.46	7.34	1.34	26.62	40.00	-13.38	H	2.1	180
100.00	46.70	-27.32	11.01	1.58	31.97	43.50	-11.53	H	2.1	100
120.00	48.10	-27.24	10.32	1.74	32.92	43.50	-10.58	H	2.1	270
340.00	40.50	-26.86	15.02	2.85	31.50	46.00	-14.50	H	1.3	120
360.00	42.50	-27.00	15.20	2.93	33.64	46.00	-12.36	H	1.3	100

Step size 24.00 MHz:

48.00	44.80	-27.46	10.58	1.19	29.11	40.00	-10.89	V	1.0	45
72.00	58.20	-27.40	6.09	1.43	38.32	40.00	-1.68	V	1.0	0
QP at 72.00 MHz:										
72.00	56.70	-27.40	6.09	1.43	36.82	40.00	-3.18	V	1.0	0
144.00	45.40	-27.15	16.40	1.86	36.52	43.50	-6.98	V	1.0	0
216.00	37.70	-26.79	11.82	2.27	25.00	43.50	-18.50	V	1.0	0
384.00	41.50	-27.15	15.12	3.04	32.51	46.00	-13.49	V	1.0	225
432.00	43.80	-27.45	15.93	3.23	35.50	46.00	-10.50	V	1.0	135
480.00	38.70	-27.74	16.96	3.41	31.33	46.00	-14.67	V	1.0	250
72.00	52.20	-27.40	6.00	1.43	32.22	40.00	-7.78	H	2.1	225
384.00	44.10	-27.15	15.43	3.04	35.41	46.00	-10.59	H	1.3	100
432.00	43.30	-27.45	16.10	3.23	35.18	46.00	-10.82	H	1.3	90
528.00	38.90	-27.89	17.83	3.58	32.42	46.00	-13.58	H	1.3	225

COMPLETED SCAN 30 - 1000 MHz, VERTICAL AND HORIZONTAL POLARIZATION.

Total # of data 25  
 V. c2.2\_

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## **AC Line Conducted Emissions**

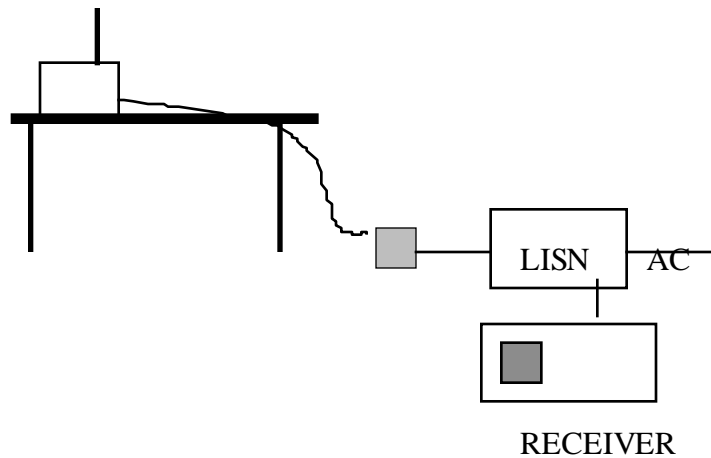
Test Requirement: 15.207

### **Measurement Equipment Used:**

Rhode & Schwarz EMI Receiver ESHS-20

Fischer Custom Communication LISN, FCC-LISN-50/250-25-2

### **Test Set-up**

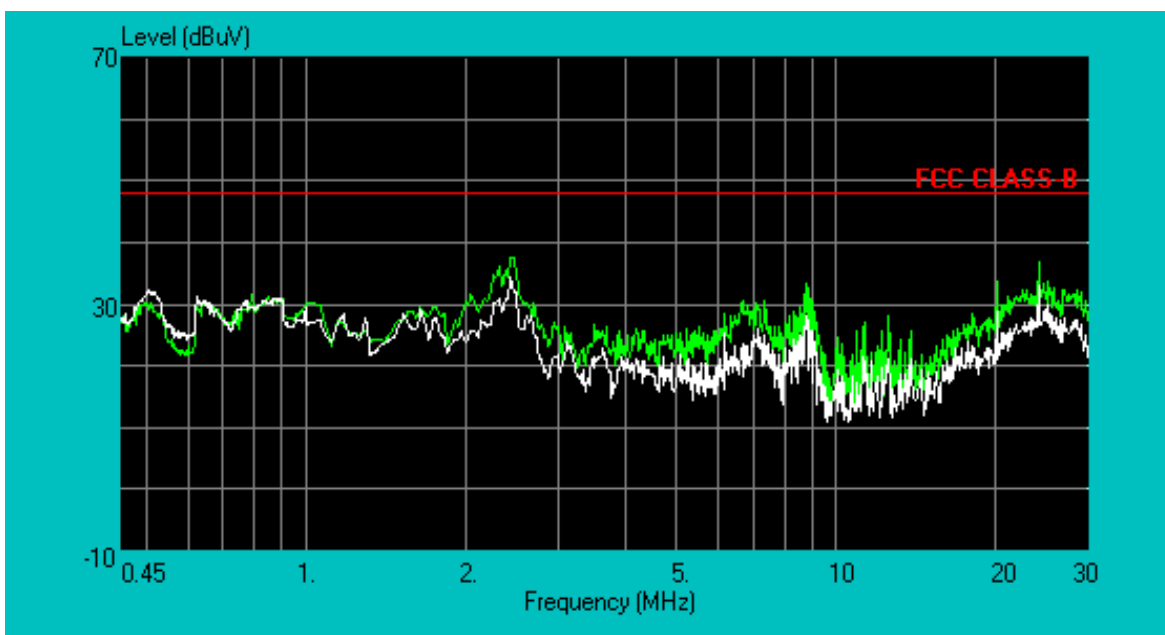


### **Test Procedure**

1. The EUT was placed on a wooden table 40 cm from a vertical ground plane and approximately 80 cm above the horizontal ground plane on the floor. The EUT was set to transmit in a normal hopping mode.
2. Line conducted data was recorded for both NEUTRAL and HOT lines.

### **Test Results**

Refer to attached graph.



```

Project No.      : 00U0131-2
Report No.      : 000405LC
Test Engr       : KERWIN CORPUZ
Company         : PROXIM
EUT             : SYMPHONY-HRF CORDLESS GATEWAY
Model          : 4930
Test Configuration: EUT
Type of Test    : FCC CLASS B
    
```

**Peak Mode: L1 (Green), L2 (White)**  
**Voltage Used: 115Vac, 60 Hz**  
**Eut mode: Frequency hopping Transmit**

**Final Conducted Emission Test:**

Conducted Room	Plot No. 00u0131-2	Date 4/5/00	Tested By: Kerwin Corupuz
----------------	-----------------------	----------------	------------------------------

**Six Highest Conducted Emission Readings**

Freq. (MHz)	Meter Reading (dBuV)	C.F. (dB)	Corrected Reading (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Reading Type (P/Q/A)	Line (L1/L2)
2.43	37.5	0	37.5	48	-10.5	P	L1
20.05	33.8	0	33.8	48	-14.2	P	L1
24.01	36.82	0	36.82	48	-11.18	P	L1
2.43	34.24	0	34.24	48	-13.76	P	L2
20.05	28.72	0	28.72	48	-19.28	P	L2
24.01	33.08	0	33.08	48	-14.92	P	L2

COMMENTS: 115Vac, 60Hz

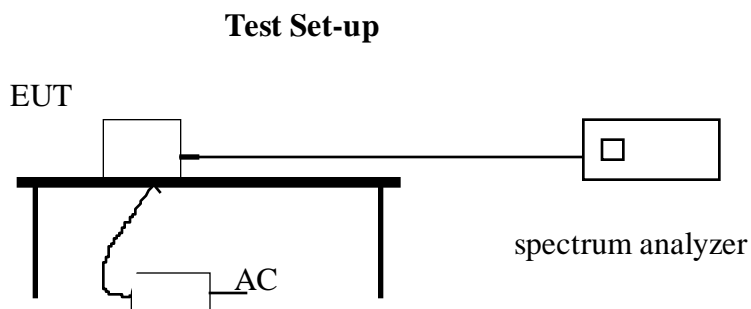


## Conducted Emission

Test Requirement: 15.247(c); "Out of Band Measurements"

### Measurement Equipment Used:

HP 8566B Spectrum Analyzer



### Test Procedure:

To do conducted measurements the connection to the integral antenna was unsoldered and a direct connection was made to a 50 ohm test port where a coax cable was attached.

The EUT is configured on a test bench as shown above. The EUT's hopping function is stopped, transmission is continuous at the Low Channel (2.402 GHz). Spectrum analyzer CENTER FREQUENCY set to 2402 MHz. Used a Resolution BW: 100 kHz and Video BW: 100 kHz to measure conducted emissions. Set the spectrum analyzer to START: 30 MHz and STOP: 2.5 GHz for the first scan. The second scan was set to START: 2.5 GHz and STOP: 22 GHz. All emissions were compared to the 20-dB attenuation requirement.

While the transmitter broadcasts a steady stream of digital data, the analyzer MAX HOLD function is used to capture the emissions.

Repeated for Mid Channel (2.440 GHz) and High Channel (2.479 GHz)

### Test Result:

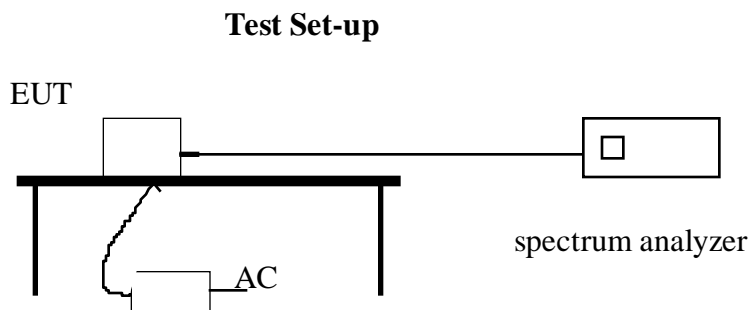
Please refer to attach plot# 1, 2, 3, 4, 5, 6

**Minimum 20dB Bandwidth for FHSS**

Test Requirement: 15.247(a)1(ii)

**Measurement Equipment Used:**

HP 8566B Spectrum Analyzer



**Test Procedure:**

To do conducted measurements the connection to the integral antenna was unsoldered and a direct connection was made to a 50 ohm test port where a coax cable was attached.

The EUT is configured on a test bench as shown above. The EUT'S hopping function is stopped, transmission is continuous at the Low Channel (2.402 GHz). Spectrum analyzer CENTER FREQUENCY set to 2402 MHz. SPAN set to 2 MHz. Used a Resolution BW: 30 kHz and Video BW: 30 kHz to measure the 20-dB bandwidth.

While the transmitter broadcasts a steady stream of digital data, the analyzer MAX HOLD function is used to capture the envelope of the transmission occupied bandwidth. Used DISPLAY and DELTA MARKER functions to measure the 20-dB Bandwidth.

Repeated for Mid Channel (2.440 GHz) and High Channel (2.479GHz)

**Test Results:** Refer to attached spectrum analyzer plot# 7, 8, 9.

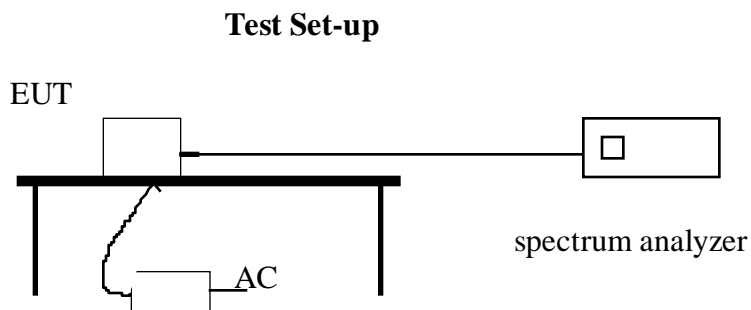
Frequency	Measured	Limit	Result
2.40178 GHz	<b>870kHz</b>	<b>&lt;1000kHz</b>	<b>PASSED</b>
2.43985 GHz	<b>844kHz</b>	<b>&lt;1000kHz</b>	<b>PASSED</b>
2.47980 GHz	<b>842kHz</b>	<b>&lt;1000kHz</b>	<b>PASSED</b>

**RF Power Output**

Test Requirement: 15.247(b)(1)

**Measurement Equipment Used:**

HP 8566B Spectrum Analyzer



**Test Procedure**

To do conducted measurements the connection to the integral antenna was unsoldered and a direct connection was made to a 50 ohm test port where a coax cable was attached.

The EUT is configured on a test bench as shown above. The EUT's hopping function is stopped, transmission is continuous at the Low Channel (2402MHz). Spectrum analyzer CENTER FREQUENCY set to Low Channel (2402 MHz). SPAN set to 5 MHz. RES BW=3 MHz, VID BW = 3 MHz. Repeated above steps for MID Channel (2440 MHz) and HIGH Channel (2479 MHz).

CHANNEL	Watts	dBm	LIMIT
2402 MHz	<b>.087</b>	<b>19.4</b>	<b>30</b>
2440 MHz	<b>.107</b>	<b>20.3</b>	<b>30</b>
2480 MHz	<b>.109</b>	<b>20.4</b>	<b>30</b>

**Test Results:**

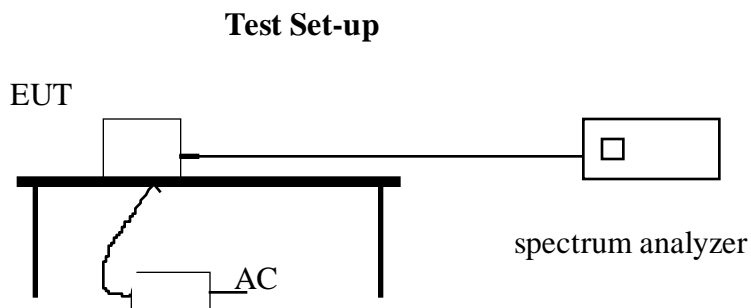
Refer to attached spectrum plot# 10, 11, 12

**Minimum Number of Hopping Channel**

Test Requirement: 15.247(a)1(ii)

**Measurement Equipment Used:**

HP 8566B Spectrum Analyzer



**Test Procedure:**

1. To do conducted measurements the connection to the integral antenna was unsoldered and a direct connection was made to a 50 ohm test port where a coax cable was attached.
2. Turn on the transmitter in normal hopping mode. The emissions will “paint” the spectrum analyzer screen with individual traces from each transmit channel. Allow the transmitter to run for at least 3 minutes or until there are no more changes to the display.
3. Count the number of individual channel traces and compare to the design goal.

**Test Results:**

Frequency Range	Number of Hopping Channel	Limit
2.40000-2.48350 GHz	<b>75</b>	<b>≥ 75</b>

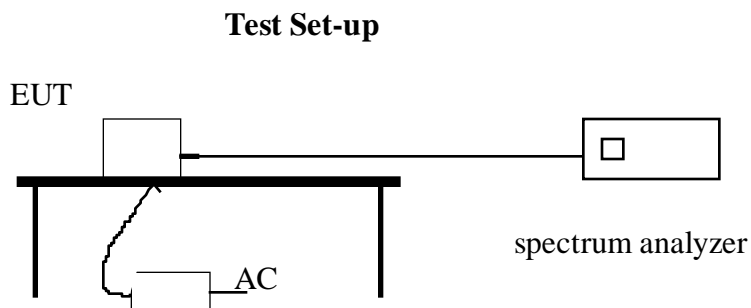
Please refer to attached spectrum plot# 13.

### **Hop Channel Separation**

Test Requirement : 15.247(a)(1)

#### **Measurement Equipment Used:**

HP 8566B Spectrum Analyzer



#### **Test Procedure:**

To do conducted measurements the connection to the integral antenna was unsoldered and a direct connection was made to a 50 ohm test port where a coax cable was attached.

Turn on the transmitter in normal hopping mode. The emissions will “paint” the spectrum analyzer screen with individual traces from each transmit channel. Allow the transmitter to run for at least 3 minutes or until there are no more changes to the display. Move MARKER to the channel, which appears to have widest Channel separation and calculate the DELTA between two markers.

#### **Test Result :**

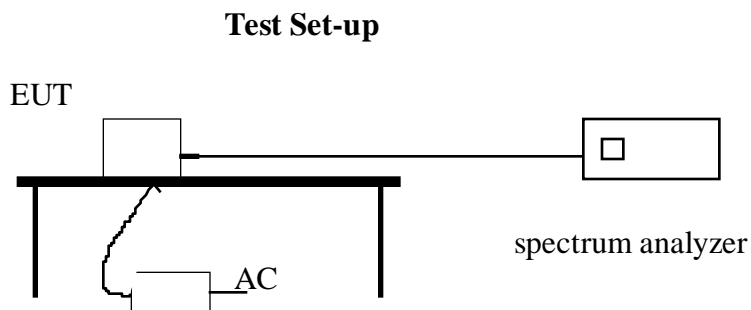
Please refer to attach spectrum plot# 14.

### **Average Time of Channel Occupancy**

Test Requirement: 15.247(a)1(ii)

#### **Measurement Equipment Used:**

HP 8566B Spectrum Analyzer



#### **Test Procedure:**

To do conducted measurements the connection to the integral antenna was unsoldered and a direct connection was made to a 50 ohm test port where a coax cable was attached.

Set the transmitter to operate in its normal frequency hopping mode.

Set the spectrum analyzer Center Frequency to a hopping channel at 2.45 GHz. Set the Sweep Time to 30 seconds. Set Trace to Max Hold. Set the Amplitude function to Linear.

The maximum number of transmissions detected in any 30-second period determines the maximum time of channel occupancy.

The duration of each transmission was measured with RBW=VBW=100kHz. SPAN set to 0 Hz. SWP set to 50.0msec.

#### **Test Results:**

Average time of single channel occupancy: 0.00545 seconds (plot# 16)

Average number of channels within a 30 seconds period: 41 channel (plot# 15)

$41 \times 0.00545 = 0.22345 \text{ second} < 0.4 \text{ second (limit)}$

Please refer to attached spectrum plot# 15, 16

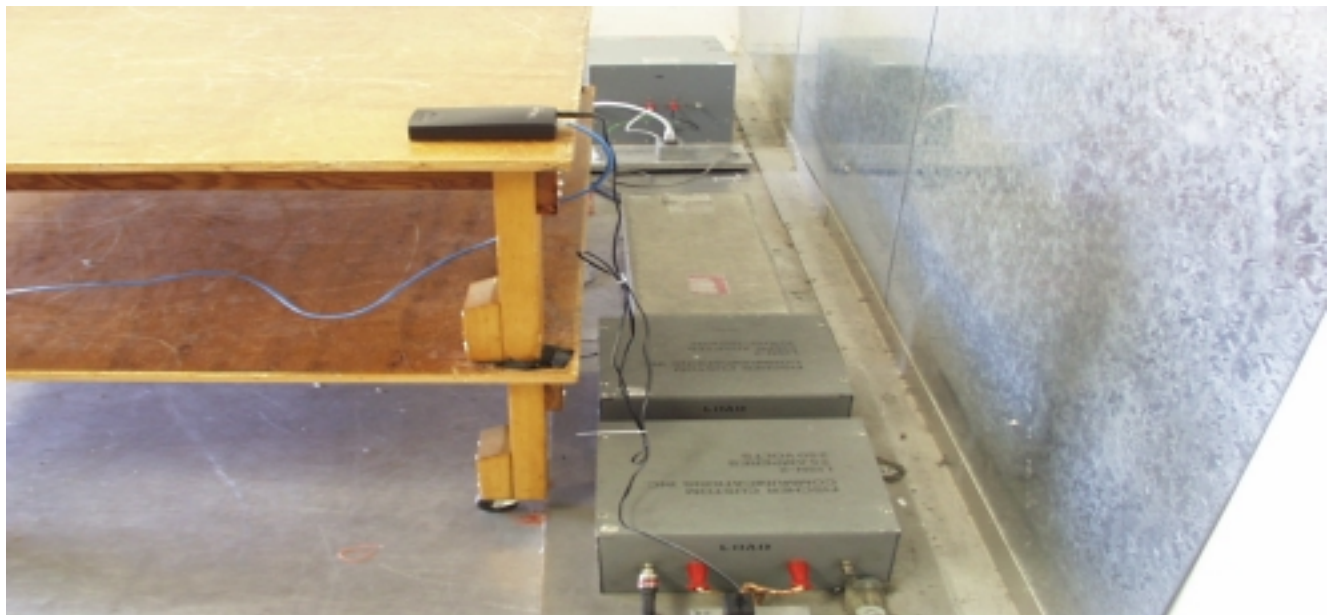


**14. TEST SETUP PHOTOS:**

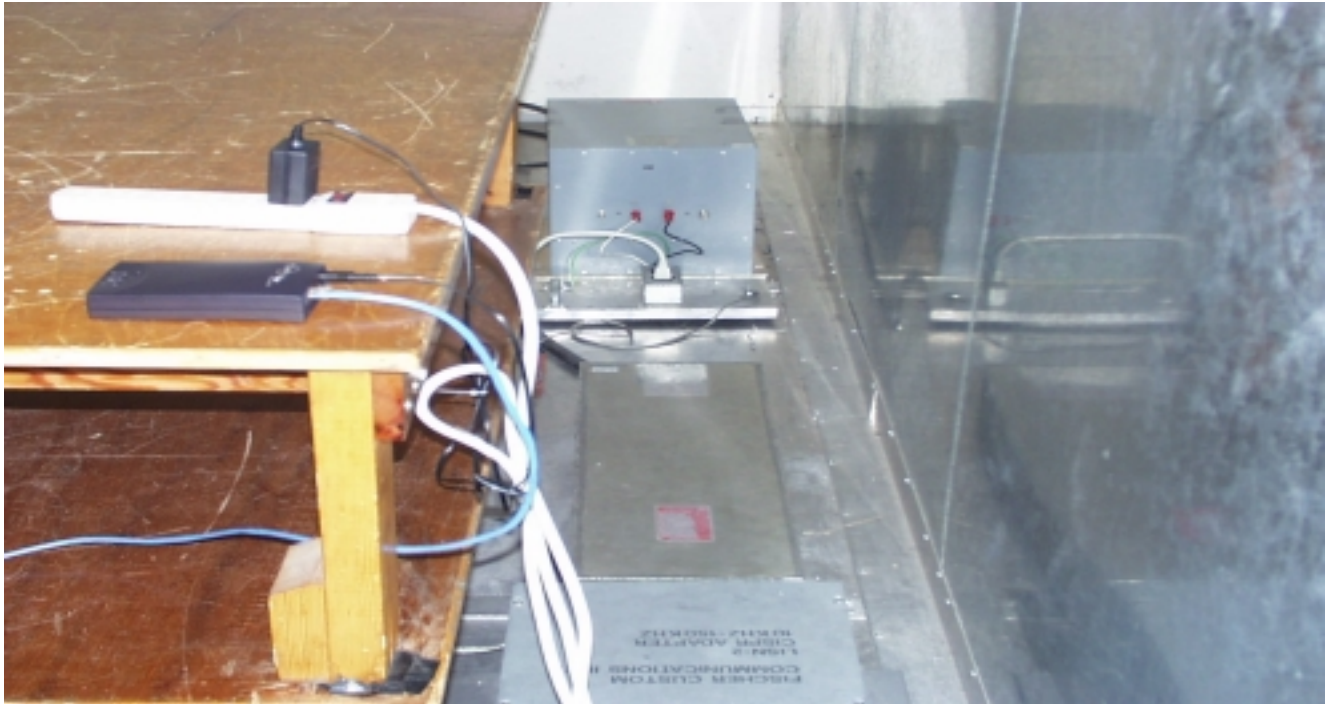


**15.109 Radiated Setup**





**15.207 AC Conducted Emissions (Configuration# 1)**



**15.207 AC conducted emission (Configuration# 2)**



**15.247 Conducted Emissions Test-Setup**



**15.205 Radiated Emission Above 1GHz test setup**

## ATTACHMENT# 1: EUT PHOTOGRAPHS



**PHOTO# 1**



**PHOTO# 2**

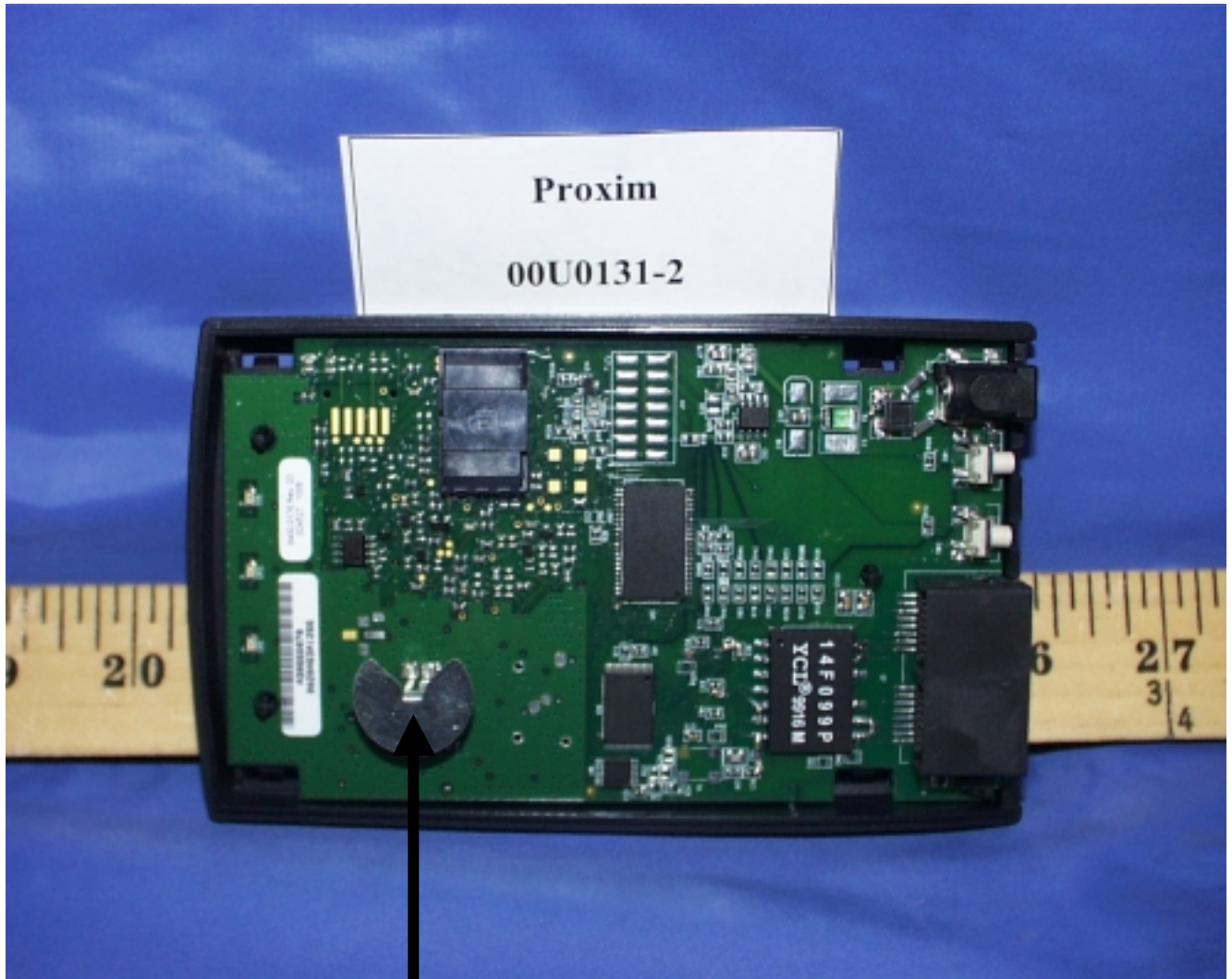


**PHOTO# 3**



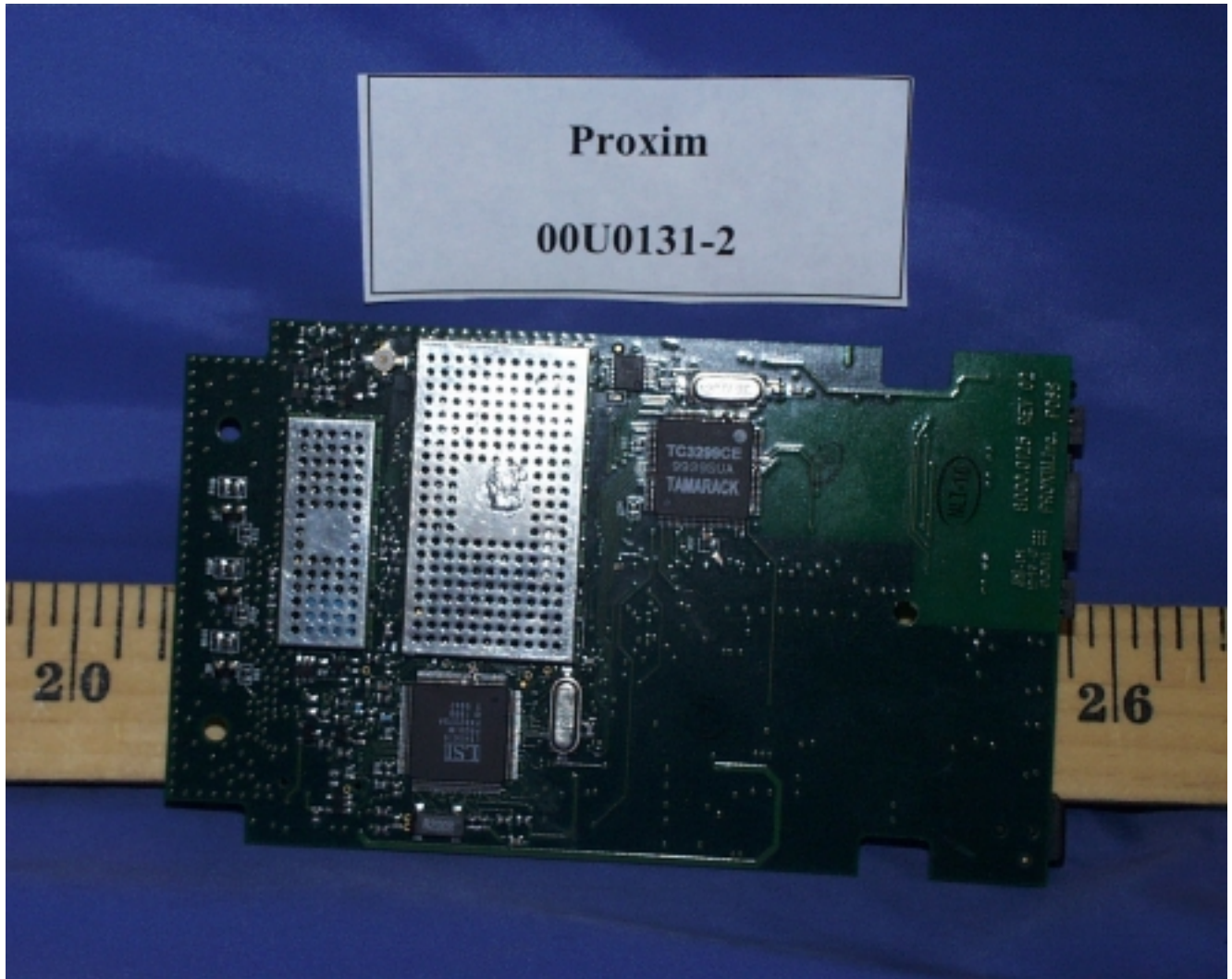
**PHOTO# 4**





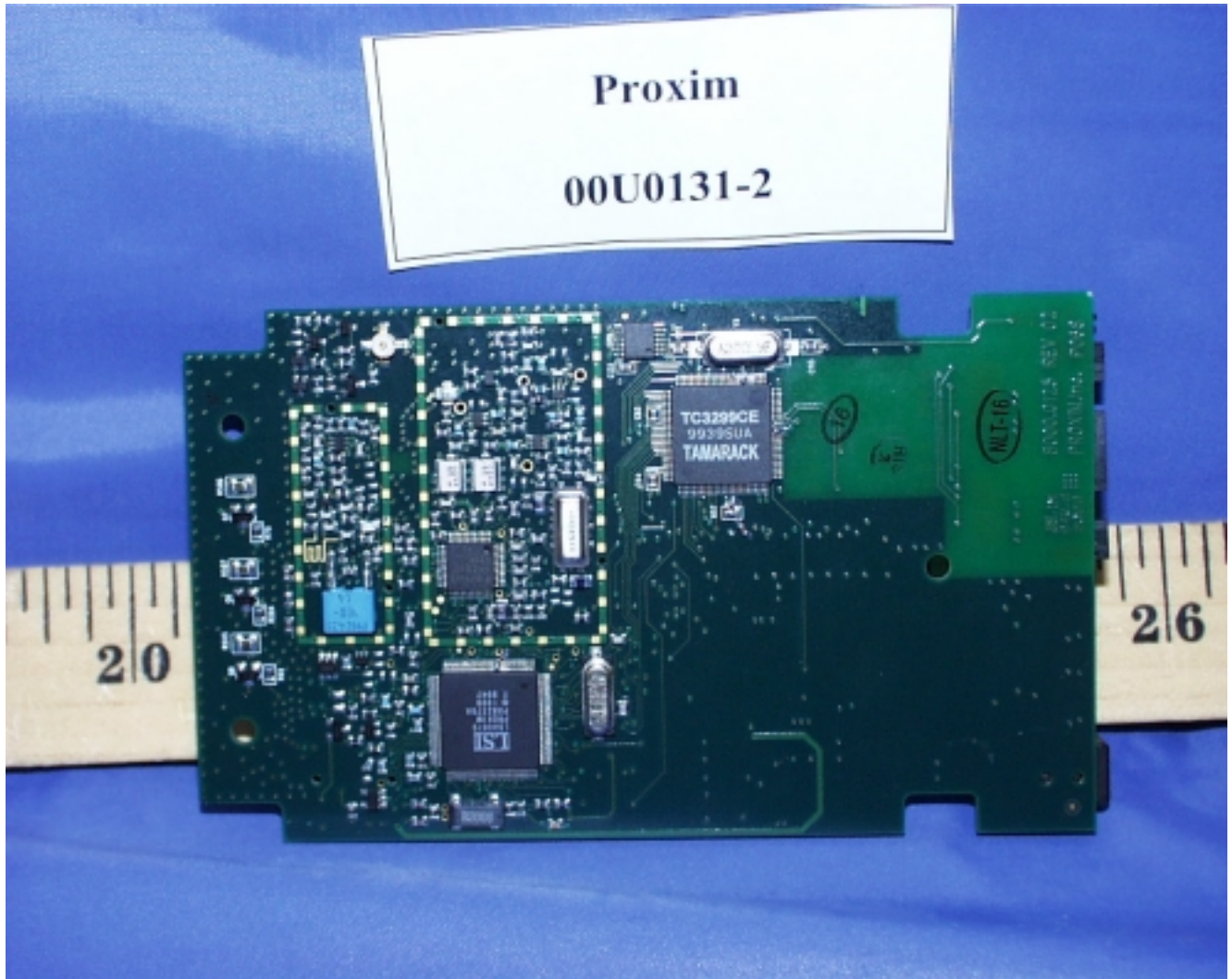
**PHOTO# 5**

**0 dBi permanently attach antenna**



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## **ATTACHMENT# 2: PROPOSED FCC ID LABEL FORMAT**

## ATTACHMENT# 3: AGENT AUTHORIZATION LETTER

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## **ATTACHMENT# 4: SYMPHONY-HOME RF CORDLESS GATEWAY TECHNICAL DESCRIPTION**

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**PROXIM CONFIDENTIAL**

**C:\WINDOWS\TEMP\bridgetechdescr.doc 14:07 04/21/00**

**Symphony-HRF Cordless Gateway Technical Description**

**PRODUCT:**

The product is a FHSS WLAN adapter operating in the 2.4-2.4835GHz band with a nominal TX output power of 100mW. It is a small desktop box with associated wall plug mounted 5V switching DC power supply, integral antenna inside the plastic enclosure and 10 base T port for connection to standard wired LAN. The nominal gain of the integral antenna is 0dBi. Refer to the manual for MPE statement. This device can either stand alone connected to a RJ-45 LAN hub port, or be connected to the RJ-45 port of a computing device.

**USER CONNECTIONS:**

There are two RJ-45 connectors supplied for the single 10 baseT port, only one is used at a time. One connection is a straight through connection, the other for configurations requiring a null connection where TX and RX pairs are reversed. The contacts of the two RJ-45 connectors are connected in parallel to the same physical 10 base T port inside the device. The green LED lights to indicate a successful connection to the LAN when the appropriate port is used.

The 5VDC power is connected via a 2.5mm coaxial power connector.

**TEST CONNECTION:**

There is a -20dB nominal 50 ohm test connection port on the PCA internal to the unit which **is not user accessible**, but which may be used to make conducted measurements on the output of the transmitter for certification purposes. For calibrated amplitude measurements during certification it is recommended that the integral antenna be temporarily disconnected by removing a jumper on the PCA. In order to provide a 50 ohm load without the integral antenna connected it is necessary to temporarily remove the series and shunt resistors which make up the -20dB nominal tap and replace them with a single 0 ohm jumper resistor at the series location intended for the 470 ohm (471) resistor.

**ACCESSORIES:**

Proxim P/N [4000.0025 Model](#) ADP-5DB wall mounted switching power supply, 100-120V/50-60Hz input, 5V 1A nominal output.

Proxim P/N [6001.0124](#) unshielded twisted pair RJ-45 cable assembly

**INTERNAL CLOCK AND RF OSCILLATOR FREQUENCIES:**

Ethernet controller	20MHz
processor ASIC	24, 4MHz, 32.768kHz

synthesizer	reference 4MHz
	TX frequency 1201-1240MHz, 500kHz steps
	RX frequency 1145.75-1184.75MHz, 500kHz steps
transmit LO, transmit and receive range	2402-2480MHz, 1MHz steps
receive LO	2291.5-2369.5MHz, 1MHz steps
receive IF	110.5MHz, 1MHz BW

**SIGNAL FLOW:**

The memory and Ethernet controller communicate with the processor ASIC which also contain the baseband radio functions, A/D and D/A conversions, transceiver control functions and memory interface.

The Ethernet controller and processor ASIC each support their own on board clock oscillators at 20 and 24MHz respectively.

The synthesizer tunes from 1201 to 1240MHz in 500kHz steps in transmit. It uses an external VCO and external loop and modulation filters, but the rest is part of an integrated 2.4GHz transceiver IC. The reference for the synthesizer is a 4 MHz ASIC output derived from the ASIC's 24MHz clock. The VCO is directly FM modulated with a mix of BFSK/QFSK with -20dB BW of <1MHz at a symbol rate of 800kb/s for a data rate of 0.8/1.6Mb/s. The transceiver IC doubles the modulated external VCO and feeds the integral antenna in through a bandpass filter, power amplifier, transmit/receive switch and lowpass filter.

The synthesizer tunes from 1145.75 to 1184.75MHz in 500kHz steps in receive. The RX path is from the antenna through the LPF and transmit /receive switch shared with the transmitter. It is a half duplex system. From the switch the receive signal is amplified in an LNA, and passes through an image reject filter to the transceiver IC where it is mixed down to the IF by the receive LO which is generated inside the transceiver IC by doubling the buffered VCO output. The IF output of the mixer goes off chip for bandpass filtering, back on for additional amplification, off again for more filtering and then back on chip for limiting and FM quadrature demodulation. The demodulated signal is amplified and filtered at baseband before being converted to a bit stream in the ASIC.

The VCO and buffer reside under one shield, the balance of the RF is under the other shield. RF filtering is distributed at each stage with final TX filtering between the transmit/receive switch and the antenna.



## ATTACHMENT# 5: USER'S GUIDE

## **ATTACHMENT# 6: CONFIDENTIALITY REQUEST LETTER**

CONFIDENTIALITY PACKAGE CONTAINS:

SYMPHONY- HRF Cordless Gateway, Schematic

SYMPHONY- HRF Cordless Gateway, Block Diagram

SYMPHONY- Home RF Frequency Hopping Theory of Operation

Maximum Duty Cycle Analysis for Symphony-HRF Cordless Gateway