EMISSION TEST REPORT

Test Report No. : 18D0045-02-1
MELCO INC. Model: WLI-PCM-US
FCC Part 15 Subpart C

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2. This test report does not constitute an endorsement by NIST/NVLAP or U.S. Government.

3. This equipment is in compliance with above regulation. We hereby certify that the data are contain a true representation of the emission profile.

4. The results in this report apply only to the sample tested.

5. This test report clearly shows that Wireless LAN, WLI-PCM-US is in compliance with FCC Part 15 Subpart C.

Date of test: May 20, 24 and 26, 1999 **Issued date:** June 1, 1999

Tested by: Naoki Sakamoto
EMC section

Approved by: R. Hashimoto
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Group Leader of EMC section

Form Version No. 1

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Test Data **A1 – A39**

1 GENERAL INFORMATION

APPLICANT	: MELCO INC.
ADDRESS	: 4-15, Shibata-Hondori, Minami-ku, Nagoya 457-8520 Japan Tel: +81-52-619-1264 Fax: +81-52-619-1265
REGULATION(S)	: FCC Part 15 Subpart C
COMPANY BRAND NAME	: BUFFALO
MODEL NUMBER	: WLI-PCM-US
SERIAL NUMBER	: -
KIND OF EQUIPMENT	: Wireless LAN
TESTED DATE	: May 20, 24 and 26, 1999
RECEIPT DATE OF SAMPLE	: May 2, 1999
TEST REPORT NUMBER	: 18D0045-02-1
TEST SITE	: A-PEX Yokowa NO.2 Open Test Site

1.1 Tested Methodology

Both conducted and radiated testing were performed according to the procedures in FCC/ANSI C63.4 (1992).
Radiated testing was performed at a distance of 3 meters from the antenna to EUT .

1.2 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 108, Yokowa-cho, Ise-shi, Mie-ken, 516-1106 Japan.
This site has been fully described in a report dated May 27, 1997 submitted to FCC office, and listed on August 18, 1997 (31040/SIT 1300F2).

2 PRODUCT DISCRIPTION

MELCO INC., Model WLI-PCM-US (referred to as the EUT in this report) is a Wireless LAN.
Clock frequency : 8MHz, 20MHz and 32.768MHz
Carrier Frequency Range : 2.412 - 2.462 GHz (5MHz step. 11 channels)
Rated RF Power Output : 3mW
Emission designator : Direct Sequence Spread Spectrum

2.1 Tested System Details

The FCC IDs for all equipment, plus description of all cables used in the tested system are:

Model	FCC ID	Description	Cable description	Backshell Material
(1) MELCO INC. M/N: WLI-PCM-US (EUT)	FDI-04600000-0	Wireless LAN	-	
(2) Digital M/N: P7X	AO9-P7XNOTE	Personal Computer	-	
(3) Digital M/N: FR-PCP 8H-AD S/N : 00187676	N/A	AC Adapter	Unshielded DC Power Cable Unshielded AC Power Cable	P.V.C. P.V.C.

3 TESTED SYSTEM DETAILS

3.1 Justification

The system was configured in typical fashion (as a customer would normally use it) for testing.

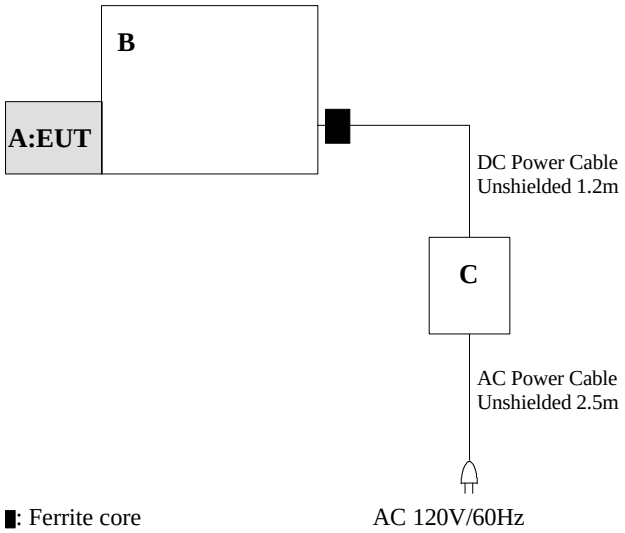
3.2 EUT Exercise Software

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to typical use.

The sequence is used:

Operation: Running (Transmitting)mode
Performed the test about channels 1, 6 and 11 among 11 channels of all carrier frequencies.
According to testing of Process Gain, tested the test about each channel of all 11 ones.

Figure 3.1 Configuration of Tested System



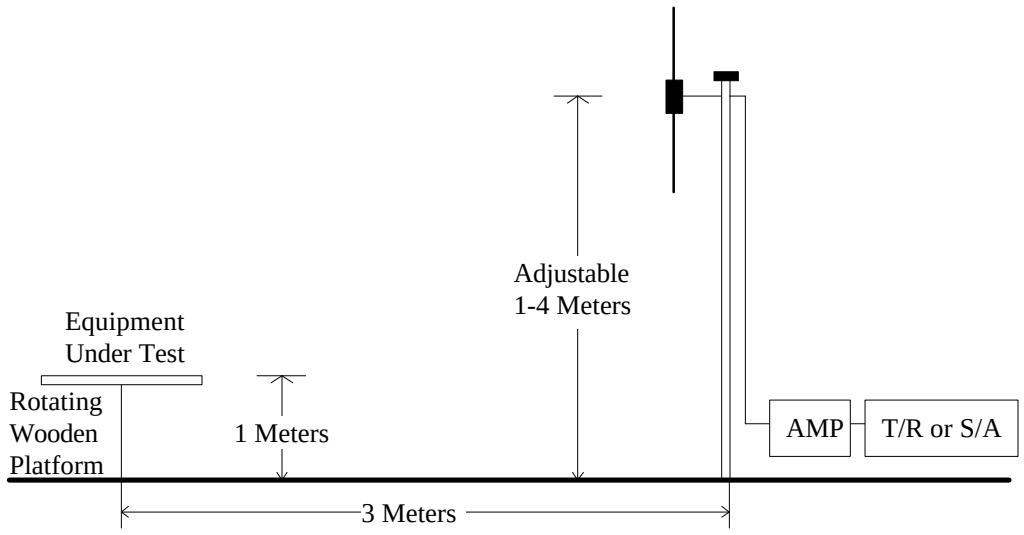
* Cabling was taken into consideration and test data was taken under worst case conditions.

4 METHODS OF MEASUREMENTS

4.1 EUT Configuration - Radiation Signal Levels

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 1m above the conducting ground plane.
EUT was placed in the center of table.
Test was made with the antenna positioned in both the horizontal and vertical planes of polarization.
The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.
The measurement distance was 3m.

4.2 Spurious Radiation Test Site



4.3 Test Items of requirement

EUT was tested the following test items of requirements according to FCC Part 15, Subpart C, Section 15.274.

a) Section 15.274 (a) (2)

For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz.

b) Section 15.274 (b)

The maximum peak output power of the transmitter shall not exceed 1 Watt. If transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

c) Section 15.274 (c)

If any 100 kHz bandwidth outside these frequency bands, the radio frequency power that is produce by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20dB below that in any 100kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in Section 15.209(a), whichever results in the lesser attenuation. All other emissions outside these bands

shall not exceed the general radiated emission limits specified in Section 15.209(a).

d) Section 15.274 (d)

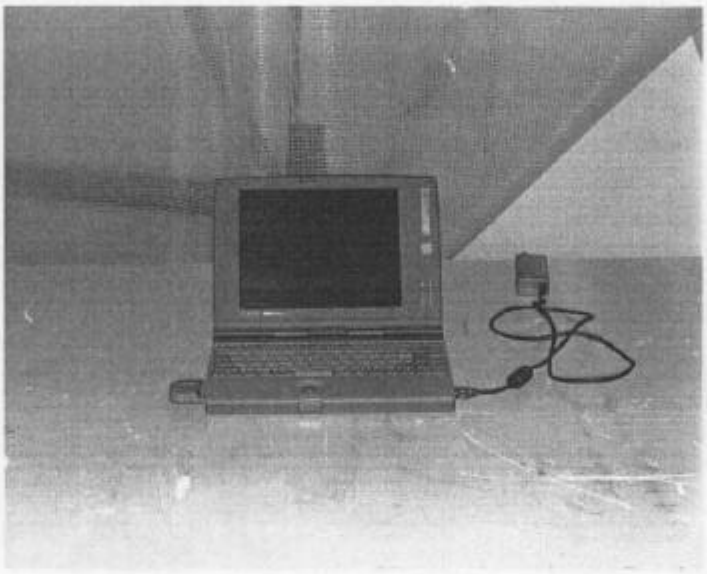
For direct sequence systems, the transmitted power density averaged over any 1 second interval shall not be greater than 8dBm in any 3kHz bandwidth within these bands.

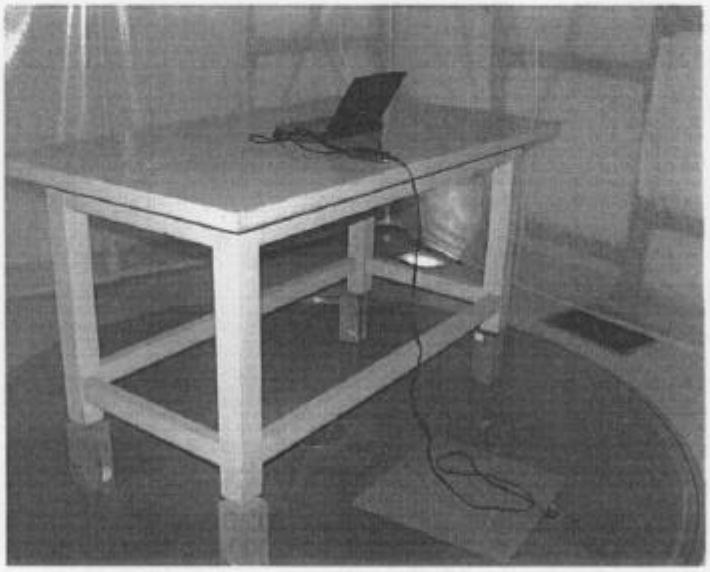
e) Section 15.274 (e)

The processing gain of a direct sequence system shall be at least 10dB. The processing gain shall be determined from the ratio in dB of the signal to noise ratio with the system spreading code turned off to the signal to noise ratio with the system spreading code turned on, as measured at the demodulated output of the receiver.

5 MEASUREMENT PHOTOS

Figure 5.1 Measurement Photos (Radiated Signal Levels)





6 TEST METHODS AND RESULTS

6.1 Section 15.274 (a) (2)

For WLI-PCM-US direct sequence system the minimum 6dB bandwidth < 500kHz.

Summary of the test result : Pass
Data of test : See Appendix (1 - 6)

6.2 Section 15.274 (b)

The maximum peak output power of WLI-PCM-US < 1Watt.

	S/A Reading		Cable Loss	Result (50 ohms)	Limits
CHNL-ID 1:	6.42dBm	+	2.3dB	= 7.46mW	< 1Watt
CHNL-ID 6:	5.00dBm	+	2.3dB	= 5.38mW	< 1Watt
CHNL-ID 11:	3.58dBm	+	2.3dB	= 2.28mW	< 1Watt

Summary of the test result : Pass
Data of test : See Appendix (7 - 9)

6.3 Section 15.274 (c)

For WLI-PCM-US direct spread system;
The frequencies produced by the modulation products of the spreading sequence were measured.
Radiated spurious emissions outside the upper band edge are attenuated by more than 20dB.

Summary of the test result : Pass
Data of test : See Appendix (10 - 15)

Radiated Signal measurements (Reference Part 15, Subpart C Section 15.209)
The initial step in collecting radiated data was a spectrum analyzer peak scan of the measurement range (30MHz-24.62GHz).
The final data was reported in the worst-case emissions.
The minimum margin to the limit is as follows :

* 30MHz - 1000MHz (Quasi-Peak detect)
  CHNL-ID 6: Transmitter Frequency 2437MHz type

Frequency (MHz)	Receiver Reading (dBuV)	Correction Factor (dBuV)	Field Strength (dBuV/m)	Limit (dBuV/m)	Margin (dBuV)
132.00	45.8	-5.8	40.0	43.5	3.5

* 1000MHz - 24.62GHz (Peak Detect)
  CHNL-ID 1 and 6: Transmitter Frequency 2412MHz and 2437MHz

Frequency (MHz)	Receiver Reading (dBuV)	Correction Factor (dBuV)	Field Strength (dBuV/m)	Limit (dBuV/m)	Margin (dBuV)
CHNL-ID 1:					
2132	54.0	-1.0	53.0	54.0	1.0
CHNL-ID 6:					
2157	54.0	-1.0	53.0	54.0	1.0

6.3.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, Cable Factor and Antenna Pad, and subtracting the Amplifier Gain from the measured reading. The sample calculation is as follows :

*** 30MHz - 1000MHz : CHNL-ID 6**
FS = RA + AF + CF + AT - AG

where FS = Field Strength
RA = Receiver Reading
AF = Antenna Factor
CF = Cable Factor
AT = Antenna Pad
AG = Amplifier Gain

Assume a receiver reading of 45.8 dBuV is obtained. The antenna Factor of 14.4 dB, Cable Factor of 3.5 dB is added The Antenna Pad of 6.0 dB and Amplifier Gain of 29.7 dB is subtracted, giving a field strength of 40.0 dBuV/m.

FS = 45.8 + 14.4 + 3.5 + 6.0 - 29.7 = 40.0 dBuV/m

*** 1000MHz - 24.62GHz : CHNL-ID1 and 6**
FS = RA + AF + CF - AG

where FS = Field Strength
RA = Spectrum Analyzer Reading
AF = Antenna Factor
CF = Cable Factor
AG = Amplifier Gain

Assume a spectrum analyzer reading of 54.0 dBuV is obtained. The antenna Factor of 30.0, the Cable Factor of 4.0 dB is added. The Amplifier Gain of 35.0 dB is subtracted, giving a field strength of 53.0 dBuV/m.

FS = 54.0 + 30.0+ 4.0 – 35.0 = 53.0 dBuV/m

Summary of the test result : Pass
Data of test : See Appendix (16 - 24)

6.4 Section 15.274 (d)

For WLI-PCM-US direct sequence system, the transmitted power density averaged over any 1 second period is less than 8dBm in any 3 kHz bandwidth within these ranges.

	S/A Reading		Cable Loss	Result (50 ohms)	Limits
CHNL-ID 1:	-16.83dBm	+	2.3dB	= -14.53dBm	< 8dBm
CHNL-ID 6:	-18.00dBm	+	2.3dB	= -15.7dBm	< 8dBm
CHNL-ID 11:	- 19.85dBm	+	2.3dB	= -17.55dBm	< 8dBm

Summary of the test result : Pass
Data of test : See Appendix (25 - 27)

6.5 Section 15.274 (e)

Interference Immunity:
This section includes interference immunity data taken empirically. The Harris PCMCIA radio design was used. This radio is an implementation of the basic waveform proposed by Harris. No architectural enhancements have been tested. Three tests were used to test interference immunity.

A. A CW interference using the FCC CW test suggested for DS processing gain.
B. An FH (802.11) waveform jammer.
C. Broadband noise.

(1) Interference using the FCC CW processing gain test
One of the interference immunity tests is the CW test recommended by the FCC for processing gain.

* Test procedure
Obtain the simplex link as shown on the test configuration figure. Perform all independent instrumentation calibrations prior to this procedure. Set operating power levels using fixed and variable attenuators in system to meet the following objectives:

1. Signal Power at receiver approximately -60 dBm (above thermal sensitivity such that thermal noise does not cause bit errors).
2. Signal Power at power meter between -20 and -40 dBm for optimal linearity.
3. Use spectrum analyzer to monitor test.
4. Ensure that CW Jammer generator RF output is disabled and measure the power at the power meter port using the power meter. This is the relative signal power, S_r.
5. Disable Transmitter, and enable CW Jammer generator RF output. Set reference CW Jammer power level at power meter port 8.6dB below S_r (minimum J/S, or 10dB processing gain reference level), set frequency to signal carrier frequency. Note the power level setting on the generator, this is the reference CW Jammer power setting, J_r.
6. Disable CW Jammer, re-establish link. BER test set should be operating error-free.
7. Enable CW Jammer at a low power level and gradually increase the CW Jammer power until the BER test set indicates the reference BER level ($1x10^{-5}$). Note nominal Jammer power setting, J_n.

This test is repeated for a fixed signal carrier frequency and for uniform steps in frequency increments of 50 kHz across the receiver passband with the CW Jammer. In this case the receiver passband is ±8.5MHz.
The procedure can be illustrated as follows:

For offset frequency - 8.5MHz to carrier frequency + 8.5MHz, Step 50 kHz.
Do:
Adjust Nominal Jammer Level setting.
Until:
Average BER is equal to reference BER.
Record indicated Nominal Jammer Level setting.
Next offset frequency.

The nominal Jammer Level settings are tabulated versus offset frequency. The J/S ratio and the processing gain are then calculated as follows:

$$(J/S) = -[(S_r - J_n) - (S_r - 8.6dB - J_r)]$$

If $J_n = J_r$ then:

$$(J/S) = -[\ 8.6dB\ ]$$

is the J/S ratio associated with 10dB processing gain.

The processing gain then is determined using the J/S ratio:

Summary of the test result : Pass
Data of test : See Appendix (28 - 39)

7 MESUREMENT UNCERTAINTY

7.1 Radiated Emission Test

The measurement uncertainty (with a 95% confidence level) for this test was ±3.3dB.

Yes The data listed in this test report may exceed the test limit because it does not have enough margin (more than 3.3dB).

No The data listed in this test report has enough margin, more than 3.3dB.

8 TEST EQUIPMENT USED

	INSTRUMENTS	Mfr.	MODEL	C/N	Calibrated Until
+	Pre Amplifier	Hewlett Packard	8447D	AF1	June 10, 1999
+	Pre Amplifier	Hewlett Packard	8449B	AF4	January 31, 2000
	Biconical Antenna	Schwarzbeck	BBA9106	BA2	July 6, 1999
+	Biconical Antenna	Schwarzbeck	BBA9106	BA5	July 6, 1999
	Logperiodic Antenna	Schwarzbeck	UHALP9108A	LA5	July 6, 1999
+	Logperiodic Antenna	Schwarzbeck	UHALP9108A	LA6	February 14, 2000
+	Horn Antenna	AH System, Inc	SAS-200/571	HA1	February 5, 2000
+	PYRAMIDAL Horn Antenna	EMCO	3160-09	APANT14	July 30, 1999
+	Spectrum Analyzer	Hewlett Packard	8567A	SA2	November 30, 1999
+	Spectrum Analyzer	Hewlett Packard	8567A	SA4	June 12, 1999
+	Spectrum Analyzer	Advantest	R3271	SA5	May 16, 2000
	Test Receiver	Rohde & Schwarz	ESVS-30	TR2	July 5, 1999
	Test Receiver	Rohde & Schwarz	ESHS-30	TR3	July 14, 1999
+	Test Receiver	Rohde & Schwarz	ESVS-10	TR4	July 14, 1999
+	Power Meter	Anritsu	ML4803A	PM1	February 4, 2000
+	Power Sensor	Anritsu	MA4601A	PS1	February 4, 2000
+	Signal Generator	Hewlett Packard	E4432B	SG1	July 30, 1999
+	Spectrum Analyzer	Anritsu	MS2602A	SA6	March 7, 2000
+	Ber Analyzer	Anritsu	MD6420A	BAN1	June 18, 1999

\+ indicates EMI Test Equipment used.

*All measurement equipment is traceable to national standard.

APPENDIX

Test Data

1: 15.274 (a)(2)	: A1 – A6
2: 15.274 (b)	: A7 – A9
3: 15.274 (c)	: A10 – A24
4: 15.274 (d)	: A25 – A27
5: 15.274 (e)	: A28 – A39