

FCC PART 15.247 REPORT

On Model: FPCWL01

Prepared for Fujitsu PC Corp.

According to FCC 15.247 Requirements

FCC ID #: MU7FPCWL01

Test Report #: FUJ-0101-2849-TCB

Prepared by: Paul Chen

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Administrative Data

Manufacturer : Fujitsu PC Corp.
 598 Gibraltar Drive,
 Milpitas, CA 95035
 FCC ID : **MU7FPCWL01**
 Class : Spread Spectrum Transceiver
 Interface Type : PCMCIA
 Frequency Range : 2402 – 2480 MHz
 Method : Frequency Hopping Spread Spectrum
 Model Name(s) : FPCWL01
 Part Number : N/A
 Max RF Output (W) : 0.097 Watts
 Power Supply : 3.3VDC, Through Host PC PCMCIA Port
 CFR Part(s) : CFR15.247
 Date(s) of Tests : January 28 - February 10, 2001
 Report Number : FUJ-0101-2849-TCB

EUT Description

The subject Model: FPCWL01 (refer to EUT in this test report) is a PCMCIA Card operating on the 2.402GHz – 2.480GHz band using Bluetooth technology. The EUT is a PC Card which inserting it into a computer with a PCMCIA slot. The EUT has an integral antenna and no external connections or controls. The EUT is control by the software drivers, which delivered with the EUT.

Test Summary

Test Summary (CFR 15.247)			
Specifications	Requirement	Results	Note
CFR15.203	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may designed the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.	Complied	Attachment C
CFR15.247(a)(i)	Frequency hopping systems operating in the 902 - 928 MHz band shall use at least 50 hopping frequencies. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.	Complied	Attachment D & F
CFR15.247(a)(ii)	Frequency hopping systems operating in the 2400 – 2483.5 MHz and the 5725 – 5850 MHz bands shall use at least 75 hopping frequencies. The maximum allowed 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.	Complied	Attachment A, D & F
CFR15.247(b)(1)	For frequency hopping systems operating in the 2400-2483.5 MHz or 5725-5850 MHz band and for all direct sequence systems: 1 watt.	Complied	Attachment G
CFR15.247(b)(4)	Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. Ses 1.1307(b)(1) of this chapter.	N/A	EUT is not a PCS device.
CFR15.247(c)	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, base on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).	Complied	Attachment D & H
CFR15.35(b)	On any frequency or frequencies above 1GHz, unless otherwise stated, the radiated limits shown are based on the use of	Complied	Attachment H

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	measurement instrumentation employing an average detector function. When average radiated emission measurements are specified in the regulations, including emission measurements below 1000MHz, there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated. Unless otherwise specified, measurements above 1000MHz shall be performed using a minimum resolution bandwidth of 1MHz. Measurements of AC power line conducted emissions are performed using a CISPR quasi-peak detector, even for device for which average radiated emission measurements are specified																										
CFR15.209.a	<p>Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:</p> <table><tr><th>Frequency (MHz)</th><th>Field strength (microvolts/meter)</th><th>Measurement distance (meters)</th></tr><tr><td>0.009-0.490.....</td><td>2400/F(kHz)</td><td>300</td></tr><tr><td>0.490-1.705.....</td><td>24000/F(kHz)</td><td>30</td></tr><tr><td>1.705-30.0.....</td><td>30</td><td>30</td></tr><tr><td>30-88.....</td><td>100**</td><td>3</td></tr><tr><td>88-216.....</td><td>150**</td><td>3</td></tr><tr><td>216-960.....</td><td>200**</td><td>3</td></tr><tr><td>Above 960.....</td><td>500</td><td>3</td></tr></table> <p>**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§15.230 and 15.241.</p>	Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	0.009-0.490.....	2400/F(kHz)	300	0.490-1.705.....	24000/F(kHz)	30	1.705-30.0.....	30	30	30-88.....	100**	3	88-216.....	150**	3	216-960.....	200**	3	Above 960.....	500	3	Complied	Attachment I
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)																									
0.009-0.490.....	2400/F(kHz)	300																									
0.490-1.705.....	24000/F(kHz)	30																									
1.705-30.0.....	30	30																									
30-88.....	100**	3																									
88-216.....	150**	3																									
216-960.....	200**	3																									
Above 960.....	500	3																									
CFR15.207(a)	<p>For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequency within the band 450kHz to 30MHz shall not exceed 250 microvolts.</p>	Complied	Attachment J																								
CFR15.31(e)	<p>For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.</p>	Complied	Attachment G																								

Test Location

EMC Compliance Management Group is located at 670 National Ave., Mountain View, CA 94043, USA.

Accreditation Bodies

EMC Compliance Management Group is a fully accredited Test Laboratory.



In compliance with the site registration requirements of Section 2.948 of the FCC Rules to perform EMI measurements for the general public.



Accredited by the National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code # 200068-0.

EUT Exercise Software

The client supplied the Bluetooth Test software. The software was used to exercise during conducted and radiated testing. No other data was transmitted to the EUT during testing.

Equipment Modification

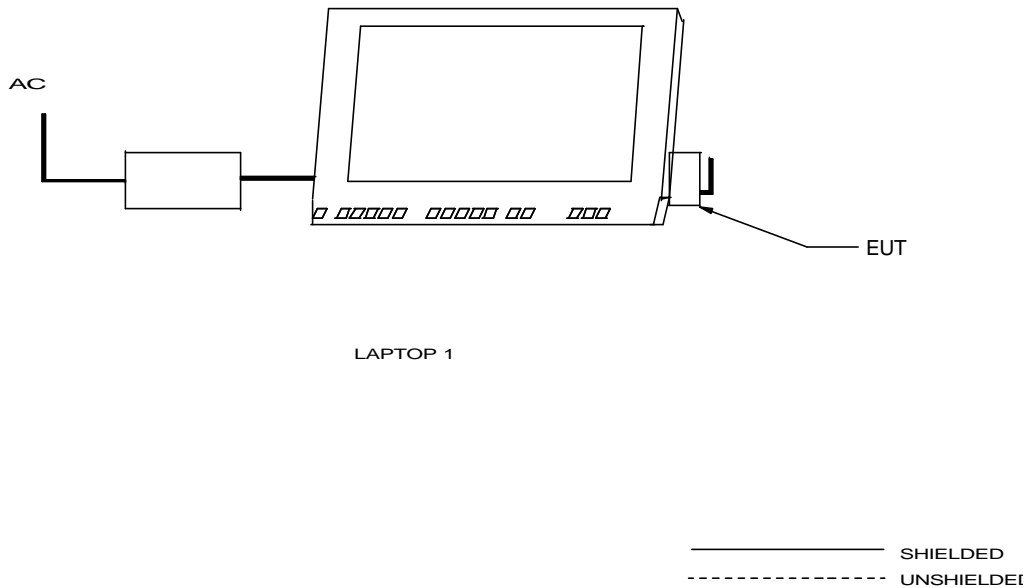
Any modifications installed previous to testing by Fujitsu Personal Systems, Inc. will be incorporated in each production model sold or leased in Europe.

There were no modifications installed by EMC Compliance Management Group.

Test System Details

EUT	
Model Number:	FPCWL01
Description:	Frequency Hopping Spread Spectrum Transceiver
Manufacturer:	Fujitsu PC Corp.
SUPPORT EQUIPMENT	
Model Number:	CP048445-01-DC
Description:	Notebook PC
Manufacturer:	Fujitsu PC Corp.
Model Number:	CA01007-0610
Description:	AC/DC Power Supply
Manufacturer:	Sanken Electric Co., Ltd.

Configuration of Tested System



ATTACHMENT A – PRODUCT INFORMATION

Frequency Range: 2.402GHz – 2.480GHz

of Channels: 79 Channels, see table below and plot 4

Channel Separation: 1.0MHz

Transmitting Method: Pseudo-random Frequency Hopping Spread Spectrum

Transmitting Power: 0.1 Watt (Max.)

Antenna (TX and RX): Retractable mono-pole antenna

Interface: PCMCIA

Power Supply: Through Host PC (AC to DC adapter)

External Connections: None

Channel ID	Frequency (MHz)	Channel ID	Frequency (MHz)	Channel ID	Frequency (MHz)	Channel ID	Frequency (MHz)
1	2402	21	2422	41	2442	61	2462
2	2403	22	2423	42	2443	62	2463
3	2404	23	2424	43	2444	63	2464
4	2405	24	2425	44	2445	64	2465
5	2406	25	2426	45	2446	65	2466
6	2407	26	2427	46	2447	66	2467
7	2408	27	2428	47	2448	67	2468
8	2409	28	2429	48	2449	68	2469
9	2410	29	2430	49	2450	69	2470
10	2411	30	2431	50	2451	70	2471
11	2412	31	2432	51	2452	71	2472
12	2413	32	2433	52	2453	72	2473
13	2414	33	2434	53	2454	73	2474
14	2415	34	2435	54	2455	74	2475
15	2416	35	2436	55	2456	75	2476
16	2417	36	2437	56	2457	76	2477
17	2418	37	2438	57	2458	77	2478
18	2419	38	2439	58	2459	78	2479
19	2420	39	2440	59	2460	79	2480
20	2421	40	2441	60	2461		

Result Table 1. Pseudo-random Frequency List

ATTACHMENT B – CFR15.205 RESTRICTED BAND

Special attention is made for the EUT's harmonic and spurious radiated emission in the restricted bands of operation. The EUT was tested from 150kHz and up to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. Above 1GHz, average measurements was used using RBW 1MHz-VBW 10Hz and linearly polarized horn antennas. In addition, peak measurements were taken to ensure that the peak levels are not more than 20dB above the average limit. All out of band emissions, other than those created by the spreading frequency, data sequence, and the carrier modulation must not exceed the limits show in Table 2 per 150.209.

Frequency (MHz)	Field strength (microvolts/meter)	Measure distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3
**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§15.230 and 15.241.		

ATTACHMENT C – CFR15.203 ANTENNA REQUIREMENT

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the applicant can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with this requirement.

The estimated antenna gain is calculated based on the difference between the conducted power output and radiated power density.

The Fujitsu Personal Systems, Inc. Model: FPCWL01 complies with the requirement of 15.203. The antennas are permanent mounted mono-pole antennas, no user accessible parts.

CHANNEL	FREQUENCY (MHz)	CONDUCTED PEAK POWER OUTPUT (dBm)	RADIATED POWER DENSITY (3m) (dBm/m)	ESTIMATED ANTENNA GAIN (dBi)
1	2401.99	+4.8	-16.8	-12.0
Estimated Antenna Gain (dBi):				-12.0

Result Table 2. Antenna Gain (estimated)

Conclusion: Pass, EUT meet 15.203 requirements. There are no provisions for connection to an external antenna or antenna replacement for users.

Test Result: Estimated Antenna Gain = -12.0

ATTACHMENT D – CFR 15.247(a)(1)(ii) 20dB BANDWIDTH (CONDUCTED)

The maximum allowed 20 dB bandwidth of the hopping channel is 1 MHz in the 2400 – 2483.5 MHz and the 5725 – 5850 MHz bands.

EUT Operating Mode =	Single Frequency
R. Bandwidth =	100 kHz
Video Bandwidth =	100 kHz
Frequency Span =	0.5 MHz
Reference Level =	120 dBuV
Sweep Time =	20 mS
RF Attenuation =	25 dB
External Attenuator =	0 dB

CHANNEL	FREQUENCY (MHz)	6dB Bandwidth (MHz)	Plot #
Low	2401.99	0.325	Plot 1
Mid	2439.99	0.322	Plot 2
High	2479.99	0.326	Plot 3

Result Table 3 - 20dB Bandwidth Measurement Results

Test Result: Pass, EUT meets minimum requirement.

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ATTACHMENT E – CFR 15.247(a)(1) FREQUENCY SEPARATION (CONDUCTED)

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

EUT Operating Mode =	Hopping
R. Bandwidth =	30 kHz
Video Bandwidth =	30 kHz
Frequency Span =	5 MHz
Reference Level =	120 dBuV
Sweep Time =	20 mS
RF Attenuation =	25 dB
External Attenuator =	0 dB



Setup Photo

Test Result: Pass minimum requirement. Frequency separation = 1.03 MHz, see plot 5.

ATTACHMENT F – CFR 15.247(a)(1)(ii) TIME OF OCCUPANCY (CONDUCTED)

The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period in a frequency hopping systems operating in the 2400 – 2483.5 MHz and the 5725 – 5850 MHz bands.

Center Frequency =	2.401.99 MHz
R. Bandwidth =	1 MHz
Video Bandwidth =	1 MHz
Frequency Span =	0 Hz
Reference Level =	120 dBuV
Sweep Time =	400 mS
RF Attenuation =	25 dB
External Attenuator =	0 dB



Occupancy Time Plot

Test Result: Pass minimum requirement. Time of occupancy = 152mS within a 30 second period.

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**ATTACHMENT G – CFR15.247(b) MAXIMUM PEAK OUTPUT POWER
MEASUREMENT (CONDUCTED)**

The maximum peak output power of the transmitter shall not exceed 1 watt (+30 dBm).

R. Bandwidth = 100 kHz
 Video Bandwidth = 100 kHz
 Frequency Span = 1 MHz
 Reference Level = 120 dBuV
 Sweep Time = 20 mS
 RF Attenuation = 25 dB
 External Attenuator = 0 dB

Peak Output Power = Power Meter Reading + Power Sensor Factor + Cable Loss

CHANNEL	CENTER FREQUENCY (MHz)	POWER METER READING (dBm)	POWER SENSOR FACTOR (dB)	Cable Loss (dB)	PEAK OUTPUT POWER (dBm)	Plot #
Low	2401.99	4.8	-0.2	1.3	5.9	6
Mid	2439.99	5.6	-0.2	1.3	6.7	7
High	2479.99	4.5	-0.2	1.3	5.6	8

Result Table 4. Output Power Measurements

CHANNEL	CENTER FREQUENCY (MHz)	POWER METER READING (dBm)	POWER SENSOR FACTOR (dB)	Cable Loss (dB)	PEAK OUTPUT POWER (dBm)	AC Supply to Host
Mid	2439.99	5.6	-0.2	1.3	6.7	102 VAC
Mid	2439.99	5.6	-0.2	1.3	6.7	138 VAC

Result Table 2a. CFR15.31(e) Voltage Variation Output Power
Measurements

Test Result: Pass, EUT meets minimum requirement.

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Setup Photo



Cable supplied by Applicant (Cable Loss Included)

ATTACHMENT H – CFR15.247(c) RADIATED EMISSION MEASUREMENT 1GHz - 25GHz (FUNDAMENTAL AND HARMONICS)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, base on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Operating Channel = Low
 Operation Frequency (OF) = 2402 MHz
 R. Bandwidth = 100 kHz
 Video Bandwidth = 100 kHz
 Test Distance = 3 Meters
 Frequency Range= 2402 to 25000 MHz
 100kHz Out-of-band plot = **Plot 9**

Freq. (MHz)	RAW Reading (dBuV)	Correction Factors (dB/m)	Polar. (V/H)	Detector (Peak/Ave)	Field Strength (dBuV/m)	Margin (dB)	Notes
2401.99	79.81	10.46	H	Peak	90.27	-	OF
2401.99	77.84	10.47	V	Peak	88.31	-	OF
4804.00	29.47	15.96	H	Ave	45.44	-8.56	RB
4804.01	33.56	15.96	V	Ave	49.53	-4.47	RB
7205.99	21.89	23.17	H	Peak	48.13	-22.14	NRB
7206.00	23.38	23.17	V	Peak	46.55	-23.72	NRB
9645.7	<20.00	-	V	Peak	-	-	NRB

Result Table 5. Low Channel Radiated Emission Measurements
(Fundamental & Harmonics)

Legends:

OF = Operating Frequency.

NRB = Non Restricted Band, Limits should be 20 dB below the “OF”.

RB = Frequency within the Restricted Bands according to CFR15.205, Limits shall comply with CFR15.209. In this case the limit is 500uV/m (54dBuV/m).

Notes:

1. An EMI receiver peak scan is made from 1 – 25 GHz frequency range using RBW/VBW = 100kHz.
2. Average measurements above 1 GHz are using RBW = 1 MHz, VBW = 10 Hz.
3. During this test EUT is manipulated through typical positions, polarity and length, the worst case emissions are reported above.

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**ATTACHMENT H – CFR15.247 (c) RADIATED EMISSION MEASUREMENT 1GHz
- 25GHz (FUNDAMENTAL AND HARMONICS) (CONT.)**

Operating Channel = Mid

Operation Frequency (OF) = 2440 MHz

Test Distance = 3 Meters

Freq. (MHz)	RAW Reading (dBuV)	Correction Factors (dB/m)	Polar. (V/H)	Detector (Peak/Ave)	Field Strength (dBuV/m)	Margin (dB)	Notes
2440.02	78.93	12.61	H	Peak	91.54	-	OF
2440.02	78.40	12.61	V	Peak	91.01	-	OF
4880.05	34.07	15.56	H	Ave	49.63	-4.37	RB
7320.1	28.32	22.50	H	Ave	50.82	-3.18	RB
9760.00	<20.00	-	H	Peak	-	-	NRB
12202.13	<20.00	-	H	Peak	-	-	RB

Result Table 6. Mid Channel Radiated Emission Measurements
(Fundamental & Harmonics)

Legends:

OF = Operating Frequency.

NRB = Non Restricted Band, Limits should be 20 dB below the “OF”.

RB = Frequency within the Restricted Bands according to CFR15.205, Limits shall comply with CFR15.209. In this case the limit is 500uV/m (54dBuV/m).

Notes:

1. An EMI receiver peak scan is made from 1 – 25 GHz frequency range using RBW/VBW = 100kHz.
2. Average measurements above 1 GHz are using RBW= 1 MHz, VBW = 10 Hz.
3. During this test EUT is manipulated through typical positions, polarity and length, the worst case emissions are reported above.

ATTACHMENT H – CFR15.247(c) RADIATED EMISSION MEASUREMENT 1GHz - 25GHz (FUNDAMENTAL AND HARMONICS) (CONT.)

Operating Channel = High

Operation Frequency (OF) = 2480 MHz

Test Distance = 3 Meters

Freq. (MHz)	RAW Reading (dBuV)	Correction Factors (dB/m)	Polar. (V/H)	Detector (Peak/Ave)	Field Strength (dBuV/m)	Margin (dB)	Notes
2480.00	79.60	11.91	V	Peak	91.51	-	OF
2480.01	79.00	11.91	H	Peak	90.91	-	OF
4960.02	33.63	16.21	H	Ave	49.84	-4.16	RB
7440.05	26.50	23.70	H	Ave	50.2	-3.80	RB
9920.10	< 30.00	-	H	Peak	-	-	NRB
12399.98	< 30.00	-	H	Peak	-	-	NRB

Result Table 7. High Channel Radiated Emission Measurements
(Fundamental & Harmonics)

Legends:

OF = Operating Frequency.

NRB = Non Restricted Band, Limits should be 20 dB below the “OF”.

RB = Frequency within the Restricted Bands according to CFR15.205, Limits shall comply with CFR15.209. In this case the limit is 500uV/m (54dBuV/m).

Notes:

1. An EMI receiver peak scan is made from 1 – 25 GHz frequency range using RBW/VBW = 100kHz.
2. Average measurements above 1 GHz are using RBW = 1 MHz, VBW = 10 Hz.
3. During this test EUT is manipulated through typical positions, polarity and length, the worst case emissions are reported above.

Test Result: Pass, EUT meet minimum requirements.

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ATTACHMENT I – CFR15.209(a) RADIATED EMISSION MEASUREMENT 212-R-01)

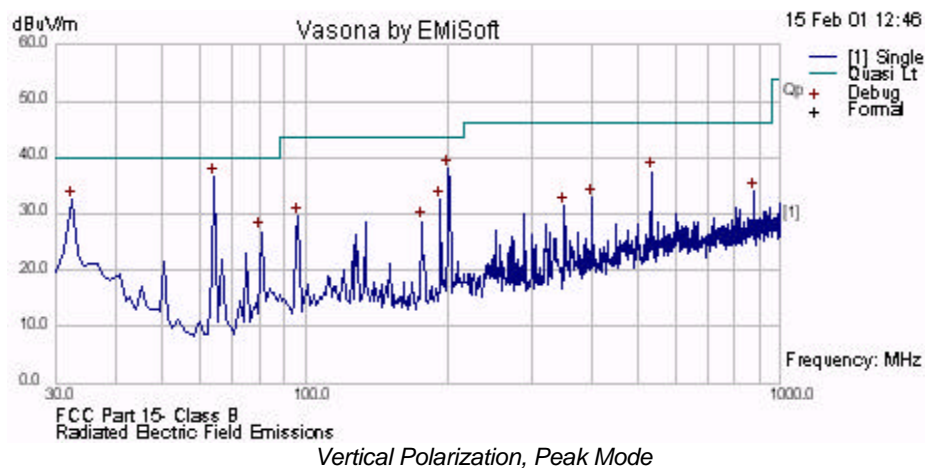
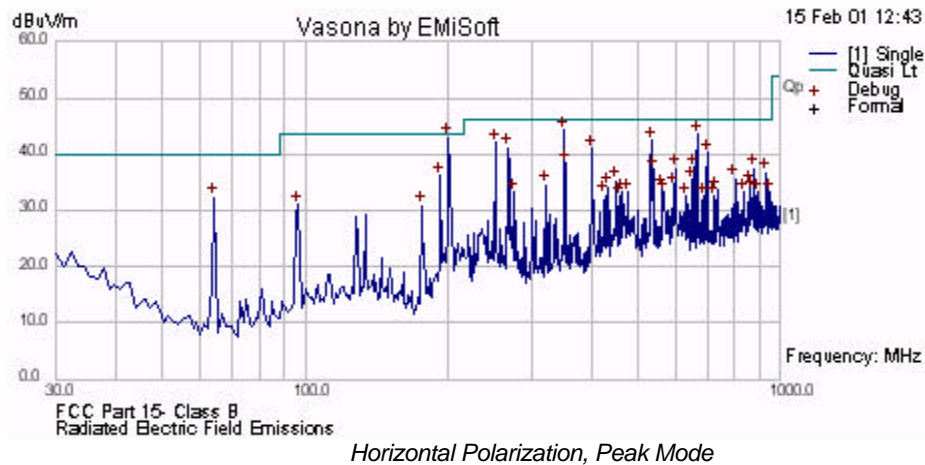
The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Operating Frequency = 2402, 2440 and 2480MHz

Res. Bandwidth = 120 kHz

Sweep Time = 30 mS



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Frequency [MHz]	Antenna Polarization [V/H]	Corrected Reading [dB μ V/m]	Delta, QP [dB]	3 Meters Limits [dB μ V/m]	Correction Factors [dB/m]
Set-up/Configuration: EN55022:1998, CISPR 16-1:1993					
200.289	V	41.5	-2.00	43.5	-7.08
668.044	V	43.55	-2.45	46.0	2.78
351.178	V	43.31	-2.69	46.0	-2.35
64.520	H	36.57	-3.43	40.0	-11.4
533.340	V	42.36	-3.64	46.0	3.14
250.032	V	42.11	-3.89	46.0	-4.52
1. All Emissions were investigated from 30 to 1000 MHz the 6 worst emissions are reported. 2. For handheld devices, the EUT is rotated through three orthogonal axes to obtain the maximum emissions.					

Result Table 8. CFR15.209 (a) Radiated Emission Test Results

*Photo for 3 Meter Chamber Scan*

Test Result: Pass, EUT meet minimum requirements.

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Prepared by EMC Compliance Management Group

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ATTACHMENT J - CFR15.207 (a) CONDUCTED EMISSION TEST RESULTS

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is back onto the AC power line on frequency within the band 450 kHz to 30 MHz shall not exceed 250 microvolts.

Operating Frequency = 2402, 2440 and 2480MHz

AC / DC Adapter =

Res. Bandwidth = 9 kHz

Sweep Time = 30 mS

Line	Frequency [MHz]	Corrected QP Reading [dB(μV)]	Delta QP [dB]	Limit [dB(μV)/m]
L1	2.3376	32.0	-16.0	48.0
L1	2.23	29.9	-18.1	48.0
L1	2.1253	29.65	-18.35	48.0
L2	2.4456	34.57	-13.43	48.0
L2	2.341	33.0	-15.0	48.0
L2	21.326	32.08	-15.92	48.0
Note: All reading are using a bandwidth of 9 kHz, with a 30 ms sweep time. A video filter was not used.				

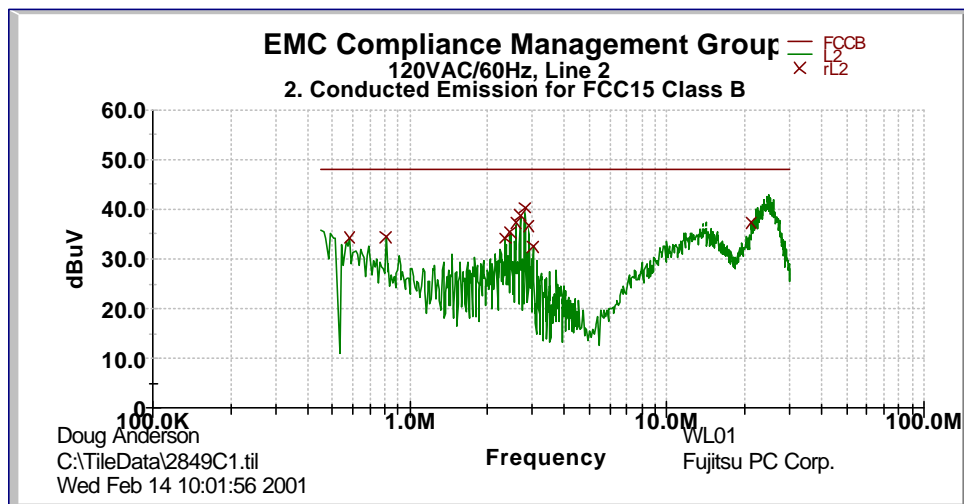
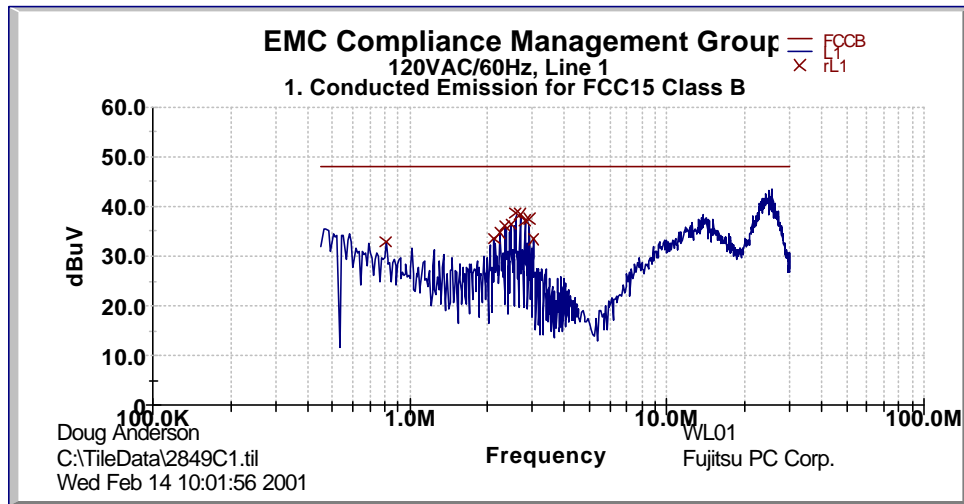
Test Result: Pass, EUT meet minimum requirements.

Test Report #: FUJ-0101-2849-TCB

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Conducted Emission Setup



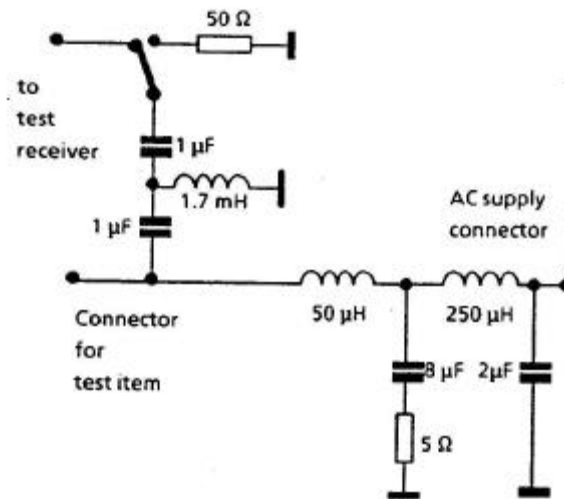
Conducted Emission Setup, showing cable placement

ATTACHMENT K - TEST EQUIPMENT

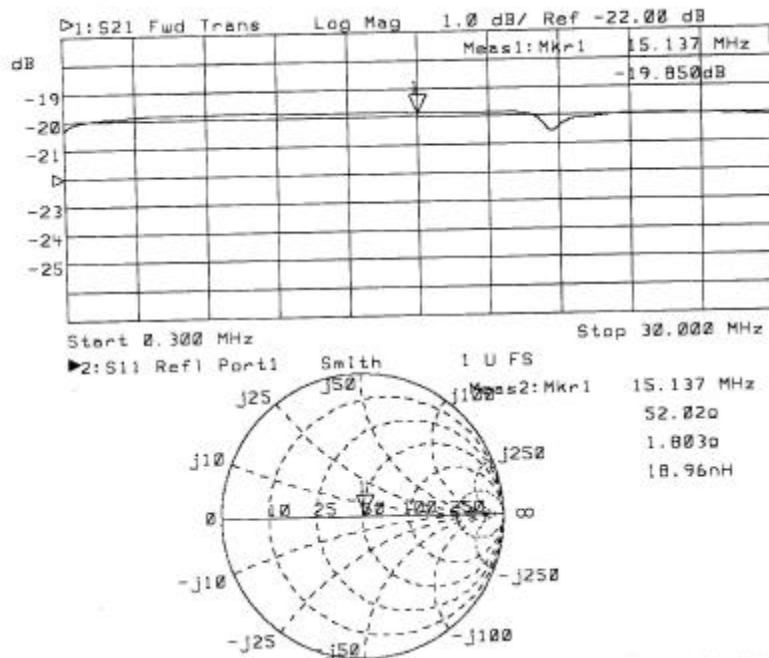
Test Equipment	Manufacturer/ Model	Serial No.	Last Cal.	Cal. Due Date
EMI Receiver	R&S / ESMI-RF	849937/006	03/01/00	03/01/01
EMI Receiver	R&S / ESAI-D	825035/005	03/01/00	03/01/01
Bilog Antenna	CHASE CBL6112A	2274	11/16/00	11/16/01
Horn Antenna	EMCO / 3115 w/ Miteq Amp	001	10/28/00	10/28/01
Horn Antenna	EMCO / 3116 w/ Miteq Amp	002	10/28/00	10/28/01
LISN	R & S / ESH3-Z5	844249/018	11/15/00	11/15/01
Signal Generator	HP / 83711B	3324A03288	08/29/00	08/29/01
RF Power Meter	Boonton / 42AD	09	03/08/00	03/08/01
RF Power Sensor	Boonton / 41-4B	157	03/08/00	03/08/01
RF Power Sensor	Boonton / 42004A	11544	03/08/00	03/08/01
Scope	Tektronix / TDS 360	B0120165	05/12/00	05/12/01
Attenuators	HP / 8491C	00423	VBU	VBU
Test Chamber	HumiTenn	A032331	VBU	VBU
Temp. Controller	Partlow Corp / MRC7000	94G86270	08/21/00	08/21/01
Note: All testing were performed using internationally recognized standards. All test instruments were calibrated and traceable to the National Institute of Standards and Technology (NIST).				

ATTACHMENT L - LISN SPECIFICATIONS

LISN use in this test is manufactured by R & S, model ESH3-Z5. This LISN complies with the FCC and CISPR requirements. The test frequency range is from 9kHz to 30MHz and impedance is 50 Ohms.



LISN Schematics (only 1 line shown)



Network Analyzer Plot