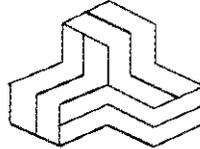


# ENGINEERING TEST REPORT



## ISA Wireless LAN Card MODEL NO.: WL-301

*In Accordance With*

**FEDERAL COMMUNICATIONS COMMISSION (FCC)  
PART 15, SUBPART C, SEC. 15.247  
Direct Sequence Spread Spectrum Transmitters operating  
in the frequency band 2412 - 2462 MHz**

**UltraTech's FILE NO.: GTT3-FTX**

**Tested for:**

**Gemtek Technology Co., Ltd.**  
11F, 181, Tatung Road, Sec. 1  
HsiChih, Taipei Hsien  
Taiwan, R.O.C.

**Tested by:**

**UltraTech - Group of Labs**  
3000 Bristol Circle  
Oakville, Ontario  
Canada L6H 6G4

**Report Prepared by:** Dan Huynh

**DATE:** May 10, 1999

## UltraTech

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# 1. EXHIBIT 1 - SUMMARY OF TEST RESULTS & GENERAL STATEMENT OF CERTIFICATION

FCC PARAGRAPH.	TEST REQUIREMENTS	COMPLIANCE (YES/NO)
15.247(a)(2)	Spectrum Bandwidth of a Direct Sequence Spread Spectrum System	Yes
15.247(b) & 1.1310	Maximum Peak Power and RF Exposure Limits	Yes
15.247(c)	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
15.247(c), 15.209 & 15.205	Transmitter Radiated Emissions	Yes
15.247(d)	Transmitted Power Density of a Direct Sequence Spread Spectrum System	Yes
15.247(e)	Processing Gain of Direct Sequence Spread Spectrum System	Yes
15.107, 15.109	AC Power Conducted Emissions & Radiated Emissions for Receiver and Digital Circuit Portions	Yes (Note 1)

**Note 1:** The digital circuits portion of the EUT has been tested and verified to comply with FCC Part 15, Subpart B, Class B Digital Devices and Radio Receivers. The engineering test report can be provided upon FCC requests.

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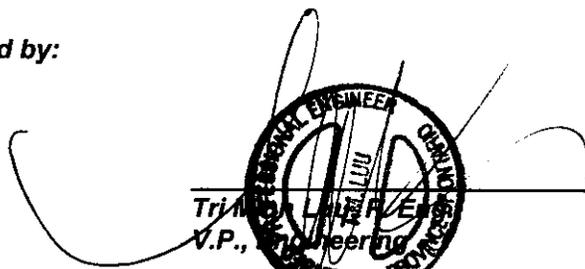
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## TESTIMONIAL AND STATEMENT OF CERTIFICATION

*THIS IS TO CERTIFY:*

- 1) *THAT the application was prepared either by, or under the direct supervision of the undersigned.*
- 2) *THAT the measurement data supplied with the application was taken under my direction and supervision.*
- 3) *THAT the data was obtained on a representative production unit.*
- 4) *THAT, to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct.*

**Certified by:**

  
Tripti L. P. Engineer  
V.P., Engineering

DATE: May 10, 1999

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## 2. EXHIBIT 2 - GENERAL INFORMATION

### 2.1. APPLICANT

Gemtek Technology Co., Ltd.  
11F, 181, Tatung Road, Sec. 1  
HsiChih, Taipei Hsien  
Taiwan, R.O.C.

Applicant's Representative: Mr. Howard Chen

### 2.2. MANUFACTURER

Gemtek Technology Co., Ltd.  
11F, 181, Tatung Road, Sec. 1  
HsiChih, Taipei Hsien  
Taiwan, R.O.C.

### 2.3. DESCRIPTION OF EQUIPMENT UNDER TEST

<b>PRODUCT NAME:</b>	ISA Wireless LAN Card
<b>MODEL NUMBER:</b>	WL-301
<b>SERIAL NUMBER:</b>	Pre-production
<b>TYPE OF EQUIPMENT:</b>	Direct Sequence Spread Spectrum Transmitters
<b>OPERATING FREQ.:</b>	2412 - 2462 MHz
<b>BANDWIDTH (6 dB OBW):</b>	11.29 MHz
<b>POWER OUTPUT:</b>	0.029 Watt (Peak)
<b>DATA RATE:</b>	2 Mb/s
<b>MODULATION TYPE:</b>	DQPSK
<b>DUTY CYCLE:</b>	Continuos
<b>OSC. FREQUENCY(IES):</b>	22 MHz, IF LO is 560 MHz, Rf LO is 2132-2182 MHz
<b>CPU SPEED:</b>	40 MHz
<b>INPUT SUPPLY:</b>	DC power from Computer

---

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**ASSOCIATED DEVICES:** AL-101 Loopy ANT and AL-102 Dipole ANT Right-Angle Antenna  
**FCC ID:** MXFWL-301  
**INTERFACE PORTS:** SMB interface

## 2.4. RELATED SUBMITTAL(S)/GRANT

Not applicable

## 2.5. TEST METHODOLOGY

These tests were conducted on a sample of the equipment for the purpose of certification compliance with Code of Federal Regulations (CFR47-1991), Part 15, Subpart C, Para. 15.247, Direct Sequence Spread Spectrum Transmitters operating in the Frequency Band 2412 - 2462 MHz.

Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4-1992 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz.

## 2.6. TEST FACILITY

AC Powerline Conducted Emissions were performed in UltraTech's shielded room, 16'(L) by 12'(W) by 12'(H).

Radiated Emissions were performed at the UltraTech's 3-10 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.

The above sites have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: September 20, 1998.

The above test site is also filed with Interference Technology International Ltd (ITI - An EC Directive on EMC).

## 2.7. UNITS OF MEASUREMENTS

Measurements of conducted emissions are reported in units of dB referenced to one microvolt [dB( $\mu$ V)].

Measurements of radiated emissions are reported in units of dB referenced to one microvolt per meter [dB( $\mu$ V)/m] at the distance specified in the report, wherever it is applicable.

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### 3. EXHIBIT 3 - SYSTEM TEST CONFIGURATION

#### 3.1. TEST SYSTEM DETAILS

The following peripherals, FCC identifiers and types interconnecting cables were used with the EUT for testing:

**EUT:** Gemtek Technology Co., Ltd., ISA Wireless LAN Card, Model: WL-301, S/N: Pre-production,  
OSC. FREQ: 22 MHz, IF LO is 560 MHz and Rf LO is 2132-2182 MHz  
I/O Cable: Shielded

- (1) **PERIPHERAL:** Ultratech Computer (System Case)  
I/O Cable: All I/O Cables were shielded  
Power Supply Cable: Non-shielded
- (2) **PERIPHERAL:** Digital printer, Model: LJ100-A2, S/N: OV44349289, FCC ID: EP8JP150  
I/O Cable: All I/O Cables were shielded  
Power Supply Cable: Non-shielded
- (3) **PERIPHERAL:** IBM Keyboard, Model: M2, S/N: 1395300, FCC ID AN0214401  
I/O Cable: Shielded
- (4) **PERIPHERAL:** IBM Mouse, Model: 1346690, S/N: 23-T48024, FCC ID: DZL210429  
I/O Cable: Shielded
- (5) **PERIPHERAL:** IBM Monitor, Model: 6542-103, S/N:88D0270, FCC ID: AN065421  
I/O Cable: Shielded  
Power Supply Cable: Non-shielded
- (6) **PERIPHERAL:** GVC Modem, Model: SM-24N/S, FCC ID DK4FSM24NS  
I/O Cable: Shielded  
Power Supply Cable: Non-shielded
- (7) **PERIPHERAL:** GVC Modem, Model: SM96VB1S/P, FCC ID: DK4SM96R  
I/O Cable: Shielded  
Power Supply Cable: Non-shielded

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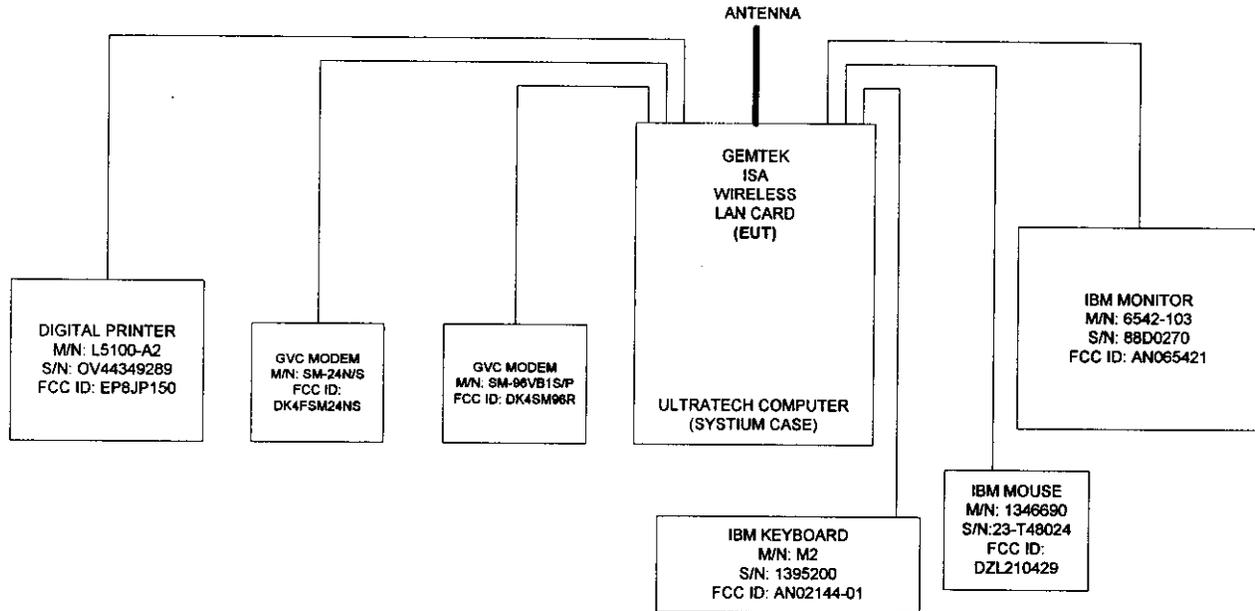
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### 3.2. BLOCK DIAGRAMS FOR CONDUCTED & RADIATED EMISSION MEASUREMENTS



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### 3.4. JUSTIFICATION

No deviation, in both configuration and operation manners, different from normal operation were required.

### 3.5. EUT OPERATING CONDITION

Software provided by Gemtek Technology Co., Ltd. to set the EUT to transmit or receive at various channel frequencies.

### 3.6. SPECIAL ACCESSORIES

No special accessories were required.

### 3.7. EQUIPMENT MODIFICATIONS

To achieve compliance, the following change(s) were made by UltraTech's test house during compliance testing:

Not required.

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## 4. EXHIBIT 4 - TEST DATA

### 4.1. 6 DB BANDWIDTH @ FCC 15.247(A)(2)

**PRODUCT NAME:** ISA Wireless LAN Card, Model No.: WL-301

**FCC REQUIREMENTS:**

For a direct sequence spread spectrum system, the minimum 6 dB bandwidth shall be at least 500 KHz.

**CLIMATE CONDITION:**

Standard Temperature and Humidity:

- Ambient temperature: 23 °C
- Relative humidity: 43 %

**POWER INPUT:**

Using DC power from computer.

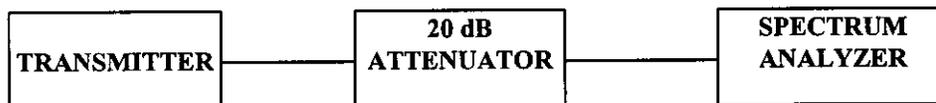
**TEST EQUIPMENT:**

- Advantest Spectrum Analyzer, Model R3271, S/N: 15050203
- Bird 20 dB Attenuator, 50 Ohm IN/OUT

**METHOD OF MEASUREMENTS:**

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using 30 KHz RBW, VBW = 100 KHz. The 6 dB bandwidth was measured and recorded.

**TEST ARRANGEMENT**



**TEST RESULTS:** Conforms.

**TEST PERSONNEL:** Mr. Hung Trinh, RFI Technician

**DATE:** April 5, 1999

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**MEASUREMENT DATA:**

CHANNEL FREQUENCY (MHz)	6 dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS/FAIL
2412	10.07	0.5	PASS
2437	11.29	0.5	PASS
2462	10.00	0.5	PASS

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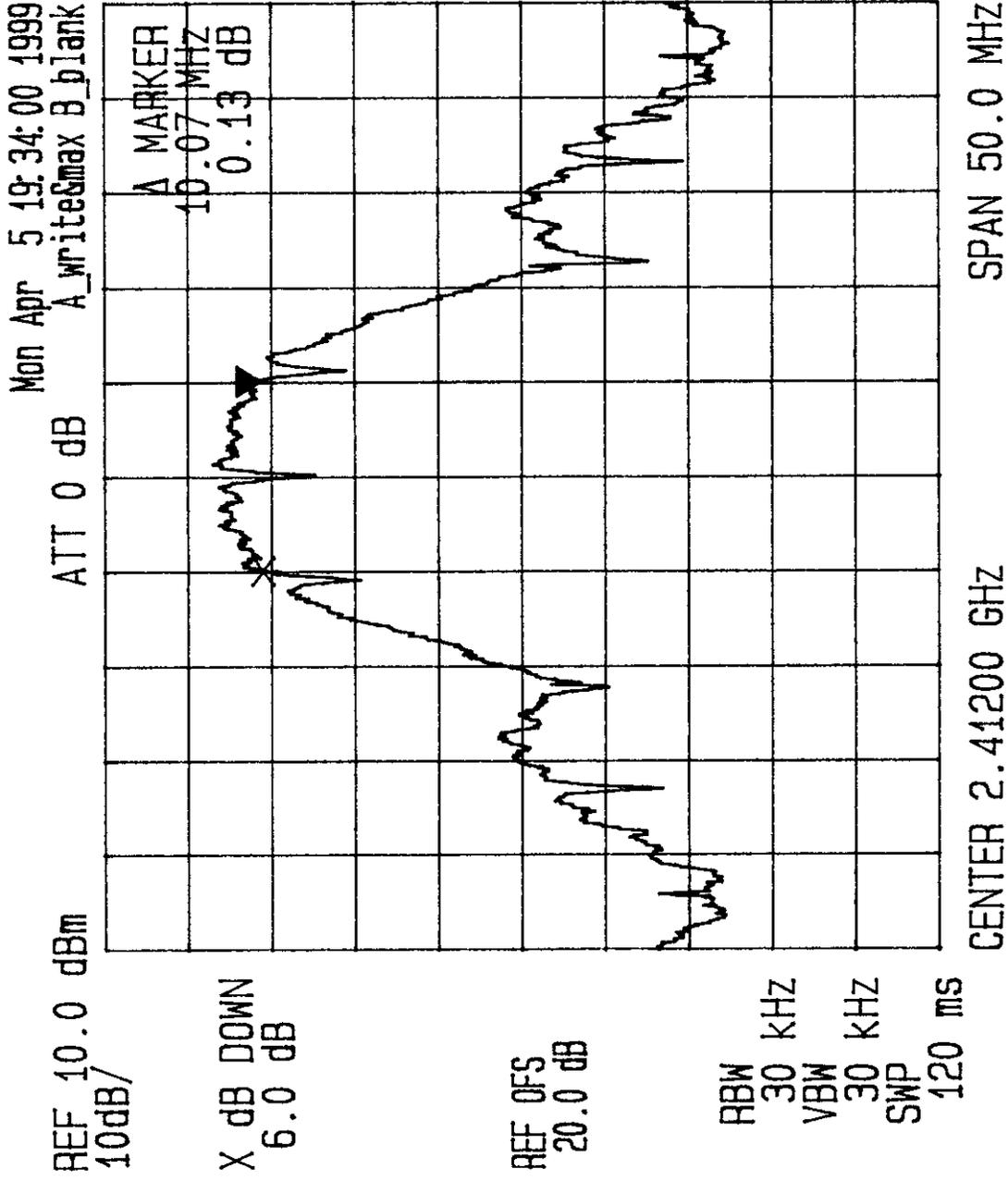
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**UltraTech**  
Engineering Labs Inc.

**GEMTEK TECHNOLOGY CO. LTD.**  
TRANSMITTER ANTENNA POWER CONDUCTED EMISSIONS  
ISA Wireless LAN Card, WL-301  
Channel #: 1, Tx Frequency: 2.412 MHz  
Modulation: 2 Mb/s **OFDM**. **DQPSK**

Date: April 25, 1999  
Tested by: Hung Trinh





**UltraTech**  
Engineering Labs Inc.

**GEMTEK TECHNOLOGY CO. LTD.**

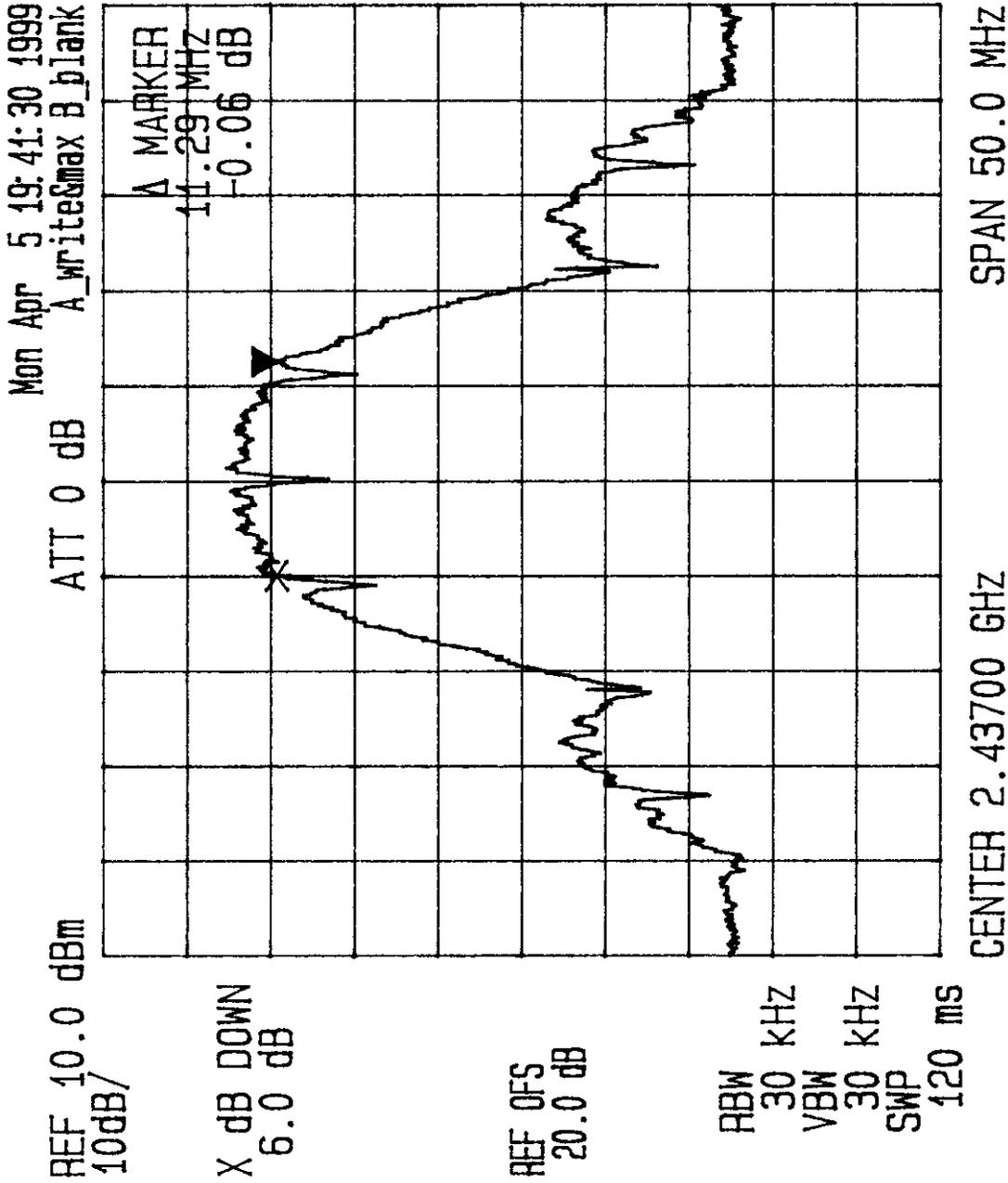
TRANSMITTER ANTENNA POWER CONDUCTED EMISSIONS

ISA Wireless LAN Card, WL-301

Channel #: 6, Tx Frequency: 2443.7 MHz

Modulation: 2 Mb/s ~~CSSK~~ DQPSK

Date: April 25, 1999  
Tested by: Hung Trinh





**UltraTech**  
Engineering Labs Inc.

**GEMTEK TECHNOLOGY CO. LTD.**

TRANSMITTER ANTENNA POWER CONDUCTED EMISSIONS

ISA Wireless LAN Card, WL-301

Channel #: //, Tx Frequency: 2462 MHz

Modulation: 2 Mb/s CSK. DQPSK

Date: April 25, 1999  
Tested by: Hung Trinh

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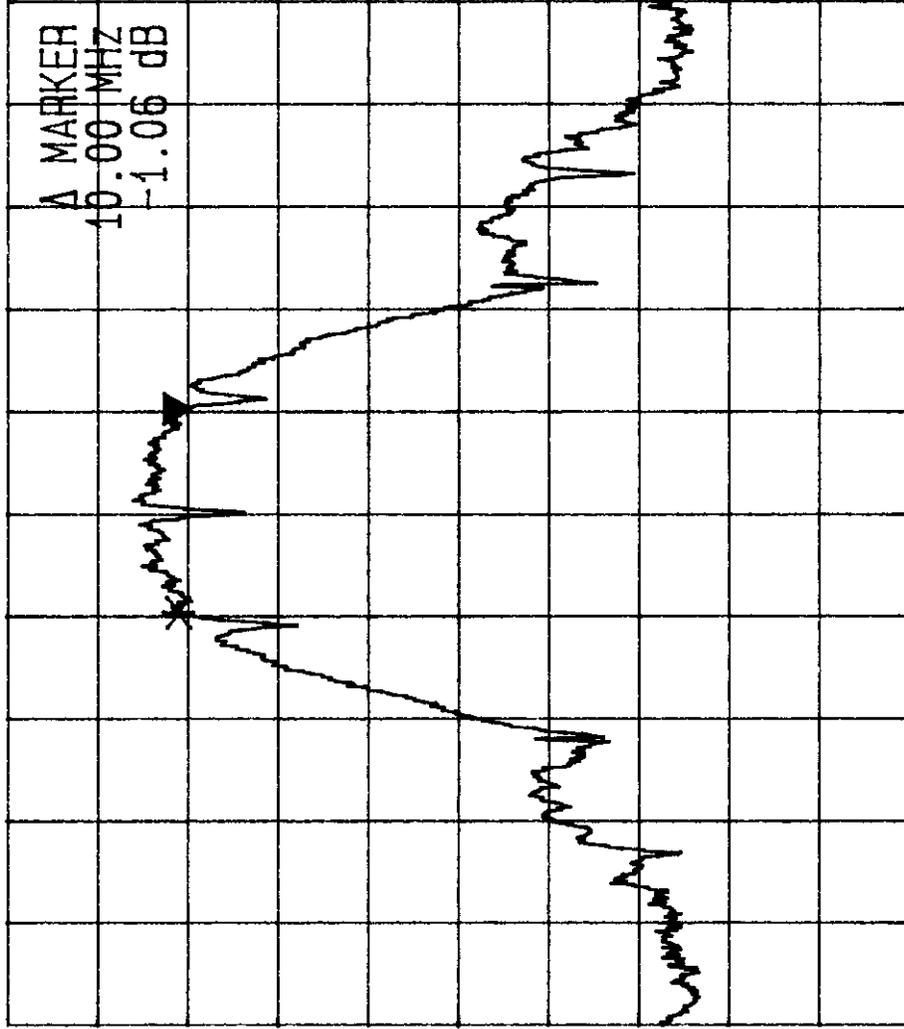
REF 10.0 dBm  
10dB/

X dB DOWN  
6.0 dB

REF OFS  
20.0 dB

RBW 30 kHz  
VBW 30 kHz  
SWP 120 ms

ATT 0 dB



CENTER 2.46200 GHz

SPAN 50.0 MHz

## 4.2. MAXIMUM PEAK OUTPUT POWER @ FCC 15.247(B) AND RF EXPOSURE LIMIT FCC 1.1310

**PRODUCT NAME:** ISA Wireless LAN Card, Model No.: WL-301

### FCC REQUIREMENTS:

FCC 15.247(b):- Maximum peak output power of the transmitter shall not exceed 1 Watt.

- (i) Systems operating in the 2400-2483.5 MHz band that used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduce by 1 dB for every 3 dB that the directional gain of the antenna exceed 6 dBi.

FCC 1.1310:- The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in 1.1307(b).

### LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Average Time (minutes)
<b>(A) Limits for Occupational/Control Exposures</b>				
300-1500	...	...	F/300	6
1500-100,000	...	...	5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
300-1500	...	...	F/1500	6
1500-100,000	...	...	1.0	30

F = Frequency in MHz

### CLIMATE CONDITION:

Standard Temperature and Humidity:

- Ambient temperature: 23 °C
- Relative humidity: 43 %

### POWER INPUT:

Using DC power from computer.

### TEST EQUIPMENT:

- HP RF Peak Power Meter, Model 8900, S/N: 2131A00124, Measuring Freq. Range: 01 - 18 GHz, 50 Ohm IN.
- HP RF Peak Power Sensor, Model 8481A, S/N: 2551A01965, Measuring Freq. Range: 0.1 - 18 GHz, 50 Ohm IN/OUT
- Bird 20 dB Attenuator, 50 Ohm IN/OUT

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**METHOD OF MEASUREMENTS:**

FCC @ 1.1310 & OST Bulletin No. 65-October 1985

$$S = PG/4\pi r^2 = EIRP/4\pi r^2$$

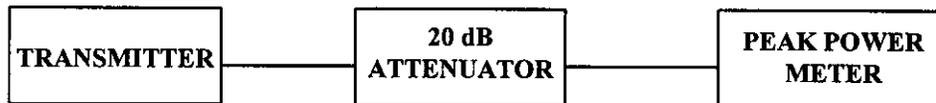
Where: P: power input to the antenna in mW  
 EIRP: Equivalent (effective) isotropic radiated power.  
 S: power density mW/cm<sup>2</sup>  
 G: numeric gain of antenna relative to isotropic radiator  
 r: distance to centre of radiation in cm

FCC radio frequency exposure limits may be exceeded at distances closer than r cm from the antenna of this device

$$r = \sqrt{PG/4\pi S}$$

FCC radio frequency exposure limits may be exceeded at distances closer than r cm from the antenna of this device

**TEST ARRANGEMENT**



**TEST RESULTS:** Conforms.

**TEST PERSONNEL:** Mr. Hung Trinh, RFI Technician

**DATE:** April 5, 1999

**MEASUREMENT DATA:**

**PEAK POWER MEASUREMENT**

ANTENNA GAIN: 3 dBi

**DIRECT PEAK POWER MEASUREMENTS AT THE ANTENNA TERMINAL  
 WITH THE ANTENNA REPLACED BY A SMA CONNECTOR**

TRANSMITTER CHANNEL OUTPUT	FUNDAMENTAL FREQUENCY (MHz)	DATA RATE / MODULATION	MEASURED PEAK TOTAL POWER (mW)	PEAK POWER LIMIT (mW)
Lowest	2412	2 Mbps DQPSK	29.0	1000.0
Middle	2437	2 Mbps DQPSK	24.0	1000.0
Highest	2462	2 Mbps DQPSK	26.0	1000.0

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***TEST CONFIGURATION 1: ISA Wireless LAN Card with AL-101 Loopy ANT***

**EFFECTIVE ISOTROPIC RADIATED POWER (EIRP) MEASURED AT 3 METER DISTANCE  
 (Substitution Method)**

TX CHANNEL OUTPUT	FUNDAMENTAL FREQUENCY (MHz)	DATA RATE / MODULATION	Tx Antenna Gain (Numeric)	Max.	(1) POWER In a full BW (mW)	PEAK POWER LIMIT (mW)	(3) MINIMUM ALLOWABLE DISTANCE (r) FROM SKIN (cm)
				Field Strength Level @ 1 MHz BW At 3 m (dBuV/m)			
1	2412	2 Mbps DQPSK	3	108.06	57.0	4000.0	2.1
6	2437	2 Mbps DQPSK	3	109.03	78.2	4000.0	2.5
11	2462	2 Mbps DQPSK	3	108.94	78.3	4000.0	2.5

Since the power density of 1 mW/cm<sup>2</sup> is at a very short distance from the radiating antenna and the antenna is required to be mounted at a distance away from the users' location, the RF exposure limit warning or SAR tests are not necessary.

**Remarks:**

- (1) Conversion of power measured in 1MHz BW using the EMI receiver to power in full BW using HP8900 peak power meter:  
 1MHz BW-Full BW power conversion factor = (peak power level measured using the HP peak power meter) - (peak power level measured using EMI receiver in 1 MHz BW)

	Peak Power Level Measured Using HP Peak Power Meter	Peak Power Level Measured Using EMI Receiver In 1MHz BW	1MHz BW to Full BW Power Conversion Factor
Channel #1 (2412 MHz)	14.62 dBm	8.13 dBm	6.49 dB
Channel #6 (2437 MHz)	13.80 dBm	9.91 dBm	6.89 dB
Channel #11 (2463 MHz)	14.15 dBm	7.16 dBm	6.99 dB

- (2) The differences between the radiated power measurement and direct peak power measurements are due to the approximation of the conversion from 1MHz-BW power to full-BW power, the linearity of the antenna gain at different frequencies and effect of packaging and installation of the internal integrated antenna inside the case.
- (3) RF EXPOSURE DISTANCE LIMITS:  $r = (PG/4\pi S)^{1/2} = (EIRP/4\pi S)^{1/2}$   
 S=1mW/cm<sup>2</sup>, G= 3 dBi

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***TEST CONFIGURATION 2: ISA Wireless LAN Card with AL-102 Dipole ANT Right-Angle***

**EFFECTIVE ISOTROPIC RADIATED POWER (EIRP) MEASURED AT 3 METER DISTANCE  
 (Substitution Method)**

TX CHANNEL OUTPUT	FUNDAMENTAL FREQUENCY (MHz)	DATA RATE / MODULATION	Tx Antenna Gain (Numeric)	Max. Field Strength Level @ 1 MHz BW At 3 m (dBuV/m)	(1) POWER In a full BW (mW)	PEAK POWER LIMIT (mW)	(3) MINIMUM ALLOWABLE DISTANCE (r) FROM SKIN (cm)
1	2412	2 Mbps DQPSK	3	108.06	164.4	4000.0	3.6
6	2437	2 Mbps DQPSK	3	109.03	166.3	4000.0	3.6
11	2462	2 Mbps DQPSK	3	108.94	142.2	4000.0	3.4

Since the power density of 1 mW/cm<sup>2</sup> is at a very short distance from the radiating antenna and the antenna is required to be mounted at a distance away from the users' location, the RF exposure limit warning or SAR tests are not necessary.

**Remarks:**

- (1) Conversion of power measured in 1MHz BW using the EMI receiver to power in full BW using HP8900 peak power meter:  
 1MHz BW-Full BW power conversion factor = (peak power level measured using the HP peak power meter) - (peak power level measured using EMI receiver in 1 MHz BW)

	Peak Power Level Measured Using HP Peak Power Meter	Peak Power Level Measured Using EMI Receiver In 1MHz BW	1MHz BW to Full BW Power Conversion Factor
Channel #1 (2412 MHz)	14.62 dBm	8.13 dBm	6.49 dB
Channel #6 (2437 MHz)	13.80 dBm	9.91 dBm	6.89 dB
Channel #11 (2463 MHz)	14.15 dBm	7.16 dBm	6.99 dB

- (2) The differences between the radiated power measurement and direct peak power measurements are due to the approximation of the conversion from 1MHz-BW power to full-BW power, the linearity of the antenna gain at different frequencies and effect of packaging and installation of the internal integrated antenna inside the case.
- (3) RF EXPOSURE DISTANCE LIMITS:  $r = (PG/4\pi S)^{1/2} = (EIRP/4\pi S)^{1/2}$   
 S=1mW/cm<sup>2</sup>, G = 3 dBi

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#### 4.3. RF CONDUCTED EMISSIONS AT THE TRANSMITTER ANTENNA TERMINAL, FCC CFR 47, PARA. 15.247(C)

**PRODUCT NAME:** ISA Wireless LAN Card, Model No.: WL-301

**FCC REQUIREMENTS:**

In any 100 KHz bandwidth outside the operating frequency band, the radio frequency power that is produced by modulation products of the spreading sequence, the information sequence and the carrier frequency shall be at least 20 dB below that in any 100 KHz bandwidth within the band that contains the highest level of the desired power.

**CLIMATE CONDITION:**

Standard Temperature and Humidity:

- Ambient temperature: 23 °C
- Relative humidity: 43 %

**POWER INPUT:**

Using DC power from computer.

**TEST EQUIPMENT:**

- Advantest Spectrum Analyzer, Model R3271, S/N: 15050203
- Bird 20 dB Attenuator, 50 Ohm IN/OUT
- Microphase Highpass Filter, P/N: CR220HIB, S/N: 1301, Cut-off Freq. 1.8 GHz. (Optional)

**METHOD OF MEASUREMENT:**

A scan was made by using a spectrum analyzer with the detector function set to PEAK mode.

Set RBW = 100 KHz, VBW = 100 KHz.

**FCC CFR 47, Para. 2.997 - Frequency spectrum to be investigated**

The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10<sup>th</sup> harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

**FCC CFR 47, Para. 2.991 - Spurious Emissions at Antenna Terminal**

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of the harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in 2.989 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

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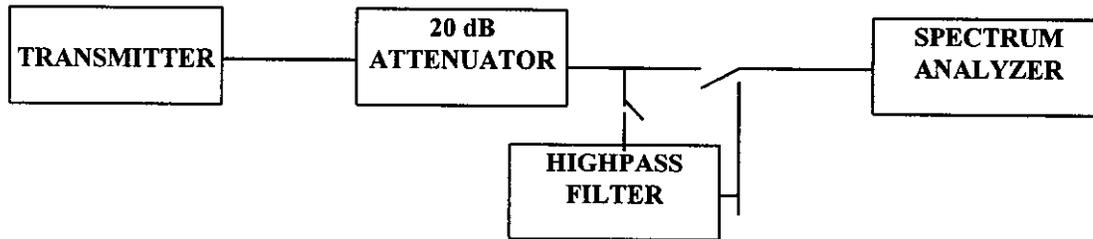
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**TEST ARRANGEMENT**



**TEST RESULTS:** Conforms.

**TEST PERSONNEL:** Mr. Hung Trinh, RFI Technician

**DATE:** April 26, 1999

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**MEASUREMENT DATA**

**SPURIOUS & HARMONIC EMISSIONS  
 AT THE TRANSMITTER ANTENNA TERMINAL**

**TEST CONFIGURATION**

- The transmitter was coupled to the Spectrum Analyzer through a 20 dB attenuator.
- The insertion loss between the transmitter output terminal and the spectrum analyzer was measured to be 20 dB
- The channel frequencies were established on the extreme edges (both upper and lower) and middle of the 2412 - 2462 MHz band at its full rated output power. The emissions were investigated up to the tenth harmonic of the fundamental emissions in each case. The measured level of the carrier was recorded and compared to the level of the emissions as required in Part 15.247(c)

<b>Channel Frequency: 2412 MHz</b> <b>Full Rated Power: 29 mW</b> <b>Modulation: DSSS, 2Mbps Data Rate, DQPSK</b>		<b>Power Level in 100 KHz BW: 2.25 dBm</b> <b>Limit = 2.25 dBm - 20 dB = -17.75 dBm</b>		
FREQUENCY (MHz)	RF LEVEL 100 kHz BW (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
2412	2.25	--	--	--
281	-52.09	-17.75	-34.34	PASS
3606	-63.53	-17.75	-45.78	PASS
24464	-48.00	-17.75	-30.25	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details				

<b>Channel Frequency: 2437 MHz</b> <b>Full Rated Power: 24 mW</b> <b>Modulation: DSSS, 2Mbps Data Rate, DQPSK</b>		<b>Power Level in 100 KHz BW: 1.19 dBm</b> <b>Limit = 1.19 dBm - 20 dB = -18.81 dBm</b>		
FREQUENCY (MHz)	RF LEVEL 100 kHz BW (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
2437	1.19	--	--	--
310	-52.44	-18.81	-33.63	PASS
3592	-63.03	-18.81	-44.22	PASS
24786	-49.31	-18.81	-30.50	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details				

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Channel Frequency: 2462 MHz Full Rated Power: 26 mW Modulation: DSSS, 2Mbps Data Rate, DQPSK		Power Level in 100 KHz BW: 1.75 dBm Limit = 1.75 dBm - 20 dB = -18.25 dBm		
FREQUENCY (MHz)	RF LEVEL 100 kHz BW (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
2462	1.75	--	--	--
338	-52.53	-18.25	-34.28	PASS
3592	-60.81	-18.25	-42.56	PASS
24721	-48.88	-18.25	-30.63	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details				

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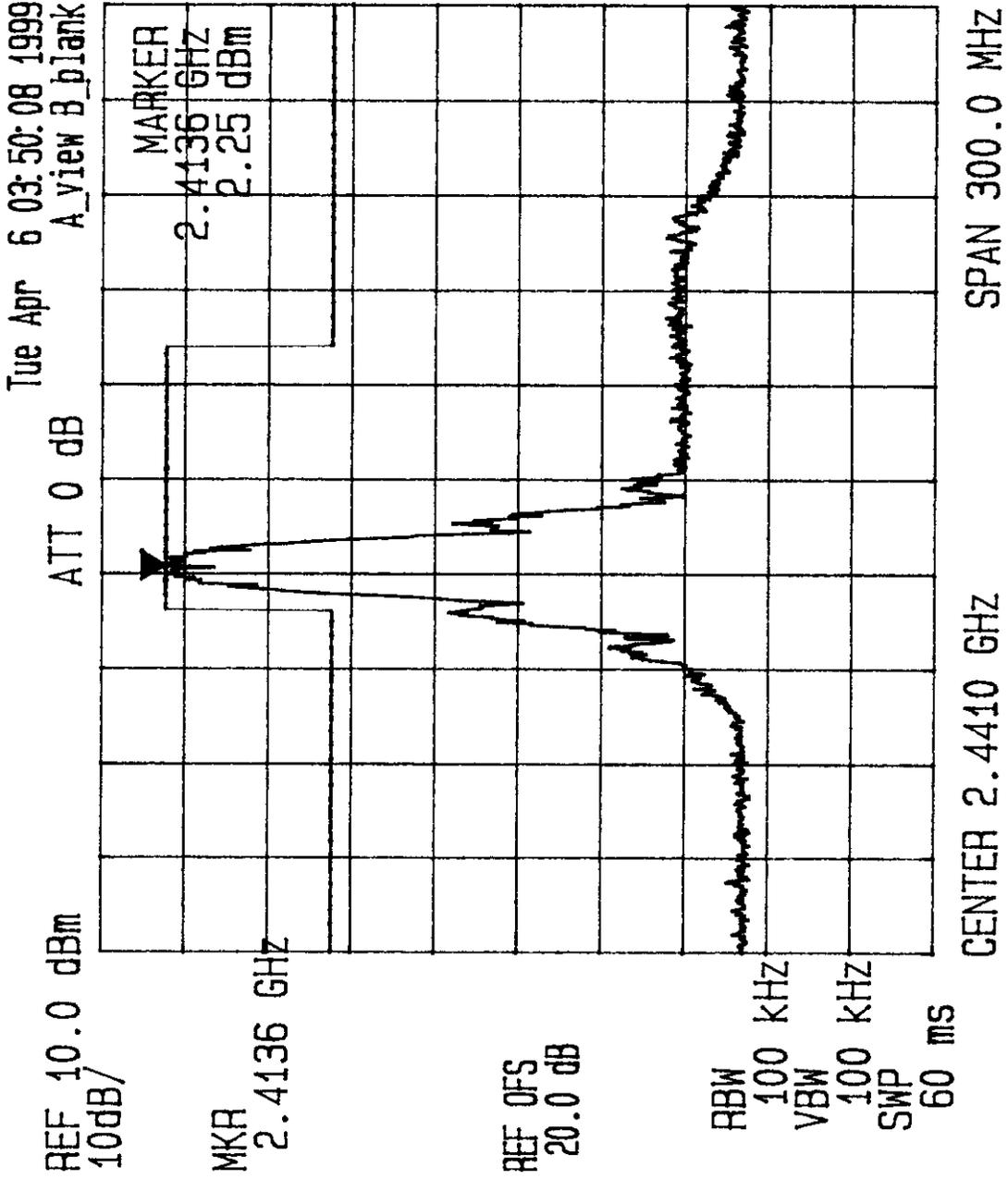
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**UltraTech**  
Engineering Labs Inc.

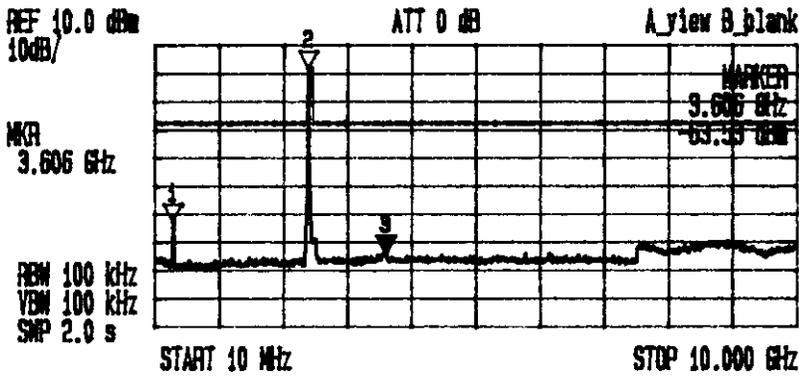
**GEMTEK TECHNOLOGY CO. LTD.**  
TRANSMITTER ANTENNA POWER CONDUCTED EMISSIONS  
ISA Wireless LAN Card, WL-301  
Channel #:       , Tx Frequency: 2.412 MHz  
Modulation: 2 Mb/s **QPSK**

Date: April 26, 1999  
Tested by: Hung Trinh



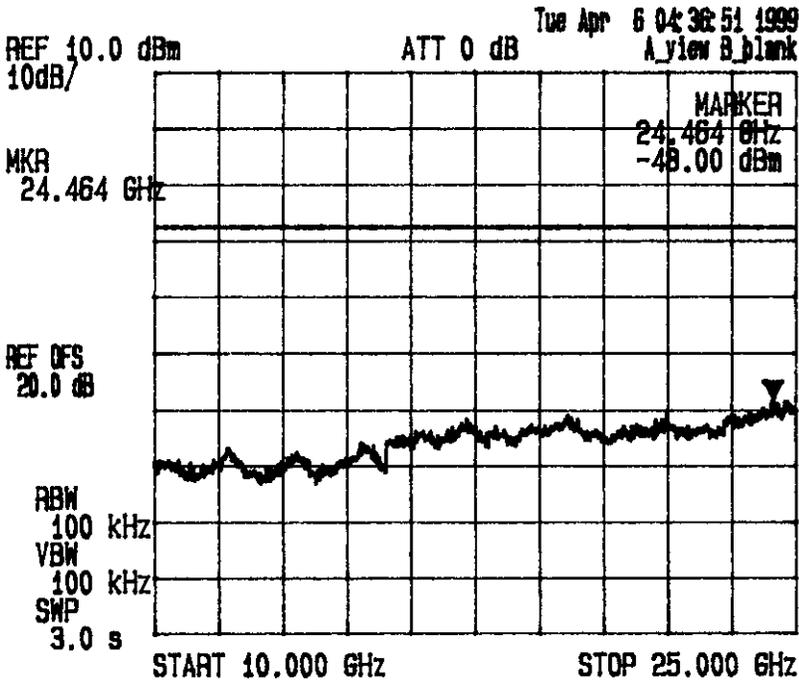
Date: April 06, 1999  
 Tested by: Hung Trinh

**GEMTEK TECHNOLOGY CO. LTD.**  
 TRANSMITTER ANTENNA POWER CONDUCTED EMISSIONS  
 ISA Wireless LAN Card, WL-301  
 Channel #: / , Tx Frequency: 2.412 MHz  
 Modulation: 2 Mb/s QPSK. DQPSK



\*\*\* Multi Marker List \*\*\*

No.	Frequency	Power	Label
No.1:	281 MHz	-52.09 dBm	A
No.2:	2.393 GHz	-2.34 dBm	A
No.3:	3.606 GHz	-63.53 dBm	A
No.4:			
No.5:			
No.6:			
No.7:			
No.8:			
A:			





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**GEMTEK TECHNOLOGY CO. LTD.**

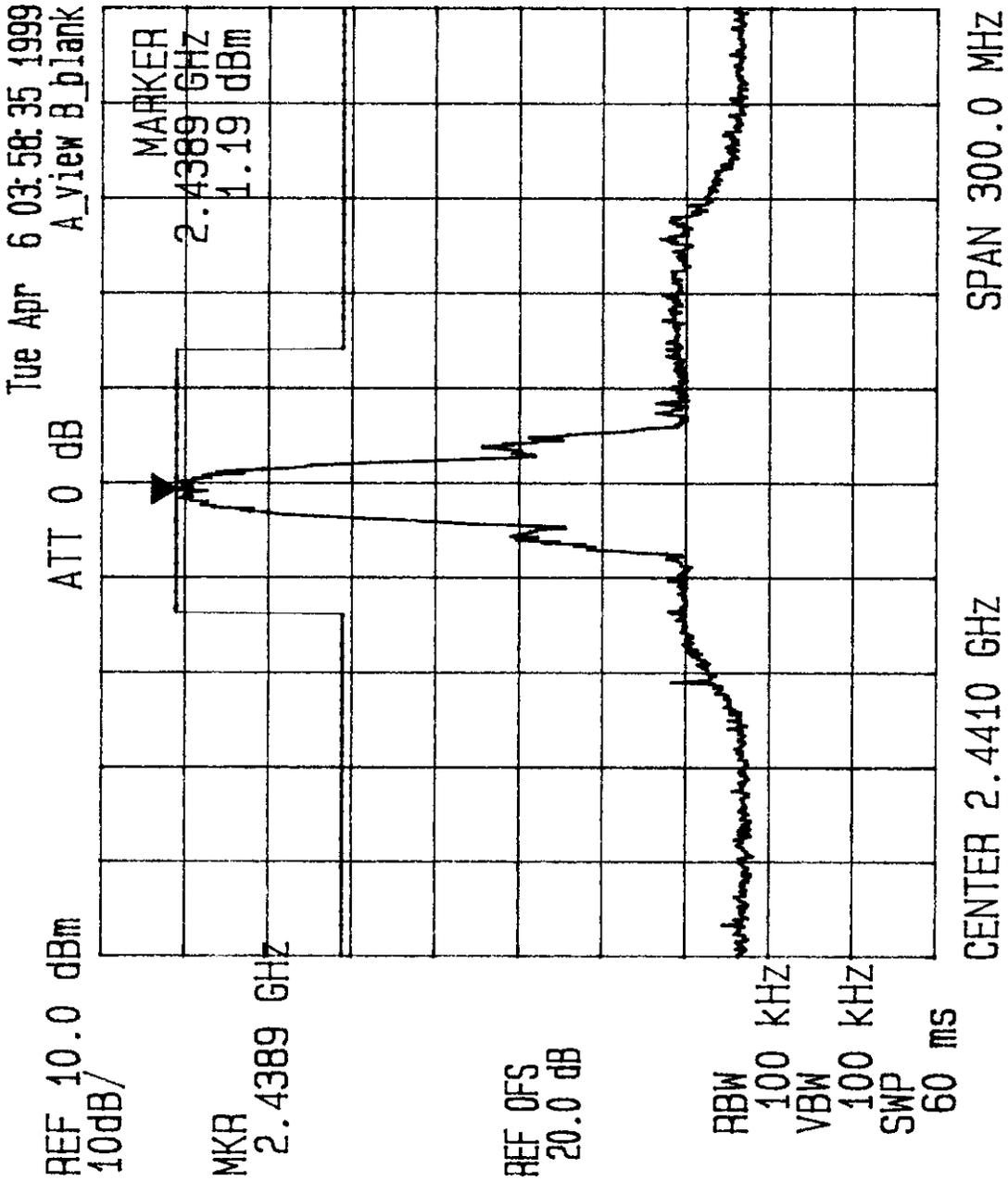
TRANSMITTER ANTENNA POWER CONDUCTED EMISSIONS

ISA Wireless LAN Card, WL-301

Channel #: 6, Tx Frequency: 2.437 MHz

Modulation: 2 Mb/s ~~CSK~~ DQPSK

Date: April 06, 1999  
Tested by: Hung Trinh

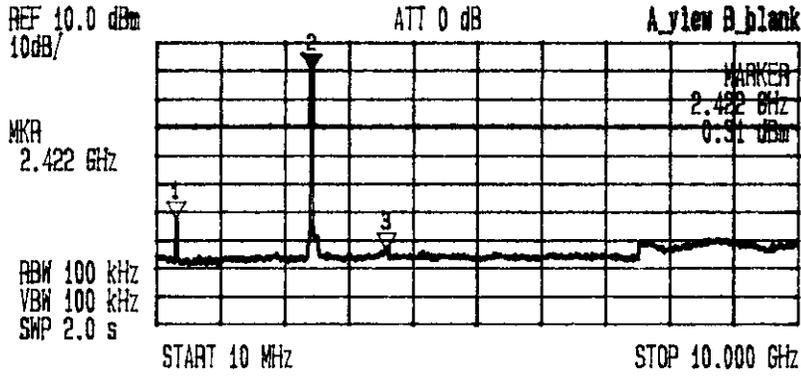


Date: April 06, 1999  
 Tested by: Hung Trinh

**GEMTEK TECHNOLOGY CO. LTD.**  
**TRANSMITTER ANTENNA POWER CONDUCTED EMISSIONS**

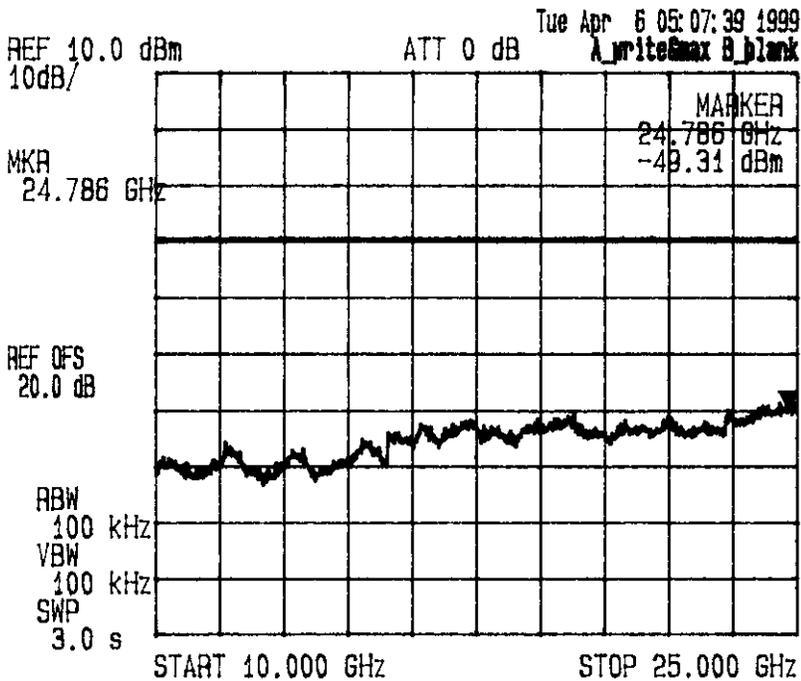
ISA Wireless LAN Card, WL-301

Channel #: 6, Tx Frequency: 2437 MHz  
 Modulation: 2 Mb/s ~~CSMA~~ DSSS



\*\*\* Multi Marker List \*\*\*

No.	Freq	Power	Label
No.1:	310 MHz	-52.44 dBm	A
No.2:	2.422 GHz	0.31 dBm	A
No.3:	3.592 GHz	-63.03 dBm	A
No.4:			
No.5:			
No.6:			
No.7:			
No.8:			
A:			





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**GEMTEK TECHNOLOGY CO. LTD.**

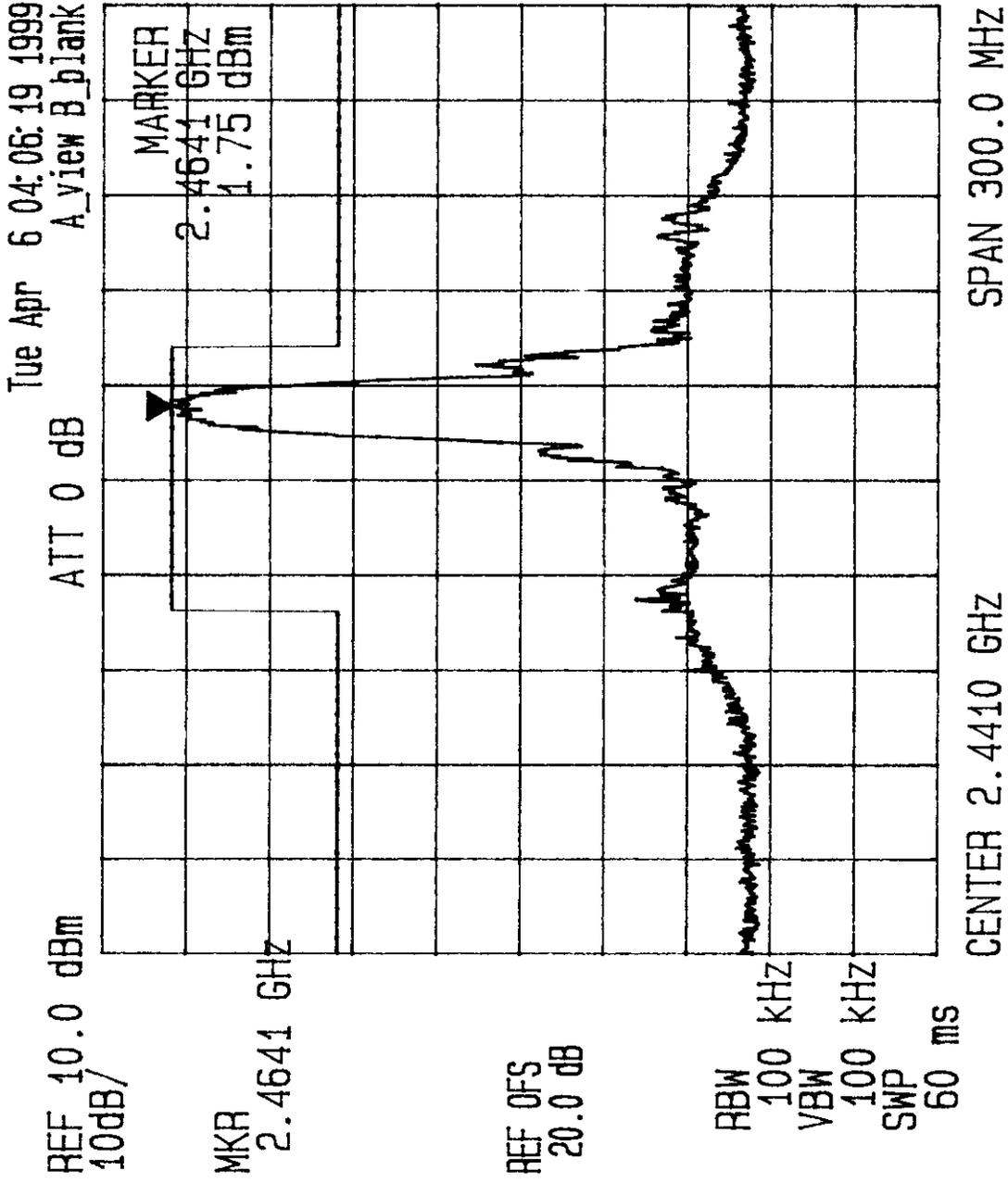
**TRANSMITTER ANTENNA POWER CONDUCTED EMISSIONS**

ISA Wireless LAN Card, WL-301

Channel #: 11, Tx Frequency: 2.4642 MHz

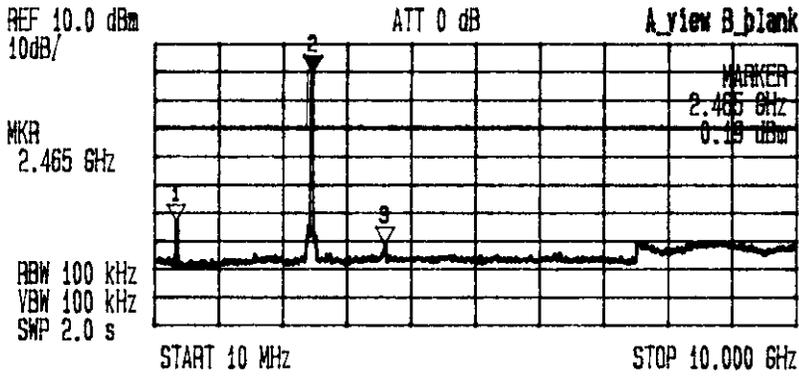
Modulation: 2 Mb/s ~~CSK~~ DQPSK

Date: April 06, 1999  
Tested by: Hung Trinh



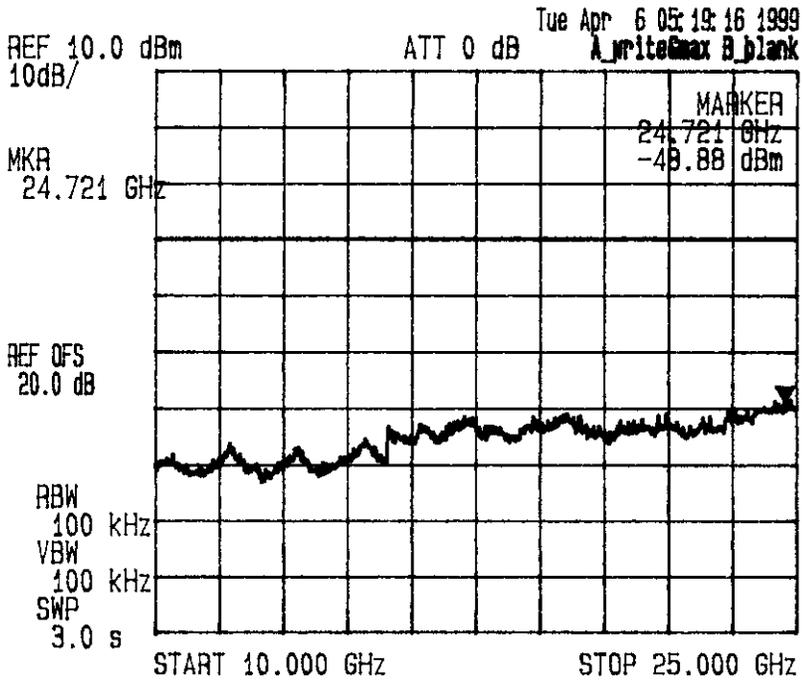
Date: April 26, 1999  
 Tested by: Hung Trinh

**GEMTEK TECHNOLOGY CO. LTD.**  
 TRANSMITTER ANTENNA POWER CONDUCTED EMISSIONS  
 ISA Wireless LAN Card, WL-301  
 Channel #: 11, Tx Frequency: 2.468 MHz  
 Modulation: 2 Mb/s **QPSK**



\*\*\* Multi Marker List \*\*\*

No.	Freq	Power	Label
No.1:	338 MHz	-52.53 dBm	A
No.2:	2.465 GHz	0.19 dBm	A
No.3:	3.592 GHz	-60.81 dBm	A
No.4:			
No.5:			
No.6:			
No.7:			
No.8:			
A:			



**4.4. TRANSMITTER RADIATED EMISSIONS @ 3 METERS, FCC CFR 47, PARA. 15.247(C), 15.209 & 15.205**

**PRODUCT NAME:** ISA Wireless LAN Card, Model No.: WL-301

**FCC REQUIREMENTS:**

In any 100 KHz bandwidth outside the operating frequency band, the radio frequency power that is produced by modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 KHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in @ 15.209(a), which lesser attenuation.

All other emissions inside restricted bands specified in @ 15.205(a) shall not exceed the general radiated emission limits specified in @ 15.209(a)

**Remarks:**

- Applies to harmonics/spurious emissions that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209.
- @ FCC CFR 47, Para. 15.237(c) - The emission limits as specified above are based on measurement instrument employing an average detector. The provisions in @15.35 for limiting peak emissions apply.

**FCC CFR 47, Part 15, Subpart C, Para. 15.205(a) - Restricted Frequency Bands**

MHz	MHz	MHz	GHz
0.090 - 0.110	162.0125 - 167.17	2310 - 2390	9.3 - 9.5
0.49 - 0.51	167.72 - 173.2	2483.5 - 2500	10.6 - 12.7
2.1735 - 2.1905	240 - 285	2655 - 2900	13.25 - 13.4
8.362 - 8.366	322 - 335.4	3260 - 3267	14.47 - 14.5
13.36 - 13.41	399.9 - 410	3332 - 3339	14.35 - 16.2
25.5 - 25.67	608 - 614	3345.8 - 3358	17.7 - 21.4
37.5 - 38.25	960 - 1240	3600 - 4400	22.01 - 23.12
73 - 75.4	1300 - 1427	4500 - 5250	23.6 - 24.0
108 - 121.94	1435 - 1626.5	5350 - 5460	31.2 - 31.8
123 - 138	1660 - 1710	7250 - 7750	36.43 - 36.5
149.9 - 150.05	1718.8 - 1722.2	8025 - 8500	Above 38.6
156.7 - 156.9	2200 - 2300	9000 - 9200	

**FCC CFR 47, Part 15, Subpart C, Para. 15.209(a)  
 -- Field Strength Limits within Restricted Frequency Bands --**

FREQUENCY (MHz)	FIELD STRENGTH LIMITS (microvolts/m)	DISTANCE (Meters)
0.009 - 0.490	2,400 / F (KHz)	300
0.490 - 1.705	24,000 / 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

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### CLIMATE CONDITION:

Standard Temperature and Humidity:

- Ambient temperature: 23 °C
- Relative humidity: 43 %

### POWER INPUT:

Using DC power from computer.

### TEST EQUIPMENT:

- Spectrum Analyzer, Advantest, Model R3271, S/N: 15050203, 100 Hz to 32 GHz)
- Microwave Amplifier, HP, Model 83017A, Frequency Range 1 to 26.5 GHz, 34-38 dBdB gain nominal.
- Active Loop Antenna, Emco, Model 6507, SN 8906-1167, Frequency Range 1 KHz - 30 MHz, @ 50 Ohms
- Log Periodic/Bow-Tie Antenna, Emco, Model 3143, SN 1029, 20 - 1000 MHz, @ 50 ohms.
- Horn Antenna, Emco, Model 3115, SN 9701-5061, Frequency Range: 1 - 18 GHz, @ 50 Ohms.
- Horn Antenna, Emco, Model 3160-09, 18-26.5GHz
- Horn Antenna, Emco, Model 3160-09, 18-26.5GHz
- Horn Antenna, Emco, Model 3160-10, 26.5-40GHz
- Mixer, Tektronix, P/N 118-0098-00, 18-26.5GHz
- Mixer, Tektronix, P/N 119-0098-00, 26.5-40GHz

### METHOD OF MEASUREMENTS:

Refer to ANSI 63.4-1992, Para. 8 for detailed radiated emissions measurement procedures.

Applies to harmonics/spurious that fall in the restricted bands listed in Section 15.205. the maximum permitted average field strength is listed in Section 15.209. A Pre-Amp and highpass filter are used for this measurement.

For measurement below 1 GHz, set RBW = 100 KHz, VBW  $\geq$  100 KHz, SWEEP=AUTO.

For measurement above 1 GHz, set RBW = 1 MHz, VBW = 1 MHz (Peak) & VBW = 10 Hz (Average), SWEEP=AUTO.

If the emission is pulsed, modified the unit for continuous operation, then use the settings above for measurements, then correct the reading by subtracting the peak-average correction factor derived from the appropriate duty cycle calculation. See Section 15.35(b) and (c).

### **FCC CFR 47, Para. 2.997 - Frequency spectrum to be investigated**

The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10<sup>th</sup> harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

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**FCC CFR 47, Para. 2.993 - Field Strength Spurious Emissions**

- (a) Measurements was made to detect spurious emissions radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data were supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph 2.989(c) as appropriate. For equipment operating on frequencies below 1 GHz, an Open Field Test is normally required, with the measuring instrument antenna located in the far field at all test frequencies. In event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurement will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with the reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.
- (b) Measurements specified in paragraph (a) of this section shall be made for the following equipment:
- (1) Those in which the spurious emission are required to be 60 dB or more below the mean power of the transmitter.
  - (2) All equipment operating on frequencies higher than 25 MHz
  - (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
  - (4) Other types of equipment as required, when deemed necessary by the Commission.

**TEST RESULTS:** Conforms.

**TEST PERSONNEL:** Mr. Hung Trinh, RFI Technician

**DATE:** March 29, 1999

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**ULTRATECH GROUP OF LABS**

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vhk.ultratech@sympatico.ca](mailto:vhk.ultratech@sympatico.ca), Website: <http://www.ultratech-labs.com>

File #: GTT3-FTX  
May 10, 1999

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**MEASUREMENT DATA**

**RADIATED EMISSIONS MEASUREMENTS @ 3 METERS**

**TEST CONFIGURATION**

- This lowest, middle and highest channels were established at its full rated output power. The emissions were investigated from the lowest frequency generated by the transmitter up to the 10th harmonic of the fundamental emissions in each case. The measured level of the carrier was recorded and compared to the level of the emissions as required in Parts 15.247(c) or 15.209(a) whichever was applicable.
- For measuring radiated emissions at frequencies below 1 GHz, the Spectrum Analyzer was set as 100 KHz RBW, VBW ≥ RBW, SWEEP TIME: AUTO, PEAK DETECTOR.
- For measuring radiated emissions at frequencies above 1 GHz, the Spectrum Analyzer was set as 1 MHz RBW, 1 MHz VBW, SWEEP TIME: AUTO for PEAK measurements and 1 MHz RBW, 10 Hz VBW, SWEEP TIME: AUTO for AVERAGE measurements.
- The following measurements were the worst cases when the radiating antenna was placed in both horizontal and vertical polarization.
- The following AVERAGE rf levels were obtained from either Peak or Average readings added by the duty cycle correction factor. DUTY CYCLE FACTOR = Continuous

**TEST CONFIGURATION 1: ISA Wireless LAN Card with AL-101 Loopy ANT**

CHANNEL FREQUENCY TESTED: 2412 MHz				Power Level in 1 MHz BW: 108.06 dBµV/m			
FULL RATED POWER: 0.029 Watt				Limit = 88.06 dBµV/m			
FREQUENCY (MHz)	RF PEAK LEVEL (dBµV/m)	RF AVG LEVEL (dBµV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBµV/m)	LIMIT 15.247 (dBµV/m)	MARGIN (dB)	PASS/ FAIL
1120.0	39.2	28.6	V	54.0	88.1	-25.4	**PASS
1120.0	38.7	24.9	H	54.0	88.1	-29.1	**PASS
1400.0	44.1	33.3	V	54.0	88.1	-20.7	**PASS
1400.0	39.4	31.7	H	54.0	88.1	-22.3	**PASS
1680.0	41.0	30.5	V	54.0	88.1	-23.5	**PASS
1680.0	39.3	26.3	H	54.0	88.1	-27.7	**PASS
2132.0	49.3	43.6	V	54.0	88.1	-44.4	PASS
2132.0	50.8	46.9	H	54.0	88.1	-41.2	PASS
2412.0	108.1		V	--	--	--	--
2412.0	101.2		H	--	--	--	--
4264.0	50.6	39.1	V	54.0	88.1	-14.9	**PASS
4264.0	50.6	38.5	H	54.0	88.1	-15.5	**PASS
4824.0	54.1	45.2	V	54.0	88.1	-8.8	**PASS
4824.0	52.0	43.8	H	54.0	88.1	-10.2	**PASS
6396.0	54.4	44.4	V	54.0	88.1	-43.6	PASS
6396.0	54.5	45.9	H	54.0	88.1	-42.2	PASS
7236.0	56.9	47.3	V	54.0	88.1	-40.7	PASS
7236.0	53.5	44.7	H	54.0	88.1	-43.4	PASS
8528.0	56.3	44.6	V	54.0	88.1	-43.4	PASS
8528.0	56.3	44.7	H	54.0	88.1	-43.4	PASS

No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details

\*\* Emission within the restricted band specified in @ 15.205(a)

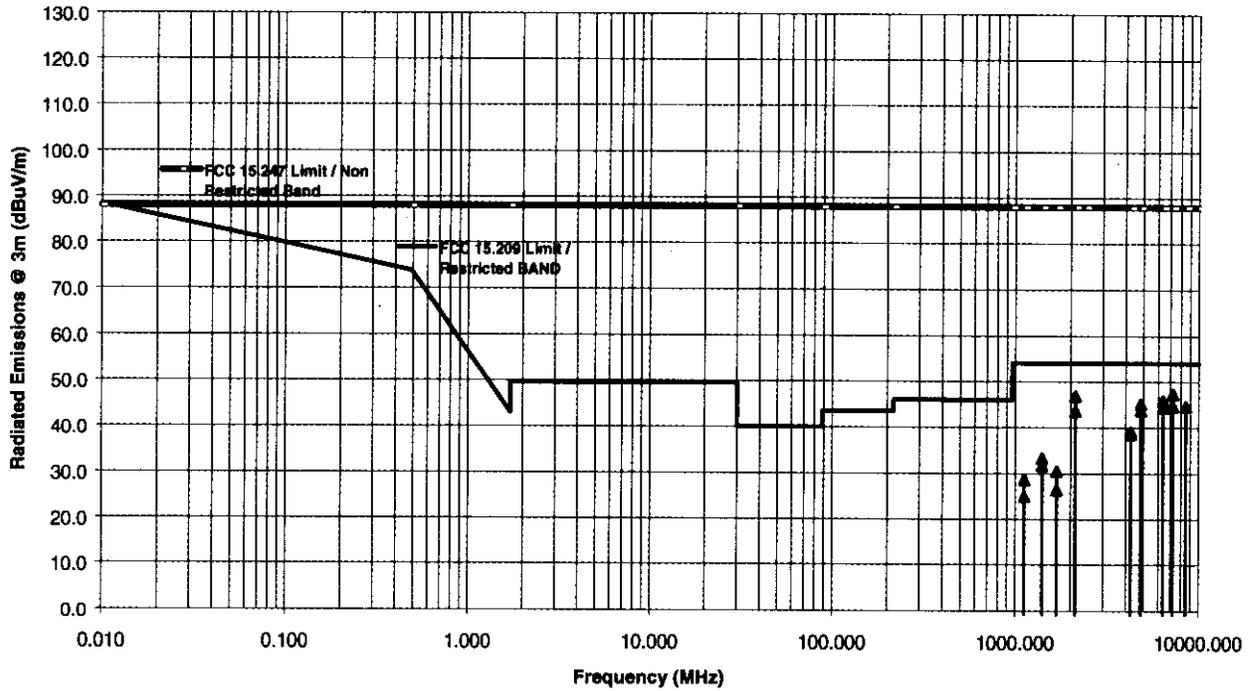
**ULTRATECH GROUP OF LABS**

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: http://www.ultratech-labs.com

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Transmitter Radiated Emissions Measurements at 3 Meter OFTS  
GEMTEK ISA Wireless LAN Card With AL-101 Loopy ANT  
TRANSMIT Freq.: 2412 MHz, 2Mbps DQPSK



**ULTRATECH GROUP OF LABS**

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vhk.ultratech@sympatico.ca](mailto:vhk.ultratech@sympatico.ca), Website: <http://www.ultratech-labs.com>

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Date: March 27 1999  
 Tested by: Hung Trinh

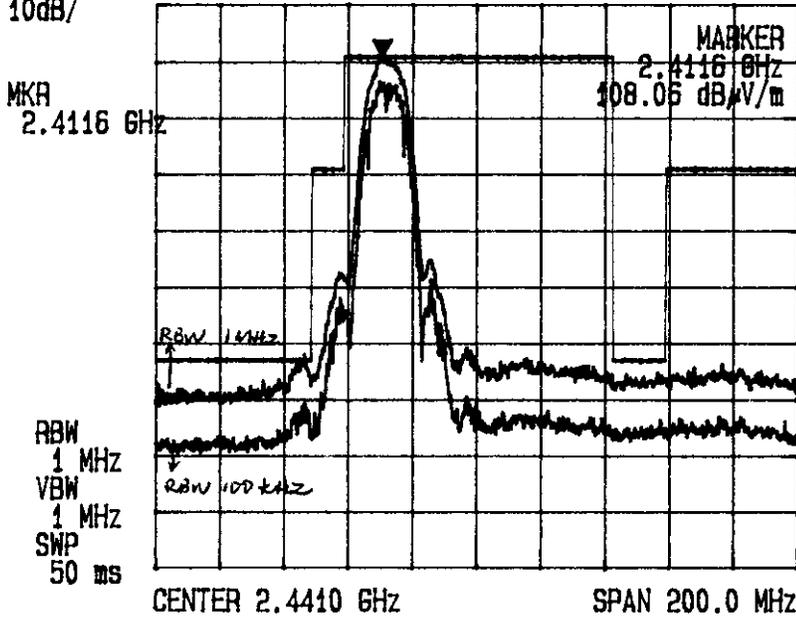
**GEMTEK TECHNOLOGY CO. LTD.**

ISA Wireless LAN Card, WL-301

Channel #: 1, Tx Frequency: 2.412 MHz  
 Modulation: [ ] 1Mb/s BPSK, [x] 2 Mb/s GFSK, DQPSK  
 Antenna: AL-101 Loopy ANT

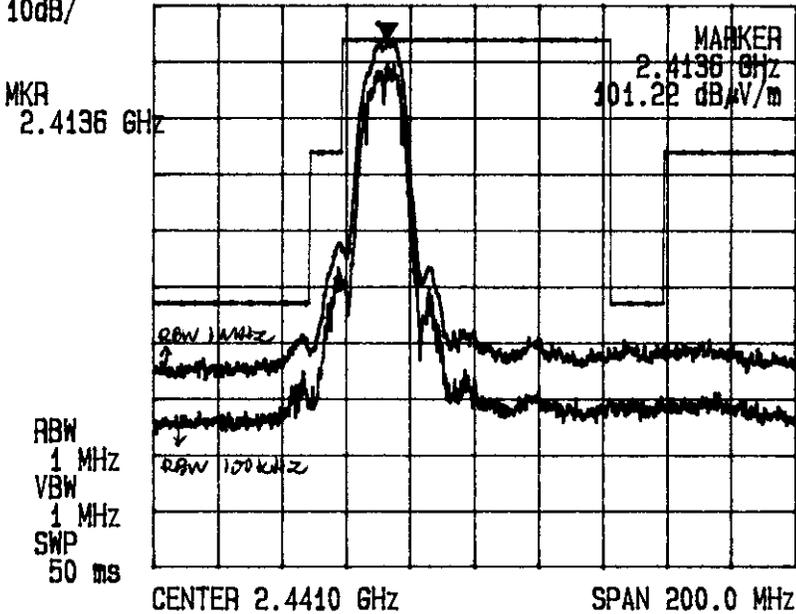
**Radiated Emissions Measurements @ 3 Meters**

1 TO 18GHz HP83017A E3115 Mon Mar 29 18:46:11 1999  
 REF 117.0 dB $\mu$ V/m ATT 20 dB A\_view B\_view  
 10dB/



**VERTICAL**

1 TO 18GHz HP83017A E3115 Mon Mar 29 18:41:36 1999  
 REF 107.0 dB $\mu$ V/m ATT 10 dB A\_view B\_view  
 10dB/



**HORIZONTAL**



CHANNEL FREQUENCY TESTED: 2437 MHz				Power Level in 1 MHz BW: 109.0 dB $\mu$ V/m			
FULL RATED POWER: 0.024 Watt				Limit = 89.0 dB $\mu$ V/m			
FREQUENCY (MHz)	RF PEAK LEVEL (dB $\mu$ V/m)	RF AVG LEVEL (dB $\mu$ V/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dB $\mu$ V/m)	LIMIT 15.247 (dB $\mu$ V/m)	MARGIN (dB)	PASS/FAIL
1120.0	39.2	28.6	V	54.0	89.0	-25.4	PASS**
1120.0	38.7	24.9	H	54.0	89.0	-29.1	PASS**
1400.0	44.1	33.3	V	54.0	89.0	-20.7	PASS**
1400.0	39.4	31.7	H	54.0	89.0	-22.3	PASS**
1680.0	41.0	30.5	V	54.0	89.0	-23.5	PASS**
1680.0	39.3	26.3	H	54.0	89.0	-27.7	PASS**
2157.0	47.9	41.7	V	54.0	89.0	-47.3	PASS
2157.0	50.6	46.2	H	54.0	89.0	-42.8	PASS
2437.0	109.0	--	V	--	--	--	--
2437.0	99.2	--	H	--	--	--	--
4314.0	51.0	40.0	V	54.0	89.0	-14.0	PASS**
4314.0	51.2	43.4	H	54.0	89.0	-10.6	PASS**
4874.0	51.6	41.2	V	54.0	89.0	-12.8	PASS**
4874.0	52.1	40.4	H	54.0	89.0	-13.6	PASS**
6471.0	52.1	41.8	V	54.0	89.0	-47.2	PASS
6471.0	53.7	43.7	H	54.0	89.0	-45.3	PASS

No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details

\*\* Emission within the restricted band specified in @ 15.205(a)

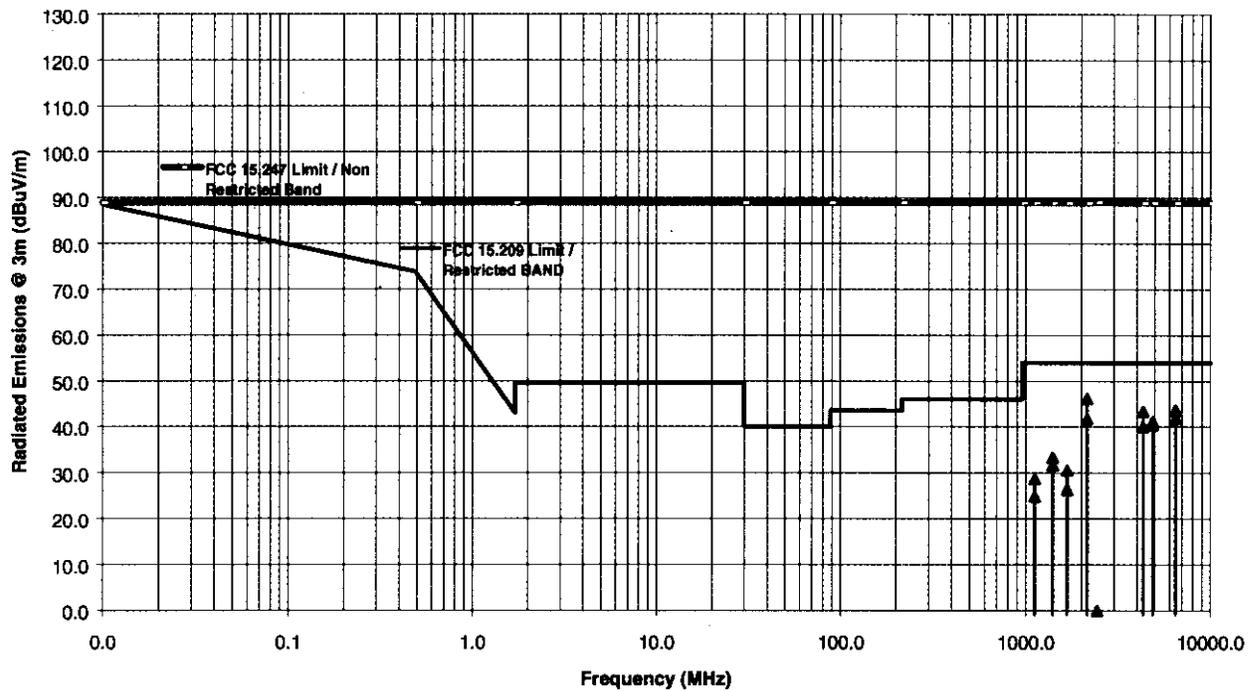
**ULTRATECH GROUP OF LABS**

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 May 10, 1999

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Transmitter Radiated Emissions Measurements at 3 Meter OFTS  
GEMTEK ISA Wireless LAN Card With AL-101 Loopy ANT  
TRANSMIT Freq.: 2437 MHz, 2Mbps DQPSK



ULTRATECH GROUP OF LABS

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File #: GTT3-FTX  
May 10, 1999

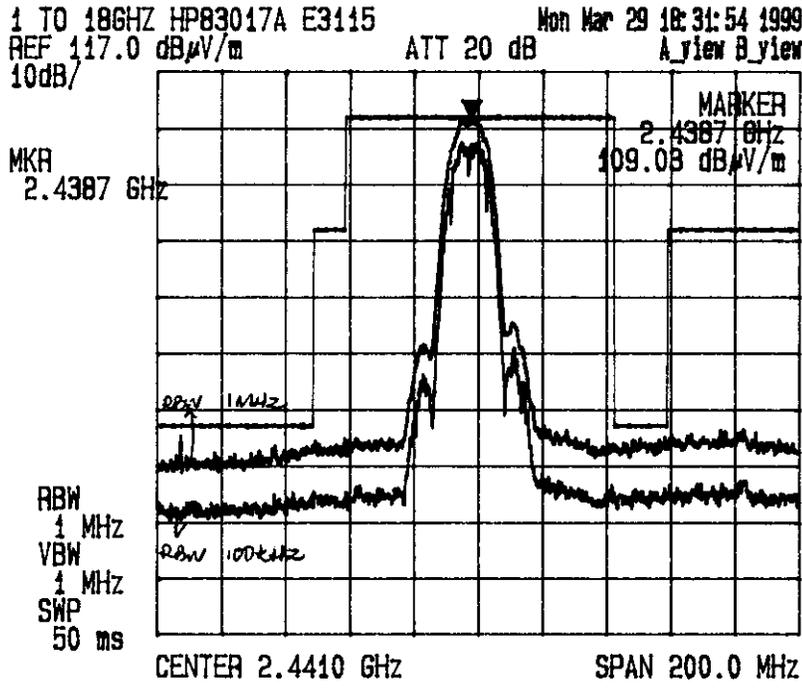
- Accredited by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia)
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Date: March 29 1999  
 Tested by: Hung Trinh

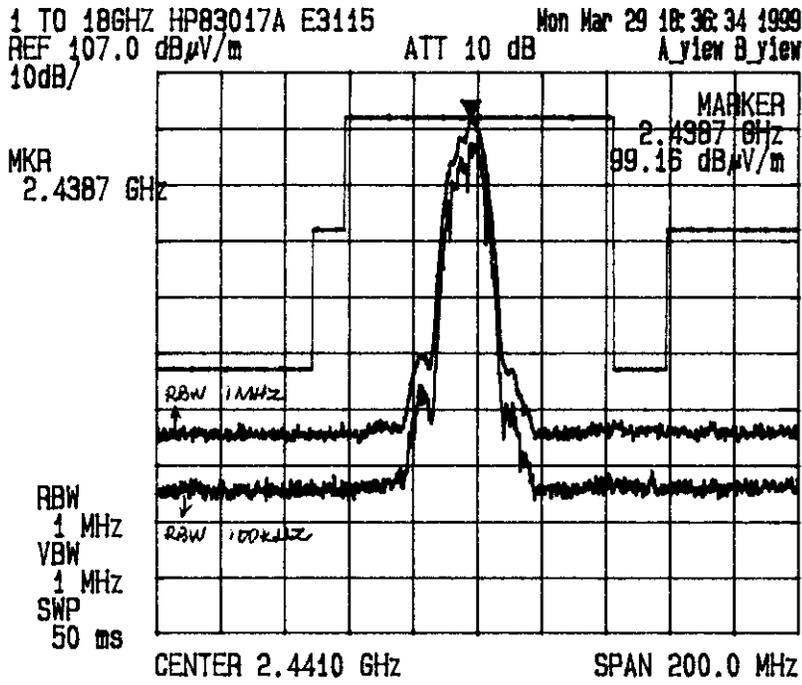
**GEMTEK TECHNOLOGY CO. LTD.**  
 ISA Wireless LAN Card, WL-301  
 Channel #: 6, Tx Frequency: 2.437 MHz  
 Modulation: [ ] 1Mb/s BPSK, [x] 2 Mb/s **QPSK**, [ ] GFSK  
 Antenna: AL-101 Loopy ANT



**Radiated Emissions Measurements @ 3 Meters**



**VERTICAL**



**HORIZONTAL**

CHANNEL FREQUENCY TESTED: 2462 MHz				Power Level in 1 MHz BW: 108.9 dBµV/m			
FULL RATED POWER: 0.026 Watt				Limit = 88.9 dBµV/m			
FREQUENCY (MHz)	RF PEAK LEVEL (dBµV/m)	RF AVG LEVEL (dBµV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBµV/m)	LIMIT 15.247 (dBµV/m)	MARGIN (dB)	PASS/FAIL
1120.0	39.2	28.6	V	54.0	88.9	-25.4	PASS**
1120.0	38.7	24.9	H	54.0	88.9	-29.1	PASS**
1400.0	44.1	33.3	V	54.0	88.9	-20.7	PASS**
1400.0	39.4	31.7	H	54.0	88.9	-22.3	PASS**
1680.0	41.0	30.5	V	54.0	88.9	-23.5	PASS**
1680.0	39.3	26.3	H	54.0	88.9	-27.7	PASS**
2182.0	47.3	40.0	V	54.0	88.9	-48.9	PASS
2182.0	50.8	46.1	H	54.0	88.9	-42.8	PASS
2462.0	108.9	--	V	--	--	--	--
2462.0	102.9	--	H	--	--	--	--
4364.0	53.0	46.7	V	54.0	88.9	-7.3	PASS**
4364.0	53.0	46.3	H	54.0	88.9	-7.7	PASS**
4924.0	51.7	39.8	V	54.0	88.9	-14.2	PASS**
4924.0	51.5	39.8	H	54.0	88.9	-14.2	PASS**
6546.0	54.8	45.0	V	54.0	88.9	-43.9	PASS
6546.0	57.4	50.6	H	54.0	88.9	-38.3	PASS

No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details

\*\* Emission within the restricted band specified in @ 15.205(a)

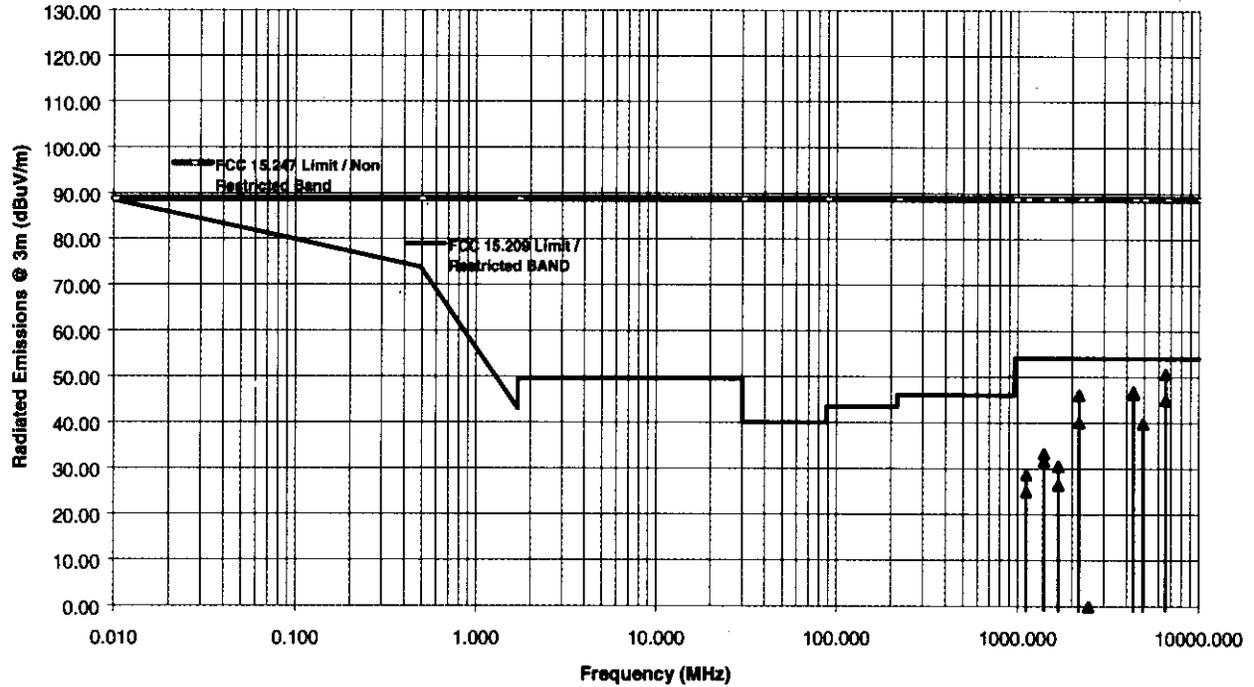
**ULTRATECH GROUP OF LABS**

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 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yhk.ultratech@sympatico.ca](mailto:yhk.ultratech@sympatico.ca), Website: <http://www.ultratech-labs.com>

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Transmitter Radiated Emissions Measurements at 3 Meter OFTS  
GEMTEK ISA Wireless LAN Card With AL-101 Loopy ANT  
TRANSMIT Freq.: 2462 MHz, 2 Mbps, DQPSK



**ULTRATECH GROUP OF LABS**

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- All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Date: March 29 1999  
Tested by: Hung Trinh

### GEMTEK TECHNOLOGY CO. LTD.

ISA Wireless LAN Card, WL-301

Channel #: //, Tx Frequency: 2462 MHz

Modulation: [ ] 1Mb/s BPSK, [x] 2 Mb/s ~~CPSK~~ DQPSK

Antenna: AL-101 Loopy ANT

### Radiated Emissions Measurements @ 3 Meters

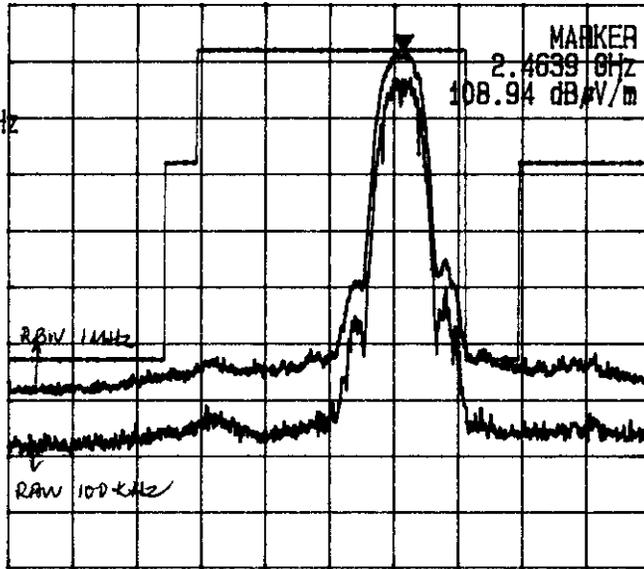
1 TO 18GHZ HP83017A E3115  
REF 117.0 dB $\mu$ V/m  
10dB/

Mon Mar 29 18:20:33 1999

ATT 20 dB

A\_view B\_view

MKA  
2.4639 GHz



CENTER 2.4410 GHz

SPAN 200.0 MHz

### VERTICAL

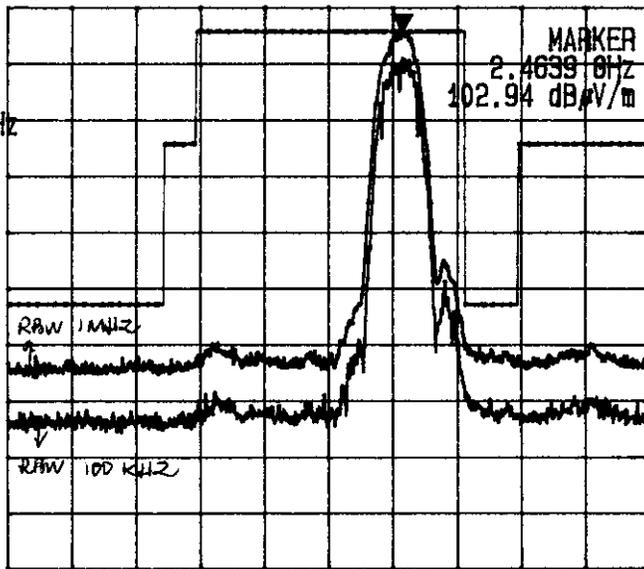
1 TO 18GHZ HP83017A E3115  
REF 107.0 dB $\mu$ V/m  
10dB/

Mon Mar 29 18:13:33 1999

ATT 10 dB

A\_view B\_view

MKA  
2.4639 GHz



CENTER 2.4410 GHz

SPAN 200.0 MHz

### HORIZONTAL

Ultra Tech  
Engineering Labs Inc.



***TEST CONFIGURATION 2: ISA Wireless LAN Card with AL-102 Dipole ANT Right-Angle***

CHANNEL FREQUENCY TESTED: 2412 MHz				Power Level in 1 MHz BW: 112.7 dB $\mu$ V/m			
FULL RATED POWER: 0.029 Watt				Limit = 92.7 dB $\mu$ V/m			
FREQUENCY (MHz)	RF PEAK LEVEL (dB $\mu$ V/m)	RF AVG LEVEL (dB $\mu$ V/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dB $\mu$ V/m)	LIMIT 15.247 (dB $\mu$ V/m)	MARGIN (dB)	PASS/FAIL
1120.0	41.5	30.2	V	54.0	92.7	-23.8	PASS**
1120.0	39.9	29.0	H	54.0	92.7	-25.0	PASS**
1680.0	43.2	31.8	V	54.0	92.7	-22.2	PASS**
1680.0	43.5	32.8	H	54.0	92.7	-21.3	PASS**
2132.0	47.8	42.9	V	54.0	92.7	-49.8	PASS
2132.0	49.0	43.6	H	54.0	92.7	-49.1	PASS
2412.0	109.9	--	V	--	--	--	--
2412.0	112.7	--	H	--	--	--	--
4264.0	50.2	44.3	V	54.0	92.7	-9.7	PASS**
4264.0	49.9	38.8	H	54.0	92.7	-15.2	PASS**
4824.0	55.2	47.6	V	54.0	92.7	-6.4	PASS**
4824.0	54.9	46.3	H	54.0	92.7	-7.7	PASS**
6396.0	54.2	43.0	V	54.0	92.7	-49.7	PASS
6396.0	53.9	44.2	H	54.0	92.7	-48.5	PASS
7236.0	56.2	45.4	V	54.0	92.7	-47.3	PASS
7236.0	58.3	50.3	H	54.0	92.7	-42.5	PASS

No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details

\*\* Emission within the restricted band specified in @ 15.205(a)

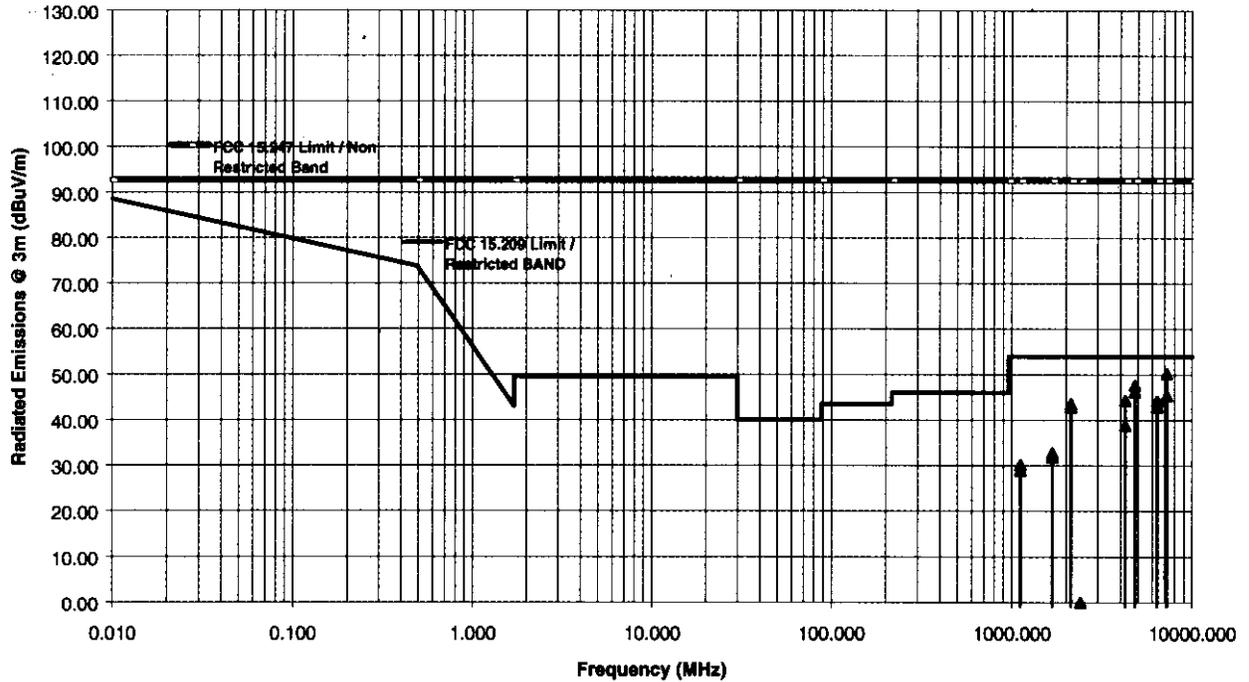
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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vhk.ultratech@sympatico.ca](mailto:vhk.ultratech@sympatico.ca), Website: <http://www.ultratech-labs.com>

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Transmitter Radiated Emissions Measurements at 3 Meter OFTS  
GEMTEK ISA Wireless LAN Card With AL-102 Dipole ANT Right-Angle  
TRANSMIT Freq.: 2412 MHz, 2 Mbps DQPSK



**ULTRATECH GROUP OF LABS**

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vhk.ultratech@sympatico.ca](mailto:vhk.ultratech@sympatico.ca), Website: <http://www.ultratech-labs.com>

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Date: March 29 1999  
Tested by: Hung Trinh

### GEMTEK TECHNOLOGY CO. LTD.

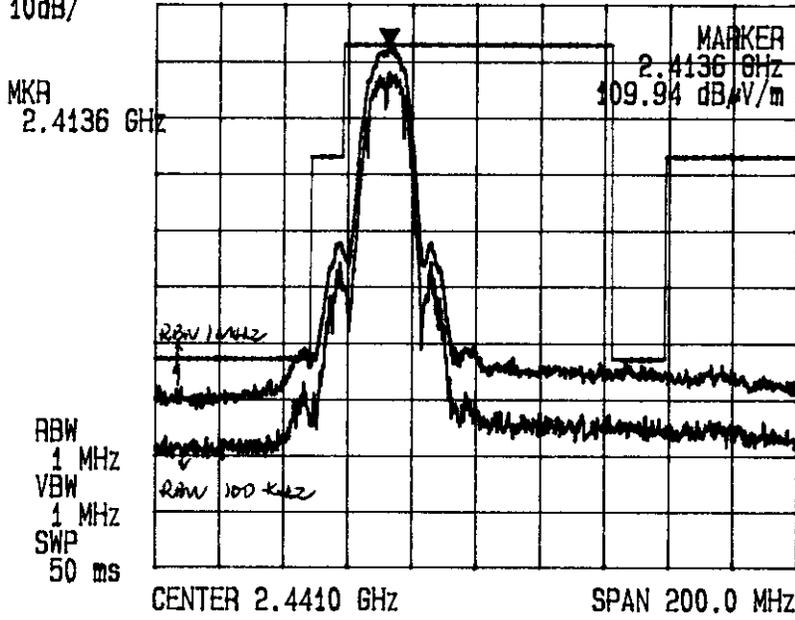
ISA Wireless LAN Card, WL-301

Channel #: 1, Tx Frequency: 2.412 MHz  
Modulation: [ ] 1Mb/s BPSK, [x] 2 Mb/s ~~QPSK~~ DQPSK  
Antenna: AL-102 Dipole ANT Right Angle

Radiated Emissions Measurements @ 3 Meters

1 TO 18GHZ HP83017A E3115  
REF 117.0 dB $\mu$ V/m  
10dB/

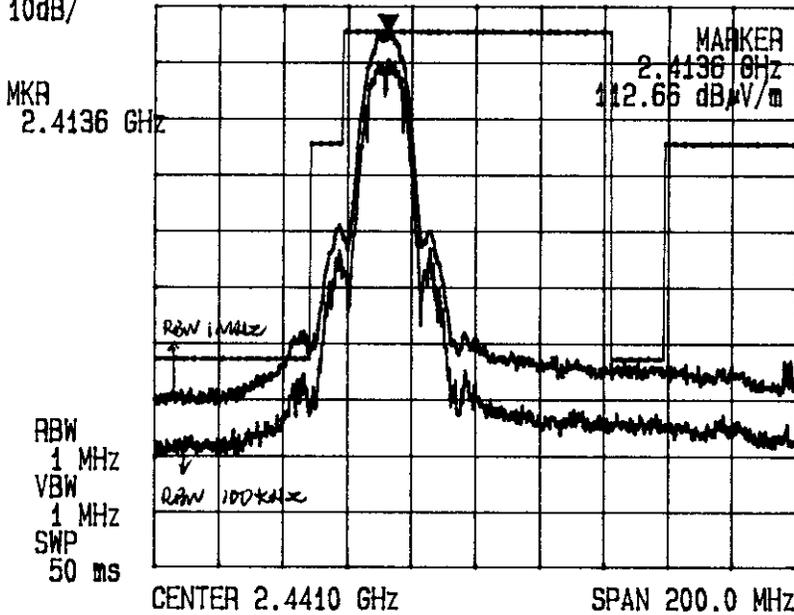
Mon Mar 29 17:44:43 1999  
ATT 20 dB  
A\_view B\_view



VERTICAL

1 TO 18GHZ HP83017A E3115  
REF 117.0 dB $\mu$ V/m  
10dB/

Mon Mar 29 17:37:20 1999  
ATT 20 dB  
A\_view B\_view



HORIZONTAL



CHANNEL FREQUENCY TESTED: 2437 MHz				Power Level in 1 MHz BW: 112.3 dB $\mu$ V/m			
FULL RATED POWER: 0.024 Watt				Limit = 92.3 dB $\mu$ V/m			
FREQUENCY (MHz)	RF PEAK LEVEL (dB $\mu$ V/m)	RF AVG LEVEL (dB $\mu$ V/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dB $\mu$ V/m)	LIMIT 15.247 (dB $\mu$ V/m)	MARGIN (dB)	PASS/FAIL
1120.0	41.5	30.2	V	54.0	92.3	-23.8	PASS**
1120.0	39.9	29.0	H	54.0	92.3	-25.0	PASS**
1680.0	43.2	31.8	V	54.0	92.3	-22.2	PASS**
1680.0	43.5	32.8	H	54.0	92.3	-21.3	PASS**
2157.0	47.5	40.6	V	54.0	92.3	-51.7	PASS
2157.0	49.1	44.8	H	54.0	92.3	-47.5	PASS
2437.0	111.3	--	V	--	--	--	--
2437.0	112.3	--	H	--	--	--	--
4314.0	50.2	40.8	V	54.0	92.3	-13.3	PASS**
4314.0	51.1	43.1	H	54.0	92.3	-10.9	PASS**
4874.0	52.5	40.2	V	54.0	92.3	-13.8	PASS**
4874.0	53.0	41.9	H	54.0	92.3	-12.1	PASS**
6471.0	54.4	45.2	V	54.0	92.3	-47.1	PASS
6471.0	54.7	45.2	H	54.0	92.3	-47.1	PASS

No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details

\*\* Emission within the restricted band specified in @ 15.205(a)

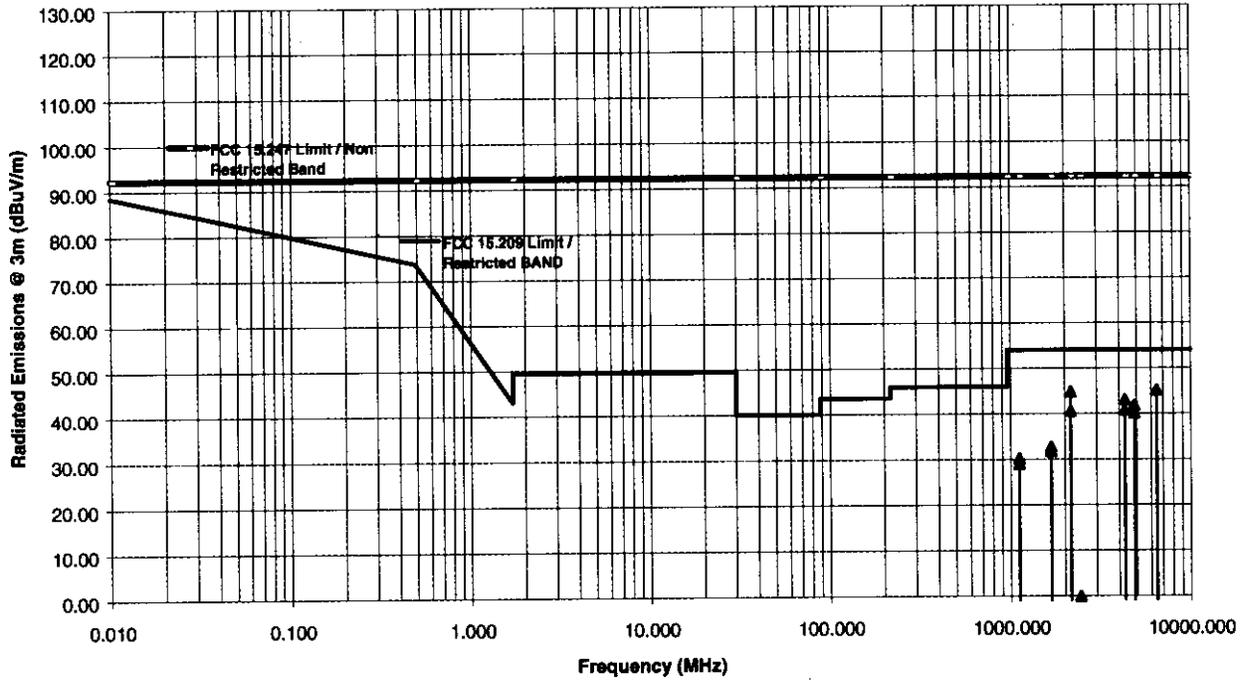
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Transmitter Radiated Emissions Measurements at 3 Meter OFTS  
GEMTEK ISA Wireless LAN Card AL-102 Dipole ANT Right-Angle  
TRANSMIT Freq.: 2437 MHz, 2 Mbps, DQPSK



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Date: March 29 1999  
Tested by: Hung Trinh

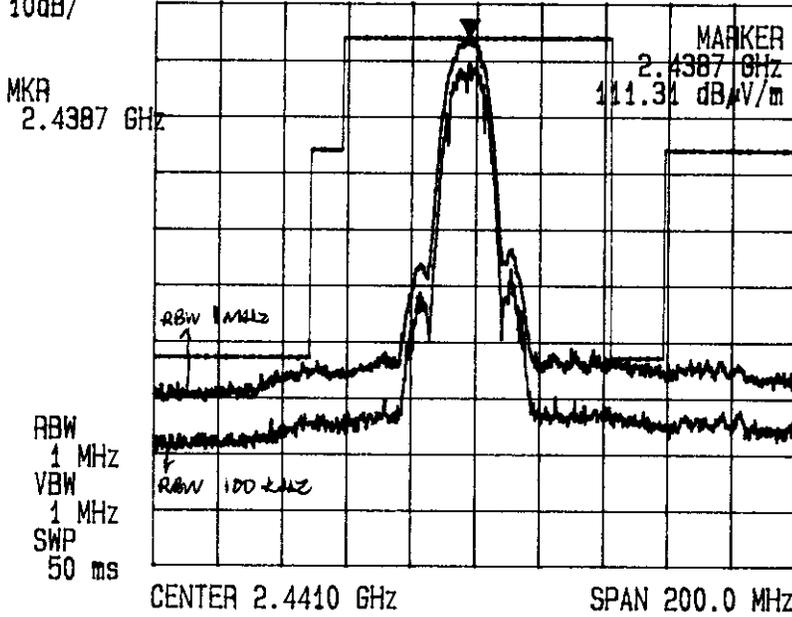
# GEMTEK TECHNOLOGY CO. LTD.

ISA Wireless LAN Card, WL-301

Channel #: 6, Tx Frequency: 2.437 MHz  
Modulation: [ ] 1 Mb/s BPSK, [X] 2 Mb/s ~~CSSK~~ DQPSK  
Antenna: AL-102 Dipole ANT Right Angle

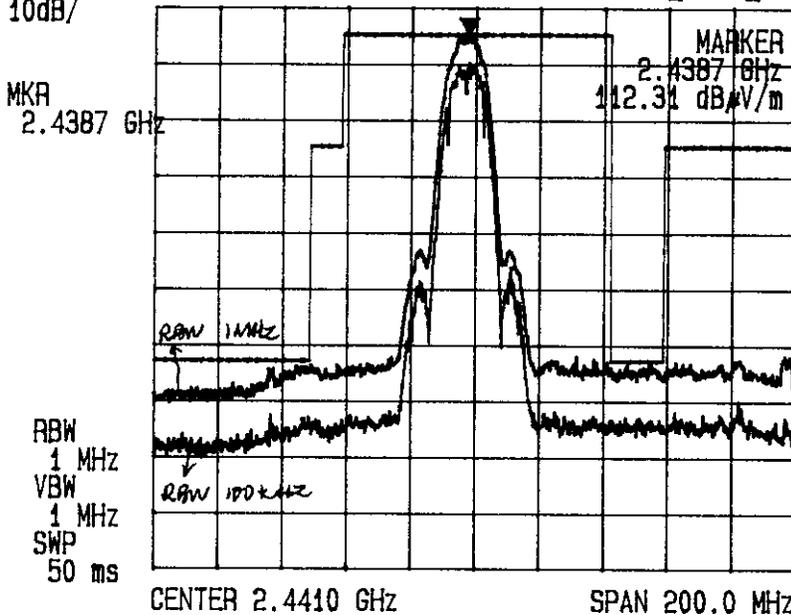
## Radiated Emissions Measurements @ 3 Meters

1 TO 18GHz HP83017A E3115 Mon Mar 29 17:20:29 1999  
REF 117.0 dB $\mu$ V/m ATT 20 dB A\_view B\_view  
10dB/



VERTICAL

1 TO 18GHz HP83017A E3115 Mon Mar 29 17:29:12 1999  
REF 117.0 dB $\mu$ V/m ATT 20 dB A\_view B\_view  
10dB/



HORIZONTAL



CHANNEL FREQUENCY TESTED: 2462 MHz				Power Level in 1 MHz BW: 111.5 dB $\mu$ V/m			
FULL RATED POWER: 0.026 Watt				Limit = 91.5 dB $\mu$ V/m			
FREQUENCY (MHz)	RF PEAK LEVEL (dB $\mu$ V/m)	RF AVG LEVEL (dB $\mu$ V/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dB $\mu$ V/m)	LIMIT 15.247 (dB $\mu$ V/m)	MARGIN (dB)	PASS/FAIL
1120.0	41.5	30.2	V	54.0	91.5	-23.8	PASS**
1120.0	39.9	29.0	H	54.0	91.5	-25.0	PASS**
1680.0	43.2	31.8	V	54.0	91.5	-22.2	PASS**
1680.0	43.5	32.8	H	54.0	91.5	-21.3	PASS**
2182.0	48.4	43.0	V	54.0	91.5	-48.5	PASS
2182.0	49.1	44.3	H	54.0	91.5	-47.2	PASS
2462.0	110.3	--	V	--	--	--	--
2462.0	111.5	--	H	--	--	--	--
4364.0	52.5	45.2	V	54.0	91.5	-8.8	PASS**
4364.0	53.1	44.3	H	54.0	91.5	-9.7	PASS**
4924.0	51.6	40.3	V	54.0	91.5	-13.7	PASS**
4924.0	52.3	41.7	H	54.0	91.5	-12.3	PASS**
6546.0	53.8	44.3	V	54.0	91.5	-47.2	PASS
6546.0	54.7	47.3	H	54.0	91.5	-44.2	PASS
8728.0	58.0	47.5	V	54.0	91.5	-44.0	PASS
8728.0	58.9	48.6	H	54.0	91.5	-42.9	PASS

No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details

\*\* Emission within the restricted band specified in @ 15.205(a)

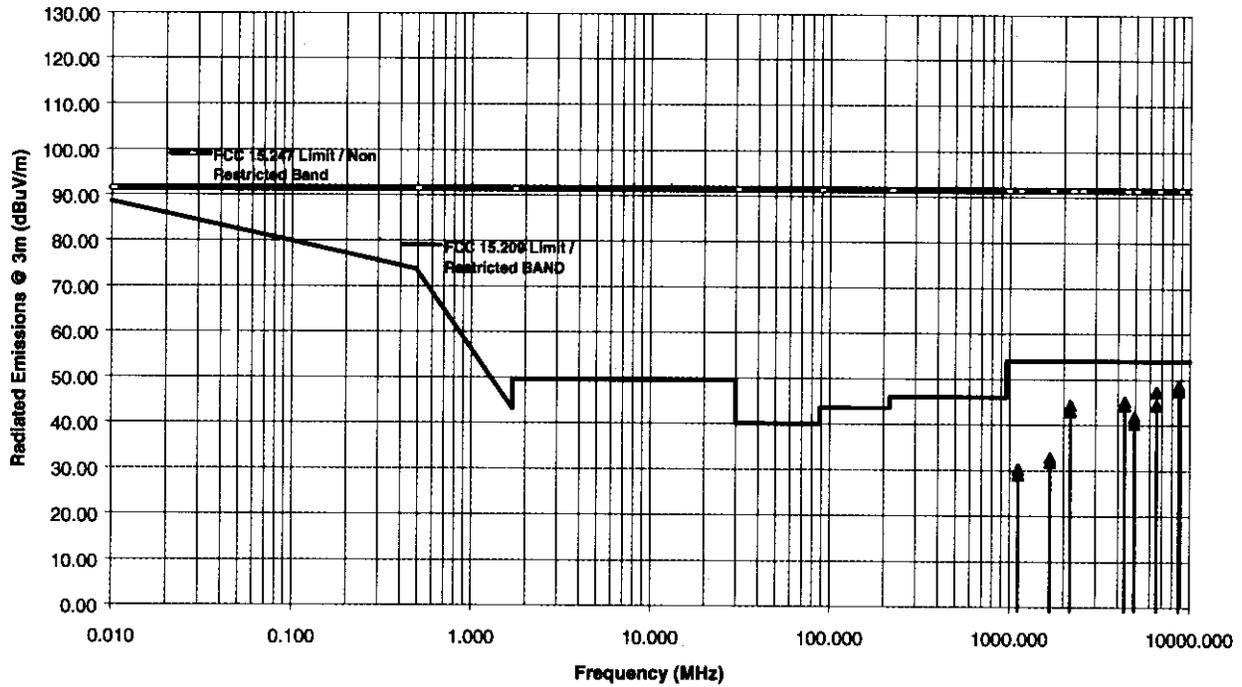
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Transmitter Radiated Emissions Measurements at 3 Meter OFTS  
GEMTEK ISA Wireless LAN Card AL-102 Dipole ANT Right-Angle  
TRANSMIT Freq.: 2462 MHz, 2 Mbps DQPSK



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Date: March 1, 1999  
Tested by: Hung Trinh

# GEMTEK TECHNOLOGY CO. LTD.

ISA Wireless LAN Card, WL-301

Channel #: 11, Tx Frequency: 2.4619 MHz  
Modulation: [ ] 1Mb/s BPSK, [x] 2 Mb/s ~~CSSK~~. ~~DRPSK~~  
Antenna: AL-102 Dipole ANT Right Angle

## Radiated Emissions Measurements @ 3 Meters

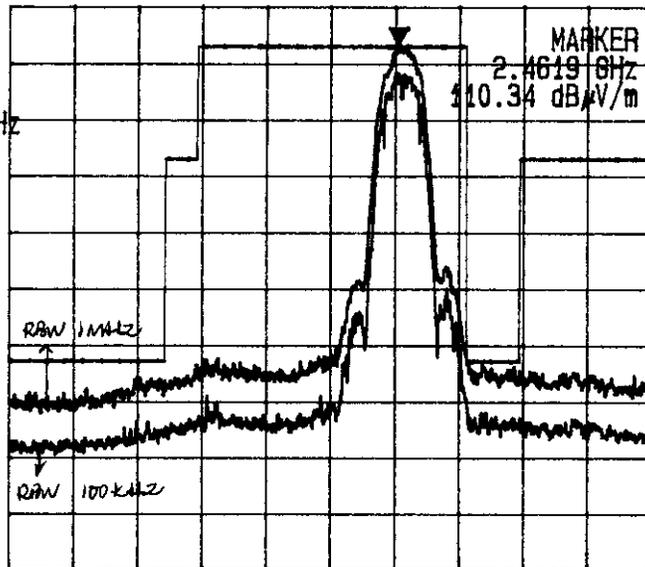
1 TO 18GHz HP83017A E3115  
REF 117.0 dB $\mu$ V/m  
10dB/

Mon Mar 29 17:56:25 1999

ATT 20 dB

A\_view B\_view

MKR  
2.4619 GHz



CENTER 2.4410 GHz

SPAN 200.0 MHz

### VERTICAL

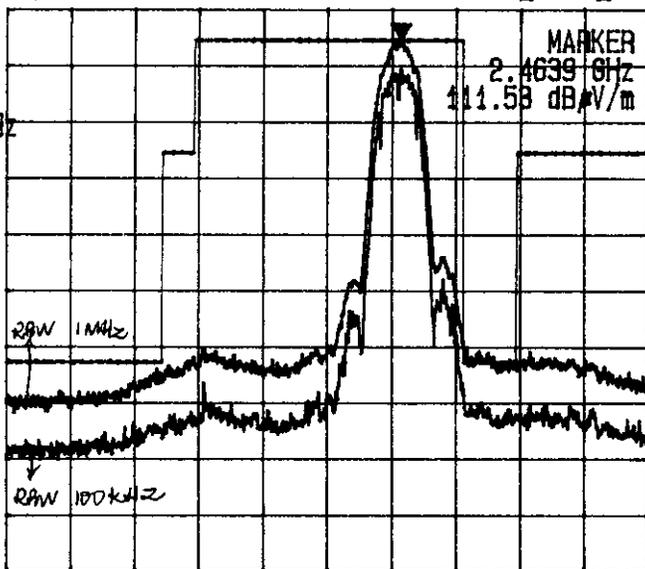
1 TO 18GHz HP83017A E3115  
REF 117.0 dB $\mu$ V/m  
10dB/

Mon Mar 29 18:00:21 1999

ATT 20 dB

A\_view B\_view

MKR  
2.4639 GHz



CENTER 2.4410 GHz

SPAN 200.0 MHz

### HORIZONTAL

**UltraTech**  
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#### 4.5. TRANSMITTED POWER DENSITY OF A DIRECT SEQUENCE SPREAD SPECTRUM SYSTEM, FCC CFR 47, PARA. 15.247(D)

**PRODUCT NAME:** ISA Wireless LAN Card, Model No.: WL-301

**FCC REQUIREMENTS:**

For a direct sequence system, the transmitted power density average over any 1 second interval shall not be greater than 8 dBm in any 3 KHz bandwidth within this band.

**CLIMATE CONDITION:**

Standard Temperature and Humidity:

- Ambient temperature: 23 °C
- Relative humidity: 43 %

**POWER INPUT:**

Using DC power from computer.

**TEST EQUIPMENT:**

- Advantest Spectrum Analyzer, Model R3271, S/N: 15050203
- Bird 20 dB Attenuator, 50 Ohm IN/OUT

**METHOD OF MEASUREMENT:**

A scan was made by using a spectrum analyzer with the detector function set to NORMAL mode.

Locate and zoom in on emission peak(s) within the passband. Set RBW = 3 KHz, VBW  $\geq$  RBW, Sweep = SPAN/3 KHz. For example, a span of 1.5 MHz, the sweep should be  $1.5 \times 10^6 / 3.0 \times 10^3 = 500$  seconds. The measured peak level must be no greater than +8 dBm.

- For devices with spectrum line spacing greater than 3 KHz no change is required.
- For devices with spectrum line spacing equal to or less than 3 KHz, the resolution bandwidth must be reduced below 3 KHz until the individual lines in the spectrum are resolved. The measurement data must then be normalized to 3 KHz by summing the power of all the individual spectral lines within 3 KHz band (in linear power units) to determine compliance.
- If the spectrum line spacing cannot be resolved on the available spectrum analyzer, the noise density function on most modern conventional spectrum analyzer will directly measure the noise power density normalized to 1 Hz noise power bandwidth. Add 30 dB for correction to 3 KHz.
- Should all the above fail or any controversy develop regarding accuracy of measurement, the Laboratory will use HP 89440A Vector Signal Analyzer for final measurement unless a clear showing can be made for a further alternate.

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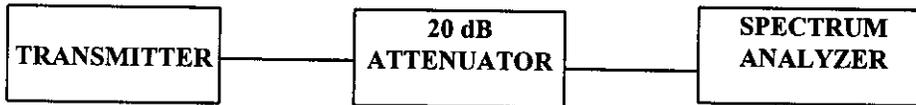
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**TEST ARRANGEMENT**



**TEST RESULTS:** Conforms.

**TEST PERSONNEL:** Mr. Hung Trinh, RFI Technician

**DATE:** April 6, 1999

**MEASUREMENT DATA:**

**TEST CONFIGURATION**

- The transmitter was coupled to the Spectrum Analyzer through a 20 dB attenuator.
- The insertion loss between the transmitter output terminal and the spectrum analyzer was measured to be 20 dB
- The channel frequencies were established on the extreme edges (both upper and lower) and middle of the 2412 - 2462 MHz band at its full rated output power. The emissions was investigated up to the tenth harmonic of the fundamental emissions in each case. the measured level of the carrier was recorded and compared to the level of the emissions as required in Part 15.247(d)

CHANNEL NUMBER	CHANNEL FREQUENCY (MHz)	RF POWER LEVEL IN 3 KHz BW (dBm)	LIMIT (dBm)	MARGIN (dB)	COMMENTS (PASS/FAIL)
1	2412	-14.25	8.0	-22.3	PASS
6	2437	-15.44	8.0	-23.4	PASS
11	2462	-14.84	8.0	-22.8	PASS

Please refer to attached plots for details.

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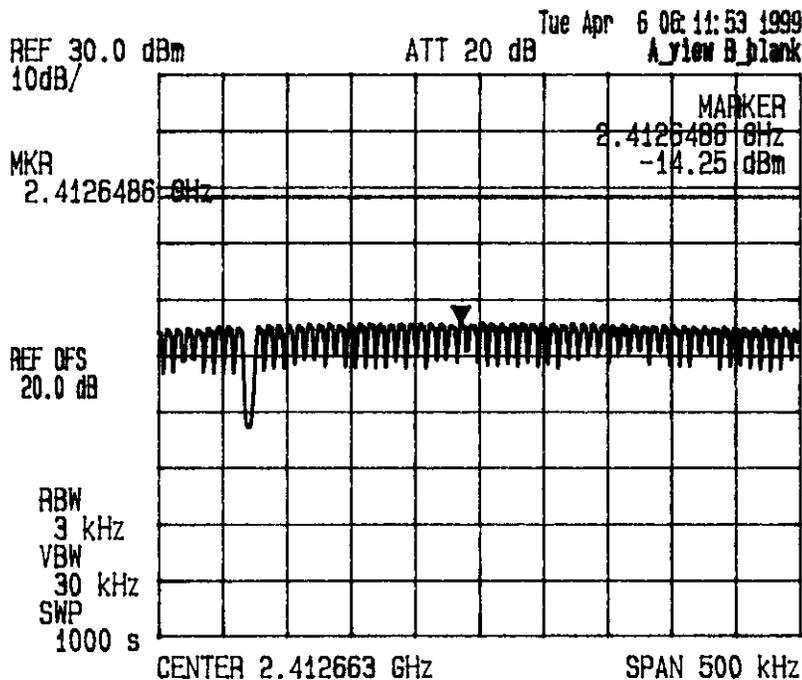
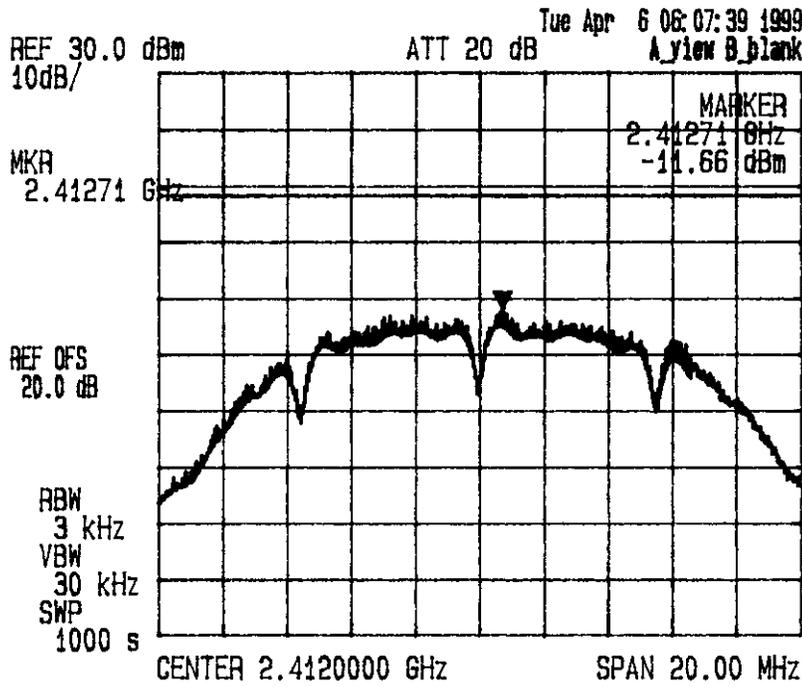
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Date: April 06, 1999  
Tested by: Hung Trinh

**GEMTEK TECHNOLOGY CO. LTD.**  
**TRANSMITTER ANTENNA POWER CONDUCTED EMISSIONS**  
ISA Wireless LAN Card, WL-301  
Channel #: 1, Tx Frequency: 2.412 MHz  
Modulation: 2 Mb/s ~~CSMA~~ **DSSS**

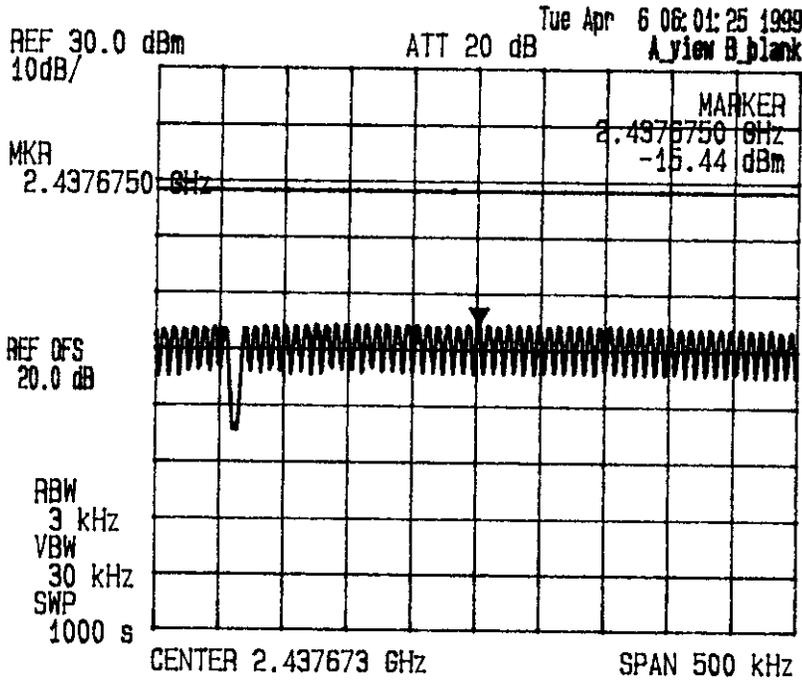
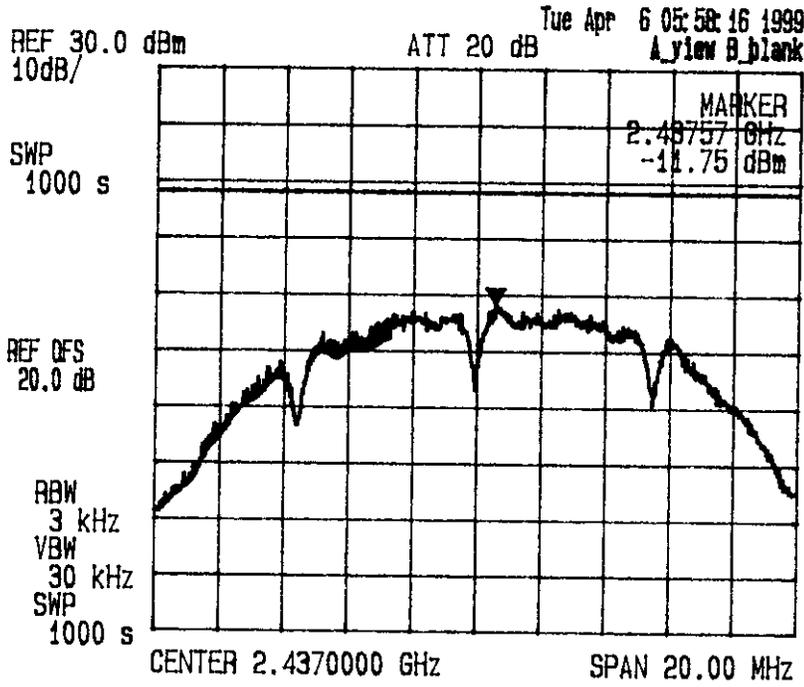


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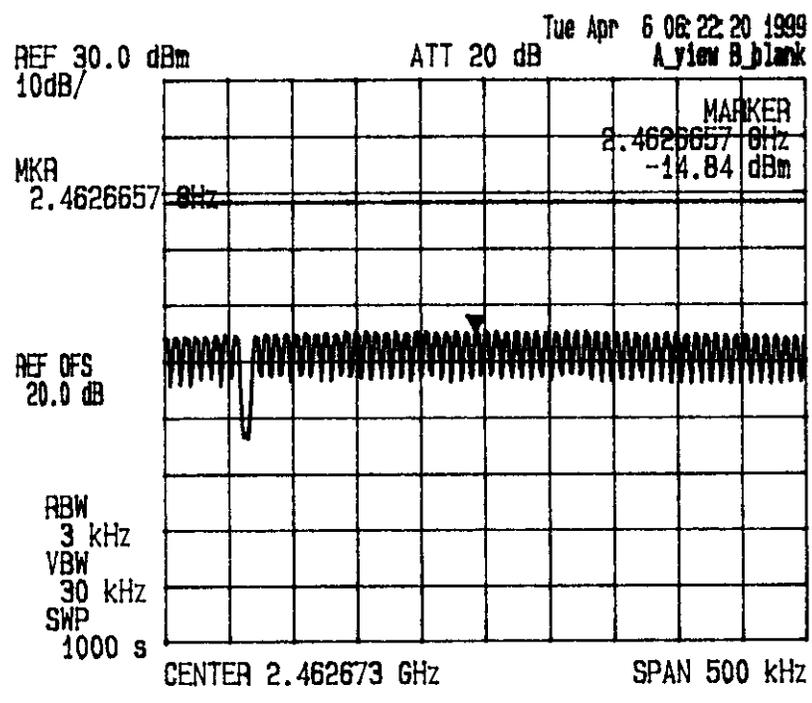
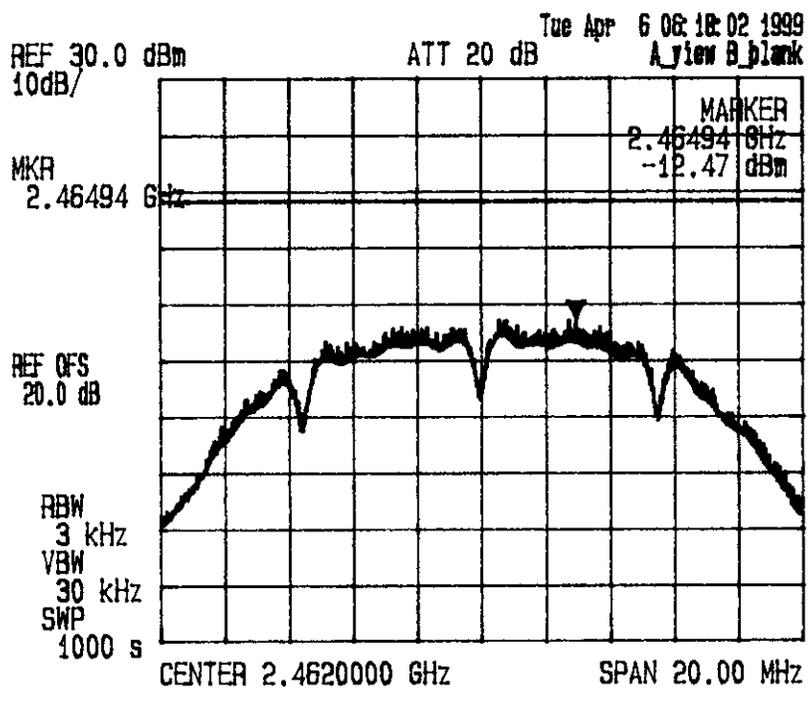
Date: April 06, 1999  
Tested by: Hung Trinh

**GEMTEK TECHNOLOGY CO. LTD.**  
TRANSMITTER ANTENNA POWER CONDUCTED EMISSIONS  
ISA Wireless LAN Card, WL-301  
Channel #: 6, Tx Frequency: 2437 MHz  
Modulation: 2 Mb/s CS-SSK



Date: April 06, 1999  
Tested by: Hung Trinh

**GEMTEK TECHNOLOGY CO. LTD.**  
TRANSMITTER ANTENNA POWER CONDUCTED EMISSIONS  
ISA Wireless LAN Card, WL-301  
Channel #: 11, Tx Frequency: 2.462 MHz  
Modulation: 2 Mb/s ~~QPSK~~ DSSS



#### 4.6. PROCESSING GAIN OF A DIRECT SEQUENCE SPREAD SPECTRUM, FCC CFR 47, PARA. 15.247(E)

**PRODUCT NAME:** ISA Wireless LAN Card, Model No.: WL-301

##### FCC REQUIREMENTS:

The processing gain of a direct sequence system shall be at least 10 dB. 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.

##### CLIMATE CONDITION:

Standard Temperature and Humidity:

- Ambient temperature: 23 °C
- Relative humidity: 43 %

##### POWER INPUT:

Using DC power from computer.

- Advantest Spectrum Analyzer, Model R3271, S/N: 15050203
- 3dB & 40 dB Attenuators, 50 Ohm IN/OUT
- Fluke RF Signal Generator, Model 6061A, Freq. Range: 10 KHz - 1050 MHz.
- HP Synthesized Sweeper, Model HP83752B, S/N: 3610A00457, Freq. Range: 10 kHz – 20 GHz.
- HP 8900 RF Peak Power Meter, Measuring Frequency Range: 100 MHz - 18 GHz.
- Bert Fireberd 4000 Communication Analyzer

##### METHOD OF MEASUREMENT:- Jamming Margin Method

The processing gain may be measured using the CW jamming margin method. Figure 1 shows the test configuration. The test consists of stepping a signal generator in 50 KHZ increments across the passband of the system. At each point, the generator level required to produce the recommended Bit Error Rate (BER) is recorded. This level is jammer level. The output power of the transmitting unit is measured at the same point. The Jammer to Signal (J/S) ratio is then calculated. Discard the worst 20% of the J/S data points. The lowest remaining J/S ratio is used when calculating the Process Gain.

The signal to noise ratio for an ideal differentially coherent detection of a differentially encoded BPSK receiver can be derived from the Bit Error Probability (Pb) versus Signal-to-Noise ratio. See attached plot for detailed information.

For measurement of the  $(S/N)_o$  we use the Pb of  $1.0 \times 10^{-4}$  minimum.

**Ref.:** Viterbi, A.J. Principles of Coherent Communications (New York: McGraw-HILL 1966), Pg. 207

Using equation (1) shown above, calculate the signal to noise ratio required for your chosen BER. This value and the measured J/S ratio are used in the following equation to calculate the Process Gain (Gp) of the system.

---

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$$G_p = (S/N)_o + M_j + L_{sys}$$

Where:

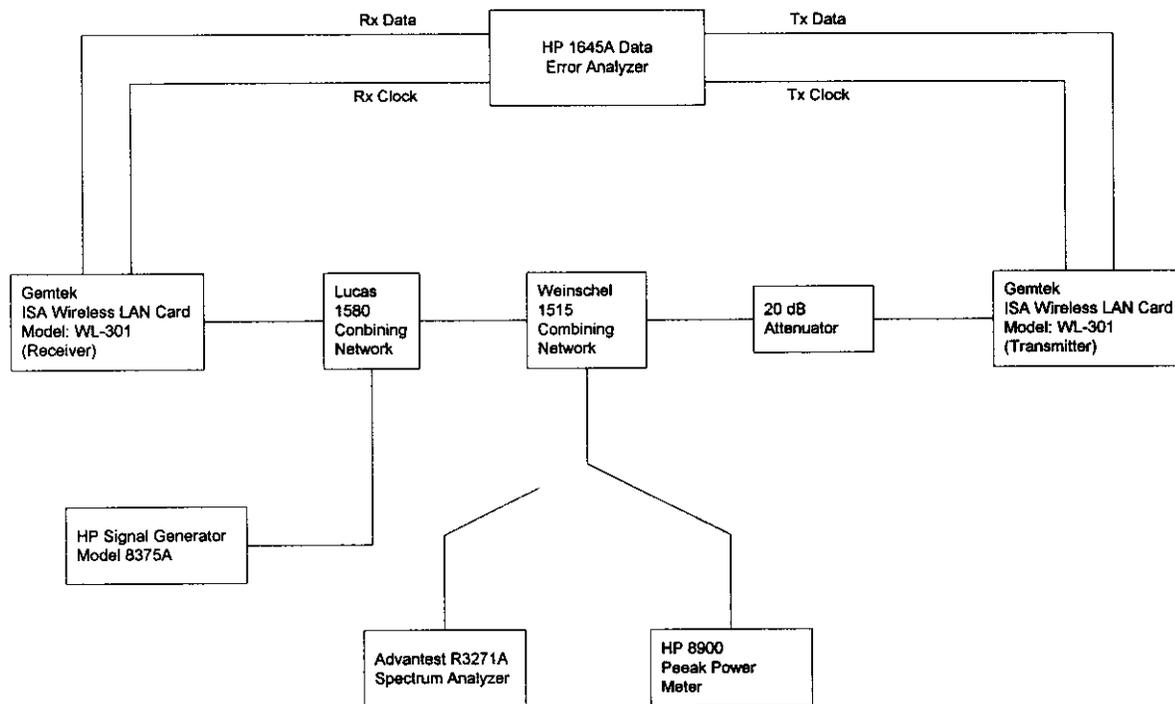
(S/N)<sub>o</sub>: Theoretical signal to noise ratio required to maintain the normal operation just before the BER appears. In real measurements the maximum error of 0.001 is allowed in an ideal system using their modulation scheme with all codes turned off (i.e. no spreading or processing gain).

M<sub>j</sub>: Maximum jammer to Signal Ratio that recorded at the detected BER.

L<sub>sys</sub>: System losses such as non-ideal synchronization, tracking circuitry, non-optimal baseband receiver filtering and etc... These losses can be in excess of 3 dB for each transmitter and receiver pair. For the purpose of this processing gain calculation we assume a L<sub>sys</sub> at its minimum value of 2 dB.

Ref.: Dixon, R, Spread Spectrum Systems. (New York: Wiley, 1984), Chapter 1.

- (S/N)<sub>o</sub>: Refer to attached curves, BER versus (S/N)<sub>o</sub> for Differential Coherent Detection of Differentially Encoded BPSK
- Processing gain  $G_p = (S/N)_o + L_{sys} + M_j = (S/N)_o + 2 + M_j$



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4.5 Definitions and Performance of Spectral and Power Efficiency

211

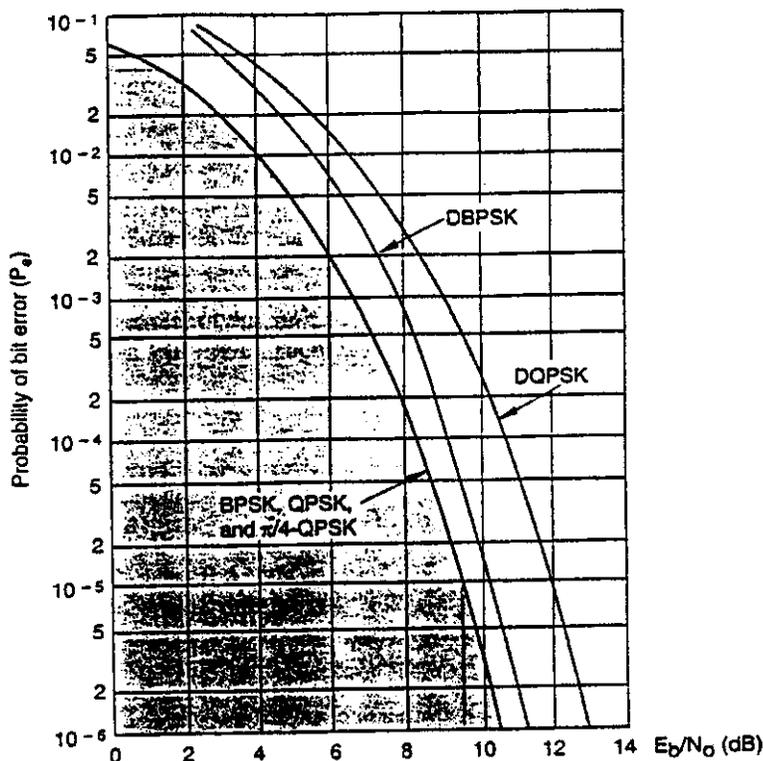


Figure 4.5.1 Theoretical  $P_e = f(E_b/N_o)$  performance in a stationary additive white Gaussian noise (AWGN) environment. Ideal, linearly amplified coherent BPSK, QPSK, and differentially demodulated DBPSK systems are illustrated. The performance of non-linearly amplified FQPSK and GMSK is compared to ideal linearly amplified QPSK in Figures 4.3.33 and 4.3.34. (From Proakis, 1989.) See Appendix A.3.

tically equivalent term bit-error rate (BER) is used in applied references and specifications.

Power efficiency of modulated systems is defined as being inversely proportional to the

$$BER = f(C/N)$$

and/or

$$BER = f(E_b/N_o)$$

equations and performance curves, where  $E_b$  is the average energy of a modulated bit and  $N_o$  is the noise power spectral density (the noise power in a normalized 1-Hz bandwidth) at the demodulator input. The higher the probability of error, the lower the power efficiency, since transmitted power is "wasted" on more bad data.

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**TEST RESULTS:** Conforms.

**TEST PERSONNEL:** Mr. Hung Trinh, RFI Technician

**DATE:** April 13, 1999

**MEASUREMENT DATA:**

**Test Method Employed: Jamming Margin**

**Test Configuration:** DQPSK MODULATION, 2 Mb/s Data Rate

Theoretical Process Gain =  $\frac{11 \text{ MHz}}{(2\text{Mb/s})/(2\text{bits/symbol})}$  = 11 numeric or 10.4 dB

Measured The Transmitter's Peak RF Power @ Receiver Input Terminal: 14.8 dBm

THEORETICAL PROCESS GAIN : 10.4dB			MIN. MEASURED PROCESSING GAIN: 15.2 dB			
Test Point	Jammer Signal Freq. +/- Fc (MHz)	(BER) x10-5	(DQPSK) Approx. (S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)
1	-5.00	1.8	11.8	2.0	2.9	16.7
2	-4.95	1.9	11.7	2.0	3.0	16.7
3	-4.90	1.5	12.0	2.0	2.8	16.8
4	-4.85	1.1	12.3	2.0	2.9	17.2
5	-4.80	1.2	12.2	2.0	2.9	17.1
6	-4.75	1.6	11.9	2.0	3.0	16.9
7	-4.70	1.5	12.0	2.0	3.0	17.0
8	-4.65	1.6	11.9	2.0	3.2	17.1
9	-4.60	1.0	12.4	2.0	3.5	17.9
10	-4.55	1.1	12.3	2.0	3.7	18.0
11	-4.50	1.0	12.4	2.0	3.4	17.8
12	-4.45	1.2	12.2	2.0	3.7	17.9
13	-4.40	2.0	11.6	2.0	3.5	17.1
14	-4.35	1.5	12.0	2.0	3.3	17.3
15	-4.30	1.1	12.3	2.0	3.2	17.5
16	-4.25	1.0	12.4	2.0	3.2	17.6
17	-4.20	1.0	12.4	2.0	3.3	17.7
18	-4.15	1.0	12.4	2.0	3.3	17.7
19	-4.10	1.1	12.3	2.0	3.6	17.9
20	-4.05	1.2	12.2	2.0	3.6	17.8
21	-4.00	1.8	11.8	2.0	3.4	17.2

Continued..

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Test Point	Jammer Signal Freq. +/- Fc (MHz)	(BER) x10-5	(DQPSK) Approx. (S/N) <sub>o</sub> (dB)	System Loss L <sub>sys</sub> (dB)	Jammer to Signal Ratio M <sub>j</sub> (dB)	Measured Processing Gain (dB)
22	-3.95	1.2	12.2	2.0	3.2	17.4
23	-3.90	2.0	11.6	2.0	3.3	16.9
24	-3.85	1.0	12.4	2.0	2.9	17.3
25	-3.80	1.1	12.3	2.0	2.9	17.2
26	-3.75	1.4	12.1	2.0	3.1	17.2
27	-3.70	1.8	11.8	2.0	3.2	17.0
28	-3.65	1.5	12.0	2.0	3.2	17.2
29	-3.60	1.1	12.3	2.0	3.5	17.8
30	-3.55	1.2	12.2	2.0	3.6	17.8
31	-3.50	1.5	12.0	2.0	3.3	17.3
32	-3.45	1.2	12.2	2.0	3.5	17.7
33	-3.40	1.6	11.9	2.0	3.3	17.2
34	-3.35	1.2	12.2	2.0	3.2	17.4
35	-3.30	1.0	12.4	2.0	2.6	17.0
36	-3.25	1.5	12.0	2.0	2.8	16.8
37	-3.20	1.8	11.8	2.0	2.8	16.6
38	-3.15	1.4	12.1	2.0	2.8	16.9
39	-3.10	1.0	12.4	2.0	3.1	17.5
40	-3.05	1.0	12.4	2.0	2.6	17.0
41	-3.00	1.8	11.8	2.0	2.5	16.3
42	-2.95	1.5	12.0	2.0	2.5	16.5
43	-2.90	1.1	12.3	2.0	2.4	16.7
44	-2.85	1.2	12.2	2.0	2.3	16.5
45	-2.80	1.5	12.0	2.0	2.2	16.2
46	-2.75	1.0	12.4	2.0	2.1	16.5
47	-2.70	1.2	12.2	2.0	2.3	16.5
48	-2.65	1.0	12.4	2.0	2.6	17.0
49	-2.60	1.5	12.0	2.0	2.4	16.4
50	-2.55	1.2	12.2	2.0	2.8	17.0
51	-2.50	1.2	12.2	2.0	2.9	17.1
52	-2.45	1.2	12.2	2.0	2.9	17.1
53	-2.40	1.0	12.4	2.0	2.8	17.2
54	-2.35	1.2	12.2	2.0	2.8	17.0
55	-2.30	1.2	12.2	2.0	2.8	17.0
56	-2.25	1.6	11.9	2.0	3.0	16.9
57	-2.20	1.5	12.0	2.0	2.9	16.9
58	-2.15	1.0	12.4	2.0	3.3	17.7
59	-2.10	1.0	12.4	2.0	3.6	18.0
60	-2.05	1.2	12.2	2.0	3.9	18.1

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Test Point	Jammer Signal Freq. +/- Fc (MHz)	(BER) x10-5	(DQPSK) Approx. (S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)
61	-2.00	1.0	12.4	2.0	3.8	18.2
62	-1.95	1.0	12.4	2.0	3.9	18.3
63	-1.90	1.4	12.1	2.0	3.6	17.7
64	-1.85	1.1	12.3	2.0	3.1	17.4
65	-1.80	1.0	12.4	2.0	3.3	17.7
66	-1.75	1.5	12.0	2.0	3.4	17.4
67	-1.70	1.0	12.4	2.0	3.5	17.9
68	-1.65	1.0	12.4	2.0	4.0	18.4
69	-1.60	1.0	12.4	2.0	4.4	18.8
70	-1.55	1.2	12.2	2.0	4.3	18.5
71	-1.50	1.1	12.3	2.0	4.4	18.7
72	-1.45	1.0	12.4	2.0	4.3	18.7
73	-1.40	1.2	12.2	2.0	4.6	18.8
74	-1.35	1.5	12.0	2.0	4.1	18.1
75	-1.30	1.1	12.3	2.0	4.2	18.5
76	-1.25	1.0	12.4	2.0	4.3	18.7
77	-1.20	1.0	12.4	2.0	4.0	18.4
78	-1.15	1.0	12.4	2.0	4.6	19.0
79	-1.10	1.0	12.4	2.0	4.9	19.3
80	-1.05	1.1	12.3	2.0	4.5	18.8
81	-1.00	1.3	12.1	2.0	4.3	18.4
82	-0.95	1.0	12.4	2.0	4.8	19.2
83	-0.90	1.1	12.3	2.0	4.6	18.9
84	-0.85	1.0	12.4	2.0	4.4	18.8
85	-0.80	1.1	12.3	2.0	3.7	18.0
86	-0.75	1.0	12.4	2.0	4.1	18.5
87	-0.70	1.1	12.3	2.0	4.3	18.6
88	-0.65	1.0	12.4	2.0	4.3	18.7
89	-0.60	1.0	12.4	2.0	4.6	19.0
90	-0.55	1.1	12.3	2.0	4.1	18.4
91	-0.50	1.0	12.4	2.0	4.3	18.7
92	-0.45	1.2	12.2	2.0	4.4	18.6
93	-0.40	1.0	12.4	2.0	4.4	18.8
94	-0.35	1.5	12.0	2.0	3.8	17.8
95	-0.30	1.0	12.4	2.0	3.0	17.4
96	-0.25	1.0	12.4	2.0	2.7	17.1
97	-0.20	1.0	12.4	2.0	1.8	16.2
98	-0.15	1.0	12.4	2.0	1.8	16.2
99	-0.10	1.1	12.3	2.0	1.1	15.4

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Test Point	Jammer Signal Freq. +/- Fc (MHz)	(BER) x10-5	(DQPSK) Approx. (S/N) <sub>o</sub> (dB)	System Loss L <sub>sys</sub> (dB)	Jammer to Signal Ratio M <sub>j</sub> (dB)	Measured Processing Gain (dB)
100	-0.05	1.6	11.9	2.0	1.6	15.5
101	0.00	1.1	12.3	2.0	0.9	15.2
102	0.05	1.0	12.4	2.0	0.9	15.3
103	0.10	1.0	12.4	2.0	1.5	15.9
104	0.15	1.0	12.4	2.0	1.9	16.3
105	0.20	1.1	12.3	2.0	2.5	16.8
106	0.25	1.1	12.3	2.0	2.1	16.4
107	0.30	1.1	12.3	2.0	2.4	16.7
108	0.35	1.1	12.3	2.0	3.2	17.5
109	0.40	1.1	12.3	2.0	3.3	17.6
110	0.45	1.0	12.4	2.0	3.2	17.6
111	0.50	1.0	12.4	2.0	3.2	17.6
112	0.55	1.3	12.1	2.0	3.1	17.2
113	0.60	1.0	12.4	2.0	3.3	17.7
114	0.65	1.0	12.4	2.0	3.1	17.5
115	0.70	1.2	12.2	2.0	3.1	17.3
116	0.75	1.1	12.3	2.0	3.3	17.6
117	0.80	1.1	12.3	2.0	3.5	17.8
118	0.85	1.0	12.4	2.0	3.8	18.2
119	0.90	1.6	11.9	2.0	3.7	17.6
120	0.95	1.0	12.4	2.0	4.5	18.9
121	1.00	1.2	12.2	2.0	4.7	18.9
122	1.05	1.0	12.4	2.0	5.1	19.5
123	1.10	1.2	12.2	2.0	4.3	18.5
124	1.15	1.2	12.2	2.0	4.1	18.3
125	1.20	1.2	12.2	2.0	3.8	18.0
126	1.25	1.2	12.2	2.0	4.1	18.3
127	1.30	1.2	12.2	2.0	4.3	18.5
128	1.35	1.0	12.4	2.0	4.2	18.6
129	1.40	1.0	12.4	2.0	4.4	18.8
130	1.45	1.2	12.2	2.0	4.6	18.8
131	1.50	1.2	12.2	2.0	4.8	19.0
132	1.55	1.0	12.4	2.0	4.9	19.3
133	1.60	1.0	12.4	2.0	4.5	18.9
134	1.65	1.1	12.3	2.0	4.0	18.2
135	1.70	1.2	12.2	2.0	3.7	17.9
136	1.75	1.0	12.4	2.0	3.5	17.9
137	1.80	1.4	12.1	2.0	3.4	17.5
138	1.85	1.1	12.3	2.0	3.2	17.5

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Test Point	Jammer Signal Freq. +/- Fc (MHz)	(BER) x10-5	(DQPSK) Approx. (S/N) <sub>o</sub> (dB)	System Loss L <sub>sys</sub> (dB)	Jammer to Signal Ratio M <sub>j</sub> (dB)	Measured Processing Gain (dB)
139	1.90	1.1	12.3	2.0	4.1	18.4
140	1.95	1.3	12.1	2.0	4.3	18.4
141	2.00	1.2	12.2	2.0	4.1	18.3
142	2.05	1.2	12.2	2.0	4.1	18.3
143	2.10	1.2	12.2	2.0	4.3	18.5
144	2.15	1.2	12.2	2.0	4.2	18.4
145	2.20	1.1	12.3	2.0	4.1	18.4
146	2.25	1.3	12.1	2.0	3.9	18.0
147	2.30	1.1	12.3	2.0	3.4	17.7
148	2.35	1.0	12.4	2.0	3.0	17.4
149	2.40	1.0	12.4	2.0	3.1	17.5
150	2.45	1.2	12.2	2.0	2.9	17.1
151	2.50	1.0	12.4	2.0	2.9	17.3
152	2.55	1.5	12.0	2.0	2.7	16.7
153	2.60	1.5	12.0	2.0	2.4	16.4
154	2.65	1.0	12.4	2.0	1.9	16.3
156	2.70	1.3	12.1	2.0	1.4	15.5
157	2.75	1.0	12.4	2.0	1.4	15.8
158	2.80	1.0	12.4	2.0	1.1	15.5
159	2.85	1.1	12.3	2.0	1.1	15.4
160	2.90	1.0	12.4	2.0	1.2	15.6
161	2.95	1.3	12.1	2.0	1.3	15.4
162	3.00	1.0	12.4	2.0	1.2	15.6
163	3.05	1.0	12.4	2.0	1.4	15.8
164	3.10	1.0	12.4	2.0	1.3	15.7
165	3.15	1.0	12.4	2.0	1.4	15.8
166	3.20	1.0	12.4	2.0	1.7	16.1
167	3.25	1.7	11.8	2.0	1.6	15.4
168	3.30	1.9	11.7	2.0	1.9	15.6
169	3.35	1.0	12.4	2.0	2.3	16.7
170	3.40	1.1	12.3	2.0	2.3	16.6
171	3.45	1.0	12.4	2.0	2.2	16.6
172	3.50	1.5	12.0	2.0	2.4	16.4
173	3.55	1.1	12.3	2.0	2.1	16.4
174	3.60	1.0	12.4	2.0	2.3	16.7
175	3.65	1.2	12.2	2.0	2.7	16.9
176	3.70	1.0	12.4	2.0	2.5	16.9
177	3.75	1.0	12.4	2.0	2.6	17.0
178	3.80	1.2	12.2	2.0	1.9	16.1

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Test Point	Jammer Signal Freq. +/- Fc (MHz)	(BER) x10-5	(DQPSK) Approx. (S/N) <sub>o</sub> (dB)	System Loss L <sub>sys</sub> (dB)	Jammer to Signal Ratio M <sub>j</sub> (dB)	Measured Processing Gain (dB)
179	3.85	1.0	12.4	2.0	2.8	17.2
180	3.90	1.0	12.4	2.0	2.7	17.1
181	3.95	1.0	12.4	2.0	3.1	17.5
182	4.00	1.0	12.4	2.0	3.3	17.7
183	4.05	1.1	12.3	2.0	3.2	17.5
184	4.10	1.2	12.2	2.0	2.9	17.1
185	4.15	1.1	12.3	2.0	3.1	17.4
186	4.20	1.0	12.4	2.0	3.1	17.5
187	4.25	1.2	12.2	2.0	3.2	17.4
188	4.30	1.0	12.4	2.0	3.0	17.4
189	4.35	1.1	12.3	2.0	2.8	17.1
190	4.40	1.1	12.3	2.0	2.8	17.1
191	4.45	1.4	12.1	2.0	3.2	17.3
192	4.50	1.3	12.1	2.0	2.6	16.7
193	4.55	1.1	12.3	2.0	2.9	17.2
194	4.60	1.0	12.4	2.0	2.9	17.3
195	4.65	1.0	12.4	2.0	2.9	17.3
196	4.70	1.0	12.4	2.0	2.8	17.2
197	4.75	1.1	12.3	2.0	2.6	16.9
198	4.80	1.4	12.1	2.0	2.2	16.3
199	4.85	1.3	12.1	2.0	2.6	16.7
200	4.90	1.4	12.1	2.0	2.7	16.8
221	4.95	1.0	12.4	2.0	2.6	17.0
222	5.00	1.2	12.2	2.0	1.8	16.0

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#### 4.7. AC POWERLINE CONDUCTED EMISSIONS, FCC CFR 47, PARA. 15.107(A)

**PRODUCT NAME:** ISA Wireless LAN Card, Model No.: WL-301

**FCC LIMIT:**

The RF voltage conducted back onto the public utility lines shall not exceed 250  $\mu$ V or 48.0 dB $\mu$ V measured from 450 KHz to 30 MHz.

**CLIMATE CONDITION:**

Standard Temperature and Humidity:

- Ambient temperature: 23 °C
- Relative humidity: 43 %

**POWER INPUT:**

Using DC power from computer.

**TEST EQUIPMENT:**

- Advantest R3271 Spectrum Analyzer, Frequency Range: 100Hz-26.5GHz, with built-in Peak, Quasi-Peak and Average Detectors.
- HP 11947A Transient Limiter, HP, Model 11947A, Frequency Range: 9KHz-200MHz, Attenuation: 10dB HP.
- HP 7475 Plotter
- EMCO 3825/2 LISN, Frequency Range: 9KHz-200MHz
- RF Shielded Enclosure (12x16x12 feet)

**METHOD OF MEASUREMENTS:**

Refer to ANSI C63.4-1992.

**TEST RESULTS:** Conforms.

**TEST PERSONNEL:** Mr. Hung Trinh, RFI Technician

**DATE:** March 30, 1999

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**MEASUREMENT DATA**

**AC POWER-LINE CONDUCTED EMISSIONS**

**REMARKS**

- All rf emissions from 450 KHz to 30 MHz were scanned, and eight highest emission levels were recorded. See attached plots.
- P: Peak Detector, 10 KHz RBW, VBW ≥ RBW
- Q: CISPR QUASI-PEAK, 9 KHz RBW, VBW ≥ RBW
- QP/BB: for broadband emission (QP level - AVG level > 6 dB); the recorded level was QP level less 13 dB.

**TEST CONFIGURATION 1: ISA Wireless LAN Card with AL-101 Loopy ANT**

FREQUENCY (MHz)	RF LEVEL (dBuV)	RECEIVER DETECTOR (P/QP/AVG)	QP/NB LIMIT (dBuV)	QP/BB LIMIT (dBuV)	MARGIN (dB)	PASS/ FAIL	LINE TESTED (L1/L2)
0.75	41.37	P	48.0	61.0	-6.6	PASS	L1
2.48	35.02	P	48.0	61.0	-13.0	PASS	L1
4.21	31.97	P	48.0	61.0	-16.0	PASS	L1
10.62	33.82	P	48.0	61.0	-14.2	PASS	L1
14.68	39.52	P	48.0	61.0	-8.5	PASS	L1
16.66	31.82	P	48.0	61.0	-16.2	PASS	L1
27.89	26.02	P	48.0	61.0	-22.0	PASS	L1
0.75	41.30	P	48.0	61.0	-6.7	PASS	L2
4.29	32.40	P	48.0	61.0	-15.6	PASS	L2
5.77	31.45	P	48.0	61.0	-16.6	PASS	L2
10.45	33.92	P	48.0	61.0	-14.1	PASS	L2
14.68	40.07	P	48.0	61.0	-7.9	PASS	L2
16.32	34.05	P	48.0	61.0	-14.0	PASS	L2
20.12	27.02	P	48.0	61.0	-21.0	PASS	L2

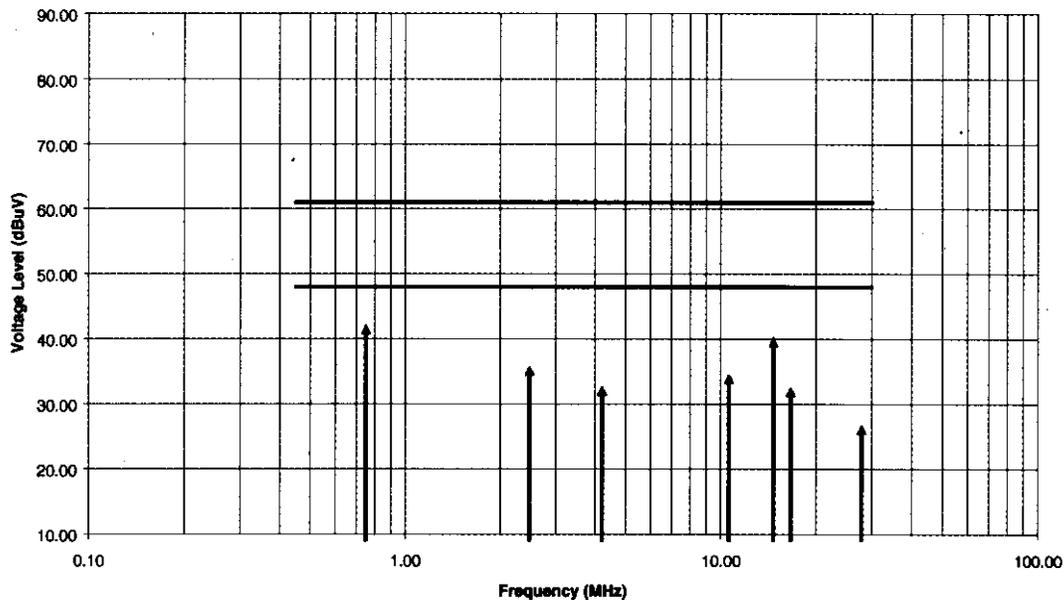
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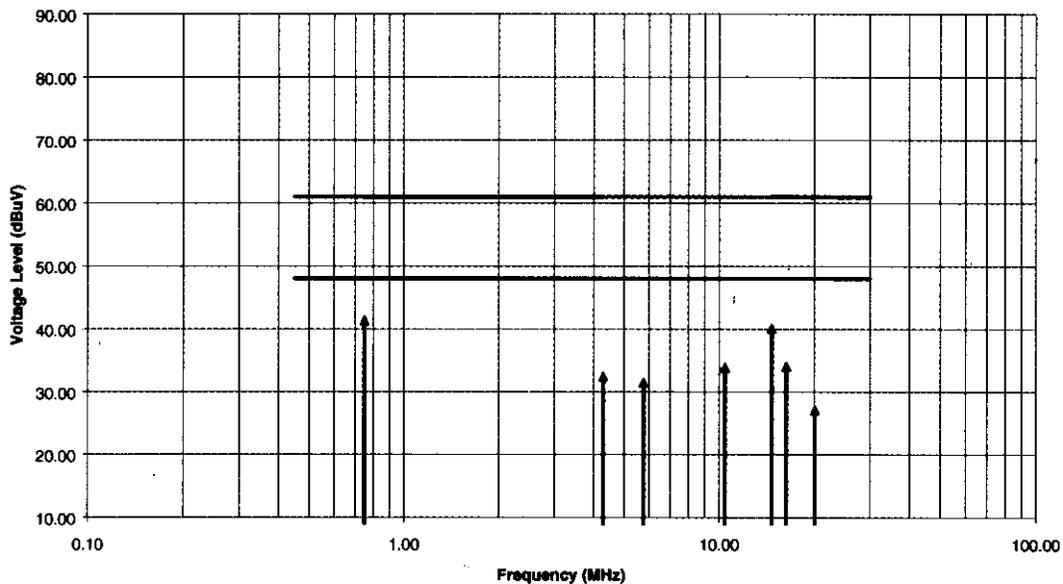
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AC Conducted Emissions - Line #1 (Hot)  
Ultratech Engineering Labs Inc.  
Gemtek ISA Wireless LAN Card with AL-101 Loopy ANT



AC Conducted Emissions - Line #2 (Neutral)  
Ultratech Engineering Labs Inc.  
Gemtek ISA Wireless LAN Card with AL-101 Loopy ANT



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May 10, 1999

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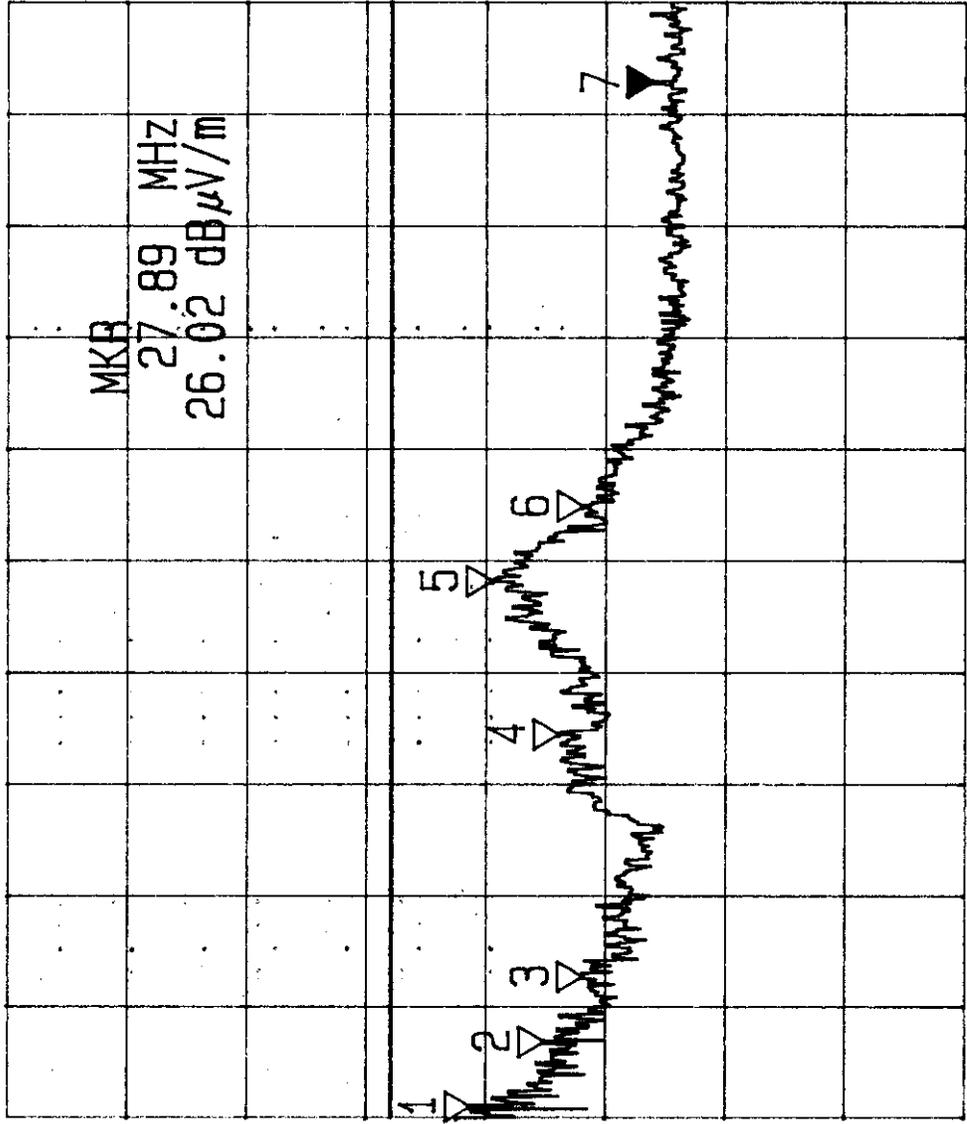
APPLICANT:  
PRODUCT:  
MODEL:

GEMTEK  
ISA WIRELESS LAN CARD  
WL-301

EMI Detector: M Peak [ ] Quasi Peak [ ] Average Temp.: 20 °C, Humidity: 83 %  
Line Tested: / Input Voltage: 120V, Tested by: HI Test Date: 30 MAR 2009  
Comments: FCC ISB with A = 101 LORRY ANT.

CONDB-FCC15  
REF 80.0 dBμV  
10dB/

ATT 0 dB A\_view B\_view



MKR  
27.89 MHz  
26.02 dBμV/m

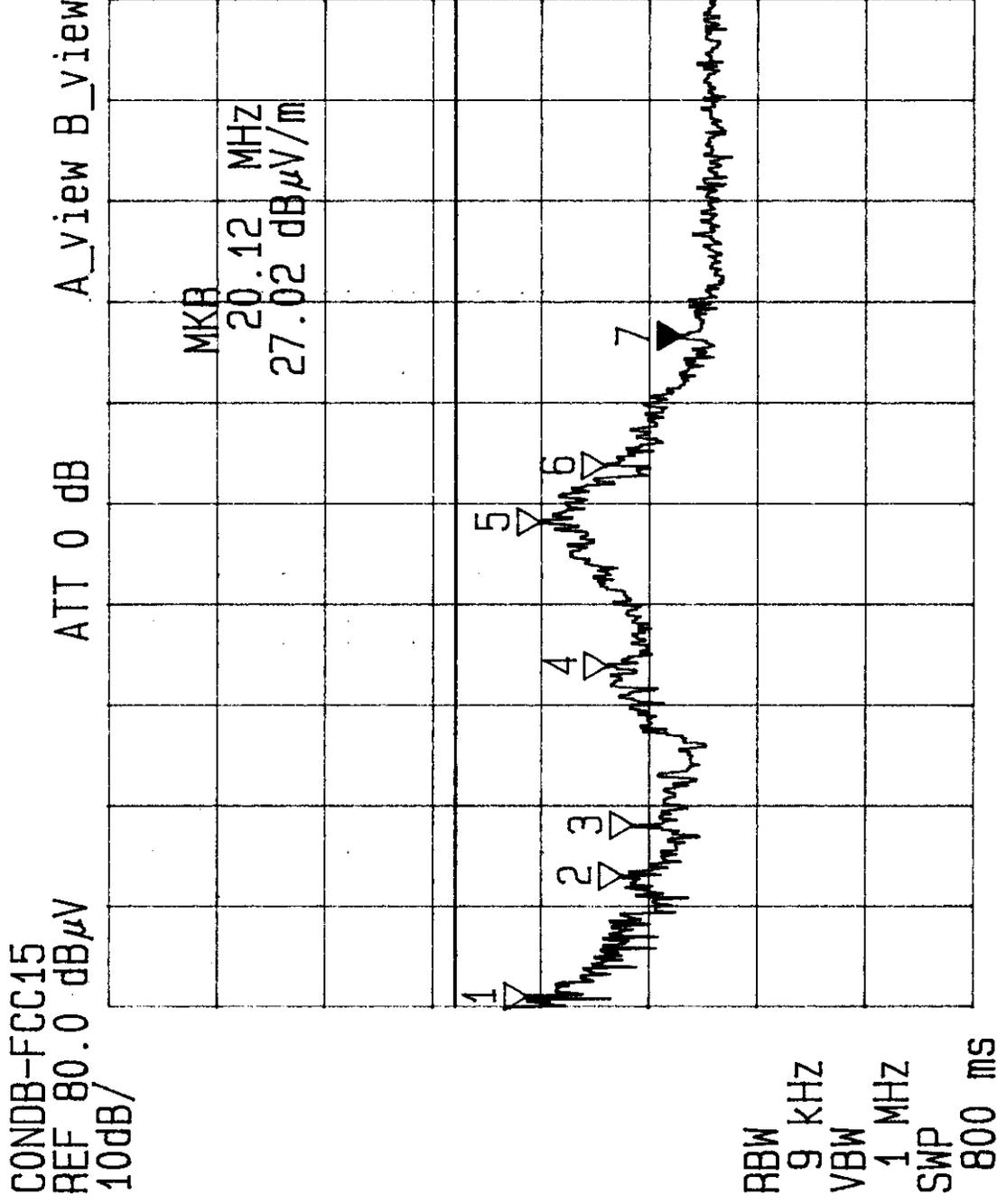
RBW 9 KHZ  
VBW 1 MHZ  
SMP 800 ms

START 450 KHZ STOP 30.00 MHZ

APPLICANT:  
PRODUCT:  
MODEL:

GREATER  
USA WIRELESS LAN CARD  
WA-301

EMI Detector: [M]Peak [ ]Quasi Peak [ ]Average Temp.: 20 °C, Humidity: 23 %  
Line Tested: 2 Input Voltage: 120V, Tested by: AT Test Date: 30 MAR 99  
Comments: FCC 15B WITH AL-101 COPY ANT



***TEST CONFIGURATION 2: ISA Wireless LAN Card with AL-102 Dipole ANT Right-Angle***

FREQUENCY (MHz)	RF LEVEL (dBuV)	RECEIVER DETECTOR (P/QP/AVG)	QP/NB LIMIT (dBuV)	QP/BB LIMIT (dBuV)	MARGIN (dB)	PASS/ FAIL	LINE TESTED (L1/L2)
0.79	41.47	P	48.0	61.0	-6.5	PASS	L1
2.77	34.67	P	48.0	61.0	-13.3	PASS	L1
9.95	34.10	P	48.0	61.0	-13.9	PASS	L1
14.72	39.50	P	48.0	61.0	-8.5	PASS	L1
17.34	31.22	P	48.0	61.0	-16.8	PASS	L1
21.35	26.70	P	48.0	61.0	-21.3	PASS	L1
26.88	25.67	P	48.0	61.0	-22.3	PASS	L1
0.75	42.30	P	48.0	61.0	-5.7	PASS	L2
9.23	32.20	P	48.0	61.0	-15.8	PASS	L2
13.71	37.65	P	48.0	61.0	-10.4	PASS	L2
14.68	39.27	P	48.0	61.0	-8.7	PASS	L2
16.36	34.92	P	48.0	61.0	-13.1	PASS	L2
17.38	32.67	P	48.0	61.0	-15.3	PASS	L2
28.52	25.82	P	48.0	61.0	-22.2	PASS	L2

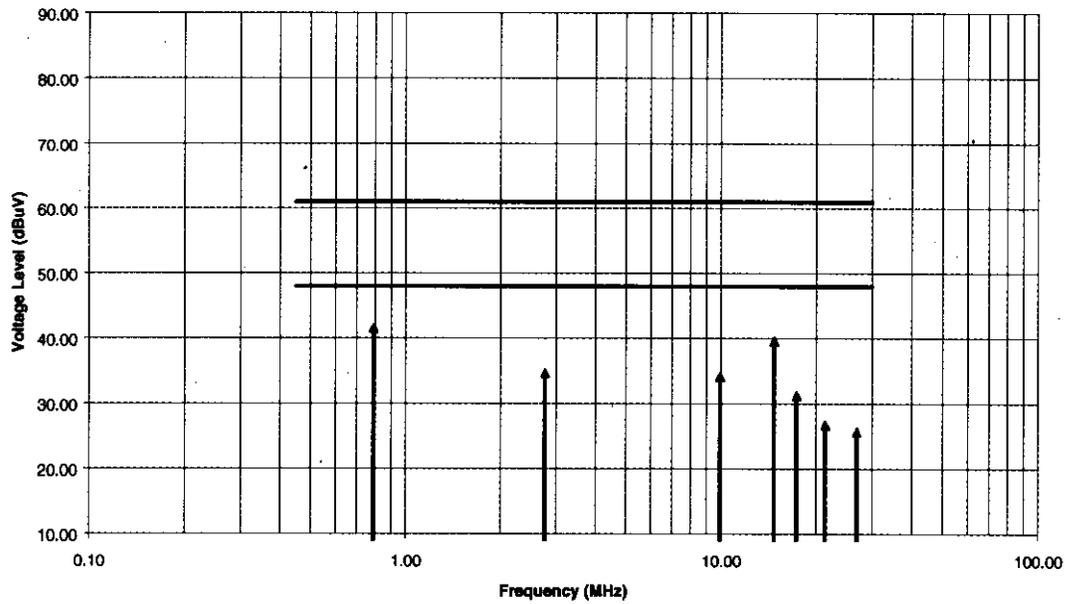
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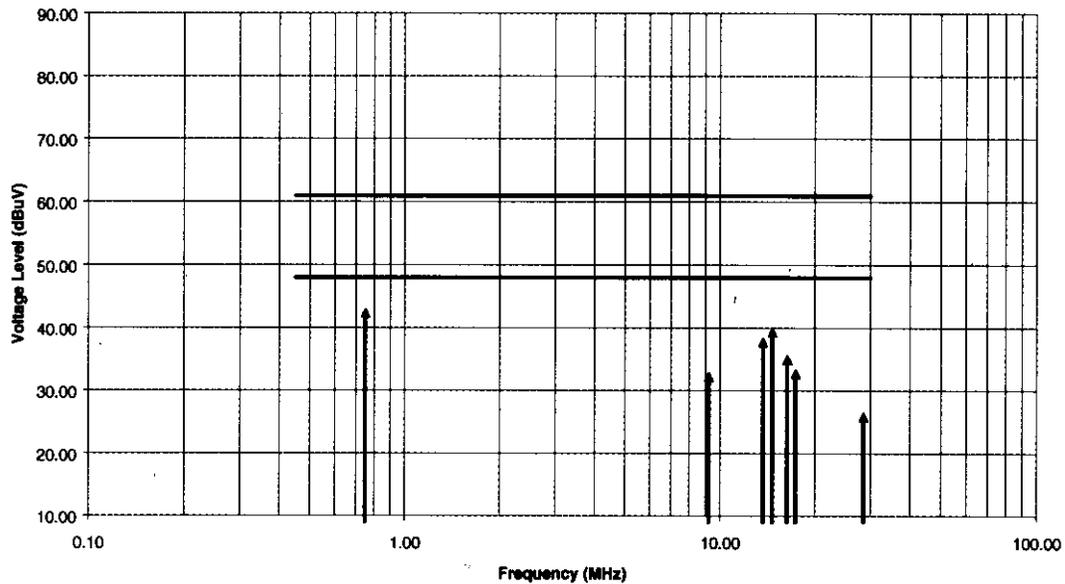
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AC Conducted Emissions - Line #1 (Hot)  
Ultratech Engineering Labs Inc.  
Gemtek ISA Wireless LAN Card with AL-102 Dipole ANT Right-Angle



AC Conducted Emissions - Line #2 (Neutral)  
Ultratech Engineering Labs Inc.  
Gemtek ISA Wireless LAN Card with AL-102 Dipole ANT Right-Angle



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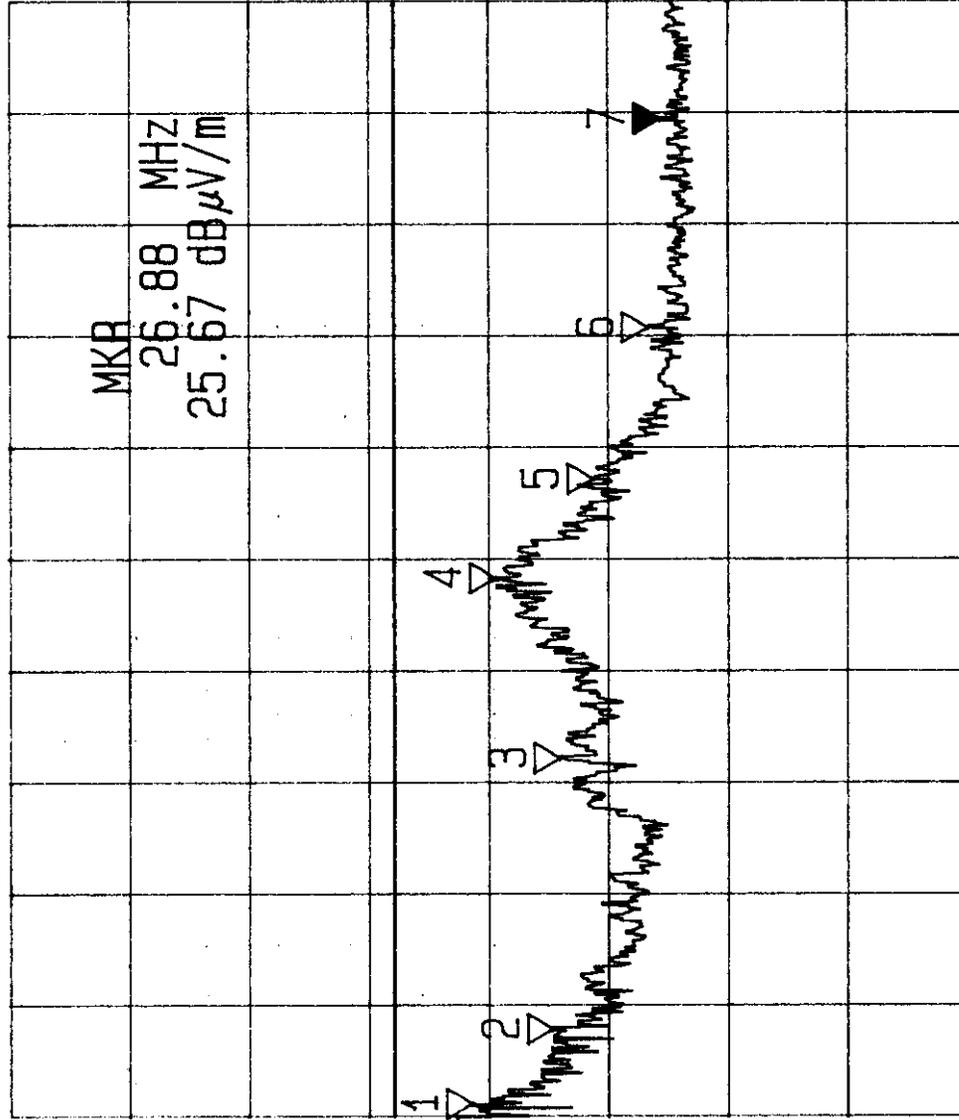
APPLICANT:  
PRODUCT:  
MODEL:

GEEMTEK  
USA WIRELESS LAN CARD  
WL-301

EMI Detector: M Peak [ ] Quasi Peak [ ] Average Temp.: 20 °C, Humidity: 23 %  
Line Tested: 1 FCC 15B WIRELESS Input Voltage: 120V, Tested by: HT Test Date: 30 MAR 09  
Comments: WIRELESS FOR DIRTY ANT. RIGHT ANGLE

CONDB-FCC15  
REF 80.0 dB $\mu$ V  
10dB/

ATT 0 dB A\_view B\_view



RBW 9 KHZ  
VBW 1 MHZ  
SWP 800 MS

START 450 KHZ STOP 30.00 MHZ

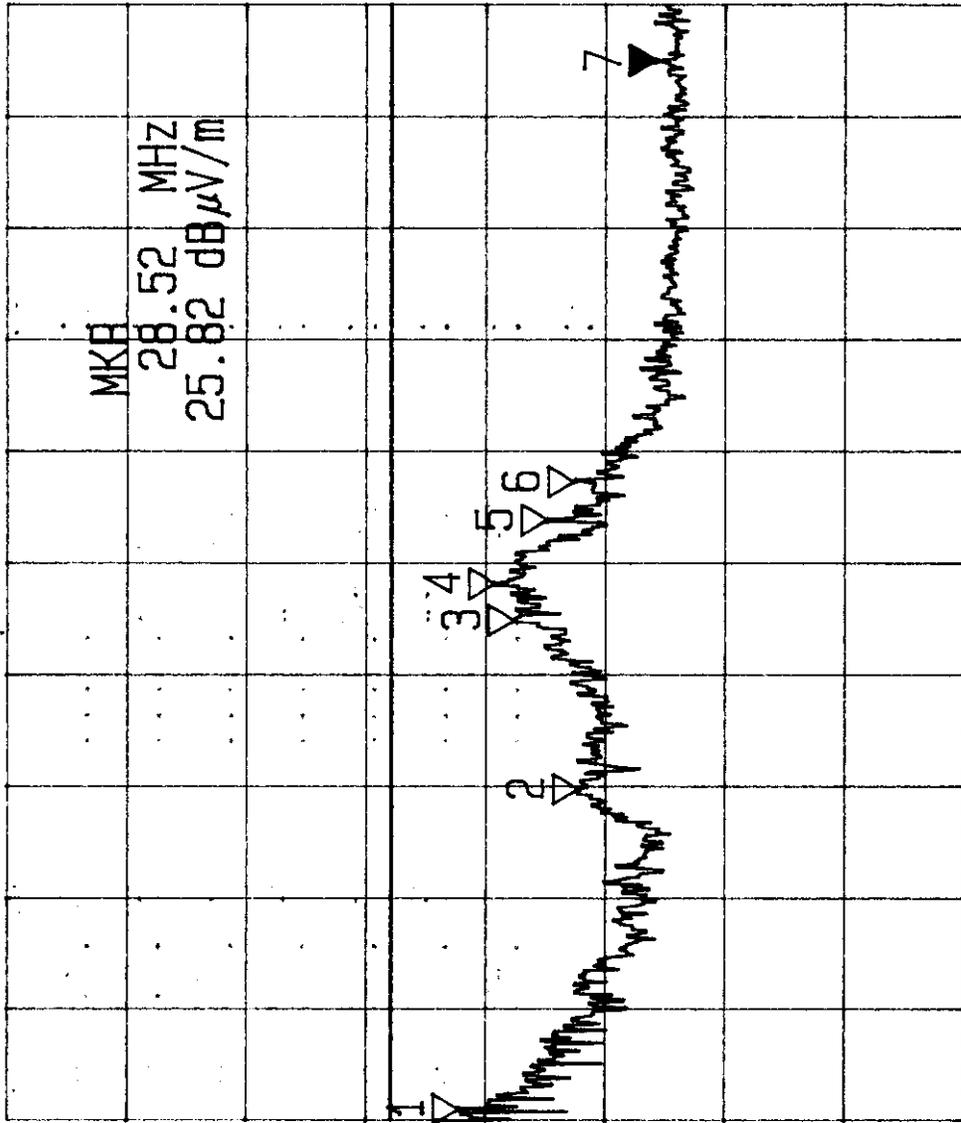
APPLICANT:  
PRODUCT:  
MODEL:

*GENIEK*  
*ISA WIRELESS LAN CARD*  
*W4-301*

EMI Detector: [M] Peak [ ] Quasi Peak [ ] Average Temp.: *20* °C, Humidity: *23* %  
Line Tested: *2*, Input Voltage: *120V*, Tested by: *HT* Test Date: *30 MAR 07*  
Comments: *20C 15B WITH AL-102 BIRDIE ANT. BRIGHT AVERAGE*

CONDB-FCC15  
REF 80.0 dB $\mu$ V  
10dB/

ATT 0 dB A\_view B\_view



RBW 9 kHz  
VBW 1 MHz  
SWP 800 ms

START 450 kHz STOP 30.00 MHz

## 5. EXHIBIT 5 - GENERAL TEST PROCEDURES

### 5.1. AC POWERLINE CONDUCTED EMISSIONS MEASUREMENTS - GENERAL TEST METHOD

- AC Powerline Conducted Emissions were performed in the shielded room, 16'(L) by 12'(W) by 12'(H).
- Conducted power-line measurements were made over the frequency range from 450 KHz to 30 MHz to determine the line-to-ground radio noise voltage which was conducted from the EUT power-input terminals that were directly connected to a public power network.
- The EUT normally received power from another device that connects to the public utility ac power lines, measurements would be made on that device with the EUT in operation to ensure that the device continues to comply with the appropriate limits while providing the EUT with power.
- If the EUT was operates only from internal or dedicated batteries, with no provisions for connection to the public utility ac power lines, ac power-line conducted measurements are not required.
- Table-top devices were placed on a platform of nominal size 1 m by 1.5m raised 80 cm above the conducting ground plane.
- The EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN to the power source. All unused 50-Ohm connectors of the LISN was terminated in 50-ohm when not connected to the measuring instruments.
- The line cord of the EUT connected to one LISN which was connected to the measuring instrument. Those power cords for the units of devices not under measurement were connected to a separate multiple ac outlets. Drawings and photographs of typically conducted emission test setups were shown in the Test Report. Each current-carrying conductor of the EUT shall be individually tested.
- The EUT was normally operated with a ground (safety) connection, the EUT was connected to the ground at the LISN through a conductor provided in the lead from the ac power mains to the LISN.
- The excess length of the power cord was folded back and forth in an 8-shape on a wooden strip with a vertical prong located on the top of the LISN case.
- The EUT was set-up in its typical configuration and operated in its various modes as described in 3.2 of the test report.
- A preliminary scan was made by using spectrum analyzer system with the detector function set to PEAK mode (10 KHz RBW, VBW  $\geq$  RBW), frequency span 450KHz-30MHz.
- The maximum conducted emission for a given mode of operation was found by using the following step-by-step procedure:
  - Step1. Monitor the frequency range of interest at a fixed EUT azimuth.
  - Step2. Manipulate the system cables and peripheral devices to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.
  - Step3. The effects of various modes of operation is examined. This is done by varying equipment operation modes as step 2 is being performed.

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- Step4. After completing step 1 through 3, record EUT and peripheral device configuration, mode of operation, cable configuration, signal levels and frequencies for final test.
- Each highest signal level at the maximized test configuration was zoomed in a small frequency span on the spectrum analyzer's display (the manipulation of cables and peripheral devices and EUT operation modes might have to be repeated to obtain the highest signal level with the spectrum analyzer set to PEAK detector mode 10 KHz RBW and  $VBW \geq RBW$ ). The spectrum analyzer was then set to CISPR QUASI-PEAK detector mode (9 KHz RBW, 1 MHz VBW) and the final highest RF signal level and frequency was record.
  - **Broad-band ac Powerline conducted emissions:-** If the EUT exhibits ac Powerline conducted emissions that exceed the limit with the instrument set to the quasi-peak mode, then measurements should be made in the average mode. If the amplitude measured in the quasi-peak mode is at least 6 dB higher than the amplitude measured in the average mode, the level measured in quasi peak mode may be reduced by 13 dB before comparing it to the limit.

## 5.2. ELECTRICAL FIELD RADIATED EMISSIONS MEASUREMENTS - GENERAL TEST METHOD

- The radiated emission measurements were performed at the UltraTech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario. The Attenuation Characteristics of OFTS have been filed to FCC.
- Radiated emissions measurements were made using the following test instruments:
  - 1) Calibrated EMCO active loop antenna in the frequency range from 10 KHz to 1 MHz
  - 2) Calibrated EMCO biconilog antenna in the frequency range from 30 MHz to 2000 MHz.
  - 3) Horn Antennas:
    - a) Horn Antenna, Emco, Model 3115, 1 – 18 GHz
    - b) Horn Antenna, Emco, Model 3160-09, 18-26.5GHz
    - c) Horn Antenna, Emco, Model 3160-10, 26.5-40GHz
    - d) Mixer, Tektronix, P/N 118-0098-00, 18-26.5GHz
    - e) Mixer, Tektronix, P/N 119-0098-00, 26.5-40GHz
  - 4) Calibrated Advantest spectrum analyzer and pre-selector/pre-amplifier. In general, the spectrum analyzer would be used as follows:
    - The rf electric field levels were measured with the spectrum analyzer set to PEAK detector (1 KHz RBW and 1 KHz VBW for frequency below 30 MHz, 100 KHz RBW and  $VBW \geq RBW$  for Frequency below 1 GHz and 1 MHz RBW and 1 MHz VBW for frequency greater than 1 GHz).
    - If any rf emission was observed to be a broadband noise, the spectrum analyzer's CISPR QUASI-PEAK detector (120 KHz RBW and 1MHz VBW) was then set to measure the signal level.
    - If the signal being measured was narrowband and the ambient field was broadband, the bandwidth of the spectrum analyzer was reduced.
- The EUT was set-up in its typical configuration and operated in its various modes as described in 3.2 of the test report.
- The frequencies of emissions was first detected. Then the amplitude of the emissions was measured at the specified measurement distance using required antenna height, polarization, and detector characteristics.

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- During this process, cables and peripheral devices were manipulated within the range of likely configuration.
- For each mode of operation required to be tested, the frequency spectrum was monitored. Variations in antenna heights (from 1 meter to 4 meters above the ground plane), antenna polarization (horizontal plane and vertical plane), cable placement and peripheral placement (each variable within bounds specified elsewhere) were explored to produce the highest amplitude signal relative to the limit.

The maximum radiated emission for a given mode of operation was found by using the following step-by-step procedure:

- Step1: Monitor the frequency range of interest at a fixed antenna height and EUT azimuth.
- Step2: Manipulate the system cables to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.
- Step3: Rotate the EUT 360 degrees to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, go back to the azimuth and repeat Step 2. Otherwise, orient the EUT azimuth to repeat the highest amplitude observation and proceed.
- Step4: Move the antenna over its full allowed range of travel (1 to 4 meters) to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, return to Step 2 with the highest amplitude observation and proceed.
- Step5: Change the polarization of the antenna and repeat Step 2 through 4. Compare the resulting suspected highest amplitude signal with that found for the other polarization. Select and note the higher of the two signals. This signal is termed the highest observed signal with respect to the limit for this EUT operational mode.
- Step6: The effects of various modes of operation is examined. This is done by varying the equipment modes as steps 2 through 5 are being performed.
- Step7: After completing steps 1 through 6, record the final highest emission level, frequency, antenna polarization and detector mode of the measuring instrument.

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**Calculation of Field Strength:**

The field strength is calculated by adding the calibrated antenna factor and cable factor, and subtracting the Amplifier gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where FS = Field Strength  
RA = Receiver/Analyzer Reading  
AF = Antenna Factor  
CF = Cable Attenuation Factor  
AG = Amplifier Gain

**Example:** If a receiver reading of 60.0 dBμV is obtained, the antenna factor of 7.0 dB/m and cable factor of 1.0 dB are added, and the amplifier gain of 30 dB is subtracted. The actual field strength will be:

$$\text{Field Level in dB}\mu\text{V/m} = 60 + 7.0 + 1.0 - 30 = 38.0 \text{ dB}\mu\text{V/m.}$$

$$\text{Field Level in } \mu\text{V/m} = 10^{(38/20)} = 79.43 \mu\text{V/m.}$$

**Notes:** The frequency and amplitude of at least six highest conducted emissions relative to the limit are recorded unless such emissions are more than 20 dB below the limit. If less than six emissions are within 20dB of the limit, the background or receiver noise level shall be reported at representative frequencies.

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## **6. EXHIBIT 6 - INFORMATION RELATED TO EQUIPMENT UNDER TESTS**

### **6.1. FCC ID LABELING AND SKETCH OF FCC LABEL LOCATION**

Refer to the attached sheets

### **6.2. PHOTOGRAPHS OF EQUIPMENT UNDER TEST**

Refer to the attached photographs

### **6.3. SYSTEM BLOCK DIAGRAM(S)**

Refer to the attached sheets

### **6.4. SCHEMATIC DIAGRAMS**

Refer to the attached sheets

### **6.5. USER'S MANUAL WITH "FCC INFORMATION TO USER STATEMENTS"**

Refer to the attached Users' manual

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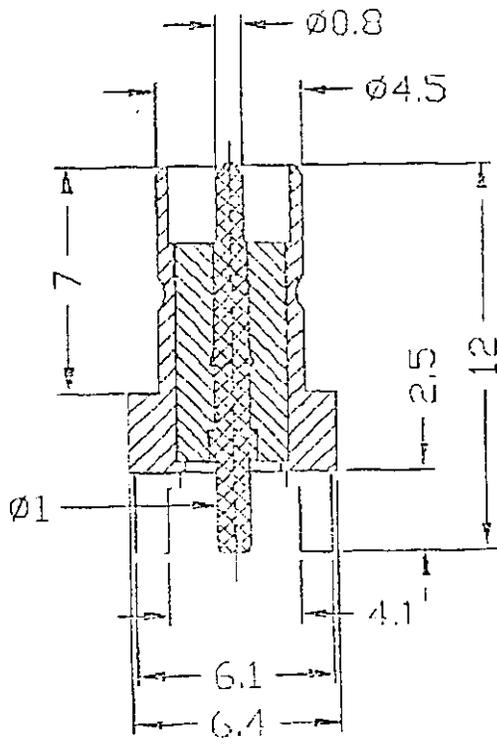
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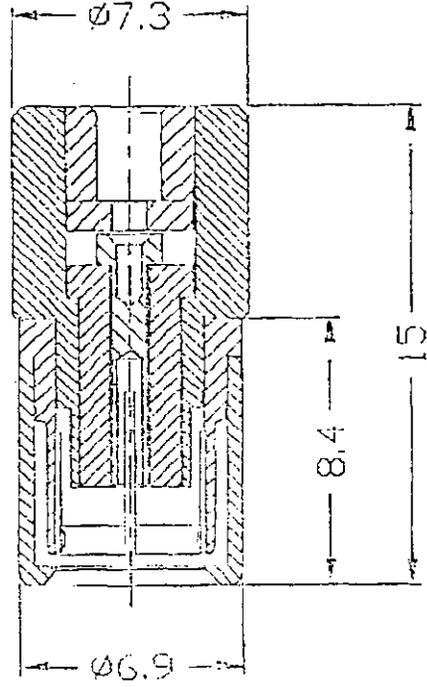
## Specification of GemTek Antenna

Model No.	AL-101 Loopy ANT	AL-102 Dipole ANT Right-Angle
Frequency range	2.4GHz~2.4835GHz	2.4GHz~2.4835GHz
Nominal Impedance	50ohm(Typical)	50ohm(Typical)
Gain	3dBi(Without cable)	3dBi
VSWR	$\leq 2.0$	$\leq 1.8$
Antenna pattern	Omni	Omni
Beam width	NA	NA
Connector Type	Modified SMB	Modified SMB

Dimension unit : mm



**JACK**  
(Mounted in PCB)



**Plug**  
(Connect to Antenna Cable)

Drawing of modify SMB connector