ENGINEERING TEST REPORT

PCMCIA Wireless LAN Card
Model No.: WL-2Ø5

FCC ID: MXF-WL2Ø5

Applicant: **GemTek Technology Co. Ltd.**
No. 1, Jen Al Road, Hsinchu Industrial Park
Hukuo Hsiang, Hsinchu Hsien
Taiwan, R.O.C.

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.: GTT11-FTX

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs …………………………………………………………… Date: ………………………	
Report Prepared by: Dan Huynh ……………………………..…………………..………………….	Tested by: Mr. Hung Trinh, RFI/EMI Technician ……………………………..…………………..………………….
Issued Date: October 14, 1999	Test Dates: August 30 – September 2, 1999

The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Telephone (905) 829-1570 Facsimile (905) 829-8050
Website: www.ultrat4ech-labs.com Email: vhk.ultratech@sympatico.ca

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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.247:1998
Title	Telecommunication - Code of Federal Regulations, CFR 47, Part 15
Purpose of Test:	To gain FCC Certification Authorization for Direct Sequence Spread Spectrum Transmitters operating in the Frequency Band 2412 - 2462 MHz .
Test Procedures	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - 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.
Environmental Classification:	• Residential • Light-industry, Commercial • Industry

1.2. RELATED SUBMITAL(S)/GRANT(S)

None

1.3. NORMATIVE REFERENCES

Publication	YEAR	Title
FCC CFR Parts 0-19	1998	Code of Federal Regulations – Telecommunication
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
CISPR 22 & EN 55022	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1		Specification for Radio Disturbance and Immunity measuring apparatus and methods

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT:	
Name:	GemTek Technology Co. Ltd.
Address:	No. 1, Jen Al Road, Hsinchu Industrial Park Hukuo Hsiang, Hsinchu Hsien Taiwan, R.O.C.,
Contact Person:	Mr. Mike Chen Phone #: 886-3-598-5535 Fax #: 886-3-598-5585 Email Address: mikechen@mail.gemtek.com.tw

MANUFACTURER:	
Name:	GemTek Technology Co. Ltd.
Address:	No. 1, Jen Al Road, Hsinchu Industrial Park Hukuo Hsiang, Hsinchu Hsien Taiwan, R.O.C.,
Contact Person:	Mr. Mike Chen Phone #: 886-3-598-5535 Fax #: 886-3-598-5585 Email Address: mikechen@mail.gemtek.com.tw

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name	GemTek Technology Co., Ltd.
Product Name	PCMCIA Wireless LAN Card
Model Name or Number	WL-2Ø5
Serial Number	Pre-production
Type of Equipment	Direct Sequence Spread Spectrum Transmitters
External Power Supply	N/A
Transmitting/Receiving Antenna Type	Integral
Primary User Functions of EUT:	Provides connectivity between mobile stations in a wireless Local Area Network (LAN)

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	▪ Portable ▪ Mobile ▪ Base station (fixed use)
Intended Operating Environment:	▪ Residential ▪ Commercial, light industry & heavy industry
Power Supply Requirement:	DC power from host computer
RF Output Power Rating:	37 mW
Operating Frequency Range:	2412 - 2462 MHz
RF Output Impedance:	50 Ohms
Duty Cycle:	Continuous
6 dB Bandwidth:	9.86 MHz
Emission Designation:	Direct Sequence Spread Spectrum
Oscillator Frequencies:	IF: 22 MHz, LO: 22MHz
Antenna Connector Type:	Integral
Antenna Description:	Manufacturer: Murata Type: 1 / 4 £f type whip antennas Model: ANCLC2R44U084GE1 Frequency Range: 2400 – 2483.5 MHz In/Out Impedance: 50 Ohms Gain: 0.5 dBi (max)

2.4. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	OMNIBOOK Laptop
Brand name:	Hewlett Packard
Model Name or Number:	DN-2100
Serial Number:	TW63403246
Connected to EUT's Port:	PCMCIA type II

Ancillary Equipment # 2	
Description:	Printer
Brand name:	Hewlett Packard DeskJet 500C
Serial Number:	MY46C1D09R

Ancillary Equipment # 3	
Description:	14400 ETC-E Modem
Brand name:	ATI Technologies Inc.
Model Name or Number:	176
Serial Number:	AT21192

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	101 kPa
Power input source:	DC power from host computer

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	▪ Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements. ▪ The EUT operates in normal Direct Sequence mode for occupancy duration, and frequency separation.
Special Test Software:	▪ Special software is provided by the Applicant to select and operate the EUT at each channel frequency continuously. For example, the transmitter will be operated at each of lowest, middle and highest frequencies individually continuously during testing.
Special Hardware Used:	None
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as an integral antenna equipment.

Transmitter Test Signals:	
Frequencies: ▪ 2412 - 2462 MHz band:	Lowest, middle and highest channel frequencies tested: 2412 MHz, 2437 MHz and 2462 MHz
Transmitter Wanted Output Test Signals: ▪ RF Power Output (measured maximum output power): ▪ Normal Test Modulation ▪ Modulating signal source:	 ▪ 37 mW ▪ Each channel is DBPSK/DQPSK modulated with data @ 1Mbps / 2 Mbps ▪ Internal

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- 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 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: Sep. 20, 1998.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC PARAGRAPH.	TEST REQUIREMENTS	COMPLIANCE (YES/NO)
15.107, 15.109	AC Power Conducted Emissions & Radiated Emissions for Receiver and Digital Circuit Portions	Yes (Note 1)
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

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.

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

5.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in Exhibit 7 of this report.

5.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 6 for Measurement Uncertainties.

5.3. MEASUREMENT EQUIPMENT USED:

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C64.3:1992, FCC 15.247 and CISPR 16-1.

5.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUACTURER:

The essential function of the EUT is provides connectivity between mobile stations in a wireless Local Area Network (LAN) over RF link.

5.5. AC POWERLINE CONDUCTED EMISSIONS @ FCC PART 15, SUBPART B, PARA.15.107(A)

5.5.1. Limits

The equipment shall meet the limits of the following table:

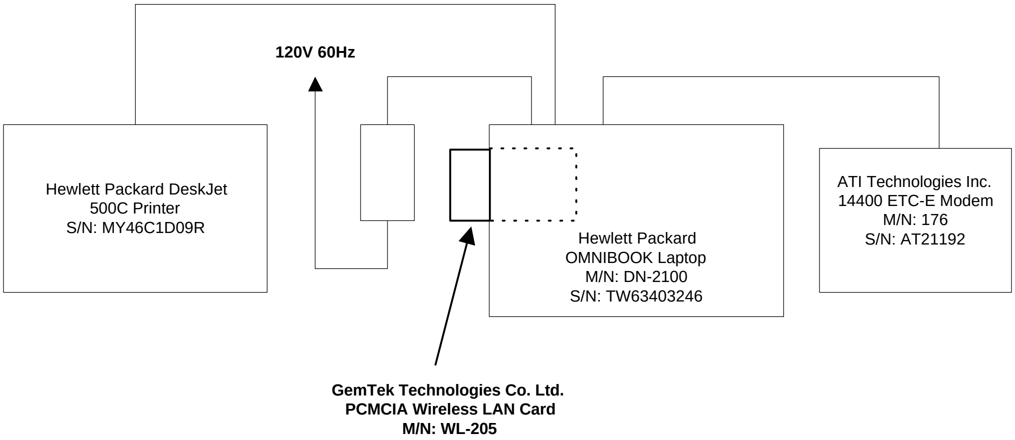
Test Frequency Range	Test Limits	EMI Detector Used	Measuring Bandwidth
0.45 to 30 MHz	48 dBμV 51 dBμV	Quasi-Peak (Narrow band) Quasi-Peak (Broad band)	B = 10 kHz B = 10 kHz

5.5.2. Method of Measurements

Refer to Exhibit 7 of this test report & ANSI C63.4:1992

5.5.3. Test Arrangement

The following drawing shows details of the test setup for emission measurements.



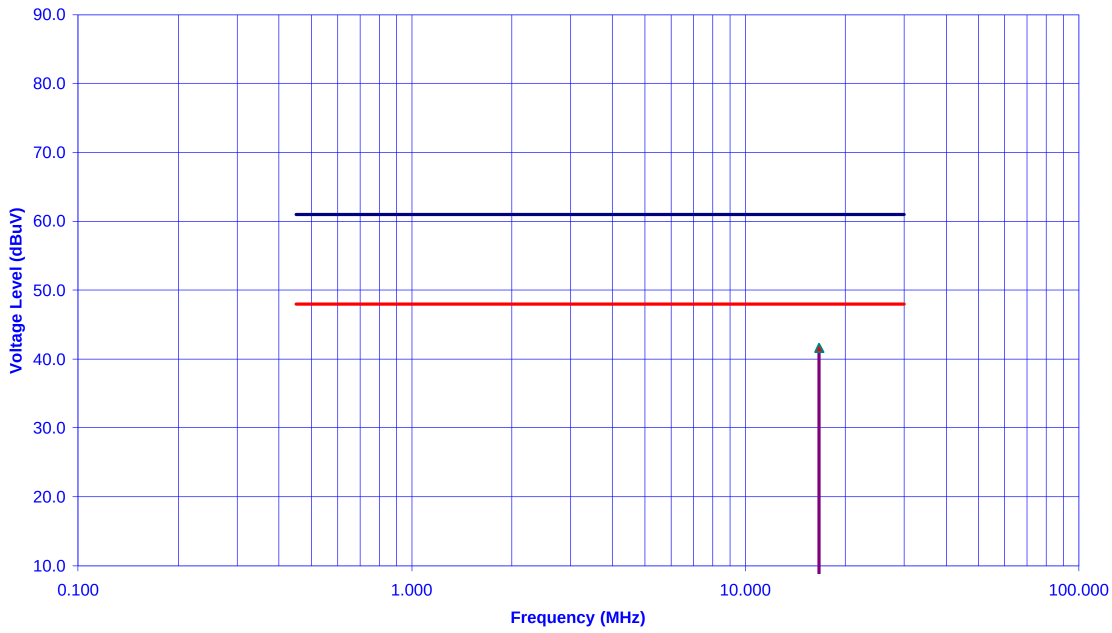
5.5.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
Transient Limiter	Hewlett Packard	11947A	310701998	9 kHz – 200 MHz 10 dB attenuation
L.I.S.N.	EMCO	3825/2	89071531	9 kHz – 200 MHz 50 Ohms / 50 μH
12'x16'x12' RF Shielded Chamber	RF Shielding	…	..	…

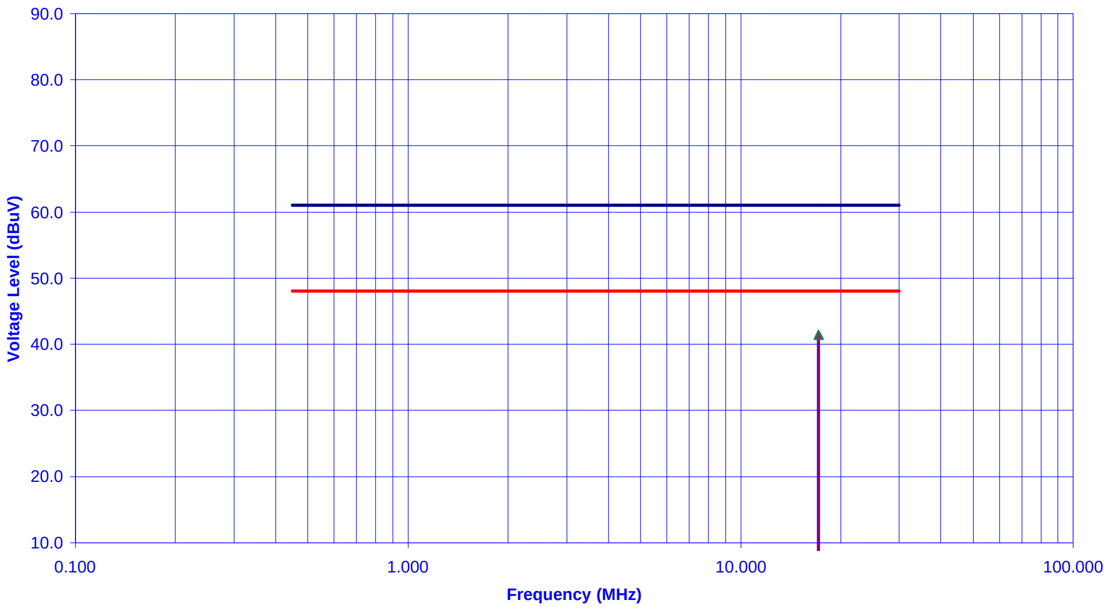
5.5.5. Test data

FREQUENCY (MHz)	RF LEVEL (dBμV)	RECEIVER DETECTOR (P/QP/AVG)	QP/NB LIMIT (dBμV)	QP/BB LIMIT (dBμV)	MARGIN (dB)	LINE TESTED (L1/L2)	Result
16.669	41.6	QP	48.0	61.0	-6.4	L1	Complied
17.145	41.4	QP	48.0	61.0	-6.6	L2	Complied

AC Conducted Emissions - Line #1 (Hot)
Gemtek Technology Co. Ltd.
PCMCIA Wireless LAN Card, Model WL-205



AC Conducted Emissions - Line #2 (Neutral)
Gemtek Technology Co. Ltd.
PCMCIA Wireless LAN Card, Model WL-205



5.5.6. Plots

Refer to Exhibit 12 Section 12.1 for actual measurement plots

5.5.7. Photographs of Test Setup

Refer to Exhibit 13 Section 13.1 for setup and arrangement of equipment under tests and its ancillary equipment.

5.6. 6 DB BANDWIDTH @ FCC 15.247(A)(2)

5.6.1. Limits

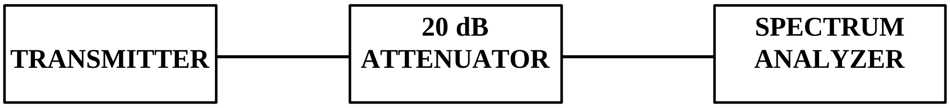
For a direct sequence spread spectrum system, the minimum 6 dB bandwidth shall be at least 500 KHz.

5.6.2. Method of Measurements

Refer to FCC 15.247(c) & ANSI C63.4:1992

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.

5.6.3. Test Arrangement



5.6.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz

5.6.5. Test Data

CHANNEL FREQUENCY (MHz)	6 dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS/FAIL
2412	9.86	0.5	PASS
2437	7.50	0.5	PASS
2462	7.21	0.5	PASS

5.6.6. Plots

Please refer to Exhibit 12 Section 12.2 for Measurements data

5.6.7. Photographs of Test Setup

None

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

5.7.1. Limits

- **FCC 15.247(b)(1):** Maximum peak output power of the transmitter shall not exceed 1 Watt.
- **FCC 15.247(b)(3):** If the antenna of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
- **FCC 15.247(b)(3)(i):** Systems operating in the 2400 - 2483.5 MHz band that are 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 exceeds 6 dBi..
- **FCC 1.1310:**- The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (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^2)	Average Time (minutes)
(A) Limits for Occupational/Control Exposures				
300-1500	...	...	F/300	6
1500-100,000	...	...	5	6
(B) Limits for General Population/Uncontrolled Exposure				
300-1500	...	...	F/1500	6
1500-100,000	...	...	1.0	30

F = Frequency in MHz

5.7.2. Method of Measurements

Refer to FCC 15.247(b)(1)&(3), ANSI C63-4:1992, FCC @ 1.1310 & OST Bulletin No. 65-October 1985

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

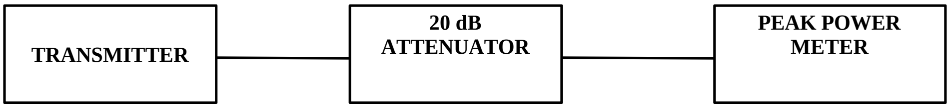
Where:
P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power.
S: power density mW/cm^2
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

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 not be exceeded at distances closer than r cm from the antenna of this device

5.7.3. Test Arrangement



5.7.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
Peak Power Meter & Peak Power Sensor	Hewlett Packard	8900 8481A	2131A00124 2551A01965	0.1-18 GHz 50 Ohms Input
Microwave Amplifier	Hewlett Packard	HP 83017A		1 GHz to 26.5 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz

5.7.5. Test data

CHANNEL FREQUENCY (MHz)	DATA RATE / MODULATION	Tx Antenna Gain (dBi)	Max. Field Strength Level @ 1 MHz BW At 3 m (dBuV/m)	(1) EIRP Power (Watts)	(2) Direct Total Peak Power (Watts)	(3) Min. Allowable Distance ® from Skin (Centi-Meter)
2412	2 Mbps DQPSK	0.5	103.59	0.027	0.037	1.5
2437	2 Mbps DQPSK	0.5	100.03	0.013	0.025	1.0
2462	2 Mbps DQPSK	0.5	103.91	0.030	0.016	1.5

Since the power density of 1 mW/cm^2 is at a very short distance from the radiating antenna and the antenna is inside the case, RF safety distance @ FCC 2.1091 and S.A.R. 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 to Full BW power conversion factor = (peak power level measured using the HP peak power meter) – (peak power level measured using EMI receiver in 1MHz 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 (2412MHz)	15.68 dBm	9.66 dBm	6.02 dB
Channel #6 (2437MHz)	13.98 dBm	7.63 dBm	6.35 dB
Channel #11 (2462MHz)	12.04 dBm	5.94 dBm	6.10 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: $r = (PG/4\Pi S)^{1/2} = (EIRP/4\Pi S)^{1/2}$

5.7.6. Plots

None

5.7.7. Photographs of Test Setup

None

5.8. TRANSMITTER ANTENNA CONDUCTED EMISSIONS, FCC CFR 47, PARA. 15.247(C)

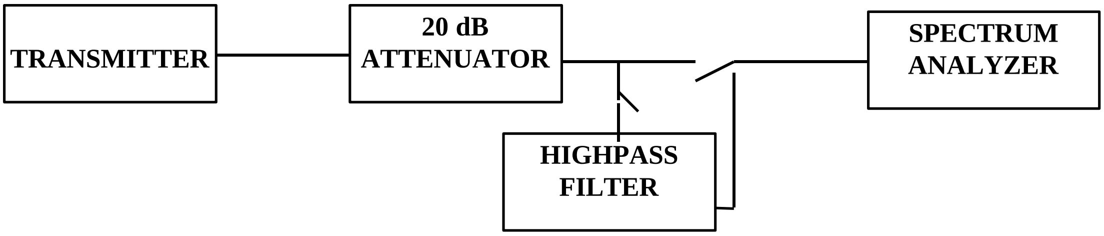
5.8.1. Limits

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.

5.8.2. Method of Measurements

Refer to FCC 15.247(c) & ANSI C63.4:1992

5.8.3. Test Arrangement



5.8.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3271	15050203	10 kHz – 26.5 GHz

5.8.5. Test data

5.8.5.1. Lowest Frequency (2412 MHz)

There were no significant RF emissions found from 10 MHz to 25 GHz. Please refer to plots for more details.

5.8.5.2. Middle Frequency (2437 MHz)

There were no significant RF emissions found from 10 MHz to 25 GHz. Please refer to plots for more details.

5.8.5.3. Highest Frequency (2462 MHz)

There were no significant RF emissions found from 10 MHz to 25 GHz. Please refer to plots for more details.

5.8.6. Plots

Please refer to Exhibit 12 Section 12.3 for Measurements data

5.8.7. Photographs of Test Setup

None

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

5.9.1. Limits

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

5.9.2. 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^{th} 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.

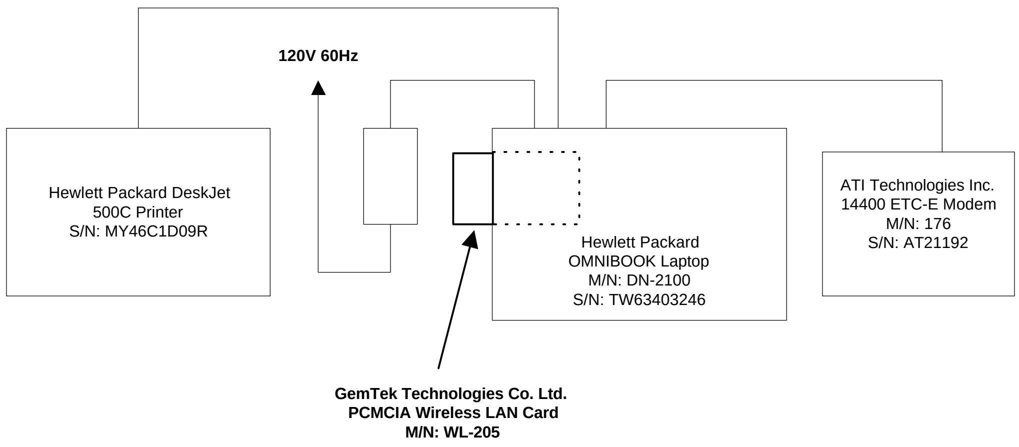
FCC CFR 47, Para. 2.993 - Field Strength Spurious Emissions

(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 he 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.

5.9.3. Test Arrangement



5.9.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3271	15050203	100 Hz to 32 GHz with external mixer for frequency above 32 GHz
Microwave Amplifier	Hewlett Packard	HP 83017A		1 GHz to 26.5 GHz
Biconilog Antenna	EMCO	3143	1029	20 MHz to 2 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna	EMCO	3160-09	..	18 GHz – 26.5 GHz
Horn Antenna	EMCO	3160-10	..	26.5 GHz – 40 GHz
Mixer	Tektronix	118-0098-00	..	18 GHz – 26.5 GHz
Mixer	Tektronix	119-0098-00	..	26.5 GHz – 40 GHz

5.9.5. Test data

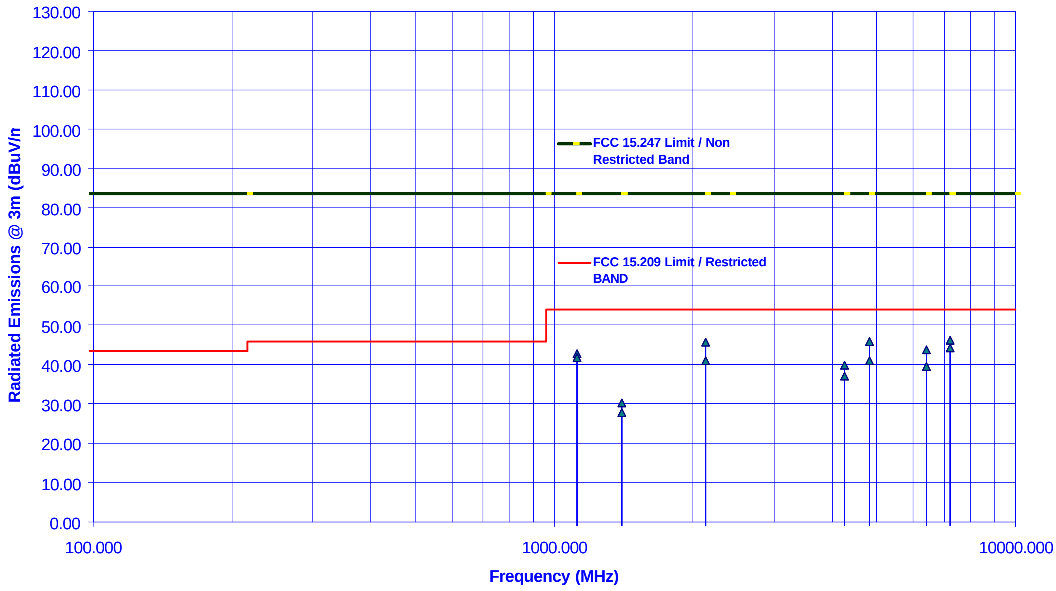
5.9.5.1. Lowest Frequency (2412 MHz)

Channel #: 1
Transmitter Frequency: 2412
Modulation: 1 Mbps DBPSK

FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
1120.00	46.53	42.69	V	54.0	83.6	-11.3	PASS*
1120.00	46.09	41.75	H	54.0	83.6	-12.3	PASS*
1400.00	41.81	30.22	V	54.0	83.6	-23.8	PASS*
1400.00	39.44	27.97	H	54.0	83.6	-26.0	PASS*
2132.00	48.63	45.63	V	54.0	83.6	-38.0	PASS
2132.00	47.56	41.16	H	54.0	83.6	-42.4	PASS
2412.00	103.25		V	--	--	--	--
2412.00	103.59		H	--	--	--	--
4264.00	50.19	39.94	V	54.0	83.6	-14.1	PASS*
4264.00	48.38	37.16	H	54.0	83.6	-16.8	PASS*
4824.00	51.81	41.06	V	54.0	83.6	-12.9	PASS*
4824.00	53.94	45.84	H	54.0	83.6	-8.2	PASS*
6396.00	53.00	43.84	V	54.0	83.6	-39.8	PASS
6396.00	51.66	39.63	H	54.0	83.6	-44.0	PASS
7236.00	54.94	46.19	V	54.0	83.6	-37.4	PASS
7236.00	54.09	44.34	H	54.0	83.6	-39.3	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions within 40 dB below the permissible limits were recorded.							

* Frequency in restricted band.

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
GemTek Technology Co. Ltd., PCMCIA Wireless LAN Card, Model WL-205
TRANSMIT Freq.: 2412 MHz

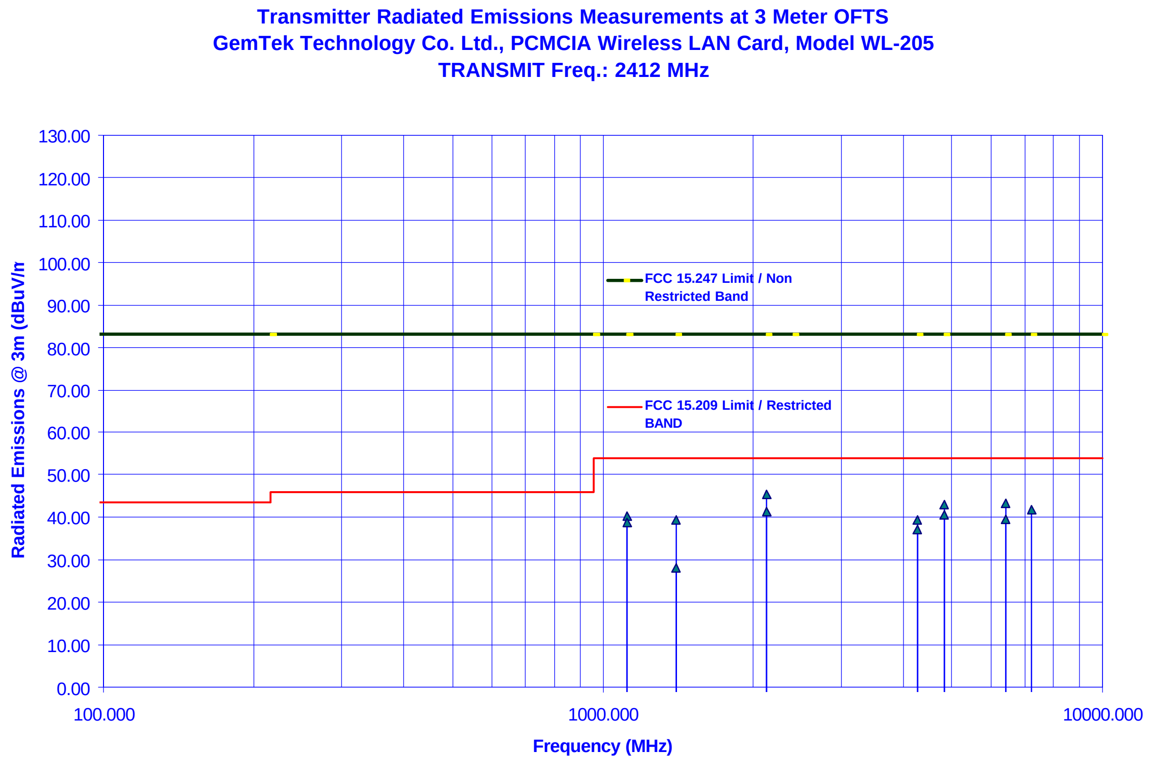


Channel #: 1
Transmitter Frequency: 2412
Modulation: 2 Mbps DQPSK

FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
1120.00	44.63	40.25	V	54.0	83.1	-13.8	PASS*
1120.00	44.59	38.78	H	54.0	83.1	-15.2	PASS*
1400.00	40.26	39.37	V	54.0	83.1	-14.6	PASS*
1400.00	38.75	28.16	H	54.0	83.1	-25.8	PASS*
2132.00	49.34	45.56	V	54.0	83.1	-37.6	PASS
2132.00	47.78	41.22	H	54.0	83.1	-41.9	PASS
2412.00	103.13	--	V	--	--	--	--
2412.00	102.78	--	H	--	--	--	--
4264.00	49.03	39.44	V	54.0	83.1	-14.6	PASS*
4264.00	48.63	37.09	H	54.0	83.1	-16.9	PASS*
4824.00	50.41	40.47	V	54.0	83.1	-13.5	PASS*
4824.00	52.94	43.03	H	54.0	83.1	-11.0	PASS*
6396.00	52.38	43.19	V	54.0	83.1	-39.9	PASS
6396.00	51.06	39.63	H	54.0	83.1	-43.5	PASS
7236.00	52.59	41.87	V	54.0	83.1	-41.3	PASS

The emissions were scanned from 10 MHz to 25 GHz and all emissions within 40 dB below the permissible limits were recorded.

* Frequency in restricted band.



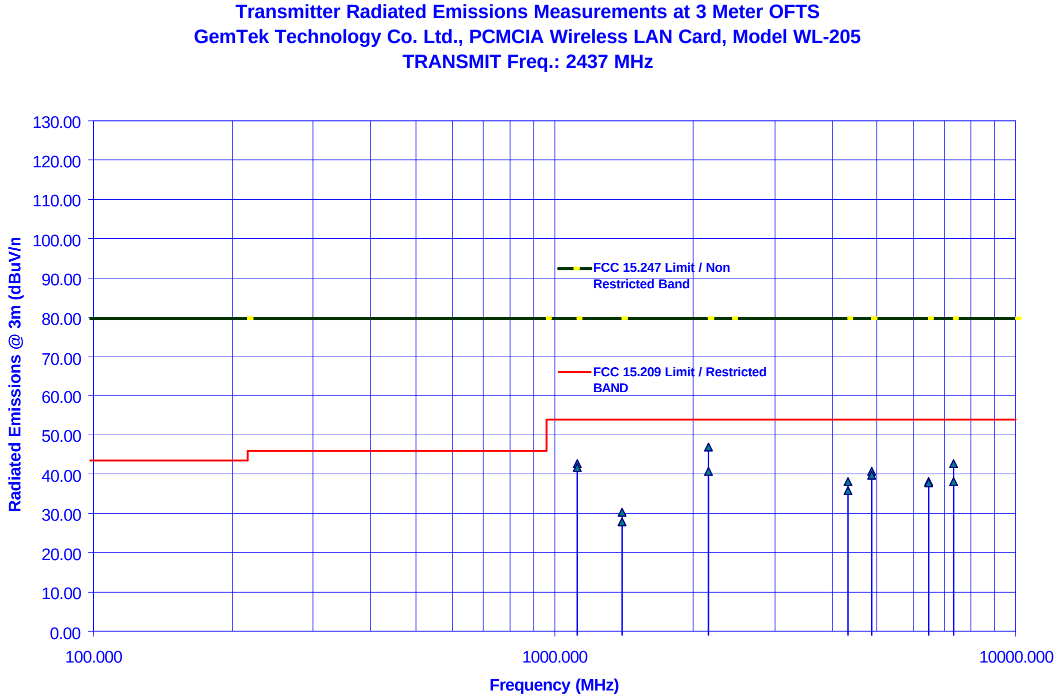
5.9.5.2. Middle Frequency (2437 MHz)

Channel #: 6
Transmitter Frequency: 2437
Modulation: 1 Mbps DBPSK

FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
1120.00	46.53	42.69	V	54.0	79.7	-11.3	PASS*
1120.00	46.09	41.75	H	54.0	79.7	-12.3	PASS*
1400.00	41.81	30.22	V	54.0	79.7	-23.8	PASS*
1400.00	39.44	27.97	H	54.0	79.7	-26.0	PASS*
2157.00	50.34	47.03	V	54.0	79.7	-32.7	PASS
2157.00	47.16	40.81	H	54.0	79.7	-38.9	PASS
2437.00	99.72	--	V	--	--	--	--
2437.00	99.66	--	H	--	--	--	--
4314.00	48.06	38.06	V	54.0	79.7	-15.9	PASS*
4314.00	48.09	35.91	H	54.0	79.7	-18.1	PASS*
4874.00	50.72	40.81	V	54.0	79.7	-13.2	PASS*
4874.00	49.66	39.72	H	54.0	79.7	-14.3	PASS*
6471.00	50.06	38.16	V	54.0	79.7	-41.6	PASS
6471.00	49.50	37.91	H	54.0	79.7	-41.8	PASS
7311.00	52.88	42.81	V	54.0	79.7	-11.2	PASS*
7311.00	50.28	38.00	H	54.0	79.7	-16.0	PASS*

The emissions were scanned from 10 MHz to 25 GHz and all emissions within 40 dB below the permissible limits were recorded.

* Frequency in restricted band

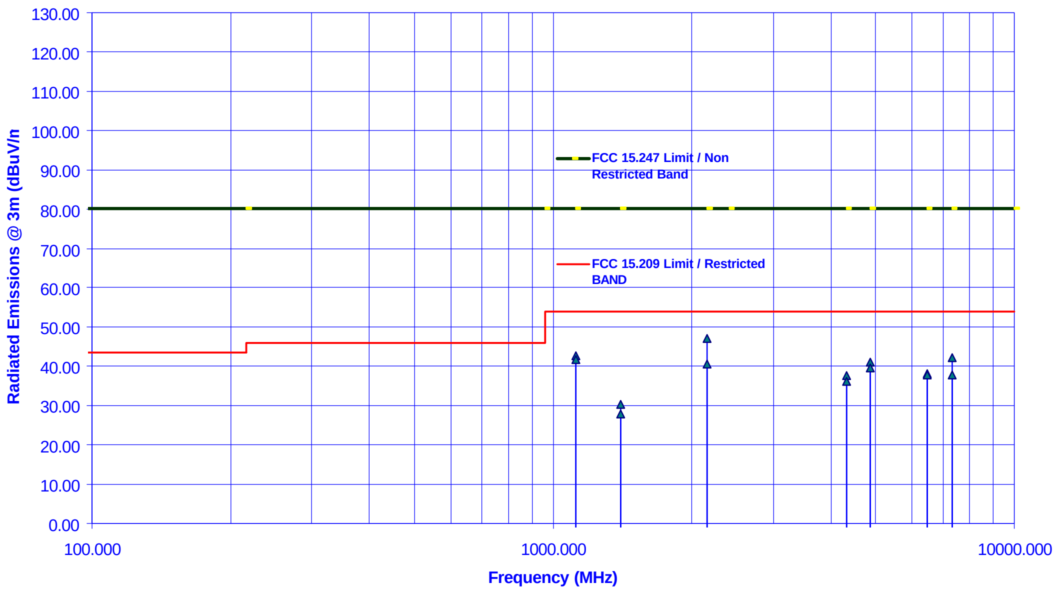


Channel #: 6
Transmitter Frequency: 2437
Modulation: 2 Mbps DQPSK

FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
1120.00	46.53	42.69	V	54.0	80.0	-11.3	PASS*
1120.00	46.09	41.75	H	54.0	80.0	-12.3	PASS*
1400.00	41.81	30.22	V	54.0	80.0	-23.8	PASS*
1400.00	39.44	27.97	H	54.0	80.0	-26.0	PASS*
2157.00	50.66	47.16	V	54.0	80.0	-32.9	PASS
2157.00	46.63	40.56	H	54.0	80.0	-39.5	PASS
2437.00	100.03	--	V	--	--	--	--
2437.00	97.03	---	H	--	--	--	--
4314.00	47.72	37.73	V	54.0	80.0	-16.3	PASS*
4314.00	47.03	36.19	H	54.0	80.0	-17.8	PASS*
4874.00	50.84	41.09	V	54.0	80.0	-12.9	PASS*
4874.00	49.59	39.66	H	54.0	80.0	-14.3	PASS*
6471.00	50.34	38.13	V	54.0	80.0	-41.9	PASS
6471.00	50.00	37.84	H	54.0	80.0	-42.2	PASS
7311.00	51.69	42.19	V	54.0	80.0	-11.8	PASS*
7311.00	50.47	37.94	H	54.0	80.0	-16.1	PASS*
The emissions were scanned from 10 MHz to 25 GHz and all emissions within 40 dB below the permissible limits were recorded.							

* Frequency in restricted band

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
GemTek Technology Co. Ltd., PCMCIA Wireless LAN Card, Model WL-205
TRANSMIT Freq.: 2437 MHz

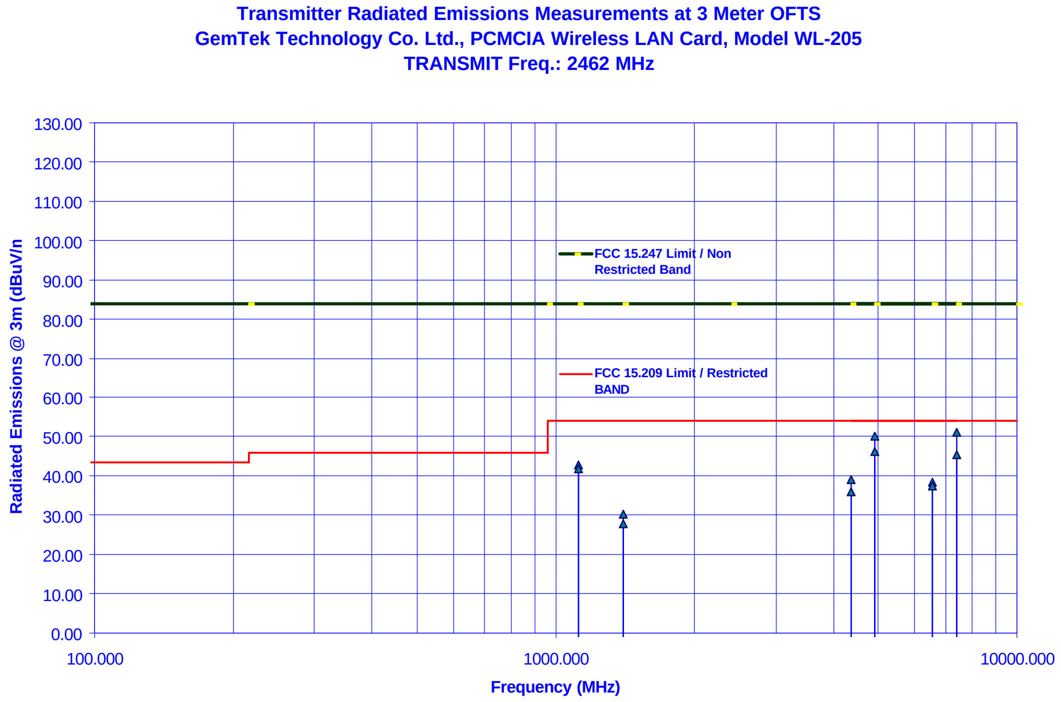


5.9.5.3. *Highest Frequency (2462 MHz)*

Channel #: 11
Transmitter Frequency: 2462
Modulation: 1 Mbps DBPSK

FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
1120.00	46.53	42.69	V	54.0	83.9	-11.3	PASS*
1120.00	46.09	41.75	H	54.0	83.9	-12.3	PASS*
1400.00	41.81	30.22	V	54.0	83.9	-23.8	PASS*
1400.00	39.44	27.97	H	54.0	83.9	-26.0	PASS*
2462.00	101.00	--	V	--	--	--	--
2462.00	103.91	--	H	--	--	--	--
4924.00	54.19	50.13	V	54.0	83.9	-3.9	PASS*
4924.00	52.28	46.22	H	54.0	83.9	-7.8	PASS*
7386.00	57.69	51.00	V	54.0	83.9	-3.0	PASS*
7386.00	53.25	45.56	H	54.0	83.9	-8.4	PASS*
4364.00	49.31	39.09	V	54.0	83.9	-14.9	PASS*
4364.00	46.94	36.03	H	54.0	83.9	-18.0	PASS*
6546.00	50.44	38.38	V	54.0	83.9	-45.5	PASS
6546.00	49.09	37.31	H	54.0	83.9	-46.6	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions within 40 dB below the permissible limits were recorded.							

* Frequency in restricted band

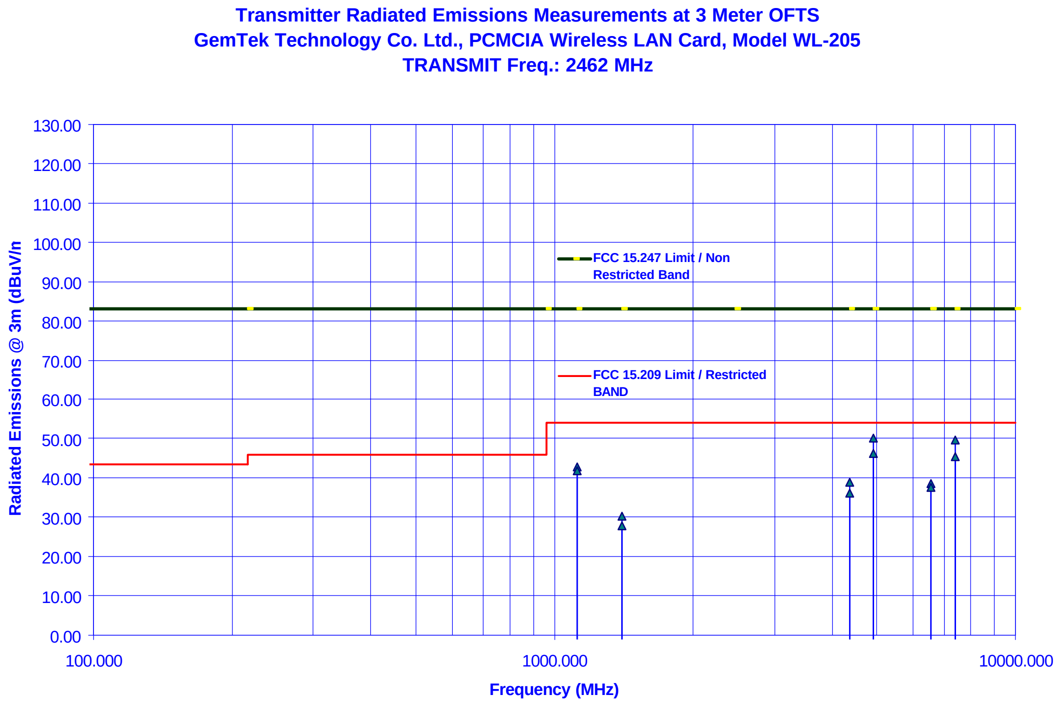


Channel #: 11
Transmitter Frequency: 2462
Modulation: 2 Mbps DQPSK

FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
1120.00	46.53	42.69	V	54.0	83.0	-11.3	PASS*
1120.00	46.09	41.75	H	54.0	83.0	-12.3	PASS*
1400.00	41.81	30.22	V	54.0	83.0	-23.8	PASS*
1400.00	39.44	27.97	H	54.0	83.0	-26.0	PASS*
2462.00	101.38	--	V	--	--	--	--
2462.00	103.03	--	H	--	--	--	--
4364.00	48.41	38.81	V	54.0	83.0	-15.2	PASS*
4364.00	46.84	36.16	H	54.0	83.0	-17.8	PASS*
4924.00	54.72	50.16	V	54.0	83.0	-3.8	PASS*
4924.00	52.16	46.09	H	54.0	83.0	-7.9	PASS*
6546.00	51.09	38.50	V	54.0	83.0	-44.5	PASS
6546.00	48.76	37.63	H	54.0	83.0	-45.4	PASS
7386.00	57.22	49.63	V	54.0	83.0	-4.4	PASS*
7386.00	53.37	45.36	H	54.0	83.0	-8.6	PASS*

The emissions were scanned from 10 MHz to 25 GHz and all emissions within 40 dB below the permissible limits were recorded.

* Frequency in restricted band



5.9.6. Plots

Please refer to Exhibit 12 Section 12.4 plots, which graphically represent the test results, recorded in the above Test Data Table.

5.9.7. Photographs of Test Setup

Refer to Exhibit 13 Section 13.2 for setup and arrangement of equipment under tests and its ancillary equipment.

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

5.10.1. Limits

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.

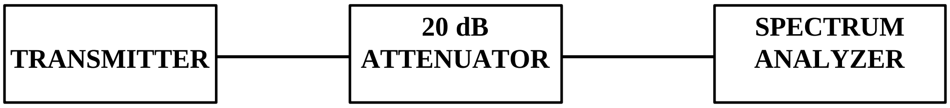
5.10.2. Methof of Measurements

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 $1.6x10^6/3.0x10^3$= 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.

5.10.3. Test Arrangement



5.10.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3271	15050203	10 kHz – 26.5 GHz

5.10.5. Test Data

Modulation: 1Mbps DBPSK					
CHANNEL NUMBER	CHANNEL FREQUENCY (MHz)	RF POWER LEVEL IN 3 KHz BW (dBm)	LIMIT (dBm)	MARGIN (dB)	COMMENTS (PASS/FAIL)
1	2412	-17.94	8.0	-25.9	PASS
6	2437	-18.56	8.0	-26.6	PASS
11	2462	-19.09	8.0	-27.1	PASS

Modulation: 2Mbps DQPSK					
CHANNEL NUMBER	CHANNEL FREQUENCY (MHz)	RF POWER LEVEL IN 3 KHz BW (dBm)	LIMIT (dBm)	MARGIN (dB)	COMMENTS (PASS/FAIL)
1	2412	-17.66	8.0	-25.7	PASS
6	2437	-18.31	8.0	-26.3	PASS
11	2462	-20.13	8.0	-28.1	PASS

5.10.6. Plots

Refer to Exhibit 12 Section 12.5 for Measurement Plots

5.10.7. Photographs of Test Setup

None

5.11. PROCESSING GAIN OF A DIRECT SEQUENCE SPREAD SPECTRUM, FCC CFR 47, PARA. 15.247(e)

5.11.1. Limits

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.

5.11.2. Method of Measurements

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 detetion 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 1.0×10^{-5} 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.

Gp = (S/N)o+Mj+Lsys

Where:

(S/N)o: 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).

Mj: Maximum jammer to Signal Ratio that recorded at the detected BER.

Lsys: 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 Lsys at its minimum value of 2 dB.

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

- (S/N)o: Refer to attached curves, BER versus (S/N)o for Differential Coherent Detection of Differentially Encoded BPSK
- Processing gain Gp = (S/N)o + Lsys + Mj = (S/N)o + 2 + Mj

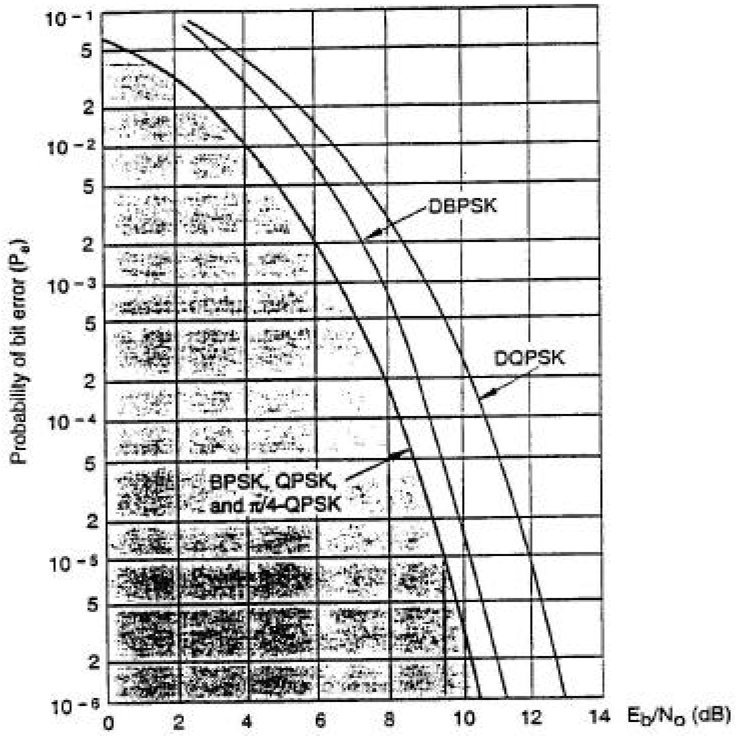


Figure 4.5.1 Theoretical $P_e = f(E_b/N_o)$ performance in a stationary additive white Gaussian noise (AWGN) environment. Ideal, linearly amplified coherent BPSK, QPSK, and differentially demodulated DBPSK systems are illustrated. The performance of non-linearly amplified FQPSK and GMSK is compared to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

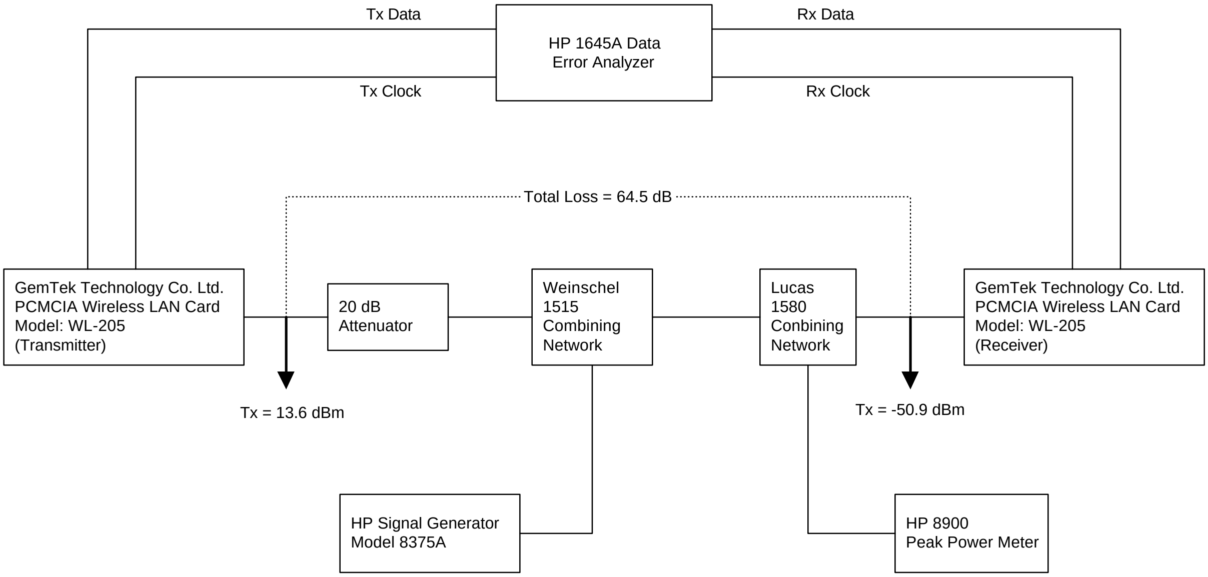
$$\text{BER} = f(C/N)$$

and/or

$$\text{BER} = f(E_b/N_o)$$

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.

5.11.3. Test Arrangement



5.11.4. Test Equipment List

- 20 dB Attenuators, 50 Ohm IN/OUT
- Weinschel 1515 Combining Network
- Lucas 1580 Combining Network
- 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.
- HP 1645A Data Error Analyzer, S/N: 1511A00680

5.11.5. Test Data

Test Method Employed: Jamming Margin

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

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

Measured Transmitter's Peak RF Power @ Receiver Input Terminal: -50.9 dBm

THEORETICAL PROCESS GAIN : 10.4dB				MIN. MEASURED PROCESSING GAIN: after discarding 19.4 % of the worst readings			
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)	Discarded Readings
1	-5.00	1.0	12.4	2.0	3.20	17.6	
2	-4.95	1.0	12.4	2.0	3.20	17.6	
3	-4.90	1.4	12.1	2.0	1.84	15.9	9
4	-4.85	1.6	11.9	2.0	1.09	15.0	1
5	-4.80	1.2	12.2	2.0	1.49	15.7	4
6	-4.75	1.2	12.2	2.0	1.77	16.0	7
7	-4.70	1.0	12.4	2.0	1.65	16.0	6
8	-4.65	1.1	12.3	2.0	1.96	16.2	13
9	-4.60	1.1	12.3	2.0	1.48	15.8	3
10	-4.55	1.2	12.2	2.0	1.77	16.0	8
11	**-4.50**	**1.6**	**11.9**	**2.0**	**2.56**	**16.5**	
12	-4.45	1.2	12.2	2.0	2.65	16.9	
13	-4.40	1.2	12.2	2.0	2.68	16.9	
14	-4.35	1.8	11.8	2.0	2.68	16.4	
15	-4.30	1.8	11.8	2.0	2.59	16.4	
16	-4.25	1.2	12.2	2.0	2.46	16.7	34
17	-4.20	1.8	11.8	2.0	2.31	16.1	25
18	-4.15	1.2	12.2	2.0	2.87	17.1	
19	-4.10	1.1	12.3	2.0	2.65	16.9	
20	-4.05	1.5	12.0	2.0	1.87	15.9	10
21	-4.00	1.9	11.7	2.0	1.24	14.9	2
22	-3.95	1.8	11.8	2.0	1.99	15.8	14
23	-3.90	1.2	12.2	2.0	2.15	16.4	20
24	-3.85	1.8	11.8	2.0	2.49	16.3	36
25	-3.80	1.8	11.8	2.0	2.49	16.3	37
26	-3.75	1.1	12.3	2.0	4.27	18.6	

Continued..

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)	Discarded Readings
27	-3.70	1.1	12.3	2.0	4.60	18.9	
28	-3.65	1.2	12.2	2.0	4.87	19.1	
29	-3.60	1.3	12.1	2.0	2.65	16.8	
30	-3.55	1.4	12.1	2.0	4.68	18.7	
31	-3.50	0.3	12.9	2.0	4.62	19.5	
32	-3.45	1.8	11.8	2.0	3.15	16.9	
33	-3.40	1.2	12.2	2.0	3.93	18.1	
34	-3.35	1.2	12.2	2.0	5.34	19.6	
35	-3.30	1.3	12.1	2.0	2.87	17.0	
36	-3.25	1.2	12.2	2.0	2.77	17.0	
37	-3.20	1.4	12.1	2.0	2.65	16.7	
38	-3.15	1.2	12.2	2.0	2.34	16.6	28
39	-3.10	1.2	12.2	2.0	2.49	16.7	38
40	-3.05	1.1	12.3	2.0	1.93	16.2	12
41	-3.00	1.0	12.4	2.0	1.52	15.9	5
42	-2.95	1.2	12.2	2.0	1.90	16.1	11
43	-2.90	1.1	12.3	2.0	2.13	16.4	16
44	-2.85	1.2	12.2	2.0	2.69	16.9	
45	-2.80	1.0	12.4	2.0	2.13	16.5	17
46	-2.75	1.0	12.4	2.0	2.22	16.6	23
47	-2.70	1.1	12.3	2.0	2.13	16.4	18
48	-2.65	1.6	11.9	2.0	2.31	16.2	26
49	-2.60	1.8	11.8	2.0	2.28	16.0	24
50	-2.55	0.3	12.9	2.0	2.31	17.2	27
51	-2.50	1.3	12.1	2.0	2.16	16.3	21
52	-2.45	1.2	12.2	2.0	2.47	16.7	35
53	-2.40	1.6	11.9	2.0	2.59	16.5	
54	-2.35	1.8	11.8	2.0	2.53	16.3	39
55	-2.30	1.0	12.4	2.0	2.63	17.0	
56	-2.25	1.1	12.3	2.0	2.78	17.1	
57	-2.20	1.2	12.2	2.0	2.72	16.9	
58	-2.15	1.1	12.3	2.0	2.36	16.6	29
59	-2.10	1.0	12.4	2.0	2.75	17.1	
60	-2.05	1.5	12.0	2.0	2.36	16.4	30
61	-2.00	1.4	12.1	2.0	2.42	16.5	32
62	-1.95	1.3	12.1	2.0	2.06	16.2	15
63	-1.90	1.8	11.8	2.0	2.68	16.4	
64	-1.85	1.1	12.3	2.0	2.43	16.7	33
65	-1.80	1.4	12.1	2.0	2.13	16.2	19

Continued..

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)	Discarded Readings
66	-1.75	1.2	12.2	2.0	2.39	16.6	31
67	-1.70	1.6	11.9	2.0	2.56	16.5	
68	-1.65	1.2	12.2	2.0	2.68	16.9	
69	-1.60	1.3	12.1	2.0	2.76	16.9	
70	-1.55	1.5	12.0	2.0	2.16	16.2	22
71	-1.50	1.3	12.1	2.0	3.19	17.3	
72	-1.45	1.0	12.4	2.0	3.16	17.5	
73	-1.40	1.8	11.8	2.0	3.25	17.0	
74	-1.35	1.6	11.9	2.0	3.09	17.0	
75	-1.30	1.0	12.4	2.0	3.09	17.5	
76	-1.25	1.0	12.4	2.0	3.66	18.0	
77	-1.20	1.4	12.1	2.0	3.12	17.2	
78	-1.15	1.3	12.1	2.0	3.26	17.4	
79	-1.10	1.5	12.0	2.0	3.18	17.2	
80	-1.05	1.7	11.8	2.0	3.08	16.9	
81	-1.00	1.4	12.1	2.0	3.59	17.7	
82	-0.95	1.7	11.8	2.0	3.25	17.1	
83	-0.90	1.5	12.0	2.0	3.28	17.3	
84	-0.85	1.2	12.2	2.0	3.19	17.4	
85	-0.80	1.3	12.1	2.0	3.25	17.4	
86	-0.75	1.5	12.0	2.0	3.47	17.5	
87	-0.70	1.4	12.1	2.0	3.18	17.2	
88	-0.65	1.6	11.9	2.0	3.16	17.1	
89	-0.60	1.8	11.8	2.0	3.68	17.4	
90	-0.55	1.7	11.8	2.0	3.06	16.9	
91	-0.50	1.3	12.1	2.0	3.56	17.7	
92	-0.45	1.4	12.1	2.0	3.58	17.6	
93	-0.40	1.6	11.9	2.0	3.27	17.2	
94	-0.35	1.4	12.1	2.0	3.30	17.4	
95	-0.30	1.6	11.9	2.0	3.72	17.6	
96	-0.25	1.7	11.8	2.0	3.44	17.3	
97	-0.20	1.5	12.0	2.0	3.26	17.3	
98	-0.15	1.4	12.1	2.0	3.57	17.6	
99	-0.10	1.4	12.1	2.0	3.67	17.7	
100	-0.05	1.2	12.2	2.0	3.36	17.6	
101	0.00	1.6	11.9	2.0	2.65	16.6	
102	0.05	1.0	12.4	2.0	2.88	17.2	
103	0.10	1.1	12.3	2.0	2.97	17.3	
104	0.15	1.5	12.0	2.0	2.86	16.9	

Continued..

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)	Discarded Readings
105	0.20	1.4	12.1	2.0	3.02	17.1	
106	0.25	1.6	11.9	2.0	3.16	17.1	
107	0.30	1.1	12.3	2.0	2.89	17.2	
108	0.35	1.6	11.9	2.0	3.12	17.0	
109	0.40	1.4	12.1	2.0	3.25	17.3	
110	0.45	1.6	11.9	2.0	3.47	17.4	
111	0.50	1.2	12.2	2.0	3.31	17.5	
112	0.55	1.1	12.3	2.0	3.65	17.9	
113	0.60	1.3	12.1	2.0	3.57	17.7	
114	0.65	1.4	12.1	2.0	3.16	17.2	
115	0.70	1.6	11.9	2.0	3.87	17.8	
116	0.75	1.7	11.8	2.0	3.78	17.6	
117	0.80	1.2	12.2	2.0	3.56	17.8	
118	0.85	1.7	11.8	2.0	3.15	17.0	
119	0.90	1.3	12.1	2.0	3.78	17.9	
120	0.95	1.6	11.9	2.0	3.55	17.5	
121	1.00	1.1	12.3	2.0	3.98	18.3	
122	1.05	1.3	12.1	2.0	3.97	18.1	
123	1.10	1.4	12.1	2.0	3.85	17.9	
124	1.15	1.7	11.8	2.0	3.79	17.6	
125	1.20	1.2	12.2	2.0	3.56	17.8	
126	1.25	1.4	12.1	2.0	3.89	18.0	
127	1.30	1.5	12.0	2.0	3.97	18.0	
128	1.35	1.8	11.8	2.0	3.85	17.6	
129	1.40	1.9	11.7	2.0	3.92	17.6	
130	1.45	1.7	11.8	2.0	4.16	18.0	
131	1.50	1.2	12.2	2.0	4.09	18.3	
132	1.55	1.4	12.1	2.0	4.15	18.2	
133	1.60	1.6	11.9	2.0	4.23	18.1	
134	1.65	1.8	11.8	2.0	4.36	18.1	
135	1.70	2.8	11.0	2.0	4.57	17.6	
136	1.75	1.4	12.1	2.0	4.35	18.4	
137	1.80	1.3	12.1	2.0	4.37	18.5	
138	1.85	1.5	12.0	2.0	4.46	18.5	
139	1.90	1.8	11.8	2.0	4.65	18.4	
140	1.95	1.9	11.7	2.0	4.78	18.5	
141	2.00	1.4	12.1	2.0	4.66	18.7	
142	2.05	1.8	11.8	2.0	4.76	18.5	
143	2.10	1.9	11.7	2.0	4.69	18.4	

Continued..

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)	Discarded Readings
144	2.15	1.0	12.4	2.0	4.75	19.1	
145	2.20	1.2	12.2	2.0	4.68	18.9	
146	2.25	1.8	11.8	2.0	4.76	18.5	
147	2.30	1.7	11.8	2.0	4.50	18.3	
148	2.35	1.6	11.9	2.0	4.13	18.0	
149	2.40	1.9	11.7	2.0	4.25	17.9	
150	2.45	1.6	11.9	2.0	4.37	18.3	
151	2.50	1.1	12.3	2.0	4.86	19.1	
152	2.55	1.0	12.4	2.0	4.05	18.4	
153	2.60	1.2	12.2	2.0	4.08	18.3	
154	2.65	1.3	12.1	2.0	4.16	18.3	
155	2.70	1.4	12.1	2.0	4.38	18.4	
156	2.75	1.6	11.9	2.0	4.32	18.2	
157	2.80	1.7	11.8	2.0	4.78	18.6	
158	2.85	1.1	12.3	2.0	4.98	19.3	
159	2.90	1.0	12.4	2.0	4.79	19.2	
160	2.95	1.5	12.0	2.0	4.62	18.6	
161	3.00	1.2	12.2	2.0	4.00	18.2	
162	3.05	1.4	12.1	2.0	4.15	18.2	
163	3.10	1.6	11.9	2.0	4.78	18.7	
164	3.15	1.8	11.8	2.0	4.69	18.5	
165	3.20	1.9	11.7	2.0	4.78	18.5	
166	3.25	1.7	11.8	2.0	4.69	18.5	
167	3.30	1.0	12.4	2.0	4.79	19.2	
168	3.35	1.2	12.2	2.0	4.69	18.9	
169	3.40	1.1	12.3	2.0	4.16	18.4	
170	3.45	1.4	12.1	2.0	4.75	18.8	
171	3.50	1.5	12.0	2.0	4.69	18.7	
172	3.55	1.7	11.8	2.0	4.31	18.2	
173	3.60	1.8	11.8	2.0	4.61	18.4	
174	3.65	1.1	12.3	2.0	4.78	19.1	
175	3.70	1.1	12.3	2.0	4.82	19.1	
176	3.75	1.3	12.1	2.0	4.00	18.1	
177	3.80	1.2	12.2	2.0	4.09	18.3	
178	3.85	1.7	11.8	2.0	4.24	18.1	
179	3.90	1.8	11.8	2.0	4.39	18.2	
180	3.95	1.4	12.1	2.0	4.71	18.8	
181	4.00	1.0	12.4	2.0	4.84	19.2	
182	4.05	1.2	12.2	2.0	5.00	19.2	

Continued..

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)	Discarded Readings
183	4.10	1.6	11.9	2.0	5.10	19.0	
184	4.15	1.8	11.8	2.0	5.26	19.0	
185	4.20	1.9	11.7	2.0	5.19	18.9	
186	4.25	1.8	11.8	2.0	5.15	18.9	
187	4.30	1.5	12.0	2.0	5.67	19.7	
188	4.35	1.7	11.8	2.0	5.78	19.6	
189	4.40	1.3	12.1	2.0	5.12	19.3	
190	4.45	1.8	11.8	2.0	5.68	19.4	
191	4.50	1.7	11.8	2.0	5.39	19.2	
192	4.55	1.1	12.3	2.0	5.38	19.7	
193	4.60	1.2	12.2	2.0	5.09	19.3	
194	4.65	1.7	11.8	2.0	5.08	18.9	
195	4.70	1.8	11.8	2.0	4.94	18.7	
196	4.75	1.0	12.4	2.0	4.78	19.1	
197	4.80	1.3	12.1	2.0	4.81	18.9	
198	4.85	1.3	12.1	2.0	5.06	19.2	
199	4.90	1.6	11.9	2.0	4.84	18.8	
200	4.95	1.4	12.1	2.0	4.88	18.9	
201	5.00	1.6	11.9	2.0	4.97	18.9	

5.11.6. Plots

None

5.11.7. Photographs of Test Setup

None

EXHIBIT 6. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994)

6.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Line Conducted)	PROBABILITY DISTRIBUTION	UNCERTAINTY (dB)	
		9-150 kHz	0.15-30 MHz
EMI Receiver specification	Rectangular	±1.5	±1.5
LISN coupling specification	Rectangular	±1.5	±1.5
Cable and Input Transient Limiter calibration	Normal (k=2)	±0.3	±0.5
Mismatch: Receiver VRC $\Gamma_1 = 0.03$ LISN VRC $\Gamma_R = 0.8$(9 kHz) 0.2 (30 MHz) Uncertainty limits $20Log(1\pm\Gamma_1\Gamma_R)$	U-Shaped	±0.2	±0.3
System repeatability	Std. deviation	±0.2	±0.05
Repeatability of EUT	--	--	--
Combined standard uncertainty	Normal	±1.25	±1.30
Expanded uncertainty U	Normal (k=2)	±2.50	±2.60

Sample Calculation for Measurement Accuracy in 150 kHz to 30 MHz Band:

$$u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)} = \pm \sqrt{(1.5^2 + 1.5^2)/3 + (0.5/2)^2 + (0.05/2)^2 + 0.35^2} = \pm 1.30 \text{ dB}$$

$U = 2u_c(y) = \pm 2.6$ dB

6.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (± dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	±1.0	±1.0
Cable Loss Calibration	Normal (k=2)	±0.3	±0.5
EMI Receiver specification	Rectangular	±1.5	±1.5
Antenna Directivit	Rectangular	+0.5	+0.5
Antenna factor variation with height	Rectangular	±2.0	±0.5
Antenna phase center variation	Rectangular	0.0	±0.2
Antenna factor frequency interpolation	Rectangular	±0.25	±0.25
Measurement distance variation	Rectangular	±0.6	±0.4
Site imperfections	Rectangular	±2.0	±2.0
Mismatch: Receiver VRC Γ_1 = 0.2 Antenna VRC Γ_R = 0.67(Bi) 0.3 (Lp) Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$)	U-Shaped	+1.1 -1.25	±0.5
System repeatability	Std. Deviation	±0.5	±0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k=2 is used:

$U = 2u_c(y) = 2x(+2.19) = +4.38$ dB And $U = 2u_c(y) = 2x(-2.21) = -4.42$ dB

EXHIBIT 7. MEASUREMENT METHODS

7.1. GENERAL TEST CONDITIONS

7.1.1. Test Conditions

- The measurement shall be made in the operational mode producing the largest emission in the frequency band being investigated consistent with normal applications.
- An attempt shall be made to maximize the detected radiated emissions, for example moving cables of the equipment, rotating the equipment by 360^o and moving the measuring receiving antenna up and down within 1 to 4 meters high.
- Where appropriate, a single tone or a bit stream shall be used to modulate the receiver. The manufacturer shall define the modulation with the highest emission in transmit mode.

7.1.2. Method of Measurements - AC Mains Conducted Emissions

- AC Mains conducted emissions measurements were performed in accordance with the standard against appropriate limits for each detector function.
- The test was performed in the shielded room, 16'(L) by 16'(W) by 12'(H).
- The test was performed were made over the frequency range from 150 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 operates only from internal or dedicated batteries, with no provisions for connection to the public utility ac power lines, AC Mains 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 were 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 outlet. 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 this test report.
- A preliminary scan was made by using spectrum analyzer system with the detector function set to PEAK mode (9 KHz RBW, VBW > RBW), frequency span 150KHz-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.

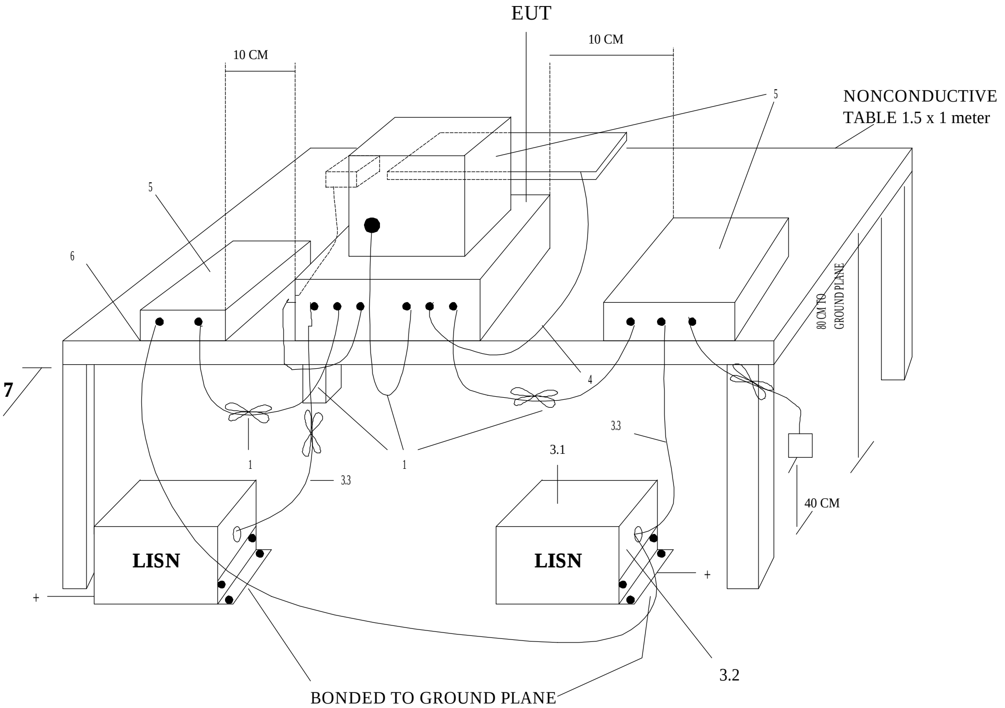
Step2. Manipulate the system cables and peripheral devices to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.

Step3. The effects of various modes of operation is examined. This is done by varying equipment operation modes as step 2 is being performed.

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 > RBW). The spectrum analyzer was then set to CISPR QUASI-PEAK detector mode (9 KHz RBW, 1 MHz VBW) and AVERAGE detector mode (9 kHz RBW, 1 Hz VBW). The final highest RF signal levels and frequencies were 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.



+LISNs may have to be moved to the side to meet 3.3 below

LEGEND:

1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back at forth forming a bundle 30 to 40 cm long, hanging approximately in the middle between ground plane and table.

2. I/O cables that are connected to a peripheral shall be bundled in center. The end of the cable may be terminated if required using correct terminating impedance. The total length shall not exceed 1m.

3. EUT connected to one LISN. Unused LISN connectors shall be terminated in 50 Ohm. LISN can be placed on top of, or immediately beneath, ground plane.
3.1 All other equipment powered from second LISN.
3.2 Multiple outlet strip can be used for multiple power cords of non-EUTequipment.
3.3 LISN at least 80 cm from nearest part of EUT chassis.

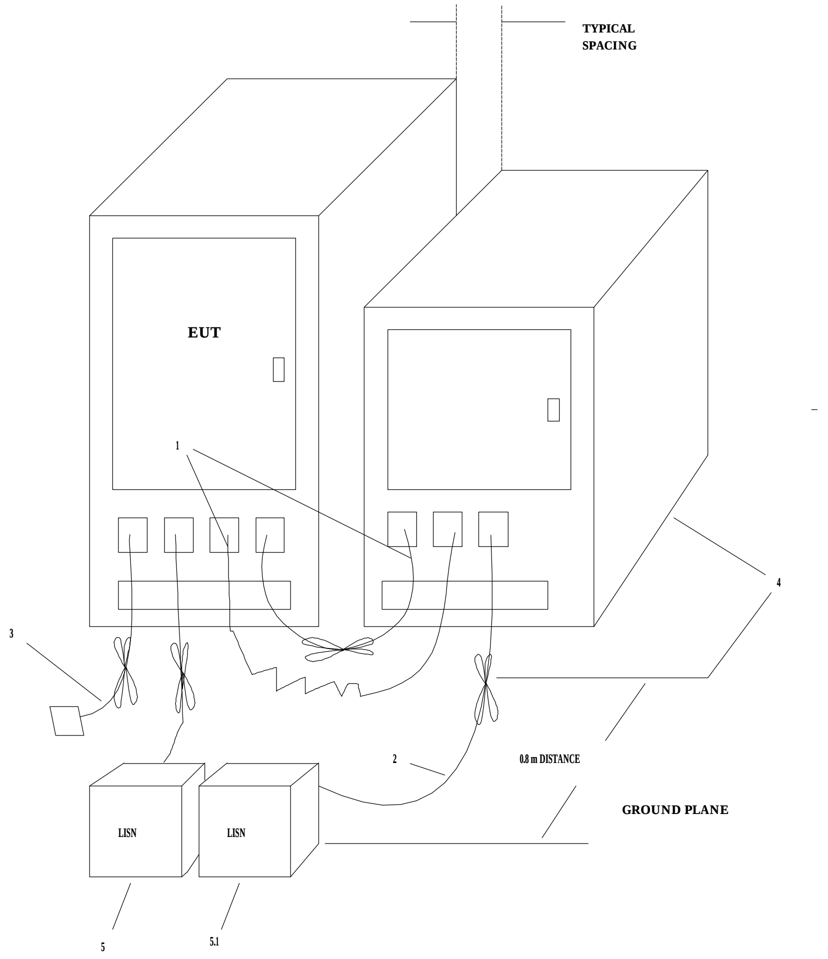
4. Cables of hand-operated devices, such as keyboards, mouses, etc., have to be placed as close as possible to the host.

5. Non-EUT components being tested.

6. Rear of EUT, including peripherals, shall be all aligned and flush with rear of tabletop.

7. Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the floor ground plane (see 5.2)

Tabletop Equipment Conducted Emissions



LEGENEND:

1. Excess I/O cables shall be bundled in center. If bundling is not possible, the cables shall be arranged in serpentine fashion. Bunding shall not exceed 40 cm in length.

2. Excess power cords shall be bundled in the center or shortened to appropriated length.

3. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated if required using correct terminating impedance. If bundling is not possible, the cable shall be arranged in serpentine fashion.

4. EUT and all cables shall be insulated from ground plane by 3 to 12 mm of insulating material.

5. EUT connected to one LISN. LISN can be placed on top of, or immediately beneath, ground plane.
5.1 All other equipment powered from second LISN.

Floor-Standing Equipment Conducted Emissions

7.1.3. Method of Measurements - Electric Field Radiated Disturbance

- The radiated emission measurements were performed at the UltraTech's 10 or 30 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, Industry Canada, ACA/Austel, NVLap and ITI.
- Radiated emissions measurements were made using the following test instruments:

1. Calibrated EMCO BiconiLog antenna in the frequency range from 30 MHz to 2000 MHz.
2. Calibrated Emco Horn antennas in the frequency range above 1000 MHz (1GHz - 40 GHz).
3. 3.Calibrated Advantest spectrum analyzer and pre-selector. 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 (120 KHz VBW and VBW ≥ RBW).

   – If any rf emission was observed to be a broadband noise, the spectrum analyzer's CISPR QUASI-PEAK detector (120 KHz RBW and VBW ≥ RBW) 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 this test report.
- The frequencies of emissions were first detected. Then the amplitude of the emissions was measured at the specified measurement distance using required antenna height, polarization, and detector characteristics.
- 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 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 are 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.

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:

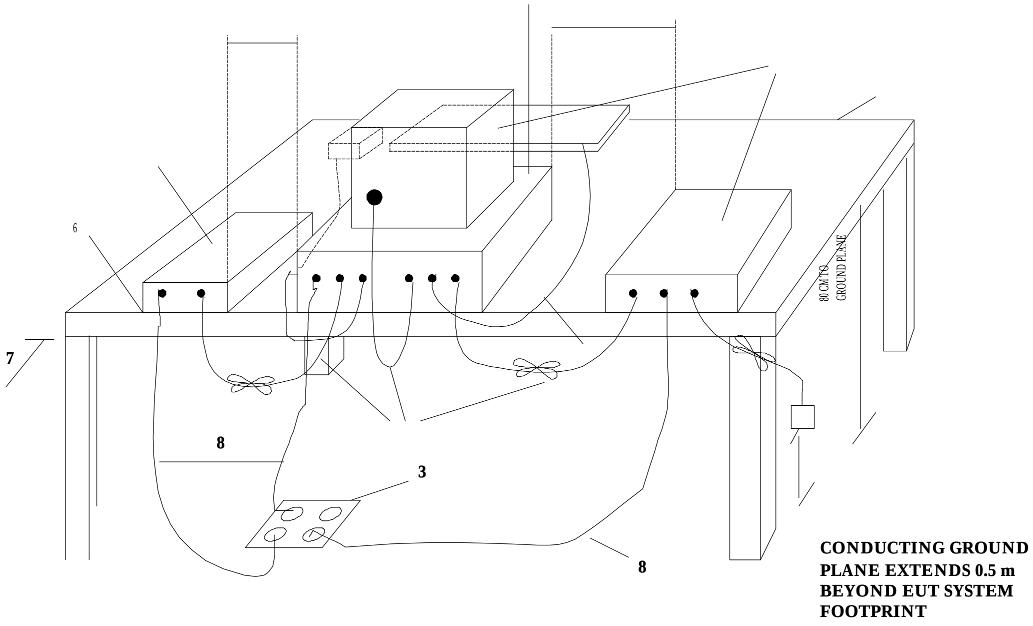
$$FS = RA + AF + CF - AG$$

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 dBuV 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:.

Field Level = 60 + 7.0 + 1.0 - 30 = 38.0 dBuV/m.

Field Level = $10^{(38/20)}$ = 79.43 uV/m.



LEGEND:

1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth forming a bundle 30 to 40 cm long, hanging approximately in the middle between ground plane and table.

2. I/O cables that are connected to a peripheral shall be bundled in center. The end of the cable may be terminated if required using correct terminating impedance. The total length shall not exceed 1m.

3. If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the ground plane with the receptable flush with the ground plane.

4. Cables of hand-operated devices, such as keyboards, mouses, etc., have to be placed as close as possible to the controller.

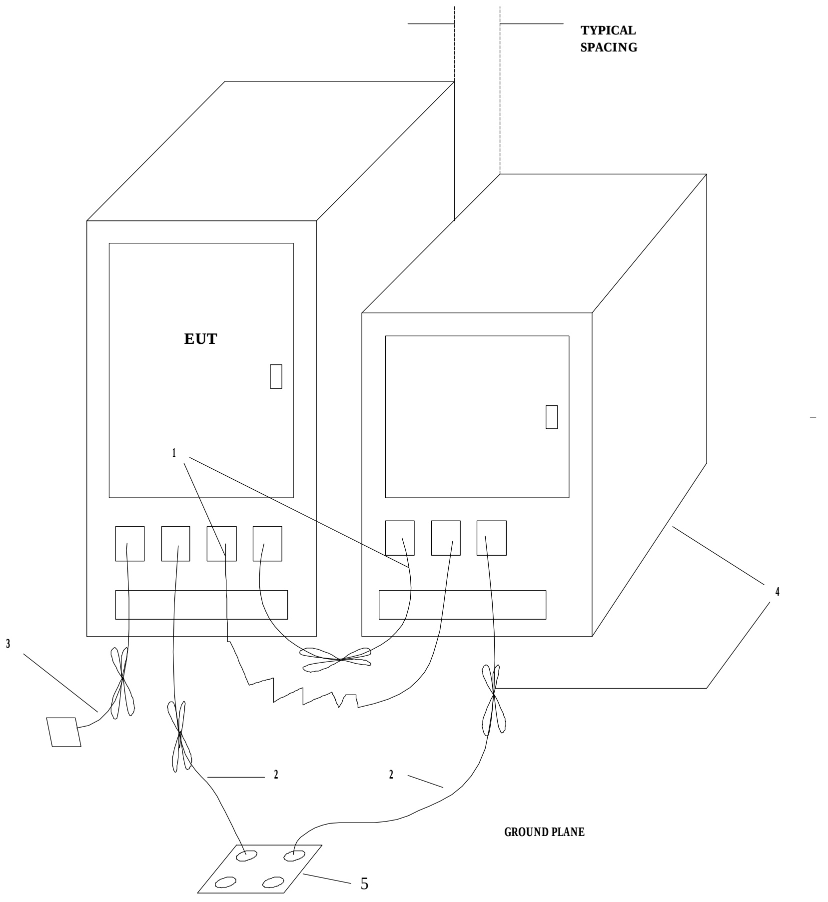
5. Non-EUT components of EUT system being tested.

6. The rear of all components of the system under test shall be located flush with the rear of the table.

7. No vertical conducting wall used.

8. Power cords drape to the floor and are routed over to receptacle.

Tabletop Equipment Radiated Emissions



LEGEND:

1. Excess I/O cables shall be bundled in center. If bundling is not possible, the cables shall be arranged in serpentine fashion.

2. Excess power cords shall be bundled in the center or shortened to appropriated length.

3. I/O cables that are not connected to aperipheral shall be bundled in the center. The end of the cable may be terminated if required using correct terminating impedance. If bundling is not possible, the cable shall be arranged in serpentine fashion.

4. EUT and all cables shall be inslulated from ground plane by 3 to 12 mm of insulating material.

5. If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the ground plane with the receptacle flush with the ground plane.

Floor-Standing Equipment Radiated Emissions

EXHIBIT 8. FCC FORM 731, APPLICANT'S LETTERS & STATEMENT

8.1. APPLICANT'S AUTHORIZATION TO APPOINT ULTRATECH ENGINEERING LABS INC. TO ACT AS AN AGENT

Please refer to attached letter.

8.2. LETTER REQUEST FOR FCC CONFIDENTIALITY FILING

Please refer to attached letter.

8.3. LETTERS OF NOTIFICATION REGARDING MULTIPLE LISTING

Please refer to attached letters of agreement for multiple listing from Gemtek Technology Co., Ltd. and NgeeAnn Polytechnic.

EXHIBIT 9. FCC ID LABEL & SKETCH OF LABEL LOCATION

Refer to attached FCC ID label.

EXHIBIT 10. "FCC INFORMATION TO USER"

Refer to user's manual.

EXHIBIT 11. PHOTOGRAPHS OF EQUIPMENT UNDER TEST

Refer to attached photographs

EXHIBIT 12. PLOTS OF MEASUREMENTS

12.1. AC CONDUCTED EMISSIONS PLOTS

Please refer to attached plots.

12.2. 6 dB BANDWIDTH PLOTS

Please refer to attached plots.

12.3. TRANSMITTER ANTENNA CONDUCTED EMISSIONS PLOTS

Please refer to attached plots.

12.4. TRANSMITTER RADIATED EMISSIONS PLOTS

Please refer to attached plots.

12.5. TRANSMITTED POWER DENSITY PLOTS

Please refer to attached plots.

EXHIBIT 13. PHOTOGRAPHS OF TEST SETUP

13.1. AC POWERLINE CONDUCTED EMISSIONS TEST SETUP PHOTOS

Please refer to attached Photos.

13.2. TRANSMITTER RADIATED EMISSIONS TEST SETUP PHOTOS

Please refer to attached Photos.

EXHIBIT 14. SYSTEM BLOCK DIAGRAM(S), SCHEMATIC DIAGRAMS & BOM

Please refer to attached system block diagrams, schematic diagrams and BOM.

EXHIBIT 15. USER'S MANUAL

Please refer to attached User's Manual.