



Nemko Test Report: 4L0050RUS1Rev3

Applicant: Motion Computing, Inc.
9433 Bee Caves Road
Building 1, Suite 250
Austin, TX 78733

**Equipment Under Test:
(E.U.T.)** M1400 (T003)

In Accordance With: **FCC Part 15, Subpart C, 15.247**
Digital Transmission System Transceiver

Tested By: Nemko Dallas Inc.
802 N. Kealy
Lewisville, Texas 75057-3136

Authorized By: 
Tom Tidwell, Frontline Group Manager

Date: 3 March, 2004

Table of Contents

Section 1. Summary of Test Results	3
Section 2. Equipment Under Test (E.U.T.)	5
Section 3. Powerline Conducted Emissions	7
Section 4. Occupied Bandwidth.....	10
Section 5. Maximum Peak Output Power	27
Section 6. RF Exposure.....	31
Section 7. Spurious Emissions (radiated).....	32
Section 8. Peak Power Spectral Density	40
Section 9. Test Equipment List	42
ANNEX A - TEST DETAILS	43
ANNEX B - TEST DIAGRAMS	54

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

Section 1. Summary of Test Results

Manufacturer: Motion Computing, Inc.

Model No.: M1400 (T003)

Serial No.: None

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C, Paragraph 15.247 for Direct Sequence Spread Spectrum devices. Radiated tests were conducted in accordance with ANSI C63.4-1992. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

New Submission

Production Unit

Class II Permissive Change

Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE. NONE
See " Summary of Test Data".



NVLAP LAB CODE: 100426-0

Nemko Dallas Inc. authorizes the above named company to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko Dallas Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This report applies only to the items tested.

Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
Powerline Conducted Emissions	15.207(a)	Complies
Minimum 6 dB Bandwidth	15.247(a)(2)	Complies
Channel Separation	15.247(a)(1)	Complies
Pseudorandom Hopping Algorithm	15.247(a)(1)	Complies
Time of Occupancy	15.247(a)(1)(ii)	Complies
20 dB Occupied Bandwidth	15.247(a)(1)	Complies
Maximum Peak Power Output	15.247(b)(1)	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	N/A
Spurious Emissions (Restricted Bands)	15.247(c)	Complies
Peak Power Spectral Density	15.247(d)	Complies

Footnotes:

The antennas are integral to the radio modules.

Section 2. Equipment Under Test (E.U.T.)

General Equipment Information

Frequency Band:

902 – 928 MHz

2400 – 2483.5 MHz

5725 – 5850 MHz

Channel Spacing:

500 kHz 802.11g

1 MHz Bluetooth

User Frequency Adjustment:

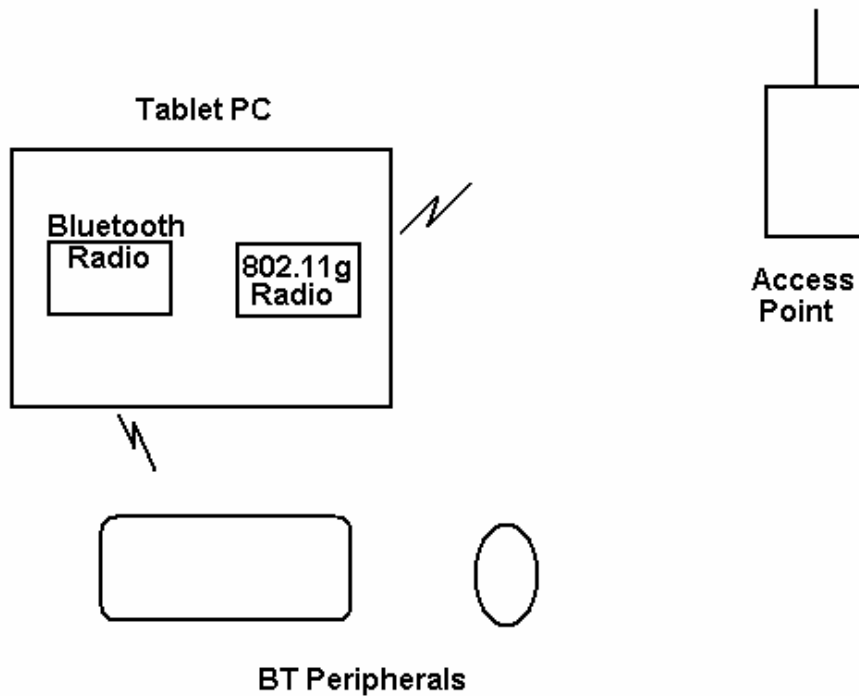
Software controlled

This product contains both an 802.11 module and a Bluetooth module that may operate simultaneously.

Description of EUT

The [M1400 \(T003\)](#) is a portable computer platform based on ultra-portable notebook PC technology utilizing Microsoft's Tablet version of Windows XP. The system utilizes Intel's 855 GME chip set, including the Banias ULV 1.0 G processor and an Intel 2200BG WLAN card. The M1400 (T003) will fully meet Microsoft's Windows XP tablet OS requirements including; fast resume, surprise undocking, and no external legacy peripheral ports.

System Diagram



EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

Section 3. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY: Brian Boyea	DATE: 1/25/04

Test Results: Complies.

Measurement Data: See attached plots.

Measurement Uncertainty: +/- 1.7 dB

NOTE: The device was tested with both radio modules transmitting simultaneously.

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

Test Data – Powerline Conducted Emissions



NEMKO Dallas, Inc.

Dallas Headquarters:

802 N. Kealy
 Lewisville, TX 75057
 Tel: (972) 436-9600
 Fax: (972) 436-2667

Conducted Emissions												
Powerline Voltage Measurement												
Complete	<u> X </u>		Job # : <u>4L0050E</u>					Test # : <u>CEPV-01</u>				
Preliminary	<u> </u>		Page <u> 1 </u>					of <u> 1 </u>				
Client Name :	<u>MOTION COMPUTING INC.</u>											
EUT Name :	<u>M1400 TABLET PC</u>											
EUT Model # :	<u>M1400 - TRADE NAME IS T003</u>											
EUT Part # :	<u>M1400</u>											
EUT Serial # :	<u>0</u>											
EUT Config. :	<u>Transmit State</u>											
Specification :	<u>CFR47 Part 15, Subpart B, Class B</u>						Reference :					
Transducer # :	<u>545</u>	Temp. (deg. C) :	<u>23</u>			Date :	<u>01/25/04</u>					
HP Filter # :	<u>704</u>	Humidity (%) :	<u>35</u>			Time :	<u>9:30 A.M.</u>					
Cable 1 # :	<u>1038</u>	EUT Voltage :	<u>120 Vac</u>			Staff :	<u>Brian Boyea</u>					
Cable 2 # :	<u>1988</u>	EUT Frequency :	<u>60 Hz</u>			Location :	<u>Lab 5</u>					
Detector 1 # :	<u>1283</u>	Peak Bandwidth:	<u>10kHz</u>			Photo ID:	<u>4L0050E CEPV-01</u>					
Detector 2 # :	<u>966</u>	QP Bandwidth	<u>10kHz</u>									
Limiter # :	<u>1193</u>	Avg. Bandwidth	<u>10kHz</u>									
Meas. Freq. (MHz)	EUT Test Point	Detector Type (P,QP, A)	Limit Type (QP, A)	Meter Reading (dBuV)	Path Loss (dB)	Transducer Factor (dB)	Corrected Reading (dBuV)	Spec.limit (dBuV)		CR/SL Diff. (dB)	Pass Fail Unc.	Comment
0.15	Neut	P	A	43.2	0	0	43.2	66	56	-12.8	Pass	
0.506	Neut	P	A	40.8	0	0	40.8	56	46	-5.2	Pass	
1.08	Neut	P	A	33.5	0	0	33.5	56	46	-12.5	Pass	
3.51	Neut	P	A	30.6	0	0	30.6	56	46	-15.4	Pass	
12.6	Neut	P	A	31.1	0	0	31.1	60	50	-18.9	Pass	
19.4	Neut	P	A	34.7	0	0	34.7	60	50	-15.3	Pass	
24.6	Neut	P	A	35.9	0	0	35.9	60	50	-14.1	Pass	
0.15	Line	P	A	43.5	0	0	43.5	66	56	-12.5	Pass	
0.431	Line	P	A	37.2	0	0	37.2	57.23	47.234	-10.0	Pass	
0.506	Line	P	A	35.8	0	0	35.8	56	46	-10.2	Pass	
1.86	Line	P	A	30.4	0	0	30.4	56	46	-15.6	Pass	
3.01	Line	P	A	31.5	0	0	31.5	56	46	-14.5	Pass	
12.69	Line	P	A	29.5	0	0	29.5	60	50	-20.5	Pass	
19.5	Line	P	A	32.6	0	0	32.6	60	50	-17.4	Pass	
22.66	Line	P	A	35.5	0	0	35.5	60	50	-14.5	Pass	

..\EMCShare\AUTOMATE\DATASHTS\CEPV_Voltage Rev C.xk: Document Control #EMC DS EM COND VOLT

Photos – Powerline Conducted Emissions

Front



Side



Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(2)
TESTED BY: David Light	DATE: 1/29/04

Test Results: Complies.

[802.11g](#)

Measurement Data: See 6 dB BW plot

Measured 6 dB bandwidth: 16 MHz
Channel Separation: 500 kHz

[802.11b](#)

Measurement Data: See 6 dB BW plot

Measured 6 dB bandwidth: 10 MHz
Channel Separation: 500 kHz

[Bluetooth](#)

Measurement Data: See 20 dB BW plot

Measured 20 dB bandwidth: 1 MHz
Channel Separation: 1 MHz

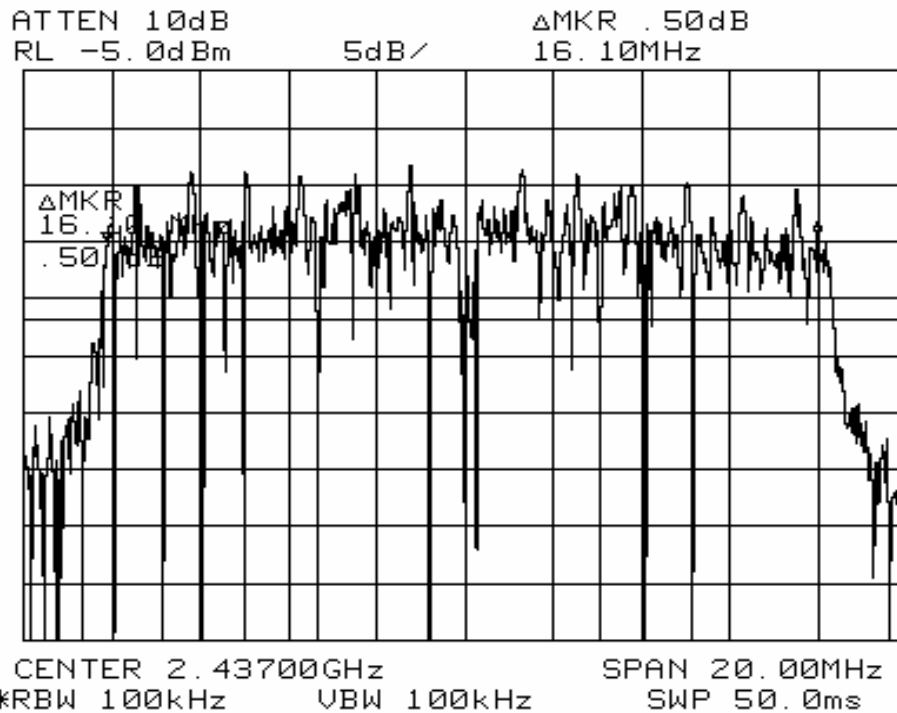
802.11g



Dallas Headquarters:
802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Nemko Dallas, Inc.

Table with 2 columns: Data Plot and Occupied Bandwidth. Includes fields for Page 2 of 3, Job No., Date, Specification, Temperature, Tested By, Relative Humidity, E.U.T., and Configuration.

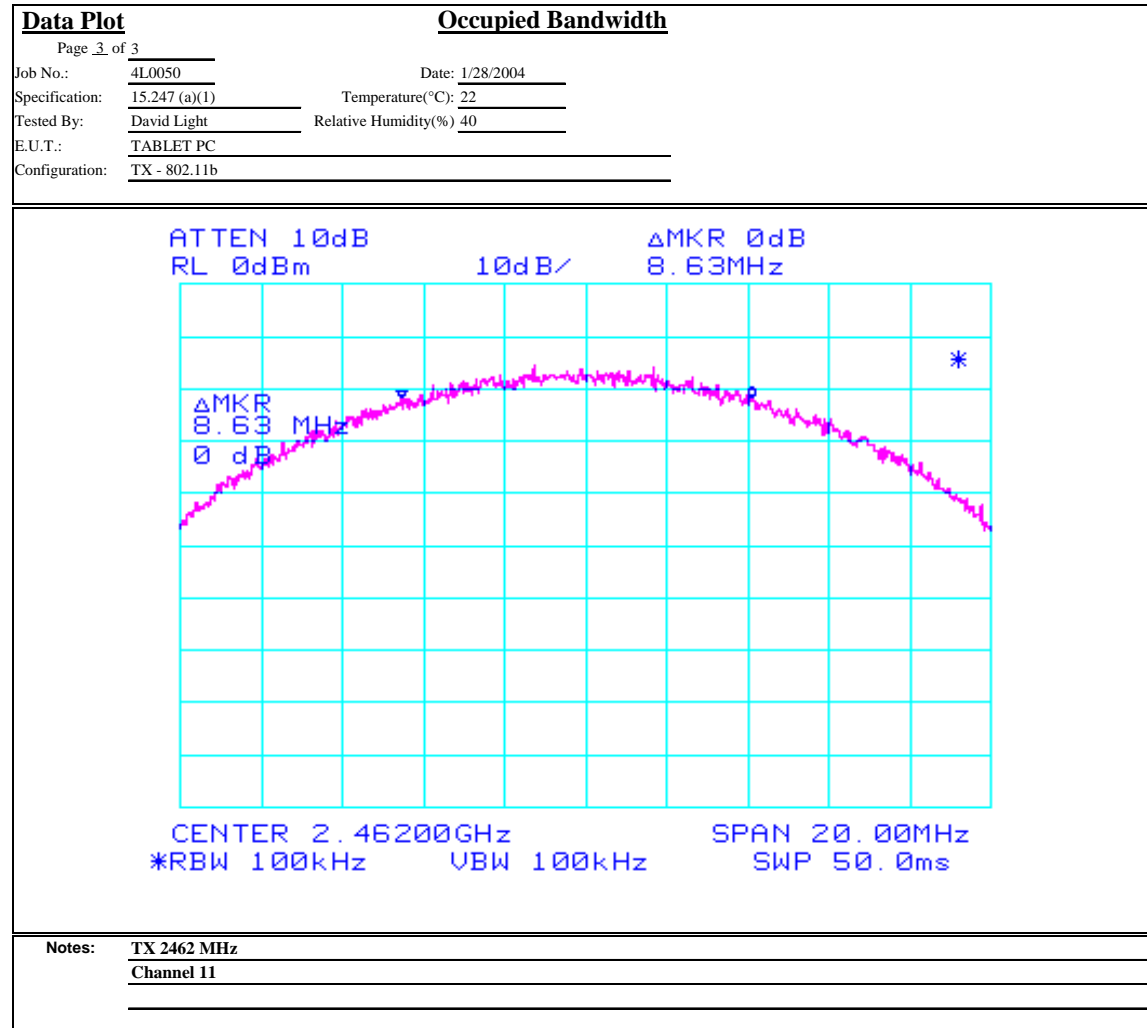


Notes table with one entry: TX 2437 MHz

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

802.11b



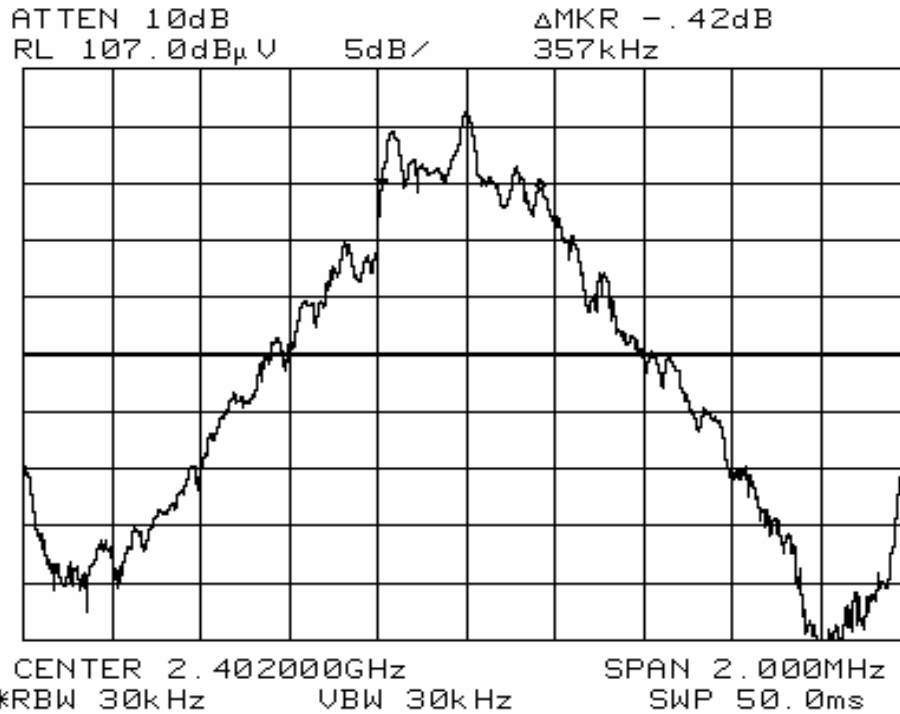
Bluetooth



Dallas Headquarters:
802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Nemko Dallas, Inc.

Table with 2 columns: Data Plot and Occupied Bandwidth. Includes fields for Page 2 of 3, Job No., Date, Specification, Temperature, Tested By, Relative Humidity, E.U.T., and Configuration.



Notes table with one entry: TX 2402 MHz

Bluetooth

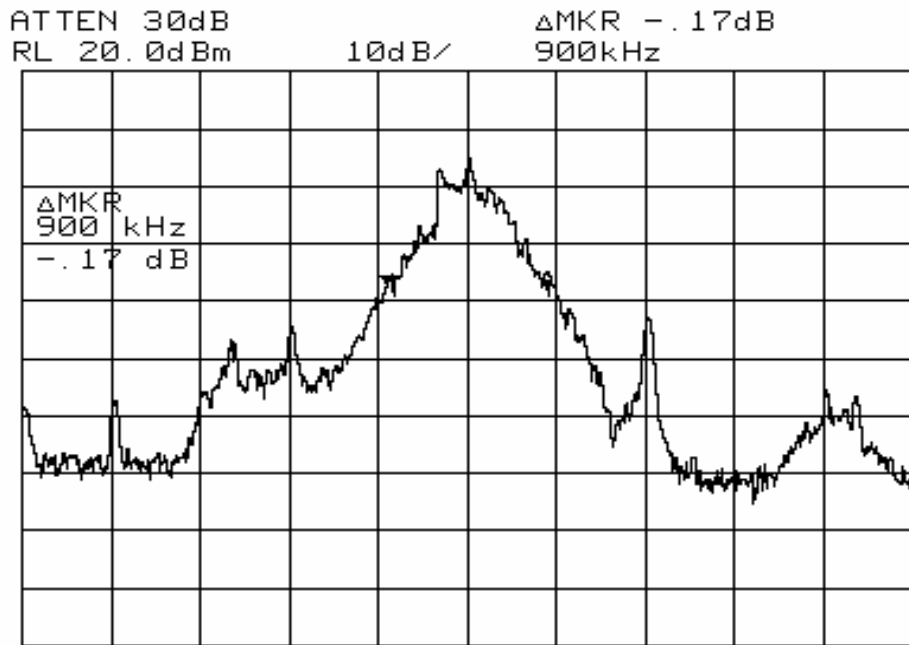


Nemko Dallas, Inc.

Dallas Headquarters:

802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Data Plot	Occupied Bandwidth
Page 3 of 3	
Job No.: 4L0050	Date: 1/28/2004
Specification: 15.247 (a)(1)	Temperature(°C): 22
Tested By: David Light	Relative Humidity(%) 40
E.U.T.: TABLET PC	
Configuration: TX - Bluetooth	



CENTER 2.440000GHz SPAN 5.000MHz
*RBW 30kHz VBW 30kHz SWP 50.0ms

Notes: TX 2440 MHz

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

Bluetooth – Channel Separation



Dallas Headquarters:

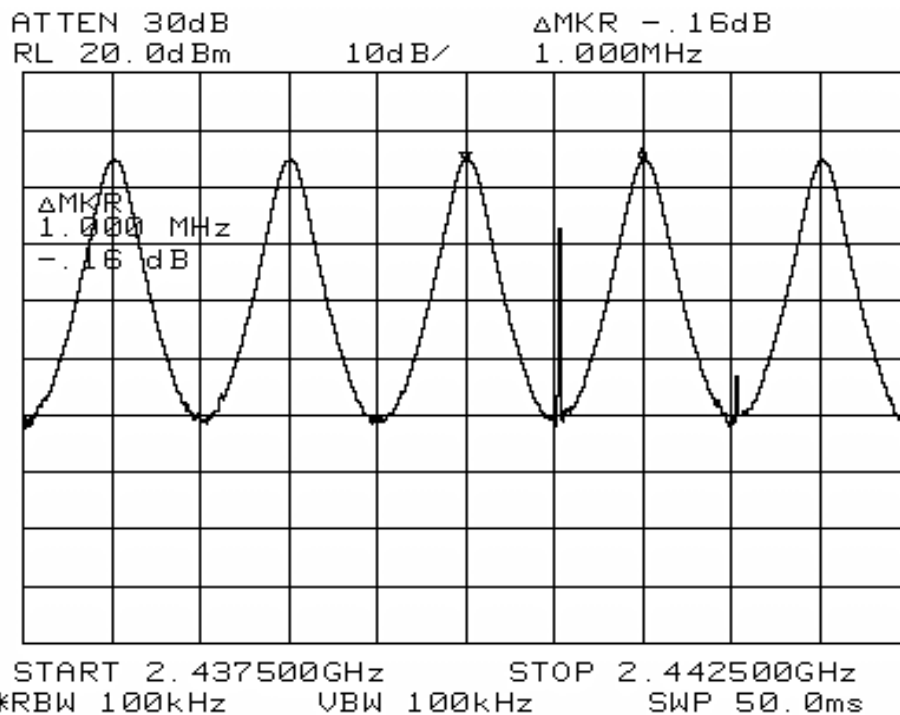
802 N. Kealy
 Lewisville, TX 75057
 Tel: (972) 436-9600
 Fax: (972) 436-2667

Nemko Dallas, Inc.

Test Plot:

Page 4 of 3

Job No.: 4L0050 Date: 1/28/2004
 Specification: 15.247 (a)(1) Temperature(°C): 22
 Tested By: David Light Relative Humidity(%) 40
 E.U.T.: TABLET PC
 Configuration: TX - Bluetooth



Notes: CHANNEL SEPARATION 1 MHz

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

Bluetooth – Number of Hopping Channels



Dallas Headquarters:

802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

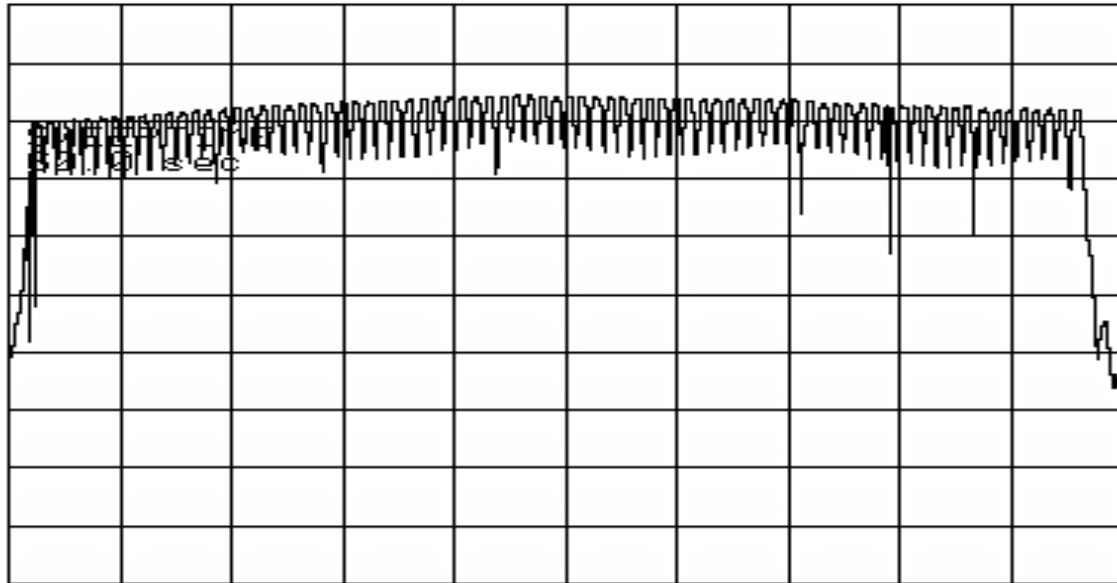
Nemko Dallas, Inc.

Test Plot:

Page 5 of 3

Job No.:	4L0050	Date:	1/28/2004
Specification:	15.247 (a)(1)	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	40
E.U.T.:	TABLET PC		
Configuration:	TX - Bluetooth		

ATTEN 30dB
RL 20.0dBm 10dB/



START 2.40000GHz STOP 2.48350GHz
*RBW 300kHz VBW 300kHz *SWP 60.0sec

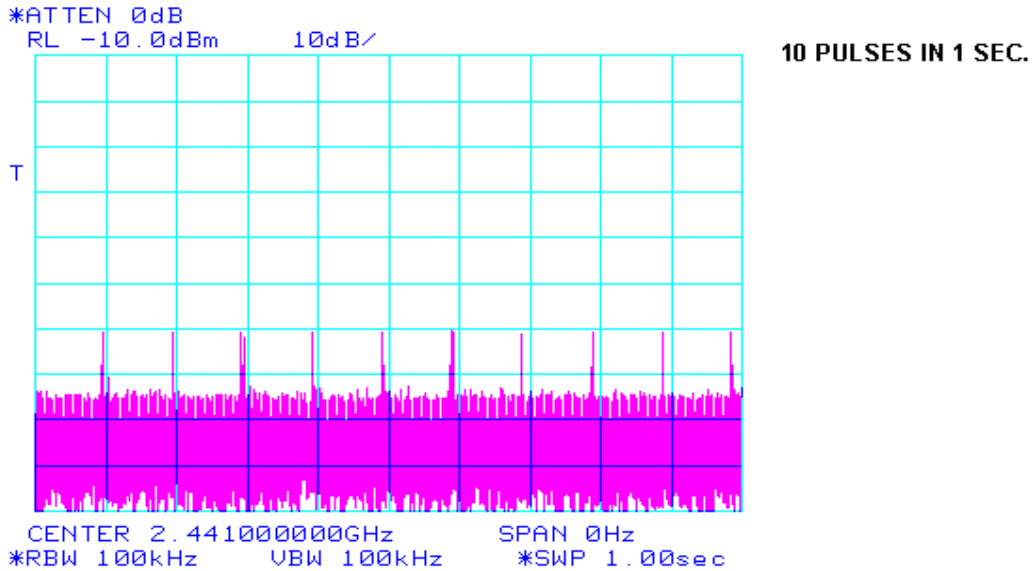
Notes: 79 HOPPING FREQUENCIES

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

Bluetooth – Time of Occupancy (continued)

<u>Data Plot</u>	<u>Time of Occupancy</u>
Page 2 of 2	
Job No.: 4L0050	Date: 2/19/2004
Specification: 15.247(a)(1)	Temperature(°C): 22
(iii)	Relative Humidity(%) 40
Tested By: David Light	
E.U.T.: TABLET PC W/ BLUETOOTH	
Configuration: NORMAL HOPPING	



Notes: 79 Channels multiplied by 0.4 = 31.6 Seconds (Limit = <0.4 seconds within 31.6 seconds)
436.7 uS per pulse multiplied by 10 pulses per second = 4.367 mS within 1 second = 138 mS in 31.6 S

Section 5. Maximum Peak Output Power

NAME OF TEST: Maximum Peak Output power	PARA. NO.: 15.247(b)(1)
TESTED BY: David Light	DATE: 1/29/04

Test Results: Complies.

Measurement Data: Refer to attached data

Note – This test was done as a radiated measurement since the antennas for both devices are integral and there is no possibility of direct connection to the test equipment.

The measurement was repeated at +/- 15% of nominal supply voltage with no variation noted in rf power output.

Maximum Peak Power(EIRP): 64.57 mW 802.11g
 87.1 mW 802.11b
 1.86 mW Bluetooth

Antenna Gain:

802.11 Main: 3 dBi
 802.11 Aux.: 3 dBi
 Bluetooth: 1 dBi

Maximum Peak Power(Conducted):

802.11g: +18dBm – (-3dB) = **+ 21 dBm (158mW)**
 802.11b: +19.4 dBm – (-3dB) = **+22.3 dBm (170 mW)**
 Bluetooth: +2.7 dBm – (-1dB) = **+3.7 dBm (2.3 mW)**

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

Test Data – Peak Power Output – 802.11g

Peak Power											
Page <u>1</u> of <u>2</u>									Complete <u>X</u>		
Job No.:	<u>4L0050</u>	Date:	<u>1/28/04</u>								
Specification:	<u>15.247</u>	Temperature(°C):	<u>22</u>								
Tested By:	<u>David Light</u>	Relative Humidity(%):	<u>40</u>								
E.U.T.:	<u>TABLET PC</u>										
Configuration:	<u>TX - LYING FLAT (WORST CASE)</u>										
Sample No:	<u>1</u>										
Location:	<u>AC 3</u>	RBW:	<u>10 MHz</u>		Measurement						
Detector Type:	<u>Peak</u>	VBW:	<u>10 MHz</u>		Distance:	<u>3 m</u>					
Test Equipment Used											
Antenna:	<u>1304</u>	Directional Coupler:									
Pre-Amp:	<u>1016</u>	Cable #1:	<u>1484</u>								
Filter:		Cable #2:	<u>1485</u>								
Receiver:	<u>1464</u>	Cable #3:									
Attenuator #1		Cable #4:									
Attenuator #2:		Mixer:									
Additional equipment used:											
Measurement Uncertainty:	<u>+/-0.7 dB</u>										
Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBi)		EIRP (dBm)	EIRP (mW)	Polarity	Comments	
										802.11 w/BT Tx ON	
2412	2.0	34.2		33	8.9		12.1	16.09	V		
2412	4.3	37.0		33	8.9		17.2	52.48	H		
2437	3.0	34.2		33	8.9		13.1	20.26	V		
2437	5.2	37.0		33	8.9		18.1	64.57	H		
2462	1.5	34.2		33	8.9		11.6	14.34	V		
2462	3.5	37.0		33	8.9		16.4	43.65	H		
Notes: The device was tested on three axis' The device was tested at +/- 15% supply voltage with no effect on power output											

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

Test Data – Peak Power – 802.11b

Peak Power										
Page <u>1</u> of <u>2</u>									Complete <u>X</u>	
Job No.:	4L0050	Date:		1/28/04		Preliminary				
Specification:	15.247	Temperature(°C):		22						
Tested By:	David Light	Relative Humidity(%):		40						
E.U.T.:	TABLET PC									
Configuration:	TX - LYING FLAT (WORST CASE) 802.11b									
Sample No:	1									
Location:	AC 3	RBW:		NA		Measurement				
Detector Type:	Peak	VBW:		NA		Distance:		3 m		
Test Equipment Used										
Antenna:	1304	Directional Coupler:								
Pre-Amp:	1016	Cable #1:		1484						
Filter:		Cable #2:		1485						
Receiver:	1464	Cable #3:								
Attenuator #1:		Cable #4:								
Attenuator #2:		Mixer:								
Additional equipment used: 1029-1030 Measurement was made with a peak power meter										
Measurement Uncertainty: +/-0.7 dB										
Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBi)		EIRP (dBm)	EIRP (mW)	Polarity	Comments
										802.11b w/BT Tx On
2412	5.0	34.2		33	8.9		15.1	32.11	V	
2412	6.5	37.0		33	8.9		19.4	87.10	H	
2437	4.0	34.2		33	8.9		14.1	25.51	V	
2437	6.0	37.0		33	8.9		18.9	77.62	H	
2462	4.5	34.2		33	8.9		14.6	28.62	V	
2462	5.9	37.0		33	8.9		18.8	75.86	H	
Notes: The device was tested on three axis'										
The device was tested at +/- 15% supply voltage with no effect on power output										

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

Section 6. RF Exposure

NAME OF TEST: RF Exposure	PARA. NO.: 15.247(b)(4)
TESTED BY:	DATE:

Test Results: [Please refer to SAR report for body SAR results.](#)

Measurement Data:

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

Section 7. Spurious Emissions (radiated)

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.247 (c)
TESTED BY: David Light	DATE: 1/29/04

Test Results: Complies.

Measurement Data: See attached table.

Testing in the restricted bands for using the 802.11x devices found that the g modulation was worst case. Only noise floor measurements were taken and the g modulation was worse at the upper band edge due to channel bandwidth.

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

Radiated Emissions – 802.11g

<u>Radiated Emissions</u>	
Page <u>1</u> of <u>2</u>	
Job No.: 4L0050	Date: 1/29/2004
Specification: 15.247/15.205	Temperature(°C): <u>20</u>
Tested By: David Light	Relative Humidity(%) <u>50</u>
E.U.T.: <u>TABLET PC</u>	
Configuration: <u>TX - UPRIGHT ON LONGER EDGE (WORST CASE) 802.11 w/BT Tx ON</u>	
Sample Number: <u>1</u>	
Location: <u>AC 3</u>	RBW: <u>1 MHz</u>
Detector Type: <u>Peak</u>	VBW: <u>1 MHz</u>
<u>Test Equipment Used</u>	
Antenna: <u>1304</u>	Directional Coupler: <u>#N/A</u>
Pre-Amp: <u>1016</u>	Cable #1: <u>1484</u>
Filter: <u>1482</u>	Cable #2: <u>1485</u>
Receiver: <u>1464</u>	Cable #3: <u>#N/A</u>
Attenuator #1: <u>#N/A</u>	Cable #4: <u>#N/A</u>
Attenuator #2: <u>#N/A</u>	Mixer: <u>#N/A</u>
Measurement Uncertainty: <u>+/- 3.6 dB</u>	

Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Detector / Polarity
4.824	37.0	33.9	4.1	33.1	41.9	74	54	Peak - NF / Vertical
7.236	38.0	35.8	5.2	32.8	46.2	74	54	Peak - NF / Vertical
9.648	40.0	37.3	5.2	34.5	48.0	74	54	Peak - NF / Vertical
12.060	41.0	40.0	6.8	34.7	53.1	74	54	Peak - NF / Vertical
14.472	35.4	41.8	7.2	33.5	50.9	74	54	Peak - NF / Vertical
4.824	37.0	33.9	4.1	33.1	41.9	74	54	Peak - NF / Horizontal
7.236	38.0	35.8	5.2	32.8	46.2	74	54	Peak - NF / Horizontal
9.648	40.0	37.3	5.2	34.5	48.0	74	54	Peak - NF / Horizontal
12.060	41.0	40.0	6.8	34.7	53.1	74	54	Peak - NF / Horizontal
14.472	35.4	41.8	7.2	33.5	50.9	74	54	Peak - NF / Horizontal
4.874	39.2	33.9	4.1	33.1	44.1	74	54	Peak - NF / Vertical
7.311	38.3	35.8	5.2	32.8	46.5	74	54	Peak - NF / Vertical
9.748	43.7	37.3	5.2	34.5	51.7	74	54	Peak - NF / Vertical
12.185	38.7	40.0	6.8	34.7	50.8	74	54	Peak - NF / Vertical
14.622	38.2	41.8	7.2	33.5	53.7	74	54	Peak - NF / Vertical
4.874	39.2	33.9	4.1	33.1	44.1	74	54	Peak - NF / Horizontal
7.311	38.3	35.8	5.2	32.8	46.5	74	54	Peak - NF / Horizontal
9.748	43.7	37.3	5.2	34.5	51.7	74	54	Peak - NF / Horizontal
12.185	38.7	40.0	6.8	34.7	50.8	74	54	Peak - NF / Horizontal
14.622	38.2	41.8	7.2	33.5	53.7	74	54	Peak - NF / Horizontal

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

Radiated Emissions – 802.11g (cont.)

<u>Radiated Spurious Emissions</u>								
Page <u>2</u> of <u>2</u>		Continuation Page						
Job No.:		Date: 1/30/2004						
Specification: 15.247/15.205		Temperature(°C): <u>22</u>						
Tested By: #N/A		Relative Humidity(%) <u>40</u>						
E.U.T.: <u>TABLET PC</u>								
Configuration: <u>TX - UPRIGHT ON LONGER EDGE (WORST CASE) 802.11 w/BT Tx ON</u>								
Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Detector / Polarity
2.4835	34.8	28.2	3.0	0.0	66.0	74	54	Peak / Horizontal
2.4835	17.0	28.2	3.0	0.0	48.2	74	54	Avg / Horizontal
4.924	40.0	33.9	4.1	33.1	44.9	74	54	Peak - NF / Horizontal
7.386	39.5	35.8	5.2	32.8	47.7	74	54	Peak - NF / Horizontal
9.848	39.8	37.3	5.2	34.5	47.8	74	54	Peak - NF / Horizontal
12.310	41	40.0	6.8	34.7	53.1	74	54	Peak - NF / Horizontal
14.772	37.6	41.8	7.2	33.5	53.1	74	54	Peak - NF / Horizontal
2.4835	33.0	28.2	3.0	0.0	64.2	74	54	Peak / Vertical
2.4835	17.4	28.2	3.0	0.0	48.6	74	54	Avg / Horizontal
4.924	40.0	33.9	4.1	33.1	44.9	74	54	Peak - NF / Vertical
7.386	39.5	35.8	5.2	32.8	47.7	74	54	Peak - NF / Vertical
9.848	39.8	37.3	5.2	34.5	47.8	74	54	Peak - NF / Vertical
12.31	41	40.0	6.8	34.7	53.1	74	54	Peak - NF / Vertical
14.772	37.6	41.8	7.2	33.5	53.1	74	54	Peak - NF / Vertical
Notes:	The spectrum was searched to 25 GHz							
	The device was tested on three axis'							
	The device was tested at 2.412, 2.437 and 2.462 MHz							

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

Radiated Emissions – Bluetooth

<u>Radiated Emissions</u>			
Page <u>1</u> of <u>2</u>			
Job No.:	4L0050	Date:	1/28/2004
Specification:	15.247/15.205	Temperature(°C):	<u>22</u>
Tested By:	<u>David Light</u>	Relative Humidity(%):	<u>40</u>
E.U.T.:	<u>TABLET PC</u>		
Configuration:	<u>TX - LYING FLAT (WORST CASE) Bluetooth</u>		
Sample Number:	<u>1</u>		
Location:	<u>AC 3</u>	RBW:	<u>1 MHz</u>
Detector Type:	<u>Peak</u>	VBW:	<u>1 MHz</u>
<u>Test Equipment Used</u>			
Antenna:	<u>1304</u>	Directional Coupler:	<u>#N/A</u>
Pre-Amp:	<u>1016</u>	Cable #1:	<u>1484</u>
Filter:	<u>1482</u>	Cable #2:	<u>1485</u>
Receiver:	<u>1464</u>	Cable #3:	<u>#N/A</u>
Attenuator #1:	<u>#N/A</u>	Cable #4:	<u>#N/A</u>
Attenuator #2:	<u>#N/A</u>	Mixer:	<u>#N/A</u>
Measurement Uncertainty: <u>+/- 3.6 dB</u>			

Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Detector / Polarity
4.804	38.1	33.9	4.1	33.1	43.0	74	54	Peak - NF / Vertical
7.206	38.7	35.8	5.2	32.8	46.9	74	54	Peak - NF / Vertical
9.608	40.7	37.3	5.2	34.5	48.7	74	54	Peak - NF / Vertical
12.010	41.5	40.0	6.8	34.7	53.6	74	54	Peak - NF / Vertical
14.412	38.1	41.8	7.2	33.5	53.6	74	54	Peak - NF / Vertical
4.804	38.1	33.9	4.1	33.1	43.0	74	54	Peak - NF / Horizontal
7.206	38.7	35.8	5.2	32.8	46.9	74	54	Peak - NF / Horizontal
9.608	40.7	37.3	5.2	34.5	48.7	74	54	Peak - NF / Horizontal
12.010	41.5	40.0	6.8	34.7	53.6	74	54	Peak - NF / Horizontal
14.412	38.1	41.8	7.2	33.5	53.6	74	54	Peak - NF / Horizontal
4.880	38.3	33.9	4.1	33.1	43.2	74	54	Peak - NF / Vertical
7.320	39.1	35.8	5.2	32.8	47.3	74	54	Peak - NF / Vertical
9.760	40.0	37.3	5.2	34.5	48.0	74	54	Peak - NF / Vertical
12.200	42.3	40.0	6.8	34.7	54.4	74	54	Peak - NF / Vertical
12.200	31.0	40.0	6.8	34.7	43.1	74	54	Avg - NF / Vertical
14.640	37.8	41.8	7.2	33.5	53.3	74	54	Peak - NF / Vertical
4.880	38.3	33.9	4.1	33.1	43.2	74	54	Peak - NF / Horizontal
7.320	39.1	35.8	5.2	32.8	47.3	74	54	Peak - NF / Horizontal
9.760	40.0	37.3	5.2	34.5	48.0	74	54	Peak - NF / Horizontal
12.200	42.3	40.0	6.8	34.7	54.4	74	54	Peak - NF / Horizontal
12.200	31.0	40.0	6.8	34.7	43.1	74	54	Avg - NF / Horizontal
14.640	37.8	41.8	7.2	33.5	53.3	74	54	Peak - NF / Horizontal

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

Radiated Emissions – Bluetooth (cont.)

<u>Radiated Spurious Emissions</u>								
Page <u>2</u> of <u>2</u>		Continuation Page						
Job No.:		Date: 1/30/2004						
Specification: 15.247/15.205		Temperature(°C): <u>22</u>						
Tested By: #N/A		Relative Humidity(%) <u>40</u>						
E.U.T.: TABLET PC								
Configuration: TX - LYING FLAT (WORST CASE) Bluetooth								
Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Detector / Polarity
2.4835	52.8	28.2	3.0	33.0	51.0	74	54	Peak / Horizontal
4.960	37.7	33.9	4.1	33.1	42.6	74	54	Peak - NF / Horizontal
7.440	41.1	35.8	5.2	32.8	49.3	74	54	Peak - NF / Horizontal
9.920	41.5	37.3	5.2	34.5	49.5	74	54	Peak - NF / Horizontal
12.400	39.3	40.0	6.8	34.7	51.4	74	54	Peak - NF / Horizontal
14.880	37.1	41.8	7.2	33.5	52.6	74	54	Peak - NF / Horizontal
2.4835	51.3	28.2	3.0	33.0	49.5	74	54	Peak / Vertical
4.960	37.7	33.9	4.1	33.1	42.6	74	54	Peak - NF / Vertical
7.44	41.1	35.8	5.2	32.8	49.3	74	54	Peak - NF / Vertical
9.920	41.5	37.3	5.2	34.5	49.5	74	54	Peak - NF / Vertical
12.4	39.3	40.0	6.8	34.7	51.4	74	54	Peak - NF / Vertical
14.880	37.1	41.8	7.2	33.5	52.6	74	54	Peak - NF / Vertical
Notes:		The spectrum was searched to 25 GHz						
		The device was tested on three axis'						
		The device was tested at 2.402, 2.440 and 2.480 MHz						

Radiated Photographs



Radiated Photographs



Radiated Photographs



EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

Section 8. Peak Power Spectral Density

NAME OF TEST: Peak Power Spectral Density	PARA. NO.: 15.247(d)
TESTED BY: David Light	DATE: 1/29/04

Test Results: Complies.

Measurement Data: See attached data. This measurement was made radiated.

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

Peak Power Spectral Density

Spectral Density										
Page <u>1</u> of <u>2</u>									Complete <u>X</u>	
Job No.: <u>4L0050</u>		Date: <u>1/28/04</u>		Preliminary _____						
Specification: <u>15.247</u>		Temperature(°C): <u>22</u>								
Tested By: <u>David Light</u>		Relative Humidity(%) <u>40</u>								
E.U.T.: <u>TABLET PC</u>									RBW 3 kHz	
Configuration: <u>TX - LYING FLAT (WORST CASE) 802.11</u>									VBW 3 kHz	
Sample No: <u>1</u>										
Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBi)		EIRP (dBm)	EIRP (mW)	Polarity	Comments
										SPECTRAL DENSITY
2412	-31.0	34.2		33	8.9		-20.9	0.01	V	
2412	-26.0	37.0		33	8.9		-13.1	0.048978	H	
2437	-27.0	34.2		33	8.9		-16.9	0.020261	V	
2437	-23.0	37.0		33	8.9		-10.1	0.097724	H	
2462	-19.0	34.2		33	8.9		-8.9	0.13	V	
2462	-25.0	37.0		33	8.9		-12.1	0.061660	H	
Notes: <u>The device was tested on three axis'</u>										

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

Section 9. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	02/11/03	02/11/05
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	07/24/03	07/23/04
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	07/24/03	07/23/04
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	10/27/03	10/26/04
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	09/22/03	09/22/05
1482	Band Pass Filter	K & L 11SH10-4000/T12000-0/0	2	Cal B4 Use	N/A
545	LISN	Schwarz Beck 8120	8120350	08/01/03	07/31/04
704	FILTER, HIGH PASS, 5 KHz	SOLAR 7930-5.0	933126	02/05/04	02/04/05
1038	CABLE, .5m	KTL RG223	N/A	06/18/03	06/17/04
1988	CABLE, 6.8m	KTL RG223	N/A	07/02/03	07/01/04
1283	Spectrum analyzer display	Hewlett Packard 85662A	1811A00223	12/19/03	12/18/04
966	Receiver	Rohde & Schwartz ESH2	880370/029	09/17/03	09/16/04
1193	LIMITER	FISCHER FCC-450B-1.25N	956	02/24/03	02/24/04
760	Antenna biconical	Electro Metrics MFC-25	477	06/05/03	06/04/04
1034	ANTENNA,LP	A.H. SYSTEMS SAS-200/510	121	06/09/03	06/08/04
1522	Cable Assy, LAB 5 - D OATS	KTL Site D OATS	N/A	03/28/03	03/27/04
1289	AMPLIFIER, RF	ICC LN1-5	421	09/10/03	09/09/04
1283	Spectrum analyzer display	Hewlett Packard 85662A	1811A00223	12/19/03	12/18/04
991	Horn antenna	EMCO 3160-10	9704-1049	CNR	N/A
983	PRE-AMP, 18-40 GHz	KTL BB1	1	09/18/03	09/17/04

ANNEX A - TEST DETAILS

Minimum Standard: §15.207 Conducted limits.

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 mH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Conducted Emission (MHz)	Limit (dBmV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

(b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

(1) For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 mV within the frequency band 535-1705 kHz, as measured using a 50 mH/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits as provided in §15.205 and §§15.209, 15.221, 15.223, 15.225 or 15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(2)
----------------------------------	-------------------------

Minimum Standard: The minimum 6 dB bandwidth shall be at least 500 kHz

NAME OF TEST: Maximum Peak Output Power

PARA. NO.: 15.247(b)(1)

Minimum Standard: The maximum peak output power shall not exceed 1 watt.

If transmitting antennas 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.

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

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operation may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Direct Measurement Method For Detachable Antennas:

If the antenna is detachable, a peak power meter is used to measure the power output with the transmitter operating into a 50 ohm load. The dBi gain of the antenna(s) employed shall be reported.

Substitution Antenna Method for Integral Antennas:

The peak field strength of the carrier is measured in a worst-case configuration with a RBW > 5 times the occupied bandwidth of the transmitted waveform. For cases where the RBW of the test instrument is not sufficient, the power is measured using a peak power meter instead of the spectrum analyzer.

The RBW of the spectrum analyzer shall be set to a value greater than the measured 6 dB occupied bandwidth of the E.U.T.

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

NAME OF TEST: Channel Separation

PARA. NO.: 15.247(a)(1)

Minimum Standard:

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

NAME OF TEST: Pseudorandom Hopping Algorithm

PARA. NO.: 15.247(a)(1)

Minimum Standard:

The system shall hop to channel frequencies that are selected from a pseudo-randomly ordered list of hopping frequencies. Each frequency must be used equally on average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their transmitters and shall shift frequencies in synchronization with the transmitted signals.

Minimum Standard:

Frequency Band (MHz)	20 dB Bandwidth	No. of Hopping Channels	Average Time of Occupancy
902 - 928	<250 kHz	50	=<0.4 sec. in 20 sec.
902 - 928	=>250 kHz	25	=<0.4 sec. in 10 sec.
2400 - 2483.5	-----	75	=<0.4 sec. in 30 sec.
5725 - 5850	-----	75	=<0.4 sec. in 30 sec.

Method Of Measurement:

The spectrum analyzer is set as follows:

- RBW: 1 MHz
- VBW: = RBW
- Span: 0 Hz
- LOG dB/div.: 10 dB
- Sweep: Sufficient to see one hop time sequence.
- Trigger: Video

The occupancy time of one hop is measured as above. The average time of occupancy is calculated over the appropriate period of time from above table (10, 20, or 30 seconds).

Avg. time of occupancy = (period from table/duration of one hop)/no. of channels multiplied by the duration of one hop.

For instance:

If a 2.4 GHz system has a measured hop duration time of 1 msec. and uses 75 channels, then the average time of occupancy would be:

$$(30 \text{ sec.} / .001 \text{ sec.}) / 75 \text{ chan.} = 400 \times 1 \text{ msec.} = 400 \text{ msec. or } 0.4 \text{ sec. in } 30 \text{ sec.}$$

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(2)
----------------------------------	-------------------------

Minimum Standard:

Frequency Band (MHz)	Maximum 20 dB Bandwidth
902 - 928	500 kHz
2400 – 2483.5	1 MHz
5725 – 5850	1 MHz

Method Of Measurement:

The spectrum analyzer is set as follows:

RBW: At least 1% of span/div.

VBW: >RBW

Span: Sufficient to display 20 dB bandwidth

LOG dB/div.: 10 dB

Sweep: Auto

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

NAME OF TEST: RF Exposure

PARA. NO.: 15.247(b)(4)

Minimum Standard:

Systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines stipulated in 1.1307(b)(1) of CFR 47.

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

NAME OF TEST: Spurious Emissions(conducted)

PARA. NO.: 15.247(c)

Minimum Standard:

In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

Frequency (MHz)	Field Strength (µV/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

THE SPECTRUM IS SEARCHED TO THE 10th HARMONIC OF THE HIGHEST FREQUENCY GENERATED IN THE EUT.

Method Of Measurement:

30 MHz - 10th harmonic plot

RBW: 100 kHz

VBW: 300 kHz

Sweep: Auto

Display line: -20 dBc

Lower Band Edge

RBW: At least 1% of span/div.

VBW: >RBW

Span: As necessary to display any spurious at band edge.

Sweep: Auto

Center Frequency: 902 MHz, 2400 MHz, or 5725 MHz

Marker: Peak of fundamental emission

Marker Δ: Peak of highest spurious level below center frequency.

Upper Band Edge

RBW: At least 1% of span/div.

VBW: >RBW

Span: As necessary to display any spurious at band edge.

Sweep: Auto

Center Frequency: 928 MHz, 2483.5 MHz, or 5850 MHz

Marker: Peak of fundamental emission

Marker Δ: Peak of highest spurious level above center frequency.

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

NAME OF TEST: Radiated Spurious Emissions	PARA. NO.: 15.247(c)
---	----------------------

Minimum Standard: In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits:

Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

Frequency (MHz)	Field Strength (µV/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

THE SPECTRUM WAS SEARCHED TO THE 10th HARMONIC

15.205 Restricted Bands

MHz	MHz	MHz	GHz
0.09-0.11	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.125-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41	1718		

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

EQUIPMENT: M1400 (T003)

TEST REPORT NO.: 4L0050RUS1Rev3

NAME OF TEST: Transmitter Power Density	PARA. NO.: 15.247(d)
---	----------------------

Minimum Standard: The transmitted power density averaged over any 1 second interval shall not be greater than +8 dBm in any 3 kHz bandwidth.

Method Of Measurement: The spectrum analyzer is set as follows:

- RBW: 3 kHz
- VBW: >3 kHz
- Span: => measured 6 dB bandwidth
- Sweep: Span(kHz)/3 (i.e. for a span of 1.5 MHz the sweep rate is 1500/3 = 500 sec.
- LOG dB/div.: 2 dB

Note: For devices with spectrum line spacing ≤ 3 kHz, the RBW of the analyzer is reduced until the spectral lines are resolved. The measurement data is normalized to 3 kHz by summing the power of all the individual spectral lines within a 3 kHz band in linear power units.

For Devices With Integral Antenna:

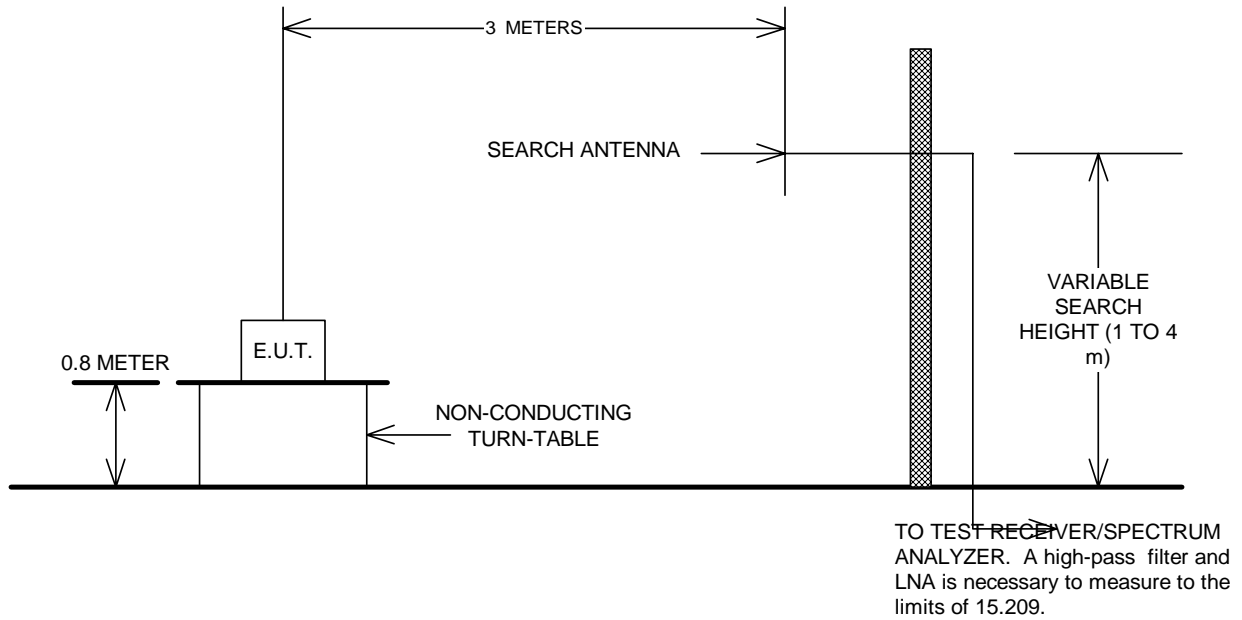
For devices with non-detachable antennas, the received field strength is peaked and the spectrum analyzer is set as above. The peak emission level is then measured and converted to a field strength by adding the appropriate antenna factor and cable loss. This field strength is then converted to an equivalent isotropic radiated power using the same method as described for Peak Power output.

Number of channels tested:

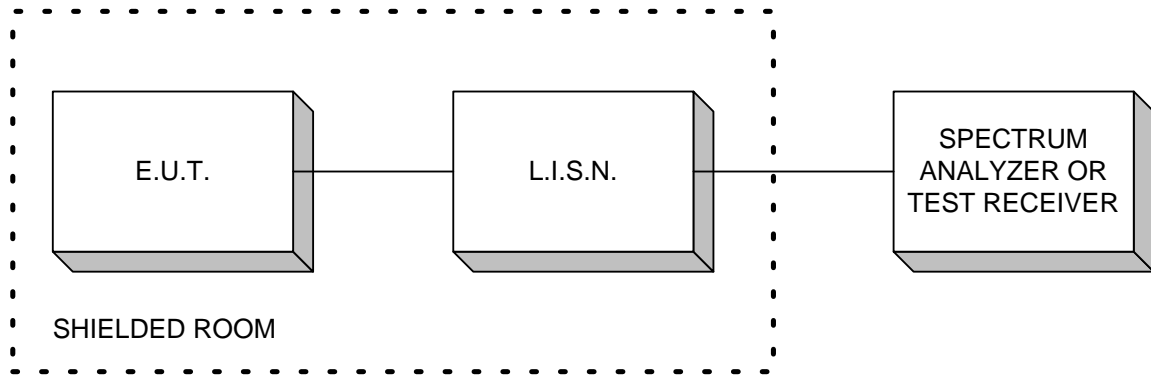
Tuning Range	Number Of Channels Tested	Channel Location In Band
1 MHz or Less	1	Middle
1 to 10 MHz	2	Top And Bottom
More Than 10 MHz	3	Top, Middle, Bottom

ANNEX B - TEST DIAGRAMS

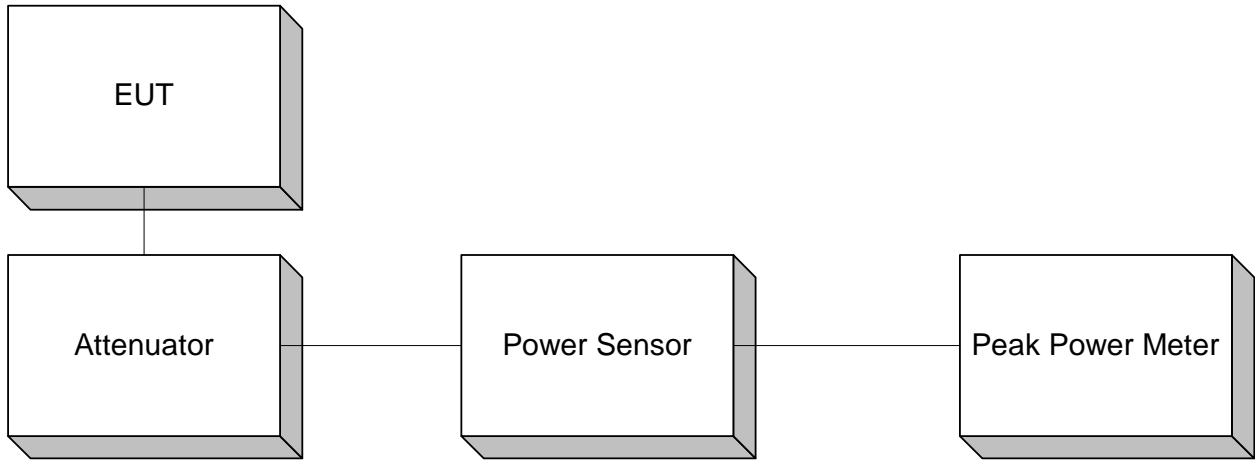
Test Site For Radiated Emissions



Conducted Emissions



Peak Power At Antenna Terminals



**Minimum 6 dB Bandwidth
Peak Power Spectral Density
Spurious Emissions (conducted)**

