



Nemko Test Report: 6L0185RUS1

Applicant: TeraHop Networks, Inc.
1225 Old Alpharetta Road
Suite 210
Alpharetta, GA 30005

Equipment Under Test: Gateway Controller model GC1030/40
(E.U.T.)

In Accordance With: **FCC Part 15, Subpart C, 15.247**
Frequency Hopping Transmitters

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

Authorized By:

A handwritten signature in black ink, appearing to read 'Kevin Rose', with a stylized flourish at the end.

Kevin Rose Wireless Engineer

Date: May 19, 2006

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Section 1. Summary of Test Results

Manufacturer: TeraHop Networks, Inc.

Model No.: Gateway Controller

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 Frequency Hopping 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**

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Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
Powerline Conducted Emissions	15.207(a)	Complies
Channel Separation	15.247(a)(1)	Complies
Time of Occupancy	15.247(a)(1)(ii)	Complies
20 dB Occupied Bandwidth	15.247(a)(1)	Complies
Peak Power Output	15.247(b)	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	Complies
Spurious Emissions (Radiated)	15.247(c)	Complies

Footnotes:

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

General Equipment Information

Frequency Band:

☐ 902 – 928 MHz
☒ 2400 – 2483.5 MHz

Frequency Range of EUT:

Bluetooth: 2402 – 2480 MHz
TTX: 2406 – 2474 MHz

Number of Channels:

Bluetooth: 79
TTX: 76

Channel Spacing:

Bluetooth: 1 MHz
TTX: 800 kHz

Power Output (EIRP):

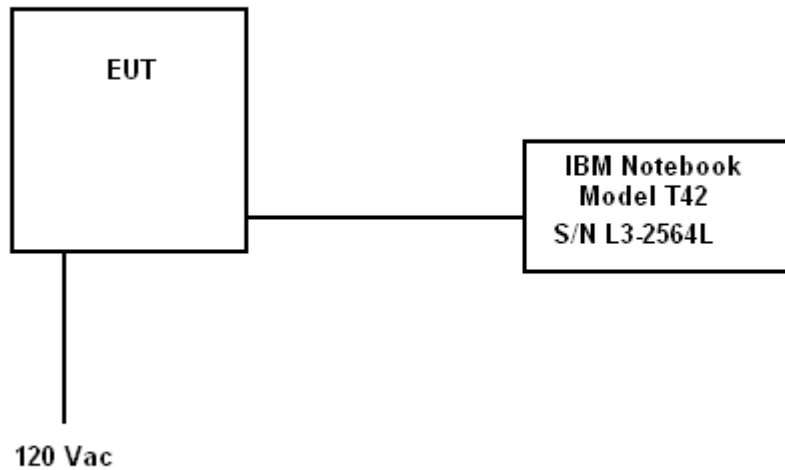
Bluetooth: 39.8 mW
TTX: 1.58 W

User Frequency Adjustment:

Software controlled

Description of EUT

The GC is critical link between the sensors and the WAN. The sensors communicate with the GC over Bluetooth. The GC can communicate with a WAN via cell, WiFi, or sat modem.

System Diagram

Section 3. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY: Arturo Ruvalcaba	DATE: 16 May 2006

Test Results: Complies.

Measurement Data: See attached plots.

Equipment Used: 969-1433-1984-970-1284

Measurement Uncertainty: +/- 10. dB
7

Temperature: 22 °C

Relative Humidity: 33 %

Test Data – Powerline Conducted Emissions

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
								Q.P.	Avg.			
0.16	N	QP	QP	53.0	1	1	55.0	65.46	55.464	-10.5	Pass	
0.16	N	A	A	42.0	1	1	44.0	65.46	55.464	-11.5	Pass	
0.202	N	QP	QP	48.0	1	1	50.0	63.53	53.528	-13.5	Pass	
0.202	N	A	A	40.0	1	1	42.0	63.53	53.528	-11.5	Pass	
0.242	N	QP	QP	45.0	1	1	47.0	62.03	52.028	-15.0	Pass	
0.242	N	A	A	39.0	1	1	41.0	62.03	52.028	-11.0	Pass	
0.401	N	QP	QP	45.0	1	1	47.0	57.83	47.833	-10.8	Pass	
0.401	N	A	A	44.5	1	1	46.5	57.83	47.833	-1.3	Unc.	
28.68	N	QP	QP	29.0	1	1	31.0	60	50	-29.0	Pass	
28.68	N	A	A	26.0	1	1	28.0	60	50	-22.0	Pass	
0.161	H	QP	QP	55.0	1	1	57.0	65.41	55.412	-8.4	Pass	
0.161	H	A	A	43.0	1	1	45.0	65.41	55.412	-10.4	Pass	
0.202	H	QP	QP	46.0	1	1	48.0	63.53	53.528	-15.5	Pass	
0.202	H	A	A	37.0	1	1	39.0	63.53	53.528	-14.5	Pass	
0.241	H	QP	QP	43.0	1	1	45.0	62.06	52.062	-17.1	Pass	
0.241	H	A	A	34.0	1	1	36.0	62.06	52.062	-16.1	Pass	
0.401	H	QP	QP	44.0	1	1	46.0	57.83	47.833	-11.8	Pass	
0.401	H	A	A	43.0	1	1	45.0	57.83	47.833	-2.8	Pass	
28.68	H	QP	QP	28.0	1	1	30.0	60	50	-30.0	Pass	
28.68	H	A	A	25.5	1	1	27.5	60	50	-22.5	Pass	

Test Setup Photographs



Section 4. Channel Separation

NAME OF TEST: Channel Separation	PARA. NO.: 15.247(a)(1)
TESTED BY: David Light	DATE: 15 May 2006

Test Results: Complies.

Measurement Data: See 20 dB BW plot
Measured 20 dB bandwidth:
Bluetooth: 870 kHz Max
Hopper: 110 kHz Max
Channel Separation:
Bluetooth: 1 MHz
TTX 800 kHz

Equipment Used: 1464-1082-1465-1466-1467

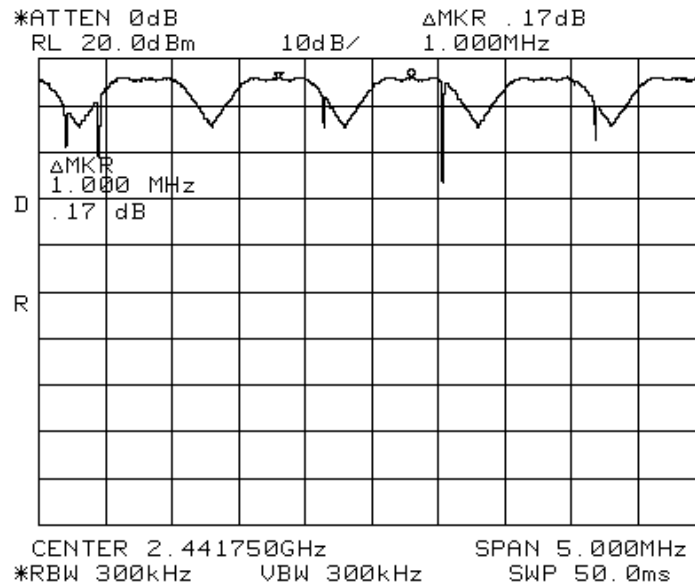
Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

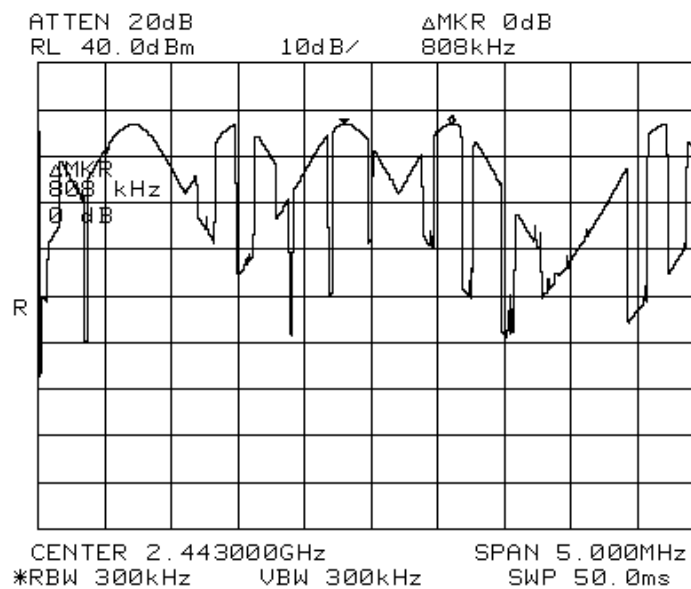
Relative Humidity: 40 %

Test Data – Channel Separation

Bluetooth

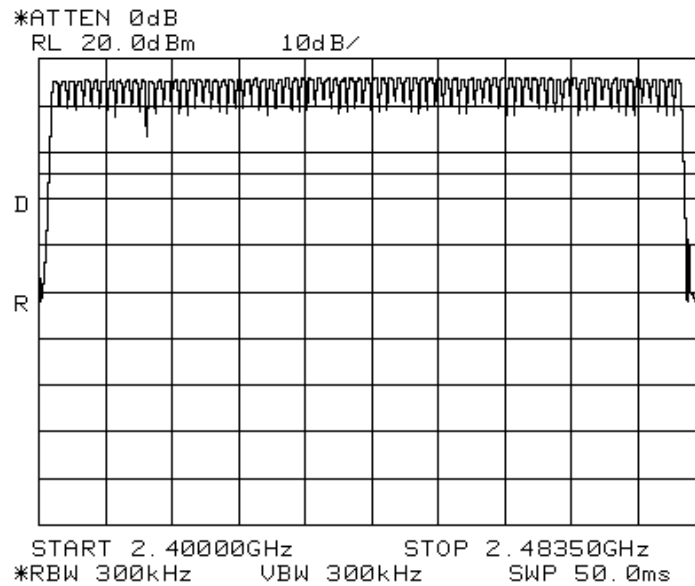


TTX

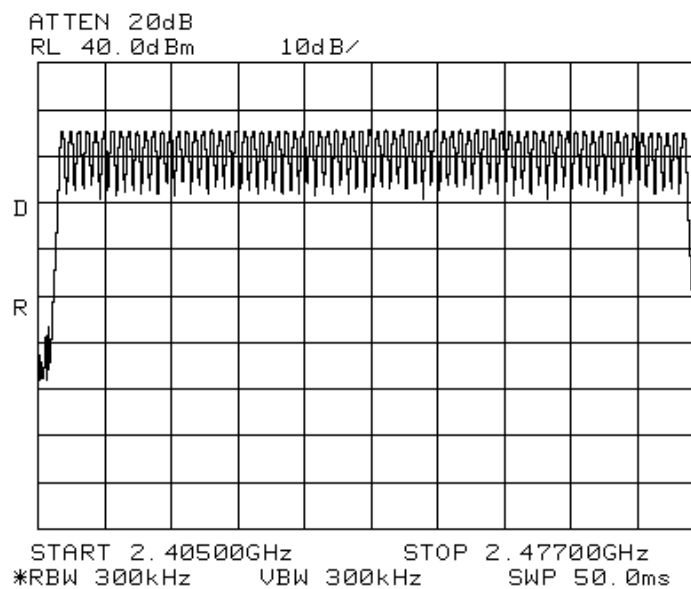


Test Data – Channels

Bluetooth – 79 Channels



TTX – 76 Channels



Section 5. Time of Occupancy

NAME OF TEST: Time of Occupancy	PARA. NO.: 15.247(a)(1)
TESTED BY: David Light	DATE: 15 May 2006

Test Results: Complies.

Bluetooth:**Measurement Data:**

Maximum Dwell Time On Any Channel: 185 mS in 31.6 seconds

TTX:**Measurement Data:**

Maximum Dwell Time On Any Channel: 168 mS in 31.4 seconds

Equipment Used: 1464-1082-1465-1466-1467

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 40 %

Test Data – Time of Occupancy

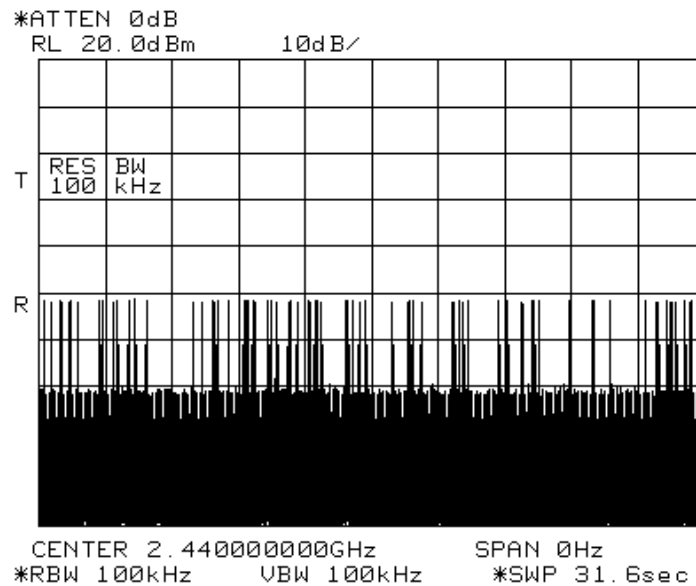
Bluetooth

Time of occupancy

0.4 x 79 channels = 31.6 seconds

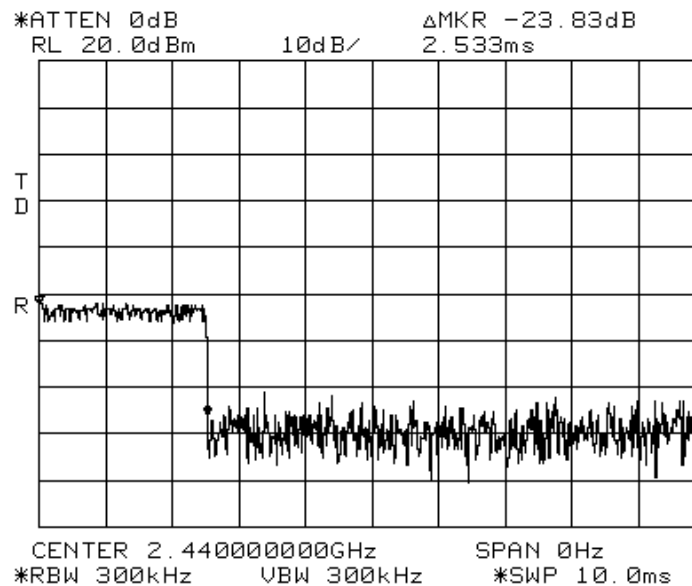
73 hops @ 2.533 mS each

185 mS in 31.6 seconds



Pulse width

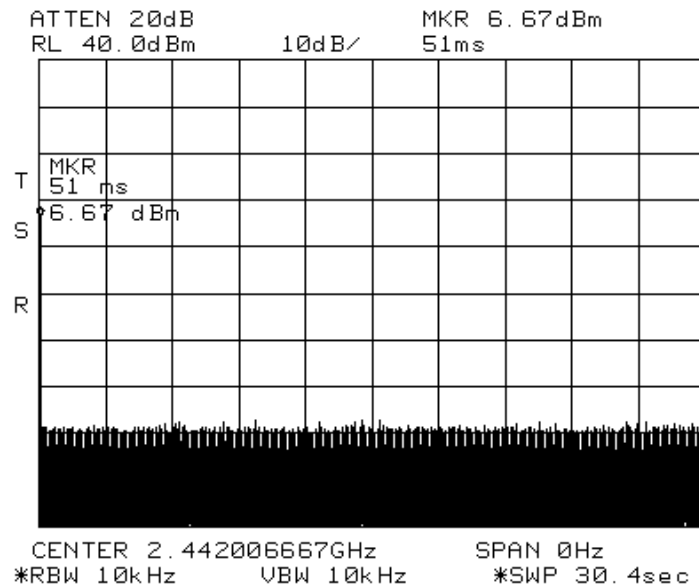
2.533 mS



Test Data – Time of Occupancy

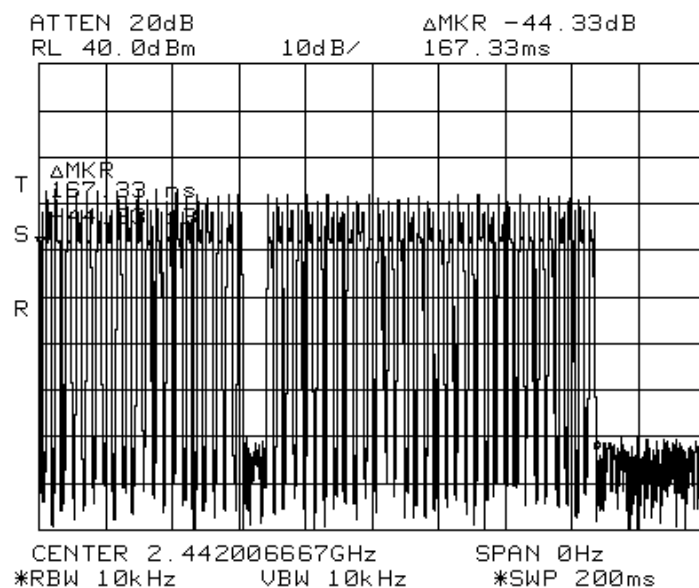
TTX

One hop @ 167.3 mS in 30.4 seconds



One hop

167.3 mS in 30.4 Seconds



Section 6. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(1)(i)
TESTED BY: David Light	DATE:15 May 2006

Test Results: Complies.

Measurement Data: See attached plots.

Equipment Used: 1464-1082-1465-1466-1467

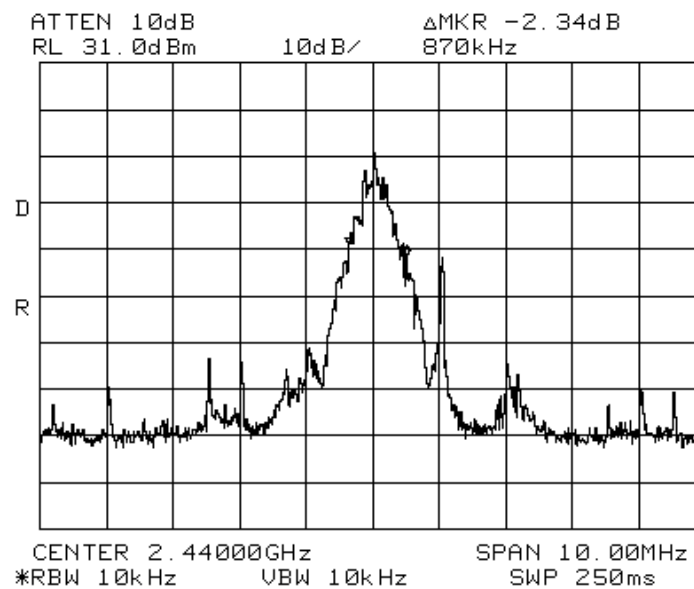
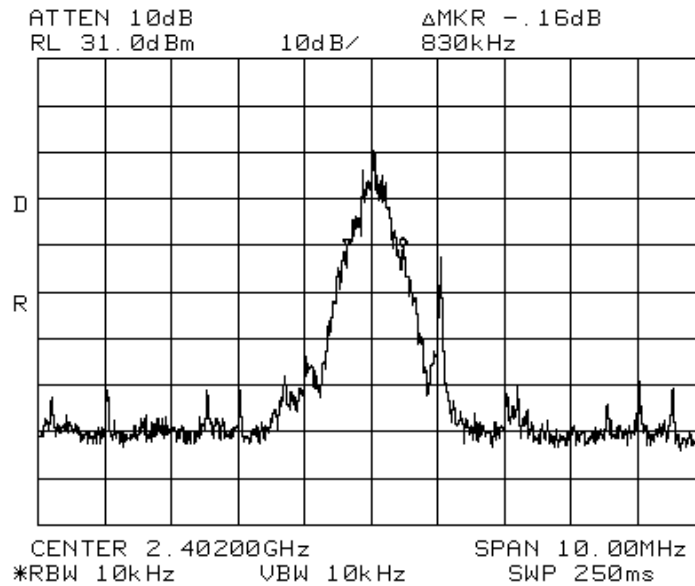
Measurement Uncertainty: +/- 0.7 dB

Temperature: 22 °C

Relative Humidity: 40 %

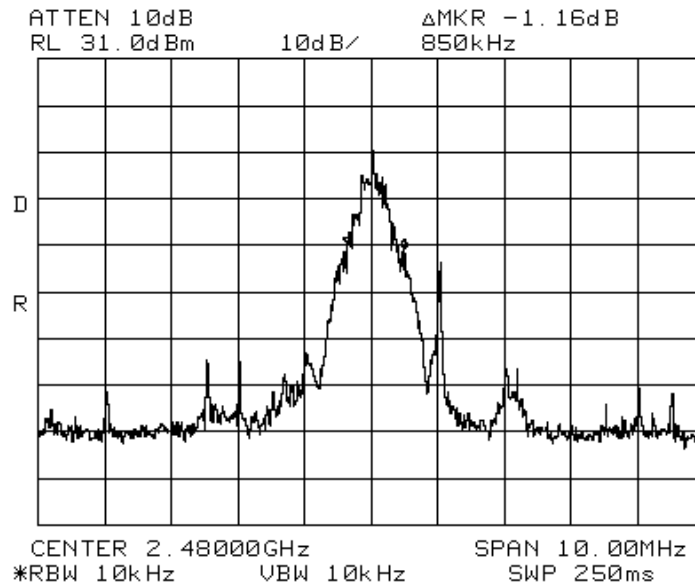
Test Data – Occupied Bandwidth

Bluetooth

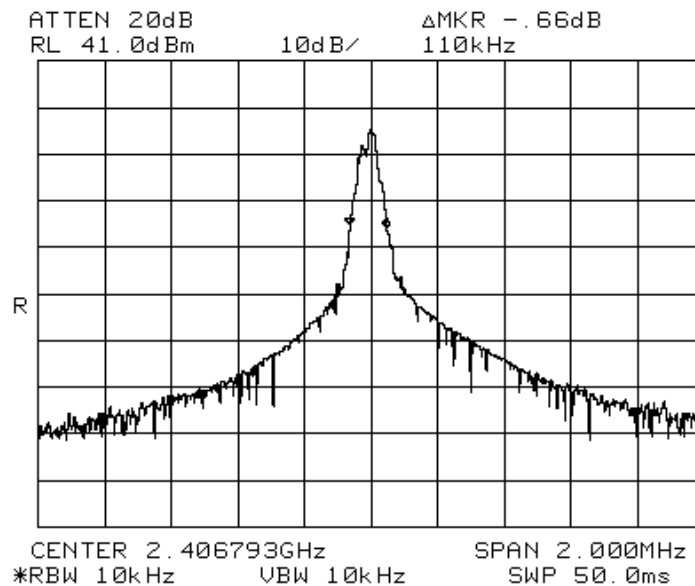


Test Data – Occupied Bandwidth

Bluetooth (Continued)

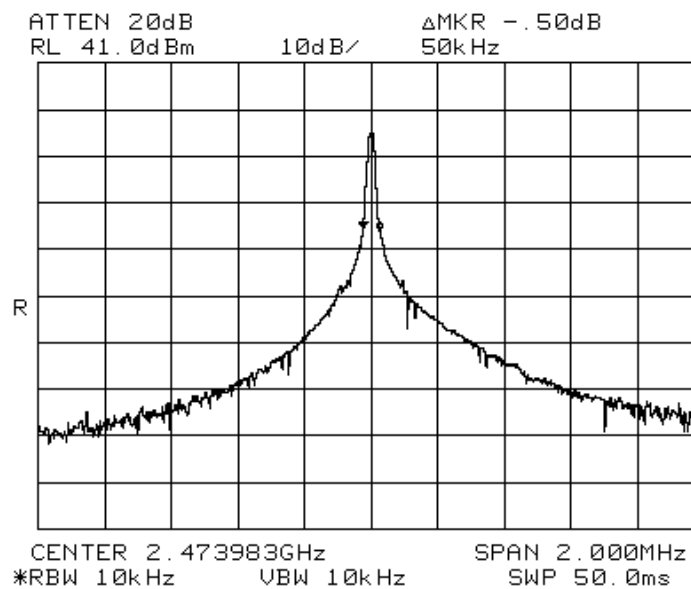
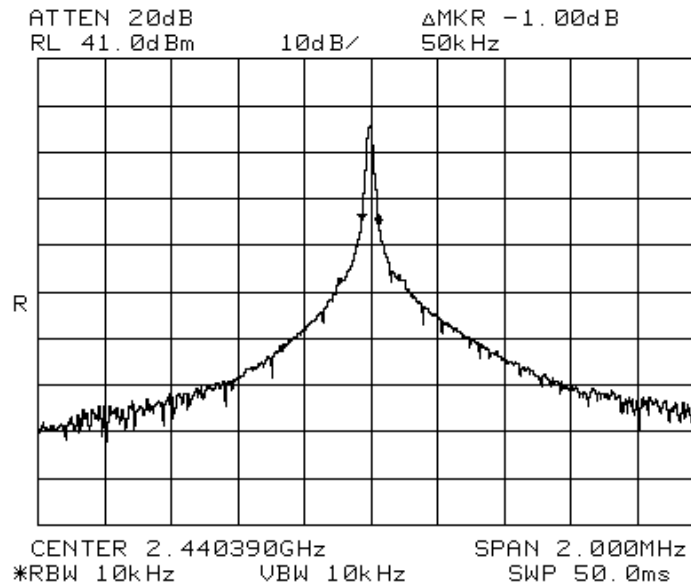


TTX



Test Data – Occupied Bandwidth

TTX (Continued)



Section 7. Peak Power Output

NAME OF TEST: Peak Power Output	PARA. NO.: 15.247 (b)
TESTED BY: David Light	DATE: 15 May 2006

Test Results: Complies.

Measurement Data: See attached plots.
Detachable antenna? ☒ Yes ☐ No
If yes, state the type of non-standard connector used: The EUT uses an SMB connector to attach to a patch type antenna that is sealed behind radome.

Antennas:

Radio	Type	Gain (dBi)	Frequency (MHz)	Peak Power (dBm)	E.I.R.P. (dBm)
Bluetooth	Patch	0	2402	15.3	15.3
Bluetooth	Patch	0	2440	16.0	16.0
Bluetooth	Patch	0	2480	15.5	15.5
TTX	Patch	5	2406	26.3	31.3
TTX	Patch	5	2440	27.0	32.0
TTX	Patch	5	2474	26.3	31.3

Equipment Used: 1464-1082-1465-1466-1467

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 40 %

Section 8. Spurious Emissions (Antenna Conducted)

NAME OF TEST: Spurious Emissions (Antenna Conducted)	PARA. NO.: 15.247(c)
TESTED BY: David Light	DATE: 15 May 2006

Test Results: Complies.

Measurement Data: See attached plots.

Equipment Used: 1464-1082-1465-1466-1467

Measurement Uncertainty: +/- 1.7 dB

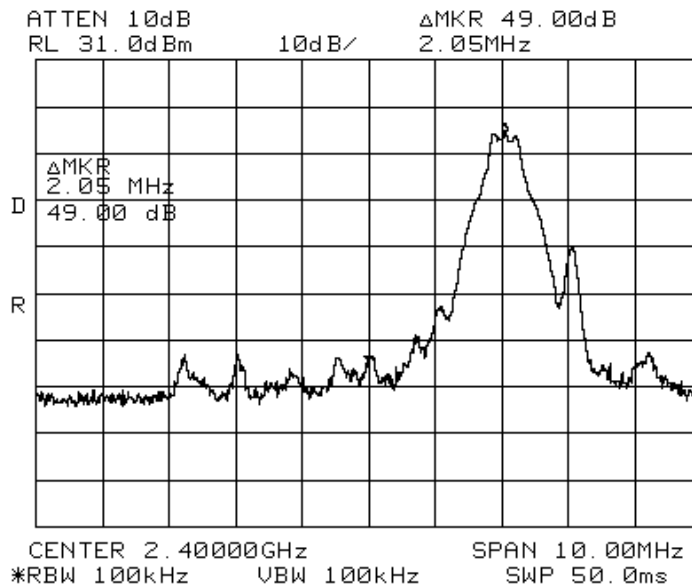
Temperature: 22 °C

Relative Humidity: 40 %

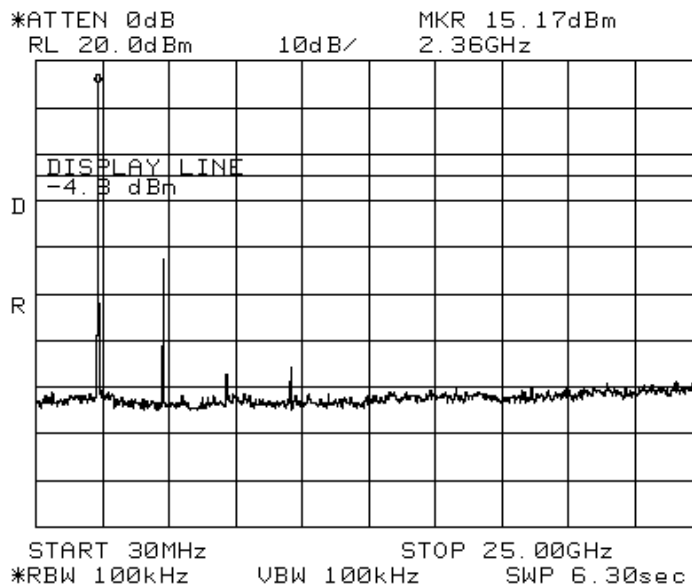
Test Data – Spurious Emission at Antenna Terminal

Bluetooth

Low Channel



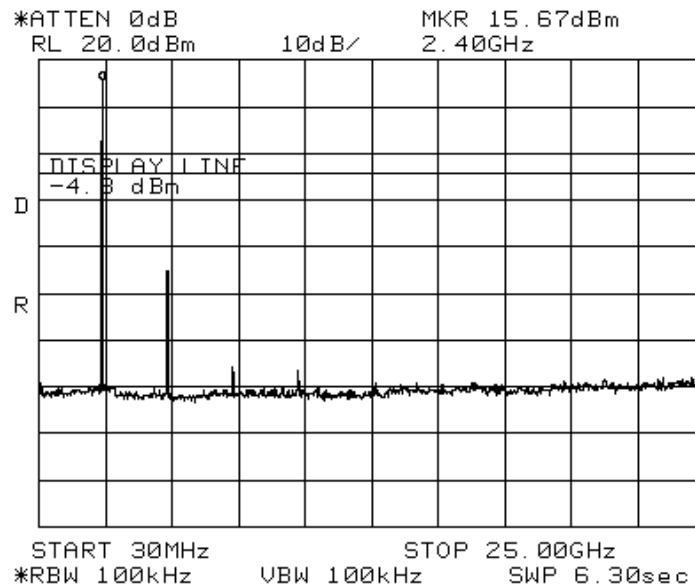
Low Channel



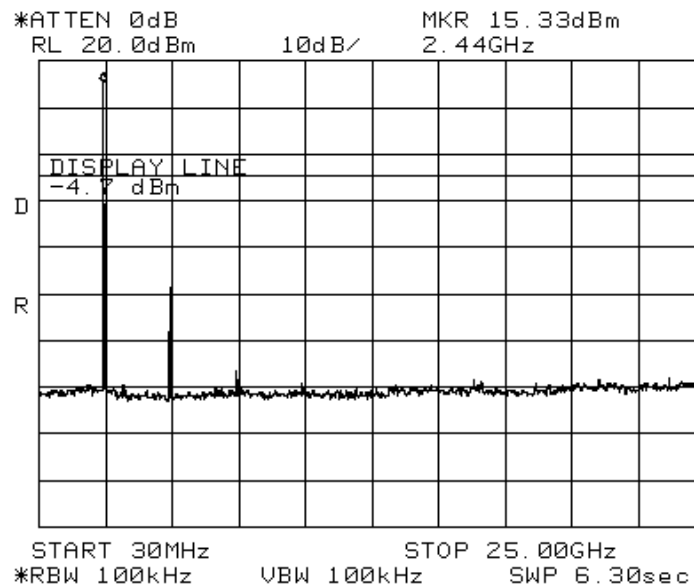
Test Data – Spurious Emission at Antenna Terminal

Bluetooth (Continued)

Mid Channel



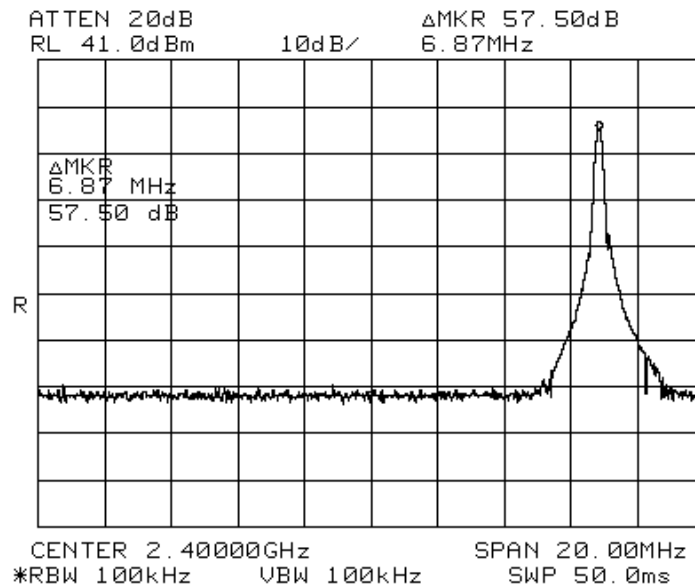
High Channel



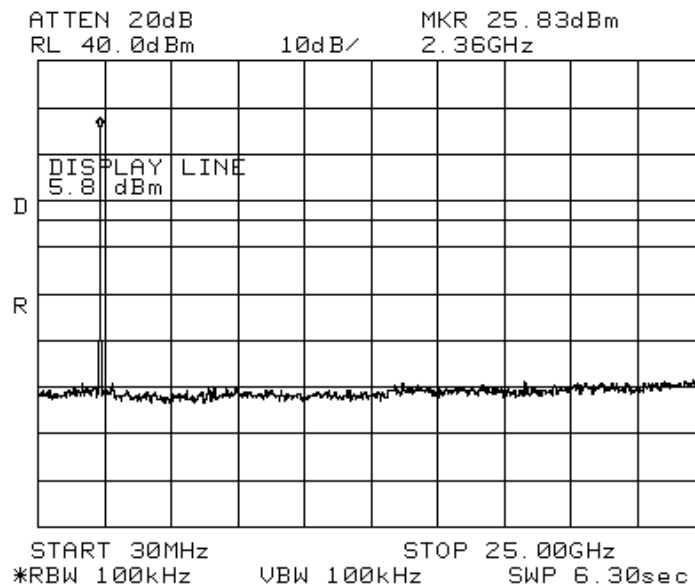
Test Data – Spurious Emission at Antenna Terminal

TTX

Low Channel

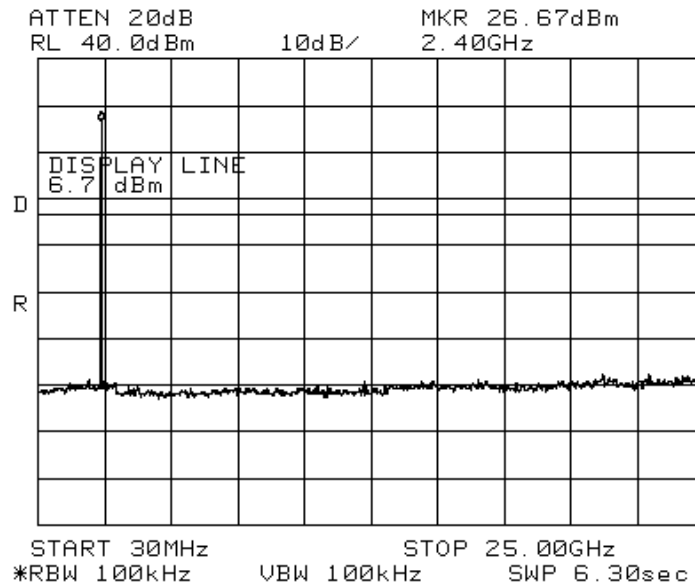


Low Channel

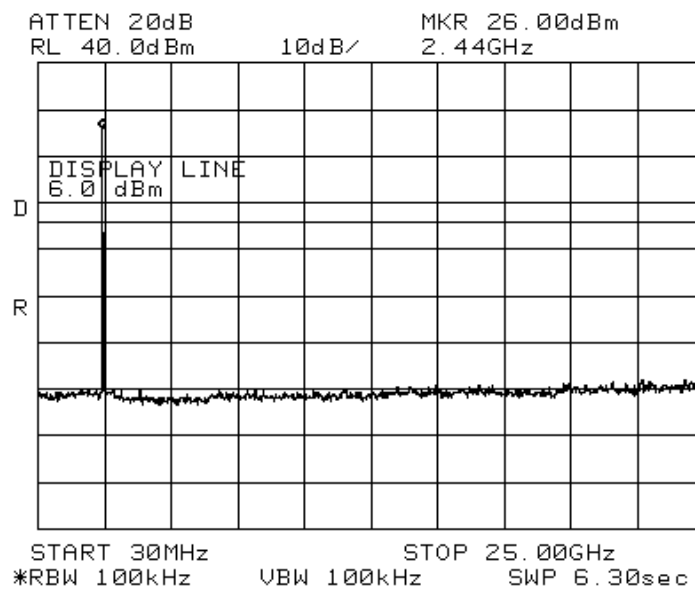


Test Data – Spurious Emission at Antenna Terminal

Mid Channel



High Channel



Section 9. Spurious Emissions (Radiated)

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.247(c)
TESTED BY: David Light	DATE: 16 May 2006

Test Results: Complies.

Measurement Data: See attached table.

Duty Cycle Calculation: See attached plots

Duty Cycle correction factor(dB) = $20 \log (rf_{ON} \text{ in ms}/100\text{ms})$

Bluetooth: Factor = $20 \log (5.1 \text{ mS}/100 \text{ mS}) = -25.9 \text{ dB}$

TTX: Factor = $20 \log (48.67 \text{ mS}/100 \text{ mS}) = -6.25 \text{ dB}$

Equipment Used: 1464-1484-1485-1016-760-759-791-991

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 40 %

Test Data - Radiated Emissions

Bluetooth

Frequency (MHz)	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
								Bluetooth Channel
4804.	44.0	33.1	4.2	30.1	51.2	74	54	P/V
7206.	40.5	35.8	5.1	33.9	47.5	74	54	P/V
9608.	42.0	37.1	5.8	33.9	51.0	74	54	P/V
4804.	46.8	33.1	4.2	30.1	54.0	74		P/H
4804.	20.9	33.1	4.2	30.1	28.1		54	A/H
7206.	40.8	35.8	5.1	33.9	47.8	74	54	P/H
9608.	41.8	37.1	5.8	33.9	50.8	74	54	P/H
								Channel
4880.	48.0	33.1	4.2	30.1	55.2	74		P/V
4880.	22.1	33.1	4.2	30.1	29.3		54	A/V
7320.	39.7	35.8	5.1	33.9	46.7	74	54	P/V
9760.	41.8	37.1	5.8	33.9	50.8	74	54	P/V
4880.	49.7	33.1	4.2	30.1	56.9	74		P/H
4880.	23.8	33.1	4.2	30.1	31.0		54	A/H
7320.	40.5	35.8	5.1	33.9	47.5	74	54	P/H
9760.	41.0	37.1	5.8	33.9	50.0	74	54	P/H
2483.	59.8	29.0	3.1	32.2	59.7	74		P/V
2483.	33.9	29.0	3.1	32.2	33.8		54	A/V
4960.	41.2	33.1	4.2	30.1	48.4	74	54	P/V
7440.	40.2	35.8	5.1	33.9	47.2	74	54	P/V
9920.	41.3	37.1	5.8	33.9	50.3	74	54	P/V
2483.	41.8	29.0	3.1	32.2	41.7	74		P/H
2483.	15.9	29.0	3.1	32.2	15.8		54	A/H
4960.	43.3	33.1	4.2	30.1	50.5	74	54	P/H
7440.	39.7	35.8	5.1	33.9	46.7	74	54	P/H
9920.	41.7	37.1	5.8	33.9	50.7	74	54	P/H
Notes:	Searched spectrum 30 MHz to							
	All emissions within 20 dB of the specification limit							
	Average measurements employ -25.9 dB duty cycle correction.							

Test Data - Radiated Emissions

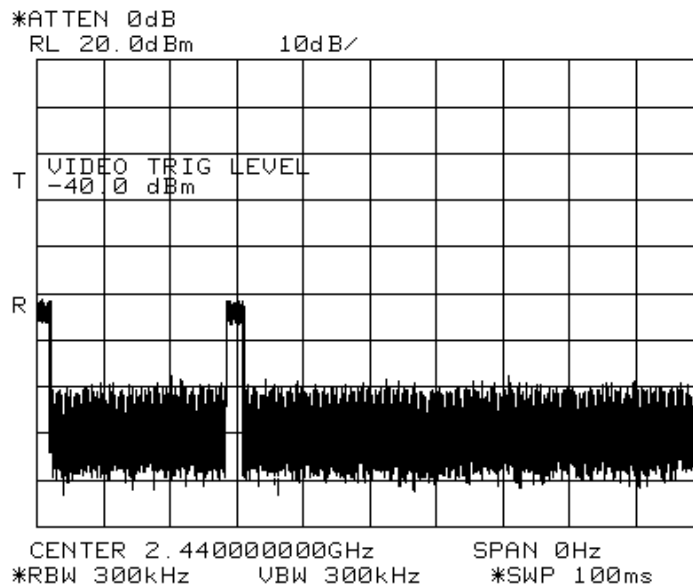
TTX

Frequency (MHz)	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
								Hopper
								TX 2406
4812.000	42.8	33.1	4.2	30.1	50.0	74	54	P/V
7218.0	39.8	35.8	5.1	33.9	46.8	74	54	P/V
9624.0	40.8	37.1	5.8	33.9	49.8	74	54	P/V
4812.000	45.7	33.1	4.2	30.1	52.9	74		P/H
4812.000	39.5	33.1	4.2	30.1	46.7		54	A/H
7218.0	39.3	35.8	5.1	33.9	46.3	74	54	P/H
9624.0	40.3	37.1	5.8	33.9	49.3	74	54	P/H
								TX 2440
4880.0	45.8	33.1	4.2	30.1	53.0	74		P/V
4880.0	39.6	33.1	4.2	30.1	46.8		54	A/V
7320.0	39.7	35.8	5.1	33.9	46.7	74	54	P/V
9760.0	42.2	37.1	5.8	33.9	51.2	74	54	P/V
4880.0	44.8	33.1	4.2	30.1	52.0	74		P/H
4880.0	38.6	33.1	4.2	30.1	45.8		54	A/H
7320.0	40.2	35.8	5.1	33.9	47.2	74	54	P/H
9760.0	41.7	37.1	5.8	33.9	50.7	74	54	P/H
								TX 2474
2483.5	46.5	29.0	3.1	12.2	66.4	74		P/V
2483.5	19.6	29.0	3.1	12.2	39.5		54	A/V
4960.0	43.8	33.1	4.2	30.1	51.0	74	54	P/V
7440.0	40.2	35.8	5.1	33.9	47.2	74	54	P/V
9920.0	42.8	37.1	5.8	33.9	51.8	74	54	P/V
2483.5	32.3	29.0	3.1	12.2	52.2	74		P/H
2483.5	20.0	29.0	3.1	12.2	39.9		54	A/H
4960.0	45.7	33.1	4.2	30.1	52.9	74	54	P/H
7440.0	40.2	35.8	5.1	33.9	47.2	74	54	P/H
9920.0	40.2	37.1	5.8	33.9	49.2	74	54	P/H
Notes:								
Searched spectrum 30 MHz to 25 GHz								
All emissions within 20 dB of the specification limit are reported								
Marker delta method used for bandedge measurement								
Average measurements employ -6.25 dB duty cycle correction. Refer to plot.								

Test Data – Duty Cycle

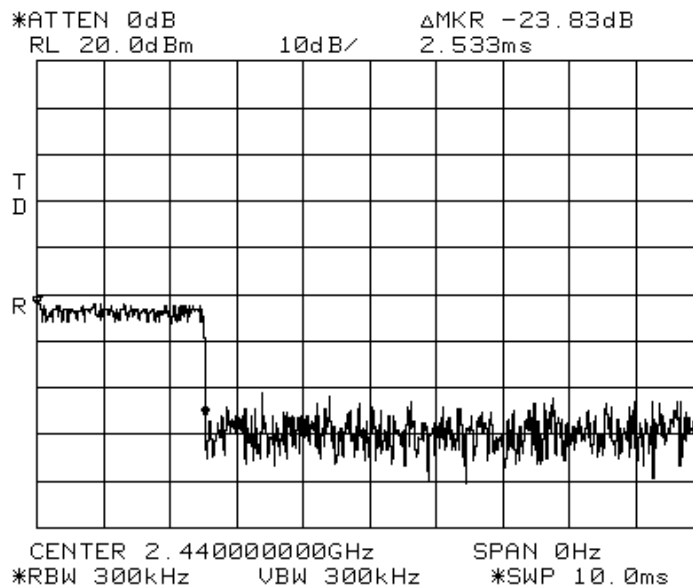
Bluetooth

2 pulses max in 100 mS



Pulse width

2.533 mS

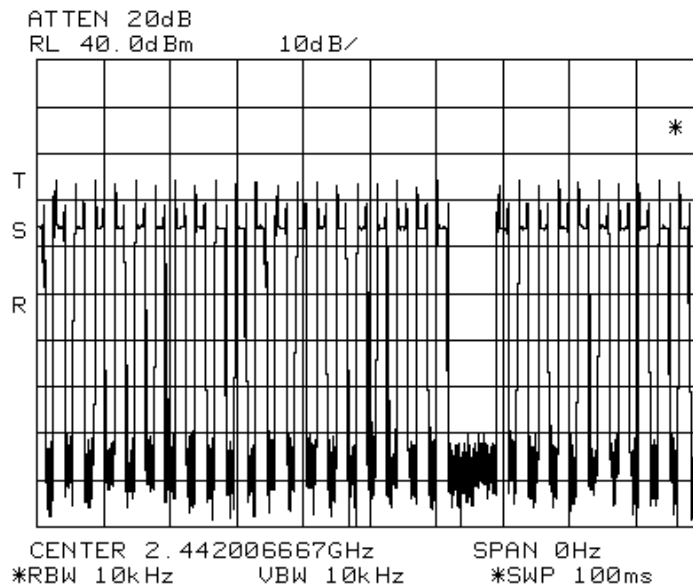


$$\text{Duty cycle correction} = 20 \log (5.066/100) = -25.9 \text{ dB}$$

Test Data – Duty Cycle

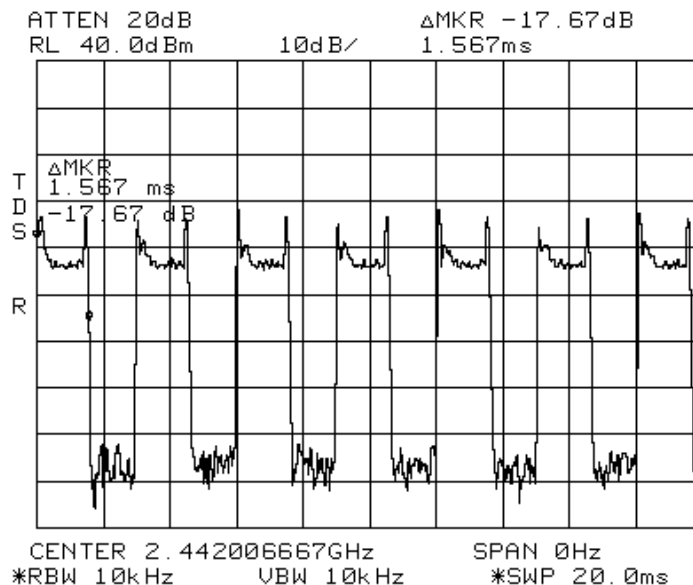
TTX

31 Pulses in 100 mS



Pulse width

1.57 mS

Duty cycle correction = $20 \log (48.58 \text{ mS}/100 \text{ mS}) = -6.25 \text{ dB}$ 

Radiated Photograph



Section 10. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/14/05	01/15/07
1465	10 db Attenuator DC 8.0 Ghz	Midwest Microwave 292/10db	NONE	CBU	N/A
1466	10 db Attenuator DC 8.0 Ghz	Midwest Microwave 292/10db	NONE	CBU	N/A
1467	10 db Attenuator DC 18 Ghz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU	N/A
1082	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	08/26/05	08/26/06
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	08/26/05	08/26/06
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	04/20/06	04/20/07
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/01/05	08/02/07
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	02/13/06	02/13/07
760	Antenna biconical	Electro Metrics MFC-25	477	08/04/05	08/04/06
791	PREAMP, 25dB	Nemko USA, Inc. LNA25	398	04/20/06	04/20/07
969	lism	Schwarzbeck NNLA 8120	8120281	02/02/06	02/02/07
1433	High pass filter	Solar 7930-5.0	933142	09/07/05	09/07/06
1984	CABLE, 1m	Nemko USA, Inc. RG223	N/A	08/10/05	08/10/06
970	CABLE, 14.8m	Nemko USA, Inc. RG223	N/A	08/10/05	08/10/06
1284	Spectrum analyzer display	Hewlett Packard 8566B	1811A00223	02/16/06	02/16/07

ANNEX A - TEST DETAILS

NAME OF TEST: Powerline Conducted Emissions

PARA. NO.: 15.207(a)

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.

NAME OF TEST: Channel Separation	PARA. NO.: 15.247(a)(1)
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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)
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Minimum Standard:

The system shall hop to channel frequencies that are selected from a pseudorandomly 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.

NAME OF TEST: Time of Occupancy

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

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:

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

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

NAME OF TEST: Peak Power Output

PARA. NO.: 15.247(b)

Minimum Standard:

Frequency Band (MHz)	No. of Hopping Channels	Maximum Peak Power Output at Antenna Port
902 - 928	at least 50	1 watt
902 – 928	25 - 49	0.25 watts
2400 – 2483.5	75	1 watt
5725 – 5850	75	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.

Calculation Of EIRP For Integral Antenna:

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation $GP/4\pi R^2 = E^2/120\pi$ and proceeding as follows:

$$P = \frac{E^2 R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

The RBW of the spectrum analyzer shall be set to a value greater than the measured 20 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

NAME OF TEST: Spurious Emissions at Antenna Terminals	PARA. NO.: 15.247(c)
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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 ($\mu\text{V/m}$ @ 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**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

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 ($\mu\text{V/m}$ @ 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

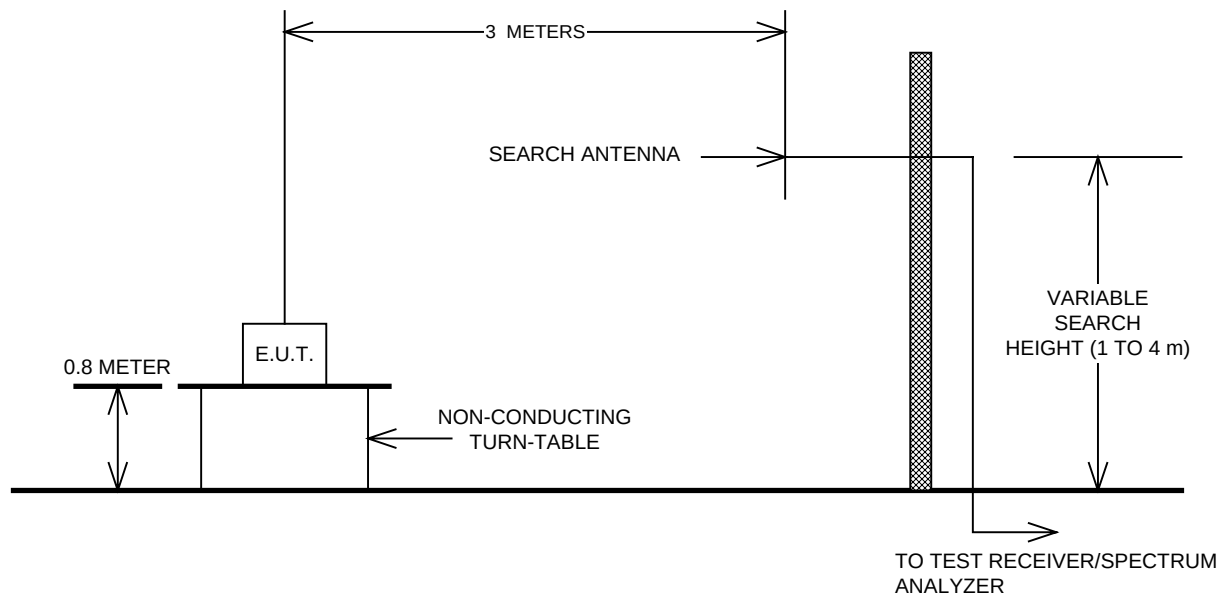
MHz	MHz	MHz	GHz
0.09-0.11	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.125-6.218	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:

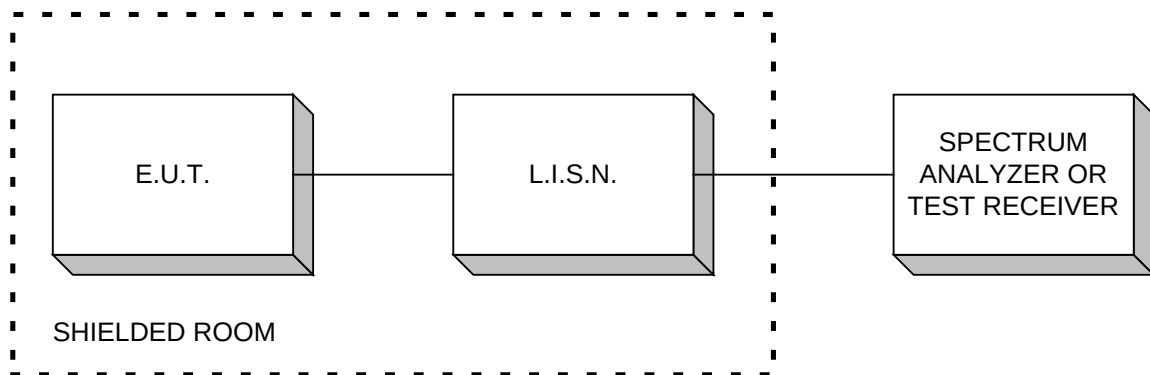
Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

ANNEX B - TEST DIAGRAMS

Test Site For Radiated Emissions



Conducted Emissions



Peak Power At Antenna Terminals

