

“Wireless that Works”SM

HYPER CORP

**1279 Quarry Lane • Suite B,
Pleasanton, CA 94566-8499
USA**

Phone: +1.925.462.9105 Fax: +1.925.280.7751

EMC Test Report

Prepared for:

Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399

Phone: +1.425.703.0383

Fax: +1.425.936.7329

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Certificate Number 1708-1

Hyper Corp is an Accredited Laboratory by The American Association For Laboratory Accreditation (A2LA) to ISO/IEC 17025-for the scope of BLUETOOTH Testing.

Signature Page

**The below listed Hyper Corporation Personnel takes responsibility
for the contents of this Test Report.**

Signatures

Test Engineer(s):

Original signed

William Elliott

Date

**Reviewed by
Technical
Manager:**

Original signed

Kevin Marquess

Date

1. *List of Revisions*

Version	Date	Author(s)	Description
001	June 22, 2002	Elliott, William	Initial Version

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2. *Disclaimer Notice*

This test report applies only to the EUT (Equipment Under Test) and the results of the specifications called out in this report.

The test results contained herein relate only to the model(s) identified. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics.

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4. *Project Details*

EUT: Lapis

Job Number: 0205005

5. Description of Test Item

Date received:	August 10,2002
Date(s) tested	August 30, 2002
Description of EUT	Microsoft Lapis – Bluetooth Enabled Dongle
Condition of EUT:	Operational / Good Condition
Product ID/Model Number	Lapis
Serial number	0022
Hardware Version	0.07
Software Version	0.07

6. Test Summary

This test report is prepared for the project of Microsoft Lapis (Bluetooth-enabled dongle).

Summary of Test Results

Specification	Description	Result
CFR 47 Part 15.109 ICES-003 Test Method: ANSI 63.4-2000	Radiated Spurious Emissions (Unintentional Radiator) 30 MHz -25GHz 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	Compliant
CFR 47 Part 15.107 ICES-003 Test Method: ANSI 63.4-2000	AC Powerline Conducted Emissions 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	Compliant

7 Documentation of test device

Documentation of the tested device has been reviewed by Hyper Corporation Engineers and found to be in compliance with applicable test specifications. All documentation is kept at Hyper Corporation's Quality Department in the Microsoft Lapis EMC Test Folder.

8. General and Special Conditions

The EUT is a Wireless Transceiver for Bluetooth manufactured by Microsoft Corporation. The transceiver connects to the USB port of personal computers by the use of a cradle that the transceiver sits in that has an integrated USB cable. The cradle is supplied to the end user as part of the overall system.

The EUT receives power from the Host computer via the USB cable attached to the cradle.

For all of the testing the EUT was operated in a normal operational mode by establishing a Bluetooth link with a Bluetooth-enabled mouse and keyboard. The "H" button was continually depressed to scroll "H"s on the video monitor, exercise the port, and send data over the USB cable. This ensured that the EUT was in a normal operating mode and that the system was being fully exercised to obtain the maximum test results.

Radiated testing was done at an open area test site with an average temperature of 81 degrees F and relative humidity of 41%. Line conducted testing was done inside in a controlled environment with an average temperature of 77 degrees F and relative humidity of 34%.

9. ***Equipment and Cable Configurations / Test Setup***

The EUT was tested in accordance with ANSI C63.4-2000 with the setup in a typical user configuration arranged to enhance repeatability.

The dongle was connected to the USB port on the computer with the supplied cradle/ USB cable that will be provided to the end user. The computer was connected to a monitor, mouse and keyboard using standard cables ports. The parallel port of the computer was terminated to a line printer to fulfill the system configuration requirements.

The cables were bundled back per the applicable requirements and kept 40 cm from the ground plane.

Cable Information for transmitter tests

Connection	Ferrite	Shield	Length	Treatment
<u>USB Dongle</u>	No	As provided	1.5m	folded back 40 cm - ground plane
<u>Video Cable</u>	No	No	1m	folded back 40 cm - ground plane
<u>Mouse Cable</u>	No	No	1.8m	folded back 40 cm - ground plane
<u>Keyboard Cable</u>	No	No	1.8m	folded back 40 cm - ground plane
<u>Printer / Parallel Port</u>	No	No	2m	folded back 40 cm - ground plane
<u>AC Cable</u>	None	None	2.4m	for PC
<u>AC Cable</u>	None	None	2.4m	for video monitor

Measuring Equipment and Calibration Information

Manufacturer Name	Description	Model Number	Serial Number	CAL DUE DATE
EMCO	Biconical Antenna	3110	9210-1581	10/16/02
EMCO	Horn Antenna	3115	9609-4906	9/12/02
FCC	LISN	Lisn2	F001	9/18/02
Schwarzbeck	Log Periodic Antenna	UHAL9107	9107384	9/18/02
Hewlett Packard	Pre-Amplifier	8449B	3008A00272	4/24/03
Hewlett Packard	Spectrum Analyzer	8546A	3807A00456	7/1/03
Hewlett Packard	RF Filter Section	85460A	3704A00424	7/1/03
Tektronix	Spectrum Analyzer	B020370	2782	6/11/03
EMCO for HP	Horn Antenna 18-26.5 GHz	971313-004	3160-09	1/23/03

Support Equipment and Information

Manufacturer Name	Description	Model Number	Serial Number
Dell Computers	Host Computer	Dimension XPS 8800R	ENQ2
Canon	Printer	K10110A	BAA63711
Dell Computers	Monitor	D1728DLS	04036A9UEP 47
Microsoft Corp.	Mouse	Intellimouse 1.2A	6710205-7
Microsoft Corp.	Mouse	PS/2 Mouse	N/A
Dell Computers	Keyboard	SK-8000	N/A
Microsoft Corp.	Bluetooth-Enabled Keyboard	KB11	Qual Unit 2

Test Setup Block Diagram

Radiated Emissions – Digital Device Testing 30 MHz- 1 GHz

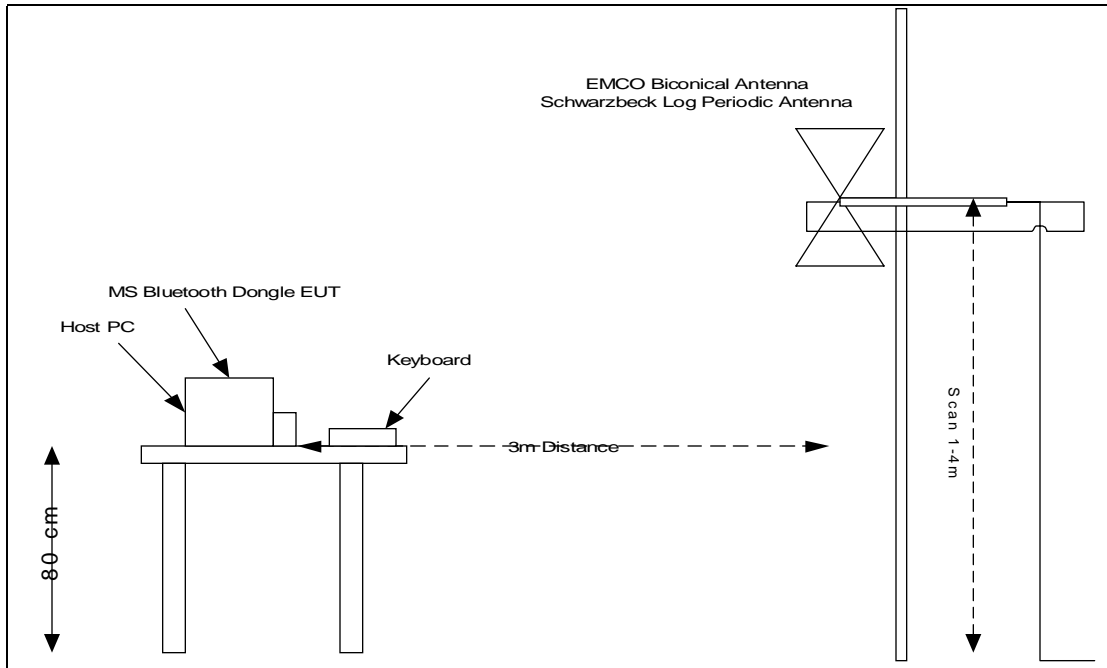


Figure 1. Receive System Setup – 30 MHz – 1 GHz

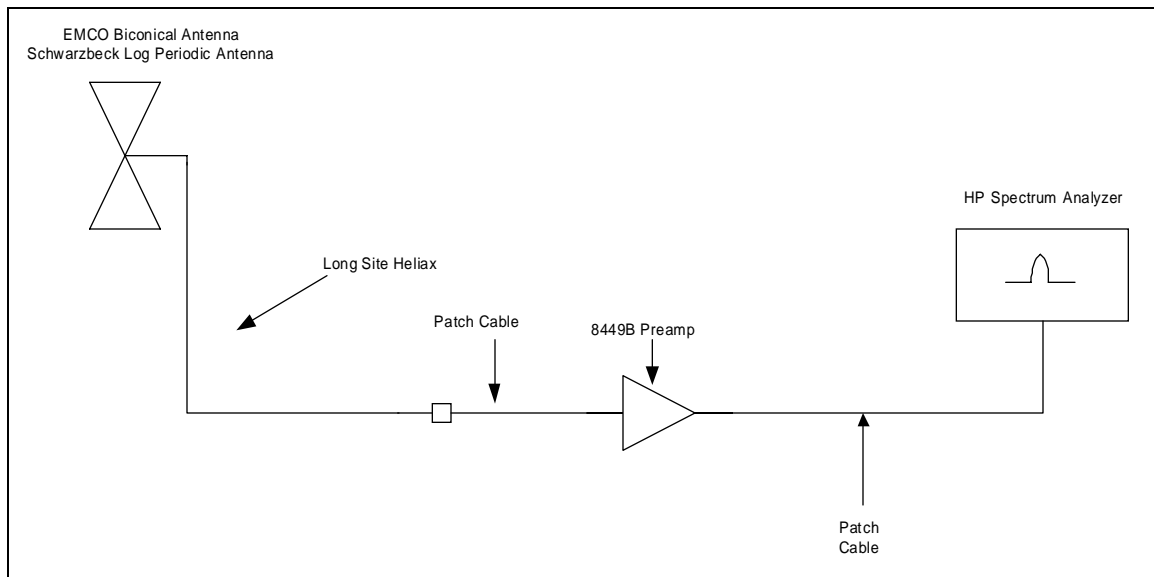


Figure 2. Receive System Description – 30 MHz – 1GHz

Radiated Emissions – Digital Device Testing 1 GHz – 18 GHz

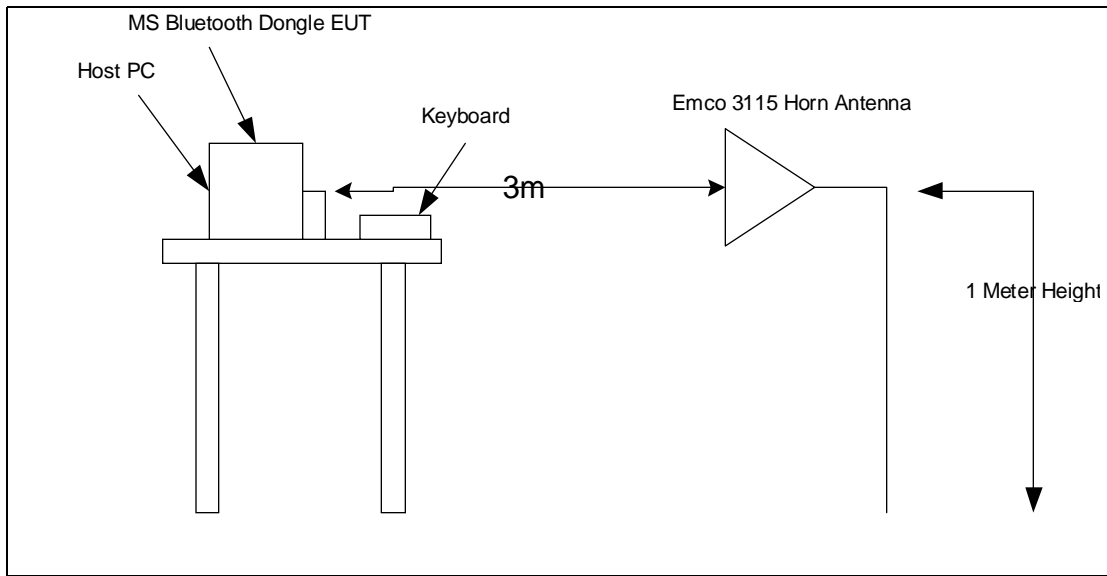


Figure 3. Receive System Setup –1 GHz – 18 GHz

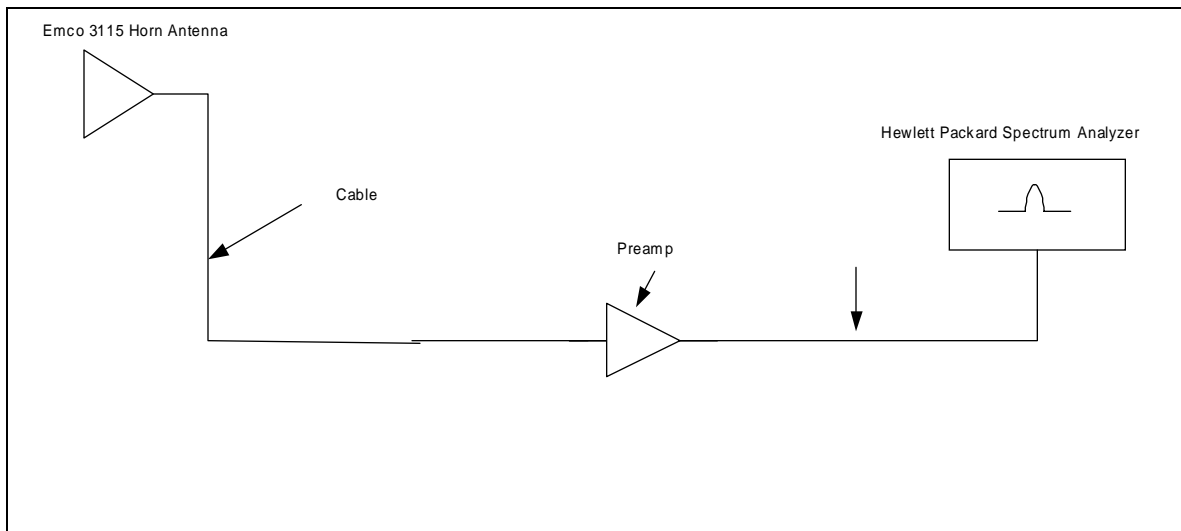


Figure 4 . Receive System Description – 30MHz – 1GHz

Line Conducted Emissions Test Setup

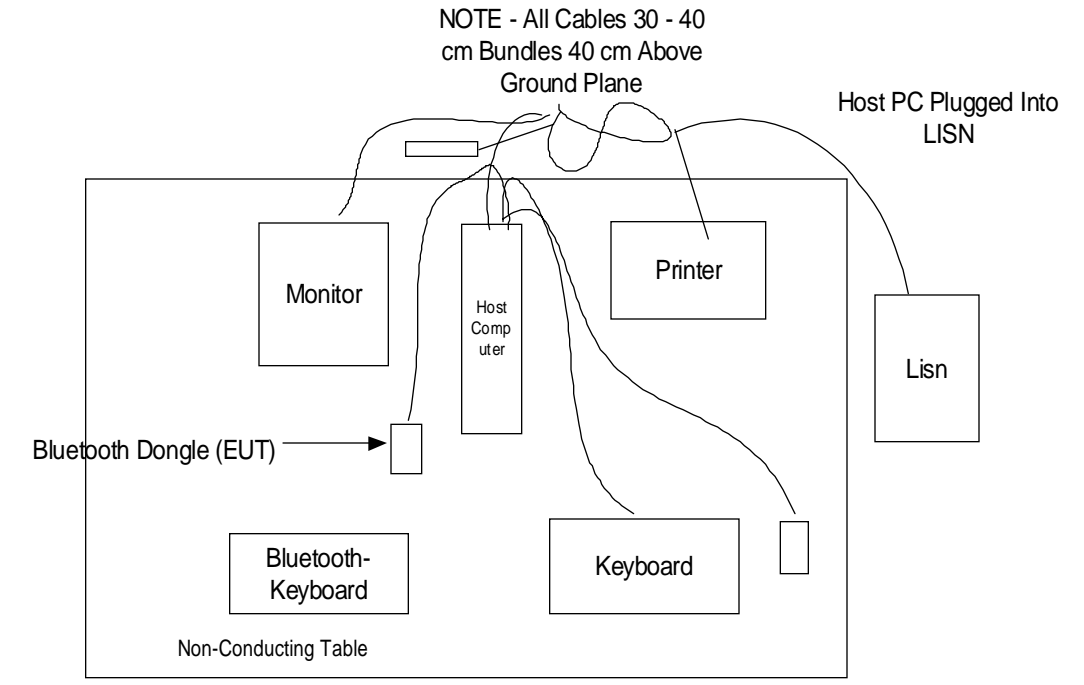


Figure 5. Line Conducted Emissions Testing Setup

All equipment and peripherals are at 10 cm apart. Monitor and printer power cables bundled and plugged into the AC mains.

Test Setup Photos

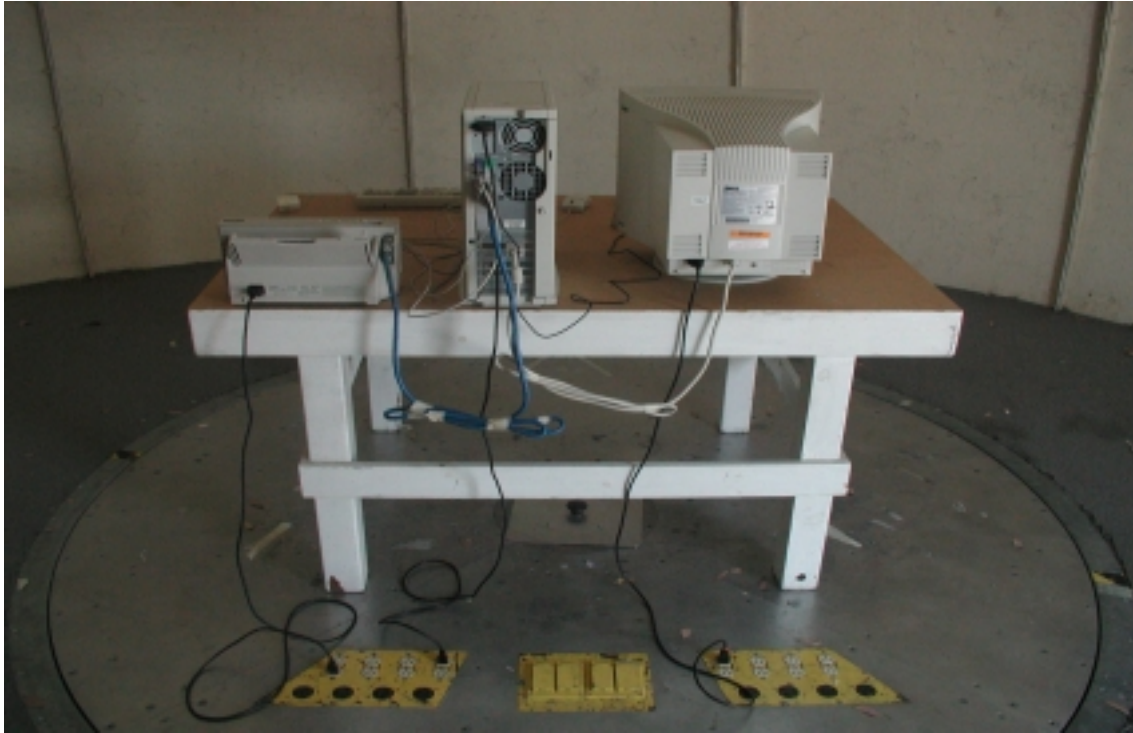


Photo 1 – MS Lapis Radiated Emissions Test Setup



Photo 2 – MS Lapis Conducted Emissions Test Setup

10. General Testing Information

Test Facility

Company	Location	Parts Tested
Underwriters Laboratory – Sunol Site 1 EMC International Services	11825 Niles Canyon Road, Sunol, CA 94586	CFR 47 Part 15.107 CFR 47 Part 15.109 ICES-003

UL Sunol – EMC Services is:
Listed Per 2.948 with the FCC
Industry Canada Listed: IC – 4121-1
And NVLAP Accredited: Ref. No. 200535-0

Test Environment

Outdoor Test Site

Nominal Temperature	81 Deg. F
Nominal Humidity	41%

Control Room / Line Conducted Room

Nominal Temperature	77 Deg. F
Nominal Humidity	34%

11. Test Procedure(s)

Testing was performed at the UL EMC International Services Lab in Sunol, Ca by the engineering staff of UL under the supervision of Hyper personnel. The testing was done in conformance to the laboratory quality system and done under the scope of their NVLAP accreditation.

The testing was performed according to the procedures in ANSI C63.4-2000.

Radiated Emissions Testing

Measurement Procedure (30 MHz - 1GHz)

The EUT was tested per ANSI C63.4-2000 at the UL Sunol OATS. The EUT was placed in a normal operation mode. A Bluetooth keyboard transmitted "H"s continuously which caused constant data flow over the USB cable and ports and also scrolled on the monitor.

The EUT was placed on a 1*1.5m wooden tabletop at 80 cm height. The EUT was 3m away from the measurement antenna.

For each range emissions were maximized by rotating the EUT through 360 degrees and scanning the antenna 1-4m for both vertical and horizontal orientations of the receive antenna.

The resolution bandwidth of the receiver was 120 kHz and the detector mode was peak.

Once the maximum emissions from the EUT were determined, their value was determined by the following relationship:

$$\text{Spur (dB}\mu\text{V/m)} = \text{Receive power(dBuV)} + \text{cable loss(dB)} - \text{preamp gain(dB)} + \text{Antenna Factor(dB/m)}$$

The unit complied with the FCC limits at all frequencies in the peak mode.

The results are presented in Appendix 1.

Measurement Procedure (1-18 GHz)

EUT Testing Procedure 1-18GHz

The EUT was tested per ANSI C63.4-2000 at the UL Sunol OATS . The EUT was placed in a normal operation mode. A Bluetooth keyboard transmitted "H"s continuously which caused constant data flow over the USB cable and ports and also scrolled on the monitor.

The EUT was placed on a 1*1.5m wooden tabletop at 80 cm height. The EUT was 3m away from the measurement antenna. The receiving horn antenna was fixed at 1m height.

For each channel emissions were maximized by rotating the EUT through 360 degrees for both vertical and horizontal orientations of the receive antenna. The receiver bandwidth was set to 1MHz per CFR requirements and the detection mode was peak.

Once the maximum emissions from the EUT were determined, their value was determined by the following relationship:

$$\text{Spur (dB}\mu\text{V/m)} = \text{Receive power(dBuV)} + \text{cable loss(dB)} - \text{preamp gain(dB)} + \text{Antenna Factor(dB/m)}$$

The unit complied with the FCC limits at all frequencies in the peak mode.

The results are presented as Appendix 1.

Measurement Procedure / Results (18-25 GHz)

Above 18 GHz the EUT was "sniffed" using a high frequency microwave system and a standard gain horn. The system is commercially available and has sufficient system sensitivity up to 40 GHz.

The EUT was exercised in each channel and the device was "sniffed" with the horn (i.e. the horn was oriented in every possible fashion at a close distance to the device) to discern if there were any frequencies that may be an issue and need to be quantified.

No signals were detected from the EUT above 18 GHz.

Line Conducted Emissions Testing

The EUT was tested per the procedures in ANSI C63.4-2000 in the line conducted emissions test room at the UL Sunol Lab by the laboratory personnel.

The EUT was placed in a normal operation mode. A Bluetooth keyboard transmitted "H"s continuously which caused constant data flow over the USB cable and ports and also scrolled on the monitor.

Cabling from the peripherals and the host computer were dressed in the manner described in the test setup section of this report in accordance to the standard. The required ports were terminated and exercised as required in the standard.

The EUT, host computer, and all peripherals were kept 10 cm apart.

The host computer was connected to the LISN and the measuring instrument was connected to the 50 ohm port of the LISN.

Measurements were performed on both current-carrying lines of the host computer power cable.

Testing was performed from 150 kHz to 30 MHz for the whole range in accordance with the ICES-003 requirements and the new FCC limits for conducted emissions effective Sept. 9th, 2002.

The unit complied with the applicable limits at all frequencies in the peak mode. Several marginal frequencies were tested in using average detection to investigate further margin to the limit and are reported as well.

The results are presented as Appendix 2.

Appendix 1 – Test Data Radiated Emissions**Radiated Emissions Testing**MS Lapis - Bluetooth Enabled Dongle
30MHz - 26.5GHz**FCC TESTING**

Tested at Underwriters Laboratory - Sunol Test Site 1

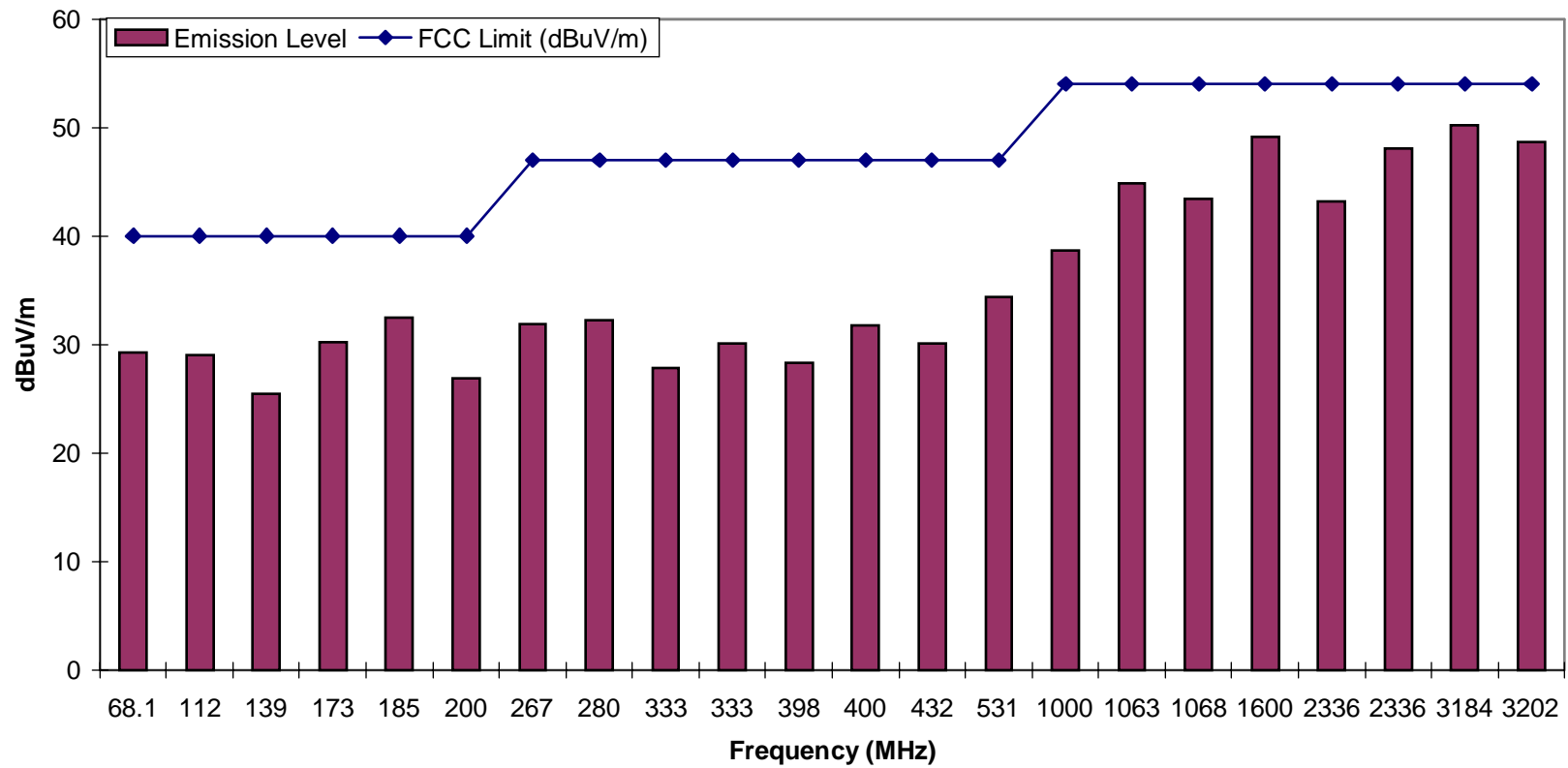
FINAL RESULTS - Digital Device Testing

Standard Applied - ANSI C63.4 - 2000

Frequency (MHz)	Worst Case Orientation	Spur Level (dBuV/m)	FCC Limit	Margin to Limit	P / F
68.09	Hor.	29.2	40	10.80	P
112.36	Hor.	29	43.5	14.50	P
139.1	Hor.	25.4	43.5	18.10	P
173.43	Hor.	30.2	43.5	13.30	P
185.1	Hor.	32.4	43.5	11.10	P
200	Vert	26.9	43.5	16.60	P
266.57	Hor.	31.8	46	14.2	P
280.28	Vert	32.2	46	13.80	P
333.21	Hor.	30.1	46	15.90	P
400.01	Hor.	31.7	46	14.30	P
530.68	Vert	34.4	46	11.60	P
1000	Hor	38.7	54	15.30	P
1062.6	Hor	44.8	54	9.20	P
1067.6	Vert	43.4	54	10.60	P
1600	Vert	49.1	54	4.90	P
2336	Hor	43.2	54	10.80	P
2336.2	Vert	48	54	6.00	P
3184.1	Vert	50.2	54	3.80	P
3202	Hor	48.6	54	5.40	P

Table 1. Results of Spurious Emissions Testing 30 MHz–25 GHz

Plot of Spurious Emissions From EUT



Graph 1 – Plot of Radiated Emissions from Digital Device Testing

Appendix 2 – Line Conducted Emission Data

Line Conducted Emissions Testing

MS Lapis - Bluetooth Enabled Dongle
 Tested at Underwriters Laboratory - Sunol
 120VAC / 60 Hz Line 1

FINAL RESULTS - Digital Device Testing

Standard Applied - ANSI C63.4 - 2000 / ICES-003

Frequency (MHz)	Spur Level (dBuV)	Detector Mode	FCC Class B Limit / Margin	ICES-003 Class B QP Limit / Margin	ICES-003 Class B Avg Limit / Margin	P / F
0.25423	45.22	Peak	61.6 / -16.38 (QP)	61.6 / -16.38	51.6 / -6.38	P
0.44779	43.45	Peak	56.9 / -13.45 (QP)	56.9 / -13.45	46.9 / -3.45	P
0.51107*	43.89	Peak	48 / -4.11	56 / -12.11	46 / -2.11	P
4.60572	40.53	Peak	48 / -7.47	56 / -15.47	46 / -5.47	P
14.44777	42.58	Peak	48 / -5.42	60 / -17.42	50 / -7.42	P
0.5115*	42.25	Avg	48 / -5.75	56 / -13.75	46 / -3.45	P

Table 2 – Line Conducted Data – Line 1

Line Conducted Emissions Testing

MS Lapis - Bluetooth Enabled Dongle
 Tested at Underwriters Laboratory - Sunol
 120VAC / 60 Hz Line 2

FINAL RESULTS - Digital Device Testing

Standard Applied - ANSI C63.4 - 2000 / ICES-003

Frequency (MHz)	Spur Level (dBuV)	Detector Mode	FCC Class B Limit / Margin	ICES-003 Class B QP Limit / Margin	ICES-003 Class B Avg Limit / Margin	P / F
0.25423	41.91	Peak	61.6 / -19.69 (QP)	61.6 / -19.69	51.6 / -9.69	P
4.60572	40.98	Peak	48 / -7.02	56 / -15.02	46 / -5.02	P
5.61822	40.15	Peak	48 / -7.85	60 / -19.85	50 / -9.85	P
15.06197	42.04	Peak	48 / -5.96	60 / -17.96	48 / -5.96	P

Table 3 – Line Conducted Data – Line 2