

EMI TEST REPORT
for
CERTIFICATION
to
FCC PART 15.227 TRANSMITTER

FCC ID: N5HG2MOUSE-TX

Manufacturer: PP Multimedia SDn. Bhd.
Test Sample: G2 Cordless Computer Mouse
Model: 1113
Report Number: M80627Tx-F

Date: 28th August 1998

**EMI TEST REPORT FOR
CERTIFICATION
TO
FCC PART 15.227 TRANSMITTER**

FCC ID: N5HG2MOUSE-TX

CERTIFICATION of COMPLIANCE with FCC PART 15 REGULATIONS.

EMC Technologies Report Number: M80627Tx-1F

Date: 28th August 1998

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**EMI TEST REPORT FOR CERTIFICATION
TO
FCC PART 15.227 TRANSMITTER**

Report Number: M80627Tx-1F

Test Sample: G2 Cordless Computer Mouse
Model: 1113

FCC ID: N5HG2MOUSE-TX

Manufacturer: PP Multimedia SDn. Bhd.
100M, Jalan SS21/39, Damasara Utama 47400
Petaling Jaya, Selangor, Malaysia

Phone: + 603 718 3606
Fax: + 603 576 6119

Responsible Party: Charlie Chia Keng Chai
Executive Director
PP Multimedia Sdn. Bhd.

Equipment Type: Intentional Radiator, Low Power Transmitter

Test Standards: FCC Part 15 Section 227 Intentional Radiators.
ANSI C63.4-1992
OET Bulletin No. 63, October 1993

Tested for: Quality Assurance Services
Locked Bag 2032 Strathfield NSW 2135
Australia
Phone : +612 9746 4900
Fax : +612 9746 8460

Test Dates: 19th and 23rd June 1998

Test Officer: Chieu Huynh

Attestation: *I hereby certify that the device(s) described herein were tested as described in this report and that the data included is that which was obtained during such testing.*

Authorised Signature: **Praveen Rao**
Laboratory Manager
EMC Technologies Pty Ltd

EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15.227 REQUIREMENTS
on the
G2 Cordless Computer Mouse

1.0 SUMMARY of RESULTS.

This report details the results of EMI tests and measurements performed on the **G2 Cordless Mouse** in accordance with the Federal Communications Commission (FCC) regulations as detailed in **Title 47 CFR, Part 15 Rules for intentional radiators**. The results and photographs of all the EUT are detailed in this report. The EUT complied with requirements for 15.227 at fundamental frequencies and spurious emissions of section 15.209.

Transmitter Fundamental Frequency: Complied, margin of 35.8 dB.
Transmitter Spurious: Complied, margin of 0.7 dB.

The measurement procedure was in accordance with ANSI C63.4-1992, and OET Bulletin No. 63. The instrumentation conformed to these requirements.

2.0 GENERAL INFORMATION

2.1 General Description of Test Setup

Test Sample: **G2 Cordless Computer Mouse**
Model: 1113
FCC ID: N5HG2MOUSE-TX
Equipment Type: Intentional Radiator, Low Power transmitter

2.2 Technical Specifications

Power Source	:	2x AAA Batteries
Frequency	:	Channel 1: 26.970 MHz Channel 2: 27.060 MHz Channel 3: 27.090 MHz Channel 4: 27.233 MHz
Baud Rate	:	4800 bps
Modulation	:	FSK
Frequency Stability	:	± 20ppm
Accuracy	:	400 dpi
Operating Temperature	:	-5° C ~ 60°
Dimension	:	118.5 x 67 x 36.4 mm

2.3 Test Sample Functional Description.

The EUT is a 2 x AAA battery operated **short range remote Wireless external Mouse**. The Mouse is designed to be factory configured in four channels and the channels cannot be changed by the end user. A receiver module is connected to the Mouse port of a personal computer. The Superheterodyne receiver is undergoing the notification process in conjunction with this application.

2.4 Test Procedure

Radiated emissions measurements were performed in accordance with the procedures of ANSI C63.4-1992. Radiated emission tests were performed at an EUT distance of 3 metres. OET Bulletin 63 dated October 1993 was used for reference.

2.5 Test Facility

- **FCC Registration**

Radiated Emission measurements were performed at EMC Technologies open area test site (OATS) situated near the town of Glenlyon, Victoria, Australia.

The above site has been fully described in a report submitted to the FCC office, and accepted in a letter dated September 24, 1996 FCC file reference **31040/SIT 1300F2**.

2.6 Units of Measurements

Radiated Emissions

Measurements are reported in units of dB relative to one microvolt per metre (dBµV/m) at a distance of 3 metres from the EUT.

2.7 Test Equipment Calibration

All measurement instrumentation and transducers were calibrated in accordance with the applicable standards by an independent NATA registered laboratory such as Hewlett-Packard Australia Limited. All equipment calibration is traceable to Australia national standards at the National Measurements Laboratory (NML). The reference antenna calibration was performed by NML and the working antennas (biconical and log-periodic) calibrated by the direct comparison method. The complete list of test equipment used for the measurements, including calibration dates and traceability, is contained in Appendix A of this report.

2.8 Ambients at OATS.

The OATS site is an area of low background ambient signals. No significant broadband ambients are present however commercial radio and TV signals exceed the limit in the FM radio, VHF and UHF television bands. Radiated prescan measurements were performed in the shielded enclosure to check for possible radiated emissions at the frequencies where the OATS ambient signals exceeded the test limit.

3.0 System Test Configuration.

The transmitter was configured to continuously transmit during the tests.

4.0 RADIATED EMISSION MEASUREMENTS

4.1 Test Procedure 25-1000 MHz

The EUT was set up on the table top (placed flat on the turntable) of total height 80 cm above the ground plane, and operated as described in section 2 of this report. The EMI Receiver was operated under software control via the Portable PC Controller through the IEEE.488 Interface Bus Card Adapter. The 25 MHz to 1000 MHz test frequency range was sub-divided into smaller bands with sufficient frequency resolution to permit reliable display and identification of possible EMI peaks while also permitting fast frequency scan times. The EUT was slowly rotated with the Peak Detector set to Max-Hold. This was performed for two antenna heights. Each significant peak was then investigated and maximised by scanning the height of the antenna between 1 to 4 metres with the Quasi-Peak detector ON. The measurement data for each frequency range was automatically corrected by the software for cable losses, antenna factors and preamplifier gain and all data was then stored on disk in sequential data files. This process was performed for both horizontal and vertical antenna polarisation.

4.2 Plotting of Measurement Data for Radiated Emissions.

The stored measurement data was combined to form a single graph which comprised of all the frequency sub-ranges over the range 25-1000 MHz. The accumulated EMI (EUT ON) was plotted as the Red trace while the Ambient signals (AMBIENT) were plotted as Green trace. The worst case radiated EMI *peak* measurements (as recorded using the Max-Hold data are presented as the upper or **RED** trace while the respective ambient signals are presented as the lower or **GREEN** trace. Occasionally, an intermittent ambient arose during the EUT ON measurement (RED trace) and could not be captured when the Ambient trace was being stored. The ambient peaks of significant amplitude with respect to the limit are tagged with the "#" symbol while EMI peaks are identified with a numeral. Ambient peaks that were present during the EUT ON measurement (RED trace) and not captured during the AMBIENT measurement were also tagged with the "#" symbol.

The highest recorded EMI signals are shown on the Peaks List on the bottom right side of the graph. For radiated EMI, each numbered peak is listed as a frequency, peak field strength, Quasi-peak field strength, turntable azimuth, antenna height and the margin relative to the limit in dB. A negative margin is the deviation of the recorded value below the limit.

At times, the quasi peak level may appear to be higher than the peak level. This happens because the individual peak is further maximised with the QP detector. This will be apparent when the peaks list at the foot of the graphs shows the quasi peak level higher than the peak level.

4.3 Calculation of Field Strength.

The field strength was calculated automatically by the software using all the pre-stored calibration data. The method of calculation is shown below:

$$E = V + AF - G + L$$

Where:

- E** = Radiated Field Strength in dB μ V/m.
- V** = EMI Receiver Voltage in dB μ V. (measured value)
- AF** = Antenna Factor in dB(m⁻¹). (stored as a data array)

- G** = Preamplifier Gain in dB. (stored as a data array)
L = Cable insertion loss in dB. (stored as a data array of
Insertion Loss versus frequency)

Example Field Strength Calculation

Assuming a receiver reading of 34.0 dBμV is obtained at 90 MHz, the Antenna Factor at that frequency is 9.2 dB. The cable loss is 1.9 dB while the preamplifier gain is 20 dB. The resulting Field Strength is therefore as follows:

$$34.0 + 9.2 + 1.9 - 20 = 25.1 \text{ dB}\mu\text{V/m}$$

5.0 Radiated Field Strength Measurement Results

The transmitter was tested together with the receiver connected to the PC. It was found that most of the emissions were from the PC.

Result: The highest radiated spurious emission was 0.7 dB below the limit at 520 MHz for Vertical Polarisation. The fundamental frequency was 35.8 dB below the speceified limit at 276.96 MHz for Horizontal Polarisation.

Spurious Emissions : Quasi Peak Levels

Graph 1: Vertical Antenna Polarisation

Graph 2: Horizontal Antenna Polarisation

Fundamental Frequency Emissions : Peak Levels

Graph 3: Vertical Antenna Polarisation

Graph 4: Horizontal Antenna Polarisation

Table 1
Summary of Results

Antenna Polarisation	Frequency MHz	Rx QP Level dBμV/m	Limit @ 3m dBμV/m	Result ±dB
FUNDAMENTAL FREQUENCY				
Horizontal	26.96	44.2 peak*	80.0	-35.8
Vertical	26.97	40.6 peak*	80.0	-39.4
SPURIOUS EMISSIONS				
Vertical	520.0	45.3	46.0	-0.7
Vertical	600.0	44.6	46.0	-1.4
Horizontal	52.26	33.9	40.0	-6.1
Vertical	66.29	33.8	40.0	-6.2
Vertical	440.07	39.3	46.0	-6.7
Horizontal	520.0	39.0	46.0	-7.0
Horizontal	66.19	32.9	40.0	-7.1
Vertical	72.11	32.4	40.0	-7.6
Vertical	52.30	32.0	40.0	-8.0
Vertical	69.74	31.7	40.0	-8.3
Vertical	202.29	34.8	43.5	-8.7

***Note :** The measured Fundamental Frequency levels reported here are Peak values
Refer graphs 1, 2, 3 and 4 in Appendix F

6.0 CONCLUSION

The G2 Cordless Computer Mouse (FCC ID: N5HG2MOUSE-TX), complied with the requirements of the FCC Parts 2 and 15 Rules for low power transmitter tested in accordance with 15.227. The results were as follows:

Transmitter Fundamental : complied, worst case margin of 35.8 dB.

Transmitter Spurious : complied, worst case margin of 0.7 dB.

APPENDIX A

MEASUREMENT INSTRUMENTATION DETAILS

EQUIPMENT TYPE	MAKE/MODEL SERIAL NUMBER	LAST CAL. DD/MM/YY	DUE DATE DD/MM/YY	CAL. INTERVAL
EMI RECEIVER	HP8574B CISPR Receiver Sn.3146A01297 including MIL-STD-462 Bandwidths	21/11/97	21/11/98	1 YEAR *2
ANTENNAS	EMCO 3109 BICONICAL 20 - 300MHz Sn. 2660	30/09/97	30/09/98	1 YEAR *3
	EMCO 3146A LOG PERIODIC 300 -1000MHz Sn. 1205	30/09/97	30/09/98	1 YEAR *3

Note *1. National Measurements Laboratory calibration.

Note *2. NATA calibration by Hewlett-Packard (Aust) Ltd

Note *3. In-house calibration. Refer to Quality Manual.

Note *4 Calibration not required

TEST SITES

Shielded Room Test Laboratory	Melbourne 11m x 8m x 4m Test Chamber 8.8m x 5.8m x 3.1m Test Chamber 3.4m x 6.1m x 2.5m Test Chamber 3.4m x 7.3m x 7.5m Test Chamber			Not required
Open Area Test Site	Melbourne 3/10 Metre site. 1-4 metre antenna mast. 1.2 metre/400 kG Turntable. (Situating at Glenlyon, near Daylesford, Victoria)	25-07-97	25-07-98	1 Year

APPENDIX B1

PHOTOGRAPHS OF TEST SAMPLE

SUBMITTED UNDER EXHIBITS
AS
EXTPHOTO.JPG
and
INTPHOTO.JPG

APPENDIX C

**TEST SAMPLE CIRCUIT ASSEMBLY DIAGRAMS
SUBMITTED UNDER EXHIBITS
AS
SCHEMAT.DOC**

APPENDIX D

**FCC ID LABELLING
SUBMITTED UNDER EXHIBITS
AS
IDLABEL.DOC**

APPENDIX E

**USER INSTRUCTIONS
SUBMITTED UNDER EXHIBITS
AS
USERMAN1.DOC
USERMAN2.DOC
USERMAN3.DOC**

APPENDIX F

GRAPHS OF EMI MEASUREMENTS

RADIATED EMI

30 MHz to 1000 MHz

Graph 1: Vertical Polarisation

Graph 2: Horizontal Polarisation

25 MHz to 89 MHz

Graph 3: Vertical Polarisation

Graph 4: Horizontal Polarisation

**GRAPHS
SUBMITTED UNDER EXHIBITS
AS
GRAPH1.JPG
GRAPH2.JPG
GRAPH3.JPG
GRAPH4.JPG**