

WAVE CORPORATION

TEST REPORT

REPORT NO. : E-1832

REFERENCE DOCUMENTS : FCC 15 CFR

TEST SITE FILE NO. : 31040/SIT
1300F2

DATE TESTED : February 13 and 23, 1998

EQUIPMENT TESTED

PET NAME : DIGITIZER

MODEL NUMBER : GD-1218-R

FCC ID : HV4GD1218R

TESTED FOR COMPLIANCE WITH : FCC 15 CFR FOR CLASS B
DIGITAL DEVICES OF SUBPART B and C

APPLICANT : WACOM Co., Ltd.
2-510-1 Toyonodai, Otone-machi,
Kitasaitama-gun, Saitama
349-1148, JAPAN

TEST RESULT : The above mentioned product has
been tested and passed.

REPORTED : March 20, 1998

WAVE CORPORATION

Oosawa 575, Yoshii-cho,
Tano-gun, Gunma, 370-2125,
JAPAN

PRESIDENT

Katsuyuki Arai

WAVE CORPORATION

TABLE OF CONTENTS

	<u>TITLE</u>	<u>PAGE NUMBER</u>
1.0	SCOPE	1
1.1	DESCRIPTION OF EQUIPMENT	1
1.2	GENERAL INFORMATION	2
2.0	REFERENCE DOCUMENTS	3
2.1	FCC DOCUMENTS	3
2.2	OTHER DOCUMENTS	3
3.0	DEFINITIONS	3
4.0	GENERAL TEST CONDITIONS	3
4.1	TEST SITES	3
4.1.1	OPEN FIELD TESTS	3
4.1.2	SHIELDED ENCLOSURE (SCREEN ROOM)	3
4.1.3	INDIVIDUAL EQUIPMENT TEST REQUIREMENTS	3
4.2	MEASUREMENT INSTRUMENTATION	3
4.2.1	MEASURING INSTRUMENT CALIBRATION	4
4.2.2	DETECTOR FUNCTION SELECTION AND BANDWIDTH	4
4.2.3	UNITS OF MEASUREMENT	4
4.2.4	ANTENNAS	4
4.3	FREQUENCY RANGE TO BE SCANNED	4
4.4	DATA REPORTING FORMAT	4
4.5	CONFIGURATION OF EQUIPMENT UNDER TEST (EUT)	4
4.5.1	TEST CONDITIONS FOR EUT	5
4.5.2	OPERATING CONDITIONS	5
4.5.3	CONDITIONS OF THE EUT	5

WAVE CORPORATION

TABLE OF CONTENTS

	<u>TITLE</u>	<u>PAGE NUMBER</u>
4.5.4	INTERFACING PORTS	5
4.5.5	EUT GROUNDING	5
4.6	TEST ENVIRONMENT	6
4.6.1	AMBIENT RADIO NOISE AND SIGNALS	6
4.6.2	TEMPERATURE	6
4.7	ARRANGEMENT OF EUT (ON TEST SITE)	6
4.8	GROUND PLANE	6
5.0	CONDUCTED POWERLINE MEASUREMENTS	6
5.1	CONDUCTED POWERLINE TEST CONFIGURATIONS	6
5.2	LINE IMPEDANCE STABILIZATION NETWORK (LISN)	6
5.3	GROUNDING	7
5.4	MEASUREMENT PROCEDURE	7
5.4.1	EUT POWER LEADS	7
5.4.2	SHIELDED POWER LEADS	7
6.0	RADIATED EMISSION MEASUREMENTS	8
6.1	DETERMINATION OF TEST RADIAL	8
6.2	RADIATED RADIO NOISE TESTS	8
7.0	RADIATED EMISSION MEASUREMENT TEST RESULTS	9
7.1	TEST SETUP	9
7.2	TEST EQUIPMENT	10
7.3	TEST PROCEDURE	11
7.4	RADIATION LIMIT	14
7.5	AMBIENT CONDITONS	14
7.6	TEST RESULTS	14

WAVE CORPORATION

TABLE OF CONTENTS

	<u>TITLE</u>	<u>PAGE NUMBER</u>
8.0	CONDUCTED POWERLINE TEST RESULTS	19
8.1	TEST SETUP	19
8.2	TEST EQUIPMENT	19
8.3	TEST PROCEDURE	20
8.4	MAXIMUM VOLTAGE, RADIO FREQUENCY	20
8.5	AMBIENT CONDITIONS	20
8.6	TEST RESULTS	20
9.1	RADIATED TEST CONFIGURATION	23
9.2	LINE CONDUCTED TEST CONFIGURATION	24
10.0	DIGITIZER (GD-1218-R)	25
11.0	GD-1218-R BLOCK DIAGRAM	26

1.0 SCOPE

The test data contained in this report was obtained utilizing test procedures, equipment, and sites which were either approved by or prescribed by the Federal Communications Commission (FCC). The test procedures described herein are the established methods for the measurement of radio noise emitted from digital devices as defined in Section 15.3 of the FCC Rules. The technical standards for digital devices are set forth in Section 15.31 of FCC Rules (47 CFR 15). Methods for the measurement of radiated and powerline conducted radio noise are covered herein. These methods of measurement are those used by the FCC in testing digital systems, intended to be used with digital devices.

1.1 DESCRIPTION OF EQUIPMENT

The GD-1218-R is an electronic device that transmits coordinate data to software running on a host computer.

This device typically includes a flat drawing surface called a "tablet", a drawing tool called "stylus" or "puck" which is referred to generally as "pointing device".

WAVE CORPORATION

1.2 GENERAL INFORMATION

APPLICANT	WACOM Co., Ltd. 2-510-1 Toyonodai, Otone-machi, Kitasaitama-gun, Saitama 349-1148, JAPAN
MANUFACTURER	WACOM Co., Ltd. 2-510-1 Toyonodai, Otone-machi, Kitasaitama-gun, Saitama 349-1148, JAPAN
EQUIPMENT TESTED	
PET NAME	DIGITIZER
MODEL NUMBER	GD-1218-R
FCC ID	HV4GD1218R
HIGHEST FREQUENCY USED IN THE EQUIPMENT	18.432MHz
RADIATED FREQUENCIES FROM THE INTENTIONAL RADIATOR	384.0KHz 460.8KHz
TEST SITE	FCC FILE NO. : 31040/SIT 1300F2 WAVE CORPORATION Oosawa 575, Yoshii-cho, Tano-gun, Gunma, 370-2125, JAPAN
TESTED FOR COMPLIANCE WITH	FCC 15 CFR FOR CLASS B DIGITAL DEVICES OF SUBPART B and C
Measurement Standard	ANSI C63.4(1992)
FREQUENCY RANGE INVESTIGATED	0.009MHz To 1GHz

4.2.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment which was utilized in performing the tests documented herein has been calibrated in accordance with the manufacturer's recommendations utilizing calibration equipment which are traceable to recognized national standards.

4.2.2 DETECTOR FUNCTION SELECTION AND BANDWIDTH

All conducted and radiated radio noise emission testing was performed utilizing Spectrum Analyzer and radio noise meters incorporating CISPR quasi peak function, if a weighting circuit was employed in that instrument.

4.2.3 UNIT OF MEASUREMENT

Measurements of radiated interference are reported in microvolts per meter of dB(uV/m) at the specified distance. Measurements of conducted radio noise interference are reported in terms of microvolts or dB(uV).

4.2.4 ANTENNAS

Measurements are made using calibrated, tuned halfwave dipole antennas, biconical and log periodic antennas. Heights and positioning of antennas for specific tests are indicated in Section 7.0.

4.3 FREQUENCY RANGE TO BE SCANNED

The frequency range from 9 KHz to 1,000 MHz is searched for radiated emissions. The frequency range from 450 KHz to 30 MHz was searched for conducted emission. Test set-ups were as diagramed in section 7.0.

4.4 DATA REPORTING FORMAT

All data is recorded and reported in accordance with part 15 and other applicable documents.

4.5 CONFIGURATION OF EQUIPMENT UNDER TEST (EUT)

For digital devices designed to be part of a multi-unit system, the EUT shall be installed in a typical system and configured in accordance with the manufacturer's instructions. It shall also be operated in a manner that is representative of the typical usage for that EUT. During all tests, the EUT and all system components shall be manipulated within the confines of typical usage to maximize each emission.

4.5.1 TEST CONDITIONS FOR EUT

Part 15 provides that the (EUT) shall be configured and operated in a manner which will tend to maximize its emission characteristics in a typical application. Power and signal distribution, grounding, interconnecting cabling and physical placement of equipment or equipments of a test system shall simulate the typical application and usage to maximize the emission characteristics in so far as practicable. The EUT shall be furnished with rated (nominal) voltage as specified in the individual-equipment power requirements. The power supplied to the EUT may need to be filtered to meet the requirements of 4.6.1. (refer to Section 7.0 for actual test conditions.)

4.5.2 OPERATING CONDITIONS

Part 15 provides that the EUT shall be operated at the specified load conditions (mechanical and / or electrical), to maximize the emission characteristics, for which it is designed. Section 7.0 describes the actual test conditions during this test.

4.5.3 CONDITIONS OF THE EUT

The EUT was operated prior to testing to allow it to stabilize to a normal operating condition.

4.5.4 INTERFACING PORTS

A digital device containing interface ports shall have each port connected to an appropriate peripheral for the purposes of testing a typical configuration. If the EUT incorporates multiple interface ports for connection of identical peripherals, only one external peripheral of each type needs to be attached to the EUT during testing, provided it can be shown through testing that the use of any additional peripherals would not take the system out of compliance. Otherwise, all interface ports on the EUT shall have an external peripheral connected to it. Refer to paragraph 7.1 for a description of the test setup.

4.5.5 EUT GROUNDING

The EUT was grounded in accordance with the manufacturer's instructions.

4.6 TEST ENVIRONMENT

The environment at the test site satisfied the requirements of FCC 47 CFR, Part 15 with respect to ambient radio noise and signals.

4.6.1 AMBIENT RADIO NOISE AND SIGNALS

The ambient levels during this test were at or below the limits prescribed in FCC Part 15 CFR and related documents.

4.6.2 TEMPERATURE

The ambient temperature during this test was within the recommended limits for this equipment. The actual conditions are described in paragraph 8.1.

4.7 ARRANGEMENT OF EUT (on test site)

The EUT unit or units and interconnecting cables were placed in the worst case positions. The actual test set-up is diagrammed in section 7.0.

4.8 GROUND PLANE

A ground screen is used for open field site testing when required to meet the FCC quality requirements.

5.0 CONDUCTED POWERLINE MEASUREMENTS

Conducted powerline measurements were made in compliance with Part 15 utilizing a LISN.

5.1 CONDUCTED POWERLINE TEST CONFIGURATIONS

The EUT was configured as illustrated in Section 8.0.

5.2 LINE IMPEDANCE STABILIZATION NETWORK (LISN)

A LISN with characteristics which conform to the requirements of Part 15 was used for the measurement of conducted powerline noise. Any correction factors used are indicated in Section 8.0.

5.3 GROUNDING

All conducted powerline measurements were performed with the LISN housing, measurement instrumentation case, ground planes, etc., electrically bonded together in such a manner that they were at the same RF potential.

5.4 MEASUREMENT PROCEDURE

Powerline conducted radio noise measurements were made at the plug end of the EUT power cord by the use of mating plugs and receptacles on the EUT and LISN.

5.4.1 EUT POWER LEADS

Refer to Section 8.0. for power lead configuration.

5.4.2 SHIELDED POWER LEADS

Equipment shall be connected to the LISN and tested with leads belonging to the equipment.

6.0 RADIATED EMISSION MEASUREMENTS

Measurements of radiated radio-noise were made using the measuring instrumentation and antenna specified in 4.2 and 4.2.4 respectively. Radiation from the EUT including radiation from all signal and power cabling was measured. Consistent with Section 4, above, the EUT was set up and operated to maximize the emission characteristics in a manner representative of actual use.

6.1 DETERMINATION OF TEST RADIAL

Radiated emission magnitudes were obtained in the azimuthal direction of maximum field strength for each predominant emission. Primarily, tests were made to determine the system spectrum signature, the strengths of the stronger emissions, and the directions in which these emerge from the system. During this testing, EUT arrangement was varied within the scope of expected usage to maximize radiations.

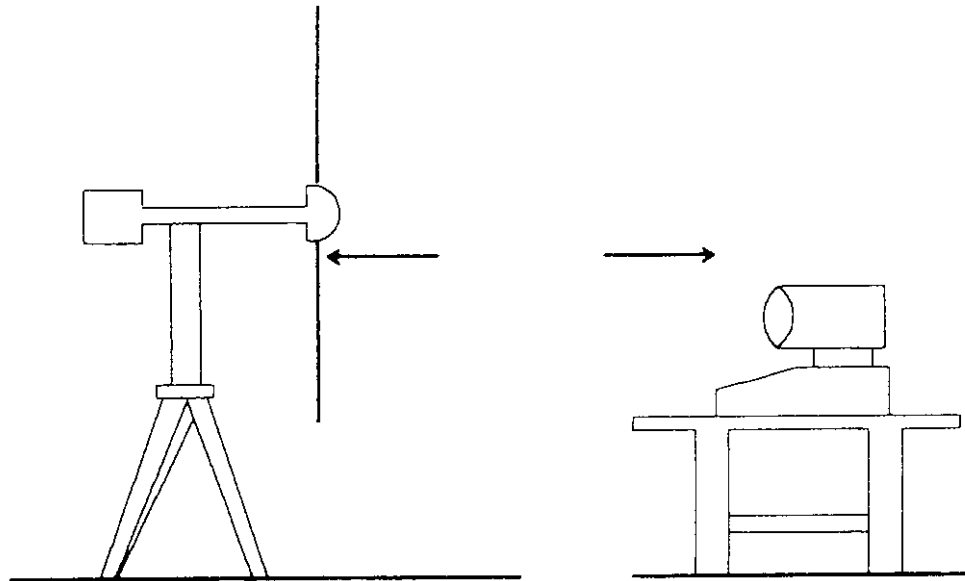
6.2 RADIATED RADIO NOISE TESTS

Radiated radio noise measurements are made at the test site described in 4.1 above. The EUT subject to radiated limit at 3 meters, shall be measured at a distance of 3 meters. Equipment subject to a limit at 10 meters would be measured at a distance of from 3 to 10 meters provided that the results are extrapolated to equivalent signals at 10 meters utilizing an inverse distance extrapolation factor (20 dB/decade). At test distances between 3 meters and 10 meters, the antenna is varied in height between 1 meter and 4 meters above ground, to determine the maximum level of emissions with this range. Both horizontal and vertical orientation of the search antenna were employed and maximum values reported. For vertical polarization, the bottom end of the dipole is kept at least 25 cm above site ground.

7.0 RADIATED EMISSION MEASUREMENT TEST RESULTS

7.1 TEST SET-UP

All measurements were made as described in Section 6.0. The diagram below shows the test set-up which was utilized to make these measurements.



WAVE CORPORATION

7.2 TEST EQUIPMENT

The following equipment was utilized in making the measurements contained in this reports.

MANUFACTURER OR TYPE	MODEL NO.	SERIAL NO.	CALIBRATION DUE
H. P. PLOTTER	7550A	2407A01925	
NEC COMPUTER	PC9801BA2	21	
H. P. SPECTRUM ANALYZER	8567A	2841A00585	04 / 98
ROHDE & SCHWARZ TEST RECEIVER	ESV	892564/024	08 / 98
H. P. PREAMPLIFIER	8447D	1937A03312	04 / 98
SCHWARZBECK BICONICAL ANTENNA	BBA9106	07	06 / 98
EMCO LOG PERIODIC ANTENNA	3146	9212-3483	06 / 98
SCHWARZBECK DIPOLE ANTENNA	VHAP	409	11 / 98
SCHWARZBECK DIPOLE ANTENNA	UHAP	409	11 / 98
H. P. SPECTRUM ANALYZER	8593E	3639A0254	11 / 98
H. P. 50GHz PREAMPLIFIER	83051A	332A00353	07 / 98
EMCO DOUBLE RIDGED GUIDE ANTENNA	3116	9610-2321	06 / 98
ADVANTEST DOUBLE RIDGED GUIDE ANTENNA	TR17206	23370003	06 / 98
ABSORBING CLAMP	MDS-21	871603	04 / 98
H. P. SPECTRUM ANALYZER	8564E	070203000	05 / 98
EMCO Line Probe	3701	1165	05 / 98
ACTIVE ROD ANTENNA	3301B	9609-3764	10 / 98
ROHDE & SCHWARZ TEST RECEIVER	ESH2	892237/017	08 / 98

* Calibration performed in accordance with manufacturer specifications.

7.3 TEST PROCEDURE

The device under test was placed on a rotatable table, if the device was floor-standing equipment. The devices under test were placed on a rotatable table top 80 cm above ground, if the devices were table-top equipments. The E.U.T. was rotated 360 degrees to determine the position of highest radiation. At 3 or 10 meters distance away, the interference receiving antenna was mounted on top of a variable height tripod. The antennas used were a tunable dipole, biconical and log periodic antennas. The height was varied between one meter and four meters above ground. Both horizontal and vertical polarization of the antenna was used to make the measurements. Refer to figure 1 for measuring conditions.