

SINGAPORE PRODUCTIVITY AND STANDARDS BOARD

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CERTIFICATE OF COMPLIANCE

GES Singapore Pte Ltd
28 Marsiling Lane
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Republic of Singapore

Date of Test: Sept 3, 1998
Test Report No.: EMC/R/00848
Job No.: 980198700

Attention: Mr. Li Jian Xin

FCC IDENTIFIER

FCC ID JUK0898GES101

NAME OF APPLICANT

GES Singapore Pte Ltd

FCC Rule Part(s) : Part 15, Docket 87-389 (Note Code#37)
Equipment Class : Class B Personal Computer/ Peripheral
EUT Type : Point of Systems of Sale
Crystal/Oscillator(s) : 33 MHz
Model No. : P101A

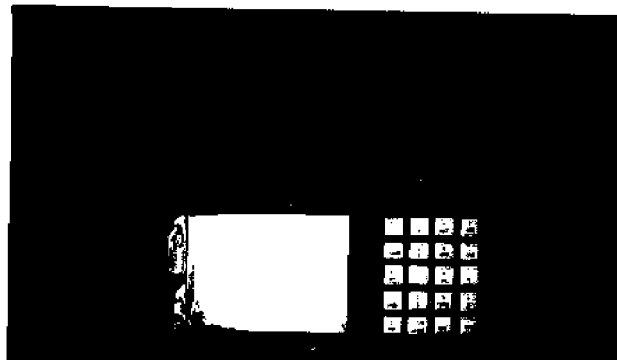
This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4 (1992).

I attest to the accuracy of data and all measurements reported herein which were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

PSB certifies that no party of this application has been denied the FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 853(a).



Colin Garl
Head



TEST REPORT

Your Ref : Date : 13 October 1998

Our Ref : EMC/R/00848
(Please quote our ref. no. in reply)

Page : 1 of 12

DID : 7729722

Fax : 7758725



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TESTING
No. 1372

FORMAL REPORT ON TESTING IN ACCORDANCE WITH FCC PART 15B : 1996 CLASS B

OF A

POINT OF SALES SYSTEM - QUANTUM

[Model: P101A]

[FCC ID: JUK0898GES101]

TEST FACILITY PSB Electrical & Electronics Test Centre
1 Science Park Drive
Singapore 118221

FCC FILING 31040/SIT 1300B3

ACCREDITATION The EETC (EMC) is accredited under UKAS to carry out the above-mentioned test(s). The results reported herein have been performed in accordance with the laboratory's terms of accreditation.

UKAS Cert No : 1372

PREPARED FOR Mr. Li Jian Xin
GES Singapore Pte Ltd
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Singapore 739152

TEST JOB NO. 980198700

TEST PERIOD 3 Sept 98 - 27 Sept 98

PREPARED BY

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TEST SUMMARY

The tests were carried out in accordance with the customer's specifications. From the results obtained, **Quantum, the Point of Sales System [Model: P101A]** with **FCC ID: JUK0598GES101**, was found to comply with FCC Part 15B: 1996 Class B requirements for personal computers and peripherals.

Modifications

No modification was made.

Note

1. The radiated emissions measured results at 131.7700MHz and 164.6750MHz are below the specification limit by a margin of 2.3dB and 2.0dB respectively, which is less than the measurement uncertainty. Hence, it is not possible to determine compliance at a confidence level of 95%. However, the measured result indicates a higher probability that the CUT complies with the specification limit.

PRODUCT DESCRIPTION

EUT Description	:	The Equipment Under Test (EUT) is a Point of Sales System . It combines serial/parallel interface, RS485/422 networking, customer display, and magnetic stripe reader in a small design to maximize the flexibility and saves counter space. It is a low cost, high performance machine with an advanced design for the retail environment.
EUT Manufacturer	:	GES Singapore Pte Ltd
EUT Model Number	:	P101A
EUT Serial Number	:	88GM0000023
Microprocessor	:	enhanced AM386 SXLV
Clock/Oscillator Frequency	:	33MHz
Port/Connectors	:	1 x parallel port (printer port) 4 x RS-232 ports (COM A, COM B, COM C and D) 1 x RS485 port 1 x PS/2 port (keyboard port) 1 x RJ-11 port 1 x DC power input
A.C. Input Power	:	115V a.c., 60Hz
Modifications	:	No modifications done

TEST CONFIGURATION DESCRIPTION

Supporting Equipment Description

The EUT and the following supporting equipment formed the required test system:

<u>Description & Model</u>	<u>FCC ID & Serial No</u>	<u>Cable Description</u>
HP Keyboard Model E03633WLUS-C	FCC ID CIGE03633 S/No Nil	1.6m keyboard cable with ferrite
HP ThinkJet Printer Model 2225C	FCC ID BS46XU2225C S/No 2550S41627Z	1.2m shielded printer power cable 1.4m unshielded power cable
Epson Link 1200 Modem Model C202A	FCC ID BKM552C202A S/No 010325	1.2m shielded serial cable 1.4m unshielded power cable with power adapter
Cash Drawer Model CD-3100-H	FCC ID Nil S/No PS7001316	1.0m unshielded RJ11 cable
GES Point of Sales System, Quantum (EUT) Model P101A	FCC ID JUK0898GES101 S/No 88GM0000023	1.4m unshielded power cable with power adapter
Tiger Power Adapter Model ADP-5501	FCC ID: Nil S/No M980055807	1.4m unshielded power cable

Test Configuration

The various ports of the system were loaded, representative of normal usage, as follows:

1. The printer was connected to the parallel port of the EUT.
2. The modem was connected to the serial port (COM B) of the EUT.
3. The phone jack of the modem was terminated with a 600Ω load.
4. The cash drawer was connected to the RJ11 port of the EUT.
5. The keyboard was connected to the PS/2 port (keyboard port) of the EUT.
6. The COM C port of the EUT was terminated with a proper load impedance to simulate the presence of the EUT peripheral at this port.
7. The RS-485 port of the EUT was terminated with a proper load impedance to simulate the presence of the EUT peripheral at this port.

The whole system was powered from 115V a.c., 60Hz mains supply.

TEST OPERATING CONDITIONS

Conducted and Radiated Emissions

The EUT was exercised in the following manner during the conducted and radiated emissions tests:

The EUT was **exercised** by running the customer's built-in programme. The programme enables the exercising of various ports of the EUT with the peripherals attached to simulate the actual usage application.

TEST INSTRUMENTATION

The following test instrumentation were used :

Conducted Emissions Test Instrumentation (3m OATS)

<u>Instrument</u>	<u>Model</u>	<u>S/No</u>	<u>Cal Due Date</u>
R&S Test Receiver (9 kHz - 30 MHz)	ESH3	862301/005	26 Feb 2000
R&S Pulse Limiter	ESH3-Z2	357.8810.52	22 Oct 1998
R&S LISN (for EUT)	ESH2-Z5	862060/017	8 Oct 1999
EMCO LISN (for others)	3825/2	9309-2128	N.A.

Radiated Emissions Test Instrumentation (10m OATS)

<u>Instrument</u>	<u>Model</u>	<u>S/No</u>	<u>Cal Due Date</u>
R&S Test Receiver	ESPC	848553/0005	28 Nov 1998
EMCO Biconical Antenna	3109	9310-2759	22 Oct 1998
EMCO Log-periodic Antenna	3146	9110-3240	22 Oct 1998

CONDUCTED EMISSIONS TEST DESCRIPTION

Test Setup

1. The test setup was in accordance with ANSI C63.4, 1992.
2. The EUT and other supporting equipment were arranged on top of a 1.5m x 1m x 0.8m high table, as shown in Appendix B.
3. The 50 Ω /50 μ H EUT LISN was connected to filtered mains.
4. The a.c. power supply for the EUT was tapped from the EUT LISN.
5. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
6. All other supporting equipment were powered separately from another LISN.

Test Method

The test was performed in the following manner:

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A quick scan, from 450kHz to 30MHz, was made on the NEUTRAL line.
3. High peaks, relative to the limit line, over the frequency range were then selected.
4. The EMI test receiver was then tuned to the selected frequencies. CISPR quasi-peak measurements with a receiver bandwidth setting of 10kHz were taken.
5. Steps 2 to 4 were then repeated for the LIVE line.

RADIATED EMISSIONS TEST DESCRIPTION

EUT Characterisation

EUT characterisation, over the frequency range 30MHz to 1GHz, was done in order to minimise radiated emission testing time while still maintaining high confidence in the test results.

The EUT was placed in a shield room, at a height of about 1m on a turntable, and its radiated emissions frequency profile was observed, using a spectrum analyzer with the appropriate broadband antenna placed 1m away from the EUT. Radiated emissions from the EUT were maximised by rotating the turntable manually, changing the antenna polarisation and manipulating the EUT cables while observing the frequency profile on the spectrum analyzer. Frequency points at which maximum emissions occurred, clock frequencies and operating frequencies were then noted for the formal radiated emissions test at PSB's Open Area Test Site (OATS).

Test Setup

1. The test setup was in accordance with ANSI C63.4: 1992.
2. The EUT and other supporting equipment were setup on a 1.5m X 1.0m X 0.8m high table placed on top of a turntable as shown in Appendix B.
3. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the ground plane.
4. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

Test Method

The test was performed in the following manner:

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Emission maximization was carried out by varying the antenna polarization, antenna height and turntable direction in the following manner:
 - a. Vertical or horizontal polarisation (whichever gave the higher emission level) was chosen.
 - b. The turntable was rotated to the direction that gave maximum emissions.
 - c. The antenna height was adjusted to the height that gave maximum emissions.
3. A quasi peak measurement was then made at the frequency point.
4. Steps 2 and 3 were then repeated for the next frequency point.
5. The frequency range covered was from 30MHz to 1GHz, using the biconical antenna for frequencies up to 200MHz, and the log-periodic antenna for frequencies above 200MHz.

TEST RESULTS

Conducted Emissions FCC Part 15B: 1996 Class B Results

FREQUENCY (MHz)	Q-P VALUE (dB μ V)	Q-P MARGIN (dB)	LINE
1.4081	36.9	-11.0	NEUTRAL
1.6702	38.8	-9.1	NEUTRAL
1.8956	38.2	-9.7	NEUTRAL
7.8784	36.7	-12.2	NEUTRAL
7.9034	35.5	-12.4	LIVE
9.3480	35.3	-12.6	LIVE

NOTES

1. All possible modes of operation were investigated, and only the 6 worst case emissions measured, using a CISPR quasi-peak detector, are reported. All other emissions were insignificant.
2. The Conducted Emissions FCC Part 15B: 1996 Class B limit is 250 μ V(47.9dB μ V) from 450kHz to 30MHz.
3. A "live" Q-P indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
4. All measuring equipment are calibrated with traceability to NPL (UK) or NIST (USA).

MEASUREMENT UNCERTAINTIES

All test measurements carried out are traceable to UK National Standards where obtainable. The uncertainty of the measurement is ± 2.4 dB at a confidence level of approximately 95%, with a coverage factor of 2.

Conducted emissions (Voltage)

9 kHz - 30 MHz (Average and Quasi-peak) ± 2.4 dB

TEST RESULTS

Radiated Emissions FCC Part 15B: 1996 Class B Results

FREQUENCY (MHz)	Q-P VALUE (dB μ V/m)	Q-P MARGIN (dB)	POL (h/v)	HEIGHT (m)	AZIMUTH (Degrees)
36.4000	35.7	-4.3	v	1.09	0
52.8000	32.8	-7.2	v	1.10	0
65.8650	28.6	-11.4	v	1.47	341
101.7700	41.2	-2.3	v	1.10	78
164.6750	41.5	-2.0	h	1.88	95
184.3150	35.9	-7.6	h	1.10	204

NOTES

- All possible modes of operation were investigated, and only the 6 worst case emissions, measured, using a CISPR quasi-peak detector, are reported. All other emissions were insignificant.
- The above Q-P values were measured at a 3m test distance.
- The Radiated Emissions FCC Part 15B: 1996 Class B limit (@ 3m) is:
 100 μ V/m (40.0dB μ V/m) from 30MHz to 88MHz
 150 μ V/m (43.5dB μ V/m) from 88MHz to 216MHz
 200 μ V/m (46.0dB μ V/m) from 216MHz to 960MHz
 500 μ V/m (54.0dB μ V/m) above 960MHz
- A "-ve" Q-P margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
- All measuring equipment are calibrated with traceability to NPL (UK) or NIST (USA).

MEASUREMENT UNCERTAINTIES

All test measurements carried out are traceable to UK National Standards where obtainable. The uncertainty of the measurement is ± 4.3 dB at a confidence level of approximately 95%, with a coverage factor of 2.

Radiated emissions (OATS)

30 MHz - 1 GHz (QP only @ 3m and 10 m) ± 4.3 dB (For EUT not bigger than 0.5m X 0.5m X 0.5m)

SAMPLE CALCULATIONS

$$\text{dB}\mu\text{V} = 20 \log_{10}(\mu\text{V})$$

$$\text{dB}\mu\text{V/m} = 20 \log_{10}(\mu\text{V/m})$$

Example 1 - For Conducted Emissions

At 20 MHz Class B limit = 250 μV = 47.96 dB μV

Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.2 dB

Q-P reading obtained directly from EMI Receiver = 40 dB μV
(Calibrated for system losses)

Therefore, Q-P margin = 40 - 47.96 = -7.96

i.e. 7.96 dB below limit

Example 2 - For Radiated Emissions

At 300 MHz Class B limit = 200 $\mu\text{V/m}$ = 46 dB $\mu\text{V/m}$

Log-periodic antenna factor & cable loss at 300 MHz = 18.511 dB

Q-P reading obtained directly from EMI Receiver = 40 dB $\mu\text{V/m}$
(Calibrated level including antenna factors & cable losses)

Therefore, Q-P margin = 40 - 46 = -6

i.e. 6 dB below limit