

# TEST REPORT

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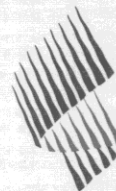
Date : 28 May 1998

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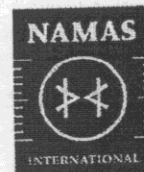
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TESTING  
No. 1372



CERT.NO.: SL97110-E

## FORMAL REPORT ON TESTING IN ACCORDANCE WITH FCC PART 15B : 1997 CLASS B

OF A

**LCD MONITOR**  
**[MODEL : P612A]**  
**[FCC ID : JUK0398GES612]**

### TEST FACILITY

PSB EMC Test Centre  
1 Science Park Drive  
Singapore 118221

### FCC FILING

31040/SIT 1300B3

### ACCREDITATION

The EMC Test Centre is accredited under UKAS and SINGLAS 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

SINGLAS Cert No : SL97110-E

### PREPARED FOR

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### TEST JOB NO.

980008900

### TEST PERIOD

14 April 98 – 20 May 98

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## TEST SUMMARY

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The tests were carried out in accordance with the customer's specifications. From the results obtained, the **LCD Monitor [model : P612A]** with **FCC ID : JUK0398GES612**, was found to comply with FCC Part 15B : 1996 Class B requirements for personal computers and peripherals.

### Modifications

1. Resistors R21 - R23, R25 - R28, R30 - R40, R42 - R46, R48 - R65 were changed from 22 $\Omega$  to 150 $\Omega$ .
2. The firmware in 64K x 8 Eeprom, U7 (AT27C512R-12JC) was modified to set the output frequency of the clock generator, U10 (ICS3161A-OCW) from 41MHz to 30MHz to drive the digital signal to LCD panel.
3. The EUT power adapter cable was coiled 4 turns around a ferrite core, AR 5H 28.5 x 28.5 x 13.7.
4. Two resistors, R680 $\Omega$  and 1.2k $\Omega$  respectively labelled with R135 and R136 were added to the EUT PCB board.

### Note

1. The measured results of radiated emissions test at 46.0485MHz and 276.4994MHz are below the specification limit by a margin of 2dB and 2.3dB 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 EUT complies with the specification limit.

## PRODUCT DESCRIPTION

|                            |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EUT Description            | : | <p>The Equipment Under Test (EUT) is a <b>LCD Monitor</b>. It is a slim and compact monitor which uses only 30% of the normal space required by other conventional monitors, hence, it increases the workplace tremendously.</p> <p>The LCD monitor's unique design stands apart from all current systems. A simple and elegant provides the optimum viewing position, from a forward and backward tilt, both the angle of viewing and the height can be adjusted to provide the user with an identical viewing posture. User controls for the OSD (On Screen Display) are placed in an easily reachable level to the right of the screen.</p> <p>For a monitor this slim, its performance is both very impressive as well as outstanding. The LCD monitor has a SVGA (800 x 600) resolution. It delivers bright, sharp screen performance in a slim, lightweight package with exceptional image clarity, focus and intense colour saturation and tailored specifically for everyday home and office applications.</p> |
| EUT Manufacturer           | : | GES Singapore Pte Ltd                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| EUT Model Number           | : | P612A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| EUT Serial Number          | : | 83GS007008                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Microprocessor             | : | 80C32                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Clock/Oscillator Frequency | : | 11.059MHz, 14.318MHz, 30MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Operating Mode/Resolution  | : | Text (720 x 400)<br>VGA (640 x 480)<br>SVGA (800 x 600)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Port/Connectors            | : | DC power jack, audio port, VGA port                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Input Power                | : | 12VDC, 2A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Modifications              | : | <ul style="list-style-type: none"><li>a. Resistors R21 - R23, R25 - R28, R30 - R40, R42 - R46, R48 - R65 were changed from 22<math>\Omega</math> to 150<math>\Omega</math>.</li><li>b. The firmware in 64K x 8 Eprom, U7 (AT27C512R-12JC) was modified to set the output frequency of the clock generator, U10 (ICS3161A-OCW) from 41MHz to 30MHz to drive the digital signal to LCD panel.</li><li>c. The EUT power adapter cable was coiled 4 turns around a ferrite core, AR 5H 28.5 x 28.5 x 13.7.</li><li>e. Two resistors , R680<math>\Omega</math> and 1.2k<math>\Omega</math> respectively labelled with R135 and R136 were added to the EUT PCB board.</li></ul>                                                                                                                                                                                                                                                                                                                                              |

## TEST CONFIGURATION DESCRIPTION

### Supporting Equipment Description

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

| <u>Description &amp; Model</u>         | <u>FCC ID &amp; Serial No</u>            | <u>Cable Description</u>                                   |
|----------------------------------------|------------------------------------------|------------------------------------------------------------|
| HP PC<br>Model Vectra VL5/200MMX.      | FCC ID DOC<br>S/No SG7400819             | 1.8m unshielded power cable                                |
| HP Keyboard<br>Model E03633YLUS3-C     | FCC ID CIGE03633<br>S/No Nil             | 1.8m keyboard cable with ferrite                           |
| HP ThinkJet Printer<br>Model 2225C     | FCC ID BS46XU2225C<br>S/No 2550S41627Z   | 1.4m shielded printer cable<br>1.8m unshielded power cable |
| HP Mouse<br>Model M-S34                | FCC ID DZL211029<br>S/No LZA63127167     | 1.8m mouse cable                                           |
| USRobotics Modem<br>Model 839          | FCC ID CJE-0340<br>S/No 0008390262051663 | 1.4m shielded modem cable                                  |
| GES LCD Monitor (EUT)<br>Model P612A   | FCC ID JUK0398GES612<br>S/No 83GS007008  |                                                            |
| EUT Power Adapter<br>Model SPN-460-12C | FCC ID N.A.<br>S/No Nil                  | 1.6m unshielded power adapter cable                        |

### Test Configuration

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

1. The mouse cable was connected to the mouse port of the PC.
2. The printer cable was connected to the parallel port of the PC.
3. The video cable of EUT was connected to the video port of the PC.
4. The modem cable was connected to the serial port (Serial A) of the PC.

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 LCD Monitor (EUT) was exercised by displaying scrolls of character 'H' on the screen with contrast and brightness control set to maximum.

In the meantime, the PC was exercised by

- a. writing 'H's to the printer and modem,
- b. writing 'H's to and reading 'H's from the harddisk and floppy disk in a read-write erase sequence.

## 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<br>(9 kHz - 30 MHz) | ESH3         | 862301/005  | 17 Aug 1998         |
| 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 (3m OATS)

| <u>Instrument</u>                       | <u>Model</u> | <u>S/No</u> | <u>Cal Due Date</u> |
|-----------------------------------------|--------------|-------------|---------------------|
| R&S Test Receiver<br>(20 MHz - 1.3 GHz) | ESVP         | 827419/001  | 17 Aug 1998         |
| EMCO Biconical Antenna                  | 3109         | 2758        | 22 Oct 1998         |
| EMCO Log-periodic Antenna               | 3146         | 3701        | 22 Oct 1998         |

## **CONDUCTED EMISSIONS TEST DESCRIPTION**

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### **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 $\Omega$ /50 $\mu$ 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:1997 Class B Results

| FREQUENCY<br>(MHz) | Q-P VALUE<br>(dB $\mu$ V) | Q-P MARGIN<br>(dB) | LINE    | MODE |
|--------------------|---------------------------|--------------------|---------|------|
| 0.4021             | 42.6                      | -5.3               | NEUTRAL | SVGA |
| 0.4010             | 42.3                      | -5.6               | LIVE    | SVGA |
| 0.4010             | 41.9                      | -6.0               | NEUTRAL | VGA  |
| 0.4010             | 41.9                      | -6.0               | LIVE    | VGA  |
| 0.4030             | 41.8                      | -6.1               | NEUTRAL | TEXT |
| 0.4010             | 41.2                      | -6.7               | LIVE    | TEXT |

### 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:1997 Class B limit is 250 $\mu$ V(47.9dB $\mu$ V) from 450kHz to 30MHz.
3. A "-ve" 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  $\pm 2.4$ 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)

$\pm 2.4$  dB

## TEST RESULTS

### Radiated Emissions FCC Part 15B:1997 Class B Results

| FREQUENCY<br>(MHz) | Q-P VALUE<br>(dB $\mu$ V/m) | Q-P MARGIN<br>(dB) | POL<br>(h/v) | HEIGHT<br>(m) | AZIMUTH<br>(Degrees) | MODE |
|--------------------|-----------------------------|--------------------|--------------|---------------|----------------------|------|
| 46.0485            | 38.0                        | -2.0               | v            | 1.00          | 209                  | SVGA |
| 146.5297           | 34.6                        | -8.9               | v            | 1.00          | 245                  | SVGA |
| 153.5719           | 34.2                        | -9.3               | h            | 1.00          | 244                  | VGA  |
| 276.4994           | 43.7                        | -2.3               | v            | 1.00          | 113                  | TEXT |
| 294.4081           | 40.7                        | -5.3               | h            | 1.00          | 340                  | VGA  |
| 300.8208           | 38.0                        | -8.0               | h            | 1.00          | 0                    | VGA  |

### 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:1997 Class B limit (@ 3m) is:
 

|                                  |       |                  |
|----------------------------------|-------|------------------|
| 100 $\mu$ V/m (40.0dB $\mu$ V/m) | from  | 30MHz to 88MHz   |
| 150 $\mu$ V/m (43.5dB $\mu$ V/m) | from  | 88MHz to 216MHz  |
| 200 $\mu$ V/m (46.0dB $\mu$ V/m) | from  | 216MHz to 960MHz |
| 500 $\mu$ V/m (54.0dB $\mu$ 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  $\pm 4$ . 3dB 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)

$\pm 4$ . 3dB (For EUT not bigger than 0.5m X 0.5m X 0.5m)

$$\text{dB}_{\mu\text{V}/\text{m}} = 20 \log (\mu\text{V}/\text{m})$$