ANNEX A

TEST INSTRUMENTATION & GENERAL PROCEDURES

3m OATS Test Instrumentation
(Conducted Emissions)

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (9kHz-30MHz)	ESH3	862301/005	2 May 2002
R&S Pulse Limiter	ESH3-Z2	357.8810.52	28 Apr 2002
EMCO LISN (for EUT) – LISN4	3816/2	9602-1036	28 Jun 2002

10m Anechoic Chamber Test Instrumentation
(Radiated Emissions)

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz – 26.5GHz) – ESMI2	ESMI	829214/006 829550/001	18 Jan 2002
HP Preamplifier (for ESMI1, 0.01-3GHz) – PA6	87405A	3950M00353	14 Apr 2002
MITEQ Preamplifier (0.1-26.5GHz) – PA10	NSP2650-N	728230	22 Mar 2002
Schaffner Bilog Antenna – BL4	CBL6112B	2593	9 May 2002
EMCO Horn Antenna – H15	3115	0003-6088	4 Oct 2001
EMCO Horn Antenna – H6	3116	0004-2473	19 May 2002

5m Anechoic Chamber Test Instrumentation
(Spectrum Bandwidth,Transmitted Power Density)

Instrument	Model	S/No	Cal Due Date
HP Spectrum Analyzer – SA2	8593E	3325A00702	18 Jul 2002

(Maximum Peak Power)

Instrument	Model	S/No	Cal Due Date
Boonton RF Power Meter	532	52101	5 Dec 2001
Boonton Power Sensor	51075	Nil	26 Mar 2002

(RF Conducted Spurious Emission at the Transmitter Antenna Terminal)

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz – 26.5GHz) – ESMI1	ESMI	849182/003 848926/007	28 Nov 2001

Maximum Permissible Exposure (MPE)Test Instrumentation

Instrument	Model	S/No	Cal Due Date
PMM Field meter	8053	0220J10308	14 Apr 2002
PMM Field Probe	EP330	1010J10301	17 Apr 2002

CONDUCTED EMISSIONS TEST DESCRIPTION

Test Set-up

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B.

2. The power supply for the EUT was fed through a 50Ω/50µH EUT LISN, connected to filtered mains.

3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.

4. All other supporting equipment were powered separately from another LISN.

Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.

2. A scan was made on the NEUTRAL line over the required frequency range using an EMI test receiver.

3. High peaks, relative to the limit line, were then selected.

4. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10kHz. For FCC tests, only Quasi-peak measurements were made; while for CISPR/EN tests, both Quasi-peak and Average measurements were made.

5. Steps 2 to 4 were then repeated for the LIVE line.

Sample Calculation Example

At 20 MHz limit = 250 µV = 47.96 dBµV

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

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

Therefore, Q-P margin = 40 - 47.96 = -7.96 i.e. **7.96 dB below limit**

RADIATED EMISSIONS TEST DESCRIPTION

EUT Characterisation

EUT characterisation, over the frequency range from 30MHz to 25GHz was done in order to minimise radiated emissions 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. 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 the Open Area Test Site (OATS).

Test Set-up

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table as shown in Annex B.

2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.

3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

Test Method

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. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:

   a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.

3. A Quasi-peak measurement was then made for that frequency point if the frequency under measurement was below 1GHz. Else, average measurement was taken.

4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

5. The frequency range covered was from 30MHz to 25GHz, using the Biconical antenna for frequencies up to 200MHz, the Log-periodic antenna for frequencies above 200MHz to 1GHz, and the Horn antenna above 1GHz.

Sample Calculation Example

At 300 MHz limit = 200 µV/m = 46 dBµV/m

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

Q-P reading obtained directly from EMI Receiver = 40 dBµV/m
(Calibrated level including antenna factors & cable losses)

Therefore, Q-P margin = 40 - 46 = -6 i.e. **6 dB below limit**

SPECTRUM BANDWIDTH TEST DESCRIPTION

Test Set-up

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B.

2. The power supply for the EUT was connected to a filtered mains.

3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.

4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 30kHz and 300kHz.

5. All other supporting equipment were powered separately from another filtered mains.

Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.

2. The 6dB bandwidth of the fundamental of the EUT transmitting / operating frequency was measured and recorded.

MAXIMUM PEAK POWER TEST DESCRIPTION

Test Set-up

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B.

2. The power supply for the EUT was connected to a filtered mains.

3. The RF antenna connector was connected to the RF power meter via a power sensor.

4. The RF power sensor was set to peak power measurement mode.

5. All other supporting equipment were powered separately from another filtered mains.

Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.

2. The peak power of the fundamental of the EUT transmitting / operating frequency was logged and recorded by the power meter.

RF CONDUCTED SPURIOUS EMISSION AT THE TRANSMITTER ANTENNA TERMINAL TEST DESCRIPTION

Test Set-up

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B.

2. The power supply for the EUT was connected to a filtered mains.

3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.

4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz.

5. All other supporting equipment were powered separately from another filtered mains.

Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.

2. The EUT was scanned from 10MHz to 25GHz and spurious emissions detected in this range were measured and recorded.

TRANSMITTED POWER DENSITY TEST DESCRIPTION

Test Set-up

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B.

2. The power supply for the EUT was connected to a filtered mains.

3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.

4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 3kHz and 30kHz.

5. All other supporting equipment were powered separately from another filtered mains.

Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.

2. The peak of the fundamental of the EUT transmitting / operating frequency was measured and recorded.

MAXIMUM PERMISSIBLE EXPOSURE (MPE) TEST DESCRIPTION

EUT Characterisation

EUT characterisation, over the required frequency range as given in table 1 of FCC Part 1.1310 was carried out to determine the EUT mode of operation that produces the highest possible level of radio frequency radiation.

The EUT was placed in a anechoic chamber, at a height of about 1m on a table. Its radio frequency radiation profile was observed, using a field meter with the appropriate field probe antenna attached and 20cm away from the EUT. E-field (V/m) readings are recorded, since the field meter is most sensitive at this setting. Positions where maximum E-field readings are detected are noted for the final, actual measurement.

Test Set-up

1. The EUT and supporting equipment were set up on top of a non-metallic table as shown in Annex B.

2. The relevant field probe was positioned at least 20cm away from the EUT and supporting equipment boundary.

Test Method

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 positions obtained from the EUT characterisation.

3. Power density measurement (mW/cm^2) was made using the field meter set to the required averaging time.

4. Steps 2 and 3 were repeated for the next position and its associate EUT operating mode, until all selected positions and modes were measured.

Sample Calculation Example

At 2400 MHz, limit = 1.0 mW/cm^2

Power density reading obtained directly from field meter = 0.3 mW/cm^2 averaged over the required 30 minutes.

Therefore, margin = 0.3 – 1.0 = -0.7 mW/cm^2 i.e. **0.7 mW/cm^2 below limit**