S-CEM/EMCD/TR/2001-2002/118

EMI/EMC TEST REPORT FOR GPS & MASTER CLOCK ALONG WITH POWER SUPPLY MANUFACTURED BY M/s. SERTEL ELECTRONICS (PVT.) LTD., CHENNAI

SAMEER - CENTRE FOR ELECTROMAGNETICS
(An institution set-up by Ministry of Information Technology, Government of India)
2nd Cross, CIT, Campus, Taramani, Chennai - 600113.

October 2001

SAMEER - CENTRE FOR ELECTROMAGNETICS
CHENNAI - 600113

EMI/EMC TEST REPORT FOR GPS & MASTER CLOCK ALONG WITH POWER SUPPLY MANUFACTURED BY M/s. SERTEL ELECTRONICS (PVT.) LTD., CHENNAI

Test request particulars

1.Test request from	: M/s. Sertel Electronics (Pvt.) Ltd., Chennai
2.Equipment Under Test (EUT)	: GPS & Master Clock Along With Power Supply
3.No.of test sample(s)	: One
4.Type of test requested & Applicable Standard	: 1. Electrical Fast Transient Test as per IEC61000-4-4, 1995 2. Electrostatic Discharge Test as per IEC61000-4-2, 1999 3. High Energy Surge Test as per IEC61000-4-5, 1995 4. 1.0 MHz Damped Oscillatory Surge Test as per IEC255-4,1976 5. Power Frequency Magnetic Field Test as per IEC 61000-4-8, 1993 6. Radiated Susceptibility Test as per IEC 61000-4-3, 1998 7. Conducted RF Immunity Test as per IEC 61000-4-6, 1996
5.Manufacturer	: M/s. Sertel Electronics (Pvt.) Ltd., Chennai
6.Model Number of EUT	: Power Supply Unit : T-PSU-24V DC GPS & Master Clock Unit : T-GPS-300
7. Serial Number of EUT	: Power Supply Unit : 100 GPS & Master Clock Unit : 90 – 01J - 15
8.Test plan concurred by	: Mr. G. Sankar, Chief Engineer
9.Tested on	: 12th – 19th October 2001
10. Test Venue	: SAMEER-CEM, Chennai.

Certified that the data reported in this report are valid only for the test sample mentioned above at the time of and under the stated conditions of measurement. Particulars on Manufacturer / Supplier, given in this report, are based on the information given by the customer, along with test request and SAMEER-CEM does not assume any responsibility for the correctness of that information for the above mentioned unit under test.

Tested by:	Reviewed by:	Approved by:	Office seal
(G. Mahesh) Scientific Officer - SD	(Sanjay Baisakhiya) Scientific Officer - SD	(Dr. Sisir K Das) Head, EMC Division	SAMEER-CENTRE FOR ELECTROMAGNETICS ★ SAMEER ★ MINISTRY OF INFORMATION TECHNOLOGY GOVERNMENT OF INDIA ★ CHENNAI-600 113 ★ 24/10/01

Equipment Under Test (EUT)	: GPS & Master Clock along with Power Supply
Model Number of EUT	: Power Supply: T-PSU-24V DC ; GPS & Master Clock : T- GPS-300
Serial Number of EUT	: Power Supply: 100 ; GPS & Master Clock : 90 – 01J - 15
Manufacturer	: M/s. Sertel Electronics (Pvt.) Ltd., Chennai

1. ELECTRICAL FAST TRANSIENT TEST

1.1 Applicable Standard: IEC 61000-4-4, 1995, Customer Specification for test limits

1.2 Laboratory Environmental Condition:

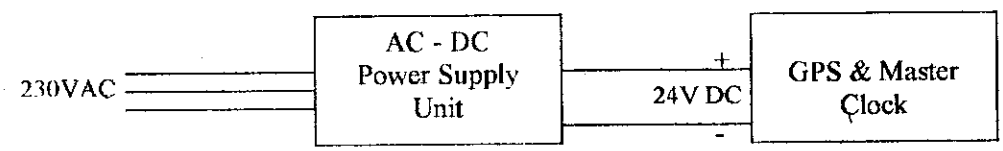
Ambient Temperature	:	26°C
Relative Humidity	:	46%
Atmospheric Pressure	:	1013 mb/hPa

1.3 Test Instrumentation:

Description	Make	Model Number	Serial Number
Fast transient burst generator	Schaffner	NSG 2025-4	2046

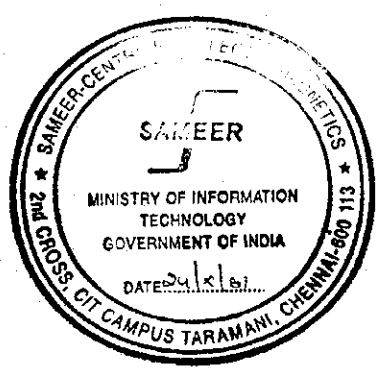
1.4 EUT Configuration:

The GPS and Master Clock unit was energized by a AC – DC power supply unit. The power supply unit converts the 230V AC to 24V DC (regulated). All the input / output ports of the GPS and Master Clock unit were in 'Open' condition during the test. The GPS and Master Clock unit was operated in 'self mode' (i.e.) without receiving any signals from satellite during the test. The schematic block diagram of EUT is as shown below and the photograph of the EUT is shown in Annexure-I.



1.5 Test Specifications:

Spike Rise time	: 5 ns ± 30%
Spike width	: 50 ns ± 30%
Burst amplitude	: 0.5 kV, 1.0 kV
Burst frequency	: 5 KHz upto 2 kV
Burst period	: 300 ms
Burst duration	: 15 ms
Spikes per burst	: 75
Mains reference	: Asynchronous
Polarity	: Positive/Negative
Test duration	: 60 seconds
Coupling mode	: L_1, N, PE



Equipment Under Test (EUT)	: GPS & Master Clock along with Power Supply
Model Number of EUT	: Power Supply: T-PSU-24V DC ; GPS & Master Clock : T- GPS-300
Serial Number of EUT	: Power Supply: 100 ; GPS & Master Clock : 90 – 01J - 15
Manufacturer	: M/s. Sertel Electronics (Pvt.) Ltd., Chennai

1.6 Test Procedure:

The individual AC lines of the AC-DC power supply unit were subjected to Electrical Fast Transients of increasing amplitude from ± 0.5 kV to ± 1.0 kV through the coupling network. The EUT was observed for malfunctions (like fluctuations in power supply output and abnormal change in GPS and Master clock display), if any.

1.7 Test observation :

No malfunction was observed in the EUT when it was subjected to electrical fast transients of amplitude upto ± 1 kV.

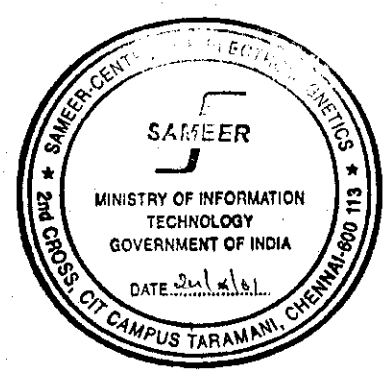
1.8 Enclosed Document:

Annexure-II shows the Electrical Fast Transient Test Setup.

Test conducted by:

G. Mahesh

(G. Mahesh)
Scientific Officer - SD



Equipment Under Test (EUT)	: GPS & Master Clock along with Power Supply
Model Number of EUT	: Power Supply: T-PSU-24V DC ; GPS & Master Clock : T- GPS-300
Serial Number of EUT	: Power Supply: 100 ; GPS & Master Clock : 90 – 01J - 15
Manufacturer	: M/s. Sertel Electronics (Pvt.) Ltd., Chennai

2. ELECTROSTATIC DISCHARGE TEST

2.1 Applicable standard : IEC 61000-4-2, 1995 and Customer specification for test limits

2.2 Laboratory Environmental Condition:

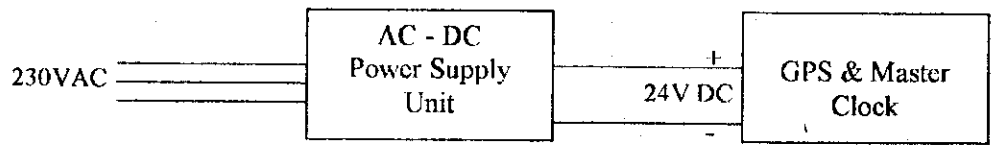
Ambient temperature	: 25°C
Relative Humidity	: 48%
Atmospheric Pressure	: 1018 mb / hPa

2.3 Test instrumentation:

Equipment	Make	Model Number	Serial Number
ESD generator	Hacfely Trench	PESD 1600	H705168

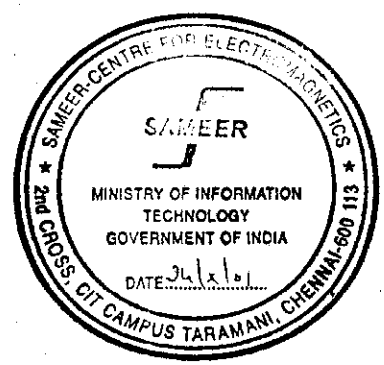
2.4 EUT configuration:

The GPS and Master Clock unit was energized by a AC – DC power supply unit. The power supply unit converts the 230V AC to 24V DC (regulated). All the input / output ports of the GPS and Master Clock unit were in 'Open' condition during the test. The GPS and Master Clock unit was operated in 'self mode' (i.e.) without receiving any signals from satellite during the test. The schematic block diagram of EUT is as shown below and the photograph of the EUT is shown in Annexure-I.



2.5 Test specifications:

Rise time	: 0.7 ns - 1 ns
Duration	: 30 ns
Capacitance	: 150 pF ± 10%
Resistance	: 330 ohm ± 5%
Operating mode	: Single
Number of discharges	: 10
Charging resistance	: Between 50 MΩ and 100 MΩ



Equipment Under Test (EUT)	: GPS & Master Clock along with Power Supply
Model Number of EUT	: Power Supply: T-PSU-24V DC ; GPS & Master Clock : T- GPS-300
Serial Number of EUT	: Power Supply: 100 ; GPS & Master Clock : 90 – 01J - 15
Manufacturer	: M/s. Sertel Electronics (Pvt.) Ltd., Chennai

2.6 Test procedure :

Electrostatic discharges were injected with output voltage increasing from ± 2kV to ± 4kV at all non-conductive user accessible points of the EUT in air discharge mode and from ± 2kV to ± 4kV on the horizontal and vertical coupling planes in indirect discharge mode and also on all metallic user accessible points of the EUT. The EUT was observed for malfunctions (like fluctuations in power supply output and abnormal change in GPS and Master clock display), if any.

2.7 Test observation:

No malfunction was observed when the EUT was subjected upto ± 4kV air and contact discharge and ± 4 kV indirect discharges.

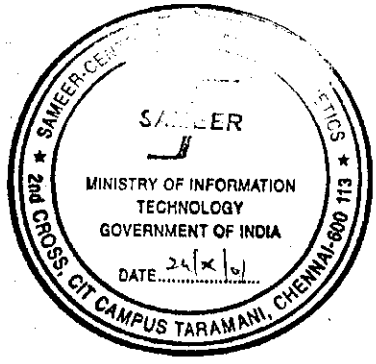
2.8 Enclosed Document:

Annexure-II shows the Electrostatic Discharge Test Setup.

Test conducted by :

G. Mahesh

(G. Mahesh)
Scientific Officer – SD



Equipment Under Test (EUT)	: GPS & Master Clock along with Power Supply
Model Number of EUT	: Power Supply: T-PSU-24V DC ; GPS & Master Clock : T- GPS-300
Serial Number of EUT	: Power Supply: 100 ; GPS & Master Clock : 90 – 01J - 15
Manufacturer	: M/s. Sertel Electronics (Pvt.) Ltd., Chennai

3. HIGH ENERGY SURGE TEST

3.1 Applicable standard: IEC 61000-4-5, 1995, Customer specification for test limits.

3.2 Laboratory Environmental Conditions:

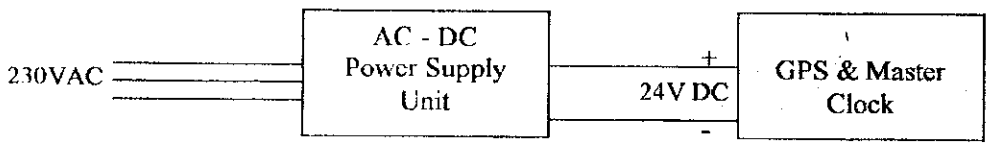
Ambient temperature : 25°C
Relative Humidity : 58%
Atmospheric Pressure : 1013 mb/hPa

3.3 Test instrumentation:

Description	Make	Model Number	Serial Number
High energy pulse generator	Schaffner	NSG 2050	244
Impulse Network	Schaffner	PNW 2050	173
Pulse couping Network	Schaffner	CDN 131 / 133	132

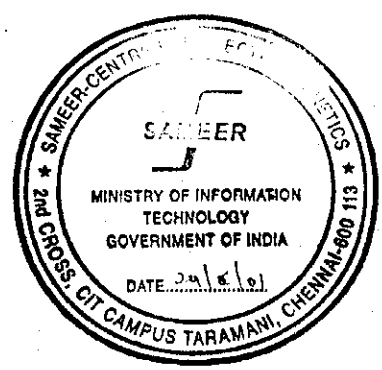
3.4 EUT Configuration :

The GPS and Master Clock unit was energized by a AC – DC power supply unit. The power supply unit converts the 230V AC to 24V DC (regulated). All the input / output ports of the GPS and Master Clock unit were in 'Open' condition during the test. The GPS and Master Clock unit was operated in 'self mode' (i.e.) without receiving any signals from satellite during the test. The schematic block diagram of EUT is as shown below and the photograph of the EUT is shown in Annexure-I.



3.5 Test specifications:

Pulse Form	: 1.2/50µS (open - circuit
	: 8/20 µS (short circuit into 2Ω impedance)
Coupling modes	: 2Ω L → N (Differential)
	12 Ω L → PE, N →PE (Common)
Repetition	: 60 seconds
Polarity	: Alternating (+/-)
Number of Pulses	: 5 each
Phasing	: 0°,90° & 270°
Severity level	: 1 KV



Equipment Under Test (EUT)	: GPS & Master Clock along with Power Supply
Model Number of EUT	: Power Supply: T-PSU-24V DC ; GPS & Master Clock : T- GPS-300
Serial Number of EUT	: Power Supply: 100 ; GPS & Master Clock : 90 – 01J - 15
Manufacturer	: M/s. Sertel Electronics (Pvt.) Ltd., Chennai

3.6 Test procedure:

The AC lines of the AC-DC power supply unit were subjected to high energy surge of increasing amplitude from ± 0.5kV to ± 1.0 kV in common mode and ± 0.5kV in differential mode through the coupling network. The EUT was observed for malfunctions (like fluctuations in power supply output and abnormal change in GPS and Master clock display), if any.

3.7 Test Observations:

Test Level	Coupling mode	Phase Angle	Observations
Upto ± 1.0 kV	Common Mode L_1 PE , N PE, L_1 N PE	0°, 90°, 270°	No malfunction was observed
± 0.5 kV	Differential Mode L_1 N	0°, 90°, 270°	No malfunction was observed

3.8 Enclosed Document:

Annexure-III shows the High Energy Surge Test Setup.

Test conducted by :

G. Mahesh

(G. Mahesh)
Scientific Officer –SD

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Equipment Under Test (EUT)	: GPS & Master Clock along with Power Supply
Model Number of EUT	: Power Supply: T-PSU-24V DC ; GPS & Master Clock : T- GPS-300
Serial Number of EUT	: Power Supply: 100 ; GPS & Master Clock : 90 – 01J - 15
Manufacturer	: M/s. Sertel Electronics (Pvt.) Ltd., Chennai

4. 1.0MHz DAMPED OSCILLATORY SURGE TEST

4.1 Applicable Standard: IEC 255-4, 1976 & Customer specification for test limits

4.2 Laboratory Environmental Conditions:

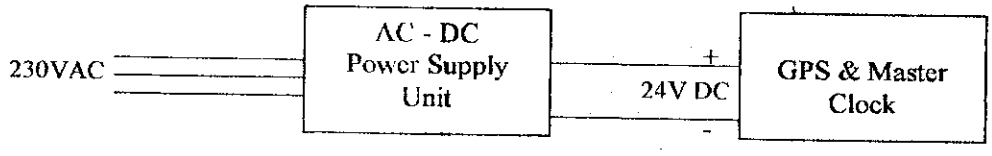
Ambient temperature	: 26°C
Relative Humidity	: 54%
Atmospheric Pressure	: 1013 mb/hPa

4.3 Test Instruments Used:

Description	Make	Model Number	Serial Number
HF test generator	Schaffner	NSG 505	000300
Coupling Network	Schaffner	NSG 522	000254

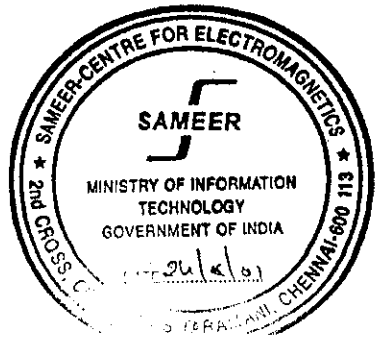
4.4 EUT Configuration :

The GPS and Master Clock unit was energized by a AC – DC power supply unit. The power supply unit converts the 230V AC to 24V DC (regulated). All the input / output ports of the GPS and Master Clock unit were in 'Open' condition during the test. The GPS and Master Clock unit was operated in 'self mode' (i.e.) without receiving any signals from satellite during the test. The schematic block diagram of EUT is as shown below and the photograph of the EUT is shown in Annexure-I.



4.5 Test Specification:

Surge amplitude	: 1 kV in longitudinal mode & Transverse mode
Rise time	: 10 ns
Half value duration	: 6 µs
Surge repetition freq.	: 400 Hz
Source impedance	: 200 Ohms
Test duration	: >2 seconds



Equipment Under Test (EUT)	: GPS & Master Clock along with Power Supply
Model Number of EUT	: Power Supply: T-PSU-24V DC ; GPS & Master Clock : T- GPS-300
Serial Number of EUT	: Power Supply: 100 ; GPS & Master Clock : 90 – 01J - 15
Manufacturer	: M/s. Sertel Electronics (Pvt.) Ltd., Chennai

4.6 Test Procedure:

High voltage damped sinusoidal surge generated by the HF test generator was superimposed in longitudinal mode and transverse mode on the powerline of the AC-DC power supply unit. The EUT was observed for malfunctions (like fluctuations in power supply output and abnormal change in GPS and Master clock display), if any.

4.7 Test Observation:

No malfunction was observed on the EUT, when it was subjected to 1.0 kV surge on the Power line in both longitudinal and transverse mode.

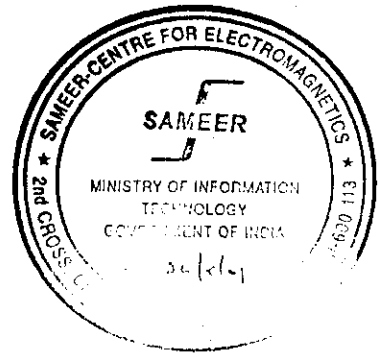
4.8 Enclosed Document:

Annexure-III shows the Damped Oscillatory Surge Test setup.

Test conducted by:

G. Mahesh

(G.Mahesh)
Scientific Officer – SD



Equipment Under Test (EUT)	: GPS & Master Clock along with Power Supply
Model Number of EUT	: Power Supply: T-PSU-24V DC ; GPS & Master Clock : T- GPS-300
Serial Number of EUT	: Power Supply: 100 ; GPS & Master Clock : 90 – 01J - 15
Manufacturer	: M/s. Sertel Electronics (Pvt.) Ltd., Chennai

5. POWER FREQUENCY MAGNETIC FIELD TEST

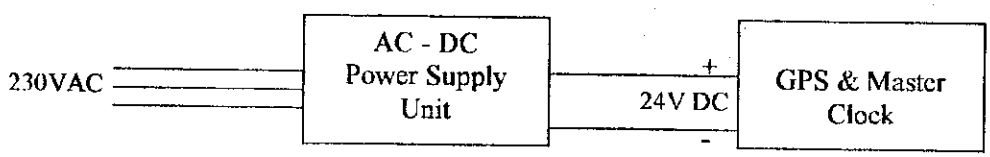
5.1 Applicable standard : IEC 61000-4-8, 1993, Customer Specification for test limits

5.2 Test instrumentation:

Description	Make	Model Number	Serial Number
Helmholtz Coil	SAMEER-CEM	---	----
Auto Transformer	AE	Dimmerset	----
AC Magnetometer	Walker scientific, USA	BBM-3D	K71993-3772
Current Transformer	---	---	---

5.3 EUT Configuration :

The GPS and Master Clock unit was energized by a AC – DC power supply unit. The power supply unit converts the 230V AC to 24V DC (regulated). All the input / output ports of the GPS and Master Clock unit were in 'Open' condition during the test. The GPS and Master Clock unit was operated in 'self mode' (i.e.) without receiving any signals from satellite during the test. The schematic block diagram of EUT is as shown below and the photograph of the EUT is shown in Annexure-I.

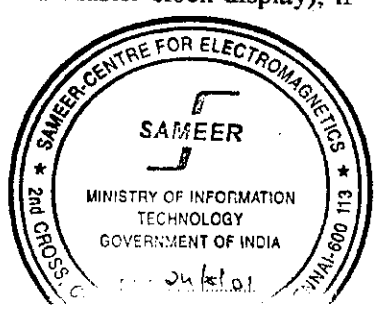


5.4 Test Limits :

Magnetic Field Strength (in A/m)
3 A/m (36.80 mG)

5.5 Test procedure:

The EUT was kept inside the Helmholtz coil, the current in the Helmholtz coil was adjusted till the required magnetic field is generated inside the Helmholtz coil. The magnetic field was monitored using the magnetic field meter. The EUT was observed for malfunctions (like fluctuations in power supply output and abnormal change in GPS and Master clock display), if any.



Equipment Under Test (EUT)	: GPS & Master Clock along with Power Supply
Model Number of EUT	: Power Supply: T-PSU-24V DC ; GPS & Master Clock : T- GPS-300
Serial Number of EUT	: Power Supply: 100 ; GPS & Master Clock : 90 – 01J - 15
Manufacturer	: M/s. Sertel Electronics (Pvt.) Ltd., Chennai

5.6 Test Observation:

No malfunction was observed in the EUT, when it was subjected to magnetic field strength of 3 A/m.

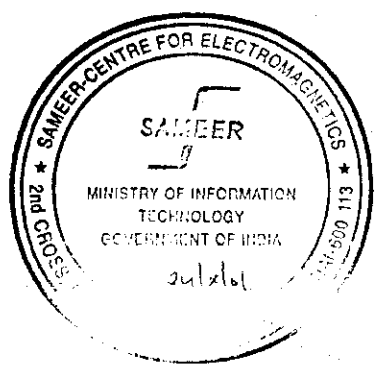
5.7 Enclosed Document:

Annexure-IV shows the Power Frequency Magnetic Field Test setup.

Test conducted by:

G.Mahesh

(G.Mahesh)
Scientific Officer – SD



Equipment Under Test (EUT)	: GPS & Master Clock along with Power Supply
Model Number of EUT	: Power Supply: T-PSU-24V DC ; GPS & Master Clock : T- GPS-300
Serial Number of EUT	: Power Supply: 100 ; GPS & Master Clock : 90 – 01J - 15
Manufacturer	: M/s. Sertel Electronics (Pvt.) Ltd., Chennai

6. RADIATED SUSCEPTIBILITY TEST

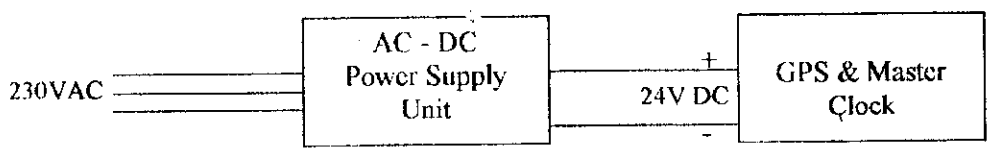
6.1 Applicable standard : IEC 1000-4-3, 1995, Customer Specification for test limits

6.2 Test instrumentation :

Equipment	Make	Model Number	Serial Number
Signal generator	R&S	SMGU	832372/006
RF power amplifier	ENI	5100L	140
RF power amplifier	AR	100HB	10373
High power biconical antenna	Electrometrics	3108B	2131
Log periodic antenna	Electrometrics	LPA25	1463
Shielded Anechoic Chamber	Ray proof	24' x 24' x 13' with 2' pyramidal absorbers	5954

6.3 EUT configuration :

The GPS and Master Clock unit was energized by a AC – DC power supply unit. The power supply unit converts the 230V AC to 24V DC (regulated). All the input / output ports of the GPS and Master Clock unit were in 'Open' condition during the test. The GPS and Master Clock unit was operated in 'self mode' (i.e.) without receiving any signals from satellite during the test. The schematic block diagram of EUT is as shown below and the photograph of the EUT is shown in Annexure-I.

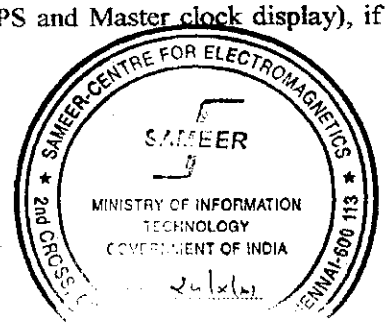


6.4 Test Specifications :

Frequency range	: 80 - 1000 MHz
Modulation	: 80% AM, 1 kHz sinewave
Field strength	: 3 V/m

6.5 Test procedure :

The test was carried out inside a shielded anechoic chamber with the EUT kept at a distance of 1m from the appropriate transmitting antenna. The unit was then subjected to 3 V/m field strength in both horizontal and vertical polarization and was observed for malfunctions (like fluctuations in power supply output and abnormal change in GPS and Master clock display), if any.



Equipment Under Test (EUT)	: GPS & Master Clock along with Power Supply
Model Number of EUT	: Power Supply: T-PSU-24V DC ; GPS & Master Clock : T- GPS-300
Serial Number of EUT	: Power Supply: 100 ; GPS & Master Clock : 90 – 01J - 15
Manufacturer	: M/s. Sertel Electronics (Pvt.) Ltd., Chennai

6.6 Test observation :

No malfunction was observed when the EUT was illuminated with 3 V/m field strength in both horizontal and vertical polarisation in the frequency band of 80 - 1000 MHz.

6.7 Enclosed Document:

Annexure-IV shows the Radiated Susceptibility Test setup.

Test conducted by :

G. Mahesh

(G. Mahesh)
Scientific Officer - SD

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Equipment Under Test (EUT) : GPS & Master Clock along with Power Supply
Model Number of EUT : Power Supply: T-PSU-24V DC ; GPS & Master Clock : T- GPS-300
Serial Number of EUT : Power Supply: 100 ; GPS & Master Clock : 90 – 01J - 15
Manufacturer : M/s. Sertel Electronics (Pvt.) Ltd., Chennai

7. CONDUCTED RF IMMUNITY TEST

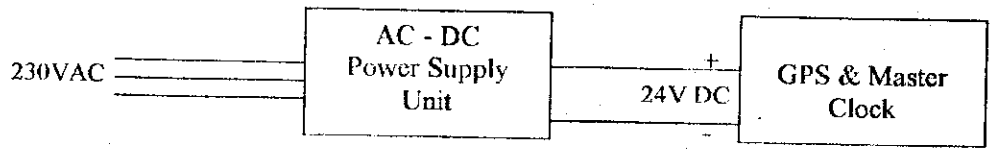
7.1 Applicable standard : EN 61000-4-6, 1996 & Customer Specification (for test limits)

7.2 Test instrumentation:

Equipment	Make	Model Number	Serial Number
Signal generator	R&S	SMGU	832372/006
RF power amplifier	ENI	2100L	170
RF power amplifier	ENI	5100L	140
Coupling and Decoupling Network	EMTEST	CDN M2	000451001001
Attenuator	EMTEST	ATT6	0004165A

7.3 EUT Configuration :

The GPS and Master Clock unit was energized by a AC – DC power supply unit. The power supply unit converts the 230V AC to 24V DC (regulated). All the input / output ports of the GPS and Master Clock unit were in 'Open' condition during the test. The GPS and Master Clock unit was operated in 'self mode' (i.e.) without receiving any signals from satellite during the test. The schematic block diagram of EUT is as shown below and the photograph of the EUT is shown in Annexure-I.



7.4 Test Specification:

Frequency range : 150 KHz - 80 MHz
RF Voltage : 3 V
Amplitude modulation : 80%, 1KHz , sinewave

7.5 Test Procedure:

Conducted RF voltage of 3V was injected on to the AC power lines of the power supply unit using coupling and decoupling network. The EUT was observed for malfunction (like fluctuations in power supply output and abnormal change in GPS and Master clock display), if any.

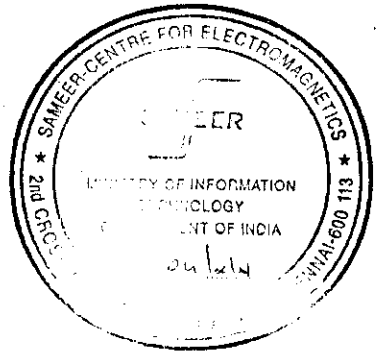
7.6 Test observation:

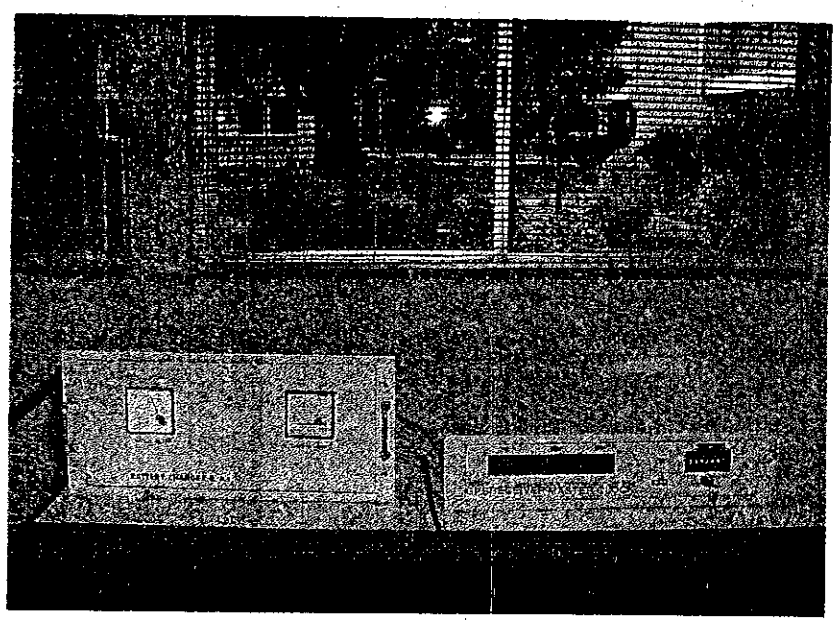
No malfunction was observed when the EUT was subjected to RF voltage of 3V in the frequency range of 150 kHz - 80 MHz.

7.7 Enclosed Document: Annexure-V shows the Conducted RF Immunity Test Setup.

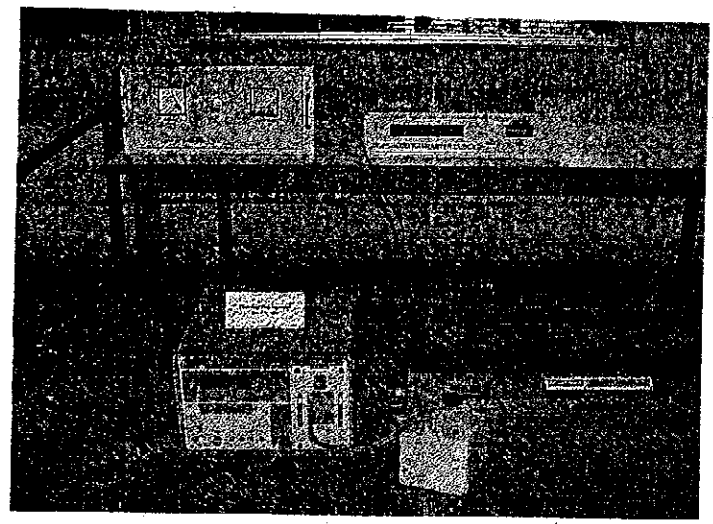
Test conducted by :

(G. Mahesh)
Scientific Officer – SD

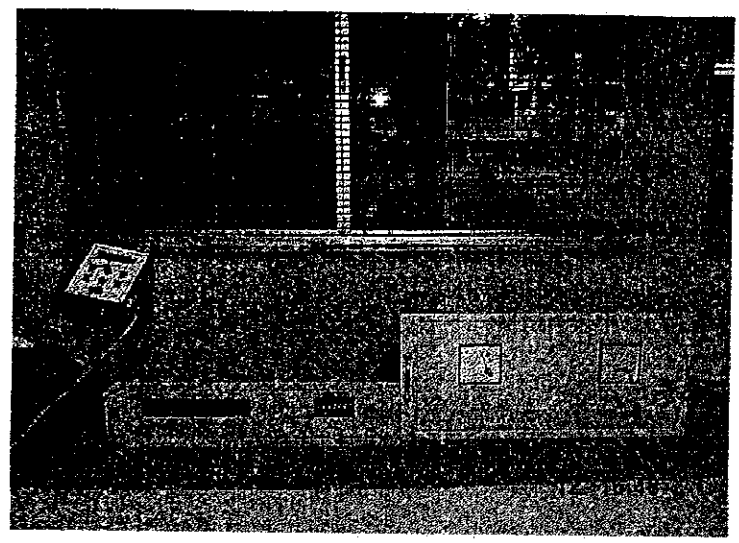




EUT: GPS &Master Clock along with Power Supply

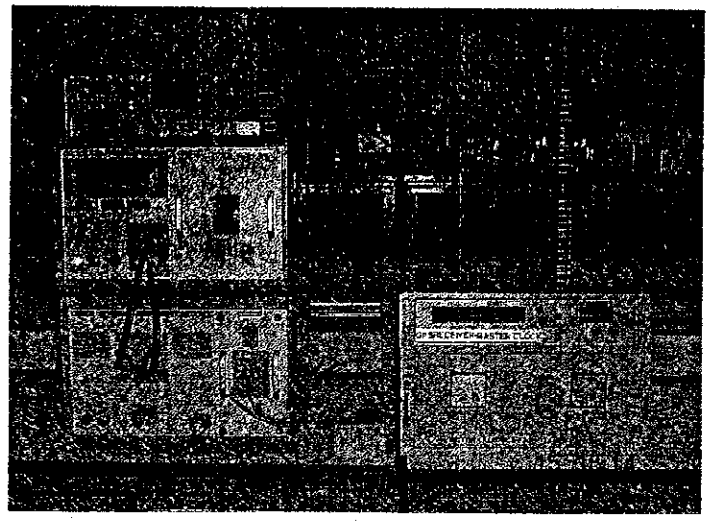


Electrical Fast Transient Test Setup

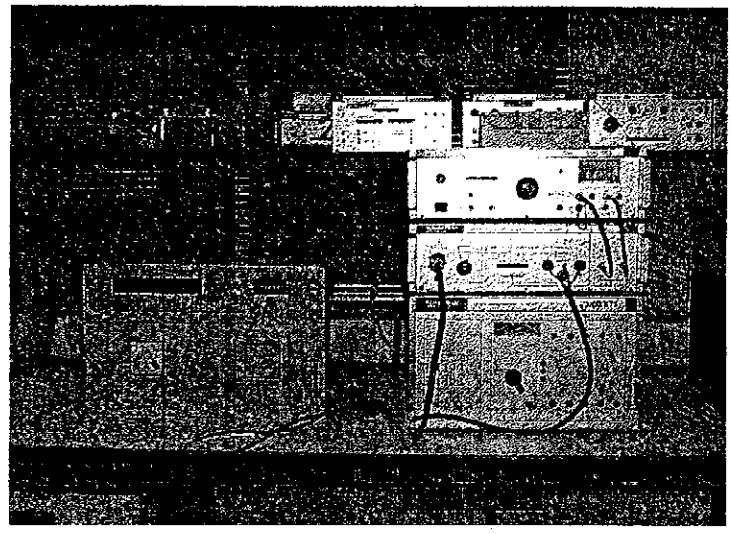


Electrostatic Discharge Test Setup

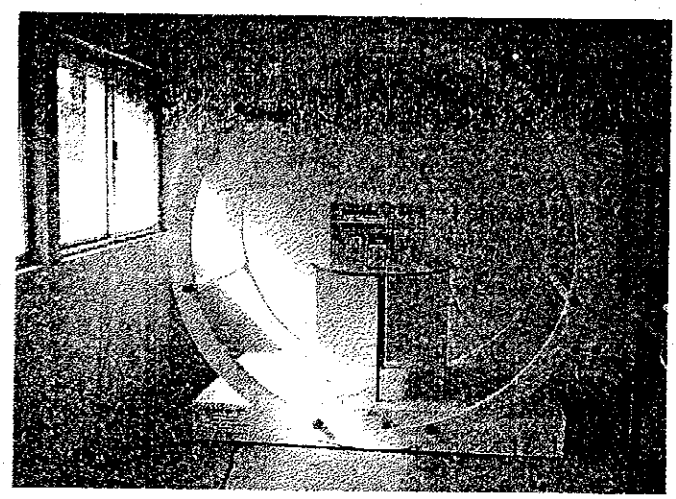
SAMEER-CENTRE FOR ELECTROMAGNETICS
SAMEER
MINISTRY OF INFORMATION TECHNOLOGY
GOVERNMENT OF INDIA
2nd CROSS
CHENNAI-600 113



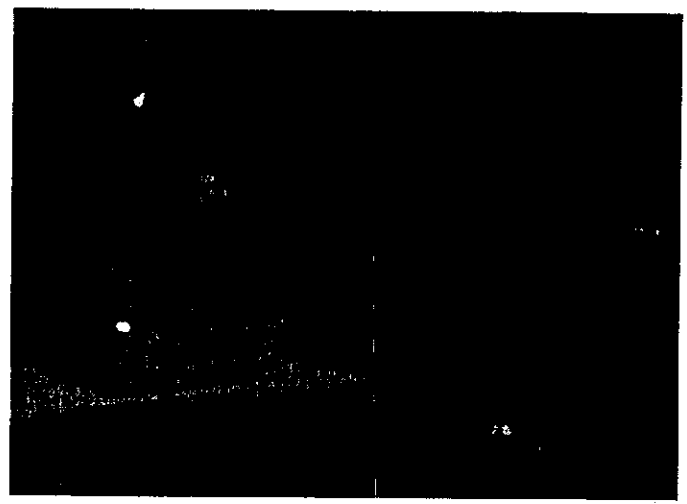
High Energy Surge Test Setup



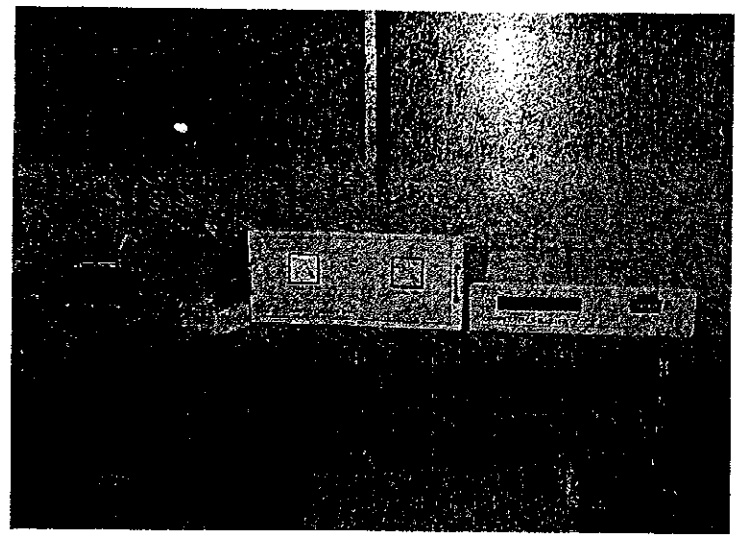
1.0 MHz Damped Oscillatory Surge Test Setup



Power Frequency Magnetic Field Test Setup



Radiated Susceptibility Test Setup



Conducted RF Immunity Test Setup