EMC
Test Report

EN60601-1-2 :1993

Foetal Heart Simulator

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Contents

Summary of EUT Performance

Test Summary

Test Subject: ***Foetal Heart Simulator***

Test Status: ***Pass***

Comments

The EUT performed as intended during the tests with the exception of the application of Electrostatic Discharges which caused the unit to change its bpm rate during application of the discharge. The EUT did not self-recover to its original bpm rate after the discharge had been removed.

EMC Test Report

ESD Exploratory **Test Status:** ***Pass***

Test Summary

Test Subject: ***Foetal Heart Simulator***

a. Contact discharge to the conductive surfaces and to coupling planes.
b. Air discharge at insulating surfaces.

Test equipment used for this test

Schaffner NSG 435 ESD Generator **S/N** ***000649*** **Calibration:** ***Aug 02***

Comments

Contact Electrostatic Discharge is not appropriate because the EUT is housed in a plastic case with no external conductive surfaces.

Air discharge and Coupling plane ESD tests were performed in accordance with the Standard to determine any weaknesses in the product.

Test Description

All Equipment:
- Record EUT ambient temperature during test.
- Record EUT ambient relative humidity during test.

(1) Set the severity level (the discharge voltage of the test generator) as indicated in the parameters section of the test indications.

Table Top Equipment:
(1) Place the EUT on a wooden stand or table which models the actual height from the ERP (Earth Reference Plane)
(2) That for the EUT in an actual installation.

Floor Standing Equipment:
(1) Place the EUT on a wooden pallet approximately 0.10 m off of the ERP (Earth Reference Plane)

EN 61000-4-2: 1995 Electromagnetic Compatibility – ESD Immunity **Test Status:** ***Pass***

Test Summary

Test Subject: ***Foetal Heart Simulator***

a. Contact discharge to the conductive surfaces and to coupling planes.
b. Air discharge at insulating surfaces.

Test equipment used for this test

Schaffner NSG 435 ESD Generator **S/N** ***000649*** **Calibration:** ***Aug 02***

Comments

Contact esd discharge is not appropriate because the eut is housed in a plastic case with no external conductive surfaces. Air discharge and Coupling plane esd tests performed in accordance with the Standard

Test Description

The Schaffner ***NSG 435*** esd gun is used to apply the test. The worst-case test points and ESD discharge mode (Contact VS Air discharge) are selected as defined by an ESD exploratory test. Otherwise contact discharge is preferred test method and Air discharges are used where contact discharge cannot be applied. Voltages for each test methods are given in the parameter section of this test plan. The voltages shown are different for each method due to the differing methods of test.

The test levels from Table 1 (Below) to be used on this EUT are shown in the parameters section of this test plan.

Table 1 -- Test Levels

1a – Contact discharge's level	Test Voltage (kV)	1b – Air discharges Level	Test Voltages (kV)
1	2	1	2
2	4	2	4
3	6	3	8
4	8	4	15
X	Special	X	Special

1) "X" is an open level. The level has to be specified in the dedicated equipment specification. If higher voltages than those shown are specified, Special test equipment may be used.

Test Set-up

The test set-up consists of the test generator, EUT and auxiliary instrumentation necessary to perform direct and in direct application of discharges to the EUT in the following manner.

EN 61000-4-2: 1995 continued -

a) Contact discharge to the conductive surfaces and to coupling planes.
b) Air discharge at insulating surfaces.

The EUT is arranged in accordance with its instructions for installation (if any).

Test Set-up
A ground reference plane is provided on the floor of the laboratory. It is a sheet of aluminium 0.25mm or greater thickness. The minimum size of the reference plane is met. It projects beyond the EUT or coupling plane by at least 0.5 m on all sides, and is connected to the protective grounding system.

The EUT is arranged and connected according to its functional requirements.

A distance of 1m minimum is provided between the equipment under test and the walls of the laboratory or test room.

The EUT is connected to the grounding system, in accordance with its installation specifications. No additional grounding connections are allowed.

The positioning of the power and signal cables are representative if installation practice.

The discharge return cable of the ESD generator is connected to the ground reference plane. The total length of this cable is in general 2m.

In cases where this length exceeds the length necessary to apply the discharges to be selected points, the excess length where possible, is placed non-inductively off the ground reference plane and does not come closer than 0.2 m to other conductive parts in the test set-up.

The connection of the earth cables to the ground reference plane and all bonding are low impedance, for example using clamping devices for high frequency applications.

Where coupling planes are specified, for example to allow indirect application of the discharge, they are constructed from the same material type and thickness as that of the ground reference plane, and are connected to the GRP via a cable with a 470 kW resistor located at each end. These resistors are capable of withstanding the discharge voltage and are insulated to avoid short circuits to the GRP when the cable lies on the GRP.

Additional Specifications for the different types of equipment are given below.

1.1 Table-top equipment

The test set-up consists of a wooden table, 0,8 m high standing on the ground reference plane.

A horizontal coupling plane (HCP), 1,6m x 0,8 m, is placed on the table. The EUT and cables are isolated from the coupling plane by an insulating support 0,5 mm thick.

If the EUT is too large to be located 0,1 m minimum from all sides of the HCP, and additional, identical HCP is used, placed 0,3 m from the first, with the short sides adjacent. The table has to be enlarged or two tables may be used. The HCPs are not bonded together, other than via resistive cables to the GRP.

Any mounting feet associated with the EUT remain in place.

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1.2 Floor-standing equipment

The EUT and cables are isolated from the ground reference plane by an insulating support about 0.1 thick.

Any mounting feet associated with the EUT remain in place.

2. Test Procedure.
2.1 Laboratory reference conditions

The ambient temperature and humidity are noted and recorded just prior to starting or continuing tests.

In the case of air discharges testing, the climatic conditions are verified to be within the following ranges.

Ambient temperature: 15 degrees C to 35 degrees C
Relative humidity : 30% to 60%

The EUT is operated within its intended climatic conditions.

2.1.2 Electromagnetic conditions

2.2 EUT excising

The Test programs and software are chosen so as to excise all normal modes of operation of the EUT. The use of special exercising software is done where possible, and where it can be shown that the EUT is being comprehensively exercised.

For conformance testing, the EUT is continually operated in its most sensitive mode (program cycle) which is determined by preliminary testing.

If monitoring equipment is required, it is de-coupled in order to reduce the possibility of erroneous failure indication.

2.3 Execution of the test.
The testing is performed by direct and indirect application of discharges to the EUT according to this test plan including:

- Representative operating conditions of the EUT.
- Whether the EUT should be tested as table-top or floor-standing,
- The points at which discharges are to be applied determined during an exploratory test and indicated above which will define worst case test points and weather contact or air discharges are to be applied;
- The test level to be applied.
- The number of discharges to be applied at each point for compliance testing.
- Whether post-installation tests are also to be applied.

2.3.1 Direct application of discharges to the EUT
The static electricity discharges is applied only to test points and surfaces to the EUT which are accessible to personnel during normal usage and were defined during the exploratory test.

EN 61000-4-2: 1995 continued -

The test voltage is increased from the minimum to the selected test level, in order to determine any threshold of failure.

The test is performed with single discharges. On pre-selected points at least ten single discharges (in the most sensitive polarity) are applied.

For the time interval between successive single discharges are applied in 1 Second intervals. Longer intervals may be necessary to determine whether a system failure has occurred.

Note – The points to which the discharges should be applied are selected by means of an exploration.

The ESD generator is held perpendicular to the surface to which the discharge is applied. This improves repeatability of the test results.

The discharge return cable of the generator is kept at a distance of at least 0,2m from the EUT while discharges are being applied.

In the case of contact discharges, the tip of the discharge electrode touches the EUT, before the discharges switch is operated.

In the case of painted surfaces covering a conducting surface, the following procedure is used:

The pointed tip of the generator penetrates the coating to make contact with the conducted surface.
Coating declared as insulating is only to be submitted to the air discharge. The contact discharge test is not applied to such surfaces.

In the case of air discharges, the round discharge tip of the discharge electrode is approached as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator (discharge electrode) is removed from the EUT.
The generator is then re-triggered for a new single discharge. This procedure is repeated until the discharges are completed.

2.3.2 Indirect application of the discharge.

Discharges to objects placed or installed near the EUT are simulated by applying the discharge of the ESD generator to a coupling plane, in the contact discharge mode.

2.3.2.1 horizontal coupling plane under the EUT
At least 10 single discharges (in the most sensitive polarity) are applied to the horizontal coupling plane, at points on each side of the EUT.

The ESD generator is positioned vertically at a distance of 0.1m from the EUT, with the discharge electrode touching the coupling plane.

2.3.2.2 Vertical coupling plane
At least 10 single discharges (in the most sensitive polarity) are applied to the centre of the one vertical edge of the coupling plane (figures 5 and 6). The coupling plane, of dimensions 0,5 m x 0,5 m, is placed parallel to,
And position at a distance of 0,1 m from, the EUT.

EN 61000-4-2: 1995 continued -

Discharges are applied to the coupling plane, with sufficient different positions such that the four faces of the EUT are completely illuminated.

The test results are classified by the operating conditions and the functional specifications of the equipment under test, as in the following, unless different specifications are given by product committees or product specifications:

1) Normal performance within the specification limits.
2) Temporary degradation or loss of function or performance which is self-recoverable.
3) Temporary degradation or loss of function or performance that requires operator intervention or system reset.
4) Degradation of loss of function which is not recoverable due to damage of equipment (components) or software, or loss of data.

Equipment is verified to not become dangerous or unsafe resulting from the application of the tests defined in this standard.

As a general rule, the test results is positive it the equipment shows its immunity, for all the period of application of the test, and at the end of the tests the EUT fulfils the functional requirements established in the technical specification.

Test Parameters

Apply 10 discharges
Low Limit: 10

Test Level
Low Limit: ***5.9 kV, 7.9kV***
Nominal Value: ***6kV, 8kV***
High Limit: ***6.1kV, 8.1kV***

6kV Contact Injection
8kV Air Discharge

Test as bench mounted equipment

Conclusion

The EUT performed as intended during the tests with the exception of the application of Air Discharges onto the front face of the housing causing the unit to change its bpm rate during application of the discharges. The EUT did not recover to its original bpm rate after the discharge had been removed

The incorrect bpm rate could be reset by the operator reselecting the correct rate.

EN61000-4-3	Class B	Radiated & Conducted Immunity	Test result: *Pass*

Test Summary

Compliance testing was carried out using a Log Periodic transmitting antenna. The forward power from a calibration file was called up and a closed loop system to generate the required RF field of 3V/m (AM modulated) across the frequency range by setting the output level from the signal generator. The interfering signal was amplitude modulated to a depth of 80%.

Test Description

Radiated immunity
Measurement Frequency range: 80MHz – 1000MHz

The EUT was monitored during the period of test and any degradation of performance was noted

Conducted immunity
Measurement Frequency range: 150kHz - 80MHz

The EUT was monitored during the period of test and any degradation of performance was noted

Performance Criteria

The test results may be classified on the basis of the operating conditions and the functional specifications of the equipment under test, according to the following performance criteria:

A The apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum level or the permissible loss is not specified by the manufacturer then either of these may be derived from the product description and what the user may reasonably expect from the apparatus if used as intended.

B The apparatus shall continue to operate as intended after the test. No degradation of performance or loss function is allowed below a performance level specified by the manufacturer when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. The minimum performance level or the permissible performance loss is not specified by the manufacturer then either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended

C Temporary loss of function is allowed, providing the loss of function is self recoverable or can be restored by the operation of the controls.

EN61000 4-3 continued -

Test equipment used for this test

Tx Antenna, Biconical:	*EMCO 3108C 30-300MHz, Log Periodic EMCO 3146 200-1000MHz*
RF Amplifier 10kHz –220MHz:	*Amplifier Research 150L*
RF Amplifier 25MHz – 1GHz:	*Amplifier Research 25W1000M7*
Signal Generator:	*Rhode and Schwarz SMX*

Comments

Performance criteria observed. - A

No deterioration or degradation of the EUT was observed throughout the application of the Radiated or Conducted RF field and the EUT continued to function as intended after the application of the applied field.

EN 61000-4-4: 1995 Electromagnetic Compatibility – EFT and Burst **Test Status: *Pass***

Test equipment used for this test

EMTest UCS500 **S/N *05 96-57*** **Calibration: *Aug 02***

Comments

The EUT is supplied with an AC mains charger adaptor which may be connected to the unit during normal operation. Transients were applied to the EUT through the charger.

Test Description

The equipment is placed on a ground reference plane and is insulated from it by an insulating support 0.1m +/- 0.01m thick.

The reference ground plane shall be a metallic sheet of copper or aluminium of 0.25mm min. thickness; other metallic Materials may be used but shall have a 0.65mm minimum thickness.

The minimum size of reference plane shall be 1m x 1m. The actual size depends on the dimensions of the EUT.

The reference ground plane shall project beyond the EUT by at least 0.1m on all sides.

The ground plane shall be connected to the protective earth [or ground].

The EUT is arranged and connected to satisfy its functional requirements, according to the equipment installation specifications.

The minimum distance between the EUT and all other conductive structures (e.g. the walls of a shielded room), except the ground plane beneath the EUT, is more than 0.5m.

The EUT is connected to the earthing system in accordance with the manufacture's installation specifications; No additional earthing connections are allowed.

The connections of the test equipment ground cables to the ground reference and all bonding shall be arranged to provide minimum inductance.

EN 61000-4-4: 1995 continued-

Coupling devices are used for the application the test voltages. They shall be coupled to the lines between the EUT and the decoupling network or between two units of equipment involved in the test.

Using the coupling clamp, the minimum distance between the coupling plates and all other conductive structures, except the ground plane beneath the coupling clamp and beneath the EUT are 0.5 m.

The length of the signal and power line be between the coupling device and the EUT are 1m or less.

If the EUT has a non-detachable supply cable more than 1m long with equipment, the excess length of this cable is gathered into a flat coil with a 0.4m diameter and situated at a distance of 01.m above the ground reference plane. The Distance of 1m or less between the EUT and the coupling device are maintained.

Application of the test voltage:

The test voltage is applied to the following lines or ports of the EUT

Power supply ports:

The EUT mains power supply cord is connected to the test generator's coupling/decoupling network

If the line current is higher than the specified current capability of the coupling/decoupling network, i.e. > 100A, The test voltage shall be applied to the EUT through a 33nf coupling capacitor.

I/O and communication ports:

The capacitive coupling clamp is used for the application of the disturbance test voltage to I/O and communication ports.

Earth connections of the cabinet:

The test point on the cabinet is the terminal for the protective earth conductor.

The test voltage is applied to the protective earth (PE) connection by the coupling/decoupling network.

Climatic conditions:

The tests is carried out in standard climatic conditions in accordance with IEC 68-1

- ambient temperature: 15 degrees C to 35 degrees C
- relative humidity 25% to 75%

The above data is recorded in the test record.
The EUT shall be operated within its intended climatic conditions.

- The EUT is tested in the normal operating conditions;
- test level shall be applied per the parameters section of this test plan;
- polarity shall be applied per the parameters section of this test plan, usually both polarities (required for a verification test);
- the test generator is operated on internal drive unless otherwise indicated by special test instructions.
- the test duration is specified in the parameters
- apply the number of events per the test parameters

EN 61000-4-4: 1995 continued -

Test Parameters

Test Level 3

Low Limit: 2.0 Voltage Peak, KV

Nominal Value: 2.0 Voltage Peak, KV

Repetition rate is 5KHz

Polarity

Nominal Value: (+)

Positive Polarity

Polarity

Nominal Value: (-)

Negative Polarity

Test Duration

Low Limit: 1 Minute

Nominal Value: 1 Minute

Conclusion

No deterioration or degradation of the EUT was observed throughout the application of the transients and the EUT continued to function as intended after the test.

EN 61000-4-5: 1995	Surge Immunity	Test Status: *Pass*

Test equipment used for this test

UCS500 **Serial Number:** *05 96-57* **Calibrated:** *Aug 02*

Comments

The EUT is supplied with an AC mains charger adaptor which may be connected to the unit during normal operation. Surges were applied to the EUT through the charger.

Test Description

The equipment is placed on a ground reference plane and is insulated from it by an insulating support 0.1m +/- 0.01m thick.

The reference ground plane shall be a metallic sheet of copper or aluminium of 0.25mm min. thickness; other metallic Materials may be used but shall have a 0.65mm minimum thickness.

The minimum size of reference plane shall be 1m x 1m. The actual size depends on the dimensions of the EUT.

The reference ground plane shall project beyond the EUT by at least 0.1m on all sides.

The ground plane shall be connected to the protective earth [or ground].

The EUT is arranged and connected to satisfy its functional requirements, according to the equipment installation specifications.

The minimum distance between the EUT and all other conductive structures (e.g. the walls of a shielded room), except the ground plane beneath the EUT, is more than 0.5m.

The EUT is connected to the earthing system in accordance with the manufacture's installation specifications; no additional earthing connections are allowed.

The connections of the test equipment ground cables to the ground reference and all bonding shall be arranged to provide minimum inductance.

EN 61000-4-5: 1995 continued-

Coupling devices are used for the application the surge. They shall be coupled to the lines between the EUT and the decoupling network or between two units of equipment involved in the test.

Using the coupling clamp, the minimum distance between the coupling plates and all other conductive structures, except the ground plane beneath the coupling clamp and beneath the EUT are 0.5 m.

The length of the signal and power line be between the coupling device and the EUT are 1m or less.

If the EUT has a non-detachable supply cable more than 1m long with equipment, the excess length of this cable is gathered into a flat coil with a 0.4m diameter and situated at a distance of 01.m above the ground reference plane. The Distance of 1m or less between the EUT and the coupling device are maintained.

Application of the surge:

The surge is applied to the following lines or ports of the EUT

Power supply ports:

The EUT mains power supply cord is connected to the test generator's coupling/decoupling network

I/O and communication ports:

The capacitive coupling clamp is used for the application of the surge to I/O and communication ports.

Earth connections of the cabinet:

The test point on the cabinet is the terminal for the protective earth conductor.

The surge is applied to the protective earth (PE) connection by the coupling/decoupling network.

Climatic conditions:

The tests is carried out in standard climatic conditions in accordance with IEC 68-1

- ambient temperature: 15 degrees C to 35 degrees C
- relative humidity: 10% to 75%

The above data is recorded in the test record.
The EUT shall be operated within its intended climatic conditions.

- The EUT is tested in the normal operating conditions;
- test level shall be applied per the parameters section of this test plan;
- polarity shall be applied per the parameters section of this test plan, usually both polarities (required for a verification test);
- the test generator is operated on internal drive unless otherwise indicated by special test instructions.
- the test duration is specified in the parameters
- apply the number of events per the test parameters

EN 61000-4-5: 1995 continued -

Test Parameters

Common Mode:	±2.0 kV Voltage Peak
Differential Mode:	±1.0 kV Voltage Peak

Polarity

Nominal Value: (+)

Positive Polarity

Polarity

Nominal Value: (-)

Negative Polarity

Test Duration

Surges applied at 90° increments starting at 0° (0V-crossover point)
5 counts at each point with a 20 second "rest time" between surges

This should be repeated at each angle in both polarities at each test voltage

Conclusion

No deterioration or degradation of the EUT was observed throughout the application of the surges and the EUT continued to function as intended after the test.

EN61000-4-11	Voltage Dips and Interrupts	Test Result: *Pass*

Test equipment used for this test

UCS500 / V40/70 *Serial Number: 0596-57 / 0063-97 41/00* *Calibrated: Aug 02*

Comments

The EUT has an AC mains charger adaptor which may be connected to the unit during normal operation

AC voltage dips and interruptions were applied to the EUT through the charger.

Test Description

Preparation for Test:

The EUT is connected to the EUT output of the Generator, all earth points are checked.
The Generator is switched on and set-up to be run via software. The EUT is turned on via the software.

The Generator software is pre-programmed with all test Parameters.

Determination of EUT Reset Level:

The Line voltage at which the EUT enters reset, and recovers reset is checked and noted.

Brownout Test:

The Generator is run until the voltage indicated is with the EUT specification nominal or as indicated in the Parameter section of this test plan. Proper operation of the EUT is confirmed.

Application of Brownout:

Dip to Specified Level.

The state of EUT of operation is confirmed to be nominal and noted. EUT line voltage is reduced using the best until the voltage shown on the best is within the low limit of brownout range shown in the test parameter section of this test plan. Then the line voltage is increased slowly until the EUT recovers from its reset state. EUT proper operation and reset recovery is confirmed.

Dip to specified level is repeated ten times.

EN61000-4-11 continued

Evaluation of Brownout Test Results.

After a brownout event of the above paragraph, the EUT is checked for recovery to the same state observed before the brownout event. Statistics are confirmed as being that observed before the brownout event. Observed anomalies and the reaction level are noted and recorded.

Level 1 reaction:
EUT recovers operation to specification limits.

Level 2 reaction:
EUT may exhibit self-recovering errors.

Level 3 reaction:
EUT may exhibit errors requiring operator intervention to correct, but may not exhibit any loss of data or equipment damage.

Level 4 reaction:
Damage results to EUT hardware, or loss of data occurs.

Test Procedure, Power Line Dip.

The Best output voltage will adjust to the specification nominal per the parameter section of this test plan. EUT operation confirmed nominal and noted. Within an interval of between 0.5 and 0.2 seconds, the Generator reduces the level to less than 10% of the EUT specification nominal line voltage. Within the same interval, the Generator will return the level to nominal specifications.

The recovery.
Operation of the EUT is noted and compared to that before the power line dip event.

Discrepancies are noted and evaluated according to the reaction levels indicated above. This step is repeated as per the parameter section.

This step is repeated dipping to a level 5% to 10% below the EUT reset level as determined above or as specified in the parameters of the test plan. Reaction is determined as stated above.

Test Procedure, Power Line Interrupt

The output voltage of the Generator will adjust to specification nominal for the EUT as shown in the parameter section of this test plan. EUT operation is confirmed nominal and noted. The Generator will interrupt the EUT power line momentarily for a time interval of between ¼ and 2 seconds (or intervals indicated in the Parameter section of the test plan)

Interrupt the power in fast bursts (minimum of 10) of interruptions, each event within the burst having a maximum interval of 1/8 second. Power interruption bursts are repeated approximately ten times. After each burst of power interruptions, EUT operation allowed to recover and is noted and evaluated as below.

This fast burst test is repeated a minimum of ten times or as shown in the parameter section.

Evaluation of Power Line Interrupt Test Results:

Level 1 reaction:
EUT recovers operation to specification limits.

EN61000-4-11 continued

Level 2 reaction:
EUT may exhibit self-recovering errors.

Level 3 reaction:
EUT may exhibit errors requiring operator intervention to correct, but may not exhibit any loss of data or equipment damage.

Level 4 reaction:
Damage results to EUT hardware, or loss of data occurs

Test Parameters

Voltage Dips:

Low Limit:	0%
Normal Value:	<5% power level (>95% dip) for 0.5 cycles
High Limit:	<5%
Low Limit:	36%
Normal Value:	40% power level (60% dip) for 5 cycles
High Limit:	44%
Low Limit:	63%
Normal Value:	70% power level (30% dip) for 25 cycles
High Limit:	77%

Voltage Interrupts

Low Limit:	0%
Nominal value:	<5% power level (>95% dip) for 5 seconds
High Limit:	<5%

Applied Frequency,

Low Limit:	49Hz
Nominal Value:	50Hz
High Limit:	51Hz

Conclusion

No deterioration or degradation of the EUT was observed throughout the application of the Voltage Dips and Interrupts and the EUT continued to function as intended after the test..

EMC Test Report

EN 55011 / CISPR 11 Class B Conducted & Radiated Emissions **Test result: *Pass***

Test Summary

Industrial, scientific and medical (ISM) radio frequency equipment - Radio disturbance characteristics - Limits and methods of measurement

Test Description

Conducted emissions
Measurement Frequency range: ***150kHz – 30MHz***

Radiated emissions
Measurement Frequency range: ***30MHz – 1000MHz***

Test equipment used for this test

LISN Artificial Mains Network 50ohms:	***EMCO 3825/2 10kHz – 30MHz***
Spectrum Analyser:	***Hewlett Packard 8567A***
Rx Antenna, Biconical:	***EMCO 3104C 30-200 MHz, Log Periodic EMCO 3146 200-1000MHz***

Comments

The EUT was exercised in its most electronically active mode, in accordance with the manufacturers instructions.

No measurements exceeded the set Class B limits for the standard.