ELECTROMAGNETIC COMPLIANCE TEST REPORT

Report Number..... :	**IEC61326_BTM000250-AlphaSA**
Date of issue ..... :	**26th March 2012**
Total number of pages ..... :	**25**

Test specification:	
Standard ..... :	IEC61326 Electrical equipment for measurement, control and laboratory use – EMC requirements

Test Report Form No. ..... :	IEC61326_BTM00250-ALPHASA
Test Report Form(s) Originator.... :	Tomco Technologies
Test Location..... :	Site 1: Tomco Technologies, 38 Payneham Road, Stepney 5069, Australia
Test Engineer..... :	Shane Dillon, Zac Bajic, David Zhang
Approved by..... :	Janice Reid
Signature.....	Janice Reid.
Test Dates..... :	5th-19thMarch 2012

Equipment Under Test (EUT): BTM00250-ALPHA-SA

Trade Mark..... :	Tomco Technologies
Manufacturer..... :	Tomco Electronics Pt y Ltd t/a Tomco Technologies
Model/Type reference..... :	BTM00250-AlphaSA
Ratings..... :	+50V DC

Contents

Normative Basic References

IEC 61326-1 Electrical equipment for measurement, control and laboratory use – EMC requirements

IEC 61000-4-2:2008, Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test – Basic EMC Publication

IEC 61000-4-3:2006, Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test

IEC 61000-4-4:2008, 2012 Electromagnetic compatibility (EMC) – Part 4-4; Testing and measurement techniques – Electrical fast transient/burst immunity test – Basic EMC Publication

IEC 61000-4-5:2005, Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test

IEC 61000-4-6:2009 2012, Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields

IEC 61000-4-8:2009, Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test – Basic EMC Publication

IEC 61000-4-11:2004, Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests

IEC 61000-3-2:2005, Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤16A per phase)

IEC61000-3-3:2008, Electromagnetic compatibility (EMC) – Part 3-3: Limits – limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current ≤16A.

CISPR11:2009 +A1:2010, Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement

Test Sample Description

Test Sample Model Number: BTM00250-AlphaSA
Serial number: 10056
Supply Voltage: +50V DC
Rated output power: 250W peak envelope power maximum @ 20% duty cycle

The EUT is an ISM sub-assembly which is intended to be integrated into scientific research apparatus.
The EUT is not capable of stand-alone ISM operation and is not intended to perform any stand-alone ISM function

Test Results Summary

Test	Test Requirement	Test Method	Class	Result
Radiated and Conducted Emissions	CISPR 11	CISPR 11	Class A, Group1	N/A[1]
Harmonic Emission on AC	IEC 61000-3-2	IEC 61000-3-2		N/A[2]
Flicker Emission on AC	IEC 61000-3-3	IEC 61000-3-2		N/A[2]
Electrostatic Discharge Immunity Test	IEC 61000-4-4	IEC 61000-4-4		PASS
Radiated Radio-Frequency Immunity	IEC 61000-4-3	IEC 61000-4-3		PASS
Fast Transient/Burst Immunity	IEC 61000-4-4	IEC 61000-4-4		PASS[3]
Surge Immunity Test	IEC 61000-4-5	IEC 61000-4-5		N/A[2]
Immunity to Conducted RF Disturbance	IEC 61000-4-6	IEC 61000-4-6		PASS
Voltage Dips, Short Interruptions and Voltage Variations Immunity Test	IEC 61000-4-11	IEC 61000-4-11		N/A[2]

1. CISPR 11, clause 6:1, “excluded from the testing requirements and limits of this standard are components and subassemblies not intended to perform any standalone ISM function”
2. No AC connection
3. DC power input and DB9 interface only.

Performance Pass/Fail Criteria

The performance of the EUT was subject to the following performance criteria as described in EN61326-1:

1. **Performance criterion 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 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.

2. **Performance criterion B**: The apparatus shall continue to operate as intended after the test. 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. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If 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.

3. **Performance criterion C**: Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

In addition to the above, the apparatus shall not become dangerous or unsafe as a result of the application of the tests defined in the Standard.

Electrostatic Discharge Immunity (IEC 61000-4-2)

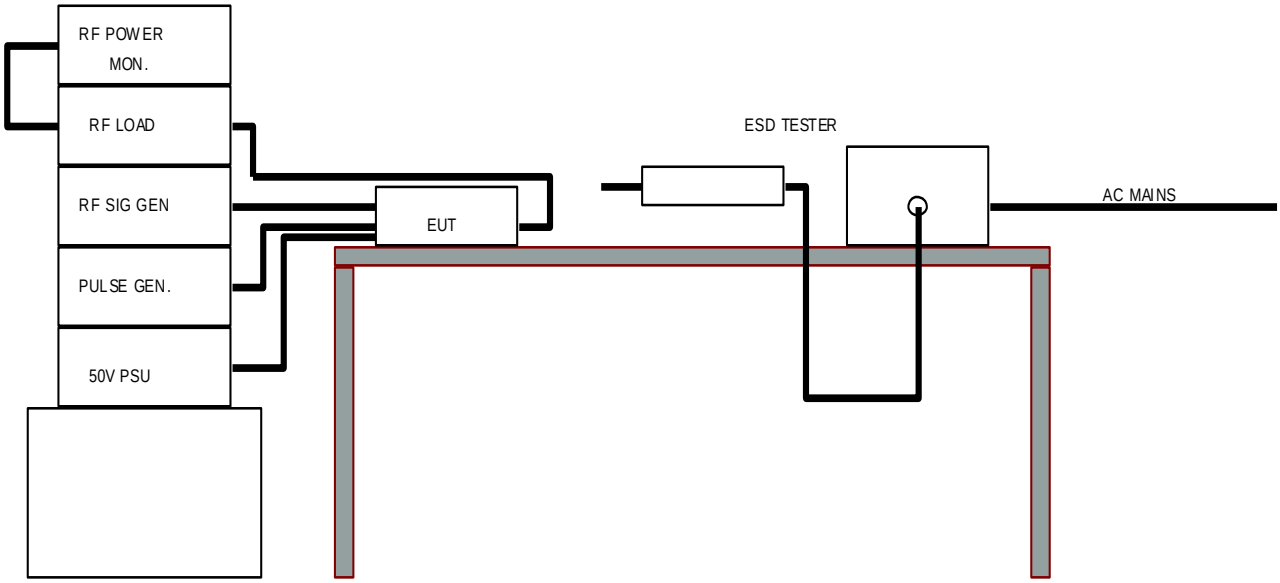
Test Sample Configuration

The EUT was configured in a way that resembles as closely as possible its arrangement in typical final installed conditions. Therefore, the EUT was powered up by applying an input voltage of +50V from a bench power supply. An input RF signal was applied to the RF input connector. A TTL GATE signal was applied via the 9-pin D connector. A 50 Ohm dummy load was connected to RF output. Output power level was measured via the sample port on the dummy load for the active tests, and was monitored for any performance anomalies.

Modification

No modifications were performed to the EUT.

Block Diagram of ESD Test Setup



Electrostatic Discharge Test Method

1. Test points were selected depending on accessibility during normal use. The module consists of a completely sealed and continuous metal enclosure, and under normal use no other points are accessible. Ten direct contact and ten air discharges of both positive and negative polarities were applied to all sides of the EUT at various points such as screws, connectors and metallic surface. Discharges were also applied to the DC input connection of the module.
2. The EUT was operated normally with a 0dBM RF input signal and GATE signal of 20% duty cycle. Output load was connected and output power level monitored while applying the discharges.
3. The applied contact discharge level was initially ±2kV. The level was then increased to ±4kV.
4. The applied air discharge level was initially ±2kV. The level was then increased to ±4kV, and then to ±8kV.

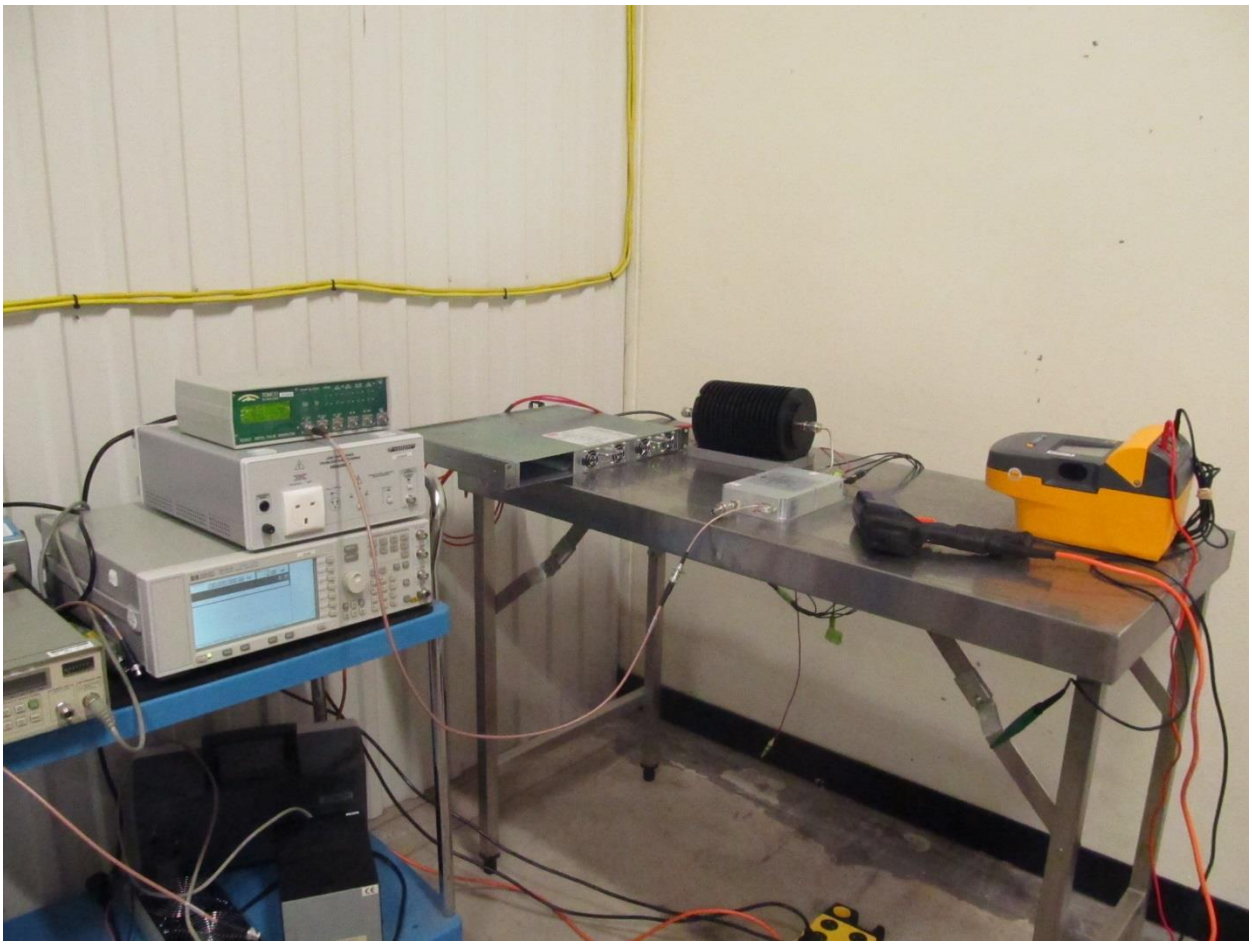
Electrostatic Discharge Test Results

For +/-2kV, +/-4kV Contact Discharges, and +/-2kV, +/-4kV, +/-8kV Air Discharges, applied to all stated test points, the EUT functioned normally with no perturbation observed to output power level.

The ambient temperature was 20 degrees, with a humidity of 58%.

Discharge location	**Type**	**Result**
Module enclosure, 10 air discharges and 10 contact discharges on top and all four sides	Air and contact	PASS, criterion A. No performance disturbance detected

Electrostatic Discharge Test Photo



Radiated Radio Frequency Immunity (IEC 61000-4-3)

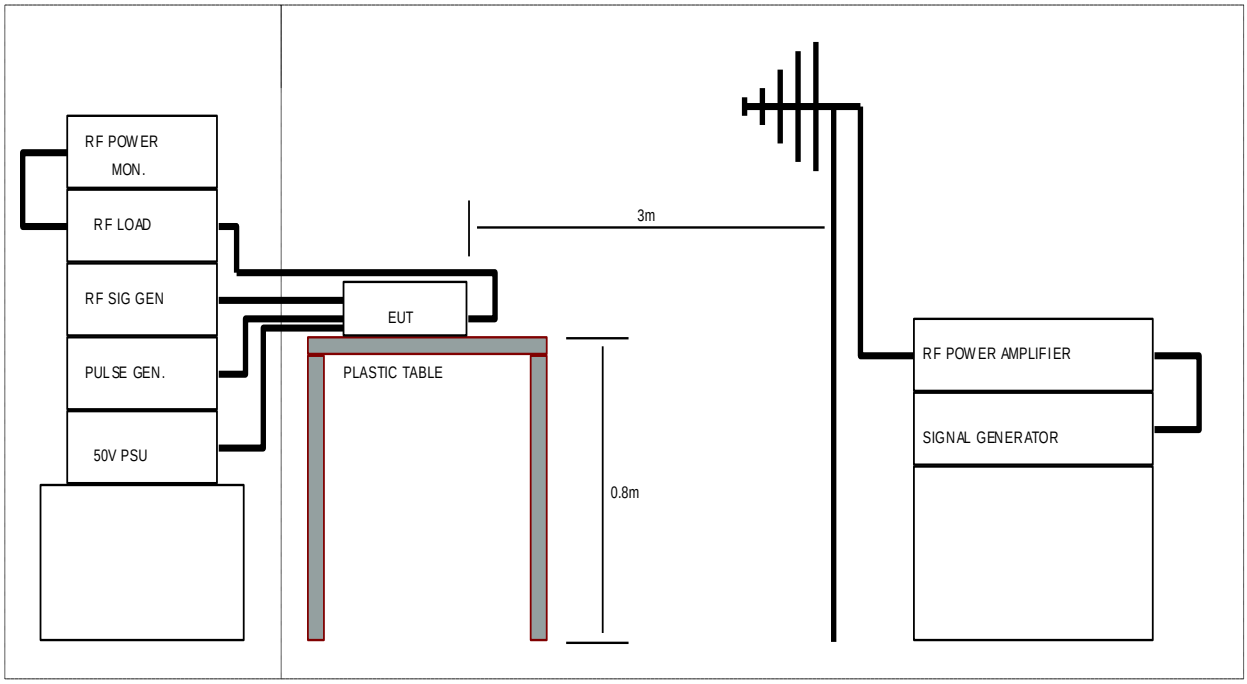
Test Sample Configuration

The EUT was configured in a way that resembles as closely as possible its arrangement in typical final installed conditions. Therefore, the EUT was powered up by applying an input voltage of +50V from a bench power supply. An input RF signal was applied to the RF input connector. A TTL GATE signal was applied via the 9-pin D connector. A 50 Ohm dummy load was connected to RF output. Output power level was measured via the sample port on the dummy load for the active tests, and was monitored for any performance anomalies.
The test was carried out in a shielded room semi-anechoic room, with metal walls covered on all internal surfaces with ferrite loaded tiles. Although not perfectly anechoic, the EUT is of sufficiently small dimensions (its largest surface measures 120x20mm), to ensure a uniform field strength over its surface. Measurements with the field strength meter confirmed this.
To further account for frequency-dependent variations in field uniformity in the reference plane, the signal generator level into the RF power amplifier was adjusted to maintain a measured field strength of *at least* 5V/m at each frequency in the 80-1000MHz range – allowing a large margin above the 3V/m recommended in the standard.
Cable lengths connected to the EUT were all approximately 1m in length, and passed through a screened aperture into another room where the test equipment was located.
Ferrite beads and other forms of RF suppression were fitted to test cables, close to the test and monitoring equipment itself, as required to ensure that the RF field did not disrupt operation of that equipment.

Modification

No modifications were performed to the EUT.

Block Diagram of Radiated RF Immunity Test Setup



Severity Level and Performance Criterion

Severity level 2, 3V/m.
Performance criterion A.

Radiated RF Immunity Test Method

1. The EUT was positioned on a 0.8m insulating support at the Tomco indoor test site.
2. For frequency range of 80MHz to 850MHz, radiating antenna was positioned 3 metres away from the EUT and connected to an RF amplifier, which was driven by a signal generator. The test was repeated for frequency ranges of 850MHz to 1GHz, 1.4GHz to 2.0GHz and 2.0GHz to 2.7GHz.
3. The electric field strength at the EUT was monitored using a field strength meter, and the signal generator level adjusted at each frequency to maintain at least 5V/m field strength.
4. In accordance with EN 61000-4-3, the frequency range of 80MHz to 1000MHz was swept incrementally with 1% steps, whilst a leveled, 80% AM modulated RF field of at least 5V/m (using CW calibration) was maintained. Additional range of 1.4GHz to 2GHz and 2.0GHz to 2.7GHz was tested in the same manner, using a field of at least 3V/m. For range of 2.0GHz to 2.7GHz, 80% AM modulated RF field of at least 1V/m was maintained.

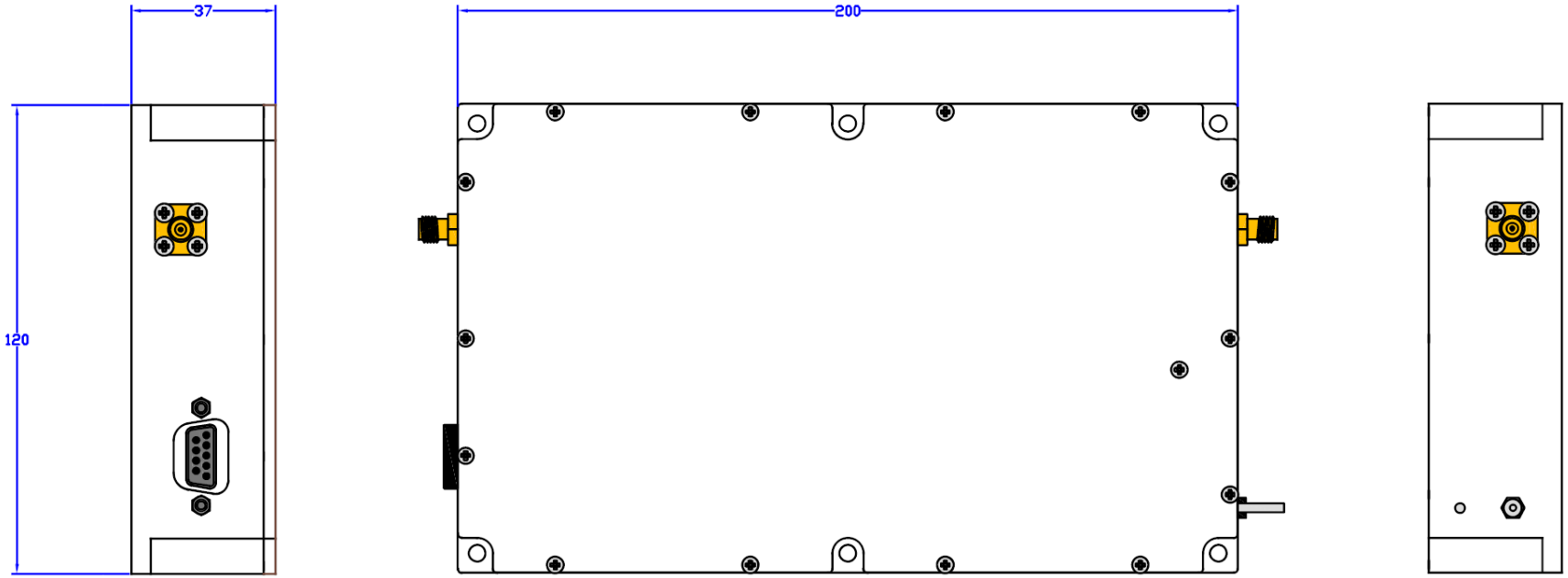
5. The test was performed with the antenna positioned for horizontal and then vertical polarization.
6. The EUT was rotated in 90 degree increments such that each surface of the EUT was in turn facing the antenna.

Radiated RF Immunity Test Results

Field	**Result**
>5V/m, 80-1000MHz, horizontal and vertical polarisation, all EUT surfaces.	PASS, criterion A. No performance disturbance detected
>3V/m, 1400-2000MHz, horizontal and vertical polarisation, all EUT surfaces.	PASS, criterion A. No performance disturbance detected
>5V/m, 2000-2700MHz, horizontal and vertical polarisation, all EUT surfaces.	PASS, criterion A. No performance disturbance detected

Radiated RF Immunity Test Setup Photo

Dimensions of EUT



Electrical Fast Transient Immunity Test (IEC 6100-4-4)

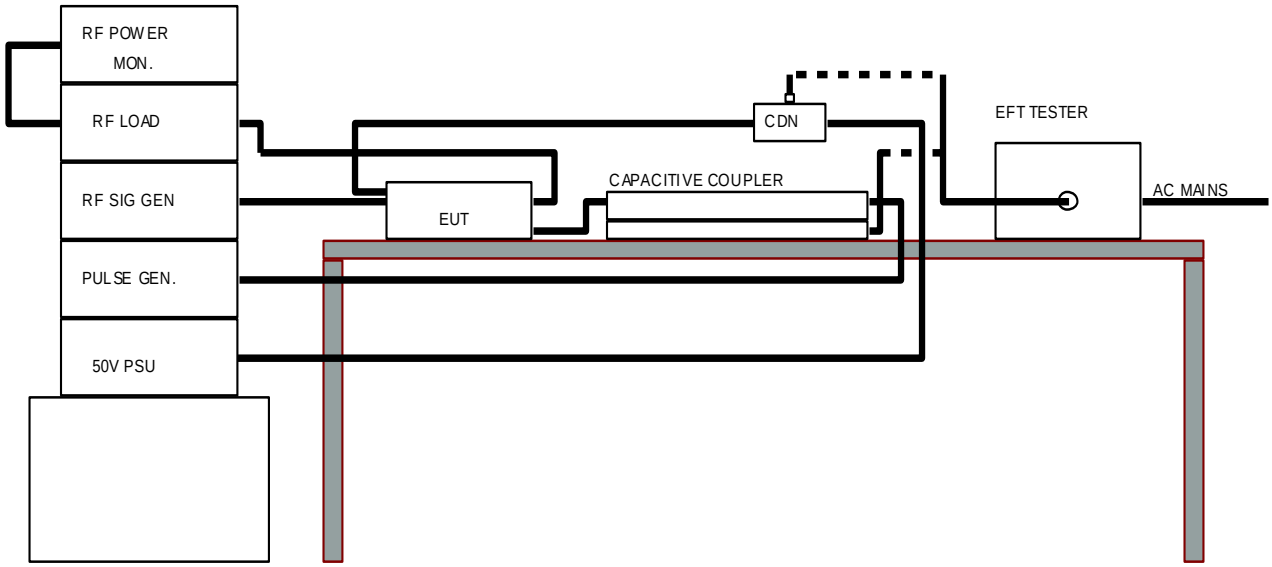
Test Sample Configuration

The EUT was configured in a way that resembles as closely as possible its arrangement in typical final installed conditions. Therefore, the EUT was powered up by applying an input voltage of +50V from a bench power supply. An input RF signal was applied to the RF input connector. A TTL GATE signal was applied via the 9-pin D connector. A 50 Ohm dummy load was connected to RF output. Output power level was measured via the sample port on the dummy load for the active tests, and was monitored for any performance anomalies.
A CDN was used to couple the disturbances onto the 50V DC supply wire. A capacitive coupling plate (1m in length) was used to couple disturbances onto the wires connected to the DB9 interface connector. The RF power output of the module was monitored to assess the performance of the module during application of the disturbances.

Modification

No modifications were performed to the EUT.

Block Diagram of Fast Transient Immunity Test Setup



Severity Level and Performance Criterion

Severity level 2 (1kV)
Performance criterion A

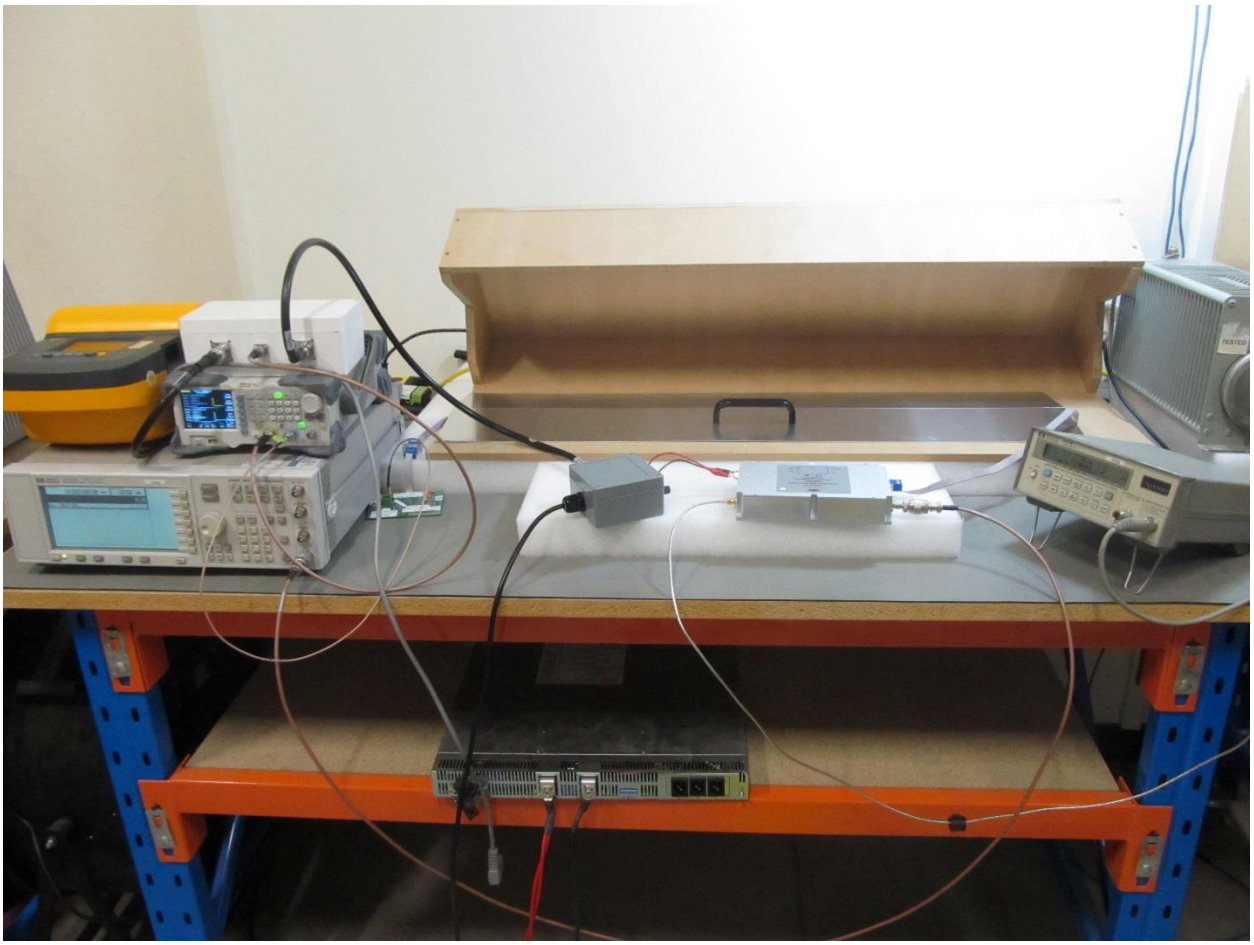
Electrical Fast Transient Test Method

1. The EUT was placed on a metal table.
2. A CDN was fitted in line with the 50V DC supply to the EUT.
3. The EUT was operated normally with a 0dBM RF input signal and GATE signal of 20% duty cycle. Output load was connected and output power level monitored while applying the disturbances to the CDN.
4. The test was repeated with a 1m long capacitive plate coupler fitted over the wires connected to the DB9 interface connector of the EUT.

Electrical Fast Transient Test Results

Disturbance location	**Result**
DC power terminal	PASS, criterion A. No performance degradation detected
DB9 Interface connector	PASS, criterion A. No performance degradation detected

Electrical Fast Transients Test Setup Photos



Conducted RF Disturbance Immunity Test (IEC 6100-4-6)

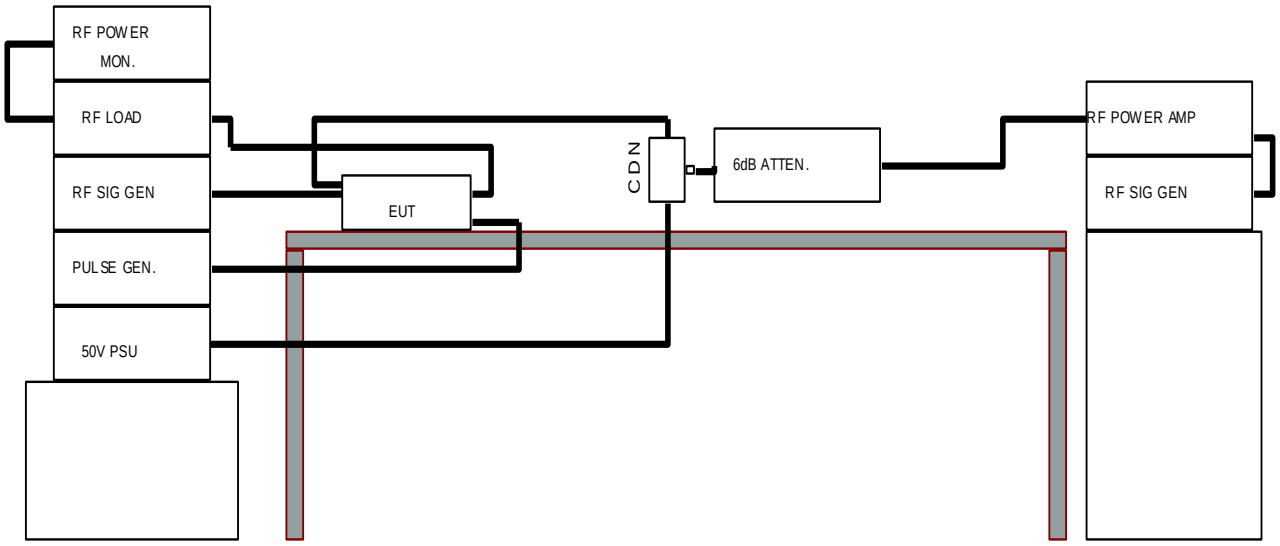
Test Sample Configuration

The EUT was configured in a way that resembles as closely as possible its arrangement in typical final installed conditions. Therefore, the EUT was powered up by applying an input voltage of +50V from a bench power supply via a CDN. An input RF signal was applied to the RF input connector. A TTL GATE signal was applied via the 9-pin D connector. A 50 Ohm dummy load was connected to RF output. Output power level was measured via the sample port on the dummy load for the active tests, and was monitored for any performance anomalies.
The CDN was used to couple the RF disturbances onto the 50V DC supply wire. The RF disturbance signal was produced by an RF power amplifier and a signal generator, and was connected to the CDN via a 6dB attenuator to maintain an acceptable return loss to the output of the amplifier, to permit the required RF level to be achieved at the CDN input at all test frequencies.
The RF power output of the EUT was monitored to assess the performance of the module during application of the disturbances.

Modification

No modifications were performed to the EUT.

Block Diagram of Conducted RF Disturbance Immunity Test Setup



Severity Level and Performance Criterion

Severity level 2: 3Vrms
Performance criterion: No measureable performance degradation or anomalous behavior.

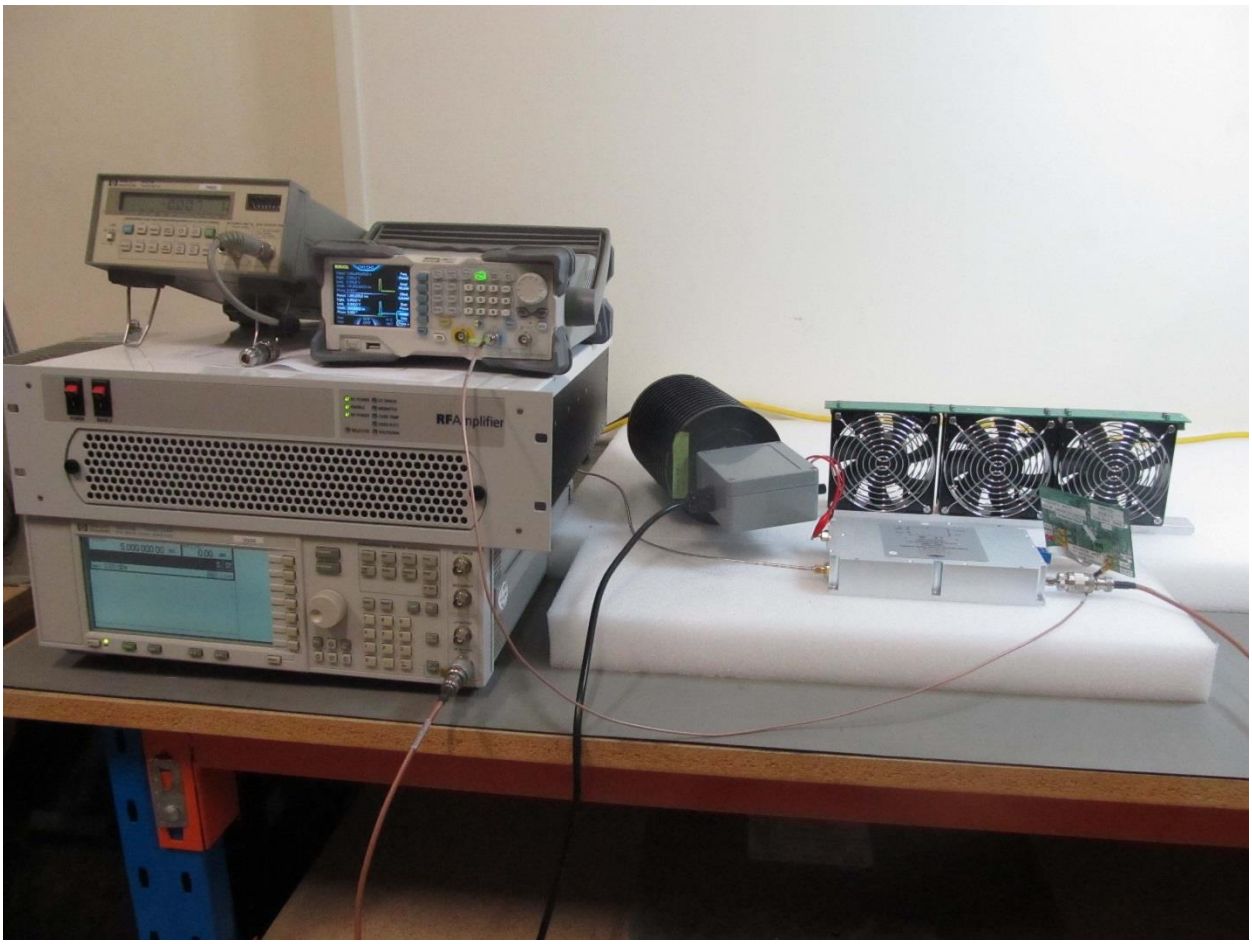
Conducted RF Disturbance Immunity Test Method

1. A signal generator was connected to an RF power amplifier. The output of the RF power amplifier was connected to the RF input of the CDN via a 6dB attenuator.
2. The CDN was fitted in line with the 50V DC supply to the EUT.
3. The EUT was operated normally with a 0dBM RF input signal and GATE signal of 20% duty cycle. Output load was connected and output power level monitored while applying the RF disturbances to the CDN. The RF disturbance was incremented over the frequency range of 0.15-80MHz in 1% steps, and the pre-calibrated 3Vrms CW level was applied with 1kHz amplitude modulation at 80% depth.
4. The output of the EUT was monitored for any abnormal behavior of disruption.

Conducted RF Disturbance Immunity Test Results

Disturbance location	**Result**
DC power terminal	PASS. No performance degradation or anomalous behaviour detected

Conducted RF Disturbance Immunity Test Setup Photos



Equipment Used During Tests

Equipment	Manufacturer	Model number	Serial no.
Signal Generator	Marconi Instruments	2024	12229/007
Signal Generator	Agilent	E4421B	GB40051152
Spectrum Analyser	HP	8595E	3114A00846
5kV Insulation Tester	Fluke	1550C	1723006
ESD gun attachment	Tomco	ESD01	N/A
RF Power Amplifier	Tomco	BT00250-AlphaS	18785
RF Power Amplifier	Tomco	BT00250-AlphaSA	18893
RF Power Amplifier	Tomco	BT00100-Gamma	18037
RF Power Amplifier	Tomco	BT00250-Lambda	18609
Antenna Biconilog-Type	Tomco	80MHz to 1GHz	13325
Antenna Horn	Tomco	1GHz to 3GHz	20670
Electric field probe	Amplifier Research	FP6001	305682
CDN (DC supply)	Tomco	Built to Clause 6.2.1 IEC61000-4-	10762
CDN (DB9 interface port)	Tomco	Built to Clause 6.2.1 IEC61000-4-	10761
6dB attenuator	Tomco		12762
Power Meter	HP	437B	3125U14412

Power Sensor	HP	8482A	2652A17206
Pulse Generator	Rigol	DSG815	DSG8A174200150
High Power Switch Apparatus	Tomco	THPS-002	18781

Photographs of EUT