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Report No.: GZEM130700339401
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TEST REPORT

| | |
|-----------------------------|--|
| Application No: | GZEM1307003394HS |
| Applicant: | Dongguan Richtek Electronics Co., Ltd. |
| Product Name: | Air Compressor |
| Product Description: | Air Compressor |
| Model No: | RCP-A24C, RCP-A24B, RCP-A24D, RCP-A24E, RCP-D070, RCP-D12B, RCP-B160, RCP-D01, RCP-D02, RCP-D08B, RCP-D10A, RCP-D13B, RCP-C43B, RCP-B28A, RCP-B28B, RCP-B28C, RCP-B49A, RCP-B49B ♣ |
| ♣ | Please refer to section 3 of this report for further details. |
| Standards: | EN 50498:2010 (as per applicant's request) |
| Date of Receipt: | 2013-07-25 |
| Date of Test: | 2013-07-30 to 2013-08-02 |
| Date of Issue: | 2013-08-29 |
| Test Result : | Pass* |

* In the configuration tested, the EUT complied with the standards specified above.

The CE mark as shown below can be used, under the responsibility of the manufacturer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives.



The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. All test results in this report can be traceable to National or International Standards.

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2 Version

| Revision Record | | | | |
|-----------------|---------|------------|----------|----------|
| Version | Chapter | Date | Modifier | Remark |
| 00 | | 2013-08-29 | | Original |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| | | | |
|---------------------------------|---|--------------------------------|--------------------------|
| Authorized for issue by: | | | |
| Tested By |  | | 2013-07-30 to 2013-08-02 |
| | <hr/> | (Evan Huang) /Project Engineer | <hr/> Date |
| Prepared By |  | | 2013-08-27 |
| | <hr/> | (Millie Li) /Clerk | <hr/> Date |
| Checked By |  | | 2013-08-29 |
| | <hr/> | (Guitar Huang) /Reviewer | <hr/> Date |

3 Test Summary

| Electromagnetic Interference (EMI) | | | | |
|--|------------------|-----------------------------------|---|--------|
| Test | Test Requirement | Test Method | Class / Severity | Result |
| Radiated Emissions (30 MHz to 1 GHz) | EN 50498:2010 | 2004/104/EC Clause 6.5 and 6.6 | Table 1 for broad band Table 2 for narrow band | PASS |
| Transient Conducted Emissions | EN 50498:2010 | 2004/104/EC & ISO 7637-2:2004 | Table 3 | PASS |
| Electromagnetic Susceptibility (EMS) | | | | |
| Test | Test Requirement | Test Method | Class / Severity | Result |
| Transient Conducted Immunity | EN 50498:2010 | 2004/104/EC & ISO 7637-2:2004 | Table 4 | PASS |
| <p>♣ Model No.: RCP-A24C, RCP-A24B, RCP-A24D, RCP-A24E, RCP-D070, RCP-D12B, RCP-B160, RCP-D01, RCP-D02, RCP-D08B, RCP-D10A, RCP-D13B, RCP-C43B, RCP-B28A, RCP-B28B, RCP-B28C, RCP-B49A, RCP-B49B</p> <p>According to the declaration from the applicant, the electrical circuit design, layout, components used and internal wiring were identical for all models, with only difference being the outer decoration and model name. Therefore only one model RCP-A24C was tested in this report.</p> | | | | |



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5 General Information

5.1 Client Information

Applicant: Dongguan Richtek Electronics Co., Ltd.
Address of Applicant: No.11, Kuiqing Road, Qingxi Town, Dongguan City, China

5.2 General Description of E.U.T.

Product Name: Air Compressor
Product Description: Air Compressor
Model No: RCP-A24C

5.3 Details of E.U.T.

Rated Supply (Voltage): DC 12V
Power Cable: 3.5m x 2 wires unscreened DC mains cable.

5.4 Description of Support Units

The EUT has been tested with DC 12V battery.

5.5 Deviation from Standards

None.

5.6 General Test Climate During Testing

Temperature: 15-30 °C Humidity: 30-70 %RH Atmospheric Pressure: 860-1060 mbar

5.7 Abnormalities from Standard Conditions

None.

5.8 Monitoring of EUT for All Immunity Test

Audio: N/A
Visual: LED and Pressure meter

5.9 Test Location

All tests were performed at:
SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory,
198 Kezhu Road, Sciencetech Park, Guangzhou Economic & Technology Development District,
Guangzhou, China 510663

Tel: +86 20 82155555 Fax: +86 20 82075059

No tests were sub-contracted.

5.10 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **NVLAP (Lab Code: 200611-0)**

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is recognized under the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0.

- **ACMA**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our NVLAP accreditation.

- **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

- **CNAS (Lab Code: L0167)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2006 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of Testing Laboratories.

- **FCC (Registration No.: 282399)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 282399, May 31, 2002.

- **Industry Canada (Registration No.: 4620B-1)**

The 3m/10m Alternate Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. has been registered by Certification and Engineering of Industry Canada for radio equipment testing with Registration No. 4620B-1.

- **VCCI (Registration No.: R-2460, C-2584, G-449 and T-1179)**

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2460, C-2584, G-449 and T-1179 respectively.

- **CBTL (Lab Code: TL129)**

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2005, the Basic Rules, IECEE 01:2006-10 and Rules of procedure IECEE 02:2006-10, and the relevant IECEE CB-Scheme Operational documents.

6 Equipment Used during Test

| RE in Chamber (for automotive) | | | | | | |
|--------------------------------|-------------------------------|-------------------|-----------|------------|--------------|----------------------|
| No. | Test Equipment | Manufacturer | Model No. | Serial No. | Cal.Due date | Calibration Interval |
| | | | | | (YYYY-MM-DD) | |
| EMC0525 | Compact Semi-Anechoic Chamber | ChangZhou ZhongYu | N/A | N/A | 2014-08-30 | 2Y |
| EMC0522 | EMI Test Receiver | Rohde & Schwarz | ESIB26 | 100283 | 2014-05-06 | 1Y |
| N/A | EMI Test Software | Audix | E3 | N/A | N/A | N/A |
| EMC0514 | Coaxial cable | SGS | N/A | N/A | 2013-12-28 | 2Y |
| EMC0524 | Bi-log Type Antenna | Schaffner -Chase | CBL6112B | 2966 | 2013-11-27 | 2Y |
| EMC2065 | Amplifier | HP | 8447F | N/A | 2013-11-07 | 1Y |
| EMC1801 | Artificial Mains Network | Schwarzbeck | NNBM 8125 | 81251342 | 2014-03-04 | 1Y |
| EMC1802 | Artificial Mains Network | Schwarzbeck | NNBM 8125 | 81251345 | 2014-03-04 | 1Y |

| ISO7637-2 Transient Conducted Emissions | | | | | | |
|---|--------------------------|--------------|-----------|-------------|--------------|----------------------|
| No. | Test Equipment | Manufacturer | Model No. | Serial No. | Cal.Due date | Calibration Interval |
| | | | | | (YYYY-MM-DD) | |
| EMC1801 | Artificial Mains Network | Schwarzbeck | NNBM 8125 | 81251342 | 2014/3/4 | 1Y |
| EMC1802 | Artificial Mains Network | Schwarzbeck | NNBM 8125 | 81251345 | 2014/3/4 | 1Y |
| EMC1803 | Electronic Switch | EM Test/AG | BS200B | V0725102620 | 2013/10/5 | 1Y |
| EMC2012 | digitizing oscilloscope | Tektronix | TDS744A | N/A | 2014/3/4 | 1Y |

| ISO7637-2 Transient Conducted Immunity | | | | | | |
|--|-------------------------|--------------|------------|-------------|--------------|----------------------|
| No. | Test Equipment | Manufacturer | Model No. | Serial No. | Cal.Due date | Calibration Interval |
| | | | | | (YYYY-MM-DD) | |
| EMC1804 | Ultra Compact Simulator | EM Test/AG | UCS 200M | V0725102618 | 2013-11-5 | 1Y |
| EMC1805 | Voltage Drop Generator | EM Test/AG | VDS 200 B2 | V0725102619 | 2013-11-5 | 1Y |

| General used equipment | | | | | | |
|------------------------|----------------|--------------|-----------|------------|--------------|----------------------|
| No. | Test Equipment | Manufacturer | Model No. | Serial No. | Cal.Due date | Calibration Interval |
| | | | | | (YYYY-MM-DD) | |
| EMC0006 | DMM | Fluke | 73 | 70681569 | 2013-11-5 | 1Y |
| EMC0007 | DMM | Fluke | 73 | 70671122 | 2013-11-5 | 1Y |

7 EMI and EMS Test Results (EN50498)

7.1 Radiated Emissions, 30 MHz to 1 GHz

| | |
|-----------------------|---|
| Test Requirement: | EN 50498 |
| Test Method: | Clause 6.5 and 6.6 of 2004/104/EC |
| Test Date: | 2013-07-30 |
| Test Voltage: | DC 13.5V |
| Frequency Range: | 30 MHz to 1 GHz |
| Measurement Distance: | 1 meter |
| Limits: | Table 1 of EN 50498 (for broadband emissions) |

| Frequency range F MHz | Limits Quasi peak dB μ V/m |
|---|--------------------------------------|
| 30 to 75 | 62 – 52 ^a |
| 75 to 400 | 52 – 63 ^b |
| 400 to 1 000 | 63 |
| ^a Decreasing linearly with the log of the frequency. | |
| ^b Increasing linearly with the log of the frequency. | |

Table 2 of EN 50498 (for narrowband emissions)

| Frequency range F MHz | Limits Average dB μ V/m |
|---|-----------------------------------|
| 30 to 75 | 52 – 42 ^a |
| 75 to 400 | 42 – 53 ^b |
| 400 to 1 000 | 53 |
| ^a Decreasing linearly with the log of the frequency. | |
| ^b Increasing linearly with the log of the frequency. | |

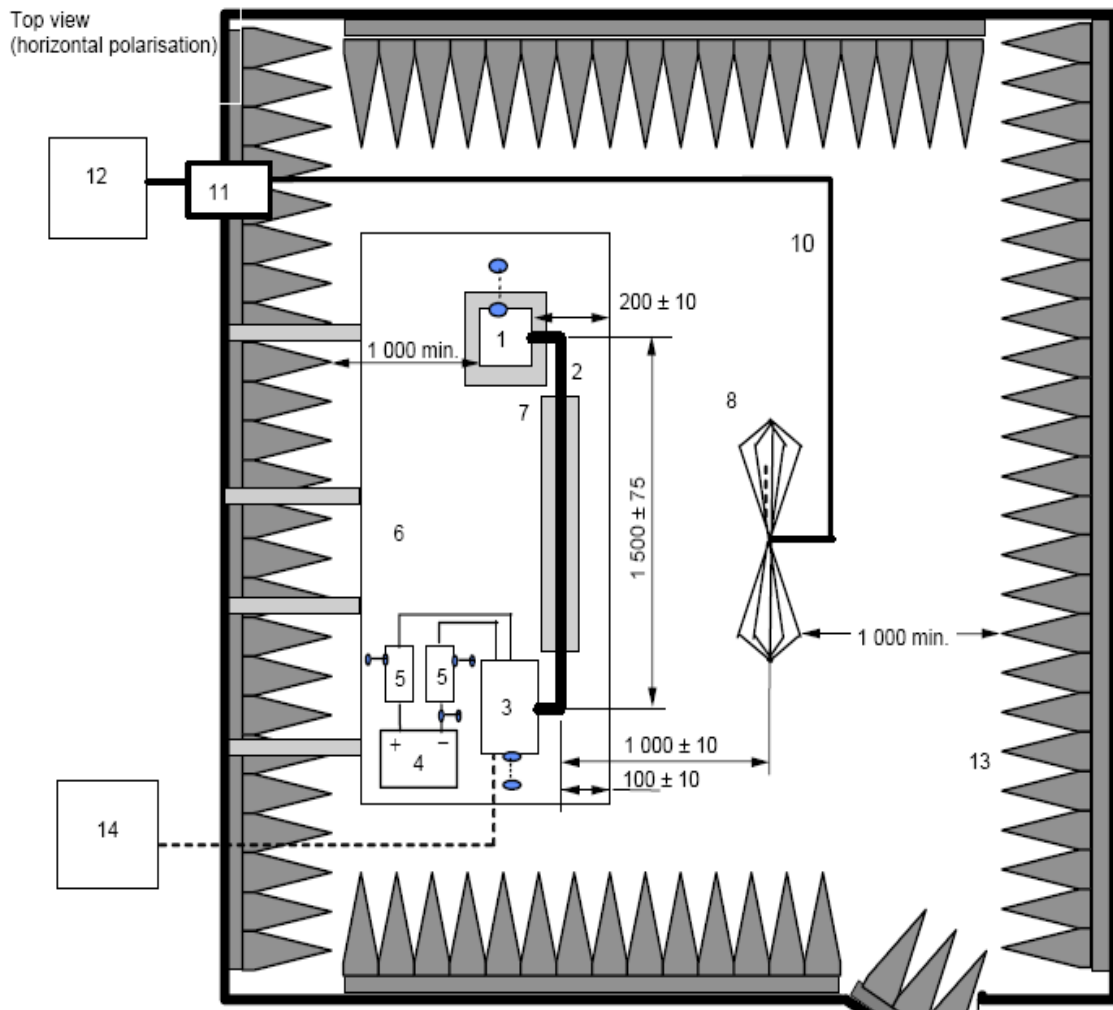
| | |
|-----------|--|
| Detector: | Peak for pre-scan (120 kHz resolution bandwidth) |
| | Quasi-Peak for broadband emissions |
| | Average for narrowband emissions |

7.1.1 E.U.T. Operation

| | |
|----------------|---|
| EUT Operation: | Test the EUT in motor running mode. |
| | Before test, the voltage of the vehicle battery is 13.5V. |
| | After test, the voltage of the vehicle battery is 13.2V. |

7.1.2 Test Setup and Procedure

The EUT was insulated placed 50 mm above the ground plane, the ground plane was in a height of 1 m from the reference plane of semi-anechoic chamber and with electrical connection. No additional electric connection was made between the EUT and ground plane as the EUT will not be intended to be bonded to the bodywork of the vehicle. The EUT was powered by 12 V vehicle battery through 5 uH/50 ohm LISN.

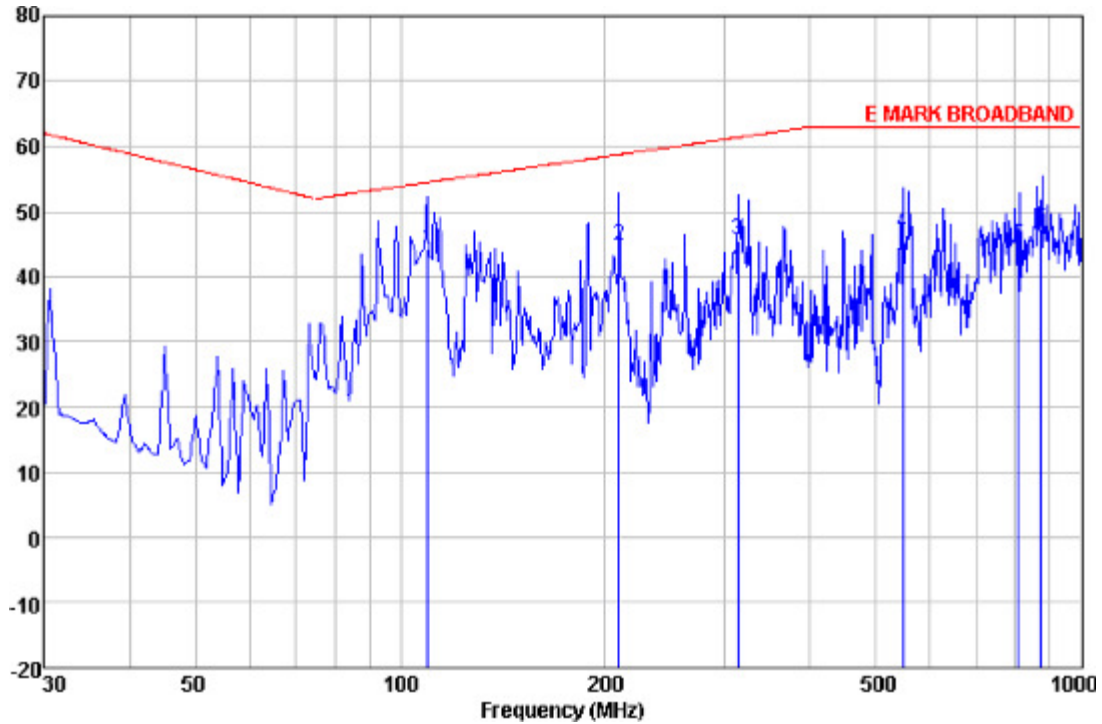


Key

| | |
|--|---------------------------------------|
| 1. EUT (grounded locally if required in test plan) | 8. Antenna |
| 2. Test harness | 10. High-quality coaxial cable |
| 3. Load simulator | 11. Bulkhead connector |
| 4. Power supply (location optional) | 12. Measuring instrument |
| 5. Artificial network (AN) | 13. RF absorber material |
| 6. Ground plane (bonded to shielded enclosure) | 14. Stimulation and monitoring system |
| 7. Low relative permittivity support | |

7.1.3 Measurement Data

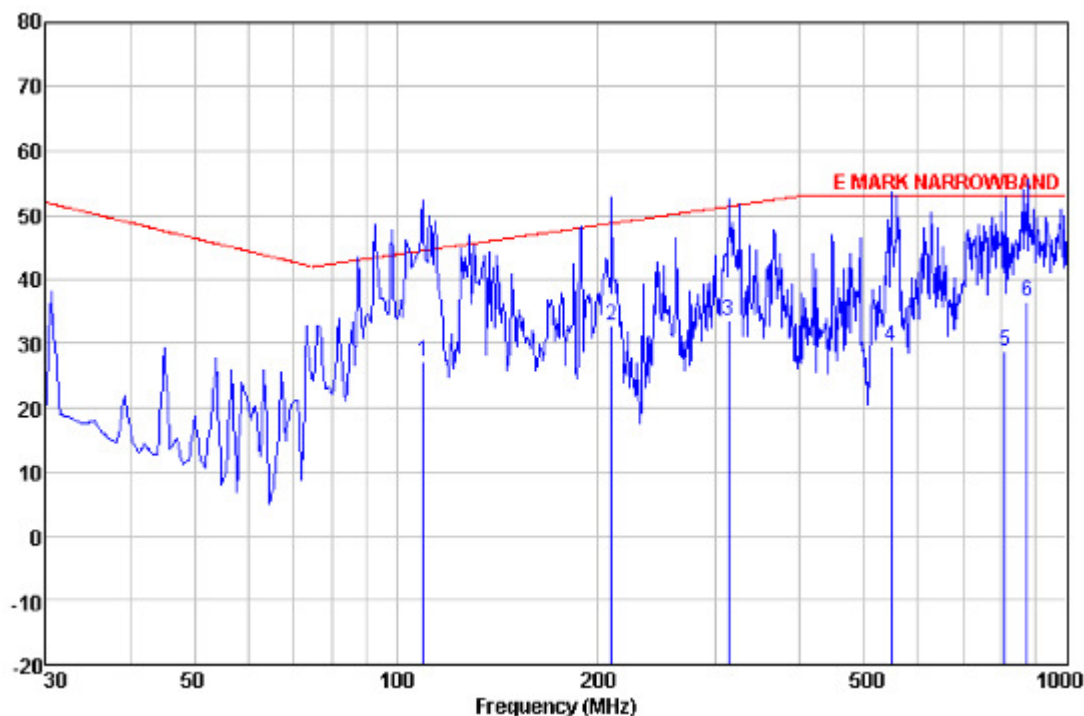
Polarisation:
Horizontal:
Peak scan
Level (dB μ V/m)



QP measurement for Broadband emissions.

| Freq | ReadAntenna Level | Cable Preamp Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Remark |
|---------|-------------------|---------------------|------------|---------------|--------------|--------------|------------|--------|
| MHz | dB μ V | dB/m | dB | dB | dB μ V/m | dB μ V/m | dB | |
| 109.540 | 58.76 | 11.86 | 0.24 | 26.56 | 44.30 | 54.49 | -10.19 | QP |
| 209.450 | 61.09 | 9.09 | 0.74 | 26.08 | 44.84 | 58.75 | -13.91 | QP |
| 313.240 | 57.14 | 13.30 | 1.03 | 25.86 | 45.61 | 61.39 | -15.78 | QP |
| 547.010 | 53.91 | 18.47 | 1.44 | 27.21 | 46.61 | 63.00 | -16.39 | QP |
| 808.910 | 49.78 | 20.20 | 1.75 | 27.03 | 44.70 | 63.00 | -18.30 | QP |
| 873.900 | 51.68 | 20.75 | 1.99 | 26.84 | 47.58 | 63.00 | -15.42 | QP |

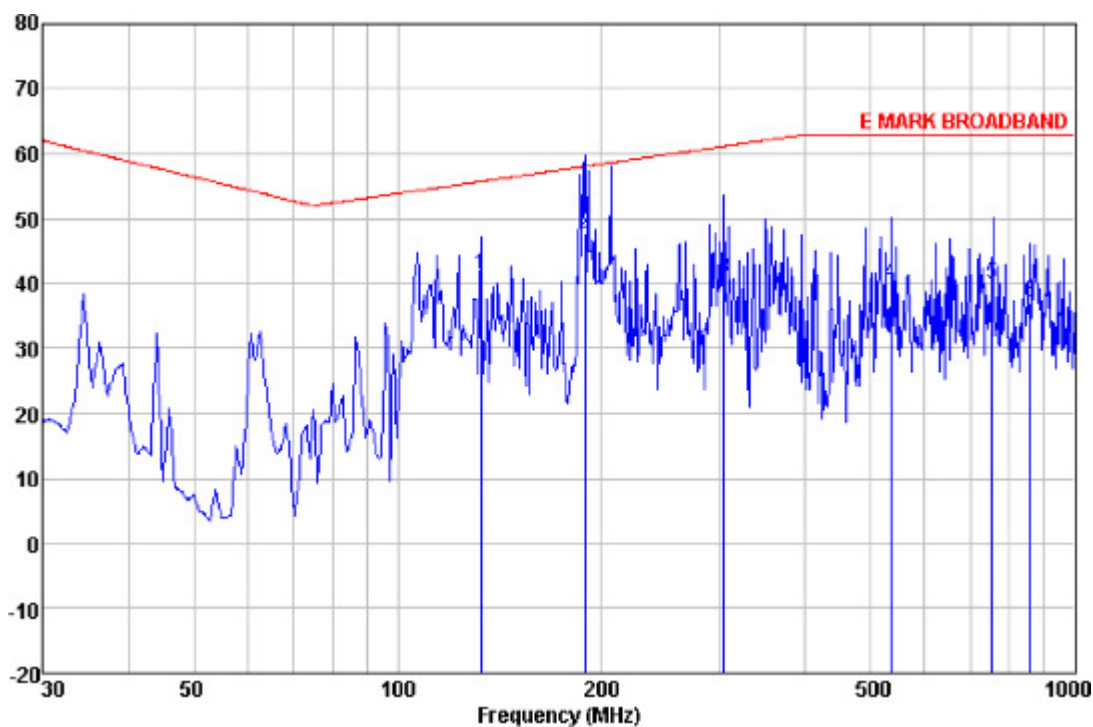
Horizontal
Peak scan
Level (dB μ V/m)



Average measurement for Narrowband emissions.

| Freq | ReadAntenna Level | Antenna Factor | Cable Loss | Preamplifier Gain | Level | Limit | Over Limit | Remark |
|---------|-------------------|----------------|------------|-------------------|--------------|--------------|------------|---------|
| MHz | dB μ V | dB/m | dB | dB | dB μ V/m | dB μ V/m | dB | |
| 109.540 | 41.76 | 11.86 | 0.24 | 26.56 | 27.30 | 44.49 | -17.19 | Average |
| 209.450 | 49.09 | 9.09 | 0.74 | 26.08 | 32.84 | 48.75 | -15.91 | Average |
| 313.240 | 45.14 | 13.30 | 1.03 | 25.86 | 33.61 | 51.39 | -17.78 | Average |
| 547.010 | 36.91 | 18.47 | 1.44 | 27.21 | 29.61 | 53.00 | -23.39 | Average |
| 808.910 | 33.78 | 20.20 | 1.75 | 27.03 | 28.70 | 53.00 | -24.30 | Average |
| 873.900 | 40.68 | 20.75 | 1.99 | 26.84 | 36.58 | 53.00 | -16.42 | Average |

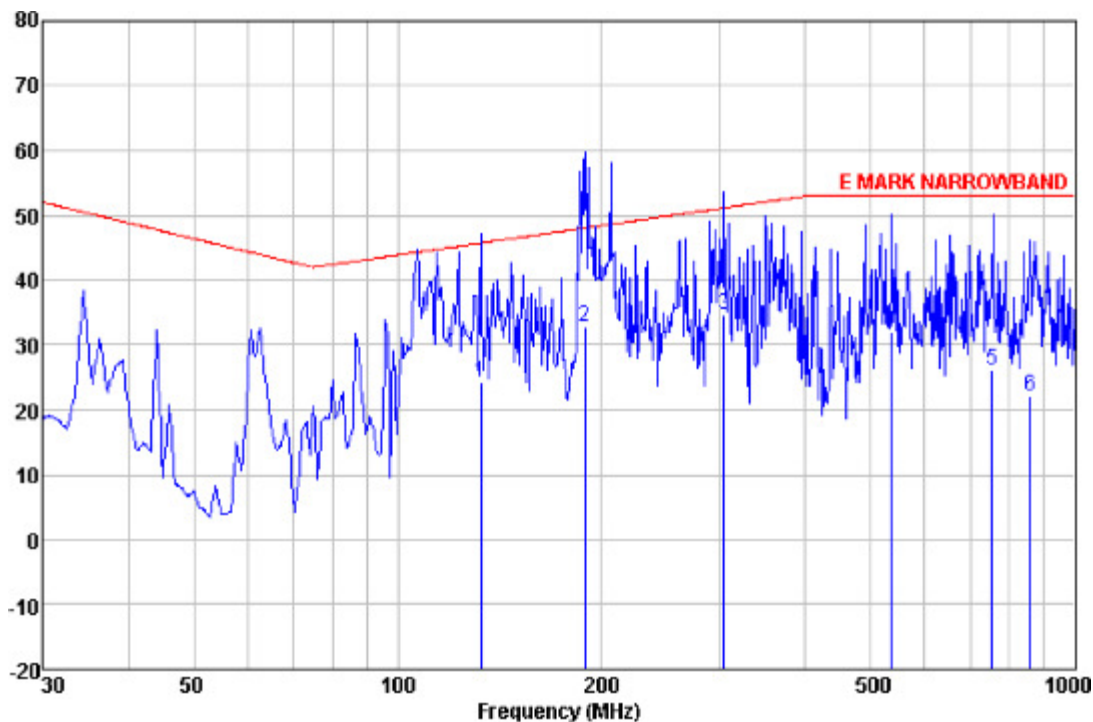
Polarisation:
Vertical:
Peak scan
Level (dB μ V/m)



QP measurement for Broadband emissions.

| Freq | ReadAntenna Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Remark |
|---------|-------------------|----------------|------------|---------------|--------------|--------------|------------|--------|
| MHz | dB μ V | dB/m | dB | dB | dB μ V/m | dB μ V/m | dB | |
| 132.820 | 55.44 | 11.84 | 0.41 | 26.43 | 41.26 | 55.76 | -14.50 | QP |
| 189.080 | 64.75 | 8.39 | 0.70 | 26.13 | 47.71 | 58.08 | -10.37 | QP |
| 303.540 | 52.74 | 12.80 | 1.00 | 25.83 | 40.71 | 61.19 | -20.48 | QP |
| 534.400 | 47.68 | 18.02 | 1.47 | 27.17 | 40.00 | 63.00 | -23.00 | QP |
| 753.620 | 45.04 | 20.25 | 1.84 | 27.09 | 40.04 | 63.00 | -22.96 | QP |
| 856.440 | 41.48 | 20.50 | 2.04 | 26.89 | 37.13 | 63.00 | -25.87 | QP |

Vertical:
Peak scan
Level (dB μ V/m)



Average measurement for Narrowband emissions.

| Freq | ReadAntenna Level | Antenna Factor | Cable Loss | Preamplifier | Level | Limit | Over | Remark |
|---------|-------------------|----------------|------------|--------------|--------------|--------------|--------|---------|
| MHz | dB μ V | dB/m | dB | dB | dB μ V/m | dB μ V/m | dB | |
| 132.820 | 38.44 | 11.84 | 0.41 | 26.43 | 24.26 | 45.76 | -21.50 | Average |
| 189.080 | 49.75 | 8.39 | 0.70 | 26.13 | 32.71 | 48.08 | -15.37 | Average |
| 303.540 | 46.74 | 12.80 | 1.00 | 25.83 | 34.71 | 51.19 | -16.48 | Average |
| 534.400 | 39.68 | 18.02 | 1.47 | 27.17 | 32.00 | 53.00 | -21.00 | Average |
| 753.620 | 31.04 | 20.25 | 1.84 | 27.09 | 26.04 | 53.00 | -26.96 | Average |
| 856.440 | 26.48 | 20.50 | 2.04 | 26.89 | 22.13 | 53.00 | -30.87 | Average |

7.2 Transient Conducted Emissions Test

Test Requirement: EN 50498
 Test Method: Clause 6.9 of 2004/104/EC & ISO 7637-2
 Test Date: 2013-08-02
 Test Voltage: DC 13.5V
 Test Limit: Table 3 of EN50498

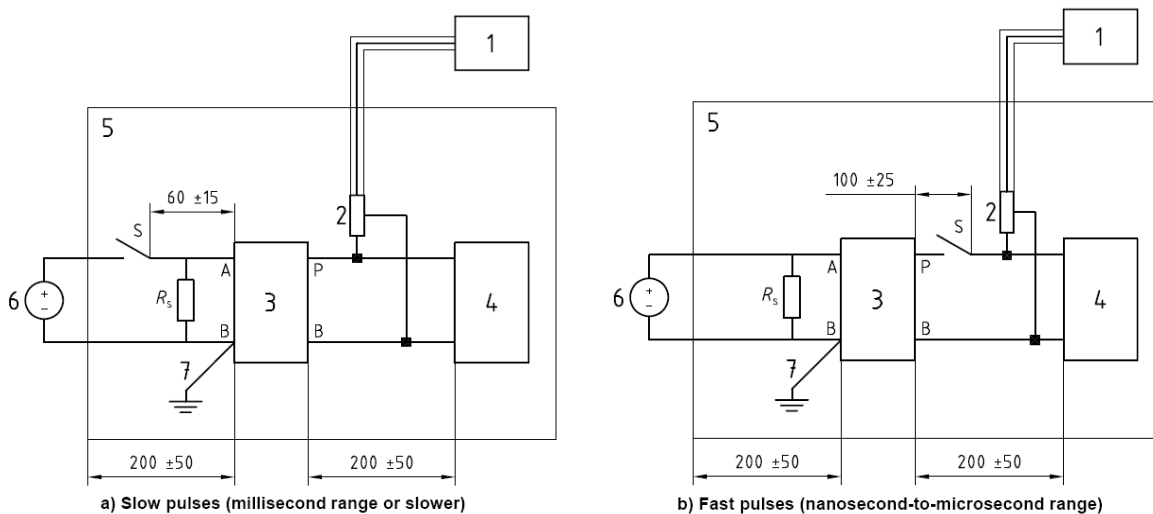
Table 3 – Limits of transient disturbances

| Polarity of pulse amplitude | Maximum allowed pulse amplitude for | |
|-----------------------------|-------------------------------------|----------------------------|
| | vehicles with 12 V systems | vehicles with 24 V systems |
| Positive | + 75 | + 150 |
| Negative | - 100 | - 450 |

7.2.1 E.U.T. Operation

EUT Operation: Test the EUT in motor running mode.

7.2.2 Test Setup



| Key | |
|-----------------------------|---------------------------------------|
| 1. oscilloscope | 5. ground plane |
| 2. voltage probe | 6. power supply |
| 3. artificial network | 7. Ground connection; length < 100 mm |
| 4. EUT(source of transient) | |

7.2.3 Measurement Data

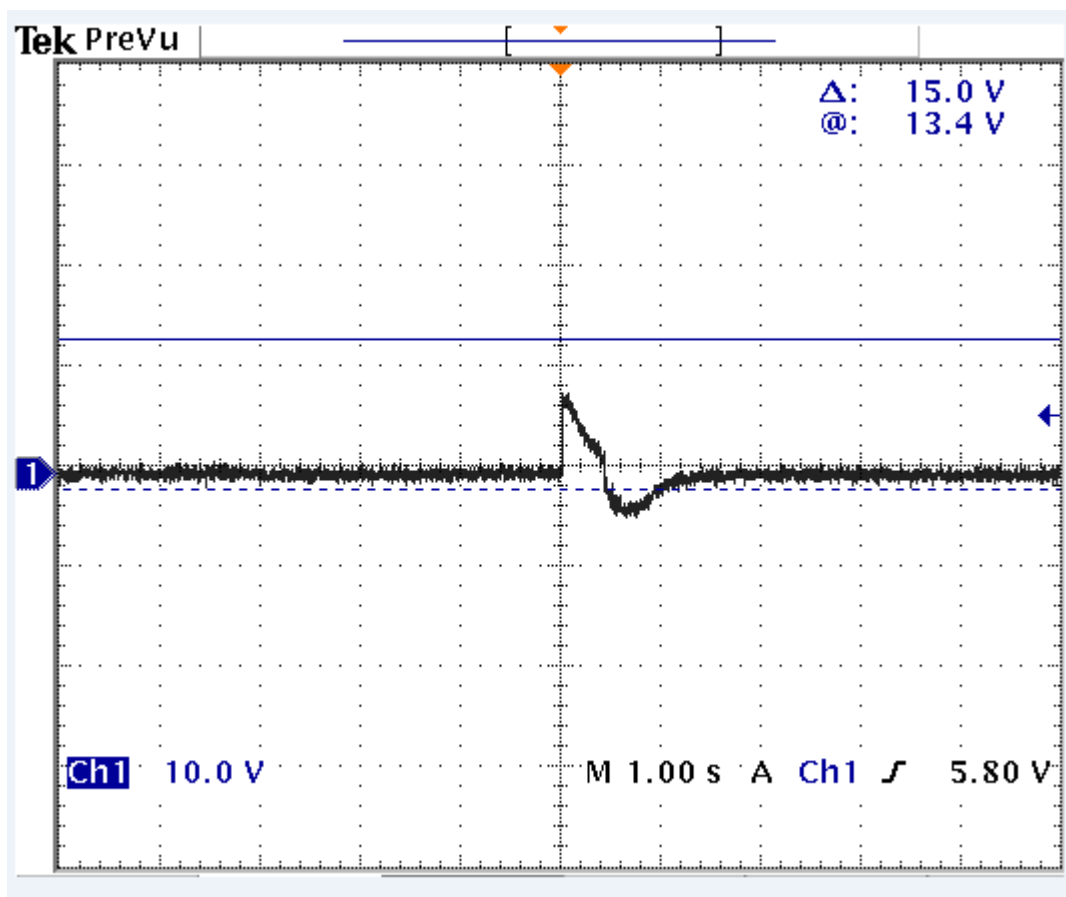
12V systems:

| Polarity of pulse amplitude | Maximum allowed pulse amplitude(V) | Type of pulse | Observation result (V) |
|-----------------------------|------------------------------------|---------------|------------------------|
| Positive | +75 | Slow | 8.4 |
| | | Fast | 8.6 |
| Negative | -100 | Slow | 2.7 |
| | | Fast | 4.7 |

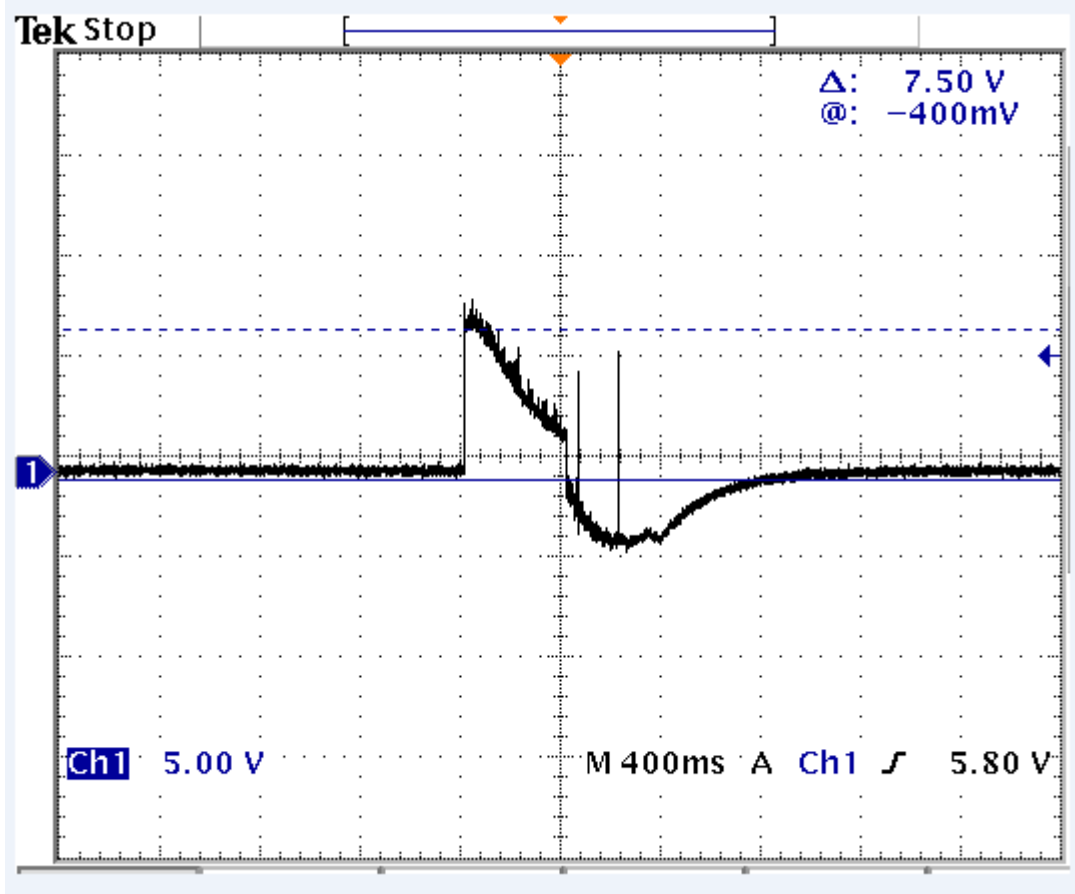
The Worst case Voltage Waveforms:

12 V systems:

Slow Pulse:



Fast Pulse:





Performance Criteria Description in A.4 of ISO 7637-2

Criterion A:

all functions of a device/system perform as designed during and after exposure to disturbance.

Criterion B:

all functions of a device/system perform as designed during exposure. However, one or more of them can go beyond specified tolerance. All functions return automatically to within normal limits after exposure is removed. Memory functions shall remain class A.

Criterion C:

one or more functions of a device/system do not perform as designed during exposure but return automatically to normal operation after exposure is removed.

Criterion D:

one or more functions of a device/system do not perform as designed during exposure and do not return to normal operation until exposure is removed and the device/system is reset by simple "operator/use" action.

Criterion E:

one or more functions of a device/system do not perform as designed during and after exposure and cannot be returned to proper operation without repairing or replacing the device/system.

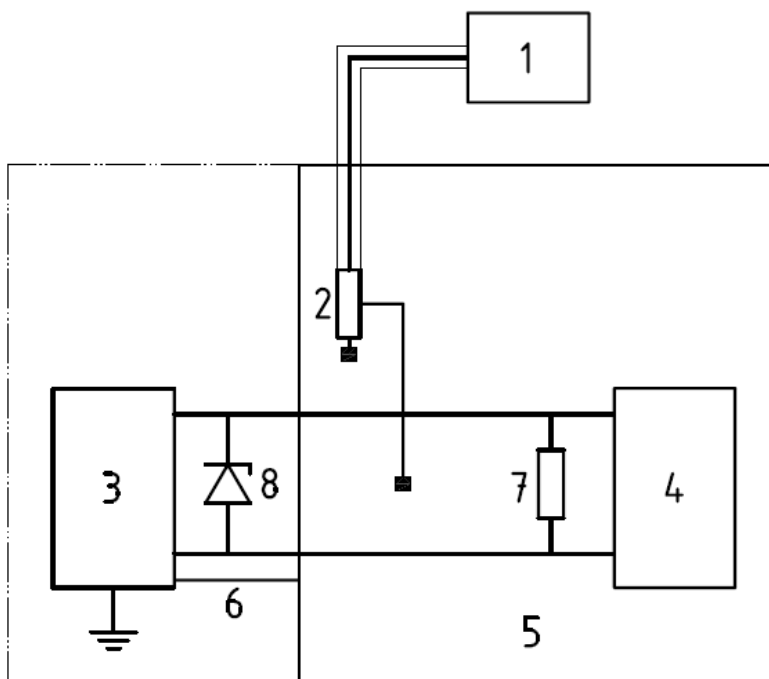
7.3 Transient Conducted Immunity

| | |
|-------------------|-------------------------------------|
| Test Requirement: | EN 50498 |
| Test Method: | Clause 6.8 2004/104/EC & ISO 7637-2 |
| Test Date: | 2013-08-02 |
| Test Voltage: | DC 13.5V |
| Test Limit: | Table 4 of EN50498 |

7.3.1 E.U.T. Operation

EUT Operation: Test the EUT in motor running mode.

7.3.2 Test Setup

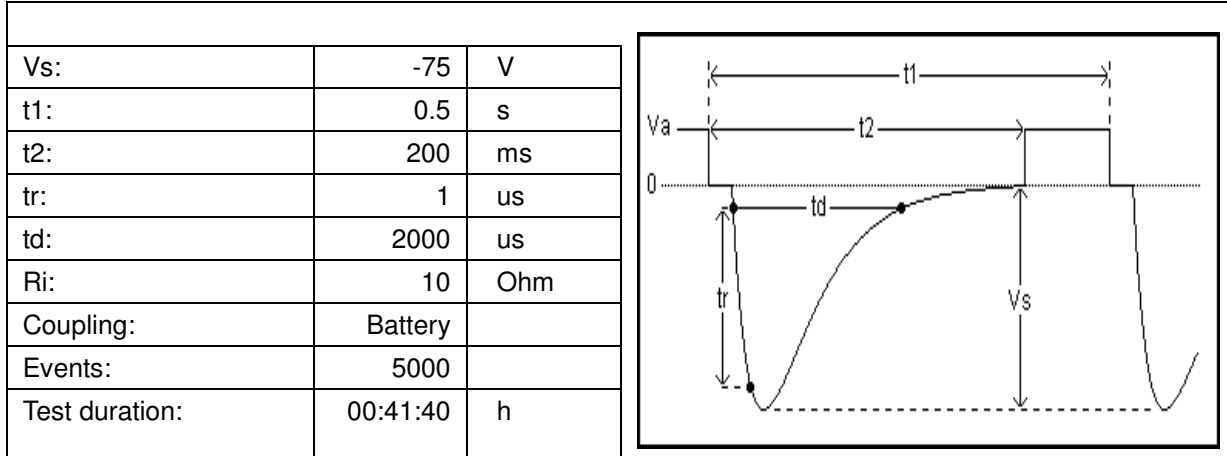


| Key | |
|---|---|
| 1. oscilloscope | 5. ground plane |
| 2. voltage probe | 6. Ground connection |
| 3. test pulse generator with internal power supply resistance R_i | 7. optional resistor (R_v) ^a |
| 4. EUT | 8. optional diode bridge ^b |
| <p>a For simulation of vehicle system loading for load dump test pulses 5a and 5b only. If used, the value of R_v shall be specified in the test plan (typical value 0,7 Ω to 40 Ω).</p> <p>b For simulation of load dump waveform for alternator with centralized load dump suppression for pulse 5b only</p> | |

7.3.3 Measurement Data

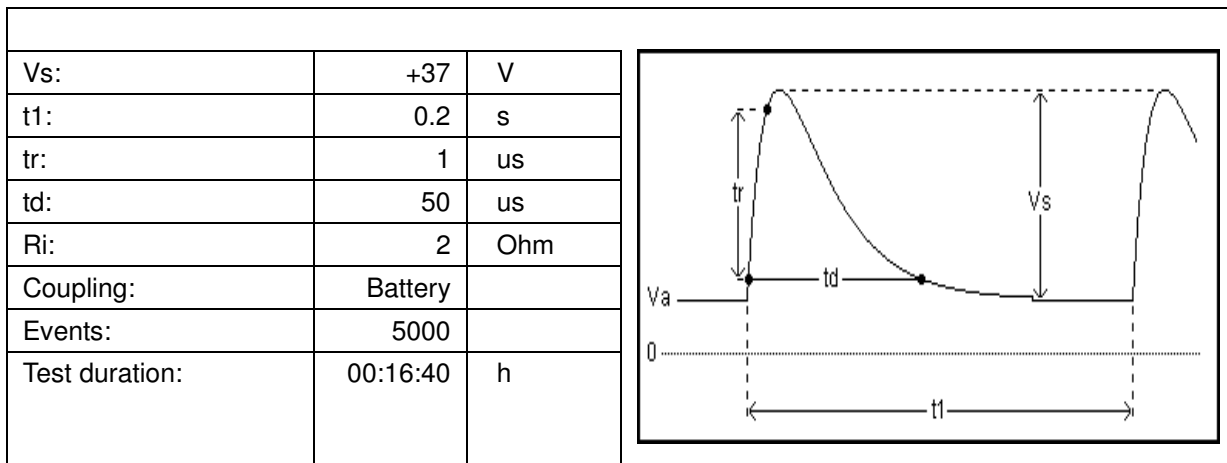
Pulse 1

12V



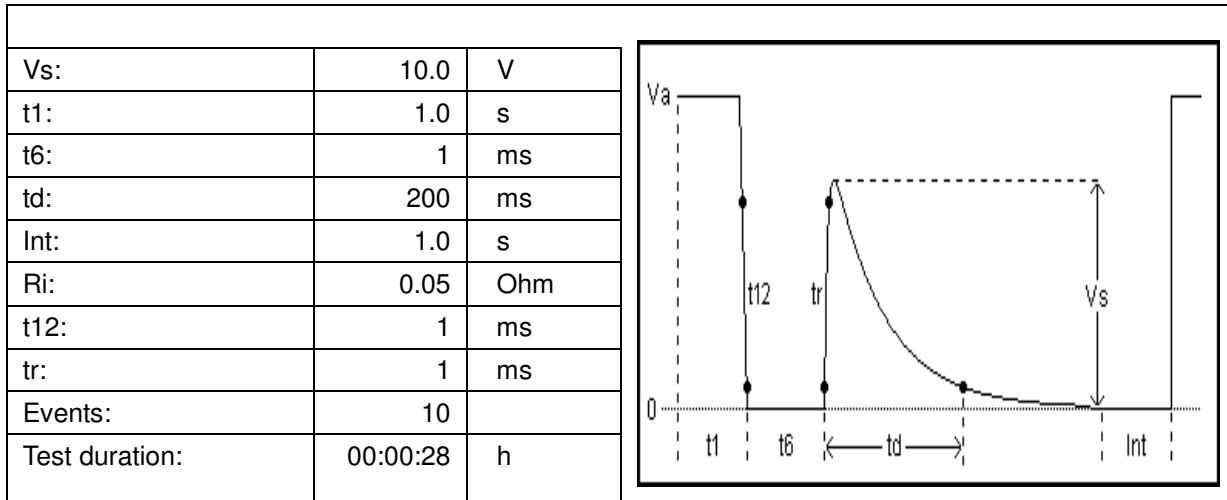
Pulse 2a

12V



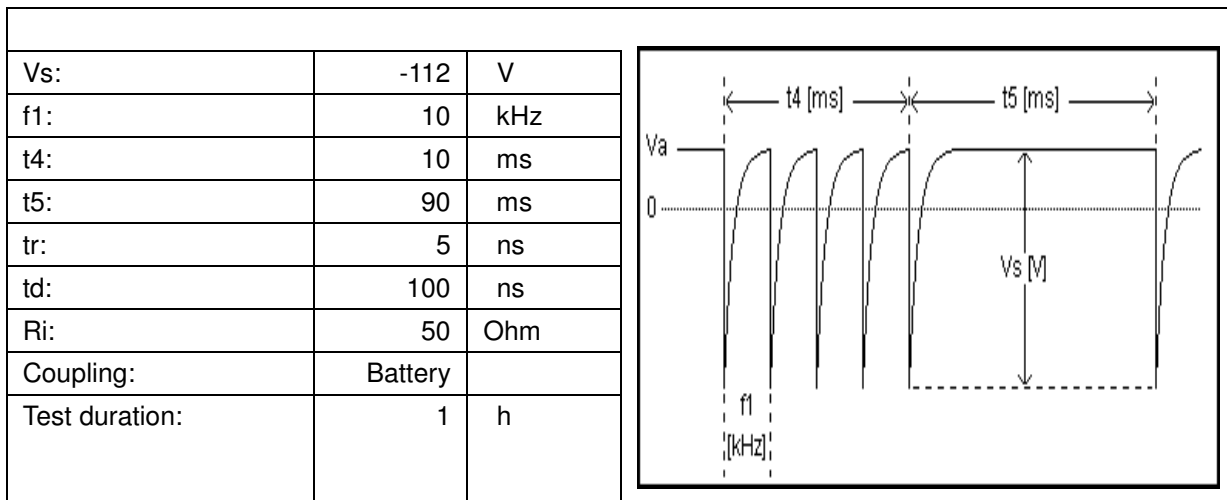
Pulse 2b

12V



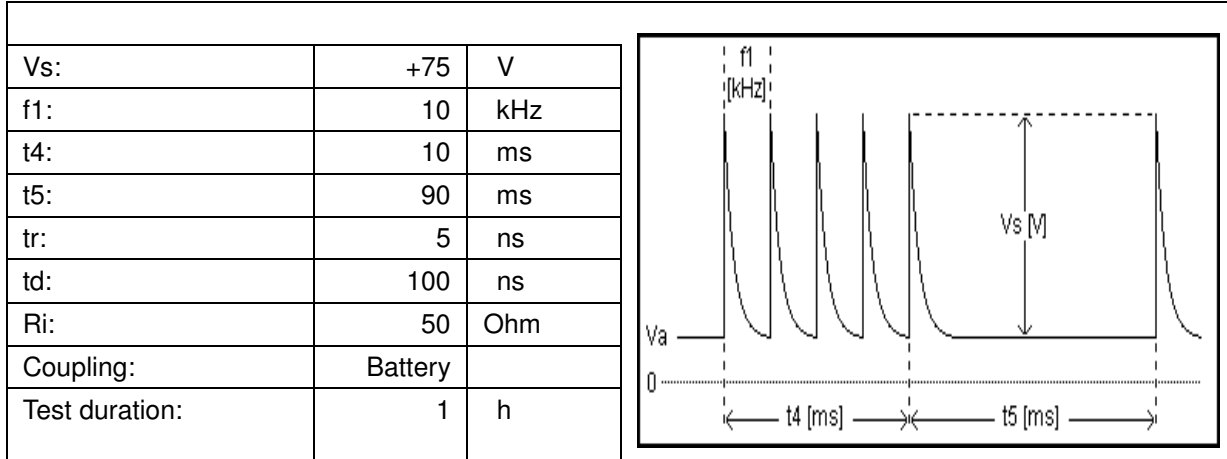
Pulse 3a

12V



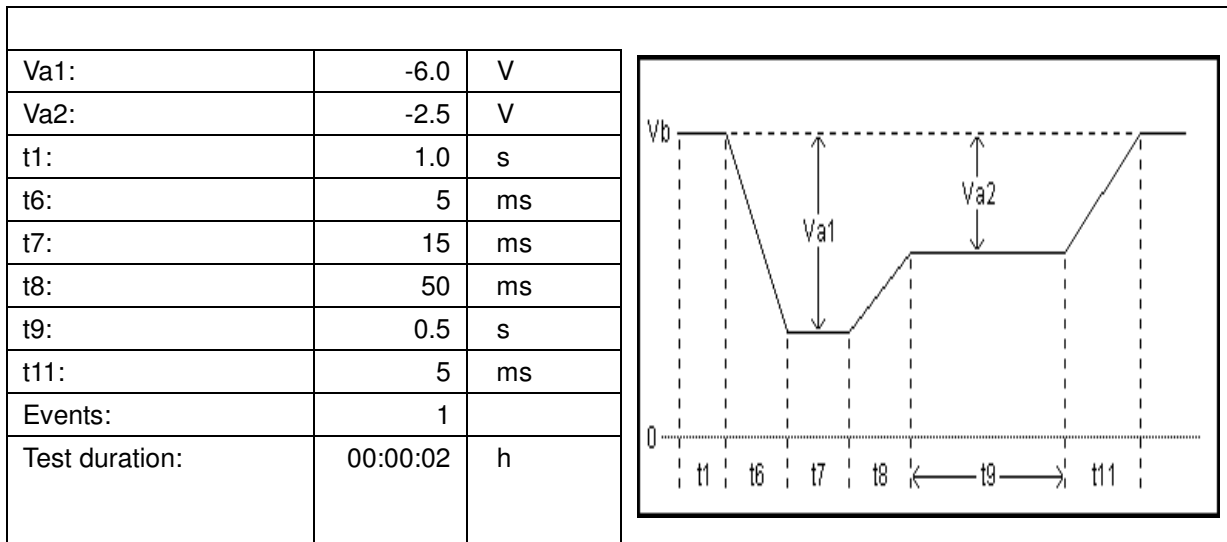
Pulse 3b

12V



Pulse 4

12V



Test Results:

| Test Pulse Number | Immunity Test Level for 12V (min. voltage) | Performance Criterion required | Performance under test |
|-------------------|--|--------------------------------|------------------------|
| | | not immunity- related | |
| 1 | III (-75) | D | (B) |
| 2 a | III (+37) | D | (A) |
| 2 b | III (+10) | D | (B) |
| 3 a | III (-112) | D | (A) |
| 3 b | III (+75) | D | (B) |
| 4 | III (-6) | D | (B) |

Remark:

EUT is not immunity- related product.

(A): No Loss of Function.

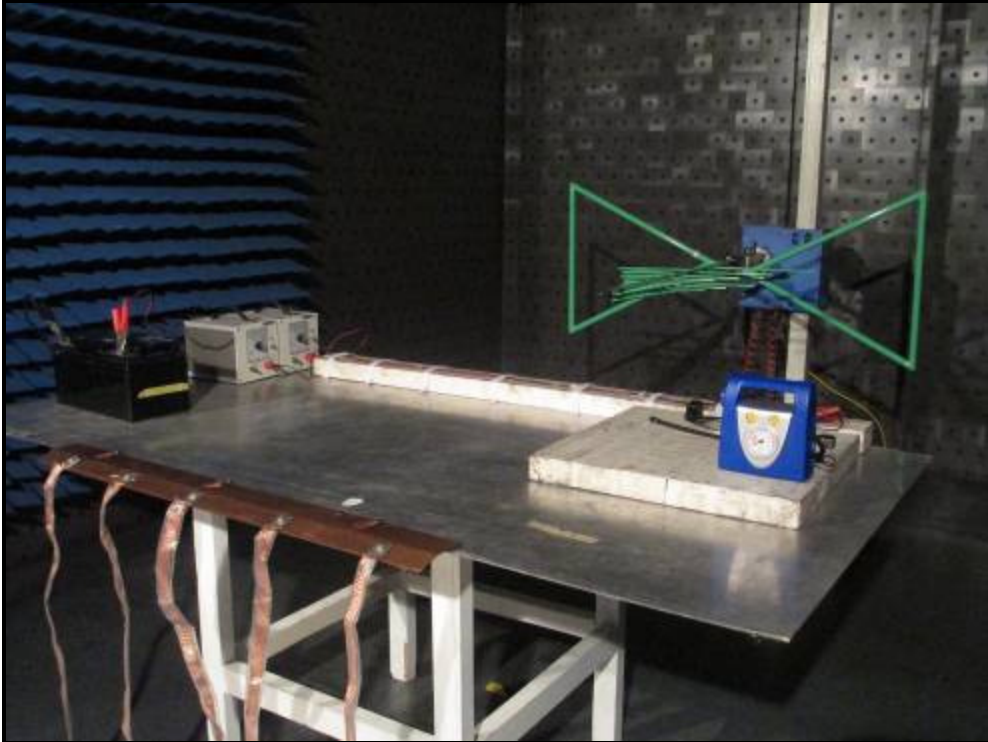
(B): During test, the EUT speed slowed, and it could recover automatically after test.

Conclusion:

The EUT can meet the requirements of the standard.

8 Photographs

8.1 Radiated Emission Test Setup

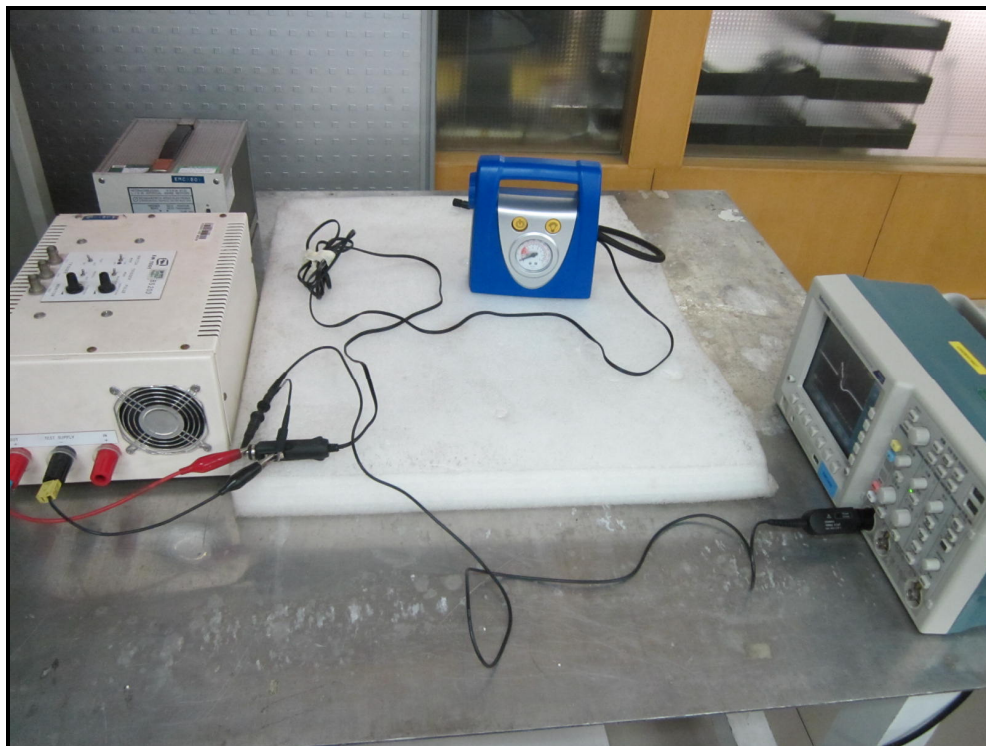


8.2 Transient Conducted Emissions Test Setup

For slow Pulse:



For fast Pulse:

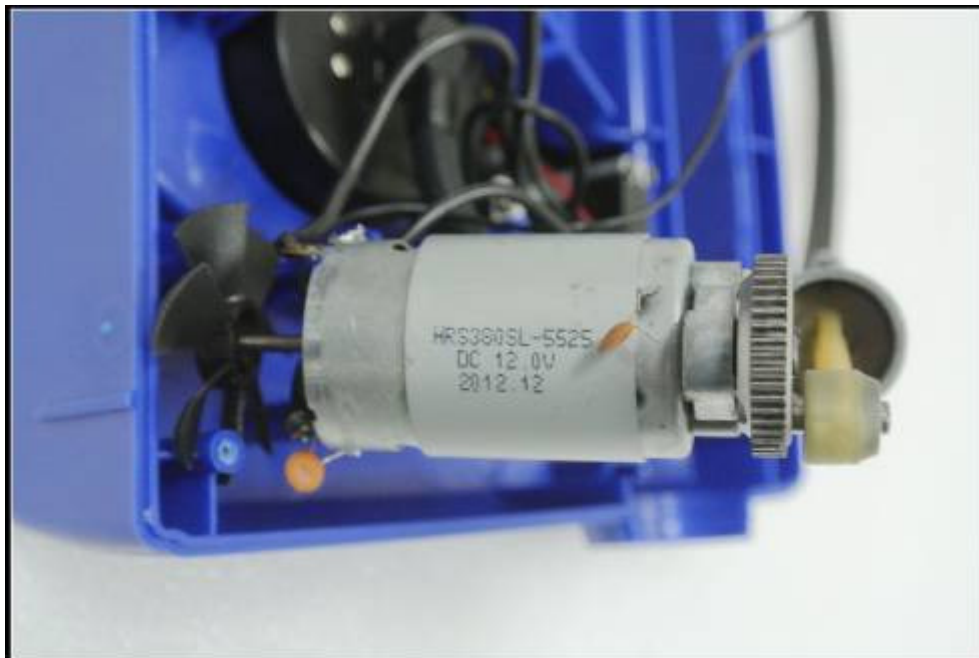
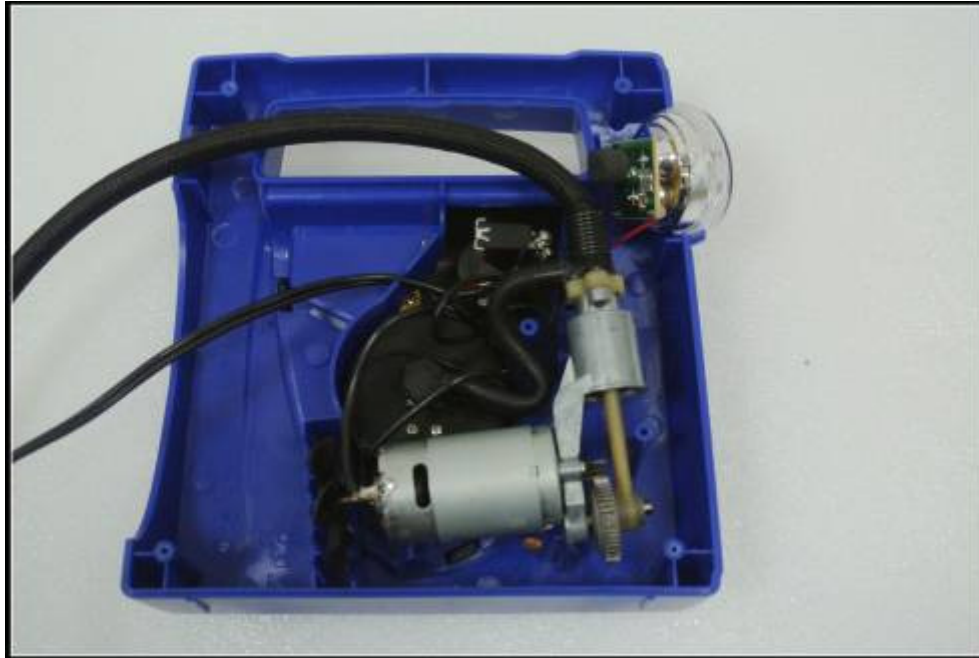


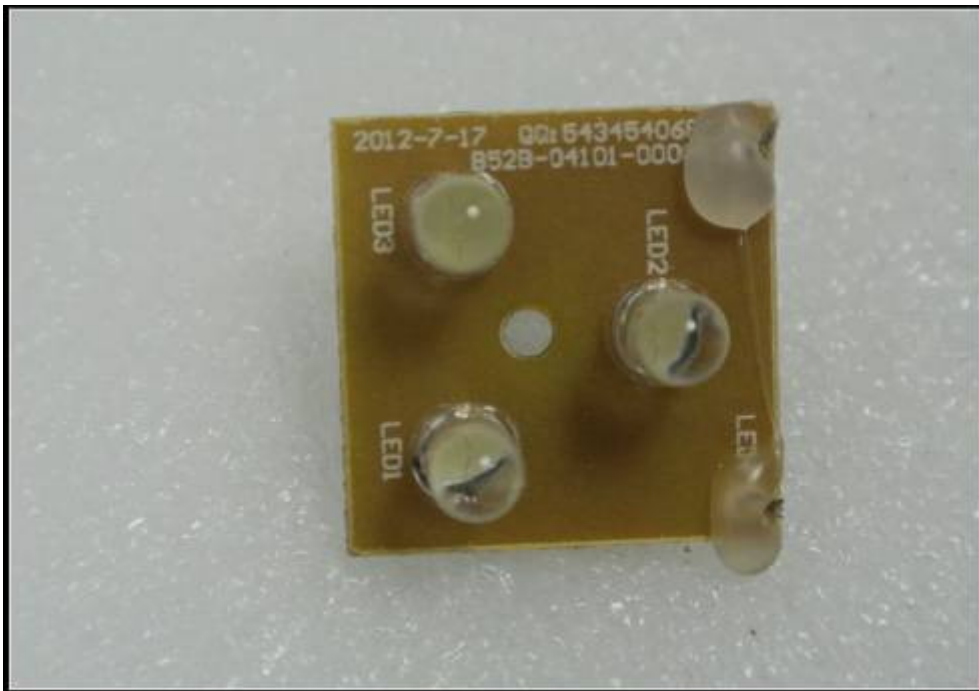
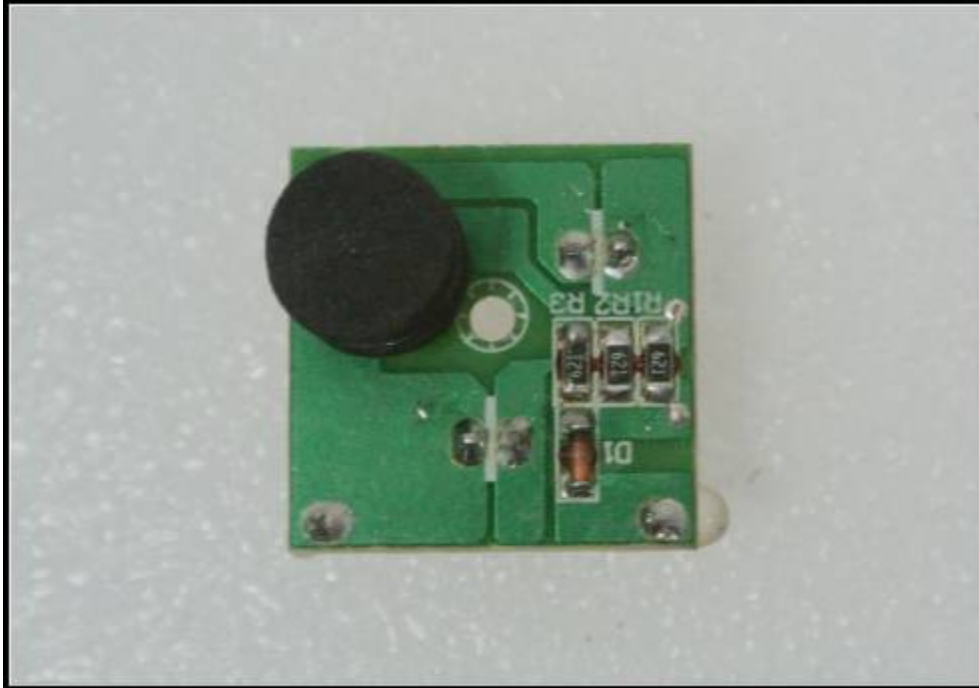
8.3 Transient Conducted Immunity Test Setup



8.4 EUT Constructional Details







--End of Report--