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### EMC COMPLIANCE REPORT In accordance with IEC 61000-6-1: 2001

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MEGAPULSE PTY LTD

48V MEGAPULSE MKII BATTERY CONDITIONER

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REPORT TL4498C

July 2004



# Certificate of Compliance

**RFI Industries Test Report: TL4498C**  
**Issue Date: July 2004**

**Test Specification:** EN 61000-6-1:2001  
Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments.

**Test Sample(s):** 48V Megapulse MKII Battery Conditioner  
**Model No:** not specified  
**Serial No:** J4803051000


**Client Details:** Mr. Ross Naddei,  
Megapulse Pty. Ltd.,  
11 Fortuna Court  
Eaton's Hill  
Queensland, 4037  
  
Phone: (07) 3325 4200  
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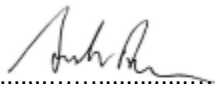
**Test Results:** **EN 61000-6-1: 2001**  
Electrostatic Discharge IEC 61000-4-2: 1995 **PASS**  
Radiated RF Immunity IEC 61000-4-3: 2002 **PASS**  
Power Frequency Magnetic Immunity IEC 61000-4-8: 1994 **PASS**

**Test Date(s):** 8<sup>th</sup> and 9<sup>th</sup> of July, 2004.

**Test House:  
(Issued by)** R.F.I. Industries Pty. Limited,  
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The **48V Megapulse MKII Battery Conditioner**, complies with the requirements of IEC 61000-6-1:2001, Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments.

  
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Simon Grilj  
(Team Leader)

  
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Andrew Burden  
(EMC Engineering Manager)

28-07-04  
.....  
Date

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**EMC COMPLIANCE REPORT  
FOR  
MEGAPULSE PTY. LTD.****1. INTRODUCTION**

Electromagnetic Compatibility (EMC) tests were performed on a 48V Megapulse MKII Battery Conditioner module in accordance with the requirements of IEC 61000-6-1: 2001.

**2. PRODUCT SAMPLE, MODIFICATIONS and CONFIGURATION****2.1 Product Sample**

The product, as supplied by the client, is described as follows:

48V Megapulse Battery MKII Conditioner module  
Model No: not specified  
Serial No: J4803051000

**2.2 Modifications**

No modifications were performed on the above sample.

**2.3 Configuration**

The product was tested in its normal operating mode whilst attached to four 12V automotive batteries.

**3. TEST FACILITY AND EQUIPMENT****3.1 Test Facility**

Tests were performed at the EMI/EMC Laboratories of RFI Industries, located at 52 Holloway Drive, Bayswater, Victoria. All RF immunity tests were carried out inside a fully shielded anechoic chamber. ESD and radiated magnetic field immunity was performed in another shielded enclosure.

**3.2 Test Equipment**

Refer to Appendix A for the measurement instrument list.

#### 4. REFERENCE STANDARDS

**EN 61000-6-1:2001**

Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments.

**IEC 61000-4-2: 1995**

Electromagnetic Compatibility – Part 4. Testing and measurement techniques  
Section 2. Electrostatic discharge immunity test.

**IEC 61000-4-3: 2002**

Electromagnetic Compatibility – Part 4. Testing and measurement techniques  
Section 3. Radiated, radio frequency, electromagnetic field immunity test.

**IEC 61000-4-8: 1994**

Electromagnetic Compatibility – Part 4. Testing and measurement techniques  
Section 8. Power frequency magnetic field immunity test.

#### 5. PERFORMANCE (PASS/FAIL) CRITERIA

The performance of the EUT was subject to the following performance criteria as specified in the referenced Standard:

**Performance criterion A:** Normal performance within the specification limits.

**Performance criterion B:** Temporary degradation or loss of function or performance, which is self-recoverable.

**Performance criterion C:** Temporary degradation or loss of function or performance, which requires operator intervention or system reset.

**Performance criterion D:** Degradation or loss of function which is not recoverable due to damage of equipment (components) or software, or loss of data.

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

## 6. IMMUNITY TEST RESULTS

### 6.1 Electrostatic Discharge Immunity – IEC 61000-4-2

#### 6.1.1 Test Procedure

##### TABLE TOP EQUIPMENT

A horizontal coupling plane (HCP), 1.6m x 0.8m is placed on top of a wooden table 0.8m high, standing on the ground reference plane. The EUT and cables are isolated from the coupling plane by an insulating film 0.5mm thick.

##### FLOOR STANDING EQUIPMENT

The EUT and cables are isolated from the ground reference plane by an insulating support 100mm thick.

- Tabletop or floor standing equipment is placed in the center of a 1m<sup>2</sup>, reference plane, at a distance of 1 meter from the enclosure walls or any other metallic structure.
- Contact discharges are applied to conductive parts of the EUT enclosure, the HCP and the VCP as applicable. Air Discharges are applied to non-conductive parts of the EUT enclosure. The VCP (0.5m x 0.5m metal plate), was placed parallel to and positioned 0.1m from the EUT, where applicable.
- The HCP and VCP are each connected to the ground reference plane using individual earth straps with a 470k $\Omega$  resistor located at each end.
- Discharges to the HCP were applied around all sides of the EUT. Discharges made to the VCP were applied to the center of one vertical edge of the coupling plane.
- The test voltage was increased from the minimum severity level up to the required severity level, in order to determine any threshold of failure.
- At least 10 single discharges were applied in both positive and negative polarities.

See photograph in Appendix B of a typical test configuration.

#### 6.1.2 Discharge Points

Contact discharges were applied to the horizontal coupling plane (HCP) at the following positions:

- All around the EUT

Contact discharges were applied to the vertical coupling plane (VCP) at the following positions:

- All around the EUT

Contact discharges were applied to the following EUT positions;

- Front of the EUT
- Rear of the EUT

Air discharges were applied to the following points;

- Front of the EUT
- Rear of the EUT

### 6.1.3 Test Results

Contact Discharges	ESD Voltage	Observation	Criteria
Horizontal Coupling Plane	±2.0 kV	No effect	Pass, Criteria A
Horizontal Coupling Plane	±4.0 kV	No effect	Pass, Criteria A
Vertical Coupling Plane	±2.0 kV	No effect	Pass, Criteria A
Vertical Coupling Plane	±4.0 kV	No effect	Pass, Criteria A
Direct	±2.0 kV	No effect	Pass, Criteria A
Direct	±4.0 kV	No effect	Pass, Criteria A

*Level 1 = ±2 kV, Level 2 = ±4 kV, Level 3 = ±6 kV, Level 4 = ±8 kV*

Air Discharges	ESD Voltage	Observation	Criteria
Insulating Surface	±2.0 kV	No effect	Pass, Criteria A
Insulating Surface	±4.0 kV	No effect	Pass, Criteria A
Insulating Surface	±8.0 kV	No effect	Pass, Criteria A

*Level 1 = ±2 kV, Level 2 = ±4 kV, Level 3 = ±8 kV, Level 4 = ±15 kV*

**Comments:** No degradation or malfunction was observed.

Climatic Conditions	
Room Temperature:	16°C (15°C to 35°C)
Humidity:	49% (30% to 60%)

**Conclusion:** The EUT complies with a performance criterion A.

## 6.2 Radiated RF Immunity - IEC 61000-4-3: 2002

### 6.2.1 Test Procedure

Prior to testing, a CW electric field was calibrated at a distance of 3 meters from the transmitting antenna using an orthogonal electric field probe. The drive level to the amplifier was recorded using immunity software and stored as a look up table.

For IEC 61000-4-3, the frequency range of 80MHz to 1000MHz was swept incrementally using 1% step sizes, whilst a leveled RF field of 3V/m (cw calibration) was maintained.

During actual testing, the orthogonal electric field probe was replaced by the EUT and the recorded electric fields stored as a lookup table were replayed back.

Once again the frequency range of 80MHz to 1000MHz was swept incrementally using 1% step sizes, however this time 80% AM @ 1kHz with a dwell time of 2 seconds was added to the calibrated RF field of 3V/m (cw calibration).

Both horizontal and vertical antenna polarizations were used to radiate the EUT in turn.

The EUT was positioned on a non-conductive table, 0.8m above the reference ground plane. All wiring to the EUT was left exposed to the electromagnetic field for a distance of 1m. All wiring less than or equal to 3m was bundled low-inductively to a 1m length. All wiring greater than 3m, had lossy r.f. ferrite clips placed 1m along the wiring.

See photograph in Appendix B of a typical test configuration.

### 6.2.2 Test Results

Field Level	EUT Orientation & Operating Mode	Polarization	Criteria
3V/m	Front panel – normal operating mode	Vertical	Pass, Criteria A
3V/m	Front panel – normal operating mode	Horizontal	Pass, Criteria A

Frequency Band: 80 – 1000MHz with 80% AM @ 1kHz

**Comments:** No degradation or malfunction was observed.

Climatic Conditions	
Room Temperature:	16°C (15°C to 35°C)
Humidity:	49% (30% to 60%)

**Conclusion:** The EUT complies with a performance criterion A.

### 6.3 Power Frequency Magnetic Immunity - IEC 61000-4-8: 1994

#### 6.3.1 Test Procedure

The EUT was placed on a wooden table, 0.8m above the ground reference plane for table top equipment, or 0.1m above the ground reference plane for floor mounted equipment.

The EUT was subjected to a 50Hz, 3A/m, magnetic field using an induction coil of 1m x 1m. The induction coil was rotated by 90° in order to expose the EUT to the test field in different orthogonal orientations. All cables were also exposed to the magnetic field for 1m of their length.

See photograph in Appendix B of a typical test configuration.

#### 6.3.2 Test Results

Axis	Magnetic Field Strength A/m	Observation	Criteria
X	3	No effect	Pass, Criteria A
Y	3	No effect	Pass, Criteria A
Z	3	No effect	Pass, Criteria A

Level 1 = 1A/m, Level 2 = 3A/m, Level 3 = 10A/m, Level 4 = 30A/m, Level 5 = 100A/m

**Comments:** No degradation or malfunction was observed.

Climatic Conditions	
Room Temperature:	20°C (15°C to 35°C)
Humidity:	50% (30% to 60%)

**Conclusion:** The EUT complies with a performance criterion A.

## APPENDIX A EMC LABORATORY TEST EQUIPMENT (Immunity Testing)

INV	Equipment	Make	Model No	Serial No	Calibration		Equip Used
					Date	Type	
467	1-1000MHz RF Amplifier	Amplifier Research	100W1000	20724		V	*
26	10kHz-220MHz RF Amplifier	Amplifier Research	250L	3710024		V	
535	TWT RF Amplifier	HUGHES	1177H04R021	145A		V	
561	TWT RF Amplifier	HUGHES	1177H-02F00	006		V	
597	TWT RF Amplifier	HUGHES	1177H10F000	112		V	
608	TWT RF Amplifier	HUGHES	1177H01F000	-		V	
310	Digital Remote Readout	Holaday	HI-4416	89709		E	
310	E-Field Probe	Holaday	HI-4422	89862	Aug. 04	E	*
501	E-Field Probe	Holaday	HI-4450	96627	Aug. 04	E	
560	Mainframe Field Monitor	Amplifier Research	FM 5004	21422			*
214	Bi-Directional Coupler	Amplifier Research	DC2000	12090		I	
526	Bi-Directional Coupler	RLC Electronics	12598-M-2565	445094	Sep. 04	I	
600	Bi-Directional Coupler	Narda Microline	3022	10096	Feb. 03	I	
581	Power Meter	Hewlett Packard	HP 437B	2935U00273		V	
582	Power Sensor	Hewlett Packard	HP 8482A	3318A29658		V	
629	Power Meter	Hewlett Packard	EPM-441A	GB37481752		V	
630	Power Sensor	Hewlett Packard	8482A	US37290856		V	
631	Power Sensor and Cable	Hewlett Packard	ECP-E18A	US37181651		V	
209	Double Ridged Guide Antenna	EMCO	3115	3945	May 04	I	
269	Biconical Antenna	EMCO	3143	1026			*
558	Double Ridge Horn	EMCO	3106	9811-2728	Jul 04	I	
633	Double Ridged Horn Antenna	EMCO	3115	9712-5369			
70	Injection Probe	FCC	F-120	8		V	
37	Function Generator	Hewlett Packard	3325A	1748A12031		I	
38	RF Signal Generator	FLUKE	6060A	3710024		I	
464	Arbitrary Waveform Generator	Hewlett Packard	33120A	US34015450		I	
466	Signal Generator	Hewlett Packard	8648B	3642U01071		V	
507	Signal Generator	Rohde & Schwarz	SMY 02	847510/038	Oct 06	I	*
525	Signal Generator	Hewlett Packard	8648A	3642U01815		V	
612	Signal Generator	Gigatronics	900/0.5-26	316705		V	
636	Signal Generator	Gigatronics	6080A	5465602		V	
638	Synthesized Signal Generator	Hewlett Packard	8673B	2938A01504		V	
471	Transient 1000 System	EMC Partner	TRA1H01B	TRA1000-215		V	*
615	Harmonics-1000	EMC Partner	HAR1000-IP	HAR1000-64		V	
476	Powerline CDN	FCC	FCC-801-M1-16	9713		V	
477	Powerline CDN	FCC	FCC-801-M2-16	9727		V	
478	Powerline CDN	FCC	FCC-801-M3-25	9712		V	
479	Powerline CDN	FCC	FCC-801-M4-16	9702		V	
275	Capacitive Coupling Clamp	RFI Industries	CCC-IEC4	4694		V	

V = Verification of operation against an internal reference  
 I = Internal calibration against a NATA traceable standard  
 E = External calibration by a NATA endorsed facility  
 O = External calibration by an International

## APPENDIX B PHOTOGRAPHS

Photograph	Description
1	Radiated RF Immunity Setup
2	Radiated RF Immunity Setup
3	Megapulse terminated to 4 automotive batteries
4	Megapulse exposed lead lengths
5	Verification check before and after RF immunity
6	Radiated magnetic field immunity
7	Megapulse positioned within the loop
8	ESD setup
9	Air discharge to the EUT
10	Verification check before and after ESD
11	Front view of the EUT
12	Rear view showing the serial number of the EUT
13	Internal circuit board layout (Image can not be shown due to patent protection)



Photograph 1.



Photograph 2.



Photograph 3.



Photograph 4.



Photograph 5.



Photograph 6.



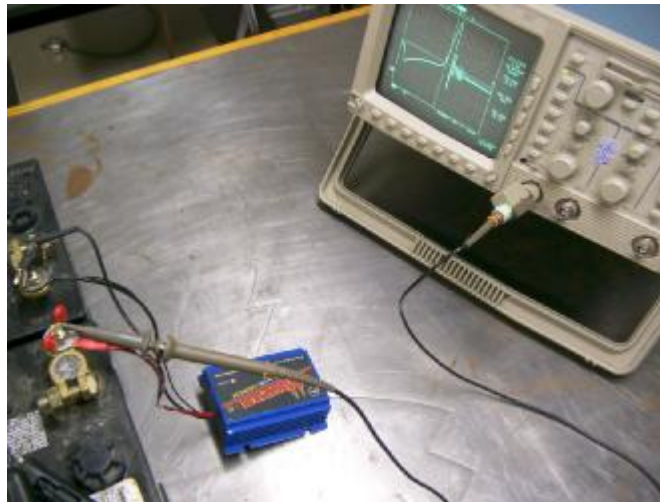
Photograph 7.



Photograph 8.



Photograph 9.



Photograph 10.



Photograph 11.



Photograph 12.

Photograph 13. (Image can not be shown due to patent protection)