

PROJECT HISTORY		
Report number	Modification to the report / comments	Date
177898TRFEMC	First release	2011-06-15
177898R1TRFEMC	Changed copy of marking plate	2011-07-05
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REMARKS		

PRODUCT VARIANTS COVERED BY THIS REPORT		
Variant model	Difference against the main model	Additional test performed
380.000.08	Trade mark (MAXAM) an model name 	None
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REMARKS		

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1 TEST STANDARDS

The tests were performed according to following standards and procedures:

NEMKO WM L0177: General routines for using instruments at Nemko

NEMKO WM L1002: Measurement Uncertainty - Policy and Statement

NEMKO WM L0077: General routines to perform EMC tests

REGULATION 10

Concerning the adoption of uniform technical prescriptions for wheeled vehicles, equipment and parts which can be fitted and/or be used on wheeled vehicles and the conditions for reciprocal recognition of approvals granted on the basis of these prescriptions

ISO 7637-1 (2002)

Road vehicles - Electrical disturbances from conduction and coupling - Part 1: Definitions and general considerations

ISO 7637-2 (2004)

Road vehicles - Electrical disturbances from conduction and coupling - Part 2: Electrical transient conduction along supply lines only

2 SUMMARY OF TEST RESULTS

Requirement – Test	Reg10 ref annex	Verdict
Radiated broadband electromagnetic emissions	7	P
Radiated narrowband electromagnetic emissions	8	P
Immunity to electromagnetic radiation	9	N
Immunity to transient disturbances conducted along supply lines	10	P
Emission of conducted disturbances	10	P
GENERAL REMARKS		
ESAs with no immunity related functions need not be tested for immunity to radiated disturbances and shall be deemed to comply with paragraph 6.7 and with Annex 9 of Regulation 10.		

3 EQUIPMENT UNDER TEST

3.1 Power supply system utilised

Battery voltage:	<input checked="" type="checkbox"/>	12 VDC	<input type="checkbox"/>	24 VDC
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3.2 EuT operation modes

Mode	Description
1	Normal operating mode

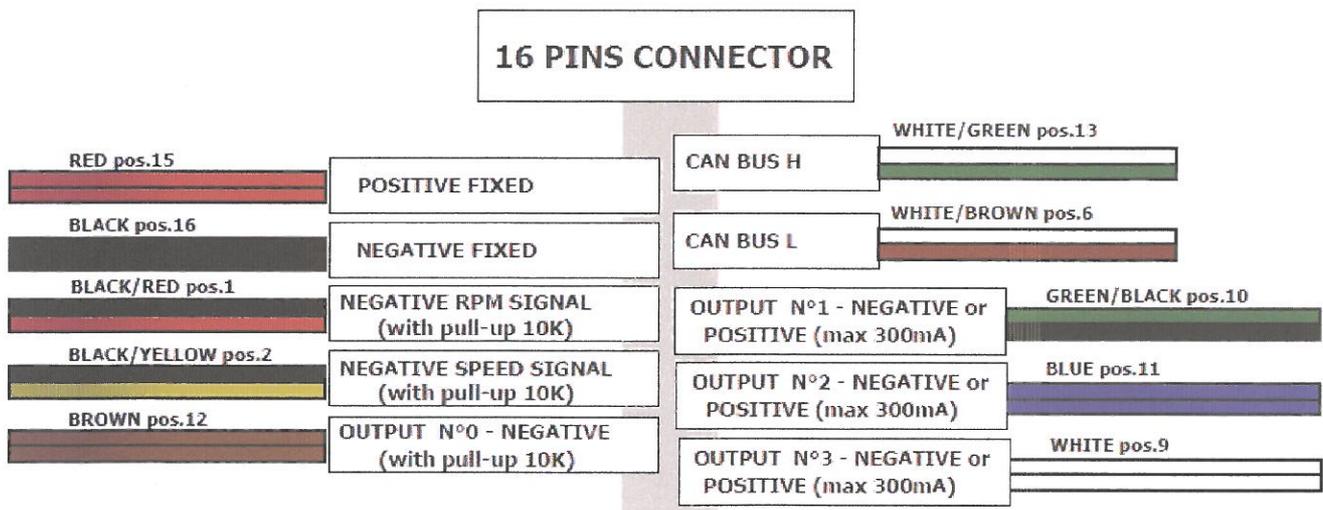
3.3 EuT configuration modes

Emission: the EuT was configured to measure its highest possible radiation level. The test modes selected are according to EuT instruction manual.

Immunity: the EuT was configured to have its highest possible susceptibility against tested phenomena. The test modes selected are according to EuT instruction manual.

Mode	Description
1	The EUT has been tested connected to a test tool provided with six LEDs for outputs status indication. The CAN BUS H and the CAN BUS L was not connected to a CAN BUS simulator, according to client's request.

3.4 Input/Output Ports



3.5 Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
AE	Test tool	TEKO	SR34-E.9	--

Note: * Use
 EUT - Equipment Under Test
 AE - Auxiliary/Associated Equipment (Not Subjected to Test)
 SIM - Simulator (Not Subjected to Test)

3.6 Performance level

The test results shall be classified in terms of the loss of function or degradation of performance of the equipment under test, relative to a performance level defined by its manufacturer or the requestor of the test, or agreed between the manufacturer and the purchaser of the product.

Definition related to the performance level:

<input type="checkbox"/>	based on the used product standard
<input checked="" type="checkbox"/>	based on the declaration of the manufacturer, requestor or purchaser

Class A:

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

Class B:

All functions of 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

Class C:

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

Class 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.

Class E:

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

During the tests, the status of the LEDs has been checked. No change allowed (according to client's request).

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

Nemko Spa
Via del Carroccio, 4
20853 Biassono (MB) - Italy

Tests site/benches are in accordance with applicable standard/s, and have been utilized by Nemko Spa testing engineer(s).

4.2 Environmental conditions

During the measurement the environmental conditions were:

Temperature: 18-28 °C

Humidity: 30-60 %

Atmospheric pressure: 860-1060 hPa

4.3 Test equipment used for the monitoring of the environmental conditions

<i>Equipment</i>	<i>Manufacturer</i>	<i>Model</i>	<i>Serial N°</i>
Thermohygrometer data loggers	Testo	175-H2	20012380/305
Digital barometer	Haemmi	ZED 150/111.121	900301402/0013

4.4 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according to CISPR 16-4-2 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements" and is documented in the Nemko Spa Technical Procedure WML1002. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device. Hereafter the best measurement capability for Nemko Spa laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	Antenna distance 1m, 3m, 10m	± 5.0 dB	(1)
Conducted Emission	--	± 2 % ampl. ± 0.005% time	(1)
Radiated Immunity	20 MHz ÷ 2.0 GHz	(0.0 ÷ 3.5) dB	(1)
Immunity to transient disturbances conducted	--	± 2 % ampl. ± 0.005% time	(1)

NOTES:

- (1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$ which has been derived from the assumed normal probability distribution with infinite degrees of freedom and for a coverage probability of 95 %.

5 TEST CONDITIONS AND RESULTS

5.1 Radiated broadband electromagnetic emissions

5.1.1 Photo documentation of the test set-up



5.1.2 Test method

E.U.T. tested according to Annex 7 of Regulation 10. The E.U.T. was tested connected to 12 Vdc and/or 24Vdc car battery. The E.U.T. was placed 50 ± 5 mm over the reference plane. All I/O cables were lifted 50 ± 5 mm over the reference plane. Radiated emission was measured on E.U.T. with horizontal and vertical polarization of antenna at a distance of 1.00 ± 0.05 m.

5.1.3 Limits

Frequency (MHz)	Limit (dB μ V/m) - Quasi-Peak
30 TO 75	62 TO 52
75 TO 400	52 TO 63
400 TO 1000	63

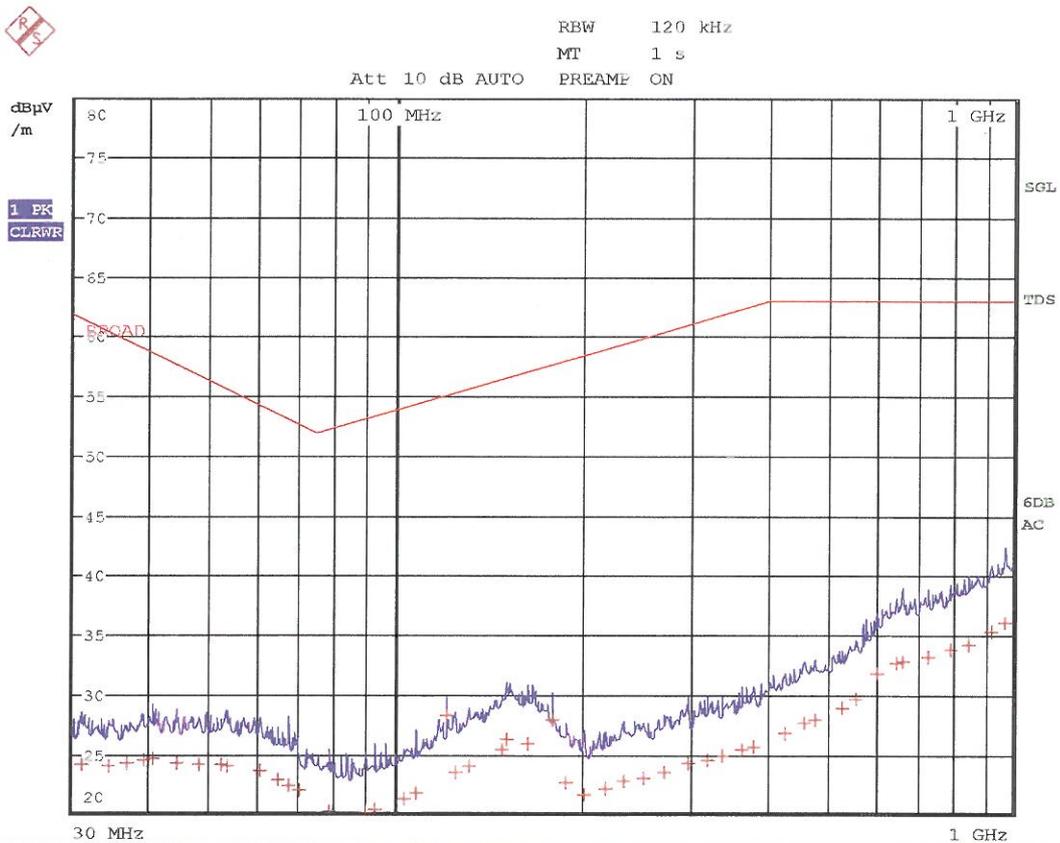
5.1.4 Test result

Verdict:	<input checked="" type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> N
Frequency range:	30MHz - 1000MHz
Kind of test site:	Semi anechoic chamber
Measurement distance:	1 m
Remarks:	

5.1.5 Test protocol

Antenna polarization: Horizontal
 Operation mode: 1
 Configuration mode: 1
 Remarks: -

Verdict: Pass



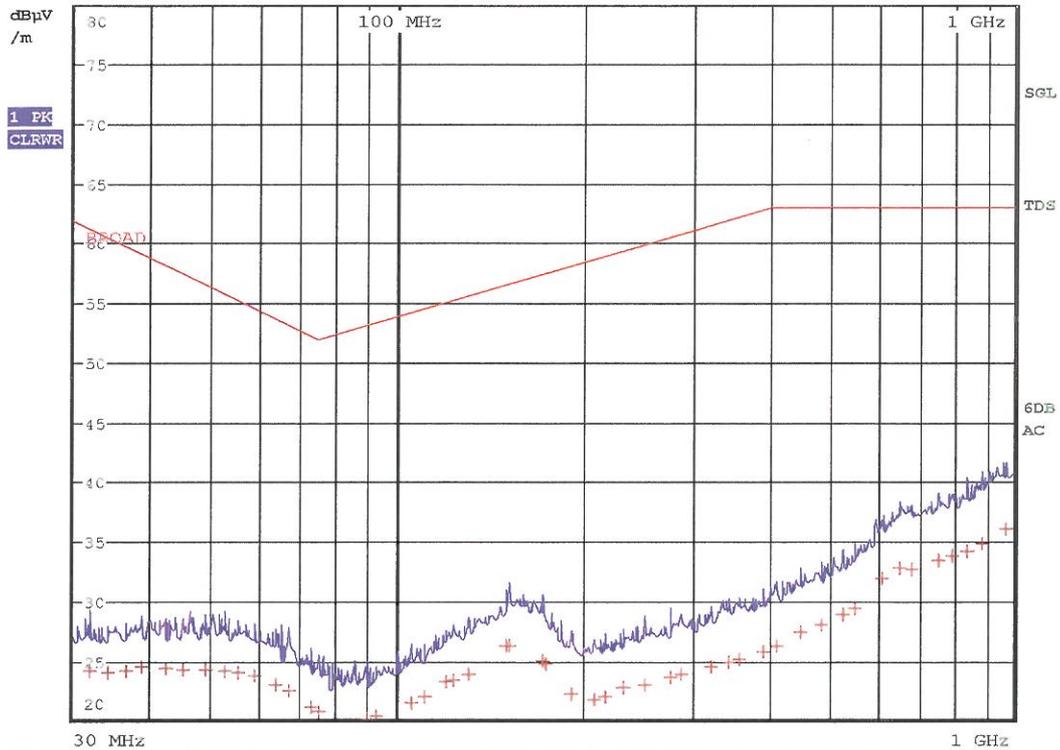
Frequency range (MHz)	Selected frequency (MHz)	Test environment noise level (Quasi-Peak dBµV)	Measured emission of E.U.T. (Quasi-Peak dBµV)	Antenna factor (dB/m)	Cable loss (dB)	Radiated emission of E.U.T. (field strength) (Quasi-Peak dBµV/m)	Field strength limits (Quasi-Peak dBµV/m)
30 - 50	40.375	5.7	5.7	18.1	0.9	24.7	58.8
50 - 75	52.250	5.6	5.6	17.6	0.9	24.1	55.9
75 - 100	92.975	5.2	5.3	13.5	1.6	20.3	53.4
100 - 130	120.775	5.4	10.1	16.3	1.9	28.3	55.1
130 - 165	151.250	6.0	6.0	18.2	2.1	26.3	56.6
165 - 200	179.275	4.8	8.2	17.2	2.5	27.9	57.7
200 - 250	232.850	5.0	5.0	14.8	2.9	22.7	59.4
250 - 320	319.250	5.6	5.7	16.0	2.8	24.4	61.5
320 - 400	379.900	5.1	5.2	17.1	3.2	25.5	62.7
400 - 520	477.900	5.6	5.6	18.7	3.5	27.8	63.0
520 - 660	648.775	7.3	7.4	21.0	4.2	32.6	63.0
660 - 820	795.850	6.4	6.4	22.6	4.8	33.8	63.0
820 - 1000	970.225	7.0	7.0	24.0	5.1	36.1	63.0

Antenna polarization: Vertical
 Operation mode: 1
 Configuration mode: 1
 Remarks: -

Verdict: Pass



REW 120 kHz
 MT 1 s
 Att 10 dB AUTO PREAMP ON



Frequency range (MHz)	Selected frequency (MHz)	Test environment noise level		Antenna factor (dB/m)	Cable loss (dB)	Radiated emission of E.U.T. (field strength)	
		Quasi-Peak (dBuV)	Measured emission of E.U.T. Quasi-Peak (dBuV)			Quasi-Peak (dBuV/m)	Field strength limits Quasi-Peak (dBuV/m)
30 - 50	38.575	6.3	6.3	17.4	0.7	24.4	59.3
50 - 75	52.450	5.5	5.6	17.6	0.9	24.1	55.9
75 - 100	93.000	5.2	5.2	13.5	1.6	20.3	53.4
100 - 130	123.400	5.1	5.2	16.3	1.9	23.4	55.3
130 - 165	152.475	5.9	6.0	18.2	2.1	26.3	56.7
165 - 200	171.925	5.5	5.5	17.2	2.3	25.0	57.5
200 - 250	232.150	5.0	5.0	14.8	2.9	22.7	59.4
250 - 320	286.475	5.6	5.6	15.6	2.6	23.9	60.8
320 - 400	392.100	5.3	5.3	17.1	3.3	25.7	62.9
400 - 520	488.025	5.7	5.8	18.7	3.6	28.1	63.0
520 - 660	653.750	7.2	7.2	21.0	4.5	32.7	63.0
660 - 820	793.450	6.5	6.5	22.6	4.7	33.8	63.0
820 - 1000	971.650	6.9	7.0	24.0	5.1	36.1	63.0

5.1.6 Test equipment used

<i>Equipment</i>	<i>Manufacturer</i>	<i>Model</i>	<i>Serial No.</i>
Trilog Broad Band Antenna 25 MHz÷2 GHz	Schwarzbeck	VULB 9168	VULB 9168-242
EMI receiver 20 Hz ÷ 8 GHz	R&S	ESU8	100202
Antenna mast	R&S	HCM	836 529/05
Controller	R&S	HCC	836 620/7
LISN	Solar	6338-5-TS-50-N	TDS351
LISN	Solar	6338-5-TS-50-N	TDS352
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530
Shielded room	Siemens	10m control room	1947

5.2 Radiated narrowband electromagnetic emissions

5.2.1 Photo documentation of the test set-up



5.2.2 Test method

E.U.T. tested according to Annex 8 of Regulation 10. The E.U.T. was tested connected to 12 Vdc and/or 24Vdc car battery. The E.U.T. was placed 50 ± 5 mm over the reference plane. All I/O cables were lifted 50 ± 5 mm over the reference plane. Radiated emission was measured on E.U.T. with horizontal and vertical polarization of antenna at a distance of 1.00 ± 0.05 m.

5.2.3 Limits

Frequency (MHz)	Limit (dB μ V/m) - Average
30 TO 75	52 TO 42
75 TO 400	42 TO 53
400 TO 1000	53

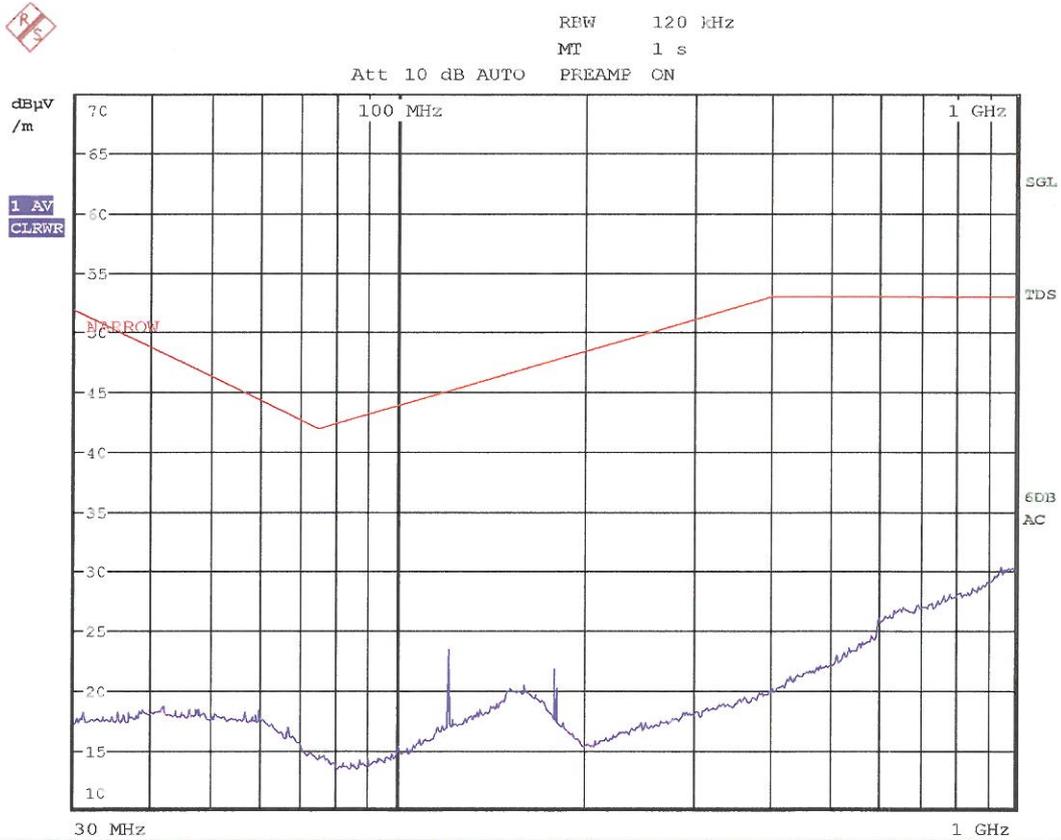
5.2.4 Test result

Verdict:	<input checked="" type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> N
Frequency range:	30MHz - 1000MHz
Kind of test site:	Semi anechoic chamber
Measurement distance:	1 m
Remarks:	

5.2.5 Test protocol

Antenna polarization: Horizontal
 Operation mode: 1
 Configuration mode: 1
 Remarks: -

Verdict: Pass



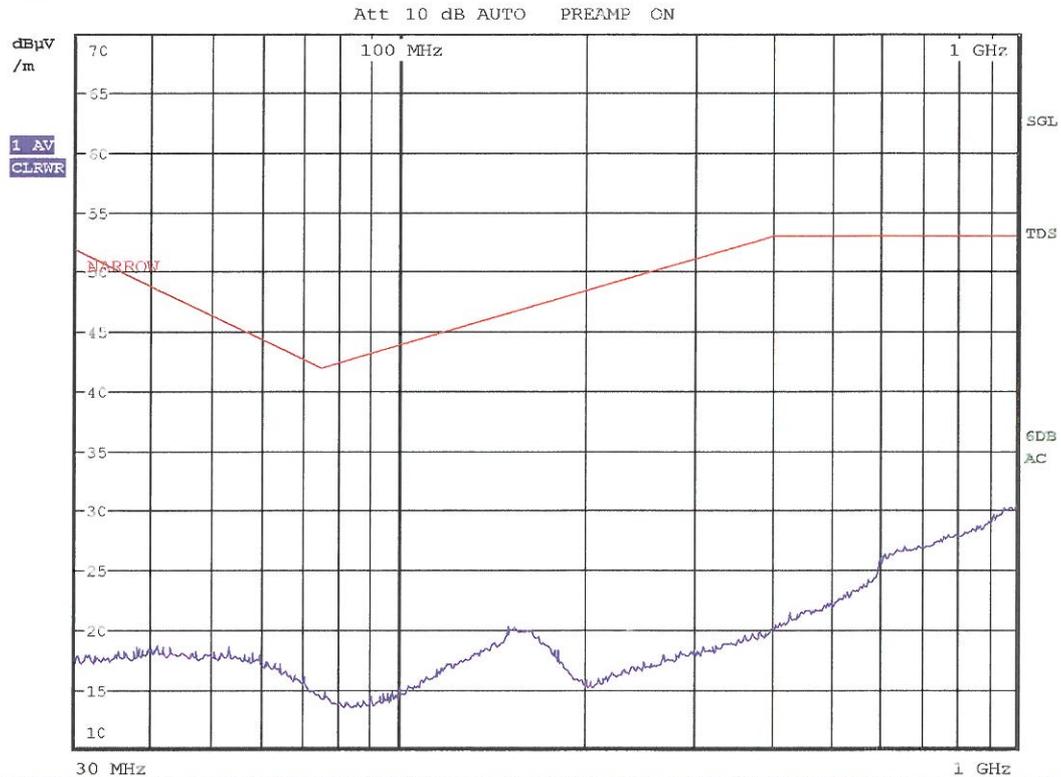
Frequency range (MHz)	Selected frequency (MHz)	Test environment noise level Average (dBuV)	Measured emission of E.U.T. Average (dBuV)	Antenna factor (dB/m)	Cable loss (dB)	Radiated emission of E.U.T. (field strength) Average (dBuV/m)	Field strength limits Average (dBuV/m)
30 - 50	41.775	-1.4	-0.4	18.1	0.9	18.6	48.4
50 - 75	59.500	-1.8	-0.4	17.6	1.0	18.2	44.5
75 - 100	99.825	-0.5	-0.4	13.5	1.5	14.6	43.9
100 - 130	120.900	-1.0	5.3	16.3	1.9	23.5	45.1
130 - 165	160.200	-0.4	0.0	18.2	2.2	20.4	47.0
165 - 200	179.100	-1.9	2.0	17.2	2.5	21.7	47.7
200 - 250	246.450	-1.2	-0.5	15.0	2.7	17.2	49.8
250 - 320	315.125	-0.9	-0.3	16.0	2.8	18.5	51.4
320 - 400	385.500	-0.6	-0.5	17.1	3.2	19.8	52.8
400 - 520	516.275	-0.3	0.2	19.0	3.8	22.9	53.0
520 - 660	658.050	1.6	1.7	21.0	4.3	27.0	53.0
660 - 820	818.100	-0.2	0.8	22.7	4.8	28.3	53.0
820 - 1000	952.275	0.2	1.2	24.0	5.1	30.3	53.0

Antenna polarization: Vertical
 Operation mode: 1
 Configuration mode: 1
 Remarks: -

Verdict: Pass



REW 120 kHz
 MT 1 s
 PREAMP ON



Frequency range (MHz)	Selected frequency (MHz)	Test environment noise level Average (dBuV)	Measured emission of E.U.T. Average (dBuV)	Antenna factor (dB/m)	Cable loss (dB)	Radiated emission of E.U.T. (field strength) Average (dBuV/m)	Field strength limits Average (dBuV/m)
30 - 50	40.775	-1.9	-0.4	18.1	0.9	18.6	48.7
50 - 75	53.100	-1.5	0.1	17.6	0.9	18.5	45.8
75 - 100	75.775	-1.7	-1.3	14.9	1.3	14.8	42.1
100 - 130	128.925	-1.6	-0.7	16.3	2.0	17.5	45.6
130 - 165	150.675	-0.9	0.0	18.2	2.1	20.3	46.6
165 - 200	165.200	-1.5	-0.8	18.2	2.3	19.7	47.2
200 - 250	249.675	-0.8	-0.4	15.0	2.7	17.3	49.9
250 - 320	310.275	-1.1	-0.6	16.0	3.1	18.5	51.3
320 - 400	398.900	-0.5	-0.5	17.1	3.2	19.8	53.0
400 - 520	518.075	-0.3	-0.1	19.0	3.8	22.6	53.0
520 - 660	659.450	1.6	1.6	21.0	4.3	26.9	53.0
660 - 820	774.575	0.5	0.6	22.3	5.1	28.0	53.0
820 - 1000	998.375	0.8	0.9	24.0	5.4	30.3	53.0

5.2.6 Test equipment used

<i>Equipment</i>	<i>Manufacturer</i>	<i>Model</i>	<i>Serial No.</i>
Trilog Broad Band Antenna 25 MHz+2 GHz	Schwarzbeck	VULB 9168	VULB 9168-242
EMI receiver 20 Hz ÷ 8 GHz	R&S	ESU8	100202
Antenna mast	R&S	HCM	836 529/05
Controller	R&S	HCC	836 620/7
LISN	Solar	6338-5-TS-50-N	TDS351
LISN	Solar	6338-5-TS-50-N	TDS352
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530
Shielded room	Siemens	10m control room	1947

5.3 Immunity to transient disturbances conducted along supply lines

5.3.1 Photo documentation of the test set-up



5.3.2 Test method

E.U.T. tested according to Annex 10 of Regulation 10. All I/O cables were lifted 50 ± 5 mm over the reference plane. The E.U.T. was placed 50 ± 5 mm over the reference plane. The E.U.T. was tested connected to 12 Vdc and/or to 24Vdc car battery.

5.3.3 Test specification

Test pulse number	Immunity test level	Min. number of pulses or test time	Functional status for systems	
			Related to immunity related functions	Not related to immunity related functions
1	III	5000 pulse	C	D
2a	III	5000 pulse	B	D
2b	III	10 pulse	C	D
3a/3b	III	1 h	A	D
4	III	1 pulse	B or C	D

5.3.4 Test result

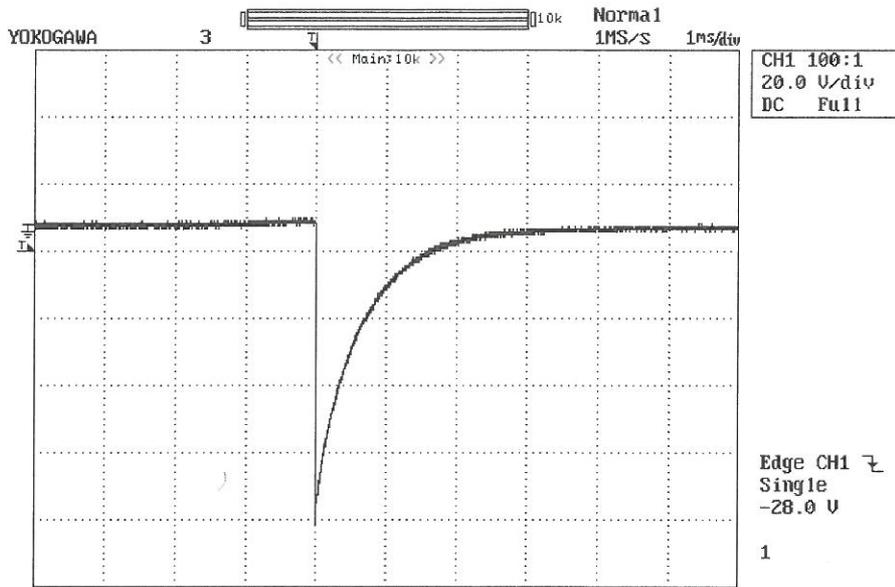
Coupling point	Pulse number	Verdict
DC power port	1	P
DC power port	2a	P
DC power port	2b	P
DC power port	3a/3b	P
DC power port	4	P

Verdict:	<input checked="" type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> N
Performance Criterion:	See table above
Operation mode:	1
Configuration mode:	1
Kind of test site:	Laboratory
Remarks:	

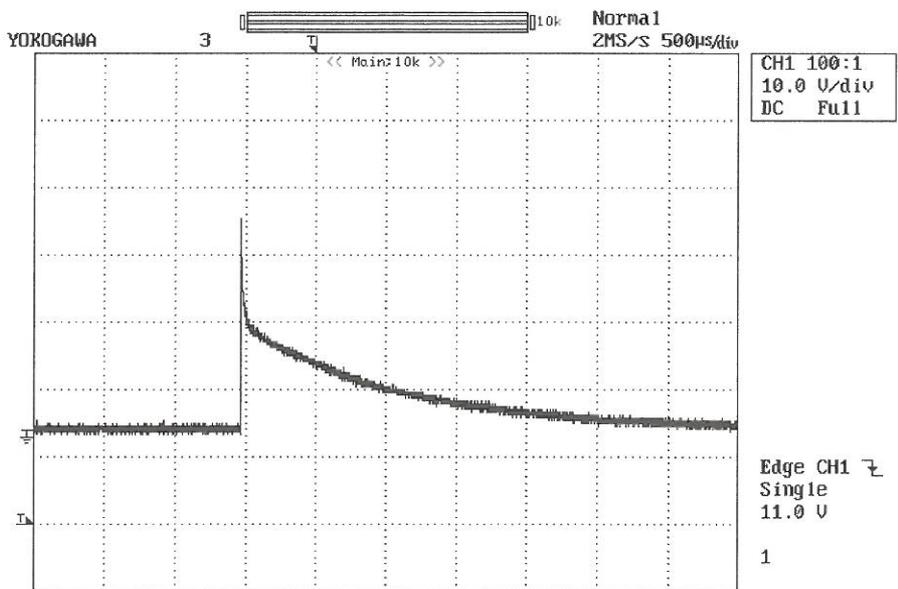
5.3.5 Test equipment used

<i>Equipment</i>	<i>Manufacturer</i>	<i>Model</i>	<i>Serial N°</i>
Pulse generator	Computec	ACS 400	P005
Pulse generator	Zenone	GVS40 GL-1000-1	453

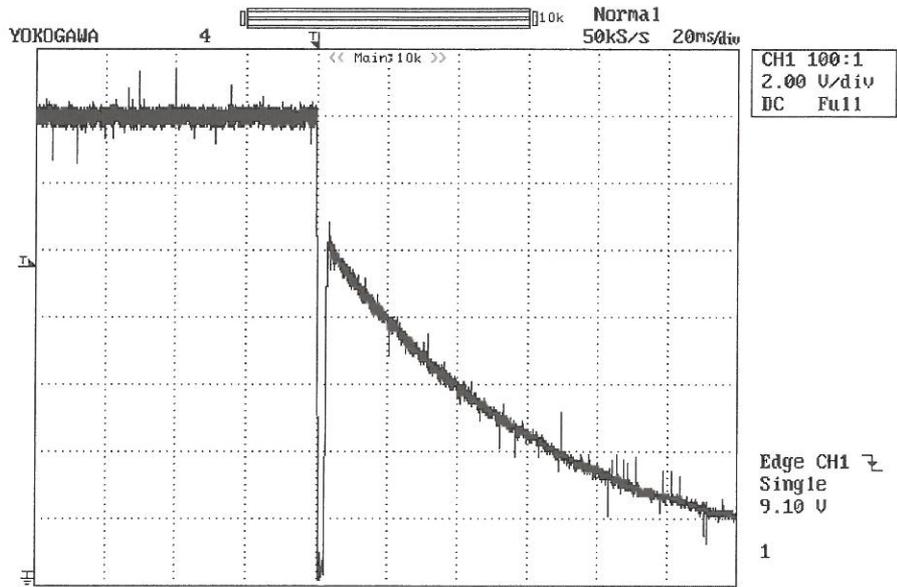
5.3.6 Pulse Voltage Waveform for 12V system



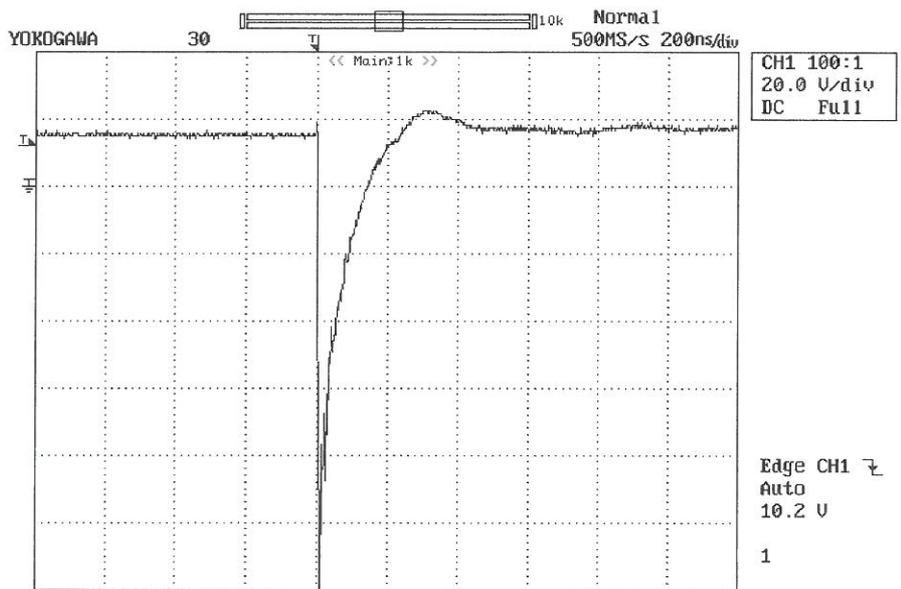
Pulse 1



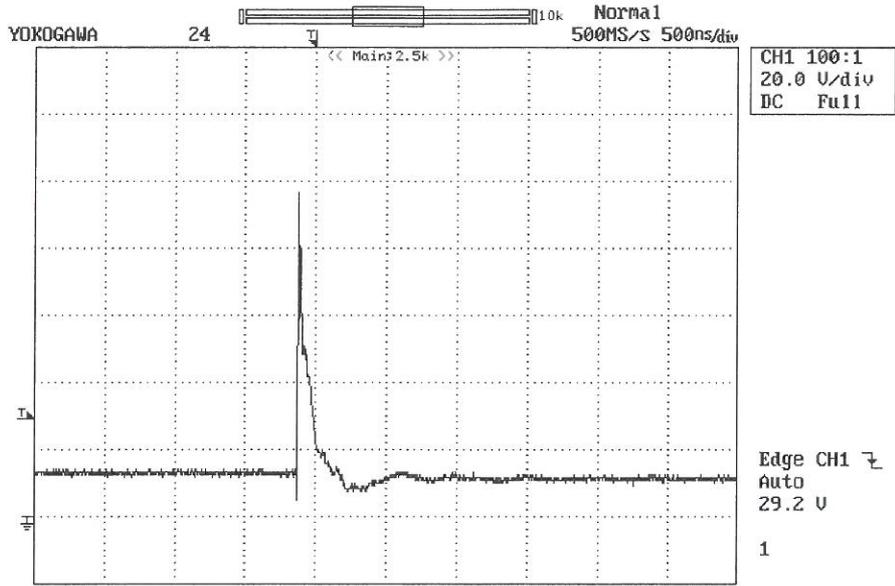
Pulse 2a



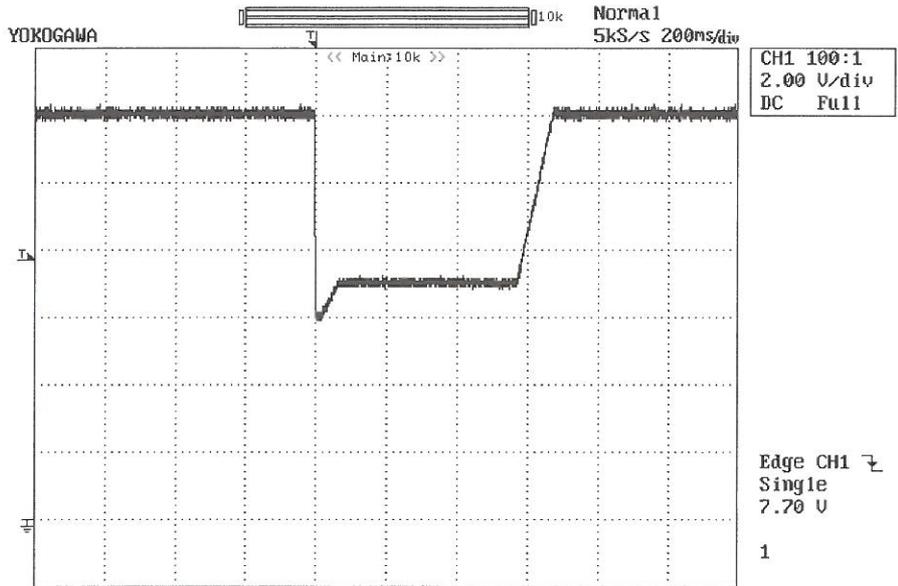
Pulse 2b



Pulse 3a



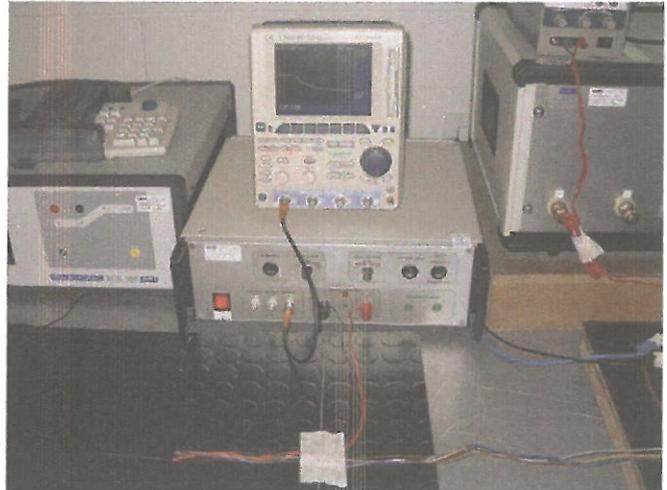
Pulse 3b



Pulse 4

5.4 Emission of conducted disturbances

5.4.1 Photo documentation of the test set-up



5.4.2 Test method

E.U.T. tested according to Annex 10 of Regulation 10. All I/O cables were lifted 50 ± 5 mm over the reference plane. The E.U.T. was placed 50 ± 5 mm over the reference plane. The E.U.T. was tested connected to 12 Vdc and/or to 24Vdc car battery.

5.4.3 Limits

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

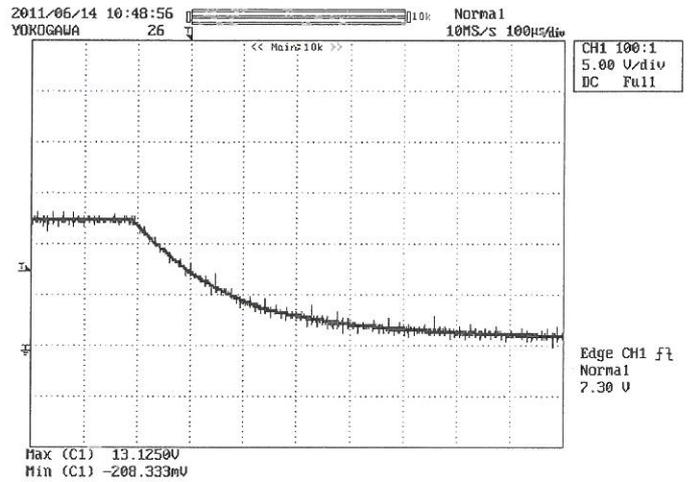
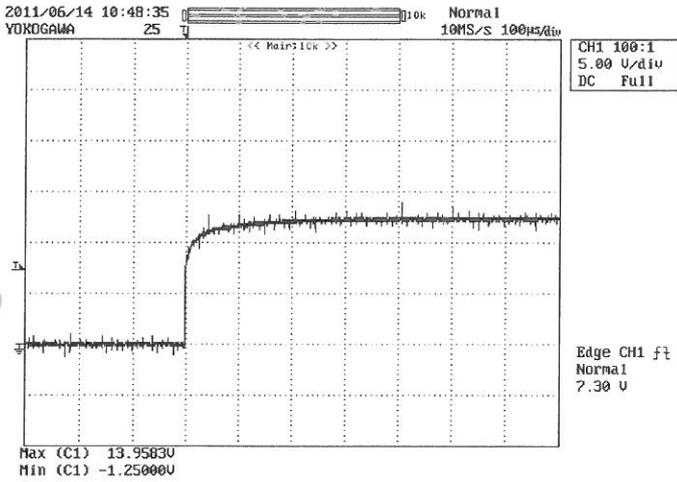
5.4.4 Test result

Verdict:	<input checked="" type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> N
Kind of test site:	Laboratory
Remarks:	

5.4.5 Test protocol

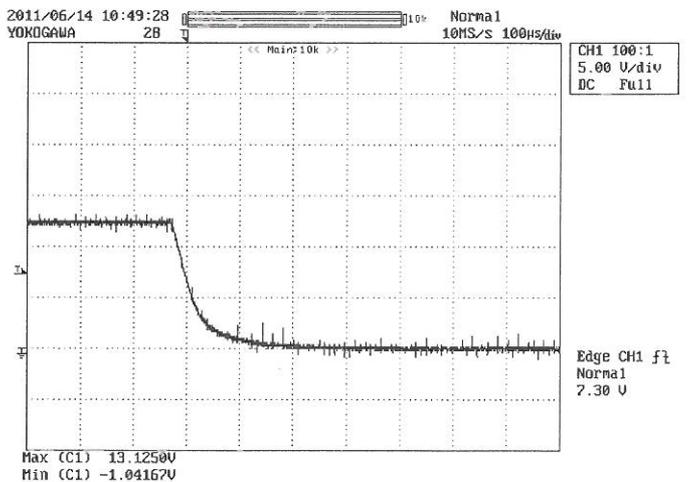
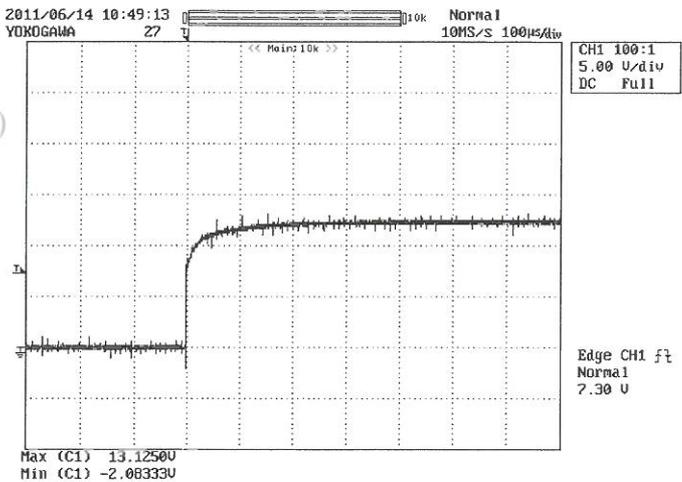
Test point: DC power supply cable
 Operation mode: 1
 Configuration mode: 1
 Remarks: Switch at the input of the LISN

Verdict: Pass



Test point: DC power supply cable
 Operation mode: 1
 Configuration mode: 1
 Remarks: Switch at the output of the LISN

Verdict: Pass



5.4.6 Test equipment used

<i>Equipment</i>	<i>Manufacturer</i>	<i>Model</i>	<i>Serial N°</i>
DC power supply	R&S	NGSM 32/10	192.0810.31
Electronic switch	Zenone	ZCN25	480
Oscilloscope	Yokogawa	DL1740E	27D904989H

6 EUT PHOTOS

