DARE!! Measurements
Test & measurement services

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands

Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

Electromagnetic Compatibility Test Report

Partial test results of a rail temperature sensor, model ED1608 RTS

Customer	:	1M2M B.V. Korne 7 3453 MJ De Meern The Netherlands
Customer's representative	:	Ms. L. Lu-Ming
In the capacity of	:	Manufacturer
Reference number	:	17C00881RPT02
Status test report	:	Final

Test engineer:	Author:	Released:
E. Bloem	M.J. Rommen	G.C. Nobel
Test engineer	Administrative assistant	Team leader

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

1 Summary

A summary of the test results gained from testing the ED1608RTS (Rail temperature sensor) is shown in the table below.

	Standard	Class / level	Result
Emission	EN 301 489-01 V1.9.2 & EN 301 489-03 V1.4.1[4]	--	Not requested (5)
Immunity	EN 301 489-01 V1.9.2 & EN 301 489-03 V1.4.1[4]	--	Pass as far as tested(5)
Emission	EN 61000-3-2 (2014)	--	Not applicable
Emission	EN 61000-3-3 (2013)	--	Not applicable
Immunity	EN 61000-6-2 (2005) + AC (2005)	--	Pass as far as tested(5)
Immunity	EN50121-4 (2006)	--	Pass as far as tested(5)
Immunity	RLN000007 V005 (2009)	--	Pass as far as tested(5)
Test plan	Not available		

Note 1: The test results presented in this report relate only to the tested sample(s).

Note 2: The test results are based on the tested mode of operation(s), the applicable performance criteria and the acceptance criteria as specified by the customer.

Note 3: At the request of the customer are not all tests performed which are described by the standard.

Note 4: EN 301 489-03 V1.4.1 is not harmonized under the EMC Directive 2014/30/EU.

Note 5: These tests are already performed: see reports 15C0844, 16C00267. Only the more severe levels are re-rested

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

The following table gives a summary of the results of the tests that have been carried out on the ED1608RTS (Rail temperature sensor).

Test sequence	Test Description	Basic standard	EUT Modified during test	Result
--	Conducted emission, test with a LISN	EN 55016-2-1 (2014)	--	Not applicable
--	Conducted emission, test with a Current Probe	EN 55022 (2010) + AC (2011)	--	Not applicable
--	Radiated emission up to 1 GHz (SAC)	EN 55016-2-3 (2010) + A1 (2010) + A2 (2014) + C1 (2013)	--	See 15C0844, 16C00267
--	Radiated emission above 1 GHz (FAC)	EN 55016-2-3 (2010) + A1 (2010) + A2 (2014) + C1 (2013)	--	See 15C0844, 16C00267
--	Harmonics	EN-IEC 61000-3-2 (2014)	--	Not applicable
--	Flicker	EN-IEC 61000-3-3 (2013)	--	Not applicable
3	ESD	EN-IEC 61000-4-2 (2009)	No	Pass
1	Radiated Immunity	EN-IEC 61000-4-3 (2006) + A1 (2008) + A2 (2010)	No	Pass
--	EFT	EN-IEC 61000-4-4 (2012)	--	Not applicable
--	Surge	EN-IEC 61000-4-5 (2014)	--	Not applicable
--	Conducted Immunity	EN-IEC 61000-4-6 (2014)	--	Not applicable
2	Power Frequency Magnetic Field[1]	EN-IEC 61000-4-8 (2010)	No	Pass
	Pulsed Magnetic Field[1]	EN-IEC 61000-4-9 (1993) + A1 (2001)	--	Not applicable

1 Tests are excluded from accreditation.
2 Only the more severe levels are re-tested.

Dijkstra Advice, Research & EMC Services B.V.
KvK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0158313704 • SWIFT code RABONL2U
Eori-number: NL805613468
VAT number: NL8056.13.468.B01

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands

Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

The table below shows details about tests that are not applicable.

Phenomenon	Comment
Conducted emission, mains terminals, continue (LISN)	The EUT is not AC supplied. The EUT is internal battery operated.
Conducted emission, mains terminals, discontinue (LISN)	During the Conducted emission continue test (LISN), no discontinue disturbances occurred. Impulse noise (clicks) occurs less than five times per minute, therefore this test is not considered (see Note 2 EN 61000-6-4 (2007))
Conducted emission, load and additional terminals, continue (VP)	The EUT is internal battery operated. The EUT doesn't have load or additional terminals. The EUT has leads, which are not easily extensible by the user (Permanently connected, or provided with a specific connector), which are shorter than 2 m.
Conducted emission, signal/ control ports (AAN/CVP/CP)	The EUT doesn't have signal or control ports.
Conducted emission, telecommunication/network ports (AAN/CVP/CP)	The EUT doesn't have multi-user telecommunications / network ports such as ISDN or Ethernet.
Harmonics	The EUT is not AC supplied. The EUT is internal battery operated.
Flicker	The EUT is not AC supplied. The EUT is internal battery operated.
EFT	The EUT is not AC supplied. The EUT is internally battery operated.
Surge	The EUT is not AC supplied. The EUT is internally battery operated.
Conducted Immunity	The EUT is internally battery operated. The EUT doesn't have I/O cables longer than 3 m.
Voltage Dips and Voltage Variations	The EUT is internally battery operated. The EUT is not AC supplied.
Traction Frequency	The EUT is not used in the 25kV/50Hz environment

Dijkstra Advice, Research & EMC Services B.V.
KvK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0158313704 • SWIFT code RABONL2U
Eori-number: NL805613468
VAT number: NL8056.13.468.B01

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands

Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

2 Table of Contents

Dijkstra Advice, Research & EMC Services B.V.
KvK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0158313704 • SWIFT code RABONL2U
Eori-number: NL805613468
VAT number: NL8056.13.468.B01

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands

Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

3 Introduction

DARE!! Measurements is requested by 1M2M B.V., to perform Electromagnetic Compatibility (EMC) tests.

The objective of the test was to assess the ED1608RTS (Rail temperature sensor) in accordance with the standards as mentioned in chapter 5 of this report, within the framework of the CE marking process. This report may only be used for this purpose.

At request of 1M2M B.V., the EMC tests are carried out, in order to find out whether the product complies with the harmonized European standards under the EMC Directive 2014/30/EU.

This report replaces the former report (17C00881RPT01) since the customer requested to add the reason why several tests are not performed in this test session. In 2015 and 2016 many EMC test were already performed and only the differences are re-tested in this session.

The test sample(s) were received on 2017 August, 17. Testing was performed on 2017 August, 17. The test report is issued on 2017 September, 27.

The tests are carried out at our facilities located in Woerden, The Netherlands.

The test results presented in this report relate only to the product tested.

In this report, the sample tested will be referred to as Equipment Under Test (EUT).

This report is in conformity with ISO 17025.

Opinions or interpretations mentioned in this report are excluded from accreditation.

All tests as described in the applied standard(s) are carried out, unless otherwise specified in this report.

4 Explanation Status Report

- Final : Formally signed report, with a final conclusion. Changes in the report will lead to a new report with a new report number.
- Preliminary : Interim signed report, with a temporary conclusion. Test is not completed, for example due to missing information. Changes in the report will lead to an updated report with a new report number.

Dijkstra Advice, Research & EMC Services B.V.
KvK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0158313704 • SWIFT code RABONL2U
Eori-number: NL805613468
VAT number: NL8056.13.468.B01

ilac-MRA RvA TESTING RvA L 279

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

5 Standards and test plan

The EUT is assessed against the following requirements.

Immunity	:	EN 301 489-01 V1.9.2 & EN 301 489-03 V1.4.1
Immunity	:	EN 61000-6-2 (2005) + AC (2005)
Immunity	:	EN50121-4 (2006)
Immunity	:	RLN000007 V005 (2009)
Test plan	:	Not available

If available, a test plan is used as a supplement.

5.1 Test plan deviations

Not applicable.

6 Measurement Uncertainties

The reported expanded uncertainty of measurement is based on a standard uncertainty of measurement multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%, but excluding the contribution of the EUT. For Emission tests, the expanded uncertainty of measurement has been determined in accordance with EN 55016-4-2 (2011). For Immunity tests, the expanded uncertainty of measurement has been determined in accordance with either the basic standard, or UKAS publication LAB34.

7 EUT details

7.1 Condition of EUT on receipt

The condition of the EUT during reception was undamaged and fully functional.

7.2 Purpose, functional and physical description

Generic remote sensor (GPS, temperature) tracker for containers, railway environments etc.

Dijkstra Advice, Research & EMC Services B.V.
KvK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0158313704 • SWIFT code RABONL2U
Eori-number: NL805613468
VAT number: NL8056.13.468.B01

The details for the EUT that is supplied for test were as follows.

Description	Sample
Name	ED1608RTS (rail temperature sensor)
Manufacturer	1M2M B.V.
Brand	1M2M
Model number	ED1608 RTS (rail temperature sensor)
Serial number	0059AC00001510BB
Rating voltage	3.8Vdc
Rating power	Not specified
Rating amperage	<80mA
Rating frequency	DC
Power supply during test	Internal battery
Dimensions (L*W*H [m])	90 x 73 x 37 mm
Software release	1.0
Hardware release	5406 (Hardware ID)
Environment to be used	Licht industrial / industrial, outdoor, railway etc.

7.3 Potential sources of emission

The highest generated or used frequency of the EUT is 868MHz (LORA).

7.4 Test configuration

The EUT is tested as table top equipment.

8 Operating conditions during test

8.1 Test considerations

None.

8.2 Mode(s) of operation

The test mode(s) during testing were defined as:

Mode of operation	Description
Mode 1	The Generic remote sensor is continuously connected with the base station (sending packages each 3 seconds (=dwell time)).

8.3 Acceptance criteria

The criteria for recording a malfunction of operating which can occur during the immunity tests are shown in the table below.

Mode of operation	Acceptance criterion
Mode 1	**Performance criterion A:** during the test no data messages may be lost. **Performance criterion B:** during the test the EUT may stop sending, however after the test the sending has to recover automatically. **Performance criterion C:** not applicable.

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

8.4 EUT monitoring

During immunity testing, the behavior and performance of the EUT will be monitored by means of monitoring the base station, which is connected to a peripheral laptop, for received packages.

The applicant's representative was present to witness the testing.

The Appendixes of this report shows pictures of the test configuration during the tests.

8.5 Minimum dwell time

The minimum dwell time is determined prior to immunity testing. Besides the requirement of the applied standard(s), the applicant states that the minimum dwell time must be 3 seconds, since the EUT transmits a burst every 3seconds.

9 Possible test case verdicts

NA or not applicable	:	test does not apply to the EUT
P(ass)	:	EUT does meet the requirement
F(ail)	:	EUT does not meet the requirement
U(ndetermined)	:	Pass or Fail could not be established
NR or not requested	:	test is not requested by customer

During pass or fail decisions, the measurement uncertainty is not taken into account.

10 Test equipment

The instruments used to perform the tests are displayed in the Appendix.

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

11 Test results

11.1 Electro Static Discharges (ESD)

11.1.1 Test method

The immunity tests to ESD are carried out in accordance with the applied standard(s) (see chapter 5) and the basic standard EN-IEC 61000-4-2 (2009), where the first standard takes precedence. Beside the test levels as described in the standard EN 301 489-01 V1.9.2 & EN 301 489-03 V1.4.1, all voltages of the lower test levels as described in the basic standard are tested.

11.1.2 Measurement Uncertainty

It has been demonstrated that the test generator meets the specified requirements in the standard with at least 95% confidence.

11.1.3 Requirements

The requirements are laid down in the table below.

EN50121-4, RLN000007 V005

Type of discharge	Test level	Performance Criterion
Air discharge	0 - ± 8 kV	B
Contact discharge	0 - ± 6 kV	B

EN301489, EN61000-6-2

Type of discharge	Test level	Performance Criterion
Air discharge	0 - ± 8 kV	See product standard
Contact discharge	0 - ± 4 kV	See product standard

Dijkstra Advice, Research & EMC Services B.V.
KvK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0158313704 • SWIFT code RABONL2U
Eori-number: NL805613468
VAT number: NL8056.13.468.B01

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

Test Results of Electro Static Discharge test

PIN number	17C00881
Test ID	29
Temperature	20 °Celsius
Humidity	40 %
Mode of operation	Mode 1
Remarks	Pass, the lower levels are also tested.

Settings

Number of single discharges at each spot	10
Time interval between discharges	1 sec.

Test Results air discharge

Discharge location	Testlevel	Note	Result
Enclosure	8 kV	See remarks	Pass
Enclosure	-8 kV	See remarks	Pass

Test Results contact discharge

Discharge location	Testlevel	Note	Result
Enclosure	6 kV	See remarks	Pass
Enclosure	-6 kV	See remarks	Pass

Test Results at Horizontal Coupling Plane

Discharge location	Testlevel	Note	Result
Enclosure	6 kV	See remarks	Pass
Enclosure	-6 kV	See remarks	Pass

Test Results at Vertical Coupling Plane

Discharge location	Testlevel	Note	Result
Enclosure	6 kV	See remarks	Pass
Enclosure	-6 kV	See remarks	Pass

Dijkstra Advice, Research & EMC Services B.V.
KvK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0158313704 • SWIFT code RABONL2U
Eori-number: NL805613468
VAT number: NL8056.13.468.B01

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

11.2 Radiated Immunity

11.2.1 Test method

The radiated immunity tests are carried out in a full anechoic room, in accordance with the applied standard(s) (see chapter 5) and the basic standard EN-IEC 61000-4-3 (2006) + A1 (2008) + A2 (2010), where the first standard takes precedence.

11.2.2 Measurement Uncertainty

The measurement uncertainty during testing is displayed in the table below.

Frequency	U (log)	U (lin)
26 MHz – 6 GHz	± 2.1 dB	+27.2 % / -21.4 %

11.2.3 Requirements

The requirements are laid down in the tables below.

EN50121-4, RLN000007 V005

Antenna polarization	Test level	Frequency range	Performance Criterion
Horizontal	10 V/m	80 – 1000 MHz	A
Vertical	10 V/m	80 – 1000 MHz	A
Horizontal	20 V/m	380 – 400 MHz	A
Vertical	20 V/m	380 – 400 MHz	A
Horizontal	20 V/m	420 – 430 MHz	A
Vertical	20 V/m	420 – 430 MHz	A
Horizontal	20 V/m	450 – 470 MHz	A
Vertical	20 V/m	450 – 470 MHz	A
Horizontal	20 V/m	800 – 1000 MHz	A
Vertical	20 V/m	800 – 1000 MHz	A
Horizontal	10 V/m	1400 – 2100 MHz	A
Vertical	10 V/m	1400 – 2100 MHz	A
Horizontal	5 V/m	2100 – 2500 MHz	A
Vertical	5 V/m	2100 – 2500 MHz	A

EN301489

Antenna polarization	Test level	Frequency range	Performance Criterion
Horizontal	3 V/m	80 – 1000 MHz	See product standard
Vertical	3 V/m	80 – 1000 MHz	See product standard
Horizontal	3 V/m	1.4 – 2.7 GHz	See product standard
Vertical	3 V/m	1.4 – 2.7 GHz	See product standard

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

EN61000-6-2

Antenna polarisation	Test level	Frequency range	Performance Criterion
Horizontal	10 V/m	80 – 1000 MHz	A
Vertical	10 V/m	80 – 1000 MHz	A
Horizontal	3 V/m	1,4 – 2,0 GHz	A
Vertical	3 V/m	1,4 – 2,0 GHz	A
Horizontal	1 V/m	2,0 – 2,7 GHz	A
Vertical	1 V/m	2,0 – 2,7 GHz	A

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

Test Results of Radiated Immunity test 380 MHz to 470 MHz Vertical

PIN number	17C00881
Test ID	25
Mode of operation	Mode 1 (side 1)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	20 V/m
Distance	3 m		

Test Results of Radiated Immunity test 800 MHz to 1 GHz Vertical

PIN number	17C00881
Test ID	26
Mode of operation	Mode 1 (side 1)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	20 V/m
Distance	3 m		

Test Results of Radiated Immunity test 380 MHz to 470 MHz Horizontal

PIN number	17C00881
Test ID	22
Mode of operation	Mode 1 (side 1)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	20 V/m
Distance	3 m		

Test Results of Radiated Immunity test 800 MHz to 1 GHz Horizontal

PIN number	17C00881
Test ID	24
Mode of operation	Mode 1 (side 1)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	20 V/m
Distance	3 m		

Dijkstra Advice, Research & EMC Services B.V.
KvK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0158313704 • SWIFT code RABONL2U
Eori-number: NL805613468
VAT number: NL8056.13.468.B01

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

Test Results of Radiated Immunity test 380 MHz to 470 MHz Vertical

PIN number	17C00881
Test ID	18
Mode of operation	Mode 1 (side 2)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	20 V/m
Distance	3 m		

Test Results of Radiated Immunity test 800 MHz to 1 GHz Vertical

PIN number	17C00881
Test ID	19
Mode of operation	Mode 1 (side 2)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	20 V/m
Distance	3 m		

Test Results of Radiated Immunity test 380 MHz to 470 MHz Horizontal

PIN number	17C00881
Test ID	20
Mode of operation	Mode 1 (side 2)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	20 V/m
Distance	3 m		

Test Results of Radiated Immunity test 800 MHz to 1 GHz Horizontal

PIN number	17C00881
Test ID	21
Mode of operation	Mode 1 (side 2)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	20 V/m
Distance	3 m		

Dijkstra Advice, Research & EMC Services B.V.
KvK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0158313704 • SWIFT code RABONL2U
Eori-number: NL805613468
VAT number: NL8056.13.468.B01

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

Test Results of Radiated Immunity test 380 MHz to 470 MHz Vertical

PIN number	17C00881
Test ID	16
Mode of operation	Mode 1 (side 3)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	20 V/m
Distance	3 m		

Test Results of Radiated Immunity test 800 MHz to 1 GHz Vertical

PIN number	17C00881
Test ID	17
Mode of operation	Mode 1 (side 3)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	20 V/m
Distance	3 m		

Test Results of Radiated Immunity test 380 MHz to 470 MHz Horizontal

PIN number	17C00881
Test ID	14
Mode of operation	Mode 1 (side 3)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	20 V/m
Distance	3 m		

Test Results of Radiated Immunity test 800 MHz to 1 GHz Horizontal

PIN number	17C00881
Test ID	15
Mode of operation	Mode 1 (side 3)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	20 V/m
Distance	3 m		

Dijkstra Advice, Research & EMC Services B.V.
KvK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0158313704 • SWIFT code RABONL2U
Eori-number: NL805613468
VAT number: NL8056.13.468.B01

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

Test Results of Radiated Immunity test 380 MHz to 470 MHz Vertical

PIN number	17C00881
Test ID	9
Mode of operation	Mode 1 (side 4)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	20 V/m
Distance	3 m		

Test Results of Radiated Immunity test 800 MHz to 1 GHz Vertical

PIN number	17C00881
Test ID	10
Mode of operation	Mode 1 (side 4)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	20 V/m
Distance	3 m		

Test Results of Radiated Immunity test 800 MHz to 1 GHz Horizontal

PIN number	17C00881
Test ID	12
Mode of operation	Mode 1 (side 4)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	20 V/m
Distance	3 m		

Test Results of Radiated Immunity test 380 MHz to 470 MHz Horizontal

PIN number	17C00881
Test ID	13
Mode of operation	Mode 1 (side 4)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	20 V/m
Distance	3 m		

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

Test Results of Radiated Immunity test 1.4 GHz to 6 GHz Vertical

PIN number	17C00881
Test ID	1
Mode of operation	Mode 1 (Side 1)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	10 V/m
Distance	2 m		

Test Results of Radiated Immunity test 1.4 GHz to 6 GHz Horizontal

PIN number	17C00881
Test ID	2
Mode of operation	Mode 1 (Side 1)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	10 V/m
Distance	2 m		

Test Results of Radiated Immunity test 1.4 GHz to 6 GHz Vertical

PIN number	17C00881
Test ID	4
Mode of operation	Mode 1 (side 2)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	10 V/m
Distance	2 m		

Test Results of Radiated Immunity test 1.4 GHz to 6 GHz Horizontal

PIN number	17C00881
Test ID	3
Mode of operation	Mode 1 (side 2)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	10 V/m
Distance	2 m		

Dijkstra Advice, Research & EMC Services B.V.
KvK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0158313704 • SWIFT code RABONL2U
Eori-number: NL805613468
VAT number: NL8056.13.468.B01

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

Test Results of Radiated Immunity test 1.4 GHz to 6 GHz Vertical

PIN number	17C00881
Test ID	5
Mode of operation	Mode 1 (side 3)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	10 V/m
Distance	2 m		

Test Results of Radiated Immunity test 1.4 GHz to 6 GHz Horizontal

PIN number	17C00881
Test ID	6
Mode of operation	Mode 1 (side 3)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	10 V/m
Distance	2 m		

Test Results of Radiated Immunity test 1.4 GHz to 6 GHz Vertical

PIN number	17C00881
Test ID	8
Mode of operation	Mode 1 (side 4)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	10 V/m
Distance	2 m		

Test Results of Radiated Immunity test 1.4 GHz to 6 GHz Horizontal

PIN number	17C00881
Test ID	7
Mode of operation	Mode 1 (side 4)
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 1%	Modulation	1000 Hz. 80% AM
Dwell time	3 s	Test level	10 V/m
Distance	2 m		

Dijkstra Advice, Research & EMC Services B.V.
KvK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0158313704 • SWIFT code RABONL2U
Eori-number: NL805613468
VAT number: NL8056.13.468.B01

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

11.3 Power frequency magnetic field

11.3.1 Test method

The power frequency magnetic field tests are carried out in accordance with the applied standard(s) (see chapter 5) and the basic standard EN-IEC 61000-4-8 (2010), where the first standard takes precedence.

11.3.2 Requirements

The requirements are laid down in the table below.

Field direction	Frequency	Test level	Performance Criterion
X, Y, Z	0 Hz 16,67 Hz 50 Hz	AC systems: 100 A/m (rms) DC systems: 300 A/m	A

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

Test Results of Power frequency magnetic field immunity test

PIN number	17C00881
Remarks	Pass

Settings

Dwell time [sec]:	3 sec

Test specifications		Antenna polarization	Mode of operation	Observation	Performance criterion required	Performance criterion attained	Pass/Fail
f (Hz)	Test Level (A/m)						
16,7 Hz	100 A/m rms	X	Mode 1	Pass, no influence observed.	A	A	Pass
		Y	Mode 1	Pass, no influence observed.	A	A	Pass
		Z	Mode 1	Pass, no influence observed.	A	A	Pass
50 Hz	100 A/m rms	X	Mode 1	Pass, no influence observed.	A	A	Pass
		Y	Mode 1	Pass, no influence observed.	A	A	Pass
		Z	Mode 1	Pass, no influence observed.	A	A	Pass
0 Hz (DC)	300 A/m	X	Mode 1	Pass, no influence observed.	A	A	Pass
		Y	Mode 1	Pass, no influence observed.	A	A	Pass
		Z	Mode 1	Pass, no influence observed.	A	A	Pass

Dijkstra Advice, Research & EMC Services B.V.
KvK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0158313704 • SWIFT code RABONL2U
Eori-number: NL805613468
VAT number: NL8056.13.468.B01

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

12 Conclusion

The ED1608RTS (Rail temperature sensor) has been partially evaluated. A partial test does not cover all the required tests, for a full compliant EMC test the emission and immunity test must be performed as described in the basic standards.

The ED1608RTS (Rail temperature sensor) meets, as far as tested, the immunity levels as described in EN 301 489-01 V1.9.2 & EN 301 489-03 V1.4.1[1], in EN 61000-6-2 (2005) + AC (2005), in EN50121-4 (2006) and in RLN000007 V005 (2009).
This is based on the tested mode of operation(s), the applicable performance criteria and the acceptance criteria as specified by the customer.

[1] EN 301 489-03 V1.4.1 is not harmonized under the EMC Directive 2014/30/EU.

Dijkstra Advice, Research & EMC Services B.V.
KvK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0158313704 • SWIFT code RABONL2U
Eori-number: NL805613468
VAT number: NL8056.13.468.B01

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

13 Appendix A: General performance criteria

Performance criterion A:
The equipment shall continue to operate as intended without operator intervention. 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 by what the user may reasonably expect from the apparatus if used as intended.

Performance criterion B:
After the test the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena 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 allowed. However, no change of actual operating state or stored data is allowed to persist after the test. If the minimum performance level (or the permissible performance loss) is not specified by the manufacturer, 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.

Performance criterion C:
Loss of function is allowed, provided the loss of function is self-recoverable or can restored by the operation of the controls by the user in accordance with the manufacturer's instructions. Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

Dijkstra Advice, Research & EMC Services B.V.
KvK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0158313704 • SWIFT code RABONL2U
Eori-number: NL805613468
VAT number: NL8056.13.468.B01

14 Appendix B: Pictures of EUT

Picture 1: Radiated immunity

Picture 2: Power frequency magnetic field

Dijkstra Advice, Research & EMC Services B.V.
KvK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0158313704 • SWIFT code RABONL2U
Eori-number: NL805613468
VAT number: NL8056.13.468.B01

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands

Tel. +31 348 430 979
Fax +31 348 430 645
www.dare.nl
measurements@dare.nl

15 Appendix C: Equipment List

ESD

Device Type	Brand	Type	ID
ESD gun	EM-Test	ESD30	1558

Radiated Immunity 80 MHz to 1000 MHz

Device Type	Brand	Type	ID
Amplifier	Prana	AP32MT255	1334
Field sensor 1	DARE!! Instruments	RadiSense IV (RadiCentre)	1500
Signal generator	DARE!! Instruments	RGN6000B	1567
Antenna	EMCO	3142	1168
AD convertor	D.A.R.E!! Development	RadiMate IV	1378
Coupler	Prana	AP32MT255 Coupler	1334
Forward power meter	DARE!! Instruments	RPR2006P	1576+1589
Reflected power meter	DARE!! Instruments	RPR1006A	1576+1497
Switch matrix	DARE!! Instruments	RSW1024S	1576
Cable SG -> amplifier	Huber & Suhner + Schwarzbeck	RG142 + Ecoflex15	1354+1476
Cable coupler -> fwd Power meter	Huber & Suhner	RG142	1594
Cable coupler -> refl Power meter	Huber & Suhner	RG142	1595
Cable coupler -> antenna	Huber & Suhner	Sucofeed_1/2	1370
Antenna tower	DARE!! Instruments	Raditower	1365

Radiated Immunity 1 GHz to 6 GHz

Device Type	Brand	Type	ID
Amplifier	DARE!! Instruments	RadiField RFS2006B	1651
Field sensor 1	DARE!! Instruments	RadiSense IV (RadiCentre)	1500
Signal generator	DARE!! Instruments	RGN6000B	1567
Antenna	DARE!! Instruments	RadiField RFS2006B	1651
AD convertor	D.A.R.E!! Development	RadiMate IV	1378
Coupler	DARE!! Instruments	RadiField RFS2006B	1651
Forward power meter	DARE!! Instruments	RadiField RFS2006B	1651
Reflected power meter	DARE!! Instruments	RadiField RFS2006B	1651
Switch matrix	DARE!! Instruments	RSW1024S	1576
Cable SG -> amplifier	Pasternack	RG217	1273
Antenna tower	DARE!! Instruments	RadiField RFS2006B	1653

Dijkstra Advice, Research & EMC Services B.V.
KvK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0158313704 • SWIFT code RABONL2U
Eori-number: NL805613468
VAT number: NL8056.13.468.B01

ilac-MRA RvA TESTING RvA L 279

Magnetic fields

Description	Brand	Type no	I.D.
Power Source	California Instruments.	5001iX	1324
Test generator	DARE!! Instruments	MF300A	1625
Inductive coil 300A	DARE!! Instruments	IS300A	1623
Current Clamp meter	Chauvin Arnoux	F65	1642
Current Clamp meter	Fluke	376	2101
EM Field Analyzer	Wandel & Goltermann	EFA-2 BN 2245	1152
B-Field Sensor	Wandel & Goltermann	BN 2245/90.10	1153