TEST REPORT

Electromagnetic compatibility (EMC)

standard for radio equipment and services

Report Reference No.....:	344088-1TRFEMC	
Tested by (name, function and signature).....:	D. Guarnone	(project handler)
Approved by (name, function and signature).....:	P. Barbieri	(verifier)
Date of issue.....:	2018-03-30	
Testing Laboratory.....:	**Nemko Spa**	
Address.....:	Via del Carroccio, 4 – 20853 Biassono (MB) – Italy	
Testing location	Nemko Spa	
Address.....:	Via del Carroccio, 4 – 20853 Biassono (MB) – Italy	
Applicant's name.....:	**Energy Team Spa**	
Address.....:	Via della Repubblica 9 20090 Trezzano Sul Naviglio MI - Italy	
Test specification:		
Standard.....:	EN 301 489-1 V2.2.0 – EN 301 489-3 V2.1.1	
	Full application of the standards	☒
	Partial application of the standards	☐
Test procedure.....:	Nemko WM L0077, WM L0177 and WM L1002	
Test Report Form No.....:	301489TRFEMC	
TRF Originator.....:	Nemko Spa	
Master TRF.....:	2009-04	

Test item description..... :	Gateway Radio device
Trade Mark.....:	EnergyTeam S.p.A.
Manufacturer.....:	**Energy Team Spa**
Address of manufacturer.....:	Via della Repubblica 9 20090 Trezzano Sul Naviglio MI - Italy
Model.....:	NG-W169
Ratings.....:	1,5 W / 24-120 VDC / 100-240 VAC 50-60 Hz

Test Report No. : 344088-1TRFEMC	2018-03-30 Date of issue

Short description of the EuT	
Gateway Radio device: equipment to receive and acquire measurement concerning environmental parameters from various measuring instruments as: Temperature, Humidity, etc. The data acquired can be processed and sent via RS-485 to one or more server set for energetic measurement publication. RF connectivity to the sensors at 169MHz.	
Number of tested samples:	1
Serial number:	161213GR153832
Electromagnetic environment:	Telecommunication centre (class A)
Equipment classification:	Equipment for fixed use
Accessories and detachable parts included:	Antenna
Other options included:	-
Testing	
Date of receipt of test sample:	2018-01-29
Testing commenced on:	2018-01-29
Testing concluded on:	2018-03-30
Possible test case verdicts:	
test case does not apply to the test object:	N (Not applicable)
test object does meet the requirement:	P (Pass)
test object does not meet the requirement:	F (Fail)

Symbols used in this test report

☒ The crossed square indicates that the listed condition, standard or equipment is applicable for this report.

☐ The empty square indicates that the listed condition, standard or equipment is not applicable for this report.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

Verdict according to the standards on page 5	**Pass**

PROJECT HISTORY		
Report number	**Modification to the report / comments**	**Date**
344088-1TRFEMCFAIL	First release	2018-02-05
344088-1TRFEMC	Second release: repeated conducted emission	2018-03-30
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REMARKS		

PRODUCT VARIANTS		
Variant model	**Difference against the main model**	**Additional test performed**
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REMARKS		

Contents

1 TEST STANDARDS

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

ETSI EN 301 489-1 V2.2.0
ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU

ETSI EN 301 489-3 V2.1.1
ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU The main standard(s) above contains references to other standards, which are listed below.

The main standard(s) above contain(s) references to other standards, which are listed below.

EN 55032 (2015)
Electromagnetic compatibility of multimedia equipment - Emission Requirements.

EN 61000-4-2 (2009)
Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test

EN 61000-4-3 (2006) + A1 (2008) + A2 (2010)
Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test

EN 61000-4-4 (2012)
Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test

EN 61000-4-5 (2006)
Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test.

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

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

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

Harmonised Standard ETSI EN 301 489-3 The following technical requirements and test specifications are relevant to the presumption of conformity Directive 2014/53/EU					
Technical Requirement Reference			**Technical Requirement Conditionally**		**Verdict**
No.	**Description**	**Reference: Clause No**	**U/C**	**Condition**	
1	Enclosure of ancillary equipment measured on a stand-alone basis	8.2 of ETSI EN 301 489-1 [1]	U	only applicable to ancillary equipment not incorporated in the radio equipment and intended to be measured on a stand-alone basis	P CLASS (A)
2	DC power input/output ports	8.3 of ETSI EN 301 489-1 [1]	C	Only where equipment has DC power input and/or output ports with a cable length greater than 3 m or from a vehicle power supply	N
3	AC mains power input/output ports	8.4 of ETSI EN 301 489-1 [1] of ETSI EN 301 489-1 [1]	C	Only where equipment has AC mains power input and/or output ports	P
4	Harmonic current emission (AC mains input port)	8.5 of ETSI EN 301 489-1 [1]	C	Only where equipment has AC mains power input ports	P
5	Voltage fluctuations and flicker (AC mains input ports)	8.6 of ETSI EN 301 489-1 [1]	C	Only where equipment has AC mains power input ports	P
6	Wired network ports	8.7	C	Only where equipment has wired network ports	N
7	Radio frequency electromagnetic field (80 MHz to 6 000	7.3	U		P
8	Electrostatic discharge	9.3 of ETSI EN 301 489-1 [1]	U		P
9	Fast transients common mode	9.4 of ETSI EN 301 489-1 [1]	U		P
10	Radio frequency common mode	7..3	U		P
11	Transients and surges in the vehicular environment	9.6 of ETSI EN 301 489-1 [1]	C	Only where equipment is connected to vehicle power supply	N
12	Voltage dips and interruptions	9.7 of ETSI EN 301 489-1 [1]	C	Only where equipment has AC mains power input ports	P
14	Surges, line to line and line to ground	9.8 of ETSI EN 301 489-1 [1]	C	Only where equipment has AC mains power input ports and/or wired network ports	P

Symbols:
U/C Indicates whether the requirement is unconditionally applicable (U) or is conditional upon the manufacturer's claimed functionality of the equipment (C).

3 EQUIPMENT UNDER TEST

3.1 Power supply system utilised

Power supply voltage:	☒	230V/50 Hz / 1ϕ	☐	115V/60Hz / 1ϕ
	☐	400V/50 Hz 3PE	☐	400V/50 Hz 3NPE
	☐	12 V DC Internal battery	☐	24V DC

3.2 EuT operation modes

Mode	Description
1	Normal working conditions.

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 E.U.T. has been tested powered by AC mains

3.5 Input/Output Ports

Port	Name	Type*	Cable Max. >3m	Cable Shielded	Description
0	Enclosure	N/E	—	—	—
1	Power supply	AC/DC	☐	☐	Two wires
2	RS485	I/O	☐	☐	Two wires
3	Antenna	RF	☐	☐	Sma

*Note:

AC = AC Power Port DC = DC Power Port N/E = Non-Electrical

I/O = Signal/Control Input or Output Port TP = Telecommunication Ports

3.6 Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
AE	--	--	--	—

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:

☐	based on the used product standard
☒	based on the declaration of the manufacturer, requestor or purchaser

According to EN 301 489-1 V2.2.0

Performance criteria for continuous phenomena applied to transmitters and receivers
During and after the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance. During the test the EUT shall not unintentionally transmit or change its actual operating state and stored data. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

Performance criteria for transient phenomena applied to transmitters and receivers
After the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance. During the EMC exposure to an electromagnetic phenomenon, a degradation of performance is, however, allowed. No change of the actual mode of operation (e.g. unintended transmission) 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 deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

Performance criteria for equipment which does not provide a continuous communication link
For radio equipment which does not provide a continuous communication link, the performance criteria described above are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests. The performance specification shall be included in the product description and documentation.

Performance criteria for ancillary equipment tested on a stand alone basis
If ancillary equipment is intended to be tested on a stand alone basis, the performance criteria described in clauses above are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests. The performance specification shall be included in the product description and documentation.

According to EN 301 489-3 V2.1.1

In the table below:

- • performance criterion A applies for immunity tests with phenomena of a continuous nature;
- • performance criterion B applies for immunity tests with phenomena of a transient nature.

NOTE: Whether a phenomenon is considered transient, continuous or otherwise is indicated in the test procedures for the phenomenon in ETSI EN 301 489-1 [1], clause 9.

Criterion	During test	After test
A	Operate as intended No loss of function No unintentional responses	Operate as intended No loss of function No degradation of performance No loss of stored data or user programmable functions
B	May show loss of function No unintentional responses	Operate as intended Lost function(s) shall be self-recoverable No degradation of performance No loss of stored data or user programmable functions

Where “operate as intended” or “no loss of function” is specified, the EUT shall demonstrate correct functioning as described in clause 5.

Where the EUT has more than one mode of operation (see clause 4.5.2), an unplanned transition from one mode to another is considered as an unintentional response. The EUT shall be tested in sufficient modes to confirm there are no such unintentional responses.

For the immunity tests to check the right work of the E.U.T. has been tested with a SEAV RES 2224 STRIP receiver provided by the applicant.

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 under Nemko Spa testing engineer

4.2 Environmental conditions

Unless different values are declared in the test case, following ambient conditions apply for the tests:

Temperature:	18-33 °C
Humidity:	30-60 %
Atmospheric pressure:	860-1060 hPa

4.3 Test equipment used for the monitoring of the environmental conditions

Equipment	Manufacturer	Model	Serial N°
Thermohygrometer data loggers	Testo	175-H2	20012380/305
Thermohygrometer data loggers	Testo	175-H2	38203337/703
Barometer	MSR	MSR145B	330080

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 Disturbance 3m, 10m Chamber	Antenna distance 1m, 3m, 10m (30÷200) MHz	5.0 dB	(1)
	Antenna distance 1m, 3m, 10m (0.2÷6) GHz	5.2 dB	(1)
	Antenna distance 1m, 3m (6÷18) GHz	5.8 dB	(1)
	Antenna distance 1m, 3m (18÷40) GHz	7.2 dB	(1)

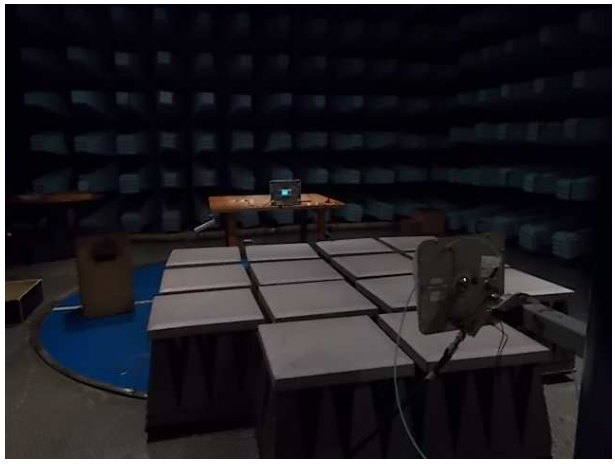
Test	Range	Measurement Uncertainty	Notes
Conducted Disturbance	9 kHz ÷ 150 kHz with AMN	3.8 dB	(1)
	150 kHz ÷ 30 MHz with AMN	3.4 dB	(1)
	150 kHz ÷ 30 MHz with AAN	4.6 dB	(1)
	9 kHz ÷ 30 MHz with voltage probe	2.9 dB	(1)
	9 kHz ÷ 30 MHz with current probe	2.9 dB	(1)
Clicks	9 kHz ÷ 150 kHz	3.8 dB	(1)
	150 kHz ÷ 30 MHz	3.4 dB	(1)
Disturbance Power	30 MHz ÷300 MHz	4.5 dB	(1)
Frequency	10 Hz ÷ 1 kHz	0.2%	(1)
	1kHz ÷ 40GHz	10-6	(1)
Harmonic Current Emission	50 Hz ÷ 2 kHz	2%	(1)
Voltage Fluctuation Emission	--	2%	(1)
Radiated Immunity 10m, 3m chambers	20 MHz ÷ 6 GHz	3.4 dB	(1)
Radiated Immunity TEM Cell	(0.01÷200) MHz	3.0 dB	(1)
Bulk Current	(1÷200) MHz	3.0 dB	(1)
Conducted RF Immunity	9 kHz ÷ 230 MHz	3.0 dB	(1)
ESD Immunity	Voltage, Current, Rise time, Duration	(2)	(1)
Burst Immunity	Voltage, frequency, burst period and duration, rise time and pulse width	(2)	(1)
Surge Immunity	Voltage, Current, Rise time, Duration	(2)	(1)
Dips Immunity	Amplitude	5%	(1)
	Duration	5%	
Magnetic Field Immunity	50 Hz	2.0dB	(1)
Damped Magnetic Field Immunity	100 kHz, 1 MHz	3 dB ampl. 10% freq.	(1)
Oscillatory Wave Immunity	Voltage, front time, frequency 100 kHz, 1 MHz	(2)	(1)
Low Frequency Immunity	15 Hz ÷ 150 kHz	2.2 dB	(1)
Automotive transients Immunity	Voltage, rise time, duration time Impulses 1, 2a, 2b, 3a, 3b and 4	(2)	(1)
Automotive transients Emission	Amplitude	10%	(1)
	Time	10%	
EMF	Lighting Equipment	26%	(1)
	Other Equipment	20%	

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 %;
(2) The instruments used for this immunity test is according to the tolerances requested by the applicable standard.

5 TEST CONDITIONS AND RESULTS

5.1 Radiated emission in the frequency range 30 MHz to 6000 MHz

5.1.1 Photo documentation of the test set-up

5.1.2 Test method according to EN 55016

Measurements were made on a semi anechoic chamber that complies with EN 55011. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 10 meters with the receiving antenna located at a fixed height (from 1 to 4 meter) in both horizontal and vertical polarities. Final measurements (quasi-peak) were then performed by rotating the EUT 360° and adjusting the receiving antenna height from 1 to 4 meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.

5.1.3 Limits

Frequency (MHz)	Limit (dBµV/m) - Quasi-Peak
30 TO 230	40
230 TO 1000	47

Frequency (MHz)	Limit (dBµV/m) – Average	Limit (dBµV/m) – Peak
1000 TO 3000	56	76
3000 TO 6000	60	80

5.1.4 Test result

Verdict:	☒ P ☐ F ☐ N
Frequency range:	30 MHz – 6 000 MHz
Kind of test site:	Semi anechoic chamber
Measurement distance:	10 m and 3 m

Remarks:

- If the highest internal frequency of the EUT is less than 108 MHz, the measurement shall only be made up to 1 GHz.
- If the highest internal frequency of the EUT is between 108 MHz and 500 MHz, the measurement shall only be made up to 2 GHz.
- If the highest internal frequency of the EUT is between 500 MHz and 1 GHz, the measurement shall only be made up to 5 GHz.
- If the highest internal frequency of the EUT is above 1 GHz, the measurement shall be made up to 6 GHz.
- Where the highest internal frequency is not known, tests shall be performed up to 6 GHz.

Remarks: In the range 1 to 6 GHz limit class B are fulfilled

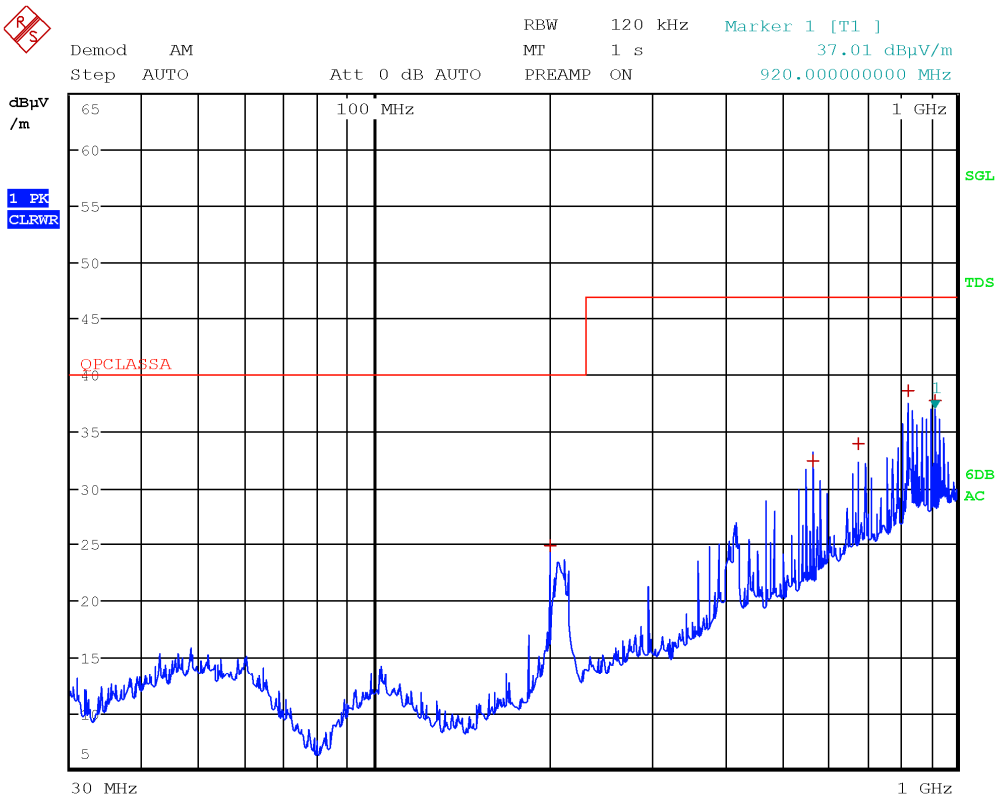
5.1.5 Test equipment used

Equipment	Manufacturer	Model	Serial No.
Trilog Broad Band Antenna	Schwarzbeck	VULB 9162	VULB 9162-025
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
Hydraulic rounding table	Nemko	RTPL 01	4.233
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530
Shielded room	Siemens	10m control room	1947
Bilog antenna 1 – 18 GHz	Schwarzbeck	STLP 9148-123	123
Broadband preamplifier	Schwarzbeck	BBV 9718	9718-137

5.1.7 Test protocol

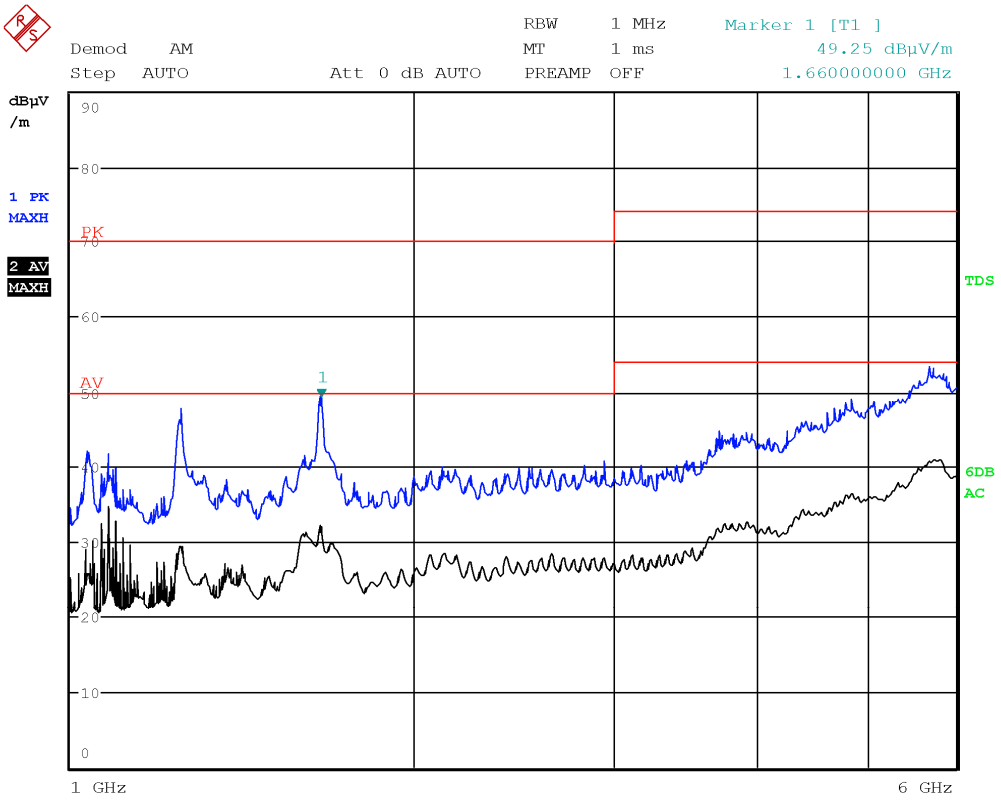
Antenna polarization: Horizontal
Operation mode: 1
Configuration mode: 1
Remarks:

Verdict: Pass



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
200.0000	24.9	40.0	-15.1	QP
568.0000	32.4	47.0	-14.6	QP
680.0000	33.9	47.0	-13.1	QP
824.0000	38.6	47.0	-8.4	QP
920.0000	37.8	47.0	-9.2	QP

Antenna polarization: Horizontal Verdict: Pass
Operation mode: 1
Configuration mode: 1
Remarks:



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
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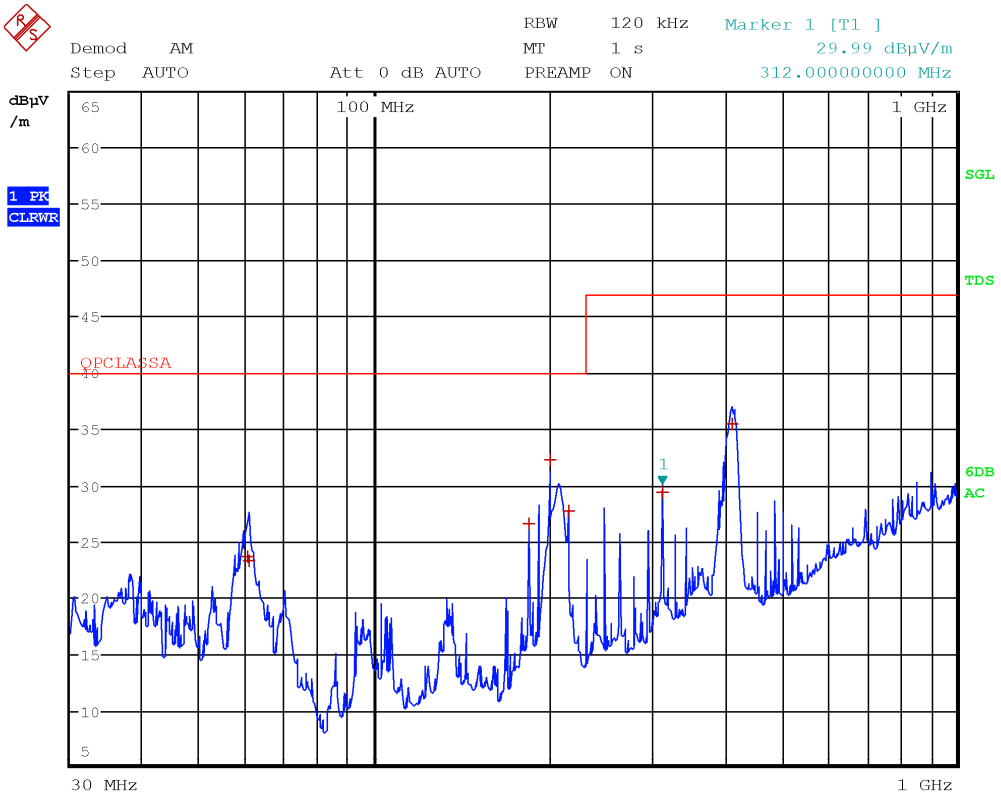
Antenna polarization: Vertical
Operation mode: 1
Configuration mode: 1
Remarks:

Verdict: Pass

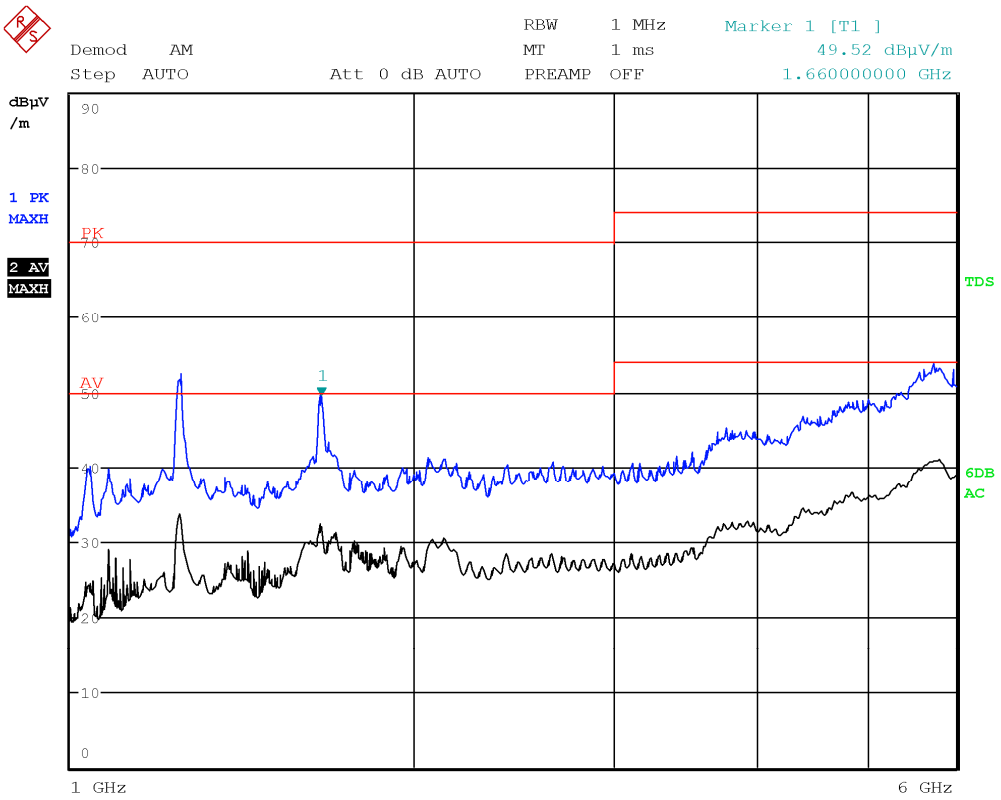


Date: 30.JAN.2018 20:09:51

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
60.4800	23.7	40.0	-16.3	QP
61.0000	23.4	40.0	-16.6	QP
184.0000	26.6	40.0	-13.4	QP
200.0000	32.3	40.0	-7.7	QP
216.0000	27.7	40.0	-12.3	QP
312.0000	29.4	47.0	-17.6	QP
412.4400	35.5	47.0	-11.5	QP

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

Verdict: Pass



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
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5.2 Conducted emission in the frequency range 150 kHz to 30 MHz

5.2.1 Photo documentation of the test set-up

5.2.2 Test method according to EN 55016 and EN 55032

Measurements were made on a ground plane that extends 1-meter minimum beyond all sides of the system under test. All power was connected to the system through Line Impedance Stabilization Networks (LISN). Conducted voltage measurements on mains lines were made at the output of the LISN. All tested process measurement and control ports were connected to an Impedance Stabilization Network (ISN) and conducted voltage measurements were made at the output of the ISN. Where an ISN was not appropriate or available measurements were made using a Capacitive Voltage Probe and Current probe.

5.2.3 Limits for low voltage AC mains port

Frequency (MHz)	Limit (dBµV) – Quasi-Peak	Limit (dBµV) – Average
0.15 TO 0.50	79	66
0.50 TO 30	73	60

5.2.4 Limits for telecommunication/network port

Frequency (MHz)	Limit (dBµV) – Quasi-Peak	Limit (dBµV) – Average
0.15 TO 0.50	97 to 87*	84 to 74*
0.50 TO 30	87	74

*The limits decrease linearly with the logarithm of the frequency

Frequency (MHz)	Limit (dBµV) – Quasi-Peak	Limit (dBµV) – Average
0.15 TO 0.50	53 to 43*	40 to 30*
0.50 TO 30	43	30

*The limits decrease linearly with the logarithm of the frequency

5.2.5 Test result

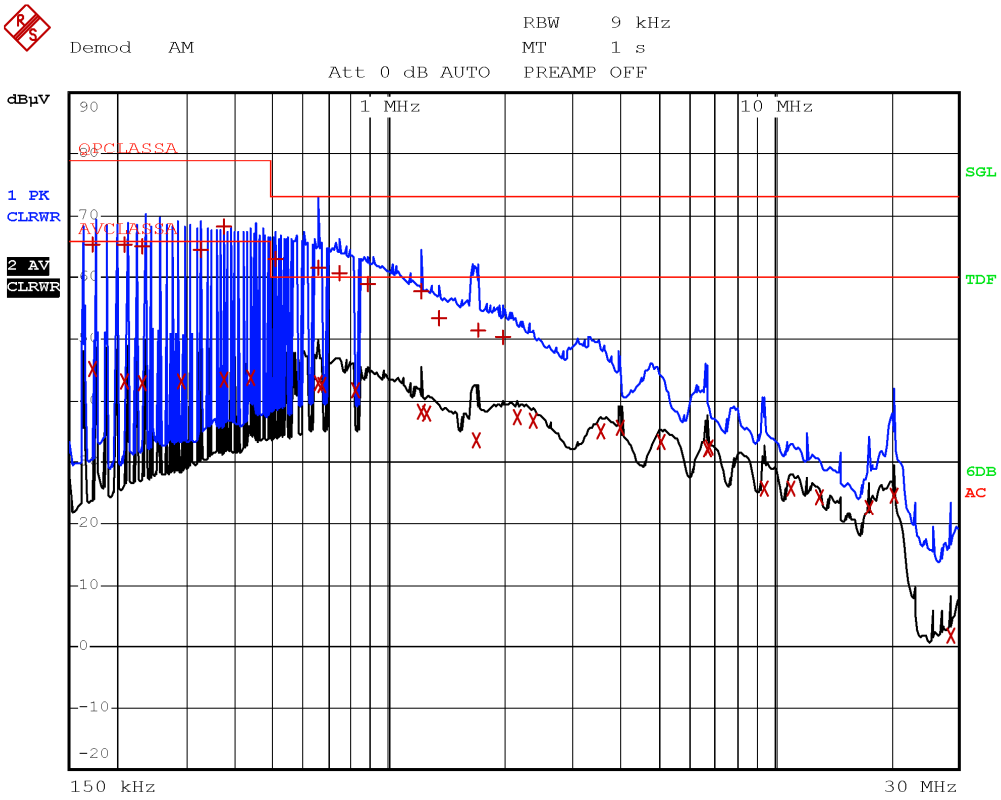
Verdict for AC mains port:	☒ P ☐ F ☐ N
Verdict for wired port:	☐ P ☐ F ☒ N
Frequency range:	0.15MHz - 30MHz
Kind of test site:	Shielded room
Remarks:	

5.2.5 Test equipment used

Equipment	Manufacturer	Model	Serial N°
EMI receiver 20 Hz ÷ 8 GHz	R&S	ESU8	100202
LISN 9 kHz ÷ 30 MHz	R&S	ESH2-Z5	872 460/041

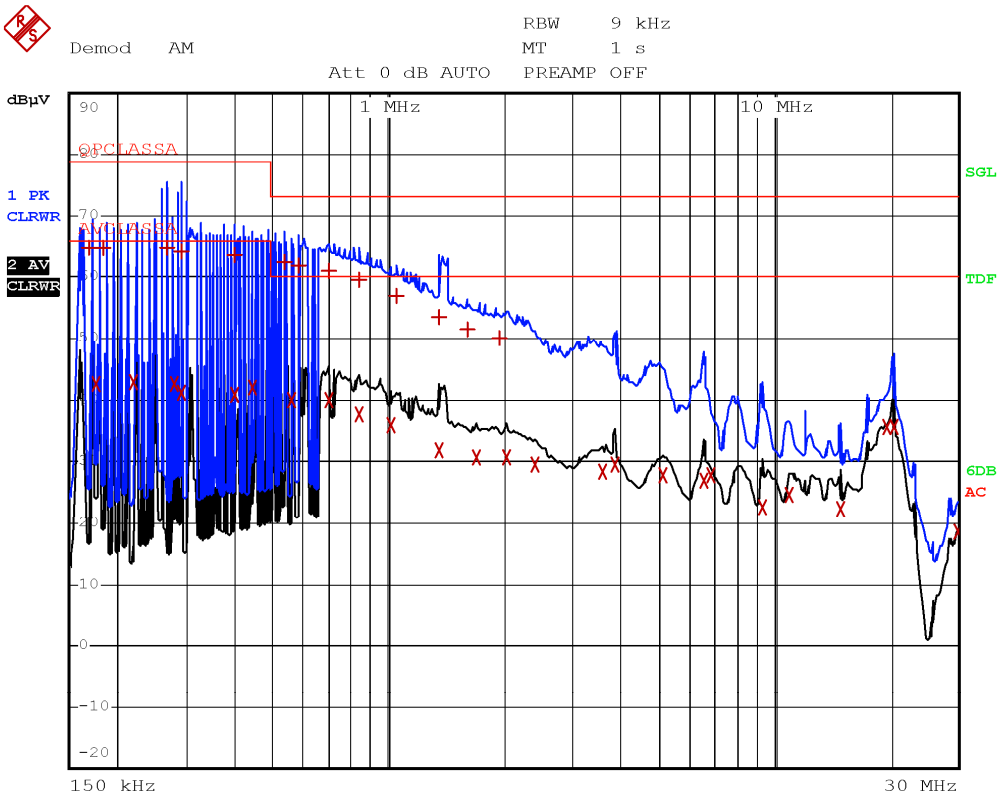
5.2.6 Test protocol

Test point: phase Verdict: Pass
Operation mode: 1
Configuration mode: 1
Remarks: 15 dBm



Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.1740	65.5	79.0	-13.5	QP
0.1740	45.2	66.0	-20.8	Av
0.2100	65.3	79.0	-13.7	QP
0.2100	43.1	66.0	-22.9	Av
0.2340	65.0	79.0	-14.0	QP
0.2340	43.0	66.0	-23.0	Av
0.2940	43.2	66.0	-22.8	Av
0.3260	64.5	79.0	-14.5	QP
0.3740	68.1	79.0	-10.9	QP
0.3740	43.3	66.0	-22.7	Av
0.4380	43.8	66.0	-22.2	Av
0.5100	63.1	73.0	-9.9	QP
0.6580	61.7	73.0	-11.3	QP
0.6580	42.9	60.0	-17.1	Av
0.6740	42.6	60.0	-17.4	Av
0.7460	60.9	73.0	-12.1	QP
0.8260	41.6	60.0	-18.4	Av
0.8900	59.0	73.0	-14.0	QP
1.2140	58.0	73.0	-15.0	QP
1.2140	38.2	60.0	-21.8	Av
1.2540	38.1	60.0	-21.9	Av
1.3500	53.5	73.0	-19.5	QP
1.6980	33.7	60.0	-26.3	Av
1.7180	51.5	73.0	-21.5	QP
1.9780	50.3	73.0	-22.7	QP
2.1700	37.3	60.0	-22.7	Av
2.3700	36.9	60.0	-23.1	Av
3.5780	35.0	60.0	-25.0	Av
4.0020	35.7	60.0	-24.3	Av
5.1100	33.4	60.0	-26.6	Av
6.7060	32.1	60.0	-27.9	Av
6.8180	32.4	60.0	-27.6	Av
9.4260	25.7	60.0	-34.3	Av
11.0420	25.8	60.0	-34.2	Av
13.0820	24.3	60.0	-35.7	Av
17.7180	22.6	60.0	-37.4	Av
20.4500	24.7	60.0	-35.3	Av
28.7300	1.7	60.0	-58.3	Av

Test point: neutral Verdict: Pass
Operation mode: 1
Configuration mode: 1
Remarks: 15 dBm



Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.17	64.7	79.0	-14.3	QP
0.178	42.7	66.0	-23.3	Av
0.186	64.9	79.0	-14.1	QP
0.222	42.8	66.0	-23.2	Av
0.266	64.7	79.0	-14.3	QP
0.282	42.4	66.0	-23.6	Av
0.29	64.1	79.0	-14.9	QP
0.29	41.2	66.0	-24.8	Av
0.398	63.7	79.0	-15.3	QP
0.398	40.9	66.0	-25.1	Av
0.442	42	66.0	-24.0	Av
0.534	62.6	73.0	-10.4	QP
0.558	39.9	60.0	-20.1	Av
0.582	62	73.0	-11.0	QP
0.702	61	73.0	-12.0	QP
0.702	40	60.0	-20.0	Av
0.838	37.8	60.0	-22.2	Av
1.022	35.9	60.0	-24.1	Av
1.046	57.1	73.0	-15.9	QP
1.362	53.5	73.0	-19.5	QP
1.362	31.9	60.0	-28.1	Av
1.602	51.5	73.0	-21.5	QP
1.694	30.8	60.0	-29.2	Av
1.954	50.2	73.0	-22.8	QP
2.034	30.6	60.0	-29.4	Av
2.414	29.6	60.0	-30.4	Av
3.598	28.5	60.0	-31.5	Av
3.874	29.5	60.0	-30.5	Av
5.15	27.9	60.0	-32.1	Av
6.618	27.1	60.0	-32.9	Av
6.866	27.9	60.0	-32.1	Av
9.326	22.6	60.0	-37.4	Av
11.01	24.7	60.0	-35.3	Av
14.846	22.3	60.0	-37.7	Av
19.582	35.7	60.0	-24.3	Av
20.382	35.7	60.0	-24.3	Av
30	18.7	60.0	-41.3	Av

5.3 Harmonics of current

5.3.1 Photo documentation of the test set-up

5.3.2 Test method according to EN 61000-3-2

This test consists on the measurement of harmonics components of the input current which may be produced by equipment having an input current up to and including 16 A per phase, and intended to be connected to public low-voltage distribution systems. The equipment is tested under specified conditions of operation.

5.3.3 Limits for AC mains input port- Class A equipment

Harmonic order (n)	Maximum permissible harmonic current (A)
Odd harmonics	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
15 ≤ n ≤ 40	0.15 x 15/n
Even harmonics	
2	1.08
4	0.43
6	0.30
8 ≤ n ≤ 40	0.23 x 8/n

5.3.4 Test result

Verdict:	☒ P ☐ F ☐ N
Frequency range:	0 kHz – 2 kHz
Kind of test site:	Laboratory
Class:	☒ A
Remarks: Test not required because the power consumption is less than 75 W but performed.	

5.3.5 Test protocol

Operation mode: 1 Verdict: Pass
Configuration mode: 1
Remarks:

Date : 02/02/2018 19:31:44 V4.22

Urms = 230.3V	Freq = 50.000	Range: 0.5 A
Irms = 0.059A	Ipk = 0.276A	cf = 4.704
P = 5.608W	S = 13.49VA	pf = 0.416
THDi = 208 %	THDu = 0.10 %	Class A

Test - Time : 5min (100 %)

Test running, Measurement within Limits

Order	Freq. [Hz]	Iavg [A]	Irms [A]	Irms% [%]	Irms%L [%]	Imax [A]	Limit [A]	Status	Vrms [V]
1	50	0.0249	0.0249	42.500		0.0249			230.28
2	100	0.0215	0.0217	36.979	2.0062	0.0217	1.0800		0.1473
3	150	0.0208	0.0208	35.417	0.9023	0.0208	2.3000		0.0491
4	200	0.0195	0.0197	33.542	4.5705	0.0197	0.4300		0.0245
5	250	0.0185	0.0185	31.615	1.6249	0.0186	1.1400		0.0245
6	300	0.0164	0.0166	28.281	5.5237	0.0166	0.3000		0.0245
7	350	0.0148	0.0148	25.260	1.9222	0.0149	0.7700		0.0245
8	400	0.0127	0.0128	21.875	5.5728	0.0128	0.2300		0.0245
9	450	0.0109	0.0109	18.542	2.7161	0.0110	0.4000		0.0245
10	500	0.0089	0.0090	15.313	4.8762	0.0090	0.1840		0.0000
11	550	0.0072	0.0071	12.188	2.1640	0.0074	0.3300		0.0000
12	600	0.0055	0.0056	9.5313	3.6422	0.0056	0.1533		0.0000
13	650	0.0000	0.0043	7.2917	2.0345	0.0045	0.2100		0.0000
14	700	0.0000	0.0033	5.5729	2.4845	0.0033	0.1314		0.0000
15	750	0.0000	0.0027	4.6354	1.8107	0.0029	0.1500		0.0000
16	800	0.0000	0.0026	4.3750	2.2291	0.0026	0.1150		0.0000
17	850	0.0000	0.0027	4.5313	2.0060	0.0027	0.1324		0.0000
18	900	0.0000	0.0027	4.6354	2.6570	0.0027	0.1022		0.0000
19	950	0.0000	0.0027	4.6354	2.2936	0.0027	0.1184		0.0000
20	1000	0.0000	0.0027	4.5313	2.8859	0.0027	0.0920		0.0000
21	1050	0.0000	0.0024	4.1667	2.2786	0.0024	0.1071		0.0000
22	1100	0.0000	0.0022	3.7500	2.6272	0.0022	0.0836		0.0000
23	1150	0.0000	0.0019	3.1771	1.9029	0.0019	0.0978		0.0000
24	1200	0.0000	0.0016	2.6563	2.0301	0.0016	0.0767		0.0000
25	1250	0.0000	0.0013	2.1875	1.4242	0.0013	0.0900		0.0000
26	1300	0.0000	0.0011	1.8229	1.5093	0.0011	0.0708		0.0000
27	1350	0.0000	0.0010	1.7188	1.2085	0.0010	0.0833		0.0000
28	1400	0.0000	0.0010	1.7708	1.5790	0.0010	0.0657		0.0000
29	1450	0.0000	0.0011	1.8750	1.4160	0.0011	0.0776		0.0000
30	1500	0.0000	0.0012	1.9792	1.8908	0.0012	0.0613		0.0000
31	1550	0.0000	0.0012	1.9792	1.5978	0.0012	0.0726		0.0000
32	1600	0.0000	0.0011	1.8750	1.9107	0.0011	0.0575		0.0000
33	1650	0.0000	0.0010	1.7708	1.5218	0.0010	0.0682		0.0000
34	1700	0.0000	0.0009	1.5625	1.6917	0.0009	0.0541		0.0000
35	1750	0.0000	0.0008	1.3542	1.2343	0.0008	0.0643		0.0000
36	1800	0.0000	0.0007	1.1458	1.3136	0.0007	0.0511		0.0000
37	1850	0.0000	0.0006	0.9896	0.9535	0.0006	0.0608		0.0000
38	1900	0.0000	0.0005	0.9375	1.1345	0.0005	0.0484		0.0000
39	1950	0.0000	0.0006	0.9896	1.0050	0.0006	0.0577		0.0245
40	2000	0.0000	0.0006	1.0417	1.3269	0.0006	0.0460		0.0245

5.3.6 Test equipment used

Equipment	Manufacturer	Model	Serial N°
Mains analyser	EMC Partner	Harmonics 1000	016

5.4 Voltage changes, voltage fluctuations and flicker

5.4.1 Photo documentation of the test set-up

5.4.2 Test method according to EN 61000-3-3

This test consists on the measurement of voltage changes, voltage fluctuations and flicker which may be produced by equipment having an input current ≤ 16 A per phase, and intended to be connected to public low-voltage distribution systems. The equipment is tested under specified conditions of operation.

5.4.3 Limits for low voltage AC mains port – Class A equipment

The value of Pst shall be not greater than 1.0.
The value of Plt shall be not greater than 0.65.
The value of d(t) during a voltage change shall not exceed 3.3 % for more than 500 ms.
The relative steady-state voltage change, dc shall not exceed 3.3 %.
The maximum relative voltage change dmax shall not exceed:

a) 4 % without additional conditions
b) 6 % for equipment which is switched manually, or switched automatically more frequently than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds), or manual restart, after a power supply interruption
c) 7 % for equipment which is attended whilst in use (for example : hair dryers, vacuum cleaners, kitchen equipment such as mixers, garden equipment such as mowers, portable tools such as electric drills), or switched on automatically, or is intended to be switched on manually, no more than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds) or manual restart, after a power supply interruption.

5.4.4 Test result

Verdict:	☒ P ☐ F ☐ N
Frequency:	50 Hz
Kind of test site:	Laboratory
Remarks:	

5.4.5 Test protocol

Operation mode: 1 Verdict: Pass
Configuration mode: 1
Remarks:

Date : 02/02/2018 19:31:00 V4.22

Urms = 230.3V	Freq = 49.984	Range: 0.5 A
Irms = 0.059A	Ipk = 0.276A	cf = 4.713
P = 5.596W	S = 13.49VA	pf = 0.415

Test - Time : 1 x 10min = 10min (21 %)

LIN (Line Impedance Network) : L: 0.24ohm +j0.15ohm N: 0.16ohm +j0.10ohm

Limits : Plt : 0.65 Pst : 1.00
dmax : 4.00 % dc : 3.00 %
dtLim: 3.00 % dt>Lim: 200ms

Test running, Measurement within Limits

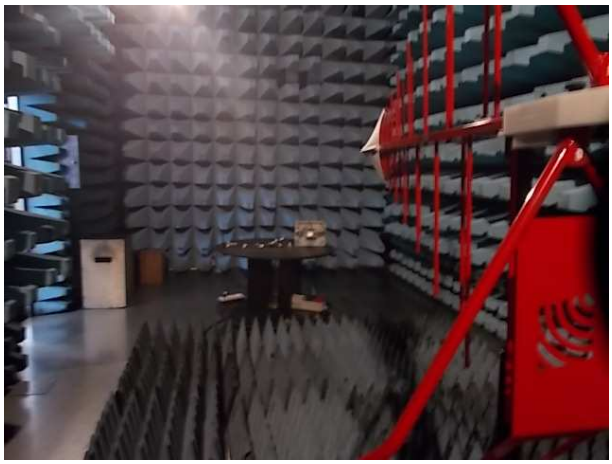
	Pst	dmax [%]	dc [%]	dt>Lim [ms]
0	0.072	0.000	0.000	0.000

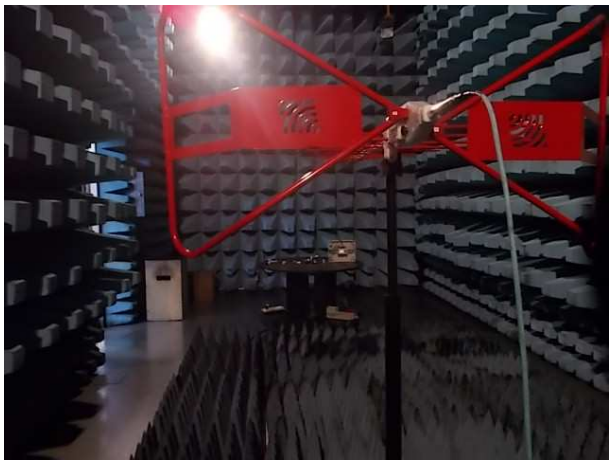
5.4.6 Test equipment used

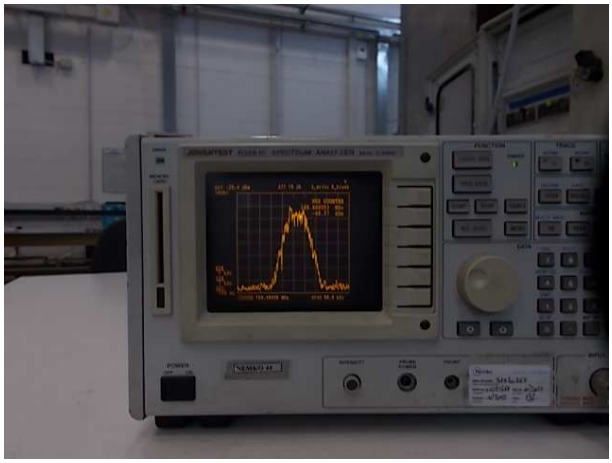
Equipment	Manufacturer	Model	Serial N°
Mains analyzer	EMC Partner	Harmonics 1000	016

5.5 Radio frequency electromagnetic field immunity test

5.5.1 Photo documentation of the test set-up







5.5.2 Test method according to EN 61000-4-3

The test allows estimating of the radiated immunity of electrical and electronic equipment to electromagnetic disturbances coming from intended radio-frequency (RF) transmitters in the frequency range 80 MHz to 6000 MHz. The interference is applied on the enclosure of the equipment by using transmitting antennas. Measurements are made in a fully anechoic chamber and the indicated field strength is pre-calibrated prior to placement of the system under test.

5.5.3 Test specification

Frequency range:	80 to 6000 MHz			
Field strength:	3 V/m			
EuT - antenna separation:	2.5 m			
Modulation:	AM with 80 % in depth and 1 KHz sine wave			
Frequency step:	1%			
Antenna polarisation:	horizontal		vertical	
Antenna position:	front	rear	left	right

5.5.4 Test result

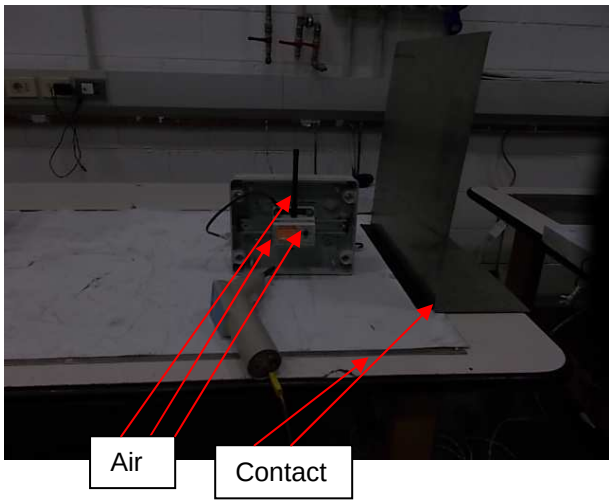
Verdict:	☒ P ☐ F ☐ N
Performance Criterion:	CT/CR
Operation mode:	1
Configuration mode:	1
Kind of test site:	Anechoic chamber
Remarks:	

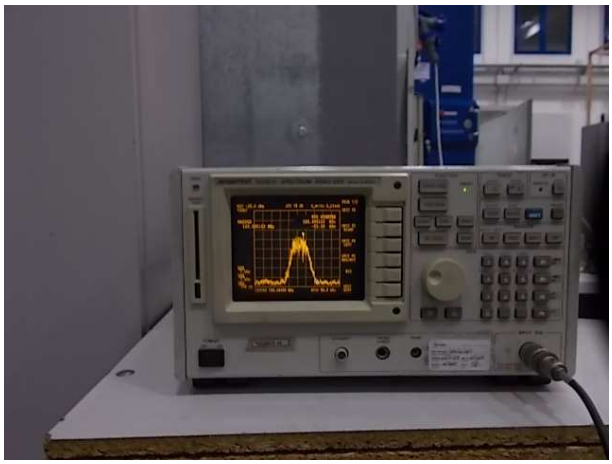
5.5.5 Test equipment used

Equipment	Manufacturer	Model	Serial N°
RF generator (10 ÷ 20000 MHz)	R&S	SMP22	839 762/107
Broadband amplifier (80 ÷ 1000 MHz)	R&S	BBA100	101163
Broadband amplifier (1000÷ 6000 MHz)	R&S	BBA150	102626
Broadband antenna (80 MHz ÷ 6 GHz)	ETS Lingren	3142E	00213107
Broadband amplifier (4.2 ÷ 18 GHz)	AR	20T4G18	300792
Semi-anechoic chamber	Nemko	3m semi-anechoic chamber	70
Shielded room	Siemens	3m control room	3

5.6 Electrostatic discharges immunity test

5.6.1 Photo documentation of the test set-up





C = Contact discharge – A = Air discharge

5.6.2 Test method according to EN 61000-4-2

The test is intended to demonstrate the immunity of equipment subjected to static electricity discharges from operators directly and to adjacent objects. The table-top equipment under test is placed on a wooden table, 0.8 m high, standing on the ground reference plane. A horizontal coupling plane (HCP) is placed on the table. The EUT and the cables are isolated from the coupling plane by an insulating support 0.5 mm thick. The floor standing equipment is isolated from the ground reference plane by an insulating support about 0.1 m thick. The vertical coupling plane (VCP) of dimensions 0.5 m x 0.5 m is placed parallel to, and positioned at a distance of 0.1 m from, the EUT. Air discharges are applied to non-metallic parts of the system. Contact discharges are applied to all accessible metallic parts. Discharges are also applied to the Horizontal and Vertical Coupling Planes.

5.6.3 Test specification

Contact discharge voltage:	4 kV	
Air discharge voltage:	8 kV	
Discharge impedance:	330 Ω / 150 pF	
Time between successive discharges:	≥ 1 sec	
Number of discharges:	≥ 10	
Type of direct discharge:	air discharge	contact discharge
Type of indirect discharge:	contact discharge	
Polarity:	positive	negative

5.6.4 Test result

Discharge location	Type of discharge
Horizontal coupling plane (HCP)	Contact
Vertical coupling plane (VCP)	Contact
Display	Air
Button	Air

Verdict:	☒ P ☐ F ☐ N
Performance Criterion:	TT/TR
Operation mode:	1
Configuration mode:	1
Kind of test site:	Laboratory
Remarks:	

5.6.5 Test equipment used

Equipment	Manufacturer	Model	Serial N°
ESD Test system	EMC Partner	ESD3000	252

5.7 Immunity to fast transient

5.7.1 Photo documentation of the test set-up

5.7.2 Test method according to EN 61000-4-4

The test is intended to demonstrate the immunity of equipment subjected to types of transient disturbances such as those originating from switching transients (interruption of inductive loads, relay contact bounce….). The bursts are applied on the mains supply port by using a coupling decoupling network and on signal and control lines ports by using a capacitive clamp. Measurements are made on a ground plane.

5.7.3 Test specification

Voltage level for AC power ports:	1 kV	
Voltage level for DC power ports:	0.5 kV	
Voltage level for signal ports, wired, and control ports:	0.5 kV	
Burst frequency:	5.0 kHz	
Coupling duration:	≥ 60 s	
Polarity:	positive	negative

5.7.4 Test result

Coupling point	Level	Coupling devices	Verdict
AC	1 kV	Network	P
I/O	0.5 kV	Clamp	P

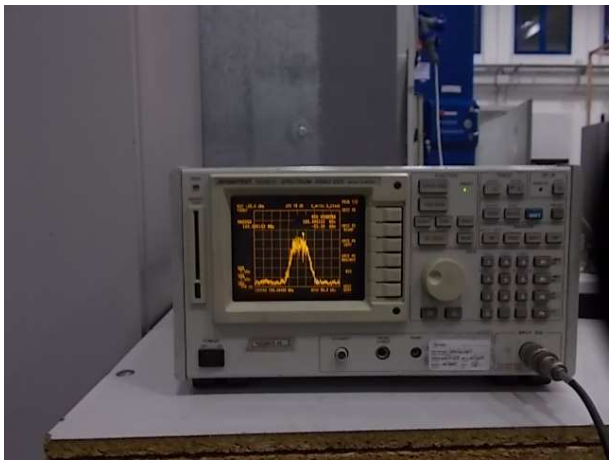
Verdict:	☒ P ☐ F ☐ N
Performance Criterion:	B
Operation mode:	1
Configuration mode:	1
Kind of test site:	Laboratory
Remarks:	

5.7.5 Test equipment used

Equipment	Manufacturer	Model	Serial N°
Pulse generator	EMC partner	Transient 2000	849
Coupling clamp	EMC partner	CDN	CNEFT1000-120
Coupling clamp	Schaffner	CDN 125	245 9219

5.8 Immunity to surge

5.8.1 Photo documentation of the test set-up



5.8.3 Test specification for AC mains power input ports

Pulse amplitude for line to line surge:	1 kV with a source impedance of 2 Ω + 18µF			
Pulse amplitude for line to earth surge:	2 kV with a source impedance of 12 Ω + 9µF			
Number of surges:	5 Surges/Phase angle			
Phase angle:	0°	90°	180°	270°
Repetition rate:	60 s			
Rise time:	1.2 µs			
Time to half value:	50 µs			
Polarity:	positive		negative	

5.8.4 Test specification for wired ports directly connected to outdoor cables

Pulse amplitude for line to ground surge:	1 kV with a source impedance of 42 Ω + 0.5µF	
Pulse amplitude for shield to ground surge:	1 kV direct on the shield of the cable	
Number of surges:	5 Surges/Polarity	
Repetition rate:	60 s	
Rise time:	1.2 µs	
Time to half value:	50 µs	
Polarity:	positive	negative

5.8.5 Test specification for wired ports connected to indoor cables

Pulse amplitude for line to ground surge:	0.5 kV with a source impedance of 42 Ω + 0.5µF	
Pulse amplitude for shield to ground surge:	0.5 kV direct on the shield of the cable	
Number of surges:	5 Surges/Polarity	
Repetition rate:	60 s	
Rise time:	1.2 µs	
Time to half value:	50 µs	
Polarity:	positive	negative

5.8.6 Test result

Coupling point	Level	Coupling network	Verdict
AC mains power input ports – line to line	1 kV	2 Ω + 18µF	P
AC mains power input ports – line to earth	2 kV	12 Ω + 9µF	P
Wired port – line to ground	1 kV	42 Ω + 0.5µF	N
Wired port – shield to ground	-	-	N

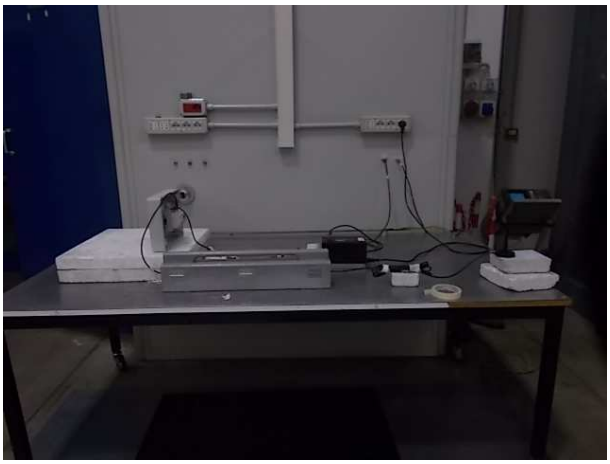
Verdict:	☒ P ☐ F ☐ N
Performance Criterion:	TT
Operation mode:	1
Configuration mode:	1
Kind of test site:	Laboratory
Remarks:	

5.8.7 Test equipment used

Equipment	Manufacturer	Model	Serial N°
Pulse generator	EMC partner	Transient 2000	849

5.9 Immunity to RF common mode

5.9.1 Photo documentation of the test set-up



5.9.2 Test method according to EN 61000-4-6

The test allows estimating of the conducted immunity of electrical and electronic equipment to electromagnetic disturbances coming from intended radio-frequency (RF) transmitters in the frequency range 150 kHz to 80 MHz. The interference is applied on mains supply, signal line and earth connection ports by using coupling decoupling networks or a clamp. Measurements are made on a ground plane. The EUT was located 10cm above the reference ground plane and any associated I/O cables attached to the EUT are located between 30mm and 50mm above the ground plane. The indicated field is pre-calibrated prior to placement of the system under test.

5.9.3 Test specification

Test voltage:	3 V
Frequency range:	0.15 MHz to 80 MHz
Modulation:	AM with 80 % in depth and 1 KHz sine wave
Frequency step:	1 % with 3 s dwell time max

5.9.4 Test result

Coupling point	Coupling and decoupling devices	Verdict
AC	M2	P
I/O	EM-CLAMP	P

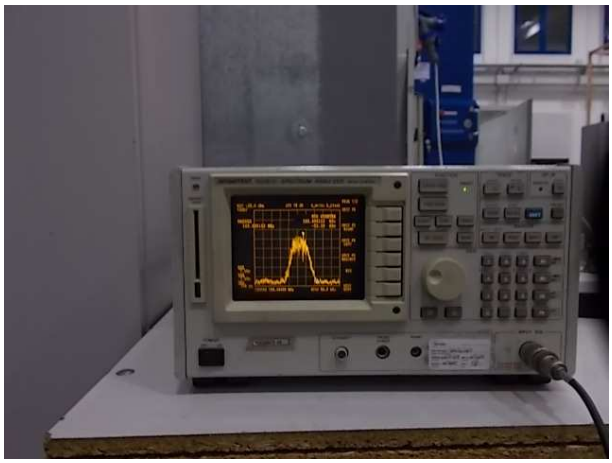
Verdict:	☒ P ☐ F ☐ N
Performance Criterion:	CT/CR
Operation mode:	1
Configuration mode:	1
Kind of test site:	Laboratory
Remarks	

5.9.5 Test equipment used

Equipment	Manufacturer	Model	Serial N°
EM injection clamp	FCC	F203I-23mm	121239
RF Conducted immunity test equipment	EM Test	CWS500 CSI	V0710102305
Attenuator 6dB	EM Test	ATT6/75	0206-18
Shielded room	Siemens	Conducted immunity test room	68
Coupling/decoupling network	EM Test	CDN M2 / M3	0307-16

5.10 Voltage dips and interruptions immunity test

5.10.1 Photo documentation of the test set-up



5.10.2 Test method according to EN 61000-4-11

The test allows estimating of the conducted immunity of electrical and electronic equipment connected to low-voltage power supply networks for voltage dips and short interruptions. Testing is performed with the product connected directly to a generator capable of simulating the voltage drops and interrupts as described.

5.10.3 Test specification

Nominal Mains Voltage	230 Vac
Rated frequency	50/60 Hz
Number of voltage dips and interruptions	3
Sync Angle	0°

5.10.4 Test result

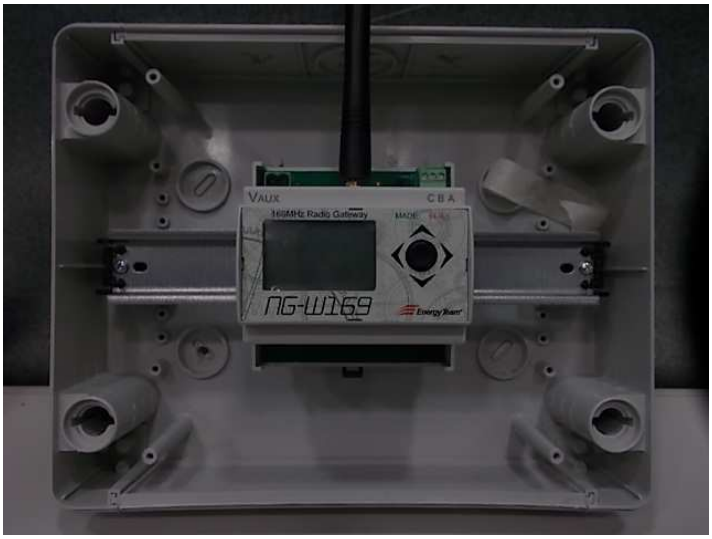
	Level of reduction	Residual voltage	Duration	Performance criterion	Verdict
1	100%	0%	0.5 cycle	TT	P
2	100%	0%	1 cycle	TT	P
3	30%	70%	500 ms	TT	P
4	100%	0%	5 sec	See remark	P

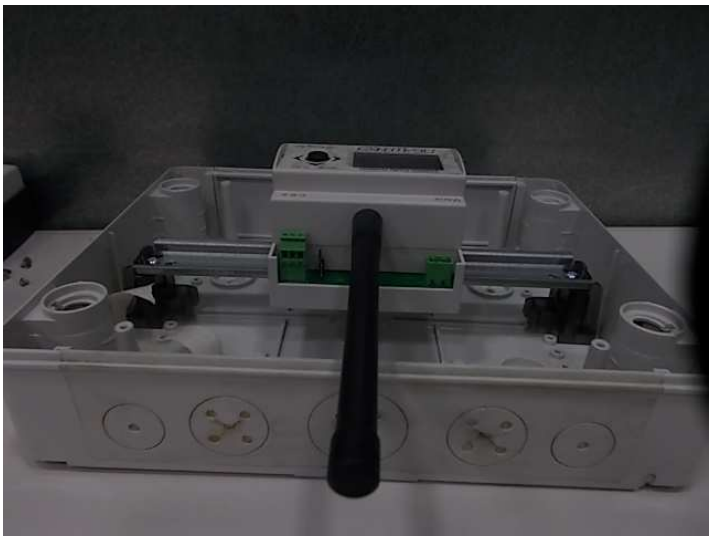
Verdict:	☒ P ☐ F ☐ N
Operation mode:	1
Configuration mode:	1
Kind of test site:	Laboratory
Remarks: In the case where the equipment is fitted with or connected to a battery back-up, the performance criteria for transient phenomena for transmitters or for receivers shall apply. In the case where the equipment is powered solely from the AC mains supply (without the use of a parallel battery back-up) volatile user data may have been lost and if applicable the communication link need not to be maintained and lost functions should be recoverable by user or operator. No unintentional responses shall occur at the end of the test.	

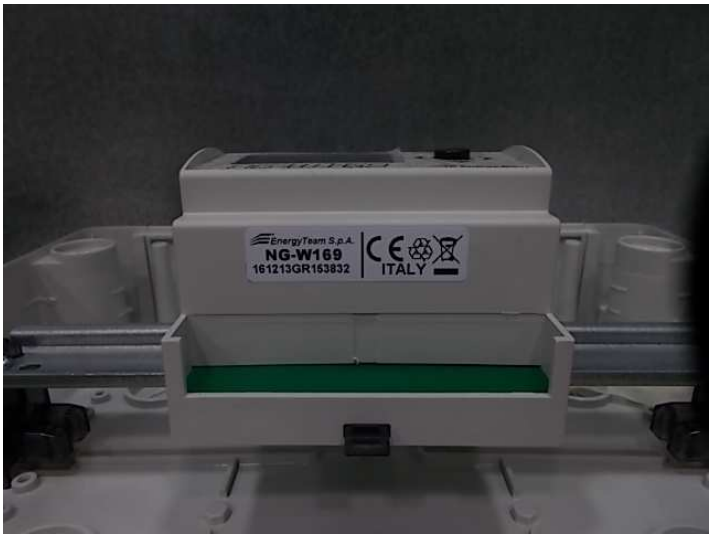
5.9.5 Test equipment used

Equipment	Manufacturer	Model	Serial N°
Pulse generator	EMC partner	Transient 2000	849

6 EUT PHOTOS



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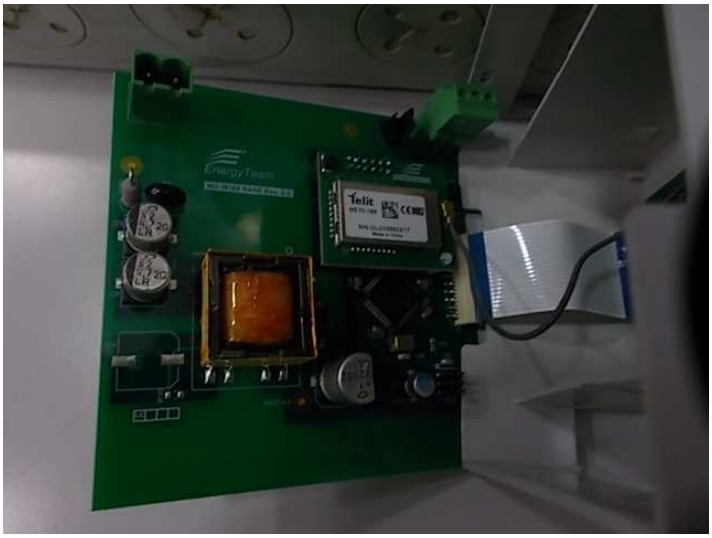

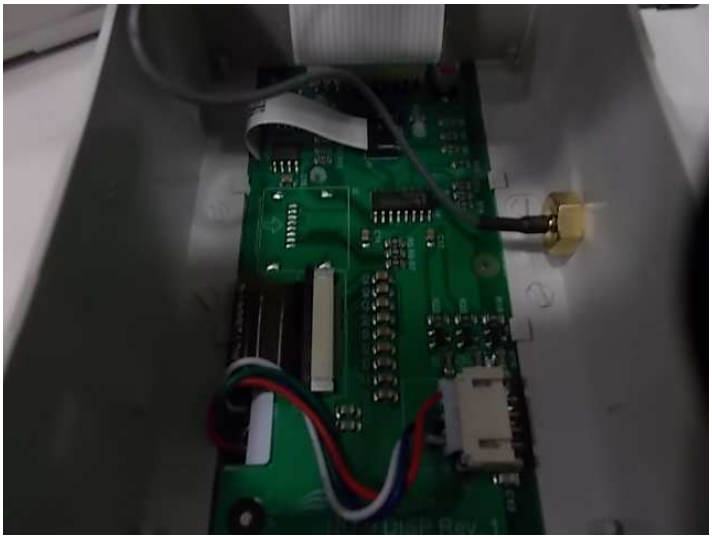

End of report