Electromagnetic Compatibility EMC

TEST REPORT

287454-1

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SGS

Test Report

Electromagnetic Compatibility (EMC)

FINAS
Finnish Accreditation Service
T004 (EN ISO/IEC 17025)

Equipment Under Test:	Valve Positioner
Trademark:	-
Model:	NDX
Type:	NDX1510HA
Manufacturer:	Metso Flow Control Oy Vanha Porvoontie 229 FI-0138 Vantaa FINLAND
Customer:	Metso Flow Control Oy Vanha Porvoontie 229 FI-0138 Vantaa FINLAND

The Equipment Under Test Was Tested According To Following Standard(s)

Title of the standard *- Product / test environment*	Reference standard	Amendment(s) of the standard
Emission - Generic standard *– Industrial environments*	EN 61000-6-4:2007	A1:2011
Emission - Generic standard *– Residential, commercial and light-industry environments**	EN 61000-6-3:2007	A1:2011
Immunity - Generic standard *– Industrial environments*	EN 61000-6-2:2005	-

*) Note: At the request of the customer, only the Conducted Emissions test for the DC Power Port was performed.

Date: 31.10.2017
Issued by: Jonas Dahlgren
Jonas Dahlgren
Testing Engineer

Date: 31.10.2017
Checked by:
Juha Sundholm
Testing Engineer

Table of Contents

Equipment Under Test (EUT)

The EUT is a Valve positioner.

Model:	NDX
Type:	NDX1510HA
Serial:	PH163429999 rev. 1.0

Type of the EUT

The EUT was tested as a tabletop unit.

Power Requirements

Rated voltage:	12-30 VDC (24 VDC used in tests)
Rated current:	20 mA

The EUT does not have an external power source. It is powered through the milliamper input (4-20 mA) signal cable (12 mA was used during testing). The Position transmitter (PT) is powered with 12-30 VDC through signal cable (24 VDC was used during testing).

Mechanical Size of the EUT

Height:	285 mm	Width:	590 mm	Depth:	285 mm

Cable Lengths and Types

Port	**Cable:**	**Length:**	**Type:**
Milliamper input	Signal cable	10.0 m	Double shielded, 2-pairs
PT (Position transmitter)	Signal cable	10.0 m	Double shielded, 2-pairs

All cables are specified as max >30 m and can be grounded at both ends and at one end only regarding the EN 61000-4-5 test.

Peripherals

Fluke 705 Loop Calibrator

- provided the 12 mA Milliamper input for the EUT in all tests
- provided by the customer

TTi EL302 POWER SUPPLY type 30V 2A

- provided the 24 VDC signal for the EUT Position transmitter (PT) in all tests
- provided by the customer

Multimeter METRA Hit 29S CAT IV

- used to check (provided more redundancy) the 12mA current signal output of the EUT Position transmitter (PT) during the radiated RF-field immunity test
- provided by the customer

Keysight 34972A LXI Data Acquisition / Switch Unit

- used in the immunity monitoring system as the position transmitter (PT) data logger in all immunity tests
- provided by the customer

D-Link DUB-E100 USB 2.0 Ethernet Adapter

- used in the immunity monitoring system as the adapter between the Keysight 34972A LXI Data Acquisition / Switch Unit and Laptop PC in all immunity tests
- provided by the customer

VIT HART MODEM HART-USB-001 USB HART Interface

- used in the immunity monitoring system as the adapter between the HART communication interface of the EUT and Laptop PC in all immunity tests
- provided by the customer

HP 6730b Laptop PC with various software

- used in the monitoring system for analyzing of the monitored data and measured values
- provided by the customer

Compressed air

- used in all tests for constant pressurizing of the EUT’s pressure container
- provided by SGS Fimko

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only. This document cannot be reproduced except in full, without prior approval of the Company.

Performance Criteria A for Immunity Testing

The EUT shall continue to operate as intended during and after the test. No degradation of performance is allowed.

Permitted loss of performance specified by the manufacturer is as follows:

PT output current shall stay within ±0.5% from undisturbed output during disturbance. Physical valve position shall stay within ±0.5% from undisturbed position during disturbance. Valve position reading indicated by LUI display shall stay within ±0.5% from undisturbed reading during disturbance. No input change of the HART communication is allowed.

Performance Criteria B for Immunity Testing

The apparatus shall continue to operate as intended after the test. 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.

During the test, degradation of performance is however allowed, provided that temporary degradation of performance or loss of function is self-recovered during or after the test. No change of actual operating state, loss of memory or stored data is allowed.

Permitted loss of performance specified by the manufacturer is as follows:

PT output current shall stay within ±1.0% from undisturbed output during disturbance. PT output current is allowed to change during disturbance. Physical valve position shall stay within ±1.0% from undisturbed position when disturbance has deceased. Physical valve position is allowed to change during disturbance. Valve position reading indicated by LUI display shall stay within ±1.0% from undisturbed position when disturbance has deceased. Valve position reading indicated by LUI display is allowed to change during disturbance. Breaks in HART communication are allowed during testing.

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 Criteria C for Immunity Testing

Permitted loss of performance specified by the manufacturer is as follows:

The content of LUI display may become unreadable during testing but the content is recoverable when disturbance has deceased.

EUT Test Conditions During Testing

Configuration of the EUT was made to correspond to the actual assembling conditions as far as possible. Air pressure of 4 Bar was fed to the EUT's pressure container. The Milliamper input was fed with 12 mA during testing. 24 VDC was fed to the PT output.

See the figure below for an overview of the system configuration during the tests.

During the emission tests:
The measurements were performed on a normally operating valve positioner. Pressure container, power and input signal source via PT and milliamper input are connected to the positioner. Peripheral device Fluke 705 Loop calibrator was connected to the EUT during the test. Fluke 705 was inside the test chamber during emission tests. The TTi EL302 POWER SUPPLY was outside the radiated emissions test chamber and connected through the filters to the turntable terminal.

During the immunity tests:
The measurements were performed on a normally operating valve positioner. Pressure container, power and input signal source via PT and milliamper input are connected to the positioner.
Redundancy was built in the performance monitoring to distinguish between disturbing of the EUT (LUI display, true valve position) and the peripheral equipment.

EUTs valve position movement was monitored with two digital vernier calibers.
EUTs display was monitored visually.
EUTs state was also monitored with manufacturer's computer software and Keysight Benchlink datalogger 3 and a python script hart_commtest.py for HART communication monitoring.
Tests were started after EUT startup adaptive phase if EUT was restarted.

A video camera and/or human eye was used to monitor the valve position %-value displayed by the LUI display during the immunity tests.

The EUT ground terminal was connected to ground in all tests when permitted.

The test conditions were proposed by the customer.

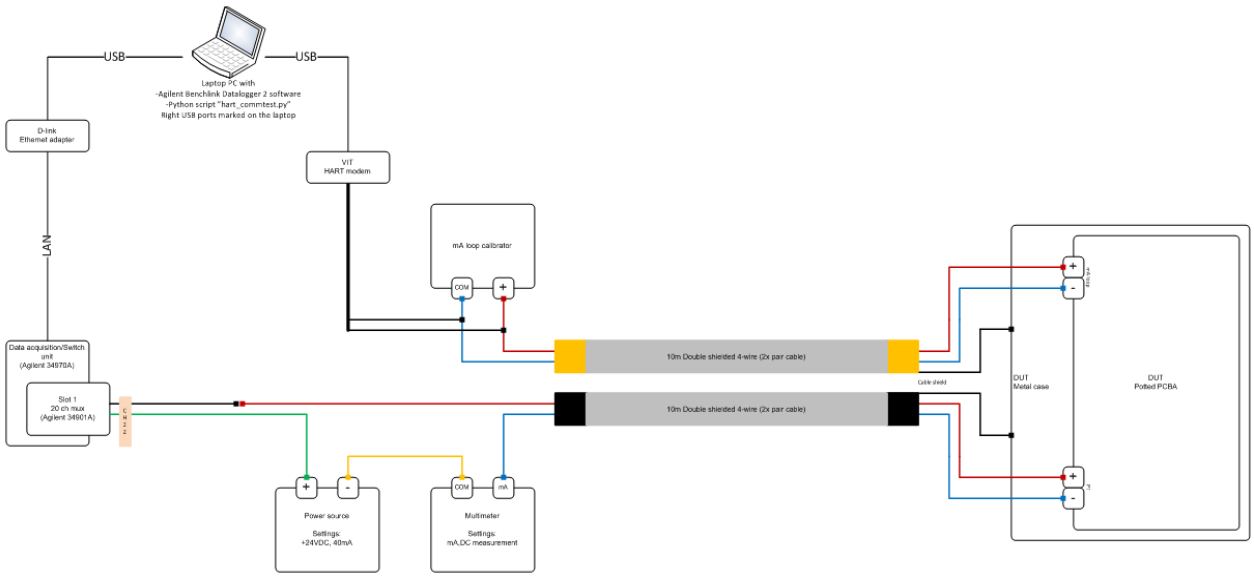
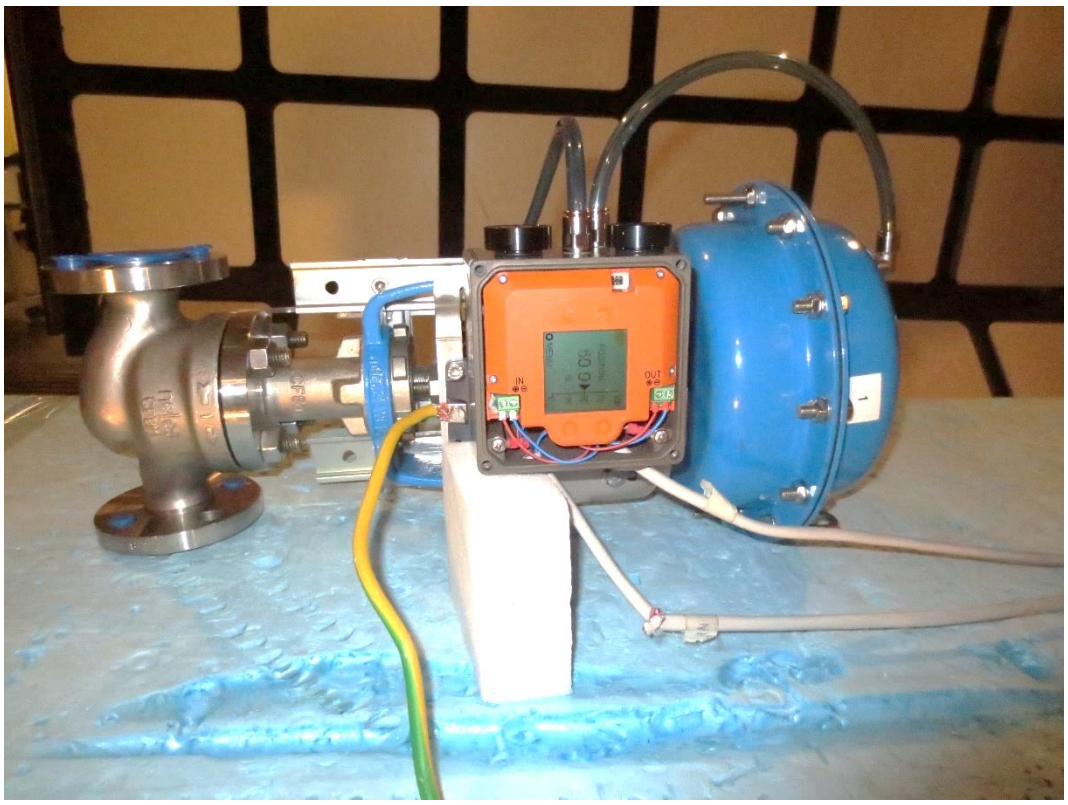
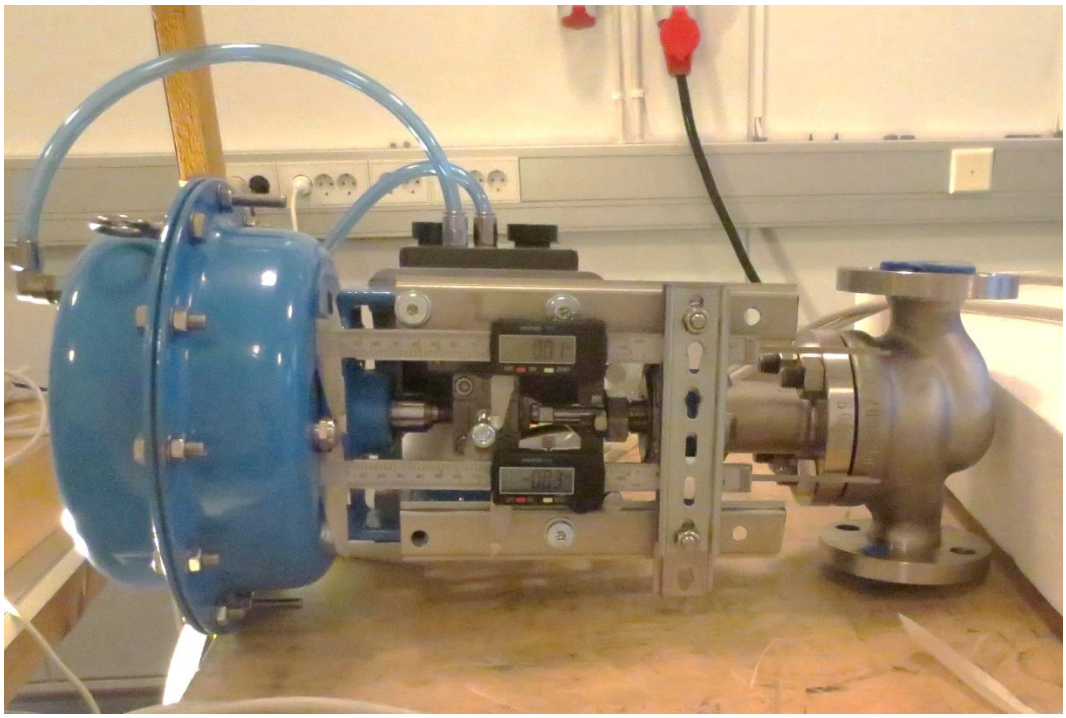


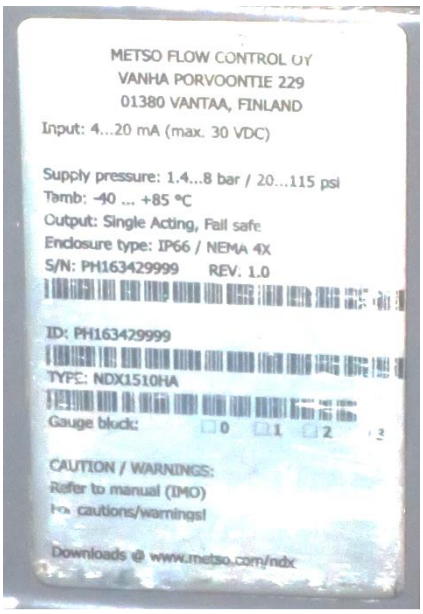
Figure 1. The system configuration during the tests including the performance monitoring parts

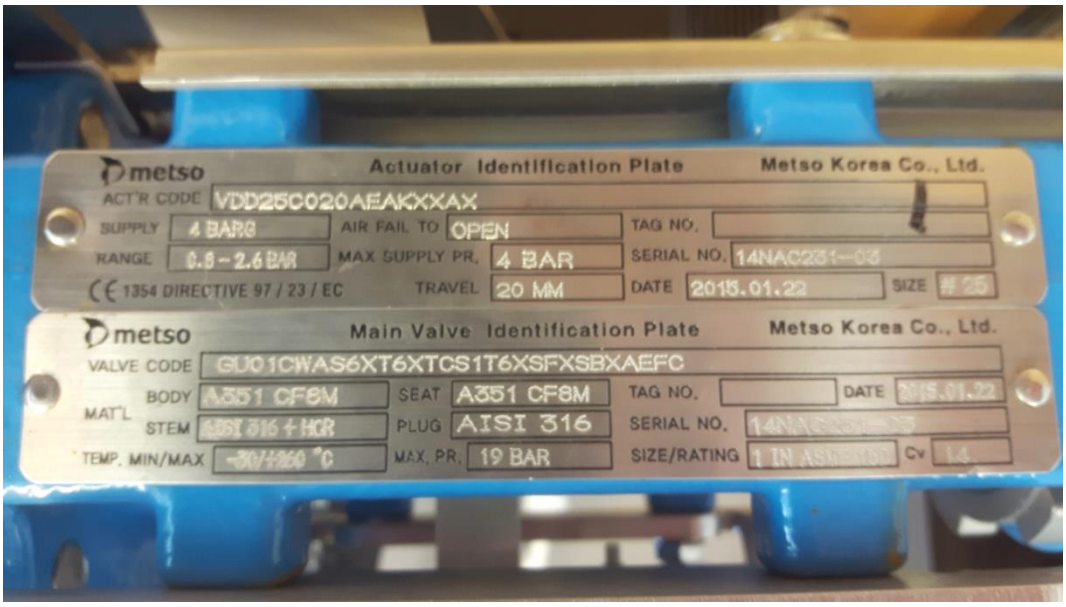
Photographs of the EUT





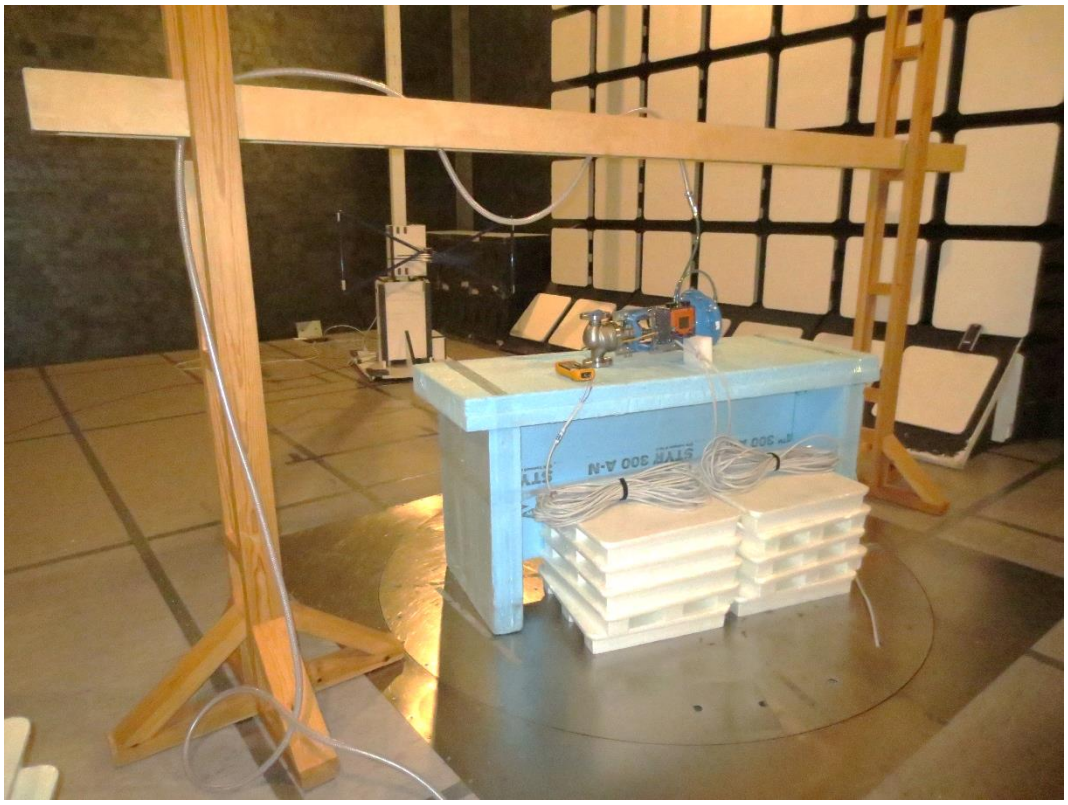
Photograph 1. The EUT



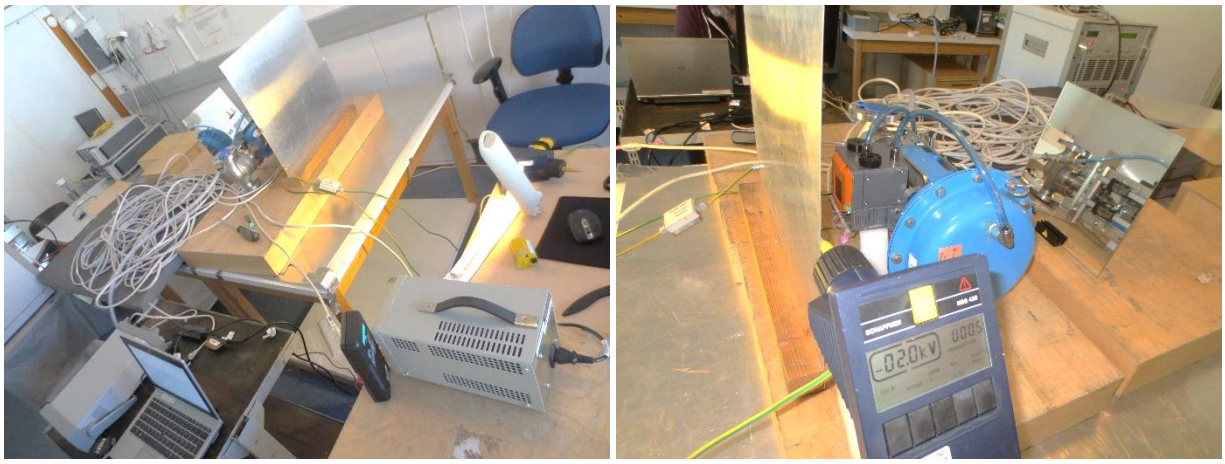


Photograph 2. The EUT marking plates

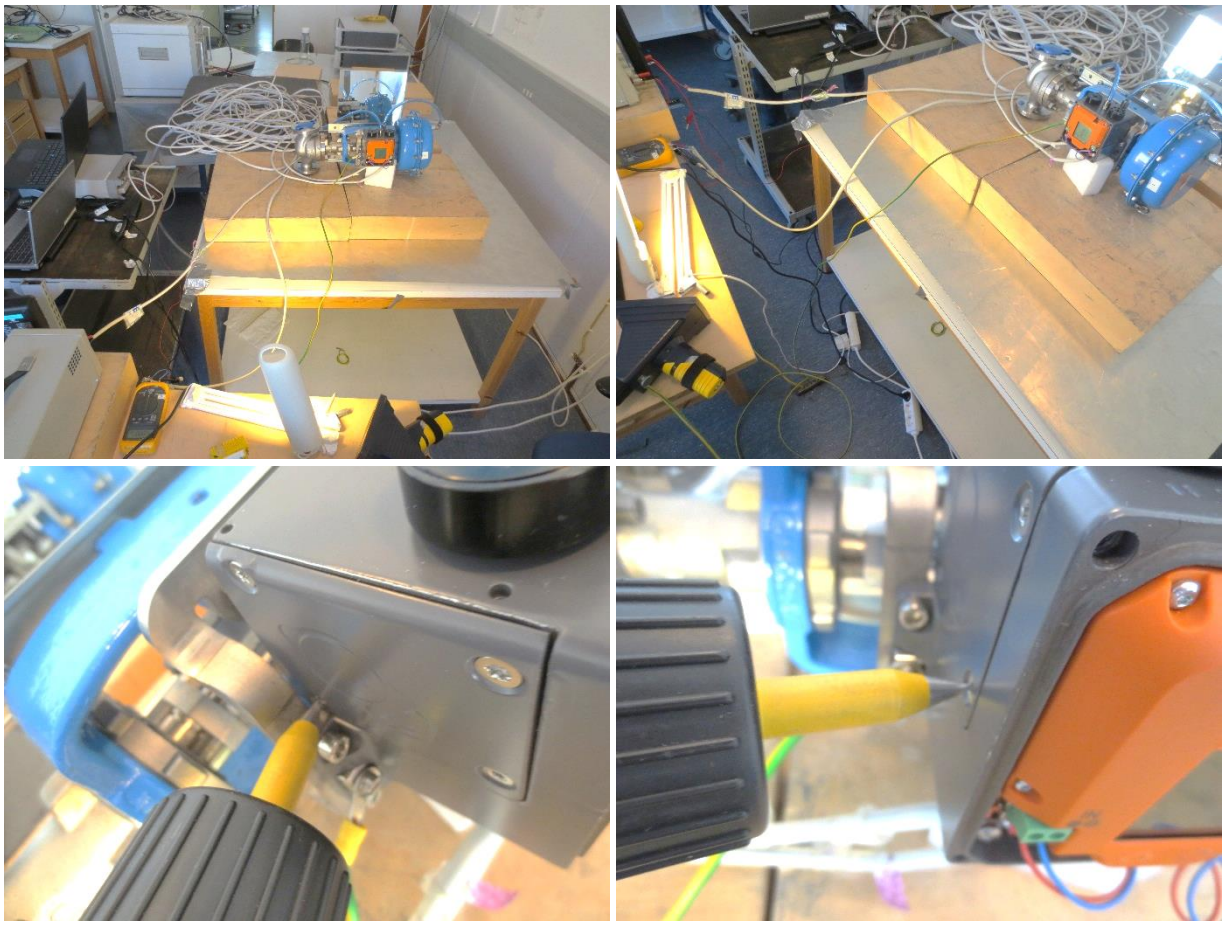
Photograph 3. The EUT and test set-up for conducted emission test



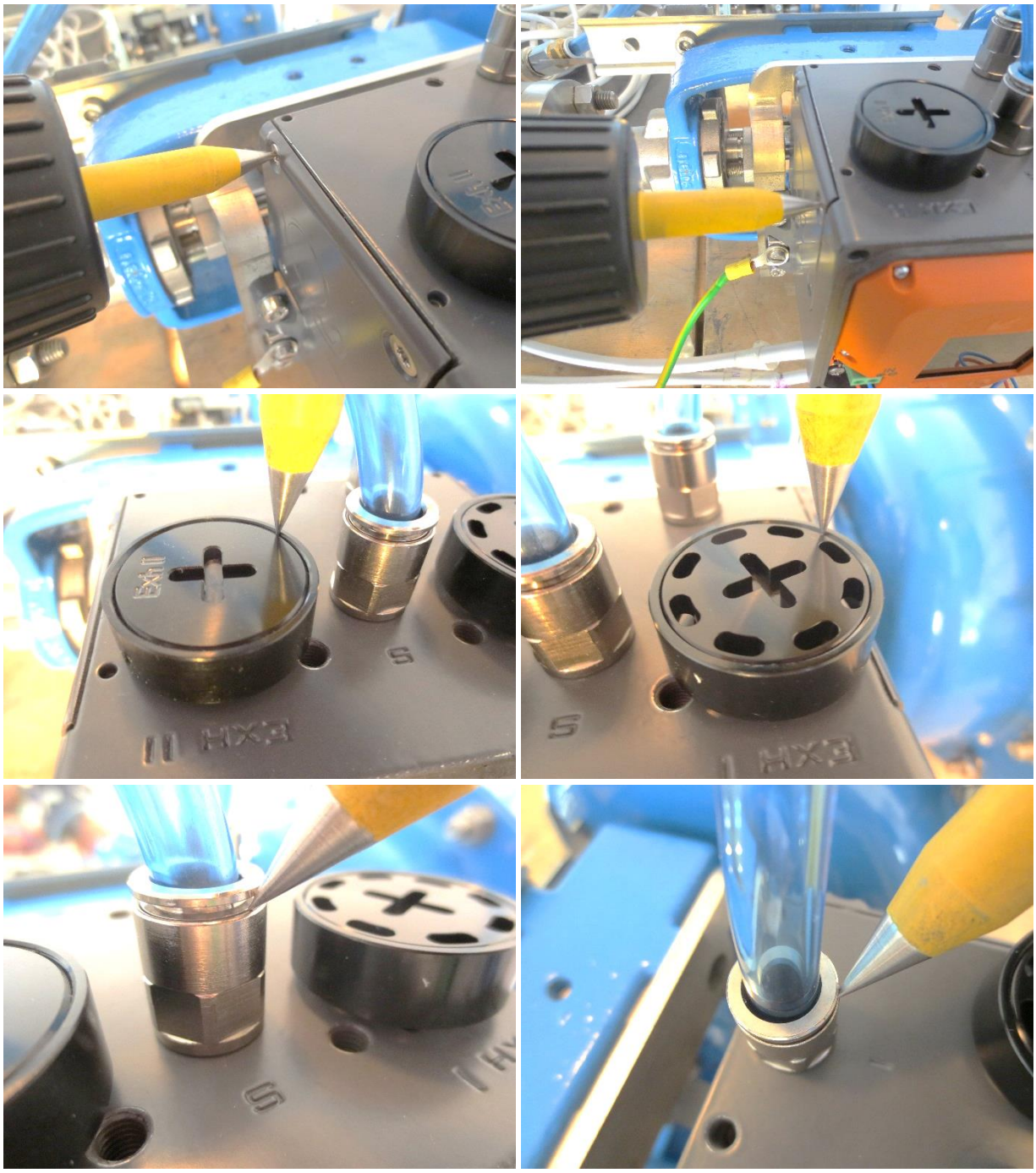
Photograph 4. The EUT and test set-up for radiated emission test



Photograph 5. The EUT and test set-up for electrostatic discharge immunity.

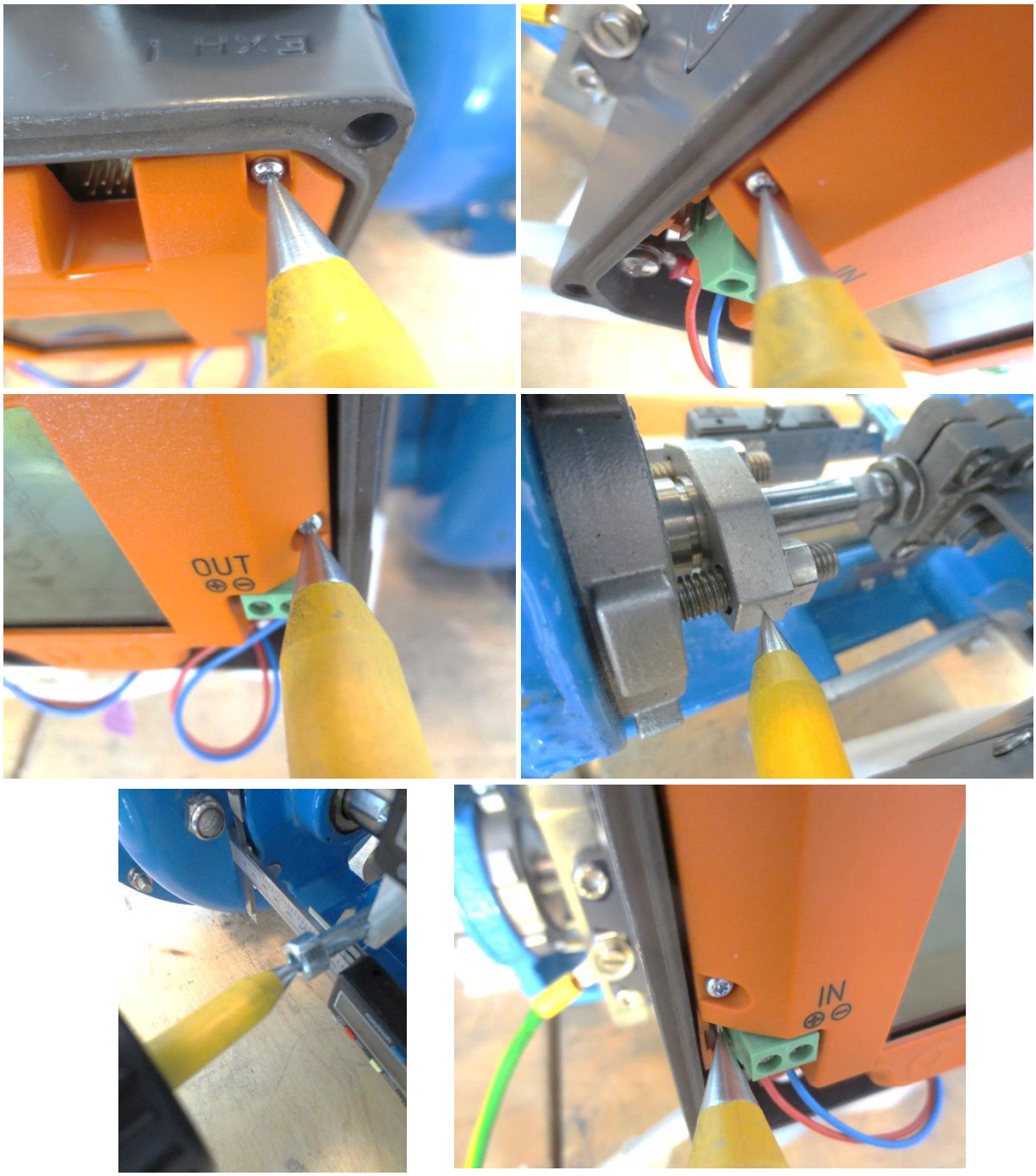


Photograph 6. The EUT and test set-up for electrostatic discharge immunity.

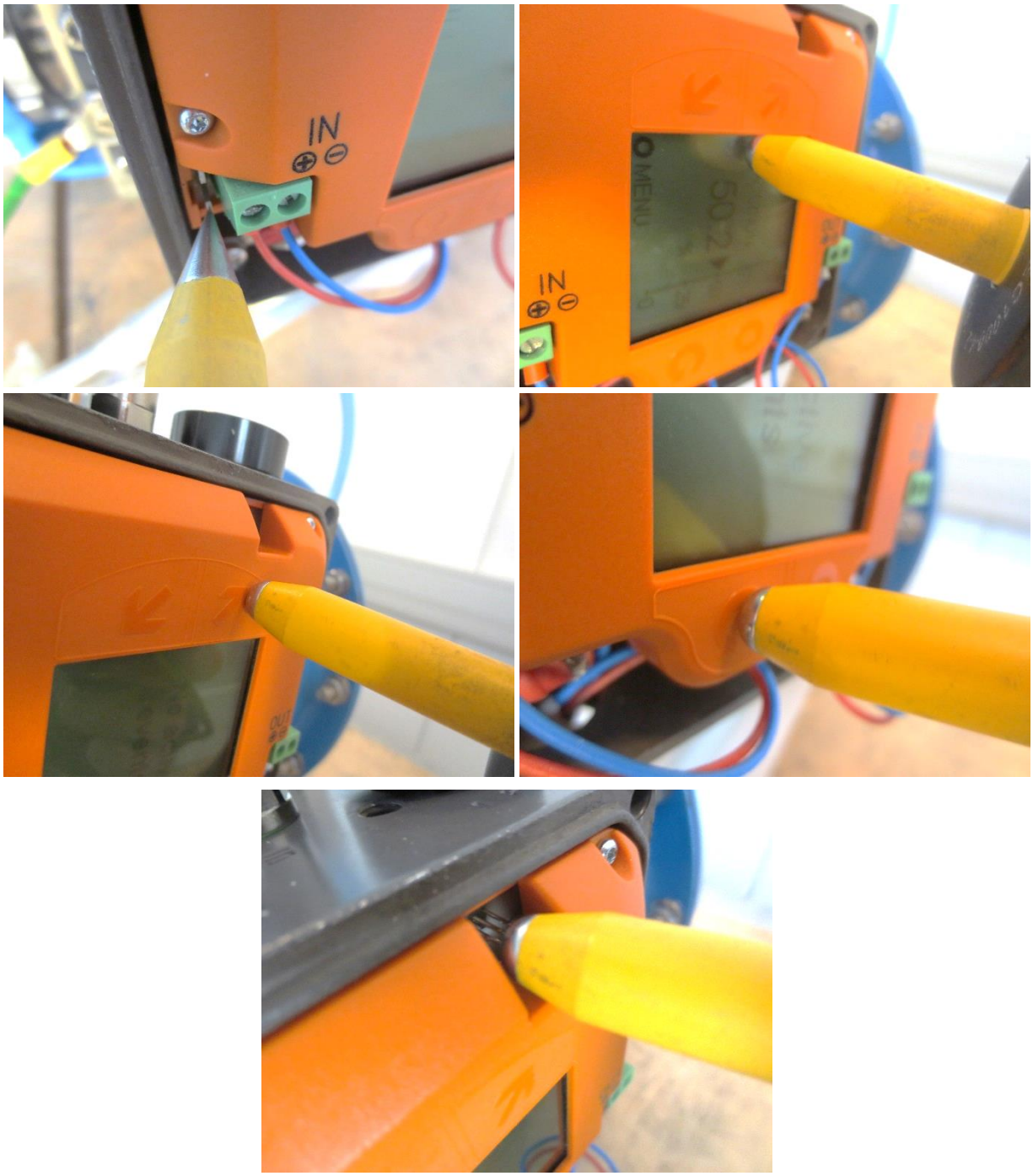


Photograph 7. The EUT and test set-up for electrostatic discharge immunity.

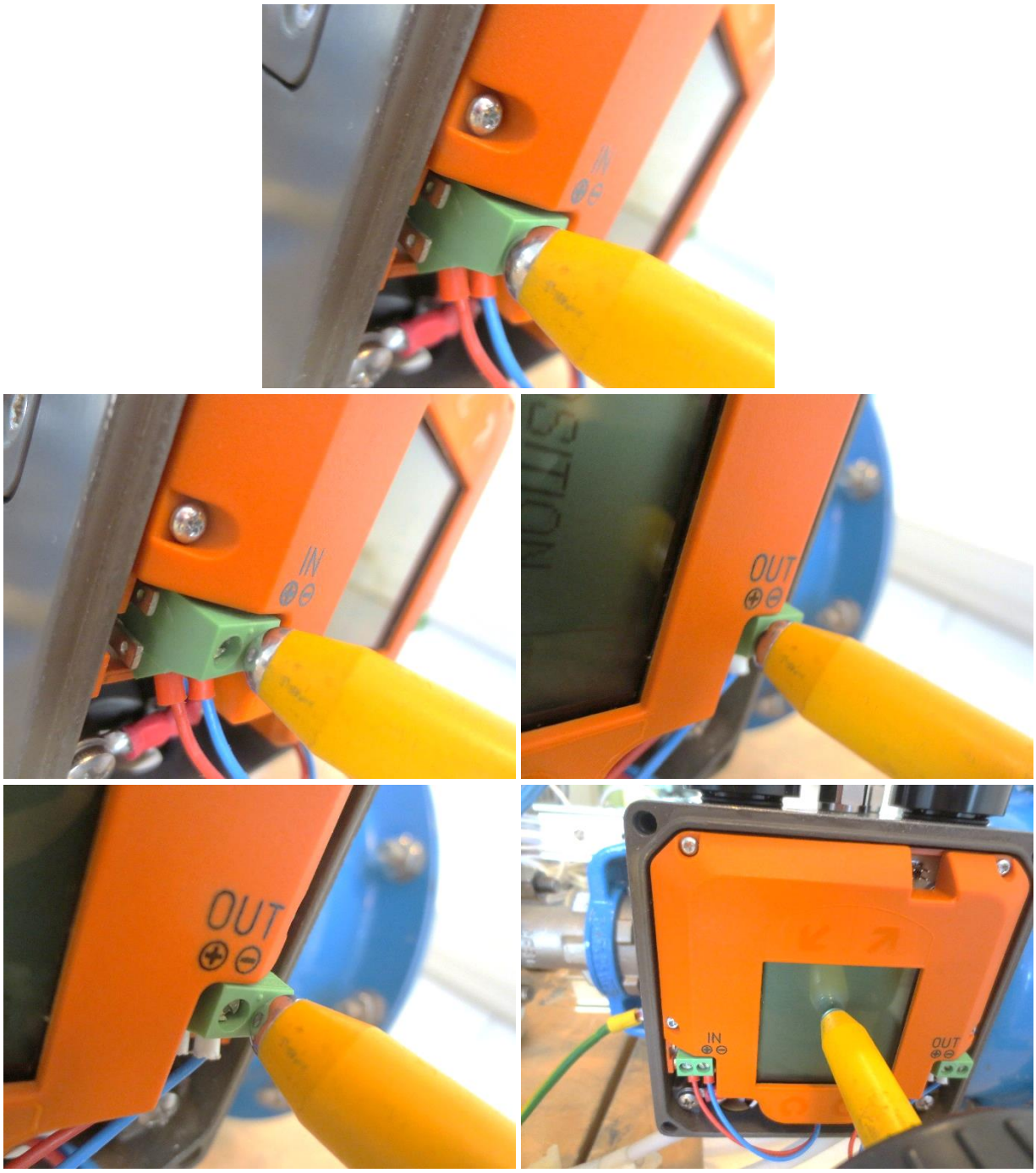
Photograph 8. The EUT and test set-up for electrostatic discharge immunity.



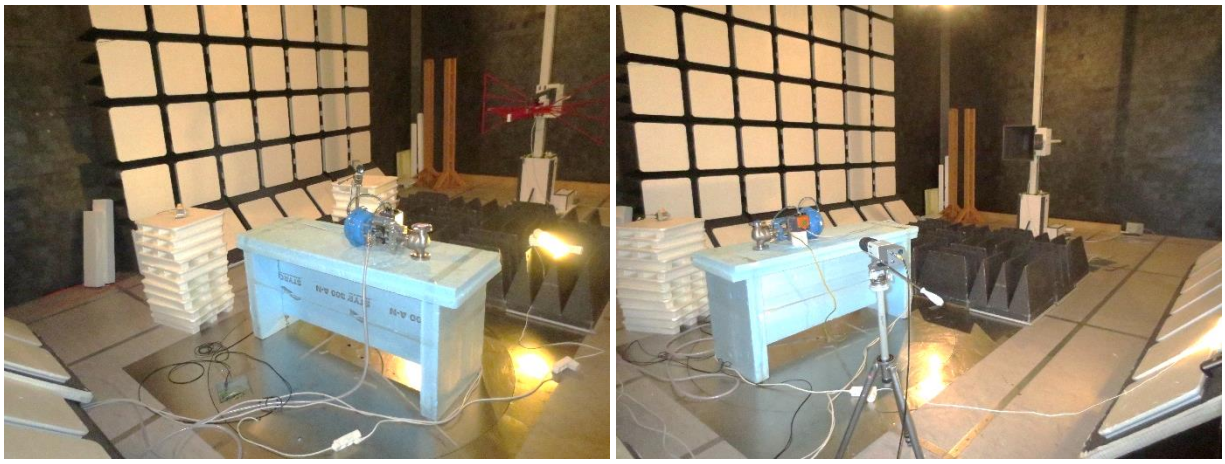
Photograph 9. The EUT and test set-up for electrostatic discharge immunity.



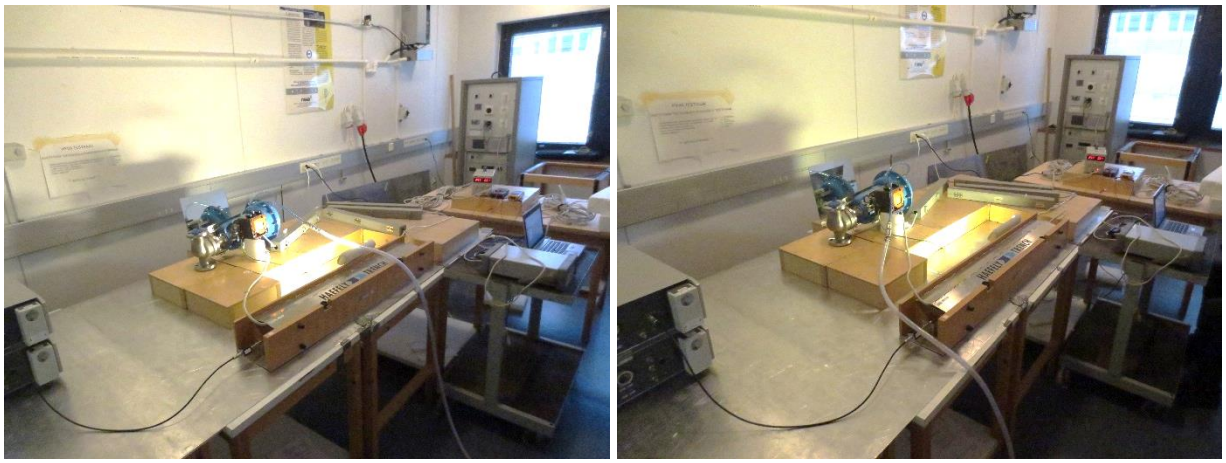
Photograph 10. The EUT and test set-up for electrostatic discharge immunity.



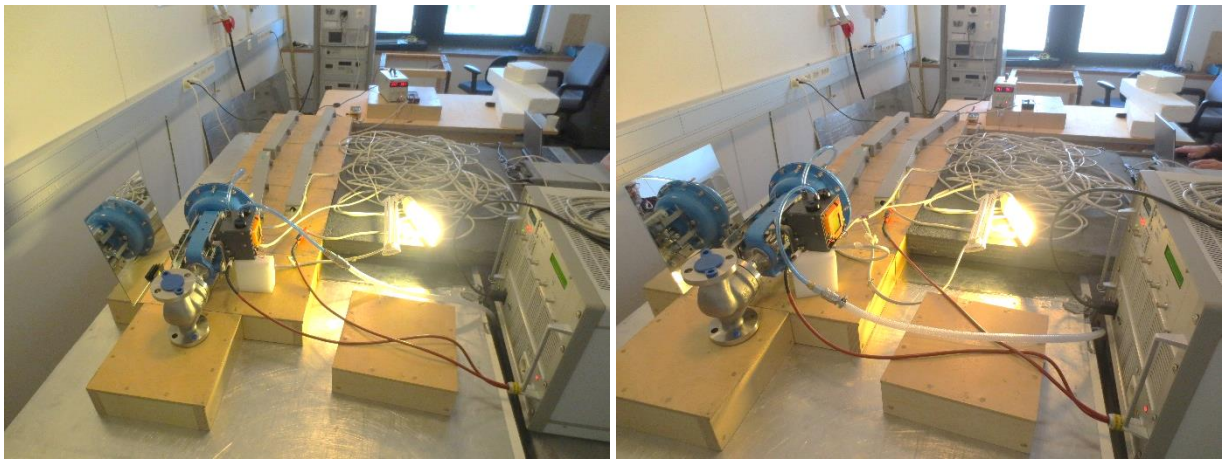
Photograph 11. The EUT and test set-up for electrostatic discharge immunity.



Photograph 12. The EUT and test set-up for radiated RF-field immunity.



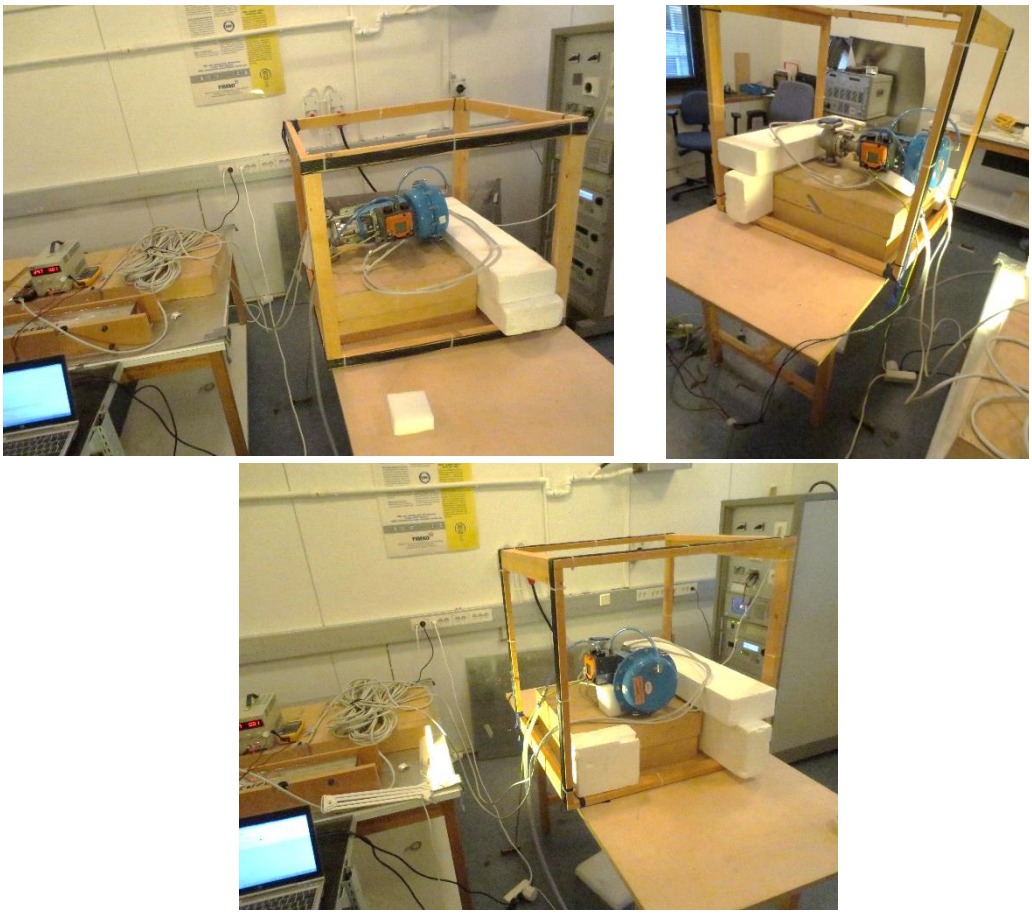
Photograph 13. The EUT and test set-up for electrical fast transient immunity.



Photograph 14. The EUT and test set-up for surge immunity.

Photograph 15. The EUT and test set-up for surge immunity.

Photograph 16. The EUT and test set-up for conducted RF-field immunity.



Photograph 17. The EUT and test set-up for power frequency magnetic field immunity.

Test Suite

Measurement/Test	Reference standard		Test site	Result
Conducted Emissions from the Power Supply Cable	EN 55016-2-1:2009 EN 55022:2010			**PASS**
Radiated Emissions	EN 55016-2-3:2010 EN 55011:2009		**3m**	**PASS**
Electrostatic Discharge Immunity	EN 61000-4-2:2009			**PASS**
Radiated RF-field Immunity	EN 61000-4-3:2006	A1:2008, A2:2010	**3m**	**PASS**
Electrical Fast Transient Immunity	EN 61000-4-4:2012			**PASS**
Surge Immunity	EN 61000-4-5:2014			**PASS**
Conducted RF-field Immunity	EN 61000-4-6:2014			**PASS**
Power Frequency Magnetic Field Immunity	EN 61000-4-8:2010			**PASS**
Voltage Dips and Short Interruptions Immunity	EN 61000-4-11:2004			**N/A[a]**

[a)] The test was not required for DC input power ports.

Testing location:	
☒ Testing Laboratory:	SGS Fimko Ltd

☒ Testing Location / address: All tests.	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
☐ Testing Location / address:	SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND

Conducted Emissions from the Power Supply Cable

Product family standard:	EN 55016-2-1, EN 55022	
Tested by:	JDA	
Date:	3.10.2017	
Temperature:	23 ºC	
Humidity:	39 %RH	
Barometric pressure:	1003 hPa	
Measurement uncertainty:	± 3.03 dB	Level of confidence 95 % (k = 2).
Test result:	**PASS**	

Test Plan

Conducted disturbance voltage was measured with an artificial mains network from 150 kHz to 30 MHz with 1.5 kHz steps and a resolution bandwidth of 10 kHz. Measurements were carried out with peak and average detectors from the positive and negative lines of the signal cable.

Non-measured input peripheral was not AMN-decoupled because of decoupling inside EUT.

The EUT was working as described in the section “EUT Test Conditions”.

Test results

Milliamper input:

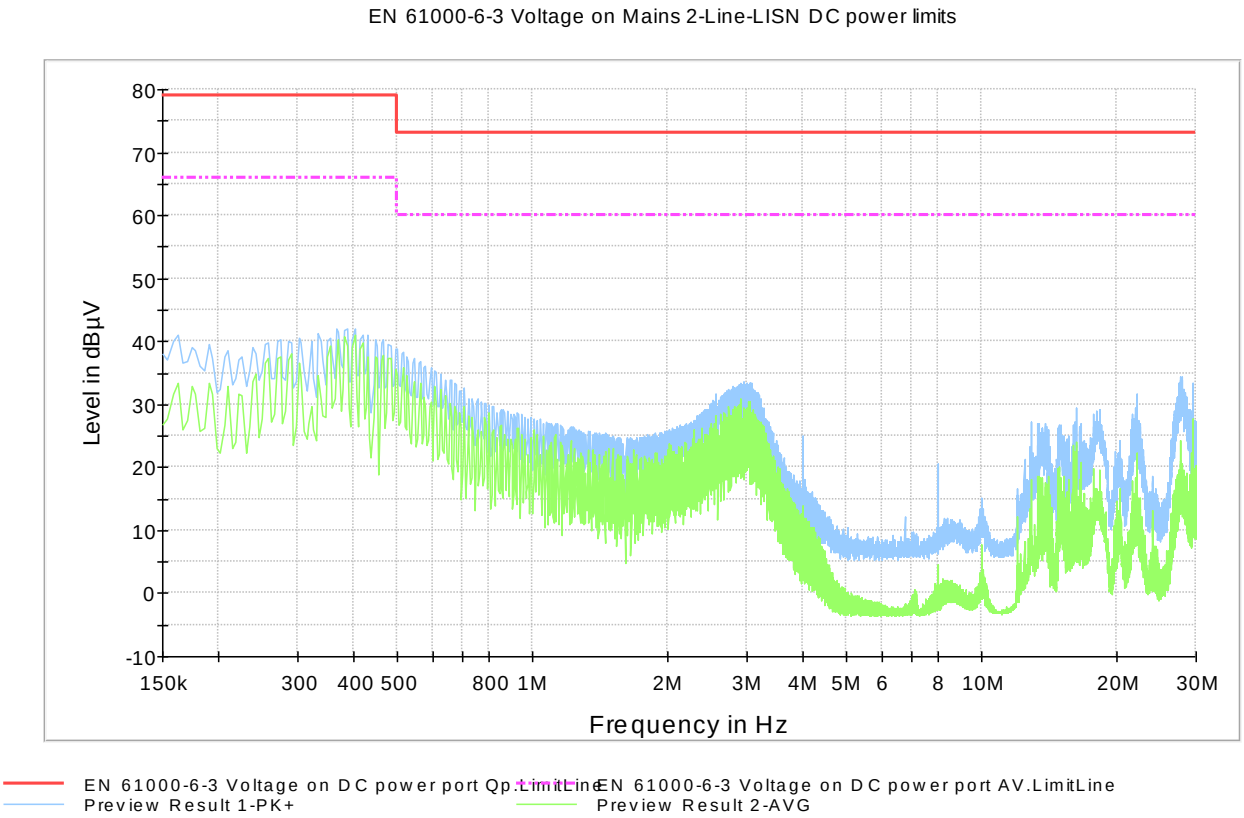


Figure 2. The measured curves with peak- and average-detectors

No final measurements were made because the margin to the limit was larger than 10dB.

PT (Position transmitter):

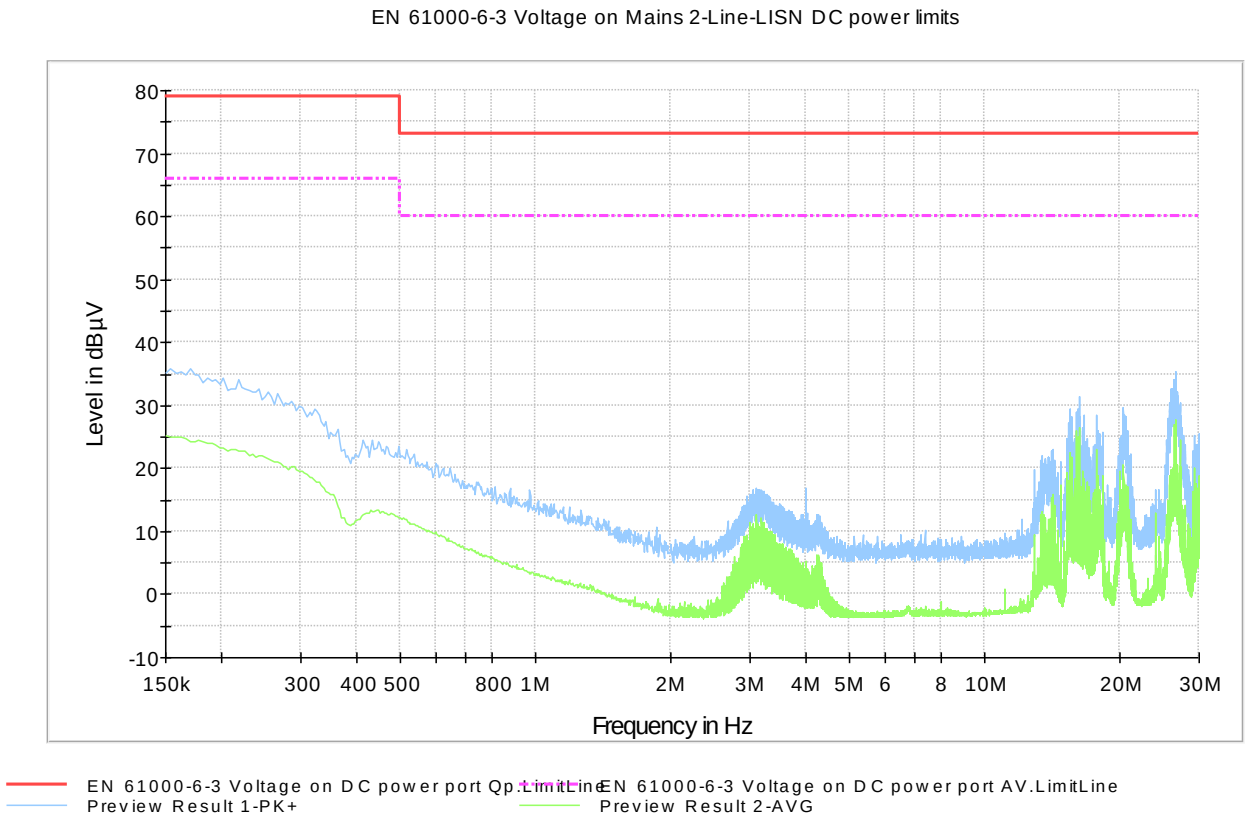


Figure 3. The measured curves with peak- and average-detectors

No final measurements were made because the margin to the limit was larger than 10dB.

Radiated Emissions

Basic standard:	EN 55016-2-3, EN 55011	
Tested by:	JDA	
Date:	2.10.2017	
Temperature:	23 ºC	
Humidity:	39 %RH	
Barometric pressure:	1016 hPa	
Measurement uncertainty:	± 4.34 dB (30 – 1000 MHz)	Level of confidence 95 % (k = 2).
Limit:	Class A	
Test result:	**PASS**	

Test plan

The radiated emission measurements were done within a semi anechoic screened chamber. The EUT was placed on a table 0.8 m above the reflecting ground plane. The measurement distance was 3 meters. The worst interferences were determined during measurements by rotating the turntable and adjusting the antenna height. The measurements were done in horizontal and vertical antenna polarizations. The supply voltage (24 VDC) to the turntable was fed through the filters.

Field strength results were converted to correspond to 10 meter measuring distance as described in Clause 7.2.3 or 8.3.4 of CISPR 11 or clause 7.3.4 of basic standard CISPR 16-2-3 so that they can be directly compared with CISPR 11 / EN 55011 limits at the specified distance for determining compliance.

The EUT was working as described in the section “EUT Test Conditions”.

Radiated measurement settings

Preliminary testing:

Turntable movement:	30 ° step
Turntable position:	0 ° to 330°
Antenna movement:	1.5 m step
Antenna height:	1.0 m to 4.0 m
Antenna polarization:	Vertical and horizontal

Final testing:

Turntable movement:	Continuous
Turntable position:	± 15 °
Antenna movement:	Continuous
Antenna height:	± 0.75 m
Antenna polarization:	Vertical and horizontal

Test results

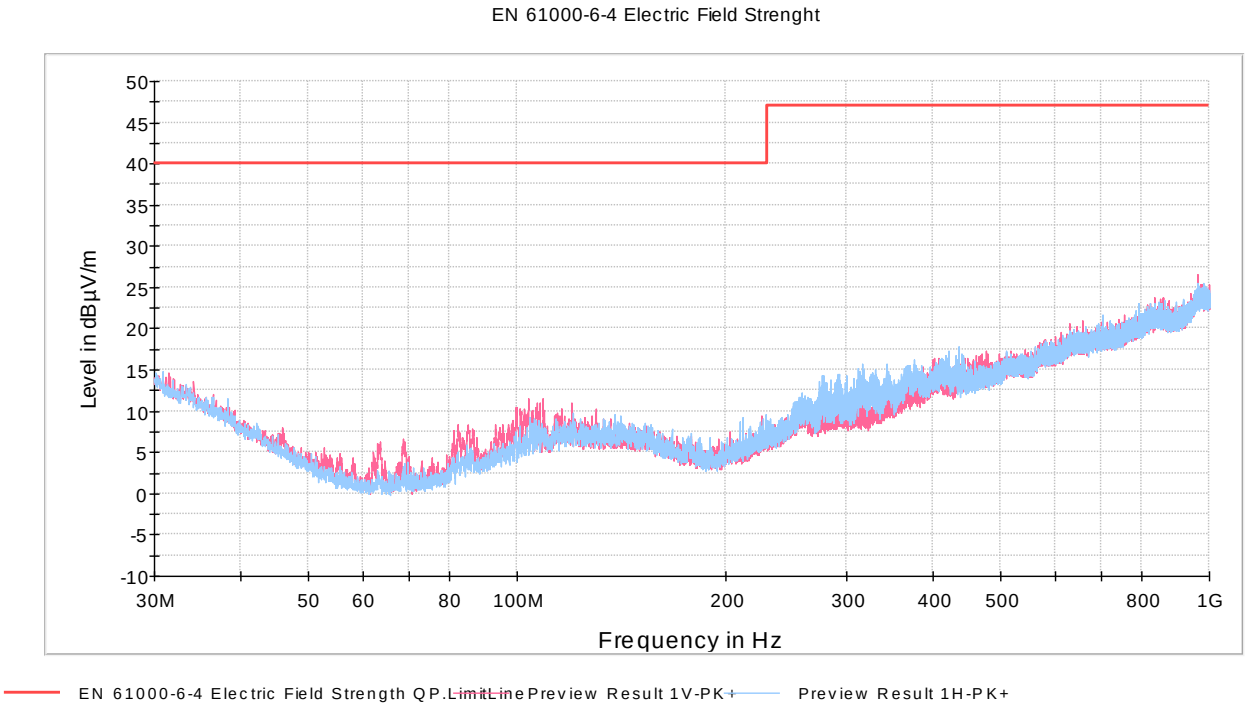


Figure 4. The measured curves with the peak-detector and both measuring antenna polarization

No final measurements were made because the margin to the limit was larger than 10dB.

Electrostatic Discharge Immunity

Basic standard:	EN 61000-4-2
Tested by:	JDA
Date:	4.10.2017
Temperature:	23 ºC
Humidity:	45 %RH
Barometric pressure:	991 hPa
Performance criteria:	Valve position and PT output :A HART: B LUI display: C
Test result:	**PASS**

Test plan

Tests were done by using the air discharge to non-conductive and the contact discharge to all conductive parts of the EUT. Also the indirect contact discharges were given to VCP (Vertical Coupling Plate) in order to simulate the objects placed near to the EUT. Indirect contact discharges to HCP (Horizontal Coupling Plane) were considered not applicable due to the type of the EUT.

At least ten discharges were given with both polarities to the selected points. Ferrite clamps were added to the wires going to the AE (peripherals) to protect the AE from the disturbance.

The EUT was working as described in the section “EUT Test Conditions”.

Test results

Discharge method:	Air discharge
Test levels:	± 2 kV, ± 4 kV, ± 8 kV
EUT test point:	Non-conductive enclosure including LUI display and touch buttons, 6-pin connector socket in front panel and screw terminals where applicable
Test remarks:	Discharge observed with ± 4 kV and ± 8 kV only to the connector pins. With ± 8 kV few HART communication packet errors were observed but connection persisted and with + 8 kV the LUI display was shuts down and restarts or in case disturbed had to be restarted by pressing the touch panel button if it did not recover in reasonable amount of time between the given discharges. Maximum calculated variation from the PT output in the measured position during the test was 0.30 %. Valve did not move. No other loss of performance was observed.

Discharge method:	Indirect contact discharge
Test level:	± 2 kV, ± 4 kV
EUT test side:	Front of EUT LUI display
Test remarks:	No loss of function was observed.

Discharge method:	Contact discharge
Test levels:	± 2 kV, ± 4 kV
EUT test point:	Conductive parts, screws, inlets etc. around LUI display enclosure and some points at valve construction - see the EUT test setup photographs
Test remarks:	When discharges were given to the touchable protruding terminals on the left of the left screw terminal, the menu changes in the LUI display and had to be returned by pressing the touch panel button. Maximum calculated variation from the PT output in the measured position during the test was 0.14 %. Valve did not move. No other loss of performance was observed other that a spike was observed in the measured curve of the position deviation at the moment a discharge was given to the valve position shaft, which was due to mechanical force from the ESD gun.

Radiated RF-field Immunity

Basic standard:	EN 61000-4-3
Tested by:	JDA
Date:	2.10.2017
Temperature:	23 ºC
Humidity:	38% RH
Barometric pressure:	1018 hPa
Performance criteria:	Valve position: A PT output, HART and LUI display: B
Test result:	**PASS**

Test plan

Test was done in a semi-anechoic chamber. Signal generator was set to 1 % logarithmic step size for the whole frequency range. The floor of the chamber was covered by ferrite tiles and wedged absorbers. All four sides of the EUT were tested with both antenna polarizations.

Ferrite clamps were added to the wires going to the AE (peripherals) outside the test chamber to protect the AE from the disturbance.

The EUT was placed on a table 0.8 m above non-reflecting ground plane. The EUT was working as described in the section “EUT Test Conditions”.

Test results

Frequency range:	80 – 1000 MHz
Modulation:	80% AM with 1 kHz modulation frequency
Test level:	10 V/m
Dwell time:	2 s
Antenna polarization:	Horizontal and vertical
EUT test side:	Front, rear, right and left side
Test remark:	Maximum calculated variation from the PT output in the measured position during the test was 0.56 % (LUI display towards antenna in horizontal polarization). Valve did not move. No other loss of performance was observed

Frequency range:	1400 – 2700 MHz
Modulation:	80% AM with 1 kHz modulation frequency
Test level:	3 V/m
Dwell time:	2 s
Antenna polarization:	Horizontal and vertical
EUT test side:	Front, rear, right and left side
Test remark:	No loss of performance was observed

Electrical Fast Transient Immunity

Basic standard:	EN 61000-4-4
Tested by:	JDA
Date:	4.10.2017
Temperature:	22 ºC
Humidity:	50 %RH
Barometric pressure:	992 hPa
Performance criteria:	A
Test result:	**PASS**

Test plan

Both polarities of the test voltage were tested. All lines of each cable were tested simultaneously. The EUT and cables were placed on an insulating support height of 10 cm height above a ground reference plane. Ferrite clamps were added to the wires going to the AE (peripherals) outside the ground reference plane to protect the AE from the disturbance.

EUT ports were considered DC power ports that are not connected to AC/DC-adapters.

The EUT was working as described in the section “EUT Test Conditions”.

Test results

Tested terminal:	Milliamper input
Coupling method:	Capacitive clamp
Coupling mode:	Common
Test level:	± 2000 V
Test time:	120 s (for a one polarity of the test voltage)
Burst period:	300 ms
Burst duration:	15 ms
Impulse repetition rate:	5 kHz
Test remarks:	Maximum calculated variation from the PT output in the measured position during the test was 0.08 %. Valve did not move. No loss of performance was observed

Tested terminal:	PT
Coupling method:	Capacitive clamp
Coupling mode:	Common
Test level:	± 2000 V
Test time:	120 s (for a one polarity of the test voltage)
Burst period:	300 ms
Burst duration:	15 ms
Impulse repetition rate:	5 kHz
Test remarks:	Maximum calculated variation from the PT output in the measured position during the test was 0.08 %. Valve did not move. No loss of performance was observed

Surge Immunity

Basic standard:	EN 61000-4-5
Tested by:	JDA
Date:	4.10.2017 and 6.10.2017
Temperature:	23 ºC
Humidity:	48 %RH
Barometric pressure:	991 hPa
Performance criteria:	Valve position: A PT output and HART: B
Test result:	**PASS**

Test plan

Test was done to the EUT ports with capacitive coupling. Testing was started with the lowest test level. Both test voltage polarities were tested with five pulses. The EUT was placed on a support 0.1 m above the ground plane.

Ferrite clamps were added to the wires going to the AE (peripherals) outside the ground reference plane to protect the AE from the disturbance, when CDN was not used.

According to the manufacturer, the EUT cables can be grounded at both ends or grounded at one end only, surge test was made separately for cables grounded at both ends as well as grounded at one end only. In the test for cables grounded at both ends, test pulses were applied between EUT enclosure and cable shield with app. 10 m cable length in between and in the AE direction.

The EUT was working as described in the section “EUT Test Conditions”.

Test results

Tested cable:	PT
Shield grounding	Both ends
Coupling method:	Capacitive coupling
Coupling path:	Line to PE
Test level:	± 500 V, ± 1000 V
Pulses:	5
Repetition rate:	60 s
Test remarks:	Maximum calculated variation from the PT output in the measured position during the test was 0.27 %. Valve did not move. No loss of function was observed.

Tested cable:	Milliamper input
Shield grounding	Both ends
Coupling method:	Capacitive coupling
Coupling path:	Line to PE
Test level:	± 500 V, ± 1000 V
Pulses:	5
Repetition rate:	60 s
Test remarks:	Maximum calculated variation from the PT output in the measured position during the test was 0.26 %. Valve did not move. No loss of function was observed.

Tested cable:	PT
Shield grounding	One end (EUT side)
Coupling method:	Capacitive coupling
Coupling path:	Line to PE
Test level:	± 500 V, ± 1000 V
Pulses:	5
Repetition rate:	60 s
Test remarks:	Maximum calculated variation from the PT output in the measured position during the test was 30.38 %. Few HART communication packet errors were observed but connection persisted. Valve did not move, or LUI display value.

Surge Immunity

Tested cable:	Milliamper input
Shield grounding	One end (EUT side)
Coupling method:	Capacitive coupling
Coupling path:	Line to PE
Test level:	± 500 V, ± 1000 V
Pulses:	5
Repetition rate:	60 s
Test remarks:	Maximum calculated variation from the PT output in the measured position during the test was 1.26 %. Few HART communication packet errors were observed but connection persisted. Valve did not move, or LUI display value.

Conducted RF-field Immunity

Basic standard:	EN 61000-4-6
Tested by:	JDA
Date:	3.10.2017
Temperature:	24 ºC
Humidity:	38 %RH
Barometric pressure:	1002 hPa
Performance criteria:	Valve position and LUI display: A PT output and HART: B
Test result:	**PASS**

Test plan

Test was done to the cables with direct injection. The injections were given to whole frequency range with 1 % logarithmic frequency steps. The EUT, some AE and cables were placed on an insulating support height of 5 – 10 cm height above a ground reference plane.

Ferrite clamps were added to the wires going to the AE (peripherals) outside the ground reference plane to decouple and protect the AE from the disturbance. Non-measured input peripheral was decoupled with ferrite clamps and not CDN-decoupled because of decoupling inside EUT.

The EUT was working as described in the section “EUT Test Conditions”.

Test results

Tested cable:	Milliamper input
Coupling:	Direct
Decoupling:	Ferrite clamp
Return path:	EUT enclosure ground CDN M1
Frequency range:	150 kHz - 80 MHz
Modulation:	80% AM with 1 kHz modulation frequency
Test level:	10 Vrms
Dwell time:	2 s
Test remark:	Maximum calculated variation from the PT output in the measured position during the test was 0.11 %. Valve did not move. No loss of performance was observed

Tested cable:	PT
Coupling:	Direct
Decoupling:	Ferrite clamp
Return path:	EUT enclosure ground CDN M1
Frequency range:	150 kHz - 80 MHz
Modulation:	80% AM with 1 kHz modulation frequency
Test level:	10 Vrms
Dwell time:	2 s
Test remark:	Maximum calculated variation from the PT output in the measured position during the test was 0.25 %. Valve did not move. No loss of performance was observed

Power Frequency Magnetic Field Immunity

Basic standard:	EN 61000-4-8
Tested by:	JDA
Date:	3.10.2017
Temperature:	23 ºC
Humidity:	40 %RH
Barometric pressure:	1002 hPa
Performance criteria:	Valve position: A PT output, HART and display: B
Test result:	**PASS**

Test plan

Test was done by the immersion method to the EUT. The EUT was placed in the centre of the coil. The EUT was positioned with different orientations in order to expose the EUT to the field. Also all the cables were exposed to the field for length of 1 m.

The magnetic field intensity was measured with a calibrated magnetic field sensor before the test.

The EUT was working as described in the section “EUT Test Conditions”.

50 and 60 Hz were recorded in same data log file, calculated deviation or other observations include both frequencies, but 50 Hz was perceived to be slightly worse.

Test results

Test level:	30 A/m
Test current:	3.38 A
Frequency	50 Hz
Measured field:	At least 30 A/m
Test time:	120 s
Polarization:	Vertical
Test remarks:	No loss of performance was observed

Test level:	30 A/m
Test current:	3.43 A
Frequency	60 Hz
Measured field:	At least 30 A/m
Test time:	120 s
Polarization:	Vertical
Test remarks:	No loss of performance was observed

Test level:	30 A/m
Test current:	3.38 A
Frequency	50 Hz
Measured field:	At least 30 A/m
Test time:	120 s
Polarization:	Horizontal (90 degree)
Test remarks:	Maximum calculated variation from the PT output in the measured position during the test was 0.53 %. LUI display value changed constantly between 49.5 % and 50.1 %. Valve did not move. No other loss of performance was observed

Test level:	30 A/m
Test current:	3.43 A
Frequency	60 Hz
Measured field:	At least 30 A/m
Test time:	120 s
Polarization:	Horizontal (90 degree)
Test remarks:	Maximum calculated variation from the PT output in the measured position during the test was 0.53 %. LUI display value changed constantly between 49.5 % and 50.1 %. Valve did not move. No other loss of performance was observed

Test level:	30 A/m
Test current:	3.38 A
Frequency	50 Hz
Measured field:	At least 30 A/m
Test time:	120 s
Polarization:	Horizontal (0 degree)
Test remarks:	Maximum calculated variation from the PT output in the measured position during the test was 0.32 %. LUI display value changed constantly between 49.7 % and 50.1 %. Valve did not move. No other loss of performance was observed

Test level:	30 A/m
Test current:	3.43 A
Frequency	60 Hz
Measured field:	At least 30 A/m
Test time:	120 s
Polarization:	Horizontal (0 degree)
Test remarks:	Maximum calculated variation from the PT output in the measured position during the test was 0.32 %. LUI display value changed constantly between 49.7 % and 50.1 %. Valve did not move. No other loss of performance was observed

Conducted Emissions

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
EMI Test receiver	ROHDE & SCHWARZ	ESS	9469	2016-11-15	2017-11-15
LISN	ROHDE & SCHWARZ	ESH3-Z5	4129	2016-12-27	2017-12-27
Transient limiter	ROHDE & SCHWARZ	ESH3-Z2	8392	2016-12-29	2017-12-29

Radiated Emissions

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
EMC Chamber 3m NSA	TDK	3 m Lauttasaari		2015-03-11	2018-03-11
EMI test receiver	ROHDE & SCHWARZ	ESCI 3	8264	2017-07-28	2018-07-28
Antenna	CHASE	CBL6111	9428	2017-05-11	2019-05-11
Turntable	DEISEL	DS 420	5015	-	-
Antenna mast	DEISEL	MA 240T	5017	-	-
Controller	EMC AUTOMATION	4630-100	5018	-	-

Electrostatic Discharge Immunity

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
ESD Generator	SCHAFFNER	NSG 435	7927	2017-03-17	2018-03-17
Vertical coupling plane	SGS-FIMKO	-	-	-	-

Radiated RF-field Immunity Test

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
EMC chamber 3m NSA	TDK	3 m Lauttasaari		2015-03-11	2018-03-11
Test software	ROHDE & SCHWARZ	EMC32	-	-	-
RF Power amplifier	OPHIR CORP.	5127RE	9767	-	-
Switch Controller	EMC AUTOMATION	RSM-1	5033	-	-
Power meter	ROHDE & SCHWARZ	NRVD	9517	2017-08-21	2018-08-21
Voltage probe	ROHDE & SCHWARZ	URV5-Z2	9778	2017-06-15	2019-06-15
RF Signal generator	MARCONI	2031	7951	2017-06-08	2019-06-08
System interface	EMC AUTOMATION	SI-200	5021	-	-
E-field Sensor	AMPLIFIER RESEARCH	FP3000A (0.01-1000MHz)	5024	2015-05-27	-
Antenna	ETS-LINDGREN	3142C	7788	2015-01-06	-
Voltage probe	ROHDE & SCHWARZ	URV5-Z4	9779	2017-06-19	2019-06-19
Turntable	DEISEL	DS 420	5015	-	-
Controller	EMC AUTOMATION	4630-100	5018	-	-
Antenna mast	DEISEL	MA 240 T	5017	-	-
Turntable	DEISEL	DS 420	5015	-	-
GPIB / RS232 Controller	KALMUS	IF488		-	-

Electrical Fast Transient

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
EFT generator	EM TEST	EFT 500N5.5	9949	2017-05-02	2018-05-02
Capacitive coupling device	HAEFELY	IP4A	9758	2017-06-09	2019-06-09

Surge Immunity

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Surge generator	HAEFELY	PSURGE 4.1 (2kV max)	9932	2017-03-01	2018-03-01
Surge generator	EMTEST	VCS 500 N8.3	10249	2017-09-27	2018-09-27
Surge line CDN	EMTEST	CNV 508 N2.2	10250	2017-09-27	2018-09-27

Conducted RF-field Immunity

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Test software	ROHDE & SCHWARZ	EMC32	-	-	-
RF Power amplifier	AR	50W1000M3	4112	-	-
Attenuator	SCHAFFNER	6dB/50W	5176	2017-01-03	2018-01-03
Directional Coupler	WERLATONE	C2630	4961	2009-01-26	-
Signal generator	MARCONI	2032 +OPT08	8017	2017-09-14	2019-09-14
Power meter	R & S	NRVD	9517	2017-08-21	2018-08-21
Voltage probe	R & S	URV5-Z2	9519	2017-08-22	2018-08-22
Direct coupling box	SGS FIMKO		5119	2017-02-27	2018-02-27
Direct coupling box	SGS FIMKO		5117	2017-02-27	2018-02-27

Power Frequency Magnetic Field Immunity

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Magn.imm.ant	SGS FIMKO	-	-	-	-
ELF Survey meter	HOLADAY	HI-3604	9503	2015-11-27	2017-11-27
Power supply	CALIFORNIA INSTRUMENTS	500i-400	9487	-	-
Power analyzer	VOLTECH	PM6000	9588	2017-01-27	-