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EN 61326-1, Electrical Equipment for Measurement, Control and Laboratory Use
Test Report

On

850S Ultrasonic Sensor
Model Number: Ultra Trak 850S

Customer Name:	UE Systems
Customer P.O:	UES015546
Date of Report:	January 12, 2022
Test Report No:	R-17753Y-1
Test Start Date:	December 17, 2021
Test Finish Date:	January 4, 2022
Test Technicians:	M. Seamans
Test Engineer:	T. Hannemann
Approved By:	T. Hannemann
Report Prepared By:	P. Harris

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Certification and Signatures

We certify that this report is a true report of the results obtained from the tests of the equipment stated and relates only to the equipment tested. We further certify that the measurements shown in this report were made in accordance with the procedures indicated and vouch for the qualifications of all Retlif Testing Laboratories personnel taking them.

Todd Hannemann
EMC Test Engineer
iNARTE Certified Technician ATL-0255-T

Matt Seamans
EMC/EMI Test Technician

Non-Warranty Provision
The testing services have been performed, findings obtained and reports prepared in accordance with generally accepted laboratory principles and practices. This warranty is in lieu of all others, either expressed or implied.

Non-Endorsement
This test report contains only findings and results arrived at after employing the specific test procedures and standards listed herein. It is not intended to constitute a recommendation, endorsement or certification of the product or material tested. This report must not be used by the client to claim product endorsement by ANSI National Accreditation Board (ANAB).

Revision History

Revisions to this document are listed below; the latest revised document supersedes all previous issues of this document.

Revision	Date	Pages Affected
-	January 12, 2022	Original Release

Test Program Summary

Report Number:	R-17753Y-1
Customer:	UE Systems
Address:	14 Hayes Street
	Elmsford, NY 10523
Test Sample:	850S Ultrasonic Sensor
Model Number:	Ultra Trak 850S
Manufacturer:	UE Systems

Test Specification:
EN 61326-1:2013 - Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General Requirements in accordance with:

- Emissions Section 7.2 for Class B Equipment
- Immunity Table 1

Test Methods:
The test methods performed on the 850S Ultrasonic Sensor and the corresponding test results are shown in Table 1.

Table 1 - Test Methods and Results

Paragraph	Test Method	Test Results
6.1	CISPR 11, Conducted Emissions, Class B	Complied
6.2	CISPR 11, Radiated Emissions, Class B	Complied
6.3	IEC 61000-3-2, Harmonics	Complied
6.4	IEC 61000-3-3, Voltage Fluctuation and Flicker	Complied
6.5	IEC 61000-4-2, Electrostatic Discharge	Complied
6.6	IEC 61000-4-3, Radiated Immunity	Complied
6.7	IEC 61000-4-4, Electrical Fast Transient/Burst, Power Ports	Complied
6.8	IEC 61000-4-4, Electrical Fast Transient/Burst, I/O Ports	Complied
6.9	IEC 61000-4-5, Surge Immunity, Power Ports	Complied
6.10	IEC 61000-4-6, Conducted Immunity, Power Ports	Complied
6.11	IEC 61000-4-6, Conducted Immunity, I/O Ports	Complied
6.12	IEC 61000-4-8, Magnetic Immunity	Complied
6.13	IEC 61000-4-11, Voltage Dips, Interrupts and Variations	Complied

Decision Rule:
The following decision rule was applied to the measurements obtained and results reported in this test report in accordance with Retlif Testing Laboratories Quality Procedure RQP-005:

Emissions:

- Complied: Acceptance based on simple acceptance; the measurement result being at or below the acceptance limit.
- Did Not-Comply: Rejection based on simple acceptance; the measurement result being above the acceptance limit.

Immunity:

- Complied: Acceptance based on simple acceptance; no recorded threshold found below the minimum acceptance limit (specified test level).
- Did Not-Comply: Rejection based on simple acceptance; any recorded threshold found to be below the minimum acceptance limit (specified test level).

All test methods listed above are included in Retlif Testing Laboratories ANSI National Accreditation Board (ANAB), ISO/IEC 17025 Scope of Accreditation, Certificate Number: L2320.03.

1.0 Scope

The purpose of this testing program was to determine the compliance of a 850S Ultrasonic Sensor (EUT), as described in Paragraph 5.0 of this report, to the essential requirements of European Community Council Directive 2014/30/EU, the EMC Directive and the essential requirements of Great Britain, UKCA Electromagnetic Compatibility Regulations 2016

2.0 Applicable Documents

The following documents form a part of this test report to the extent specified herein:

RCM-001	-	Retlif Testing Laboratories, Calibration Manual
RQM-001	-	Retlif Testing Laboratories, Quality Assurance Manual
RQP-005	-	Retlif Testing Laboratories, Measurement Uncertainty
MIL-PRF-15733J	-	Filters, Radio Frequency Interference, General Specifications for
CISPR 11: 2009 (Modified), A1: 2010	-	Industrial, scientific and medical (ISM) radio-frequency equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement
IEC 61000-4-2: 2008	-	Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test
IEC 61000-4-3: 2006, A1: 2007, A2: 2010	-	Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test
IEC 61000-4-4: 2004, A1: 2010	-	Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test
IEC 61000-4-5: 2005, Corr. October 2009	-	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test
IEC 61000-4-6: 2008	-	Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio frequency fields.
IEC 61000-4-8: 2009	-	Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test
IEC 61000-4-11: 2004	-	Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity test
EN 61326-1: 2013	-	Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements
ISO/IEC 17025:2017	-	General Requirements for the Competence of Testing and Calibration Laboratories
ANAB AR 2250: 2020/03/12	-	Accreditation Requirements: ISO/IEC 17025 Testing Laboratories

3.0 Acronyms and Definitions

The following acronyms may be used within this test report:

ANAB:	ANSI National Accreditation Board
ANSI:	American National Standards Institute
BCI:	Bulk Cable Injection
CISPR:	International Special Committee on Radio Interference
CE:	Conducted Emissions
CI:	Conducted Immunity
dB:	Decibel
dBµA:	Decibels Relative to One Microampere
dBµV:	Decibels Relative to One Microvolt
dBµV/m:	Decibels Relative to One Microvolt per Meter
EMC:	Electromagnetic Compatibility
EMI:	Electromagnetic Interference
EN:	European Norm
EUT:	Equipment Under Test
GHz:	Gigahertz
GPIB:	General Purpose Interface Bus
Hz:	Hertz
IEC:	International Electrotechnical Commission
ISM:	Industrial, Scientific and Medical
kHz:	Kilohertz
LISN:	Line Impedance Stabilization Network
mA:	Milliampere
mS:	Millisecond
mΩ:	Milliohm
MHz:	Megahertz
OATS:	Open Area Test Site
RE:	Radiated Emissions
RF:	Radio Frequency
RI:	Radiated Immunity
RMS:	Root Mean Square
µA:	Microampere
µF:	Microfarad
µH:	Microhenry
µV:	Microvolt
µV/m:	Microvolts per Meter
V/m:	Volts per Meter
Ω:	Ohm

4.0 General Requirements

4.1 Test Environment

All testing was performed at the Retlif Testing Laboratories Goffstown, New Hampshire facility. Each test method was performed in the environment specified within the test standard. Where the test environment deviated from that specified, it is noted in the applicable test method.

4.1.1 Shielded Enclosures

All testing which required the use of a shielded enclosure was performed in a solid steel, double wall, modular type enclosure. The attenuation characteristics of the enclosure were in accordance with IEEE-Std-299. All input power lines to the enclosure were filtered utilizing filters manufactured in accordance with MIL-PRF-15733J and tested in accordance with MIL-STD-220C. The walls of the enclosure were treated with a combination of carbon impregnated foam and ferrite tile. The enclosure met the field uniformity requirements contained therein.

4.1.2 Conducted Emissions

All conducted emissions testing described herein was performed on a conducting ground plane. The conducting ground plane for measuring AC power line conducted emissions consisted of a floor-earth grounded conducting surface. The conducting surface was a minimum of 2.0 meters x 2.0 meters in size and extended at least 0.5 meters beyond the vertical projection (footprint) of the EUT.

4.1.3 Radiated Emissions

4.1.3.1 Exploratory

Exploratory radiated measurements were performed at the measurement distance or at a closer distance than that specified for compliance to determine the emission characteristics of the EUT. Where a shielded room was used, care was taken to account for shielded room reflections.

4.1.3.2 Formal

4.1.3.2.1 Measurements in the frequency range 30 MHz to 1 GHz

Radiated emissions measurements in the frequency range of 30 MHz to 1 GHz were performed on an open area test site (OATS). The test site was comprised of a ground plane and flush mount metallic turntable which is configured to comply with the obstruction free area and minimum ground plane dimensions of ANSI C63.4. The equipment under test was placed on an 80 cm high non-metallic test stand positioned on top of the flush mount turntable. The turntable, test stand and EUT were inside a weather protected enclosure. The OATS complied with the normalized site attenuation specified in ANSI C63.4.

4.2 Test Instrumentation

A listing of all test instrumentation utilized is contained within each applicable test method. These listings indicate the model, manufacturer, frequency range, last calibration date and calibration due date of all instrumentation utilized. Test and measurement equipment requiring calibration were calibrated as specified in Retlif Testing Laboratories Calibration Manual; RCM-001. All calibrations were in accordance with the requirements of ISO/IEC 17025 and meet the traceability requirements defined in ANAB AR 2250.

4.2.1 Measurement Uncertainty

In accordance with ISO/IEC 17025, Retlif Testing Laboratories has produced an estimate of the uncertainty of its measurements using accepted methods of analysis, through the production and application of suitable uncertainty of measurement procedures. For emissions testing, measurement uncertainty has been calculated in order to provide a confidence level of 95% (K=2.0). For immunity/susceptibility testing, measurement uncertainty has been calculated to provide a minimum confidence level of 90% (K=1.64). The results of these calculations are shown in the table below:

Table 2 - Measurement Uncertainty

Test Method	Confidence Level	Probability Distribution	K	Expanded Uncertainty
Conducted Emissions	95 %	Normal	2.00	3.74 dB
Radiated Emissions	95 %	Normal	2.00	6.08 dB
Harmonics	95 %	Normal	2.00	3.12 %
Flicker	95 %	Normal	2.00	5.01 %
Radiated Immunity	90 %	Normal	1.64	1.68 dB
Conducted Immunity	95 %	Normal	2.00	2.21 dB
Magnetic Immunity	95 %	Normal	2.00	1.45 dB

For Electrostatic Discharge (ESD), Electrical Fast Transient/Burst (EFT/B) and Surge immunity testing, the test methods specify the limits to the values of the major sources of uncertainty of measurement. The test equipment utilized to perform these tests has been determined to meet the requirements of the relevant standards and the results have been reported in accordance with the relevant standards. Therefore, the requirements for measurement uncertainty are deemed to have been satisfied.

4.3 Detector Function

For the conducted emissions testing described herein Peak, Quasi-Peak and Average detector functions in accordance with CISPR 16 were utilized.

For the radiated emissions testing described herein a Quasi-Peak detector function in accordance with CISPR 16 was utilized.

5.0 Description of Equipment Under Test

5.1 EUT Description

The test sample was a 850S Ultrasonic Sensor, Model Number: Ultra Trak 850S. It measured 3.5 cm Diameter deep by 5.7 cm high, and weighed less than 1.0 kg. The 850S Ultrasonic Sensor was manufactured by UE Systems of Elmsford, NY 10523.

The EUT is an 850S Ultrasonic Sensor and transmitter. It passively senses ultrasounds produced by mechanical equipment in the form of friction, impaction, and turbulence then processes that level of decibel into an analog signal. The 850s can be used for a wide range of applications, including ultrasound condition-based lubrication, bearing fault detection, valve leakage and steam trap issues with existing measurement systems. It is powered by 22-26 VDC with a max current draw of 30 mA.

5.1.1 EUT Identification Plate

The following photograph depicts the ID Label of the EUT.

5.2 Electrical Characteristics

5.2.1 Power Input - Rated

Table 3 details the rated electrical power requirements of the OnTrak Host System:

Table 3 - Power Input, Rated

Input Voltage	Frequency	Current	Phase
100 to 240 VAC	50 to 60 Hz	200.0 mA	Single

5.2.2 Power Input - Configuration During Test

Table 4 details the power input configuration of the OnTrak Host System during the performance of all testing specified herein.

Table 4 - Power Input, Configuration During Test

Input Voltage	Frequency	Current	Phase
230 VAC	50 Hz	114 mA	Single

5.2.3 Internal Frequencies

The highest clock frequency generated or used by the EUT was less than 80 MHz.

5.3 EUT Configuration

For all test methods, the EUT was configured as shown in Figure 1, General Test Setup.

5.3.1 Power Leads and Interconnecting Cables

All power and interconnecting cables, including cable length, routing and type were as specified in Table 5:

Table 5 - EUT Interconnecting Cable Configurations

EUT Component	EUT Port	Cable Length (Meters)	Signal Description	Cable Description	Routed To
EUT	I/O	3.0	DC Power, Current Feedback	Shielded / Multi-Conductor	OnTrak Host

5.3.2 Unpopulated Ports
All ports of the EUT were populated during the course of this test program.

5.4 Modifications
No modifications were made to the EUT during the course of this testing program in order to demonstrate compliance with the specified requirements.

5.5 Mode of Operation
During the performance of all emissions testing specified herein, the EUT was sending sensor current reading to OnTrak system, support laptop displaying averaged sensor date at a 5 second rate.

During the performance of all immunity testing specified herein, the EUT ending sensor data to OnTrak system, support laptop displaying sensor data in lubrication mode.

The Support Laptop was running the following software during the course of this testing program:

- Chrome Browser (Support Laptop)

5.5.1 Support Equipment
All equipment that was utilized to achieve the EUT operating state specified in Paragraph 5.5 is listed in Table 6:

Table 6 - Support Equipment

Description	Manufacturer	Model Number	Serial Number
OnTrak	UE System	ON-TRAK-ENET-16	P200963
Laptop PC	Dell	P106F	N/A

5.6 Susceptibility Criteria

The following were considered indications of EUT susceptibility:

- Loss of sensor data
- Sensor reading ± 1 dB from nominal

The following performance criteria, as outlined in EN 61326-1, were used to determine compliance with the requirements:

IEC 61000-4-2	- Performance Criteria B
IEC 61000-4-3	- Performance Criteria A
IEC 61000-4-4	- Performance Criteria B
IEC 61000-4-5	- Performance Criteria B
IEC 61000-4-6	- Performance Criteria A
IEC 61000-4-8	- Performance Criteria A
IEC 61000-4-11	- Performance Criteria B and C

Performance Criteria A: During testing, the equipment shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the equipment 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, either of these may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

Performance Criteria B: During testing, the equipment 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 equipment is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. 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 equipment if used as intended.

Performance Criteria C: During testing, temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

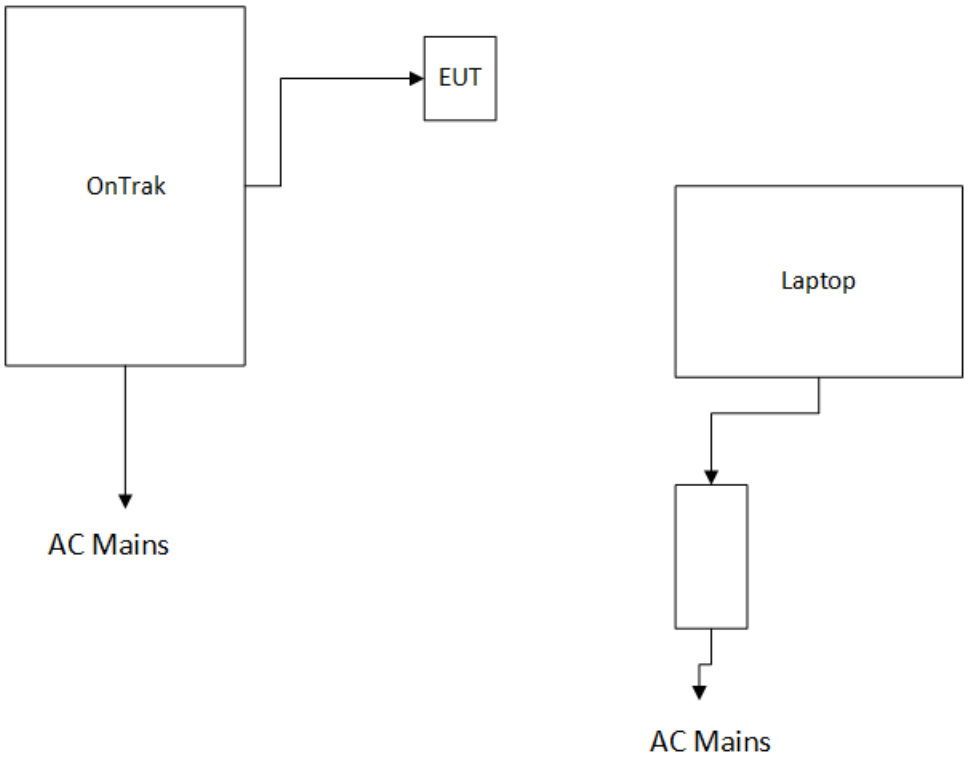
5.6.1 Monitoring Equipment

All equipment that was utilized to monitor the EUT for indications of degradation or malfunction (susceptibility), as detailed in Paragraph 5.6, is listed in Table 7:

Table 7 - Monitoring Equipment

Description	Manufacturer	Model Number	Serial Number
Laptop PC	Dell	P106F	N/A

Figure 1 - General Test Setup



6.0 Test Sequence and Results

The following test methods were performed on the 850S Ultrasonic Sensor. All testing documented herein was performed in the sequence shown in Table 8:

Table 8 - Test Sequence and Results

Testing Dates	Para.	Test Method	Results
December 21, 2021	6.1	CISPR 11, Conducted Emissions, Class B	Complied
December 21, 2021	6.4	IEC 61000-3-3, Voltage Fluctuation and Flicker	Complied
December 21, 2021	6.3	IEC 61000-3-2, Harmonics	Complied
December 23, 2021	6.2	CISPR 11, Radiated Emissions, Class B	Complied
January 3, 2022	6.6	IEC 61000-4-3, Radiated Immunity	Complied
January 3-4, 2022	6.9	IEC 61000-4-5, Surge Immunity, Power Ports	Complied
January 4, 2022	6.13	IEC 61000-4-11, Voltage Dips, Interrupts and Variations	Complied
January 4, 2022	6.7	IEC 61000-4-4, Electrical Fast Transient/Burst, Power Ports	Complied
January 4, 2022	6.8	IEC 61000-4-4, Electrical Fast Transient/Burst, I/O Ports	Complied
January 5, 2022	6.11	IEC 61000-4-6, Conducted Immunity, I/O Ports	Complied
January 5, 2022	6.10	IEC 61000-4-6, Conducted Immunity, Power Ports	Complied
January 5, 2022	6.5	IEC 61000-4-2, Electrostatic Discharge	Complied
January 5, 2022	6.12	IEC 61000-4-8, Magnetic Immunity	Complied

See individual test methods contained in Paragraphs 6.1 through 6.13 of this test report for a full description of the test procedures utilized and the results obtained.

6.1 CISPR 11, Group 1, Class B, Conducted Emissions, 150 kHz to 30 MHz

6.1.1 Normative Reference
CISPR 11: 2009 (Modified), A1:2010

6.1.2 Purpose
The purpose of this test was to determine the magnitude of the radio frequency emissions emanating from the EUT via conduction on the AC power leads in the frequency range of 150 kHz to 30 MHz.

6.1.3 Test Limits
The limits shown in Table 9 were used to determine compliance of the EUT to the Group 1, Class B requirements of CISPR 11:

Table 9 - Conducted Emissions, Test Limits

Frequency Range MHz	Group 1, Class B Limit [dBµV]	
	Quasi-Peak	Average
0.15 to 0.50	66.0 to 56.0	56.0 to 46.0
0.50 to 5.00	56.0	46.0
5.00 to 30.0	60.0	50.0

From 150 to 500 kHz the limit decreases linearly with the logarithm of frequency. The lower limit applies at all transition frequencies.

6.1.4 Leads Tested
The following AC power leads of the EUT Host were tested in order to demonstrate compliance:

- 230 VAC, 50 Hz, Hot
- 230 VAC, 50 Hz, Neutral

6.1.5 Test Setup

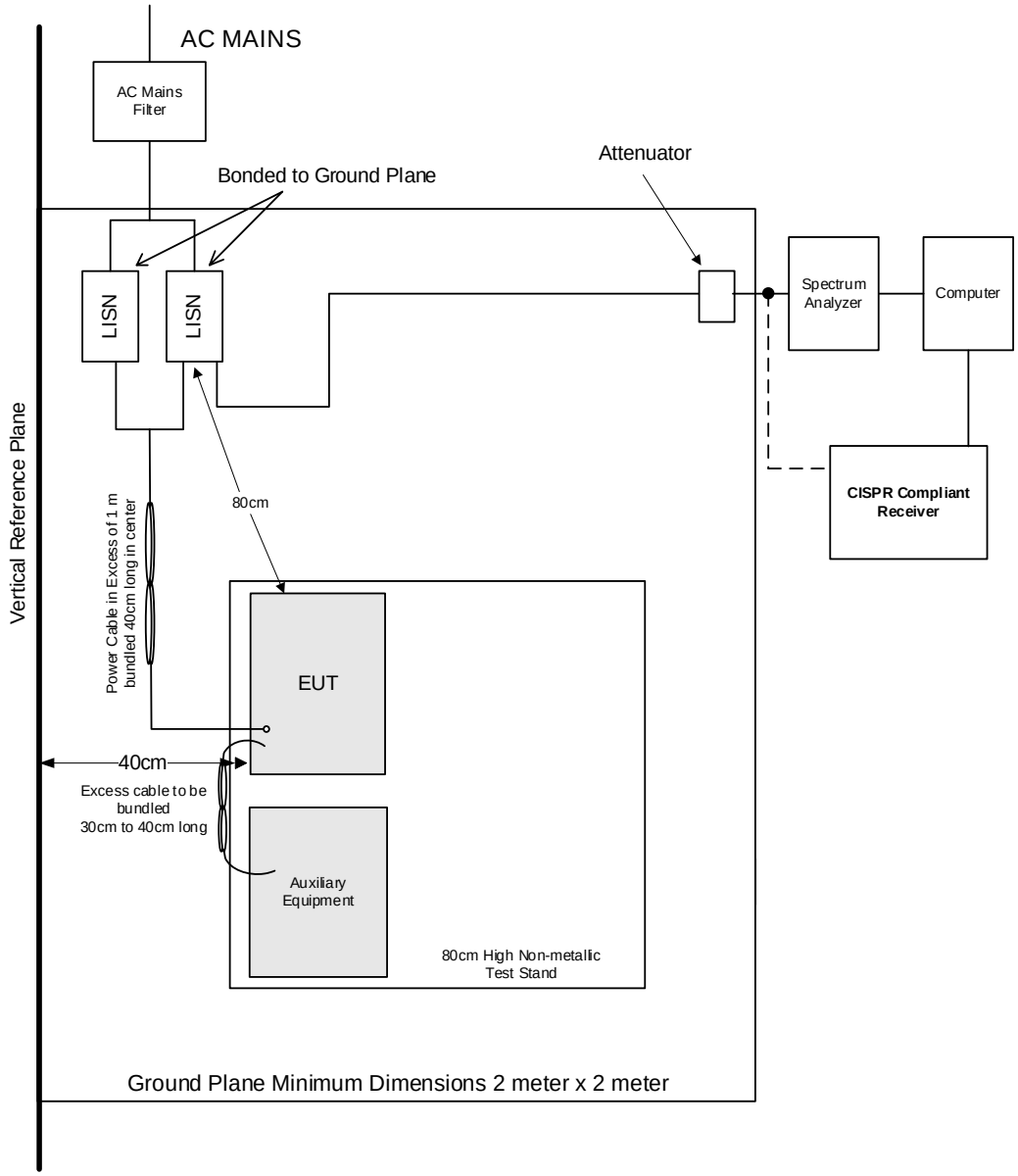
The EUT and associated cabling, configured as detailed in Paragraph 5.0 herein, was placed on a 0.8 m high non-conductive test stand above the horizontal ground plane. The horizontal ground plane extended at least 0.5 m beyond the boundary of the equipment under test, and had a minimum size of 2.0 m x 2.0 m. The 0.8 m test stand was positioned such that the distance between the EUT and the vertical reference plane was 0.4 m. All EUT components were located at least 0.8 m from all other metal surfaces. The ground plane was connected to the reference earth terminal of the LISN (V-network) with a conductor as short as possible. The LISN was located so that its closest surface was no less than 0.8 m from the nearest boundary of the equipment under test.

Each current carrying conductor of the EUT's power cord was then connected to a 50 ohm/50 µH LISN. The LISNs were mounted to the ground plane in a position that produced a minimum distance of 0.8 m between the EUT and the LISNs. Power cord length in excess of 1.0 m was folded to and forth to form a bundle in the approximate center of the cable not exceeding 0.4 m until the overall cable length was equal to 1.0 m. Earth connections, where required for safety purposes, were connected to the reference "earth" point of the LISN. Where not otherwise provided or specified by the manufacturer, they were 1 m long and run parallel to the mains connection at a distance of not more than 0.1 m.

The power and signal cables were oriented in relation to the ground plane in a manner equivalent to actual use. Excess lengths of interconnecting cables were bundled at the approximate center of the cable with bundles 30 to 40 cm in length, such that no cable was closer than 0.4 m to the horizontal ground plane.

The RF port of the LISN was connected to the test receiver by means of 50 Ohm coaxial cable through a transient limiting device. The RF ports of LISNs installed in power leads not under test were terminated in 50 Ohms.

Figure 2 - Conducted Emissions, Test Setup



6.1.6 Test Equipment

The details of the test equipment utilized during the performance of this test method are shown below:

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
5188	Cybertron	COMPUTER, CONTROL	N/A	TSVQJA2221	No Calibration Required	
5208	OMEGA	HYGROMETER	-20 to 70 deg. C, 0-99% RH	OM-73	1/18/2021	1/31/2022
5209	SOLAR ELECTRONICS	LISN	50 uH, 150 kHz - 30	21106-50-BP-25-BNC	4/28/2021	4/30/2022
5210	SOLAR ELECTRONICS	LISN	50 uH, 150 kHz - 30	21106-50-BP-25-BNC	4/28/2021	4/30/2022
5218	COM-POWER	GENERATOR, COMB	100 kHz - 400 MHz	CGC-510E	8/19/2021	8/31/2022
712	ROHDE & SCHWARZ	RECEIVER, EMI	20 Hz - 26.5 GHz	ESIB26	1/6/2021	1/31/2022

6.1.7 Test Procedure

With the test instrumentation and the EUT configured as stated above, the following steps were performed:

1. The EUT was operated as detailed in Paragraph 5.5 herein.
2. The measurement system was configured to measure the emissions on the first lead under test in the frequency range of 150 kHz to 30 MHz, utilizing a peak detector function.
3. The peak data obtained in Step 2 was then compared to the specified Quasi-Peak and average limits.
4. If the peak data obtained in Step 2 was found to be in compliance with the average limit, then this lead of the test sample was found to comply and the next lead under test was configured for testing beginning at Step 2.
5. If the peak data obtained in Step 2 was found to be in compliance with the Quasi-Peak limit but not the average limit, the emissions exceeding the average limit were measured utilizing a CISPR compliant receiver with an average detector.
6. If the average data obtained in Step 5 complied with the average limit then this lead of the test sample was found to comply and the next lead under test was configured for testing beginning at Step 2.
7. If the peak data obtained in Step 2 did not comply with the both specified Quasi-Peak and average limits the emissions exceeding the specified limits were measured utilizing a CISPR compliant receiver with both Quasi-Peak and average detectors.
8. The obtained Quasi-Peak data was then compared to the specified Quasi-Peak limit, and the average data was compared to the average limit. If the obtained data was found to be in compliance with specified limits, then this lead of the test sample was found to comply.
9. Steps 1 through 8 were repeated for each remaining lead of the EUT.

6.1.8 Sample Calculations

Shown below is a sample showing calculations used, either manually or under software control, to derive the final corrected reading.

$R_C = M_R + C_{IL} + A_{IL}$

Where:
R_C = Corrected Reading in dBµV
M_R = Meter Reading in dBµV
C_{IL} = Insertion Loss of Cable in dB
A_{IL} = Insertion Loss of Attenuator in dB

Example:
Mr = 43.5 dBµV
C_{IL} = 0.15 dB
A_{IL} = 10.2 dB

R_C = 43.5 + 0.15 + 10.2 = 53.85 dBµV

6.1.9 Test Results

The EUT complied with the requirements specified for this method. No emissions were observed which exceeded the specified Group 1, Class B limits of CISPR 11.

See the following photographs and test data for a full presentation of the test setup and results obtained.

Test Photographs
Conducted Emissions

Test Photographs
Conducted Emissions

EUT Configuration

Test Setup

CISPR 11, Conducted Emissions, Class B
150 kHz to 30 MHz
Test Data

EMISSIONS TEST DATA SHEET	
Test Specification:	EN 61326-1; Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements, Part 1: General Requirements
Method:	CISPR 11, Conducted Emissions, Group 1, Class B, 150 kHz to 30 MHz
Job Number/Customer:	R-17753Y-1 / UE Systems
Test Sample:	850S Ultrasonic Sensor
Model Number:	UltraTrak 850S
Part Number:	N/A
Serial Number:	N/A
Operating Mode:	Sending sensor current reading to OnTrak system, support laptop displaying average sensor data at a 5 second rate.
Technician:	M. Seamans
Date(s):	December 21st, 2021
Temperature:	21.9 ºC
Relative Humidity:	29.6 %
Port Tested:	230 VAC 50 Hz of Host Device

Frequency	Lead Tested	Peak Meter Reading	Quasi-Peak Meter Reading	Average Meter Reading	Quasi-Peak Limit	Average Limit
MHz		dBuV	dBuV	dBuV	dBuV	dBuV
0.233	Hot	46.23	42.20	41.20	62.34	52.34
0.232	Neutral	45.39	41.40	40.40	62.38	52.38
0.281	Hot	47.07	40.00	38.10	60.79	50.79
0.277	Neutral	47.34	39.00	36.30	60.91	50.91
3.952	Hot	38.03	33.10	26.50	56	46
4.244	Neutral	38.17	30.40	21.40	56	46
4.469	Hot	37.63	30.80	24.00	56	46
4.762	Neutral	38.17	30.50	26.50	56	46
13.420	Hot	41.77	40.80	38.10	60	50
12.800	Neutral	42.18	41.40	39.00	60	50
23.126	Hot	45.26	45.10	42.60	60	50
23.126	Neutral	44.27	44.60	42.40	60	50

The frequency range was scanned from 0.15 MHz to 30 MHz.
The six highest emissions relative to the limit are presented.
The emissions observed from the EUT do not exceed the specified limits.

6.2 CISPR 11, Group 1, Class B, Radiated Emissions, 30 MHz to 1 GHz

6.2.1 Normative Reference
CISPR 11 Edition 5: 2009 (Modified), +A1:2010

6.2.2 Purpose
The purpose of this test was to determine the magnitude of the radio frequency emissions emanating from the EUT via radiation from the enclosure and connected cabling in the frequency range of 30 MHz to 1 GHz.

6.2.3 Test Limits
The limits shown in Table 10 were used to determine compliance of the EUT to the Group 1, Class B requirements of CISPR 11.

Table 10 - Radiated Emissions, Test Limits

Frequency Range	Group 1, Class B Quasi-Peak Limit [dBµV/m], at 3.0 Meters
30.0 MHz to 230.0 MHz	40.0
230.0 MHz to 1.0 GHz	47.0

6.2.4 Test Setup
The EUT and associated cabling, configured as detailed in Paragraph 5.0 herein was placed on a 0.8 m non-conductive test stand on the flush mounted turntable. The turntable positions were relative to the EUT as follows:

When facing the EUT the front is at 0°, the rear is at 180° and the left side is at 270°. The test stand was situated such that the nearest part of the boundary of the EUT was located 3.0 m from the measuring antenna.

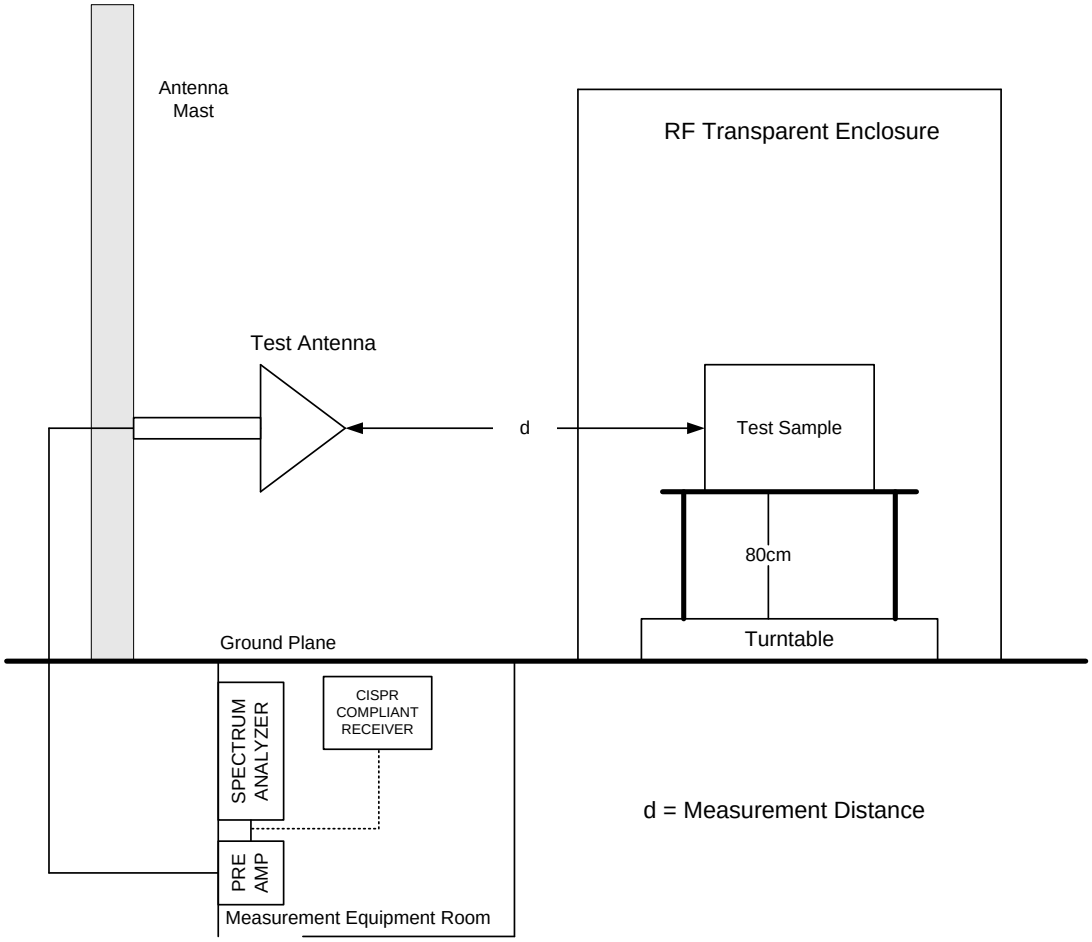
The AC power cables were routed to the AC mains outlet located on top of the turntable. Excess power cable length was left on the surface of the turntable. Earth connections, where required for safety purposes, were connected to a ground reference point on the turntable. Where not otherwise provided or specified by the manufacturer, they were 1.0 m long and run parallel to the mains connection at a distance of not more than 0.1 m.

The power and signal cables were oriented in relation to the ground plane in a manner equivalent to actual use. Excess lengths of interconnecting cables were bundled at the approximate center of the cable with bundles 30 to 40 cm in length, such that no cable was closer than 0.4 m to the surface of the turntable. Care was taken during testing to relocate all system components and cabling in an effort to maximize the emissions from the EUT.

Test Setup (con't.)

The antenna was connected via coaxial cable to a CISPR compliant receiver for final readings and to a broadband pre-amplifier, which in turn was connected to a spectrum analyzer in order to maximize emissions.

Figure 3 - Radiated Emissions, Test Setup



6.2.5 Test Equipment

The details of the test equipment utilized during the performance of this test method are shown below:

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
3427B	ETS / EMCO	ANTENNA, BICONICAL	20 - 200 MHz	3104	10/27/2020	4/30/2022
4029B	RETLIF	OPEN AREA TEST SITE, ATTENUATION	3 / 10 Meters	RNH	9/28/2021	9/30/2023
443	ELECTRO-METRICS	ANTENNA, LOG PERIODIC	200 MHz - 1000 MHz	LPA-25	7/21/2021	1/31/2023
5188	Cybertron	COMPUTER, CONTROL	N/A	TSVQJA2221	No Calibration Required	
5242	TELEDYNE MICROWAVE	CABLE, COAXIAL	10 kHz - 6 GHz	PR90-195-1275, 106'	9/29/2021	9/30/2022
712	ROHDE & SCHWARZ	RECEIVER, EMI	20 Hz - 26.5 GHz	ESIB26	1/6/2021	1/31/2022

6.2.6 Test Procedure

With the test instrumentation and the EUT configured as stated above, the following steps were performed:

1. The EUT was operated as detailed in Paragraph 5.5 herein.
2. The spectrum analyzer was configured to display the frequency range of test.
3. With the test antenna both horizontally and vertically polarized, the EUT cabling was relocated in order to maximize the radiated emissions.
4. The operating mode of the EUT was varied in order to determine the operating mode which produced maximum radiated emissions with respect to the limit.
5. The EUT configuration which produced maximum radiated emissions with respect to the limit was maintained for the duration of testing.
6. The frequency of test was scanned to determine the frequency of all emissions from the EUT.
7. At each frequency upon which an emission was determined to be from the EUT the following steps were performed in order to further maximize the observed emissions:
    a. The test antenna height was varied from 1.0 m to 4.0 m.
    b. The test antenna polarization was varied from vertical to horizontal.
    c. The EUT was rotated 360° about its vertical axis.
8. The RF cable from the test antenna was connected to the CISPR compliant receiver.
9. The following was recorded for a minimum of the six highest emissions, with respect to the specified limit:
    a. Frequency of emission.
    b. Quasi-Peak detector receiver meter reading.
    c. Correction factor consisting of antenna factor and cable loss.
    d. Test antenna height and polarization.
    e. Turntable position.

6.2.7 Sample Calculations

Shown below is a sample showing calculations used, either manually or under software control, to derive the final corrected reading.

$R_C = M_R + C_{IL} + A_F$

Where:
R_C = Corrected Reading in dBµV/m
M_R = Meter Reading in dBµV
C_{IL} = Insertion Loss of Cable in dB
A_F = Antenna Factor in dB

Example:
M_R = 25.3 dBµV
C_{IL} = 3.6 dB
A_F = 12.4dB

R_C = 25.3 + 3.6 + 12.4 = 41.3 dBµV/m

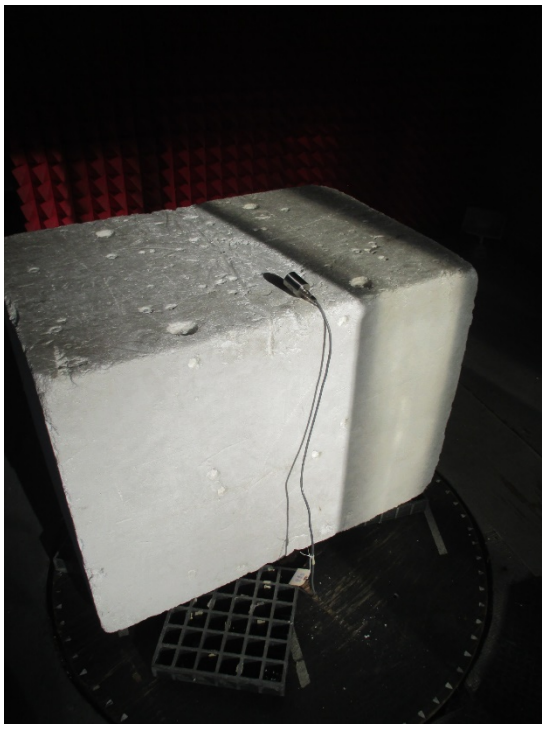
6.2.8 Test Results

The EUT complied with the requirements specified for this method. No emissions were observed which exceeded the specified Group 1, Class B limits of CISPR 11.

See the following photographs and test data for a full presentation of the test setup and results obtained.

Test Photographs
Radiated Emissions

Test Photographs
Radiated Emissions



EUT Configuration

Test Photographs
Radiated Emissions

Horizontal Antenna Polarization, 30 to 200 MHz

Vertical Antenna Polarization, 30 to 200 MHz

Test Photographs
Radiated Emissions

Horizontal Antenna Polarization, 200 MHz to 1 GHz

Vertical Antenna Polarization, 200 MHz to 1 GHz

CISPR 11 Radiated Emissions, Group 1, Class B
30 MHz to 1 GHz
Test Data

EMISSIONS TEST DATA SHEET	
Test Specification:	EN 61326-1; Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements, Part 1: General Requirements
Method:	CISPR 11 Radiated Emissions, Group 1,Class B, 30 MHz to 1 GHz
Job Number/Customer:	R-17753Y-1 / UE Systems
Test Sample:	850S Ultrasonic Sensor
Model Number:	UltraTrak 850S
Part Number:	N/A
Serial Number:	N/A
Operating Mode:	Sending sensor current reading to OnTrak system, support laptop displaying average sensor data at a 5 second rate.
Technician:	M. Seamans
Date(s):	December 23rd, 2021
Test Distance:	3m
Detector:	Quasi-Peak

TEST PARAMETERS

Frequency	Antenna Position	EUT Orientation	Meter Reading	Correction Factor	Corrected Reading	Limit
MHz	(H/V)– Height(m)	Degrees	dBuV	dB	dBuV/m	dBuV/m
30.00	-	-	-	-	-	40
|	-	-	-	-	-	|
35.00*	H-1m	180.0	12.07	13.23	25.30	|
110.00*	H-1m	180.0	7.82	14.78	22.60	|
195.00*	H-1m	180.0	8.76	19.75	28.50	|
205.00*	H-1m	180.0	3.32	18.38	21.70	|
|	-	-	-	-	-	|
230.00	-	-	-	-	-	40
230.00	-	-	-	-	-	47
|	-	-	-	-	-	|
600.00*	H-1m	180.0	8.09	23.41	31.50	|
995.00*	H-1m	180.0	8.41	30.59	39.00	|
|	-	-	-	-	-	|
1000.00	-	-	-	-	-	47

No EUT emissions were observed at the specified test distance throughout the given frequency spectrum. * This emission is not from the EUT. It is a measurement of minimum measurement system sensitivity (Noise Floor).

6.3 IEC 61000-3-2, Class A, Power Frequency Harmonics, 100 Hz to 2 kHz

6.3.1 Normative Reference
IEC 61000-3-2 Edition 3.2: 2005, +A1: 2008, +A2: 2009

6.3.2 Purpose
The purpose of this test method was to determine the magnitude of harmonic components of the AC input current of the EUT over the frequency range of 100 Hz to 2 kHz, the 40th harmonic.

6.3.3 Test Limits
The limits for Class A equipment shown in Table 11 were used to determine compliance of the EUT to the requirements of IEC 61000-3-2.

Table 11 - Power Frequency Harmonics, Test Limits

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 ≤ 39	0.15 * (15/n)
Even Harmonics	
2	1.08
4	0.43
6	0.30
8 ≤ n ≤ 40	0.23 * (8/n)

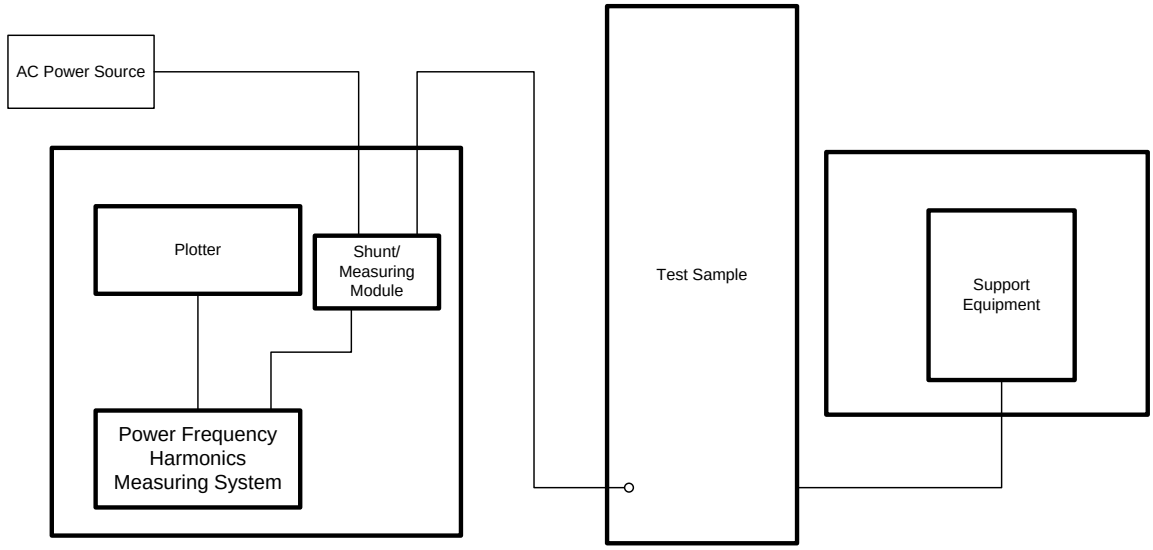
6.3.4 Power Port Tested
The following AC power port of the EUT Host was tested in order to demonstrate compliance:

- 230 VAC, 50 Hz

6.3.5 Test Setup

The EUT and associated cabling, configured as detailed in Paragraph 5.0 herein, was placed in its normal orientation. The AC power leads of the EUT were routed through the shunt / measuring module of the power frequency analyzer. This configuration was based upon the test setup shown in Figure 4.

Figure 4 - Power Frequency Harmonics, Test Setup



6.3.6 Test Equipment

The details of the test equipment utilized during the performance of this test method are shown below:

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
4990	ROHDE & SCHWARZ	GENERATOR, AUDIO	1 Hz - 1.3 MHz	SPN 336.3019.32	2/25/2021	2/28/2022
5048	COMBINOVA	ANALYZER, POWER		300	10/21/2021	10/31/2022
7010	ELGAR	POWER SOURCE, AC	0 - 400 VAC, 45 Hz - 3 KHz	3001	Calibrate Before Use	

6.3.7 Test Procedure

With the test instrumentation and EUT configured as stated above, the following steps were performed on each AC Input of the EUT:

1. The power frequency analyzer was configured to acquire magnitudes of the harmonic components of the AC input current from 100 Hz to 2 kHz.
2. The EUT was powered on and the operating mode was varied to determine the mode which produced maximum harmonic emissions with respect to the limit.
3. The value of AC input power and the magnitude of harmonic emissions were recorded.

6.3.8 Test Results

The EUT complied with the requirements for this method. No harmonic emissions were observed which exceeded the limits for Class A equipment.

See the following photographs and test data for a full presentation of the test setup and results obtained.

Test Photographs
Power Frequency Harmonics

Test Photographs
Power Frequency Harmonics

Test Setup

IEC 61000-3-2, Harmonic Current Emissions
Test Data

EMISSIONS TEST DATA SHEET	
Test Specification:	EN 61326-1; Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements, Part 1: General Requirements
Method:	IEC 61000-3-2, Harmonic Current Emissions
Job Number/Customer:	R-17753Y-1 / UE Systems
Test Sample:	850S Ultrasonic Sensor
Model Number:	UltraTrak 850S
Part Number:	N/A
Serial Number:	N/A
Operating Mode:	Sending sensor current reading to OnTrak system, support laptop displaying average sensor data at a 5 second rate.
Technician:	M. Seamans
Date(s):	December 21st, 2021
Power Port Tested:	230 VAC 50 Hz
Temperature:	19.7 ºC
Relative Humidity:	28.3 %

COMBINOVA ANALYZER 300

Current Harmonics

Setup: DEFAULT_H Gen setting: 1(1) U : 232.04 V fu: 49.999 Hz
Live Analysed periods: 40 I : 113.7 mA P: 7.4 W
Module: M1 Limit: Class A (IEC1000) I1: 80.8 mA
Note:
THD=98.85 % (PF=0.281) PASSED

Next measure | Change to bar graph | Relative current | Write to disk

No	A	Lim A	No	A	Lim A	No	A	Lim A
1	0.081		15	0.022	0.150	29	0.006	0.078
2	0.000	1.080	16	0.000	0.115	30	0.000	0.061
3	0.030	2.300	17	0.019	0.132	31	0.004	0.073
4	0.000	0.430	18	0.000	0.102	32	0.000	0.058
5	0.030	1.140	19	0.017	0.118	33	0.003	0.068
6	0.000	0.300	20	0.000	0.092	34	0.000	0.054
7	0.029	0.770	21	0.015	0.107	35	0.002	0.064
8	0.000	0.230	22	0.000	0.084	36	0.000	0.051
9	0.027	0.400	23	0.013	0.098	37	0.001	0.061
10	0.000	0.184	24	0.000	0.077	38	0.000	0.048
11	0.026	0.330	25	0.010	0.090	39	0.001	0.058
12	0.000	0.153	26	0.000	0.071	40	0.000	0.046
13	0.024	0.210	27	0.008	0.083			
14	0.000	0.131	28	0.000	0.066			

Current range: 1 Ap

Appl: DEFAULT (1212_00)

EUT meets specified limit for Class A equipment

6.4 IEC 61000-3-3, Voltage Fluctuation and Flicker

6.4.1 Normative Reference
IEC 61000-3-3 Edition 2.0: 2008

6.4.2 Purpose
The purpose of this test method was to determine the voltage changes produced by the equipment under test.

6.4.3 Test Limits
The limits shown below were used to determine compliance of the EUT to the requirements of IEC 61000-3-3.

- The value of P_{st} shall not be greater than 1.0;
- The value of P_{lt} shall not be 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, d_c, shall not exceed 3.3%;
- The maximum relative voltage change d_{max} shall not exceed;
  - 4% without additional conditions;
  - 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
  - 7% for equipment which is
    - Attended whilst in use (for example: hair dryers, vacuum cleaners, kitchen equipment such as mixers, garden equipment such as lawn 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

P_{st} and P_{lt} requirements were not applied to voltage changes caused by manual switching.

The limits were not applied to voltage changes associated with emergency switching or emergency interruptions.

6.4.4 Power Port Tested

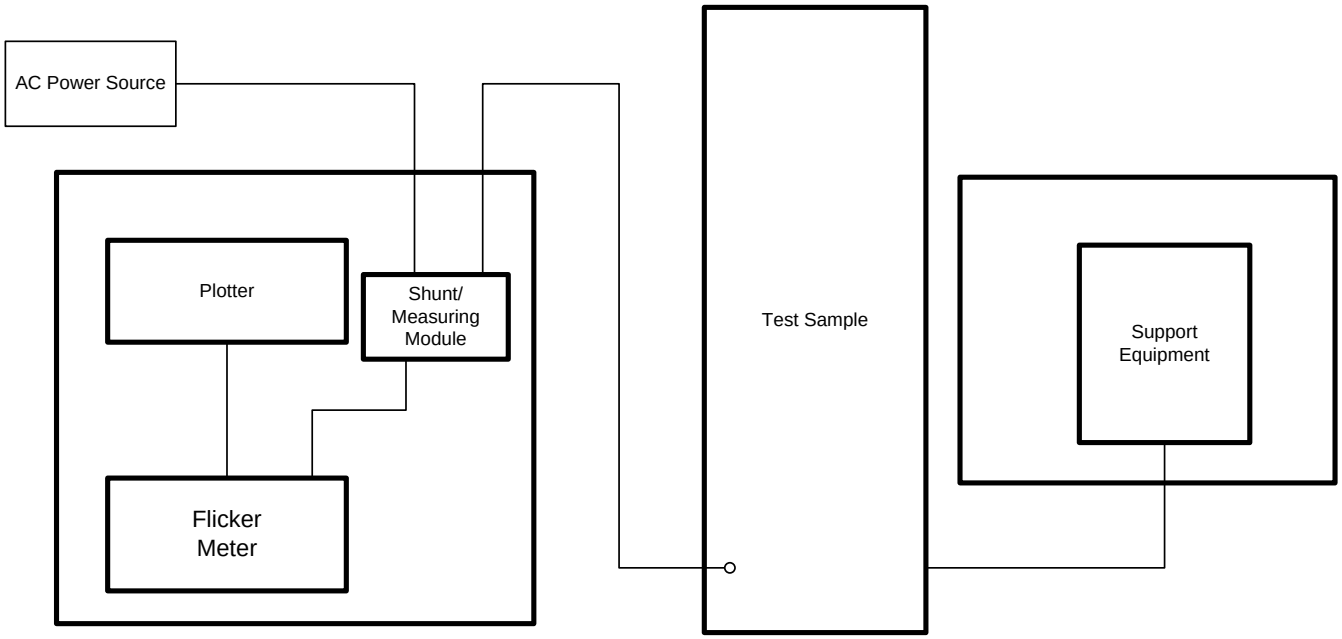
The following AC power port of the EUT Host was tested in order to demonstrate compliance:

- 230 VAC, 50 Hz

6.4.5 Test Setup

The test instrumentation and EUT were configured as shown in the attached photographs and detailed in Paragraph 5.0 herein. This configuration was based upon the Test Setup Diagram shown in Figure 5 and the requirements of IEC 61000-3-3. The AC power leads of the EUT were routed through the shunt / measuring module of the flickermeter.

Figure 5 - Voltage Fluctuation and Flicker, Test Setup



6.4.6 Test Equipment

The details of the test equipment utilized during the performance of this test method are shown below:

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
4990	ROHDE & SCHWARZ	GENERATOR, AUDIO	1 Hz - 1.3 MHz	SPN 336.3019.32	2/25/2021	2/28/2022
5048	COMBINOVA	ANALYZER, POWER		300	10/21/2021	10/31/2022
7010	ELGAR	POWER SOURCE, AC	0 - 400 VAC, 45 Hz - 3 KHz	3001	Calibrate Before Use	

6.4.7 Test Procedure

With the test instrumentation and EUT configured as stated above, the following steps were performed on each AC Input of the EUT:

1. The mode of operation of the EUT was configured such that one complete cycle of operation was performed during the observation period.
2. The flickermeter was configured to measure short term flicker for an observation period of 10 minutes.
3. The flickermeter was configured to measure long term flicker for an observation period of two (2) hours.
4. At the end of the observation period the values of P_{st}, P_{lt}, d(t), d_c and d_{max} were recorded.

6.4.8 Test Results

The EUT complied with the requirements specified for this method. No voltage fluctuation or flicker values were observed in excess of the limit specified in IEC 61000-3-3.

See the following photographs and test data for a full presentation of the test setup and results obtained.

Test Photographs
Voltage Fluctuation and Flicker

Test Photographs
Voltage Fluctuation and Flicker

Test Setup

IEC 61000-3-3, Voltage Fluctuations & Flicker
Test Data

EMISSIONS TEST DATA SHEET	
Test Specification:	EN 61326-1; Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements, Part 1: General Requirements
Method:	IEC 61000-3-3 Voltage Fluctuations & Flicker
Job Number/Customer:	R-17753Y-1 / UE Systems
Test Sample:	850S Ultrasonic Sensor
Model Number:	UltraTrak 850S
Part Number:	N/A
Serial Number:	N/A
Operating Mode:	Sending sensor current reading to OnTrak system, support laptop displaying average sensor data at a 5 second rate.
Technician:	M. Seamans
Date(s):	December 21st, 2021
Power Port Tested:	230 VAC 50 Hz
Temperature:	19.7 ºC
Relative Humidity:	28.3 %

COMBINOVA ANALYZER 300

Extreme Flicker-I M1

Note:
Numerical Reference Impedance
U: 232.0 V I: 114.0 mA f: 49.998 Hz PF: 0.282

Next measure

Extreme time graph

Change to histogram

Write to disk

Select module

EVALUATION:----------

Type of observation period		Short	Long		Limit
Observation time	Tp :	10	120	min	
Maximum relative voltage change	dmax:		0.00	%	4
Max rel steady state voltage change	dc :		0.00	%	3
Duration of d(t) > 3 %	t :		0.00	s	0.2
Short term flicker severity	Pst :		0.00		1.00
Long term flicker severity	Plt :	---	0.00		0.65

Based on 12 (12) short term cycles

PASSED

Measurement completed

Appl: DEFAULT (1311_00)

EUT passes short- and long-term flicker requirements as well as dmax and dc.

6.5 IEC 61000-4-2, Electrostatic Discharge

6.5.1 Normative Reference
IEC 61000-4-2: 2008

6.5.2 Purpose
The purpose of this test method was to determine the ability of the EUT to withstand electrostatic discharges applied directly to the EUT and those applied to objects adjacent to the EUT.

6.5.3 Test Parameters
The critical parameters of the electrostatic discharge generator and the applied voltage waveform are shown below:

Air:

Discharge Voltage:	2.0 kV, 4.0 kV, 8.0 kV
Discharge Polarity:	Positive/Negative
Discharge Rate:	1 PPS
Rise Time:	0.7 to 1 nanosecond
Pulse Duration:	20 nanoseconds
Storage Capacitor:	150 picofarads
Discharge Resistor:	330 Ohms

Contact:

Discharge Voltage:	2.0 kV, 4.0 kV
Discharge Polarity:	Positive/Negative
Discharge Rate:	1 PPS
Rise Time:	0.7 to 1 nanosecond
Pulse Duration:	20 nanoseconds
Storage Capacitor:	150 picofarads
Discharge Resistor:	330 Ohms

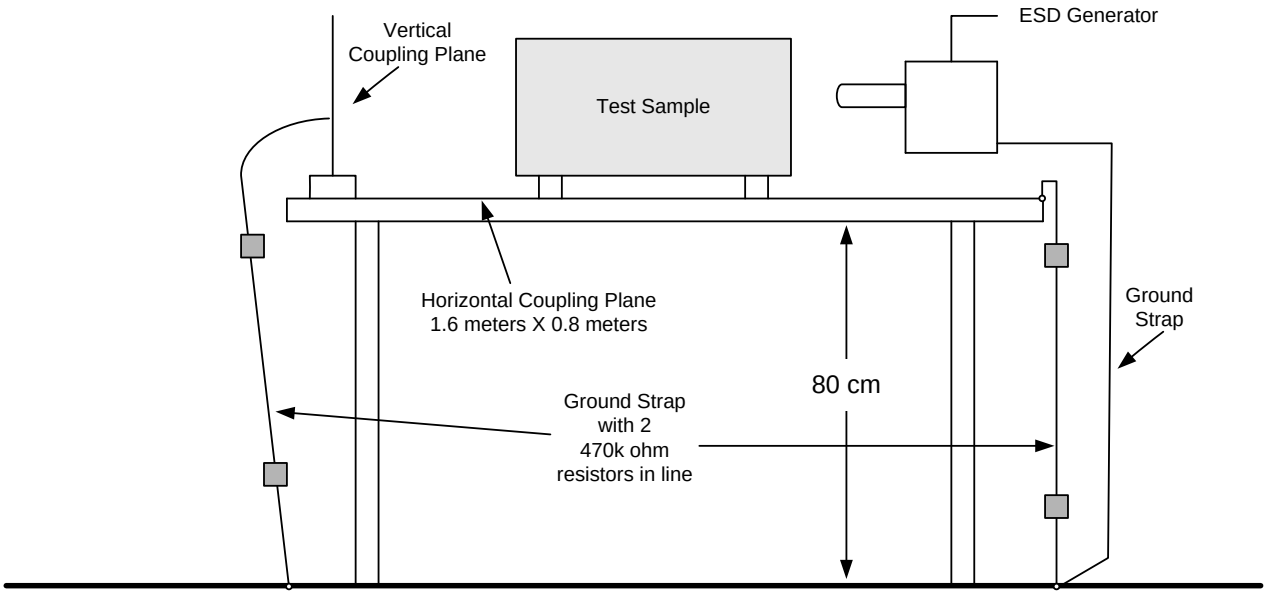
6.5.4 Test Setup

A horizontal coupling plane measuring 1.6 x 0.8 m was placed on an 80 cm high non-metallic test stand, above the ground reference plane. The EUT and associated cabling, configured as detailed in Paragraph 5.0 herein, were placed on 0.5 mm insulating supports above the horizontal coupling plane. The EUT was positioned such that it was located a minimum of 0.1 m from all sides of the horizontal coupling plane.

The minimum size of the ground reference plane was 1.0 m^2 and projected beyond the EUT by at least 0.5 m on each side. The ground reference plane was connected to the protective grounding system. A distance of 1.0 meter minimum was maintained between the equipment under test and the walls of the laboratory and any other metallic structure. The EUT was connected to the grounding system in accordance with its installation specifications. The position of the power and signal cables was representative of installation practice.

The discharge return cable of the ESD generator was connected to the ground reference plane. The total length of the cable was 2.0 m. The vertical and horizontal coupling planes were connected to the ground reference plane via cables with 470k Ohm resistors located at each end. The vertical coupling plane was positioned parallel to at a distance of 0.1 m from the EUT.

Figure 6 - Electrostatic Discharge, Test Setup



NOTE: Test sample is placed on a 0.5mm insulating mat above the horizontal ground plane

6.5.5 Test Point Determination

The ESD generator was set to the continuous discharge mode. With the EUT configured as stated above, all surfaces of the equipment were probed at a discharge rate of approximately 10 PPS in order to determine areas on the equipment which were susceptible. After this probing and/or an engineering evaluation, the test points specified on the following data sheets were selected.

6.5.6 Test Equipment

The details of the test equipment utilized during the performance of this test method are shown below:

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
461	SCHAFFNER	ESD SIMULATOR	150 pF / 330 Ohm	NSG 435	11/1/2021	11/30/2022
5049A	FLUKE	MULTIMETER, DIGITAL	True RMS Multimeter	111	4/19/2021	4/30/2022
5178	FLUKE	PROBE, HIGH VOLTAGE	1KV - 40 KV DC, 28 KV RMS AC	80K-40	11/4/2021	11/30/2022
5208	OMEGA	HYGROMETER	-20 to 70 deg. C, 0-99% RH	OM-73	1/18/2021	1/31/2022

6.5.7 Test Procedure

With the EUT and test instrumentation configured as stated above, the following steps were performed:

1. The ESD generator was configured to apply 2.0 kV contact discharges.
2. 10 positive discharges were then applied to each test point indicated in the contact discharge test points indicated on the following data sheet at a repetition rate of 1.0 PPS.
3. The ESD generator was configured to apply negative discharges and Step 2 was repeated.
4. Steps 1 through 3 were repeated for each remaining contact discharge level specified.
5. The ESD generator was then configured to apply 2.0 kV air discharges.
6. 10 positive discharges were then applied to each test point indicated in the air discharge test points specified on the following data sheet at a repetition rate of 1.0 PPS.
7. The ESD generator was configured to apply negative discharges and Step 5 was repeated.
8. Steps 5 through 7 were repeated for each remaining air discharge level specified.

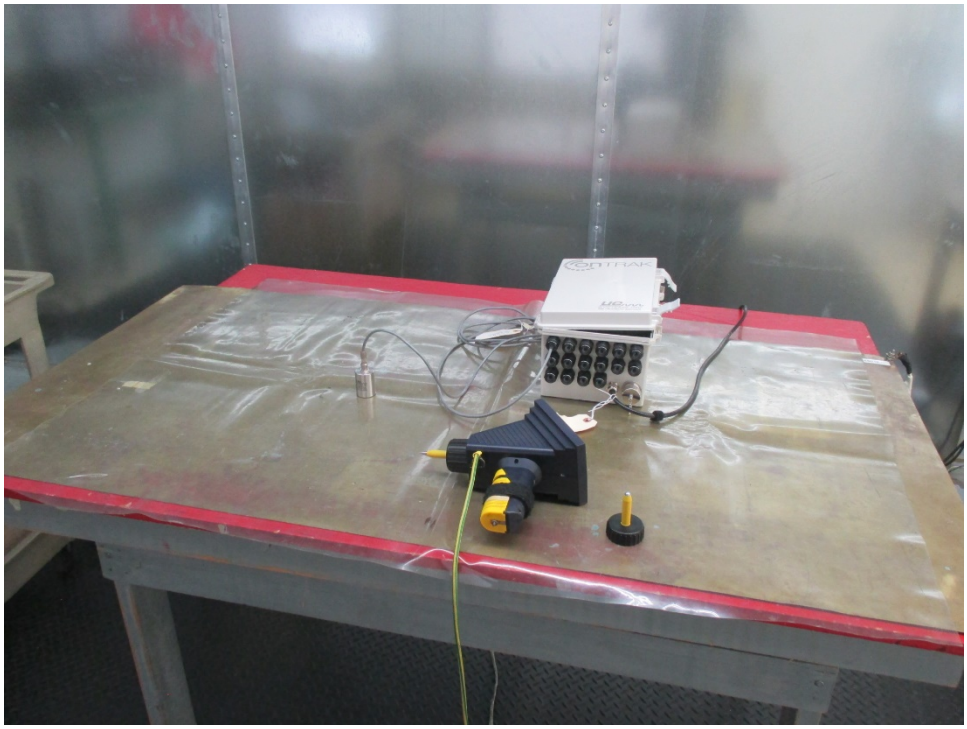
6.5.8 Test Results

The EUT complied with the requirements specified for this method. The test sample did not exhibit any malfunction or degradation of performance beyond that specified in Paragraph 5.6 herein when subjected to the electrostatic discharges specified above.

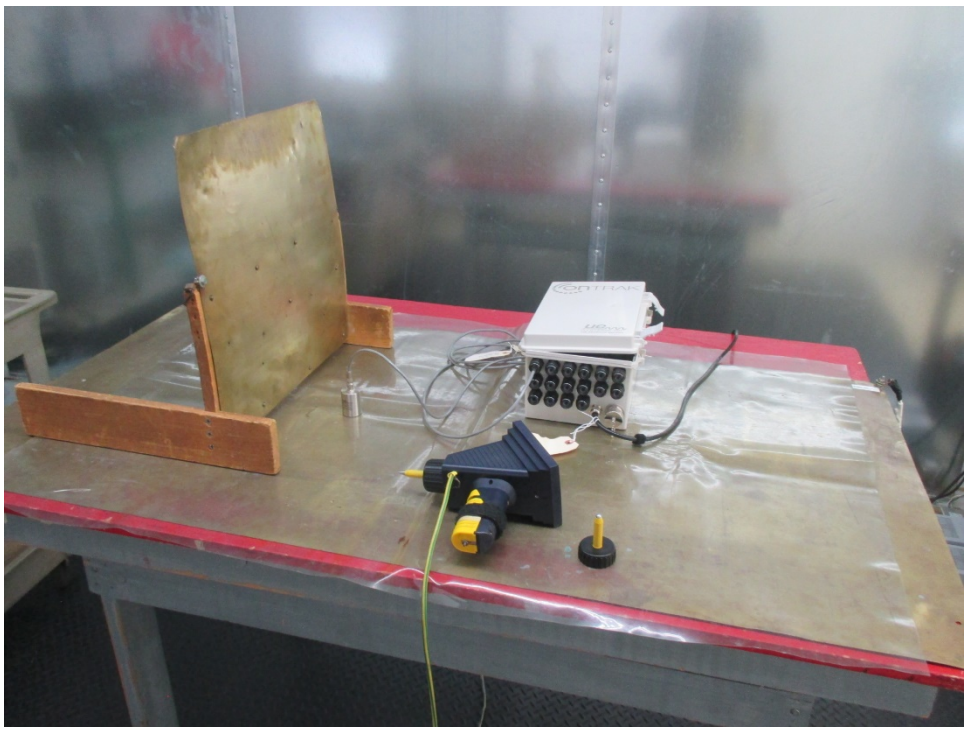
See the following photographs and test data for a full presentation of the test setup and results obtained.

Test Photographs
Electrostatic Discharge

Test Photographs
Electrostatic Discharge



General Setup



Vertical Coupling Plane

IEC 61000-4-2, Electrostatic Discharge
Test Data

IMMUNITY TEST DATA SHEET	
Test Specification:	EN61326-1; Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements, Part 1: General Requirements
Method:	IEC 61000-4-2, Electrostatic Discharge, Contact
Job Number/Customer:	R-17753Y-1 / UE Systems
Test Sample:	850S Ultrasonic Sensor
Model Number:	UltraTrak 850S
Part Number:	N/A
Serial Number:	N/A
Operating Mode:	Sending sensor data to On Trak system, support laptop displaying sensor data in lubrication mode.
Technician:	M. Seamans
Date(s):	January 5th, 2022
Temperature:	21.0 ºC
Relative Humidity:	33.6 %

TEST PARAMETERS

The EUT was subjected to ten positive and ten negative Direct and Indirect Contact Discharges. Discharges were applied at the levels and rate to each point at a rate of 1.0 PPS as detailed below:

Test Point	Level kV
IO Connector	±2.0 / ±4.0
EUT: Top	|
EUT: Side	|
EUT: Bottom	±2.0 / ±4.0
Horizontal Coupling Plane:	±2.0 / ±4.0
Front	|
Left	|
Right	|
Rear	±2.0 / ±4.0
Vertical Coupling Plane:	±2.0 / ±4.0
Front	|
Left	|
Right	|
Rear	±2.0 / ±4.0

The test sample did not exhibit any malfunction, degradation of performance or deviation from specified indication beyond the tolerances defined by Performance Criteria B.

IMMUNITY TEST DATA SHEET	
Test Specification:	EN61326-1; Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements, Part 1: General Requirements
Method:	IEC 61000-4-2, Electrostatic Discharge, Air
Job Number/Customer:	R-17753Y-1 / UE Systems
Test Sample:	850S Ultrasonic Sensor
Model Number:	UltraTrak 850S
Part Number:	N/A
Serial Number:	N/A
Operating Mode:	Sending sensor data to On Trak system, support laptop displaying sensor data in lubrication mode.
Technician:	M. Seamans
Date(s):	January 5th, 2022
Temperature:	21.0 ºC
Relative Humidity:	33.6 %

TEST PARAMETERS

The EUT was subjected to ten positive and ten negative Direct Air Discharges. Discharges were applied at the levels and rate to each point at a rate of 1.0 PPS as detailed below:

Test Point	Level kV
No Applicable test points	N/A

The test sample did not exhibit any malfunction, degradation of performance or deviation from specified indication beyond the tolerances defined by Performance Criteria B.

6.6 IEC 61000-4-3, Radiated Immunity, 80 MHz to 1 GHz, 1.4 GHz to 2.7 GHz

6.6.1 Normative Reference
IEC 61000-4-3: 2008

6.6.2 Purpose
The purpose of this test method was to determine if the EUT was so constructed as to have an adequate level of intrinsic immunity to radiated electromagnetic fields in the frequency range of 80 to 1000 MHz and 1.4 to 2.7 GHz, enabling the EUT to operate as intended.

6.6.3 Test Parameters
The critical parameters of the applied electromagnetic field are as shown in Table 12 below:

Table 12 - Radiated Immunity, Test Parameters

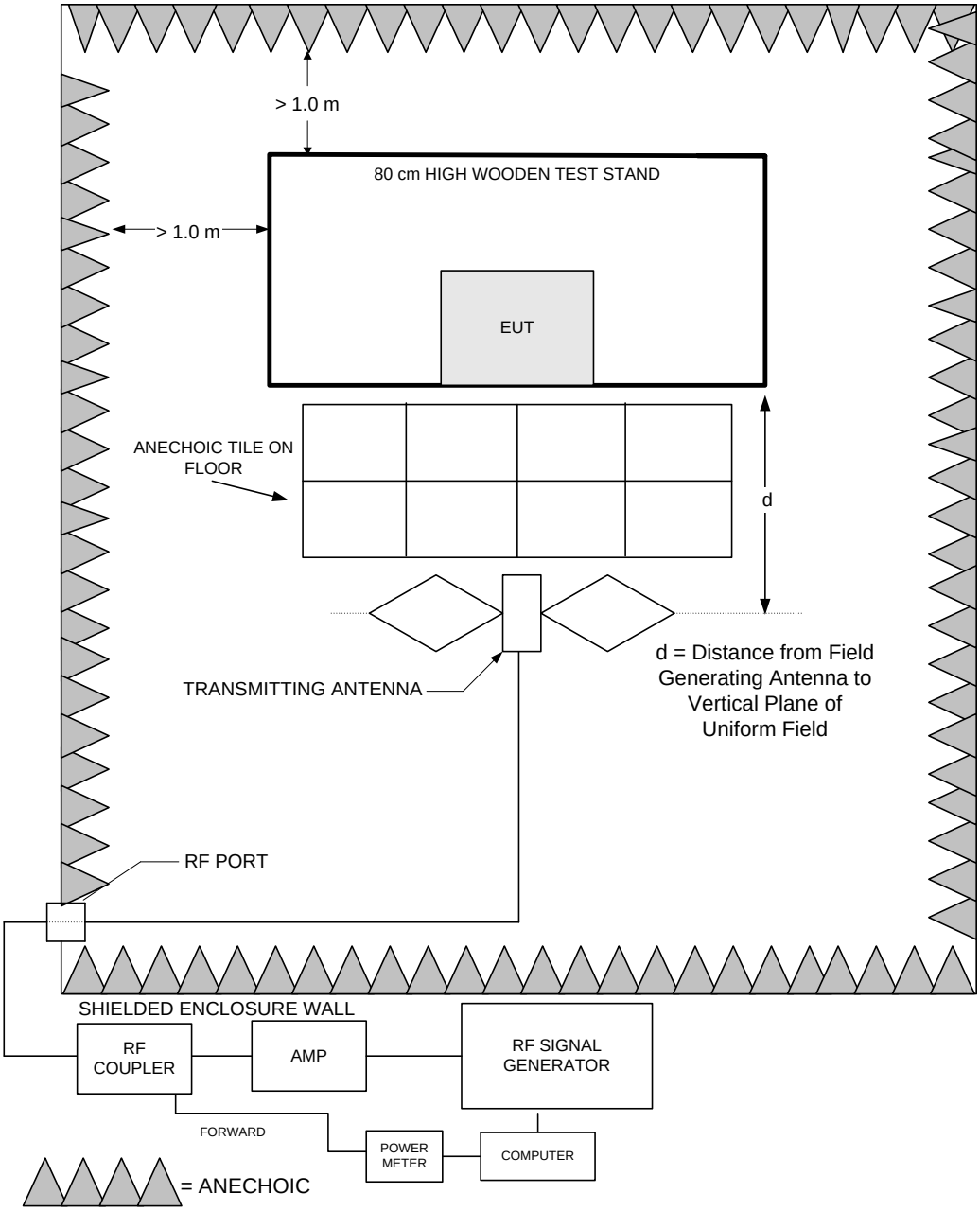
Frequency Range	80 to 1000 MHz	1.4 to 2.0 GHz	2.0 to 2.7 GHz
Field Strength	3 V/m	3 V/m	1 V/m
Windows Tested	N/A	1	
Modulation	1 kHz, 80%, AM		
Dwell Time	1.0 second		
Polarization of Applied Field	Horizontal and Vertical		

6.6.4 Test Setup
The EUT and associated cabling, configured as detailed in Paragraph 5.0 herein, was placed on an 80 cm high non-metallic test stand within the semi-anechoic test chamber. The test enclosure ceiling, walls and portions of the floor were treated with a mixture of ferrite tile and carbon impregnated foam absorber. The test stand was positioned such that the front edge of the stand was at, and parallel to, the vertical plane which defined the uniform field area. Excess lengths of cables interconnecting units of the EUT, were bundled low inductively in the approximate center of the cable to form a bundle 30 to 40 cm in length. Unterminated cables and those exiting the test area were routed horizontally along the front edge of the test stand, then vertically to the enclosure floor.

The field generating antenna was positioned in the same location as during calibration. An RF signal generator was connected to the input of the RF power amplifier. The output of the RF power amplifier was connected to an RF coupler which in turn was connected to the test antenna. A power meter was connected to the forward power port of the RF coupler.

The RF signal generator and power meter were connected to a control computer via a GPIB port. The control computer was running software which adjusted the forward power at each frequency step necessary to obtain the specified field strength. The necessary forward power was calculated based upon that recorded during field uniformity calibration, which was performed prior to testing as specified in Paragraph 6.2.2 of IEC 61000-4-3.

Figure 7 - Radiated Immunity, Test Setup



6.6.5 Test Equipment

The details of the test equipment utilized during the performance of this test method are shown below:

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
4003A	ETS / EMCO	ANTENNA, DOUBLE RIDGED GUIDE	1 - 18 GHz	3105	Inspect Before Use	
4025	UNIVERSAL SHIELDING	SHIELDED ENCLOSURE, TEST CHAMBER	100dB, 14 KHz - 10	24X16X12	No Calibration Required	
4025F	RETLIF	SHIELDED ENCLOSURE, FIELD UNIFORMITY	80 MHz - 6 GHz	ANECHOIC	5/11/2021	5/31/2022
4202	ETS / EMCO	ANTENNA, BICONILOG	26 MHz - 2.7 GHz	3142	Inspect Before Use	
4994	AR	AMPLIFIER, RF POWER	80 - 1000 MHz, 250W	250W1000	9/27/2021	9/30/2022
5058	BOONTON ELECTRONICS	METER, RF POWER	10 KHz - 100 GHz	4232A	9/20/2021	9/30/2022
5059	BOONTON ELECTRONICS	SENSOR, RF POWER	10 KHz - 8 GHz	51011-EMC	8/24/2021	8/31/2022
5107	AGILENT / HP	GENERATOR, SIGNAL	100 kHz - 20 GHz	N5183A	1/27/2021	1/31/2022
5151	DELL	COMPUTER, CONTROL	N/A	OPTIPLEX 755	No Calibration Required	
5176	WERLATONE	DIRECTIONAL COUPLER, COAXIAL	80 MHz - 1 GHz, 40dB, 500W	C5982-10	5/26/2021	5/31/2022
5239	MINI-CIRCUITS	DIRECTIONAL COUPLER, COAXIAL	900 MHz - 9 GHz	ZGBDC35-93HP+	5/26/2021	5/31/2022
5240	PASTERNACK	CABLE, COAXIAL	DC - 18 GHz	PE33117	5/25/2021	5/31/2022
5252	DIGI-SENSE	HYGROMETER	0 - 50 deg. c, 10 - 90 % RH	20250-30	10/18/2021	10/31/2022
837	AR	AMPLIFIER, RF POWER	0.8 GHz - 4.2 GHz, 25W	25SIG4A	9/30/2021	9/30/2022
S1045	RETLIF	TILE3, COMMERCIAL, RADIATED IMMUNITY, NH-	80 MHz - 1 GHz|1 kHz AM|Signal Generator: MXG	IEC 61000-4-3	No Calibration Required	
S1057	RETLIF	TILE3, COMMERCIAL, RADIATED IMMUNITY, NH-	1-6 GHz|Subranged|Signal Generator: MXG	IEC 61000-4-3	No Calibration Required	

6.6.6 Test Procedure

With the EUT configured as described above, the following steps were performed:

1. The field generating antenna was horizontally polarized with the front of the EUT facing the antenna.
2. The software on the control computer was initiated, which performed the following steps:
    a. The software calculated the forward power required at each frequency step to attain the specified field level.
    b. The output frequency of the signal generator was adjusted to the start frequency of the test.
    c. The output level of the generator was increased until the required power was measured at the forward port of the RF coupler.
    d. The specified modulation was enabled.
    e. This condition was held for the dwell time specified in the test parameters.
    f. The frequency was incremented by 1%.
    g. Steps c through f were repeated until the EUT was subjected to the specified field strength over the entire frequency range of test.
3. At each frequency step, the EUT was monitored for degradation or malfunction.
4. The field generating antenna was vertically polarized and Steps 2 and 3 were repeated.
5. Steps 2 through 4 were repeated with each of the rear, left and right sides of the test sample facing the field generating antenna.
6. For frequencies greater than 1 GHz, Steps 1 through 5 were repeated for each applicable 1.5 m x 0.5 m window occupied by the EUT.

6.6.7 Sample Calculations

Shown below is a sample showing calculations used to determine the forward power necessary to obtain the required test field strength in V/m.

$P_T = P_C – R$

Where:
P_T = Test Forward Power in dBm
P_C = Calibration Forward Power at E_C in dBm
R = 20 LOG (E_C / E_T)
E_C = Calibration Field Strength in V/m
E_T = Required Test Field Strength in V/m

Example:
E_C = 18.0 V/m
E_T = 10.0 V/m
P_C = 31.5 dBm

P_T = 31.5 – 20 LOG (18.0 / 10.0)
= 31.5 – 20 LOG (1.8)
= 31.5 – 20 (.255)
= 31.5 – 5.1
= 26.4 dBm

6.6.8 Test Results

The EUT complied with the requirements specified for this method. The test sample did not exhibit any malfunction or degradation of performance beyond that specified in Paragraph 5.6 herein when subjected to the radiated electromagnetic field specified above.

See the following photographs and test data for a full presentation of the test setup and results obtained.

Test Photographs
Radiated Immunity

Test Photographs
Radiated Immunity

Horizontal Antenna Polarization, 80 MHz to 1 GHz, Side 1

Vertical Antenna Polarization, 80 MHz to 1 GHz, Side 1

Test Photographs
Radiated Immunity

Horizontal Antenna Polarization, 80 MHz to 1 GHz, Side 2

Vertical Antenna Polarization, 80 MHz to 1 GHz, Side 2

Test Photographs
Radiated Immunity

Horizontal Antenna Polarization, 80 MHz to 1 GHz, Side 3

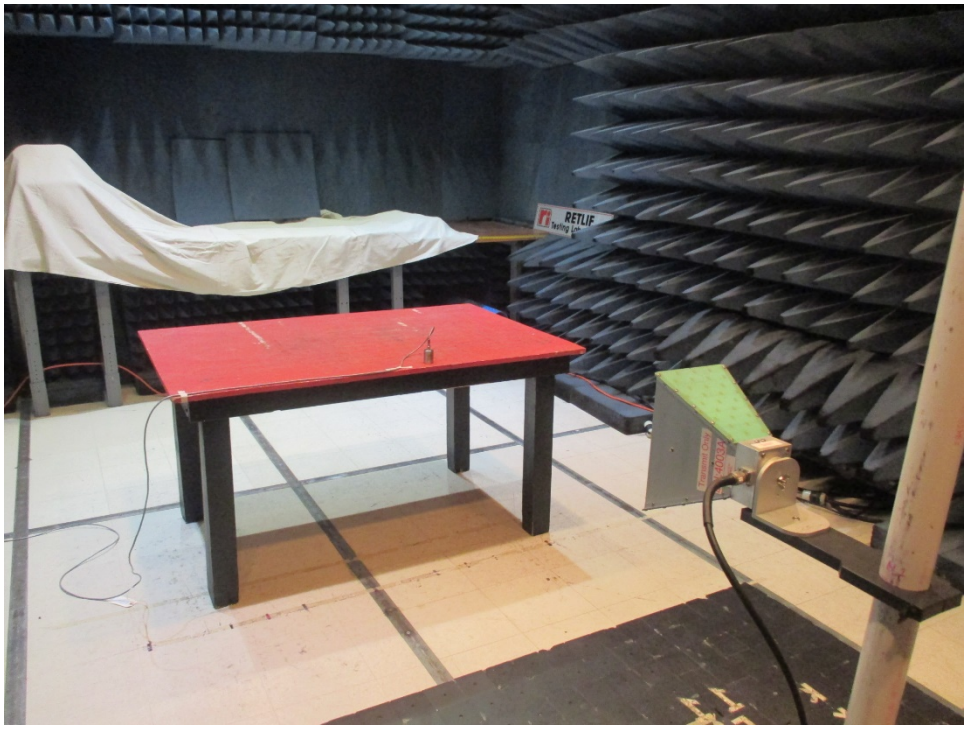
Vertical Antenna Polarization, 80 MHz to 1 GHz, Side 3

Test Photographs
Radiated Immunity

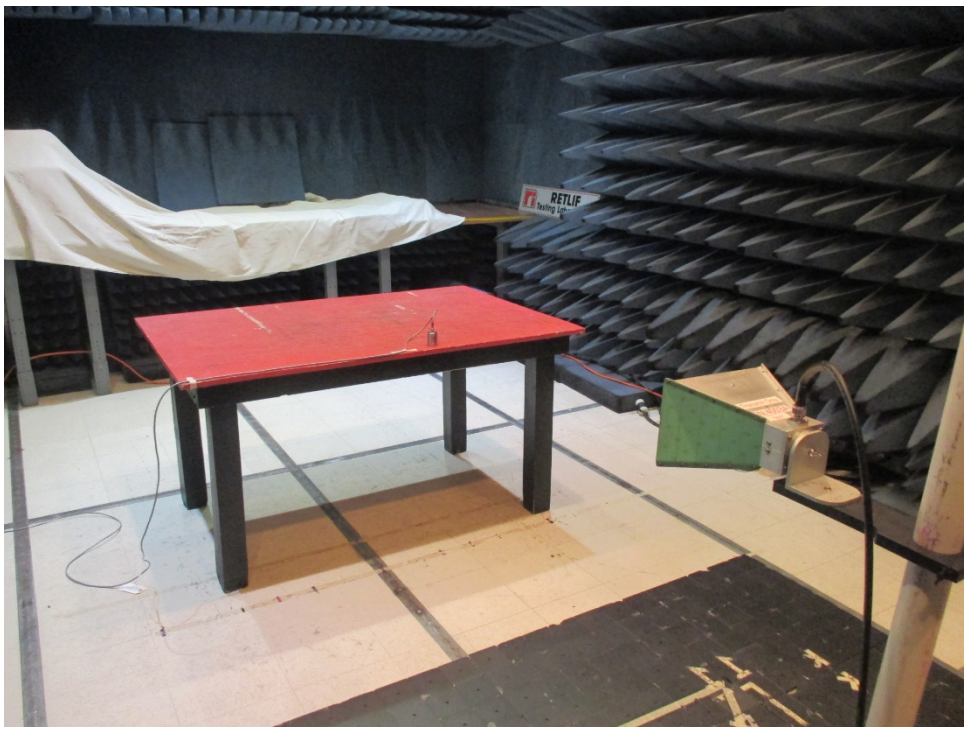
Horizontal Antenna Polarization, 80 MHz to 1 GHz, Side 4

Vertical Antenna Polarization, 80 MHz to 1 GHz, Side 4

Test Photographs
Radiated Immunity

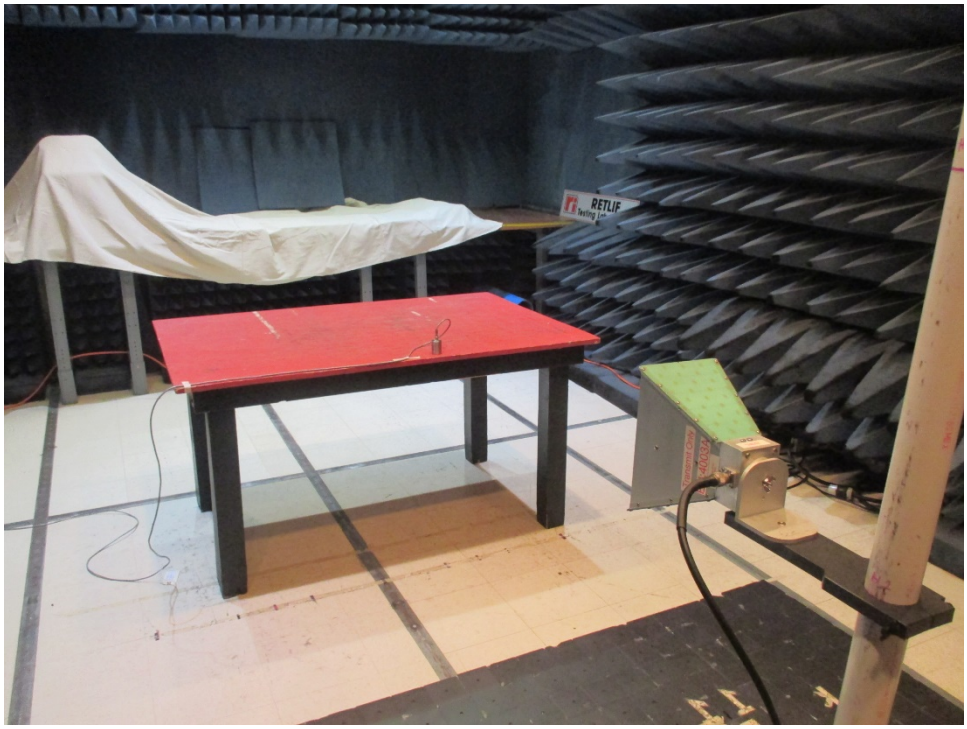


Horizontal Antenna Polarization, > 1 GHz, Side 1

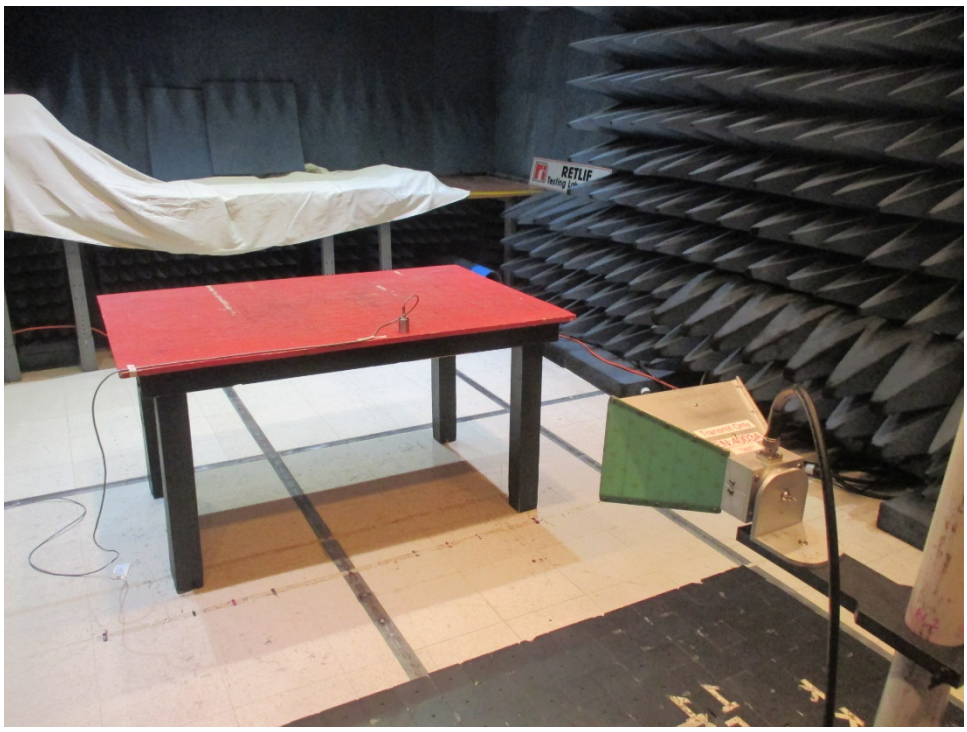


Vertical Antenna Polarization, > 1 GHz, Side 1

Test Photographs
Radiated Immunity

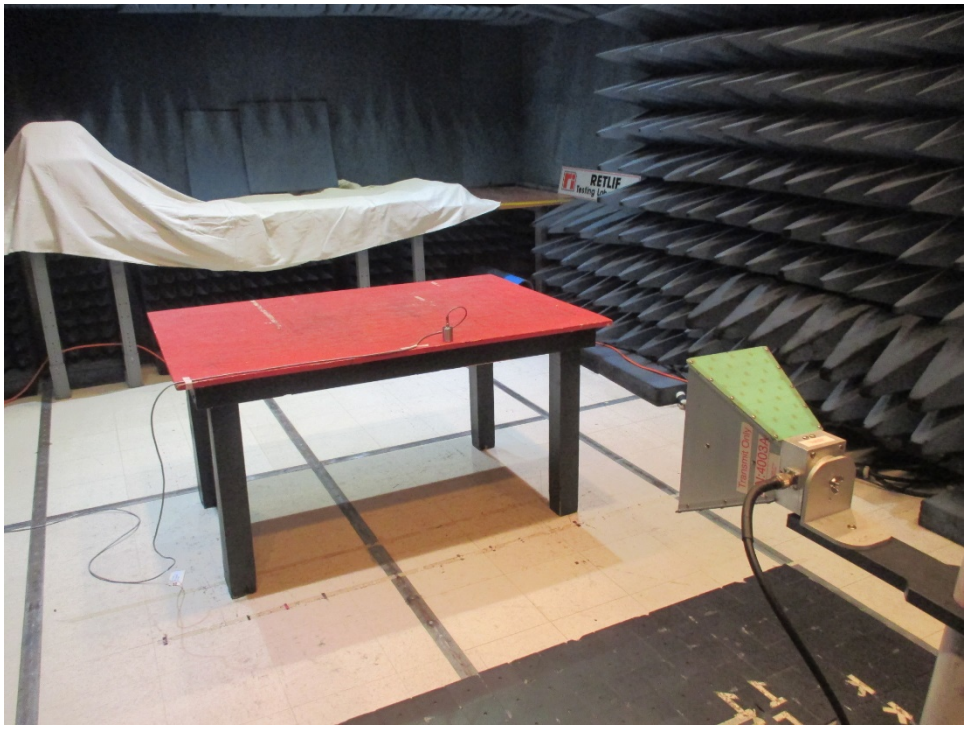


Horizontal Antenna Polarization, > 1 GHz, Side 2

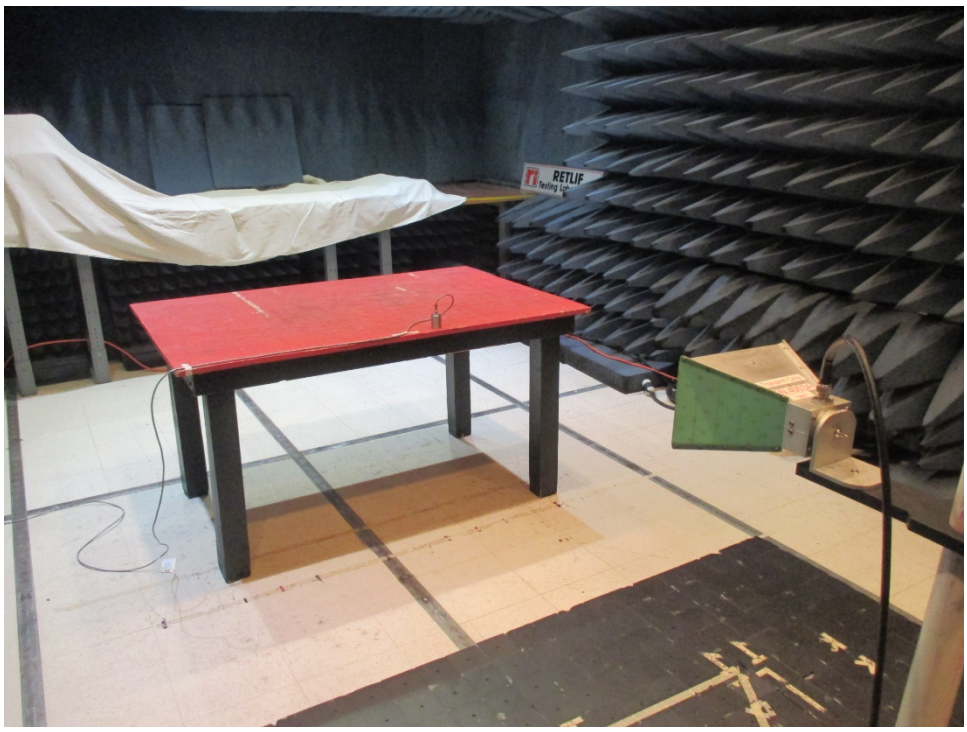


Vertical Antenna Polarization, > 1 GHz, Side 2

Test Photographs
Radiated Immunity

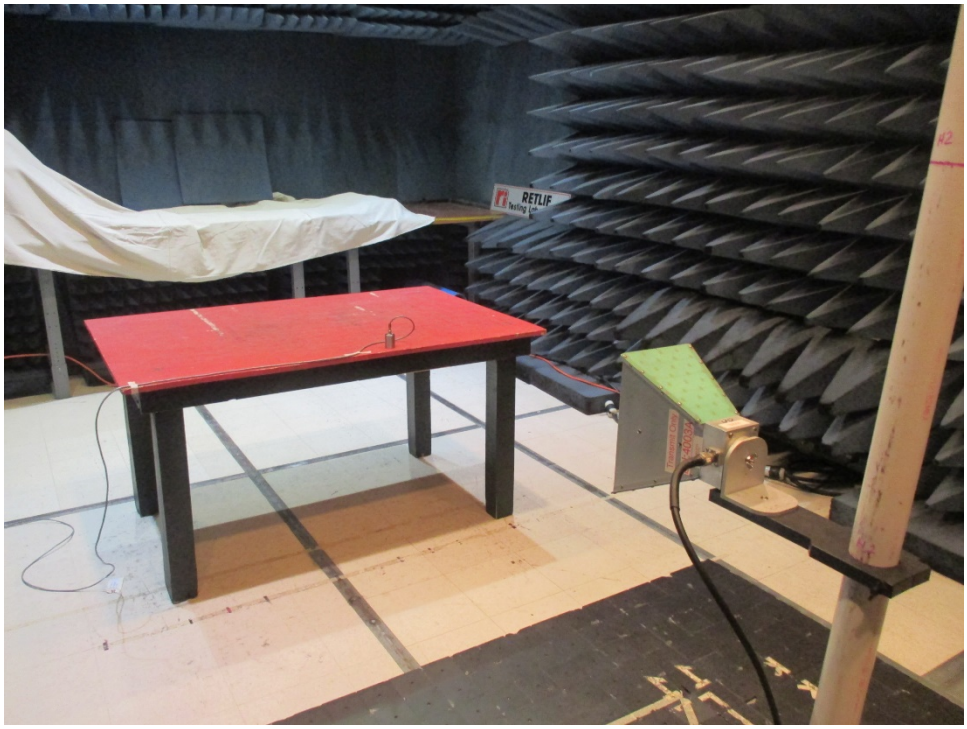


Horizontal Antenna Polarization, > 1 GHz, Side 3

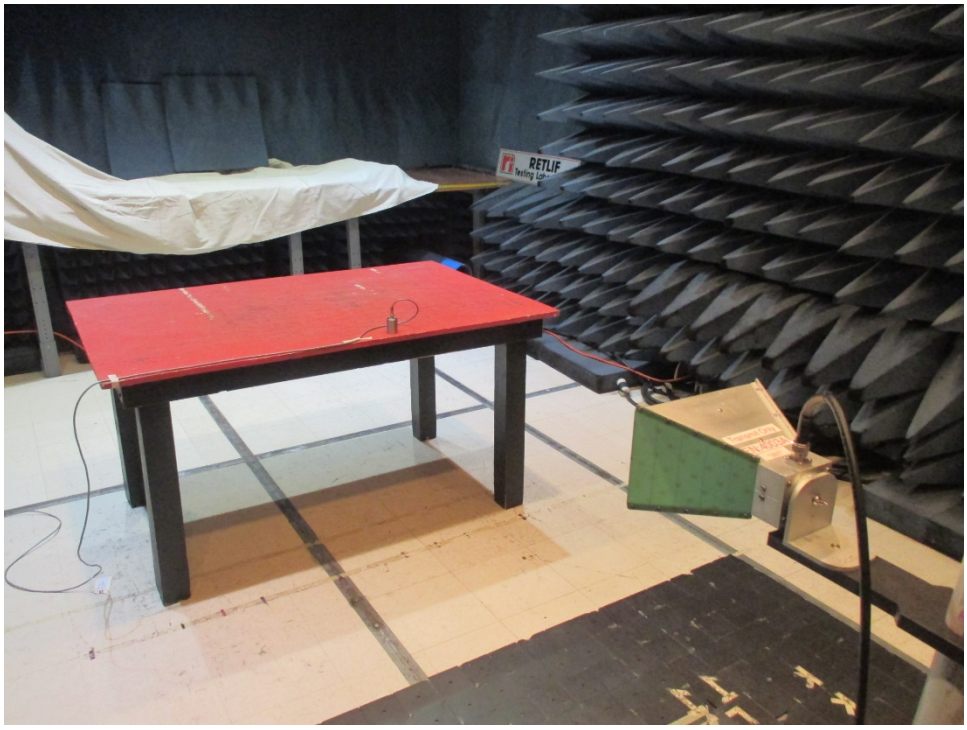


Vertical Antenna Polarization, > 1 GHz, Side 3

Test Photographs
Radiated Immunity



Horizontal Antenna Polarization, > 1 GHz, Side 4



Vertical Antenna Polarization, > 1 GHz, Side 4

IEC 61000-4-3, Radiated Immunity
Test Data

IMMUNITY TEST DATA SHEET

Test Specification:	EN 61326-1; Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements, Part 1: General Requirements	
Method:	IEC 61000-4-3, Radiated Immunity, 80 MHz to 1 GHz, 1.4 to 2.7 GHz	
Job Number/Customer:	R-17753Y-1 / UE Systems	
Test Sample:	850S Ultrasonic Sensor	
Model Number:	UltraTrak 850S	
Part Number:	N/A	
Serial Number:	N/A	
Operating Mode:	Sending sensor data to On Trak system, support laptop displaying sensor data in lubrication mode.	
Technician:	M. Seamans	
Date(s):	January 3rd, 2022	
Temperature:	21.5 ºC	
Relative Humidity:	26.0 %	
Antenna Distance:	Below 1 GHz: 2.2m	Above 1 GHz: 1.5m

TEST PARAMETERS

The entire frequency range indicated below was swept at a 1% step size and 1.0 second dwell at each step. Testing was performed with the generating antenna facing each side of the EUT.

Frequency MHz	Antenna Polarization Horizontal/Vertical	Modulation	Level V/m
80	H/V	80% AM, 1 kHz	3
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1000	|	|	3
1400	|	|	3
|	|	|	|
|	|	|	|
|	|	|	|
|	|	|	|
|	|	|	|
2000	|	|	3
2000	|	|	1
|	|	|	|
|	|	|	|
|	|	|	|
|	|	|	|
2700	H/V	80% AM, 1 kHz	1

The test sample did not exhibit any malfunction, degradation of performance or deviation from specified indication beyond the tolerances defined by Performance Criteria A.

6.7 IEC 61000-4-4, Electrical Fast Transient / Burst, Power Ports

6.7.1 Normative Reference
IEC 61000-4-4: 2004, +Cor2: 2007, +A1: 2010

6.7.2 Purpose
The purpose of this test method was to determine if the EUT was so constructed as to have an adequate level of intrinsic immunity to electrical fast transient bursts applied to input power ports, enabling the EUT to operate as intended.

6.7.3 Test Parameters
The critical parameters of the electrical fast transient/burst generator and the applied waveform are shown below:

Transient Voltage:	0.5 kV, 1.0 kV
Transient Polarity:	Positive and Negative
Repetition Rate:	5 kHz
Rise Time of Pulse:	5 ns ± 30%
Pulse Duration:	50 ns ± 30%
Burst Period:	300 ms ± 20%
Burst Duration:	15 ms ± 20%

6.7.4 Power Port Tested
The following power port of the EUT Host was tested, in the coupling mode shown, in order to demonstrate compliance:

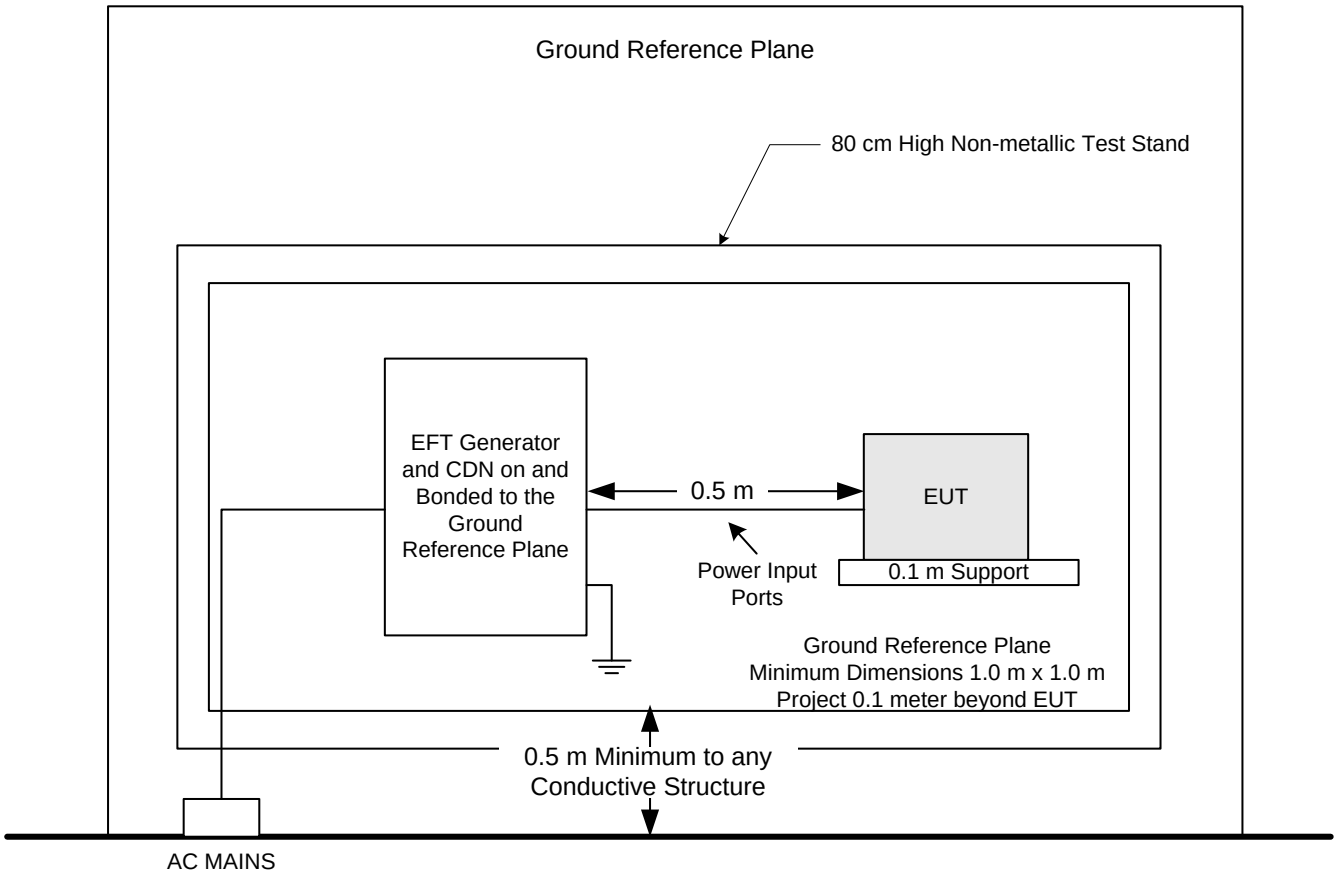
- 230 VAC, 50 Hz
  - Coupling Modes:
    - Hot to Earth Reference
    - Neutral to Earth Reference
    - Ground to Earth Reference
    - All Leads to Earth Reference

6.7.5 Test Setup

The EUT and associated cabling, configured as detailed in Paragraph 5.0 herein, were placed on 0.1 m thick insulating supports above the ground reference plane, which was installed on an 80 cm high non-metallic test stand. The minimum size of the ground reference plane was 1.0 m^2 and projected beyond the EUT by at least 0.1 m on each side. The ground reference plane was connected to the protective grounding system. A distance of 0.5 m minimum was maintained between the equipment under test and the walls of the laboratory and any other metallic structure. The EUT was connected to the grounding system in accordance with its installation specifications. All cables to the EUT were placed on the 0.1 m insulating support above the ground reference plane. The cables not under test were routed as far as possible from the port under test, in order to minimize the coupling between cables.

The test generator including the coupling/decoupling network was placed directly on, and bonded to, the ground reference plane. The length of power leads connecting the EUT to the coupling/decoupling network was 0.5 m.

Figure 8 - Electrical Fast Transient Burst, Power Ports Test Setup



6.7.6 Test Equipment

The details of the test equipment utilized during the performance of this test method are shown below:

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
5104	EMC PARTNER	GENERATOR, SURGE	4KV EFT - SURGE - DIPS	TRANSIENT 2000	7/30/2021	7/31/2022
5208	OMEGA	HYGROMETER	-20 to 70 deg. C, 0-99% RH	OM-73	1/18/2021	1/31/2022

6.7.7 Test Procedure

With the EUT and test instrumentation configured as stated above, the following steps were performed:

1. The transient generator was configured to apply 0.5 kV transients.
2. Positive transients were applied to the input power leads in the coupling modes specified above, for a period of 1 minute for each mode.
3. The EUT was continuously monitored for malfunction or degradation as specified in Paragraph 5.6 herein.
4. The transient generator was configured to apply negative transients and Steps 2 and 3 were repeated.
5. Steps 2 through 4 were repeated for each remaining test level specified.

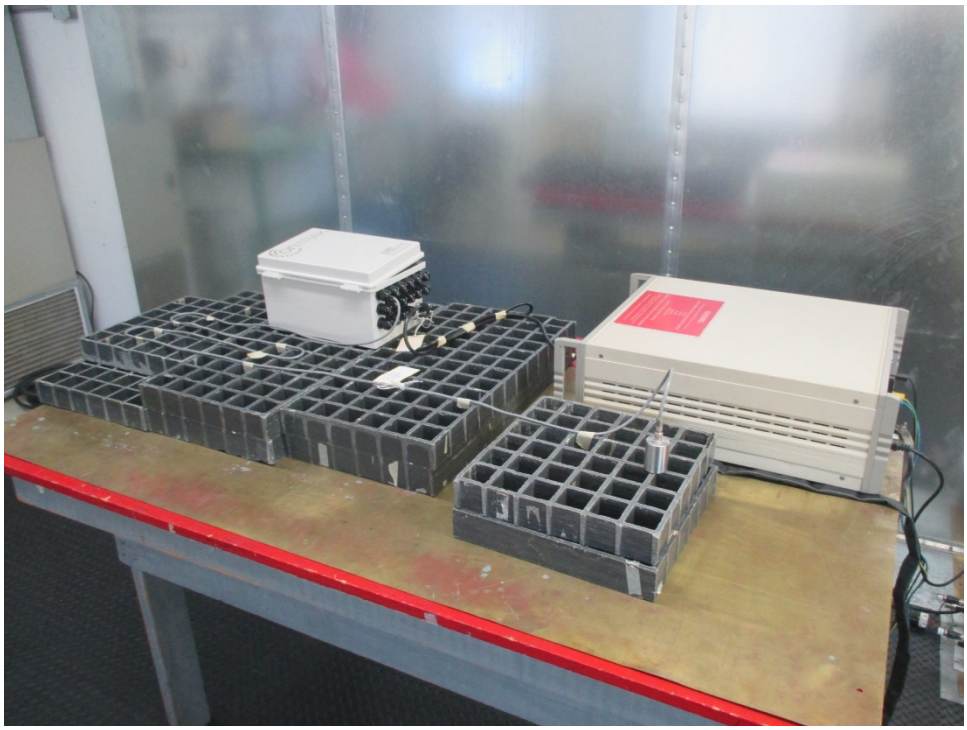
6.7.8 Test Results

The EUT complied with the requirements specified for this method. The test sample did not exhibit any malfunction or degradation of performance beyond that specified in Paragraph 5.6 herein when subjected to the electrical fast transients/bursts specified above.

See the following photographs and test data for a full presentation of the test setup and results obtained.

Test Photographs
Electrical Fast Transients/Bursts

Test Photographs
Electrical Fast Transients/Bursts



Power Port Test Configuration

IEC 61000-4-4, Electrical Fast Transients - Power Ports
Test Data

IMMUNITY TEST DATA SHEET

Test Specification:	EN61326-1; Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements, Part 1: General Requirements
Method:	IEC 61000-4-4, Electrical Fast Transient Bursts - Power
Job Number/Customer:	R-17753Y-1 / UE Systems
Test Sample:	850S Ultrasonic Sensor
Model Number:	UltraTrak 850S
Part Number:	N/A
Serial Number:	N/A
Operating Mode:	Sending sensor data to On Trak system, support laptop displaying sensor data in lubrication mode.
Power Port Tested:	230 VAC 50 Hz of Host
Technician:	M. Seamans
Date(s):	January 4th, 2022
Temperature:	21.4 ºC
Relative Humidity:	22.0 %

TEST PARAMETERS

The EUT was subjected to 5 by 50 nsec Electrical Fast Transients applied to the input power port with a burst duration of 15 ms and period of 300 ms.

Power Lead Tested	Repetition Rate kHz	Polarity ±	Duration Minutes	Level kV
230 VAC, 50 Hz, Hot	5.0	+	1.0	0.5 / 1.0
230 VAC, 50 Hz, Neutral	"	+	"	"
Ground	"	+	"	"
All	5.0	+	1.0	0.5 / 1.0
230 VAC, 50 Hz, Hot	5.0	-	1.0	0.5 / 1.0
230 VAC, 50 Hz, Neutral	"	-	"	"
Ground	"	-	"	"
All	5.0	-	1.0	0.5 / 1.0

The test sample did not exhibit any malfunction, degradation of performance or deviation from specified indication beyond the tolerances defined by Performance Criteria B.

6.8 IEC 61000-4-4, Electrical Fast Transient / Burst, I/O Ports

6.8.1 Normative Reference
IEC 61000-4-4: 2004, +Cor2: 2007, +A1: 2010

6.8.2 Purpose
The purpose of this test method was to determine if the EUT was so constructed as to have an adequate level of intrinsic immunity to electrical fast transient bursts applied to I/O ports, enabling the EUT to operate as intended.

6.8.3 Test Parameters
The critical parameters of the electrical fast transient/burst generator and the applied waveform are shown below:

Transient Voltage:	0.25 kV, 0.5 kV
Transient Polarity:	Positive and Negative
Repetition Rate:	5 kHz
Rise Time of Pulse:	5 ns ± 30%
Pulse Duration:	50 ns ± 30%
Burst Period:	300 ms ± 20%
Burst Duration:	15 ms ± 20%

6.8.4 I/O Port Tested
The following I/O port of the EUT Host was tested in order to demonstrate compliance:

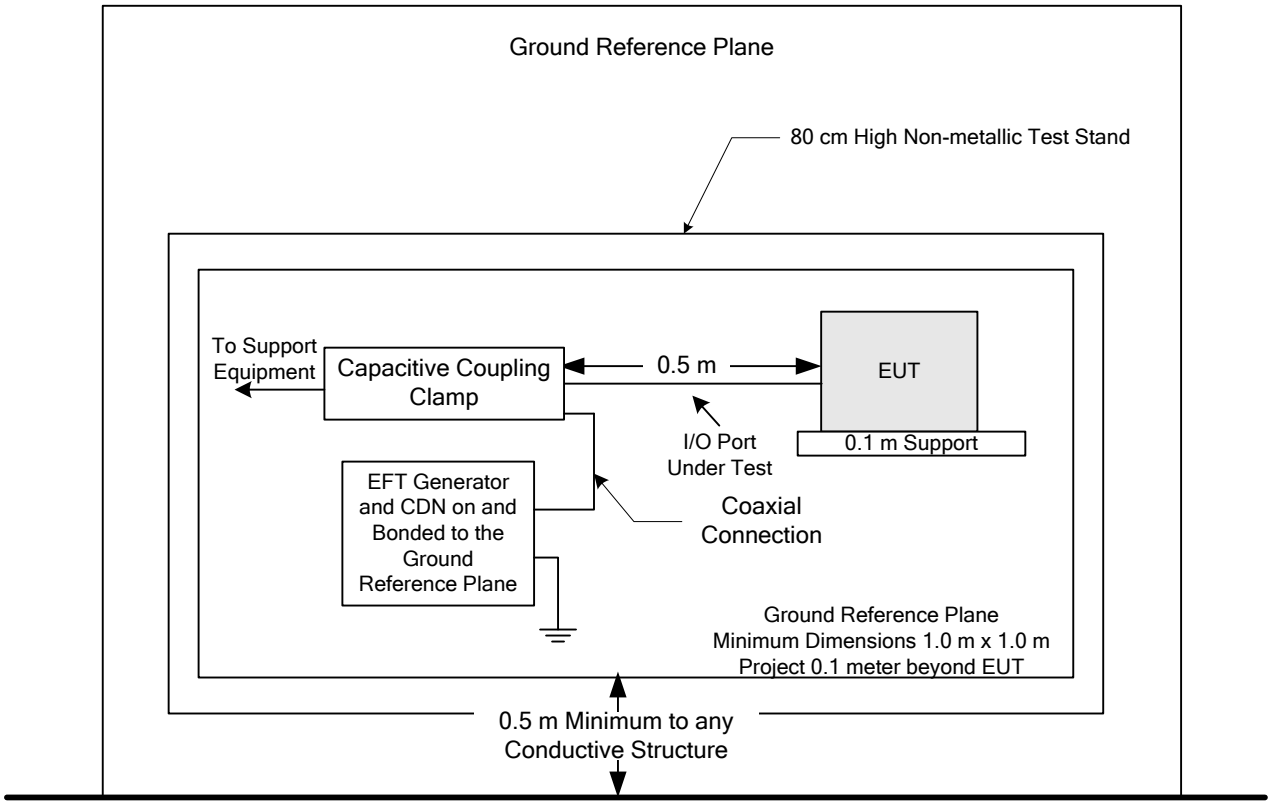
- I/O

6.8.5 Test Setup

The EUT and associated cabling, configured as detailed in Paragraph 5.0 herein, were placed on 0.1 m thick insulating supports above the ground reference plane, which was installed on an 80 cm high non-metallic test stand. The minimum size of the ground reference plane was 1.0 m^2 and projected beyond the EUT by at least 0.1 m on each side. The ground reference plane was connected to the protective grounding system. A distance of 0.5 m minimum was maintained between the equipment under test and the walls of the laboratory and any other metallic structure. The EUT was connected to the grounding system in accordance with its installation specifications. All cables to the EUT were placed on the 0.1 m insulating support above the ground reference plane. The cables not under test were routed as far as possible from the cable under test, in order to minimize the coupling between cables.

The test generator including the capacitive coupling clamp was placed directly on, and bonded to, the ground reference plane. The I/O port under test was installed in the capacitive coupling clamp. The length of I/O cable between the capacitive coupling clamp and EUT was 0.5 m. The output of the test generator was connected to the end of the capacitive coupling clamp nearest the EUT.

Figure 9 - Electrical Fast Transient Burst, I/O Port Setup



6.8.6 Test Equipment

The details of the test equipment utilized during the performance of this test method are shown below:

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
467B	SCHAFFNER	COUPLING CLAMP, CAPACITIVE		CDN 125	7/30/2021	7/31/2022
5104	EMC PARTNER	GENERATOR, SURGE	4KV EFT - SURGE - DIPS	TRANSIENT 2000	7/30/2021	7/31/2022
5208	OMEGA	HYGROMETER	-20 to 70 deg. C, 0-99% RH	OM-73	1/18/2021	1/31/2022

6.8.7 Test Procedure

With the EUT and test instrumentation configured as stated above, the following steps were performed:

1. The transient generator was configured to apply 0.25 kV transients.
2. Positive transients were applied to the first I/O port specified for a period of 1 minute.
3. The EUT was continuously monitored for malfunction or degradation as specified in Paragraph 5.6 herein.
4. The transient generator was configured to apply negative transients and Steps 2 and 3 were repeated.
5. Steps 2 through 4 were repeated for each remaining test level specified.

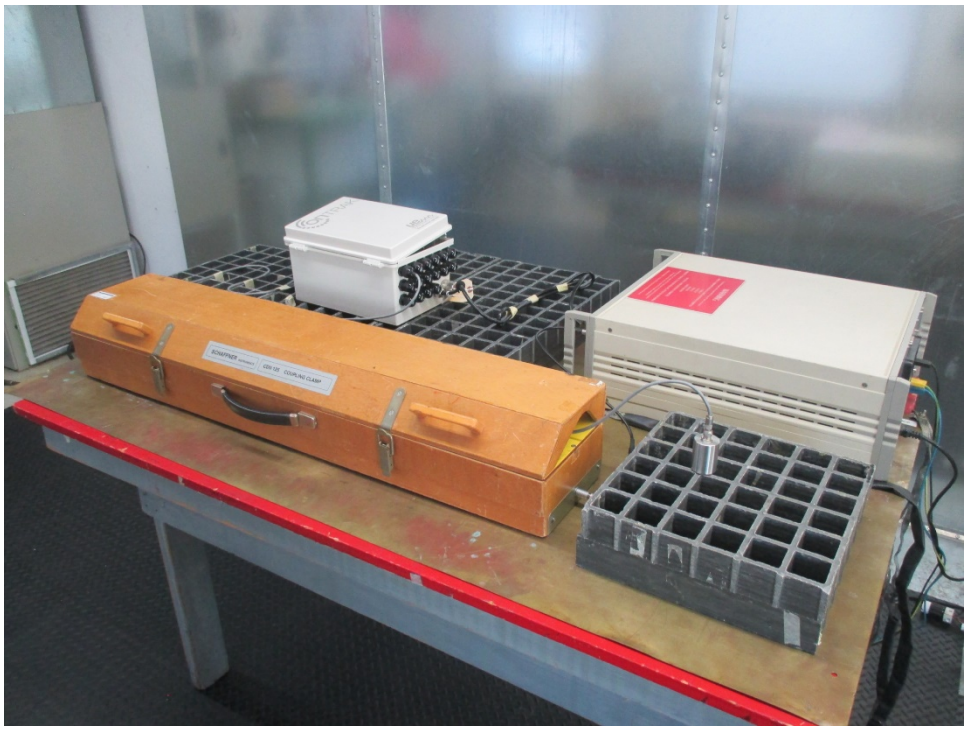
6.8.8 Test Results

The EUT complied with the requirements specified for this method. The test sample did not exhibit any malfunction or degradation of performance beyond that specified in Paragraph 5.6 herein when subjected to the electrical fast transients/bursts specified above.

See the following photographs and test data for a full presentation of the test setup and results obtained.

Test Photographs
Electrical Fast Transients/Bursts

Test Photographs
Electrical Fast Transients/Bursts



I/O Port Test Configuration, I/O

IEC 61000-4-4, Electrical Fast Transients - I/O Ports
Test Data

IMMUNITY TEST DATA SHEET

Test Specification:	EN61326-1; Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements, Part 1: General Requirements
Method:	IEC 61000-4-4, Electrical Fast Transient Bursts - I/O Ports
Job Number/Customer:	R-17753Y-1 / UE Systems
Test Sample:	850S Ultrasonic Sensor
Model Number:	UltraTrak 850S
Part Number:	N/A
Serial Number:	N/A
Operating Mode:	Sending sensor data to On Trak system, support laptop displaying sensor data in lubrication mode.
Technician:	M. Seamans
Date(s):	January 4th, 2022
Temperature:	20.7 ºC
Relative Humidity:	22.4 %

TEST PARAMETERS

The EUT was subjected to 5 by 50 nsec Electrical Fast Transients applied to the I/O port with a burst duration of 15 ms and period of 300 ms.

I/O Port Tested	Repetition Rate kHz	Polarity ±	Duration Minutes	Level kV
I/O	5.0	+	1.0	0.25 / 0.5
I/O	5.0	-	1.0	0.25 / 0.5

The test sample did not exhibit any malfunction, degradation of performance or deviation from specified indication beyond the tolerances defined by Performance Criteria B.

6.9 IEC 61000-4-5, Surge, Power Ports

6.9.1 Normative Reference
IEC 61000-4-5: 2005, +Corr. October: 2009

6.9.2 Purpose
The purpose of this test method was to determine if the EUT was so constructed as to have an adequate level of intrinsic immunity to common and differential mode surges applied to input power ports, enabling the EUT to operate as intended.

6.9.3 Test Parameters
The critical parameters of the applied surge waveform are shown below:

Voltage:	0.5 kV Differential Mode	
	0.5 kV, 1.0 kV Common Mode	
Polarity:	Positive and Negative	
Pulse Phase:	0˚, 90˚, 180˚, 270˚	
	Open Circuit	Short Circuit
Rise Time:	1.2 µsec	8.0 µsec
Duration:	50.0 µsec	20.0 µsec
Rep Rate:	1 ppm	

6.9.4 Power Port Tested
The following power port of the EUT Host was tested, in the coupling mode shown, in order to demonstrate compliance:

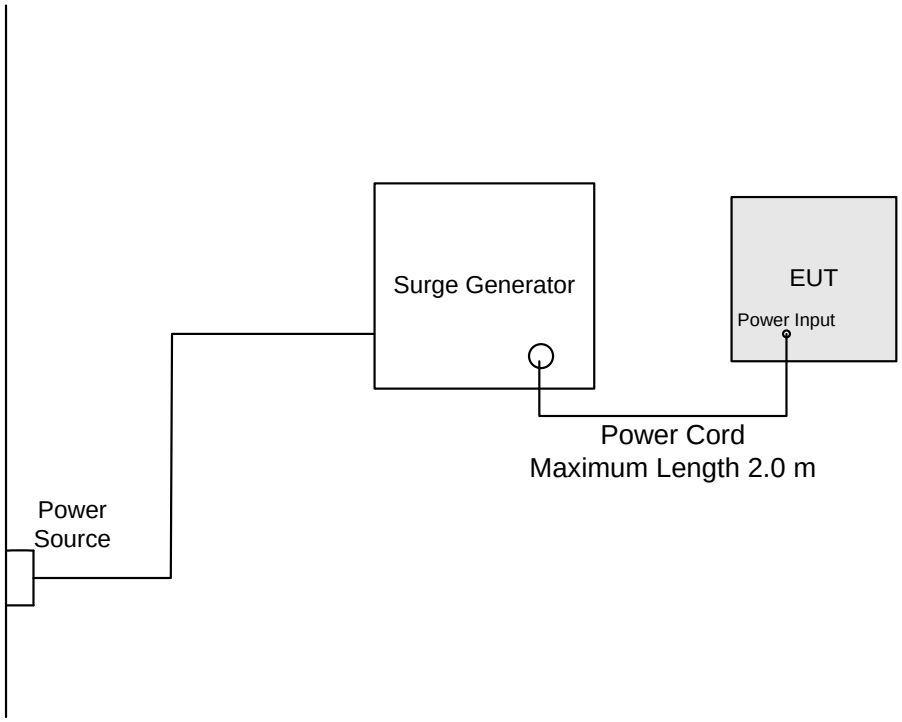
- 230 VAC, 50 Hz
  - Coupling Modes:
    - Common Mode: Hot to Ground
    - Common Mode: Neutral to Ground
    - Differential Mode: Hot to Neutral

6.9.5 Test Setup

The EUT and associated cabling was configured as detailed in Paragraph 5.0 herein. The EUT was connected to the grounding system in accordance with its installation specifications.

The input power ports of the EUT were connected to the capacitive coupling/decoupling network contained within the test generator. The length of power leads connecting the EUT to the capacitive coupling/decoupling network did not exceed 2.0 m.

Figure 10 - Surge, Power Ports, Test Setup



6.9.6 Test Equipment

The details of the test equipment utilized during the performance of this test method are shown below:

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
5096	TEKTRONIX	OSCILLOSCOPE	200 MHz	TDS2022B	7/30/2021	7/31/2022
5104	EMC PARTNER	GENERATOR, SURGE	4KV EFT - SURGE - DIPS	TRANSIENT 2000	7/30/2021	7/31/2022
5208	OMEGA	HYGROMETER	-20 to 70 deg. C, 0-99% RH	OM-73	1/18/2021	1/31/2022
5226	TEKTRONIX	PROBE, OSCILLOSCOPE	100X, DC - 500 MHz	P5100A	10/22/2021	10/31/2022

6.9.7 Test Procedure

With the EUT and test instrumentation configured as stated above, the following steps were performed:

1. The transient generator was configured to apply 0.5 kV transients.
2. Five positive 0.5 kV transients were applied to the power ports in the coupling modes specified, at a repetition rate not exceeding 1 ppm, at each specified phase angle.
3. The EUT was continuously monitored for malfunction or degradation as specified in Paragraph 5.6 herein.
4. The transient generator was configured to apply negative transients and Steps 2 and 3 were repeated.
5. Steps 2 through 4 were repeated for each remaining test level specified.

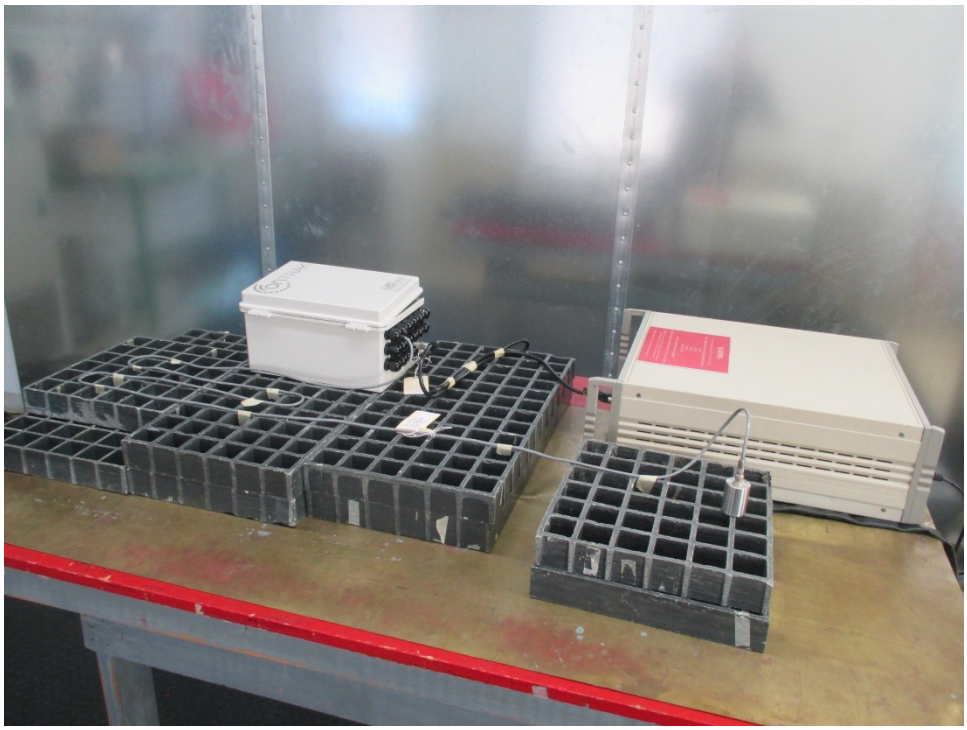
6.9.8 Test Results

The EUT complied with the requirements specified for this method. The test sample did not exhibit any malfunction or degradation of performance beyond that specified in Paragraph 5.6 herein when subjected to the surges specified above.

See the following photographs and test data for a full presentation of the test setup and results obtained.

Test Photographs
Surge

Test Photographs
Surge



Power Port Test Configuration

IEC 61000-4-5, Surge Immunity - Power Ports
Test Data

IMMUNITY TEST DATA SHEET

Test Specification:	EN 61326-1, Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements, Part 1: General Requirements
Method:	IEC 61000-4-5, Surge Immunity - Power Ports
Job Number/Customer:	R-17753Y-1 / UE Systems
Test Sample:	850S Ultrasonic Sensor
Model Number:	UltraTrak 850S
Part Number:	N/A
Serial Number:	N/A
Operating Mode:	Sending sensor data to On Trak system, support laptop displaying sensor data in lubrication mode.
Power Port Tested:	230 VAC 50 Hz of Host
Technician:	M. Seamans
Date(s):	January 4th, 2022
Temperature:	20.6 ºC
Relative Humidity:	24.9 %

TEST PARAMETERS

The EUT was subjected to 5 unidirectional surges as specified below. The characteristics of the applied waveform were:

Definitions	**Front Time µs**	**Time to Half Value µs**
Open Circuit Voltage	1.2 ± 30%	50 ± 20%
Short Circuit Current	8 ± 20%	20 ± 20%

Coupling Mode	**Repetition Rate PPM**	**Polarity ±**	**Phase Angle Degrees**	**Level kV**
Hot to Neutral	1.0	+	0	0.5
|	|	-	0	|
|	|	+	90	|
|	|	-	90	|
|	|	+	180	|
|	|	-	180	|
|	|	+	270	|
Hot to Neutral	1.0	-	270	0.5
Hot to Ground	1.0	+	0	0.5 / 1.0
|	|	-	0	|
|	|	+	90	|
|	|	-	90	|
|	|	+	180	|
|	|	-	180	|
|	|	+	270	|
Hot to Ground	1.0	-	270	0.5 / 1.0
Neutral to Ground	1.0	+	0	0.5 / 1.0
Neutral to Ground	1.0	-	0	0.5 / 1.0

The test sample did not exhibit any malfunction, degradation of performance or deviation from specified indication beyond the tolerances defined by Performance Criteria B.

6.10 IEC 61000-4-6, Conducted Immunity, Power Ports, 0.15 to 80 MHz

6.10.1 Normative Reference
IEC 61000-4-6 Edition 3.0: 2008-10

6.10.2 Purpose
The purpose of this test method was to determine if the EUT was so constructed as to have an adequate level of intrinsic immunity to radio frequency electromagnetic energy injected into input power leads in the frequency range of 0.15 to 80 MHz, enabling the EUT to operate as intended.

6.10.3 Test Parameters
The critical parameters of the applied electromagnetic energy for testing the power port(s) were as shown below:

Frequency Range:	0.15 to 80 MHz
Applied Signal Level:	3 Vrms
Modulation:	1 kHz, 80%, AM
Injection Method:	Coupling Decoupling Network (CDN)
Step Size:	1%
Dwell Time:	1.0 second

6.10.4 Power Port Tested
The following power port of the EUT Host was tested in order to demonstrate compliance:

- 230 VAC, 50 Hz

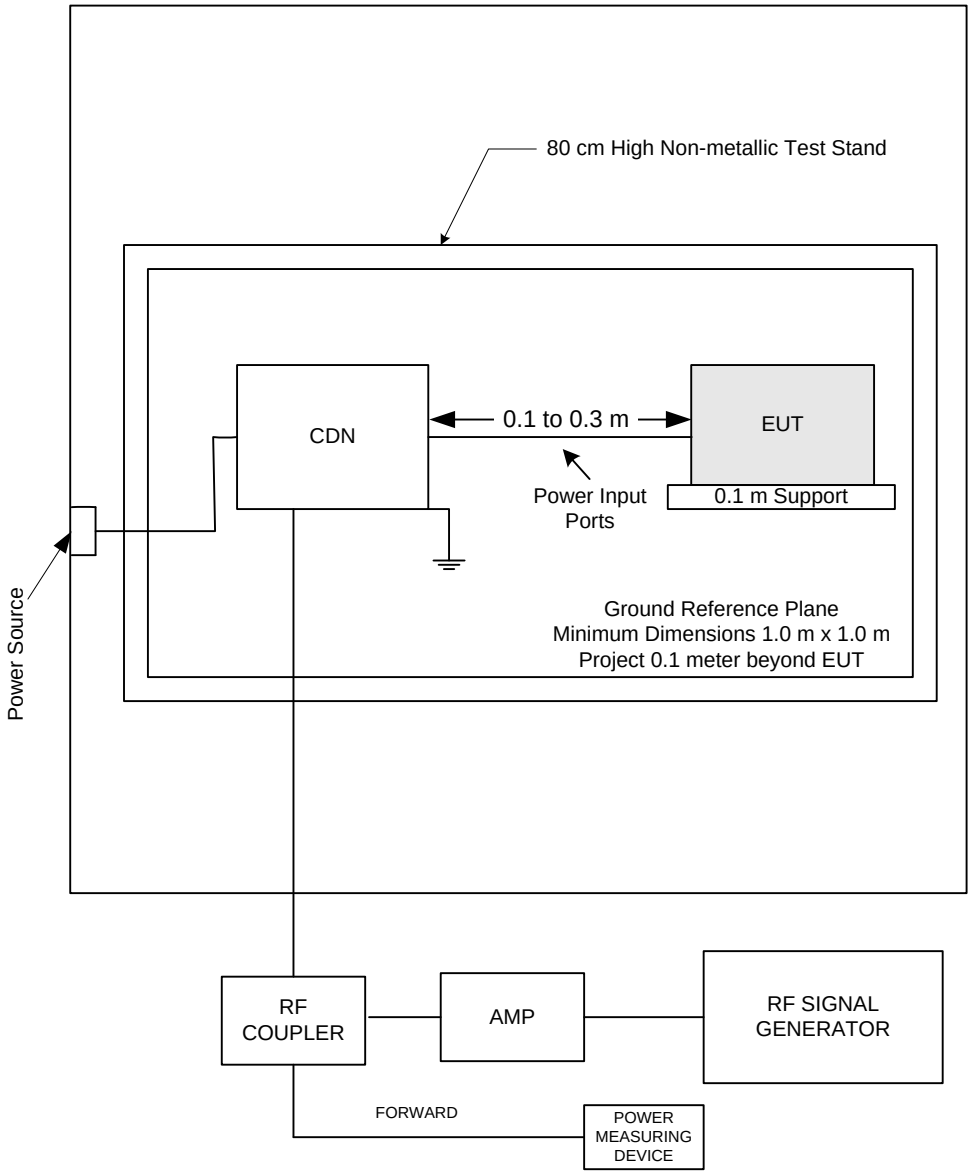
6.10.5 Test Setup

The EUT and associated cabling, configured as detailed in Paragraph 5.0 herein, were placed on 0.1 m thick insulating supports above the ground reference plane, which was installed on an 80 cm high non-metallic test stand. The minimum size of the ground reference plane was 1.0 m^2 and projected beyond the EUT by at least 0.1 m on each side. The ground reference plane was connected to the protective grounding system. A distance of 0.5 meter minimum was maintained between the equipment under test and the walls of the laboratory and any other metallic structure. The EUT was connected to the grounding system in accordance with its installation specifications. All cables to the EUT were supported at least 30 mm above the ground reference plane. The cables not under test were routed as far as possible from the cable under test, in order to minimize the coupling between cables.

A coupling/decoupling network was installed in series with the power input leads of the port under test. The coupling/decoupling network was bonded to the ground reference plane at a distance of 0.1 to 0.3 meters from the EUT.

An RF signal generator was connected to the input of the RF power amplifier. The output of the RF power amplifier was connected to an RF coupler which in turn was connected to the CDN. A power meter was connected to the forward power port of the RF coupler.

Figure 11 - Conducted Immunity, Power Ports Test Setup



6.10.6 Test Equipment

The details of the test equipment utilized during the performance of this test method are shown below:

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
4895	AGILENT / HP	ANALYZER, SPECTRUM	9 KHz - 22 GHz	8593EM	4/12/2021	4/30/2022
4975	ENI	AMPLIFIER, RF POWER	100 kHz - 150 MHz,	325LA-HP	No Calibration Required	
5112	JFW INDUSTRIES	ATTENUATOR, COAXIAL	6 dB, DC - 4 GHz	50FHC-006-50N	3/1/2021	3/31/2022
5208	OMEGA	HYGROMETER	-20 to 70 deg. C, 0-99% RH	OM-73	1/18/2021	1/31/2022
5245	RETLIF	CABLE, COAXIAL	10 kHz - 1 GHz	10' TYPE N	3/1/2021	3/31/2022
530A	IFR / AEROFLEX	GENERATOR, SIGNAL	10 KHz - 1.2 GHz	2023	9/17/2021	9/30/2022
532	WERLATONE	DIRECTIONAL COUPLER, COAXIAL	10 kHz - 1 GHz, 40dB, 100W	C2630	3/1/2021	3/31/2022
555A	FISCHER CUSTOM COMM	COUPLING / DECOUPLING NETWORK	150 KHz - 230 MHz	FCC-801-M3-16	3/2/2021	3/31/2022

6.10.7 Test Procedure

With the EUT configured as described above, the following steps were performed:

1. The output frequency of the signal generator was adjusted to the start frequency of the test.
2. The output level of the generator was increased until the required power was measured at the forward port of the RF coupler.
3. The specified modulation was enabled.
4. This condition was held for the dwell time specified in the test parameters.
5. The frequency was incremented by 1%.
6. Steps 2 through 5 were repeated until the EUT was subjected to the specified test level over the entire frequency range of test.
7. At each frequency step, the EUT was monitored for degradation or malfunction.

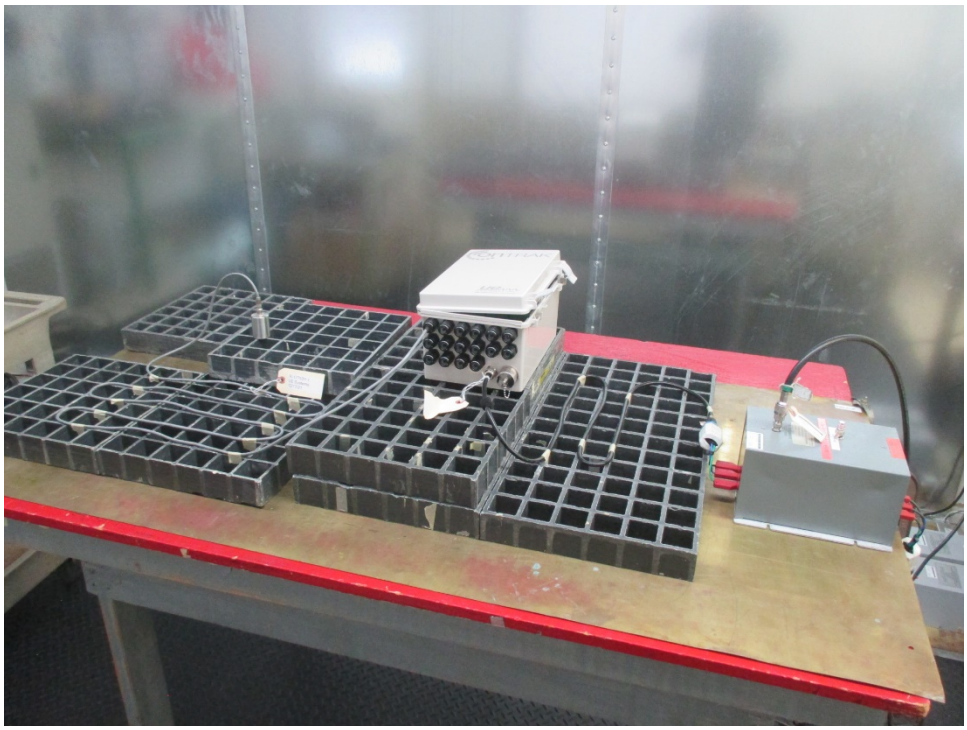
6.10.8 Test Results

The EUT complied with the requirements specified for this method. The test sample did not exhibit any malfunction or degradation of performance beyond that specified in Paragraph 5.6 herein when subjected to the conducted disturbances specified above.

See the following photographs and test data for a full presentation of the test setup and results obtained.

Test Photographs
Conducted Immunity

Test Photographs
Conducted Immunity



Power Port Test Configuration

IEC 61000-4-6, Conducted Disturbance Induced by Radio Frequency Fields
150 kHz to 80 MHz, Power Ports
Test Data

IMMUNITY TEST DATA SHEET

Test Specification:	EN61326-1; Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements, Part 1: General Requirements
Method:	IEC 61000-4-6, Conducted Immunity, Power Ports, 150 kHz to 80 MHz
Job Number/Customer:	R-17753Y-1 / UE Systems
Test Sample:	850S Ultrasonic Sensor
Model Number:	UltraTrak 850S
Part Number:	N/A
Serial Number:	N/A
Operating Mode:	Sending sensor data to On Trak system, support laptop displaying sensor data in lubrication mode.
Power Port Tested:	230 VAC 50 Hz of Host
Technician:	M. Seamans
Date(s):	January 5th, 2022
Temperature:	21.2 ºC
Relative Humidity:	23.3 %
Injection Method:	CDN

TEST PARAMETERS

The entire frequency range indicated below was swept at a 1% step size and 1.0 second dwell at each step.

Frequency MHz	Modulation	Level Vrms
0.15	1 kHz AM, 80%	3
80	1 kHz AM, 80%	3

The test sample did not exhibit any malfunction, degradation of performance or deviation from specified indication beyond the tolerances defined by Performance Criteria A.

6.11 IEC 61000-4-6, Conducted Immunity, I/O Ports, 0.15 to 80 MHz

6.11.1 Normative Reference
IEC 61000-4-6 Edition 3.0: 2008-10

6.11.2 Purpose
The purpose of this test method was to determine if the EUT was so constructed as to have an adequate level of intrinsic immunity to radio frequency electromagnetic energy injected into I/O ports in the frequency range of 0.15 to 80 MHz, enabling the EUT to operate as intended.

6.11.3 Test Parameters
The critical parameters of the applied electromagnetic energy for testing the I/O ports were as shown below:

Frequency Range:	0.15 to 80 MHz
Applied Signal Level:	3 Vrms
Modulation:	1 kHz, 80%, AM
Injection Method:	Direct Injection
Step Size:	1%
Dwell Time:	1.0 second

6.11.4 I/O Port Tested
The following I/O port of the EUT was tested utilizing the coupling mode shown, in order to demonstrate compliance:

- I/O, Direct Injection

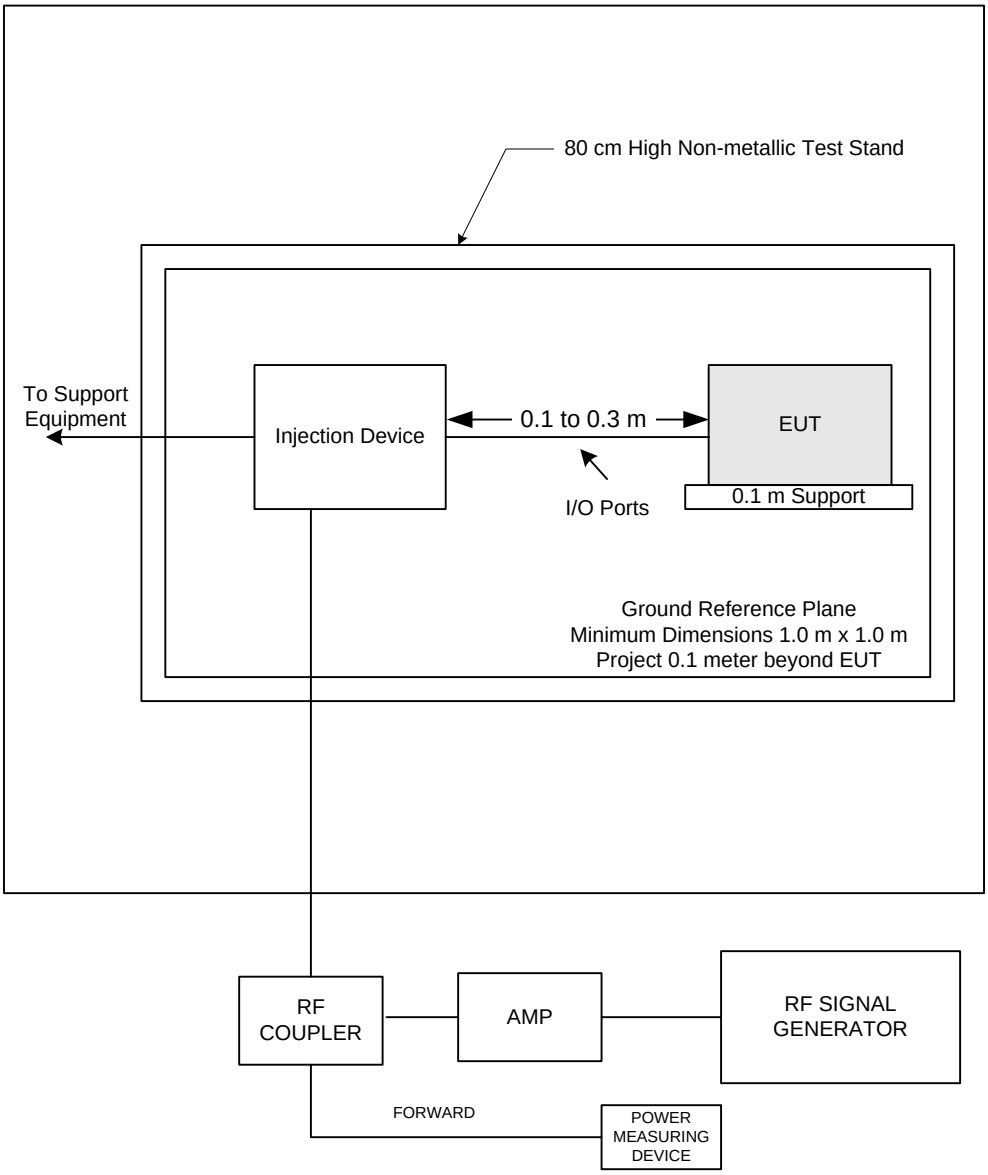
6.11.5 Test Setup

The EUT and associated cabling, configured as detailed in Paragraph 5.0 herein, were placed on 0.1 m thick insulating supports above the ground reference plane, which was installed on an 80 cm high non-metallic test stand. The minimum size of the ground reference plane was 1.0 m^2 and projected beyond the EUT by at least 0.1 m on each side. The ground reference plane was connected to the protective grounding system. A distance of 0.5 meter minimum was maintained between the equipment under test and the walls of the laboratory and any other metallic structure. The EUT was connected to the grounding system in accordance with its installation specifications. All cables to the EUT were supported at least 30 mm above the ground reference plane. The ports not under test were routed as far as possible from the cable under test, in order to minimize the coupling between cables.

An injection device was installed on the I/O port under test, at a distance of 0.1 to 0.3 meters from the EUT.

An RF signal generator was connected to the input of the RF power amplifier. The output of the RF power amplifier was connected to an RF coupler which in turn was connected to the injection device. A power meter was connected to the forward power port of the RF coupler.

Figure 12 - Conducted Immunity, I/O Ports Test Setup



6.11.6 Test Equipment

The details of the test equipment utilized during the performance of this test method are shown below:

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
4895	AGILENT / HP	ANALYZER, SPECTRUM	9 KHz - 22 GHz	8593EM	4/12/2021	4/30/2022
4936	RETLIF	INJECTION DEVICE, DIRECT	150 kHz - 230 MHz	ENV50141	3/2/2021	3/31/2022
4975	ENI	AMPLIFIER, RF POWER	100 kHz - 150 MHz,	325LA-HP	No Calibration Required	
5112	JFW INDUSTRIES	ATTENUATOR, COAXIAL	6 dB, DC - 4 GHz	50FHC-006-50N	3/1/2021	3/31/2022
5208	OMEGA	HYGROMETER	-20 to 70 deg. C, 0-99% RH	OM-73	1/18/2021	1/31/2022
5246	RETLIF	CABLE, COAXIAL	10 kHz - 1 GHz	5' TYPE N	3/1/2021	3/31/2022
530A	IFR / AEROFLEX	GENERATOR, SIGNAL	10 KHz - 1.2 GHz	2023	9/17/2021	9/30/2022
532	WERLATONE	DIRECTIONAL COUPLER, COAXIAL	10 kHz - 1 GHz, 40dB, 100W	C2630	3/1/2021	3/31/2022
555A	FISCHER CUSTOM COMM	COUPLING / DECOUPLING NETWORK	150 KHz - 230 MHz	FCC-801-M3-16	3/2/2021	3/31/2022

6.11.7 Test Procedure

With the EUT configured as described above, the following steps were performed:

1. The output frequency of the signal generator was adjusted to the start frequency of the test.
2. The output level of the generator was increased until the required power was measured at the forward port of the RF coupler.
3. The specified modulation was enabled.
4. This condition was held for the dwell time specified in the test parameters.
5. The frequency was incremented by 1%.
6. Steps 2 through 5 were repeated until the EUT was subjected to the specified test level over the entire frequency range of test.
7. At each frequency step, the EUT was monitored for degradation or malfunction.

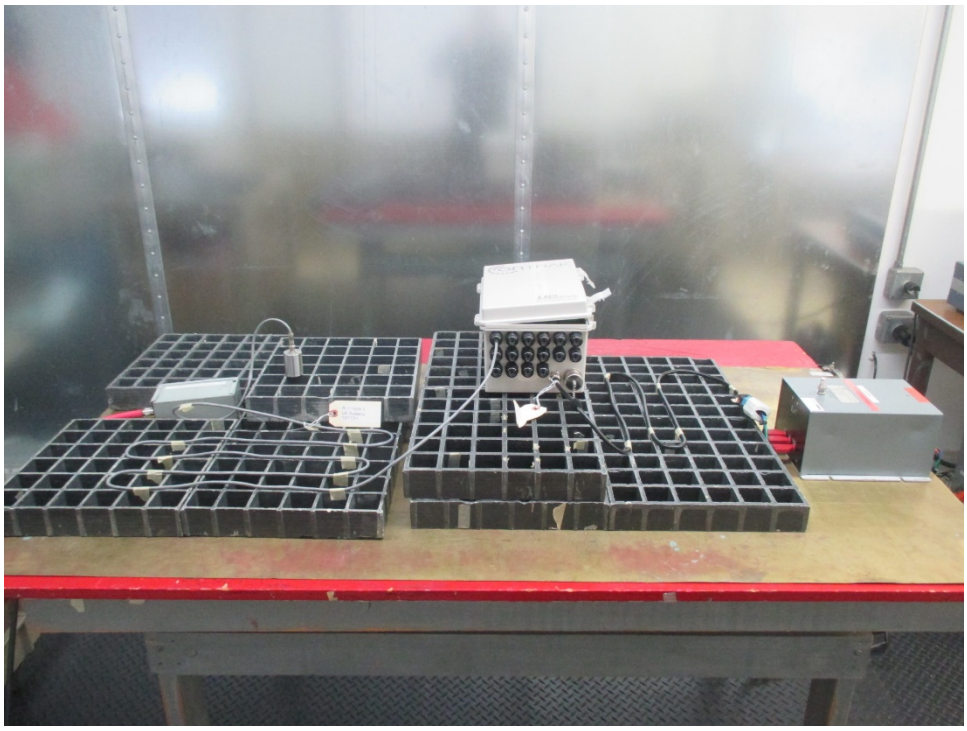
6.11.8 Test Results

The EUT complied with the requirements specified for this method. The test sample did not exhibit any malfunction or degradation of performance beyond that specified in Paragraph 5.6 herein when subjected to the conducted disturbances specified above.

See the following photographs and test data for a full presentation of the test setup and results obtained.

Test Photographs
Conducted Immunity

Test Photographs
Conducted Immunity



I/O Port Test Configuration, Direct Injection

IEC 61000-4-6, Conducted Disturbance Induced by Radio Frequency Fields
150 kHz to 80 MHz - I/O Ports
Test Data

IMMUNITY TEST DATA SHEET

Test Specification:	EN61326-1; Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements, Part 1: General Requirements
Method:	IEC 61000-4-6, Conducted Immunity, I/O Ports, 150 kHz to 80 MHz
Job Number/Customer:	R-17753Y-1 / UE Systems
Test Sample:	850S Ultrasonic Sensor
Model Number:	UltraTrak 850S
Part Number:	N/A
Serial Number:	N/A
Operating Mode:	Sending sensor data to On Trak system, support laptop displaying sensor data in lubrication mode.
I/O Port Tested:	IO
Technician:	M. Seamans
Date(s):	January 5th, 2022
Temperature:	21.2 ºC
Relative Humidity:	23.3 %
Injection Method:	Direct

TEST PARAMETERS

The entire frequency range indicated below was swept at a 1% step size and 1 second dwell at each step.

Frequency MHz	Modulation	Level		Level Achieved V / IC
		Vrms (V)	mArms (IC)	
0.15	1 kHz AM, 80%	3	20	V
80	1 kHz AM, 80%	3	20	V

The test sample did not exhibit any malfunction, degradation of performance or deviation from specified indication beyond the tolerances defined by Performance Criteria A.

6.12 IEC 61000-4-8, Power Frequency, Magnetic Immunity

6.12.1 Normative Reference
IEC 61000-4-8 Edition 2.0, 2009-09

6.12.2 Purpose
The purpose of this test method was to determine if the EUT was so constructed that it has an adequate level of intrinsic immunity to power frequency magnetic fields.

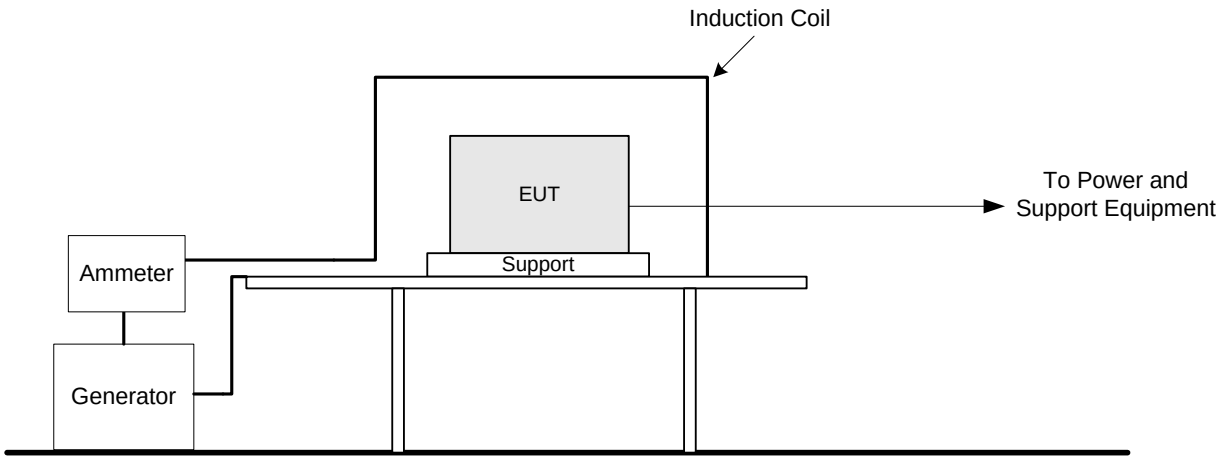
6.12.3 Test Parameters
The critical parameters of the applied magnetic energy were as shown below:

Frequency:	50 Hz
Applied Signal Level:	3 A/m RMS

6.12.4 Test Setup
The EUT and associated cabling, configured as detailed in Paragraph 5.0 herein, were placed on 0.8 m high non-metallic table above the ground reference plane, centered within the induction coil. A distance of 0.5 meter minimum was maintained between the equipment under test and the walls of the laboratory and any other metallic structure. The earth terminal was connected to a ground reference plane. The cables not under test were routed as far as possible from the cable under test, in order to minimize the coupling between cables.

The test generator was positioned such that it was less than 3.0 meters from the induction coil. One terminal of the generator was connected to one wire of the induction coil and the other to the other wire of the induction coil. An ammeter was placed in series with the lead connected to the hot lead of the induction coil.

Figure 13 - Power Frequency Magnetic Immunity, Test Setup



6.12.5 Test Equipment

The details of the test equipment utilized during the performance of this test method are shown below:

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
3106	SOLAR ELECTRONICS	ANTENNA, LOOP	30 Hz - 100 KHz	7334-1	11/12/2020	5/31/2022
4275	RETLIF	COIL, MAGNETIC FIELD GENERATING	(1m X 1m)	RTL-0010	Inspect Before Use	
4990	ROHDE & SCHWARZ	GENERATOR, AUDIO	1 Hz - 1.3 MHz	SPN 336.3019.32	2/25/2021	2/28/2022
5132	AMPROBE	PROBE, CURRENT	300V 40A 400Hz	LH41A	11/10/2021	11/30/2022
5188	Cybertron	COMPUTER, CONTROL	N/A	TSVQJA2221	No Calibration Required	
712	ROHDE & SCHWARZ	RECEIVER, EMI	20 Hz - 26.5 GHz	ESIB26	1/6/2021	1/31/2022

6.12.6 Test Procedure

With the EUT and test instrumentation configured as stated above, the following steps were performed:

1. The required input current to the induction coil was calculated as shown below.
2. The output frequency of the signal generator was adjusted to the input power frequency of the EUT.
3. The output level of the signal generator was increased until the current calculated in Step 1 was observed on the ammeter.
4. The EUT was allowed to stabilize and was monitored for any signs of malfunction as specified in Paragraph 5.6 herein.
5. This procedure was then repeated with the unit under test configured in each of the remaining 2 mutually perpendicular axes.
6. Steps 2 through 5 were repeated at each specified test frequency.

6.12.7 Sample Calculations

Shown below is a sample showing calculations used to determine the current necessary to obtain the required test field strength in A/m.

$I_{TEST} = H_{TEST}$ / Coil Factor

Where:
I_{TEST} = Current Applied to the Coil in Amps
H_{TEST} = Magnetic Field Strength of Test
Coil Factor = Constant

Example:
H_{TEST} = 3 A/m
Coil Factor = 0.91

I_{TEST} = 3 A/m / 0.91 = 3.30 Amps

6.12.8 Test Results

The EUT complied with the requirements specified for this method. The test sample did not exhibit any malfunction or degradation of performance beyond that specified in Paragraph 5.6 herein when subjected to the power frequency magnetic fields specified above.

See the following photographs and test data for a full presentation of the test setup and results obtained.

Test Photographs
Power Frequency, Magnetic Immunity

Test Photographs
Power Frequency, Magnetic Immunity

Test Setup, X Axis

Test Setup, Y Axis

Test Photographs
Power Frequency, Magnetic Immunity

Test Setup, Z Axis

IEC 61000-4-8, Power Frequency Magnetic Field Immunity
Test Data

IMMUNITY TEST DATA SHEET	
Test Specification:	EN 61326-1, Electrical Equipment for Measurement, Control and Laboratory Use-EMC Requirements, Part 1: General Requirements
Method:	IEC 61000-4-8, Power Frequency Magnetic Field Immunity
Job Number/Customer:	R-17753Y-1 / UE Systems
Test Sample:	850S Ultrasonic Sensor
Model Number:	UltraTrak 850S
Part Number:	N/A
Serial Number:	N/A
Operating Mode:	Sending sensor data to On Trak system, support laptop displaying sensor data in lubrication mode.
Technician:	M. Seamans
Date(s):	January 5th, 2022
Temperature:	20.6 ºC
Relative Humidity:	35.4 %
Power Frequency Magnetic Field Ambient:	Limit: 3 A/m = 3.78 mG Measured: 0.1479 mG

TEST PARAMETERS

Frequency Hz	Test Sample Orientation X/Y/Z	Duration Minutes	Level A/m
50	X	1	3
50	Y	1	3
50	Z	1	3

The test sample did not exhibit any malfunction, degradation of performance or deviation from specified indication beyond the tolerances defined by Performance Criteria A.

6.13 IEC 61000-4-11, Voltage Dips and Interrupts

6.13.1 Normative Reference
IEC 61000-4-11: 2004

6.13.2 Purpose
The purpose of this test method was to determine the effects that voltage dips and interrupts of the AC input voltage had on the EUT's operation.

6.13.3 Test Parameters
The input voltage range tested and parameters applied are as shown in Table 13 and Table 14:

Table 13 – Voltage Dips and Interrupts, Input Voltage Range

Minimum Rated Input Voltage:	120
Maximum Rated Input Voltage:	230
20% of Minimum Voltage:	24
Input Voltage Range:	110

Table 14 - Voltage Dips and Interrupts, Test Parameters

Test No.	Freq	Duration		Voltage Variation			Rep Rate	Rep	Criteria
		Cycles	mSec	EUT Voltage	% of EUT Voltage	Test Voltage			
1	50	½	10	120	0	0	10 sec	3	B
2		1	20		0	0	10 sec	3	B
3		25/30	500		70	84	10 sec	3	C
4		250/300	5000		0	0	10 sec	3	C
5	50	½	10	230	0	0	10 sec	3	B
6		1	20		0	0	10 sec	3	B
7		25/30	500		70	161	10 sec	3	C
8		250/300	5000		0	0	10 sec	3	C

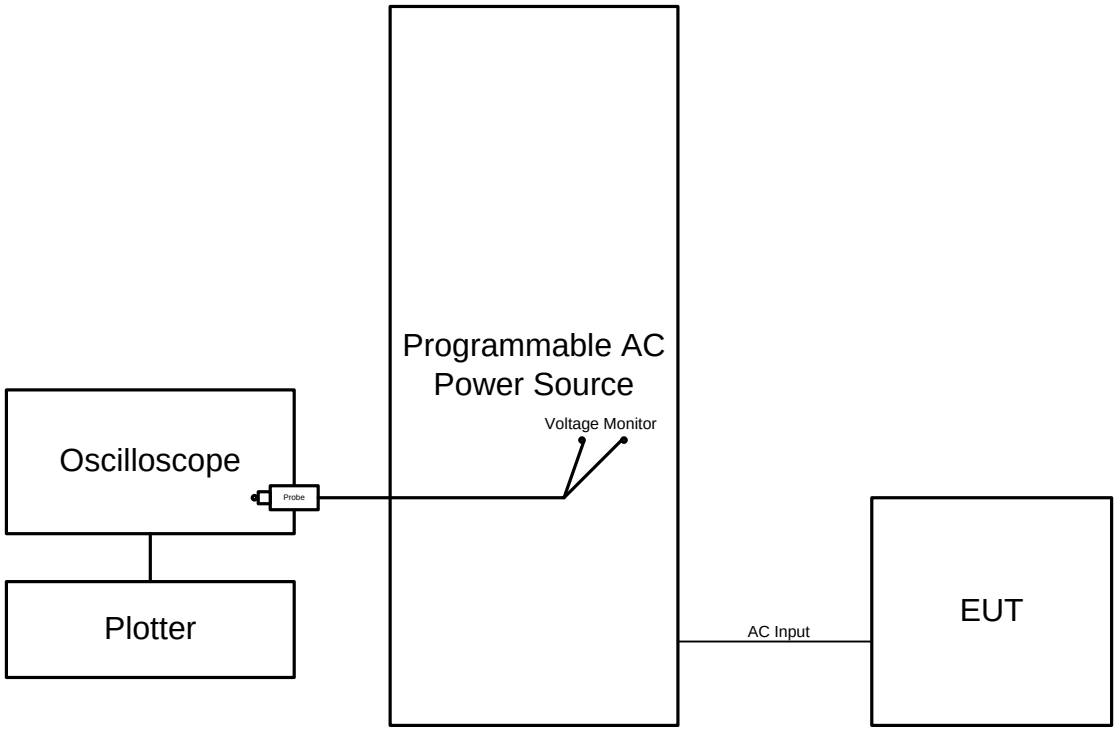
6.13.4 Power Port Tested
The following power port of the EUT was tested in order to demonstrate compliance:

- 230 VAC, 50 Hz

6.13.5 Test Setup

The EUT and associated cabling was configured as detailed in Paragraph 5.0 herein. The EUT was connected to the grounding system in accordance with its installation specifications. The input power to the EUT was provided by a programmable AC power source. An oscilloscope was connected across the AC output of the programmable AC power source.

Figure 14 - Voltage Dips and Interrupts, Test Setup



6.13.6 Test Equipment

The details of the test equipment utilized during the performance of this test method are shown below:

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
5049A	FLUKE	MULTIMETER, DIGITAL	True RMS Multimeter	111	4/19/2021	4/30/2022
5104	EMC PARTNER	GENERATOR, SURGE	4KV EFT - SURGE - DIPS	TRANSIENT 2000	7/30/2021	7/31/2022
5208	OMEGA	HYGROMETER	-20 to 70 deg. C, 0-99% RH	OM-73	1/18/2021	1/31/2022

6.13.7 Test Procedure

With the EUT and test instrumentation configured as stated above, the following steps were performed:

1. The programmable AC power source was configured to provide voltage deviation number 1 specified in the table above.
2. The parameters of voltage deviation number 1 were verified on the oscilloscope.
3. The power input port of the EUT was connected to the programmable AC power source and the EUT was placed in the operating mode detailed in Paragraph 5.5 herein.
4. Voltage deviation number 1 was applied. The number of repetitions and the repetition rate was as specified in the table above.
5. The EUT was monitored for any degradation as specified in Paragraph 5.6 herein.
6. Steps 1 through 5 were repeated for each remaining voltage deviation.

6.13.8 Sample Calculations

Shown below is a sample showing calculations used to determine the time duration, in milliseconds, of AC Power Line Dips and Interrupts.

$T_I = C_{II} \times (1000/F)$

Where:
T_I = Interrupt Duration in Milliseconds
C_{II} = Number of Cycles
F = AC Line Frequency

Example:
½ Cycle Dropout at 50 Hz
$C_{II} = 0.5$
F = 50

$T_I = 0.5 \times (1000/50)$
$= 0.5 \times 20$
= 10 milliseconds

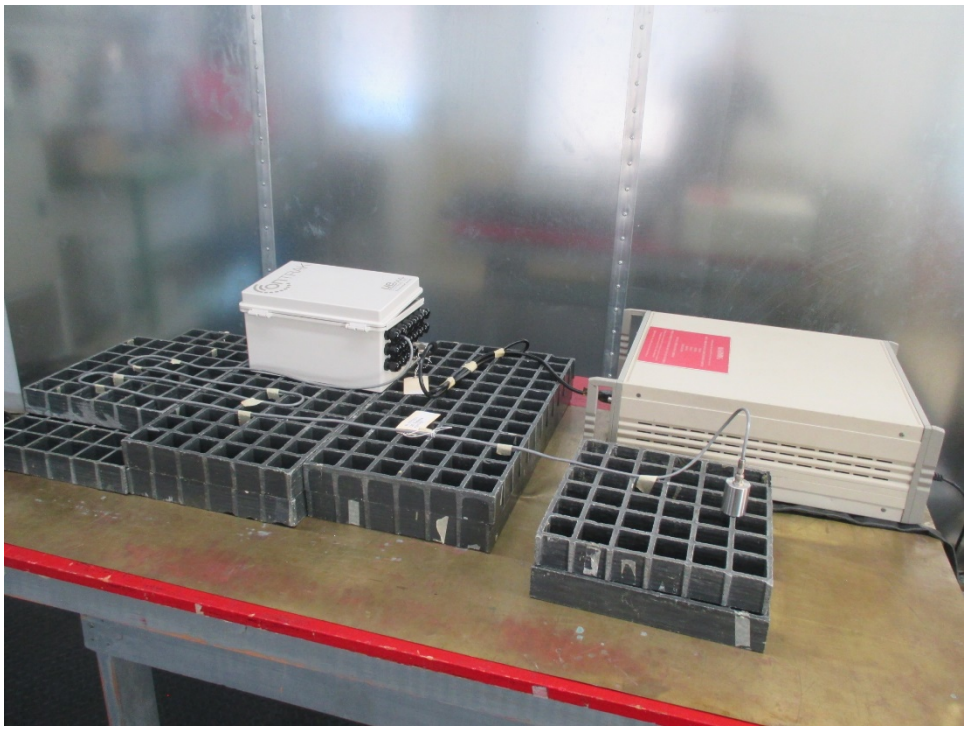
6.13.9 Test Results

The EUT complied with the requirements specified for this method. The test sample did not exhibit any malfunction or degradation of performance beyond that specified in Paragraph 5.6 herein when subjected to the Voltage Dips and Interrupts specified above.

See the following photographs and test data for a full presentation of the test setup and results obtained.

Test Photographs
Voltage Dips and Interrupts

Test Photographs
Voltage Dips and Interrupts



Test Setup

IEC 61000-4-11, Voltage Dips, Short Interruptions and Voltage Variations Test Data

IMMUNITY TEST DATA SHEET

Test Specification:	EN 61326-1; Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements, Part 1: General Requirements
Method:	IEC 61000-4-11, Voltage Dips, Short Interruptions and Voltage Variations
Job Number/Customer:	R-17753Y-1 / UE Systems
Test Sample:	850S Ultrasonic Sensor
Model Number:	UltraTrak 850S
Part Number:	N/A
Serial Number:	N/A
Operating Mode:	Sending sensor data to On Trak system, support laptop displaying sensor data in lubrication mode.
Power Port Tested:	230 VAC 50 Hz of Host
Technician:	M. Seamans
Date(s):	January 4th, 2022
Temperature:	21.3 ºC
Relative Humidity:	21.8 %

TEST PARAMETERS

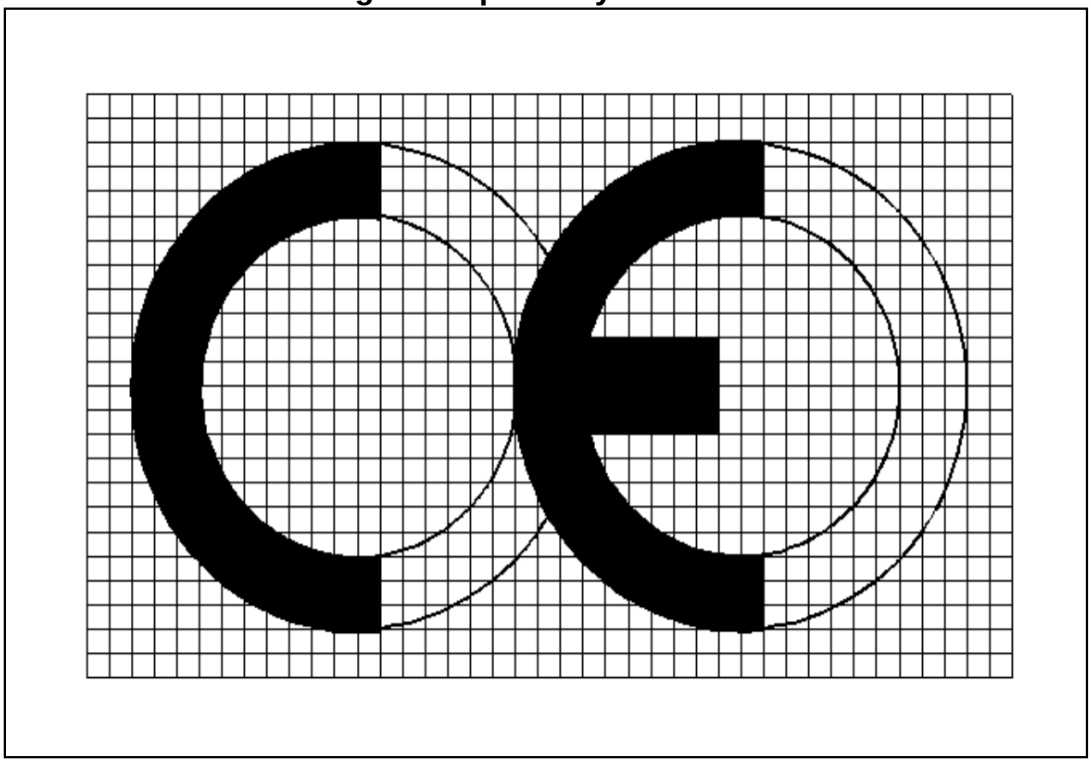
The EUT was subjected to 3 voltage dips/interruptions of the AC input. The interruptions were applied with intervals of 10-seconds minimum between each event.

Duration		Voltage Variation			Interval Between Events Sec	# of Events	Performance Criteria	
Cycles	mSec	Rated Voltage	Residual % of Rated	Test Voltage			Minimum Required	Observed
0.5	10.0	230	0.0	0	10	3	B	A
1	20.0	230	0.0	0	10	3	B	A
25	500.0	230	70.0	161	10	3	C	A
250	5000.0	230	0.0	0	10	3	C	C
0.5	10.0	120	0.0	0	10	3	B	A
1	20.0	120	0.0	0	10	3	B	A
25	500.0	120	70.0	84	10	3	C	A
250	5000.0	120	0.0	0	10	3	C	C

The test sample did not exhibit a malfunction, degradation of performance or deviation from specified indication beyond the tolerances defined by the Performance Criteria outlined above.

Appendix A: Labeling Information

CE Marking as Required by the EMC Directive



The CE Marking As Required By Council Directive 2014/30/EU, the EMC Directive, in Accordance with the CE Marking Directive (93/68/EEC)

General Marking Requirements

1. The CE Marking shall be placed on the apparatus or its data plate visibly, legibly, and indelibly. Where this is not possible or not warranted, it shall be placed on the packaging and the accompanying documents. The CE marking shall be affixed before the apparatus is placed on the market. The CE marking shall be at least 5 mm high and shall maintain the proportions shown above.

2. The manufacturer shall ensure that the apparatus being placed on the market bear a form of identification, such as a type, batch, or serial number. The manufacturer shall indicate on the apparatus their name, registered trade name, or registered trade mark, as well as the postal address at which they can be reached. If unable to place this information on the apparatus itself, it shall be placed on the packaging or a document accompanying the apparatus.

Notes:

1. By placing the CE marking on a product, the manufacturer is stating that the device complies with ALL applicable EU directives. The test report in which this information is contained shows compliance of the device to the requirements of the EMC directive only, other directives may or may not be applicable at this time.

2. The information shown above is valid as of the issue date of the test report in which it is contained.

Appendix B: Obligations of the Manufacturer

Equipment Requirements

Equipment shall be so designed and manufactured as to ensure that:

(a) The electromagnetic disturbance generated does not exceed the level above which radio and telecommunications equipment or other equipment cannot operate as intended;

(b) It has a level of immunity to the electromagnetic disturbance to be expected in its intended use which allows it to operate without unacceptable degradation of its intended use.

Documentation Requirements

The manufacturer shall establish the technical documentation, which shall specify the applicable requirements and cover the design, manufacture, and operation of the apparatus. It shall, wherever possible, contain at least the following elements:

(a) A general description of the apparatus;

(b) Conceptual design and manufacturing drawings and schemes of components, sub-assemblies, circuits, etc.;

(c) Descriptions and explanations necessary for the understanding of those drawings and schemes and the operation of the apparatus;

(d) A list of the harmonized standards applied in full or in part the references of which have been published in the *Official Journal of the European Union* and, where those harmonized standards have not been applied, descriptions of the solutions adopted to meet the essential requirements of the EMC Directive, including a list of other relevant technical specifications applied. In the event of partly applied harmonized standards, the technical documentation shall specify the parts which have been applied;

(e) Results of design calculations made, examinations carried out, etc.;

(f) Test reports.

Manufacturing Requirements

1. The manufacturer shall ensure that the apparatus is accompanied by easily understood instructions that make clear the intended use for the apparatus and any precautions that must be taken in order to ensure its compliance.

2. The manufacturer shall ensure that procedures are in place for the apparatus production to remain in conformity with the EMC directive. If the manufacturer has reason to believe that the apparatus no longer conforms to this directive, they shall immediately take the necessary measures to bring the apparatus into conformity.

3. A manufacturer may, by a written mandate, appoint an authorized representative.

Appendix C: Declaration of Conformity

Contents of the Declaration of Conformity as Required by the EMC Directive

The EU Declaration of Conformity must contain the following information:

(a) Apparatus model/Product (product, type, batch, or serial number);

(b) Name and address of manufacturer or his authorized representative;

(c) This declaration of conformity is issued under the sole responsibility of the manufacturer;

(d) Object of the declaration (identification of the apparatus allowing traceability; it may include a color image of sufficient clarity where necessary for the identification of the apparatus);

(e) References to the relevant harmonized standards used, including the date of the standard, or references to other technical specifications, including the date of the specification, in relation to which conformity is declared;

(f) Where applicable, the notified body … (name, number) performed … (description of intervention) and issued the certificate;

(g) Additional information:
Signed for and on behalf of:
(place and date of issue):
(name, function) (signature):

Notes:
The manufacturer or his authorized representative in the Community shall hold the technical documentation and the EU Declaration of Conformity at the disposal of the authorities for a period of at least ten years after the date on which such apparatus was placed on the market. If neither the manufacturer nor his authorized representative is established within the Community, the obligation to hold the EU Declaration of Conformity and the technical documentation at the disposal of the competent authorities rests with the person who places the apparatus on the Community market. These documents must be presented upon request by the competent authorities in a timely manner, and they must be original documents.

Appendix D: Sample Declaration of Conformity

EU Declaration of Conformity (DoC)

We

Company name:	Name of manufacturer or authorized representative	
Postal address:	Any street	
Postcode and city:	Postcode	Any city
Telephone number:	Telephone number	
E-Mail address:	E-Mail@anyway.com	

declare that the DoC is issued under our sole responsibility and belongs to the following product:

Apparatus model/Product:	Apparatus
Type:	Type or
Batch:	Batch or
Serial Number:	Serial Number

Object of the declaration (identification of the apparatus allowing traceability; it may include a color image of sufficient clarity where necessary for the identification of the apparatus):

Identification of the apparatus	{Insert Picture Here}

The object of the declaration described above is in conformity with the relevant Union harmonization legislation:
EMC Directive 2014/30/EU

…	…
…	…
…	…
…	…

The following harmonized standards and technical specifications have been applied:

Title, Date of standard/specification:

…	…
…	…
…	…
…	…
…	…
…	…

Additional Information

Additional Information

Signed for and on behalf of:

Place of issue	yyyy/mm/dd	
Place of issue	Date of issue	Name, function, signature

Appendix E: UKCA Labeling Information

UKCA Marking

Rules for using the UKCA image

You must make sure that:

- if you reduce or enlarge the size of your marking, the letters forming the UKCA marking must be in proportion to the version set out below
- the UKCA marking is at least 5mm in height – unless a different minimum dimension is specified in the relevant legislation
- the UKCA marking is easily visible, legible

Placing the UKCA Marking

In most cases, you must apply the UKCA marking to the product itself or to the packaging. In some cases, it may be placed on the manuals or on other supporting literature. This will vary depending on the specific regulations that apply to the product

General Rules

3. The UKCA marking must be clearly visible and legible when you affix it to the product. If this is not possible, you must attach it to the packaging (if any) or accompanying documents.

4. UKCA markings must only be placed on a product by you as the manufacturer or your authorized representative (where permitted in the relevant legislation).

5. When affixing the UKCA marking, you take full responsibility for your product's conformity with the requirements of the relevant legislation.

6. You must only use the UKCA marking to demonstrate conformity with the relevant UK legislation.

7. You must not place any marking or sign that may misconstrue the meaning or form of the UKCA marking to third parties.

8. You must not attach other markings on the product which affect the visibility, legibility or meaning of the UKCA marking.

9. The UKCA marking cannot be placed on products unless there is a specific requirement to do so in the legislation.

10. A product may have additional markings and marks, as long as they:
    - fulfil a different function from that of the UKCA marking
    - are not likely to cause confusion with the UKCA marking
    - do not reduce the legibility and visibility of the UKCA marking

CE Marking for both the GB and EU Market

The UKCA marking will not be recognized on the EU or Northern Ireland markets. Products currently requiring a CE marking for sale in the EU will continue to need a CE mark (and meet the other EU rules).

Although you are encouraged to prepare to use the UKCA marking for the GB market as soon as possible, you do not need to change the conformity marking on your product if it is CE marked and if either of the following apply:

- you self-declare the conformity of your good against the regulations
- you voluntarily use a testing or notified body to test against European or international standards

You may need to take additional action if your good needs third-party conformity assessment.

Check whether your UK approved body is taking steps that help you continue to export to the EU without needing to find an EU notified body.

If not, you may need to apply for a new certificate from an EU notified body if you also want to sell your product in the EU. Your approved body should provide another body of your choice with information relating to your conformity assessments in order to facilitate this.

Using both the CE and UKCA Marking

Both the CE and UKCA mark can be placed on a product so long as neither impedes the visibility of the other and requirements of both the GB and EU legislation are met.

The essential requirements and standards that can be used to demonstrate conformity with them for UKCA marked goods have not changed. That means that if your good is currently made to the technical requirements necessary for CE marking then it will be made to the same technical requirements that exist for UKCA marking. However, the conformity assessment bodies that test them may need to be different.

Appendix F: UKCA Obligations of the Manufacturer

Obligations of Manufacturer

A manufacturer is a person who manufactures apparatus, or has apparatus designed or manufactured, and markets that apparatus under their name or trademark.

The obligations of manufacturers of apparatus include:

1. Before placing apparatus on the GB market, the manufacturer must ensure that it has been designed and manufactured in accordance with the essential requirements as set out in Schedule 1 to the 2016 Regulations and that they have had have a relevant conformity assessment procedure carried out and technical documentation drawn up.
2. Once this has been done, the manufacturer must draw up a declaration of conformity[1], and affix the UKCA marking[2] to the apparatus, except where it is not possible or warranted to affix the UKCA marking to the apparatus, in which case it must be affixed to the packaging and the accompanying documents. Until 31 December 2022, the UKCA marking may be affixed to a label affixed to, or a document accompanying, the apparatus, even where it can otherwise be affixed to the apparatus.
3. Qualifying Northern Ireland goods can be placed on the GB market with the CE and CE UKNI conformity markings, see further detail in Section 10 on Qualifying Northern Ireland Goods.
4. Manufacturers must keep technical documentation and the declaration of conformity for 10 years after the apparatus has been placed on the GB market.
5. Manufacturers must also label apparatus with their name, registered trade name or registered trademark and address; the type batch or serial number (or other identification); and ensure that they are accompanied by relevant instructions in English.
6. Manufacturers must ensure that procedures are in place for series production to remain in conformity with Part 2 of the 2016 Regulations. In doing so, they must take account of any changes in electrical equipment design or characteristics, and any change in a harmonized standard or in another technical specification by reference to which the Declaration of Conformity was drawn up.
7. Manufacturers must take action where they have reason to believe that the apparatus they have placed on the GB market is not in conformity with the 2016 Regulations.
8. Manufacturers must also cooperate with and provide information to enforcing authorities following any requests.

Manufacturers based in Northern Ireland can follow the legislation as it applies to Northern Ireland and place qualifying Northern Ireland goods on the GB market without any additional approvals. See further detail in Section 10 on Qualifying Northern Ireland Goods.

[1] A Declaration of Conformity is a document that declares that the product is in conformity with the relevant statutory requirements applicable to the specific product.

[2] Until 31 December 2021, apparatus conforming to EU rules, including the CE marking, may be placed on the market of Great Britain.

Record Keeping

You, or your authorized representative (where allowed for in the relevant legislation), must keep documentation to demonstrate that your product conforms with the regulatory requirements. This must be kept for up to 10 years after the product is placed on the market.

This information can be requested at any time by market surveillance or enforcement authorities to check that your product conforms with the statutory requirements.

The information you must keep will vary depending on the specific legislation relevant to your product. You must keep general records of:

- how the product is designed and manufactured
- how the product has been shown to conform to the relevant requirements
- the addresses of the manufacturer and any storage facilities

You should keep the information in the form of a technical file which can be supplied if requested by a market surveillance authority.

Appendix G: UKCA Declaration of Conformity

Contents of the UK Declaration of Conformity

The UK Declaration of Conformity is a document which must be drawn up for most products lawfully bearing a UKCA marking. We recommend that manufacturers have a separate UK Declaration of Conformity to their EU Declaration of Conformity.

In the document you as the manufacturer, or your authorized representative (where allowed for in the relevant legislation), should:

- declare that the product is in conformity with the relevant statutory requirements applicable to the specific product
- make sure the document has the name and address of the manufacturer (or your authorized representative) together with information about the product and the conformity assessment body (where relevant)

The UK Declaration of Conformity should be available to market surveillance authorities on request.

The information required on the Declaration of Conformity can vary depending on the application legislation but generally should include:

- your name and full business address or that of your authorized representative
- the product's serial number, model or type identification
- a statement, stating you take full responsibility for the product's compliance
- the details of the approved body which carried out the conformity assessment procedure (if applicable)
- the relevant legislation with which the product complies
- your name and signature
- the date the declaration was issued
- supplementary information (if applicable)

Appendix H: UKCA Sample Declaration of Conformity (UK Doc)

<COMPANY NAME/LOGO/TRADEMARK>
UKCA Declaration of Conformity (UK DoC)

In accordance with UK Government Guidance

We

Company name:	Name of manufacturer or authorized representative	
Postal address:	Any street	
Postcode and city:	Postcode	Any city
Telephone number:	Telephone number	
E-Mail address:	E-Mail@anyway.com	

declare that the UK DoC is issued under our sole responsibility and belongs to the following product:

Apparatus model/Product:	Apparatus
Type:	Type or
Batch:	Batch or
Serial Number:	Serial Number

Object of the declaration (identification of the apparatus allowing traceability; it may include a color image of sufficient clarity where necessary for the identification of the apparatus):

Identification of the apparatus	{Insert Picture Here}

The object of the declaration described above is in conformity with the relevant legislation:
Electromagnetic Compatibility Regulations 2016

…	…
…	…
…	…
…	…

The following harmonized standards and technical specifications have been applied:

Title, Date of standard/specification:

…	…
…	…
…	…
…	…

Additional Information

Additional Information

Signed for and on behalf of:

Place of issue	yyyy/mm/dd	
Place of issue	Date of issue	Name, Title, signature