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Electromagnetic Compatibility Test Report

Test results of a Wireless Motion Tracker, model DOT

Customer	:	Xsens Technologies B.V. Pantheon 6A 7521 PR Enschede The Netherlands
Customer's representative	:	Mr. R. Gielians
In the capacity of	:	Manufacturer
Reference number	:	19C00442RPT01
Status test report	:	Final

Test engineer:	Author:	Released:
R. Boot & E. Bloem	A. Tijs	G.C. Nobel
Test engineer	Test Engineer	Team leader

1 Summary

A summary of the test results gained from testing the Wireless Motion Tracker is shown in the table below.

	Standard	Class / level	Result (Pass/Fail)
Emission	EN 61326-1 (2013)	B	Pass
Immunity	EN 61326-1 (2013)	industrial electromagnetic environment	Pass
Emission	EN 61000-3-2 (2014)	A	NA
Emission	EN 61000-3-3 (2013)	-	NA
Emission/immunity	EN 301 489-01 V2.1.1 & EN 301 489-03 V1.6.1[3]	Radio and ancillary equipment for portable use (portable equipment), class B	Pass
immunity	EN 301 489-17 V3.1.1 (2017-02)[3]	--	Pass
Test plan	19C00442TPR02 dated 2019 October, 4		

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

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

Note 3: The EN 301 489-01 V2.1.1 & EN 301 489-03 V1.6.1 is not harmonized under the EMC Directive 2014/30/EU.

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The following table gives a summary of the results of the tests that have been carried out on the Wireless Motion Tracker.

Test sequence	Test Description	Basic standard	EUT Modified during test (yes/no)	Result (Pass/Fail)
--	Conducted emission, test with a LISN	EN 55032 (2015) + AC (2016)	--	NA
--	Conducted emission at telecommunication ports, test with an AAN	EN 55032 (2015) + AC (2016)	--	Na
--	Conducted emission at telecommunication ports, test with a Current Probe	EN 55032 (2015) + AC (2016)	--	NA
--	Conducted emission at telecommunication ports, test with a Capacitive Voltage Probe1 & Current Probe	EN 55032 (2015) + AC (2016)	--	NA
2	Radiated emission up to 1 GHz (SAC)	EN 55032 (2015) + AC (2016)	No	Pass
--	Radiated emission above 1 GHz (FAC)	EN 55032 (2015) + AC (2016)	--	NA
-	Harmonics	EN-IEC 61000-3-2 (2014)	--	NA
--	Flicker	EN-IEC 61000-3-3 (2013)	--	NA
1	ESD	EN-IEC 61000-4-2 (2009)	No	Pass
3	Radiated Immunity	EN-IEC 61000-4-3 (2006) + A1 (2008) + A2 (2010)	Yes[1]	Pass
4	Power Frequency Magnetic Field	EN-IEC 61000-4-8 (2010)	No	Pass
--	EFT	EN-IEC 61000-4-4 (2012)	--	NA
--	Surge	EN-IEC 61000-4-5 (2014) + A1 (2017)	--	NA
--	Conducted Immunity	EN-IEC 61000-4-6 (2014)	--	NA
--	Voltage Dips and Interruptions 230V – 50Hz	EN-IEC 61000-4-11 (2004) + A1 (2017)	--	NA
--	Voltage Dips and Interruptions All other voltages and frequencies.	EN-IEC 61000-4-11 (2004) + A1 (2017)	--	NA
--	Transients and surges in the vehicular environment (12 V)	ISO 7637-2 (2004)	--	NA
--	Transients and surges in the vehicular environment (24 V)	ISO 7637-2 (2004)	--	NA

[1] changed PCB layout with improved ground layer, see picture 1

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

Phenomenon	Comment
Conducted emission, mains terminals, continue (LISN)	The EUT is not AC supplied. The EUT is internal battery operated.
Conducted emission, telecommunication/network ports (AAN/CVP/CP)	The EUT doesn't have multi-user telecommunications / network ports such as ISDN or Ethernet.
Radiated emission above 1 GHz (FAC)	The highest frequency of the internal sources of the EUT is less than 108MHz.
EFT	The EUT is not AC supplied.
Surge	The EUT is not AC supplied
Conducted Immunity	The EUT is internally battery operated.
Voltage Dips and Voltage Variations	The EUT is internally battery operated. The EUT is not AC supplied.

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2 Table of Contents

3 Introduction

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

The objective of the test was to assess the Wireless Motion Tracker in accordance with the standards as mentioned in chapter 5 of this report, within the framework of the CE marking process. This report may only be used for this purpose.

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

The test sample(s) were received on 2019 October, 7. Testing was performed on 2019 October, 7 - 9; November, 13. The test report is issued on 2019 December, 11.

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

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

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

This report is in conformity with ISO 17025.

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

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

4 Explanation Status Report

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

5 Standards and test plan

The EUT is assessed against the following requirements.

- Emission : EN 61326-1 (2013)
- Immunity : EN 61326-1 (2013)
- Emission : EN 61000-3-2 (2014)
- Emission : EN 61000-3-3 (2013)
- Emission/immunity : EN 301 489-01 V2.1.1 & EN 301 489-03 V1.6.1
- immunity : EN 301 489-17 V3.1.1 (2017-02)
- Test plan : 19C00442TPR02 dated 2019 October, 4

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

5.1 Test plan deviations

None

5.2 Basic standards

In deviation to the product standards, the latest versions of the basic standards are applied.

6 Measurement Uncertainties

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

7 EUT details

7.1 Condition of EUT on receipt

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

7.2 Purpose, functional and physical description

The Xsens DOT system can contain 1 up to 5 Trackers (XS -T01) including a Charger (XS-C01) that can charge a maximum of 5 Trackers at the same time. The XS-C01 can be powered via a micro USB cable that is delivered with the package. The XS-T01 housing can differ in appearance (color), but all variants are mechanically and electrically identical. The XS-T01 is a miniature motion tracker, using advanced sensor fusion algorithms, that transmits its data wireless via a certified radio-chip to an external device where the data is collected and stored by an App. The XS-T01 can be charged via its micro USB connector. To simulate the most demanding common customer application of the Xsens DOT system, the XS-T01 (5x), including the XS-C01 that is powered by the micro USB cable, is selected as Equipment Under Test (EUT)

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

Description	Sample
Name	Wireless Motion Tracker
Manufacturer	Xsens Technologies B.V.
Brand	Xsens
Model number	DOT
Serial number	Primary trackers (in charger): F3:72:4F:8C:28:9B ; C5:B5:DD:EB:70:7B; DB:17:F7:7C:38:BC; C7:FA:AC:44:9B:5F; F2:FB:E2:43:7F:0A; Running tracker: D6:E8:0D:26:74:89
Rating voltage	VDD can be set from 4.5V DC - 5.5V DC (both tracker and charger)
Rating power	~250mW at 5V DC (single tracker while charging); 1250mW (5 trackers charging on Charger)
Rating amperage	Undefined
Rating frequency	Not applicable (DC)
Power supply during test	~30mW from the internal battery (1 tracker); ~1250mW from 5V USB (Charger; while charging 5 trackers)
Dimensions (L*W*H)	Xsens DOT tracker: Plastic housing (36.3 x 30.4 x 10.8 mm); Xsens DOT charger: Plastic housing (183.6 x 53.5 x 21.1 mm)
Software release	0.2.0 (XS-T01)
Hardware release	XS-C01 (Charger) 1.3; XS-T01 (Tracker) 1.6
Environment to be used	Industrial and non-industrial

7.3 Potential sources of emission

The highest generated or used frequency of the EUT is 64 MHz.

7.4 Interfaces to external objects

The cable connections to EUT and peripheral equipment during testing are displayed in the table below.

Description	Port type	Cable length	Max cable length	Type of cable	Fixing shield	Load at port	Note
USB power and communication cable	DC supply	1m.	2.9m	Shielded	Both sides	Wall adapter / laptop	(The EUT is delivered without USB power supply)

The maximum cable length is specified by the customer. It is the responsibility of the customer to clearly indicate in the user- or installation manual or on the product that the cable length must never be exceeded.

7.5 Test configuration

The EUT is tested as Table top equipment.
According the information of the customer, the class of emission is B.

8 Operating conditions during test

8.1 Test considerations

The EUT has a certified radio chip; ublox ANNA B112, for Radio communication (Bluetooth): 2402 – 2480 MHz, see EU Declaration of Conformity UBX-18058993

Because the EUT dimensions are less than ½ λ at 1GHz (15cm), the radiated immunity tests will be carried out for two EUT sides towards the antenna in the frequency range between 80MHz and 1000MHz. In the frequency range between 1GHz and 2.7 (6) GHz all four EUT sides towards the antenna will be tested. (In accordance with section 8.2 of the basic standard EN-IEC 61000-4-3 (2006).

8.2 Mode(s) of operation

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

Mode of operation	Description
Mode 1	Measurement mode: The XS-T01 is continuously outputting data to the peripheral host/smart-phone. The output configuration is fixed to a 60Hz sample rate. A set of 5 trackers are running in measurement mode during the tests. The host/smart-phone will log the data of all 5 trackers during the measurement.
Mode 2	Charging mode* A maximum of 5x XS-T01 trackers charging in the XS-C01 charger. The XS-T01 are in IDLE mode and not transmitting data. * To reduce testing time Operating mode 1 and 2 are combined for the worst-case scenario (this is not a normal user scenario, then it is either operation mode 1 or operating mode 2)

8.3 Acceptance criteria

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

Mode of operation	Acceptance criterion
Mode 1	Performance criterion A: Quantity to be monitored: Accelerometer initial offset error Applicable: On the combined 3-channel axis (mean of the norm) Performance criteria: 9.51 < x < 10.11 m/s² Quantity to be monitored: Gyroscope initial offset error Applicable: On each of the 3 Individual axis (mean) Performance criteria: -1 < x < 1 deg/s Performance criterion B: The equipment shall continue to operate as intended after the test. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. Performance criterion C: Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.
Mode 2	Performance criterion A: Blue led on EUT shall blink (charging) or stay on continuously (charging ended) Performance criterion B: The equipment shall continue to operate as intended after the test. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. Performance criterion C: Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

8.4 EUT monitoring

During immunity testing, the behavior and performance of the EUT will be monitored by means of On peripheral mobile phone: Samsung SM-G960F/DS (Galaxy S9).

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

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

8.5 Minimum dwell time

The minimum dwell time is determined prior to immunity testing. Besides the requirement of the applied standard(s), the applicant states that the minimum dwell time must be 1 sec.

9 Possible test case verdicts

- NA or not applicable : test does not apply to the EUT

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

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

10 Test equipment

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

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11 Test results

11.1 Radiated emission up to 1 GHz (SAC)

11.1.1 Test method

The radiated emission tests are carried out in a Semi Anechoic Chamber (SAC). The tests are recorded with a Spectrum Analyzer / EMI Receiver. The test method is in accordance with the applied standard(s) (see chapter 5) and with the basic standard EN 55011 (2009) + A1 (2010), where the first standard takes precedence.

11.1.2 Measurement Uncertainty

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

Frequency	U (log)	U (lin)
30 MHz – 200 MHz	+ 5.0 dB	+78.5 % / -44.0 %
200 MHz – 1000 MHz	+ 6.4 dB	+109.6 % / -52.3 %

11.1.3 Requirements

EN 61326-1 (2013)

For Class A equipment, the requirements are laid down in the table below.

Frequency band	QP limit, < 20kVA @ 3m [dBµV/m]	QP limit, < 20kVA @ 5m [dBµV/m]	QP limit, > 20kVA @ 3m [dBµV/m]	QP limit, > 20kVA @ 5m [dBµV/m]
30 MHz - 230 MHz	50	46	60	56
230 MHz - 1 GHz	57	53	60	56

For Class B equipment, the requirements are laid down in the table below.

Frequency band	QP limit @ 3m [dBµV/m]	QP limit @ 5m [dBµV/m]
30 MHz - 230 MHz	40	36
230 MHz - 1 GHz	47	43

EN 301 489-01 V2.1.1 & EN 301 489-03 V1.6.1

Frequency band	QP class A[1] @ 3m [dBµV/m]	QP class B @ 3m [dBµV/m]
30 MHz - 230 MHz	50	40
230 MHz - 1 GHz	57	47

[1] For ancillary equipment intended to be used in an industrial environment or a telecommunication center.

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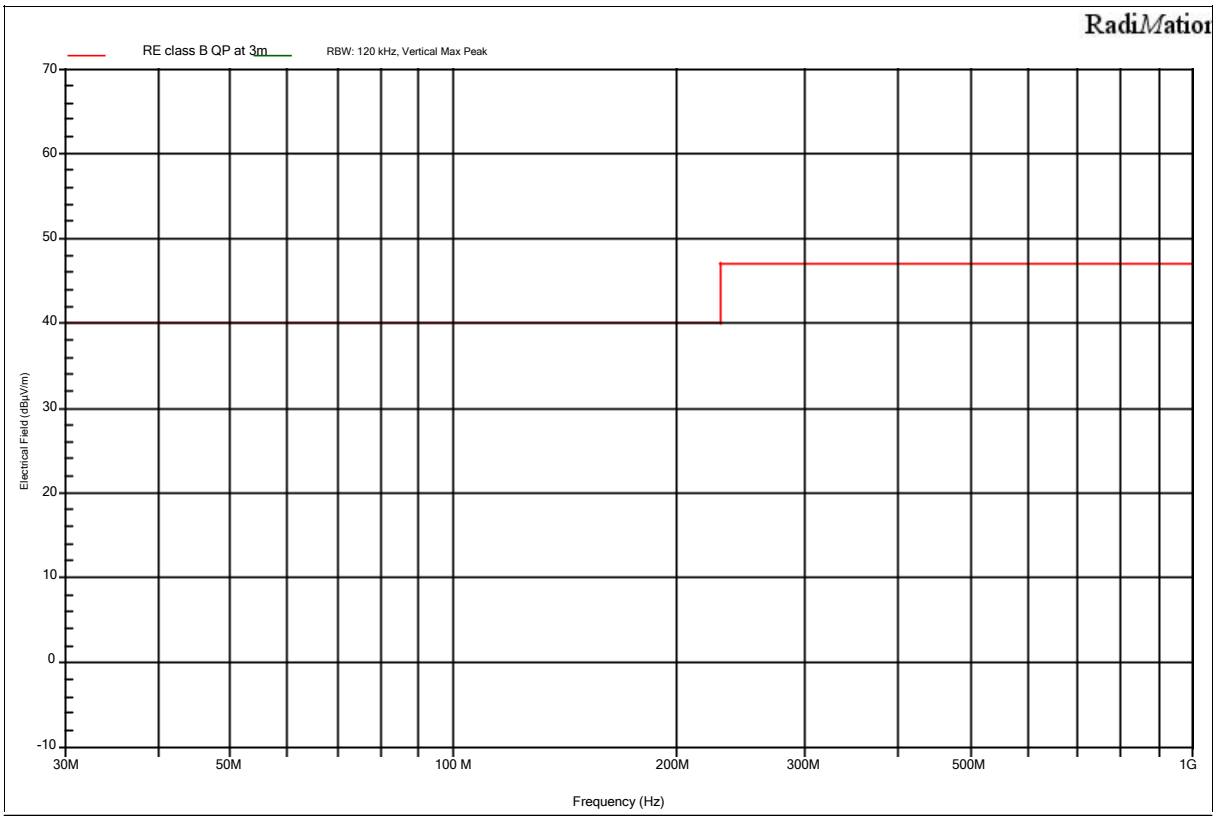
Result Radiated Emission Semi Anechoic Chamber 30.000 MHz to 1.000 GHz

PIN number:	19C00442	Bandwidth:	120 kHz
Test ID:	2	Antenna Distance:	3 m
		Antenna Height:	1 - 4 m
Mode of operation:	Mode 1,2		

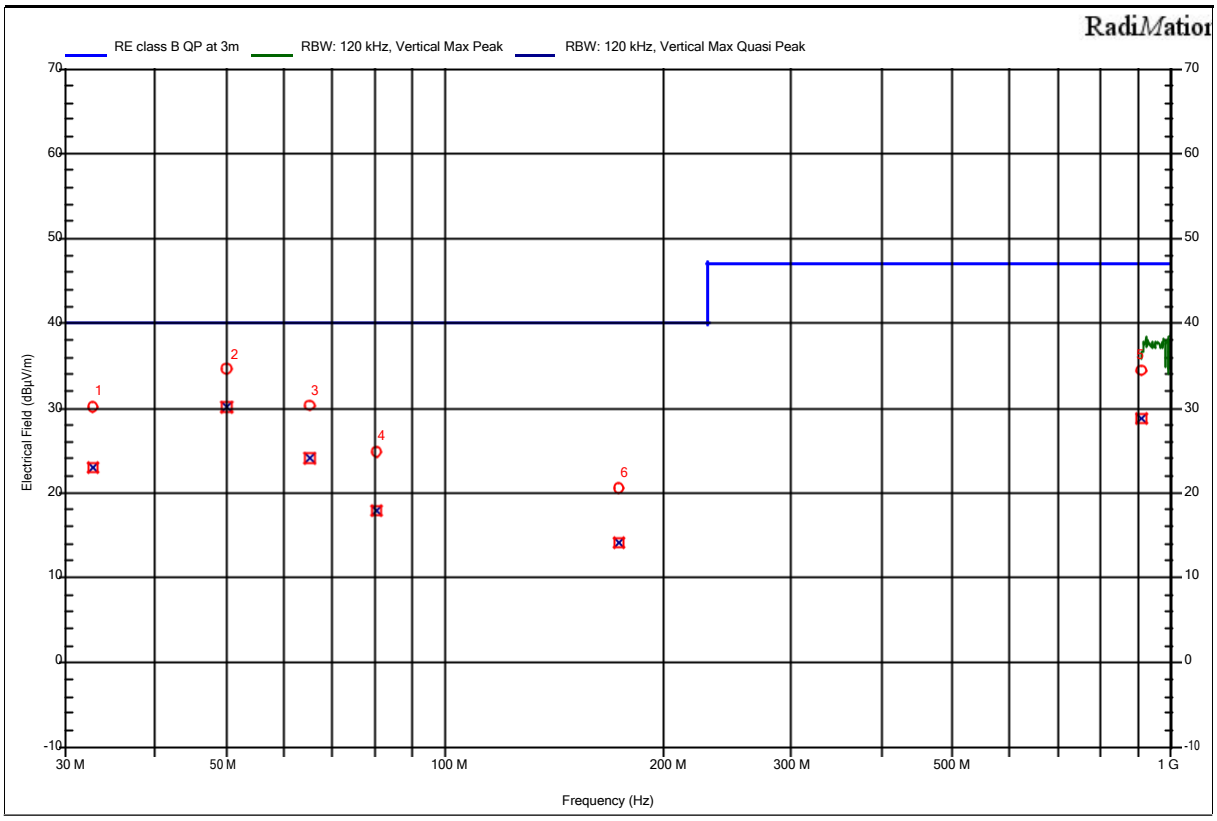


Remarks

Pre-scan

Result Radiated Emission Semi Anechoic Chamber 30.000 MHz to 1.000 GHz

PIN number:	19C00442	Bandwidth:	120 kHz
Test ID:	3	Antenna Distance:	3 m
		Antenna Height:	1 - 4 m
Mode of operation:	Mode 1,2		



Detected Peaks

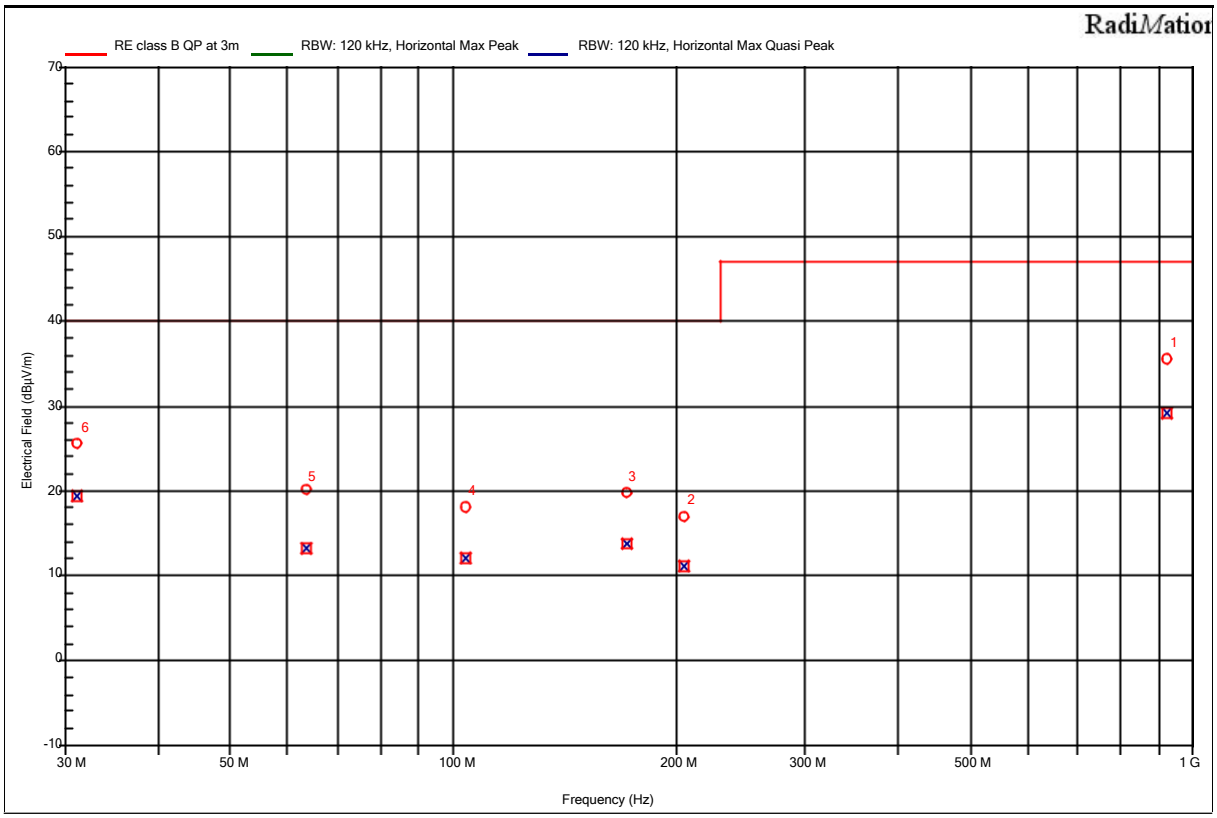
Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Angle	Height	Polarization	Status
1	32.743 MHz	23 dBµV/m	40 dBµV/m	20 degrees	98.2 cm	Vertical	Pass
2	49.992 MHz	30.1 dBµV/m	40 dBµV/m	181 degrees	98.2 cm	Vertical	Pass
3	65.071 MHz	24.2 dBµV/m	40 dBµV/m	251 degrees	1.8 m	Vertical	Pass
4	80.678 MHz	17.8 dBµV/m	40 dBµV/m	271 degrees	98.3 cm	Vertical	Pass
5	910.655 MHz	28.8 dBµV/m	47 dBµV/m	108 degrees	3.8 m	Vertical	Pass
6	173.855 MHz	14.1 dBµV/m	40 dBµV/m	230 degrees	1.5 m	Vertical	Pass

Remarks

Pass

Result Radiated Emission Semi Anechoic Chamber 30.000 MHz to 1.000 GHz

PIN number:	19C00442	Bandwidth:	120 kHz
Test ID:	4	Antenna Distance:	3 m
		Antenna Height:	1 - 4 m
Mode of operation:	Mode 1,2		



Detected Peaks

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Angle	Height	Polarization	Status
1	921.703 MHz	29.1 dBµV/m	47 dBµV/m	-49 degrees	98.4 cm	Horizontal	Pass
2	205.826 MHz	11.1 dBµV/m	40 dBµV/m	-48 degrees	4 m	Horizontal	Pass
3	171.761 MHz	13.8 dBµV/m	40 dBµV/m	-43 degrees	1.7 m	Horizontal	Pass
4	104.352 MHz	12.1 dBµV/m	40 dBµV/m	43 degrees	2.5 m	Horizontal	Pass
5	63.607 MHz	13.2 dBµV/m	40 dBµV/m	21 degrees	3 m	Horizontal	Pass
6	31.140 MHz	19.4 dBµV/m	40 dBµV/m	-89 degrees	3.8 m	Horizontal	Pass

Remarks

Pass

11.2 Electro Static Discharges (ESD)

11.2.1 Test method

The immunity tests to ESD are carried out in accordance with the applied standard(s) (see chapter 5) and the basic standard EN-IEC 61000-4-2 (2009), where the first standard takes precedence. Beside the test levels as described in the standard EN 61326-1 (2013), all voltages of the lower test levels as described in the basic standard are tested.

11.2.2 Measurement Uncertainty

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

11.2.3 Requirements

he requirements are laid down in the table below.

EN 61326-1 (2013)
EN 301 489-01 V2.1.1 & EN 301 489-03 V1.6.1
EN 301 489-17 V3.1.1 (2017-02)

Type of discharge	Test level	Performance Criterion
Air discharge	0 - ± 8 kV	B
Contact discharge	0 - ± 4 kV	B

Test Results of Electro Static Discharge test

PIN number	19C00442
Test ID	1
Temperature	22 °Celsius
Humidity	50 %
Mode of operation	Mode 1,2
Remarks	Pass VCP: no influence observed HCP: no influence observed (mean of accelerometer= 9.87, Mean of the gyroscope = 0.006X, 0.008Y, 0.007Z Contact discharge: some data packages lost while discharging 4 kV on the USB connector. After the test no influence observed. Air discharge: no influence observed The lower levels are tested also

Settings

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

Test Results air discharge

Discharge location	Test level	Note	Result
Enclosure (See discharge points in ESD pictures)	8 kV	See remarks	Pass
Enclosure (See discharge points in ESD pictures)	-8 kV	See remarks	Pass

Test Results contact discharge

Discharge location	Test level	Note	Result
Enclosure (See discharge points in ESD pictures)	4 kV	See remarks	Pass
Enclosure (See discharge points in ESD pictures)	-4 kV	See remarks	Pass

Test Results at Horizontal Coupling Plane

Discharge location	Test level	Note	Result
Enclosure (See discharge points in ESD pictures)	4 kV	See remarks	Pass
Enclosure (See discharge points in ESD pictures)	-4 kV	See remarks	Pass

Test Results at Vertical Coupling Plane

Discharge location	Test level	Note	Result
Enclosure (See discharge points in ESD pictures)	4 kV	See remarks	Pass
Enclosure (See discharge points in ESD pictures)	-4 kV	See remarks	Pass

11.3 Radiated Immunity

11.3.1 Test method

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

11.3.2 Measurement Uncertainty

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

Frequency	U (log)	U (lin)
26 MHz – 6 GHz	± 2.1 dB	+28.0 % / -21.9 %

11.3.3 Requirements

The requirements are laid down in the table below.

EN 61326-1 (2013)

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

EN 301 489-01 V2.1.1 & EN 301 489-03 V1.6.1
EN 301 489-17 V3.1.1 (2017-02)

Antenna polarization	Test level	Frequency range	Performance Criterion
Horizontal	3 V/m	80 – 1000 MHz	See product standard
Vertical	3 V/m	80 – 1000 MHz	See product standard
Horizontal	3 V/m	1 – 6 GHz	See product standard
Vertical	3 V/m	1 – 6 GHz	See product standard

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Test Results of Radiated Immunity test 80 MHz to 1 GHz Vertical

PIN number	19C00442
Test ID	8
Mode of operation	Mode 1,2, 000 degrees (EUT is facing antenna)
Angle, observation and result	Pass, mode 2 (charging mode), no influence observed mode 1 (measuring mode), no influence observed.

Settings

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

Test Results of Radiated Immunity test 80 MHz to 1 GHz Horizontal

PIN number	19C00442
Test ID	7
Mode of operation	Mode 1,2, 000 degrees (EUT is facing antenna)
Angle, observation and result	Pass, mode 2 (charging mode), no influence observed mode 1 (measuring mode), no influence observed.

Settings

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

Test Results of Radiated Immunity test 80 MHz to 1 GHz Vertical

PIN number	19C00442
Test ID	5
Mode of operation	Mode 1,2; 270 degrees (see pictures)
Angle, observation and result	Pass, mode 2 (charging mode), no influence observed mode 1 (measuring mode), no influence observed. Log data analysed on laptop with accelerometer initial offset error (mean) = 9.859 and Gyroscope initial offset error (mean) = 0.0024(X), -0.00037(Y), -0.0098(Z)

Settings

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

Test Results of Radiated Immunity test 80 MHz to 1 GHz Horizontal

PIN number	19C00442
Test ID	6
Mode of operation	Mode 1,2; 270 degrees (see pictures)
Angle, observation and result	Pass, mode 2 (charging mode), no influence observed mode 1 (measuring mode), no influence observed.

Settings

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

Test Results of Radiated Immunity test 1 GHz to 6 GHz Vertical

PIN number	19C00442
Test ID	28
Mode of operation	Mode 1,2; 000 deg; pcb layout changed of tracker
Angle, observation and result	Pass, no influence observed.

Settings

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

Test Results of Radiated Immunity test 1 GHz to 6 GHz Horizontal

PIN number	19C00442
Test ID	27
Mode of operation	Mode 1,2; 000 deg; pcb layout changed of tracker
Angle, observation and result	Pass, no influence observed.

Settings

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

Test Results of Radiated Immunity test 1 GHz to 6 GHz Vertical

PIN number	19C00442
Test ID	30
Mode of operation	Mode 1,2; 090 deg; pcb layout changed of tracker
Angle, observation and result	Pass, no influence observed.

Settings

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

Test Results of Radiated Immunity test 1 GHz to 6 GHz Horizontal

PIN number	19C00442
Test ID	34
Mode of operation	Mode 1,2; 90 deg; pcb layout changed of tracker
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 0.3%	Modulation	1000 Hz. 80% AM
Dwell time	1 s	Test level	3 V/m
Distance	3 m		

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Test Results of Radiated Immunity test 1 GHz to 6 GHz Vertical

PIN number	19C00442
Test ID	32
Mode of operation	Mode 1,2; 180 deg; pcb layout changed of tracker
Angle, observation and result	Pass, no influence observed.

Settings

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

Test Results of Radiated Immunity test 1 GHz to 6 GHz Horizontal

PIN number	19C00442
Test ID	33
Mode of operation	Mode 1,2; 180 deg; pcb layout changed of tracker
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 0.5%	Modulation	1000 Hz. 80% AM
Dwell time	2 s	Test level	3 V/m
Distance	3 m		

Test Results of Radiated Immunity test 1 GHz to 6 GHz Vertical

PIN number	19C00442
Test ID	31
Mode of operation	Mode 1,2; 270 deg; pcb layout changed of tracker
Angle, observation and result	Pass, no influence observed.

Settings

Frequency step	logarithmic step of 0.2%	Modulation	1000 Hz. 80% AM
Dwell time	1 s	Test level	3 V/m
Distance	3 m		

Test Results of Radiated Immunity test 1 GHz to 6 GHz Horizontal

PIN number	19C00442
Test ID	35
Mode of operation	Mode 1,2; 270 deg; pcb layout changed of tracker
Angle, observation and result	Pass, no influence observed.

Settings

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

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11.4 Power frequency magnetic field

11.4.1 Test method

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

11.4.2 Measurement Uncertainty

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

Frequency	U (log)	U (lin)
50 Hz, 60 Hz	± 0.4 dB	+5.3 % / -5.0 %

11.4.3 Requirements

The requirements are laid down in the table below.

Field direction	Test level	Performance Criterion
X,Y,Z	30 A/m	A

Test Results of Power frequency magnetic field immunity test

PIN number	18C00442, Xsens technologies
Remarks	Mode 1, 2

Settings

Test level [A/m]:	30	Dwell time [sec]:	1 sec

Test specifications	Antenna polarization	Mode of operation	Observation	Performance criterion required	Performance criterion attained	Pass/Fail
50 Hz	X	Mode 1,2	No influence observed	No influence observed	A	Pass
	Y	Mode 1,2	No influence observed	No influence observed	A	Pass
	Z	Mode 1,2	No influence observed	No influence observed	A	Pass
60 Hz	X	Mode 1,2	No influence observed	No influence observed	A	Pass
	Y	Mode 1,2	No influence observed	No influence observed	A	Pass
	Z	Mode 1,2	No influence observed	No influence observed	A	Pass

12 Conclusion

The Wireless Motion Tracker meets the class B emission limits as described in EN 61326-1 (2013) and in the EN 301 489-01 V2.1.1 & EN 301 489-03 V1.6.1[1].

The Wireless Motion Tracker meets the industrial immunity levels as described in EN 61326-1 (2013), EN 301 489-01 V2.1.1[1] & EN 301 489-03 V1.6.1[1] and in the EN 301 489-17 V3.1.1 (2017-02[1] if the modifications as described in this report are applied. This is based on the tested mode of operation(s), the applicable performance criteria and the acceptance criteria as specified by the customer.

Meeting the requirements of these standard(s) and the requirements mentioned in this report, means presumption of conformity with EMC Directive 2014/30/EU.

It is the responsibility of the customer to implement the modifications in a correct way.

12.1 Remarks

It is the responsibility of the manufacturer to ensure, that all of the following products are equal to the measured sample. And as such ensure that all manufactured Wireless Motion Trackers are in compliance with the harmonised standards under EMC Directive 2014/30/EU, as mentioned above.

Furthermore, in order to fulfil the European CE-legislation, it is the responsibility of the manufacturer of the equipment to draw up a declaration of conformity and to have technical file documentation containing information to demonstrate the conformity of the product to the applicable requirements. At the same time, every unit brought to the market or put into service has to be marked with the CE-mark.

[1] The EN 301 489-01 V2.1.1 & EN 301 489-03 V1.6.1 is not harmonized under the EMC Directive 2014/30/EU

13 Appendix A: General performance criteria

The general principles (performance criteria) for the evaluation of the immunity test results are the following.

Performance criterion A

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 criterion B

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.

EXAMPLE 1 A data transfer is controlled/checked by parity check or by other means. In the case of malfunctioning, such as caused by a lightning strike, the data transfer will be repeated automatically. The reduced data transfer rate at this time is acceptable.
EXAMPLE 2 During testing, an analogue function value may deviate. After the test, the deviation vanishes.
EXAMPLE 3 In the case of a monitor used only for man-machine monitoring, it is acceptable that some degradation takes place for a short time, such as flashes during the burst application. EXAMPLE 4 An intended change of the operating state is allowed if self-recoverable.

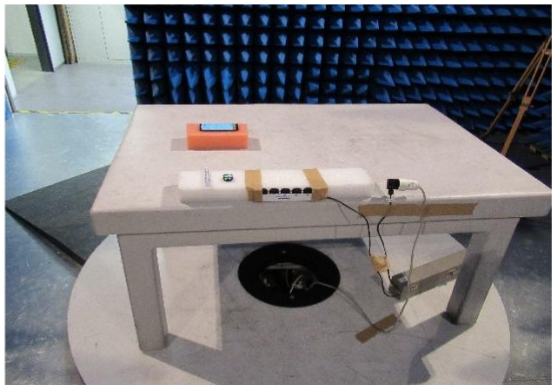
Performance criterion C

Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

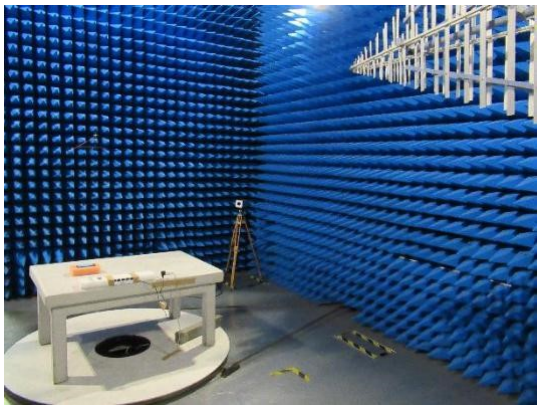
EXAMPLE 1 In the case of an interruption in the mains longer than the specified buffer time, the power supply unit of the equipment is switched off. The switch-on may be automatic or carried out by the operator.
EXAMPLE 2 After a program interruption caused by a disturbance, the processor functions of the equipment stops at a defined position and is not left in a "crashed state". The operator's decision prompts may be necessary.
EXAMPLE 3 The test results in an opening of an over-current protection device that is replaced or reset by the operator.

14 Appendix B: Pictures of EUT

Picture 1: left EUT is the old layout, right EUT is the new layout

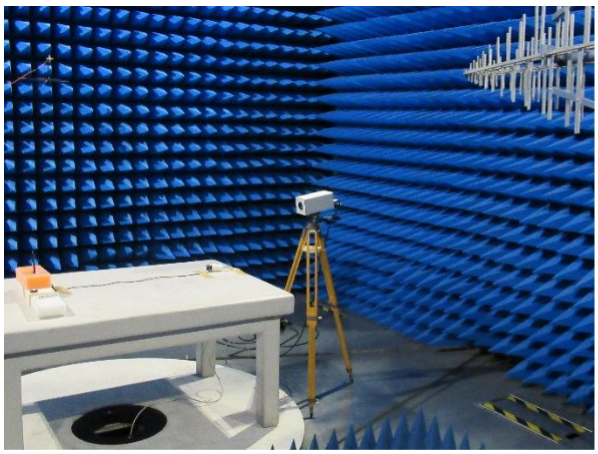


Picture 2: Radiated emission



Picture 3: Radited emission 30-1000MHz

Picture 4: Radiated immunity



Picture 5: Radiated immunity

Picture 6: Power frequency magnetic field

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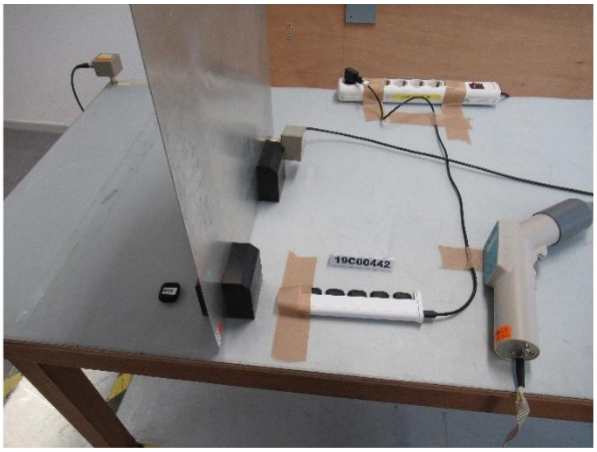
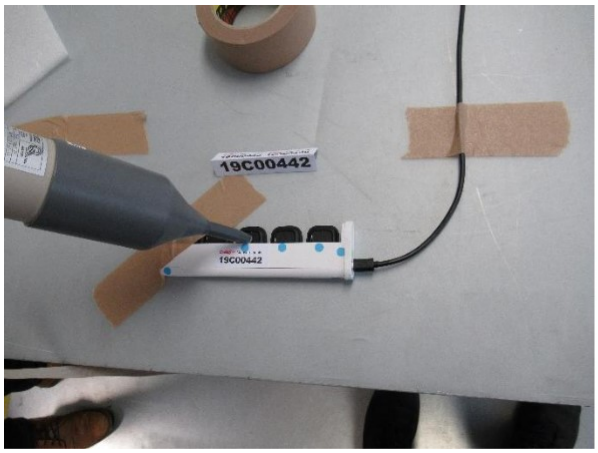
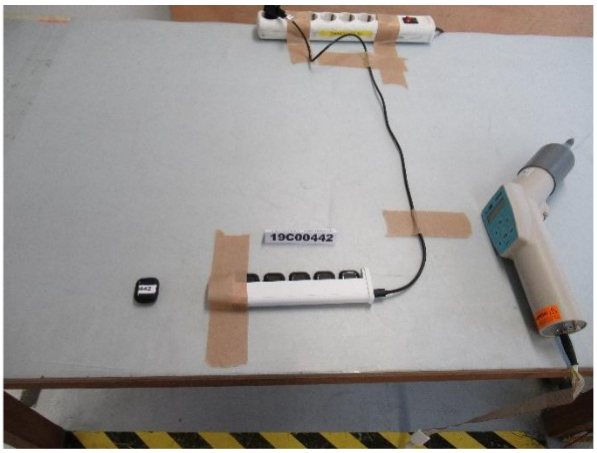
Picture 7: Electro static discharge



Picture 8: Electro static discharge

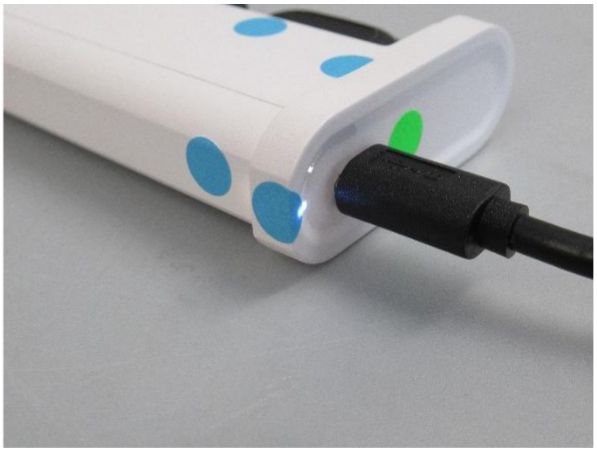


Picture 9: Electro static discharge



Picture 10: Electro static discharge

Picture 11: Electro static discharge


Picture 12: Electro static discharge

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15 Appendix C: Equipment List

Radiated Emission Semi Anechoic Chamber 30 MHz to 1000 MHz

Device Type	Brand	Type	ID
Antenna tower	DARE!! Instruments	RadiTower (RadiCentre)	1569+1496
Turn table	DARE!! Instruments	RadiTurn (RadiCentre)	1569+1367
Cable antenna -> preamp	RFS	Cellflex SCF12-50J	1496
Antenna	Rohde & Schwarz	HL 562	1527
Spectrum analyser	Rohde & Schwarz	ESU 8 Input 2 (LAN)	1556
Cable preamp -> analyser	Pasternack / Huber & Suhner	RG217 / Sucofeed_1/2	1478

ESD

Device Type	Brand	Type	ID
Climate chamber	ESPEC	PMS-CA	2058
ESD gun	EMC partners	Virtual ESD Gun	1753

Radiated Immunity 80 MHz to 1000 MHz

Device Type	Brand	Type	ID
Amplifier	Prâna	MT 200 SC	1537
Field sensor 1	DARE!! Instruments	RSS2010B	1711
Signal generator	DARE!! Instruments	RGN6000B	1567
Antenna	Rohde & Schwarz	HL 562 with folded rear elements	1527
Turn table	DARE!! Development	Raditurn	1367
Coupler	Prana	MT 200 SC	1537
Forward power meter	DARE!! Instruments	RPR2018P	1648+1529
Reflected power meter	DARE!! Instruments	RPR1006A	1648+1498
Switch matrix	DARE!! Instruments	RSW1024S	ID1648
Cable SG -> amplifier	Huber & Suhner	RG142	1228
Cable coupler -> antenna	Huber & Suhner	Sucofeed_1/2	1225
Antenna tower	DARE!! Instruments	RadiTower RAT1001B + RPL2010A	1569 + 1496
Cable coupler -> antenna	RFS	Cellflex SCF12-50J	1496

Radiated Immunity 1 GHz to 6 GHz

Device Type	Brand	Type	ID
Amplifier	DARE!! Instruments	RadiField RFS2006B	1647
Field sensor 1	DARE!! Instruments	RSS2010B	1711
Signal generator	DARE!! Instruments	RGN6000B	1567
Antenna	DARE!! Instruments	RadiField RFS1006B	1647
Turn table	DARE!! Instruments	RadiTurn	1367
Coupler	DARE!! Instruments	RadiField RFS2006B	1647
Forward power meter	DARE!! Instruments	RadiField RFS2006B	1647
Reflected power meter	DARE!! Instruments	RadiField RFS2006B	1647
Switch matrix	DARE!! Instruments	RSW1024S	ID1648
Cable SG -> amplifier	Pasternack / Huber & Suhner	RG217 / Sucofeed_1/2	1478
Antenna tower	DARE!! Instruments	RadiTower (RadiCentre)	1569+1496

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