

Test Report

Electromagnetic Compatibility (EMC)

HELEM2207000317-1



TESTS ACCORDING TO FCC PART 15 B AND ISED CANADA REQUIREMENTS

Equipment Under Test: Breathing sensor and smart garment

Model: Oxa1

Type: -

Trademark: OXA

Manufacturer / Customer: Nanoleq AG
Hofwisenstrasse 50 A
8153 Rümlang
Switzerland

FCC Rule Part: FCC CFR 47 Part 15 Subpart B, Class B
IC Rule Part: ICES-003 Issue 7, Class B

Date: 14 November 2022

Date: 14 November 2022

Issued by:

A handwritten signature in blue ink that appears to read "Henri Mäki".

Henri Mäki
Testing Engineer

Checked by:

A handwritten signature in blue ink that appears to read "Rauno Repo".

Rauno Repo
Senior EMC Specialist

TABLE OF CONTENTS

TABLE OF CONTENTS	2
GENERAL REMARKS	3
Disclaimer	3
RELEASE HISTORY	4
PRODUCT DESCRIPTION	5
Equipment Under Test (EUT)	5
General description	5
Samples and modifications	5
Ports and cables	5
Peripherals	6
TEST CONDITIONS	7
Operation modes	7
Emission Measurement Uncertainty	7
SUMMARY OF TESTING	8
EMISSION TESTS	9
Conducted Emissions In The Frequency Range 150 kHz – 30 MHz	9
Radiated Emissions In The Frequency Range 30 MHz – 12.5 GHz	11
TEST EQUIPMENT	15
Conducted emissions	15
Radiated emissions	15

GENERAL REMARKS**Disclaimer**

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/Terms-and-Conditions/Terms-e-Document.aspx>

Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

RELEASE HISTORY

Version	Changes	Issued
1.0	Initial release	10 November 2022
1.1	EUT model name corrected	14 November 2022

PRODUCT DESCRIPTION**Equipment Under Test (EUT)**

EUT information	
General Product Description	Breathing sensor and smart garment
Trademark	OXA
Model	Oxa1
Type	-
Serial number	-
Power input port type	Battery operated (charging via USB-C)
Rated voltage	-
Rated current	-
Rated frequency	DC
Rated power	-
EUT Highest operation freq.	-
Hardware Version (if any)	-
Software Version (if any)	-
Mechanical size of the EUT (mm)	-
Parallel models	-
Radio module or chip	Insight SiP ISP1507

The EUT was tested as a tabletop unit.

General description

The equipment under test is a breathing sensor and a smart garment. The sensor monitors heartbeat, breath, and temperature change in real-time. The garment includes a breathing band to provide breathing rate and depth, and electrodes to provide heart rate and heart rate variability.

The sensor includes a Bluetooth 5.0 Low Energy module in order to connect to a mobile device for guided breathing sessions.

Samples and modifications

No.	Name	Description
1	EUT	Sensor (sample number 3323) and garment (bra). Sensor has been modified to have Vdd power wires outside the enclosure.

Ports and cables

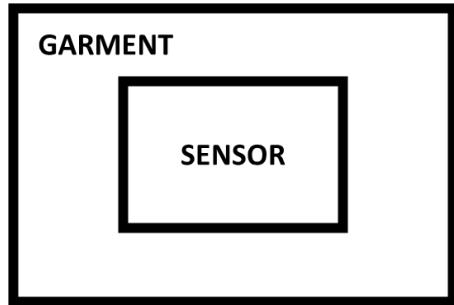
Cable / Port	Description
USB-C	Used for charging

Peripherals

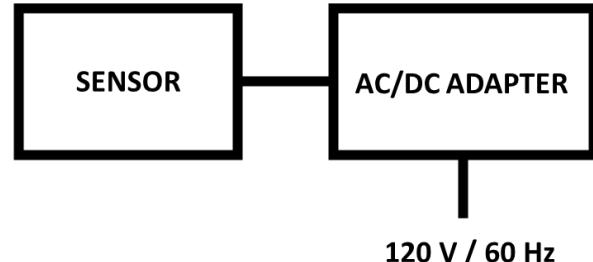
Peripheral	Description / Usage
AC/DC adapter	Huawei HW-050100E01. Charging the EUT during Conducted emissions test. Provided by the laboratory.

TEST CONDITIONS

Configuration of the EUT was made to correspond to the actual assembling conditions as far as possible. The sensor was either attached to the garment or peripheral AC/DC adapter (input voltage 120 V, 60 Hz). The Bluetooth radio of the sensor was transmitting at the three BLE advertising channels (2402, 2426, 2480 MHz).



Operation mode 1



Operation mode 2

Figure 1: Test setup block diagram

Operation modes

During the tests the EUT was in the following operation modes:

Mode	Description
1	Sensor attached to garment
2	Charging the sensor

Emission Measurement Uncertainty

The uncertainties comply with CISPR 16-4-2 ed.2 requirements ($U_{lab} < U_{cisp}$).

SUMMARY OF TESTING

Test Specification	Description of Test	Result
FCC CFR 47 15/B §15.107, ICES-003 3.2.1	Conducted emissions, Class B	PASS
FCC CFR 47 15/B §15.109, ICES 003 3.2.2	Radiated emissions, Class B	PASS

Decision rule used for the emission tests are defined in standard CISPR 16-4-2 / EN 55016-4-2 clause 4.2

Test Facility

Testing Laboratory / address: FCC designation number: FI0002 ISED CAB identifier: T004	SGS Fimko Ltd Takomotie 8 FI-00380, HELSINKI FINLAND
Test Site:	<input type="checkbox"/> K10LAB, ISED Canada registration number: 8708A-1 <input checked="" type="checkbox"/> K5LAB, ISED Canada registration number: 8708A-2 <input type="checkbox"/> T10LAB

EMISSION TESTS**Conducted Emissions In The Frequency Range 150 kHz – 30 MHz**

Standard: ANSI C63.4-2014
Tested by: PKA
Date: 7 November 2022
Temperature: 24 °C
Humidity: 44 %RH
Barometric pressure: 1008 mbar
Measurement uncertainty: ± 2.9 dB Level of confidence 95 % (k = 2)

FCC Rule: 15.107(a)

ICES-003: 3.2.1

Test Plan

Conducted disturbance voltage was measured with an artificial main network from 150 kHz to 30 MHz with a resolution bandwidth of 9 kHz. Measurements were carried out with peak and average detectors from the phase(s) and neutral lines of the power supply cable.

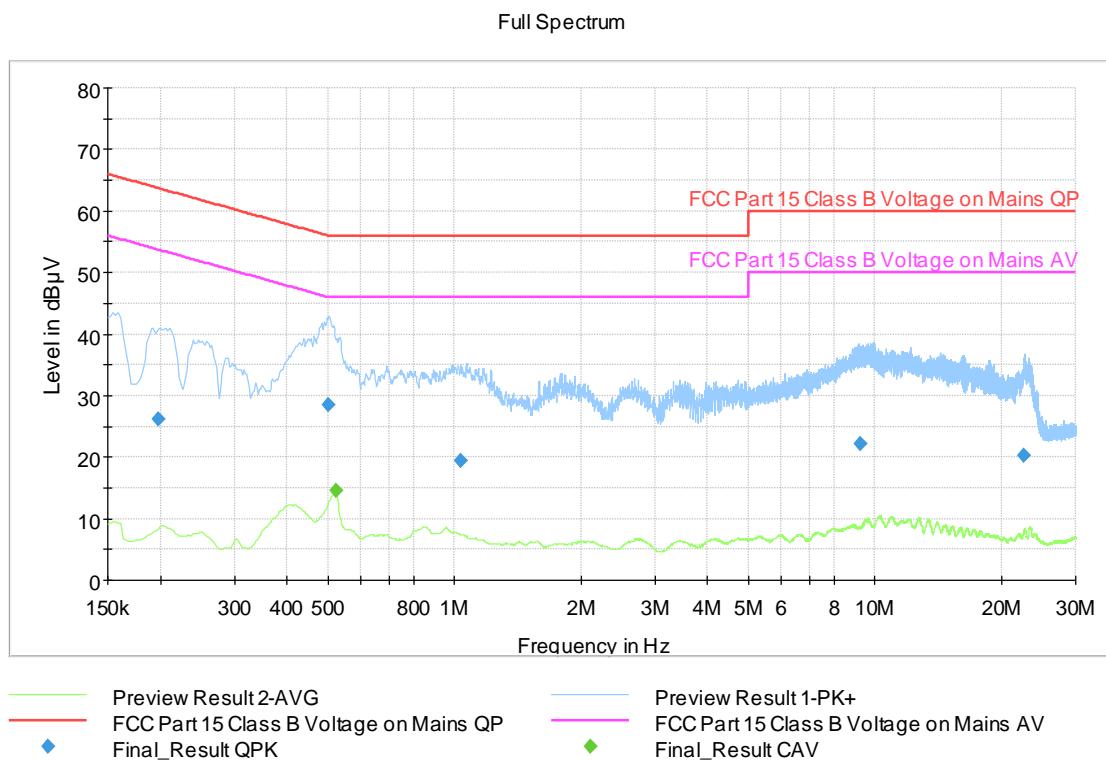
The EUT was working as described in the section “Test Conditions” using Operation mode 2.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency.

Conducted Emissions In The Frequency Range 150 kHz – 30 MHz

Test results

**Figure 2:** Graphical presentation of conducted emissions**Table 1:** Test results for conducted emissions

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.198000	26.24	---	63.69	37.45	15 x 1000.0	9.000	L1	9.7
0.500500	28.42	---	56.00	27.58	15 x 1000.0	9.000	L1	9.7
0.522500	---	14.54	46.00	31.46	15 x 1000.0	9.000	L1	9.7
1.032750	19.42	---	56.00	36.58	15 x 1000.0	9.000	L1	9.8
9.212000	22.08	---	60.00	37.92	15 x 1000.0	9.000	L1	10.2
22.600750	20.33	---	60.00	39.67	15 x 1000.0	9.000	L1	10.6

Correction factor (dB) in the final result tables contains the sum of the transducers (cables + LISN).

QuasiPeak and Average values are the measured values corrected with the correction factor.

Radiated Emissions In The Frequency Range 30 MHz – 12.5 GHz

Standard:	ANSI C63.4-2014
Tested by:	HEM
Date:	7 November 2022
Temperature:	24 °C
Humidity:	44 %RH
Barometric pressure:	1008 hPa
Measurement uncertainty:	± 4.9 dB (30 – 200 MHz) Level of confidence 95 % (k = 2) ± 4.1 dB (200 – 1 000 MHz) ± 4.3 dB (1 – 18 GHz)

FCC Rule: 15.109(a)**ICES-003: 3.2.2****Test plan**

The radiated emission measurements were done within a semi anechoic screened chamber. Additional floor absorbers were used on the floor between the EUT and receiving antenna in radiated emission test above 1 GHz. The EUT was placed on a table 0.8 m above the reflecting ground plane. The measurement distance was 3 meters. The worst interferences were determined during measurements by rotating the turntable and adjusting the antenna height. The measurements were done in horizontal and vertical antenna polarizations. The supply voltage to the turntable was fed through the filter.

The EUT was working as described in the section “EUT Test Conditions” using Operation modes 1 and 2. Above 1 GHz only the results with Operation mode 1 are presented.

Radiated measurement settings**Preliminary testing:**

Turtable movement:	30° step (30-1000 MHz),	15° step (1-12.5 GHz)
Turtable position:	0° to 330° (30-1000 MHz),	0° to 345° (1-12.5 GHz)
Antenna movement:	1.5 m step	
Antenna height:	1.0 m to 4.0 m	
Antenna polarization:	Vertical and horizontal	

Final testing:

Turtable movement:	Continuous	
Turtable position:	± 30 ° (30-1000 MHz),	± 15 ° (1-12.5 GHz)
Antenna movement:	Continuous	
Antenna height:	± 1.5 m	
Antenna polarization:	Vertical and horizontal	

Radiated Emissions In The Frequency Range 30 MHz – 12.5 GHz

Test results

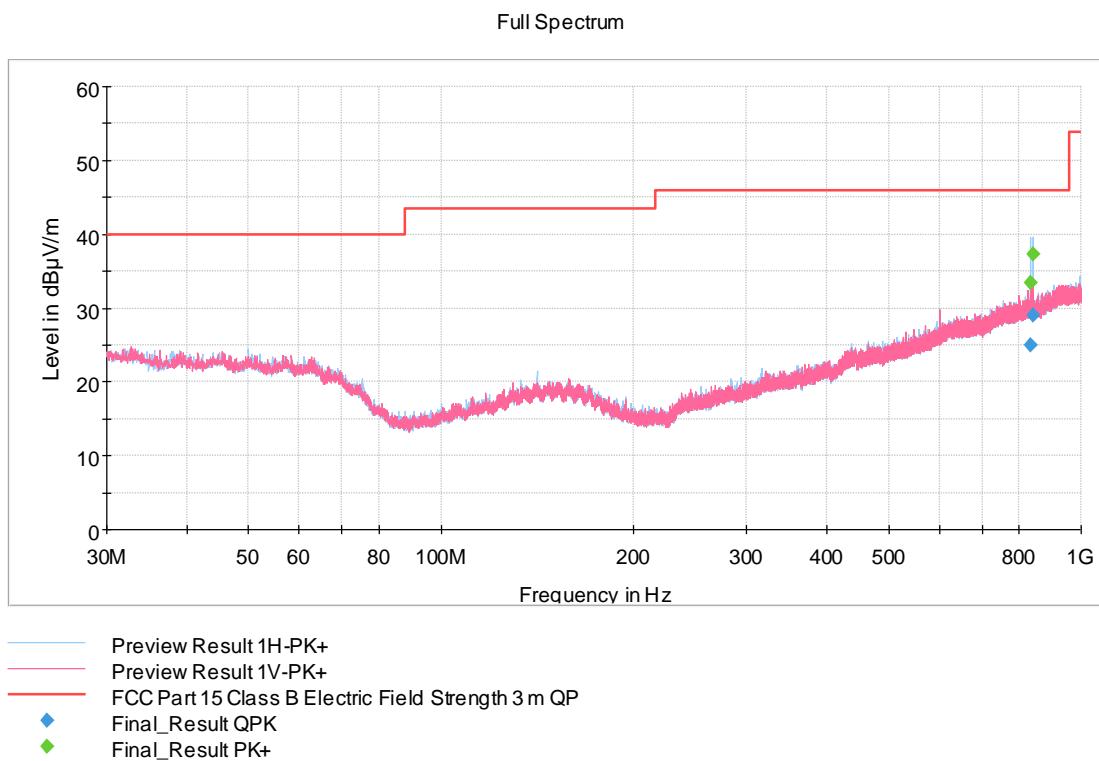


Figure 3: Graphical presentation of radiated emissions (30-1000 MHz), Operation mode 1

Table 2: Test results for radiated emissions (30-1000 MHz), Operation mode 1

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
832.690000	24.99	46.00	21.01	15 x 1000.0	120.000	294.0	H	195.0	30.3
841.390000	29.04	46.00	16.96	15 x 1000.0	120.000	286.0	H	181.0	30.3

Correction factor (dB) in the final result tables contains the sum of the transducers (antenna + cables). QuasiPeak values are the measured values corrected with the correction factor.

Radiated Emissions In The Frequency Range 30 MHz – 12.5 GHz

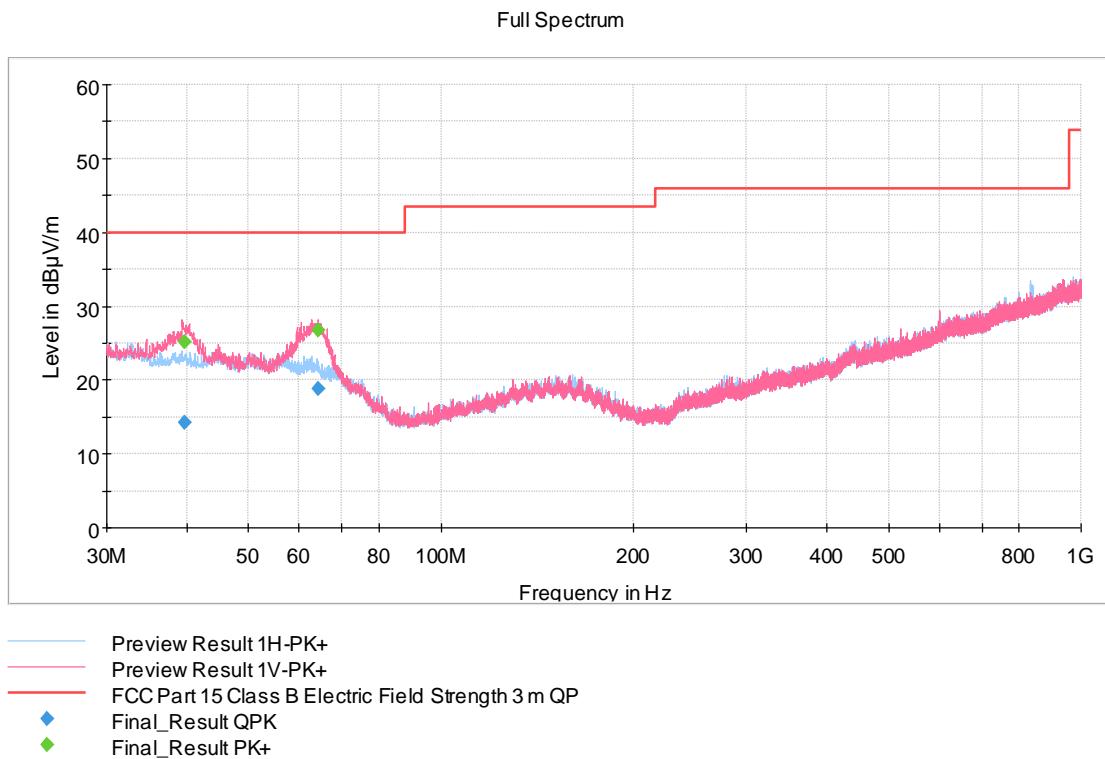


Figure 4: Graphical presentation of radiated emissions (30-1000 MHz), Operation mode 2

Table 3: Test results for radiated emissions (30-1000 MHz), Operation mode 2

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
39.780000	14.23	40.00	25.77	15 x 1000.0	120.000	100.0	V	315.0	17.1
64.090000	18.74	40.00	21.26	15 x 1000.0	120.000	100.0	V	149.0	17.4

Correction factor (dB) in the final result tables contains the sum of the transducers (antenna + cables). QuasiPeak values are the measured values corrected with the correction factor.

Radiated Emissions In The Frequency Range 30 MHz – 12.5 GHz

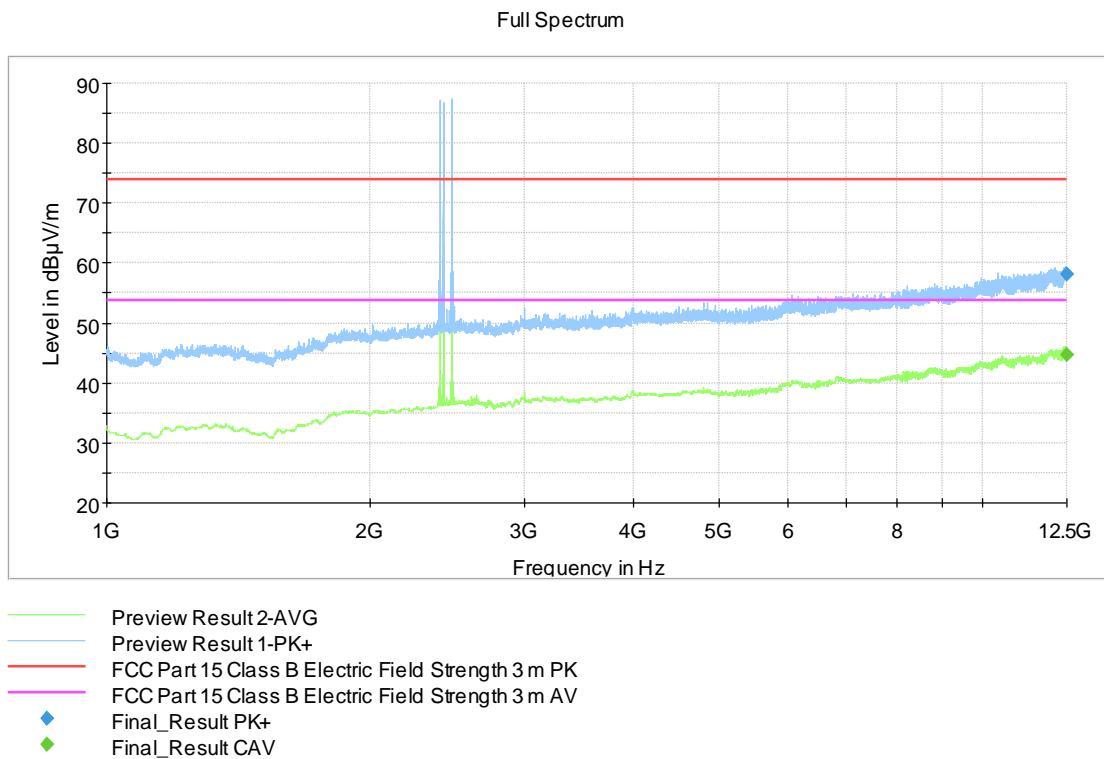


Figure 5: Graphical presentation of radiated emissions (1-12.5 GHz), Operation mode 1

Table 4: Test results for radiated emissions (1-12.5 GHz), Operation mode 1

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
12492.800000	58.21	---	73.90	15.69	15 x 1000.0	1000.000	294.0	V	266.0	27.0
12499.400000	---	44.75	53.90	9.15	15 x 1000.0	1000.000	123.0	V	10.0	27.1

Correction factor (dB) in the final result tables contains the sum of the transducers (antenna + amplifier + cables).

MaxPeak and CAverage values are the measured values corrected with the correction factor.

Note: the emissions within 2400-2483.5 MHz ISM band are caused by the Bluetooth radio of the sensor (frequencies 2402, 2426, and 2480 MHz).

TEST EQUIPMENT**Conducted emissions**

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	inv. 10679	2022-06-20	2023-06-20
LISN	ROHDE & SCHWARZ	ENV216	inv. 9611	2022-02-02	2023-02-02
POWER SUPPLY	CALIFORNIA INSTR.	5001 iX Series II	inv. 7826	NCR	NCR
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-	-

Radiated emissions

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
ANTENNA	SCHWARZBECK	VULB 9168	inv. 8911	2020-11-04	2022-11-04
ANTENNA	EMCO	3117	inv. 7293	2022-06-16	2024-06-16
ANTENNA MAST	MATURO	TAM 4.0E	inv. 10181	NCR	NCR
ATTENUATOR	PASTERNACK	10 dB, DC-40 GHz	sn. A1	2021-04-20	2023-04-20
ATTENUATOR	PASTERNACK	PE 7004-4 (4dB)	inv. 10126	2021-03-30	2023-03-30
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	inv. 10679	2022-06-20	2023-06-20
MAST & TURNTABLE CONTROLLER	MATURO	NCD	inv. 10183	NCR	NCR
POWER SUPPLY	CALIFORNIA INSTR.	5001 iX Series II	inv. 7826	NCR	NCR
RF PREAMPLIFIER	CIAO	CA118-3123	inv. 10278	2022-09-21	2023-09-21
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-	-
TURNTABLE	MATURO	DS430 UPGRADED	inv. 10182	NCR	NCR

NCR = No Calibration Required

END OF REPORT