

FCC Test Report

Aguardio ApS

H2O Leak Sensor, Model: H2O Leak Sensor

In accordance with FCC 47 CFR Part 15B
(2.4 GHz Bluetooth Low Energy)

Prepared for: Aguardio ApS
The Spring
Hasselager Allé 8
8260 Viby J
Denmark

FCC ID: 2BCEP-400101



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Document 75958298-01 Issue 01

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Andrew Lawson	Chief Engineer, EMC	Authorised Signatory	01 September 2023

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15B. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Ahmad Javid	01 September 2023	

FCC Accreditation
492497/UK2010 Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15B: 2021 for the tests detailed in section 1.3.



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Glasgow G75 0QF, United Kingdom
Registered number: SC215164

TÜV SÜD Ltd is a
TÜV SÜD Group Company

Phone: +44 (0) 1489 558100
Fax: +44 (0) 1489 558101
www.tuvsud.com/en

TÜV SÜD
Octagon House
Concorde Way
Fareham
Hampshire PO15 5RL
United Kingdom

TÜV SÜD

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	01 September 2023

Table 1

1.2 Introduction

Applicant	TÜV SÜD Danmark ApS
Manufacturer	Aguardio ApS
Model Number(s)	H20 Leak Sensor
Serial Number(s)	Not Serialised (FAR-724725-005)
Hardware Version(s)	1.5B
Software Version(s)	1.0.1
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15B: 2021
Order Number	Signed QAF detailing
Date	12-April-2023
Date of Receipt of EUT	24-April-2023
Start of Test	12-May-2023
Finish of Test	13-May-2023
Name of Engineer(s)	Ahmad Javid
Related Document(s)	ANSI C63.4: 2014



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15B is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: Battery Powered Leak Sensor - Operating				
2.1	15.109	Radiated Disturbance	Pass	ANSI C63.4: 2014

Table 2



1.4 Declaration of Build Status

MAIN EUT	
MANUFACTURING DESCRIPTION	Leak Sensor
MANUFACTURER	Xtel Wireless ApS
MODEL	H2O Leak Sensor
PART NUMBER	XT0184, 80018400
HARDWARE VERSION	1.5B
SOFTWARE VERSION	1.0.1
PSU VOLTAGE/FREQUENCY/CURRENT	3.6V Li-SOCI2 Battery
HIGHEST INTERNALLY GENERATED FREQUENCY	32MHz
FCC ID (if applicable)	2BCEP-400101
INDUSTRY CANADA ID (if applicable)	31231-400101
TECHNICAL DESCRIPTION (a brief technical description of the intended use and operation)	The Aguardio Leak Sensor detects water leaks by measuring the temperature difference between the water inlet pipe temperature and the ambient room temperature. The difference in temperature triggers the alarm.
COUNTRY OF ORIGIN	Denmark
RF CHARACTERISTICS (if applicable)	
TRANSMITTER FREQUENCY OPERATING RANGE (MHz)	2400-2483.5 MHz
RECEIVER FREQUENCY OPERATING RANGE (MHz)	2400-2483.5 MHz
INTERMEDIATE FREQUENCIES	
EMISSION DESIGNATOR(S): https://fccid.io/Emissions-Designator/	1M00GXW
MODULATION TYPES: (i.e. GMSK, QPSK)	GFSK
OUTPUT POWER (W or dBm)	3 dBm
SEPARATE BATTERY/POWER SUPPLY (if applicable)	
MODULES (if applicable)	
ANCILLARIES (if applicable)	

Table 3

I hereby declare that the information supplied is correct and complete.

Name: Thomas Munch-Laursen
Position held: CEO, Aguardio
Date: 11 August 2023



1.5 Product Information

1.5.1 Technical Description

The Equipment under test (EUT) was a Aguardio ApS H2O Leak Sensor, Model: H2O Leak Sensor.

The primary function of the EUT is to detect water leaks by measuring the temperature difference between the water inlet pipe temperature and the ambient room temperature. The difference in temperature triggers the alarm.

1.5.2 Test Configuration

Configuration	Description
Battery Powered Leak Sensor	The EUT was powered by a 3.6V Li-SOCl ₂ Battery.

Table 4

1.5.3 Modes of Operation

Mode	Description
Idle	The EUT was operating with the intentional transmitters switched off

Table 5

1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.

The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Model: H2O Leak Sensor, Serial Number: Not Serialised (FAR-724725-005)			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 6



1.8 Test Location

TÜV SÜD conducted the following tests at our Octagon House Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: Battery Powered Leak Sensor - Operating		
Radiated Disturbance	Ahmad Javid	UKAS

Table 7

Office Address:

TÜV SÜD
Octagon House
Concorde Way
Fareham
Hampshire
PO15 5RL
United Kingdom



2 Test Details

2.1 Radiated Disturbance

2.1.1 Specification Reference

FCC 47 CFR Part 15B, Clause 15.109

2.1.2 Equipment Under Test and Modification State

H20 Leak Sensor, S/N: Not Serialised (FAR-724725-005) - Modification State 0

2.1.3 Date of Test

12-May-2023 to 13-May-2023

2.1.4 Test Method

The EUT was set up on a non-conductive table 0.8 m above a reference ground plane within a semi-anechoic chamber on a remotely controlled turntable.

A pre-scan of the EUT emissions profile using a peak detector was made at a 3 m antenna distance whilst varying the antenna-to-EUT azimuth and polarisation.

Using a list of the highest emissions detected during the pre-scan along with their bearing and associated antenna polarisation, the EUT was then formally measured using a Quasi-Peak, Peak or CISPR Average detector as appropriate.

The readings were maximised by adjusting the antenna height, polarisation and turntable azimuth, in accordance with the specification.

2.1.5 Example Calculation

Below 1 GHz:

$$\begin{aligned}\text{Quasi-Peak level (dB}\mu\text{V/m)} &= \text{Receiver level (dB}\mu\text{V)} + \text{Correction Factor (dB/m)} \\ \text{Margin (dB)} &= \text{Quasi-Peak level (dB}\mu\text{V/m)} - \text{Limit (dB}\mu\text{V/m)}\end{aligned}$$

Above 1 GHz:

$$\begin{aligned}\text{CISPR Average level (dB}\mu\text{V/m)} &= \text{Receiver level (dB}\mu\text{V)} + \text{Correction Factor (dB/m)} \\ \text{Margin (dB)} &= \text{CISPR Average level (dB}\mu\text{V/m)} - \text{Limit (dB}\mu\text{V/m)}\end{aligned}$$

$$\begin{aligned}\text{Peak level (dB}\mu\text{V/m)} &= \text{Receiver level (dB}\mu\text{V)} + \text{Correction Factor (dB/m)} \\ \text{Margin (dB)} &= \text{Peak level (dB}\mu\text{V/m)} - \text{Limit (dB}\mu\text{V/m)}\end{aligned}$$

2.1.6 Example Test Setup Diagram

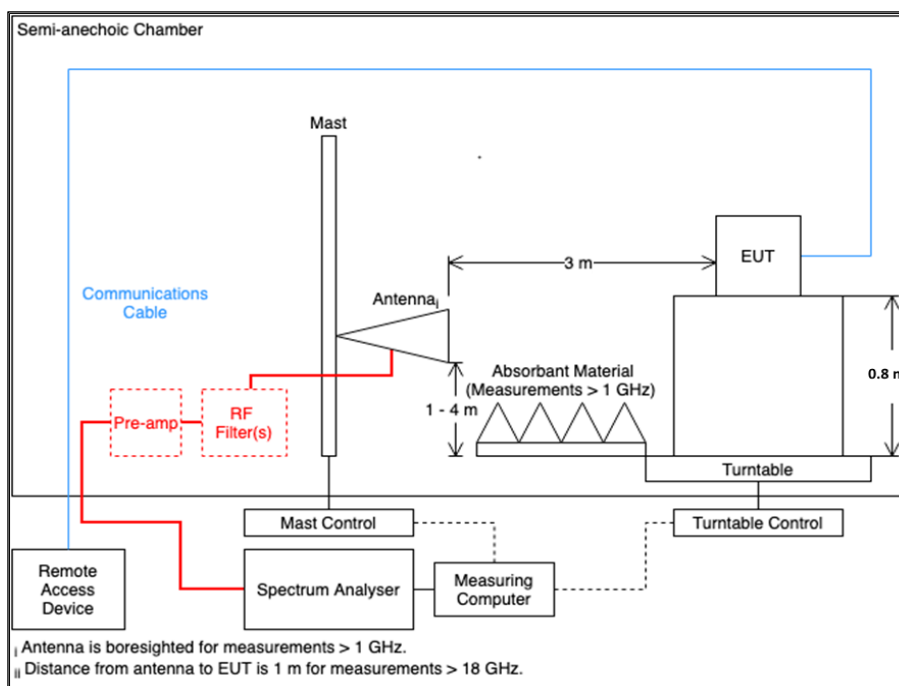


Figure 1 - Radiated Disturbance Example Test Setup

2.1.7 Environmental Conditions

Ambient Temperature 20.1 °C
Relative Humidity 40.2 %
Atmospheric Pressure 1016.0 mbar

2.1.8 Specification Limits

Required Specification Limits, Field Strength - Class B Test Limit at a 3 m Measurement Distance		
Frequency Range (MHz)	Test Limit (μV/m)	Test Limit (dBμV/m)
30 to 88	100	40.0
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

Supplementary information:
 Note 1. A Quasi-peak detector is to be used for measurements below 1 GHz.
 Note 2. A CISPR Average detector is to be used for measurements above 1 GHz.
 Note 3. The Peak test limit above 1 GHz is 20 dB higher than the CISPR Average test limit.

Table 8



2.1.9 Test Results

Results for Configuration and Mode: Battery Powered Leak Sensor - Operating.

This test was performed to the requirements of the Class B limits.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Highest frequency generated or used within the EUT: 2.4 GHz
Which necessitates an upper frequency test limit of: 13 GHz

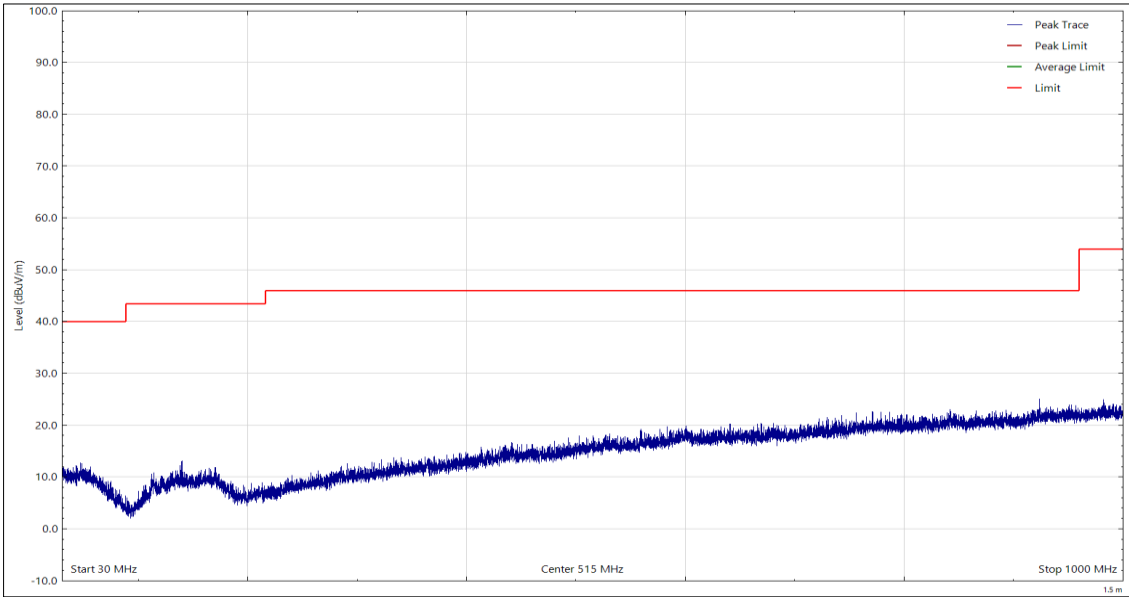


Figure 2 - 30 MHz to 1 GHz, Quasi-Peak, Horizontal

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 9

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

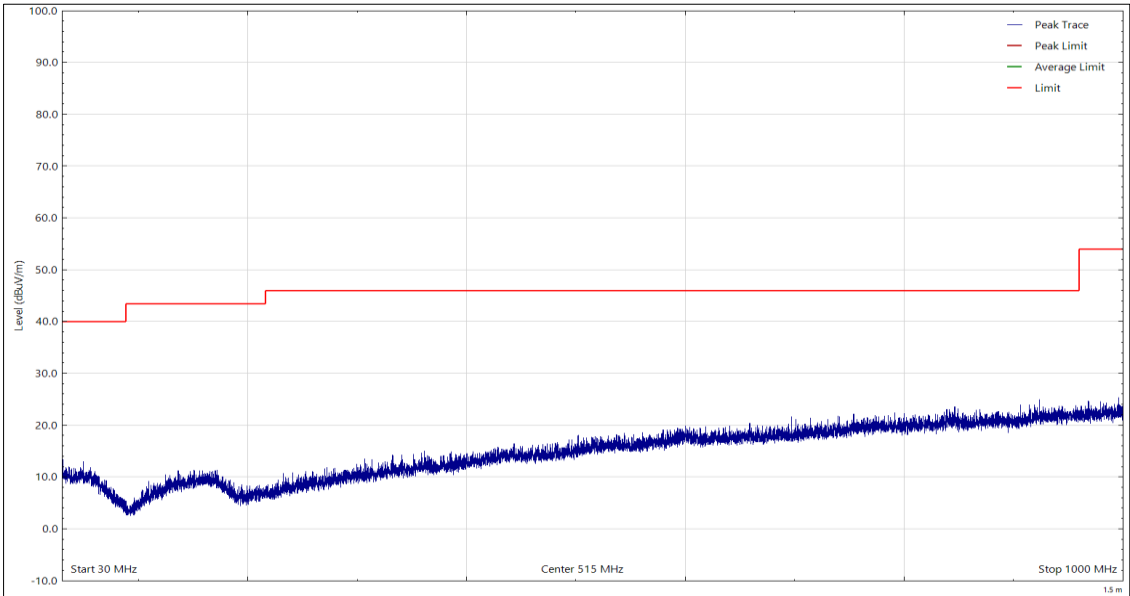


Figure 3 - 30 MHz to 1 GHz, Quasi-Peak, Vertical

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 10

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

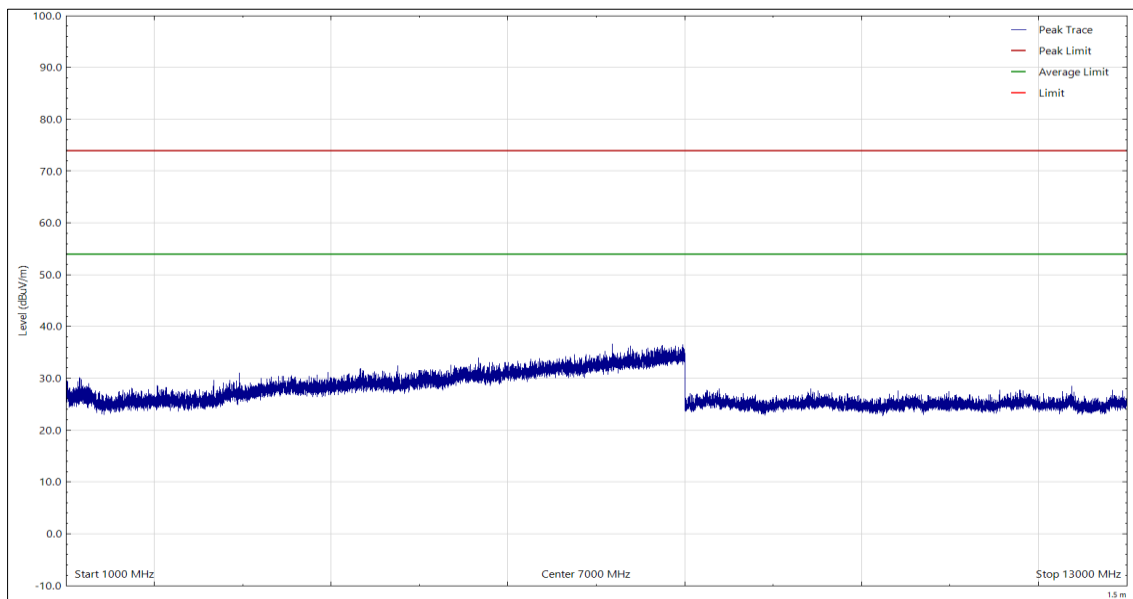


Figure 4 - 1 GHz to 13 GHz, Peak, Horizontal

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 11

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

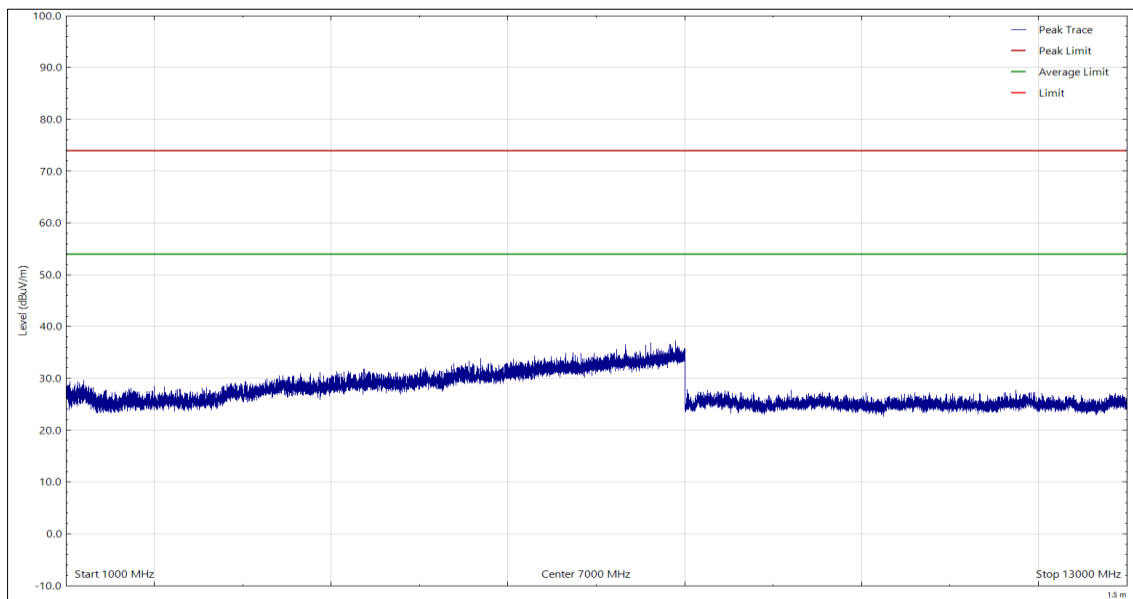


Figure 5 - 1 GHz to 13 GHz, Peak, Vertical

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 12

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

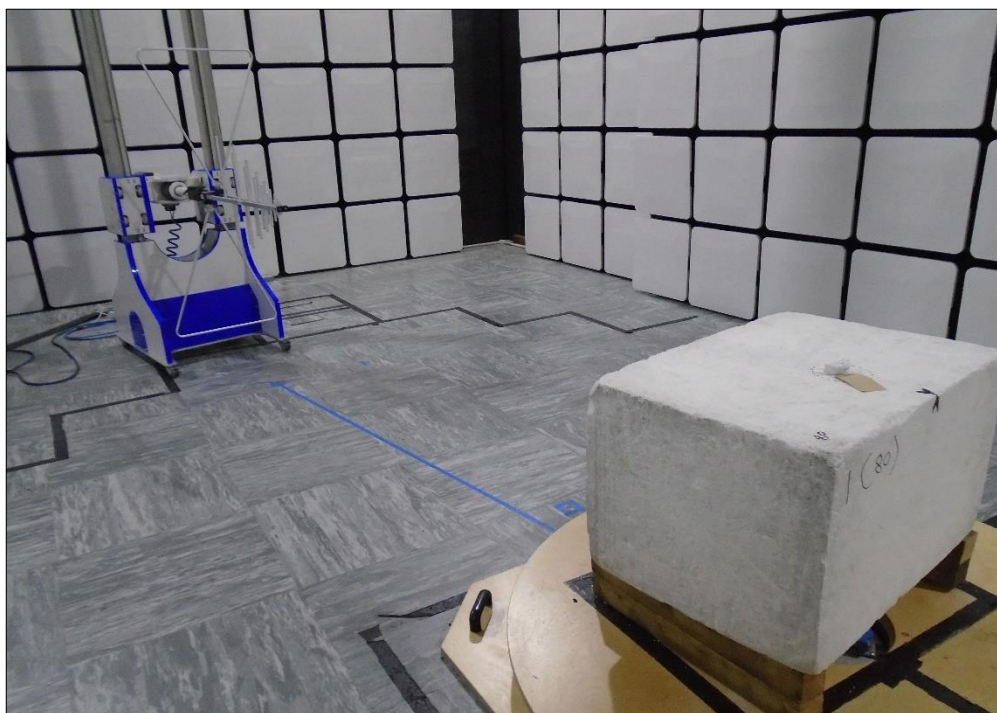


Figure 6 - Test Setup - 30 MHz to 1 GHz

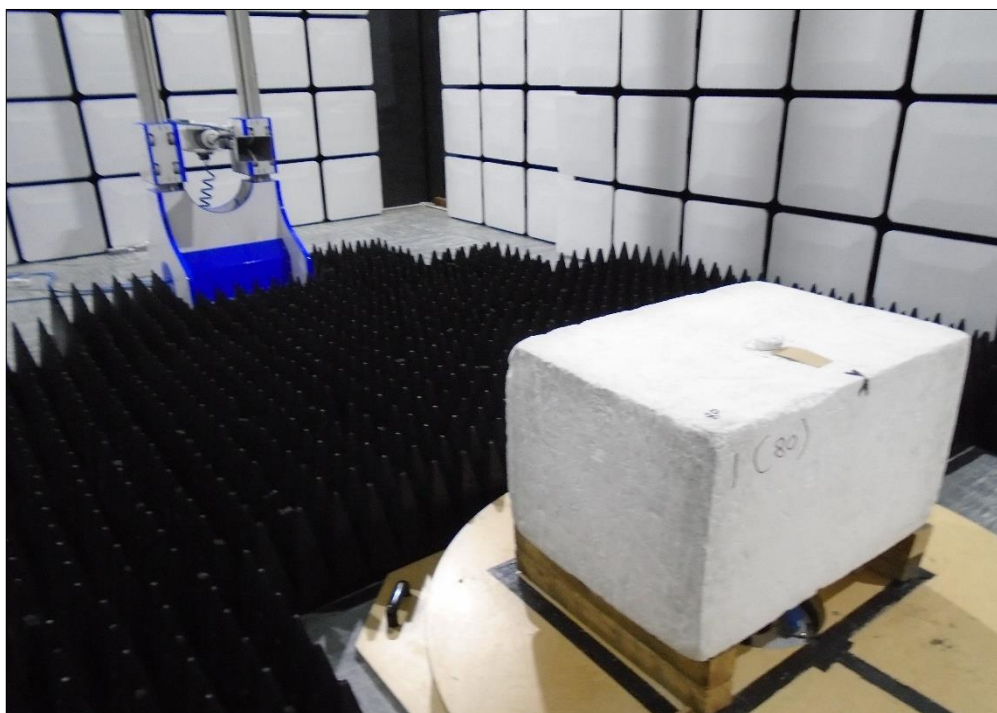


Figure 7 - Test Setup - 1 GHz to 8 GHz



Figure 8 - Test Setup - 8 GHz to 13 GHz



2.1.10 Test Location and Test Equipment Used

This test was carried out in RF Chamber 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Screened Room (11)	Rainford	Rainford	5136	36	24-Nov-2024
Emissions Software	TUV SUD	EmX V3.1.11	5125	-	Software
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	12-Jul-2023
Mast and Turntable Controller	Maturo	Maturo NCD	5159	-	TU
Mast	Maturo	TAM 4.0-P	5158	-	TU
Turntable	Maturo	TT 15WF	5160	-	TU
Cable (SMA to SMA, 1 m)	Junkosha	MWX221-01000AMSAMS/A	5513	12	14-Apr-2024
Cable (SMA to SMA, 2 m)	Junkosha	MWX221-02000AMSAMS/A	5518	12	14-Apr-2024
Cable (N-Type to N-Type, 8 m)	Junkosha	MWX221-08000NMSNMS/B	5522	12	14-Apr-2024
Pre-Amplifier (1 GHz to 26.5 GHz)	Agilent Technologies	8449B	5445	12	25-May-2024
Pre-Amplifier (8 GHz to 18 GHz)	Wright Technologies	APS06-0061	5595	12	25-Oct-2023
Antenna (Tri-log, 30 MHz to 1 GHz)	Schwarzbeck	VULB 9168	5942	24	03-Feb-2024
Attenuator 4dB	Pasternack	PE7074-4	6202	24	16-Jul-2024
Antenna (DRG, 1 GHz to 10.5 GHz)	Schwarzbeck	BBHA9120B	5215	12	28-May-2023
Antenna (DRG, 7.5 GHz to 18 GHz)	Schwarzbeck	HWRD750	5216	12	29-May-2023

Table 13

TU - Traceability Unscheduled



3 **Test Equipment Information**

3.1 **General Test Equipment Used**

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Thermo-Hygro-Barometer	PCE Instruments	OCE-THB-40	5470	12	20-Apr-2024

Table 14



4 Incident Reports

No incidents reports were raised.



5 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Radiated Disturbance	30 MHz to 1 GHz, Bilog Antenna, ± 5.2 dB 1 GHz to 40 GHz, Horn Antenna, ± 6.3 dB

Table 15

Worst case error for both Time and Frequency measurement 12 parts in 10^6 .

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115:2021, Clause 4.4.3 (Procedure 2). The measurement results are directly compared with the test limit to determine conformance with the requirements of the standard.

Risk: The uncertainty of measurement about the measured result is negligible with regard to the final pass/fail decision. The measurement result can be directly compared with the test limit to determine conformance with the requirement (compare IEC Guide 115). The level of risk to falsely accept and falsely reject items is further described in ILAC-G8.