

## Test Report

<b>Product</b>	InSite Construction Data Acquisition System		
<b>Name and address of the applicant</b>	Vemaventuri AB Johan på Gårdas Gata 5A 412 50 Gothenburg, Sweden		
<b>Name and address of the manufacturer</b>	Vemaventuri AB Johan på Gårdas Gata 5A 412 50 Gothenburg, Sweden		
<b>Model</b>	NODE-0		
<b>Rating</b>	3.7 VDC		
<b>Trademark</b>	ISC Node		
<b>Serial number</b>	See page 3		
<b>Additional information</b>	This product contains following FCC/ISED certified radio module: - Wi-fi, ESP32-WROOM-32U		
<b>Tested according to</b>	<b>FCC Part 15, subpart B</b> Other Class B Digital Device <b>Industry Canada ICES-003, Issue 7</b> Information Technology Equipment (ITE)		
<b>Order number</b>	PRJ0011210		
<b>Tested in period</b>	2022-05-12 to 2022-10-03 and 2023-06-07 to 2023-06-09		
<b>Issue date</b>	2024-04-11		
<b>Name and address of the testing laboratory</b>	 Instituttveien 6 Kjeller, Norway www.nemko.com	CAB Number: FCC: NO0001 ISED: NO0470	 
An accredited technical test executed under the Norwegian accreditation scheme			
 Prepared by [Christian Borge]		 Approved by [Frode Sveisen]	
<p>This report shall not be reproduced except in full without the written approval of Nemko. Opinions and interpretations expressed within this report are not part of the current accreditation. This report was originally distributed electronically with digital signatures. For more information contact Nemko.</p>			

## Revision history

Version	Date	Comment	Sign
461063-06-R00	2022-11-21	First version	gns
B	2023-08-23	Retest of EMC, Conducted Emissions and Radiated Emissions, according to EN 61000-6-2 and 61000-6-4 due to new PCB layout and new components	CB
C	2024-04-11	Updated module info	FS



### **THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.**

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

Nemko Group authorizes the above-named entity to reproduce this report provided it is reproduced in its entirety and for use by the entity's employees only. Any reproduction of parts of this report requires approval in writing from Nemko Group.

Any use that a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko Group accepts no responsibility for damages suffered by any third party caused by decisions made or actions based on this report.

## CONTENTS

<b>1</b>	<b>INFORMATION .....</b>	<b>4</b>
1.1	Tested Item .....	4
1.2	Test Environment .....	5
1.3	Test Engineer(s) .....	5
1.4	Test Equipment .....	5
1.5	Test Configurations .....	5
1.6	Other Comments .....	5
<b>2</b>	<b>TEST REPORT SUMMARY .....</b>	<b>6</b>
2.1	General .....	6
2.2	Test Summary .....	6
<b>3</b>	<b>TEST RESULTS.....</b>	<b>7</b>
3.1	Power Line Conducted Emissions .....	7
3.2	Spurious Emissions (Radiated).....	9
<b>4</b>	<b>MEASUREMENT UNCERTAINTY .....</b>	<b>14</b>
<b>5</b>	<b>TEST SETUPS .....</b>	<b>15</b>
5.1	Radiated Emissions Test .....	15
5.2	Power Line Conducted Emissions Test.....	15
<b>6</b>	<b>TEST EQUIPMENT USED .....</b>	<b>16</b>

# 1 INFORMATION

## 1.1 Tested Item

<b>Name</b>	ISC Node
<b>Model name</b>	NODE-0
<b>FCC ID</b>	2A60FPICBKM01
<b>ISED ID</b>	28483-PICBKM01
<b>FCC / ISED Class</b>	B
<b>Serial number</b>	Marked as "Nemko 461063 00002"
<b>Hardware identity and/or version</b>	HV02MK08
<b>Software identity and/or version</b>	v.1.4.3
<b>Power Supply</b>	3.69VDC (System has 1x3.69 lithium-ion batteries) (100 -240AC AC/DC charger)
<b>Interfaces</b>	N/A

### Description of Tested Device(s)

The EUT is a Insite Construction Data Acquisition System.

The EUT supports IEEE 802.11 b/g/n modes and HT20 and HT40 modes (only for 11n). The antenna used for wi-fi is recommended by the module manufacturers.

The EUT does not have smart antenna system.

The EUT contains the following radio modules:

Marketing Name	FCC ID	ISED Canada ID	HVIN
WROOM-32U	2A60F-ESP32WROOM32U	28483-ESPWROOM32U	02MK08

## 1.2 Test Environment

Temperature:	20 – 25 °C
Relative humidity:	30 – 50 %
Normal test voltage:	3.69DC

The values are the limit registered during the test period.

## 1.3 Test Engineer(s)

Christian Borge

## 1.4 Test Equipment

See list of test equipment in clause 6.

## 1.5 Test Configurations

Configuration 1)	Wi-fi active with ISC Concrete Detection Sensor sensors
Configuration 2)	Wi-fi active with ISC Pressure Sensors
Configuration 3)	Wi-fi active with PSK , ISC Concrete Detection and ISC Temperature sensors

## 1.6 Other Comments

All tests were performed with all ports populated and operating.

## 2 TEST REPORT SUMMARY

### 2.1 General

All measurements are traceable to national standards.

All tests were performed in accordance with ANSI C63.4-2014 where applicable. Radiated emissions are made in a 10m semi-anechoic chamber. A description of the test facility is on file with FCC and Industry Canada.

<input checked="" type="checkbox"/> New Submission	<input checked="" type="checkbox"/> Production Unit
<input type="checkbox"/> Class II Permissive Change	<input type="checkbox"/> Pre-production Unit
JAB    Equipment Code	<input type="checkbox"/> Family Listing

### 2.2 Test Summary

Name of test	FCC CFR 47, Paragraph #	ISED RSS-GEN, Issue 5, Paragraph #	ISED ICES-003, Issue 7, Paragraph #	Verdict
Power Line Conducted Emission	15.107(a)	7.2	3.2.1	Complies
Spurious Emissions (Radiated)	15.109	7.3	3.2.2	Complies

### 3 TEST RESULTS

#### 3.1 Power Line Conducted Emissions

FCC Part 15.107 (a)

ISED RSS-Gen Issue 5, Clause 7.2

ISED ICES-003 Issue 7, Clause 3.2.1

Measurement procedure: ANSI C63.4-2014 using 50  $\mu$ H/50 ohms LISN.

Test Results: **Complies**

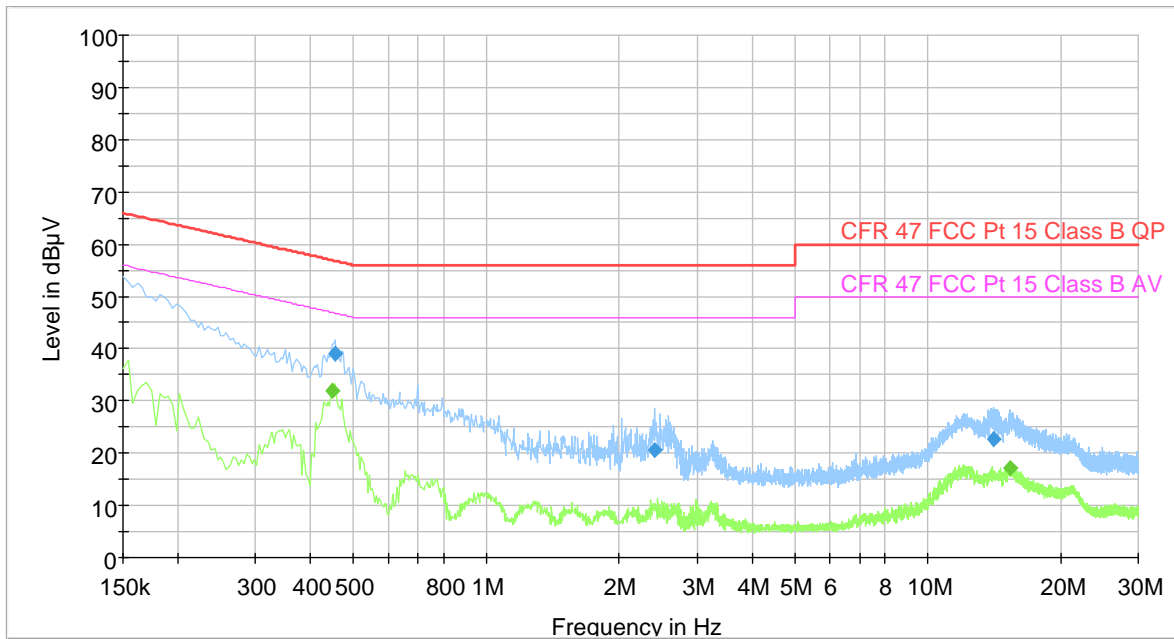
Measurement Data: **See attached plots.**

AC/DC adapter model: SD150-12U (from CUI INC)

Highest measured value (L1 and N):

Frequency (MHz)	QuasiPeak (dB $\mu$ V)	Average (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line
0.446000	---	31.99	46.95	14.96	15000.0	9.000	N
0.454000	38.97	---	56.80	17.83	15000.0	9.000	N
2.406000	20.57	---	56.00	35.43	15000.0	9.000	L1
14.122000	22.73	---	60.00	37.27	15000.0	9.000	N
15.322000	---	17.16	50.00	32.84	15000.0	9.000	L1

Full Spectrum



- Preview Result 2-AVG
- Preview Result 1-PK+
- CFR 47 FCC Pt 15 Class B QP
- CFR 47 FCC Pt 15 Class B AV
- ◆ Final\_Result QPK
- ◆ Final\_Result CAV

120Vac, 60Hz with sensors in charging mode



### 3.2 Spurious Emissions (Radiated)

FCC Part 15.109

ISED RSS-Gen Issue 5, Clause 7.3

ISED ICES-003 Issue 7, Clause 3.2.2

#### Test Results:

#### Radiated Emissions 30 - 1000 MHz and 1 – 18GHz

Detector: Quasi-Peak

Measuring distance 3 m

The EUT were rotated 360 degrees and the antenna height varied between 1 and 4 m on all found frequencies.

#### With sensors in charging mode 30-1000MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/)
141.493372	11.54	43.50	31.96	15000.0	120.000	357.0	H	303.0	-11.5
251.427582	32.42	46.00	13.58	15000.0	120.000	113.0	H	266.0	-12.2
381.827836	29.33	46.00	16.67	15000.0	120.000	104.0	H	271.0	-8.5
810.817852	23.27	46.00	22.73	15000.0	120.000	150.0	H	260.0	-0.5

#### With sensors in charging mode 1-18GHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4833.485600	54.84	---	74.00	19.16	15000.0	1000.000	100.0	H	145.0	-1.2
4834.050000	---	31.48	54.00	22.52	15000.0	1000.000	100.0	H	145.0	-1.2
4853.850000	---	31.64	54.00	22.36	15000.0	1000.000	100.0	H	145.0	-1.2
4854.044400	70.30	---	74.00	3.70	15000.0	1000.000	100.0	H	51.0	-1.2
3254.633200	42.16	---	74.00	31.84	15000.0	1000.000	100.0	V	88.0	-5.9
3282.500000	---	30.21	54.00	23.79	15000.0	1000.000	100.0	V	88.0	-5.8

#### With all sensors 30-1000MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/)
81.646498	20.57	40.00	19.43	15000.0	120.000	207.0	V	21.0	-17.4
247.718904	31.45	46.00	14.55	15000.0	120.000	150.0	H	147.0	-12.3
901.686404	23.68	46.00	22.32	15000.0	120.000	150.0	V	2.0	1.1

#### With all sensors 1-18GHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
81.646498	20.57	40.00	19.43	15000.0	120.000	207.0	V	21.0	-17.4	
247.718904	31.45	46.00	14.55	15000.0	120.000	150.0	H	147.0	-12.3	
901.686404	23.68	46.00	22.32	15000.0	120.000	150.0	V	2.0	1.1	

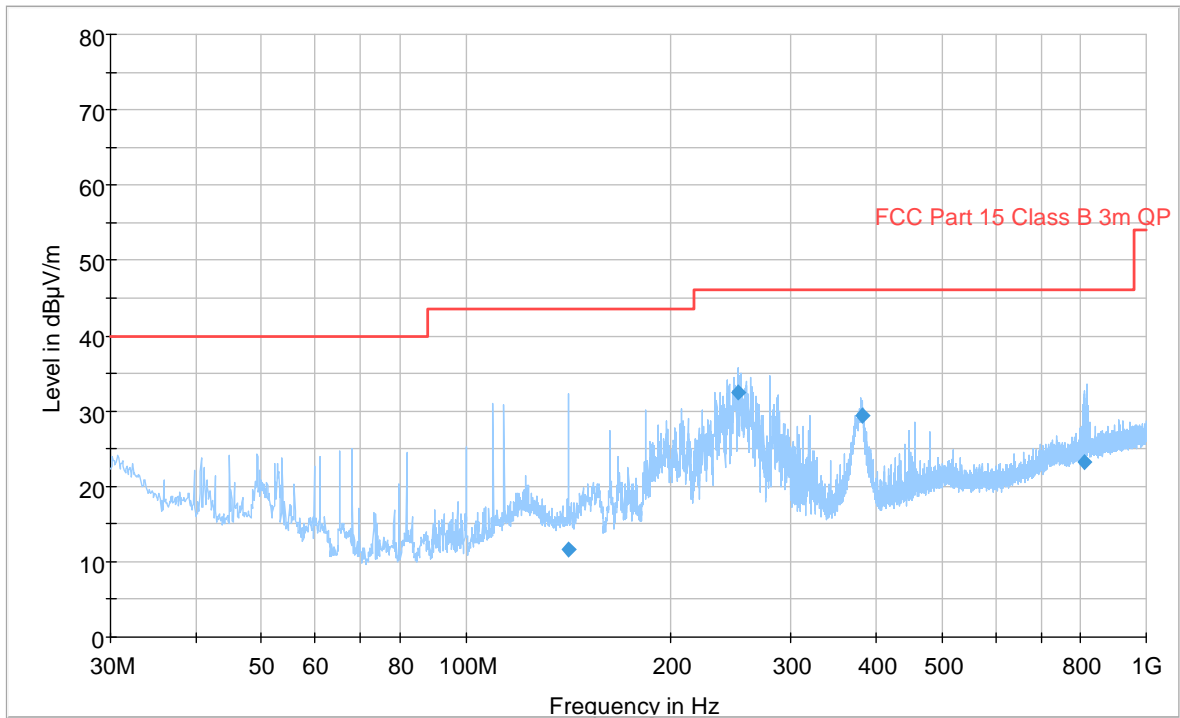
3235.750000	---	30.10	54.00	23.90	15000.0	1000.000	100.0	V	104.0	-6.0
3242.225200	44.58	---	74.00	29.42	15000.0	1000.000	100.0	V	104.0	-6.0

### Requirements/Limit

<b>FCC</b>	<b>Part 15.109</b>	
<b>ISED</b>	<b>ICES-003 Issue 7, Clause 3.2.2</b>	
	<b>Radiated emission limit @3 meters</b>	
<b>Frequency (MHz)</b>	<b>FCC Quasi Peak (dBµV/m)</b>	<b>ISED Quasi Peak (dBµV/m)</b>
<b>30 – 88</b>	40.0	40.0
<b>88 – 216</b>	43.5	43.5
<b>216 – 230</b>	46.0	46.0
<b>230 – 960</b>	46.0	47.0
<b>Above 960<sup>1</sup></b>	54.0	54.0

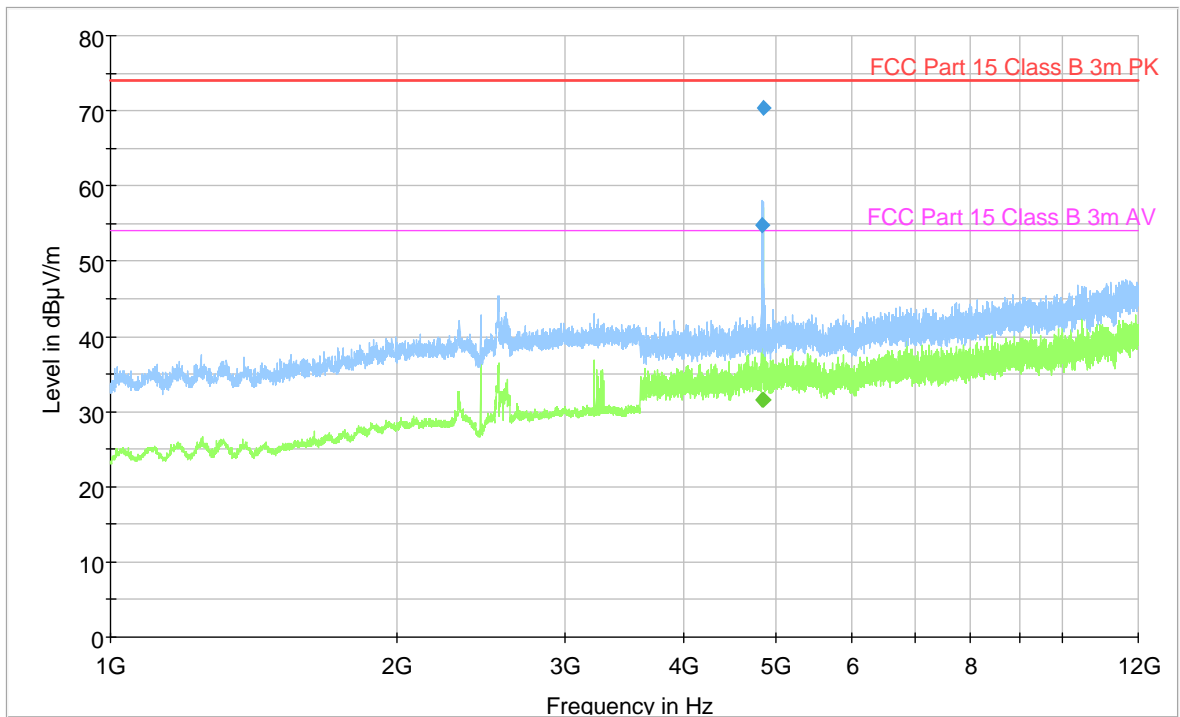
<sup>1</sup> The limit above 1000 MHz is specified for Average Detector, when the measurement is performed with a Peak Detector a Duty-Cycle Correction Factor has to be calculated to find the corresponding Average Detector value.

Full Spectrum



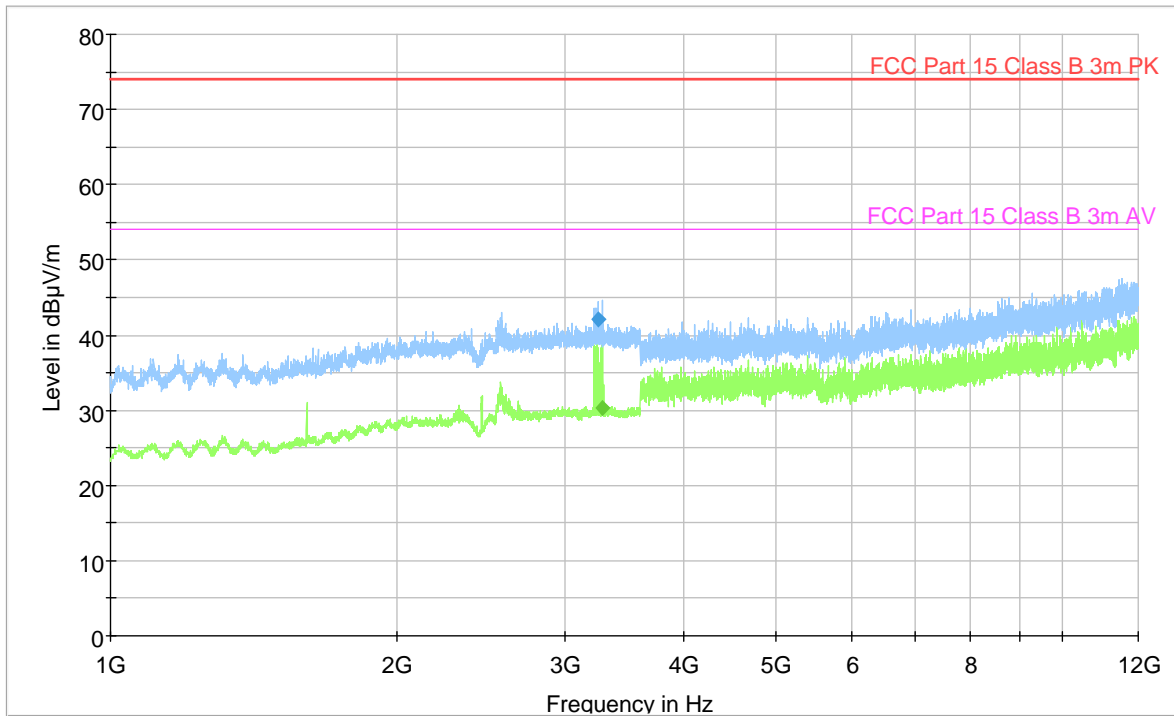
30 – 1000MHz, with sensors and charging mode

Full Spectrum



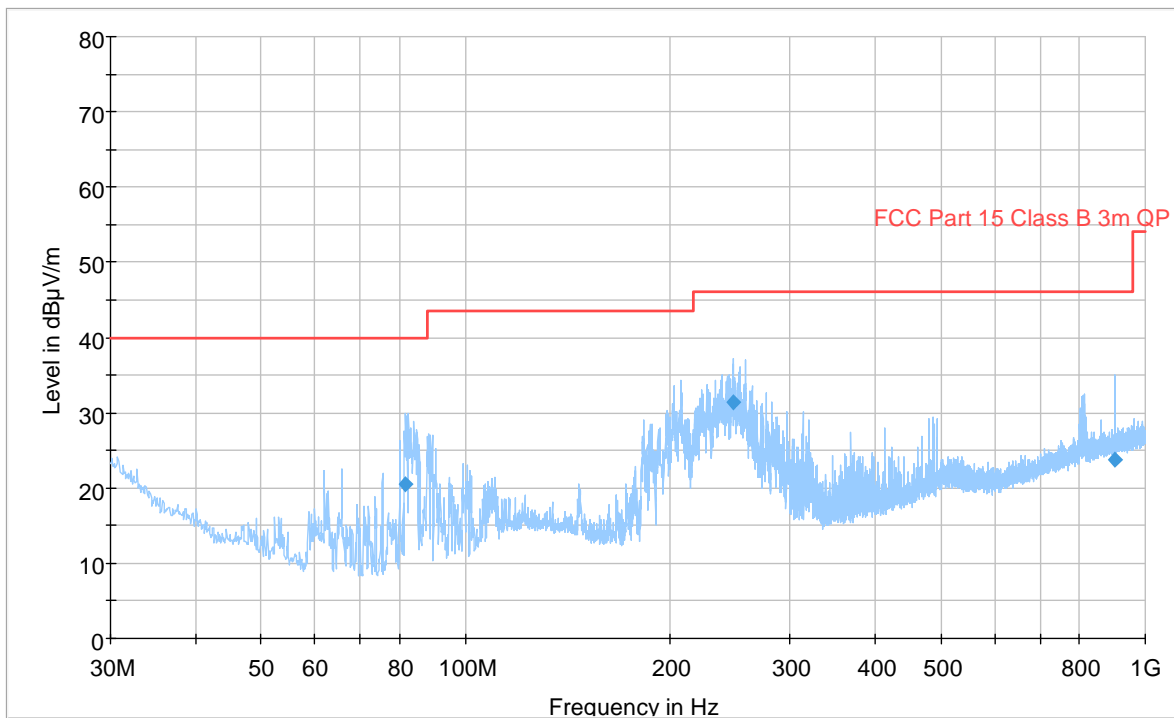
HP, 1 - 18GHz, with sensors and charging mode

Full Spectrum



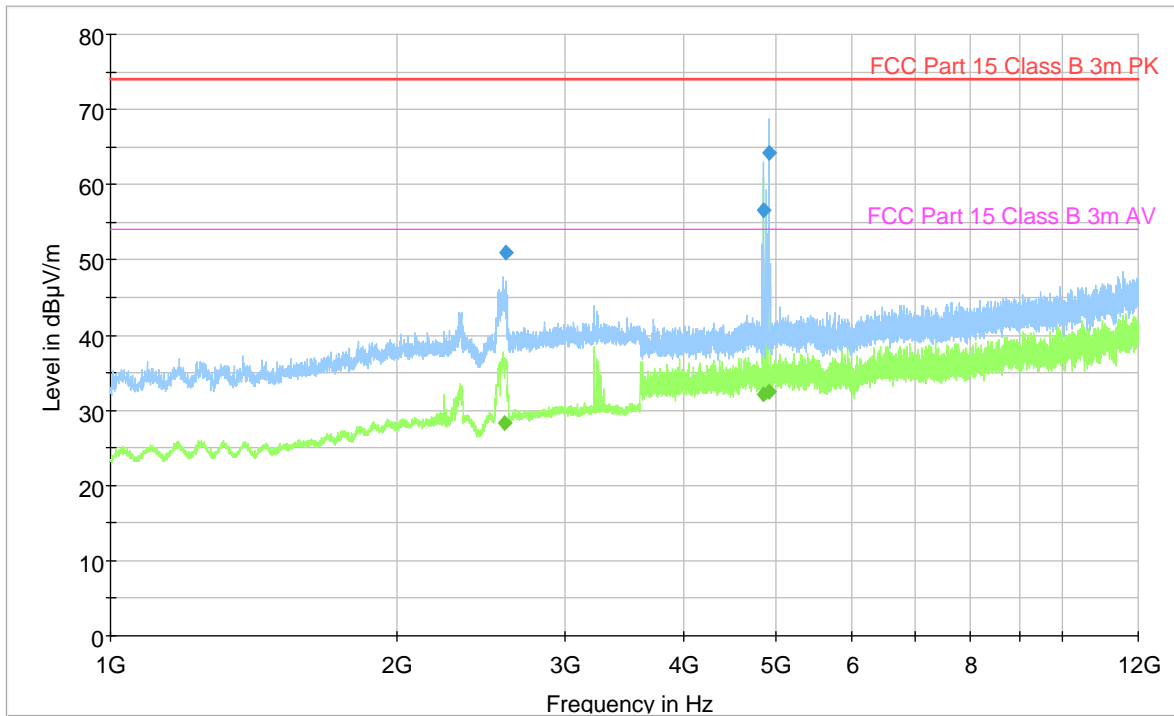
VP, 1 - 18GHz, with sensors and charging mode

Full Spectrum



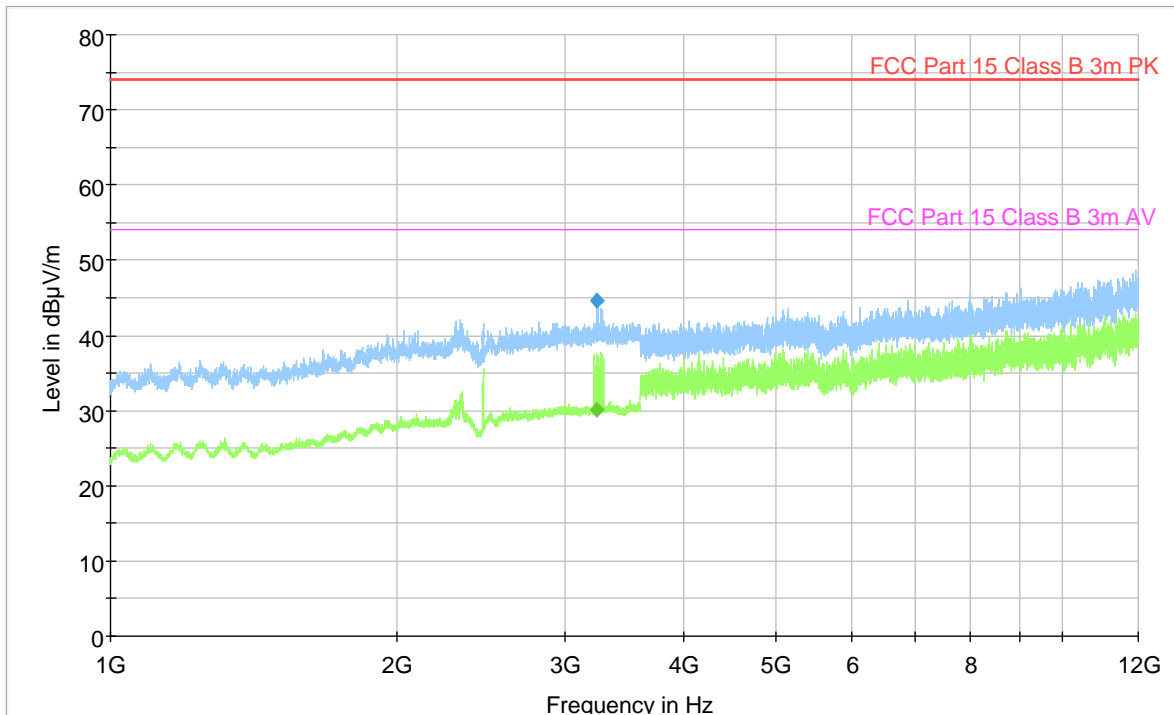
30 - 1000MHz, with all sensors

Full Spectrum



HP, 1 - 18GHz, with all sensors

Full Spectrum



VP, 1 - 18GHz, with all sensors

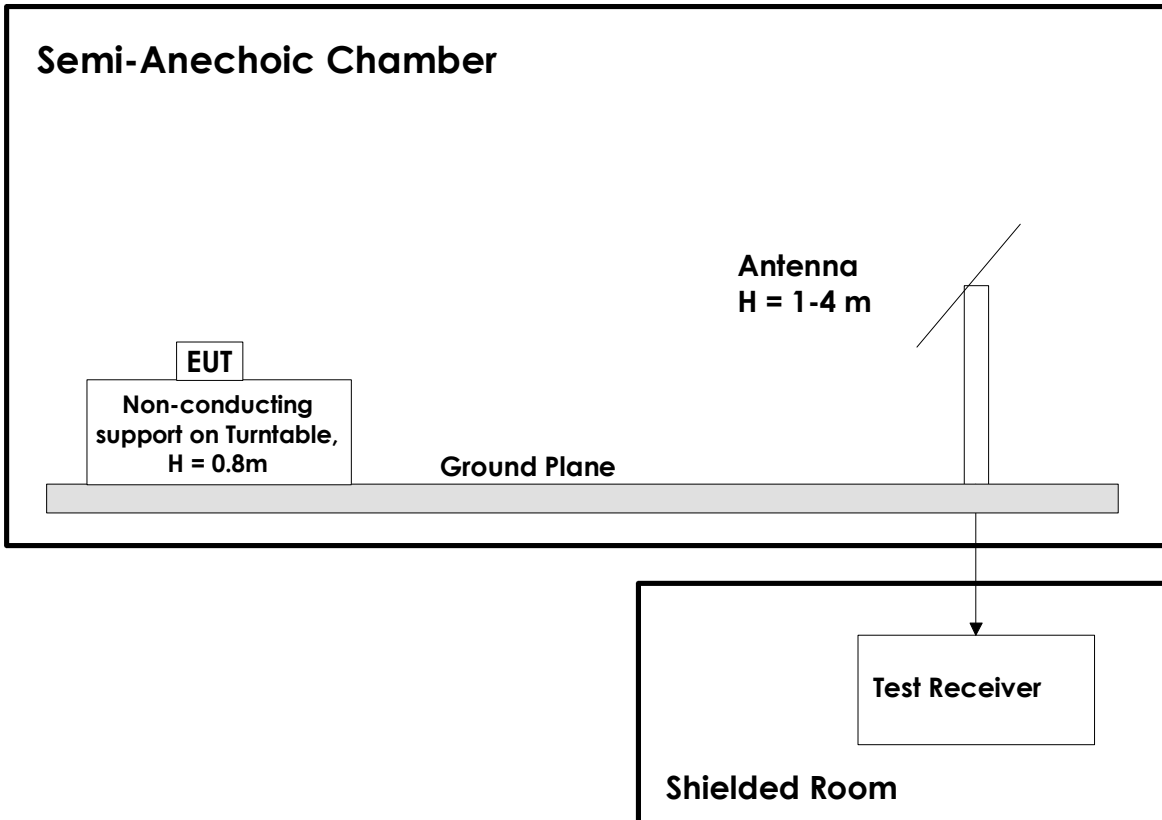
## 4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		Uncertainty
Spurious Emissions, Radiated	< 1 GHz	±2.5 dB
	> 1 GHz	±2.2 dB
Power Line Conducted Emissions		+2.9 / -4.1 dB
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor  $k=2$

## 5 Test Setups

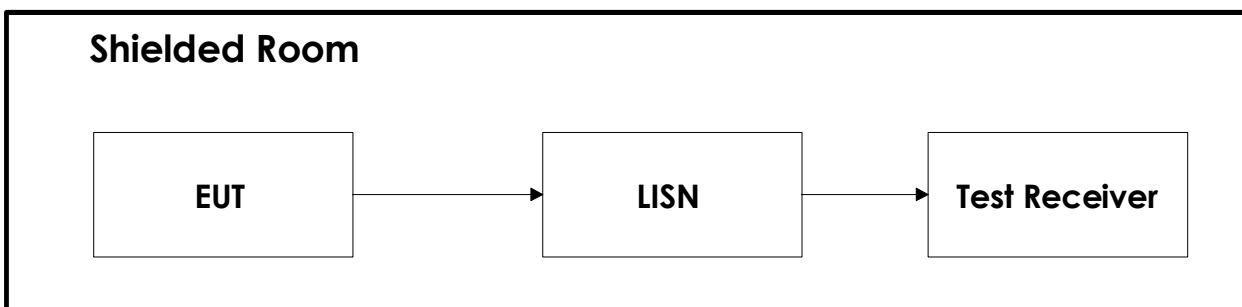
### 5.1 Radiated Emissions Test



#### Test Set-Up 1

This test setup is used for all radiated emissions tests. For frequencies below 30 MHz the measuring distance is 10m, for all other frequencies it is 3m or 1m. Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna. For measurements above 18 GHz the test receiver is moved inside the anechoic chamber and located next to the antenna to minimize the cable loss. All measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers. A pre-amplifier is used for all measurements above 30 MHz.

### 5.2 Power Line Conducted Emissions Test



#### Test Set-Up 2

## 6 Test Equipment Used

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test house.

No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2023-01	2024-01
3	VULB	BiLog Antenna	Schwarzbeck	LR 1616	2022-05	2024-05
4	310N	Preamplifier	Sonoma Inst.	LR 1686	2021-08	2023-08
5	3117	Antenna, Horn	ETS	LR1717	2022-12	2027-12
6	ESC13	Measuring Receiver	Rohde & Schwarz	N-4259	2021-10	2023-12
7	ENV216	Two Line V-Network	Rohde & Schwarz	LR 1665	2021-12	2023-11
8	3117-PA	Preamplifier	ETS	LR 1757	2021-08	2023-08

COU = Calibrate on Use

The software listed below has been used for one or more tests.

No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.50.40	EMC test software