

## 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>	HUB-0		
<b>Rating</b>	18.5VDC		
<b>Trademark</b>	ISC Hub		
<b>Serial number</b>	See page 3		
<b>Additional information</b>	This product contains following FCC/ISED certified radio modules: - Wi-fi, ESP32-WROOM-32U - LTE/GNSS, SARA-R510M8S-01B		
<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]
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## Revision history

Version	Date	Comment	Sign
461063-05-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".

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# 1 INFORMATION

## 1.1 Tested Item

<b>Name</b>	ISC HUB
<b>Model name</b>	HUB-0
<b>FCC ID</b>	2A60FPICHBM01
<b>ISED ID</b>	28483-PICHBM01
<b>FCC / ISED Class</b>	B
<b>Serial number</b>	Marked as "Nemko 461063 00001"
<b>Hardware identity and/or version</b>	HV02MK12
<b>Software identity and/or version</b>	v.1.4.3
<b>Power Supply</b>	18.5VDC (System has 5x3.7 lithium-ion batteries) (100 -240AC AC/DC charger)
<b>Interfaces</b>	Ethernet

### 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 and LTE are recommended by the module manufacturers.

The EUT does not have smart antenna system. The LTE and wi-fi can transmit simultaneously.

The EUT contains the following radio modules:

Marketing Name	FCC ID	ISED Canada ID	HVIN
WROOM-32U	2A60F-ESP32WROOM32U	28483-ESPWROOM32U	02MK08
SARA-R5	2A60FUBX19KM01	28483-UBX19KM01	01MK12

## 1.2 Test Environment

Temperature:	20 – 25 °C
Relative humidity:	30 – 50 %
Normal test voltage:	18.5DC

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)	Normal ethernet communication and wi-fi mode
Configuration 2)	LTE , wi-fi mode and charging mode
Configuration 3)	LTE , wi-fi mode and ISC Pressure sensors mode

Note: In ethernet enabled mode , LTE is disconnected. That is either LTE or ethernet can be selected at a time.

## 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**

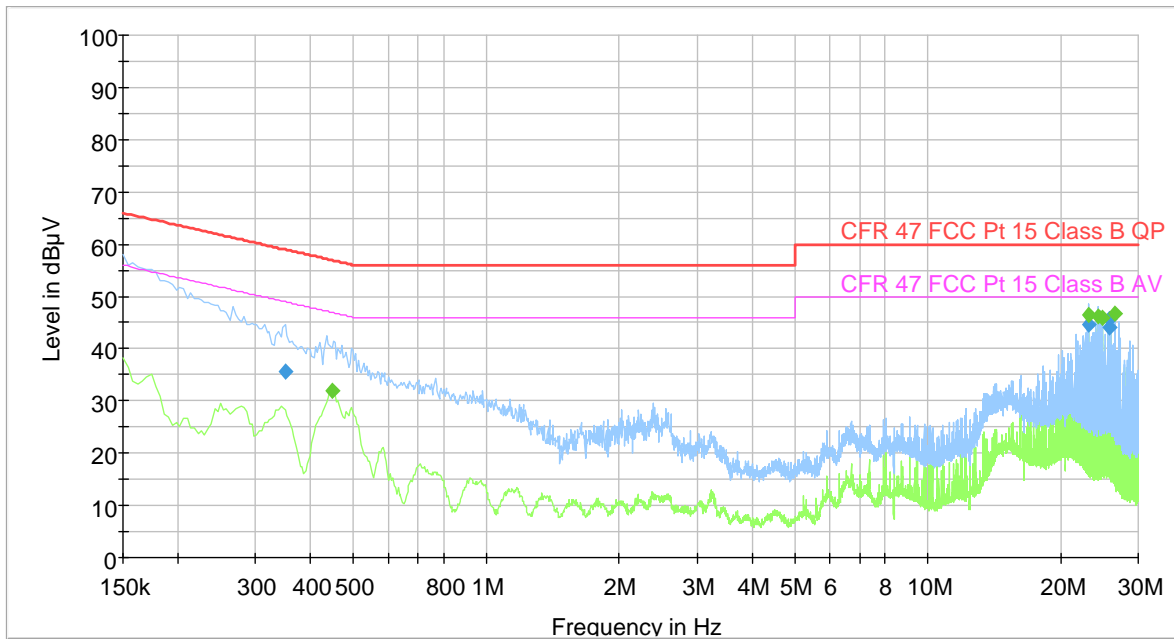
Measurement Data: **See attached plots.**

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
0.350000	35.55	---	58.96	23.41	15000.0	9.000	N
0.446000	---	31.94	46.95	15.01	15000.0	9.000	N
23.130000	44.62	---	60.00	15.38	15000.0	9.000	N
23.134000	---	46.38	50.00	3.62	15000.0	9.000	N
24.358000	---	46.08	50.00	3.92	15000.0	9.000	N
24.906000	---	45.79	50.00	4.21	15000.0	9.000	N
25.882000	45.51	---	60.00	14.49	15000.0	9.000	N
25.886000	43.96	---	60.00	16.04	15000.0	9.000	N
26.494000	---	46.59	50.00	3.41	15000.0	9.000	N

Full Spectrum



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

120Vac, 60Hz 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.

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
50.391942	34.26	40.00	5.74	15000.0	120.000	103.0	V	50.0	-15.3
123.944778	37.56	43.50	5.94	15000.0	120.000	268.0	H	105.0	-10.9
151.180918	38.60	43.50	4.90	15000.0	120.000	221.0	H	127.0	-11.9
205.778344	31.97	43.50	11.53	15000.0	120.000	215.0	H	244.0	-11.9
236.985094	43.48	46.00	2.52	15000.0	120.000	100.0	H	134.0	-12.6
266.682502	42.33	46.00	3.67	15000.0	120.000	100.0	H	130.0	-11.4
661.289516	39.37	46.00	6.63	15000.0	120.000	100.0	V	0.0	-2.9

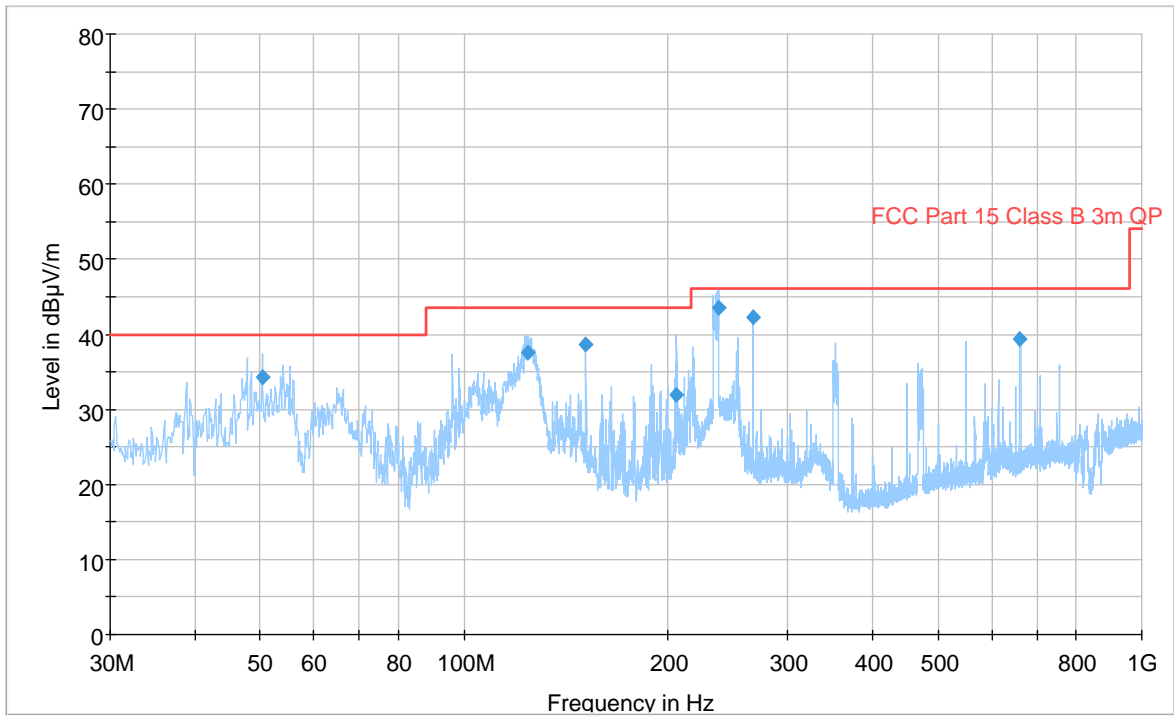
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
11570.450000	37.97	54.00	16.03	15000.0	1000.000	100.0	V	204.0	6.4

#### Requirements/Limit

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

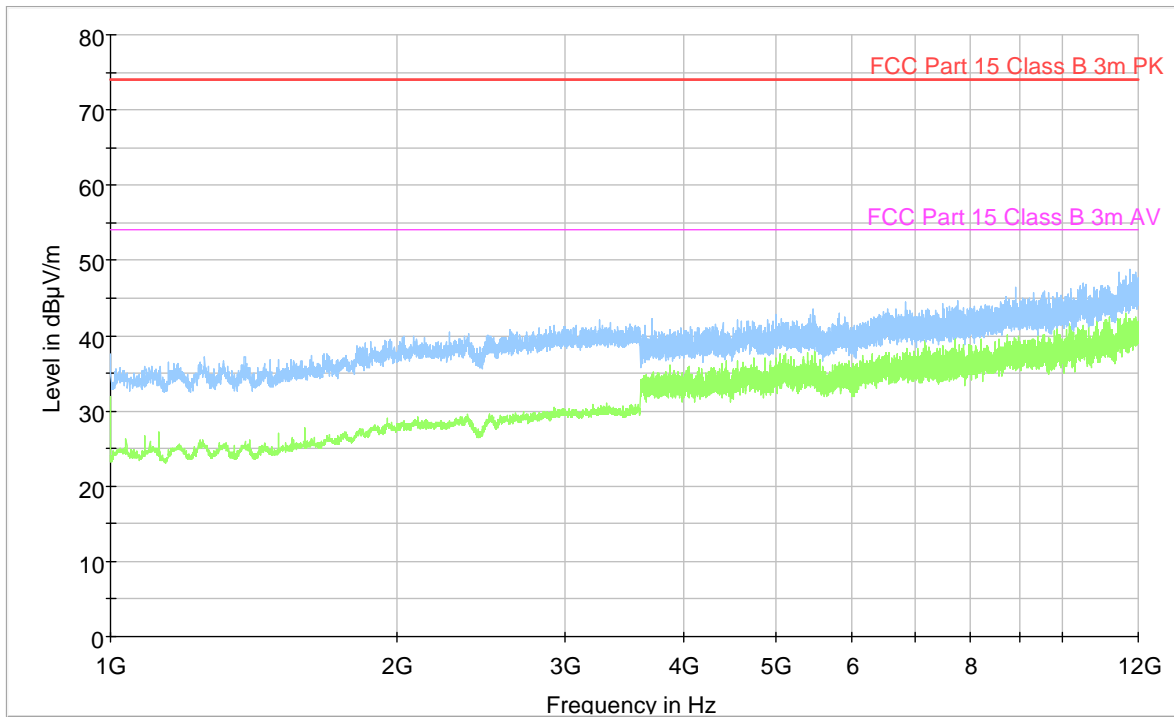
<sup>1</sup> The limit above 1000 MHz is specified for Average Detector, when the measurement is performed with a Peak Detector a Duty-Cycle Correction Factor has to be calculated to find the corresponding Average Detector value.

Full Spectrum



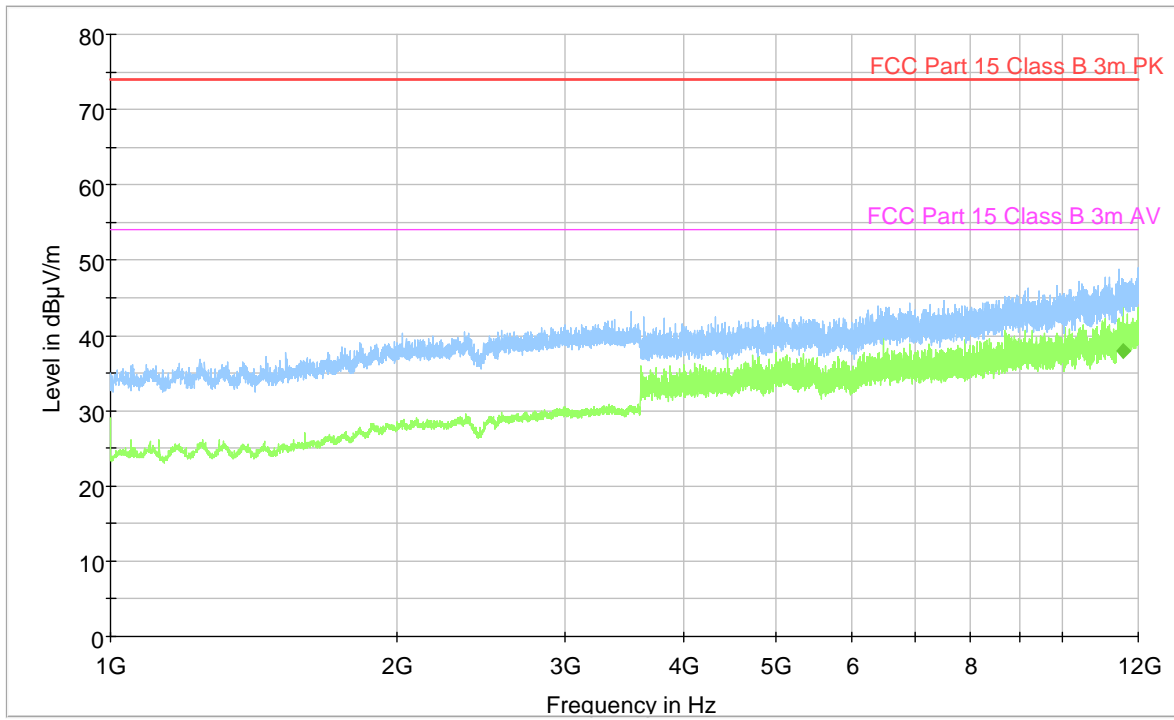
30 – 1000MHz

Full Spectrum



HP, 1 - 18GHz,

Full Spectrum



VP, 1 - 18GHz,

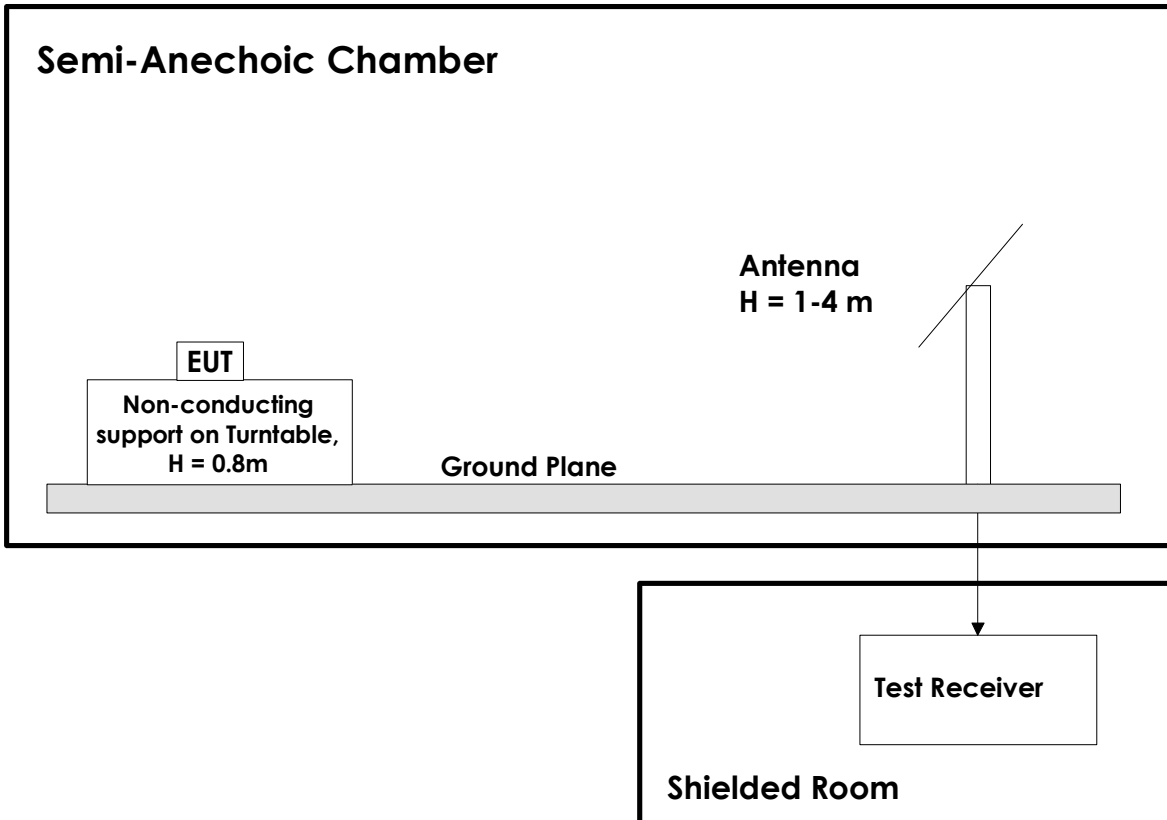
## 4 Measurement Uncertainty

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

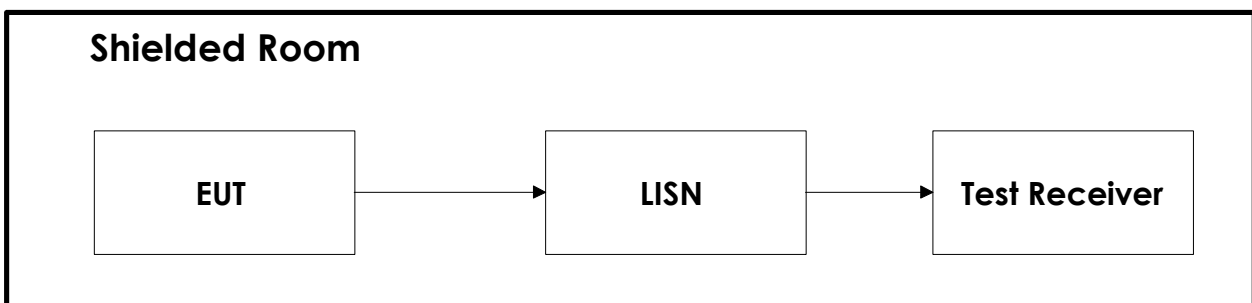
### 5.1 Radiated Emissions Test



#### 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