

# Test Report

## Electromagnetic Compatibility

<b>Product</b>	Data Acquisition SONO HUB
<b>Name and address of the applicant</b>	Vemaventuri AB Johan på Gårdas Gata 5A 41250, Gothenburg SWEDEN
<b>Name and address of the manufacturer</b>	Vemaventuri AB Johan på Gårdas Gata 5A 41250, Gothenburg SWEDEN
<b>Model</b>	HUB-1
<b>Rating</b>	5V DC (From internal battery or from 5V DC with external USB power adapter)
<b>Trademark</b>	 VEMAVENTURI
<b>Additional information</b>	USB power adapter is not a part of EUT
<b>Tested according to</b>	FCC CFR 47 Subpart 15B ISED Canada ICES-003, Issue 7
<b>Project number</b>	PRJ0059523
<b>Tested in period</b>	2024-09-30
<b>Issue date</b>	2024-11-29
<b>Name and address of the testing laboratory</b>	Nemko Scandinavia AS <input type="checkbox"/> Location 1: Philip Pedersens vei 11, 1366 Lysaker, Norway <input checked="" type="checkbox"/> Location 2: Instituttveien 6, 2007 Kjeller, Norway
  An accredited technical test executed under the Norwegian accreditation scheme	
 Prepared by [Jørn Gustavsen]	
 Approved by [Roger Berget]	

## REPORT REVISIONS

Report Edition	Date	Project	Description
A	2024-11-29	PRJ0059523	First issued

**THIS REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATION(S) TESTED.**

It is the manufacturer's responsibility to assure the additional production units of this product are manufactured with identical electrical and mechanical components. The manufacturer is responsible to the authorities for any modifications made to the product, which result in non-compliance to the relevant regulations.

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Opinions expressed within this report regarding general assessments and qualifications for PASS or FAIL to the standards limits and requirements, are not part of the current accreditation. Neither is opinions expressed regarding model variants covered by the testing performed in this report.

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

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## DESCRIPTION OF TESTED ITEM(S)

Product description.....	The tested item is a LTE connected device with USB-C charging and data ports, integrated with a water to cement ratio measurement probe. Input/Output with USB-C charging & data port, (input 5VDC@3A MAX also USB data interface). Contains lithium-Ion battery as a power source to the device during normal operation. This device will be used on construction sites to measure the water to cement content ratio in fresh concrete and will be operated by the skilled personals.
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Model/type .....	HUB-1
Serial number .....	/
Operating voltage.....	5V DC (From internal battery or from 5V DC with external USB power adapter)
Maximum power/current.....	3A
Insulation class .....	Class III
Highest clock frequency .....	280MHz
Hardware version .....	HV01MK04
Software version .....	1.0.0

Mounting position.....	<input type="checkbox"/> Tabletop equipment <input type="checkbox"/> Wall/ceiling mounted equipment <input type="checkbox"/> Floor standing equipment <input checked="" type="checkbox"/> Handheld equipment <input type="checkbox"/> Rack mounted equipment <input type="checkbox"/> Console equipment <input type="checkbox"/> Other:
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## CRITICAL MODULES/PARTS

Description	Manufacturer	Type
Microcontroller	ST Microelectronics	STM32H7A3ZIT6
LTE Module	U-Blox	LARA-R6001D-00B
UDisplay	Riverdi	RVT43HLTNWCO0-B
USB-C Port	Amphenol ICC	MUSBRM1C1M0
M16 circular connector	Lumberg	0317_07
Lithium Ion Battery	Nitecore	NL2150
LTE SIM CARD	Onomondo	n/a
Battery charging IC	Monolithic Power Systems Inc.	MP2722
LTE module power regulator IC	Texas Instruments	TPS61022RWUR

## TEST PERIPHERALS

The following is a listing of support equipment utilized during the measurements:

Description	Manufacturer	Model	FCC Id.
USB power adapter	Samsung	EP-TA20EBE	-

The following is a listing of support cables utilized during the measurements:

Description	Condition		
	Length	Shielded	Ferrite Core
USB Cable	1.2m	<input type="checkbox"/>	<input type="checkbox"/>

This equipment has been tested with certain cable types and cable configurations. Any changes to these parameters when installed may influence the EMC properties of this equipment.

## INPUT/OUTPUT PORTS

Port name	Type	Purpose	Comments
USB-C	USB-C	Charging	Charging of EuT

## OPERATING MODES

OP no.	Description	Applied for testing
OP1	Active Mode (Charging and measuring)	<input checked="" type="checkbox"/>

## POWER SUPPLY CONDITIONS

The following nominal power supply conditions have been tested:

PC no.	Voltage	Frequency	Type	Ground terminal
PC1	120 V	<input type="checkbox"/> AC 50Hz / <input checked="" type="checkbox"/> AC 60Hz / <input type="checkbox"/> DC	<input type="checkbox"/> 3AC / <input type="checkbox"/> 3ACN / <input type="checkbox"/> PoE	<input type="checkbox"/> PE / <input type="checkbox"/> GND / <input checked="" type="checkbox"/> None

- The power supply voltage has been selected after a maximum disturbance investigation over the product's rated voltage range.
- Additional chassis grounding was applied.

## OTHER INFORMATION

Modifications .....	None
Additional information .....	Since the EUT can be operated while it is connected to/charging from an USB power adapter, all tests have been perform with an external USB adapter attached. This connection is considered worst case compared to operating on battery only.  USB adaper is not a part of EUT

## TEST ENVIRONMENT

Test laboratory .....	<input checked="" type="checkbox"/> KJELLER (Instituttveien 6, N-2007 Kjeller, Norway) <input type="checkbox"/> LYSAKER (Philip Pedersens vei 11, N-1366 Lysaker, Norway)						
Laboratory accreditation .....	 <p><b>Norsk Akkreditering – TEST 033</b> P06 – Electromagnetic Compatibility</p>						
Environmental conditions .....	<p>The climatic conditions during the tests are within limits specified by the manufacturer for the operation of the product and the test equipment.</p> <p>The climatic conditions during tests are within the following limits:</p> <table><tr><td><b>Ambient temperature:</b></td><td>15 – 35 °C</td></tr><tr><td><b>Relative humidity:</b></td><td>25 – 75 %RH</td></tr><tr><td><b>Atmospheric pressure:</b></td><td>86 – 106 kPa</td></tr></table> <p>If explicitly required by the test standard, or the requirements are tighter than the above; the climatic conditions are recorded and documented separately in this test report.</p>	<b>Ambient temperature:</b>	15 – 35 °C	<b>Relative humidity:</b>	25 – 75 %RH	<b>Atmospheric pressure:</b>	86 – 106 kPa
<b>Ambient temperature:</b>	15 – 35 °C						
<b>Relative humidity:</b>	25 – 75 %RH						
<b>Atmospheric pressure:</b>	86 – 106 kPa						
Calibration .....	All instruments used in the tests of this test report are calibrated and traceable to national or international standards. Between calibrations test set-ups are controlled and verified on a regular basis by intermediate checks to ensure, with 95% confidence that the instruments remain within their calibrated levels. The instrumentation accuracy is within limits agreed by the IECEE/CTL and defined by Nemko.						
Measurement uncertainties .....	Uncertainty in EMC emission measurements stated in this report are calculated from the standard measurement uncertainties multiplied by the coverage factor k=2. It was determined in accordance with ANSI C63.4. The true value is in the corresponding interval with a probability of 95%. <b>If some emission measurements have a margin to the required limit which is less than the instrumentation measurement uncertainty provided by the laboratory, occurrences are marked with an asterisk (*) in the "Margin" columns.</b> <i>Further information about measurement uncertainties is provided on request.</i>						

## TEST REPORT SUMMARY

### APPLIED STANDARDS

Standards	Titles
<b>FCC CFR 47 Subpart 15B</b>	<i>Digital devices - Unintentional radiators, Class A Digital Device</i>
<b>ISED Canada ICES-003, Issue 7</b>	<i>Spectrum Management and Telecommunications Policy. Interference-Causing Equipment Standard. Information Technology Equipment (Including Digital Apparatus - Limits and Methods of Measurement (Issue 7, June 2020)</i>

\* : An asterisk (\*) placed after the standard name indicates standards that are not within the laboratory scope of accreditation.

### TEST SUMMARY

Requirements – Tests	Reference standards	Verdict
<b>Conducted Emissions</b> (Method: FCC Part 12.107 per ANSI C63.4-2014)	FCC CFR 47 Subpart 15B ISED Canada ICES-003, Issue 7	<b>PASS</b>
<b>Radiated Emissions (Below 1GHz)</b> (Method: FCC Part 12.109 per ANSI C63.4-2014)	FCC CFR 47 Subpart 15B ISED Canada ICES-003, Issue 7	<b>PASS</b>
<b>Radiated Emissions (Above 1GHz)</b> (Method: FCC Part 12.109 per ANSI C63.4-2014)	FCC CFR 47 Subpart 15B ISED Canada ICES-003, Issue 7	<b>PASS</b>

PASS : Tested and complied with the requirements  
FAIL : Tested and failed the requirements  
N/A : Test not relevant to this specimen (evaluated by the test laboratory)  
- : Test not performed (instructed by the applicant)  
\* : An asterisk (\*) placed after the verdict in the Result column indicates a test item that are not within Nemko's scope of accreditation  
# : A grid (#) placed after the verdict in the Result column indicates a test item that are only partly covered by Nemko's scope of accreditation. Further information or details may be provided within the test chapter

### NOTES

None

# Test Results

## CONDUCTED EMISSIONS

### TEST DESCRIPTION

#### Method

These measurements have been performed according to ANSI C63.4-2014.

#### Set-up

The measurement was performed at the power supply terminal of the specimen. Nominal supply voltage was provided. The specimen was energized and in normal operating mode during the measurement.

- The specimen and its cables were elevated 10 cm above a ground plane.
- The specimen and its cables were elevated 40 cm above a ground plane.
- The specimen and its cables were placed 40 cm from a vertical ground plane, 80 cm over ground plane.
- The specimen was mounted directly on, and bonded to a ground plane. Cables and auxiliary equipment were elevated by 1 cm
- The specimen was connected to an Artificial Mains Network (AMN) by its power supply cable, which was adjusted to 100cm length by folding.
- The specimen was connected to an Artificial Mains Network (AMN) by a 0.8 m shielded power supply cable directly connected to the AMN.
- Artificial Hand was applied to the specimen during test (for location see photos)

#### Conditions

- Frequency range was 150kHz – 30MHz.

The measuring bandwidth is 9 kHz in the frequency range 150 kHz – 30 MHz. Measurement was made with a 4.5 kHz step size and 20 ms dwell time.

Measurement uncertainty:  $\pm 3.3$  dB

#### Instruments used during measurement

Instrument list: [AMN: R&S / ENV216 \(LR-1665\) \(11/2026\)](#)  
[EMI Receiver: R&S / ESR 7 \(LR-1675\) \(07/2026\)](#)

#### Conformity

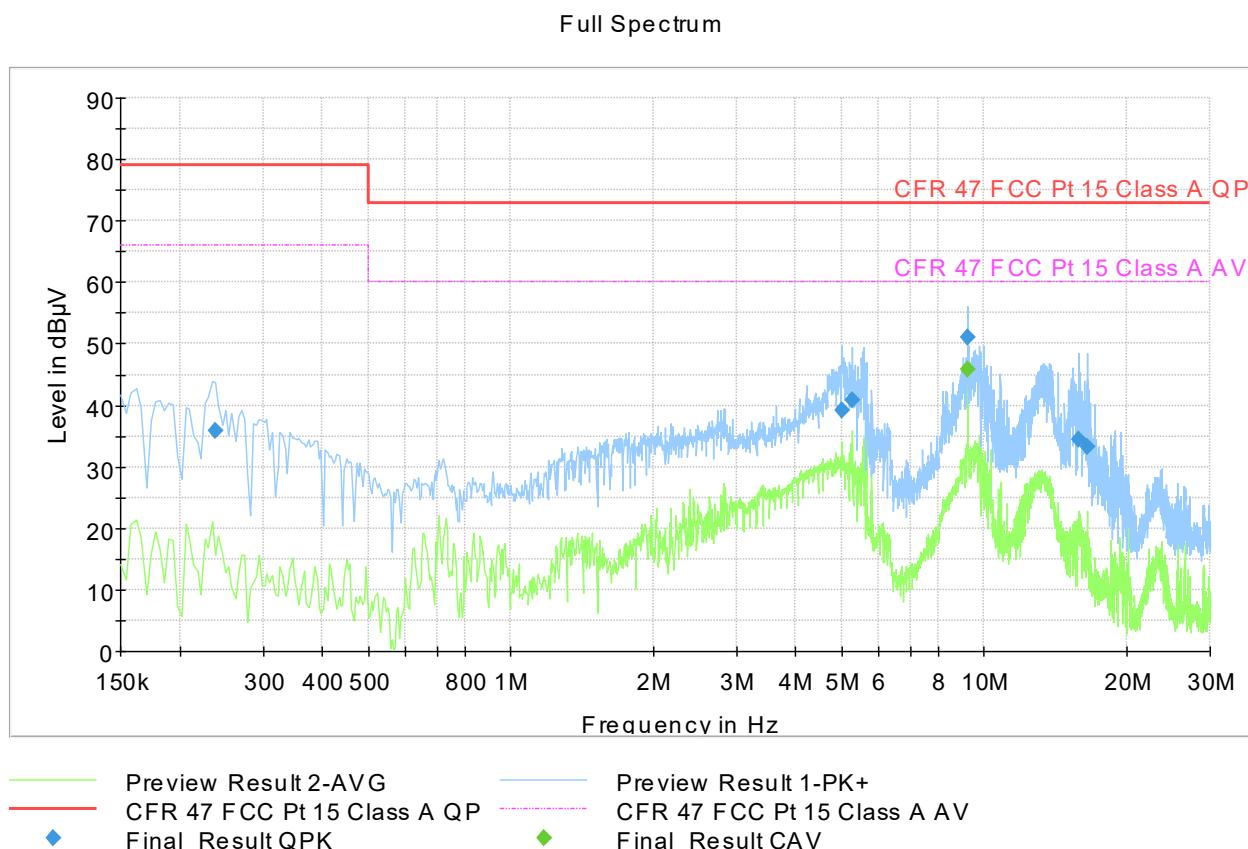
Verdict:

Pass

Test engineer:

[Jørn Gustavsen](#)

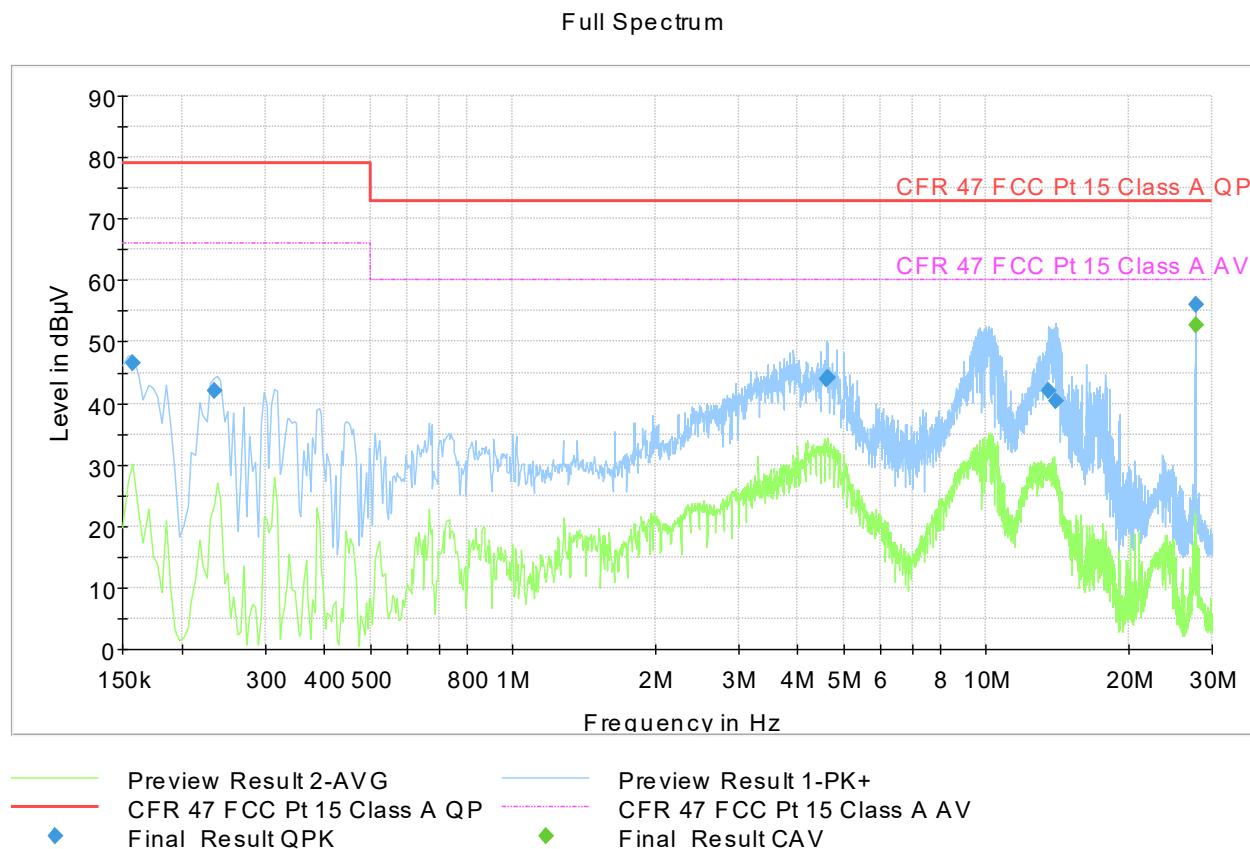
## EMISSION SPECTRUM



## MEASUREMENT DATA

Frequency (MHz)	QuasiPeak (dB $\mu$ V)	CAverage (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.238000	35.91	---	79.00	43.09	15000.0	9.000	N	OFF	9.7
5.014000	39.24	---	73.00	33.76	15000.0	9.000	N	OFF	9.6
5.262000	40.89	---	73.00	32.11	15000.0	9.000	N	OFF	9.6
9.218000	---	45.92	60.00	14.08	15000.0	9.000	L1	OFF	9.8
9.222000	51.04	---	73.00	21.96	15000.0	9.000	N	OFF	9.6
15.858000	34.50	---	73.00	38.50	15000.0	9.000	N	OFF	9.7
16.486000	33.13	---	73.00	39.87	15000.0	9.000	N	OFF	9.7

## EMISSION SPECTRUM (WITH ARTIFICIAL HAND)



## MEASUREMENT DATA

Frequency (MHz)	QuasiPeak (dB $\mu$ V)	CAverage (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.158000	46.62	---	79.00	32.38	15000.0	9.000	L1	OFF	9.7
0.234000	42.05	---	79.00	36.95	15000.0	9.000	L1	OFF	9.7
4.606000	43.93	---	73.00	29.07	15000.0	9.000	L1	OFF	9.8
4.618000	44.16	---	73.00	28.84	15000.0	9.000	L1	OFF	9.8
13.558000	42.09	---	73.00	30.91	15000.0	9.000	L1	OFF	9.9
14.078000	40.46	---	73.00	32.54	15000.0	9.000	N	OFF	9.7
27.658000	---	52.72	60.00	7.28	15000.0	9.000	N	OFF	9.8
27.662000	56.10	---	73.00	16.90	15000.0	9.000	N	OFF	9.8

## RADIATED EMISSIONS (BELOW 1GHZ)

### TEST DESCRIPTION

#### Method

These measurements have been performed according to ANSI C63.4-2014.

#### Set-up

The measurements were performed in a semi-anechoic chamber (SAC). Nominal supply voltage was provided. The specimen was energized and in normal operating mode during the measurement.

- The specimen and its cables were elevated 10 cm above the site ground plane and placed in the centre of the turntable.
- The specimen and its cables were placed on a table 80 cm above the site ground plane and placed in the centre of the turntable.

Antenna type = Hybrid bilog antenna

Antenna elevation = 100-400 cm above the ground reference plane with bore-sight movement.

Specimen rotation = 0-360°.

- Band-stop filter(s) was used to suppress the wanted RF transmission band to protect the measurement equipment.

Frequency range:  30-1000MHz

Measurement distance:  10m

#### Conditions

The measuring bandwidth is 120 kHz in the frequency range 30 MHz – 960 MHz. Frequency sweeps with RBW = 120 kHz and VBW = 1 MHz was applied with a sweep time of 20 ms (step size resolution < 60 kHz ).

Measurement uncertainty: ± 5.2 dB (3m distance in SAC10); ± 5.1 dB (3m distance in SAC3)

#### Instruments used during measurement

Instrument list:   
[Antenna, Hybrid: Sunol / JB3 \(N-4525\) \(04/2025\)](#)  
[EMI Receiver: R&S / ESU40 \(LR-1639\) \(01/2025\)](#)  
[Preamplifier: Sonoma / 310N \(LR-1686\) \(08/2025\)](#)

#### Conformity

Verdict:

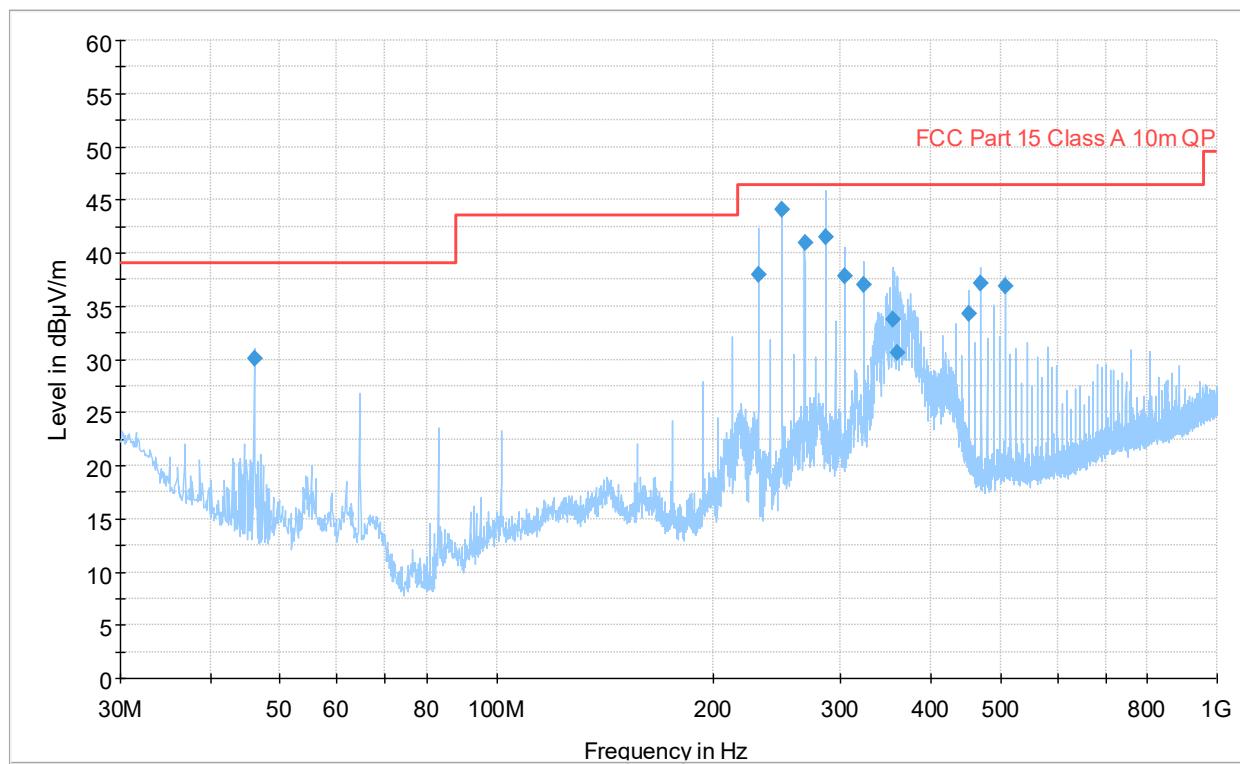
Pass

Test engineer:

Jørn Gustavsen

## EMISSION SPECTRUM

Full Spectrum



## MEASUREMENTS DATA

Frequency (MHz)	QuasiPeak ( $\text{dB}\mu\text{V}/\text{m}$ )	Limit ( $\text{dB}\mu\text{V}/\text{m}$ )	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. ( $\text{dB}/\text{m}$ )
46.102792	30.05	39.10	9.05	15000.0	120.000	300.0	V	336.0	-13.9
230.467050	37.97	46.40	8.43	15000.0	120.000	387.0	H	44.0	-12.8
248.956504	44.09	46.40	*2.31	15000.0	120.000	388.0	H	88.0	-12.3
267.398222	40.96	46.40	5.44	15000.0	120.000	400.0	H	162.0	-11.4
285.786552	41.43	46.40	*4.97	15000.0	120.000	370.0	H	192.0	-10.3
304.257068	37.84	46.40	8.56	15000.0	120.000	393.0	H	244.0	-10.1
322.682964	37.03	46.40	9.37	15000.0	120.000	300.0	H	249.0	-9.8
354.729470	33.81	46.40	12.59	15000.0	120.000	218.0	H	336.0	-8.9
360.094312	30.63	46.40	15.77	15000.0	120.000	205.0	H	328.0	-8.7
451.847078	34.24	46.40	12.16	15000.0	120.000	248.0	H	145.0	-6.4
470.277006	37.19	46.40	9.21	15000.0	120.000	203.0	H	175.0	-6.0
507.132794	36.83	46.40	9.57	15000.0	120.000	200.0	H	345.0	-5.2

## RADIATED EMISSIONS (ABOVE 1GHZ)

### TEST DESCRIPTION

#### Method

These measurements have been performed according to ANSI C63.4-2014.

#### Set-up

Nominal supply voltage was provided. The specimen was energized and in normal operating mode during the measurement.

- The specimen and its cables were elevated 10 cm above the floor and placed in the centre of the turntable.
- The specimen and its cables were placed on a table 80 cm above the floor and placed in the centre of the turntable.

#### Facility:

- 3m semi-anechoic chamber (SAC3) with extra floor absorbers\* (calibrated volume: D=2.0m / H=2.0m).
- 10m semi-anechoic chamber (SAC10) with extra floor absorbers\* (calibrated volume: D=1.5m / H=2.0m).

\* The reference ground plane was covered with ferrite absorbers in the reflecting area between the specimen and the measuring antenna.

Measurement distance =  3m.

Antenna elevation = 100-400 cm above the floor with bore-sight movement.

Specimen rotation = 0-360°.

Measurements were performed with a double-ridged guide horn antenna.

- Band-stop filter(s) was used to suppress the wanted RF transmission band to protect the measurement equipment.

#### Frequency range:

<input type="checkbox"/> 1-2GHz	Highest internal frequency of specimen:
<input type="checkbox"/> 1-5GHz	<input type="checkbox"/> Below 108MHz
<input checked="" type="checkbox"/> 1-6GHz	<input checked="" type="checkbox"/> Between 108MHz and 500MHz
<input type="checkbox"/> 1-12GHz	<input type="checkbox"/> Between 500MHz and 1000MHz
<input type="checkbox"/> 1-18GHz	<input type="checkbox"/> Above 1000MHz

The measuring bandwidth is 1 MHz in the above frequency range. Frequency sweeps with RBW = 1 MHz and VBW = 1 MHz was applied with a sweep time of 100 ms (proper segmentation of the frequency range was applied to obtain step size resolution < 500 kHz).

Measurement uncertainty: ± 5.1 dB (1-6GHz); ± 5.2 dB (6-18GHz)

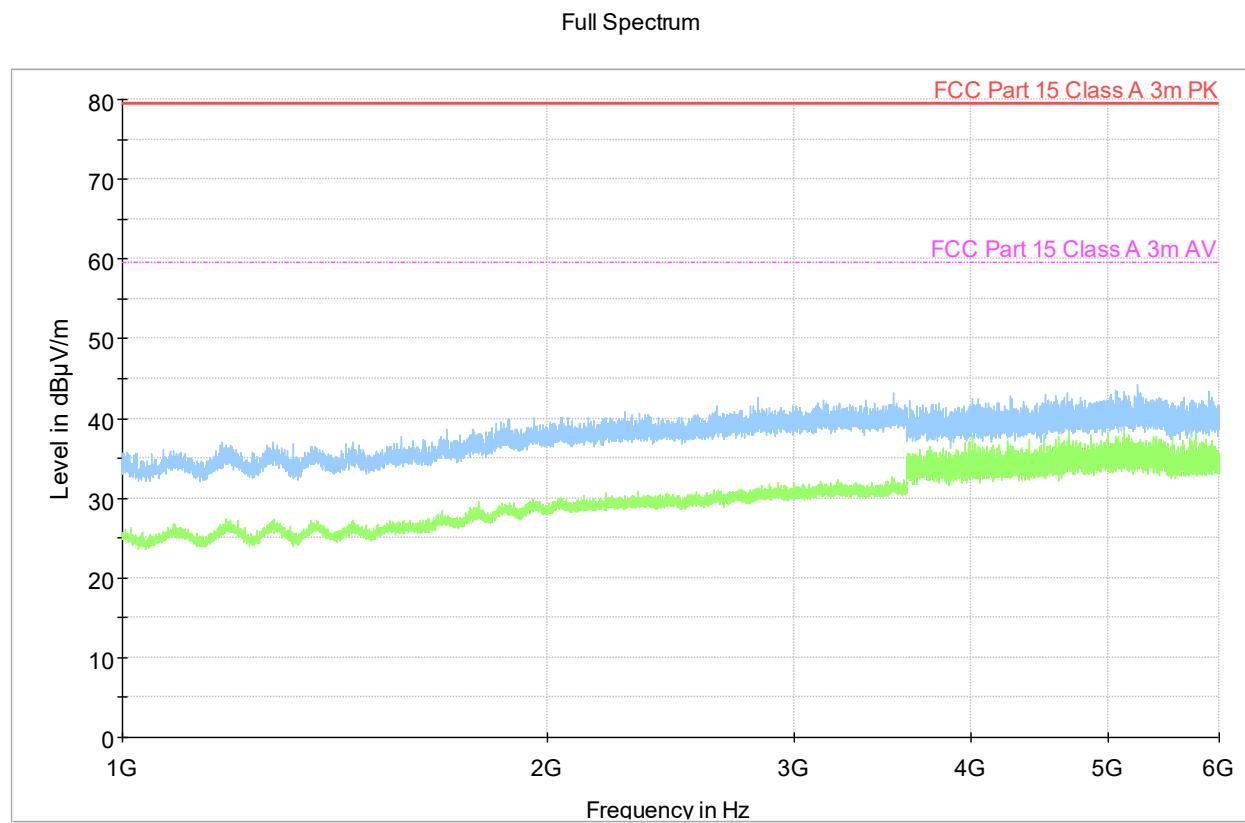
#### Instruments used during measurement

Instrument list: Antenna, Horn: ETS / 3117 (LR-1717) (12/2027)  
EMI Receiver: R&S / ESU40 (LR-1639) (01/2025)  
Preamplifier: ETS / 3117-PA (LR-1757) (08/2025)

#### Conformity

Verdict: **Pass**  
Test engineer: **Jørn Gustavsen**

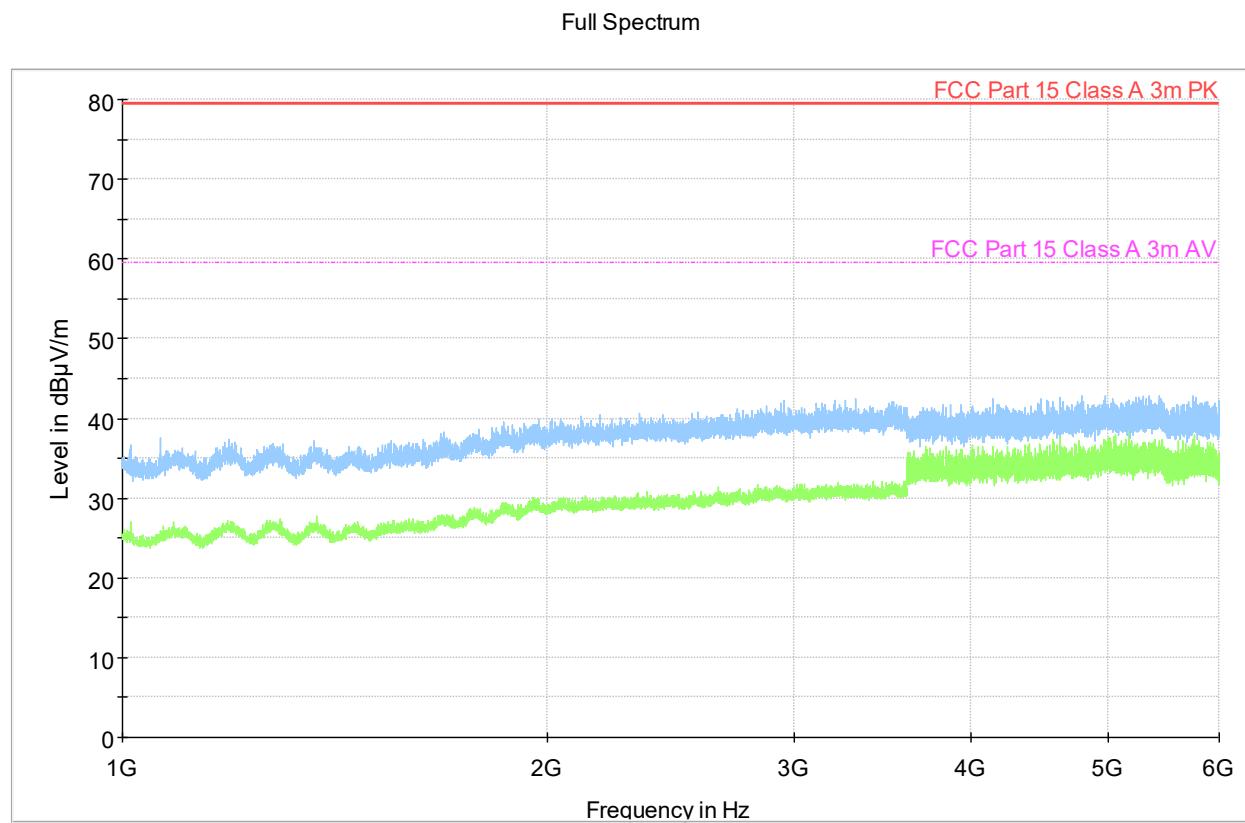
## EMISSION SPECTRUM (HORIZONTAL POLARIZATION)



## MEASUREMENTS DATA

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	CAverage (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
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## EMISSION SPECTRUM (VERTICAL POLARIZATION)



## MEASUREMENTS DATA

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	CAverage (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
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## Annexes

## PHOTOS

Photographs of the test item(s) and the test setups are placed in an addendum to this report. The addendum is a separate file only linked to this report by its common report number.