

# Test Report

## Electromagnetic Compatibility

<b>Product</b>	Earplug with noise cancellation
<b>Name and address of the applicant</b>	Minuendo AS Nedre Slottsgate 2C 0153 Oslo Norway
<b>Name and address of the manufacturer</b>	Minuendo AS Nedre Slottsgate 2C 0153 Oslo Norway
<b>Model</b>	MSA101
<b>Rating</b>	Smart alert: Internal battery Charger: 100-230V AC 50/60 Hz
<b>Trademark</b>	Minuendo
<b>Additional information</b>	FCC ID: 2A8VEMSA101
<b>Tested according to</b>	FCC CFR 47 Subpart 15B ISED Canada ICES-003, Issue 7
<b>Project number</b>	PRJ0025108
<b>Tested in period</b>	2023-02-08
<b>Issue date</b>	2023-03-27
<b>Name and address of the testing laboratory</b>	Nemko Scandinavia AS Philip Pedersens vei 11, 1366 Lysaker, Norway
  An accredited technical test executed under the Norwegian accreditation scheme	
  Prepared by [Jan G. Eriksen]      Approved by [G.Suhanthakumar]	

## REPORT REVISIONS

Report Edition	Date	Project	Description
A	2023-03-27	PRJ0025108	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".

This report was originally distributed electronically with digital signatures. For more information contact Nemko.

## DESCRIPTION OF TESTED ITEM(S)

Product description.....	Noise cancelling earplugs (including charger)
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Model/type .....	Earplug: Smart alert earplugs MSA1 Charger: any with USB connector
FCC ID .....	2A8VEMSA101
Serial number .....	E2236067
Operating voltage.....	Depent on USB charger
Maximum power/current.....	1A
Insulation class .....	-
Highest clock frequency .....	-
Hardware version .....	-
Software version .....	-

Mounting position.....	<input type="checkbox"/> Tabletop equipment <input type="checkbox"/> Wall/ceiling mounted equipment <input type="checkbox"/> Floor standing equipment <input type="checkbox"/> Handheld equipment <input type="checkbox"/> Rack mounted equipment <input type="checkbox"/> Console equipment <input checked="" type="checkbox"/> Other: Head worn / connected to charger
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## ACCESSORIES USED DURING TEST

Description	Manufacturer	Type
Charger with USB connector	CUI INC.	SMI5-5-V-138

## INPUT/OUTPUT PORTS

Port name and description	Cable		
	Longer than 3m	Attached during test	Shielded
Magnetic charger connector	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<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.

## OPERATING MODES

OP no.	Description	Applied for testing	
		Emissions	Immunity
OP1	Noise cancellation mode	<input checked="" type="checkbox"/>	<input type="checkbox"/>
OP2	Charging mode	<input checked="" type="checkbox"/>	<input type="checkbox"/>

## POWER SUPPLY CONDITIONS

The following nominal power supply conditions have been tested:

PC no.	Voltage	Frequency	Type	Ground terminal
PC1	115 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 type="checkbox"/> None

## PHOTOS AND DRAWINGS

Copy of FCC ID .....	EN 352-2:2020   Minuendo - Smart Alert Earplugs - MSA101 FCC-id: 2A8VEMSA101
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Copy of marking label.....	
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Photo of the test item .....	 Smart Alert Earplug	 charging connector
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## OTHER INFORMATION

Modifications .....	None
Additional information .....	None

## 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 .....	<p>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.</p> <p>The instrumentation accuracy is within limits agreed by the IECEE/CTL and defined by Nemko.</p>						
Measurement uncertainties .....	<p>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 CISPR 16-4-2. The true value is in the corresponding interval with a probability of 95%. Uncertainties for continuous immunity tests are calculated based on the same principles as for EMC emission uncertainties.</p> <p>For Harmonics and Flicker measurements the measurement uncertainty is calculated based on the same principles as for EMC emission uncertainties.</p> <p>Uncertainties for transient immunity are kept within the requirements of the relevant basic standard.</p> <p><i>Further information about measurement uncertainties is provided on request.</i></p>						
Decision rules .....	<p>As specified by CISPR 16-4-2; if our measurement uncertainty <math>U_{LAB}</math> is less than or equal to <math>U_{CISPR}</math>, compliance is deemed to occur if no measured disturbance level exceeds the limit hence "PASS" is indicated, and non-compliance is deemed to occur if any measured disturbance level exceeds the limits hence "FAIL" is indicated.</p> <p>For continuous immunity tests, uncertainties are not considered when applying the calibrated test levels. Tests are performed at the test levels specified by the test standard. PASS and FAIL decisions are based on behaviour observations of the specimen.</p> <p>For transient immunity tests, uncertainties are not considered if the test equipment is kept within the requirements of the relevant basic standard. Tests are performed at the test levels specified by the test standard. PASS and FAIL decisions are based on behaviour observations of the specimen.</p> <p>For Harmonics and Flicker measurements the measurement uncertainty is considered, and measurements are marked if necessary. In doing so, the associated uncertainty of measurement has been considered.</p> <p><i>Further information about decision rules is provided on request.</i></p>						

## TEST REPORT SUMMARY

### APPLIED STANDARDS

Standards	Titles
<b>FCC CFR 47 Subpart 15B</b>	<i>Digital devices - Unintentional radiators, Class B 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>

### TEST SUMMARY

Requirements – Tests	Reference standards	Verdict
Conducted Emissions	FCC CFR 47 Subpart 15B:0 ISED Canada ICES-003, Issue 7:0 FCC Part 12.107 per ANSI C63.4-2014	PASS
Radiated Emissions (Below 1GHz)	FCC CFR 47 Subpart 15B:0 ISED Canada ICES-003, Issue 7:0 FCC Part 12.109 per ANSI C63.4-2014	PASS
Radiated Emissions (Above 1GHz)	FCC CFR 47 Subpart 15B:0 ISED Canada ICES-003, Issue 7:0 FCC Part 12.109 per ANSI C63.4-2014	N/A

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 test items that are not within Nemko's scope of accreditation  
# : A grid (#) placed after the verdict in the Result column indicates test items that are only partly covered by Nemko's scope of accreditation. Further information is detailed in the test section

### ABOUT REFERENCE STANDARDS AND TEST LEVELS

Product standards with dated references to basic standards may have been performed according to the newest edition of the basic standard. This may impact the compliance criteria or technical performance of the test, still this is adequate if the test is expected to confirm compliance to the intention of the product standard. The table above lists the actual editions of the basic standards which have been used during testing.

The choice of immunity test levels could be higher than those specified by the reference standards when we consider the nature of the specimen and its intended use or based on customer requests.

### NOTES

None

## Test Results

## CONDUCTED EMISSIONS FCC PART 15B

### TEST DESCRIPTION

#### Method

The reference method for this test is listed in the table under clause TEST SUMMARY.

#### 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

#### Conditions

- Frequency range was 9kHz – 30MHz.
- Frequency range was 10kHz – 30MHz.
- Frequency range was 150kHz – 30MHz.

The measuring bandwidth is 200Hz in the frequency range 9 kHz – 150 kHz. Measurement was made with a 100 Hz step size and 100 ms dwell time.

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:  $\pm 3.7$  dB (9 kHz – 150 kHz);  $\pm 3.3$  dB (150 kHz – 30 MHz)

#### Instruments used during measurement

Instrument list: [AMN: R&S / ENV216 \(LR-1665\) \(11/2023\)](#)  
[EMI Receiver: R&S / ESCI 3 \(N-4259\) \(12/2023\)](#)

#### Conformity

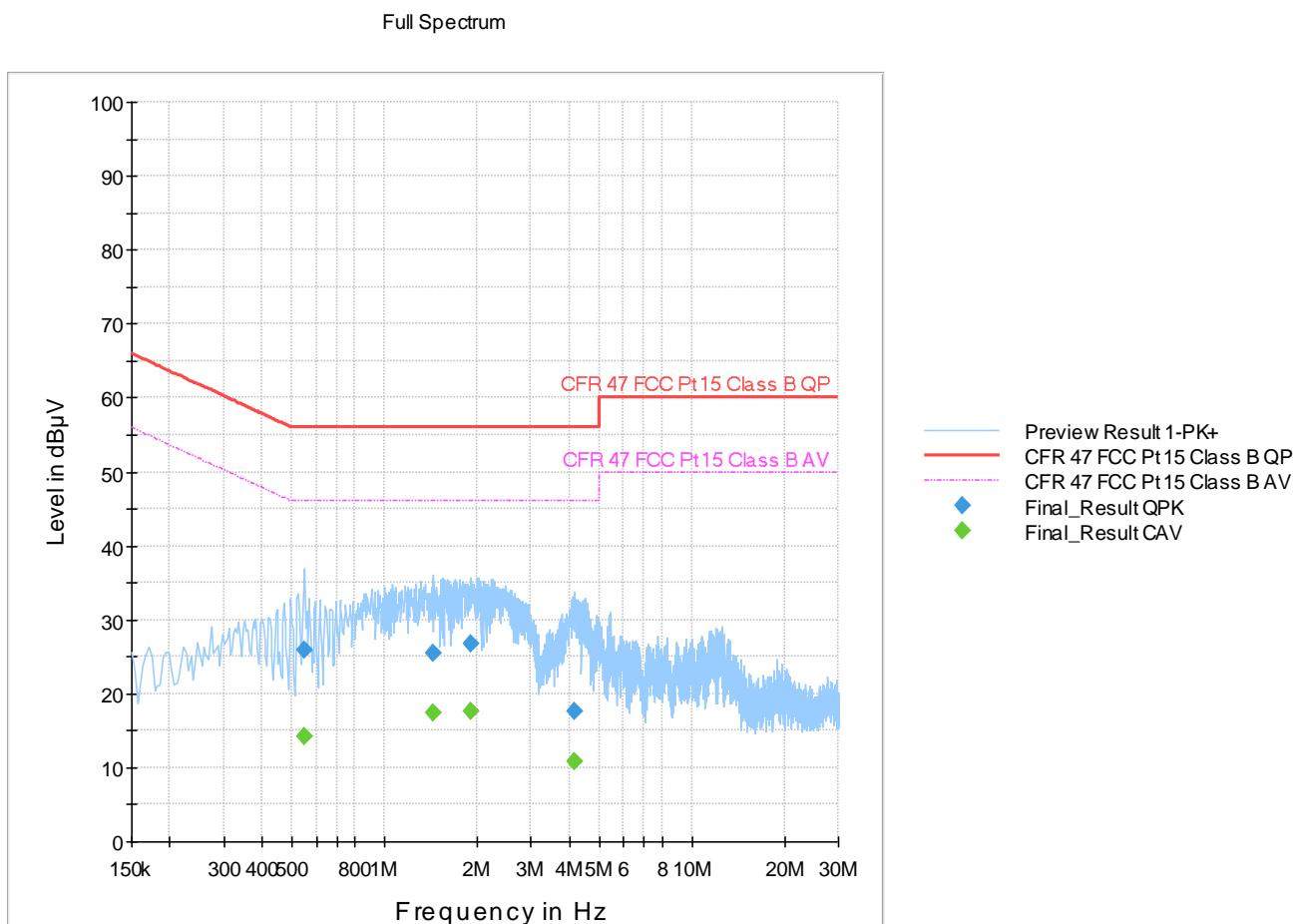
Verdict:

PASS

Test engineer:

Jan G Eriksen

## EMISSION SPECTRUM



Charging mode

## MEASUREMENT DATA

Charging

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)
0.546000	---	14.15	46.00	31.85	15000.0	9.000	N	OFF	9.6
0.546000	25.97	---	56.00	30.03	15000.0	9.000	N	OFF	9.6
1.430000	25.54	---	56.00	30.46	15000.0	9.000	L1	OFF	9.7
1.430000	---	17.44	46.00	28.56	15000.0	9.000	L1	OFF	9.7
1.910000	26.71	---	56.00	29.29	15000.0	9.000	L1	OFF	9.7
1.910000	---	17.53	46.00	28.47	15000.0	9.000	L1	OFF	9.7
4.134000	---	10.84	46.00	35.16	15000.0	9.000	N	OFF	9.5
4.134000	17.70	---	56.00	38.30	15000.0	9.000	N	OFF	9.5

## RADIATED EMISSIONS FCC PART 15B (BELOW 1GHZ)

### TEST DESCRIPTION

#### Method

The reference method for this test is listed in the table under clause TEST SUMMARY.

#### 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.
- Ferrite clamps type CMAD were applied to cables leaving the test volume.
- A CDNE was applied to the power supply cable.

Antenna type = Hybrid bilog antenna

Antenna elevation = 100-400 cm above the ground reference plane.

Specimen rotation = 0-360°.

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

Frequency range: Measurement distance:

- 30-300MHz
- 30-1000MHz
- Other:

- 3m
- 5m
- 10m

#### Conditions

The measuring bandwidth is 120 kHz in the frequency range 30 MHz – 1000 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: ± 4.9 dB (3m distance in SAC10); ± 4.6 dB (3m distance in SAC3); ± 4.6 dB (10m distance in SAC10)

#### Instruments used during measurement

Instrument list: Antenna Log-periodic: Schwarzbeck / VUSLP 9111B (N-4804.01) (04/2024)  
EMI Receiver: R&S / ESU40 (LR-1639) (01/2024)

#### Conformity

Verdict:

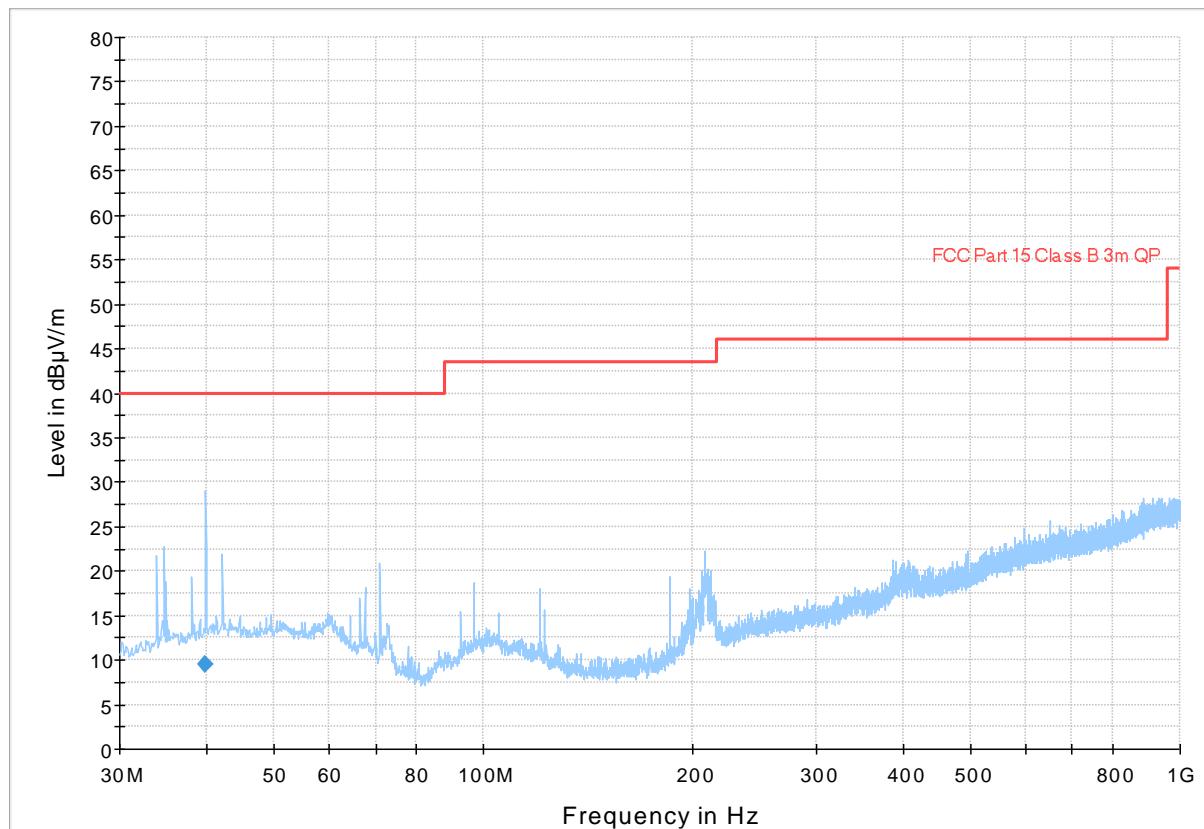
PASS

Test engineer:

Jan G Eriksen

## EMISSION SPECTRUM NON-CHARGE

Full Spectrum

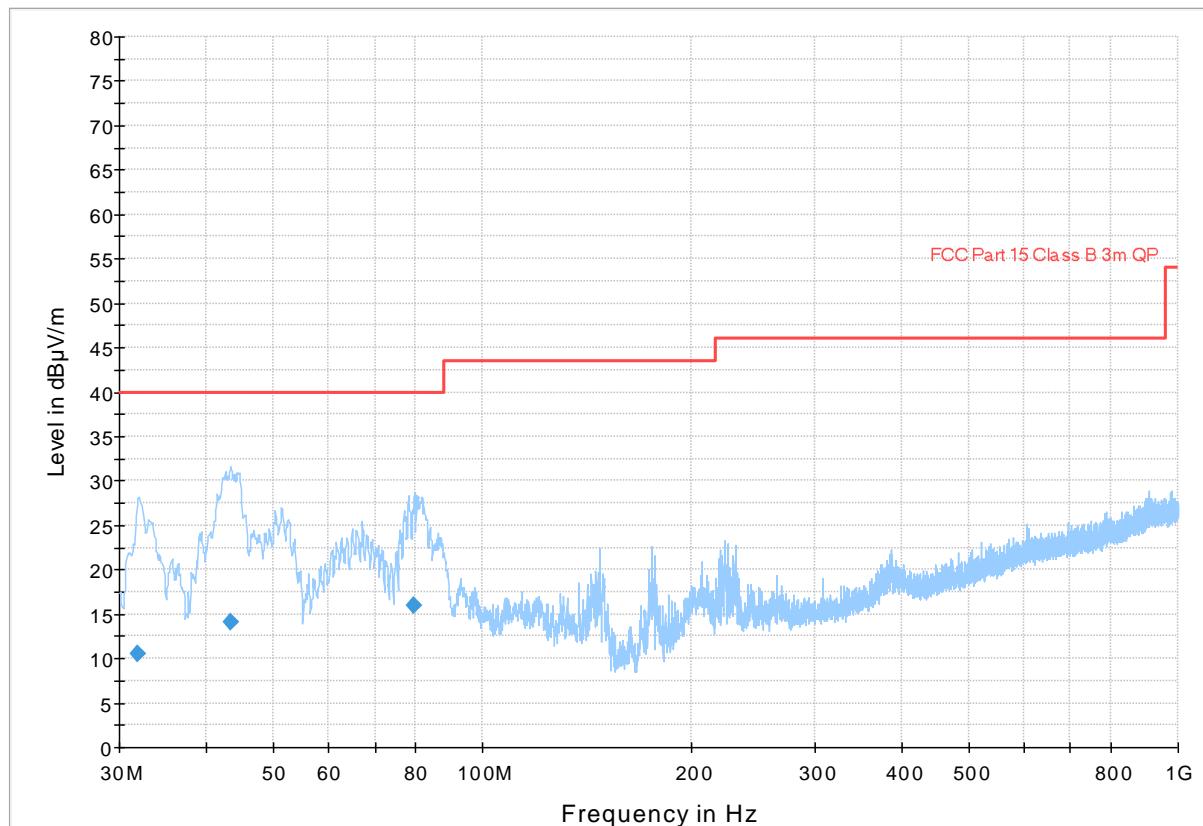


## MEASUREMENTS DATA NON-CHARGE

Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
39.818994	9.55	40.00	30.45	15000.0	120.000	395.0	V	171.0	-13.5

## EMISSION SPECTRUM CHARGE

Full Spectrum



## MEASUREMENTS DATA CHARGE

Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
31.894082	10.49	40.00	29.51	15000.0	120.000	140.0	V	39.0	-15.5
43.335996	14.07	40.00	25.93	15000.0	120.000	102.0	V	208.0	-13.5
79.678794	15.90	40.00	24.10	15000.0	120.000	102.0	V	201.0	-18.6

## Annexes

## PHOTOS

Test set-up for EMC emissions measurements



Non-charging seen from antenna



Non-charging seen from device



Charging seen from device



Charging – spurious mains