





Test Report

Electromagnetic Compatibility

Product	Charger with WiFi	
Name and address of the applicant	Minuendo AS Nedre Slottsgate 2C 0153 Oslo, Norway	
Name and address of the manufacturer	Minuendo AS Nedre Slottsgate 2C 0153 Oslo, Norway	
Model	MSA2	
Rating	100-240V AC, 15W, 2.4GHz WLAN	
Trademark	Minuendo	
Additional information	FCC ID: 2A8VEMSA2	
Tested according to	FCC CFR 47 Subpart 15B ISED Canada ICES-003, Issue 7	
Order number	456388	
Tested in period	2022-04-22 - 2022-07-06	
Issue date	2022-01-11	
Name and address of the testing laboratory	Nemko Scandinavia AS Philip Pedersens vei 11, 1366 Lysaker, Norway	 
An accredited technical test executed under the Norwegian accreditation scheme		
 Prepared by [Jan Gunnar Eriksen]		 Approved by [G.Suhanthakumar]

REPORT REVISIONS

Revision #	Date	Order #	Description
00	2022-09-30	456388	First issued
01	2022-10-21	456388	Corrected Model name, included trademark and corrected voltage rating
02	2022-10-24	456388	Editorial generating new report number
03	2023-01-11	456388	Report covering new FCC ID for part 15B certification



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.....:	The product is a charger for up to eight noise cancellation headphones
FCC ID Information.....:	The product contains FCC ID 2AC7Z-ESP32WROOM32E
Model/type.....:	MSA2
Serial number.....:	-
Operating voltage.....:	100 – 240V AC 50/60 Hz
Maximum power/current.....:	15 VA
Insulation class.....:	-
Highest clock frequency.....:	240 MHz
Hardware version.....:	-
Software version.....:	-
Mounting position.....:	<input checked="" type="checkbox"/> Table top equipment <input checked="" 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 type="checkbox"/> Other:

RF CHARACTERISTICS OF THE TRANSMITTER

Type.....:	Wifi 2.4 GHz
Frequency range.....:	2400 – 2483.5 MHz
Number of channels.....:	According to IEEE 802.11 standards and national regulations
Channel BW.....:	According to IEEE 802.11 standards
Rated output power.....:	According to IEEE 802.11 standards
Receiver category.....:	According to IEEE 802.11 standards
Classification.....:	According to IEEE 802.11 standards
Operating modes.....:	According to IEEE 802.11 standards
Types of modulation.....:	According to IEEE 802.11 standards
Tunable bands.....:	None
User frequency adjustment.....:	None
Antenna type.....:	PCB
Antenna gain.....:	-
Antenna connection.....:	PCB
Number of antennas.....:	1
Antenna diversity/MIMO.....:	None

INPUT/OUTPUT PORTS

Port name and description	Cable		
	Longer than 3m	Attached during test	Shielded
AC mains 115V / 60 Hz	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Earbuds in charging mode	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

OPERATING MODES

OP no.	Description	Applied for testing	
		Emissions	Immunity
OP1	Charging of earpods	<input checked="" type="checkbox"/>	<input type="checkbox"/>

PHOTOS AND DRAWINGS

Copy of marking label.....:	<div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="text-align: center;"> <p>minuendo® www.minuendo.com</p> </div> <div style="text-align: right;"> </div> </div> <div style="margin-top: 10px;"> <table style="width: 100%; border: none;"> <tr> <td style="width: 30%;">Name:</td> <td>Smart Alert dock</td> <td rowspan="6" style="text-align: center; vertical-align: middle;"> </td> </tr> <tr> <td>Model:</td> <td>MSA2</td> </tr> <tr> <td>S/N:</td> <td>DYYWWUID</td> </tr> <tr> <td>WiFi SSID:</td> <td>Minuendo-dock-XXXXXXX</td> </tr> <tr> <td>MAC:</td> <td>2C:54:91:88:C9:E3</td> </tr> <tr> <td>Input rating</td> <td>100-240V~,50/60Hz, 0.35A</td> </tr> <tr> <td>Output rating:</td> <td>5.0V = 0.12A per port</td> <td rowspan="3" style="text-align: center; vertical-align: middle;"> </td> </tr> <tr> <td>MFG:</td> <td>HAPRO ELECTRONICS AS</td> </tr> <tr> <td colspan="2" style="text-align: center;"> </td> </tr> </table> </div> <div style="margin-top: 10px; display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Minuendo AS Nedre Slottsgate 2 C 0153 Oslo, Norway</p> <p>Made in Norway</p> </div> <div style="width: 45%; text-align: right;"> <p>FCC ID: 2A8VEMSA2 Device contains FCC ID: 2AC7Z-ESP32EROOM32E IC: 21098-ESPWROOMM32E</p> </div> </div>	Name:	Smart Alert dock		Model:	MSA2	S/N:	DYYWWUID	WiFi SSID:	Minuendo-dock-XXXXXXX	MAC:	2C:54:91:88:C9:E3	Input rating	100-240V~,50/60Hz, 0.35A	Output rating:	5.0V = 0.12A per port		MFG:	HAPRO ELECTRONICS AS		
Name:	Smart Alert dock																				
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MFG:	HAPRO ELECTRONICS AS																				




OTHER INFORMATION

Modifications	None
Additional information	-

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

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>Norsk Akkreditering – TEST 033 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. The climatic conditions during tests are within the following limits:</p> <p>Ambient temperature: 15 – 35 °C Relative humidity: 25 – 75 %RH Atmospheric pressure: 86 – 106 kPa</p> <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>
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. 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. For Harmonics and Flicker measurements the measurement uncertainty is calculated based on the same principles as for EMC emission uncertainties. Uncertainties for transient immunity are kept within the requirements of the relevant basic standard. <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 U_{LAB} is less than or equal to U_{CISPR}, 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. 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. 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. 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. <i>Further information about decision rules is provided on request.</i></p>

EVALUATION OF PERFORMANCE

PERFORMANCE TESTS

Performance checks	Observing that charging functions normally.
Performance tests	Observing that charging functions normally.
Monitoring during tests	Manual monitoring of charging.
<p>Note 1: Performance check is a short functional test carried out during or after a technical test to confirm that the equipment operates.</p> <p>Note 2: Performance test is a measurement or a group of measurements carried out during and/or after a technical test to confirm that the equipment complies with selected parameters as defined in the equipment standard.</p> <p>Note 3: Monitoring during tests describes which functions were monitored and how.</p>	

GENERAL PERFORMANCE CRITERIA

In order to pass each test, the specimen shall meet the following general criteria:

During test	After test
<p>Performance criterion A: Operate as intended. No loss of function. No unintentional responses.</p>	<p>Performance criterion A: Operate as intended. No loss of function. No degradation of performance. No loss of stored data or user programmable functions.</p>
<p>Performance criterion B: May be loss of function (one or more). No unintentional responses.</p>	<p>Performance criterion B: Operate as intended. Lost function(s) shall be self-recoverable. No degradation of performance. No loss of stored data or user programmable functions.</p>
<p>Performance criterion C: May be loss of function (one or more).</p>	<p>Performance criterion C: Lost function(s) shall be recoverable by the operator. Operate as intended after recovering. No degradation of performance.</p>

TRANSMITTER PERFORMANCE CRITERIA

In order to pass each test, the transmitter functions shall meet the following criteria:

During continuous tests	During transient tests
<p>Performance criterion CT: During and after the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance. During the test the EUT shall not unintentionally transmit or change its actual operating state and stored data. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.</p>	<p>Performance criterion TT: After the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance. During the EMC exposure to an electromagnetic phenomenon, a degradation of performance is, however, allowed. No change of the actual mode of operation (e.g. unintended transmission) or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.</p>
<p>Modification by the manufacturer: Not modified</p>	<p>Modification by the manufacturer: Not modified</p>

RECEIVER PERFORMANCE CRITERIA

In order to pass each test, the receiver functions shall meet the following criteria:

During continuous tests	During transient tests
<p>Performance criterion CR : During and after the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance. During the test the EUT shall not unintentionally transmit or change its actual operating state and stored data. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.</p>	<p>Performance criterion TR : After the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance. During the EMC exposure to an electromagnetic phenomenon, a degradation of performance is, however, allowed. No change of the actual mode of operation (e.g. unintended transmission) or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.</p>
<p>Modification by the manufacturer: Not modified</p>	<p>Modification by the manufacturer: Not modified</p>

Note: In the subsequent test sections of this report, the required and actual specimen performance during immunity testing is indicated by the nomenclatures as given by the tables above (A or B and CT, TT, CR or TR).

SUMMARY OF TESTING

APPLIED STANDARDS

Standards	Titles
FCC CFR 47 Subpart 15B	<i>Digital devices - Unintentional radiators, Class B Digital Device</i>
ISED Canada ICES-003, Issue 7	<i>Spectrum Management and Telecommunications Policy. Interference-Causing Equipment Standard. Information Technology Equipment (Including Digital Apparatus - Limits and Methods of Measurement (Issue 6, June 2016)</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	PASS

- 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

NOTES

Note 1: Product standards with dated references to basic standards may have been performed by Nemko AS according to the newest edition of the basic standard. This may impact the compliance criteria or technical performance of the test, still this is considered to be adequate as long as 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.

Note 2: The choice of immunity test levels could be higher than those specified by the reference standards when we take into account the nature of the specimen and its intended use, or based on customer requests.

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: ± 3.7 dB (9 kHz – 150 kHz); ± 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) (10/2023)

Conformity

Verdict:

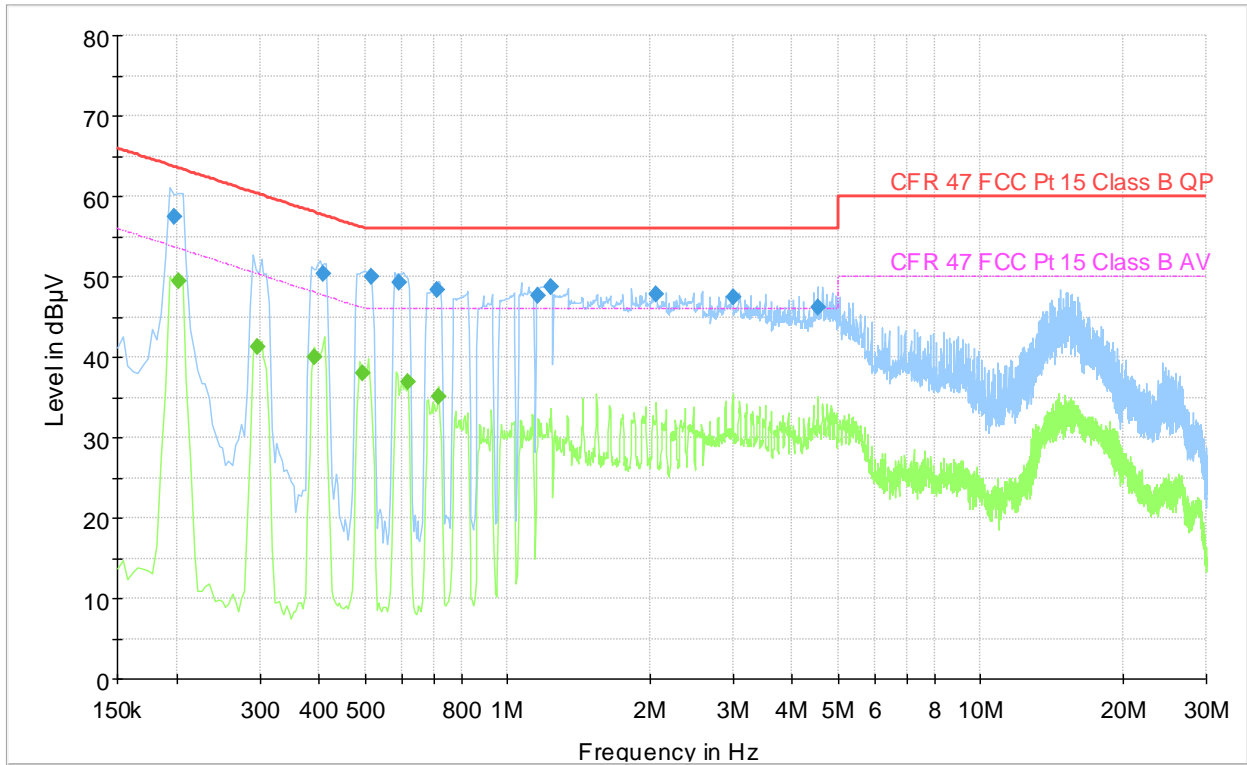
PASS

Test engineer:

Jan G Eriksen

EMISSION SPECTRUM

Full Spectrum



MEASUREMENT DATA

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter
0.198	57.5	---	63.7	6.2	1000	9	N	OFF
0.202	---	49.4	53.5	4.9	1000	9	N	OFF
0.296	---	41.3	50.4	9.1	1000	9	N	OFF
0.392	---	39.9	48.0	8.1	1000	9	N	OFF
0.408	50.4	---	57.7	7.3	1000	9	N	OFF
0.496	---	38.0	46.1	8.1	1000	9	L1	OFF
0.516	49.9	---	56.0	6.1	1000	9	L1	OFF
0.592	49.2	---	56.0	6.8	1000	9	N	OFF
0.616	---	37.0	46.0	9.0	1000	9	N	OFF
0.712	48.3	---	56.0	7.7	1000	9	N	OFF
0.716	---	35.0	46.0	11.0	1000	9	N	OFF
1.156	47.7	---	56.0	8.3	1000	9	N	OFF
1.240	48.7	---	56.0	7.3	1000	9	N	OFF
2.068	47.8	---	56.0	8.2	1000	9	L1	OFF
2.996	47.5	---	56.0	8.5	1000	9	L1	OFF
4.548	46.2	---	56.0	9.8	1000	9	N	OFF

RADIATED EMISSIONS (BELOW 1GHZ)

FCC PART 15B

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°.

Frequency range:

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

Measurement distance:

- 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, bilog: Sunol / JB3 \(N-4525\) \(03/2022\)](#)
 [EMI Receiver: R&S / ESU40 \(LR-1639\) \(01/2023\)](#)
 [Preamplifier: Sonoma / 310N \(LR-1686\) \(08/2022\)](#)

Conformity

Verdict:

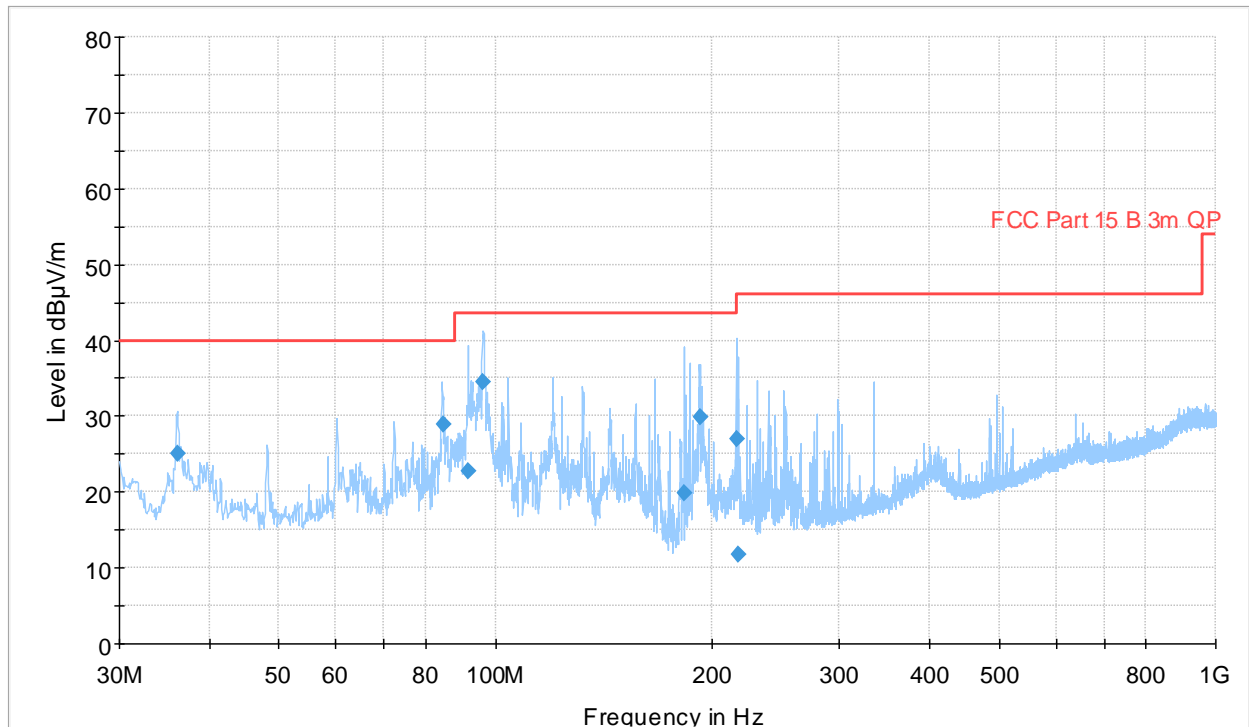
PASS

Test engineer:

Jan G Eriksen

EMISSION SPECTRUM

Full Spectrum



— Preview Result 1-PK+ — FCC Part 15 B 3m QP ◆ Final_Result QPK

MEASUREMENTS DATA

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
36.228450	25.1	40.0	14.9	1000.0	120.000	131.0	V	294.0	-14.5
84.413350	28.9	40.0	11.1	1000.0	120.000	239.0	H	168.0	-17.8
91.669100	22.7	43.5	20.8	1000.0	120.000	119.0	V	309.0	-16.0
95.995800	34.5	43.5	9.0	1000.0	120.000	201.0	H	25.0	-15.1
182.477400	19.9	43.5	23.7	1000.0	120.000	153.0	H	82.0	-16.1
191.992150	29.9	43.5	13.6	1000.0	120.000	182.0	H	110.0	-15.0
215.863000	27.0	43.5	16.5	1000.0	120.000	200.0	H	45.0	-13.9
217.672950	11.7	46.0	34.3	1000.0	120.000	251.0	V	99.0	-13.9

RADIATED EMISSIONS (ABOVE 1GHZ)

FCC PART 15B

TEST DESCRIPTION

Method

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

Set-up

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

- The measurements were performed in a semi-anechoic chamber (SAC3) (calibrated volume: D=2.0m / H=2.0m).
- The measurements were performed in a semi-anechoic chamber (SAC10) (calibrated volume: D=1.5m / H=2.0m).
- The measurements were performed in a fully anechoic room (FAR) (calibrated volume: D=1.2m / H=2.0m).

- 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.

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 = fixed at centre of specimen height.

Specimen rotation = 0-360°.

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

Frequency range:

- 1-2 GHz
- 1-5 GHz
- 1-6 GHz
- 1-12 GHz

Highest internal frequency of specimen:

- Below 108MHz
- Between 108MHz and 500MHz
- Between 500MHz and 1000MHz
- 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

Instruments used during measurement

Instrument list: Antenna Horn: ETS / 3117 (LR-1717) (12/2022)
 EMI Receiver: R&S / ESU40 (LR-1639) (01/2023)
 Preamplifier: ETS / 3117-PA (LR-1757) (08/2022)

Conformity

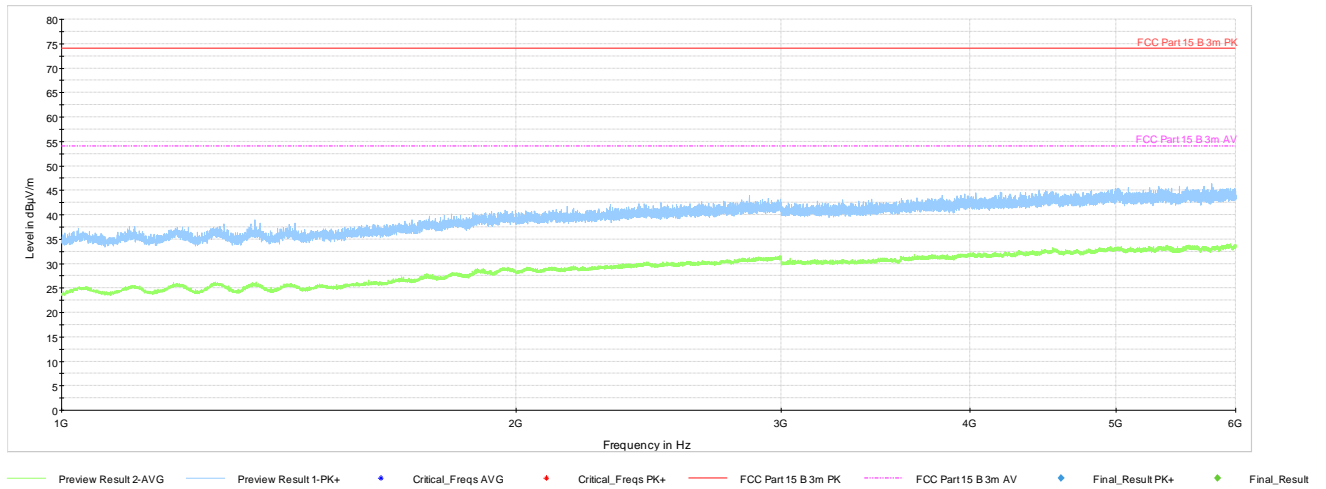
Verdict:

PASS

Test engineer:

Jan G Eriksen

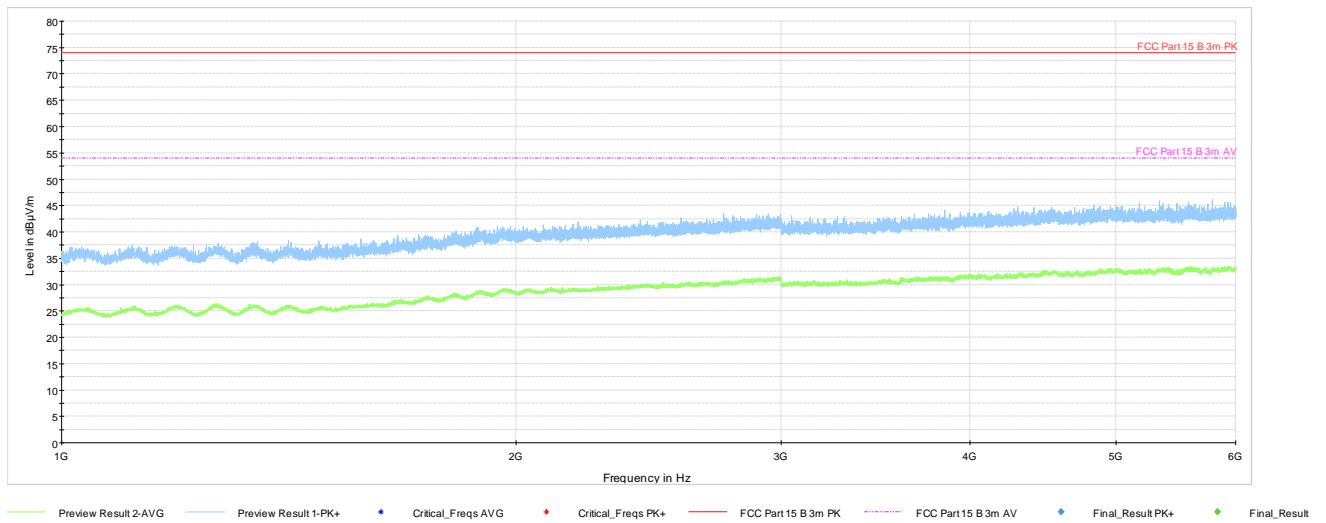
EMISSION SPECTRUM (HORIZONTAL POLARIZATION)



MEASUREMENTS DATA

No data measured

EMISSION SPECTRUM (VERTICAL POLARIZATION)



MEASUREMENTS DATA

No data measured