

Test Report

Report Number:

F210996E1

Equipment under Test (EUT):

SmartLink

Applicant:

medic assist GmbH & Co. KG

Manufacturer:

medic assist GmbH & Co. KG



Deutsche
Akkreditierungsstelle
D-PL-17186-01-01
D-PL-17186-01-02
D-PL-17186-01-03

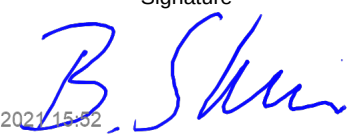
References

- [1] **ANSI C63.4:2014** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- [2] **FCC 47 CFR Part 2:** General Rules and Regulations
- [3] **FCC 47 CFR Part 15:** Radio Frequency Devices (Subpart B)
- [4] **ICES-003 Issue 7: (October 2020)** Spectrum Management and Telecommunications. Interference-Causing Equipment Standard. Information Technology Equipment (Including Digital Apparatus) —Limits and Methods of Measurement

Test Result

The requirements of the tests performed as shown in the overview (clause 4) were fulfilled by the equipment under test. The complete test results are presented in the following.

“Passed” indicates that the equipment under test conforms with the relevant limits of the testing standard without taking any measurement uncertainty into account. However, the measurement uncertainty is calculated and shown in this test report.

Tested by:	Mohamed Yassine KHALEK	 12.08.2021 12:55	12.08.2021
	Name	Signature	Date
Reviewed and approved by:	Bernd STEINER	 12.08.2021 15:32	12.08.2021
	Name	Signature	Date

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The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalisations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT NUMBER.

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1 Identification

1.1 Applicant

Name:	medic assist GmbH & Co.KG
Address:	Friederikastraße 148, 44789 Bochum
Country:	Germany
Name for contact purposes:	Ulrich Möller
Phone:	+49 234 33367-170
eMail address:	ulrich.moeller@medicassist.de
Applicant represented during the test by the following person:	None

1.2 Manufacturer

Name:	medic assist GmbH & Co.KG
Address:	Friederikastraße 148, 44789 Bochum
Country:	Germany
Name for contact purposes:	Ulrich Möller
Phone:	+49 234 33367-170
eMail address:	ulrich.moeller@medicassist.de
Manufacturer represented during the test by the following person:	None

1.3 Test Laboratory

The tests were carried out by: **PHOENIX TESTLAB GmbH**
Königswinkel 10
32825 Blomberg
Germany

Accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) in compliance with DIN EN ISO/IEC 17025 under Reg. No. D-PL-17186-01-06 and D-PL-17186-01-05, FCC Test Firm Designation Number DE0004, FCC Test Firm Registration Number 469623, CAB Identifier DE0003 and ISD# 3469A.

1.4 EUT (Equipment under Test)

Type of equipment: *	AED remote monitoring system
Order number: *	SmartLink
Serial number:*	EUT 1: 21225054700000004 EUT 2: 21296065420000001
FCC ID: *	2A2C5-SL-MA-1550-5X
PCB identifier: *	rev. 8
Hardware version: *	8
Software version: *	atom21070701

* Declared by the applicant

2 EUTs were used for the tests. EUT 1 was used for the frequency range 30 MHz - 1GHz and EUT 2 was used for the frequency range 1 – 10 GHz.

Note: PHOENIX TESTLAB GmbH does not take samples. The samples used for tests are provided exclusively by the applicant.

1.5 Technical Data of Equipment

General			
Power supply EUT: *	LiMnO ₂ battery, customer specific		
Supply voltage EUT: *	U _{nom} = 3.0 V _{DC}	U _{min} = 2.0 V _{DC}	U _{max} = 3.3 V _{DC}
Temperature range: *	Operating 0°C - 50°C, Storage -20°C - 60°C		
Lowest / highest internal clock frequency: *	32.768 kHz / 12 MHz / 1979.9 MHz		

Cellular module						
Manufacturer:	Quectel					
Model name: *	BG95-M3					
FCC ID of module:	XMR201910BG95M3					
IC of module:	10224A-2019BG95M3					
Power supply module: *	DC via DC/DC converter					
Supply voltage module: *	U _{nom} =	4.0 V _{DC}	U _{min} =	3.8 V _{DC}	U _{max} =	4.2 V _{DC}
Serial Number: *	N/A					
IMEI: *	EUT 1: 867730055132066 EUT 2: 867730055131282					
Supported bands: * / **	1/2/3/4/5/8/12/13/18/19/20/25/26/27/28/66/71/85					
Max. output power: *	Power Class 5, 21dBm @ LTE Bands					
Antenna type: *	Chip antenna					
Antenna name: *	SYNZEN SZP-C-1L13					
Antenna connector: *	None.					
Antenna gain: *	Peak Gain: 0.36 dBi @ 698-960 MHz, 3.18 dBi @ 1710-2200 MHz Average Gain: -5 dBi					

*: Declared by the applicant.

Ports / Connectors				
Identification	Connector		Length during test	Shielding (Yes / No)
	EUT	Ancillary		
Optional 2 nd sensor interface	RJ45	-	Not used	-
-	-	-	-	-

Equipment necessary for testing	
None	-

1.6 Dates

Date of receipt of test sample:	02.07.2021
Start of test:	12.07.2021
End of test:	03.08.2021

2 Operational States

General function of the EUT:

Since the EUT (SmartLink) necessarily is in deep sleep mode most of the time in order to assure a battery lifetime of typically 5 years, the manufacturer established a special test mode for the EMC measurements. The typical usage scenario is a 24 h wakeup procedure triggered by the AED to be monitored. The AED tests itself once a day and afterwards (wireless) wakes up the DUT in order to transfer its self-test result. The DUT then starts additionally measurements related to AED and environment. Depending on the urgency of the results, the DUT transfers the result and internal logs immediately or later via a cellular network connection to the (SmartConnect) backend server. After the data transfer (few kB) is completed the DUT enters the deep sleep mode again.

Function of the EUT during the measurements:

The above-described process lasts only a few seconds, so it is not suitable to perform any EMC measurement using this scenario. Therefore, the implemented EMC test mode assures the permanent operation of the EUT without entering the sleep mode. Being in EMC test mode the DUT continuously performs environmental and AED checks.

The EUT was supplied by 3.0 V_{DC} by its battery during all tests.

3 Additional Information

The EUT was not labeled as required by FCC / IC.

4 Overview

Conducted emissions FCC 47 CFR Part 15 section 15.107 (a),(b) [3] ICES-003 Issue 7 section 3.2.1[4]					
Application	Frequency range	Limits	Reference standard	Tested EUT	Status
AC supply line Class A	0.15 to 0.5 MHz 0.5 to 30 MHz	79 dB(μV) QP 66 dB(μV) AV 73 dB(μV) QP 60 dB(μV) AV	ANSI C63.4	-	Not applicable
AC supply line Class B	0.15 to 0.5 MHz 0.5 to 5 MHz 5 to 30 MHz	66 to 56 dB(μV) QP* 56 to 46 dB(μV) AV* 56 dB(μV) QP 46 dB(μV) AV 60 dB(μV) QP 50 dB(μV) AV	ANSI C63.4	-	Not applicable
*: Decreases with the logarithm of the frequency					

Radiated emissions FCC 47 CFR Part 15 section 15.109 (a),(b) [3]					
Application	Frequency range	Limits	Reference standard	Tested EUT	Status
Radiated Emission Class A	30 to 88 MHz 88 to 216 MHz 216 to 960 MHz 960 to 1000 MHz above 1000 MHz	39.0 dB(μV/m) QP at 10 m 43.5 dB(μV/m) QP at 10 m 46.5 dB(μV/m) QP at 10 m 49.5 dB(μV/m) QP at 10 m 49.5 dB(μV/m) AV at 10 m and 69.5 dB(μV/m) PK at 10 m	ANSI C63.4	-	-
Radiated Emission Class B	30 to 88 MHz 88 to 216 MHz 216 to 960 MHz 960 to 1000 MHz above 1000 MHz	40.0 dB(μV/m) QP at 3 m 43.5 dB(μV/m) QP at 3 m 46.0 dB(μV/m) QP at 3 m 54.0 dB(μV/m) QP at 3 m 54.0 dB(μV/m) AV at 3 m and 74.0 dB(μV/m) PK at 3 m	ANSI C63.4	1 2	Passed

Radiated emissions ICES-003 Issue 7 section 3.2.2 [4]					
Application	Frequency range	Limits	Reference standard	Tested EUT	Status
Radiated Emission Class A	30 to 88 MHz 88 to 216 MHz 216 to 230 MHz 230 to 960 MHz 960 to 1000 MHz above 1000 MHz	40.0 dB(μV/m) QP at 10 m 43.5 dB(μV/m) QP at 10 m 46.4 dB(μV/m) QP at 10 m 47.0 dB(μV/m) QP at 10 m 49.5 dB(μV/m) QP at 10 m No limit available for 10 m	ANSI C63.4	-	-
Radiated Emission Class A	30 to 88 MHz 88 to 216 MHz 216 to 230 MHz 230 to 960 MHz 960 to 1000 MHz above 1000 MHz	50.0 dB(μV/m) QP at 3 m 54.0 dB(μV/m) QP at 3 m 56.9 dB(μV/m) QP at 3 m 57.0 dB(μV/m) QP at 3 m 60.0 dB(μV/m) QP at 3 m 60 dB(μV/m) AV at 3 m and 80 dB(μV/m) PK at 3 m	ANSI C63.4	-	-
Radiated Emission Class B	30 to 88 MHz 88 to 216 MHz 216 to 230 MHz 230 to 960 MHz 960 to 1000 MHz above 1000 MHz	30.0 dB(μV/m) QP at 10 m 33.1 dB(μV/m) QP at 10 m 35.6 dB(μV/m) QP at 10 m 37.0 dB(μV/m) QP at 10 m 43.5 dB(μV/m) QP at 10 m No limit available for 10 m	ANSI C63.4	-	-
Radiated Emission Class B	30 to 88 MHz 88 to 216 MHz 216 to 230 MHz 230 to 960 MHz 960 to 1000 MHz above 1000 MHz	40.0 dB(μV/m) QP at 3 m 43.5 dB(μV/m) QP at 3 m 46.0 dB(μV/m) QP at 3 m 47.0 dB(μV/m) QP at 3 m 54.0 dB(μV/m) QP at 3 m 54 dB(μV/m) AV at 3 m and 74 dB(μV/m) PK at 3 m	ANSI C63.4	1 2	Passed

Remark: As declared by the applicant the highest internal clock frequency is 1979.9 MHz.
The radiated emission measurement must be carried out up to 5th of the highest internal clock frequency in this case 10 GHz.

The EUT was classified by the applicant as CLASS B equipment.

5 Results

5.1 Radiated emissions

5.1.1 Test method

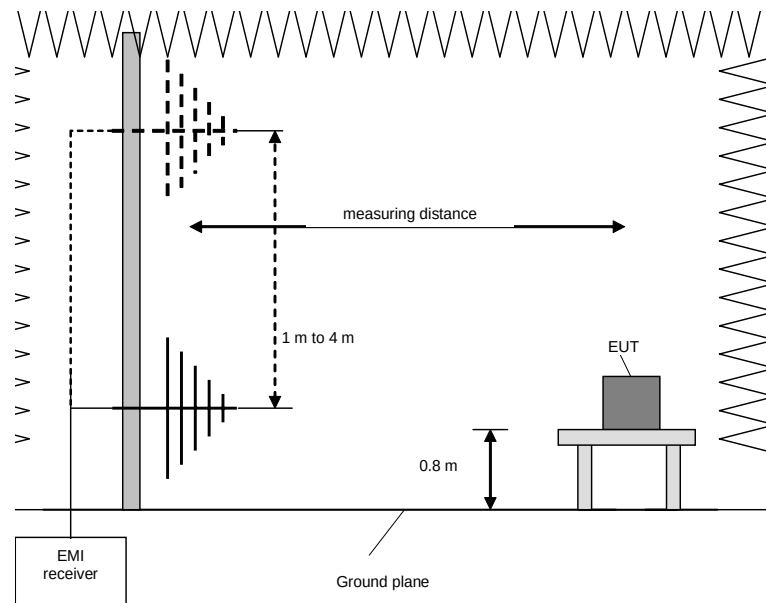
Preliminary and final measurement 30 MHz to 1 GHz

The preliminary and final measurements are performed in a semi-anechoic chamber with a metal ground plane in a 3 m distance.

During the tests the EUT is rotated in the range of 0 ° to 360 °, the measuring antenna is set to horizontal and vertical polarization and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

The resolution bandwidth of the EMI Receiver is set to the following values:

Test	Frequency range	Resolution bandwidth
Preliminary measurement	30 MHz to 1 GHz	100 kHz
Frequency peak search	+ / - 1 MHz	10 kHz
Final measurement	30 MHz to 1 GHz	120 kHz



Procedure preliminary measurement:

The following procedure is used:

- 1) Set the measuring antenna to 1 m height.
- 2) Monitor the frequency range at horizontal polarisation of the measuring antenna and an EUT / turntable azimuth of 0 °.
- 3) Rotate the EUT by 360° to maximize the detected signals.
- 4) Repeat steps 2 to 3 with the vertical polarisation of the measuring antenna.
- 5) Increase the height of the measuring antenna for 0.5 m and repeat steps 2 to 4 until the final height of 4 m is reached.
- 6) The highest values for each frequency are saved by the software, including the measuring antenna height and polarization and the turntable azimuth for that value.

Procedure final measurement:

The following procedure is used:

- 1) Select the highest frequency peaks (lowest margin to the limit) for the final measurement.
- 2) The software determines the exact peak frequencies by doing a partial scan with reduced RBW with +/- 10 times the RBW of the pre-scan of the selected peaks.
- 3) If the EUT is portable or ceiling mounted, find the worst-case EUT orientation (x,y,z) for the final test.
- 4) The worst-case measuring antenna height is found via varying the height by +/- 0.5 m from the value obtained in the preliminary measurement while monitoring the emission level.
- 5) The worst-case turntable position is found via varying the turntable azimuth by +/- 30° from the value obtained in the preliminary measurement while monitoring the emission level.
- 6) The final measurement is performed at the worst-case measuring antenna height and the worst-case turntable azimuth.
- 7) Steps 2 to 6 are repeated for each frequency peak selected in step 1.

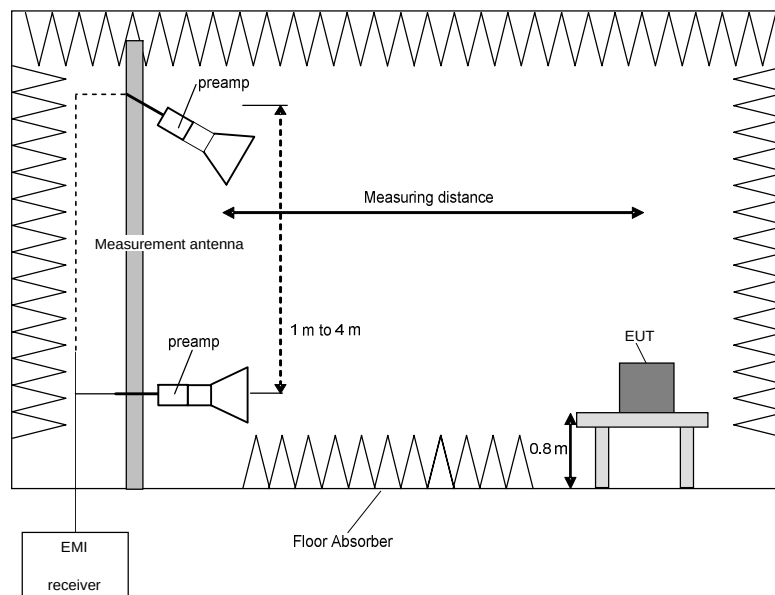
Preliminary and final measurement > 1 GHz

The preliminary and final measurements are performed in a semi-anechoic chamber with floor absorbers between EUT and measuring antenna. The measuring distance is 3 m.

During the tests the EUT is rotated in the range of 0 ° to 360 °, the measuring antenna is set to horizontal and vertical polarisation and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions. While changing the height, the measuring antenna gets tilted so that it is always aiming at the EUT.

The resolution bandwidth of the EMI Receiver is set to the following values:

Test	Frequency range	Resolution bandwidth
Preliminary measurement	1 - 40 GHz	1 MHz
Frequency peak search	+ / - 10 MHz	100 kHz
Final measurement	1 - 40 GHz	1 MHz



Procedure preliminary measurement:

The following procedure is used:

- 1) Set the measuring antenna to 1 m height.
- 2) Monitor the frequency range at horizontal polarisation of the measuring antenna and an EUT / turntable azimuth of 0 °.
- 3) Rotate the EUT by 360° to maximize the detected signals.
- 4) Repeat steps 2 to 3 with the vertical polarisation of the measuring antenna.
- 5) Increase the height of the measuring antenna for 0.5 m and repeat steps 2 to 4 until the final height of 4 m is reached.
- 6) The highest values for each frequency are saved by the software, including the measuring antenna height and polarization and the turntable azimuth for that value.

Procedure final measurement:

The following procedure is used:

- 1) Select the highest frequency peaks (lowest margin to the limit) for the final measurement.
- 2) The software determines the exact peak frequencies by doing a partial scan with reduced RBW with +/- 10 times the RBW of the pre-scan of the selected peaks.
- 3) If the EUT is portable or ceiling mounted, find the worst-case EUT orientation (x,y,z) for the final test.
- 4) The worst-case measuring antenna height is found via varying the height by +/- 0.5 m from the value obtained in the preliminary measurement while monitoring the emission level.
- 5) The worst-case turntable position is found via varying the turntable azimuth by +/- 30° from the value obtained in the preliminary measurement while monitoring the emission level.
- 6) The final measurement is performed at the worst-case measuring antenna height and the worst-case turntable azimuth.
- 7) Steps 2 to 6 are repeated for each frequency peak selected in step 1.

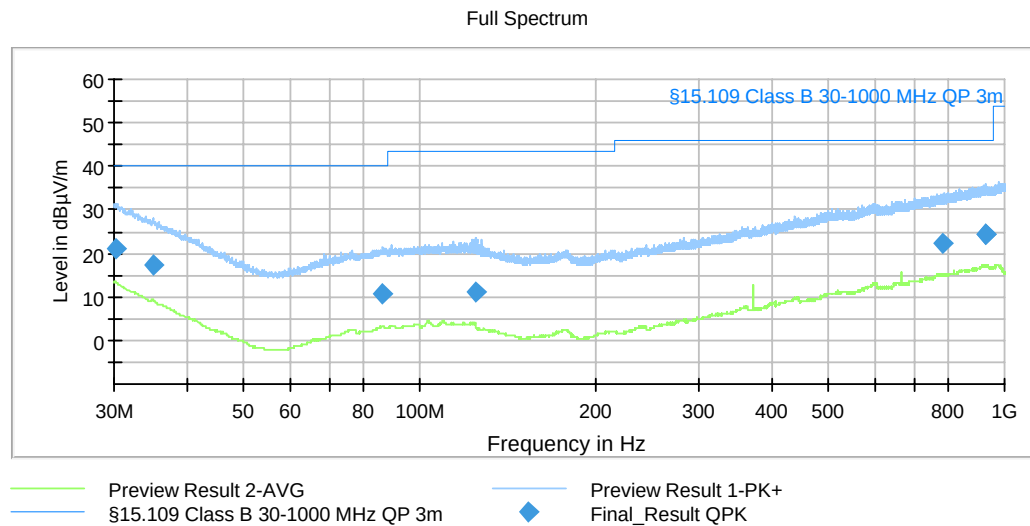
5.1.2 Test results final measurement 30 MHz to 1 GHz

Ambient temperature:	23 °C
Relative humidity:	60 %

Date:	16.07.2021
Tested by:	Y. KHALEK

Radiated emissions according to FCC 47 CFR Part 15 section 15.109 (a), (b) [3]

The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above-mentioned standard. The measured points marked with “◆” are the measured results of the standard subsequent measurement in a semi-anechoic chamber.



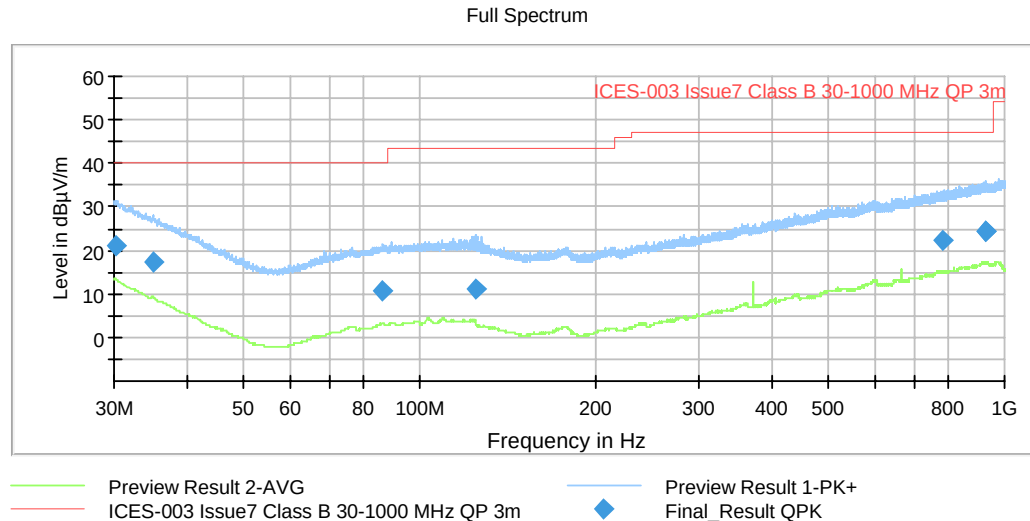
The results of the standard subsequent measurement in a semi-anechoic chamber are indicated in the table below. The limits as well as the measured results (levels) refer to the above-mentioned standard while taking account of the specified requirements for a 3 m measuring distance.

Frequency in MHz	QuasiPeak in dB(μV/m)	Limit in dB(μV/m)	Margin in dB	Meas. Time in ms	Bandwidth in kHz	Height in cm	Pol	Azimuth in deg	Corr. in dB
30.3	20.98	40.0	19.0	1000	120.0	247.0	V	66	25.8
34.93	17.30	40.0	22.7	1000	120.0	142.0	V	231	23.1
86.49	10.62	40.0	29.4	1000	120.0	384.0	H	191	17.0
124.33	11.08	43.5	32.4	1000	120.0	117.0	V	113	17.2
786.66	22.51	46.0	23.5	1000	120.0	346.0	H	115	28.7
928.15	24.52	46.0	21.5	1000	120.0	250.0	H	206	30.2
928.16	24.52	46.0	21.5	1000	120.0	210.0	H	203	30.2
Measurement uncertainty: ± 5.12 dB									

Test result: Passed

Radiated emissions according to ICES-003 Issue 7 section 3.2.2 [4]

The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above-mentioned standard. The measured points marked with “◆” are the measured results of the standard subsequent measurement in a semi-anechoic chamber.



The results of the standard subsequent measurement in a semi-anechoic chamber are indicated in the table below. The limits as well as the measured results (levels) refer to the above-mentioned standard while taking account of the specified requirements for a 3 m measuring distance.

Frequency in MHz	QuasiPeak in dB(μV/m)	Limit in dB(μV/m)	Margin in dB	Meas. Time in ms	Bandwidth in kHz	Height in cm	Pol	Azimuth in deg	Corr. in dB
30.3	20.98	40.0	19.0	1000	120.0	247.0	V	66	25.8
34.93	17.30	40.0	22.7	1000	120.0	142.0	V	231	23.1
86.49	10.62	40.0	29.4	1000	120.0	384.0	H	191	17.0
124.33	11.08	43.5	32.4	1000	120.0	117.0	V	113	17.2
786.66	22.51	47.0	24.5	1000	120.0	346.0	H	115	28.7
928.15	24.52	47.0	22.5	1000	120.0	250.0	H	206	30.2
928.16	24.52	47.0	22.5	1000	120.0	210.0	H	203	30.2
Measurement uncertainty: ± 5.12 dB									

Test result: Passed

The correction factor was calculated as follows:

Corr. (dB) = cable attenuation (dB) + 6 dB attenuator (dB) + antenna factor (dB)

Therefore, the reading can be calculated as follows:

Reading dB(μV/m) = result QuasiPeak dB(μV/m) - Corr. (dB)

Test equipment (please refer to chapter 6 for details)
1 - 9

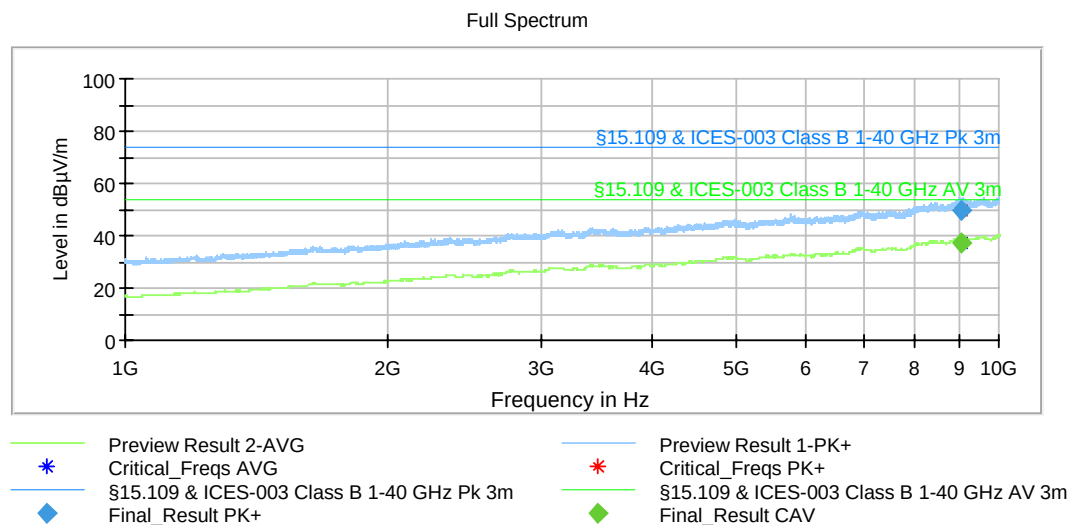
5.1.3 Test results final measurement above 1 GHz

Ambient temperature:	23 °C
Relative humidity:	47 %

Date:	03.08.2021
Tested by:	R. BRAUN

Radiated emissions according to FCC 47 CFR Part 15 section 15.109 (a), (b) [3] and ICES-003 Issue 7 section 3.2.2 [4]

The curves in the diagram only represent the maximum measured value for each frequency point of all preliminary measurements, which were carried out with various EUT and antenna positions. The top measured curve represents the peak measurement. The measured points marked with "◆" are frequency points for the final peak detector measurement. These values are indicated in the following table. The bottom measured curve represents the average measurement. The measured points marked with "◆" are frequency points for the final average detector measurement.



The results of the standard subsequent measurement above 1 GHz in a semi-anechoic chamber are indicated in the table below. The limits as well as the measured results (levels) refer to the above-mentioned standard while taking account of the specified requirements for a 3 m measuring distance.

Frequency in MHz	MaxPeak in dB(μV/m)	Average in dB(μV/m)	Limit in dB(μV/m)	Margin in dB	Meas. Time in ms	Bandwidth in kHz	Height in cm	Pol	Azimuth in deg	Corr. in dB
9060.400	---	37.36	54.0	16.6	100	1000.000	126.0	H	249	19.3
9061.100	49.33	---	74.0	24.7	100	1000.000	100.0	H	229	19.3
Measurement uncertainty ± 5.14 dB										

Test result: Passed

The correction factor was calculated as follows:

Corr. (dB) = cable attenuation (dB) + preamplifier (dB) + antenna factor (dB)

Therefore, the reading can be calculated as follows:

Reading (dBμV/m) = result Peak or Average (dBμV/m) - Corr. (dB)

Test equipment (please refer to chapter 6 for details)

3 - 11

6 Test Equipment used for Tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal Due
1	Attenuator 6 dB	WA2-6	Weinschel	8254	410119	Calibration not necessary	
2	Ultralog Antenna	HL562E	Rohde & Schwarz	101079	482978	18.03.2021	03.2024
3	Software EMC32 M276	EMC32	Rohde & Schwarz	100970	482972	Calibration not necessary	
4	RF Switch Matrix	OSP220	Rohde & Schwarz		482976	Calibration not necessary	
5	Turntable	TT3.0-3t	Maturo	825/2612/.01	483224	Calibration not necessary	
6	Antennasupport	BAM 4.5-P-10kg	Maturo	222/2612.01	483225	Calibration not necessary	
7	Controller	NCD	Maturo	474/2612.01	483226	Calibration not necessary	
8	Semi Anechoic Chamber M276	SAC5-2	Albatross Projects	C62128-A540-A138-10-0006	483227	Calibration not necessary	
9	EMI Testreceiver	ESW44	Rohde & Schwarz	101828	482979	14.11.2019	11.2021
10	Log.-Per. antenna	HL050	Rohde & Schwarz	100908	482977	13.08.2019	08.2022
11	Low Noise Amplifier 100 MHz - 18 GHz	LNA-30-00101800-25-10P	Narda-Miteq	2110917	482967	18.02.2020	02.2022

7 Test site Validation

Test equipment	PM. No.	Frequency range	Type of validation	According to	Val. Date	Val Due
Semi anechoic chamber M276	483227	30 – 1000 MHz	NSA/RSM	CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017	03.03.2021	02.03.2023
Semi anechoic chamber M276	483227	1 -18 GHz	SVSWR	CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017	25.02.2021	24.02.2023

8 Report History

Report Number	Date	Comment
F210996E1	12.08.2021	Initial Test Report
-	-	-
-	-	-

9 List of Annexes

Annex A	Test Setup Photos	2 pages
Annex B	EUT External Photos	4 pages
Annex C	EUT Internal Photos	4 pages