EMC TEST REPORT

FCC Title 47 CFR Part 18

Report Reference No	G0M-2112-1231-EF01ISM-V01
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	DAkkS - Registration number : D-PL-12092-01-04 FCC Filed Test Laboratory, Reg.-No.: 96970
Applicant	eResearchTechnology GmbH
Address	Sieboldstrasse 3 97230 Estenfeld Germany
Test Specification Standard(s)	Title 47 CFR Part 18 FCC MP-5:1986
Non-Standard Test Method	None
Equipment under Test (EUT):	
Product Description	Spirometer System
Model(s)	SpiroSphere
Additional Model(s)	None
Brand Name(s)	None
Hardware Version(s)	N7 (12.07.06)
Software Version(s)	SpiroSpherePackage V4.6.5 Jet_Lib + TestAPP 1.0.0
FCC-ID	2AAUFSPS003
IC	11335A-SPS003
Contains FCC-ID	2AAUFSPS003
Contains IC	11335A-SPS003
Test Result	**PASSED**

Possible test case verdicts:		
required by standard but not tested	N/T	
not required by standard	N/R	
required by standard but not appl. to test object	N/A	
test object does meet the requirement	P(PASS)	
test object does not meet the requirement	F(FAIL)	
Testing:		
Date of receipt of test item	2022-02-03	
Report:		
Compiled by	Stephan Liebich	
Tested by (+ signature) (Responsible for Test)	Stephan Liebich	.....
Approved by (+ signature) (Test Lab Technician)	Andreas Pflug	.....
Date of Issue	2022-05-12	
Total number of pages	36	
General Remarks:		
The test results presented in this report relate only to the object tested. **The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.** This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.		
Additional Comments:		
Without 2G/3G module tested		

ABBREVIATIONS AND ACRONYMS

Acronyms	
Acronym	Description
EUT	Equipment Under Test
FCC	Federal Communications Commission
T_{NOM}	Nominal operating temperature
V_{NOM}	Nominal supply voltage

VERSION HISTORY

Version History			
Version	Issue Date	Remarks	Revised By
01	2022-05-12	Initial Release	--

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1 Equipment (Test Item) Under Test

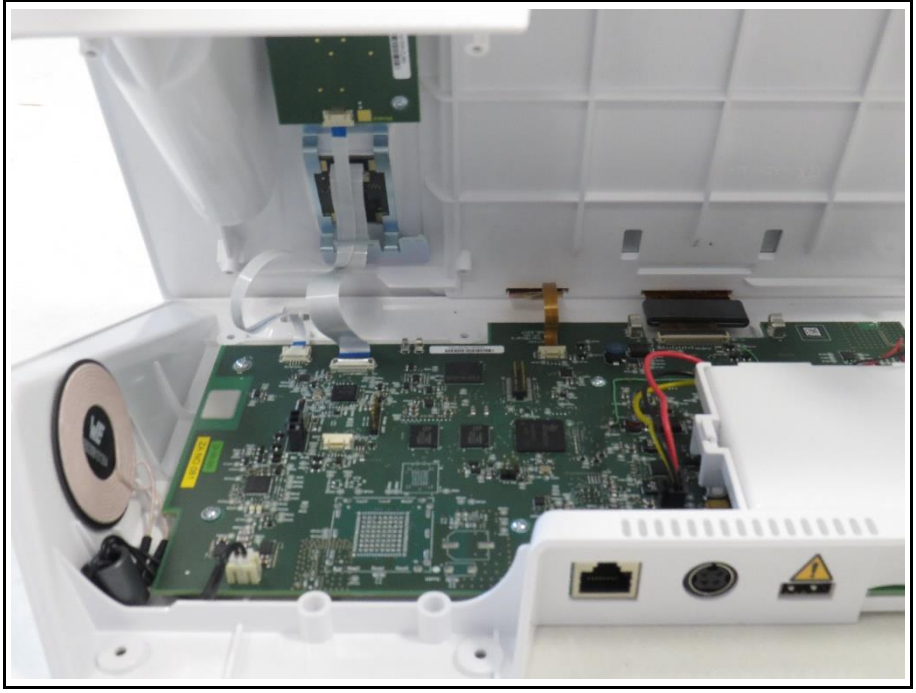
Description	Spirometer System (The SpiroSphere is a compact device to measure inspiratory and expiratory lung function parameters in adults and children aged 4 years and older.)	
Model	SpiroSphere	
Additional Model(s)	None	
Brand Name(s)	None	
Serial Number(s)	10010004	
Sample-ID	38263	
Hardware Version(s)	N7 (12.07.06)	
Software Version(s)	SpiroSpherePackage V4.6.5 Jet_Lib + TestAPP 1.0.0	
EUT Dimensions [cm]	33 x 20 x 18	
FCC-ID	2AAUFSPS003	
Contains FCC-ID	11335A-SPS003	
Equipment Kind	Miscellaneous	
Equipment type	Table top	
RF power [W]	25	
Highest internal frequency [MHz]	0.112 to 0.3 (wireless power transmission frequency) 2470 (radio frequency) 20 to 71 (clock frequency display) 52 (eMMC bus clock) 25 (ETH PH)	
Radio Module 1	Type	Bluetooth Basic Rate / Bluetooth Low Energy / IEEE 802.11 b/g/n
	Model	WL18 MODGB
	Manufacturer	Texas Instruments
	FCC-ID	Z64-WL18SBMOD
	IC	451I-WL18SBMOD
Radio Module 2	Type	Wireless Power Transmission System
	Model	unspecified
	Manufacturer	unspecified
	FCC-ID	--
	IC	--
Supply Voltage	V_{NOM}	120 V AC / 60 Hz via dedicated AC/DC-adapter 3.7 V DC by internal rechargeable lithium ion battery
AC/DC-Adaptor	Model	GTM91099-3009-4.0-T2
	Vendor	GlobTek, Inc.
	Input	100 to 240 V AC 50/60 Hz
	Output	5 V DC
Manufacturer	eResearchTechnology GmbH Sieboldstrasse 3 97230 Estenfeld Germany	

1.1 Equipment Ports

Name	Type	Attributes		Comment
AC Mains	AC	Count: Cable length [m]: Direction: Service only: Shielded:	1 > 3 In No No	Port of dedicated AC/DC-adapter
USB 2.0	IO	Count: Cable length [m]: Direction: Service only: Shielded:	2 < 3 IO No Yes	--
Ethernet	IO	Count: Cable length [m]: Direction: Service only: Shielded:	1 < 30 IO No Yes	Shield on both sides connected to ground; CAT 5e
USB	IO	Count: Cable length [m]: Direction: Service only: Shielded:	1 < 3 IO Yes Yes	USB 2.0

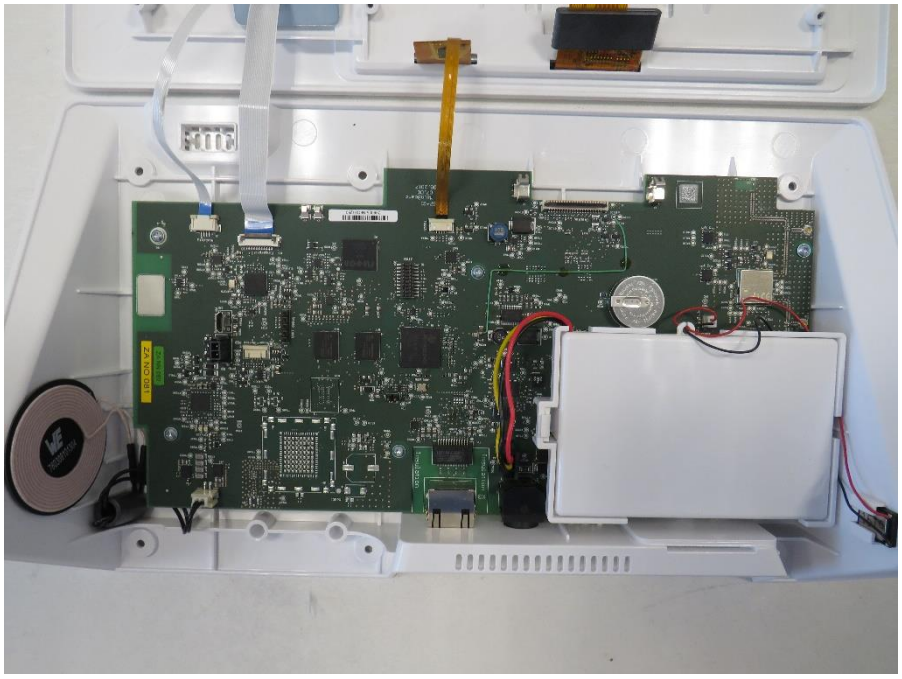
Description:	
AC	AC mains power input/output port
DC	DC power input/output port
BAT	DC power input port connected to external battery
IO	Input/Output port
TP	Telecommunication port
NE	Non-electrical port

1.2 Equipment Photos - Internal

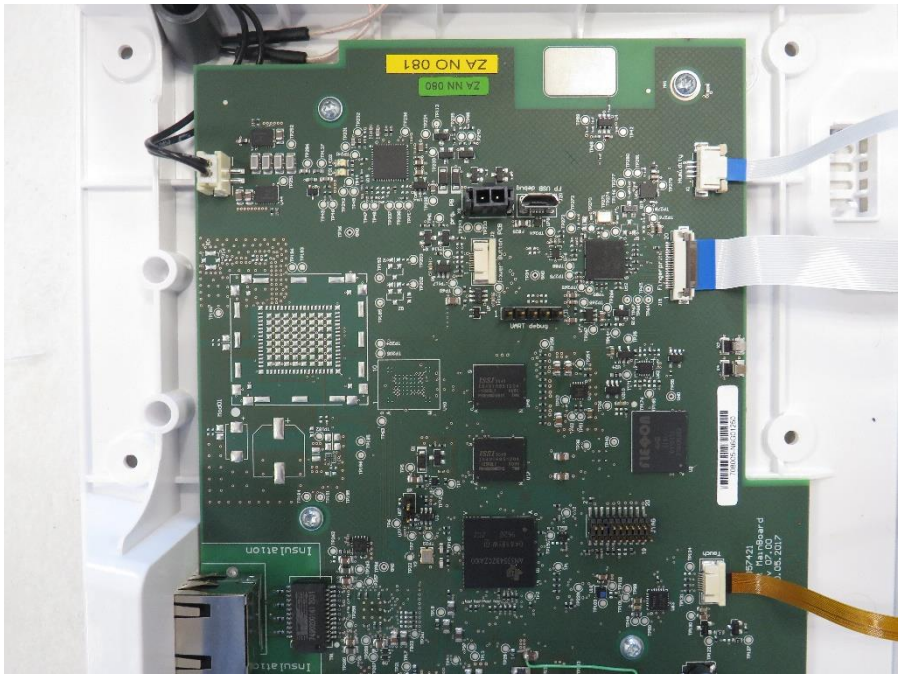
EUT WITH OPEN COVER FOCUS


EUT WITH OPEN COVER

EUT PCB MAINBOARD



EUT PCB MAINBOARD FOCUS 1



EUT PCB MAINBOARD FOCUS 2

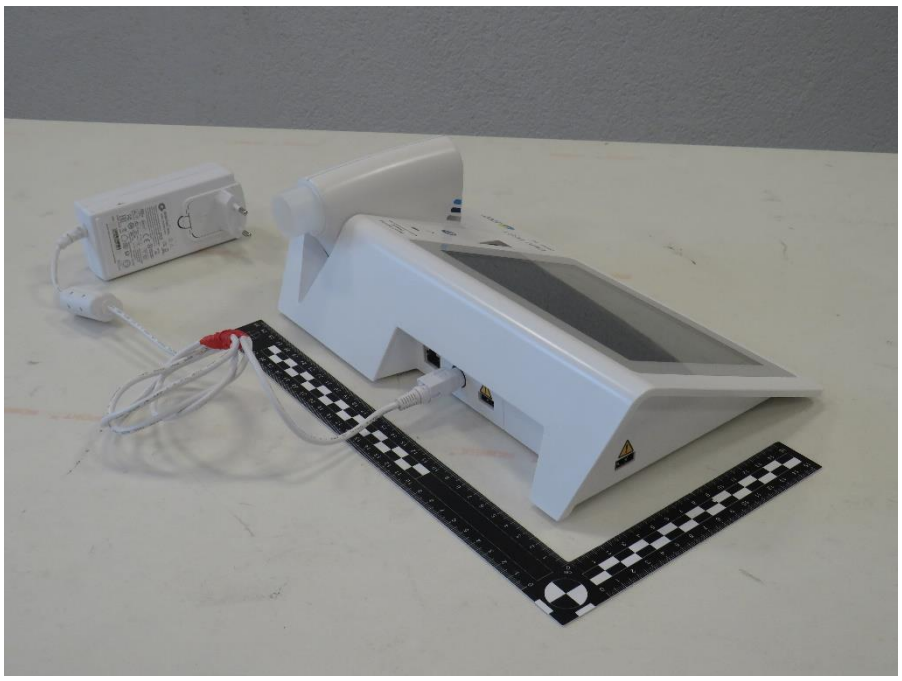
EUT PCB FINGERPRINT SWITCH

1.3 Equipment Photos - External

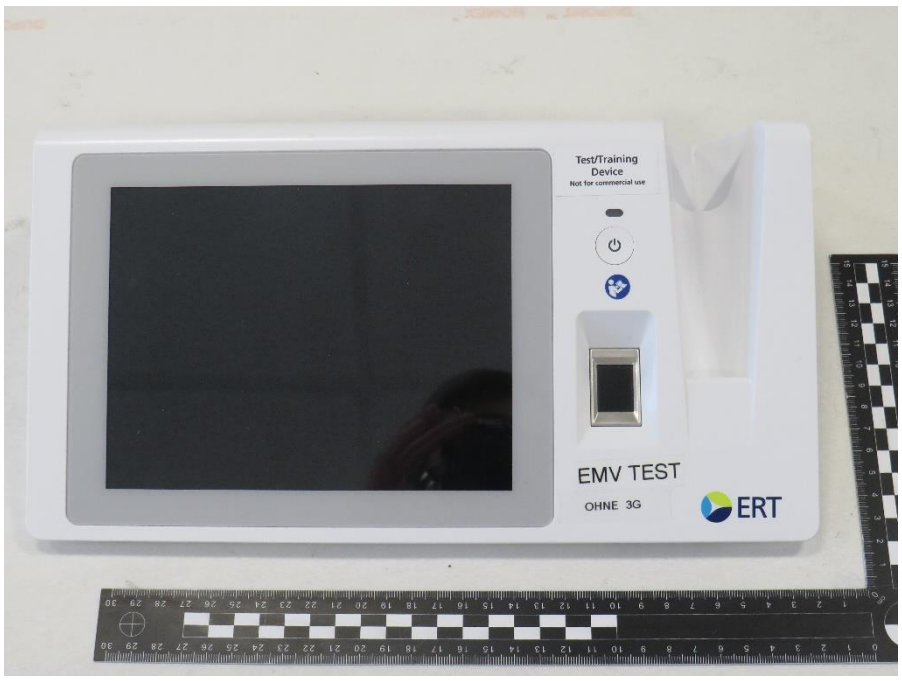
EUT TEST SETUP

EUT IN PERSPECTIVE I

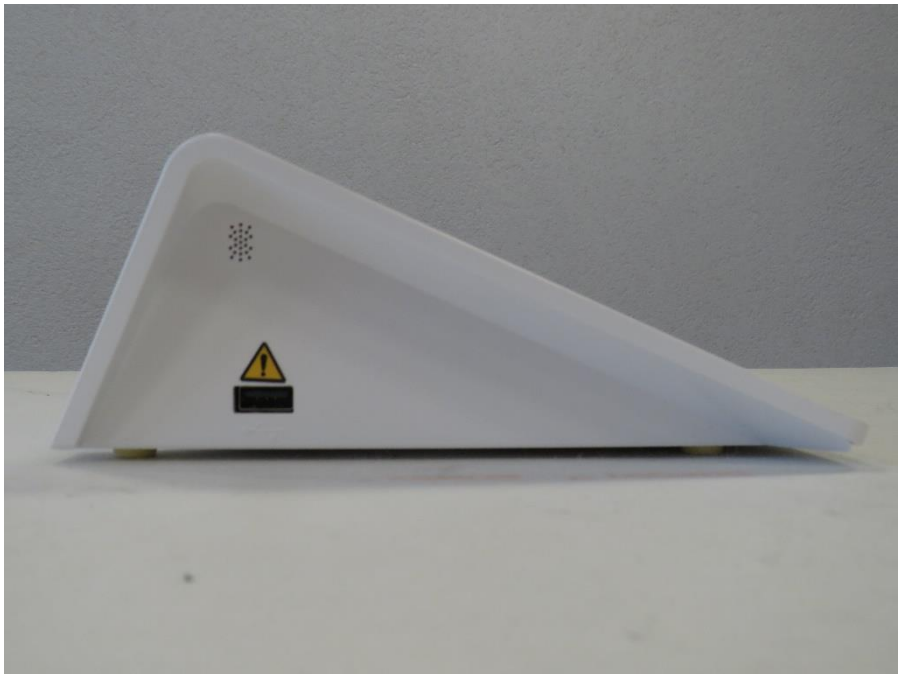
EUT IN PERSPECTIVE II



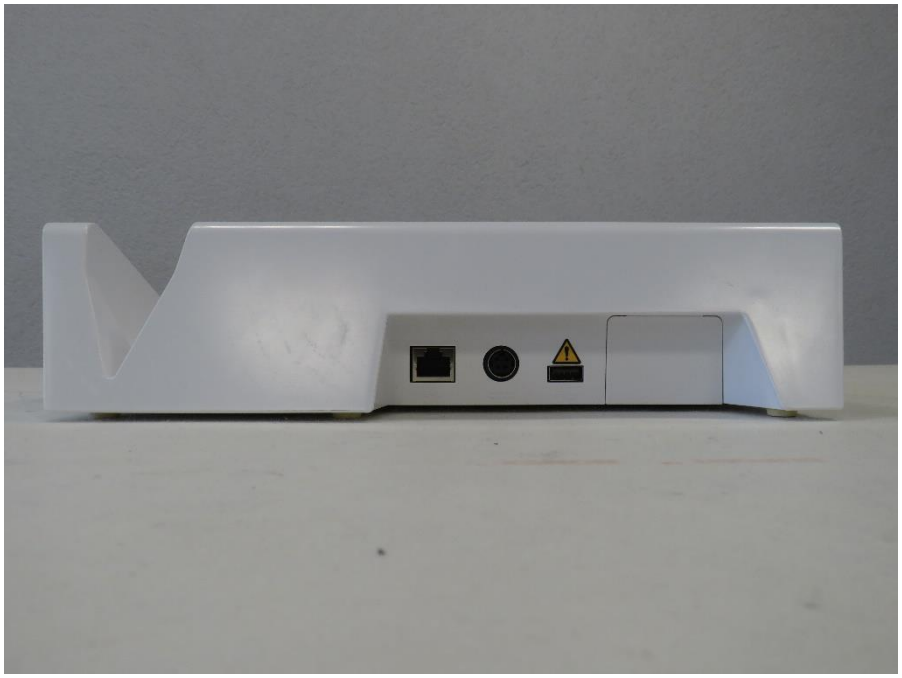
EUT FRONT SIDE



EUT LEFT SIDE

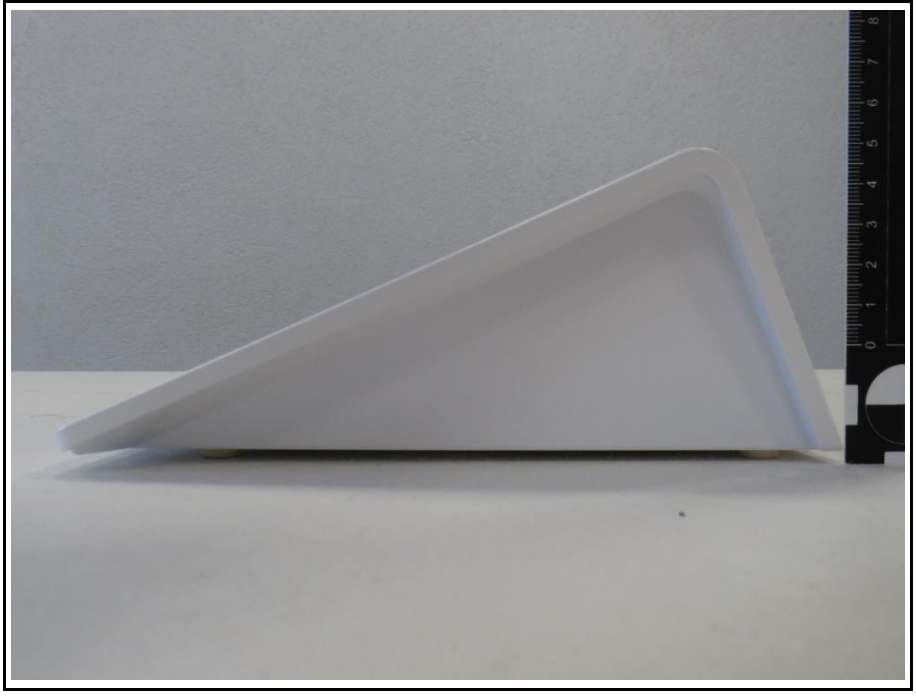


EUT REAR SIDE



EUT CONNECTORS REAR

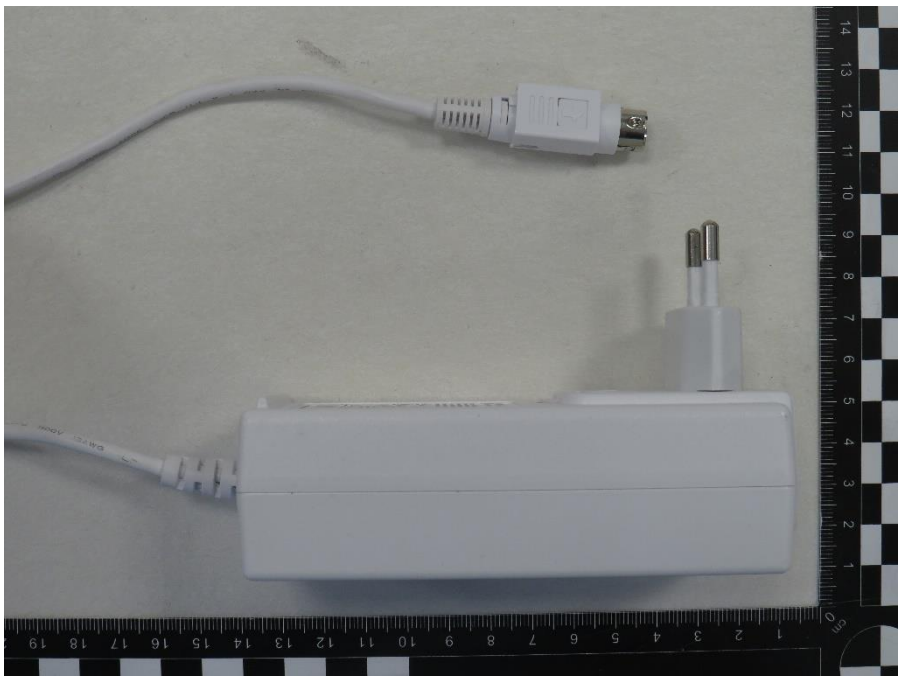
EUT RIGHT SIDE



EUT BOTTOM SIDE

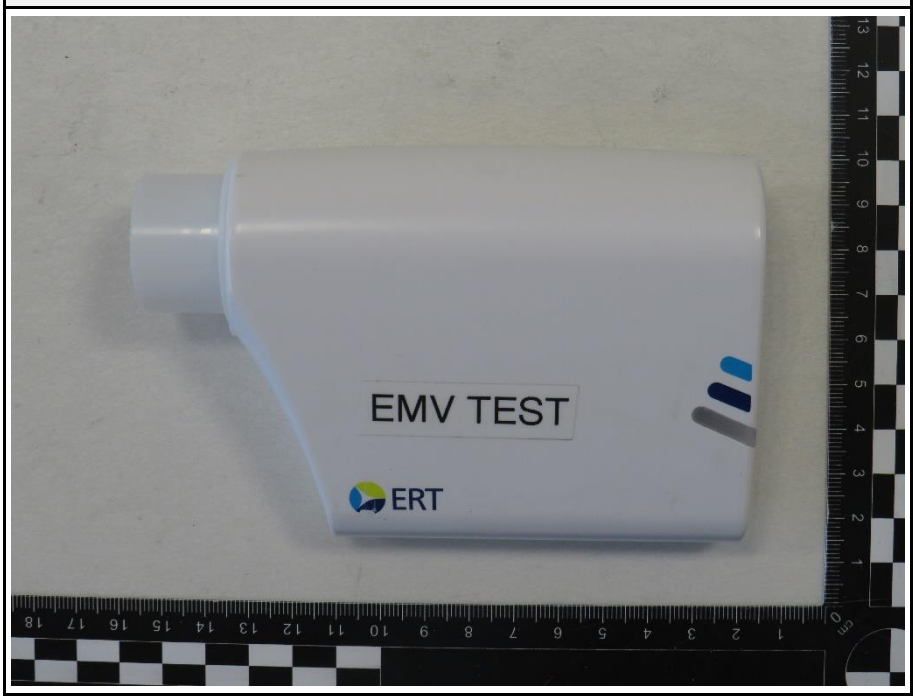
EUT LABEL

AC/DC-ADAPTER

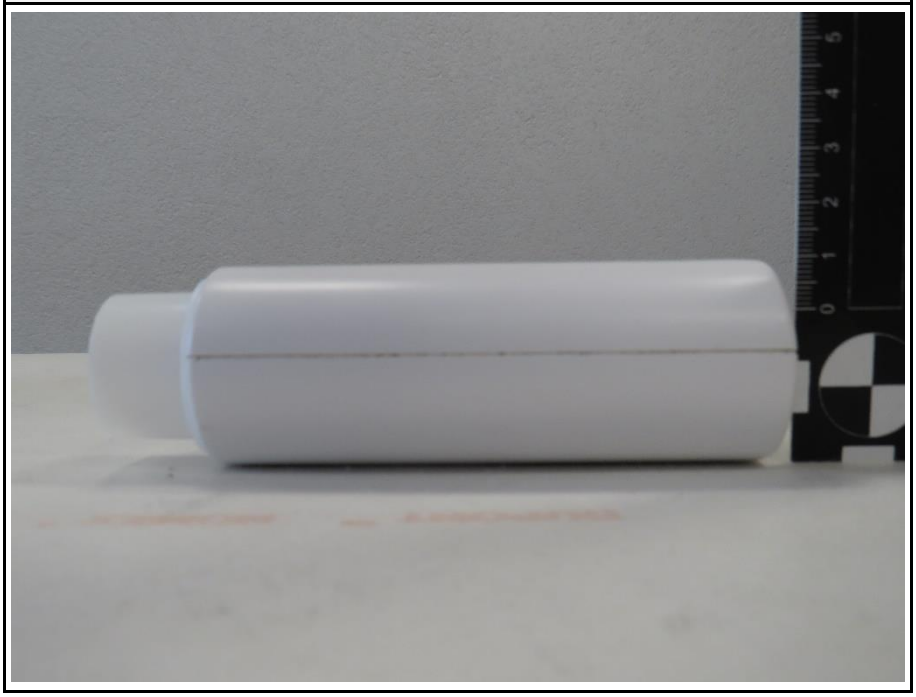


AC/DC-ADAPTER LABEL

SPIROSPHERE SENSOR RIGHT SIDE



SPIROSPHERE SENSOR TOP SIDE

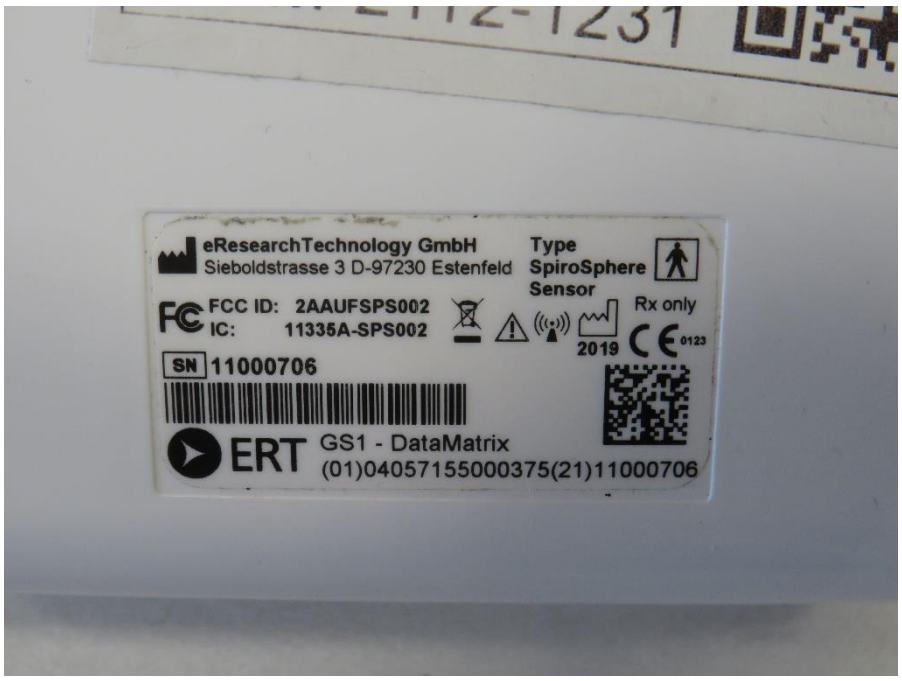


SPIROSPHERE SENSOR BOTTOM SIDE

SPIROSPHERE SENSOR FRONT SIDE

SPIROSPHERE SENSOR REAR SIDE

SPIROSPHERE SENSOR LEFT SIDE

SPIROSPHERE SENSOR LABEL


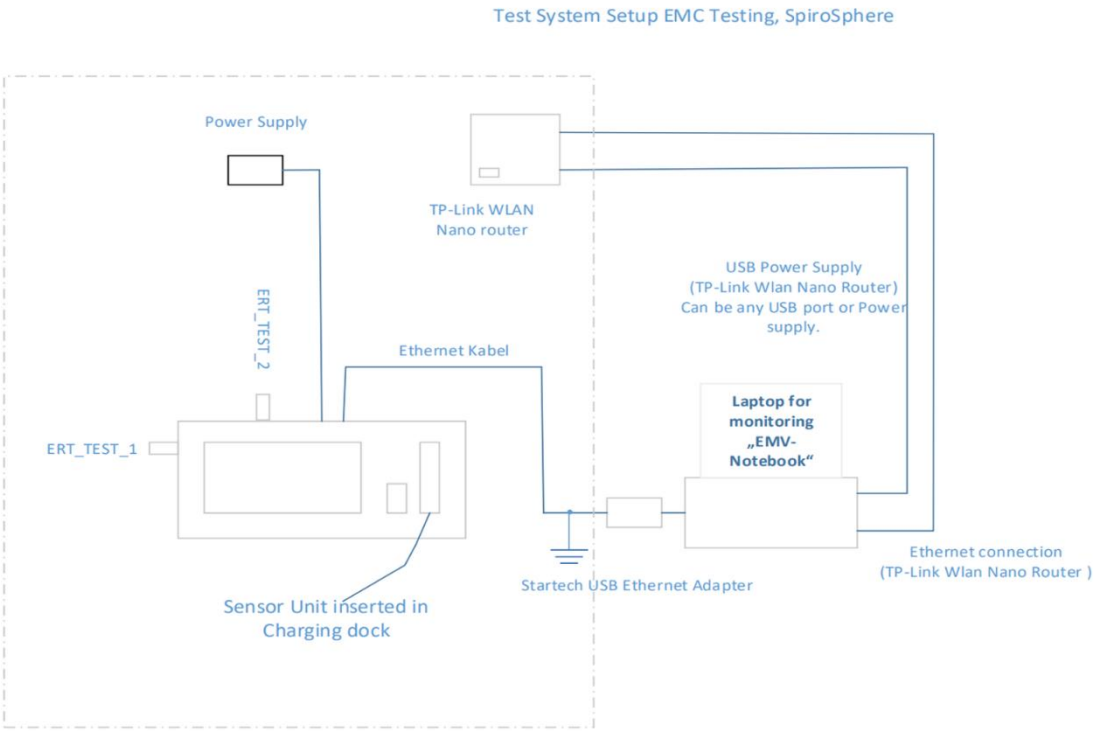
1.4 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
SIM/AE	Sensor Unit	ERT	SpiroSphere Sensor	Customer Support Equipment; Companion Device for Bluetooth connection and Wireless Power Transmission
MON	Laptop	Fujitsu	LIFEBOOK E Series	Customer Support Equipment
SIM	Software	Hammer Software	MetaPing 1.7.2.34	Customer Support Equipment; for WLAN and LAN traffic
SIM	USB-Stick	Silicon-Power	UFD 3.0 Silicon-Power8G USB Device	2x for data traffic via USB
AE	WLAN Router	tp-link	TL-WR802N(EU)	Customer Support Equipment
AE	USB/Ethernet-adapter	StarTech.com	USB31000SW	Customer Support Equipment
CBL	LAN-cable	Datwyler Uninet	652011	Customer Support Equipment; CAT.5e
CBL	USB-cable	AWM	E74020-C	USB 2.0
Description:				
AE	Auxiliary Equipment			
SIM	Simulator			
MON	Monitoring Equipment			
CBL	Connecting Cable			
Comment: --				

1.5 Operational Modes

Mode #	Description
1	Charging mode Continuous battery charging of Sensor Unit. Traffic on all ports (Ping (MetaPing-SW) via LAN connection + read and write date via USB connection). WLAN 2.4 GHz is activated and sends windows ping to WLAN Router. Internal battery of EUT is charging.
Comment: --	

1.6 EUT Configuration

Configuration #	Description
1	EUT is powered via dedicated AC/DC-adapter. AC/DC-adapter is powered by external laboratory power supply unit. Sensor Unit is inserted into the EUT. All ports are connected to the corresponding support equipment (see block diagram). Both sides of the Ethernet cable shield are connected to ground. Block diagram: 
Comment: --	

1.7 Sample emission level calculation

The following is a description of terms and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyser in dBµV. Any external preamplifiers used are taken into account through internal analyser settings.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strengths to voltages, which can be measured directly on the spectrum analyser. It is treated as a loss in dB. Cable losses have been included with the A.F. to simplify the calculations. The antenna factor is used in calculations as follows:

Reading on Analyser (dBµV) + A.F. (dB/m) = Net field strength (dBµV/m)

Net:

This is the net field strength measurement (as shown above).

Limit:

This is the FCC Class B radiated emission limit (in units of dBµV/m). The FCC limits are given in units of µV/m. The following formula is used to convert the units of µV/m to dBµV/m:

Limit (dBµV/m) = 20*log (µV/m)

Margin:

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:

Reading + AF	= Net Reading	:	Net reading - FCC limit	= Margin
+21.5 dBµV + 26 dB/m	= 47.5 dBµV/m	:	47.5 dBµV/m - 57.0 dBµV/m	= -9.5 dB

2 Result Summary

FCC 47 CFR Part 18				
Reference	**Requirement**	**Reference Method**	**Result**	**Remarks**
Emission				
FCC 18.305	Radiated emissions	FCC MP-5:1986	PASS	--
FCC 18.307	AC power line conducted emissions	FCC MP-5:1986	PASS	--
Comment: --				

Possible Test Case Verdicts	
PASS	Test object does meet the requirements
FAIL	Test object does not meet the requirements
N/T	Required by standard but not tested
N/R	Not required by standard for the test object

2.1 Test Conditions and Results - Radiated emissions acc. to FCC MP-5

2.1.1 Information

Test Information	
Reference	FCC 18.305
Reference method	FCC MP-5:1986 Section 5
Highest internal frequency [MHz]	0.3
Measurement range	9 kHz to 30 MHz
Temperature [°C]	22 – 23
Humidity [%]	26 – 29
Operator	Stephan Liebich
Date	2022-02-14

2.1.2 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	Radimation	2020.1.8

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic chamber (NSA)	Frankonia	AC1	EF00062	2021-02	2024-02
Anechoic chamber (SVSWR)	Frankonia	AC 1	EF01011	2019-06	2022-06
Programmable AC Source	Chroma ATE Inc.	61604	EF01068	2021-07	2022-07
Loop antenna	Rohde & Schwarz Vertriebs GmbH	HFH2-Z2	EF00184	2021-01	2024-01
EMI Test Receiver	Keysight	N9038A-526/WXP	EF01070	2021-07	2022-07
Climatic Sensor	Embedded Data Systems, LLC.	280010000025417E	EF01054	2021-03	2022-03
Comments: Loop antenna height 2 m (center of the loop to ground)					

2.1.3 Limits

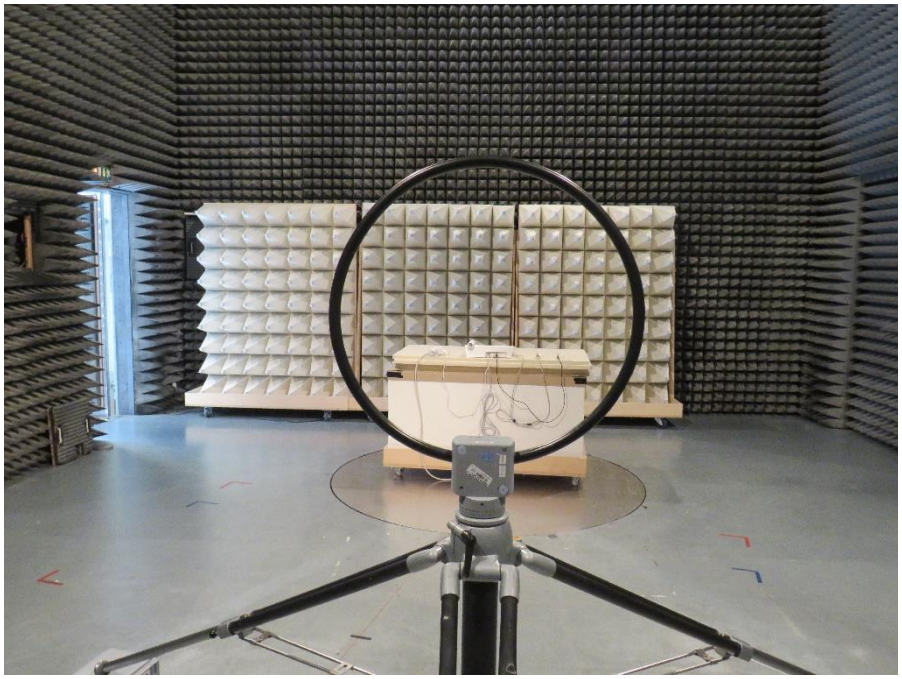
Limits (Any non-ISM frequency)					
Frequency [MHz]	Bandwidth	Detector	Limit [µV/m]	Limit [dBµV/m]	Distance [m]
< 0.15	200 Hz	Average	15	23.5	300
0.15 - 30	9 kHz	Average	15	23.5	300
30 - 1000	100 kHz	Average	15	23.5	300
> 1000	1 MHz	Average	15	23.5	300
Comment: extrapolation factor by ANSI 63.10 (2020)					

2.1.4 Results

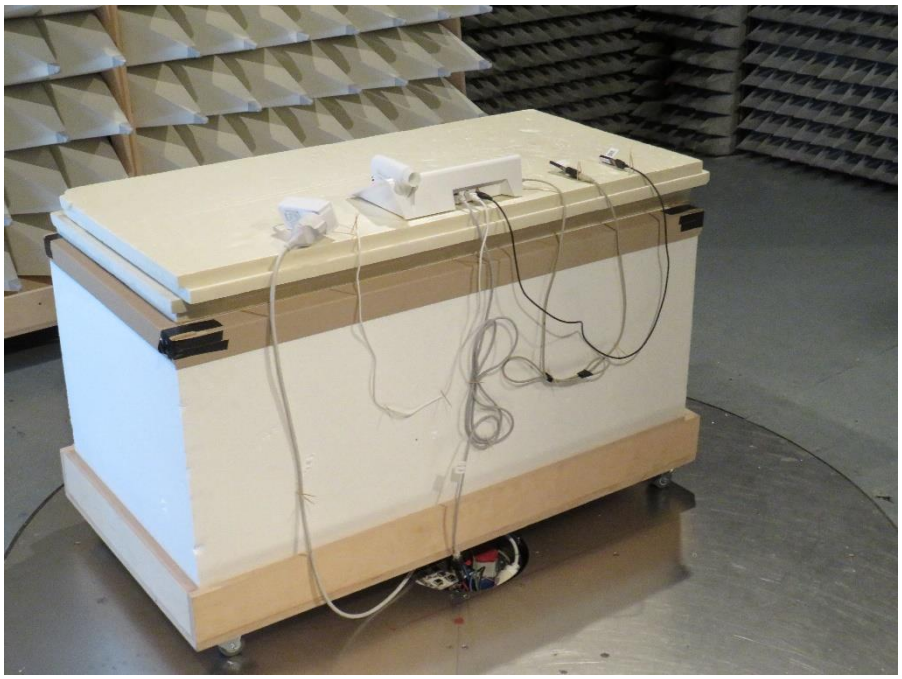
Test Results			
Operational mode	EUT Configuration	Verdict	Remark
1	1	PASS	120 V AC / 60 Hz

2.1.5 Setup Photos

TEST SETUP - 9 kHz to 30 MHz - X-Axis



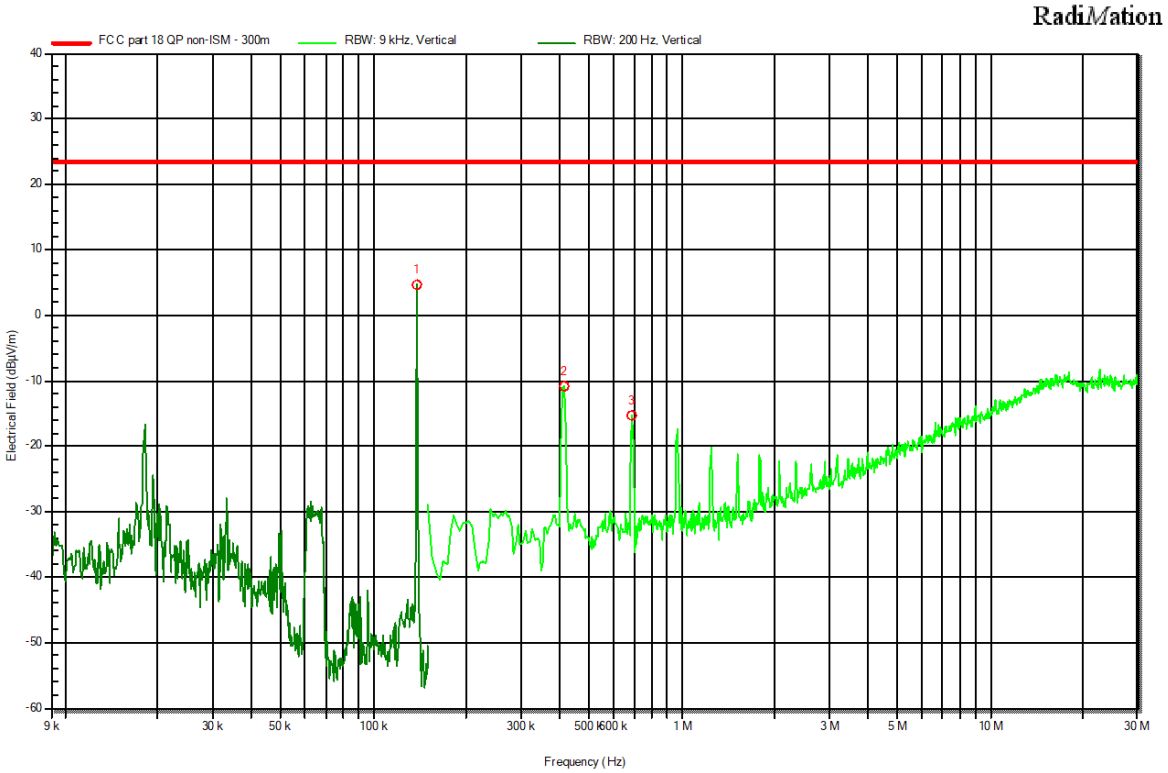
TEST SETUP - FOCUS



2.1.6 Records

Radiated emissions
according to FCC Part 18

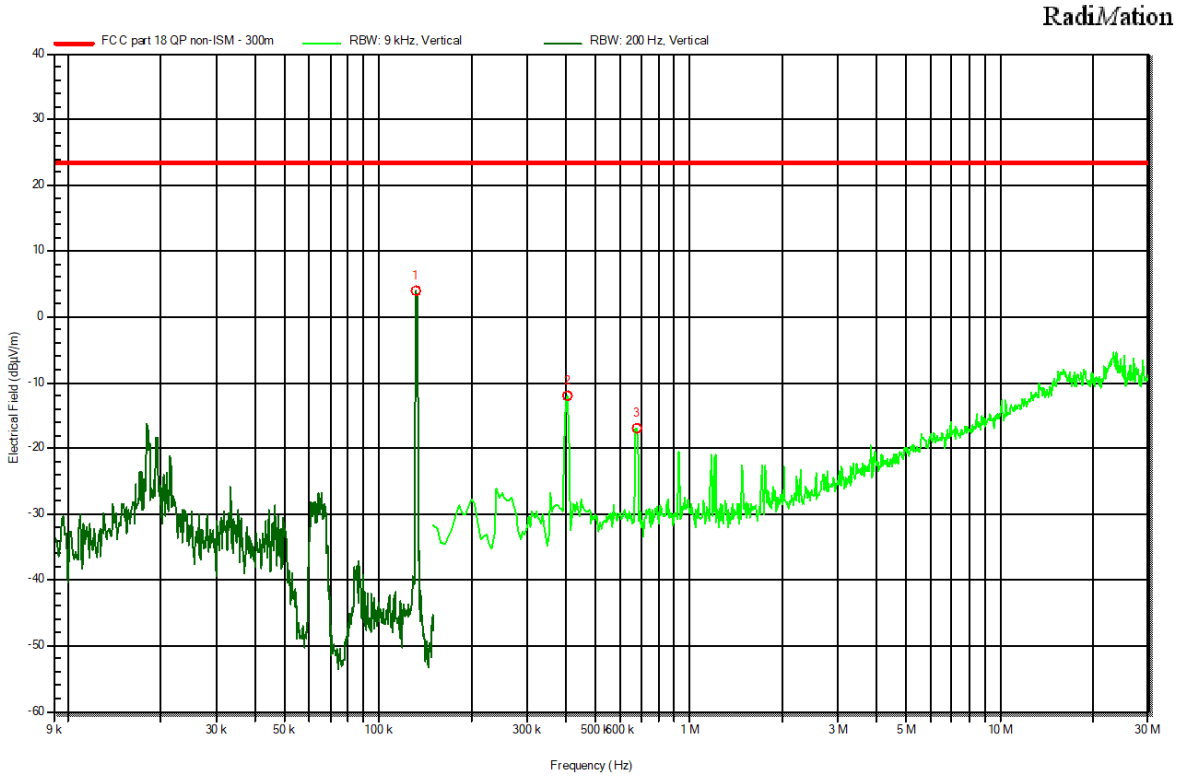
Project Number:	G0M-2112-1231
Applicant:	eResearchTechnology GmbH
Model Description:	Spirometer System
Model:	SpiroSphere
Test Sample ID:	38263
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2022-02-14
Operating Conditions:	ambient temperature: 23 °Celsius power input: 120 V AC / 60 Hz
Antenna:	Rohde & Schwarz HFH 2-Z2, X-Axis
Measurement Distance:	3m, converted to 300m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Note 1:	137,8 kHz WPT frequency



	Frequency	Average	Average Limit	Status	Angle	Height	Polarization
1	137,8 kHz	4,56 dBµV/m	23,52 dBµV/m	Pass	-10 degrees	2 m	X
2	415,553 kHz	-10,93 dBµV/m	23,52 dBµV/m	Pass	-10 degrees	2 m	X
3	690,109 kHz	-15,33 dBµV/m	23,52 dBµV/m	Pass	-10 degrees	2 m	X

Radiated emissions
according to FCC Part 18

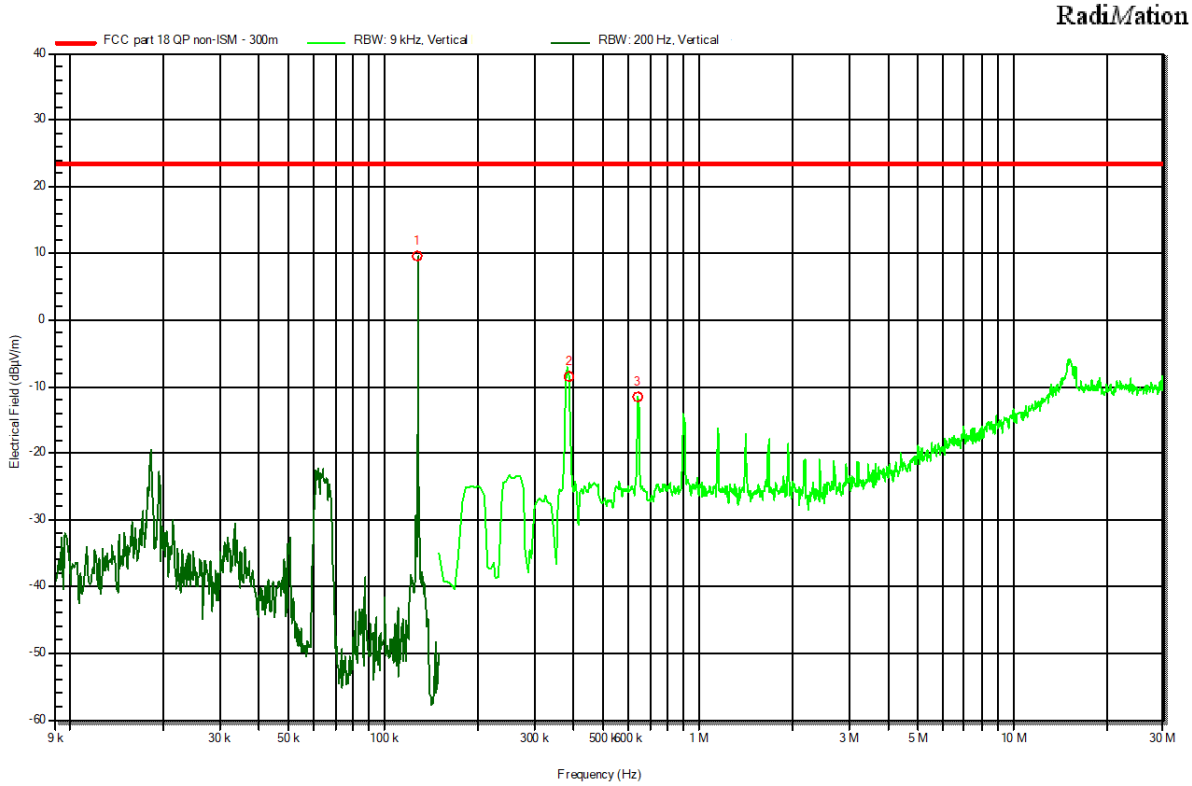
Project Number:	G0M-2112-1231
Applicant:	eResearchTechnology GmbH
Model Description:	Spirometer System
Model:	SpiroSphere
Test Sample ID:	38263
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2022-02-14
Operating Conditions:	ambient temperature: 23 °Celsius power input: 120 V AC / 60 Hz
Antenna:	Rohde & Schwarz HFH 2-Z2, Y-Axis
Measurement Distance:	3m, converted to 300m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Note 1:	131,5 kHz WPT frequency



	Frequency	Average	Average Limit	Status	Angle	Height	Polarization
1	131,5 kHz	3,87 dBµV/m	23,52 dBµV/m	Pass	-10 degrees	2 m	Y
2	406,552 kHz	-12,10 dBµV/m	23,52 dBµV/m	Pass	-10 degrees	2 m	Y
3	676,606 kHz	-16,99 dBµV/m	23,52 dBµV/m	Pass	-10 degrees	2 m	Y

Radiated emissions
according to FCC Part 18

Project Number:	G0M-2112-1231
Applicant:	eResearchTechnology GmbH
Model Description:	Spirometer System
Model:	SpiroSphere
Test Sample ID:	38263
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2022-02-14
Operating Conditions:	ambient temperature: 23 °Celsius power input: 120 V AC / 60 Hz
Antenna:	Rohde & Schwarz HFH 2-Z2, Z-Axis
Measurement Distance:	3m, converted to 300m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Note 1:	128,2 kHz WPT frequency



	Frequency	Average	Average Limit	Status	Angle	Height	Polarization
1	128,2 kHz	9,70 dBµV/m	23,52 dBµV/m	Pass	-12 degrees	2 m	Z
2	388,548 kHz	-08,38 dBµV/m	23,52 dBµV/m	Pass	-12 degrees	2 m	Z
3	640,599 kHz	-11,58 dBµV/m	23,52 dBµV/m	Pass	-12 degrees	2 m	Z

2.2 Test Conditions and Results - Conducted emissions acc. to FCC MP-5

2.2.1 Information

Test Information	
Reference	FCC 18.307
Reference method	FCC MP-5:1986 Section 7
Measurement range	150 kHz - 30 MHz
Temperature [°C]	21 – 22
Humidity [%]	32 – 35
Operator	Stephan Liebich
Date	2022-02-09

2.2.2 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	Radimation	2020.1.8

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
AMN	Schwarzbeck	NSLK 8127	EF01592	2021-07	2022-07
AMN	R&S	ESH3-Z5	EF00036	2021-08	2023-08
Pulse Limiter	R&S	ESH3-Z2	EF01063	2021-07	2022-07
EMI Test Receiver	R&S	ESR 7	EF00943	2021-08	2022-08
Climatic Sensor	Embedded Data Systems, LLC.	2800100000254 17E	EF01054	2021-03	2022-03

2.2.3 Limits

Limits		
Frequency [MHz]	Limit Quasi-peak [dBµV/m]	Limit Average [dBµV/m]
0.15-0.5	66-56*	56-46*
0.5-5	56	46
5-30	60	50
Comment: *decreases with the logarithm of the frequency		

2.2.4 Results

AC power line conducted emissions					
Port	Coupling	Operational mode	EUT Configuration	Verdict	Remark
AC Mains	AMN	1	1	PASS	120 V AC / 60 Hz

2.2.5 Setup Photos

TEST SETUP - AC Mains

2.2.6 Records

Conducted emissions at the mains power port according to FCC Part 18

Project Number:	G0M-2112-1231
Applicant:	eResearchTechnology GmbH
Model Description:	Spirometer System
Model:	SpiroSphere
Test Sample ID:	38263
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2022-02-09
Operating Conditions:	ambient temperature: 22 °Celsius power input: 120 V AC / 60 Hz
LISN:	Schwarzbeck NSLK 8127 RC N
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Applied to Port:	AC Mains
Note 1:	worst case

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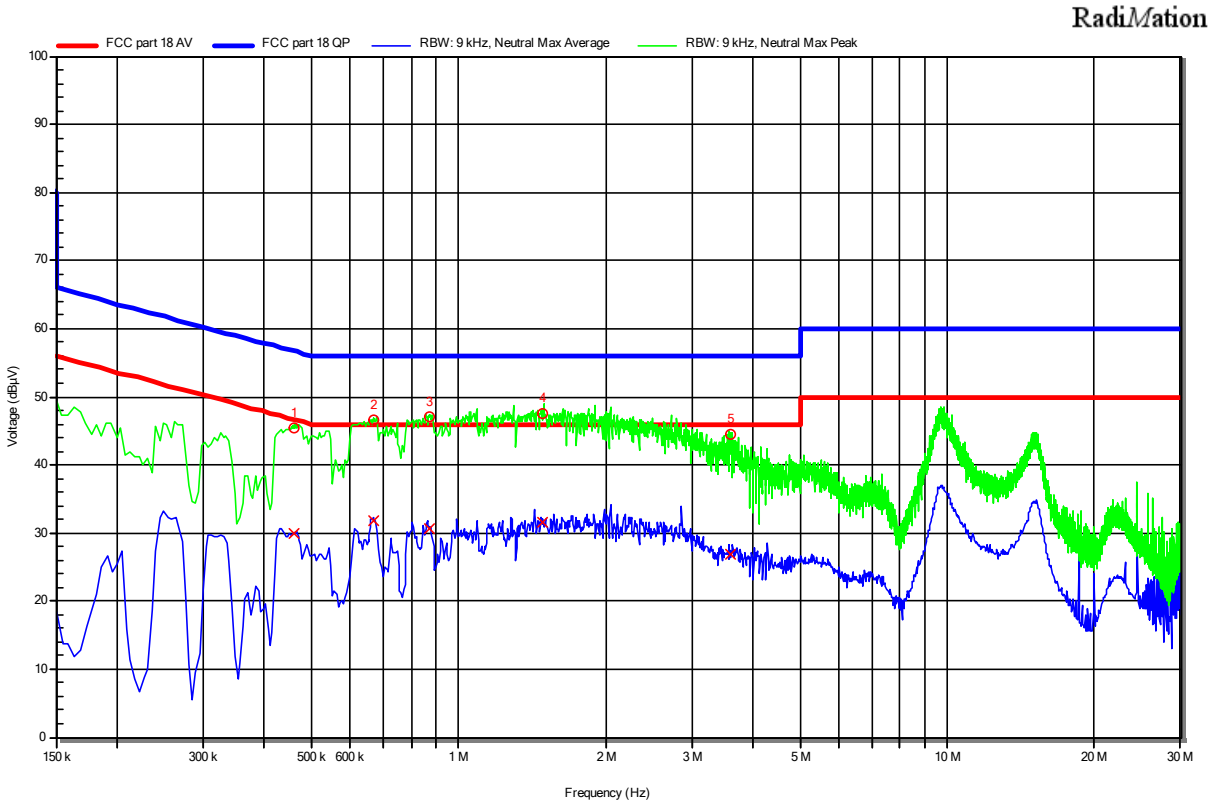

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	LISN
1	460.5 kHz	43.89 dBµV	56.68 dBµV	-12.79 dB	Pass	Neutral
2	671.55 kHz	44.65 dBµV	56 dBµV	-11.35 dB	Pass	Neutral
3	870 kHz	44.64 dBµV	56 dBµV	-11.36 dB	Pass	Neutral
4	1.486 MHz	43.93 dBµV	56 dBµV	-12.07 dB	Pass	Neutral
5	3.588 MHz	38.84 dBµV	56 dBµV	-17.16 dB	Pass	Neutral

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	LISN
1	460.5 kHz	29.93 dBµV	46.68 dBµV	-16.75 dB	Pass	Neutral
2	671.55 kHz	31.71 dBµV	46 dBµV	-14.29 dB	Pass	Neutral
3	870 kHz	30.73 dBµV	46 dBµV	-15.27 dB	Pass	Neutral
4	1.486 MHz	31.46 dBµV	46 dBµV	-14.54 dB	Pass	Neutral
5	3.588 MHz	26.88 dBµV	46 dBµV	-19.12 dB	Pass	Neutral

Conducted emissions at the mains power port
according to FCC Part 18

Project Number:	G0M-2112-1231
Applicant:	eResearchTechnology GmbH
Model Description:	Spirometer System
Model:	SpiroSphere
Test Sample ID:	38263
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2022-02-09
Operating Conditions:	ambient temperature: 22 °Celsius power input: 120 V AC / 60 Hz
LISN:	Schwarzbeck NSLK 8127 RC L
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Applied to Port:	AC Mains
Note 1:	worst case

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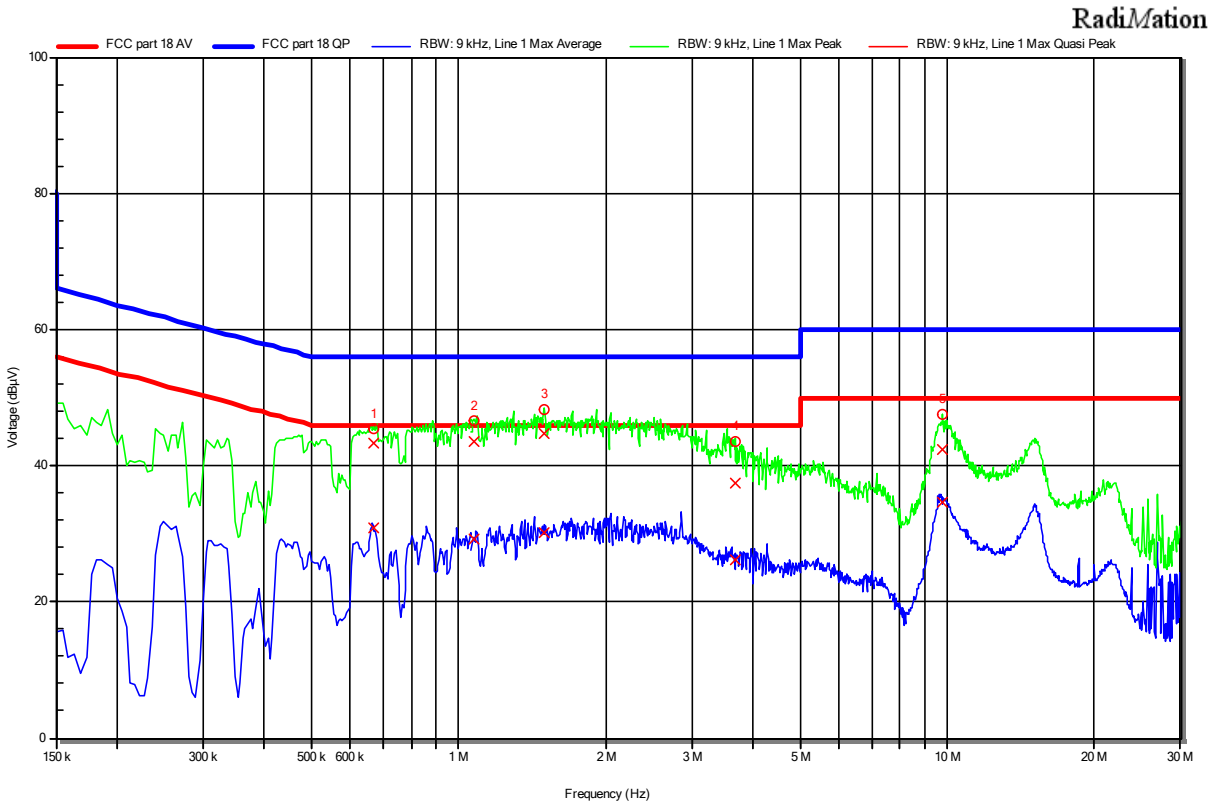

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	LISN
1	668.85 kHz	43.27 dBµV	56 dBµV	-12.73 dB	Pass	Line 1
2	1.072 MHz	43.65 dBµV	56 dBµV	-12.35 dB	Pass	Line 1
3	1.496 MHz	44.61 dBµV	56 dBµV	-11.39 dB	Pass	Line 1
4	3.683 MHz	37.38 dBµV	56 dBµV	-18.62 dB	Pass	Line 1
5	9.794 MHz	42.29 dBµV	60 dBµV	-17.71 dB	Pass	Line 1

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	LISN
1	668.85 kHz	30.83 dBµV	46 dBµV	-15.17 dB	Pass	Line 1
2	1.072 MHz	29.25 dBµV	46 dBµV	-16.75 dB	Pass	Line 1
3	1.496 MHz	30.09 dBµV	46 dBµV	-15.91 dB	Pass	Line 1
4	3.683 MHz	26.2 dBµV	46 dBµV	-19.8 dB	Pass	Line 1
5	9.794 MHz	34.63 dBµV	50 dBµV	-15.37 dB	Pass	Line 1

3 Measurement Uncertainty

All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2.

Test Name	Measurement Uncertainty
Conducted emissions at the mains power port	150kHz to 30MHz, 3.35dB
Radiated Emission	30MHz to 200MHz @ 3m, 5.1dB 200MHz to 1GHz @ 3m, 5.3dB >1GHz to 6GHz @3m, 5.95dB