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Test Report

Report Number:

F200562E2

Equipment under Test (EUT):

Oceanographic radar
WERA model 4.0

Applicant:

HELZEL Messtechnik GmbH

Manufacturer:

HELZEL Messtechnik GmbH

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)

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.

Tested and written by:	Wolfgang KASALOWSKY Name	W. Kasalowsky Signature	07.09.2020 Date
Reviewed and approved by:	Michael DINTER Name	B. Sln Signature	07.09.2020 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:	HELZEL Messtechnik GmbH
Address:	Carl-Benz-Strasse 9 24568 Kaltenkirchen
Country:	Germany
Name for contact purposes:	Mr. Thomas HELZEL
Phone:	+49 4191 95 20 0
Fax:	+49 4191 95 20 40
eMail Address:	helzel@helzel.com
Applicant represented during the test by the following person:	None

1.2 Manufacturer

Name:	HELZEL Messtechnik GmbH
Address:	Carl-Benz-Strasse 9 24568 Kaltenkirchen
Country:	Germany
Name for contact purposes:	Mr. Thomas HELZEL
Phone:	+49 4191 95200
Fax:	+49 4191 952040
eMail Address:	helzel@helzel.com
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 ISED# 3469A.

1.4 EUT (Equipment under Test)

Test object: *	Oceanographic radar		
Type: *	WERA model 4.0		
FCC ID: *	2AV3S-WERA		
Serial number: * HW version *:	Unit	Serial number *	HW version *
	User interface PC	3095364s002	-
	Frequency control rack	FCR -1948-134	V4.4
	Receiver rack	RER-2011-198	V3.17
	Receiver input filter	RIN-2014-421	V12.0
	Receiver input filter	RIN-2014-422	V12.0
	Power amplifier rack	PAR-1902-94	V1.6
Firmware version *:	V3.3.2		

* Declared by the applicant

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

EUT data			
Power supply EUT: *	AC mains		
Supply voltage EUT: *	U_{nom} = 120 V_{AC} / 60 Hz	U_{min} = 102 V_{AC}/ 60 Hz	U_{max} = 138 V_{AC}/ 60 Hz
	U_{nom} = 240 V_{AC} / 60 Hz	U_{min} = 204 V_{AC}/ 60 Hz	U_{max} = 276 V_{AC}/ 60 Hz
Temperature range: *	+10°C to + 30°C		
Lowest / highest internal clock frequency: *	3.2 GHz		

* Declared by the applicant

Ports / Connectors				
Identification			Length during test	Shielding (Yes / No)
	EUT	Ancillary		
Ethernet	RJ45	WAN		Yes
AC in	Rubber connector	AC mains		No
TX antenna	N connector	Attenuator, Spectrum	1m	Yes
RX antenna	N connector	Not used	Not used	---

Ancillary devices:	
Monitor *2	PHILIPS MODEL ID:221S8LDAB/00, S/N: ZV0A1848025834
Keyboard *2	CHERRY Modell RS 6000 USB 0N, S/N: 1205787
Mouse *2	M/N: M-U0026, P/N: 810-003656, S/N: 1849HS022T68

*1 Provided by the laboratory
*2 Provided by the applicant

1.6 Dates

Date of receipt of test sample:	05.05.2020
Start of test:	04.06.2020
End of test:	22.07.2020

2 Operational States

Description of function of the EUT:

The EUT is an oceanographic radar in FMCW mode built for professional use.

The following states were defined as the operating conditions:

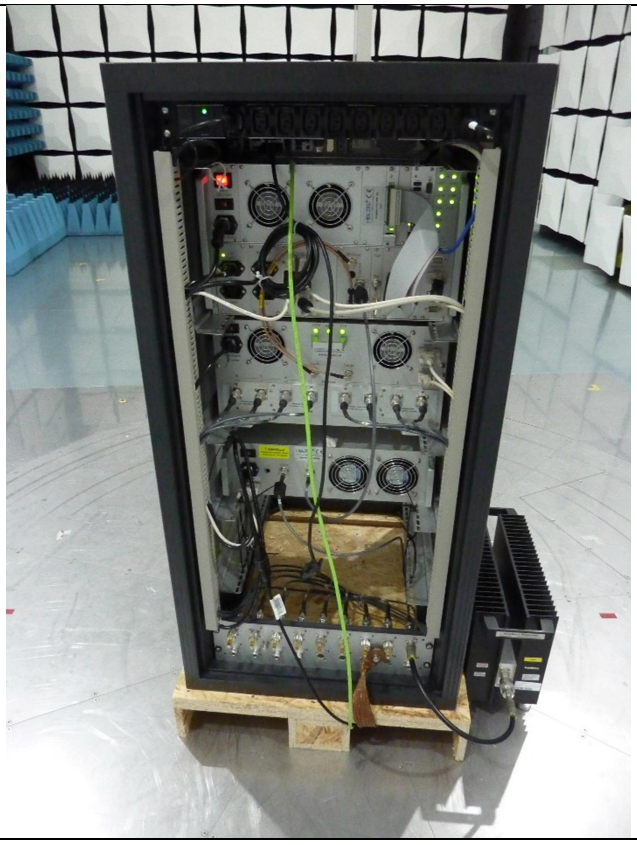
The EUT was operated in the mode “test acquisition” with TX switched on and in a second run with TX switched off.

The TX port and the RX ports were terminated with a 50 Ohm load.
The Ethernet port was connected via fibre optic converters to the internet.

The bandwidth reduction was set to parameter 7000m (21.4 kHz) for the 5.250 MHz to 5.275 MHz band and to parameter 1650m (90.0 kHz) for the 13.45 MHz to 13.55 MHz and for 16.1 MHz to 16.2 MHz band.

To reduce the stress of the internal power supplies the applicant recommends supplying the EUT with 240 V AC (Voltage between two phases with 180 degrees phase shift) if possible.
During the tests the EUT was powered with 120 V AC or 240 V AC. Please refer to the test cases.

The physical boundaries of the EUT are shown below.



3 Additional Information

General information:

- none

Classification of cables:

- none

Maximum length of cables, declared by the manufacturer:

- no maximum length declared

Type of cables, declared by the manufacturer:

- no special type of cable declared

Deviation of the standard or test plan:

- no deviation

Special EMC measures, as a result of the tests:

- none

4 Overview

Conducted emissions FCC 47 CFR Part 15 section 15.107 (b) [3] / ICES-003 Issue 6 section 6.1 [4]					
Application	Frequency range	Limits	Reference standard	Remark	Status
AC supply line	0.15 to 0.5 MHz 0.5 to 30 MHz	79 dBµV (QP) 66 dBµV (AV) 73 dBµV (QP) 60 dBµV (AV)	ANSI C63.4	Class A	Passed
AC supply line	0.15 to 0.5 MHz 0.5 to 5 MHz 5 to 30 MHz	66 to 56 dBµV (QP)* 56 to 46 dBµV (AV)* 56 dBµV (QP) 46 dBµV (AV) 60 dBµV (QP) 50 dBµV (AV)	ANSI C63.4	Class B	-
*: Decreases with the logarithm of the frequency					
Radiated emissions FCC 47 CFR Part 15 section 15.109 (b) [3] / ICES-003 Issue 6 section 6.2 [4]					
Application	Frequency range	Limits	Reference standard	Remark	Status
Radiated Emission	30 to 88 MHz 88 to 216 MHz 216 to 960 MHz 960 to 1000 MHz above 1000 MHz	39.0 dBµV /m QP at 10 m 43.5 dBµV /m QP at 10 m 46.5 dBµV /m QP at 10 m 49.5 dBµV /m QP at 10 m 49.5 dBµV /m AV at 10 m and 69.5 dBµV /m PK at 10 m	ANSI C63.4	Class A	Passed
Radiated Emission	30 to 88 MHz 88 to 216 MHz 216 to 960 MHz 960 to 1000 MHz above 1000 MHz	40.0 dBµV/m QP at 3 m 43.5 dBµV/m QP at 3 m 46.0 dBµV/m QP at 3 m 54.0 dBµV/m QP at 3 m 54.0 dBµV/m AV at 3 m and 74.0 dBµV/m PK at 3 m	ANSI C63.4	Class B	-

Remark: As declared by the applicant the highest internal clock frequency is 3.2 GHz.
Therefore the radiated emission measurement must be carried out up to 5th of the highest internal clock frequency in this case 16 GHz.

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

5 Results

5.1 Conducted emissions on power supply lines

5.1.1 Test method

This test will be carried out in a shielded chamber. Table top devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm above the ground plane. Floor-standing devices will be placed directly on the ground plane. The setup of the Equipment under test will be in accordance to [1].

The frequency range 150 kHz to 30 MHz will be measured with an EMI Receiver set to MAX Hold mode with peak and average detector and a resolution bandwidth of 9 kHz. A scan will be carried out on the phase (or plus pole in case of DC powered devices) of the AC mains network. If levels detected 10 dB below the appropriable limit, this emission will be measured with the average and quasi-peak detector on all lines.

Frequency range	Resolution bandwidth
150 kHz to 30 MHz	9 kHz

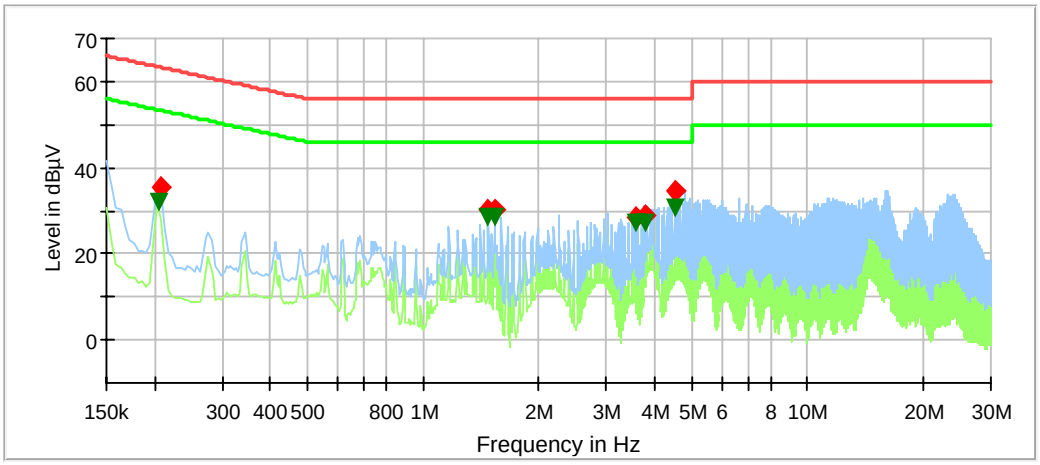
5.1.2 Results conducted emission measurement on AC mains

Ambient temperature:	22 °C

Relative humidity:	45 %

Test description:	Conducted emission measurement
EUT:	WERA model 4.0
Manufacturer:	HELZEL Messtechnik GmbH
Operating conditions:	Test acquisition, TX off
Test site:	Phoenix TESTLAB GmbH, shielded room M4
Operator:	W. Kasalowsky
Comment:	120 VAC / 60 Hz
Date of test	22.07.2020

The curves in the diagrams below only represent for each frequency point the maximum measured value of all preliminary measurements which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by and the average measured ◆ points by ▼.



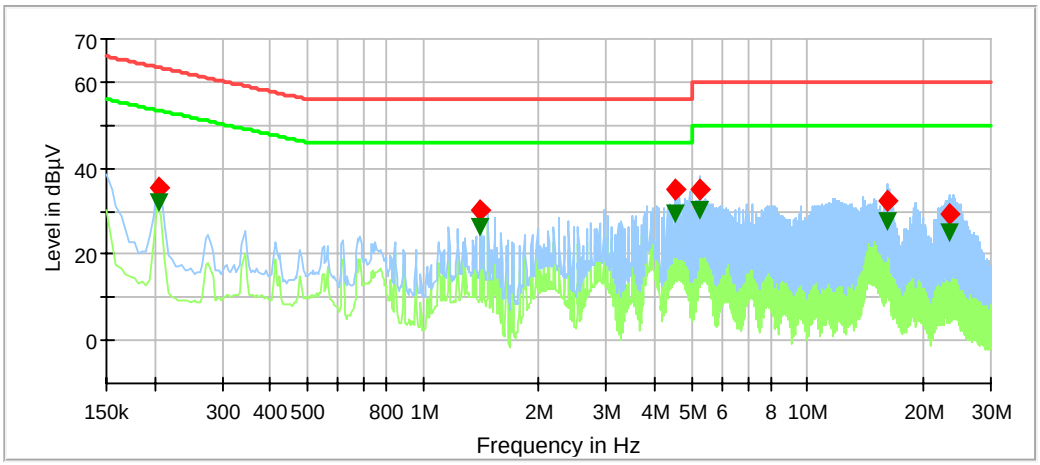
Preview Result 2-AVG
FCC 15.107 Class B V AV
Preview Result 1-PK+
Final_Result QPK
FCC 15.107 Class B V QI
Final_Result AVG

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Transducer (dB)
0.205800	---	32.06	53.37	21.32	5000.0	9.000	L1	GND	9.8
0.206700	35.48	---	63.34	27.85	5000.0	9.000	L1	GND	9.8
1.474800	30.14	---	56.00	25.86	5000.0	9.000	N	GND	9.9
1.474800	---	28.34	46.00	17.66	5000.0	9.000	N	GND	9.9
1.536000	---	28.45	46.00	17.55	5000.0	9.000	N	GND	9.9
1.536900	30.10	---	56.00	25.90	5000.0	9.000	N	GND	9.9
3.560100	28.54	---	56.00	27.46	5000.0	9.000	N	GND	10.3
3.561000	---	27.08	46.00	18.92	5000.0	9.000	N	GND	10.3
3.765300	---	27.23	46.00	18.77	5000.0	9.000	N	GND	10.3
3.766200	28.96	---	56.00	27.04	5000.0	9.000	L1	GND	10.3
4.516800	34.72	---	56.00	21.28	5000.0	9.000	L1	GND	10.3
4.518600	---	30.72	46.00	15.28	5000.0	9.000	N	GND	10.3
Measurement uncertainty				+2.76 dB / -2.76 dB					

Test description:	Conducted emission measurement
EUT:	WERA model 4.0
Manufacturer:	HELZEL Messtechnik GmbH
Operating conditions:	Test acquisition, TX on
Test site:	Phoenix TESTLAB GmbH, shielded room M4
Operator:	W. Kasalowsky
Comment:	120 VAC / 60 Hz
Date of test	22.07.2020

The curves in the diagrams below only represent for each frequency point the maximum measured value of all preliminary measurements which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by and the average measured ◆ points by ▼.



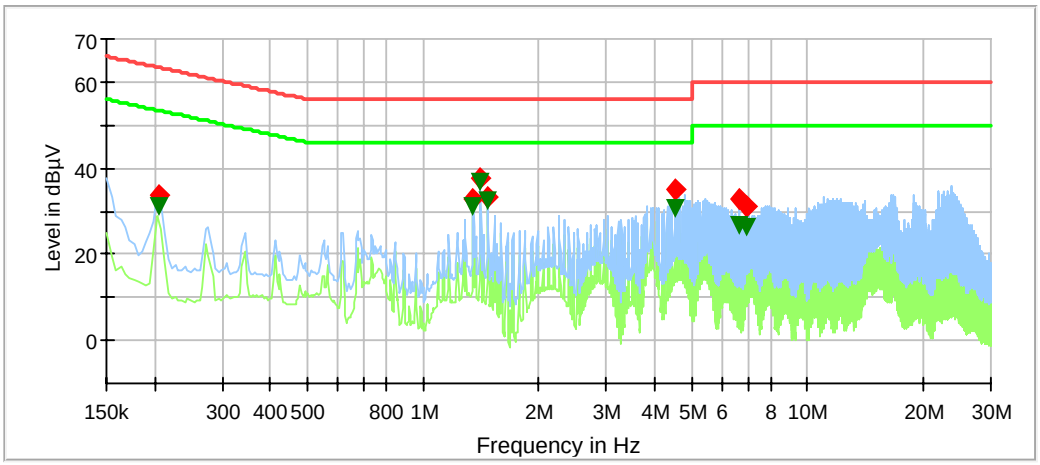
Preview Result 2-AVG
FCC 15.107 Class B V AV
Preview Result 1-PK+
Final_Result QPK
FCC 15.107 Class B V QI
Final_Result AVG

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Transducer (dB)
0.204900	---	31.99	53.41	21.42	5000.0	9.000	L1	GND	9.8
0.205800	35.52	---	63.37	27.85	5000.0	9.000	L1	GND	9.8
1.412700	---	26.13	46.00	19.87	5000.0	9.000	N	GND	9.9
1.413600	30.19	---	56.00	25.81	5000.0	9.000	L1	GND	9.9
4.518600	35.11	---	56.00	20.89	5000.0	9.000	L1	GND	10.3
4.519500	---	29.45	46.00	16.55	5000.0	9.000	L1	GND	10.3
5.270100	34.81	---	60.00	25.19	5000.0	9.000	L1	GND	10.3
5.271000	---	30.35	50.00	19.65	5000.0	9.000	N	GND	10.3
16.224000	32.38	---	60.00	27.62	5000.0	9.000	N	GND	10.9
16.228500	---	27.58	50.00	22.42	5000.0	9.000	N	GND	10.9
23.411400	29.41	---	60.00	30.59	5000.0	9.000	L1	GND	10.9
23.416800	---	25.06	50.00	24.94	5000.0	9.000	N	GND	11.0
Measurement uncertainty				+2.76 dB / -2.76 dB					

Test description:	Conducted emission measurement
EUT:	WERA model 4.0
Manufacturer:	HELZEL Messtechnik GmbH
Operating conditions:	Test acquisition, TX off
Test site:	Phoenix TESTLAB GmbH, shielded room M4
Operator:	W. Kasalowsky
Comment:	240 VAC / 60 Hz
Date of test	22.07.2020

The curves in the diagrams below only represent for each frequency point the maximum measured value of all preliminary measurements which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by and the average measured ◆ points by ▼.



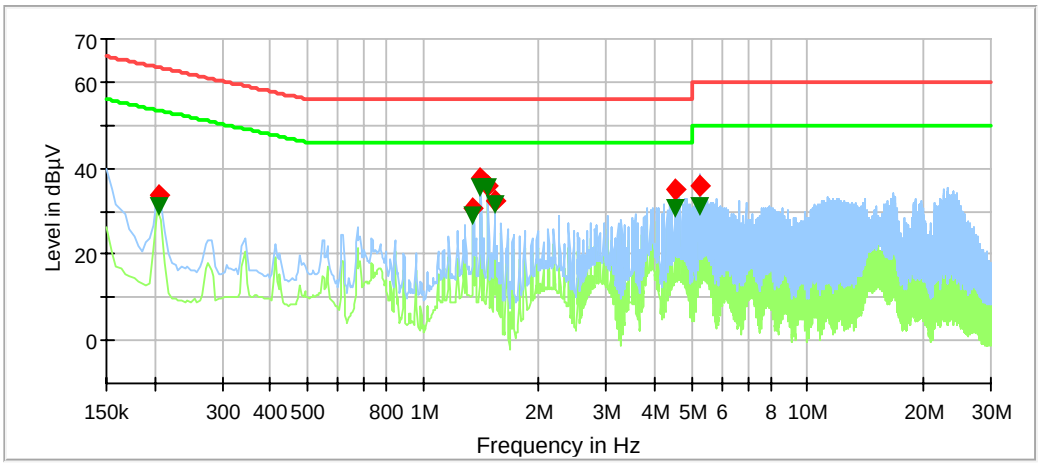
Preview Result 2-AVG
FCC 15.107 Class B V AV
Preview Result 1-PK+
Final_Result QPK
FCC 15.107 Class B V QI
Final_Result AVG

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Transducer (dB)
0.204900	33.75	---	63.41	29.66	5000.0	9.000	L1	GND	9.8
0.205800	---	31.08	53.37	22.29	5000.0	9.000	L1	GND	9.8
1.350600	---	31.06	46.00	14.94	5000.0	9.000	L1	GND	9.9
1.350600	32.90	---	56.00	23.10	5000.0	9.000	L1	GND	9.9
1.411800	---	36.57	46.00	9.43	5000.0	9.000	L1	GND	9.9
1.411800	37.77	---	56.00	18.23	5000.0	9.000	L1	GND	9.9
1.473000	33.14	---	56.00	22.86	5000.0	9.000	N	GND	9.9
1.473000	---	32.47	46.00	13.53	5000.0	9.000	N	GND	9.9
4.517700	---	30.69	46.00	15.31	5000.0	9.000	L1	GND	10.3
4.519500	35.06	---	56.00	20.95	5000.0	9.000	N	GND	10.3
6.639900	---	26.57	50.00	23.43	5000.0	9.000	L1	GND	10.4
6.640800	32.70	---	60.00	27.30	5000.0	9.000	N	GND	10.4
Measurement uncertainty				+2.76 dB / -2.76 dB					

Test description:	Conducted emission measurement
EUT:	WERA model 4.0
Manufacturer:	HELZEL Messtechnik GmbH
Operating conditions:	Test acquisition, TX on
Test site:	Phoenix TESTLAB GmbH, shielded room M4
Operator:	W. Kasalowsky
Comment:	240 VAC / 60 Hz
Date of test	22.07.2020

The curves in the diagrams below only represent for each frequency point the maximum measured value of all preliminary measurements which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by and the average measured ◆ points by ▼.



Preview Result 2-AVG
FCC 15.107 Class B V AV
Preview Result 1-PK+
Final_Result QPK
FCC 15.107 Class B V QI
Final_Result AVG

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Transducer (dB)
0.204900	---	31.15	53.41	22.26	5000.0	9.000	L1	GND	9.8
0.204900	33.50	---	63.41	29.91	5000.0	9.000	L1	GND	9.8
1.351500	---	28.77	46.00	17.23	5000.0	9.000	L1	GND	9.9
1.351500	30.79	---	56.00	25.21	5000.0	9.000	L1	GND	9.9
1.412700	---	35.65	46.00	10.35	5000.0	9.000	L1	GND	9.9
1.412700	37.69	---	56.00	18.31	5000.0	9.000	L1	GND	9.9
1.473900	---	35.34	46.00	10.66	5000.0	9.000	N	GND	9.9
1.473900	36.04	---	56.00	19.96	5000.0	9.000	N	GND	9.9
1.536000	32.41	---	56.00	23.59	5000.0	9.000	N	GND	9.9
1.536000	---	31.40	46.00	14.60	5000.0	9.000	N	GND	9.9
4.517700	---	30.47	46.00	15.53	5000.0	9.000	N	GND	10.3
4.519500	35.06	---	56.00	20.94	5000.0	9.000	N	GND	10.3
Measurement uncertainty				+2.76 dB / -2.76 dB					

Test equipment (please refer to chapter 6 for details)
14 - 19

5.2 Radiated emissions

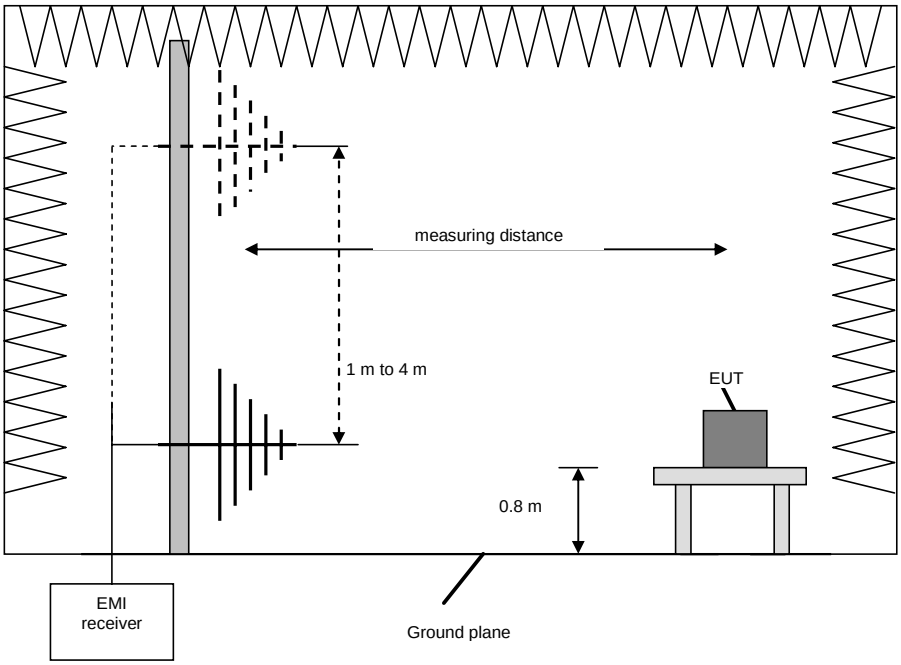
5.2.1 Test method

Preliminary and final measurement (30 MHz to 1 GHz)

The preliminary and final measurements were conducted in a semi-anechoic chamber with a metal ground plane in a 3 m distance.
During the test the EUT will be rotated in the range of 0 ° to 360 °, the measuring antenna will be 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 will be 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 measurement antenna to 1 m height.
2. Monitor the frequency range at vertical polarisation and a EUT azimuth of 0 °.
3. Rotate the EUT by 360° to maximize the detected signals.
4. Repeat 1) to 2) with the vertical polarisation of the measuring antenna.
5. Increase the height of the antenna for 0.5 m and repeat steps 2 – 4 until the final height of 4 m is reached.
6. The highest values for each frequency will be saved by the software, including the antenna height, measurement antenna polarization and turntable azimuth for that value.

Procedure final measurement:

The following procedure is used:

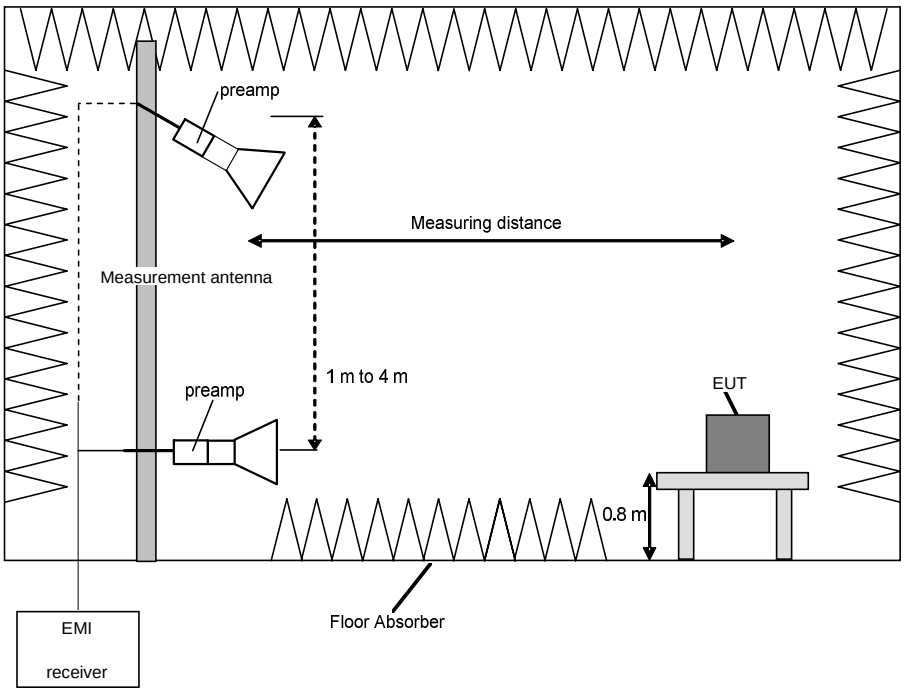
1. Select the highest frequency peaks to the limit for the final measurement.
2. The software will determine the exact peak frequencies by doing a partial scan with reduced RBW with +/- 10 times the RBW of the pre-scan of the selected peaks.
3. If the EUT is portable or ceiling mounted, find the worst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

Preliminary and final measurement (1 – 40 GHz)

The preliminary and final measurements were conducted in a semi-anechoic chamber with floor absorbers between EUT and measurement antenna in a 3 m distance.
During the test the EUT will be rotated in the range of 0 ° to 360 °, the measuring antenna will be 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. For each height the angle of the antenna will be tilted so that the measurement antenna is always aiming at the EUT.

The resolution bandwidth of the EMI Receiver will be 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 measurement antenna to 1 m height.
2. Monitor the frequency range at vertical polarisation and a EUT azimuth of 0 °.
3. Rotate the EUT by 360° to maximize the detected signals.
4. Repeat 1) to 2) with the vertical polarisation of the measuring antenna.
5. Increase the height of the antenna for 0.5 m and repeat steps 2 – 4 until the final height of 4 m is reached.
6. The highest values for each frequency will be saved by the software, including the antenna height, measurement antenna polarization and turntable azimuth for the highest value.

Procedure final measurement:

The following procedure is used:

1. Select the highest frequency peaks to the limit for the final measurement.
2. The software will determine 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 measurement antenna height is found by the measurement software by varying the measurement antenna height by +/- 0.5 m from the worst case value obtained in the preliminary measurement, and to monitor the emission level.
5. The worst azimuth turntable position is found by varying the turntable azimuth by +/- 30° from the worst case value obtained in the preliminary measurement, and to monitor the emission level.
6. The final measurement is performed at the worst case antenna height and the worst case turntable azimuth.
7. Steps 2 – 6 will be repeated for each frequency peak selected in step 1.

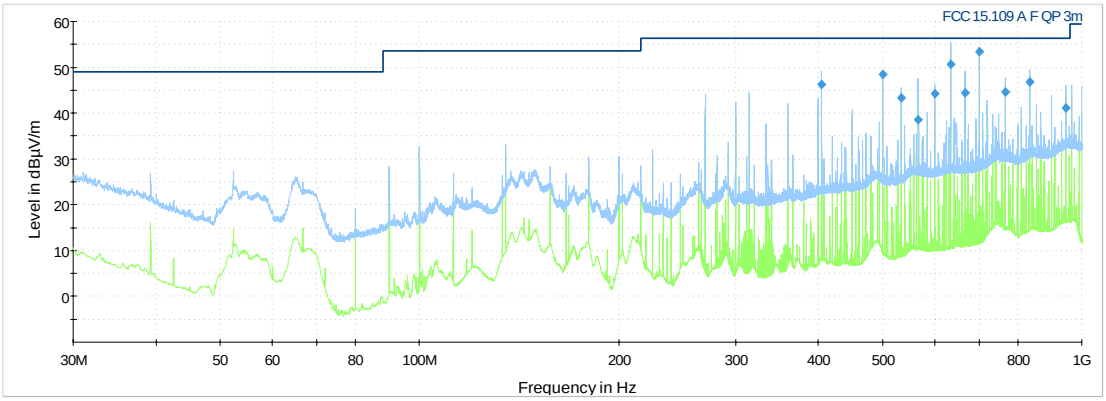
5.2.2 Result final measurement from 30 MHz to 1 GHz

Ambient temperature	21 °C

Relative humidity	56 %

Test description:	Radiated emission measurement according to FCC PART 15
EUT:	WERA model 4.0
Manufacturer:	HELZEL Messtechnik GmbH
Operating conditions:	Test acquisition, TX off
Test site:	Phoenix TESTLAB GmbH, semi anechoic chamber M276
Operator:	W. Kasalowsky
Comment:	240V AC 60Hz
Date of test	04.06.2020

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.

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
404.975000	46.30	56.40	10.10	1000.0	120.000	128.0	V	-10.0	24.1
499.975000	48.39	56.40	8.01	1000.0	120.000	100.0	H	183.0	26.1
533.350000	43.29	56.40	13.11	1000.0	120.000	125.0	H	207.0	26.6
566.625000	38.55	56.40	17.85	1000.0	120.000	169.0	V	207.0	28.4
600.025000	44.22	56.40	12.18	1000.0	120.000	131.0	V	176.0	28.1
633.350000	50.71	56.40	5.69	1000.0	120.000	150.0	H	177.0	29.0
666.625000	44.34	56.40	12.06	1000.0	120.000	107.0	H	144.0	28.7
700.000000	53.37	56.40	3.03	1000.0	120.000	164.0	H	187.0	29.2
766.625000	44.67	56.40	11.73	1000.0	120.000	148.0	H	200.0	30.8
833.300000	46.79	56.40	9.61	1000.0	120.000	204.0	H	177.0	31.9
944.975000	41.13	56.40	15.27	1000.0	120.000	211.0	H	1.0	33.9
Measurement uncertainty: ± 4.8 dB									

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 (dBµV/m) = result QuasiPeak (dBµV/m) - Corr. (dB)

Test equipment (please refer to chapter 6 for details)
5 – 10, 12, 13, 19

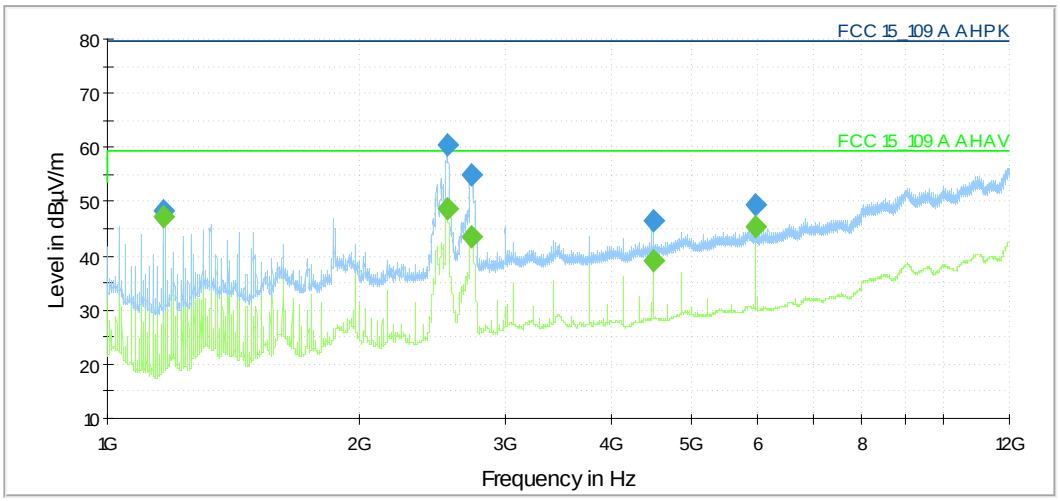
5.2.3 Result final measurement above 1 GHz

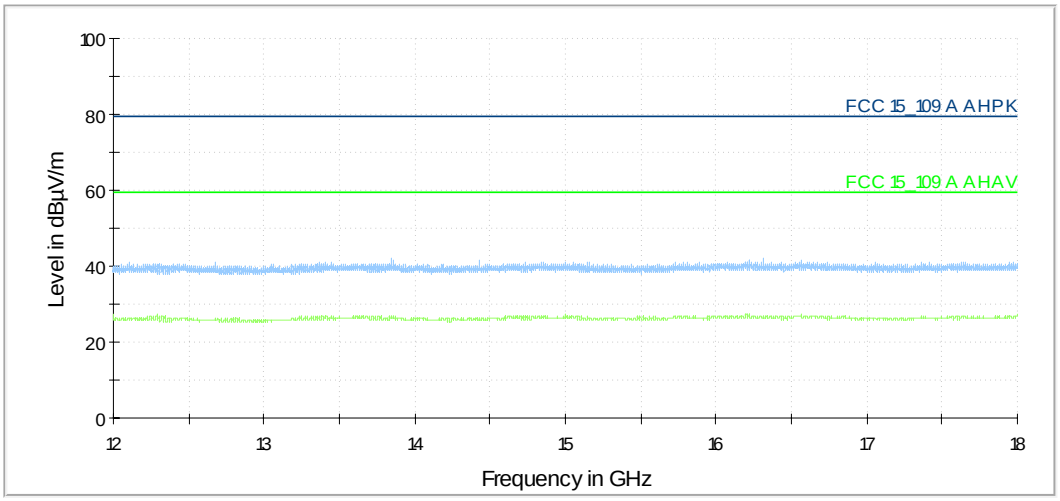
Ambient temperature	22 °C

Relative humidity	56 %

Test description:	Radiated emission measurement according to FCC PART 15
EUT:	WERA model 4.0
Manufacturer:	HELZEL Messtechnik GmbH
Operating conditions:	Test acquisition, TX off
Test site:	Phoenix TESTLAB GmbH, semi anechoic chamber M276
Operator:	W. Kasalowsky
Comment:	240V AC 60Hz
Date of test	15.07.2020

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 in account the specified requirements for a 3 m measuring distance.

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m) PK/AV	Margin (dB)	Meas. Time (ms)	Band-width (MHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1170.000000	48.31	---	79.50	31.19	100.0	1000.0	201.0	H	2.0	-9.5
1170.000000	---	47.29	59.50	12.21	100.0	1000.0	201.0	H	2.0	-9.5
2551.700000	---	48.78	59.50	10.72	100.0	1000.0	190.0	H	52.0	-0.7
2551.700000	60.63	---	79.50	18.87	100.0	1000.0	190.0	H	52.0	-0.7
2728.150000	55.00	---	79.50	24.50	100.0	1000.0	242.0	H	49.0	0.8
2728.150000	---	43.53	59.50	15.97	100.0	1000.0	242.0	H	49.0	0.8
4489.050000	46.38	---	79.50	33.12	100.0	1000.0	100.0	V	53.0	7.4
4500.000000	---	39.04	59.50	20.46	100.0	1000.0	100.0	V	53.0	7.4
5945.950000	49.41	---	79.50	30.09	100.0	1000.0	123.0	V	58.0	11.1
5945.950000	---	45.35	59.50	14.15	100.0	1000.0	123.0	V	58.0	11.1
Measurement uncertainty: ± 5.1 dB										

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 Avarege (dBµV/m) - Corr. (dB)

Test equipment (please refer to chapter 6 for details)
1 – 10, 12, 19

6 Test Equipment used for Tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal Due
1	Low Noise Amplifier 100 MHz - 18 GHz	LNA-30-00101800-25-10P	Narda-Miteq	2110917	482967	18.02.2020	02.2022
2	Log Per Antenna	HL050	Rohde & Schwarz	4062.4063.02-100908	482977	13.08.2019	08.2022
3	Low Noise Amplifier 12 GHz - 18 GHz	LNA-30-12001800-13-10P	Narda-Miteq	2089798	482968	17.02.2020	02.2022
4	Standard Gain Horn 20 dB, 12 GHz-18 GHz	18240-20	Flann	267220	483025	Calibration not necessary	
5	RF Switch Matrix	OSP220	Rohde & Schwarz		482976	Calibration not necessary	
6	Turntable	TT3.0-3t	Maturo	825/2612/.01	483224	Calibration not necessary	
7	Antennasupport	BAM 4.5-P-10kg	Maturo	222/2612.01	483225	Calibration not necessary	
8	Controller	NCD	Maturo	474/2612.01	483226	Calibration not necessary	
9	Systemsoftware EM276	EMC32	Rohde & Schwarz	100970	482972	Calibration not necessary	
10	EMI Testreceiver	ESW44	Rohde & Schwarz	101828	482979	14.11.2019	11.2021
11	loop antenna	HFH2-Z2	Rohde & Schwarz	100417	481912	05.02.2020	02.2021
12	Semi Anechoic Chamber M276	SAC5-2	Albatross Projects	C62128-A540-A138-10-0006	483227	Calibration not necessary	
13	Antenna (Bilog)	CBL6111D	Schaffner Elektrotest GmbH / Teseq GmbH	25761	480894	19.10.2017	10.2020
14	LISN	NSLK8128	Schwarzbeck	8128161	480138	11.02.2020	02.2022
15	Software	EMC32	Rohde & Schwarz	100061	481022	Calibration not necessary	
16	Shielded chamber M4	B83117-S1-X158	Siemens	190075	480088	Calibration not necessary	
17	EMI Receiver / Spectrum Analyser	ESIB 26	Rohde & Schwarz	100292	481182	12.02.2020	02.2022
18	Transient Filter Limiter	CFL 9206A	Teseq GmbH	38268	481982	12.02.2020	02.2022
19	AC power supply	AC6803A AC source 2000VA	Keysight	JPVJ002509	482350	Calibration not necessary	

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	ANSI C63.4a-2017	19.09.2019	18.09.2021
Semi anechoic chamber M276	483227	1 -18 GHz	SVSWR	CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017	01.10.2019	30.09.2021
Shielded chamber M4	480088	9 kHz – 30 MHz	GND-Plane	ANSI C63.4-2014	06.11.2018	05.11.2020

8 Report History

Report Number	Date	Comment
F200562E2	07.09.2020	Initial Test Report
-	-	-
-	-	-

9 List of Annexes

Annex A	Test Setup Photos	6 pages