

# Test Report

Report Number:

**E212507E1**

Equipment under Test (EUT):

**AL900**

Applicant:

**EKF Elektronik GmbH**

Manufacturer:

EKF Elektronik GmbH



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

## References

### Family standards / generic standards:

- [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

### Note on the release status

The officially published CFR version, which is updated annually, may not reflect recent CFR changes. For this reason, the version of the eCFR valid at the start of the test period is taken into account. For more information see: [eCFR :: Title 47 of the CFR -- Telecommunication](#)

## Test result

The requirements of the standards listed under the section "product (-family) standard(s) / generic standard(s)" on page 2 of this test report were fulfilled by the EUT. Restrictions for the use of the EUT in certain environments and / or under special conditions of use are defined in chapter 3, if applicable. Details are shown in the following pages.

tested by:

Jens HANSELLE  
12.08.2022



Signature

tested, written and  
approved by:

Ulrich Kracht  
12.08.2022



Signature

reviewed by:

Matthias WIRTH  
12.08.2022



Signature

The measurement uncertainty for all measurement and test procedures of the laboratory have been determined and can be viewed if required. With regard to the emission measurement method according to CISPR 16-4-2 (EN 55016-4-2), the measurement uncertainty of the test laboratory ( $U_{\text{Lab}}$ ) is less than the CISPR-defined measurement uncertainty ( $U_{\text{CISPR}}$ ). This means that if the measured values for emitted interference fall below the limit value, the requirements of the relevant standard are met. For disturbance immunity, the decision rule of "simple acceptance" is applied with respect to the disturbance level.

If the customer requires an individual decision rule for conformity to the standard or the standard does not specify a decision rule, the measurement uncertainty and the decision rule are explicitly stated in the test report.

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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:                                                          | EKF Elektronik GmbH               |
| Address:                                                       | Philipp-Reis-Str. 4<br>59065 Hamm |
| Country:                                                       | Germany                           |
| Applicant represented during the test by the following person: | Mr. Jahnke 09.05.2022             |

## 1.2 Manufacturer

|                                                                |                                   |
|----------------------------------------------------------------|-----------------------------------|
| Name:                                                          | EKF Elektronik GmbH               |
| Address:                                                       | Philipp-Reis-Str. 4<br>59065 Hamm |
| Country:                                                       | Germany                           |
| Applicant represented during the test by the following person: | Mr. Jahnke 09.05.2022             |

## 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)

|                        |                                                         |
|------------------------|---------------------------------------------------------|
| Type of equipment: *   | <b>AL900</b>                                            |
| Serial number: *       | 52050306 marked with DUT                                |
| PCB identifier: *      | M4 94V – 0 2213                                         |
| Hardware version: *    | AL900-0100                                              |
| Software version: *    | ---                                                     |
| FCC ID: *              | 2A36S-AL900                                             |
| Product description: * | 9port PoE+ Gigabit Ethernet Switch with AVB/TSN support |

\* 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

|                               |                                            |
|-------------------------------|--------------------------------------------|
| Power supply:                 | $U_{nom}$ = Input range 48 VDC, 54 VDC, 3A |
| Supply voltage:               | $U_{min}$ = 48 VDC                         |
|                               | $U_{max}$ = 54 VDC                         |
| highest internal frequency: * | 2,5 GHz                                    |

\* Declared by the applicant

## 1.6 Dates

|                                 |            |
|---------------------------------|------------|
| Date of receipt of test sample: | 09.05.2022 |
| Start of test:                  | 09.05.2022 |
| End of test:                    | 13.05.2022 |

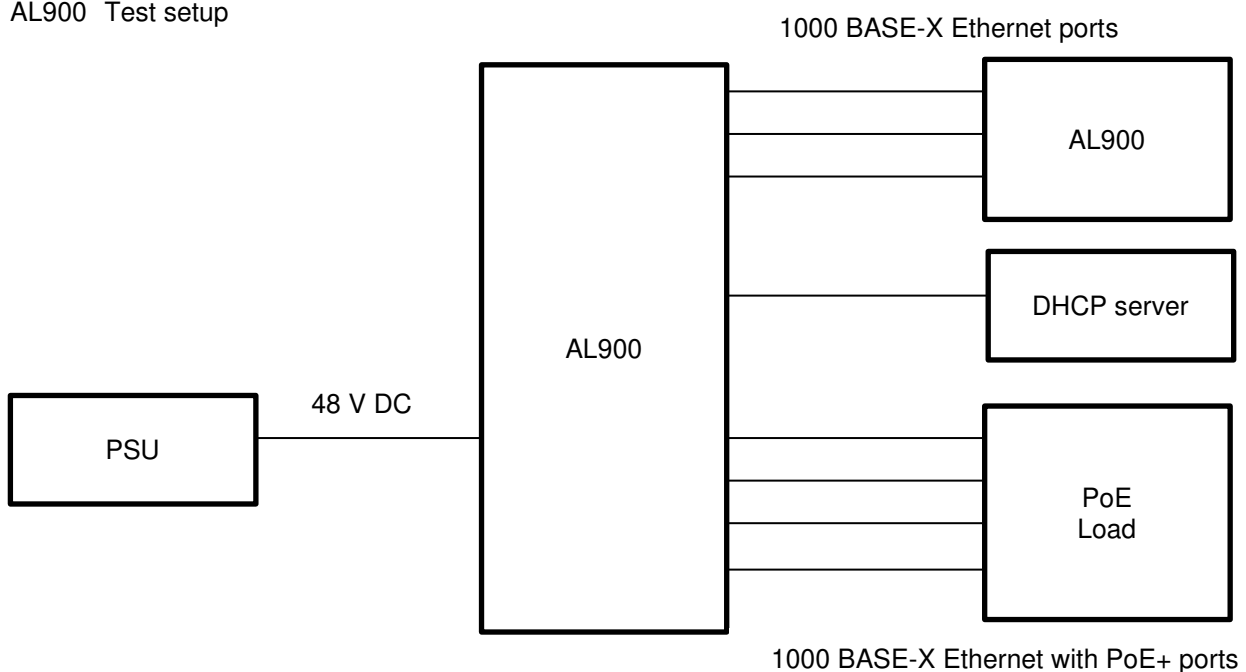
## 2 Operational States and Test Setup

Description of function of the EUT:

|   |                                                                                                                                         |  |
|---|-----------------------------------------------------------------------------------------------------------------------------------------|--|
| 1 | Introduction                                                                                                                            |  |
|   |                                                                                                                                         |  |
| - | The AL900-0100 is a self managed network switch. It has 8 Ports (port 1- port 8) with AVB capability). No user configuration is needed. |  |
| - | 1000BASE-T Ethernet switch, 9 + 1 ports.                                                                                                |  |
| - | PoE+ support up to 120W in total (ports 5 – port 8). 4x PoE+ (802.3at PoE+). Up to 25W / port.                                          |  |
| - | SFP rear connector (25000BASE-X) for cascading two switches (over SGMII).                                                               |  |
| - | Nominal 48VDC / 54 VDC power input                                                                                                      |  |
|   |                                                                                                                                         |  |
|   |                                                                                                                                         |  |
|   |                                                                                                                                         |  |
|   |                                                                                                                                         |  |
|   |                                                                                                                                         |  |

The system was setup as follows:

AL900 Test setup



## 2 I/O ports and connectors

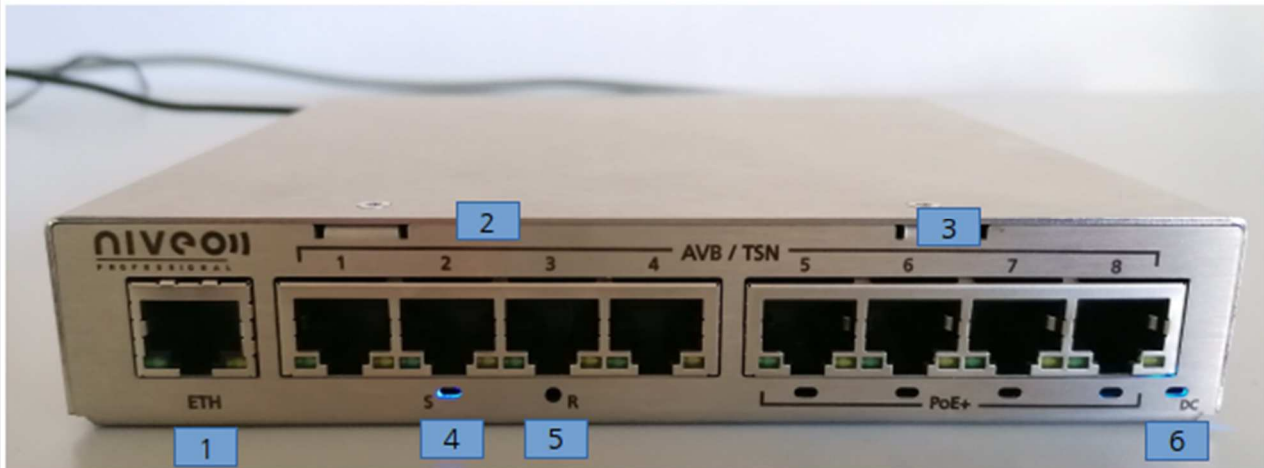


photo: front connections (photo similar)

1: Ethernet VLAN Port (not AVB applicable)

2: Port 1 – Port 4 are 1000 BASE-X Ethernet ports which are AVB applicable

3: Port 5 – Port 8 are 1000 BASE-X Ethernet ports which are AVB applicable.  
4x PoE+ (802.3at PoE+). Up to 25W / port. 120W in total.

4: System LED. Normal State at booting is on.

5: Reset function. A reset will reboot the system. Power will be on.

6: DC LED: This LED is a tricolor LED. Normal state is :

- Green on
- Blue on

This signals that the power is OK.

| Port No.                     | Name | Type* | Cable Max. >3m | Cable Shielded | Comments (Sip/Sop lines must include description of use) |
|------------------------------|------|-------|----------------|----------------|----------------------------------------------------------|
| 1                            | VLAN | TP    | 10 m           | Yes            |                                                          |
| 2                            | LAN  | TP    | 10m            | Yes            |                                                          |
| 3                            | POE  | TP    | 10 m           | Yes            |                                                          |
| Supplementary information:   |      |       |                |                |                                                          |
| TP = Telecommunication Ports |      |       |                |                |                                                          |

## 2 I/O ports and connectors

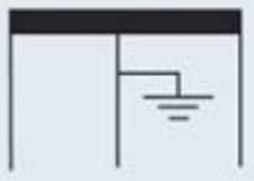
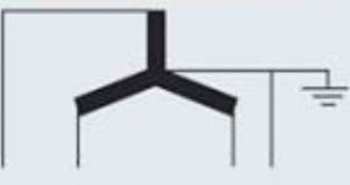


photo: back connections (photo similar)

- 1: Power input connector. DC Input range 48 VDC, 54 VDC, 3A max.
- 2: Management Ethernet Port without AVB applicable. This 1000 BASE-X Ethernet port is for service only. Not usable for customer.
- 3: SFP 2500 BASE-X port for cascading two AL900-0100 switches. It is a SGMII connection and not hipot resistant!

| Port No.                                                                                                                                                                                       | Name                                               | Type* | Cable Max. >3m | Cable Shielded | Comments (Sip/Sop lines must include description of use) |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|-------|----------------|----------------|----------------------------------------------------------|
| 0                                                                                                                                                                                              | Enclosure                                          | N/E   | —              | —              | None                                                     |
| 1                                                                                                                                                                                              | <input checked="" type="checkbox"/> DC Power Ports | DC    | 1 m            | No             |                                                          |
| 2                                                                                                                                                                                              | MGMT                                               | TP    | -              | -              | Service Port – not used during test                      |
| 3                                                                                                                                                                                              | SFP                                                | TP    | 10 m           | Yes            |                                                          |
| Supplementary information:<br>*Note: AC = AC Power Port      DC = DC Power Port      N/E = Non-Electrical<br>Batt=Battery<br>Sip/Sop= Signal Input/output Port<br>TP = Telecommunication Ports |                                                    |       |                |                |                                                          |

The following states were defined as the operating conditions:

| Rated voltage for all tests and measurements:                                       |                          |                         |
|-------------------------------------------------------------------------------------|--------------------------|-------------------------|
| 1 Single Phase, 3 wire (Residential), grounded midpoint                             |                          |                         |
|    | Conducted emission tests | Radiated emission tests |
| $U_B = 120 \text{ V}$<br>(against ground)                                           | X                        | X                       |
| $U_B = 240 \text{ V}$<br>(Phase conductors)                                         |                          |                         |
| 3 Phase, 4 wire (Industrial and Commercial), solidly grounded wye                   |                          |                         |
|   | Conducted emission tests | Radiated emission tests |
| $U_B = 208Y/120 \text{ V}$                                                          |                          |                         |
| $U_B = 240Y/131 \text{ V}$                                                          |                          |                         |
| $U_B = 480Y/277 \text{ V}$                                                          |                          |                         |
| $U_B = 600Y/347 \text{ V}$                                                          |                          |                         |
| 3 Phase, 3 wire (Industrial and Commercial), corner grounded delta                  |                          |                         |
|  | Conducted emission tests | Radiated emission tests |
| $U_B = 240 \text{ V}$                                                               |                          |                         |
| $U_B = 480 \text{ V}$                                                               |                          |                         |
| $U_B = 600 \text{ V}$                                                               |                          |                         |

Ancillary equipment provided by the customer

|                     |                      |                                                                                      |
|---------------------|----------------------|--------------------------------------------------------------------------------------|
| AL900: SN: 52050305 |                      |    |
| PoE Load            | 3 X<br>LTC4269IDKD-2 |   |
| PoE Load            | 1 X<br>LTC4269IDKD-2 |  |

Ancillary equipment provided by the customer

|             |                                         |                                                                                     |
|-------------|-----------------------------------------|-------------------------------------------------------------------------------------|
| DHCP server | FRITZ!Box<br>SN:<br>F422.382.00.030.808 |   |
| PSU:        | MEAN WELL<br>NDR-120-48                 |  |

### 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:

- none

Special EMC measures, as a result of the tests:

- none

## 4 Overview

| Conducted emissions FCC 47 CFR Part 15 section 15.107 (a),(b) [3]<br>ICES-003 Issue 7 section 3.2.1[4] |                                                |                                                                                                            |                    |            |        |
|--------------------------------------------------------------------------------------------------------|------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------|------------|--------|
| Application                                                                                            | Frequency range                                | Limits                                                                                                     | Reference standard | Tested EUT | Status |
| AC supply line<br>Class A                                                                              | 0.15 to 0.5 MHz<br>0.5 to 30 MHz               | 79 dB(μV) QP<br>66 dB(μV) AV<br>73 dB(μV) QP<br>60 dB(μV) AV                                               | ANSI<br>C63.4      |            | ---    |
| AC supply line<br>Class B                                                                              | 0.15 to 0.5 MHz<br>0.5 to 5 MHz<br>5 to 30 MHz | 66 to 56 dB(μV) QP*<br>56 to 46 dB(μV) AV*<br>56 dB(μV) QP<br>46 dB(μV) AV<br>60 dB(μV) QP<br>50 dB(μV) AV | ANSI<br>C63.4      | 1          | Passed |
| *: 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<br>88 to 216 MHz<br>216 to 960 MHz<br>960 to 1000 MHz<br><br>above 1000 MHz | 39.0 dB(μV/m) QP at 10 m<br>43.5 dB(μV/m) QP at 10 m<br>46.5 dB(μV/m) QP at 10 m<br>49.5 dB(μV/m) QP at 10 m<br><br>49.5 dB(μV/m) AV at 10 m and<br>69.5 dB(μV/m) PK at 10 m | ANSI C63.4         | -          | ---<br><br>---       |
| Radiated Emission Class A                                        | 30 to 88 MHz<br>88 to 216 MHz<br>216 to 960 MHz<br>960 to 1000 MHz<br><br>above 1000 MHz | 50.0 dB(μV/m) QP at 3 m<br>53.5 dB(μV/m) QP at 3 m<br>56.0 dB(μV/m) QP at 3 m<br>64.0 dB(μV/m) QP at 3 m<br><br>64.0 dB(μV/m) AV at 3 m and<br>84.0 dB(μV/m) PK at 3 m       | ANSI C63.4         | -          | ---<br><br>---       |
| Radiated Emission Class B                                        | 30 to 88 MHz<br>88 to 216 MHz<br>216 to 960 MHz<br>960 to 1000 MHz<br><br>above 1000 MHz | 40.0 dB(μV/m) QP at 3 m<br>43.5 dB(μV/m) QP at 3 m<br>46.0 dB(μV/m) QP at 3 m<br>54.0 dB(μV/m) QP at 3 m<br><br>54.0 dB(μV/m) AV at 3 m and<br>74.0 dB(μV/m) PK at 3 m       | ANSI C63.4         | 1          | Passed<br><br>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<br>88 to 216 MHz<br>216 to 230 MHz<br>230 to 960 MHz<br>960 to 1000 MHz | 40.0 dB(μV/m) QP at 10 m<br>43.5 dB(μV/m) QP at 10 m<br>46.4 dB(μV/m) QP at 10 m<br>47.0 dB(μV/m) QP at 10 m<br>49.5 dB(μV/m) QP at 10 m | ANSI C63.4         | -          | ---    |
|                                                       | above 1000 MHz                                                                       | No limit available for 10 m                                                                                                              |                    |            |        |
| Radiated Emission Class A                             | 30 to 88 MHz<br>88 to 216 MHz<br>216 to 230 MHz<br>230 to 960 MHz<br>960 to 1000 MHz | 50.0 dB(μV/m) QP at 3 m<br>54.0 dB(μV/m) QP at 3 m<br>56.9 dB(μV/m) QP at 3 m<br>57.0 dB(μV/m) QP at 3 m<br>60.0 dB(μV/m) QP at 3 m      | ANSI C63.4         | -          | ---    |
|                                                       | above 1000 MHz                                                                       | 60 dB(μV/m) AV at 3 m<br>80 dB(μV/m) PK at 3 m                                                                                           |                    |            | ---    |
| Radiated Emission Class B                             | 30 to 88 MHz<br>88 to 216 MHz<br>216 to 230 MHz<br>230 to 960 MHz<br>960 to 1000 MHz | 30.0 dB(μV/m) QP at 10 m<br>33.1 dB(μV/m) QP at 10 m<br>35.6 dB(μV/m) QP at 10 m<br>37.0 dB(μV/m) QP at 10 m<br>43.5 dB(μV/m) QP at 10 m | ANSI C63.4         | -          | ---    |
|                                                       | above 1000 MHz                                                                       | No limit available for 10 m                                                                                                              |                    |            |        |
| Radiated Emission Class B                             | 30 to 88 MHz<br>88 to 216 MHz<br>216 to 230 MHz<br>230 to 960 MHz<br>960 to 1000 MHz | 40.0 dB(μV/m) QP at 3 m<br>43.5 dB(μV/m) QP at 3 m<br>46.0 dB(μV/m) QP at 3 m<br>47.0 dB(μV/m) QP at 3 m<br>54.0 dB(μV/m) QP at 3 m      | ANSI C63.4         | 1          | Passed |
|                                                       | above 1000 MHz                                                                       | 54 dB(μV/m) AV at 3 m<br>74 dB(μV/m) PK at 3 m                                                                                           |                    |            | Passed |

Remark: As declared by the applicant the highest internal clock frequency is 2,5 GHz.  
Therefore the radiated emission measurement must be carried out up to 5<sup>th</sup> of the highest internal clock frequency in this case 12,5 GHz.

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

## 5 Results

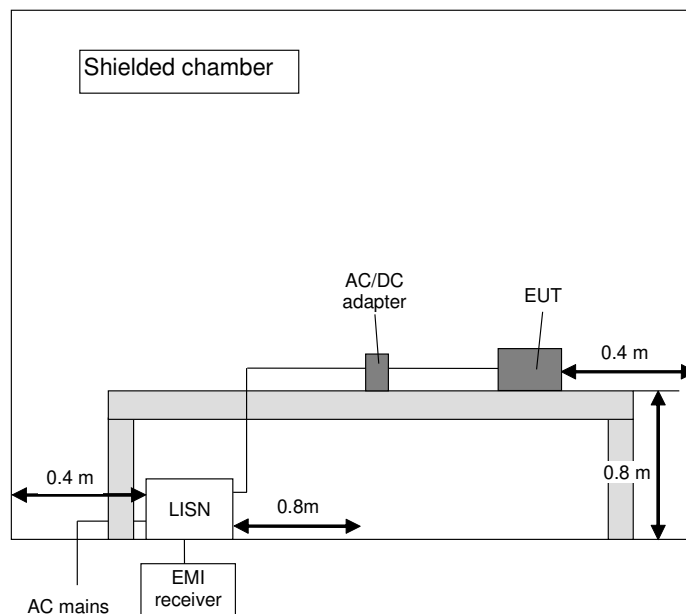
### 5.1 Conducted emissions on power supply lines

#### 5.1.1 Test method

The test is carried out in a shielded chamber. Table-top devices are 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 are placed directly on the ground plane. In case of DC powered equipment, which is not exclusively powered by a battery, it is connected to the LISN via a suitable AC/DC adaptor. The setup of the equipment under test is in accordance to [1].

The frequency range 150 kHz to 30 MHz is measured with an EMI receiver set to MAX hold mode with Peak and Average detectors and a resolution bandwidth of 9 kHz. A scan is carried out on the phase and neutral line of the AC mains network. If emissions less than 10 dB below the appropriate limit are detected, these emissions are measured with an Average and Quasi-Peak detector on all lines.

| Frequency range   | Resolution bandwidth |
|-------------------|----------------------|
| 150 kHz to 30 MHz | 9 kHz                |



**5.2 Conducted emission measurement on AC mains according to  
FCC 47 CFR Part 15 section 15.107 and ICES-003 Issue 7 section 3.2.1  
Frequency range 150 kHz to 30 MHz**

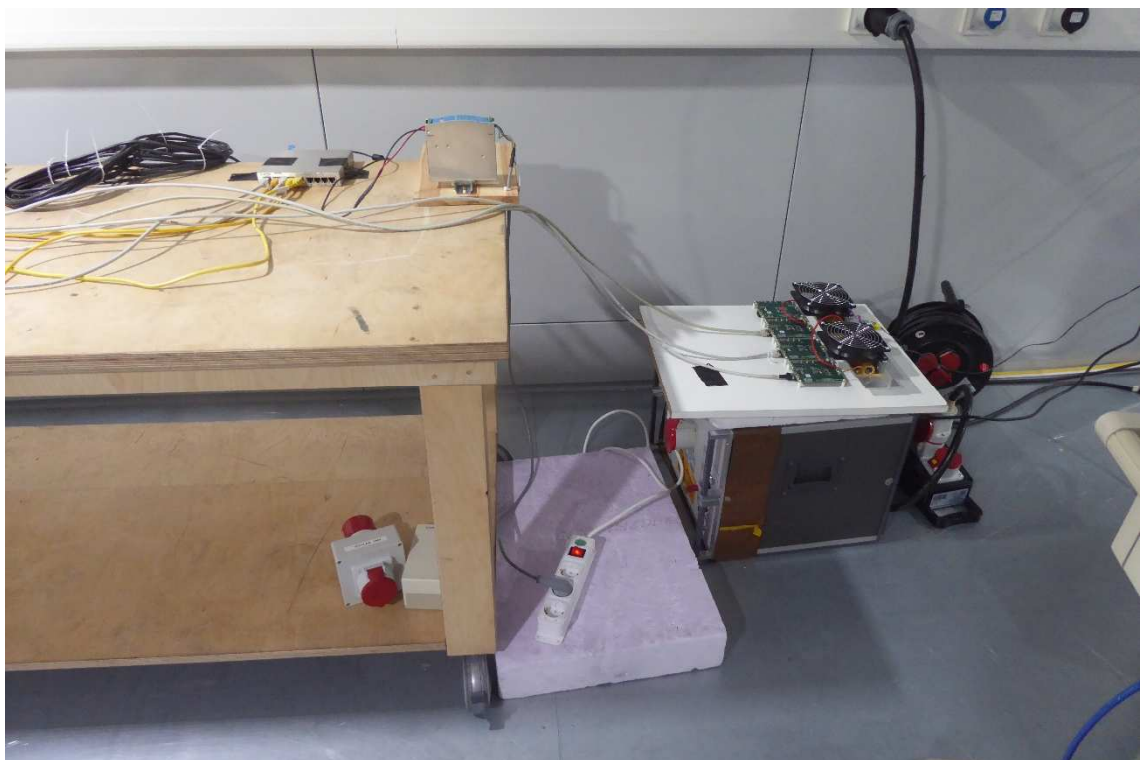
Measuring setup:            -Table setup  
                                     -Photo(s) of the test setup is shown below



**Test setup 1: Conducted Emission/Overview**



**Test setup 2: Conducted Emission/Test point AC**



**Test setup 3: Conducted Emission/ Ancillary equipment**

Measuring record: The measuring records are presented on the following pages.

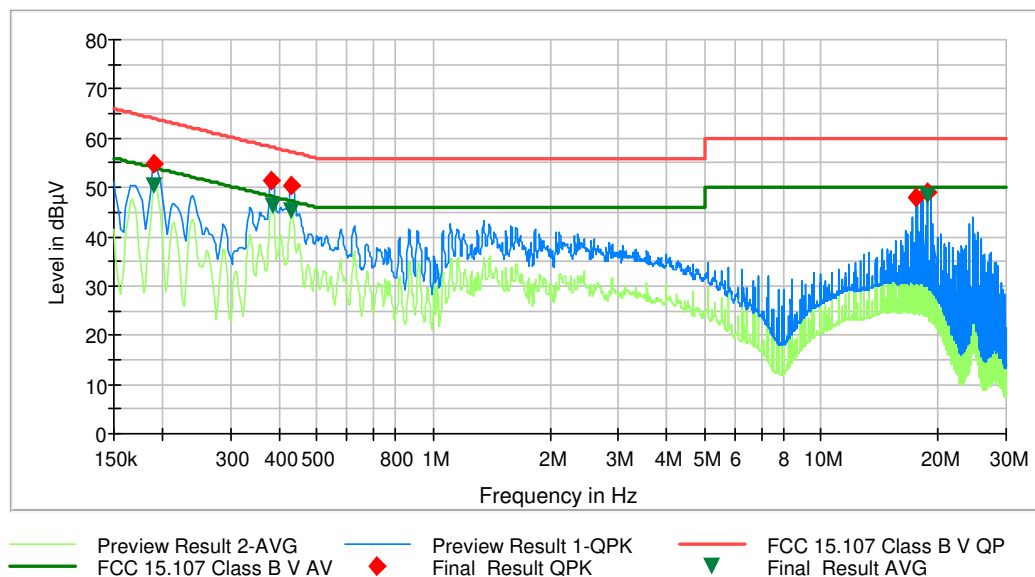
Measuring result: The requirements Class B made in the test documents were passed.

|      |                     |
|------|---------------------|
| Time | 13.05.2022 09:25:55 |
|------|---------------------|

#### EUT Info

|                       |                    |
|-----------------------|--------------------|
| Test site:            | shielded room M155 |
| Setup:                | table setup        |
| Operator:             | U.Kracht           |
| EUT:                  | AL900              |
| Manufacturer:         | EKF Elektronik     |
| Operating conditions: | active             |
| Comment:              | 120 V 60 Hz        |

The curves in the diagram 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 "▼".



**Graphic 1: 212507\_120V\_PSU1\_01\_Graphics\_Full Spectrum**

| Frequency | QuasiPeak | Average  | Limit    | Margin | Meas. Time | Band width | Line | PE  | Corr. |
|-----------|-----------|----------|----------|--------|------------|------------|------|-----|-------|
| [MHz]     | [dBμV/m]  | [dBμV/m] | [dBμV/m] | [dB]   | [ms]       | [kHz]      | []   | []  | [dB]  |
| 0,1905    | ---       | 50,38    | 54,01    | 3,64   | 15000,     | 9,00       | N    | GND | 9,80  |
| 0,1905    | 54,74     | ---      | 64,01    | 9,27   | 15000,     | 9,00       | N    | GND | 9,80  |
| 0,3818    | 51,38     | ---      | 58,24    | 6,86   | 15000,     | 9,00       | L1   | GND | 9,80  |
| 0,3863    | ---       | 46,45    | 48,14    | 1,70   | 15000,     | 9,00       | L1   | GND | 9,80  |
| 0,4290    | 50,46     | ---      | 57,27    | 6,81   | 15000,     | 9,00       | N    | GND | 9,80  |
| 0,4313    | ---       | 45,26    | 47,23    | 1,97   | 15000,     | 9,00       | N    | GND | 9,80  |
| 17,6258   | 47,85     | ---      | 60,00    | 12,15  | 15000,     | 9,00       | L1   | GND | 10,70 |
| 18,7553   | ---       | 48,43    | 50,00    | 1,57   | 15000,     | 9,00       | L1   | GND | 10,80 |
| 18,7553   | 48,96     | ---      | 60,00    | 11,04  | 15000,     | 9,00       | L1   | GND | 10,80 |

**Table 1: 212507\_120V\_PSU1\_01\_Final\_Result**

Measuring equipment:

| Test site and Type                                          |            | Manufacturer       | Serial No. | PM. No. | Val. Date  | Val Due |
|-------------------------------------------------------------|------------|--------------------|------------|---------|------------|---------|
| M155<br>Shielded chamber                                    |            | Albatross Projects |            | 482786  | *          | *       |
| Type of validation: GND-Plane according to: ANSI C63.4-2014 |            |                    |            |         | 25.09.2020 | 09.2022 |
| Test equipment                                              | Type       | Manufacturer       | Serial No. | PM. No. | Cal. Date  | Cal Due |
| Systemsoftware EMC32<br>M155                                | EMC32      | Rohde & Schwarz    | 100619     | 483182  | *          | *       |
| LISN                                                        | NSLK8128RC | Schwarzbeck        | 0412       | 483186  | 15.02.2022 | 02.2024 |
| LISN                                                        | NSLK8128   | Schwarzbeck        | 8128155    | 480058  | 14.02.2022 | 02.2024 |
| Transient Limiter                                           | CFL9206A   | Ametek CTS Europe  | 56222      | 483263  | 14.02.2022 | 02.2024 |
| EMI Testreceiver ESR7                                       | ESR7       | Rohde & Schwarz    | 101939     | 482558  | 15.02.2022 | 02.2024 |

(\*) Calibration not necessary

time stamp: 24.03.2022 used: 18.05.2022

## 5.3 Radiated emissions

### 5.3.1 Test method

The radiated emission measurement is subdivided into two stages.

- A measurement carried out in a semi anechoic chamber with reflecting ground plane and various antenna heights in the frequency range 30 MHz to 1 GHz.
- A measurement carried out in a fully anechoic chamber and various antenna heights of 100 to 400 cm at a distance of 3 m to the EUT position in the frequency range 1 GHz to 40 GHz.

#### Preliminary and final measurement 30 MHz to 1 GHz

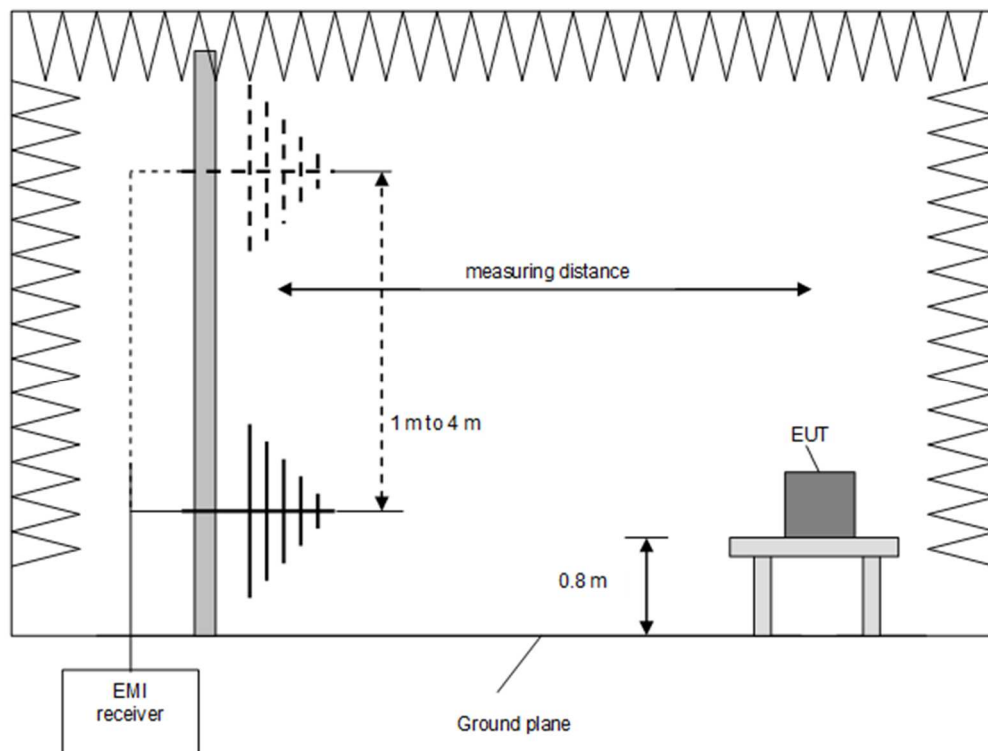
The preliminary and final measurements are performed in a semi-anechoic chamber with a metal ground plane in a 3 m distance.

Tabletop devices will set up on a non-conducting support with a height of 80 cm

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.

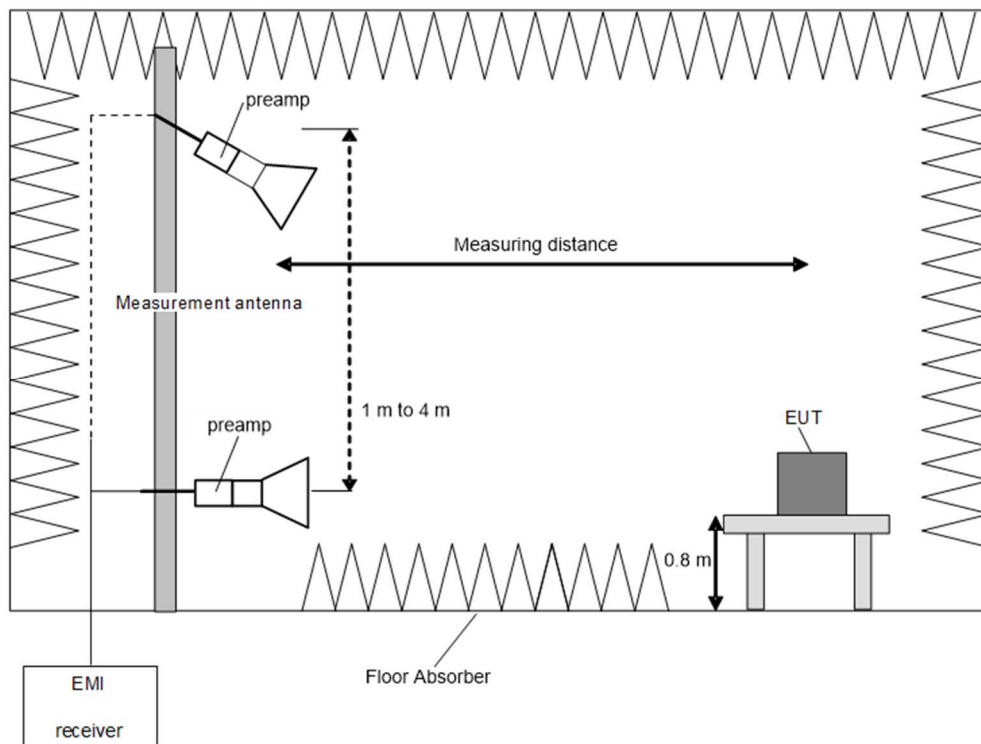
### Preliminary and final measurement > 1 GHz

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:

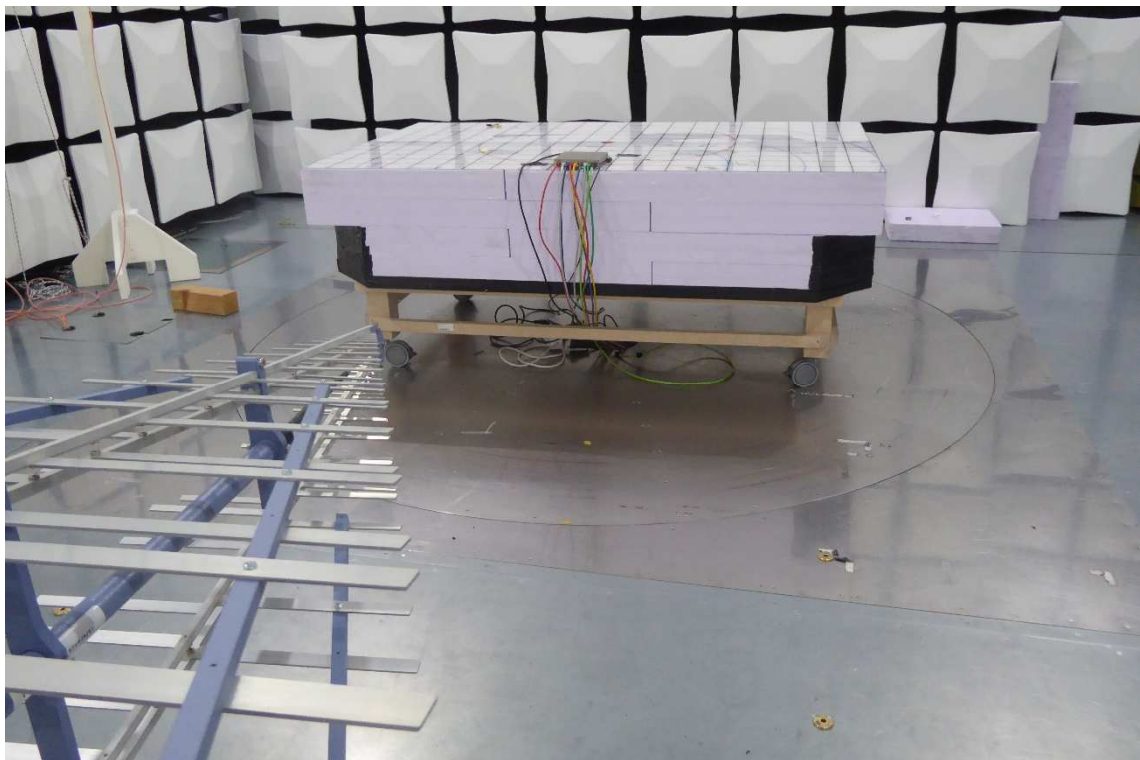
The following procedure is used:

- 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.

#### 5.4 Radiated radio disturbance Frequency range 30 MHz to 1 GHz according to FCC 47 CFR Part 15 section 15.109 and ICES-003 Issue 7 section 3.2.2

Measuring setup:

- Table setup
- Photo(s) of the test setup is shown below



**Test setup 4: Radiated Emission/Turntable position 0**

Measuring procedure SAC: The interfering field strength is measured in a semi anechoic chamber. Here the equipment under test is measured from various sides in normal fitted position. The antenna is adjusting in height whether the test object is emitting interference at certain frequencies. This procedure makes it possible to ascertain without the effect of external interference sources. If measuring above 1 GHz, the ground of the SAC shall be covered with ground absorber. The measuring procedure above 1 GHz is performed according to the above mentioned standard.

Measuring record: The measuring records are presented on the following pages.

Measuring result: The requirements Class B made in the test documents were passed.

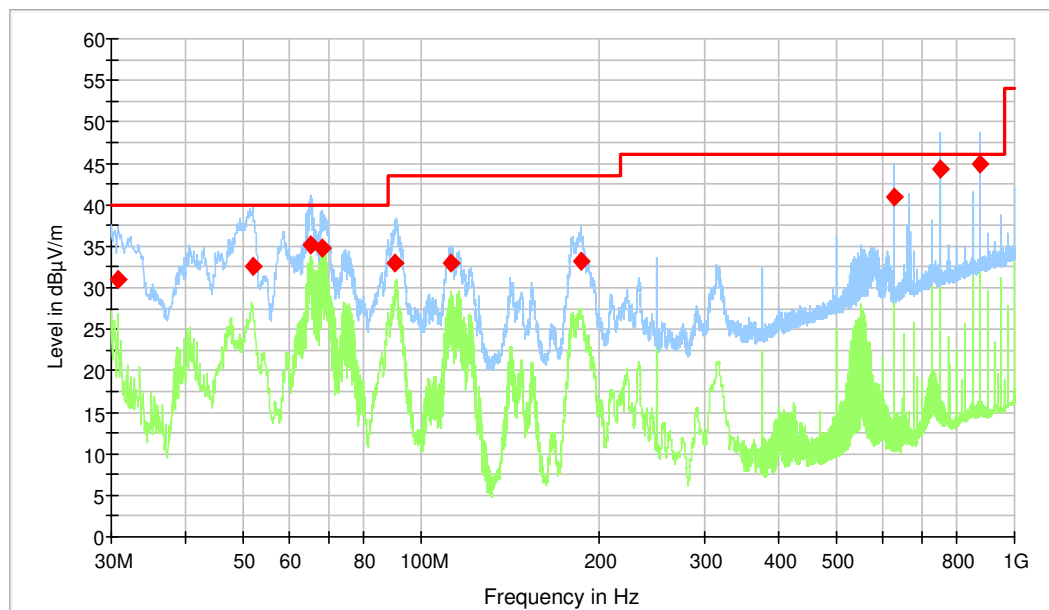
## Measurement result 212507FCC01

### Test Time

|      |                     |
|------|---------------------|
| Time | 10.05.2022 13:18:33 |
|------|---------------------|

### EUT Info

|                       |                                                  |
|-----------------------|--------------------------------------------------|
| Test site:            | PHOENIX TESTLAB GmbH, Semi Anechoic Chamber M153 |
| Setup:                | Table setup                                      |
| Operator:             | J. Hanselle                                      |
| EUT:                  | AL900                                            |
| Manufacturer:         | EKF                                              |
| Operating conditions: | 120 V 60 Hz, ETH 1Gbit/s, POE 20 W, 12,5 W       |
| Comment:              |                                                  |



**Graphic 2: 212507FCC01\_Graphics\_Full Spectrum**

| Frequency | QuasiPeak | Limit    | Margin | Meas. Time | Band width | Height | Pol | Azimuth | Corr. |
|-----------|-----------|----------|--------|------------|------------|--------|-----|---------|-------|
| [MHz]     | [dBμV/m]  | [dBμV/m] | [dB]   | [ms]       | [kHz]      | [cm]   | []  | [deg]   | [dB]  |
| 30,6900   | 31,01     | 40,00    | 8,99   | 1000,0     | 120,0      | 274,00 | V   | -5,00   | 25,20 |
| 51,8580   | 32,59     | 40,00    | 7,41   | 1000,0     | 120,0      | 100,00 | V   | 337,00  | 12,70 |
| 65,1060   | 35,20     | 40,00    | 4,80   | 1000,0     | 120,0      | 133,00 | V   | 18,00   | 13,20 |
| 68,1900   | 34,73     | 40,00    | 5,27   | 1000,0     | 120,0      | 142,00 | V   | 37,00   | 14,10 |
| 90,4380   | 32,95     | 43,52    | 10,57  | 1000,0     | 120,0      | 102,00 | V   | 265,00  | 16,90 |
| 112,2180  | 32,97     | 43,52    | 10,55  | 1000,0     | 120,0      | 109,00 | V   | 18,00   | 17,50 |
| 185,2740  | 33,12     | 43,52    | 10,40  | 1000,0     | 120,0      | 102,00 | V   | 15,00   | 14,90 |
| 624,9900  | 40,92     | 46,02    | 5,10   | 1000,0     | 120,0      | 143,00 | H   | 203,00  | 25,90 |
| 875,0100  | 44,83     | 46,02    | 1,19   | 1000,0     | 120,0      | 109,00 | H   | 241,00  | 29,10 |
| 749,9940  | 44,32     | 46,02    | 1,70   | 1000,0     | 120,0      | 109,00 | H   | -14,00  | 27,50 |

**Table 2: 212507FCC01\_Final\_Result**

Measuring equipment:

| Test site and Type                                                                                    |         | Manufacturer       | Serial No. | PM. No. | Val. Date  | Val Due |
|-------------------------------------------------------------------------------------------------------|---------|--------------------|------------|---------|------------|---------|
| M153<br>Semi Anechoic Chamber                                                                         |         | Albatross Projects |            | 482784  | -          | -       |
| Type of validation: NSA according to: ANSI C63.4a-2017<br>CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017 |         |                    |            |         | 22.02.2022 | 02.2023 |
| Test equipment                                                                                        | Type    | Manufacturer       | Serial No. | PM. No. | Cal. Date  | Cal Due |
| Ultralog Antenna                                                                                      | HL562E  | Rohde & Schwarz    | 101061     | 483152  | 18.05.2021 | 05.2024 |
| Attenuator 6 dB                                                                                       | WA2-6   | Weinschel          |            | 482794  | *          | *       |
| Systemsoftware EMC32<br>M153                                                                          | EMC32   | Rohde & Schwarz    | 100622     | 483150  | *          | *       |
| RF Switch Matrix                                                                                      | OSP 220 | Rohde & Schwarz    | 101376     | 483141  | *          | *       |
| RF Switch Matrix                                                                                      | OSP 220 | Rohde & Schwarz    | 101367     | 483142  | *          | *       |
| RF Switch Matrix                                                                                      | OSP 220 | Rohde & Schwarz    | 101423     | 483143  | *          | *       |
| EMI Testreceiver ESW                                                                                  | ESW     | Rohde & Schwarz    | 101819     | 483149  | 18.02.2022 | 02.2024 |

(\*) Calibration not necessary

time stamp: 24.03.2022 used: 18.05.2022

## 5.5 Radiated radio disturbance according to FCC 47 CFR Part 15 section 15.109 and ICES-003 Issue 7 section 3.2. Frequency range 1 GHz up to 40 GHz

- Measuring setup:
- Table setup
  - Photo(s) of the test setup is shown below



**Test setup 5: Radiated Emission/1 GHz - 12 GHz**



**Test setup 6: Radiated Emission/12 GHz - 18 GHz**

Measuring procedure SAC: The interfering field strength is measured in a semi anechoic chamber. The ground of the SAC is covered with floor absorber. Here the equipment under test is measured from various sides in normal fitted position. This procedure makes it possible to ascertain without the effect of external interference sources and without adjusting the antenna in height whether the test object is emitting interference at certain frequencies. The measuring procedure above 1 GHz is performed according to the above mentioned standard.

Measuring record: The measuring records are presented on the following pages.

Measuring result: The requirements Class B made in the test documents were passed.

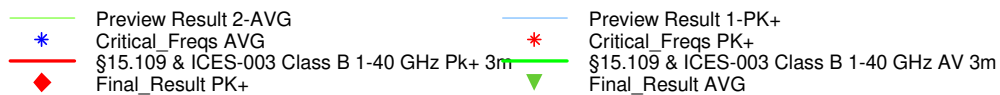
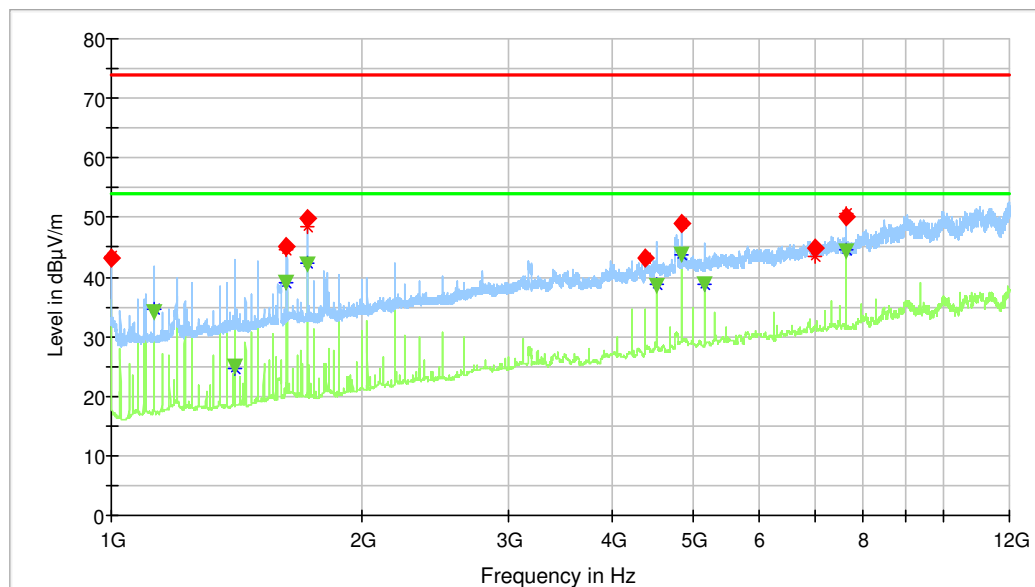
## Measurement result 212507FCC02

### Test Time

|      |                     |
|------|---------------------|
| Time | 10.05.2022 09:21:54 |
|------|---------------------|

### EUT Info

|                       |                                                  |
|-----------------------|--------------------------------------------------|
| Test site:            | PHOENIX TESTLAB GmbH, Semi Anechoic Chamber M153 |
| Setup:                | Table setup                                      |
| Operator:             | J. Hanselle                                      |
| EUT:                  | AL900                                            |
| Manufacturer:         | EKF                                              |
| Operating conditions: | 120 V 60 Hz, ETH 1Gbit/s                         |
| Comment:              |                                                  |



**Graphic 3: 212507FCC02\_Graphics\_Full Spectrum**

| Frequency | MaxPeak  | Average  | Limit    | Margin | Meas. Time | Band width | Height | Pol | Azimuth | Corr.  |
|-----------|----------|----------|----------|--------|------------|------------|--------|-----|---------|--------|
| [MHz]     | [dBμV/m] | [dBμV/m] | [dBμV/m] | [dB]   | [ms]       | [kHz]      | [cm]   | []  | [deg]   | [dB]   |
| 1000,0000 | 43,29    | ---      | 74,00    | 30,71  | 1000,0     | 1000,      | 103,00 | H   | 103,00  | -12,70 |
| 1124,9000 | ---      | 34,03    | 54,00    | 19,97  | 1000,0     | 1000,      | 112,00 | H   | 12,00   | -12,20 |
| 1406,7500 | ---      | 24,99    | 54,00    | 29,01  | 1000,0     | 1000,      | 149,00 | H   | -7,00   | -9,70  |
| 1624,9000 | 45,01    | ---      | 74,00    | 28,99  | 1000,0     | 1000,      | 301,00 | H   | 233,00  | -7,70  |
| 1625,0000 | ---      | 39,06    | 54,00    | 14,94  | 1000,0     | 1000,      | 301,00 | H   | 233,00  | -7,70  |
| 1718,7500 | ---      | 42,01    | 54,00    | 11,99  | 1000,0     | 1000,      | 296,00 | V   | 347,00  | -7,40  |
| 1718,7500 | 49,75    | ---      | 74,00    | 24,25  | 1000,0     | 1000,      | 304,00 | V   | 344,00  | -7,40  |
| 4375,0000 | 43,27    | ---      | 74,00    | 30,73  | 1000,0     | 1000,      | 162,00 | V   | 10,00   | 3,10   |
| 4531,2500 | ---      | 38,60    | 54,00    | 15,40  | 1000,0     | 1000,      | 146,00 | H   | 321,00  | 3,80   |
| 4843,7500 | ---      | 43,73    | 54,00    | 10,27  | 1000,0     | 1000,      | 112,00 | V   | 8,00    | 5,00   |
| 4843,9500 | 49,11    | ---      | 74,00    | 24,89  | 1000,0     | 1000,      | 148,00 | V   | 10,00   | 5,00   |
| 5156,2500 | ---      | 38,76    | 54,00    | 15,24  | 1000,0     | 1000,      | 101,00 | H   | 22,00   | 5,70   |
| 7011,5500 | 44,93    | ---      | 74,00    | 29,07  | 1000,0     | 1000,      | 388,00 | H   | 135,00  | 8,30   |
| 7656,2500 | ---      | 44,29    | 54,00    | 9,71   | 1000,0     | 1000,      | 108,00 | V   | -2,00   | 8,50   |
| 7656,2500 | 50,09    | ---      | 74,00    | 23,91  | 1000,0     | 1000,      | 112,00 | V   | 2,00    | 8,50   |

**Table 3: 212507FCC02\_Final\_Result**

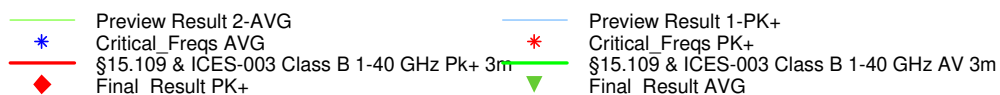
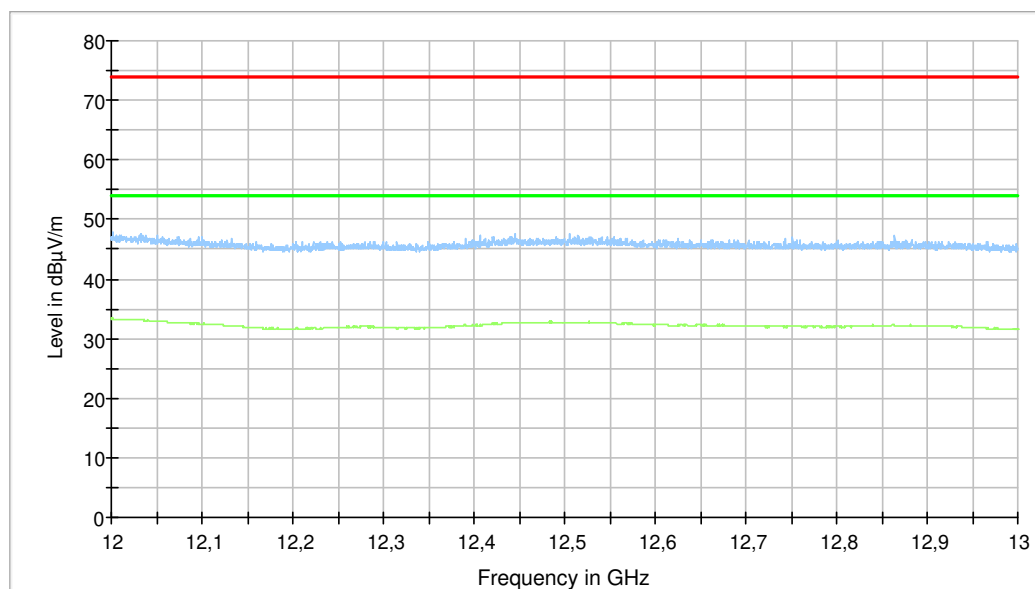
## Measurement result 212507FCC03

### Test Time

|      |                     |
|------|---------------------|
| Time | 10.05.2022 11:17:21 |
|------|---------------------|

### EUT Info

|                       |                                                  |
|-----------------------|--------------------------------------------------|
| Test site:            | Phoenix TESTLAB GmbH, Semi Anechoic Chamber M153 |
| Setup:                | Table setup                                      |
| Operator:             | J. Hanselle                                      |
| EUT:                  | al900                                            |
| Manufacturer:         | EKF                                              |
| Operating conditions: | 120 V 60 Hz, ETH 1Gbit/s                         |
| Comment:              |                                                  |



**Graphic 4: 212507FCC03\_Graphics\_Full Spectrum**

Measuring equipment:

| Test site                                                                                                | Type                   | Manufacturer         | Serial No. | PM. No. | Val. Date  | Val Due |
|----------------------------------------------------------------------------------------------------------|------------------------|----------------------|------------|---------|------------|---------|
| M154<br>Fully Anechoic Chamber                                                                           |                        | Albatross Projects   |            | 482785  | -          | -       |
| Type of validation: SVSWR according to: ANSI C63.4a-2017<br>CISPR 16-1-4 + Cor1:2010 + A1:2012 + A2:2017 |                        |                      |            |         | 22.04.2022 | 04.2023 |
| Test equipment                                                                                           | Type                   | Manufacturer         | Serial No. | PM. No. | Cal. Date  | Cal Due |
| Antenna (Log.Per.)                                                                                       | HL050                  | Rohde & Schwarz      | 100908     | 482977  | 13.08.2019 | 08.2022 |
| standard gain horn antenna                                                                               | 18240-20               | Flann Microwave      | 483        | 480294  | *          | *       |
| standard gain horn antenna                                                                               | 20240-20               | Flann Microwave      | 411        | 480297  | *          | *       |
| standard gain horn antenna                                                                               | 22240-20               | Flann Microwave      | 469        | 480299  | *          | *       |
| Preamplifier 100 MHz - 13 GHz                                                                            | JS3-00101200-23-5A     | MITEQ Hauppauge N.Y. | 681851     | 480337  | 17.02.2022 | 02.2024 |
| Preamplifier 18 GHz - 26 GHz                                                                             | JS4-18002600-20-5A     | MITEQ Hauppauge N.Y. | 658697     | 480342  | 17.02.2022 | 02.2024 |
| Preamplifier 12 GHz - 18 GHz                                                                             | JS3-12001800-16-5A     | MITEQ Hauppauge N.Y. | 571667     | 480343  | 17.02.2022 | 02.2024 |
| Preamplifier 26 GHz - 40 GHz                                                                             | JS4-26004000-25-5A     | MITEQ Hauppauge N.Y. | 563593     | 480344  | *          | *       |
| standard gain horn antenna                                                                               | 18240-20               | Pro Nova             | 269813     | 483215  | *          | *       |
| standard gain horn antenna                                                                               | 20240-20               | Flann                | 266399     | 483026  | *          | *       |
| standard gain horn antenna                                                                               | 22240-20               | Flann                | 266405     | 483027  | *          | *       |
| Preamplifier 1 GHz -18 GHz                                                                               | LNA-30-00101800-25-10P | Narda-Miteq          | 2110917    | 482967  | 18.02.2022 | 02.2024 |
| Preamplifier 12 GHz -18 GHz                                                                              | LNA-30-12001800-13-10P | Narda-Miteq          | 2089798    | 482968  | *          | *       |
| Preamplifier 18 GHz - 26 GHz                                                                             | LNA-30-18002650-20-10P | Narda-Miteq          | 2110911    | 482969  | 18.02.2022 | 02.2024 |
| Preamplifier 26 GHz - 40 GHz                                                                             | LNA-30-26004000-27-10P | Narda-Miteq          | 2110293    | 482970  | 18.02.2022 | 02.2024 |
| EMI Receiver / Spectrum Analyser                                                                         | ESW                    | Rohde & Schwarz      | 101819     | 483149  | 18.02.2022 | 02.2024 |
| Systemsoftware EMC32 M154                                                                                | EMC32                  | Rohde & Schwarz      | 100638     | 483173  | *          | *       |

(\*) Calibration not necessary

time stamp: 24.03.2022 used: 28.06.2022

## 6 Report History

| Report Number | Date       | Comment             |
|---------------|------------|---------------------|
| E212507E1     | 10.08.2022 | Initial Test Report |
| -             | -          | -                   |
| -             | -          | -                   |

## 7 List of Annexes

|         |                     |         |
|---------|---------------------|---------|
| Annex A | Test Setup Photos   | 4 pages |
| Annex B | EUT external Photos | 5 pages |
| Annex C | EUT internal Photos | 4 pages |