Test report

24-0165RP41-003

Product / EUT:	*RFID Reader*
Type designation:	*ARE H3.0 Iso FDX B/A*
Tested type:	*ARE H3.0 Iso FDX B/A*
EUT authorization:	☒ Certification ☐ Suppliers Declaration of Conformity
Production level:	*ID Number 1007338*
Firmware:	*v1.1.6.0*
S/N:	*000169*
FCC ID:	*V7IAREH30LF*
Manufacturer:	*AEG Identifikationssysteme GmbH* *Hörvelsinger Weg 47* *89081 Ulm / Germany*
Test remit:	47 CFR Part 15 – Subpart C – Intentional radiators in accordance with the procedures given in ANSI C63.10-2013 and ANSI C63.4a-2017
The standards were:	☒ kept ☐ kept, for the limited scope of testing ☐ not kept
Remark:	☒ Validation covered by the accredited scope ☐ Validation not covered by the accredited scope according:_____ ☐ Validation of the EMC-requirements partly proceeded

Remark: The test results effects only to the related items tested at the time of the test. The test report shall not be reproduced except in full without the written approval of the testing laboratory. Information provided by the customer are identified in italic letters and may have an influence on the validity of test results.

Applicant:	*AEG Identifikationssysteme GmbH* *Hörvelsinger Weg 47* *89081 Ulm / Germany*

EUT-

Date of arrival:	08/16/2024
Test ID:	24-0165PR33-002
Date(s) of test:	08/26/2024 till 08/28/2024

Burgrieden, 11/15/2024

Released by:

Principal Engineer - Christian Vogelmann

Test laboratory:	EMCE GmbH Ingenieurbüro für EMV-Prüfungen und Schaltungsentwicklung Untere Wiesen 1 / 88483 Burgrieden / Germany

DAkkS-Registration No:	D-PL-12122-01-00
USA / CAB-Registration No.:	BNetzA-CAB-02/21-01
Canada / CAB Identifier:	DE-0019

Designated by:
Bundesnetzagentur

Bundesnetzagentur

BNetzA-CAB-02/21-01

Accredited by:
Deutsche Akkreditierungsstelle GmbH

ilac-MRA

DAkkS
Deutsche Akkreditierungsstelle
D-PL-12122-01-00

Scope:

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1 General information

Project manager: Mr. S. Vogelmann
Inspector: Mr. S. Vogelmann

EMCE GmbH
Ingenieurbüro für EMV-Prüfungen und Schaltungsentwicklung

Contact person: Mr. Leuthe / AEG Identifikationssysteme GmbH

Remarks: n/a

State of revision:

Source document	New Document	Date / Reviser	Modifications

2 EUT information

Sampling: The device was selected and provided by the customer.

Description: *The device is a battery-powered RFID handheld reader that is used to identify animals.*

Voltage supply: *Internal battery powered.*

Frequency list: *RFID 134.2 kHz, 32.768 kHz, 16 MHz, 17.1776 MHz, 84 MHz*

Max. clock frequency: *84 MHz*

Temperature range: *n/a*

Dimension [mm]: *(LxWxH) / 225 x 135 x 25*

RF technology:

- ☐ Wi-Fi @2.4 GHz
- ☐ Wi-Fi @5 GHz
- ☐ Bluetooth - classic
- ☐ Bluetooth - low energy
- ☒ RFID @134.2 kHz
- ☐ RFID @13.56 MHz

Supplied / used equipment:

Designation	Type	Manufacturer	S/N
TAG	*n/a*	*AEG ID GmbH*	*n/a*

Configuration:

- ☒ As-delivered condition
- ☐ Modified

* _____

Cable designation	Type	Length	Remarks
n/a			

Software designation	Type	Manufacturer	Version
n/a			

Pictures of the EUT

Reader

Charger

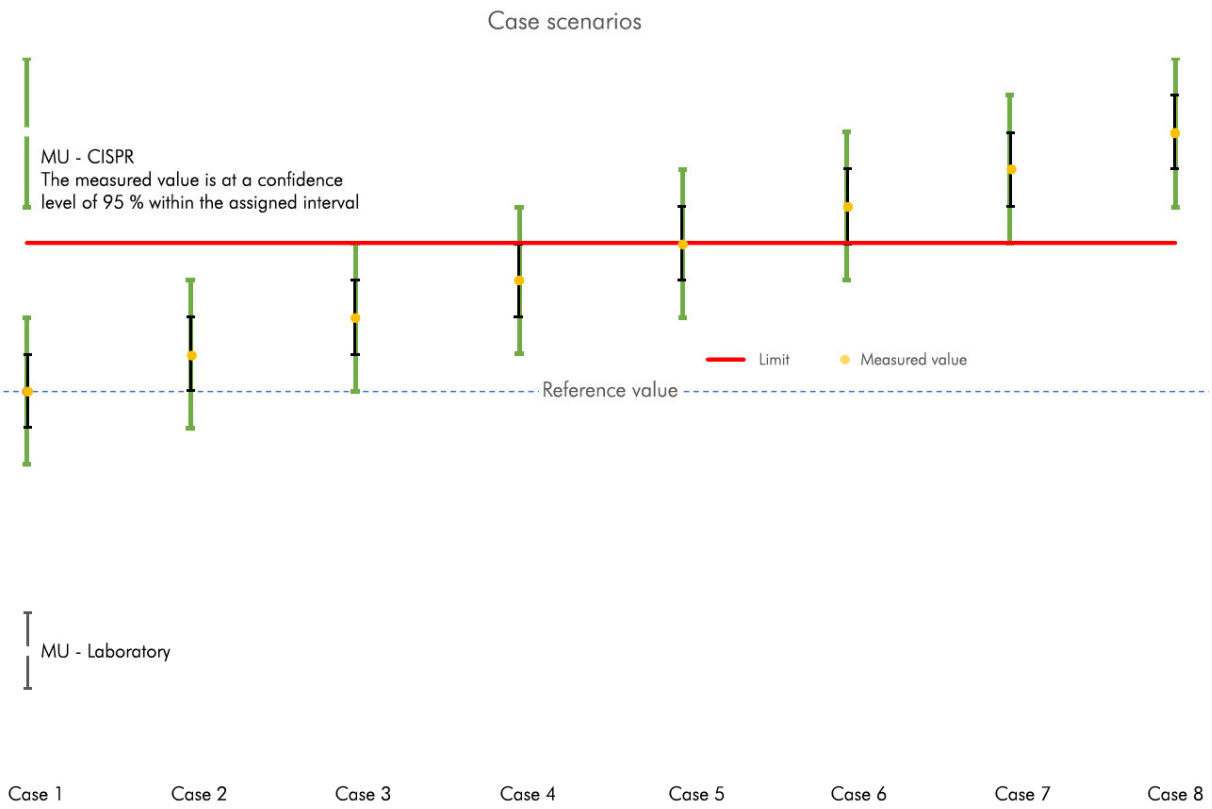
Product Name: 25W Charger
Model: TC25 SN:20230801
Batch ID:20230801
Trademark: Womeng
Manufature Date: 01-08-2023
Term of Validity:01-08-2026
Input: AC 100-240V~50/60Hz 0.8A
Output: USB-C DC 5V⎓ 3A, 9V⎓ 2.77A, 12V⎓ 2.08A
Manufacture: BRAVE FOREST LIMITED
Importer: BRAVE FOREST LIMITED
Manufacturer Address:
GB, BT9 7GL, NORTHERN IRELAND, BELFAST, 59 STOCKMANS WAY
TEL: +8616254290803
Email: BRAVEFORESTLIMITED@outlook.com
ETIM
22
PAP
EC REP
Name:Sea&Mew Consulting GmbH
Address:Mittenhuber Straße 4,92318 Neumarkt
Email:Compliance.EU@outlook.com
Made in china

3 Decision rules for conformity assessment

"Binary" decision rule - pass / fail
Unless otherwise stated in the test module, the following specifications apply:

Interference emission

No measurement uncertainties are taken into account for the statement of conformity. In the case of conducted and radiated interference emission, the measurement is considered passed if the measurement result is below the permitted limit value. The accepted measurement uncertainties for a direct statement of conformity, determined for the U_{Lab} laboratory, must be less than the U_{CISPR} values determined in the CISPR16-4-2 standard. The measurement uncertainties are stated with a confidence level of 95 %. In this case the uncertainty of measurement is not taken into account for the conformity statement.



The test is passed for case 1 - 5. A rejection is made in case 6 - 8.

The test is considered as passed if the evaluation criteria for immunity to interference and the limits of emitted interference of the specified standard are met. Measurement uncertainties are not considered.

4 Test equipment list of EMCE GmbH

Inv.-No.	Designation	Type	Manufacturer	S/N	Calibration: Interval /valid until
002	Passive probe	ESH2-Z3	Rohde & Schwarz		1 Year(s)/ 2024-12-31
003	LISN 1	ESH3-Z5	Rohde & Schwarz	835268/007	1 Year(s)/ 2025-03-31
004	LISN 2	ESH3-Z5	Rohde & Schwarz	835268/003	1 Year(s)/ 2025-03-31
006	LISN	NNBM 8125	Schwarzbeck	8125371	1 Year(s)/ 2025-02-28
007	Absorbing clamp	MDS 21	Schwarzbeck	942436	1 Year(s)/ 2025-01-31
008	Loop antenna 9kHz-30MHz	HFH2-Z2	Rohde & Schwarz	835776/0002	3 Year(s)/ 2026-02-28
009	Antenna 30-300MHz	VHBA9123 / BBA9106	Schwarzbeck	435	3 Year(s)/ 2024-12-22
010	Antenna 250-1200MHz	UHALP 9108A	Schwarzbeck	108	3 Year(s)/ 2025-12-20
013	Antenna 9 kHz-30 MHz	Ø 1.5 m	EMCE GmbH		1 Year(s)/ 2024-12-31
014	OATS	Test site 3 m referred to ANSI C63.4a-2017	EMCE GmbH		3 Year(s)/ 2027-05-06
015	OATS	Test site 10 m referred to ANSI C63.4a-2017	EMCE GmbH		3 Year(s)/ 2027-05-06
041	Loop antenna shielded	HZ-10 0816.2511.02	Rohde & Schwarz	849788/0020	3 Year(s)/ 2026-01-10
042-2	AC-Source	EMV D 5000/PAS/SyCore	Spitzenberger & Spies	A274700 / 00501	3 Year(s)/ 2026-02-10
042-1	Analyzer Reference System	ARS 16/3	Spitzenberger & Spies	A274707 / 00501	3 Year(s)/ 2024-12-28
043	Receiver	3DH/E Fieldmeter ESM-100	Maschek	971521	3 Year(s)/ 2026-09-11
059	Log.-per. antenna	HL050	Rohde & Schwarz	100006	3 Year(s)/ 2025-10-21
067	LISN	ESH2-Z5	Rohde & Schwarz	872460/043	1 Year(s)/ 2025-03-31
068	LISN	ESH2-Z5	Rohde & Schwarz	872460/042	1 Year(s)/ 2025-03-31
070	Pulse limiter + 10 dB Attenuator	ESH3-Z2	Rohde & Schwarz	n/a	1 Year(s)/ 2025-08-31

Inv.-No.	Designation	Type	Manufacturer	S/N	Calibration: Interval /valid until
073	Absorbing clamp	MDS21	Schwarzbeck	881757	1 Year(s)/ 2025-03-31
116	Vertical rod antenna	VAMP 9243	Schwarzbeck	9243-205	3 Year(s)/ 2026-05-19
117	LISN	ESH3-Z6	Rohde & Schwarz	100521	1 Year(s)/ 2025-02-28
118	Current Probe	F-52	Fischer Customs Communication, Inc.	08398	1 Year(s)/ 2025-01-31
174	LISN	ESH3-Z6	Rohde & Schwarz	101003	1 Year(s)/ 2025-02-28
175	EMI Test receiver	ESR7	Rohde & Schwarz	101108 Firmware: FW V3.46 SP3	1 Year(s)/ 2024-11-15
178	V-LISN 5 µH	NNHV 8123-400	Schwarzbeck	018	1 Year(s)/ 2025-02-28
184	V-LISN 5 µH	NNHV8123-400	Schwarzbeck	019	1 Year(s)/ 2025-02-28
225	Electric and Magnetic Field Probe-Analyzer	EHP-200A	Narda S.T.S. / PMM	170WX70205	3 Year(s)/ 2025-07-22
226	HL050 Log.-Per. Antenna 850 MHz to 26.5 GHz	HL050 4062.4063.02	Rohde & Schwarz	100829	3 Year(s)/ 2026-07-27
229	Test receiver	ESS 5 Hz - 1000 MHz	Rohde & Schwarz	845420/0005	1 Year(s)/ 2025-01-19
230	FSV40 Signal Analyzer 40 GHz	FSV40	Rohde & Schwarz	101717	2 Year(s)/ 2026-02-06
233	OSP-B157W 8 PORT	OSP-B157W8	Rohde & Schwarz	100925	2 Year(s)/ 2026-01-31
236	Broad-Band Horn Antenna 0.5-6 GHz	BBHA 9120 E	Schwarzbeck	00831	3 Year(s)/ 2027-06-25
237	Exposure Level Tester	ELT-400	Narda Safety Test Solutions	O-0028	3 Year(s)/ 2026-03-03
239	Broadband Horn Antenna 15-40 GHz	BBHA 9170	Schwarzbeck	00932	5 Year(s)/ 2029-05-23
253	Broadband Preamplifier 20-1000 MHz	ESV-Z3	Rohde & Schwarz	881 909/030	1 Year(s)/ 2025-08-31
257	Pulse limiter + 10 dB Attenuator	ESH3-Z2	Rohde & Schwarz	102769	1 Year(s)/ 2025-08-31
262	EM Clamp	KEMZ 801A	Teseq	78033	1 Year(s)/ 2025-01-31

Inv.-No.	Designation	Type	Manufacturer	S/N	Calibration: Interval /valid until
718	EMC-Software	BAT-EMC Vers. 3.18.0.19	Nexio	n/a	
997	EMC Software	EMC32 Vers. 10.60.20	Rohde & Schwarz	n/a	
1046	Environmental Simulation Chamber	MKF 115 (E3.1)	Binder GmbH	12-02215	3 Year(s)/ 2026-03-24
1212	EMC Software	WMS32 Vers. 10.60.20	Rohde & Schwarz	n/a	
8007	LPDA Broadband Antenna 180 - 1500 MHz	VULP 9118A	Schwarzbeck	899	3 Year(s)/ 2024-10-27
8008	LPDA Broadband Antenna 180 - 1500 MHz	VULP 9118A	Schwarzbeck	900	3 Year(s)/ 2024-10-27
8009	Field Monitoring Loop	FESP 5134-1	Schwarzbeck	00078	3 Year(s)/ 2024-12-20
8028	EMI Test Receiver	ESW26	Rohde & Schwarz	103119	1 Year(s)/ 2025-05-07
8033	Antenna 30-300 MHz	VHBB9124 / BBA9106	Schwarzbeck	1808	3 Year(s)/ 2026-04-21
8034	Antenna 30-300 MHz	VHBB9124 / BBA9106	Schwarzbeck	1812	3 Year(s)/ 2026-04-21
8044	EMI Test Receiver	ESW44	Rohde & Schwarz	103371	1 Year(s)/ 2025-02-28
8048	Power Sensor	NRQ6	Rohde & Schwarz	101890	2 Year(s)/ 2026-08-28

5 Testplan provided by customer

☐ Test according to the test plan provided by the customer
☐ Deviation from the test plan authorized by the customer
☒ Test according standard

Source document	Date / Reviser	Modifications

6 EMC Tests

7 Test(s) according 47 CFR Part 15 Subpart C - 08/22/2024

7.1 Requirements and conformance test specifications

Standard

47 CFR Part 15 Subpart C
ANSI C63.10-2020
KDB n/a
-

Requirement		Regulation section 47 CFR Part 15 Subpart C
☒	Antenna requirement	§ 15.203
☒	Restricted bands of operation	§ 15.205 (a) (b) (c)
☒	Terminal voltage on powerline	§ 15.207 (a)(c)
☒	Radiated emissions H-Field of intentional radiators	§ 15.209 (a) (b) (c) (d) (e) (f)
☒	Radiated emissions E-Field of intentional radiators	§ 15.209 (a) (b) (c) (d) (e) (f)

7.2 Antenna requirements

☒ No deviation from the standard
☐ Deviation from the standard
☐ Test not requested
☐ Test not carried out
* ____

Measurement procedure:

Rules and specification	47 CFR Part 15 Section 15.203
Guide	n/a

Requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficiently to comply with the provisions of this section.

Antenna:

☐ Print antenna
☒ Internal antenna
☐ External antenna

☒ Single Antenna ☐ Antenna array
☐ MIMO ☐ __-

Antenna connector:

☒ Permanent attached
☐ Unique coupling to the intentional radiator

☐ SMA ☐ UFL
☒ Internal plug

Test result

Requirement:

☒ kept
☐ not kept

Remarks: n/a

7.3 Restricted bands of operation

☒ No deviation from the standard
☐ Deviation from the standard
☐ Test not requested
☐ Test not carried out
*

Requirement: 47 CFR Part 15 Section 15.205 (a)(b)(c)
Guide n/a

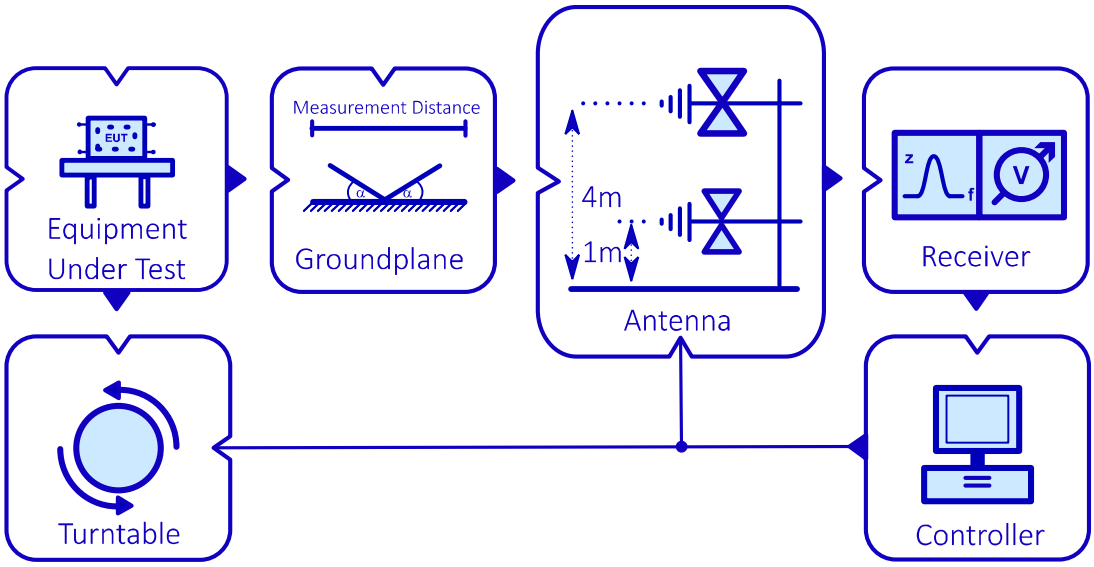
Restricted bands

f / MHz	f / MHz	f / MHz	f / GHz
0.090-0.110	12.57675-12.57725	322-335.4	4.500-5.150
0.495 – 0.505	13.36-13.41	399.9-410	5.350-5.460
2.1735-2.1905	16.42-16.423	608-614	7.250-7.750
4.125-4.128	16.69475-16.69525	960-1427	8.025-8.500
4.17725-4.17775	16.80425-16.80475	1435-1626.5	9.0-9.2
4.20725-4.20775	25.5-25.67	1645.5-1646.5	9.3-9.5
5.677-5.683	37.5-38.25	1660-1710	10.6-12.7
6.215-6.218	73-74.6	1718.8-1722.2	13.25-13.4
6.26775-6.26825	74.8-75.2	2200-2300	14.47-14.5
6.31175-6.31225	108-138	2310-2390	15.35-16.2
8.291-8.294	149.9-150.05	2483.5-2500	17.7-21.4
8.362-8.366	156.52475-156.52525	2655-2900	22.01-23.12
8.37625-8.38675	156.7-156.9	3260-3267	23.6-24.0
8.41425-8.41475	162.0125-167.17	3332-3339	31.2-31.8
12.29-12.293	167.72-173.2	3345.8-3358	36.43-36.5
12.51975-12.52025	240-285	3500-4400	above 38.6

Only spurious emissions are permitted in any of the frequency bands listed before. The field strength of emissions appearing within these frequency bands shall not exceed the radiated emission limits; general requirements. At frequencies equal to or less than 1000 MHz, compliance with the radiated emission limits; general requirements shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions.

Basic structure - Setup

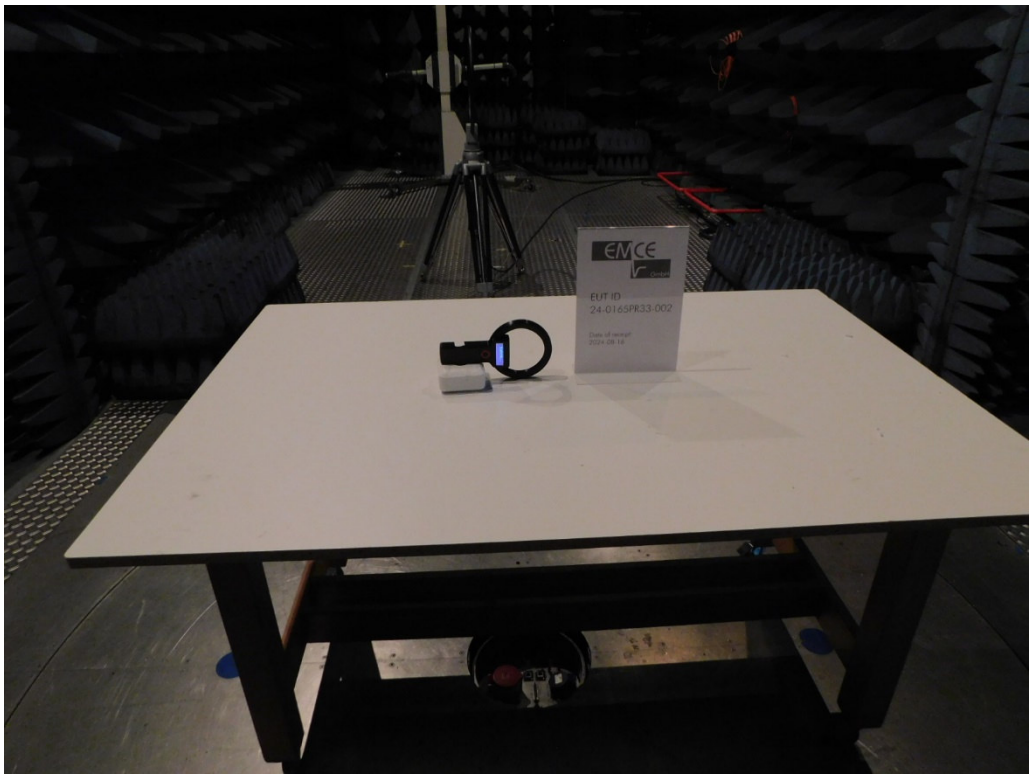
OATS / SAC



7.3.1 Test set up

According ANSI C63.10-2020

Photo(s) showing the interconnection of the major function units



Test location

Pre-test					
☒	Inv.-No.	Designation	Type (L x W x H)	Manufacturer	Location
	062	Semi anechoic chamber # 2	13.5 x 6.1 x 5.5 m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden

Final test					
☒	Inv.-No.	Designation	Type (L x W x H)	Manufacturer	Location
☒	062	Semi anechoic chamber # 2	13.5 x 6.1 x 5.5 m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	014	Open area test site	10 m	EMCE GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	015	Open area test site	3 m	EMCE GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden

7.3.2 Test

Used frequency band: ☒ 0.119 – 0.140 MHz
☐ _____ MHz

Nearest restricted band: ☒ 0.090 - 0.110 MHz

Limits for radiated emissions in the restricted bands

Technical requirements			
Detector	Frequency / MHz	Limit / µV/m	Measurement distance / m
AV	0.009 – 0.09	2400/F(kHz)	300
QP	0.09 – 0.110	2400/F(kHz)	300
AV	0.110 – 0.49	2400/F(kHz)	300
QP	0.49 – 1.705	24000/F(kHz)	30
QP	1.705 – 30.0	30	30
Detector	Frequency / MHz	Limit / dBµV/m	Measurement distance / m
QP	30.0 – 88.0	40.0	3
QP	88.0 – 216.0	43.5	3
QP	216.0 – 960.0	46.0	3
QP	960.0 – 1000.0	54.0	3
AV	> 1000	54.0	3
PK	> 1000	74.0	3
The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.			

Test procedure

See test for radiated emissions of intentional radiators.

Test result

Used frequency range outside of restricted bands

☒ kept
☐ not kept

General emission limits for restricted frequency bands:

☒ kept
☐ not kept

See test for radiated emissions of intentional radiators.

General emission limits for adjacent restricted frequency band:

☒ kept
☐ not kept

Remarks: n/a

7.4 Terminal voltage on powerline

☐ No deviation from the standard
☐ Deviation from the standard
☒ Test not requested*
☐ Test not carried out

*During charging mode the RFID Reader is not operational.

7.5 Radiated emissions H-Field of intentional radiators

☒ No deviation from the standard
☐ Deviation from the standard
☐ Test not requested
☐ Test not carried out
*
____

Measurement procedure:

Rules and specification	47 CFR Part 15 Section 15.209 (a)(b)(c)(d)(e)(f)
Guide	ANSI C63.10-2020

The radiated magnetic fields are measured in a frequency range from 9 kHz to 30 MHz. For this purpose, a shielded active loop antenna is used, which is directly connected to a receiver according to CISPR 16 specifications. For the measurement, the loop antenna is successively aligned once parallel to the DUT and once perpendicular to the DUT. The center of the loop antenna is 1 m above the ground. This setup is also used to determine the spectrum of intentional radiators.
The test is performed at a distance of 3 m between the antenna and the EUT in the frequency range up to 30MHz. A Quasi-Peak or Average-Detector is used, depending on the frequency range. The Average-Detector is used in the frequency bands 9-90 kHz and 110-490 kHz, otherwise the quasi-peak is determined. For pulse modulated devices with a pulse repetition frequency of 20 Hz or less, the Peak-Detector is used (§15.35a Note).
To speed up the measurement process, a pre-measurement is performed with the Peak- and Average-Detectors. The spectrum is determined by rotating the EUT by 360° and the antenna orientation changed accordingly. The maxhold function is used. Hand-held or body-worn devices are rotated through three orthogonal axes to determine maximum emanation. Also the placement and layout of the equipment and the cables are arranged to maximize the disturbance level.
For the re-measurement, the 10 frequencies with the highest exceedance or the smallest distance to the limit are selected. The Average and Quasi-Peak-Detectors are used for the final measurement. Depending on the limit lines, 6 final measurements are documented. The highest limit exceeding or, in case of compliance with the limit, the emissions found with the smallest distance to the limit are documented.
If less than six emission frequencies with a distance of 20 dB are below the limit value, the noise level of the measuring device at representative frequencies is indicated.

The final measurement is performed at a test distance of 3 m. In case the regulation requires testing at different distances, the result is extrapolated by an extrapolation factor 40 dB / decade to the required distance.
Frequency, the measured value, antenna information and the limit will be printed out.

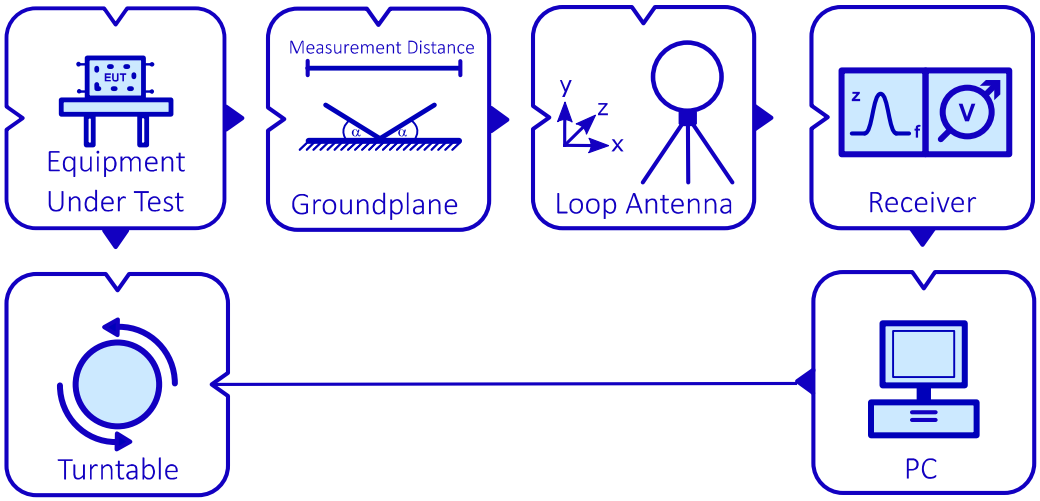
The reported test results are calculated using the following formula to normalize the results for the requested test distance:

Field strength (dBμV/m) = Reading (dBμV) + AF (dB/m) + CF (dB) + 40 *(D_T/D_R) (dB)

AF = Correction factor for the antenna
CF = Correction factor for the cable loss
DT = Test distance
DR = Reference distance for the limit defined in the standard

Basic structure - Setup

OATS / SAC



7.5.1 Test set up

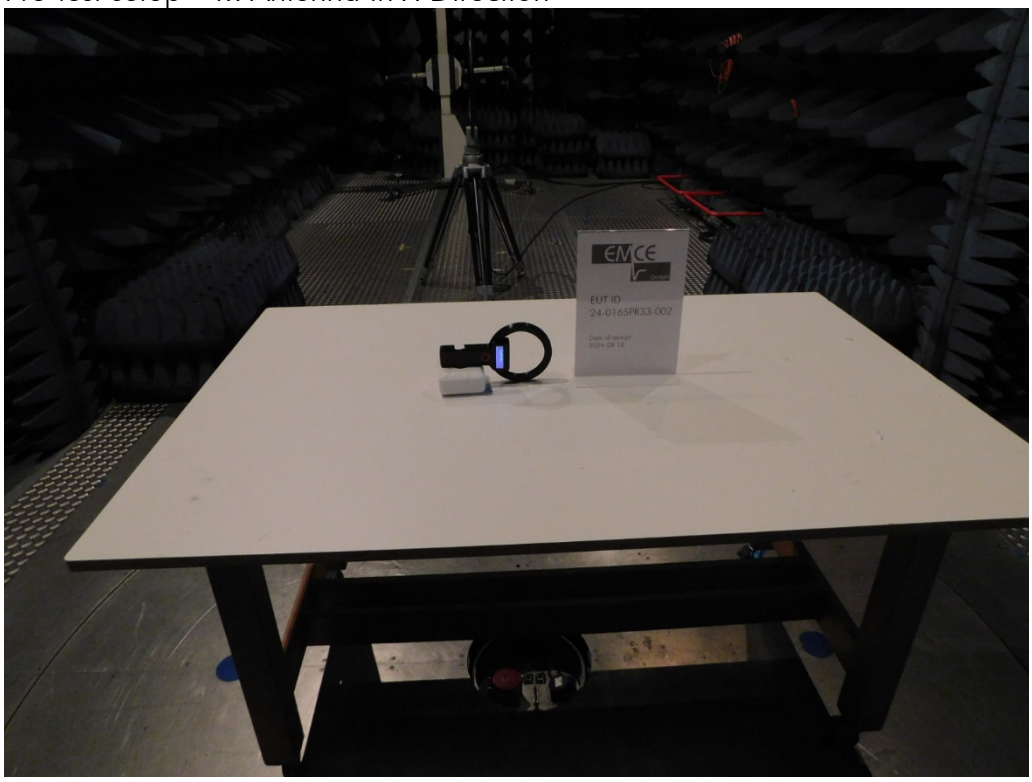
According ANSI C63.10-2020

Photo(s) showing the interconnection of the major function units

Final test setup

Tx-Antenna in X-Direction

Pre-test setup - Tx-Antenna in X-Direction



Test location

Pre-test					
☒	Inv.-No.	Designation	Type (L x W x H)	Manufacturer	Location
☒	062	Semi anechoic chamber # 2	13.5 x 6.1 x 5.5 m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden

Final test					
☒	Inv.-No.	Designation	Type (L x W x H)	Manufacturer	Location
	062	Semi anechoic chamber # 2	13.5 x 6.1 x 5.5 m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
☒	1345	Open area test site	3 - 30 m	EMCE GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden

Used test equipment

Pre-test					
☒	Inv.-No.	Designation	Type	Manufacturer	S/N
☒	008	Antenna 9 kHz – 30 MHz	HFH2-Z2	Rohde & Schwarz	835776/0002
☒	042	AC-Source / Analyzer / Norm impedance	EMV D5000/PAS	Spitzenberger + Spies	A274700/ 0 0501
☒	997	Software	EMC32	Rohde & Schwarz	n/a
☒	8044	EMI Test Receiver	ESW44	Rohde & Schwarz	103371

Final test					
☒	Inv.-No.	Designation	Type	Manufacturer	S/N
☒	008	Antenna 9 kHz – 30 MHz	HFH2-Z2	Rohde & Schwarz	835776/0002
	042	AC-Source / Analyzer / Norm impedance	EMV D5000/PAS	Spitzenberger + Spies	A274700/ 0 0501
☒	229	Test receiver	ESS 5 Hz – 1000 MHz	Rohde & Schwarz	845420/0005
	997	Software	EMC32	Rohde & Schwarz	n/a

All used test equipment are checked resp. calibrated periodically.

☒ Test equipment was checked and complied to the requirements

Test-/Measurement uncertainty

The measurement uncertainty in the test met the guideline of CISPR16-4-2 or better.

Measurement uncertainty of the radiated emission with an extended coverage factor of k = 2:

Frequency	Measurement uncertainty
9 kHz – 30 MHz	on request

7.5.2 Test

Rules and specification 47 CFR Part 15 Section 15.209 (a)(b)(c)(d)(e)(f)

Frequency range: 9 kHz – 30 MHz

Limits for radiated emissions

Technical requirements			
Detector	Frequency / MHz	Limit / µV/m	Measurement distance / m
AV	0.009 – 0.09	2400/F(kHz)	300
QP	0.09 – 0.110	2400/F(kHz)	300
AV	0.110 – 0.49	2400/F(kHz)	300
QP	0.49 – 1.705	24000/F(kHz)	30
QP	1.705 – 30.0	30	30
For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz			

☒ The level of any unwanted emissions shall not exceed the level of the fundamental frequency

Rx-Antenna Orientation

☒ Vertical

☒ Parallel to EUT
☒ Orthogonal to EUT

Antenna Height

☒ 1 m - Loop center above ground

Antenna Distance - EUT

☐ 3 m ☒ 10 m ☐ 30 m

EUT Orientation to Antenna

☒ X-Axis* ☐ Y-Axis ☐ Z-Axis
*worst case for maximum emanation

Rationale for selecting the EUT test set up

Equipment units:

Stand alone

Operation mode

EUT arrangement:	☒ Tabletop	☐ Floor standing
Power supply:	☐ 120 V/60 Hz	☒ Internal battery

Continuous read mode without tag, at maximum read rate.

Environmental conditions

Temperature [10 – 40 °C]:	29.6 °C
Relative humidity [10 – 90 %]:	52 %

Environmental conditions during the test: ☒ kept ☐ not kept

Test result

Limits for unwanted radiated emissions: ☒ kept ☐ not kept

No unwanted radiated emissions exceed the level of the fundamental frequency: ☒ kept ☐ not kept

Remarks: n/a

Records

Pre-test measurement

☒ Readings

☒ Diagram

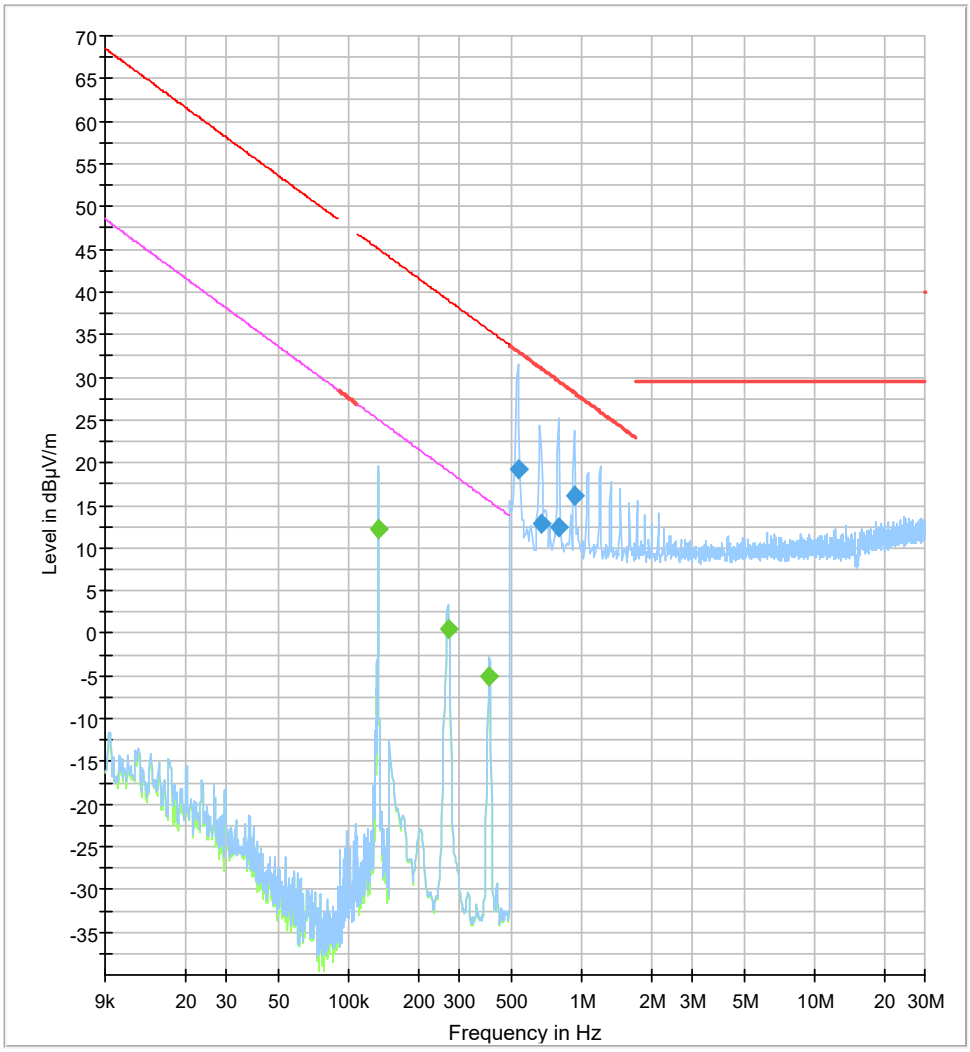
Final measurement

☒ Readings

☒ Diagram

EUT Information

EUT Name:	ARE H3.0 Iso FDX B/A
Test_ID: / SN:	24-0165PR33-002
Customer:	AEG Identifikationssysteme GmbH
Operational condition:	Continuous reading
Test specification:	47 CFR Part 15 Subart C §15.209 - SAC@3 m
Antenna information:	Distance EUT-Ant.: 3.0 m / Polarization: Parallel/Orth. / Ant.Height: 1.0 m
Operator:	S. Vogelmann
File #:	24-0165RC38-002-062
Comment #1:	Tx-Antenna in X-Direction (vertical)
Comment #2:	



Preview Result 2-AVG
Limit AVG
Final_Result AVG
Preview Result 1-PK+
Limit PK+
Limit QPK
Final_Result QPK

Pre-Test Result – SAC @3.0 m antenna distance

Frequency (MHz)	QuasiPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Band-width (kHz)	Pol	Azimuth (deg)	Corr. (dB)
0.134215	---	12.22	25.05	12.83	15000.0	0.200	Parallel	175.0	-60.0
0.268300	---	0.55	19.03	18.48	15000.0	9.000	Orthogonal	91.0	-60.1
0.402500	---	-4.99	15.51	40.50	15000.0	9.000	Parallel	356.0	-60.1
0.536826	19.12	---	33.01	13.88	15000.0	9.000	Orthogonal	268.0	-20.0
0.674460	12.92	---	30.61	52.53	15000.0	9.000	Parallel	350.0	-20.0
0.805755	12.33	---	29.48	17.15	15000.0	9.000	Parallel	-2.0	-20.0
0.939575	16.18	---	28.15	11.96	15000.0	9.000	Orthogonal	269.0	-20.0
Test results normalized to reference distance for limit value with 40 dB/Dec.									

Final Result – OATS @10.0 m antenna distance

Frequency (MHz)	QuasiPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Band-width (kHz)	Pol	Azimuth (deg)	Corr. (dB)
134.20		1.3	25.05	23.75	15000.0	0.200	Parallel	340.0	-40.0
268.30		-2.9	19.03	21.93	15000.0	9.000	Parallel	340.0	-40.1
402.50		-8.8	15.51	24.31	15000.0	9.000	Orthogonal	0	-40.1
536.83	15.5		33.01	17.51	15000.0	9.000	Orthogonal	130.0	0.0
674.46	19.8		30.61	10.81	15000.0	9.000	Orthogonal	86.0	0.0
805.76	13.6		29.48	15.88	15000.0	9.000	Orthogonal	266.0	0.0
939.58	13.5		28.15	14.65	15000.0	9.000	Orthogonal	340.0	0.0
Test results normalized to reference distance for limit value with 40 dB/Dec.									

7.6 Radiated emissions E-Field of intentional radiators

☒ No deviation from the standard
☐ Deviation from the standard
☐ Test not requested
☐ Test not carried out
*
____

Measurement procedure:

Rules and specification	47 CFR Part 15 Section 15.209 (a)(b)(c)(d)(e)(f)
Guide	ANSI C63.10-2020

The radiated interference emission is measured on an alternative open area test site OATS in the frequency range 30 - 1000 MHz. The measurement distance is 3 m or 10 m, depending on the standard. Above 1 GHz, the measurement is performed in a 3 m semi-anechoic chamber with floor absorber to reduce ground reflections. For the measurement of the field strength a biconical antenna up to 200 MHz, a logperiodic antenna from 200 MHz to 1 GHz and horn antennas or double stacked logperiodic antenna above 1 GHz are used. All antennas are linearly polarized. External low-noise preamplifiers are used in the range above 1 GHz to improve measurement sensitivity. Special measures, such as filters or attenuators, are taken to avoid overloading the amplifiers. The antenna height is varied between 1 m and 4 m as required. The elevation angle of the antenna can be corrected via the antenna mast to ensure that the main lobe of the antenna is always directed at the EUT. A turntable allows the alignment of the EUT towards the antenna to maximize the radiated emission. The test sites are located above a metallic ground plane. Table-top devices are placed on a non-conductive wooden table. Hand-held, body-worn, or ceiling-mounted devices are examined in 3 orthogonal axis orientations to determine the maximum emission level. Floor-standing devices are placed directly on the grounded metal turntable/reference insulated from ground plane by an insulating material <12 mm.
During an initial automated pre-test run in a semi-anechoic chamber, the desired frequency range is measured. The receiver is operated as an analyzer and the frequency ranges are run sequentially depending on the antenna. For the measurement, the turntable is continuously rotated from 0° - 360° and back, and the antenna height is changed in 0.5 m increments after each complete turntable cycle. The antenna position is then changed from 1.0 m to 4.0 m in 0.5 m steps for vertical polarization and back for horizontal polarization. During a cycle, the frequency range is continuously swept with peak detector and max hold function. Depending on the test specification, an average detector is also used if required. For each discrete antenna polarization over all positions, the maximum peak values are recorded with frequency, level, turntable position, antenna height and antenna

polarization. Significant peaks or clock frequencies are marked and re-measured with increased frequency accuracy. The recordings are used to determine the exact frequency and to optimize the interference level. At the predefined position, the turntable position is fine-adjusted in the range of ±20° and then the antenna height is varied by ±0.3 m. At the maximized position, the emission is measured with quasi-peak or average detector and listed. The six highest emissions are selected for final measurement in the OATS.
In a final test run, an open area test site measurement is made at selected frequencies determined by the previous test procedure. For each selected frequency, the frequency setting is optimized again in the OATS and the field strength value is maximized, rotating the EUT 360° at an antenna height of 1.0 m for vertical antenna polarization and 2.0 m for horizontal antenna polarization. At the azimuth position of the EUT for the highest radiation, the antenna height is varied within 1.0 m and 4.0 m until the highest interference level is reached. To maximize the interference level at the determined position, the turntable azimuth is fine-adjusted by ±45° and the antenna height is fine-adjusted by ±0.3 m. The setup of the instrument and the cables are manipulated within the range to produce the highest emission.
Final measurement is made using a receiver conforming to CISPR 16 guidelines with a quasi-peak and average detector.
The identified frequency and amplitude of the six highest radiated emissions relative to the limit lines are listed. If fewer than six emission frequencies are within 20 dB of the limit, the noise level of the instrument at representative frequencies is reported.
For documentation of final testing below 1 GHz on the OATS the plots recorded in den SAC are indicated as Pre-test.
In case the regulation requires testing at different distances, the result is extrapolated by an extrapolation factor 20 dB / decade to the required distance.

The reported test results are calculated using the following formula to normalize the results to the requested test distance:

$$\text{Result (dB}\mu\text{V/m)} = \text{Reading (dB}\mu\text{V)} + \text{AF (dB/m)} + \text{CF (dB)} + 20 * (D_T/D_R)\ \text{(dB)}$$

AF = Correction factor for the antenna
CF = Correction factor for the cable loss
D_T = Test distance
D_R = Reference distance for the limit defined in the standard

Example:

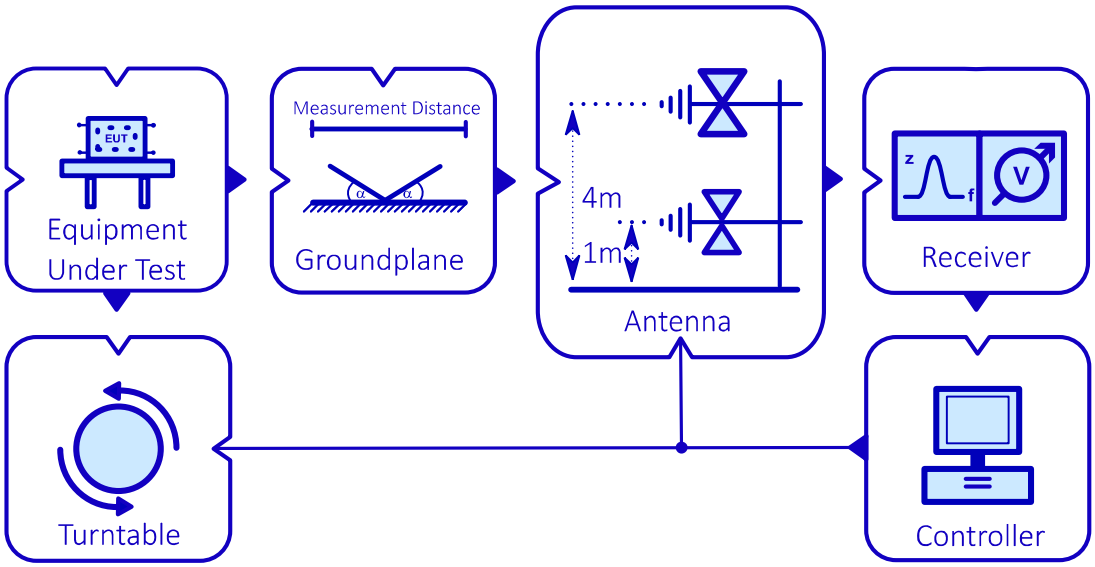
Test frequency	500.00 MHz
Reading	12.3 dBμV
$AF_{(500.00\ MHz)}$	17.1 dB/m
$CF_{(500.00\ MHz)}$	1.4 dB
DT =	3 m
DR =	3 m

Calculated final result for the electrical field strength E(f):

$E_{(500.00\ MHz)}$ = 12.3 dBμV + 17.1 dB/m + 1.4 dB + 0 dB = 30.8 dBμV/m

Basic structure - Setup

OATS / SAC



7.6.1 Test set up

According ANSI C63.10-2020

Photo(s) showing the interconnection of the major function units

Final test setup

Tx-Antenna in Z-Direction

Pre-test setup - Tx-Antenna in Z-Direction

Test location

Pre-test					
☒	Inv.-No.	Designation	Type (L x W x H)	Manufacturer	Location
☒	062	Semi anechoic chamber # 2	13.5 x 6.1 x 5.5 m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden

Final test					
☒	Inv.-No.	Designation	Type (L x W x H)	Manufacturer	Location
	062	Semi anechoic chamber # 2	13.5 x 6.1 x 5.5 m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	014	Open area test site	10 m	EMCE GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
☒	015	Open area test site	3 m	EMCE GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden

Used test equipment

Pre-test					
☒	Inv.-No.	Designation	Type	Manufacturer	S/N
☒	042	AC-Source / Analyzer / Norm impedance	EMV D5000/PAS	Spitzenberger + Spies	A274700/ 0 0501
☒	997	Software	EMC32	Rohde & Schwarz	n/a
☒	8008	LPDA	VULP 9118A 180 - 1500 MHz	Schwarzbeck	900
☒	8034	Antenna 30-300 MHz	VHBB9124 / BBA9106	Schwarzbeck	1812
☒	8044	EMI Test Receiver	ESW44	Rohde & Schwarz	103371

Final test					
☒	Inv.-No.	Designation	Type	Manufacturer	S/N
☒	042	AC-Source / Analyzer / Norm impedance	EMV D5000/PAS	Spitzenberger + Spies	A274700/ 0 0501
	059	Logper. Antenna	HL050	Rohde & Schwarz	100006
	222	Broadband Preamplifier	BBV 9718 0.5-18GHz	Schwarzbeck	9718-316
	226	Log.-per. antenna	HL050	Rohde & Schwarz	100829
☒	229	Test receiver	ESS 5 Hz – 1000 MHz	Rohde & Schwarz	845420/0005
	236	Broad-Band Horn Antenna	BBHA 9120 E 0.5-6 GHz	Schwarzbeck	00831
	239	Broadband Horn Antenna	BBHA 9170 15-40 GHz	Schwarzbeck	00932
	997	Software	EMC32	Rohde & Schwarz	n/a
	8004	Broadband Preamplifier	BLMA 1840-5G 18-40 GHz	BONN Elektronik GmbH	2113300
☒	8007	LPDA	VULP 9118A 180 - 1500 MHz	Schwarzbeck	899
☒	8033	Antenna 30-300 MHz	VHBB9124 / BBA9106	Schwarzbeck	1808
	8044	EMI Test Receiver	ESW44	Rohde & Schwarz	103371

All used test equipment are checked resp. calibrated periodically.

☒ Test equipment was checked and complied to the requirements

Test-/Measurement uncertainty

The measurement uncertainty in the test met the guideline of CISPR16-4-2 or better.

Measurement uncertainty of the radiated emission with an extended coverage factor of k = 2:

Frequency	Measurement uncertainty
30 MHz – 225 MHz	4.8 dB (valid for 10 m-OATS)
225 MHz – 1 GHz	4.9 dB (valid for 10 m-OATS)
30 MHz – 225 MHz	4.8 dB (valid for 3 m-OATS)
225 MHz – 1 GHz	6.2 dB (valid for 3 m-OATS)

7.6.2 Test

Rules and specification 47 CFR Part 15 Section 15.209 (a)(b)(c)(d)(e)(f)

Highest frequency generated or used in the device or on which the device operates or tunes:	Upper frequency of measurement:
☒ <10 GHz	☒ 10th harmonic of the highest frequency or 40 GHz, whichever is lower
☐ 10 GHz – 30 GHz	☐ 5th harmonic of the highest frequency or 100 GHz, whichever is lower
☐ 30 GHz – 95 GHz	☐ 5th harmonic of the highest frequency or 200 GHz, whichever is lower
☐ ≥95 GHz	☐ 3rd harmonic of the highest frequency or 750 GHz, whichever is lower

Frequency range:		
	☐ 9 kHz – 30 MHz	☒ 30 MHz – 1000 MHz
	☐ 1 – 5 GHz	☐ 5 – 18 GHz
	☐ 18 – 26 GHz	☐ 26 – 40 GHz

Limits for radiated emissions

Technical requirements			
Detector	Frequency / MHz	Limit / dBµV/m	Measurement distance / m
QP	30.0 – 88.0	40.0	3
QP	88.0 – 216.0	43.5	3
QP	216.0 – 960.0	46.0	3
QP	960.0 – 1000.0	54.0	3
AV	> 1000	54.0	3
PK	> 1000	74.0	3
The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.			

Rationale for selecting the EUT test set up

Equipment units:

Stand-alone device.

EUT Orientation

☐ X-Direction ☐ Y-Direction ☒ Z-Direction*

*worst case for maximum emanation

Operation mode

EUT arrangement:	☒ Tabletop	☐ Floor standing
Power supply:	☐ 120 V/60 Hz	☐ Internal battery

Continuous read mode with tag inside of the antenna loop, at maximum read rate.

Environmental conditions

Temperature [10 – 40 °C]:	34.4 °C
Relative humidity [10 – 90 %]:	43 %

Environmental conditions during the test: ☒ kept ☐ not kept

Test result

Limits for unwanted radiated emissions: ☒ kept ☐ not kept

Remarks: n/a

Records

Pre-test measurement

☒ Readings

☒ Diagram

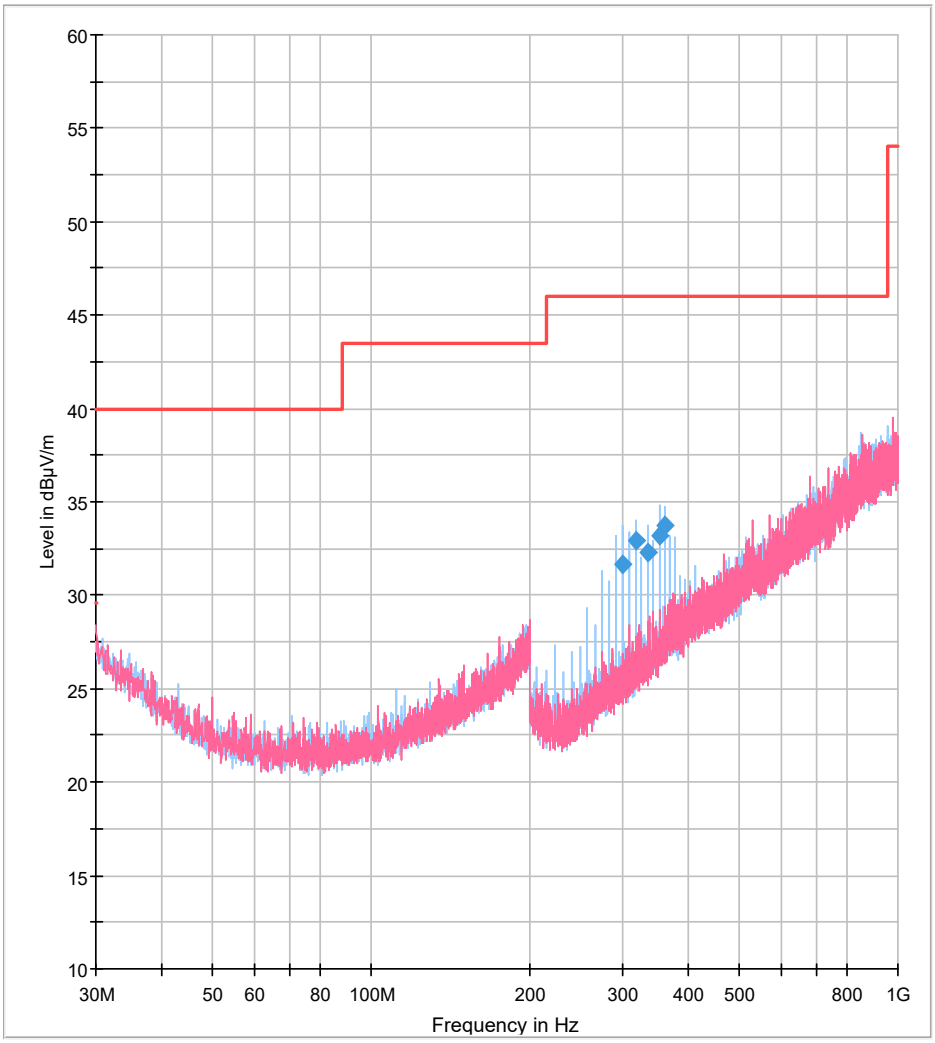
Final measurement

☒ Readings

☒ Diagram

EUT Information

EUT Name:	ARE H3.0 Iso FDX B/A
Test_ID: / SN:	24-0165PR33-002
Customer:	AEG Identifikationssysteme GmbH
Operational condition:	Continuous reading
Test specification:	47 CFR Part 15 Subpart C §15.209 - SAC@3 m
Antenna information:	Distance EUT-Ant.: 3.0 m / Polarization: H/V / Ant.Height: 1.0-4.0 m
Operator:	S. Vogelmann
File #:	24-0165RC35-002-044
Comment #1:	Power supply 120 V / 60 Hz
Comment #2:	Tx-Antenna in Z-Direction (horizontal)



Limit_QPK
Preview Result 1V-PK+
Preview Result 1H-PK+
Final_Result QPK

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
50.208456	6.04	40.00	33.96	5000.0	120.000	135.0	V	253.0	10.6
300.651331	31.68	43.50	11.82	5000.0	120.000	324.0	H	280.0	11.0
317.824778	32.88	43.50	10.62	5000.0	120.000	132.0	H	86.0	15.4
335.011472	32.27	46.00	13.73	5000.0	120.000	135.0	H	101.0	12.0
352.191422	33.22	46.00	12.78	5000.0	120.000	110.0	H	107.0	15.6
360.781500	33.70	46.00	12.30	5000.0	120.000	335.0	V	193.0	25.4

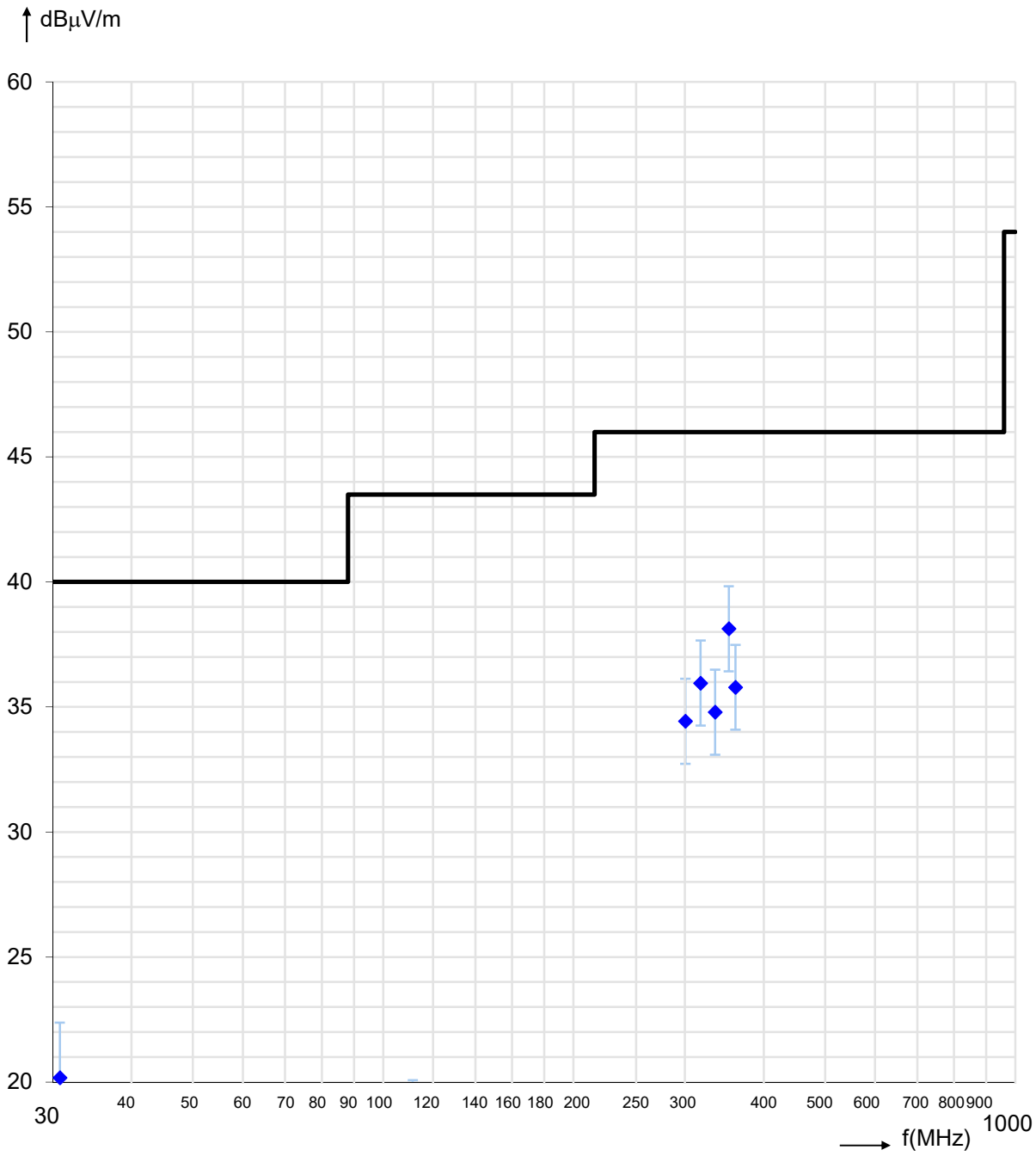
Final measurement

Readings – Antenna horizontal / vertical polarized

Frequency	Readings	+ AF Antenna correction factor	+ KF Cable correction factor	Field strength	Limit	Margin	Antenna-Height	Antenna-Polarization	Turn Table-Position
MHz	dBµV	dB/m	dB	dBµV/m	dBµV/m	dB	m	hor./ver.	Degree
30.800	6.1	13.4	0.6	20.2	40.0	19.8	2.60	V	75
300.651	19.4	12.9	2.1	34.4	46.5	12.1	1.35	H	90
317.810	20.4	13.4	2.2	36.0	46.5	10.5	1.00	H	90
335.058	18.7	13.8	2.3	34.8	46.5	11.7	1.35	H	90
352.160	21.7	14.1	2.3	38.1	46.5	8.4	1.00	H	90
360.792	19.2	14.2	2.3	35.8	46.5	10.7	3.30	V	180

Diagram radio disturbances – Antenna horizontal / vertical polarized

Limit: 47 CFR Part 15 Section 15.209



8 Summary

47 CFR Part 15 Subpart C

Requirement	Regulation section	Result	Remarks
Antenna requirement	§ 15.203	Pass	n/a
Restricted bands of operation	§ 15.205 (a) (b) (c)	Pass	n/a
Terminal voltage on powerline	§ 15.207 (a)(c)	Not relevant	n/a
Radiated emissions H-Field of intentional radiators	§ 15.209 (a) (b) (c) (d) (e) (f)	Pass	n/a
Radiated emissions E-Field of intentional radiators	§ 15.209 (a) (b) (c) (d) (e) (f)	Pass	n/a

Burgrieden, 11/15/2024

Responsible inspector:

Project manager – Steffen Vogelmann

- End of Test Report -