

Test report

21-0076RP21_001

Product / EUT: *RFID Reader*
 Type designation: *ARE i9 HF*
 Tested type: *ARE i9 HF*
 Production level: *04/2021*
 Firmware version: *n/a*
 S/N: *Pilot series*
 Manufacturer: *AEG Identifikationssysteme GmbH*
Hörvelsinger Weg 47
89081 Ulm / Germany

EUT authorization: ☒ Certification ☐ Declaration of Conformity
☐ Verification

FCC ID: V7IAREI9HF

Test remit: FCC Rules 47 CFR Part 15 – Subpart C – Intentional radiators
 in accordance with the procedures given in
 §15.205; 15.207; 15.209; 15.215; 15.225

Test procedure: ANSI C63.10-2013

The standards were: ☒ kept*
☐ not kept*

*Remark: ☒ Validation covered by the accredited scope
☐ Validation not covered by the accredited scope
 according: _____
☐ Validation of the EMC-requirements partly proceeded

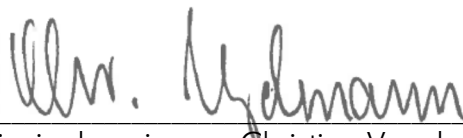


Applicant: AEG Identifikationssysteme GmbH
Hörvelsinger Weg 47
89081 Ulm / Germany

EUT-
Date of arrival: 03/29/2021
Test ID: 21-0076PR13-007; 21-0076PR13-009
Date(s) of test: 05/06/2021 – 05/07/2021

Burgrieden, 05/26/2021

Released by:



Principal engineer - Christian Vogelmann

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

DAkS-Registration No: D-PL-12122-01-01
D-PL-12122-01-02
CAB-Registration No.: BnetzA-CAB-02/21-01/1
FCC-Registration No.: 239304

Accredited by:

Bundesnetzagentur



BNetzA-CAB-02/21-01

Deutsche Akkreditierungsstelle GmbH



Deutsche
Akkreditierungsstelle
D-PL-12122-01-01
D-PL-12122-01-02



Responsible inspector: Mr. S. Vogelmann
EMCE GmbH
Ingenieurbüro für EMV-Prüfungen und Schaltungsentwicklung

Contact person: Mr. Waitzinger / AEG Identifikationssysteme GmbH

EUT

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

Description: RFID Reader operating in the frequency range 13.56 MHz

Voltage supply: 120 V / 60 Hz

Frequency list: 32.768 kHz, 13.56 MHz, 27.12 MHz, 84 MHz

Temperature range: n/a

Size: (LxWxH) / mm - 70 x 40 x 25

Supplied / used equipment:

Designation	Type	Manufacturer	S/N
Laptop	W25CSW	Terra	n/a
Power supply – Laptop	A12-065N2A	Chicony	F134091506009041
Power supply	APS 1612 T	Ansmann	n/a
USB A Converter	151801	Manhattan	n/a



Configuration:

☒
☐

As-delivered condition*
Modified*

*21-0076PR13-009 is the same hardware level as
21-0076PR13-007 but with a modified firmware for a
higher duty-cycle 66 % used for radiated emissions.

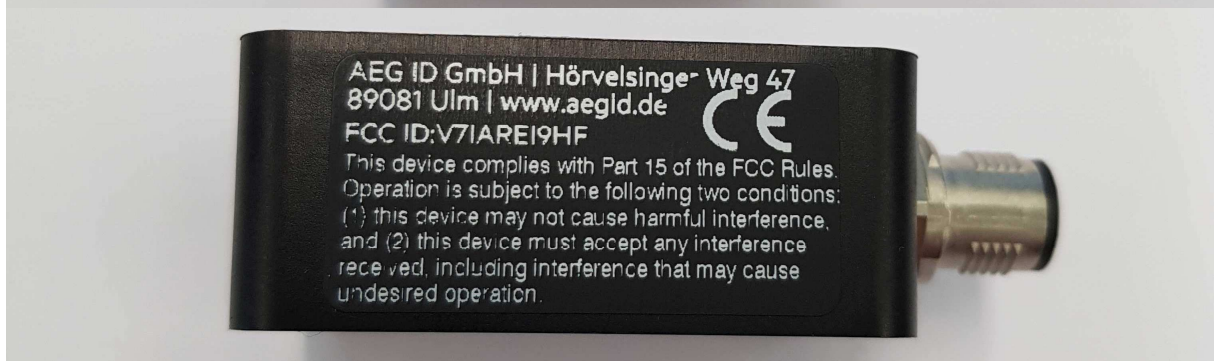
Cable designation	Type	Length	Remarks
Interconnection cable	Shielded	3.0 m	
Mains cord extension	3-core	1.0 m	
DC cable	2-core	1.6 m	
USB Cable	Shielded	0.4 m	

Remarks:

n/a



External photos EUT





State of revision:

Source document	New Document	Date / Reviser	Modifications

Test equipment list of EMCE GmbH:

Inv.-No.	Designation	Type	Manufacturer	S/N	Calibration: Interval /valid until
001	Test receiver	ESS 5Hz - 1000MHz	Rohde & Schwarz	833776/008 Firmware: Main: 1.21 OTP: 02.01 GRA: 02.03	1 Year(s)/ 2021-11-26
003	LISN 1	ESH3-Z5	Rohde & Schwarz	835268/007	1 Year(s)/ 2022-01-31
004	LISN 2	ESH3-Z5	Rohde & Schwarz	835268/003	1 Year(s)/ 2022-01-31
006	LISN	NNBM 8125	Schwarzbeck	8125371	2 Year(s)/ 2022-02-28
007	Absorbing clamp	MDS 21	Schwarzbeck	942436	1 Year(s)/ 2022-03-04
008	Loop antenna 9kHz-30MHz	HFH2-Z2	Rohde & Schwarz	835776/0002	3 Year(s)/ 2022-11-20
009	Antenna 30-300MHz	VHBA9123 / BBA9106	Schwarzbeck	435	3 Year(s)/ 2021-12-05
010	Antenna 250-1200MHz	UHALP 9108A	Schwarzbeck	108	3 Year(s)/ 2022-11-25
011	Antenna 30-300MHz	VHBA9123 / BBA9106	Schwarzbeck	0403/94	3 Year(s)/ 2022-11-25
012	Antenna 250-1200MHz	UHALP 9108A	Schwarzbeck	166	3 Year(s)/ 2021-12-05
013	Antenna 9 kHz-30 MHz	Ø 1.5 m	EMCE GmbH		1 Year(s)/ 2021-10-31
014	OATS	Test site 3 m referred to ANSI C63.4-2014	EMCE GmbH		3 Year(s)/ 2024-04-23
015	OATS	Test site 10 m referred to ANSI C63.4-2014	EMCE GmbH		3 Year(s)/ 2024-04-26
020	Coupling clamp	IP4A	Haefely	082672-13	1 Year(s)/ 2021-10-31
022	ESD-Gun	NSG 435	Schaffner	577	1 Year(s)/ 2022-03-16
024	RF-Generator	SMY01	Rohde & Schwarz	844146/046	2 Year(s)/ 2022-08-21
025	Current clamp BCI	F-120-2	FCC	47	1 Year(s)/ 2021-08-31

Inv.-No.	Designation	Type	Manufacturer	S/N	Calibration: Interval /valid until
026	Coupling-/Decoupling Network M3	CDN 801-M3-25	FCC	92	1 Year(s)/ 2021-07-31
030	Coupling-/Decoupling Network S1 - 9-pol. D-Sub	CDN 801-S1/ 9pol. DSUB	EMCE GmbH		1 Year(s)/ 2021-07-31
031	Coupling-/Decoupling Network S1 - 9-pol. D-Sub	CDN 801-S1/ 9pol. DSUB	EMCE GmbH		1 Year(s)/ 2021-07-31
032	RF Power Amplifier	75A250	Amplifier Research	22789	2 Year(s)/ 2023-08-31
034	Coupling-/Decoupling Network AF2	CDN-AF2	EMCE GmbH		1 Year(s)/ 2021-07-31
038	Helmholtz coil	1 m x 1 m	EMCE GmbH		1 Year(s)/ 2021-09-30
039	Helmholtz coil	1 m x 1 m	EMCE GmbH		1 Year(s)/ 2021-09-30
040	Current transformer		EMCE GmbH		1 Year(s)/ 2021-09-30
041	Loop antenna shielded	HZ-10 0816.2511.02	Rohde & Schwarz	849788/0020	3 Year(s)/ 2022-12-02
042-2	AC-Source	EMV D 5000/PAS/SyCore	Spitzenberger & Spies	A274700 / 00501	3 Year(s)/ 2022-10-30
042-1	Analyzer Reference System	ARS 16/3	Spitzenberger & Spies	A274707 / 00501	3 Year(s)/ 2021-11-07
043	Receiver	3DH/E Fieldmeter ESM-100	Maschek	971521	3 Year(s)/ 2023-08-13
044	CDN	CN-U	EMC-Partner	86	1 Year(s)/ 2021-09-30
045	CDN	DN-HF	EMC-Partner	86	1 Year(s)/ 2021-09-30
046	CDN	DN-LF2	EMC-Partner	86	1 Year(s)/ 2021-09-30
047	CDN	DN-LF1	EMC-Partner	86	1 Year(s)/ 2021-09-30
050	Data Acquisition/ Switch Unit	Agilent 34970A	Agilent Technologies	MY41019453	3 Year(s)/ 2023-02-06
051	20 Channel Multiplexer	Agilent 34901A	Agilent Technologies	MY41013531	3 Year(s)/ 2023-02-06
054	Helmholtz coil	1.25 m x 1.25 m	EMCE GmbH		1 Year(s)/ 2021-09-30

Inv.-No.	Designation	Type	Manufacturer	S/N	Calibration: Interval /valid until
055	Helmholtz coil	1.25 m x 1.25 m	EMCE GmbH		1 Year(s)/ 2021-09-30
058	Receiver	ESIB 40	Rohde & Schwarz	100200/ Firmware 4.35	1 Year(s)/ 2021-05-31
059	Log.-per. antenna	HL050	Rohde & Schwarz	100006	3 Year(s)/ 2022-08-13
062-2	Semi-Anechoic Chamber 13.5x6.1x5.5 m	30 - 1000 MHz referred to ANSI C63.4-2014	EMC-Technik & Consulting GmbH		3 Year(s)/ 2024-01-31
062-1	Semi-Anechoic Chamber 13.5x6.1x5.5 m	1 - 18 GHz referred to CISPR16 1-4: 2010-04 Ed. 3	EMC-Technik & Consulting GmbH		3 Year(s)/ 2024-05-14
067	LISN	ESH2-Z5	Rohde & Schwarz	872460/043	1 Year(s)/ 2022-01-31
068	LISN	ESH2-Z5	Rohde & Schwarz	872460/042	1 Year(s)/ 2022-01-31
070	Pulse limiter + 10 dB Attenuator	ESH3-Z2	Rohde & Schwarz	n/a	1 Year(s)/ 2021-08-31
073	Absorbing clamp	MDS21	Schwarzbeck	881757	1 Year(s)/ 2022-03-31
074	Synthesizer signal generator	SMX	Rohde & Schwarz	5SM02675	2 Year(s)/ 2021-11-19
115	Strip line 50 Ohm		EMCE GmbH		1 Year(s)/ 2022-02-28
116	Vertical rod antenna	VAMP 9243	Schwarzbeck	9243-205	3 Year(s)/ 2023-02-19
117	LISN	ESH3-Z6	Rohde & Schwarz	100521	1 Year(s)/ 2022-01-31
118	Current Probe	F-52	Fischer Customs Communication, Inc.	08398	1 Year(s)/ 2021-08-31
119	10V Insertion Unit 50 Ohm	URV5-Z2	Rohde & Schwarz	100911	2 Year(s)/ 2021-07-31
122	Power Meter	NRVS	Rohde & Schwarz	833430 / 0017	2 Year(s)/ 2021-08-28
123	Directional coupler	BDC 0100- 50/500	BONN Elektronik	087261	1 Year(s)/ 2021-08-31
127	Function/ Arbitrary Waveform Generator	Agilent 33220A	Agilent Technologies	MY44026679	3 Year(s)/ 2022-02-28
128	Signal Generator	SMF100A	Rohde & Schwarz	100137	2 Year(s)/ 2023-02-16

Inv.-No.	Designation	Type	Manufacturer	S/N	Calibration: Interval /valid until
129	ESD-Gun	ESD30N	EM TEST GmbH	V1012106114	3 Year(s)/ 2023-03-30
131	Coupling network	M3/AC	Dr. Hubert GmbH	A3052006	1 Year(s)/ 2021-07-31
132	LF-Amplifier	A1110-05	Dr. Hubert GmbH	111A1110	2 Year(s)/ 2021-11-30
134	10 V Insertion Unit 50 Ohm	URV5-Z2	Rohde & Schwarz	101025	2 Year(s)/ 2021-11-15
136	Directional coupler	BDC 0842-40/200	Bonn Elektronik	108082	1 Year(s)/ 2021-08-31
137	Power Amplifier	CBA3G-100	Teseq GmbH	T43943	2 Year(s)/ 2022-11-30
140	Burst/Surge-Generator	Transient 3000	EMC-Partner	TRA3000 104033	2 Year(s)/ 2021-11-30
142	Coupling / Decoupling Network for Burst and Surge	CNI 503 B7.4	EM TEST GmbH	V1125109869	2 Year(s)/ 2021-10-29
143	Ultra-Compact Simulator	UCS 500 N7	EM TEST AG	V1125109868	2 Year(s)/ 2021-10-28
147	10-V-insertion unit 50 Ohm	URV5-Z2	Rohde & Schwarz	101049	2 Year(s)/ 2022-02-25
151	DSO Infiniium 2500 MHz	DSO9254A	Agilent Technologies	MY52090137	2 Year(s)/ 2022-03-06
154	Capacitive voltage clamp	CDN 500	Teseq GmbH	656	3 Year(s)/ 2021-06-26
159	Function/Arbitrary Waveform Generator	Agilent 33220A	Agilent Technologies	MY44058563	3 Year(s)/ 2022-04-30
163	Power Sensor	NRV-Z4	Rohde & Schwarz	100575	2 Year(s)/ 2022-04-08
174	LISN	ESH3-Z6	Rohde & Schwarz	101003	1 Year(s)/ 2022-01-31
175	EMI Test receiver	ESR7	Rohde & Schwarz	101108 Firmware: FW V3.46 SP3	1 Year(s)/ 2021-10-30
178	V-LISN 5 μ H	NNHV 8123-400	Schwarzbeck	018	1 Year(s)/ 2022-01-31
184	V-LISN 5 μ H	NNHV8123-400	Schwarzbeck	019	1 Year(s)/ 2022-01-31
186	Signal Generator 9kHz - 3.3GHz	SML03	Rohde & Schwarz	836927/005	2 Year(s)/ 2022-10-31
187	Arbitrary Generator	AutoWave	EM Test GmbH	P1450145409	3 Year(s)/ 2022-10-24

Inv.-No.	Designation	Type	Manufacturer	S/N	Calibration: Interval /valid until
190	Coupling-/ Decoupling Network M1	CDN M132	Ametek	40493	1 Year(s)/ 2021-07-31
191	Coupling-/ Decoupling Network M2	CDN M232S	Ametek	37701	1 Year(s)/ 2021-07-31
192	Coupling-/ Decoupling Network M3	CDN M332	Ametek	37749	1 Year(s)/ 2021-07-31
193	Coupling-/ Decoupling Network M3	CDN M332	Ametek	37750	1 Year(s)/ 2021-07-31
194	Coupling-/ Decoupling Network M4	CDN M432	Ametek	39127	1 Year(s)/ 2021-07-31
195	Coupling-/ Decoupling Network M5	CDN M532	Ametek	40558	1 Year(s)/ 2021-07-31
196	Coupling-/ Decoupling Network AF2	CDN A201A	Ametek	40613	1 Year(s)/ 2021-07-31
197	Coupling-/ Decoupling Network AF2	CDN A201A	Ametek	40614	1 Year(s)/ 2021-07-31
198	Coupling-/ Decoupling Network S1 - 9-pol. D-Sub	CDN S900	Ametek	40033	1 Year(s)/ 2021-07-31
199	Coupling-/ Decoupling Network S1 - RJ45	CDN ST08A	Ametek	39792	1 Year(s)/ 2021-07-31
200	Coupling-/ Decoupling Network S1 - RJ45	CDN ST08A	Ametek	39794	1 Year(s)/ 2021-07-31
201	Coupling-/ Decoupling Network S1 - USB	CDN USB/p	Ametek	40162	1 Year(s)/ 2021-07-31
202	Coupling-/ Decoupling Network S1 - USB 3.0	CDN USB3.0	Ametek	40536	1 Year(s)/ 2021-07-31
204	Coupling-/Decoupling Network S1 - 9-pol. D- Sub	CDN S900	Ametek	40034	1 Year(s)/ 2021-07-31
208	RF Power Meter	NRVD	Rohde & Schwarz	832378/056	2 Year(s)/ 2022-05-14

Inv.-No.	Designation	Type	Manufacturer	S/N	Calibration: Interval /valid until
214	Load Dump Simulator	LD 200N	em test	P1551169024	3 Year(s)/ 2022-10-22
215	Ultra-Compact Simulator for automobiles	UCS200N100	em test	P1607171950	3 Year(s)/ 2022-10-23
216	Voltage Drop Simulator	VDS 200Q100.1	em test	P1612177896	3 Year(s)/ 2022-10-16
217	Automotive Power Fail Module	PFM 200N100.1	em test	P1606171835	3 Year(s)/ 2022-10-24
222	Broadband Preamplifier 0.5-18GHz	BBV 9718	Schwarzbeck	9718-316	1 Year(s)/ 2021-05-31
223	Broadband Preamplifier 12-28GHz	BBV 9719	Schwarzbeck	9719-024	1 Year(s)/ 2021-05-31
224	SMB100A Signal Generator	SMB100A	Rohde & Schwarz	108055	3 Year(s)/ 2023-01-20
225	Electric and Magnetic Field Probe-Analyzer	EHP-200A	Narda S.T.S. / PMM	170WX70205	3 Year(s)/ 2022-02-28
227	Field Probe HI-6006	HI-6006	ETS-Lindgren	00213536	1 Year(s)/ 2021-07-09
228	Coupling device network AF4	CDN AF4-32	EMCE GmbH		1 Year(s)/ 2021-07-31
229	Test receiver	ESS 5 Hz - 1000 MHz	Rohde & Schwarz	845420/0005	1 Year(s)/ 2021-12-10
230	FSV40 Signal Analyzer 40 GHz	FSV40	Rohde & Schwarz	101717	2 Year(s)/ 2022-01-16
231	Vector Signal Generator SMBV100A	SMBV100A	Rohde & Schwarz	262891	3 Year(s)/ 2023-10-02
233	OSP-B157W 8 PORT	OSP-B157W8	Rohde & Schwarz	100925	2 Year(s)/ 2022-01-17
235	ESD-Gun	NSG 435	Teseq	7275	1 Year(s)/ 2021-09-04
236	Broad-Band Horn Antenna 0.5-6 GHz	BBHA 9120 E	Schwarzbeck	00831	5 Year(s)/ 2024-02-13
237	Exposure Level Tester	ELT-400	Narda Safety Test Solutions	O-0028	3 Year(s)/ 2023-02-06
239	Broadband Horn Antenna 15-40 GHz	BBHA 9170	Schwarzbeck	00932	5 Year(s)/ 2024-05-23
241	Coupling Network M2	CN M232-300-DC	Teseq	52495	1 Year(s)/ 2021-07-31
242	Coupling Network M4	CN M432-AC	Teseq	53779	1 Year(s)/ 2021-07-31

Inv.-No.	Designation	Type	Manufacturer	S/N	Calibration: Interval /valid until
243	Coupling Network M2	CN M232-AC	Teseq	50442	1 Year(s)/ 2021-07-31
244	Coupling Network M3	CN M332-AC	Teseq	53480	1 Year(s)/ 2021-07-31
245	Coupling Network M4	CN A401-M	Teseq	53736	1 Year(s)/ 2021-07-31
246	Coupling Network T8	CN T8-AC	Teseq	53835	1 Year(s)/ 2021-07-31
247	Coupling Network T8	CN T8-DC	Teseq	53849	1 Year(s)/ 2021-07-31
248	Coupling Network T4	CN T444-AC	Teseq	53832	1 Year(s)/ 2021-07-31
249	Coupling Network T4	CN T444-DC	Teseq	51260	1 Year(s)/ 2021-07-31
250	Coupling Network M5	CN M532-AC	Teseq	540086	1 Year(s)/ 2021-07-31
251	Isolation Transformer	ITF 22	Teseq	540068	
253	Broadband Preamplifier 20-1000 MHz	ESV-Z3	Rohde & Schwarz	881 909/030	1 Year(s)/ 2021-05-31
255	Coupling Network AF2	CN A201-M	Teseq	52135	1 Year(s)/ 2021-07-31
257	Pulse limiter + 10 dB Attenuator	ESH3-Z2	Rohde & Schwarz	102769	1 Year(s)/ 2021-08-31
258	SMB100A Signal Generator	SMB100A 100 kHz - 40 GHz	Rohde & Schwarz	181667	3 Year(s)/ 2023-12-14
259	SMB100B Signal Generator	SMB100B 8 kHz - 6 GHz	Rohde & Schwarz	101679	3 Year(s)/ 2022-11-01
260	Coupling Network	CDN HF Chirurgie	EMCE GmbH	n/a	1 Year(s)/ 2021-09-30
262	EM Clamp	KEMZ 801A	Teseq	78033	1 Year(s)/ 2021-07-31
718	EMC-Software	BAT-EMC Vers. 3.18.0.19	Nexio	n/a	
997	EMC Software	EMC32 Vers. 10.60.15	Rohde & Schwarz	n/a	
1046	Environmental Simulation Chamber	MKF 115 (E3.1)	Binder GmbH	12-02215	3 Year(s)/ 2023-03-19
1212	EMC Software	WMS32 Vers. 10.60.15	Rohde & Schwarz	n/a	

Scope:

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EMC-Test(s)

1 Test(s) according 47 CFR Part 15 Subpart C - 03/29/2021

1.1 Requirements and conformance test specifications

Standard

47 CFR Part 15 Subpart C

ANSI C63.10-2013

KDB n/a

-

Test mode application		
☒	Antenna requirement	§ 15.203
☒	Restricted bands of operation	§ 15.205 (a) (b) (c) (d(7))
☒	Terminal voltage on powerline	§ 15.207 (a)
☒	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)
☒	Emission bandwidth inside the operating frequency band	§ 15.215 (b) (c)
☒	Field strength mask within the operation band 13.110-14.010 MHz	§ 15.225 (a) (b) (c) (d) (f)
☒	Frequency stability	§ 15.225 (e) (f)



1.2 Antenna requirements

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

*

Measurement procedure:

Rules and specification
Guide

47 CFR Part 15 Section 15.203
n/a

Requirement:

- ☒ Permanent attached
- ☐ Unique coupling to the intentional radiator

Test result

Requirement:

- ☒ kept
- ☐ not kept

Authorized antenna:

- ☐ Print antenna
- ☒ Internal antenna
- ☐ External antenna

| Remarks: n/a

1.3 Restricted bands of operation

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

*

Measurement procedure:

Rules and specification
Guide

47 CFR Part 15 Section 15.205 (a) (b) (c)
ANSI C63.10-2013

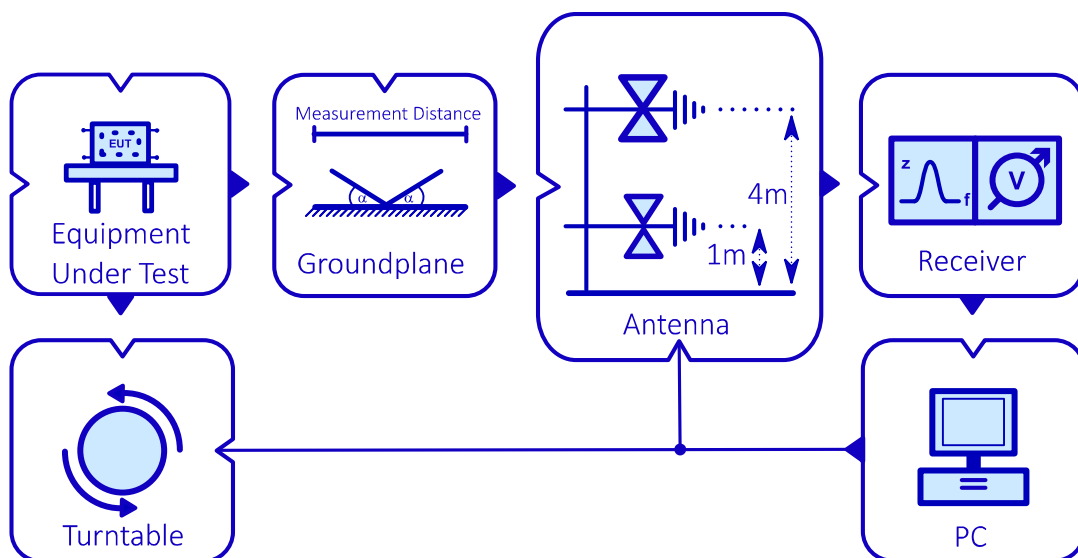
Restricted bands

f / MHz	f / MHz	f / MHz	f / GHz
0.090-0.110	37.5-38.25	3345.8-3358	9.0-9.2
0.495 – 0.505	73-74.6	3500-4400	9.3-9.5
2.1735-2.1905	74.8-75.2	4500-5150	10.6-12.7
3.020-3.026	108-138	5350-5460	13.25-13.4
4.125-4.128	149.9-150.05	7250-7750	14.47-14.5
4.17725-4.17775	156.52475-156.52525	8025-8500	15.35-16.2
4.20725-4.20775	156.7-156.9		17.7-21.4
5.677-5.683	162.0125-167.17		22.01-23.12
6.215-6.218	167.72-173.2		23.6-24.0
6.26775-6.26825	240-285		31.2-31.8
6.31175-6.31225	322-335.4		36.43-36.5
8.291-8.294	399.9-410		above 38.6
8.362-8.366	608-614		
8.37625-8.38675	960-1427		
8.41425-8.41475	1435-1626.5		
12.29-12.293	1645.5-1646.5		
12.51975-12.52025	1660-1710		
12.57675-12.57725	1718.8-1722.2		
13.36-13.41	2200-2300		
16.42-16.423	2310-2390		
16.69475-16.69525	2655-2900		
16.80425-16.80475	3260-3267		
25.5-25.67	3332-3339		

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





1.3.1 Test set up

See test for radiated emissions of intentional radiators.

Test location

See test for radiated emissions of intentional radiators.

Used test equipment

See test for radiated emissions of intentional radiators.

1.3.2 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:

- | | |
|---|---|
| ☐ < 1.705 MHz | ☐ 30 MHz |
| ☒ 1.705 – 108 MHz | ☒ 1000 MHz |
| ☐ 108 – 500 MHz | ☐ 2000 MHz |
| ☐ 500 – 1000 MHz | ☐ 5000 MHz |
| ☐ > 1000 MHz | ☐ 5. harmonic of the highest frequency or 40 GHz, whichever is lower |

Used frequency band: ☒ 13.110-14.010 MHz

Nearest restricted band: ☒ 13.360-13.410 MHz

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 in the restricted bands

Technical requirements			
Detector	Frequency / MHz	Limit / dB μ V	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	30.0	30
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.



Technical requirements

Devices operated pursuant to §15.225 [13.110-14.010 MHz] are exempt from complying with this section for the 13.36-13.41 MHz band only.

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.

Limits for next restricted frequency band:

☒ kept*
☐ not kept

See test for spectrum mask within the operation band.

*Devices operated pursuant to §15.225 [13.110-14.010 MHz]
are exempt from complying with this section for the 13.36-13.41 MHz band only.

Remarks: n/a

Records

- ☒ Diagrams - radiated emissions
- ☒ Readings - radiated emissions

1.4 Terminal voltage on powerline

- ☒ No deviation from the standard*
- ☐ Pre-compliance*
- ☐ Test not requested*
- ☐ Test not carried out*

*

Measurement procedure:

Rules and specification
Guide

47 CFR Part 15 Section 15.207 (a)
ANSI C63.10-2013

The conducted disturbances are recorded in the frequency range from 150 kHz to 30 MHz. For this purpose line impedance stabilization networks (LISNs) are used which are inserted between the DUT and the mains supply. The output of one LISN is connected directly to a receiver according to CISPR 16 guidelines via a pulse limiter and 10 dB fixed attenuator. Not used ports of the LISN are terminated by 50 Ω . The Average- and Quasi-Peak-Detectors are provided to evaluate the spectrum. To speed up the measurement process, a pre-measurement is performed with the Peak- and Average-Detectors. The 10 frequencies with the smallest distance to the limit and priority with the highest exceeding are selected and remeasured. The Average and Quasi-Peak-Detectors are used for the final measurement. This measurement procedure is performed for each individual current conductor.

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.

For the measurement, it may be necessary to terminate the antenna output to distinguish the interference level caused by the unintentional part from the intentional part (see ANSI C63.4 section 13.1.3.1).

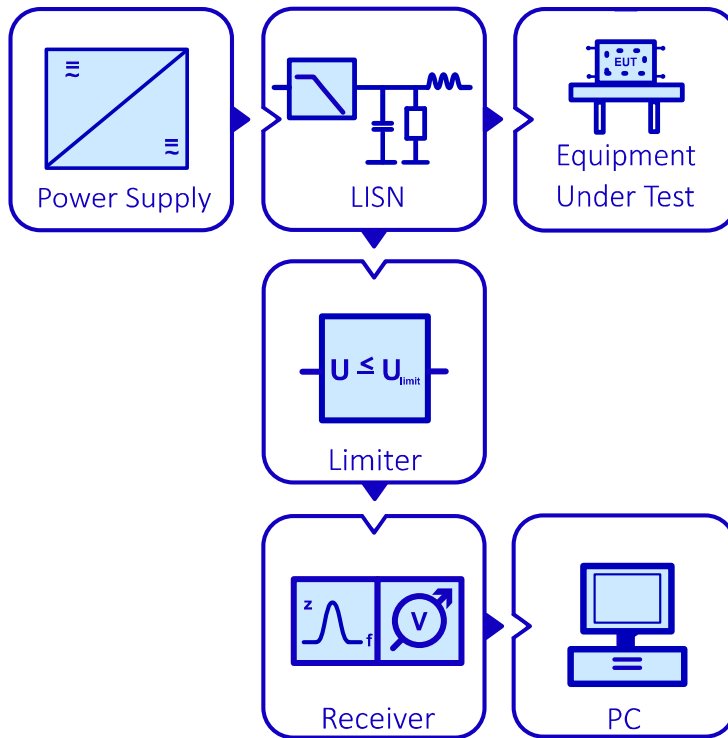
The documented final test results are calculated using the following formula:

$$\text{Result (dB}\mu\text{V)} = \text{Measured Value (dB}\mu\text{V)} + \text{ATF (dB)} + \text{CF (dB)}.$$

ATF = correction factor for the pulse limiter + 10 dB attenuator

CF = Correction factor for the cable attenuation

Basic structure - Setup





1.4.1 Test set up

According ANSI C63.10-2013



Test location

☒	Inv.-No.	Designation	Type (L x W x H)	Manufacturer	Location
☒	588	Shielded room # 2	8.3/5.8 x 5.5/2.9 x 3.4 m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	1319	Shielded room #5	5.6 x 5.0 x 3.8 m	Albatross Projects GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden

Used test equipment

☒	Inv.-No.	Designation	Type	Manufacturer	S/N
☒	001	Test receiver	ESS 5 Hz – 1000 MHz	Rohde & Schwarz	833776/008
	003	LISN 1	ESH3-Z5	Rohde & Schwarz	835268/007
☒	004	LISN 2	ESH3-Z5	Rohde & Schwarz	835268/003
	005	LISN 3	NNB 4/32T	Rolf Heine HF-Technik	4/32T-96015
	042	AC-Source / Analyzer / Norm impedance	EMV D5000/PAS	Spitzenberger + Spies	A274700/ 0 0501
	058	Test receiver	ESIB 40	Rohde & Schwarz	100200
☒	067	LISN 5	ESH2-Z5	Rohde & Schwarz	0872460/043
	068	LISN 4	ESH2-Z5	Rohde & Schwarz	0872460/042
☒	070	Pulse limiter / 10 dB attenuator	ESH3-Z2	Rohde & Schwarz	357.8810.52
	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 terminal voltage with an extended coverage factor of $k = 2$:

Frequency	Measurement uncertainty
9 kHz – 150 kHz	4.0 dB
150 kHz – 30 MHz	3.6 dB

1.4.2 Test

Rules and specification 47 CFR Part 15 Section 15.207 (a)

Frequency range: 150 kHz – 30 MHz

Limits for conducted emissions

Technical requirements			
Detector	Frequency / MHz	Limit QP-Detector / dB μ V	Limit AV-Detector / dB μ V
QP AV	0.15 – 0.5	66.0 – 56.0	56.0 – 46.0
QP AV	0.5 – 5.0	56.0	46.0
QP AV	5.0 – 30.0	60	50.0

Rationale for selecting the EUT test set up

Equipment units:

RFID reader with external power supply and evaluation unit in minimum configuration.

Cabling:

- ☒ Standard cables
☐ Special cables provided by the manufacturer

Port #	Designation	Remarks
# 1	AC power line	L1/N
# 2		
# 3		



Operation mode

EUT arrangement: ☒ Tabletop ☐ Floor standing
Power supply: ☒ 120 V/60 Hz ☐ 240 V/60 Hz

Reading tag continuously with the tag placed at maximum reading distance.

Environmental conditions

Temperature [10 – 40 °C]: 25 °C
Relative humidity [10 – 90 %]: 46 %

Environmental conditions during the test: ☒ kept
☐ not kept

Test result

Limits for conducted powerline emissions: ☒ kept
☐ not kept
☐ not relevant

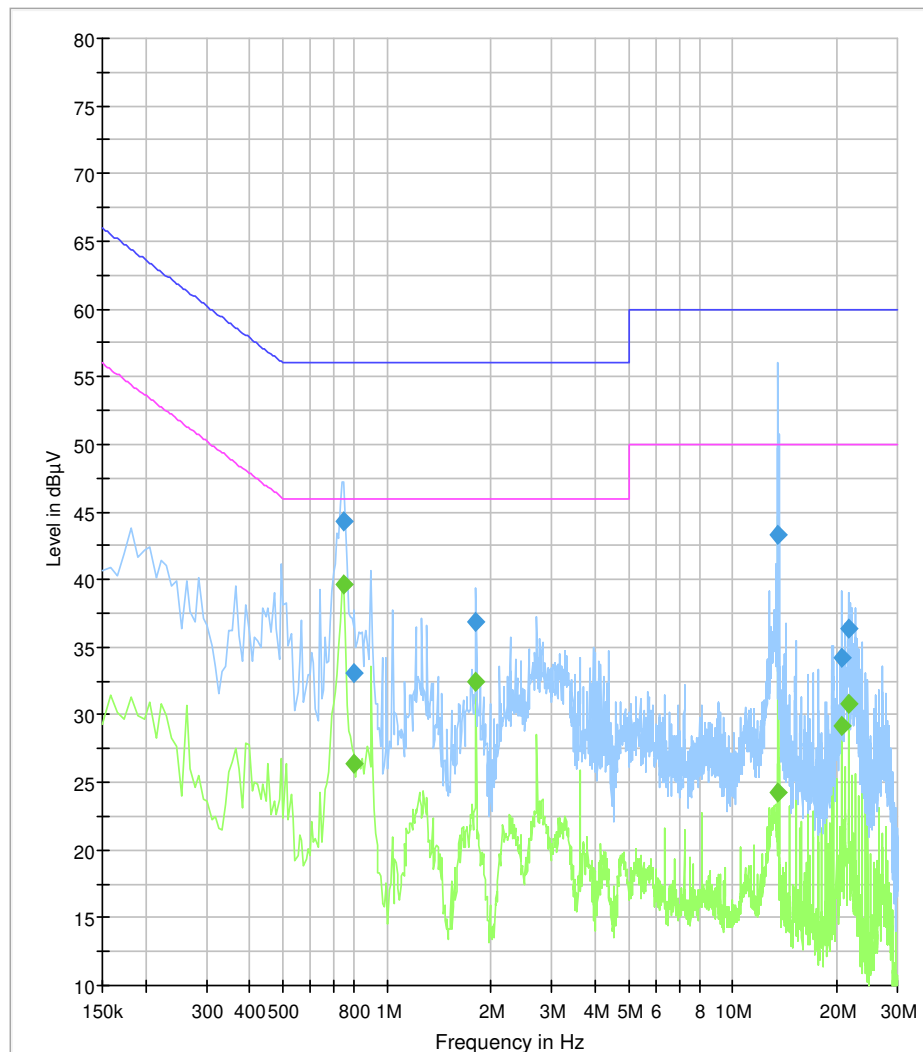
| Remarks: n/a

Records

☒ Readings
☒ Diagram

EUT Information

EUT Name:	ARE i9 HF
Test_ID: / SN:	21-0076PR13-007
Customer:	AEG Identifikationssysteme GmbH
Operational condition:	Continuous reading with tag placed at maximum reading distance
Test specification:	47 CFR Part 15 Subpart C §15.207
LISN port	N / Reader
Operator:	S. Vogelmann
File #:	21-0076RC13-007-001
Comment #1:	
Comment #2:	



— Preview Result 2-AVG	— Preview Result 1-PK+
— 47 CFR 15 Subpart C §15.207 QP	— 47 CFR Part 15 Subpart C §15.207 AV
◆ Final_Result QPK	◆ Final_Result AVG

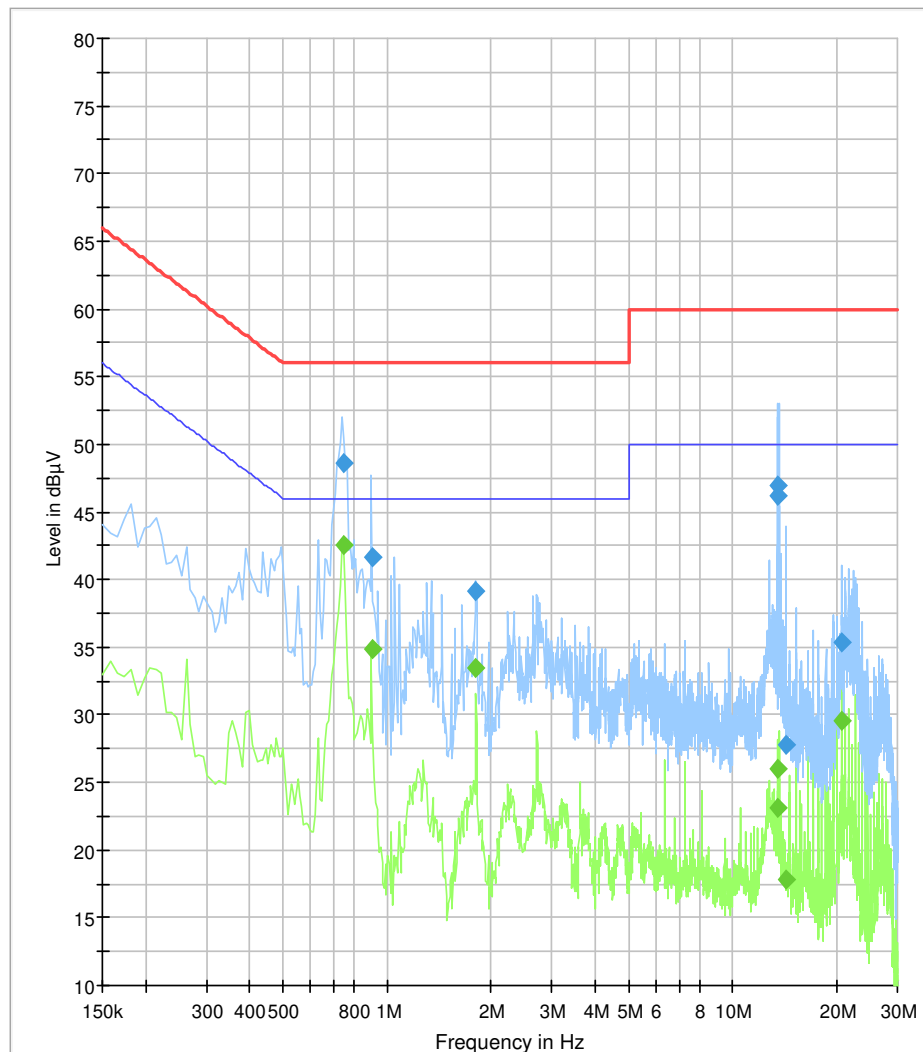
Final result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.746000	---	39.64	46.00	6.36	5000.0	10.000	N	9.9
0.746000	44.26	---	56.00	11.74	5000.0	10.000	N	9.9
0.802000	---	26.42	46.00	19.58	5000.0	10.000	N	9.9
0.802000	33.03	---	56.00	22.97	5000.0	10.000	N	9.9
1.810000	---	32.40	46.00	13.60	5000.0	10.000	N	10.0
1.810000	36.90	---	56.00	19.10	5000.0	10.000	N	10.0
13.570000	---	24.21	50.00	25.79	5000.0	10.000	N	10.2
13.570000	43.33	---	60.00	16.67	5000.0	10.000	N	10.2
20.610000	---	29.15	50.00	20.85	5000.0	10.000	N	10.2
20.610000	34.16	---	60.00	25.84	5000.0	10.000	N	10.2
21.618000	---	30.87	50.00	19.13	5000.0	10.000	N	10.3
21.618000	36.34	---	60.00	23.66	5000.0	10.000	N	10.3

(

EUT Information

EUT Name:	ARE i9 HF
Test_ID: / SN:	21-0076PR13-007
Customer:	AEG Identifikationssysteme GmbH
Operational condition:	Continuous reading with tag placed at maximum reading distance
Test specification:	47 CFR Part 15 Subpart C §15.207
LISN port	L1 / Reader
Operator:	S. Vogelmann
File #:	21-0067TE16-002
Comment #1:	
Comment #2:	



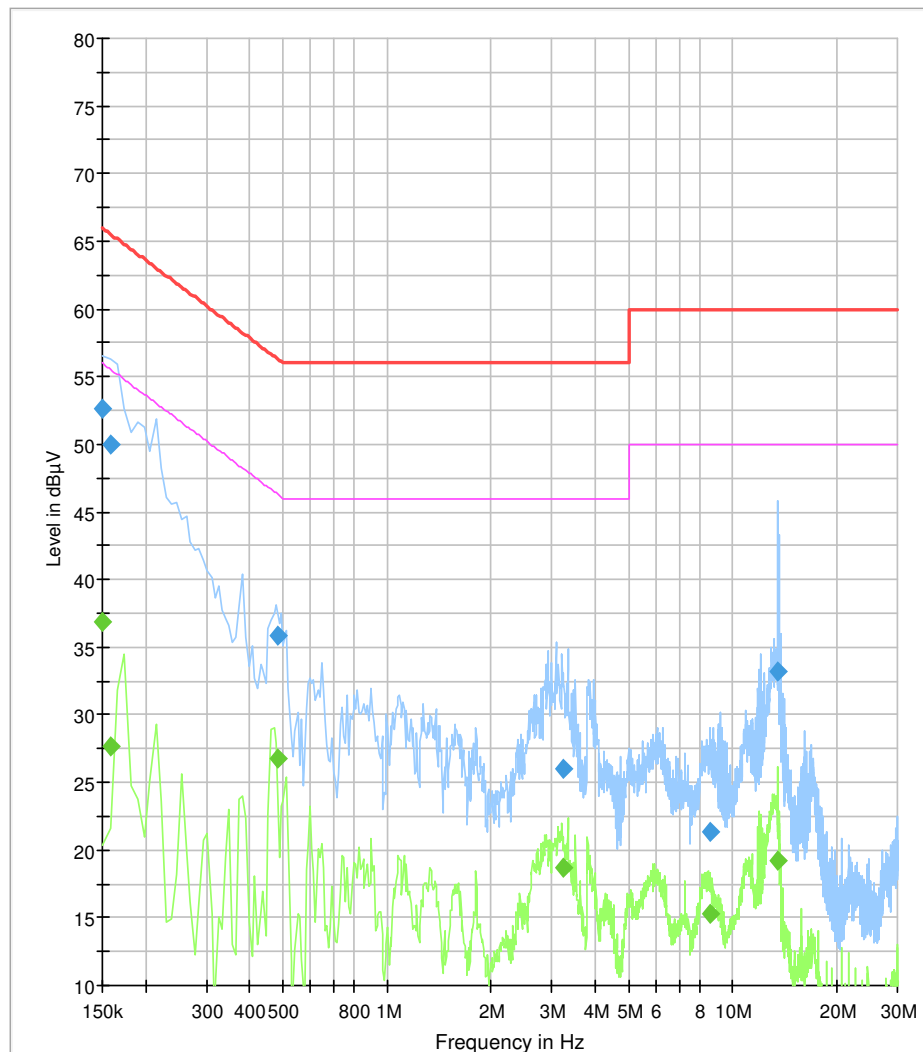
— Preview Result 2-AVG	— Preview Result 1-PK+
— 47 CFR Part 15 Subpart C §15.207 QP	— 47 CFR Part 15 Subpart C §15.207 AV
◆ Final_Result QPK	◆ Final_Result AVG

Final result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.746000	48.62	---	56.00	7.38	5000.0	10.000	L1	9.9
0.746000	---	42.48	46.00	3.52	5000.0	10.000	L1	9.9
0.906000	41.61	---	56.00	14.39	5000.0	10.000	L1	10.0
0.906000	---	34.85	46.00	11.15	5000.0	10.000	L1	10.0
1.810000	39.13	---	56.00	16.87	5000.0	10.000	L1	10.0
1.810000	---	33.46	46.00	12.54	5000.0	10.000	L1	10.0
13.546000	46.95	---	60.00	13.05	5000.0	10.000	L1	10.2
13.546000	---	23.12	50.00	26.88	5000.0	10.000	L1	10.2
13.570000	46.17	---	60.00	13.83	5000.0	10.000	L1	10.2
13.570000	---	25.98	50.00	24.02	5000.0	10.000	L1	10.2
14.274000	27.79	---	60.00	32.21	5000.0	10.000	L1	10.2
14.274000	---	17.88	50.00	32.12	5000.0	10.000	L1	10.2
20.610000	35.38	---	60.00	24.62	5000.0	10.000	L1	10.2
20.610000	---	29.58	50.00	20.42	5000.0	10.000	L1	10.2

EUT Information

EUT Name:	ARE i9 HF
Test_ID: / SN:	21-0076PR13-007
Customer:	AEG Identifikationssysteme GmbH
Operational condition:	Continuous reading with tag placed at maximum reading distance
Test specification:	47 CFR Part 15 Subpart C §15.207
LISN port	N / PC
Operator:	S. Vogelmann
File #:	21-0067TE16-004
Comment #1:	
Comment #2:	



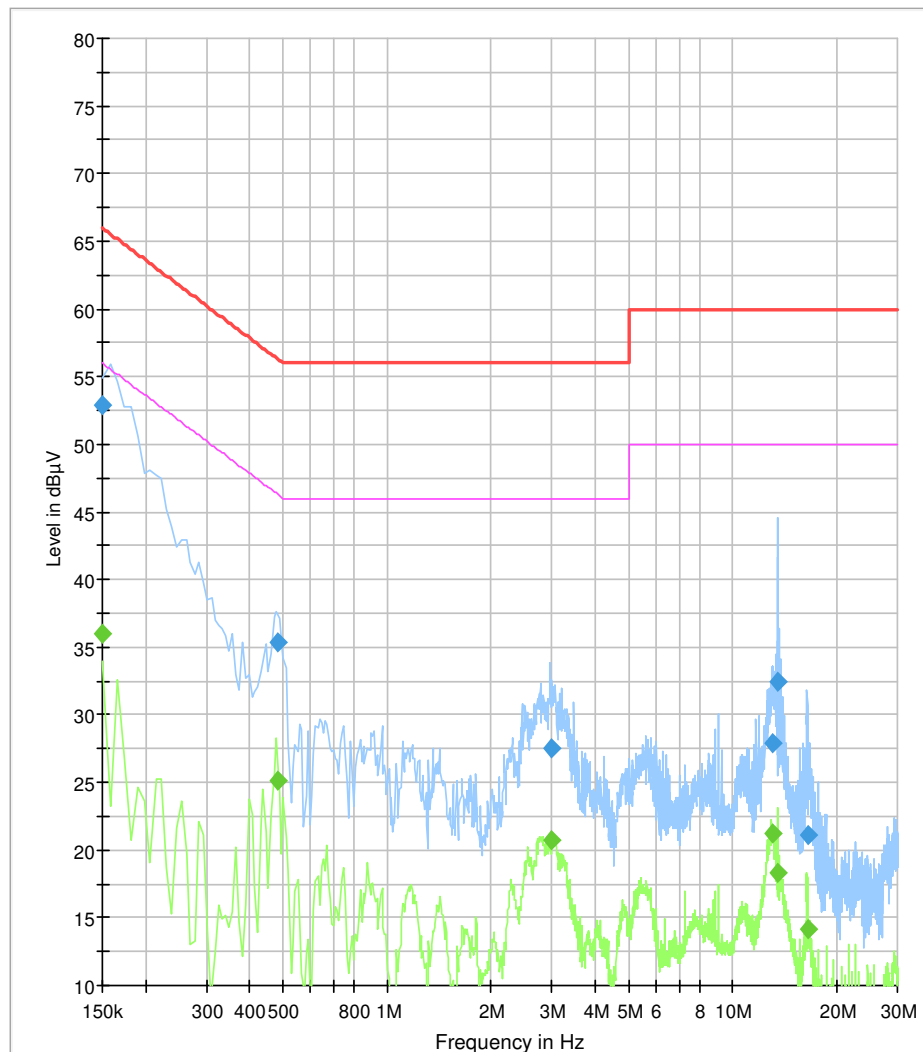
Preview Result 2-AVG	Preview Result 1-PK+
47 CFR Part 15 Subpart C §15.207 QP	47 CFR Part 15 Subpart C §15.207 AV
Final_Result QPK	Final_Result AVG

Final result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.150000	---	36.91	56.00	19.09	5000.0	10.000	N	9.9
0.150000	52.62	---	66.00	13.38	5000.0	10.000	N	9.9
0.158000	---	27.60	55.57	27.97	5000.0	10.000	N	9.9
0.158000	50.01	---	65.57	15.56	5000.0	10.000	N	9.9
0.482000	35.83	---	56.31	20.47	5000.0	10.000	N	9.9
0.482000	---	26.81	46.31	19.49	5000.0	10.000	N	9.9
3.250000	26.03	---	56.00	29.97	5000.0	10.000	N	10.0
3.250000	---	18.76	46.00	27.24	5000.0	10.000	N	10.0
8.618000	21.41	---	60.00	38.59	5000.0	10.000	N	10.2
8.618000	---	15.35	50.00	34.65	5000.0	10.000	N	10.2
13.570000	33.22	---	60.00	26.78	5000.0	10.000	N	10.2
13.570000	---	19.19	50.00	30.81	5000.0	10.000	N	10.2

EUT Information

EUT Name:	ARE i9 HF
Test_ID: / SN:	21-0076PR13-007
Customer:	AEG Identifikationssysteme GmbH
Operational condition:	Continuous reading with tag placed at maximum reading distance
Test specification:	47 CFR Part 15 Subpart C §15.207
LISN port	L1 / PC
Operator:	S. Vogelmann
File #:	21-0067TE16-004
Comment #1:	
Comment #2:	



— Preview Result 2-AVG	— Preview Result 1-PK+
— 47 CFR Part 15 Subpart C §15.207 QP	— 47 CFR Part 15 Subpart C §15.207 AV
◆ Final_Result QPK	◆ Final_Result AVG

Final result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.150000	52.84	---	66.00	13.16	5000.0	10.000	L1	9.9
0.150000	---	35.99	56.00	20.01	5000.0	10.000	L1	9.9
0.482000	35.33	---	56.31	20.97	5000.0	10.000	L1	9.9
0.482000	---	25.14	46.31	21.16	5000.0	10.000	L1	9.9
3.002000	27.50	---	56.00	28.50	5000.0	10.000	L1	10.0
3.002000	---	20.69	46.00	25.31	5000.0	10.000	L1	10.0
13.066000	27.90	---	60.00	32.10	5000.0	10.000	L1	10.2
13.066000	---	21.22	50.00	28.78	5000.0	10.000	L1	10.2
13.538000	32.44	---	60.00	27.56	5000.0	10.000	L1	10.2
13.538000	---	18.29	50.00	31.71	5000.0	10.000	L1	10.2
16.498000	21.10	---	60.00	38.90	5000.0	10.000	L1	10.2
16.498000	---	14.13	50.00	35.87	5000.0	10.000	L1	10.2

1.5 Radiated emissions of intentional radiators

1.5.1 Radiated emissions H-Field of intentional radiators

- ☒ No deviation from the standard*
☐ Precompliance*
☐ 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 C63.10-2013

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 30 MHz. 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:

$$\text{Field strength (dB}\mu\text{V/m)} = \text{Reading (dB}\mu\text{V)} + \text{AF (dB/m)} + \text{CF (dB)} + 40 \cdot (\text{D}_\text{T}/\text{D}_\text{R}) \text{ (dB)}$$

AF = Correction factor for the antenna

CF = Correction factor for the cable loss

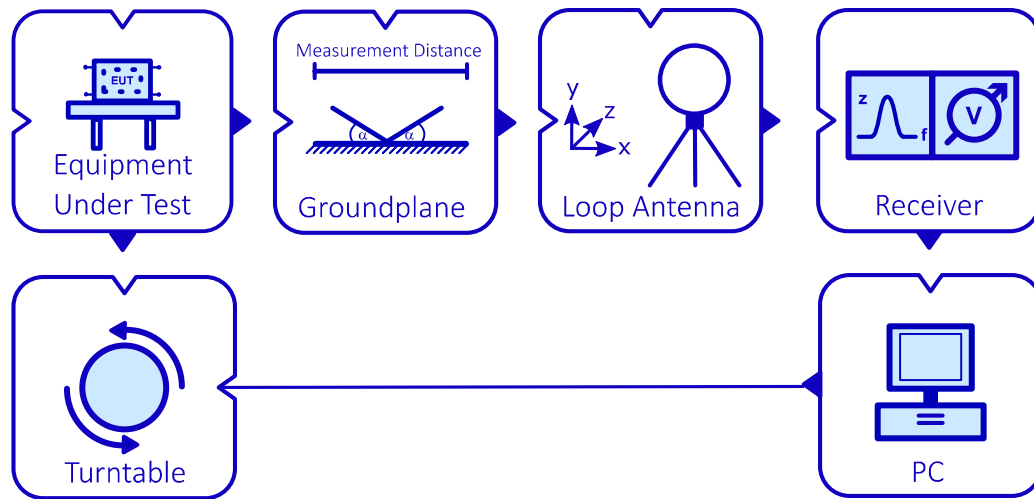
DT = Test distance

DR = Reference distance for the limit defined in the standard



Basic structure - Setup

OATS / SAC

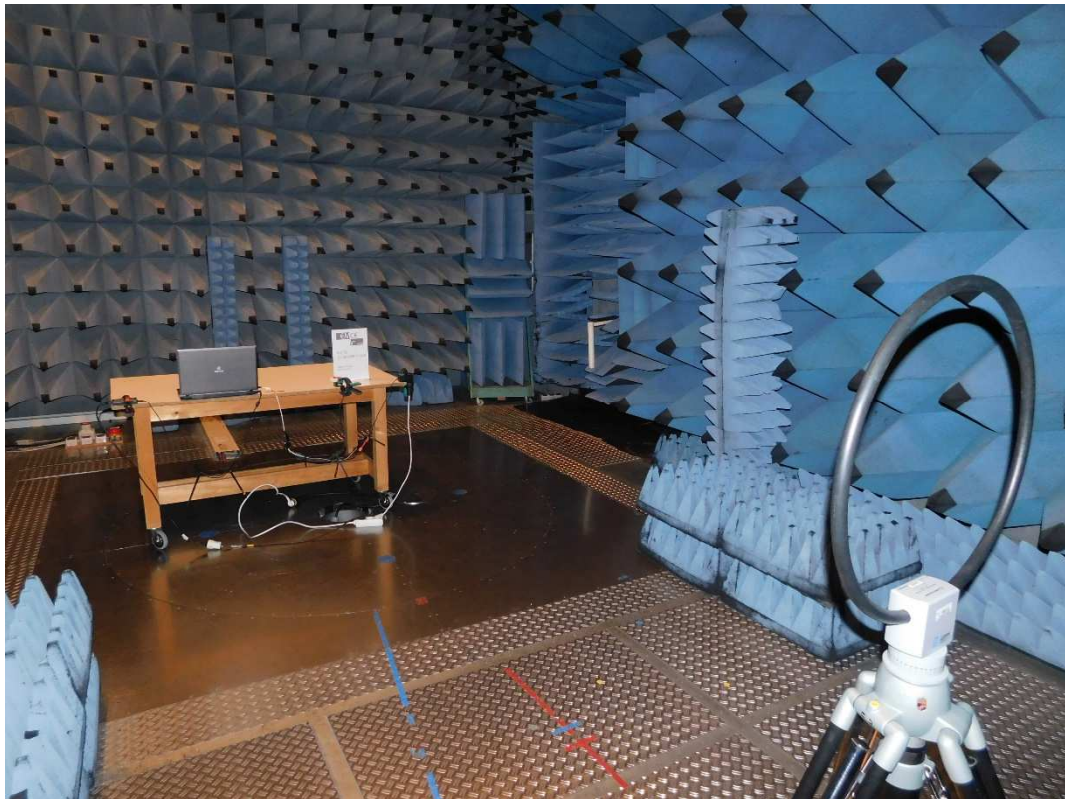


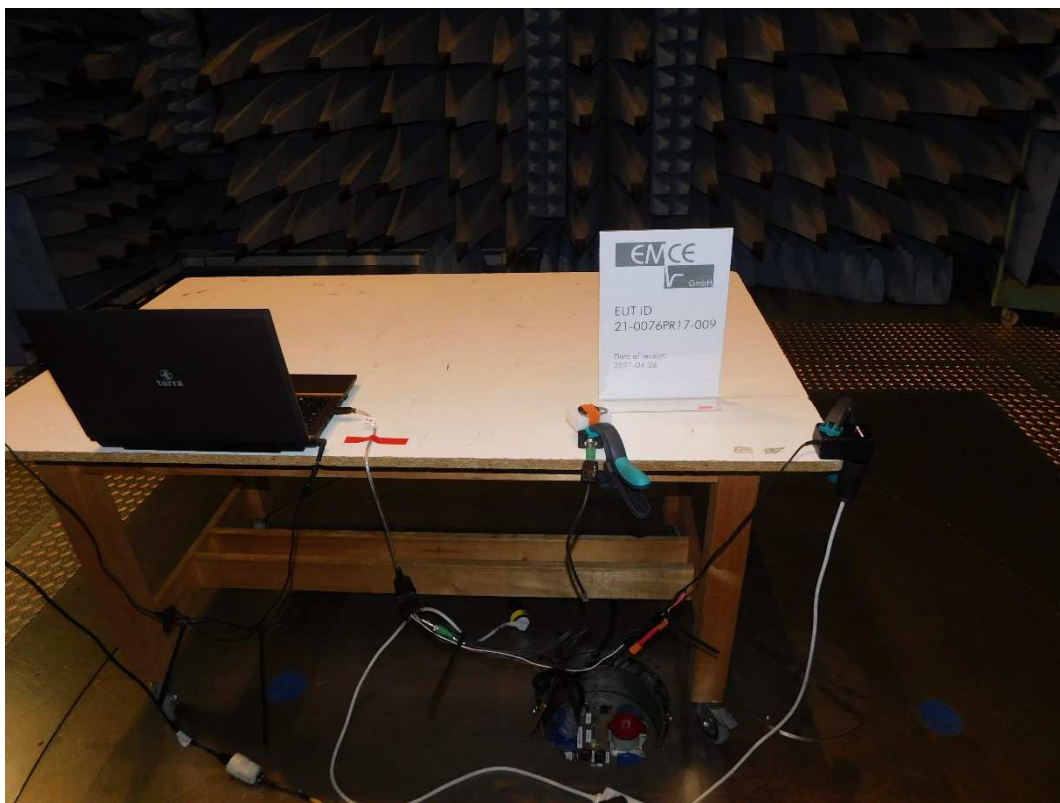
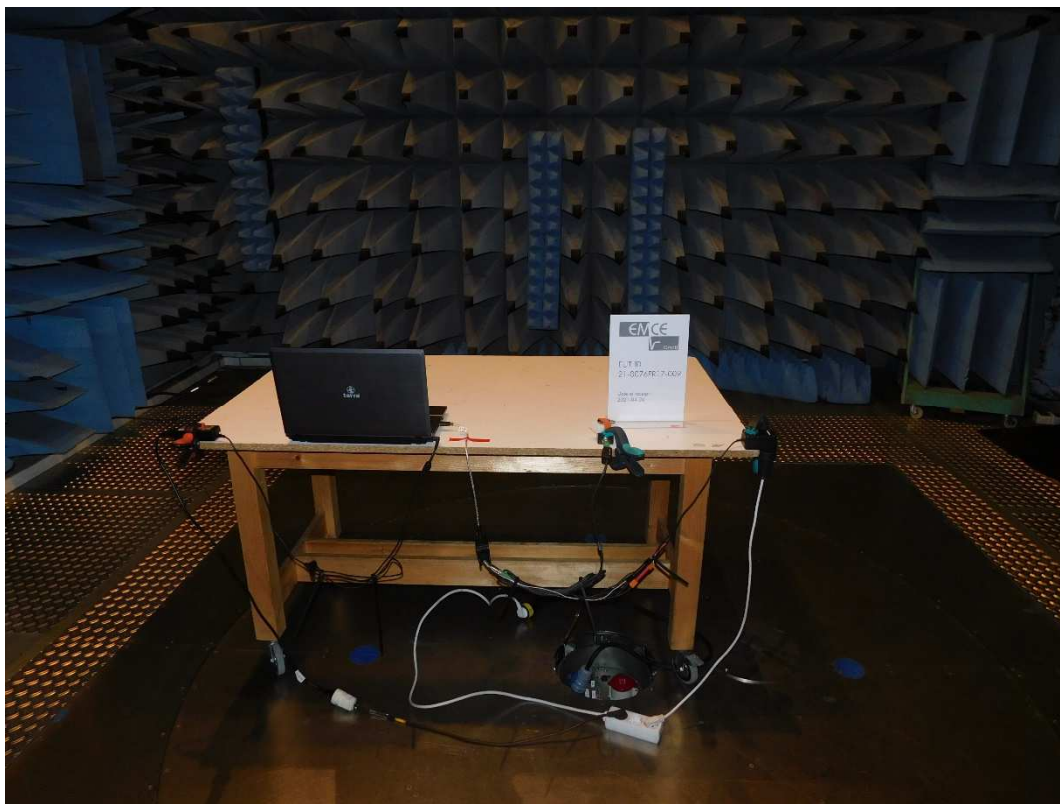


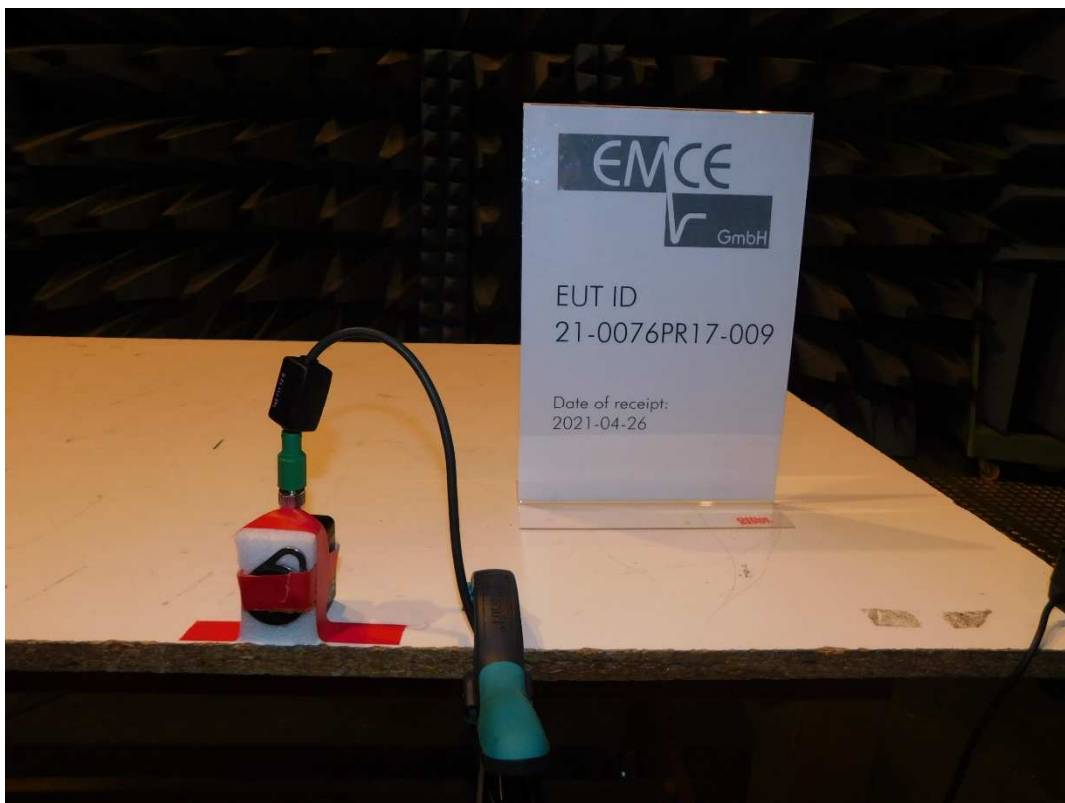
1.5.1.1 Test set up

According ANSI C63.10-2013

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







Test location

Pre-compliance 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-compliance 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
	058	Test receiver	ESIB 40	Rohde & Schwarz	100200
	997	Software	EMC32	Rohde & Schwarz	n/a

Final test					
☒	Inv.-No.	Designation	Type	Manufacturer	S/N
	001	Test receiver	ESS 5 Hz – 1000 MHz	Rohde & Schwarz	833776/008
☒	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
☒	058	Test receiver	ESIB 40	Rohde & Schwarz	100200
	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

1.5.1.2 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 / dB μ V	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	30.0	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			

Antenna Orientation

☒ 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

Rationale for selecting the EUT test set up

Equipment units:

RFID reader with external power supply and evaluation unit in minimum configuration.

Cabling:

- ☒ Standard cables
☐ Special cables provided by the manufacturer

Port #	Designation	Remarks
# 1	AC power line	L1/N
# 2		
# 3		

Operation mode

EUT arrangement: ☒ Tabletop ☐ Floor standing
 Power supply: ☒ 120 V/60 Hz ☐ 240 V/60 Hz

Reading tag continuously with the tag placed at maximum reading distance.

Environmental conditions

Temperature [10 – 40 °C]: 26 °C
 Relative humidity [10 – 90 %]: 48 %

Environmental conditions during the test: ☒ kept
☐ not kept

Test result

Limits for unwanted radiated emissions: ☒ kept
☐ not kept
☐ not relevant

Remarks: n/a



Records

Pre-compliance measurement

- ☐ Readings
☐ Diagram

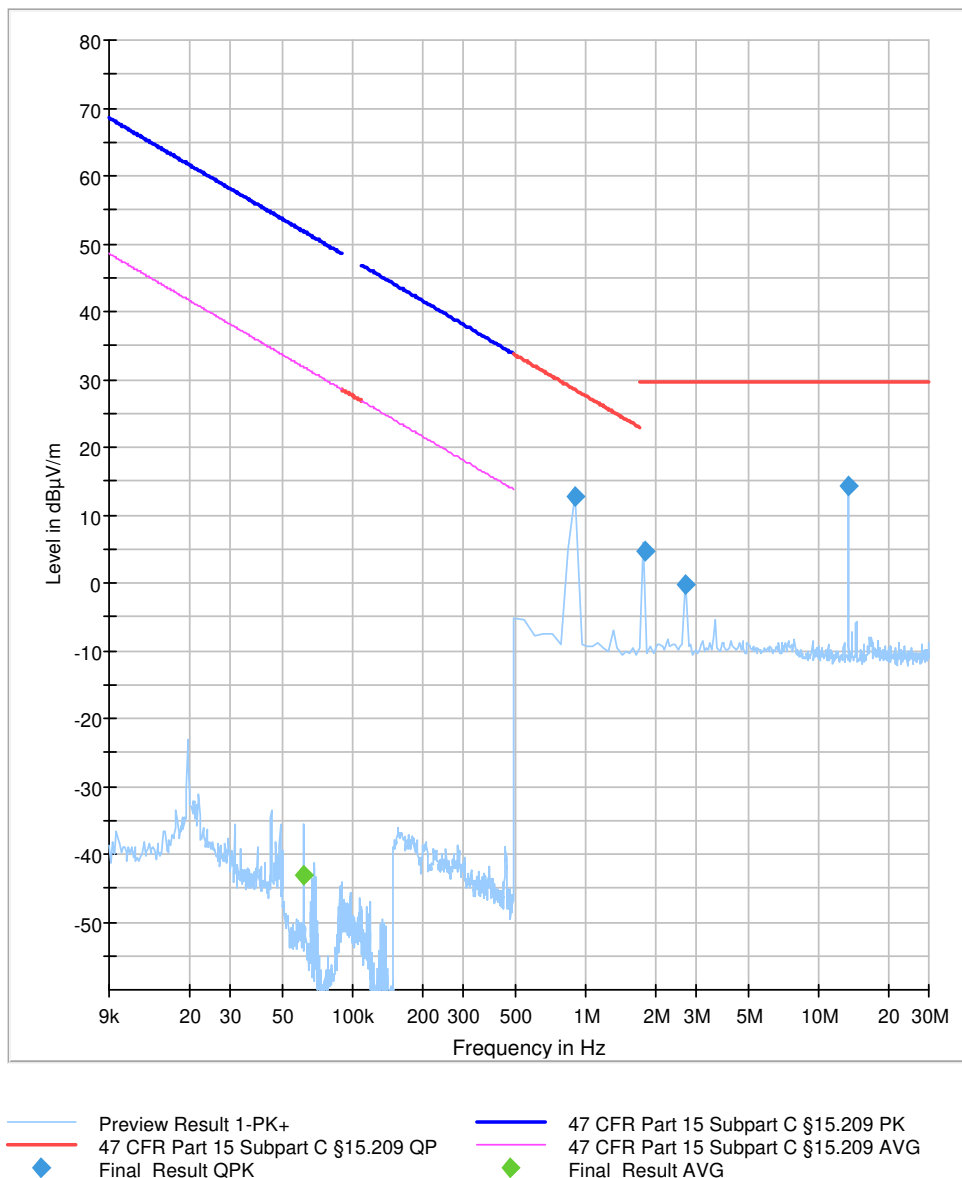
Final measurement

- ☒ Readings
☒ Diagram

EUT Information

EUT Name:	ARE i9 HF
Test_ID: / SN:	21-0076PR13-009
Customer:	AEG Identifikationssysteme GmbH
Operational condition:	Continuous reading with transponder inside the field
Test specification:	47 CFR Part 15 Subpart C
Antenna information:	Distance EUT-Ant.: 3.0 m / Polarization: H/V / Ant.Height: 1.0 m
Operator:	S. Vogelmann
File #:	21-0076RC17-009-010
Comment #1:	"worst case" orientation of the reader
Comment #2:	

Full Spectrum





Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
0.061593	---	31.81	74.81	5000.0	0.200	H	217.0	-59.9	@300 m
0.903968	12.83	28.48	15.65	5000.0	9.000	V	336.0	-20.0	@30 m
1.807042	4.68	29.54	24.86	5000.0	9.000	V	-24.0	-19.9	@30 m
2.712116	-0.30	29.54	29.84	5000.0	9.000	V	326.0	-19.9	@30 m
13.559559	14.34	29.54	15.20	5000.0	9.000	V	85.0	-20.1	@30 m

1.5.2 Radiated emissions E-Field of intentional radiators

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

*

Measurement procedure:

Rules and specification
Guide

47 CFR Part 15 Section 15.209 (a)(b)(c)(d)(e)(f)
ANSI C63.10-2013

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 225 MHz, a logperiodic antenna from 225 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 $\pm 20^\circ$ 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 $\pm 45^\circ$ 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-compliance.

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:

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

AF = Correction factor for the antenna

CF = Correction factor for the cable loss

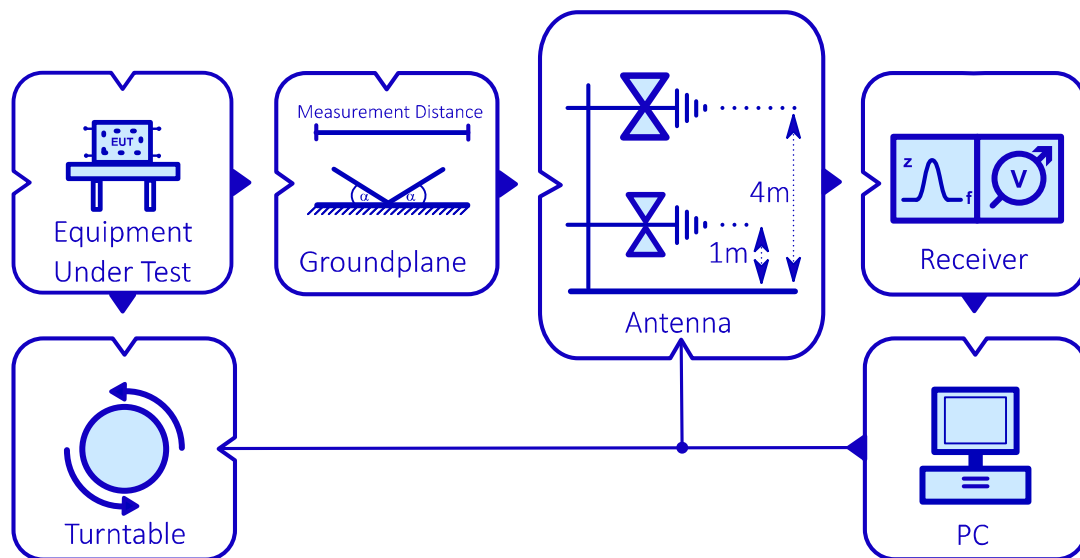
D_T = Test distance

D_R = Reference distance for the limit defined in the standard



Basic structure - Setup

OATS / SAC





1.5.2.1 Test set up

According ANSI C63.4-2003

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

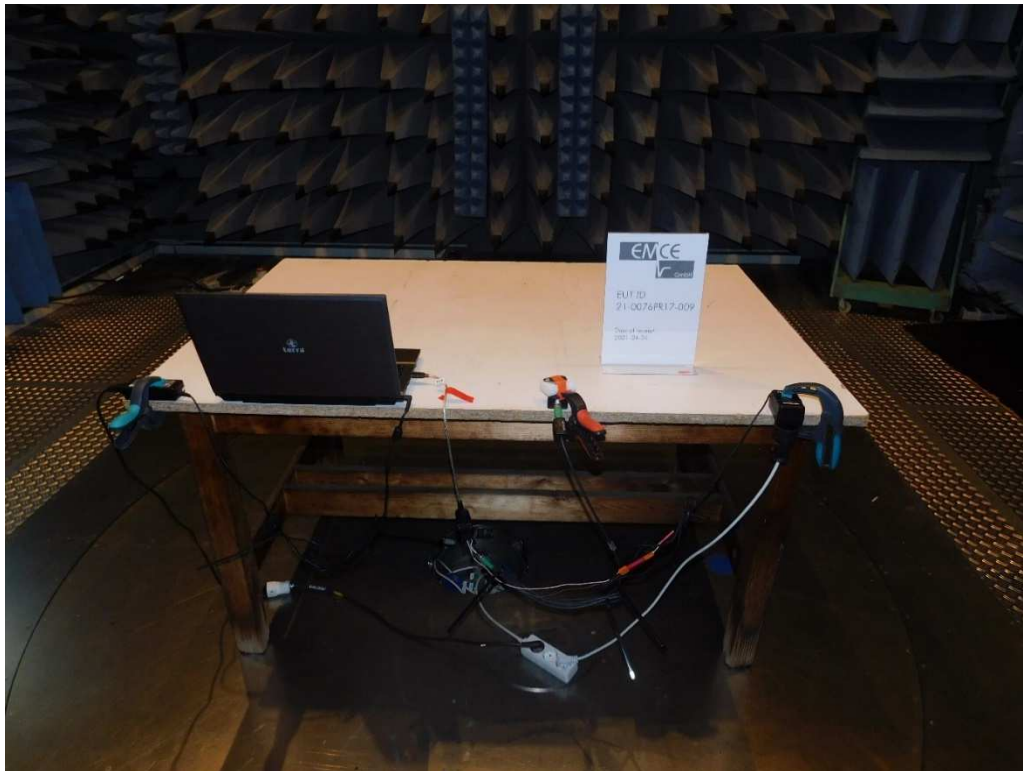
Final test setup







Precompliance test setup



Test location

Pre-compliance 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-compliance test					
☒	Inv.-No.	Designation	Type	Manufacturer	S/N
☒	010	Antenna 250 – 1200 MHz	UHALP 9108A	Schwarzbeck	108
☒	011	Antenna 30 – 300 MHz	VHBA9123 / BBA9106	Schwarzbeck	0408/94
☒	042	AC-Source / Analyzer / Norm impedance	EMV D5000/PAS	Spitzenberger + Spies	A274700/ 0 0501
☒	058	Test receiver	ESIB 40	Rohde & Schwarz	100200
	059	Logper. Antenna	HL050	Rohde & Schwarz	100006
☒	997	Software	EMC32	Rohde & Schwarz	n/a

Final test					
☒	Inv.-No.	Designation	Type	Manufacturer	S/N
☒	001	Test receiver	ESS 5 Hz – 1000 MHz	Rohde & Schwarz	833776/008
☒	009	Antenna 30 – 300 MHz	VHBA9123 / BBA9106	Schwarzbeck	435
☒	012	Antenna 250 – 1200 MHz	UHALP 9108A	Schwarzbeck	166
☒	042	AC-Source / Analyzer / Norm impedance	EMV D5000/PAS	Spitzenberger + Spies	A274700/ 0 0501
	058	Test receiver	ESIB 40	Rohde & Schwarz	100200
	059	Logper. Antenna	HL050	Rohde & Schwarz	100006
	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
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)

1.5.2.2 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:

- ☐ < 1.705 MHz
☒ 1.705 – 108 MHz
☐ 108 – 500 MHz
☐ 500 – 1000 MHz
☐ > 1000 MHz

- ☐ 30 MHz
☒ 1000 MHz
☐ 2000 MHz
☐ 5000 MHz
☐ 5. harmonic of the highest frequency or 40 GHz, whichever is lower

Frequency range:

- ☐ 9 kHz – 30 MHz
☐ 1 – 5 GHz
☐ 18 – 26 GHz

- ☒ 30 MHz – 1000 MHz
☐ 5 – 18 GHz
☐ 26 – 40 GHz

Limits for radiated emissions

Technical requirements			
Detector	Frequency / MHz	Limit / dB μ V	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:

RFID reader with external power supply and evaluation unit in minimum configuration.

Cabling:

- ☒ Standard cables
☐ Special cables provided by the manufacturer

Port #	Designation	Remarks
# 1	AC power line	L1/N
# 2		
# 3		

EUT Orientation

- ☒ X-Direction ☒ Y-Direction ☒ Z-Direction

Operation mode

- EUT arrangement: ☒ Tabletop ☐ Floor standing
Power supply: ☒ 120 V/60 Hz ☐ 240 V/60 Hz

Reading tag continuously with the tag placed at maximum reading distance.

Environmental conditions

Temperature [10 – 40 °C]: 11 °C
Relative humidity [10 – 90 %]: 45 %

Environmental conditions during the test: ☒ kept
 ☐ not kept



Test result

Limits for unwanted radiated emissions:

- ☒ kept
- ☐ not kept
- ☐ not relevant

| Remarks: n/a

Records

Pre-compliance measurement

- ☒ Readings
- ☒ Diagram

Final measurement

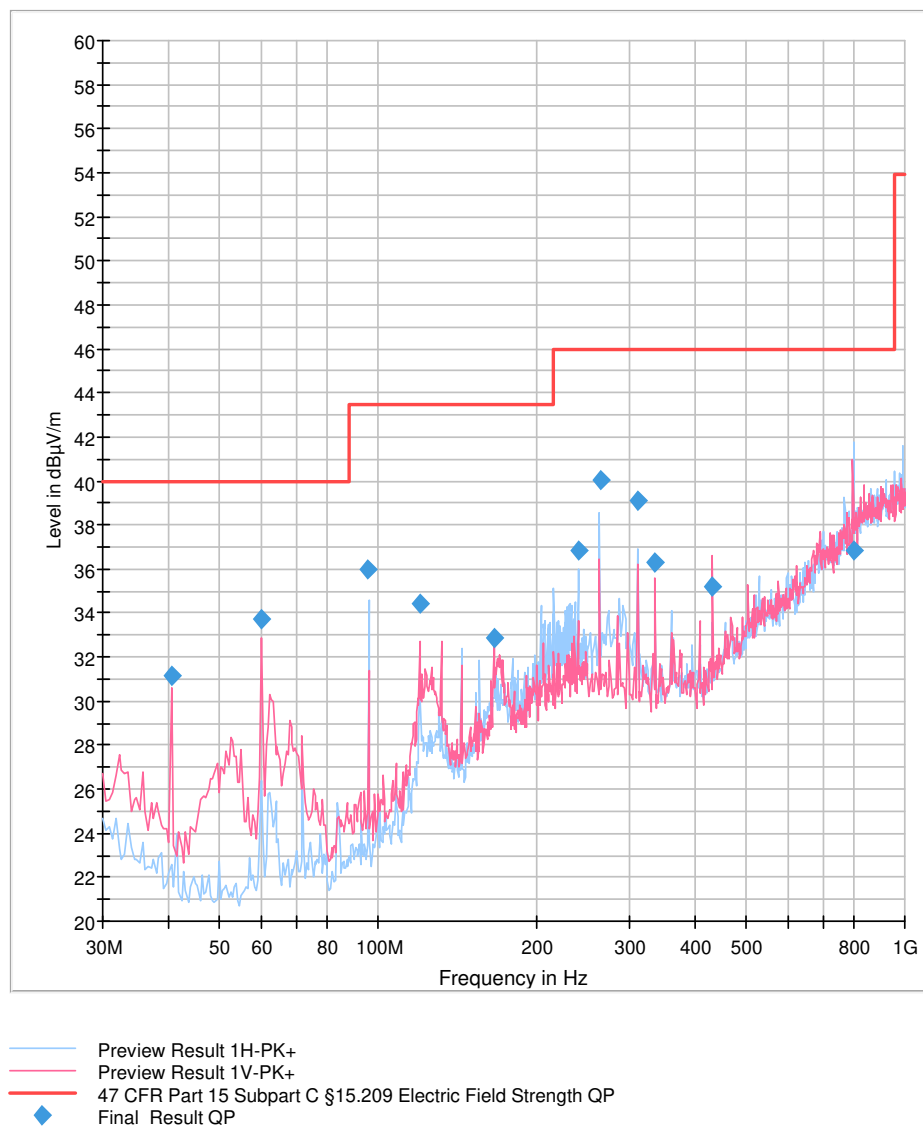
- ☒ Readings
- ☒ Diagram

Pre-compliance measurement

EUT Information

EUT Name:	ARE i9 HF
Test_ID: / SN:	21-0076PR13-009
Customer:	AEG Identifikationssysteme GmbH
Operational condition:	Continuous reading (fast read cycle)
Test specification:	47 CFR Part 15 Subpart C §15.209
Antenna information:	Distance EUT-Ant.: 3.0 m / Polarization: H/V / Ant.Height: 1.0-4.0 m
Operator:	S. Vogelmann
File #:	21-0076RC017-009-001
Comment #1:	
Comment #2:	

Full Spectrum



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)
40.689378	31.18	40.00	8.82	5000.0	120.000	127.0	V	23.0	9.7
60.006413	33.72	40.00	6.28	5000.0	120.000	105.0	V	246.0	8.5
95.947094	35.99	43.50	7.51	5000.0	120.000	210.0	H	276.0	10.0
119.947094	34.43	43.50	9.07	5000.0	120.000	107.0	V	179.0	11.3
166.693387	32.90	43.50	10.60	5000.0	120.000	105.0	V	109.0	13.7
239.894188	36.85	46.00	9.15	5000.0	120.000	285.0	H	276.0	17.7
263.861323	40.03	46.00	5.97	5000.0	120.000	135.0	H	305.0	15.9
311.875752	39.08	46.00	6.92	5000.0	120.000	135.0	H	320.0	15.0
335.861323	36.28	46.00	9.72	5000.0	120.000	285.0	V	280.0	15.3
431.784369	35.19	46.00	10.81	5000.0	120.000	185.0	V	295.0	17.9
799.717835	36.86	46.00	9.14	5000.0	120.000	121.0	H	197.0	23.2

Final measurement

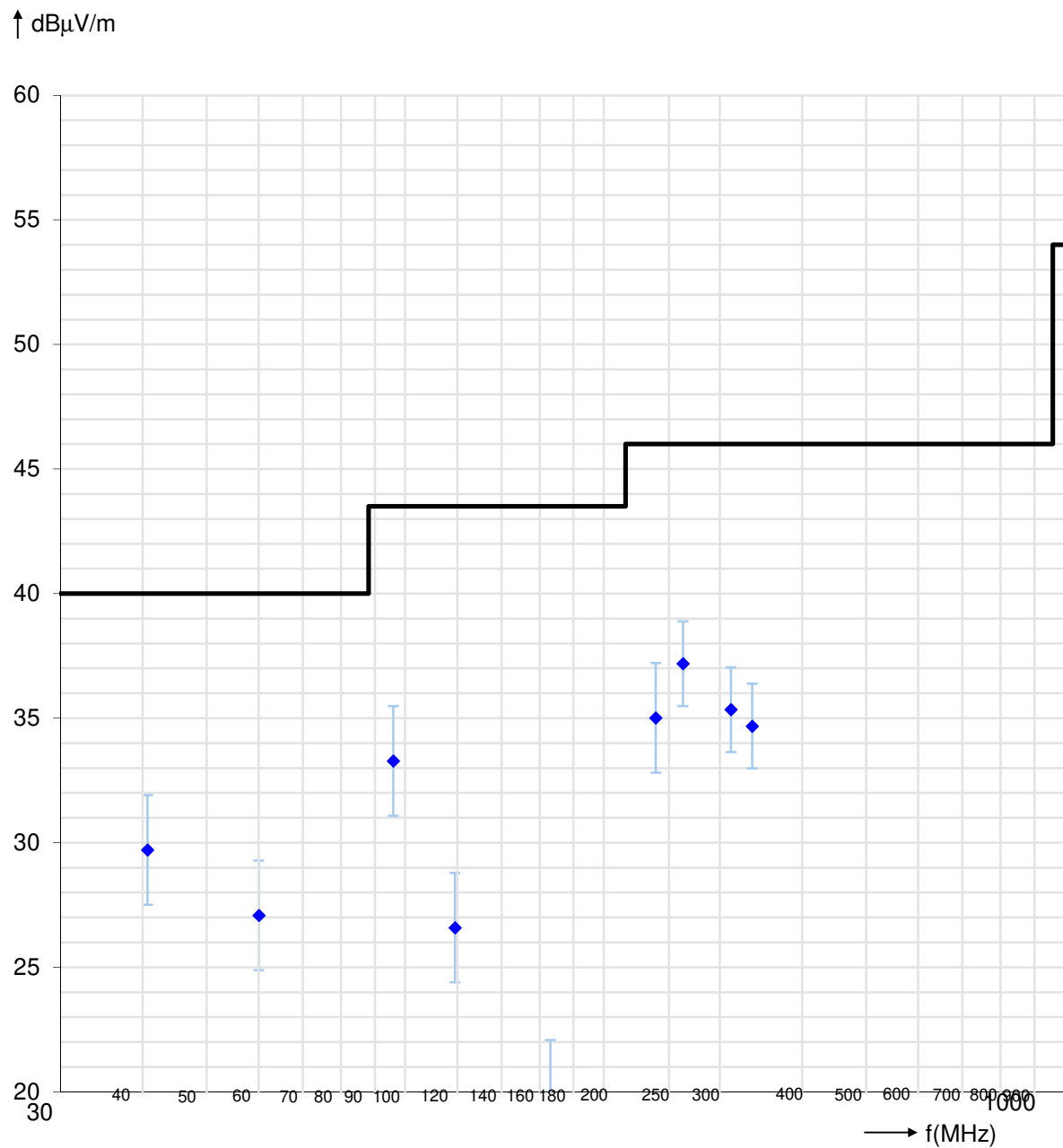
Readings – Antenna horizontal / vertical polarized

Frequency	Readings	+ AF Antenna correction factor	+ KF Cable correction factor	Field strength	Limit	Margin	Antenna- Height	Antenna- Polarization	Turn Table- Position
MHz	dB μ V	dB/m	dB	dB μ V/m	dB μ V/m	dB	m	hor./ver.	Degree
40.680	19.5	9.3	0.9	29.7	40.0	10.3	1.0	V	43
60.000	17.8	8.2	1.1	27.1	40.0	12.9	1.0	V	273
95.940	22.5	9.4	1.4	33.3	43.5	10.2	1.2	V	302
119.000	14.5	10.5	1.6	26.6	43.5	16.9	1.1	V	264
166.000	5.0	13.0	1.9	19.9	43.5	23.6	1.2	V	10
239.930	15.8	16.9	2.3	35.0	46.0	11.0	3.0	H	10
263.900	20.1	14.6	2.4	37.2	46.0	8.8	2.3	H	178
311.900	18.8	13.9	2.7	35.3	46.0	10.7	3.3	H	0
335.886	17.8	14.1	2.8	34.7	46.0	11.3	2.4	V	10



Diagram radio disturbances – Antenna horizontal / vertical polarized

Limit: 47 CFR Part 15 Subpart C §15.209





1.6 Emission bandwidth inside the operating frequency band

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

*

Measurement procedure:

Rules and specification
Guide

47 CFR Part 15 Section 15.215(c)
ANSI C63.10-2013

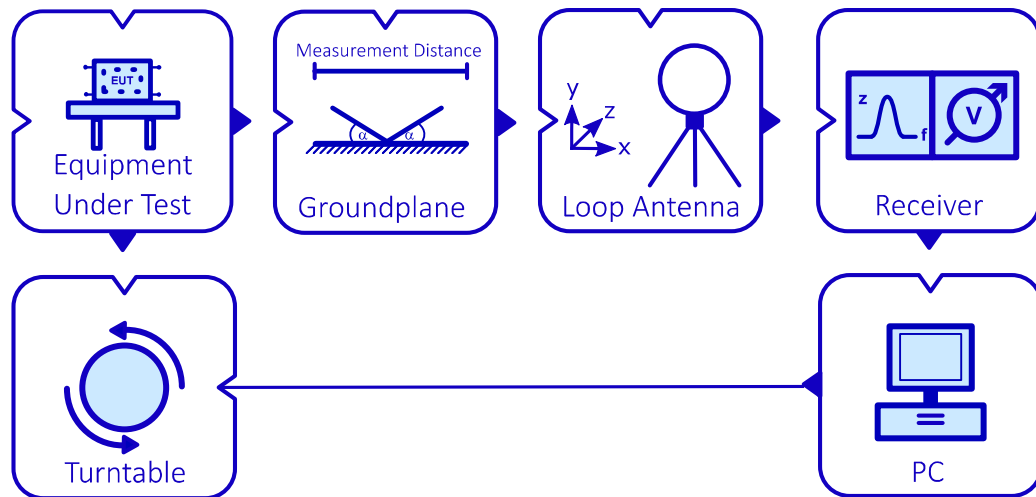
The occupied bandwidth is measured as the width of the spectral envelope of the modulated signal, at an amplitude level reduced from a reference value by 20 dB. The reference value is either the level of the unmodulated carrier or the highest level of the spectral envelope of the modulated signal, as stated by the applicable requirement. The test is performed in a semi anechoic chamber while the EUT is positioned to a receiving antenna for maximum output power. The modulated signal is recorded with an analyzer.

The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. After the trace of the spectrum analyzer is stabilized the envelope of the signal the amplitude -20 dB below the reference value is determined. The occupied bandwidth is the calculated value between both specific - 20 dB frequency positions.



Basic structure - Setup

OATS / SAC

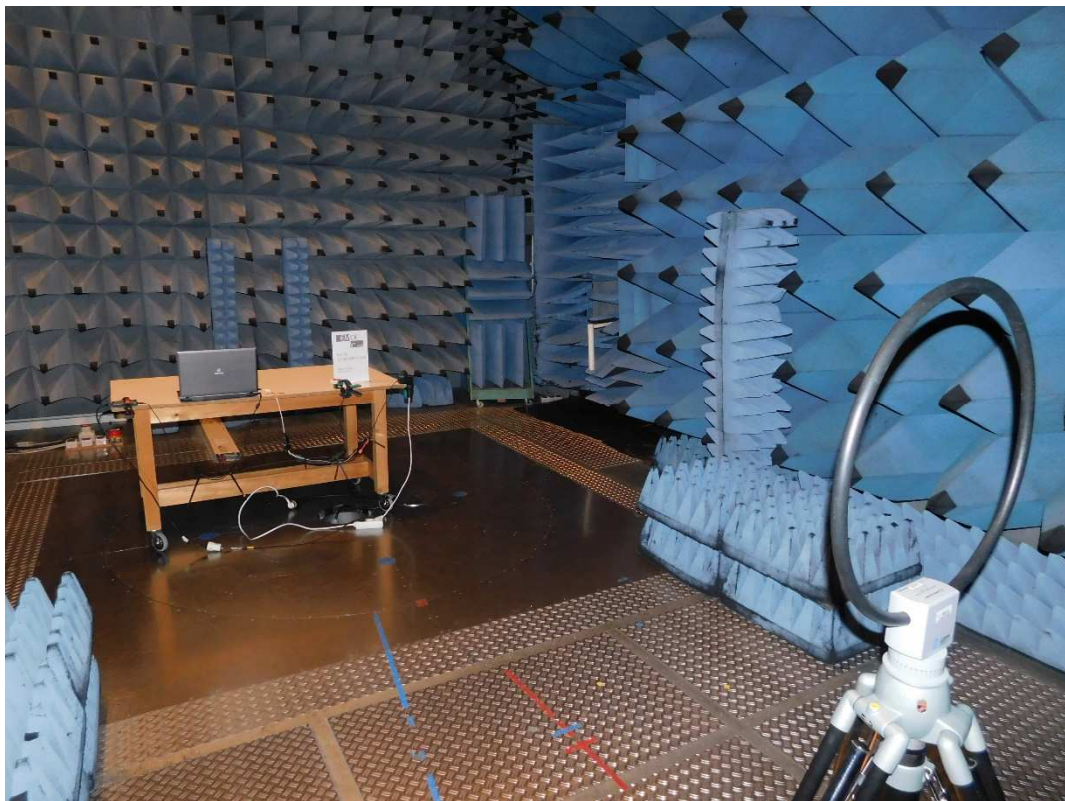


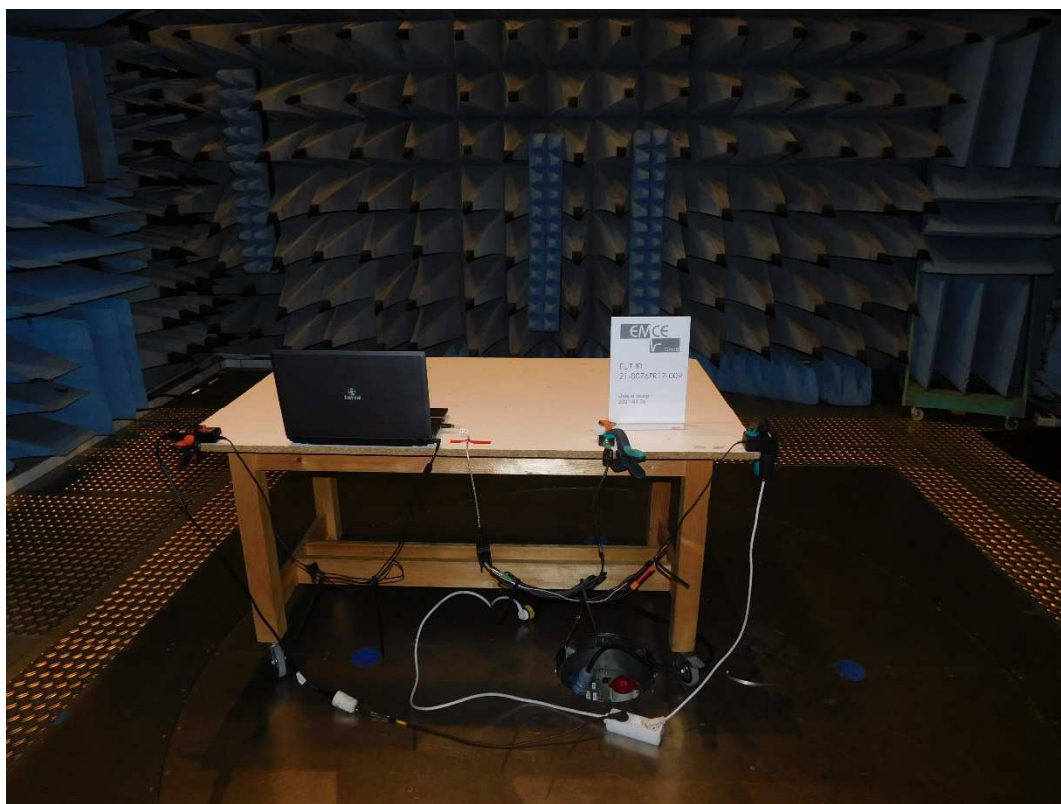


1.6.1 Test set up

According ANSI C63.10-2013

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





Test location

Pre-compliance 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-compliance 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
	058	Test receiver	ESIB 40	Rohde & Schwarz	100200
	997	Software	EMC32	Rohde & Schwarz	n/a

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
☒	058	Test receiver	ESIB 40	Rohde & Schwarz	100200
☒	230	FSV40 Signal Analyzer 40 GHz	FSV40	Rohde & Schwarz	101717
☒	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
9 kHz – 30 MHz

Measurement uncertainty
on request



1.6.2 Test

Rules and specification 47 CFR Part 15 Section 15.215(c)

Frequency range: 9 kHz – 30 MHz

20 dB Emission Bandwidth Inside operating frequency band

Operation mode

EUT arrangement: ☒ Tabletop ☐ Floor standing
Power supply: ☒ 120 V/60 Hz ☐ ___ VDC

Reading tag continuously with the tag placed at maximum reading distance.

Test result

20 dB Bandwidth @20 °C 2.647 kHz

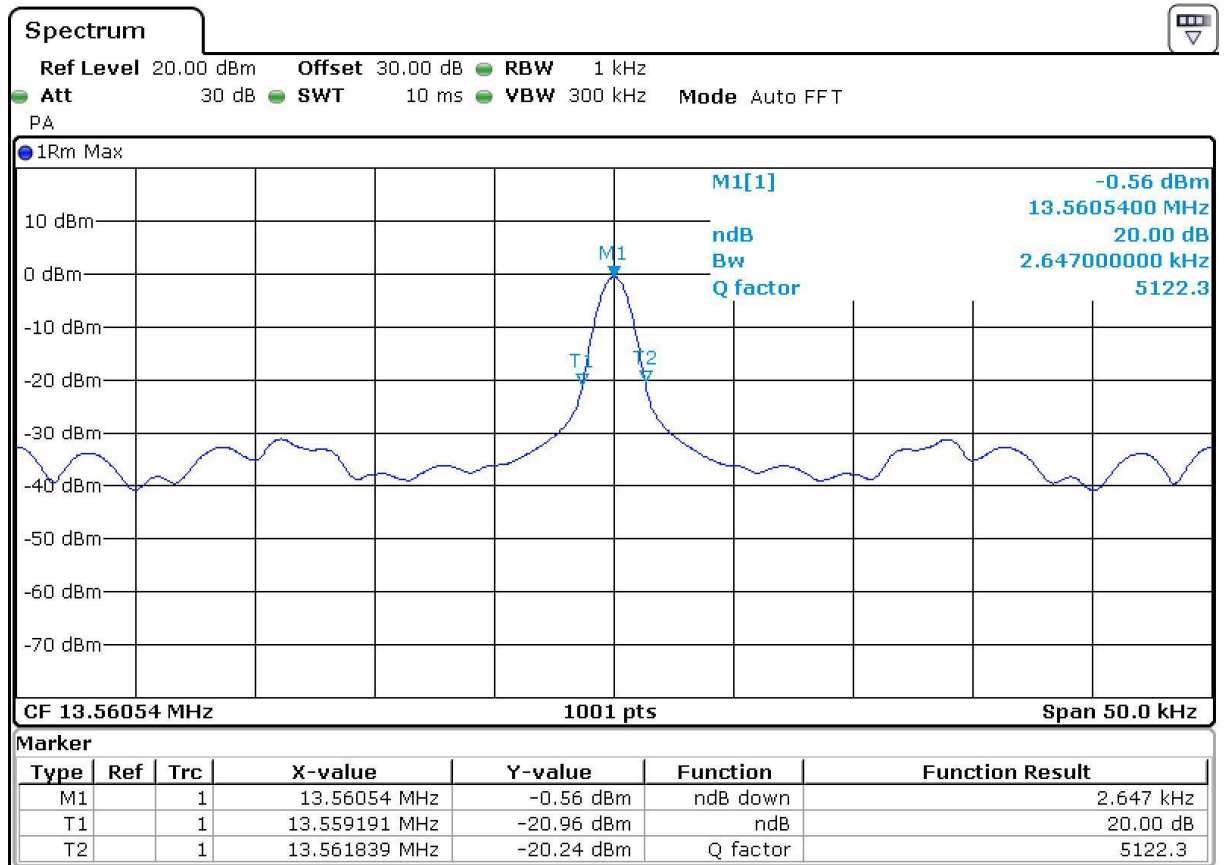
20 dB Bandwidth within the used frequency band
13.110 – 14.010 MHz: ☒ kept
☐ not kept.

Remarks: n/a

Records

☒ Readings
☒ Diagram

20 dB Bandwidth @20 °C
21-0076PR13-009





1.7 Field strength mask within the operation band 13.110-14.010 MHz

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

*

Measurement procedure:

Rules and specification
Guide

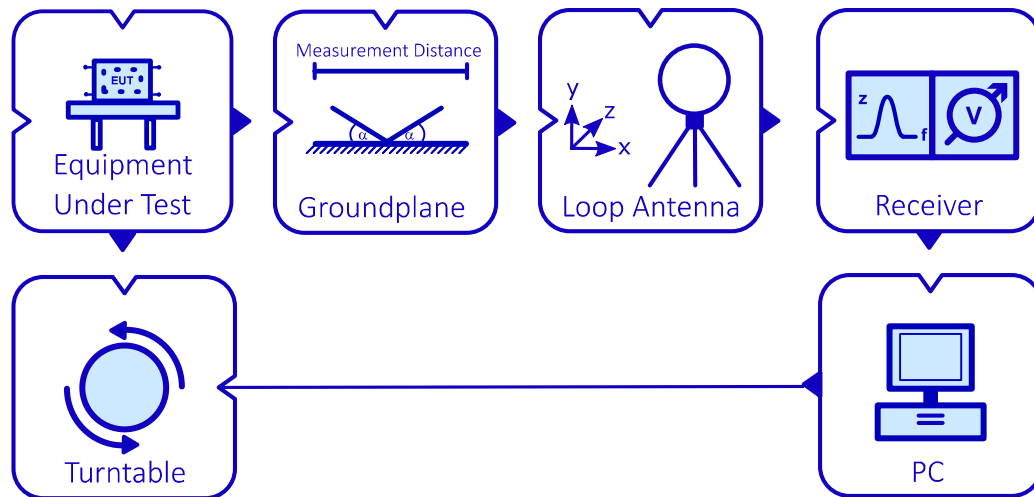
47 CFR Part 15 Section 15.209 (a)(b)(c)(d)
ANSI C63.10-2013

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 field strength mask. Measurements shall be made around the EUT and the orientation of the measurement antenna shall be investigated to determine the maximum radiated emission level. Cables or wires shall be manipulated within the range of likely arrangements to maximize the measured emission levels. External antenna(s) shall be positioned for maximum radiated emissions. If the EUT is equipped with or uses an adjustable antenna, then the EUT antenna shall be manipulated through typical positions and lengths during exploratory testing to maximize emission levels. Where EUTs are designed to be installed in one of two orientations (be located horizontally on a table or mounted vertically to the wall), these devices shall be tested in both orientations. EUTs that can be operated in multiple orientations (such as handheld, portable, or modular devices) shall be tested in three orientations. However, in all cases, the antenna shall be adjusted and the EUT orientated to permit the measurement of the maximum emission from the EUT. When rotating the EUT, the maximum antenna coupling between the EUT and the measurement antenna must be achieved at some point during the rotation.



Basic structure - Setup

OATS / SAC

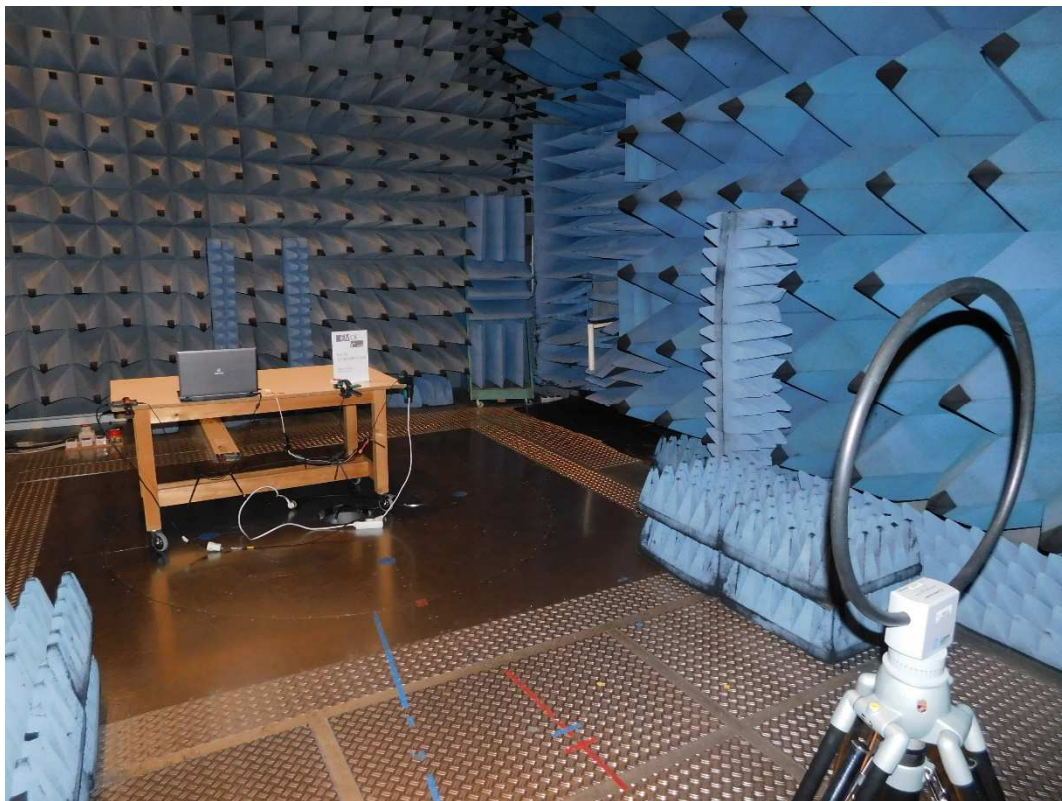


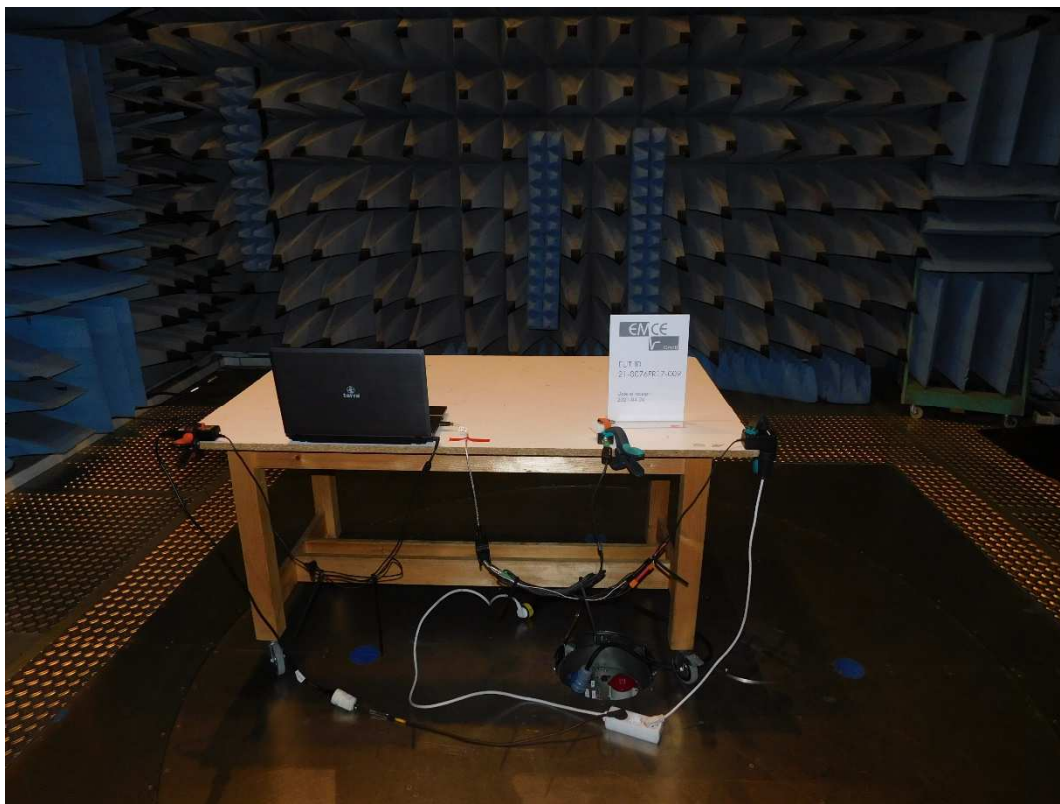


1.7.1 Test set up

According ANSI C63.10-2013

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





Test location

Pre-compliance 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-compliance 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
	058	Test receiver	ESIB 40	Rohde & Schwarz	100200
	997	Software	EMC32	Rohde & Schwarz	n/a

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
	058	Test receiver	ESIB 40	Rohde & Schwarz	100200
☒	230	FSV40 Signal Analyzer 40 GHz	FSV40	Rohde & Schwarz	101717
☒	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
9 kHz – 30 MHz

Measurement uncertainty
on request

1.7.2 Test

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

Limits for radiated emissions

Technical requirements				
Detector	Frequency / MHz	QP-Limit / dB μ V	RBW / kHz	Measurement distance / m
QP	13.110 – 13.410	40.5	10 kHz	30
QP	13.410 – 13.553	50.5	10 kHz	30
QP	13.553 – 13.567	84.8	10 kHz	30
QP	13.567 – 13.710	50.5	10 kHz	30
QP	13.710 – 14.010	40.5	10 kHz	30
The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.				

Operation mode

EUT arrangement: ☒ Tabletop ☐ Floor standing
 Power supply: ☒ 120 V/60 Hz ☐ 12 VDC

Reading tag continuously with the tag placed at maximum reading distance.

Test result

Limits for the field strength mask:
 13.110 – 14.010 MHz: ☒ kept ☐ not kept.

Remarks: n/a

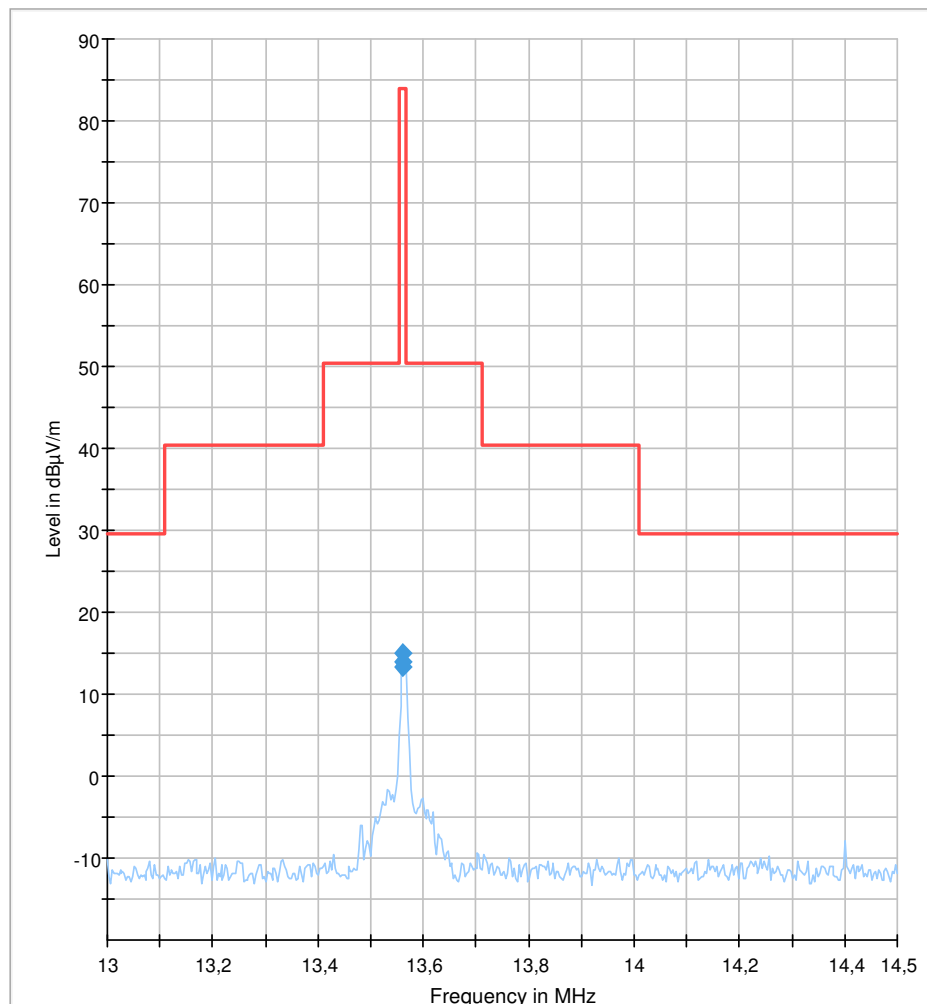
Records

☒ Readings
☒ Diagram

EUT Information

EUT Name:	ARE i9 HF
Test_ID: / SN:	21-0076PR13-009
Customer:	AEG Identifikationssysteme GmbH
Operational condition:	Continuous reading with transponder inside the field
Test specification:	47 CFR Part 15 Subpart C §15.225
Antenna information:	Distance EUT-Ant.: 3.0 m / Polarization: H/V / Ant.Height: 1.0 m
Operator:	S. Vogelmann
File #:	21-0076RC17-009-013
Comment #1:	Position H: Antenna vertical / orthogonal to EUT
Comment #2:	Position V: Antenna vertical / parallel to EUT

Full Spectrum



— Preview Result 2-AVG
— Preview Result 1-PK+
— 47 CFR Part 15 Subpart C §15.225 Emission mask
◆ Final_Result QPK



Final result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
13.560124	15.01	84.00	68.99	5000.0	9.000	V	90.0	-20.1	@30 m
13.560160	13.42	84.00	70.58	5000.0	9.000	H	343.0	-20.1	@30 m
13.561082	13.89	84.00	70.11	5000.0	9.000	V	53.0	-20.1	@30 m

1.8 Frequency stability

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

*

Measurement procedure:

Rules and specification
Guide

47 CFR Part 15 Section 15.209 (e)
ANSI C63.10-2013

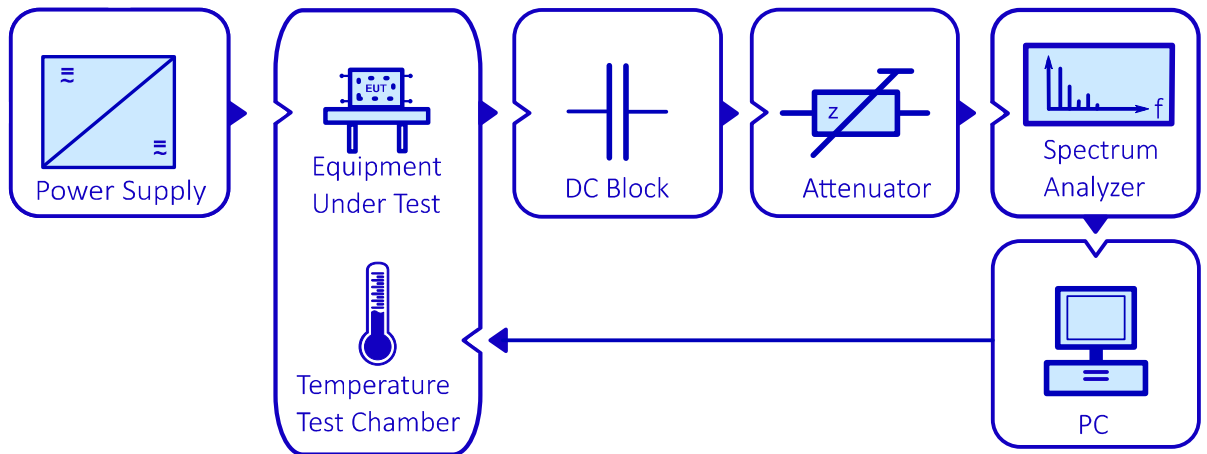
The frequency stability of the carrier frequency of an intentional radiator is determined over a temperature range of -20°C to $+50^{\circ}\text{C}$ and at supply voltages of 85 % to 115 % of the nominal voltage at 20°C ambient temperature. For battery-powered devices, a new battery is used or, if possible, an external power supply is used to set 115 %, 100% and 85 % of the battery normal voltage. If an antenna connection is available, the transmitter is connected directly to the input of a spectrum analyzer. If necessary, an impedance matching network and a DC blocking filter are also connected in between. Alternatively, a test fixture is used. The transmitter is operated unmodulated. The peak detector of the spectrum analyzer is used, whereby the resolution bandwidth and video bandwidth are selected accordingly to achieve the highest possible accuracy. Starting from the highest temperature, the temperature range is lowered in 10° steps to the lowest temperature. At each temperature, the DUT is switched on after reaching a stable value and the carrier frequency is determined at switch-on, after 2, 5 and 10 minutes.

Frequency stability test with respect to supply voltage variation is performed when, the EUT is supplied by nominal voltage at ambient temperature of $+20^{\circ}\text{C}$. The EUT is turned on and its output coupled to a spectrum analyzer by a test antenna placed near (approx.. 15 cm) the EUT. The spectrum analyzer is adjusted to obtain a suitable signal. The frequency is recorded at 85 %; 100 % and 115 % nominal voltage.



Basic structure - Setup

OATS / SAC





1.8.1 Test set up

According ANSI C63.10-2013



Test location

Final test					
☒	Inv.-No.	Designation	Type (L x W x H)	Manufacturer	Location
☒	1046	Environmental Simulation Chamber -40 - +180 °C 10 % - 98 % r.H.	Indoor 0.6 x 0.4 x 0.48 m	Binder GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden

Used test equipment

Final test					
☒	Inv.-No.	Designation	Type	Manufacturer	S/N
☒	1046	Environmental Simulation Chamber	MKF 115 (E3.1)	Binder GmbH	12-02215
☒	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
☒	230	FSV40 Signal Analyzer 40 GHz	FSV40	Rohde & Schwarz	101717
☒	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



1.8.2 Test

Rules and specification	47 CFR Part 15 Section 15.215(c)
Frequency range:	13.110 - 14.010 MHz
Temperature range:	-20 °C to +50 °C
Voltage range:	85 % to 115 % of the rated supply voltage
Frequency tolerance:	±0.01% of the operating frequency

Operation mode

EUT arrangement: ☒ Tabletop ☐ Floor standing
Power supply: ☒ 120 V/60 Hz ☐ ___ VDC

Reading tag continuously with the tag placed at maximum reading distance.

Test result

Limits for frequency tolerance over

Temperature variations: ☒ kept
☐ not kept

Supply voltage variations: ☒ kept
☐ not kept

Remarks: n/a

Records

☒ Readings
☒ Diagram

Carrier Frequency Stability vs. Temperature

Fundamental frequency at 20°C, 49%rH – 13.56016MHz

Temp. / °C	Frequency of fundamental / kHz				Max. frequency tolerance / ppm	Limit / ppm
	at start	after 2 min	after 5 min	after 10 min		
50	13560.26	13560.36	13560.16	13560.36	15	±100
40	13560.46	13560.46	13560.46	13560.56	29	±100
30	13560.26	13560.26	13560.06	13560.06	7	±100
20	13560.16	13560.26	13560.26	13560.06	7	±100
10	13560.26	13560.46	13560.16	13560.06	22	±100
0	13560.26	13560.36	13560.16	13560.46	22	±100
-10	13560.46	13560.36	13560.16	13560.26	22	±100
-20	13560.46	13560.36	13560.16	13560.36	22	±100

Carrier Frequency Stability vs. Supply Voltage Variation

Fundamental frequency at 20°C, 49%rH – 13.56016MHz

Nominal Voltage U_N	Frequency of fundamental / kHz			Max. frequency tolerance / ppm	Limit / ppm
	85 % U_N	100 % U_N	115 % U_N		
120 V / 60 Hz	13560.16	13560.36	13560.16	0	±100

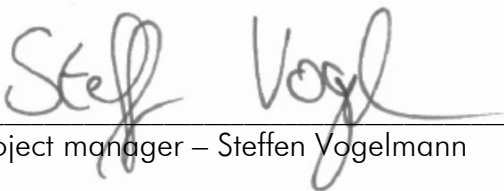
2 Summary

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) (d(7))	Pass	n/a
Terminal voltage on powerline	§ 15.207 (a)	Pass	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
Emission bandwidth inside the operating frequency band	§ 15.215 (b) (c)	Pass	n/a
Field strength mask within the operation band 13.110-14.010 MHz	§ 15.225 (a) (b) (c) (d) (f)	Pass	n/a
Frequency stability	§ 15.225 (e) (f)	Pass	n/a

Burgrieden, 05/25/2021

Responsible inspector:


Project manager – Steffen Vogelmann

- End of Test Report -