

Test report

AIN50c01

Product / EUT: RFID reader
Type designation: ARE H9 - HF/A/F/U/C/B/H/Li FCC ID: V7IAREH9HF-1
URH 1HL - x/F/U/C/B/H/Li/CS5 FCC ID: V7IURH1HL
Tested type: ARE H9 - HF/A/F/U/C/B/H/Li
EUT authorization: ☒ Certification ☐ Declaration of Conformity
☐ Verification
Production level: n/a
S/N: 003653
Manufacturer: AEG Identifikationssysteme GmbH
Hörvelsinger Weg 47
89081 Ulm / Germany

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

The standards were: ☒ kept*
☐ not kept*

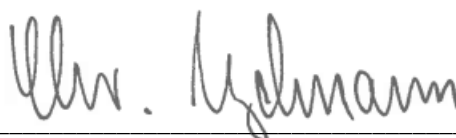
***Remark:** ☒ Validation covered by the accredited scope
☐ Validation not covered by the accredited scope
according: _____
☐ Validation of the EMC-requirements partly proceeded

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

EUT-
Date of arrival: 2016-11-28
Test ID: PRN48_04
Date(s) of test: 2016-12-05; 2016-12-14; 2017-03-22

Burgrieden, 2017-03-31

Released by:



Principal engineer - Christian Vogelmann

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.



Bundesnetzagentur



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



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

DAkkS-Registration No.: D-PL-12122-01-01
CAB-Registration No.: BnetzA-CAB-02/21-01/1
FCC-Registration No.: 219415

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

Contact person: Mr. Waitzinger / AEG Identifikationssysteme GmbH

Test procedure: ANSI C63.10-2013

EUT Description: Handheld HF-RFID reader.
A = AEG ID foil
F = Ferrite antenna
U = USB interface
H = HID interface
B = Bluetooth interface
CSx = customer specific software, sequential number
C = real time clock
Li = Lithium Ion battery

Voltage supply: Battery powered 7.2V

Frequency list: 32.768 kHz; 13.56 MHz; 20 MHz; 22.1184 MHz; 26 MHz;
2483.5 MHz

Temperature range: n/a

Size: LxWxH / cm - 13.5x7.0x2.5



Supplied /
used equipment:

Designation	Type	Manufacturer	S/N
Laptop	Inspiron 5150	Dell	CN-0W0941- 1296136J-2083
AC Adapter (Inspiron 5150)	PA-1131-02D	Dell	CN-9Y819-48010- 36O-0954
Bluetooth – USB Stick	USB Bluetooth Nano Stick	CSL Computer	Mod.No. - BSN23996
Transponder (tag)	Mifare disc	AEG ID	9990000000000000
Bluetooth module (EUT)	WT12	bluegiga	FCC ID: QOQWT12
EUT Battery (2x)	800 mAh / 7.2 V	XTAR	n/a

Configuration:

☒
☐

As-delivered condition*

Modified*

* _____

Cable designation	Type	Length	Remarks
AC power cord – laptop	3-wire	160 cm	n/a
USB cable	Shielded	100 cm	n/a

Remarks:

The corresponding German editions of the regulations were
used for the test procedures.



State of revision:

Source document	New Document	Date / Reviser	Modifications
AIN50_01	AIN50a01	2017-01-10 / P. Hauser	Editorial corrections, frequency list updated
AIN50a01	AIN50b01	2017-03-22 / P. Hauser	Measurements added of BT spurious emissions up to 26 GHz and fundamental conducted output power.
AIN50b01	AIN50c01	2017-03-31 / P. Hauser	Measurement of fundamental frequency vs. low edge supply voltage added.

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)/ 2017-10-31
008	Loop antenna 9kHz-30MHz	HFH2-Z2	Rohde & Schwarz	835776/0002	3 Year(s)/ 2019-11-25
009	Antenna 30-300MHz	VHBA9123 / BBA9106	Schwarzbeck	435	3 Year(s)/ 2018-10-27
010	Antenna 250-1200MHz	UHALP 9108A	Schwarzbeck	108	2 Year(s)/ 2018-11-04
011	Antenna 30-300MHz	VHBA9123 / BBA9106	Schwarzbeck	0403/94	2 Year(s)/ 2018-11-04
012	Antenna 250-1200MHz	UHALP 9108A	Schwarzbeck	166	3 Year(s)/ 2018-11-10
014	OATS	3m	EMCE GmbH		3 Year(s)/ 2017-10-31
015	OATS	10m	EMCE GmbH		3 Year(s)/ 2017-10-31
042	AC-Source/ Analyser/ Norm impedance	EMV D 5000/PAS	Spitzenberger+ Spies	A2747 00/0 0501 A2747 07/00501 (ARS16/3)	2 Year(s)/ 2017-08-31
058	Receiver	ESIB 40	Rohde & Schwarz	100200/ Firmware 4.35	1 Year(s)/ 2017-04-07
059	Log.-per. antenna	HL050	Rohde & Schwarz	100006	3 Year(s)/ 2018-03-10
067	LISN	ESH2-Z5	Rohde&Schwarz	872460/043	1 Year(s)/ 2017-08-30
068	LISN	ESH2-Z5	Rohde&Schwarz	872460/042	1 Year(s)/ 2017-08-31
070	Pulse limiter + 10dB Attenuator	ESH3-Z2	Rohde&Schwarz	n/a	1 Year(s)/ 2017-08-31
175	EMI Test receiver	ESR7	Rohde & Schwarz	101108 Firmware: FW V2.26	1 Year(s)/ 2017-07-20
222	Preamplifier 0.5 – 18 GHz	BBV 9718	Schwarzbeck	9718-316	1 Year(s)/ 2017-08-31
223	Preamplifier 12 – 28 GHz	BBV 9719	Schwarzbeck	9719-024	1 Year(s)/ 2017-08-31



Scope:

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1 EMC-Test(s)

1.1 Emission according 47 CFR Part 15 Subpart C – 12/02/2016

1.1.1 Terminal voltage according 47 CFR Part 15 Subpart C – 12/02/2016

- ☒ Full compliance
☐ Precompliance
☐ Test not requested*
☐ Test not carried out*

*

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
	584	Shielded room # 3	3.6 x 3.6 x 2.5 m	Siemens AG	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	678	Shielded room # 4	4.0 x 4.0 x 3.5 m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	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
	679	Full anechoic chamber # 3	8.8 x 4.6 x 4.2 m	Albatross Projects 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
	042	Voltage- / current source test site	0-382VDC 0-270VAC 1 x 10 kW/3 x 5 kW	Spitzenberger + Spies	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	n/a	Alternative test site	n/a	n/a	n/a



1.1.1.1 Test set up

According ANSI C63.10-2013



Used test equipment

☒	Inv.-No.	Designation	Type	Manufacturer	S/N
	001	Test receiver	ESS 5 Hz - 1000 MHz	Rohde & Schwarz	833776/008
	002	Probe	ESH2-Z3	Rohde & Schwarz	
	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
	006	LISN	NNBM 8125	Schwarzbeck	8125371
	007	Absorbing clamp	MDS 21	Schwarzbeck	942436
	025	Current clamp BCI	F-120-2	FCC	47
	026	Coupling device network	CDN 801-M3-25	FCC	92
	030	Coupling device network	CDN-S9	EMCE GmbH	
	031	Coupling device network	CDN-S9	EMCE GmbH	
	036	Coupling device network	CDN-M5-25	EMCE GmbH	
	037	Coupling device network	CDN-S1	EMCE GmbH	
☒	042	AC-Source / Analyser / Norm impedance	EMV D5000/PAS	Spitzenberger + Spies	A274700/ 0 0501
	058	Test receiver	ESIB 40	Rohde & Schwarz	100200
	060	HF-coupling clamp	KEMA 801	Schaffner	20808
☒	067	LISN 5	ESH2-Z5	Rohde & Schwarz	0872460/043
	068	LISN 4	ESH2-Z5	Rohde & Schwarz	0872460/042
	073	Absorbing clamp	MDS 21	Schwarzbeck	881757
☒	175	Test receiver	ESR 7	Rohde & Schwarz	101108

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

1.1.1.2 Test

Regulation

47 CFR Part 15 Subpart C – 12/02/2016

☐ 9 kHz – 30 MHz

☒ 150 kHz – 30 MHz

Mains supply

Limits:

☒ Section 15.207

☐ __

Operation mode

EUT arrangement:

☒ Tabletop

☐ Floor standing

Power supply - laptop:

☒ 120 V/60 Hz

☐ 240 V/60 Hz

Power supply - EUT:

☐ 120 V/60 Hz

☒ 7.2 VDC

Rated voltage variation:

☐ 85 %

☐ 115 %

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

Continuous operation of the RFID reader, supplied with the internal batteries. No tag in field, this operation mode shows highest emanations. The Bluetooth module was configured as "Master" and active. During the test the remote station was removed from the laptop and the Bluetooth module was polling for a BT device. RFID and Bluetooth module were active at the same time.

Environmental conditions

Temperature: 15 - 35 °C

Humidity: 30 - 60 %

Air pressure: 860 - 1060 hPa

Environmental conditions during the test:

☒ kept

☐ not kept



Test - / Measurement procedure

Measurements are made with a receiver according to CISPR guidelines. The required frequency range is scanned in an automatic operation. If the emission is closer than 6 dB to the limits or more, the receiver will stop and measure the exact value with a quasi-peak or average detector. The frequency, the maximum reading and the limit will be printed out.

Test result

Limits for continuous disturbances:

☒ kept
☐ not kept

| Remarks: n/a

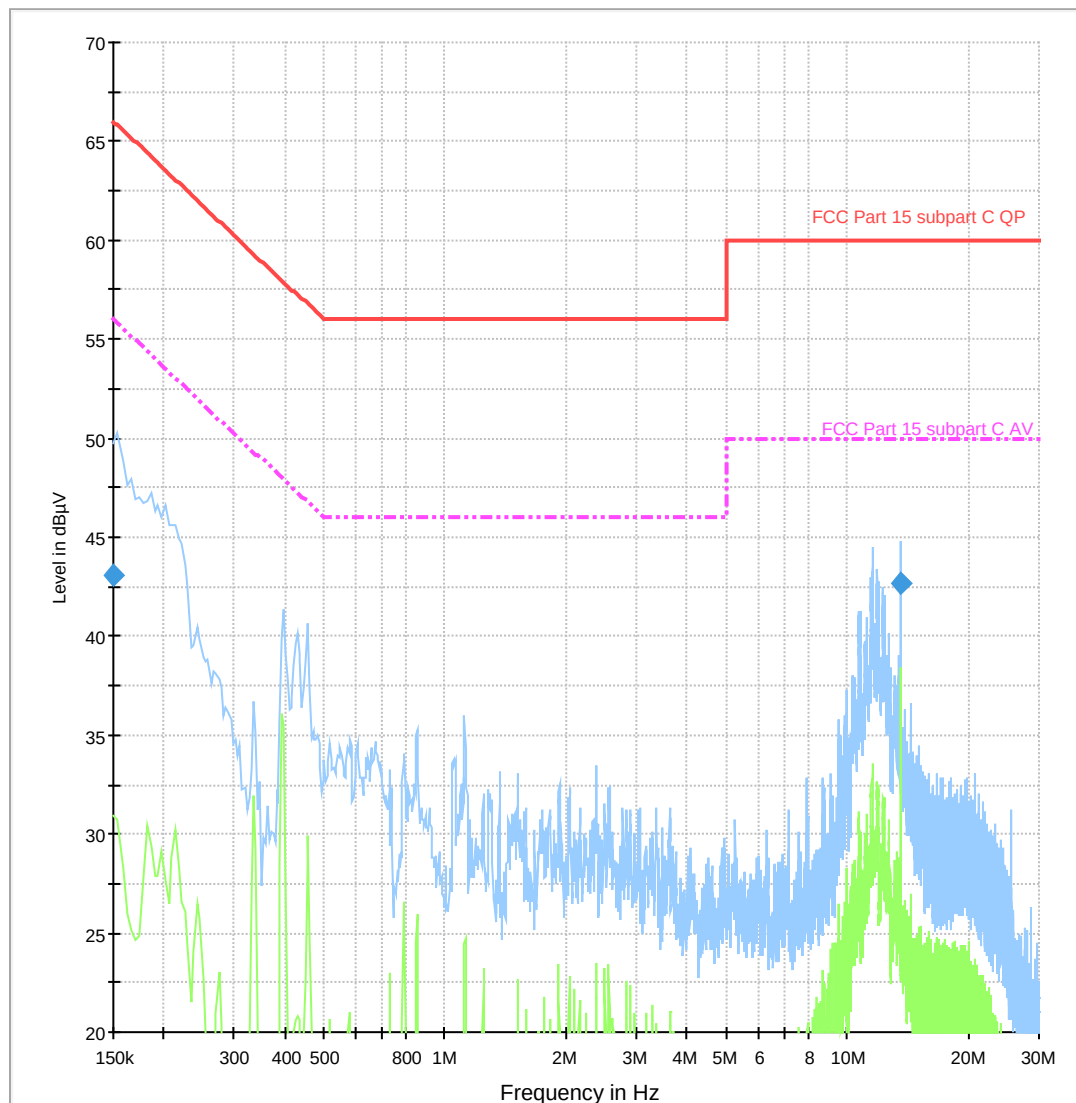
Protocol scope

- ☒ Readings - continuous emission
- ☒ Diagram - continuous emission

EUT Information

Test:	Terminal voltage
EUT Name:	ARE H9 - HF/A/F/U/C/B/H/Li
Applicant:	AEG ID GmbH
Serial Number:	Prototype
Test_ID:	PRN48_04
Test condition:	No tag in field, BT connection active
Port#:	L1
Test specification:	47 CFR part 15 Subpart C
Operator:	P. Hauser
File #:	AIN50_01

Voltage with 4-Line-LISN



— FCC Part 15 subpart C QP [..EMI conducted]	--- FCC Part 15 subpart C AV [..EMI conducted]
— Preview Result 1-PK+ [Preview Result 1.Result:1]	— Preview Result 2-AVG [Preview Result 2.Result:2]
◆ Final Result 1-QPK [Final Result 1.Result:1]	



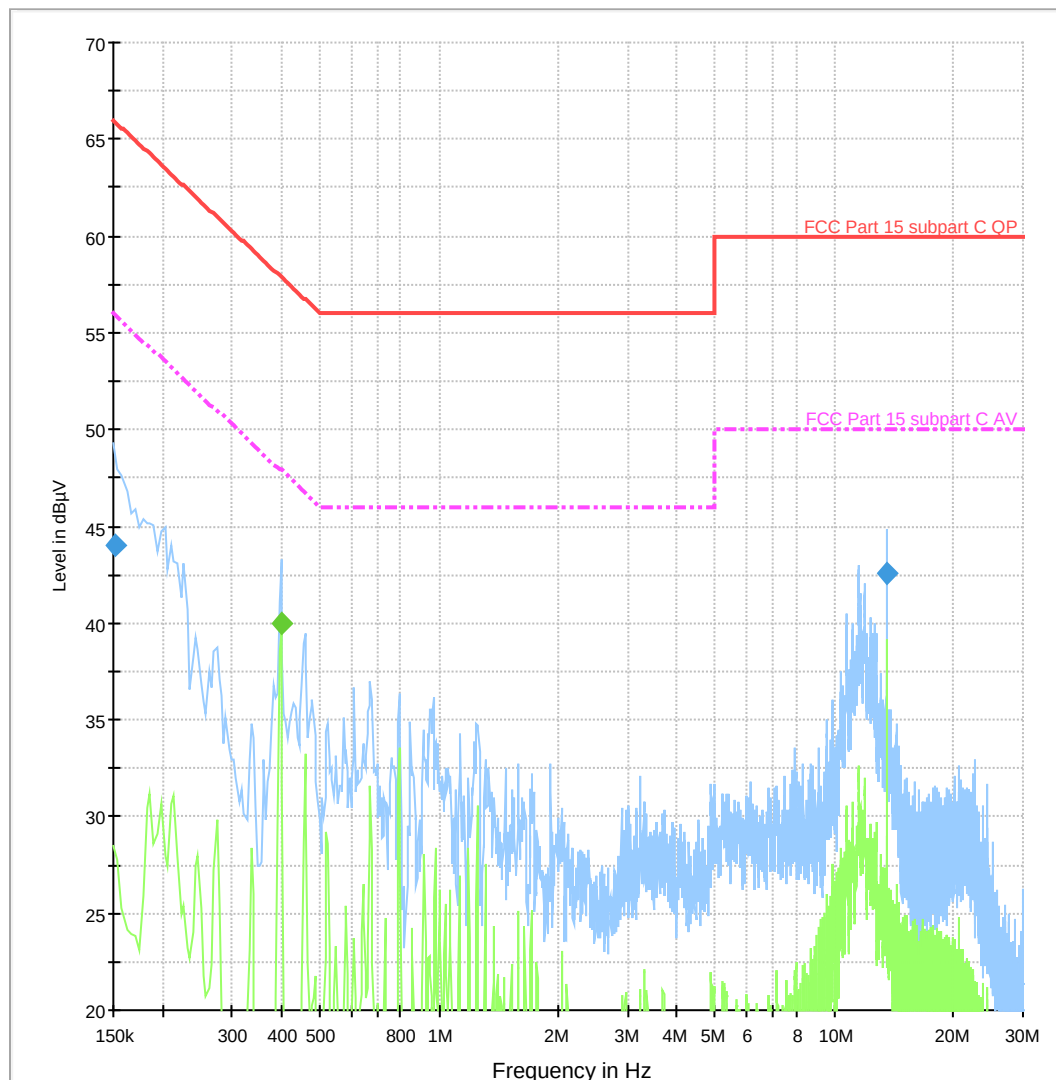
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.150000	43.1	1000.0	9.000	GND	L1	9.9	22.9	66.0	
13.562000	42.7	1000.0	9.000	GND	L1	10.2	17.3	60.0	

EUT Information

Test:	Terminal voltage
EUT Name:	ARE H9 - HF/A/F/U/C/B/H/Li
Applicant:	AEG ID GmbH
Serial Number:	Prototype
Test_ID:	PRN48_04
Test condition:	No tag in field, BT connection active
Port#:	N
Test specification:	47 CFR part 15 Subpart C
Operator:	P. Hauser
File #:	AIN50_02

Voltage with 4-Line-LISN



— FCC Part 15 subpart C QP [..EMI conducted]	— FCC Part 15 subpart C AV [..EMI conducted]
— Preview Result 1-PK+ [Preview Result 1.Result:1]	— Preview Result 2-AVG [Preview Result 2.Result:2]
◆ Final Result 1-QPK [Final Result 1.Result:1]	◆ Final Result 2-AVG [Final Result 2.Result:1]



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.151000	44.0	1000.0	9.000	GND	N	9.9	21.9	65.9	
13.562000	42.6	1000.0	9.000	GND	N	10.2	17.4	60.0	

Final Result 2

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.398000	39.9	1000.0	9.000	GND	N	9.9	8.0	47.9	

1.1.2 Radio disturbances according 47 CFR Part 15 Subpart C – 12/02/2016

- ☒ Full compliance
☐ Precompliance
☐ Test not requested*
☐ Test not carried out*

* _____

Test location

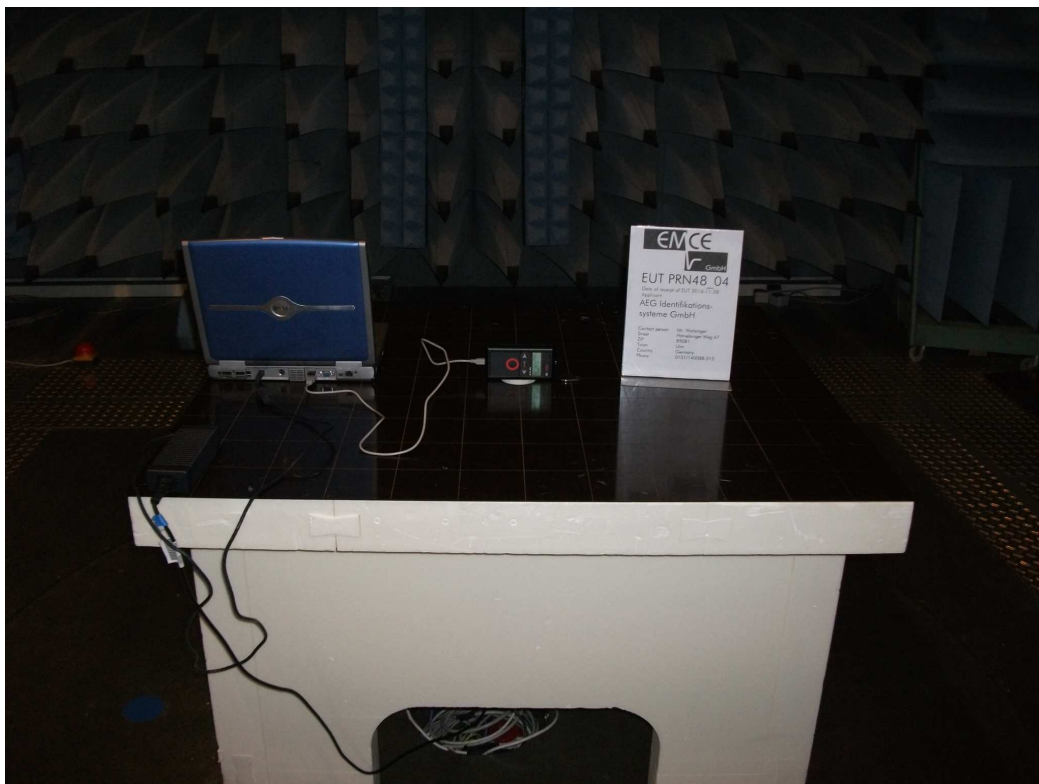
☒	Inv.-No.	Designation	Type (L x W x H)	Manufacturer	Location
	588	Shielded room # 2	8.3/5.8 x 5.5/2.9 x 3.4 m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	584	Shielded room # 3	3.6 x 3.6 x 2.5 m	Siemens AG	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	678	Shielded room # 4	4.0 x 4.0 x 3.5 m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
☒	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
	679	Full anechoic chamber # 3	8.8 x 4.6 x 4.2 m	Albatross Projects 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
	042	Voltage- / current source test site	0-382VDC 0-270VAC 1 x 10 kW/3 x 5 kW	Spitzenberger + Spies	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	n/a	Alternative test site	n/a	n/a	n/a



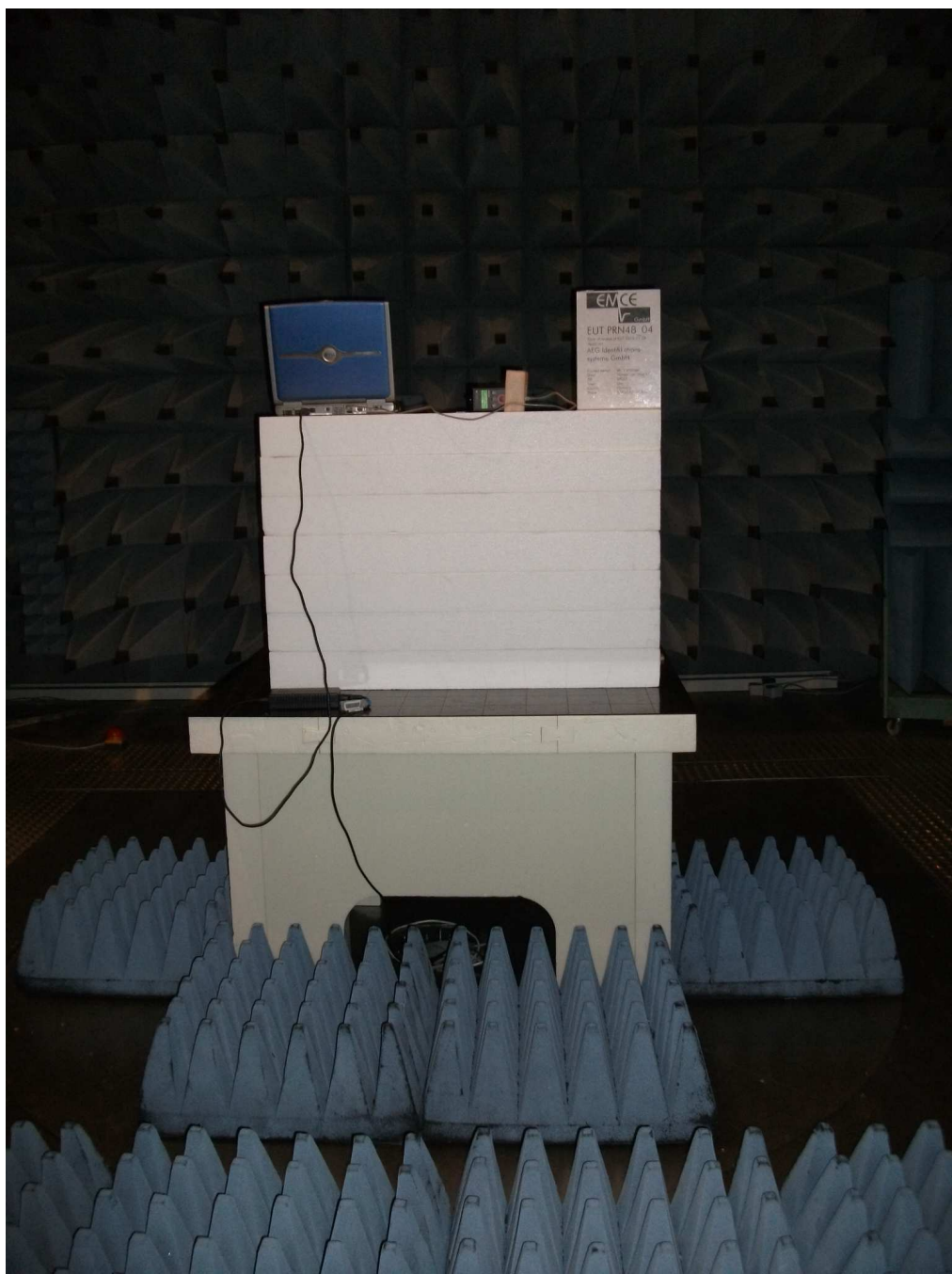
1.1.2.1 Test set up

According ANSI C63.10-2013









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
	006	LISN	NNBM 8125	Schwarzbeck	8125371
	007	Absorbing clamp	MDS 21	Schwarzbeck	942436
	008	Antenna 9 kHz – 30 MHz	HFH2-Z2	Rohde & Schwarz	835776/0002
☒	009	Antenna 30 – 300 MHz	VHBA9123 / BBA9106	Schwarzbeck	435
☒	010	Antenna 250 – 1200 MHz	UHALP 9108A	Schwarzbeck	108
☒	011	Antenna 30 – 300 MHz	VHBA9123 / BBA9106	Schwarzbeck	0408/94
☒	012	Antenna 250 – 1200 MHz	UHALP 9108A	Schwarzbeck	166
☒	013	Antenna 9 kHz – 30 MHz	Loop antenna 1.5 m Ø	EMCE GmbH	
	025	Current clamp BCI	F-120-2	FCC	47
	041	HZ-10	Shielded coil	Rohde & Schwarz	849788/020
	042	AC-Source / Analyser / 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
	060	HF coupling clamp	KEMA 801	Schaffner	20808
	063	Logper. Antenna	HL023 A2	Rohde & Schwarz	
	067	LISN 5	ESH2-Z5	Rohde & Schwarz	0872460/043
	068	LISN 4	ESH2-Z5	Rohde & Schwarz	0872460/042
	073	Absorbing clamp	MDS 21	Schwarzbeck	881757
	116	Vertical rod antenna	VAMP 9243	Schwarzbeck	9243-205
☒	175	Test receiver	ESR 7	Rohde & Schwarz	101108
☒	222	Preamp	BBV 9718	Schwarzbeck	9718-316
☒	223	Preamp	BBV 9719	Schwarzbeck	9719-024
☒	1108	Attenuator	20 dB	Huber Suhner	1000750733

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
30 MHz – 300 MHz	4.4 dB
300 MHz – 1 GHz	3.4 dB
1 GHz – 18 GHz	on request

1.1.2.2 Test – Radiated emission fundamental

Regulation

47 CFR Part 15 Subpart C – 12/02/2016

☒ 9 kHz – 30 MHz
 ☐ 150 kHz – 1 GHz
☐ 30 MHz – 1000 MHz
 ☐ 1 – 18 GHz

Limits: ☐ Section 15.209* ☒ Section 15.225*

* The limits for frequencies below 30MHz were corrected for a closer measuring distance by using an extrapolation factor of 40 dB/decade..

Test distance: ☐ 3 m ☐ 5 m
☒ 10 m ☐ 30 m

Operation mode

EUT arrangement: ☒ Tabletop ☐ Floor standing
 Power supply - laptop: ☒ 120 V/60 Hz ☐ 240 V/60 Hz
 Power supply - EUT: ☐ 120 V/60 Hz ☒ 7.2 VDC
 Rated voltage variation: ☐ 85 % ☐ 115 %

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

Continuous operation of the RFID reader, supplied with the internal batteries. No tag in field, this operation mode shows highest emanations. The Bluetooth module was configured as "Master" and active. During the test the remote station was removed from the laptop and the Bluetooth module was polling for a BT device. RFID and Bluetooth module were active at the same time.

Environmental conditions

Temperature: 15 - 35 °C
 Humidity: 30 - 60 %
 Air pressure: 860 - 1060 hPa

Environmental conditions during the test: ☒ kept ☐ not kept

Test - / Measurement procedure

The test was performed at an antenna to EUT distance of 10m in the frequency range $\leq 30\text{MHz}$ and at 3m distance for frequencies $\geq 30\text{MHz}$. Measurements were made with a CISPR receiver with quasi-peak. The average detector is used in the frequency bands 9-90kHz, 110-490kHz and above 1000MHz. For pulse modulated devices with a pulse repetition frequency of 20Hz or less, peak detector is used (15.35a Note). The frequency, the measured value, antenna information and the limit will be printed out.

The reported test results are calculated with the following formula:

$$\text{Field strength (dB}\mu\text{V/m)} = \text{Reading (dB}\mu\text{V)} + \text{AF (dB/m)} + \text{CF (dB)}$$

AF = Correction factor for the antenna
CF = Correction factor for the cable loss

$$\text{Limit}_{10\text{m}} \text{ (dB}\mu\text{V/m)} = \text{Limit (dB}\mu\text{V/m)} + \text{LCF}_{10\text{m}} \text{ (dB)}$$

Limit_{10m} Limit calculated for 10m test distance
LCF_{10m} = Limit Correction factor for 10m test distance
LCF_{10m} for 30m antenna distance = 20dB
LCF_{10m} for 100m antenna distance = 40dB
LCF_{10m} for 300m antenna distance = 60dB

Test result - fundamental

Frequency	Field strength	Limit _{10m}	Margin	Ant.-	Ant.-	Detector	Receiver	Supply voltage	Remarks
				Distance	Polar.	Peak /	6dB BW		
MHz	dB μ V/m	dB μ V/m	dB	m	H/V	QP / AV	kHz		
13.5607	43.0	104.0	61.0	10.0	V	QP	10	7.2VDC	Full charged battery
13.5604	42.8	104.0	61.2	10.0	V	QP	10	5.0VDC	Low edge power supply

Limit_{10m} Limit calculated for 10m test distance

Limits for radiated disturbances:

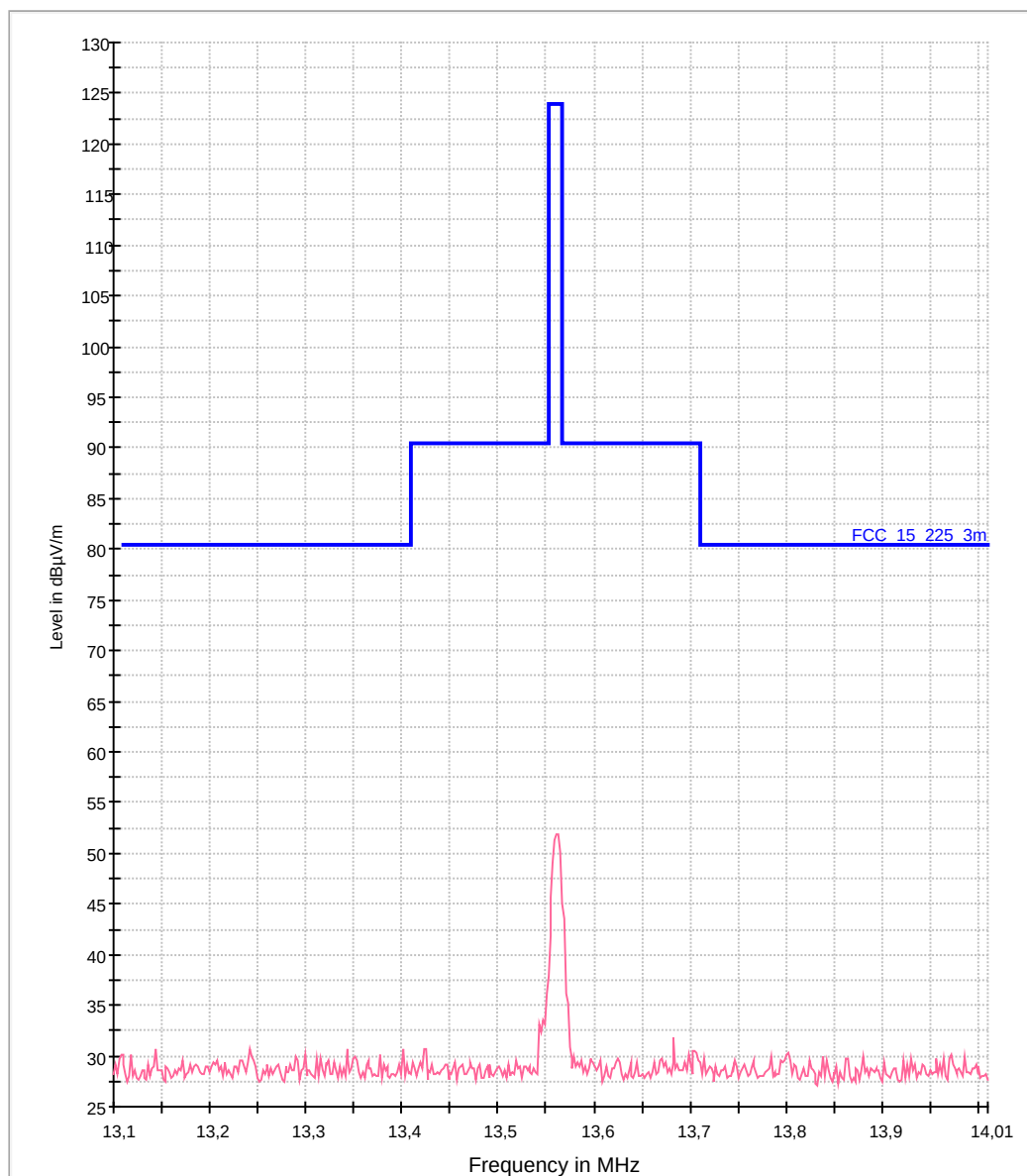
☒ kept
☐ not kept

Remarks: n/a

EUT Information

EUT Name:	ARE H9 - HF/A/F/U/C/B/H/Li
Test_ID / SN:	PRN48_04
Customer:	AEG ID GmbH
Operational condition:	No tag in field, BT I/F active
Test specification:	47 CFR Part 15 Section 15.225
Antenna information:	Distance EUT-Ant.: 3.0 m / Polarisation: V / Ant.Height: 1.0 m
Operator:	P. Hauser
File #:	AIN49_23

Magnetic Field Strength dB μ V with Sweep_SAC2



— FCC_15_225_3m [..EMI radiated] — Preview Result 1V-PK+ [Preview Result 1V.Result:2]

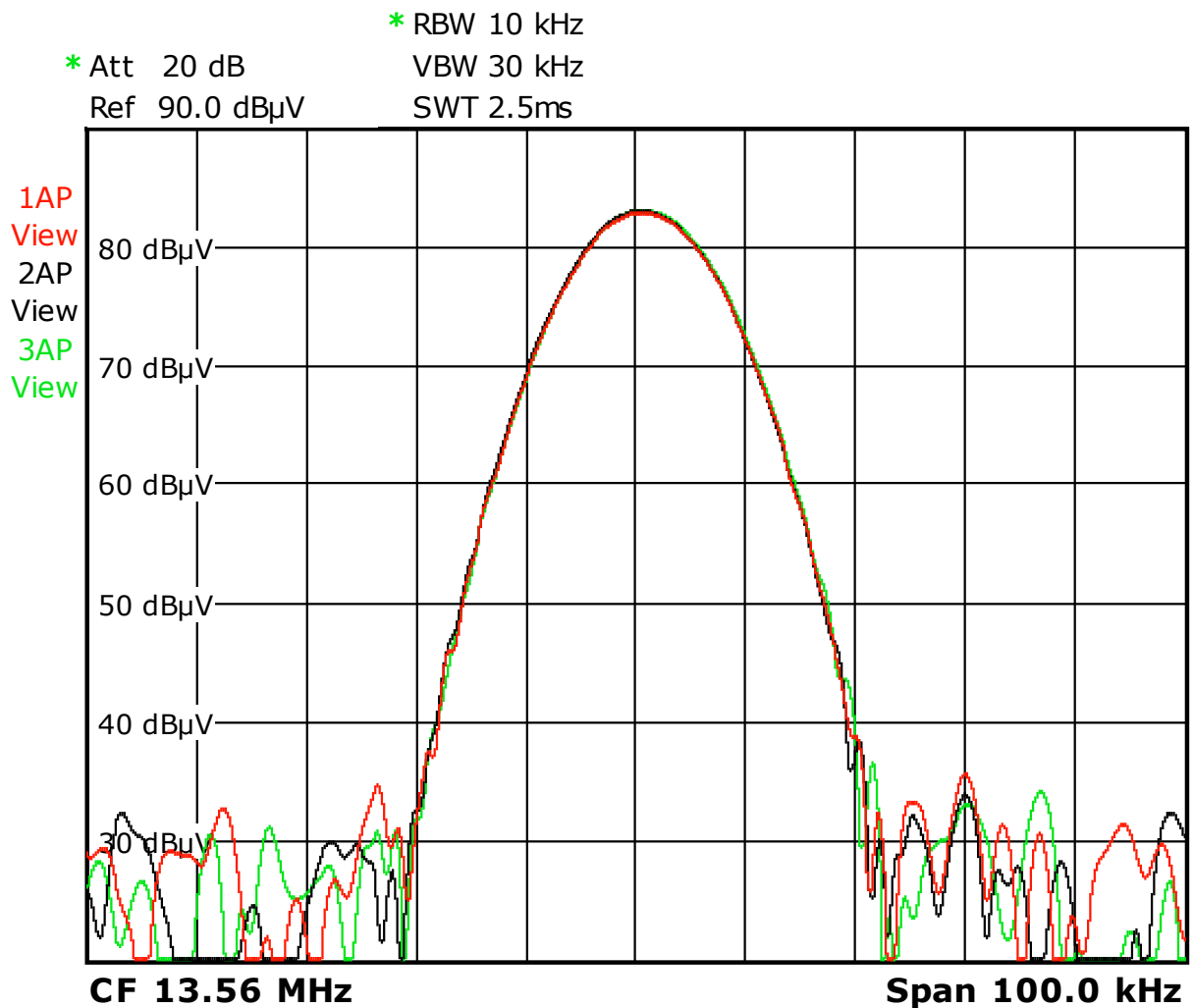


Fundamental frequency at 23°C, 43%rH – 13.5607MHz

Ambient temperature / °C	Frequency of fundamental / MHz at start	Frequency of fundamental / MHz after 2min	Frequency of fundamental / MHz after 5min	Frequency of fundamental / MHz after 10min
50	13.5607	13.5608	13.5606	13.5608
40	13.5609	13.5609	13.5609	13.5610
30	13.5607	13.5607	13.5605	13.5605
20	13.5606	13.5607	13.5607	13.5605
10	13.5607	13.5609	13.5606	13.5605
0	13.5607	13.5608	13.5606	13.5609
-10	13.5609	13.5608	13.5606	13.5607
-20	13.5609	13.5608	13.5606	13.5608



Diagram, frequency of fundamental vs. temperature at -20°C ; 20°C ; 50°C points

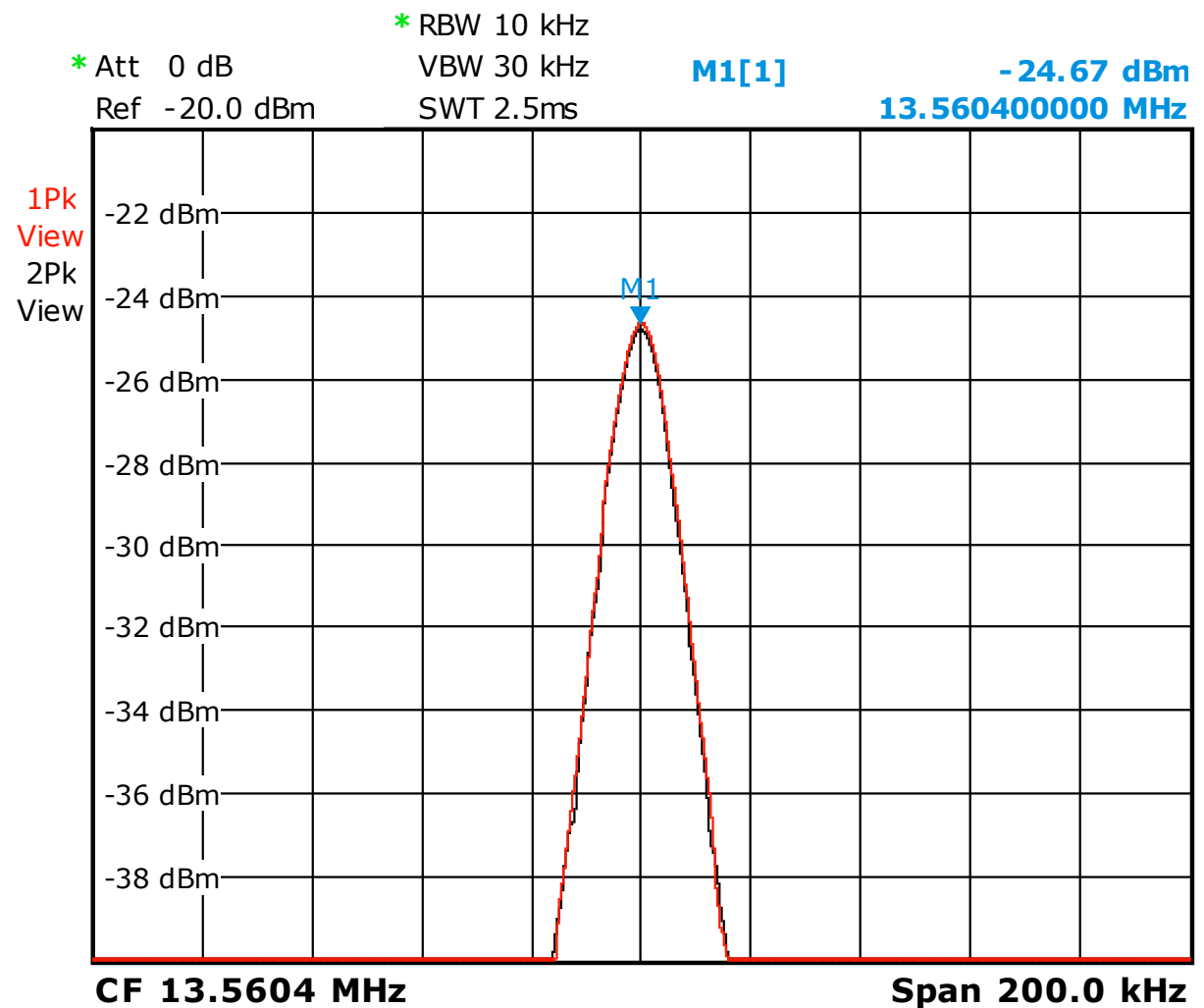


PRN48_04, ARE H9 HF tr.1 20degC, tr.2 -20degC, tr.3 +50degC

Date: 6.DEC.2016 13:02:55



Diagram, frequency and level of fundamental vs. supply voltage
at 7.2 VDC and low edge power supply 5.0 VDC



tr.1 7.2 VDC tr.2 5.0 VDC

Date: 31.MAR.2017 14:29:46

Red trace: Nominal voltage (7.2 VDC)

Black trace: Low battery voltage (5.0 VDC)

1.1.2.3 Test – Spurious emissions

Regulation

47 CFR Part 15 Subpart C – 12/02/2016

- ☒ 9 kHz – 30 MHz
 ☐ 150 kHz – 1 GHz
☒ 30 MHz – 1000 MHz
 ☒ 1 – 18 GHz

Limits: ☒ Section 15.209* ☐ __

Test distance: ☒ 3 m ☐ 5 m
☒ 10 m ☐ 30 m

Operation mode

EUT arrangement: ☒ Tabletop ☐ Floor standing
 Power supply - laptop: ☒ 120 V/60 Hz ☐ 240 V/60 Hz
 Power supply - EUT: ☐ 120 V/60 Hz ☒ 7.2 VDC
 Rated voltage variation: ☐ 85 % ☐ 115 %

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

Continuous operation of the RFID reader, supplied with the internal batteries. No tag in field, this operation mode shows highest emanations. The Bluetooth module was configured as “Master” and active. During the test the remote station was removed from the laptop and the Bluetooth module was polling for a BT device. RFID and Bluetooth module were active at the same time.

Environmental conditions

Temperature [10 - 40°C]: 11°C
 Relative humidity [10 - 90%]: 84%

Environmental conditions during the test: ☒ kept
☐ not kept



Test - / Measurement procedure

The test was performed at an antenna to EUT distance of 10m in the frequency range $\leq 30\text{MHz}$ and at 3m distance for frequencies $\geq 30\text{MHz}$. Measurements were made with a CISPR receiver with quasi-peak. The average detector is used in the frequency bands 9-90kHz, 110-490kHz and above 1000MHz. For pulse modulated devices with a pulse repetition frequency of 20Hz or less, peak detector is used (15.35a Note). The frequency, the measured value, antenna information and the limit will be printed out.

The reported test results are calculated with the following formula:

$$\text{Field strength (dB}\mu\text{V/m)} = \text{Reading (dB}\mu\text{V)} + \text{AF (dB/m)} + \text{CF (dB)}$$

AF = Correction factor for the antenna
CF = Correction factor for the cable loss

$$\text{Limit}_{10\text{m}} (\text{dB}\mu\text{V/m}) = \text{Limit (dB}\mu\text{V/m)} + \text{LCF}_{10\text{m}} (\text{dB})$$

Limit_{10m} Limit calculated for 10m test distance
LCF_{10m} = Limit Correction factor for 10m test distance
LCF_{10m} for 30m antenna distance = 20dB
LCF_{10m} for 100m antenna distance = 40dB
LCF_{10m} for 300m antenna distance = 60dB

Test result

Limits for intentional radiators: ☒ kept
☐ not kept

Level of the fundamental > unwanted emission: ☒ kept
☐ not kept

Protocol scope

- ☒ Readings - Antenna horizontal polarized.
- ☒ Diagram - Antenna horizontal polarized.
- ☒ Readings - Antenna vertical polarized.
- ☒ Diagram - Antenna vertical polarized.
- ☐ Bandwidth plot – Frequency response vs. supply voltage
- ☒ Pretest handheld – 3 axis.
- ☒ Bluetooth harmonics and spurious emissions
- ☒ Bluetooth conducted output power



Readings - Antenna vertical polarized, Antenna loop lowest height 1 m

Frequency	Field strength	Limit _{10m}	Margin	Ant.-	Ant.-	Detector	Receiver	Remarks
				Distance	Polar.	Peak /	6dB BW	
MHz	dBµV/m	dBµV/m	dB	m	H/V	QP / AV	kHz	
27.1214	22.0	49.5	27.5	10.0	V	QP	10	

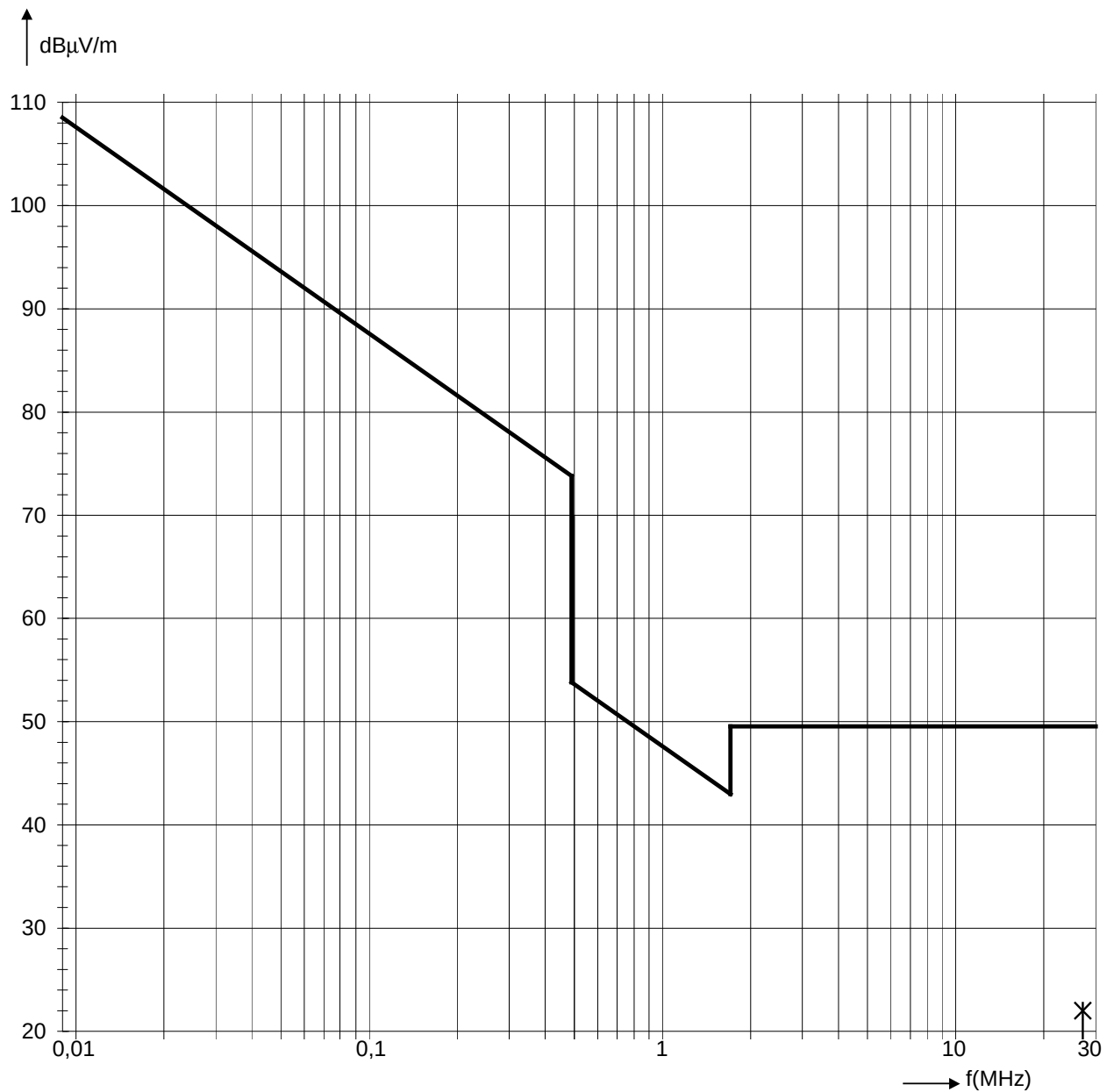
Limit_{10m} Limit calculated for 10m test distance



Diagram - Antenna vertical polarized

Limits according FCC Rules 47 CFR Part 15 – Subpart C

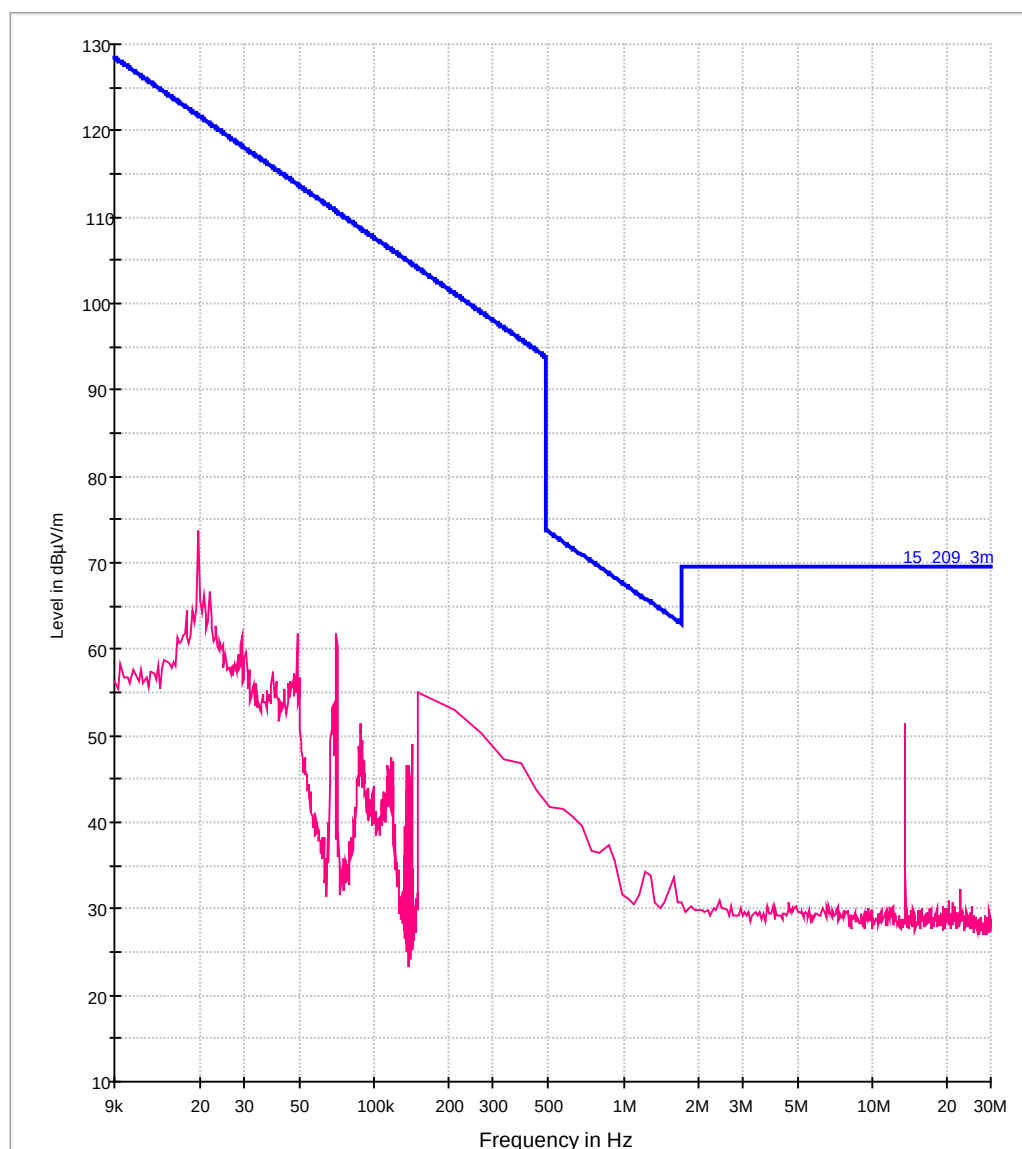
☒ Section 15.209 – Corrected to 10m distance EUT-Antenna



EUT Information

EUT Name:	ARE H9 - HF/A/F/U/C/B/H/Li
Test_ID: / SN:	PRN48_04
Customer:	AEG ID GmbH
Operational condition:	No tag in field, BT I/F active
Test specification:	47 CFR Part 15 Section 15.209
Antenna information:	Distance EUT-Ant.: 3.0 m / Polarisation: V / Ant.Height: 1.0 m
Operator:	P. Hauser
File #:	AIN49_22

Magnetic Field Strength dB μ V with Sweep_SAC2



— 15_209_3m [.\EMI radiated]
— MaxPeak-MaxHold [Preview Result 1V.Result:2]



Readings - Antenna horizontal polarized

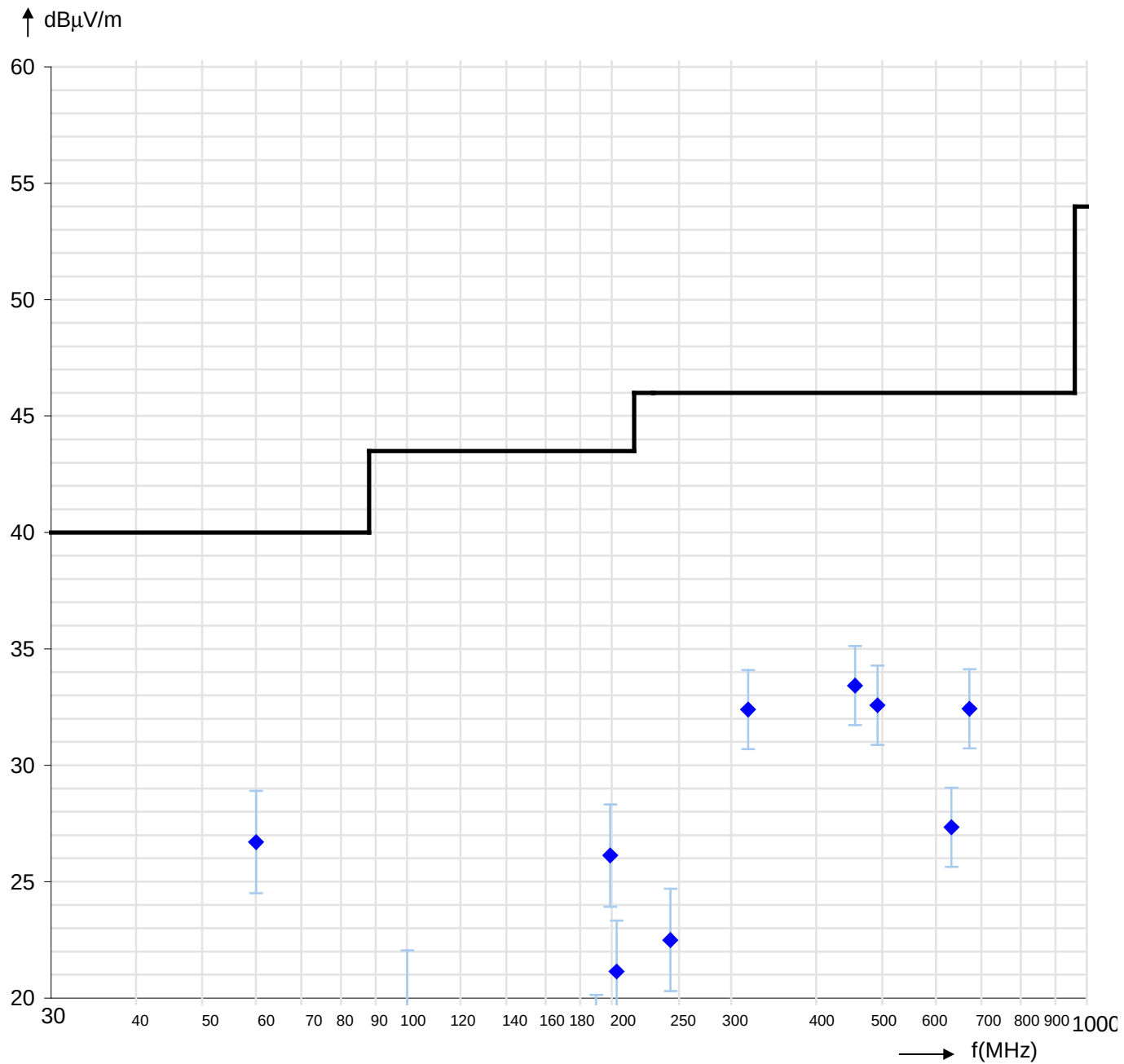
Frequency	Readings	+ AF Antenna correction factor	+ KF Cable correction factor	Field strength	Limit	Margin	Antenna- Height	Antenna- Polarization	Turn Table- Position
MHz	dBµV	dB/m	dB	dBµV/m	dBµV/m	dB	m	hor./ver.	Degree
60.000	17.1	8.4	1.2	26.7	40.0	13.3	3.0	H	90
100.130	9.0	9.3	1.6	19.9	43.5	23.6	2.5	H	70
189.840	1.2	14.5	2.2	17.9	43.5	25.6	2.0	H	100
199.100	8.3	15.6	2.3	26.1	43.5	17.4	2.2	H	120
203.400	3.1	15.8	2.3	21.1	43.5	22.4	2.0	H	120
244.080	3.0	17.0	2.5	22.5	46.0	23.5	1.8	H	100
317.700	15.6	13.9	2.9	32.4	46.0	13.6	1.4	H	110
456.030	12.9	17.0	3.5	33.4	46.0	12.6	1.2	H	270
492.110	11.5	17.4	3.6	32.6	46.0	13.4	1.0	H	270
632.200	3.9	19.3	4.1	27.3	46.0	18.7	1.0	H	120
672.110	8.2	19.9	4.3	32.4	46.0	13.6	1.0	H	120



Diagram radio disturbances – Antenna horizontal polarized

Limits:

☒ Section 15.209* ☐ __





Readings - Antenna vertical polarized

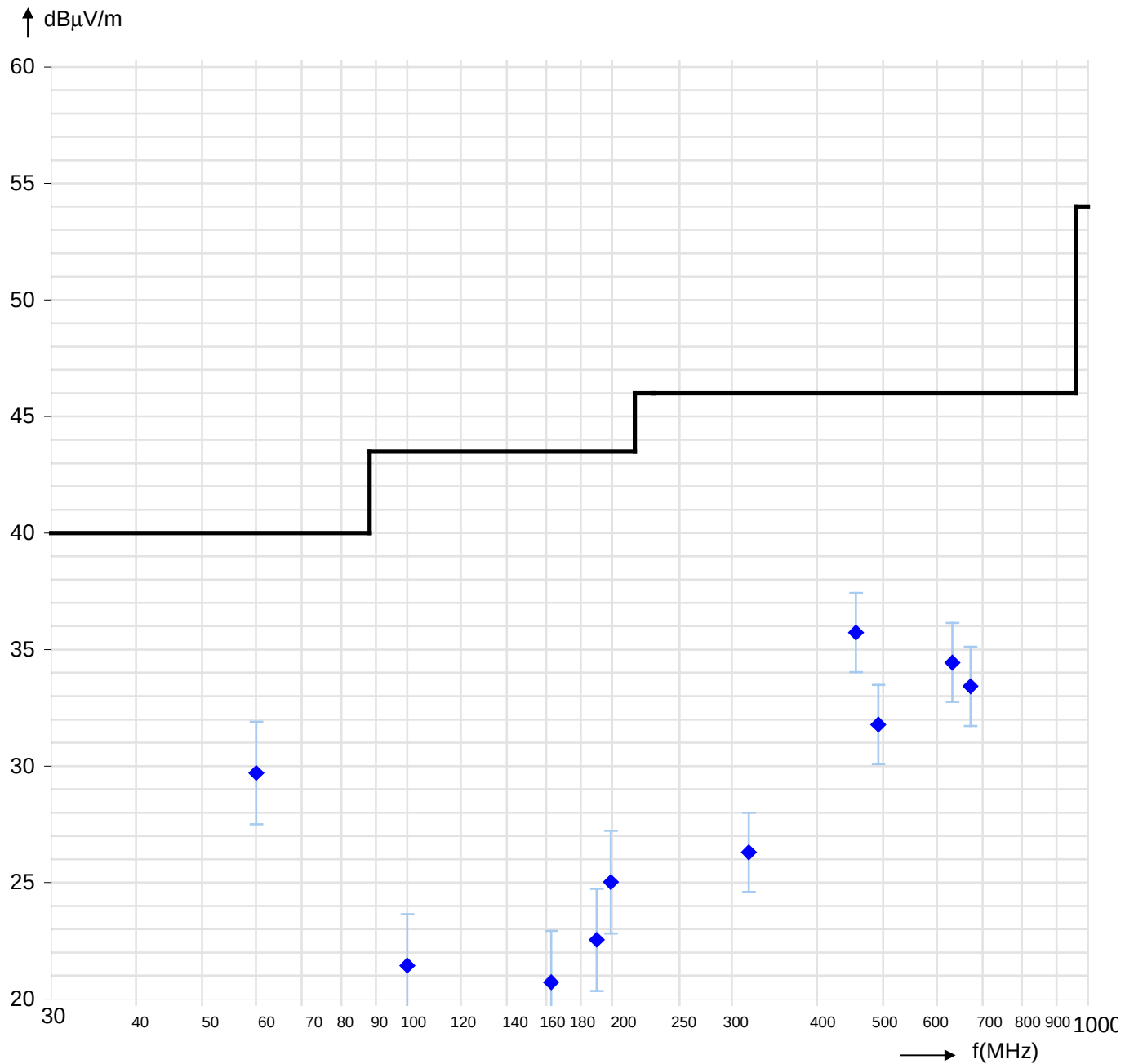
Frequency	Readings	+ AF Antenna correction factor	+ KF Cable correction factor	Field strength	Limit	Margin	Antenna- Height	Antenna- Polarization	Turn Table- Position
MHz	dB μ V	dB/m	dB	dB μ V/m	dB μ V/m	dB	m	hor./ver.	Degree
60.000	20.1	8.4	1.2	29.7	40.0	10.3	1.0	V	70
100.000	10.6	9.3	1.6	21.4	43.5	22.1	1.0	V	90
162.700	6.0	12.7	2.0	20.7	43.5	22.8	1.0	V	120
189.850	5.8	14.5	2.2	22.5	43.5	21.0	1.0	V	160
199.100	7.2	15.6	2.3	25.0	43.5	18.5	1.0	V	120
317.700	9.5	13.9	2.9	26.3	46.0	19.7	1.0	V	210
456.030	15.2	17.0	3.5	35.7	46.0	10.3	1.0	V	210
492.110	10.7	17.4	3.6	31.8	46.0	14.2	1.0	V	220
632.200	11.0	19.3	4.1	34.4	46.0	11.6	1.0	V	200
672.110	9.2	19.9	4.3	33.4	46.0	12.6	1.0	V	200



Diagram radio disturbances – Antenna vertical polarized

Limits:

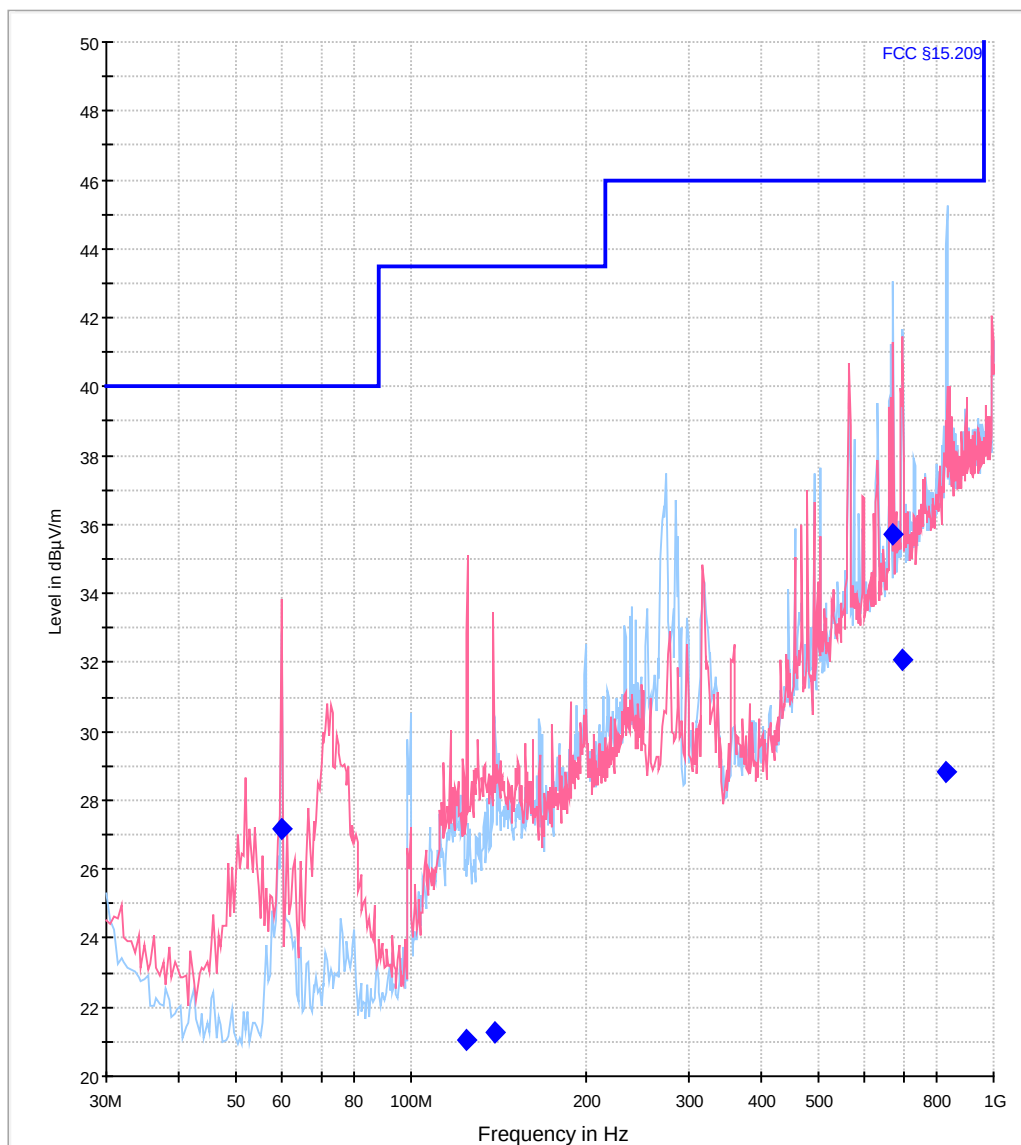
☒ Section 15.209* ☐ __



EUT Information

EUT Name:	ARE H9 - HF/A/F/U/C/B/H/Li
Test_ID: / SN:	PRN48_04
Customer:	AEG ID GmbH
Operational condition:	No tag in field, BT IF active
Test specification:	47 CFR Part 15 Section 15.209
Antenna information:	Distance EUT-Ant.: 3.0 m / Polarisation: H/V / Ant.Height: 1.0-4.0 m
Operator:	P. Hauser
File #:	AIN49_01
Comment #1:	X-axis

Electric Field Strength with Sweep_SAC2_FCC



— FCC §15.209 [..EMI radiated]	— Preview Result 1H-PK+ [Preview Result 1H.Result:2]
— Preview Result 1V-PK+ [Preview Result 1V.Result:2]	◆ Final Result 1-QPK [Final Result 1.Result:1]



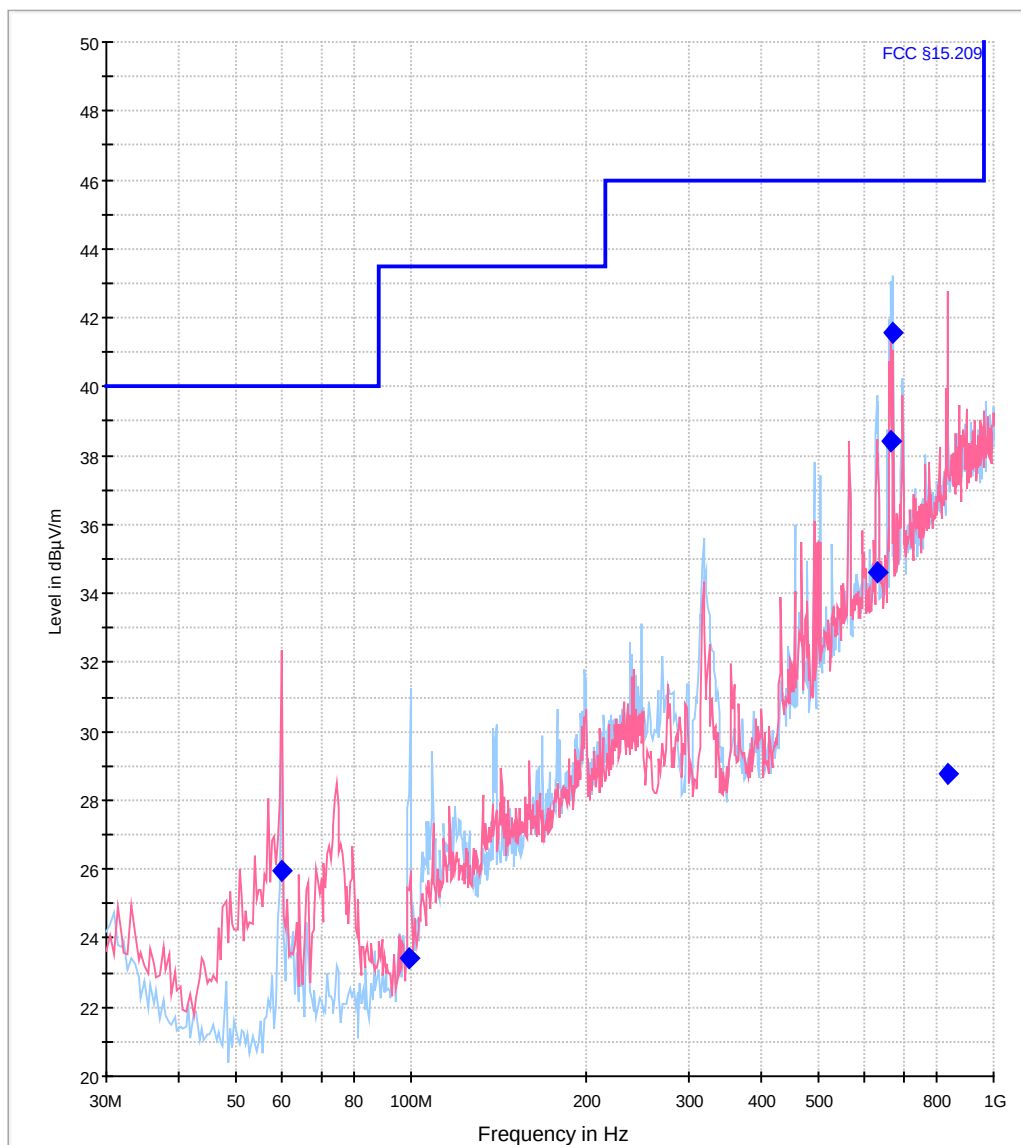
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Limit (dBµV/m)	Margin (dB)
59.991984	27.2	5000.0	120.000	119.7	V	272.0	8.7	40.0	12.8
60.272545	17.7	5000.0	120.000	170.2	V	130.0	8.7	40.0	22.3
124.849699	21.0	5000.0	120.000	170.2	V	338.0	11.4	43.5	22.5
139.727455	21.3	5000.0	120.000	119.7	V	345.0	12.3	43.5	22.2
672.116232	35.7	5000.0	120.000	254.3	H	256.0	21.4	46.0	10.3
695.727455	32.1	5000.0	120.000	254.3	H	258.0	21.8	46.0	13.9
829.038077	28.8	5000.0	120.000	219.9	V	330.0	23.2	46.0	17.2

EUT Information

EUT Name:	URH 1 HL - xF/U/C/B/H/Li/CS5
Test_ID: / SN:	PRN48_04
Customer:	AEG ID GmbH
Operational condition:	No tag in field, BT IF active
Test specification:	47 CFR Part 15 Section 15.209
Antenna information:	Distance EUT-Ant.: 3.0 m / Polarisation: H/V / Ant.Height: 1.0-4.0 m
Operator:	P. Hauser
File #:	AIN49_02
Comment #1:	Y-axis

Electric Field Strength with Sweep_SAC2_FCC



— FCC §15.209 [..EMI radiated]
 — Preview Result 1V-PK+ [Preview Result 1V.Result:2]

— Preview Result 1H-PK+ [Preview Result 1H.Result:2]
 ◆ Final Result 1-QPK [Final Result 1.Result:1]



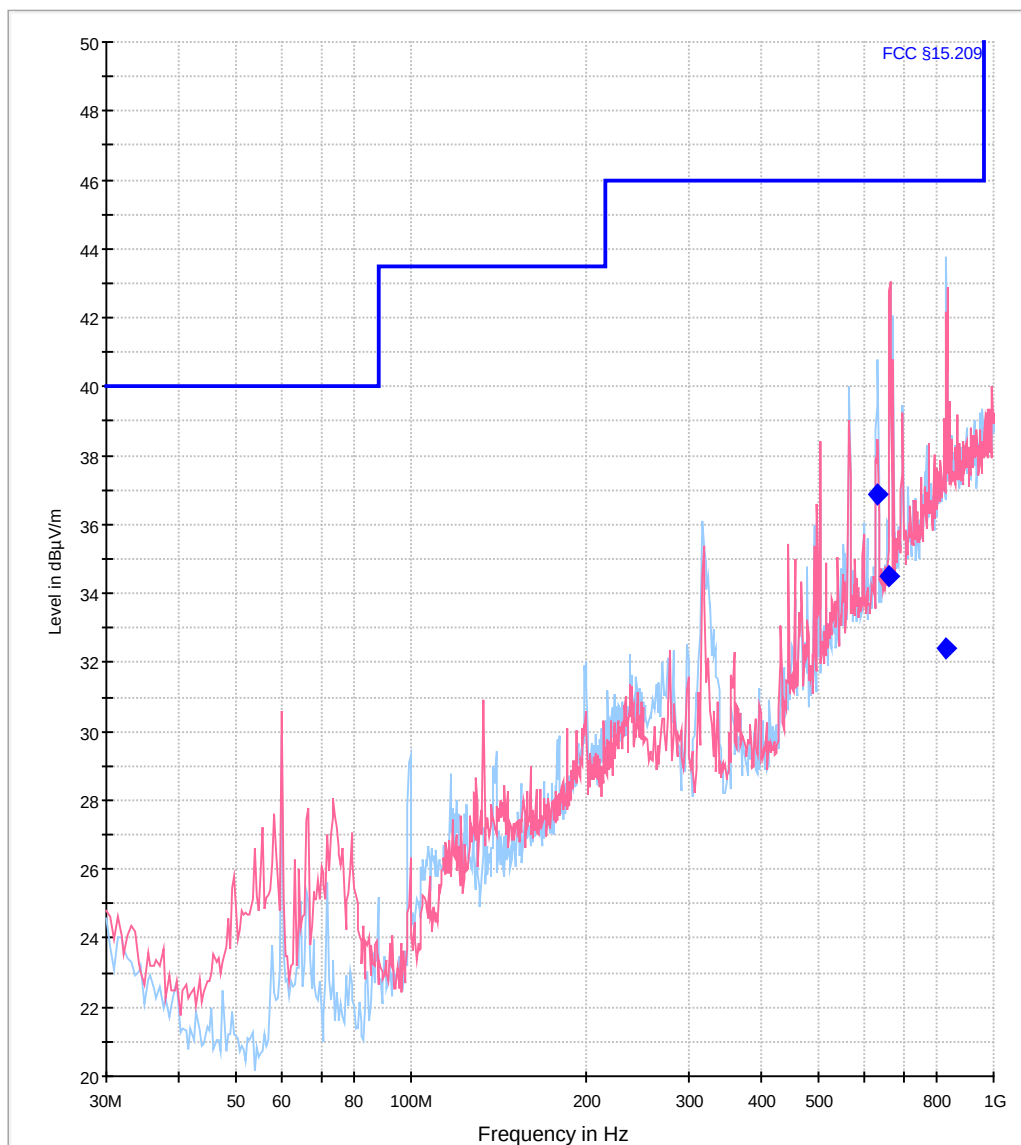
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Limit (dBµV/m)	Margin (dB)
60.000000	26.0	5000.0	120.000	170.3	V	260.0	8.7	40.0	14.0
99.575151	23.4	5000.0	120.000	170.3	H	293.0	9.7	43.5	20.1
632.220441	34.6	5000.0	120.000	169.8	H	281.0	20.6	46.0	11.4
665.222445	38.4	5000.0	120.000	169.8	H	296.0	21.2	46.0	7.6
672.116232	41.6	5000.0	120.000	169.8	H	277.0	21.4	46.0	4.4
832.961924	28.8	5000.0	120.000	220.2	V	340.0	23.2	46.0	17.2

EUT Information

EUT Name:	ARE H9 - HF/A/F/U/C/B/H/Li
Test_ID: / SN:	PRN48_04
Customer:	AEG ID GmbH
Operational condition:	No tag in field, BT IF active
Test specification:	47 CFR Part 15 Section 15.209
Antenna information:	Distance EUT-Ant.: 3.0 m / Polarisation: H/V / Ant.Height: 1.0-4.0 m
Operator:	P. Hauser
File #:	AIN49_03
Comment #1:	Z-axis

Electric Field Strength with Sweep_SAC2_FCC



— FCC §15.209 [..EMI radiated]
 — Preview Result 1V-PK+ [Preview Result 1V.Result:2]

— Preview Result 1H-PK+ [Preview Result 1H.Result:2]
 ◆ Final Result 1-QPK [Final Result 1.Result:1]



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Limit (dBµV/m)	Margin (dB)
632.549098	36.9	5000.0	120.000	170.3	H	250.0	20.6	46.0	9.1
663.559118	34.5	5000.0	120.000	120.0	V	42.0	21.1	46.0	11.5
831.519038	32.4	5000.0	120.000	119.9	H	0.0	23.2	46.0	13.6

Final Result 1 – BT harmonics

Frequency (GHz)	Peak (dBμV/m)	Average (dBμV/m)	Bandwidth (MHz)	Height (cm)	Polarization	Limit PK (dBμV/m)	Margin - PK (dB)
4.860	41.2		1.0	120.0	H	74.0	32.8
7.290	<54		1.0	120.0	H	74.0	≥20
9.720	55.8		1.0	120.0	H	74.0	18.2
12.150	<54		1.0	120.0	H	74.0	≥20
14.580	<54		1.0	120.0	H	74.0	≥20
17.010	<60		1.0	120.0	H	74.0	≥14
19.440	<60		1.0	120.0	H	74.0	≥14
21.870	<60		1.0	120.0	H	74.0	≥14
24.300	<60		1.0	120.0	H	74.0	≥14

EUT Information

EUT Name: ARE H9 - HF/A/F/U/C/B/H/Li
 Test_ID: / SN: PRN48_04
 Customer: AEG ID GmbH
 Operational condition: Reading tag, BT serial transmission mode
 Test specification: 47 CFR part 15
 Antenna information: Distance EUT-Ant.: 3.0 m / Polarisation: H/V / Ant.Height: 1.0-4.0 m
 Operator: P. Hauser
 File #: AIO12_02

Electric Field Strength with Sweep_SAC2_FCC

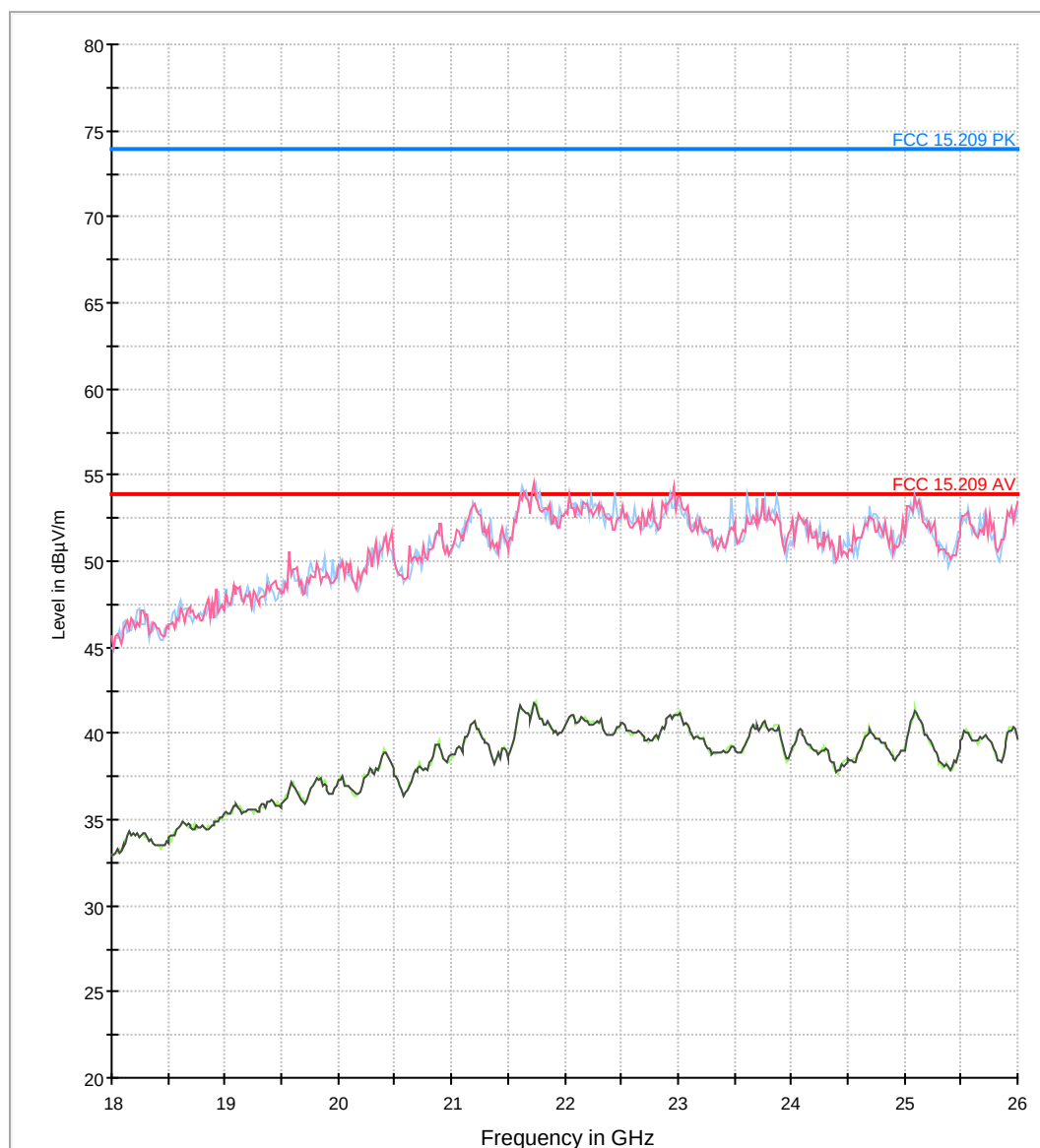


— FCC 15.209 PK [..]	— FCC 15.209 AV [..EMI radiated]
— Preview Result 1H-PK+ [Preview Result 1H.Result:2]	— Preview Result 2H-AVG [Preview Result 2H.Result:4]
— Preview Result 1V-PK+ [Preview Result 1V.Result:2]	— Preview Result 2V-AVG [Preview Result 2V.Result:4]

EUT Information

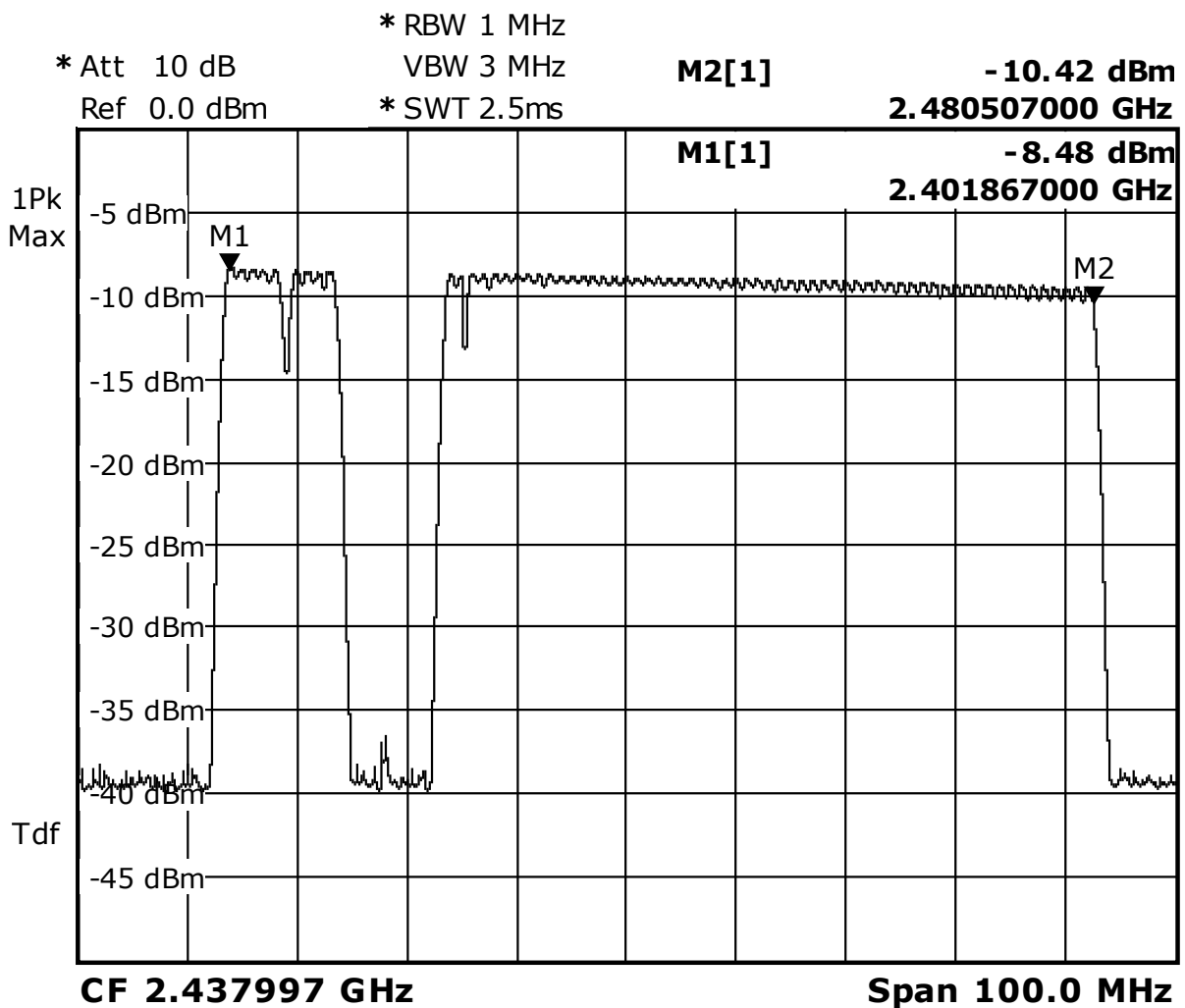
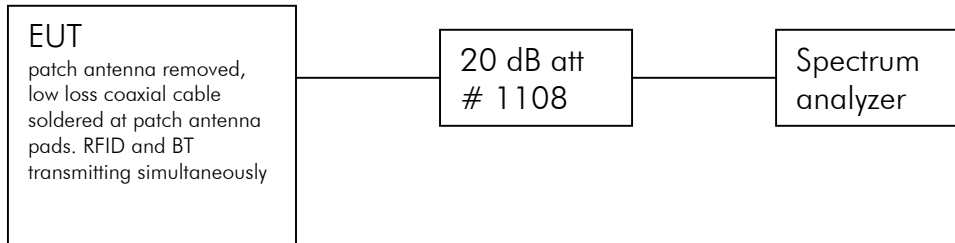
EUT Name:	ARE H9 - HF/A/F/U/C/B/H/Li
Test_ID: / SN:	PRN48_04
Customer:	AEG ID GmbH
Operational condition:	Reading tag, BT serial transmission mode
Test specification:	47 CFR part 15
Antenna information:	Distance EUT-Ant.: 3.0 m / Polarisation: H/V / Ant.Height: 1.0-4.0 m
Operator:	P. Hauser
File #:	AIO12_03

Electric Field Strength with Sweep_SAC2_FCC



— FCC 15.209 PK [..]	— FCC 15.209 AV [..EMI radiated]
— Preview Result 1H-PK+ [Preview Result 1H.Result:2]	— Preview Result 2H-AVG [Preview Result 2H.Result:4]
— Preview Result 1V-PK+ [Preview Result 1V.Result:2]	— Preview Result 2V-AVG [Preview Result 2V.Result:4]

Test setup BT conducted output power



Date: 22.MAR.2017 17:26:38

Bluetooth conducted maximum power density: -8.4 dBm at 2.402 GHz /
Spectrum analyzer settings: RBW= 3 kHz / VBW= 10 kHz / Span= 300 kHz /
Sweep time= 100s



1.1.2.4 Restricted bands of operation

Regulation

47 CFR Part 15 Subpart C – 12/02/2016

- Requirement: ☒ Section 15.205(a)
- Limit spurious emission: ☒ Section 15.209
☒ CISPR quasi peak detector ($f \leq 1\text{GHz}$)
☐ Average detector ($f > 1\text{GHz}$)

Operation mode

- | | | |
|--------------------------|---|---|
| EUT arrangement: | ☒ Tabletop | ☐ Floor standing |
| Power supply - laptop: | ☒ 120 V/60 Hz | ☐ 240 V/60 Hz |
| Power supply - EUT: | ☐ 120 V/60 Hz | ☒ 7.2 VDC |
| Rated voltage variation: | ☐ 85 % | ☐ 115 % |

Continuous operation of the RFID reader, supplied with the internal batteries. No tag in field, this operation mode shows highest emanations. The Bluetooth module was configured as "Master" and active. During the test the remote station was removed from the laptop and the Bluetooth module was polling for a BT device. RFID and Bluetooth module were active at the same time.

Environmental conditions

- Temperature [10 - 40°C]: 21°C
- Relative humidity [10 - 90%]: 49%
- Environmental conditions during the test: ☒ kept
☐ not kept



Test - / Measurement procedure

Position the EUT in front of the measuring antenna. The analyzer is set to peak detector and the trace mode to max. hold. Set the analyzer to the identified fundamental and the sweep is continued until the trace is stabilized. The frequencies of the maximum of the envelope and the outermost points attenuated by 20dB to the maximum are noted.

Test result

Measured fundamental: 13.5607 MHz
20dB-Emission Bandwidth: 0.1398 MHz

Fundamental out
of restricted bands: ☒ kept
☐ not kept

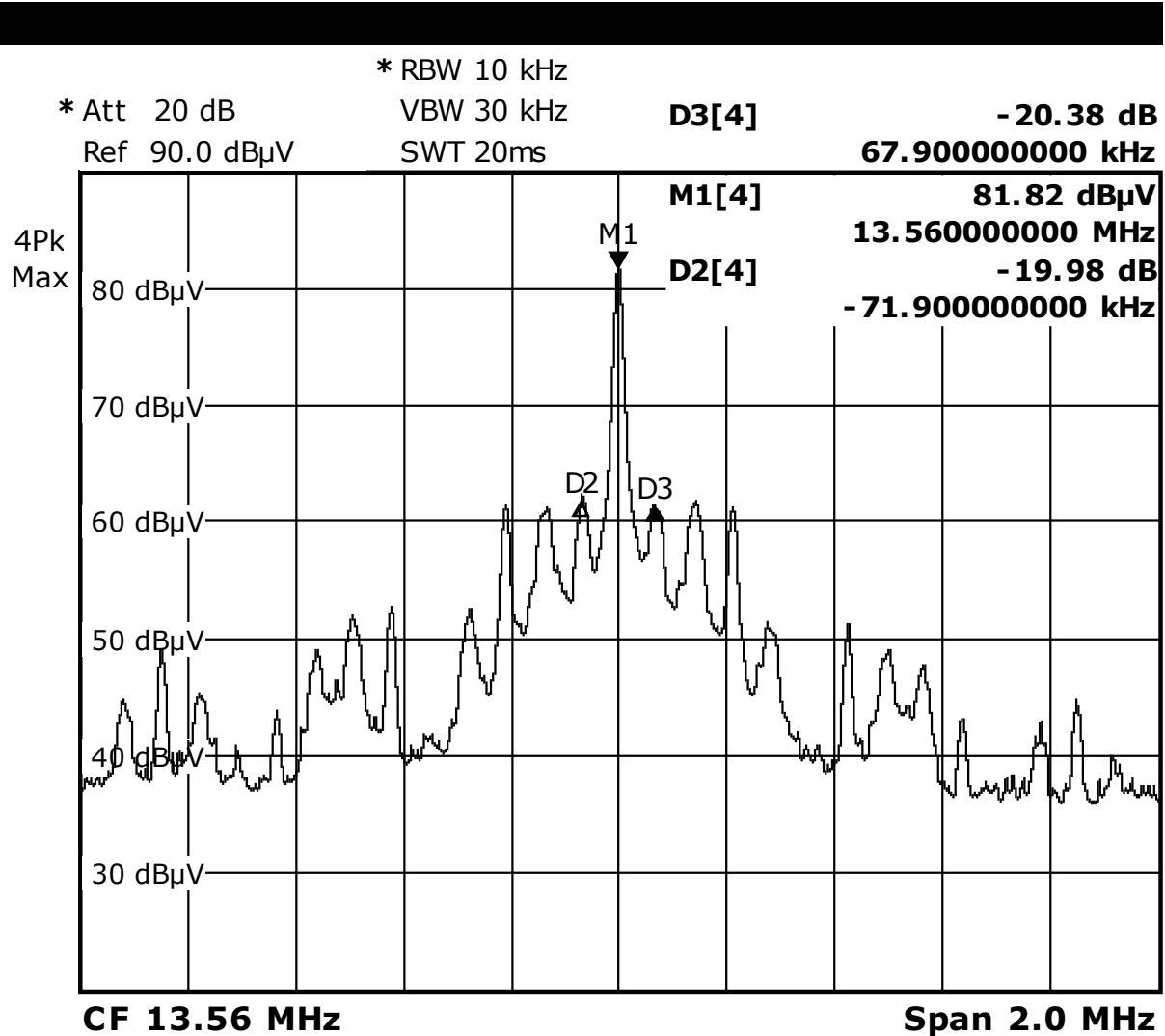
Limit spurious emission: ☒ kept
☐ not kept

Remarks: n/a

Protocol scope

☒ Diagram – 20dB-Emission bandwidth.

Occupied bandwidth



PRN48_04, ARE H9 HF 20dB BW

Date: 6.DEC.2016 14:04:32

Occupied bandwidth BW = D3 – D2 = 67.9 kHz - -71.9 kHz=139.8 kHz



1.1.2.5 Antenna requirement

Regulation

47 CFR Part 15 Subpart C – 12/02/2016

Requirement:

- ☒ Section 15.203
- ☒ 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



2 Summary

Regulation	Class / Test level	Result	Remark(s)
FCC Rules 47 CFR Part 15 Subpart C			
Terminal voltage 0.15-30 MHz	Section 15.207	Limits kept	
Radiated emissions 0.009-30 MHz	Sections 15.209; 15.225	Limits kept	
Radiated emissions 30-26000 MHz	Section 15.209	Limit kept	
Occupied bandwidth	Section 15.215(c)	Requirement kept	
Restricted bands	Section 15.205(a)	Requirement kept	
Antenna requirement	Section 15.203	Requirement kept	
Power spectral density	Section 15.247	Limit kept	BT and RFID active at the same time

Burgrieden, 2017-03-31

Report generated by:



Acceptance inspector – Peter Hauser