

Test report

AIO32_01

Product / EUT: RFID reader
Type designation: ARE i2 – 22X/USB
Tested type: ARE i2 – 22X/USB
EUT authorization: ☒ Certification ☐ Declaration of Conformity
☐ Verification
Production level: 07/2017
S/N: n/a
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
ANSI C63.10-2013

The standards were: ☒ kept*
☐ not kept*

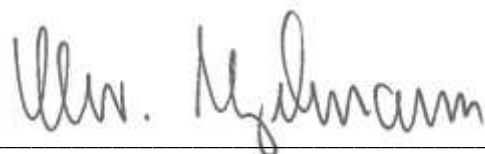
*Remark: ☒ Validation covered by the accredited scope
☐ Validation not covered by the accredited scope
according: _____
☐ Validation of the EMC-requirements partly proceeded

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

EUT-
Date of arrival: 2017-07-31
Test ID: PRO31_01
Date(s) of test: 2017-07-31; 2017-08-01

Burgrieden, 2017-09-05

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

BNNetzA-CAB-02/21-01



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

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.: 219415

Responsible inspector:

Mr. Hauser

EMCE GmbH

Ingenieurbüro für EMV-Prüfungen und Schaltungsentwicklung

Contact person:

Mr. Waitzinger / AEG Identifikationssysteme GmbH

EUT Description:

HF-RFID reader with USB I/F.

Options list:

USB = USB interface

X = Reader without integrated antenna

Algorithm:

22 = Iso 14443 + Iso 15693

Voltage supply:

12 – 30 VDC

Frequency list:

260 kHz; 13.56 MHz; 22.1184 MHz; 48 MHz

Temperature range:

n/a

Approximate size:

(LxWxH) / mm - 90x60x38



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
AC Adapter (EUT)	PA-1131-02D	Dell	CN-09Y819-48010-36H-0043
Tag	13.56 MHz	NXP	E004020000516B68
Antenna	AANX9L-HF flex 0.5m	AEG	000136

Configuration:



As-delivered condition*



Modified*

*

Cable designation	Type	Length	Remarks
AC power cord – laptop	3-wire	160 cm	n/a
USB cable	Shielded	140 cm	Ferrite core WE 742 711 31, 2 cm off the EUT
Antenna cable	Coaxial, 50 Ω	50 cm	Ferrite core WE 742 711 11, 2 cm off the EUT
DC cable	2-wire	150 cm	n/a

Remarks:

n/a



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)/ 2017-10-31
003	LISN 1	ESH3-Z5	Rohde & Schwarz	835268/007	1 Year(s)/ 2017-08-31
004	LISN 2	ESH3-Z5	Rohde & Schwarz	835268/003	1 Year(s)/ 2017-08-31
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
013	Antenna 9kHz-30MHz	Ø 1.5m	EMCE GmbH		1 Year(s)/ 2017-08-31
014	OATS	3m	EMCE GmbH		1 Year(s)/ 2017-08-31
015	OATS	10m	EMCE GmbH		1 Year(s)/ 2017-08-31
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)/ 2018-04-06
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



Scope:

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1 EMC-Test(s)

1.1 Emission according 47 CFR Part 15 Subpart C - 08/07/2017

1.1.1 Terminal voltage according 47 CFR Part 15 Subpart C - 08/07/2017

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

*

Test location

<input checked="" type="checkbox"/>	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
<input checked="" type="checkbox"/>	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

<input checked="" type="checkbox"/>	Inv.-No.	Designation	Type	Manufacturer	S/N
<input checked="" type="checkbox"/>	001	Test receiver	ESS 5 Hz – 1000 MHz	Rohde & Schwarz	833776/008
	002	Probe	ESH2-Z3	Rohde & Schwarz	
<input checked="" type="checkbox"/>	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	
<input checked="" type="checkbox"/>	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
<input checked="" type="checkbox"/>	067	LISN 5	ESH2-Z5	Rohde & Schwarz	0872460/043
	068	LISN 4	ESH2-Z5	Rohde & Schwarz	0872460/042
<input checked="" type="checkbox"/>	070	Pulse limiter / 10 dB attenuator	ESH3-Z2	Rohde & Schwarz	357.8810.52
	073	Absorbing clamp	MDS 21	Schwarzbeck	881757

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 - 08/07/2017

☐ 9 kHz – 30 MHz

☒ 150 kHz – 30 MHz

Mains supply
Limits:

☒ Section 15.207

☐ __

Operation mode

EUT arrangement:

☒ Tabletop

☐ Floor standing

Power supply:

☒ 120 V/60 Hz

☒ 19 VDC (EUT)

Rated voltage variation:

☐ 85 %

☐ 115 %

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

Continuous operation of the RFID reader, attached at the laptop USB I/F and supplied by an desktop power supply.

The external antenna was disconnected from the EUT, the antenna output was terminated with 50 Ω . Packets of unsuccessful tag readings were transferred via USB.

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 quasipeak 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 emanation
- ☒ Diagram - continuous emanation



EMCE GmbH Ing_buero fuer EMV_Pruefungen Conducted emission - Terminal voltage

31. Jul 17 11:30

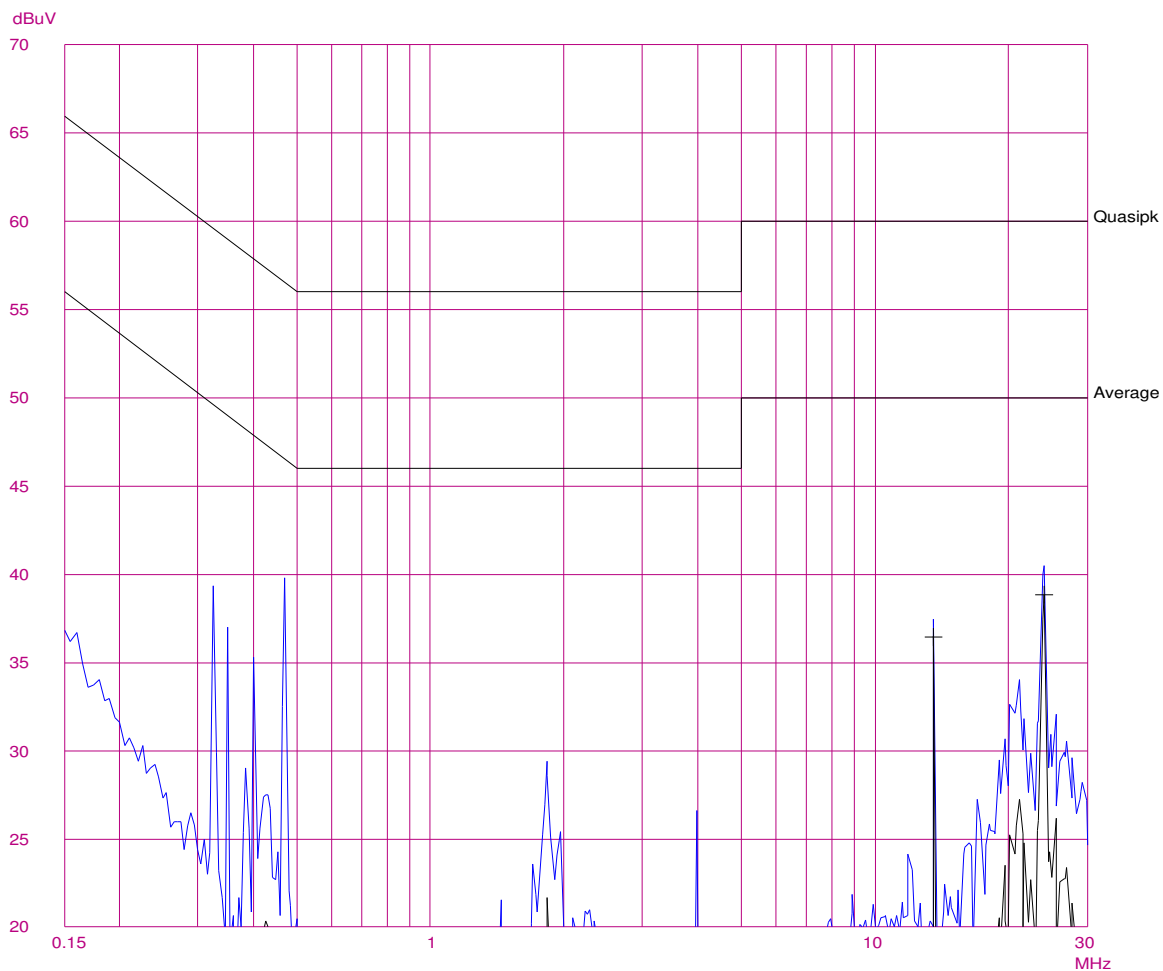
EUT: ARE i2 HF
Manuf: AEG ID GmbH
Op Cond: 50R termination, 19 VDC supply, USB I/F
Operator: P. Hauser
Test Spec: 47 CFR Part 15 Subpart C
Comment: Test_ID EUT PRO31_01
AIO31_01, port L1 - EUT

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150k	30M	5k	10k	PK+AV	20ms	AUTO	LN	OFF 60dB

Final Measurement: x QP / + AV
Meas Time: 1 s
Subranges: 50
Acc Margin: 18dB

Transducer No.	Start	Stop	Name
3 2	1Hz	1000M	Ca_#1006
20	9k	30M	Lim_#070





EMCE GmbH Ing_buero fuer EMV_Pruefungen Conducted emission - Terminal voltage

31. Jul 17 11:30

EUT: ARE i2 HF
Manuf: AEG ID GmbH
Op Cond: 50R termination, 19 VDC supply, USB I/F
Operator: P. Hauser
Test Spec: 47 CFR Part 15 Subpart C
Comment: Test_ID EUT PRO31_01
AIO31_01, port L1 - EUT

Scan Settings (1 Range)

Frequencies				Receiver Settings			
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp OpRge
150k	30M	5k	10k	PK+AV	20ms	AUTO LN	OFF 60dB

Final Measurement Results:

Frequency	QP Level	QP Limit
MHz	dBuV	dBuV
0.47000	16.3	56.5

Frequency	AV Level	AV Limit
MHz	dBuV	dBuV
13.56000	36.4	50.0
24.00500	38.8	50.0

* limit exceeded



EMCE GmbH Ing_buero fuer EMV_Pruefungen Conducted emission - Terminal voltage

31. Jul 17 11:41

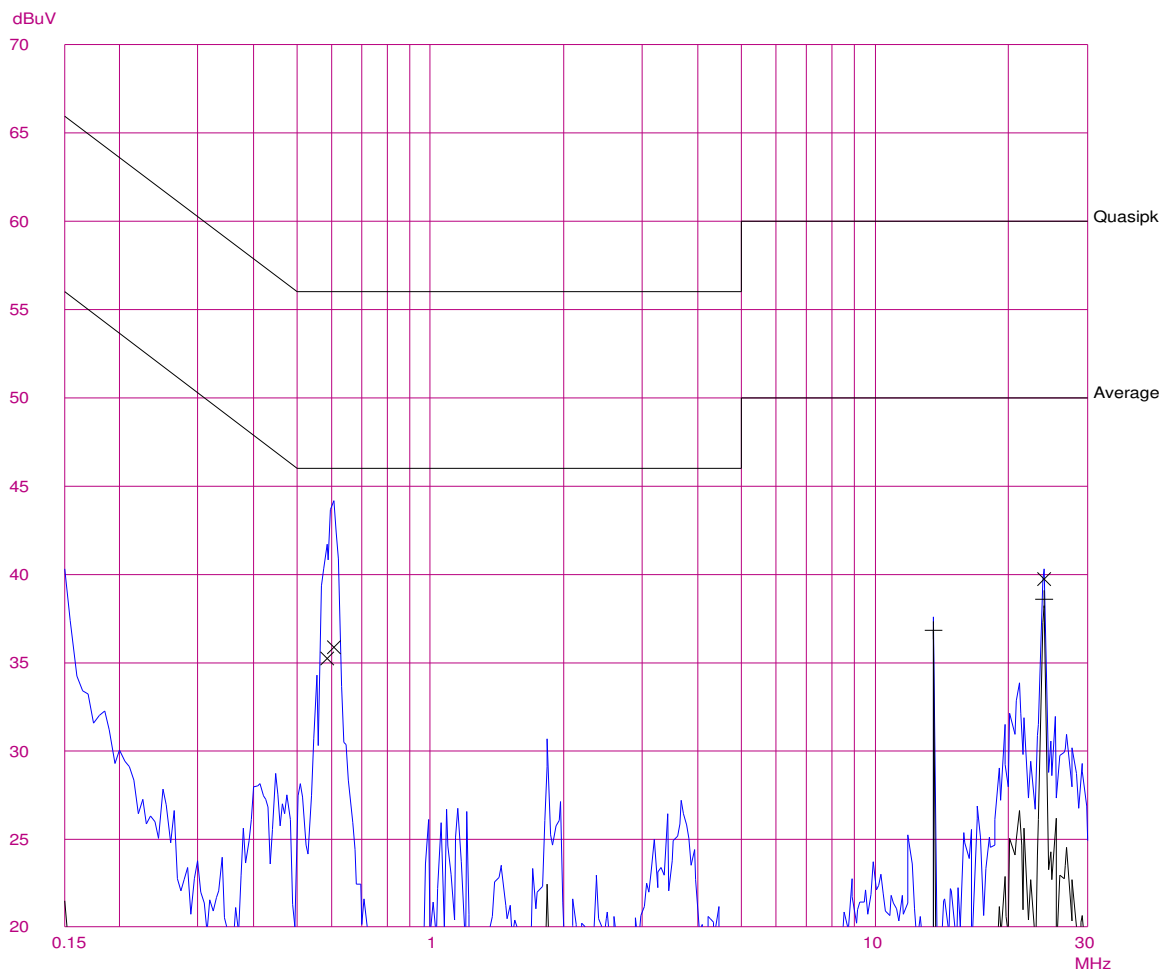
EUT: ARE i2 HF
Manuf: AEG ID GmbH
Op Cond: 50R termination, 19 VDC supply, USB I/F
Operator: P. Hauser
Test Spec: 47 CFR Part 15 Subpart C
Comment: Test_ID EUT PRO31_01
AIO31_02, port N - EUT

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150k	30M	5k	10k	PK+AV	20ms	AUTO	LN	OFF 60dB

Final Measurement: x QP / + AV
Meas Time: 1 s
Subranges: 50
Acc Margin: 20dB

Transducer No.	Start	Stop	Name
3 2	1Hz	1000M	Ca_#1006
20	9k	30M	Lim_#070





EMCE GmbH Ing_buero fuer EMV_Pruefungen Conducted emission - Terminal voltage

31. Jul 17 11:41

EUT: ARE i2 HF
Manuf: AEG ID GmbH
Op Cond: 50R termination, 19 VDC supply, USB I/F
Operator: P. Hauser
Test Spec: 47 CFR Part 15 Subpart C
Comment: Test_ID EUT PRO31_01
AIO31_02, port N - EUT

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150k	30M	5k	10k	PK+AV	20ms	AUTO	LN OFF	60dB

Final Measurement Results:

Frequency MHz	QP Level dBuV	QP Limit dBuV
0.58500	35.2	56.0
0.60500	35.8	56.0
24.00500	39.7	60.0

Frequency MHz	AV Level dBuV	AV Limit dBuV
13.56000	36.8	50.0
24.00500	38.5	50.0

* limit exceeded



EMCE GmbH Ing_buero fuer EMV_Pruefungen Conducted emission - Terminal voltage

31. Jul 17 11:52

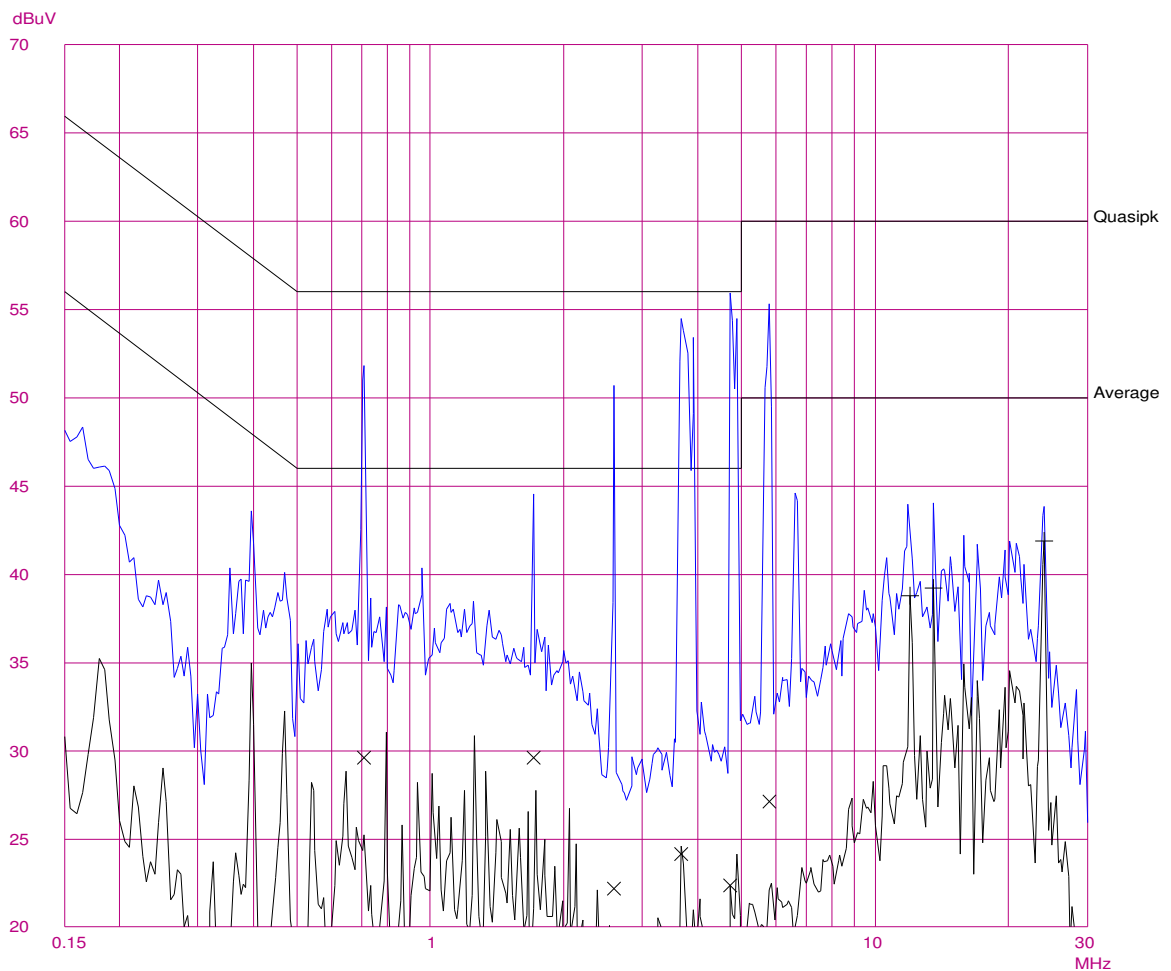
EUT: ARE i2 HF
Manuf: AEG ID GmbH
Op Cond: 50R termination, 19 VDC supply, USB I/F
Operator: P. Hauser
Test Spec: 47 CFR Part 15 Subpart C
Comment: Test_ID EUT PRO31_01
AIO31_03, port L1 - laptop

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150k	30M	5k	10k	PK+AV	20ms	AUTO	LN	OFF 60dB

Final Measurement: x QP / + AV
Meas Time: 1 s
Subranges: 50
Acc Margin: 12dB

Transducer No.	Start	Stop	Name
3 2	1Hz	1000M	Ca_#1006
20	9k	30M	Lim_#070



EMCE GmbH Ing_buero fuer EMV_Pruefungen Conducted emission - Terminal voltage

31. Jul 17 11:52

EUT: ARE i2 HF
Manuf: AEG ID GmbH
Op Cond: 50R termination, 19 VDC supply, USB I/F
Operator: P. Hauser
Test Spec: 47 CFR Part 15 Subpart C
Comment: Test_ID EUT PRO31_01
AIO31_03, port L1 - laptop

Scan Settings (1 Range)

Frequencies				Receiver Settings			
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp OpRge
150k	30M	5k	10k	PK+AV	20ms	AUTO LN	OFF 60dB

Final Measurement Results:

Frequency MHz	QP Level dBuV	QP Limit dBuV
0.71000	29.6	56.0
1.70500	29.6	56.0
2.59000	22.1	56.0
3.66000	24.1	56.0
4.74000	22.3	56.0
5.78000	27.1	60.0

Frequency MHz	AV Level dBuV	AV Limit dBuV
12.00000	38.7	50.0
13.56000	39.2	50.0
24.00500	41.8	50.0

* limit exceeded



EMCE GmbH Ing_buero fuer EMV_Pruefungen Conducted emission - Terminal voltage

31. Jul 17 12:04

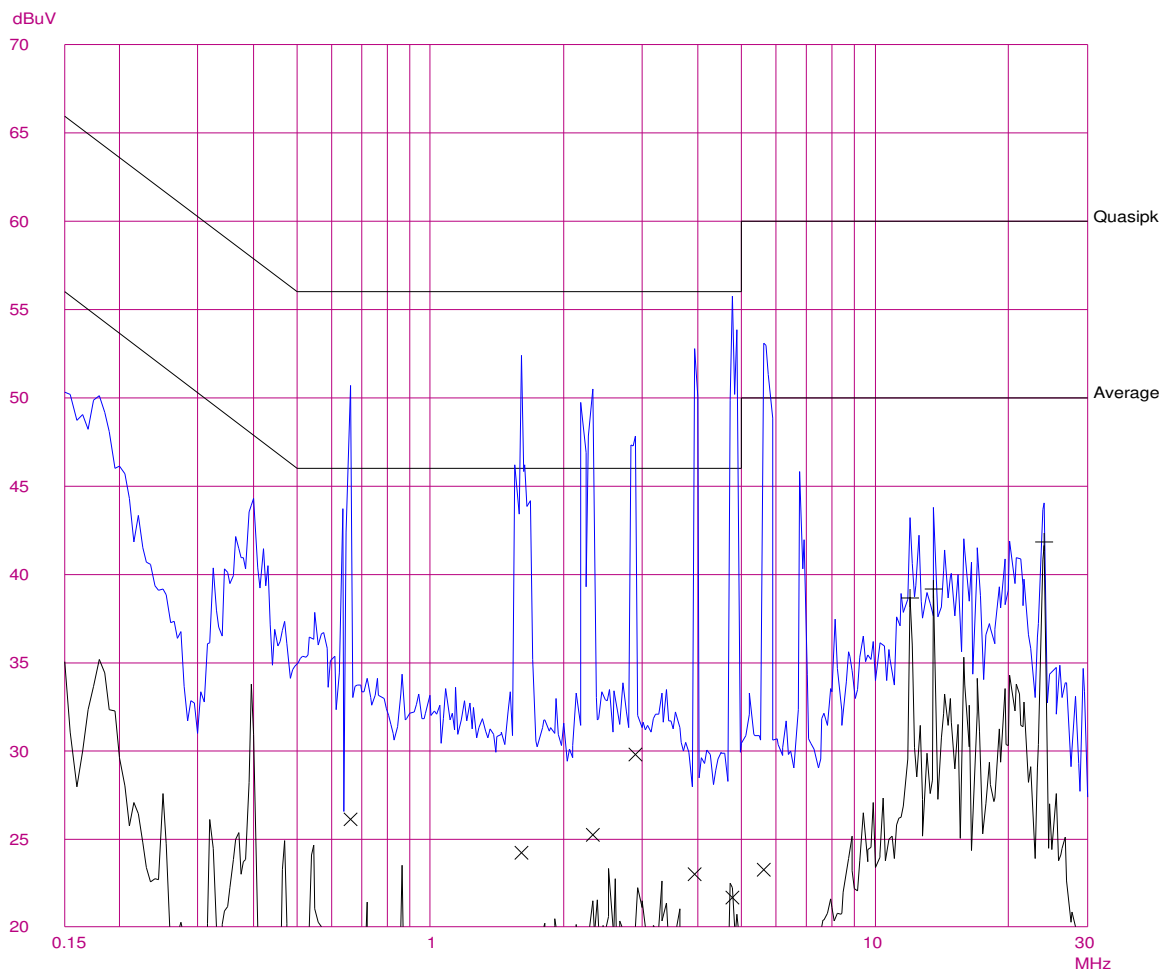
EUT: ARE i2 HF
Manuf: AEG ID GmbH
Op Cond: 50R termination, 19 VDC supply, USB I/F
Operator: P. Hauser
Test Spec: 47 CFR Part 15 Subpart C
Comment: Test_ID EUT PRO31_01
AIO31_04, port N - laptop

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150k	30M	5k	10k	PK+AV	20ms	AUTO	LN	OFF 60dB

Final Measurement: x QP / + AV
Meas Time: 1 s
Subranges: 50
Acc Margin: 12dB

Transducer No.	Start	Stop	Name
3 2	1Hz	1000M	Ca_#1006
20	9k	30M	Lim_#070





EMCE GmbH Ing_buero fuer EMV_Pruefungen Conducted emission - Terminal voltage

31. Jul 17 12:04

EUT: ARE i2 HF
Manuf: AEG ID GmbH
Op Cond: 50R termination, 19 VDC supply, USB I/F
Operator: P. Hauser
Test Spec: 47 CFR Part 15 Subpart C
Comment: Test_ID EUT PRO31_01
AIO31_04, port N - laptop

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150k	30M	5k	10k	PK+AV	20ms	AUTO	LN	OFF 60dB

Final Measurement Results:

Frequency MHz	QP Level dBuV	QP Limit dBuV
0.66000	26.1	56.0
1.60000	24.1	56.0
2.31500	25.2	56.0
2.88500	29.8	56.0
3.92500	23.0	56.0
4.79000	21.6	56.0
5.62000	23.2	60.0

Frequency MHz	AV Level dBuV	AV Limit dBuV
12.00000	38.6	50.0
13.56000	39.1	50.0
24.00500	41.8	50.0

* limit exceeded

1.1.2 Radio disturbances according 47 CFR Part 15 Subpart C - 08/07/2017

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

* _____

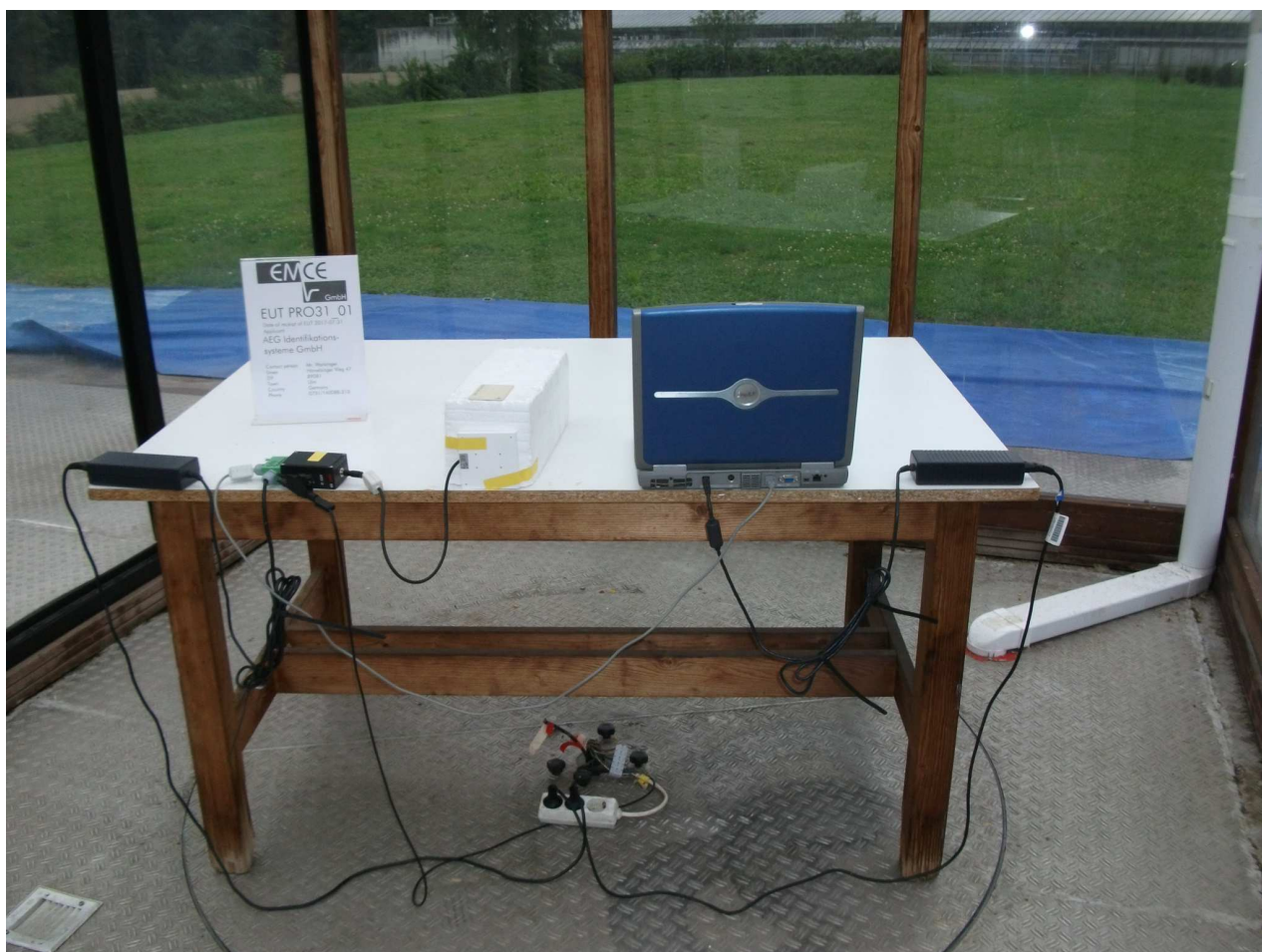
Test location

<input checked="" type="checkbox"/>	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
<input checked="" type="checkbox"/>	014	Open area test site	10 m	EMCE GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
<input checked="" type="checkbox"/>	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

<input checked="" type="checkbox"/>	Inv.-No.	Designation	Type	Manufacturer	S/N
<input checked="" type="checkbox"/>	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
<input checked="" type="checkbox"/>	008	Antenna 9 kHz – 30 MHz	HFH2-Z2	Rohde & Schwarz	835776/0002
<input checked="" type="checkbox"/>	009	Antenna 30 – 300 MHz	VHBA9123 / BBA9106	Schwarzbeck	435
<input checked="" type="checkbox"/>	010	Antenna 250 – 1200 MHz	UHALP 9108A	Schwarzbeck	108
<input checked="" type="checkbox"/>	011	Antenna 30 – 300 MHz	VHBA9123 / BBA9106	Schwarzbeck	0408/94
<input checked="" type="checkbox"/>	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
<input checked="" type="checkbox"/>	042	AC-Source / Analyser / Norm impedance	EMV D5000/PAS	Spitzenberger + Spies	A274700/ 0 0501
<input checked="" type="checkbox"/>	058	Test receiver	ESIB 40	Rohde & Schwarz	100200
	059	Logger. Antenna	HL050	Rohde & Schwarz	100006
	060	HF coupling clamp	KEMA 801	Schaffner	20808
	063	Logger. 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

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 - 08/07/2017

☒ 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: ☒ 120 V/60 Hz ☒ 19 VDC (EUT)

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

Continuous operation of the RFID reader, attached at the laptop USB I/F and supplied by a desktop power supply. Tag inside of the field at approximately half reading distance. Packets of tag readings were transferred via USB.

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 ≤ 30 MHz and at 3m distance for frequencies ≥ 30 MHz. Measurements were made with a CISPR receiver with quasi-peak. The average detector is used in the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. For pulse modulated devices with a pulse repetition frequency of 20 Hz 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 = 20 dB
LCF_{10m} for 100m antenna distance = 40 dB
LCF_{10m} for 300m antenna distance = 60 dB

Test result - fundamental

Frequency	Field strength	Limit _{10m}	Margin	Ant.- Distance	Ant.- Polar.	Detector Peak /	Receiver 6dB BW	Supply voltage	Remarks
MHz	dBμV/m	dBμV/m	dB	m	H/V	QP / AV	kHz		
13.560	61.4	104.0	42.6	10.0	V	QP	10	19 VDC	
13.560	61.9	104.0	42.1	10.0	V	QP	10	34.5 VDC	
13.560	60.8	104.0	43.2	10.0	V	QP	10	10.2 VDC	

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

Fundamental frequency at 20° C, 46 %rH – 13.560 MHz

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	13.560	13.560	13.560	13.560
40	13.560	13.560	13.560	13.560
30	13.560	13.560	13.560	13.560
20	13.560	13.560	13.560	13.560
10	13.560	13.560	13.560	13.560
0	13.560	13.560	13.560	13.560
-10	13.560	13.560	13.560	13.560
-20	13.560	13.560	13.560	13.560

Limit for radiated fundamental:

☒ kept
☐ not kept

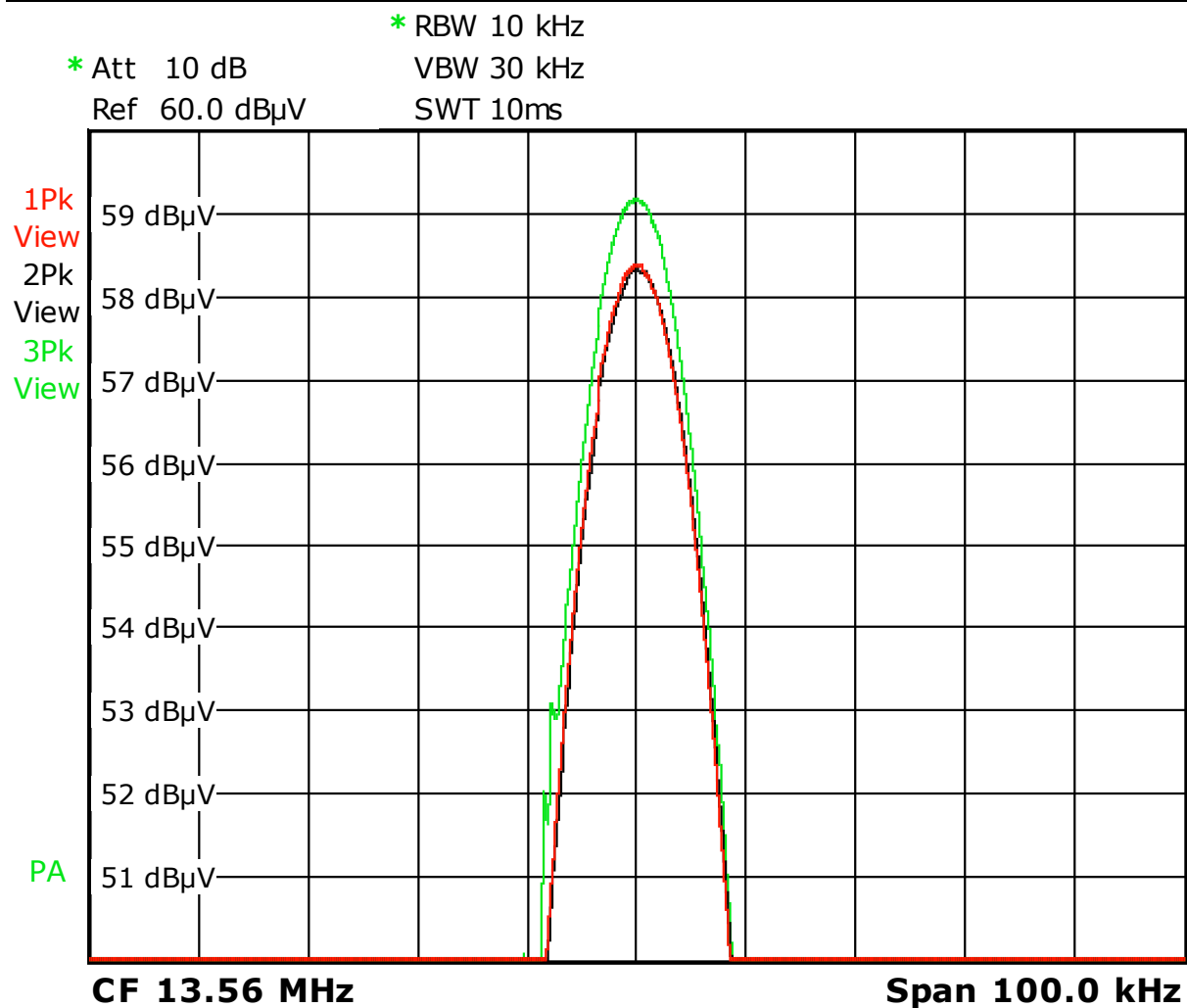
Frequency tolerance according §15.225(e)
(temperature and voltage variation):

☒ kept
☐ not kept

Remarks: n/a



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



PRO31_01, ARE i2 HF, tr. 1 20deg C, tr2 50deg C, tr.3 -20deg

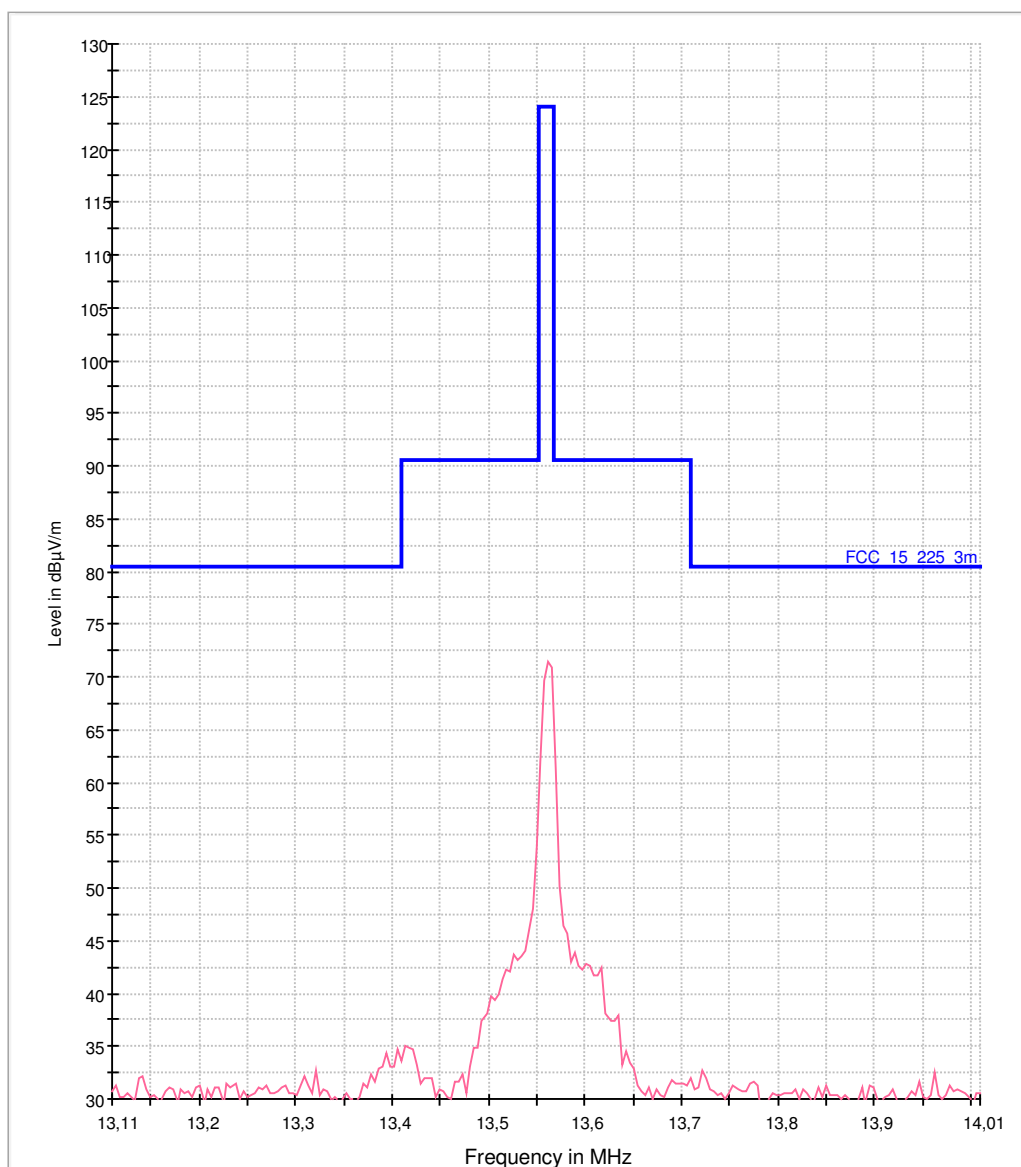
C

Date: 1.AUG.2017 17:35:08

EUT Information

EUT Name:	ARE i2 – 22X/USB
Test_ID: / SN:	PRO31_01
Customer:	AEG ID GmbH
Operational condition:	Tag in field 1/2 reading distance, 19VDC supply
Test specification:	47 CFR part 15.225
Antenna information:	Distance EUT-Ant.: 3.0 m / Polarisation: V / Ant.Height: 1.0 m
Operator:	P. Hauser
File #:	AIO31_13

Magnetic Field Strength dB μ V with Sweep_SAC2



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



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: ☒ 120 V/60 Hz ☒ 19 VDC (EUT)

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

Continuous operation of the RFID reader, attached at the laptop USB I/F and supplied by a desktop power supply. Tag inside of the field at approximately half reading distance. Packets of tag readings were transferred via USB.

Environmental conditions

Temperature [10 - 40°C]: 26.9 °C
Relative humidity [10 - 90%]: 57.0 %

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



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	
27.120	27.2	49.5	22.3	10.0	V	QP	10	

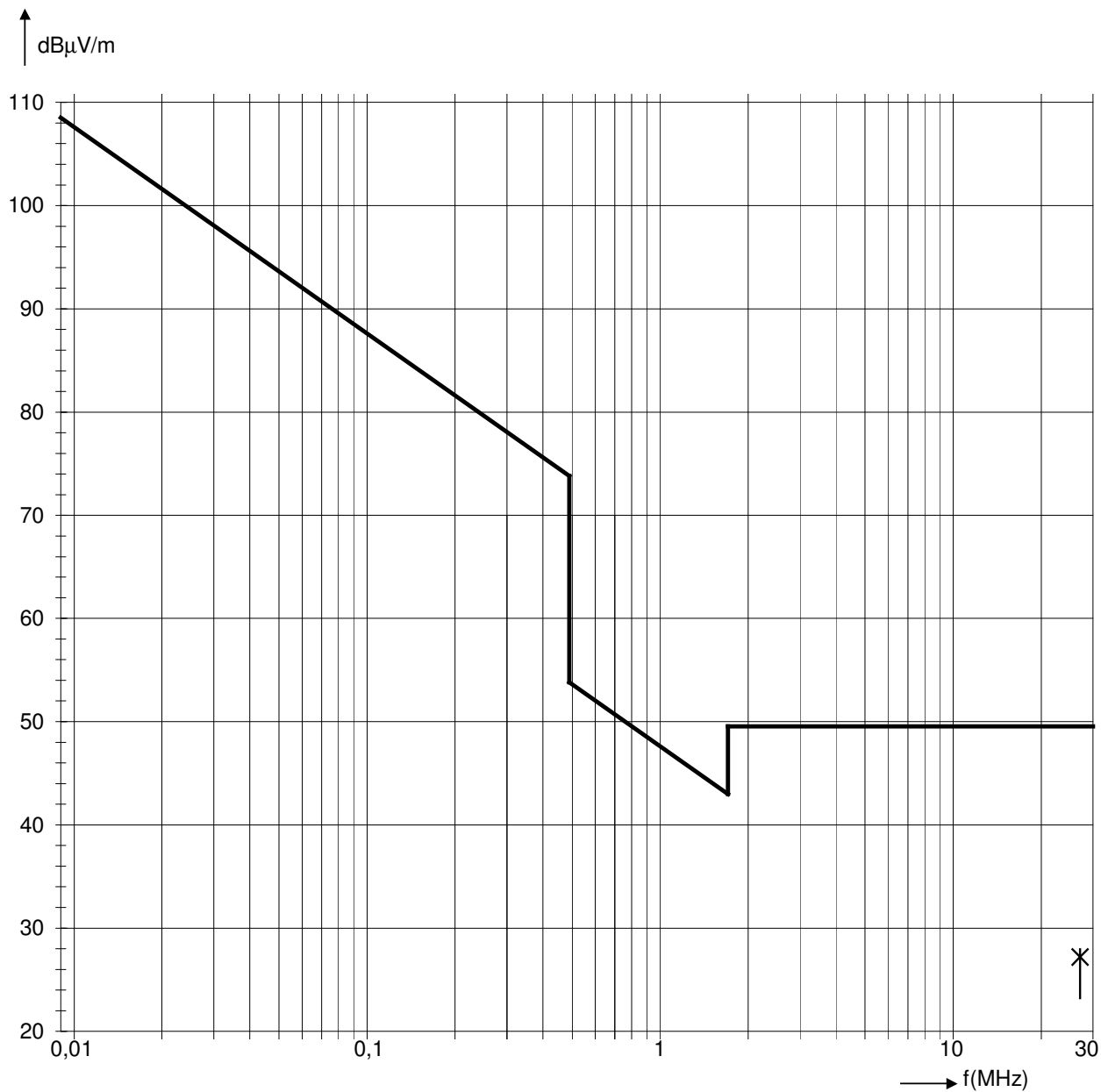
Limit_{10m} Limit calculated for 10m test distance



Diagram - Antenna vertical polarized

Limits according FCC Rules 47 CFR Part 15 – Subpart C

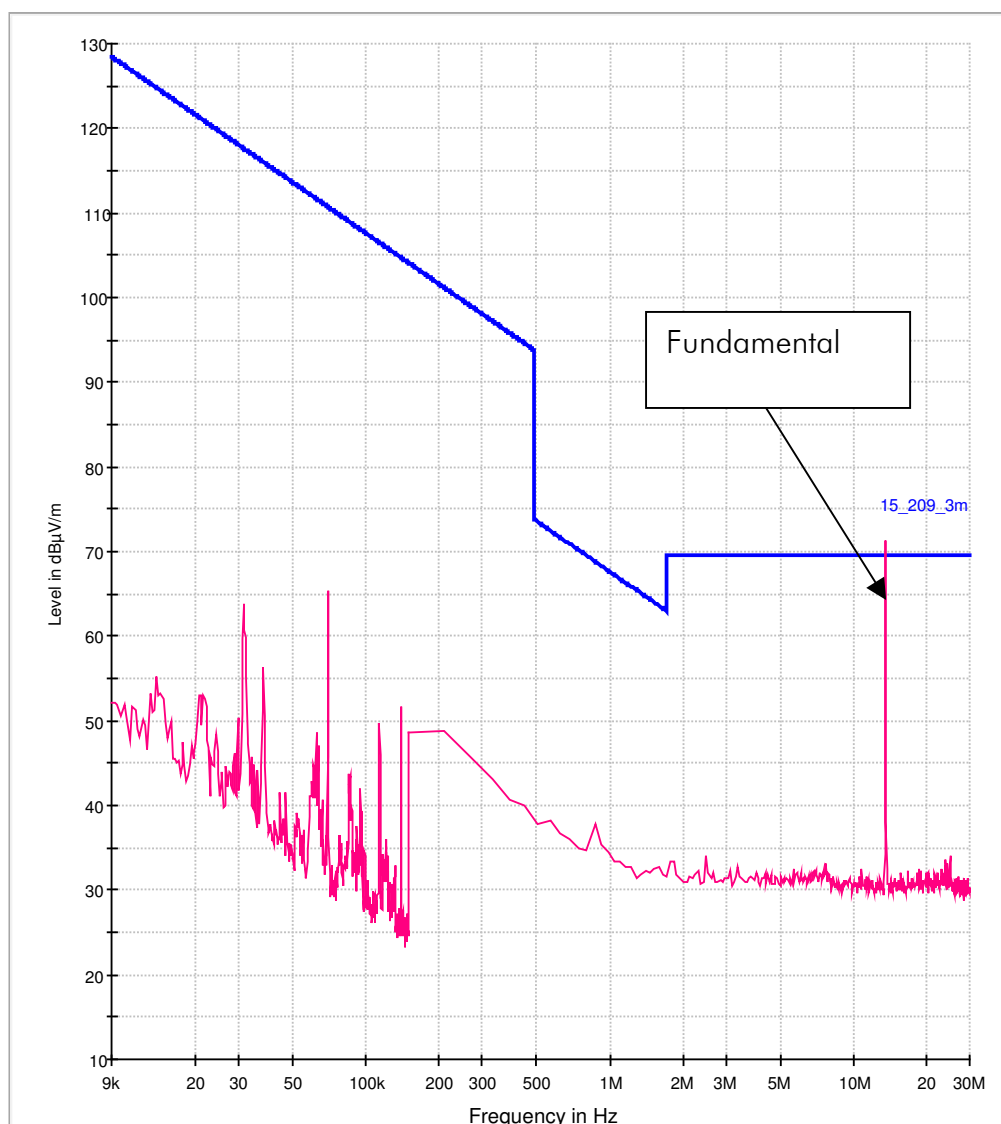
☒ Section 15.209 – Corrected to 10m distance EUT-Antenna



EUT Information

EUT Name:	ARE i2 – 22X/USB
Test_ID: / SN:	PRO31_01
Customer:	AEG ID GmbH
Operational condition:	Tag inside of the field, 1/2 reading distance, 19VDC supply
Test specification:	47 CFR part 15
Antenna information:	Distance EUT-Ant.: 3.0 m / Polarisation: V / Ant.Height: 1.0 m
Operator:	P. Hauser
File #:	AIO31_12

Magnetic Field Strength dB μ V with Sweep_SAC2



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

Preview Result 1V-PK+ [Preview Result 1V.Result:2]



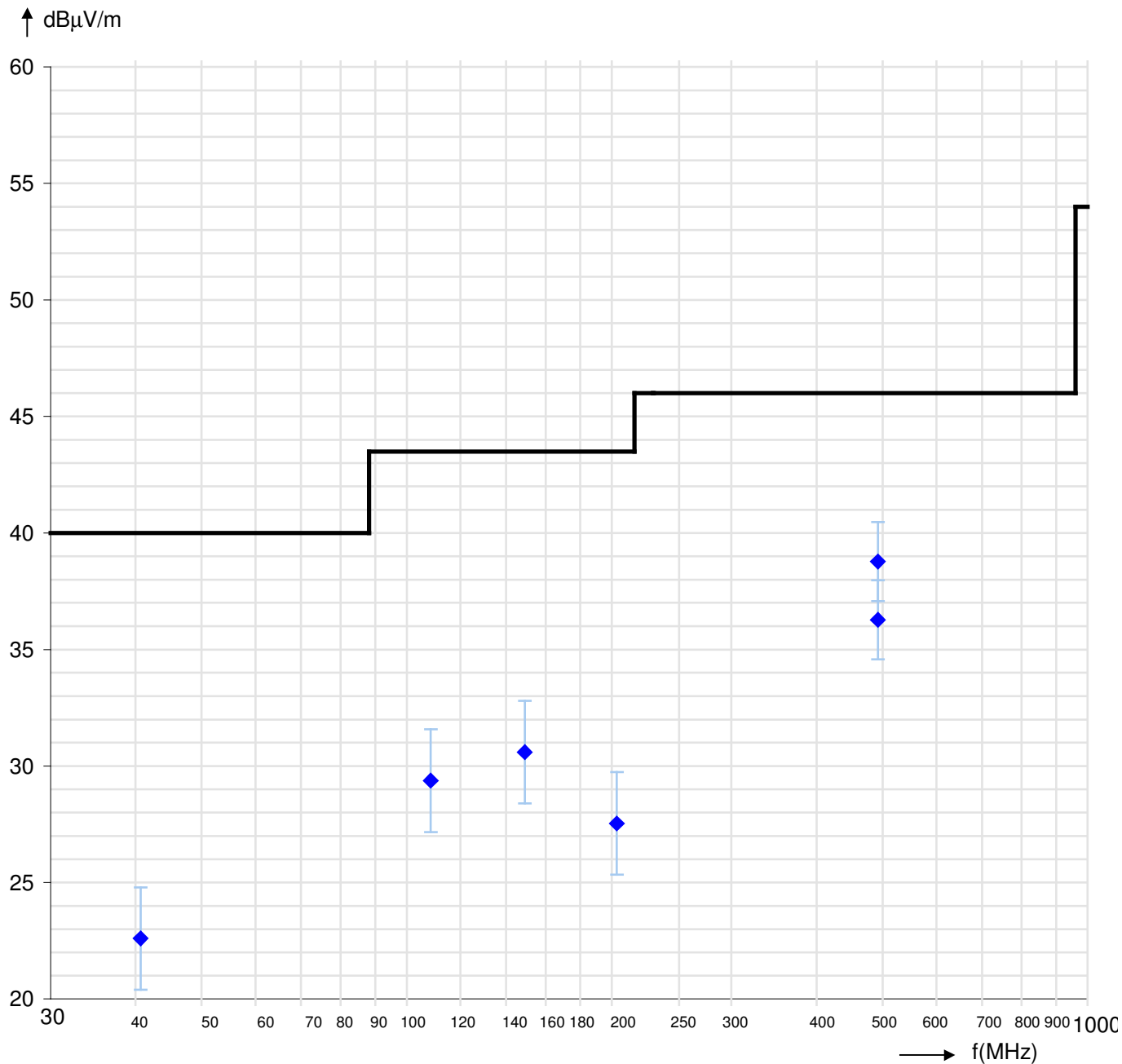
Readings - Antenna horizontal polarized

Frequency	Readings	+ AF Antenna correction factor	+ KF Cable correction factor	Field strength	Limit	Margin	Antenna- Height	Antenna- Polarization	Turn Table- Position
MHz	dB μ V	dB/m	dB	dB μ V/m	dB μ V/m	dB	m	hor./ver.	Degree
40.680	12.2	9.4	1.0	22.6	40.0	17.4	2.1	H	290
108.480	18.0	9.7	1.6	29.4	43.5	14.1	2.0	H	100
149.160	16.5	12.2	1.9	30.6	43.5	12.9	2.0	H	100
203.400	9.5	15.8	2.3	27.5	43.5	16.0	1.6	H	120
492.090	17.7	17.4	3.6	38.8	46.0	7.2	1.2	H	210
491.960	15.2	17.4	3.6	36.3	46.0	9.7	1.2	H	210



Diagram radio disturbances – Antenna horizontal polarized

Limits: ☒ Section 15.209* ☐ __



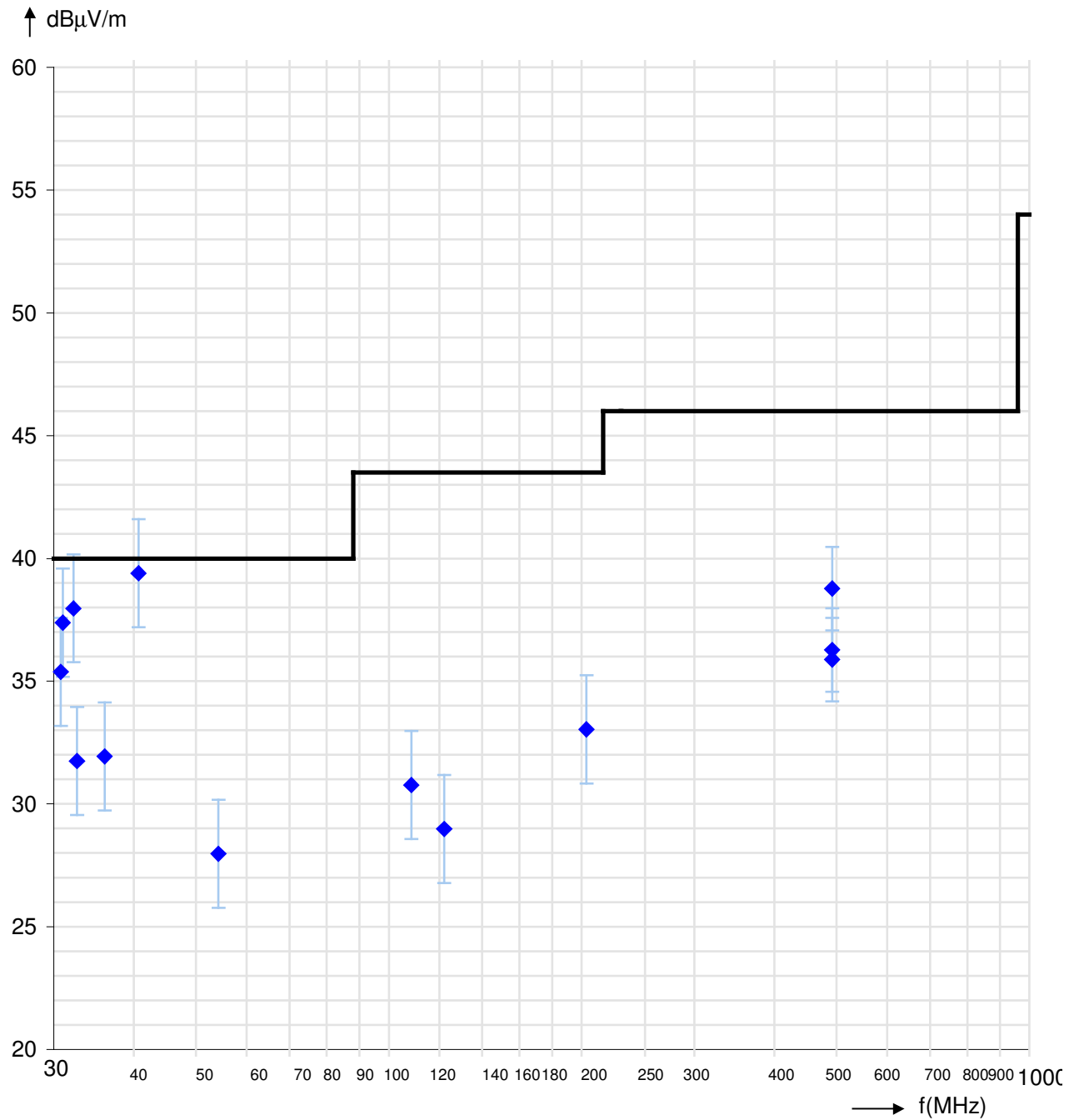
Readings - Antenna vertical polarized

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
30.780	22.6	11.9	0.8	35.4	40.0	4.6	1.0	V	90
30.980	24.7	11.8	0.9	37.4	40.0	2.6	1.0	V	90
32.180	25.8	11.3	0.9	38.0	40.0	2.0	1.0	V	90
32.600	19.7	11.2	0.9	31.7	40.0	8.3	1.0	V	90
36.000	20.8	10.2	0.9	31.9	40.0	8.1	1.0	V	200
40.680	29.0	9.4	1.0	39.4	40.0	0.6	1.0	V	90
54.240	18.4	8.4	1.1	28.0	40.0	12.0	1.0	V	90
108.480	19.4	9.7	1.6	30.8	43.5	12.7	1.0	V	90
122.040	16.5	10.7	1.7	29.0	43.5	14.5	1.0	V	90
203.400	15.0	15.8	2.3	33.0	43.5	10.5	1.0	V	100
491.960	15.2	17.4	3.6	36.3	46.0	9.7	1.4	V	120
492.090	17.7	17.4	3.6	38.8	46.0	7.2	1.4	V	120
492.220	14.8	17.4	3.6	35.9	46.0	10.1	1.4	V	120



Diagram radio disturbances – Antenna vertical polarized

Limits: ☒ Section 15.209* ☐ __





1.1.2.4 Restricted bands of operation

Regulation

47 CFR Part 15 Subpart C - 08/07/2017

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: ☒ 120 V/60 Hz ☒ 19 VDC (EUT)

Continuous operation of the RFID reader, attached at the laptop USB I/F and supplied with the desktop power supply. Tag in field at approximately half reading distance. Packets of tag readings were transferred via USB.

Environmental conditions

Temperature [10 - 40°C]: 20 °C
Relative humidity [10 - 90%]: 50 %

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: 13.5600 MHz
20dB-Emission Bandwidth: 27.95 kHz

Fundamental out
of restricted bands: ☒ kept
☐ not kept

Limit spurious emission: ☒ kept
☐ not kept

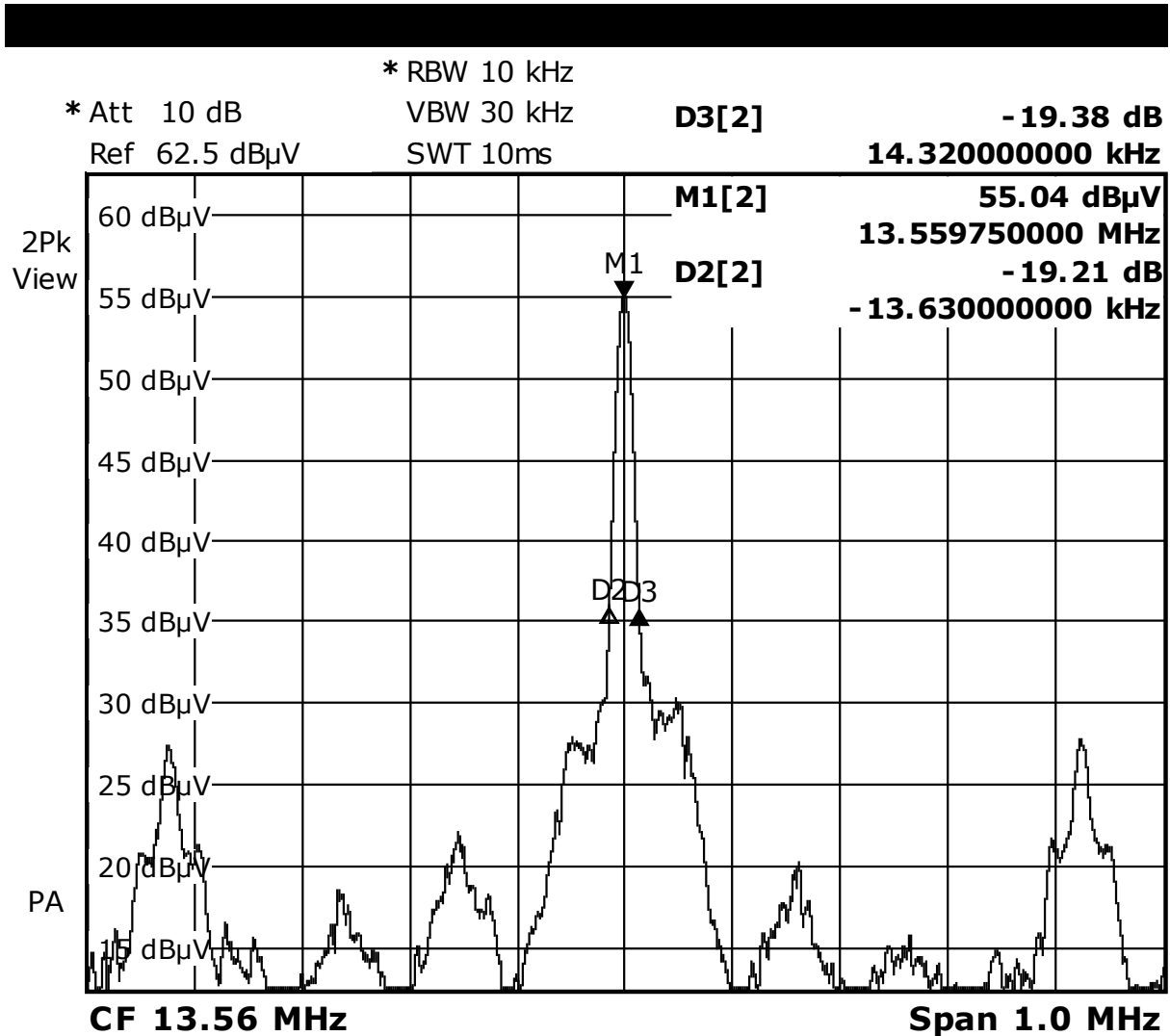
Remarks: n/a

Protocol scope

☒ Diagram – 20dB-Emission bandwidth.



Occupied bandwidth



PRO31_01, ARE i2 HF, 20dB BW

Date: 1.AUG.2017 10:08:57

Occupied bandwidth BW = D3 – D2 = 14.32 kHz - -13.63 kHz=27.95 kHz



1.1.2.5 Antenna requirement

Regulation

47 CFR Part 15 Subpart C - 08/07/2017

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 - AANX9L-HF flex 0.5m

| 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 [30-1000 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	

Burgrieden, 2017-09-05

Report generated by:



Acceptance inspector – Peter Hauser