Bundesnetzagentur

Test report

AIN19a02

BNetzA-CAB-02/21-01

Product / EUT:	RFID reader
Type designation:	ARE-i2 – 23X/RS232/S
Tested type:	ARE-i2 – 23X/RS232/S
EUT authorization:	☒ Certification ☐ Declaration of Conformity ☐ Verification
Production level:	03/2016
S/N:	13255
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
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:	2016-03-21
Test ID:	PRN12_02
Date(s) of test:	2016-03-23 – 2016-04-25

Burgrieden, 2016-07-08

Released by:

Principal engineer - Christian Vogelmann

Test laboratory:	☒ EMCE GmbH Ingenieurbüro für EMV-Prüfungen und Schaltungsentwicklung Untere Wiesen 1 / 88483 Burgrieden / Germany DAkkS-Registration No.: D-PL-12122-01-01 CAB-Registration No.: BnetzA-CAB-02/21-01/1 FCC-Registration No.: 219415
Test procedure:	ANSI C63.10-2013
Responsible inspector:	Mr. Hauser EMCE GmbH Ingenieurbüro für EMV-Prüfungen und Schaltungsentwicklung
Contact person:	Mr. Kösler / AEG Identifikationssysteme GmbH
EUT-	
Description:	Industrial LF-RFID reader. Used abbreviations for the options: RS232 = RS232 interface X = reader without integrated antenna S = shielded antenna cable
Voltage supply:	9 to 30VDC
Fundamental frequency:	134kHz,
Frequency list:	260kHz; 17.1776MHz
Temperature range:	n/a
Approximate size:	LxWxH / mm - 60x90x38

Supplied /
used equipment:

Designation	Type	Manufacturer	S/N
Laptop	Lifebook E8110	Fujitsu Siemens	YK2B046965
AC Adapter (Lifebook E8110)	ADP-80NB A	Fujitsu Siemens	CP293661-01
Power supply - EUT	PA1131-O2D	Dell	CN09Y819-48010-36H-0043
Antenna	AAN X1F-flex 3m shield	AEG ID	6544
Transponder (tag)	ISO HDX, Duplo	AEG ID	004000000402A553
Battery	Lead acid 12V / 7.2Ah	Panasonic	n/a

Configuration: ☒ As-delivered condition*
☐ Modified*
* _____

Cable designation	Type	Length	Remarks
RS232 cable	Shielded	1.5m	n/a
Power supply	2 wire	1.5m	n/a
Antenna cable	Shielded	3.0m	n/a
Ground wire	Single wire	1.8m	n/a

Remarks: n/a

State of revision:

Source document	New Document	Date / Reviser	Modifications
AIN19_02	AIN19a02	2016-06-24 Chr. Vogelmann	List of valid equipment shrink to used equipment. Environmental conditions recorded.

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)/ 2016-10-05
003	LISN 1	ESH3-Z5	Rohde & Schwarz	835268/007	1 Year(s)/ 2016-08-31
004	LISN 2	ESH3-Z5	Rohde & Schwarz	835268/003	1 Year(s)/ 2016-11-30
008	Loop antenna 9kHz-30MHz	HFH2-Z2	Rohde & Schwarz	835776/0002	3 Year(s)/ 2016-11-22
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)/ 2016-09-05
011	Antenna 30-300MHz	VHBA9123 / BBA9106	Schwarzbeck	0403/94	2 Year(s)/ 2016-09-05
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
062	Semi anechoic chamber #2	13.0m x 7.0m x 5.0m	EMC-Technik & Consulting GmbH		1 Year(s)/ 2016-07-31
067	LISN	ESH2-Z5	Rohde&Schwarz	872460/043	1 Year(s)/ 2016-08-31
068	LISN	ESH2-Z5	Rohde&Schwarz	872460/042	1 Year(s)/ 2016-08-31
070	Pulse limiter + 10dB Attenuator	ESH3-Z2	Rohde&Schwarz	n/a	1 Year(s)/ 2016-08-31
175	EMI Test receiver	ESR7	Rohde & Schwarz	101108 Firmware:	1 Year(s)/ 2016-07-14

Inv.-No.	Designation	Type	Manufacturer	S/N	Calibration: Interval /valid until
				FW V2.26	
997	EMC Software	EMC32 Vers. 8.53.0	Rohde& Schwarz	n/a	

Scope:

1 EMC-Test(s)

1.1 Emission according 47 CFR Part 15 Subpart C - 04/2016

1.1.1 Terminal voltage according 47 CFR Part 15 Subpart C - 04/2016

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

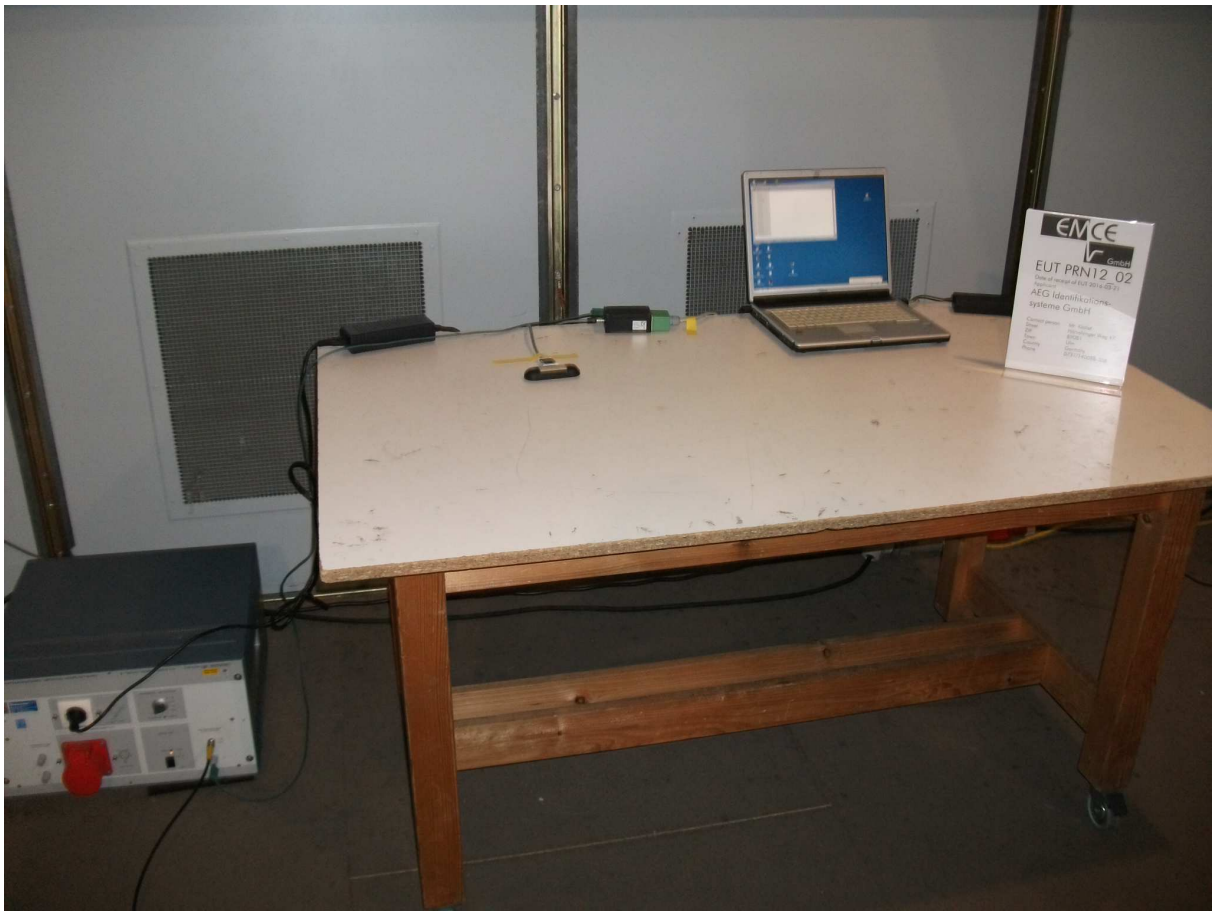
*

Test location

☒	Inv.-No.	Designation	Type (LxWxH)	Manufacturer	Location
☒	588	Shielded room #2	8.3/5.8 x 5.5/2.9 x 3.4m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	584	Shielded room #3	3.6 x 3.6 x 2.5m	Siemens AG	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	678	Shielded room #4	4.0 x 4.0 x 3.5m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	062	Semi anechoic chamber #2	13.5 x 6.1 x 5.5m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	679	Full anechoic chamber #3	8.8 x 4.6 x 4.2m	Albatross Projects GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	014	Open area test site	10m	EMCE GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	015	Open area test site	3m	EMCE GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	042	Voltage- / current source test site	0-382VDC 0-270VAC 1x10kW / 3x5kW	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 5Hz - 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

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
9kHz – 150kHz	4.0dB
150kHz – 30MHz	3.6dB

1.1.1.2 Test

Regulation

47 CFR Part 15 Subpart C - 04/2016

☐ 9kHz - 30MHz ☒ 150kHz - 30MHz

Mains supply
Limits: ☒ Section 15.207 ☐ __

Operation mode

EUT arrangement: ☒ Tabletop ☐ Floor standing
Power supply: ☒ 120V/60Hz ☐ 240V/60Hz
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, supplied with the desktop power supply and attached at the laptop RS232-port.
RFID tag placed at approx. half reading distance.

Environmental conditions

Temperature [10 - 40°C]: 20°C
Relative humidity [10 - 90%]: 46%

Environmental conditions during the test: ☒ kept ☐ not kept

Test - / Measurement procedure

Measurements are made with a receiver according CISPR 16 guidelines. A pulse limiter and a 10dB attenuator at the receiver input is used to protect the receiver. The required frequency range is scanned in an automatically operation. When the EUT is arranged the frequency range is monitored. The setup of the equipment and the cables are manipulated within the range to produce the highest emission. Frequency steps of <0.5 x receiver bandwidth and peak / average detectors are used. If the conducted emission is closer than 20dB to the limits or exceeds, the receiver will retest the emission with quasipeak or average detector. The identified frequency and amplitude of the six highest conducted emissions relative to the limit lines are listed for each current-carrying conductor. If less than six emission frequencies are within the 20dB of the limit, the noise level of the measuring instrument at representative frequencies are reported.
The reported test results are calculated with the following formula:

Result (dBμV) = Reading (dBμV) + ATF (dB) + CF (dB)

ATF = Correction factor for the pulse limiter / 10dB attenuator
CF = Correction factor for the cable loss

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

23. Mar 16 17:30

Terminal voltage

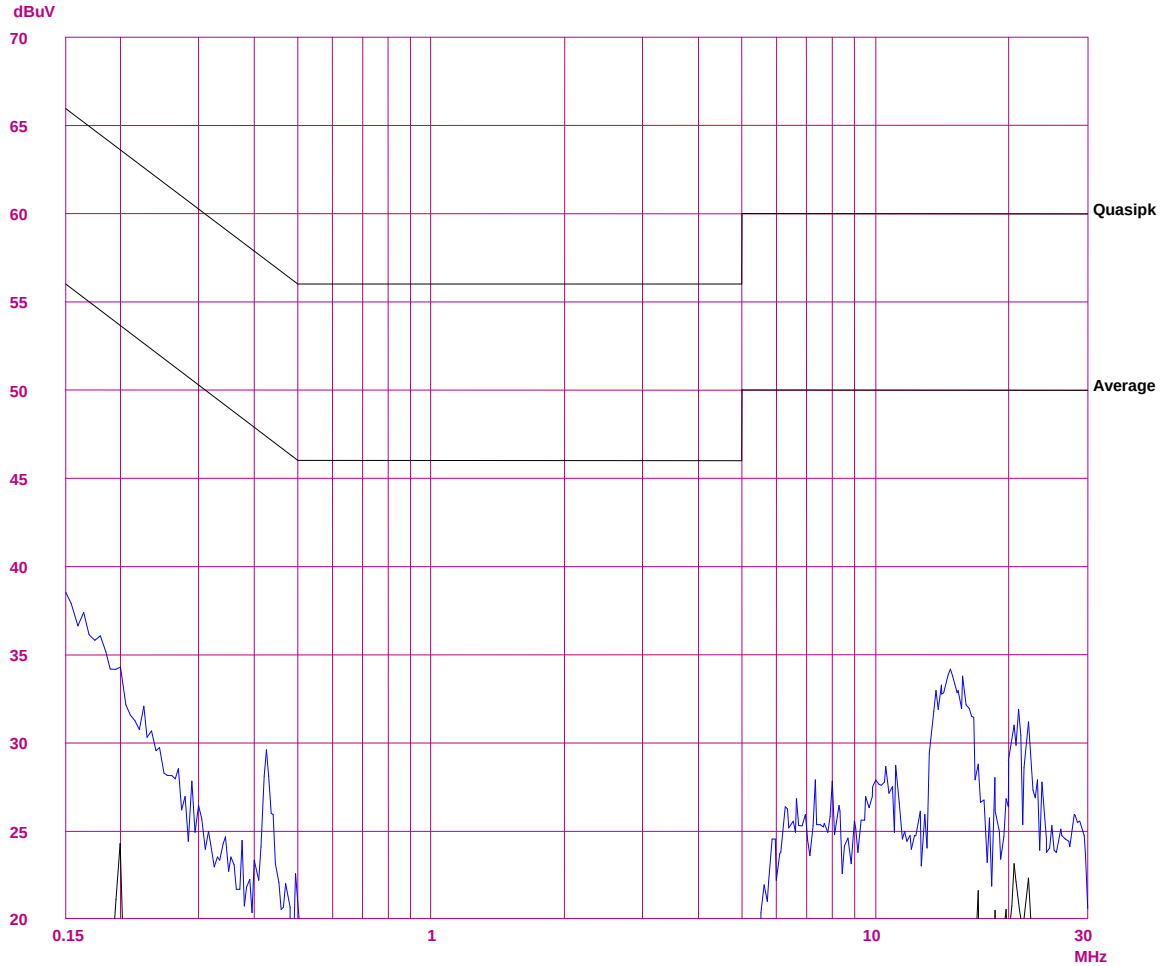
EUT: ARE i2 23X / RS232
Manuf: AEG ID GmbH
Op Cond: Reading tag, half reading distance
Operator: P. Hauser
Test Spec: 47 CFR Part 15 Subpart C
Comment: Test_ID PRN12_02
AIN12_41, Phase L1 - EUT

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: 6dB

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



EMCE GmbH Ing_buero fuer EMV_Pruefungen **23. Mar 16 17:30**

Terminal voltage

EUT: **ARE i2 23X / RS232**
Manuf: **AEG ID GmbH**
Op Cond: **Reading tag, half reading distance**
Operator: **P. Hauser**
Test Spec: **47 CFR Part 15 Subpart C**
Comment: **Test_ID PRN12_02**
AIN12_41, Phase 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:

no Results

EMCE GmbH Ing_buero fuer EMV_Pruefungen

23. Mar 16 17:42

Terminal voltage

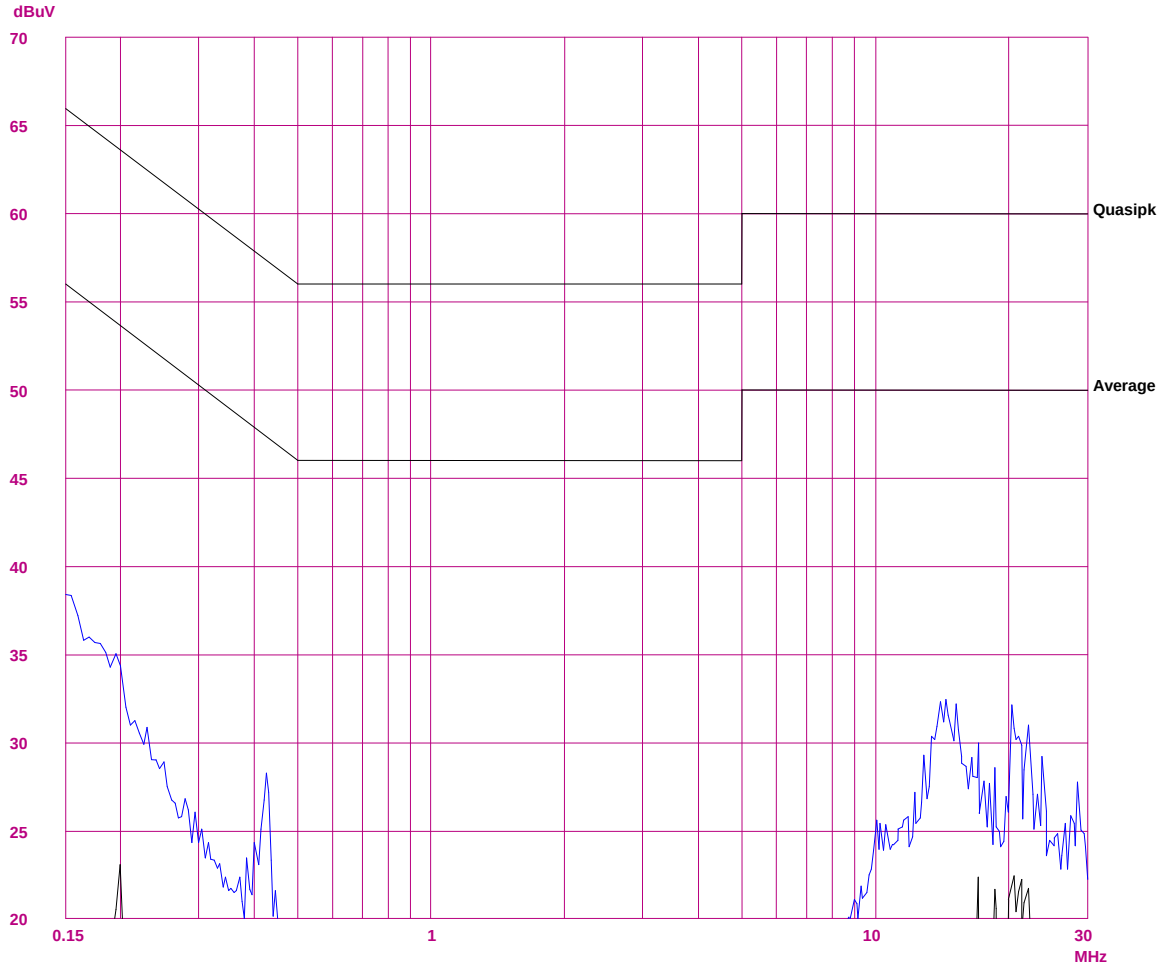
EUT: ARE i2 23X / RS232
Manuf: AEG ID GmbH
Op Cond: Reading tag, half reading distance
Operator: P. Hauser
Test Spec: 47 CFR Part 15 Subpart C
Comment: Test_ID PRN12_02
AIN12_42, Phase N - EUT

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: 6dB

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



EMCE GmbH Ing_buero fuer EMV_Pruefungen

23. Mar 16 17:42

Terminal voltage

EUT:	**ARE i2 23X / RS232**
Manuf:	**AEG ID GmbH**
Op Cond:	**Reading tag, half reading distance**
Operator:	**P. Hauser**
Test Spec:	**47 CFR Part 15 Subpart C**
Comment:	**Test_ID PRN12_02**
	AIN12_42, Phase 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:

no Results

EMCE GmbH Ing_buero fuer EMV_Pruefungen

23. Mar 16 17:53

Terminal voltage

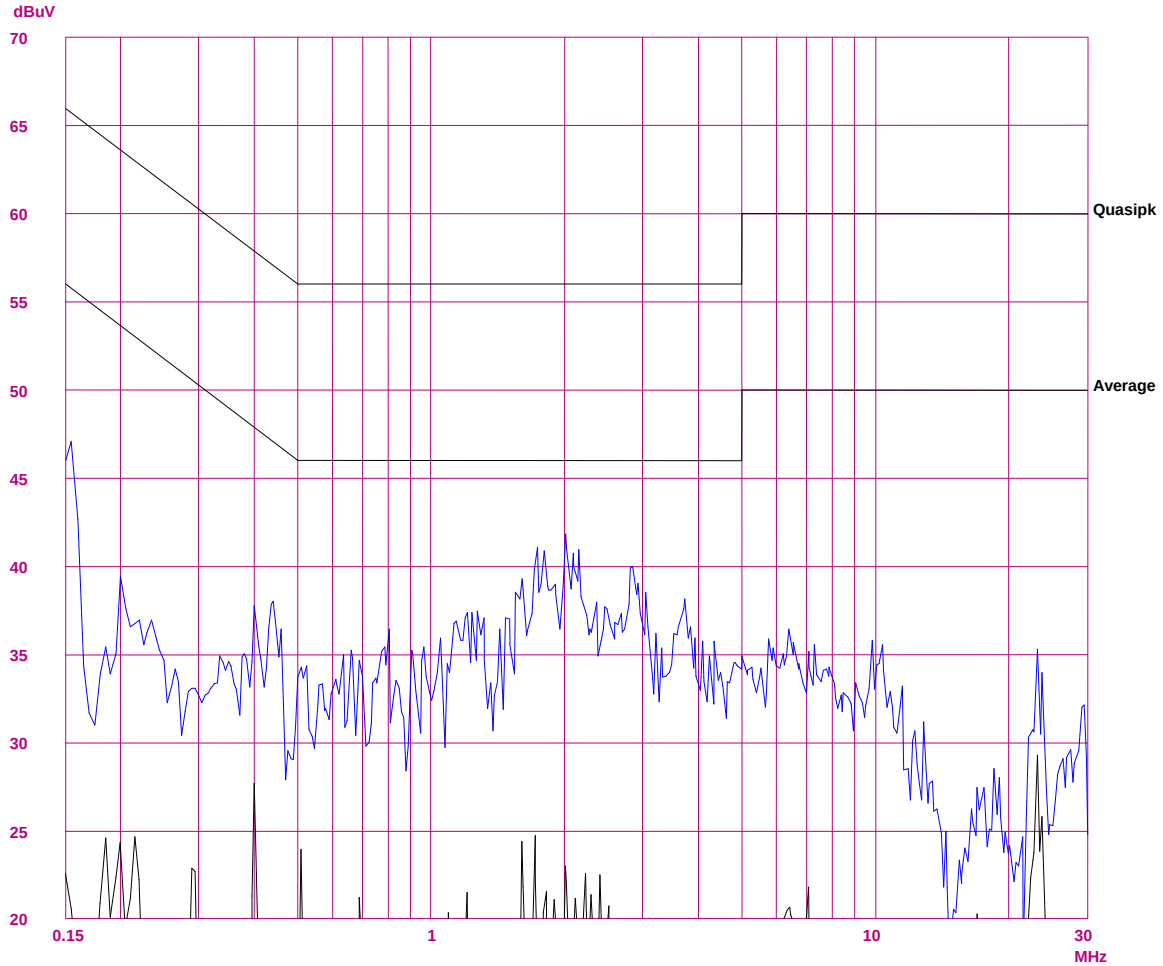
EUT:	**ARE i2 23X / RS232**
Manuf:	**AEG ID GmbH**
Op Cond:	**Reading tag, half reading distance**
Operator:	**P. Hauser**
Test Spec:	**47 CFR Part 15 Subpart C**
Comment:	**Test_ID PRN12_02**
	AIN12_43, Phase L1 - laptop

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: 6dB

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



EMCE GmbH Ing_buero fuer EMV_Pruefungen **23. Mar 16 17:53**

Terminal voltage

EUT: **ARE i2 23X / RS232**
Manuf: **AEG ID GmbH**
Op Cond: **Reading tag, half reading distance**
Operator: **P. Hauser**
Test Spec: **47 CFR Part 15 Subpart C**
Comment: **Test_ID PRN12_02**
AIN12_43, Phase 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:

no Results

EMCE GmbH Ing_buero fuer EMV_Pruefungen

23. Mar 16 18:04

Terminal voltage

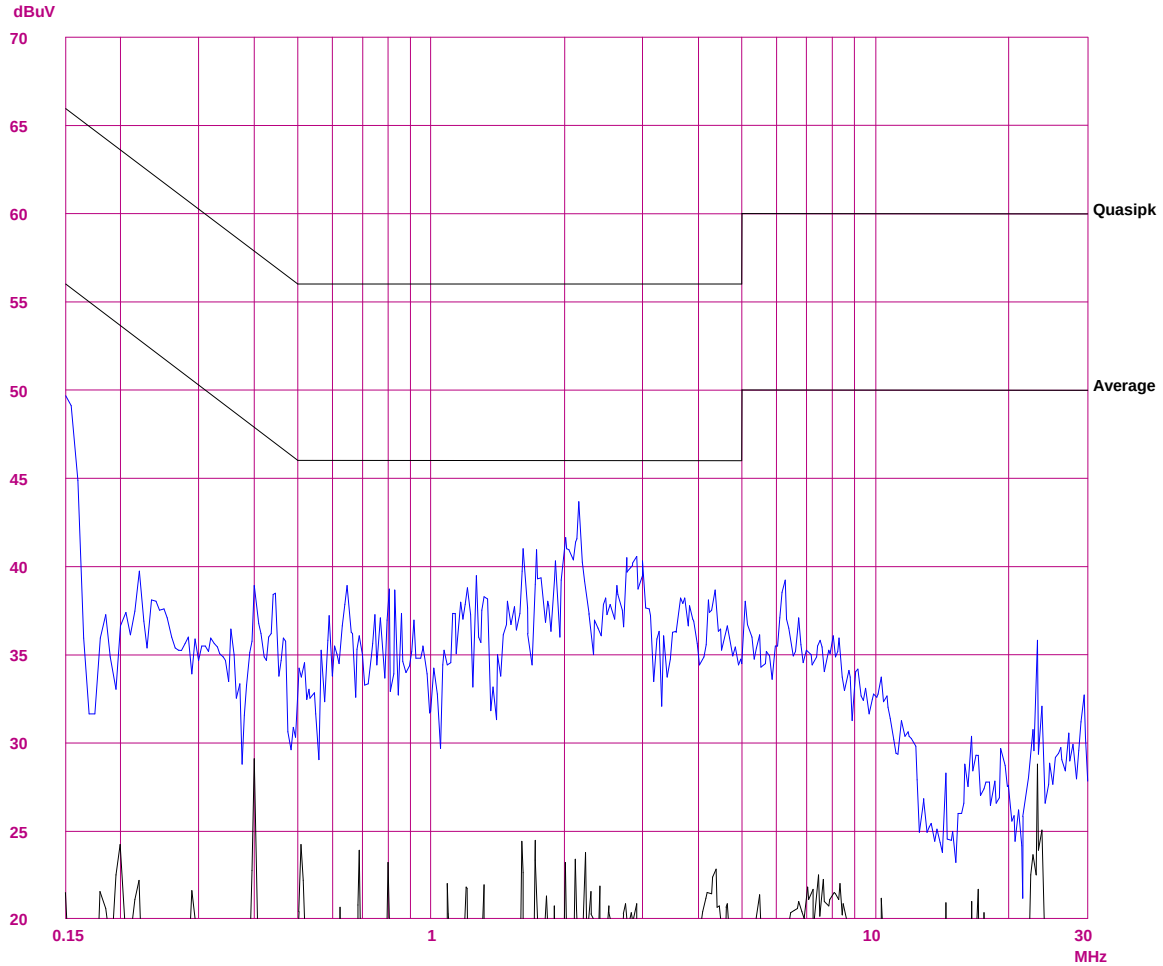
EUT: ARE i2 23X / RS232
Manuf: AEG ID GmbH
Op Cond: Reading tag, half reading distance
Operator: P. Hauser
Test Spec: 47 CFR Part 15 Subpart C
Comment: Test_ID PRN12_02
AIN12_44, Phase N - laptop

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: 6dB

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



EMCE GmbH Ing_buero fuer EMV_Pruefungen **23. Mar 16 18:04**

Terminal voltage

EUT: **ARE i2 23X / RS232**
Manuf: **AEG ID GmbH**
Op Cond: **Reading tag, half reading distance**
Operator: **P. Hauser**
Test Spec: **47 CFR Part 15 Subpart C**
Comment: **Test_ID PRN12_02**
AIN12_44, Phase 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:

no Results

1.1.2 Radio disturbances according 47 CFR Part 15 Subpart C - 04/2016

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

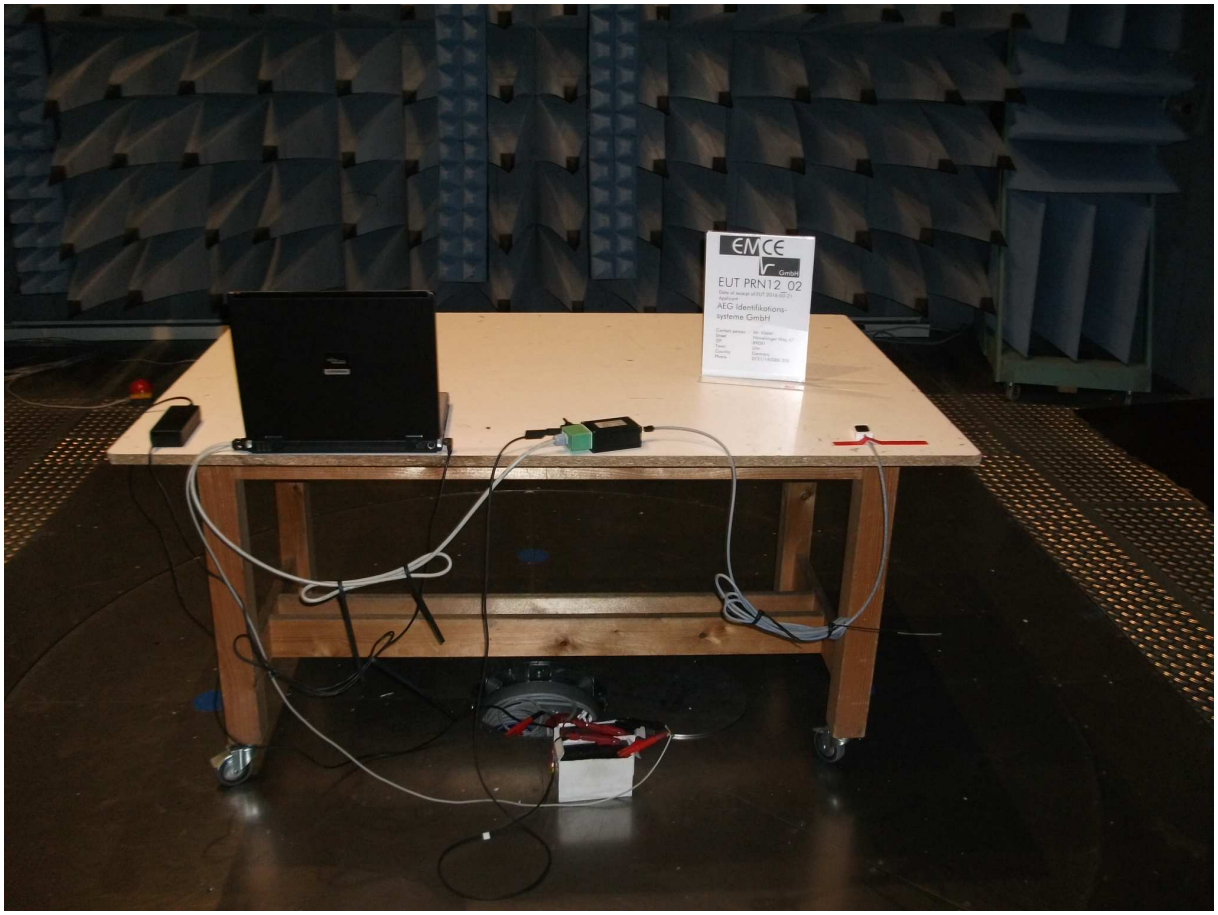
*

Test location

☒	Inv.-No.	Designation	Type (LxWxH)	Manufacturer	Location
	588	Shielded room #2	8.3/5.8 x 5.5/2.9 x 3.4m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	584	Shielded room #3	3.6 x 3.6 x 2.5m	Siemens AG	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	678	Shielded room #4	4.0 x 4.0 x 3.5m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
☒	062	Semi anechoic chamber #2	13.5 x 6.1 x 5.5m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	679	Full anechoic chamber #3	8.8 x 4.6 x 4.2m	Albatross Projects GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
☒	014	Open area test site	10m	EMCE GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
☒	015	Open area test site	3m	EMCE GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	042	Voltage- / current source test site	0-382VDC 0-270VAC 1x10kW / 3x5kW	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


EMCE
EUT PRN12_02
AEG Identifikations-
systeme GmbH

Used test equipment

☒	Inv.-No.	Designation	Type	Manufacturer	S/N
☒	001	Test receiver	ESS 5Hz - 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 9kHz – 30MHz	HFH2-Z2	Rohde & Schwarz	835776/0002
☒	009	Antenna 30 – 300MHz	VHBA9123 / BBA9106	Schwarzbeck	435
☒	010	Antenna 250 -1200MHz	UHALP 9108A	Schwarzbeck	108
☒	011	Antenna 30 – 300MHz	VHBA9123 / BBA9106	Schwarzbeck	0408/94
☒	012	Antenna 250 -1200MHz	UHALP 9108A	Schwarzbeck	166
	013	Antenna 9kHz – 30 MHz	Loop antenna 1.5m ∅	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

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
9kHz – 30MHz	on request
30MHz – 300MHz	4.4dB
300MHz – 1GHz	3.4dB
1GHz – 18GHz	on request

1.1.2.2 Test – Radiated emission fundamental

Regulation

47 CFR Part 15 Subpart C - 04/2016

	☒ 9kHz - 30MHz	☐ 150kHz – 1GHz
	☐ 30MHz - 1000MHz	☐ 1 – 18GHz
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:	☐ 3m	☐ 5m
	☒ 10m	☐ 30m

Operation mode

EUT arrangement:	☒ Tabletop	☐ Floor standing
Power supply:	☒ 24VDC	☐ 240V/60Hz
Rated voltage variation:	☒ 0.85*9V	☒ 1.15*30V

Continuous operation of the RFID reader, supplied with the desktop power supply and attached at the laptop RS232-port. The emanation was maximized while placing the RFID tag inside the field or without tag.

Environmental conditions

Temperature [10 - 40°C]:	20°C
Relative humidity [10 - 90%]:	49%
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 ≤30MHz and at 3m distance for frequencies ≥30MHz. 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:

Field strength (dBµV/m) = Reading (dBµV) + AF (dB/m) + CF (dB)

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

$Limit_{10m}$ (dBµV/m) = Limit (dBµV/m) + LCF_{10m} (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

Frequency	Field strength	$Limit_{10m}$	Margin	Ant.-	Ant.-	Detector	Receiver	Supply voltage	Remarks
				Distance	Polar.	Peak /	6dB BW		
MHz	dBµV/m	dBµV/m	dB	m	H/V	QP / AV	kHz		
0.13422	59.0	85.0	26.0	10.0	V	AV	0.2	24V	
0.13422	59.0	85.0	26.0	10.0	V	AV	0.2	7.65V	
0.13422	59.0	85.0	26.0	10.0	V	AV	0.2	34.5V	

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

Limits for radiated disturbances: ☒ kept ☐ not kept

Remarks: n/a

1.1.2.3 Test – Spurious emissions

Regulation

47 CFR Part 15 Subpart C - 04/2016

	☒ 9kHz - 30MHz	☐ 150kHz – 1GHz
	☒ 30MHz - 1000MHz	☐ 1 – 18GHz
Limits:	☒ Section 15.209	☐ __
Test distance:	☒ 3m	☐ 5m
	☒ 10m	☐ 30m

Operation mode

EUT arrangement:	☒ Tabletop	☐ Floor standing
Power supply:	☒ 24VDC	☐ 240V/60Hz
Rated voltage variation:	☐ 85%	☐ 115%

Continuous operation of the RFID reader, supplied with the desktop power supply and attached at the laptop RS232-port.
RFID tag placed at approx. half reading distance.

Environmental conditions

Temperature [10 - 40°C]:	20°C
Relative humidity [10 - 90%]:	49%
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 ≤30MHz and at 3m distance for frequencies ≥30MHz. 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:

Field strength (dBµV/m) = Reading (dBµV) + AF (dB/m) + CF (dB)

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

$Limit_{10m}$ (dBµV/m) = Limit (dBµV/m) + LCF_{10m} (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

Remarks: Radio disturbances below the limit line with a margin >10dB to the limit are generally not listed.

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
☐ Precompliance measurement(s).

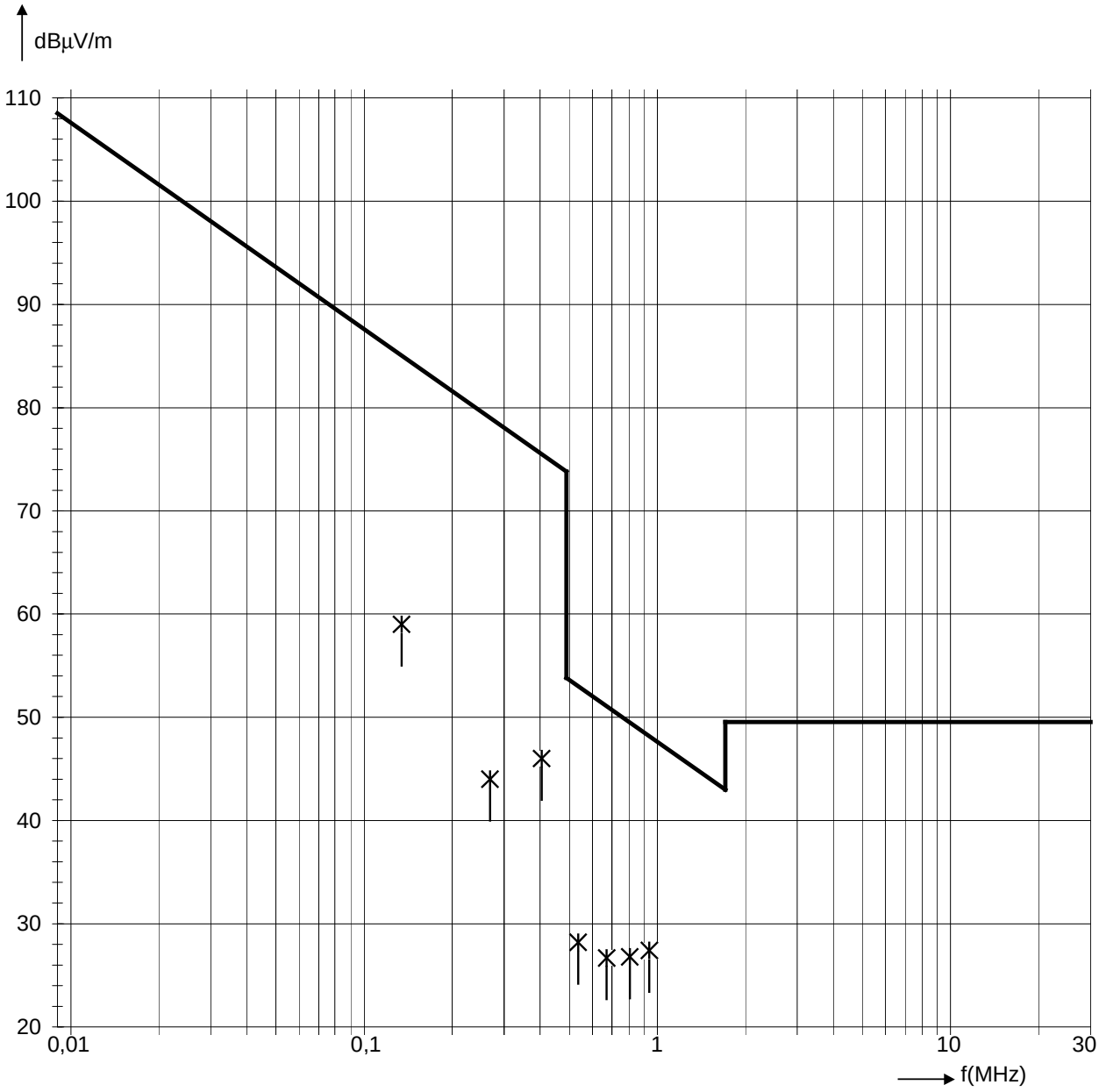
Readings - Antenna vertical polarized, Antenna loop lowest height 1m

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	
0.26844	44.0	79.0	35.0	10.0	V	AV	10	Increased ambient noise
0.40266	46.0	75.5	29.5	10.0	V	AV	10	Increased ambient noise
0.53688	28.2	53.0	24.8	10.0	V	QP	10	
0.67110	26.7	51.1	24.4	10.0	V	QP	10	
0.80532	26.8	49.5	22.7	10.0	V	QP	10	
0.93954	27.4	48.1	20.7	10.0	V	QP	10	
1.07376	26.2	47.0	20.8	10.0	V	QP	10	
1.20798	26.1	46.0	19.9	10.0	V	QP	10	

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

Diagram - Antenna vertical polarized

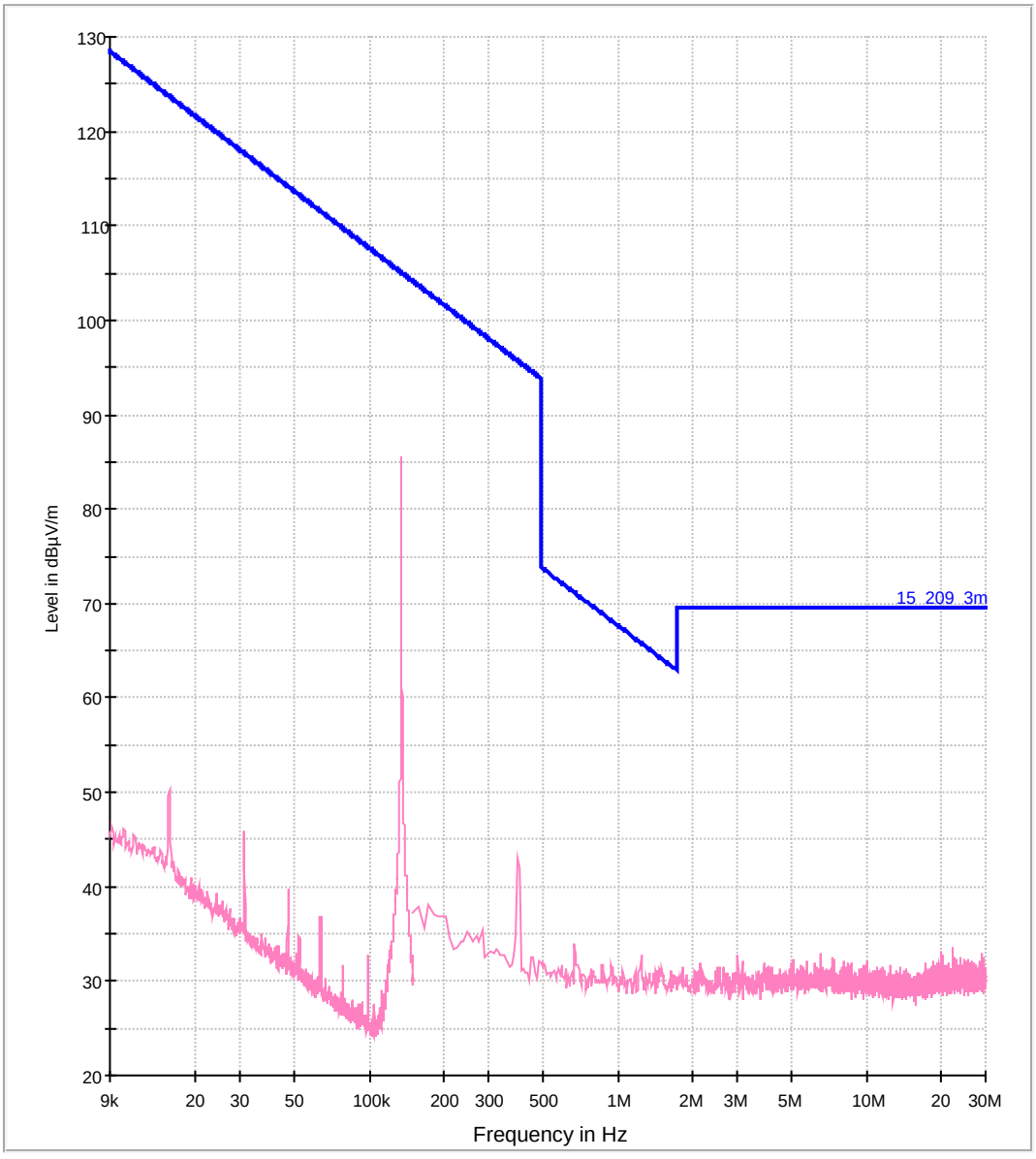
Limits according FCC Rules CFR 47 Part 15 – Subpart C
☒ Section 15.209 – Corrected to 10m distance EUT-Antenna



EUT Information

EUT Name:	ARE i2 - 23X/RS232/S
Test_ID: / SN:	PRN12_02
Customer:	AEG ID GmbH
Operational condition:	Field on, no tag in field
Test specification:	47 CFR §15.209
Antenna information:	Distance EUT-Ant.: 3.0m / Polarisation: V / Ant.Height: 1.0m
Operator:	P. Hauser
File #:	AIN18_10

Magnetic Field Strength dBµV with Sweep_SAC2



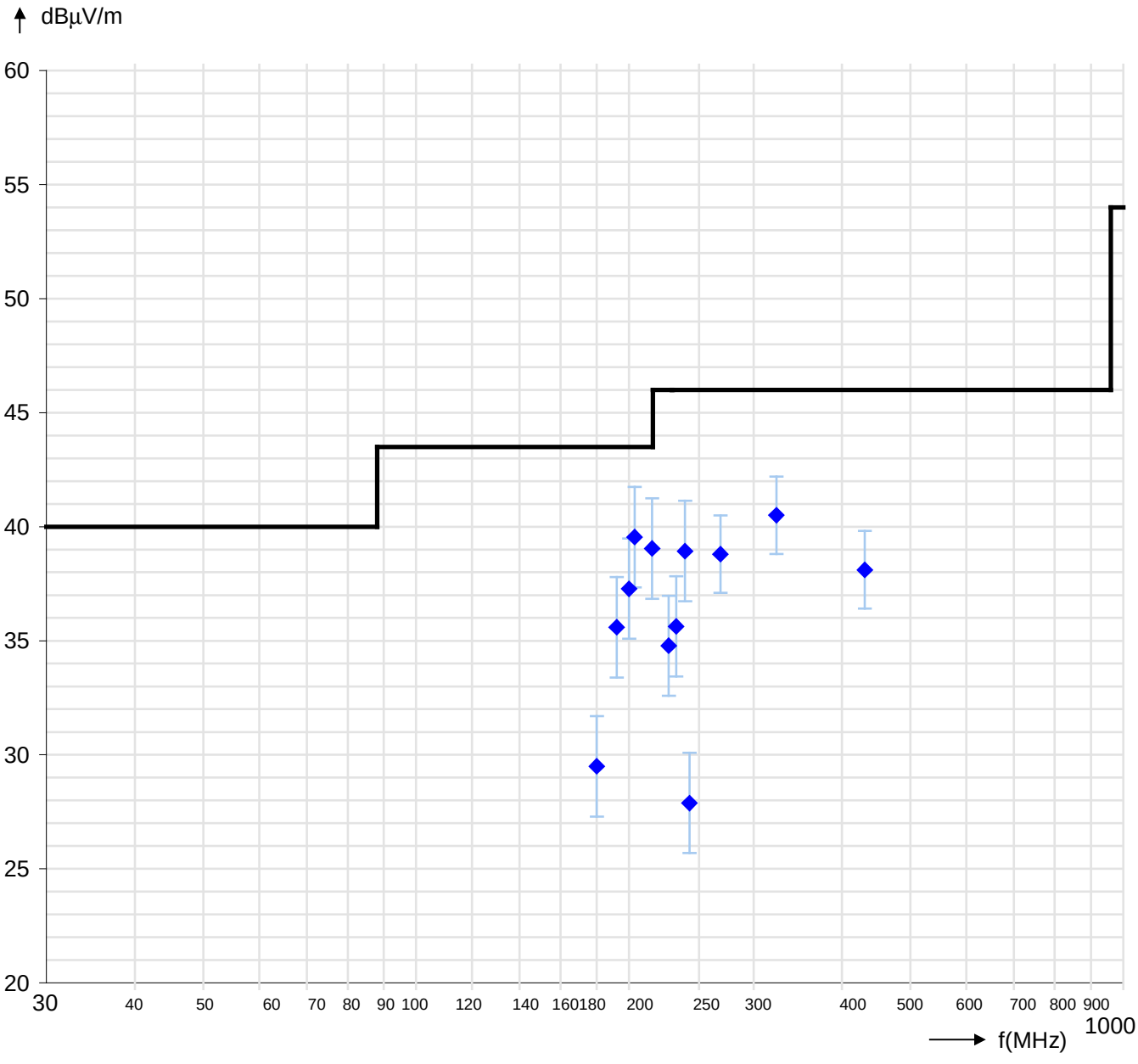
15_209_3m [..\EMI radiated\]
MaxPeak-MaxHold [Preview Result 1V.Result:2]
Preview Result 1V-PK+ [Preview Result 1V.Result:2]

Readings - Antenna horizontal polarized

Frequency	Readings	+ AF Antenna correction factor	+ KF Cable correction factor	Field strength	Limit	Margin	Antenna-Height	Antenna-Polarization	Turntable position
MHz	dBµV	dB/m	dB	dBµV/m	dBµV/m	dB	m	hor./ver.	deg.
180.020	13.5	13.9	2.1	29.5	43.5	14.0	1.6	H	215
191.990	18.7	14.7	2.2	35.6	43.5	7.9	1.6	H	210
200.020	19.3	15.7	2.3	37.3	43.5	6.2	1.4	H	210
203.660	21.5	15.8	2.3	39.5	43.5	4.0	1.4	H	195
215.420	21.0	15.7	2.4	39.0	43.5	4.5	1.4	H	195
227.580	15.7	16.7	2.4	34.8	46.0	11.2	1.6	H	195
233.180	16.4	16.8	2.5	35.6	46.0	10.4	1.6	H	195
240.020	19.5	16.9	2.5	38.9	46.0	7.1	1.4	H	195
243.400	8.4	17.0	2.5	27.9	46.0	18.1	1.6	H	195
269.200	21.7	14.5	2.6	38.8	46.0	7.2	1.2	H	195
323.040	23.7	13.9	2.9	40.5	46.0	5.5	1.2	H	235
430.800	18.2	16.5	3.4	38.1	46.0	7.9	1.2	H	235

Diagram radio disturbances – Antenna horizontal polarized

Limits: ☒ Section 15.209* ☐ __

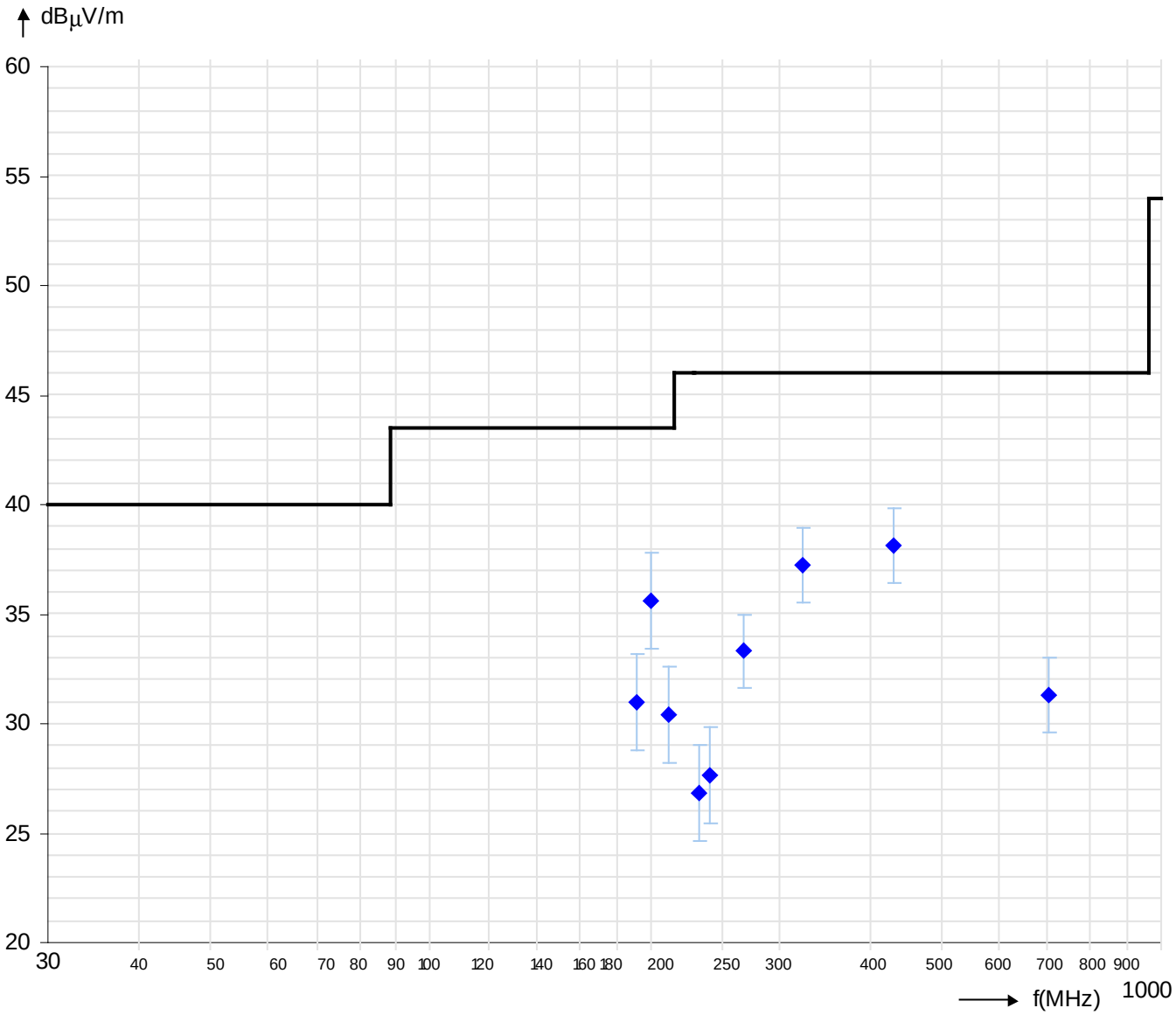


Readings - Antenna vertical polarized

Frequency	Readings	+ AF Antenna correction factor	+ KF Cable correction factor	Field strength	Limit	Margin	Antenna-Height	Antenna-Polarization	Turntable position
MHz	dBµV	dB/m	dB	dBµV/m	dBµV/m	dB	m	hor./ver.	deg.
191.990	14.1	14.7	2.2	31.0	43.5	12.5	1.0	V	170
200.020	17.6	15.7	2.3	35.6	43.5	7.9	1.0	V	170
212.020	12.4	15.7	2.3	30.4	43.5	13.1	1.0	V	170
233.180	7.6	16.8	2.5	26.8	46.0	19.2	1.0	V	170
240.650	8.2	16.9	2.5	27.6	46.0	18.4	1.0	V	185
269.050	16.2	14.5	2.6	33.3	46.0	12.7	1.0	V	185
323.040	20.4	13.9	2.9	37.2	46.0	8.8	1.0	V	190
430.800	18.2	16.5	3.4	38.1	46.0	7.9	1.0	V	240
699.950	6.6	20.4	4.4	31.3	46.0	14.7	1.0	V	240

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 - 04/2016

Requirement: ☒ Section 15.205(a)

Limit spurious emission: ☒ Section 15.209
☒ CISPR quasi peak detector (f ≤ 1GHz)
☐ Average detector(f > 1GHz)

Operation mode

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

Continuous operation of the RFID reader, supplied with the desktop power supply and attached at the laptop RS232-port.
RFID tag placed at approx. half reading distance.

Environmental conditions

Temperature [10 - 40°C]:	23°C
Relative humidity [10 - 90%]:	44%

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: 0.13422MHz
20dB-Emission Bandwidth: 0.678kHz

Fundamental out of restricted bands: ☒ kept ☐ not kept

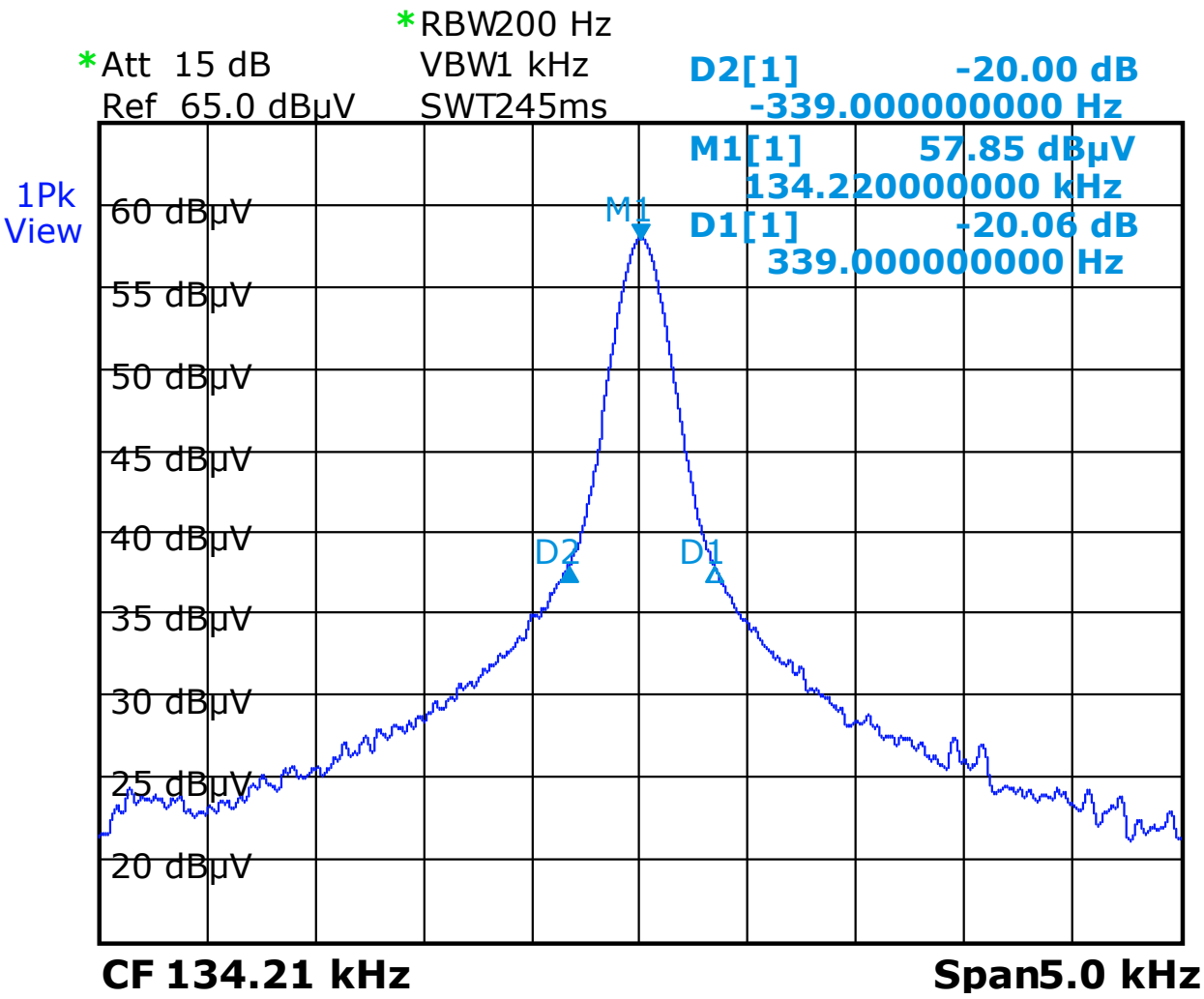
Limit spurious emission: ☒ kept ☐ not kept

Remarks: n/a

Protocol scope

☒ Diagram – 20dB-Emission bandwidth.

Occupied bandwidth



PRN12_02, ARE i2 - 23X/RS232

Date: 23.MAR.2016 10:23:35

Occupied bandwidth BW = D1 - D2 = 0.339kHz - -0.339kHz=0.678kHz

1.1.2.5 Antenna requirement

Regulation

47 CFR Part 15 Subpart C - 04/2016

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 - AAN X1F-flex 3m

Remarks: n/a

2 Summary

Regulation	Class / Test level	Result	Remark(s)
FCC Rules **47 CFR Part 15 Subpart C**			
Terminal voltage 0.15-30MHz	Section 15.207	Limits kept	
Radiated emissions 0.009-30MHz	Section 15.209	Limits kept	
Radiated emissions 30-1000MHz	Section 15.209	Limits kept	
Occupied bandwidth	Section 15.215(c)	n. r.	
Restricted bands	Section 15.205(a)	Requirement kept	
Antenna requirement	Section 15.203	Requirement kept	

n. r. – not relevant

Burgrieden, 2016-07-08

Report generated by:

Acceptance inspector – Peter Hauser