

FCC ID: 2ADFV-5E902029FCC

EMI - TEST REPORT

- FCC Part 15.225 -

Test Report No. : T38693-00-00HU

18. November 2014

Date of issue

Type / Model Name : 5E9020.29-FCC**Product Description** : Transponder Reader Kit Mifare USB**Applicant** : B&R Industrieelektronik GmbH

Address : B&R Strasse 1

A-5142 Eggelsberg

Manufacturer : B&R Industrieelektronik GmbH

Address : B&R Strasse 1

A-5142 Eggelsberg

Licence holder : B&R Industrieelektronik GmbH

Address : B&R Strasse 1

A-5142 Eggelsberg

Test Result according to the
standards listed in clause 1 test
standards:**POSITIVE**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test results
without the written permission of the test laboratory.

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (October, 2014)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths
Part 15, Subpart A, Section 15.207	AC Line conducted emissions

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (October, 2014)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements
Part 15, Subpart C, Section 15.225	Operation within the band 13.110-14.010 MHz
ANSI C63.4: 2009	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C95.1:1992	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
CISPR 16-4-2: 2003	Uncertainty in EMC measurement

2 SUMMARY

GENERAL REMARKS:

The EuT is working at frequency of 13.56 MHz.

The EuT has a Data connection via USB to a PC.

FINAL ASSESSMENT:

The equipment under test **fulfills** the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 25. August 2014

Testing concluded on : 28. August 2014

Checked by:



Klaus Gegenfurtner
I confirm the correctness
and Integrity of this
documents
2014.11.13 11:44:38
+01'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:



Markus Huber
I'm the author of this
document
2014.11.13
11:38:13 +01'00'

Markus Huber

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EuT

3.2 Power supply system utilised

Power supply voltage : Primary: 115 V / 60 Hz / 1 ϕ
Secondary: USB 5.0 V / DC

3.3 Short description of the Equipment under Test (EuT)

The EuT is a RFID reader which will be built in an engine for industrial use.

Number of tested samples: 1
Serial number: Prototype

EuT operation mode:

The equipment under test was operated during the measurement under the following conditions:

- Tag reading mode at 13.56 MHz

-

EuT configuration:

The following peripheral devices and interface cables were connected during the measurements:

- | | |
|--------------------------------------|----------------------------------|
| - USB cable male type A | Model : Supplied by manufacturer |
| - Fujitsu LapTop | Model : Supplied by CSA |
| - Power Supply CASIO, Model: AD-C53U | Model : Supplied by CSA |
| - | Model : |
| - | Model : |
| - | Model : |
| - customer specific cables | |

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

**CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY**

4.2 Statement regarding the usage of logos in test reports

The accreditation and notification body logos displayed in this test report are only valid for standards listed in the accreditation or notification scope of CSA Group Bayern GmbH.

4.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

4.4 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor $k = 2$. The true value is located in the corresponding interval with a probability of 95 %. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 / 11.2003 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, CSA Group Bayern GmbH, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

4.5 Measurement Protocol for FCC, VCCI and AUSTEL

4.5.1 GENERAL INFORMATION

4.5.1.1 Test Methodology

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.5.1.2 Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

5 TEST CONDITIONS AND RESULTS

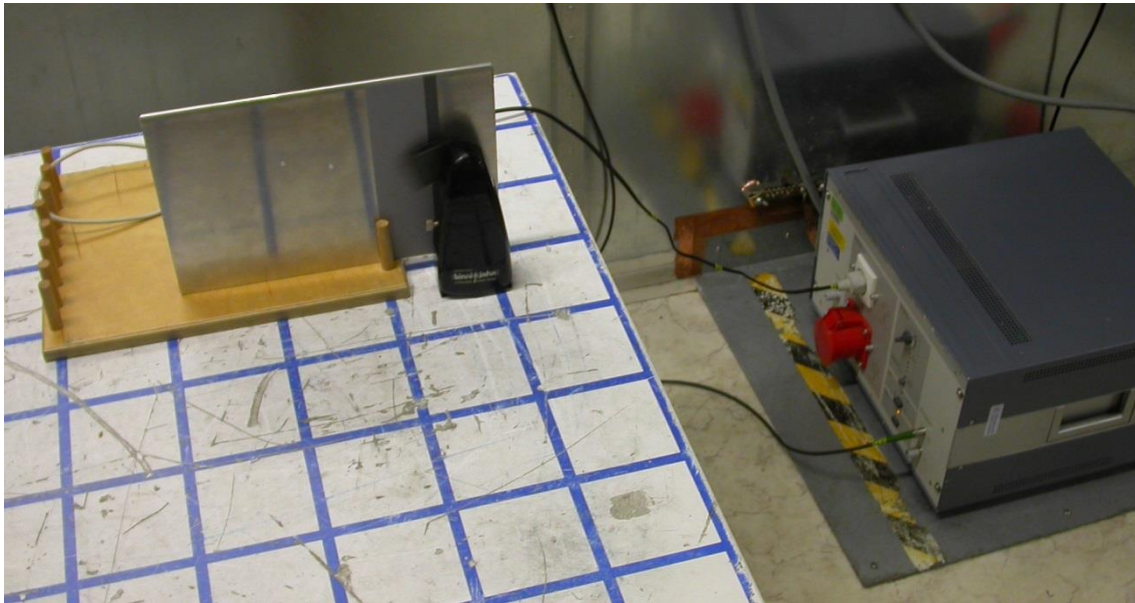
5.1 Conducted emissions

For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up



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The final level, expressed in dB μ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC Limit or to the CISPR limit.

To convert between dB μ V and μ V, the following conversions apply:

$$\text{dB}\mu\text{V} = 20(\log \mu\text{V})$$

$$\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$$

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EuT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with 50 Ω /50 μ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeters above the floor and is positioned 40 centimeters from the vertical ground plane (wall) of the screen room. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

5.1.4 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin 3.07 dB at 13.56 MHz

The requirements are **FULFILLED**.

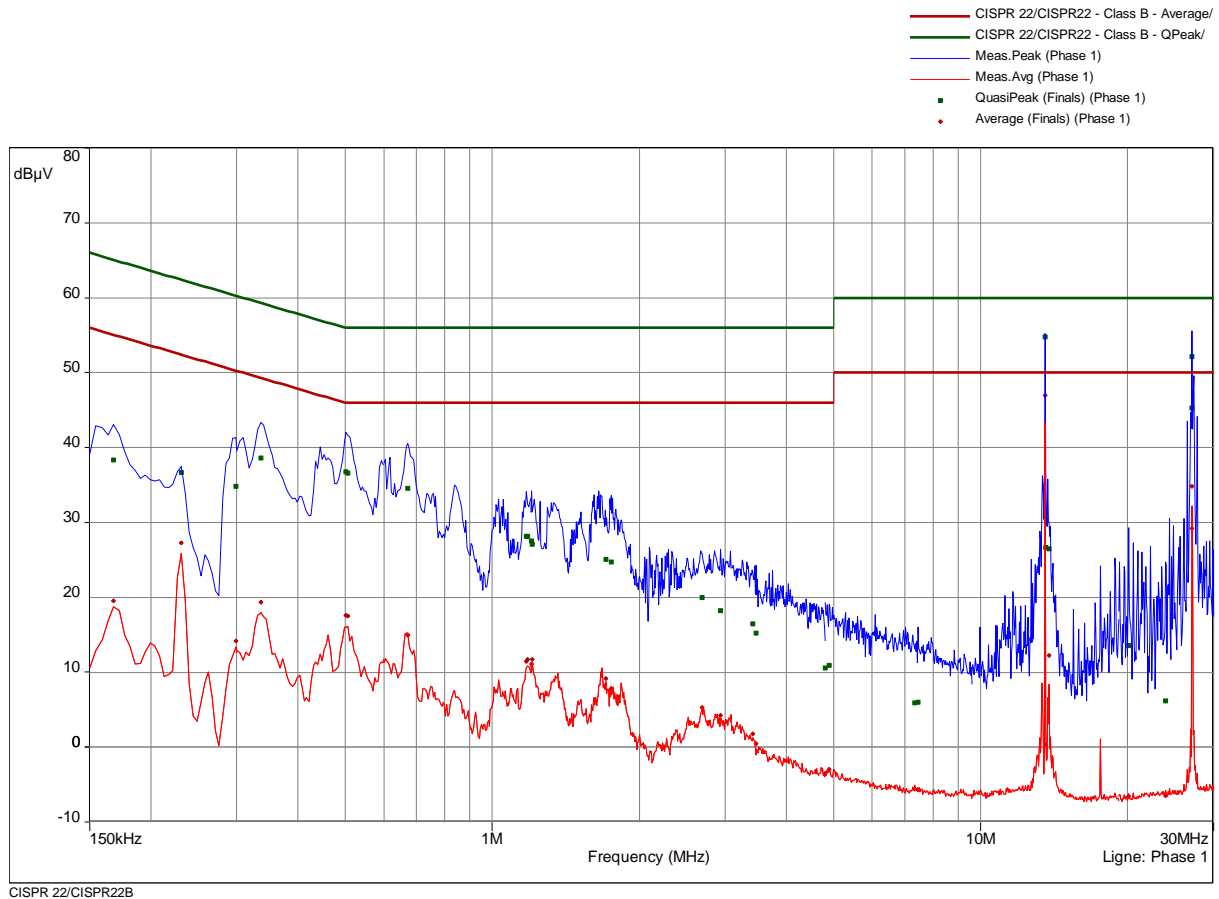
Remarks:

FCC ID: 2ADFV-5E902029FCC

5.1.5 Test protocol

Test point L1
 Operation mode: Tag reading mode – with Tag
 Remarks:
 Date: 26.08.14
 Tested by: Huber Markus

Result: passed



CISPR 22/CISPR22B

freq MHz	SR	QP dB(μV)	margin dB	limit dB	AV dB(μV)	margin dB	limit dB	line
0.168	1	38.33	26.73	65.06	19.52	35.54	55.06	Phase 1
0.231	1	36.72	25.7	62.41	27.29	25.13	52.41	Phase 1
0.2985	1	34.84	25.44	60.28	14.17	36.11	50.28	Phase 1
0.336	2	38.6	20.7	59.3	19.41	29.89	49.3	Phase 1
0.5025	2	36.77	19.23	56	17.61	28.39	46	Phase 1
0.507	2	36.61	19.39	56	17.53	28.47	46	Phase 1
0.672	3	34.6	21.4	56	14.96	31.04	46	Phase 1
1.176	3	28.19	27.81	56	11.48	34.52	46	Phase 1
1.1805	3	28.19	27.81	56	11.75	34.25	46	Phase 1
1.2045	4	27.55	28.45	56	11.12	34.88	46	Phase 1
1.209	4	27.11	28.89	56	11.7	34.3	46	Phase 1
1.7085	4	25.06	30.94	56	9.16	36.84	46	Phase 1
1.7535	4	24.72	31.28	56	7.83	38.17	46	Phase 1

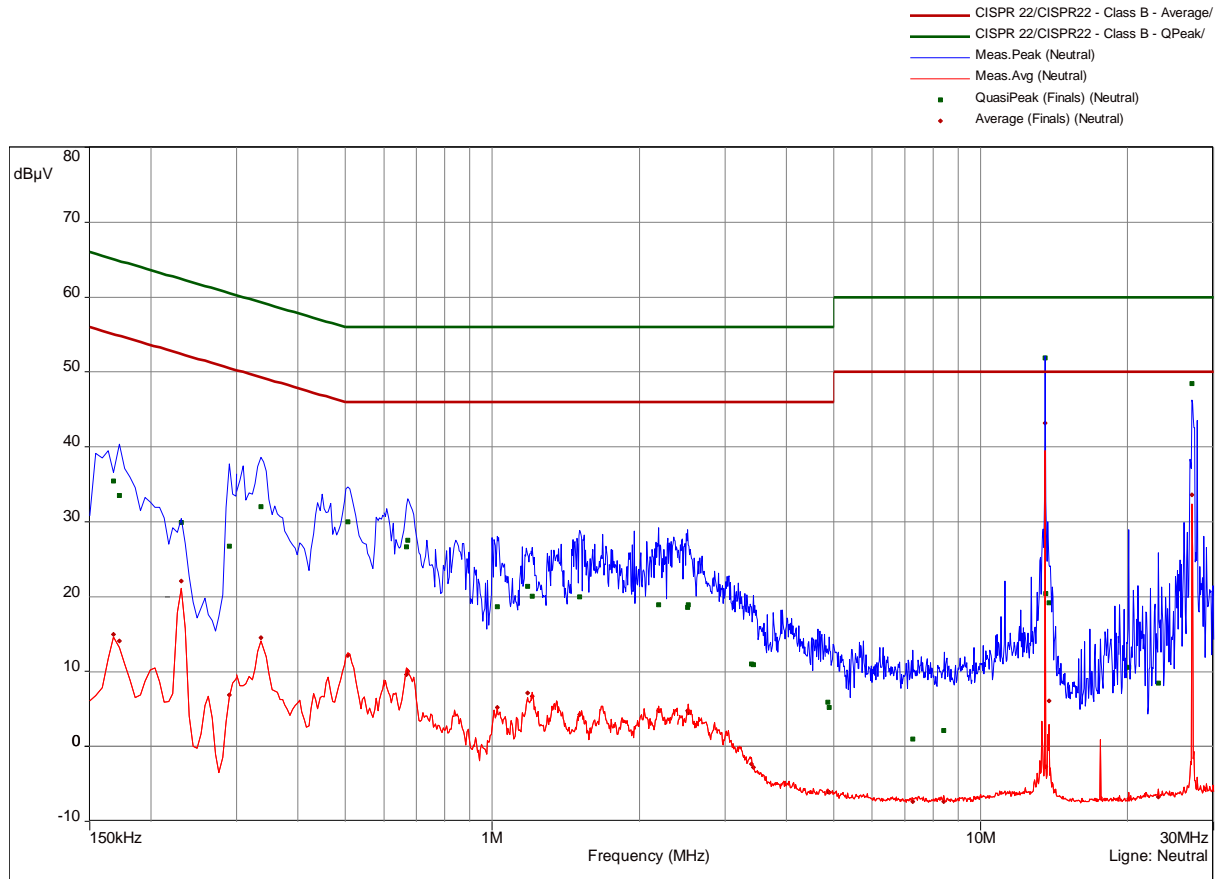
FCC ID: 2ADFV-5E902029FCC

freq MHz	SR	QP dB(μV)	margin dB	limit dB	AV dB(μV)	margin dB	limit dB	line
2.6925	5	19.94	36.06	56	5.28	40.72	46	Phase 1
2.9355	5	18.25	37.75	56	4.22	41.78	46	Phase 1
3.417	5	16.49	39.51	56	1.76	44.24	46	Phase 1
3.471	5	15.27	40.73	56	0.48	45.52	46	Phase 1
4.8135	6	10.62	45.38	56	-3.46	49.46	46	Phase 1
4.899	6	10.9	45.1	56	-3	49	46	Phase 1
7.32	6	5.88	54.12	60	-5.62	55.62	50	Phase 1
7.437	6	6	54	60	-5.66	55.66	50	Phase 1
13.56	7	54.76	5.24	60	46.93	3.07	50	Phase 1
13.596	7	26.66	33.34	60	0.4	49.6	50	Phase 1
13.794	7	26.51	33.49	60	12.28	37.72	50	Phase 1
20.127	8	13.54	46.46	60	-6.61	56.61	50	Phase 1
23.952	8	6.22	53.78	60	-6.47	56.47	50	Phase 1
27.1155	8	45.26	14.74	60	29.23	20.77	50	Phase 1
27.12	8	52.16	7.84	60	34.83	15.17	50	Phase 1

FCC ID: 2ADFFV-5E902029FCC

Test point: N
 Operation mode: Tag reading mode – with Tag
 Remarks:
 Date: 26.08.14
 Tested by: Huber Markus

Result: passed



CISPR 22/CISPR22B

freq MHz	SR	QP dB(μV)	margin dB	limit dB	AV dB(μV)	margin dB	limit dB	line
0.168	9	35.49	29.57	65.06	14.98	40.08	55.06	Neutral
0.1725	9	33.55	31.29	64.84	14.07	40.77	54.84	Neutral
0.231	9	29.93	32.49	62.41	22.12	30.3	52.41	Neutral
0.2895	9	26.73	33.81	60.54	6.86	43.68	50.54	Neutral
0.336	10	32.02	27.28	59.3	14.5	34.8	49.3	Neutral
0.507	10	29.96	26.04	56	12.11	33.89	46	Neutral
0.6675	11	26.69	29.31	56	9.6	36.4	46	Neutral
0.672	11	27.57	28.43	56	10.04	35.96	46	Neutral
1.023	11	18.7	37.3	56	5.22	40.78	46	Neutral
1.1805	11	21.39	34.61	56	7.11	38.89	46	Neutral
1.209	12	20.05	35.95	56	6.75	39.25	46	Neutral
1.5105	12	19.99	36.01	56	4.2	41.8	46	Neutral
2.1945	12	18.9	37.1	56	4.8	41.2	46	Neutral
2.5125	13	18.58	37.42	56	4.81	41.19	46	Neutral
2.5215	13	18.96	37.04	56	4.52	41.48	46	Neutral

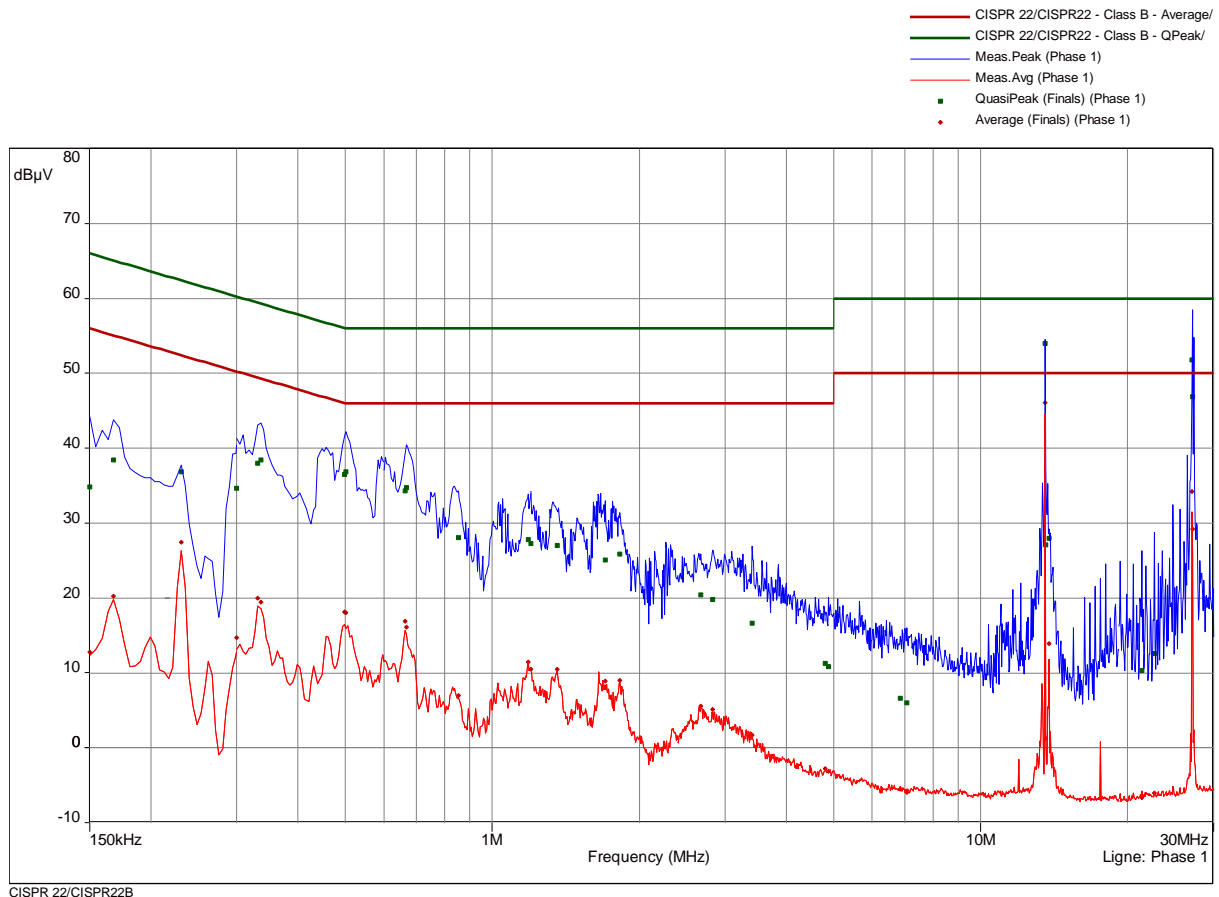
FCC ID: 2ADFV-5E902029FCC

freq MHz	SR	QP dB(μV)	margin dB	limit dB	AV dB(μV)	margin dB	limit dB	line
3.399	13	11.04	44.96	56	-2.33	48.33	46	Neutral
3.426	13	10.96	45.04	56	-2.82	48.82	46	Neutral
4.8675	14	5.91	50.09	56	-6.01	52.01	46	Neutral
4.8945	14	5.17	50.83	56	-6.14	52.14	46	Neutral
7.266	14	0.96	59.04	60	-7.36	57.36	50	Neutral
8.409	14	2.09	57.91	60	-7.33	57.33	50	Neutral
13.56	15	51.88	8.12	60	43.16	6.84	50	Neutral
13.5915	15	20.46	39.54	60	-2.7	52.7	50	Neutral
13.7895	15	19.2	40.8	60	6.05	43.95	50	Neutral
20.127	16	10.6	49.4	60	-6.98	56.98	50	Neutral
23.1015	16	8.49	51.51	60	-6.7	56.7	50	Neutral
27.12	16	48.48	11.52	60	33.62	16.38	50	Neutral

FCC ID: 2ADFFV-5E902029FCC

Result: passed

Test point L1
Operation mode: Tag reading mode – without Tag
Remarks:
Date: 26.08.14
Tested by: Huber Markus



CISPR 22/CISPR22B

freq MHz	SR	QP dB(μV)	margin dB	limit dB	AV dB(μV)	margin dB	limit dB	line
0.15	1	34.85	31.15	66	12.75	43.25	56	Phase 1
0.168	1	38.47	26.59	65.06	20.24	34.82	55.06	Phase 1
0.231	1	36.88	25.54	62.41	27.42	25	52.41	Phase 1
0.3	1	34.69	25.55	60.24	14.66	35.58	50.24	Phase 1
0.3315	2	38	21.42	59.41	19.96	29.46	49.41	Phase 1
0.336	2	38.48	20.82	59.3	19.46	29.84	49.3	Phase 1
0.498	2	36.54	19.49	56.03	18.17	27.86	46.03	Phase 1
0.5025	2	36.87	19.13	56	18.01	27.99	46	Phase 1
0.663	3	34.28	21.72	56	16.87	29.13	46	Phase 1
0.6675	3	34.72	21.28	56	16.14	29.86	46	Phase 1
0.852	3	28.09	27.91	56	6.96	39.04	46	Phase 1
1.185	3	27.79	28.21	56	11.42	34.58	46	Phase 1
1.2	4	27.31	28.69	56	10.47	35.53	46	Phase 1
1.3575	4	27.04	28.96	56	10.5	35.5	46	Phase 1
1.704	4	25.08	30.92	56	8.94	37.06	46	Phase 1
1.8255	4	25.85	30.15	56	8.98	37.02	46	Phase 1

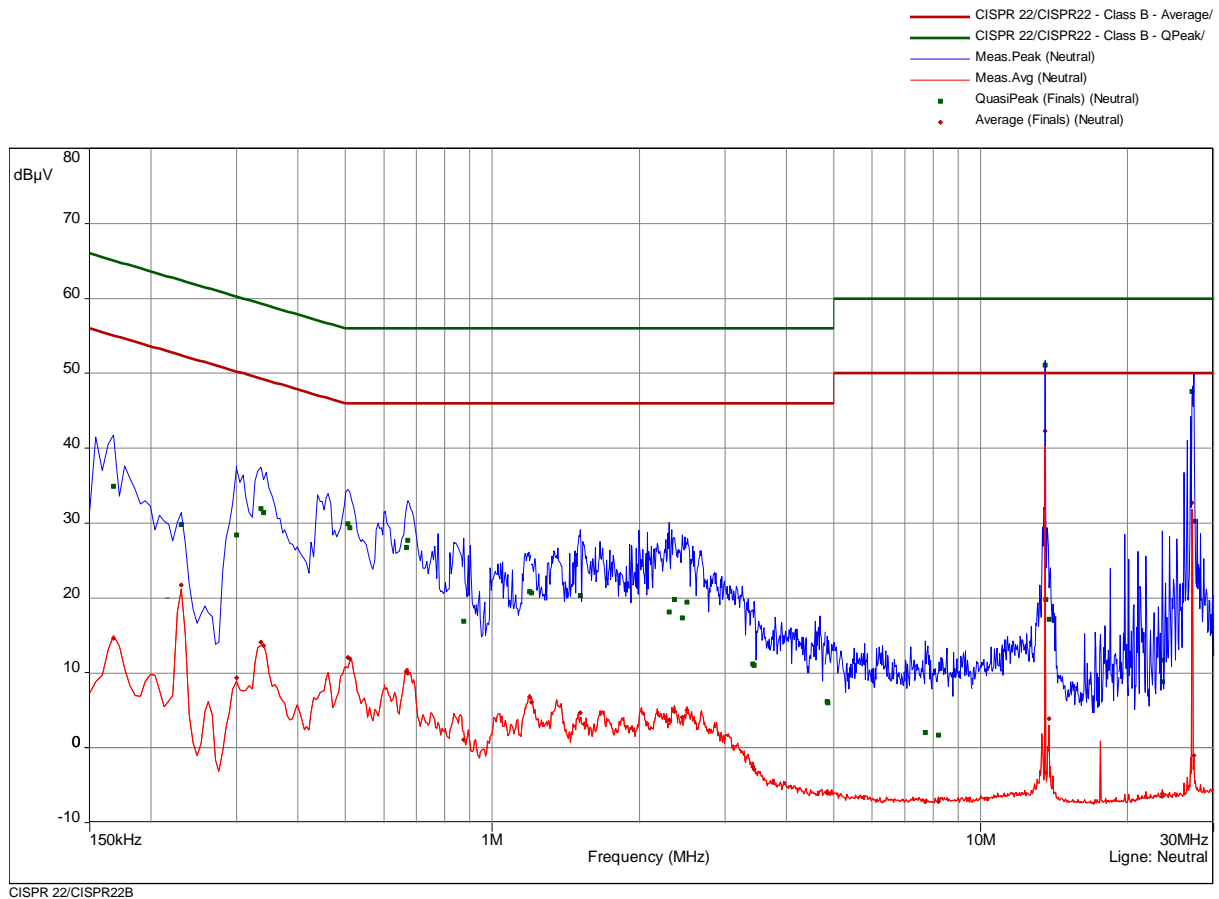
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freq MHz	SR	QP dB(μV)	margin dB	limit dB	AV dB(μV)	margin dB	limit dB	line
0.15	1	34.85	31.15	66	12.75	43.25	56	Phase 1
0.168	1	38.47	26.59	65.06	20.24	34.82	55.06	Phase 1
0.231	1	36.88	25.54	62.41	27.42	25	52.41	Phase 1
0.3	1	34.69	25.55	60.24	14.66	35.58	50.24	Phase 1
0.3315	2	38	21.42	59.41	19.96	29.46	49.41	Phase 1
0.336	2	38.48	20.82	59.3	19.46	29.84	49.3	Phase 1
0.498	2	36.54	19.49	56.03	18.17	27.86	46.03	Phase 1
0.5025	2	36.87	19.13	56	18.01	27.99	46	Phase 1
0.663	3	34.28	21.72	56	16.87	29.13	46	Phase 1
0.6675	3	34.72	21.28	56	16.14	29.86	46	Phase 1
0.852	3	28.09	27.91	56	6.96	39.04	46	Phase 1
1.185	3	27.79	28.21	56	11.42	34.58	46	Phase 1
1.2	4	27.31	28.69	56	10.47	35.53	46	Phase 1
1.3575	4	27.04	28.96	56	10.5	35.5	46	Phase 1
1.704	4	25.08	30.92	56	8.94	37.06	46	Phase 1
1.8255	4	25.85	30.15	56	8.98	37.02	46	Phase 1
2.67	5	20.39	35.61	56	5.53	40.47	46	Phase 1
2.823	5	19.81	36.19	56	5.14	40.86	46	Phase 1
3.4035	5	16.65	39.35	56	1.72	44.28	46	Phase 1
4.809	6	11.28	44.72	56	-2.8	48.8	46	Phase 1
4.8855	6	10.82	45.18	56	-3.18	49.18	46	Phase 1
6.8385	6	6.64	53.36	60	-5.48	55.48	50	Phase 1
7.0635	6	6.01	53.99	60	-5.92	55.92	50	Phase 1
13.56	7	54.01	5.99	60	46.12	3.88	50	Phase 1
13.5825	7	27.08	32.92	60	1.3	48.7	50	Phase 1
13.7895	7	27.95	32.05	60	13.88	36.12	50	Phase 1
21.3915	8	10.35	49.65	60	-6.67	56.67	50	Phase 1
22.6695	8	12.57	47.43	60	-6	56	50	Phase 1
27.12	8	51.76	8.24	60	34.25	15.75	50	Phase 1
27.1245	8	46.88	13.12	60	29.17	20.83	50	Phase 1

FCC ID: 2ADFFV-5E902029FCC

Result: passed

Test point: N
 Operation mode: Tag reading mode – without Tag
 Remarks:
 Date: 26.08.14
 Operator: Markus Huber



CISPR 22/CISPR22B

freq MHz	SR	QP dB(µV)	margin dB	limit dB	AV dB(µV)	margin dB	limit dB	line
0.168	9	34.93	30.13	65.06	14.59	40.47	55.06	Neutral
0.231	9	29.79	32.63	62.41	21.76	30.66	52.41	Neutral
0.3	9	28.38	31.86	60.24	9.37	40.87	50.24	Neutral
0.336	10	31.92	27.38	59.3	14.08	35.22	49.3	Neutral
0.3405	10	31.4	27.79	59.19	13.69	35.5	49.19	Neutral
0.507	10	29.92	26.08	56	12.04	33.96	46	Neutral
0.5115	10	29.34	26.66	56	11.89	34.11	46	Neutral
0.6675	11	26.71	29.29	56	10.2	35.8	46	Neutral
0.672	11	27.75	28.25	56	9.92	36.08	46	Neutral
0.8745	11	16.93	39.07	56	1.12	44.88	46	Neutral
1.194	11	20.85	35.15	56	6.78	39.22	46	Neutral
1.2045	12	20.68	35.32	56	6.11	39.89	46	Neutral
1.515	12	20.34	35.66	56	4.72	41.28	46	Neutral
2.307	12	18.11	37.89	56	3.73	42.27	46	Neutral
2.361	12	19.79	36.21	56	4.9	41.1	46	Neutral

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freq MHz	SR	QP dB(μV)	margin dB	limit dB	AV dB(μV)	margin dB	limit dB	line
2.4495	13	17.38	38.62	56	4.08	41.92	46	Neutral
2.508	13	19.48	36.52	56	5.03	40.97	46	Neutral
3.4125	13	11.18	44.82	56	-2.49	48.49	46	Neutral
3.4395	13	11.02	44.98	56	-2.84	48.84	46	Neutral
4.845	14	6.2	49.8	56	-6	52	46	Neutral
4.8675	14	6.01	49.99	56	-6.03	52.03	46	Neutral
7.6935	14	2.01	57.99	60	-7.2	57.2	50	Neutral
8.202	14	1.71	58.29	60	-7.22	57.22	50	Neutral
13.56	15	51.07	8.93	60	42.33	7.67	50	Neutral
13.6095	15	19.77	40.23	60	-3.29	53.29	50	Neutral
13.794	15	17.14	42.86	60	3.92	46.08	50	Neutral
23.5155	16	11.72	48.28	60	-6.14	56.14	50	Neutral
23.5245	16	8.82	51.18	60	-6.51	56.51	50	Neutral
27.12	16	47.6	12.4	60	32.74	17.26	50	Neutral
27.327	16	30.25	29.75	60	-1.02	51.02	50	Neutral

FCC ID: 2ADFV-5E902029FCC**5.2 Field strength of the fundamental wave**

For test instruments and accessories used see section 6 Part CPR 1.

5.2.1 Description of the test location

Test location: OATS1

Test distance: 3 metres

5.2.2 Photo documentation of the test set-up**5.2.3 Description of Measurement**

The magnetic field strength from the EuT will be measured on an open area test site in the frequency range of 9 kHz to 30 MHz using a tuned receiver and a shielded loop antenna. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003. The antenna was positioned 3, 10 or 30 meters horizontally from the EuT. Measurements have been made in all three orthogonal axes and the shielded loop antenna was rotated to locate the maximum of the emissions. In the case where larger measuring distances are required the results will extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2]. The final measurement will be performed with an EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 to 490 kHz where an average detector will be used according to Section 15.209 (d) [2].

The final level, expressed in $\text{dB}\mu\text{V}/\text{m}$, is arrived at by taking the reading from the EMI receiver (Level $\text{dB}\mu\text{V}$) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has to be compared with the relevant FCC limit.

The resolution bandwidth during the measurement is as follows:

9 kHz – 150 kHz: ResBW: 200 Hz

150 kHz – 30 MHz: ResBW: 9 kHz

FCC ID: 2ADFFV-5E902029FCC

Example:

Frequency (MHz)	Level (dBμV)	+	Factor (dB)	=	Level (dBμV/m)	Limit (dBμV/m)	=	Delta (dB)
1.705	5	+	20	=	25	30	=	5

5.2.4 Test result

Measured value at 3m

Frequency [MHz]	L: PK [dBμV]	L: AV [dBμV]	L: QP [dBμV]	Correct. [dB]	L: PK [dBμV/m]	L: AV [dBμV/m]	L: QP [dBμV/m]	Limit [dBμV/m]	Delta [dB]
13.56	22.2	12.1	16.8	20.0	42.2	32.1	36.8	124.0	-87.2

Calculated value at 30m:

Frequency [MHz]	L: PK [dBμV]	L: AV [dBμV]	L: QP [dBμV]	Correct. [dB]	L: PK [dBμV/m]	L: AV [dBμV/m]	L: QP [dBμV/m]	Limit [dBμV/m]	Delta [dB]
13.56	-17.8	-27.9	-23.2	20.0	2.2	-7.9	-3.2	84.0	-87.2

Limit according to FCC Part 15 Subpart 15.225(a)

Frequency (MHz)	Field strength of fundamental wave		Measurement distance (meters)
	(μV/m)	dB (μV/m)	
13.553-13.567	15848	84	30

The requirements are **FULFILLED**.

Remarks:

FCC ID: 2ADFV-5E902029FCC**5.3 Spurious emissions (Magnetic field) 9 kHz – 30 MHz**

For test instruments and accessories used see section 6 Part SER 1.

5.3.1 Description of the test location

Test location: OATS1

Test distance: 3 metres

5.3.2 Photo documentation of the test set-up**5.3.3 Description of Measurement**

The spurious emissions from the EuT will be measured on an open area test site in the frequency range of 9 kHz to 30 MHz using a tuned receiver and a shielded loop antenna. The antenna was positioned 3, 10 or 30 meters horizontally from the EuT. Measurements have been made in all three orthogonal axes and the shielded loop antenna was rotated to locate the maximum of the emissions. In the case where larger measuring distances are required the results will be extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2]. The final measurement will be performed with an EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 to 490 kHz where an average detector will be used according to Section 15.209 (d) [2].

The final level, expressed in dB μ V/m, is arrived at by taking the reading from the EMI receiver (Level dB μ V) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has to be compared with the relevant FCC limit.

The resolution bandwidth during the measurement is as follows:

9 kHz – 150 kHz: ResBW: 200 Hz

150 kHz – 30 MHz: ResBW: 9 kHz

FCC ID: 2ADFDV-5E902029FCC

Example:

Frequency (MHz)	Level (dBμV)	+	Factor (dB)	=	Level (dBμV/m)	Limit (dBμV/m)	=	Delta (dB)
1.705	5	+	20	=	25	30	=	5

5.3.4 Test result

Frequency [kHz]	L: QP [dBμV]	L: AV [dBμV]	Bandwidth [kHz]	Correct. [dB]	L: QP [dBμV/m]	L: AV [dBμV/m]	Limit [dBμV/m]	Delta [dB]
536.8	24.1	19.7	9.0	20	44.1	39.7	73.0	-33.3
1073.6	23.4	18.0	9.0	20	43.4	38.0	67.0	-29.0
1342.0	21.6	15.9	9.0	20	41.6	35.9	65.0	-29.1

Note: No unwanted emissions from the EuT could be measured in the relevant frequency ranges.
Only ambient noises could be detected!

Limit according to FCC Part 15 Subpart 15.209(a):

Frequency (MHz)	Field strength of spurious emissions		Measurement distance
	(μV/m)	dB(μV/m)	(metres)
0.009-0.490	2400/F(kHz)	--	300
0.490-1.705	24000/F (kHz)	--	30
1.705-30.0	30	29.5	30

The requirements are **FULFILLED**.

Remarks:

FCC ID: 2ADFFV-5E902029FCC**5.4 Radiated emissions (electric field) 30 MHz – 1 GHz**

For test instruments and accessories used see section 6 Part **SER 2**.

5.4.1 Description of the test location

Test location: OATS1

Test distance: 3 metres

5.4.2 Photo documentation of the test set-up

Note: Internal photos are short term confidentiality.

5.4.3 Description of Measurement

Spurious emissions from the EuT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003.

The Interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna was positioned 3, 10 or 30 meters horizontally from the EuT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarization's and the EuT are rotated 360 degrees.

The final level, expressed in dBμV/m, is arrived by taking the reading from the EMI receiver (Level dBμV) and adding the correction factors and cable loss factor (Factor dB) to it. This is done automatically in the EMI receiver, where the correction factors are stored. This result then has the FCC or CISPR limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets at page.

FCC ID: 2ADFFV-5E902029FCC

The resolution bandwidth during the measurement is as follows:

30 MHz – 1000 MHz:

ResBW: 120 kHz

Example:

Frequency (MHz)	Level (dBμV)	+	Factor (dB)	=	Level (dBμV/m)	Limit (dBμV/m)	=	Delta (dB)
719	75	+	32.6	=	107.6	110	=	-2.4

5.4.4 Test result

Frequency (MHz)	Reading Vert. (dBμV)	Reading Hor. (dBμV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dBμV/m)	Level Hor. (dBμV/m)	Limit (dBμV/m)	Dlimit (dB)
32,2219	14,3		12,6		26,9		40,0	-13,1
41,5422	16,8		14,3		31,1		40,0	-8,9
59,0813	15,1		14,6		29,7		40,0	-10,3
145,1000	8,6		13,1		21,7		43,5	-21,8
225,1545	9,4		12,2		21,6		46,0	-24,4
61,6379		6,4		13,6		20,0	40,0	-20,0
138,3000		5,1		13,6		18,7	43,5	-24,8
54,2396	12,9	19,2	14,8	13,9	27,7	33,1	40,0	-6,9
67,9960	5,4	7,8	14,0	13,1	19,4	20,9	40,0	-19,1
81,3600	9,7		10,7		20,4		40,0	-19,6
40,6800	12,1	5,9	14,2	13,1	26,3	19,0	40,0	-13,7

Limit according to FCC Part 15 Subpart 15.209(a)

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (meters)
	(μV/m)	dB (μV/m)	
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

The requirements are **FULFILLED**.

Remarks: The values of the test result show an extract of the critical spurious emission level.

FCC ID: 2ADFV-5E902029FCC

5.5 Frequency tolerance of the carrier

For test instruments and accessories used see section 6 Part FE.

5.5.1 Description of the test location

Test location: AREA4

5.5.2 Photo documentation of the test set-up



5.5.3 Test result

Test conditions		Test result		
		Frequency (MHz)		
T_{min} (-20)°C	V_{nom} (5.0)V	13.56046		
T (-10)°C	V_{nom} (5.0)V	13.56046		
T (0)°C	V_{nom} (5.0)V	13.56046		
T (10)°C	V_{nom} (5.0)V	13.56044		
T_{nom} (20)°C	V_{min} (4.25)V	13.56044		
	V_{nom} (5.0)V	13.56044		
	V_{max} (5.75)V	13.56044		
T (30)°C	V_{nom} (5.0)V	13.56042		
T (40)°C	V_{nom} (5.0)V	13.56038		
T_{max} (50)°C	V_{nom} (5.0)V	13.56038		
Maximum tolerance of carrier frequency (Hz)		-0.06 / +0.02		
Measurement uncertainty		± 10 Hz		

FCC ID: 2ADJV-5E902029FCC

Limit according to FCC Part 15 Subpart 15.225 (e): ± 0.01 % of carrier frequency at 13.560 MHz = ± 1.356 kHz

The requirements are **FULFILLED**.

Remarks:

5.6 Emission Bandwidth

For test instruments and accessories used see section 6 Part MB.

5.6.1 Description of the test location

Test location: Shielded Room S4

5.6.2 Photo documentation of the test set-up



5.6.3 Description of Measurement

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio of -20 dB. The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or the first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.

The resolution bandwidth of measuring instrument was set to a value as shown in the following table below according to ANSI C63.4-2003.

Fundamental frequency	Minimum resolution bandwidth
9 kHz to 30 MHz	1kHz
30 to 1000 MHz	10 kHz
1000 MHz to 40 GHz	100 kHz

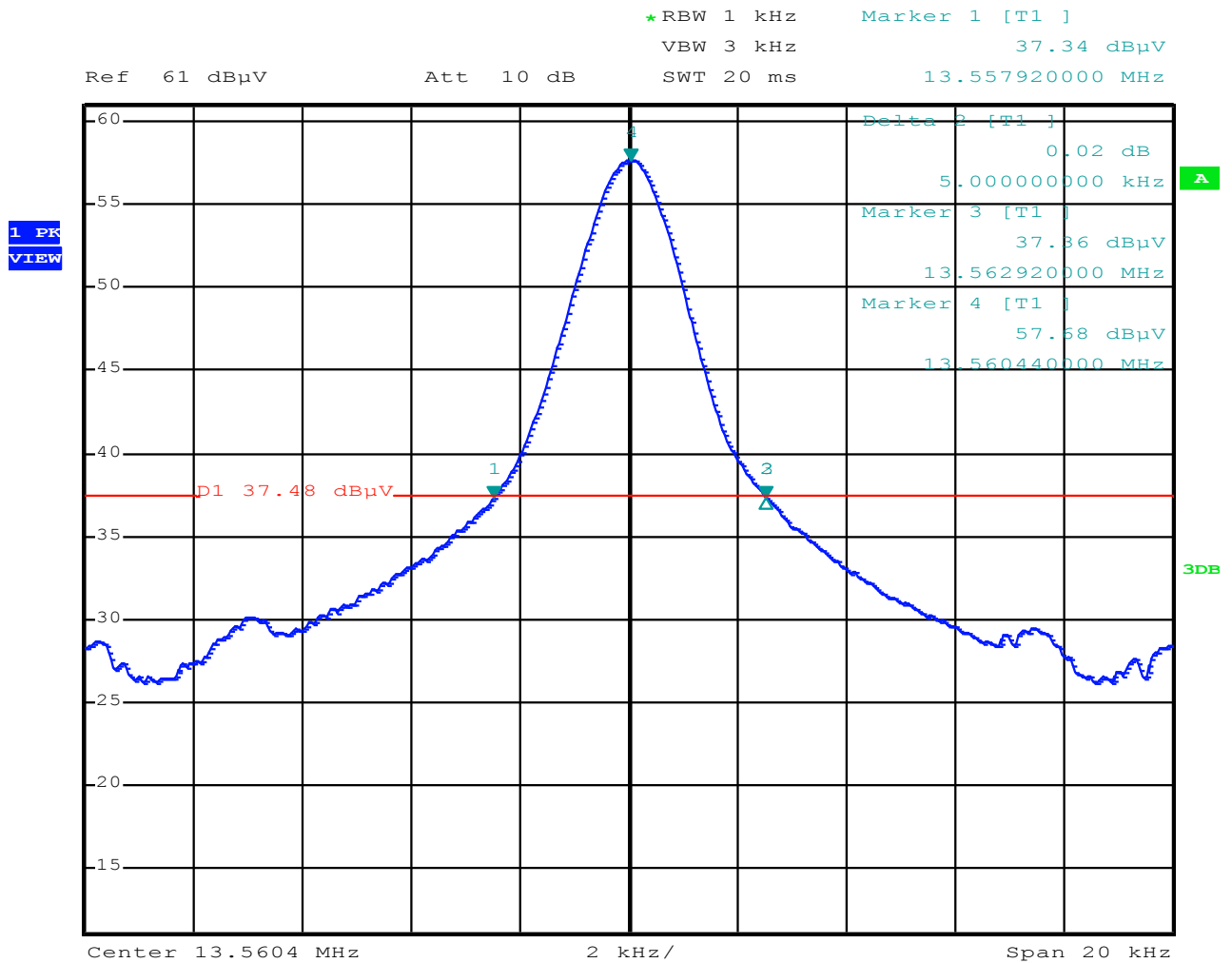
5.6.4 Test result

Channel Frequency [MHz]	20 dB Bandwidth [kHz]
13.56	5.00

Remarks: For detailed test result please refer to following test protocol.

FCC ID: 2ADFFV-5E902029FCC

5.6.5 Test protocol



FCC ID: 2ADFV-5E902029FCC**5.7 Transmitter spectrum mask**

For test instruments and accessories used see section 6 Part MB.

5.7.1 Description of the test location

Test location: AREA4

5.7.2 Photo documentation of the test set-up**5.7.3 Test result**

The absolute levels of RF power at any frequency shall not exceed the limits defined in FCC Part §15.225 a-d

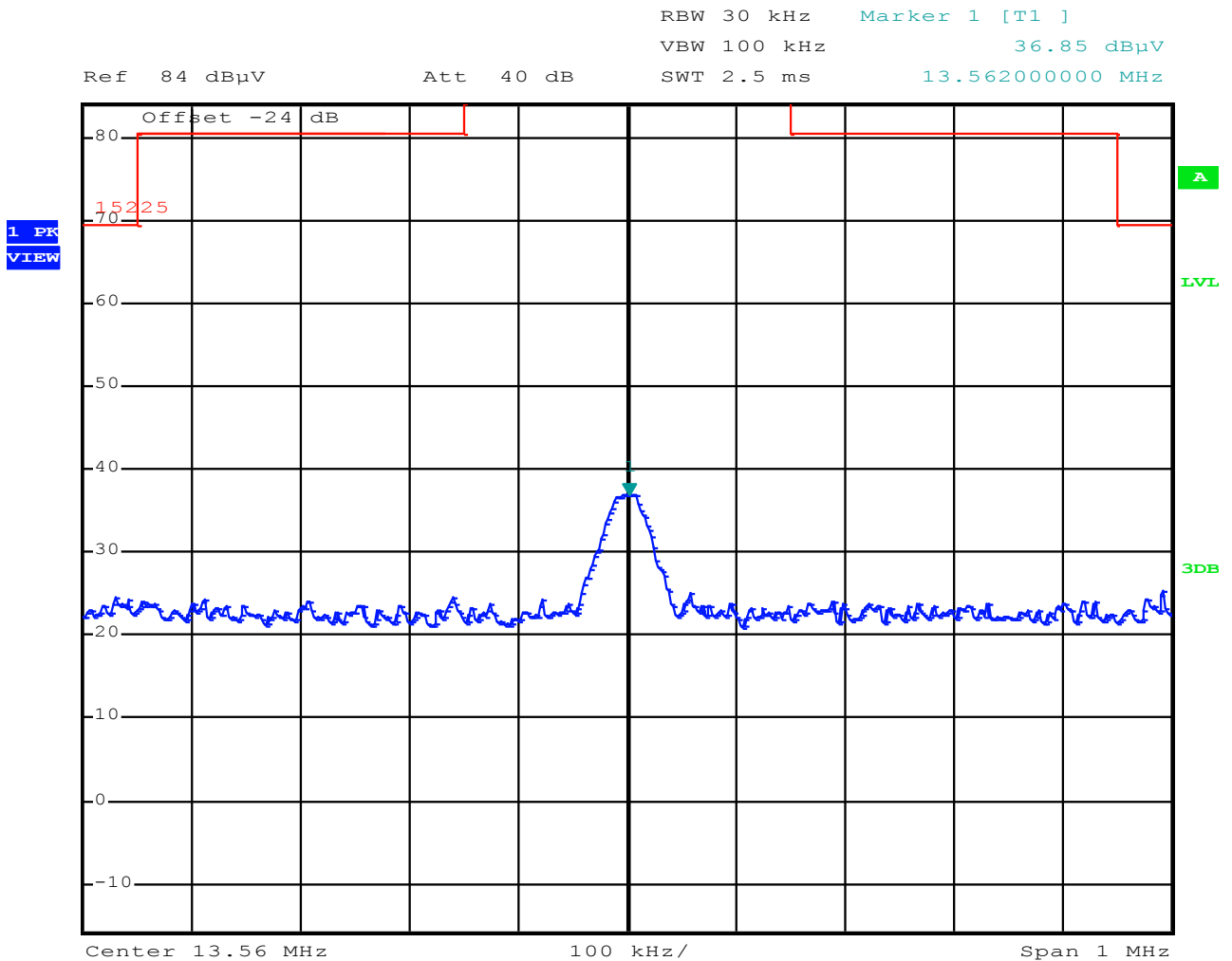
The requirements are **FULFILLED**.

Remarks:

FCC ID: 2ADFV-5E902029FCC

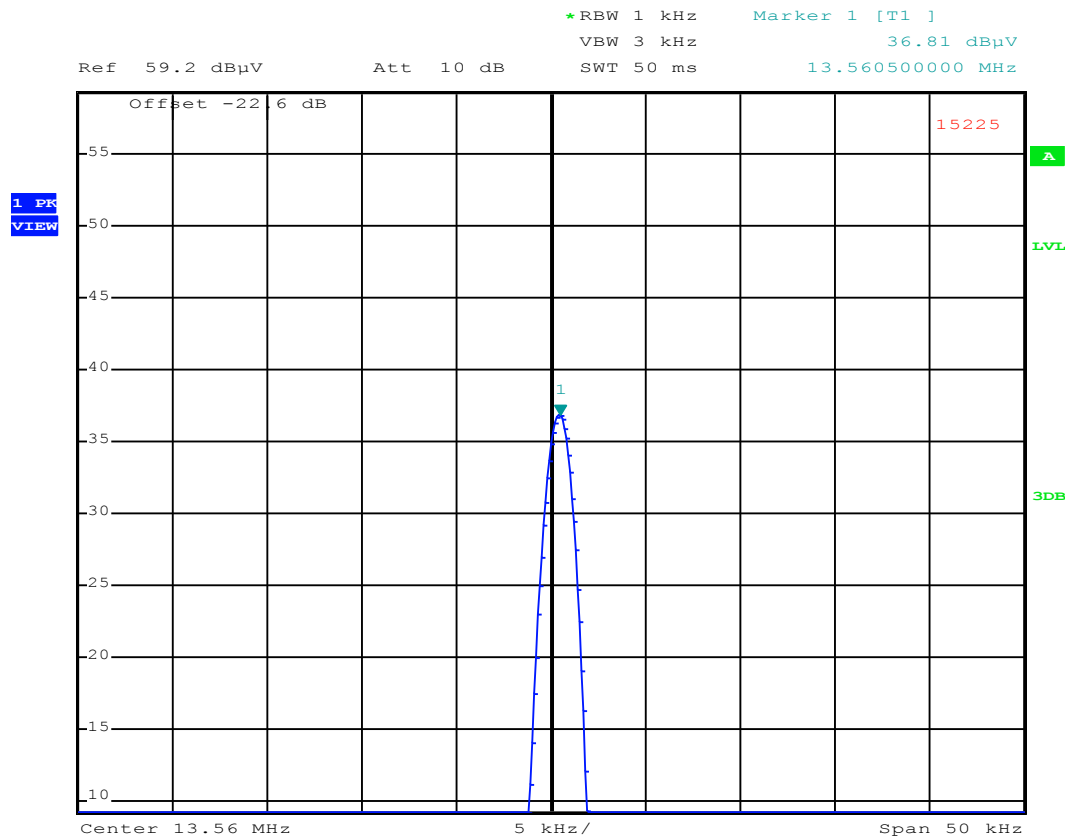
5.7.4 Test protocol

Spectrum mask for modulated signal



FCC ID: 2ADFFV-5E902029FCC

Spectrum mask for modulated signal



6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used, in addition to the test accessories, are calibrated and verified regularly.

The calibration intervals and the calibration history will be given out on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	ESHS 30	02-02/03-05-002	17/07/2015	17/07/2014		
	ESH 2 - Z 5	02-02/20-05-004	18/10/2014	18/10/2013	28/08/2014	28/02/2014
	N-4000-BNC	02-02/50-05-138				
	N-1500-N	02-02/50-05-140				
	ESH 3 - Z 2	02-02/50-05-155			10/10/2014	10/04/2014
	SP 103 /3.5-60	02-02/50-05-182				
CPR 1	ESR 7	02-02/03-13-001	03/06/2015	03/06/2014		
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
FE	FSP 30	02-02/11-05-001	24/10/2014	24/10/2013		
	HFRAE 5161 _ 50 kHz-120	02-02/24-11-004				
	METRA HIT World	02-02/32-10-001	21/08/2015	21/08/2014		
	WK-340/40	02-02/45-05-001	24/06/2015	24/06/2014	24/12/2014	24/06/2014
	6543A	02-02/50-05-157				
MB	FSP 30	02-02/11-05-001	24/10/2014	24/10/2013		
	HFRAE 5161 _ 50 kHz-120	02-02/24-11-004				
	METRA HIT World	02-02/32-10-001	21/08/2015	21/08/2014		
	WK-340/40	02-02/45-05-001	24/06/2015	24/06/2014	24/12/2014	24/06/2014
	6543A	02-02/50-05-157				
SER 1	ESR 7	02-02/03-13-001	03/06/2015	03/06/2014		
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
SER 2	ESVS 30	02-02/03-05-006	03/07/2015	03/07/2014		
	VULB 9168	02-02/24-05-005	08/04/2015	08/04/2014	08/10/2014	08/04/2014
	S10162-B	02-02/50-05-031				
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				