EMI – TEST REPORT

- FCC Part 15.225 -

Type / Model Name	:	5E9030.29
Product Description	:	Transponder Reader Mifare 22mm 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**

Test Report No. :	**T41334-00-00HU**	19. September 2016 Date of issue

Deutsche Akkreditierungsstelle D-PL-12030-01-00

Contents

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (October, 2015)

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 15.38	Incorporation by reference

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (October, 2015)

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 15.207	Conducted limits
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements
Part 15, Subpart C, Section 15.215	Additional provisions to the general radiated emission limitations
Part 15, Subpart C, Section 15.225	Operation within the band 13.110 - 14.010 MHz

FCC Rules and Regulations Part 1, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969

Part 1, Subpart I, Section 1.1310	Radiofrequency radiation exposure limits
Part 1, Subpart 2, Section 2.1093	Radiofrequency radiation exposure evaluation: portable device

OET Bulletin 65, 65A, 65B, 65C Edition 97-01, August 1997 – Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

ANSI C63.10: 2013	Testing Unlicensed Wireless Devices
ANSI C95.1:2005	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:

For testing, the USB Transponder Reader was set in TX-continuous mode. The test software is available for testing only.

All radiated measurements were made with the device positioned in table top orientation.
The values in the test report shows only the maximum measured value.

For detailed information about the device please refer to the user manual.

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 : 06. July 2016

Testing concluded on : 14. July 2016

Checked by:

Klaus Gegenfurtner
I confirm the correctness and Integrity of this document
2016.09.20 08:14:34 +02'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:

Markus Huber
I'm the author of this document
2016.09.19 16:38:50 +02'00'

Markus Huber

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EUT – See attachment A

3.2 Power supply system utilised

Power supply voltage : Supplied via USB 5.0 V / DC

3.3 Short description of the equipment under test (EUT)

The EuT is a Transponder Reader which will be powerd via USB – Port.

Number of tested samples: 1
Serial number: Prototype

EUT operation mode:

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

- Cont. tag reading mode at 13.56 MHz

- Standby

EUT configuration:

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

- Test software Model : Supplied by manufacturer
- LapTop Model : Supplied by CSA Group Bayern GmbH
- Model :

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY

4.2 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

4.3 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.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	± 3.29 dB
20 dB Bandwidth	Center frequency of EuT	95%	± 2.5 x 10^{-7}
99% Occupied Bandwidth	Center frequency of EuT	95%	± 2.5 x 10^{-7}
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	± 3.53 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	± 3.71 dB
Radiated Spurious Emissions	1000 MHz to 10000 MHz	95%	± 2.34 dB
Peak conducted output power	902 MHz to 928 MHz	95%	± 0.35 dB
Conducted Spurious Emissions	9 kHz to 10000 MHz	95%	± 2.15 dB

4.1 Measurement Protocol for FCC

4.1.1 GENERAL INFORMATION

4.1.1.1 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.

4.1.1.2 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.

4.1.2 DETAILS OF TEST PROCEDURES

General Standard information

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.

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

See attachment C

5.1.3 Applicable standard

According to FCC Part 15, Section 15.107(a):
Except for Class A devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the given limits.

5.1.4 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.4 described under item 4.4.3. 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.

5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin 19.59 dB at 0.498 MHz

Limit according to FCC Part 15, Section 15.107(a):

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

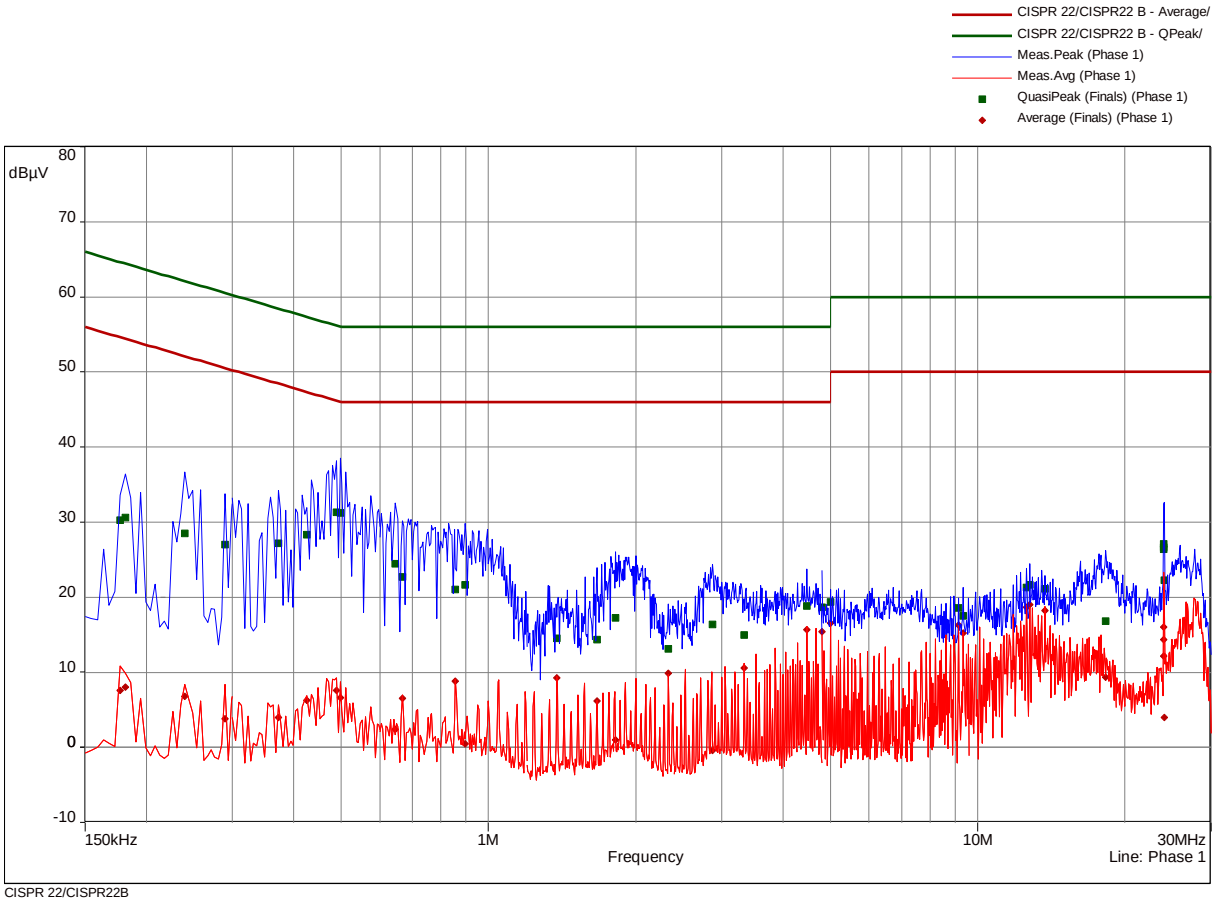
* Decreases with the logarithm of the frequency

The requirements are **FULFILLED.**

Remarks: For detailed test result please refer to following test protocols

5.1.6 Test protocol

Test point L1 Result: Passed
Operation mode: Standby - Connection via USB
Remarks:
Tested by: Huber Ma.

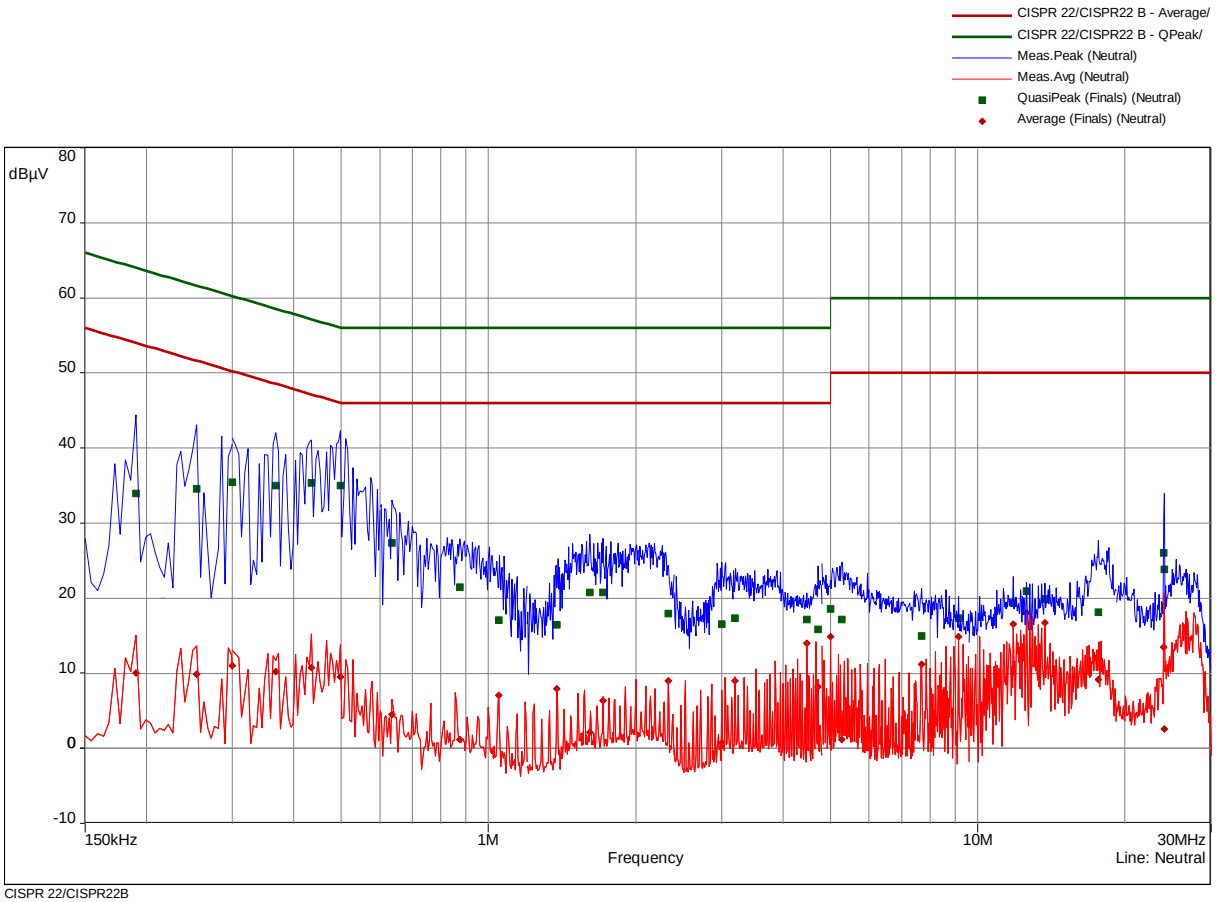


FCC ID: 2ADFV-5E903029

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.177	1	30.24	34.38	64.63	7.60	47.02	54.63	Phase 1	9.84
0.1815	1	30.66	33.76	64.42	8.04	46.38	54.42	Phase 1	9.84
0.24	1	28.49	33.60	62.10	6.80	45.29	52.10	Phase 1	9.83
0.2895	1	27.02	33.52	60.54	3.82	46.72	50.54	Phase 1	9.82
0.372	2	27.20	31.26	58.46	3.97	44.48	48.46	Phase 1	9.81
0.426	2	28.29	29.04	57.33	6.24	41.09	47.33	Phase 1	9.81
0.489	2	31.29	24.89	56.18	7.60	38.59	46.18	Phase 1	9.82
0.498	2	31.25	24.78	56.03	6.58	39.45	46.03	Phase 1	9.82
0.645	3	24.49	31.51	56.00	2.39	43.61	46.00	Phase 1	9.81
0.6675	3	22.70	33.30	56.00	6.55	39.45	46.00	Phase 1	9.81
0.8565	3	21.07	34.93	56.00	8.86	37.14	46.00	Phase 1	9.81
0.897	3	21.66	34.34	56.00	0.46	45.54	46.00	Phase 1	9.81
1.38	4	14.52	41.48	56.00	9.27	36.73	46.00	Phase 1	9.79
1.668	4	14.36	41.64	56.00	6.16	39.84	46.00	Phase 1	9.79
1.8165	4	17.21	38.79	56.00	1.00	45.00	46.00	Phase 1	9.80
2.334	4	13.12	42.88	56.00	9.83	36.17	46.00	Phase 1	9.79
2.868	5	16.40	39.60	56.00	-0.40	46.40	46.00	Phase 1	9.79
3.336	5	14.93	41.07	56.00	10.54	35.46	46.00	Phase 1	9.81
4.479	5	18.86	37.14	56.00	15.71	30.29	46.00	Phase 1	9.81
4.809	6	18.63	37.37	56.00	15.43	30.57	46.00	Phase 1	9.82
5.0025	6	19.35	40.65	60.00	16.56	33.44	50.00	Phase 1	9.82
9.147	6	18.57	41.43	60.00	16.29	33.71	50.00	Phase 1	9.87
9.336	6	17.52	42.48	60.00	15.21	34.79	50.00	Phase 1	9.88
12.5745	7	21.32	38.68	60.00	18.66	31.34	50.00	Phase 1	10.00
12.7635	7	21.67	38.33	60.00	18.98	31.02	50.00	Phase 1	10.01
13.7175	7	21.16	38.84	60.00	18.20	31.80	50.00	Phase 1	10.05
18.258	7	16.77	43.23	60.00	9.31	40.69	50.00	Phase 1	10.25
23.997	8	27.10	32.90	60.00	14.35	35.65	50.00	Phase 1	10.34
24.0015	8	26.63	33.37	60.00	12.19	37.81	50.00	Phase 1	10.34
24.006	8	26.43	33.57	60.00	16.00	34.00	50.00	Phase 1	10.34
24.0555	8	22.29	37.71	60.00	4.03	45.97	50.00	Phase 1	10.34

FCC ID: 2ADFV-5E903029

Test point	N	Result: Passed
Operation mode:	Standby - Connection via USB	
Remarks:		
Tested by:	Huber Ma.	



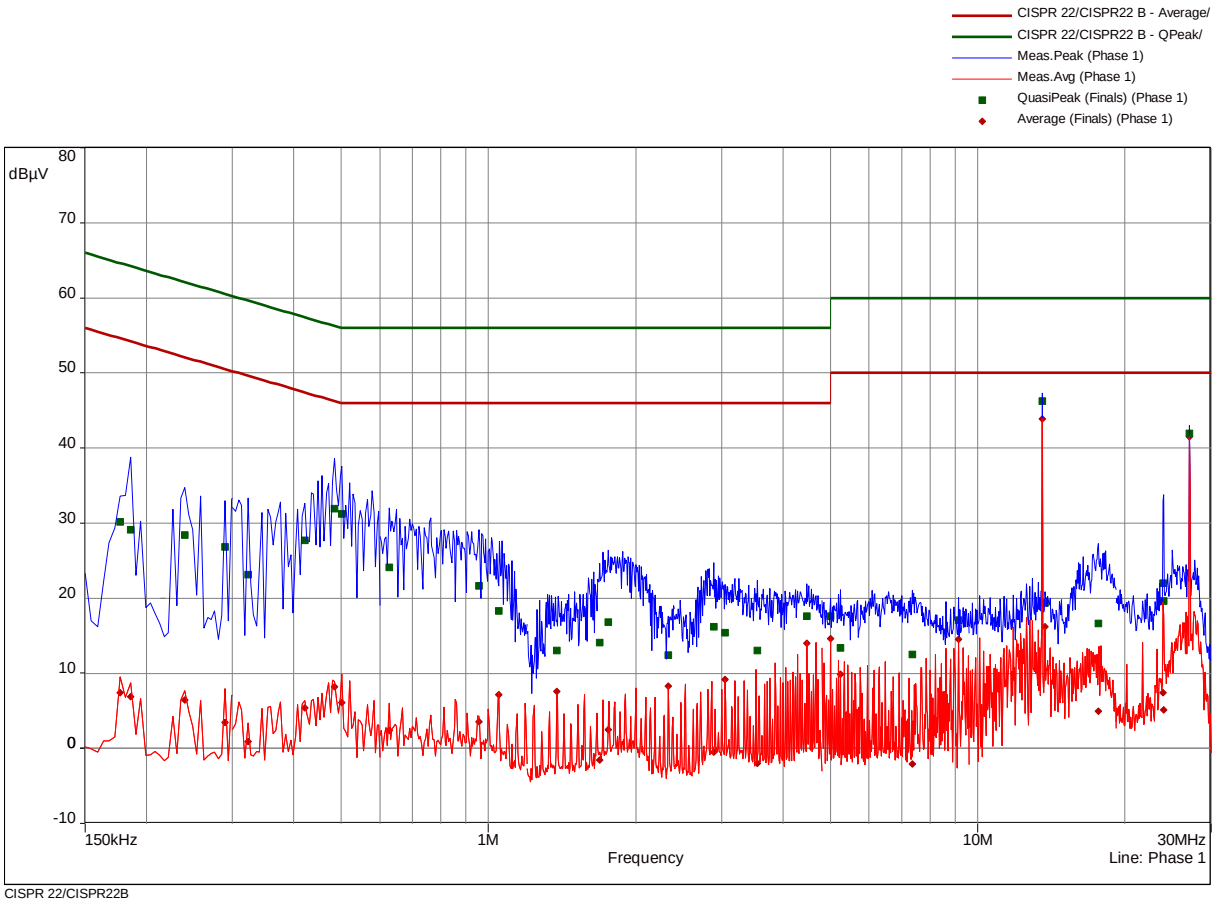
CISPR 22/CISPR22B

FCC ID: 2ADFV-5E903029

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.1905	9	33.96	30.05	64.01	10.01	44.01	54.01	Neutral	9.85
0.2535	9	34.55	27.09	61.64	9.88	41.76	51.64	Neutral	9.84
0.3	10	35.48	24.76	60.24	11.03	39.21	50.24	Neutral	9.82
0.3675	10	35.03	23.52	58.56	10.23	38.33	48.56	Neutral	9.81
0.435	10	35.37	21.78	57.16	10.78	36.38	47.16	Neutral	9.82
0.498	10	35.00	21.03	56.03	9.52	36.51	46.03	Neutral	9.82
0.636	11	27.38	28.62	56.00	4.51	41.49	46.00	Neutral	9.81
0.8745	11	21.45	34.55	56.00	1.19	44.81	46.00	Neutral	9.81
1.05	11	17.05	38.95	56.00	7.08	38.92	46.00	Neutral	9.81
1.38	12	16.50	39.50	56.00	7.96	38.04	46.00	Neutral	9.79
1.614	12	20.80	35.20	56.00	2.10	43.90	46.00	Neutral	9.79
1.7175	12	20.81	35.19	56.00	6.40	39.60	46.00	Neutral	9.79
2.334	12	17.92	38.08	56.00	9.03	36.97	46.00	Neutral	9.79
2.994	13	16.58	39.42	56.00	0.75	45.25	46.00	Neutral	9.79
3.192	13	17.36	38.64	56.00	9.00	37.00	46.00	Neutral	9.80
4.479	13	17.20	38.80	56.00	14.00	32.00	46.00	Neutral	9.80
4.713	13	15.86	40.14	56.00	8.19	37.81	46.00	Neutral	9.81
5.0025	14	18.56	41.44	60.00	14.89	35.11	50.00	Neutral	9.81
5.2815	14	17.16	42.84	60.00	1.20	48.80	50.00	Neutral	9.81
7.671	14	14.95	45.05	60.00	11.17	38.83	50.00	Neutral	9.81
9.147	14	17.36	42.64	60.00	14.84	35.16	50.00	Neutral	9.81
11.814	15	19.34	40.66	60.00	16.52	33.48	50.00	Neutral	9.85
12.5745	15	20.92	39.08	60.00	18.03	31.97	50.00	Neutral	9.87
13.7175	15	19.89	40.11	60.00	16.71	33.29	50.00	Neutral	9.90
17.628	15	18.15	41.85	60.00	9.20	40.80	50.00	Neutral	10.02
23.9745	16	26.01	33.99	60.00	13.51	36.49	50.00	Neutral	9.96
24.0915	16	23.82	36.18	60.00	2.60	47.40	50.00	Neutral	9.96

FCC ID: 2ADFV-5E903029

Test point	L1	Result: Passed
Operation mode:	Cont. Tx at 13.56 MHz	
Remarks:	Connection via USB	
Tested by:	Huber Ma.	



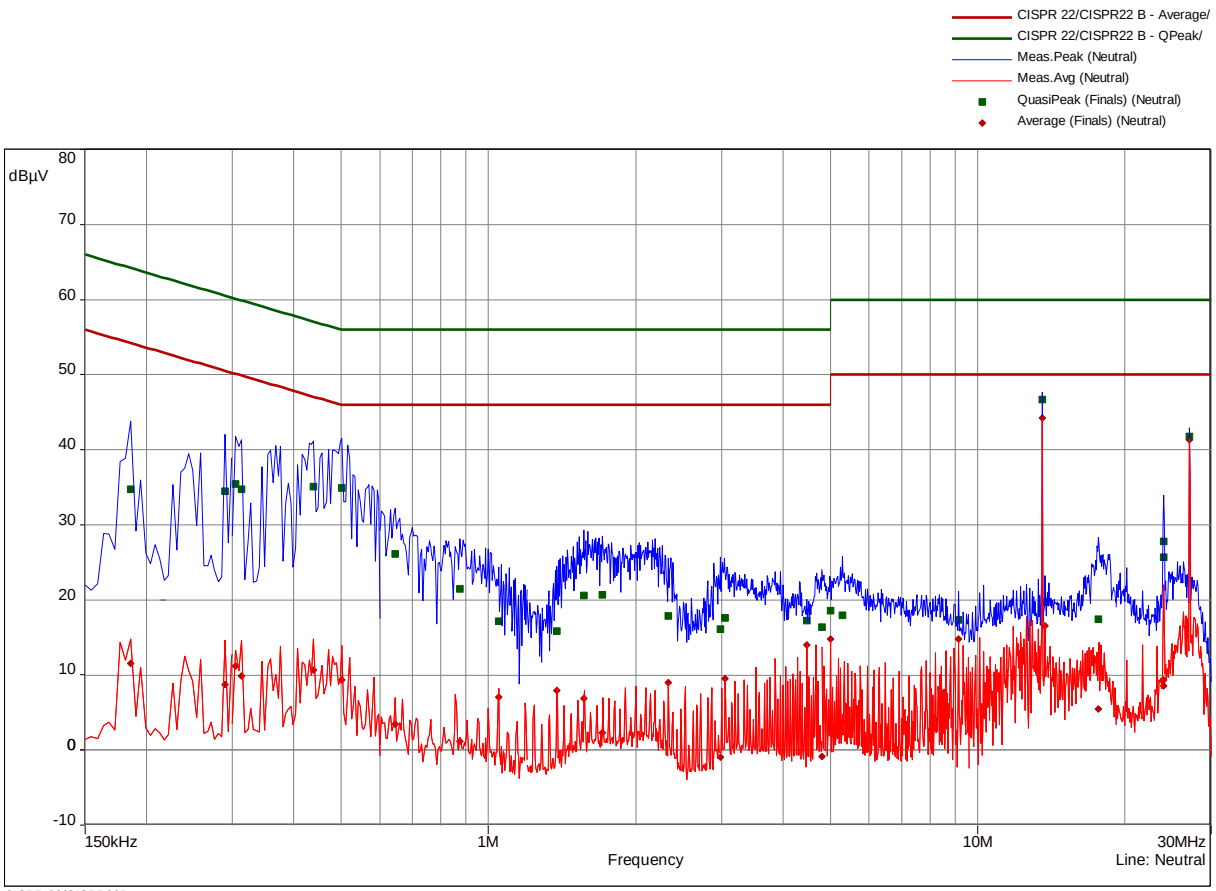
freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.177	1	30.19	34.43	64.63	7.43	47.20	54.63	Phase 1	9.84
0.186	1	29.14	35.07	64.21	6.92	47.29	54.21	Phase 1	9.84
0.24	1	28.41	33.68	62.10	6.48	45.61	52.10	Phase 1	9.83
0.2895	1	26.84	33.69	60.54	3.41	47.13	50.54	Phase 1	9.82
0.3225	2	23.18	36.46	59.64	0.94	48.70	49.64	Phase 1	9.82
0.4215	2	27.67	29.74	57.42	5.35	42.07	47.42	Phase 1	9.81
0.4845	2	31.97	24.29	56.26	8.18	38.08	46.26	Phase 1	9.82
0.5025	2	31.22	24.78	56.00	6.12	39.88	46.00	Phase 1	9.82
0.627	3	24.07	31.93	56.00	2.36	43.64	46.00	Phase 1	9.82
0.9555	3	21.64	34.36	56.00	3.52	42.48	46.00	Phase 1	9.82

FCC ID: 2ADFV-5E903029

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
1.05	3	18.34	37.66	56.00	7.13	38.87	46.00	Phase 1	9.81
1.38	4	12.99	43.01	56.00	7.60	38.40	46.00	Phase 1	9.79
1.6905	4	14.08	41.92	56.00	-1.57	47.57	46.00	Phase 1	9.79
1.758	4	16.82	39.18	56.00	2.48	43.52	46.00	Phase 1	9.79
2.334	4	12.38	43.62	56.00	8.26	37.74	46.00	Phase 1	9.79
2.886	5	16.23	39.77	56.00	-0.51	46.51	46.00	Phase 1	9.79
3.048	5	15.44	40.56	56.00	9.19	36.81	46.00	Phase 1	9.80
3.543	5	13.08	42.92	56.00	-2.02	48.02	46.00	Phase 1	9.82
4.479	5	17.57	38.43	56.00	13.98	32.02	46.00	Phase 1	9.81
5.0025	6	17.59	42.41	60.00	14.65	35.35	50.00	Phase 1	9.82
5.241	6	13.38	46.62	60.00	9.86	40.14	50.00	Phase 1	9.83
7.347	6	12.51	47.49	60.00	-2.06	52.06	50.00	Phase 1	9.85
9.147	6	17.05	42.95	60.00	14.57	35.43	50.00	Phase 1	9.87
13.56	7	46.29	13.71	60.00	43.84	6.16	50.00	Phase 1	10.04
13.7175	7	19.37	40.63	60.00	16.18	33.82	50.00	Phase 1	10.05
17.6505	7	16.65	43.35	60.00	4.95	45.05	50.00	Phase 1	10.22
23.943	8	21.98	38.02	60.00	7.37	42.63	50.00	Phase 1	10.34
23.961	8	19.62	40.38	60.00	5.08	44.92	50.00	Phase 1	10.34
27.12	8	41.95	18.05	60.00	41.55	8.45	50.00	Phase 1	10.34

FCC ID: 2ADFV-5E903029

Test point	N	Result: Passed
Operation mode:	Cont. Tx at 13.56 MHz	
Remarks:	Connection via USB	
Tested by:	Huber Ma.	



CISPR 22/CISPR22B

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.186	9	34.77	29.44	64.21	11.57	42.65	54.21	Neutral	9.85
0.2895	9	34.44	26.10	60.54	8.75	41.79	50.54	Neutral	9.82
0.3045	10	35.42	24.70	60.12	11.16	38.96	50.12	Neutral	9.82
0.3135	10	34.70	25.17	59.88	9.89	39.99	49.88	Neutral	9.82
0.4395	10	35.06	22.01	57.07	10.64	36.43	47.07	Neutral	9.82
0.5025	10	34.92	21.08	56.00	9.32	36.68	46.00	Neutral	9.82
0.645	11	26.15	29.85	56.00	3.47	42.53	46.00	Neutral	9.81
0.8745	11	21.47	34.53	56.00	1.20	44.80	46.00	Neutral	9.81

FCC ID: 2ADFV-5E903029

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
1.05	11	17.17	38.83	56.00	7.08	38.92	46.00	Neutral	9.81
1.38	12	15.83	40.17	56.00	7.92	38.08	46.00	Neutral	9.79
1.569	12	20.61	35.39	56.00	6.92	39.08	46.00	Neutral	9.79
1.7085	12	20.66	35.34	56.00	2.27	43.73	46.00	Neutral	9.79
2.334	12	17.83	38.17	56.00	8.99	37.01	46.00	Neutral	9.79
2.976	13	16.14	39.86	56.00	-0.90	46.90	46.00	Neutral	9.79
3.048	13	17.62	38.38	56.00	9.55	36.45	46.00	Neutral	9.79
4.479	13	17.25	38.75	56.00	13.98	32.02	46.00	Neutral	9.80
4.8	13	16.40	39.60	56.00	-0.85	46.85	46.00	Neutral	9.81
5.0025	14	18.54	41.46	60.00	14.84	35.16	50.00	Neutral	9.81
5.2905	14	17.99	42.01	60.00	3.74	46.26	50.00	Neutral	9.81
9.147	14	17.34	42.66	60.00	14.75	35.25	50.00	Neutral	9.81
13.56	15	46.71	13.29	60.00	44.23	5.77	50.00	Neutral	9.89
13.7175	15	19.73	40.27	60.00	16.52	33.48	50.00	Neutral	9.90
17.6505	15	17.47	42.53	60.00	5.46	44.54	50.00	Neutral	10.02
23.988	16	27.84	32.16	60.00	9.36	40.64	50.00	Neutral	9.96
23.9925	16	25.66	34.34	60.00	8.53	41.47	50.00	Neutral	9.96
27.12	16	41.81	18.19	60.00	41.37	8.63	50.00	Neutral	9.83

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

See attachment C

5.2.3 Applicable standard

According to FCC Part 15, Section 15.225(a):
The field strength of any emission within the band 13.553 – 13.567 MHz shall not exceed 15848 µV/m at 30 m.

5.2.4 Description of Measurement

The transmitted field strength of the EUT has to be measured at an open area test site using a tuned receiver and a shielded loop antenna. The set up of the equipment under test will be in accordance with ANSI C63.4. The measurement has been performed at 3 m. The results have been compared to the limits defined at 30 m distances according to FCC Part 15C, Section 15.31(f)(2) using an inverse linear distance extrapolation factor of 40 dB/decade.

5.2.5 Test result

a) Result at a measurement distance of 3m

Frequency (MHz)	Level PK (dBµV)	Level AV (dBµV)	Level QP (dBµV)	Band-width (kHz)	Correct. factor (dB)	Corrected Level PK dB(µV/m)	Corrected Level AV dB(µV/m)	Corrected Level QP dB(µV/m)
13.56	25.9	20.6	22.03	9.0	20	45.9	40.6	42.03

b) Result extrapolated to a distance of 30 m

Frequency (MHz)	Level PK (dBµV)	Level AV (dBµV)	Level QP (dBµV)	Correct. factor (dB)	Corrected Level PK dB(µV/m)	Corrected Level AV dB(µV/m)	Corrected Level QP dB(µV/m)	Limit dB(µV/m)	Delta (dB)
13.56	-14.10	-19.40	-17.97	20	5.9	0.6	2.03	84.0	-83.4

Limit according to FCC Part 15, Section 15.225(a):

Frequency	Field strength of fundamental wave		Measurement distance
(MHz)	(µV/m)	dB(µV/m)	(metres)
13.553 - 13.567	15848	84.0	30

The requirements are **FULFILLED.**

Remarks: _____

_____

5.3 Spurious emissions

For test instruments and accessories used see section 6 Part SER 1, SER 2.

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

See attachment C

5.3.3 Applicable standard

According to FCC Part 15C, Section 15.209:
The emissions from an intentional radiator shall not exceed the field strength levels specified in the table below.

5.3.4 Description of Measurement

The spurious emissions of the EUT have to be measured at an open area test site in the frequency range from 9 kHz to 1000 MHz using a tuned EMI receiver. The set up of the equipment under test will be in accordance with ANSI C63.4. The measurement has been performed at 3 m. The results have been compared to the limits defined at 30 m or 300 m distances according to FCC Part 15C, Section 15.31(f)(2) using an inverse linear distance extrapolation factor of 40 dB/decade. The final measurement has been performed with the EMI receiver using 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).
The resolution bandwidth during the measurement is as follows:

9 kHz – 150 kHz:	RBW:	200 Hz
150 kHz – 30 MHz:	RBW:	9 kHz
30 MHz – 1000 MHz:	RBW:	120 kHz

5.3.5 Test result

Results at a measurement distance of 3m

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

Frequency [MHz]	L: QP [dBµV]	Correct. [dB]	L: QP [dBµV/m]	Limit [dBµV/m]	Delta [dB]
33.78	3.7	13.4	17.1	40.0	-22.9
118.54	9.3	12.9	22.2	43.5	-21.3
517.43	4.8	21.9	26.7	46.0	-19.3

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

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

Frequency	Field strength of spurious emissions		Measurement distance
(MHz)	(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
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: Measurement has been performed up to 1 GHz.

No undesired emissions occurred in the frequency range from 9 kHz up to 135.6 MHz

5.4 Frequency tolerance

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

5.4.1 Description of the test location

Test location: AREA4 (Climatic Chamber)

5.4.2 Photo documentation of the test set-up

See attachment C

5.4.3 Applicable standard

According to FCC Part 15, Section 15.225(e):
The frequency tolerance of t he carrier signal shall be maintained within ±0.01 % of the operating frequency over a temperature range of -20 °C to +50 °C at normal supply voltage and for a variation in the primary supply voltage from 85 % to 115 % of the rated supply voltage at a temperature of 20 °C. For battery operated equipment, the equipment shall be performed using a new battery.

5.4.4 Description of Measurement

The frequency tolerance has been measured radiated using a spectrum analyser. The center frequency of the spectrum analyser has been set to the fundamental frequency. This is an alternative test method because the EuT can not be operated in un-modulated mode. The limit line was set to 10 dB below the carrier. The frequencies of the upper (f_U) and lower (f_L) points, where the displayed power envelope of the modulation including frequency drift is equal to the appropriate level, have been recorded. The centre frequency is calculated as $f_C = (f_U + f_L)/2$. The measurement has been performed at normal and extreme test conditions from -20 °C to +50 °C in steps of 10 degrees (According to FCC Part 2.1055).

5.4.5 Test result

Test conditions		Test result Frequency (MHz)
T_{min} (-20)°C	V_{nom} (5.0 V)	13.560312
T (-10)°C	V_{nom} (5.0 V)	13.560292
T (0)°C	V_{nom} (5.0 V)	13.560272
T (10)°C	V_{nom} (5.0 V)	13.560252
T_{nom} (20)°C	V_{min} (4.25 V)	13.560272
	V_{nom} (5.0 V)	13.560272
	V_{max} (5.75 V)	13.560272
T (30)°C	V_{nom} (5.0 V)	13.560272
T (40)°C	V_{nom} (5.0 V)	13.560272
T_{max} (50)°C	V_{nom} (5.0 V)	13.560272
Measurement uncertainty		± 10 Hz

Carrier frequency: f_c = 13.56 MHz

Max. tolerance: ± 0.01 % of 13.56 MHz = ± 1.356 kHz

Lowest frequency: f_l = 13.560252 MHz

Lowest tolerance: $f_l - f_c$ = - 0.20kHz < - 1.356 kHz

Limit according to FCC Part 15, Section 15.225(e):
The frequency tolerance of the carrier signal shall be maintained within ±0.01 % of the operating frequency.

The requirements are **FULFILLED.**

Remarks: _____

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5.5 20 dB Bandwidth

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

5.5.1 Description of the test location

Test location: AREA4

5.5.2 Photo documentation of the test set-up

See attachment C

5.5.3 Applicable standard

According to FCC Part 15C, Section 15.215(c):
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in section 15.217 to 15.257, must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed.

5.5.4 Description of Measurement

The frequency range has been measured radiated using a test fixture and a spectrum analyser. The limit line is set to 20 dB below the carrier. The frequency of the upper (F_H) and lower (F_L) points, where the displayed power envelope of the modulation including frequency drift is equal to the appropriate level, is recorded as the modulation bandwidth. The measurement has been performed at normal and extreme test conditions in modulated transmitting mode.
Spectrum analyzer settings:
RBW: 1 kHz
VBW: 3 kHz
Detector Peak

5.5.5 Test result

Carrier Frequency (MHz)	(F_L) (MHz)	(F_H) (MHz)	Bandwidth (kHz)	Limit (kHz)
13.56	13.557452	13.562752	5.3	14.0

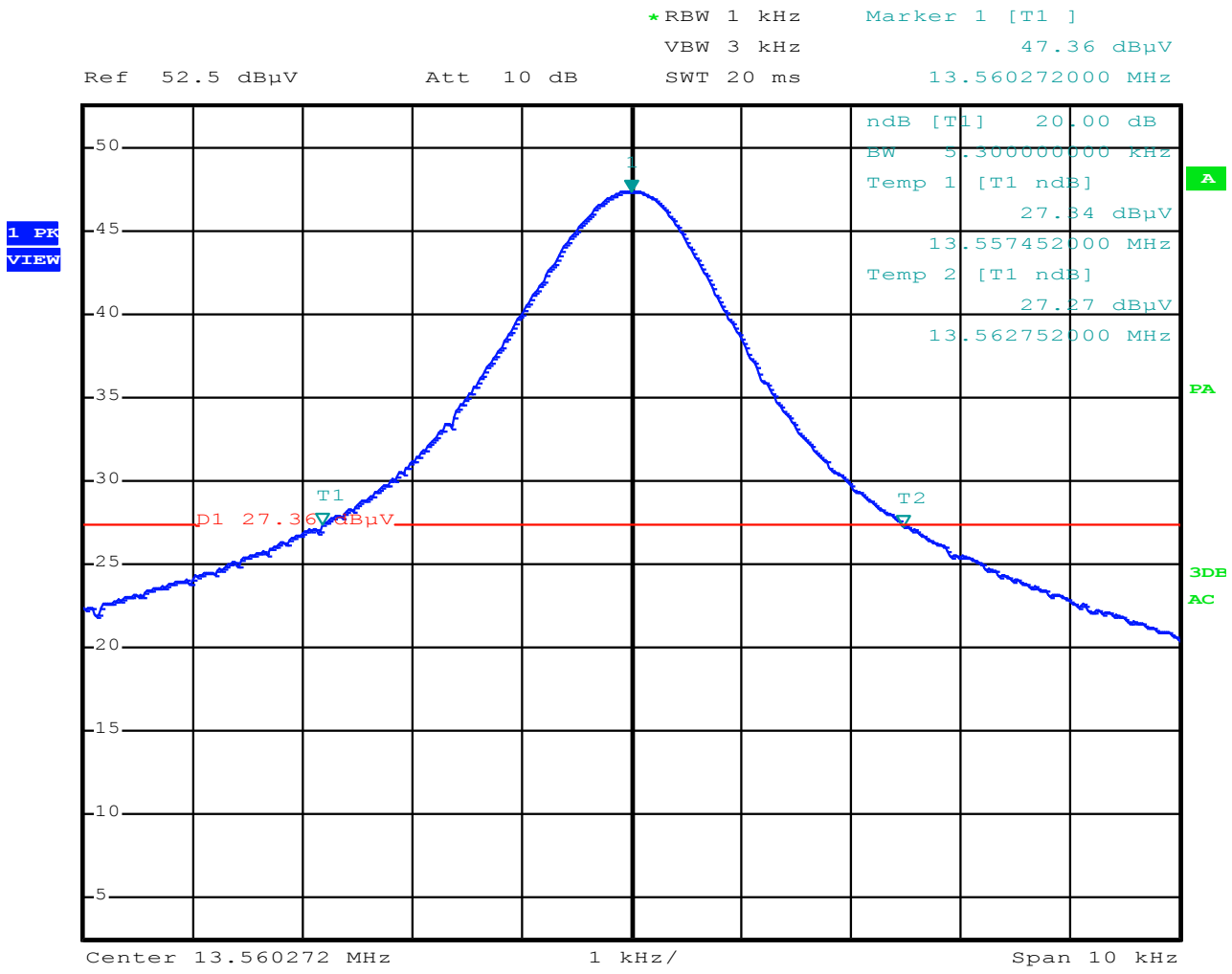
Limit according to FCC Part 15C, Section 15.215(c):

Frequency band (MHz)	Limit 20 dB bandwidth (kHz)
13.553 - 13.567	14.0

The requirements are **FULFILLED.**

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

5.5.6 Test protocol



5.6 Transmitter spectrum mask

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

5.6.1 Description of the test location

Test location: AREA4

5.6.2 Photo documentation of the test set-up

See attachment C

5.6.3 Applicable standard

According to FCC Part 15C, Section 15.225 (a-d):
The field strength of any emission shall not exceed the limits given in FCC Part 15C, Section 15.225 (a-d)

5.6.4 Description of Measurement

The spectrum mask is measured using a spectrum analyser. The profile of the spectrum mask is displayed on analyser and have to be adjusted to the reference level given as maximum output power measured in OATS. The marker is set up manually to the particular maximum level at the effective limit in the frequency range and recorded. The measurement was performed radiated.

5.6.5 Test result

Frequency band (MHz)	Emission level (dBµV/m)	Limit (dBµV/m)
13.110 – 13.410	≤ 10	40.5
13.410 - 13.553	≤ 10	50.5
13.553 - 13.567	0.6	84.0
13.567 – 13.710	≤ 10	50.5
13.710 – 14.010	≤ 20	40.5
outside of 13.110 – 14.010	≤ 10	29.5

Limits according to FCC Part 15C, Section 15.225(a-d):
The absolute levels of RF power at any frequency shall not exceed the limits defined in the following table:

Frequency band (MHz)	Emission level limit at 30 m (µV/m)
13.110 – 13.410	106
13.410 - 13.553	334
13.553 - 13.567	15.848
13.567 – 13.710	334
13.710 – 14.010	106
outside of 13.110 – 14.010	30

The requirements are **FULFILLED.**

Remarks: _____

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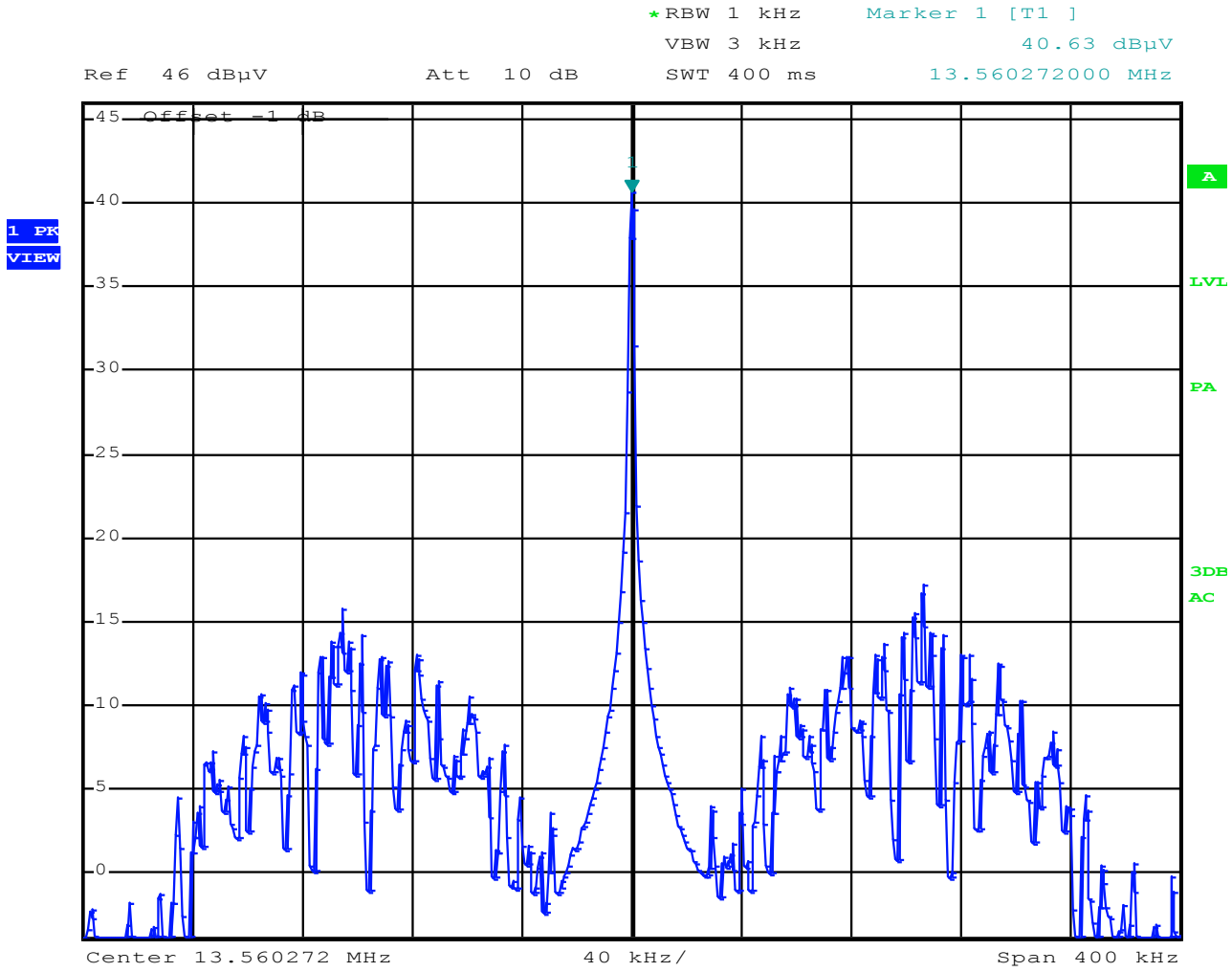
5.6.6 Test protocol

Spectrum mask of modulated signal



The values of the plot are extrapolated to a measurement distance of 3 m. (calculated Limit 124 dBµV/m)

5.7 Receiver radiated emissions

5.7.1 Description of the test location

Test location: None

5.7.2 Applicable standard

According to FCC Part 15, Section 15.109(a):
The emission of an unintentional radiator shall not exceed the specified field strength level at 3 m.

Remarks: This test is not applicable. The receive mode is too short to make an assessment.

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available 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	17/07/2016	17/07/2015		
	ESH 2 - Z 5	02-02/20-05-004	26/10/2017	26/10/2015	21/07/2016	21/01/2016
	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	06/11/2016	06/11/2015	21/09/2016	21/03/2016
	SP 103 /3.5-60	02-02/50-05-182				
CPR 1	FMZB 1516	01-02/24-01-018			21/01/2017	21/01/2016
	ESCI	02-02/03-05-004	17/09/2016	17/09/2015		
	INA 265 A / CAS 3025	02-02/50-05-028	13/04/2017	13/04/2016		
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
FE	ESCI	02-02/03-05-004	17/09/2016	17/09/2015		
	HFRAE 5161 _ 50 kHz-120	02-02/24-11-004				
	METRAHIT WORLD	02-02/32-15-001	24/11/2016	24/11/2015		
	WK-340/40	02-02/45-05-001	07/07/2016	07/07/2015		
	6543A	02-02/50-05-157				
MB	FSP 30	02-02/11-05-001	01/10/2016	01/10/2015		
	HFRAE 5161 _ 50 kHz-120	02-02/24-11-004				
SER 1	FMZB 1516	01-02/24-01-018			21/01/2017	21/01/2016
	ESCI	02-02/03-05-004	17/09/2016	17/09/2015		
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
SER 2	ESVS 30	02-02/03-05-003	09/07/2016	09/07/2015		
	VULB 9168	02-02/24-05-005	20/04/2017	20/04/2016	20/10/2016	20/04/2016
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				