



EMI – TEST REPORT

- FCC Part 15.225 -

Type / Model Name : EBI 10-System (IF 100, IF 100-1, IF 150, IF 200)

Product Description : Wireless data logger system

Applicant : Xylem Analytics Germany GmbH

Address : Dr. Karl-Slevogt-Str. 1
82362 Weilheim, Germany

Manufacturer : Xylem Analytics Germany GmbH

Address : Dr. Karl-Slevogt-Str. 1
82362 Weilheim, Germany

Licence holder : Xylem Analytics Germany GmbH

Address : Dr. Karl-Slevogt-Str. 1
82362 Weilheim, Germany

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

POSITIVE

Test Report No. : T40058-00-02HU

05. September 2016
Date of issue



Deutsche
Akkreditierungsstelle
D-PL-12030-01-00

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.

Contents

1	<u>TEST STANDARDS</u>	3
2	<u>SUMMARY</u>	4
3	<u>EQUIPMENT UNDER TEST</u>	5
3.1	Photo documentation of the EUT – See attachment A	5
3.2	Power supply system utilised	5
3.3	Short description of the equipment under test (EUT)	5
4	<u>TEST ENVIRONMENT</u>	6
4.1	Address of the test laboratory	6
4.2	Environmental conditions	6
4.3	Statement of the measurement uncertainty	6
4.1	Measurement Protocol for FCC	7
5	<u>TEST CONDITIONS AND RESULTS</u>	8
5.1	AC power line conducted emissions	8
5.2	Field strength of the fundamental wave	18
5.3	Spurious emissions	20
5.4	Frequency tolerance	23
5.5	20 dB Bandwidth	25
5.6	Transmitter spectrum mask	28
6	<u>USED TEST EQUIPMENT AND ACCESSORIES</u>	31

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

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:

Interface for data logging system. The system consists of a fixed interface and one up to four mobile data logger (EBI10 Series, EBI100 Series). The interface identifies a logger in the programming slot via 13.56 MHz RFID-Transceiver. In the mobile data logger is a RFID-Tag only. A 2.4 GHz "ZigBee" port (Chipset according IEEE 802.15.4) is used for data exchange, communication and programming the data logger. The power supply as stand alone system is normally via USB, cascaded up to max. 3 systems the 15 VDC power supply have to be used. The test was performed as a complete system (base station EBI IF 200 and 4 dataloggers).

- Variants of the EUT:

Variant	Device-Name	Comment	Antenna 13.56 MHz
I01	IF200	programming unit	integrated
I02	IF100	programming unit	integrated
I03	IF100-1	programming unit	integrated
I04	IF150	programming unit	integrated
I05	IF300	programming unit	integrated

Note: The interface IF 200 has the most options and is as worst case selected for test.

For testing, the base station and the logger are set in TX-continuous mode. The test software is available for testing only. Radiated tests are performed with base station and logger set in TX-continuous mode.

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 system and dataloggers 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 : 02. May 2016

Testing concluded on : 12. May 2016

Checked by:



Eduard Stangl
I confirm the
correctness of this
document!
2016.09.07 13:10:11
+02'00'

Eduard Stangl
Technical Director

Tested by:



Hermann Smetana
I am the author of
this document
2016.09.05
13:23:29 +02'00'

Hermann Smetana
Radio Team

FCC ID: VQ5-EBIIFXXX

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EUT – See attachment A

3.2 Power supply system utilised

Power supply voltage : 100-240 V / 50-60 Hz / 1 ϕ , 6-15 V DC

3.3 Short description of the equipment under test (EUT)

The EUT is a wireless data logger system, which consist of a RFID base station and EBI dataloggers (EBI10 Series, EBI100 Series).

Number of tested samples: 1
Serial number, IF200: 20007277,
Firmware number: 2.08

EUT operation mode:

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

- Cont. tag reading mode at 13.56 MHz

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 power line conducted emissions	0.15 MHz to 30 MHz	95%	$\pm 3.29 \text{ dB}$
20 dB Bandwidth	Center frequency of EuT	95%	$\pm 2.5 \times 10^{-7}$
99% Occupied Bandwidth	Center frequency of EuT	95%	$\pm 2.5 \times 10^{-7}$
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	$\pm 3.53 \text{ dB}$
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	$\pm 3.71 \text{ dB}$
Radiated Spurious Emissions	1000 MHz to 10000 MHz	95%	$\pm 2.34 \text{ dB}$
Field strength of the fundamental	100 kHz to 100 MHz	95%	$\pm 3.53 \text{ dB}$
Conducted Spurious Emissions	9 kHz to 10000 MHz	95%	$\pm 2.15 \text{ dB}$

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

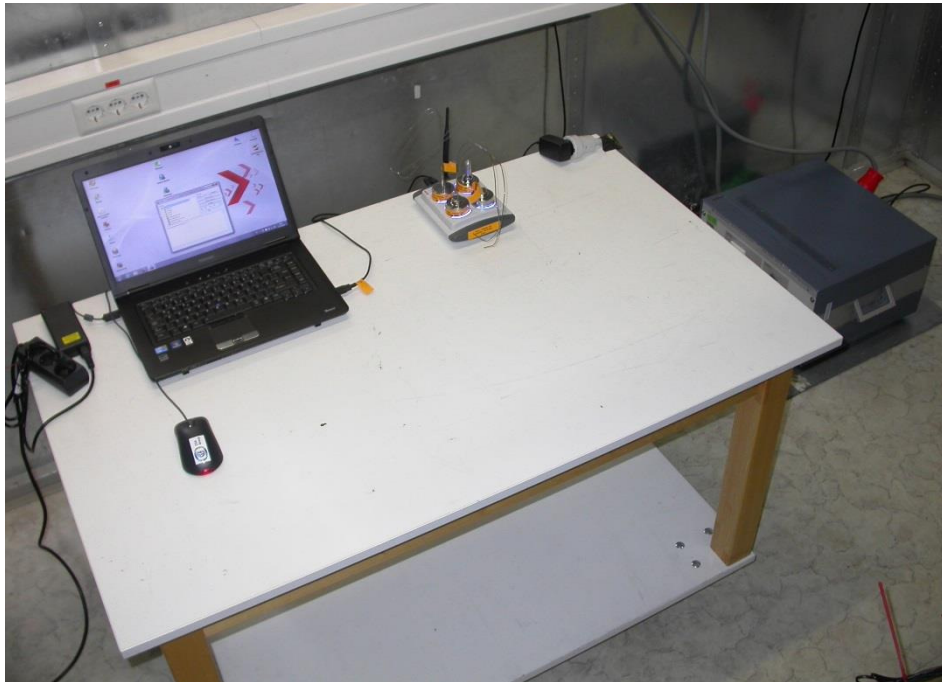
5.1 AC power line conducted emissions

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



5.1.3 Applicable standard

According to FCC Part 15, Section 15.207(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 C63.10 described under item 6.2. 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.

FCC ID: VQ5-EBIIFXXX

5.1.5 Test result

Possible Operation modes:

- Transmitting software on, one of four data logger in the interface (Interface with only one port)
- Transmitting software on, four of four data logger in the interface (Interface with up to 4 ports)

Note: TX 13.56 Mhz at the interface IF 200 means, TX at port1 to port4, one after the other and then beginning at port1 one again with reading the tags of the logger.

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin 1.8 dB at 13.56 MHz

Limit according to FCC Part 15, Section 15.207(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**.

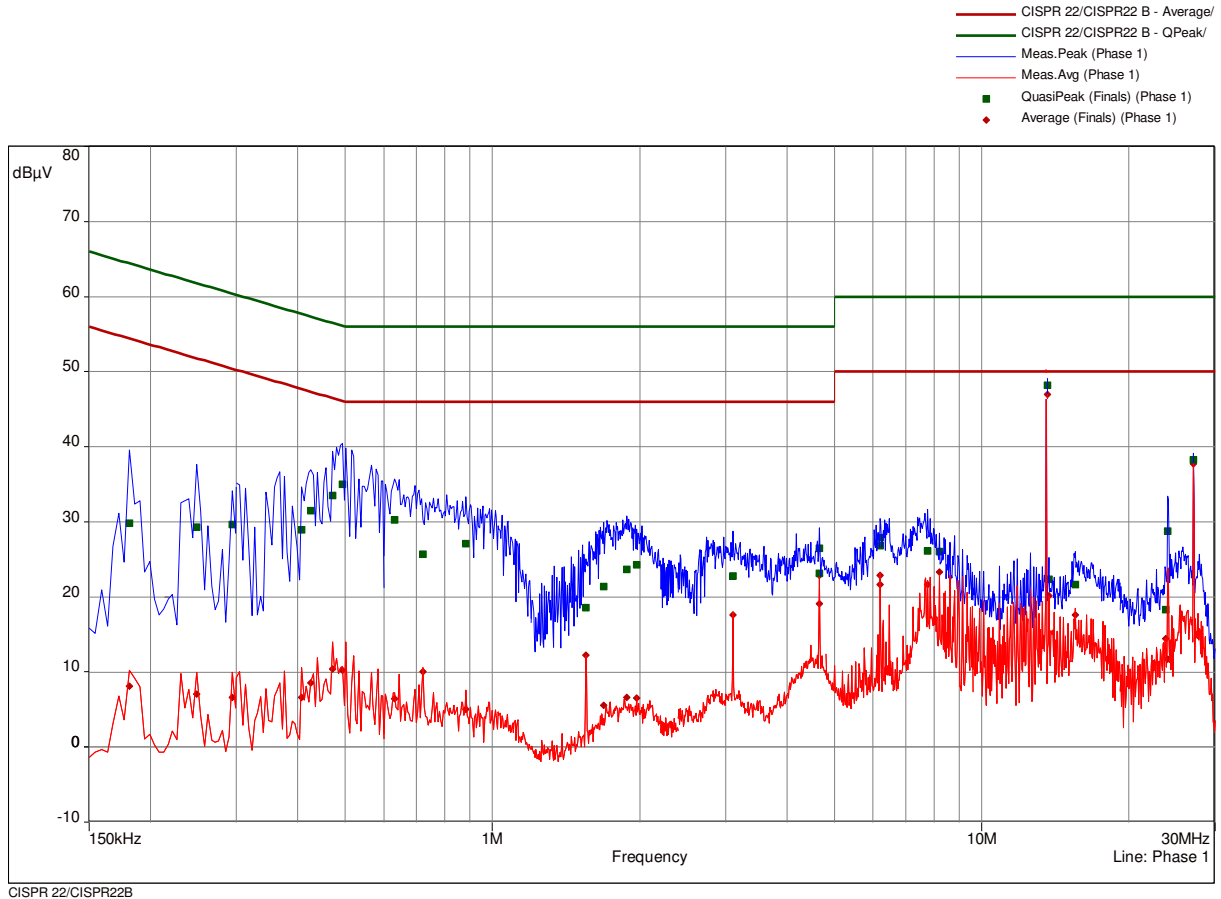
Remarks: For detailed test result please refer to following test protocols

FCC ID: VQ5-EBIIFXXX

5.1.6 Test protocol

Test point: L1
 Operation mode: TX, one of four data logger in the interface
 Remarks: Connection via USB
 Tested by: Huber Ma.

Result: Passed



freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(μV)	dB	dB	dB(μV)	dB	dB		dB
0.1815	1	29.83	34.59	64.42	8.09	46.33	54.42	Phase 1	9.84
0.249	1	29.28	32.51	61.79	7.04	44.75	51.79	Phase 1	9.83
0.294	1	29.68	30.73	60.41	6.63	43.78	50.41	Phase 1	9.82
0.408	2	28.93	28.76	57.69	6.58	41.11	47.69	Phase 1	9.81
0.426	2	31.51	25.82	57.33	8.57	38.76	47.33	Phase 1	9.81
0.471	2	33.49	23.01	56.50	10.38	36.11	46.50	Phase 1	9.82
0.4935	2	34.99	21.12	56.11	10.23	35.88	46.11	Phase 1	9.82
0.6315	3	30.28	25.72	56.00	6.42	39.58	46.00	Phase 1	9.82
0.7215	3	25.68	30.32	56.00	10.03	35.97	46.00	Phase 1	9.81
0.8835	3	27.06	28.94	56.00	5.04	40.96	46.00	Phase 1	9.81

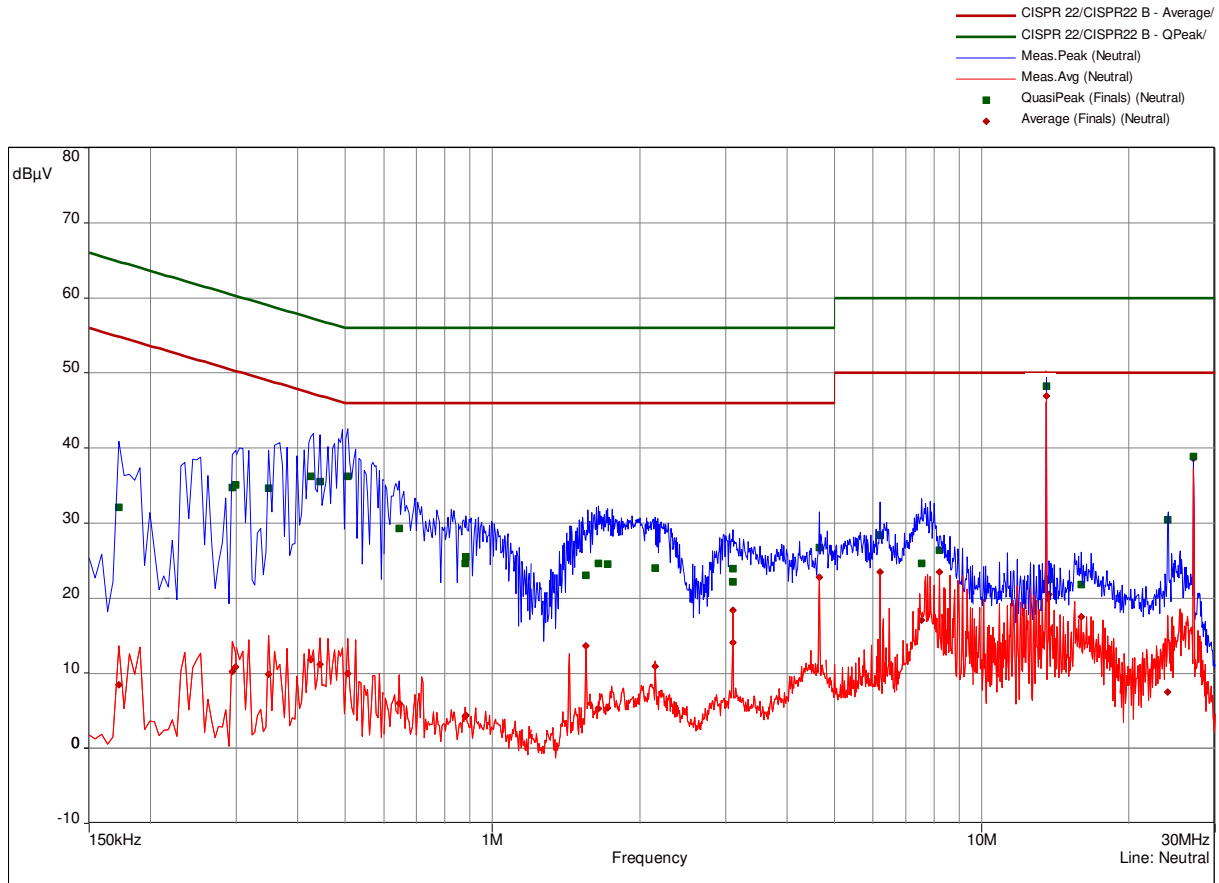
FCC ID: VQ5-EBIIFXXX

freq MHz	SR	QP dB(μ V)	margin dB	limit dB	AV dB(μ V)	margin dB	limit dB	line	corr dB
1.551	4	18.56	37.44	56.00	12.23	33.77	46.00	Phase 1	9.78
1.6905	4	21.43	34.57	56.00	5.53	40.47	46.00	Phase 1	9.79
1.8795	4	23.64	32.36	56.00	6.63	39.37	46.00	Phase 1	9.80
1.974	4	24.28	31.72	56.00	6.52	39.48	46.00	Phase 1	9.81
3.102	5	22.83	33.17	56.00	17.57	28.43	46.00	Phase 1	9.80
4.6545	5	26.52	29.48	56.00	22.85	23.15	46.00	Phase 1	9.82
4.659	5	23.11	32.89	56.00	19.14	26.86	46.00	Phase 1	9.82
6.204	6	26.86	33.14	60.00	21.66	28.34	50.00	Phase 1	9.83
6.2085	6	27.90	32.10	60.00	22.88	27.12	50.00	Phase 1	9.83
7.761	6	26.12	33.88	60.00	21.62	28.38	50.00	Phase 1	9.85
8.193	6	26.05	33.95	60.00	23.32	26.68	50.00	Phase 1	9.86
13.56	7	52.29	7.71	60.00	48.09	1.81	50.00	Phase 1	10.04
13.7175	7	22.35	37.65	60.00	20.18	29.82	50.00	Phase 1	10.05
15.5175	7	21.65	38.35	60.00	17.62	32.38	50.00	Phase 1	10.13
23.754	8	18.28	41.72	60.00	14.41	35.59	50.00	Phase 1	10.34
23.997	8	28.76	31.24	60.00	11.75	38.25	50.00	Phase 1	10.34
27.12	8	38.24	21.76	60.00	37.76	12.24	50.00	Phase 1	10.34

FCC ID: VQ5-EBIIFXXX

Test point N
Operation mode: TX, one of four data logger in the interface
Remarks: Connection via USB
Tested by: Huber Ma.

Result: Passed



freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(μV)	dB	dB	dB(μV)	dB	dB		dB
0.1725	9	32.14	32.70	64.84	8.43	46.41	54.84	Neutral	9.85
0.294	9	34.78	25.63	60.41	10.22	40.19	50.41	Neutral	9.82
0.2985	9	35.10	25.19	60.28	10.82	39.46	50.28	Neutral	9.82
0.3495	10	34.66	24.31	58.97	9.85	39.12	48.97	Neutral	9.81
0.426	10	36.25	21.08	57.33	11.79	35.54	47.33	Neutral	9.81
0.444	10	35.52	21.47	56.99	11.20	35.78	46.99	Neutral	9.82
0.507	10	36.28	19.72	56.00	9.96	36.04	46.00	Neutral	9.82
0.645	11	29.33	26.67	56.00	6.02	39.98	46.00	Neutral	9.81
0.879	11	24.65	31.35	56.00	4.23	41.77	46.00	Neutral	9.81
0.8835	11	25.55	30.45	56.00	4.39	41.61	46.00	Neutral	9.81

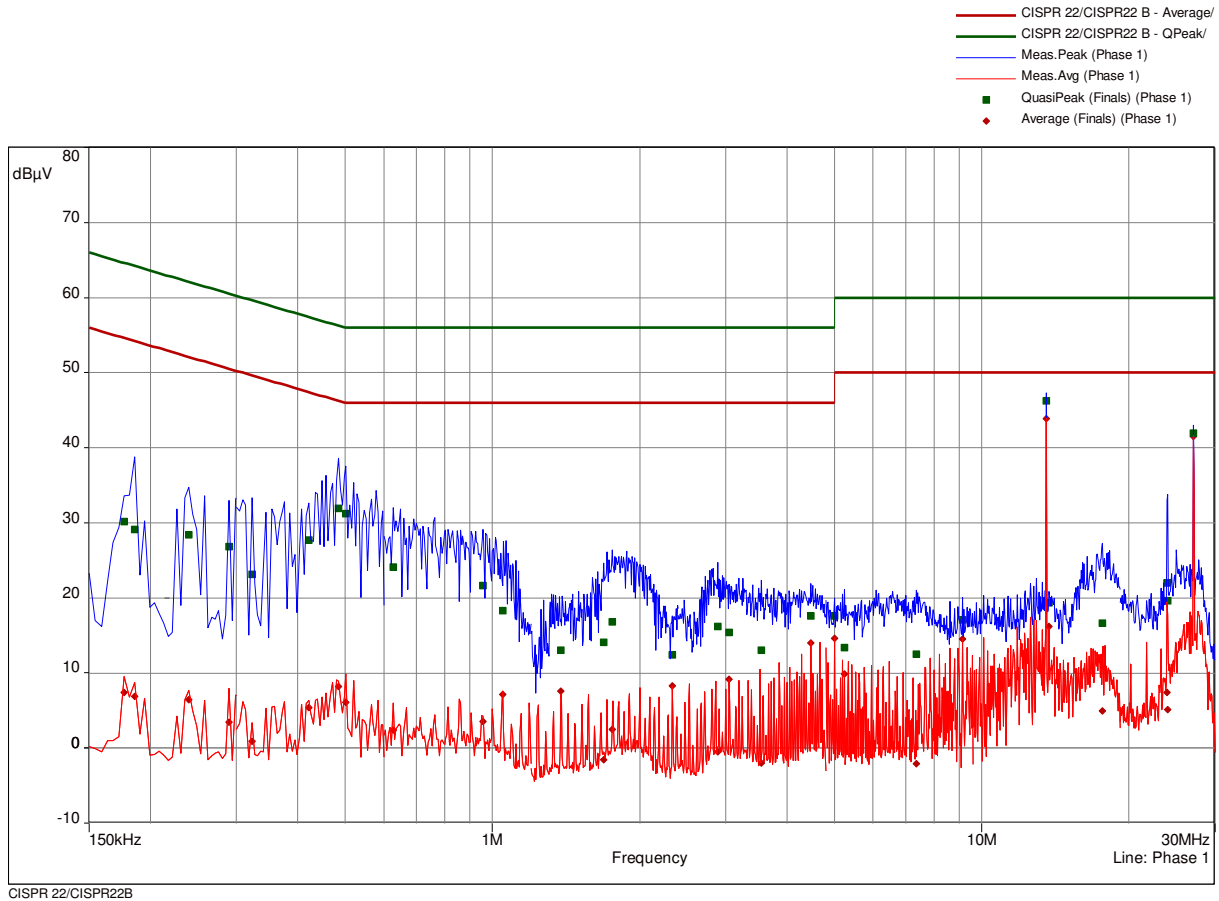
FCC ID: VQ5-EBIIFXXX

freq MHz	SR	QP dB(μV)	margin dB	limit dB	AV dB(μV)	margin dB	limit dB	line	corr dB
1.551	12	23.10	32.90	56.00	13.68	32.32	46.00	Neutral	9.78
1.6455	12	24.67	31.33	56.00	5.27	40.73	46.00	Neutral	9.79
1.722	12	24.52	31.48	56.00	5.39	40.61	46.00	Neutral	9.79
2.154	12	24.03	31.97	56.00	10.94	35.06	46.00	Neutral	9.80
3.102	13	23.91	32.09	56.00	18.36	27.64	46.00	Neutral	9.79
3.1065	13	22.17	33.83	56.00	14.11	31.89	46.00	Neutral	9.79
4.6545	13	26.70	29.30	56.00	22.79	23.21	46.00	Neutral	9.81
6.204	14	28.39	31.61	60.00	23.50	26.50	50.00	Neutral	9.81
7.5315	14	24.68	35.32	60.00	17.07	32.93	50.00	Neutral	9.81
8.193	14	26.43	33.57	60.00	23.51	26.49	50.00	Neutral	9.81
13.56	15	52.37	7.63	60.00	48.12	1.88	50.00	Neutral	9.89
13.7175	15	22.54	37.46	60.00	20.46	29.54	50.00	Neutral	9.90
15.9585	15	21.83	38.17	60.00	17.52	32.48	50.00	Neutral	9.96
23.9835	16	30.40	29.60	60.00	7.54	42.46	50.00	Neutral	9.96
27.12	16	38.90	21.10	60.00	38.61	11.39	50.00	Neutral	9.83

FCC ID: VQ5-EBIIFXXX

Test point L1
Operation mode: TX, four of four data logger in the interface
Remarks: Connection via USB
Tested by: Huber Ma.

Result: Passed



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

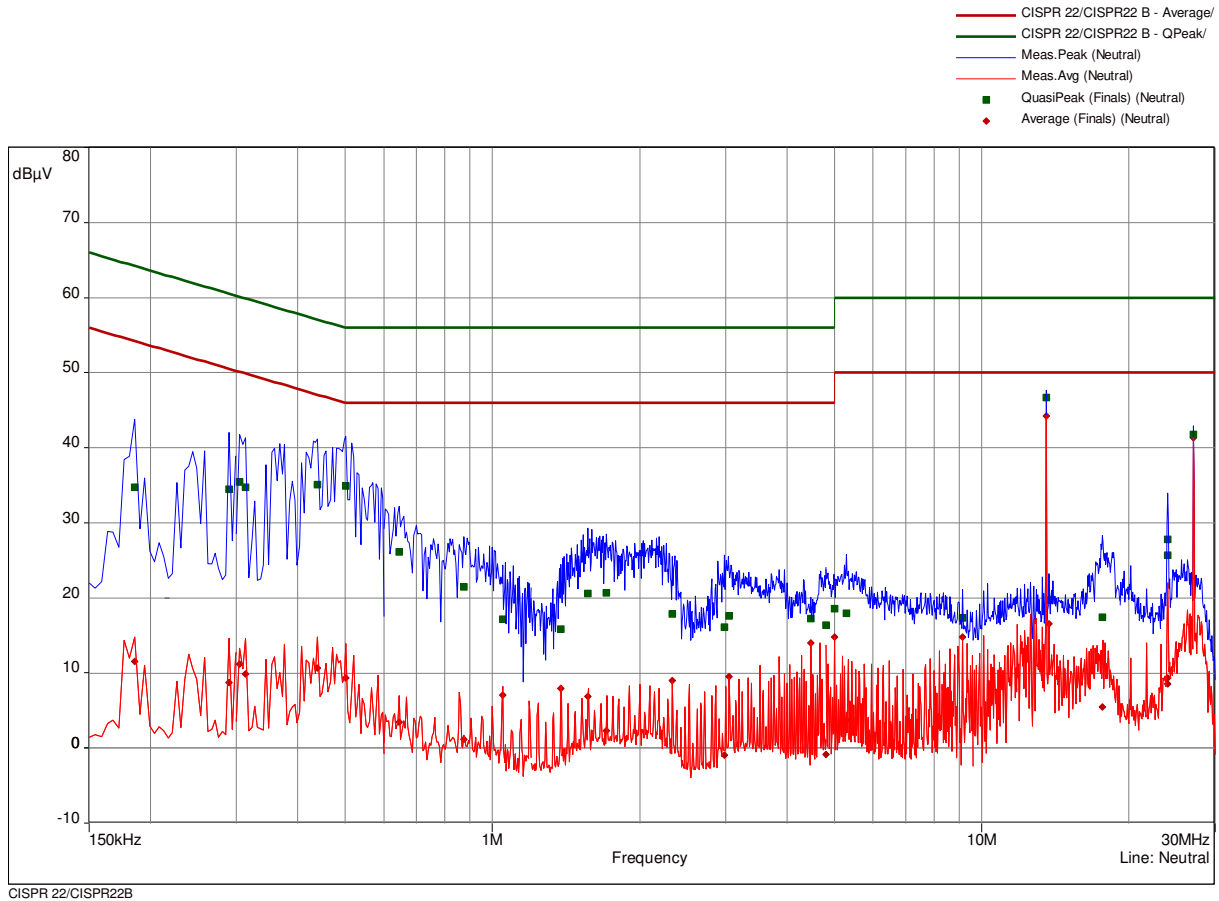
FCC ID: VQ5-EBIIFXXX

freq MHz	SR	QP dB(μV)	margin dB	limit dB	AV dB(μV)	margin dB	limit dB	line	corr 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: VQ5-EBIIFXXX

Test point N
Operation mode: TX, four of four data logger in the interface
Remarks: Connection via USB
Tested by: Huber Ma.

Result: Passed



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: VQ5-EBIIFXXX

freq MHz	SR	QP dB(μV)	margin dB	limit dB	AV dB(μV)	margin dB	limit dB	line	corr 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

FCC ID: VQ5-EBIIFXXX

5.2 Field strength of the fundamental wave

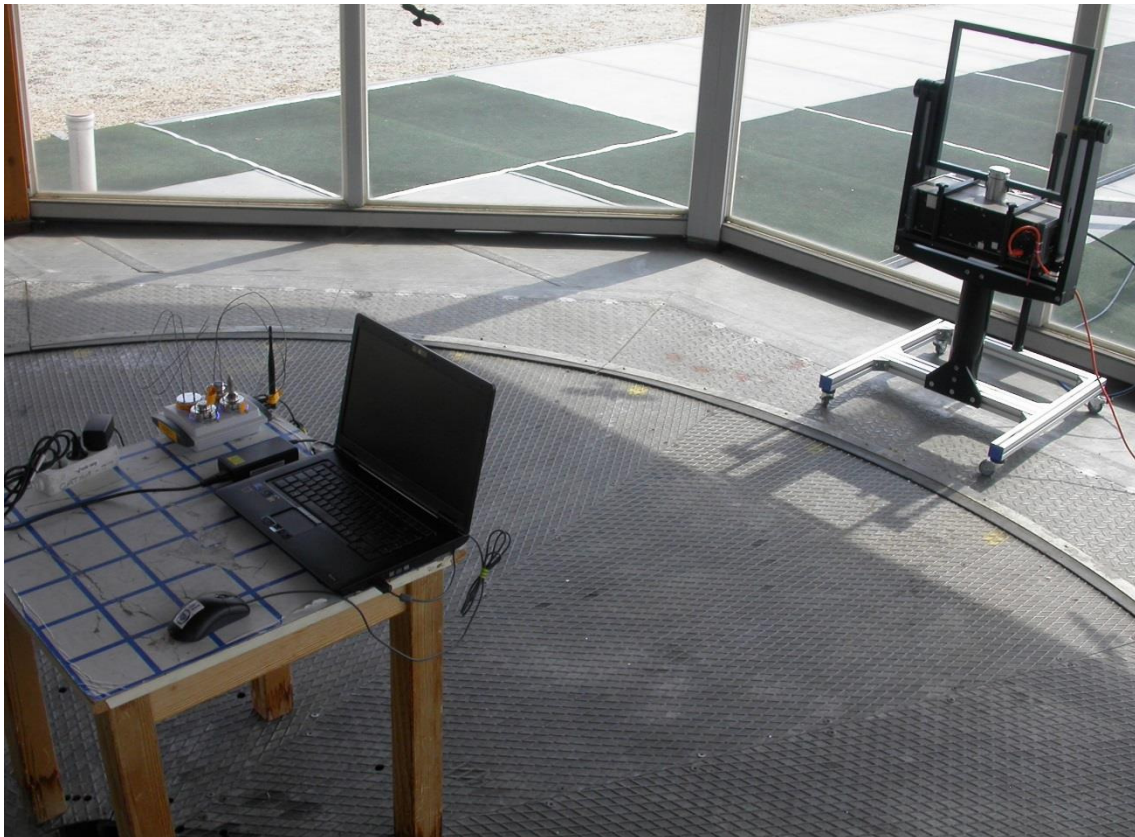
For test instruments and accessories used see section 6 Part CPR 1.

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



FCC ID: VQ5-EBIIFXXX

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 $\mu\text{V/m}$ 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. The final measurement has been performed with an EMI receiver using quasi peak detector and a resolution bandwidth of 9 kHz.

5.2.5 Test result

- a) Result at a measurement distance of 3m

Frequency (MHz)	Level (dB μV)	Ant. factor (dB 1/m)	Field strength dB($\mu\text{V/m}$)
13.56	24.1	20.0	44.1

- b) Result extrapolated to a distance of 30 m

Frequency (MHz)	Level (dB μV)	Ant. factor (dB 1/m)	Field strength dB($\mu\text{V/m}$)	Limit dB($\mu\text{V/m}$)	Delta (dB)
13.56	-15.9	20.0	4.1	84.0	-79.9

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

Frequency (MHz)	Field strength of fundamental wave ($\mu\text{V/m}$)	dB($\mu\text{V/m}$)	Measurement distance (metres)
13.553 - 13.567	15848	84.0	30

The requirements are **FULFILLED**.

Remarks:

5.3 Spurious emissions

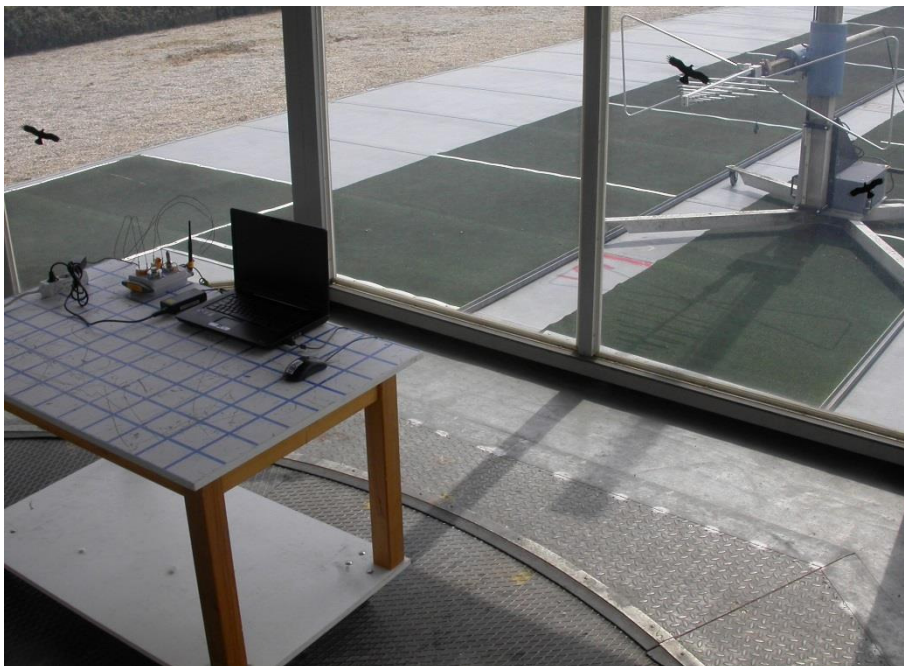
For test instruments and accessories used see section 6 Part SER 1, SER 2.

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



FCC ID: VQ5-EBIIFXXX

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 noises could be detected!

FCC ID: VQ5-EBIIFXXX

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

Frequency (MHz)	Field strength of spurious emissions		Measurement distance
	($\mu\text{V/m}$)	dB($\mu\text{V/m}$)	(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

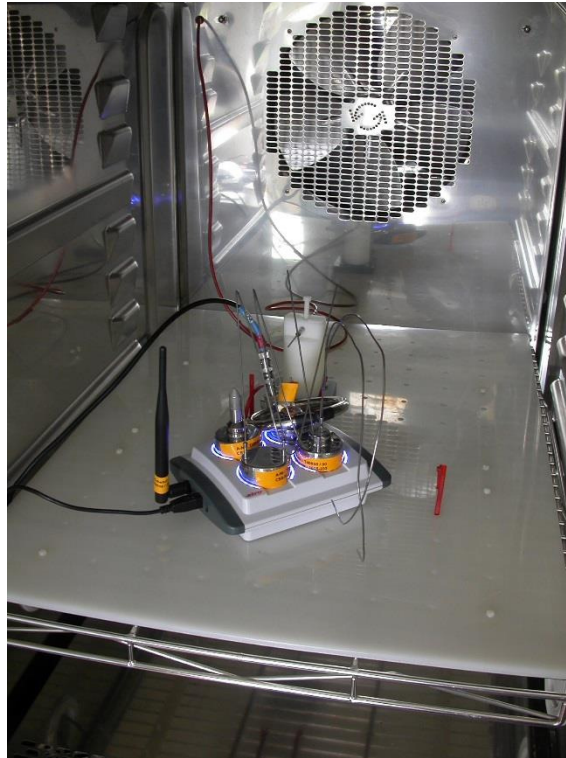
5.4 Frequency tolerance

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



5.4.3 Applicable standard

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 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).

FCC ID: VQ5-EBIIFXXX

5.4.5 Test result

Test conditions		Test result
		Frequency (MHz)
$T_{min} (-20)^{\circ}C$	$V_{nom} (5.0 V)$	13.5601
$T (-10)^{\circ}C$	$V_{nom} (5.0 V)$	13.5601
$T (0)^{\circ}C$	$V_{nom} (5.0 V)$	13.5601
$T (10)^{\circ}C$	$V_{nom} (5.0 V)$	13.5598
$T_{nom} (20)^{\circ}C$	$V_{min} (4.25 V)$	13.5601
	$V_{nom} (5.0 V)$	13.5601
	$V_{max} (5.75 V)$	13.5601
$T (30)^{\circ}C$	$V_{nom} (5.0 V)$	13.5601
$T (40)^{\circ}C$	$V_{nom} (5.0 V)$	13.5600
$T_{max} (50)^{\circ}C$	$V_{nom} (5.0 V)$	13.5600
Measurement uncertainty		$\pm 10 \text{ Hz}$

Carrier frequency: $f_c = 13.56 \text{ MHz}$

Max. tolerance: $\pm 0.01 \% \text{ of } 13.56 \text{ MHz} = \pm 1.356 \text{ kHz}$

Lowest frequency: $f_l = 13.5598 \text{ MHz}$

Lowest tolerance: $f_l - f_c = -0.20 \text{ kHz} < -1.356 \text{ kHz}$

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

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01 \%$ of the operating frequency.

The requirements are **FULFILLED**.

Remarks:

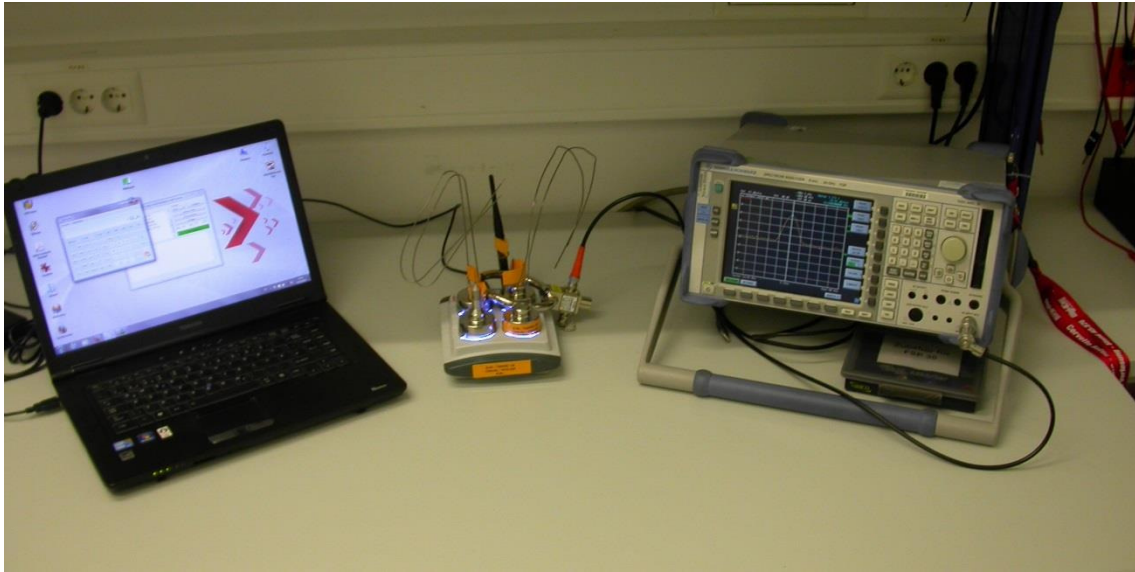
5.5 20 dB Bandwidth

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

5.5.1 Description of the test location

Test location: Shielded Room S6

5.5.2 Photo documentation of the test set-up



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.

FCC ID: VQ5-EBIIFXXX

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 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	13.55862	13.56128	2.66	14.0

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

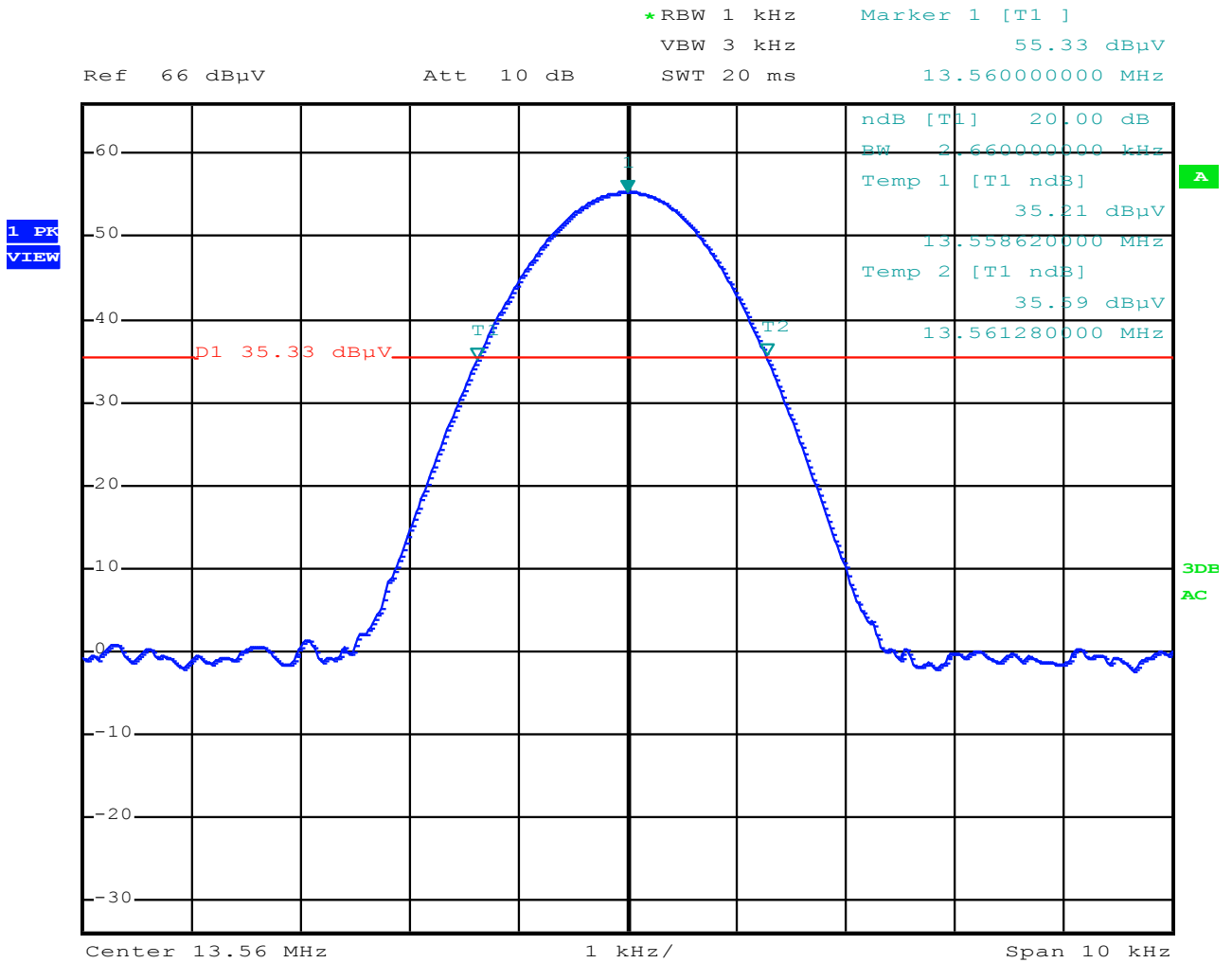
Frequency band (MHz)	Limit 20 dB bandwidth (kHz)
13.553 - 13.567	14.0

The requirements are **FULFILLED**.

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

FCC ID: VQ5-EBIIFXXX

5.5.6 Test protocol



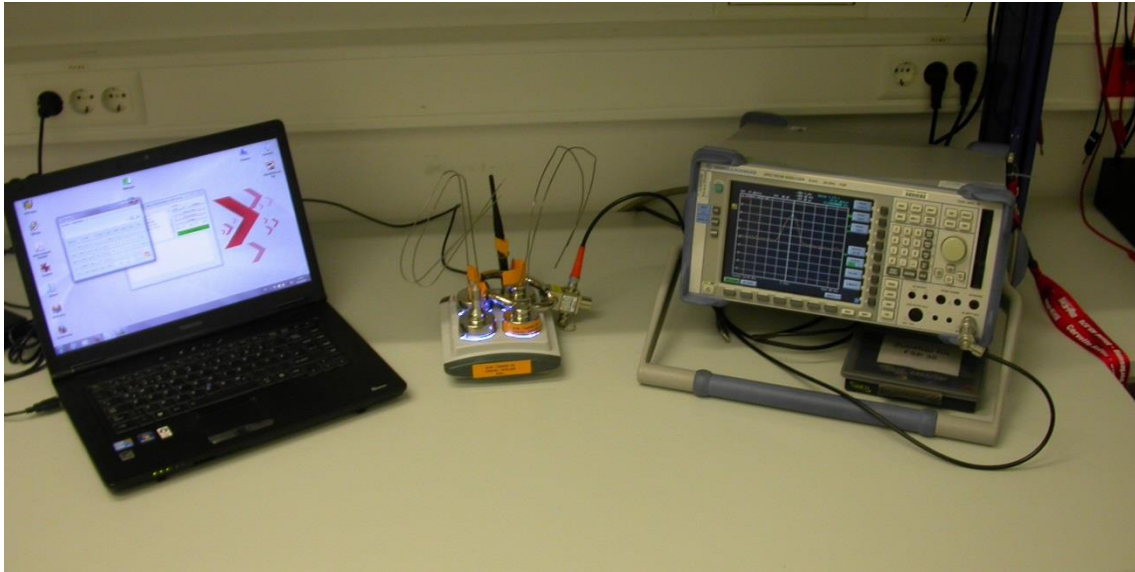
FCC ID: VQ5-EBIIFXXX
Transmitter spectrum mask

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



FCC ID: VQ5-EBIIFXXX

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 (dB μ V/m)	Limit (dB μ V/m)
13.110 – 13.410	≤ 10	40.5
13.410 - 13.553	≤ 10	50.5
13.553 - 13.567	4.1	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 (μ V/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

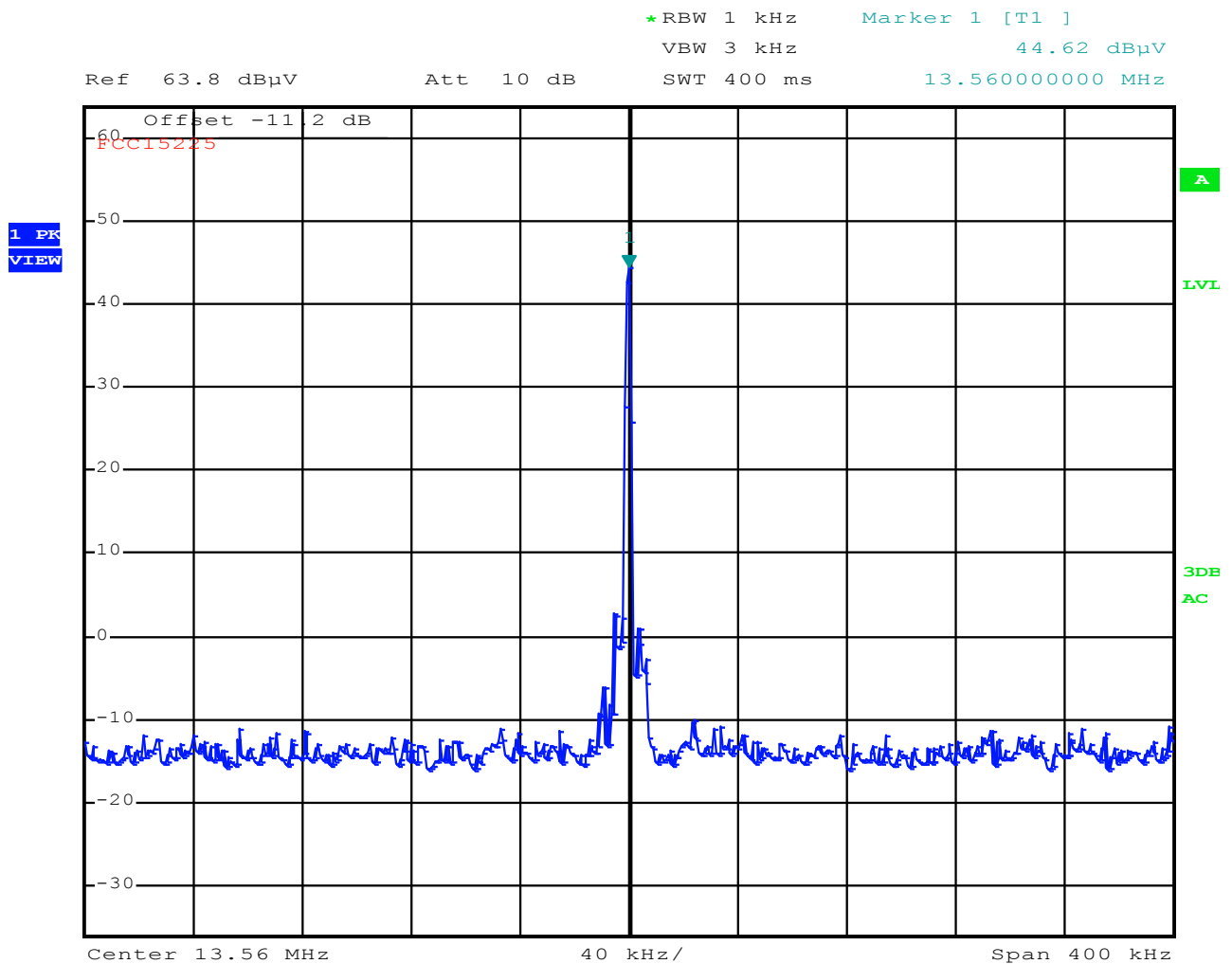
The requirements are **FULFILLED**.

Remarks:

FCC ID: VQ5-EBIIFXXX

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)

FCC ID: VQ5-EBIIFXXX

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				