

EMI - TEST REPORT

- FCC Part 15.209, RSS Gen -

Type / Model Name : RR01 & RR02

Product Description : Active Timing System

Applicant : race result AG

Address : Haid-und-Neu-Str. 7

76131 Karlsruhe

GERMANY

Manufacturer : race result AG

Address : Haid-und-Neu-Str. 7

76131 Karlsruhe

GERMANY

<p>Test Result according to the standards listed in clause 1 test standards:</p>	<p>POSITIVE</p>
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<p>Test Report No. : T39567-00-03JP</p>	<p>11. November 2015 Date of issue</p>
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DAkkS
Deutsche
Akkreditierungsstelle
D-PL-12030-01-01
D-PL-12030-01-02

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 (September, 2014)

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

Part 15, Subpart C, Section 15.207

Part 15, Subpart C, Section 15.209

Part 15, Subpart C, Section 15.215

Conducted limits

Radiated emission limits, general requirements

Additional provisions

RSS-Gen Issue 4, Nov 2014

General Requirements and Information for the Certification of Radio Apparatus

RSS-Gen 8.8

RSS-Gen 8.9

RSS-Gen 6.6

Conducted limits

Radiated emission limits, general requirements

Additional provisions

ANSI C63.10: 2013

Testing Unlicensed Wireless Devices

2 EQUIPMENT UNDER TEST

2.1 Photo documentation of the EUT



FCC ID: SZO-RR02 & SZO-RR01

IC: 20465-RR02 & 20465-RR01





2.2 Short description of the equipment under test (EUT)

The active timing system is used for time measurements in sport events and consists out of the RR02 (base station) and the RR01 (transponder). The RR02s 125 kHz loop antenna is placed on the time measurement position. The RR01 is mounted on the participant of the event or its equipment. The 125 kHz signal triggers a 2.4GHz transmission between the RR02 and the RR01. This message contains the required information and is stored.

For testing purposes of the 125 kHz function the RR01 was defined as TAG.

Number of tested samples: 1 Set (1x RR01, 1x RR02 and one AC/DC adapter)
 Serial number: none (RR02)
 AETUN02 (RR01)

2.3 Variants of the EUT

none

2.4 Operation frequency and channel plan

The operating frequency is 125 kHz.

2.5 EUT operation mode:

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

- 125kHz TX signal is active, 2.4GHz communication is active

2.6 Antenna

A wire is used as 125 kHz loop antenna. The length of the loop antenna is specified from 5m to 25m with a maximum loop width of 0.6m. 4mm connectors are used as plugs.

2.7 Power supply system utilised

Power supply voltage :
 RR02: 115 V / 60 Hz / 1 ϕ (AC/DC adapter) or
 5.0V DC (USB port) or
 4.0V DC (battery supplied)
 RR01: 3V DC (battery supplied)

2.8 Peripheral devices and interface cables

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

- AC/DC power supply* Model : ETSA120150U, CUI Japan
 *part of EUT

Port	Cable	Screening	Transmission	Status	Length
1	AC power line	unshielded	analogue	active	2.0m

3 TEST RESULT SUMMERY

FCC Rule Part	RSS Rule Part	Description	Result
15.207	RSS-Gen 8.8	AC power line conducted emissions	passed
15.209	RSS-Gen 8.9	Radiated emission limits	passed
15.215	RSS-Gen 6.6	Additional provisions(99% / 20dB Bandwidth)	No limit defined

This test report deals with the 125 kHz function of the EuT.

3.1 Final assessment

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

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

Testing commenced on : 04 June 2015

Testing concluded on : 14 September 2015

Checked by:



Klaus Gegenfurtner
I confirm the correctness and
Integrity of this documents
2015.11.11 14:54:50 +01'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:



Jürgen Pessinger
2015.11.11
14:46:50 +01'00'

Jürgen Pessinger

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.

4.4 Measurement protocol for FCC and IC

4.4.1 General information

4.4.1.1 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 Open Area test site is listed under the Canadian Test-Sites File-No:

IC 3009A-1

In compliance with RSS 210 testing for RSS compliance may be achieved by following the procedures set out in ANSI C63.10 and applying the CISPR 22 limits.

4.4.1.2 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.

4.4.1.3 Details of test procedures

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 C63.10 and applying the CISPR 22 limits.

5 TEST CONDITIONS AND RESULTS

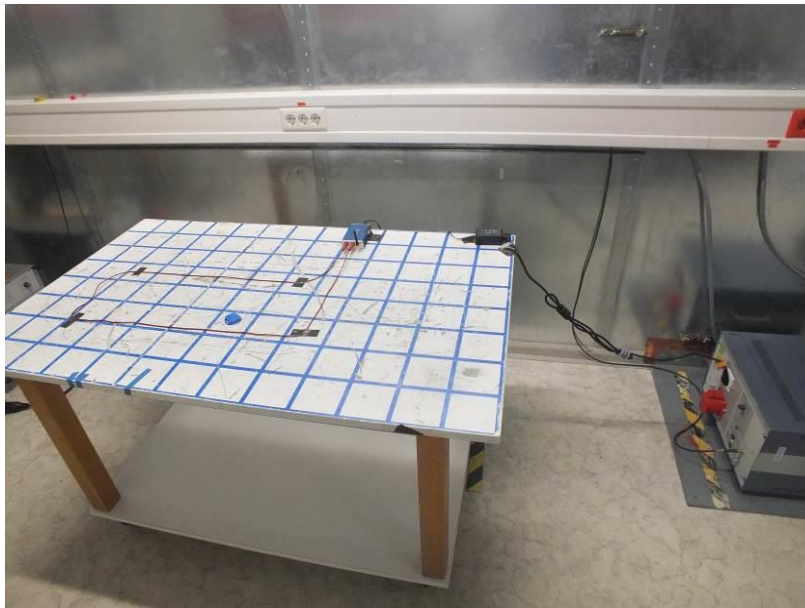
5.1 AC power line conducted emissions

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 and RSS-Gen 8.8

5.1.4 Description of Measurement

The measurements are performed according the procedures set out in ANSI C63.10

5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin 4.19 dB at 0.3945 MHz

Limit according to FCC Part 15, Section 15.207(a) and RSS Gen 8.8 Table 3:

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	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: Pretests indicates that shorter loop antenna length leads to higher emission results. To create
a worst case scenario a loop antenna length of 2m was used even though the specification lists a
minimum length of 5m. The measurement was made at the AC input of the dedicated AC/DC
power adapter.

5.1.6 Test protocol

Test point

L1

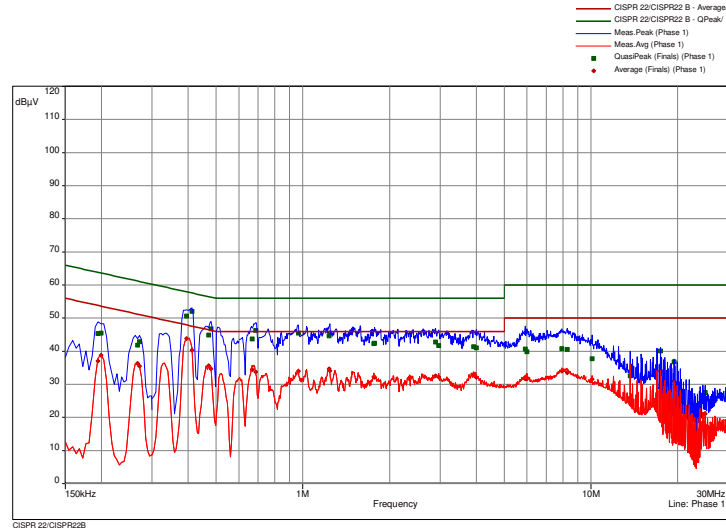
Result: PASS

Operation mode:

125kHz TX signal is active, 2.4GHz communication is active

Remarks:

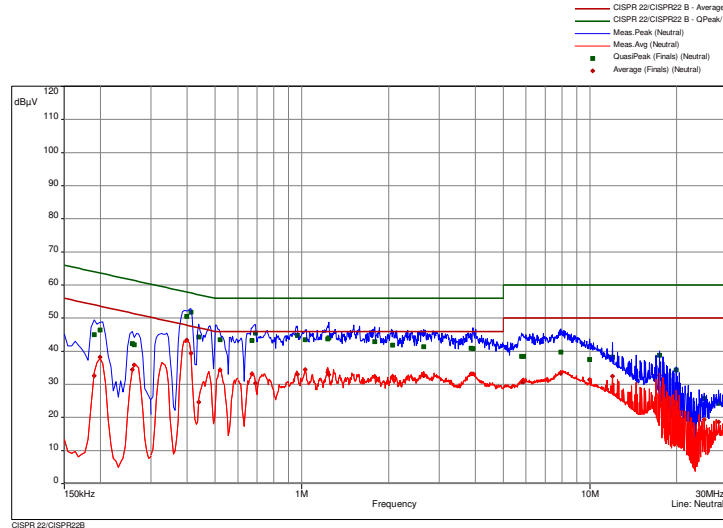
none



freq	QP	margin	limit	AV	margin	limit	line	corr
MHz	dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.195	45.35	18.48	63.82	37.08	16.74	53.82	Phase 1	9.83
0.1995	45.48	18.15	63.63	38.74	14.89	53.63	Phase 1	9.83
0.267	41.81	19.40	61.21	36.28	14.93	51.21	Phase 1	9.82
0.2715	42.85	18.22	61.07	35.52	15.55	51.07	Phase 1	9.82
0.3945	50.58	7.39	57.97	43.78	4.19	47.97	Phase 1	9.81
0.4125	52.02	5.57	57.60	40.28	7.32	47.60	Phase 1	9.81
0.471	44.94	11.56	56.50	35.61	10.88	46.50	Phase 1	9.81
0.48	46.73	9.61	56.34	34.72	11.62	46.34	Phase 1	9.81
0.6675	43.70	12.30	56.00	34.47	11.53	46.00	Phase 1	9.81
0.6855	46.31	9.69	56.00	33.80	12.20	46.00	Phase 1	9.81
0.9645	45.53	10.47	56.00	33.94	12.06	46.00	Phase 1	9.81
1.236	44.70	11.30	56.00	34.71	11.29	46.00	Phase 1	9.80
1.2405	45.47	10.53	56.00	34.12	11.88	46.00	Phase 1	9.80
1.7625	42.36	13.64	56.00	32.29	13.71	46.00	Phase 1	9.79
1.776	42.45	13.55	56.00	32.14	13.86	46.00	Phase 1	9.79
2.8905	42.83	13.17	56.00	32.57	13.43	46.00	Phase 1	9.79
2.958	41.78	14.22	56.00	32.20	13.80	46.00	Phase 1	9.79
3.912	41.36	14.64	56.00	32.93	13.07	46.00	Phase 1	9.81
4.0065	41.06	14.94	56.00	32.16	13.84	46.00	Phase 1	9.81
5.916	40.72	19.28	60.00	31.68	18.32	50.00	Phase 1	9.84
5.9835	39.90	20.10	60.00	31.63	18.37	50.00	Phase 1	9.84
7.923	40.84	19.16	60.00	33.95	16.05	50.00	Phase 1	9.86
8.265	40.53	19.47	60.00	33.57	16.43	50.00	Phase 1	9.86
10.0905	37.75	22.25	60.00	31.58	18.42	50.00	Phase 1	9.91
13.6635	32.58	27.42	60.00	25.76	24.24	50.00	Phase 1	10.05
17.439	40.11	19.89	60.00	34.01	15.99	50.00	Phase 1	10.21
19.4295	36.82	23.18	60.00	30.89	19.11	50.00	Phase 1	10.31
24.4155	26.67	33.33	60.00	21.00	29.00	50.00	Phase 1	10.34
24.9105	27.53	32.47	60.00	21.15	28.85	50.00	Phase 1	10.35

Test point: N
 Operation mode: 125kHz TX signal is active, 2.4GHz communication is active
 Remarks: none

Result: PASS



freq MHz	QP dB(µV)	margin dB	limit dB	AV dB(µV)	margin dB	limit dB	line	corr dB
0.1905	45.01	19.00	64.01	32.53	21.48	54.01	Neutral	9.85
0.1995	46.37	17.26	63.63	38.20	15.43	53.63	Neutral	9.85
0.258	42.30	19.20	61.50	34.43	17.06	51.50	Neutral	9.83
0.2625	41.98	19.37	61.35	35.88	15.48	51.35	Neutral	9.83
0.399	50.50	7.38	57.87	43.38	4.50	47.87	Neutral	9.81
0.4125	51.77	5.83	57.60	39.35	8.24	47.60	Neutral	9.81
0.4395	44.33	12.74	57.07	24.61	22.46	47.07	Neutral	9.81
0.5205	43.49	12.51	56.00	34.37	11.63	46.00	Neutral	9.82
0.672	43.25	12.75	56.00	33.20	12.80	46.00	Neutral	9.81
0.69	45.51	10.49	56.00	30.38	15.62	46.00	Neutral	9.81
0.9645	44.77	11.23	56.00	33.07	12.93	46.00	Neutral	9.81
1.0275	43.53	12.47	56.00	34.42	11.58	46.00	Neutral	9.81
1.2315	43.72	12.28	56.00	33.65	12.35	46.00	Neutral	9.80
1.2405	44.06	11.94	56.00	32.90	13.10	46.00	Neutral	9.80
1.7895	42.87	13.13	56.00	32.40	13.60	46.00	Neutral	9.79
2.064	41.83	14.17	56.00	32.30	13.70	46.00	Neutral	9.80
2.6475	41.36	14.64	56.00	32.57	13.43	46.00	Neutral	9.78
3.8625	40.94	15.06	56.00	33.17	12.83	46.00	Neutral	9.81
3.93	40.84	15.16	56.00	33.13	12.87	46.00	Neutral	9.81
5.7855	38.47	21.53	60.00	30.66	19.34	50.00	Neutral	9.81
5.8845	38.48	21.52	60.00	30.77	19.23	50.00	Neutral	9.82
7.932	39.72	20.28	60.00	33.32	16.68	50.00	Neutral	9.81
9.9645	37.46	22.54	60.00	31.39	18.61	50.00	Neutral	9.83
11.958	38.27	21.73	60.00	32.47	17.53	50.00	Neutral	9.86
17.439	38.79	21.21	60.00	32.69	17.31	50.00	Neutral	10.02
19.929	34.34	25.66	60.00	28.10	21.90	50.00	Neutral	10.13
24.9105	25.64	34.36	60.00	19.32	30.68	50.00	Neutral	9.94
27.903	24.25	35.75	60.00	18.67	31.33	50.00	Neutral	9.79

5.2 Field strength of fundamental

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

5.2.1 Description of the test location

Test location: OATS 1
Test distance: 3 m

5.2.2 Photo documentation of the test set-up



5.2.1 Applicable standard

According to FCC Part 15C, Section 15.209 and RSS-Gen 8.9:

5.2.2 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.10.

The resolution bandwidth during the measurement is as follows:

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

5.2.3 Test result

The measurement value is calculated from a distance of 3 m to 300 m by subtracting the factor 40 dB/decade.

f (kHz)	Level Pk@3m (dB μ V)	Corr. factor (dB/m)	Field strength Pk@3m dB(μ V/m)	Distance corr. 3m to 300m (dB)	Corrected level Pk@300m dB(μ V/m)	Limit AV@300m dB(μ V/m)	Delta (dB)
125	84.6	20.5	105.1	-80	25.1	25.6	-0.5

Note: The correction factor includes cable loss and antenna factor.

Note: If the measured PK level is below the AV limit, no AV measurement was performed

Limit according to FCC Part 15C, Section 15.209(a) and RSS Gen 8.9 Table 5:

Frequency (MHz)	Field strength		Measurement distance (metres)
	($\mu\text{V}/\text{m}$)	$\text{dB}(\mu\text{V}/\text{m})$	
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: Loop current setting was set to maximum (100%) for testing. Prescans indicate that a loop antenna length of 12m leads to the highest transmission power. 12m loop antenna with a width of 0.6m was used for testing. The orientation shown in the testsetup picture is the worst case Position.

5.3 Spurious emissions

For test instruments and accessories used see section 6 Part **SER1**.

5.3.1 Description of the test location

Test location: OATS 1
Test distance: 3 m

5.3.2 Photo documentation of the test set-up



5.3.3 Applicable standard

According to FCC Part 15C, Section 15.209 and RSS-Gen 8.9:

5.3.4 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.10.

Instrument settings:

9 kHz – 150 kHz	RBW:	200 Hz
150 kHz - 30 MHz	RBW:	9 kHz

5.3.5 Test result

Frequency range 9 kHz to 490 kHz

f (kHz)	Level Pk@3m (dB μ V)	Ant. factor (dB/m)	Field strength Pk@3m dB(μ V/m)	Distance corr. 3m to 300m (dB)	Corrected level Pk@300m dB(μ V/m)	Limit AV@300m dB(μ V/m)	Delta (dB)
250	73.6	20.5	94.1	-80	14.1	19.6	-5.5
375	52.1	20.5	72.6	-80	-7.4	16.1	-23.5

Note: The correction factor includes cable loss and antenna factor.

Note: If the measured PK level is below the AV limit, no AV measurement was performed

Frequency range 490 kHz to 30 MHz

f (kHz)	Level QP@3m (dB μ V)	Ant. factor (dB/m)	Field strength QP@3m dB(μ V/m)	Distance corr. 3m to 30m (dB)	Corrected level QP@30m dB(μ V/m)	Limit QP@30m dB(μ V/m)	Delta (dB)
500	28.2	20.5	48.7	-40	8.7	33.6	-24.9
625	38.0	20.5	58.5	-40	18.5	31.6	-13.1
750	45.1	20.5	65.6	-40	25.6	30.1	-4.5
875	44.7	20.5	65.2	-40	25.2	28.7	-3.5
100	39.1	20.5	59.6	-40	19.6	27.6	-8
1250	39.3	20.5	59.8	-40	19.8	25.6	-5.8
1375	40.2	20.5	60.7	-40	20.7	24.8	-4.1
1500	37.6	20.5	58.1	-40	18.1	24	-5.9
1625	24.8	20.5	45.3	-40	5.3	23.3	-18
1750	31.1	20.5	51.6	-40	11.6	30	-18.4

Note: The correction factor includes cable loss and antenna factor.

Limit according to FCC Part 15C, Section 15.209(a) and RSS Gen 8.9 Table 5:

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (metres)
	(μ V/m)	dB(μ V/m)	
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: Loop current setting was set to maximum (100%) for testing. Prescans indicate that a loop antenna length of 12m leads to the highest emission level. 12m loop antenna with a width of 0.6m was used for testing. The orientation shown in the testsetup picture is the worst case Position. The frequency range from 9 kHz to 30 MHz was tested

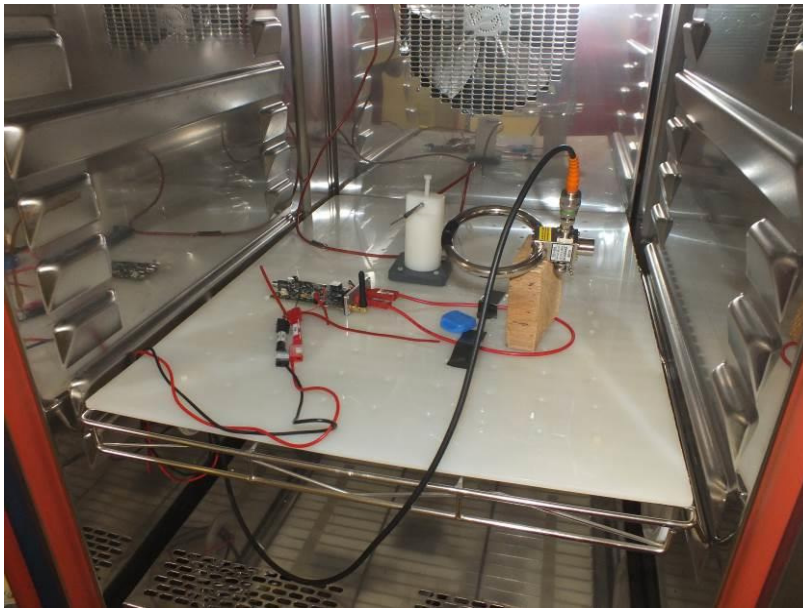
5.4 Emission bandwidth

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

5.4.1 Description of the test location

Test location: AREA4

5.4.2 Photo documentation of the test set-up



5.4.3 Applicable standard

According to FCC Part 15C, Section 15.215 and RSS-Gen 6.6:

5.4.4 Description of Measurement

Spectrum analyser settings:

RBW: 300 Hz, VBW: 1 kHz, Span: 60 kHz, Trace mode: max. hold, Detector: max. peak;

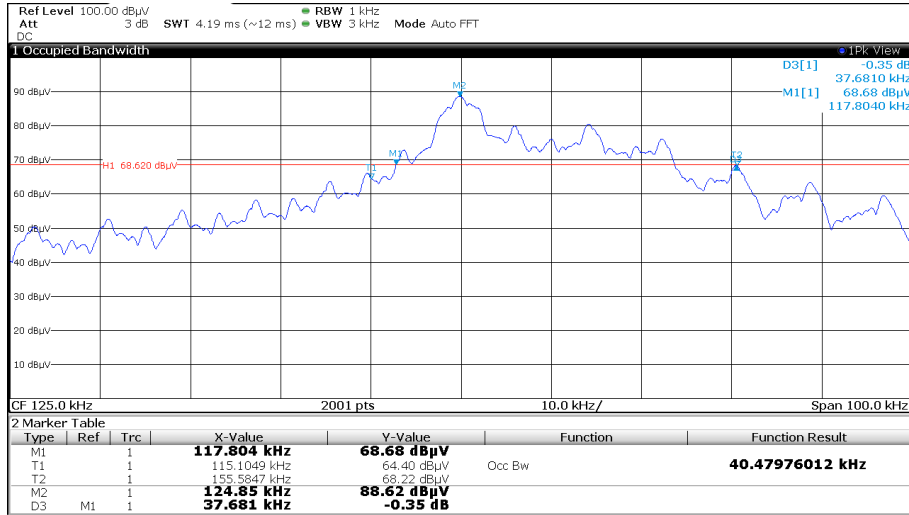
5.4.5 Test result

Operating frequency [kHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
125	37.69	40.48

The requirements are **FULFILLED**.

Remarks: none

5.4.6 Test protocols



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	18/10/2015	18/10/2013	21/01/2016	21/07/2015
	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	19/11/2015	19/11/2014	09/12/2015	09/06/2015
CPR 1	FMZB 1516	01-02/24-01-018			19/01/2016	19/01/2015
	ESR 7	02-02/03-13-001	29/05/2016	29/05/2015		
	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				
MB	FSW43	02-02/11-15-001	05/08/2016	05/08/2015		
	HFRAE 5161 _ 50 kHz-120	02-02/24-11-004				
	WK-340/40	02-02/45-05-001	07/07/2016	07/07/2015		
SER 1	FMZB 1516	01-02/24-01-018			19/01/2016	19/01/2015
	ESR 7	02-02/03-13-001	29/05/2016	29/05/2015		
	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				