

EMI – TEST REPORT

- FCC Part 15.249, RSS210 -

Test Report No. : T38855-00-02KJ

29. January 2015

Date of issue

Type / Model Name : US-1442

Product Description : Temp Sensor

Applicant : smaXtec animal care sales GmbH

Address : Wastiangasse 4

8010 GRAZ, AUSTRIA

Manufacturer : smaXtec animal care sales GmbH

Address : Wastiangasse 4

8010 GRAZ, AUSTRIA

Licence holder : smaXtec animal care sales GmbH

Address : Wastiangasse 4

8010 GRAZ, AUSTRIA

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 (September, 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

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (September, 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 15.207	Conducted limits
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements
Part 15, Subpart C, Section 15.249	Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz

ANSI C63.4: 2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
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ANSI C63.10: 2013	Testing Unlicensed Wireless Devices
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ANSI C95.1:2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
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CISPR 16-4-2: 2013	Uncertainty in EMC measurement
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CISPR 22: 2005 EN 55022: 2006	Information technology equipment
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2 EQUIPMENT UNDER TEST

2.1 Photo documentation of the EUT – Detailed photos see attachment A



2.2 Short description of the equipment under test (EUT)

The Temp Sensor is an electronic device that is intended to measure the temperature inside the rumen of cattle. Due to its radio interface, one needs extra devices for data read out and for initialization to be done prior to operation. Basestation and Repeater are used for data readout during the Temp Sensor operation and the USB antenna for the initialization process.

Number of tested samples: 1
Serial number: Prototype

2.3 Operation frequency and channel plan

The EUT is working on 905.5 MHz and 906 MHz.

2.4 Transmit operating modes

The EUT uses 2-GFSK and provides following data rate: 19200 bps

2.5 Antennas

The following antenna shall be used with the EUT:

Number	Characteristic	Frequency range (MHz)	Gain (dBi)
1	PCB-antenna	905.5	-10

2.6 Power supply system utilised

Power supply voltage : Minamoto ER17505, Primary Lithium Thionyl Chloride, 3.6V 3400 mAh

2.7 Peripheral devices and interface cables

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

- _____ Model : _____
- _____ Model : _____

2.8 Determination of worst case conditions for final measurement

Measurements have been made in all three orthogonal axes. All tests were performed in TX continuous mode modulated at 905.5 MHz.

3 Test result summery

Operating in the 902 MHz – 928 MHz band:

FCC Rule Part	RSS Rule Part	Description	Result
15.35(c)	RSS-Gen, 6.10	Pulsed operation	passed
15.203	RSS Gen, 8.3	Antenna requirement	passed
15.204	RSS Gen, 8.2	External radio frequency power amplifiers	passed
15.205(a)	RSS Gen, 8.1	Emissions in restricted bands	passed
15.207(a)	RSS Gen, 8.8	AC power line conducted emissions	not applicable
15.215(c)	-	EBW	passed
-	RSS-Gen, 6.6	OBW	passed
15.249(a)	RSS-210, A2.9(a)	Field strength of fundamental	passed
15.249(d)	RSS-210, A2.9(b)	Out-of-band emission, radiated	passed
-	RSS-Gen, 6.11	Transmitter frequency stability	not applicable

The mentioned RSS Rule Parts in the above table are related to:

RSS Gen, Issue 4, November 2014

RSS 210, Issue 8, December 2010

RSS 102, Issue 4, March 2010

3.1 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 : 20 October 2014

Testing concluded on : 29 January 2015

Checked by:

Tested by:

Klaus Gegenfurtner
Teamleader Radio

Josef Knab
Radio Team

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 a listed Open Site 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 C63.4 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 C63.4 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: NONE

Remarks: The test is not applicable, because the EuT is battery powered.

5.2 Field strength of fundamental

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

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 15.249(a):

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the effective limits.

5.2.2 Description of Measurement

The radiated emission of the fundamental wave from the EUT is measured using a spectrum analyser and appropriate linear polarized antennas. The set up of the EUT and the measurement procedure is in accordance to ANSI C63.10, Item 6.5. The EUT is measured in TX continuous mode modulated under normal conditions.

Analyser settings:

Peak measurement: RBW: 120 KHz

Detector: Max peak

5.2.3 Test result

Frequency (MHz)	Reading level PK (dB μ V)	Bandwidth (kHz)	Correction Factor K_E (dB)	Corrected level PK dB(μ V/m)	Limit AV dB(μ V/m)	Delta (dB)	Limit Peak dB(μ V/m)	Delta (dB)
905.5	106.2	120	-14.8	91.4	94	-2.6	114	-22.6

Note: The correction factor K_E is computed in clause 5.5.

Average-Limit according to FCC Part 15C, Section 15.249(a):

Frequency (MHz)	Field strength of fundamental	
	(mV/m)	dB(μ V/m)
902 - 928	50	94

Peak-Limit according to FCC Part 15C, Section 15.249(e):

However the peak fieldstrength shall not exceed the maximum permitted average limit by more than 20 dB.

The requirements are **FULFILLED**.

Remarks:

5.3 Out-of-band emission, radiated

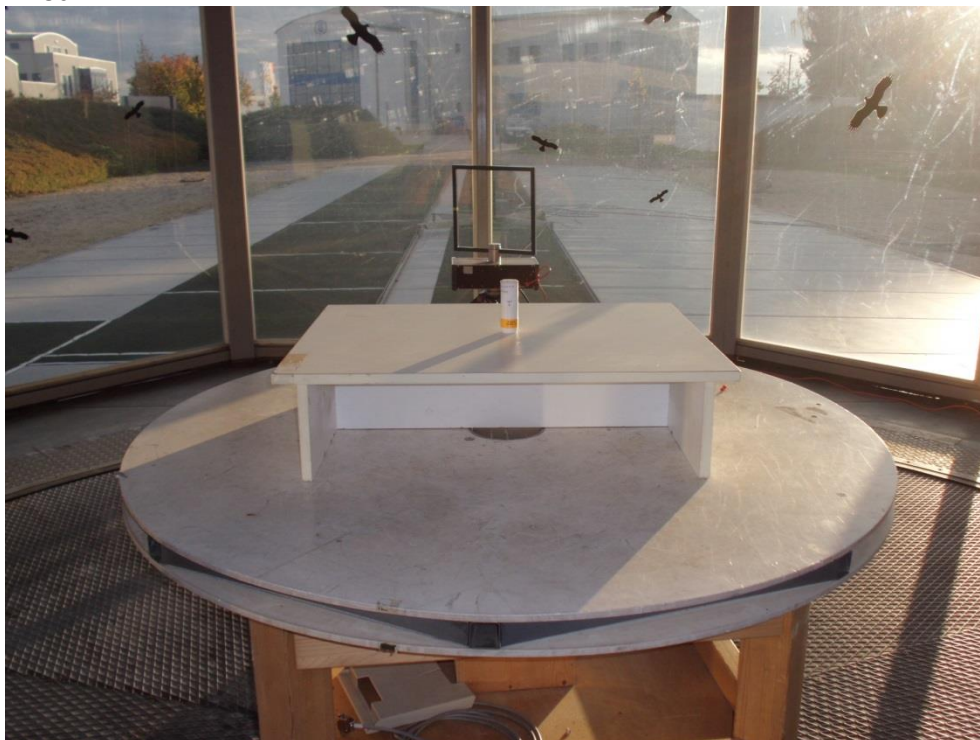
For test instruments and accessories used see section 6 Part **SER1**, **SER 2**, **SER 3**.

5.3.1 Description of the test location

Test location: OATS 1
Test location: Anechoic chamber 2
Test distance: 3 m

5.3.2 Photo documentation of the test set-up

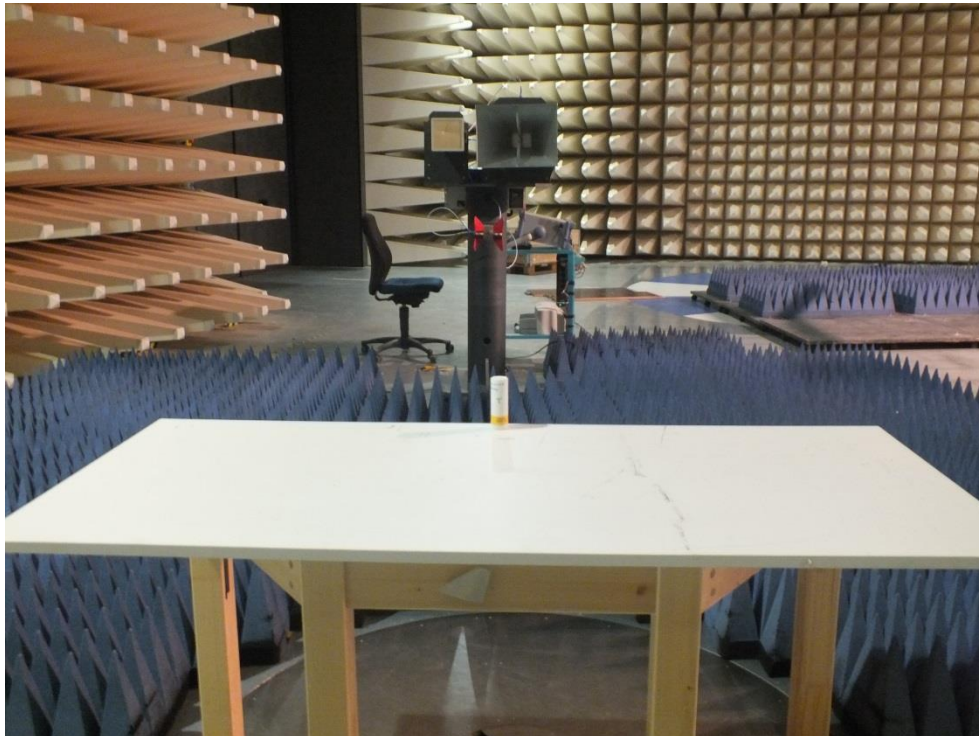
Test setup 9 kHz – 30 MHz:



Test setup 30 MHz – 1000 MHz:



Test setup 1 GHz – 12 GHz:



5.3.3 Applicable standard

According to FCC Part 15C, Section 15.249 (d):

Emission radiated outside of the specified frequency bands, except harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated limit in FCC Part 15C, Section 15.209, whichever is the lesser attenuation.

5.3.4 Description of Measurement

The radiated emissions from the EUT are measured in the frequency range of 9 kHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. The setup of the EUT and the measurement procedure is in accordance to ANSI C63.10, Item 6.3. In the frequency range above 1 GHz a spectrum analyser is used with appropriate linear polarized antennas. If the emission level in peak mode complies with the average limit testing is stopped and peak values will be reported, otherwise, the emission is measured in average mode again and reported. The EUT is measured in TX continuous mode modulated under normal conditions.

Instrument settings:

9 kHz – 150 kHz	RBW:	200 Hz
150 kHz - 30 MHz	RBW:	9 kHz
30 MHz – 1000 MHz:	RBW:	120 kHz
1000 MHz – 12 GHz	RBW:	1 MHz

5.3.5 Test result $f < 30$ MHz

Note: In the frequency range 9 kHz to 30 MHz no emission could be detected. The frequencies mention the noise level. The measurement results from distance 3 m are extrapolated (D factor) to the specified distance.

Frequency (MHz)	Reading PK dB(μ V)	D factor dB(μ V/m)	Level PK dB(μ V/m)	Limit AV dB(μ V/m)	Delta (dB)
0.047	52.0	-80.0	-28.0	34.2	-62.2
1.5	51.0	-40.0	11.0	24.1	-13.1
18.2	39.0	-40.0	-1.0	29.5	-30.5

5.3.6 Test result $f < 1$ GHz

Note: In the frequency range 30 MHz to 1000 MHz no emission could be detected. The frequencies mention the noise level.

Frequency (MHz)	Reading level QP dB μ V	Reading level AV dB μ V	Bandwidth (kHz)	Correction factor (dB/m)	Corrected level QP dB(μ V/m)	Corrected level AV dB(μ V/m)	Limit dB(μ V/m)	Delta (dB)
150	0.0	-	120	13.4	13.4	-	43.5	-30.1
300	1.2	-	120	15.9	17.1	-	46.0	-28.9
450	-1.6	-	120	20.4	18.8	-	46.0	-27.2
600	-2.5	-	120	24.1	21.6	-	46.0	-24.4
750	-1.4	-	120	26.8	25.4	-	46.0	-20.6
900	-1.0	-	120	28.9	27.9	-	46.0	-18.1

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

5.3.7 Test result f > 1 GHz

Frequency (MHz)	Level PK dB(μV/m)	Limit PK dB(μV/m)	Margin PK (dB)	Level AV dB(μV/m)	Limit AV dB(μV/m)	Margin AV (dB)
1586.87	43.5	74.0	30.5	43.5	54.0	-10.5
2716.75	44.5	74.0	29.5	29.7	54.0	-24.3
3622.37	49.5	74.0	24.5	34.7	54.0	-19.3
6302.00	45.9	74.0	28.1	31.1	54.0	-22.9
8150.00	47.4	74.0	26.6	32.6	54.0	-21.4
8488.00	47.4	74.0	26.6	47.4	54.0	-6.6

Limit according to FCC Part 15C, Section 15.209:

Frequency (MHz)	15.209 Limits (μV/m)	Measurement distance (m)
0.009 - -0.49	2400/f(kHz)	300
0.49 – 1.705	24000/f(kHz)	30
1.705 – 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Average limit according to FCC Part 15C, Section 15.249(a):

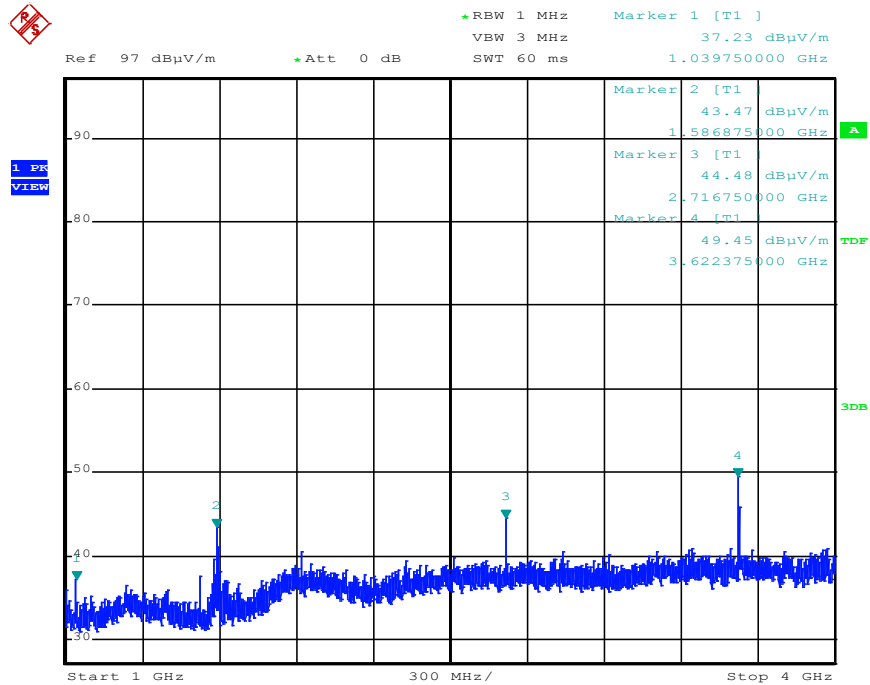
Fundamental frequency (MHz)	Field strength of harmonics	
	(μV/m)	dB(μV/m)
902 - 928	500	54
2400 - 2483.5	500	54
5725 - 5875	500	54
24000 - 24250	2500	68

The requirements are **FULFILLED**.

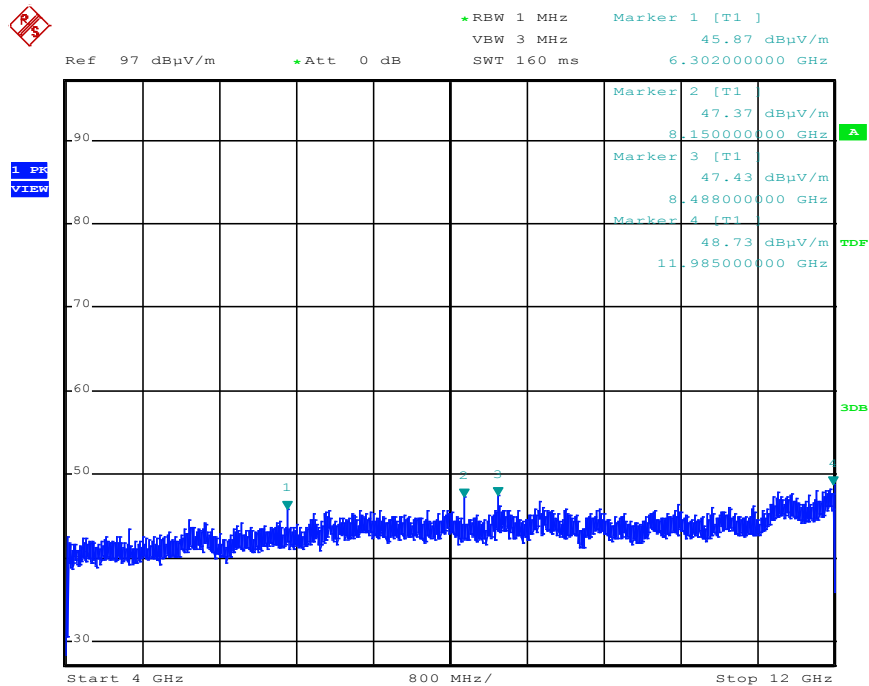
Remarks: The measurement was performed up to the 10th harmonic. For detailed test results please refer to following test protocols.

5.3.8 Test protocols

Spurious emissions from 1 to 4 GHz (incl. Fundamental carrier)



Spurious emissions from 4 to 12 GHz



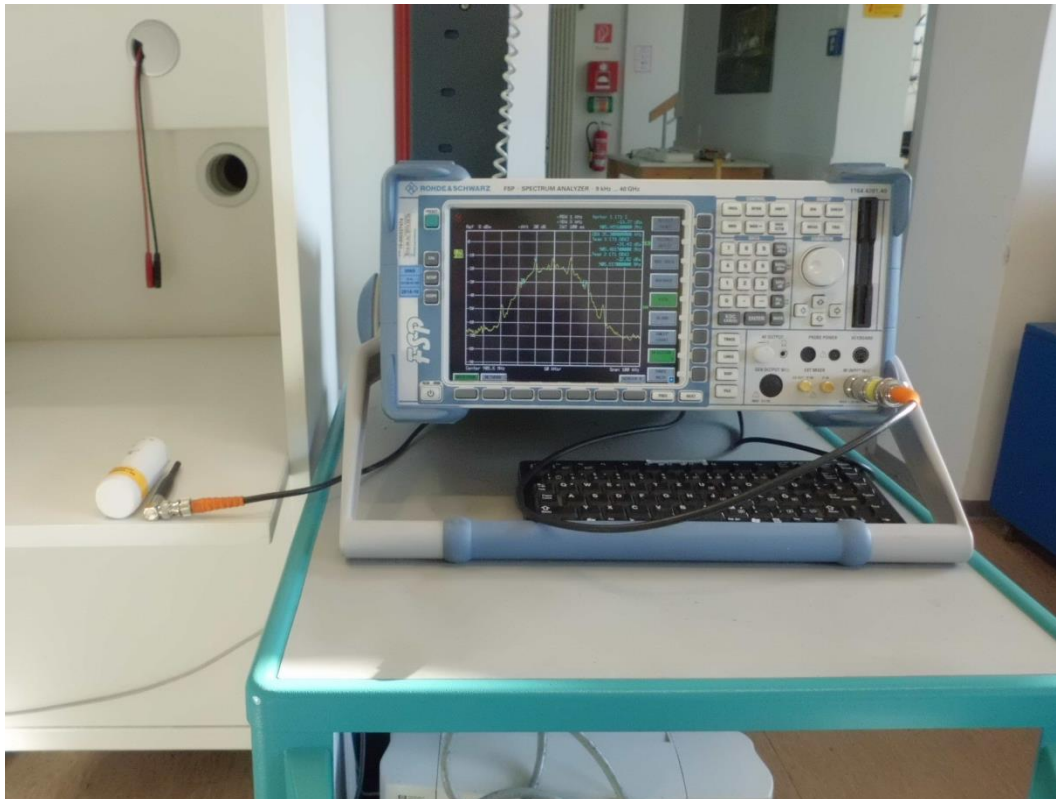
5.4 EBW and OBW

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 15, Section 15.215(c):

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in Section 15.217 through Section 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.

5.4.4 Description of Measurement

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio of -20 dB (99%). The x-dB-down (OBW) function of the analyser is used. The measurement is performed with normal modulation in TX continuous mode.

Spectrum analyser settings:

RBW: 1 kHz, VBW: 3 kHz, Span: 100 kHz, Trace mode: max. hold, Detector: max. peak;

5.4.5 Test result

Operating frequency band (MHz)	20 dB Bandwidth (MHz)
$f_{low} > 902$	$f_{low} = 905.4801$
$f_{high} < 928$	$f_{high} = 905.5195$

80% bandwidth of the permitted band:

20.8 MHz (904.6 MHz to 925.4)

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

If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

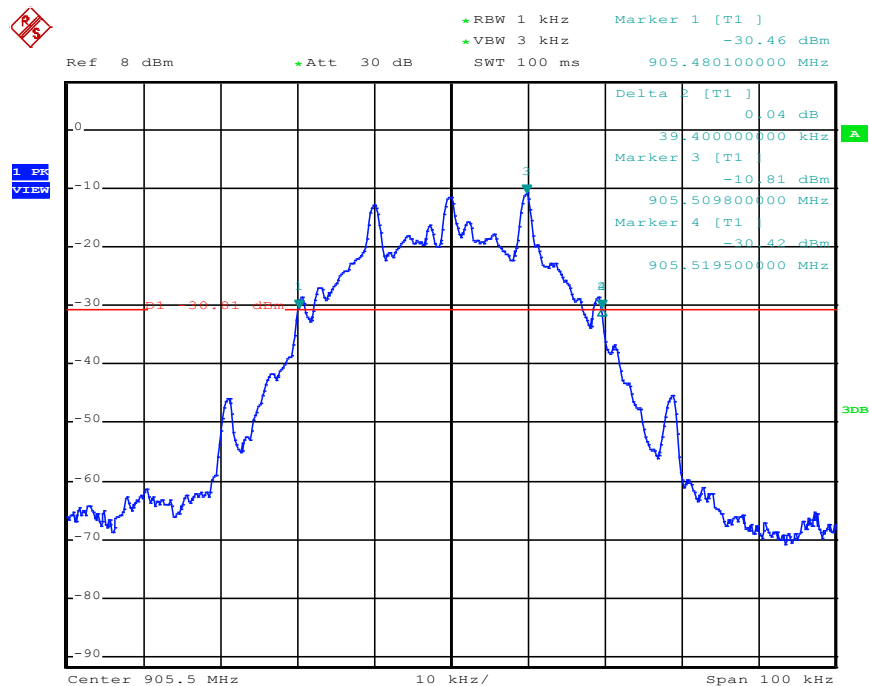
The requirements are **FULFILLED**.

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

The OBW99 is measured for RSS only.

5.4.6 Test protocols

20 dB bandwidth



FCC ID: OHCMETDGS1

IC: 10671A-METDGS1

OBW 99%

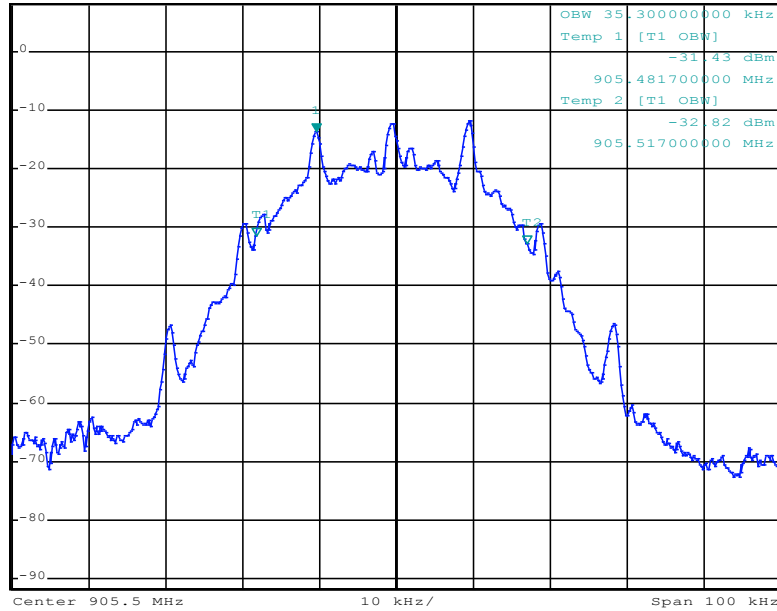


*RBW 1 kHz Marker 1 [T1]
*VBW 3 kHz -13.77 dBm
SWT 100 ms 905.489600000 MHz

Ref 8 dBm

*Att 30 dB

1 PK
VIEW



3dB

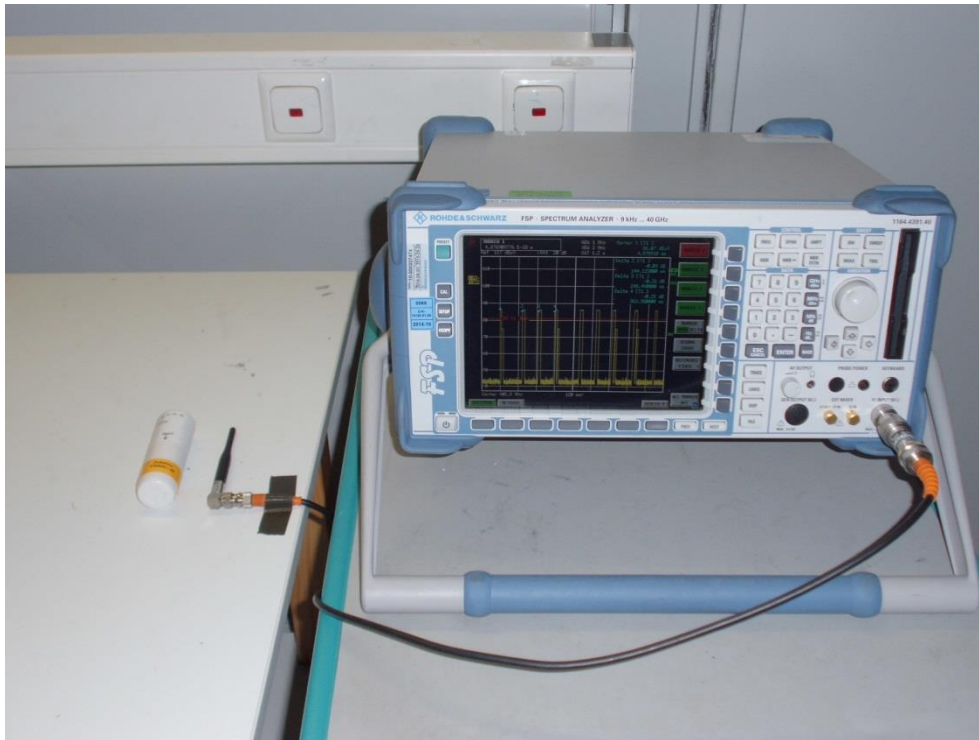
5.5 Correction for pulse operation (duty cycle)

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

5.5.1 Description of the test location

Test location: Shielded Room S4

5.5.2 Photo documentation of the test set-up



5.5.3 Applicable standard

According to FCC Part 15A, Section 15.35(c):

When the radiated emission limits are expressed in terms of average value and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1s. In cases where the pulse train exceeds 0.1s, the measured field strength shall be determined from the average absolute voltage during a 0.1s interval during which the field strength is at its maximum. The exact method of calculating the average field strength shall be submitted.

5.5.4 Description of Measurement

The duty cycle factor (dB) is calculated applying the following formula:

$$KE = 20 \log (T_{on} / 100 \text{ ms})$$

KE: pulse operation correction factor

T_{on} pulse duration of one pulse = 18.1 ms

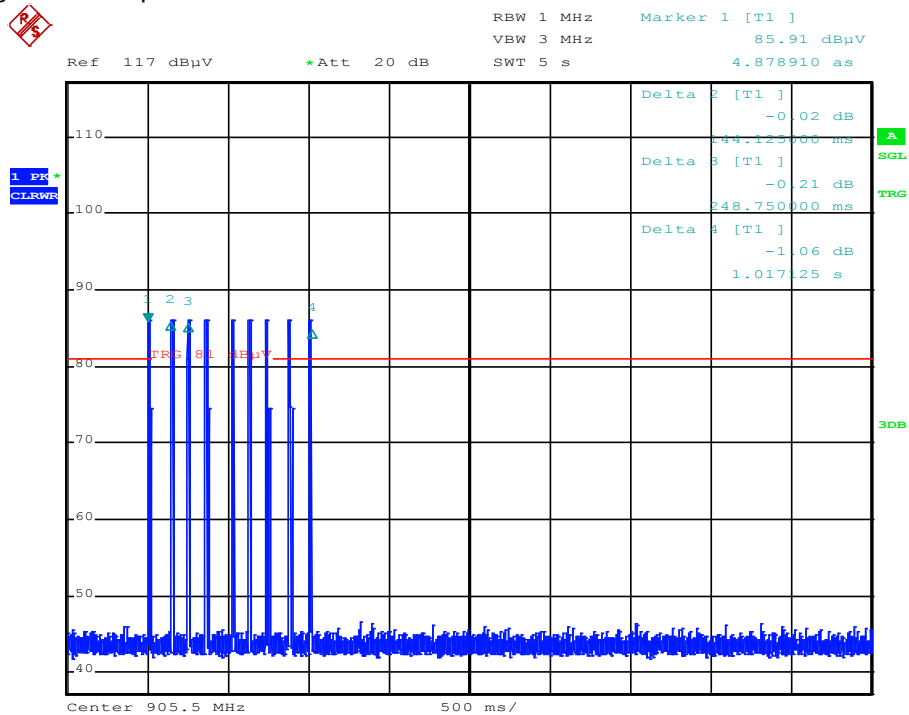
5.5.5 Test result

$K_E = -14.8 \text{ dB}$

Remarks: The pulse train (T_w) exceeds 100 ms, therefore the duty cycle has been calculated by averaging the sum of the pulse widths over the 100 ms width with the highest average value.
For detailed results, please see the test protocol below.

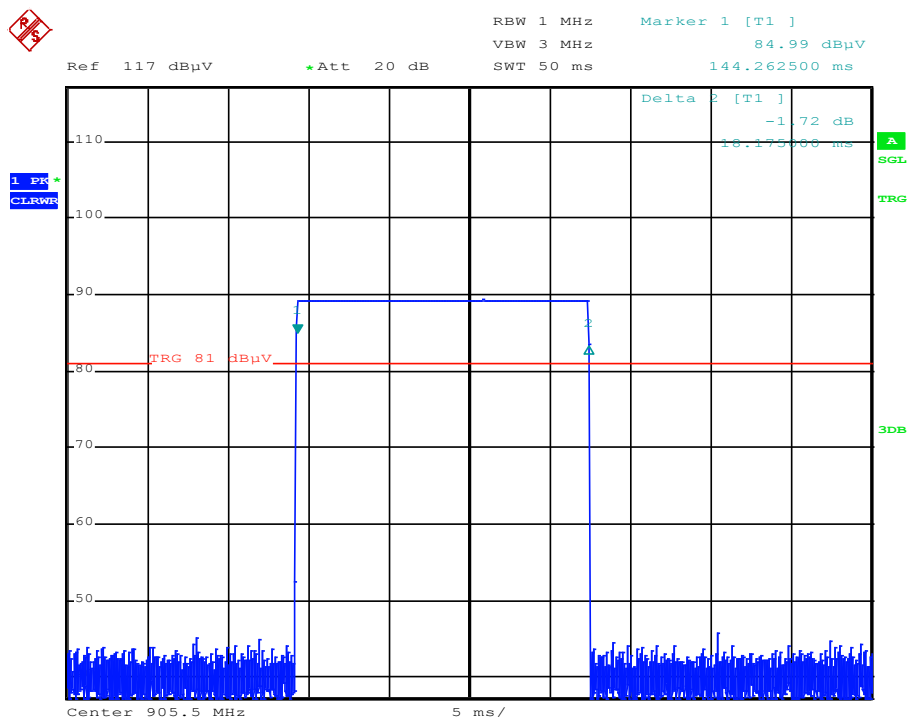
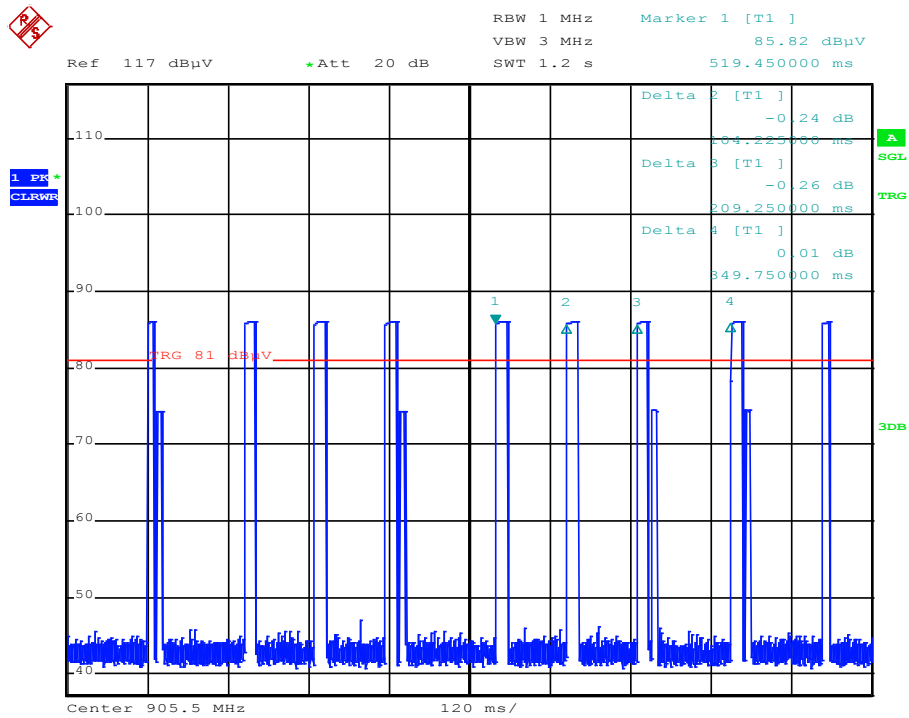
Correction for Pulse Operation (Duty Cycle) FCC Part 15A, Section 15.35(c)

Note: The EUT needs a companion device for communication. The higher bursts viewable belong to the EUT. The lower bursts belong to the companion device.



FCC ID: OHCMETDGS1

IC: 10671A-METDGS1



5.6 Antenna application

5.6.1 Applicable standard

According to FCC Part 15C, Section 15.203(a):

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section.

5.6.2 Result

The EUT uses an integrated PCB antenna. No other antenna than that furnished by the responsible party or external power amplifier can be applied by a customer.

The antenna of the EUT meets the requirement of FCC Part 15C, Section 15.203 and 15.204.

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.
CPR 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	04/03/2015	04/09/2014
	S10162-B	02-02/50-05-032				
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
DC	FSP 40	02-02/11-11-001	02/10/2015	02/10/2014		
	RF Antenna	02-02/24-05-032				
MB	FSP 40	02-02/11-11-001	02/10/2015	02/10/2014		
	RF Antenna	02-02/24-05-032				
SER 1	FMZB 1516	01-02/24-01-018			13/02/2015	13/02/2014
	ESCI	02-02/03-05-005	09/12/2015	09/12/2014		
	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	04/03/2015	04/09/2014
	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				
SER 3	FSP 40	02-02/11-11-001	02/10/2015	02/10/2014		
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	AFS4-01000400-10-10P-4	02-02/17-13-002				
	AMF-4F-04001200-15-10P	02-02/17-13-003				
	3117	02-02/24-05-009	07/05/2015	07/05/2014		
	WHJS 1000-10EE	02-02/50-05-070				
	Sucoflex N-2000-SMA	02-02/50-05-075				
	WHK 3.0/18G-10EF	02-02/50-05-180				
	SF104/11N/11N/1500MM	02-02/50-13-015				