FCC ID: 2ADP3E093 IC:12561A-E093

EMI – TEST REPORT

- FCC Part 15.247, RSS210 -

Test Report No. : T39103-00-00JP	25. February 2015 Date of issue

Type / Model Name : E093

Product Description : Eartag for animals

Applicant : MKW electronics GmbH

Address : Jutogasse 3

4675 Weibern, AUSTRIA

Manufacturer : MKW electronics GmbH

Address : Jutogasse 3

4675 Weibern, AUSTRIA

Licence holder : MKW electronics GmbH

Address : Jutogasse 3

4675 Weibern, AUSTRIA

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

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 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 15.209	Radiated emission limits, general requirements
Part 15, Subpart C, Section 15.247	Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz

RSS-210 Issue 8, December 2010	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
RSS-Gen Issue 4, November 2014	General Requirements for Compliance of Radio Apparatus
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.
ANSI C63.10: 2013	Testing Unlicensed Wireless Devices
KDB 558074 D01 v03r02	Guidance for performing compliance measurements on DTS operating under §15.247, June 5, 2014.
KDB 447498 D01 v03r02	Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies

2 EQUIPMENT UNDER TEST

2.1 Short description of the equipment under test (EUT)

The Eartag is attached to the animal's ear (especially cows). Through radio signals the position of Eartags is determined in the barn or outdoor area. The Eartag incorporates also an acceleration sensor. The communication and data exchange between the Eartags and the SMARTBOW station (separate FCC ID and IC ID) operates via the SMARTBOW Wallpoints (separate FCC ID and IC ID) in the barn or outdoor area.

Number of tested samples: 2
Serial number: 303 (radiated sample) & 301 (sample with temporary antenna connector)

EUT configuration:
(The CDF filled by the applicant can be viewed at the test laboratory.)

2.2 Variants of the EUT

none

2.3 Operation frequency and channel plan

The operating frequency band is 2400 MHz to 2483.5 MHz.

Channel A: 2441.75 MHz

2.4 Transmit operating modes

This test sample is using a transmission technology based on Multi Dimen-sional Multiple Access (MDMA). The applied spread spectrum modulation Chirp Spread Spectrum (CSS) is using a transmitter signal which will be sweeped from the lower edge of 2.4 GHz ISM band to the higher edge. It means that every signal will use the whole ISM frequency band and no further canalisation is possible. For testing appears the consequence that all measurement have to be performed at one operating frequency only.

1.1 Antennas

The following antennas shall be used with the EUT: fixed internal antenna

2.5 Power supply system utilised

Power supply voltage, V_{nom} : 3V DC (battery supplied)
REMARK: For testing issues the device was supplied by DC power supply via temporary DC connectors due to limited battery capacity.

2.6 Peripheral devices and interface cables

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

- DC power supply Model : NSP-3630, Manson

2.7 Determination of worst case conditions for final measurement

Measurements are made in all three orthogonal axes to define the maximum emissions.

3 TEST RESULT SUMMERY

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a)	RSS Gen, 8.8	AC power line conducted emissions	Not applicable[1]
15.247(a)(2)	RSS210, A8.2(a)	-6 dB / 99% BW	passed
15.247(b)(3)	RSS-210, A8.4(4)	Peak power	passed
15.209	RSS-Gen, 8.9	General field strength limits	passed
15.247(d)	RSS-210, A8.5	Out-of-band emission, radiated	passed[2]
15.247(d)	RSS-Gen, 8.10	Emissions in restricted bands	Passed[2]
15.247(e)	RSS-210, A8.2(b)	PSD	passed
--	RSS-Gen, 8.11	Transmitter frequency stability	Not applicable[3]

[1]Equipment is battery supplied
[2]All emissions are below the general field strength limits – no separate measurement for this item was performed
[3]Not applicable for equipment operating in the frequency range 2400 – 2483.5MHz

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 : 01 December 2014

Testing concluded on : 02 December 2014

Checked by:

Klaus Gegenfurtner
I confirm the correctness and
Integrity of this documents
2015.02.25 13:44:01 +01'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:

Jürgen Pessinger
2015.02.25
13:43:26 +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

The Open Area test site is a listed Open Site under the Canadian Test-Sites File-No:

IC 3009A

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

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 -6 dB / 99% BW

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

5.1.1 Description of the test location

Test location: AREA4

5.1.2 Applicable standard

According to FCC Part 15, Section 15.247(a)(2) and RSS210, A8.2(a):
Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 – 2483.5 MHz and 5725 – 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

5.1.3 Description of Measurement

The bandwidth was measured at an amplitude level reduced from the reference level of a modulated channel by a ratio of -6 dB. The reference level is the level of the highest signal amplitude observed at the transmitter at either the fundamental frequency or the first order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical. An alternative is to use the bandwidth measurement of the analyser.

Spectrum analyser settings:
RBW: 100 kHz, VBW: 300 kHz, Detector: Max peak, Sweep time: Auto

5.1.4 Test result

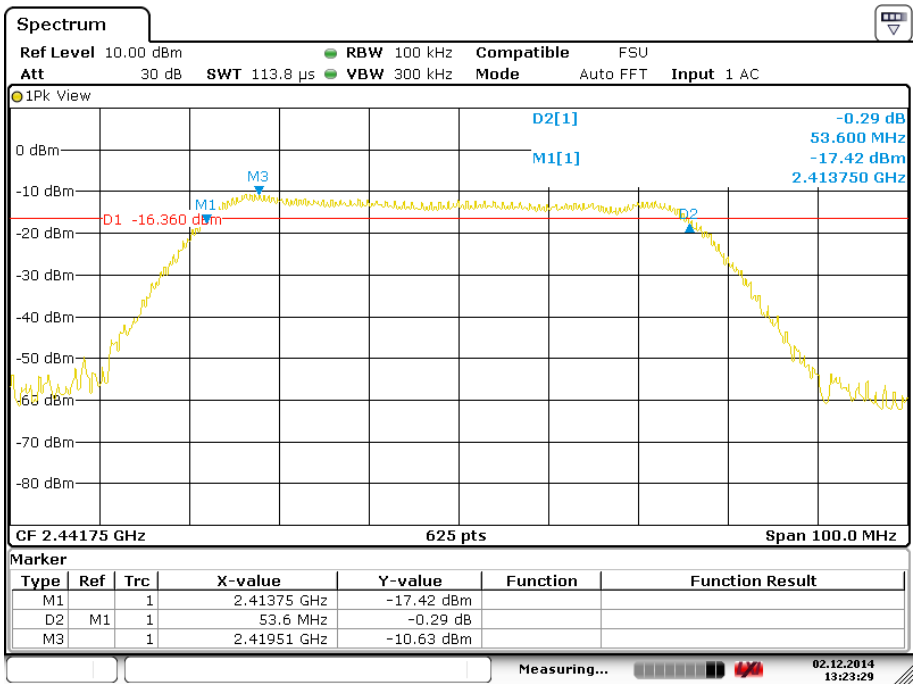
The requirements are **FULFILLED.**

Remarks: For detailed test results please refer to following test protocol

5.1.5 Test protocol

-6dB BW

CH	frequency [MHz]	-6dB Bandwidth [MHz]	minimum Limit [MHz]	Result
1	2441.75	53.6	0.5	Limit kept



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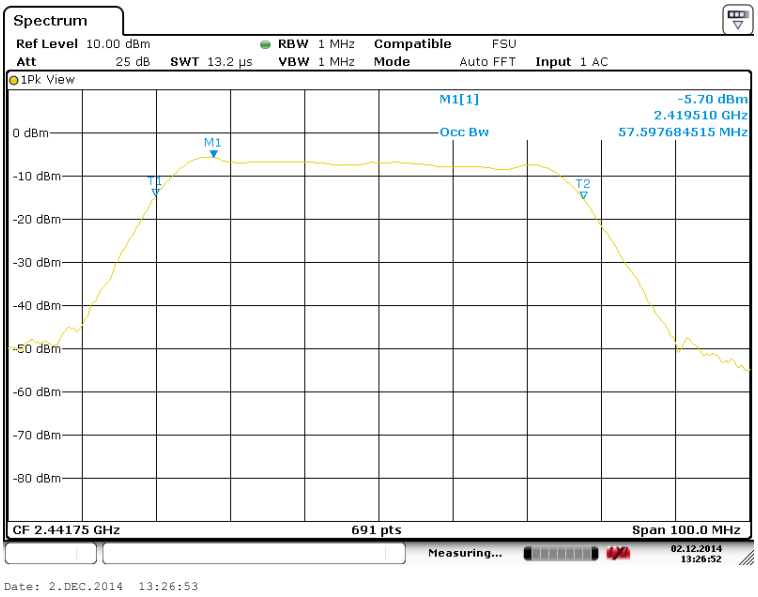
99% BW

CH	frequency [MHz]	99% Bandwidth [MHz]	Limit [MHz]	Result
1	2441.75	57.5976	none	Limit kept



5.2 Maximum peak conducted output power

For test instruments and accessories used see section 6 Part **CPC 3**.

5.2.1 Description of the test location

Test location: AREA4

5.2.2 Applicable standard

According to FCC Part 15, Section 15.247(b)(3) and RSS-210, A8.4(4):
For systems using digital modulation in the 2400-2483.5 MHz and 5725 – 5850 MHz bands, the maximum peak output power of the transmitter shall not exceed 1 Watt. The limit is based on transmitting antennas of directional gain that do not exceed 6 dBi.

5.2.3 Description of Measurement

The maximum peak conducted output power is measured using a peak power meter following the procedure set out in KDB 558074, item 9.1.2. The EUT is set in TX continuous mode while measuring.

5.2.4 Test result

CH	frequency [MHz]	conducted output power [dBm]	Limit [dBm]	Result
1	2441.75	7.3	30	Limit kept

Peak Power Limit according to FCC Part 15, Section 15.247(b)(3) and RSS-210, A8.4(4):

Frequency (MHz)	Peak Power Limit	
	(dBm)	(Watt)
902-928	30	1.0
2400-2483.5	**30**	**1.0**
5725-5850	30	1.0

The requirements are **FULFILLED.**

Remarks: none

5.3 Power spectral density

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

5.3.1 Description of the test location

Test location: AREA4

5.3.2 Applicable standard

According to FCC Part 15, Section 15.247(e) and RSS-210, A8.2(b):
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

5.3.3 Description of Measurement

The measurement is performed using the procedure 10.2 set out in KDB-558074. The power measurement was done using the integrated band power method. Therefore the PKPSD is measured. The max peak was located and with the spectrum analyser and a marker set to peak.

Spectrum analyser settings:
RBW: 3 kHz, VBW: 10 kHz, Detector: Peak, Sweep time: Auto

5.3.4 Test result

CH	Nominal frequency [MHz]	Power Spectral Density [dBm]	Limit [dBm/3kHz]	Result
1	2441.75	-27.48	8	Limit kept

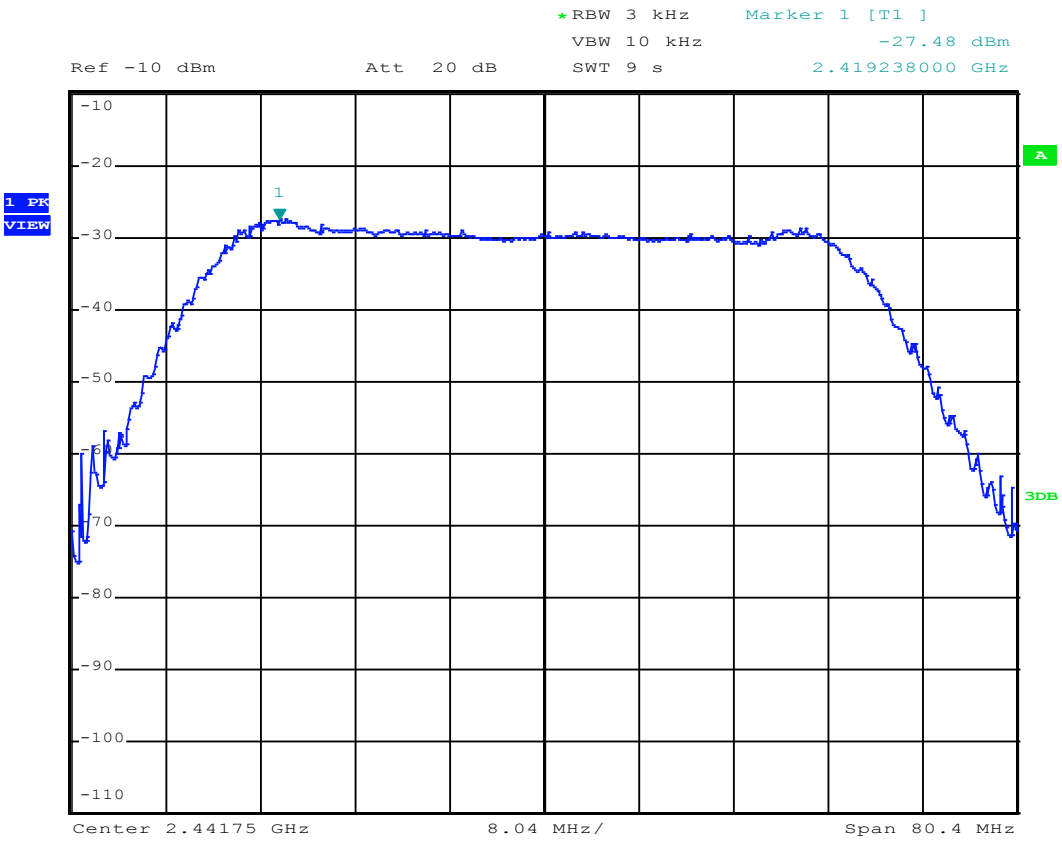
Power spectral density limit according to FCC Part 15, Section 15.247(e):

Frequency (MHz)	Power spectral density limit (dBm/3 kHz)
2400 - 2483.5	8

The requirements are **FULFILLED.**

Remarks: For detailed test results please refer to following test protocol

5.3.5 Power spectral density plot



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5.4 Band edge compliance

For test instruments and accessories used see section 6 Part **SER3**.

5.4.1 Description of the test location

Test location: Anechoic chamber 1
Test distance: 3 m

5.4.2 Applicable standard

According to FCC Part 15C, Section 15.247(d) and RSS-210, 8.5:
In any 100 kHz bandwidth outside the frequency bands 2400 – 2483.5 MHz and 5725 – 5850 MHz, the digitally modulated radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) or RSS-Gen, 8.9 is not required.

5.4.3 Description of Measurement

The radiated measurement is made with a test setup following the procedures set out in ANSI C63.4. Pre-measurements indicate that highest emission is in vertical polarization. Transducer factor is active in the spectrum analyser to have already corrected values displayed.

Spectrum analyser settings:
RBW: 1 MHz, VBW: 1 MHz, Detector: Max peak, Trace: Max hold, Sweep: auto

5.4.4 Test result

All emissions found are below the general limit according to §15.209(a) and RSS-Gen, 8.9.

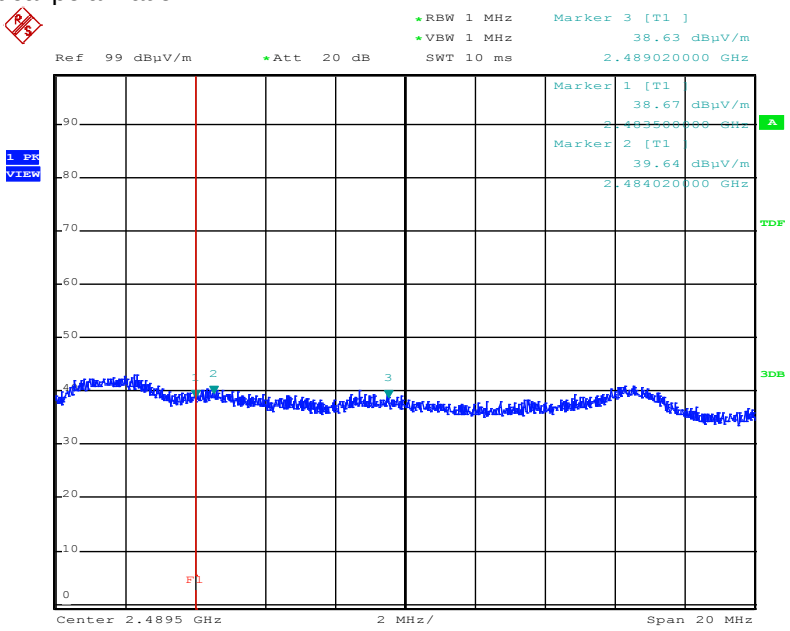
The requirements are **FULFILLED.**

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

The general limit according to §15.209(a) and RSS-Gen, 8.9 is kept.

5.4.5 Test protocol

Bandedge high, vertical polarization



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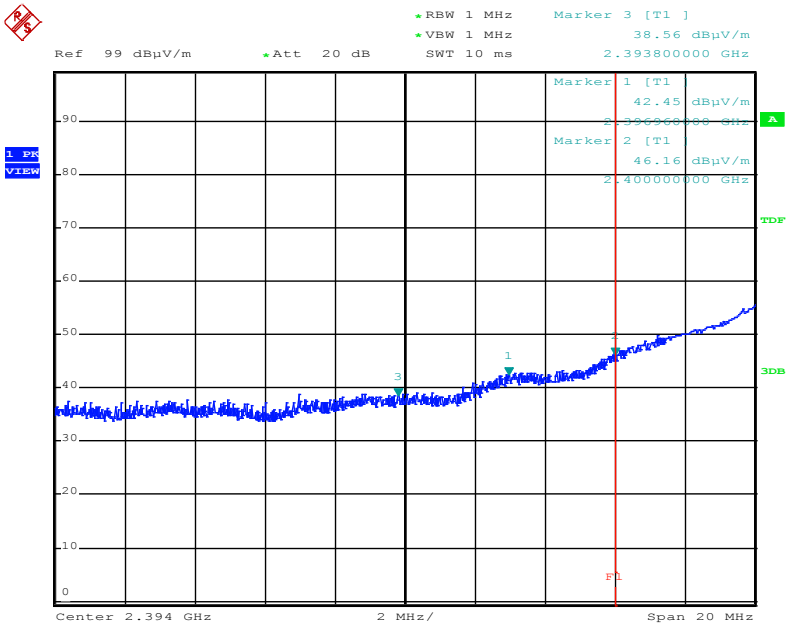
Bandedge low, vertical polarization



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5.5 Radiated spurious emissions

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

5.5.1 Description of the test location

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

5.5.2 Applicable standard

According to FCC Part 15C, Section 15.209 and RSS-Gen, 8.9:
The emissions from intentional radiators shall not exceed the effective field strength limits.

5.5.3 Description of Measurement

The radiated power of the spurious emission from the EUT is measured in a test setup following the procedures set out in ANSI C63.4. If the emission level of the EUT in peak mode complies with the average limit, no further measurement will be made otherwise the emission will be measured in average mode again and reported.

The resolution bandwidth during the measurement is as follows:
30 MHz – 1000 MHz: RBW: 120 kHz
> 1GHz: RBW: 1 MHz

5.5.4 Test result

30 – 1000 MHz

Frequency (MHz)	Reading QP Vert. (dBµV)	Reading QP Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level QP Vert. (dBµV/m)	Level QP Hor. (dBµV/m)	QP Limit (dBµV/m)	Dlimit (dB)
159.99	5.0	-2.3	10.8	11.3	15.8	9.0	43.5	-27.7
192.00	11.9	6.3	13.3	13.8	25.2	20.1	43.5	-18.3
256.00	6.1	1.9	16.8	16.9	22.9	18.8	46.0	-23.1
320.00	-0.1	2.8	19.6	19.2	19.5	22.0	46.0	-24.0

1 GHz – 25 GHz

Frequency (MHz)	Reading PK Vert. (dBµV)	Reading PK Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level PK Vert. (dBµV/m)	Level PK Hor. (dBµV/m)	Limit AV (dBµV/m)	Dlimit (dB)
1024.00	59.6	--	-20.7	--	38.9	--	54.0	-15.1
1030.00	--	61.8	--	-20.8	--	41.0	54.0	-13.0
1114.00	--	58.6	--	-20.6	--	38.0	54.0	-16.0
1330.00	59.5	--	-19.5	--	40.0	--	54.0	-14.0
1438.00	--	60.1	--	-20.5	--	39.6	54.0	-14.4
1558.00	--	61.7	--	-21.2	--	40.5	54.0	-13.5
1678.00	59.1	--	-20.0	--	39.1	--	54.0	-14.9
1894.00	--	61.3	--	-16.0	--	45.3	54.0	-8.7
1996.00	60.6	59.8	-15.9	-15.9	44.7	43.9	54.0	-9.3
2002.00	57.6	--	-15.9		41.6	--	54.0	-12.4
4816.00	--	48.6	--	2.1	--	50.7	54.0	-3.3
4832.00	--	46.5	--	2.1	--	48.6	54.0	-5.4
4896.00	**56.8**	--	**2.3**		**59.1**	--	**54.0**	**5.1***
7232.00	40.7	--	7.7		48.5	--	54.0	-5.5
7280.00	--	38.8	--	7.7	--	46.5	54.0	-7.5
7376.00	**49.0**	--	**7.6**		**56.6**	--	**54.0**	**2.6***
9760.00	--	39.4	--	7.8	--	47.2	54.0	-6.8
9776.00	39.4	41.7	7.8	7.8	47.2	49.5	54.0	-4.5

*Duty cycle correction is applied for these frequencies to show compliance

Duty cycle correction applied

Frequency (MHz)	Level PK (dBµV/m)	Duty cycle correction(dB)*	Level AV (dBµV/m)	Limit AV (dBµV/m)	Dlimit (dB)
4896.00	59.1	-37.9	21.2	54.0	-32.8
7376.00	56.6	-37.9	18.7	54.0	-35.3

*Calculation of duty cycle correction can be found under subclause 5.6 of this report

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 the 10th harmonic of the highest fundamental frequency.

All three orthogonal axes were tested to define the maximum emissions.

5.6 Correction for pulse operation (duty cycle)

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

5.6.1 Description of the test location

Test location: AREA4

5.6.2 Applicable standard

According to FCC Part 15A, Section 15.35(c) and RSS-Gen, 6.10.

5.6.3 Description of Measurement

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

$$\delta(dB) = 20 \log ((t_1 + t_2 + \ldots + t_n) / T)$$

δ(dB) duty cycle correction factor expressed in dB
t_1 duration of pulse 1 in the defined time period T
t_n duration of pulse n in the defined time period T
T period of one complete puls train or 100ms if the complete puls train is longer 100ms

5.6.4 Test result

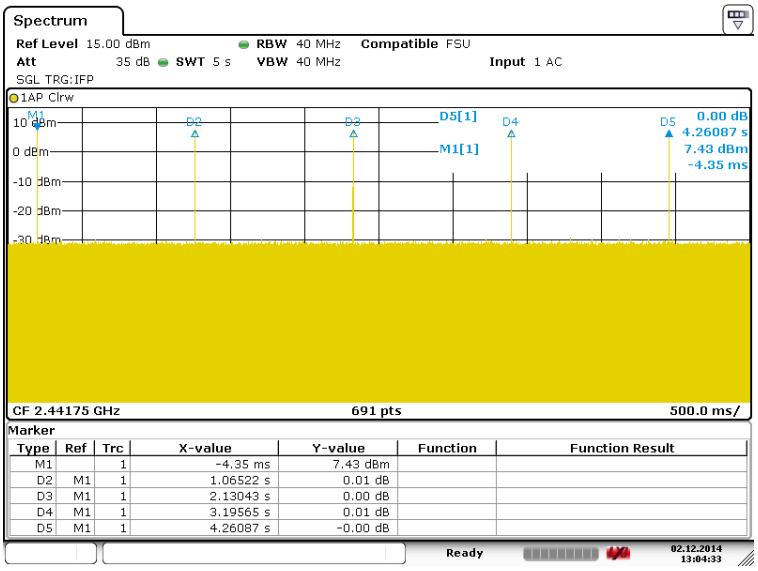
t_1 [ms]	t_2 [ms]	t_3 [ms]	t_4 [ms]	*T* [ms]
1.273	--	--	--	100

RESULT δ(dB) = -37.9

Remarks: Maximum duty cycle used for calculation.

5.6.5 Test protocol

Determination of T = 1.065s (due to 100ms maximum 100ms are used)



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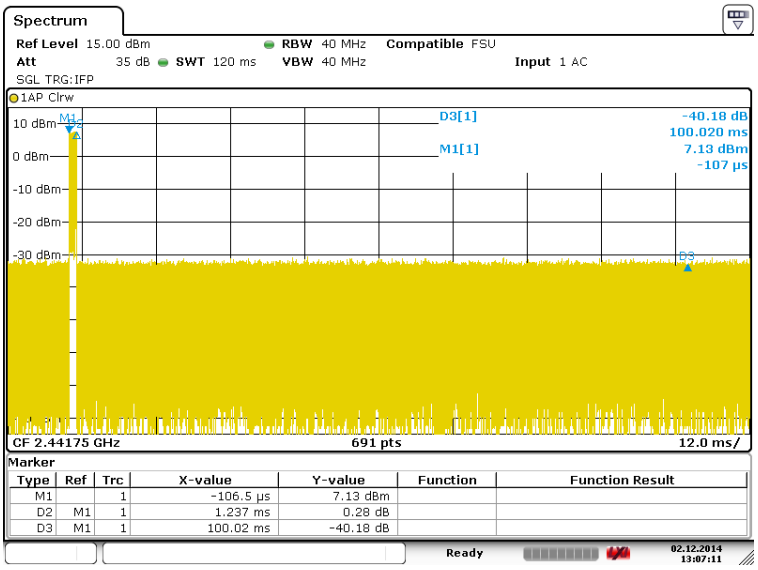

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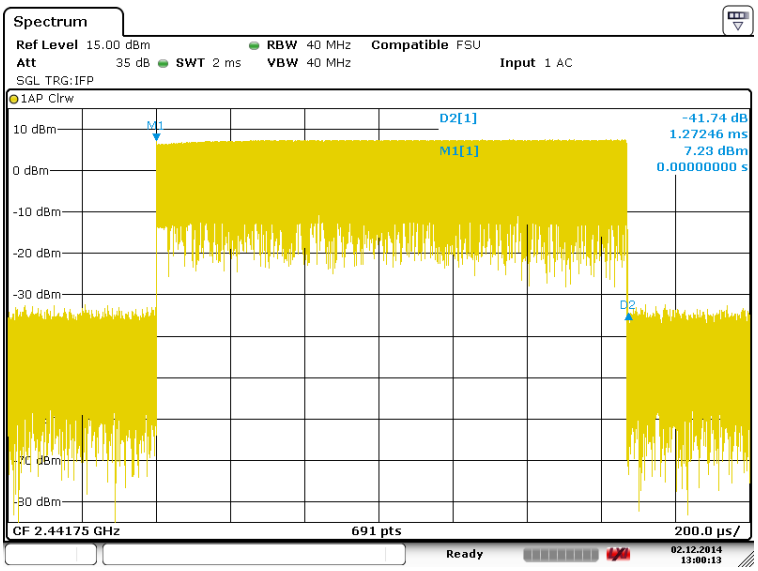
Determination of t_1 = 1.273ms



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.
CPC 3	NRVS	02-02/07-06-003				
	NRV-Z15	02-02/07-07-001	28/07/2015	28/07/2014		
	NSP 3630	02-02/50-14-015				
DC	FSP 30	02-02/11-05-001	20/10/2015	20/10/2014		
	NSP 3630	02-02/50-14-015				
MB	ESR 3	01-02/03-13-001	13/08/2015	13/08/2014		
	FSP 30	02-02/11-05-001	20/10/2015	20/10/2014		
	NSP 3630	02-02/50-14-015				
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	02-02/50-05-032				
	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		
	JS4-18004000-30-5A	02-02/17-05-017				
	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		
	BBHA 9170	02-02/24-05-014				
	Sucoflex N-2000-SMA	02-02/50-05-075				
	KMS102-0.2 m	02-02/50-11-020				
	SF104/11N/11N/1500MM	02-02/50-13-015				