

FCC ID: XYN2503

IC ID: 8748A-2503

EMI - TEST REPORT

- FCC Part 15.249, RSS210 -

Test Report No. : T36927-00-00KJ	17. June 2013 <hr/> Date of issue
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Type / Model Name : 2503

Product Description : RF2IR USB Dongle

Applicant : ruwido austria gmbh

Address : Koestendorfer Str. 8

5202 NEUMARKT, AUSTRIA

Manufacturer : ruwido austria gmbh

Address : Koestendorfer Str. 8

5202 NEUMARKT, AUSTRIA

Licence holder : ruwido austria gmbh

Address : Koestendorfer Str. 8

5202 NEUMARKT, AUSTRIA

Test Result according to the standards listed in clause 1 test standards:	POSITIVE
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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, 2012)

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 B – Unintentional Radiators (September, 2012)

Part 15, Subpart B, Section 15.109	Radiated emission limits.
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FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (September, 2012)

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 15.249	Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz
ANSI C63.4: 2003	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
CISPR 16-4-2: 2003	Uncertainty in EMC measurement
CISPR 22: 2005 EN 55022: 2006	Information technology equipment

2 SUMMARY

2.1 GENERAL REMARKS:

The EUT is a 2.4 GHz – transceiver USB dongle for low power data transmission in 3 channels of the operating band of 2.4 GHz to 2.4835 GHz MHz and has an integrated printed antenna.

A temporary connector can not be implemented due to the small size of the module. A suitable test fixture can also not be used to convert radiated measurements to conducted measurements therefore all measurements were performed radiated.

Items	Description
Transceiver Chip	MCP24J40
Power type	5 VDC (USB powered)
Modulation	OQPSK
Data rate	250 kbps
Frequency range	2400 MHz to 2483.5 MHz
Channel spacing	25 MHz
Channel numbers	3
Antenna type	Inverted F antenna (PCB)

Channel	Frequency [MHz]
1	2425
2	2450
3	2475

2.2 Test result summary

Operating in the 2400 MHz – 2483.5 MHz band:

FCC Rule Part	RSS Rule Part	Description	Result
15.35(c)	RSS-Gen, 4.5	Pulsed operation	passed
15.203	RSS Gen, 7.1.2	Antenna requirement	passed
15.204	RSS Gen, 7.1.1	External radio frequency power amplifiers	passed
15.205(a)	RSS-Gen, 7.2.2	Emissions in restricted bands	passed
15.207(a)	RSS Gen, 7.2.4	AC power line conducted emissions	passed
15.215(c)		-20 dBc EBW	passed
	RSS-Gen, 4.6.1	99 % Bandwidth	passed
15.249(a)	RSS-210, A2.9(a)	Field strength of fundamental	passed
15.249(d)	RSS Gen, 7.2.5	Out-of-band emission, radiated	passed
	RSS-Gen, 7.2.6	Transmitter frequency stability	not applicable
15.109 (a)	RSS-Gen, 6.1	Receiver radiated emissions	passed

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

RSS Gen, Issue 3, December 2010

RSS 210, Issue 8, December 2010

RSS 102, Issue 4, March 2010

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2.3 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 : 21 May 2013

Testing concluded on : 12 June 2013

Checked by:

Tested by:

Klaus Gegenfurtner
Dipl. Ing.(FH)
Manager: Radio Group

Josef Knab
Radio Senior Expert

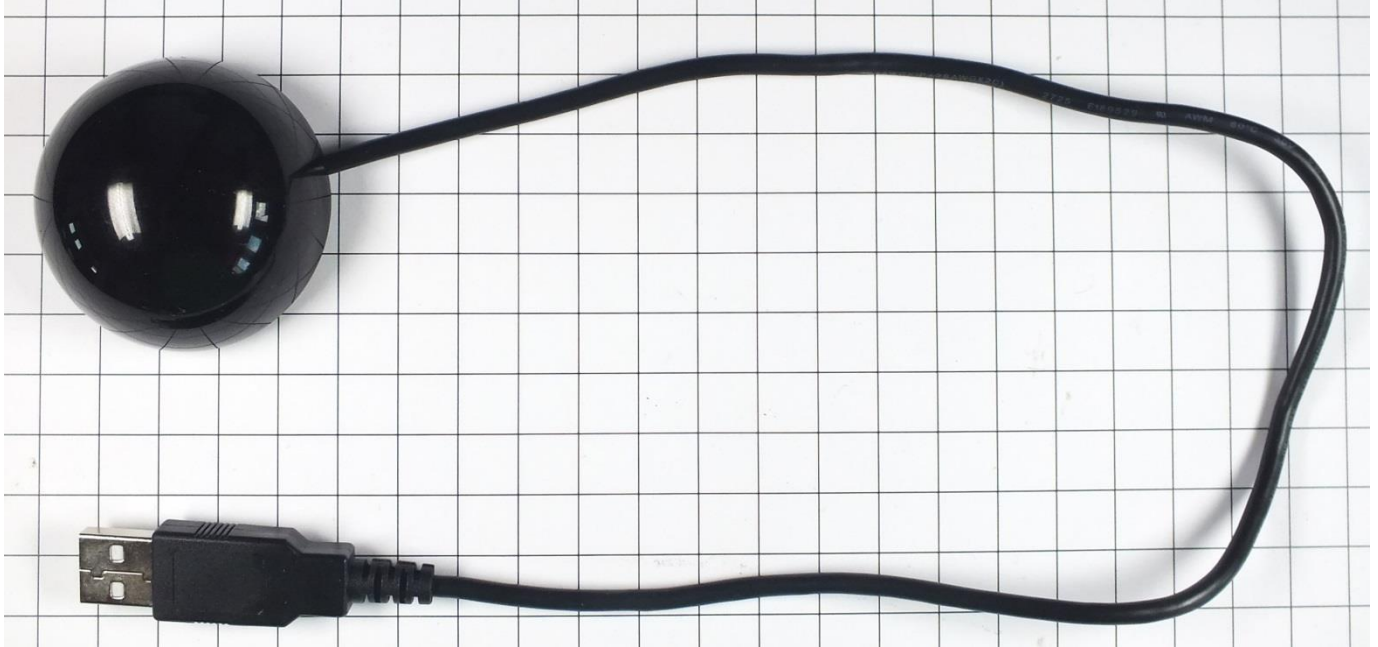
FCC ID: XYN2503

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3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EUT – Internal photos see attachment A

top view



bottom view



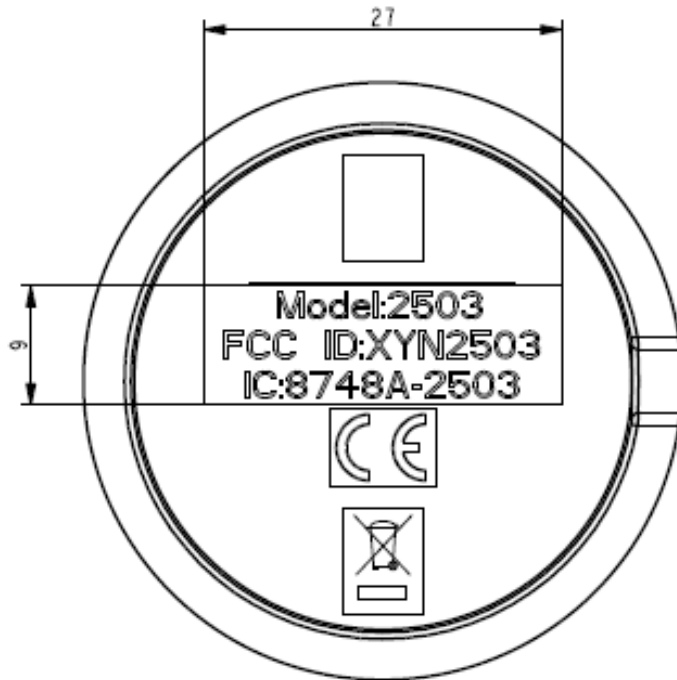
side view



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**Lable placement
(inside of the battery cover)**



USB Charger (not part of tested system)



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3.3 Power supply system utilised

Power supply voltage : 5.0 V DC (USB powered)

3.4 Short description of the equipment under test (EUT)

The EuT is a transceiver USB dongle with integrated infrared booster for TV set top boxes and operate in the frequency band from 2400 MHz to 2483.5 MHz.

Number of tested samples: 1
Serial number: Prototype

EUT operation mode:

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

- cont. TX at CH1, CH2 and CH3 (2425 MHz, 2450 MHz and 2475 MHz)

- standby / cont. RX mode

-

EUT configuration:

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

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

- USB charger	Model : MSH-TR-018A
-	Model :
-	Model :
-	Model :

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

mikes-testingpartners gmbh
Ohmstrasse 2-4
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. The reader may notice that tolerances within the calibration of the equipment and facilities may cause additional uncertainty. The measurement uncertainty is calculated for all measurements listed in this test report acc. to CISPR 16-4-2 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurement“ and documented in the mikes-testingpartners gmbh quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, mikes-testingpartners 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 diversity and modifications in production processes may result in additional deviation. If necessary, refer to the test lab for the actual measurement uncertainty for specific tests. The manufacturer has the sole responsibility of continued compliance of the EUT.

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

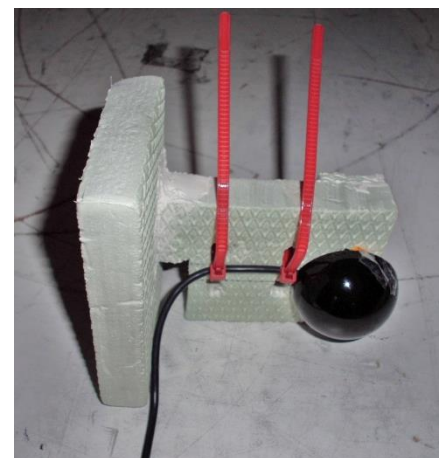
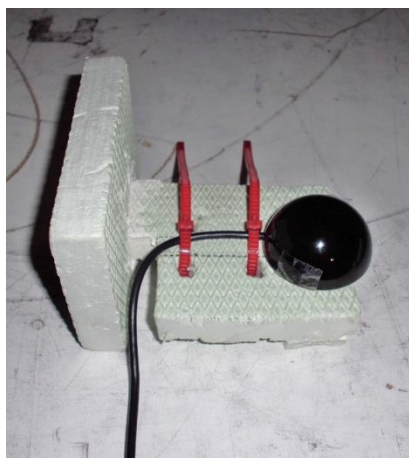
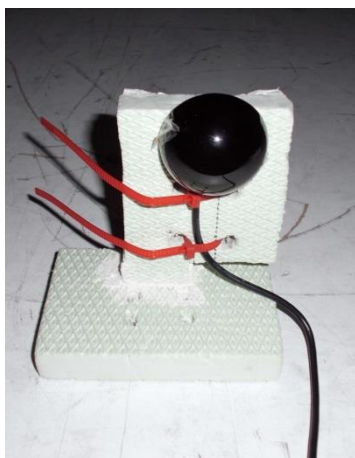
The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables 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.

4.5 Determination of worst case measurement conditions

Measurements have been made in all three orthogonal axes. The worst case results are written down in the respective parts of this test report.



5 TEST CONDITIONS AND RESULTS

5.1 Conducted emissions

For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up



5.1.3 Applicable standard

According to FCC Part 15, Section 15.207(a):

Except as shown in paragraphs (b) and (c) of this Section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the given limits.

5.1.4 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.4 described under item 4.4.3. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

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5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin > 10 dB

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.

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5.1.6 Test protocol

Test point	L1
Operation mode:	cont. TX at 2450 MHz
Remarks:	-

Result: passed

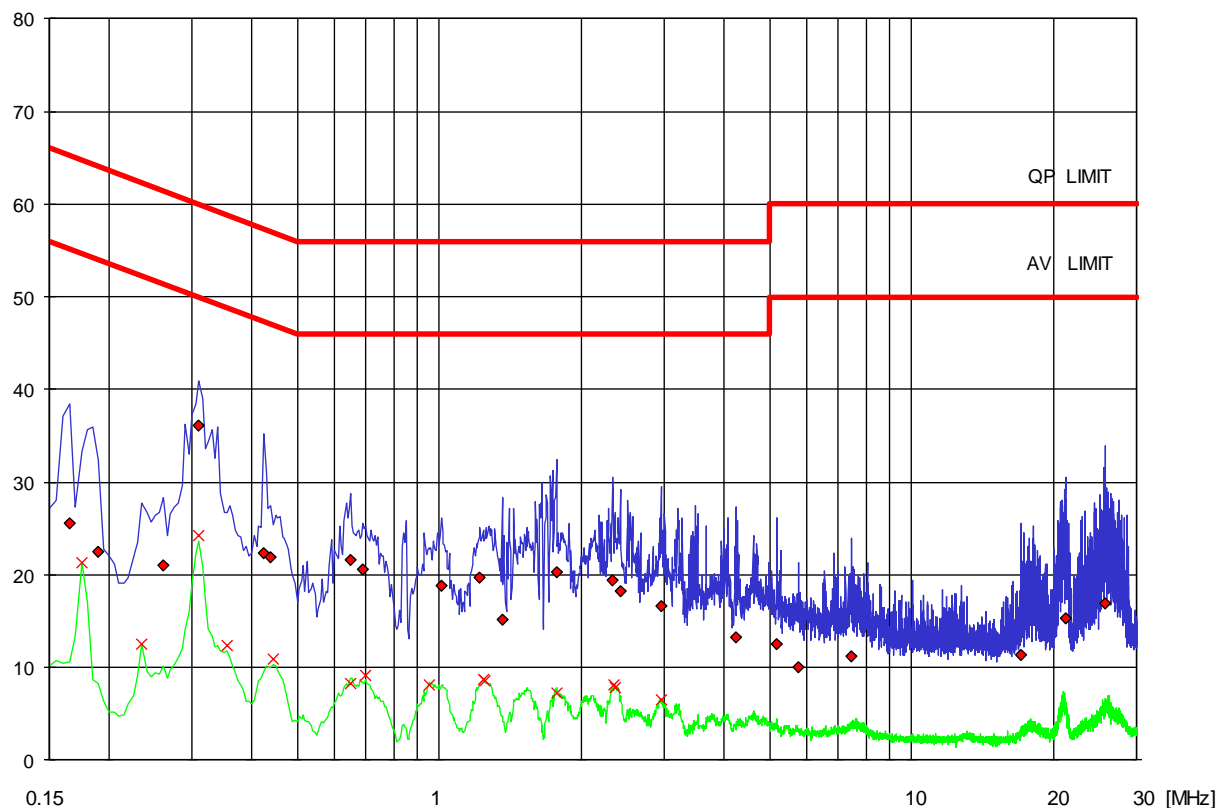
Freq kHz	QP- L dB[μV]	D -Limit QP [dB]	Freq kHz	AV-L dB[μV]	D -Limit AV [dB]
165	25,6	-39,6	175	21,3	-33,4
190	22,5	-41,5	235	12,5	-39,8
260	21	-40,4	310	24,2	-25,8
310	36,1	-23,9	355	12,4	-36,4
425	22,4	-34,9	445	10,9	-36,1
440	21,9	-35,2	650	8,3	-37,7
650	21,6	-34,4	700	9,1	-36,9
690	20,6	-35,4	955	8,2	-37,8
1010	18,8	-37,2	1245	8,7	-37,3
1220	19,7	-36,3	1250	8,6	-37,4
1360	15,1	-40,9	1770	7,3	-38,7
1770	20,3	-35,7	2345	8,1	-37,9
2330	19,4	-36,6	2365	7,9	-38,1
2415	18,2	-37,8	2950	6,5	-39,5
2945	16,6	-39,4			

[illegible]dB [μ V]

Legend

PK: AV:

Detector: QP: ◆ AV: ✗



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Test point:	N
Operation mode:	cont. TX at 2450 MHz
Remarks:	-

Result: passed

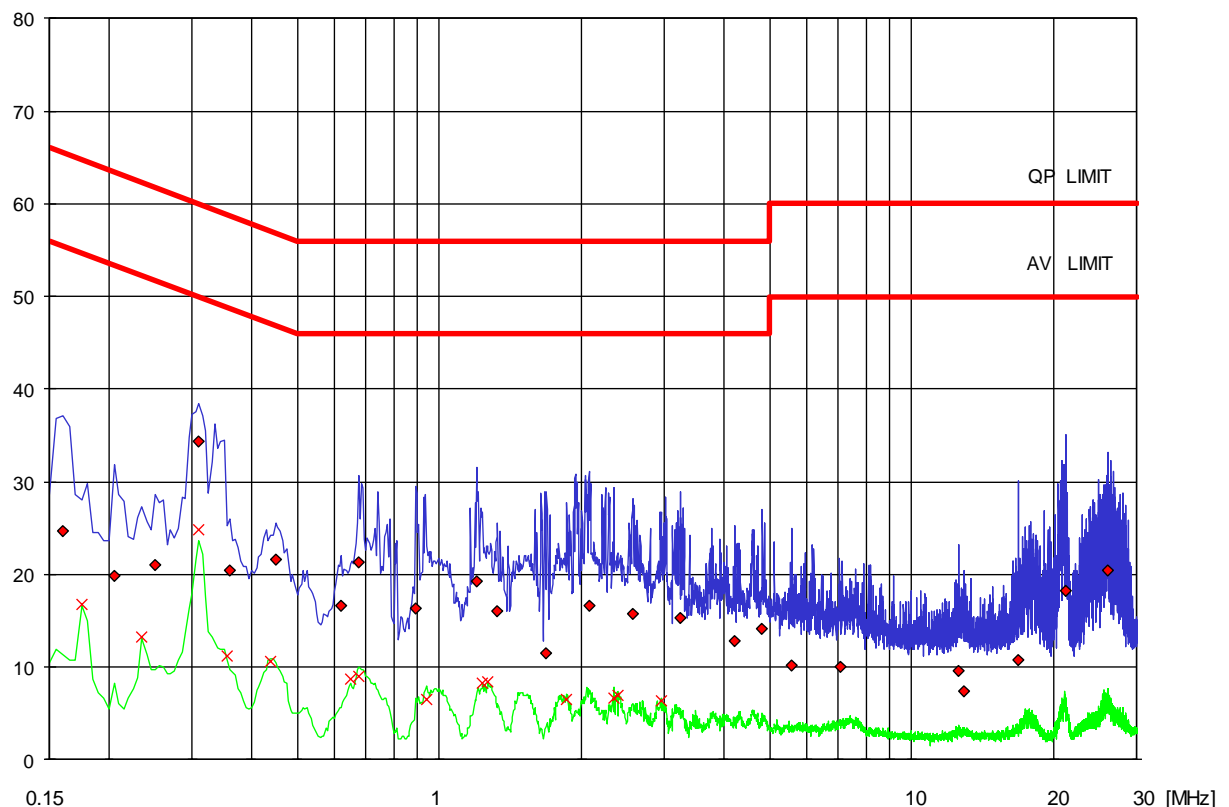
Freq kHz	QP- L dB[μV]	D -Limit QP [dB]	Freq kHz	AV-L dB[μV]	D -Limit AV [dB]
160	24,7	-40,8	175	16,8	-37,9
205	19,9	-43,5	235	13,2	-39,1
250	21	-40,8	310	24,8	-25,2
310	34,4	-25,6	355	11,2	-37,6
360	20,4	-38,3	440	10,6	-36,5
450	21,6	-35,3	650	8,7	-37,3
620	16,6	-39,4	675	9	-37,0
675	21,3	-34,7	940	6,5	-39,5
890	16,3	-39,7	1235	8,3	-37,7
1200	19,3	-36,7	1270	8,5	-37,5
1330	16,1	-39,9	1860	6,5	-39,5
1685	11,5	-44,5	2340	6,7	-39,3
2075	16,6	-39,4	2385	7	-39,0
2575	15,7	-40,3	2945	6,4	-39,6
3235	15,3	-40,7			

[illegible]dB [μ V]

Legend

PK: AV:

Detector: QP: ◆ AV: ✗



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Test point:	L1
Operation mode:	standby / cont. RX mode
Remarks:	-

Result: passed

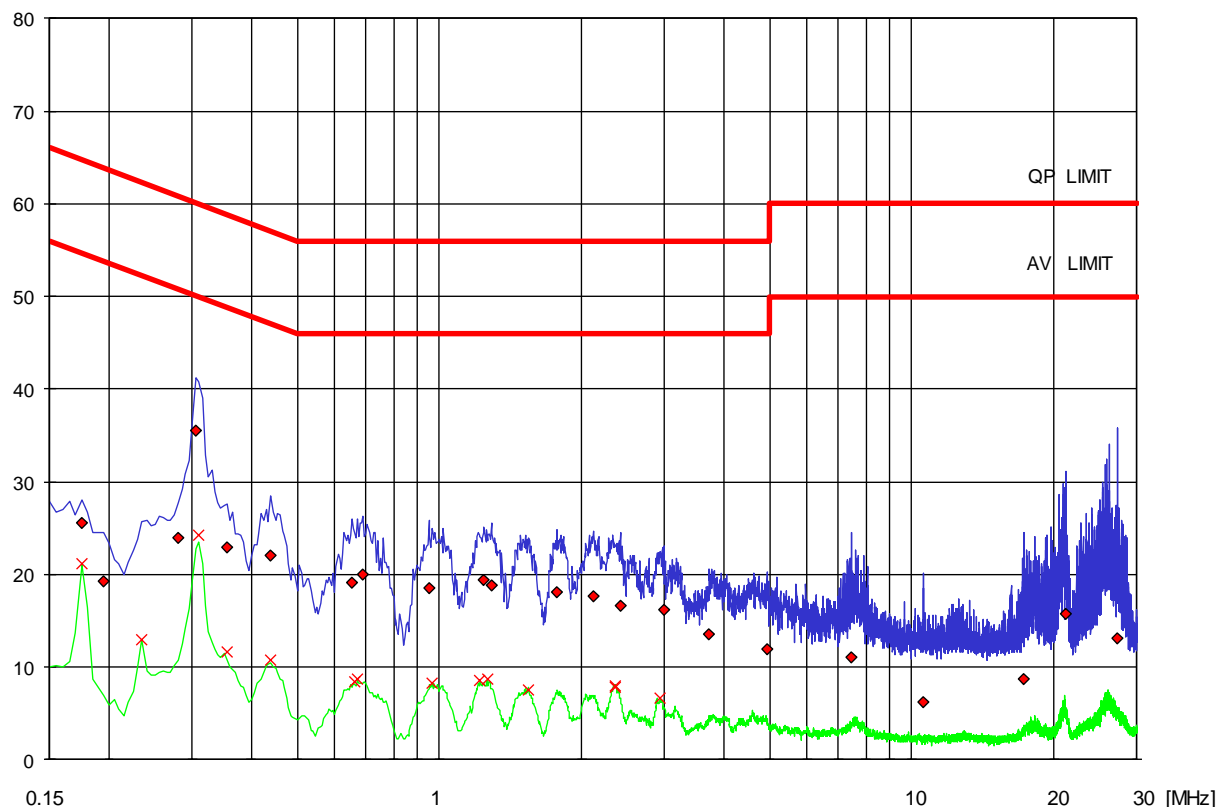
Freq kHz	QP- L dB[μV]	D -Limit QP [dB]	Freq kHz	AV-L dB[μV]	D -Limit AV [dB]
175	25,6	-39,1	175	21,2	-33,5
195	19,3	-44,5	235	13	-39,3
280	24	-36,8	310	24,3	-25,7
305	35,5	-24,6	355	11,7	-37,1
355	22,9	-35,9	440	10,8	-36,3
440	22,1	-35,0	660	8,5	-37,5
655	19,2	-36,8	670	8,7	-37,3
690	20	-36,0	965	8,3	-37,7
950	18,6	-37,4	1220	8,6	-37,4
1245	19,4	-36,6	1265	8,7	-37,3
1290	18,9	-37,1	1545	7,6	-38,4
1775	18,1	-37,9	2355	8	-38,0
2115	17,7	-38,3	2360	7,9	-38,1
2415	16,7	-39,3	2940	6,7	-39,3
2990	16,2	-39,8			

[illegible]dB [μ V]

Legend

PK: AV:

Detector: QP: ◆ AV: ✗



FCC ID: XYN2503

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Test point:	N
Operation mode:	standby / cont. RX mode
Remarks:	-

Result: passed

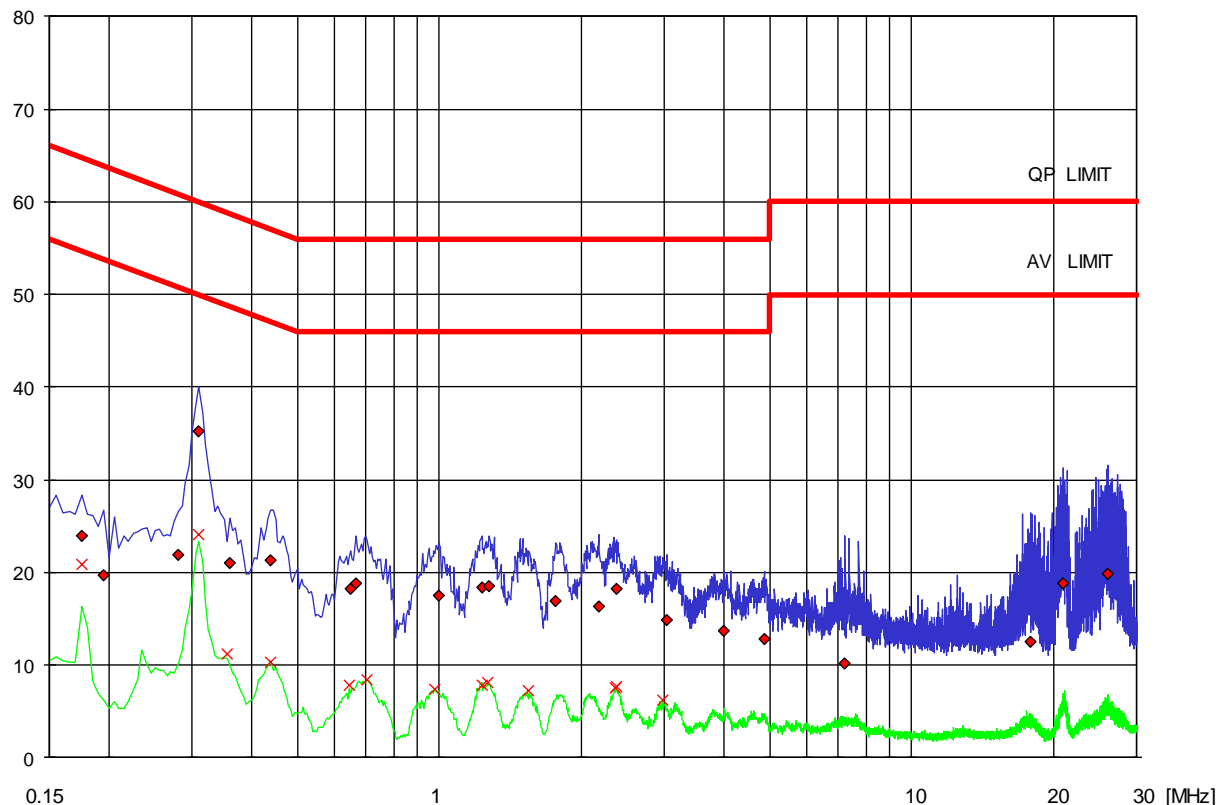
Freq	QP- L	D -Limit	Freq	AV-L	D -Limit
kHz	dB[μV]	QP [dB]	kHz	dB[μV]	AV [dB]
175	24	-40,7	175	20,9	-33,8
195	19,7	-44,1	310	24,1	-25,9
280	21,9	-38,9	355	11,2	-37,6
310	35,2	-24,8	440	10,4	-36,7
360	21	-37,7	645	7,8	-38,2
440	21,3	-35,8	705	8,4	-37,6
650	18,2	-37,8	980	7,4	-38,6
665	18,9	-37,1	1230	7,9	-38,1
995	17,5	-38,5	1265	8,1	-37,9
1230	18,4	-37,6	1545	7,3	-38,7
1275	18,5	-37,5	2350	7,5	-38,5
1765	16,9	-39,1	2370	7,7	-38,3
2175	16,3	-39,7	2965	6,2	-39,8
2370	18,3	-37,7			
3035	14,9	-41,1			

[illegible]dB [μ V]

Legend

PK: AV:

Detector: QP: AV:



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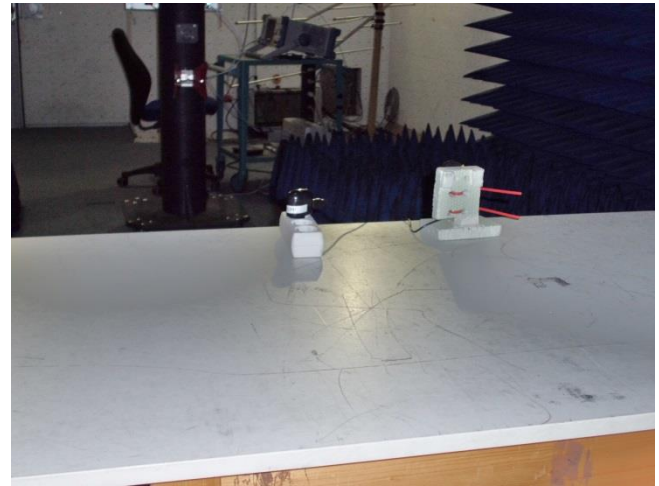
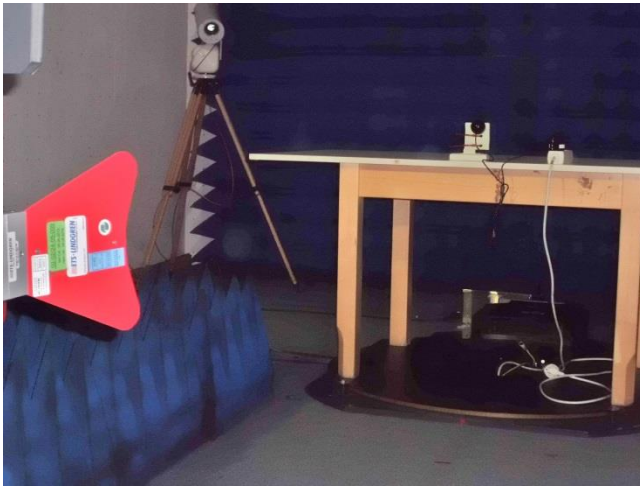
5.2 Radiated emission of the fundamental wave

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

5.2.1 Description of the test location

Test location: Anechoic chamber 2
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 C63.4, Item 8.3. The EUT is measured in TX continuous mode modulated under normal conditions.

Analyser settings:

Peak measurement: RBW: 1 MHz
AV measurement: RBW: 1 MHz

VBW: 1 MHz
VBW: 10 Hz

Detector: Max peak
Detector: Max peak

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5.2.3 Test result
Channel 1

Frequency (MHz)	Reading level PK (dBμV)	Reading level AV (dBμV)	Bandwidth (kHz)	Correction factor (dB)	Corrected level PK dB(μV/m)	Corrected level AV dB(μV/m)	Limit AV dB(μV/m)	Delta (dB)
2425	80.0	-	1000	4.1	84.1	-	94.0	-9.9

Channel 2

Frequency (MHz)	Reading level PK (dBμV)	Reading level AV (dBμV)	Bandwidth (kHz)	Correction factor (dB)	Corrected level PK dB(μV/m)	Corrected level AV dB(μV/m)	Limit AV dB(μV/m)	Delta (dB)
2450	88.3	-	1000	4.3	92.6	-	94.0	-1.4

Channel 3

Frequency (MHz)	Reading level PK (dBμV)	Reading level AV (dBμV)	Bandwidth (kHz)	Correction factor (dB)	Corrected level PK dB(μV/m)	Corrected level AV dB(μV/m)	Limit AV dB(μV/m)	Delta (dB)
2475	78.8	-	1000	4.3	83.1	-	94.0	-10.9

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

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

Frequency (MHz)	Field strength of fundamental	
	(mV/m)	dB(μV/m)
902 - 928	50	94
2400 - 2483.5	50	94
5725-5875	50	94
24000 - 24250	250	108

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: No average measurement performed, because the peak limits met the average limits.

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5.3 Spurious emissions radiated

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

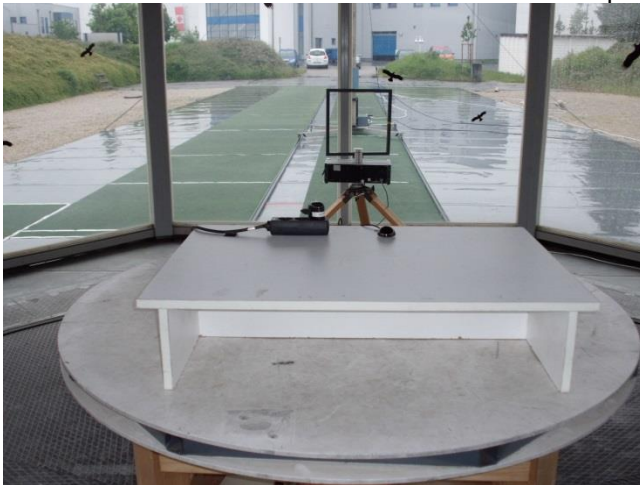
5.3.1 Description of the test location

Test location: OATS 1
 Test location: Anechoic chamber 2

Test distance: 3 m (9 kHz to 18 GHz)
 1 m (18GHz to 25 GHz)

5.3.2 Photo documentation of the test set-up

Test setup 9 kHz – 30 MHz



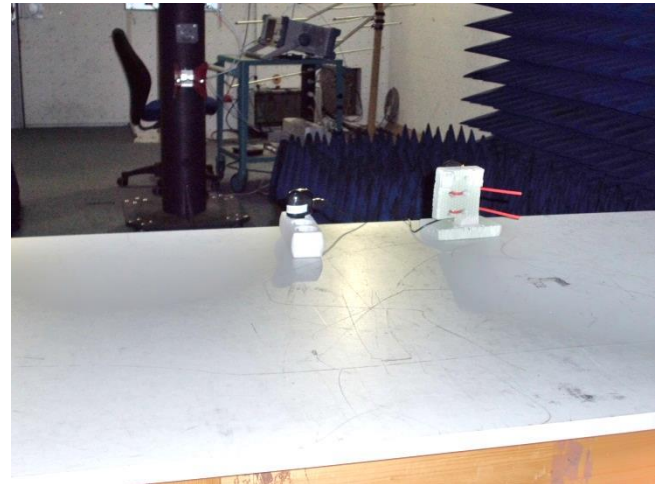
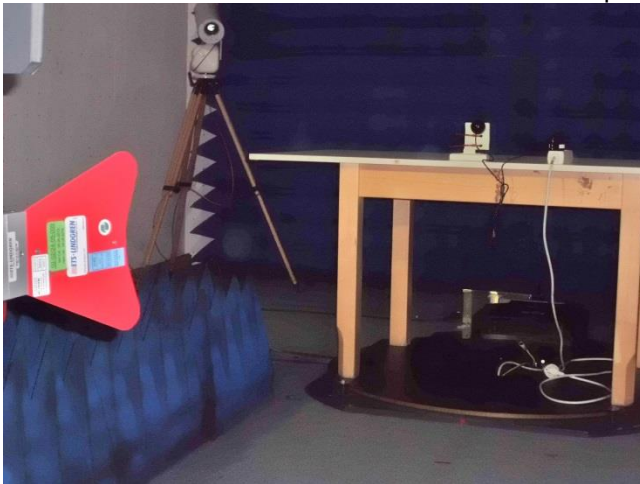
Test setup 30 MHz – 1000 MHz



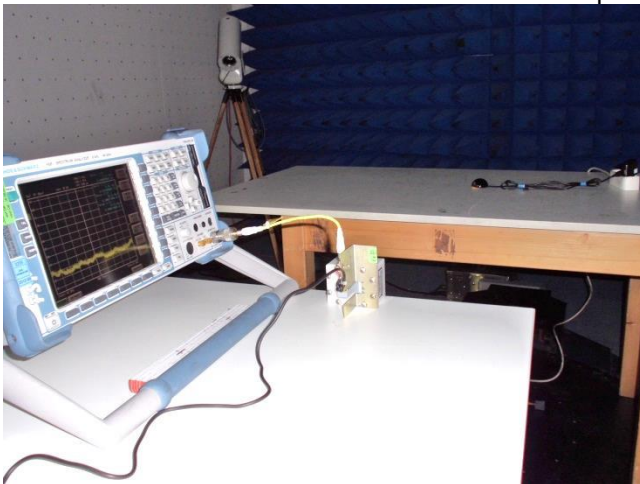
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Test setup 1 GHz – 18 GHz



Test setup 18 GHz – 40 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 C63.4, Item 8.3. 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.

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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 – 25 GHz	RBW:	1 MHz

5.3.5 Test result $f < 1$ GHz

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)
0.5*	25.0	-	9	20.0	45.0	-	73.6	-28.6
2.0*	33.0	-	9	20.0	53.0	-	69.5	-16.5
30*	13.0	-	120	12.3	25.3	-	40.0	-14.7
300*	2.0	-	120	16.5	18.5	-	46.0	-27.5
450*	1.5	-	120	20.4	21.9	-	46.0	-24.1
750*	0.3	-	120	26.8	27.1	-	46.0	-18.9
1000*	0.4	-	120	30.1	30.5	-	54.0	-23.5

*) Ambient noise

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

5.3.6 Test result $f > 1$ GHz

Channel 1

Frequency (MHz)	Level PK (dB μ V)	Duty Cycle Correction (dB)	Level AV (dB μ V)*	Correction factor (dB/m)	Corrected level PK dB(μ V/m)	Corrected level AV dB(μ V/m)	Limit PK dB(μ V/m)	Limit AV dB(μ V/m)	Delta (dB)
4850.0	55.8	-20.0	35.8	3.0	58.8	38.8	74.0	54.0	-15.2
7276.9	39.8	-20.0	19.8	6.2	44.8	24.8	74.0	54.0	-29.2
9702.4	39.5	-20.0	-19.5	9.5	49.0	29.0	74.0	54.0	-25.0
18000*	39.3	-20.0	19.3	-0.8	38.5	18.5	74.0	54.0	-35.5
24000*	38.4	-20.0	18.4	0.7	39.1	19.1	74.0	54.0	-34.9

*) Ambient noise

Note: Average values were calculated from the subtraction of peak values minus correction duty cycle factor.

Channel 2

Frequency (MHz)	Level PK (dB μ V)	Duty Cycle Correction (dB)	Level AV (dB μ V)*	Correction factor (dB/m)	Corrected level PK dB(μ V/m)	Corrected level AV dB(μ V/m)	Limit PK dB(μ V/m)	Limit AV dB(μ V/m)	Delta (dB)
4900.9	52.8	-20.0	32.8	3.3	56.1	36.1	74.0	54.0	-17.9
7351.1	50.6	-20.0	30.6	6.3	56.9	36.9	74.0	54.0	-17.1
18000*	39.3	-20.0	19.3	-0.8	38.5	18.5	74.0	54.0	-35.5
24000*	38.4	-20.0	18.4	0.7	39.1	19.1	74.0	54.0	-34.9

*) Ambient noise

Note: Average values were calculated from the subtraction of peak values minus correction duty cycle factor.

FCC ID: XYN2503
IC ID: 8748A-2503
Channel 3

Frequency (MHz)	Level PK (dBμV)	Duty Cycle Correction (dB)	Level AV (dBμV*)	Correction factor (dB/m)	Corrected level PK dB(μV/m)	Corrected level AV dB(μV/m)	Limit PK dB(μV/m)	Limit AV dB(μV/m)	Delta (dB)
4950.4	52.9	-20.0	-32.9	3.5	56.4	36.4	74.0	54.0	-17.6
7426.8	41.1	-20.0	21.1	6.4	47.5	27.5	74.0	54.0	-26.5
9901.8	39.8	-20.0	19.8	9.4	49.2	29.2	74.0	54.0	-24.8
18000*	39.3	-20.0	19.3	-0.8	38.5	18.5	74.0	54.0	-35.5
24000*	38.4	-20.0	18.4	0.7	39.1	19.1	74.0	54.0	-34.9

*) Ambient noise

Note: Average values were calculated from the subtraction of peak values minus correction duty cycle factor.

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 (25000 MHz). The average values
 where calculated from the subtraction of peak values minus correction duty cycle factor.
 For detailed test result please refer to following test protocols.

FCC ID: XYN2503

IC ID: 8748A-2503

5.4 EBW 20 dB and OBW 99%

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: 100 kHz

Sweep time: 10 s

VBW: 300 kHz

Detector: PK

Span: 10 MHz

FCC ID: XYN2503
IC ID: 8748A-2503

5.4.5 Test result

Operating frequency band (MHz)	20 dB Bandwidth Channel 1 (MHz)	20 dB Bandwidth Channel 2 (MHz)	20 dB Bandwidth Channel 3 (MHz)
$f_{\text{low}} > 2400$	$f_{\text{low}} = 2423.44$	$f_{\text{low}} = 2448.43$	$f_{\text{low}} = 2473.60$
$f_{\text{high}} < 2483.5$	$f_{\text{high}} = 2426.40$	$f_{\text{high}} = 2451.42$	$f_{\text{high}} = 2476.25$

80% bandwidth of the permitted band:

66.8 MHz

Maximum frequency drift under extreme conditions: -94.51 kHz

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.

To show the compliance under frequency stability, the EuT was tested under extreme voltage and temperature conditions. Due to the fact of the small frequency drift, the measurement where only performend at the worst case conditions.

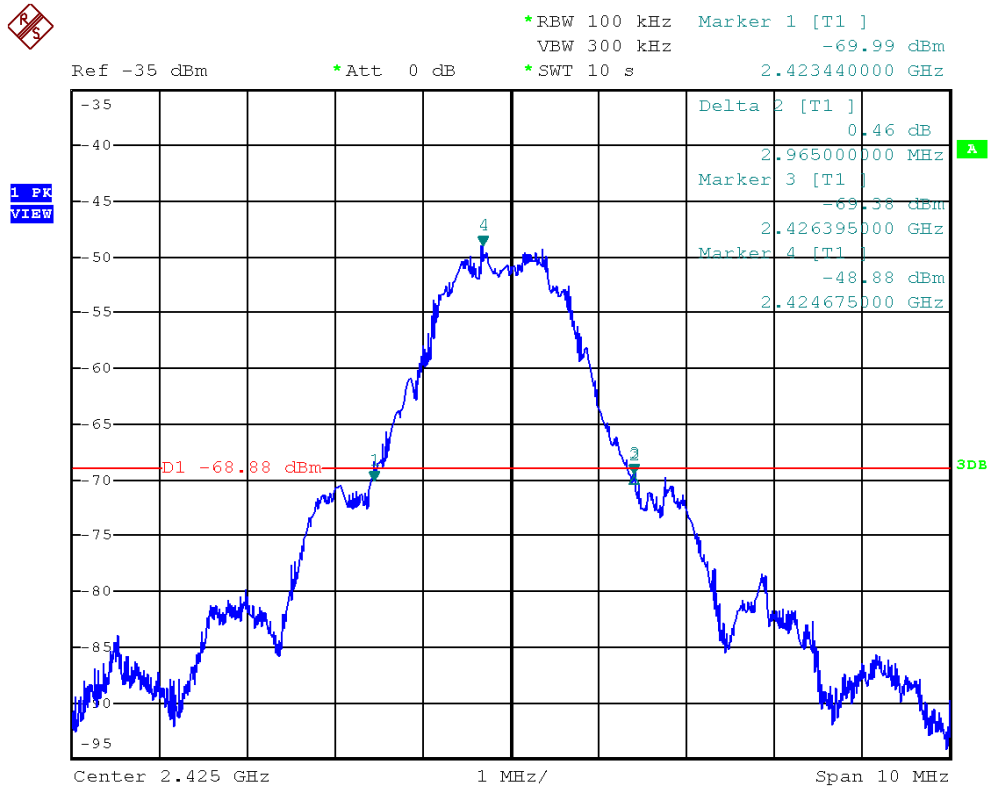
5.4.6 Test protocols

Test conditions		Test result					
		Channel 1		Channel 2		Channel 3	
		Frequency reading (MHz)	Frequency error (kHz)	Frequency reading (MHz)	Frequency error (kHz)	Frequency reading (MHz)	Frequency error (kHz)
$T_{\text{max}}(50^{\circ}\text{C})$	$4.2 V_{\text{min}}$	2425.02473	24.73	2449.90949	-90.51	2474.90820	-91.80
	$5.8 V_{\text{max}}$	2425.02472	24.72	2449.90955	-90.45	2474.90820	-91.80
$T_{\text{nom}}(20^{\circ}\text{C})$	$5.0 V_{\text{nom}}$	2425.03150	31.50	2449.91675	-83.25	2474.91150	-88.50
$T_{\text{min}}(-20^{\circ}\text{C})$	$4.2 V_{\text{min}}$	2425.02882	28.82	2449.92238	-77.62	2474.90549	-94.51
	$5.8 V_{\text{max}}$	2425.02883	28.83	2449.92242	-77.58	2474.90554	-94.46
Measurement uncertainty		$\pm 3 \text{ dB}$					

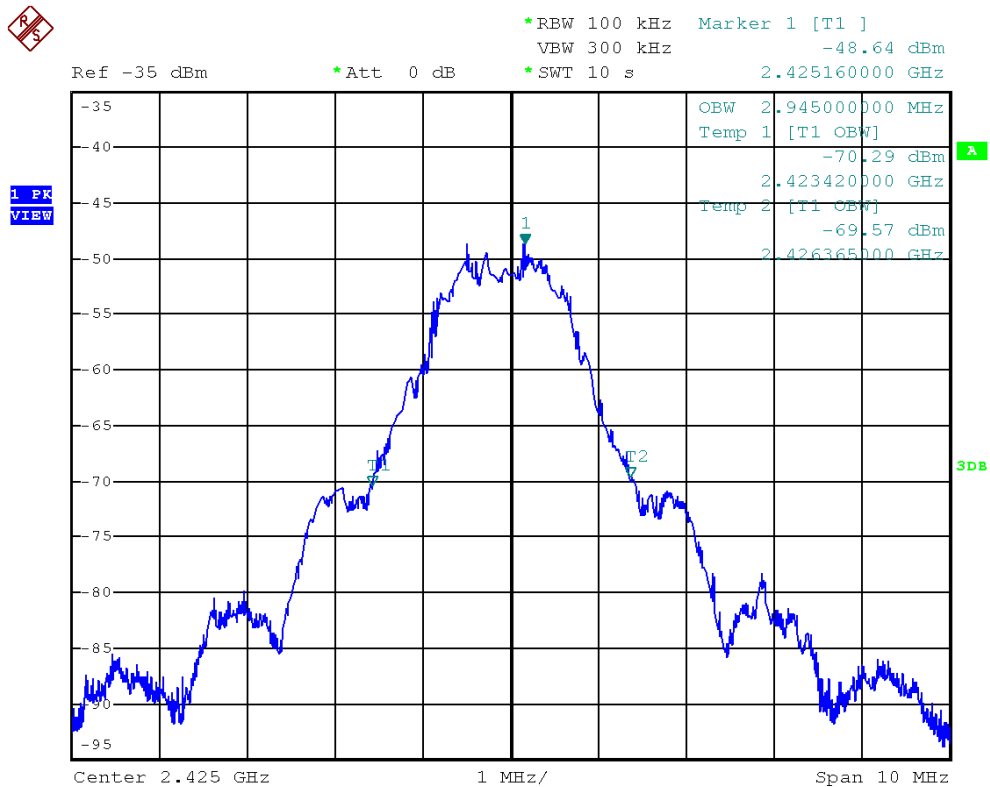
FCC ID: XYN2503

IC ID: 8748A-2503

Channel 1 - 20 dB bandwidth



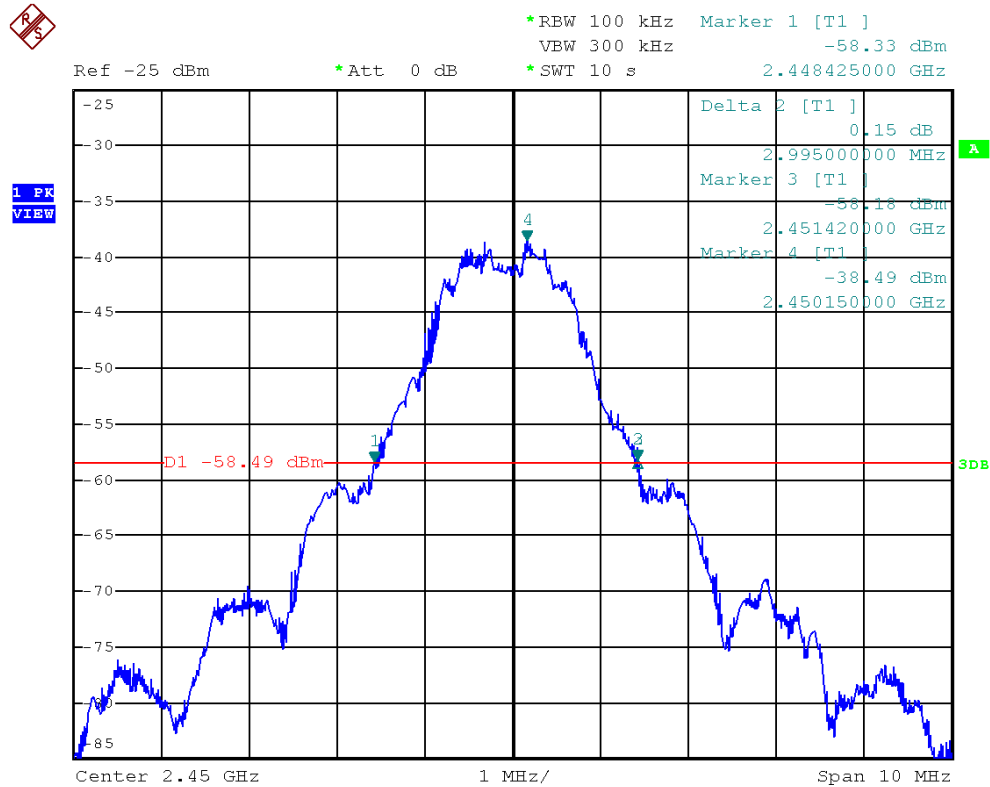
Channel 1 - OBW 99%



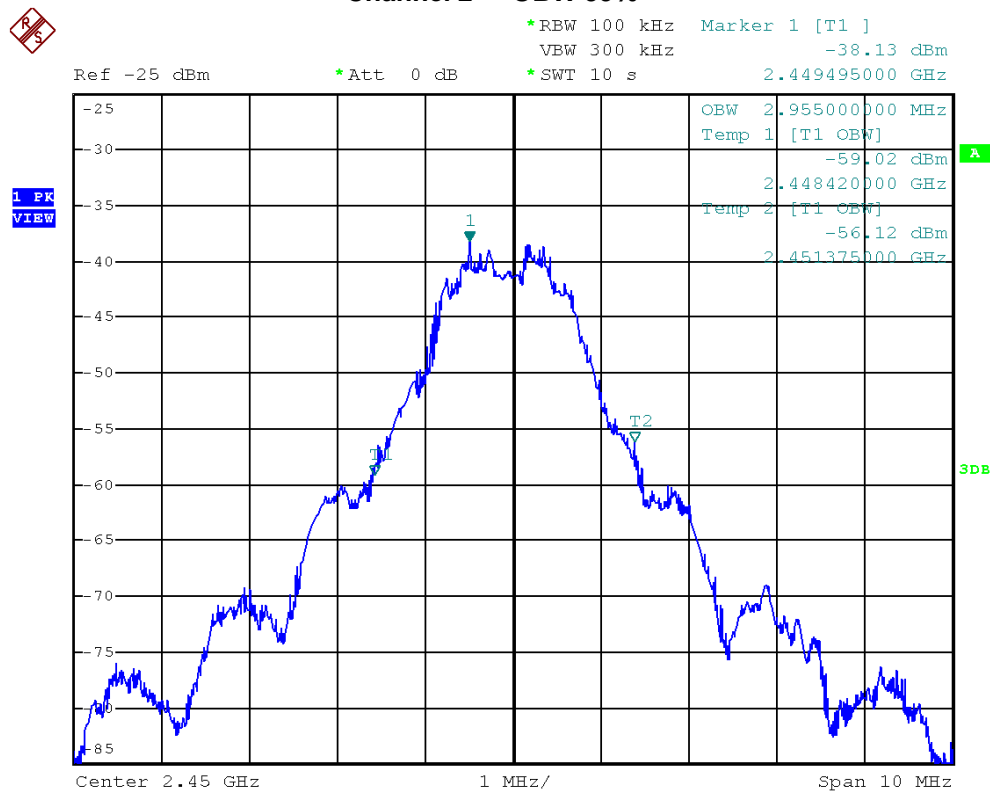
FCC ID: XYN2503

IC ID: 8748A-2503

Channel 2 - 20 dB bandwidth



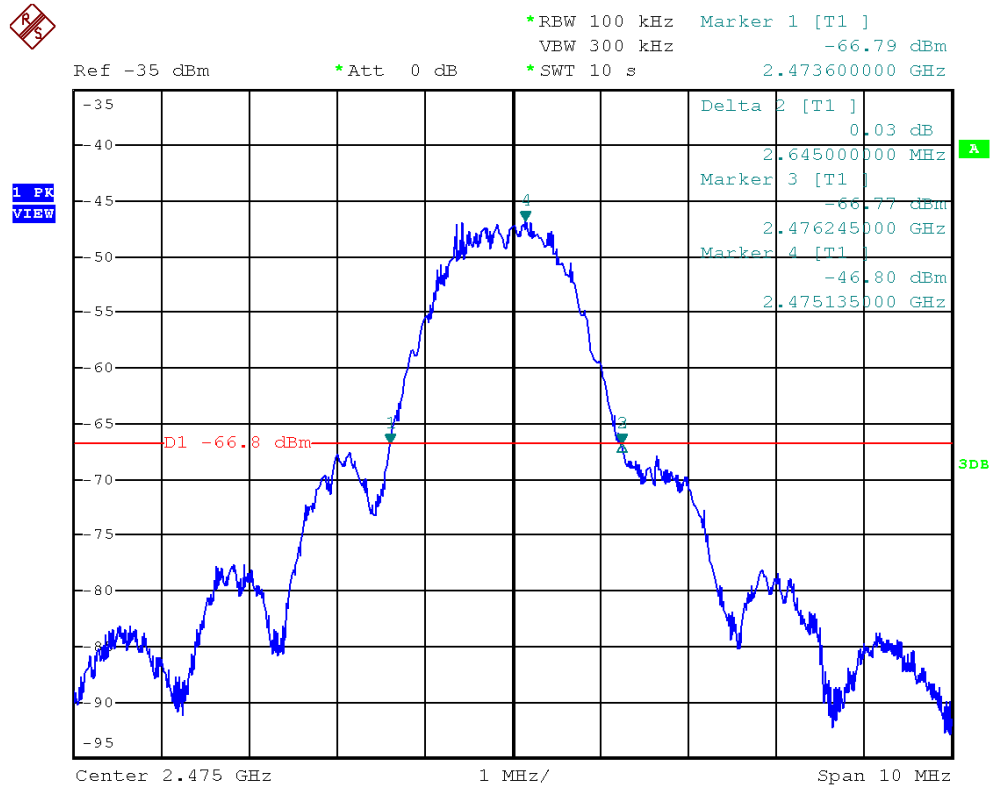
Channel 2 - OBW 99%



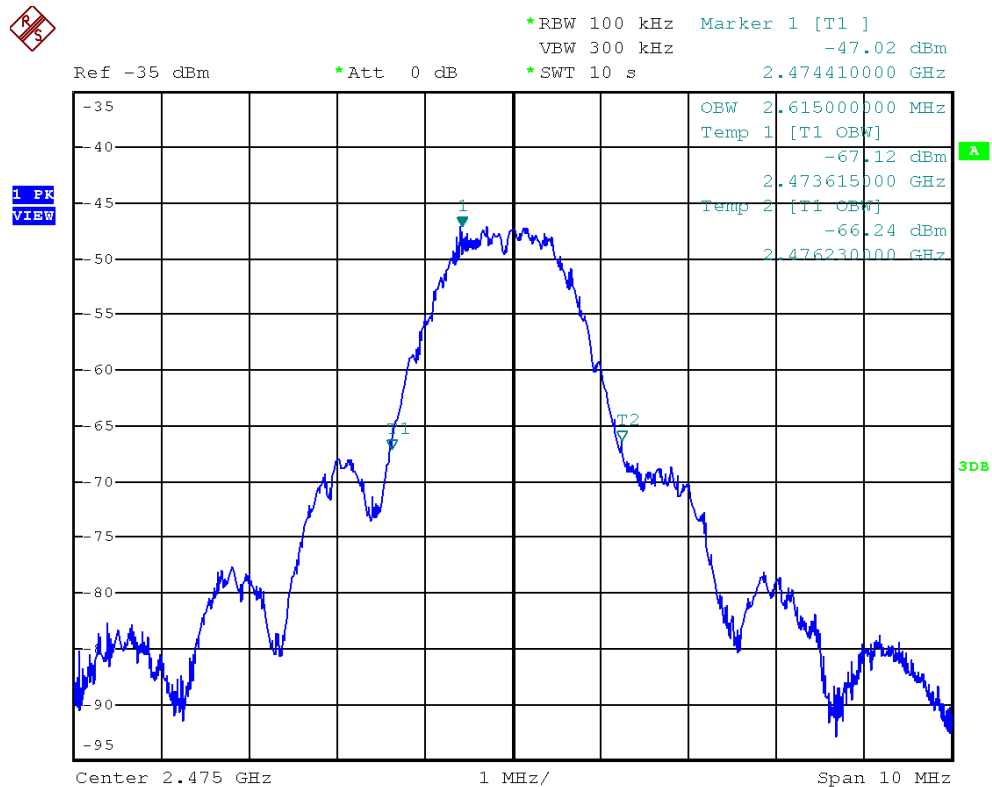
FCC ID: XYN2503

IC ID: 8748A-2503

Channel 3 - 20 dB bandwidth



Channel 3 - OBW 99%



FCC ID: XYN2503

IC ID: 8748A-2503

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 puls train, including blanking intervals, as long as the pulse train does not exceed 0.1s. In cases where the puls 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.

FCC ID: XYN2503

IC ID: 8748A-2503

5.5.4 Description of Measurement

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

$$KE = 20 \log \left(\left(\frac{t_{iw}}{T_w} \right) * \left(\frac{t_{iB}}{T_B} \right) \right) = 20 \log \left((0.360 * 2) / 100 \right) = \underline{\underline{-42.9 \text{ dB}}}$$

KE: pulse operation correction factor
t_{iw}: pulse duration for one complete pulse track
t_{iB}: pulse duration for one pulse
T_w: a period of the pulse track
T_B: a period of one pulse

5.5.5 Test result

Duty cycle	<i>t_{iw}</i> (ms)	<i>T_w</i> (ms)	<i>t_{iB}</i> (ms)	<i>p</i>	<i>KE</i> (dB)
Within 100 ms	-	100	0.360	2	-42.9 (max. -20 dB)

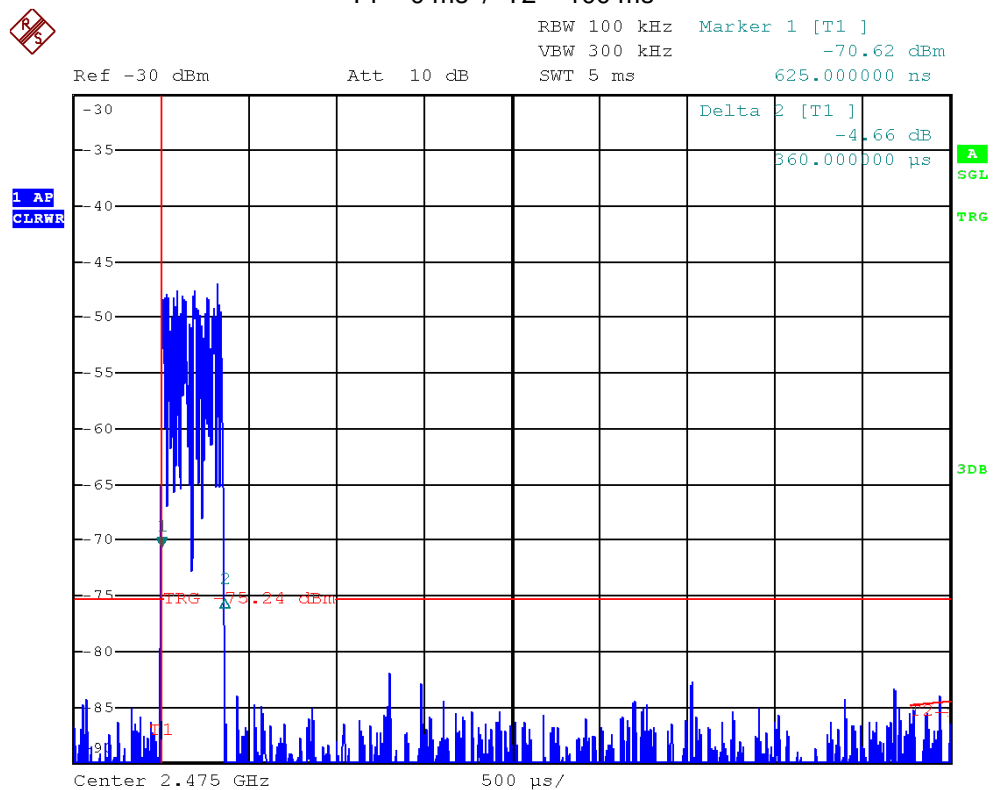
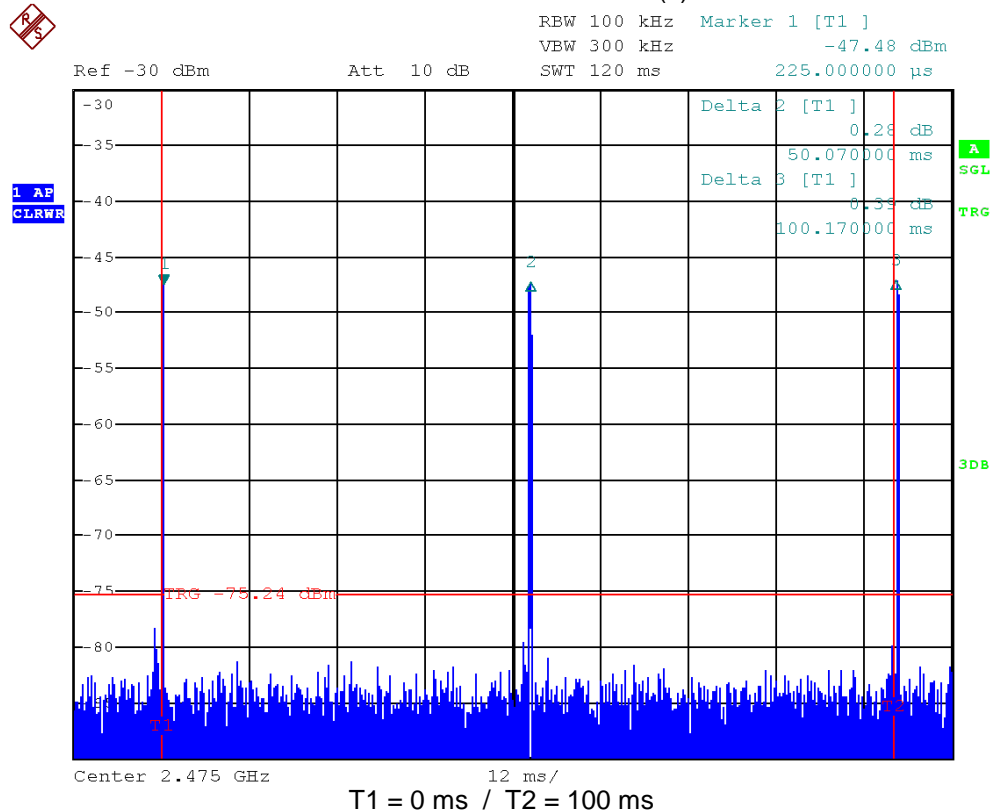
Remarks: The pulse train (*T_w*) exceeds 100 ms. Therefore the duty cycle have been calculated by
 averaging the sum of the pulse widths over the 100 ms width with the highest average value.
 For detailed test result please refer to following test protocols.

FCC ID: XYN2503

IC ID: 8748A-2503

5.5.6 Test protocol

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



FCC ID: XYN2503

IC ID: 8748A-2503

Antenna application

5.5.7 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.

Remarks: The EUT use 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.

FCC ID: XYN2503

IC ID: 8748A-2503

5.6 Receiver radiated emissions

For test instruments and accessories used see section 6 Part **SER2** and **SER3**.

5.6.1 Description of the test location

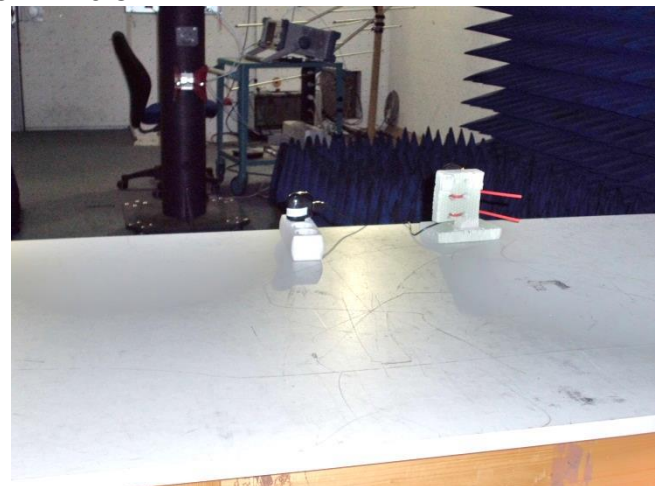
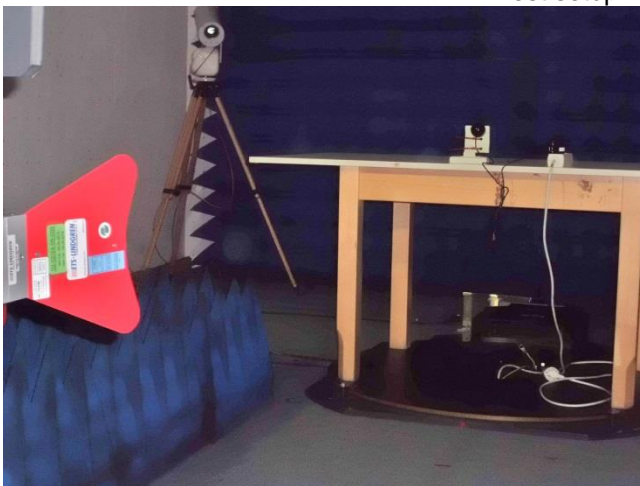
Test location: OATS 1
Test location: Anechoic chamber 2
Test distance: 3 m

5.6.2 Photo documentation of the test set-up

Test setup 30 MHz – 1000 MHz



Test setup 1 GHz – 18 GHz



5.6.3 Applicable standard

According to FCC Part 15C, Section 15.109(a):

Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 m shall not exceed the given limit.

FCC ID: XYN2503
IC ID: 8748A-2503

5.6.4 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. In the frequency range above 1 GHz a spectrum analyser is used with appropriate linear polarized antennas. The set up of the EUT will be in accordance to ANSI C63.4. If the emission level in peak mode complies with the average limit then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported. During the test, the EUT was set into continuous transmitting mode, modulated.

Instrument settings:

30 MHz – 1000 MHz: RBW: 120 kHz
1000 MHz – 40 GHz RBW = VBW: 1 MHz

5.6.5 Test result $f < 1$ GHz

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)
30*	13.0	-	120	12.3	25.3	-	40.0	-14.7
300*	2.0	-	120	16.5	18.5	-	46.0	-27.5
450*	1.5	-	120	20.4	21.9	-	46.0	-24.1
750*	0.3	-	120	26.8	27.1	-	46.0	-18.9
1000*	0.4	-	120	30.1	30.5	-	54.0	-23.5

*) Ambient noise

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

5.6.6 Test result $f > 1$ GHz

Frequency (MHz)	Level PK (dB μ V)	Duty Cycle Correction (dB)	Level AV (dB μ V)*	Correction factor (dB/m)	Corrected level PK dB(μ V/m)	Corrected level AV dB(μ V/m)	Limit PK dB(μ V/m)	Limit AV dB(μ V/m)	Delta (dB)
1500*	47.5	-	-	1.2	48.7	-	74.0	54.0	-5.3
2500*	47.2	-	-	4.4	51.6	-	74.0	54.0	-2.4
3500*	47.6	-	-	2.5	50.1	-	74.0	54.0	-3.9
4500*	39.0	-	-	3.0	42.0	-	74.0	54.0	-12.0

*) Ambient noise

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

Limit according to FCC Part 15C, Section 15.109:

Frequency (MHz)	15.109 Limits dB(μ V/m)	Measurement distance (m)
30-88	40	3
88-216	43,5	3
216-960	46	3
Above 960	54	3

The requirements are **FULFILLED**.

Remarks: The measurement was performed up to the 5th harmonic (12500 MHz).

FCC ID: XYN2503
IC ID: 8748A-2503

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	11/07/2013	11/07/2012		
	ESH 2 - Z 5	02-02/20-05-004	06/06/2015	06/06/2013	06/12/2013	06/06/2013
	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			05/10/2013	05/04/2013
CPR 3	FSP 40	02-02/11-11-001	18/09/2013	18/09/2012		
	AMF-4F-04001200-15-10P	02-02/17-05-004				
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	3117	02-02/24-05-009	04/04/2014	04/04/2013		
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				
DC	FSP 30	02-02/11-05-001	18/10/2013	18/10/2012		
	RF Antenna	02-02/24-05-032				
MB	FSP 40	02-02/11-11-001	18/09/2013	18/09/2012		
	RF Antenna	02-02/24-05-032				
	MetraHIT World	02-02/32-10-001	09/08/2013	09/08/2012		
	WK-340/40	02-02/45-05-001	31/05/2014	31/05/2011	19/08/2013	19/02/2013
	6543A	02-02/50-05-157				
SER 1	FMZB 1516	01-02/24-01-018			14/02/2014	14/02/2013
	ESCI	02-02/03-05-005	03/12/2013	03/12/2012		
	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	26/06/2013	26/06/2012		
	VULB 9168	02-02/24-05-005	11/04/2014	11/04/2013	11/10/2013	11/04/2013
	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	18/09/2013	18/09/2012		
	AMF-4F-04001200-15-10P	02-02/17-05-004				
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	3117	02-02/24-05-009	04/04/2014	04/04/2013		
	R1 _ 18 - 40 GHz	02-02/30-09-002			08/01/2014	08/01/2013
	Sucoflex N-1000-SMA	02-02/50-05-072				
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				

FCC ID: XYN2503

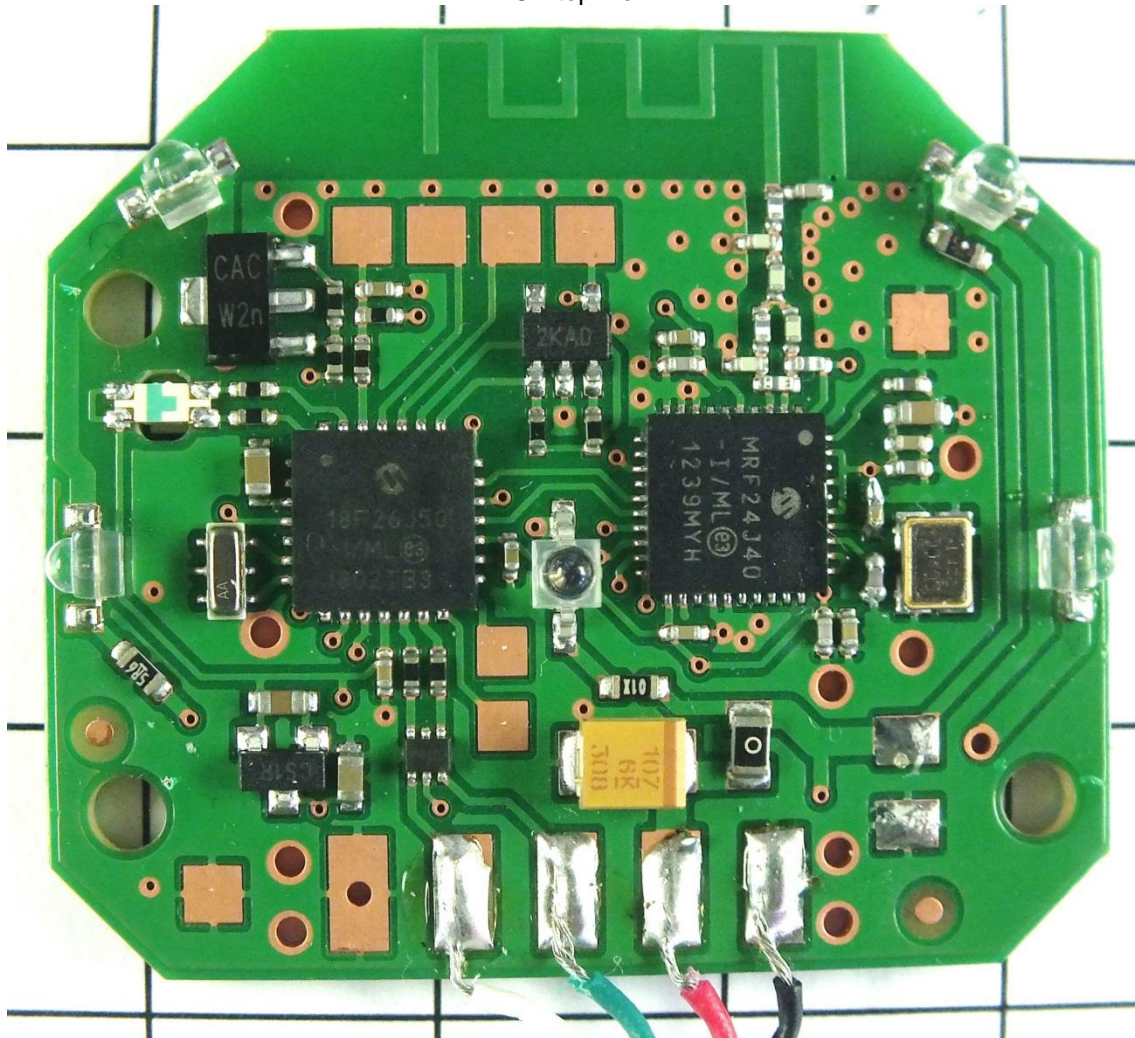
IC ID: 8748A-2503

7 Attachment A – Internal photos

Interior view of housind and PCB



PCB top view



FCC ID: XYN2503

IC ID: 8748A-2503

PCB bottom view

