

FCC ID: LTQFO4AM902TRA
IC ID: 3659A-FO4AM902TRA

EMI - TEST REPORT

- FCC Part 15.249, RSS210 -

Test Report No. : T38860-01-00HU

29. January 2015

Date of issue

Type / Model Name : FO4-AM902TRA**Product Description** : Transceiver for remote vehicle access**Applicant** : Delphi Deutschland GmbH

Address : Albert-Einstein-Str. 5

51674 Wiehl

Manufacturer : Delphi Deutschland GmbH

Address : Albert-Einstein-Str. 5

51674 Wiehl

Licence holder : Delphi Deutschland GmbH

Address : Albert-Einstein-Str. 5

51674 Wiehl

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 (October, 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 (October, 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: 2009 | 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 Test result summary

The FO4-AM902TRA is a transceiver for remote vehicle access:

Operating in the 902 MHz – 928 MHz band:

| FCC Rule Part | RSS Rule Part | Description | Result |
|-----------------|------------------|-----------------------------------|----------------|
| 15.207(a) | RSS Gen, 8.8 (3) | AC power line conducted emissions | not applicable |
| 15.215(c) | RSS Gen, 4.6.3 | -20 dBc EBW | not applicable |
| 15.249(a) | RSS-Gen, 8.9 (4) | Field strength of fundamental | passed |
| 15.249(d) | RSS-210, A8.5 | Out-of-band emission, radiated | passed |
| 15.205(a) | RSS-Gen, 8.10 | Emissions in restricted bands | passed |
| 15.35(c) | RSS-Gen, 6.10 | Pulsed operation | not applicable |
| 15.107 | RSS Gen, 8.8 (3) | AC power line conducted emissions | not applicable |
| | RSS-Gen, 8.11 | Transmitter frequency stability | not applicable |
| | RSS-Gen, 6.6 | 99 % Bandwidth | passed |
| OET Bulletin 65 | RSS102, 3.2 | Co-location, Co-transmission | 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

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2.2 GENERAL REMARKS:

For detailed technical informations please refer to the manufacturer documents.

The EuT has an internal antenna and is powered by a vehicle battery.

Declaration of manufacturer:

There are exist 4 different versions from the device.

The manufacturer declared that the models are technical identical expect the following items:

- ⇒ VMC 102, TX RKE1 ANT3, 903.43 MHz
- ⇒ VMC 104, TX RKE1 ANT2, 903.42 MHz
- ⇒ VMC 105, TX RKE2 ANT2, 902.38 MHz
- ⇒ VMC 101, TX RKE2 ANT3, 902.38 MHz

This test report covers complete testing on VMC 102, TX RKE1 ANT3, 903.43 MHz with the highest radiated power level.

With the other samples only partly tests were performed:

- ⇒ Field strength of fundamental
- ⇒ Unwanted emission in the spurious domain

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 : 04. November 2014

Testing concluded on : 11. November 2014

Checked by:

Tested by:

Klaus Gegenfurtner
Teamleader Radio

Markus Huber

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3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EUT – Please see attachment A

3.2 Power supply system utilised

Power supply voltage : 12.5 V / DC (Vehicle regulated)

3.3 Short description of the equipment under test (EUT)

The EUT is a transceiver module for remote vehicle access.

Number of tested samples: 1
Serial number: Prototype
Type/Model Name: GB5T-15K619-CA
Plattform: Ford

EUT operation mode:

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

- Continuous modulated Tx mode

- Rx mode

-

EUT configuration:

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

- _____ Model : _____
- _____ Model : _____
- _____ Model : _____
- _____ Model : _____
- _____ Model : _____
- _____ Model : _____

- Customer specific cables
- Unscreened power cables

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY

4.2 Statement regarding the usage of logos in test reports

The accreditation and notification body logos displayed in this test report are only valid for standards listed in the accreditation or notification scope of CSA Group Bayern GmbH.

4.3 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

4.4 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.

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4.5 Measurement protocol for FCC and IC

4.5.1 General information

4.5.1.1 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.

4.5.1.2 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.

4.5.1.3 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.

4.5.1.4 Conducted emission

The final level, expressed in dB μ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit or to the CISPR limit.

To convert between dB μ V and μ V, the following conversion formula apply:

$$\begin{aligned} \text{dB}\mu\text{V} &= 20 \cdot \log(\mu\text{V}) \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)} \end{aligned}$$

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with 50 Ω / 50 μ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin of a peak mode measurement appears to be less than 20 dB, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

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4.5.1.5 Radiated emission (electrical field 30 MHz - 1 GHz)

Spurious emission from the EUT is measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarised antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is established in accordance with ANSI C63.4. The interface cables that are closer than 40 cm to the ground plane are bundled in the center in a serpentine fashion so that they are at least 40 cm from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screened room located outside the test area. The antenna is positioned 3, 10 or 30 m horizontally from the EUT and is repeated vertically. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 m and the EUT is rotated 360 degrees.

The final level in dBµV/m is calculated by add on the reading value from the EMI receiver (level dBµV) the correction factor. The FCC or CISPR limit is subtracted from this result in order to provide the limit margin listed in the measurement protocol.

The resolution bandwidth setting:

30 MHz – 1000 MHz: RBW: 120 kHz

Example:

| | | | | | | | | | |
|--------------------|-------------------------|---|-----------------------------|---|-------------------|---|-------------------------|---|---------------|
| Frequency (MHz) | Reading level (dBµV) | + | Correction Factor (dB/m) | = | Level (dBµV/m) | - | CISPR Limit (dBµV/m) | = | Delta (dB) |
| 719.0 | 75.0 | + | 32.6 | = | 107.6 | - | 110.0 | = | -2.4 |

4.5.2 Radiated emission (electrical field 1 GHz - 40 GHz)

Description of measurement

Radiated emissions from the EUT are measured in the frequency range 1 GHz up to the maximum frequency as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a 1.0 X 1.5 metre non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is following set out in ANSI C63.4. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screened room located outside the test area. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyser set to max peak detector function and a resolution 1 MHz and video bandwidth 3 MHz for peak and 10 Hz for average measurement. The conditions determined as worst case will then be used for the final measurements. When the EUT is larger than the beam width of the measuring antenna it will be moved over the surface for the four sides of the equipment. Where appropriate, the test distance may be reduced in order to detect emissions under better uncertainty and are calculated at the specified test distance.

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: NONE

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.

5.1.5 Test result

Limit according to FCC Part 15, Section 15.207(a):

| 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

Remarks: The measurement is not applicable.

The EuT has no AC mains connections.

The EuT is separated powered by a 12.5 V / DC vehicle battery.

5.2 Radiated emission of the fundamental wave

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 power of the fundamental wave from the EUT is measured in the frequency range of 30 to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the Equipment under test will be in accordance to ANSI C63.4-2003.

The Interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna was positioned 3, 10 or 30 meters horizontally from the EuT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarization's and the EuT are rotated 360 degrees.

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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

5.3.2 Photo documentation of the test set-up



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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 will be in accordance to ANSI C63.4. 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 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:

| | | |
|--------------------|------|---------|
| 9 kHz – 150 kHz | RBW: | 200 Hz |
| 150 kHz - 30 MHz | RBW: | 9 kHz |
| 30 MHz – 1000 MHz: | RBW: | 120 kHz |
| 1000 MHz – 40 GHz | RBW: | 1 MHz |

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5.3.5 Test result $f < 1$ GHz

| Frequency [kHz] | L: QP [dB μ V] | L: AV [dB μ V] | Bandwidth [kHz] | Correct. [dB] | L: QP [dB μ V/m] | L: AV [dB μ V/m] | Limit [dB μ V/m] | Delta [dB] |
|-----------------|--------------------|--------------------|-----------------|---------------|----------------------|----------------------|----------------------|------------|
| 536.8 | 24.1 | 19.7 | 9.0 | 20 | 44.1 | 39.7 | 73.0 | -33.3 |
| 1073.6 | 23.4 | 18.0 | 9.0 | 20 | 43.4 | 38.0 | 67.0 | -29.0 |
| 1342.0 | 21.6 | 15.9 | 9.0 | 20 | 41.6 | 35.9 | 65.0 | -29.1 |

| Frequency [MHz] | L: QP [dB μ V] | Correct. [dB] | L: QP [dB μ V/m] | Limit [dB μ V/m] | Delta [dB] |
|-----------------|--------------------|---------------|----------------------|----------------------|------------|
| 73.50 | 2.8 | 12.0 | 14.8 | 40.0 | -22.9 |
| 162.20 | 6.9 | 14.6 | 21.5 | 43.5 | -21.3 |

In both frequency ranges only ambient noises could be detected.

5.3.6 Test result $f > 1$ GHz

VMC 102:

| Frequency (MHz) | L: PK (dB μ V) | L: AV (dB μ V) | Bandwidth (kHz) | Correct. (dB) | Duty Cycle Correct. factor (dB) | Corrected PK level dB(μ V/m) | Effective limit dB(μ V/m) | Delta (dB) |
|-----------------|--------------------|--------------------|-----------------|---------------|---------------------------------|-----------------------------------|--------------------------------|------------|
| 1806.86 | 69.3 | -- | 1000 | -17.3 | -- | 52.1 | 54.0 | -1.9 |
| 2710.29 | 60.6 | -- | 1000 | -13.6 | -- | 47.0 | 54.0 | -7.0 |
| 3613.72 | 61.3 | -- | 1000 | -12.3 | -- | 49.0 | 54.0 | -5.0 |
| 4517.15 | 47.5 | -- | 1000 | 1.5 | -- | 49.0 | 54.0 | -5.0 |
| 5420.58 | 42.2 | -- | 1000 | 4.3 | -- | 46.6 | 54.0 | -7.4 |
| 6324.01 | 41.8 | -- | 1000 | 6.0 | -- | 47.8 | 54.0 | -6.2 |

VMC 104:

| Frequency (MHz) | L: PK (dB μ V) | L: AV (dB μ V) | Bandwidth (kHz) | Correct. (dB) | Duty Cycle Correct. factor (dB) | Corrected PK level dB(μ V/m) | Effective limit dB(μ V/m) | Delta (dB) |
|-----------------|--------------------|--------------------|-----------------|---------------|---------------------------------|-----------------------------------|--------------------------------|------------|
| 1806.84 | 67.7 | -- | 1000 | -17.3 | -- | 50.40 | 54.0 | -3.60 |
| 2710.26 | 59.6 | -- | 1000 | -13.6 | -- | 46.00 | 54.0 | -8.00 |
| 3613.68 | 58.4 | -- | 1000 | -12.3 | -- | 46.10 | 54.0 | -7.90 |
| 4517.10 | 46.2 | -- | 1000 | 1.5 | -- | 47.70 | 54.0 | -6.30 |
| 5420.52 | 41.0 | -- | 1000 | 4.3 | -- | 45.30 | 54.0 | -8.70 |
| 6323.94 | 39.8 | -- | 1000 | 6.0 | -- | 45.80 | 54.0 | -8.20 |

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VMC 105:

| Frequency (MHz) | L: PK (dBµV) | L: AV (dBµV) | Bandwidth (kHz) | Correct. (dB) | Duty Cycle Correct. factor (dB) | Corrected PK level dB(µV/m) | Effective limit dB(µV/m) | Delta (dB) |
|-----------------|--------------|--------------|-----------------|---------------|---------------------------------|-----------------------------|--------------------------|------------|
| 1804.76 | 66.9 | -- | 1000 | -17.3 | -- | 49.60 | 54.0 | -4.40 |
| 2707.14 | 58.7 | -- | 1000 | -13.6 | -- | 45.10 | 54.0 | -8.90 |
| 3609.52 | 57.6 | -- | 1000 | -12.3 | -- | 45.30 | 54.0 | -8.70 |
| 4511.90 | 45.8 | -- | 1000 | 1.5 | -- | 47.30 | 54.0 | -6.70 |
| 5414.28 | 42.1 | -- | 1000 | 4.3 | -- | 46.40 | 54.0 | -7.60 |
| 6316.66 | 40.5 | -- | 1000 | 6.0 | -- | 46.50 | 54.0 | -7.50 |

VMC 101:

| Frequency (MHz) | L: PK (dBµV) | L: AV (dBµV) | Bandwidth (kHz) | Correct. (dB) | Duty Cycle Correct. factor (dB) | Corrected PK level dB(µV/m) | Effective limit dB(µV/m) | Delta (dB) |
|-----------------|--------------|--------------|-----------------|---------------|---------------------------------|-----------------------------|--------------------------|------------|
| 1804.76 | 66.3 | -- | 1000 | -17.3 | -- | 49.00 | 54.0 | -5.00 |
| 2707.14 | 58.4 | -- | 1000 | -13.6 | -- | 44.80 | 54.0 | -9.20 |
| 3609.52 | 57.0 | -- | 1000 | -12.3 | -- | 44.70 | 54.0 | -9.30 |
| 4511.90 | 45.4 | -- | 1000 | 1.5 | -- | 46.90 | 54.0 | -7.10 |
| 5414.28 | 42.9 | -- | 1000 | 4.3 | -- | 47.20 | 54.0 | -6.80 |
| 6316.66 | 41.6 | -- | 1000 | 6.0 | -- | 47.60 | 54.0 | -6.40 |

Limit according to FCC Part 15C, Section 15.209:

| Frequency (MHz) | 15.209 Limits dB(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 | 40 | 3 |
| 88-216 | 43.5 | 3 |
| 216-960 | 46 | 3 |
| Above 960 | 54 | 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 |

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Peak-Limit according to FCC Subpart 15.249(a), Subpart 15.249(e)

| Frequency (MHz) | Fieldstrength of harmonics | |
|-----------------|----------------------------|-----------------|
| | (μ V/m) | dB (μ V/m) |
| 902-928 | 5000 | 74 |
| 2400-2483.5 | 5000 | 74 |
| 5725-5875 | 5000 | 74 |

Average-Limit according to FCC Subpart 15.249(d) for spurious emissions outside of the specified frequency band:

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

| Frequency [MHz] | 50dB below of the fundamental [dB μ V/m] | 15.209 Limits [dB μ V/m] | General Radiated Limits [dB μ V/m] |
|-----------------|--|------------------------------|--|
| 30-88 | 44 | 40 | 44 |
| 88-216 | 44 | 43.5 | 44 |
| 216-960 | 44 | 46 | 46 |
| Above 960 | 44 | 54 | 54 |

Restricted bands of operation:

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209

| MHz | MHz | GHz |
|-----------------------|-----------------|---------------|
| 25.5 – 25.67 | 960 – 1240 | 4.5 – 5.15 |
| 37.5 – 38.25 | 1300 – 1427 | 5.35 – 5.46 |
| 73 – 74.6 | 1435 – 1626.5 | 7.25 – 7.75 |
| 74.8 – 75.2 | 1645.5 – 1646.5 | 8.025 – 8.5 |
| 108 – 121.94 | 1660 – 1710 | 9.0 – 9.2 |
| 123 – 138 | 1718.8 – 1722.2 | 9.3 – 9.5 |
| 149.9 – 150.05 | 2200 – 2300 | 10.6 – 12.7 |
| 156.52475 – 156.52525 | 2310 – 2390 | 13.25 – 13.4 |
| 156.7 – 156.9 | 2483.5 – 2500 | 14.47 – 14.5 |
| 162.0125 – 167.17 | 2655 – 2900 | 15.35 – 16.2 |
| 167.72 – 173.2 | 3260 – 3267 | 17.7 – 21.4 |
| 240 – 285 | 3332 – 3339 | 22.01 – 23.12 |
| 322 – 335.4 | 3345.8 – 3358 | 23.6 – 24.0 |
| 399.9 – 410 | 3600 – 4400 | 31.2 – 31.8 |
| 608 – 614 | | 36.43 – 36.5 |

The requirements are **FULFILLED**.

Remarks: The measurement was performed up to the 10th harmonic (10.0 GHz).

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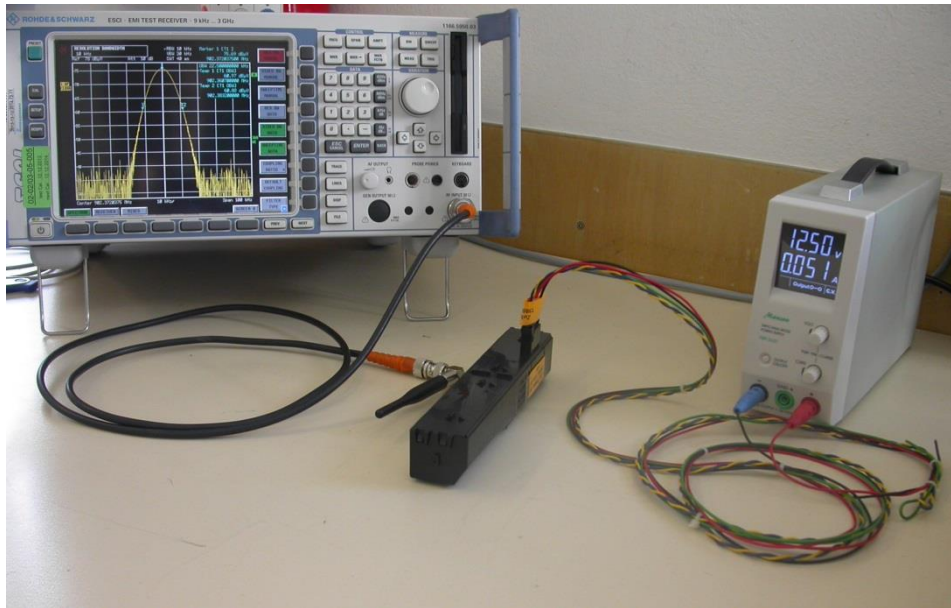
5.4 20 dB bandwidth

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 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. The reference level is the level of the highest signal amplitude observed from the transmitter at the fundamental frequency. Alternative is the x-dB-down function of the analyser used. The EBW is then directly shown in the marker display. The measurement is performed with normal modulation and a transfer rate means the worst case.

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5.4.5 Test result

| Fundamental [MHz] | 20dB Bandwidth F1 [MHz] | 20dB Bandwidth F2 [MHz] | Measured Bandwidth [MHz] | LIMIT Fundamental $f \cdot 0,0050$ [MHz] |
|-------------------|-------------------------|-------------------------|--------------------------|--|
| 902.374 | 902.359612 | 902.386475 | 0.027 | 4.51 |
| | | | | |
| | | | | |

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

| Frequency (MHz) | 20 dB BW limit dependent of the carrier (%) |
|-----------------|---|
| 70 – 900 | 0.25 |
| above 900 | 0.50 |

The bandwidth of the emission shall be no wider than 0.50% of the centre frequency for devices operating above 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

The requirements are **FULFILLED**.

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

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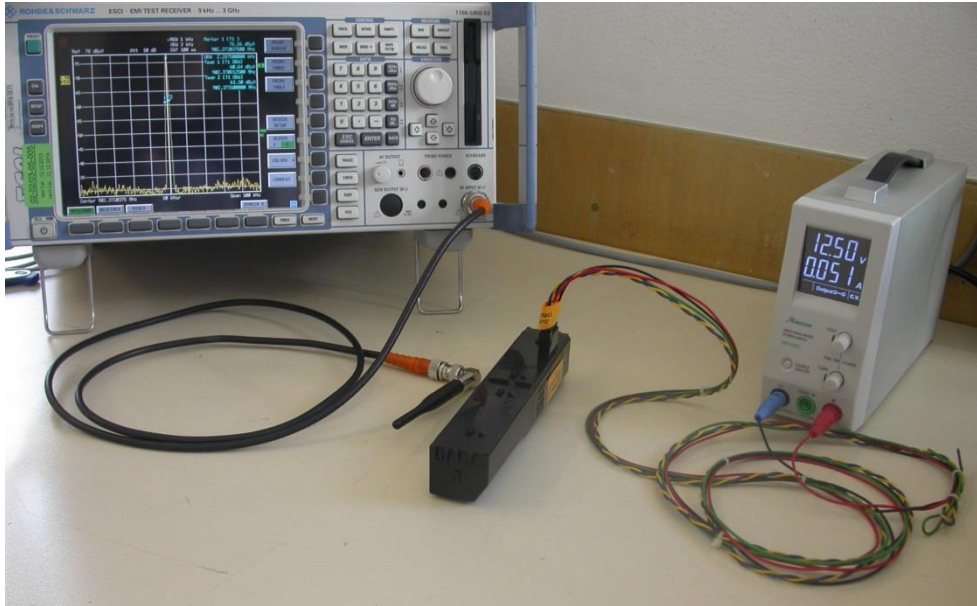
5.5 Bandwidth of momentary signals

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

5.5.1 Description of the test location

Test location: AREA4

5.5.2 Photo documentation of the test set-up



5.5.3 Test result

| Fundamental frequency (MHz) | 99% bandwidth f_1 (MHz) | 99% bandwidth f_2 (MHz) | Measured bandwidth (MHz) | Limit (MHz) |
|-----------------------------|---------------------------|---------------------------|--------------------------|-------------|
| 902.37 | 902.37081 | 902.37310 | 0.0023 | 4.51 |
| | | | | |

Limit according to RSS 210, Annex 1, section A1.1.3:

The 99% bandwidth shall be no wider than 0.50% of the center frequency for devices operating above 900 MHz.

The requirements are **FULFILLED**.

Remarks: For detailed results, please see the test protocol below.

The Rhode & Schwarz analyzer which we used for this measurement calculates automatically

the 99 % emission bandwidth.

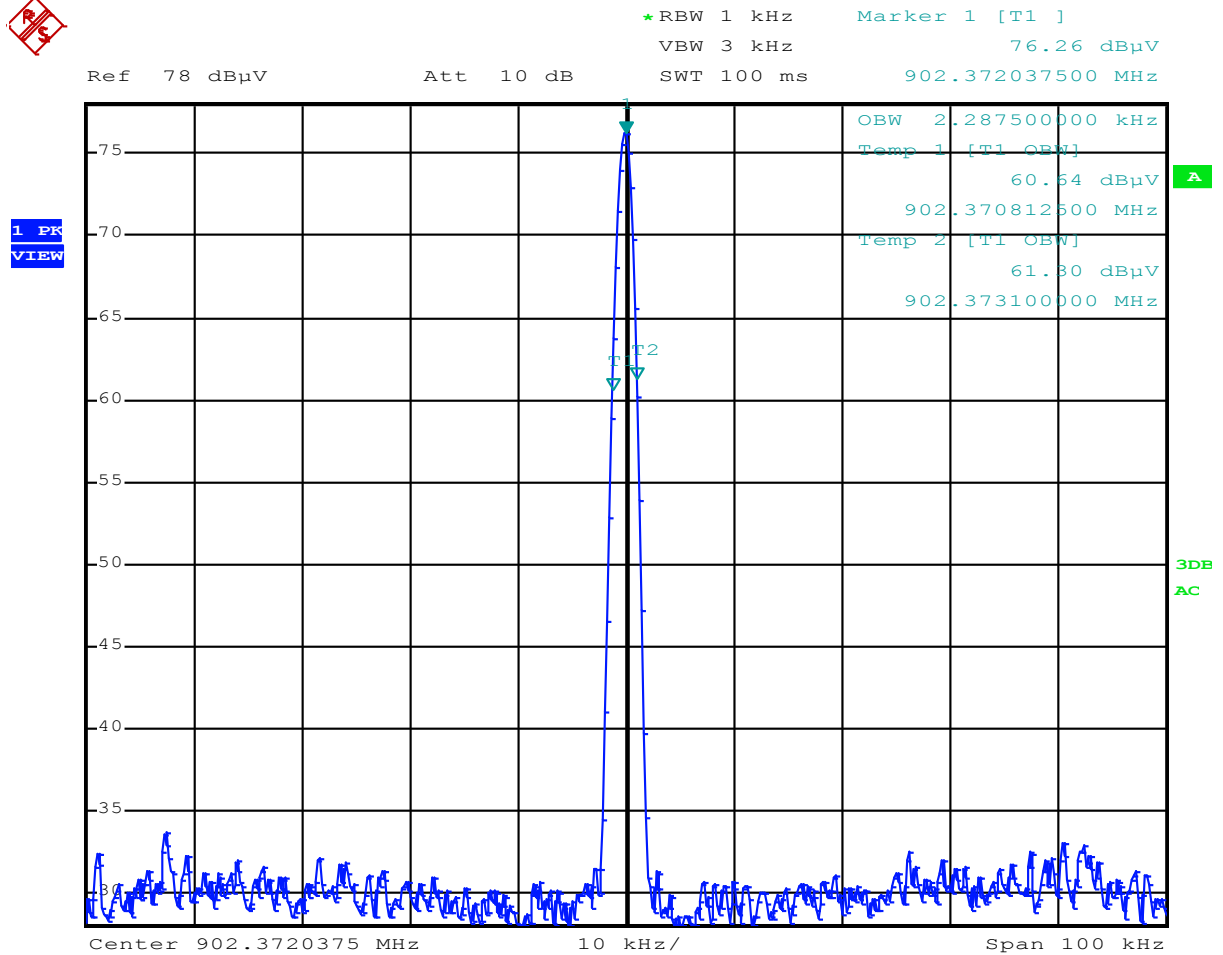
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5.5.4 Test protocol

Emission bandwidth

RSS 210 Annex 1, section A1.1.3

The 99 % emission bandwidth was automatically calculated by the used Rhode & Schwarz analyzer.



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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 use an antenna which will be soldered directly on on the PCB.

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.

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5.7 Receiver radiated emissions

For test instruments and accessories used see section 6 Part **SER1**, **SER2** and **SER3**.

5.7.1 Description of the test location

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

5.7.2 Photo documentation of the test set-up



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5.7.3 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.

5.7.4 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 setup 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:

| | | |
|--------------------|------------|---------|
| 9 kHz – 150 kHz | RBW: | 200 Hz |
| 150 kHz - 30 MHz | RBW: | 9 kHz |
| 30 MHz – 1000 MHz: | RBW: | 120 kHz |
| 1000 MHz – 40 GHz | RBW = VBW: | 1 MHz |

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5.7.5 Test result f < 1 GHz

| Frequency [kHz] | L: QP [dBµV] | L: AV [dBµV] | Bandwidth [kHz] | Correct. [dB] | L: QP [dBµV/m] | L: AV [dBµV/m] | Limit [dBµV/m] | Delta [dB] |
|-----------------|--------------|--------------|-----------------|---------------|----------------|----------------|----------------|------------|
| 536.8 | 24.1 | 19.7 | 9.0 | 20 | 44.1 | 39.7 | 73.0 | -33.3 |
| 1073.6 | 23.4 | 18.0 | 9.0 | 20 | 43.4 | 38.0 | 67.0 | -29.0 |
| 1342.0 | 21.6 | 15.9 | 9.0 | 20 | 41.6 | 35.9 | 65.0 | -29.1 |

| Frequency [MHz] | L: QP [dBµV] | Correct. [dB] | L: QP [dBµV/m] | Limit [dBµV/m] | Delta [dB] |
|-----------------|--------------|---------------|----------------|----------------|------------|
| 33.78 | 3.7 | 13.4 | 17.1 | 40.0 | -22.9 |
| 118.54 | 9.3 | 12.9 | 22.2 | 43.5 | -21.3 |
| 517.43 | 4.8 | 21.9 | 26.7 | 46.0 | -19.3 |

In both frequency ranges only ambient noises could be detected.

5.7.6 Test result f > 1 GHz

Rx mode

| Frequency (GHz) | L: PK (dBµV) | L: AV (dBµV) | Bandwidth (kHz) | Correct. (dB) | L: PK dB(µV/m) | L: AV dB(µV/m) | Limit AV dB(µV/m) | Delta (dB) |
|-----------------|--------------|--------------|-----------------|---------------|----------------|----------------|-------------------|------------|
| 3761.0 | 26.2 | | 1000 | 3.3 | 29.5 | | 54.0 | -24.5 |
| 8536.0 | 23.2 | | 1000 | 7.5 | 30.7 | | 54.0 | -23.3 |
| | | | | | | | | |

In the frequency range from 1 GHz up to 10 GHz only ambient noises could be detected.

Limit according to FCC Part 15 Subpart 15.209(a)

| Frequency (MHz) | Field strength of spurious emissions | | Measurement distance (meters) |
|-----------------|--------------------------------------|-----------|-------------------------------|
| | (µV/m) | dB (µV/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 |

Limit according to FCC part, Section 15.109(a):

| Frequency (MHz) | Limit (µV/m) | Limit dB(µV/m) |
|-----------------|--------------|----------------|
| 30 - 88 | 100 | 40 |
| 88 - 216 | 150 | 43.5 |
| 216 - 960 | 200 | 46 |
| Above 960 | 500 | 54 |

The requirements are **FULFILLED**.

Remarks: The measurement was performed up to the 10th harmonic (10 GHz).

Test was performed with all 4 variants of the sample.

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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 | 02-02/50-05-031 | | | | |
| | NW-2000-NB | 02-02/50-05-113 | | | | |
| | KK-EF393/U-16N-21N20 m | 02-02/50-12-018 | | | | |
| MB | ESCI | 02-02/03-05-005 | 12/12/2014 | 12/12/2013 | | |
| | RF Antenna | 02-02/24-05-032 | | | | |
| | METRA HIT World | 02-02/32-10-001 | 21/08/2015 | 21/08/2014 | | |
| | NSP 3630 | 02-02/50-14-015 | | | | |
| SER 1 | ESR 7 | 02-02/03-13-001 | 03/06/2015 | 03/06/2014 | | |
| | HFH 2 - Z 2 | 02-02/24-05-020 | 26/08/2017 | 26/08/2014 | 13/02/2015 | 13/02/2014 |
| | 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 | | |
| | Sucoflex N-2000-SMA | 02-02/50-05-075 | | | | |
| | SF104/11N/11N/1500MM | 02-02/50-13-015 | | | | |