



Inter**Lab**[®]

FCC Measurement/Technical Report on

BMW CSM 3.0 AE

Car Sharing external module

61 35 9 331 589-03 (BMW)

2708-041-001-00 (peiker)

NFC card reader

Report Reference: MDE_PEIKER_1219_FCCc_rev.6

Test Laboratory:

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Note:

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

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0 Summary

0.1 Technical Report Summary

Type of Authorization

Certification for an intentional radiator operating at 13.56 MHz

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 (10-1-13 Edition) and 15 (10-1-13 Edition). The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 15, Subpart C – Intentional Radiators

§ 15.205 Restricted bands of operation

§ 15.207 Conducted limits

§ 15.209 Radiated emission limits; general requirements

§ 15.215 Additional provisions to the general radiated emission limitations

§ 15.225 Operation within the band 13.110-14.010 MHz

Note:

Instead of applying ANSI C63.4–1992, which is referenced in the FCC Public Note, the newer ANSI C63.4–2009 is applied.

Summary Test Results:

The EUT complied with all performed tests as listed in chapter 0.2 Measurement Summary.

0.2 Measurement Summary

| | | | |
|--|--------------|-----------------|-------------------------------------|
| FCC Part 15, Subpart C | | § 15.207 | |
| Conducted Emissions AC Power line The measurement was performed according to ANSI C63.4 | | | |
| OP-Mode | Setup | Port | 2009 Final Result |
| - | - | - | N/A |
| FCC Part 15, Subpart C | | §15.209 | |
| Radiated Emissions The measurement was performed according to ANSI C63.4 | | | |
| OP-Mode | Setup | Port | 2009 Final Result |
| op-mode 1 | Setup_01 | Enclosure | passed |
| FCC Part 15, Subpart C | | § 15.215 | |
| Occupied Bandwidth The measurement was performed according to FCC § 2.1049 | | | |
| OP-Mode | Setup | Port | 10-1-13 Edition Final Result |
| op-mode 1 | Setup_01 | Enclosure | passed |
| FCC Part 15, Subpart C | | § 15.225 | |
| Spectrum Mask The measurement was performed according to ANSI C63.4 | | | |
| OP-Mode | Setup | Port | 2009 Final Result |
| op-mode 1 | Setup_01 | Enclosure | passed |
| FCC Part 15, Subpart C | | § 15.225 | |
| Frequency Tolerance The measurement was performed according to FCC § 2.1055 | | | |
| OP-Mode | Setup | Port | 10-1-13 Edition Final Result |
| op-mode 1 | Setup_01 | Enclosure | passed |

N/A The EUT is DC powered by a lead-acid vehicles battery

0.3 Report revision

| Report version control | | | |
|------------------------|--------------|---|------------------|
| Version | Release date | Changes | Version validity |
| rev.1 | 04.08.2014 | Section 3.2. of the initial version | not valid |
| rev.2 | 25.11.2014 | Retesting and correction of the occupied bandwidth values | not valid |
| rev.3 | 09.12.2014 | Section 6: FCC and IC Correlation of measurement requirements table updated | not valid |
| rev.4 | 19.12.2014 | Section 1.8: FCC and IC ID numbers changed | not valid |
| rev.5 | 03.02.2015 | Section 6: FCC and IC Correlation of measurement requirements table updated | not valid |
| rev.6 | 06.02.2015 | Section 3: updated calibration periods | valid |

Responsible for
Accreditation Scope:



Responsible
for Test Report:





Administrative Data

0.4 Testing Laboratory

Company Name: 7Layers AG
Address Borsigstr. 11
40880 Ratingen
Germany

This facility has been fully described in a report submitted to the FCC and accepted under the registration number 96716.

The test facility is also accredited by the following accreditation organisation:
Laboratory accreditation no.: DAkkS D-PL-12140-01-01

Responsible for Accreditation Scope: Dipl.-Ing. Bernhard Retka
Dipl.-Ing. Robert Machulec
Dipl.-Ing. Andreas Petz
Dipl.-Ing. Marco Kullik

Report Template Version: 2012-03-14

0.5 Project Data

Responsible for testing and report: Dipl.-Ing. Dobrin Dobrinov
Date of Test(s): 2014-03-21 to 2014-11-25
Date of Report: 2015-02-06

0.6 Applicant Data

Company Name: peiker acoustic GmbH & Co. KG
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0.7 Manufacturer Data

Company Name: please see applicant data
Address:
Contact Person:

1 Test object Data

1.1 General EUT Description

| | |
|-----------------------------|-----------------------------------|
| Equipment under Test | BMW CSM 3.0 AE |
| Type Designation: | Car Sharing external module |
| Kind of Device: | 13.56 MHz NFC card reader |
| Voltage Type: | DC from vehicle lead-acid battery |
| Voltage level: | 12 V DC |

General product description:

The BMW CSM 3.0 ECE Main unit is a part of the BMW CSM 3.0 Car Sharing module. It comprises GSM/UMTS and BT communication modules, NFC and RFID card readers built in the Main module and NFC card reader built in the external module as well.

Specific product description for the EUT:

The object of this test report is the NFC card reader of the external module, operating in 13.56 MHz frequency range.

The EUT provides the following ports:

Ports

- Enclosure
- DC in (12 V)
- CAN bus interface (to the Body CAN of the vehicle)
- LIN bus (communication to the AE module of the CSM)
- High speed USB (for communication to the HeadUnit)
- BT A2D or HFP (for communication to the Head Unit)
- GSM/UMTS connector for external antenna
- SIM card (voice/data) tray

The main components of the EUT are listed and described in Chapter 1.2.



1.2 EUT Main components

Type, S/N, Short Descriptions etc. used in this Test Report

| Short Description | Equipment under Test | Type Designation | Serial No. | HW Status | SW Status | Date of Receipt |
|---|-----------------------------|--|------------|-----------|-----------|-----------------|
| EUT A (Code: BI350c02) | Car Sharing external module | BMW CSM 3.0 AE 61 35 9 331 589-03 (BMW) 2708-041-001-00 (peiker) | #03 | D1-AI02 | V1.1 | - |
| Remark: EUT A is equipped with an integral antenna (gain = 2.15 dBi). | | | | | | |
| EUT B (Code: BI350e02) | Car Sharing external module | BMW CSM 3.0 AE 61 35 9 331 589-03 (BMW) 2708-041-001-00 (peiker) | #05 | D1-AI02 | V1.1 | - |
| Remark: EUT A is equipped with an integral antenna (gain = 2.15 dBi). | | | | | | |

NOTE: The short description is used to simplify the identification of the EUT in this test report.

1.3 Ancillary Equipment

For the purposes of this test report, ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

| Short Description | Equipment under Test | Type Designation | Serial No. | HW Status | SW Status | FCC ID |
|-------------------|--------------------------------|------------------------|------------|-----------|-----------|--------|
| AE 1 | LIN-Gateway for CSM test setup | peiker; CSM3.0 PCB C1; | E229342 | - | V-06 | - |

1.4 Auxiliary Equipment

For the purposes of this test report, auxiliary equipment is defined as equipment which is used temporarily to enable operational and control features especially used for the tests of the EUT which is not used during normal operation or equipment that is used during the tests in combination with the EUT but is not subject of this test report. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Auxiliary Equipment can influence the test results.

| Short Description | Equipment under Test | Type Designation | Serial no. | HW Status | SW Status | FCC ID |
|--------------------------|----------------------|---|---------------------|-----------|--------------|--------|
| AUX 1 (Code BI350XYZ) | NFC test Tag | Tagstar Systems, Mifare Standard 4k, | UID: 9C 4D 81 15 | - | - | - |
| AUX 2 | Laptop | Fujitsu-Siemens E-Lifebook | S/N: DSCK 013817 | E 781 | Win 7 Pro | - |
| AUX 3 | Laptop AC adapter | Fujitsu-Siemens SED100P2-19.0 | S/N: 07Y17323A | - | - | - |



1.5 EUT Setups

This chapter describes the combination of EUTs and equipment used for testing. The rationale for selecting the EUTs, ancillary and auxiliary equipment and interconnecting cables, is to test a representative configuration meeting the requirements of the referenced standards.

| Setup No. | Combination of EUTs | Description and Rationale |
|-----------|------------------------|---|
| Setup_01 | EUT A + AUX 1-3 + AE 1 | EUT reading a tag (representative setup for radiated emission measurements in normal conditions) |
| Setup_02 | EUT B + AUX 1-3 + AE 1 | EUT reading a tag (representative setup for occupied bandwidth and radiated measurements in extreme conditions) |

1.6 Operating Modes

This chapter describes the operating modes of the EUTs used for testing.

| Op. Mode | Description of Operating Modes | Remarks |
|-----------|--------------------------------|--|
| op-mode 1 | modulated carrier signal | EUT is transmitting a periodic modulated signal and is continuously reading TAG information. |

1.7 Special software used for testing

None

1.8 Product labelling

1.8.1 FCC ID label

QWY-CSM3-AE-US

1.8.2 IC ID label

6588A-CSM3AEUS

1.8.3 Location of the label on the EUT

Please refer to the documentation of the applicant.

2 Test Results

2.1 Spurious radiated emissions

Standard FCC Part 15, Subpart C

The test was performed according to: ANSI C63.4

2.1.1 Test Description

The test set-up was made in accordance to the general provisions of ANSI C63.4 in a typical installation configuration. The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m² in the semi-anechoic chamber. The influence of the EUT support table that is used between 30–1000 MHz was evaluated.

The measurement procedure is implemented into the EMI test software ES-K1 from R&S. Exploratory tests are performed at 3 orthogonal axes to determine the worst-case orientation of a body-worn or handheld EUT. The final test on all kind of EUTs is performed at 2 axes. A pre-check is also performed while the EUT is powered from both AC and DC (battery) power in order to find the worst-case operating condition.

1. Measurement up to 30 MHz

The Loop antenna HFH2-Z2 is used.

Step 1: pre measurement

- Anechoic chamber
- Antenna distance: 10 m
- Detector: Peak-Maxhold
- Frequency range: 0.009 – 0.15 and 0.15 – 30 MHz
- Frequency steps: 0.1 kHz and 5 kHz
- IF-Bandwidth: 0.2 kHz and 10 kHz
- Measuring time / Frequency step: 100 ms

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: final measurement

For the relevant emissions determined in step 1, an additional measurement with the following settings will be performed. Intention of this step is to find the maximum emission level.

- Open area test side
- Antenna distance: according to the Standard
- Detector: Quasi-Peak
- Frequency range: 0.009 – 30 MHz
- Frequency steps: measurement at frequencies detected in step 1
- IF-Bandwidth: 200 Hz – 10 kHz
- Measuring time / Frequency step: 100 ms

2. Measurement above 30 MHz and up to 1 GHz

Step 1: Preliminary scan

Preliminary test to identify the highest amplitudes relative to the limit.

Settings for step 1:

- Antenna distance: 3 m
- Detector: Peak-Maxhold
- Frequency range: 30 – 1000 MHz
- Frequency steps: 60 kHz
- IF-Bandwidth: 120 kHz
- Measuring time / Frequency step: 100 μ s
- Turntable angle range: -180° to 180°
- Turntable step size: 90°
- Height variation range: 1 – 3 m
- Height variation step size: 2 m
- Polarisation: Horizontal + Vertical

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: second measurement

For the relevant emissions determined in step 1, an additional measurement with the following settings will be performed. Intention of this step is, to find out the approximate turntable angle and antenna height for each frequency.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range: -180° to 180°
- Turntable step size: 45°
- Height variation range: 1 – 4 m
- Height variation step size: 0.5 m
- Polarisation: horizontal + vertical

After this step, the EMI test system has determined the following values for each frequency (of step 1):

- Frequency
- Azimuth value (of turntable)
- Antenna height

The last two values have now the following accuracy:

- Azimuth value (of turntable): 45°
- Antenna height: 0.5 m

Step 3: final measurement

In this step, the accuracy of the turntable azimuth and antenna height will be improved.

This is necessary to find out the maximum value of every frequency.

For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will be slowly varied by $\pm 22.5^\circ$ around this value.

During this action, the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position the antenna height is also slowly varied by ± 25 cm around the antenna height determined.

During this action, the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range: -22.5° to $+22.5^\circ$ around the determined value
- Height variation range: -0.25 m to $+0.25$ m around the determined value



Step 4: final measurement with QP detector

With the settings determined in step 3, the final measurement will be performed:

EMI receiver settings for step 4:

- Detector: Quasi-Peak (< 1 GHz)
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

After the measurement a plot will be generated, which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

2.1.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (d)

... In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

FCC Part 15, Subpart C, §15.209, Radiated Emission Limits

| Frequency in MHz | Limit (µV/m) | Measurement distance (m) | Limit(dBµV/m @10m) |
|------------------|--------------|--------------------------|-----------------------|
| 0.009 – 0.49 | 2400/F(kHz) | 300 | Limit (dBµV/m)+59.1dB |
| 0.49 – 1.705 | 24000/F(kHz) | 30 | Limit (dBµV/m)+19.1dB |
| 1.705 – 30 | 30 | 30 | Limit (dBµV/m)+19.1dB |

| Frequency in MHz | Limit (µV/m) | Measurement distance (m) | Limit (dBµV/m) |
|------------------|--------------|--------------------------|----------------|
| 30 – 88 | 100 | 3 | 40.0 |
| 88 – 216 | 150 | 3 | 43.5 |
| 216 – 960 | 200 | 3 | 46.0 |
| above 960 | 500 | 3 | 54.0 |

§15.35(b)

..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

Used conversion factor: $\text{Limit (dBµV/m)} = 20 \log (\text{Limit (µV/m)}/1\mu\text{V/m})$

2.1.3 Test Protocol

Temperature: 23 – 24 °C
 Air Pressure: 1009 – 1011 hPa
 Humidity: 38 – 41 %

2.1.3.1 Measurement up to 30 MHz

| Op. Mode | Setup | Port |
|-----------|----------|-----------|
| op-mode 1 | Setup_01 | Enclosure |

| Polarisation | Frequency MHz | Corrected value dBµV/m | | | Limit dBµV/m | Limit dBµV/m | Limit dBµV/m | Delta to limit dB | Delta to limit dB |
|--------------|---------------|------------------------|------|----|--------------|--------------|--------------|-------------------|-------------------|
| | | QP | Peak | AV | QP | Peak | AV | QP/Peak | AV |
| - | - | - | - | - | - | - | - | - | - |

Remark: No spurious emissions in the range 20 dB below the limit found therefore step 2 was not performed. Please refer to the plot in the annex.

2.1.3.2 Measurement above 30 MHz

| Op. Mode | Setup | Port |
|-----------|----------|-----------|
| op-mode 1 | Setup_01 | Enclosure |

| Polarisation | Frequency MHz | Corrected value dBµV/m | | | Limit dBµV/m | Limit dBµV/m | Limit dBµV/m | Delta to limit dB | Delta to limit dB |
|--------------|---------------|------------------------|------|----|--------------|--------------|--------------|-------------------|-------------------|
| | | QP | Peak | AV | QP | Peak | AV | QP/Peak | AV |
| - | - | - | - | - | - | - | - | - | - |

Remark: No spurious emissions in the range 20 dB below the limit found therefore step 2 was not performed. Please refer to the plot in the annex.

2.1.4 Test result: Spurious radiated emissions

| FCC Part 15, Subpart C | Op. Mode | Result |
|------------------------|-----------|--------|
| | op-mode 1 | passed |



2.2 Occupied bandwidth

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

2.2.1 Test Description

The Equipment Under Test (EUT) was setup in a shielded room to perform the occupied bandwidth measurements.

The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.

The results recorded were measured with the modulation which produces the worst-case (widest) occupied bandwidth.

2.2.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.215 (c)

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. ...

2.2.3 Test Protocol

Temperature: 23 °C
 Air Pressure: 1010 hPa
 Humidity: 39 %

| Op. Mode | Setup | Port |
|-----------|----------|-----------|
| op-mode 1 | Setup_02 | Enclosure |

| 20 dB bandwidth kHz | 99% bandwidth kHz | Remarks |
|---------------------|-------------------|---|
| 435.9 kHz | 428.858 kHz | The 20 dB bandwidth from 13.341563 MHz to 13.777435 MHz is contained within the designated frequency band 13.110 MHz to 14.010 MHz. |

Remark: Please see annex for the measurement plot.

2.2.4 Test result: Occupied bandwidth

| FCC Part 15, Subpart C | Op. Mode | Result |
|------------------------|-----------|--------|
| | op-mode 1 | passed |

2.3 Spectrum mask

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.225

2.3.1 Test Description

The test set-up was made in accordance to the general provisions of ANSI C 63.4. The Equipment Under Test (EUT) was set up on a non-conductive table in the anechoic chamber.

The radiated emissions measurements were made in a typical installation configuration. The measurement procedure is implemented into the EMI test software ES-K1 from R&S. The Loop antenna HFH2-Z2 is used.

- Anechoic chamber
- Antenna distance: 10 m
- Detector: Peak-Maxhold
- Frequency range: 13.06 – 14.06 MHz
- Frequency steps: 5 kHz
- IF-Bandwidth: 10 kHz
- Measuring time / Frequency step: 100 ms

2.3.2 Test Limits

FCC Part 15, Subpart C, §15.225 (a-d), and §15.209, corrected by the means of the extrapolation of §15.31 due to the reduced measuring distance from 30 m to 10 m.

2.3.3 Test Protocol

Temperature: 22°C
 Air Pressure: 1009 hPa
 Humidity: 38%

| Op. Mode | Setup | Port |
|-----------|----------|-----------|
| op-mode 1 | Setup_01 | Enclosure |

| Maximum value dBµV/m | Limit dBµV/m | Remarks |
|-------------------------|-----------------|-------------------------|
| 38.49 | 103 | measuring distance 10 m |

Remark: Please see annex for the measurement plot.

2.3.4 Test result: Spectrum mask

| FCC Part 15, Subpart C | Op. Mode | Result |
|------------------------|-----------|--------|
| | op-mode 1 | passed |



2.4 Frequency tolerance

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.225

2.4.1 Test Description

The Equipment Under Test (EUT) is placed in a temperature chamber. The frequency drift during temperature and voltage variation is measured by the means of a spectrum analyzer with frequency counter function. The temperature was varied from $-20\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$. At $+20\text{ }^{\circ}\text{C}$ the extreme power supply voltages of 85% to 115% DC are applied. After reaching each target temperature and waiting sufficient time allowing the temperature to stabilize, one measurement is performed immediately after powering on the EUT, and two further measurements are performed after 5 and 10 minutes continuous operation of EUT.

2.4.2 Test Limits

FCC Part 15, Subpart C, §15.225 (e): The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.



Test Protocol

Ambient temperature: 23 °C
 Air Pressure: 1009 hPa
 Humidity: 38 %

| Op. Mode | Setup | Port |
|-----------|----------|-----------|
| op-mode 1 | Setup_02 | Enclosure |

| Temperature | Voltage | Time | Frequency | Delta | Verdict |
|-------------|---------|--------|-----------|-------|---------|
| / °C | / V | / min. | / MHz | / Hz | |
| 60 | 12.00 | 0 | 13.559736 | -264 | Passed |
| 60 | 12.00 | 5 | 13.559691 | -309 | Passed |
| 60 | 12.00 | 10 | 13.559683 | -317 | Passed |
| 50 | 12.00 | 0 | 13.559805 | -195 | Passed |
| 50 | 12.00 | 5 | 13.559762 | -238 | Passed |
| 50 | 12.00 | 10 | 13.559746 | -254 | Passed |
| 40 | 12.00 | 0 | 13.559876 | -124 | Passed |
| 40 | 12.00 | 5 | 13.559832 | -168 | Passed |
| 40 | 12.00 | 10 | 13.559810 | -190 | Passed |
| 30 | 12.00 | 0 | 13.559830 | -170 | Passed |
| 30 | 12.00 | 5 | 13.559862 | -138 | Passed |
| 30 | 12.00 | 10 | 13.559903 | -97 | Passed |
| 20 | 9.00 | 0 | 13.559793 | -207 | Passed |
| 20 | 9.00 | 5 | 13.559794 | -206 | Passed |
| 20 | 9.00 | 10 | 13.559796 | -204 | Passed |
| 20 | 12.00 | 0 | 13.559792 | -208 | Passed |
| 20 | 12.00 | 5 | 13.559793 | -207 | Passed |
| 20 | 12.00 | 10 | 13.559794 | -206 | Passed |
| 20 | 16.00 | 0 | 13.559820 | -180 | Passed |
| 20 | 16.00 | 5 | 13.559810 | -190 | Passed |
| 20 | 16.00 | 10 | 13.559802 | -198 | Passed |
| 10 | 12.00 | 0 | 13.560052 | 52 | Passed |
| 10 | 12.00 | 5 | 13.560061 | 61 | Passed |
| 10 | 12.00 | 10 | 13.560075 | 75 | Passed |
| 0 | 12.00 | 0 | 13.560188 | 188 | Passed |
| 0 | 12.00 | 5 | 13.560195 | 195 | Passed |
| 0 | 12.00 | 10 | 13.560202 | 202 | Passed |
| -10 | 12.00 | 0 | 13.560165 | 165 | Passed |
| -10 | 12.00 | 5 | 13.560170 | 170 | Passed |
| -10 | 12.00 | 10 | 13.560177 | 177 | Passed |

Remarks: - The EUT working temperature range (-10° C to +60° C) and extreme supply voltages (+9.0 V and +16.0 V) are set by the manufacturer.
 - The limit is a delta of max. ±1356 Hz (0.01 %).

2.4.3 Test result: Frequency tolerance

| FCC Part 15, Subpart C | Op. Mode | Result |
|------------------------|-----------|--------|
| | op-mode 1 | passed |



3 Test Equipment

The calibration, hardware and software states are shown for the testing period.

Test Equipment Anechoic Chamber

| | | | |
|----------------------|---------------------------------------|------------|------------|
| Lab ID: | Lab 2 | | |
| Manufacturer: | Frankonia | | |
| Description: | Anechoic Chamber for radiated testing | | |
| Type: | 10.58x6.38x6.00 m ³ | | |
| | NSA (FCC) | 2014/01/09 | 2017/01/09 |

Single Devices for Anechoic Chamber

| Single Device Name | Type | Serial Number | Manufacturer |
|---------------------|--|---------------|------------------------------------|
| Air compressor | none | - | Atlas Copco |
| Anechoic Chamber | 10.58 x 6.38 x 6.00 m ³ FCC listing 96716 3m Part15/18 | none | Frankonia 2014/01/09 2017/01/08 |
| Controller Maturo | MCU | 961208 | Maturo GmbH |
| EMC camera | CE-CAM/1 | - | CE-SYS |
| EMC camera Nr.2 | CCD-400E | 0005033 | Mitsubishi |
| Filter ISDN | B84312-C110-E1 | - | Siemens&Matsushita |
| Filter Universal 1A | BB4312-C30-H3 | - | Siemens&Matsushita |

Test Equipment Auxiliary Equipment for Conducted emissions

| | |
|----------------------|-----------------------------------|
| Lab ID: | Lab 1 |
| Manufacturer: | Rohde & Schwarz GmbH & Co.KG |
| Description: | EMI Conducted Auxiliary Equipment |

Single Devices for Auxiliary Equipment for Conducted emissions

| Single Device Name | Type | Serial Number | Manufacturer |
|--|----------------------------|---------------|---|
| Cable "LISN to ESI" | RG214 | W18.03+W48.03 | Huber&Suhner |
| Impedance Stabilization Network | ISN T800 | 36159 | Teseq GmbH |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Standard Calibration | | 2014/02/06 2016/02/28 |
| Impedance Stabilization Network, Coupling Decoupling Network | ISN/CDN ENY41 | 100002 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Standard calibration | | 2013/03/01 2015/03/31 |
| Impedance Stabilization Network, Coupling Decoupling Network | ISN/CDN ST08 | 36292 | Teseq GmbH |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Standard calibration | | 2014/01/10 2016/01/31 |
| Impedance Stabilization Network, Coupling Decoupling Network | ISN/CDN T8-Cat6 | 32187 | Teseq GmbH |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Standard Calibration | | 2014/01/08 2016/01/31 |



Single Devices for Auxiliary Equipment for Conducted emissions (continued)

| <i>Single Device Name</i> | <i>Type</i> | <i>Serial Number</i> | <i>Manufacturer</i> | |
|---------------------------|----------------------------|----------------------|-------------------------------|-------------------|
| One-Line V-Network | ESH 3-Z6 | 100489 | Rohde & Schwarz GmbH & Co. KG | |
| One-Line V-Network | ESH 3-Z6 | 100570 | Rohde & Schwarz GmbH & Co. KG | |
| | <i>Calibration Details</i> | | <i>Last Execution</i> | <i>Next Exec.</i> |
| | Standard Calibration | | 2013/11/25 | 2016/11/24 |
| Two-Line V-Network | ESH 3-Z5 | 828304/029 | Rohde & Schwarz GmbH & Co. KG | |
| | <i>Calibration Details</i> | | <i>Last Execution</i> | <i>Next Exec.</i> |
| | Standart Calibration | | 2013/03/01 | 2015/02/28 |
| Two-Line V-Network | ESH 3-Z5 | 829996/002 | Rohde & Schwarz GmbH & Co. KG | |
| | <i>Calibration Details</i> | | <i>Last Execution</i> | <i>Next Exec.</i> |
| | Standard Calibration | | 2013/03/01 | 2015/02/28 |



Test Equipment Auxiliary Equipment for Radiated emissions

Lab ID: Lab 2
Description: Equipment for emission measurements
Serial Number: see single devices

Single Devices for Auxiliary Equipment for Radiated emissions

| Single Device Name | Type | Serial Number | Manufacturer |
|--|----------------------------|------------------------|---|
| Antenna mast | AM 4.0 | AM4.0/180/119205 13 | Maturo GmbH |
| Antenna mast | AS 620 P | 620/37 | HD GmbH |
| Broadband Amplifier 18MHz-26GHz | JS4-18002600-32-5P | 849785 | Miteq |
| Broadband Amplifier 1GHz-4GHz | AFS4-01000400-1Q-10P-4 | - | Miteq |
| Broadband Amplifier 30MHz-18GHz | JS4-00101800-35-5P | 896037 | Miteq |
| Cable "ESI to EMI Antenna" | EcoFlex10 | W18.01-2+W38.01- 2 | Kabel Kusch |
| Cable "ESI to Horn Antenna" | UFB311A+UFB293C | W18.02-2+W38.02- 2 | Rosenberger Micro-Coax |
| Double-ridged horn | HF 906 | 357357/001 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Standard Calibration | | 2012/05/18 2015/05/17 |
| Double-ridged horn | HF 906 | 357357/002 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Standard Calibration | | 2012/06/26 2015/06/25 |
| High Pass Filter | 4HC1600/12750-1.5-KK | 9942011 | Trilithic |
| High Pass Filter | 5HC2700/12750-1.5-KK | 9942012 | Trilithic |
| High Pass Filter | 5HC3500/12750-1.2-KK | 200035008 | Trilithic |
| High Pass Filter | WHKX 7.0/18G-8SS | 09 | Wainwright |
| Horn Antenna Schwarzbeck 15-26 GHz BBHA 9170 | BBHA 9170 | | |
| Log.-per. Antenna | HL 562 Ultralog | 100609 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Standard Calibration | | 2012/12/18 2015/12/17 |
| Log.-per. Antenna | HL 562 Ultralog | 830547/003 | Rohde & Schwarz GmbH & Co. KG |
| Loop Antenna | HFH2-Z2 | 829324/006 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Standard calibration | | 2014/11/27 2017/11/27 |



Single Devices for Auxiliary Equipment for Radiated emissions (continued)

| <i>Single Device Name</i> | <i>Type</i> | <i>Serial Number</i> | <i>Manufacturer</i> |
|------------------------------------|--------------------|----------------------------|----------------------|
| Pyramidal Horn Antenna 26,5 GHz | 3160-09 | 00083069 | EMCO Elektronik GmbH |
| Pyramidal Horn Antenna 40 GHz | 3160-10 | 00086675 | EMCO Elektronik GmbH |
| Tilt device Maturo (Rohacell) | Antrieb TD1.5-10kg | TD1.5- 10kg/024/3790709 | Maturo GmbH |

Test Equipment Auxiliary Test Equipment

Lab ID: Lab 2, Lab 3
Manufacturer: see single devices
Description: Single Devices for various Test Equipment
Type: various
Serial Number: none

Single Devices for Auxiliary Test Equipment

| <i>Single Device Name</i> | <i>Type</i> | <i>Serial Number</i> | <i>Manufacturer</i> |
|---------------------------------------|----------------------------|----------------------|---|
| Broadband Power Divider N (Aux) | 1506A / 93459 | LM390 | Weinschel Associates |
| Broadband Power Divider SMA | WA1515 | A855 | Weinschel Associates |
| Digital Multimeter 03 (Multimeter) | Fluke 177 | 86670383 | Fluke Europe B.V. |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Customized calibration | | 2013/12/04 2015/12/03 |
| Fibre optic link Satellite (Aux) | FO RS232 Link | 181-018 | Pontis |
| Fibre optic link Transceiver (Aux) | FO RS232 Link | 182-018 | Pontis |
| Isolating Transformer | LTS 604 | 1888 | Thalheimer Transformatorenwerke GmbH |
| Notch Filter Ultra Stable (Aux) | WRCA800/960-6EEK | 24 | Wainwright |
| Signal Analyzer | FSV30 | 103005 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Standard | | 2014/02/10 2016/02/09 |
| Spectrum Analyser | FSP3 | 836722/011 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Standard | | 2012/06/13 2015/06/12 |
| Spectrum Analyser | FSU26 | 200418 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Standard calibration | | 2014/07/29 2015/07/28 |
| Vector Signal Generator | SMIQ 03B | 832492/061 | Rohde & Schwarz GmbH & Co.KG |



Test Equipment Radio Lab Test Equipment

Lab ID: Lab 3
Description: Radio Lab Test Equipment

Single Devices for Radio Lab Test Equipment

| <i>Single Device Name</i> | <i>Type</i> | <i>Serial Number</i> | <i>Manufacturer</i> |
|--|---|----------------------|---|
| Broadband Power DividerWA1515 SMA | | A856 | Weinschel Associates |
| Coax Attenuator 10dB SMA 2W | 4T-10 | F9401 | Weinschel Associates |
| Coax Attenuator 10dB SMA 2W | 56-10 | W3702 | Weinschel Associates |
| Coax Attenuator 10dB SMA 2W | 56-10 | W3711 | Weinschel Associates |
| Coax Cable Huber&Suhner | Sucotest 2,0m | | Huber&Suhner |
| Coax Cable Rosenberger Micro Coax FA210A0010003030 SMA/SMA 1,0m | FA210A0010003030 | 54491-2 | Rosenberger Micro-Coax |
| Power Meter | NRVD Standard calibration | 828110/016 | Rohde & Schwarz GmbH & Co.KG 2014/05/13 2015/05/12 |
| RF Step Attenuator RSP | RSP | 833695/001 | Rohde & Schwarz GmbH & Co.KG |
| Rubidium Frequency Standard | Datum, Model: MFS Standard calibration | 5489/001 | Datum-Beverly 2014/07/03 2015/07/02 |
| Sensor Head A | NRV-Z1 Standard calibration | 827753/005 | Rohde & Schwarz GmbH & Co.KG 2014/05/13 2015/05/12 |
| Signal Generator SME | SME03 <i>Calibration Details</i> Standard calibration | 827460/016 | Rohde & Schwarz GmbH & Co.KG <i>Last Execution</i> <i>Next Exec.</i> 2011/12/02 2017/12/01 |
| Signal Generator SMP | SMP02 <i>Calibration Details</i> Standard calibration | 836402/008 | Rohde & Schwarz GmbH & Co. KG <i>Last Execution</i> <i>Next Exec.</i> 2013/05/06 2016/05/05 |
| Spectrum Analyser | FSIQ26 <i>Calibration Details</i> Standard Calibration | 840061/005 | Rohde & Schwarz GmbH & Co. KG <i>Last Execution</i> <i>Next Exec.</i> 2013/02/12 2015/02/11 |
| Temperature Chamber Vötsch 03 | VT 4002 <i>Calibration Details</i> Customized calibration Customized calibration | 58566002150010 | Vötsch <i>Last Execution</i> <i>Next Exec.</i> 2012/03/12 2014/03/11 2014/03/11 2016/03/10 |



Test Equipment Temperature Chamber 01

Lab ID: Lab 4
Manufacturer: see single devices
Description: Temperature Chamber KWP 120/70
Type: Weiss
Serial Number: see single devices

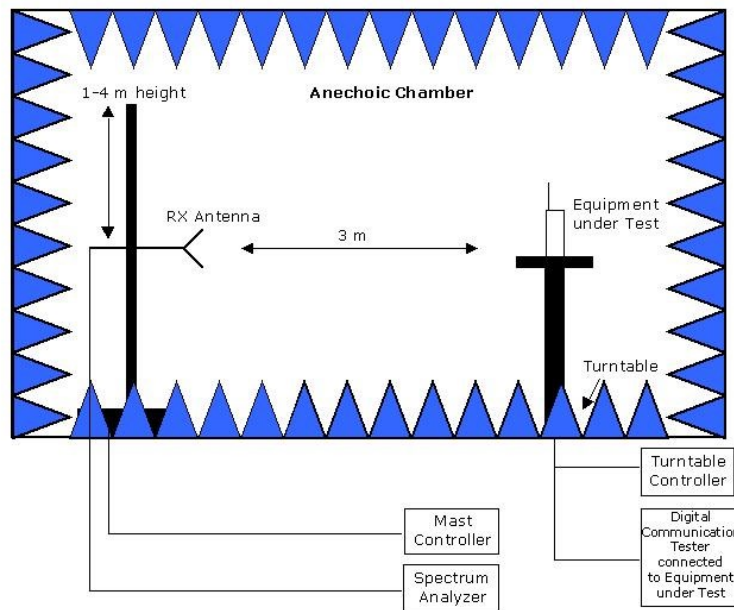
Single Devices for Temperature Chamber 01

| <i>Single Device Name</i> | <i>Type</i> | <i>Serial Number</i> | <i>Manufacturer</i> |
|------------------------------|----------------------------|----------------------|---|
| Temperature Chamber Weiss 01 | KWP 120/70 | 59226012190010 | Weiss Umwelttechnik GmbH |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Customized calibration | | 2012/03/12 2014/03/11 |
| | Customized calibration | | 2014/03/12 2016/03/11 |

4 Photo Report

Photos are included in an external report.

5 Setup Drawings



Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

Drawing 1: Setup in the Anechoic chamber:
Measurements below 1 GHz: Semi-anechoic, conducting ground plane.



6 FCC and IC Correlation of measurement requirements

The following table shows the correlation of measurement requirements for Radio equipment operating in the Band 13.110-14.010 MHz from FCC and IC..

Radio equipment

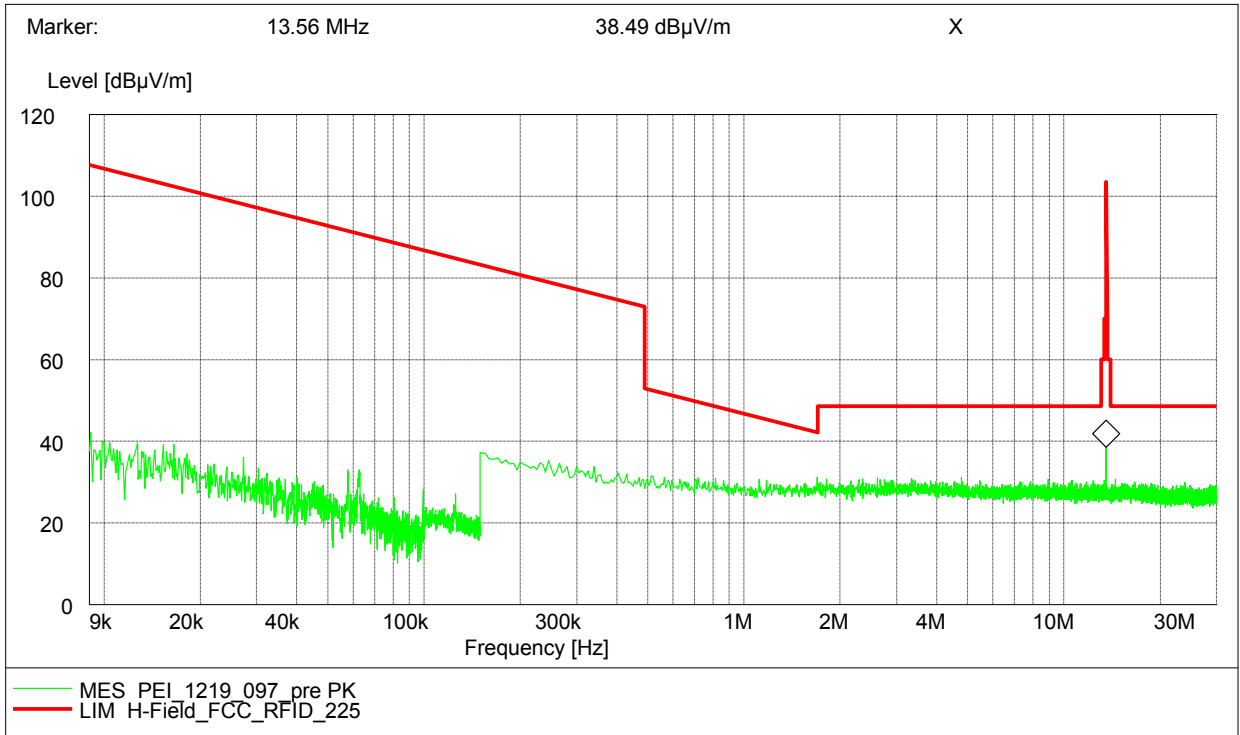
| Measurement | FCC reference | IC reference |
|--|--------------------------|---|
| Conducted emissions on AC Mains | § 15.207 | RSS-Gen Issue 4: 8.8 |
| Out-of-band emissions | § 15.225 (d) | RSS Gen Issue 4: 6.13/8.9/8.10; RSS-210 Issue 8: A2.6 |
| In-band emissions | § 15.225 (a) / (b) / (c) | RSS-210 Issue 8: A2.6 |
| Frequency Stability | § 15.225 (e) | RSS-210 Issue 8: A2.6 |
| Antenna requirement | § 15.203 / 15.204 | RSS-Gen Issue 4: 8.3 |
| Receiver spurious emissions | - | RSS-210 Issue 8: 2.3; RSS Gen Issue 4: 5/7 *) |
| Handling of active and passive tag devices of RFID application | § 15.225 (f) | RSS Gen Issue 4: 8.7 |

*) Receivers are exempted from certification besides if operating in stand-alone mode in the frequency range 30–960 MHz or if these are scanner receivers.

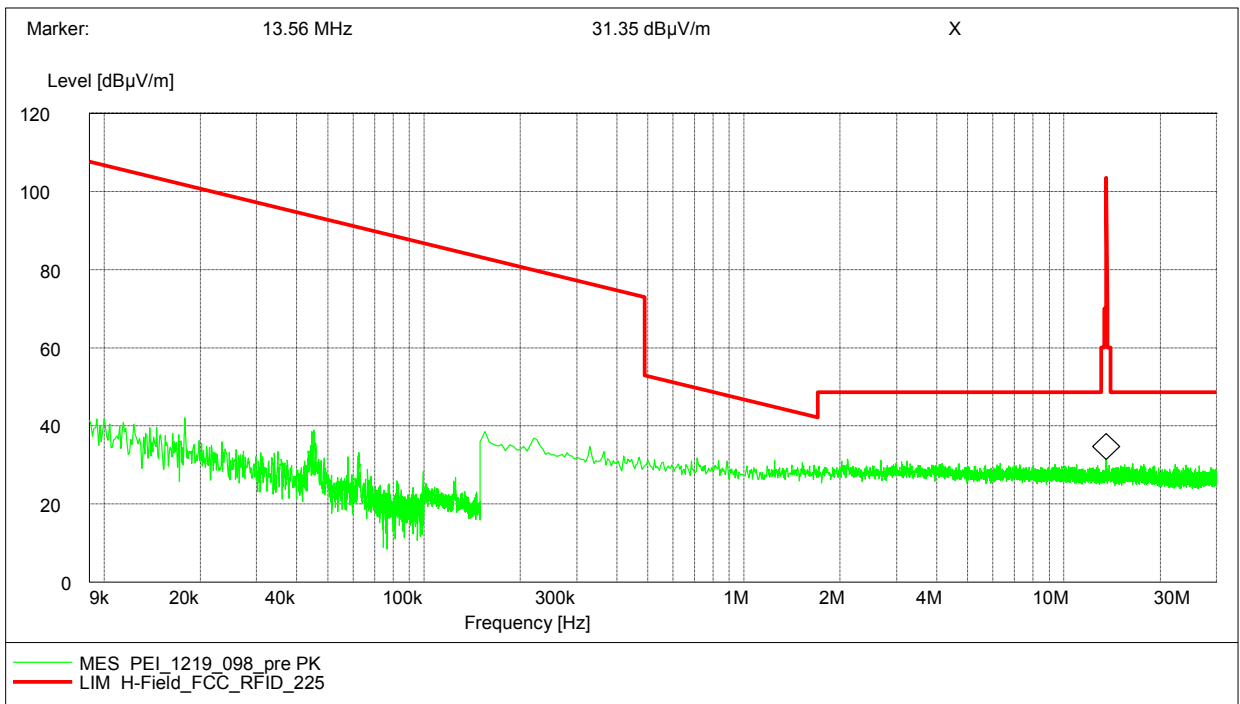
7 Annex measurement plots

7.1 Radiated emissions

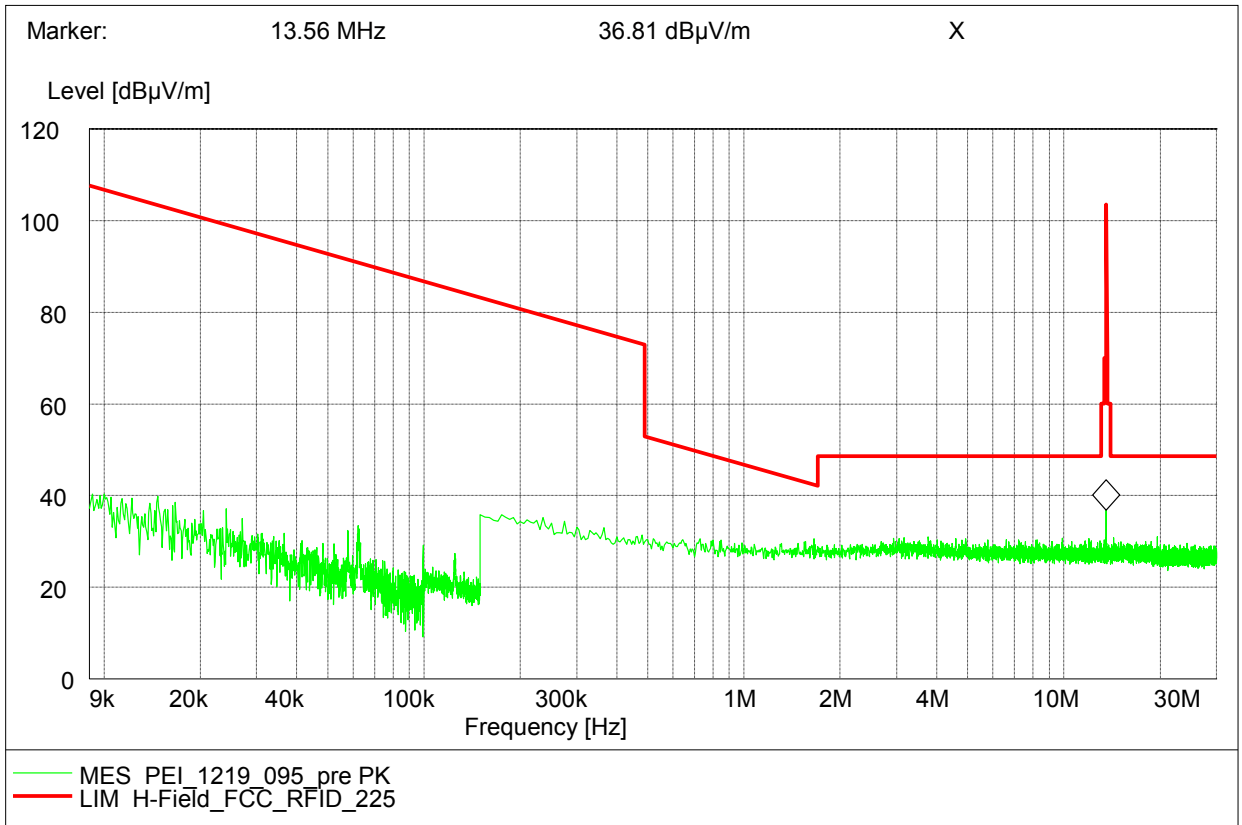
7.1.1 Radiated emissions (f < 30 MHz)



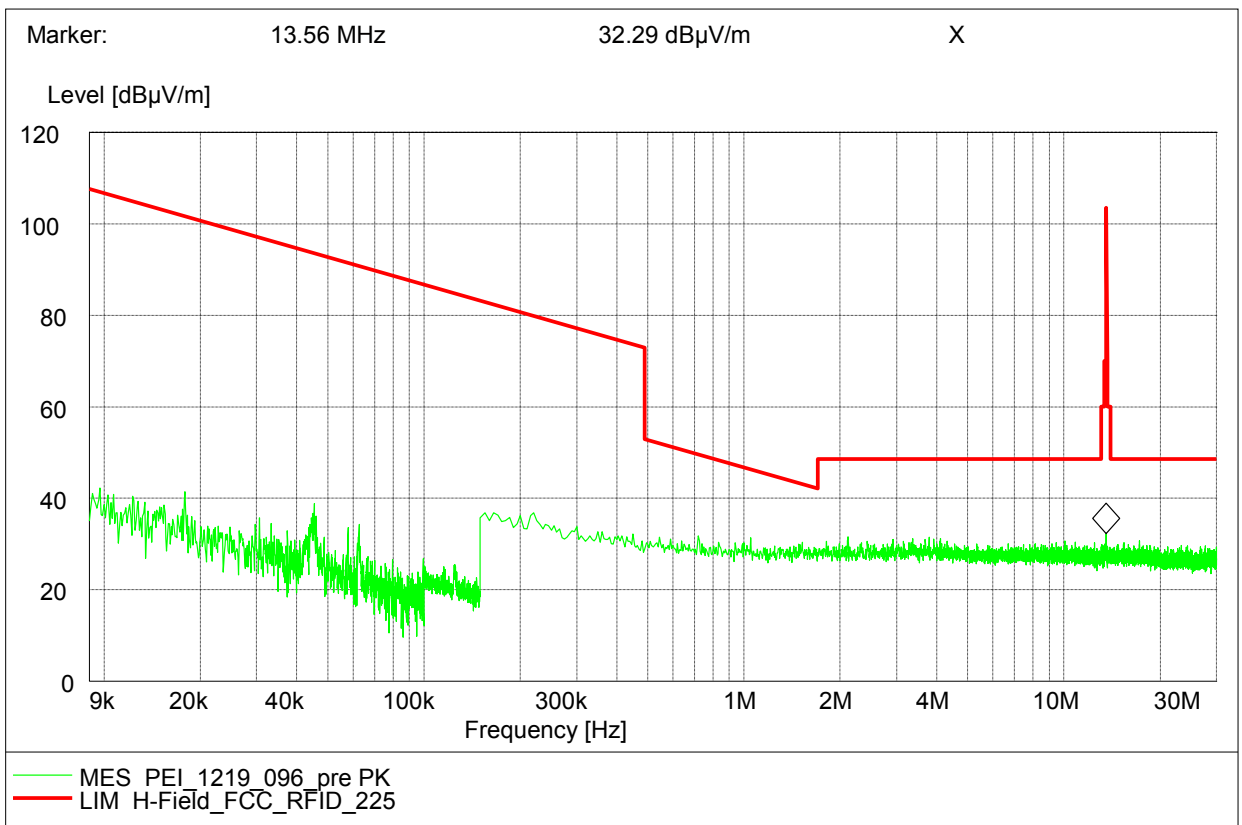
Antenna position 0°
EUT side 2, horizontal position



Antenna position 90°
EUT side 2, horizontal position



Antenna position 0°
EUT side 1, horizontal position



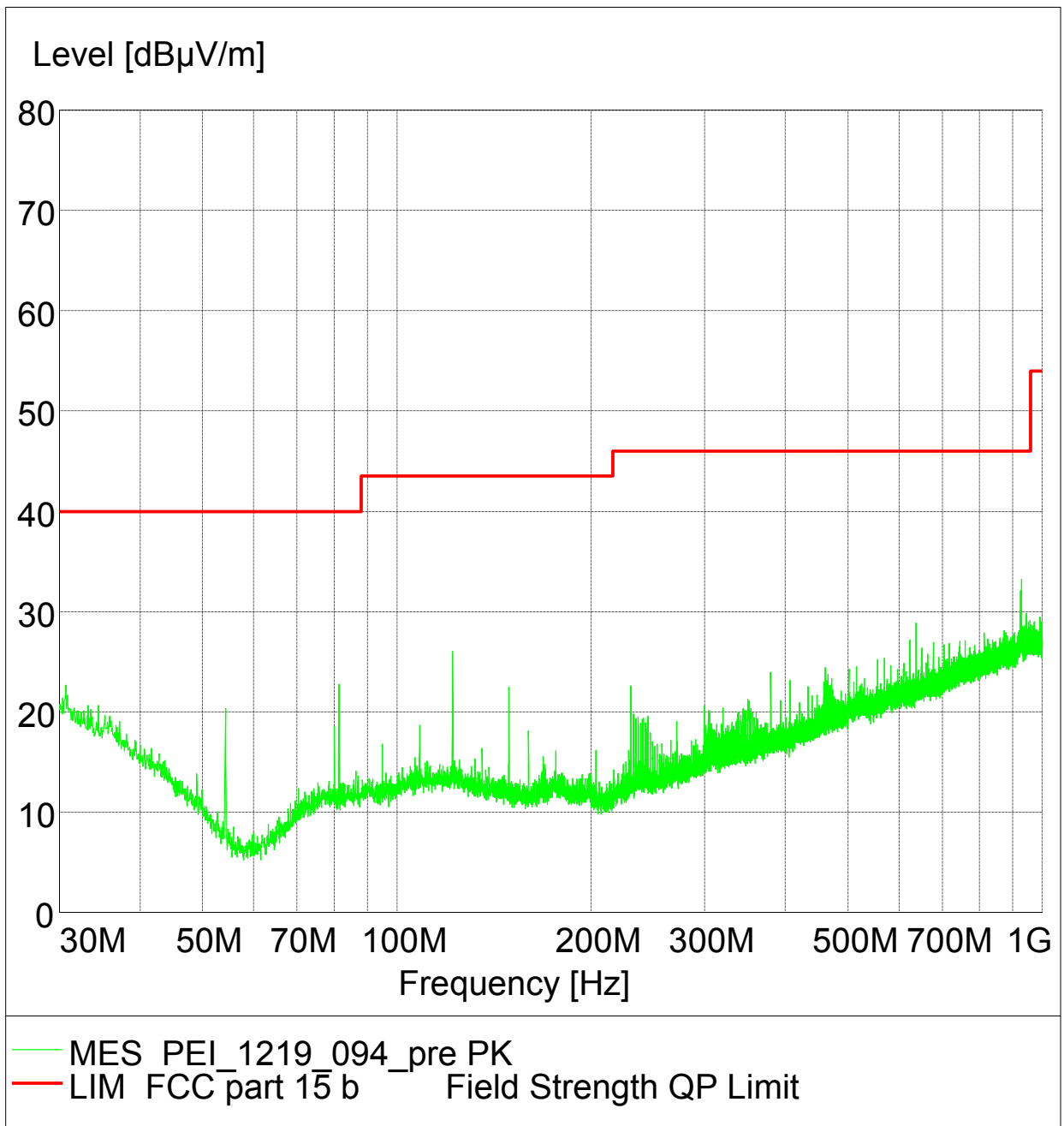
Antenna position 90°
EUT side 1, horizontal position

7.1.2 Radiated emissions (f > 30 MHz)


EUT: (BI350e02)
 Manufacturer: PEIKER
 Operating Condition: NFC TX on 13,56 MHz
 Test Site: 7 layers, Ratingen
 Test Specification: FCC part 15.209/225
 Comment: Horizontal EUT position
 Start of Test: 22.07.2014 / 10:43:32

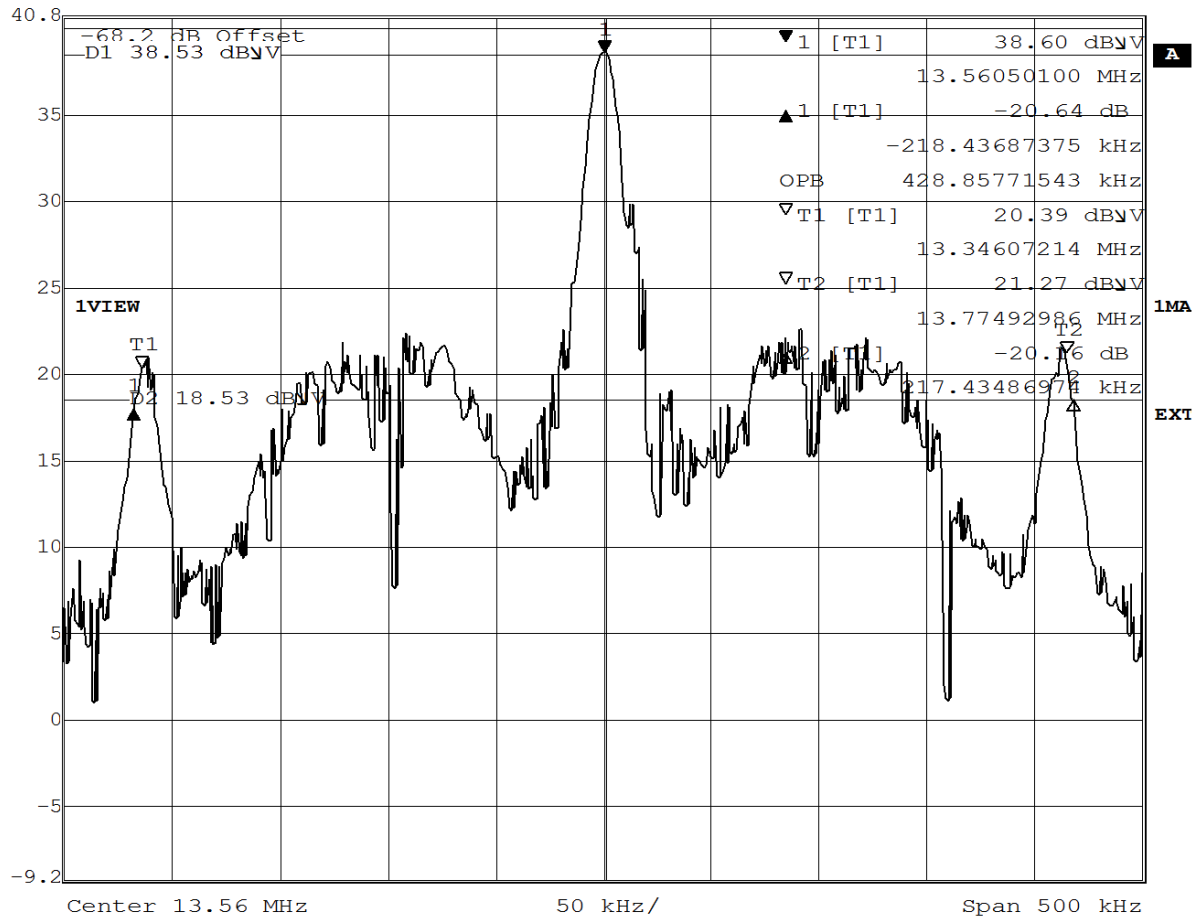
SCAN TABLE: "FCC part 15 c"

| Short Description: | | | FCC part 15 b | | | |
|--------------------|-----------|----------|---------------|------------|-----------|------------|
| Start | Stop | Step | Detector | Meas. Time | IF Bandw. | Transducer |
| Frequency | Frequency | Width | | | | |
| 30.0 MHz | 1.0 GHz | 60.0 kHz | MaxPeak | 1.0 ms | 120 kHz | HL562 |



7.2 Occupied bandwidth

| | | | | | |
|---|-------------------|-----|--------|--------|-------|
|  | Delta 1 [T1] | RBW | 10 kHz | RF Att | 30 dB |
| Ref Lvl | -20.64 dB | VBW | 1 MHz | | |
| 40.8 dBV | -218.43687375 kHz | SWT | 25 ms | Unit | dBV |



Date: 25.NOV.2014 16:04:39

$\Delta 1 = 13.341563 \text{ MHz}$, $\Delta 2 = 13.777435 \text{ MHz} \Rightarrow 20 \text{ dB occupied bandwidth} = 435.9 \text{ kHz}$;

99% bandwidth = 428.858 kHz

7.3 Spectrum mask

