InterLab®

FCC Measurement/Technical Report on

BMW CSM 3.0 ECE

Car Sharing Main module
61 35 9 363 068-01 (BMW)
2515-057-001-51 (peiker)

NFC card reader

Report Reference: MDE_PEIKER_1219_FCCa_rev.5

Test Laboratory:
7Layers AG
Borsigstrasse 11
40880 Ratingen
Germany

DAkkS
Deutsche
Akkreditierungsstelle
D-PL-12140-01-01

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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		2009
OP-Mode	**Setup**	**Port**	**Final Result**
-	-	-	N/A

FCC Part 15, Subpart C	**§15.209**	
Radiated Emissions		
The measurement was performed according to ANSI C63.4		2009
OP-Mode	**Setup**	**Port**	**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		10-1-13 Edition
OP-Mode	**Setup**	**Port**	**Final Result**
op-mode 1	Setup_02	Enclosure	passed

FCC Part 15, Subpart C	**§ 15.225**	
Spectrum Mask		
The measurement was performed according to ANSI C63.4		2009
OP-Mode	**Setup**	**Port**	**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		10-1-13 Edition
OP-Mode	**Setup**	**Port**	**Final Result**
op-mode 2	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 7: FCC and IC Correlation of measurement requirements table updated	not valid
rev.4	03.02.2015	Section 7: FCC and IC Correlation of measurement requirements table updated	not valid
rev.5	06.02.2015	Section 3: updated calibration periods	valid

Responsible for Accreditation Scope: _____ Responsible for Test Report: _____

1 Administrative Data

1.1 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

1.2 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

1.3 Applicant Data

Company Name:	peiker acustic GmbH & Co. KG
Address:	Max-Planck-Strasse 28-32 61381 Friedrichsdorf/Ts Germany
Contact Person:	Mr. Stefan Hofmann
Phone:	+49 6172-767 220
Fax:	
E-Mail:	stefan.hofmann@peiker.de

1.4 Manufacturer Data

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

2 Test object Data

2.1 General EUT Description

Equipment under Test	BMW CSM 3.0 ECE
Type Designation:	Car Sharing Main unit
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 module 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 which are 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 built in the Main 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 2.2.

2.2 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: BI340x04)	Car Sharing Main module	Car Sharing Main module 61 35 9 363 068-01 (BMW) 2515-057-001-51 (peiker)	-	D1-AI02	4.22 V1.0 - 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.

2.3 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	–

2.4 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	-	-	-

2.5 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 measurements in normal and extreme conditions)

2.6 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.

2.7 Special software used for testing

None

2.8 Product labelling

2.8.1 FCC ID label

QWY-CSM3-MM-US

2.8.2 IC ID label

6588A-CSM3MMUS

2.8.3 Location of the label on the EUT

Please refer to the documentation of the applicant.

3 Test Results

3.1 Spurious radiated emissions

Standard FCC Part 15, Subpart C

The test was performed according to: ANSI C63.4

3.1.1 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 µs
- 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 ± 22.5° 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° 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.

3.1.2 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: Limit (dBµV/m) = 20 log (Limit (µV/m)/1µV/m)

3.1.3 Test Protocol

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

3.1.3.1 Measurement up to 30 MHz

Op. Mode	Setup	Port
op-mode 1	Setup_01	Enclosure

Polari-sation	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.

3.1.3.2 Measurement above 30 MHz

Op. Mode	Setup	Port
op-mode 1	Setup_01	Enclosure

Polari-sation	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.

3.1.4 Test result: Spurious radiated emissions

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

3.2 Occupied bandwidth

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

3.2.1 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.

3.2.2 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. …

3.2.3 Test Protocol

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

Op. Mode	Setup	Port
op-mode 1	Setup_01	Enclosure

20 dB bandwidth kHz	99% bandwidth kHz	Remarks
433.9 kHz	427.856 kHz	The 20 dB bandwidth from 13.345571 MHz to 13.779439 MHz is contained within the designated frequency band 13.110 MHz to 14.010 MHz.

Remark: Please see annex for the measurement plot.

3.2.4 Test result: Occupied bandwidth

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

3.3 Spectrum mask

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.225

3.3.1 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

3.3.2 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.

3.3.3 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
32.01	103	measuring distance 10 m

Remark: Please see annex for the measurement plot.

3.3.4 Test result: Spectrum mask

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

3.4 Frequency tolerance

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.225

3.4.1 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 °C to +50 °C. At +20 °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.

3.4.2 Test Limits

FCC Part 15, Subpart C, §15.225 (e): The frequency tolerance of the carrier signal shall be maintained within ±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_01	Enclosure

Temperature / °C	Voltage / V	Time / min.	Frequency / MHz	Delta / Hz
60	12.00	0	13.559762	-238
60	12.00	5	13.559641	-359
60	12.00	10	13.559526	-474
50	12.00	0	13.559962	-38
50	12.00	5	13.559895	-105
50	12.00	10	13.559878	-122
40	12.00	0	13.560069	69
40	12.00	5	13.559978	-22
40	12.00	10	13.559952	-48
30	12.00	0	13.560156	156
30	12.00	5	13.560075	75
30	12.00	10	13.560038	38
20	9.00	0	13.560141	141
20	9.00	5	13.560116	116
20	9.00	10	13.560113	113
20	12.00	0	13.560144	144
20	12.00	5	13.560119	119
20	12.00	10	13.560102	102
20	16.00	0	13.560142	142
20	16.00	5	13.560118	118
20	16.00	10	13.560113	113
10	12.00	0	13.560166	166
10	12.00	5	13.560154	154
10	12.00	10	13.560038	38
0	12.00	0	13.560449	449
0	12.00	5	13.560380	380
0	12.00	10	13.560343	343
-10	12.00	0	13.560506	506
-10	12.00	5	13.560473	473
-10	12.00	10	13.560460	460

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

3.4.3 Test result: Frequency tolerance

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

4 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 m³		
	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 m³ 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	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard Calibration		2014/02/06	2016/02/28
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN ENY41	100002	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2013/03/01	2015/03/31
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN ST08	36292	Teseq GmbH	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2014/01/10	2016/01/31
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN T8-Cat6	32187	Teseq GmbH	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard Calibration		2014/01/08	2016/01/31

Single Devices for Auxiliary Equipment for Conducted emissions (continued)

Single Device Name	*Type*	*Serial Number*	*Manufacturer*	
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	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard Calibration		2013/11/25	2016/11/24
Two-Line V-Network	ESH 3-Z5	828304/029	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standart Calibration		2013/03/01	2015/02/28
Two-Line V-Network	ESH 3-Z5	829996/002	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Exec.*
	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	AM4.0/180/11920513	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	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard Calibration		2012/05/18	2015/05/17
Double-ridged horn	HF 906	357357/002	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Exec.*
	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	
	Calibration Details		*Last Execution*	*Next Exec.*
	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	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2014/11/27	2017/11/27

Single Devices for Auxiliary Equipment for Radiated emissions (continued)

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
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

Single Device Name	*Type*	*Serial Number*	*Manufacturer*	
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.	
	Calibration Details		*Last Execution*	*Next Exec.*
	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	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard		2014/02/10	2016/02/09
Spectrum Analyser	FSP3	836722/011	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard		2012/06/13	2015/06/12
Spectrum Analyser	FSU26	200418	Rohde & Schwarz GmbH & Co.KG	
	Calibration Details		*Last Execution*	*Next Exec.*
	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

Single Device Name	*Type*	*Serial Number*	*Manufacturer*	
Broadband Power Divider SMA	WA1515	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	828110/016	Rohde & Schwarz GmbH & Co.KG	
	Standard calibration		2014/05/13	2015/05/12
RF Step Attenuator RSP	RSP	833695/001	Rohde & Schwarz GmbH & Co.KG	
Rubidium Frequency Standard	Datum, Model: MFS	5489/001	Datum-Beverly	
	Standard calibration		2014/07/03	2015/07/02
Sensor Head A	NRV-Z1	827753/005	Rohde & Schwarz GmbH & Co.KG	
	Standard calibration		2014/05/13	2015/05/12
Signal Generator SME	SME03	827460/016	Rohde & Schwarz GmbH & Co.KG	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2011/12/02	2017/12/01
Signal Generator SMP	SMP02	836402/008	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2013/05/06	2016/05/05
Spectrum Analyser	FSIQ26	840061/005	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard Calibration		2013/02/12	2015/02/11
Temperature Chamber Vötsch 03	VT 4002	58566002150010	Vötsch	
	Calibration Details		*Last Execution*	*Next Exec.*
	Customized calibration		2012/03/12	2014/03/11
	Customized calibration		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

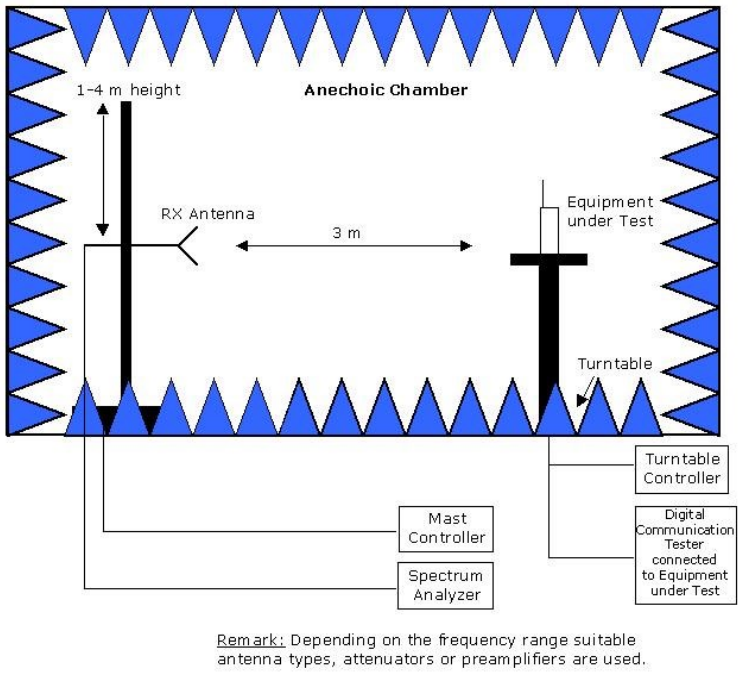
Single Devices for Temperature Chamber 01

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

5 Photo Report

Photos are included in an external report.

6 Setup Drawings



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

7 FCC and IC Correlation of measurement requirements for Radio equipment operating in the Band 13.110-14.010 MHz from FCC and IC

Radio equipment

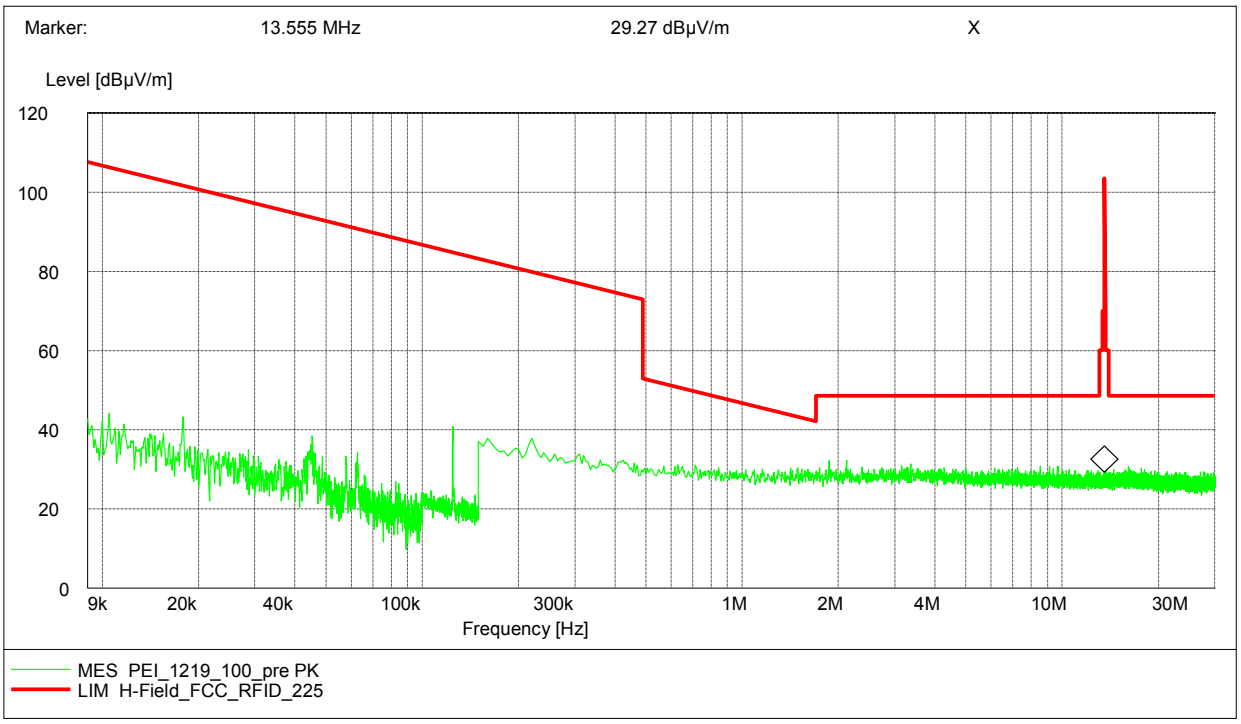
Measurement	FCC reference	IC reference
Conducted emissions on AC Mains	§ 15.207	RSS-Gen Issue 4: 8.8
Out-of-band emissions	§ 15.225 (d)	RSS Gen Issue 4: 6.13/8.9/8.10; RSS-210 Issue 8: A2.6
In-band emissions	§ 15.225 (a) / (b) / (c)	RSS-210 Issue 8: A2.6
Frequency Stability	§ 15.225 (e)	RSS-210 Issue 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.

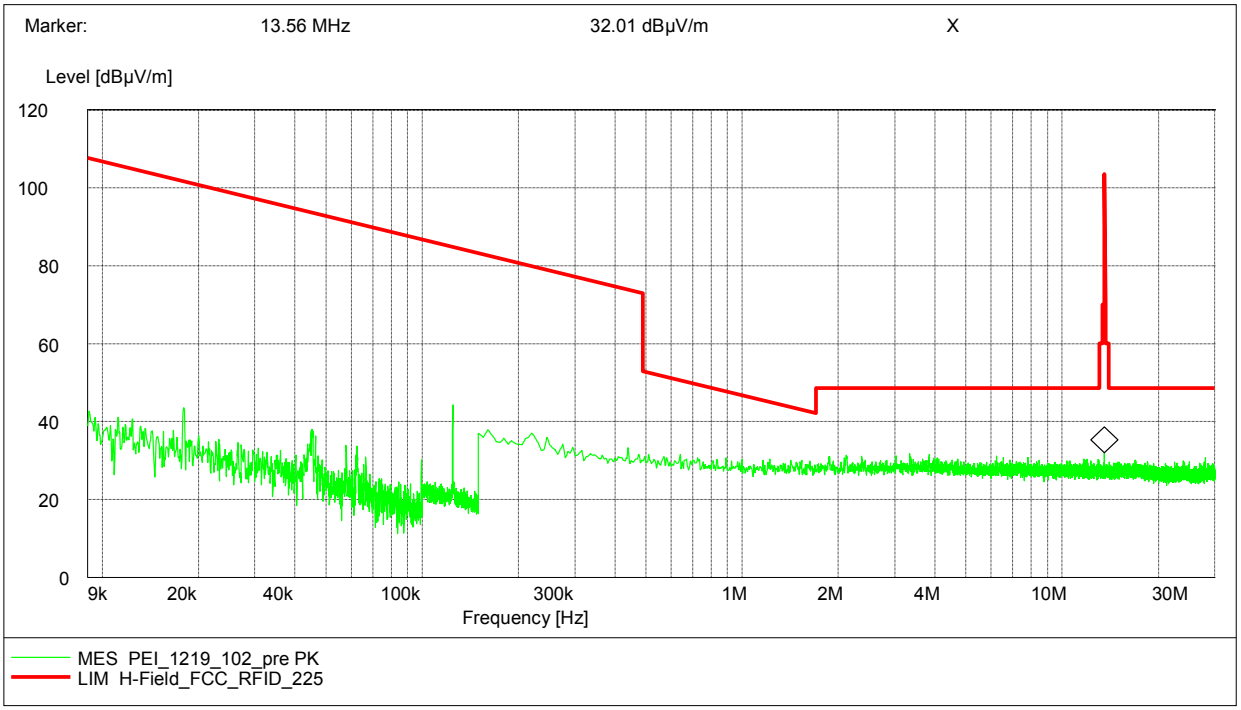
8 Annex measurement plots

8.1 Radiated emissions

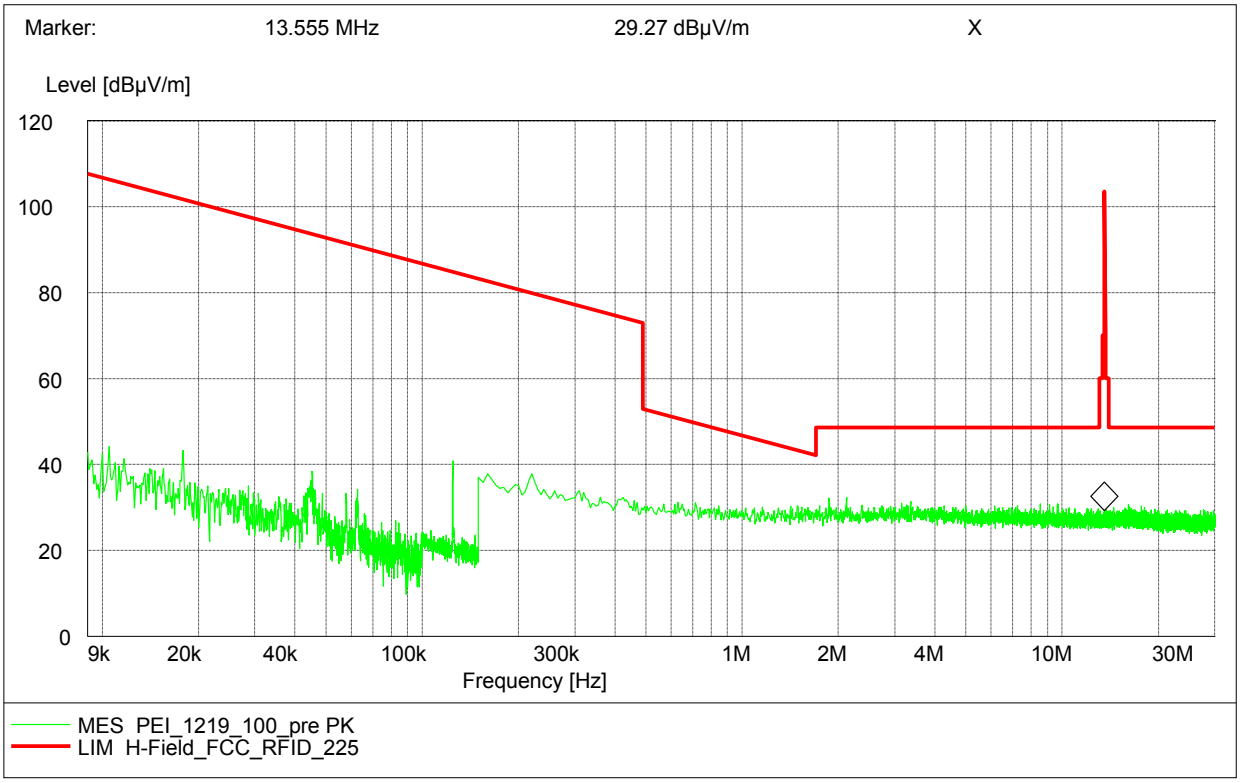
8.1.1 Radiated emissions (f < 30 MHz)



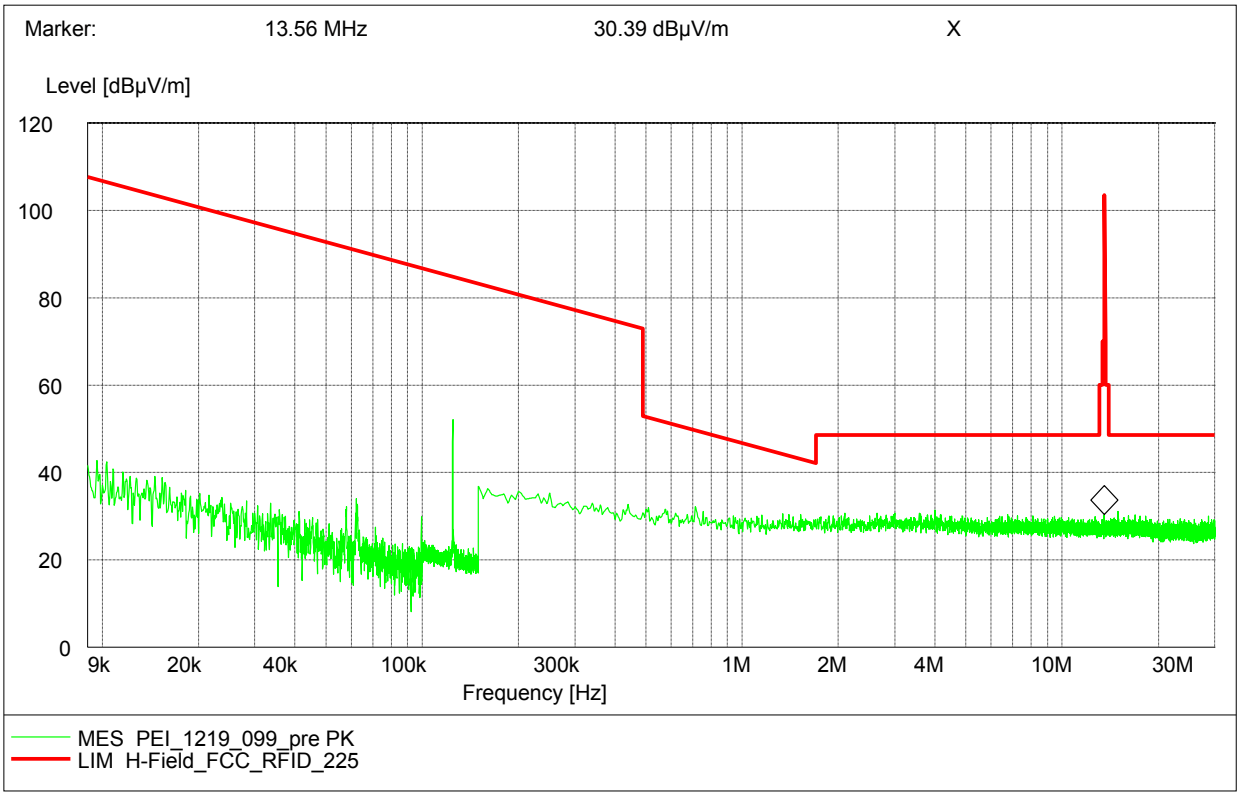
Antenna position 90°
EUT side 1, horizontal position



Antenna position 90°
EUT side 2, horizontal position



Antenna position 0°
EUT side 1, horizontal position



Antenna position 0°
EUT side 2, horizontal position

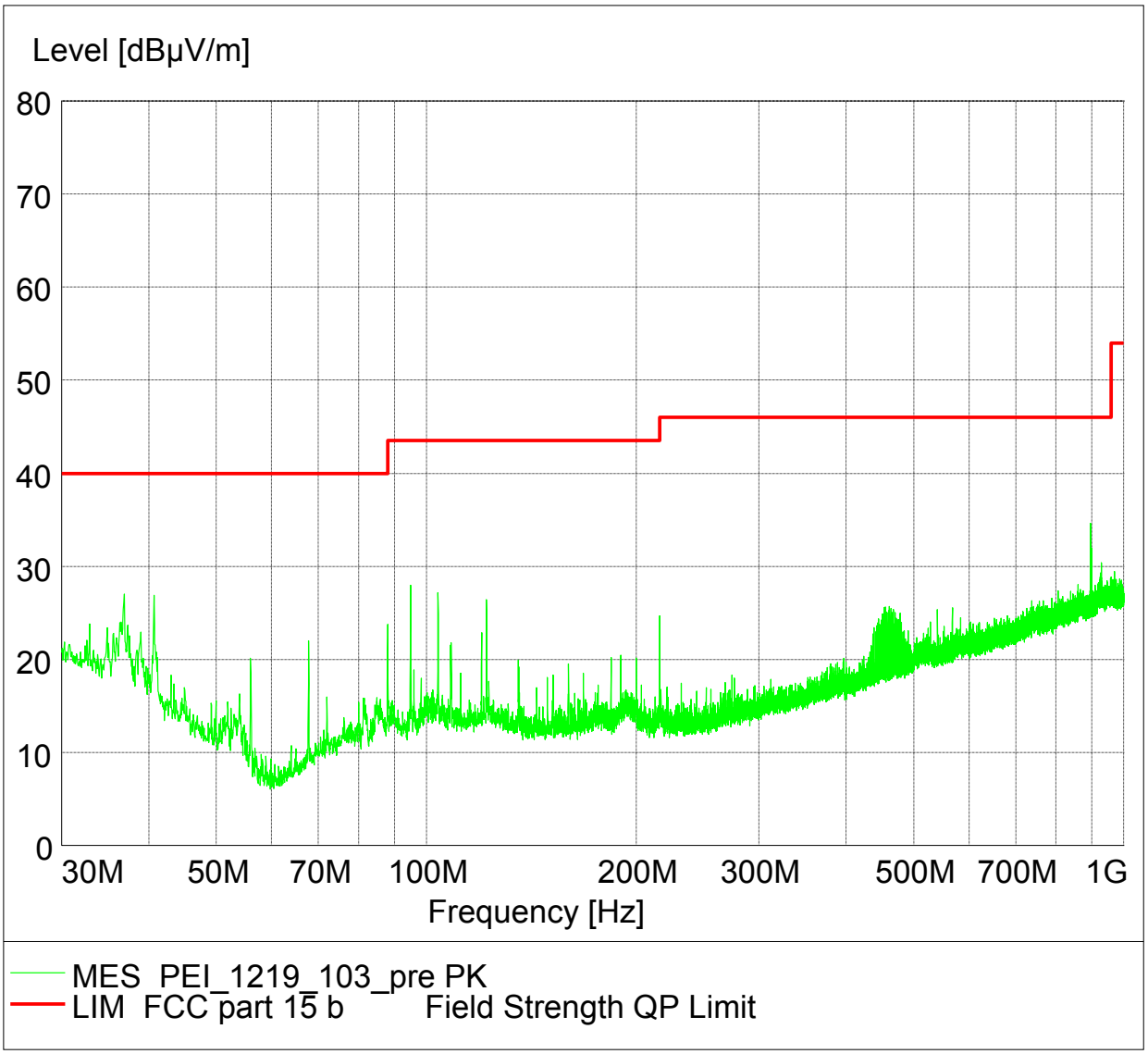
Remark: The both, NFC and RFID transmitters are operating simultaneously, respectively on 13.56 MHz and 124.6 kHz.

8.1.2 Radiated emissions (f > 30 MHz)

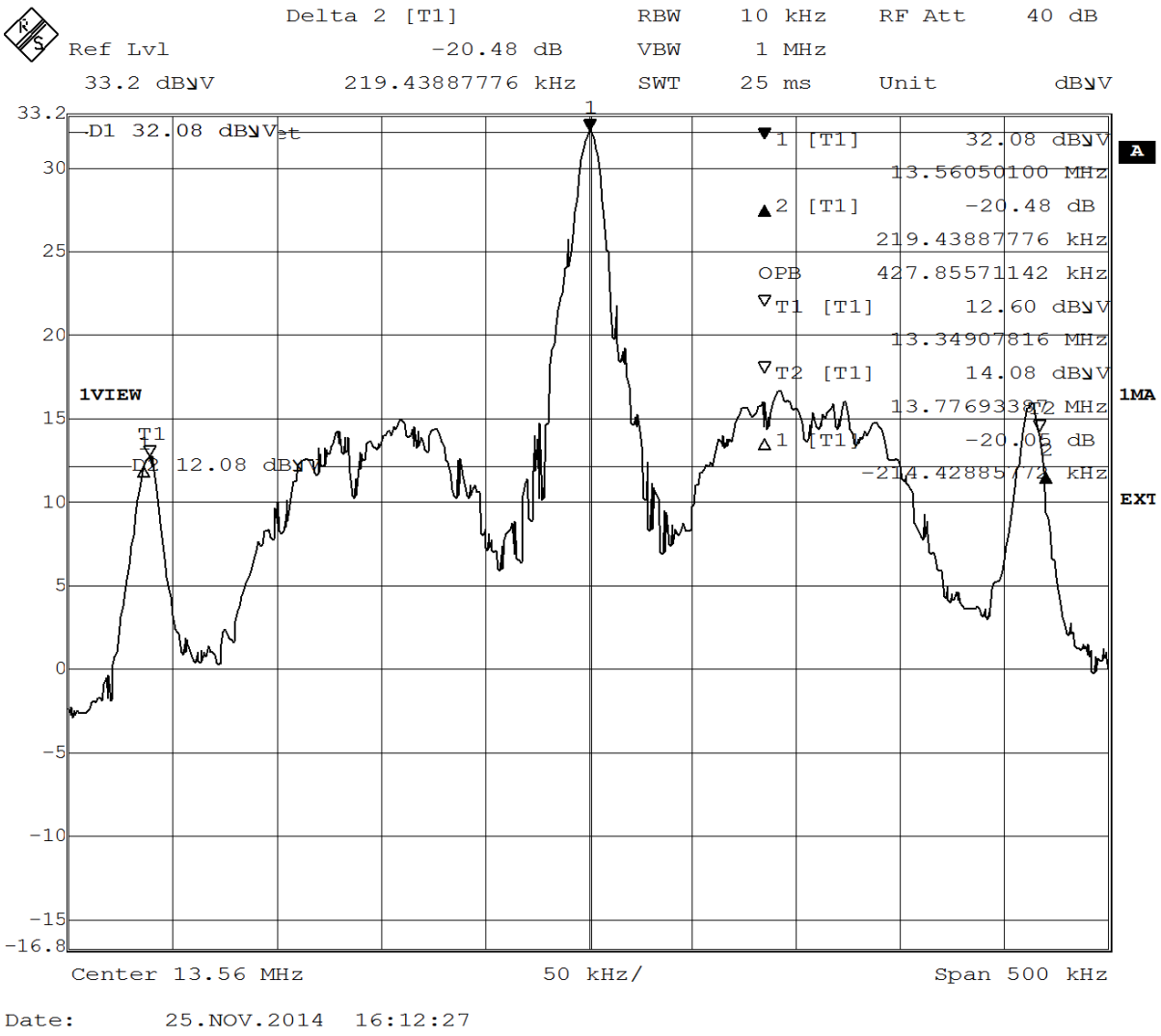
```
EUT:                    (BI340x04)
Manufacturer:           Peiker
Operating Condition:    NFC TX on 13,56 MHz
Test Site:              7 layers, Ratingen
Test Specification:     FCC 15.209 / 15.225
Comment:                Horizontal EUT position
Start of Test:          11.07.2014 / 09:39:26
```

SCAN TABLE: "FCC part 15 c"

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



Occupied bandwidth



Δ1 = 13.345571 MHz, Δ2 = 13.779439 MHz => 20 dB occupied bandwidth = 433.9 kHz;

99% bandwidth = 427.855711 kHz

8.2 Spectrum mask