



Inter**Lab**[®]

FCC Measurement/Technical Report on
Field disturbance sensor
(5.8 GHz transceiver)
Cobra 5480

Report Reference: MDE_FAKT_1105_FCCa

Test Laboratory:

Borsigstr. 11
Germany
7Layers AG
40880 Ratingen



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.

7Layers AG
Borsigstrasse 11
40880 Ratingen, Germany
Phone: +49 (0) 2102 749 0
Fax: +49 (0) 2102 749 350
www.7Layers.com

Aufsichtsratsvorsitzender •
Chairman of the Supervisory Board:
Markus Becker
Vorstand • Board:
Dr. H.-J. Meckelburg

Registergericht • registered in:
Düsseldorf, HRB 44096
USt-IdNr • VAT No.:
DE 203159652
TAX No. 147/5869/0385



Table of Contents

0 Summary	3
0.1 Technical Report Summary	3
0.2 Measurement Summary	4
1 Administrative Data	5
1.1 Testing Laboratory	5
1.2 Project Data	5
1.3 Applicant Data	5
1.4 Manufacturer Data	5
2 Test object Data	6
2.1 General EUT Description	6
2.2 EUT Main components	7
2.3 Ancillary Equipment	7
2.4 Auxiliary Equipment	7
2.5 EUT Setups	8
2.6 Operating Modes	8
2.7 Special software used for testing	8
2.8 Product labelling	8
3 Test Results	9
3.1 Field strength of Fundamental / Radiated power output	9
3.2 Field Strength of Harmonics / Spurious radiated emissions	11
4 Test Equipment	17
5 Photo Report	21
6 Setup Drawings	21
7 Annex measurement plots	22
7.1 Field strength	22



0 Summary

0.1 Technical Report Summary

Type of Authorization

Certification for an Intentional Radiator (Frequency Hopping Spread Spectrum).

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 (10-1-10 Edition) and 15 (10-1-10 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

§ 15.201 Equipment authorization requirement

§ 15.205 Restricted bands of operation

§ 15.207 Conducted limits

§ 15.209 Radiated emission limits; general requirements

§ 15.245 Operation within the bands 902–928 MHz, 2435–2465 MHz, 5785–5815 MHz, 10500–10550 MHz, and 24075–24175 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

-

-

AC Port (power line)

N/A

FCC Part 15, Subpart C

§ 15.245 (b)

Field strength of Fundamental / Radiated power output

The measurement was performed according to FCC § 15.31

10-1-10 Edition

OP-Mode

Setup

Port

Final Result

op-mode 1

Setup_01

Enclosure

passed

FCC Part 15, Subpart C

§ 15.245 (b), § 15.35 (b), § 15.209

Field Strength of Harmonics / Spurious 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

N/A not applicable (the EUT is powered by DC)



7 layers AG, Borsigstr. 11
40880 Ratingen, Germany
Phone +49 (0)2102.749 0

Responsible for
Accreditation Scope:

B. Roth

Responsible
for Test Report:

A. Delt



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. Thomas Hoell
Dipl.-Ing. Andreas Petz

Report Template Version: 2011-08-16

1.2 Project Data

Responsible for testing and report: Dipl.-Ing. Andreas Petz
Date of Test(s): 2011-05-20 to 2011-07-27
Date of Report: 2011-10-04

1.3 Applicant Data

Company Name: FAKT S.r.l.
Address: Via Lithos, 53
25086 Rezzato (BS)
Italy
Contact Person: Mr. Nicola Scartapacchio

1.4 Manufacturer Data

Company Name: COBRA Automotive Technologies S.p.A.
Address: Via Astico 41
21100 Varese
Italy
Contact Person: Mr. Dario Parisi



2 Test object Data

2.1 General EUT Description

Equipment under Test	Field disturbance sensor
Type Designation:	Cobra 5480
Kind of Device: (optional)	Vehicular Alarm System
Voltage Type:	DC (vehicular battery)
Voltage level:	12.0 V
Modulation Type:	None

General product description:

Field disturbance sensor is a radio application intended to work at low output power only at a short distance of the device.

Operation within the bands 902–928 MHz, 2435–2465 MHz, 5785–5815 MHz, 10500–10550 MHz, and 24075–24175 MHz is permitted.

Specific product description for the EUT:

The EUT is a field disturbance sensor intended to be used as part of a vehicular alarm system. It is assembled using an integral antenna. The EUT is supplied by the vehicular batteries and is not intended to be connected to AC Mains. It operates in the 5785–5815 MHz band.

The EUT provides the following ports:

Ports

Enclosure

DC Port

Data port (proprietary)

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: DA150a01)	Field disturbance sensor	Innenraum-sensor	0039 249627 99161821003	04	2400	2011-05-20

Remark: EUT A is equipped with an integral antenna.

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
-	-	-	-	-	-	-

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
-	-	-	-	-	-	-



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	setup for radiated measurements

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	The EUT transmits on 5765.5 MHz	continuously transmitting

2.7 Special software used for testing

None (during the tests).

(For service / programming: Monitoring Software 5480 Porsche UDS.vi)

2.8 Product labelling

2.8.1 FCC ID label

Please refer to the documentation of the applicant.

2.8.2 Location of the label on the EUT

Please refer to the documentation of the applicant.



3 Test Results

3.1 Field strength of Fundamental / Radiated power output

Standard FCC Part 15, 10-1-10 Edition Subpart C

The test was performed according to: FCC §15.245, §15.31, ANSI C63.4-2009

3.1.1 Test Description

Please refer to the description at sub-clause 3.2.1, esp. item no. 3.

3.1.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.245 (b)

(b) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency (MHz)	Field strength of fundamental (mV/m)	Measurement distance (m)	Limit (dB μ V/m @3m)
902 – 928	500	3	114.0
2435 – 2465	500	3	114.0
5785 – 5815	500	3	114.0
10500 – 10550	2500	3	128.0
24075 – 24175	2500	3	128.0

Used conversion factor: Limit (dB μ V/m) = 20 log (Limit (μ V/m)/1 μ V/m)

(b) (2) Field strength limits are specified at a distance of 3 meters.



3.1.3 Test Protocol

Temperature: 25 °C
Air Pressure: 1013 hPa
Humidity: 36 %

Op. Mode	Setup	Port
op-mode 1	Setup_01	Enclosure

Radiated output power measured as field strength at a distance of 3 meters.

Polarisation	Frequency MHz	Field strength of Fundamental dB μ V/m		Limit (§15.209) dB μ V/m		Margin to limit dB	
		Peak	AV	Peak	AV	Peak	AV
Vertical + horizontal	5765.5	55.09	47.29	74.0	54.0	18.91	6.71

Remark: Please see annex for the measurement plot.

The measured power (field strength) is below the general limits of §15.209.
The emission is a wideband emission.

3.1.4 Test result: Peak power output

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



3.2 Field Strength of Harmonics / Spurious radiated emissions

Standard FCC Part 15, 10-1-10 Edition Subpart C

The test was performed according to: FCC §15.245, §15.31, ANSI C63.4-2009

3.2.1 Test Description

The test set-up was made in accordance to the general provisions of ANSI C63.4-2009. The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m in the semi-anechoic chamber. The influence of the EUT support table that is used between 30–1000 MHz was evaluated.

The test was performed at the distance of 3 m between the EUT and the receiving antenna. The measurement procedure is implemented into the EMI test software ES-K1 from R&S. The radiated emissions measurements were made in a typical installation configuration. 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 test set-up was made in accordance to the general provisions of ANSI C63.4-2009. 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.

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:

- 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 +/-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. Measurement above 1 GHz

The following modifications apply to the measurement procedure for the frequency range above 1 GHz and up to 26.5 GHz:

The Equipment Under Test (EUT) was set up on a non-conductive support at 1.4 m height in the fully-anechoic chamber. The measurement distance was reduced to 1 m. The results were extrapolated by the extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements, inverse linear-distance squared for the power reference level measurements). Due to the fact that in this frequency range a double ridged wave guided horn antenna (up to 18 GHz) and a horn antenna (18–26.5 GHz) are used, the steps 2–4 are omitted. Step 1 was performed with one height of the receiving antenna only.

EMI receiver settings:

- Detector: Peak, Average
- IF Bandwidth = 1 MHz

The following modifications apply to the measurement procedure for the frequency range above 26.5 GHz and up to 40 GHz:

Step a) The Equipment Under Test (EUT) was set up on a non-conductive support close to the measuring antenna (horn antenna). The test is performed as pre-test and the measurement distance was reduced to approx. 0.3 m. No path correction is applied to the result displayed at the spectrum analyser. Again, steps 2–4 are omitted. Step 1 is performed at one height of the receiving antenna only. The EUT is investigated at all six sides and each result is compared to the noise floor, i.e. the result of the measurement of the free space without the EUT.

In order to increase the dynamic for the pre-test, the IF Bandwidth is reduced.

Important spectrum analyser settings:

- Detector: Peak, Average
- Resolution Bandwidth = 100 kHz

Step b) If relevant peaks were found, the final test will be performed in the fully-anechoic chamber. The distance will be chosen properly in respect to the margin to the noise floor and the far field condition, typically between 0.2 and 1.0 m. The results will be extrapolated by the extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements, inverse linear-distance squared for the power reference level measurements) to obtain correct results referring to the required measurement distance.

Important spectrum analyser settings:

- Detector: Peak, Average
- IF Bandwidth = 1 MHz

3.2.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.245 (b)

(b) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency (MHz)	Field strength of harmonics (mV/m)	Measurement distance (m)	Limit (dB μ V/m @3m)
902 – 928	1.6	3	64.1
2435 – 2465	1.6	3	64.1
5785 – 5815	1.6	3	64.1
10500 – 10550	25	3	88.0
24075 – 24175	25	3	88.0

Used conversion factor: Limit (dB μ V/m) = 20 log (Limit (μ V/m)/1 μ V/m)

(b) (2) Field strength limits are specified at a distance of 3 meters.

(b) (1) Regardless of the limits shown in the above table, harmonic emissions in the restricted bands below 17.7 GHz, as specified in § 15.205, shall not exceed the field strength limits shown in § 15.209. Harmonic emissions in the restricted bands at and above 17.7 GHz shall not exceed the following field strength limits:

(i) For the second and third harmonics of field disturbance sensors operating in the 24075–24175 MHz band and for other field disturbance sensors designed for use only within a building or to open building doors, 25.0 mV/m.

(ii) For all other field disturbance sensors, 7.5 mV/m.

(iii) Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation unless their emissions in the restricted bands, other than the second and third harmonics from devices operating in the 24075–24175 MHz band, fully comply with the limits given in § 15.209. Continuous operation of field disturbance sensors designed to be used in farm equipment, vehicles such as fork lifts that are intended primarily for use indoors or for very specialized operations, or railroad locomotives, railroad cars and other equipment which travels on fixed tracks is permitted. A field disturbance sensor will be considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration (e.g., putting a vehicle into reverse gear, activating a turn signal, etc.).

All harmonic emissions in restricted bands	Field strength (mV/m)	Measurement distance (m)	Limit (dB μ V/m @3m)
< 17.7 GHz:	0.5	3	54.0
≥ 17.7 GHz:	(i) 25.0 (ii) 7.5	3	88.0 77.5

Used conversion factor: Limit (dB μ V/m) = 20 log (Limit (μ V/m)/1 μ V/m)



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

Frequency in MHz	Limit (μ V/m)	Measurement distance (m)	Limit(dB μ V/m @10m)
0.009 – 0.49	2400/F(kHz)	300	Limit (dB μ V/m)+30dB
0.49 – 1.705	24000/F(kHz)	30	Limit (dB μ V/m)+10dB
1.705 – 30	30	30	Limit (dB μ V/m)+10dB

Frequency in MHz	Limit (μ V/m)	Measurement distance (m)	Limit (dB μ V/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

Used conversion factor: Limit (dB μ V/m) = 20 log (Limit (μ V/m)/1 μ V/m)

(b) (3) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

(b) (4) The emission limits shown above are based on measurement instrumentation employing an average detector. The provisions in § 15.35 for limiting peak emissions apply.

§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....



3.2.3 Test Protocol

Temperature: 25–26 °C
Air Pressure: 1013–1018 hPa
Humidity: 26–33 %

3.2.3.1 Measurement up to 30 MHz

Op. Mode	Setup	Port								
op-mode 1	Setup_01	Enclosure								
Polarisation	Frequency MHz	Corrected value dB μ V/m			Limit dB μ V/m	Limit dB μ V/m	Limit dB μ V/m	Margin to limit dB	Margin to limit dB	
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV	
0°	–	–	–	–	–	–	–	–	–	–
90°	–	–	–	–	–	–	–	–	–	–

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

3.2.3.2 Measurement above 30 MHz

Op. Mode	Setup	Port								
op-mode 1	Setup_01	Enclosure								
Polarisation	Frequency MHz	Corrected value dB μ V/m			Limit dB μ V/m	Limit dB μ V/m	Limit dB μ V/m	Margin to limit dB	Margin to limit dB	
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV	
Vertical + horizontal	5751.5	–	54.05	45.05	–	74.0	54.0	19.95	9.95	

Remark: No (further) spurious emissions in the range 20 dB below the limit found.
Please see annex for the measurement plot.

3.2.4 Test result: Spurious radiated emissions

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 1
Manufacturer:	Frankonia
Description:	Anechoic Chamber for radiated testing
Type:	10.58x6.38x6 m ³

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 <i>Calibration Details</i>	none	Frankonia <i>Last Execution</i> <i>Next Exec.</i>
	FCC listing 96716 3m Part15/18	2011/01/11	2014/01/10
	IC listing 3699A-1 3m	2011/02/07	2014/02/06
Controller Mastro	MCU	961208	Mastro 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 Radiated emissions

Lab ID:	Lab 1
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	AS 620 P	620/37	HD GmbH
Biconical dipole	VUBA 9117 <i>Calibration Details</i>	9117-108	Schwarzbeck <i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2008/10/27 2013/10/26
Broadband Amplifier 18MHz-26GHz	JS4-18002600-32-5P <i>Calibration Details</i>	849785	Miteq
	Path Calibration		<i>Last Execution</i> <i>Next Exec.</i>
		2011/05/11	2011/11/10
Broadband Amplifier 1GHz-4GHz	AFS4-01000400-1Q-10P-4 <i>Calibration Details</i>	-	Miteq
	Path Calibration		<i>Last Execution</i> <i>Next Exec.</i>
		2011/05/11	2011/11/10
Broadband Amplifier 30MHz-18GHz	JS4-00101800-35-5P <i>Calibration Details</i>	896037	Miteq
	Path Calibration		<i>Last Execution</i> <i>Next Exec.</i>
		2011/05/11	2011/11/10
Cable "ESI to EMI Antenna"	EcoFlex10 <i>Calibration Details</i>	W18.01-2+W38.01- Kabel Kusch 2	
	Path Calibration		<i>Last Execution</i> <i>Next Exec.</i>
		2011/05/11	2011/11/10

Single Devices for Auxiliary Equipment for Radiated emissions (continued)

Single Device Name	Type	Serial Number	Manufacturer	
Cable "ESI to Horn Antenna"	UFB311A+UFB293C	W18.02-2+W38.02-	Rosenberger Micro-Coax	
	<i>Calibration Details</i>	2		
	Path Calibration		<i>Last Execution</i>	<i>Next Exec.</i>
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		2009/04/16	2012/04/15
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		2009/04/28	2012/04/27
High Pass Filter	4HC1600/12750-1.5-KK	9942011	Trilithic	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Path Calibration		2011/05/11	2011/11/10
High Pass Filter	5HC2700/12750-1.5-KK	9942012	Trilithic	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Path Calibration		2011/05/11	2011/11/10
High Pass Filter	5HC3500/12750-1.2-KK	200035008	Trilithic	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Path Calibration		2011/05/11	2011/11/10
High Pass Filter	WHKX 7.0/18G-8SS	09	Wainwright	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Path Calibration		2011/05/11	2011/11/10
Log.-per. Antenna	HL 562 Ultralog	830547/003	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Standard Calibration		2009/05/27	2012/05/26
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	DKD calibration		2008/10/07	2011/10/06
Network Analyzer	E5071B	MY42200813	Agilent	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Standard Calibration		2010/11/09	2011/11/09
Pyramidal Horn Antenna 3160-09 26,5 GHz		00083069	EMCO Elektronik GmbH	
Pyramidal Horn Antenna 3160-10 40 GHz		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 1
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
AC Power Source	Chroma 6404	64040001304	Chroma ATE INC.
Broadband Power Divider 1506A / 93459 N (Aux)		LM390	Weinschel Associates
Broadband Power Divider WA1515 SMA		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>
	Standard calibration		2009/10/07 2011/10/06
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
Vector Signal Generator	SMIQ 03B	832492/061	Rohde & Schwarz GmbH & Co.KG



Test Equipment Emission measurement devices

Lab ID: **Lab 1**
Description: Equipment for emission measurements
Serial Number: see single devices

Single Devices for Emission measurement devices

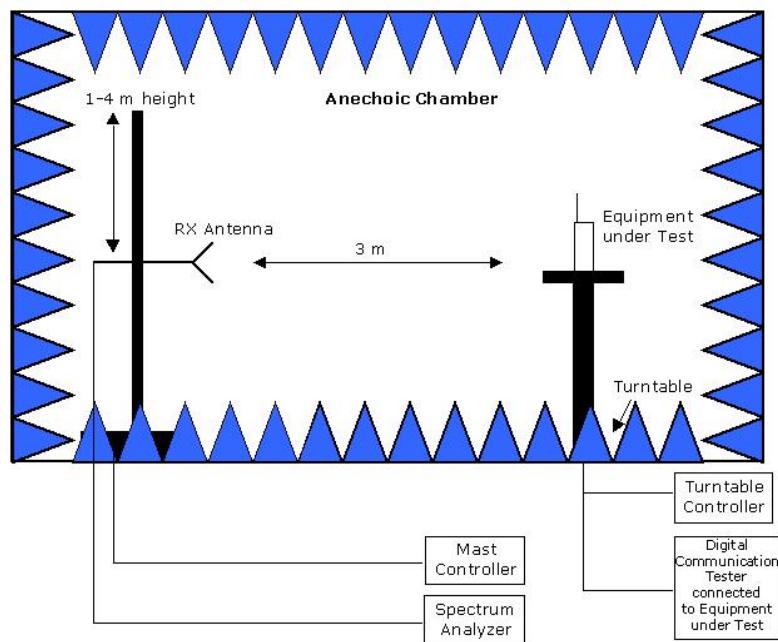
Single Device Name	Type	Serial Number	Manufacturer
Personal Computer	Dell	30304832059	Dell
Power Sensor	NRV-Z1	836219/005	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2009/10/20 2011/10/19
Powermeter	NRVS	836333/064	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2009/10/15 2011/10/14
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG
Spectrum Analyzer	ESIB 26	830482/004	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2009/12/03 2011/12/02

The pre-tests in the frequency range 26–40 GHz have been performed by a 7Layers' engineer at the place:
Ruhr University Bochum, Universitätsstrasse 150, 44780 Bochum, Germany.
Used Instrument: Spectrum Analyser R&S FSEK30, S/N 100122.

5 Photo Report

Photos are included in an external report.

6 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.
Measurements above 1 GHz: Fully-anechoic, absorbers on all surfaces

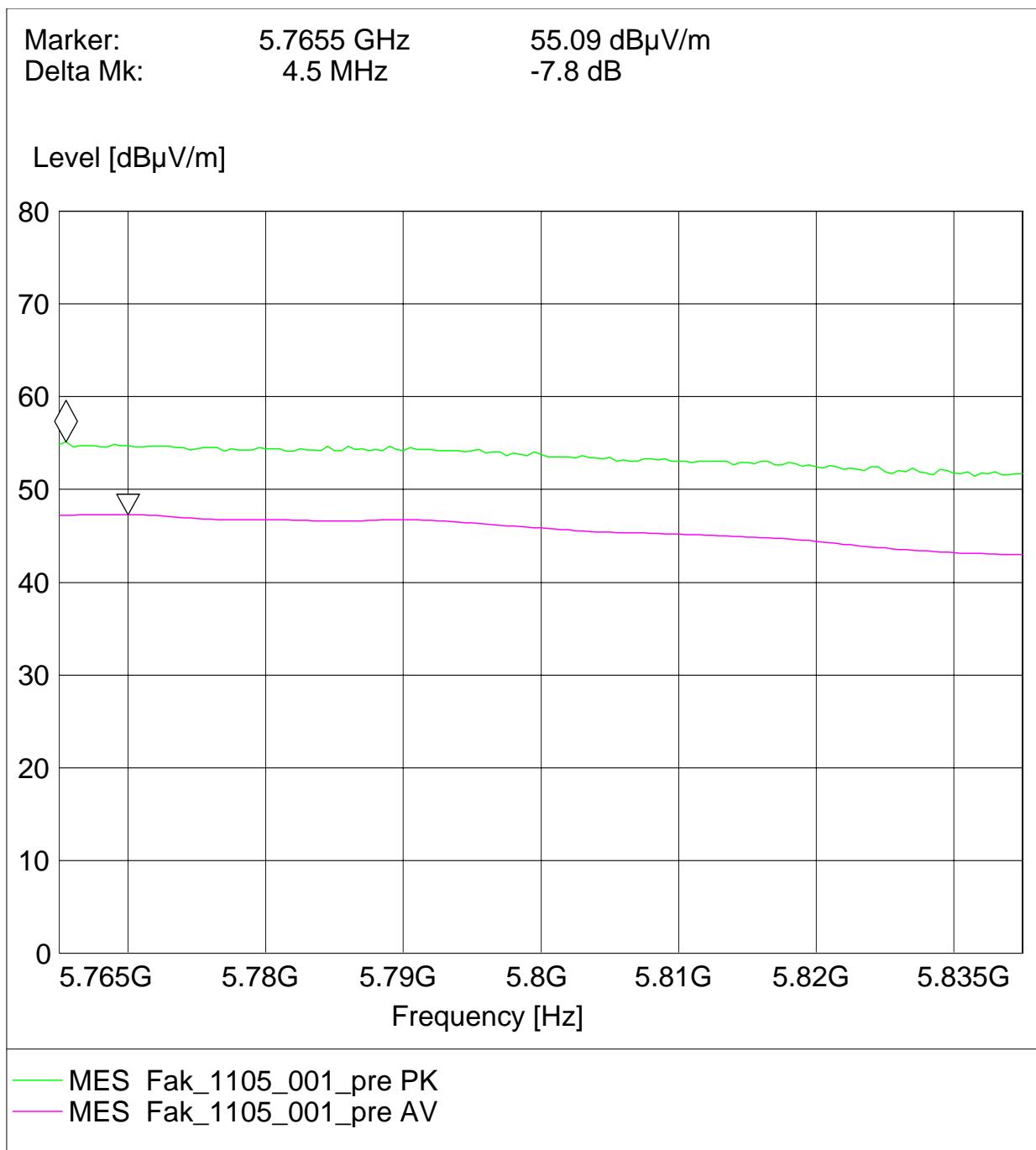
7 Annex measurement plots

7.1 Field strength

7.1.1 Field strength of Fundamental / Radiated power output

Op. Mode

op-mode 1

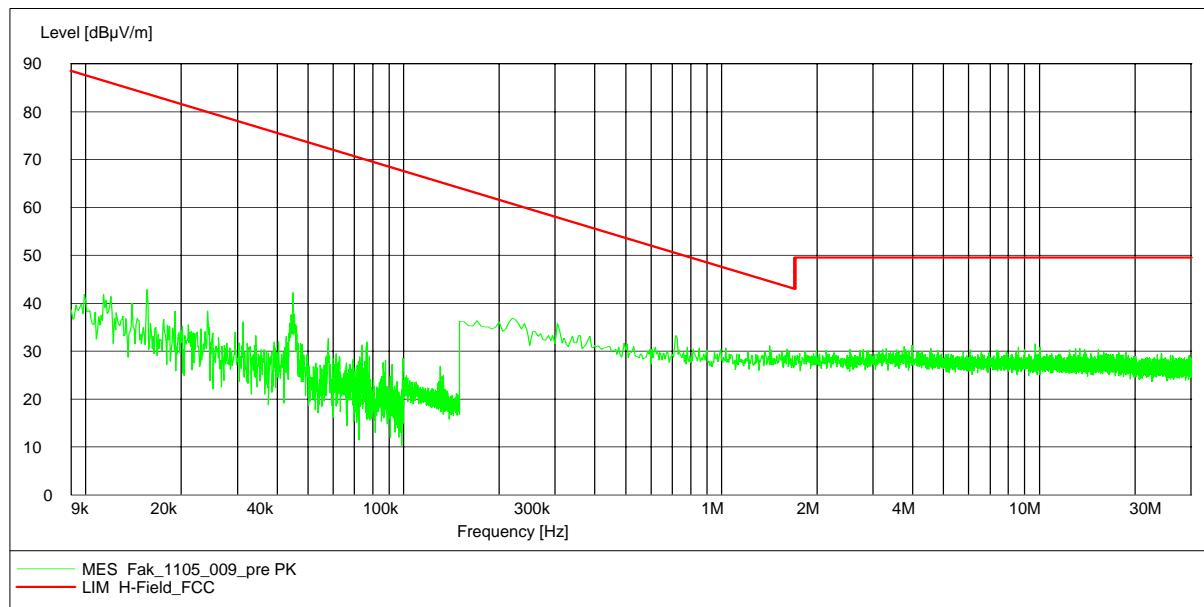


7.1.2 Field Strength of Harmonics / Spurious radiated emissions (f ≤ 30 MHz)

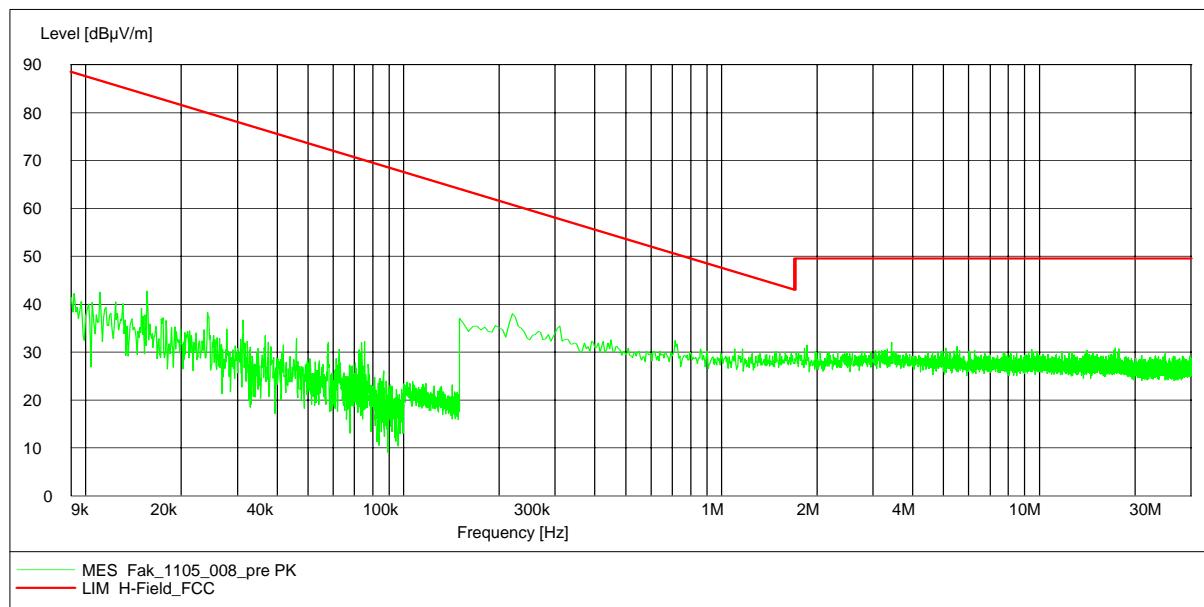
Op. Mode

op-mode 1

Antenna position 90°
EUT position front side



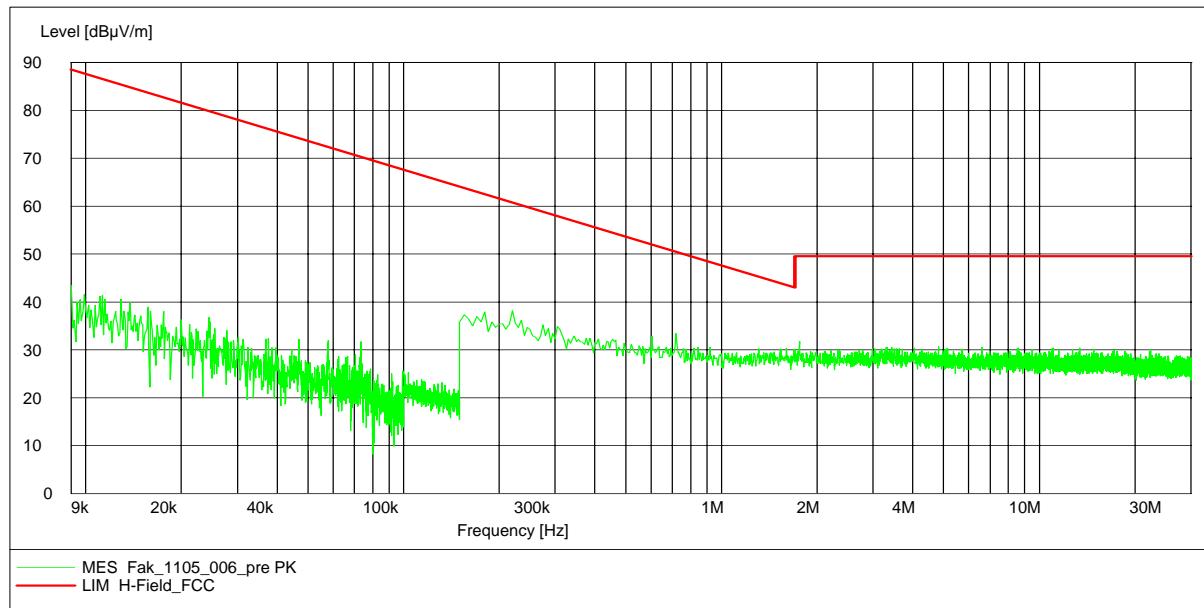
Antenna position 90°
EUT position right side



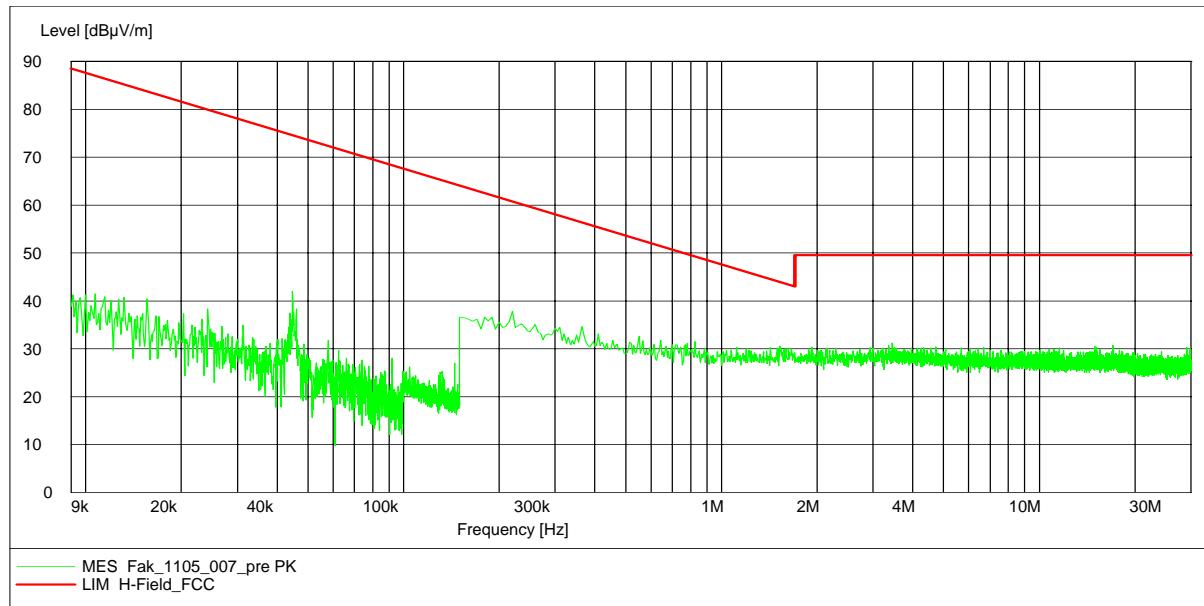
Op. Mode

op-mode 1

Antenna position 0°
EUT position front side



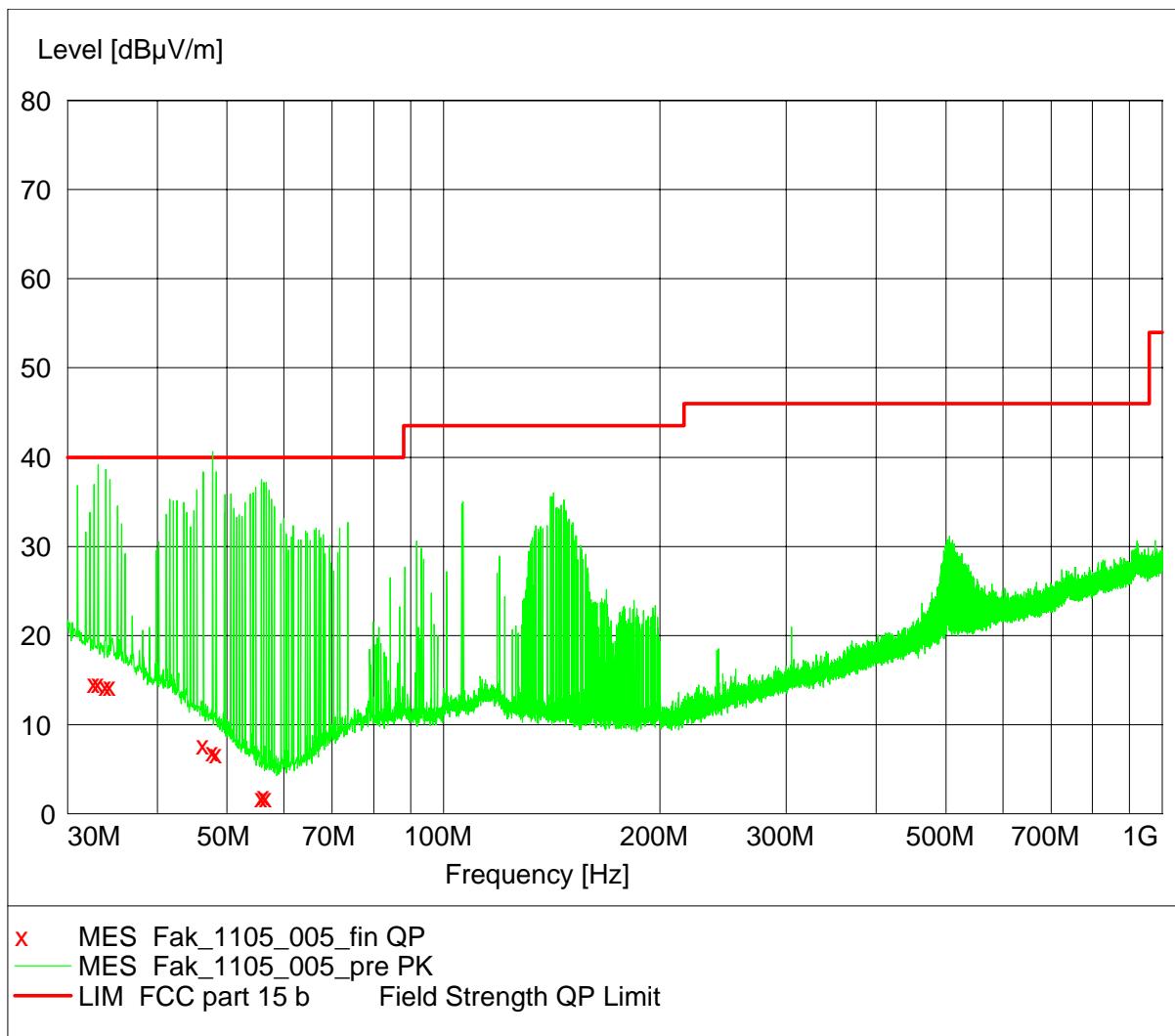
Antenna position 0°
EUT position right side



7.1.3 Field Strength of Harmonics / Spurious radiated emissions (30 MHz < f ≤ 1000 MHz)

Op. Mode

op-mode 1



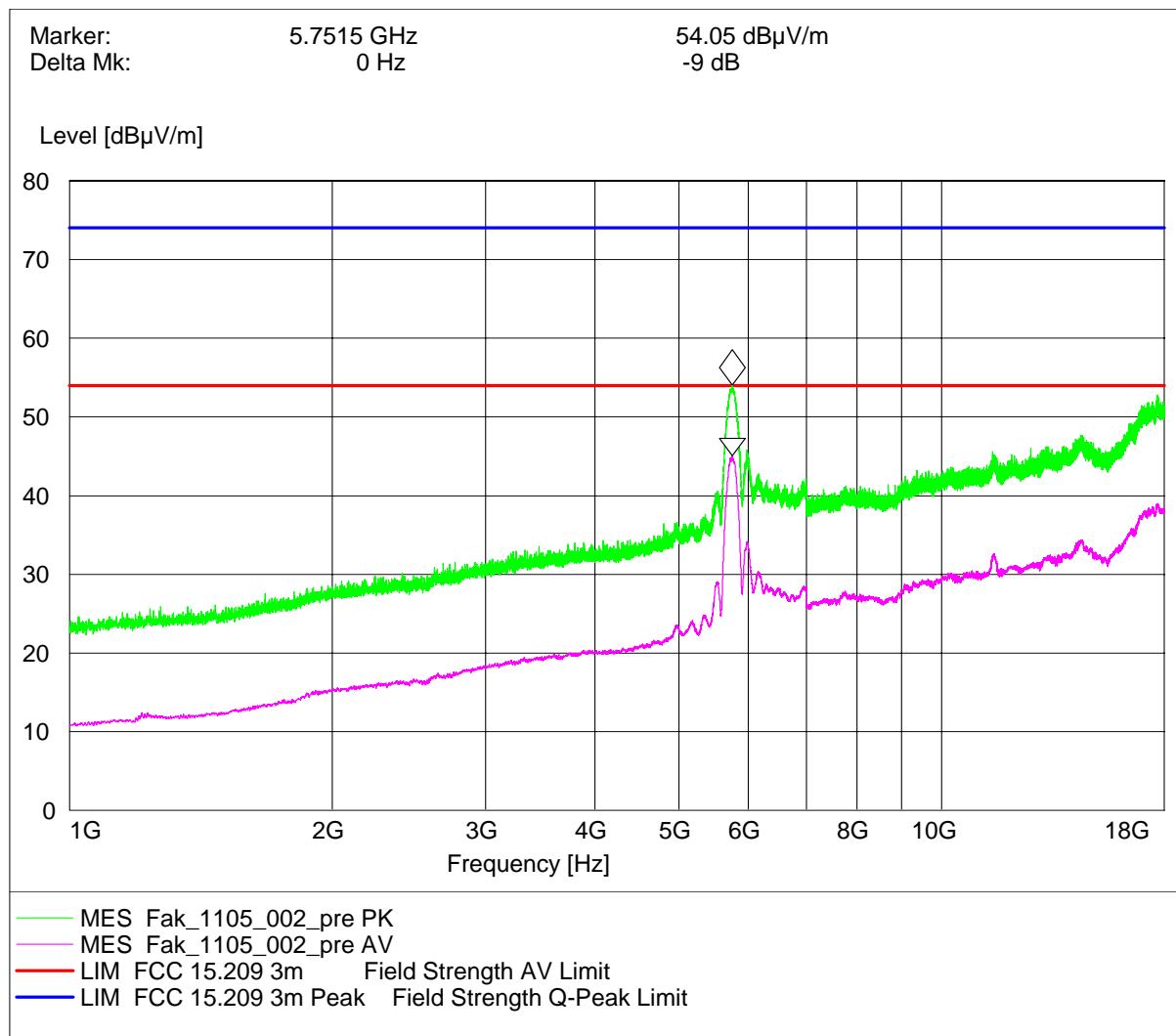
MEASUREMENT RESULT: "Fak_1105_005_fin QP"

Frequency MHz	Level dB μ V/m	Transd dB	Limit dB μ V/m	Margin dB	Height cm	Azimuth deg	Polarisation
32.640000	14.70	19.1	40.0	25.3	292.0	67.00	VERTICAL
33.060000	14.60	18.9	40.0	25.4	175.0	247.00	VERTICAL
33.900000	14.30	18.5	40.0	25.7	100.0	226.00	VERTICAL
34.380000	14.30	18.2	40.0	25.7	174.0	292.00	VERTICAL
46.380000	7.80	11.1	40.0	32.2	129.0	247.00	VERTICAL
47.760000	7.00	10.2	40.0	33.0	114.0	157.00	VERTICAL
48.300000	6.80	9.9	40.0	33.2	107.0	202.00	VERTICAL
55.800000	1.90	5.2	40.0	38.1	393.0	157.00	VERTICAL
56.220000	2.10	5.0	40.0	37.9	223.0	247.00	VERTICAL
56.700000	1.90	4.8	40.0	38.1	176.0	247.00	VERTICAL

7.1.4 Field Strength of Harmonics / Spurious radiated emissions (1 GHz < f ≤ 18 GHz)

Op. Mode

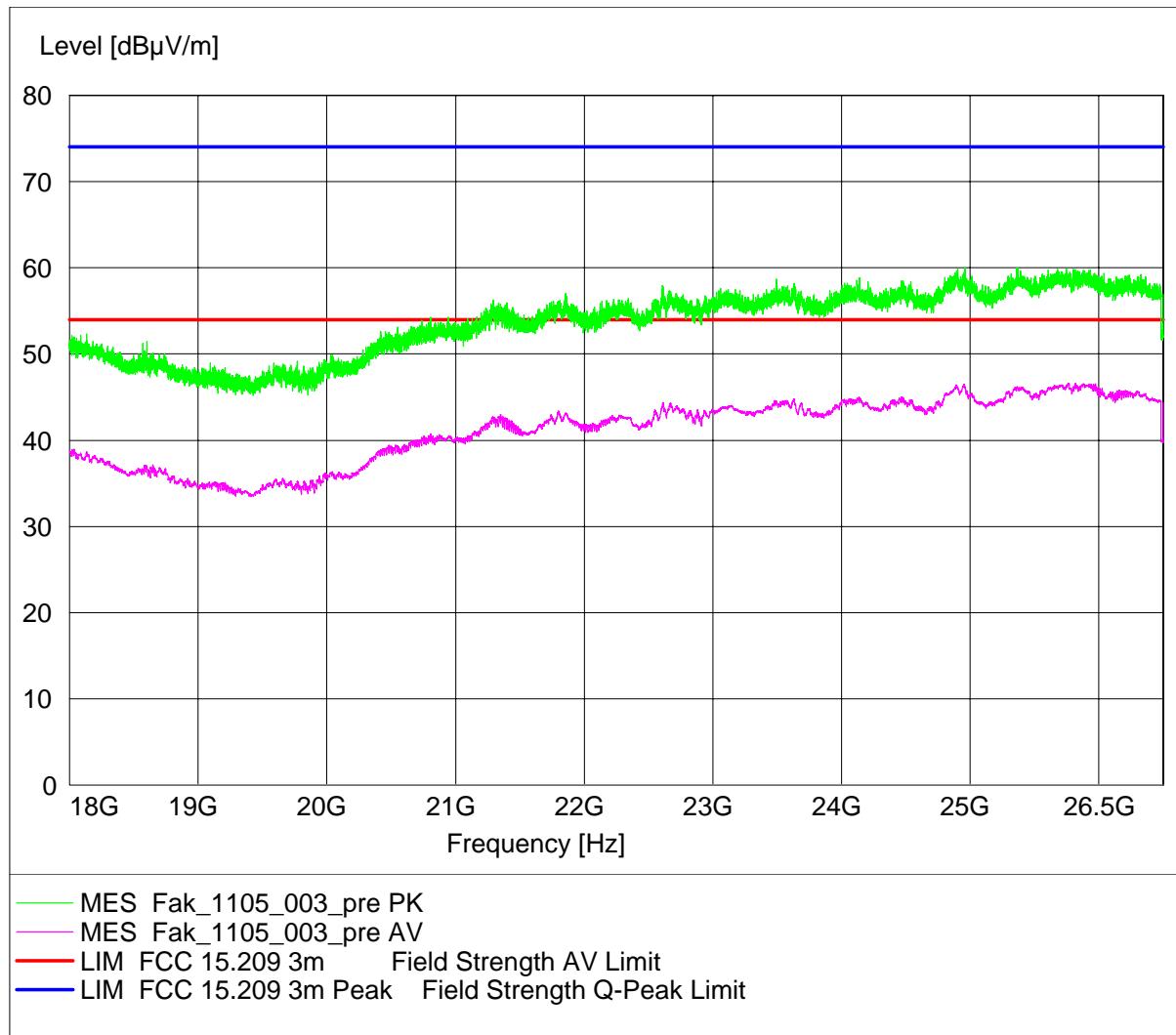
op-mode 1



7.1.5 Field Strength of Harmonics / Spurious radiated emissions (18 GHz < f ≤ 26.5 GHz)

Op. Mode

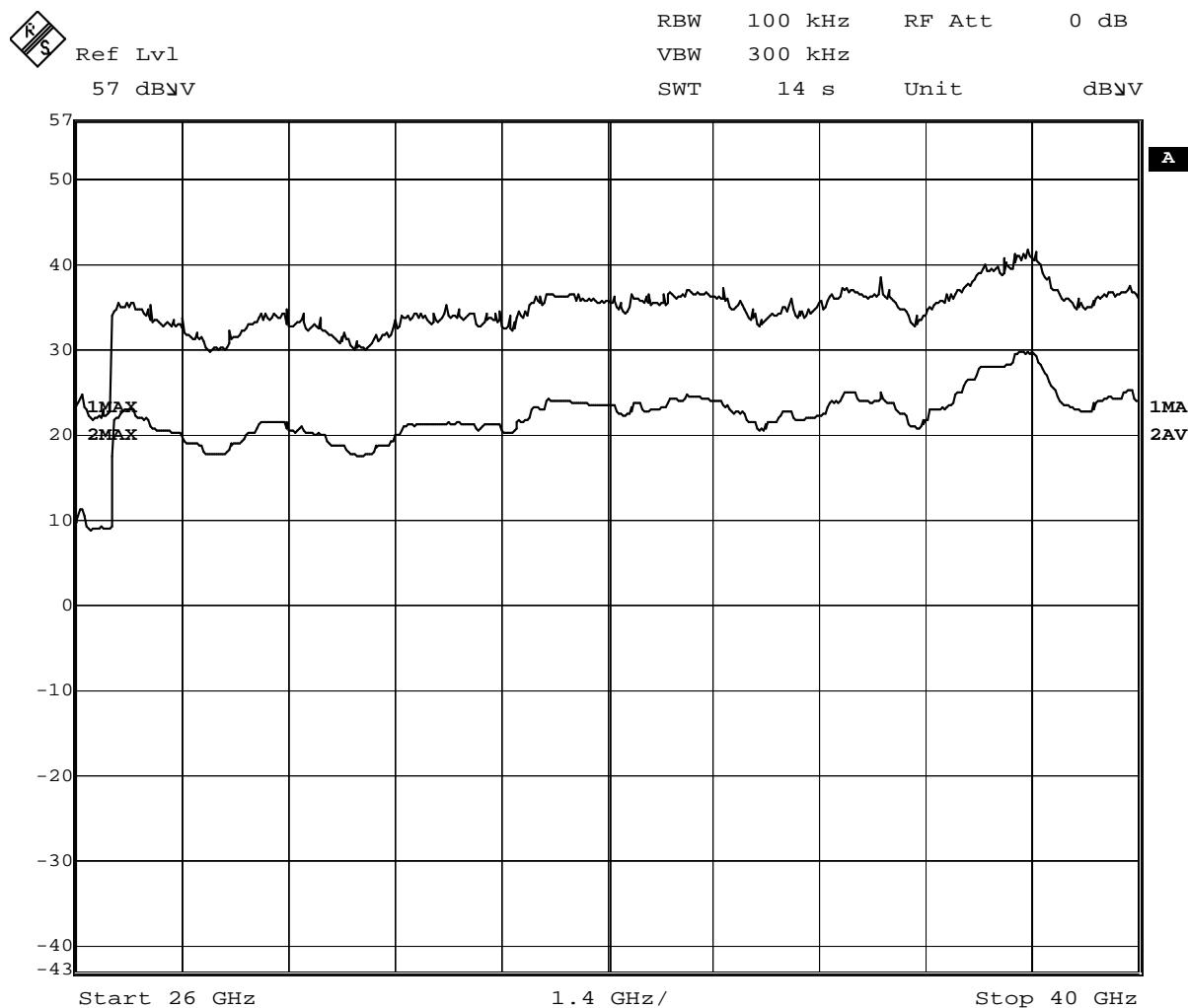
op-mode 1



7.1.6 Field Strength of Harmonics / Spurious radiated emissions (26.5 GHz < f ≤ 40 GHz)

Op. Mode

op-mode 1 pre-test



For comparison: Noise floor, EUT is switched off:

