



Inter**Lab**[®]

FCC Measurement/Technical Report on

TRACO - Transponder controller module

RFID Reader (125 KHz) / Part No. 0362101

Report Reference: MDE_S&B_1102_FCCa

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 testing laboratory.

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0 Summary

0.1 Technical Report Summary

Type of Authorization

Certification for an intentional radiator 0.125 MHz RFID Reader

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

§ 15.205 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

Note:

None

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 §15.209

Radiated Emissions

The measurement was performed according to ANSI C63.4

| OP-Mode | Setup | Port | 2003 Final Result |
|----------------|--------------|-------------|--------------------------|
| op-mode 1 | Setup_01 | Enclosure | passed |

FCC Part 15, Subpart C § 15.209

Peak Output Power

The measurement was performed according to ANSI C63.4

| OP-Mode | Setup | Port | 2003 Final Result |
|----------------|--------------|-------------|--------------------------|
| op-mode 1 | Setup_01 | Enclosure | passed |

FCC Part 15, Subpart C § 15.207

Conducted Emissions AC Power line

The measurement was performed according to ANSI C63.4

| OP-Mode | Setup | OP-Mode | 2003 Setup |
|----------------|--------------|----------------|-------------------|
| op-mode 1 | Setup_01 | op-mode 1 | Setup_01 |

Responsible for
Accreditation Scope:



Responsible
for Test Report:




7 layers AG, Borsigstr. 11
40880 Ratingen, Germany
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1 Administrative Data

1.1 Testing Laboratory

Company Name: 7 Layers 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:
Deutscher Akkreditierungs Rat DAR-Registration no. DGA-PL-192/99-02

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

Report Template Version: 2011-02-14

1.2 Project Data

Responsible for testing and report: Dipl.-Ing. Carsten Steinröder
Date of Test(s): 2011-04-19
Date of Report: 2011-04-21

1.3 Applicant Data

Company Name: Scheidt & Bachmann GmbH
Address: Breite Straße 132
41238 Mönchengladbach
Germany
Contact Person: Dr.-Ing. Klaus Hense

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 | RFID Reader |
| Type Designation: | TRACO - Transponder controller module |
| Kind of Device: | 0.125 MHz - RFID Reader module |
| (optional) | |
| Voltage Type: | DC |
| Voltage level: | 5.0 – 10.0 V |

General product description:

The EUT is a 125 kHz RFID short range transmitter module which is basically intended to detect money container with RFID chip inside of Scheidt & Bachmann ticket vending machines or detect RFID chips embedded in coins (ChipCoin®) inside of Scheidt & Bachmann machines for parking or leisure systems.

The EUT provides the following ports:

Ports

Enclosure
DC power in
AC power via external AC/DC power supply
Antenna connectors

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: U0000a01) | RFID Reader | TRACO | - | E | - | 2011-04-19 |

Remark: EUT A is equipped with an external antenna (see chapter 2.3 for details).

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 | Part No. | HW Status | SW Status |
|-------------------|----------------------|-----------------------|----------|-----------|-----------|
| AE 1 | ANTa01 | Transponder Coil 80UH | 03623690 | - | - |
| AE 2 | ANTb01 | PCB Coinlock Antenna | 04290010 | C | - |
| AE 3 | ANTc01 | Aircoil 490UH | 04184530 | B | - |
| AE 4 | ANTd01 | Aircoil 490UH 100*100 | 04184970 | C | - |
| AE 5 | ANTe01 | Aircoil 490UH 60mm | 04193960 | A | - |
| AE 6 | ANTf01 | Aircoil 490UH | 04200430 | - | - |
| AE 7 | ANTg01 | Aircoil 490µH 100*100 | 04203110 | A | - |
| AE 8 | ANTh01 | Aircoil 490µH 30*30 | 04208300 | B | - |
| AE 9 | ANTI01 | Aircoil 980µH 30*30 | 04317010 | A | - |
| AE 10 | ANTj01 | Aircoil 490UH 60*30 | 04344830 | A | - |
| AE 11 | ANTk01 | Aircoil 980UH | 04185320 | A | - |
| AE 12 | ANTI01 | Aircoil 490µH 30*30 | 04236520 | - | - |

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 | Controller Board | 03525770 | - | - | - | - |
| AUX 2 | AC/DC Supply | FW7333M/06 | - | - | - | - |



2.5 EUT Setups

This chapter describes the combination of EUTs and ancillary equipment used for testing.

| Setup No. | Combination of EUTs | Description |
|-----------|----------------------------|-------------|
| Setup_01 | EUT A + AE 1 + AUX1 | - |
| Setup_02 | EUT A + AE 2 + AUX1 | - |
| Setup_03 | EUT A + AE 3 + AUX1 | - |
| Setup_04 | EUT A + AE 4 + AUX1 | - |
| Setup_05 | EUT A + AE 5 + AUX1 | - |
| Setup_06 | EUT A + AE 6 + AUX1 | - |
| Setup_07 | EUT A + AE 7 + AUX1 | - |
| Setup_08 | EUT A + AE 8 + AUX1 | - |
| Setup_09 | EUT A + AE 9 + AUX1 | - |
| Setup_10 | EUT A + AE 10 + AUX1 | - |
| Setup_11 | EUT A + AE 11 + AUX1 | - |
| Setup_12 | EUT A + AE 12 + AUX1 | - |
| Setup_13 | EUT A + AE 7 + AUX1 + AUX2 | - |

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 | carrier signal | EUT is transmitting a continuous modulated signal |

3 Test Results

3.1 Spurious radiated emissions

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

The test was performed according to: ANSI C 63.4, 2003

3.1.1 Test Description

The test set-up was made in accordance to the general provisions of ANSI C 63.4-2003. 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 test was performed at the distance of 3 m between the EUT and the receiving antenna.

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.

1. Measurement up to 30 MHz

The test set-up was made in accordance to the general provisions of ANSI C 63.4-2003. 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

Measurement 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 $\pm 22.5^{\circ}$ 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



Measurement above 1 GHz

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

The measurement distance was reduced to 1m. 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 (18-25 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
- RBW = VBW = 100 kHz

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, §15.209, 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)+30dB |
| 0.49 – 1.705 | 24000/F(kHz) | 30 | Limit (dBµV/m)+10dB |
| 1.705 – 30 | 30 | 30 | Limit (dBµV/m)+10dB |

| 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 |

3.1.3 Test Protocol

Temperature: 25°C
 Air Pressure: 1011 hPa
 Humidity: 30%

3.1.3.1 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 |
| 0° | - | - | - | - | - | - | - | - | - |
| 90° | - | - | - | - | - | - | - | - | - |

| Op. Mode | | Setup | | | Port | | | | |
|--------------|---------------|------------------------|------|----|--------------|--------------|--------------|-------------------|-------------------|
| op-mode 1 | | Setup_02 | | | 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 |
| 0° | - | - | - | - | - | - | - | - | - |
| 90° | - | - | - | - | - | - | - | - | - |



Op. Mode Setup Port

op-mode 1 Setup_03 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 |
| 0° | - | - | - | - | - | - | - | - | - |
| 90° | - | - | - | - | - | - | - | - | - |

Op. Mode Setup Port

op-mode 1 Setup_04 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 |
| 0° | - | - | - | - | - | - | - | - | - |
| 90° | - | - | - | - | - | - | - | - | - |

Op. Mode Setup Port

op-mode 1 Setup_05 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 |
| 0° | - | - | - | - | - | - | - | - | - |
| 90° | - | - | - | - | - | - | - | - | - |

Op. Mode Setup Port

op-mode 1 Setup_06 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 |
| 0° | - | - | - | - | - | - | - | - | - |
| 90° | - | - | - | - | - | - | - | - | - |

Op. Mode Setup Port

op-mode 1 Setup_07 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 |
| 0° | - | - | - | - | - | - | - | - | - |
| 90° | - | - | - | - | - | - | - | - | - |

Op. Mode Setup Port

op-mode 1 Setup_08 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 |
| 0° | - | - | - | - | - | - | - | - | - |
| 90° | - | - | - | - | - | - | - | - | - |

| Op. Mode | | Setup | | | Port | | | | |
|--------------|---------------|------------------------------|------|----|--------------------|--------------------|--------------------|-------------------|-------------------|
| op-mode 1 | | Setup_09 | | | 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 | Delta to limit dB | Delta to limit dB |
| | | QP | Peak | AV | QP | Peak | AV | QP/Peak | AV |
| 0° | - | - | - | - | - | - | - | - | - |
| 90° | - | - | - | - | - | - | - | - | - |

| Op. Mode | | Setup | | | Port | | | | |
|--------------|---------------|------------------------------|------|----|--------------------|--------------------|--------------------|-------------------|-------------------|
| op-mode 1 | | Setup_10 | | | 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 | Delta to limit dB | Delta to limit dB |
| | | QP | Peak | AV | QP | Peak | AV | QP/Peak | AV |
| 0° | - | - | - | - | - | - | - | - | - |
| 90° | - | - | - | - | - | - | - | - | - |

| Op. Mode | | Setup | | | Port | | | | |
|--------------|---------------|------------------------------|------|----|--------------------|--------------------|--------------------|-------------------|-------------------|
| op-mode 1 | | Setup_11 | | | 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 | Delta to limit dB | Delta to limit dB |
| | | QP | Peak | AV | QP | Peak | AV | QP/Peak | AV |
| 0° | - | - | - | - | - | - | - | - | - |
| 90° | - | - | - | - | - | - | - | - | - |

| Op. Mode | | Setup | | | Port | | | | |
|--------------|---------------|------------------------------|------|----|--------------------|--------------------|--------------------|-------------------|-------------------|
| op-mode 1 | | Setup_12 | | | 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 | Delta to limit dB | Delta to limit dB |
| | | QP | Peak | AV | QP | Peak | AV | QP/Peak | AV |
| 0° | - | - | - | - | - | - | - | - | - |
| 90° | - | - | - | - | - | - | - | - | - |

Remark: No (further) 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.
The found peak at 0.125 MHz is the wanted signal of the EUT.

3.1.4 Test result: Spurious radiated emissions

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



3.2 Peak power output

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.209, ANSI C 63.4, 2003

3.2.1 Test Description

Please refer to sub-clause 3.1.1.

3.2.2 Test Limits

Please refer to sub-clause 3.1.2.

3.2.3 Test Protocol

Temperature: 25°C
 Air Pressure: 1011 hPa
 Humidity: 30%

| Op. Mode | Setup | Port |
|------------------------|------------------|--|
| op-mode 1 | Setup_01 | Enclosure |
| Output power dBµV/m | Frequency MHz | Remarks |
| 50.27 | 0.125 | Maximum radiated field strength at fundamental frequency |

| Op. Mode | Setup | Port |
|------------------------|------------------|--|
| op-mode 1 | Setup_02 | Enclosure |
| Output power dBµV/m | Frequency MHz | Remarks |
| 45.76 | 0.125 | Maximum radiated field strength at fundamental frequency |

| Op. Mode | Setup | Port |
|------------------------|------------------|--|
| op-mode 1 | Setup_03 | Enclosure |
| Output power dBµV/m | Frequency MHz | Remarks |
| 45.61 | 0.125 | Maximum radiated field strength at fundamental frequency |

| Op. Mode | Setup | Port |
|------------------------|------------------|--|
| op-mode 1 | Setup_04 | Enclosure |
| Output power dBµV/m | Frequency MHz | Remarks |
| 63.50 | 0.125 | Maximum radiated field strength at fundamental frequency |

| Op. Mode | Setup | Port |
|------------------------|------------------|--|
| op-mode 1 | Setup_05 | Enclosure |
| Output power dBµV/m | Frequency MHz | Remarks |
| 54.59 | 0.125 | Maximum radiated field strength at fundamental frequency |

| Op. Mode | Setup | Port |
|------------------------|------------------|--|
| op-mode 1 | Setup_06 | Enclosure |
| Output power dBµV/m | Frequency MHz | Remarks |
| 45.68 | 0.125 | Maximum radiated field strength at fundamental frequency |



| Op. Mode | Setup | Port |
|------------------------------|------------------|--|
| op-mode 1 | Setup_07 | Enclosure |
| Output power dB μ V/m | Frequency MHz | Remarks |
| 64.12 | 0.125 | Maximum radiated field strength at fundamental frequency |

| Op. Mode | Setup | Port |
|------------------------------|------------------|--|
| op-mode 1 | Setup_08 | Enclosure |
| Output power dB μ V/m | Frequency MHz | Remarks |
| 50.34 | 0.125 | Maximum radiated field strength at fundamental frequency |

| Op. Mode | Setup | Port |
|------------------------------|------------------|--|
| op-mode 1 | Setup_09 | Enclosure |
| Output power dB μ V/m | Frequency MHz | Remarks |
| 46.05 | 0.125 | Maximum radiated field strength at fundamental frequency |

| Op. Mode | Setup | Port |
|------------------------------|------------------|--|
| op-mode 1 | Setup_10 | Enclosure |
| Output power dB μ V/m | Frequency MHz | Remarks |
| 55.07 | 0.125 | Maximum radiated field strength at fundamental frequency |

| Op. Mode | Setup | Port |
|------------------------------|------------------|--|
| op-mode 1 | Setup_11 | Enclosure |
| Output power dB μ V/m | Frequency MHz | Remarks |
| 43.95 | 0.125 | Maximum radiated field strength at fundamental frequency |

| Op. Mode | Setup | Port |
|------------------------------|------------------|--|
| op-mode 1 | Setup_12 | Enclosure |
| Output power dB μ V/m | Frequency MHz | Remarks |
| 54.05 | 0.125 | Maximum radiated field strength at fundamental frequency |

3.2.4 Test result: Peak power output

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



3.3 Conducted emissions (AC power line)

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

The test was performed according to: ANSI C 63.4, 2003

3.3.1 Test Description

The test set-up was made in accordance to the general provisions of ANSI C 63.4-2003. The Equipment Under Test (EUT) was setup in a shielded room to perform the conducted emissions measurements in a typical installation configuration. The EUT was powered from 50 μ H || 50 Ohm Line Impedance Stabilization Network (LISN). The LISN's unused connections were terminated with 50 Ohm loads.

The measurement procedure consists of two steps. It is implemented into the EMI test software ES-K1 from R&S.

Step 1: Preliminary scan

Intention of this step is, to determine the conducted EMI-profile of the EUT.

EMI receiver settings:

- Detector: Peak - Maxhold
- Frequency range: 150 kHz – 30 MHz
- Frequency steps: 5 kHz
- IF-Bandwidth: 9 kHz
- Measuring time / Frequency step: 20 ms
- Measurement on phase + neutral lines of the power cords

On basis of this preliminary scan the highest amplitudes and the corresponding frequencies relative to the limit are identified. Emissions above the limit and emissions which are in the 10 dB range below the limit are considered.

Step 2: Final measurement

Intention of this step is, to determine the highest emissions with the settings defined in the test specification for the frequencies identified in step 1.

EMI receiver settings:

- Detector: Quasi-Peak
- IF - Bandwidth: 9 kHz
- Measuring time: 1 s / frequency

At each frequency determined in step 1, four measurements are performed in the following combinations:

- 1) Neutral lead - reference ground (PE grounded)
- 2) Phase lead - reference ground (PE grounded)
- 3) Neutral lead - reference ground (PE floating)
- 4) Phase lead - reference ground (PE floating)

The highest value is reported.



3.3.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.207

| Frequency Range (MHz) | QP Limit (dBµV) | AV Limit (dBµV) |
|-----------------------|-----------------|-----------------|
| 0.15 – 0.5 | 66 to 56 | 56 to 46 |
| 0.5 – 5 | 56 | 46 |
| 5 – 30 | 60 | 50 |

Used conversion factor: Limit (dBµV) = 20 log (Limit (µV)/1µV).

3.3.3 Test Protocol

Temperature: 25°C
 Air Pressure: 1011 hPa
 Humidity: 30%
 Remark: -

| Op. Mode | | Setup | Port | | |
|------------|---------------|---------------------|----------------------|---------------------|---------|
| op-mode 1 | | Setup_13 | AC Port (power line) | | |
| Power line | Frequency MHz | Measured value dBµV | limit dBµV | Delta to limit dBµV | Remarks |
| - | - | - | - | - | - |

Remark: No final measurement was performed because no frequencies (peaks) were found within the offset for acceptance analysis during the preliminary scan. Please see annex for the measurement plot.

3.3.4 Test result: Conducted emissions (AC power line)

| 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 m³

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 |
| 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 <i>Calibration Details</i> | W18.03+W48.03 | Huber&Suhner <i>Last Execution</i> <i>Next Exec.</i> |
| | Path Calibration | | 2010/11/06 2011/11/05 |
| Two-Line V-Network | ESH 3-Z5 | 828304/029 | Rohde & Schwarz GmbH & Co. KG |
| Two-Line V-Network | ESH 3-Z5 <i>Calibration Details</i> | 829996/002 | Rohde & Schwarz GmbH & Co. KG <i>Last Execution</i> <i>Next Exec.</i> |
| | DKD calibration | | 2008/10/13 2011/10/12 |
| | DKD calibration | | 2011/01/20 2013/01/19 |

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 | AS 620 P | 620/37 | HD GmbH | |
| Biconical dipole | VUBA 9117 | 9117-108 | Schwarzbeck | |
| | Calibration Details | | Last Execution | Next Exec. |
| | Standard Calibration | | 2008/10/27 | 2013/10/26 |
| Broadband Amplifier 18MHz-26GHz | JS4-18002600-32-5P | 849785 | Miteq | |
| | Calibration Details | | Last Execution | Next Exec. |
| | Path Calibration | | 2010/11/06 | 2011/05/05 |
| Broadband Amplifier 1GHz-4GHz | AFS4-01000400-1Q-10P-4 | - | Miteq | |
| | Calibration Details | | Last Execution | Next Exec. |
| | Path Calibration | | 2010/11/06 | 2011/05/05 |
| Broadband Amplifier 30MHz-18GHz | JS4-00101800-35-5P | 896037 | Miteq | |
| | Calibration Details | | Last Execution | Next Exec. |
| | Path Calibration | | 2010/11/06 | 2011/05/05 |
| Cable "ESI to EMI Antenna" | EcoFlex10 | W18.01-2+W38.01-2 | Kabel Kusch | |
| | Calibration Details | | Last Execution | Next Exec. |
| | Path Calibration | | 2010/11/06 | 2011/05/05 |
| Cable "ESI to Horn Antenna" | UFB311A+UFB293C | W18.02-2+W38.02-2 | Rosenberger Micro-Coax | |
| | Calibration Details | | Last Execution | Next Exec. |
| | Path Calibration | | 2010/11/06 | 2011/05/05 |
| Double-ridged horn | HF 906 | 357357/001 | Rohde & Schwarz GmbH & Co. KG | |
| | Calibration Details | | Last Execution | Next Exec. |
| | Standard Calibration | | 2009/04/16 | 2012/04/15 |
| Double-ridged horn | HF 906 | 357357/002 | Rohde & Schwarz GmbH & Co. KG | |
| | Calibration Details | | Last Execution | Next Exec. |
| | Standard Calibration | | 2009/04/28 | 2012/04/27 |
| High Pass Filter | 4HC1600/12750-1.5-KK | 9942011 | Trilithic | |
| | Calibration Details | | Last Execution | Next Exec. |
| | Path Calibration | | 2010/11/06 | 2011/05/05 |
| High Pass Filter | 5HC2700/12750-1.5-KK | 9942012 | Trilithic | |
| | Calibration Details | | Last Execution | Next Exec. |
| | Path Calibration | | 2010/11/06 | 2011/05/05 |
| High Pass Filter | 5HC3500/12750-1.2-KK | 200035008 | Trilithic | |
| | Calibration Details | | Last Execution | Next Exec. |
| | Path Calibration | | 2010/11/06 | 2011/05/05 |
| High Pass Filter | WHKX 7.0/18G-8SS | 09 | Wainwright | |
| | Calibration Details | | Last Execution | Next Exec. |
| | Path Calibration | | 2010/11/06 | 2011/05/05 |
| Log.-per. Antenna | HL 562 Ultralog | 830547/003 | Rohde & Schwarz GmbH & Co. KG | |

Single Devices for Auxiliary Equipment for Radiated emissions (continued)

| Single Device Name | Type | Serial Number | Manufacturer | Last Execution | Next Exec. |
|------------------------------------|----------------------------|----------------------------|-------------------------------|----------------|------------|
| | <i>Calibration Details</i> | | | | |
| | Standard Calibration | | | 2009/05/27 | 2012/05/26 |
| Loop Antenna | HFH2-Z2 | 829324/006 | Rohde & Schwarz GmbH & Co. KG | | |
| | <i>Calibration Details</i> | | | | |
| | DKD calibration | | | 2008/10/07 | 2011/10/06 |
| Network Analyzer | E5071B | MY42200813 | Agilent | | |
| | <i>Calibration Details</i> | | | | |
| | Standard Calibration | | | 2010/11/09 | 2011/11/09 |
| 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 Maturó (Rohacell) | Antrieb TD1.5-10kg | TD1.5- 10kg/024/3790709 | Maturó GmbH | | |

Test Equipment Auxiliary Test Equipment

| | |
|-----------------------|---|
| Lab ID: | Lab 2 |
| 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 | Last Execution | Next Exec. |
|---------------------------------------|----------------------------|---------------|---------------------------------------|----------------|------------|
| AC Power Source | Chroma 6404 | 64040001304 | Chroma ATE INC. | | |
| 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> | | | | |
| | 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 Transformatorwerke 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 Digital Signalling Devices

Lab ID: Lab 1, Lab 2
Description: Signalling equipment for various wireless technologies.

Single Devices for Digital Signalling Devices

| Single Device Name | Type | Serial Number | Manufacturer |
|---|--|---------------|---|
| Bluetooth Signalling Unit CBT CBT | | 100589 | Rohde & Schwarz GmbH & Co. KG |
| | <i>Calibration Details</i> | | <i>Last Execution</i> <i>Next Exec.</i> |
| | Standard Calibration | | 2008/08/14 2011/08/13 |
| Universal Radio Communication Tester | CMU 200 | 102366 | Rohde & Schwarz GmbH & Co. KG |
| | <i>HW/SW Status</i> | | <i>Date of Start</i> <i>Date of End</i> |
| | Hardware: B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B56V14, B68 3v04, PCMCIA, U65V04 Software: K21 4v21, K22 4v21, K23 4v21, K24 4v21, K42 4v21, K43 4v21, K53 4v21, K56 4v22, K57 4v22, K58 4v22, K59 4v22, K61 4v22, K62 4v22, K63 4v22, K64 4v22, K65 4v22, K66 4v22, K67 4v22, K68 4v22, K69 4v22 Firmware: µP1 8v50 02.05.06 --- | | 2007/07/16 |

Test Equipment Emission measurement devices

Lab ID: Lab 1, Lab 2
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 |



Test Equipment Multimeter 12

Lab ID: Lab 3
Description: Ex-Tech 520
Serial Number: 05157876

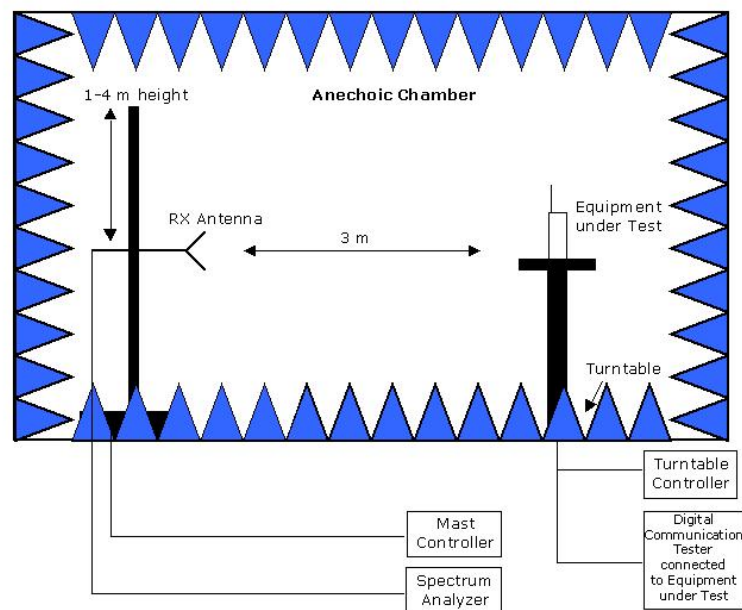
Single Devices for Multimeter 12

| <i>Single Device Name</i> | <i>Type</i> | <i>Serial Number</i> | <i>Manufacturer</i> | |
|---------------------------------------|----------------------------|----------------------|--------------------------|-------------------|
| Digital Multimeter 12 (Multimeter) | EX520 | 05157876 | Extech Instruments Corp. | |
| | <i>Calibration Details</i> | | <i>Last Execution</i> | <i>Next Exec.</i> |
| | Standard calibration | | 2009/10/07 | 2011/10/06 |

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. For measurements below 1 GHz the ground was replaced by a conducting ground plane.

7 FCC and IC Correlation of measurement requirements

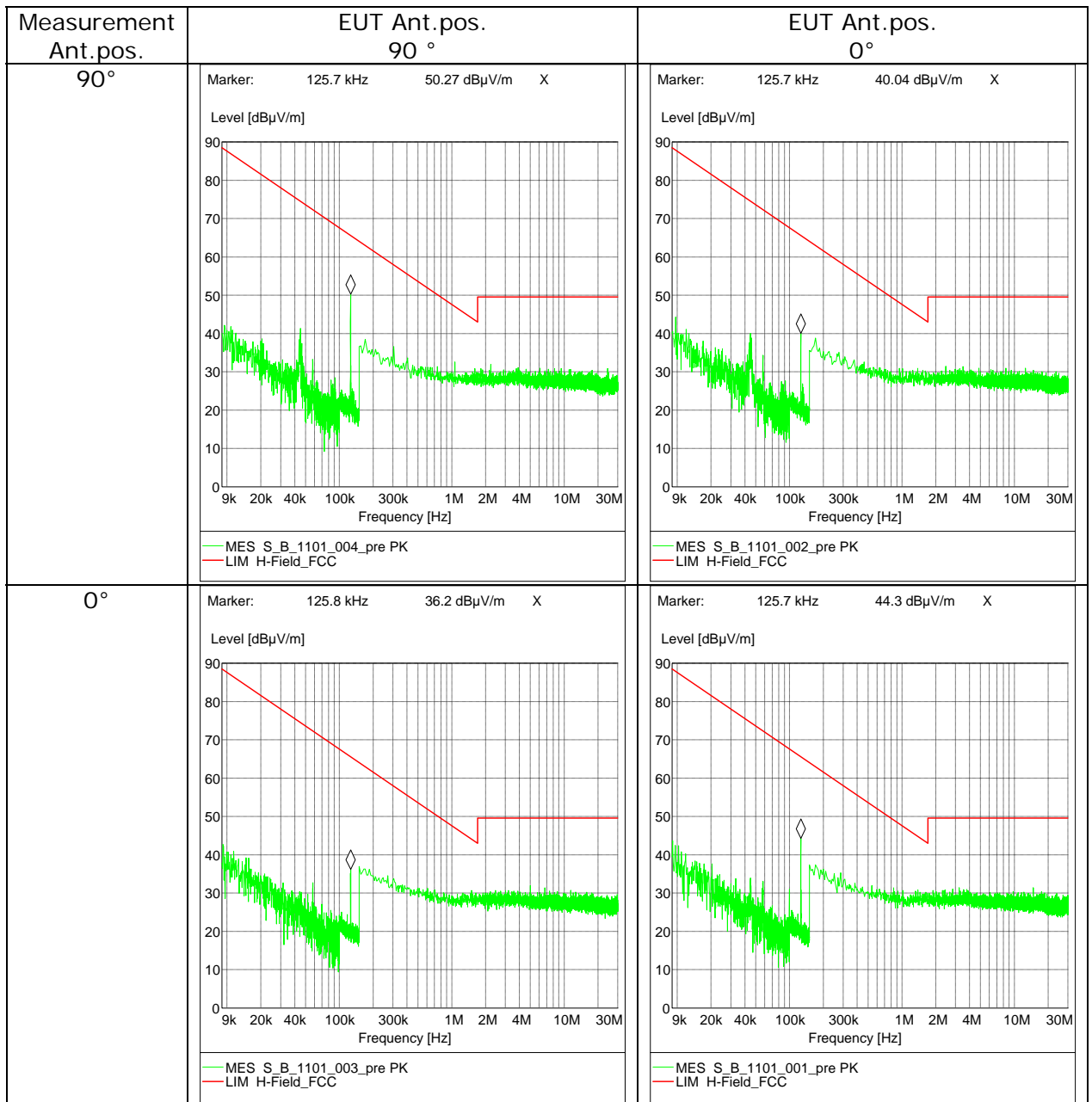
The following tables show the correlation of measurement requirements from FCC and IC standards.

| Measurement | FCC reference | IC reference |
|---------------------------------|---------------|----------------|
| Conducted emissions on AC mains | § 15.207 | RSS-Gen: 7.2.4 |
| Spurious radiated emissions | § 15.209 | RSS-Gen: 6; |

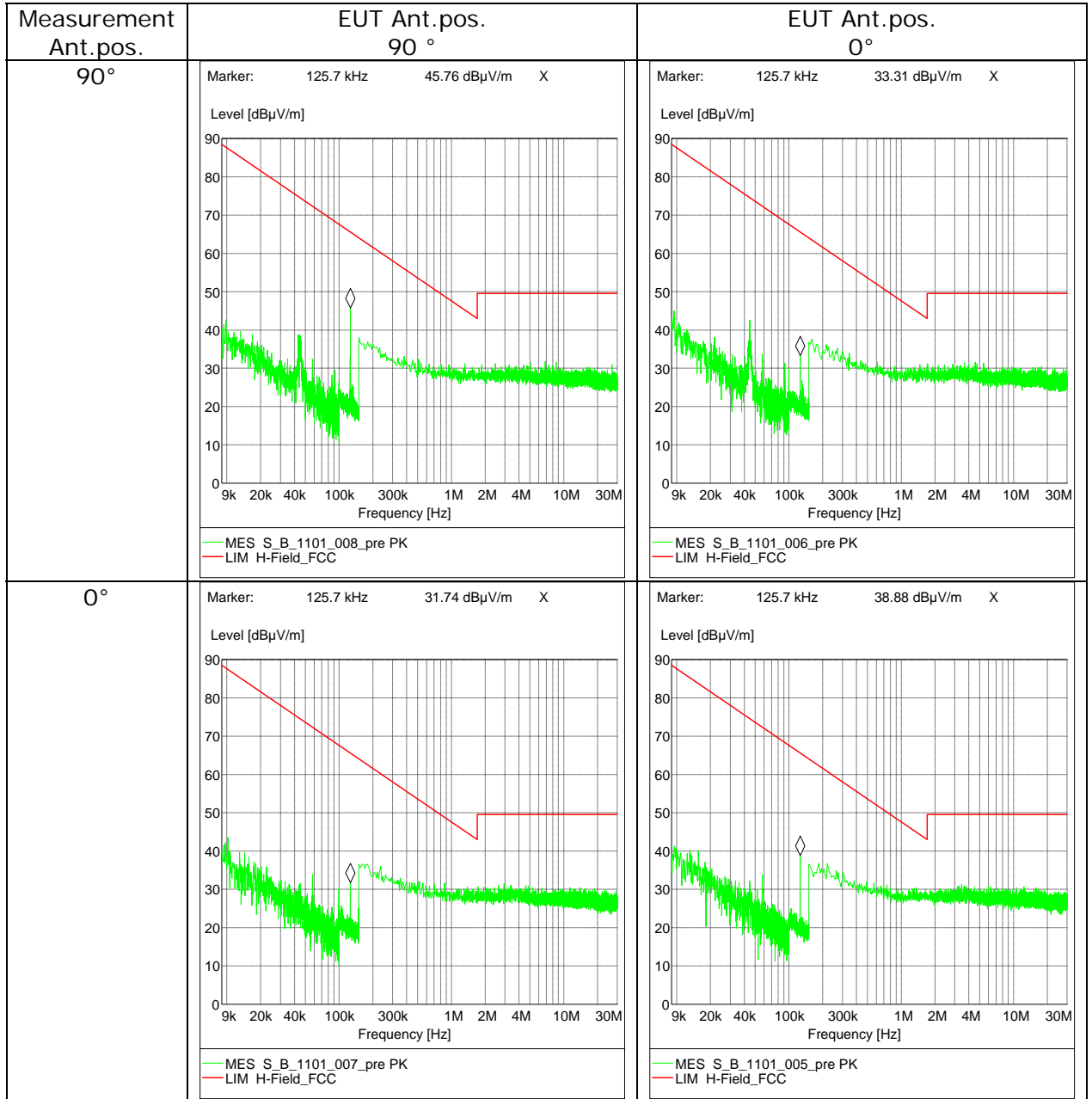
8 Annex measurement plots

8.1 Radiated emissions and peak output power

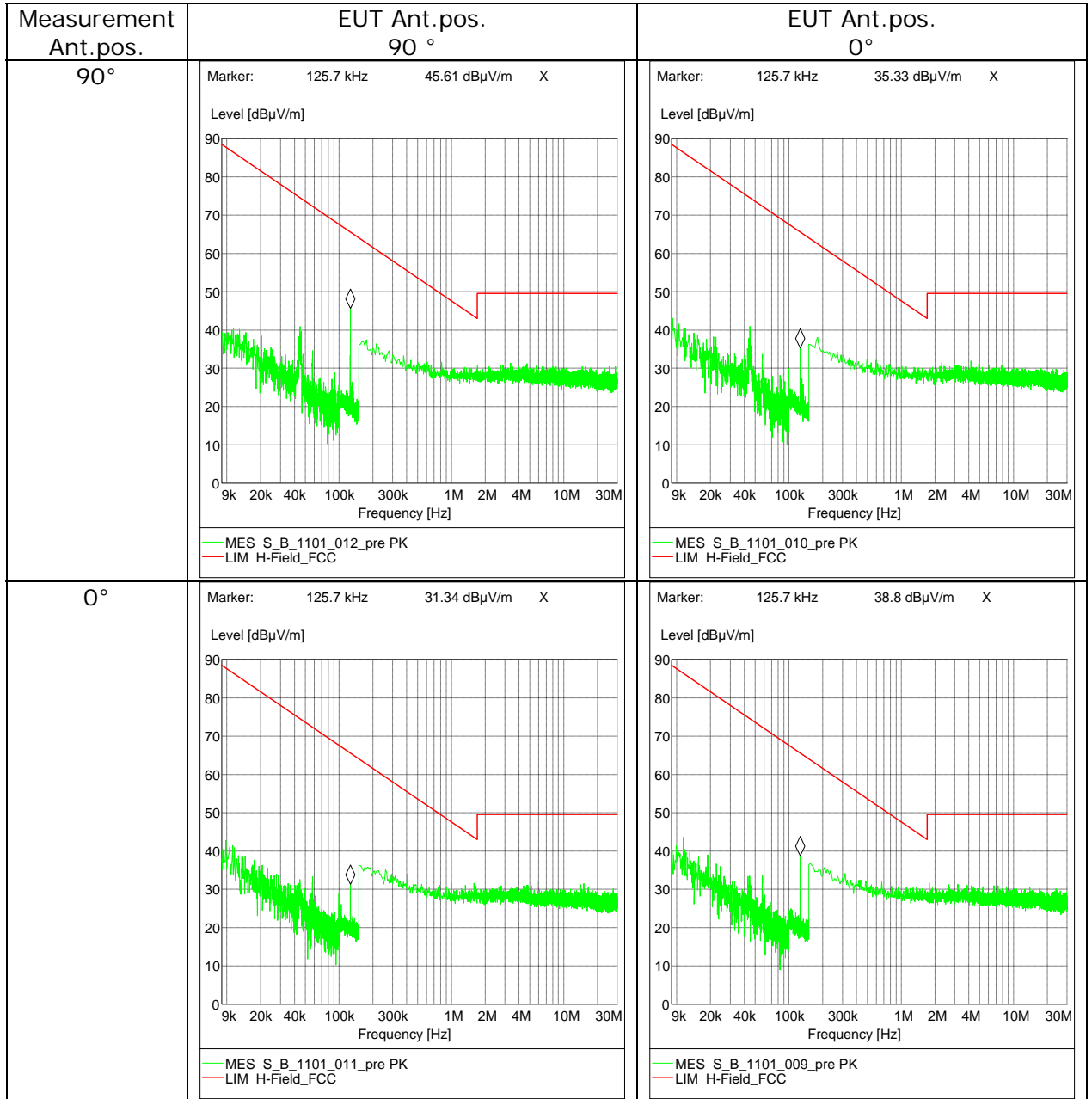
| Op. Mode | Setup |
|-----------|----------|
| op-mode 1 | Setup_01 |



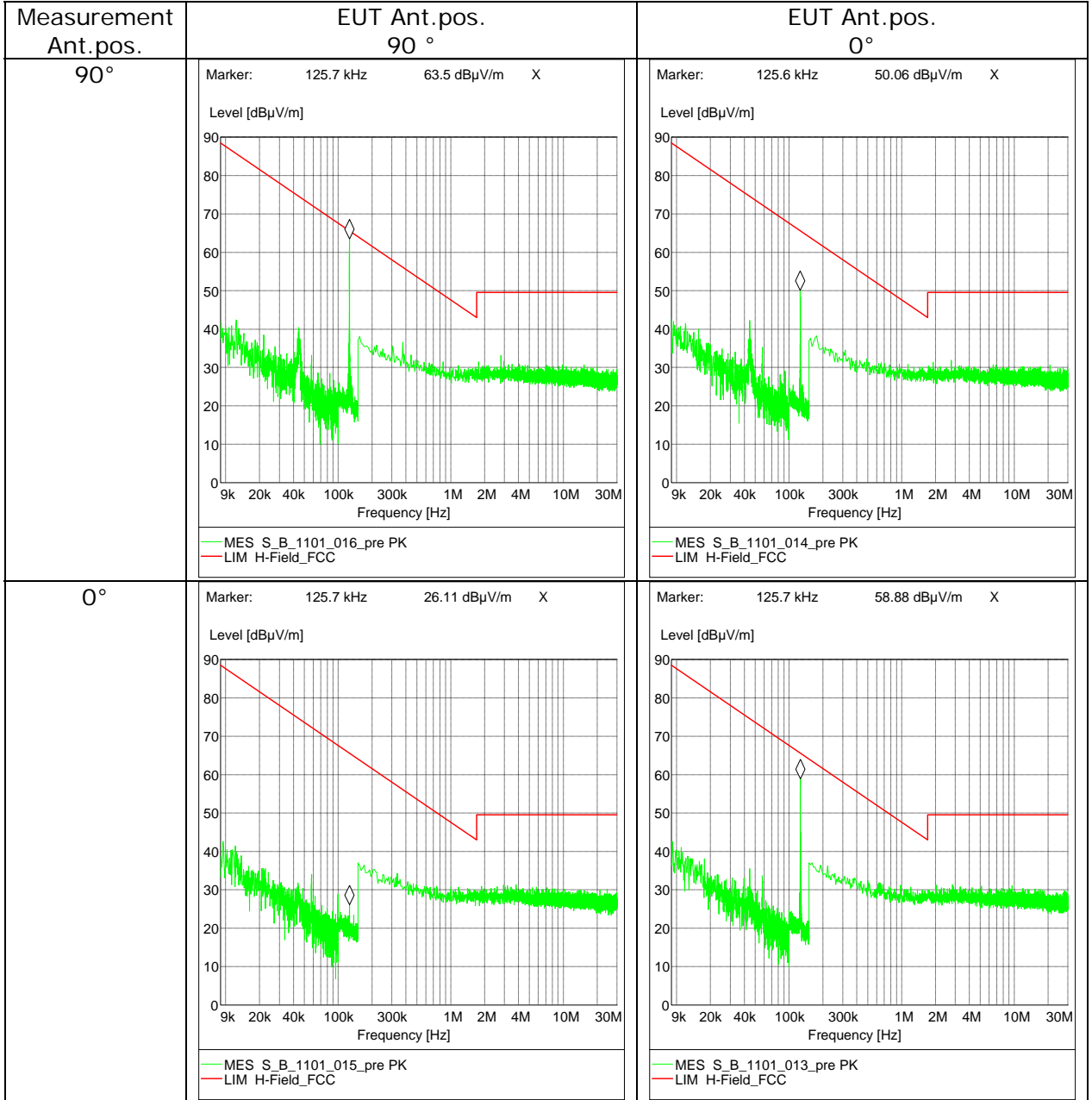
Op. Mode **Setup**
 op-mode 1 Setup_02



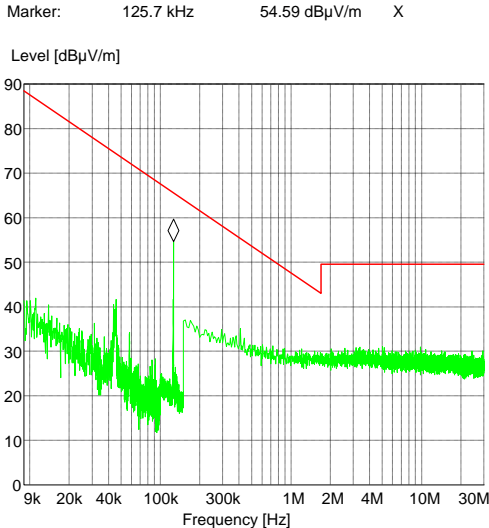
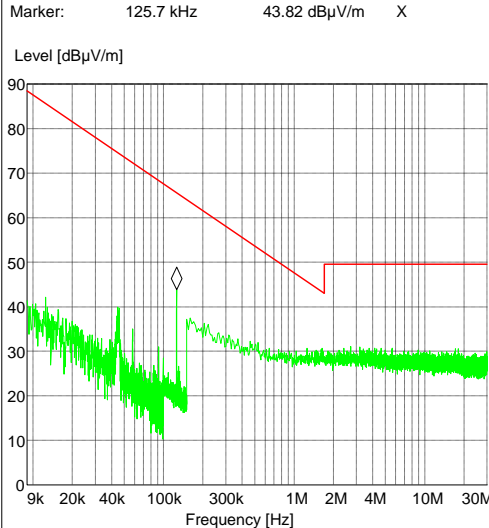
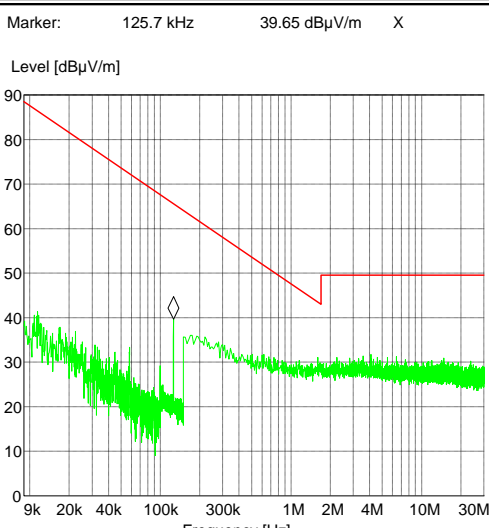
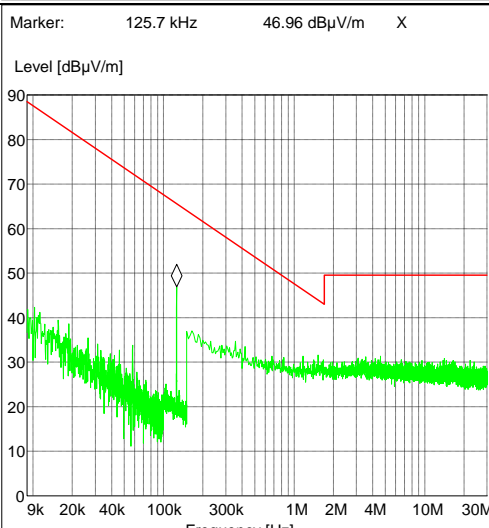
| | |
|-----------------|--------------|
| Op. Mode | Setup |
| op-mode 1 | Setup_03 |



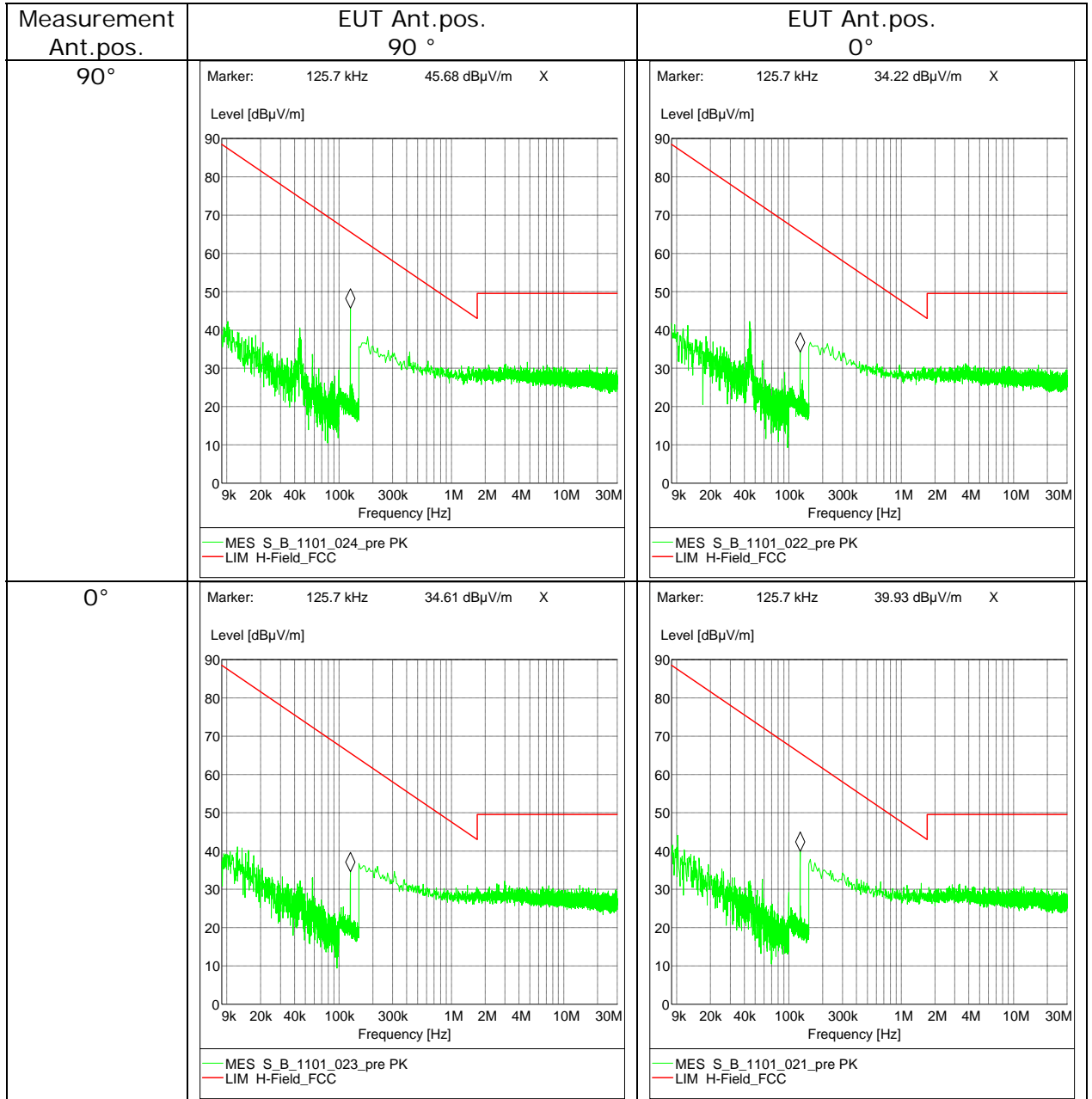
Op. Mode **Setup**
 op-mode 1 Setup_04



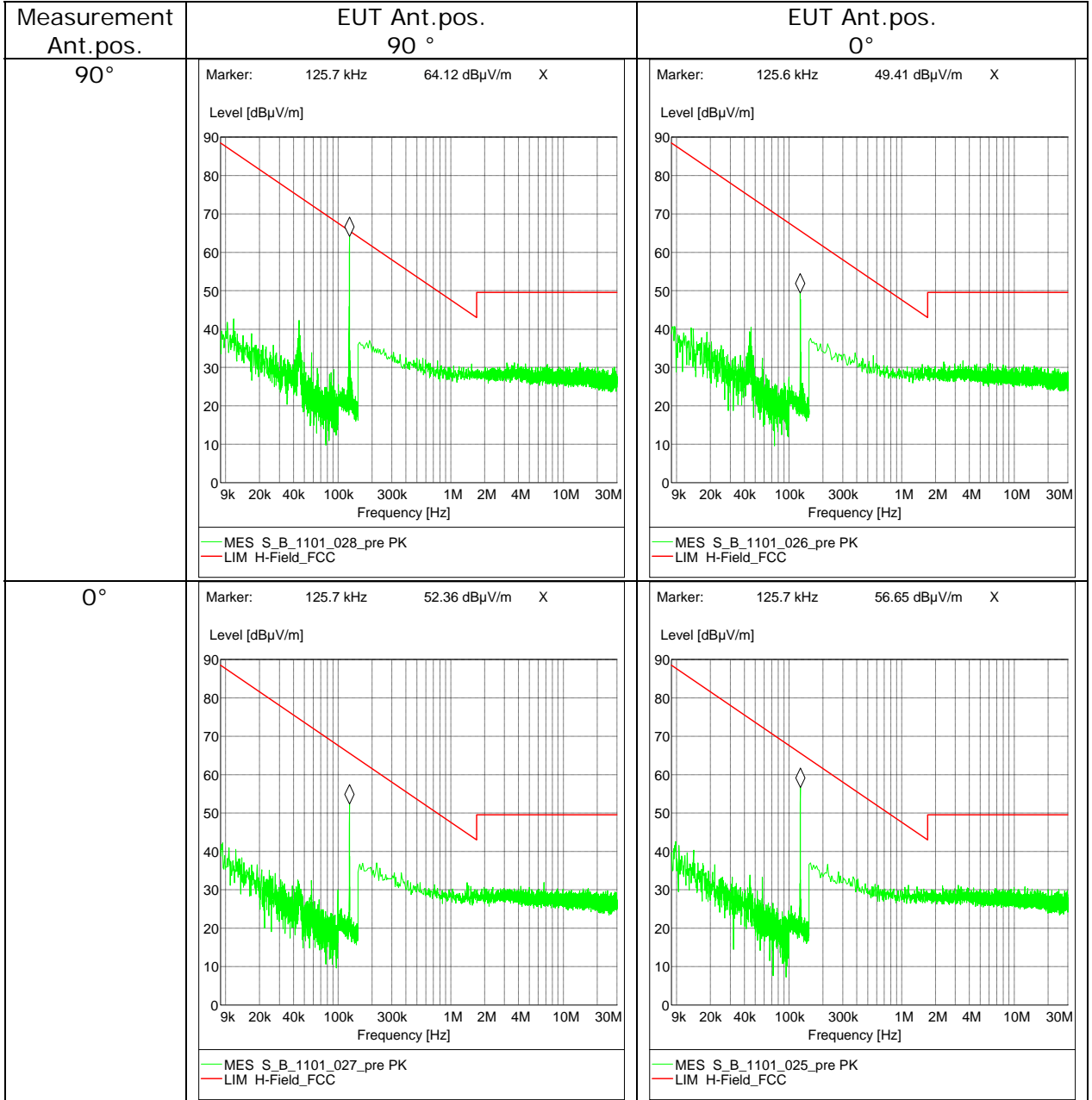
Op. Mode **Setup**
 op-mode 1 Setup_05

| Measurement Ant.pos. | EUT Ant.pos. 90 ° | EUT Ant.pos. 0 ° |
|-------------------------|---|--|
| 90 ° | Marker: 125.7 kHz 54.59 dBµV/m X  — MES S_B_1101_020_pre PK — LIM H-Field_FCC | Marker: 125.7 kHz 43.82 dBµV/m X  — MES S_B_1101_018_pre PK — LIM H-Field_FCC |
| 0 ° | Marker: 125.7 kHz 39.65 dBµV/m X  — MES S_B_1101_019_pre PK — LIM H-Field_FCC | Marker: 125.7 kHz 46.96 dBµV/m X  — MES S_B_1101_017_pre PK — LIM H-Field_FCC |

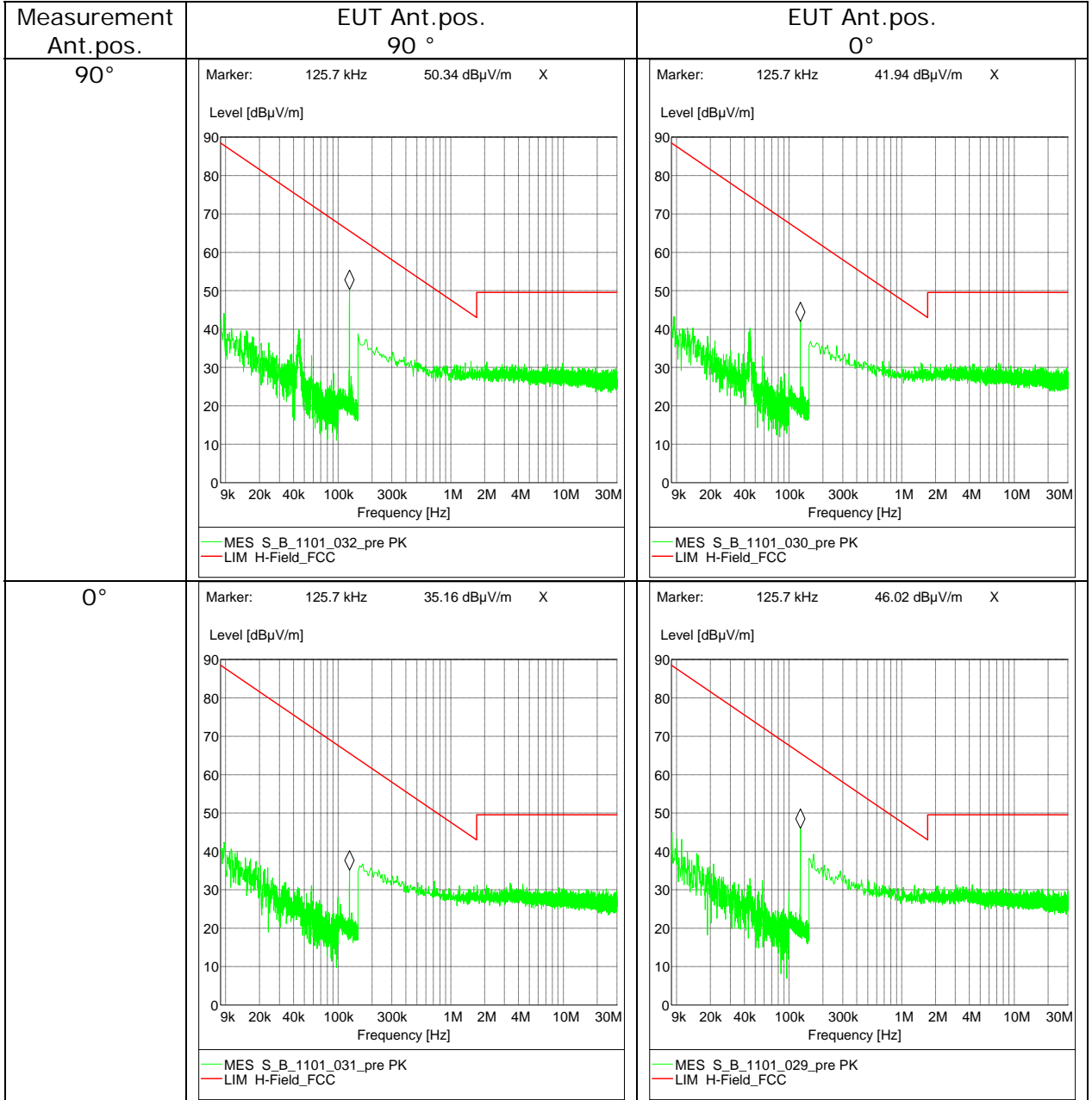
Op. Mode **Setup**
 op-mode 1 Setup_06



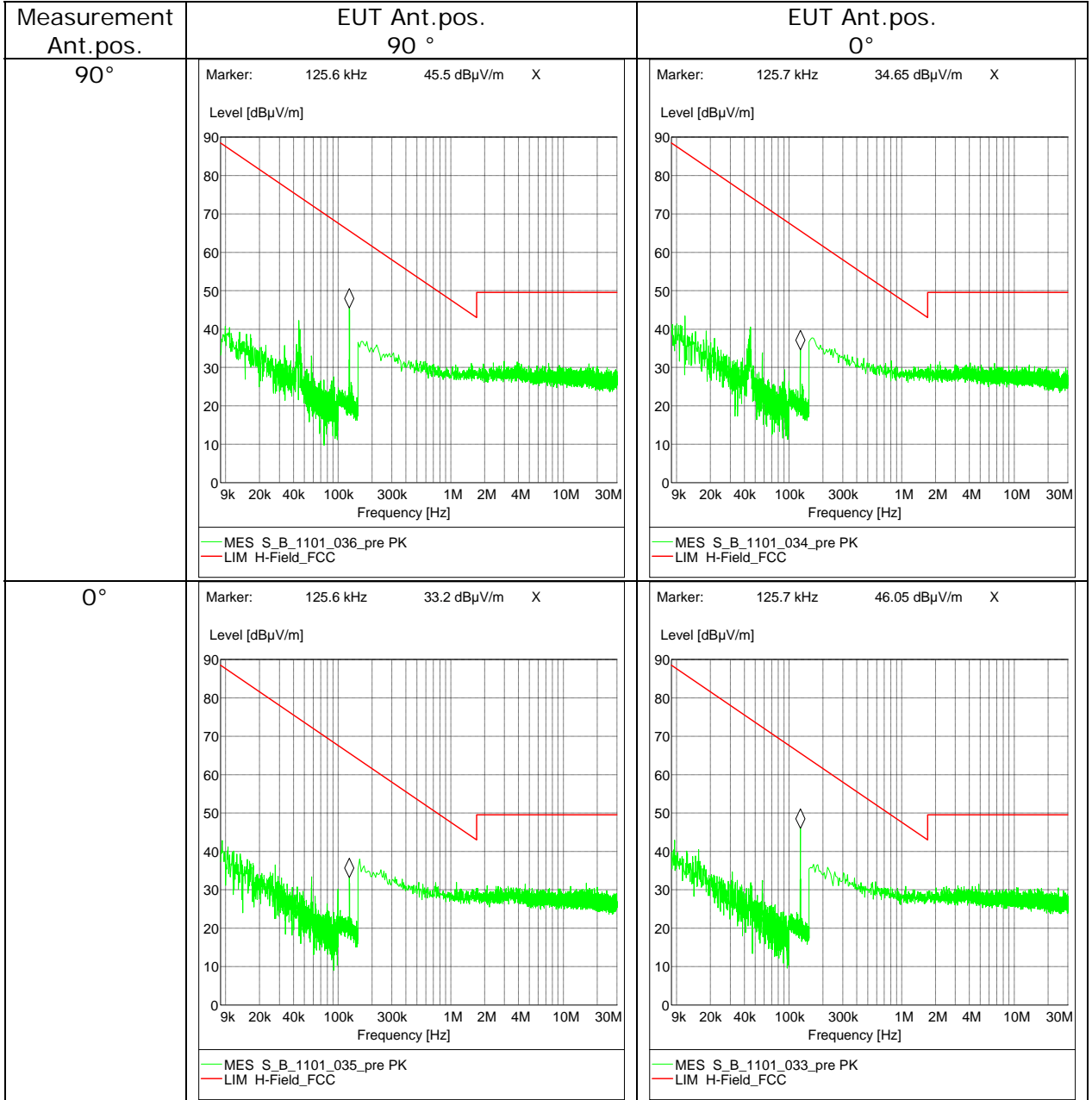
Op. Mode **Setup**
 op-mode 1 Setup_07



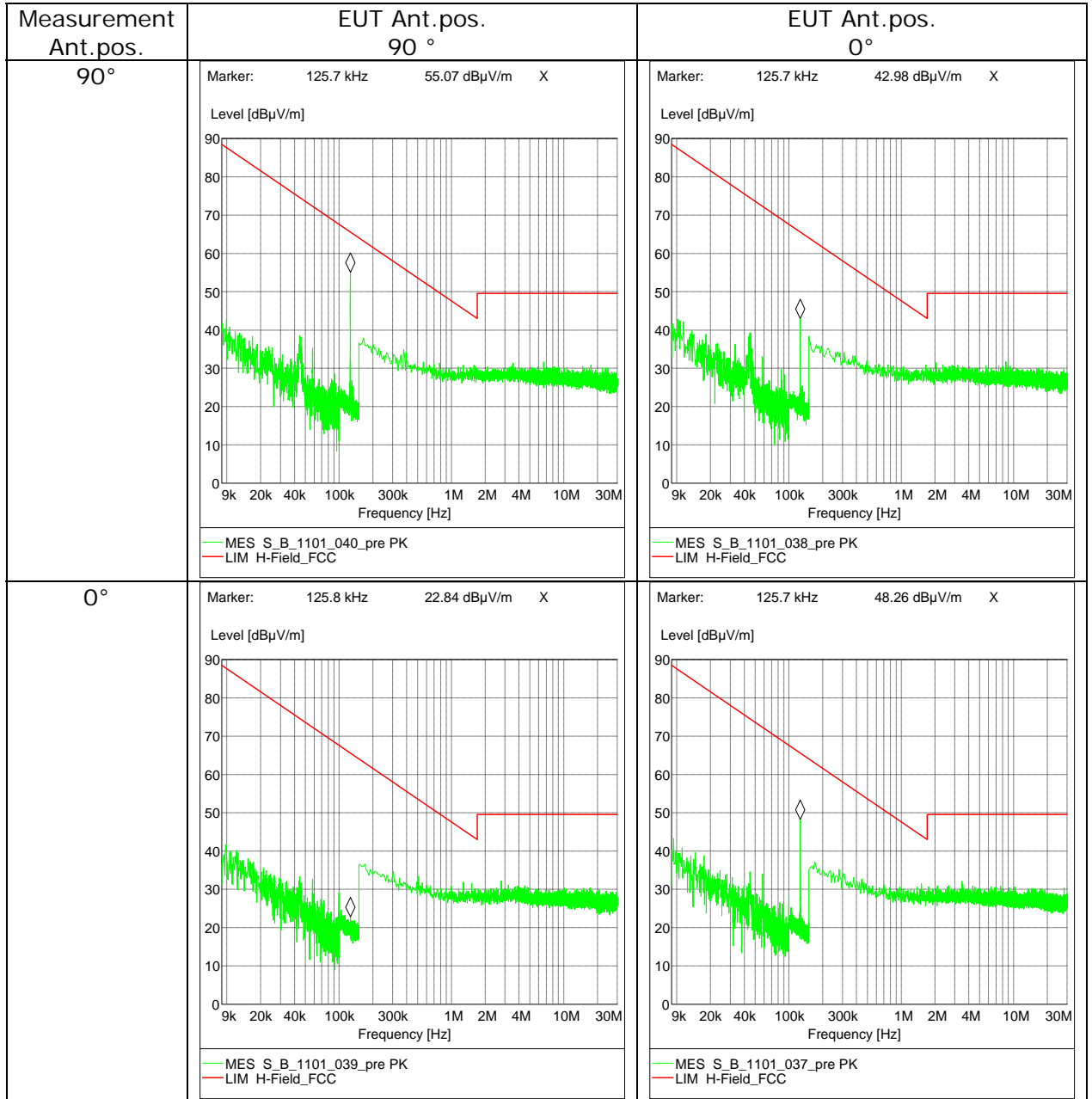
Op. Mode **Setup**
 op-mode 1 Setup_08



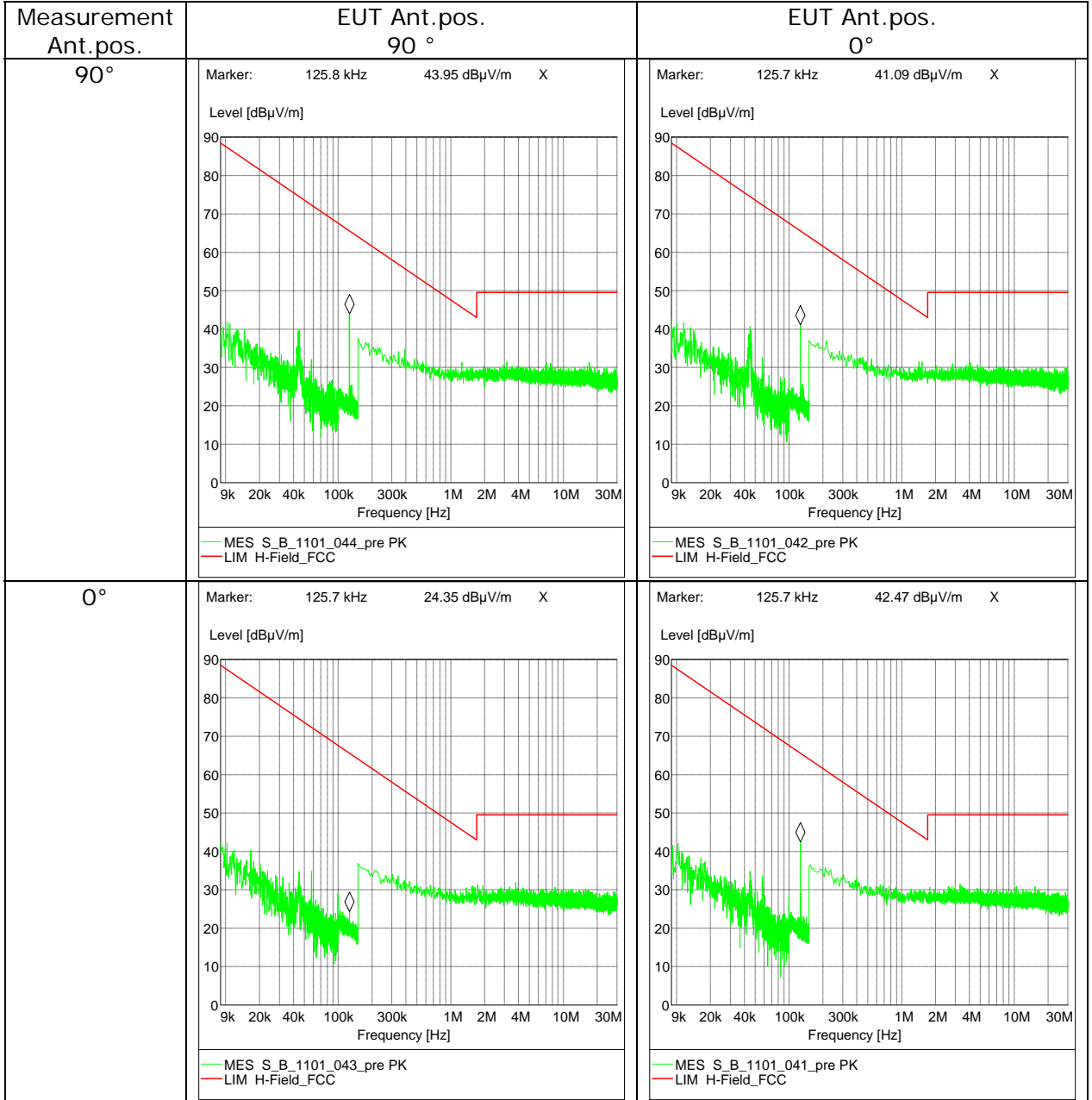
Op. Mode **Setup**
 op-mode 1 Setup_09



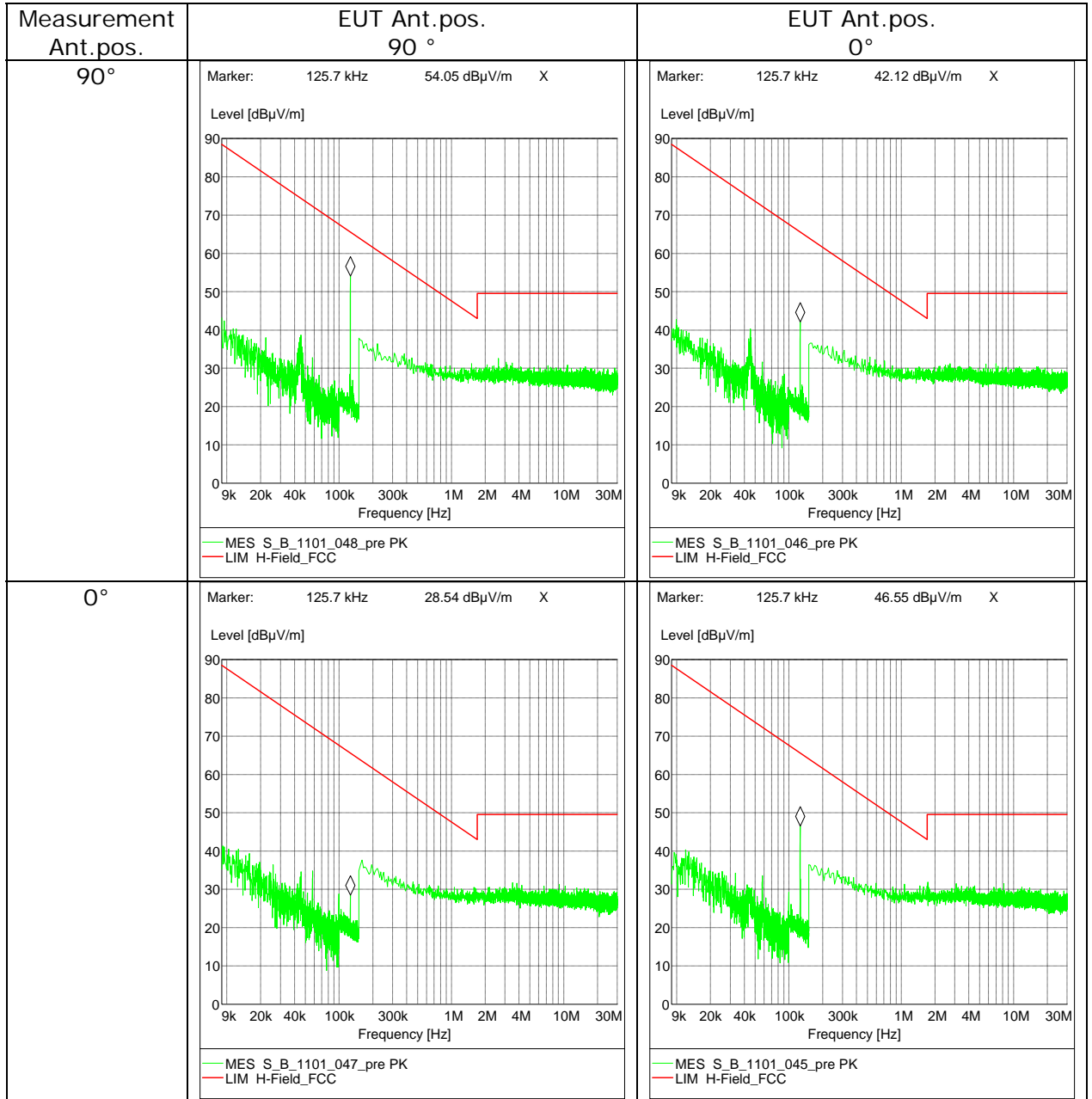
| | |
|-----------------|--------------|
| Op. Mode | Setup |
| op-mode 1 | Setup_10 |



Op. Mode **Setup**
 op-mode 1 Setup_11



Op. Mode **Setup**
 op-mode 1 Setup_12



8.2 AC Mains conducted

| Short Description: | | FCC Voltage | | | | | |
|--------------------|----------------|-------------|-----------------|------------|-----------|------------|--|
| Start Frequency | Stop Frequency | Step Width | Detector | Meas. Time | IF Bandw. | Transducer | |
| 150.0 kHz | 30.0 MHz | 5.0 kHz | MaxPeak Average | 20.0 ms | 9 kHz | ESH3-Z5 | |

