



InterLab<sup>®</sup>

FCC Measurement/Technical Report on

Bluetooth transceiver  
N14509

**Report Reference:** MDE\_FAKT\_1102\_FCCb

**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 (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

§ 15.207 Conducted limits

§ 15.209 Radiated emission limits; general requirements

§ 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz

#### **Note:**

The tests were selected and performed with reference to the FCC Public Notice DA 00-705, released March 30, 2000.

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

<b>FCC Part 15, Subpart C</b>			<b>§ 15.207</b>
Conducted emissions (AC power line)			
The measurement was performed according to ANSI C63.4			
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	<b>2009 Final Result</b> N/A
<b>FCC Part 15, Subpart C</b>			<b>§ 15.247 (a) (1)</b>
Occupied bandwidth			
The measurement was performed according to FCC § 15.31			
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	<b>10-1-10 Edition Final Result</b> N/P
<b>FCC Part 15, Subpart C</b>			<b>§ 15.247 (b) (1)</b>
Peak power output			
The measurement was performed according to FCC § 15.31			
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	<b>10-1-10 Edition Final Result</b> N/P
<b>FCC Part 15, Subpart C</b>			<b>§ 15.247 (d)</b>
Spurious RF conducted emissions			
The measurement was performed according to FCC § 15.31			
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	<b>10-1-10 Edition Final Result</b> N/P
<b>FCC Part 15, Subpart C</b>			<b>§ 15.247 (d), § 15.35 (b), § 15.209</b>
Spurious radiated emissions			
The measurement was performed according to ANSI C63.4			
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	<b>2009 Final Result</b>
op-mode 1	Setup_a01	Enclosure	passed
op-mode 2	Setup_a01	Enclosure	passed
op-mode 3	Setup_a01	Enclosure	passed
op-mode 6	Setup_a01	Enclosure	passed
op-mode 7	Setup_a01	Enclosure	passed
op-mode 8	Setup_a01	Enclosure	passed
op-mode 10	Setup_a01	Enclosure	passed
op-mode 11	Setup_a01	Enclosure	passed
op-mode 12	Setup_a01	Enclosure	passed
<b>FCC Part 15, Subpart C</b>			<b>§ 15.247 (d)</b>
Band edge compliance			
The measurement was performed according to FCC § 15.31 / ANSI C63.4			
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	<b>10-1-10 Edition / 2009 Final Result</b> N/P

FCC Part 15, Subpart C		§ 15.247 (a) (1) (iii)	
Dwell time			
The measurement was performed according to FCC § 15.31			
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	10-1-10 Edition <b>Final Result</b> N/P

FCC Part 15, Subpart C		§ 15.247 (a) (1)	
Channel separation			
The measurement was performed according to FCC § 15.31			
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	10-1-10 Edition <b>Final Result</b> N/P

FCC Part 15, Subpart C		§ 15.247 (a) (iii)	
Number of hopping frequencies			
The measurement was performed according to FCC § 15.31			
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	10-1-10 Edition <b>Final Result</b> N/P

N/A not applicable (the EUT is powered by DC, car battery)  
 N/P not performed

The test case selection was done on applicant's demand.

This test report replaces the test report "MDE\_FAKT\_1102\_FCCa"

Responsible for Accreditation Scope: 

Responsible for Test Report: 



## **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. Thomas Hoell  
Dipl.-Ing. Andreas Petz

Report Template Version: 2011-05-25

### **1.2 Project Data**

Responsible for testing and report: Dipl.-Ing. Carsten Steinröder  
Date of Test(s): 2011-05-19 to 2011-05-24  
Date of Report: 2012-03-07

### **1.3 Applicant Data**

Company Name: FAKT S.r.l.  
Address: PO Box: 20086  
Via Lithos, 53  
Rezzato (BS)  
Italy  
Contact Person: Mr. Nicola Scartapacchio

### **1.4 Manufacturer Data**

Company Name: MAGNETI MARELLI S.p.A  
Address: PO Box: 20011  
Via A. Borletti, 61/63  
Corbetta (MI)  
Italy  
Contact Person: Mr. Franco Schinco

## 2 Test object Data

### 2.1 General EUT Description

<b>Equipment under Test</b>	Bluetooth transceiver
<b>Type Designation:</b>	N14509
<b>Kind of Device:</b> <b>(optional)</b>	Car Radio with Bluetooth
<b>Voltage Type:</b>	DC (car battery)
<b>Voltage level:</b>	12 V
<b>Modulation Type:</b>	GFSK, 8DPSK, $\pi/4$ DQPSK

#### General product description:

Bluetooth is a short-range radio link intended to be a cable replacement between portable and/or fixed electronic devices.

Bluetooth operates in the unlicensed ISM Band at 2.4 GHz. In the US a band of 83.5 MHz width is available. In this band, the Bluetooth technology defines 79 RF channels spaced 1 MHz (2402 - 2480 MHz). The actual RF channel is chosen from a pseudo-random hopping sequence through the 79 channels. A channel is occupied for a defined amount of time slots, with a nominal slot length of 625  $\mu$ s. The maximum time slot length on one channel is defined by the packet type and is 0.625 ms for DH1 packets, 1.875 ms for DH3 and 3.125 ms for DH5. The nominal hop rate is 1600 hops/s for DH1, 1600/3 for DH3 and 1600/5 for DH5. All frequencies are equally used. The maximum nominal average time of occupancy is 0.4 s within a period of 79\*0.4 seconds.

The basic data rate of 1 Mbps uses GFSK modulation and the enhanced data rate uses PSK modulation. For the enhanced data rate of 3 Mbps 8DPSK modulation and of 2 Mbps  $\pi/4$  DQPSK modulation is used.

#### The EUT provides the following ports:

##### Ports

Enclosure  
Different special car cable harness 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: DA130c01)	Bluetooth transceiver	N14509	-	EP2	BT Tests Bridge software	2011-03-30

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_a01	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 2402 MHz	Loopback mode, basic data rate 1 Mbps
op-mode 2	The EUT transmits on 2441 MHz	Loopback mode, basic data rate 1 Mbps
op-mode 3	The EUT transmits on 2480 MHz	Loopback mode, basic data rate 1 Mbps
op-mode 4	The EUT is in Hopping mode	The EUT is hopping on 79 channels, basic data rate 1 Mbps
op-mode 6	The EUT transmits on 2402 MHz	Loopback mode, enhanced data rate 3 Mbps
op-mode 7	The EUT transmits on 2441 MHz	Loopback mode, enhanced data rate 3 Mbps
op-mode 8	The EUT transmits on 2480 MHz	Loopback mode, enhanced data rate 3 Mbps
op-mode 10	The EUT transmits on 2402 MHz	Loopback mode, enhanced data rate, 2 Mbps
op-mode 11	The EUT transmits on 2441 MHz	Loopback mode, enhanced data rate, 2 Mbps
op-mode 12	The EUT transmits on 2480 MHz	Loopback mode, enhanced data rate, 2 Mbps

The EUT is equipped with a temporary RS232 connector placed on an external Test Adapter PCB. By using an external PC and the Infineon BlueTool software it is possible to set the EUT in the "Bluetooth Test Mode" which allows connecting the EUT to a signalling unit. The signalling unit control the EUT to put it in the required operating modes for testing.

For Bluetooth technology, the Bluetooth Specification defines a test mode that enables the operator during the tests to set the EUT into a mode that it can be externally controlled by the signalling unit in the active Bluetooth radio-link "over-the-air." The Bluetooth test mode is completely documented in the Bluetooth Specifications.

## 2.7 Product labelling

### 2.7.1 FCC ID label

Please refer to the documentation of the applicant.

### 2.7.2 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, 10-1-10 Edition Subpart C

**The test was performed according to:** ANSI C63.4-2009

#### 3.1.1 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  $\mu$ s (BT Timing 1.25 ms)
- Turntable angle range:  $-180$  to  $+180^\circ$
- Turntable step size:  $90^\circ$
- 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  $+180^\circ$
- Turntable step size:  $45^\circ$
- 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):  $45^\circ$
- 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  $\pm 25$  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:  $-22.5^\circ$  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

### 3. Measurement above 1 GHz

The following modifications apply to the measurement procedure for the frequency range above 1 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 (18–25 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
- IF Bandwidth = 1 MHz

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.

For the enhanced data rate packets the test is performed as worst-case-check in order to verify that emissions have a comparable level as found at basic data rate. Typically, the measurement for these packets is performed in the frequency range 1 to 8 GHz but it depends on the emissions found during the test for the basic data rate. Please refer to the results for the used frequency range.

#### 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)+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

§15.35(b)

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

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

### 3.1.3 Test Protocol

Temperature: 25 °C  
 Air Pressure: 1012 hPa  
 Humidity: 36 %

#### 3.1.3.1 Measurement up to 30 MHz

Op. Mode	Setup	Port							
op-mode 1	Setup_a01	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°	-	-	-	-	-	-	-	-	-

Remark: No (further) spurious emissions in the range 20 dB below the limit found therefore step 2 was not performed. The found peak at 91.2 / 99.2 kHz is an emission from the loop antenna's power supply.

#### 3.1.3.2 Measurement above 30 MHz

Op. Mode	Setup	Port							
op-mode 1	Setup_a01	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
Vertical + horizontal	-	-	-	-	-	74.0	54.0	-	-

Remark: No (further) spurious emissions in the range 20 dB below the limit found.

Op. Mode	Setup	Port							
op-mode 2	Setup_a01	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
Vertical + horizontal	-	-	-	-	-	74.0	54.0	-	-

Remark: No (further) spurious emissions in the range 20 dB below the limit found.

**Op. Mode**      **Setup**                      **Port**  
 op-mode 3      Setup\_a01                      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
Vertical + horizontal	-	-	-	-	-	74.0	54.0	-	-

Remark: No (further) spurious emissions in the range 20 dB below the limit found.

**Op. Mode**      **Setup**                      **Port**  
 op-mode 6      Setup\_a01                      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
Vertical + horizontal	-	-	-	-	-	-	-	-	-

Remark: No (further) spurious emissions in the range 20 dB below the limit found.  
 The measurement was performed from 1 GHz up to 8 GHz because no significant spurious emissions were found outside this frequency range in op-mode 1, 2 and 3.

**Op. Mode**      **Setup**                      **Port**  
 op-mode 7      Setup\_a01                      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
Vertical + horizontal	-	-	-	-	-	-	-	-	-

Remark: No (further) spurious emissions in the range 20 dB below the limit found.  
 The measurement was performed from 1 GHz up to 8 GHz because no significant spurious emissions were found outside this frequency range in op-mode 1, 2 and 3.

**Op. Mode**      **Setup**                      **Port**  
 op-mode 8      Setup\_a01                      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
Vertical + horizontal	-	-	-	-	-	-	-	-	-

Remark: No (further) spurious emissions in the range 20 dB below the limit found.  
 The measurement was performed from 1 GHz up to 8 GHz because no significant spurious emissions were found outside this frequency range in op-mode 1, 2 and 3.

**Op. Mode**      **Setup**                      **Port**  
 op-mode 10      Setup\_a01                      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
Vertical + horizontal	-	-	-	-	-	-	-	-	-

Remark: No (further) spurious emissions in the range 20 dB below the limit found.  
 The measurement was performed from 1 GHz up to 8 GHz because no significant spurious emissions were found outside this frequency range in op-mode 1, 2 and 3.

**Op. Mode**      **Setup**                      **Port**  
 op-mode 11      Setup\_a01                      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
Vertical + horizontal	-	-	-	-	-	-	-	-	-

Remark: No (further) spurious emissions in the range 20 dB below the limit found.  
 The measurement was performed from 1 GHz up to 8 GHz because no significant spurious emissions were found outside this frequency range in op-mode 1, 2 and 3.

**Op. Mode**      **Setup**                      **Port**  
 op-mode 12      Setup\_a01                      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
Vertical + horizontal	-	-	-	-	-	-	-	-	-

Remark: No (further) spurious emissions in the range 20 dB below the limit found.  
 The measurement was performed from 1 GHz up to 8 GHz because no significant spurious emissions were found outside this frequency range in op-mode 1, 2 and 3.

### 3.1.4 Test result: Spurious radiated emissions

FCC Part 15, Subpart C	Op. Mode	Result
	op-mode 1	passed
	op-mode 2	passed
	op-mode 3	passed
	op-mode 6	passed
	op-mode 7	passed
	op-mode 8	passed
	op-mode 10	passed
	op-mode 11	passed
	op-mode 12	passed

## 4 Test Equipment

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

### Test Equipment Anechoic Chamber

<b>Lab ID:</b>	<b>Lab 1</b>
Manufacturer:	Frankonia
Description:	Anechoic Chamber for radiated testing
Type:	10.58x6.38x6 m <sup>3</sup>

### 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 <sup>3</sup>	none	Frankonia
	<i>Calibration Details</i>		<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 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 Radiated emissions

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



**Single Devices for Auxiliary Equipment for Radiated emissions (continued)**

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>		
Cable "ESI to Horn Antenna"	UFB311A+UFB293C	W18.02-2+W38.02-2	Rosenberger Micro-Coax		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Exec.</i>
	Path Calibration			2011/05/11	2011/11/10
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 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 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 N (Aux)	1506A / 93459	LM390	Weinschel Associates
Broadband Power Divider SMA	WA1515	A855	Weinschel Associates
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	Fluke Europe B.V.
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	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 Digital Signalling Devices

**Lab ID:** Lab 1  
**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
Universal Radio Communication Tester	CMU 200	837983/052	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2008/12/01    2011/11/30
	<i>HW/SW Status</i>		<i>Date of Start</i> <i>Date of End</i>
	HW options: B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B54V14, B56V14, B68 3v04, B95, PCMCIA, U65V02 SW options: K21 4v11, K22 4v11, K23 4v11, K24 4v11, K27 4v10, K28 4v10, K42 4v11, K43 4v11, K53 4v10, K65 4v10, K66 4v10, K68 4v10, Firmware: µP1 8v40 01.12.05 ---		2007/01/02
	SW: K62, K69		2008/11/03

### 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

### Test Equipment Multimeter 12

**Lab ID:** Lab 2  
**Description:** Ex-Tech 520  
**Serial Number:** 05157876

#### Single Devices for Multimeter 12

Single Device Name	Type	Serial Number	Manufacturer
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

### Test Equipment Regulatory Bluetooth RF Test Solution

**Lab ID:** Lab 2  
**Description:** Regulatory Bluetooth RF Tests  
**Type:** Bluetooth RF  
**Serial Number:** 001

#### Single Devices for Regulatory Bluetooth RF Test Solution

Single Device Name	Type	Serial Number	Manufacturer
ADU 200 Relay Box 7	Relay Box	A04380	Ontrak Control Systems Inc.
Power Meter NRVD	NRVD	832025/059	
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2010/06/21 2011/06/20
Power Sensor NRV Z1 A	PROBE	832279/013	
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2010/06/22 2011/06/21
Power Supply	NGSM 32/10	2725	
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2010/06/21 2011/06/20
Rubidium Frequency Normal MFS	Datum MFS	002	Datum GmbH
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2010/07/05 2011/07/04
Signal Analyser FSIQ26	1119.6001.26	832695/007	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2009/06/24 2011/06/23
Vector Signal Generator SMIQ03B	SMIQ03B	832870/017	
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2010/06/23 2013/06/20

### Test Equipment Shielded Room 07

**Lab ID:** Lab 2  
**Description:** Shielded Room 4m x 6m

### Test Equipment T/H Logger 04

**Lab ID:** Lab 2  
**Description:** Lufft Opus10  
**Serial Number:** 7481

#### Single Devices for T/H Logger 04

Single Device Name	Type	Serial Number	Manufacturer
ThermoHygro DataloggerOpus10 THI (8152.00) 04 (Environ)		7481	Lufft Mess- und Regeltechnik GmbH

**Test Equipment Temperature Chamber 01**

<b>Lab ID:</b>	<b>Lab 2</b>
Manufacturer:	see single devices
Description:	Temperature Chamber KWP 120/70
Type:	Weiss
Serial Number:	see single devices

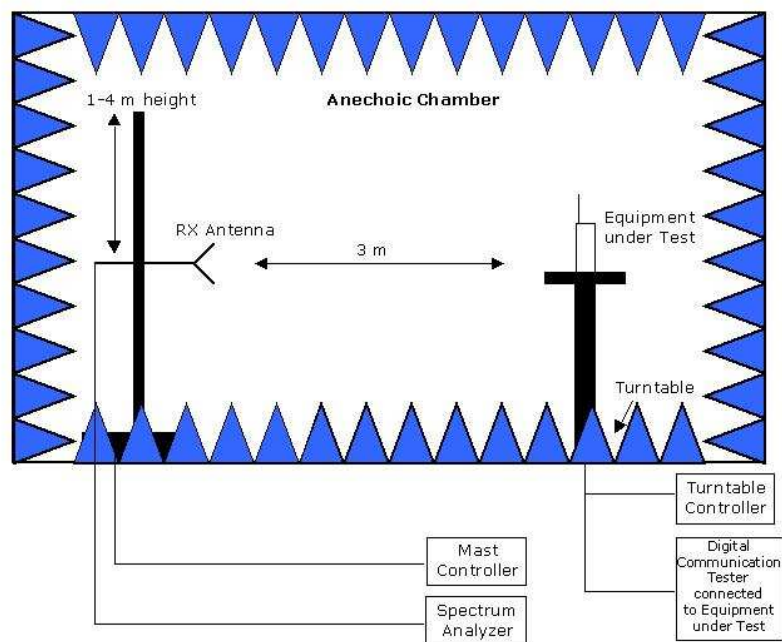
**Single Devices for Temperature Chamber 01**

Single Device Name	Type	Serial Number	Manufacturer
Temperature Chamber Weiss 01	KWP 120/70	59226012190010	Weiss Umwelttechnik GmbH
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Specific calibration		2010/03/16   2012/03/15

## 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 FCC and IC Correlation of measurement requirements

The following tables show the correlation of measurement requirements for Bluetooth equipment and Digital Apparatus from FCC and IC standards.

### Bluetooth® equipment

Measurement	FCC reference	IC reference
Conducted emissions on AC mains	§ 15.207	RSS-Gen: 7.2.4
Occupied bandwidth	§ 15.247 (a) (1)	RSS-210: A8.1
Peak power output	§ 15.247 (b) (1)	RSS-210: A8.4
Spurious RF conducted emissions	§ 15.247 (d)	RSS-Gen: 6; RSS-210: A8.5
Spurious radiated emissions	§ 15.247 (d)	RSS-Gen: 6; RSS-210: A8.5
Band edge compliance	§ 15.247 (d)	RSS-210: A8.5
Dwell time	§ 15.247 (a) (1) (iii)	RSS-210: A8.1
Channel separation	§ 15.247 (a) (1)	RSS-210: A8.1
No. of hopping frequencies	§ 15.247 (a) (1) (iii)	RSS-210: A8.1
Antenna requirement	§ 15.203 / 15.204	RSS-Gen: 7.1.2

### Digital Apparatus

Measurement	FCC reference	IC reference
Conducted Emissions (AC Power Line)	§15.107	ICES-003
Spurious Radiated Emissions	§15.109	ICES-003

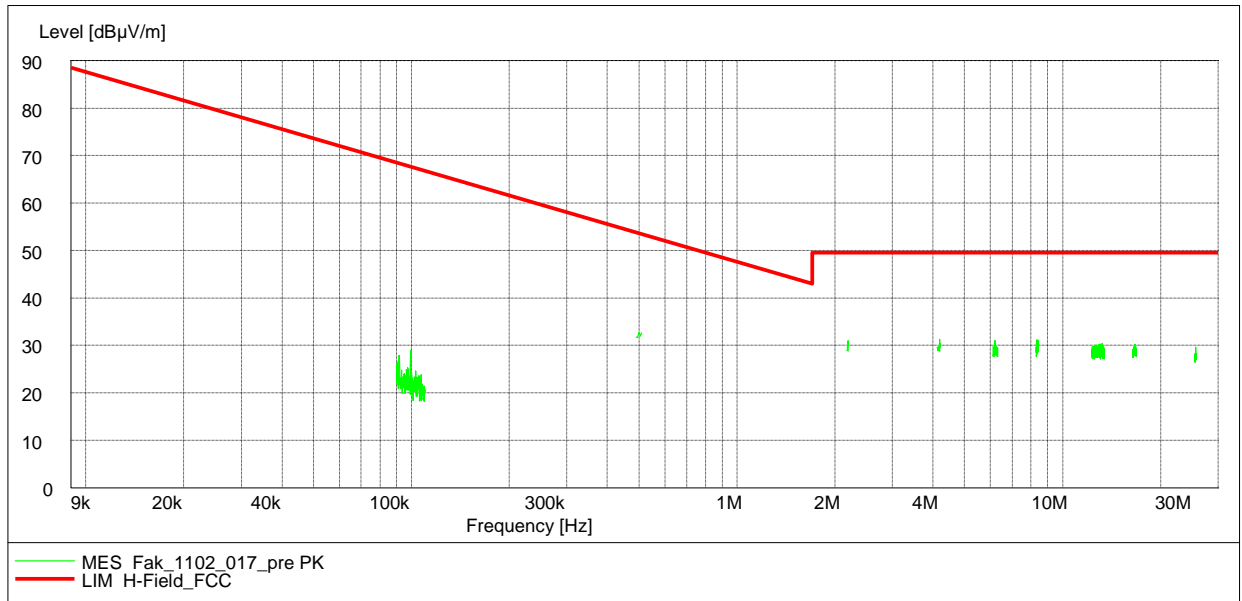


## 8 Annex measurement plots

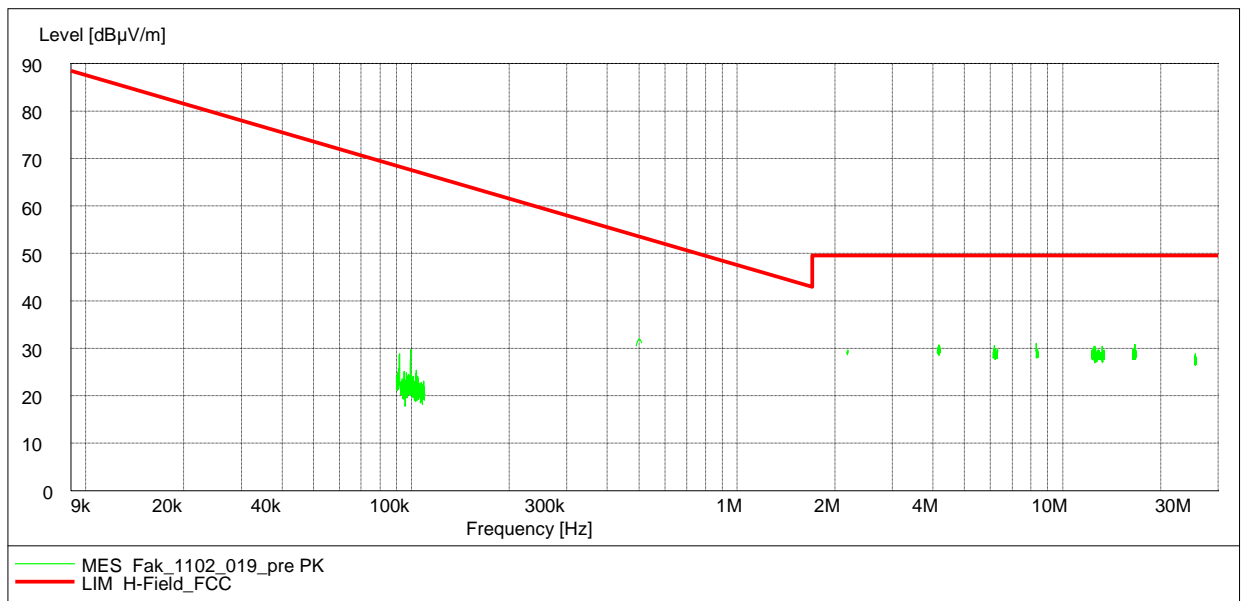
### 8.1 Radiated emissions (f < 30 MHz)

#### Op. Mode

op-mode 1



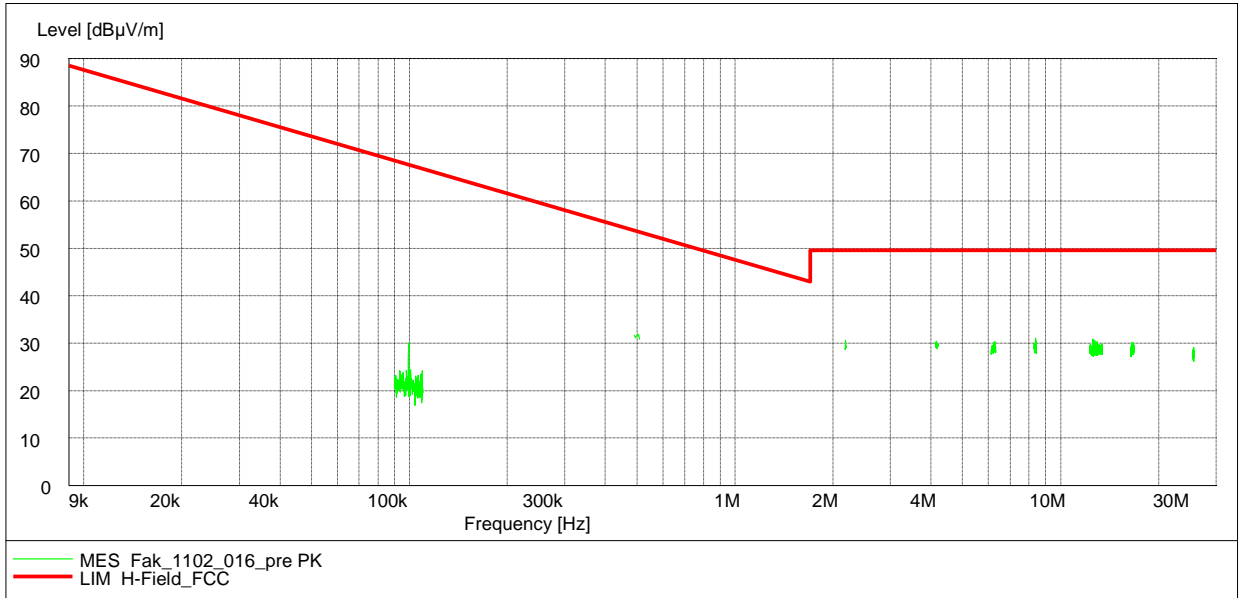
Antenna position 90°  
EUT position front side



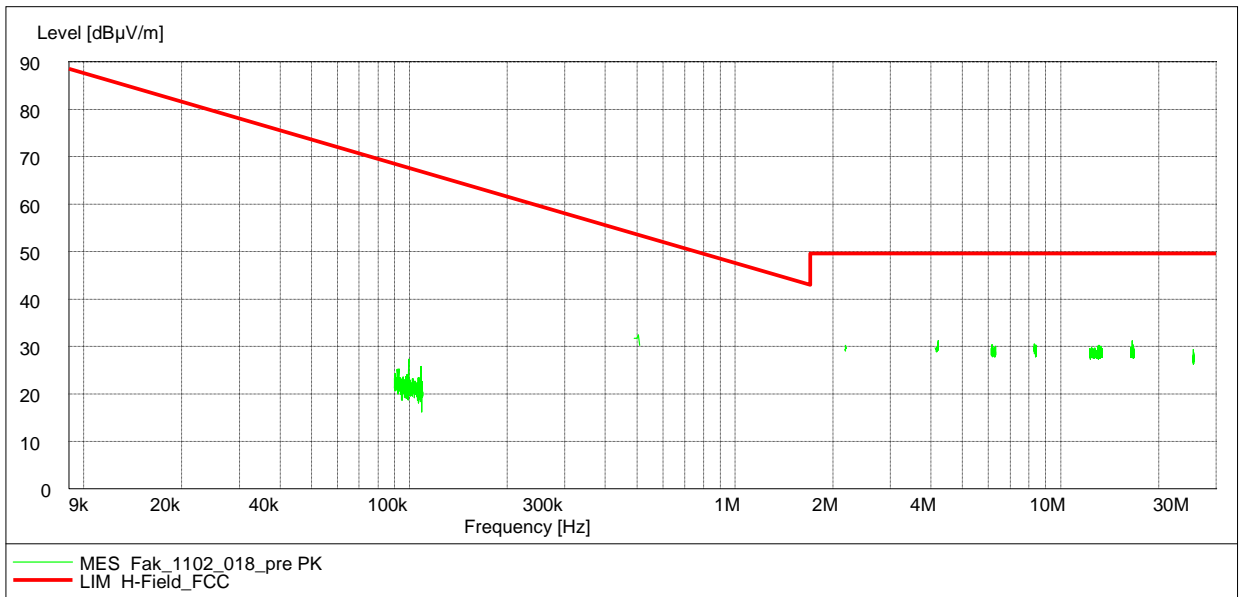
Antenna position 90°  
EUT position right side

**Op. Mode**

op-mode 1



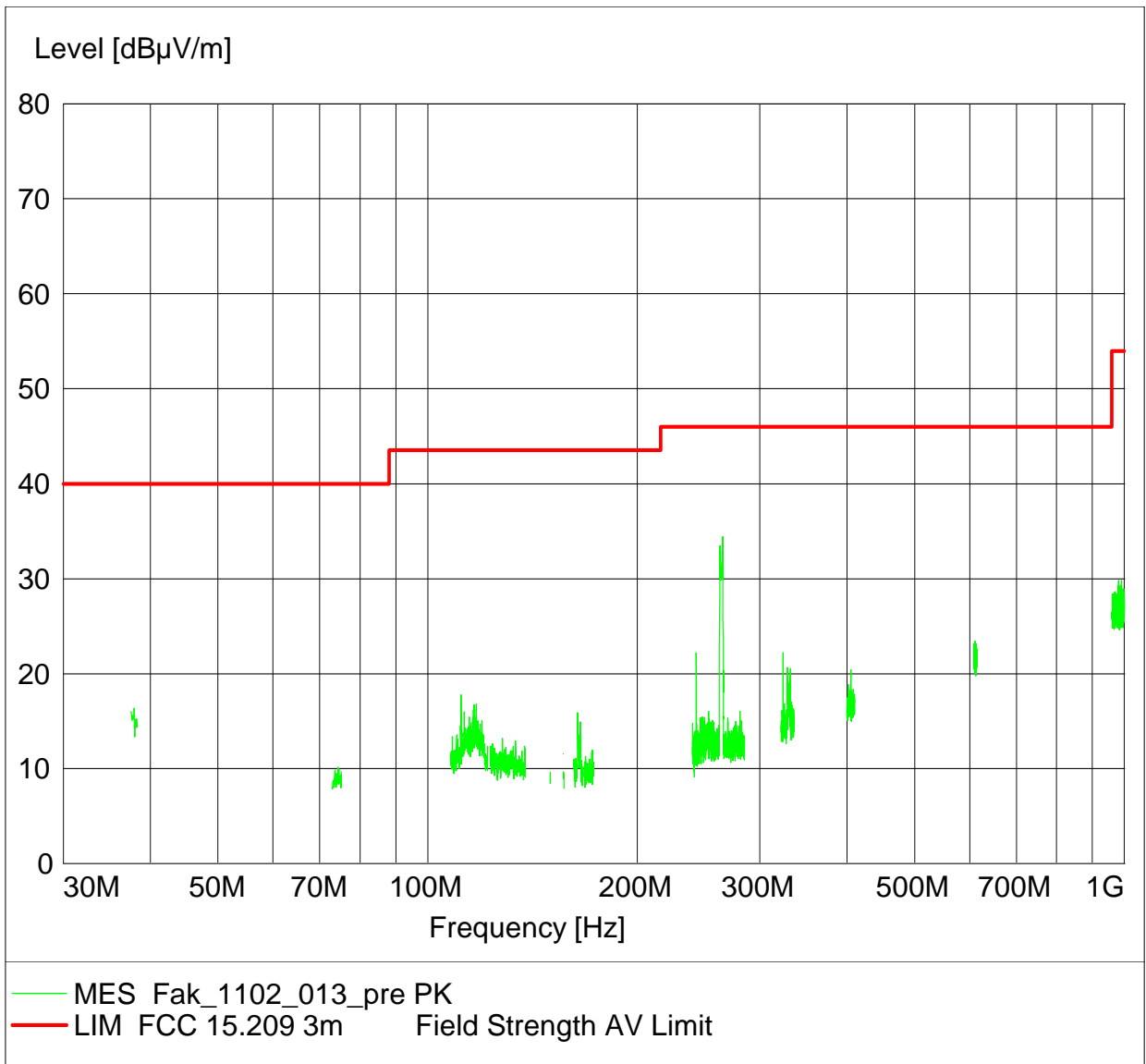
Antenna position 0°  
EUT position front side



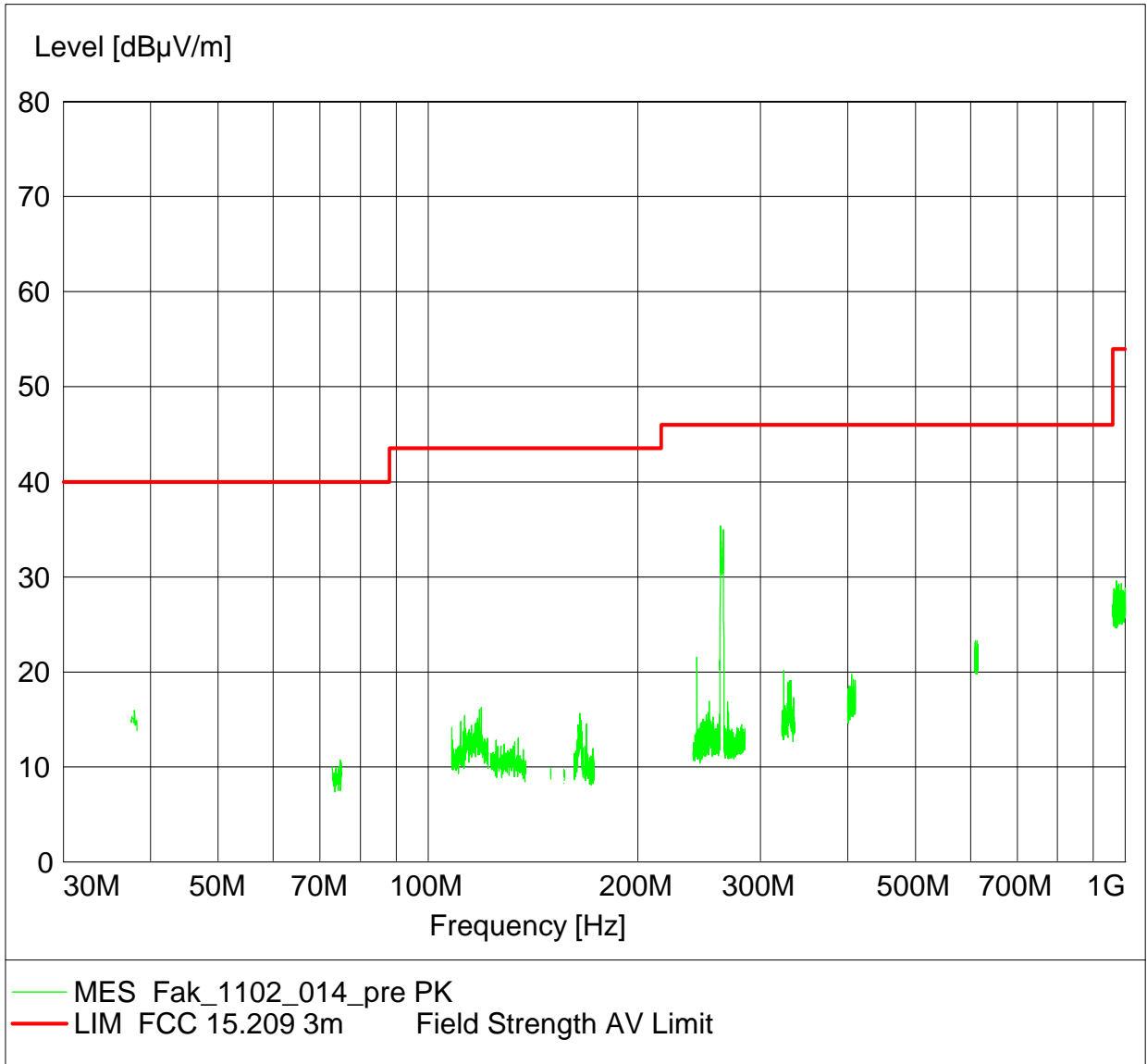
Antenna position 0°  
EUT position right side

## 8.2 Radiated emissions (30 MHz - 1 GHz)

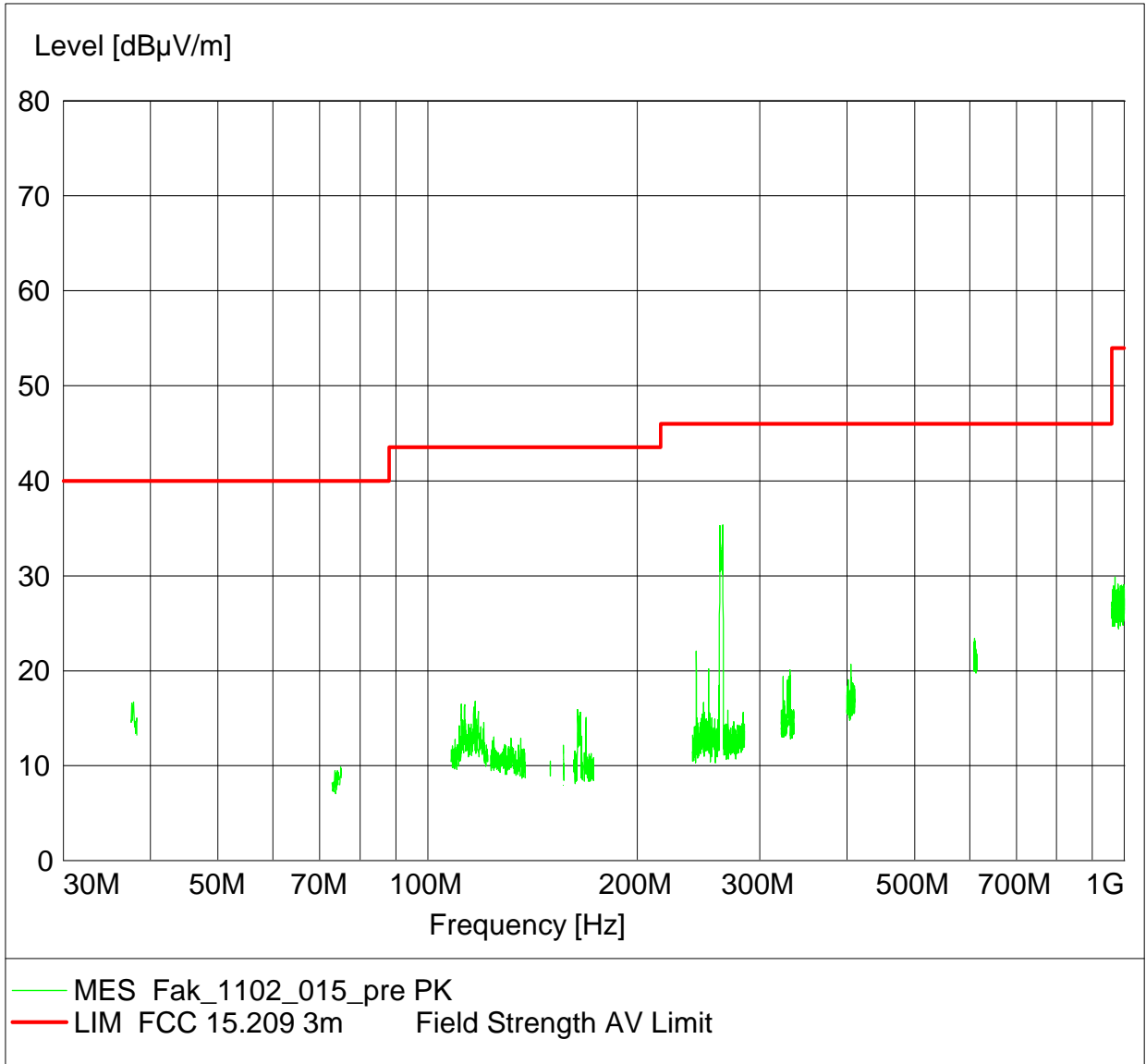
EUT: (DA130c01) / 20.05.2011  
 Manufacturer: Fakt  
 Operating Condition: TX on 2402 MHz  
 Test Site: 7 layers, Ratingen  
 Operator: Giz/Doe  
 Test Specification: FCC 15.247 (15.35b, 15.209)  
 Comment: vertical + horizontal antenna polarisation  
 Start of Test: 20.05.2011 / 21:02:52



EUT: (DA130c01) / 20.05.2011  
Manufacturer: Fakt  
Operating Condition: TX on 2441 MHz  
Test Site: 7 layers, Ratingen  
Operator: Giz/Doe  
Test Specification: FCC 15.247 (15.35b, 15.209)  
Comment: vertical + horizontal antenna polarisation  
Start of Test: 20.05.2011 / 21:22:23

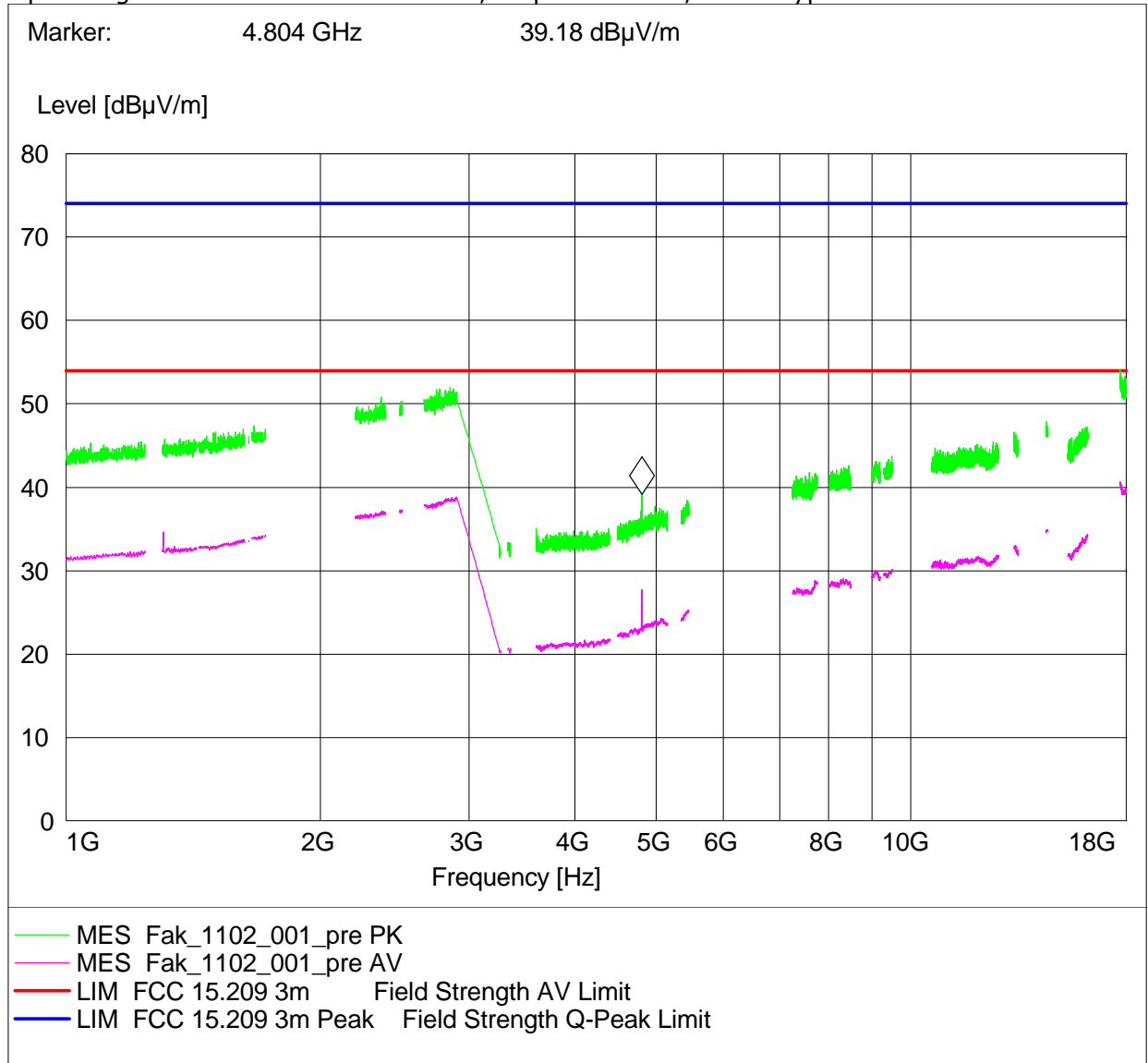


EUT: (DA130c01) / 20.05.2011  
Manufacturer: Fakt  
Operating Condition: TX on 2480 MHz  
Test Site: 7 layers, Ratingen  
Operator: Giz/Doe  
Test Specification: FCC 15.247 (15.35b, 15.209)  
Comment: vertical + horizontal antenna polarisation  
Start of Test: 20.05.2011 / 21:39:10

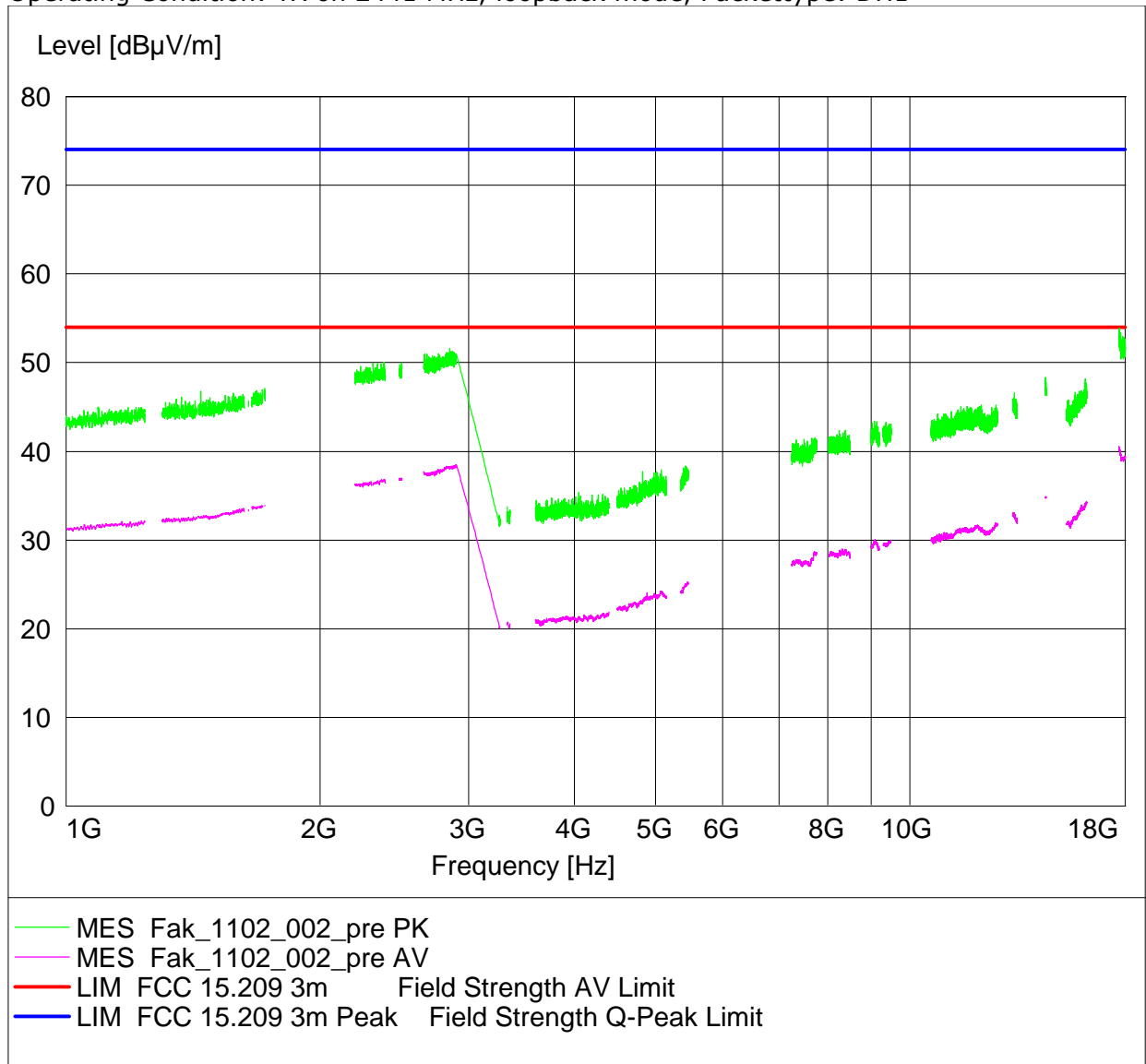


### 8.3 Radiated emissions (above- 1 GHz)

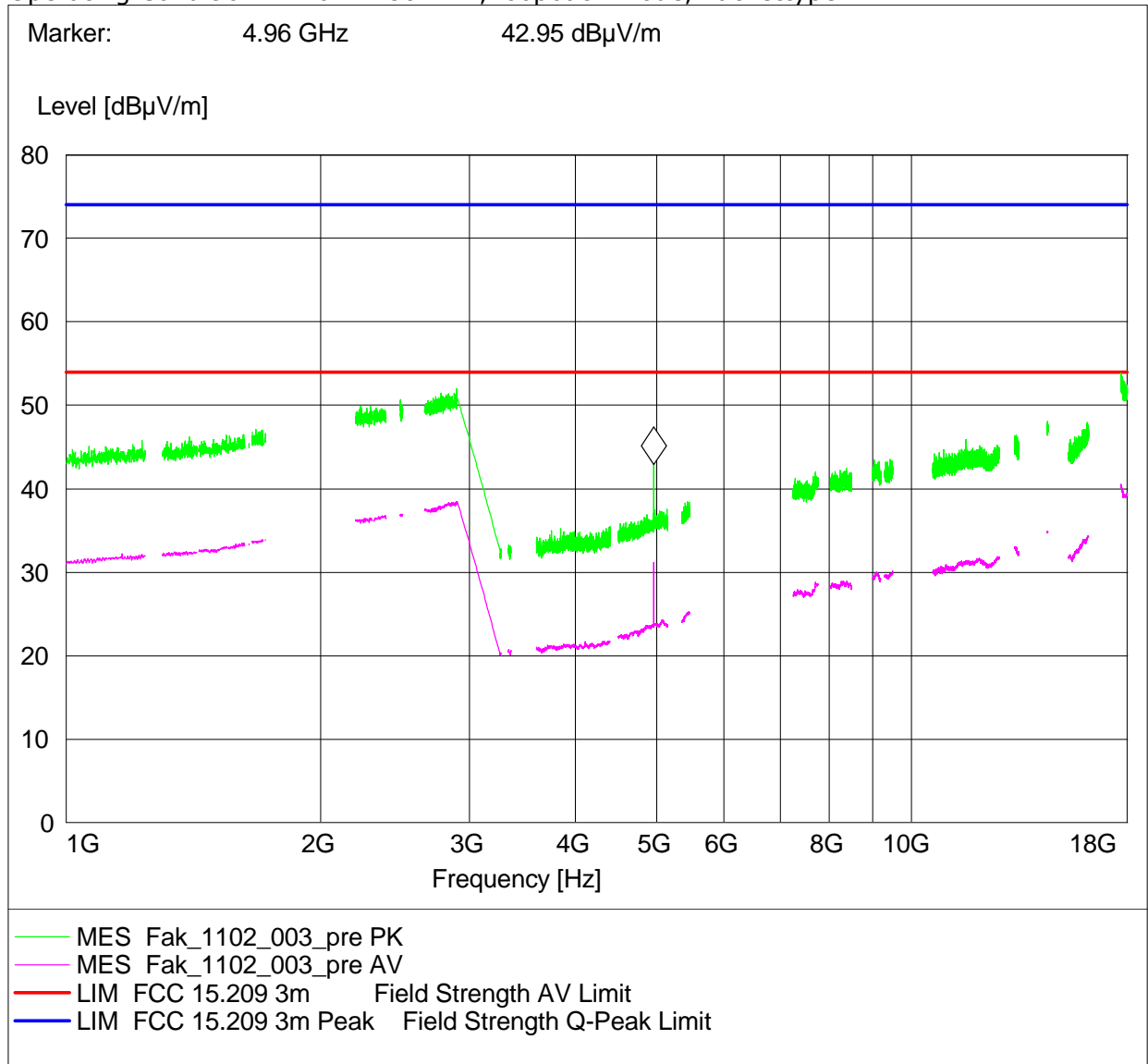
Operating Condition: TX on 2402 MHz, loopback mode, Packettype: DH1



Operating Condition: TX on 2441 MHz, loopback mode, Packettype: DH1

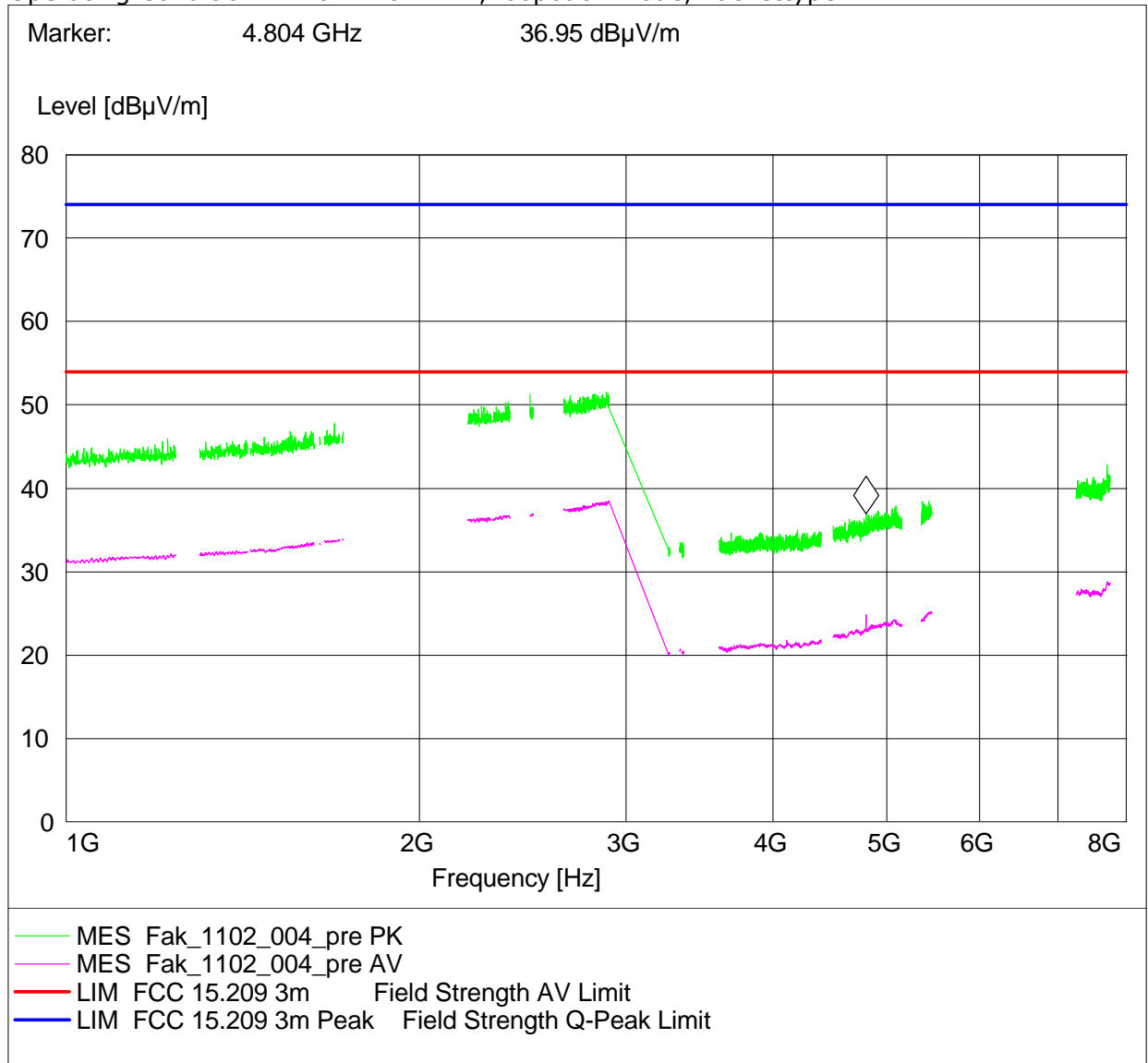


Operating Condition: TX on 2480 MHz, loopback mode, Packettype: DH1

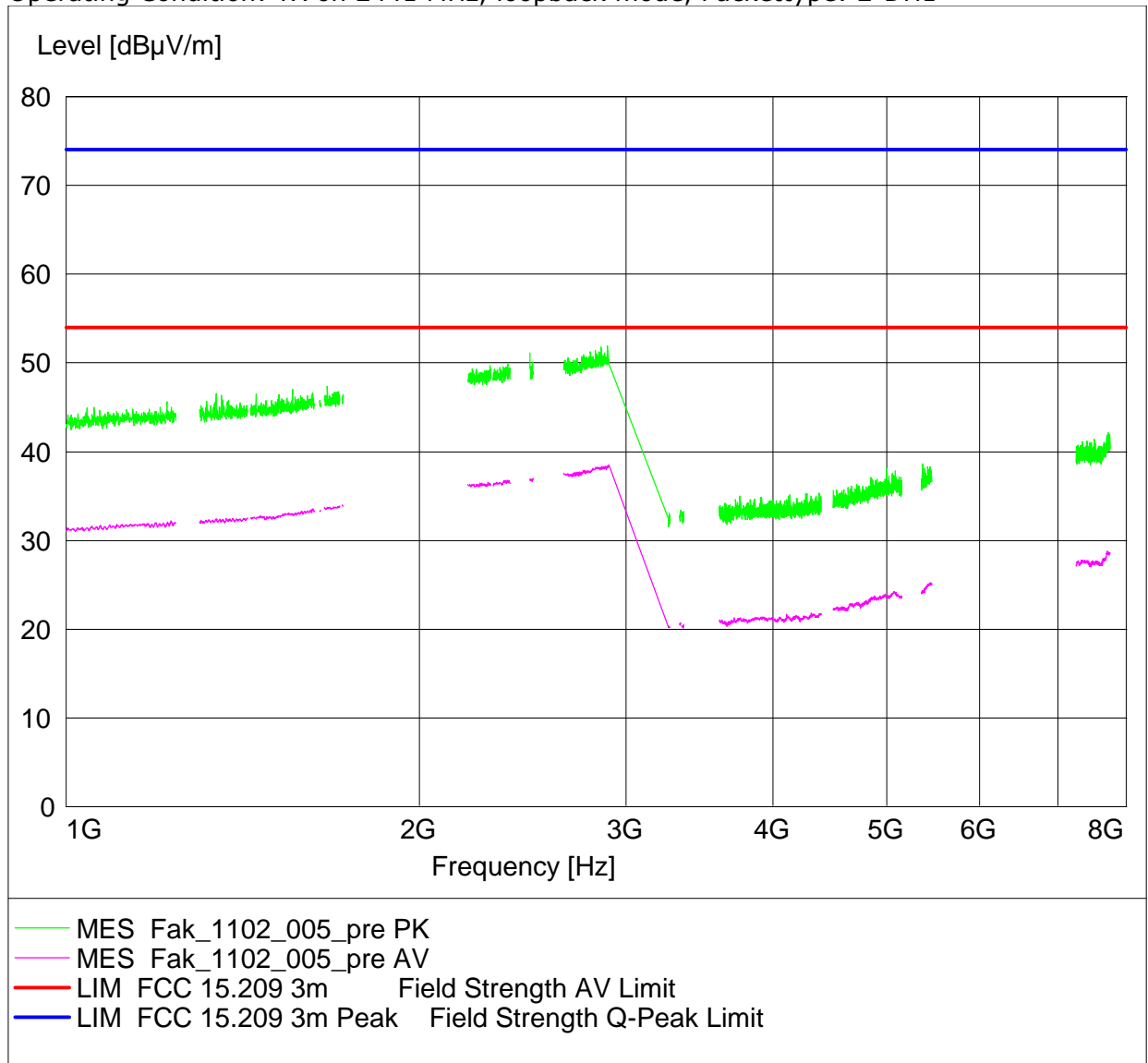




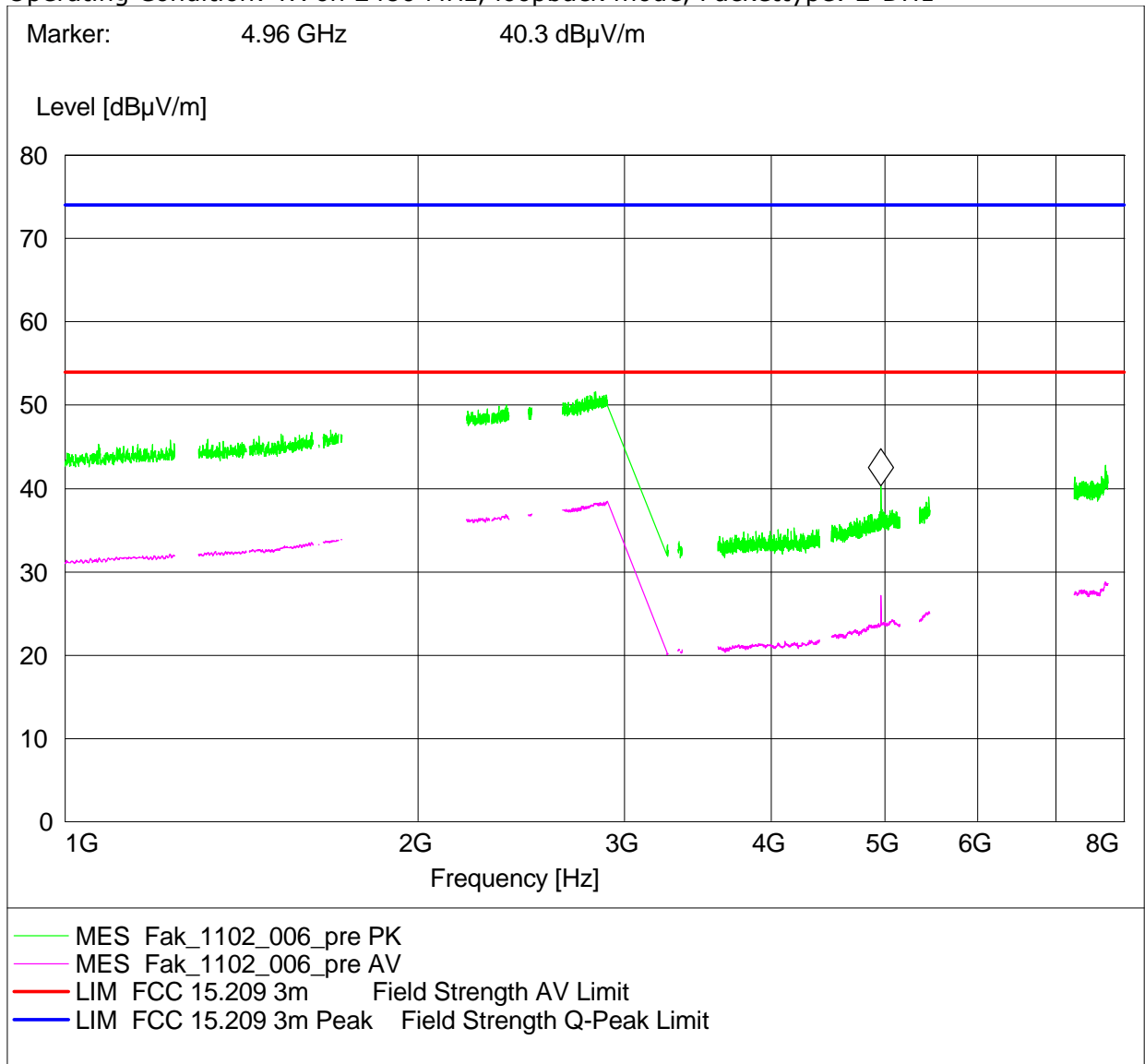
Operating Condition: TX on 2402 MHz, loopback mode, Packettype: 2-DH1



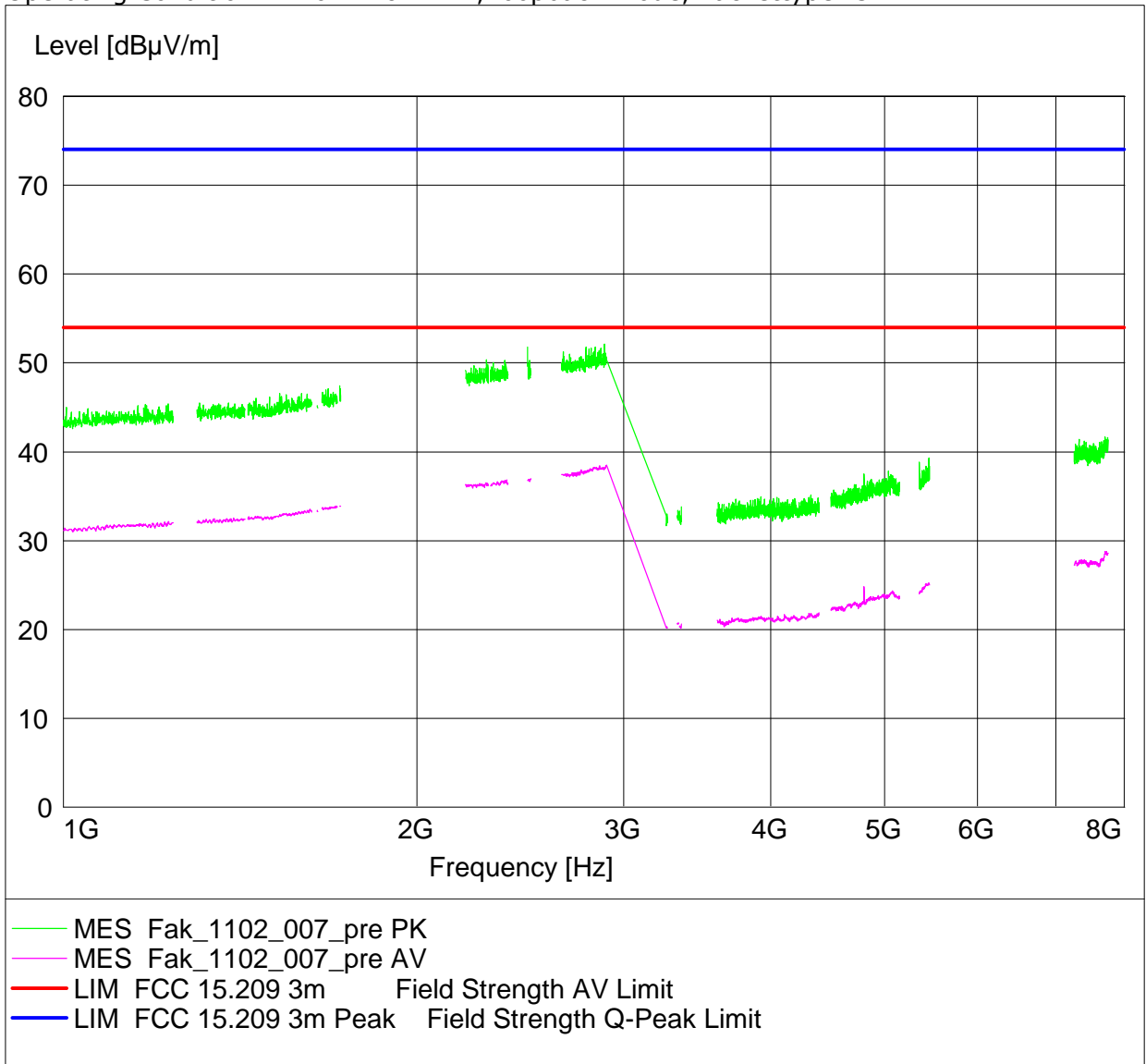
Operating Condition: TX on 2441 MHz, loopback mode, Packettype: 2-DH1



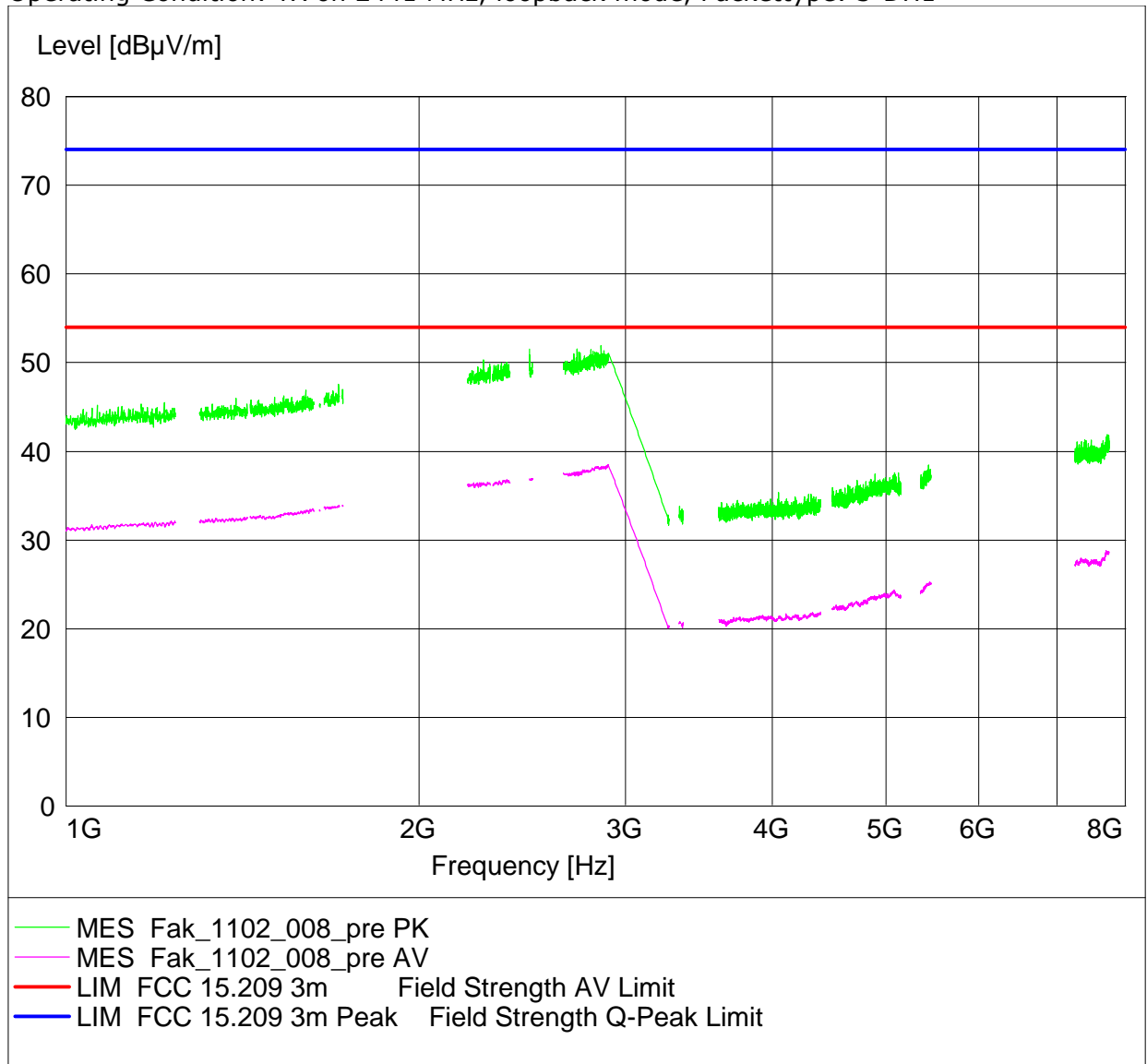
Operating Condition: TX on 2480 MHz, loopback mode, Packettype: 2-DH1



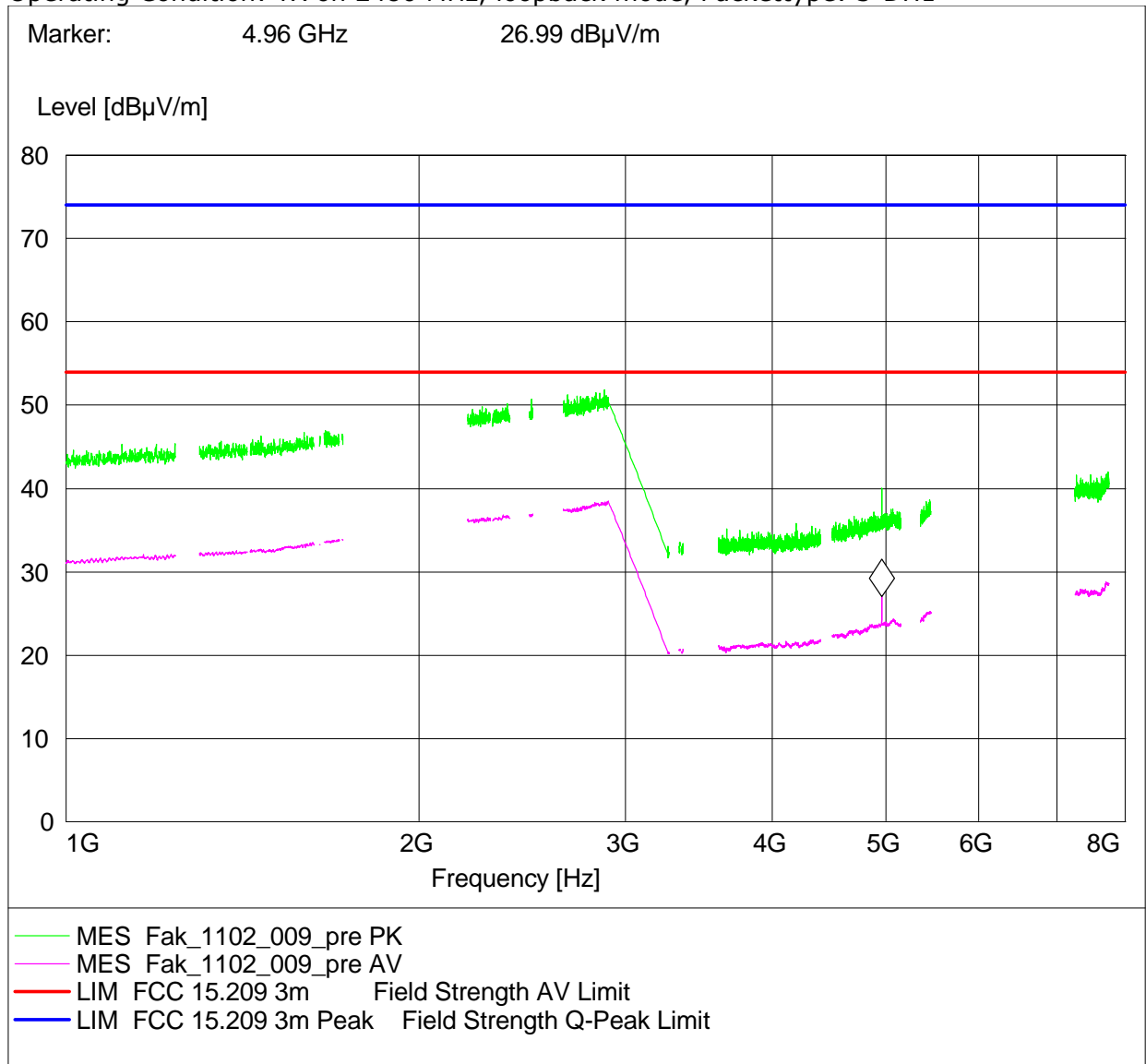
Operating Condition: TX on 2402 MHz, loopback mode, Packettype: 3-DH1



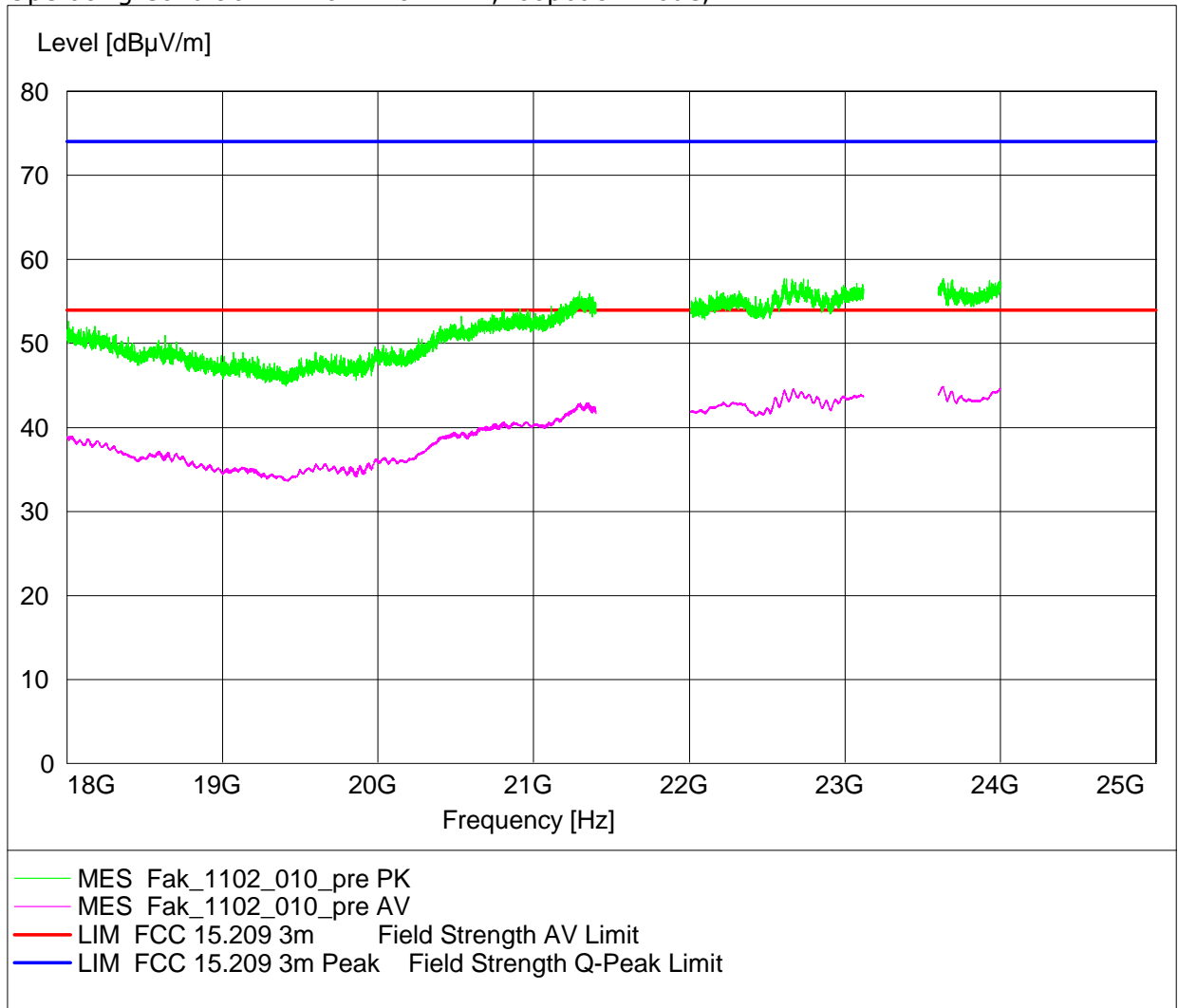
Operating Condition: TX on 2441 MHz, loopback mode, Packettype: 3-DH1



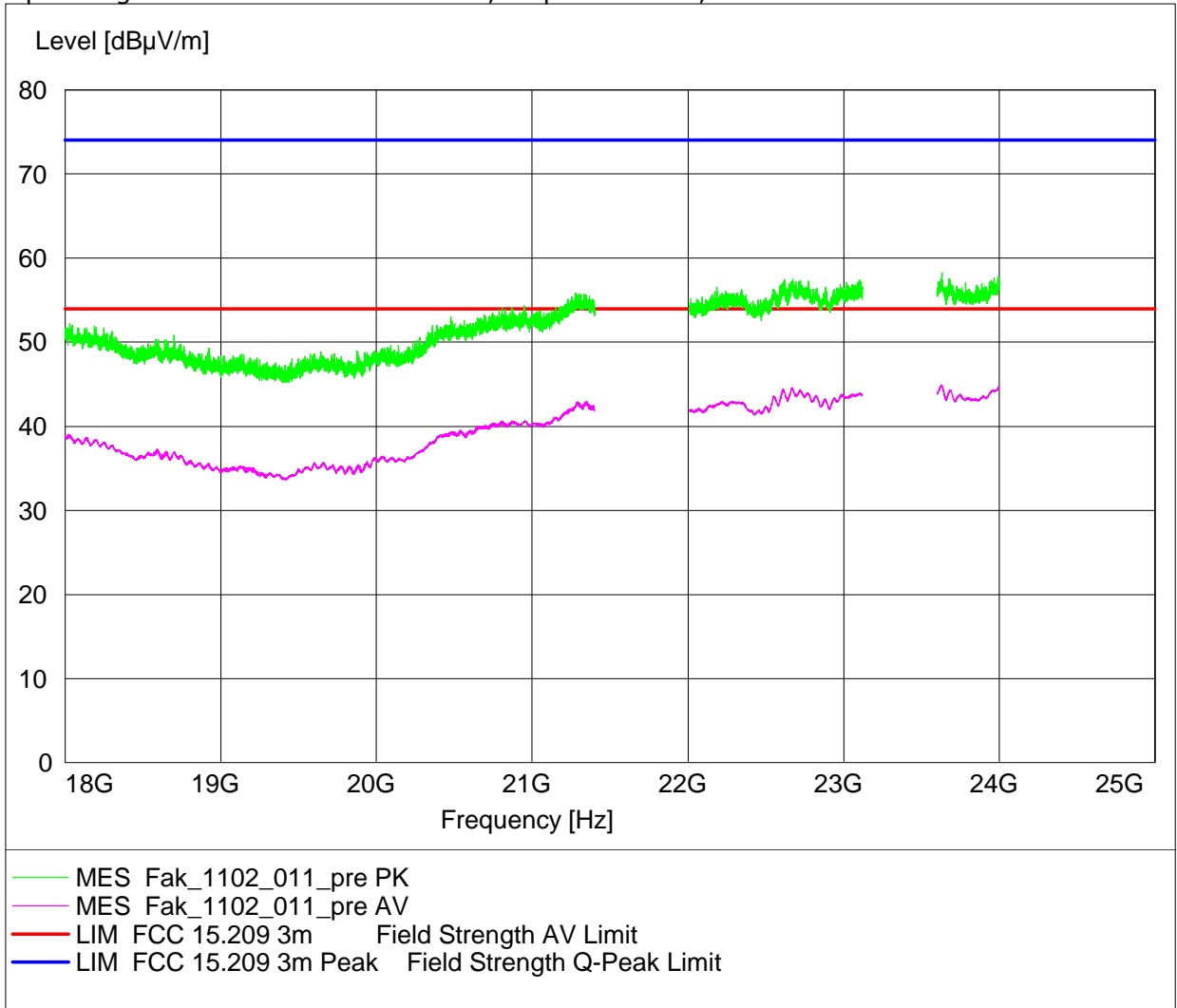
Operating Condition: TX on 2480 MHz, loopback mode, Packettype: 3-DH1



Operating Condition: TX on 2402 MHz, loopback mode, DH1



Operating Condition: Tx on 2441 MHz, loopback mode, DH1





Operating Condition: TX on 2480 MHz, loopback mode, DH1

