



**InterLab®**

FCC Measurement/Technical Report on

NFC transceiver  
**INARI8-3GAN-1**

**Report Reference:** MDE\_AAVAM\_1301\_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 test laboratory.

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## 0 Summary

### 0.1 Technical Report Summary

#### Type of Authorization

Certification for an intentional radiator operating at 13.56 MHz

#### Applicable FCC Rules

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

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 15, Subpart C – Intentional Radiators

§ 15.205 Restricted bands of operation

§ 15.207 Conducted limits

§ 15.209 Radiated emission limits; general requirements

§ 15.215 Additional provisions to the general radiated emission limitations

§ 15.225 Operation within the band 13.110-14.010 MHz

#### Note:

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

#### Summary Test Results:

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



## 0.2 Measurement Summary

<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			2009
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	<b>Final Result</b>
op-mode 1	Setup_01	AC port (power line)	passed
<b>FCC Part 15, Subpart C</b>	<b>§ 15.209</b>		
Radiated Emissions			
The measurement was performed according to ANSI C63.4			2009
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	<b>Final Result</b>
op-mode 1	Setup_01	Enclosure	passed
<b>FCC Part 15, Subpart C</b>	<b>§ 15.215</b>		
Occupied Bandwidth			
The measurement was performed according to FCC § 2.1049			10-1-13 Edition
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	<b>Final Result</b>
op-mode 1	Setup_02	Enclosure	passed
<b>FCC Part 15, Subpart C</b>	<b>§ 15.225</b>		
Spectrum Mask			
The measurement was performed according to ANSI C63.4			2009
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	<b>Final Result</b>
op-mode 1	Setup_01	Enclosure	passed
<b>FCC Part 15, Subpart C</b>	<b>§ 15.225</b>		
Frequency Tolerance			
The measurement was performed according to FCC § 2.1055			10-1-13 Edition
<b>OP-Mode</b>	<b>Setup</b>	<b>Port</b>	<b>Final Result</b>
op-mode 2	Setup_01	Enclosure	passed

Responsible for  
Accreditation Scope:

Responsible  
for Test Report:



## 1 Administrative Data

### 1.1 Testing Laboratory

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

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

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

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

Report Template Version: 2012-03-14

### 1.2 Project Data

Responsible for testing and report: Patrick lomax  
Date of Test(s): 2014-03-21 to 2014-03-24  
Date of Report: 2014-03-26

### 1.3 Applicant Data

Company Name: Aava Mobile Oy  
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### 1.4 Manufacturer Data

Company Name: please see applicant data  
Address:

Contact Person:



## 2 Test object Data

### 2.1 General EUT Description

<b>Equipment under Test</b>	Tablet computer with embedded cellular modem and WLAN/BT
<b>Type Designation:</b>	Inari8-3GAN-1
<b>Kind of Device: (optional)</b>	13.56 MHz NFC transceiver
<b>Voltage Type:</b>	DC of AC/DC converter or DC (internal battery)
<b>Voltage level:</b>	120 – 240 V, 50 – 60 Hz AC / 3.8 V DC

#### General product description:

The Inari8-3GAN-1 is a tablet computer with embedded cellular modem and WLAN/BT. It supports the following technologies: WCDMA, HSDPA, HSUPA, HSPA+, GPRS, EDGE and LTE for cellular communication, IEEE 802.11 a/b/g/n for WiFi, Bluetooth 4.0 + HS and NFC transceiver. The EUT has a built in GPS receiver as well.

#### Specific product description for the EUT:

The object of this test report is the NFC transceiver, operating in 13.56 MHz frequency range.

#### The EUT provides the following ports:

##### Ports

- Enclosure
- AC in (@ charger)
- DC in (Micro USB interface @ tablet)
- Audio Jack (3.5 mm @ tablet)
- Data (USB 2.0 Port @ tablet)
- DC in (12 V @ docking station)
- Data (LAN @ docking station)
- Data (docking connector)
- Data (2 x USB 2.0 Port @ docking station)
- Data (1 x USB 3.0 Port @ docking station)
- Data (HDMI @ docking station)

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: DE1004000ab01) Remark:	Inari8- 3GAN-C1	Variant: AB-W, B	IN140 60109	Pre-Prod Sample IMEI: 866274011175167	Win.8.1 Pro.	-
EUT B (Code: DE1004000ad02) Remark:	Inari8- 3GAN-A1	Variant: AB-W, B	IN140 60123	Pre-Prod Sample IMEI: 866274011175209	Win.8.1 Pro.	-

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

## 2.3 Ancillary Equipment

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

Short Description	Equipment under Test	Type Designation	Serial No.	HW Status	SW Status	FCC ID
AE 1	Docking Station (DS)	AavaMobile	XHH40560983	-	-	-
AE 2	AC/DC adapter for DS (USA st.)	Toshiba, Model: PA396U-1ACA	G71C000CK110; TO113510001671A	-	-	-
AE 3	USB Cable, Type A <=> Micro USB	28AWG/1P+24A WG/2C E326508, AWM 2725, 1m	-	-	-	-
AE 4	dummy battery module	AavaMobile/ INARI	#3	-	-	-

## 2.4 Auxiliary Equipment

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

Short Description	Equipment under Test	Type Designation	Serial no.	HW Status	SW Status	FCC ID
AUX 1 (Code DE1004000 tag1)	NFC Tag	UPM RAFLATRAC Race Track	25_17	-	-	-

## 2.5 EUT Setups

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

Setup No.	Combination of EUTs	Description and Rationale
Setup_01	EUT A + AUX 1	EUT reading a tag (representative setup for radiated measurements)
Setup_02	EUT A + AUX 1 + AE 4	EUT reading a tag (representative setup for radiated measurements in normal and extreme conditions)
Setup_03	EUT A + AE 1-3 + AUX 1	EUT reading a tag (representative test for radiated emissions measurements above 30 MHz)
Setup_04	EUT A + AE 1-3 + AUX 1	setup for test "AC Mains conducted"

## 2.6 Operating Modes

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

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

## 2.7 Special software used for testing

NXP Application version 1.6.

## 2.8 Product labelling

### 2.8.1 FCC ID label



### 2.8.2 Location of the label on the EUT

Please refer to the documentation of the applicant.



### 3 Test Results

#### 3.1 Conducted emissions (AC power line)

**Standard** FCC Part 15, Subpart C

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

##### 3.1.1 Test Description

The test set-up was made in accordance to the general provisions of ANSI C63.4. 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  $50\mu\text{H} \parallel 50\text{ Ohm}$  Line Impedance Stabilization Network (LISN) which meets the requirements of ANSI C63.4, Annex B, in the frequency range of the measurements. 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
- AC Mains supplied at 120 V / 60 Hz

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.



### 3.1.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.207

Frequency Range (MHz)	QP Limit (dB $\mu$ V)	AV Limit (dB $\mu$ V)
0.15 – 0.5	66 to 56	56 to 46
0.5 – 5	56	46
5 – 30	60	50

Used conversion factor: Limit (dB $\mu$ V) = 20 log (Limit ( $\mu$ V)/1 $\mu$ V).

### 3.1.3 Test Protocol

Temperature: 23 °C  
Air Pressure: 1009 hPa  
Humidity: 39 %

Op. Mode	Setup	Port
op-mode 1	Setup_04	AC Port (power line)

Power line	Frequency MHz	Measured value dB $\mu$ V	Delta to limit dB $\mu$ V	Remarks
L1	0.210	51.3	11.9	QP-detector
N	0.280	42.0	18.8	QP-detector
N	0.420	38.2	19.2	QP-detector
L1	13.560	45.7	4.3	QP-detector

Remark: Please see annex for the measurement plot.

The operating frequency (wanted signal / carrier) of the EUT is set to 13.56 MHz (NFC) by the manufacturer and cannot be changed.

The conducted emission found in the last row of the table above, clearly corresponds to the fixed transmitter frequency of the EUT. It was determined, that this emission on the AC mains is based on radiated coupling into the test setup. Therefore, for the assessment of the test result, the fixed transmitter frequency of the EUT is not considered.

The chosen operating mode is selected as representative mode to generate "worst-case" conditions, i.e. high power consumption.

### 3.1.4 Test result: Conducted emissions (AC power line)

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



### 3.2 Spurious radiated emissions

**Standard** FCC Part 15, Subpart C

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

#### 3.2.1 Test Description

The test set-up was made in accordance to the general provisions of ANSI C63.4 in a typical installation configuration. The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m<sup>2</sup> in the semi-anechoic chamber. The influence of the EUT support table that is used between 30–1000 MHz was evaluated.

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

##### 1. Measurement up to 30 MHz

The Loop antenna HFH2-Z2 is used.

###### **Step 1:** pre measurement

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

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

###### **Step 2:** final measurement

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

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

## 2. Measurement above 30 MHz and up to 1 GHz

### Step 1: Preliminary scan

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

Settings for step 1:

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

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

### Step 2: second measurement

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

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

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

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

The last two values have now the following accuracy:

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

### Step 3: final measurement

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

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

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

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.

#### 3.2.2 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 ( $\mu$ V/m)	Measurement distance (m)	Limit(dB $\mu$ V/m @10m)
0.009 – 0.49	2400/F(kHz)	300	Limit (dB $\mu$ V/m) +59.1dB
0.49 – 1.705	24000/F(kHz)	30	Limit (dB $\mu$ V/m) +19.1dB
1.705 – 30	30	30	Limit (dB $\mu$ V/m) +19.1dB

Frequency in MHz	Limit ( $\mu$ V/m)	Measurement distance (m)	Limit (dB $\mu$ 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

#### §15.35(b)

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

Used conversion factor: Limit (dB $\mu$ V/m) = 20 log (Limit ( $\mu$ V/m)/1 $\mu$ V/m)



### 3.2.3 Test Protocol

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

#### 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 $\mu$ V/m			Limit dB $\mu$ V/m	Limit dB $\mu$ V/m	Limit dB $\mu$ V/m	Delta to limit dB	Delta to limit dB	
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV	
–	–	–	–	–	–	–	–	–	–	–

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

#### 3.2.3.2 Measurement above 30 MHz

Op. Mode	Setup	Port								
op-mode 1	Setup_03	Enclosure								
Polarisation	Frequency MHz	Corrected value dB $\mu$ V/m			Limit dB $\mu$ V/m	Limit dB $\mu$ V/m	Limit dB $\mu$ V/m	Delta to limit dB	Delta to limit dB	
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV	
vertical	30.120	27.6	–	–	40.0	–	–	12.4	–	
vertical	30.780	29.5	–	–	40.0	–	–	10.5	–	
vertical	31.320	27.7	–	–	40.0	–	–	12.3	–	
vertical	48.000	27.4	–	–	40.0	–	–	12.6	–	
vertical	49.080	24.4	–	–	40.0	–	–	15.6	–	
vertical	72.000	27.2	–	–	40.0	–	–	12.8	–	
vertical	87.960	33.1	–	–	40.0	–	–	6.9	–	
vertical	103.980	40.1	–	–	43.5	–	–	3.4	–	
vertical	180.000	36.0	–	–	43.5	–	–	7.5	–	
horizontal	939.960	33.6	–	–	46.0	–	–	12.4	–	

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



### 3.3 Occupied bandwidth

**Standard** FCC Part 15, Subpart C

**The test was performed according to:** FCC §15.31

#### 3.3.1 Test Description

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

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

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

#### 3.3.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.215 (c)

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

#### 3.3.3 Test Protocol

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

Op. Mode	Setup	Port
op-mode 1	Setup_02	Enclosure
20 dB bandwidth kHz	99% bandwidth kHz	Remarks
40.080 kHz	430.862 kHz	The 99% bandwidth from 13.346072 MHz to 13.776934 MHz is contained within the designated frequency band 13.110 MHz to 14.010 MHz.

Remark: Please see annex for the measurement plot.

#### 3.3.4 Test result: Occupied bandwidth

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



### 3.4 Spectrum mask

**Standard** FCC Part 15, Subpart C

**The test was performed according to:** FCC §15.225

#### 3.4.1 Test Description

The test set-up was made in accordance to the general provisions of ANSI C 63.4. The Equipment Under Test (EUT) was set up on a non-conductive table in the anechoic chamber. The radiated emissions measurements were made in a typical installation configuration. The measurement procedure is implemented into the EMI test software ES-K1 from R&S. The Loop antenna HFH2-Z2 is used.

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

#### 3.4.2 Test Limits

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

#### 3.4.3 Test Protocol

Temperature: 23 °C  
Air Pressure: 1009 hPa  
Humidity: 39 %

Op. Mode	Setup	Port
op-mode 1	Setup_01	Enclosure
Maximum value dB $\mu$ V/m	Limit dB $\mu$ V/m	Remarks
-54.76	103	measuring distance 10 m

Remark: Please see annex for the measurement plot.

#### 3.4.4 Test result: Spectrum mask

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



### 3.5 Frequency tolerance

**Standard** FCC Part 15, Subpart C

**The test was performed according to:** FCC §15.225

#### 3.5.1 Test Description

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

#### 3.5.2 Test Limits

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



## Test Protocol

Temperature: 23 °C  
Air Pressure: 1009 hPa  
Humidity: 38 %

Op. Mode	Setup	Port		
op-mode 1	Setup_02	Enclosure		
Temperature / °C	Voltage / V	Time / min.	Frequency / MHz	Delta / Hz
50	3.8	0	13.559905	-102
50	3.8	5	13.559899	-101
50	3.8	10	13.559898	-95
40	3.8	0	13.559912	-88
40	3.8	5	13.559906	-94
40	3.8	10	13.559903	-97
30	3.8	0	13.559925	-75
30	3.8	5	13.559922	-78
30	3.8	10	13.559918	-82
20	4.35	0	13.559936	-64
20	4.35	5	13.559933	-67
20	4.35	10	13.559932	-68
20	3.8	0	13.559935	-65
20	3.8	5	13.559933	-67
20	3.8	10	13.559932	-68
20	3.5	0	13.559934	-66
20	3.5	5	13.559933	-67
20	3.5	10	13.559932	-68
10	3.8	0	13.559948	-51
10	3.8	5	13.559948	-52
10	3.8	10	13.559949	-50
0	3.8	0	13.559965	-35
0	3.8	5	13.559964	-36
0	3.8	10	13.559965	-35
-10	3.8	0	13.559985	-25
-10	3.8	5	13.559984	-26
-10	3.8	10	13.559984	-26
-20	3.8	0	13.560022	22
-20	3.8	5	13.560021	21
-20	3.8	10	13.560021	21

Remark: The limit is a delta of max.  $\pm 1356$  Hz (0.01 %).

### 3.5.3 Test result: Frequency tolerance

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



## 4 Test Equipment

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

### Test Equipment Anechoic Chamber

Lab ID:	Lab 2		
Manufacturer:	Frankonia		
Description:	Anechoic Chamber for radiated testing		
Type:	10.58x6.38x6.00 m <sup>3</sup>		
	Calibration Details	Last Execution	Next Exec.
	NSA (FCC, IC)	2011/01/10	2014/01/10
	NSA (FCC)	2014/01/09	2017/01/09

### Single Devices for Anechoic Chamber

Single Device Name	Type	Serial Number	Manufacturer
Air compressor	none	-	Atlas Copco
Anechoic Chamber	10.58 x 6.38 x 6.00 m <sup>3</sup>	none	Frankonia
	Calibration Details	Last Execution	Next Exec.
	FCC listing 96716 3m Part15/18	2011/01/11	2014/01/10
	IC listing 3699A-1 3m	2011/02/07	2014/02/06
	FCC listing 96716 3m Part15/18	2014/01/09	2017/01/08
Controller Maturo	MCU	961208	Maturo GmbH
EMC camera	CE-CAM/1	-	CE-SYS
EMC camera Nr.2	CCD-400E	0005033	Mitsubishi
Filter ISDN	B84312-C110-E1		Siemens&Matsushita
Filter Universal 1A	BB4312-C30-H3	-	Siemens&Matsushita



## Test Equipment Auxiliary Equipment for Conducted emissions

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

### Single Devices for Auxiliary Equipment for Conducted emissions

Single Device Name	Type	Serial Number	Manufacturer
Cable "LISN to ESI"	RG214	W18.03+W48.03	Huber&Suhner
Impedance Stabilization Network	ISN T800	36159	Teseq GmbH
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2014/02/06 2016/02/28
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN ENY41	100002	Rohde & Schwarz GmbH & Co. KG
	Standard calibration		2013/03/01 2015/03/31
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN ST08	36292	Teseq GmbH
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2014/01/10 2016/01/31
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN T8-Cat6	32187	Teseq GmbH
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2014/01/08 2016/01/31
One-Line V-Network	ESH 3-Z6	100489	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2011/02/08 2014/02/07
One-Line V-Network	ESH 3-Z6	100570	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2013/11/25 2016/11/24
Two-Line V-Network	ESH 3-Z5	828304/029	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standart Calibration		2013/03/01 2015/02/28
Two-Line V-Network	ESH 3-Z5	829996/002	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2013/03/01 2015/02/28



### Test Equipment Auxiliary Equipment for Radiated emissions

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

### Single Devices for Auxiliary Equipment for Radiated emissions

Single Device Name	Type	Serial Number	Manufacturer
Antenna mast	AM 4.0	AM4.0/180/119205 13	Maturo GmbH
Antenna mast	AS 620 P	620/37	HD GmbH
Biconical Broadband Antenna	SBA 9119	9119-005	Schwarzbeck
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2009/06/04 2014/06/03
Biconical dipole	VUBA 9117 Standard Calibration	9117-108	Schwarzbeck 2012/01/18 2015/01/17
Broadband Amplifier 18MHz-26GHz	JS4-18002600-32-5P	849785	Miteq
Broadband Amplifier 1GHz-4GHz	AFS4-01000400-1Q-10P-4	-	Miteq
Broadband Amplifier 30MHz-18GHz	JS4-00101800-35-5P	896037	Miteq
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01-2+W38.01-2	Kabel Kusch
Cable "ESI to Horn Antenna"	UFB311A+UFB293C	W18.02-2+W38.02-2	Rosenberger Micro-Coax
Double-ridged horn	HF 906 Standard Calibration	357357/001	Rohde & Schwarz GmbH & Co. KG 2012/05/18 2015/05/17
Double-ridged horn	HF 906 Standard Calibration	357357/002	Rohde & Schwarz GmbH & Co. KG 2012/06/26 2015/06/25
High Pass Filter	4HC1600/12750-1.5-KK	9942011	Trilithic
High Pass Filter	5HC2700/12750-1.5-KK	9942012	Trilithic
High Pass Filter	5HC3500/12750-1.2-KK	200035008	Trilithic
High Pass Filter	WHKX 7.0/18G-8SS	09	Wainwright
Horn Antenna Schwarzbeck 15-26 GHz	BBHA 9170		
BBHA 9170			
Log.-per. Antenna	HL 562 Ultralog <i>Calibration Details</i>	100609	Rohde & Schwarz GmbH & Co. KG <i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2012/12/18 2015/12/17
Log.-per. Antenna	HL 562 Ultralog	830547/003	Rohde & Schwarz GmbH & Co. KG
Loop Antenna	HFH2-Z2 <i>Calibration Details</i>	829324/006	Rohde & Schwarz GmbH & Co. KG <i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2011/10/27 2014/10/26
Pyramidal Horn Antenna 26,5 GHz	3160-09	00083069	EMCO Elektronik GmbH
Pyramidal Horn Antenna 40 GHz	3160-10	00086675	EMCO Elektronik GmbH



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

Single Device Name	Type	Serial Number	Manufacturer
Tilt device Maturo (Rohacell)	Antrieb TD1.5-10kg	TD1.5-10kg/024/3790709	Maturo GmbH

#### Test Equipment Auxiliary Test Equipment

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

#### Single Devices for Auxiliary Test Equipment

Single Device Name	Type	Serial Number	Manufacturer
Broadband Power Divider1506A / 93459 N (Aux)		LM390	Weinschel Associates
Broadband Power DividerWA1515 SMA		A855	Weinschel Associates
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	Fluke Europe B.V.
Calibration Details		Last Execution	Next Exec.
	Customized calibration	2013/12/04	2015/12/03
Fibre optic link Satellite (Aux)	FO RS232 Link	181-018	Pontis
Fibre optic link Transceiver (Aux)	FO RS232 Link	182-018	Pontis
Isolating Transformer	LTS 604	1888	Thalheimer Transformatorenwerke GmbH
Notch Filter Ultra Stable (Aux)	WRCA800/960-6EEK	24	Wainwright
Spectrum Analyser	FSP3	836722/011	Rohde & Schwarz GmbH & Co. KG
Calibration Details		Last Execution	Next Exec.
	Standard	2012/06/13	2015/06/12
Vector Signal Generator	SMIQ 03B	832492/061	Rohde & Schwarz GmbH & Co.KG



## Test Equipment Digital Signalling Devices

**Lab ID:** Lab 1, Lab 2, Lab 3  
**Description:** Signalling equipment for various wireless technologies.

### Single Devices for Digital Signalling Devices

Single Device Name	Type	Serial Number	Manufacturer
Bluetooth Signalling Unit CBT		100589	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2011/11/24   2014/11/23
CMW500	CMW500	107500	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Initial factory calibration		2012/01/26   2014/01/25
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2011/11/28   2014/11/27
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		2007/07/16
	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		
	---		
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		2011/12/07   2014/12/06
	<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		2007/01/02
	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		
	---		
	SW: K62, K69		2008/11/03
Vector Signal Generator	SMU200A	100912	Rohde & Schwarz GmbH & Co. KG



### 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 Meter	NRVD	828110/016	Rohde & Schwarz GmbH & Co.KG
	Standard calibration		2013/05/03 2014/05/02
Sensor Head A	NRV-Z1	827753/005	Rohde & Schwarz GmbH & Co.KG
	Standard calibration		2013/04/30 2014/04/29
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	standard calibration		2011/05/12 2014/05/11
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		2011/12/05 2013/12/31
	Standard Calibration		2014/01/07 2016/01/31
	<i>HW/SW Status</i>		<i>Date of Start</i> <i>Date of End</i>
	Firmware-Update 4.34.4 from 3.45 during calibration		2009/12/03

### Test Equipment Multimeter 12

**Lab ID:** Lab 4  
**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>
	Customized calibration		2013/12/04 2015/12/03



## Test Equipment Radio Lab Test Equipment

**Lab ID:** Lab 3  
**Description:** Radio Lab Test Equipment

### Single Devices for Radio Lab Test Equipment

Single Device Name	Type	Serial Number	Manufacturer
Broadband Power Divider SMA	WA1515	A856	Weinschel Associates
Coax Attenuator 10dB SMA 2W	4T-10	F9401	Weinschel Associates
Coax Attenuator 10dB SMA 2W	56-10	W3702	Weinschel Associates
Coax Attenuator 10dB SMA 2W	56-10	W3711	Weinschel Associates
Coax Cable Huber&Suhner	Sucotest 2,0m		Huber&Suhner
Coax Cable Rosenberger Micro Coax FA210A0010003030	FA210A0010003030	54491-2	Rosenberger Micro-Coax
SMA/SMA 1,0m			
Power Meter	NRVD	828110/016	Rohde & Schwarz GmbH & Co.KG
	Standard calibration		2013/05/03 2014/05/02
RF Step Attenuator RSP	RSP	833695/001	Rohde & Schwarz GmbH & Co.KG
Rubidium Frequency Standard	Datum, Model: MFS	5489/001	Datum-Beverly
	Standard calibration		2013/06/24 2014/06/23
Sensor Head A	NRV-Z1	827753/005	Rohde & Schwarz GmbH & Co.KG
	Standard calibration		2013/04/30 2014/04/29
Signal Generator SME	SME03	827460/016	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2011/11/25 2014/11/24
Signal Generator SMP	SMP02	836402/008	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2013/05/06 2016/05/05
Spectrum Analyser	FSIQ26	840061/005	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2013/02/12 2015/02/11
Temperature Chamber Vötsch 03	VT 4002	58566002150010	Vötsch
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Customized calibration		2012/03/12 2014/03/11



### Test Equipment Regulatory Bluetooth RF Test Solution

**Lab ID:** Lab 4  
**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.
Bluetooth Signalling Unit CBT CBT	Standard calibration	100302	Rohde & Schwarz GmbH & Co.KG 2013/08/28 2014/08/27
Power Meter NRVD	NRVD Standard calibration	832025/059	2013/08/26 2014/08/25
Power Sensor NRV Z1 A	PROBE Standard calibration	832279/013	2013/08/28 2014/08/27
Power Supply	NGSM 32/10 Standard calibration	2725	2013/06/14 2015/06/13
Rubidium Frequency Normal MFS	Datum MFS Standard calibration	002	Datum GmbH 2013/08/27 2014/08/26
Signal Analyser FSIQ26	1119.6001.26	832695/007	Rohde & Schwarz GmbH & Co.KG
Vector Signal Generator	SMIQ03B SMIQ03B Standard calibration	832870/017	2013/06/21 2016/06/20

### Test Equipment Shielded Room 02

**Lab ID:** Lab 1  
**Manufacturer:** Frankonia  
**Description:** Shielded Room for conducted testing  
**Type:** 12 qm  
**Serial Number:** none

### Test Equipment Shielded Room 07

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

### Test Equipment T/H Logger 04

**Lab ID:** Lab 4  
**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

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

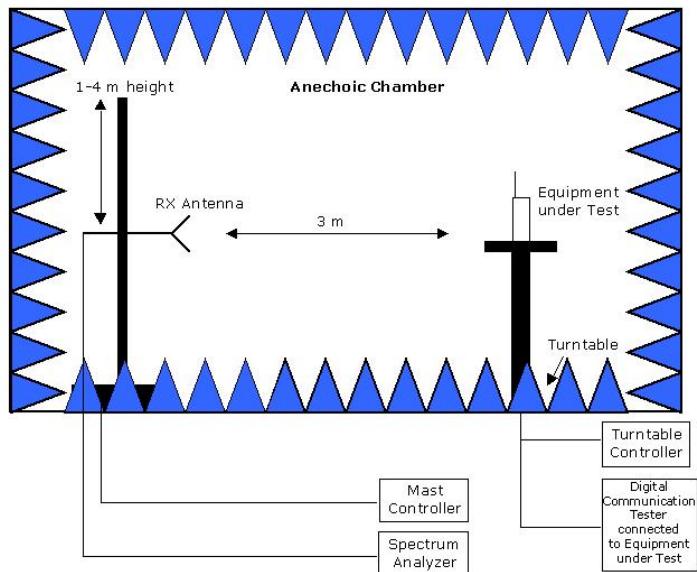
### Single Devices for Temperature Chamber 01

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

## 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.



## 7 FCC and IC Correlation of measurement requirements

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

### Radio equipment

Measurement	FCC reference	IC reference
Conducted emissions on AC Mains	§ 15.207	RSS-Gen Issue 3: 7.2.4
Out-of-band emissions	§ 15.225 (d)	RSS-Gen Issue 3: 7.2.5; RSS-210 Issue 8: A2.6
In-band emissions	§ 15.225 (a) / (b) / (c)	RSS-210 Issue 8: A2.6
Frequency stability	§ 15.225 (e)	RSS-210 Issue 8: A2.6
Antenna requirement	§ 15.203 / 15.204	RSS-Gen Issue 3: 7.1.2
Receiver spurious emissions	-	RSS-210 Issue 8: 2.3 RSS-Gen Issue 3: 6 *)
Handling of active and passive tag devices of RFID application	§ 15.225 (f)	RSS-Gen Issue 3: 7.1.8

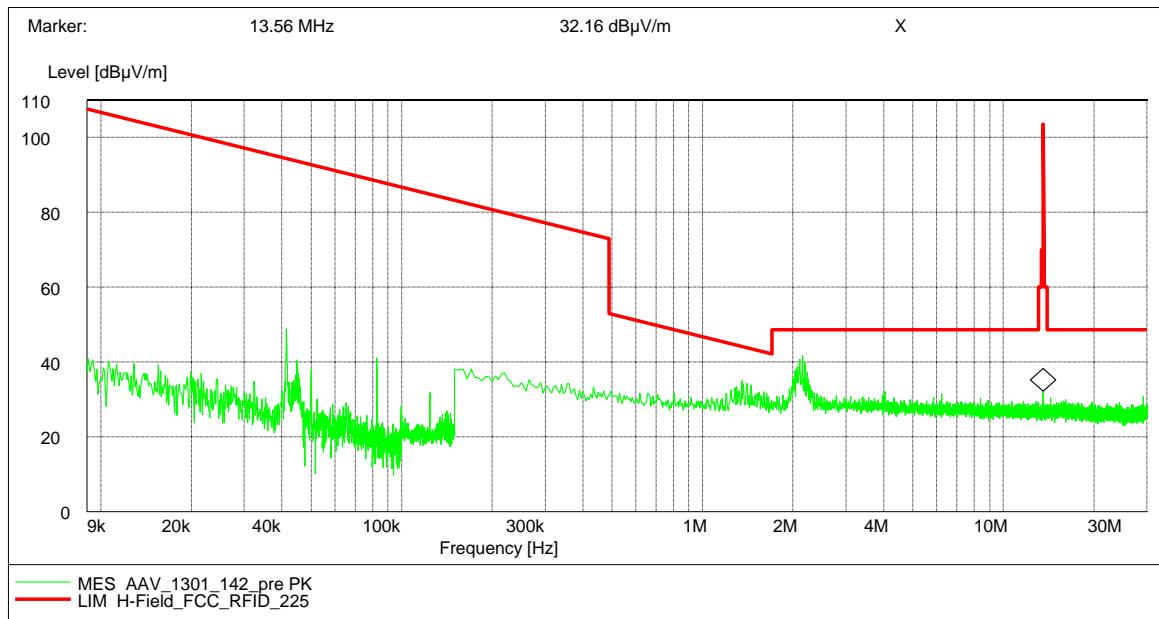
\*) Receivers operating below 30 MHz are exempted with respect to Notice 2012-DRS0126.

## 8 Annex measurement plots

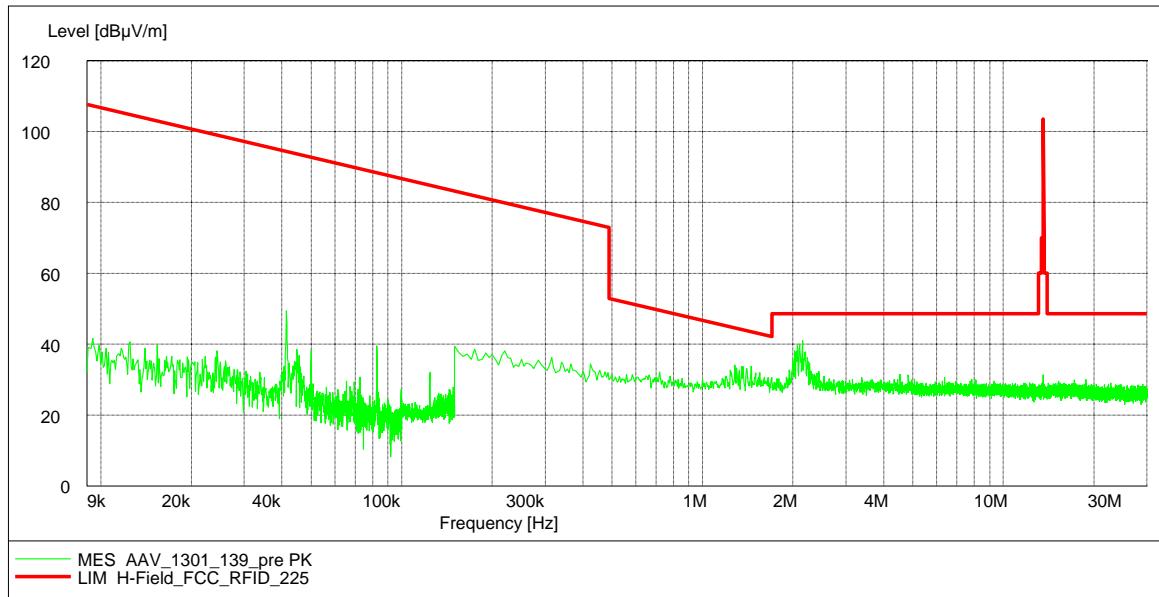
### 8.1 Radiated emissions

#### 8.1.1 Radiated emissions ( $f < 30$ MHz)

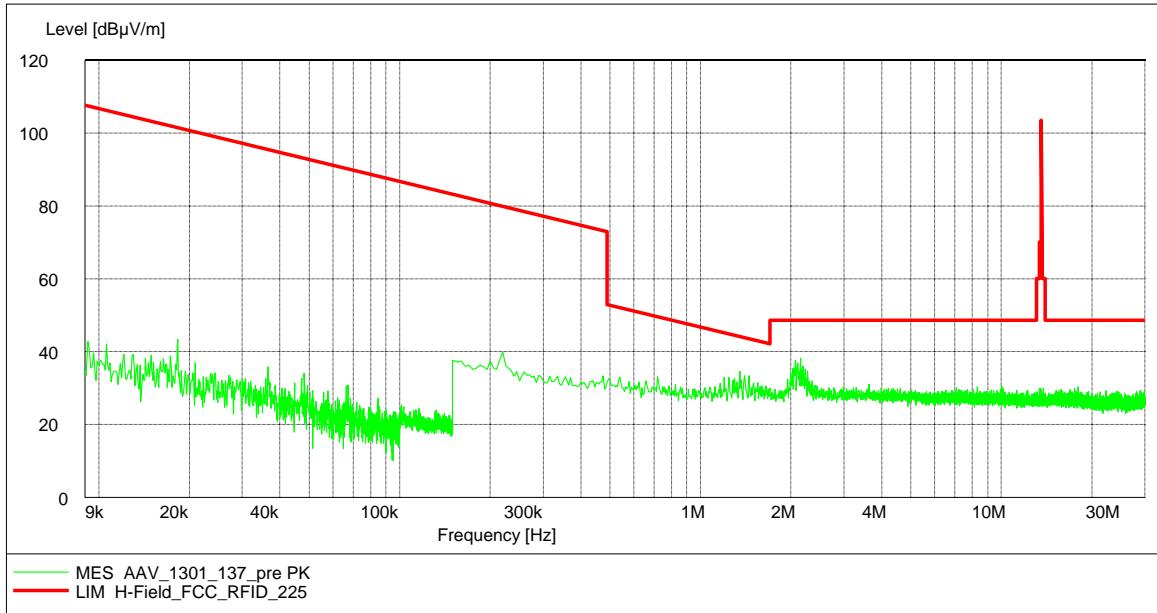
Antenna position 90°  
EUT position horizontal



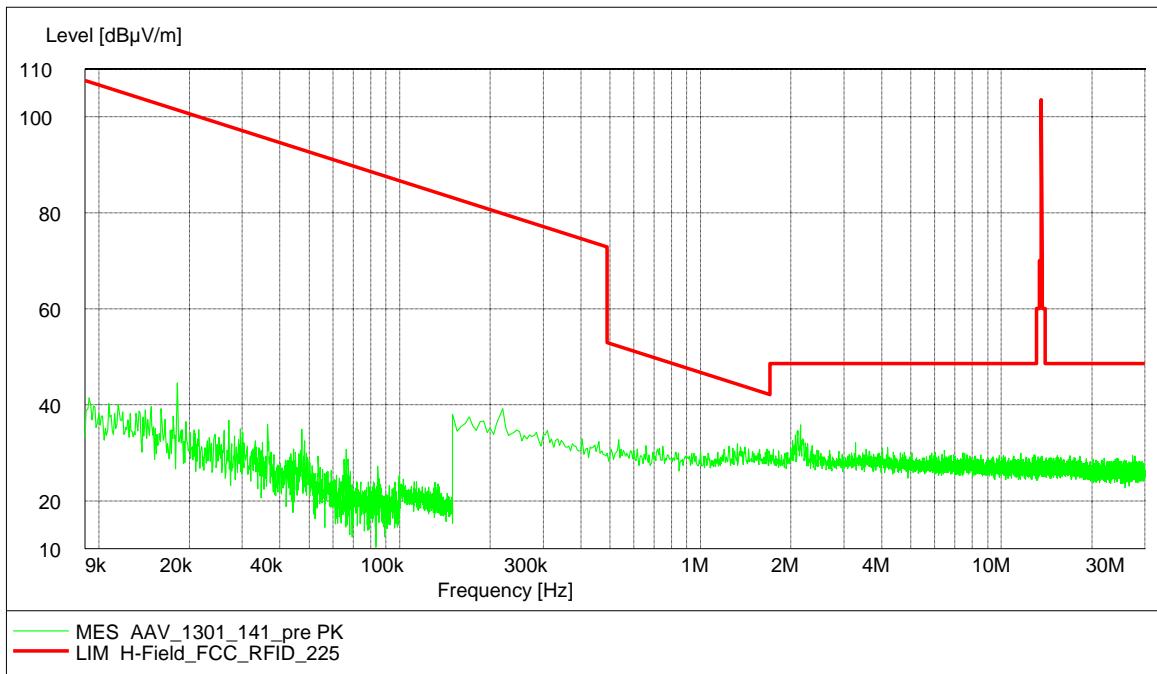
Antenna position 90°  
EUT position vertical



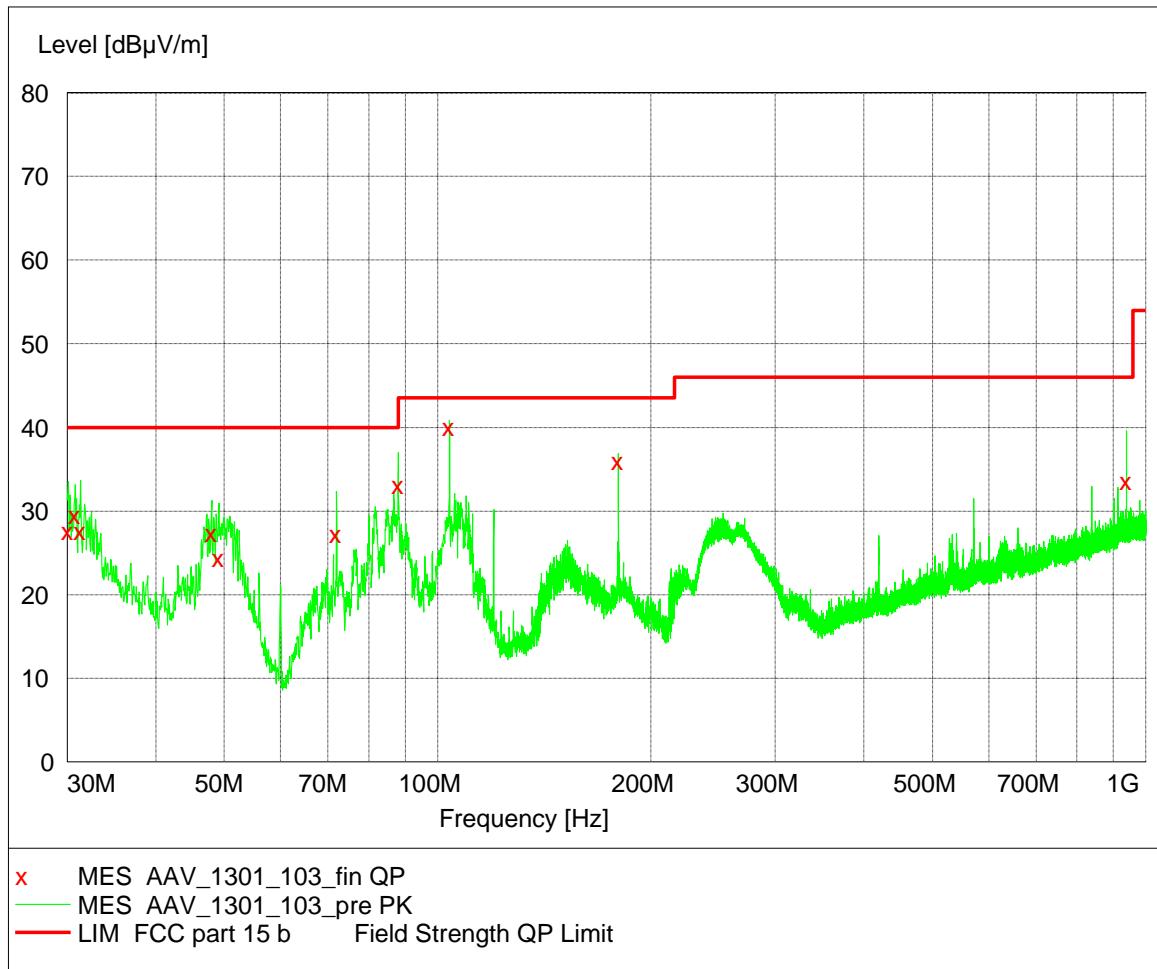
Antenna position 0°  
EUT position vertical



Antenna position 0°  
EUT position horizontal

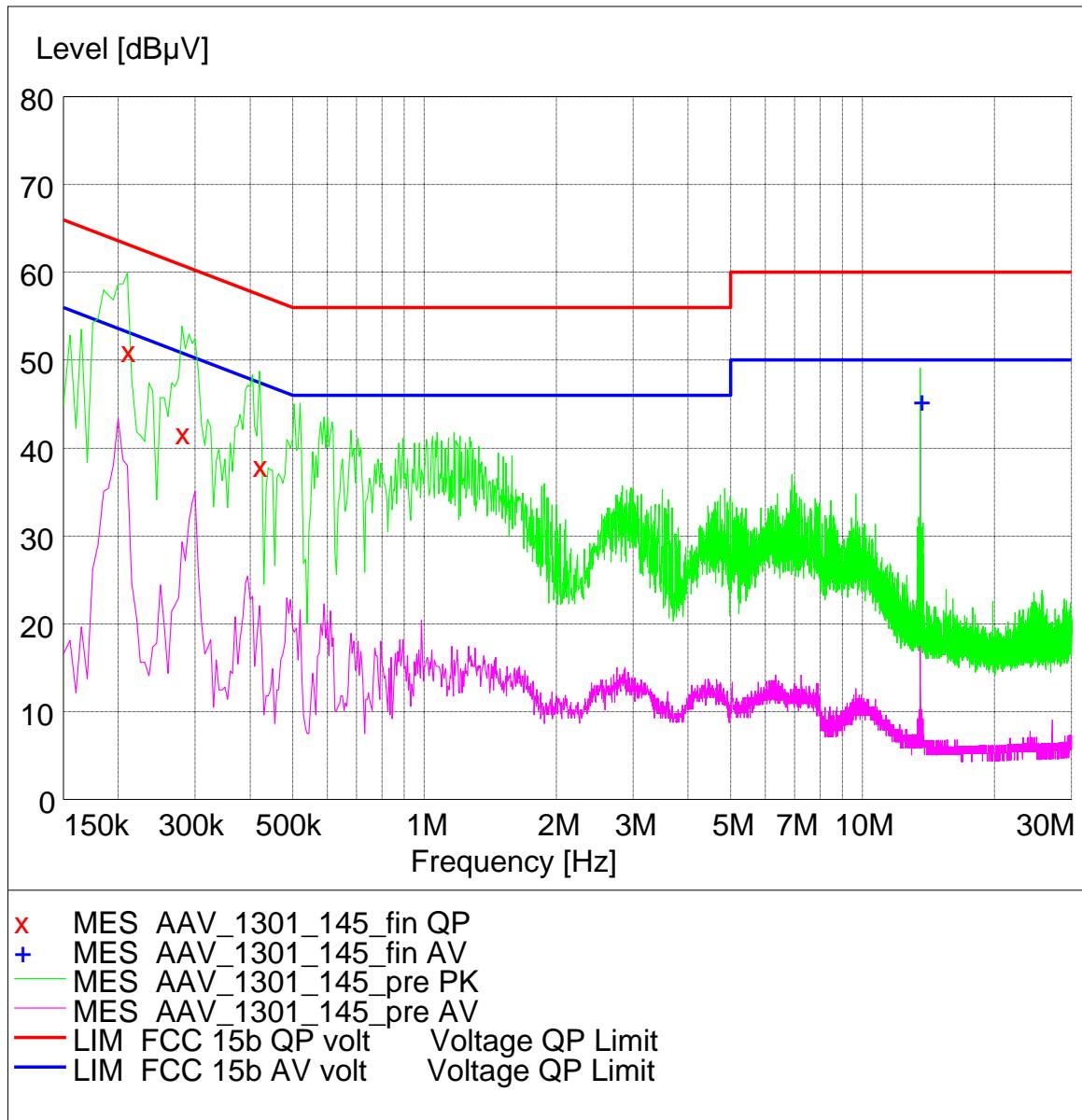


### 8.1.2 Radiated emissions (f > 30 MHz)

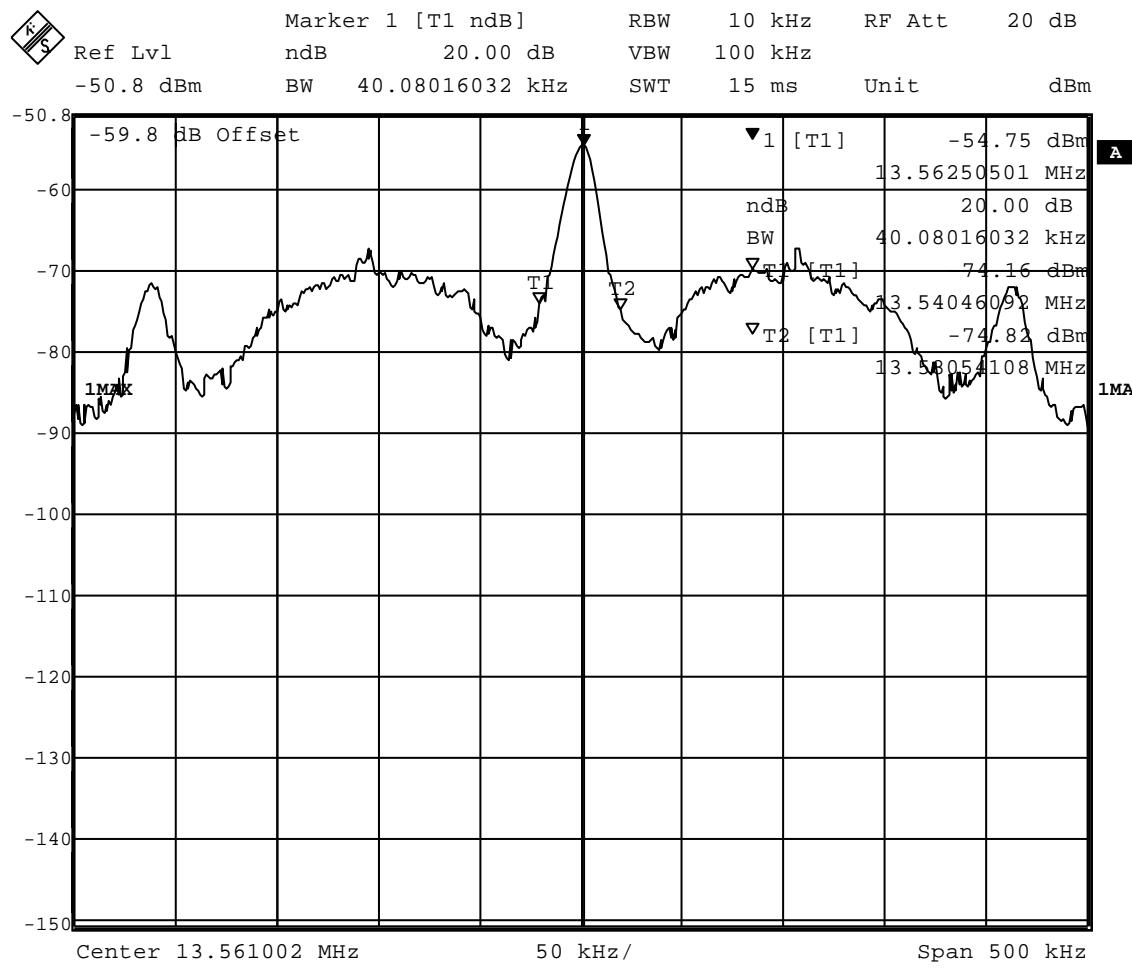


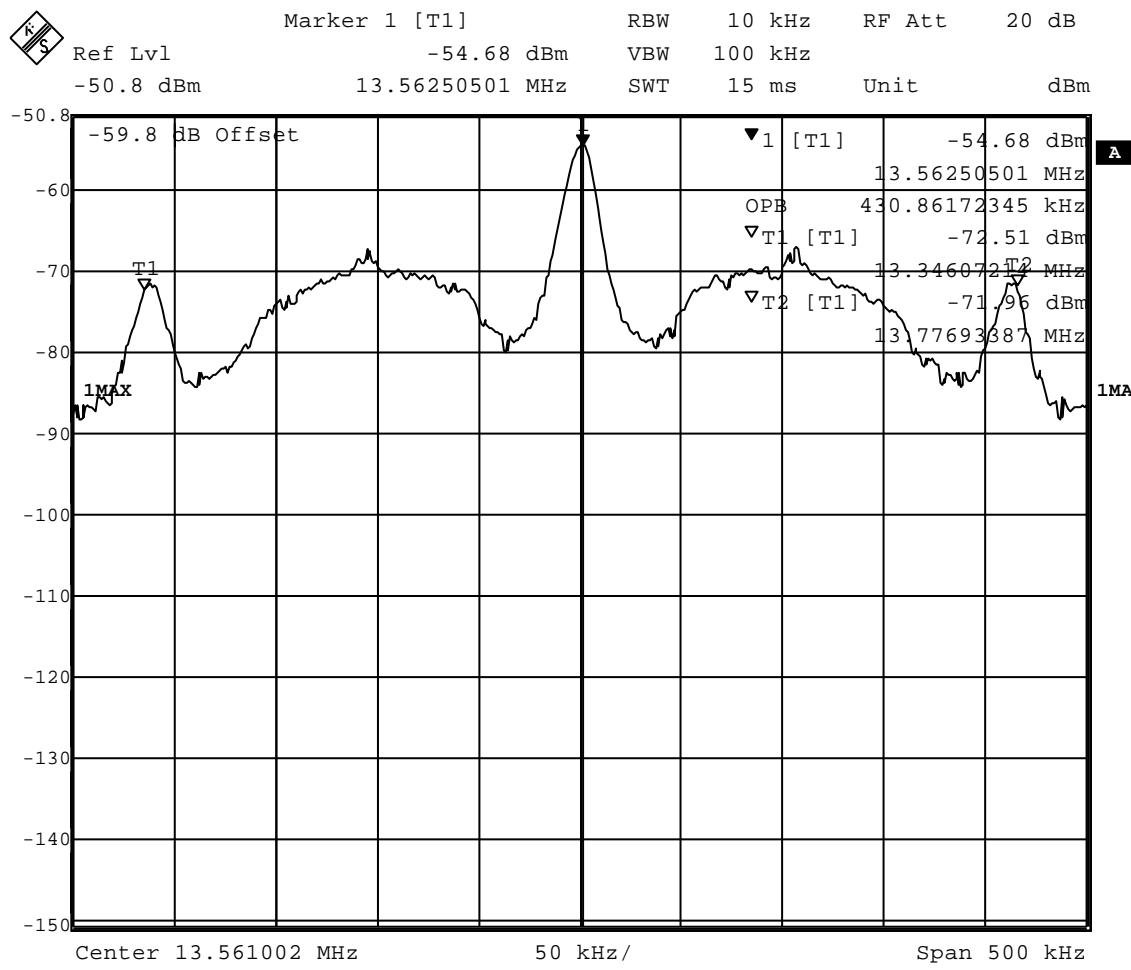
## 8.2 AC Mains conducted

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



### 8.3 Occupied bandwidth





#### 8.4 Spectrum mask

