

# Test Report

Report Number: F136015E1, 2<sup>nd</sup> version

Applicant:

**Miele & Cie. KG Werk Oelde**

Manufacturer:

**Miele & Cie. KG Werk Oelde**

Equipment under Test (EUT):

**HR1622 with EPI7674 inside**



Laboratory (CAB) accredited by  
Deutsche Akkreditierungsstelle GmbH (DAkkS)  
in compliance with DIN EN ISO/IEC 17025  
under the Reg. No. D-PL-17186-01-02,  
FCC Test site registration number 90877 and  
Industry Canada Test site registration IC3469A-1

## REFERENCES

- [1] **ANSI C63.4-2009** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- [2] **FCC CFR 47 Part 15 (August 2013)** Radio Frequency Devices
- [3] **RSS-210 Issue 8 (December 2010)** Licence-exempt Radio Apparatus (All Frequency Bands):  
Category I Equipment
- [4] **RSS-Gen Issue 3 (December 2010)** General Requirements and Information for the Certification of Radio Apparatus

## TEST RESULT

The requirements of the tests performed as shown in the overview (clause 4) were fulfilled by the equipment under test.  
The complete test results are presented in the following.

Test engineer:	Thomas KÜHN <small>Name</small>	 <small>Signature</small>	23 May 2014 <small>Date</small>
Authorized reviewer:	Bernd STEINER <small>Name</small>	 <small>Signature</small>	23 May 2014 <small>Date</small>

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## 1 Identification

### 1.1 Applicant

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Applicant represented during the test by the following person:	Mr. Andreas FABRIZIUS

### 1.2 Manufacturer

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Manufacturer represented during the test by the following person:	Mr. Andreas FABRIZIUS

### 1.3 Test laboratory

The tests were carried out at: **PHOENIX TESTLAB GmbH**  
**Königswinkel 10**  
**32825 Blomberg**  
**Germany**

accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) in compliance with DIN EN ISO/IEC 17025 under Reg. No. D-PL-17186-01-02, FCC Test site registration number 90877 and Industry Canada Test site registration IC3469A-1.

## 1.4 EUT (Equipment Under Test)

Test object: *	Kitchen oven with temperature sensor inside
Type: *	HR1622 with EPI7674 inside
FCC ID: *	SSVNAEPI01
IC: *	5669B-NAEPI01
Serial number of kitchen oven (HR1622): *	00/727039713
Hardware version of EPI: *	9031811
Serial number of EPI: *	A1217000300
Software version of EPI: *	ID 2518V19
Highest / lowest internal frequency: *	434.6975 MHz / 32.768 kHz

## 1.5 Technical data of equipment

Operating frequency range: *	433.0525 MHz to 434.6975 MHz					
Channel spacing: *	2.5 kHz					
Number of channels: *	659					
Antenna type: *	Internal (inside cooking chamber)					
Modulation: *	None					
Bit rate of transmitter: *	None					
Supply Voltage HR1622: *	$U_{Nom} =$	120 VAC	$U_{Min} =$	$U_{Nom} - 15\%$	$U_{Max} =$	$U_{Nom} + 15\%$
Supply Voltage EPI7674: *	$U_{Nom} =$	3.3 VDC	$U_{Min} =$	3.3 VDC	$U_{Max} =$	3.3 VDC
Power Supply:	AC-mains (120 V AC / 60 Hz), two phases either with 120 ° or 180 ° phase angle (HR1954), internally by HR1622 (EPI7674)					
Temperature range: *	0 °C to 85 °C					
Ancillaries to be tested with: *	None					

\* declared by the applicant.

The following external I/O cables were used:

Identification	Connector		Length
	EUT	Ancillary	
Power supply	5 pole CEE 16 (mounted for testing)	-	1.5 m
-	-	-	-

\*: Length during the test if no other specified.

## 1.6 Dates

Date of receipt of test sample:	29 November 2013
Start of test:	29 November 2013
End of test:	03 December 2013

## 2 Operational states

The EUT is a kitchen oven with a temperature sensor inside, which it was mounted inside the oven. The oven was supplied by an AC-mains network with 120 VAC / 60 Hz during all tests. For every test a preliminary measurement was carried out without temperature sensor mounted inside the oven in order to identify the emissions caused by the oven which is exempted from a CFR 47 Part 15 certification. Object of this test report is the CFR 47 Part 15 C transmitter.

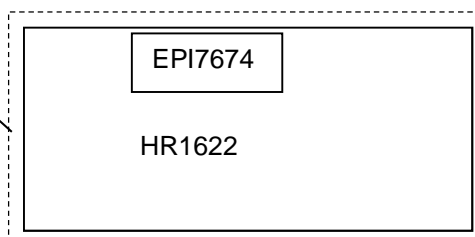
For detail information of the functionality of the EUT please refer the functional description of the applicant.

The timing was measured on an unmodified sample of the temperature sensor. The emission measurements were carried out with a modified sample, which operates continuously. This modification was a firmware modification, as declared by the applicant both samples were using the same hardware.

The following operation modes were used during the tests:

Operation mode	Description of the operation mode
0	No transmission, no temperature sensor (EPI7674) installed
2	Transmit on lowest channel (433.0525 MHz)
3	Transmit on highest channel (434.6975 MHz)

Physical boundary of the EUT:



### 3 Additional information

During the tests the EUT was not labelled as required by FCC / IC.

### 4 Overview

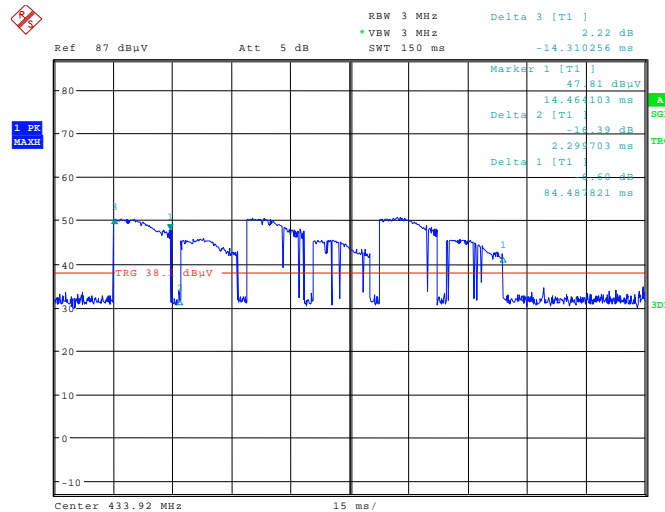
Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS 210, Issue 8 [3] or RSS-Gen, Issue 3 [4]	Status	Refer page
Occupied bandwidth	433.0525 – 434.6975 MHz	15.231 (e)	A1.1.3 [3]	Passed	11 et seq.
Radiated emissions	0.009 – 5,000	15.231 (e) 15.205 (a) 15.209 (a)	2.5 [3] A1.1 [3] 7.2 [4]	Passed	14 et seq.
Conducted emissions on supply line	0.15 - 30	15.207 (a)	7.2.4 [4]	Passed	36 et seq.

## 5 Test results

### 5.1 Calculation of the measurement results

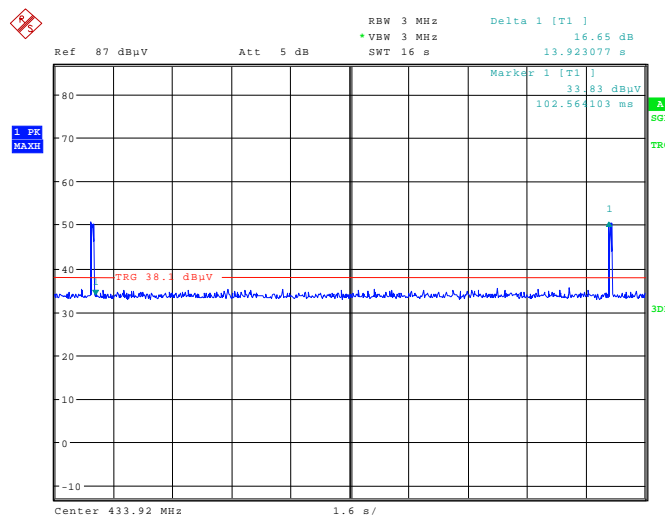
Because short transmission pulses with a long pulse pause all measurements were carried out with a peak detector and the average value is calculated over the real pulse train as required in Part 15.35. To calculate the average value the timing of the emission was measured. A detail view to the transmission pulse was recorded and the total transmitter on time was calculated. For details of the transmitter timing refer to the applicant's functional description. The following plots were made with a high resolution bandwidth in order to show the timing for the whole operation band.

136015\_1.wmf: Complete pulse train measuring phase:



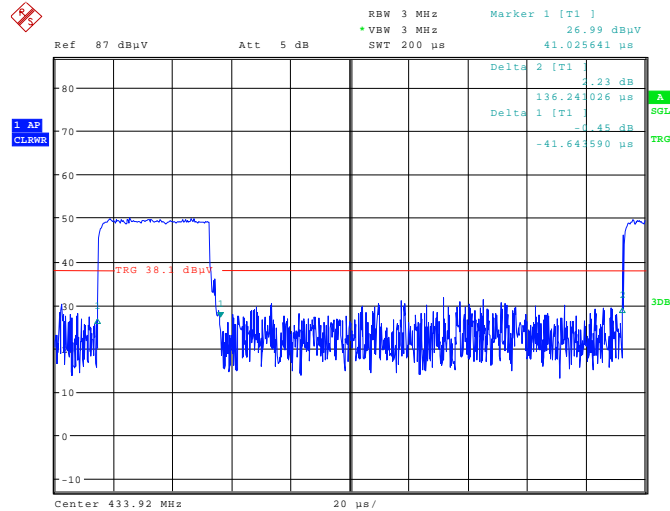
The complete pulse train consists of 6 identical sub pulse trains which may differ in transmit power (belongs on the used food probe).

136015\_3.wmf: Time between two transmissions in measuring phase:





136015\_2.wmf: single pulse (measuring phase):

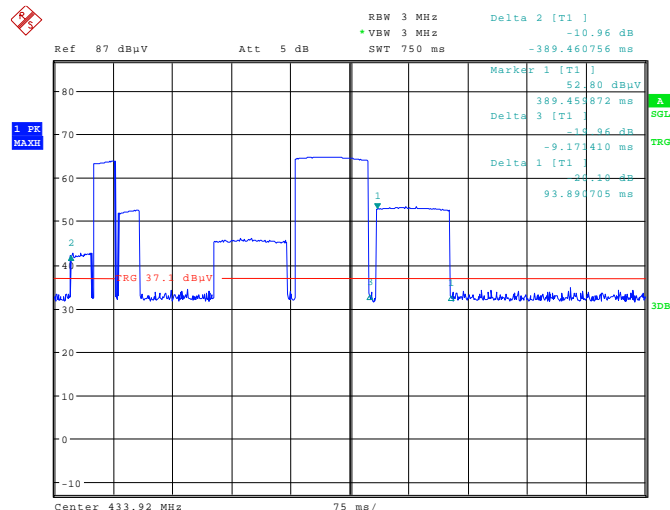


Length of period = 177.88 µs, length of pulse = 41.644 µs, number of transmissions = 492 (87.452 ms / 177.88 µs).

Duty cycle correction factor according to 15.35c:

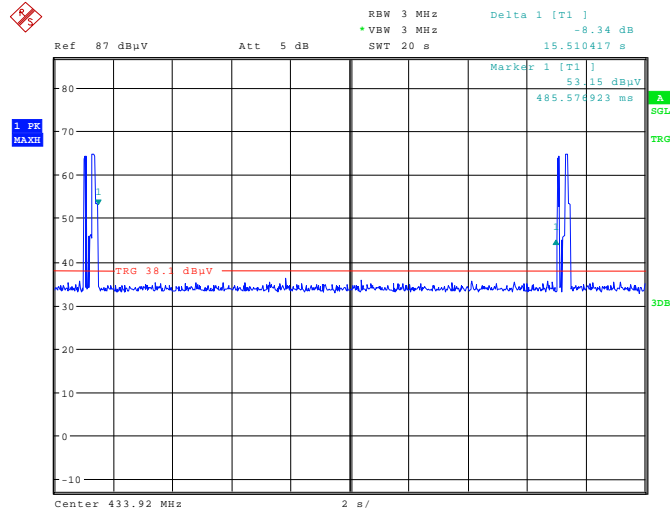
$$F \text{ [dB]} = 20 * \log (492 * 41.664 \mu\text{s} / 100 \text{ ms}) = -13.8 \text{ dB (measuring phase)}$$

136015\_4.wmf: Complete pulse train scan phase:

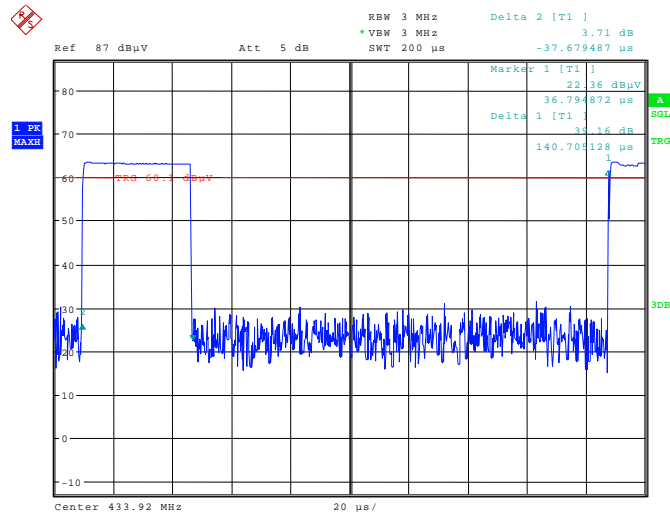


The complete pulse train consists of 6 (3 for resonator 1 and 3 for resonator 2) sub pulse trains with different transmit power. The time for transmitting for the different resonators is always the same.

136015\_3.wmf: Time between two transmissions in scan phase:



136015\_6.wmf: single pulse (scan phase):



Length of period = 178.34 μs, length of pulse = 36.795 μs, number of transmissions = 526 (93.891 ms / 178.34 μs).

Duty cycle correction factor according to 15.35c:

$$F \text{ [dB]} = 20 * \log (526 * 36.795 \mu\text{s} / 100 \text{ ms}) = -14.3 \text{ dB (measuring phase)}$$

So the measured peak values were calculated with 13.8 dB down into average values, because the correction factor for the scan phase represents the worst case.

TEST EQUIPMENT USED FOR THE TEST:
6, 24

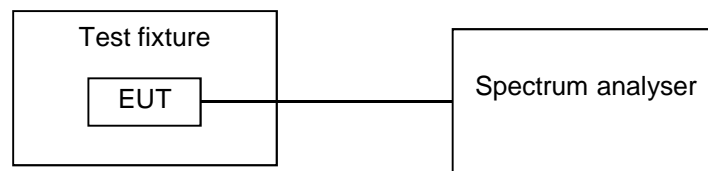
## 5.2 Occupied bandwidth

### 5.2.1 Method of measurement (20 dB bandwidth, 99 % bandwidth)

The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed or a test fixture has to be used. The EUT has to be switched on, the transmitter shall work with its maximum data rate.

The measurement will be performed at the upper, the lower end and the middle of the assigned frequency band.

Test set-up:



#### 20 dB bandwidth:

The following spectrum analyser settings shall be used:

- Span: App. 2 to 3 times the 20 dB bandwidth, centred on the actual channel.
- Resolution bandwidth: Between 1 % to 5 % of the required bandwidth, if no requirements were made, the following minimum values shall be used:  
From 9 kHz to 30 MHz:  $RBW_{min} = 1 \text{ kHz}$ ;  
from 30 MHz to 1000 MHz:  $RBW_{min} = 10 \text{ kHz}$ ;  
and from 1000 MHz to 40 GHz:  $RBW_{min} = 100 \text{ kHz}$ .
- Video bandwidth:  $\geq$  the resolution bandwidth.
- Sweep: Auto.
- Detector function: peak.
- Trace mode: Max hold.

After trace stabilisation the marker shall be set on the signal peak. The first display line has to be set on this value. The second display line has to be set 20 dB below the first line (or the peak marker). The frequency lines shall be set on the intersection points between the second display line and the measured curve.

#### 99 % bandwidth:

The following spectrum analyser settings shall be used:

- Span: Wide enough to capture product of the modulation process, centred on the actual channel.
- Resolution bandwidth: As close to 1% of the selected span as is possible without being below 1%.
- Video bandwidth: Three times the resolution bandwidth.
- Sweep: Auto.
- Detector function: peak.
- Trace mode: Max hold.

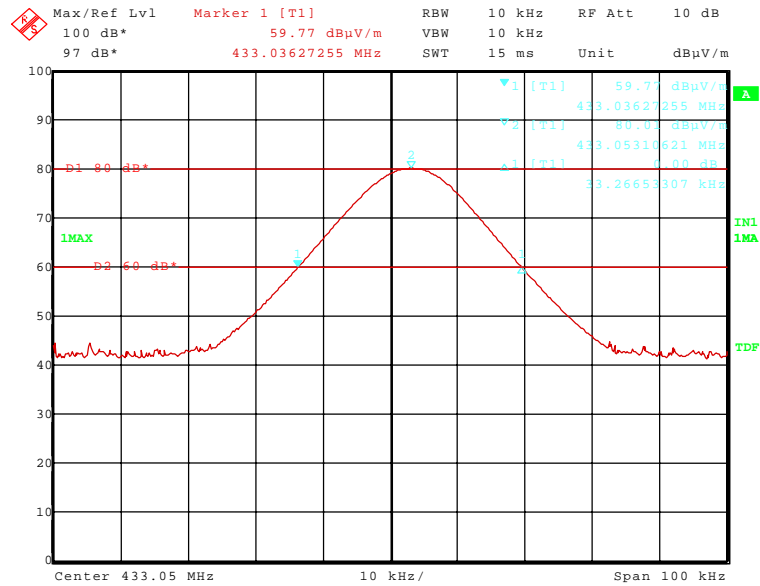
After trace stabilisation the marker shall be set on the signal peak and use the 99 % bandwidth function of the spectrum analyser.

### 5.2.2 Test results (occupied bandwidth)

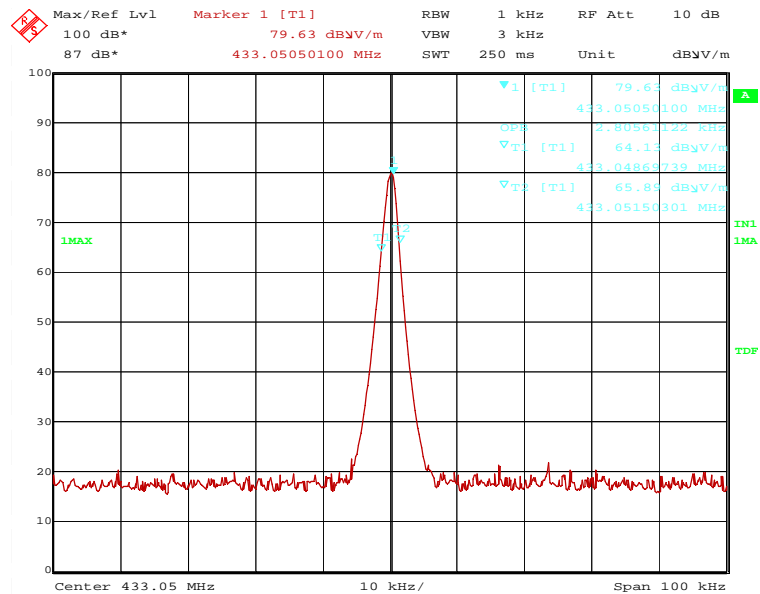
Ambient temperature	21 °C
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Relative humidity	60 %
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136015\_7.wmf: 20 dB bandwidth at the lower end of the assigned frequency band (operation mode 1):



136015\_8.wmf: 99 % bandwidth at the lower end of the assigned frequency band (operation mode 2):



Lower frequency	Upper frequency	Bandwidth	LIMIT (0.25 % of the center frequency)
Transmitter operates at the lower end of the assigned frequency band (operation mode 1)			
20 dB bandwidth			
433.036273 MHz	433.069539 MHz	33.267 kHz	1.085 MHz
99 % dB bandwidth			
433.048697 MHz	433.051503 MHz	2.806 kHz	1.085 MHz
Transmitter operates at the upper end of the assigned frequency band (operation mode 2)			
20 dB bandwidth			
434.681368 MHz	434.714634 MHz	33.267 kHz	1.085 MHz
99 % dB bandwidth			
434.696197 MHz	434.699003 MHz	2.806 kHz	1.085 MHz
Measurement uncertainty		+0.66 dB / -0.72 dB	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

24, 31

## 5.3 Radiated emissions

### 5.3.1 Method of measurement (Radiated emissions)

The radiated emission measurement is subdivided into four stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 9 kHz to 110 GHz.
- A final measurement carried out on an outdoor test site without reflecting ground plane and a fixed antenna height in the frequency range 9 kHz to 30 MHz.
- A final measurement carried out on an open area test site with reflecting ground plane and various antenna height in the frequency range 30 MHz to 1 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 110 GHz.

All measurements will be carried out with the EUT working on the middle and upper and lower edge of the assigned frequency band. For this reason the hopping function of the EUT has to be disabled.

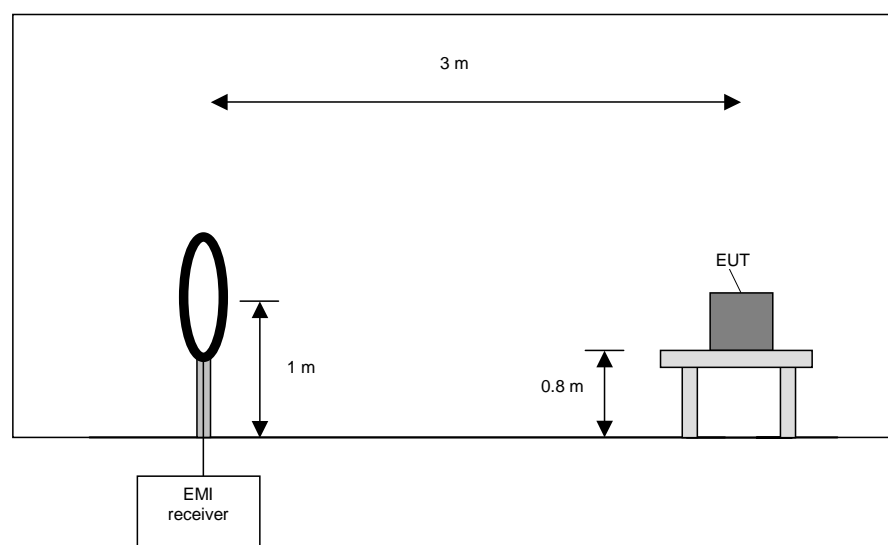
#### Preliminary measurement (9 kHz to 30 MHz):

In the first stage a preliminary measurement will be performed in a shielded room with a measuring distance of 3 meters. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set-up of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

The frequency range 9 kHz to 30 MHz will be monitored with a spectrum analyser while the system and its cables will be manipulated to find out the configuration with the maximum emission levels if applicable. The EMI Receiver will be set to MAX Hold mode with peak detector. The EUT and the measuring antenna will be rotated around their vertical axis to found the maximum emissions.

The resolution bandwidth of the spectrum analyser will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	10 kHz



Preliminary measurement procedure:

Prescans were performed in the frequency range 9 kHz to 150 kHz and 150 kHz to 30 MHz.

The following procedure will be used:

- 1) Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
- 2) Manipulate the system cables within the range to produce the maximum level of emission.
- 3) Rotate the EUT by 360 ° to maximize the detected signals.
- 4) Make a hardcopy of the spectrum.
- 5) Measure the frequencies of highest detected emission with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
- 6) Repeat steps 1) to 5) with the other orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).
- 7) Rotate the measuring antenna and repeat steps 1) to 5).

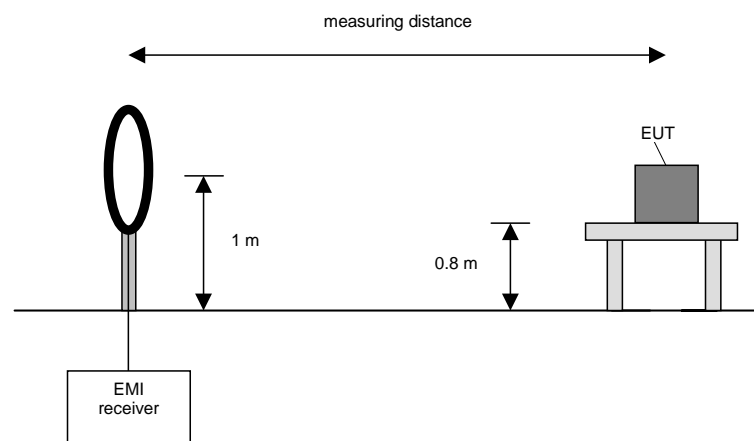
**Final measurement (9 kHz to 30 MHz):**

In the second stage a final measurement will be performed on an open area test site with no conducting ground plane with measuring distances of 3 m, 10 m and 30 m. In the case where larger measuring distances are required the results will be extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2]. The final measurement will be performed with a EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 kHz to 490 kHz where an average detector will be used according Section 15.209 (d) [2].

On the during the preliminary measurement detected frequencies the final measurement will be performed while rotating the EUT and the measuring antenna in the range of 0 ° to 360 ° around their vertical axis until the maximum value is found.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz



Final measurement procedure:

The following procedure will be used:

- 1) Monitor the frequency range with the measuring antenna at vertical orientation parallel to the EUT at an azimuth of 0 °.
- 2) Rotate the EUT by 360 ° to maximize the detected signals and note the azimuth and orientation.
- 3) Rotate the measuring antenna to find the maximum and note the value.
- 4) Rotate the measuring antenna and repeat steps 1) to 3) until the maximum value is found.
- 5) Repeat steps 1) to 4) with the other orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).

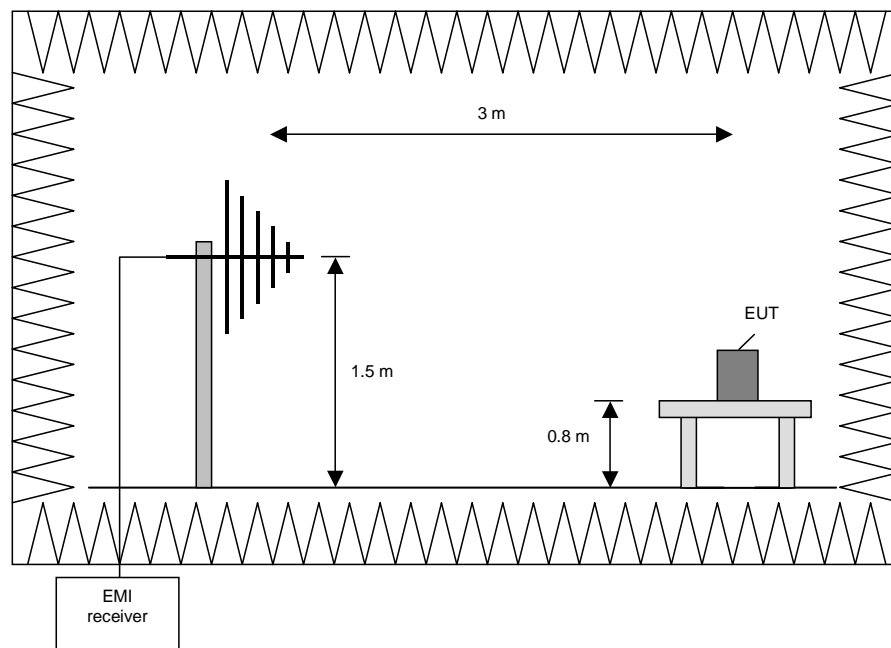
**Preliminary measurement (30 MHz to 1 GHz)**

In the first stage a preliminary measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set-up of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

The frequency range 30 MHz to 1 GHz will be measured with an EMI Receiver set to MAX Hold mode with peak detector and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 230 MHz	100 kHz
230 MHz to 1 GHz	100 kHz





Procedure preliminary measurement:

Prescans were performed in the frequency range 30 MHz to 230 MHz and 230 MHz to 1 GHz.

The following procedure will be used:

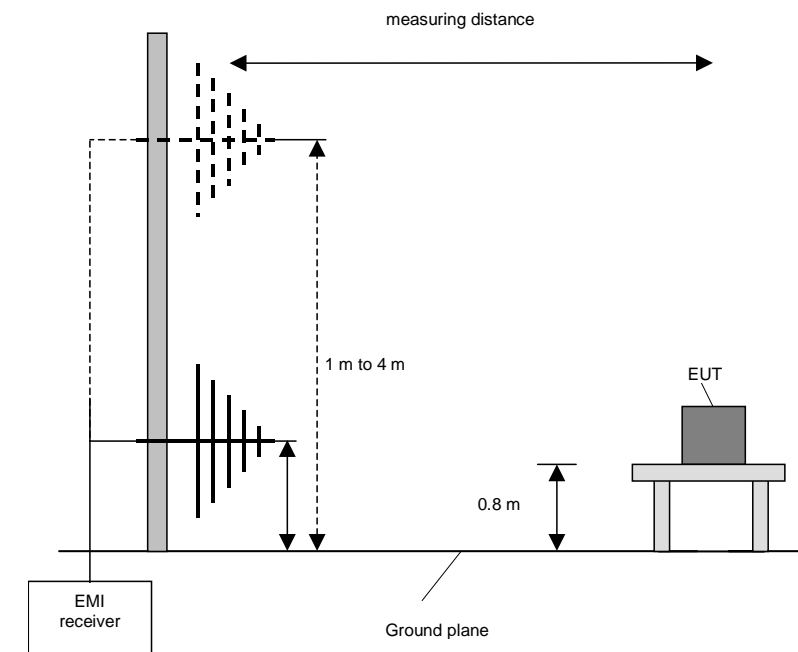
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
6. Repeat 1) to 4) with the other orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).
7. Repeat 1) to 5) with the vertical polarisation of the measuring antenna.

**Final measurement (30 MHz to 1 GHz)**

A final measurement on an open area test site will be performed on selected frequencies found in the preliminary measurement. During this test the EUT will be rotated in the range of 0 ° to 360 °, the measuring antenna will be set to horizontal and vertical polarisation and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



Procedure final measurement:

The following procedure will be used:

- 1) Measure on the selected frequencies at an antenna height of 1 m and a EUT azimuth of 23 °.
- 2) Move the antenna from 1 m to 4 m and note the maximum value at each frequency.
- 3) Rotate the EUT by 45 ° and repeat 2) until an azimuth of 337 ° is reached.
- 4) Repeat 1) to 3) for the other orthogonal antenna polarization.
- 5) Move the antenna and the turntable to the position where the maximum value is detected.
- 6) Measure while moving the antenna slowly +/- 1 m.
- 7) Set the antenna to the position where the maximum value is found.
- 8) Measure while moving the turntable +/- 45 °.
- 9) Set the turntable to the azimuth where the maximum value is found.
- 10) Measure with Final detector (QP and AV) and note the value.
- 11) Repeat 5) to 10) for each frequency.
- 12) Repeat 1) to 11) for each orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).

**Preliminary and final measurement (1 GHz to 110 GHz)**

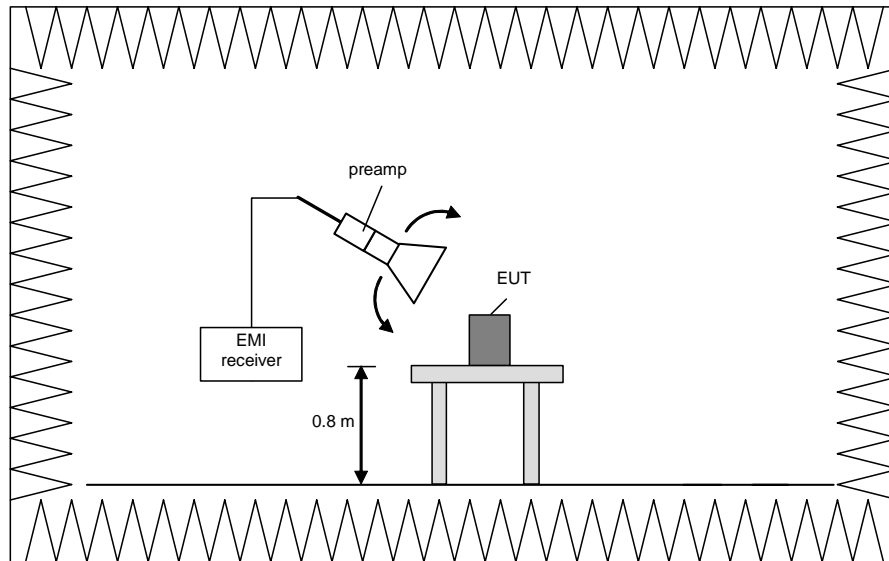
This measurement will be performed in a fully anechoic chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set-up of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

**Preliminary measurement (1 GHz to 110 GHz)**

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The spectrum analyser set to MAX Hold mode with peak detector and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna, the antenna close to the EUT and while moving the antenna over all sides of the EUT. With the spectrum analyser in CLEAR / WRITE mode the cone of the emission should be found. Than the measuring distance will be set to 3 m with the receiving antenna moving in this cone of emission. At this position the final measurement will be carried out.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	100 kHz
4 GHz to 12 GHz	100 kHz
12 GHz to 18 GHz	100 kHz
18 GHz to 26.5 GHz	100 kHz
26.5 GHz to 40 GHz	100 kHz
40 GHz to 60 GHz	100 kHz
50 GHz to 75 GHz	100 kHz
75 GHz to 110 GHz	100 kHz

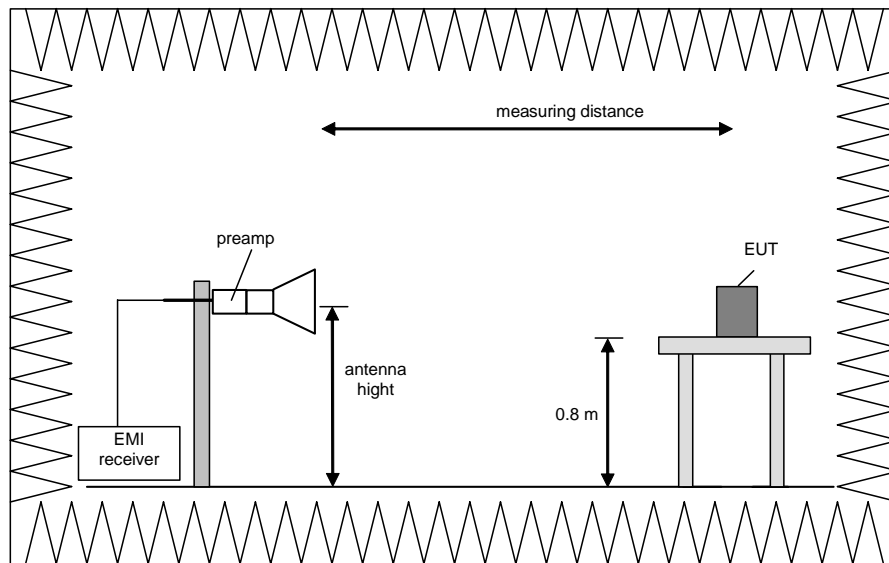


### **Final measurement (1 GHz to 110 GHz)**

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1 MHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 ° in order to have the antenna inside the cone of radiation.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	1 MHz
4 GHz to 12 GHz	1 MHz
12 GHz to 18 GHz	1 MHz
18 GHz to 26.5 GHz	1 MHz
26.5 GHz to 40 GHz	1 MHz
40 GHz to 60 GHz	1 MHz
50 GHz to 75 GHz	1 MHz
75 GHz to 110 GHz	1 MHz



Procedure of measurement:

The measurements were performed in the frequency range 1 GHz to 4 GHz, 4 GHz to 12 GHz, 12 GHz to 18 GHz, 18 GHz to 26.5 GHz, 26.5 GHz to 40 GHz, 40 GHz to 60 GHz, 60 GHz to 75 GHz and 75 GHz to 110 GHz.

The following procedure will be used:

- 1) Monitor the frequency range at horizontal polarisation and move the antenna over all sides of the EUT (if necessary move the EUT to another orthogonal axis).
- 2) Change the antenna polarisation and repeat 1) with vertical polarisation.
- 3) Make a hardcopy of the spectrum.
- 4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
- 5) Change the analyser mode to Clear / Write and found the cone of emission.
- 6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3 m and the antenna will be still inside the cone of emission.
- 7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarisation and azimuth and the peak and average detector, which causes the maximum emission.
- 8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beam width.

Step 1) to 6) are defined as preliminary measurement.

### 5.3.2 Test results (radiated emissions)

#### 5.3.2.1 Preliminary radiated emission measurement

Ambient temperature	21 °C	Relative humidity	36 %
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**Position of EUT:** The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

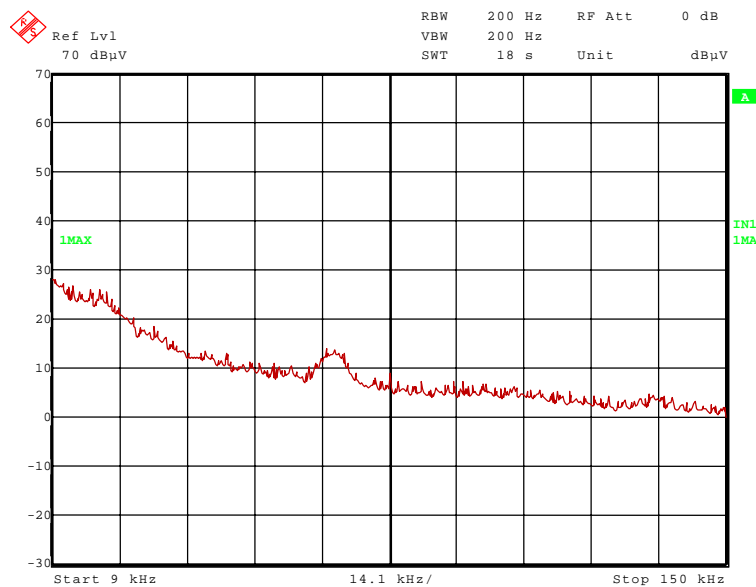
**Cable guide:** The cable of the EUT runs vertically to the false floor. For further information of the EUT set-up refer to the pictures in annex A of this test report.

**Test record:** During the test, the EUT transmits continuously. All results are shown in the following.

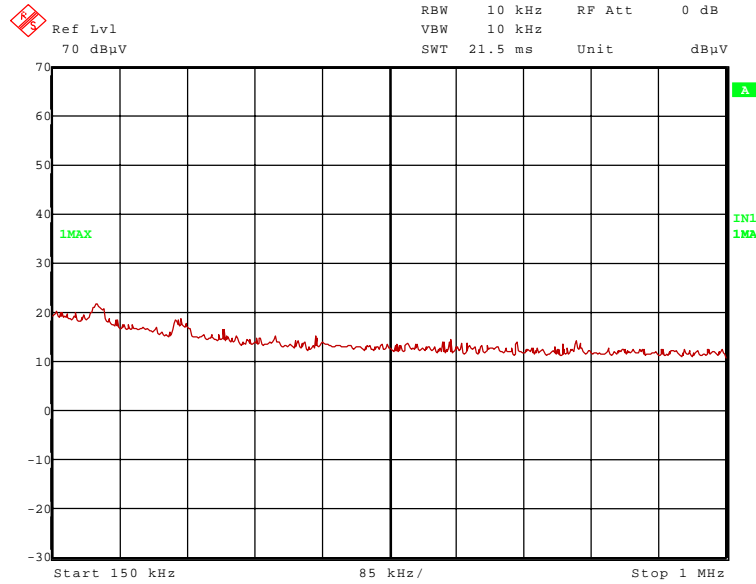
**Supply voltage:** The EUT was supplied by AC mains with 120 VAC / 60 Hz.

Oven without transmitter:

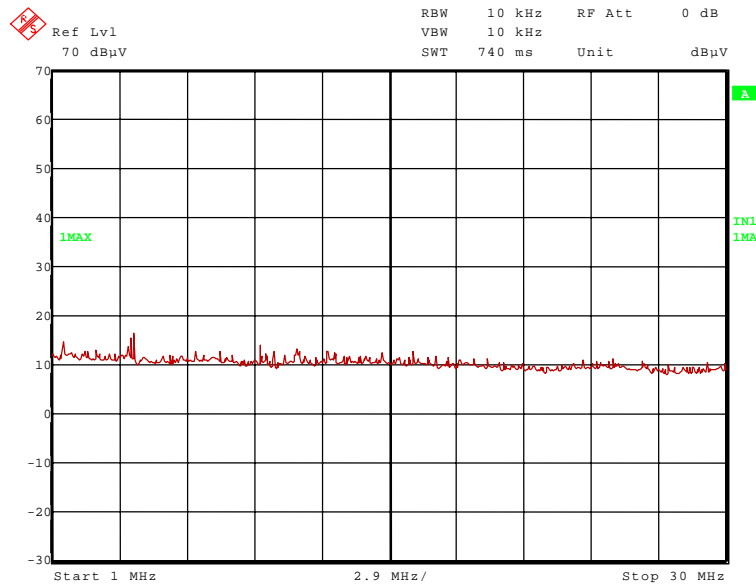
136015\_12.wmf: Spurious emissions from 9 kHz to 150 kHz (operation mode 0):



136015\_13.wmf: Spurious emissions from 150 kHz to 1 MHz (operation mode 0):



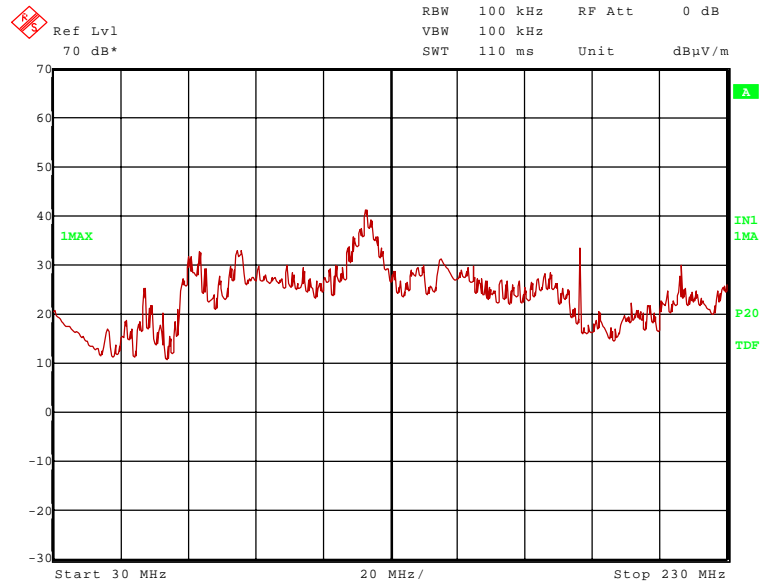
136015\_14.wmf: Spurious emissions from 1 MHz to 30 MHz (operation mode 0):



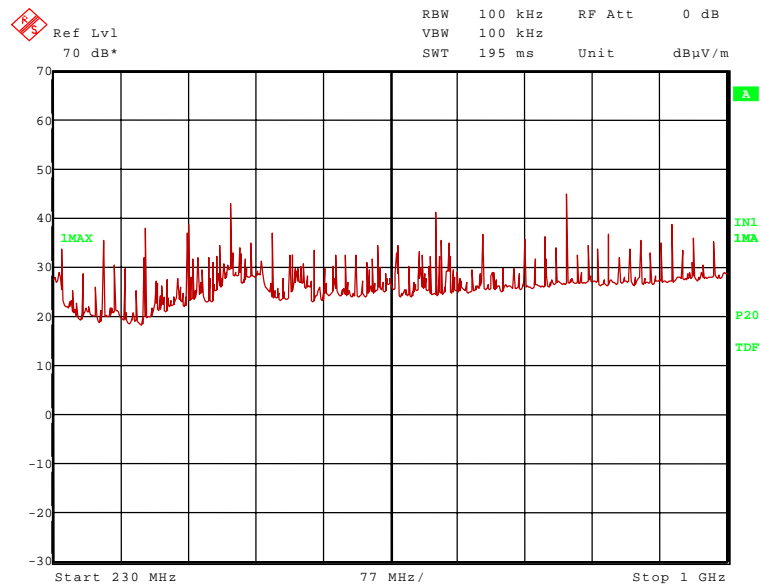
The following frequencies were found during the oven measurement (transmitter not installed):

204.500 kHz, 311.500 kHz, 1.464 MHz, 4.480 MHz and 9.932 MHz.

136015\_9.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 0):



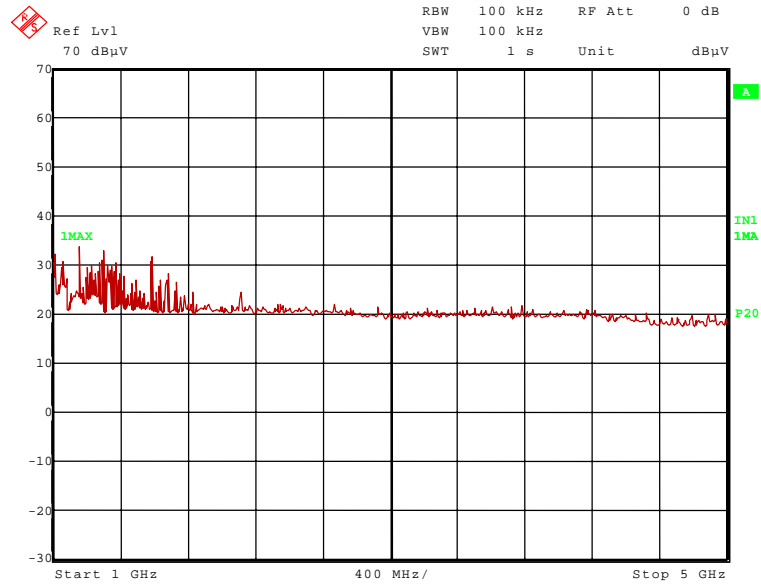
136015\_10.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 0):



The following frequencies were found during the oven measurement (transmitter not installed):

57.110 MHz, 62.500 MHz, 70.209 MHz, 73.556 MHz, 85.853 MHz, 122.470 MHz, 144.469 MHz,  
 177.450 MHz, 182.312 MHz, 216.000 MHz, 288.000 MHz, 336.000 MHz, 384.000 MHz,  
 432.000 MHz, 587.500 MHz, 666.664 MHz, 816.000 MHz and 936.000 MHz.

136015\_11.wmf: Spurious emissions from 1 GHz to 5 GHz (operation mode 0):



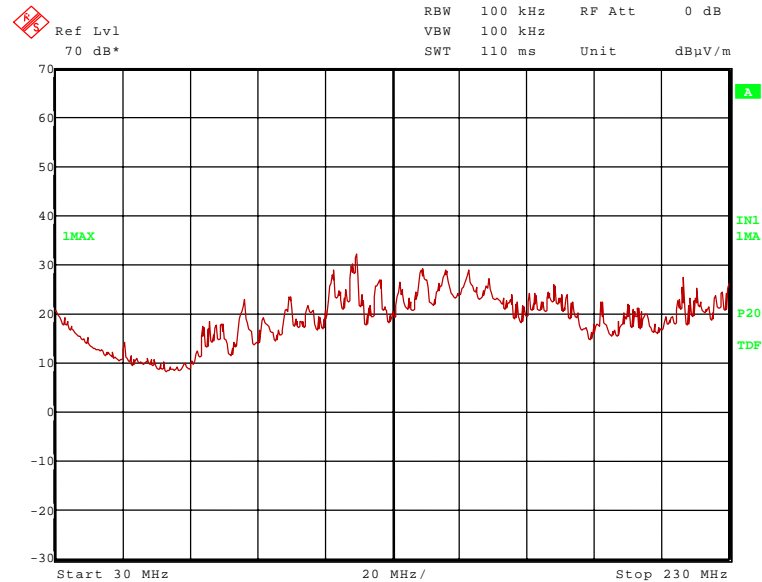
The following frequencies were found during the oven measurement (transmitter not installed):

1.008 GHz, 1.056 GHz, 1.152 GHz, 1.296 GHz, 1.368 GHz, 1.584 GHz, 1.680 GHz  
and 2.112 GHz.

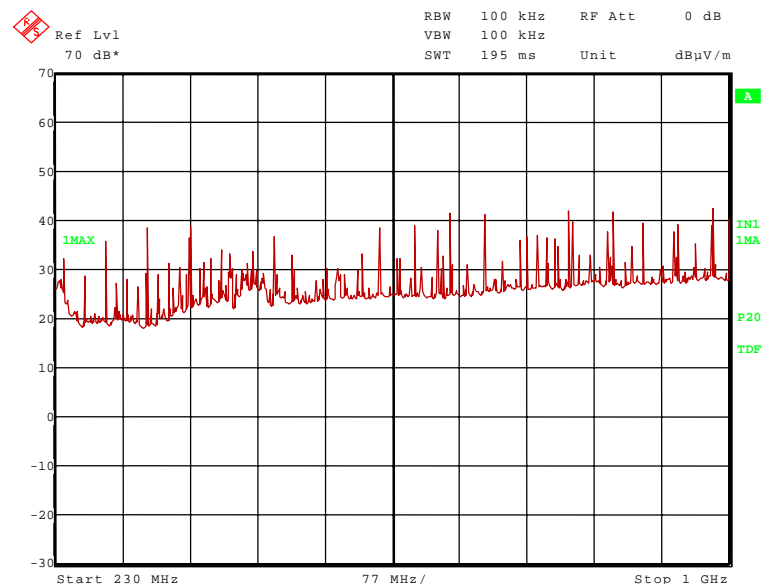


EUT operates on the lower end of the assigned frequency band:

136015\_15.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 1):



136015\_16.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 1, carrier notched):

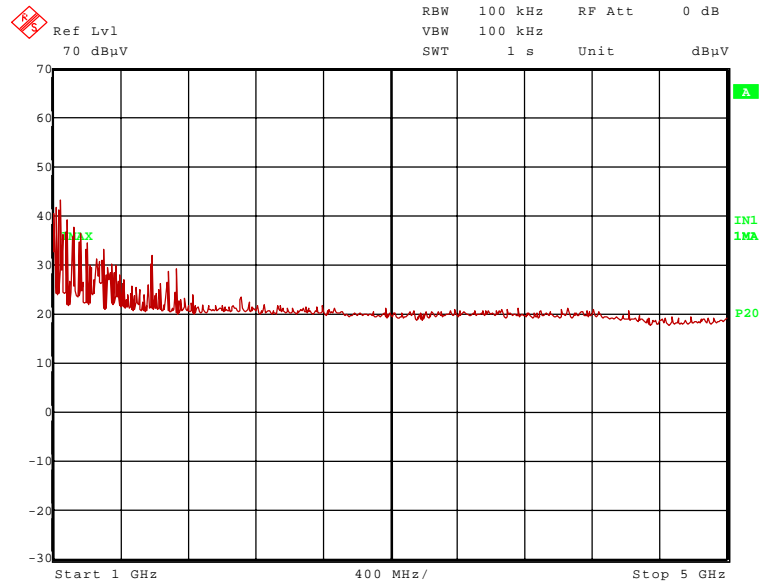


The following additional frequencies were found during the preliminary radiated emission test:

433.0525 MHz, 580.000 MHz, 640.000 MHz, 680.000 MHz, 720.000 MHz, 760.000 MHz, 780.000 MHz, 800.000 MHz, 820.000 MHz, 860.000 MHz, 866.105 MHz and 980.000 MHz.

These frequencies have to be measured on the open area test site. The results were presented in the following

136015\_17.wmf: Spurious emissions from 1 GHz to 5 GHz (operation mode 1):



The following additional frequencies with a duty cycle caused by the switching of the transmitter were found during the preliminary radiated emission test:

1299.1575 MHz, and 1732.2100 MHz.

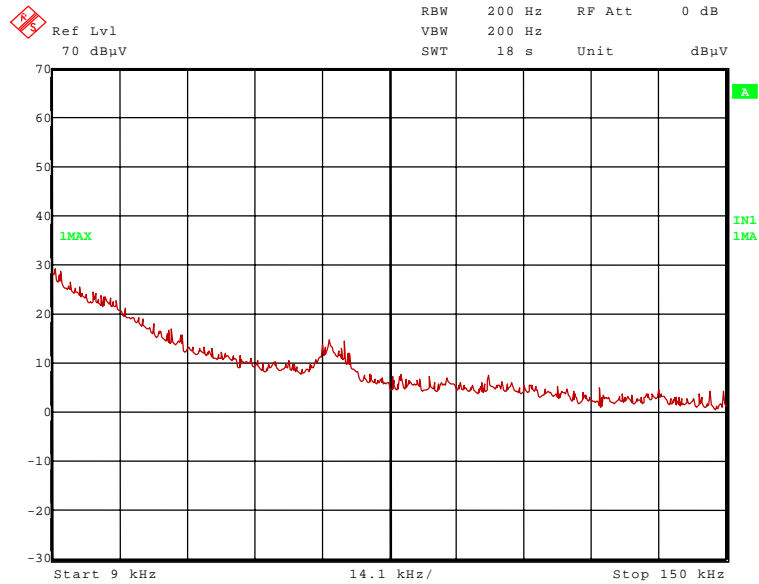
The following additional frequencies with without a duty cycle caused by the switching of the transmitter were found during the preliminary radiated emission test:

1000.000 MHz, 1016.000 MHz, 1040.000 MHz, 1080.000 MHz, 1120.000 MHz and 1160.000 MHz.

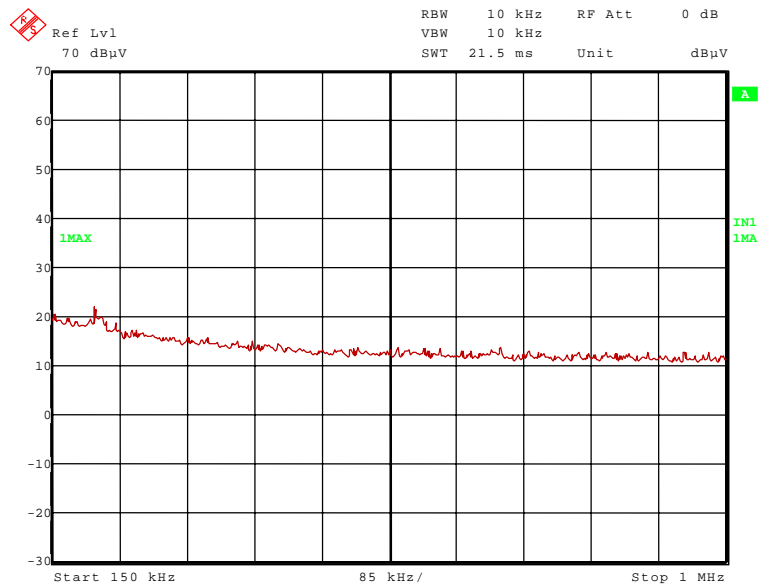
At these frequencies a final measurement has to be performed. The result is presented in the following.

EUT operates on the upper end of the assigned frequency band:

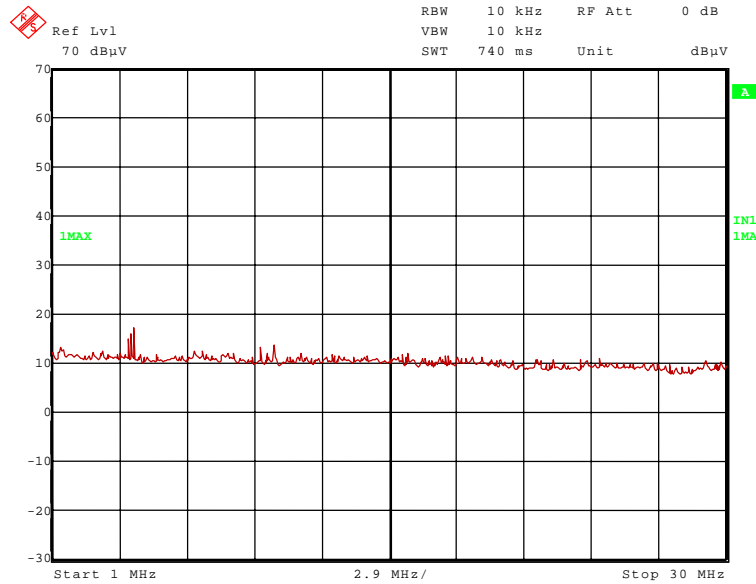
136015\_21.wmf: Spurious emissions from 9 kHz to 150 kHz (operation mode 2):



136015\_22.wmf: Spurious emissions from 150 kHz to 1 MHz (operation mode 2):

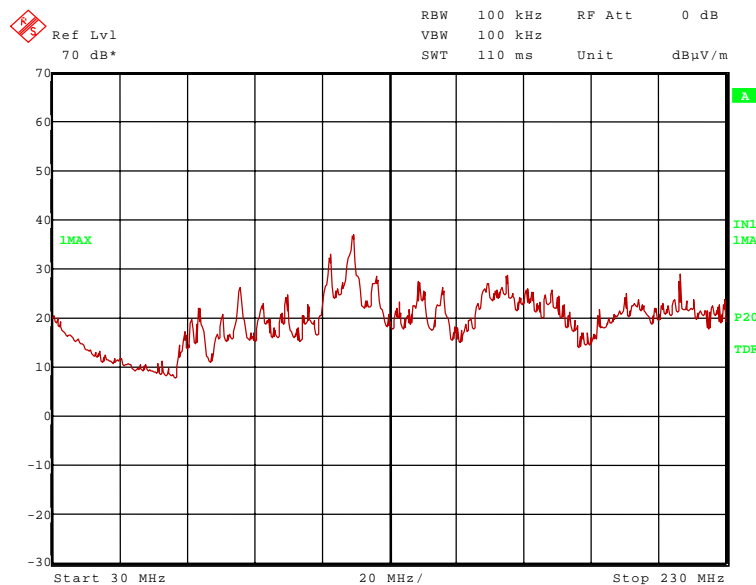


136015\_23.wmf: Spurious emissions from 1 MHz to 30 MHz (operation mode 2):

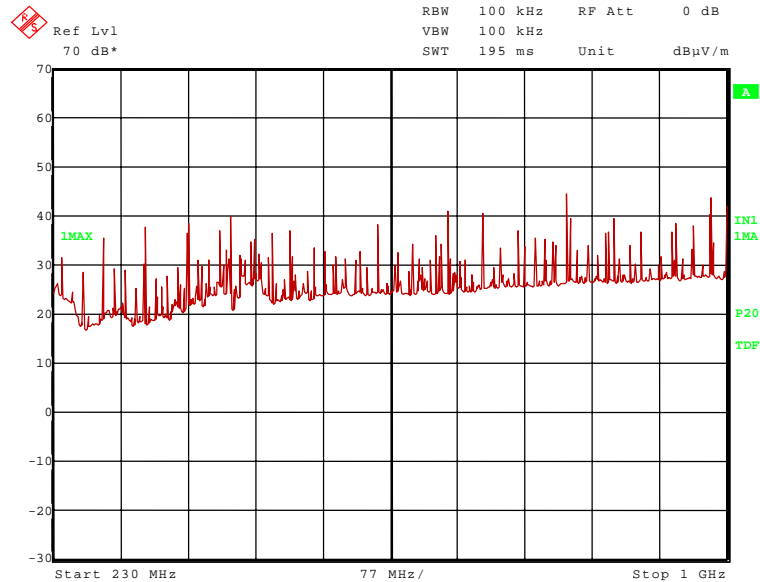


No significant additional frequencies above the noise floor of the system were found during the preliminary radiated emission test, so no measurements were carried out on the outdoor test site.

136015\_19.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 2):



136015\_20.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 2, carrier notched):

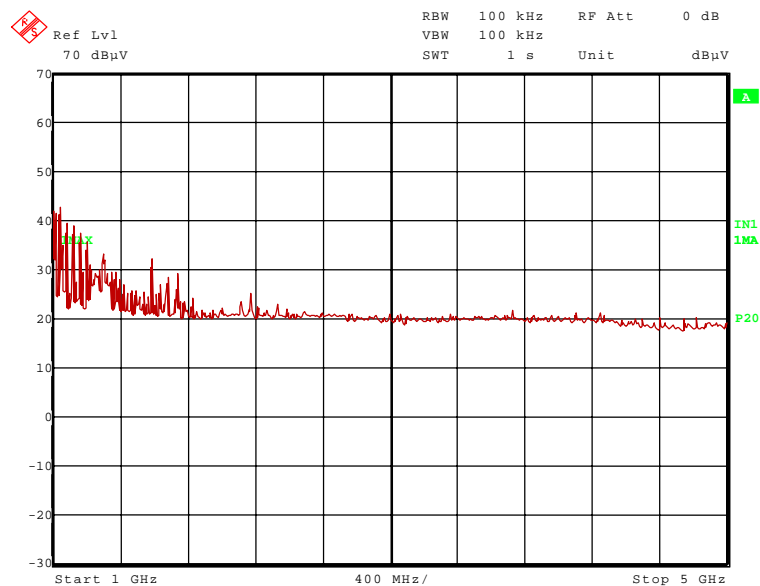


The following additional frequencies were found during the preliminary radiated emission test:

420.000 MHz, 434.6975 MHz, 460.000 MHz, 480.000 MHz, 588.000 MHz, 640.000 MHz, 680.000 MHz, 740.000 MHz, 760.000 MHz, 792.000 MHz, 820.000 MHz, 869.395 MHz, 940.000 MHz and 980.000 MHz.

These frequencies have to be measured on the open area test site. The results were presented in the following

136015\_18.wmf: Spurious emissions from 1 GHz to 5 GHz (operation mode 2):



The following additional frequencies with a duty cycle caused by the switching of the transmitter were found during the preliminary radiated emission test:

1304.0925 MHz, 1738.790 MHz and 2173.4875 MHz.

The following additional frequencies with without a duty cycle caused by the switching of the transmitter were found during the preliminary radiated emission test:

1000.000 MHz, 1016.000 MHz 1040.000 MHz, 1080.000 MHz, 1120.000 MHz and 1160.000 MHz.

At these frequencies a final measurement has to be performed. The result is presented in the following.

#### TEST EQUIPMENT USED THE TEST:

29, 31 – 36, 44, 45, 73, 80, 133, 142, 156
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### 5.3.2.2 Final radiated emission measurement (30 MHz to 1 GHz)

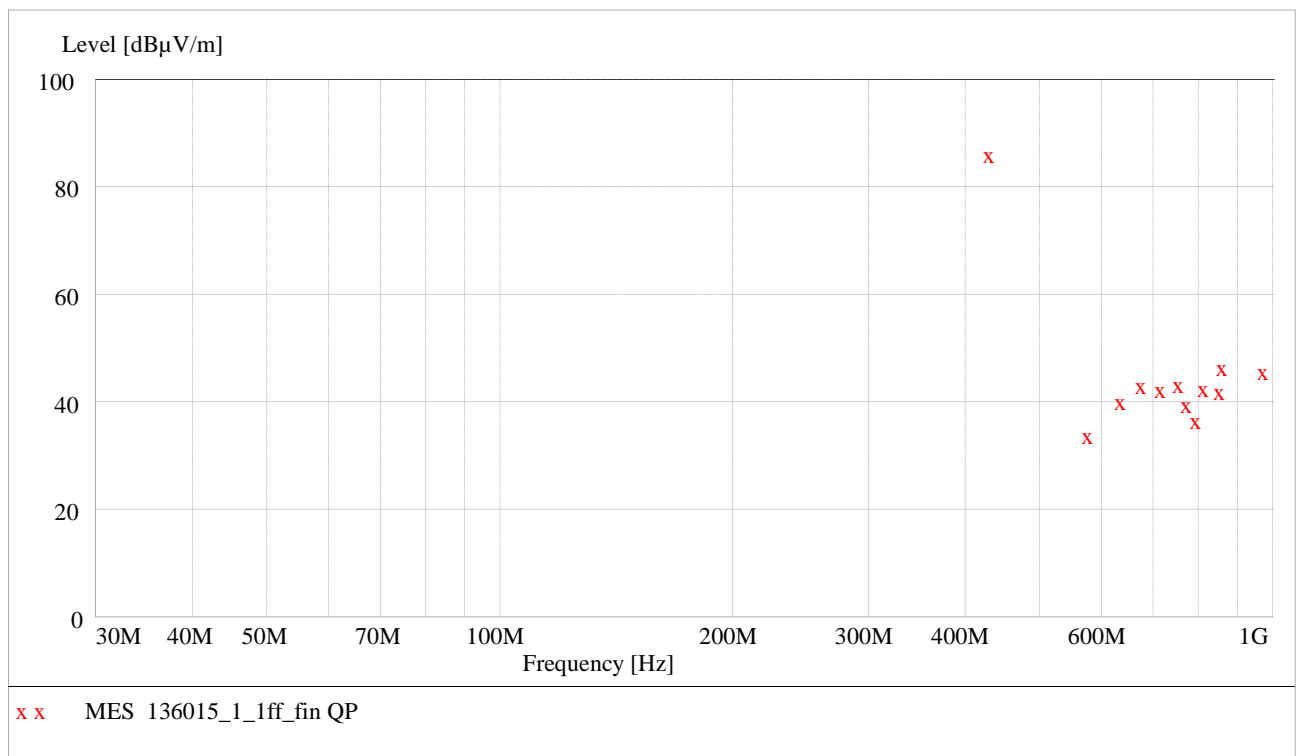
Ambient temperature	21 °C	Relative humidity	35 %
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- Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
- Cable guide: The cable of the EUT runs vertically to the false floor. For further information of the EUT set-up refer to the pictures in annex A of this test report.
- Test record: During the test, the EUT transmits continuously. All results are shown in the following.
- Supply voltage: The EUT was supplied by AC mains with 120 VAC / 60 Hz.
- Test results: The test results were calculated with the following formula:  

$$\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{cable loss [dB]} + \text{antenna factor [dB/m]} + \text{duty cycle correction factor [dB]}$$

The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above-mentioned standard. The measured points marked with x are the measured results of the standard final measurement on the open area test site but without consideration of the duty cycle correction factor.

136015\_1\_1ff: EUT operates on the lower end of the assigned frequency band (operation mode 1):



The results of the standard final measurement on the open area test site are indicated in the table below. The limits as well as the measured results (levels) refer to the above-mentioned standard while taking account of the specified requirements for a 3 m measuring distance.

The measurement time with the quasi-peak measuring detector is 1 second.

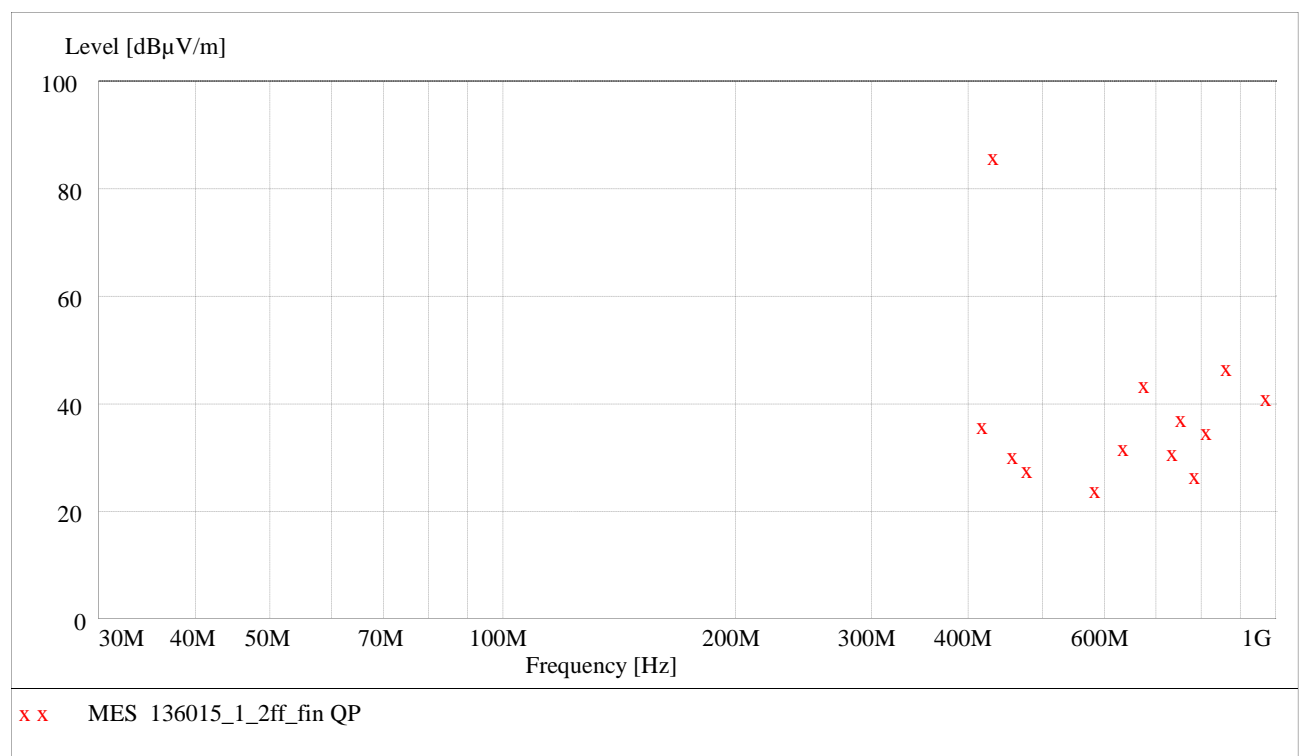
**Result measured with the peak detector and corrected to average:**  
(These values are marked in the above diagram by x)

Spurious emissions outside restricted bands										
Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Correction factor dB	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
433.0525 *	72.6	72.8	0.2	67.7	-13.8	16.4	2.3	100.0	109.0	Vert.
580.000	34.2	52.8	38.6	12.4	- **	19.0	2.8	173.0	90.0	Vert.
640.000	40.5	52.8	12.3	17.9	- **	19.7	2.9	188.0	78.0	Vert.
680.000	43.5	52.8	9.3	20.8	- **	19.8	2.9	271.0	268.0	Vert.
720.000	42.8	52.8	10.0	18.7	- **	21.1	3.0	172.0	81.0	Vert.
760.000	43.7	52.8	9.1	18.9	- **	21.7	3.1	285.0	125.0	Vert.
780.000	39.9	52.8	12.9	15.2	- **	21.5	3.2	151.0	270.0	Vert.
800.000	37	52.8	15.8	12.5	- **	21.3	3.2	297.0	199.0	Vert.
820.000	43	52.8	9.8	17.8	- **	22.0	3.2	100.0	27.0	Hor.
860.000	42.4	52.8	10.4	16.8	- **	22.3	3.3	192.0	315.0	Hor.
866.105	32.9	52.8	19.9	21.1	-13.8	22.2	3.4	103.0	135.0	Vert.
Spurious emissions inside restricted bands										
980.000	46.0	52.8	6.8	18.7	- **	23.8	3.5	184.0	266.0	Vert.
Measurement uncertainty				+2.2 dB / -3.6 dB						

\*: Wanted signal, no spurious

\*\* : No duty cycle observed at this frequency, so Quasi-peak detector and no correction factor was used

136015\_1\_2ff: EUT operates on the upper end of the assigned frequency band (operation mode 2):





The results of the standard final measurement on the open area test site are indicated in the table below. The limits as well as the measured results (levels) refer to the above-mentioned standard while taking account of the specified requirements for a 3 m measuring distance.

The measurement time with the quasi-peak measuring detector is 1 second.

**Result measured with the peak detector and corrected to average:**  
(These values are marked in the above diagram by x)

Spurious emissions outside restricted bands										
Frequency MHz	Result dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Readings dB $\mu$ V	Correction factor dB	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
420.000	36.4	52.8	16.4	18.1	- **	16.0	2.3	150.0	62.0	Vert.
434.6975 *	72.6	72.8	0.2	67.6	-13.8	16.4	2.4	150.0	336.0	Vert.
460.000	30.8	52.8	22.0	11.7	- **	16.7	2.4	150.0	274.0	Vert.
480.000	28.2	52.8	24.6	8.8	- **	17.0	2.4	150.0	0.0	Vert.
588.000	24.6	52.8	28.2	2.7	- **	19.1	2.8	100.0	0.0	Vert.
640.000	32.3	52.8	20.5	9.7	- **	19.7	2.9	174.0	217.0	Vert.
680.000	44.1	52.8	8.7	21.4	- **	19.8	2.9	215.0	15.0	Vert.
740.000	31.3	52.8	21.5	6.4	- **	21.8	3.1	185.0	189.0	Vert.
760.000	37.6	52.8	15.2	12.8	- **	21.7	3.1	196.0	142.0	Vert.
792.000	27.2	52.8	25.6	2.6	- **	21.4	3.2	153.0	0.0	Vert.
820.000	35.2	52.8	17.6	10.0	- **	22.0	3.2	102.0	225.0	Hor.
869.395	33.4	52.8	19.4	21.7	-13.8	22.1	3.4	101.0	22.0	Vert.
Spurious emissions inside restricted bands										
980.000	41.5	52.8	11.3	14.2	- **	23.8	3.5	150.0	211.0	Vert.
Measurement uncertainty				+2.2 dB / -3.6 dB						

\*: Wanted signal, no spurious

\*\* : No duty cycle observed at this frequency, so Quasi-peak detector and no correction factor was used

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

14 – 20

### 5.3.2.3 Final radiated emission measurement (1 GHz to 5 GHz)

Ambient temperature	21 °C	Relative humidity	37 %
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Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: The cable of the EUT runs vertically to the false floor. For further information of the EUT set-up refer to the pictures in annex A of this test report.

Test record: During the test, the EUT transmits continuously. All results are shown in the following. The test results were calculated with the following formula:

$$\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{cable loss [dB]} + \text{antenna factor [dB/m]} - \text{Preamp [dB]} + \text{duty cycle correction factor [dB]}$$

Supply voltage: The EUT was supplied by AC mains with 120 VAC / 60 Hz.

Resolution bandwidth: For all measurements a resolution bandwidth of 1 MHz was used.

EUT operates on the lower end of the assigned frequency band (operation mode 1):

#### Result measured with the peak detector and corrected to average:

Remark: At these frequencies a duty cycle was monitored.

Frequency MHz	Result dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Readings dB $\mu$ V	Correction factor	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1299.1575	23.4	52.8	29.4	36.0	-13.8	25.0	26.5	2.7	150	Vert.	No
1732.2100	24.4	52.8	28.4	35.1	-13.8	26.5	26.5	3.1	150	Hor.	No
Measurement uncertainty							+2.2 dB / -3.6 dB				

#### Result measured with the peak detector:

Remark: At these frequencies no duty cycle was monitored.

Frequency MHz	Result dB $\mu$ V/m	Limit * dB $\mu$ V/m	Margin dB	Readings dB $\mu$ V	Correction factor	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1000.000	42.7	52.8	10.1	42.8	-	24.0	26.5	2.4	150	Vert.	Yes
1016.000	39.5	52.8	13.3	39.5	-	24.1	26.5	2.4	150	Hor.	Yes
1040.000	45.3	52.8	7.5	45.3	-	24.2	26.5	2.3	150	Vert.	Yes
1080.000	41.8	52.8	11.0	41.5	-	24.4	26.5	2.4	150	Vert.	Yes
1120.000	41.2	52.8	11.6	40.6	-	24.6	26.5	2.5	150	Vert.	Yes
1160.000	40.4	52.8	12.2	39.7	-	24.7	26.5	2.5	150	Vert.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB				

\*: Average limit; because the values measured with the peak detector are below the average limit, no measurements with the average detector were carried out.

EUT operates on the upper end of the assigned frequency band (operation mode 2):

**Result measured with the peak detector and corrected to average:**

Remark: At these frequencies a duty cycle was monitored.

Frequency MHz	Result dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Readings dB $\mu$ V	Correction factor	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1304.0925	23.9	52.8	28.9	36.5	-13.8	25.0	26.5	2.7	150	Vert.	Yes
1738.7900	24.6	52.8	28.2	35.2	-13.8	26.6	26.5	3.1	150	Hor.	No
2173.4875	24.1	52.8	28.7	33.2	-13.8	27.7	26.5	3.5	150	Hor.	No
Measurement uncertainty							+2.2 dB / -3.6 dB				

Remark: At these frequencies no duty cycle was monitored.

Frequency MHz	Result dB $\mu$ V/m	Limit * dB $\mu$ V/m	Margin dB	Readings dB $\mu$ V	Correction factor	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1000.000	42.7	52.8	10.1	42.8	-	24.0	26.5	2.4	150	Vert.	Yes
1016.000	39.5	52.8	13.3	39.5	-	24.1	26.5	2.4	150	Hor.	Yes
1040.000	45.3	52.8	7.5	45.3	-	24.2	26.5	2.3	150	Vert.	Yes
1080.000	41.8	52.8	11.0	41.5	-	24.4	26.5	2.4	150	Vert.	Yes
1120.000	41.2	52.8	11.6	40.6	-	24.6	26.5	2.5	150	Vert.	Yes
1160.000	40.4	52.8	12.4	39.7	-	24.7	26.5	2.5	150	Vert.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB				

\*: Average limit; because the values measured with the peak detector are below the average limit, no measurements with the average detector were carried out.

Test: Passed

**TEST EQUIPMENT USED FOR THE TEST:**

29, 31 – 34, 36, 44, 45, 73, 156

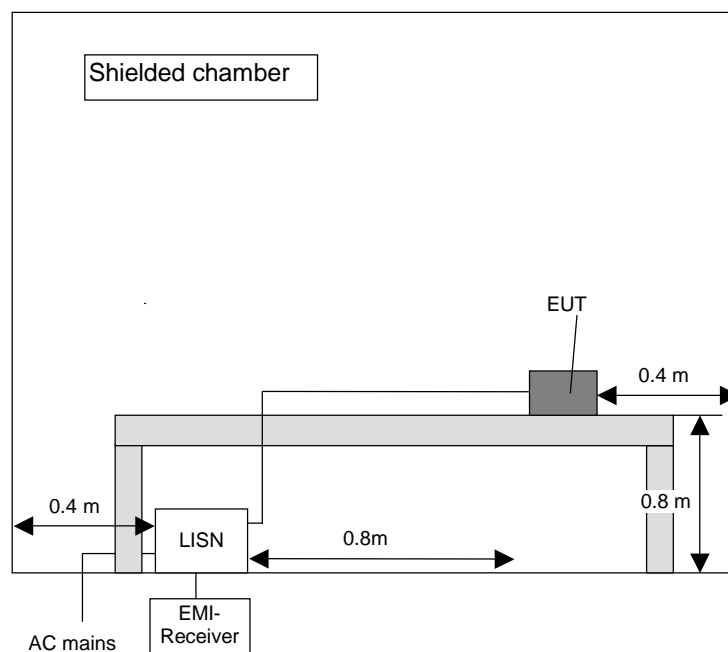
## 5.4 Conducted emissions on power supply lines (150 kHz to 30 MHz)

### 5.4.1 Method of measurement

This test will be carried out in a shielded chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm above the ground plane. Floor-standing devices will be placed directly on the ground plane. The set-up of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

The frequency range 150 kHz to 30 MHz will be measured with an EMI Receiver set to MAX Hold mode with peak and average detector and a resolution bandwidth of 9 kHz. A scan will be carried out on the phase (or plus pole in case of DC powered devices) of the AC mains network. If levels detected 10 dB below the appropriate limit, this emission will be measured with the average and quasi-peak detector on all lines.

Frequency range	Resolution bandwidth
150 kHz to 30 MHz	9 kHz



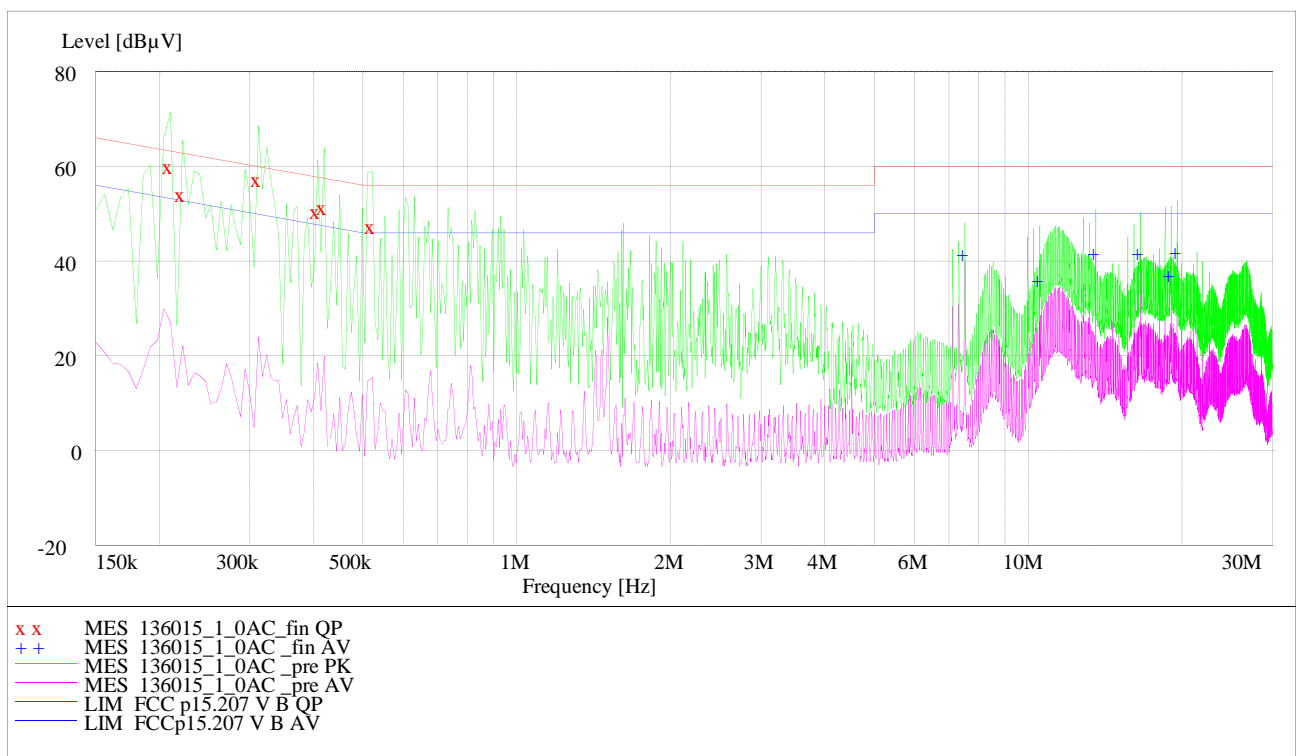
### 5.4.2 Test results (conducted emissions on power supply lines)

Ambient temperature	21 °C	Relative humidity	27 %
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- Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m.
- Cable guide: The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.
- Test record: All results are shown in the following. This test was carried out in normal hopping mode of the EUT.
- Supply voltage: The EUT was supplied by AC mains with 120 VAC / 60 Hz.

The curves in the diagram only represent for each frequency point the maximum measured value of all preliminary measurements, which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by an "x" and the average measured points by a "+".

#### 136015\_1\_0AC: EUT without transmitter (operation mode 0):



**Result measured with the quasi-peak detector (marked by an x):**

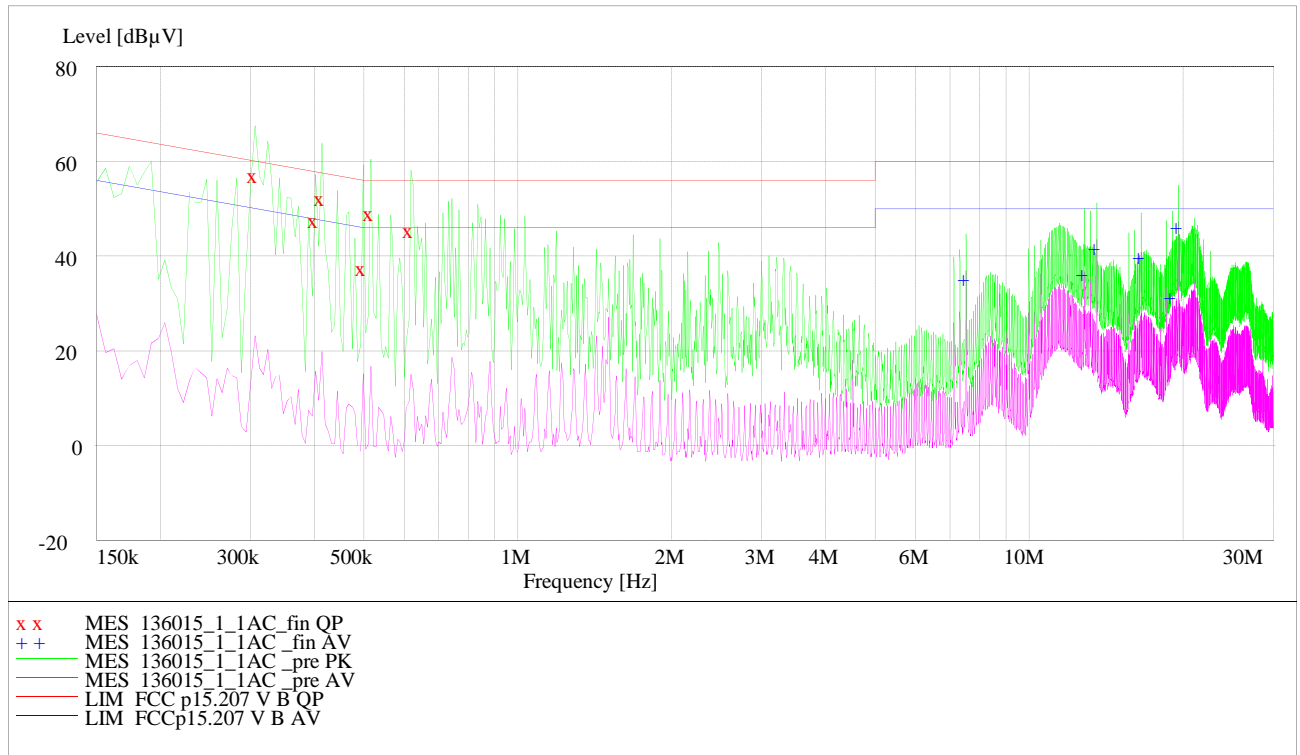
Frequency MHz	Level dB $\mu$ V	Transducer dB	Limit dB $\mu$ V	Margin dB	Line	PE
0.210000	60.3	1.0	63.2	2.9	L1	GND
0.222000	54.4	1.0	62.7	8.3	L1	FLO
0.312000	57.7	0.8	59.9	2.2	L1	FLO
0.408000	51.0	0.9	57.7	6.7	L1	FLO
0.420000	51.7	0.9	57.4	5.8	L1	FLO
0.522000	47.8	0.8	56.0	8.2	L1	FLO

**Result measured with the average detector (marked by a +):**

Frequency MHz	Level dB $\mu$ V	Transducer dB	Limit dB $\mu$ V	Margin dB	Line	PE
7.524000	42.0	1.1	50.0	8.0	N	GND
10.530000	36.5	1.4	50.0	13.5	N	GND
13.542000	42.3	1.8	50.0	7.7	L1	GND
16.554000	42.3	2.1	50.0	7.7	L1	FLO
19.014000	37.7	2.3	50.0	12.3	L3	FLO
19.566000	42.4	2.4	50.0	7.6	L3	FLO

The curves in the diagram only represent for each frequency point the maximum measured value of all preliminary measurements, which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by an "x" and the average measured points by a "+".

136015\_1\_1AC: EUT operates on lowest channel (operation mode 1):



**Result measured with the quasi-peak detector (marked by an x):**

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.306000	57.4	0.9	60.1	2.7	L1	GND
0.402000	47.9	0.8	57.8	9.9	L1	FLO
0.414000	52.5	0.9	57.6	5.0	L1	GND
0.498000	37.8	0.8	56.0	18.2	L1	GND
0.516000	49.4	0.8	56.0	6.6	L1	GND
0.618000	45.8	0.8	56.0	10.2	L1	FLO

**Result measured with the average detector (marked by a +):**

Frequency MHz	Level dB $\mu$ V	Transducer dB	Limit dB $\mu$ V	Margin dB	Line	PE
7.524000	35.8	1.1	50.0	14.2	N	FLO
12.828000	36.8	1.7	50.0	13.2	N	FLO
13.548000	42.3	1.8	50.0	7.7	L1	GND
16.560000	40.4	2.1	50.0	9.6	L1	FLO
19.020000	32.0	2.3	50.0	18.0	L1	GND
19.572000	46.7	2.4	50.0	3.3	L3	FLO

Test: The emissions found, were caused by the HE1622 which is an exempted device according to CFR 47 Part 15.103 (d) and not by the EUT. So this test can be assumed as "Passed".

TEST EQUIPMENT USED FOR THE TEST:
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1 - 4, 20
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## 6 Test equipment and ancillaries used for tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
1	Shielded chamber M4	-	Siemens AG	B83117-S1-X158	480088	Weekly verification (system cal.)	
2	EMI Receiver	ESIB 26	Rohde & Schwarz	1088.7490	481182	03/09/2012	03/2014
3	LISN	NSLK8128	Schwarzbeck	8128161	480138	05/04/2012	04/2014
4	High pass filter	HR 0.13-5ENN	FSY Microwave Inc.	DC 0109 SN 002	480340	Weekly verification (system cal.)	
6	Spectrum analyser	FSU	Rohde & Schwarz	200125	480956	02/15/2012	02/2014
14	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification (system cal.)	
15	EMI Receiver	ESIB 26	Rohde & Schwarz	1088.7490	481182	03/09/2012	03/2014
16	Controller	HD100	Deisel	100/670	480139	-	-
17	Turntable	DS420HE	Deisel	420/620/80	480087	-	-
18	Antenna support	AS615P	Deisel	615/310	480086	-	-
19	Antenna	CBL6111 D	Chase	22921	480674	08/27/2011	08/2014
20	EMI Software	ES-K1	Rohde & Schwarz	-	480111	-	-
24	Loop Antenna $\varnothing = 225$ mm	-	Phoenix Test-Lab	-	410085	Six-month verification (system cal.)	
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	02/13/2013	02/2014
32	Controller	MCU	Maturo	MCU/043/971107	480832	-	-
33	Turntable	DS420HE	Deisel	420/620/80	480315	-	-
34	Antenna support	AS615P	Deisel	615/310	480187	-	-
35	Antenna	CBL6112 B	Chase	2917	480447	09/28/2010	09/2015
36	Horn Antenna	3115 A	EMCO	9609-4918	480183	11/09/2011	11/2014
44	RF-cable No. 3	Sucoflex 106B	Suhner	0563/6B	480670	Weekly verification (system cal.)	
45	RF-cable No. 40	Sucoflex 106B	Suhner	0708/6B	481330	Weekly verification (system cal.)	
73	High Pass Filter	WHJS1000 C11/60EF	Wainwright Instruments GmbH	1	480413	Weekly verification (system cal.)	
80	Tuneable Notch Filter	TTR 375-3EE	TELONIC Berkeley	-	480330	Six-month verification (system cal.)	
133	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	02/16/2012	02/2014
142	RF-cable No. 36	Sucoflex 106B	Huber + Suhner	-	480865	Weekly verification (system cal.)	
156	Preamplifier	JS3-00101200-23-5A	Miteq	681851	480337	Weekly verification (system cal.)	

## 7 Report history

Report Number	Date	Comment
F136015E1	17 January 2014	Document created
F136015E1, 2 <sup>nd</sup> version	23 May 2014	Change of the FCC ID / IC
-	-	-

## 8 List of annexes

ANNEX A TEST SETUP PHOTOGRAPHS 6 pages

136015\_1\_3.JPG: EPI7674 inside HR1622, test set-up fully anechoic chamber  
 136015\_1\_4.JPG: EPI7674 inside HR1622, test set-up fully anechoic chamber  
 136015\_1\_2.JPG: EPI7674 inside HR1622, test set-up fully anechoic chamber  
 136015\_1\_1.JPG: EPI7674 inside HR1622, test set-up fully anechoic chamber  
 136015\_1\_5.JPG: EPI7674 inside HR1622, test set-up open area test site  
 136015\_1\_7.JPG: EPI7674 inside HR1622, test set-up shielded chamber

ANNEX B EXTERNAL PHOTOGRAPHS 4 pages

136015\_1\_c.JPG: HR1622, 3-D-view 1  
 136015\_1\_e.JPG: HR1622, 3-D.view 2  
 136015\_1\_b.JPG: HR1622, cooking chamber (door opened)  
 136015\_1\_f.JPG: HR1622, type plate view

ANNEX C INTERNAL PHOTOGRAPHS 6 pages

136015\_1\_k.JPG: EPI7674 inside HR1622, internal view 1 (cover removed)  
 136015\_1\_j.JPG: EPI7674 inside HR1622, internal view to main PCB  
 136015\_1\_m.JPG: EPI7674 bottom view  
 136015\_1\_n.JPG: EPI7674 bottom view, type plate removed  
 136015\_1\_l.JPG: EPI7674 top view  
 136015\_1\_i.JPG: EPI7674 inside HR1622, antenna view