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# Test Report

Report Number: F132604E2

Applicant:

**Miele & Cie. KG Werk Oelde**

Manufacturer:

**Miele & Cie. KG Werk Oelde**

Equipment under Test (EUT):

**H6880BP with EPI7674 inside**

DAkkS
Deutsche
Akkreditierungsstelle
D-PL-17186-01-01
D-PL-17186-01-02
D-PL-17186-01-03

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.

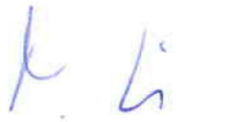
**[2] FCC CFR 47 Part 15 (August 2013)** Radio Frequency Devices

**[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 |  | 06 November 2013 |
| | Name | Signature | Date |
| Authorized reviewer: | Bernd STEINER |  | 06 November 2013 |
| | Name | Signature | Date |

## RESERVATION

This test report is only valid in its original form.

## Contents: Page

# 1 Identification

## 1.1 Applicant

| | |
|---|---|
| Name: | Miele & Cie. KG<br>Werk Oelde |
| Address: | Carl-Miele-Platz 1<br>59302 Oelde |
| Country: | Germany |
| Name for contact purposes: | Mr. Andreas FABRIZIUS |
| Phone: | +49 52 45 91 – 74 615 |
| Fax: | +49 52 45 91 – 78 46 15 |
| eMail Address: | andreas.fabrizius@miele.de |
| Applicant represented during the test by the following person: | Mr. Andreas FABRIZIUS |

## 1.2 Manufacturer

| | |
|---|---|
| Name: | Miele & Cie. KG<br>Werk Oelde |
| Address: | Carl-Miele-Platz 1<br>59302 Oelde |
| Country: | Germany |
| Name for contact purposes: | Mr. Andreas FABRIZIUS |
| Phone: | +49 52 45 91 – 74 615 |
| Fax: | +49 52 45 91 – 78 46 15 |
| eMail Address: | andreas.fabrizius@miele.de |
| 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 DGA Deutsche Akkreditierungsstelle GmbH 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: * | H6880BP with EPI7674 inside |
| FCC ID: * | SSVSK3010 |
| IC: * | 5669B-SK3010 |
| Serial number of kitchen oven (H6880BP): * | 61110026 |
| Hardware version of EPI: * | 90318112 |
| Serial number of EPI: * | A1314000082 |
| 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 H6880BP: * | $U_{Nom}$ = | 120 VAC | $U_{Min}$= | $U_{Nom}$ – 15 % | $U_{Max}$= | $U_{Nom}$ + 15 % |
| | $U_{Nom}$ = | 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) (H6880BP), internally by H6880BP (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: | 12 June 2013 |
| Start of test: | 12 June 2013 |
| End of test: | 10 July 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.

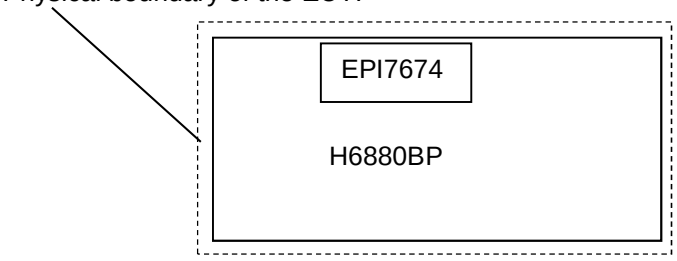
For detail information of the functionality of the EUT please refer the functional description of the applicant.

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

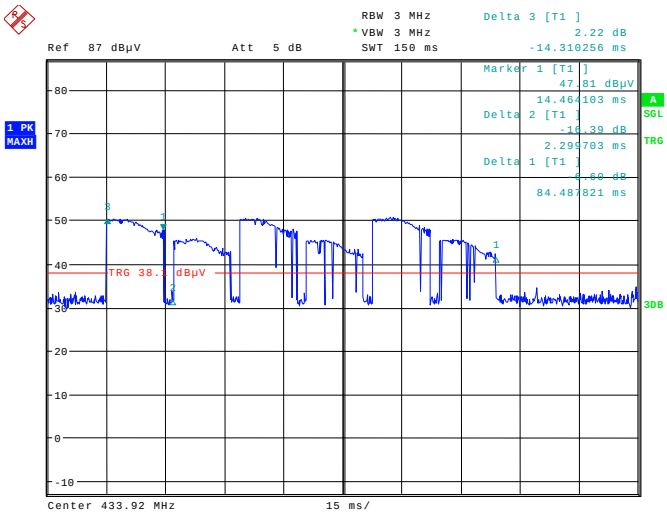
| Application | Frequency range [MHz] | FCC 47 CFR Part 15 section [2] | RSS 210, Issue 8 [3] or RSS-Gen, Issue 3 [4] | Status | Refer page |
|---|---|---|---|---|---|
| Occupied bandwidth | 433.0525 – 434.6975 MHz | 15.231 (e) | A1.1.3 [3] | Passed | 11 et seq. |
| Radiated emissions | 0.009 – 5,000 | 15.231 (e)<br>15.205 (a)<br>15.209 (a) | 2.5 [3]<br>A1.1 [3]<br>7.2 [4] | Passed | 14 et seq. |
| Conducted emissions on supply line | 0.15 - 30 | 15.207 (a) | 7.2.4 [4] | Passed | 34 et seq. |

# 5 Test results

## 5.1 Calculation of the measurement results

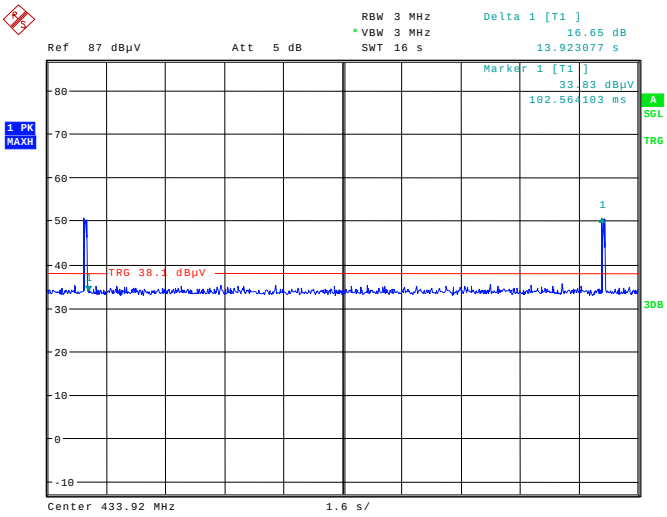
Because short transmission pulses with a long pulse pause all measurements were carried out with a peak detector and the average value is calculated over the real pulse train as required in Part 15.35. To calculate the average value the timing of the emission was measured. A detail view to the transmission 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.

132604_1.wmf: Complete pulse train measuring phase:

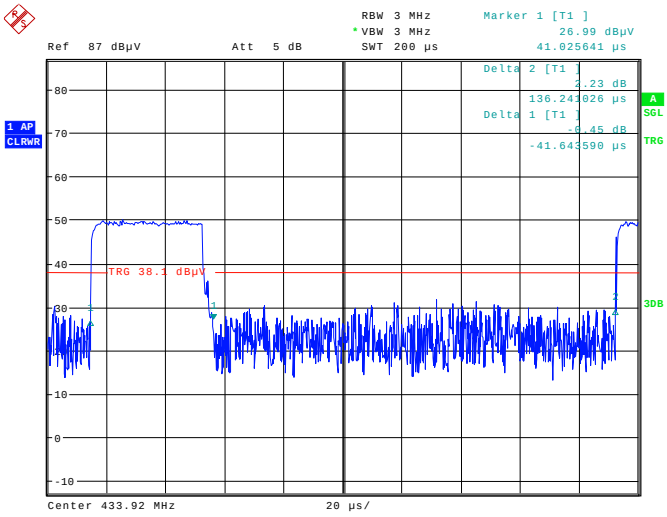



The complete pulse train consists of 6 identical sub pulse trains which may differ in transmit power (belongs on the used food probe).

132604_3.wmf: Time between two transmissions in measuring phase:



132604_2.wmf: single pulse (measuring phase):

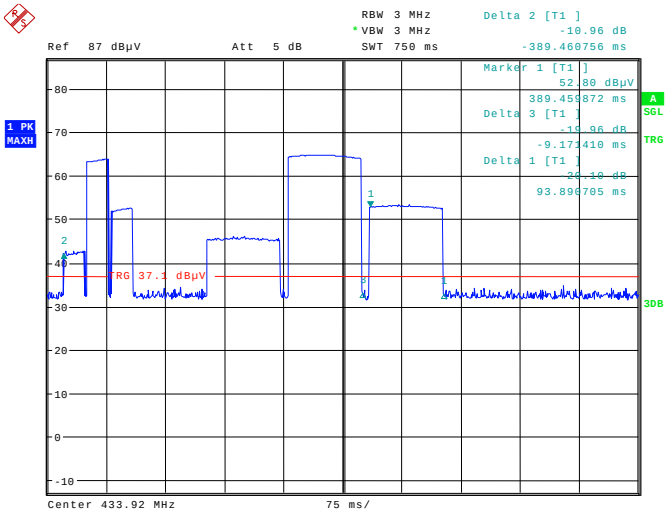



Length of period = 177.88 µs, length of pulse = 41.644 µs, number of transmissions = 492 (87.452 ms / 177.88 µs).

Duty cycle correction factor according to 15.35c:

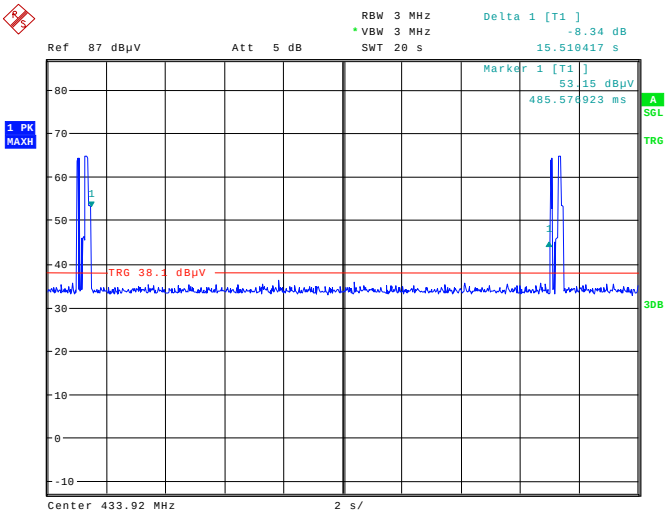
F [dB] = 20 * log (492 * 41.664 µs / 100 ms) = -13.8 dB (measuring phase)

132604_4.wmf: Complete pulse train scan phase:

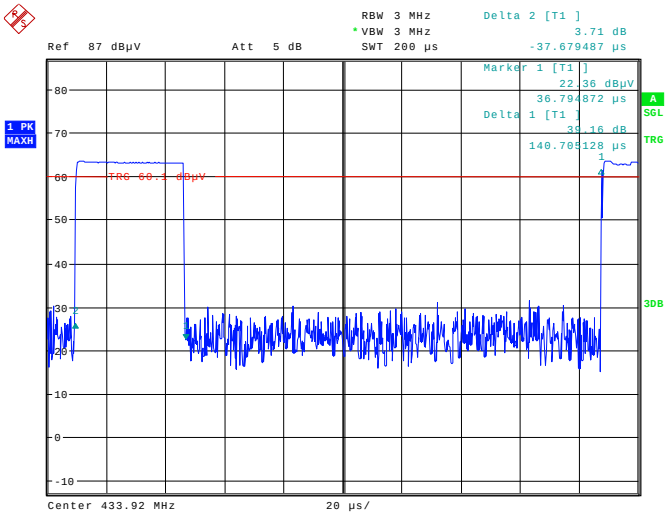



The complete pulse train consists of 6 (3 for resonator 1 and 3 for resonator 2) sub pulse trains with different transmit power. The time for transmitting for the different resonators is always the same.

132604_3.wmf: Time between two transmissions in scan phase:




132604_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 [dB] = 20 * log (526 * 36.795 µs / 100 ms) = -14.3 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 |

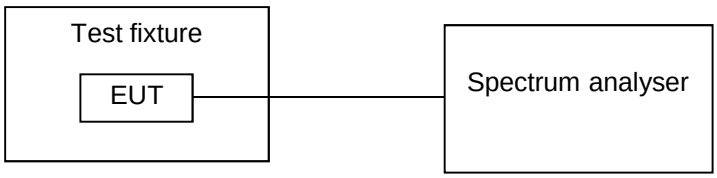
## 5.2 Occupied bandwidth

### 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 kHz;
  from 30 MHz to 1000: MHz $RBW_{min}$ = 10 kHz;
  and from 1000 MHz to 40 GHz: $RBW_{min}$ = 100 kHz.
- Video bandwidth: ≥ 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.

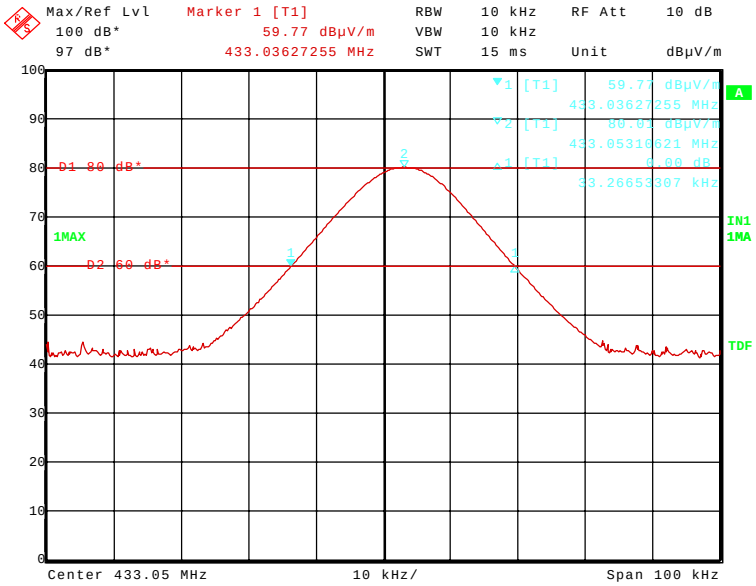
After trace stabilisation the marker shall be set on the signal peak and use the 99 % bandwidth function of the spectrum analayser.

### 5.2.2 Test results (occupied bandwidth)

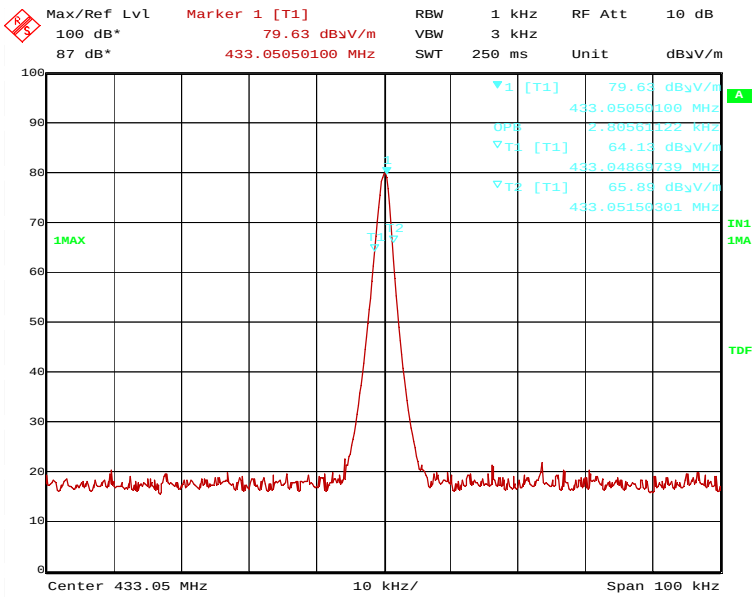
| | |
|---|---|
| Ambient temperature | 21 °C |

| | |
|---|---|
| Relative humidity | 60 % |

132604_16.wmf: 20 dB bandwidth at the lower end of the assigned frequency band (operation mode 1):




132604_27.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 side 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 side 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 disenabled.

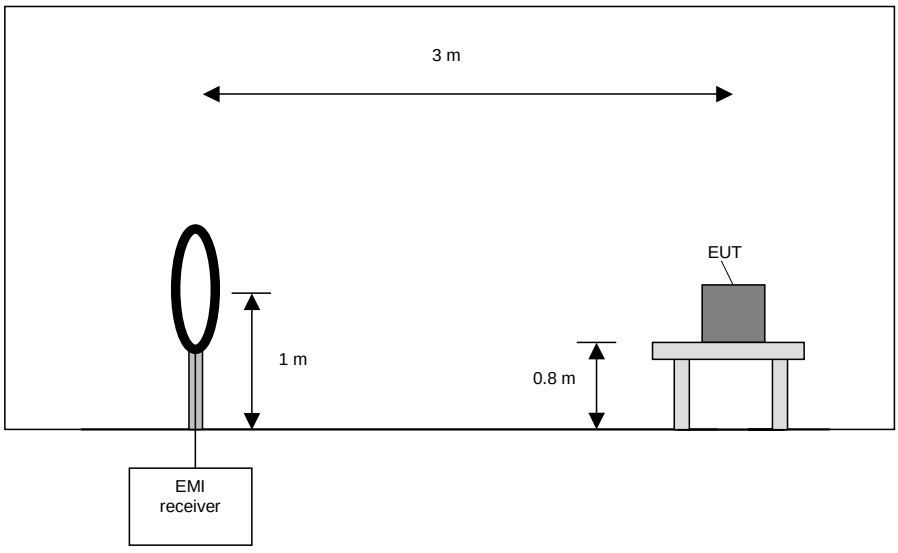
**Preliminary measurement (9 kHz to 30 MHz):**

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).

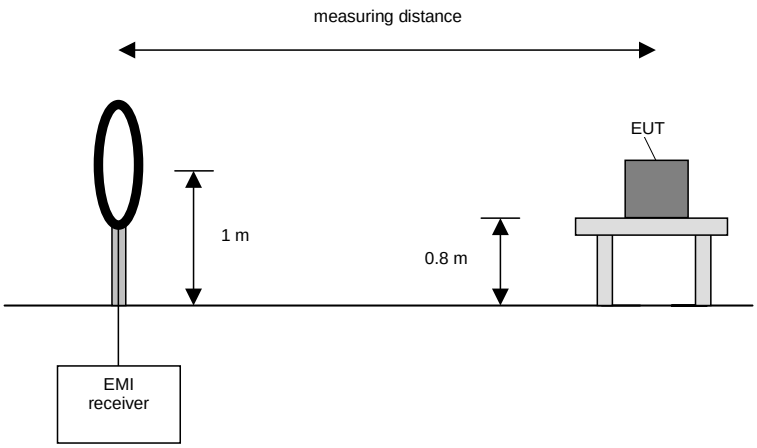
**Final measurement (9 kHz to 30 MHz):**

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).

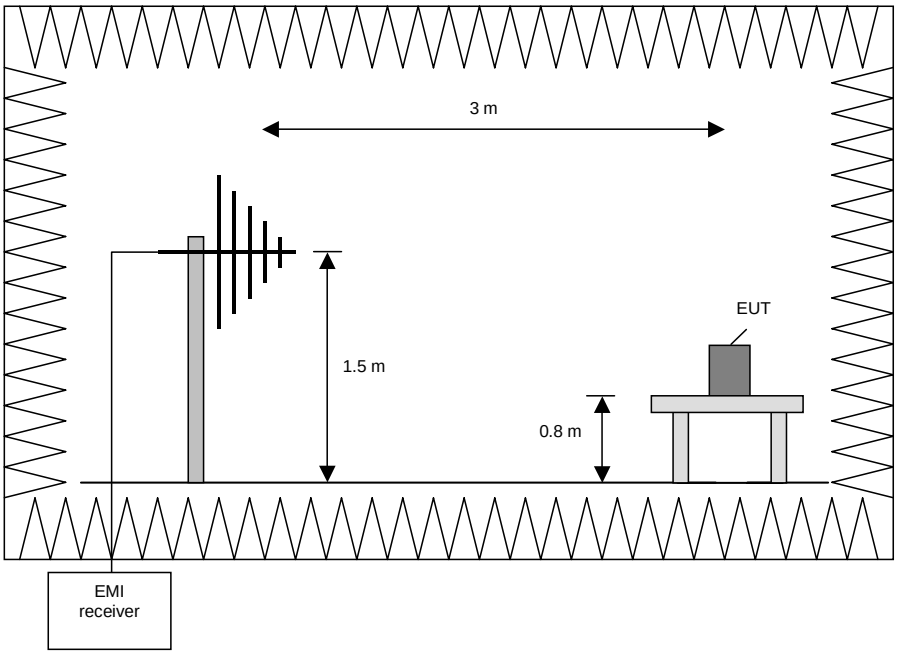
**Preliminary measurement (30 MHz to 1 GHz)**

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:

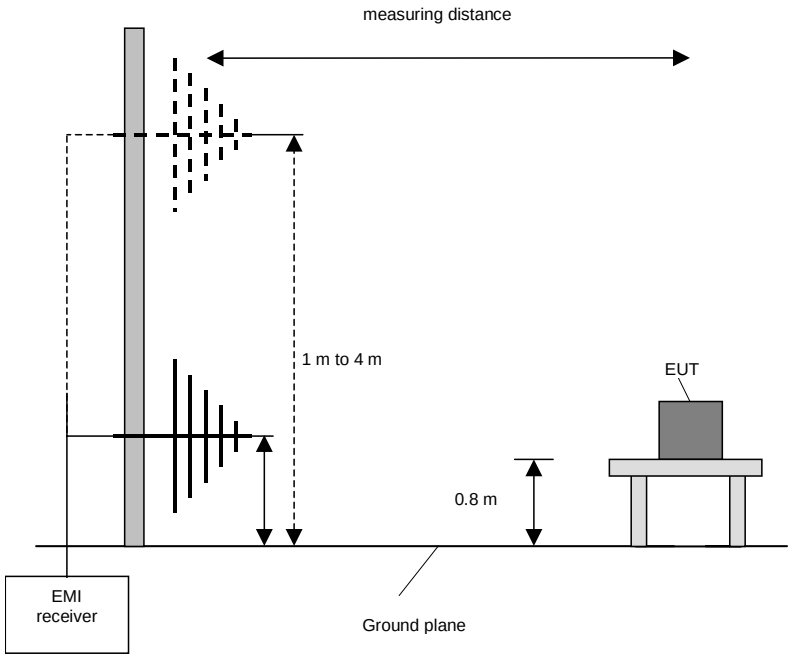
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the 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)**

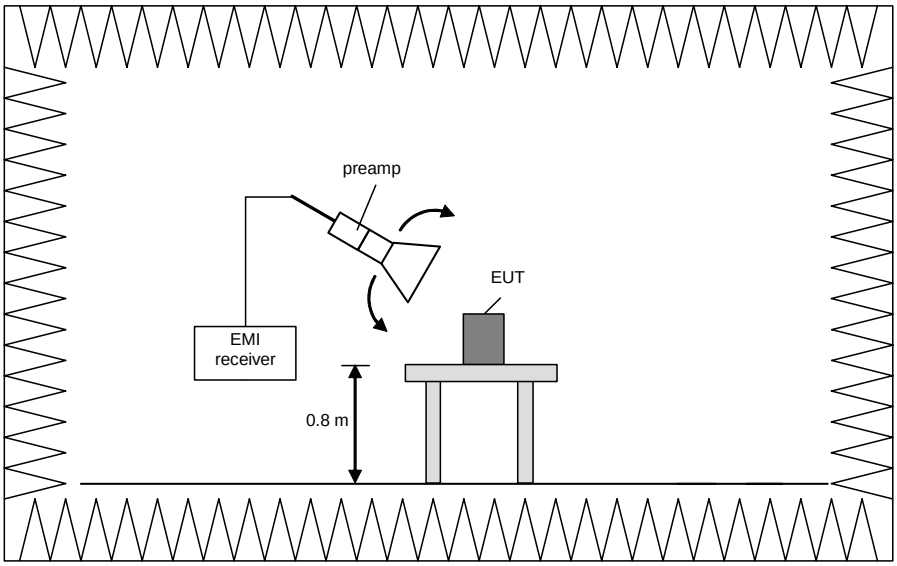
This measurement will be performed in a fully anechoic chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set-up of the Equipment under test will be in accordance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

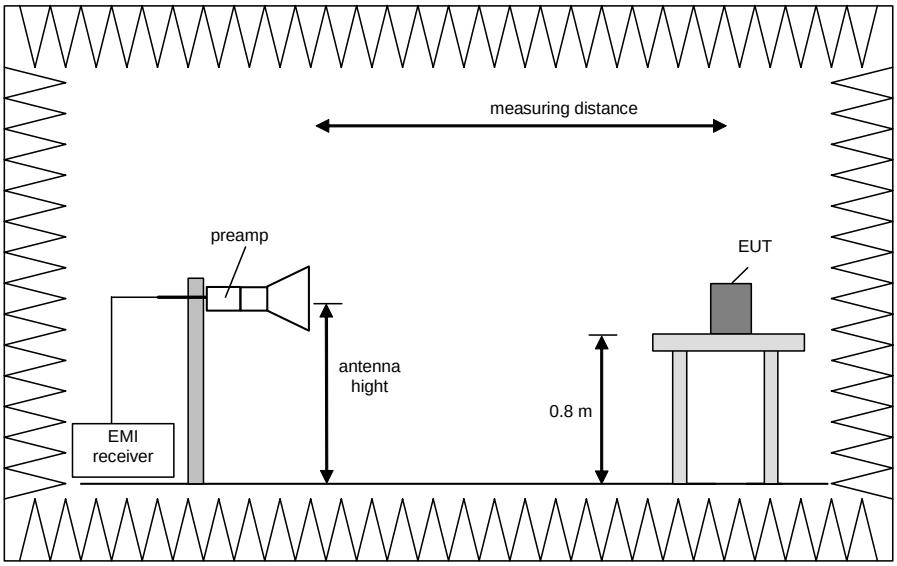



**Final measurement (1 GHz to 110 GHz)**

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 | 60 % |

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.

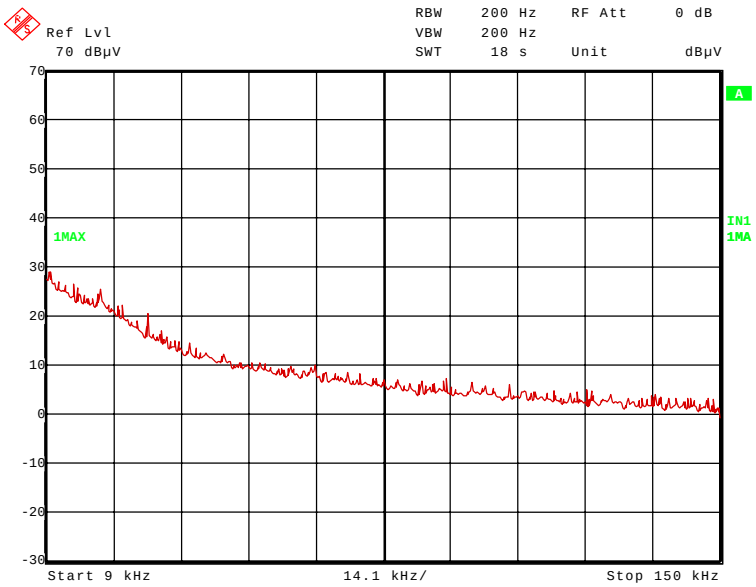
Cable guide: The cable of the EUT runs vertically to the false floor. For further information of the EUT set-up refer to the pictures in annex A of this test report.

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

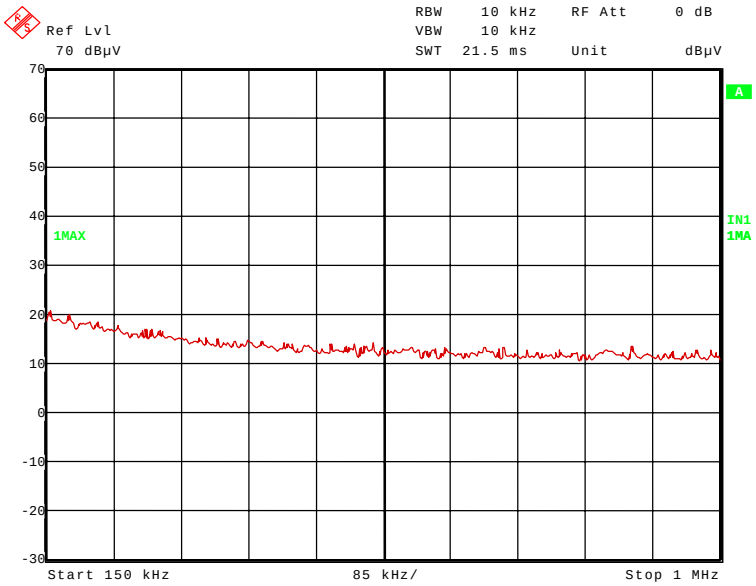
Supply voltage: The EUT was supplied by AC mains with 120 VAC / 60 Hz.

Oven without transmitter:

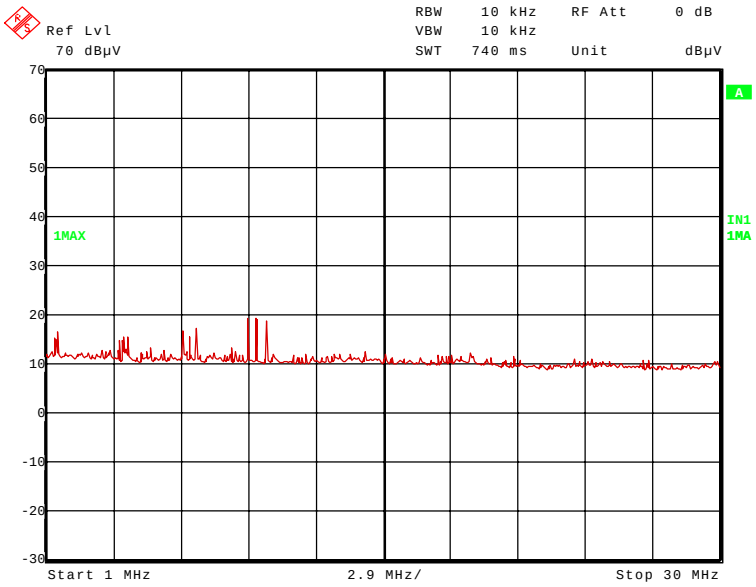
132604_48.wmf: Spurious emissions from 9 kHz to 150 kHz (operation mode 0):



132604_49.wmf: Spurious emissions from 150 kHz to 1 MHz (operation mode 0):



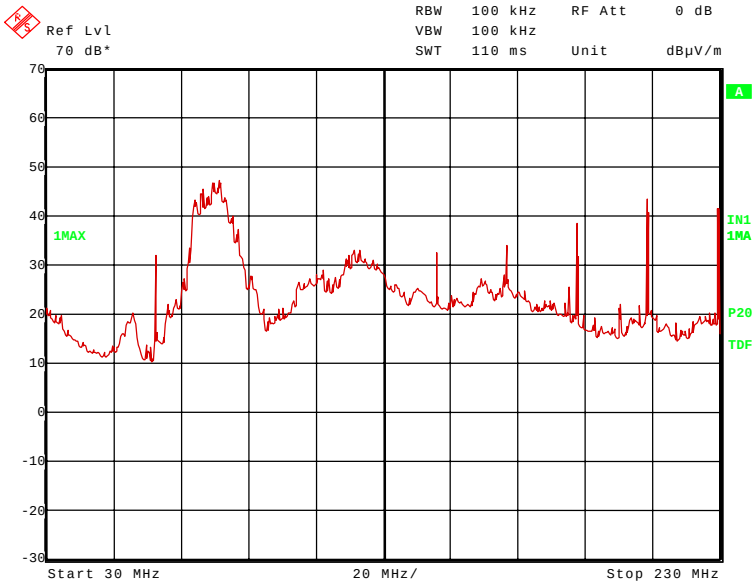

132604_50.wmf: Spurious emissions from 1 MHz to 30 MHz (operation mode 0):



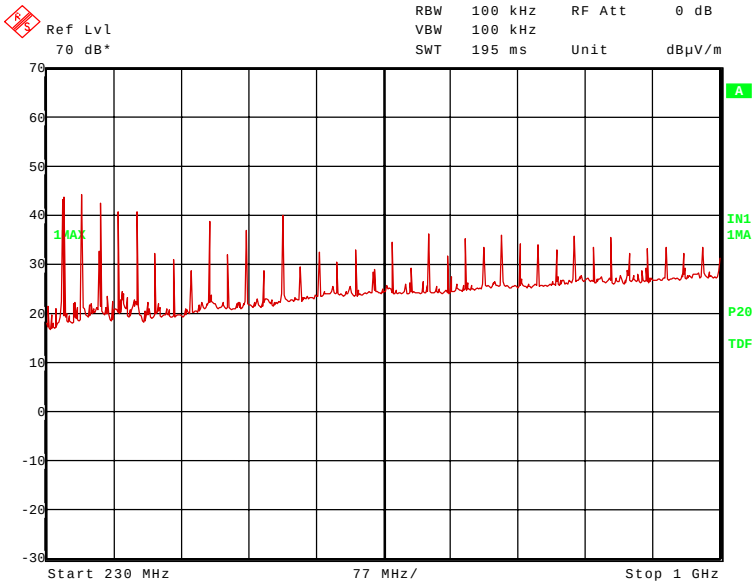

The following frequencies were found during the oven measurement (transmitter not installed):

1.495 MHz, 4.485 MHz, 7.475 MHz and 10.044 MHz.

132604_18.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 0):



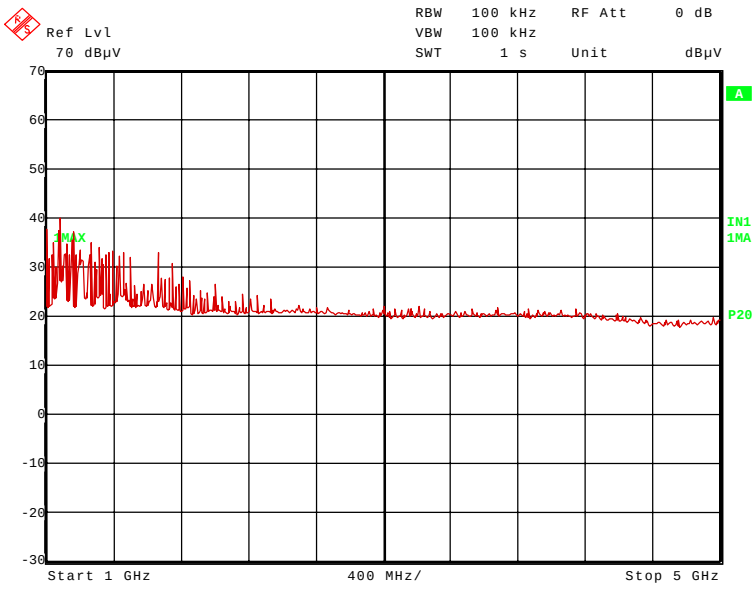

132604_19.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 0):




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

62.500 MHz, 83.368 MHz, 125.000 MHz, 145.833 MHz, 154.990 MHz, 166.666 MHz, 187.500 MHz, 208.332 MHz, 229.166 MHz, 270.832 MHz, 291.666 MHz, 333.332 MHz, 500.000 MHz, 666.664 MHz and 833.330 MHz.

132604_25.wmf: Spurious emissions from 1 GHz to 5 GHz (operation mode 0):

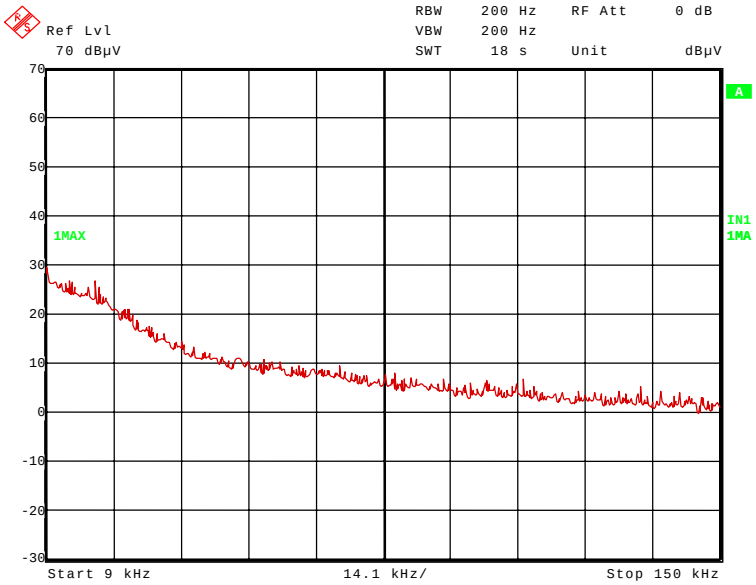



The following frequencies were found during the oven measurement (transmitter not installed):

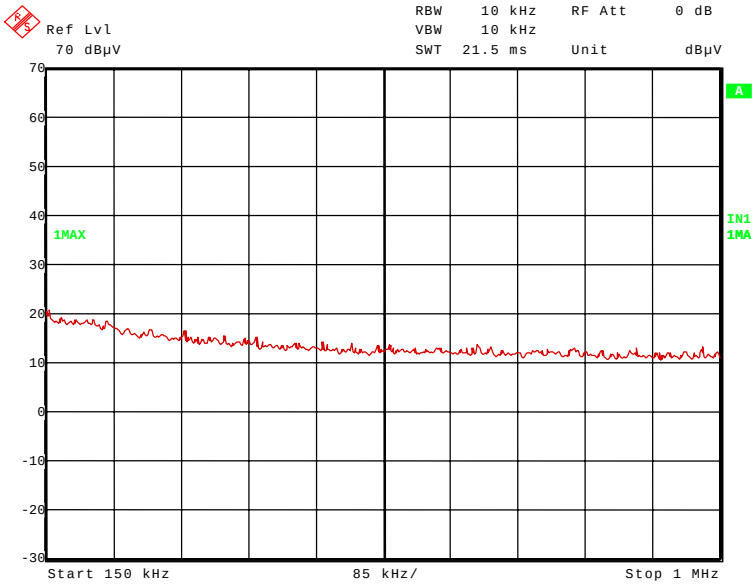
1.020 GHz, 1.060 GHz, 1.100 GHz, 1.140 GHz, 1.333 GHz and 1.416 GHz.

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

132604_51.wmf: Spurious emissions from 9 kHz to 150 kHz (operation mode 1):

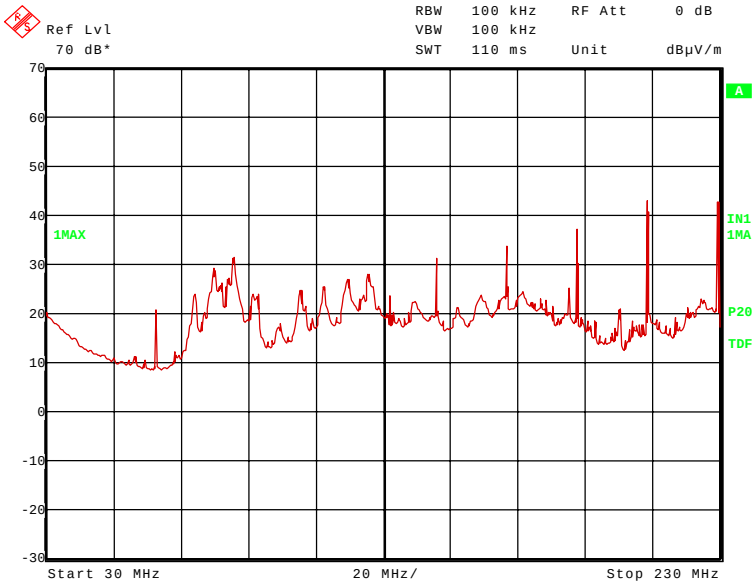



132604_52.wmf: Spurious emissions from 150 kHz to 1 MHz (operation mode 1):

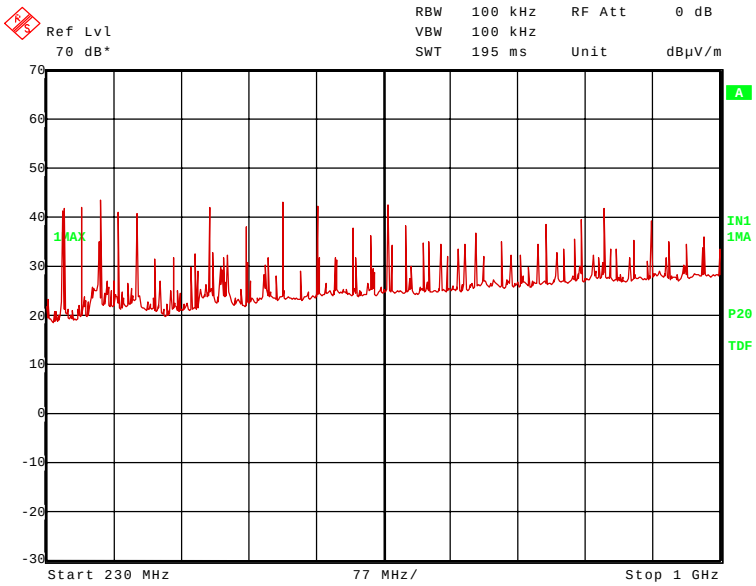



No significant additional frequencies above the noise floor of the system and the measurement results without transmitter were found during the preliminary radiated emission test, so no measurements were carried out on the outdoor test site.

132604_20.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 1):




132604_21.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 1, carrier notched):

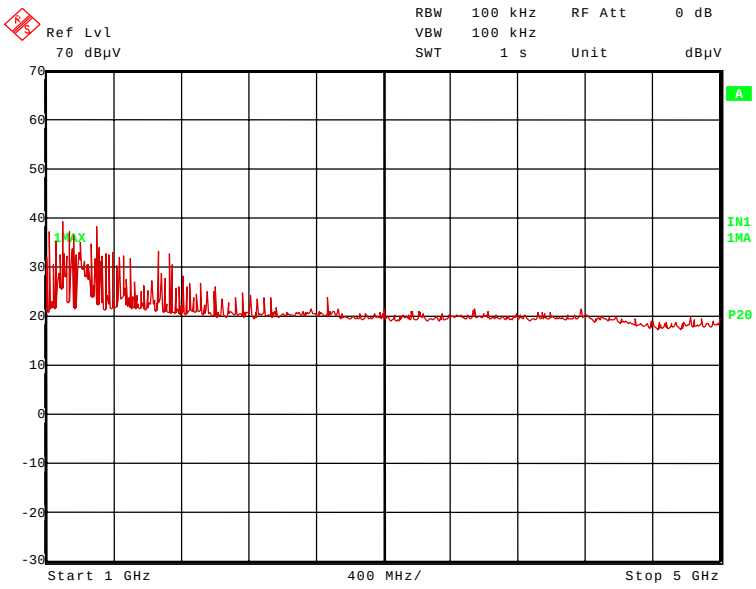



The following additional frequencies were found during the preliminary radiated emission test:

433.0525 MHz, 520.000 MHz, 540.000 MHz, 720.000 MHz, 800.000 MHz, 840.000 MHz, 866.105 MHz, 880.000 MHz and 920.000 MHz.

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

132604_26.wmf: Spurious emissions from 1 GHz to 5 GHz (operation mode 1):



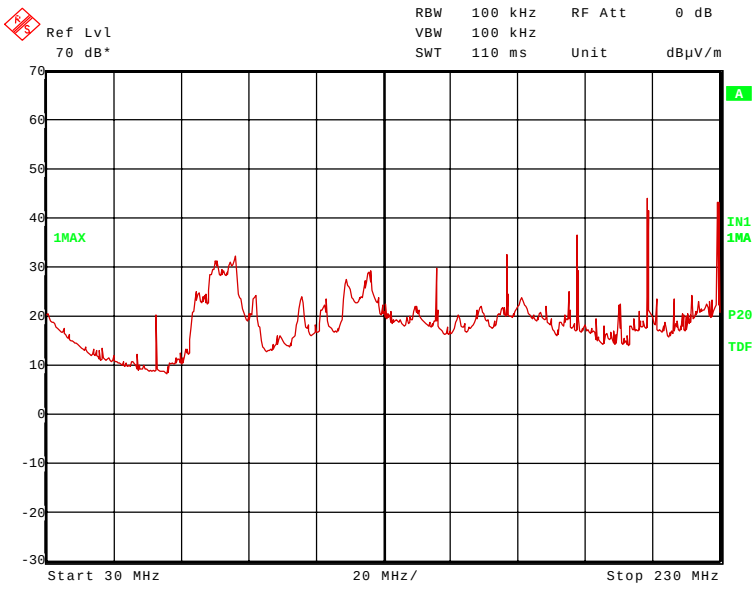

The following additional frequencies were found during the preliminary radiated emission test:

1299.1575 MHz and 1732.21 MHz.

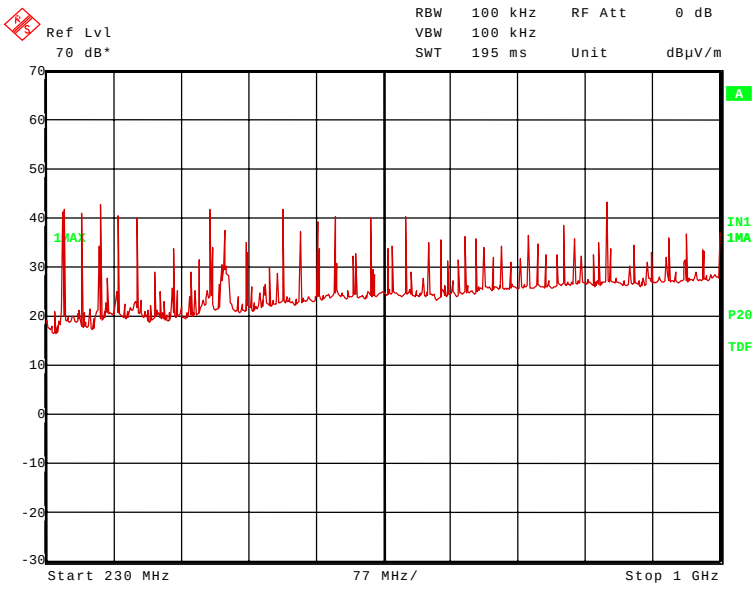
At these frequencies a final measurement has to be performed. The result is presented in the following.

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

132604_23.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 2):



132604_22.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 2, carrier notched):

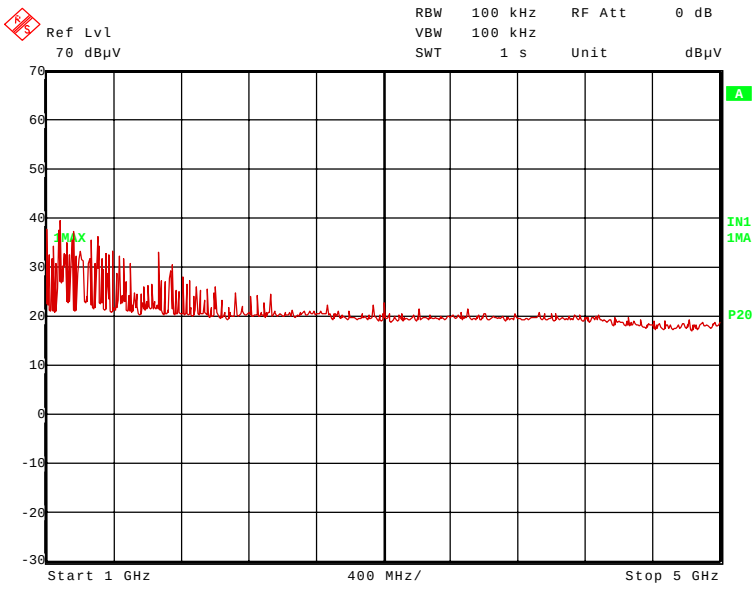



The following additional frequencies were found during the preliminary radiated emission test:

434.6975 MHz, 600.000 MHz, 640.000 MHz, 780.000 MHz, 820.000 MHz, 860.000 MHz and 869.395 MHz.

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

132604_24.wmf: Spurious emissions from 1 GHz to 5 GHz (operation mode 2):




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

1304.0925 MHz and 1738.790 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 – 35, 36, 44, 45, 73, 80, 133, 142, 156 |

### 5.3.2.2 Final radiated emission measurement (30 MHz to 1 GHz)

| | | | |
|---|---|---|---|
| Ambient temperature | 21 °C | Relative humidity | 55 % |

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.

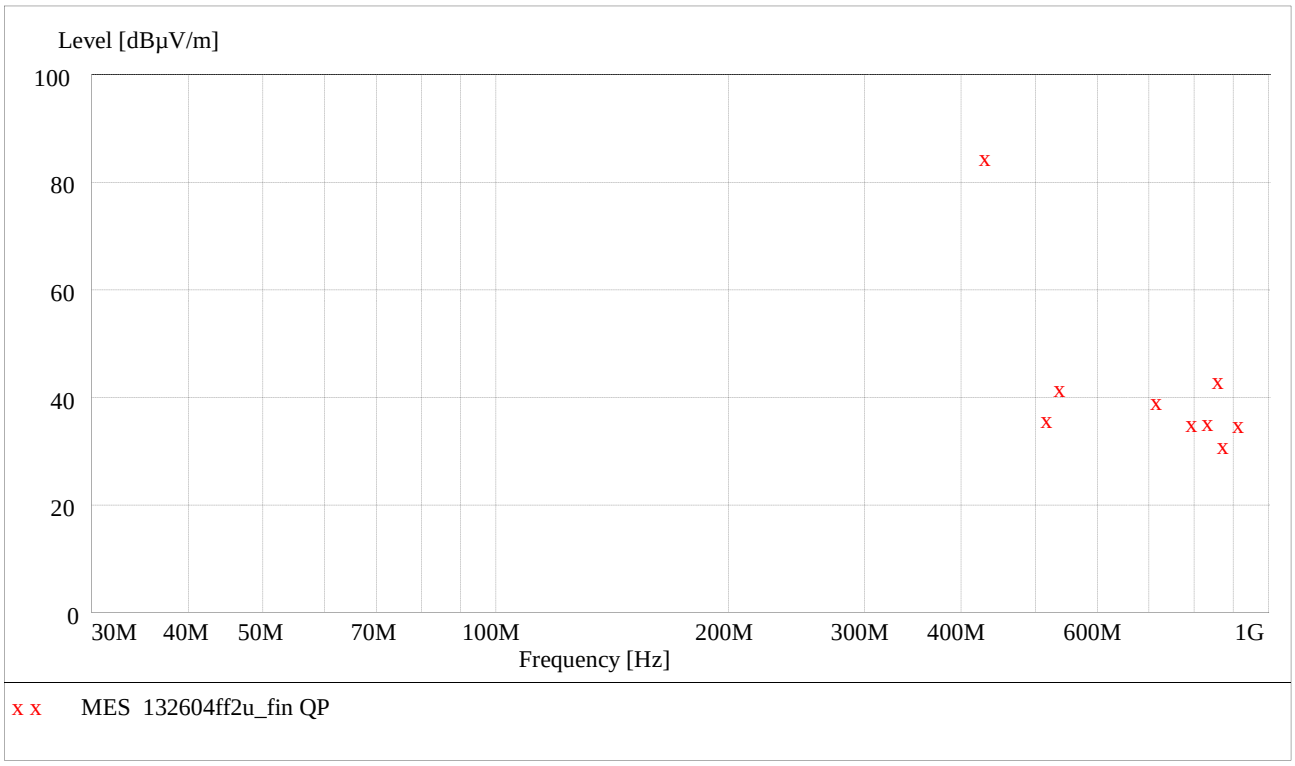
Supply voltage: The EUT was supplied by AC mains with 120 VAC / 60 Hz.

Test results: The test results were calculated with the following formula:

Result [dBµV/m] = reading [dBµV] + cable loss [dB] + antenna factor [dB/m] + 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.

132064ff2u: EUT operates on the lower end of the assigned frequency band (operation mode 1):




Data record name: 132604ff2u

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.

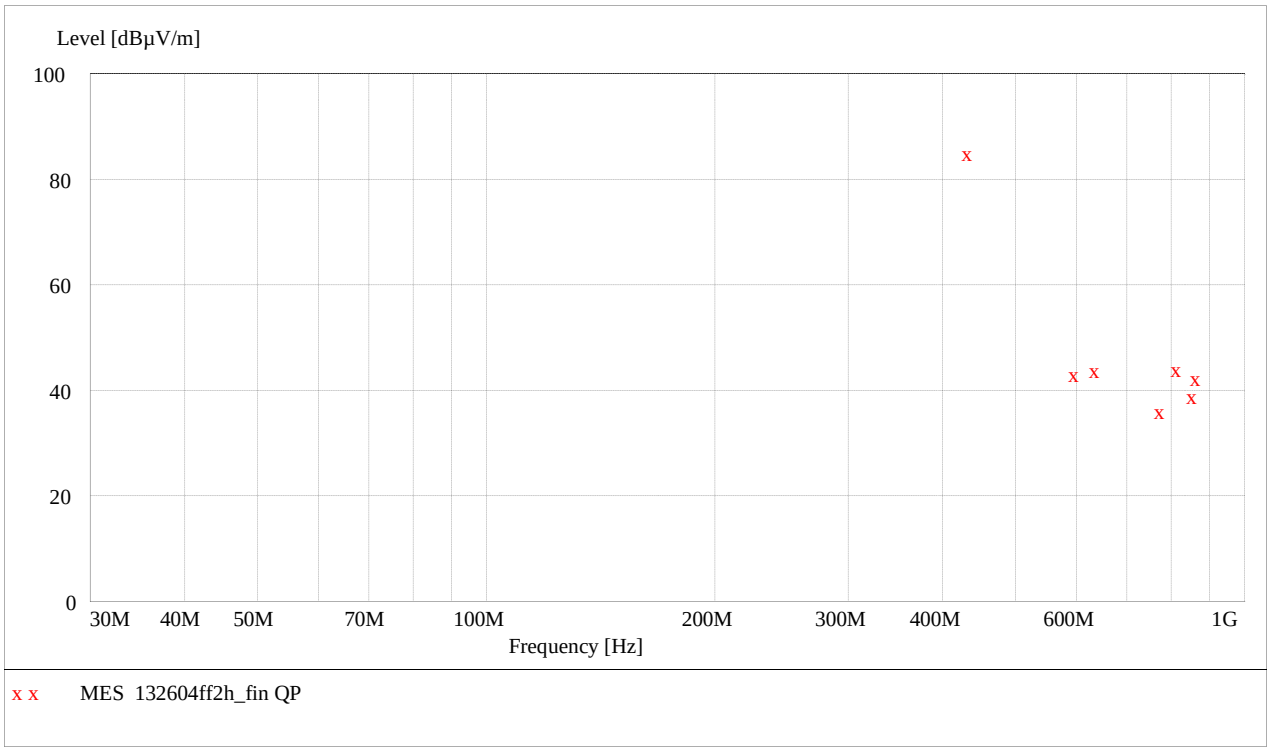
The measurement time with the quasi-peak measuring detector is 1 second.

**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<br>MHz | Result<br>dBµV/m | Limit<br>dBµV/m | Margin<br>dB | Readings<br>dBµV | Correction factor<br>dB | Antenna factor<br>dB/m | Cable loss<br>dB | Height<br>cm | Azimuth<br>deg | Pol. |
| 433.0525 | 71.2 | 72.8 | 1.6 | 52.5 | -13.8 | 16.4 | 2.3 | 100 | 0 | Vert. |
| 520.000 | 36.3 | 52.8 | 16.5 | 16.0 | - ** | 17.7 | 2.6 | 202 | 357 | Vert. |
| 540.000 | 42.2 | 52.8 | 10.6 | 21.0 | - ** | 18.5 | 2.7 | 114 | 11 | Vert. |
| 720.000 | 39.7 | 52.8 | 13.1 | 15.6 | - ** | 21.1 | 3.0 | 135 | 14 | Vert. |
| 800.000 | 35.6 | 52.8 | 17.2 | 11.1 | - ** | 21.3 | 3.2 | 173 | 25 | Vert. |
| 840.000 | 35.8 | 52.8 | 17.0 | 9.9 | - ** | 22.7 | 3.2 | 112 | 287 | Vert. |
| 866.105 | 29.9 | 52.8 | 22.9 | 4.3 | -13.8 | 22.2 | 3.4 | 179 | 21 | Vert. |
| 880.000 | 31.6 | 52.8 | 21.2 | 6.2 | - ** | 22.0 | 3.4 | 211 | 344 | Vert. |
| 920.000 | 35.4 | 52.8 | 17.4 | 8.9 | - ** | 23.1 | 3.4 | 100 | 163 | 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

132604ff2h: 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<br>MHz | Result<br>dBµV/m | Limit<br>dBµV/m | Margin<br>dB | Readings<br>dBµV | Correction factor<br>dB | Antenna factor<br>dB/m | Cable loss<br>dB | Height<br>cm | Azimuth<br>deg | Pol. |
| 434.698 | 71.3 | 72.8 | 1.5 | 66.3 | -13.8 | 16.4 | 2.4 | 100 | 0 | Vert. |
| 600.000 | 43.1 | 52.8 | 9.7 | 21.1 | - ** | 19.2 | 2.8 | 102 | 11 | Vert. |
| 640.000 | 43.9 | 52.8 | 8.9 | 21.3 | - ** | 19.7 | 2.9 | 102 | 12 | Vert. |
| 780.000 | 36.2 | 52.8 | 16.6 | 11.5 | - ** | 21.5 | 3.2 | 254 | 154 | Vert. |
| 820.000 | 44.1 | 52.8 | 8.7 | 18.9 | - ** | 22.0 | 3.2 | 206 | 181 | Vert. |
| 860.000 | 38.9 | 52.8 | 13.9 | 13.3 | - ** | 22.3 | 3.3 | 202 | 24 | Vert. |
| 869.395 | 28.7 | 52.8 | 24.1 | 17.0 | -13.8 | 22.1 | 3.4 | 179 | 21 | 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 | 45 % |

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:

Result [dBµV/m] = reading [dBµV] + cable loss [dB] + antenna factor [dB/m] – Preamp [dB] + 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:**

| Frequency GHz | Result dBµV/m | Limit dBµV/m | Margin dB | Readings dBµV | Correction factor | Antenna factor 1/m | Preamp dB | Cable loss dB | Height cm | Pol. | Restr. Band |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.2991575 | 28.6 | 52.8 | 24.2 | 40.7 | -13.8 | 25.0 | 26.0 | 2.7 | 150 | Hor. | No |
| 1.7322100 | 27.1 | 52.8 | 25.7 | 37.2 | -13.8 | 26.5 | 25.9 | 3.1 | 150 | Hor. | No |
| Measurement uncertainty | | | | | | +2.2 dB / -3.6 dB | | | | | |

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

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

| Frequency GHz | Result dBµV/m | Limit dBµV/m | Margin dB | Readings dBµV | Correction factor | Antenna factor 1/m | Preamp dB | Cable loss dB | Height cm | Pol. | Restr. Band |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.3040925 | 41.7 | 52.8 | 11.1 | 39.9 | -13.8 | 25.0 | 25.9 | 2.7 | 150 | Hor. | Yes |
| 1.7387900 | 38.7 | 52.8 | 14.1 | 34.9 | -13.8 | 26.6 | 25.9 | 3.1 | 150 | Hor. | No |
| Measurement uncertainty | | | | | | +2.2 dB / -3.6 dB | | | | | |

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

| |
|---|
| 29, 31 – 34, 36, 44, 45, 73, 156 |

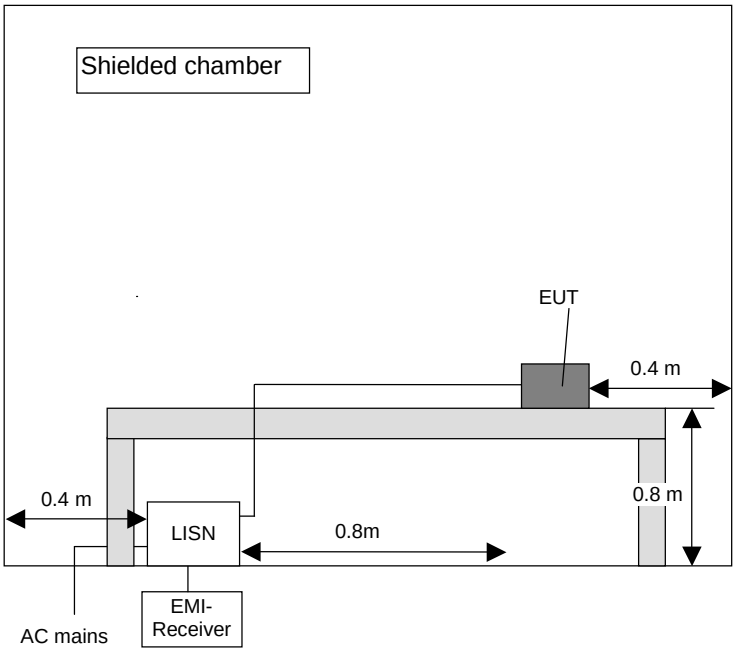
## 5.4 Conducted emissions on power supply lines (150 kHz to 30 MHz)

### 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 appropriable 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 | 55 % |

Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m.

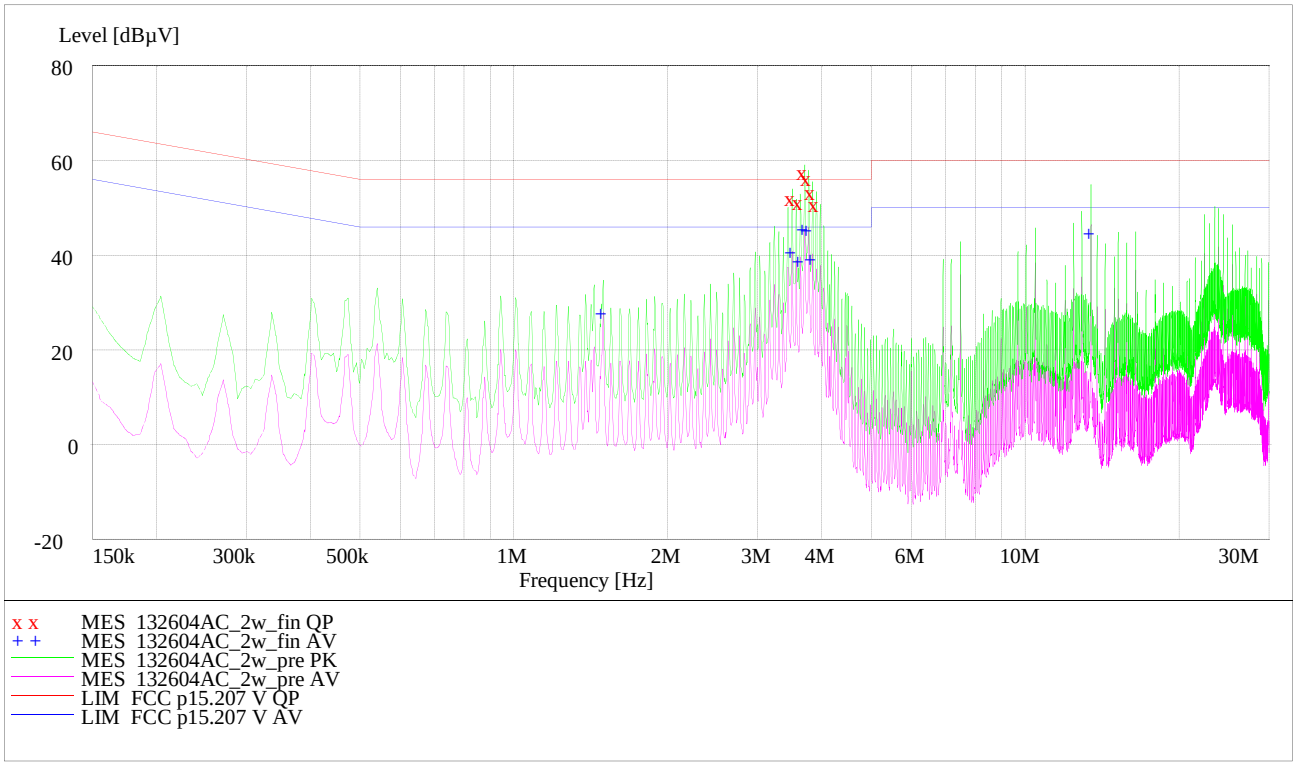
Cable guide: The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

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 “+”.

132604AC_2w: EUT without transmitter (operation mode 0):



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

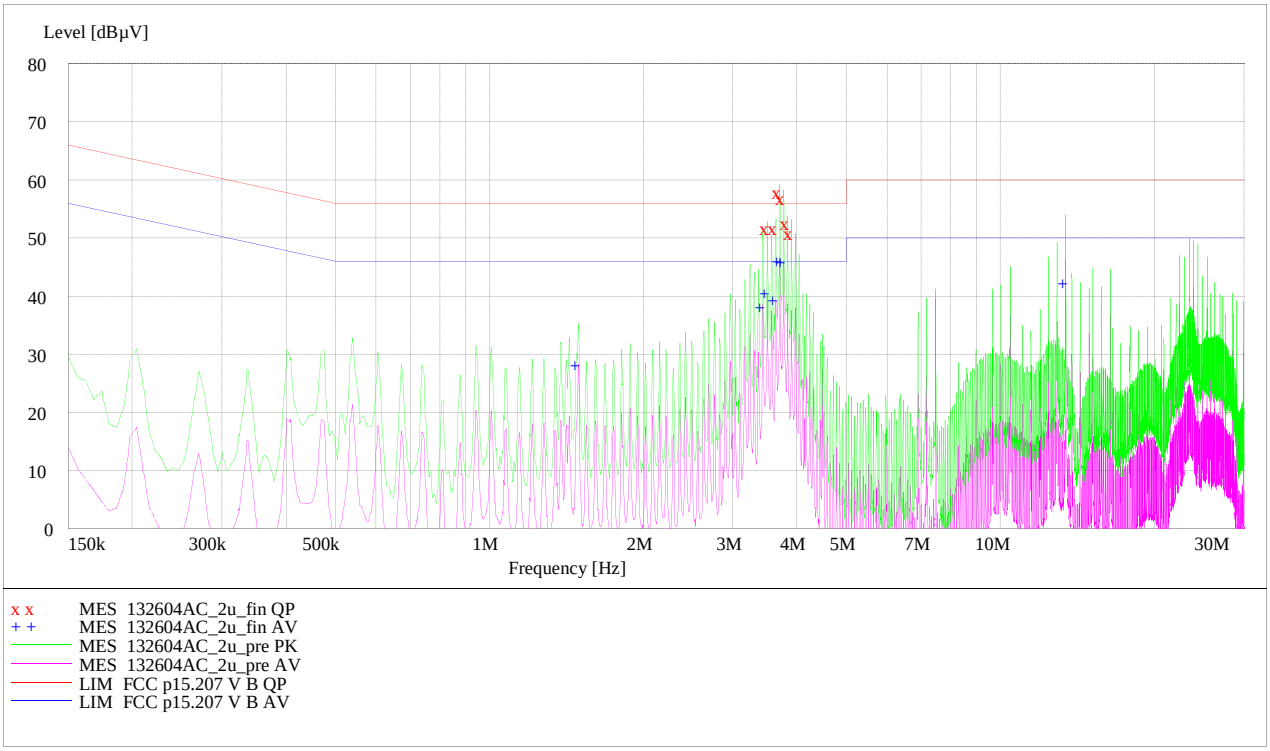
| Frequency MHz | Level dBµV | Transducer dB | Limit dBµV | Margin dB | Line | PE |
|---|---|---|---|---|---|---|
| 3.504 | 52.4 | 0.9 | 56.0 | 3.6 | N | GND |
| 3.636 | 51.7 | 0.7 | 56.0 | 4.3 | N | FLO |
| 3.702 | 57.8 | 0.7 | 56.0 | -1.7 | N | FLO |
| 3.774 | 56.7 | 0.7 | 56.0 | -0.6 | N | GND |
| 3.840 | 53.6 | 0.7 | 56.0 | 2.4 | N | FLO |
| 3.906 | 51.1 | 0.7 | 56.0 | 4.9 | N | FLO |

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

| Frequency MHz | Level dBµV | Transducer dB | Limit dBµV | Margin dB | Line | PE |
|---|---|---|---|---|---|---|
| 1.494 | 28.2 | 0.7 | 46.0 | 17.8 | N | FLO |
| 3.504 | 40.9 | 0.9 | 46.0 | 5.1 | N | GND |
| 3.636 | 39.1 | 0.7 | 46.0 | 6.9 | N | GND |
| 3.702 | 45.8 | 0.7 | 46.0 | 0.2 | N | GND |
| 3.774 | 45.7 | 0.7 | 46.0 | 0.3 | N | FLO |
| 3.840 | 39.6 | 0.7 | 46.0 | 6.4 | N | GND |
| 13.458 | 45.0 | 1.8 | 50.0 | 5.0 | L1 | GND |

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 “+”.

132604AC_2u: EUT operates on lower 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 |
|---|---|---|---|---|---|---|
| 3.504 | 51.8 | 0.9 | 56.0 | 4.2 | N | FLO |
| 3.636 | 51.9 | 0.7 | 56.0 | 4.1 | N | FLO |
| 3.702 | 58.0 | 0.7 | 56.0 | -1.9 | N | FLO |
| 3.768 | 57.0 | 0.7 | 56.0 | -0.9 | N | GND |
| 3.840 | 52.7 | 0.7 | 56.0 | 3.3 | N | FLO |
| 3.906 | 51.0 | 0.7 | 56.0 | 5.0 | N | FLO |

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

| Frequency MHz | Level dBµV | Transducer dB | Limit dBµV | Margin dB | Line | PE |
|---|---|---|---|---|---|---|
| 1.494 | 28.3 | 0.7 | 46.0 | 17.7 | N | GND |
| 3.432 | 38.3 | 0.8 | 46.0 | 7.7 | N | GND |
| 3.504 | 40.7 | 0.9 | 46.0 | 5.3 | N | GND |
| 3.636 | 39.4 | 0.7 | 46.0 | 6.6 | N | FLO |
| 3.702 | 46.2 | 0.7 | 46.0 | -0.1 | N | FLO |
| 3.768 | 46.0 | 0.7 | 46.0 | 0.0 | N | FLO |
| 13.446000 | 42.3 | 1.8 | 50.0 | 7.7 | L1 | FLO |

Test: The emissions found, were caused by the BP 6780 BP 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: |
|---|
| 1 - 4, 20 |

# 6 Test equipment and ancillaries used for tests

| No. | Test equipment | Type | Manufacturer | Serial No. | PM. No. | Cal. Date | Cal. due |
|---|---|---|---|---|---|---|---|
| 1 | Shielded chamber M47 | - | Albatross Projects | B83117-C6439-T262 - | 480662 | 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 | 12/20/2012 | 12/2013 |
| 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 ∅ = 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 | 09/2013 |
| 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 |
|---|---|---|
| F132604E2 | 06 November 2013 | Document created |
| - | - | - |
| - | - | - |

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132604_2_1.JPG: EPI7674 inside H6880BP, test set-up fully anechoic chamber
132604_2_2.JPG: EPI7674 inside H6880BP, test set-up fully anechoic chamber
132604_2_3.JPG: EPI7674 inside H6880BP, test set-up open area test site
132604_2_5.JPG: EPI7674 inside H6880BP, test set-up shielded chamber

ANNEX B EXTERNAL PHOTOGRAPHS 4 pages

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