

Test Report

Report Number:

F170587E2

Equipment under Test (EUT):

SRF-6/2/1-E-H

Applicant:

Bernstein AG

Manufacturer:

Bernstein AG



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



References

- [1] **ANSI C63.10: 2013** American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- [2] **FCC CFR 47 Part 15** Radio Frequency Devices
- [3] **RSS-210 Issue 9 (August 2016)** Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
- [4] **RSS-Gen Issue 4 (November 2014)** General Requirements for Compliance 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.

| | | | |
|------------------------|----------------|--|------------|
| Tested and written by: | Michael DINTER |  | 09.02.2018 |
| | Name | Signature | Date |
| Authorized reviewer: | Thomas KÜHN |  | 09.02.2018 |
| | Name | Signature | Date |

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| Contents: | Page |
|--|-------------|
| 1 Identification | 4 |
| 1.1 Applicant | 4 |
| 1.2 Manufacturer | 4 |
| 1.3 Test Laboratory | 4 |
| 1.4 EUT (Equipment Under Test) | 5 |
| 1.5 Technical data of equipment..... | 5 |
| 1.6 Ancillary equipment used for test..... | 6 |
| 1.7 Dates..... | 6 |
| 2 Operational states and test setup..... | 6 |
| 3 Additional information..... | 7 |
| 4 Overview | 7 |
| 5 Results | 8 |
| 5.1 Conducted emission measurement on ac mains (150 kHz to 30 MHz) | 8 |
| 5.1.1 Method of measurement conducted emission..... | 8 |
| 5.1.2 Test result (conducted emission measurement on AC mains)..... | 9 |
| 5.2 Radiated emissions | 11 |
| 5.2.1 Method of measurement (radiated emissions) | 11 |
| 5.2.2 Results preliminary measurement 9 kHz to 1 GHz..... | 18 |
| 5.2.3 Result final measurement from 9 kHz to 30 MHz | 20 |
| 5.2.4 Result final measurement from 30 MHz to 1 GHz | 21 |
| 5.3 99 % bandwidth | 23 |
| 5.3.1 Method of measurement | 23 |
| 5.3.2 Test results | 24 |
| 6 Test equipment..... | 25 |
| 7 Report history | 26 |
| 8 List of annexes | 26 |

1 Identification

1.1 Applicant

| | |
|--|---|
| Name: | Bernstein AG |
| Address: | Hans-Bernstein-Str. 1 32457 Porta Westfalica |
| Country: | Germany |
| Name for contact purposes: | Mr. Viktor KELLER |
| Phone: | +49 0571-793-504 |
| Fax: | +49 0571-793-555 |
| eMail Address: | v.keller@de.bernstein.eu |
| Applicant represented during the test by the following person: | None |

1.2 Manufacturer

| | |
|---|---|
| Name: | Bernstein AG |
| Address: | Hans-Bernstein-Str. 1 32457 Porta Westfalica |
| Country: | Germany |
| Name for contact purposes: | Mr. Viktor KELLER |
| Phone: | +49 0571-793-504 |
| Fax: | +49 0571-793-555 |
| eMail Address: | v.keller@de.bernstein.eu |
| Manufacturer represented during the test by the following person: | None |

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 Firm Accreditation with the registration number 469623, designation number DE0004 and Industry Canada Test site registration SITE# IC3469A-1.

1.4 EUT (Equipment Under Test)

| | |
|--|--|
| Test object: * | SRF-6/2/1-E-H with the actuator: SRF-0 |
| Type / PMN: * | SRF-6/2/1-E-H |
| FCC ID: * | 2ABA6SRF |
| IC-Number: * | 11535A-SRF |
| Serial number: * | None |
| PCB identifier: * | 5901240065_06 |
| HVIN (Hardware Version Identification Number): * | BAG-RF-03 |
| FVIN (Firmware Version Identification Number): * | BAG-RF-1.0 |
| Lowest internal frequency: * | 10 kHz |
| Highest internal frequency: * | 24 MHz |

*: Declared by the applicant. The EUT was not labeled during the tests.

1.5 Technical data of equipment

| | | | | | | |
|--------------------------|---|---------|--------------------|-----------|--------------------|---------|
| Channel 1 | RX: | 125 kHz | TX: | 125 kHz | | |
| Antenna type: * | Internal antenna | | | | | |
| Number of channels: * | 1 | | | | | |
| Antenna connector: * | None | | | | | |
| Modulation: * | AM | | | | | |
| Data rate: * | 3,9 kBit/s | | | | | |
| Supply Voltage: * | U _{Nom} = | 24 V DC | U _{Min} = | 19.6 V DC | U _{Max} = | 30 V DC |
| Temperature range: * | -25°C to 70°C | | | | | |
| Ancillary used for test: | Safety relay Bernstein SCR ON4W22-3.6-S 6075111020 delivered by the applicant, AC/DC Adapter Phoenix Contact MINI-PS-100-240AC/24DC/1 | | | | | |

*: declared by the applicant.

| Ports / Connectors | | | |
|--------------------|-----------|-----------|--------------------|
| Identification | Connector | | Length during test |
| | EUT | Ancillary | |
| Power supply / IO | Fixed | M12 | 5 m |
| - | - | - | - |

1.6 Ancillary equipment used for test

| |
|--|
| Ancillaries tested with: |
| Safety relay Bernstein SCR ON4W22-3.6-S 6075111020 and TAG SRF-0, delivered by the applicant |

1.7 Dates

| | |
|---------------------------------|------------|
| Date of receipt of test sample: | 07.07.2017 |
| Start of test: | 07.07.2017 |
| End of test: | 31.08.2017 |

2 Operational states and test setup

Description of function of the EUT:

The EUT is a 125 kHz RFID System used as a safety switch.

The following states were defined as the operating conditions:

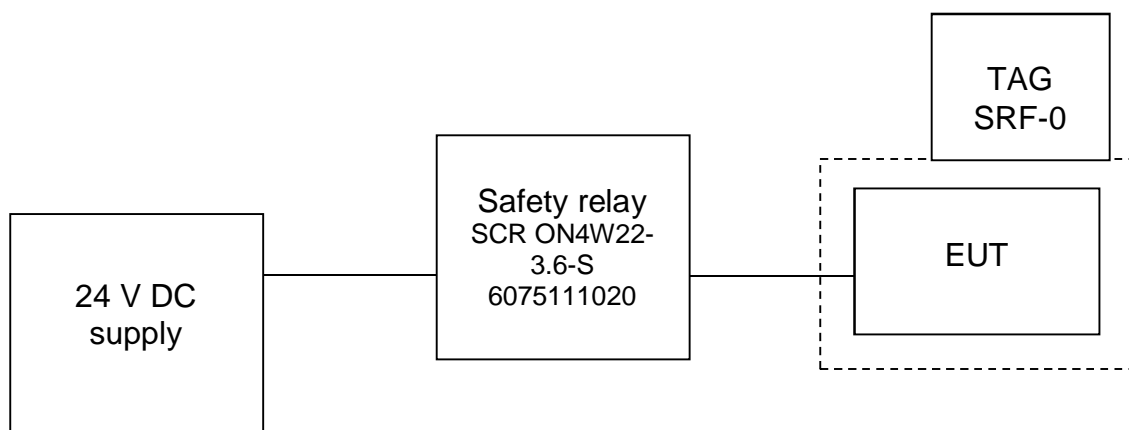
During all tests the EUT was supplied by 24 V DC via the Safety relay Bernstein SCR ON4W22-3.6-S 6075111020.

The tests were carried out with an unmodified sample, which operates in normal mode continuous reading TAG.

No spurious emission measurement of the receiver was carried out, because the co-located permanently operating transmitter.

During the radiated emission test the EUT was supplied via 24 V DC by an external power supply. During the conducted emission test the EUT was supplied with 24 V DC by an AC/DC Adapter Phoenix Contact MINI-PS-100-240AC/24DC/1, which was connected to an AC mains network with 120 V AC / 60 Hz.

The physical boundaries of the EUT are shown below.



3 Additional information

The EUT was not labeled as required by FCC / IC.

The internal photos were delivered by the applicant in order to keep the tested sample operational because of the encapsulated housing could not be opened without destroying.

4 Overview

| Application | Frequency range [MHz] | FCC 47 CFR Part 15 section [2] | RSS-Gen, Issue 4 [4] and RSS 210, Issue 9 [3] | Status | Refer page |
|------------------------------------|-----------------------|--------------------------------|---|----------|------------|
| Conducted emissions on supply line | 0.15 – 30 | 15.207 | 8.8 [4] | Passed | 8 et seq. |
| Radiated emissions | 0.009 – 1.000 | 15.205 15.209 | 8.9 [4] 4.4 [3] | Passed | 11 et seq. |
| 99% bandwidth | 0.125 | - | 6.4 [4] | Passed * | 24 et seq. |
| Antenna requirement | - | 15.203 | 8.3 [4] | Passed * | - |

*: Integrated antenna only, requirement fulfilled.

5 Results

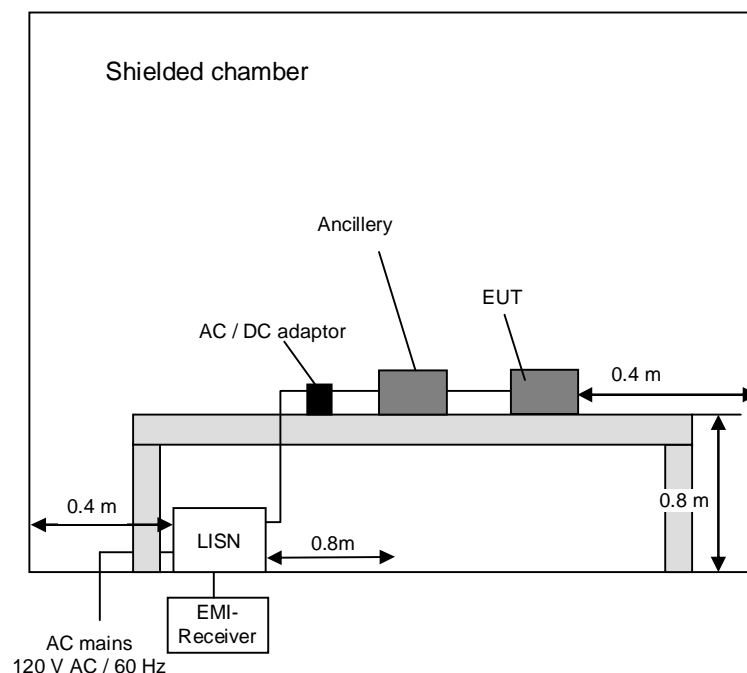
5.1 Conducted emission measurement on ac mains (150 kHz to 30 MHz)

5.1.1 Method of measurement conducted emission

This test will be carried out in a shielded chamber. Table top 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 setup of the Equipment under test will be in accordance to [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 |



5.1.2 Test result (conducted emission measurement on AC mains)

| | | | |
|----------------------|-------|--------------------|------|
| Ambient temperature: | 20 °C | Relative humidity: | 45 % |
|----------------------|-------|--------------------|------|

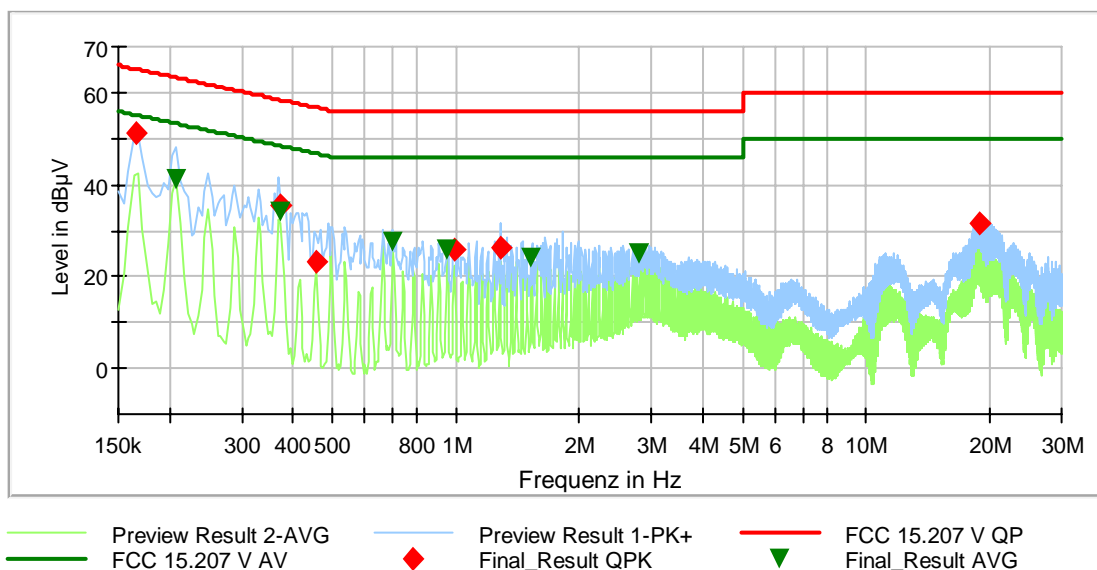
Position of EUT: The EUT was set-up on a wooden table of a height of 0.8 m.

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

Test record: The tests were carried out with an unmodified sample, which continuously reading a TAG.

Power supply: During the conducted emission test the EUT was supplied with 24 V DC by an AC/DC Adapter Phoenix Contact MINI-PS-100-240AC/24DC/1 which was connected to an AC mains network with 120 V AC / 60 Hz.

Operation states: As described in chapter 2.



170587vACfcc

07.07.2017

Final_Result

| Frequency (MHz) | QuasiPeak (dBμV) | Average (dBμV) | Limit (dBμV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | PE | Corr. (dB) |
|--|------------------|----------------|--------------|-------------|-----------------|-----------------|------|-----|------------|
| 0.165300 | 50.99 | --- | 65.19 | 14.20 | 5000.0 | 9.000 | L1 | GND | 9.8 |
| 0.206700 | --- | 41.12 | 53.34 | 12.22 | 5000.0 | 9.000 | L1 | GND | 9.8 |
| 0.371400 | --- | 34.01 | 48.47 | 14.46 | 5000.0 | 9.000 | L1 | FLO | 9.9 |
| 0.372300 | 35.66 | --- | 58.45 | 22.79 | 5000.0 | 9.000 | L1 | GND | 9.9 |
| 0.455100 | 23.34 | --- | 56.78 | 33.44 | 5000.0 | 9.000 | N | GND | 9.9 |
| 0.702600 | --- | 27.55 | 46.00 | 18.45 | 5000.0 | 9.000 | L1 | FLO | 9.9 |
| 0.950100 | --- | 25.93 | 46.00 | 20.07 | 5000.0 | 9.000 | L1 | FLO | 9.9 |
| 0.993300 | 25.70 | --- | 56.00 | 30.30 | 5000.0 | 9.000 | L1 | FLO | 9.9 |
| 1.282200 | 26.29 | --- | 56.00 | 29.71 | 5000.0 | 9.000 | L1 | GND | 9.9 |
| 1.528800 | --- | 24.02 | 46.00 | 21.98 | 5000.0 | 9.000 | L1 | GND | 9.9 |
| 2.808600 | --- | 24.90 | 46.00 | 21.10 | 5000.0 | 9.000 | N | GND | 10.2 |
| 18.968100 | 31.38 | --- | 60.00 | 28.62 | 5000.0 | 9.000 | L1 | GND | 10.9 |
| Measurement uncertainty: +2.76 dB / -2.76 dB | | | | | | | | | |

Test: Passed

Test equipment used (refer chapter 6):

9, 11 - 14

5.2 Radiated emissions

5.2.1 Method of measurement (radiated emissions)

The radiated emission measurement is subdivided into six stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 9 kHz to 1 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 preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 30 MHz to 1 GHz.
- A final measurement carried out on an open area test site with reflecting ground plane and various antenna heights in the frequency range 30 MHz to 1 GHz.
- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 40 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 40 GHz.

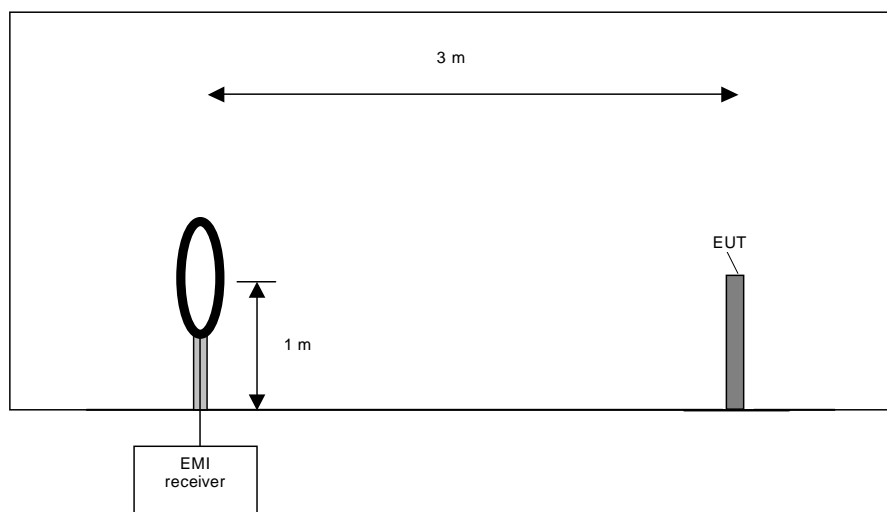
Preliminary measurement (9 kHz to 30 MHz):

In the first stage a preliminary measurement will be performed in a shielded room with a measuring distance of 3 meters. Table-top 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 [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. 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).

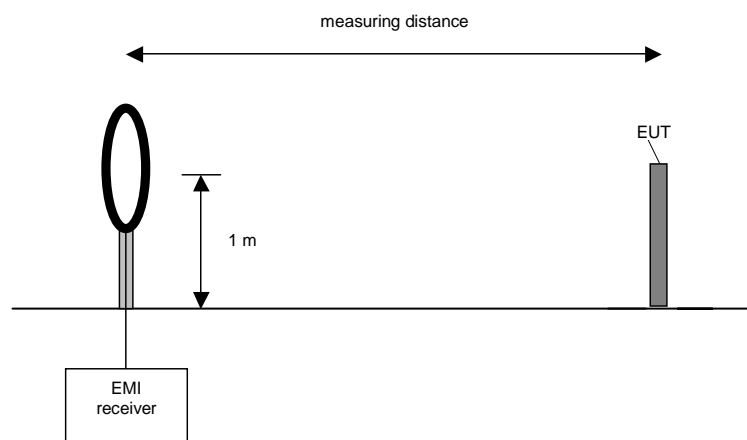
Final measurement (9 kHz to 30 MHz):

In the second stage a final measurement will be performed on an open area test site with no conducting ground plane in a 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 frequencies, which were detected during the preliminary measurements, 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 (if the EUT is a module and might be used in a handheld equipment application).

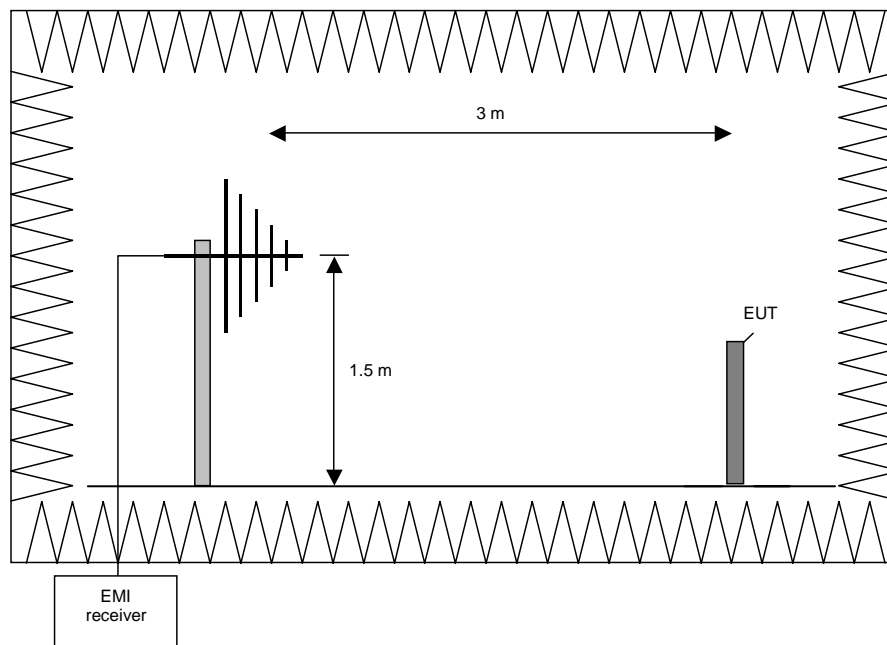
Preliminary measurement (30 MHz to 1 GHz)

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 [1].

The frequency range 30 MHz to 1 GHz will be measured with an EMI Receiver set to MAX Hold mode and a resolution bandwidth of 120 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 1 GHz | 120 kHz |



Procedure preliminary measurement:

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

The following procedure will be used:

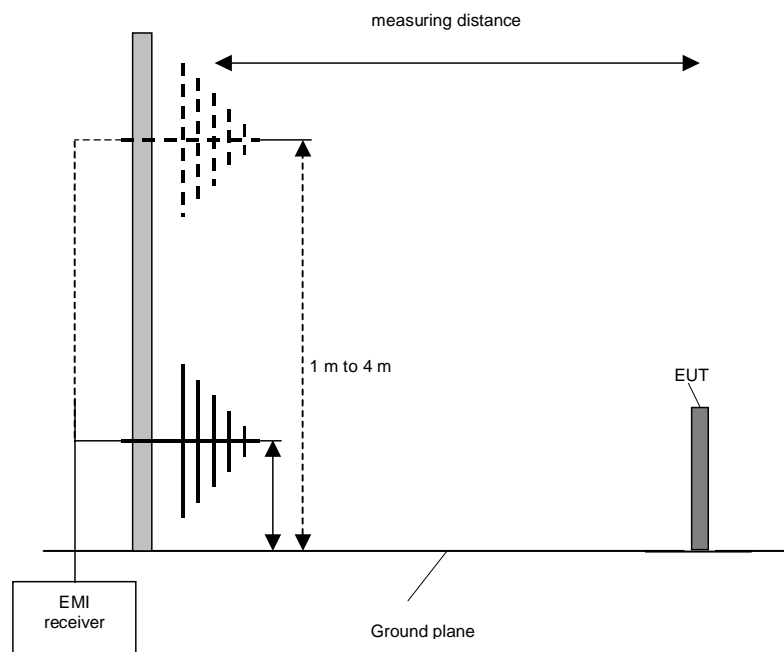
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the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

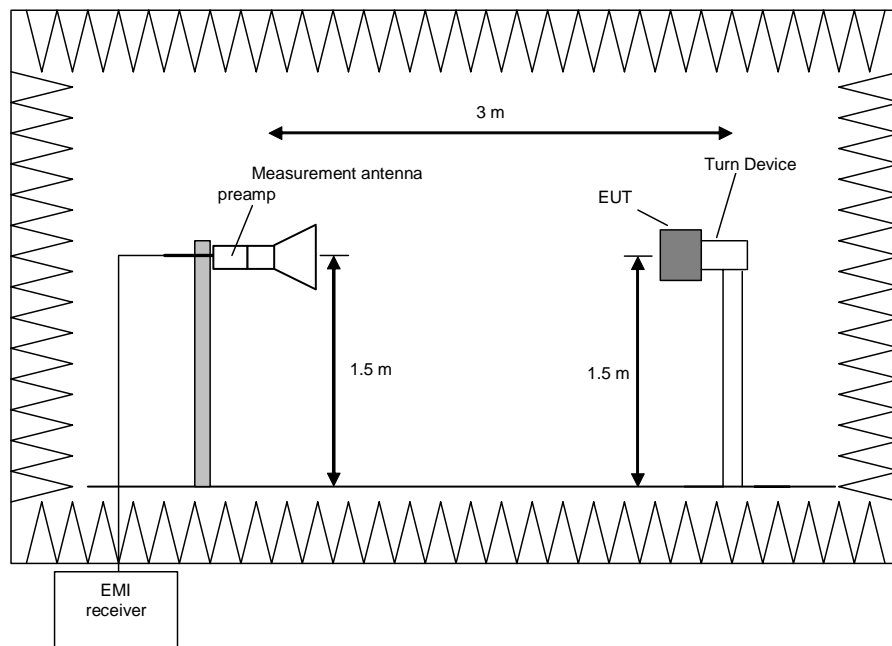
Preliminary and final measurement (1 GHz to 110 GHz)

This measurement will be performed in a fully anechoic chamber. Table top devices will set up on a non-conducting turn device on the height of 1.5 m. The set-up of the Equipment under test will be in accordance to [1].

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 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 °. This measurement is repeated after raising the EUT in 30 ° steps according 6.6.5.4 in [1].

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 preliminary measurement:

Prescans were performed in the frequency range 1 to 110 GHz.

The following procedure will be used:

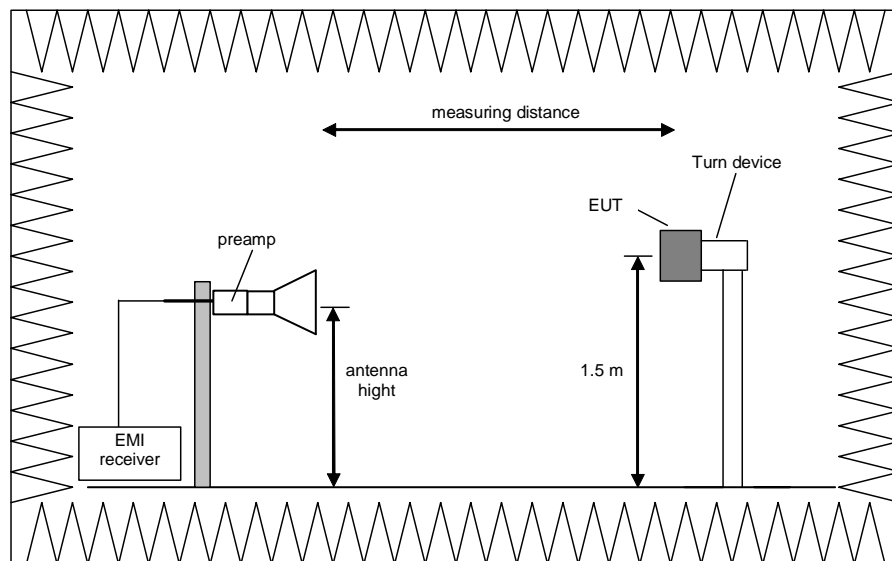
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Rotate the EUT by 360° to maximize the detected signals.
3. Repeat 1) to 2) with the vertical polarisation of the measuring antenna.
4. Make a hardcopy of the spectrum.
5. Repeat 1) to 4) with the EUT raised by an angle of 30° (60°, 90°, 120° and 150°) according to 6.6.5.4 in [1].
6. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
7. The measurement antenna polarisation, with the according EUT position (Turntable and Turn device) which produces the highest emission for each frequency will be used for the final measurement. The six closest values to the applicable limit will be used for the final measurement.

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 antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1 MHz. The measurement will be performed by rotating the turntable through 0 to 360° in the worst-case EUT orientation which was obtained during the preliminary measurements.

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 110 GHz.

The following procedure will be used:

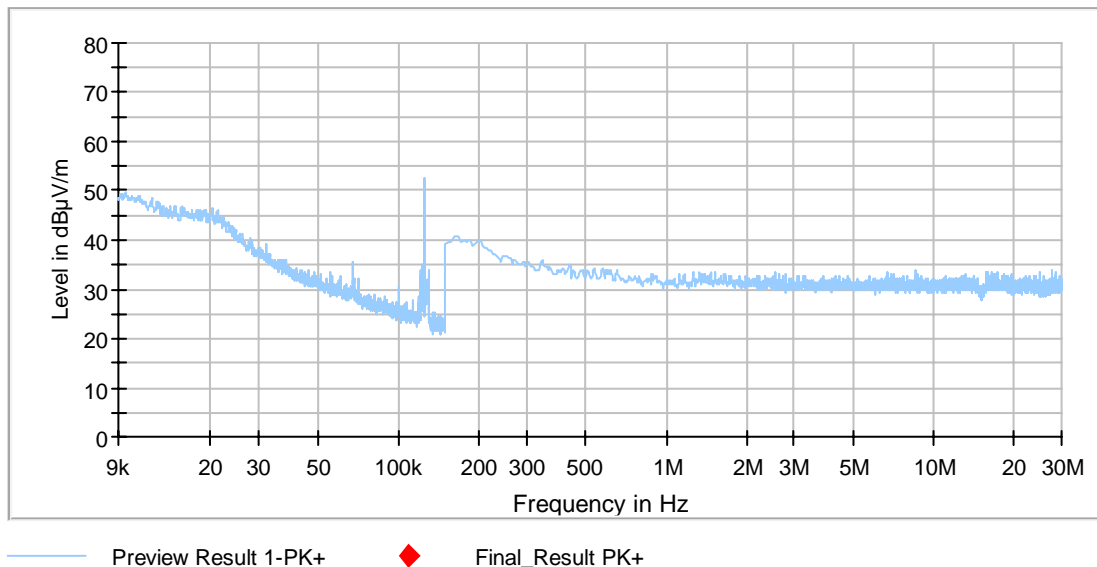
- 1) Set the turntable and the turn device to obtain the worst-case emission for the first frequency identified in the preliminary measurements.
- 2) Set the measurement antenna polarisation to the orientation with the highest emission for the first frequency identified in the preliminary measurements.
- 3) Set the spectrum analyser to EMI mode with peak and average detector activated.
- 4) Rotate the turntable from 0° to 360° to find the EUT angle that produces the highest emissions.
- 5) Note the highest displayed peak and average values
- 6) Repeat the steps 1) to 5) for each frequency detected during the preliminary measurements.

5.2.2 Results preliminary measurement 9 kHz to 1 GHz

| | | | |
|---------------------|-------|-------------------|------|
| Ambient temperature | 22 °C | Relative humidity | 49 % |
|---------------------|-------|-------------------|------|

| | |
|------------------|--|
| Position of EUT: | The EUT was set-up on a non-conducting table. |
| 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: | The tests were carried out with an unmodified sample, which continuously reading a TAG. All results are shown in the following. |
| Power supply: | During this test the EUT was powered with 24 V DC. |
| Frequency range: | According to [2] from 9 kHz to 1 GHz. |
| Remark: | The measurement was carried out in the position, that causes the maximum emission position as evaluated in additional pre-tests. |

170587: Spurious emissions from 9 kHz to 30 MHz



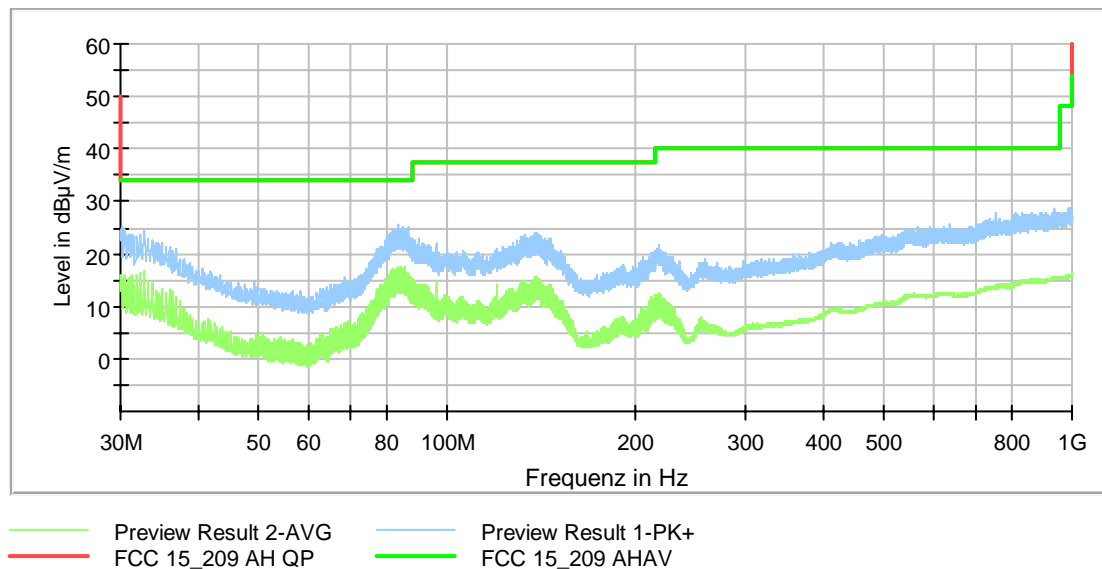
Except the fundamental of the EUT at no frequency was a value above the noise of the system therefore only a final measurement for the fundamental on the open area test site was carried out. No spurious emissions caused by the equipment under test were found.

The following emission was found according to [2] and [3]. (fundamental of transmitter)

125 kHz.

Remark: No further emissions caused by the equipment under were found.

170587FCCah2: Spurious emissions from 30 MHz to 1000 MHz



The following frequencies were found outside and inside the restricted bands found according to FCC 47 CFR Part 15 section 15.209.

| Frequency (MHz) |
|-----------------|
| 30.468000 |
| 81.708000 |
| 84.822800 |
| 132.048000 |
| 205.536000 |
| 989.412000 |

Test equipment used (refer chapter 6):

1 – 6 , 9 , 10

5.2.3 Result final measurement from 9 kHz to 30 MHz

| | | | |
|---------------------|-------|-------------------|------|
| Ambient temperature | 16 °C | Relative humidity | 56 % |
|---------------------|-------|-------------------|------|

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 and 10 m.

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

Test record: The tests were carried out with an unmodified sample, which continuously reading a TAG. All results are shown in the following.

Power supply: During this test the EUT was supplied with 24 V DC .

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

$$\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{antenna factor [dB/m]}$$

| Results with measuring distance of 3 m | | | | | | |
|--|---------------------|----------------------------------|-----------|----------|---------------------|-----------------------------------|
| Frequency MHz | Result dB μ V/m | Limit ²⁾ dB μ V/m | Margin dB | Detector | Readings dB μ V | Antenna factor ¹⁾ dB/m |
| 0.125 | 57.4 | 105.7 | 48.2 | AV | 37.4 | 20.0 |
| Results with measuring distance of 10 m | | | | | | |
| Frequency MHz | Result dB μ V/m | Limit ²⁾ dB μ V/m | Margin dB | Detector | Readings dB μ V | Antenna factor ¹⁾ dB/m |
| 0.125 | 34.4 | 84.8 | 50.4 | AV | 14.4 | 20.0 |
| Measurement uncertainty: +2.2 dB / -3.6 dB | | | | | | |

¹⁾: Cable loss included

²⁾: Limits according to [2] and [3] extrapolated with a factor of 40dB/decade according to [2]

Test: Passed

Test equipment used (refer chapter 6):

2, 22, 23

5.2.4 Result final measurement from 30 MHz to 1 GHz

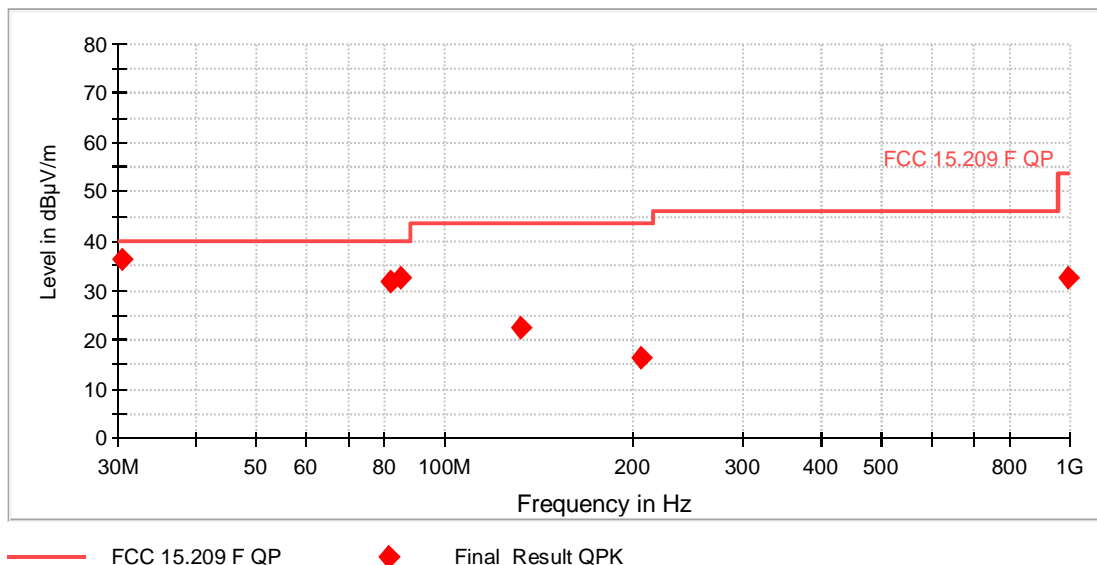
| | | | |
|---------------------|-------|-------------------|------|
| Ambient temperature | 21 °C | Relative humidity | 59 % |
|---------------------|-------|-------------------|------|

- Position of EUT: The EUT was setup on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
- Test record: The tests were carried out with an unmodified sample, which continuously reading a TAG. All results are shown in the following.
- Power supply: During this test the EUT was supplied with 24 V DC .
- Test results: The test results were calculated with the following formula:

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

The results of the standard subsequent 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 seconds.



170587FCCff

12.07.2017

Final_Result

| Frequency (MHz) | QuasiPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-------------------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 30.468000 | 36.30 | 40.00 | 3.70 | 1000.0 | 120.000 | 114.0 | V | 279.0 | 26.0 |
| 81.708000 | 31.82 | 40.00 | 8.18 | 1000.0 | 120.000 | 400.0 | H | 256.0 | 16.3 |
| 84.822800 | 32.71 | 40.00 | 7.29 | 1000.0 | 120.000 | 400.0 | H | 231.0 | 16.8 |
| 132.048000 | 22.65 | 43.50 | 20.85 | 1000.0 | 120.000 | 107.0 | V | 286.0 | 20.5 |
| 205.536000 | 16.14 | 43.50 | 27.36 | 1000.0 | 120.000 | 138.0 | H | 55.0 | 18.5 |
| 989.412000 | 32.49 | 54.00 | 21.51 | 1000.0 | 120.000 | 170.0 | V | 339.0 | 35.5 |
| Measurement uncertainty | | | | +/- 4.8 dB | | | | | |

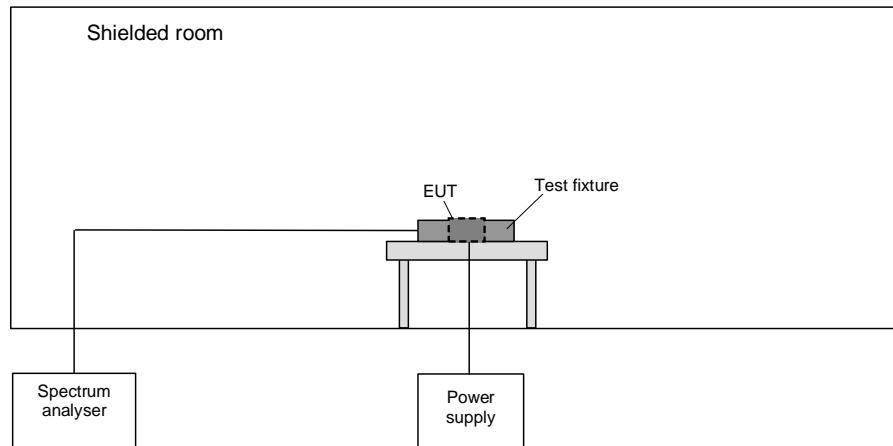
Test: Passed

Test equipment used (refer chapter 6):

12, 15 - 21

5.3 99 % bandwidth

5.3.1 Method of measurement



The following procedure will be used for the occupied bandwidth measurement according to [1]:

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.

The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.

The span between the two recorded frequencies is the occupied bandwidth.

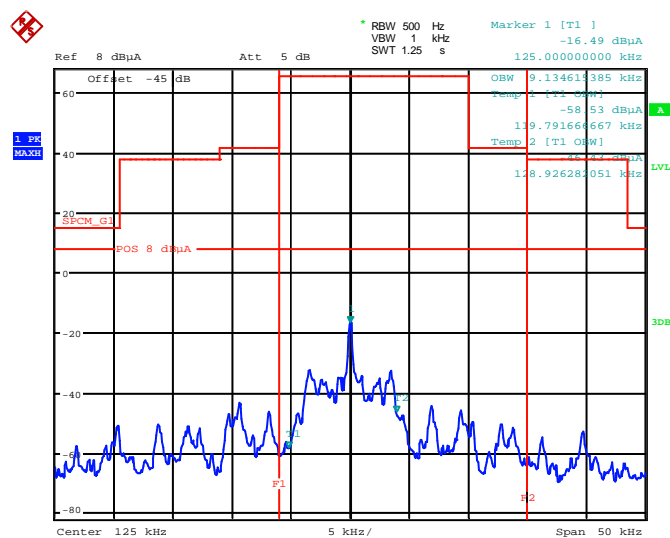
5.3.2 Test results

| | | | |
|----------------------|-------|--------------------|------|
| Ambient temperature: | 21 °C | Relative humidity: | 62 % |
|----------------------|-------|--------------------|------|

Test record: The tests were carried out with an unmodified sample, which operates in normal mode continuous reading TAG. All results are shown in the following.

Power supply: During this test the EUT was supplied with 24 V DC.

170587_99.wmf: 99 % bandwidth:



| F_L | F_U | BW ($F_U - F_L$) |
|-------------------------|-------------|---------------------|
| 119.791 kHz | 128.923 kHz | 9.132 kHz |
| Measurement uncertainty | | $< 1 \cdot 10^{-7}$ |

Test equipment used (refer chapter 6):

23 - 24

6 Test equipment

| No. | Test equipment | Type | Manufacturer | Serial No. | PM. No. | Cal. Date | Cal Due |
|-----|----------------------------------|---------------------------|---|---------------------|---------|---------------------------|---------|
| 1 | EMI Receiver / Spectrum Analyser | ESW44 | Rohde & Schwarz | 101635 | 482467 | 22.06.2017 | 06.2019 |
| 2 | loop antenna | HFH2-Z2 | Rohde & Schwarz | 100417 | 481912 | 20.10.2016 | 10.2017 |
| 3 | Turntable | DS420 HE | Deisel | 420/620/00 | 480315 | Calibration not necessary | |
| 4 | Antenna support | AS620P | Deisel | 620/375 | 480325 | Calibration not necessary | |
| 5 | Multiple Control Unit | MCU | Maturo GmbH | MCU/043/97110 7 | 480832 | Calibration not necessary | |
| 6 | Fully anechoic chamber M20 | B83117-E2439-T232 | Albatross Projects | 103 | 480303 | Calibration not necessary | |
| 7 | Antenna mast | AS615P | Deisel | 615/310 | 480187 | Calibration not necessary | |
| 8 | RF-cable No.36 | Sucoflex 106B | Suhner | 0587/6B / Kabel 36 | 480865 | Calibration not necessary | |
| 9 | Software | EMC32 | Rohde & Schwarz | | 481800 | Calibration not necessary | |
| 10 | Antenna (Bilog) | CBL6112B | Schaffner EMV GmbH (-Chase) | 2688 | 480328 | 19.06.2017 | 06.2020 |
| 11 | LISN | NSLK8128 | Schwarzbeck | 8128155 | 480058 | 16.02.2016 | 02.2018 |
| 12 | EMI Receiver / Spectrum Analyser | ESIB 26 | Rohde & Schwarz | 100292 | 481182 | 15.02.2016 | 02.2018 |
| 13 | Shielded chamber M4 | B83117-S1-X158 | Siemens | 190075 | 480088 | Calibration not necessary | |
| 14 | Transient Filter Limiter | CFL 9206A | Teseq GmbH | 38268 | 481982 | 18.02.2016 | 02.2018 |
| 15 | Attenuator 6 dB | WA2-6 | Weinschel | 8254 | 410119 | Calibration not necessary | |
| 16 | Open area test site M6 | - | Phoenix Contact | - | 480085 | Calibration not necessary | |
| 17 | Antenna mast | MA240-0 | Inn-Co GmbH | MA240-0/030/6600603 | 480086 | Calibration not necessary | |
| 18 | Turntable | DS412 | Deisel | 412/316 | 480087 | Calibration not necessary | |
| 19 | Controller | HD100 | Deisel | 100/349 | 480139 | Calibration not necessary | |
| 20 | Antenna (Bilog) | CBL6111D | Schaffner Elektrotest GmbH / Teseq GmbH | 25761 | 480894 | 18.09.2014 | 09.2017 |
| 21 | Software | EMC32 | Rohde & Schwarz | 100061 | 481022 | Calibration not necessary | |
| 22 | Outdoor test site | - | PHOENIX TESTLAB GmbH | - | 480293 | Calibration not necessary | |
| 23 | EMI Receiver / Spectrum Analyser | ESI 40 | Rohde & Schwarz | 100064/040 | 480355 | 15.02.2017 | 02.2018 |
| 24 | Loop antenna | Loop antenna Æ = 11 cm | PHOENIX TESTLAB GmbH | - | 410084 | Calibration not necessary | |

7 Report history

| Report Number | Date | Comment |
|-----------------------------------|------------|-------------------|
| F170587E2 | 22.11.2017 | Document created |
| F170587E2 2 nd version | 08.02.2018 | Editorial changes |
| - | - | - |

8 List of annexes

Annex A Test setup photos 5 pages

Test setup photos
 170587_01.jpg: EUT, test setup magnetic field strength fully anechoic chamber
 170587_02.jpg: EUT, test setup electric field strength fully anechoic chamber
 170587_03.jpg: EUT, test setup outdoor test site magnetic field strength
 170587_04.jpg: EUT, test setup open area test site.
 170587_05.jpg: EUT, test setup conducted emission test

Annex B External photos 7 pages

170587eut1.jpg: EUT, 3D view 1
 170587eut2.jpg: EUT, 3D view 2
 170587eut3.jpg: EUT, Type plate
 170587eut4.jpg: EUT, LED view 1
 170587anc1.jpg: Type plate ancillary equipment SCR
 170587anc2.jpg: Top view ancillary equipment SCR
 170587anc3.jpg: Type plate TAG

Annex C Internal photos 3 pages

170587_pcb_01.jpg: EUT, PCB, top view 1 (photo delivered by the applicant)
 170587_pcb_02.jpg: EUT, PCB, top view 2 (photo delivered by the applicant)
 170587_pcb_03.jpg: EUT, PCB, bottom view (photo delivered by the applicant)