

# Test Report

Report Number:

**F170754E1**

Equipment under Test (EUT):

**Control panel for welding inverters  
Einschub TPS/i Touch G2**

Applicant:

**Fronius International GmbH**

Manufacturer:

**Fronius International GmbH**



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) incl. Amendment (November 2017)**  
Licence-exempt Radio Apparatus: Category I Equipment
- [4] **RSS-Gen Issue 5 (April 2018)** General Requirements for Compliance of Radio Apparatus

## Test result

The requirements of the tests performed as shown in the overview (chapter 4 of this test report) were fulfilled by the equipment under test.

The complete test results are presented in the following.

Test engineer:	Manuel BASTERT		09/06/2018
	Name	Signature	Date
Authorized reviewer:	Bernd STEINER		09/06/2018
	Name	Signature	Date

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## 1 Identification

### 1.1 Applicant

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Applicant represented during the test by the following person:	None.

### 1.2 Manufacturer

Name:	Fronius International GmbH
Address:	Günter-Fronius-Straße 1, 4600 Wels
Country:	Austria
Name for contact purposes:	Mr. Jan HERNDLER
Phone:	+43-7242-241-2648
Fax:	+43-7242-241-0
eMail Address:	herndler.jan@fronius.com
Applicant 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: *	Control Panel for welding inverters
Type / PMN: *	Einschub TPS/i Touch G2
FCC ID: *	QKWSPBMCU2
IC: *	12270A-SPBMCU2
HVIN (Hardware Version Identification Number): *	Einschub TPS/i Touch G2
FVIN (Firmware Version Identification Number): *	V1.8 Beta
HMN (Host model name):*	N/A
Order number	43,0001,3547
Serial number: *	Engineering sample
PCB identifier: *	1614685

#### 1.5 Technical data of equipment

Type of modulation: *	ASK (Protocol support for ISO 14443A/B, ISO 15693, NFCIP-2, NFC-Forum, EMV contactless targets with a data rate up to 848 Kbps.)					
Operating frequency: *	13.56 MHz					
Number of channels: *	1					
Antenna type: *	Internal loop antenna					
Antenna dimensions:*	79 * 64 mm <sup>2</sup>					
Supply voltage: *	$U_{nom} =$	24 V <sub>DC</sub>	$U_{min} =$	21.6V	$U_{max} =$	26.4V
Temperature range: *	-10 °C to +60 °C					

\*: declared by the applicant.

The following external I/O cables were used:

Identification	Connector		Length
	EUT	Ancillary	
Ethernet*	HSD	RJ45	Not used
Power (AC-Adaptor)	Customized	CE	2 m

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

#### 1.6 Ancillary equipment

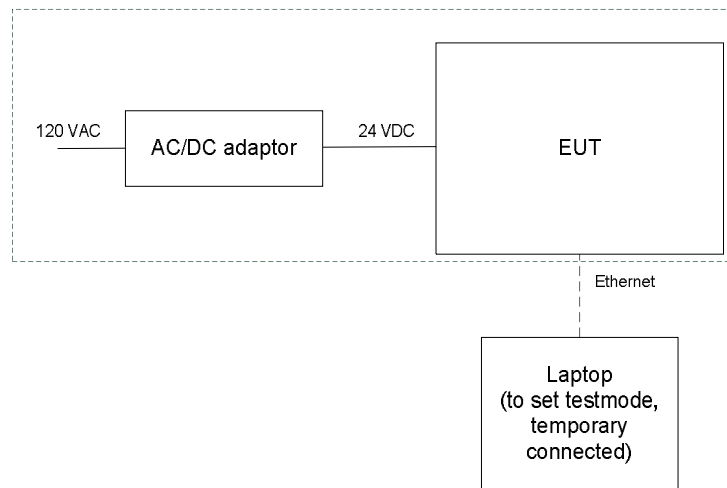
AC power adapter UE36LCP1-240150SPA by UE electronic provided by the applicant (only for testing; EUT is normally supplied by the welding apparatus).

#### 1.7 Dates

Date of receipt of test sample:	07.09.2017
Start of test:	09.08.2017
End of test:	06.09.2018

## 2 Operational states and test setup

The EUT is a control panel to be inserted into a welding inverter with RFID functionality. The EUT was powered with 24 V<sub>DC</sub> by an ancillary AC adaptor and set to transmit continuously. The EUT was placed on a positioner to perform measurements in all directions. Please see the photos in Annex A for further details.



## 3 Additional information

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

## 4 Overview

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS-Gen, Issue 5 [4] and RSS 210, Issue 9 [3]	Status	Refer page
Conducted emissions on supply line	0.15 – 30	15.207	8.8 [4]	Passed	7 et seq.
Radiated emissions	0.009 – 1.000	15.205 15.209	8.9 [4] 4.4 [3]	Passed	10 et seq.
99 % bandwidth	13.56	-	6.7 [4]	-	22 et seq.
Antenna requirement	-	15.203	-	Passed *	-

\*: Integrated antennas only, requirement fulfilled.

## 5 Results

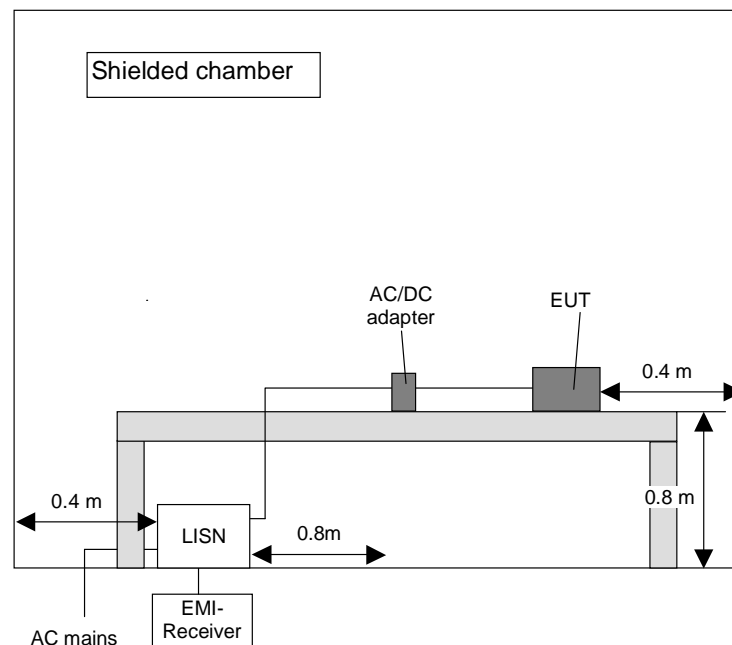
### 5.1 Conducted emissions on power supply lines (150 kHz to 30 MHz)

#### 5.1.1 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 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



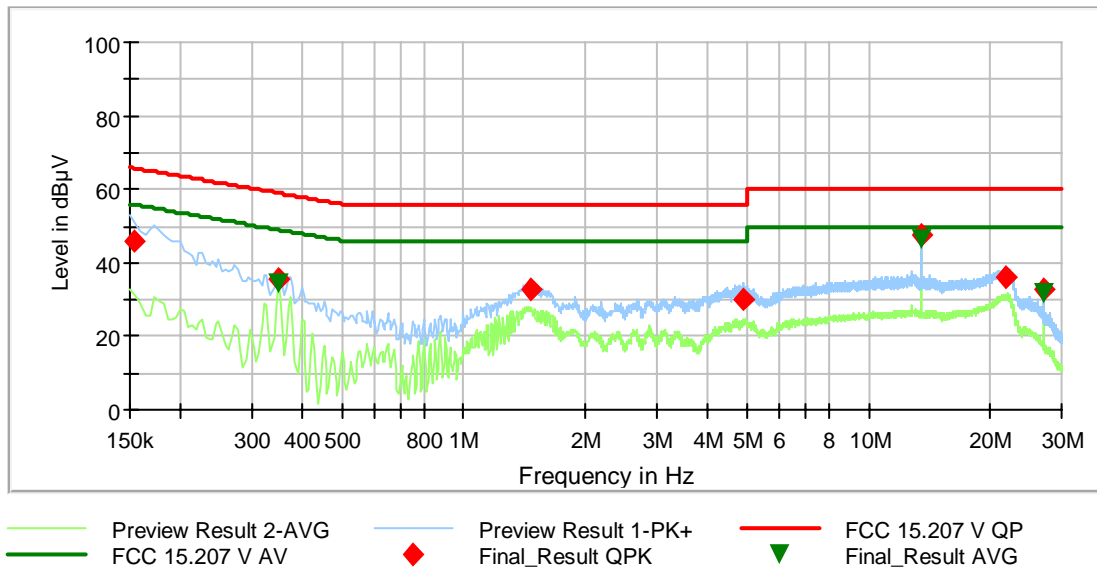
### 5.1.2 Test results (conducted emissions on power supply lines)

Ambient temperature	22 °C
Tested by	M. Bastert B. Rohde

Relative humidity	45 %
Date	18.04.2018

- Position of EUT:** The EUT was set-up on a non-conducting table of a height of 0.8 m.
- Cable guide:** The cables of the EUT were 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 test was carried out in test mode of the EUT (refer also clause 2 of this test report). All results are shown in the following.
- Supply voltage:** During this test the EUT was powered with 24 V<sub>AC</sub> by an AC adapter (see chapter 1.6), which was itself supplied with 120 V<sub>AC</sub> / 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 **◆** and the average measured points by **+**.





## Final result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.1527	46.00	---	65.85	19.85	5000	9	L1	FLO	9.8
0.3480	---	34.44	49.01	14.57	5000	9	L1	FLO	9.9
0.3489	35.30	---	58.99	23.69	5000	9	L1	FLO	9.9
1.4712	32.85	---	56.00	23.15	5000	9	N	FLO	9.9
4.9065	30.17	---	56.00	25.83	5000	9	L1	FLO	10.3
13.5600	47.35	---	60.00	12.65	5000	9	L1	FLO	10.7
13.5600	---	46.26	50.00	3.74	5000	9	L1	FLO	10.7
21.8202	35.97	---	60.00	24.03	5000	9	L1	FLO	10.9
27.1185	32.92	---	60.00	27.08	5000	9	L1	FLO	11.1
27.1203	---	31.49	50.00	18.51	5000	9	L1	FLO	11.1
Measurement uncertainty: +6.7 dB / -6.0 dB									

Remark: The limits of FCC 15.207 are identical to [3]

Test: Passed

Test equipment used (see chapter 6):

1 - 5
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## 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 5 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 5 GHz.

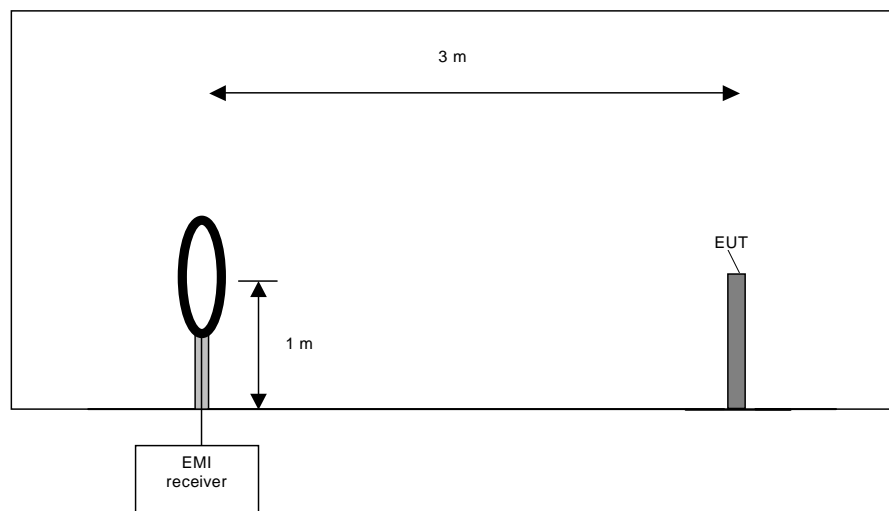
#### **Preliminary measurement (9 kHz to 30 MHz):**

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).

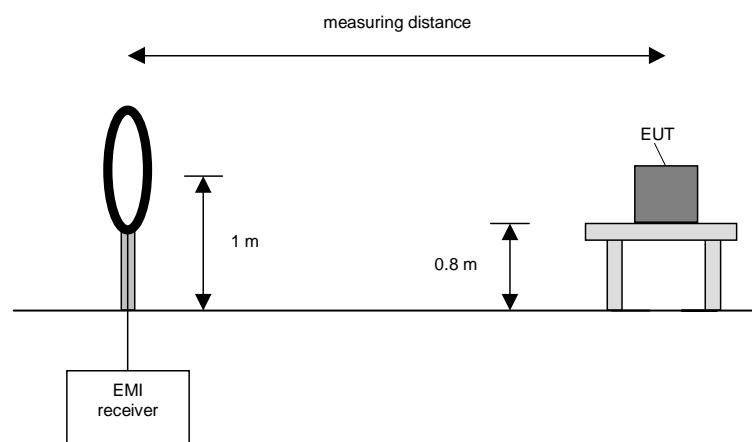
**Final measurement (9 kHz to 30 MHz):**

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).

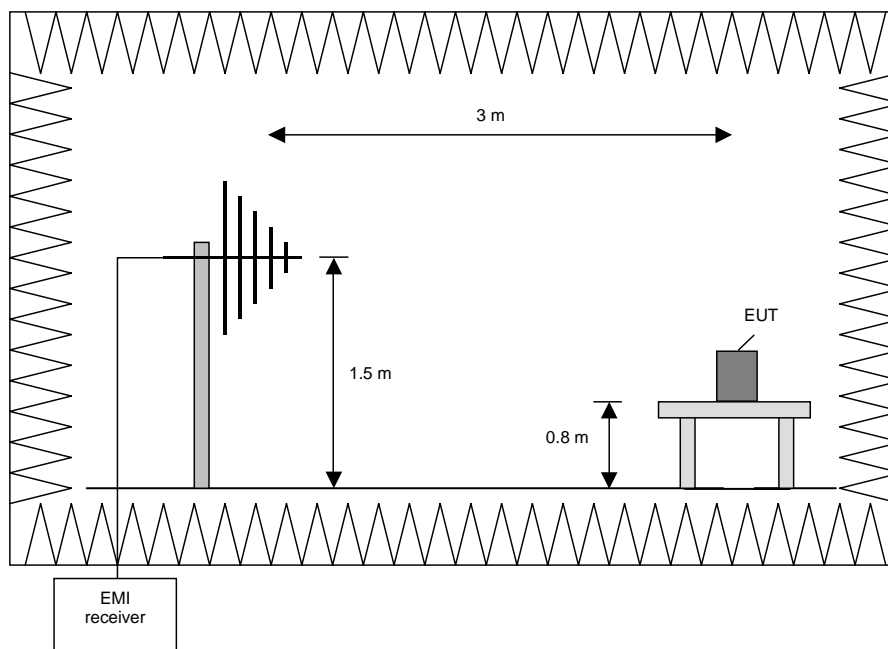
**Preliminary measurement (30 MHz to 1 GHz)**

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:

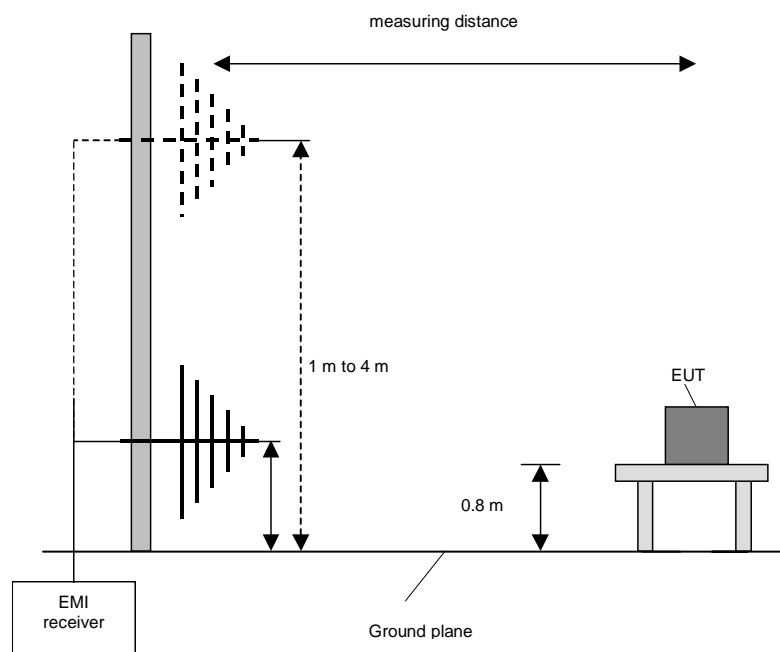
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the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

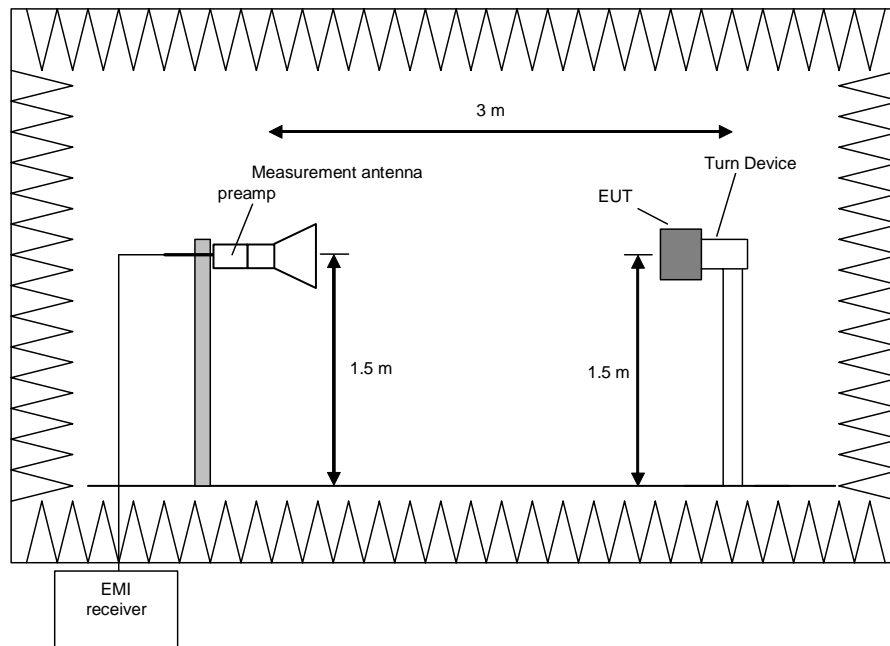
This measurement will be performed in a fully anechoic chamber. Table top devices will set up on a non-conducting turn device on the height of 1.5 m. The set-up of the Equipment under test will be in accordance to [1].

**Preliminary measurement (1 GHz to 40 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 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 40 GHz.

The following procedure will be used:

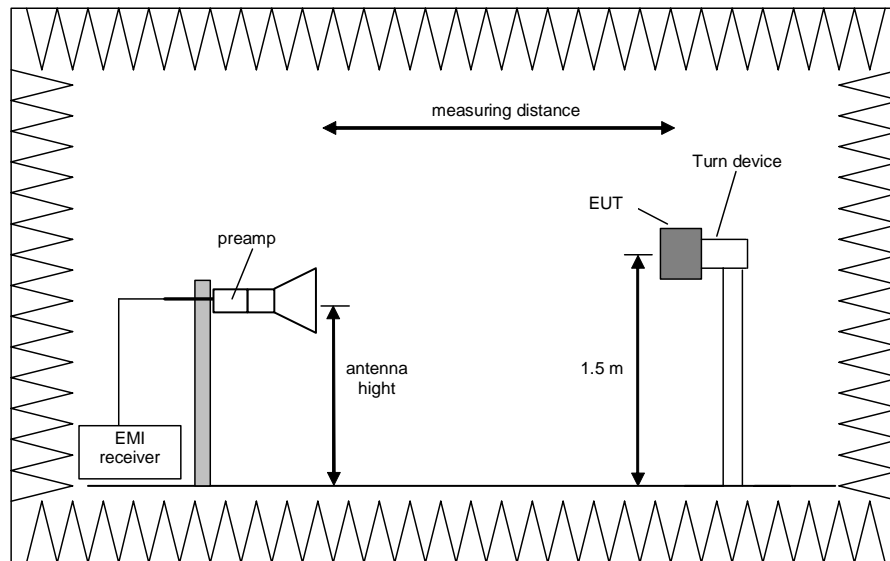
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Rotate the EUT by 360° to maximize the detected signals.
3. Repeat 1) to 2) with the vertical polarisation of the measuring antenna.
4. Make a hardcopy of the spectrum.
5. Repeat 1) to 4) with the EUT raised by an 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:

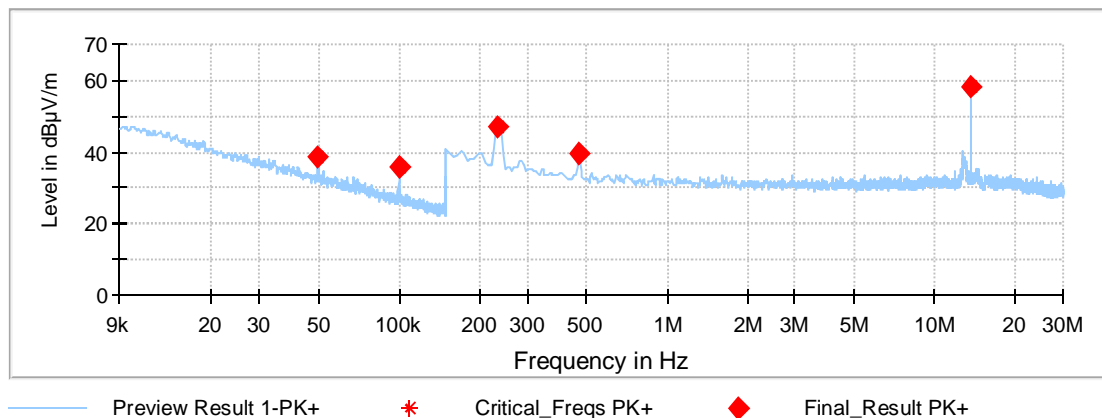
- 1) Set the turntable and the turn device to obtain the worst-case emission for the first frequency identified in the preliminary measurements.
- 2) Set the measurement antenna polarisation to the orientation with the highest emission for the first frequency identified in the preliminary measurements.
- 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	37 %
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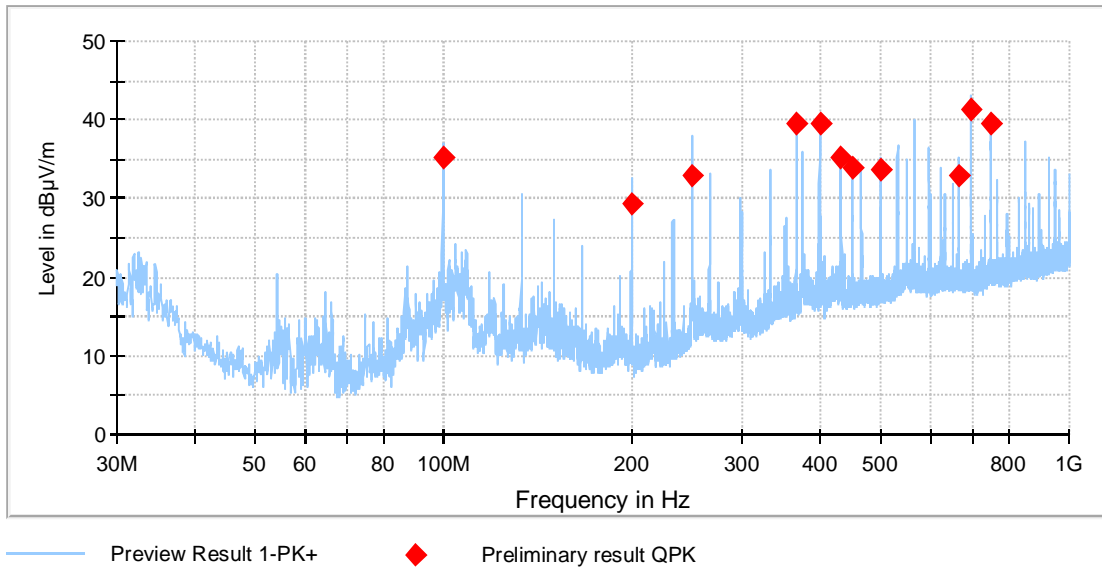
- Position of EUT: The EUT was set-up on a non-conducting table.
- Cable guide: The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.
- Test record: The test was carried out in test mode of the EUT (refer also clause 2 of this test report). All results are shown in the following.
- Power supply: During this test the EUT was powered with 24 V<sub>AC</sub> by an AC adapter (see chapter 1.6), which was itself supplied with 120 V<sub>AC</sub> / 60 Hz.
- Frequency range: According to [2] from 9 kHz to 1 GHz.



The following emissions were found according to [2] and [3].

Frequency
49.820 kHz
99.734 kHz
234.575 kHz
468.4 kHz
13.56 MHz

Those frequencies had to be measured on the outdoor test site. The result is presented in the following.



The following frequencies were found emission test outside restricted bands during the preliminary radiated:

99.743 MHz, 199.459 MHz, 365.766 MHz, 398.988 MHz, 432.259 MHz, 450.010 MHz, 498.753 MHz, 664.962 MHz, 698.282 MHz and 750.031 MHz

-

The following frequency was found inside the restricted bands during the preliminary radiated.

- 249.948 MHz.

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

Test equipment used (see chapter 6)

14 – 21

### 5.2.3 Result final measurement from 9 kHz to 30 MHz

Ambient temperature	12 °C	Relative humidity	69 %
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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 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 test was carried out in test mode of the EUT (refer also clause 2 of this test report). All results are shown in the following.
- Power supply: During this test the EUT was powered with 24 V<sub>AC</sub> by an AC adapter (see chapter 1.6), which was itself supplied with 120 V<sub>AC</sub> / 60 Hz.

Test results:

Frequency [MHz]	Reading [dBμV]	Result* [dBμV/m]	Limit acc. 15.209 [dBμV/m]	Margin [dB]	Detector (acc. To §15.209 (d))	Antenna factor [dB/m]	Measuring Distance [m]	Distance correction factor** [dB]
0.049820	23.9	-35.9 @ 300m	33.7	69.5	AV	20.2	3	80.0
0.099734	25.7	-34.1 @ 300m	27.6	61.7	QP	20.2	3	80.0
0.468400	12.2	-47.6 @ 300m	14.2	61.8	AV	20.2	3	80.0
0.234575	29.5	-30.2 @ 300m	20.2	50.4	AV	20.3	3	80.0
13.560000	36.6	16.9 @ 30m	29.5	12.6	QP	20.3	3	40.0
Measurement uncertainty: +2.2 dB / -3.6 dB								

Note: \*Result @ normative distance = Reading + Antenna factor – Distance correction factor

\*\* 40dB/decade according Part §15.31 (f) (2)

Test: Passed

Test equipment used for the test:

6, 21, 23

### 5.2.4 Result final measurement from 30 MHz to 1 GHz

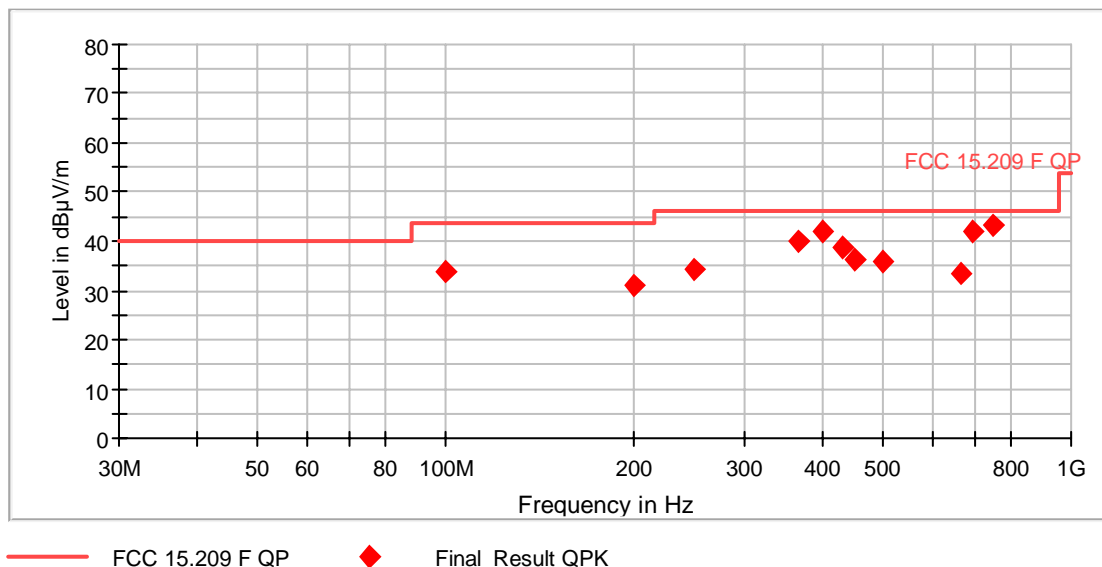
Ambient temperature	22 °C	Relative humidity	55 %
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- Position of EUT:** The EUT was setup on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
- Test record:** The test was carried out in test mode of the EUT (refer also clause 2 of this test report). All results are shown in the following.
- Power supply:** During this test the EUT was powered with 24 V<sub>AC</sub> by an AC adapter (see chapter 1.6), which was itself supplied with 120 V<sub>AC</sub> / 60 Hz.
- Test results:** The test results were calculated with the following formula:
- $$\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{cable loss [dB]} + \text{antenna factor [dB/m]} + 6 \text{ dB}$$

The measured points and the limit line in the following diagrams refer to the standard measurement of the emitted interference in compliance with the above-mentioned standard. The measured points marked with an ◆ are the measured results of the standard final measurement on the open area test site.

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 5 seconds.



**Result measured with the quasi-peak detector:**

Spurious emissions inside restricted bands									
Frequency	Result	Limit	Margin	Readings	Antenna factor	Cable loss	Height	Azimuth	Pol.
MHz	dB $\mu$ V/m	dB $\mu$ V/m	dB	dB $\mu$ V	dB/m	dB	cm	deg	
249.948	34.37	46.0	11.6	20.5	12.1	1.8	121	127	Vert.
Spurious emissions outside restricted bands									
Frequency	Result	Limit	Margin	Readings	Antenna factor	Cable loss	Height	Azimuth	Pol.
MHz	dB $\mu$ V/m	dB $\mu$ V/m	dB	dB $\mu$ V	dB/m	dB	cm	deg	
99.743	33.98	43.5	9.5	22.1	10.8	1.1	102	130	Vert.
199.459	31.05	43.5	12.5	20.6	8.9	1.5	102	340	Vert.
365.766	39.84	46.0	6.2	23.4	14.3	2.1	100	346	Hor.
398.988	42.04	46.0	4.0	24.2	15.7	2.2	112	336	Hor.
432.259	38.82	46.0	7.2	20.2	16.3	2.3	102	192	Vert.
450.010	36.49	46.0	9.5	17.5	16.6	2.4	206	233	Vert.
498.753	35.93	46.0	10.1	16.0	17.4	2.5	104	139	Hor.
664.962	33.36	46.0	12.6	10.7	19.7	2.9	107	214	Vert.
698.282	42.21	46.0	3.8	19.2	20.0	3.0	115	168	Hor.
750.031	43.29	46.0	2.7	18.5	21.7	3.1	120	107	Hor.
Measurement uncertainty: +2.2 dB / -3.6 dB									

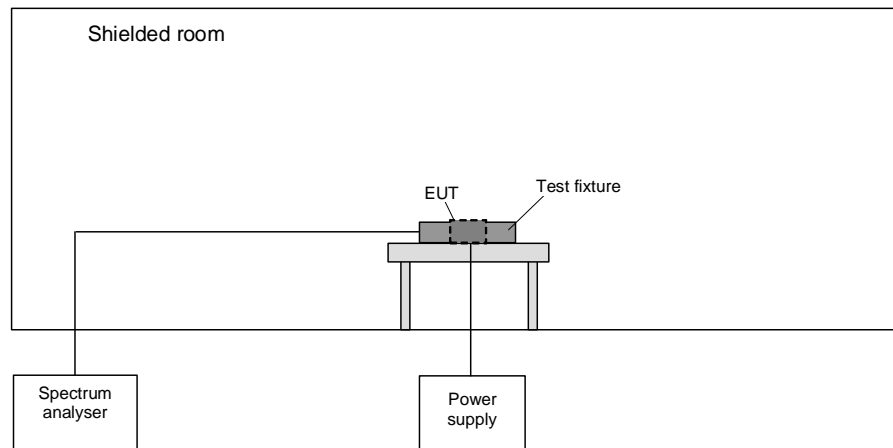
Test: Passed

Test equipment used (see chapter 6):

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## 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.

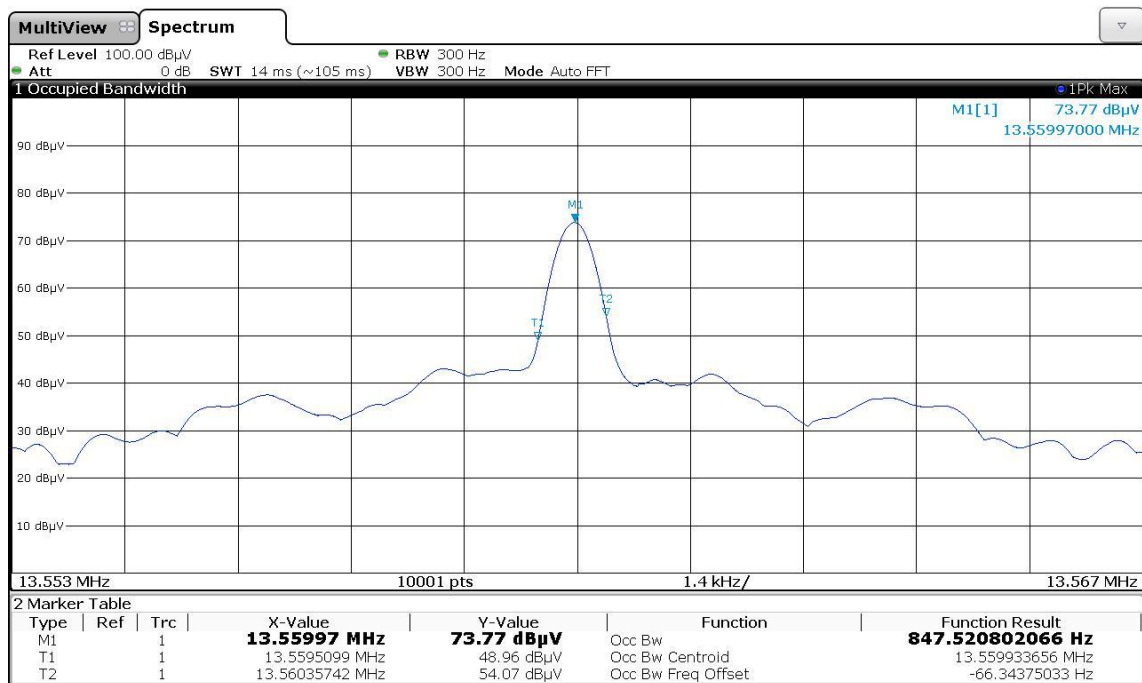
### 5.3.2 Test results

Ambient temperature:	21 °C	Relative humidity:	47 %
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Test record: The test was carried out in TAGs reading and writing mode of the EUT (refer also clause 2 of this test report). All results are shown in the following.

Power supply: During this test the EUT was powered with 24 V<sub>AC</sub> by an AC adapter (see chapter 1.6), which was itself supplied with 120 V<sub>AC</sub> / 60 Hz.

#### 99 % bandwidth at 13.56 MHz:



Frequency	F <sub>L</sub>	F <sub>U</sub>	BW (F <sub>U</sub> - F <sub>L</sub> )
13.56 MHz	13.5595099 MHz	13.56035742 MHz	847.5 Hz
Measurement uncertainty: < 1*10 <sup>-7</sup>			

Test equipment used (see chapter 6)

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## 6 Test equipment

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal Due
1	Shielded chamber M4	B83117-S1-X158	Siemens	190075	480088	Calibration not necessary	
2	EMI Receiver / Spectrum Analyser	ESIB 26	Rohde & Schwarz	100292	481182	15.02.2016	02.2018
						28.02.2018	02.2020
3	LISN	NSLK8128	Schwarzbeck	8128161	480138	16.02.2016	02.2018
						13.03.2018	03.2020
4	Transient Filter Limiter	CFL 9206A	Teseq GmbH	38268	481982	14.03.2018	03.2020
5	Software	EMC32	Rohde & Schwarz	100061	481022	Calibration not necessary	
6	Outdoor test site	-	PHOENIX TESTLAB	-	480293	Calibration not necessary	
7	Open area test site M6	Freifeld M6	Phoenix Contact	-	480085	Calibration not necessary	
8	EMI Receiver	ESIB 7	Rohde & Schwarz	100304	480521	18.02.2016	02.2018
						26.02.2018	02.2020
9	Controller	HD100	Deisel	100/349	480139	Calibration not necessary	
10	Turntable	DS412	Deisel	412/316	480087	Calibration not necessary	
11	Antenna mast	MA240-0	Inn-Co	MA240- 0/030/6600603	480086	Calibration not necessary	
12	Antenna (Bilog)	CBL6111D	Schaffner / Teseq	25761	480894	19.10.2017	10.2020
13	Attenuator 6 dB	R412706000	Radiall	9833	410082	Calibration not necessary	
14	Fully anechoic chamber M20	B83117-E2439- T232	Albatross Projects	103	480303	Calibration not necessary	
15	EMI Receiver / Spectrum Analyser	ESW44	Rohde & Schwarz	101635	482467	22.06.2017	06.2019
16	Multiple Control Unit	MCU	Maturo GmbH	MCU/043/97110 7	480832	Calibration not necessary	
17	Turntable	DS420 HE	Deisel	420/620/00	480315	Calibration not necessary	
18	Antenna mast	AS615P	Deisel	615/310	480187	Calibration not necessary	
19	Antenna (Bilog)	CBL6112B	Schaffner	2688	480328	19.06.2017	06.2020
20	RF cable 36	Sucoflex 106B	Suhner	0522/6B	480571	Calibration not necessary	
21	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	29.02.2016	02.2018
						23.02.2018	02.2020
22	Loop antenna	11 cm	PHOENIX TESTLAB	-	410084	Calibration not necessary	
23	EMI Receiver / Spectrum Analyser	ESI 40	Rohde & Schwarz	100064/040	480355	15.02.2017	02.2018
						27.02.2018	02.2019



## 7 Report history

Report Number	Date	Comment
F170754E1	09/06/2018	Document created
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## 8 List of annexes

Annex A	Test setup photos	5 pages
Annex B	Internal photos	9 pages
Annex C	External photos	2 pages