

# Test Report

Report Number:

**F180889E1**

Equipment under Test (EUT):

**MGB2-L2-MLI-U-Y0000-BJ-156392 / MGB2-L1-MLI-U-Y0000-BJ-136776**

Applicant:

**EUCHNER GmbH & Co. KG**

Manufacturer:

**EUCHNER GmbH & Co. KG**



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: 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.

Tested and written by:	Thomas KÜHN		08/24/2018
	Name	Signature	Date
Authorized reviewer:	Bernd STEINER		08/24/2018
	Name	Signature	Date

This test report is only valid in its original form.

Any reproduction of its contents in extracts without written permission of the accredited test laboratory PHOENIX TESTLAB GmbH is prohibited.

The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalisations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT NUMBER.

This test report is valid in hardcopy form as well as in electronic form.

**Contents:**

	<b>Page</b>
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 Dates .....	6
2 Operational states and test setup .....	6
3 Additional information .....	6
4 Overview .....	7
5 Results .....	8
5.1 Conducted emissions on power supply lines (150 kHz to 30 MHz) .....	8
5.1.1 Method of measurement .....	8
5.1.2 Test results (conducted emissions on power supply lines) .....	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 .....	16
5.2.3 Result final measurement from 9 kHz to 30 MHz .....	19
5.2.4 Result final measurement from 30 MHz to 1 GHz .....	20
5.3 99 % bandwidth .....	22
5.3.1 Method of measurement .....	22
5.3.2 Test results .....	23
6 Test equipment .....	24
7 Report history .....	24
8 List of annexes .....	25

## 1 Identification

### 1.1 Applicant

Name:	EUCHNER GmbH + Co. KG
Address:	Kohlhammerstraße 16 70771 Leinfelden-Echterdingen
Country:	Germany
Name for contact purposes:	Mr. Tobias KÖNIG
Phone:	+49 711 7597-360
eMail Address:	tobias.koenig@euchner.de
Applicant represented during the test by the following person:	---

### 1.2 Manufacturer

Name:	EUCHNER GmbH + Co. KG
Address:	Kohlhammerstraße 16 70771 Leinfelden-Echterdingen
Country:	Germany
Name for contact purposes:	Mr. Tobias KÖNIG
Phone:	+49 711 7597-360
eMail Address:	tobias.koenig@euchner.de
Manufacturer represented during the test by the following person:	---

### 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)

Type object: *	Safety switch
Model name / HVIN: *	02
PMN: *	MGB2-L2-MLI-U-Y0000-BJ-156392 / MGB2-L1-MLI-U-Y0000-BJ-136776
Serial No.:	15632 000063 / 136776 000232
FCC ID: *	2AJ58-02
IC: *	22052-02
PCB identifier:	128922
Hardware version: *	V1.3.5
Software version: *	V1.0.4.0
Lowest internal frequency: *	125 kHz with 2 kHz AM
Highest internal frequency: *	72 MHz processor internal

## 1.5 Technical data of equipment

Rated RF output power: *	<125 mW			
Antenna type: *	Rod antenna with 0.0027 m <sup>2</sup>			
Operation frequency: *	125 kHz			
Number of channels: *	1			
Antenna connector: *	None			
Modulation: *	AM			
Data rate: *	2 kbit/s			
Supply voltage: *	$U_{\text{Nom}} = 24.0 \text{ V}_{\text{DC}}$	$U_{\text{Min}} = 20.4 \text{ V}_{\text{DC}}$	$U_{\text{Max}} = 27.6 \text{ V}_{\text{DC}}$	
Power supply: *	External			
Temperature range: *	-25 °C to 55 °C			

\*: declared by the applicant.

Ports / Connectors			
Identification	Connector		Length during test
	EUT	Ancillary	
DC / Data	5 pole M12 connector	-	3 m
-	-	-	-
-	-	-	-

Ancillary equipment used for the tests
Handle module MGB2-H-BA1A3-R136691, Busmodule MBM (both supplied by the applicant)
AC/DC adaptor Enercell Cat-No. 273-316 (supplied by the laboratory)

## 1.6 Dates

Date of receipt of test sample:	07/02/2018
Start of test:	07/03/2018
End of test:	07/04/2018

## 2 Operational states and test setup

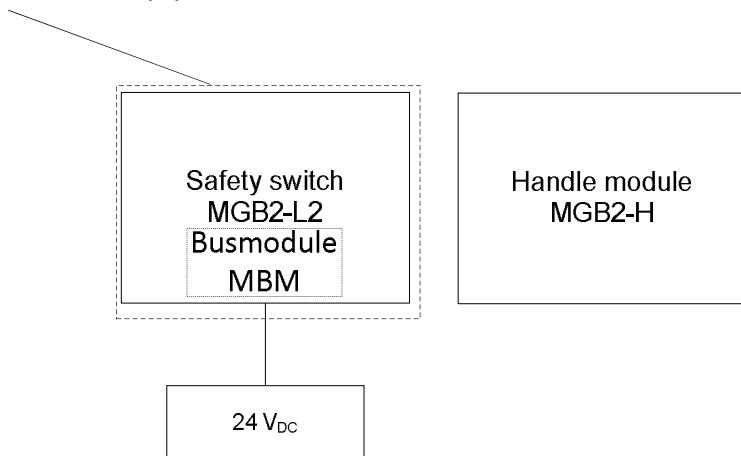
The EUT is a safety switch for machines. It will prevent either to open the protected door or to start machine actions as long as the protected door is open.

During all measurements a Handle module MGB2-H-BA1A3-R136691 was positioned at its intended position related to the EUT.

During all measurements the EUT was powered with 24 V<sub>DC</sub> by an external laboratory power supply, except for the emission measurement on the power supply line, were the EUT was supplied by an AC/DC adaptor Enercell Cat-No. 273-316.

All measurements were carried out with an unmodified sample operating in normal operation mode.

Physical boundaries of the Equipment Under Test



## 3 Additional information

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

The EUT is also available as MGB2-L1-MLI-U-Y0000-BJ-136776. As pre-tests have shown, the MGB2-L2-MLI-U-Y0000-BJ-156392 causes higher emissions for all test cases, so all tests were carried out with the MGB2-L2-MLI-U-Y0000-BJ-156392.

## 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	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	-	6.7 [4]	-	22 et seq.
Antenna requirement	-	15.203	-	Passed *	-

\*: Integrated antenna only, requirement fulfilled.

## 5 Results

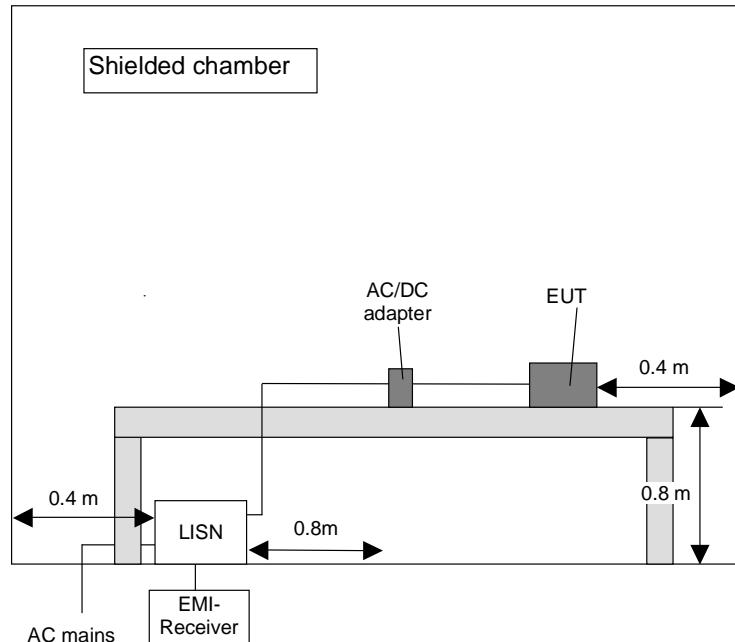
### 5.1 Conducted emissions on power supply lines (150 kHz to 30 MHz)

#### 5.1.1 Method of measurement

This test will be carried out in a shielded chamber. Tabletop devices will be 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 applicable 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	Relative humidity	56 %
---------------------	-------	-------------------	------

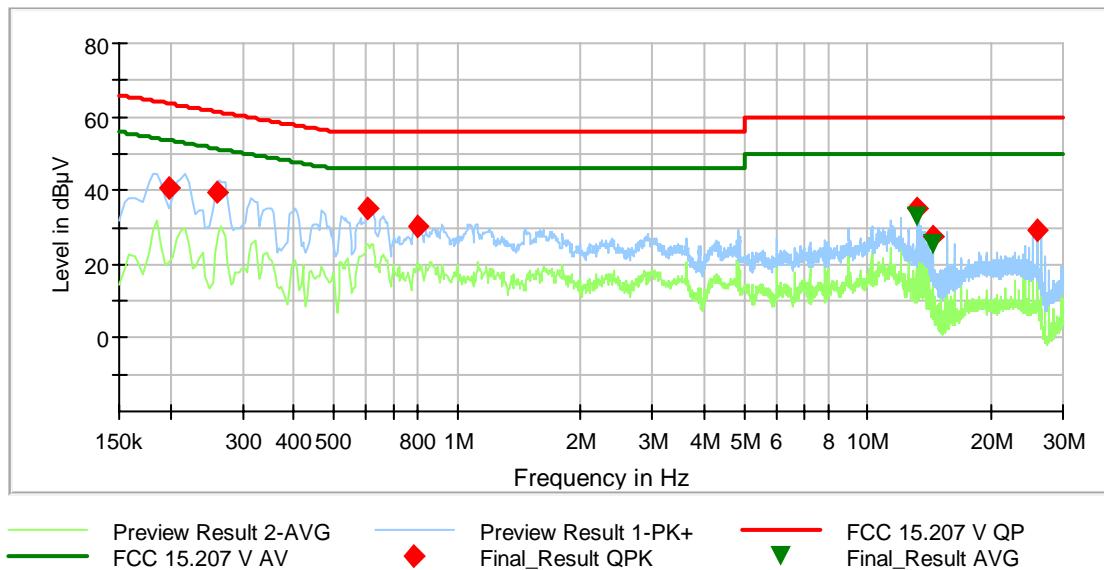
Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m.

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: The test was carried out with a handle module attached to 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>DC</sub> by the ENERCEL AC adaptor CAT.No. 273-316, 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 +.



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

Frequency (MHz)	QuasiPeak (dB $\mu$ V)	Average (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Transducer (dB)
0.198600	40.6	---	63.7	23.1	5000	9	L1	FLO	9.8
0.261600	39.5	---	61.4	21.9	5000	9	N	GND	9.9
0.601800	35.0	---	56.0	21.0	5000	9	N	GND	9.9
0.800700	30.3	---	56.0	25.7	5000	9	N	GND	9.9
13.264800	---	33.2	50.0	16.8	5000	9	N	FLO	10.8
13.264800	35.1	---	60.0	24.9	5000	9	L1	FLO	10.7
14.467200	27.6	---	60.0	32.4	5000	9	L1	GND	10.7
14.471700	---	25.5	50.0	24.5	5000	9	L1	GND	10.7
25.926000	29.2	---	60.0	30.8	5000	9	N	FLO	11.2
Measurement uncertainty					±2.78 dB				

Test: Passed

Test equipment used (see chapter 6):

1 - 5

## 5.2 Radiated emissions

### 5.2.1 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 1 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 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 side with reflecting ground plane and various antenna heights in the frequency range 30 MHz to 1 GHz.

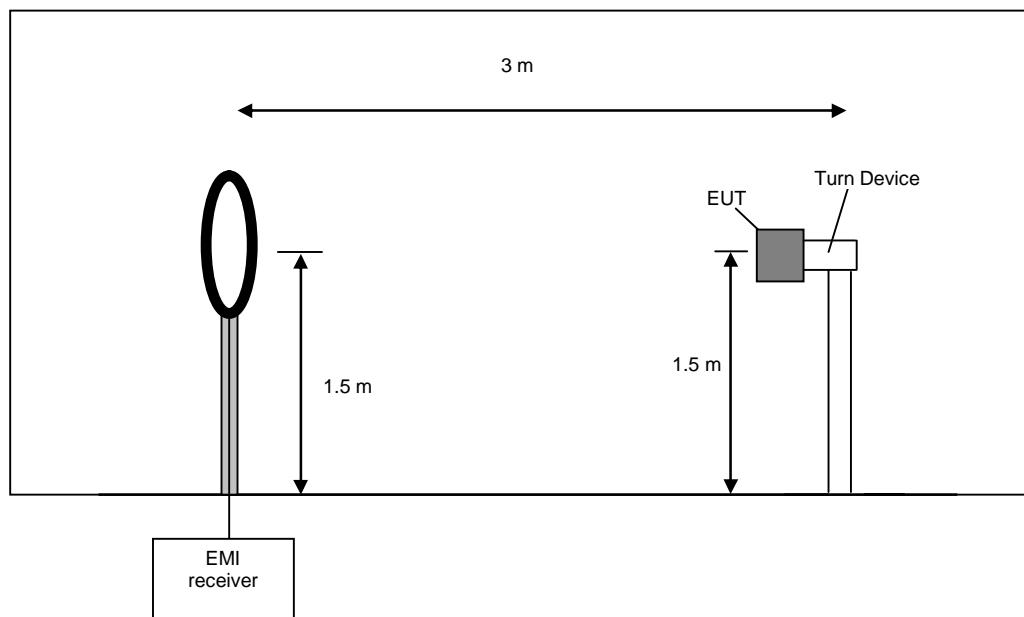
#### Preliminary measurement (9 kHz to 30 MHz):

In the first stage a preliminary measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Table top devices will set up on a non-conducting turn device on the height of 1.5 m. Floor-standing devices will be placed directly on the turntable/ground plane. The setup 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 measurement will be performed in three orientations 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 spectrum analyser will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	300 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).

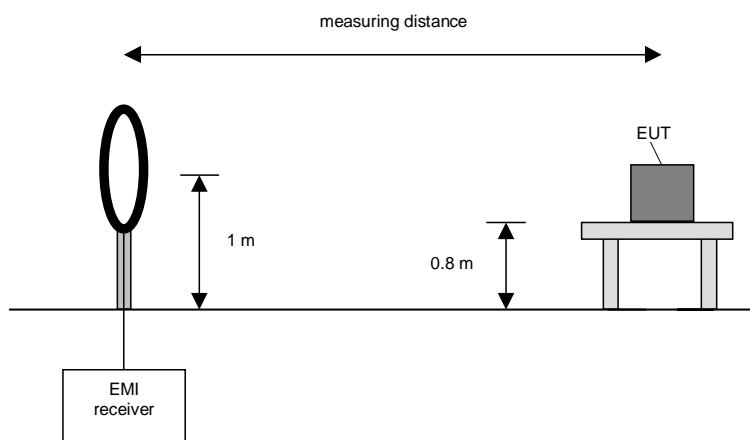
Final measurement (9 kHz to 30 MHz):

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).

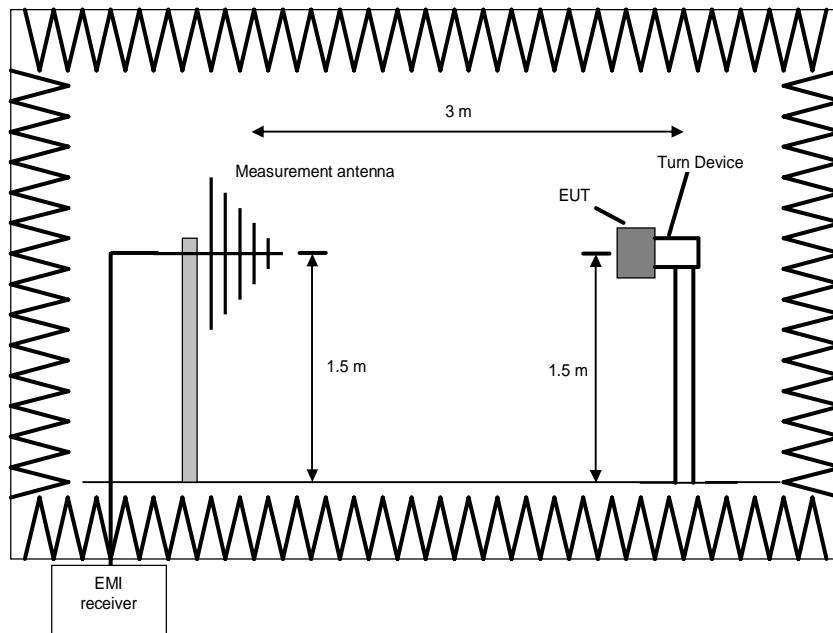
### Preliminary measurement (30 MHz to 1 GHz)

In the first stage a preliminary measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Table top devices will set up on a non-conducting turn device on the height of 1.5 m. Floor-standing devices will be placed directly on the turntable/ground plane. The setup 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 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
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:

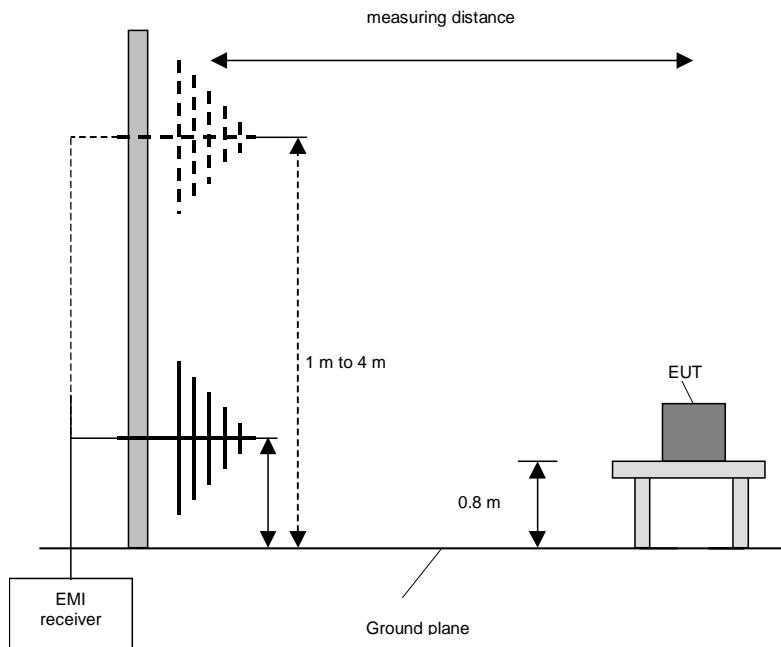
- 1) Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
- 2) Manipulate the system cables within the range to produce the maximum level of emission.
- 3) Rotate the EUT by 360 ° to maximize the detected signals.
- 4) Repeat 1) to 3) with the vertical polarisation of the measuring antenna.
- 5) Make a hardcopy of the spectrum.
- 6) Repeat 1) to 5) with the EUT raised by an angle of 30 ° (60 °, 90 °, 120 ° and 150 °) according to 6.6.5.4 in [1].
- 7) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.

### 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.

### 5.2.2 Results preliminary measurement 9 kHz to 1 GHz

Ambient temperature	22 °C	Relative humidity	48 %
---------------------	-------	-------------------	------

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

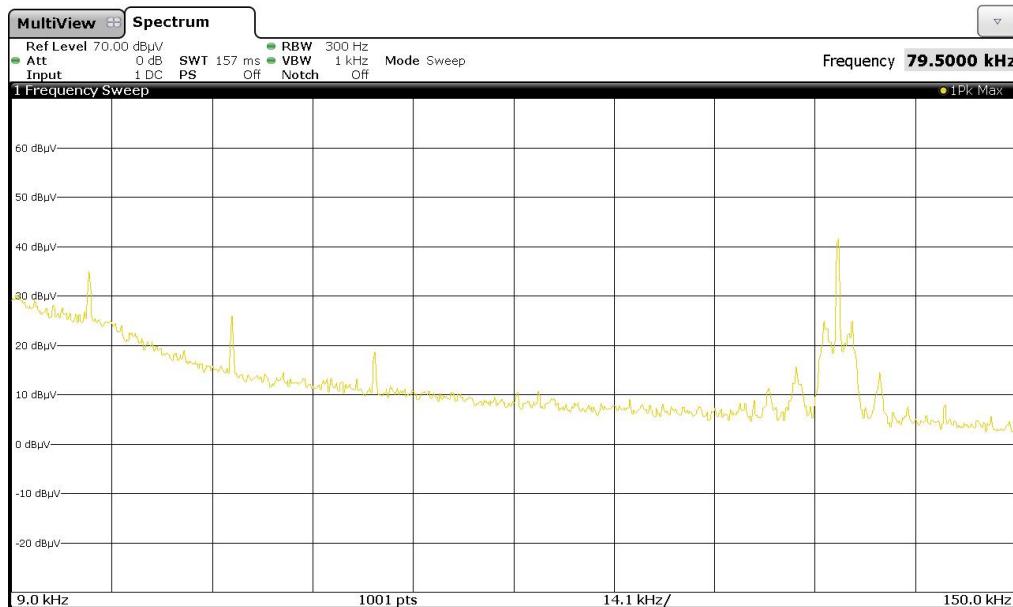
Cable guide: The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

Test record: The test was carried out with a handle module attached to the EUT (refer also clause 2 of this test report). All results are shown in the following.

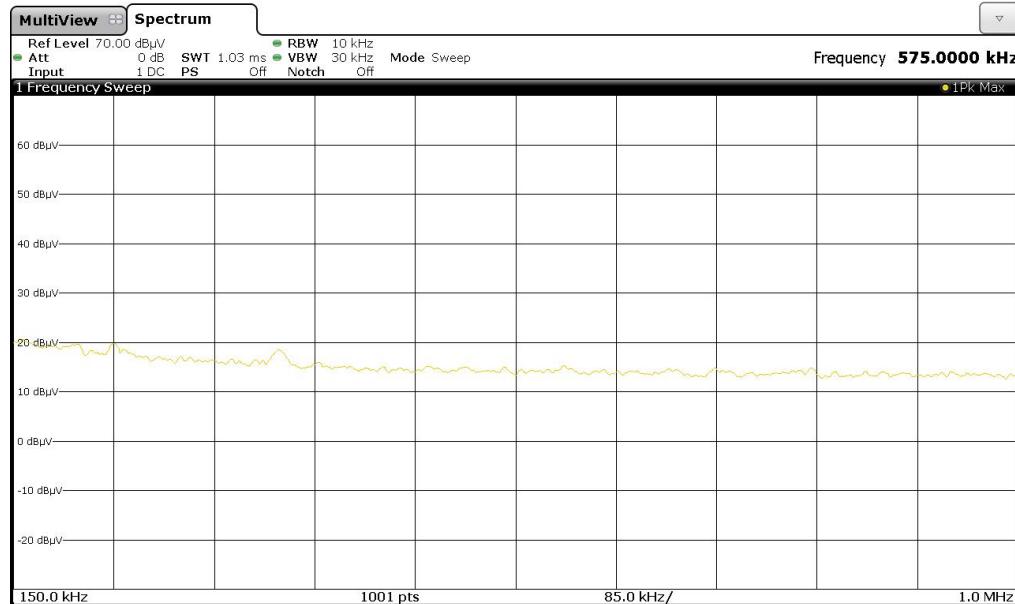
Power supply: During this test the EUT was powered with 24 V<sub>DC</sub> by an external power supply.

Frequency range: According to [2] from 9 kHz to 1 GHz.

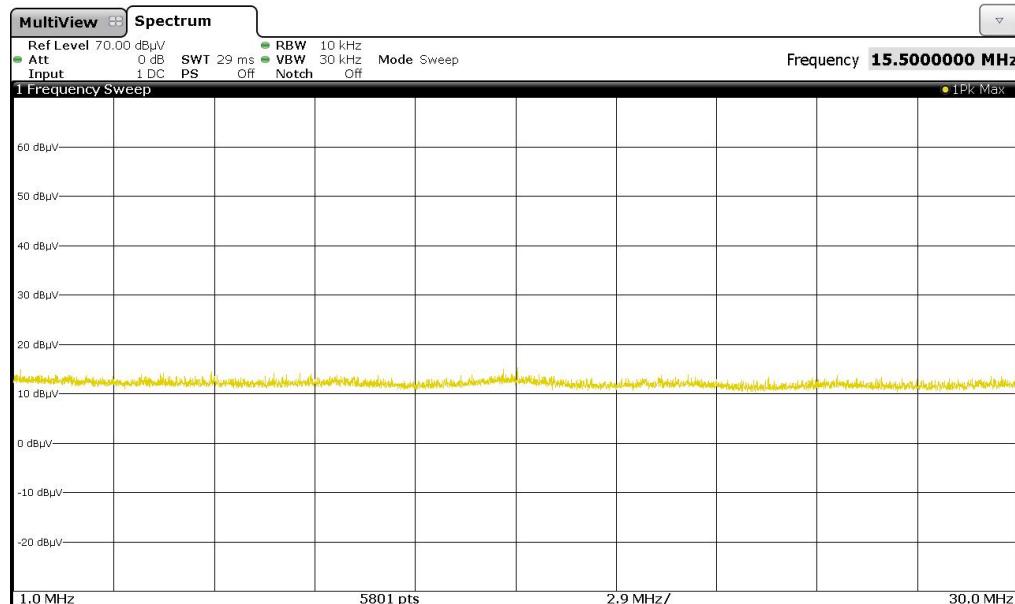
180889\_1.png: Spurious emissions from 9 kHz to 150 kHz



180889\_2.png: Spurious emissions from 150 kHz to 1 MHz



180889\_3.png: Spurious emissions from 1 MHz to 30 MHz

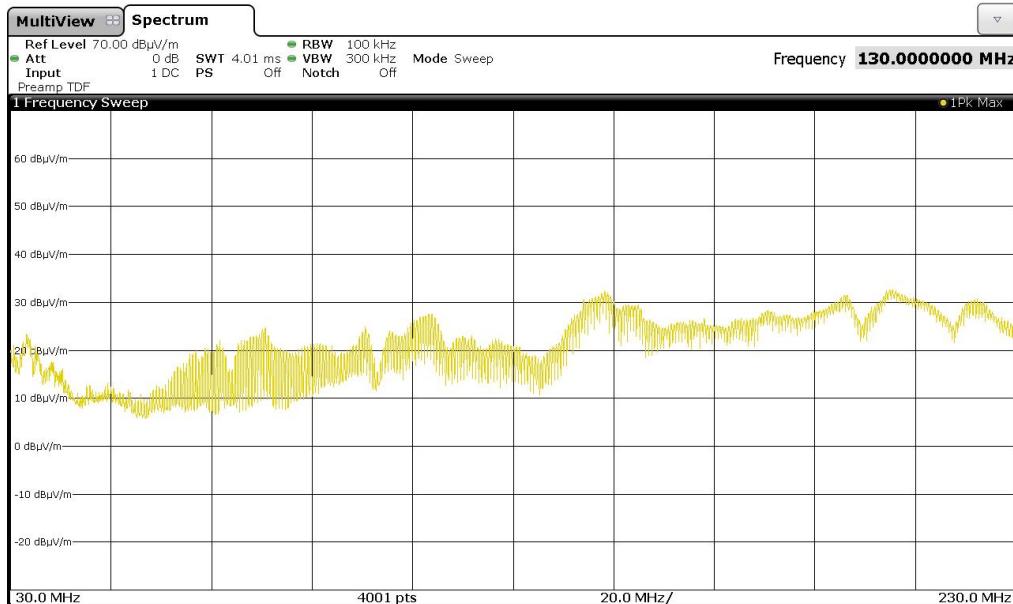


The following emissions were found according to [2] and [3].

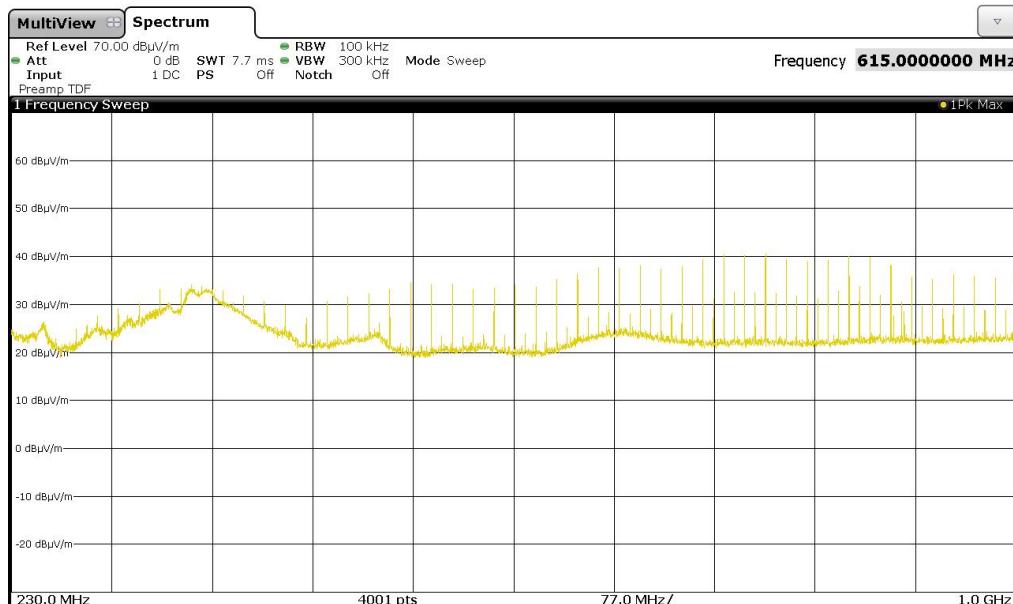
- 20.000 kHz, 40.000 kHz, 123.060 kHz, 125.000 kHz and 126.940 kHz.

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

### 180889\_4.png: Spurious emissions from 30 MHz to 230 MHz



### 180889\_5.png: Spurious emissions from 230 MHz to 1 GHz



The following frequency was found emission test inside restricted bands during the preliminary radiated:

- 113.837 MHz.

The following frequencies were found outside the restricted bands during the preliminary radiated.

- 33.745 MHz, 80.100 MHz, 147.561 MHz, 195.191 MHz, 204.850 MHz, 222.250 MHz, 366.895 MHz, 536.000 MHz, 648.000 MHz, 712.000 MHz, 808.500 MHz and 952.000 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)

6 - 14, 25, 26

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

Ambient temperature	20 °C	Relative humidity	50 %
---------------------	-------	-------------------	------

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 test was carried out with a handle module attached to 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>DC</sub> by an external power supply.

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

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

Results with measuring distance of 3 m							
Frequency (kHz)	Result (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Distance correction <sup>2)</sup> (dB)	Readings (dB $\mu$ V)	Detector	Antenna factor <sup>1)</sup> (dB/m)
20.000	-27.2 @ 300 m	41.6	68.8	-80.0	32.8	AV	20.0
40.000	-35.5 @ 300 m	35.6	71.1	-80.0	24.5	AV	20.0
123.060	-34.2 @ 300 m	25.8	60.0	-80.0	35.0	AV	20.0
125.000	-0.4 @ 300 m	25.7	26.1	-80.0	59.6	AV	20.0
126.940	-26.0 @ 300 m	25.5	51.5	-80.0	34.0	AV	20.0
Results with measuring distance of 10 m							
Frequency (kHz)	Result (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Distance correction <sup>2)</sup> (dB)	Readings (dB $\mu$ V)	Detector	Antenna factor <sup>1)</sup> (dB/m)
123.060	-26.0 @ 300 m	25.8	51.8	-60.0	14.0	AV	20.0
125.000	-11.0 @ 300 m	25.7	36.7	-60.0	29.0	AV	20.0
126.940	-25.0 @ 300 m	25.5	50.5	-60.0	15.0	AV	20.0

All other emissions are below the noise floor of the measuring system

Measurement uncertainty:  $\pm 4.78$  dB

<sup>1)</sup>: Cable loss included

<sup>2)</sup>: Correction Factor according to [2] and [3] extrapolated with a factor of 40 dB/decade according to [2]

Test: Passed

Test equipment used for the test:

14- 16, 25, 26

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

Ambient temperature	22 °C	Relative humidity	56 %
---------------------	-------	-------------------	------

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 with a handle module attached to 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>DC</sub> by an external power supply.

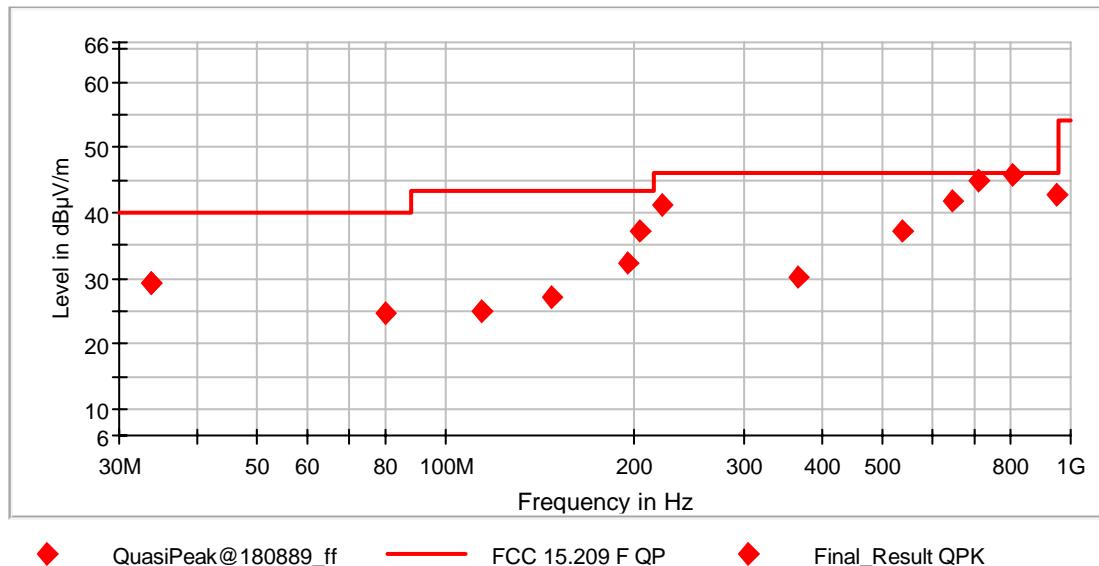
Test results: The test results were calculated with the following formula:

$$\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{cable loss [dB]} + \text{antenna factor [dB/m]} + 6 \text{ dB}$$

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 (MHz)	Result (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
113.837	25.0	43.5	18.5	1000	120	206	H	111	18.5
Spurious emissions outside restricted bands									
Frequency (MHz)	Result (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
33.745	29.4	40.0	10.6	1000	120	150	V	46	25.7
80.100	24.5	40.0	15.5	1000	120	146	V	292	15.2
147.561	27.2	43.5	16.3	1000	120	173	V	308	19.0
195.191	32.4	43.5	11.1	1000	120	123	V	21	16.6
204.850	37.1	43.5	6.4	1000	120	103	V	8	17.3
222.250	41.1	46.0	4.9	1000	120	149	V	136	17.7
366.895	30.3	46.0	15.7	1000	120	100	H	0	23.7
536.000	37.3	46.0	8.7	1000	120	100	V	289	28.2
648.000	41.7	46.0	4.3	1000	120	134	H	335	30.6
712.000	45.0	46.0	1.0	1000	120	118	H	130	31.4
808.500	45.9	46.0	0.1	1000	120	393	H	50	32.7
952.000	42.7	46.0	3.3	1000	120	150	H	326	36.4
Measurement uncertainty				$\pm 4.78$ dB					

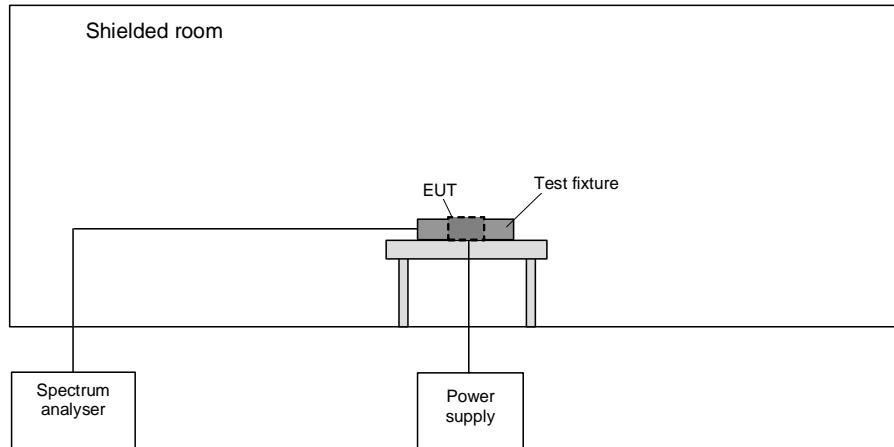
Test: Passed

Test equipment used (see chapter 6):

2, 17 – 22, 25, 26

## 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.

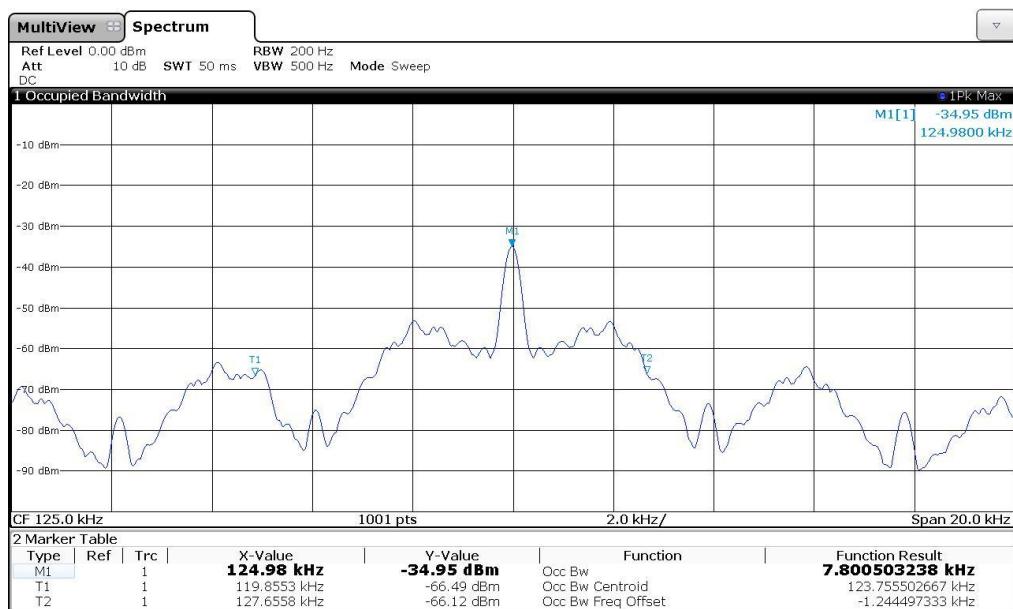
### 5.3.2 Test results

Ambient temperature:	22 °C	Relative humidity:	58 %
----------------------	-------	--------------------	------

Test record: The test was carried out with a handle module attached to 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>DC</sub> by an external power supply.

180089\_6.jpeg: 99 % bandwidth at 125 kHz:



Frequency	F <sub>L</sub>	F <sub>U</sub>	BW (F <sub>U</sub> - F <sub>L</sub> )
125 kHz	119.8553 kHz	127.6558 kHz	7.8005 kHz
Measurement uncertainty			< 1*10 <sup>-7</sup>

Test equipment used (see chapter 6)

23 - 26

## 6 Test equipment

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal Due
1	LISN	NSLK8128	Schwarzbeck	8128161	480138	03/13/2018	03/2020
2	Software	EMC32	Rohde & Schwarz	100061	481022	Calibration not necessary	
3	Shielded chamber M4	B83117-S1-X158	Siemens	190075	480088	Calibration not necessary	
4	EMI Receiver / Spectrum Analyser	ESIB 26	Rohde & Schwarz	100292	481182	02/28/2018	02/2020
5	Transient Filter Limiter	CFL 9206A	Teseq	38268	481982	03/14/2018	03/2020
6	Antenna mast	AS615P	Deisel	615/310	480187	Calibration not necessary	
7	Turntable	DS420 HE	Deisel	420/620/00	480315	Calibration not necessary	
8	Multiple Control Unit	MCU	Maturo	MCU/043/971107	480832	Calibration not necessary	
9	Antenna (Bilog)	CBL6112B	Schaffner	2688	480328	06/19/2017	06/2020
10	RF-cable No.36	Sucoflex 106B	Suhner	0587/6B	480865	Calibration not necessary	
11	EMI Receiver / Spectrum Analyser	ESW44	Rohde & Schwarz	101635	482467	06/22/2017	06/2019
12	Fully anechoic chamber M20	B83117-E2439-T232	Albatross Projects	103	480303	Calibration not necessary	
13	Antenna support	AS620P	Deisel	620/375	480325	Calibration not necessary	
14	Loop antenna	HFH2-Z2	Rohde & Schwarz	100417	481912	12/19/2017	12/2018
15	Outdoor test site	-	PHOENIX TESTLAB	-	480293	Calibration not necessary	
16	EMI Receiver / Spectrum Analyser	ESI 40	Rohde & Schwarz	100064/040	480355	02/27/2018	02/2019
17	Open area test site M6	Freifeld M6	Phoenix Contact	-	480085	Calibration not necessary	
18	Antenna mast	MA240-0	Inn-Co	MA240-0/030/6600603	480086	Calibration not necessary	
19	Turntable	DS412	Deisel	412/316	480087	Calibration not necessary	
20	Controller	HD100	Deisel	100/349	480139	Calibration not necessary	
21	Antenna (Bilog)	CBL6111D	Schaffner	25761	480894	10/19/2017	10/2020
22	EMI Receiver / Spectrum Analyser	ESR7	Rohde & Schwarz	101939	482558	09/19/2017	09/2019
23	Signal & Spectrum Analyzer	FSW43	Rohde & Schwarz	100586 & 100926	481720	05/30/2018	05/2019
24	Loop antenna	Loop antenna $\Delta$ 11 cm	PHOENIX TESTLAB	-	410084	Calibration not necessary	
25	Power Supply	TOE8852 (DC)	Toellner	51712	480233	Calibration not necessary	
26	Multimeter	971A	Hewlett Packard	JP40010640	480724	01/31/2018	01/2019

## 7 Report history

Report Number	Date	Comment
F180889E1	08/24/2018	Document created
-	-	-
-	-	-
-	-	-

## 8 List of annexes

Annex A            Test setup photos            7 pages

180889\_b.jpg: MGB2-L2-MLI-U-Y0000-BJ-156392, test set-up fully anechoic chamber  
180889\_a.jpg: MGB2-L2-MLI-U-Y0000-BJ-156392, test set-up fully anechoic chamber  
180889\_c.jpg: MGB2-L2-MLI-U-Y0000-BJ-156392, test set-up fully anechoic chamber  
180889\_d.jpg: MGB2-L2-MLI-U-Y0000-BJ-156392, test set-up fully anechoic chamber  
180889\_e.jpg: MGB2-L2-MLI-U-Y0000-BJ-156392, test set-up outdoor test site  
180889\_f.jpg: MGB2-L2-MLI-U-Y0000-BJ-156392, test set-up open area test site  
180889\_g.jpg: MGB2-L2-MLI-U-Y0000-BJ-156392, test set-up shielded chamber

Annex B            External photographs            10 pages

180889\_1.jpg: MGB2-L2-MLI-U-Y0000-BJ-156392, 3-D-view 1  
180889\_2.jpg: MGB2-L2-MLI-U-Y0000-BJ-156392, 3-D-view 2  
180889\_3.jpg: MGB2-L2-MLI-U-Y0000-BJ-156392, type plate view  
180889\_14.jpg: MGB2-L1-MLI-U-Y0000-BJ-136776, 3-D-view 1  
180889\_15.jpg: MGB2-L1-MLI-U-Y0000-BJ-136776, 3-D-view 2  
180889\_16.jpg: MGB2-L1-MLI-U-Y0000-BJ-136776, type plate view  
180889\_11.jpg: MGB2-H-BA1A3-R-136691, 3-D-view  
180889\_12.jpg: MGB2-H-BA1A3-R-136691, type plate view  
180889\_25.jpg: MGB2-L2-MLI-U-Y0000-BJ-156392 with MGB2-H-BA1A3-R-136691  
180889\_17.jpg: MGB2-L1-MLI-U-Y0000-BJ-136776 with MGB2-H-BA1A3-R-136691

Annex C            Internal photographs            13 pages

180889\_5.jpg: MGB2-L2-MLI-U-Y0000-BJ-156392, internal view 1 (top covers removed)  
180889\_6.jpg: MGB2-L2-MLI-U-Y0000-BJ-156392, internal view 2 (bottom cover removed)  
180889\_4.jpg: MGB2-L2-MLI-U-Y0000-BJ-156392, internal view 3 (PCB removed)  
180889\_9.jpg: MGB2-L2-MLI-U-Y0000-BJ-156392, PCB, top view  
180889\_10.jpg: MGB2-L2-MLI-U-Y0000-BJ-156392, PCB, bottom view  
180889\_18.jpg: MGB2-L1-MLI-U-Y0000-BJ-136776, internal view 1 (top covers removed)  
180889\_19.jpg: MGB2-L1-MLI-U-Y0000-BJ-136776, internal view 2 (bottom cover removed)  
180889\_20.jpg: MGB2-L1-MLI-U-Y0000-BJ-136776, internal view 3 (PCB removed)  
180889\_21.jpg: MGB2-L1-MLI-U-Y0000-BJ-136776, PCB, top view  
180889\_22.jpg: MGB2-L1-MLI-U-Y0000-BJ-136776, PCB, bottom view  
180889\_13.jpg: MGB2-H-BA1A3-R-136691, internal view  
180889\_23.jpg: MGB2-L2-MLI-U-Y0000-BJ-156392 with MGB2-H-BA1A3-R-136691  
180889\_24.jpg: MGB2-L1-MLI-U-Y0000-BJ-136776 with MGB2-H-BA1A3-R-136691