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Test Report

Report Number:

F190354E5

Equipment under Test (EUT):

CES-I-BP-M-C07-SB-160076

Applicant:

EUCHNER GmbH & Co. KG

Manufacturer:

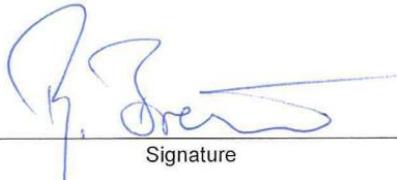
EUCHNER GmbH & Co. KG

References

- [1] **ANSI C63.4:2014** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- [2] **FCC 47 CFR Part 2:** General Rules and Regulations
- [3] **FCC 47 CFR Part 15:** Radio Frequency Devices (Subpart B)
- [4] **ICES-003 Issue 6: (January 2016)** Spectrum Management and Telecommunications. Interference-Causing Equipment Standard. Information Technology Equipment (Including Digital Apparatus) —Limits and Methods of Measurement

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:	Ruben BRAUN		29.07.2019
	Name	Signature	Date
Reviewed and approved by:	Bernd STEINER		29.07.2019
	Name	Signature	Date

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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.

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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:	None

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:	None

1.3 Test Laboratory

The tests were carried out by:

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 and D-PL-17186-01-05, FCC Test Firm Designation Number DE0004, FCC Test Firm Registration Number 469623, CAB Identifier DE0003 and ISED# 3469A.

1.4 EUT (Equipment under Test)

Test object: *	Safety switch
Type: *	CES-I-BP-M-C07-SB-160076
FCC ID: *	2AJ58-12
IC Certification Number: *	22052-12
Serial number: *	N/A
PCB identifier: *	PCB 161674
HVIN (Hardware Version Identification Number): *	12
FVIN (Firmware Version Identification Number): *	Not necessary
Hardware version: *	LP-KPL CES-C07-BP V2.1.1.x
Software version: *	N/A
Lowest internal frequency: *	N/A
Highest internal frequency: *	N/A

* Declared by the applicant

Note: Phoenix Testlab GmbH does not take samples. The samples used for tests are provided exclusively by the applicant.

1.5 Technical Data of Equipment

Rated RF output power: *	<125 mW					
Antenna type: *	Rod antenna with 0.0027 m ² (average area times number of turns)					
Number of channels: *	1					
Antenna connector: *	None					
Modulation: *	AM					
Data rate: *	2 kbit/s					
Supply Voltage: *	U _{nom} =	24.0 V DC	U _{min} =	20.4 V DC	U _{max} =	27.6 V DC
Temperature range: *	-25 °C to +55 °C					

* Declared by the applicant

Ports / Connectors			
Identification	Connector		Length during test
	EUT	Ancillary	
DC / Data	Custom 5 pole	Custom	1 m / 10 m

Ancillary Equipment			
EUCHNER CES-A-BTN-C07-156230 ^{*1}			
Custom ancillary equipment (Siemens LOGO! 12/24RC) for EUT monitoring ^{*1}			

^{*1} Provided by the laboratory

1.6 Dates

Date of receipt of test sample:	25.04.2019
Start of test:	08.05.2019
End of test:	15.05.2019

2 Operational States

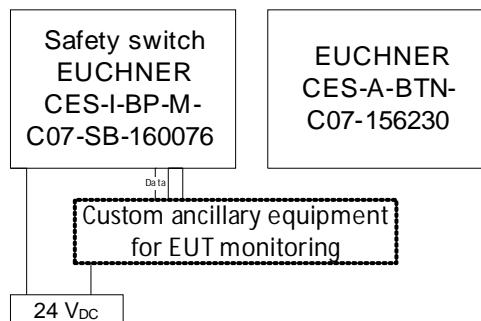
The EUT is a safety switch for machines. It will prevent either to open the protected door or to start machine actions as long as the protected door is open.

During all measurements an EUCHNER CES-A-BTN-C07-156230 was positioned at its intended position related to the EUT (0.33 x maximum detection distance).

During all measurements the EUT was powered with 24 V_{DC} by an external laboratory power supply. Additionally, custom ancillary equipment for monitoring (Siemens LOGO! 12/24RC) was connected to the EUT during the tests.

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 labeled as required by FCC / IC.

4 Overview

Conducted emissions FCC 47 CFR Part 15 section 15.107 [3] / ICES-003 Issue 6 section 6.1 [4]					
Application	Frequency range	Limits	Reference standard	Remark	Status
AC supply line	0.15 to 0.5 MHz 0.5 to 5 MHz 5 to 30 MHz	66 to 56 dB μ V (QP)* 56 to 46 dB μ V (AV)* 56 dB μ V (QP) 46 dB μ V (AV) 60 dB μ V (QP) 50 dB μ V (AV)	ANSI C63.4	Class B	Passed
*: Decreases with the logarithm of the frequency					
Radiated emissions FCC 47 CFR Part 15 section 15.109 [3] / ICES-003 Issue 6 section 6.2 [4]					
Application	Frequency range	Limits	Reference standard	Remark	Status
Radiated Emission	30 to 88 MHz 88 to 216 MHz 216 to 960 MHz 960 to 1000 MHz above 1000 MHz	40.0 dB μ V/m QP at 3 m 43.5 dB μ V/m QP at 3 m 46.0 dB μ V/m QP at 3 m 54.0 dB μ V/m QP at 3 m 54.0 dB μ V/m AV at 3 m and 74.0 dB μ V/m PK at 3 m	ANSI C63.4	Class B	Passed

Remark: As declared by the applicant the highest internal clock frequency is 2.480 GHz.

Therefore the radiated emission measurement must be carried out up to 5th of the highest internal clock frequency in this case 13 GHz.

The EUT was classified by the applicant as CLASS B equipment.

5 Results

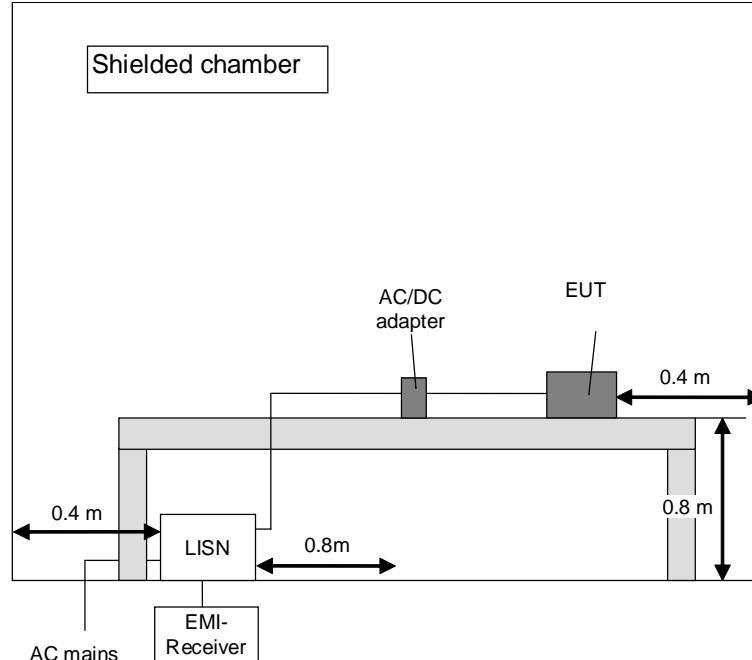
5.1 Conducted emissions on power supply lines

5.1.1 Test method

This test will be carried out in a shielded chamber. Table top 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 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



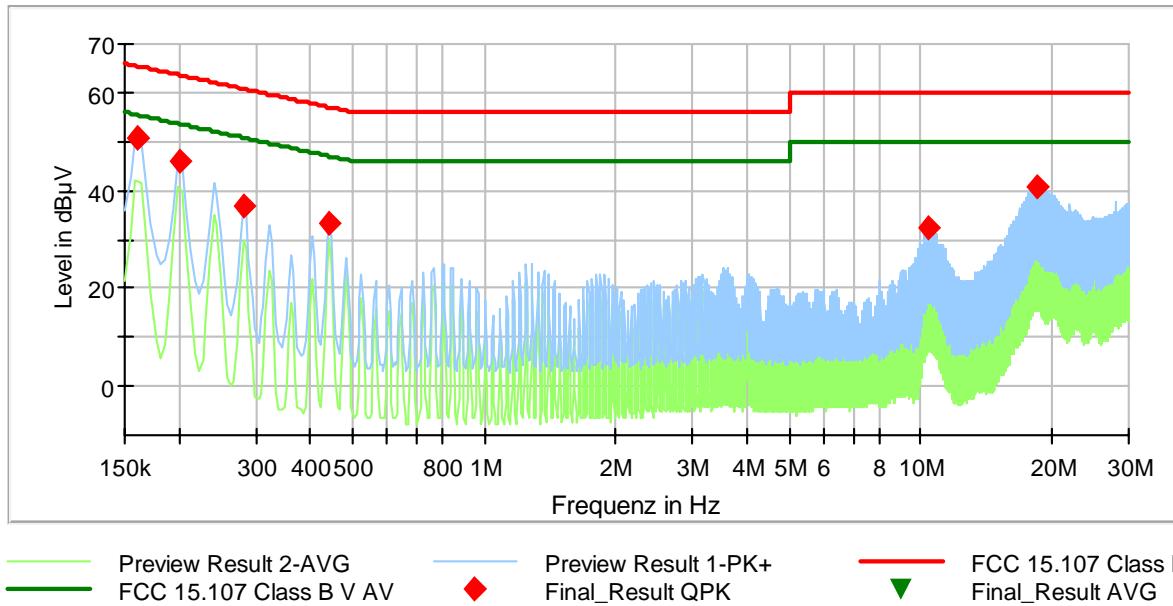
5.1.2 Results conducted emission measurement on AC mains

Ambient temperature:	22 °C	Relative humidity:	48 %
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Test description: Conducted emission measurement
 EUT: CES-I-BP-M-C07-SB-160076
 Manufacturer: EUCHNER GmbH & Co. KG
 Operating conditions: 120 V, 60 Hz on AC/DC power supply (to 24 V DC), 125 kHz
 RFID active
 Test site: Phoenix TESTLAB GmbH, shielded room M4
 Operator: R. BRAUN
 Comment: AC / DC adaptor, Phoenix Contact MINI-SYS-PS-100-
 240AC/24DC/1.3
 Date of test 08.05.2019



The curves in the diagrams below 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 .



Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Transducer (dB)
0.160800	50.89	---	65.42	14.53	5000.0	9.000	N	FLO	9.8
0.201300	45.88	---	63.56	17.68	5000.0	9.000	N	FLO	9.8
0.281400	36.78	---	60.77	23.99	5000.0	9.000	N	FLO	9.9
0.442500	33.42	---	57.01	23.60	5000.0	9.000	N	FLO	9.9
10.384800	32.59	---	60.00	27.41	5000.0	9.000	L1	FLO	10.6
18.434400	40.65	---	60.00	19.35	5000.0	9.000	N	FLO	10.9
Measurement uncertainty				+2.76 dB / -2.76 dB					

Test equipment (please refer to chapter 6 for details)
1-5

5.2 Radiated emissions

5.2.1 Test method

The radiated emission measurement is subdivided into two stages.

- 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.

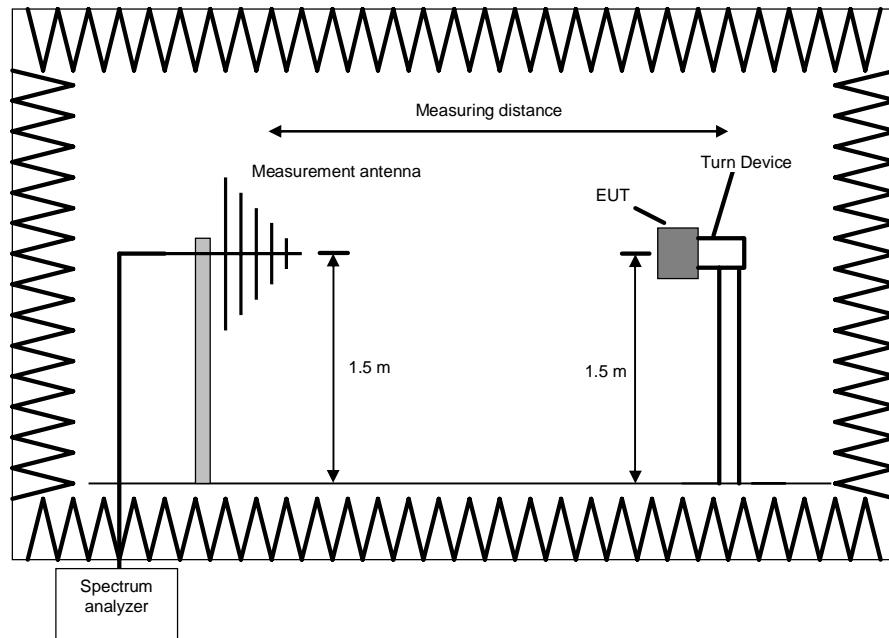
Preliminary measurement (30 MHz to 1 GHz)

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. 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 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 to [1].

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

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	100 kHz



Procedure preliminary measurement:

The following procedure is used:

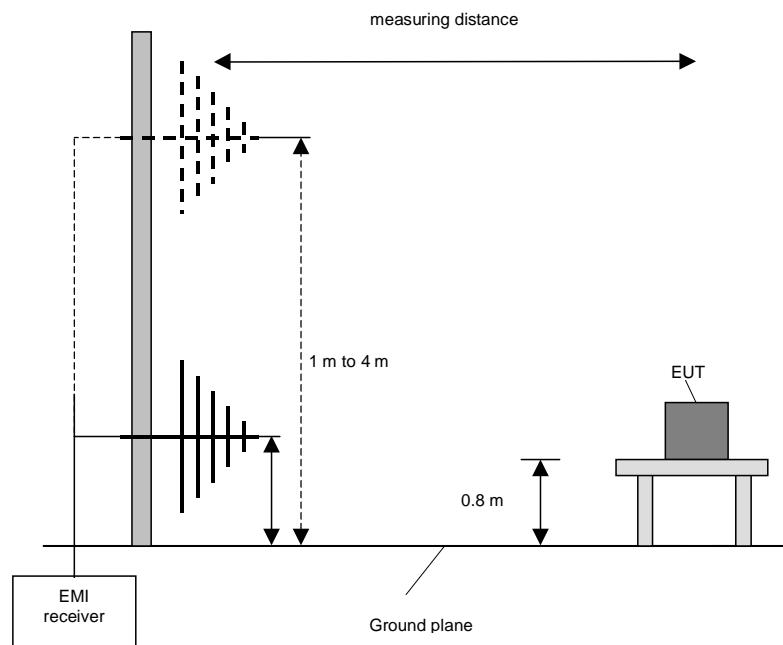
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Rotate the EUT by 360° to maximize the detected signals.
3. Repeat 1) to 2) with the vertical polarisation of the measuring antenna.
4. Make a hardcopy of the spectrum.
5. Repeat 1) to 4) with the EUT raised by an angle of 30° (60°, 90°, 120° and 150°) [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 (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 polarization 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:

Measure on the selected frequencies at an antenna height of 1 m and a EUT azimuth of 23 °.

Move the antenna from 1 m to 4 m and note the maximum value at each frequency.

Rotate the EUT by 45 ° and repeat 2) until an azimuth of 337 ° is reached.

Repeat 1) to 3) for the other orthogonal antenna polarization.

Move the antenna and the turntable to the position where the maximum value is detected.

Measure while moving the antenna slowly +/- 1 m.

Set the antenna to the position where the maximum value is found.

Measure while moving the turntable +/- 45 °.

Set the turntable to the azimuth where the maximum value is found.

Measure with Final detector (QP and AV) and note the value.

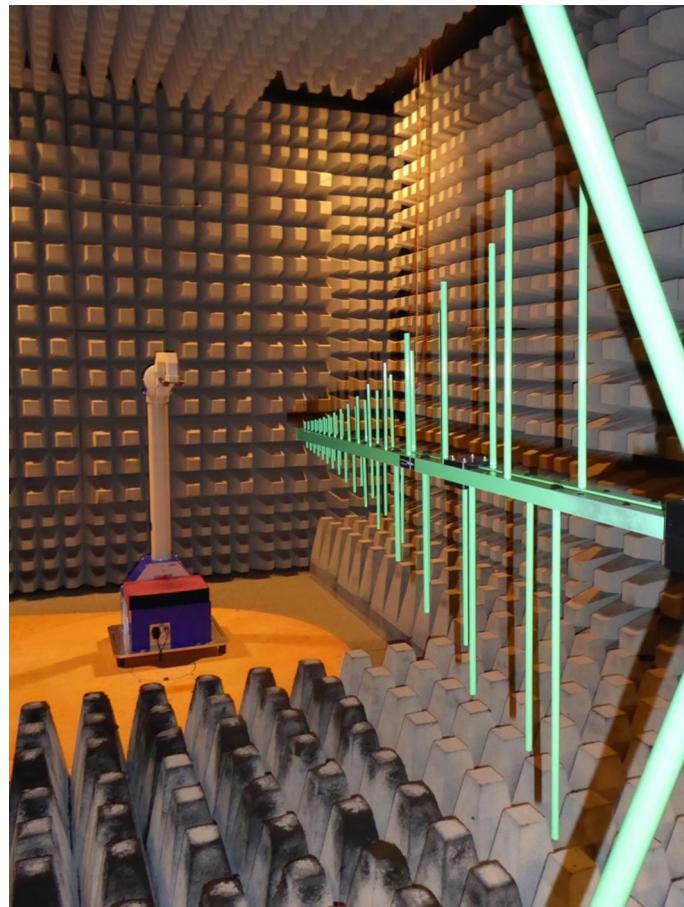
Repeat 5) to 10) for each frequency.

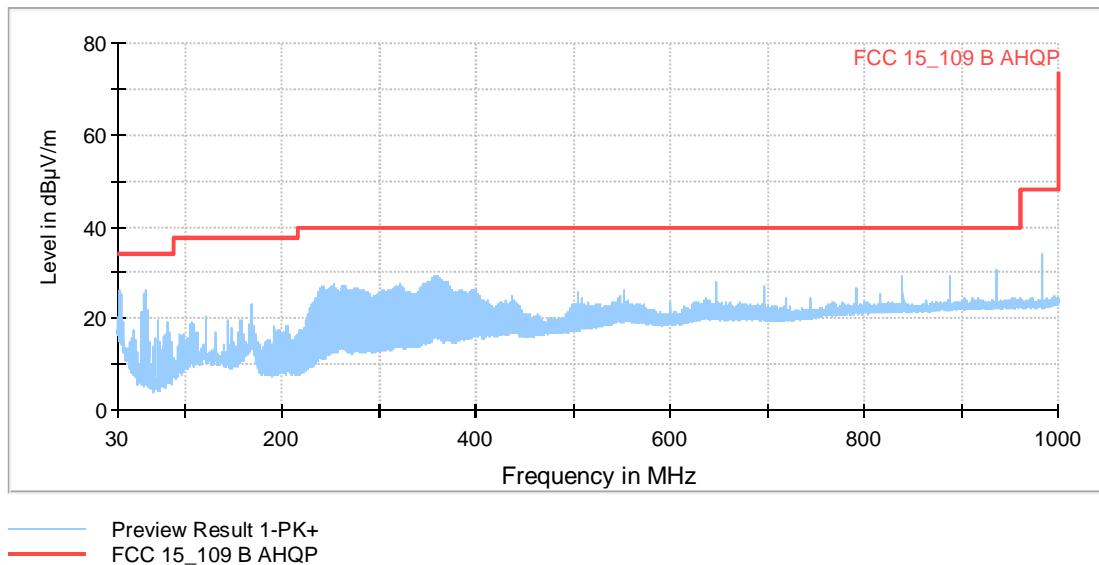
Repeat 1) to 11) for each orthogonal axes of the EUT if handheld equipment.

5.2.2 Results preliminary measurement 30 MHz to 1 GHz

Ambient temperature:	22 °C	Relative humidity:	32 %
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Test description: Radiated emission measurement
EUT: CES-I-BP-M-C07-SB-160076
Manufacturer: EUCHNER GmbH & Co. KG
Operating conditions: 24 V DC, 125 kHz RFID active
Test site: Phoenix TESTLAB GmbH, anechoic chamber M20
Operator: R. BRAUN
Comment: -
Date of test 08.05.2019





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

Frequency (MHz)
32.025
58.050
168.000
358.300
648.000
936.000
984.000

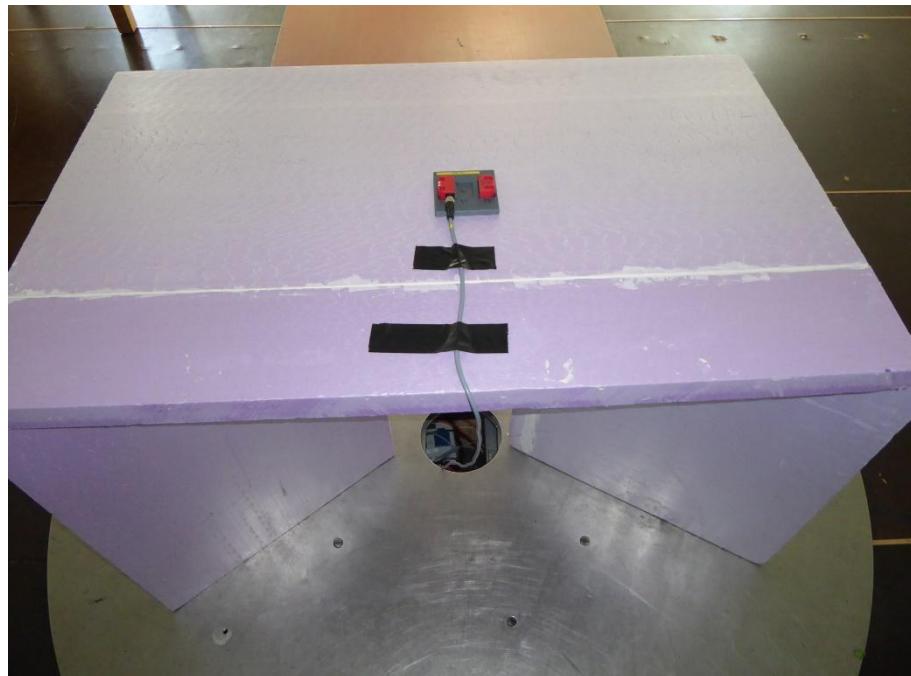
These frequencies have to be measured with in a final measurement.

Test equipment (please refer to chapter 6 for details)
2, 6-13, 21, 22

5.2.3 Result final measurement from 30 MHz to 1 GHz

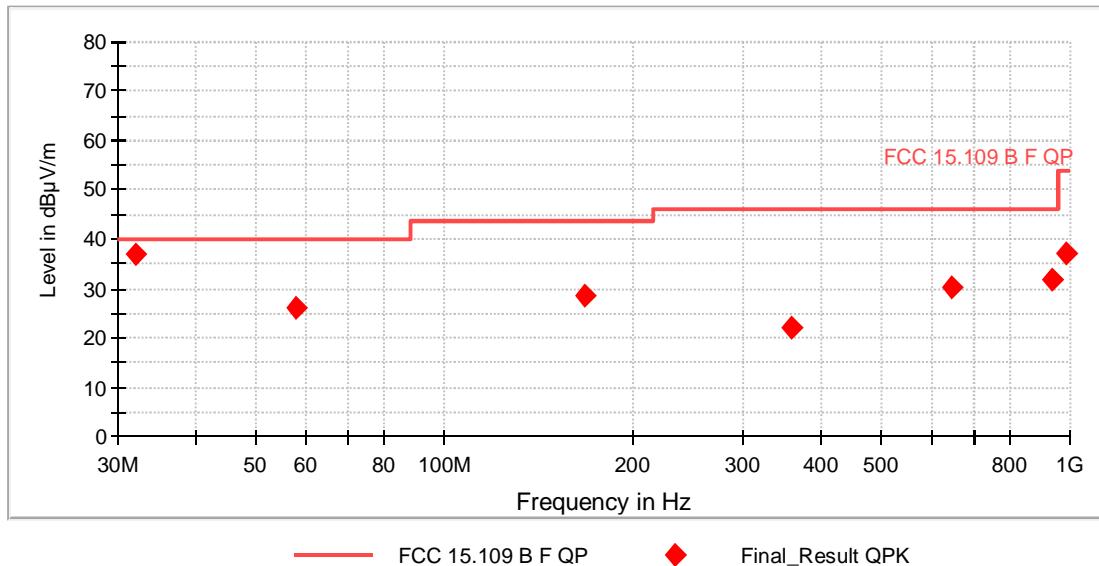
Ambient temperature	15 °C	Relative humidity	31 %
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Test description: Radiated emission measurement according to FCC PART 15
EUT: CES-I-BP-M-C07-SB-160076
Manufacturer: EUCHNER GmbH & Co. KG
Operating conditions: 24 V DC, 125 kHz RFID active
Test site: Phoenix TESTLAB GmbH, OATS M6
Operator: R. Braun
Comment:
Date of test 15.05.2019



Final measurement

The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above mentioned standard. The measured points marked with “◆” are the measured results of the standard subsequent 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 on the next page. 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.

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
32.025000	37.25	40.00	2.75	1000.0	120.000	166.0	V	313.0	26.3
58.050000	26.06	40.00	13.94	1000.0	120.000	225.0	V	190.0	12.9
168.000000	28.63	43.50	14.87	1000.0	120.000	152.0	H	283.0	17.8
358.300000	21.89	46.00	24.11	1000.0	120.000	100.0	H	59.0	23.2
648.000000	30.32	46.00	15.68	1000.0	120.000	129.0	H	323.0	30.1
936.000000 *	31.01	46.00	14.99	1000.0	120.000	150.0	H	135.0	23.0
984.000000	37.21	54.00	16.79	1000.0	120.000	202.0	H	34.0	35.4
Measurement uncertainty:					+/- 4.78 dB				

* Remark: The emission at 936 MHz could not be measured due to an external interferer. Therefore, the determined result from the preliminary measurement in the anechoic chamber is taken as the final result.

Test: Passed

The correction factor was calculated as follows:

Corr. (dB) = cable attenuation (dB) + 6 dB attenuator (dB) + antenna factor (dB)

Therefore the reading can be calculated as follows:

Reading (dB μ V/m) = result QuasiPeak (dB μ V/m) - Corr. (dB)

Test equipment (please refer to chapter 6 for details)
2, 14-20

6 Test Equipment used for Tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal Due
1	LISN	NSLK8128	Schwarzbeck	8128155	480058	14.03.2018	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	28.02.2018	02.2020
5	Transient Filter Limiter	CFL 9206A	Teseq GmbH	38268	481982	14.03.2018	03.2020
6	Antenna mast	AS615P	Deisel	615/310	480187	Calibration not necessary	
7	Fully anechoic chamber M20	B83117-E2439-T232	Albatross Projects	103	480303	Calibration not necessary	
8	Turntable	DS420 HE	Deisel	420/620/00	480315	Calibration not necessary	
9	Antenna (Bilog)	CBL6112B	Schaffner EMV GmbH (-Chase)	2688	480328	19.06.2017	06.2020
10	Multiple Control Unit	MCU	Maturo GmbH	MCU/043/97110 7	480832	Calibration not necessary	
11	RF-cable No.36	Sucoflex 106B	Suhner	0587/6B / Kabel 36	480865	Calibration not necessary	
12	HF-Cable	Sucoflex 104	Huber+Suhner	517402	482392	Calibration not necessary	
13	Positioner	TDF 1.5- 10Kg	Maturo	15920215	482034	Calibration not necessary	
14	Attenuator 6 dB	WA2-6	Weinschel	8254	410119	Calibration not necessary	
15	Open area test site M6	Freifeld M6	Phoenix Contact	-	480085	Calibration not necessary	
16	Antenna mast	MA240-0	Inn-Co GmbH	MA240-0/030/6600603	480086	Calibration not necessary	
17	Turntable	DS412	Deisel	412/316	480087	Calibration not necessary	
18	Controller	HD100	Deisel	100/349	480139	Calibration not necessary	
19	Antenna (Bilog)	CBL6111D	Schaffner Elektrotest GmbH / Teseq GmbH	25761	480894	19.10.2017	10.2020
20	EMI Receiver / Spectrum Analyser	ESIB7	Rohde & Schwarz	100304	480521	26.02.2018	02.2020
21	Antenna support	AS620P	Deisel	620/375	480325	Calibration not necessary	
22	EMI Receiver / Spectrum Analyser	ESW44	Rohde & Schwarz		482467	29.03.2018	03.2020

7 Test site Validation

Test equipment	PM. No.	Frequency range	Type of validation	According to	Val. Date	Val Due
Fully anechoic chamber M20	480303	1 -18 GHz	SVSWR	CISPR 16-1-4 Amd. 1	13.07.2018	12.07.2020
Shielded chamber M4	480088	9 kHz – 30 MHz	GND-Plane	ANSI C63.4-2014	06.11.2018	05.11.2020
OATS M6	480085	30 – 1000 MHz	NSA	ANSI C63.4-2014	25.10.2018	24.10.2020

8 Report History

Report Number	Date	Comment
F190354E5	29.07.2019	Initial Test Report

9 List of Annexes

Annex A

Test Setup Photos

03 pages