TEST REPORT
Nr. R23154801

Federal Communication Commission (FCC)

Report Reference No. .....:	R23154801
Date of issue: .....:	28.11.2023
Total number pages: .....:	86
Customer name .....:	Autec S.r.l.
Address .....:	Via Pomaroli, 65 – 36030 Caldogno (VI) – Italy
Test specification:	
Standards .....:	FCC Rules & Regulations, Title 47:2021 Part 15 paragraph(s): 203, 204, 205, 207, 209, 215 and 247
Non-standard test method .....:	N/A
Test Report Form No. .....:	15-247_Hopping_DEKRA
Test Report Form(s) Originator ...:	DEKRA Testing and Certification S.r.l.
Master TRF .....:	2023-11

General disclaimer:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of DEKRA Testing and Certification S.r.l.

(*) Test item description .....:	Transceiver radio module
(*) Trademark .....:	Autec
(*) Manufacturer .....:	Autec S.r.l.
(*) Model / Type reference .....:	FSARTBAU1
(*) FCC ID .....:	OQA-FSARTBAU1
(*) Rating(s) .....:	3,3 Vdc

Report

Tested by (name + signature) .....:	G. Gandini	.....
Approved by (name + signature) .....:	F. Marenda	.....

(*) information provided by the customer

1 Summary

2 Reference standard	
FCC Rules and Regulation Title 47 part 15:2021	--
3 List of attachments	
Attachment 1: Measurement uncertainty, judgement of compliance and quality manual references	
4 Deviation(s) from test specification	
None	
5 Testing location	
DEKRA Testing and Certification S.r.l. Via della Fisica, 20 – 36016 Thiene (VI) – Italy Test site facility's FCC registration number: 182474	

Revision index	***Date***	***Change history***
1.0	28.11.2023	--

Testing and sampling:	
Date of receipt of test item ..... :	03.08.2023
Testing start date ..... :	07.09.2023
Testing end date ..... :	28.11.2023
Sampling procedure ..... :	Sample used for testing chosen by the customer; DEKRA Testing and Certification S.r.l. cannot be considered responsible for the selection of the sample
Internal identification ..... :	Adhesive label with the product number P230748

General remarks:

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The test results presented in this report relate only to the object tested.

“(see appended table)": refers to a table appended to the report.

Throughout this report a comma is used as the decimal separator.

Tests reported in this test report marked by wording: “Test not accredited by ACCREDIA” are not part of the ACCREDIA accreditation of this laboratory.

Possible test case verdicts:	
Test case does not apply to the test object:	N/A (Not Applicable)
Test object meets the requirement:	P (Pass)
Test object does not meet the requirement:	F (Fail)
Test object was not evaluated for the requirement:	N/E (Not Executed)

Definition of symbols used in this test report:

☒ Indicates that the listed condition, standard or equipment is applicable for this report.

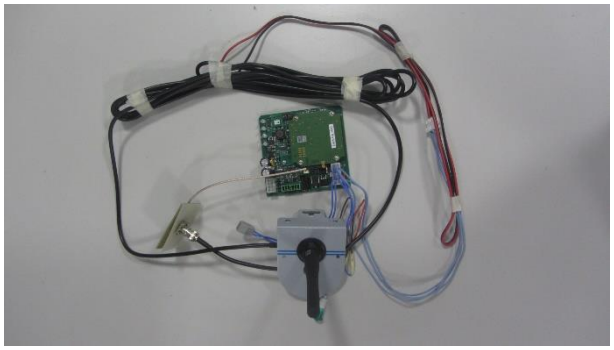
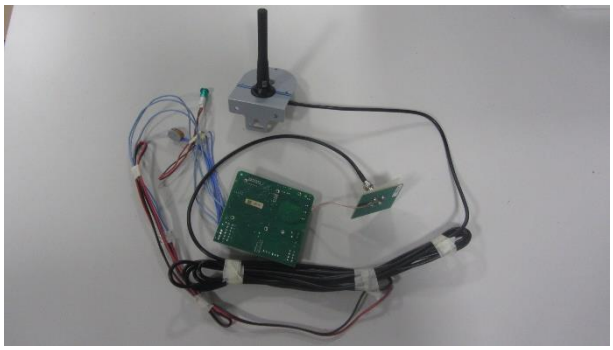
☐ Indicates that the listed condition, standard or equipment is not applicable for this report.

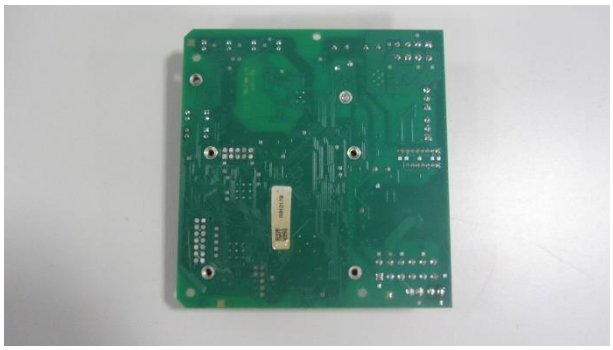
6 General description of tested item and testing condition(s)

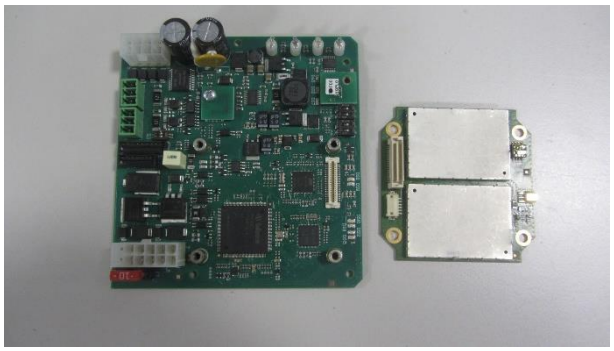
Description ..... :	Transceiver radio module						
Model Number ..... :	FSARTBAU1						
FCC ID ..... :	OQA-FSARTBAU1						
Serial Number ..... :	--						
Brand name ..... :	Autec						
Frequency band ..... :	902 – 928 MHz						
Nominal frequencies ..... :	F_L: 915,075 MHz	F_M: 921,425 MHz	F_H: 927,875 MHz				
Test power supply ..... :		Voltage and Frequency	Reference poles				
			N	L1	L2	L3	PE
	☐	AC:	☐	☐	☐	☐	☐
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC: 3,3 V					☐
Pseudo randomly ordered list of hopping frequencies ..... :	See document fsartbau1_operational_description-rev0						
Type of equipment ..... :	☑ Transmitter unit ☑ Receiver unit						
Type of station ..... :	☑ Portable station ❑ Mobile station						
Test arrangements of EUT ..... :	*Intended operational arrangement(s) of EUT*	*Test arrangement (see basic standard)*					
	❑ Table-top only	Table-top					
	❑ Floor-standing only	Floor-standing					
	❑ Can be floor-standing or table-top	Table-top					
	❑ Rack mounted	In rack or table-top					
	☑ Other, for example wall mounted, ceiling mounted, handheld, body worn	Table-top					
Operating modes ..... :	No.	Operating mode of test item					
	1	EUT in continuous transmission at maximum power					
Declination of responsibility ..... :	Information relating to the description of the sample, components list, and software/hardware version (if reported) are provided by the customer. DEKRA Testing and Certification S.r.l. cannot be considered responsible for this information, for any other document sent by the customer and for any difference between the software version present in the tested sample and that present in the object intended for final sale. In some cases, the software in the tested sample is in a version dedicated exclusively to the test, and therefore does not represent the software installed in the final version of the product.						

6.1 Photos of the test item

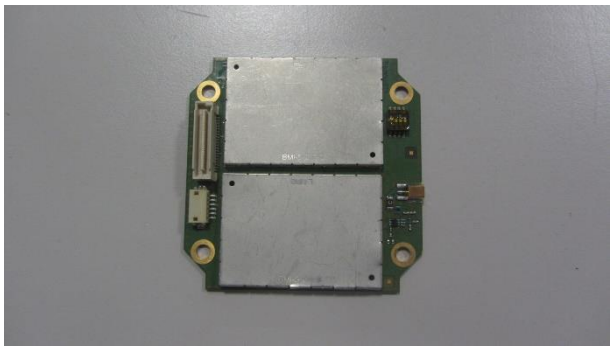
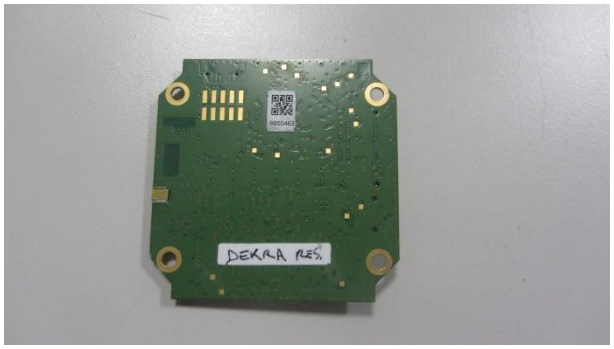
EUT on expansion board of a receiver unit

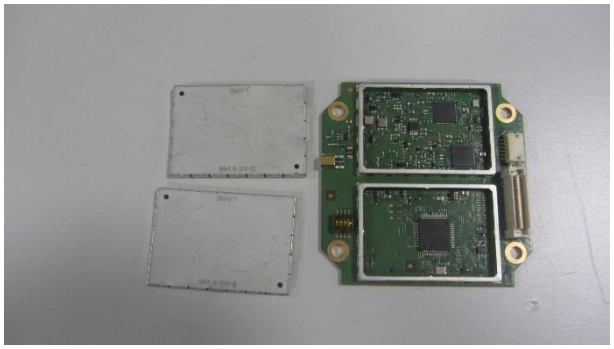



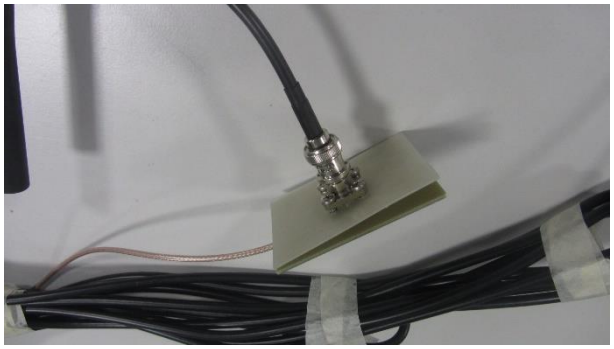


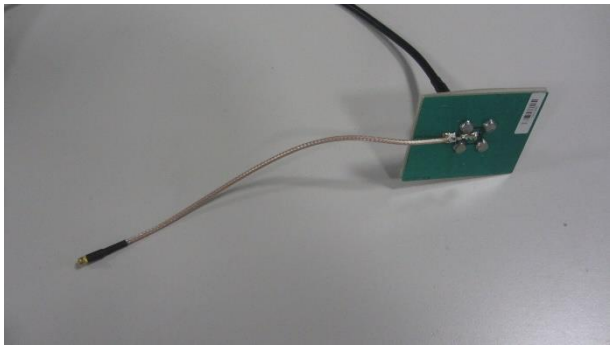



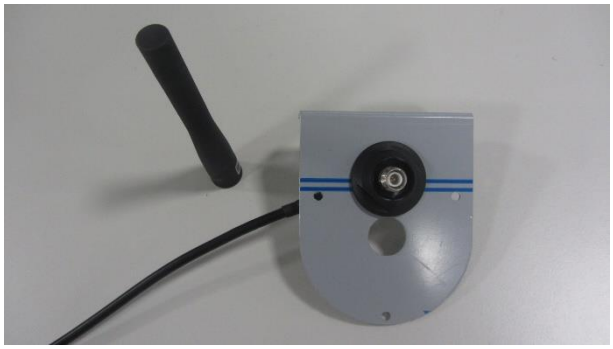




DEKRA RES



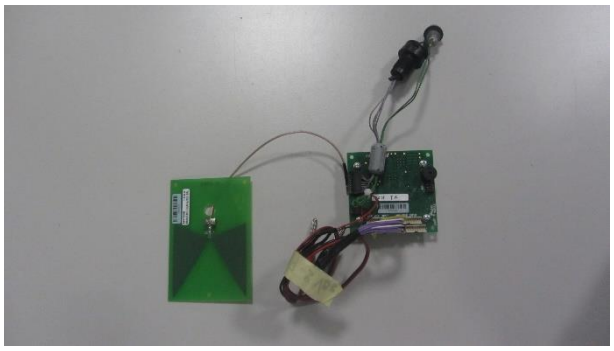
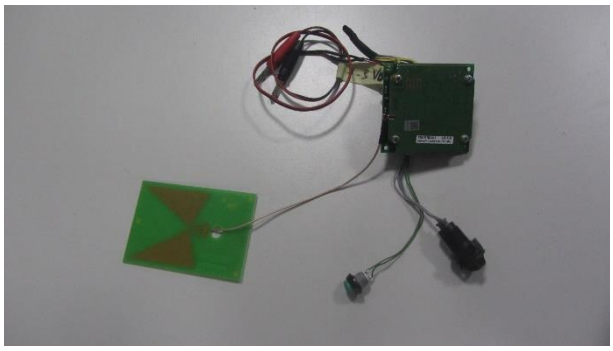
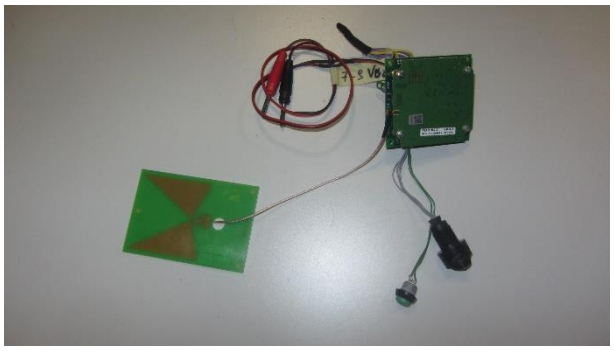



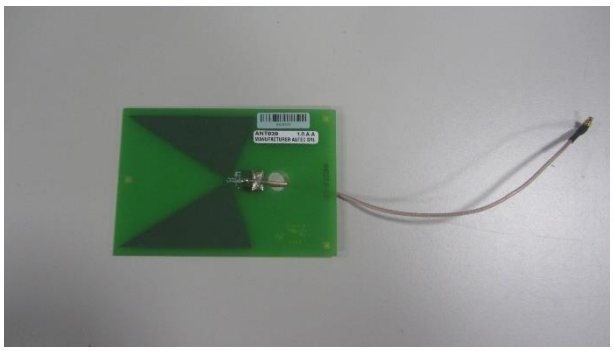


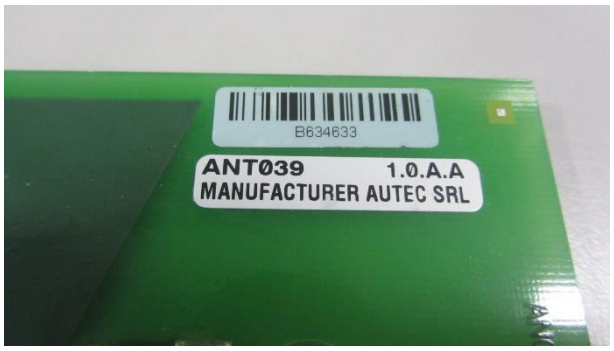



ANT042

EUT on expansion board of a transmitter unit


B634633
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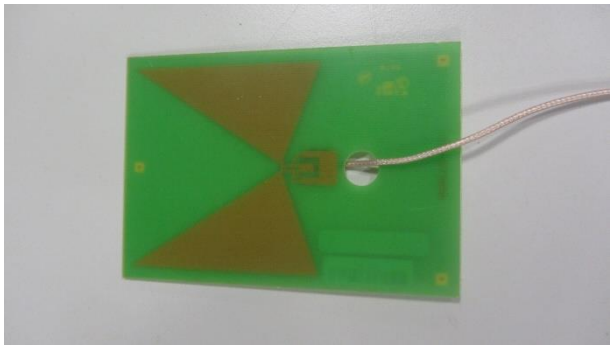
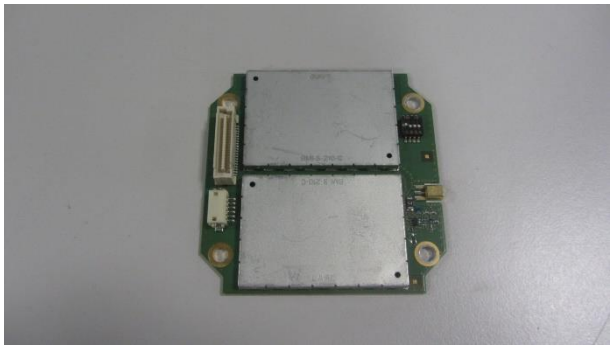
MANUFACTURER AUTEC SRL


ANT039 1.0.A.A
MANUFACTURER AUTEC SRL

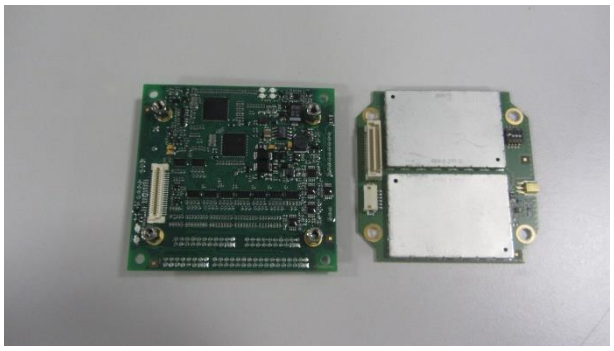
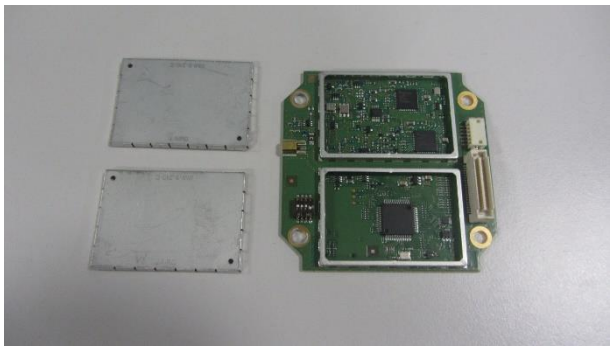



Test TX


FSARTBAU1 2.0.A.A
MANUFACTURER AUTEC SRL




Test TX




FSARTBAU1 2.0.A.A
MANUFACTURER AUTEC SRL

7 Verdict summary section

FCC Rules & Regulations, Title 47:2021 Part 15 paragraph(s): 203, 204, 205, 207, 209, 215 and 247			
Clause	**Requirement – Test case**	**Basic standard**	**Verdict**
Part 15.247 (a) (1)	Pseudo randomly ordered list of hopping frequencies	--	**P**
Part 15.203	Antenna requirements	ANSI C63.10	**P**
Part 15.207	Conducted emissions	ANSI C63.10	**P**
Part 15.209	Radiated emissions and spurious emissions	ANSI C63.10	**P**
Part 15.247	20 dB Bandwidth	ANSI C63.10	**P**
Part 15.247	Channel Separation	ANSI C63.10	**P**
Part 15.247	Number of Hopping Channel	ANSI C63.10	**P**
Part 15.247	Time of occupancy	ANSI C63.10	**P**
Part 15.247	Band edge	ANSI C63.10	**P**
Part 15.209 and 15.247	Peak Output Power	ANSI C63.10	**P**

Normative references	
Reference no.	***Description***
FCC Rules and Regulation Title 47 part 15:2021	--
KDB 558074 D01 15.247 Meas Guidance v05r02	Guidance for compliance measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices operating under section 15.247 of the FCC rules
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 – 40 GHz
ANSI C63.10:2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

8 Test conditions

8.1 General

<table>
<tr><td>Environmental reference conditions.....:</td><td>The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment.
The climatic conditions during the tests were within the following limits:
<table>
<tr><th>Temperature</th><th>Humidity</th><th>Atmospheric pressure</th></tr>
<tr><td>15 °C – 35 °C</td><td>30 % - 60 %</td><td>800 hPa – 1060 hPa</td></tr>
<tr><td colspan="3">If explicitly required in the basic standard or applied product standard the climatic values are recorded and documented separately in this test report.</td></tr>
</table></td></tr>
<tr><td>Measurement uncertainties .....:</td><td>Attachment 1</td></tr>
</table>

9 Test results

9.1 Antenna requirements

Tested by .....:	G. Gandini	
Test date .....:	07.09.2023	
Reference standards.....:	FCC Rules and Regulation; Titles 47 Part. 15.203 and 15.204	
Test specification .....:	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§ 15.211, 15.213, 15.217, 15.219, 15.221, or § 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded	
Antenna type .....:	☐	Integral antenna
	☒	External antenna
Antenna gain .....:	-0,36 dBi for ANT039 1,23 dBi for ANT042	
External R.F. power amplifier.....:	Not Present	

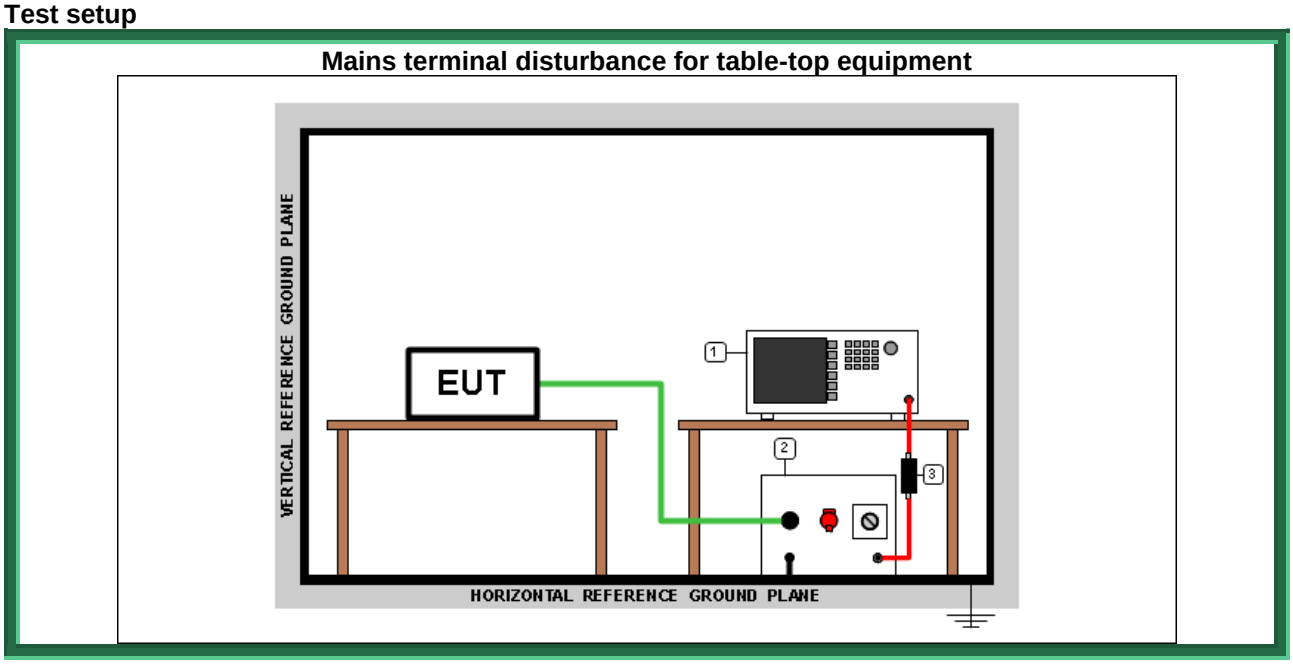
9.2 Conducted emission

Tested by .....:	G. Gandini	
Test date .....:	28.11.2023	
Test location (stand).....:	Shielded chamber (CMC A001)	
Reference standards.....:	FCC Rules and Regulation; Titles 47 Part. 15.207 ANSI C63.10 cl. 6.2	
Test set-up description.....:	☒	Table top equipment set-up (80 cm above the reference ground plane)
	☐	Floor standing equipment set-up (insulating material up to 12 mm thick)
	☐	False floor installation equipment set-up (insulating material up to 34 cm above the reference ground plane)
Supplementary Test set-up description.....:	--	
Test method applied.....:	☒	Artificial mains network, 50 µH/50 Ω LISN
	☐	Other:

Acceptance limits

Frequency range (MHz)	*dB(µV) Quasi-peak*	*dB(µV) Average*
0,15 to 0,50	66 to 56	56 to 46
0,5 to 5	56	46
5 to 30	60	50

Test setup



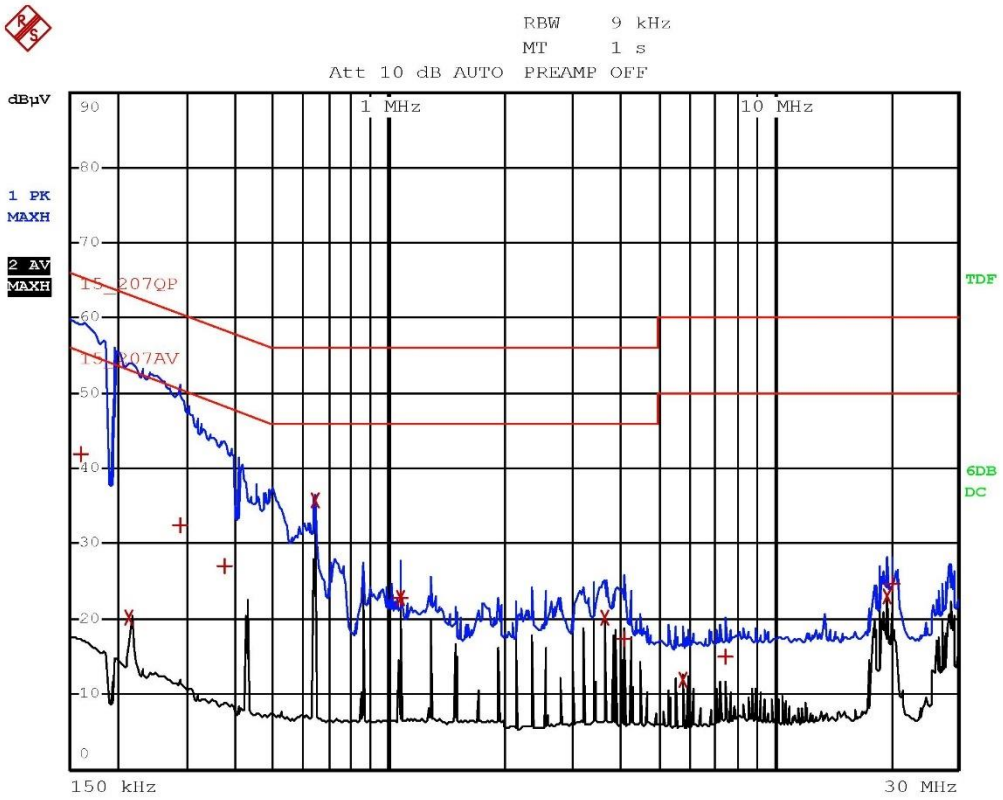
Test setup PE001_01							
Nr.	*Id. Number*	*Manufacturer*	*Model*	*Serial number*	*Description*	*Last calibration date*	*Calibration expiration*
3	CMC S010	Rohde & Schwarz	ESH3-Z2	--	Pulse limiter	January 2023	January 2024
2	CMC S200	Schwarzbeck	NSLK 8128	8128-273	V-LISN	January 2023	January 2024
1	CMC S206	Rohde & Schwarz	ESCI 7	100781	EMC Receiver 9KHz-7GHz	December 2022	December 2023

Result

Line	*Frequency Range (MHz)*	*Graphs*	*Remarks*	*Result*
+3,3 Vdc	0,15 – 30	G23154865	EUT on expansion board of a receiver unit	P
-3,3 Vdc	0,15 – 30	G23154866	EUT on expansion board of a receiver unit	P
+3,3 Vdc	0,15 – 30	G23154867	EUT on expansion board of a transmitter unit	P
-3,3 Vdc	0,15 – 30	G23154868	EUT on expansion board of a transmitter unit	P

Graphs Legend
PK: Peak; QP [1s] (quasi-peak at 1 second) values are marked with a +
AV: Average; AV [1s] (average at 1 second) values are marked with a X

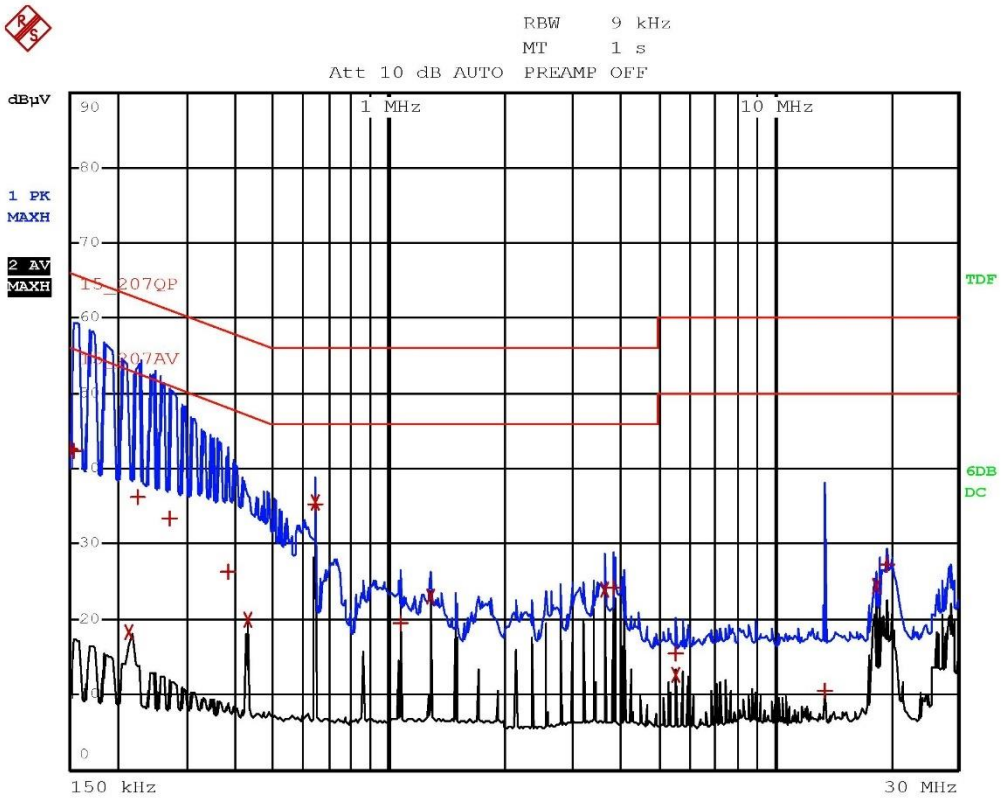
Graphs



Gandini 23154865-Line (+)-Tx Rx

EDIT PEAK LIST (Final Measurement Results)			
Trace1:	15_207QP		
Trace2:	15_207AV		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1 Quasi Peak	162 kHz	41.97	-23.38
2 Average	214 kHz	20.16	-32.88
1 Quasi Peak	286 kHz	32.36	-28.27
1 Quasi Peak	374 kHz	27.03	-31.37
2 Average	642 kHz	35.90	-10.09
1 Quasi Peak	1.07 MHz	22.77	-33.22
2 Average	1.07 MHz	22.73	-23.26
2 Average	3.642 MHz	20.09	-25.90
1 Quasi Peak	4.074 MHz	17.27	-38.72
2 Average	5.786 MHz	12.04	-37.95
1 Quasi Peak	7.498 MHz	15.06	-44.93
2 Average	19.71 MHz	23.05	-26.94
1 Quasi Peak	20.258 MHz	24.77	-35.22

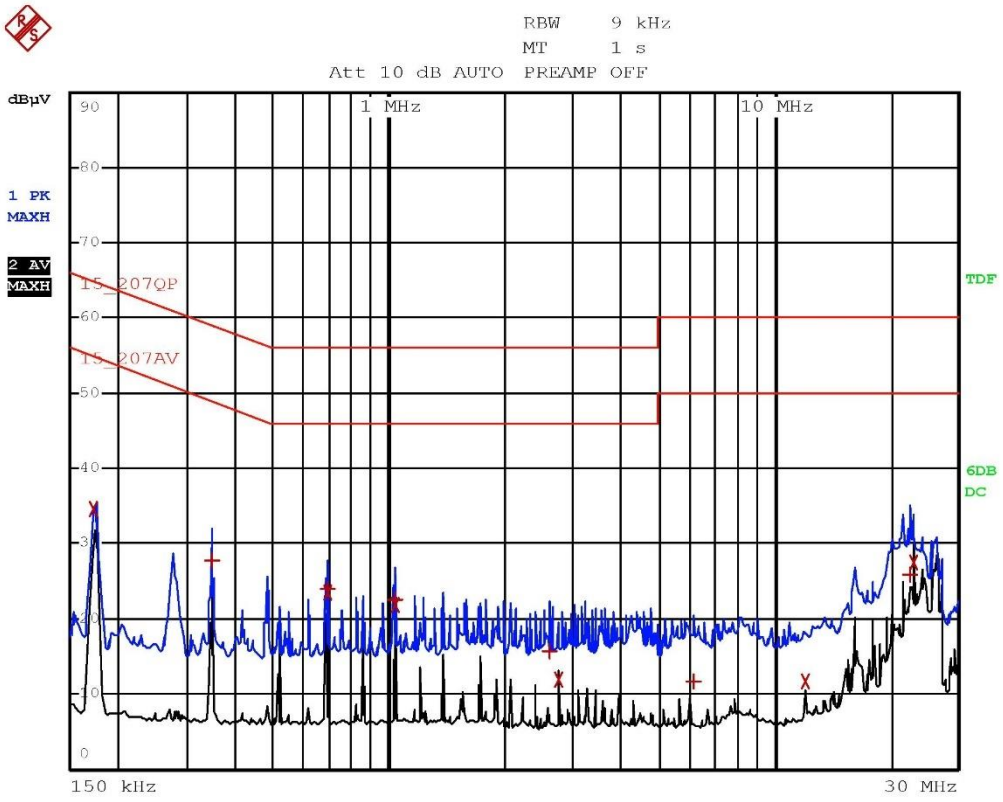
Gandini 23154865-Line (+)-Tx Rx



Gandini 23154866-Line (-)-Tx Rx

EDIT PEAK LIST (Final Measurement Results)			
Trace1:	15_207QP		
Trace2:	15_207AV		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1 Quasi Peak	150 kHz	42.68	-23.31
1 Quasi Peak	154 kHz	42.47	-23.30
2 Average	214 kHz	18.34	-34.70
1 Quasi Peak	226 kHz	36.31	-26.27
1 Quasi Peak	270 kHz	33.52	-27.59
1 Quasi Peak	382 kHz	26.44	-31.78
2 Average	430 kHz	19.94	-27.30
2 Average	642 kHz	35.58	-10.41
1 Quasi Peak	642 kHz	35.37	-20.62
1 Quasi Peak	1.074 MHz	19.55	-36.44
2 Average	1.286 MHz	23.07	-22.92
2 Average	3.642 MHz	23.87	-22.12
1 Quasi Peak	3.854 MHz	24.30	-31.69
1 Quasi Peak	5.57 MHz	15.52	-44.47
2 Average	5.57 MHz	12.59	-37.40
1 Quasi Peak	13.566 MHz	10.48	-49.51
2 Average	18.458 MHz	24.39	-25.60
1 Quasi Peak	19.71 MHz	27.18	-32.81

Gandini 23154866-Line (-)-Tx Rx



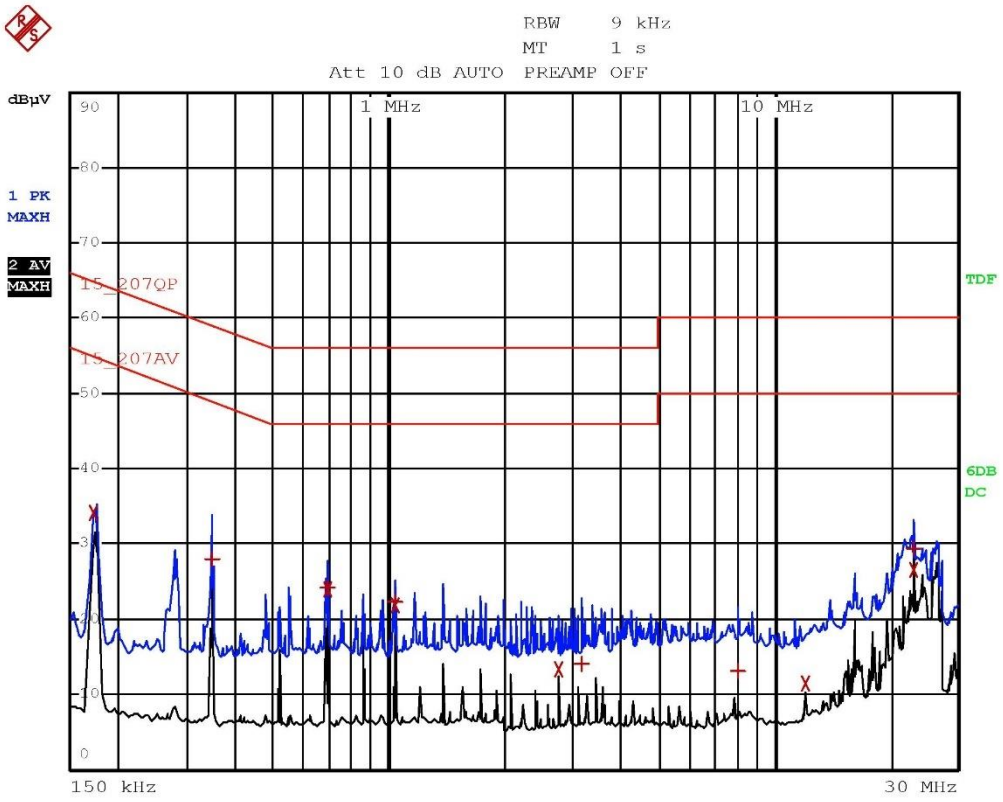
Segalla 23154867-Line (+) -Tx Rx

EDIT PEAK LIST (Final Measurement Results)

Trace1:	15_207QP
Trace2:	15_207AV
Trace3:	---

TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
2 Average	174 kHz	34.57	-20.19
1 Quasi Peak	346 kHz	27.83	-31.21
1 Quasi Peak	690 kHz	24.07	-31.92
2 Average	690 kHz	23.58	-22.41
1 Quasi Peak	1.034 MHz	22.48	-33.51
2 Average	1.034 MHz	21.85	-24.15
1 Quasi Peak	2.614 MHz	15.82	-40.17
2 Average	2.754 MHz	12.03	-33.96
1 Quasi Peak	6.194 MHz	11.76	-48.23
2 Average	12.002 MHz	11.58	-38.41
1 Quasi Peak	22.454 MHz	25.76	-34.23
2 Average	23.13 MHz	27.56	-22.43

Segalla 23154867-Line (+) -Tx Rx



Segalla 23154868-Line (-) -Tx Rx

EDIT PEAK LIST (Final Measurement Results)			
Trace1:	15_207QP		
Trace2:	15_207AV		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
2 Average	174 kHz	34.13	-20.63
1 Quasi Peak	346 kHz	28.05	-31.00
1 Quasi Peak	690 kHz	24.26	-31.73
2 Average	690 kHz	24.03	-21.96
1 Quasi Peak	1.034 MHz	22.35	-33.64
2 Average	1.034 MHz	21.94	-24.05
2 Average	2.758 MHz	13.36	-32.63
1 Quasi Peak	3.165 MHz	14.01	-41.98
1 Quasi Peak	8.049 MHz	13.00	-46.99
2 Average	12.002 MHz	11.34	-38.66
1 Quasi Peak	23.13 MHz	29.36	-30.64
2 Average	23.13 MHz	26.60	-23.39

Segalla 23154868-Line (-) -Tx Rx

9.3 Emissions in restricted frequency bands and in unrestricted frequency bands

Tested by .....:	G. Gandini	
Test date .....:	07.11.2023	
Test location (stand) .....:	Semi-anechoic chamber (CMC A070)	
Reference standards.....:	FCC Rules and Regulation; Titles 47 Part. 15.209 ANSI C63.10 cl. 6.3, 6.4, 6.5 and 6.6	
Test set-up description.....:	☒	Table top equipment set-up (80 cm above the reference ground plane)
	☐	Floor standing equipment set-up (insulating material up to 12 mm thick)
	☐	False floor installation equipment set-up (insulating material up to 34 cm above the reference ground plane)
Supplementary test set-up description.....:	--	
Test method applied .....:	OATS or SAC with measurement distance [m]: 10 m for frequencies below 1 GHz 3 m for frequencies above 1 GHz	
Supplementary information.....:	--	

Acceptance limits

Acceptance limits for emissions in restricted frequency bands (f < 1000 MHz)		
Frequency range (MHz)	*Test distance (m)*	*Limits [dB(µV/m)]*
0,009 to 0,490	300	20log(2400/F(kHz))
0,490 to 1,705	30	20log(24000/F(kHz))
1,705 to 30	30	20log(30)
30 to 88	3	20log(100)**
88 to 216	3	20log(150)**
216 to 960	3	20log(200)**
Above 960	3	20log(500)

**: except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54 – 72 MHz, 76 – 88 MHz, 174 – 216 MHz or 470 – 806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.
Perimeter protection systems may operate in the 54 – 72 MHz and 76 – 88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.
Remarks: the emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9 – 90 kHz and 110 – 490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector. The results have been extrapolated to the specified distance using an extrapolation factor

Acceptance limits for emissions in restricted frequency bands (f ≥ 1000 MHz)			
Frequency (MHz)	*Test distance (m)*	*AV limits [dB(µV/m)]*	*Peak limits [dB(µV/m)]*
> 1000	3	54	74