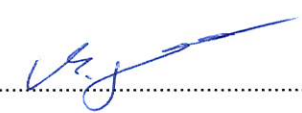
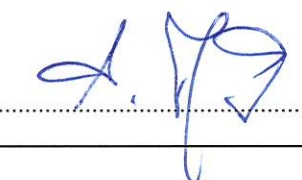


EMC TEST REPORT	
Title 47 CFR Part 15B, ISED ICES-003 Issue 7	
Report Reference No	G0M-2112-1241-EF0115B-V01
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	    A2LA - Registration number: 1983.01 (ISED) ISED wireless device testing laboratory: CN 3470A DAKKS - Registration number : D-PL-12092-01-04 (FCC) FCC Filed Test Laboratory, Reg.-No.: 96970
Applicant	fischertechnik GmbH
Address	Klaus-Fischer-Str. 1 72178 Waldachtal Germany
Test Specification Standard(s)	Title 47 CFR Part 15 Subpart B ISED ICES-003 Issue 7 ANSI C63.4:2014+A1:2017
Non-Standard Test Method	None
Equipment under Test (EUT):	
Product Description	Roboter Chassis Early Coding for Toy and Education market
Model(s)	Roboter Chassis 183268
Additional Model(s)	None
Brand Name(s)	fischertechnik
Hardware Version(s)	PL-221c
Software Version(s)	0.20
FCC-ID	2AFD4-183268
IC	None
Test Result	PASSED

Possible test case verdicts:		
required by standard but not tested	N/T	
not required by standard	N/R	
required by standard but not appl. to test object	N/A	
test object does meet the requirement	P(PASS)	
test object does not meet the requirement	F(FAIL)	
Testing:		
Date of receipt of test item	2022-02-23	
Report:		
Compiled by	Manuel Engel	
Tested by (+ signature) (Responsible for Test)	Manuel Engel	
Approved by (+ signature) (Test Lab Engineer)	Andreas Pflug	
Date of Issue	2022-10-11	
Total number of pages	32	
General Remarks:		
The test results presented in this report relate only to the object tested. The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.		
Additional Comments:		

ABBREVIATIONS AND ACRONYMS

Acronyms	
Acronym	Description
EUT	Equipment Under Test
FCC	Federal Communications Commission
ISED	Innovation, Science and Economic Development Canada
T _{NOM}	Nominal operating temperature
V _{NOM}	Nominal supply voltage

VERSION HISTORY

Version History			
Version	Issue Date	Remarks	Revised By
01	2022-10-11	Initial Release	-

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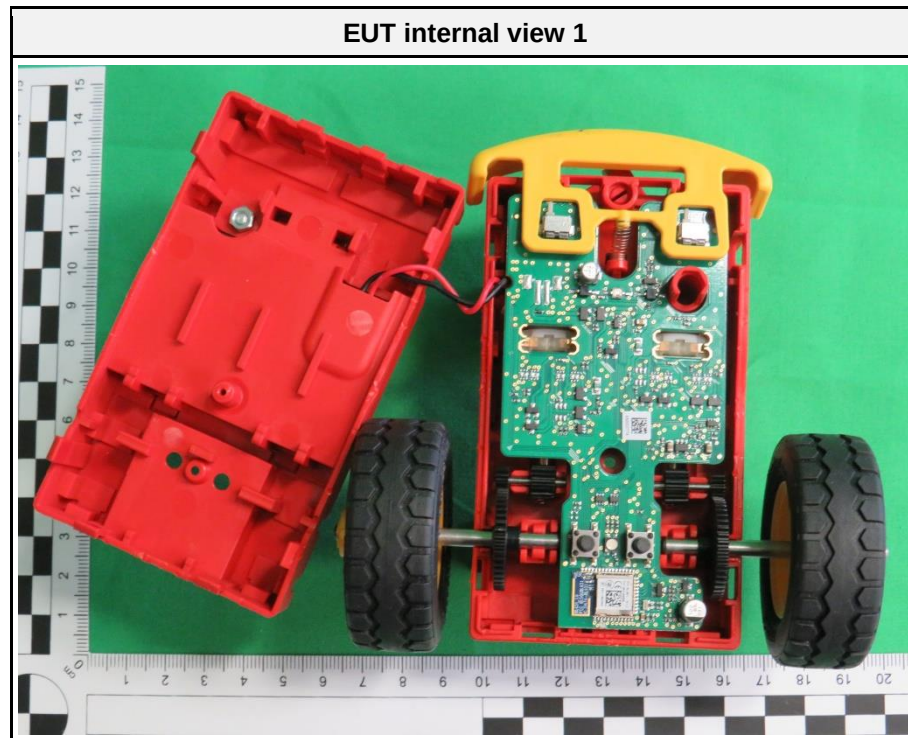
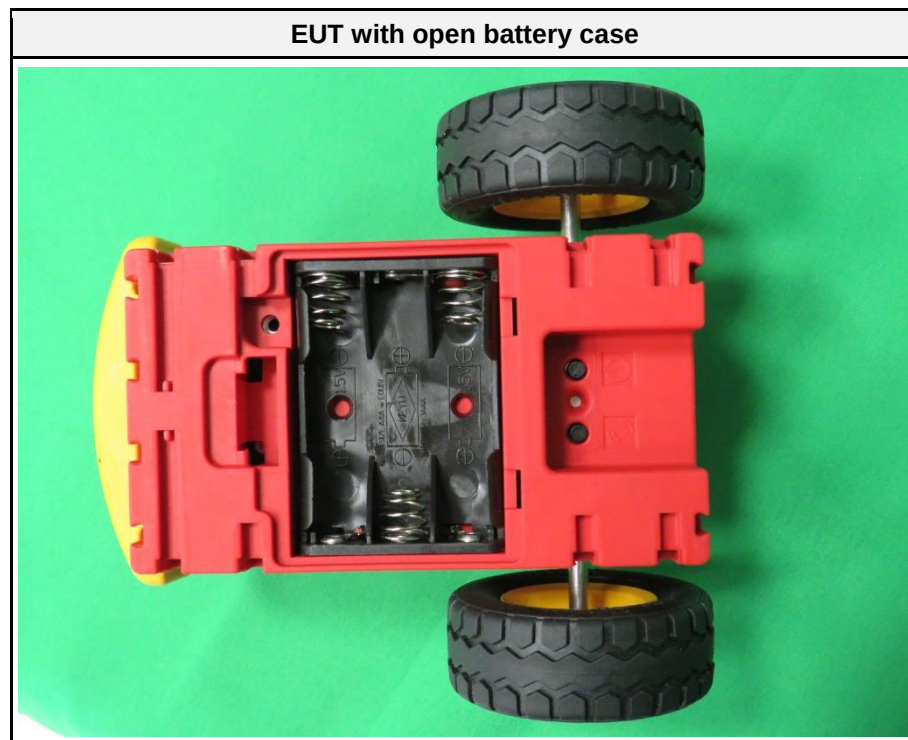
1 Equipment (Test Item) Under Test

Description	Roboter Chassis Early Coding for Toy and Education market	
Intended Use	Programming and remote control of a robot chassis assembled with 2 motors via Bluetooth Low Energy	
Model	Roboter Chassis 183268	
Additional Model(s)	None	
Brand Name(s)	fischertechnik	
Serial Number(s)	Mac: DE:7C:05:7F:77:1F PCB No: AA00037774	
Sample ID	38603	
Hardware Version(s)	PL-221c	
Software Version(s)	0.20	
EUT Dimensions [cm]	12 x 12 x 5	
FCC-ID	2AFD4-183268	
IC	None	
Class	Class B	
Equipment type	Table top	
Highest internal frequency [MHz]	2483.5	
Protective Earth	None	
Radio Module	Type	Bluetooth Low Energy
	Model	BL651 Series / Chip: nRF52810
	Manufacturer	Laird / Chip: Nordic Semiconductor
	FCC-ID	SQGBL651
	IC	3147A-BL651
Supply Voltage	V _{NOM}	4.5 V DC via 3 x 1.5 AAA batteries
AC/DC-Adaptor	None	
Manufacturer	Knobloch Elektronik- Produktions- und Vertriebs GmbH Selitstraße 10 55234 Erbes-Büdesheim GERMANY	

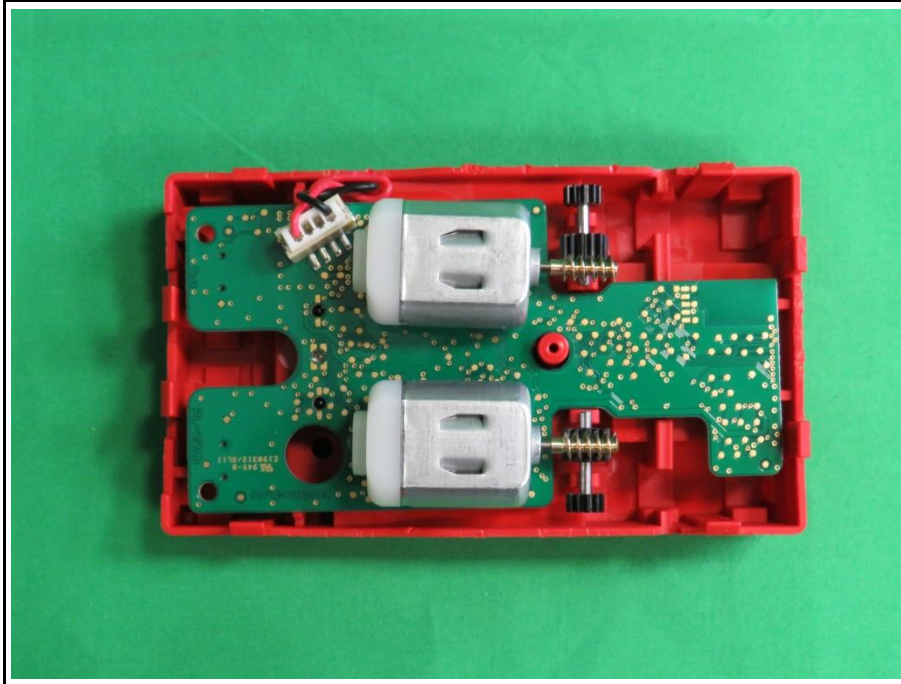
1.1 Equipment Ports

Name	Type	Attributes	Comment
-	-	Count: - Cable length [m]: 0 Direction: IO Service only: No Shielded: Yes	-
Description:			
AC	AC mains power input/output port		
DC	DC power input/output port		
BAT	DC power input port connected to external battery		
IO	Input/Output port		
TP	Telecommunication port		
NE	Non-electrical port		

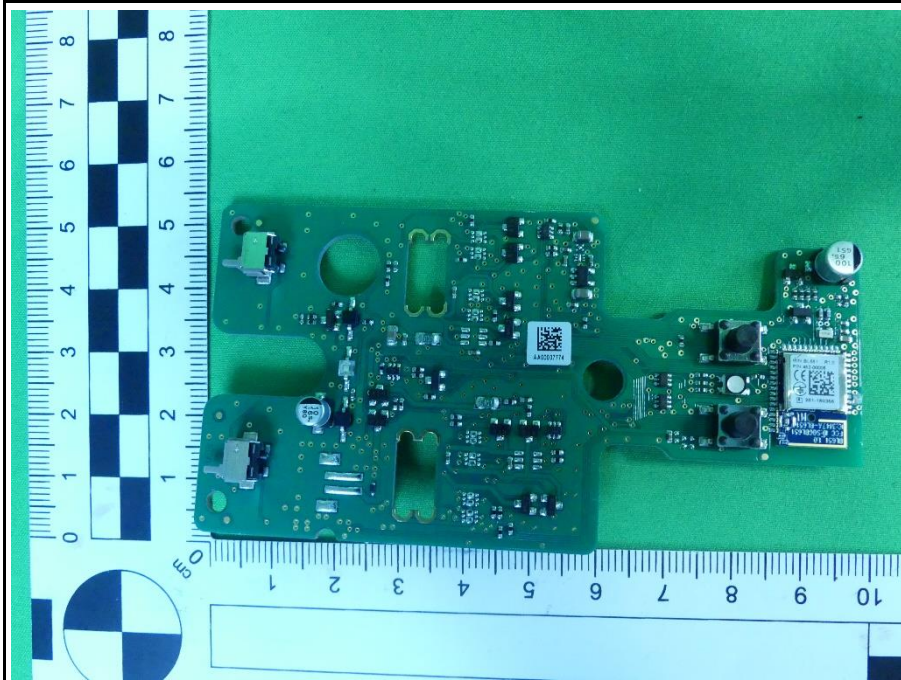
1.2 Equipment Photos - Internal



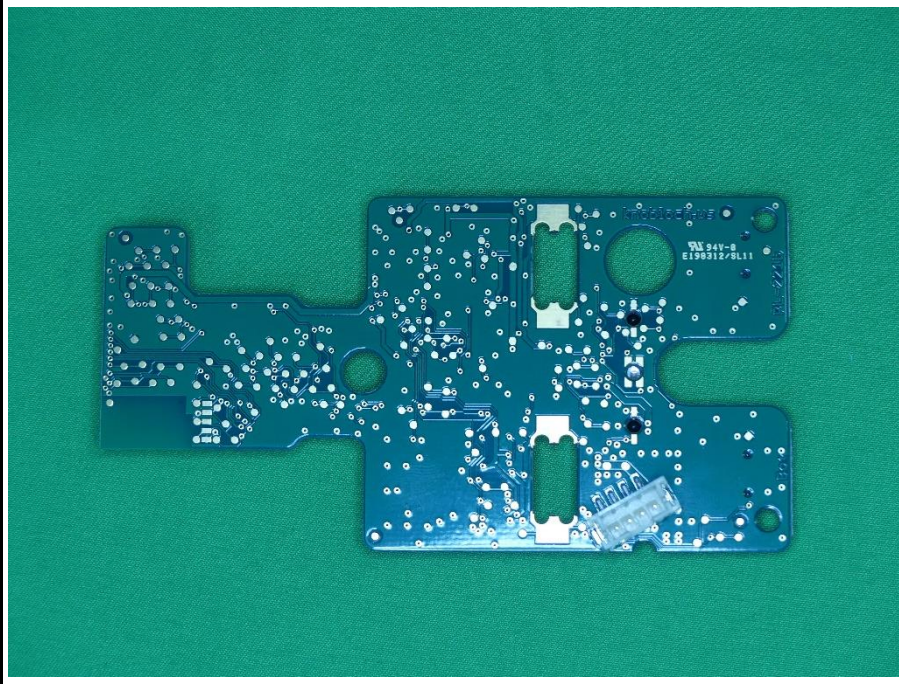
EUT internal view 2



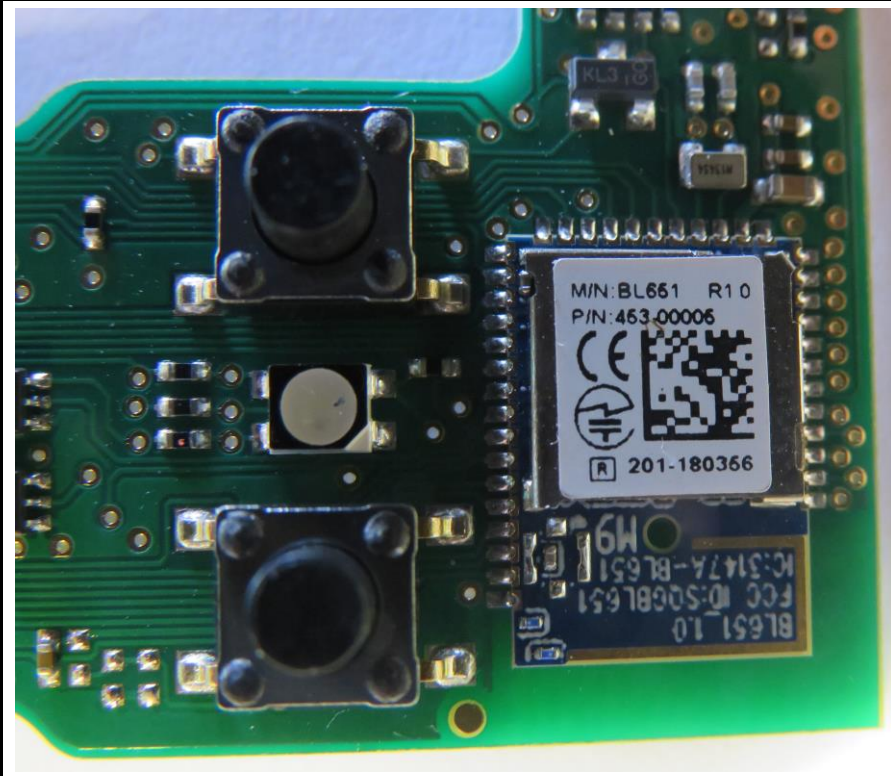
PCB top view



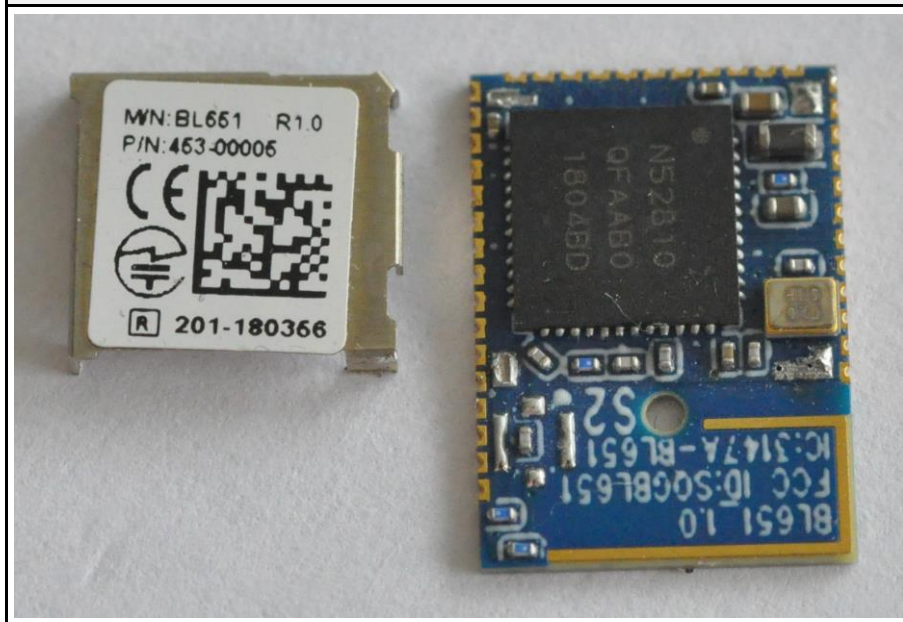
PCB bottom view



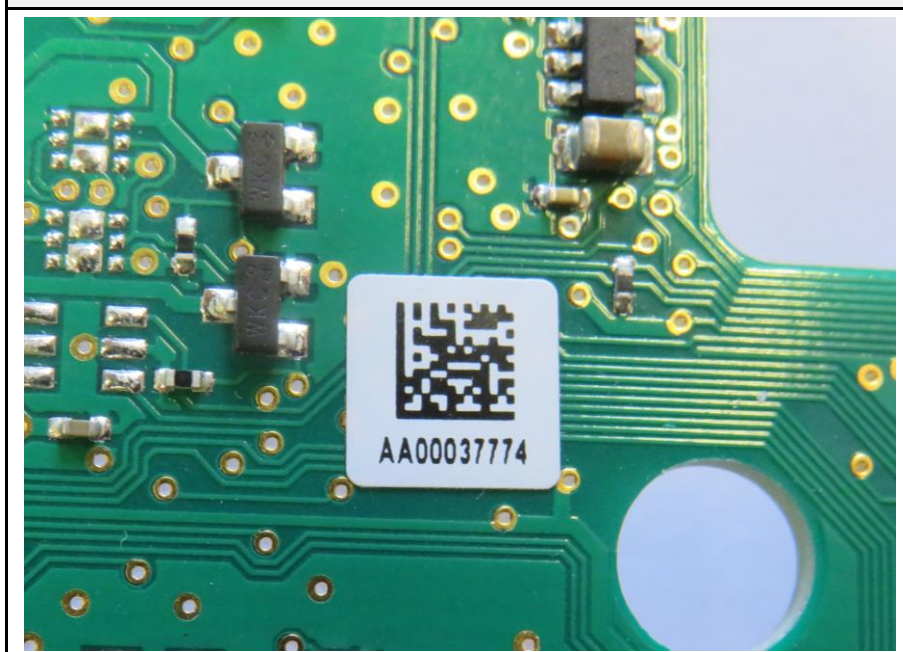
Bluetooth module



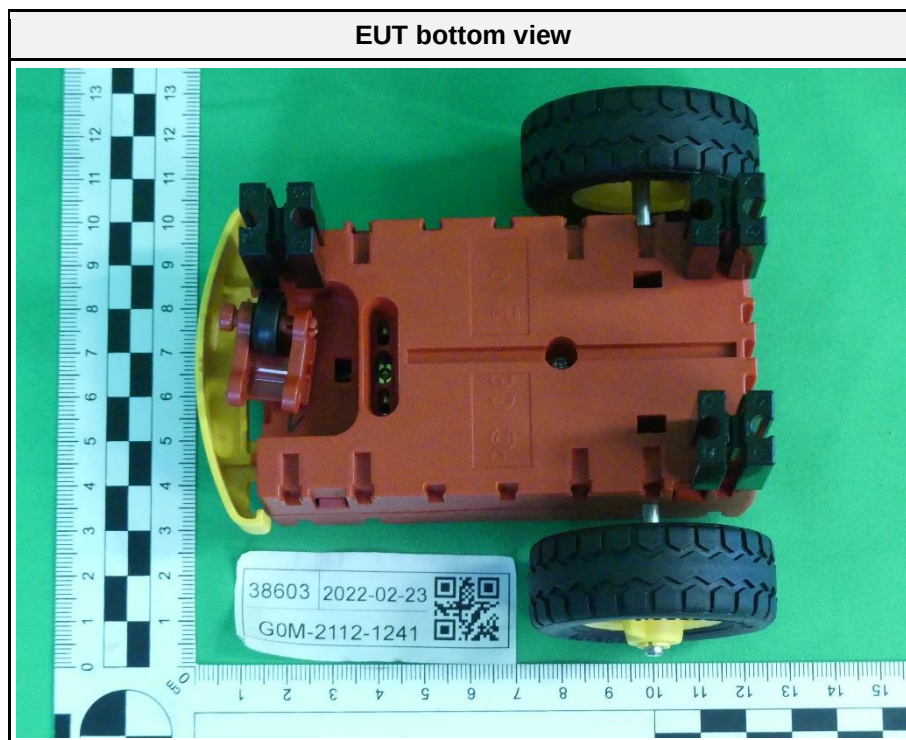
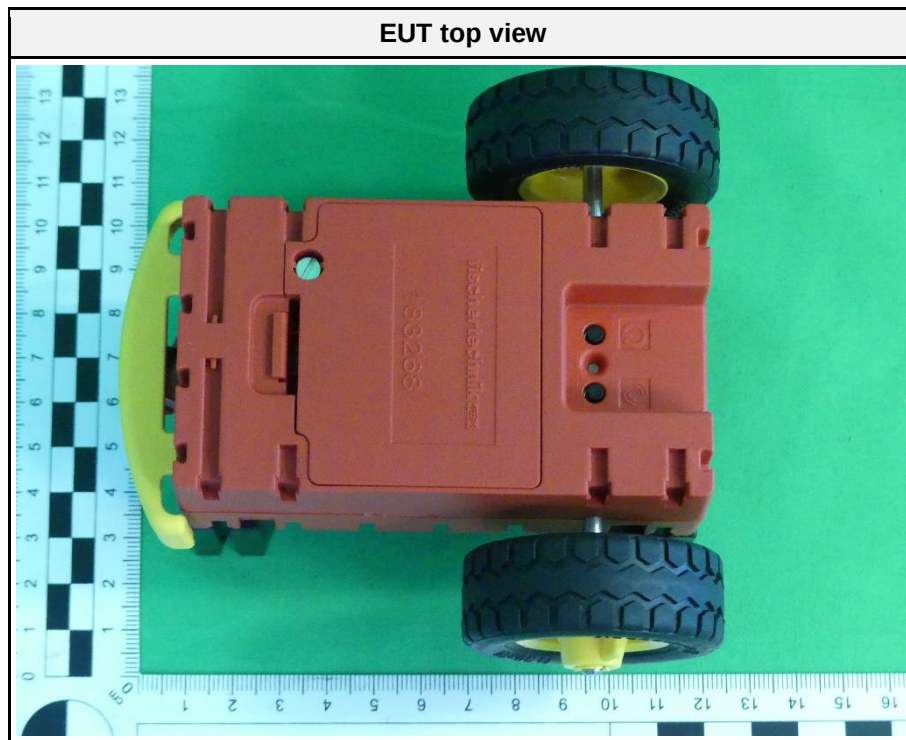
Bluetooth module open



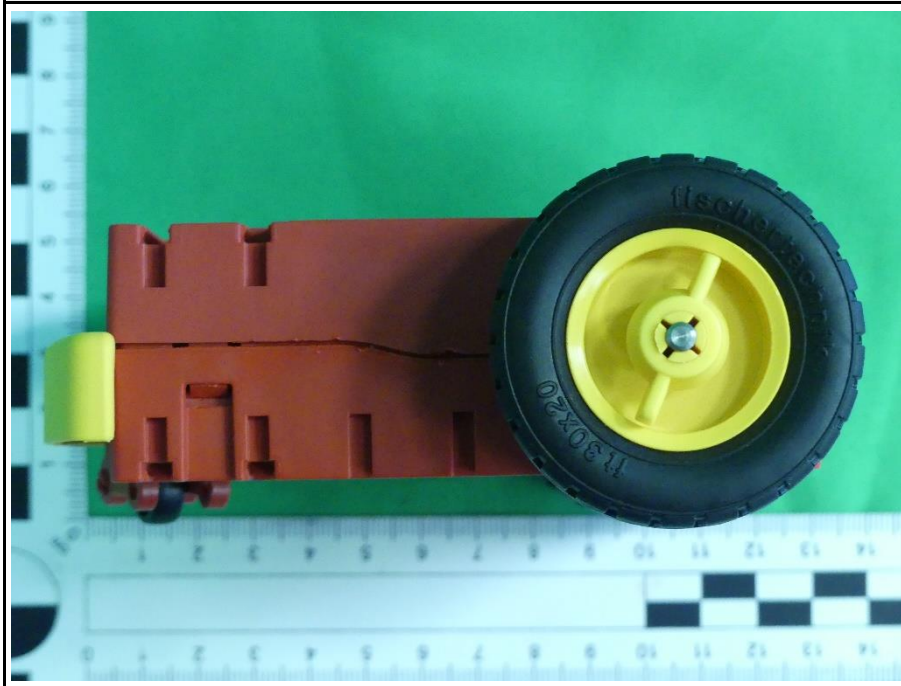
EUT PCB number



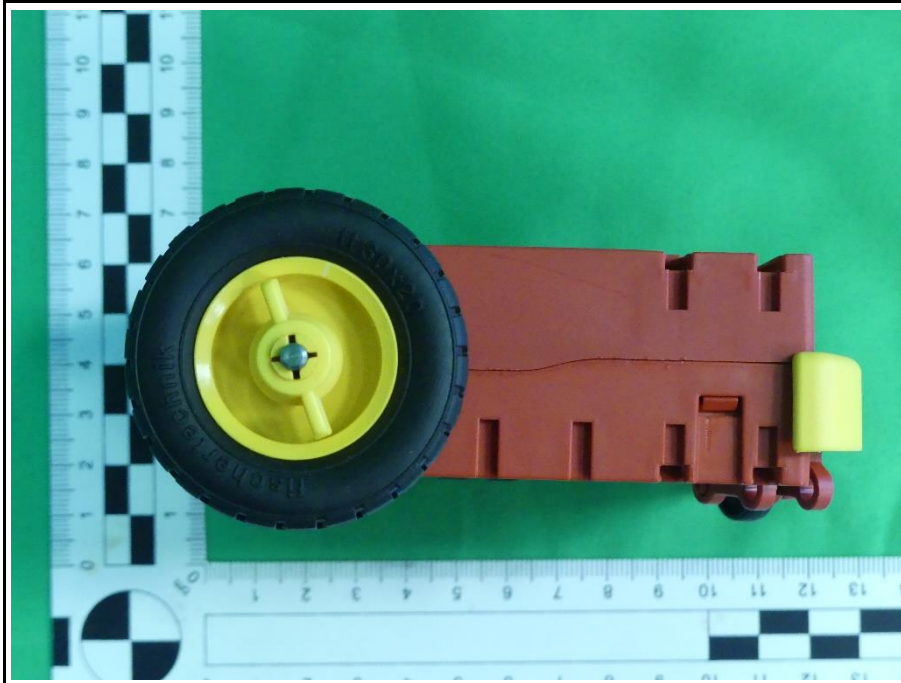
1.3 Equipment Photos - External



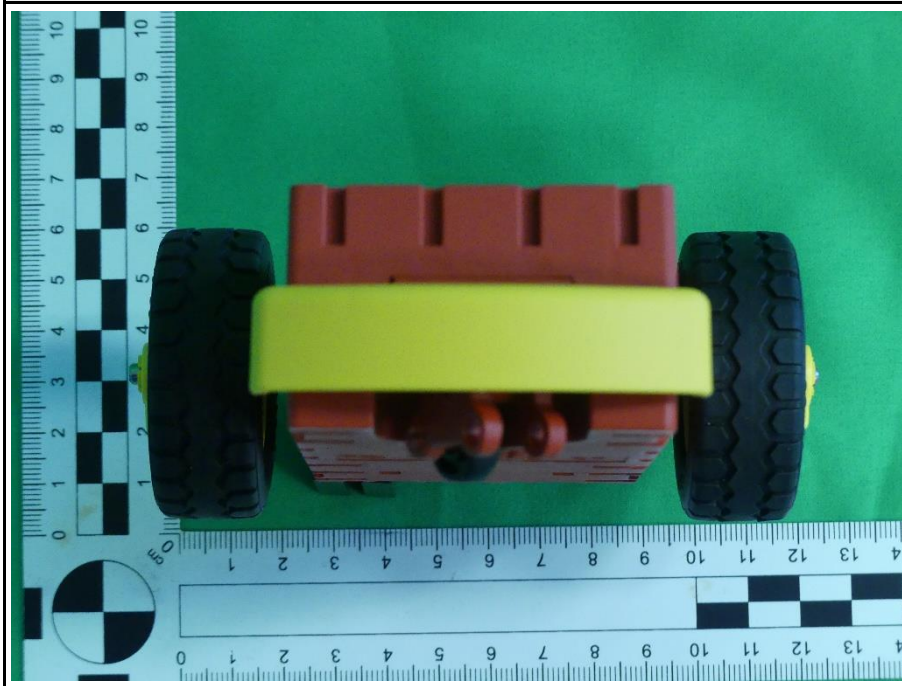
EUT left view



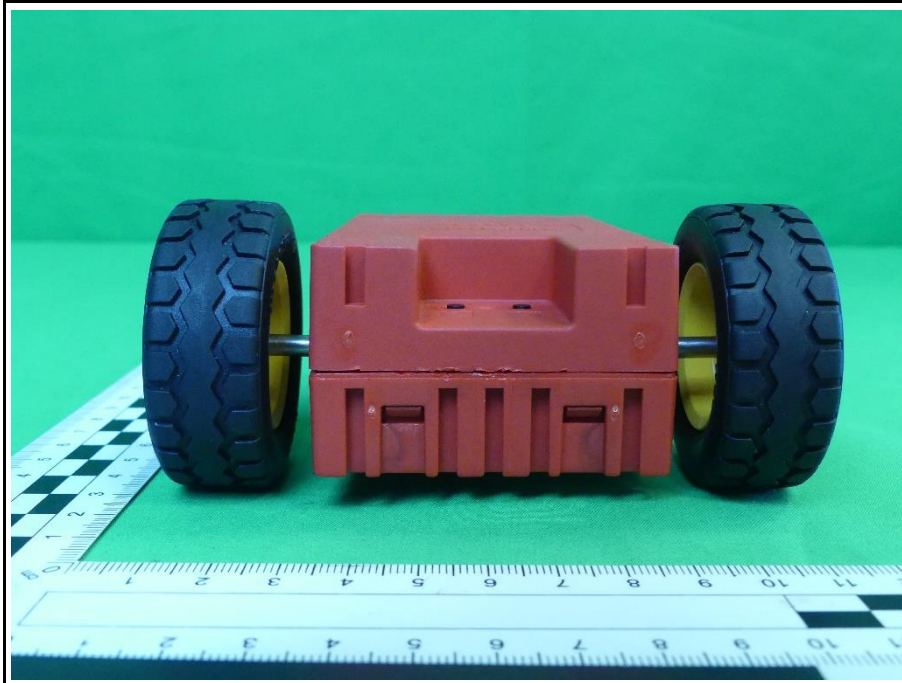
EUT right view



EUT front view



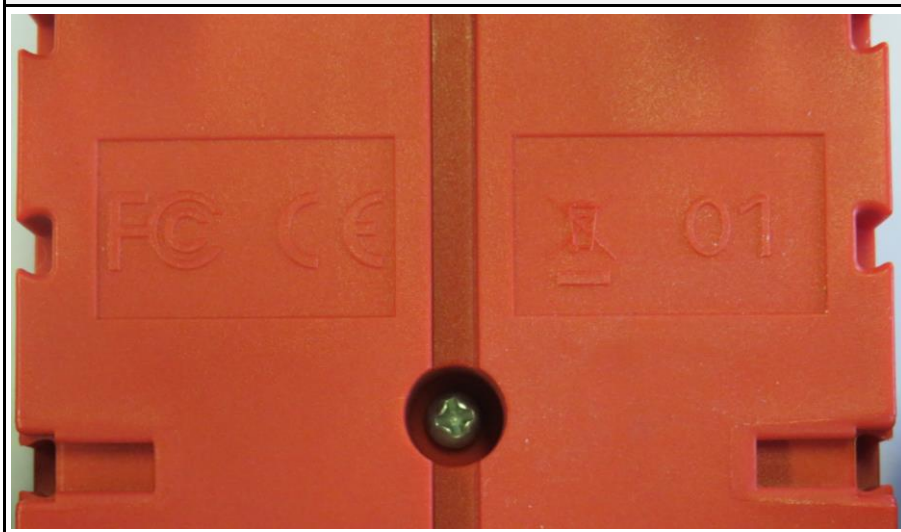
EUT back view



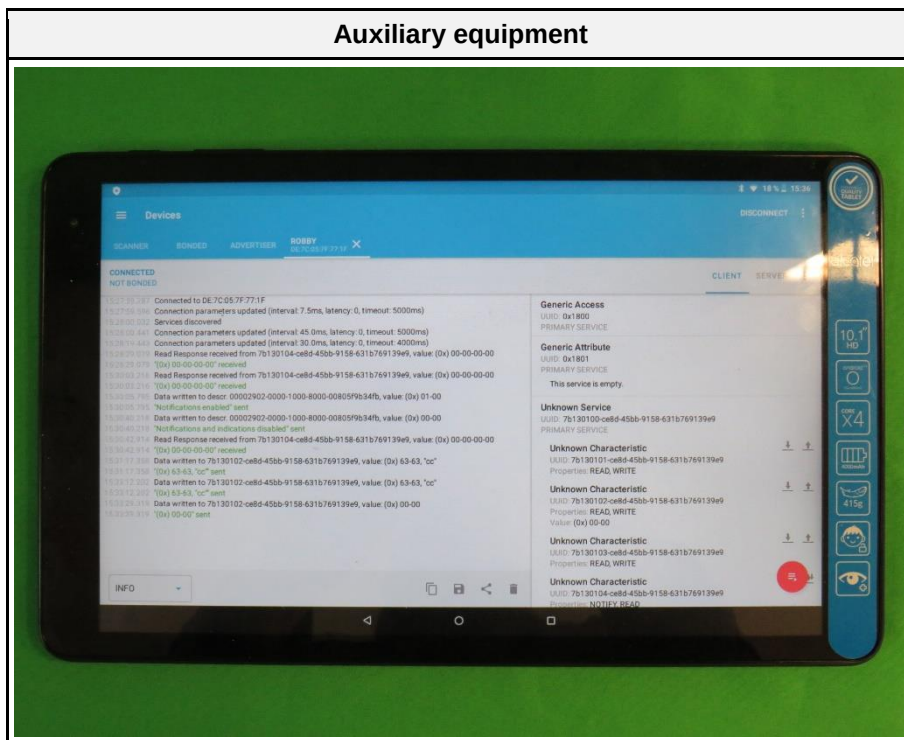
EUT Label 1



EUT EUT Label 2

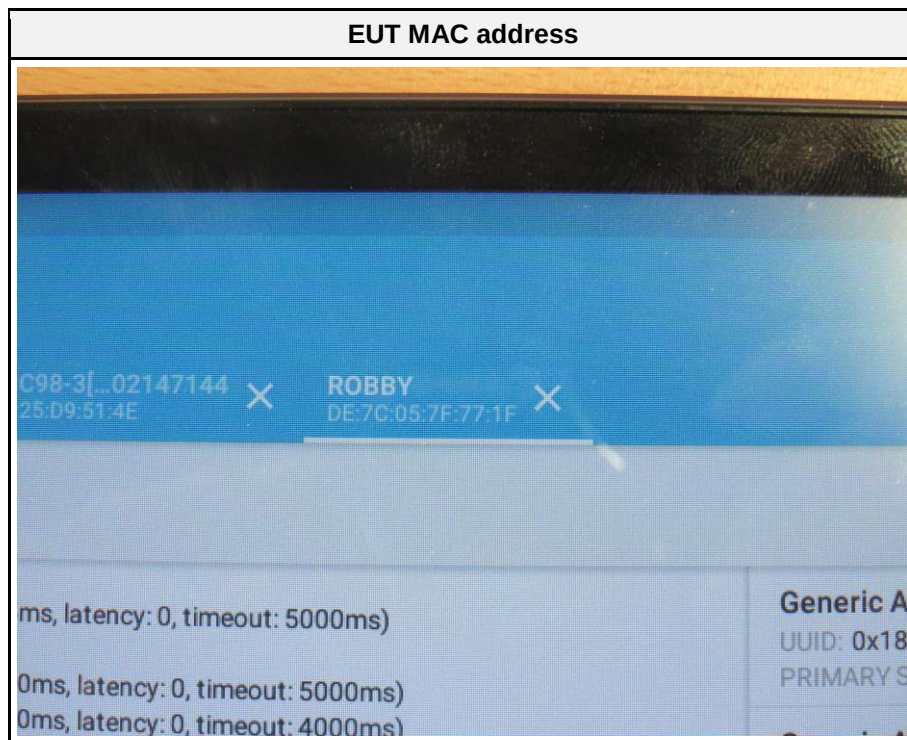


Auxiliary equipment



Label auxiliary equipment





1.4 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
AE	Tablet	alcatel	8082	Customer device
SW	App	nRF connect	Version 4.24.3	Use for monitoring and control of EUT
AE	Batteries	ANSMANN	Alkaline Batterie Micro AAA	-
Description:				
AE	Auxiliary Equipment			
SIM	Simulator			
MON	Monitoring Equipment			
CBL	Connecting Cable			
SW	Software			
Comment:				

1.5 Operational Modes

Mode #	Description
1	Bluetooth connected. Motor 99% freewheel (PWM signal.)
Comment: worst case	

1.6 EUT Configuration

Configuration #	Description
1	EUT powered via 3 batteries. Companion device tablet for Bluetooth outside test volume
Comment: -	

1.7 Sample emission level calculation

The following is a description of terms and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyser in dBµV. Any external preamplifiers used are taken into account through internal analyser settings.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strengths to voltages, which can be measured directly on the spectrum analyser. It is treated as a loss in dB. Cable losses have been included with the A.F. to simplify the calculations. The antenna factor is used in calculations as follows:

$$\text{Reading on Analyser (dB}\mu\text{V)} + \text{A.F. (dB/m)} = \text{Net field strength (dB}\mu\text{V/m)}$$

Net:

This is the net field strength measurement (as shown above).

Limit:

This is the FCC Class B radiated emission limit (in units of dBµV/m). The FCC limits are given in units of µV/m. The following formula is used to convert the units of µV/m to dBµV/m:

$$\text{Limit (dB}\mu\text{V/m)} = 20 \cdot \log(\mu\text{V/m})$$

Margin:

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:

Reading + AF	= Net Reading	:	Net reading - FCC limit	= Margin
+21.5 dBµV + 26 dB/m	= 47.5 dBµV/m	:	47.5 dBµV/m - 57.0 dBµV/m	= -9.5 dB

2 Result Summary

Title 47 CFR Part 15B, ISED ICES-003 Issue 7				
Reference	Requirement	Reference Method	Result	Remarks
Emission				
FCC 15.109 ICES-003, 3.2.2	Radiated emissions	ANSI C63.4:2014 +A1:2017	PASS	
FCC 15.107 ICES-003, 3.2.1	AC power line conducted emissions	ANSI C63.4:2014 +A1:2017	N/R	
Comment:				

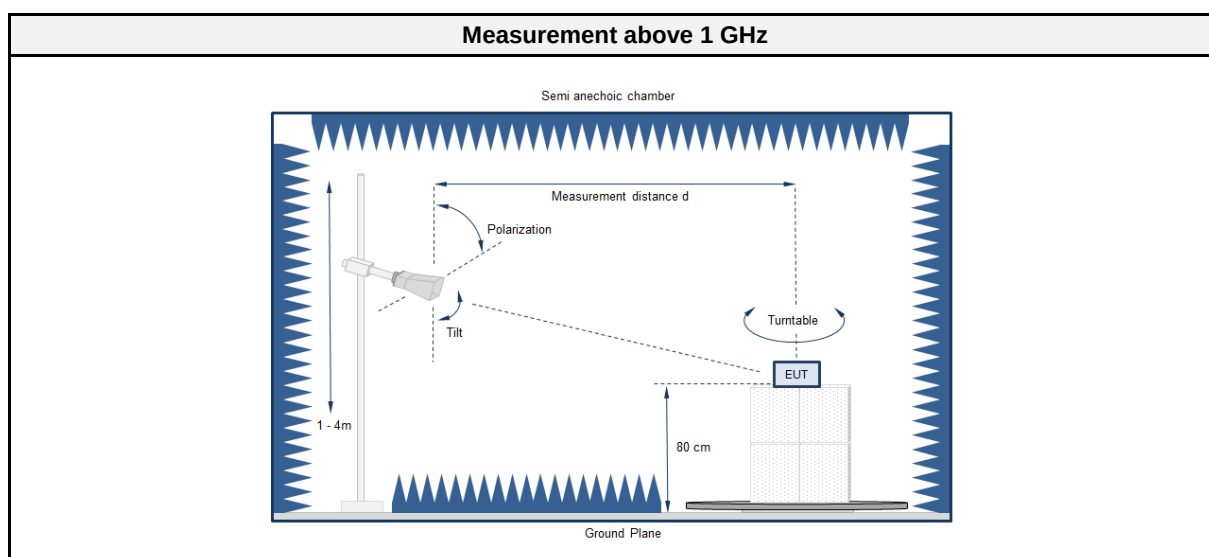
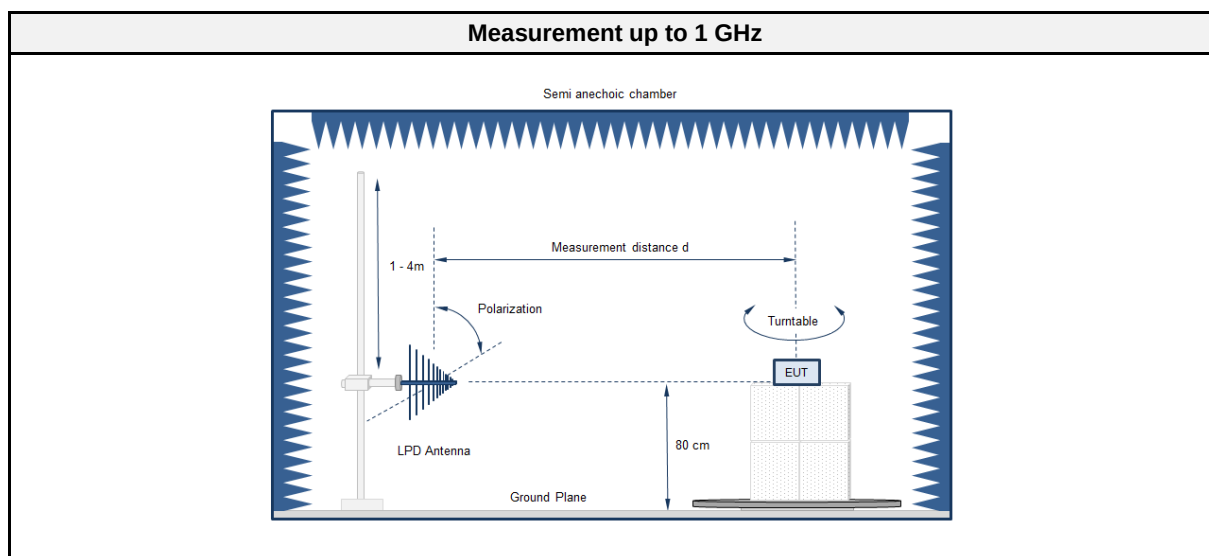
Possible Test Case Verdicts	
PASS	Test object does meet the requirements
FAIL	Test object does not meet the requirements
N/T	Required by standard but not tested
N/R	Not required by standard for the test object

2.1 Test Conditions and Results - Radiated emissions acc. to ANSI C63.4

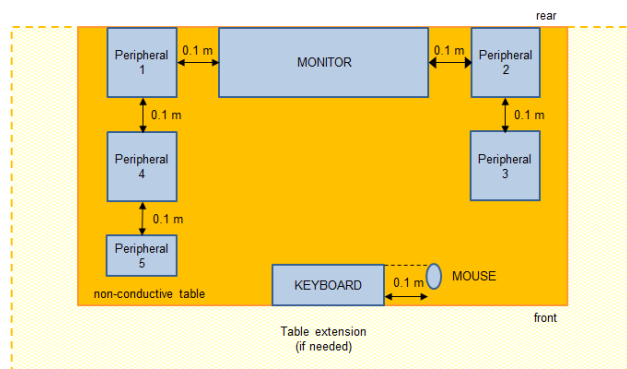
2.1.1 Information

Test Information	
Reference	FCC 15.109, ICES-003, 3.2.2
Reference method	ANSI C63.4:2014+A1:2017 Section 8
Equipment class	Class B
Equipment type	Table top
Highest internal frequency [MHz]	2483.5
Measurement range	30 MHz to 13000 MHz
Temperature [°C]	22 ± 1
Humidity [%]	32 - 37
Operator	Manuel Engel
Date	2022-03-18 and 2022-03-21

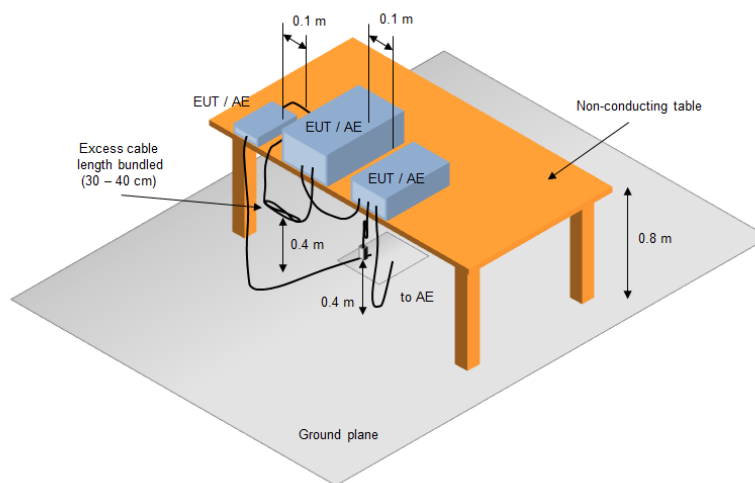
2.1.2 Setup



Equipment placement - Table top



Test Setup



2.1.3 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	Radimation	2020.1.8

Test Equipment AC 1					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Semi-Anechoic chamber	Frankonia GmbH	AC 6 (SAC10-3)	EF00910	2021-07	2024-07
Anechoic chamber (SVSWR)	Frankonia	AC 1	EF01011	2019-06	2022-06
EMI Test Receiver	Keysight	N9038A-526/WXP	EF01070	2021-07	2022-07
Horn Antenna	Schwarzbeck	BBHA9120D	EF00018	2019-10	2022-10
Climatic Sensor	Embedded Data Systems, LLC.	2800100000254 17E	EF01054	2021-03	2022-03

Test Equipment AC 6					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic chamber (NSA)	Frankonia	AC6	EF00910	2021-07	2024-07
EMI Test Receiver	R&S	ESU26	EF00887	2021-07	2022-07
TRILOG Broadband Antenna	Schwarzbeck	VULB 9162	EF00978	2019-10	2022-10
Climatic Sensor	Embedded Data Systems, LLC.	9A00100000254 77E	EF01124	2021-03	2022-03

2.1.4 Procedure

Exploratory measurement
1. The EUT was placed on a non-conductive table at a height of 0.8m. 2. The EUT and support equipment, if needed, were set up to simulate typical usage. 3. Cables, of type and length specified by the manufacturer, were connected to at least one port of each type and were terminated by a device or simulating load of actual usage. 4. The antenna was placed at a distance of 3 or 10 m. 5. The received signal was monitored at the measurement receiver. 6. This procedure has to be performed in both antenna polarizations, horizontal and vertical. 7. The arrangement of the equipment with the maximum emission level is shown on the setup picture at item 2.1.2

Final measurement
1. The EUT was placed on a 0.8 m non-conductive table at a 3 or 10 m distance from the receive antenna. The antenna output was connected to the measurement receiver. 2. A broadband hybrid antenna was used for the frequency range 30 – 1000 MHz. Above one 1 GHz a double ridged broadband horn antenna was used. The antenna was placed on an adjustable height antenna mast. 3. The EUT and cable arrangement were based on the exploratory measurement results. 4. Emissions were maximized at each frequency by rotating the EUT and adjusting the receive antenna height and polarization. The maximum values were recorded. 5. The test data of the worst-case conditions were recorded and shown on the next pages.

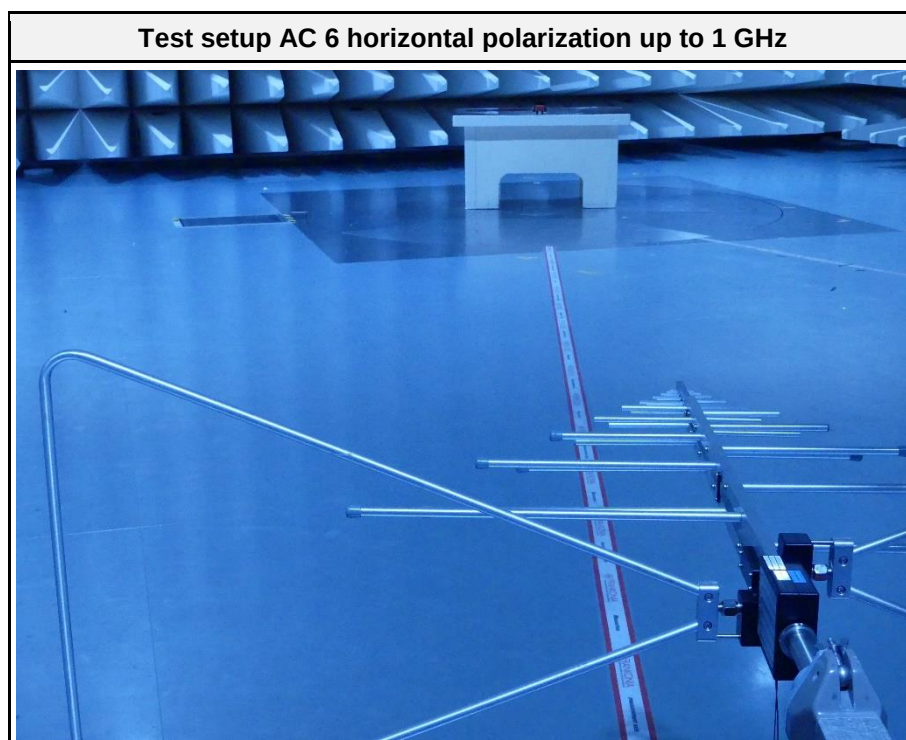
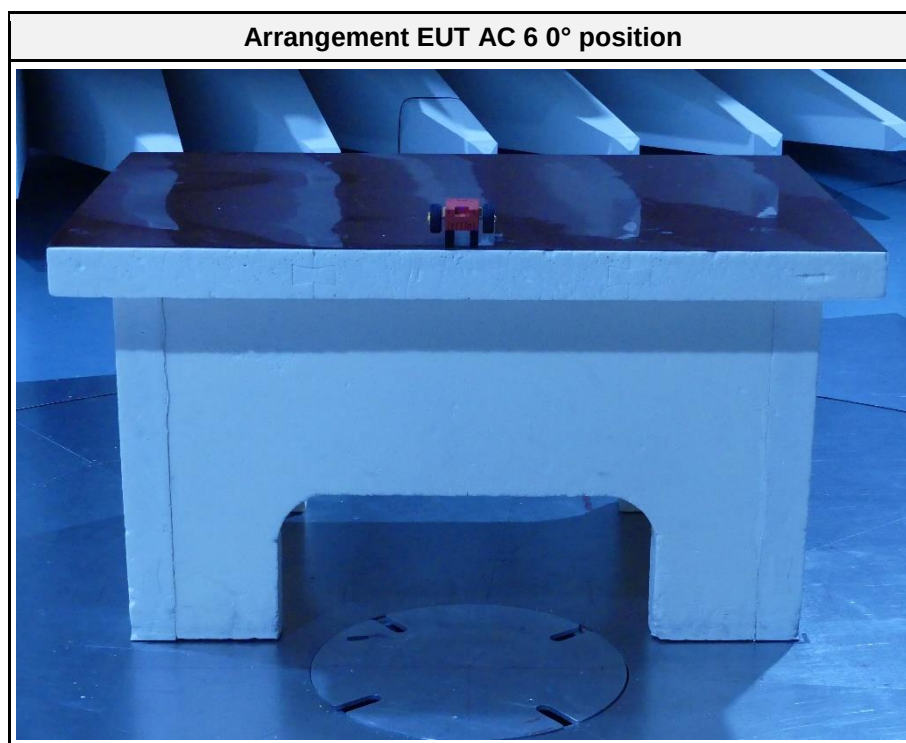
2.1.5 Limits

Class B @ 3 m		
Frequency [MHz]	Detector	Limit [dBμV/m]
30 - 88	Quasi-peak	40
88 - 216	Quasi-peak	43.5
216 - 960	Quasi-peak	46
960 - 1000	Quasi-peak	54
> 1000	Peak	74
	Average	54

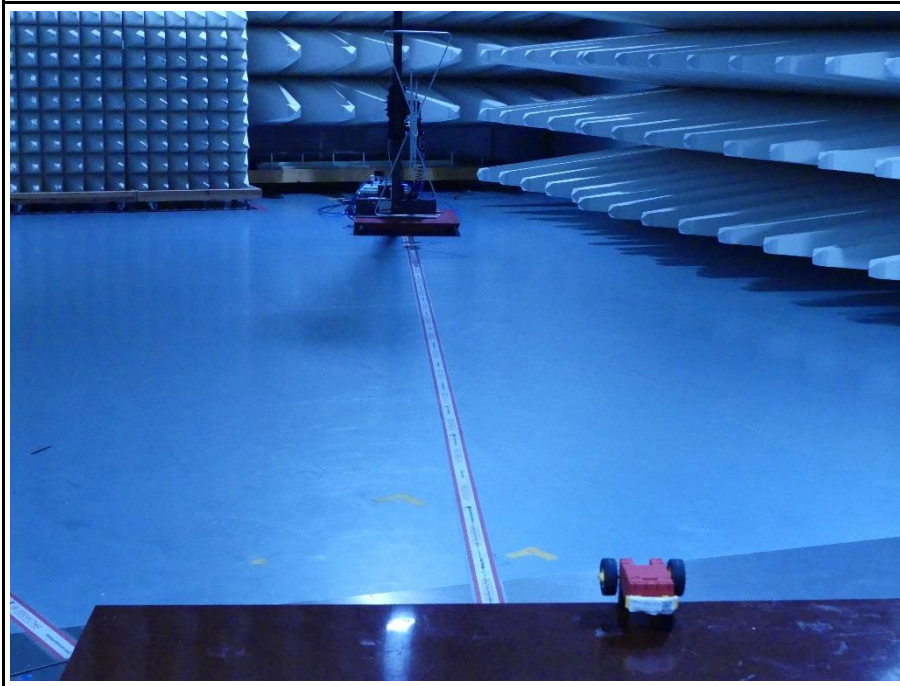
2.1.6 Results

Test Results			
Operational mode	EUT Configuration	Verdict	Remark
1	1	PASS	-

2.1.7 Setup Photos

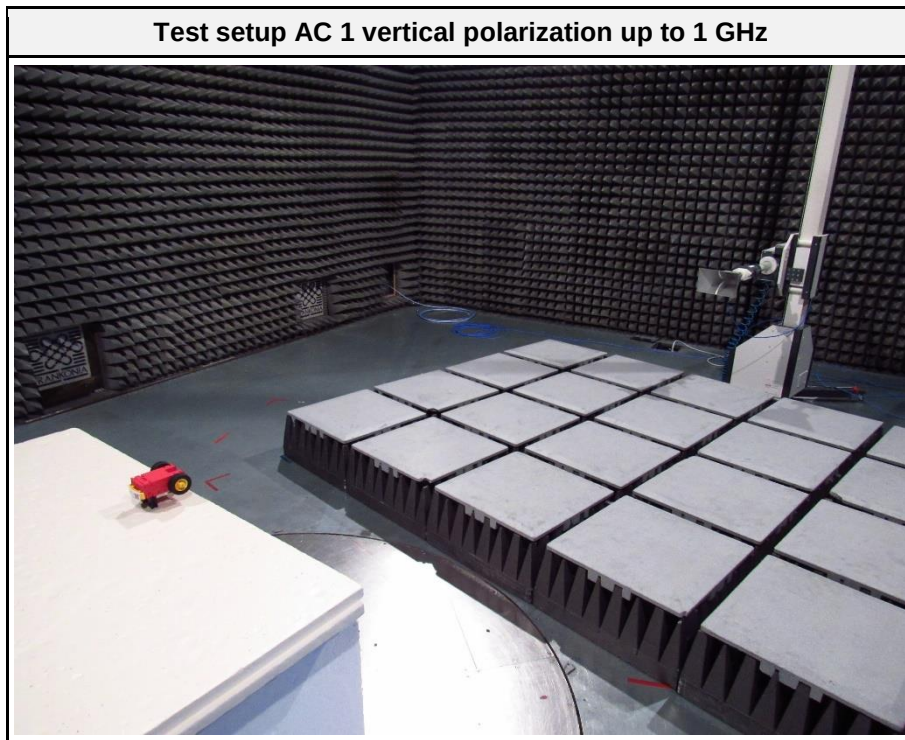


Test setup AC 6 vertical polarization up to 1 GHz



Test setup AC 1 0° position horizontal polarization up to 1 GHz





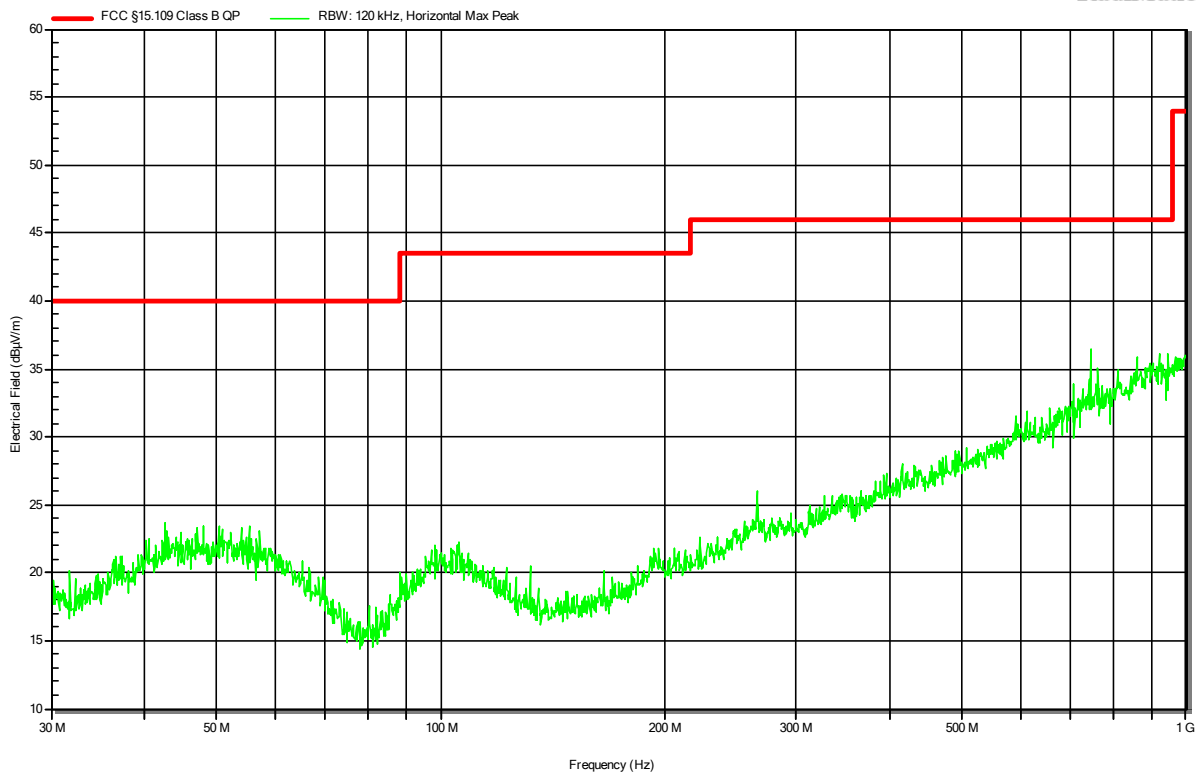
2.1.8 Records

**Radiated emissions
according to FCC 15B**

Project Number: G0M-2112-1241
 Applicant: fischertechnik GmbH
 Model Description: Roboter Chassis Early Coding for Toy and Education market
 Model: Roboter Chassis 183268
 Test Sample ID: 38603
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Engel
 Test Date: 2022-03-21
 Operating Conditions: ambient temperature: 22 °Celsius
 power input: 4.5 V via 3 x AAA battery
 Antenna: Schwarzbeck VULB 9162, Horizontal
 Measurement Distance: 10 m, converted to 3 m
 Operational Mode: Mode 1
 EUT Configuration: Configuration 1
 Note 1: Height 1m, angle 0°

Index 5

RadiMation

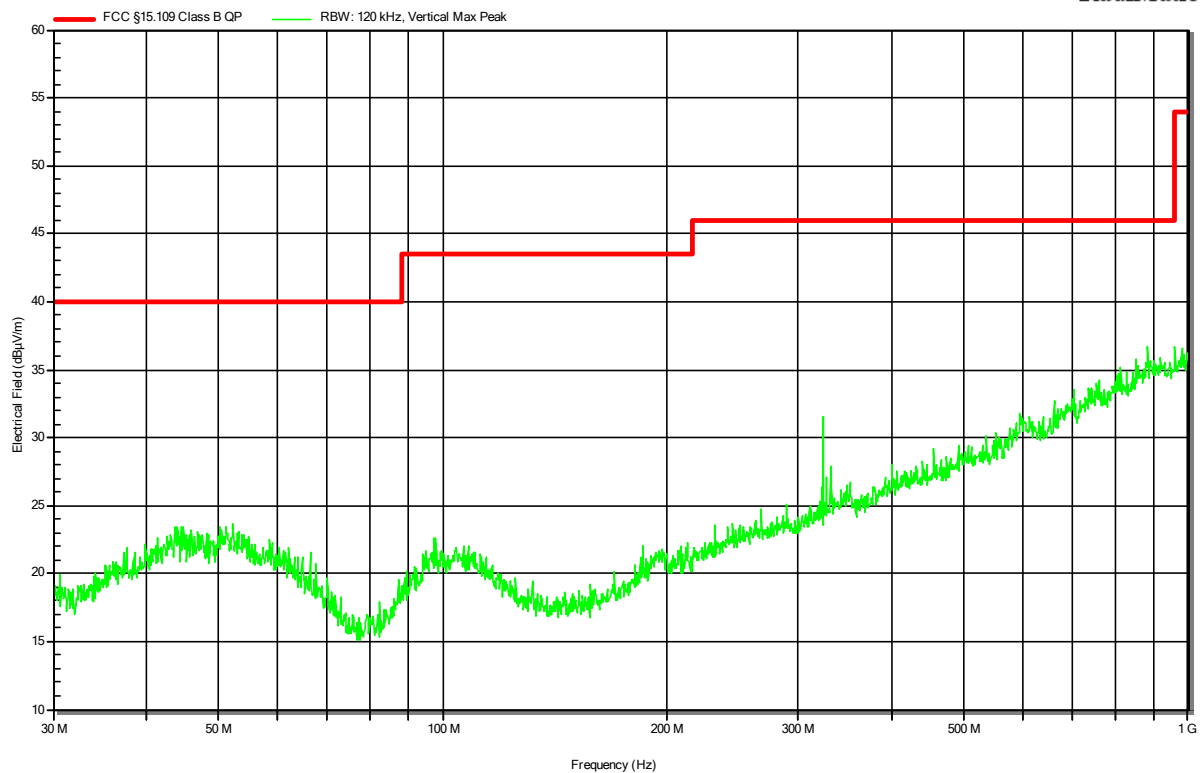


Radiated emissions according to FCC 15B

Project Number: G0M-2112-1241
Applicant: fischertechnik GmbH
Model Description: Roboter Chassis Early Coding for Toy and Education market
Model: Roboter Chassis 183268
Test Sample ID: 38603
Test Site: Eurofins Product Service GmbH
Operator: Mr. Engel
Test Date: 2022-03-21
Operating Conditions: ambient temperature: 22 °Celsius
power input: 4.5 V via 3 x AAA battery
Antenna: Schwarzbeck VULB 9162, Vertical
Measurement Distance: 10 m, converted to 3 m
Operational Mode: Mode 1
EUT Configuration: Configuration 1
Note 1: Height 1 m, angle 0°

Index 3

RadiMation

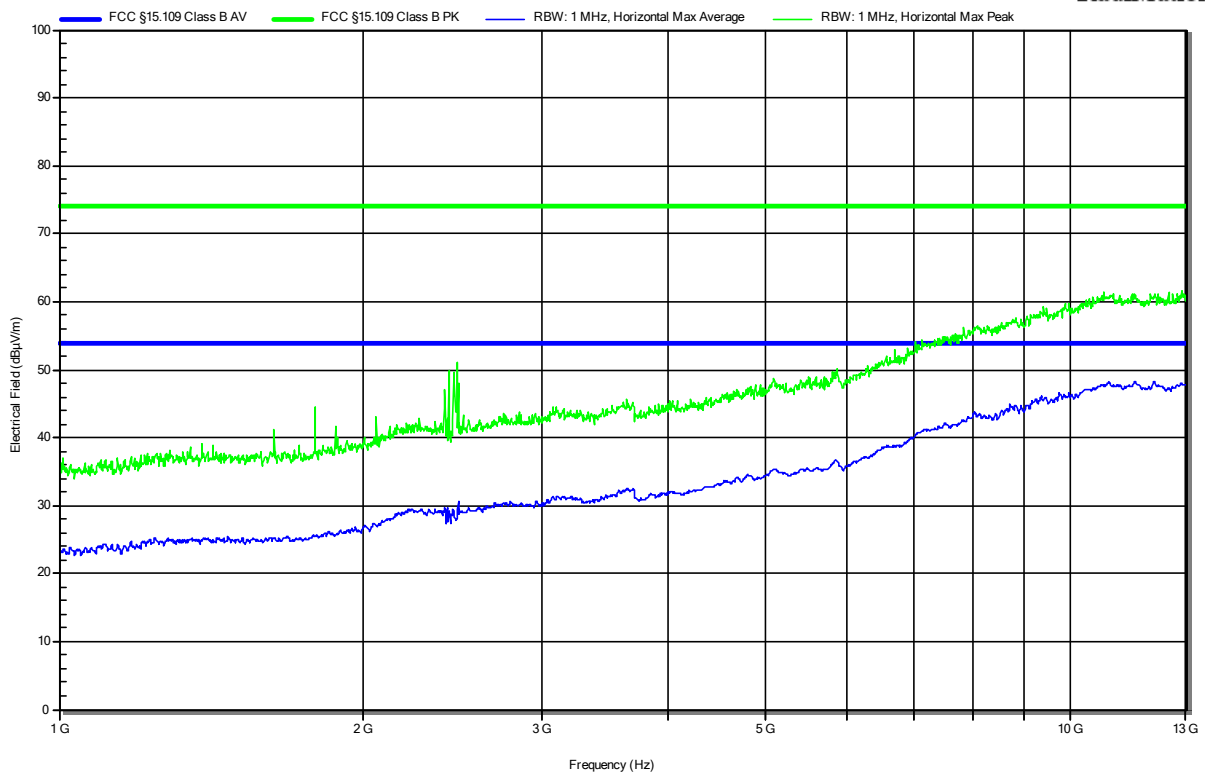


Radiated emissions according to FCC 15B

Project Number: G0M-2112-1241
 Applicant: fischertechnik GmbH
 Model Description: Roboter Chassis Early Coding for Toy and Education market
 Model: Roboter Chassis 183268
 Test Sample ID: 38603
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Engel
 Test Date: 2022-03-18
 Operating Conditions: ambient temperature: 22 °Celsius
 power input: 4.5 V via 3 x AAA battery
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement Distance: 3 m
 Operational Mode: Mode 1
 EUT Configuration: Configuration 1
 Note 1: Height 1 m, angle 0°

Index 1

Radiation

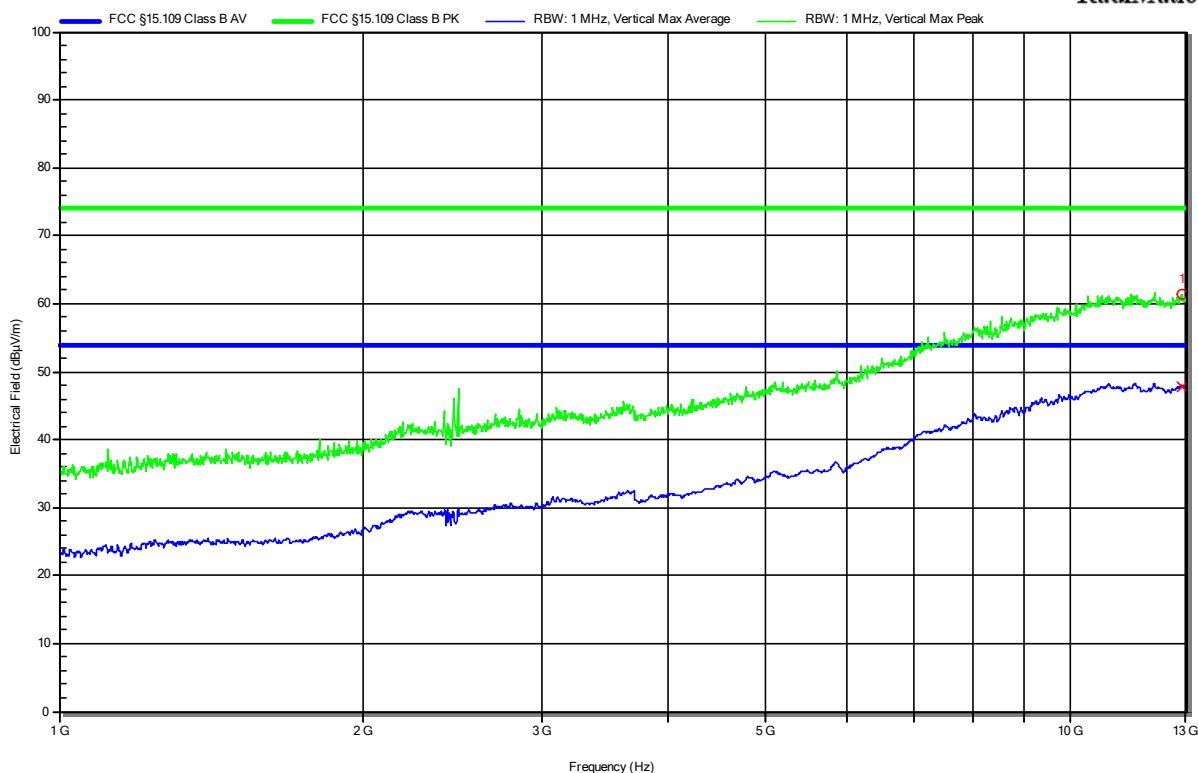


Radiated emissions according to FCC 15B

Project Number: G0M-2112-1241
Applicant: fischertechnik GmbH
Model Description: Roboter Chassis Early Coding for Toy and Education market
Model: Roboter Chassis 183268
Test Sample ID: 38603
Test Site: Eurofins Product Service GmbH
Operator: Mr. Engel
Test Date: 2022-03-18
Operating Conditions: ambient temperature: 22 °Celsius
power input: 4.5 V via 3 x AAA battery
Antenna: Schwarzbeck BBHA 9120D, Vertical
Measurement Distance: 3 m
Operational Mode: Mode 1
EUT Configuration: Configuration 1
Note 1: Height 1 m, angle 0°

Index 2

Radiation



Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	12,889 GHz	61,33 dBμV/m	73,98 dBμV/m	-12,65 dB	Pass	0 degrees	1 m
Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	12,889 GHz	47,81 dBμV/m	53,98 dBμV/m	-6,17 dB	Pass	0 degrees	1 m

3 Measurement Uncertainty

All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2.

Test Name	Measurement Uncertainty
Radiated Emission AC 1	1 GHz to 6 GHz @ 3 m, 5.3 dB >1GHz to 6GHz @ 3m, 5.95dB
Radiated Emission AC 6	30 MHz to 1 GHz @ 10 m 6.25 dB