





EMC TEST REPORT Title 47 CFR Part 15B, ISED ICES-003 Issue 7	
Report Reference No	G0M-2112-1232-EF0115B-V01
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	    <p> 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 </p>
Applicant	WTO Werkzeug-Einrichtungen GmbH
Address	Neuer Hohdammweg 1 77797 Ohlsbach Germany
Test Specification Standard(s)	Title 47 CFR Part 15 Subpart B ISED ICES-Gen Issue 1 ; Amendment 1 (February 2021) ISED ICES-003 Issue 7 ANSI C63.4:2014+A1:2017
Non-Standard Test Method	None
Equipment under Test (EUT):	
Product Description	SDTH Controller
Model(s)	WTO SC 002
Additional Model(s)	None
Brand Name(s)	WTO
Hardware Version(s)	K / EH40
Software Version(s)	2.3.00
FCC-ID	2AZ56115715
IC	27343-115715
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	2022-05-18	
Report:		
Compiled by	Manuel Engel	
Tested by (+ signature) (Responsible for Test)	Manuel Engel	
Approved by (+ signature) (Deputy Head of Lab)	Jens Marquardt	
Date of Issue	2022-07-25	
Total number of pages	30	
General Remarks:		
<p>The test results presented in this report relate only to the object tested.</p> <p>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.</p> <p>This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.</p>		
Additional Comments:		

Additional Variants (not tested and not evaluated variants)		
Not-tested Variant	Description	
1	Product Type Description	SDTH Controller
	Model name	WTO SC 002
	Brand name	Coromant Capto® DTH Plus
	Hardware Version	K / EH40
	Software Version	2.3.00
2	Product Type Description	SDTH Controller
	Model name	WTO SC 002
	Brand name	WTO
	Hardware Version	K / EH10
	Software Version	2.3.00
3	Product Type Description	SDTH Controller
	Model name	WTO SC 002
	Brand name	Coromant Capto® DTH Plus
	Hardware Version	K / EH10
	Software Version	2.3.00
4	Product Type Description	SDTH Controller
	Model name	WTO SC 002
	Brand name	WTO
	Hardware Version	K / EH30
	Software Version	2.3.00
5	Product Type Description	SDTH Controller
	Model name	WTO SC 002
	Brand name	Coromant Capto® DTH Plus
	Hardware Version	K / EH30
	Software Version	2.3.00
6	Product Type Description	SDTH Controller
	Model name	WTO SC 002
	Brand name	WTO
	Hardware Version	K / EH50
	Software Version	2.3.00
7	Product Type Description	SDTH Controller
	Model name	WTO SC 002
	Brand name	Coromant Capto® DTH Plus
	Hardware Version	K / EH50
	Software Version	2.3.00
8	Product Type Description	SDTH Controller
	Model name	WTO SC 002
	Brand name	WTO
	Hardware Version	K / EH63
	Software Version	2.3.00
9	Product Type Description	SDTH Controller
	Model name	WTO SC 002
	Brand name	Coromant Capto® DTH Plus
	Hardware Version	K / EH63
	Software Version	2.3.00
<p>Comment: Those named additional variants above have not been tested. Those additional variants of the series have been declared by the manufacturer. The test report explicitly states that those variants were neither tested nor assessed nor evaluated.</p>		

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	2022-07-25	Initial Release	-

REPORT INDEX

1	Equipment (Test Item) Under Test.....	7
1.1	Equipment Ports.....	8
1.2	Equipment Photos - Internal.....	9
1.3	Equipment Photos - External.....	13
1.4	Support Equipment.....	17
1.5	Operational Modes.....	17
1.6	EUT Configuration.....	17
1.7	Sample emission level calculation.....	18
2	Result Summary.....	19
2.1	Test Conditions and Results - Radiated emissions acc. to ANSI C63.4.....	20
3	Measurement Uncertainty	30

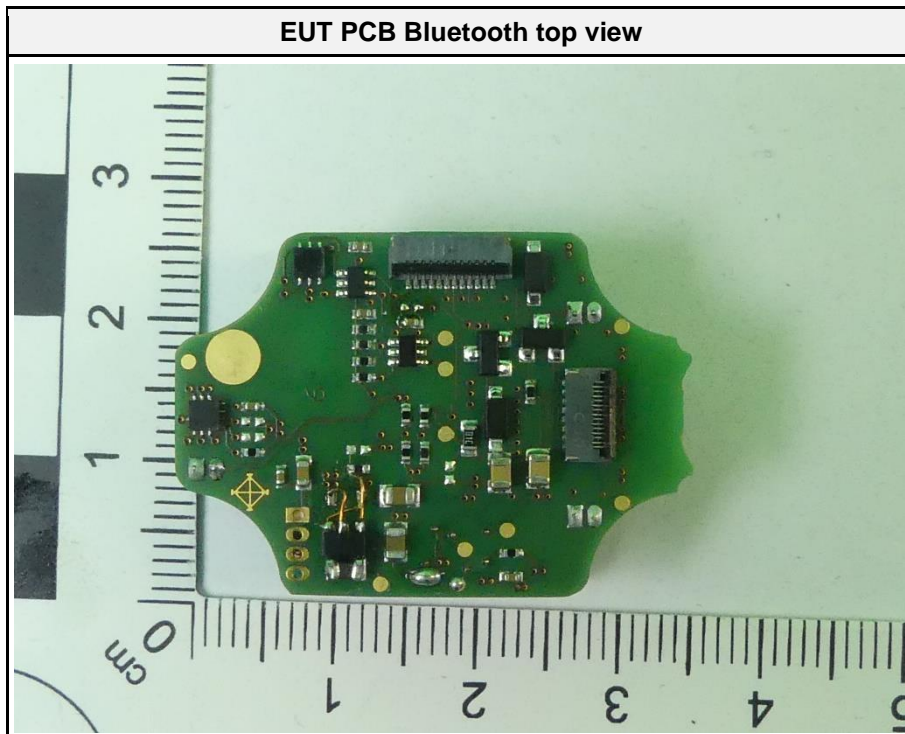
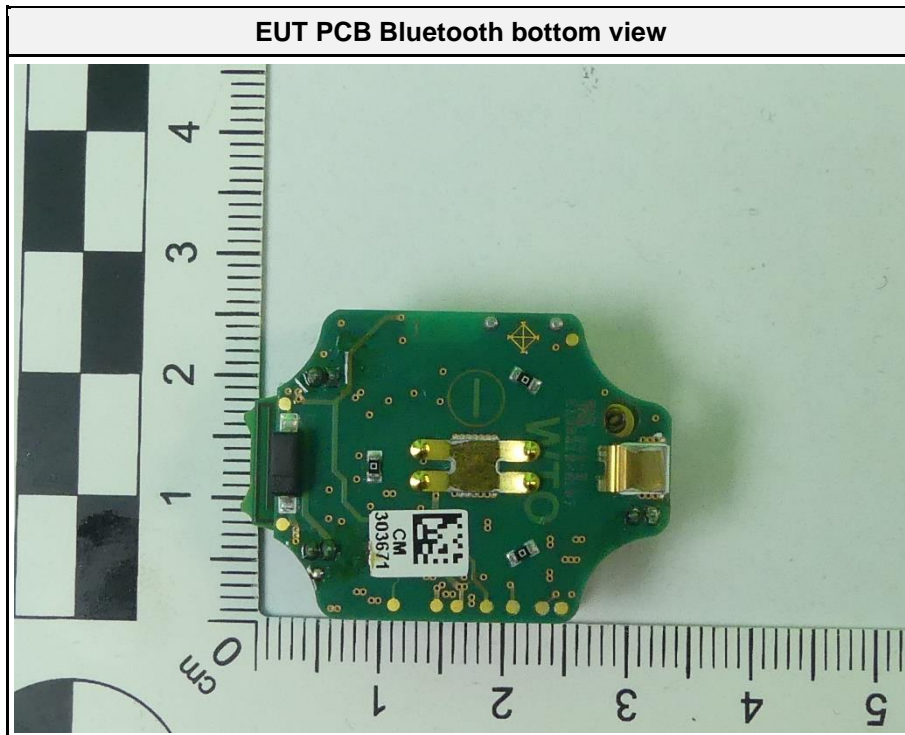
1 Equipment (Test Item) Under Test

Description	SDTH Controller		
Intended Use	Smart Driven Tool Holders Controller The electronic unit type WTO SC 002 enables the transmission of sensor data of tool holders based on Bluetooth® low energy 5.0 technology. This enables condition monitoring and predictive maintenance		
Model	WTO SC 002		
Additional Model(s)	None		
Brand Name(s)	WTO		
Hardware Version(s)	K / EH40		
Software Version(s)	2.3.00		
Number of tested samples	1		
Sample Identification	EUT #	Sample-ID	Serial Number
	EUT 1	37517	L22-000021-1.2
EUT Dimensions [cm]	4.2 x 3.5 x 1.95		
FCC-ID	2AZ56115715		
IC	27343-115715		
Class	Class B		
Equipment type	Table top		
Highest internal frequency [MHz]	2483		
Protective Earth	No		
Radio Module/ Chipset	Type	Bluetooth Low Energy	
	Model	EYSKBNZWB	
	Manufacturer	Taiyo Yuden	
	FCC-ID	RYEYSKBN	
	IC	4389B-EYSKBN	
Supply Voltage	V _{NOM}	The Power Supply has a 3-stage concept: When the tool is not turned, a battery delivers the needed energy for the sleep mode. When the tool starts to turn, the energy harvester delivers voltages up to 140 V, which are rectified and DC/DC converted to 3.6 VDC. With this voltage the BLE controller is supplied and a SuperCap is charged until it reaches 3.5 V. When the tool is stopped, the Harvester's voltage goes down to 0 V, then the SuperCap delivers its energy until it is empty and then the battery takes the role of the Power Supply	
AC/DC-Adaptor	None		
Manufacturer	WTO Werkzeug-Einrichtungen GmbH Auf der oberen Au 45 77797 Ohlsbach Germany		

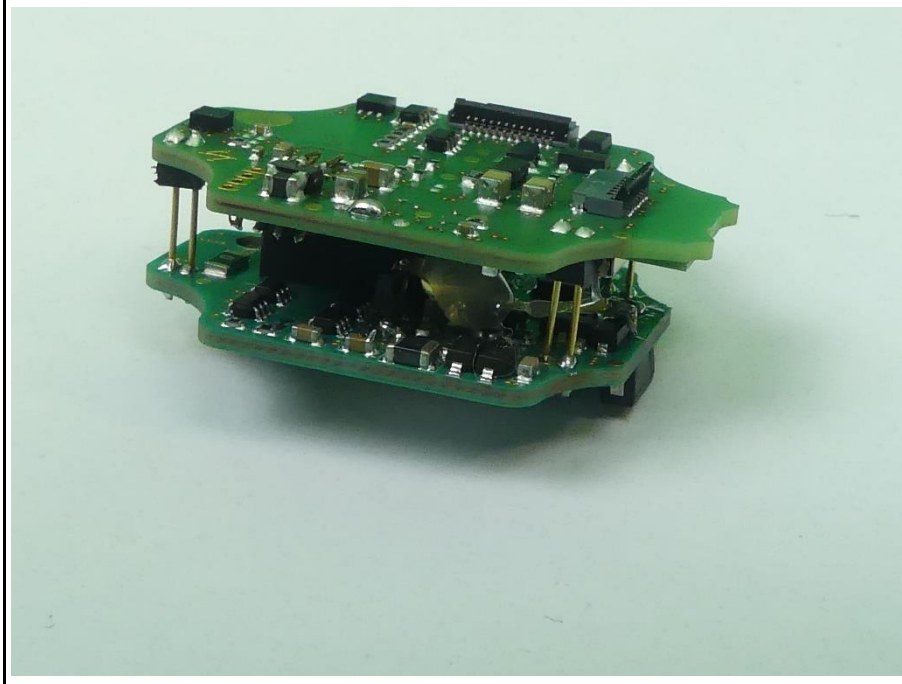
1.1 Equipment Ports

Name	Type	Attributes	Comment
-	-	Count: - Direction: - Max. cable length [m]: - Shielded: - Service only: -	-
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		

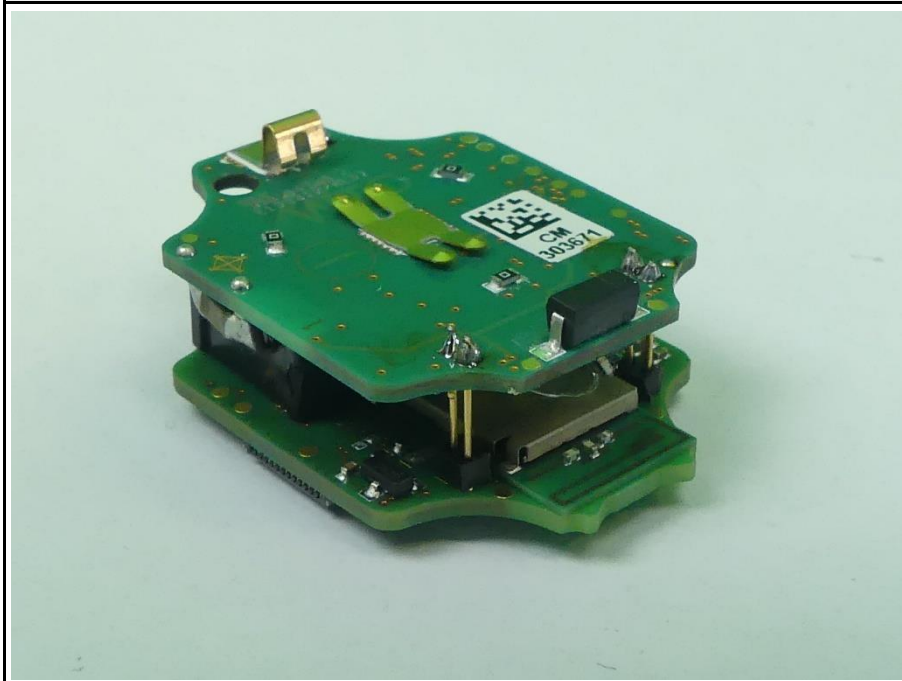
1.2 Equipment Photos - Internal



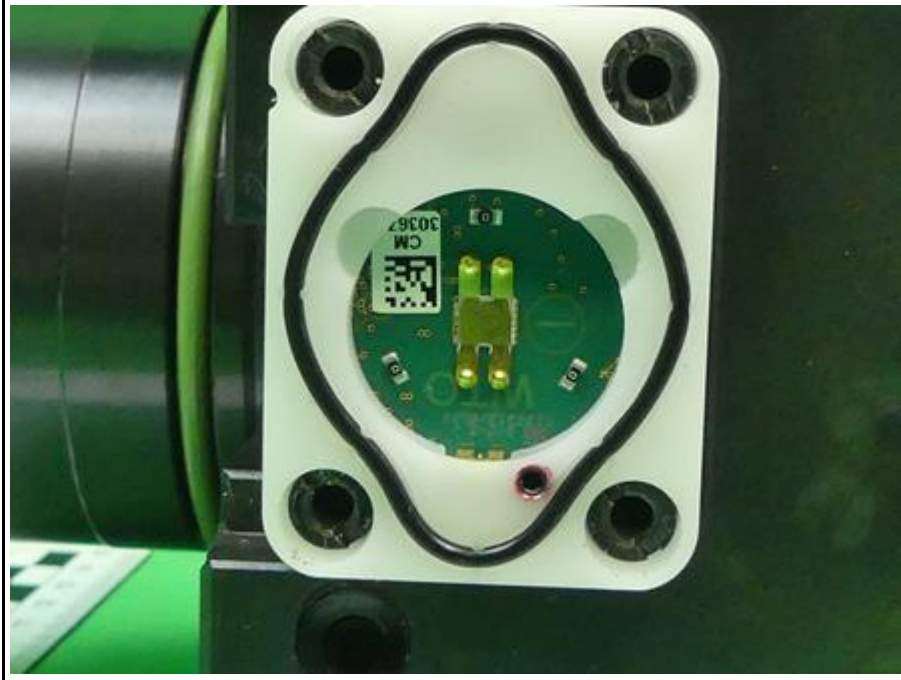
EUT PCB Bluetooth view 1



EUT PCB Bluetooth view 2

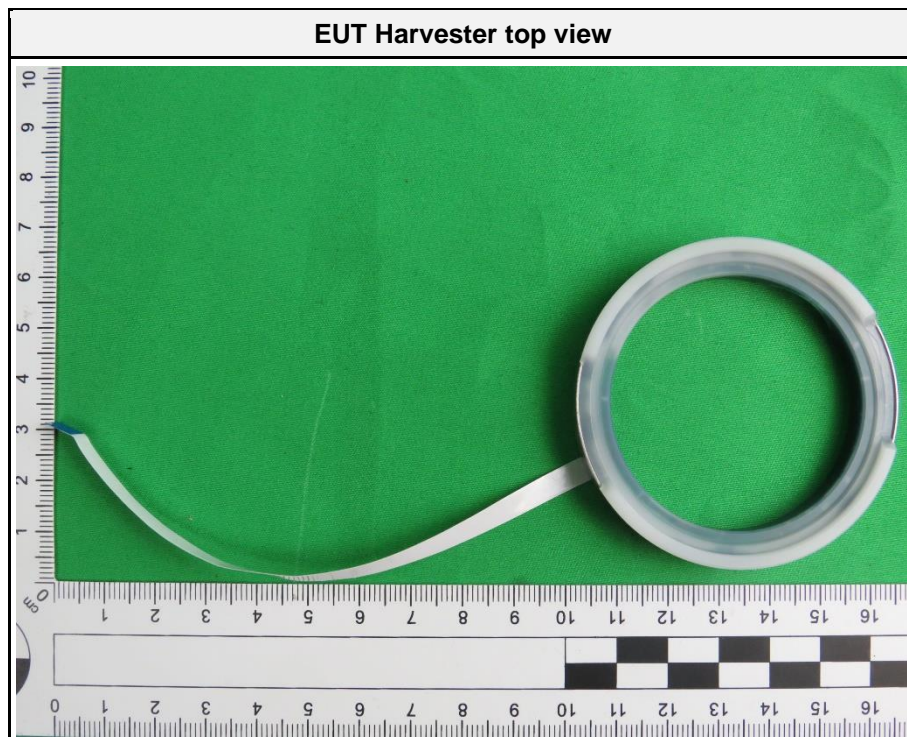
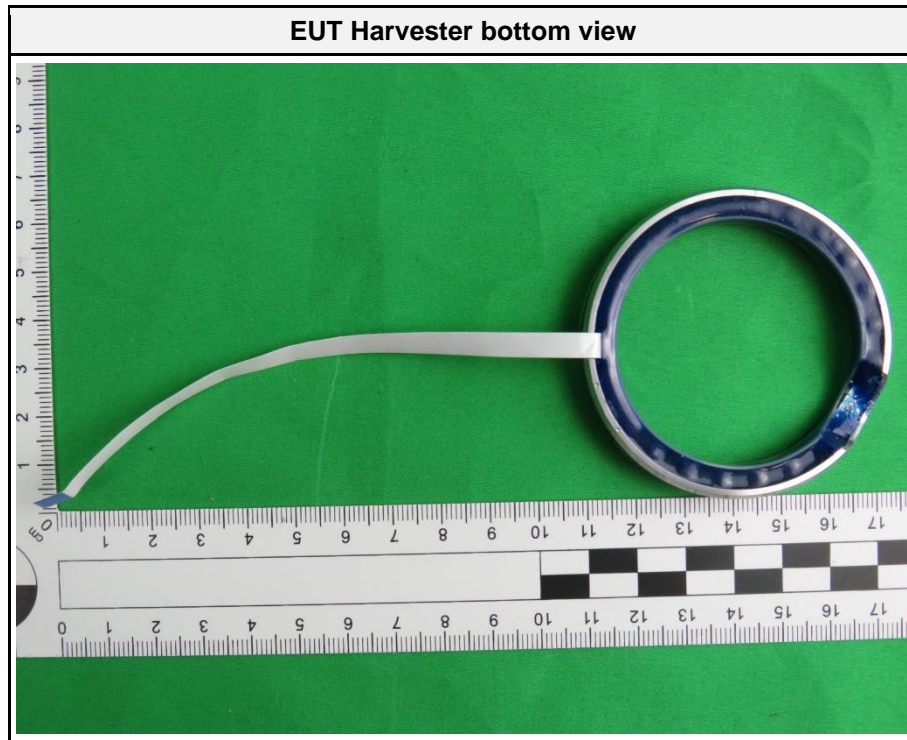


EUT Electronic unit

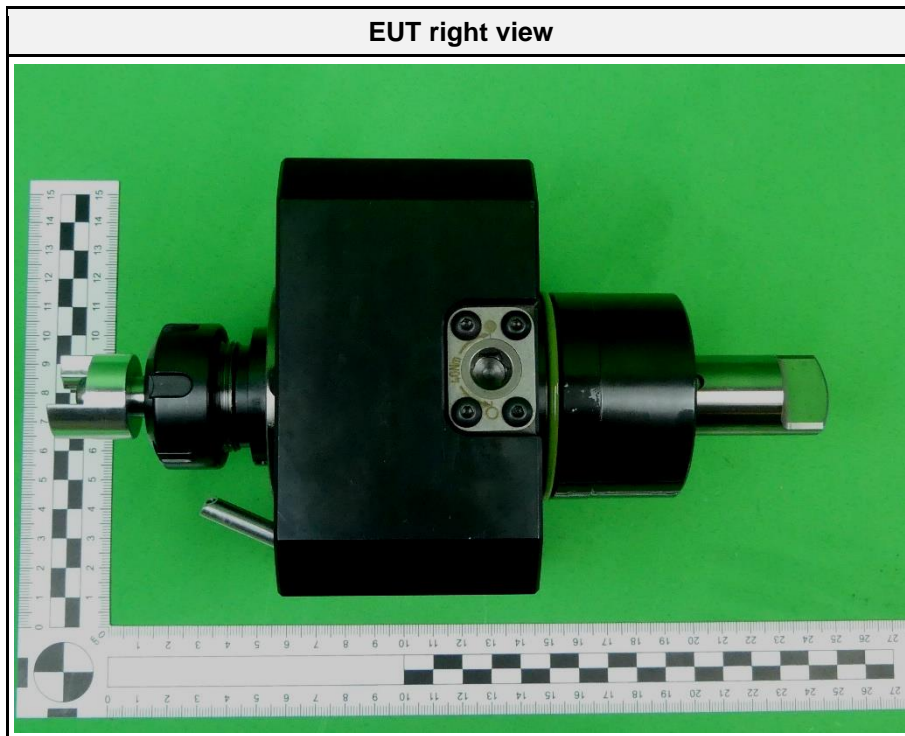


Bluetooth Module unshielded

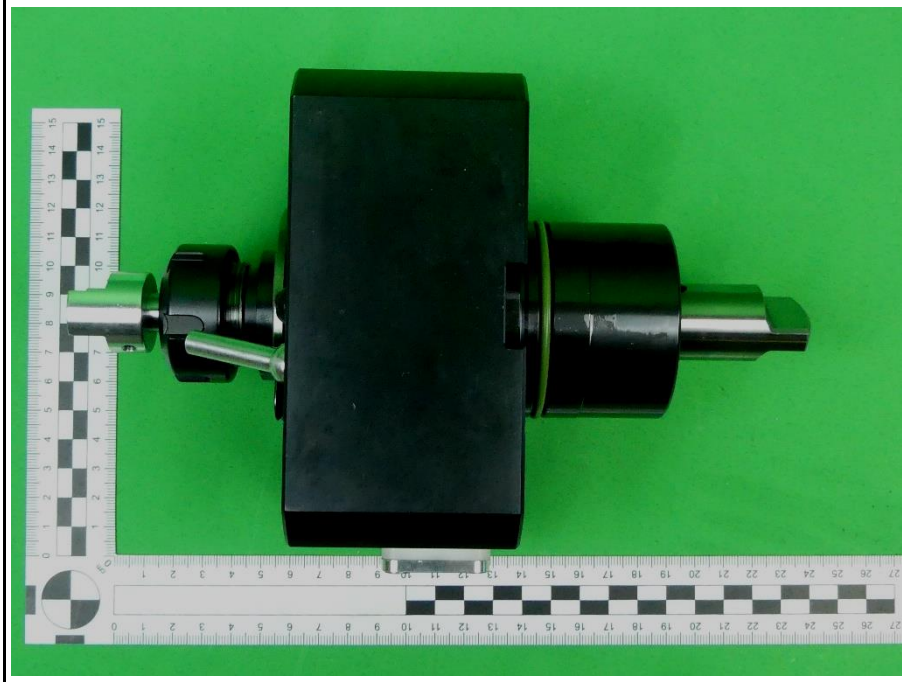




1.3 Equipment Photos - External



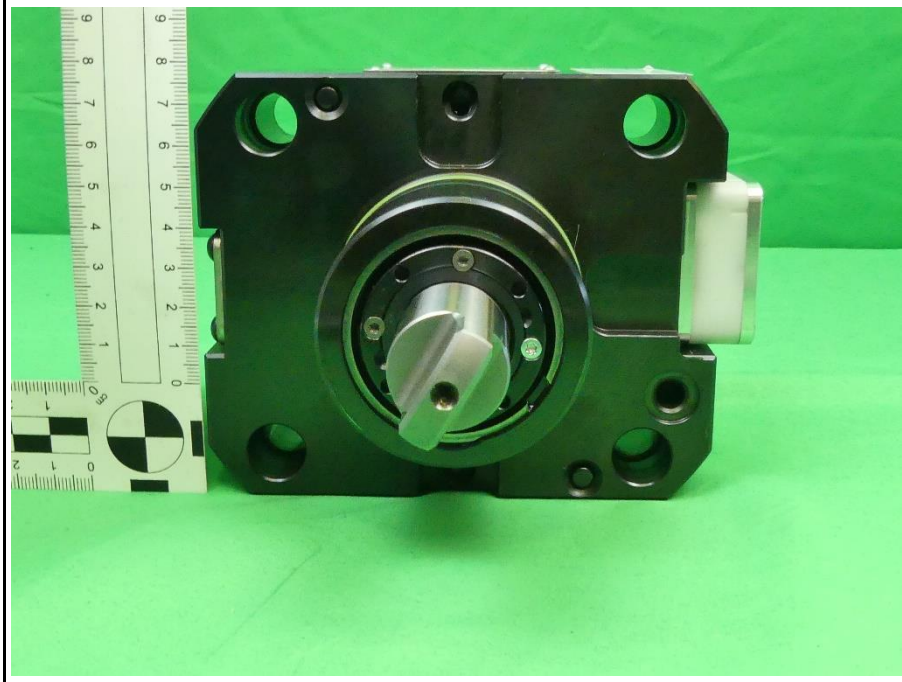
EUT bottom view



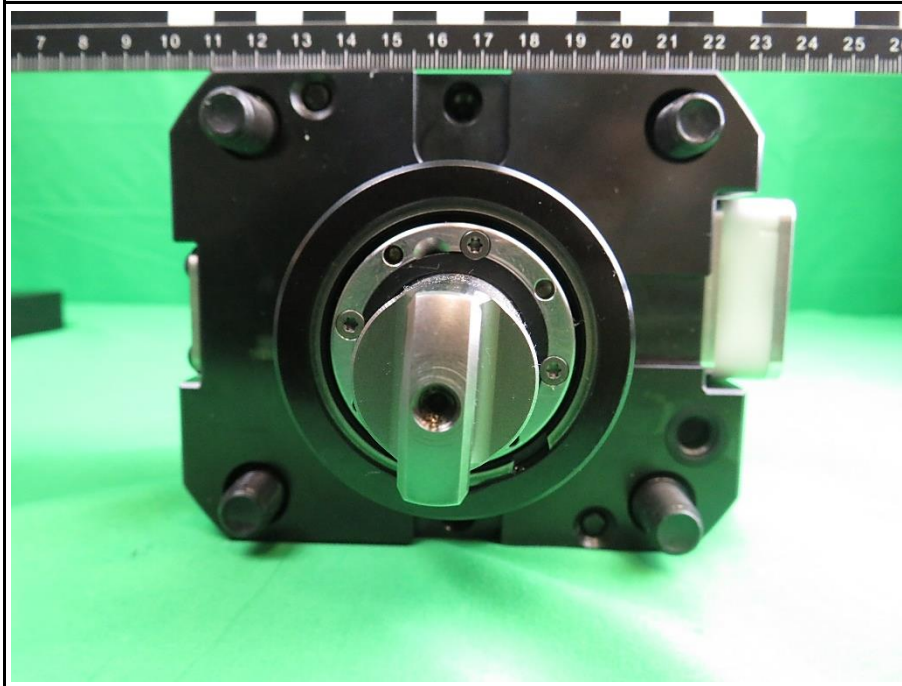
EUT left view



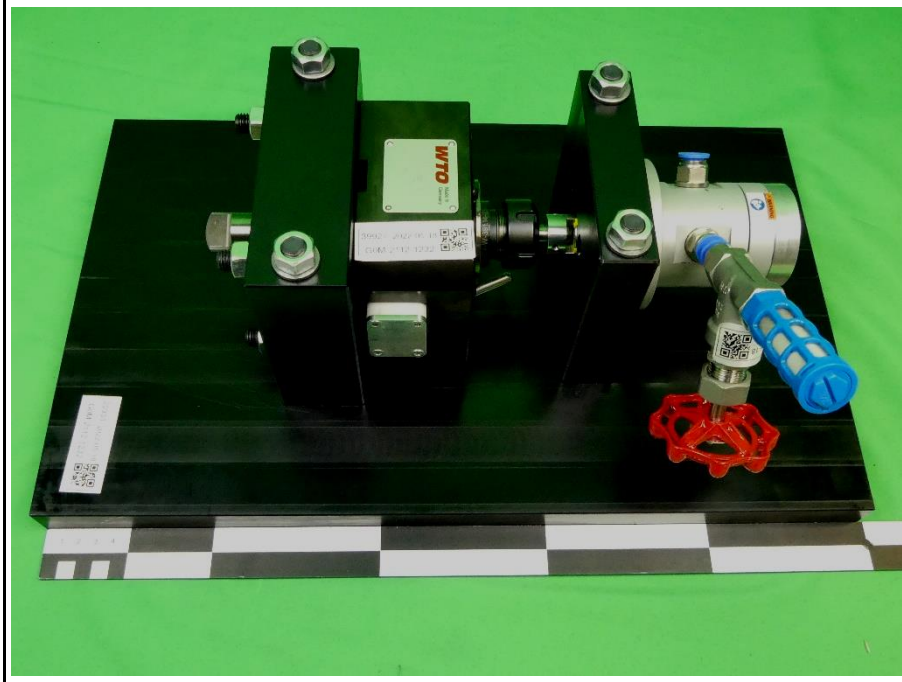
EUT back view



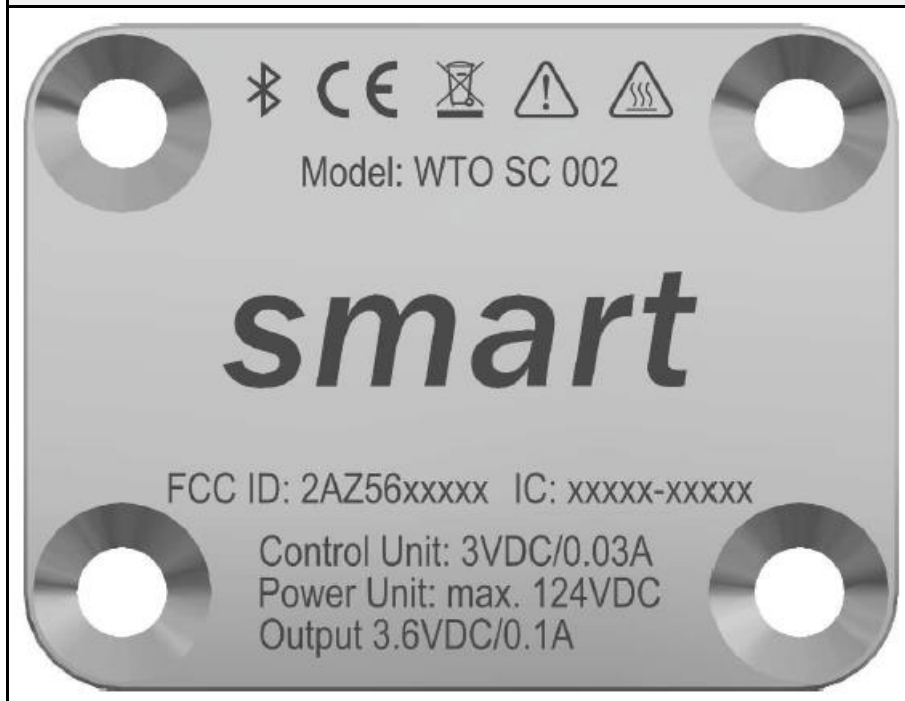
EUT front view



EUT mounted on test stand



EUT draft labelling



1.4 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
AE	Notebook	DELL	Latitude 7480	Customer device
AE	Test stand	WTO	116568	Customer device
AE	Air motor	DEPRAG	63X-001F05	Customer device
SW	PC software	WTO	QuickFlex® smart	Version 22.3.27.2
Description:				
AE	Auxiliary Equipment			
SIM	Simulator			
MON	Monitoring Equipment			
CBL	Connecting Cable			
SW	Software			
Comment: -				

1.5 Operational Modes

Mode #	Description
1	2.4 GHz Bluetooth Low Energy The BLE Controller transmits to notebook data like temperatures, accelerations and battery levels. Likewise time lengths, delays, work cycles and life cycles are measured and stored.
Comment:	

1.6 EUT Configuration

Configuration #	Description
1	Device mounted on a test stand with an air motor. This one is driven by control air. The rotational speed was 4100 rpm \pm 5 %.
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	No relevant port
Comment:				

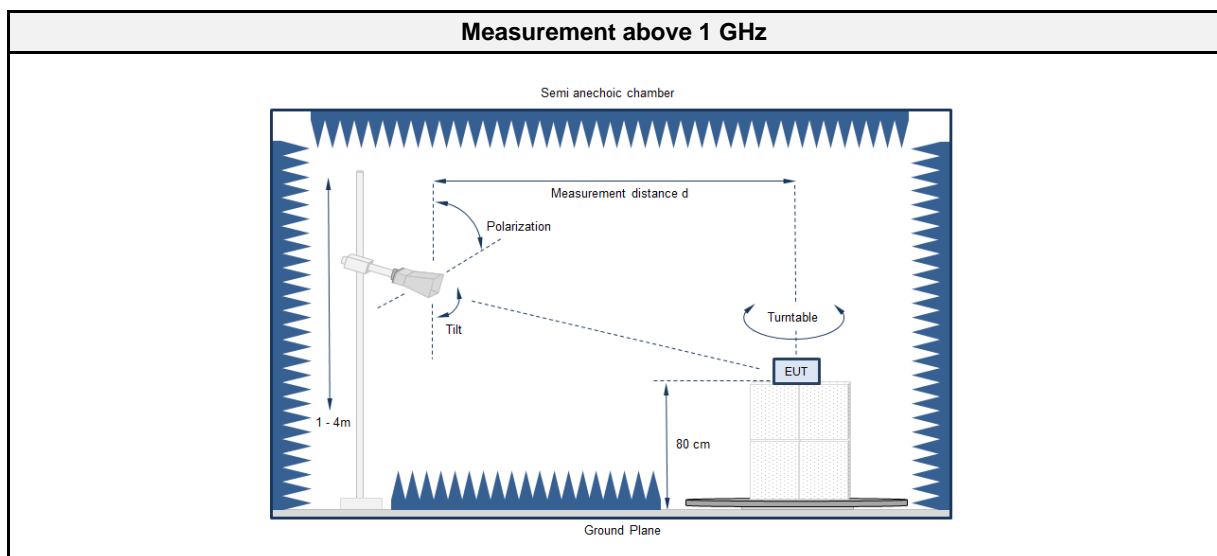
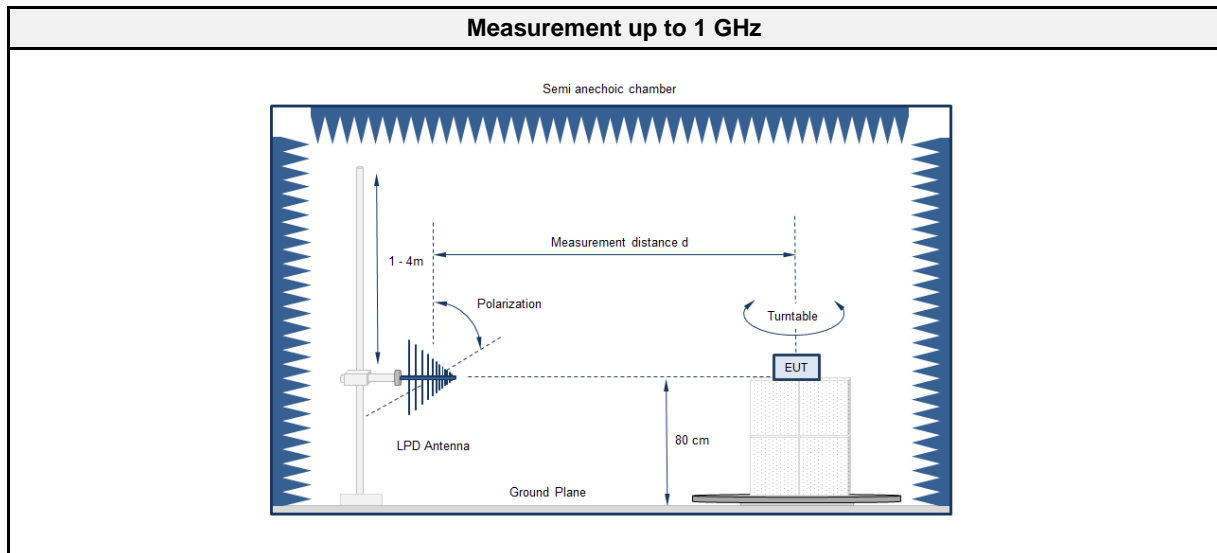
Possible Test Case Verdicts	
PASS	Test object does meet the requirements
FAIL	Test object does not meet the requirements
N/T	Required by standard but not tested
N/R	Not required by standard for the test object

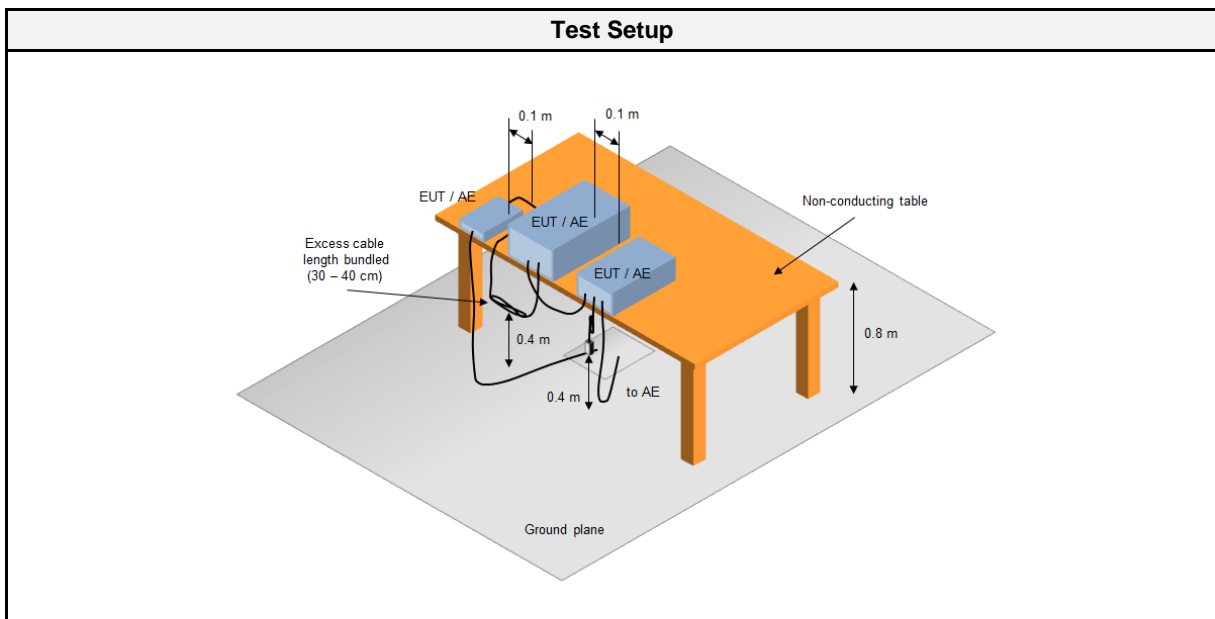
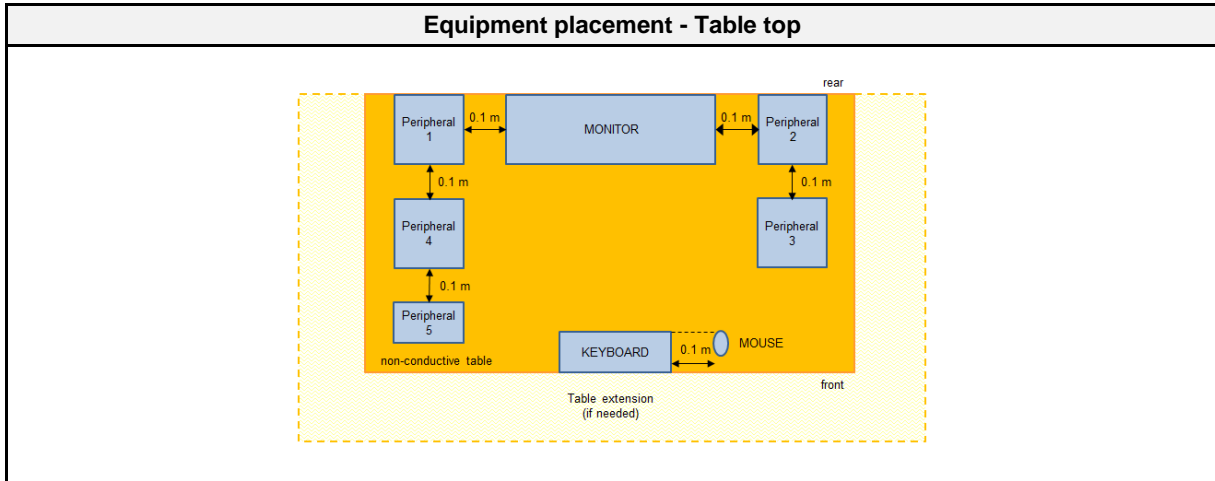
2.1 Test Conditions and Results - Radiated emissions acc. to ANSI C63.4

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 (2.4 GHz ISM band)
Measurement range	30 MHz to 13000 MHz
Temperature [°C]	23 ± 1
Humidity [%]	41 ± 2
Operator	Manuel Engel
Date	2022-05-30

2.1.2 Setup





2.1.3 Equipment

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

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic chamber (NSA)	Frankonia	AC6	EF00910	2021-07	2024-07
Anechoic chamber (SVSWR)	Frankonia	AC6	EF00899	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
Horn Antenna	ETS-Lindgren	3117	EF00976	2019-03	2022-03
Climatic Sensor	Embedded Data Systems, LLC.	9A00100000254 77E	EF01124	2021-03	2022-05

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 meter 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 1 GHz the antenna was placed on an adjustable height antenna mast. In the range 1- 18 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.

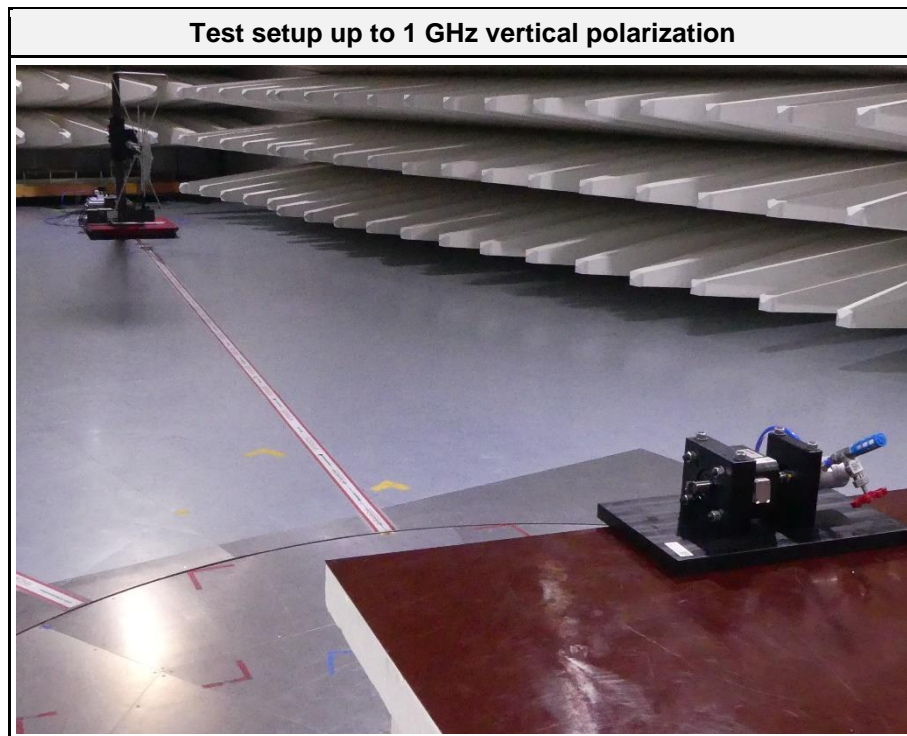
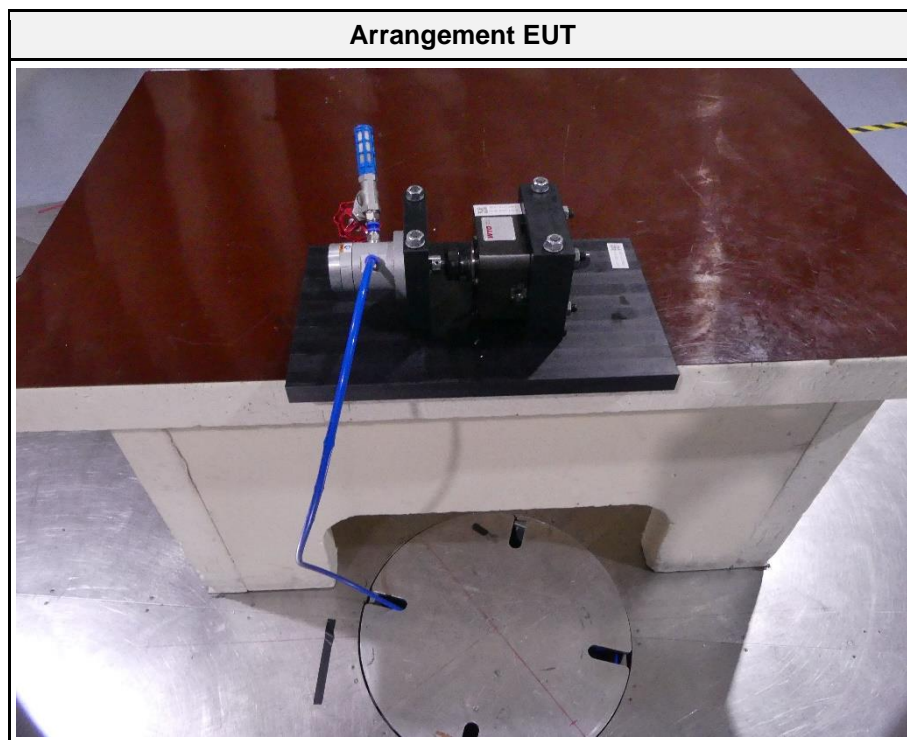
2.1.5 Limits

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 Average	74 54

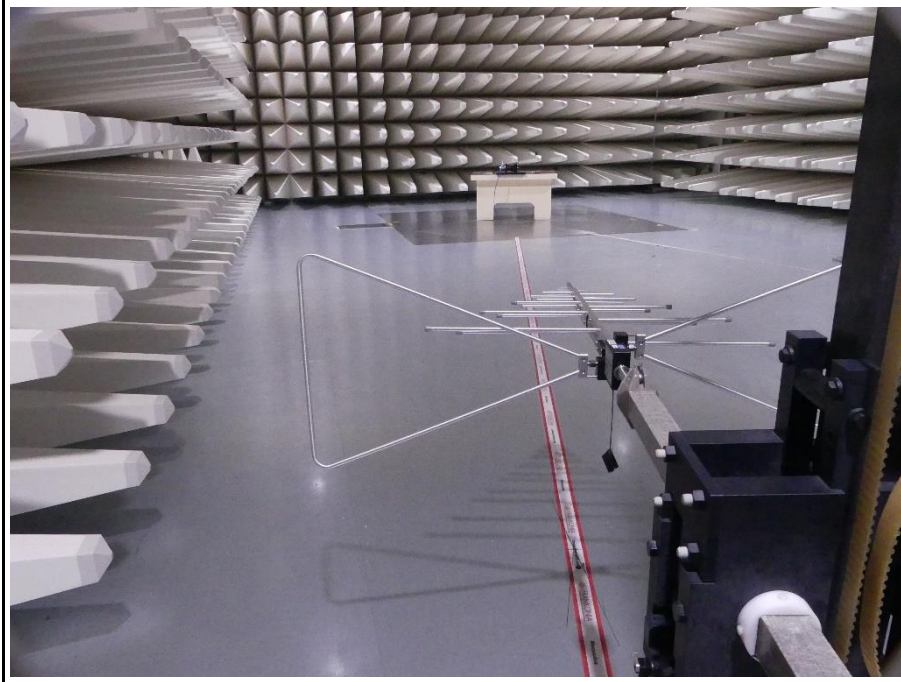
2.1.6 Results

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

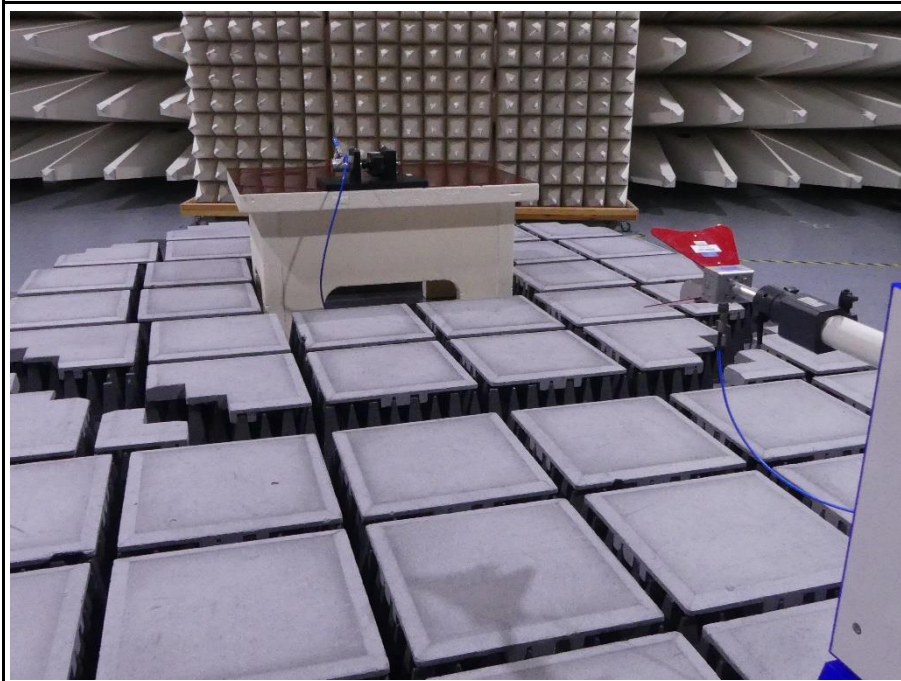
2.1.7 Setup Photos



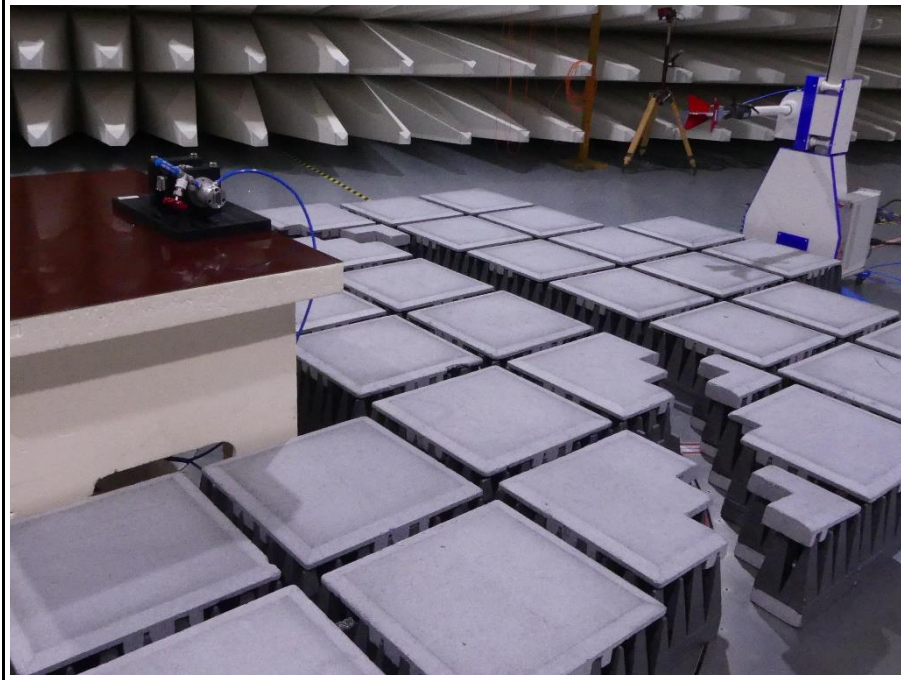
Test setup up to 1 GHz horizontal polarization



Test setup above 1 GHz vertical polarization



Test setup above 1 GHz horizontal polarization



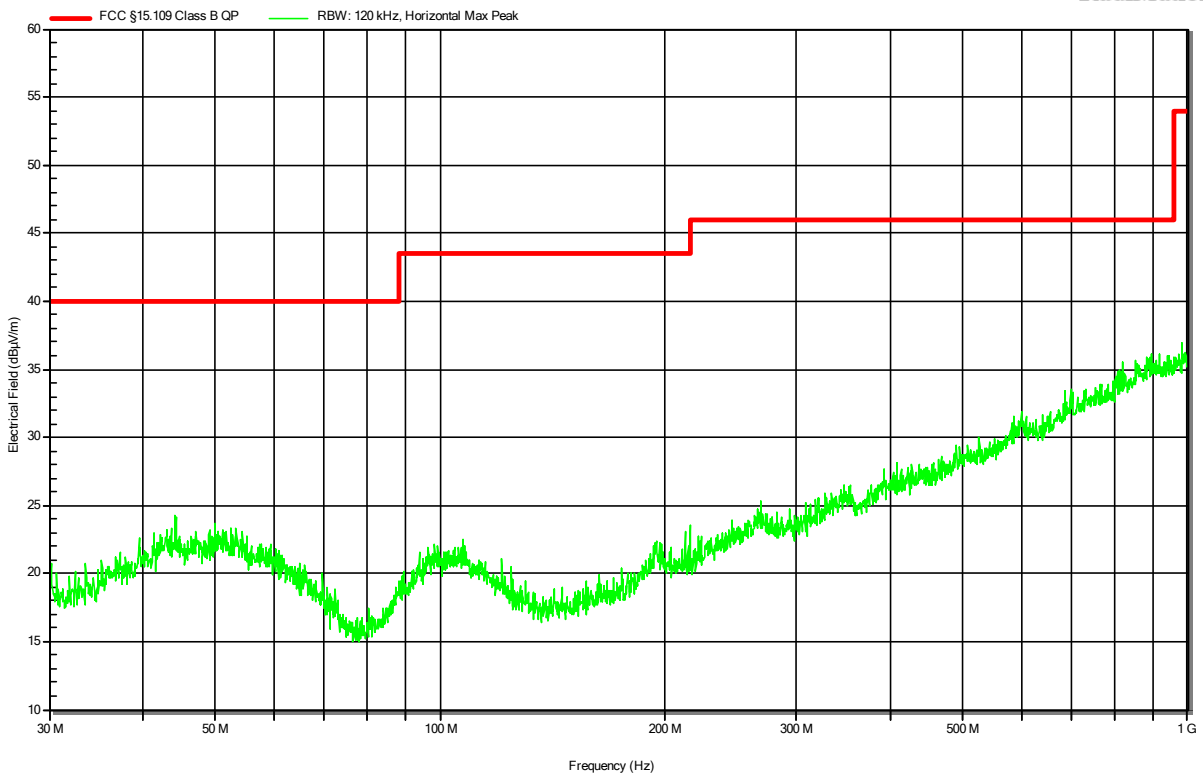
2.1.8 Records

Radiated emissions according to FCC 15B

Project Number:	G0M-2112-1232
Applicant:	WTO Werkzeug-Einrichtungen GmbH
Model Description:	SDTH Controller
Model:	WTO SC 002
Test Sample ID:	39927
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2022-05-30
Operating Conditions:	ambient temperature: 23 °Celsius power input: Powered by Harvester
Antenna:	Schwarzbeck VULB 9162, Horizontal
Measurement Distance:	10 m, converted to 3 m
Operational Mode:	Mode 1
EUT Configuration:	Configuration 1
Note 1:	Height 1 m, angle 0°

Index 8

RadiMation

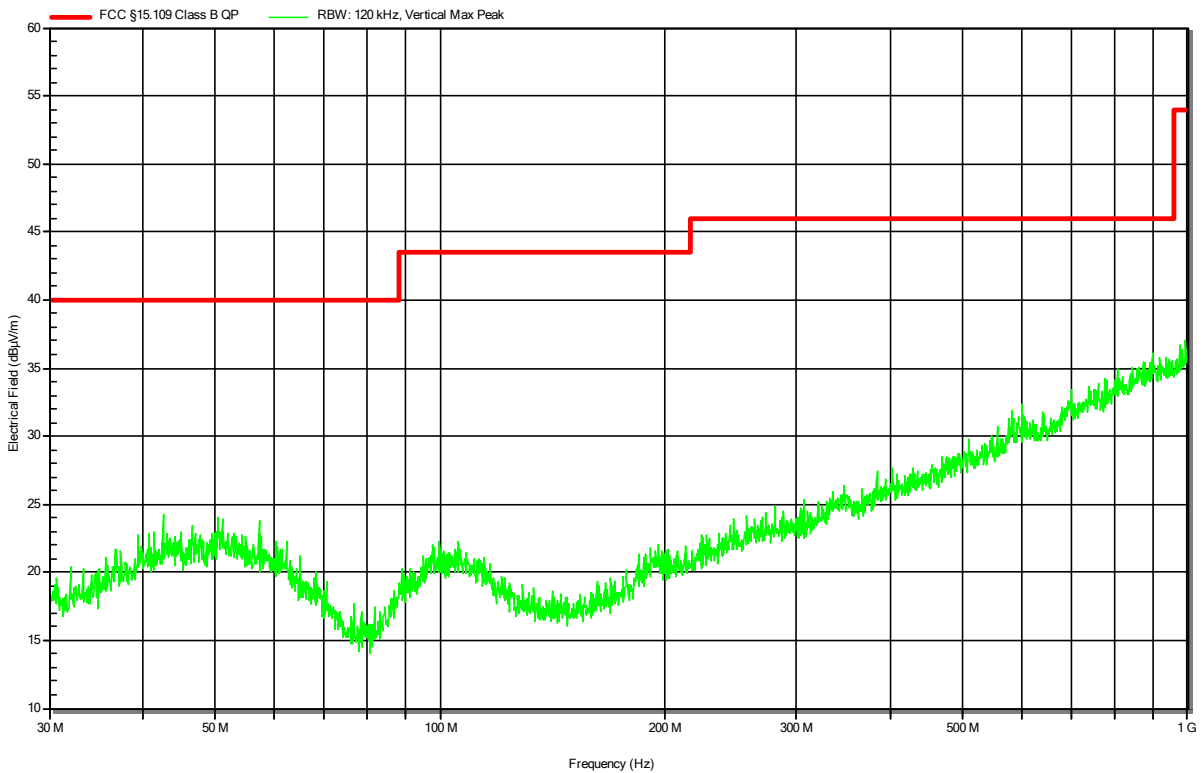


Radiated emissions according to FCC 15B

Project Number: G0M-2112-1232
 Applicant: WTO Werkzeug-Einrichtungen GmbH
 Model Description: SDTH Controller
 Model: WTO SC 002
 Test Sample ID: 39927
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Engel
 Test Date: 2022-05-30
 Operating Conditions: ambient temperature: 23 °Celsius
 power input: Powered by Harvester
 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 7

RadiMation

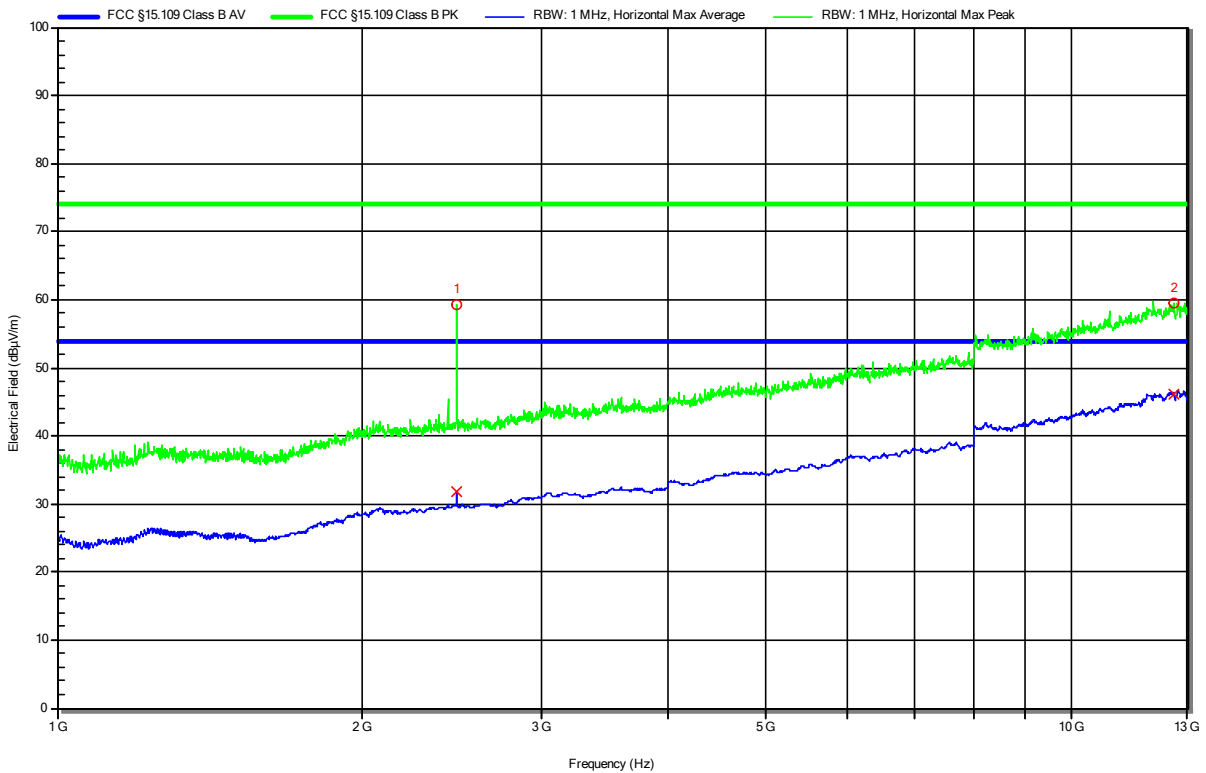


Radiated emissions according to FCC 15B

Project Number: G0M-2112-1232
 Applicant: WTO Werkzeug-Einrichtungen GmbH
 Model Description: SDTH Controller
 Model: WTO SC 002
 Test Sample ID: 39927
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Engel
 Test Date: 2022-05-30
 Operating Conditions: ambient temperature: 23 °Celsius
 power input: Powered by Harvester
 Antenna: ETS-Lindgren 3117, Horizontal
 Measurement Distance: 3 m
 Operational Mode: Mode 1
 EUT Configuration: Configuration 1

Index 1

RadiMation



Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	2.477 GHz	59.4 dBµV/m	74 dBµV/m	-14.6 dB	Carrier 2.4 GHz ISM band		
2	12.583 GHz	59.5 dBµV/m	74 dBµV/m	-14.4 dB	Pass	0 degrees	1 m

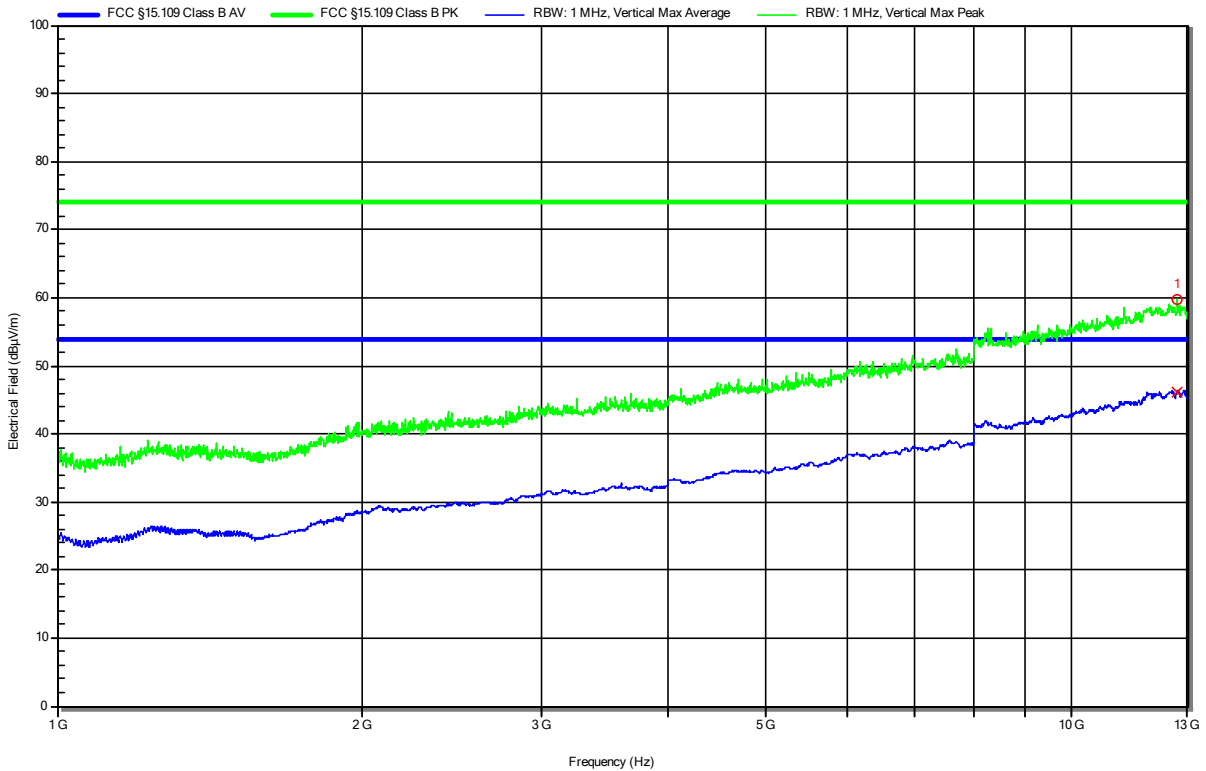
Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	2.477 GHz	31.8 dBµV/m	54 dBµV/m	-22.2 dB	Carrier 2.4 GHz ISM band		
2	12.583 GHz	46.2 dBµV/m	54 dBµV/m	-7.8 dB	Pass	0 degrees	1 m

Radiated emissions according to FCC 15B

Project Number: G0M-2112-1232
 Applicant: WTO Werkzeug-Einrichtungen GmbH
 Model Description: SDTH Controller
 Model: WTO SC 002
 Test Sample ID: 39927
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Engel
 Test Date: 2022-05-30
 Operating Conditions: ambient temperature: 23 °Celsius
 power input: Powered by Harvester
 Antenna: ETS-Lindgren 3117, Vertical
 Measurement Distance: 3 m
 Operational Mode: Mode 1
 EUT Configuration: Configuration 1

Index 2

RadiMation



Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	12.694 GHz	59.7 dBµV/m	74 dBµV/m	-14.3 dB	Pass	0 degrees	1 m
Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	12.694 GHz	46.1 dBµV/m	54 dBµV/m	-7.9 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	30 MHz to 1 GHz @ 10 m, 6.25 dB 1 GHz to 6 GHz @ 3 m, 4.86 dB 6 GHz to 18 GHz @ 3 m, max. 5.39 dB