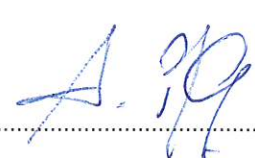


EMC TEST REPORT FCC Title 47 CFR Part 15B, ISED ICES-003 Issue 7	
Report Reference No	G0M-2205-1489-EF0115B-V01
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	    A2LA - Registration number: 1983.01 (ISED) ISED wireless device testing laboratory: CN 3470A DAkkS - Registration number : D-PL-12092-01-04 (FCC) FCC Filed Test Laboratory, Reg.-No.: 96970
Applicant	Testo SE & Co. KGaA
Address	Celciusstr. 2 79822 Titisee-Neustadt 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	testo 316i / Battery powered (6x AA) detector for fluegas with LED and Bluetooth Low Energy
Model(s)	testo 316i
Additional Model(s)	None
Brand Name(s)	testo
Hardware Version(s)	2.0
Software Version(s)	0.2.3
FCC-ID	WAF-TESTO316
IC	6127B-TESTO316
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	2022-06-09	
Report:		
Compiled by	Florian Voigt	
Tested by (+ signature)	Florian Voigt	
Supervised by (+ signature) (Responsible for Test)	Matthias Handrik	
Approved by (+ signature) (Test Lab Engineer)	Andreas Pflug	
Date of Issue	2022-09-21	
Total number of pages	33	
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	2022-09-21	Initial Release	-

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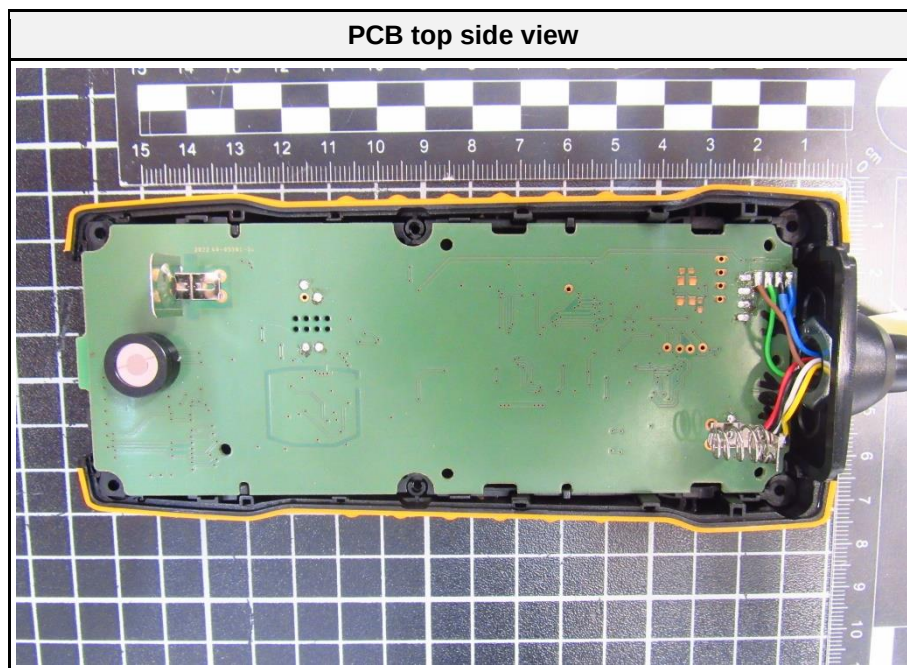
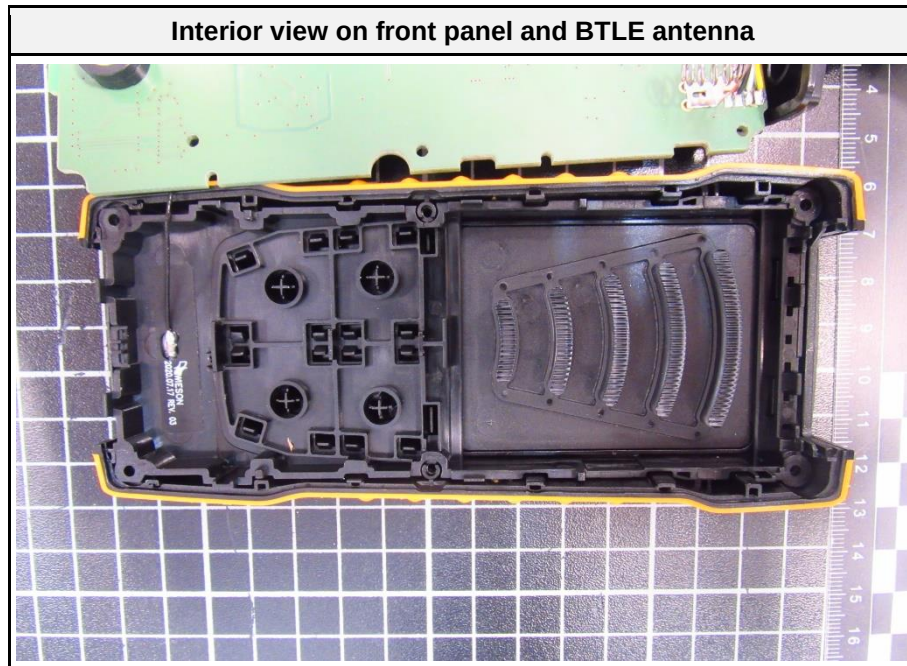
1 Equipment (Test Item) Under Test

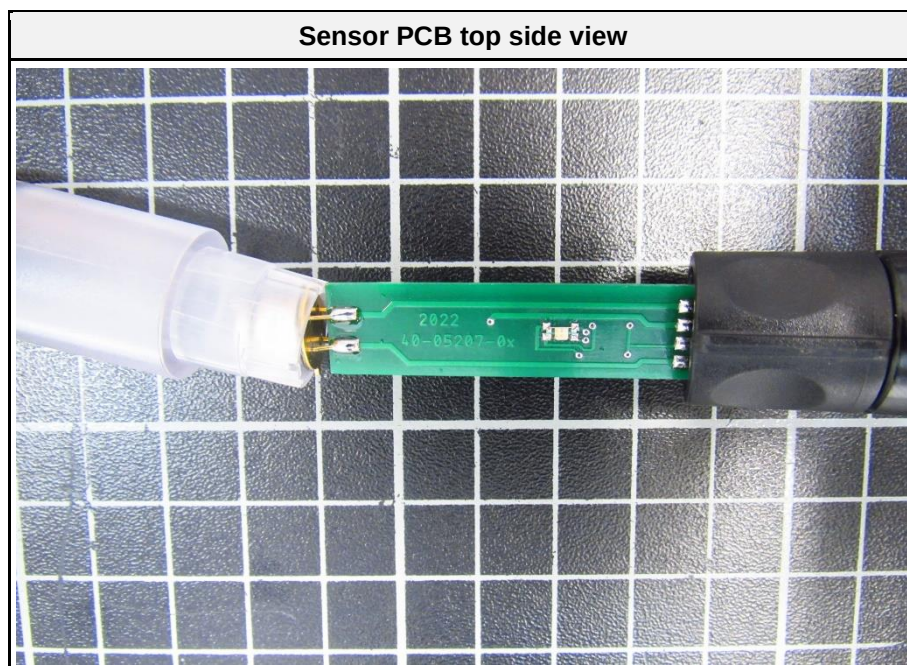
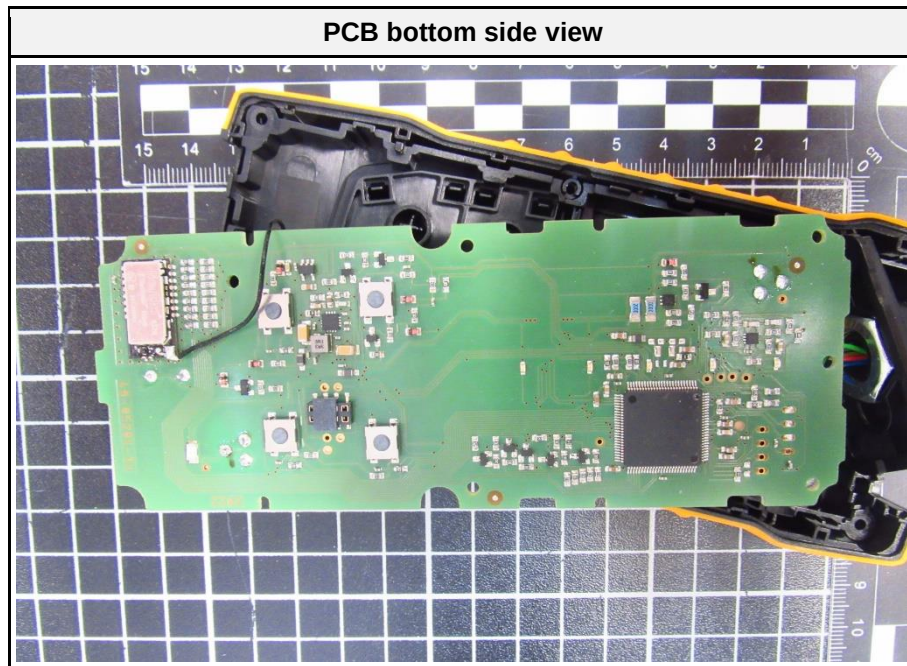
Description	testo 316i / Battery powered (6x AA) detector for fluegas with LED and Bluetooth Low Energy		
Intended Use	Detection and measurement of gas concentrations.		
Model	testo 316i		
Additional Model(s)	None		
Brand Name(s)	testo		
Hardware Version(s)	2.0		
Software Version(s)	0.2.3		
Number of tested samples	1		
Sample Identification	EUT #	Sample-ID	Serial Number
	EUT 1	40111	Demo Unit 220660101
EUT Dimensions [cm]	54.5 x 6.5 x 3.5		
FCC-ID	WAF-TESTO316		
IC	6127B-TESTO316		
Class	Class B		
Equipment type	Table top		
Highest internal frequency [MHz]	2480		
Protective Earth	No		
Radio Module	Type	Bluetooth Low Energy	
	Model	LSD4BT-S37B	
	Manufacturer	Lierda Science & Technology Group Co., Ltd.	
Supply Voltage	V _{NOM}	9 V DC (6 x Battery 1,5V non-rechargeable battery)	
AC/DC-Adaptor	None		
Manufacturer	Testo SE & Co. KGaA Celcisustr. 2 79822 Titisee-Neustadt Germany		

1.1 Equipment Ports

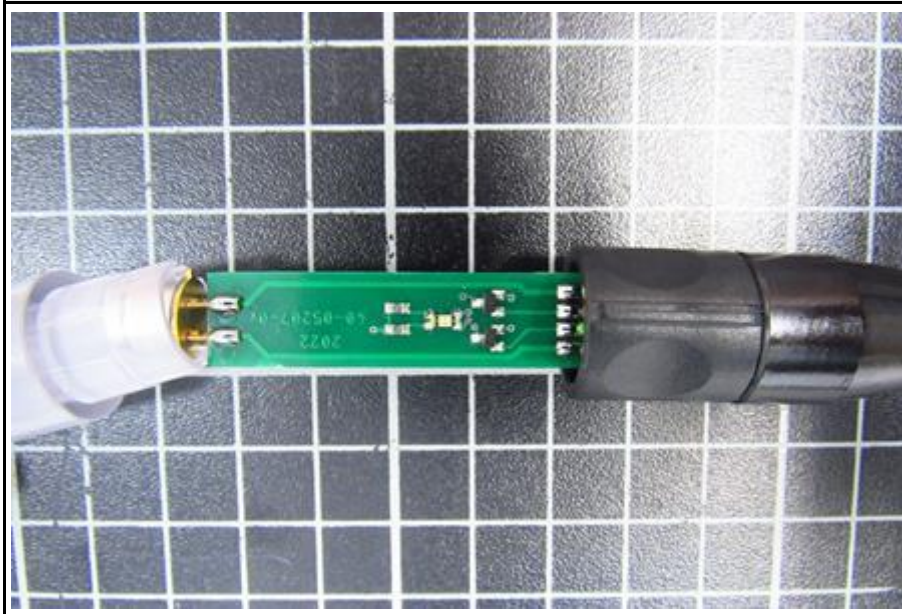
Name	Type	Attributes	Comment
None			
Description:			
AC	AC mains power input/output port		
DC	DC power input/output port		
BAT	DC power input port connected to external battery		
IO	Input/Output port		
TP	Telecommunication port		
NE	Non-electrical port		

1.2 Equipment Photos - Internal

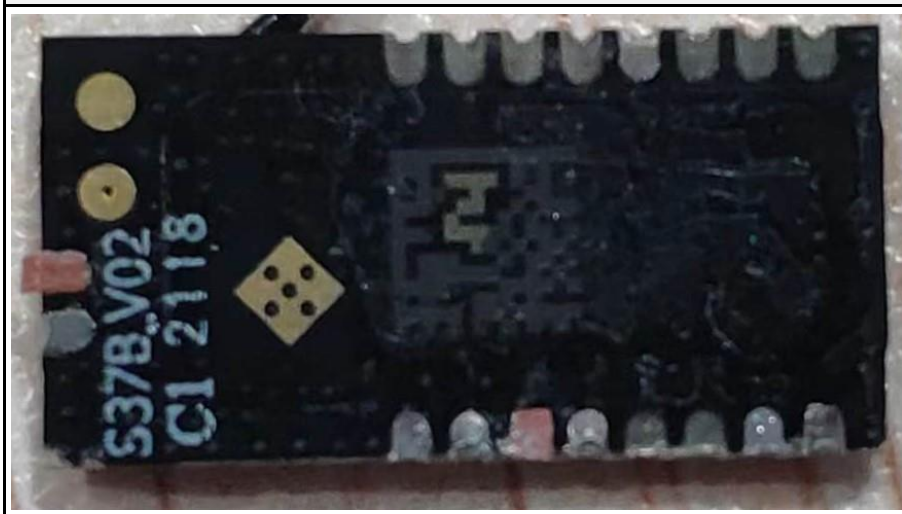




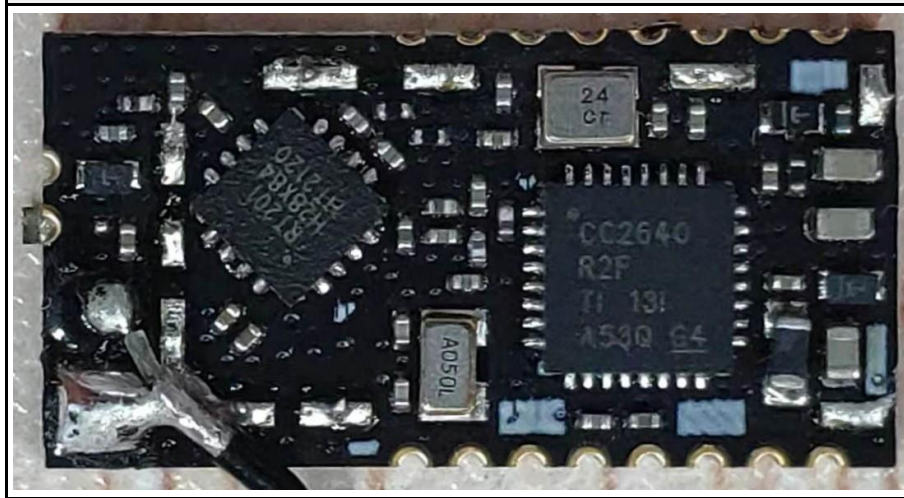
Sensor PCB bottom side view



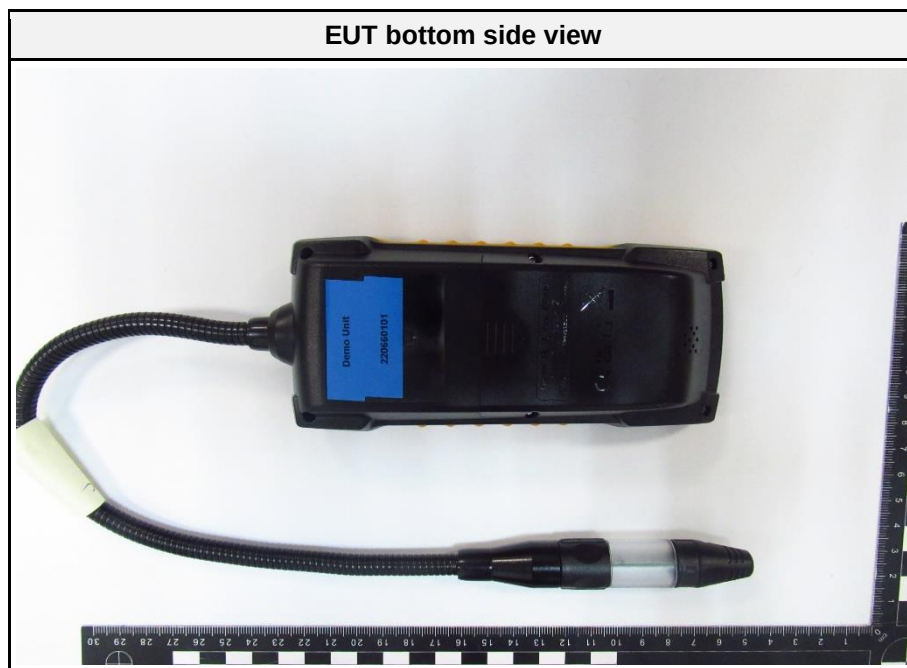
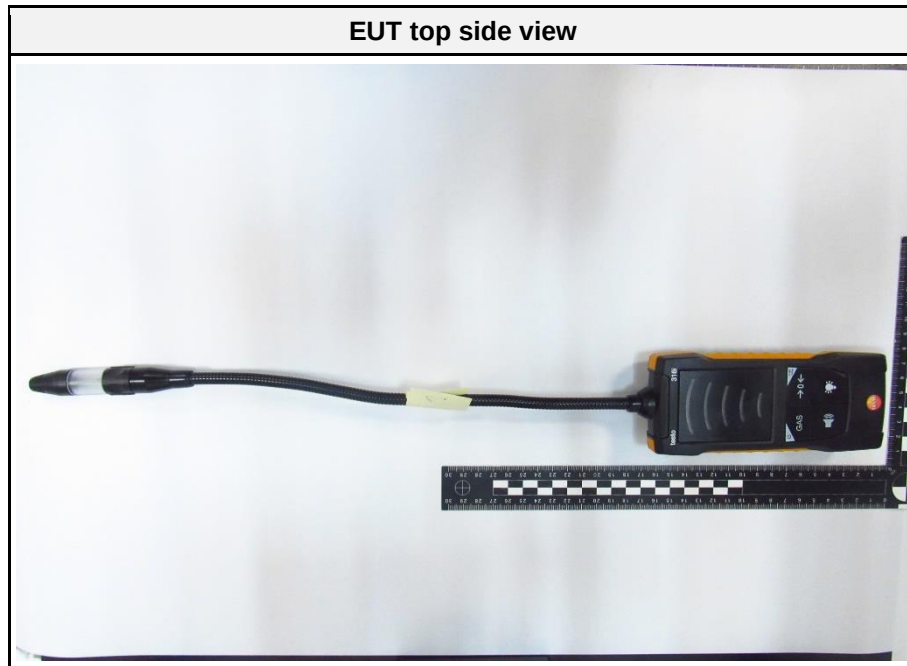
Modul S37 Back_Detail



Modul S37 Front_Detail



1.3 Equipment Photos - External



EUT front side view



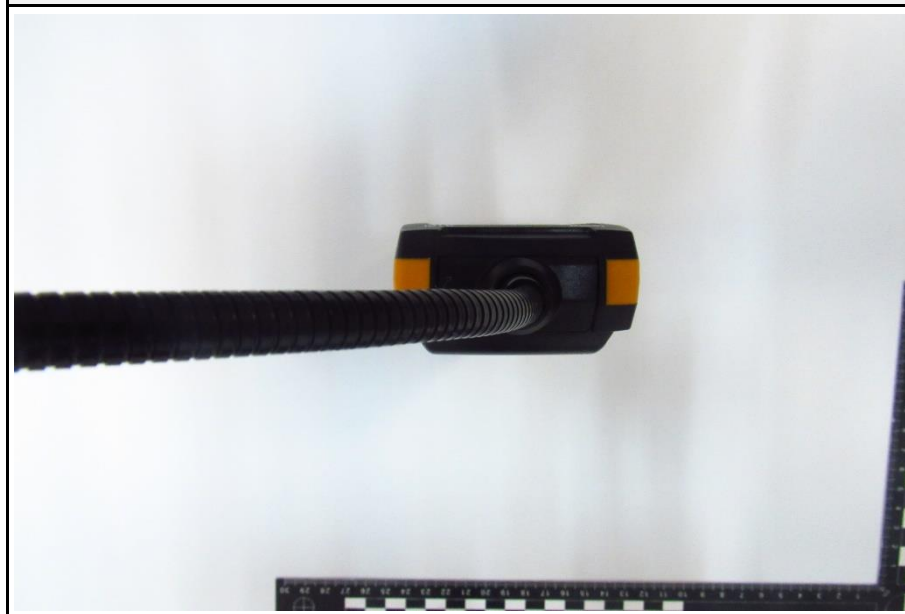
EUT left side view



EUT right side view



EUT back side view

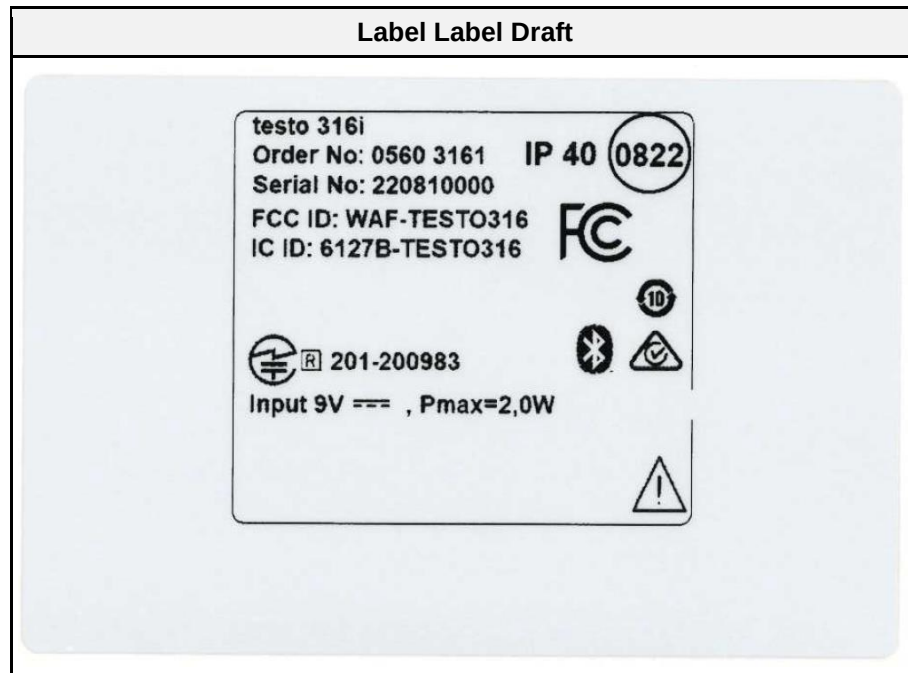


EUT batteries view



EUT Label





1.4 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
AE	Mobile handset	Motorola	Moto G4 Plus (XT1642)	Maintaining connection to EUT
AE	Companion Android-Application	Testo	testo Smart v15.4.0.62224	Customer support equipment; Continuously reading data from EUT
Description:				
AE	Auxiliary Equipment			
SIM	Simulator			
MON	Monitoring Equipment			
CBL	Connecting Cable			
Comment:				

1.5 Operational Modes

Mode #	Description
1	EUT is measuring continuously each second the gas concentration and transmitting the results to the companion Android-Application for display via BTLE.
Comment:	

1.6 EUT Configuration

Configuration #	Description
1	EUT assembled with 6x1.5V DC non-rechargeable batteries.
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	Not directly or indirectly connectable to mains network
Comment:				

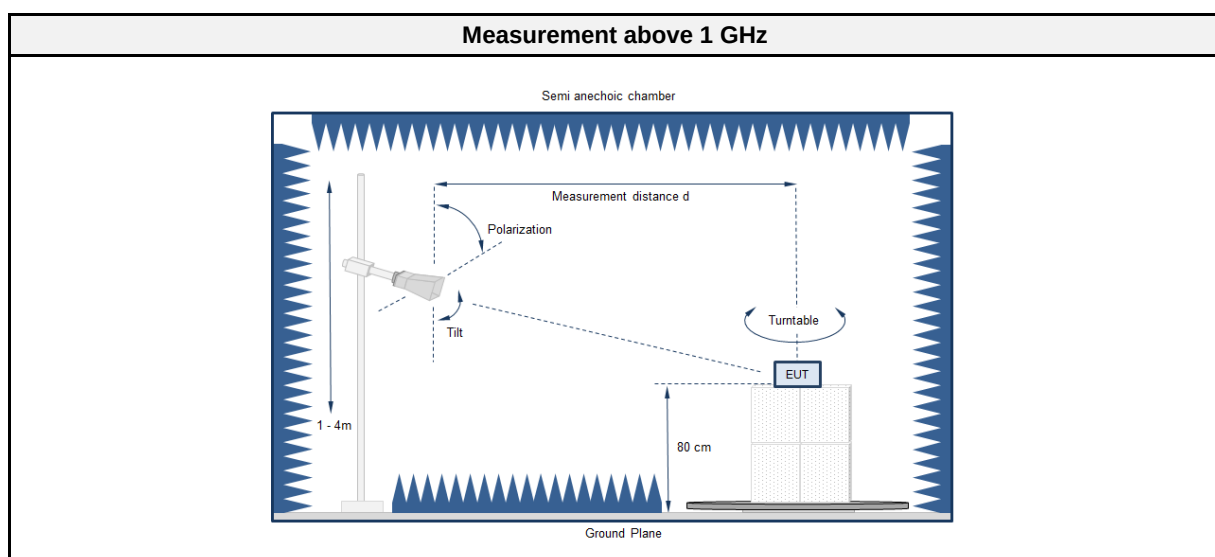
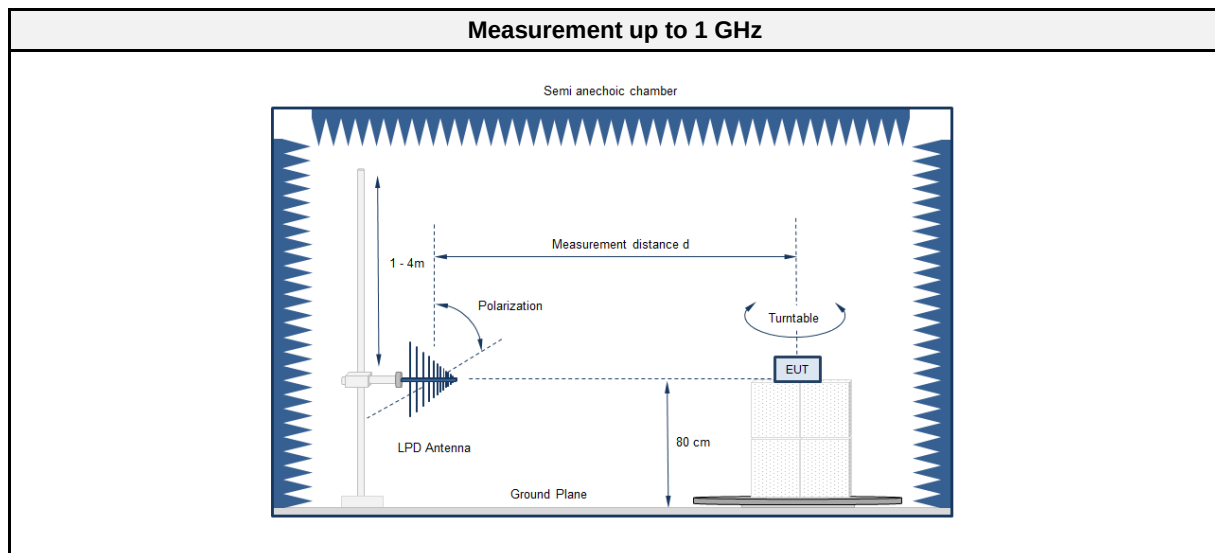
Possible Test Case Verdicts	
PASS	Test object does meet the requirements
FAIL	Test object does not meet the requirements
N/T	Required by standard but not tested
N/R	Not required by standard for the test object

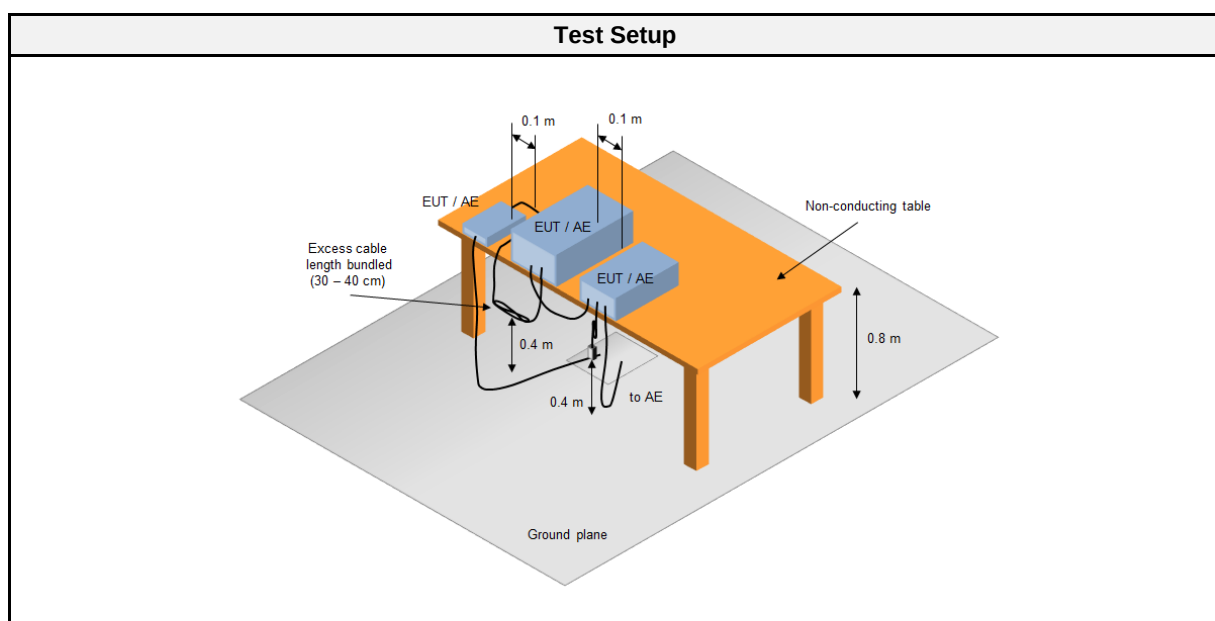
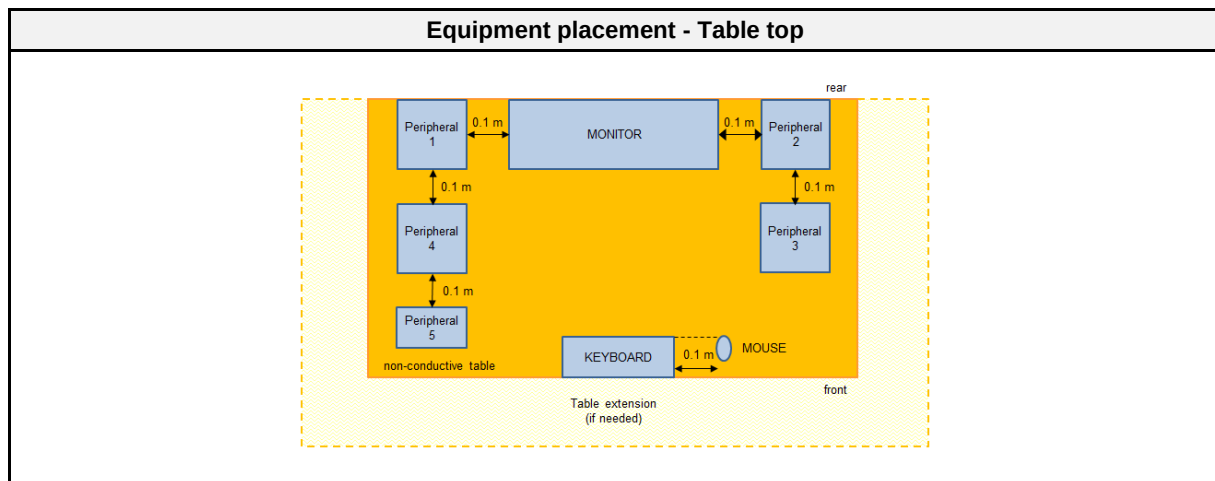
2.1 Test Conditions and Results - Radiated emissions acc. to ANSI C63.4

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	Portable
Highest internal frequency [MHz]	2480
Measurement range	30 MHz to 13000 MHz
Temperature [°C]	22 ±3
Humidity [%]	55 ±3
Operator	Florian Voigt
Date	2022-06-09

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	AC1	EF00062	2021-02	2024-02
Anechoic chamber (SVSWR)	Frankonia	AC 1	EF01011	2019-06	2022-06
EMI Test Receiver	Keysight	N9038A-526/WXP	EF01070	2021-07	2022-07
Biconical Antenna	R&S	HK 116	EF00030	2021-05	2024-05
LPD Antenna	R&S	HL 223	EF01565	2020-03	2023-03
Horn Antenna	Schwarzbeck	BBHA9120D	EF00018	2019-10	2022-10
Climatic Sensor	Embedded Data Systems, LLC.	2800100000254 17E	EF01054	2022-04	2023-04

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 m distance from the receive antenna. The antenna output was connected to the measurement receiver.
2.	A biconical antenna was used for the frequency range 30 – 200 MHz, a logarithmic periodical antenna was used for the frequency range from 200 – 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.

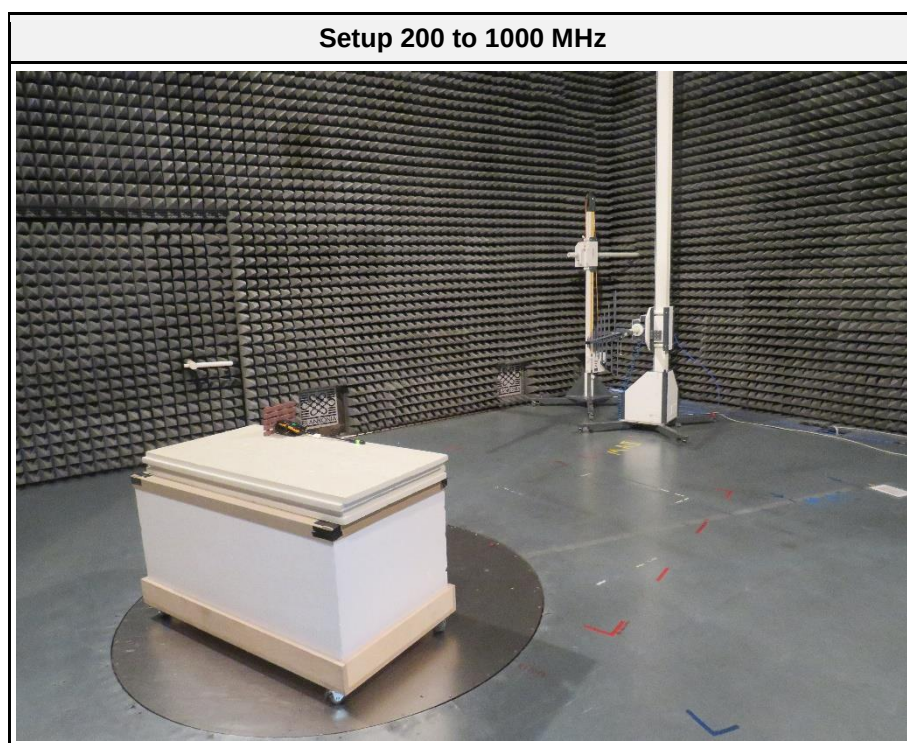
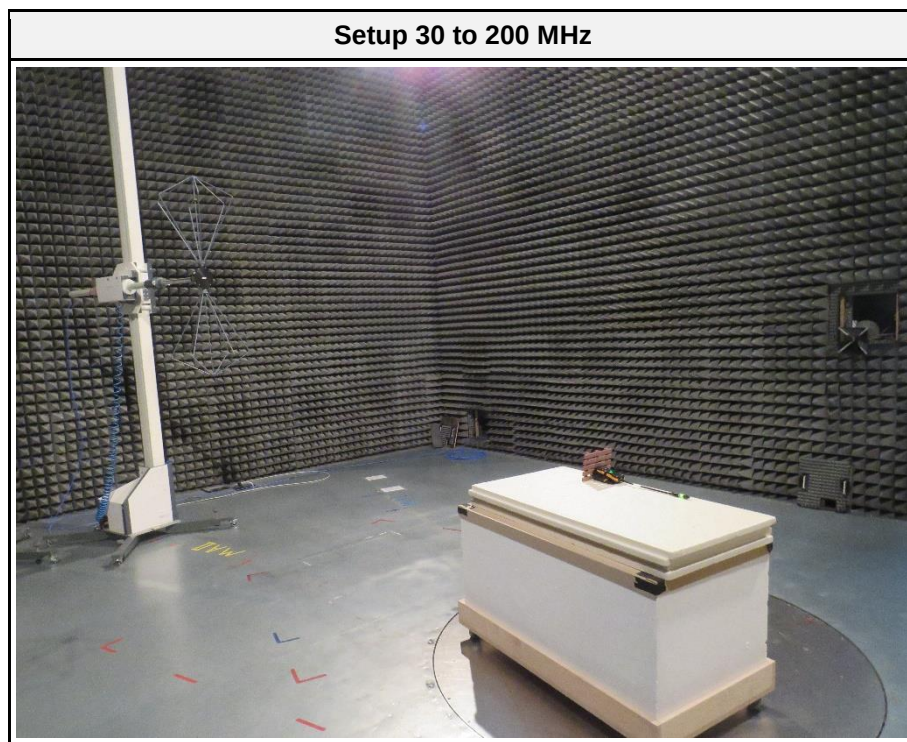
2.1.5 Limits

Class B @ 3 m		
Frequency [MHz]	Detector	Limit [dB μ V/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

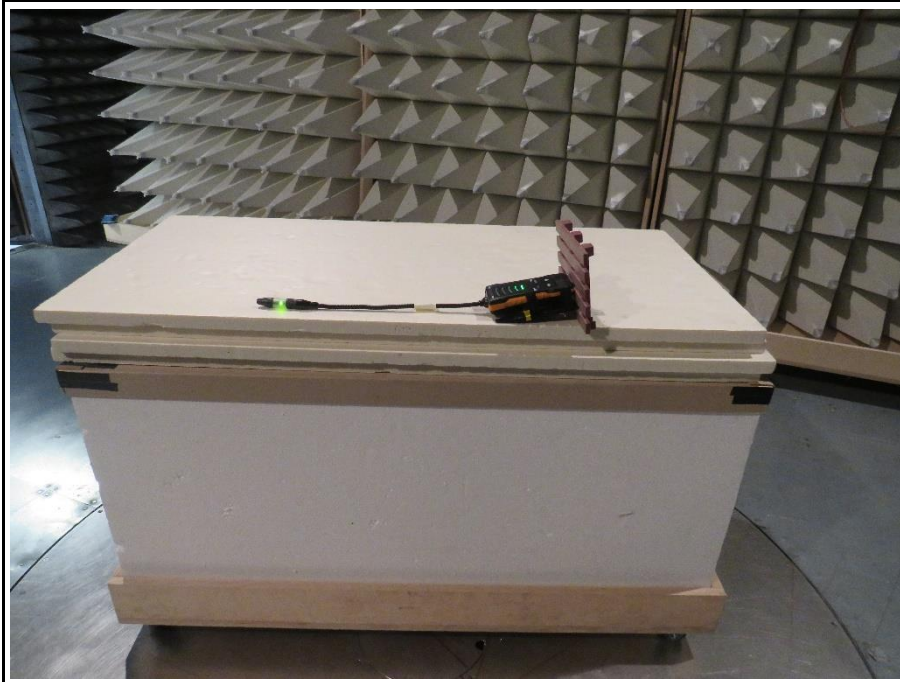
2.1.6 Results

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

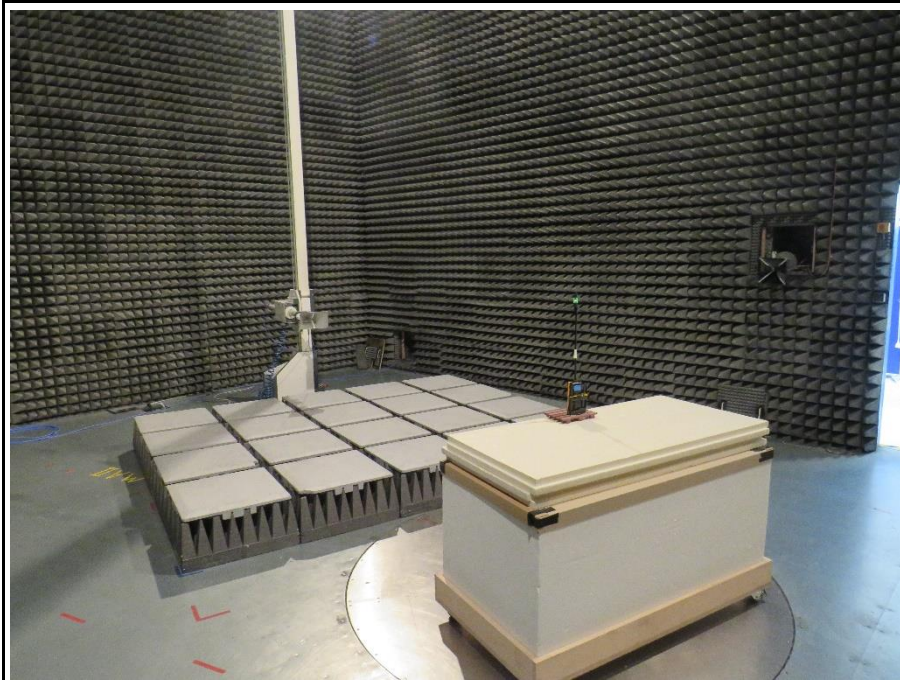
2.1.7 Setup Photos



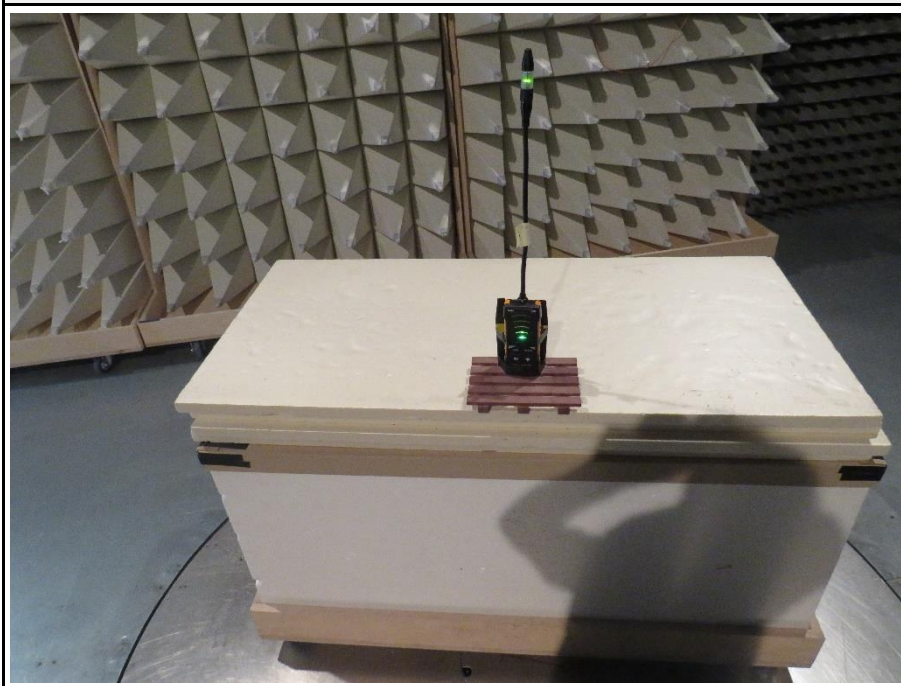
Setup EUT view below 1GHz



Setup 1 to 13 GHz



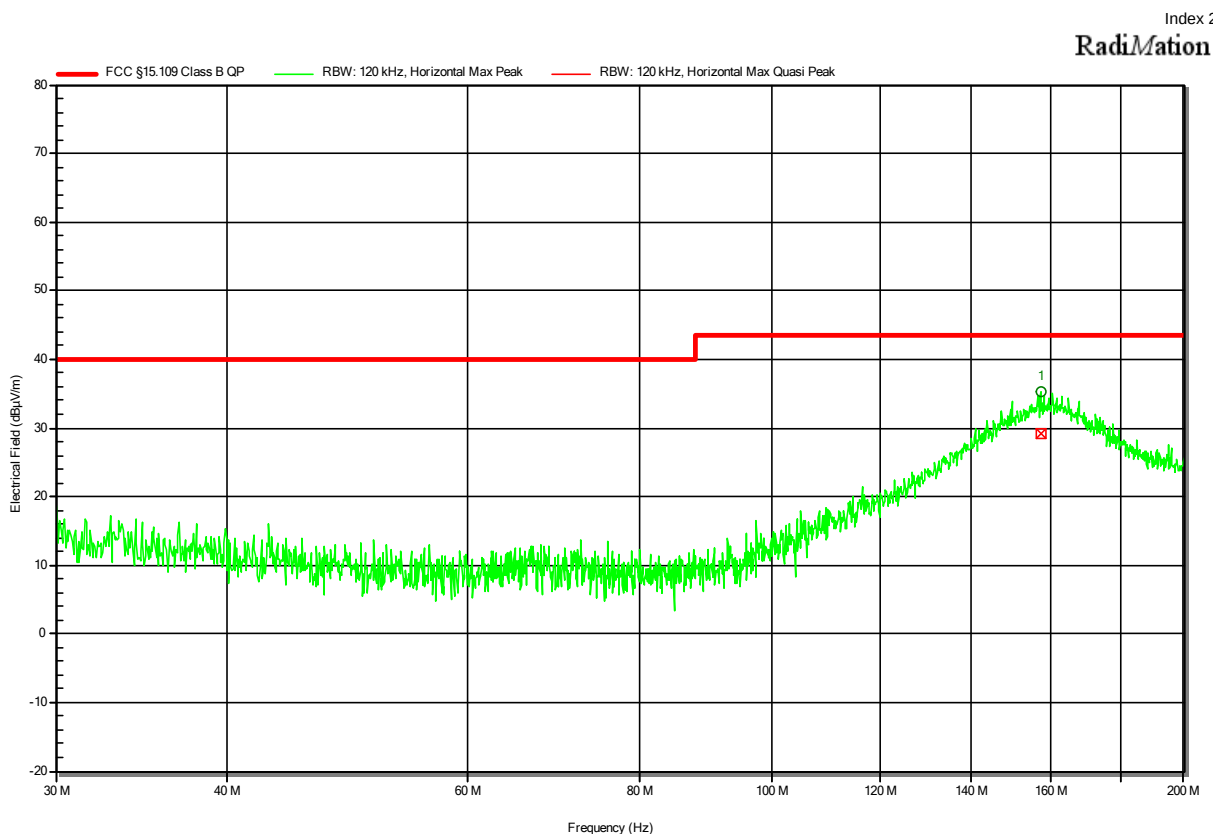
Setup EUT view above 1 GHz



2.1.8 Records

Radiated emissions according to FCC part 15B

Project Number: G0M-2205-1489
 Applicant: Testo SE & Co. KGaA
 Model Description: testo 316i / Battery powered (6x AA) detector for fluegas with LED and Bluetooth Low Energy / Order No. 0560 3161
 Model: testo 316i
 Test Sample ID: 40111
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Voigt
 Test Date: 2022-06-09
 Operating Conditions: ambient temperature: 22 °Celsius
 power input: 6.0 VD C
 Antenna: Rohde & Schwarz HK 116, Horizontal
 Measurement Distance: 3 m
 Operational Mode: 1
 EUT Configuration: 1
 Note 1:



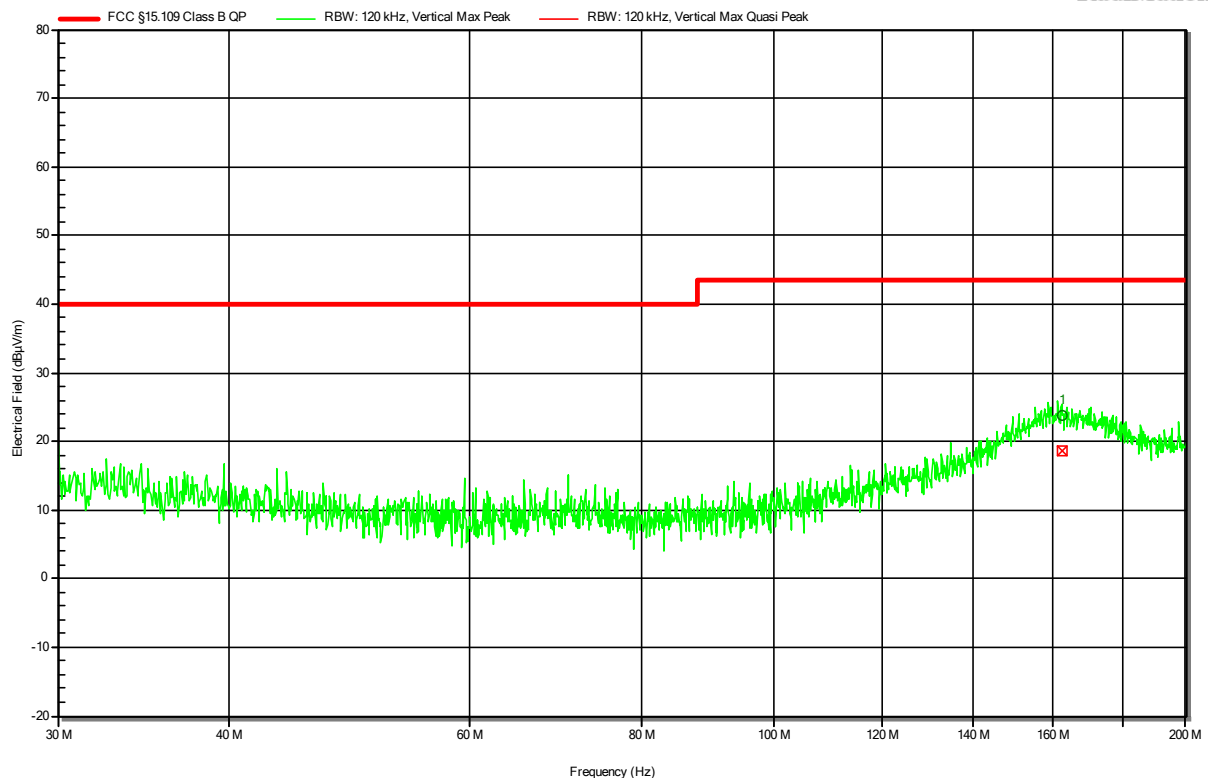
Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	157.155 MHz	29.21 dBµV/m	43.52 dBµV/m	-14.31 dB	Pass	0 degrees	2.05 m

Radiated emissions according to FCC part 15B

Project Number: G0M-2205-1489
Applicant: Testo SE & Co. KGaA
Model Description: testo 316i / Battery powered (6x AA) detector for fluegas with LED and Bluetooth Low Energy / Order No. 0560 3161
Model: testo 316i
Test Sample ID: 40111
Test Site: Eurofins Product Service GmbH
Operator: Mr. Voigt
Test Date: 2022-06-09
Operating Conditions: ambient temperature: 22 °Celsius
power input: 6.0 VD C
Antenna: Rohde & Schwarz HK 116, Vertical
Measurement Distance: 3 m
Operational Mode: 1
EUT Configuration: 1
Note 1:

Index 3

RadiMation



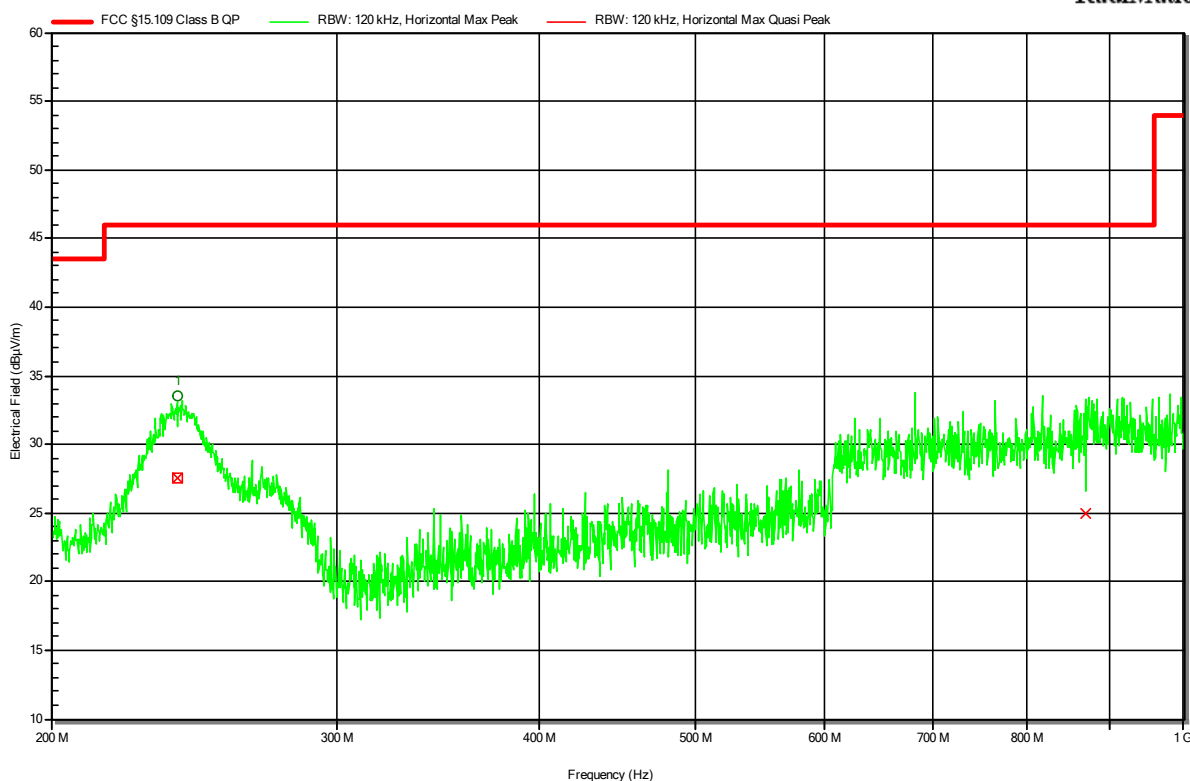
Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	162.556 MHz	18.52 dBµV/m	43.52 dBµV/m	-25.01 dB	Pass	125 degrees	2.05 m

Radiated emissions according to FCC part 15B

Project Number: G0M-2205-1489
Applicant: Testo SE & Co. KGaA
Model Description: testo 316i / Battery powered (6x AA) detector for fluegas with LED and Bluetooth Low Energy / Order No. 0560 3161
Model: testo 316i
Test Sample ID: 40111
Test Site: Eurofins Product Service GmbH
Operator: Mr. Voigt
Test Date: 2022-06-09
Operating Conditions: ambient temperature: 22 °Celsius
power input: 6.0 VD C
Antenna: Rohde & Schwarz HL 223, Horizontal
Measurement Distance: 3 m
Operational Mode: 1
EUT Configuration: 1
Note 1:

Index 4

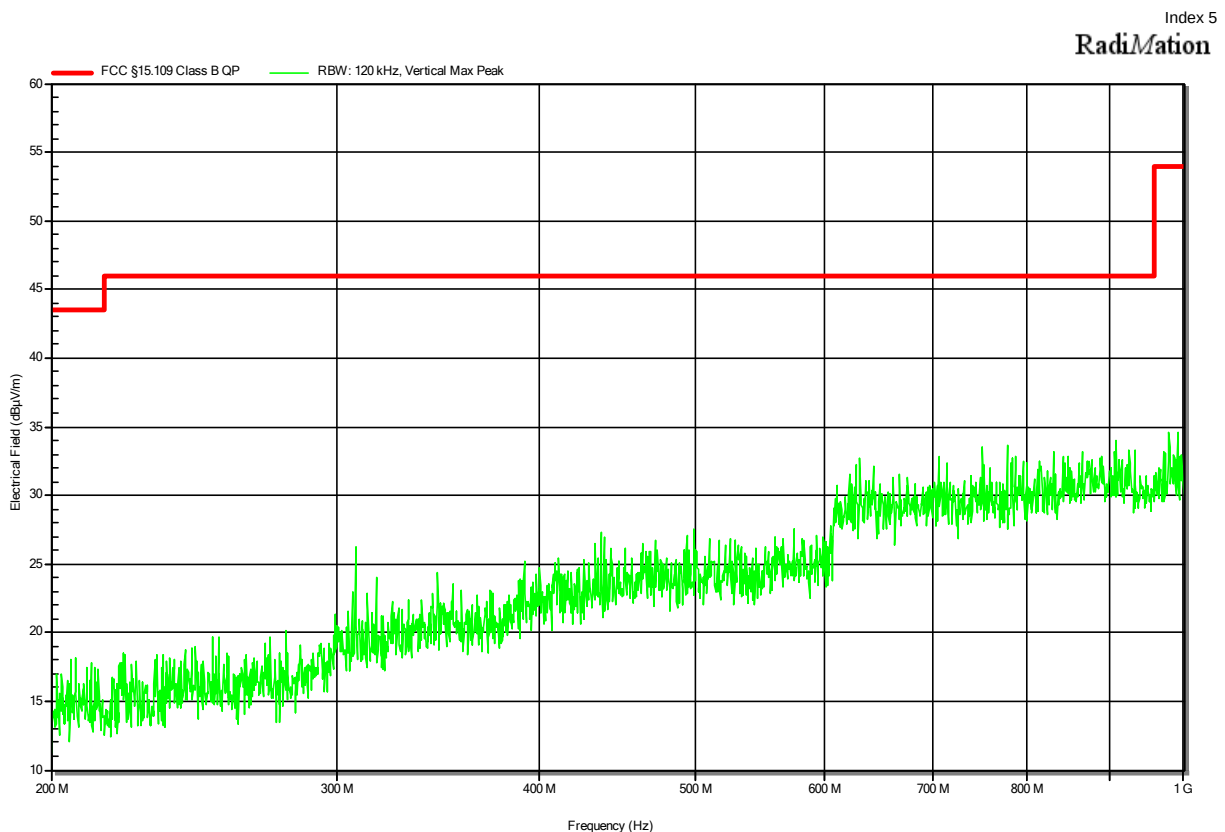
RadiMation



Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	239.361 MHz	27.56 dBµV/m	46.02 dBµV/m	-18.46 dB	Pass	0 degrees	1.37 m

Radiated emissions according to FCC part 15B

Project Number: G0M-2205-1489
Applicant: Testo SE & Co. KGaA
Model Description: testo 316i / Battery powered (6x AA) detector for fluegas with LED and Bluetooth Low Energy / Order No. 0560 3161
Model: testo 316i
Test Sample ID: 40111
Test Site: Eurofins Product Service GmbH
Operator: Mr. Voigt
Test Date: 2022-06-09
Operating Conditions: ambient temperature: 22 °Celsius
power input: 6.0 VD C
Antenna: Rohde & Schwarz HL 223, Vertical
Measurement Distance: 3 m
Operational Mode: 1
EUT Configuration: 1
Note 1:

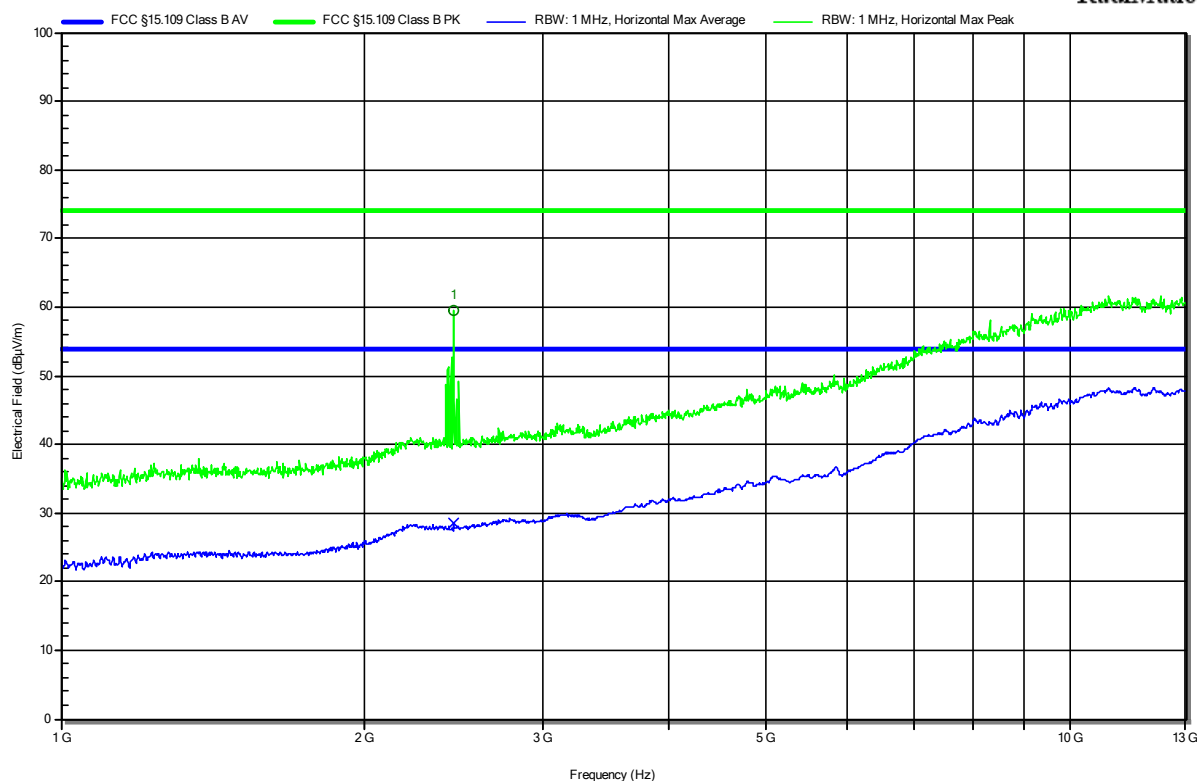


Radiated emissions according to FCC part 15B

Project Number: G0M-2205-1489
 Applicant: Testo SE & Co. KGaA
 Model Description: testo 316i / Battery powered (6x AA) detector for fluegas with LED and Bluetooth Low Energy / Order No. 0560 3161
 Model: testo 316i
 Test Sample ID: 40111
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Voigt
 Test Date: 2022-06-09
 Operating Conditions: ambient temperature: 22 °Celsius
 power input: 6.0 VD C
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement Distance: 3 m
 Operational Mode: 1
 EUT Configuration: 1
 Note 1:

Index 6

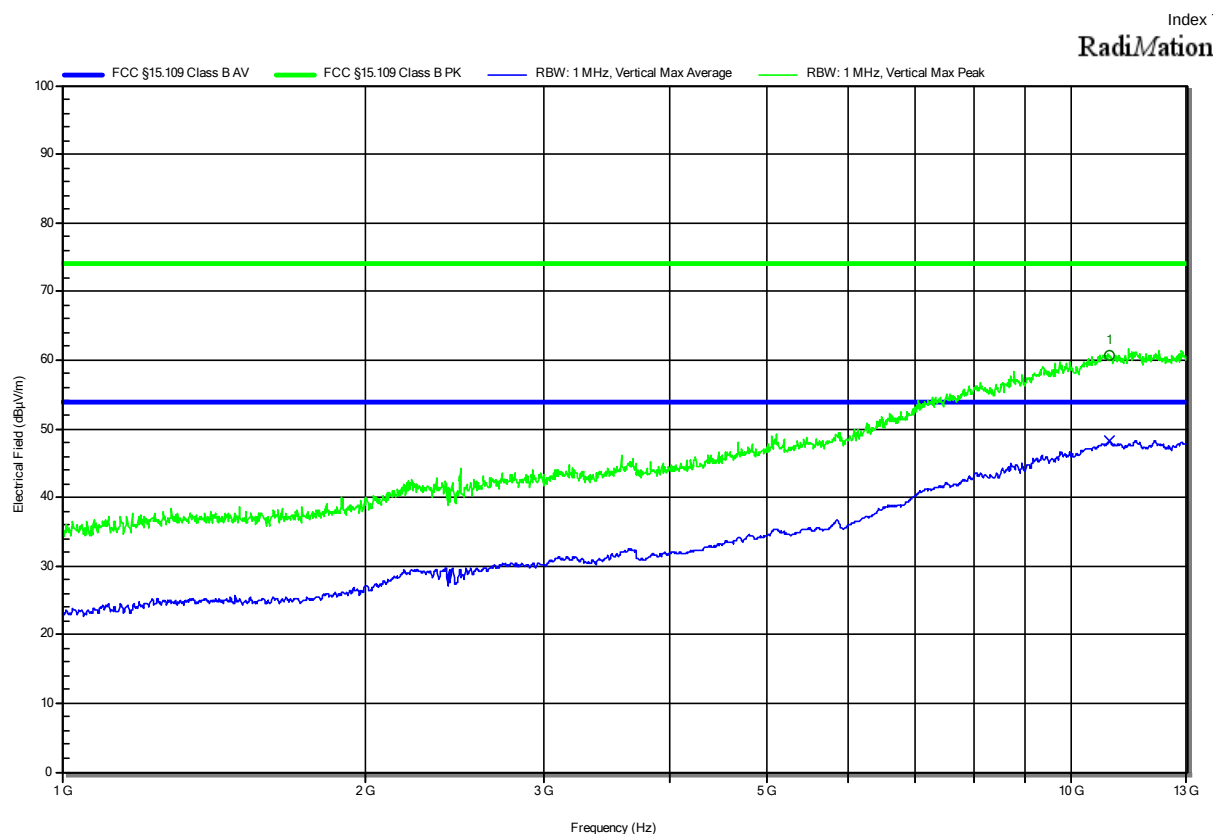
RadiMation



Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	2.448 GHz	59.41 dBµV/m	---	---	BLE carrier	---	---

Radiated emissions according to FCC part 15B

Project Number: G0M-2205-1489
 Applicant: Testo SE & Co. KGaA
 Model Description: testo 316i / Battery powered (6x AA) detector for fluegas with LED and Bluetooth Low Energy / Order No. 0560 3161
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 Test Date: 2022-06-09
 Operating Conditions: ambient temperature: 22 °Celsius
 power input: 6.0 VD C
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement Distance: 3 m
 Operational Mode: 1
 EUT Configuration: 1
 Note 1:



Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	10.9 GHz	60.79 dBµV/m	73.98 dBµV/m	-13.19 dB	Pass	0 degrees	1 m
Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	10.9 GHz	48.21 dBµV/m	53.98 dBµV/m	-5.77 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
Conducted emissions at the mains power port	150kHz to 30MHz, 3.35dB
Radiated Emission	30MHz to 200MHz @ 3m, 5.1dB 200MHz to 1GHz @ 3m, 5.3dB >1GHz to 13GHz @3m, 5.95dB