R F – T E S T R E P O R T

- FCC Part 15B -

Type / Model Name	:	ROX 12.1
Product Description	:	Bicycle Computer
Applicant	:	TQ Systems GmbH
Address	:	Gut Delling, Mühlstrasse 2
		82229 SEEFELD, GERMANY
Manufacturer	:	SIGMA-ELEKTRO GmbH
Address	:	Dr.-Julius-Leber-Strasse 15
		67433 NEUSTADT, GERMANY

Test Result according to the standards listed in clause 1 test standards:	**POSITIVE**

Test Report No. :	**80122879-09 Rev_1**	02. November 2022

Deutsche Akkreditierungsstelle
D-PL-12030-01-03
D-PL-12030-01-04

Contents

1 TEST STANDARDS 3

2 TEST RESULT SUMMARY 4

2.1 Revision history of test report 4
2.2 Final assessment 4

3 EQUIPMENT UNDER TEST 5

3.1 Information provided by the Client 5
3.2 Sampling 5
3.3 Photo documentation of the EUT – Detailed photos see Attachment A 5
3.4 General remarks 5
3.5 Power supply system utilised 5
3.6 Short description of the Equipment under Test (EUT) 5
3.7 EUT operation mode 5
3.8 EUT configuration 6

4 TEST ENVIRONMENT 7

4.1 Address of the test laboratory 7
4.2 Environmental conditions 7
4.3 Statement of the measurement uncertainty 7
4.4 Conformity Decision Rule 7
4.5 Measurement protocol for FCC and ISED 7

5 TEST CONDITIONS AND RESULTS 11

5.2 Radiated emission < 1 GHz (electric field) 14
5.3 Photo documentation of the test setup – see Attachment B Part SER 2 14
5.4 Radiated emission > 1 GHz (electric field) 17

6 USED TEST EQUIPMENT AND ACCESSORIES 20

7 DETAILED MEASUREMENT UNCERTAINTY 21

7.1 Overview 21
7.2 Definitions and symbols 21
7.3 Measurement uncertainty 21

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15 Subpart B - Unintentional Radiators (September 2021)

Part 15, Subpart B, Section 15.109	Radiated emission, general requirements ☐ Class A device ☒ Class B device
ANSI C63.4: 2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
CISPR 16-4-2: 2011 + A1: 2014 EN 55016-4-2: 2011	Uncertainty in EMC measurement

ISED Canada Rules and Regulations - Information Technology Equipment (Including Digital Apparatus)

ICES-003, Issue 7, October 15, 2020	Radiated emission ☐ Class A device ☒ Class B device
ANSI C63.4: 2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

2 TEST RESULT SUMMARY

FCC Rule Part	ISED Standard	Description
15.107	ICES-003/RSS-Gen	AC power line conducted emissions
15.109	ICES-003/RSS-Gen	Radiated Emissions

Type of test		Test result
Emission:		
A4	Conducted emission (AC mains power / DC power)	passed
A5	Radiated emission (< 1 GHz)	passed
SER 3	Radiated emission (> 1 GHz)	passed

A4 not applicable, EUT is a mobile device

2.1 Revision history of test report

Test report No	Rev.	Issue Date	Changes
80122879-09	2	02 November 2022	Test Mode “JBP” (EUT over USB to PC) measured

The test report with the highest revision number replaces the previous test reports.

2.2 Final assessment

Select final Assessment

Date of receipt of test sample : acc. to storage records

Testing commenced on : 20 May 2022

Testing concluded on : 10 June 2022

Checked by:

Jürgen Pessinger
2022.11.03 07:27:30 +01'00'

Jürgen Pessinger
Radio Team

Tested by:

Christopher Thaller
2022.11.02 08:38:12 +01'00'

Christopher Thaller
Radio Team

3 EQUIPMENT UNDER TEST

3.1 Information provided by the Client

Please note, we do not take any responsibility for information provided by the client or his representative which may have an influence on the validity of the test results.

3.2 Sampling

The customer is responsible for the choice of sample. Sample configuration, start-up and operation is carried out by the customer or according his/her instructions.

3.3 Photo documentation of the EUT – Detailed photos see Attachment A

3.4 General remarks

This report covers the emissions of the BLE-Chip "NRF52832" in combination with the host device ROX12.1.
It also covers the emissions of the WLAN-Module "WFM200" in combination with the host device ROX12.1.

3.5 Power supply system utilised

Power supply voltage	:	3.8V, battery supplied

3.6 Short description of the Equipment under Test (EUT)

The EUT is a bicycle computer.
One SMD antenna is used within the system for BLE and one for WLAN. The EUT has only integrated antennas.
The modulation used by the EUT for BLE is GFSK with a data rate of 1 Mbit/s or 2Mbit/s.

Number of tested samples	:	1 radiated sample DUT5
Serial number	:	REV 0201
Firmware version	:	Linux Test Software
	:	

3.7 EUT operation mode

The equipment under test was operated during the measurement under the following conditions:

- Operation mode: RX Receive Mode, JBP – EUT connected to PC over USB

3.8 EUT configuration

The following peripheral devices and interface cables were connected during the measurements:

- Lab laptop Model : hp EliteBook
- hp notebook charger Model : CT:WDWRT0BAR9N3HX

Modifications during the EMC test: None

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15 - 35 °C
Humidity:	30 - 60 %
Atmospheric pressure:	86 - 106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor k = 2. The true value is located in the corresponding interval with a probability of 95 %. The measurement uncertainty was calculated for all measurements listed in this test report on basis of the ETSI Technical Report TR 100 028 Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1 and Part 2. The results are documented in the quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

4.4 Conformity Decision Rule

The applied conformity decision rule is based on ILAC G8:09/2019 clause 4.2.1 Binary Statement for Simple Acceptance Rule (w = 0).
Details can be found in the procedure CSA_B_V50_29.

4.5 Measurement protocol for FCC and ISED

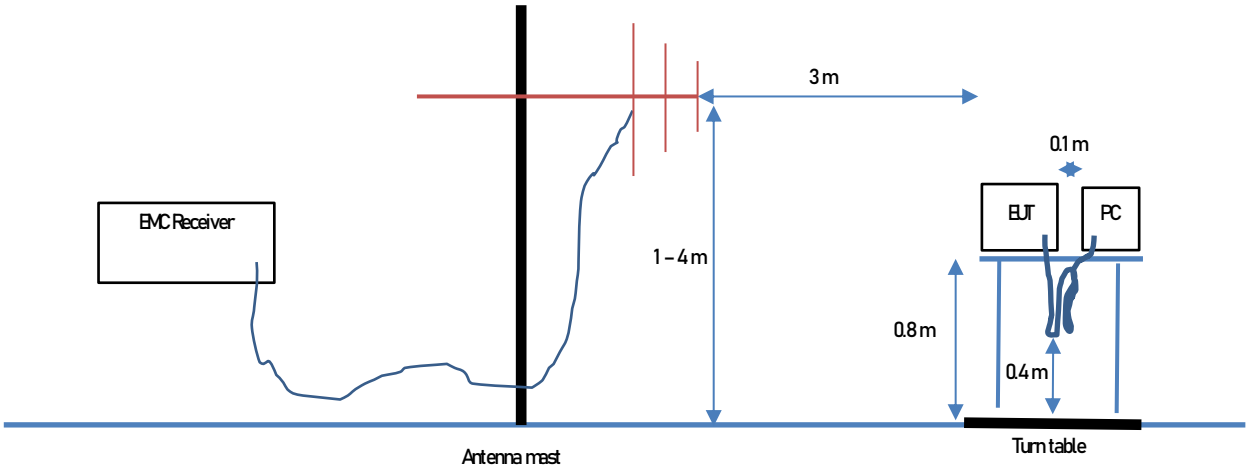
4.5.1 General information

CSA Group Bayern GmbH is recognized as wireless testing laboratory under the CAB identifier:

FCC: DE 0011
ISED: DE0009

4.5.2 Details of test procedures

4.5.2.1 Radiated emission



4.5.2.1.1 **OATS1 test site (30 MHz - 1 GHz)**
Test setup according ANSI C63.4

Description of measurement

Spurious emission from the EUT is measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 metre non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is established in accordance witl [redacted] e interface cables that are closer than 40 centimetres to the ground plane are bundled in the cer [redacted] e fashion so that they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the centre of the table and to a screened room located outside the test area.
The antenna is positioned 3 or 10 metres horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 metres, measurement scans are made with both horizontal and vertical antenna polarization planes and the EUT is rotated 360 degrees.

The final level is calculated in a calculation sheet by taking the reading from the EMI receiver (Level dBµV) and adding the correction factors and cable loss factor (Factor dB) on to it. The limit is subtracted from this result in order to provide the limit margin listed in the measurement protocols.

Example:

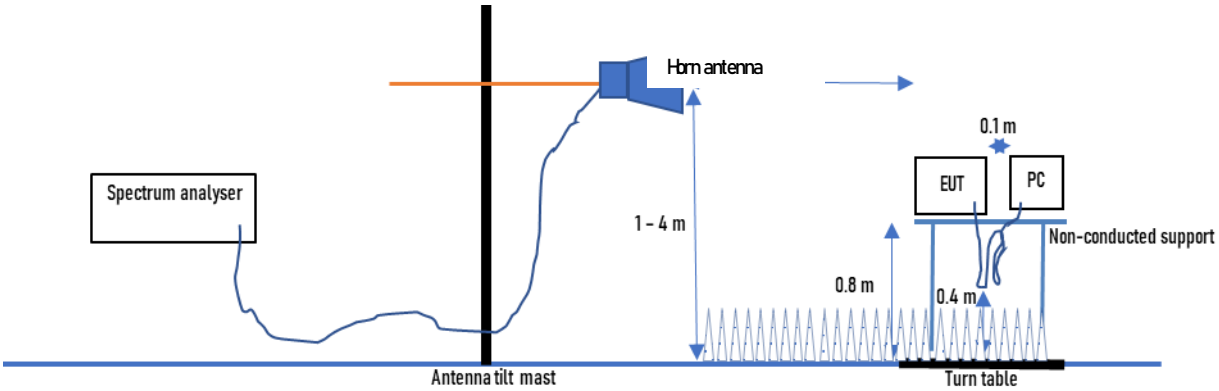
Frequency (MHz)	Reading (dBµV)	+	Correction* (dB/m)	=	Level (dBµV/m)	-	Limit (dBµV/m)	=	Dlimit (dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

*Correction Factor = Antenna Factor + Cable Attenuation = 30 dB/m + 2.6 dB = 32.6 dB/m

The resolution bandwidth during the measurement is as follows:
30 MHz – 1000 MHz: RBW: 120 kHz

4.5.2.1.2 **Anechoic chamber 1, 1000 MHz – 18000 MHz**

Test setup according ANSI C63.4

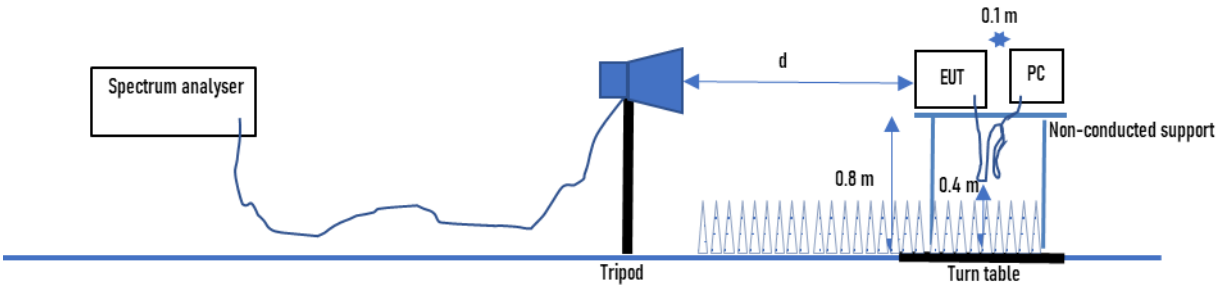


Description of measurement

Radiated emission from the EUT are measured in the frequency range of 1 GHz to the maximum frequency as specified in 47 CFR Part 15 Subpart A section 15.33, using a tuned receiver (spectrum analyser) and appropriate linearly polarized antennas. Table top equipment is placed on a 0.65 X 1.0 metre non-conducting table 80 centimetres above the ground plane. The turntable is fully covered with the appropriate absorber (Type VHP-12).
The interface cables that are closer than 40 centimetres to the ground plane are bundled in the centre in a serpentine fashion, so they are at least 40 centimetres from the ground plane. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyser set to a peak detector function and a RBW= 1 MHz and VBW = 3 MHz. All tests are performed at a test distance of 3 metres. Hand-held or body-worn devices are rotated around three orthogonal axes in order to determine the position, angle and configuration having the maximum emission. The antenna height is then adjusted from 1 m to 4 m maximizing the measured value. The antenna is mounted to a boresight axis, so the antenna centre always points to the EUT. The turntable is rotated 360° until the spectrum analyser displays the maximum level at the observed frequency. The antenna height is then adjusted from 1 m to 4 m maximizing the measured value. The turntable is re-adjusted to re-affirm the maximum emission value which is then recorded. This procedure is repeated for all frequencies of interest.

4.5.2.1.3 **Anechoic chamber 1, 18 GHz – 40 GHz**

Test setup according ANSI C63.4



Description of measurement

Radiated emission from the EUT are measured in the frequency range of 1 GHz to the maximum frequency as specified in 47 CFR Part 15 Subpart A section 15.33, using a tuned receiver (spectrum analyser) and appropriate linearly polarized antennas. Table top equipment is placed on a 0.65 X 1.0 metre non-conducting table 80 centimetres above the ground plane. The turntable is fully covered with the appropriate absorber (Type VHP-12).
The interface cables that are closer than 40 centimetres to the ground plane are bundled in the centre in a serpentine fashion, so they are at least 40 centimetres from the ground plane. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyser set to a peak detector function and an RBW= 1 MHz and VBW = 3 MHz. All tests are performed at a test distance of 3 metres. Hand-held or body-worn devices are rotated around three orthogonal axes in order to determine the position, angle and configuration having the maximum emission. The turntable is rotated 360° until the spectrum analyser displays the maximum level at the observed frequency, the maximum emission value is then recorded. This procedure is repeated for all frequencies of interest.
Where appropriate in frequency range 18 GHz - 40 GHz, the test distance may be reduced to 1 m in order to reduce the noise level to hold a minimum distance between noise level and limit. The limit will be adopted to the measurement distance.

5 TEST CONDITIONS AND RESULTS

5.1 AC power line conducted emissions

For test instruments and accessories used see section 6 Part **A 4**.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up – see Attachment B Part A4

5.1.3 Applicable standard

According to FCC Part 15, Section 15.207(a):
Except as shown in paragraphs (b) and (c) of this Section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the given limits.

5.1.4 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.10 described under item 4.4.3. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin -9.5 dB at 0.475 MHz

Limit according to FCC Part 15, Section 15.207(a):

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

The requirements are **FULFILLED.**

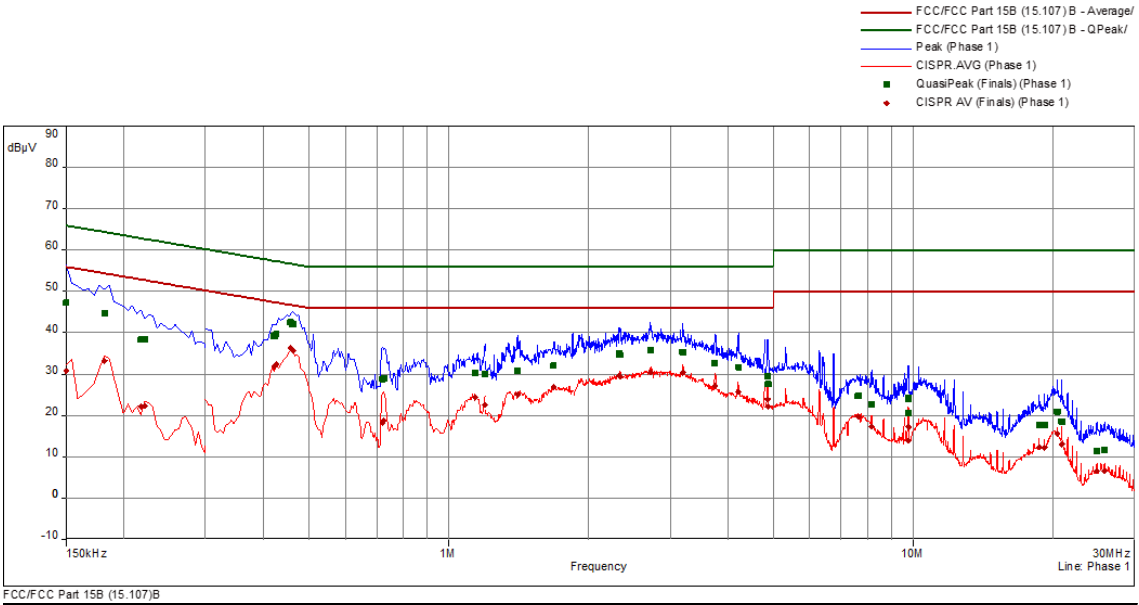
Remarks: For detailed test result please see the following test protocols.

Travel adapter Samsung Model: EP-TA20EWE, hp notebook charger: CT:WDWRT0BAR9N3HX

5.1.6 Test protocol

Test point L1 Result: passed

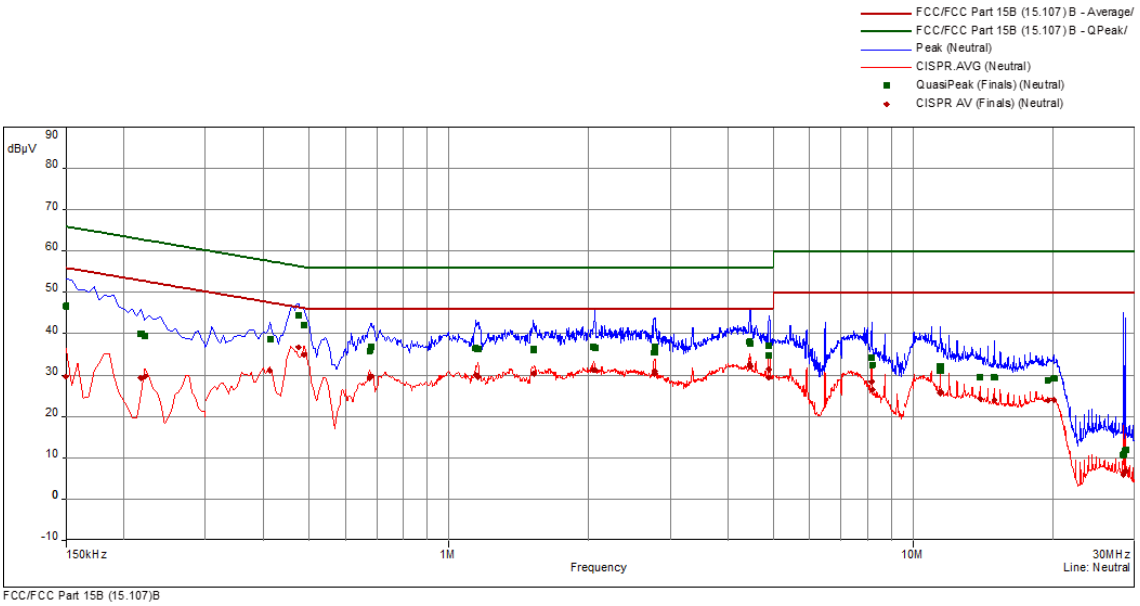
Operation mode: RX Receive Mode, JBP – EUT connected to PC over USB



FCC/FCC Part 15B (15.107)B

Frequency (MHz)	QuasiPeak (dBµV)	QP Margin (dB)	QP Limit (dBµV)	CISPR AV (dBµV)	CISPR AV Margin (dB)	AV Limit (dBµV)	Line	Correction (dB)
0.150	47.3	-18.7	66.0	30.8	-25.2	56.0	Phase 1	10.1
0.182	44.8	-19.6	64.4	33.2	-21.2	54.4	Phase 1	10.1
0.218	38.3	-24.6	62.9	22.2	-30.7	52.9	Phase 1	10.1
0.222	38.6	-24.2	62.7	22.2	-30.5	52.7	Phase 1	10.1
0.422	39.3	-18.1	57.4	31.9	-15.5	47.4	Phase 1	10.2
0.426	39.7	-17.6	57.3	32.3	-15.0	47.3	Phase 1	10.2
0.458	42.5	-14.2	56.7	36.4	-10.4	46.7	Phase 1	10.2
0.462	42.2	-14.5	56.7	35.8	-10.9	46.7	Phase 1	10.2
0.722	28.9	-27.2	56.0	18.2	-27.8	46.0	Phase 1	10.2
0.726	29.0	-27.0	56.0	18.7	-27.3	46.0	Phase 1	10.2
1.140	30.4	-25.6	56.0	24.4	-21.6	46.0	Phase 1	10.2
1.199	30.2	-25.8	56.0	22.5	-23.5	46.0	Phase 1	10.2
1.407	30.8	-25.2	56.0	25.1	-20.9	46.0	Phase 1	10.3
1.686	32.2	-23.8	56.0	26.8	-19.2	46.0	Phase 1	10.3
2.330	35.0	-21.0	56.0	29.5	-16.5	46.0	Phase 1	10.3
2.339	34.8	-21.2	56.0	29.3	-16.7	46.0	Phase 1	10.3
2.720	35.9	-20.1	56.0	30.5	-15.5	46.0	Phase 1	10.3
3.197	35.4	-20.6	56.0	30.4	-15.6	46.0	Phase 1	10.4
3.750	32.7	-23.3	56.0	27.1	-18.9	46.0	Phase 1	10.4
4.214	31.7	-24.3	56.0	25.7	-20.4	46.0	Phase 1	10.4
4.868	29.6	-26.4	56.0	24.0	-22.0	46.0	Phase 1	10.4
4.877	27.7	-28.3	56.0	22.2	-23.8	46.0	Phase 1	10.4
7.622	24.8	-35.2	60.0	19.7	-30.3	50.0	Phase 1	10.6
8.157	22.8	-37.3	60.0	17.3	-32.7	50.0	Phase 1	10.7
9.780	20.6	-39.4	60.0	14.0	-36.0	50.0	Phase 1	10.7
9.785	24.2	-35.8	60.0	17.2	-32.8	50.0	Phase 1	10.7
18.704	17.6	-42.4	60.0	12.3	-37.7	50.0	Phase 1	11.4
19.185	17.8	-42.3	60.0	12.3	-37.7	50.0	Phase 1	11.4
20.469	21.0	-39.0	60.0	15.6	-34.4	50.0	Phase 1	11.5
20.933	18.5	-41.5	60.0	13.1	-36.9	50.0	Phase 1	11.5
24.915	11.4	-48.6	60.0	6.5	-43.5	50.0	Phase 1	11.7
25.883	11.7	-48.3	60.0	6.6	-43.4	50.0	Phase 1	11.7

Test point N Result: passed
Operation mode: RX Receive Mode, JBP – EUT connected to PC over USB



FCC/FCC Part 15B (15.107)B

Frequency (MHz)	QuasiPeak (dBµV)	QP Margin (dB)	QP Limit (dBµV)	CISPR AV (dBµV)	CISPR AV Margin (dB)	AV Limit (dBµV)	Line	Correction (dB)
0.150	46.8	-19.2	66.0	29.6	-26.4	56.0	Neutral	10.1
0.218	40.1	-22.8	62.9	29.3	-23.6	52.9	Neutral	10.1
0.222	39.7	-23.1	62.7	29.8	-22.9	52.7	Neutral	10.1
0.413	38.8	-18.8	57.6	31.1	-16.5	47.6	Neutral	10.2
0.476	44.5	-11.9	56.4	36.9	-9.5	46.4	Neutral	10.2
0.489	42.2	-14.0	56.2	35.0	-11.2	46.2	Neutral	10.2
0.677	35.9	-20.1	56.0	29.4	-16.6	46.0	Neutral	10.2
0.681	36.8	-19.2	56.0	29.8	-16.3	46.0	Neutral	10.2
1.145	36.6	-19.4	56.0	30.0	-16.0	46.0	Neutral	10.2
1.158	36.4	-19.6	56.0	29.7	-16.3	46.0	Neutral	10.2
1.524	36.4	-19.6	56.0	30.5	-15.5	46.0	Neutral	10.3
1.529	36.2	-19.8	56.0	30.4	-15.6	46.0	Neutral	10.3
2.051	36.9	-19.1	56.0	31.2	-14.8	46.0	Neutral	10.3
2.069	36.6	-19.4	56.0	31.2	-14.8	46.0	Neutral	10.3
2.778	35.5	-20.5	56.0	30.4	-15.6	46.0	Neutral	10.3
2.783	36.9	-19.1	56.0	31.1	-15.0	46.0	Neutral	10.3
4.452	38.2	-17.8	56.0	32.8	-13.2	46.0	Neutral	10.4
4.470	37.8	-18.2	56.0	32.2	-13.9	46.0	Neutral	10.4
4.895	37.2	-18.8	56.0	31.4	-14.6	46.0	Neutral	10.4
4.899	34.8	-21.2	56.0	29.5	-16.5	46.0	Neutral	10.4
8.162	34.4	-25.7	60.0	28.5	-21.6	50.0	Neutral	10.6
8.166	32.5	-27.5	60.0	26.5	-23.5	50.0	Neutral	10.6
11.459	31.1	-28.9	60.0	25.7	-24.3	50.0	Neutral	10.8
11.477	32.2	-27.8	60.0	26.0	-24.0	50.0	Neutral	10.8
13.974	29.6	-30.4	60.0	24.2	-25.8	50.0	Neutral	11.0
14.973	29.5	-30.5	60.0	23.9	-26.1	50.0	Neutral	11.0
19.533	28.9	-31.1	60.0	23.8	-26.2	50.0	Neutral	11.2
20.132	29.1	-30.9	60.0	24.0	-26.0	50.0	Neutral	11.3
28.439	10.8	-49.2	60.0	5.9	-44.2	50.0	Neutral	11.1
28.722	11.9	-48.1	60.0	6.7	-43.3	50.0	Neutral	11.1

5.2 Radiated emission < 1 GHz (electric field)

For test instruments and accessories used see section 6 Part **A 5**.

5.2.1 Description of the test location

Test location: OATS 1
Test distance: 3 m

5.3 Photo documentation of the test setup – see Attachment B Part SER 2

5.3.1 Test result

Frequency range: 9 kHz - 1000 MHz

The requirements are **FULFILLED.**

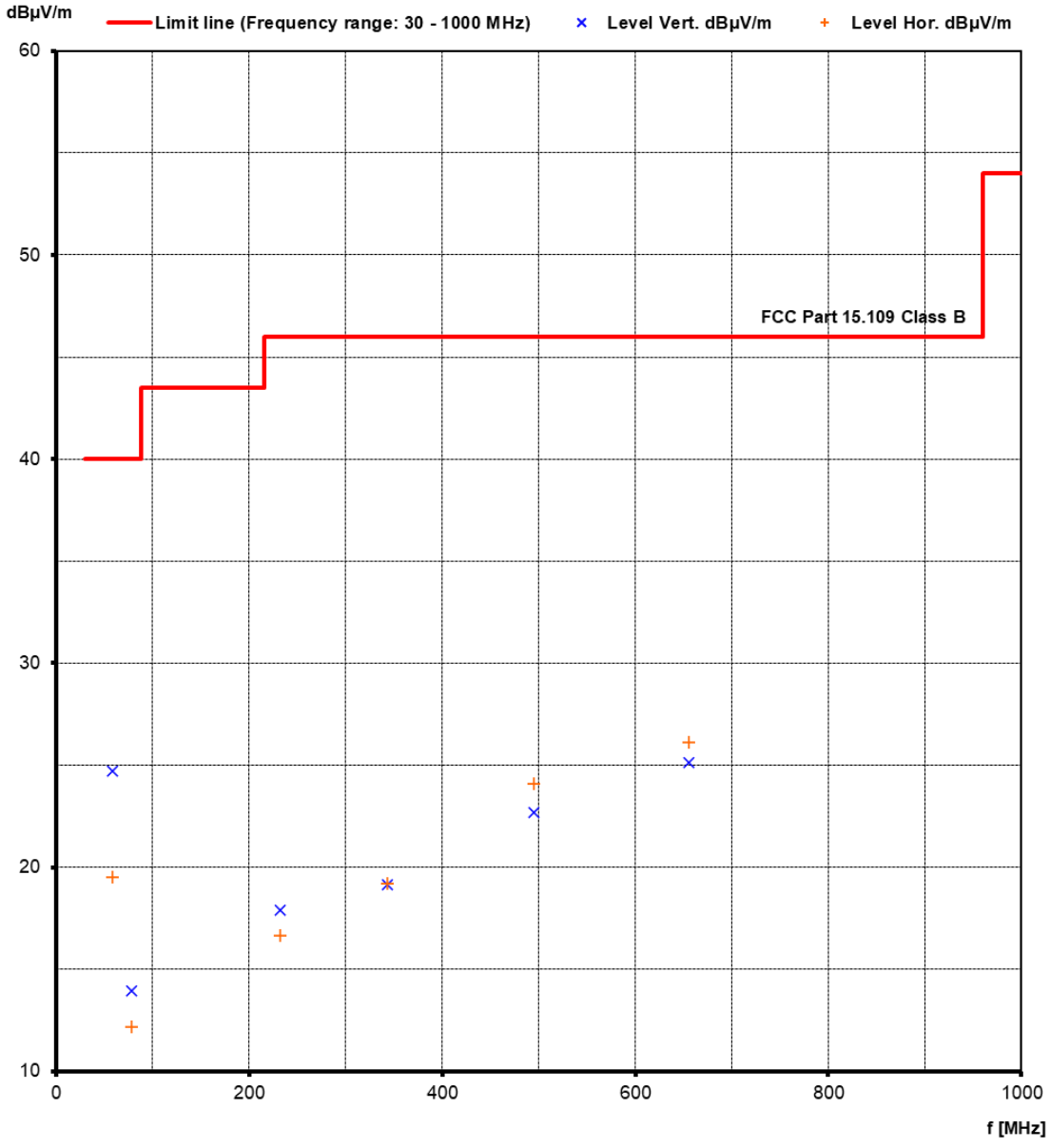
Remarks: For detailed results, please see the following page(s).

For description of the measurement see 4.5.2.

5.3.2 Test protocol

Operation mode: Operation mode: RX Receive Mode, JBP – EUT connected to PC over USB: RX Result: passed

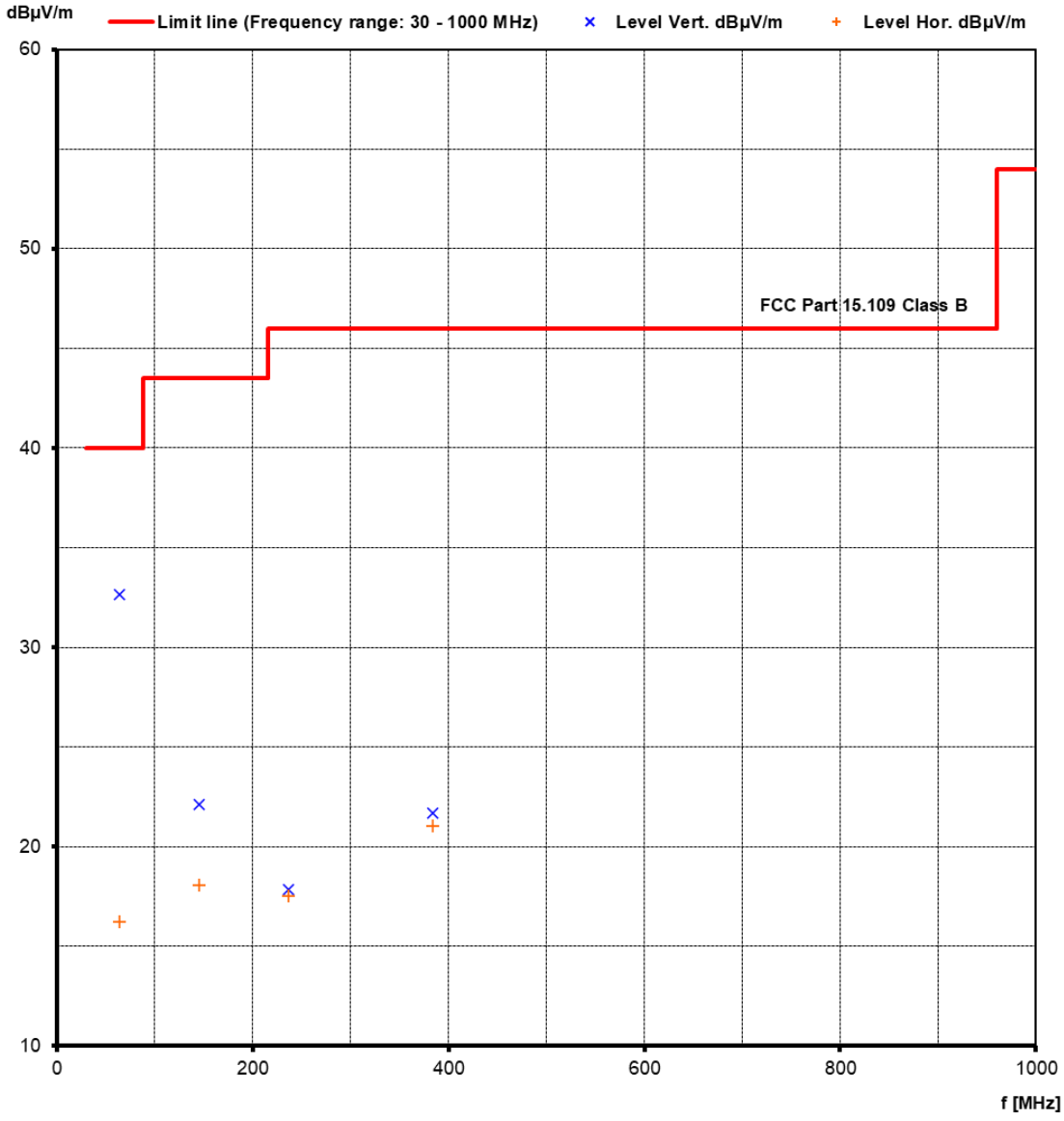
Frequency (MHz)	Reading Vert. (dBµV)	Reading Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dBµV/m)	Level Hor. (dBµV/m)	Limit (dBµV/m)	Dlimit (dB)
58.32	7.6	1.3	17.1	18.2	24.7	19.5	40.0	-15.3
77.82	-0.6	-2.8	14.5	15.0	13.9	12.2	40.0	-26.1
232.00	-0.2	-1.2	18.1	17.8	17.9	16.6	46.0	-28.1
343.00	-2.3	-2.7	21.4	21.9	19.1	19.2	46.0	-26.8
495.00	-2.9	-1.8	25.6	25.9	22.7	24.1	46.0	-21.9
655.00	-3.7	-3.2	28.8	29.3	25.1	26.1	46.0	-19.9



No emissions detected, only noise values of the OATS.

Operation mode: Operation mode: RX Receive Mode, JBP – EUT connected to PC over USB, JBP (EUT over USB to PC) Result: passed

Frequency (MHz)	Reading Vert. (dBµV)	Reading Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dBµV/m)	Level Hor. (dBµV/m)	Limit (dBµV/m)	Dlimit (dB)
64.00	18.2	2.6	14.5	13.6	32.7	16.2	40.0	-7.3
145.00	8.5	3.6	13.6	14.5	22.1	18.1	43.5	-21.4
236.00	4.8	4.1	13.1	13.4	17.9	17.5	46.0	-28.1
384.00	2.3	2.0	19.4	19.1	21.7	21.1	46.0	-24.3



5.4 Radiated emission > 1 GHz (electric field)

For test instruments and accessories used see section 6 Part **SER 3**.

5.4.1 Description of the test location

Test location: Anechoic chamber 1
Test distance: 3 m

5.4.2 Photo documentation of the test setup – see Attachment B Part SER 3

5.4.3 Test result

Frequency range: 1 GHz – 26 GHz

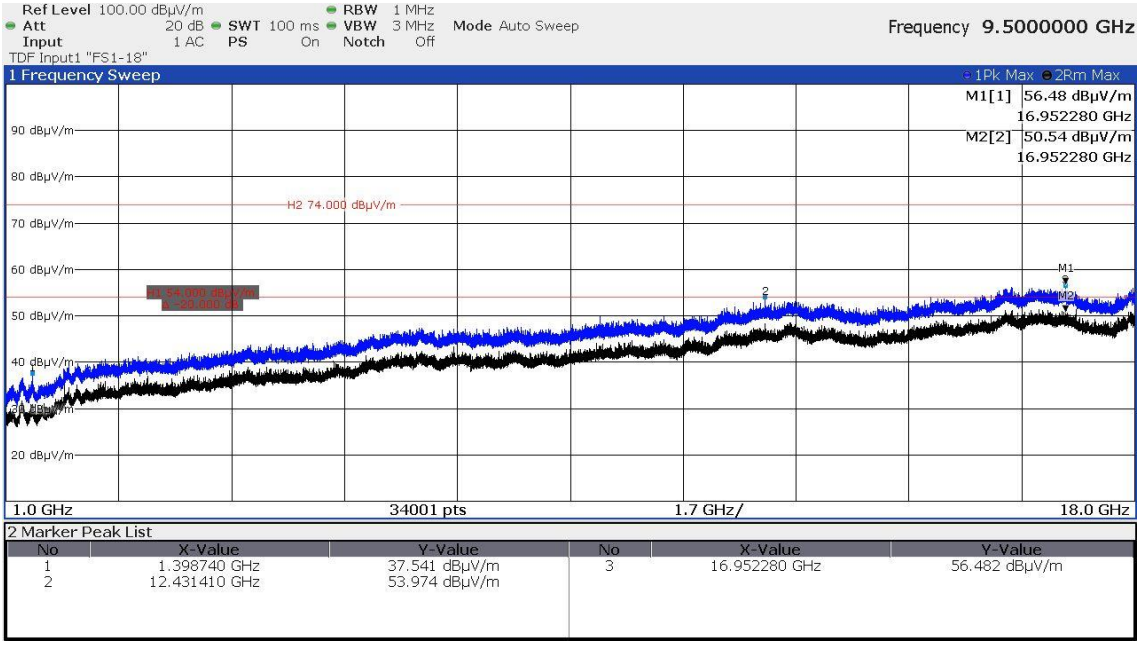
The requirements are **FULFILLED.**

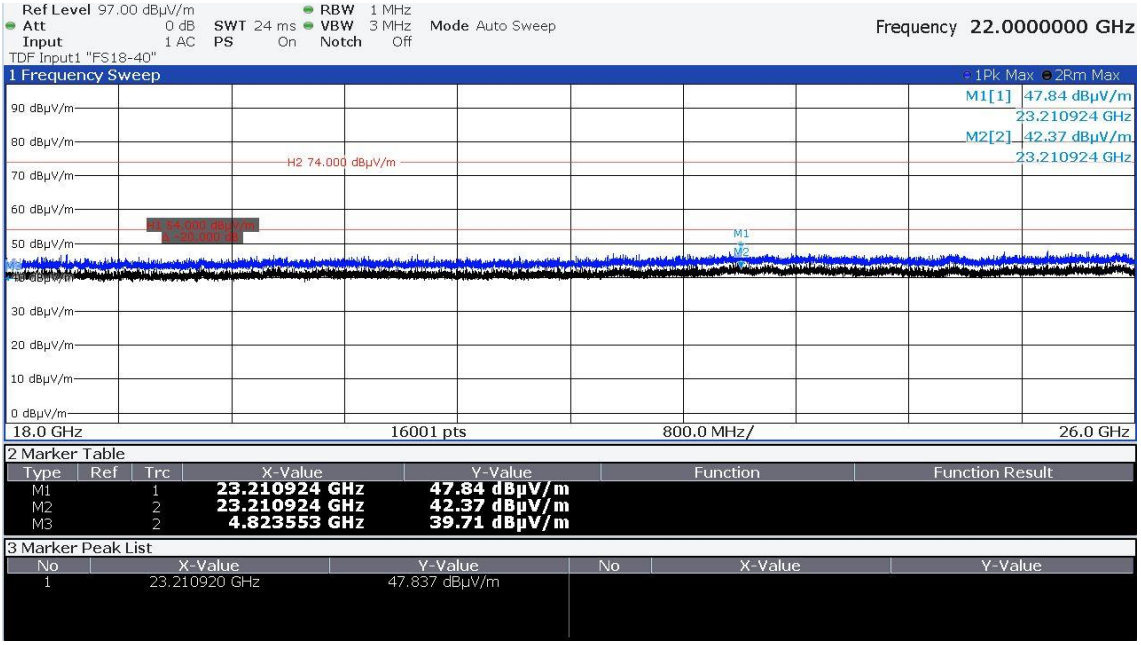
Remarks: For detailed results, please see the following page(s).

For description of the measurement see 4.5.2.

Test protocol

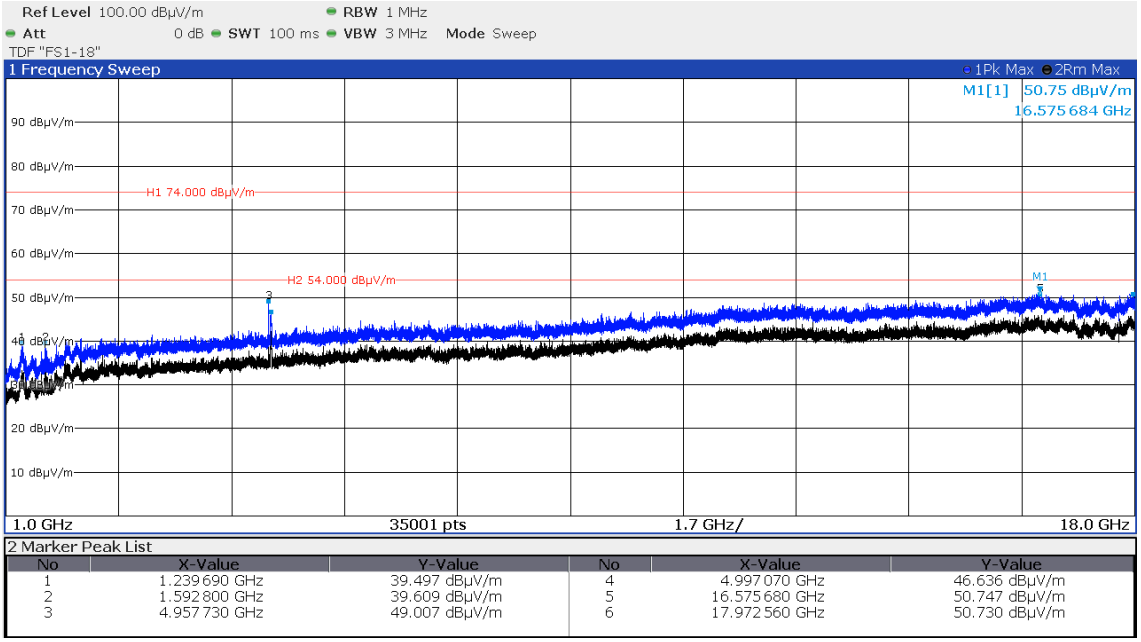
Operation mode: Operation mode: RX Receive Mode, JBP – EUT connected to PC over USB Result: passed

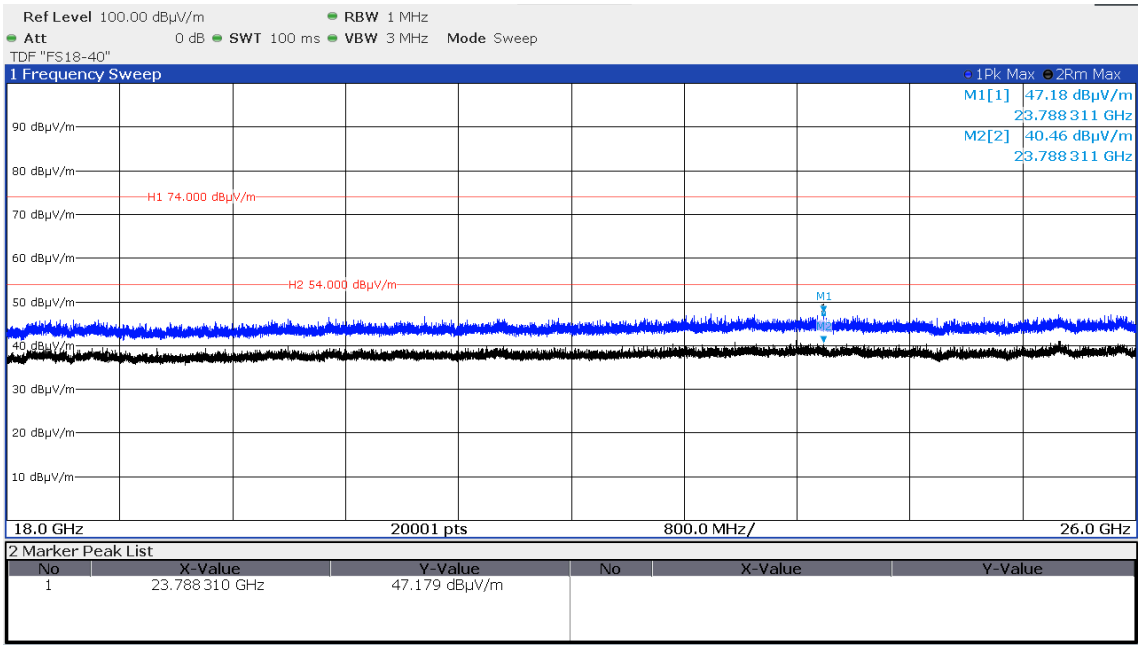




Operation mode: Operation mode: RX Receive Mode, JBP – EUT connected to PC over USB JBP (EUT over USB to PC)

Result: passed





2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	23.788 310 GHz	47.179 dBµV/m			

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used, in addition to the test accessories, are calibrated and verified regularly.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	BAT-EMC 3.21.0.24	01-02/68-13-001				
	ESCI	02-02/03-15-001	17/06/2023	17/06/2022		
	ESH 2 - Z 5	02-02/20-05-004	31/10/2022	31/10/2019	22/03/2023	22/09/2022
	N-4000-BNC	02-02/50-05-138				
	ESH 3 - Z 2	02-02/50-05-155	13/11/2022	13/11/2019	10/02/2023	10/08/2022
	6430	02-02/50-13-014				
A5	ESW26	02-02/03-17-002	10/02/2023	10/02/2022		
	VULB 9168	02-02/24-05-005	20/12/2022	20/12/2021	03/07/2023	03/07/2022
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
	50F-003 N 3 dB	02-02/50-21-010				
SER 3	ESW26	02-02/03-17-002	10/02/2023	10/02/2022		
	FSW43[1]	02-02/11-21-001	16/05/2023	16/05/2022		
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	LNA-40-18004000-33-5P	02-02/17-20-002				
	3117	02-02/24-05-009	23/06/2023	23/06/2022		
	BBHA 9170	02-02/24-05-013	19/05/2023	19/05/2020	10/03/2023	10/03/2022
	WHK 3.0/18G-10EF	02-02/50-05-180				
	BAM 4.5-P	02-02/50-17-024				
	NCD	02-02/50-17-025				
	KK-SF106-2X11N-6,5M	02-02/50-18-016				
	KMS116-GL140SE-KMS116-	02-02/50-20-026				
	BAT-EMC 3.21.0.24	02-02/68-13-001				

7 Detailed measurement uncertainty

7.1 Overview

Measurement instrumentation uncertainty shall be taken into account when determining compliance or non-compliance with a disturbance limit.
The measurement instrumentation uncertainty for a test laboratory shall be evaluated. The standard uncertainty $u(x_i)$ in decibels and the sensitivity coefficient c_i shall be evaluated for the estimate x_i of each quantity. The combined standard uncertainty $u_c(y)$ of the estimate y of the measurand shall be calculated as

$$u_c(y) = \sqrt{\sum_i c_i^2 \; u^2(x_i)}$$

The expanded measurement instrumentation uncertainty U_{lab} for a test laboratory shall be calculated as $U_{lab} = 2\, u_c(y)$

$$U_{lab} = 2\, u_c(y)$$

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If U_{lab} is less than or equal to U_{cispr} in the table below, then:
- compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} in the table below, then:
- compliance is deemed to occur if no measured disturbance, increased by ($U_{lab} – U_{cispr}$), exceeds the disturbance limit.
- non-compliance is deemed to occur if any measured disturbance, increased by ($U_{lab} – U_{cispr}$), exceeds the disturbance limit.

7.2 Definitions and symbols

X_i	Input quantity
x_i	estimate of X_i
$u(x_i)$	standard uncertainty of x_i
c_i	sensitivity coefficient
$u_c(y)$	(combined) standard uncertainty of y
Y	result of a measurement, (the estimate of the measured), corrected for all recognised significant systematic effects
U	expanded uncertainty of y

7.3 Measurement uncertainty

Measurement	U_{lab} [dB]
Conducted disturbance	+ 2.53 / - 2.77
Radiated disturbance (electric field) - 10 m test distance - 3 m test distance - Frequency range: 30 MHz – 200 MHz	 + 3.16 / - 3.22 + 3.16 / - 3.22
Radiated disturbance (electric field) - 10 m test distance - 3 m test distance - Frequency range: 200 MHz – 1000 MHz	 + 4.51 / - 4.51 + 4.51 / - 4.51
Radiated disturbance (electric field) - 3 m test distance - Frequency range: 1 GHz – 30 GHz	 + 5.07 / -3.70