TÜVNORD

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Test Report acc. to FCC Title 47 CFR Part 15

relating to

FEIG ELECTRONIC GmbH
ID MRM103

Test report no. 25013579_Rev.01

Title 47 - Telecommunication
Part 15 - Radio Frequency Devices
Subpart C – Intentional Radiators
Measurement Procedure:
ANSI C63.4-2014
ANSI C63.10-2013

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Manufacturer's grantee code	PJM
Manufacturer's address	Industriestr. 1a, 35781 Weilburg, Germany
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TESTING LABORATORY	
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Testing laboratory name	**TÜV NORD Hochfrequenztechnik GmbH & Co. KG**
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RELEVANT STANDARD	
Title	**47 - Telecommunication**
Part	**15 – Radio Frequency Devices**
Subpart	**Subpart C – Intentional Radiators - Section 15.225**
Measurement procedure	**ANSI C63.10-2013, ANSI C63.4-2014**

EQUIPMENT UNDER TEST (EUT)	
Equipment category	RFID Reader
Trade name	Feig Electronic
Type designation	**ID MRM103**
Serial no.	ID MRM103-A: SN 1200 ID MRM103-E: SN 1300 ID MRM103-USB: SN 1400 ID MRM103-USBC: SN 1500
Variants	ID MRM103-A // ID MRM103-E // ID MRM103-USB // ID MRM103-USBC

Test result summary

The tables summarize the results for the tested equipment corresponding with the requirements defined in FCC Subpart, Section 15.225. Full testing according to FCC 15.225 may not be required. If partial testing was performed, this shall be indicated in the relevant column (N.t.[x], not tested) of the tables below.

Clause	Requirements headline	FCC Rule	Test result
7.1	Antenna Requirement	§15.203	**Pass**
7.2	Conducted limits	§15.207	**Pass**
7.3	Restricted bands of operation	§15.205 & §15.225 (a) – (d)	**Pass**
7.4	Radiated emission limits	§15.209 & §15.225 (a) – (d)	**Pass**
7.5	Frequency tolerance	§15.225 (e)	**Pass**
7.6	20 dB Bandwidth	§15.215 (c)	**Pass**

** As far as in this report statements on conformity are made, decision rules according to DIN EN ISO/IEC 17025:2018, 7.8.6 have been applied. If the report does not state otherwise, procedure 1 according to IEC Guide 115 ed.2.0 2021 (uncertainty of measurement calculated) has been applied on measurement and test procedures which are the basis of this report. For more information see clause 8.1.*

Additional information to the test report

Remarks	Description
N.t.[1]	Not tested, because the antenna is part of the PCB
N.t.[2]	Not tested, because the EUT is directly battery powered
N.t.[3]	Not tested, because not applicable to the EUT
N.t.[4]	Not tested, because not ordered

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Reference(s) to this test report is the following TÜV NORD Hochfrequenztechnik GmbH & Co. KG test report(s)	
☐ Yes Test report(s) no.:	☒ No

The equipment passed all the performed tests	
☒ Yes	☐ No

Signature	TÜVNORD Digital unterschrieben von Trepper Ralf Datum: 2025.12.19 12:42:47 +01'00'	TÜVNORD i. A. Digital unterschrieben von Raschka Denis Datum: 2025.12.19 12:46:13 +01'00'
	Tested by	**Approved by**
Name	**Mr. Ralf Trepper**	**Mr. Anup Shrestha**
Designation	**Radio Test Engineer Laboratory Manager**	**Radio Test Engineer**
Date of issue	**2025-12-19**	**2025-12-19**

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1 Revision history

Revision	Date of issue	Creator	Content of change
00	2025-12-01	R.Trepper	Initial final release
00	2025-12-19	R.Trepper	The reference to standard ANSI 63.10:2013 on page 8 has been replaced with standard ANSI 63.10:2020.
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Table 1-1: Revision history

Note: If the document has been changed by revision number, all previous documents are no longer valid and must be destroyed.

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2 Introduction

This test report **is not an expert opinion** and consists of:

- Test result summary
- List of contents
- Introduction and further information
- Performance assessment
- Detailed test information
- List of measurement equipment
- Photographs and further test results (plots, graphs, etc.)

The tests were carried out in a representative assembly and in accordance with the test methods and/or requirements stated in:

Item	Applied Standard
Radio test	FCC Title 47 CFR Part 15 Subpart C Section 15.225, ANSI C63.4-2014 & ANSI C63.10-2020+Cor. 1-2023, ANSI C63.10a-2024_Errata

3 Administrative Data

3.1 Testing laboratory

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Phone:+49 221 8888 950

FCC Registration Number: **763407**

Accredited by:

DAkkS Deutsche Akkreditierungsstelle GmbH
DAkkS accreditation number: D-PL-12053-01

3.2 Applicant´s details

Company name:	FEIG ELECTRONIC GmbH
Address:	Industriestr. 1a
	35781 Weilburg
Country:	Germany
Contact person:	Mr. Reinhard Monno
Telephone:	+49 6471 3109 0
Fax:	+49 6471 3109 99
Email:	Reinhard.Monno@feig.de
Date of order:	20.11.2025
Date of receipt:	06.11.2025
Period of testing time:	06.11.2025 – 28.11.2025
Internal project number:	Fg 25-128

3.3 Manufacturer´s details

Manufacturer´s name	: (please see Applicant´s details)
Address	: (please see Applicant´s details)

4 Equipment under test (EUT)

4.1 EUT: short description

EUT Type designation	ID MRM103
Type of equipment	RFID-Reader
Trademark	Feig Electronic
A/N Article no.	---
S/N Serial no.	ID MRM103-A: **SN 1200** ID MRM103-E: **SN 1300** ID MRM103-USB: **SN 1400** ID MRM103-USBC: **SN 1500**
HW Hardware status	FE1232
SW Software status	RF-Stack V1.00
Variants	ID MRM103-A, ID MRM103-E, ID MRM103-USB, ID MRM103-USBC

4.2 Additional Equipment: short description

Additional Equipment	Type
RFID tag	Passive tag
---	---

4.3 EUT operating mode

EUT operating mode no.	Description of operating modes	Additional information
OP 1	Pulsed modulated	Continuous reading of RFID Tag
OP 2	---	---
OP 3	---	---

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4.4 Additional declaration and description of EUT

(Application´s declaration: ☐= not selected, ☒= selected)

EUT	☒ tabletop unit ☐ floor-standing ☒ wall-mounted ☒ built in	Typical use ☒ fixed use ☐ portable use ☐ vehicular use	Typical operating cycle of EUT ☒ ≤ 1 sec ☐ _____
Place of use	☒ Residential, commercial and light industry ☐ Industrial environment ☐ Telecom centres only ☐ Vehicular use		
Generated or used frequencies	13.56 MHz (carrier frequency) 25 MHz (Crystal frequency) ≤ 250 MHz (CPU-Kernel internal frequency)		
Operating frequency bands over which the equipment is intended to operate	13.110 MHz – 14.010 MHz		
Environment(s) in which the equipment is intended to be used	-25°C to +55°C		

Power line

☐ AC	☐ L1, ☐ L2, ☐ L3, ☐ N, ☐ PE	--- V/ AC	☐ 50 Hz ☐ 60 Hz	EUT grounding: ☒ none ☐ with power supply ☐ additional
☒ DC	USBC: 5 V DC // MRM103-A, -E, -USB: 12-24 V DC			
Tested with:	USBC: 4.5 – 5.5 V DC // MRM103-A, -E, -USB: 12-24 V DC			

Other ports

Port type	Function	Shielding	Total cable length used during the test
USB	Power supply + data transfer	☒ screened ☐ unscreened	1.8m
---	---	☐ screened ☐ unscreened	---

Remarks:

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For issuing this report, the following product documentation was used:

Title	Description	Version
Installation	Installation Guide	ID MR103 - Manual M50720-1e-ID-B

List of annexes belonging to this document:

Description	Date	Identification
External photographs of the **E**quipment **U**nder **T**est (EUT)	2025-12-01	Annex no. 1
Internal photographs of the **E**quipment **U**nder **T**est (EUT)	2025-12-01	Annex no. 2
Channel occupancy / bandwidth	2025-12-01	Annex no. 3
Label sample	2025-12-01	Annex no. 4
Functional description / User manual	2025-12-01	Annex no. 5
Test setup photos	2025-12-01	Annex no. 6
Block diagram	2025-12-01	Annex no. 7
Operational description	2025-12-01	Annex no. 8
Schematics	2025-12-01	Annex no. 9
Parts list	2025-12-01	Annex no. 10
Frequency Stability	2025-12-01	Annex no. 11

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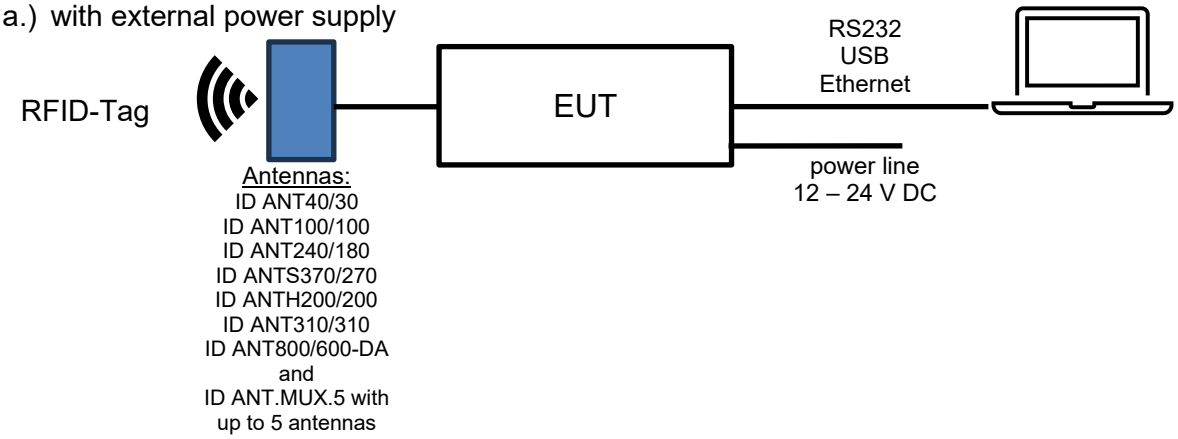
4.5 Modifications

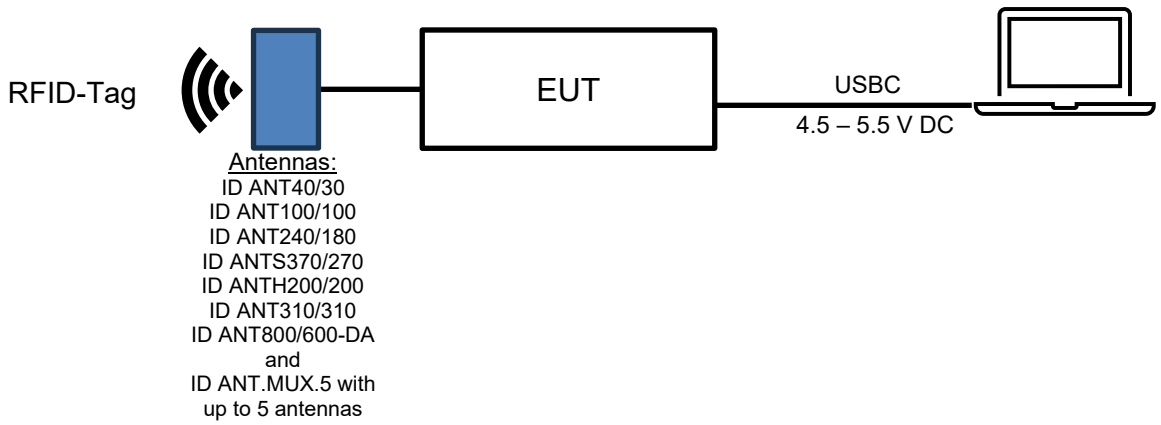
Modification	☐ applicable ☒ not applicable
1	---
2	---

4.6 System Setup

a.) with external power supply



b.) with USBC powered



Description of the function:

The EUT (ID MR103) is a RFID Reader and identifies transponders with an operating frequency of 13.56 MHz. It is powered over 5 V DC for ID MRM103-USBC supply or 12.0 V DC for ID MRM103-A, ID MRM103-E, ID MRM103-USB. The tag identification logs are displayed on a controller PC connected via USB, USBC, RS232 or Ethernet in the software provided by the manufacturer.

5 Conclusions, Observations & Comments

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The results of the tests as stated in this report are exclusively applicable to the EUT as identified in this report. TÜV NORD Hochfrequenztechnik GmbH & Co. KG cannot be held liable for properties of the EUT that have not been observed during these tests.

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6 Operation description

6.1 EUT details

The EUT is a multi-tag HF proximity reader that identifies transponders with an operating frequency of 13.56 MHz. The reader offers an integrated antenna and is suitable to be used in the fields of applications like library, logistics and industry.

6.2 EUT configuration

The EUT is powered ON via 5 V DC for ID MRM103-USBC supply or 12.0 V DC for ID MRM103-A, ID MRM103-E, ID MRM103-USB. After initialization, the EUT identifies transponder, and the identification data are transferred to the controller PC which are displayed in the software provided by the manufacturer.

6.3 EUT measurement description

Radiated measurements

The EUT was tested in a typical fashion. During preliminary emission tests the EUT was operated in the continuous measuring mode for worst case emission mode investigation. Therefore, the final qualification testing was completed with the EUT operated in continuous measuring mode. All tests were performed with the EUT's typical voltages described above.

To establish the maximum radiation, firstly, there have been viewed all orthogonal adjustments of the test samples, secondly the test ample have been rotated at all adjustments around the own axis between 0° and 360°, and thirdly, the antenna polarization between horizontal and vertical had been varied.

Radiated measurements from 9 kHz – 30 MHz, 30MHz – 1 GHz and above 1 GHz were performed using a small loop antenna, Linear polarized Logarithmic Periodic Broadband Antenna, stacked Logarithmic-Periodic Broadband Antenna for linear polarized and horn antennas respectively with a measuring distance of 3 m inside SAC.

Radiated measurement above 1 GHz is made by placing loose-laid RF absorber material on the ground plane.

Additionally, radiated emission measurements above 1 GHz are made using calibrated linearly polarized antennas, which may have a smaller beamwidth (main lobe) than do the antennas used for frequencies below 1 GHz. The measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal.

Conducted measurements

The EUT was directly connected to a Laptop via USB interface. It has been tested with activated EUT with the Laptop and only Laptop without EUT modes. The typical voltage of 120 V AC / 60 Hz is provided on the artificial mains network.

Environmental Conditions during the tests

Temperature: 20 - 23°C // Relative Humidity: 29 - 42 % // Air Pressure: 1004 - 1012 hPa

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7 Compliance assessment

7.1 Antenna requirement

7.1.1 Regulation

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.

7.1.2 Test result

Antenna Type	Antenna description	Frequency MHz	Gain dBd	Number of Antennas
External	Loop antenna **ID ANT40/30**	**13.560**	**0**	**1**
External	Loop antenna **ID ANT100/100**	**13.560**	**0**	**1**
External	Loop antenna **ID ANT240/180**	**13.560**	**0**	**1**
External	Loop antenna **ID ANTS240/180**	**13.560**	**0**	**1**
External	Loop antenna **ID ANTS370/270**	**13.560**	**0**	**1**
External	Loop antenna **ID ANTH200/200**	**13.560**	**0**	**1**
External	Loop antenna **ID ANT310/310**	**13.560**	**0**	**1**
External	Loop antenna **ID ANT800/600-DA**	**13.560**	**0**	**1**
External	Antenna switch **ID ANT.MUX.5**	**13.560**	**0**	**up to 5**

The equipment passed the performed tests	☒ **Yes**	☐ **No**	☐ **N.t.^{x}**

Test setup photos / test results are attached	☒ **Yes**	☐ **No**	Annexe no.: 2

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7.2 Conducted limits

7.2.1 Regulations

(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 limits in the following table, as measured using a 50 μH /50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Conducted Limits		
Frequency of Emission	**Quasi-Peak (QP)**	**Average (AV)**
MHz	**dBμV**	**dBμV**
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		

(b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

1) For carrier current system containing their fundamental emission within the frequency band 535–1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 μV within the frequency band 535–1705 kHz, as measured using a 50 μH /50 Ω LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in §15.205, §15.209, §15.221, §15.223, or §15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

7.2.2 Test procedures

The EUT and the additional equipment (if required) are connected to the main power through a line impedance stabilization network (LISN). The LISN must be appropriate to ANSI C63.10-2013 Section 6. Additional equipment must also be connected to a second LISN with the same specifications described in the above section (if required).

7.2.3 Test results

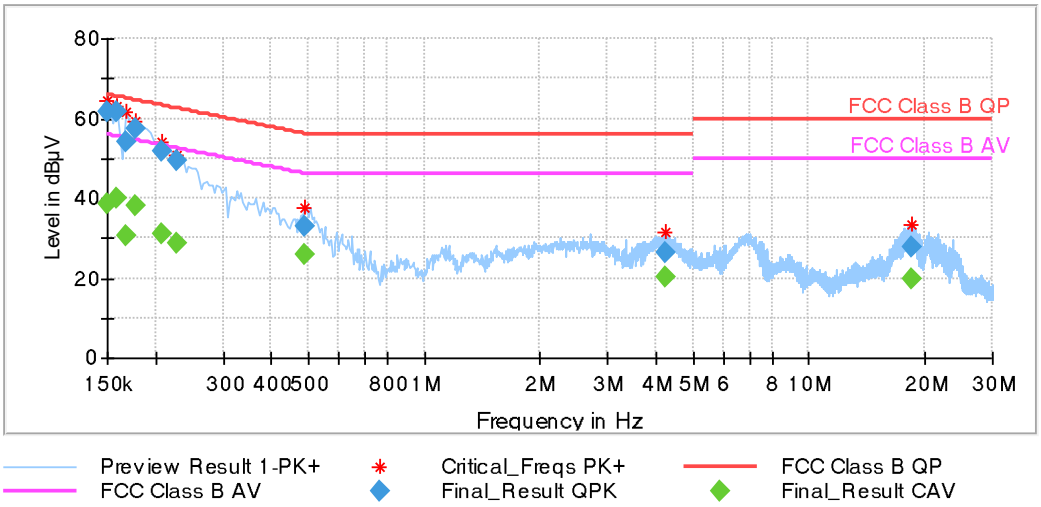
Test location and equipment

Test site	EMV Laboratory TÜV NORD Hochfrequenztechnik				
Receiver	☒ 665				
Additional equipment	☒ 272	☒ 60	☐ 71a	☒ 551	☐ 672
Cable	☒ KISN2				
Test Software	☒ EMC32		☐ ELEKTRA		

Measurement results

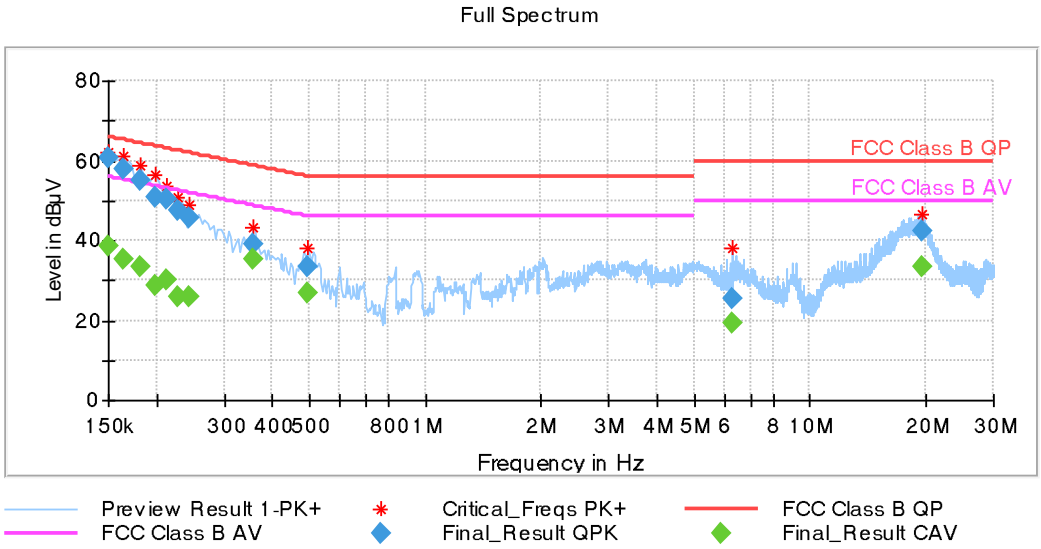
Conducted emissions - Tested with only Laptop without EUT

Full Spectrum



Freq. (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	BW (kHz)	Line	PE	Corr dB
0.150000	---	38.51	56.00	17.49	1000.0	9.000	L1	GND	20.2
0.150000	61.79	---	66.00	4.21	1000.0	9.000	L1	GND	20.2
0.159000	---	40.08	55.52	15.43	1000.0	9.000	N	GND	20.0
0.159000	61.46	---	65.52	4.05	1000.0	9.000	N	GND	20.0
0.168000	54.28	---	65.06	10.78	1000.0	9.000	L1	GND	20.0
0.168000	---	30.54	55.06	24.52	1000.0	9.000	L1	GND	20.0
0.177000	57.19	---	64.63	7.44	1000.0	9.000	L1	GND	20.1
0.177000	---	38.16	54.63	16.47	1000.0	9.000	L1	GND	20.1
0.208500	51.54	---	63.27	11.72	1000.0	9.000	L1	GND	20.0
0.208500	---	31.13	53.27	22.13	1000.0	9.000	L1	GND	20.0
0.226500	---	28.81	52.58	23.77	1000.0	9.000	N	GND	20.0
0.226500	49.29	---	62.58	13.29	1000.0	9.000	N	GND	20.0
0.487500	32.97	---	56.21	23.24	1000.0	9.000	L1	GND	20.0
0.487500	---	26.12	46.21	20.09	1000.0	9.000	L1	GND	20.0
4.249500	---	20.02	46.00	25.98	1000.0	9.000	N	GND	20.1
4.249500	26.23	---	56.00	29.77	1000.0	9.000	N	GND	20.1
18.41100	---	19.80	50.00	30.20	1000.0	9.000	N	GND	20.1
18.41100	27.75	---	60.00	32.25	1000.0	9.000	N	GND	20.1

Conducted emissions - Tested with Laptop with active EUT_ (ID MRM103-A)



Freq. (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	BW (kHz)	Line	PE	Corr dB
0.150000	60.54	---	66.00	5.46	1000.0	9.000	N	GND	20.2
0.150000	---	38.49	56.00	17.51	1000.0	9.000	N	GND	20.2
0.163500	---	35.10	55.28	20.18	1000.0	9.000	N	GND	20.0
0.163500	57.73	---	65.28	7.56	1000.0	9.000	N	GND	20.0
0.181500	---	33.27	54.42	21.15	1000.0	9.000	N	GND	20.0
0.181500	55.04	---	64.42	9.37	1000.0	9.000	N	GND	20.0
0.199500	---	28.48	53.63	25.15	1000.0	9.000	L1	GND	20.1
0.199500	50.64	---	63.63	12.99	1000.0	9.000	L1	GND	20.1
0.213000	---	29.96	53.09	23.13	1000.0	9.000	L1	GND	20.0
0.213000	50.19	---	63.09	12.90	1000.0	9.000	L1	GND	20.0
0.226500	47.31	---	62.58	15.26	1000.0	9.000	N	GND	20.0
0.226500	---	26.05	52.58	26.53	1000.0	9.000	N	GND	20.0
0.244500	45.43	---	61.94	16.51	1000.0	9.000	L1	GND	20.0
0.244500	---	25.81	51.94	26.14	1000.0	9.000	L1	GND	20.0
0.357000	39.05	---	58.80	19.74	1000.0	9.000	N	GND	20.1
0.357000	---	35.40	48.80	13.40	1000.0	9.000	N	GND	20.1
0.496500	---	26.75	46.06	19.31	1000.0	9.000	L1	GND	20.1
0.496500	33.44	---	56.06	22.61	1000.0	9.000	L1	GND	20.1
6.279000	---	19.51	50.00	30.49	1000.0	9.000	N	GND	20.1
6.279000	25.35	---	60.00	34.65	1000.0	9.000	N	GND	20.1
19.51350	---	33.51	50.00	16.49	1000.0	9.000	L1	GND	20.1
19.51350	42.15	---	60.00	17.85	1000.0	9.000	L1	GND	20.1

The equipment passed the performed tests	☒ Yes	☐ No	☐ N.t.x
Test setup photos/ test results are atteched	☒ Yes	☐ No	Annex no.:6

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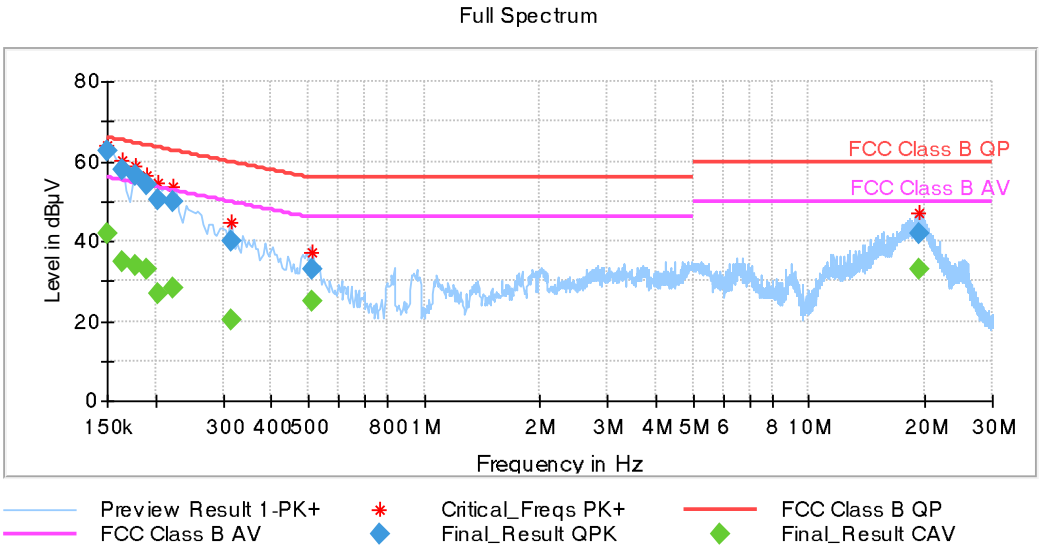
Conducted emissions - Tested with Laptop with active EUT_ (ID MRM103-E)

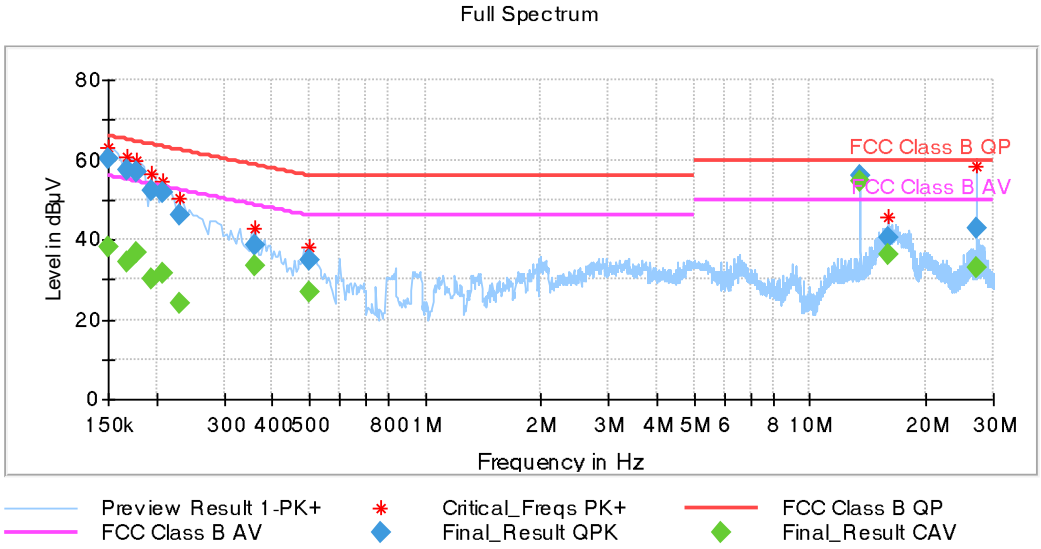


Freq. (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	BW (kHz)	Line	PE	Corr dB
0.150000	62.52	---	66.00	3.48	1000.0	9.000	N	GND	20.2
0.150000	---	41.72	56.00	14.28	1000.0	9.000	N	GND	20.2
0.163500	---	34.84	55.28	20.44	1000.0	9.000	N	GND	20.0
0.163500	57.71	---	65.28	7.58	1000.0	9.000	N	GND	20.0
0.177000	---	33.90	54.63	20.73	1000.0	9.000	N	GND	20.0
0.177000	56.51	---	64.63	8.12	1000.0	9.000	N	GND	20.0
0.190500	---	32.85	54.02	21.16	1000.0	9.000	L1	GND	20.1
0.190500	53.97	---	64.02	10.04	1000.0	9.000	L1	GND	20.1
0.204000	50.24	---	63.45	13.20	1000.0	9.000	N	GND	20.0
0.204000	---	26.92	53.45	26.52	1000.0	9.000	N	GND	20.0
0.222000	---	28.19	52.74	24.56	1000.0	9.000	L1	GND	20.0
0.222000	49.85	---	62.74	12.89	1000.0	9.000	L1	GND	20.0
0.316500	---	20.45	49.80	29.35	1000.0	9.000	L1	GND	20.0
0.316500	40.15	---	59.80	19.65	1000.0	9.000	L1	GND	20.0
0.510000	33.09	---	56.00	22.91	1000.0	9.000	N	GND	20.1
0.510000	---	25.07	46.00	20.93	1000.0	9.000	N	GND	20.1
19.34700	41.93	---	60.00	18.07	1000.0	9.000	L1	GND	20.1
19.34700	---	33.00	50.00	17.00	1000.0	9.000	L1	GND	20.1

The equipment passed the performed tests	☒ Yes	☐ No	☐ N.t.x

Test setup photos/ test results are atteched	☒ Yes	☐ No	Annex no.:6

Conducted emissions - Tested with Laptop with active EUT_ (ID MRM103-USB)



Freq. (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	BW (kHz)	Line	PE	Corr dB
0.150000	60.24	---	66.00	5.76	1000.0	9.000	N	GND	20.2
0.150000	---	38.02	56.00	17.98	1000.0	9.000	N	GND	20.2
0.168000	---	34.50	55.06	20.56	1000.0	9.000	N	GND	20.0
0.168000	57.21	---	65.06	7.85	1000.0	9.000	N	GND	20.0
0.177000	57.12	---	64.63	7.51	1000.0	9.000	N	GND	20.0
0.177000	---	36.57	54.63	18.06	1000.0	9.000	N	GND	20.0
0.195000	---	30.34	53.82	23.49	1000.0	9.000	L1	GND	20.1
0.195000	52.13	---	63.82	11.69	1000.0	9.000	L1	GND	20.1
0.208500	51.77	---	63.27	11.49	1000.0	9.000	N	GND	20.0
0.208500	---	31.31	53.27	21.96	1000.0	9.000	N	GND	20.0
0.231000	---	24.15	52.41	28.26	1000.0	9.000	N	GND	20.0
0.231000	46.13	---	62.41	16.28	1000.0	9.000	N	GND	20.0
0.361500	---	33.63	48.69	15.07	1000.0	9.000	N	GND	20.0
0.361500	38.39	---	58.69	20.30	1000.0	9.000	N	GND	20.0
0.501000	---	26.73	46.00	19.27	1000.0	9.000	N	GND	20.1
0.501000	34.61	---	56.00	21.39	1000.0	9.000	N	GND	20.1
13.56000	---	54.80	50.00	-4.80	1000.0	9.000	N	GND	20.1
13.56000	55.82	---	60.00	4.18	1000.0	9.000	N	GND	20.1
15.89550	40.46	---	60.00	19.54	1000.0	9.000	L1	GND	20.1
15.89550	---	36.46	50.00	13.54	1000.0	9.000	L1	GND	20.1
27.13200	42.71	---	60.00	17.29	1000.0	9.000	L1	GND	20.1
27.13200	---	33.06	50.00	16.94	1000.0	9.000	L1	GND	20.1

The equipment passed the performed tests	☒ **Yes**	☐ **No**	☐ **N.t.x**

Test setup photos/ test results are atteched	☒ **Yes**	☐ **No**	Annex no.:6

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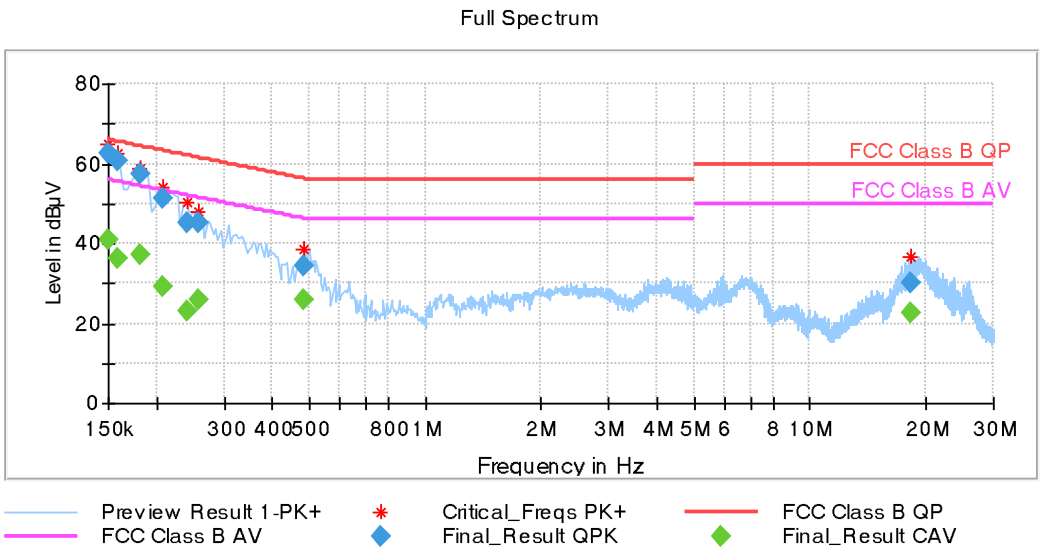
Conducted emissions - Tested with Laptop with active EUT_ (ID MRM103-USBC)



Freq. (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	BW (kHz)	Line	PE	Corr dB
0.150000	---	40.85	56.00	15.15	1000.0	9.000	N	GND	20.2
0.150000	62.46	---	66.00	3.54	1000.0	9.000	N	GND	20.2
0.159000	60.82	---	65.52	4.70	1000.0	9.000	L1	GND	20.0
0.159000	---	36.26	55.52	19.26	1000.0	9.000	L1	GND	20.0
0.181500	---	37.24	54.42	17.18	1000.0	9.000	N	GND	20.0
0.181500	57.50	---	64.42	6.91	1000.0	9.000	N	GND	20.0
0.208500	51.32	---	63.27	11.95	1000.0	9.000	N	GND	20.1
0.208500	---	29.37	53.27	23.90	1000.0	9.000	N	GND	20.1
0.240000	---	23.07	52.10	29.02	1000.0	9.000	L1	GND	20.0
0.240000	45.15	---	62.10	16.94	1000.0	9.000	L1	GND	20.0
0.258000	---	25.81	51.50	25.69	1000.0	9.000	N	GND	20.0
0.258000	45.02	---	61.50	16.48	1000.0	9.000	N	GND	20.0
0.483000	---	26.08	46.29	20.21	1000.0	9.000	N	GND	20.0
0.483000	34.34	---	56.29	21.94	1000.0	9.000	N	GND	20.0
18.33900	---	22.76	50.00	27.24	1000.0	9.000	N	GND	20.1
18.33900	30.13	---	60.00	29.87	1000.0	9.000	N	GND	20.1

The equipment passed the performed tests	☒ **Yes**	☐ **No**	☐ **N.t.x**

Test setup photos/ test results are atteched	☒ **Yes**	☐ **No**	Annex no.:6

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7.3 Restricted bands of operation

7.3.1 Regulations

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

Restricted bands of operation			
Frequency Band	**Frequency Band**	**Frequency Band**	**Frequency Band**
MHz	**MHz**	**MHz**	**GHz**
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	([2])
13.36-13.41	---	---	---
[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz. [2] Above 38.6			

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in § 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in § 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in § 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in § 15.35 apply to these measurements.

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(c) Except as provided in paragraphs (d) and (e) of this section, regardless of the field strength limits specified elsewhere in this subpart, the provisions of this section apply to emissions from any intentional radiator.

(d) The following devices are exempt from the requirements of this section:

1. Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph (a) of this section, the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a) of this section, and the fundamental emission is outside of the bands listed in paragraph (a) of this section more than 99% of the time the device is actively transmitting, without compensation for duty cycle.

2. Transmitters are used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.

3. Cable locating equipment operated pursuant to §15.213.

4. Any equipment operated under the provisions of §15.253, 15.255, and 15.256 in the frequency band 75-85 GHz, or §15.257 of this part.

5. Biomedical telemetry devices operating under the provisions of §15.242 of this part are not subject to the restricted band 608-614 MHz but are subject to compliance within the other restricted bands.

6. Transmitters operating under the provisions of subparts D or F of this part.

7. Devices operated pursuant to §15.225 are exempt from complying with this section for the 13.36-13.41 MHz band only.

8. Devices operated in the 24.075-24.175 GHz band under §15.245 are exempt from complying with the requirements of this section for the 48.15-48.35 GHz and 72.225-72.525 GHz bands only and shall not exceed the limits specified in §15.245(b).

9. Devices operated in the 24.0-24.25 GHz band under §15.249 are exempt from complying with the requirements of this section for the 48.0-48.5 GHz and 72.0-72.75 GHz bands only and shall not exceed the limits specified in §15.249(a).

10. White space devices operating under subpart H of this part are exempt from complying with the requirements of this section for the 608-614 MHz band.

(e) Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbance sensors operating under the provisions of § 15.245 shall not exceed the limits specified in § 15.245(b).

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7.3.2 Test results

Test location and equipment

Test site	☐ 660 Semi Anechoic Chamber ☒ 706 Semi Anechoic Chamber ☐ Radio laboratory					
Receiver	☐ 665	☐ 666	☒ 696			
Test equipment	☒ 406	☐ 445a	☐ 667	☐ 668	☐ 669	☐ 691
	☐ 93	☐ 462	☐ 560	☐ 284	☐ 23	☒ 697
	☒ 698	☒ 707	☒ 708	☒ 709	☐ 223a	
Cable	☐ K189	☐ K193	☐ K194	☐ K59	☐ K51	☐ K176
	☒ K198	☒ K199	☒ K203	☒ K205	☐ K195	☐ K164
Test-Software	☐ EMC32		☒ ELEKTRA			

The equipment passed the performed tests	☒ **Yes****	☐ **No**	☐ **N.t.x**

Test setup photos	☒ **Yes**	☐ **No**	**Annex no. 6**

** *All emissions that falls under the restricted bands of operations are included in clause 7.4 and are marked blue.*

7.4 Radiated emission limits

7.4.1 Regulations

The device operating in the frequency band 13.110-14.010, the field strength of any emission shall not exceed the following limits.

Frequency (MHz)	Field strength (dBµV/m)	Measurement distance (m)
13.553 - 13.567	84	30
13.410 - 13.553 and 13.567 - 13.710	50.5	30
13.110 - 13.410 and 13.710 - 14.010	40.5	30

(a) Outside the band 13.110-14.010, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (dBµV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
above 960	500	3
**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.		

(c) In the emission table above, the tighter limit applies at the band edges.

(d) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators, which operate under the provisions of other sections within this part, and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(e) 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, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

(f) The provisions in §§ 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

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(g) In accordance with §15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in §15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in §15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in §15.109 that are applicable to the incorporated digital device.

(h) 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.

7.4.2 Test procedure

According to ANSI C63.4-2014 Section 8 “Radiated Emissions Testing”, the EUT and this peripheral (when additional equipment exists) are placed on a turn table which is 0.8 m above the ground. The turn table would be allowed to rotate 360° to determine the position of the maximum emission level. The test distance between the EUT and the receiving antenna is 3m. To find the maximum emission, the polarization of the receiving antenna is changed in horizontal and vertical polarization; the position of the EUT was changed in different orthogonal determinations.

Measurement procedures for electric field radiated emissions from 9 kHz - 1 GHz & 1 GHz - 40 GHz are covered in Clause 8 of ANSI C63.4-2014. The ANSI C63.4-2014 measurement procedure consists of both an exploratory test and a final measurement. The exploratory test is critical to determine the frequency of all significant emissions. For each mode of operation required to be tested, the frequency spectrum is monitored. Variations in antenna height, antenna orientation, antenna polarization, EUT azimuth, and cable or wire placement are explored to produce the emission that has the highest amplitude relative to the limit.

The final measurements are made based on the findings in the exploratory testing. When making exploratory and final measurements it is necessary to maximize the measured radiated emission. Sub clause 8.3.2 of ANSI C63.4-2014 states that the measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” We consider the “cone of radiation” to be the 3 dB beam width of the measurement antenna.

While the “bore-sighting” technique is not explicitly mentioned in ANSI C63.4-2014, it is a useful technique for measurements using a directional antenna, such as a double-ridged waveguide antenna. Several precautions must be observed, including knowledge of the beam width of the antenna and the resulting illumination area relative to the size of the EUT, estimation for source of the emission and general location within larger EUTs, measuring system sensitivity, etc.

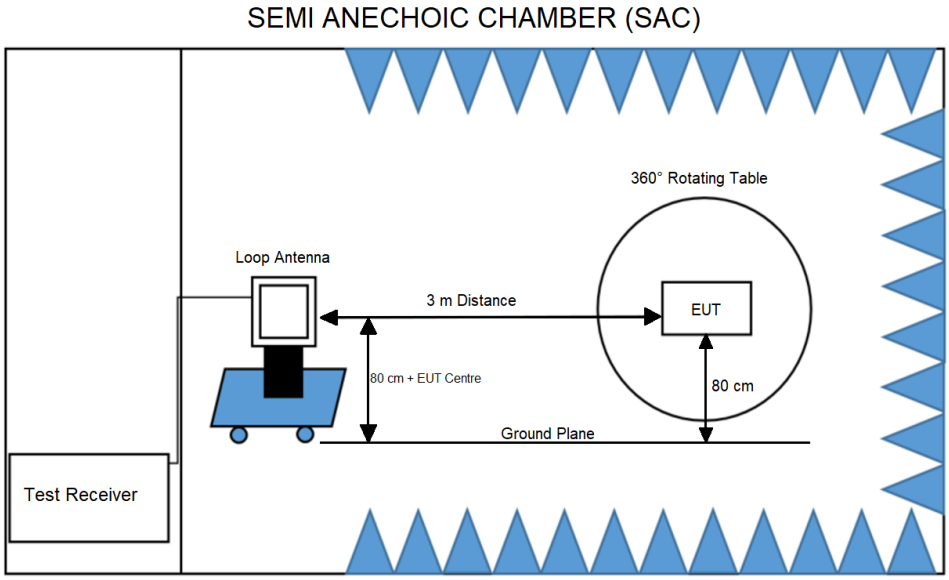
ANSI C63.4-2014 requires that the measurement antenna is kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. That means that if the directional radiation pattern of the EUT results in a maximum emission at an upwards angle from the EUT, when a directional antenna is used to make the measurement, it will be necessary for it to be pointed towards the source of the emission within the EUT. This can be done by either pointing the antenna at an angle towards the source of the emission, or by rotating the EUT, in both height and polarization, to maximize the measured emission. The emission must be kept within the illumination area of the 3 dB beamwidth of the antenna so that the maximum emission from the EUT is measured.

Radiated emissions test characteristics	
Frequency range	9 kHz - 40000 MHz
Test distance	10m, 3 m*
Test instrumentation resolution bandwidth	9 kHz (20 kHz – 30 MHz)
	120 kHz (30 MHz – 1.000 MHz)
	1 MHz (1000 MHz – 40000 MHz)
Receive antenna height	1 m (20 kHz – 30 MHz)
Receive antenna polarization	0° - 90° (20 kHz – 30 MHz)
Receive antenna scan height	1 m - 4 m (1000 MHz - 40000 MHz)
Receive antenna polarization	vertical/horizontal (Above 30 MHz)

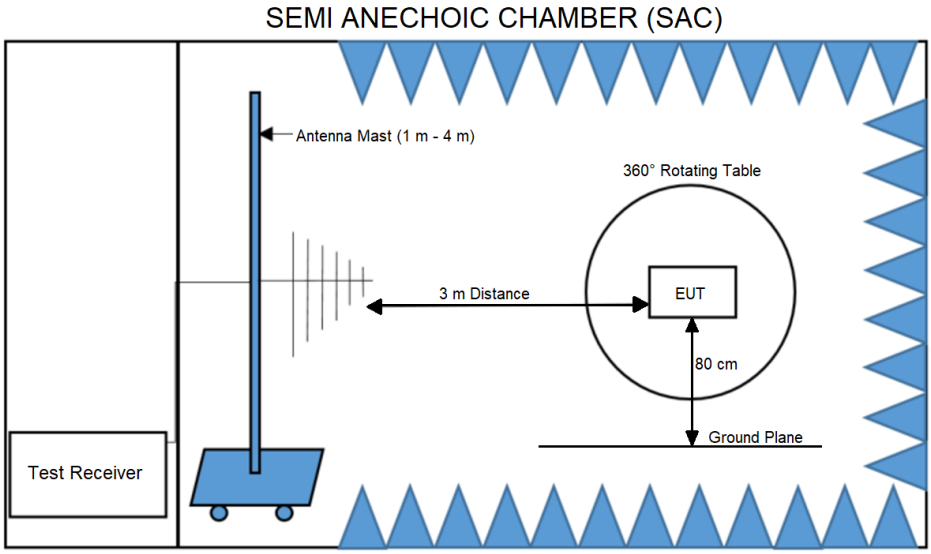
*According to Section 15.31 (f) (1): At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

7.4.3 Test setups

Radiated measurements setup (9 kHz – 30 MHz)



Radiated measurements setup (30 MHz – 1 GHz)



Radiated measurements from 9 kHz – 30 MHz, 30MHz – 1 GHz, using a small loop antenna and Linear polarized Logarithmic Periodic Broadband Antenna respectively with a measuring distance of 3 m inside SAC as shown in the above test setup diagrams.

7.4.4 Calculation of the field strength

The field strength is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor (without the use of a pre-amplifier)

Corrected Level = Receiver Level + Correction Factor – Pre-amplifier (with the use of a pre-amplifier)

Receiver Level: Receiver reading without correction factors
Correction Factor: Antenna factor + cable loss

For example:
The receiver reading is 32.7 dBµV. The antenna factor for the measured frequency is +2.5 dB (1/m) and the cable factor for the measured frequency is 0.71 dB, giving a field strength of 35.91dBµV/m.
The 35.91dBµV/m value can be mathematically converted to its corresponding level in µV/m.

Level in µV/m = Common Antilogarithm (35.91/20) = 62.44

For test distance other than what is specified, but fulfilling the requirements of Section 15.31 (f) (1) the field strength is calculated by adding additionally an extrapolation factor of 20 dB/decade (inverse linear distance for field strength measurements).

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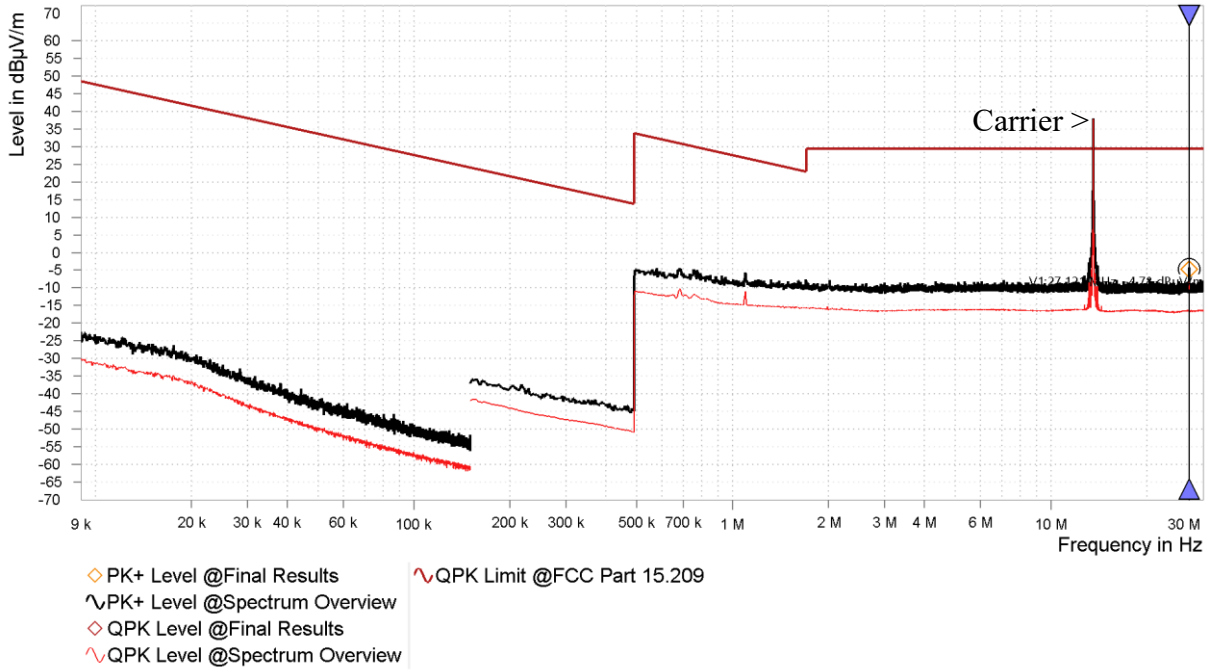
7.4.5 Test results

Test location and equipment

Test site	☐ 660 Semi Anechoic Chamber ☒ 706 Semi Anechoic Chamber ☐ Radio laboratory					
Receiver	☐ 665	☐ 666	☒ 696			
Test equipment	☒ 406	☐ 445a	☐ 667	☐ 668	☐ 669	☐ 691
	☐ 93	☐ 462	☐ 560	☐ 284	☐ 23	☒ 697
	☒ 698	☒ 707	☒ 708	☒ 709	☐ 223a	
Cable	☐ K189	☐ K193	☐ K194	☐ K59	☐ K51	☐ K176
	☒ K198	☒ K199	☒ K203	☒ K205	☐ K195	☐ K164
Test-Software	☐ EMC32		☒ ELEKTRA			

Measurement results ID MRM103-A + ID ANT 40/30

Radiated emission 9 kHz – 30 MHz



Freq. [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	PK+ Level [dBµV/m]	PK+: QPK Limit [dBµV/m]	PK+ Margin [dB]	Corr. [dB]	Pol.	Azi. [deg]	Ant. Height [m]	Meas. BW [kHz]
13.560	37.71	84.00	46.29	---	---	---	-18.05	0	0	1.00	9
27.121	---*	29.50	---	-4.78	29.50	34.28	-18.41	V	-135	1.00	9

the PK value is more than 6 dB lower than the QPK Limit, therefore no QPK measurements were performed.

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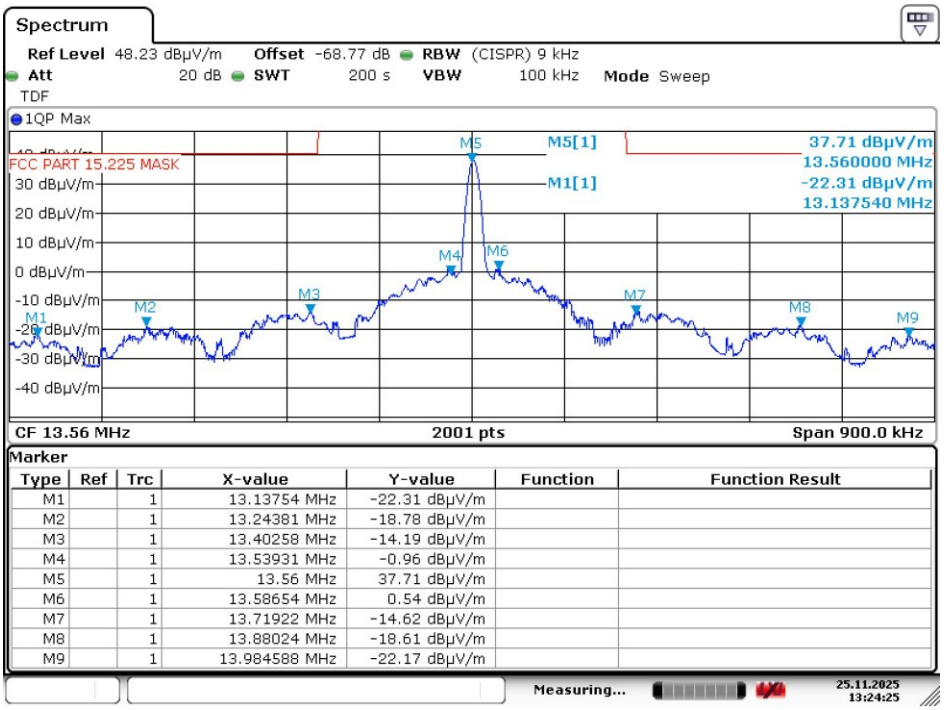
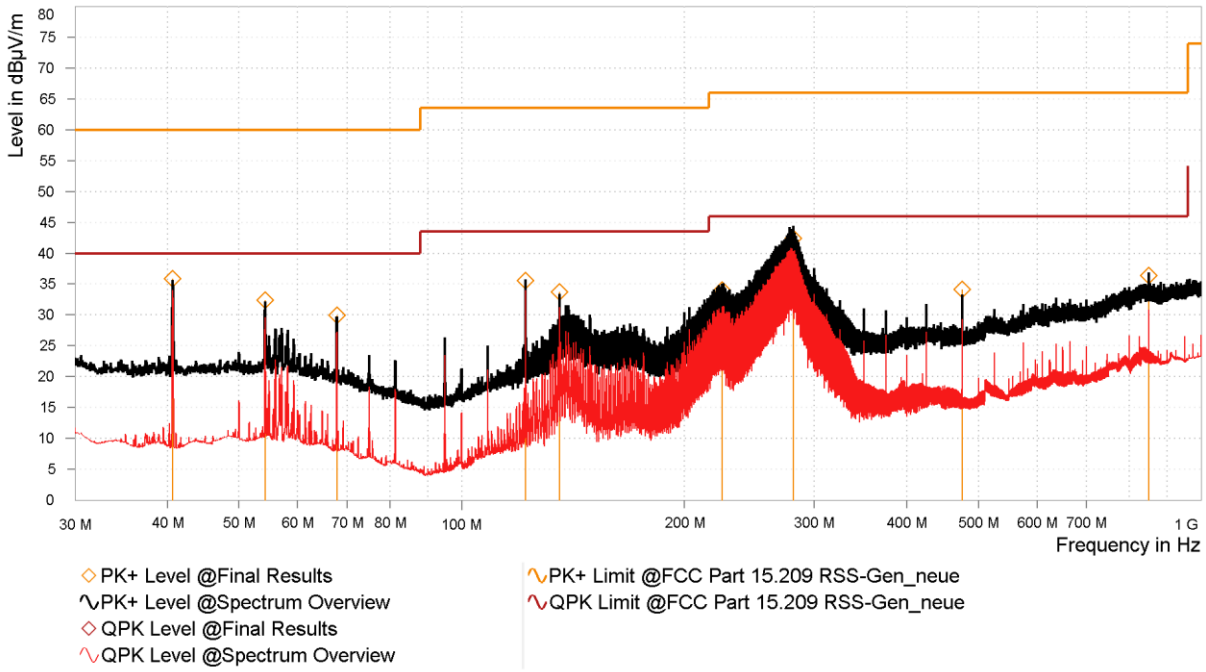


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	13.13754 MHz	-22.31 dBµV/m		
M2		1	13.24381 MHz	-18.78 dBµV/m		
M3		1	13.40258 MHz	-14.19 dBµV/m		
M4		1	13.53931 MHz	-0.96 dBµV/m		
M5		1	13.56 MHz	37.71 dBµV/m		
M6		1	13.58654 MHz	0.54 dBµV/m		
M7		1	13.71922 MHz	-14.62 dBµV/m		
M8		1	13.88024 MHz	-18.61 dBµV/m		
M9		1	13.984588 MHz	-22.17 dBµV/m		

Date: 25.NOV.2025 13:24:25

Radiated emission 30 MHz – 1 GHz



Freq. [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	PK Level [dBµV/m]	PK Limit [dBµV/m]	PK Margin [dB]	Corr. [dB]	Pol.	Azi. [deg]	Ant. Height [m]	Meas. BW [kHz]
40.680	---*	40.00	---	35.90	60.00	24.10	17.90	V	135	1.00	120.000
54.240	---*	40.00	---	32.40	60.00	27.60	18.21	V	-43	1.00	120.000
67.800	---*	40.00	---	29.95	60.00	30.05	16.73	V	-65	1.00	120.000
122.040	---*	43.50	---	35.59	63.50	27.91	16.55	V	-125	1.00	120.000
135.600	---*	43.50	---	33.70	63.50	29.80	17.32	V	-125	1.00	120.000
225.000	---*	46.00	---	34.06	66.00	31.94	14.92	V	144	1.00	120.000
281.160	---*	46.00	---	42.44	66.00	23.56	18.01	H	24	1.00	120.000
475.020	---*	46.00	---	34.10	66.00	31.90	22.81	V	-13	1.14	120.000
850.020	---*	46.00	---	36.42	66.00	29.58	29.17	V	-37	1.00	120.000

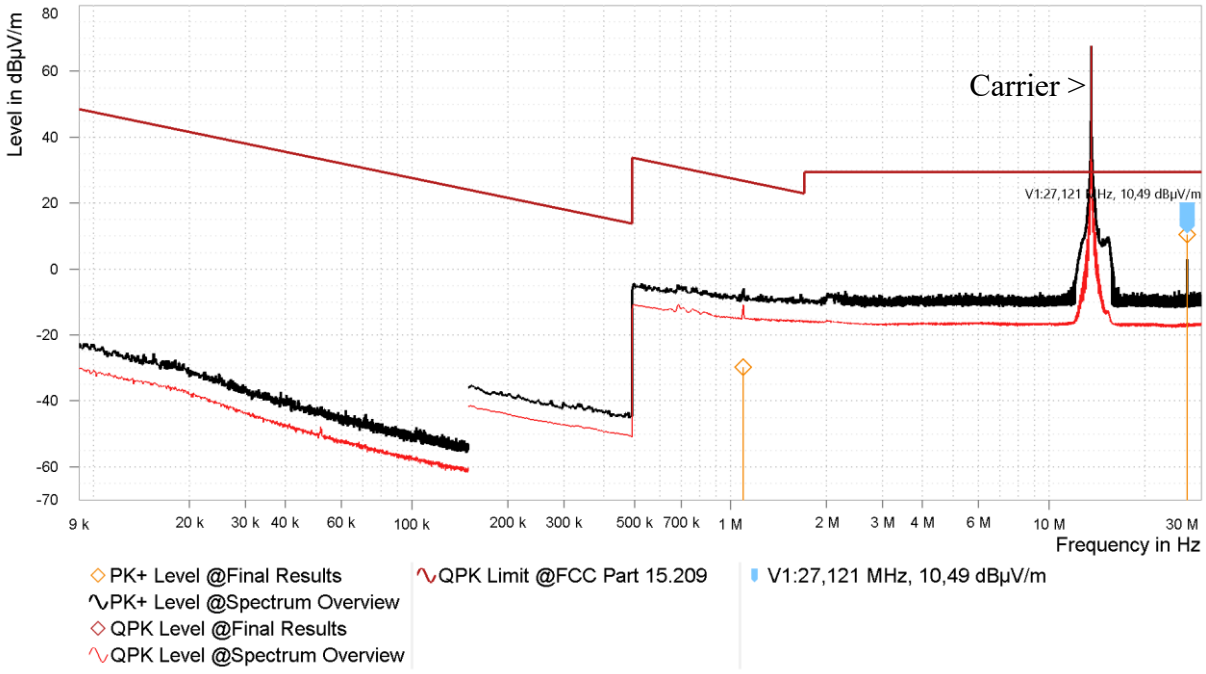
the PK value is lower than the QPK Limit, therefore no QPK measurements were performed.

The equipment passed the performed tests	☒ **Yes**	☐ **No**	☐ **N.t.x**

Test setup photos	☒ **Yes**	☐ **No**	**Annex no. 6**

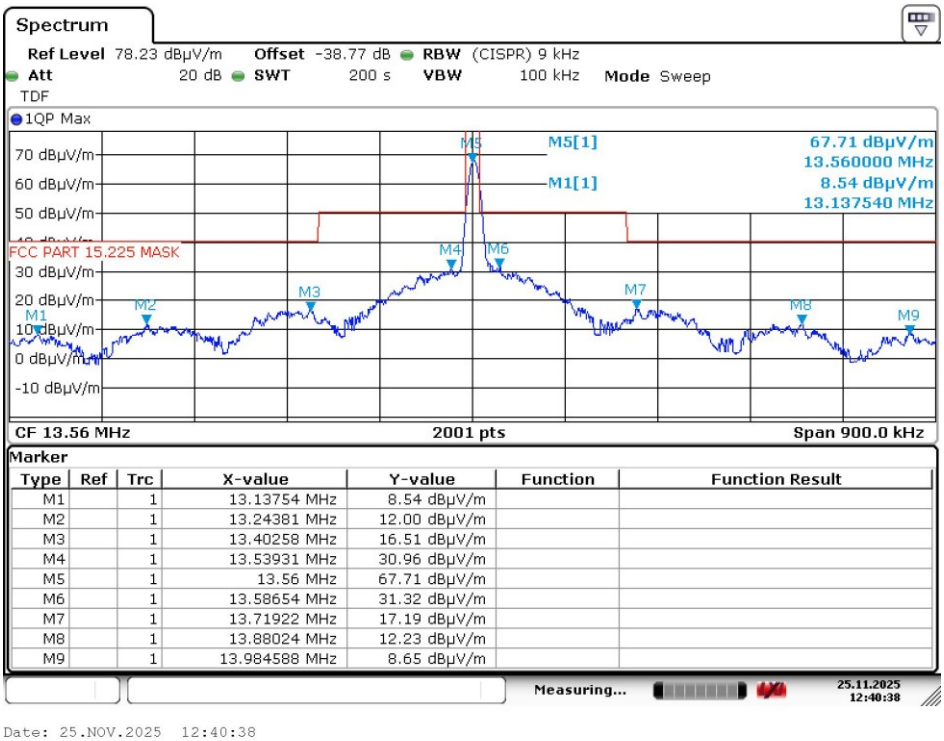
Measurement results ID MRM103-USBC + ID ANT 310/310

Radiated emission 9 kHz – 30 MHz

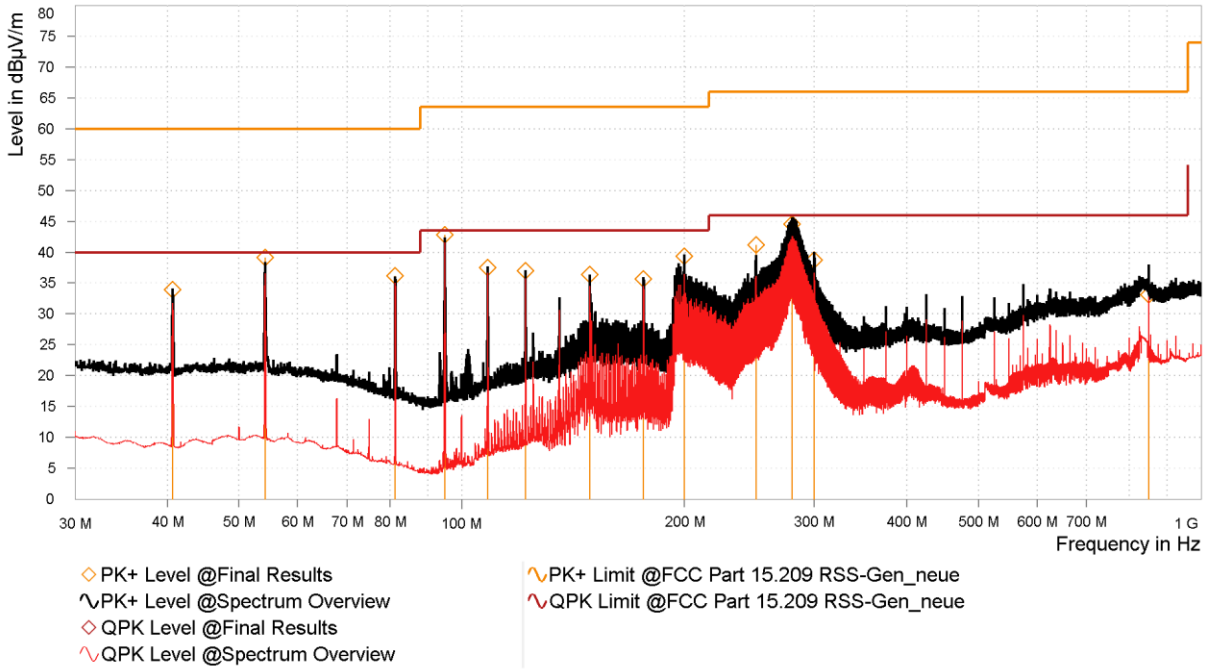


Freq. [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	PK+ Level [dBµV/m]	PK+: QPK Limit [dBµV/m]	PK+ Margin [dB]	Corr. [dB]	Pol. [deg]	Azi. [deg]	Ant. Height [m]	Meas. BW [kHz]
1.095	---*	26.77	---	-29.84	26.77	56.61	-18.34	0	-120	1.00	9
13.560	67.71	84.00	16.29	---	---	---	-18.05	0	0	1.00	9
27.121	---*	29.50	---	10.49	29.50	19.01	-18.41	0	176	1.00	9

the PK value is more than 6 dB lower than the QPK Limit, therefore no QPK measurements were performed.



Radiated emission 30 MHz – 1 GHz



Freq. [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	PK Level [dBµV/m]	PK Limit [dBµV/m]	PK Margin [dB]	Corr. [dB]	Pol.	Azi. [deg]	Ant. Height [m]	Meas. BW [kHz]
40.680	---*	40.00	---	33.92	60.00	26.08	17.90	V	-43	1.00	120.000
54.240	---*	40.00	---	39.09	60.00	20.91	18.21	V	-165	1.00	120.000
54.240	---*	40.00	---	39.16	60.00	20.84	18.21	V	-170	1.00	120.000
81.360	---*	40.00	---	36.20	60.00	23.80	13.85	V	114	1.00	120.000
94.920	42.25	43.50	1.25	42.80	63.50	20.70	12.71	V	135	1.14	120.000
108.480	---*	43.50	---	37.51	63.50	25.99	15.01	V	127	1.00	120.000
122.040	---*	43.50	---	36.98	63.50	26.52	16.55	V	97	1.00	120.000
149.160	---*	43.50	---	36.32	63.50	27.18	17.92	V	175	1.00	120.000
176.280	---*	43.50	---	35.69	63.50	27.81	17.17	V	-133	1.00	120.000
199.980	---*	43.50	---	39.36	63.50	24.14	14.71	H	-65	1.00	120.000
250.020	---*	46.00	---	41.16	66.00	24.84	16.66	H	-45	1.00	120.000
279.990	---*	46.00	---	44.59	66.00	21.41	17.98	H	-95	1.00	120.000
280.020	---*	46.00	---	41.87	66.00	24.13	17.98	H	-103	1.00	120.000
300.000	---*	46.00	---	38.70	66.00	27.30	18.58	H	-95	1.00	120.000
850.050	---*	46.00	---	33.09	66.00	32.91	29.17	H	-43	1.00	120.000

the PK value is lower than the QPK Limit, therefore no QPK measurements were performed.

The equipment passed the performed tests	☒ **Yes**	☐ **No**	☐ **N.t.x**

Test setup photos	☒ **Yes**	☐ **No**	**Annex no. 6**

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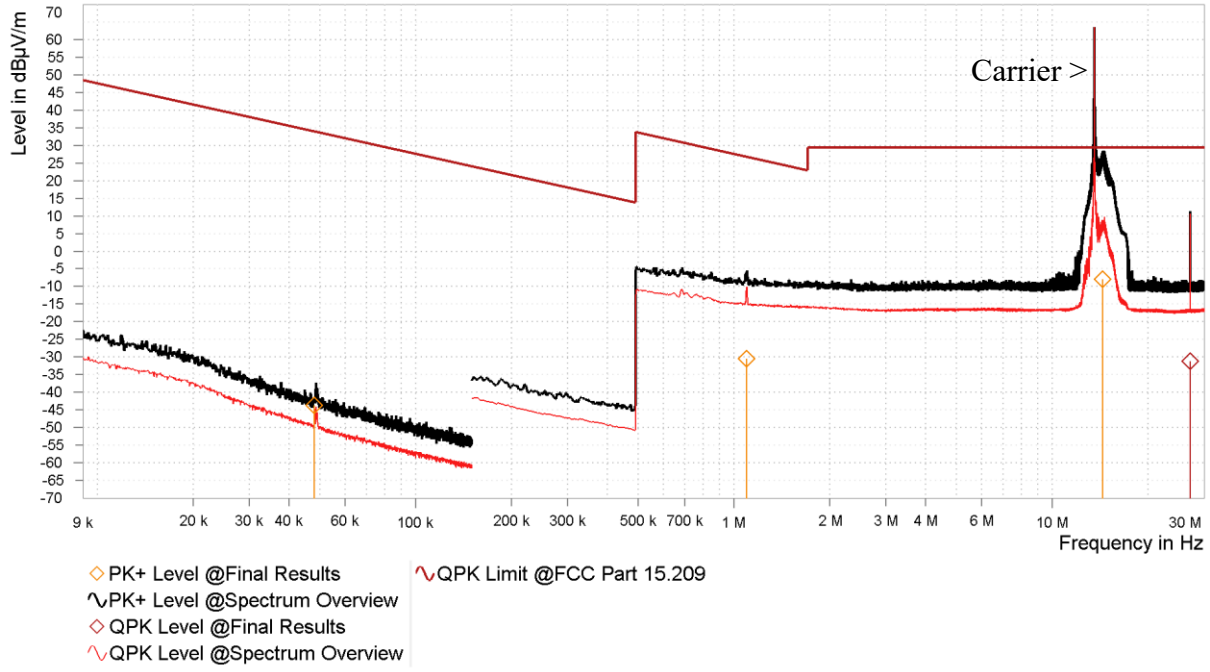
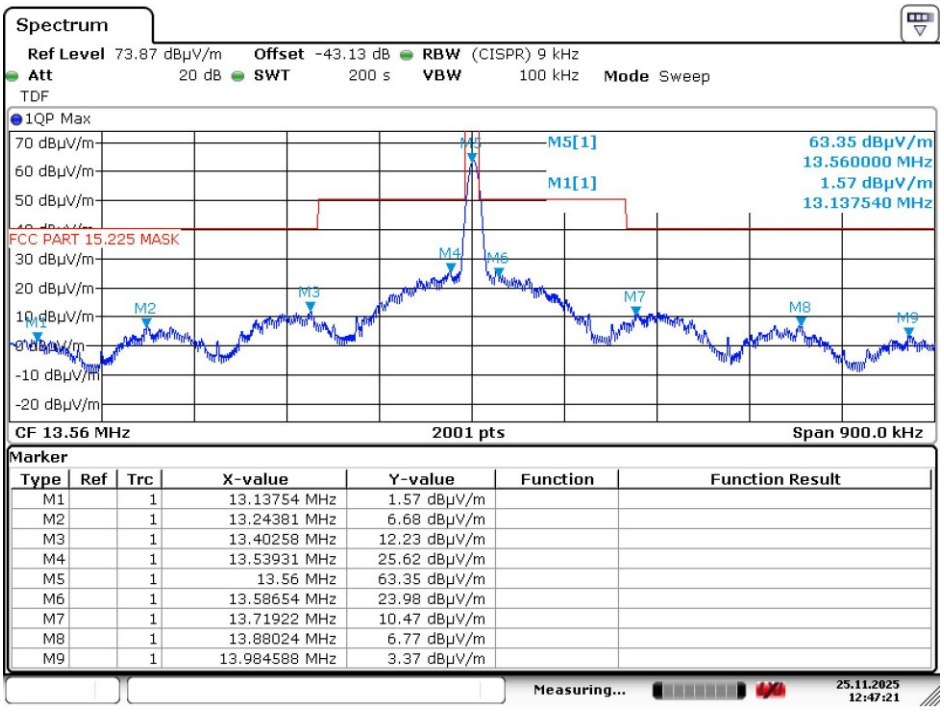
Measurement results ID MRM103-E + ID ANT 800/600-DA

Radiated emission 9 kHz – 30 MHz



Freq. [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	PK+ Level [dBµV/m]	PK+: QPK Limit [dBµV/m]	PK+ Margin [dB]	Corr. [dB]	Pol.	Azi. [deg]	Ant. Height [m]	Meas. BW [kHz]
1.095	---*	26.77	---	-30.50	26.77	57.27	-18.34	V	-60	1.00	9.000
13.560	63.35	84.00	20.65	---	---	---	-18.05	0	0	1.00	9
14.415	---*	29.50	---	-8.02	29.50	37.52	-18.48	V	-180	1.00	9.000
27.121	-31.27	29.50	60.77				-18.41	V	167	1.00	9.000

the PK value is more than 6 dB lower than the QPK Limit, therefore no QPK measurements were performed.



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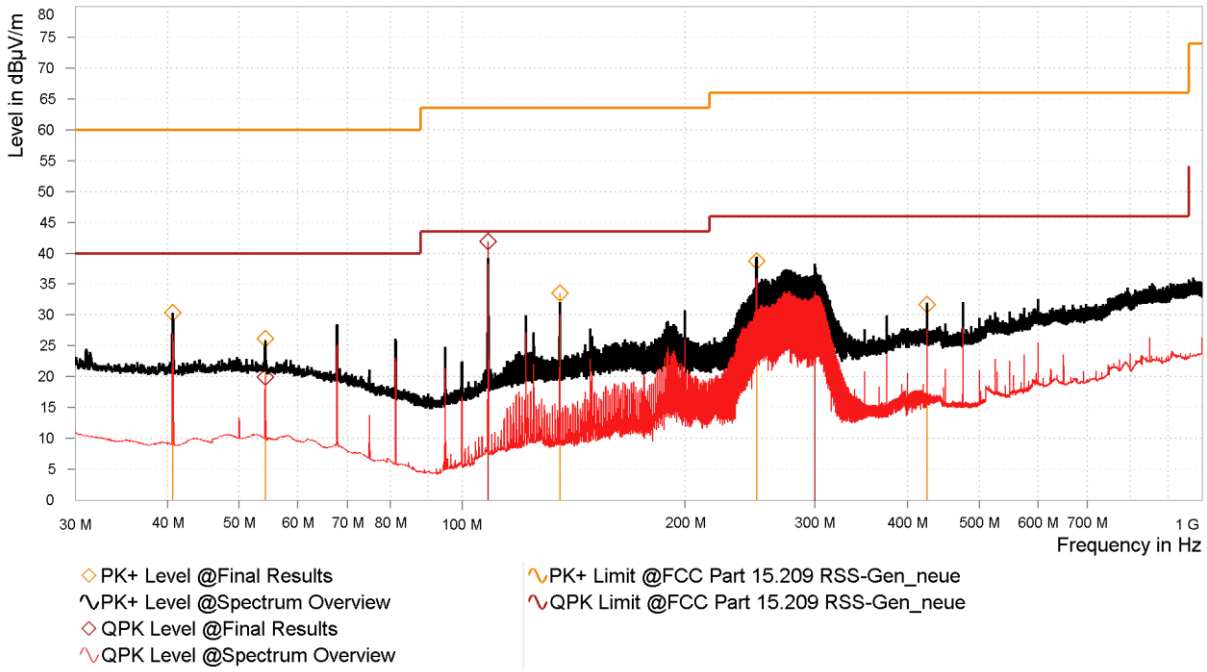
Radiated emission 30 MHz – 1 GHz



Freq. [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	PK Level [dBµV/m]	PK Limit [dBµV/m]	PK Margin [dB]	Corr. [dB]	Pol.	Azi. [deg]	Ant. Height [m]	Meas. BW [kHz]
40.680	---*	40.00	---	30.36	60.00	29.64	17.90	V	105	1.00	120.000
54.240	19.97	40.00	20.03	---	---	---	18.21	V	75	1.14	120.000
54.240	---*	40.00	---	26.12	60.00	33.88	18.21	V	97	1.00	120.000
108.480	41.85	43.50	1.65	---	---	---	15.01	H	-13	3.00	120.000
135.600	---*	43.50	---	33.51	63.50	29.99	17.32	H	-178	2.08	120.000
249.990	---*	46.00	---	38.75	66.00	27.25	16.65	V	-82	1.00	120.000
300.000	33.30	46.00	12.70	---	---	---	18.58	H	76	1.14	120.000
425.010	---*	46.00	---	31.70	66.00	34.30	21.52	H	-45	1.00	120.000

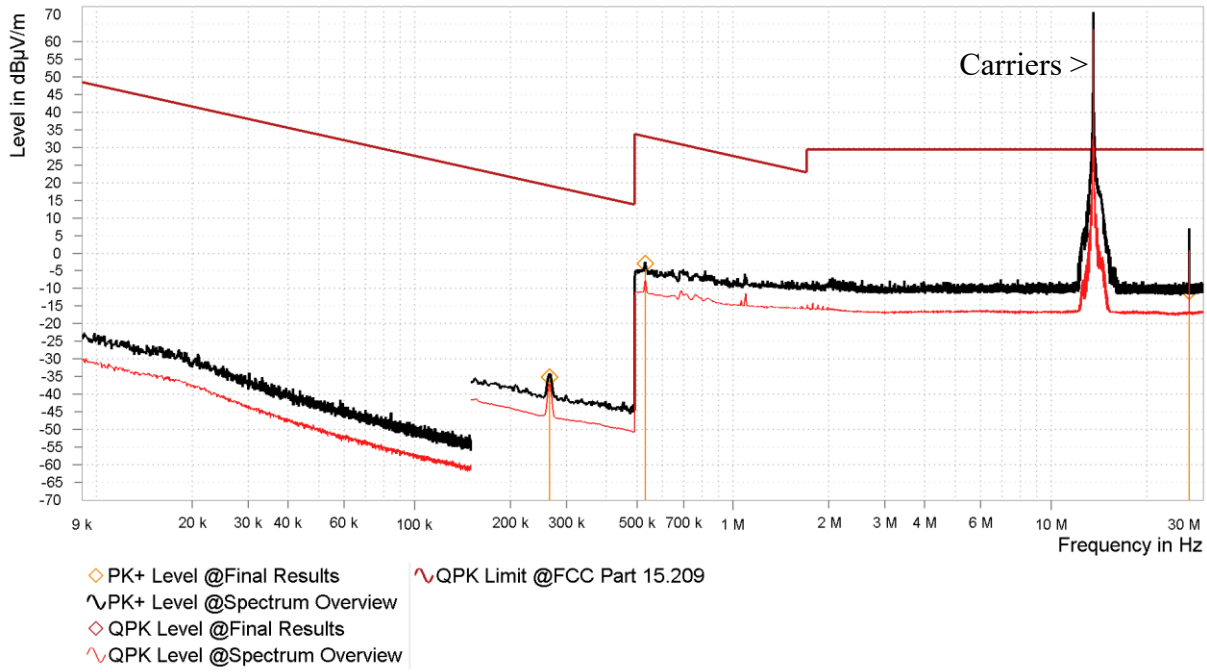
the PK value is more than 6 dB lower than the QPK Limit, therefore no QPK measurements were performed.

The equipment passed the performed tests	☒ **Yes**	☐ **No**	☐ **N.t.x**

Test setup photos	☒ **Yes**	☐ **No**	**Annex no. 6**

Measurement results_ID MRM103-A + ID ANT.MUX.5 + (ID ANT240/180 + ID ANTS240/180 + ID ANTS370/270 + ID ANT310/310 + ID ANT100/100)

Radiated emission 9 kHz – 30 MHz



Freq. [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	PK+ Level [dBµV/m]	PK+: QPK Limit [dBµV/m]	PK+ Margin [dB]	Corr. [dB]	Pol.	Azi. [deg]	Ant. Height [m]	Meas. BW [kHz]
0.265	---*	19.14	---	-35.15	19.14	54.29	-58.26	V	180	1.00	9.000
0.530	---*	33.11	---	-3.04	33.11	36.15	-18.26	V	-174	1.00	9.000
27.121	---*	29.50	---	-10.88	29.50	30.38	-18.41	V	-105	1.00	9.000

the PK value is more than 6 dB lower than the QPK Limit, therefore no QPK measurements were performed.

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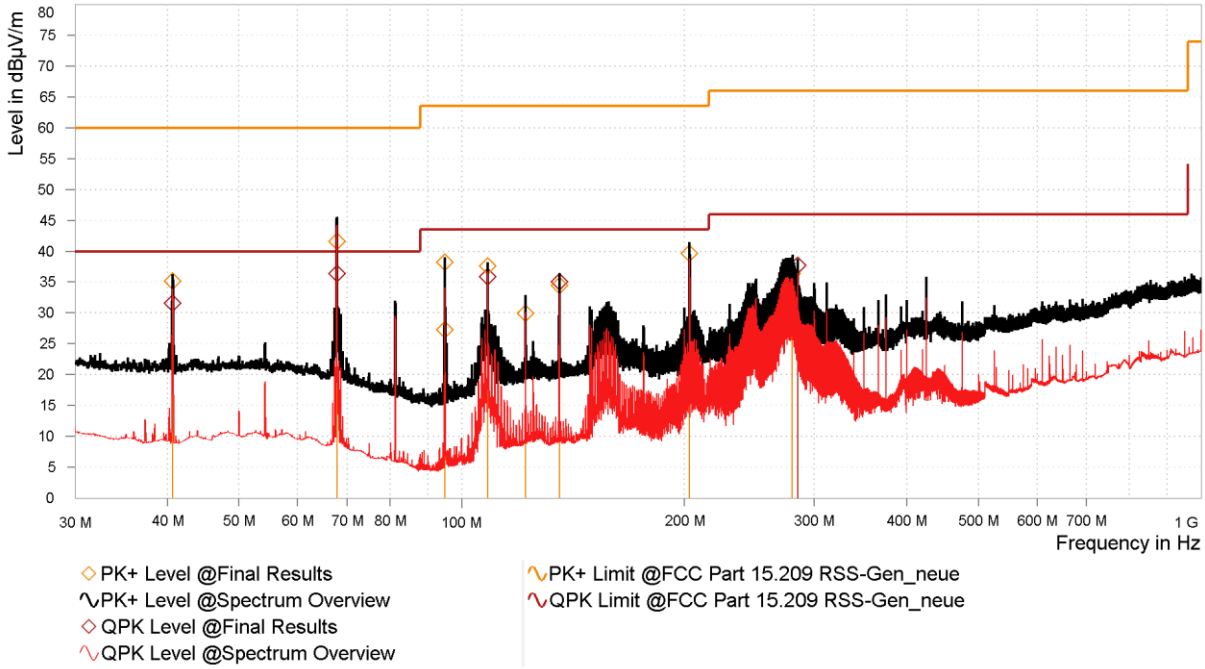
Radiated emission 30 MHz – 1 GHz



Freq. [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	PK Level [dBµV/m]	PK Limit [dBµV/m]	PK Margin [dB]	Corr. [dB]	Pol.	Azi. [deg]	Ant. Height [m]	Meas. BW [kHz]
40.680	31.62	40.00	8.38	35.10	60.00	24.90	17.90	V	45	2.56	120.000
67.800	36.41	40.00	3.59	41.56	60.00	18.44	16.73	V	-105	1.82	120.000
94.920	27.29	43.50	16.21	38.23	63.50	25.27	12.71	V	-75	1.81	120.000
108.480	35.84	43.50	7.66	37.63	63.50	25.87	15.01	V	-112	1.00	120.000
122.040	---*	43.50	---	29.95	63.50	33.55	16.55	V	-52	2.06	120.000
135.600	35.04	43.50	8.46	34.45	63.50	29.05	17.32	V	135	1.57	120.000
203.190	18.84	43.50	24.66	39.68	63.50	23.82	14.69	V	135	1.14	120.000
280.110	---*	46.00	---	36.41	66.00	29.59	17.98	H	-73	1.00	120.000
284.790	37.74	46.00	8.26	---	66.00	---	18.12	V	-178	1.57	120.000

the PK value is more than 6 dB lower than the QPK Limit, therefore no QPK measurements were performed.

The equipment passed the performed tests	☒ **Yes**	☐ **No**	☐ **N.t.x**

Test setup photos	☒ **Yes**	☐ **No**	**Annex no. 6**

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7.5 Frequency tolerance

7.5.1 Regulations

The frequency tolerance of the carrier signal shall be maintained within ± 0.01 % of the operating frequency over a temperature variation of -20 °C to +55 °C at normal supply voltage, and for a variation in the primary supply voltage from 85 % to 115 % of the rated supply voltage at a temperature of 20 °C.

7.5.2 Test procedure

Stability with respect to ambient temperature

Supply the EUT with nominal ac voltage or install a new or fully charged battery in the EUT. If possible, a dummy load should be connected to the EUT, because an antenna near the metallic walls of an environmental test chamber could affect the output frequency of the EUT. If the EUT is equipped with a permanently attached, adjustable-length antenna, the EUT should be placed in the center of the chamber with the antenna adjusted to the shortest length possible. Turn the EUT on, and tune it to one of the number of frequencies required

Couple the intentional radiator output to the measuring instrument by connecting an antenna to the measurement instrument with a suitable length of coaxial cable and placing the measurement antenna near the EUT (e.g., 15 cm away) or by connecting a dummy load to the measuring instrument through an attenuator, if necessary.

Supply the EUT with nominal ac voltage or install a new or fully charged battery in the EUT. Turn the EUT on and couple its output to the measuring instrument by connecting an antenna to the measurement instrument with a suitable length of coaxial cable.

Adjust the location of the measurement antenna and the controls on the measuring instrument to obtain a suitable signal level (i.e., a level that will not overload the measuring instrument, but is strong enough to allow measurement of the operating or fundamental frequency of the EUT).

Tune the EUT to any one of the number of frequencies specified. Turn the EUT off and place it inside an environmental chamber if appropriate. Allow the chamber to stabilize at +20 °C before proceeding. Turn on the EUT and record the operating frequency of the intentional radiator at startup and two, five, and ten minutes after startup. Turn the EUT off and allow it to cool to the ambient temperature and then repeat this procedure for the number of the frequencies specified. Four measurements are made at each operating frequency.

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Stability with respect to input voltage

Supply the EUT with nominal ac voltage or install a new or fully charged battery in the EUT. If possible, a dummy load should be connected to the EUT, because an antenna near the metallic walls of an environmental test chamber could affect the output frequency of the EUT. If the EUT is equipped with a permanently attached, adjustable-length antenna, the EUT should be placed in the center of the chamber with the antenna adjusted to the shortest length possible. Turn the EUT on and tune it to one of the number of frequencies required.

Couple the intentional radiator output to the measuring instrument by connecting an antenna to the measurement instrument with a suitable length of coaxial cable and placing the measurement antenna near the EUT (e.g., 15 cm away) or by connecting a dummy load to the measuring instrument through an attenuator, if necessary.

Adjust the location of the measurement antenna and the controls on the measuring instrument to obtain a suitable signal level (i.e., a level that will not overload the measuring instrument, but is strong enough to allow measurement of the operating or fundamental frequency of the EUT). Turn the EUT off and place it inside an environmental temperature chamber. For devices that are normally operated continuously, the EUT may be energized while inside the test chamber. For devices that have oscillator heaters, energize only the heater circuit while the EUT is inside the chamber.

Set the temperature control on the chamber to the highest specified EUT operating temperature and allow the temperature inside the chamber to stabilize at the set temperature before starting frequency measurements.

While maintaining a constant temperature inside the environmental chamber, turn the EUT on and record the operating frequency at startup and two, five, and ten minutes after the EUT is energized. Four measurements in total are made.

Repeat the above procedure until the number of specified frequencies has been measured. After all measurements have been made at the highest specified temperature, turn the EUT off. Repeat the above measurement process for the EUT with the test chamber set at the lowest temperature specified by the regulatory or procuring agency. Measurements shall be made at the number of frequencies specified.

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7.5.3 Test results

Test location and equipment

Test site	☐ 660 Semi Anechoic Chamber ☐ 706 Semi Anechoic Chamber ☒ Radio laboratory					
Receiver	☒ 502	☐ 666	☐ 696			
Test equipment	☒ 226	☒ 401	☒ 102a	☒ Test fixture		☐ 691
	☐ 93	☐ 462	☐ 560	☐ 284	☐ 23	☐ 697
	☐ 698	☐ 707	☐ 708	☐ 709	☐ 223a	
Cable	☒ EMV9	☐ K193	☐ K194	☐ K59	☐ K51	☐ K176
	☐ K198	☐ K199	☐ K203	☐ K205	☐ K195	☐ K164
Test-Software	☐ EMC32		☐ ELEKTRA			

Measurement results_ID MRM103-A + ID ANT40/30

Frequency stability when varying supply voltage

Temperature (°C)	Voltage (V DC)	Measured frequency (MHz)	Frequency error (kHz)	Frequency error (ppm)
+20	V_{nom} = 12.0	13.560012	0.012	0.87
+20	V_{mid} = 18.0	13.560012	0.012	0.87
+20	V_{max} = 24.0	13.560011	0.011	0.83
		Maximum frequency error	0.012	0.87

Frequency stability with respect to ambient temperature

Temperature (°C)	Voltage (V DC)	Measured frequency (MHz)	Frequency error (kHz)	Frequency error (ppm)
-20	12.0	13.560028	0.028	2.04
-10	12.0	13.560093	0.093	6.88
0	12.0	13.560102	0.102	7.50
10	12.0	13.560097	0.097	7.13
20	12.0	13.560012	0.012	0.87
30	12.0	13.560073	0.073	5.41
40	12.0	13.560005	0.005	0.33
50	12.0	13.559979	-0.021	-1.56
		Maximum frequency error	0.102	7.50

The equipment passed the performed tests	☒ **Yes**	☐ **No**	☐ **N.t.^{x}**

Test setup photos	☒ **Yes**	☐ **No**	**Annex no. 12, 6**

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Measurement results_ID MRM103-USBC + ID ANT310/310

Frequency stability when varying supply voltage

Temperature (°C)	Voltage (V DC)	Measured frequency (MHz)	Frequency error	
			(kHz)	(ppm)
+20	V_{min} = 4.5	13.560011	0.011	0.80
+20	V_{nom} = 5.0	13.560011	0.011	0.80
+20	V_{max} = 5.5	13.560011	0.011	0.80
		Maximum frequency error	0.011	0.80

Frequency stability with respect to ambient temperature

Temperature (°C)	Voltage (V DC)	Measured frequency (MHz)	Frequency error	
			(kHz)	(ppm)
-20	5.0	13.560028	0.028	2.06
-10	5.0	13.560092	0.092	6.79
0	5.0	13.560102	0.102	7.49
10	5.0	13.560093	0.093	6.83
20	5.0	13.560011	0.011	0.80
30	5.0	13.560078	0.078	5.72
40	5.0	13.560005	0.005	0.35
50	5.0	13.559980	-0.020	-1.47
		Maximum frequency error	0.102	7.49

The equipment passed the performed tests	☒ **Yes**	☐ **No**	☐ **N.t.[x]**

Test setup photos	☒ **Yes**	☐ **No**	**Annex no. 12, 6**

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Measurement results_ID MRM103-E + ID ANT800/600-DA

Frequency stability when varying supply voltage

Temperature (°C)	Voltage (V DC)	Measured frequency (MHz)	Frequency error	
			(kHz)	(ppm)
+20	V_{nom} = 12.0	13.560011	0.011	0.83
+20	V_{mid} = 18.0	13.560011	0.011	0.83
+20	V_{max} = 24.0	13.560011	0.011	0.83
		Maximum frequency error	0.012	0.83

Frequency stability with respect to ambient temperature

Temperature (°C)	Voltage (V DC)	Measured frequency (MHz)	Frequency error	
			(kHz)	(ppm)
-20	12.0	13.560028	0.028	2.07
-10	12.0	13.560092	0.092	6.78
0	12.0	13.560102	0.102	7.49
10	12.0	13.560099	0.099	7.29
20	12.0	13.560011	0.011	0.78
30	12.0	13.560066	0.066	4.83
40	12.0	13.560004	0.004	0.32
50	12.0	13.559979	-0.021	-1.52
		Maximum frequency error	0.102	7.50

The equipment passed the performed tests	☒ **Yes**	☐ **No**	☐ **N.t.[x]**

Test setup photos	☒ **Yes**	☐ **No**	**Annex no. 12, 6**

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7.6 20 dB Bandwidth

7.6.1 Regulations

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band to minimize the possibility of out-of-band operation.

7.6.2 Test procedure

The test procedure is taken from

ANSI C63.10-2013 Section 6.9.3 Occupied bandwidth measurements

The occupied bandwidth is measured as the width of the spectral envelope of the modulated signal, at an amplitude level reduced from a reference value by a specified ratio (or in decibels, a specified number of dB down from the reference value). Typical ratios, expressed in dB, are -6 dB, -20 dB, and -26 dB, corresponding to 6 dB BW, 20 dB BW, and 26 dB BW, respectively. In this sub-clause, the ratio is designated by “-xx dB.” The reference value is either the level of the unmodulated carrier or the highest level of the spectral envelope of the modulated signal, as stated by the applicable requirement. Some requirements might specify a specific maximum or minimum value for the “-xx dB” bandwidth; other requirements might specify that the “−xx dB” bandwidth be entirely contained within the authorized or designated frequency band.

a) The spectrum analyzer center frequency is set to the nominal EUT channel frequency. The span range for the EMI receiver or spectrum analyzer shall be between two and five times the OBW.

b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW, unless otherwise specified by the applicable requirement.

c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.

d) Steps a) through c) might require iteration to adjust within the specified tolerances.

e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target “−xx dB down” requirement; that is, if the requirement calls for measuring the −20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value.

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f) Set detection mode to peak and trace mode to max hold.

g) Determine the reference value: Set the EUT to transmit an unmodulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyser marker to the highest level of the displayed trace (this is the reference value).

h) Determine the "−xx dB down amplitude" using [(reference value) − xx]. Alternatively, this calculation may be made by using the marker-delta function of the instrument.

i) If the reference value is determined by an unmodulated carrier, then turn the EUT modulation ON, and either clear the existing trace or start a new trace on the spectrum Analyser and allow the new trace to stabilize. Otherwise, the trace from step g) shall be used for step j).

j) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the "- xx dB down amplitude" determined in step h). If a marker is below this "−xx dB down amplitude" value, then it shall be as close as possible to this value. The occupied bandwidth is the frequency difference between the two markers. Alternatively, set a marker at the lowest frequency of the envelope of the spectral display, such that the marker is at or slightly below the "-xx dB down amplitude" determined in step h). Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.

k) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labelled. Tabular data may be reported in addition to the plot(s).

7.6.3 Test results

Test location and equipment

Test site	☐ 660 Semi Anechoic Chamber ☐ 706 Semi Anechoic Chamber ☒ Radio laboratory					
Receiver	☒ 502	☐ 666	☐ 696			
Test equipment	☒ 226	☒ 401	☒ 102a	☒ Test fixture		☐ 691
	☐ 93	☐ 462	☐ 560	☐ 284	☐ 23	☐ 697
	☐ 698	☐ 707	☐ 708	☐ 709	☐ 223a	
Cable	☒ EMV9	☐ K193	☐ K194	☐ K59	☐ K51	☐ K176
	☐ K198	☐ K199	☐ K203	☐ K205	☐ K195	☐ K164
Test-Software	☐ EMC32		☐ ELEKTRA			

Measurement results

	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
ID MRM103-A + ID ANT40/30	2.774	11.169
ID MRM103-USBC + ID ANT310/310	2.774	10.695
ID MRM103-E + ID ANT800/600-DA	2.774	10.695

The equipment passed the performed tests	☒ **Yes**	☐ **No**	☐ **N.t.[x]**

Test setup photos	☒ **Yes**	☐ **No**	**Annex no. 12, 3**

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8 Measurement Uncertainty

The total uncertainty of measurement is the result of the mathematically-statistically distribution of the individual measurement uncertainty (MU) of the used measurement equipment. It is supposed that all individual deviations accidentally but not inevitable normally distributed. The total deviation is supposed to be normally distributed (RSS=Root-Sum-of-the-squares deviation corresponds to a measurement uncertainty which will be not exceeded with a probability of 68 %). Measurement uncertainty Δ, which will be not exceeded with a probability of 95 %, is 2 x RSS. For the following measurements and tests are the values as from the laboratory given:

Clause	Title	Meas. Uncert.
7.2	Conducted limits	± 2 dB
7.4	Radiated emission limits	± 4 dB
7.5	Frequency tolerance	± $5*10^{-8}$
7.6	Occupied Bandwidth	± $5*10^{-8}$

Table 8-1: Uncertainty of measurement

8.1 Decision rule

As far as in this report statements on conformity are made, decision rules according to DIN EN ISO/IEC 17025:2018, 7.8.6 have been applied. If the report does not state otherwise, procedure 1 according to IEC Guide 115 ed. 2.0 2021 (uncertainty of measurement calculated) has been applied on measurement and test procedures, which are the basis of this report.

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9 List of test equipment

State Dezember 16. 2025					
Marking	**Manufacturer**	**SW/Type/Serial-No.**	**Last Cal./Val.**	**Next Cal. /Val. (± 1 month)**	**No.**
1 Measuring Instruments					
Attenuator	Tektronix	011-0085-00	Mar 24	Mar 27	61
Attenuator	Radiall	---	Nov 22	Nov 25	62
Attenuator 3dB	Suhner	6803/17	Nov 22	Nov 25	137
Attenuator 3dB / 18 GHz	Suhner	3dB/18GHz	Nov 22	Nov 25	299
Attenuator 6dB / 18 GHz	Suhner	6dB/18GHz	Nov 22	Nov 25	344
Attenuator 20dB / 20GHz	Parzich	40AH-20	Nov 22	Nov 25	354
Attenuator 3dB / 12,4 GHz	Narda	TB 50902-1, S/N: 35005	Mar 24	Mar 27	183a
Attenuator 6dB / 12,4 GHz	Narda	TB 50902-2, S/N: 36328	Mar 24	Mar 27	183b
Attenuator 10dB / 12,4 GHz	Narda	S/N: 36500	Mar 24	Mar 27	183c
Attenuator 20dB / 12,4 GHz	Narda	8491A, S/N: 6218	Mar 24	Mar 27	183d
Terminator	KDI	T173CS	Nov 22	Nov 25	490
Variable transformer	RFT	LS 002	---	---	154a
Variable transformer	Schunt+Ben	---	---	---	155
Power sensor	Marconi	6914	Apr 25	Apr 27	258
Power sensor	Rohde & Schwarz	NRP18SN	Apr 24	Apr 26	651
3-Path Diode Power Sensor 10 MHz to 8 GHz	Rohde & Schwarz	NRP8S	Feb 25	Feb 27	663
3-Path Diode Power Sensor 10 MHz to 18 GHz	Rohde & Schwarz	NRP18S-20	Feb 25	Feb 27	664
Coaxial Directional Coupler	Narda	3003-20	Feb 24	Feb 27	370/342
Coaxial directional coupler	Mini Circuits	ZFDC-20-5	Jun 24	Jun 26	434
Coaxial directional coupler	Narda	3022 / 50204	Oct 25	Oct 28	303
Coaxial High Pass Filter	Mini circuits	NHP-700	Jun 24	Jun 27	435
Coaxial High Pass Filter	Mini circuits	NHP-200	Jun 24	Jun 27	405
Coaxial High Pass Filter	Mini circuits	NHP-25+	Jun 24	Jun 27	455
High Pass Filter	Mini circuits	VHF-1200+	Jun 24	Jun 27	452
High Pass Filter	Morita Tech	MT-SCHLC-500/T300-0/0	Mar 24	Mar 27	703
High Pass Filter	Morita Tech	MT-SCHPFF-1000-T855-0/0	Mar 24	Mar 27	704
High Pass Filter	Morita Tech	MT-SCHPF-2000/ T1720-0/0	Mar 24	Mar 27	705
Bandpass Filter	Schomandl	BN86871	Dec 24	Dec 27	66
Bandpass Filter	Schomandl	BN68673	Dec 24	Dec 27	67
Band Reduction Filter	Morita Tech	MT-SC12FVRC-5250/X200-0/0	Mar 24	Mar 27	701
Band Reduction Filter	Morita Tech	MT-SCBRF-5597.5/255-0/0	Mar 24	Mar 27	702
Low Pass Filter	Mini circuits	SLP550	Jun 24	Jun 27	273
Low Pass Filter	Mini circuits	SLP550	Jun 24	Jun 27	274
Coaxial Fixed Attenuator DC – 1 GHz	Texscan	HFP50/10	Aug 23	Aug 26	60
8 Wire Impedance Stabilisation Network	Schwarzbeck	CAT5 8158	Jan 24	Jan 26	71a
T-Section - 50 W	Rohde & Schwarz	BN 42441/50	Dec 24	Dec 27	93
RF Current Injection Clamp 0.15 – 1GHz	Lüthi GmbH	EM 101	Mar 25	Mar 27	156
Absorbing Clamp MDS 30MHz – 1GHz	Lüthi GmbH	MDS-21	Jan 23	Jan 26	160
Insertion Unit	Rohde & Schwarz	URV5-Z4	Sep 24	Sep 26	162
Coaxial RF Termination - 0 – 1000 MHz	Telewave Inc.	TWL 35	Dec 24	Dec 27	164
Coaxial RF Termination - 0 – 1000 MHz	Telewave Inc.	TWL 60	Dec 24	Dec 27	165
Fixed Attenuator - DC – 1.5GHz	Bird	Mod/ 8343-060	May 23	May 26	177
CDN up to 230 MHz	MEB	KEN-M 2 /M 3	Nov 24	Nov 26	262
CDN up to 230 MHz	MEB	KEN-M 2 /M 3	Sep 24	Sep 26	264
Impulse limiter 10 dB	Rohde & Schwarz	ESH3 Z2	Jun 24	Jun 26	272

Fixed Attenuator - DC – 18 GHz | 30 dB	MTS	---	Mar 24	Mar 26	276
Termination Resistor 50 W	Radiall	404011	Dec 24	Dec 27	309
Branching device (4x) 50W	Rohde & Schwarz	892228/20	Oct 25	Oct 28	320
Dummy-Load - 2 – 18 GHz	Narda	MODEL 367NF	Jan 23	Jan 26	343
DC Block Adapter - 0.045 – 26.5 GHz	Hewlett-Packard	11742A	Mar 24	Mar 27	356
150W attenuator	Weinschel	49-20-33	Nov 22	Nov 25	374
Fixed Coaxial Attenuator - DC – 18 GHz	Weinschel	23-6-34	Mar 23	Mar 26	375
Attenuator 60 dB (10 MHz – 8 GHz)	---	---	Mar 23	Mar 26	376
Insertion Unit 100V | 100 kHz – 2 GHz	Rohde & Schwarz	URY-Z4	Jun 24	Jun 26	417
Panoramic Adapter (Monitoring)	Schwarzbeck	PAN1550	---	---	429
DC-BLOCK - DC – 6.0 GHz |50 W	Mini Circuits	BLK-6-N+	Dec 24	Dec 27	462
DC-BLOCK – 0,1 GHz – 5.0 GHz	Microlab/FRX	HR-D18	Mar 24	Mar 27	90b
Terminating resistor 50Ω SMA	---	---	Jan 23	Jan 26	493
Terminating resistor 50Ω SMA	---	SC 60-601-0000-31	Jan 23	Jan 26	497
Fixed Attenuator –0 – 40 GHz	Anritsu	41KC-10	Jan 23	Jan 26	504
Fixed Attenuator – 0 – 40 GHz	Anritsu	41KC-10	Jan 23	Jan 26	505
Fixed Attenuator – 0 – 40 GHz	Anritsu	41KC-3	Jan 23	Jan 26	507
Electric Dummy Load	RA-NAV Lab.	DA-75U	---	---	526
Power Splitter / Combiner	Mini Circuits	ZESC-2-11	Nov 22	Nov 25	527
3 Way Power Splitter / Combiner	Mini Circuits	ZFSC-3-1	Mar 23	Mar 26	529
3 Way Power Splitter / Combiner	Mini Circuits	ZFSC-3-1	Mar 23	Mar 26	530
RF-Attenuator - 6 dB	Haefely	---	Mar 23	Mar 26	540
RF-Attenuator - 1– 120 MHz | 12 dB	Haefely	---	Mar 23	Mar 26	541
RF-Attenuator - 1– 120 MHz | 39 dB	Haefely	---	Mar 23	Mar 26	542
LISN 9kHz – 30 MHz	Schwarzbeck	NNLA 8120 (SN: 8120499A)	Dec 24	Dec 26	551
HV Probe P6013A	Tektronix	P6013A	Oct 24	Oct 26	559
VLISN 5µH	Schwarzbeck	8125-1944	Apr 24	Apr 26	585
VLISN 5µH	Schwarzbeck	8125-1945	Apr 24	Apr 26	586
20dB Attenuator, up to 18 GHz	Mini Circuit	BW-N20W5+	Nov 22	Nov 25	594
Step Attenuator - DC-18 GHz | 0 to 11 dB	Hewlett-Packard	8494B	Nov 22	Nov 25	604
Analyser Reference System	Spitzenberger & Spies	PAS 1000 SyCore + ARS 16/1	Jun 24	Jun 26	606a/b/c
Capacitive Coupling Clamp 5 kV	Schlöder	SFT 415	Jul 23	Jul 26	608
Current probe TRMS	BEHA APROB	CHB35	Jan 25	Jan 27	652
Semi Anechoic Chamber	COMTEST	SAC-3m	May 25	May 27	660
Maturo Turntable	Maturo	TT2.0SI (SN: TT2.05SI/817 SW: 1.0.0.4473)	---	---	667
Maturo Antenna Mast	Maturo	TAM4.5-E-10kg (SN: 10011/216/2588.01)	---	---	668
Maturo Controller	Maturo	FCU3.0/009/2588.01 (SN: 10014/2019)	---	---	669
EMC-Semi Anechoic Chamber (SAC)	Frankonia	SAC-5 Plus L-Dome Design	Jan 24	Jan 26	706
Frankonia Boresight Antenna Mast	Frankonia	FBM 1-4 SN: 0212	---	---	707
Frankonia Turntable	Frankonia	FTM 3-2 SN: FC06.1-2022-277	---	---	708
Frankonia Positioning Controller	Frankonia	FC06.1B SN: FC06.1-2022-277	---	---	709
Current probe 20 Hz – 100 MHz	Rohde & Schwarz	EZ-17 (0816.2063.03)	May 23	May 26	670
Coupling Decoupling Network	AMETEK	CDN ST08A	Nov 24	Nov 26	672
BONN HF Switch Matrix DC – 8 GHz	BONN Elektronik	BAS 0080-3	---	---	682
External Directional Coupler	BONN Elektronik	BDC 1060-40/500	Feb 24	Feb 26	683
BI-Directional Coax. Coup. 50-1000 MHz	Narda	3020A	Nov 24	Nov 26	141
Vertical coupling plate	TÜV NORD HFT	---	---	---	265

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Measuring table	TÜV NORD HFT	---	---	---	106
Data line coupling network	EM Test AG	CNV 504/ 508	---	---	285
OSP230 BASE Unit 2HU with TS	OSP230	S/N: 102031	Aug 25 (Val. only)	Aug 27	698
2 Generators					
EFT/Burst Generator	Schlöder	SFT 1400	Oct. 24	Oct 26	46a
ESD Generator	Schlöder	SESD 216	Feb 24	Feb 26	653
Signal Generator	Rohde & Schwarz	SMB100A SW 4.20.028.58	Nov 24	Nov 26	571
RF Generator	Rohde & Schwarz	SGT100A	Jun 24	Jun 26	636
Signal Generator	Rohde & Schwarz	SMG	Jun 24	Jun 26	136a
Vector Signal Generator	Rohde & Schwarz	SMCV100B s/n: 107493	Jul 25 (Manufac. Calib + Val.)	Jul 27	713
Signal Generator	Marconi	2042	Oct 2024	Oct 26	6
Signal Generator	Marconi	2024	Oct 2024	Oct 26	213
Puls Generator	EM Test	EFT 200	Aug 25	Aug 27	180a
Puls Generator	EM Test	MPG 200	Jun 25	Jun 27	181
Surge Generator	H+H	MIG063 IN S-T	Aug 25	Aug 27	561
Wideband Radio Communication Tester (Only for monitoring)	Rohde & Schwarz	CMW500 S/N: 171332	---	---	691
Magnetic field generator	Peter Hofbauer Electronic GmbH	LST-4510 S/N: 1272	Oct 25	Oct 27	715
3. Antennas					
Active Loop Antenna 8.3 kHz – 30 MHz	Rohde & Schwarz	HFH2-Z2E S/N: 101171	Jul 25	Jul 27	697
Biconical Ant. 30-300 MHz	Schwarzbeck	VHA9103/BBA9106	Jun 24	Jun 26	80/616
Biconical Ant. 20-300 MHz	Schwarzbeck	VHBB 9124 / BBA9106	Mar 25	Mar 27	692
Biconical Ant. 20-300 MHz	Schwarzbeck	VHBB 9124 / BBA9106	Mar 25	Mar 27	693
Biconical Antenna 9 kHz – 300 MHz	Schwarzbeck	EFS9218 / 9218-194	Sept 25	Sept 27	523
Double Ridged Horn	Schwarzbeck	BBHA9120C	Apr 24	Apr 26	169
Double Ridged Horn	Schwarzbeck	BBHA 9120A	Jun 24	Jun 26	284
Tri-Log Broadband	Schwarzbeck	VULB9168	Aug 25	Aug 27	406
Broadband Horn 14-40 GHz	Schwarzbeck	BBHA9170	Apr 24	Apr 26	442
Log Per Antenna 0.7-20 GHz	Schwarzbeck	STLP9148	Aug 25	Aug 27	445a
Log Per Antenna 0.2 – 3.5 GHz	Schwarzbeck	VUSLP 9111B	Mar 25	Mar 27	694
Log Per Antenna 0.2 – 3.5 GHz	Schwarzbeck	VUSLP 9111B	Mar 25	Mar 27	695
Bilog Ant.	CHASE	CBL6111	Jun 24	Jun 26	167
Spectrum analyser Mixer 220 – 325 GHz	Radiometer Physics	SAM325 / 20029	in calibration	in calibration	591
Dual Mode Potter Horn 220-325 GHz	Radiometer Physics	325-WR2	---	---	592
Dual Mode Potter Horn 75-110 GHz	Radiometer Physics	---	---	---	649
Gain Horn Antenna 50-75 GHz	Dorado	GH-15-20	---	---	511
Standard Gain Horn 1.7 – 2.6 GHz	Narda	645	---	---	514
W-band active Sextupler with input drive amplifier	Spacek Labs Inc.	AW-6XW-0	---	---	221a
60 to 65 GHz active frequency quadrupler	Spacek Labs Inc.	A625-4XW-0	---	---	222a
Harmonic Mixer 40-60 GHz	Rohde & Schwarz	FS-Z60/ 100037	in calibration	in calibration	515
Gain Horn Antenna 40-60 GHz	Dorado	GH-19-20 / 070106	---	---	518
Spectrum analyser Mixer 90-140 GHz	Radiometer Physics	SAM140 / 20006	in calibration	in calibration	545
Dual Mode Potter Horn 90-140 GHz	Radiometer Physics	140-WR8	---	---	547
Spectrum analyser Mixer 140-220GHz	Radiometer Physics	SAM220 / 20002	in calibration	in calibration	546
Dual Mode Potter Horn 140-220 GHz	Radiometer Physics	220-WR5.1	---	---	548
Harmonic Mixer 60-90 GHz	Rohde & Schwarz	FS-Z90 / 100062	in calibration	in calibration	501
Dual Mode Potter Horn 60-90 GHz	Radiometer Physics	90-W12	---	---	549
Gain Horn 33-55 GHz	Dorado	040810	---	---	383
Gain Horn 50-75 GHz	Dorado	031003	---	---	384
Gain Horn 75-110 GHz	Dorado	040808	---	---	385

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Standard Gain Ant. 26.5-40 GHz	Maury Microwave	U211C	---	---	532/628
Waveguide Harmonic Mixer 50 – 75 GHz	Keysight	M1971V	Mar 24	Mar 26	673
Waveguide Harmonic Mixer 75 – 110 GHz	Keysight	M1971W	Mar 24	Mar 26	674
Stacked Log.-Per. Antenna 70 MHz – 10 GHz	Schwarzbeck	STLP 9129	---	---	662
Spectrum/Signal Analyzer Extension Module 110 GHz – 170 GHz (WR-6.5)	Virginia Diodes, Inc.	SAX 637	in calibration	in calibration	675
Spectrum/Signal Analyzer Extension Module 140 GHz – 220 GHz (WR-5.1)	Virginia Diodes, Inc.	SAX 636	in calibration	in calibration	677
Spectrum/Signal Analyzer Extension Module 220 GHz – 330 GHz (WR-3.4)	Virginia Diodes, Inc.	SAX 635	in calibration	in calibration	679
Conical Gain Horn Ant. 110 GHz – 170 GHz [21 dBi]	Virginia Diodes, Inc.	Conical Antenna WR-6.5	---	---	687
Conical Gain Horn Ant. 140 GHz – 220 GHz [21 dBi]	Virginia Diodes, Inc.	Conical Antenna WR-5.1	---	---	688
Diagonal Gain Horn Ant. 220 GHz – 330 GHz [26 dBi]	Virginia Diodes, Inc.	Diagonal Antenna WR-3.4	---	---	689
Magnetic field coil 1m x 1m	Peter Hofbauer Electronic GmbH	7-134-A-2	Oct 25	Oct 27	714
4. Amplifier					
RF-Power Amplifier 250 kHz – 150 MHz	ENI	3100LA	---	---	123
RF pre-amplifier 100kHz-1.3GHz	HP	8447E	Sep 24	Sep 26	166a
Mitteq amplifier 26.5-40 GHz	Mitteq	---	Mar 24	Mar 26	223a
RF pre-amplifier 1-18GHz	Narda	---	Mar 24	Mar 26	345
Mitteq Amplifier 18-26GHz	Mitteq	---	Jun 23	Jun 26	433
Microwave amplifier 12-28GHz	Schwarzbeck	BBV9719	Mar 24	Mar 26	443
Microwave amplifier 0.5-18GHz	Schwarzbeck	BBV9718	Mar 24	Mar 26	444
RF-Power Amplifier 10kHz-1000 MHz	Poetschke	8100 (Band 1) BHED (Band 2) BHED (Band 3)	---	---	684
RF-Power Amplifier 800 MHz – 4,2 GHz	Amplifier Research	10S1G4	---	---	685
RF-Power Amplifier 4 GHz – 8 GHz	Amplifier Research	35S4G8A	---	---	686
RF-Power Amplifier 0.69 GHz – 6 GHz	Rohde & Schwarz	BBA150-D110/E60	---	---	690
5. Power supplies					
Programmable Power Supply	Fluke	PM 2813	---	---	28a
Power Supply	HP	---	---	---	125
Power Supply	Sorensen	LM 30-6	---	---	134a
Power Supply	HP	6034L	---	---	226
Regulated Power Supply	Farnell	AP60-50	---	---	408
Power Supply	EA	PSI 8080-40-DT	---	---	560
Power Supply	HP	6032A	---	---	644
6. Meters					
Microwave Frequency Counter	Hewlett-Packard	5351B	Aug 25	Aug 27	432
Temperature test cabinet	Heraeus Vötsch	VMT04/35	---	---	102a
Temperature and Climate Test Chamber	Weiß Umwelttechnik, WKL 34/40	S.N.: 5667998 // SW: Simpac 1.5.10	Mar 24	Mar 26	562
Temperature test cabinet	Brabender	TTE 32/40 H	---	---	87
Web Sensor with PoE- temperature, humidiy / digital pressure gauage	COMET	T7610 S.N.: 24960098	Jan 24	Jan 26	711
Web Sensor with PoE- temperature, humidiy / digital pressure gauage	COMET	T7610 S.N.: 24960099	Jan 24	Jan 26	712
Digital-Hygro-Thermometer	Greisinger	GFTH95	Mar 25	Mar 28	57a
Power Meter	Marconi	6960/ S.N: 1214	Dec 22	Dec 25	139a
Multimeter	Gossen Metrawatt	Metrahit pro	Jan 24	Jan 26	215a
Humidity/Temperature Measuring device	TESTO	Testo 625	Jan 24	Jan 26	259a
Multimeter	Gossen Metrawatt	Metrahit 26S	Dec 24	Dec 26	313
Level and Power Meter - 9 kHz – 3 GHz	Rohde & Schwarz	URY	Jun 24	Jun 26	307

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Temperature test device	Ahlhorn	Almemo 2390-5 PT100	Apr 23	Apr 26	401/402
Digital-Vacuum-/Barometer	Greisinger	GDH12AN	Mar 25	Mar 28	558
Digital Storage Oscilloscope	Tektronix	TDS 2012C	Apr 24	Apr 26	568
Miniature Flat, Zero-Biased Schottky Detector –0.1– 18 GHz	Narda	4503A-03	Sep 24	Sep 26	613
Digital-Vacuum-/Barometer	Greisinger	GDH-200-14	Jan 24	Jan 27	632
Network Analyser 9 kHz -6 GHz	Rohde & Schwarz	ZVL6 (SN: 101268)	Nov 24	Nov 26	534
Signal Analyser 10 Hz – 30 GHz	Rohde & Schwarz	FSV 30 S/N: 100932	in calibration	in calibration	502
EMI Test receiver ESW26	Rohde & Schwarz	R&S ESW26 (SN: 101383/26 SW: R&S ESW2.10)	Jan 24	Jan 26	665
EMI Test Receiver ESW44	Rohde & Schwarz	R&S ESW44 SN: 103281	Jul 25	Jul 27	696
Signal analyser Keysight 50GHz	Keysight	UXA N9040B (SN: MY57213006 SW: A.27.02/2020 1.0)	Mar 24	Mar 26	666
7. test/control software					
EMC32	Rohde & Schwarz	V10.60.20	---	---	---
Maturo mcApp	Maturo	SW: V3.4.9.4537 (19.04.04)	---	---	---
SPS EMC	Spitzenberger & Spies	SW: V4.1.3	---	---	---
EMV-Soft	Schlöder GmbH	SW: V11.95	---	---	---
ISMISO	EM Test AG	SW: V3.63	---	---	---
ELEKTRA	Rohde & Schwarz	SW: V 5.02.1	---	---	---

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10 List of test cables

Internal Cable Number	Connector Type	Frequency Range (MHz)	Cable Length (m)	Manufacturer
3	N	0,5 - 8000	3	Cellflex
4	N	0,5 - 8000	3	Cellflex
12a	N	10 – 265000	6	Huber + Suhner
14a	BNC	10 – 1000	1.00	Telemeter
17a	APC3.5	10 – 26500	2.13	Huber + Suhner
18a	APC3.5	10 – 26500	2.13	Huber + Suhner
22	BNC	10 – 1000	1.50	---
27	BNC	10 – 1000	1.00	Fabrica Milanese Cond.
35	N	10 – 2000	1.10	Fujikura
40	BNC	---	0.50	Aircell
44	SMA	---	0.50	Huber + Suhner
45	SMA	10 – 18000	0.50	Huber + Suhner
48	SMA		0.50	Huber + Suhner
49	N	10 – 18000	1.00	Huber + Suhner
50	N	10 – 18000	1.00	Huber + Suhner
51	N	10 – 18000	1.00	Huber + Suhner
58	N	10 – 18000	2.00	Huber + Suhner
59	N	10 – 18000	1.00	Huber + Suhner
60	N	10 – 18000	2.00	Huber + Suhner
61	N	10 – 18000	1.00	Huber + Suhner
62	SMA	---	0.50	Huber + Suhner
63	SMA	10 – 18000	0.50	Huber + Suhner
64	SMA	10 – 18000	0.50	Huber + Suhner
65	APC3.5	10 – 26500	0.60	---
66	APC3.5	10 – 26500	0.60	---
67	APC3.5	10 – 26500	0.60	---
68	APC3.5	10 – 26500	0.60	---
76	SMA	10 – 30000	3.00	Gore
79	BNC/N	10 – 1000	5.00	---
80	SMA	---	0.25	Huber + Suhner
87	SMA	10 – 18000	0.15	Huber + Suhner
88	SMA	10 – 18000	0.15	Huber + Suhner
89	SMA	10 – 18000	0.15	Huber + Suhner
90	SMA	10 – 18000	0.15	Huber + Suhner
94	BNC	---	1.10	---
100	N	10 – 26500	6.00	Rosenberg
101	N	10 – 18000	2.90	Huber + Suhner
102	SMA	10 – 18000	2.00	Huber + Suhner
112	BNC	10 – 1000	0.50	---
114	SMA	10 – 18000	0.25	Huber + Suhner
116	SMA	10 – 18000	0.25	Huber + Suhner
119	N	10 – 20000	8.00	Jyebao
121	SMA	10 – 18000	1.50	Huber + Suhner
122	SMA	10 – 18000	2.00	Huber + Suhner
123	SMA	10 – 18000	2.00	Huber + Suhner
145	SMA	10 – 26500	8.00	Huber + Suhner
147	APC3.5	10 – 40000	1.50	Jyebao
148	APC3.5	10 – 40000	3.00	Jyebao
154	BNC	10 – 1000	1.00	---
158	SMA	10 – 26500	2.00	Huber + Suhner
161	SMA	10 – 18000	1.00	Huber + Suhner
162	APC3.5	10 – 26500	2.00	Huber + Suhner
163	APC3.5	10 - 26500	2.00	Huber + Suhner
164	APC3.5	10 – 26500	2.00	Huber + Suhner
165	APC2.9	10 – 26500	2.00	Huber + Suhner
167	APC3.5	10 – 40000	1.00	Jyebao

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Internal Cable Number	Connector Type	Frequency Range (MHz)	Cable Length (m)	Manufacturer
168	APC3.5	10 – 40000	1.00	Jyebao
169	APC3.5	10 – 40000	1.00	Jyebao
170	APC3.5	10 – 40000	1.00	Jyebao
171	APC3.5	10 – 40000	1.00	Jyebao
172	SAM	---	0.90	Huber + Suhner
173	APC	10 – 26500	2.00	Huber + Suhner
174	APC	10 – 26500	---	Huber + Suhner
175	SMA	10 – 18000	0.40	Huber + Suhner
188	N	10 – 18000	5.00	Huber + Suhner
189	PC-PC	10 – 26500	6.00	Jyebao
190	PC-PC	10 – 26500	6.00	Jyebao
192	N-N	10 – 18000	3.0	Jyebao
193	N-N	10 – 18000	3.0	Jyebao
194	N-SMA	10 – 18000	2.0	Jyebao
195	N-SMA	10 – 18000	2.0	Jyebao
196	7/16-N	10 – 7000	5.0	TRU
197	N-7/16	10 – 7000	2.5	TRU
198	SMA – N	10 – 18000	1.5	Huber + Suhner
199	N-N	10 – 18000	2.5	Huber + Suhner
200	SMA – N	10 – 18000	1.5	Huber + Suhner
201	7/16 – 7/16	10 – 7000	3.0	RFS
202	N-N	10 – 18000	6,0	Huber + Suhner
203	N-N	10 – 18000	2.5	Huber + Suhner
204	N-N	10 – 18000	2.5	TRU
205	N-N	10 – 18000	7.0	Huber + Suhner
206	PC2.9 – PC2.9	10 – 40000	3.0	Huber + Suhner
207	PC2.9 – PC2.9	10 – 40000	7.0	Huber + Suhner
208	PC2.9 – PC2.9	10 – 40000	1,2	Teledyne Storm Microwave
209	PC2.9 – PC2.9	10 – 40000	1,2	Teledyne Storm Microwave
210	PC2.9 – PC2.9	10 – 40000	1,2	Teledyne Storm Microwave
211	---	10 – 40000	0,9	Junkosha
212	---	10 – 40000	0,9	Junkosha
213	BNC - BNC	0,1 - 4000	1	Huber + Suhner
214	BNC - BNC	0,1 - 4000	1	Huber + Suhner
215	BNC - BNC	0,1 - 4000	3	Huber + Suhner
216	BNC - BNC	0,1 - 4000	1	Agilent
217	BNC - BNC	0,1 - 2000	0,5	Sytronic
357	BNC - BNC	0,1 - 2000	1,5	---
EMV 1	BNC	---	2.00	Henn
EMV 2	BNC	10 – 1000	2.00	Henn
EMV 4	BNC	---	9.70	Henn
EMV 5	BNC	---	3.80	Henn
EMV 6	BNC/N	10 – 1000	5.00	Lüthi
EMV 7	BNC	10 – 1000	1.50	Henn
EMV 8	BNC	10 – 1500	1.70	Henn
EMV 9	BNC	10 – 1000	1.70	Henn
EMV 11	BNC	---	5.20	Hasselt
EMV 12	BNC	10 – 1000	2.40	Hasselt
EMV 13	BNC	10 – 1000	4.10	Hasselt
EMV 14	BNC	10 – 1000	2.50	Hasselt
EMV 15	BNC	---	0.90	Henn
EMV 16	Fischer	---	2.00	---
EMV 18a	Fischer	---	1.00	---
EMV 19a	Fischer	---	1.50	---
KISN2	BNC	10 – 2000	4.80	---

End of test report

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