

Test Report

21-1-0171401T03a-C01



Deutsche
Akreditierungsstelle
D-PL-12047-01-01
D-PL-12047-01-03
D-PL-12047-01-04

Number of pages: 16 **Date of Report:** 2022-Dec-23

Testing company: CETECOM GmbH
Im Teelbruch 116
45219 Essen Germany
Tel. + 49 (0) 20 54 / 95 19-0
Fax: + 49 (0) 20 54 / 95 19-150 **Applicant:** Siemens AG

Product: **Vibration and temperature sensor**
Model: **SITRANS MS200**

FCC ID: LYH-MS200 **IC:** 267AA-MS200

Testing has been carried out in accordance with:

FCC Regulations
Title 47 CFR, Chapter I, Subchapter A, Part 15
Subpart B Unintentional Radiators
§ 15.109 Radiated emission limits

ISED-Regulations
ICES-003, Issue 7
Information Technology Equipment (including Digital Apparatus)

Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method and limit".

Tested Technology:

Test Results: **The EUT complies with the requirements in respect of all parameters subject to the test.**
The test results relate only to devices specified in this document
The current version of Test Report 21-1-0171401T03a-C01 replaces the test report 21-1-0171401T03a dated 2022-Jul-22. The replaced test report is herewith invalid.

Signatures:


Ninovic Perez
Test Lab Manager
Authorization of test report


Hicham Laayouni
Test Manager
Responsible of test report

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The listed attachments are separate documents.			

1 General information

1.1 Disclaimer and Notes

The test results of this test report relate exclusively to the test item specified in this test report as specified in chapter 2.7. CETECOM does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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All rights and remedies regarding vendor's products and services for which CETECOM has prepared this test report shall be provided by the party offering such products or services and not by CETECOM.

In no case this test report can be considered as a Letter of Approval.

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 10 years at CETECOM.

Also we refer on special conditions which the applicant should fulfill according §2.927 to §2.948, special focus regarding modification of the equipment and availability of sample equipment for market surveillance tests.

1.2 Attestation

I declare that all measurements were performed by me or under my supervision and that all measurements have been performed and are correct to my best knowledge and belief to Industry Canada standards. All of the above requirements are met in accordance with enumerated standards.

1.3 Summary of Test Results

Test case	Reference in FCC ☒	Reference in ISED ☒	Reference in RSS-GEN ☒	Page	Remark	Result
AC-Power Lines Conducted Emissions	§15.107	ICES-003, Issue 7	RSS Gen, Issue 5, Chapter 8.8	--	--	N/A
Radiated field strength emissions 30 MHz – 1 GHz	§15.109 §15.33 §15.35	ICES-003, Issue 7	RSS-Gen., Issue 5 Chapter 8.9, Chapter 7.3	10	--	PASSED
Radiated field strength emissions above 1 GHz	§15.109 §15.33 §15.35	ICES-003, Issue 7	RSS-Gen., Issue 5 Chapter 8.9, Chapter 7.3	12	--	PASSED

PASSED The EUT complies with the essential requirements in the standard.
 FAILED The EUT does not comply with the essential requirements in the standard.
 N/A Test case does not apply to the test object.
 NP The test was not performed by the CETECOM Laboratory.

*The calculation of the measurement uncertainty shows compliance with the "maximum measurement uncertainties" of the tested standard and therefore for result evaluation the stated uncertainties will not be additionally added to the measured results.

1.4 Summary of Test Methods

Test case	Test method
AC-Power Lines Conducted Emissions	ANSI C63.4-2014 chapter 7
Radiated field strength emissions 30 MHz – 1 GHz	ANSI C63.4-2014 chapter 8.2.3
Radiated field strength emissions above 1 GHz	ANSI C63.4-2014 chapter 8.3

2 Administrative Data

2.1 Identification of the Testing Laboratory

Company name:	CETECOM GmbH
Address:	Im Teelbruch 116 45219 Essen - Kettwig Germany
Responsible for testing laboratory:	Dipl.-Ing. Ninovic Perez
Accreditation scope:	DAkkS Webpage: FCC ISED
IC Lab company No. / CAB ID:	3462D / DE0005
Test location:	CETECOM GmbH; Im Teelbruch 116; 45219 Essen - Kettwig

2.2 General limits for environmental conditions

Temperature:	22±2 °C
Relative. humidity:	45±15% rH

2.3 Test Laboratories sub-contracted

Company name:	--
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2.4 Organizational Items

Responsible test manager:	Hicham Laayouni
Receipt of EUT:	2022-Mar-28
Date(s) of test:	2022-Mar-30

2.5 Applicant's details

Applicant's name:	Siemens AG
Address:	Oestliche Rheinbrueckenstraße 50 D-76187 Karlsruhe Baden-Wuerttemberg Germany
Contact Person:	Vadim Baskal
Contact Person's Email:	vadim.baskal@siemens.com

2.6 Manufacturer's details

Manufacturer's name:	Siemens Milltronics Process Instruments inc
Address:	1954, Technology Drive ON K9J 6X7 Peterborough Canada

2.7 Equipment under Test (EUT)

EUT No. *)	Sample No.	Product	Model	Type	SN	HW	SW
EUT 1	21-1-01714S14_C01	Vibration and temperature sensor	SITRANS MS200	7MP2210-2AB21-2AB1	7MP2210-2AB21-2AB1	1.00.00	1.0.0

*) EUT short description is used to simplify the identification of the EUT in this test report.

2.8 Untested Variant (VAR)

VAR No. *)	Sample No.	Product	Model	Type	SN	HW	SW
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*) The listed additional untested model variant(s) (VAR) is/are not object of evaluation of compliance. For further information please see Annex 5: Declaration of applicant of model differences.

If the table above does not show any other line than the headline, no untested variants are available.

2.9 Auxiliary Equipment (AE)

AE No. *)	Sample No.	Auxiliary Equipment	Model	SN	HW	SW
AE 3	21-1-01714S08_C01	Battery	LS 14500	N/A	N/A	N/A

*) AE short description is used to simplify the identification of the auxiliary equipment in this test report. If the table above does not show any other line than the headline, no AE was used during testing nor was taken into account for evaluation

2.10 Connected cables (CAB)

CAB No. *)	Sample No.	Cable Type	Connectors / Details	Length
--	--	--	--	--

*) CAB short description is used to simplify the identification of the connected cables in this test report. If the table above does not show any other line than the headline, no cable was used during testing nor was taken into account for evaluation

2.11 Software (SW)

SW No. *)	Sample No.	SW Name	Description	SW Status
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*) SW short description is used to simplify the identification of the used software in this test report. If the table above does not show any other line than the headline, no SW was used during testing nor was taken into account for evaluation.

2.12 EUT set-ups

set-up no. *)	Combination of EUT and AE	Description
1	EUT 1 + AE 1	Used for Radiated measurements

*) EUT set-up no. is used to simplify the identification of the EUT set-up in this test report.

2.13 EUT operation modes

EUT operating mode no. *)	Operating modes	Additional information
1	Sensor active mode	Sensor active for temperature and vibration measurement, no BLE TX Base on V1.0.0

*) EUT operating mode no. is used to simplify the test report.

3 Equipment under test (EUT)

3.1 General Data of Main EUT as Declared by Applicant

Firmware	<input checked="" type="checkbox"/> for normal use	<input type="checkbox"/> Special version for test execution	
Power supply	<input type="checkbox"/> AC Mains	-	
	<input type="checkbox"/> DC Mains	-- V DC via -- Connector	
	<input checked="" type="checkbox"/> Battery	3.6 V – SAFT LS14500	
Operational conditions	$T_{nom} = --^{\circ}C$	$T_{min} = -30^{\circ}C$	$T_{max} = +80^{\circ}C$
EUT sample type	Production		
Weight	0.3 kg		
Size [LxWxH]	11.0 cm x 3.0 cm x 2.0 cm		
Interfaces/Ports	--		
For further details refer Applicants Declaration & following technical documents			

3.2 Modifications on Test sample

Additions/deviations or exclusions	--
---	----

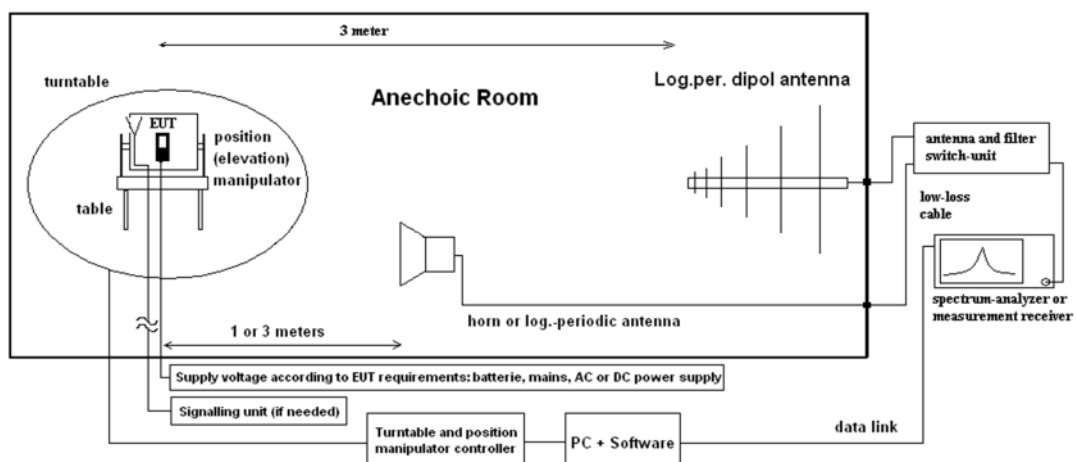
4 Measurements

4.1 Radiated field strength emissions 30 MHz – 1 GHz

4.1.1 Description of the general test setup and methodology, see below example:

Evaluating the field emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a NSA-compliant semi anechoic room (SAR) recognized by the regulatory commissions.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 0.8 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 90°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software.

Measurement antenna: horizontal and vertical, heights: 1,0 m and 1,82 m as worst-case determined by an exploratory emission measurements. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies

Based on the exploratory measurements, the most critical frequencies are re-measured by main-taining the EUT's worst-case operation mode, cable position, etc. either on 10m OATS or 3m semi-anechoic room.

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position). The measurement antenna height between 1 m and 4 m.

On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out

Formula:

$$E_C = E_R + AF + C_L + D_F - G_A \quad (1)$$

$$M = L_T - E_C \quad (2)$$

- AF = Antenna factor
- C_L = Cable loss
- D_F = Distance correction factor (if used)
- E_C = Electrical field – corrected value
- E_R = Receiver reading
- G_A = Gain of pre-amplifier (if used)
- L_T = Limit
- M = Margin

All units are dB-units, positive margin means value is below limit.

4.1.2 Sample calculation

Raw-Value [dBuV/m]	Antenna factor	Distance Correction [dB]	Cable Loss	Preamplifier	Resulting correction value [dB]	Final result [dBuV/m]	Remarks
32.7	22.25	--	3.1	--	25.35	58.05	--

Remark: This calculation is based on an example value at 800.4 MHz

4.1.3 Measurement Location

Test site	CETECOM GmbH Essen
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4.1.4 Limit

Frequency Range [MHz]	Class B <input checked="" type="checkbox"/> (3 meters)		Class A <input type="checkbox"/> (10 meters)		Detector	RBW / VBW [kHz]
	Limit [µV/m]	Limit [dBµV/m]	Limit [µV/m]	Limit [dBµV/m]		
30 - 88	100	40.0	90	39.0	Quasi peak	100 / 300
88 - 216	150	43.5	150	43.5	Quasi peak	100 / 300
216 - 960	200	46.0	210	46.4	Quasi peak	100 / 300
960 - 1000	500	54.0	300	49.5	Quasi peak	100 / 300

4.1.5 Result

Diagram	Set-up	Mode	Maximum Level [dBµV/m] Frequency Range 30 – 1000 MHz	Result
3.01	1 (Laying)	1	35.1	PASSED
3.02	1 (Standing)	1	35.45	PASSED

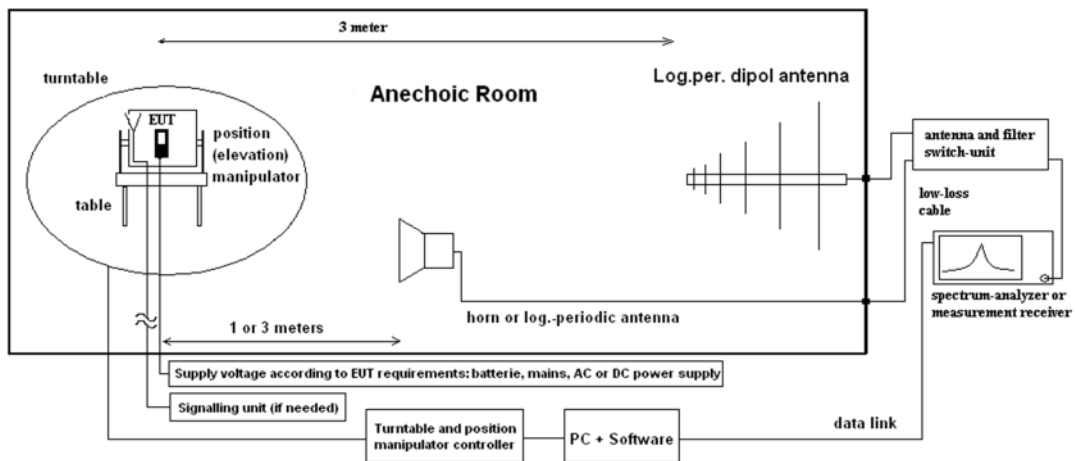
Remark: for more information and graphical plot see annex A1 **CETECOM_TR21-1-0171401T03a_C01_A1**

4.2 Radiated field strength emissions above 1 GHz

4.2.1 Description of the general test setup and methodology, see below example:

Evaluating the emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a CISPR 18-1-4:2010 compliant fully anechoic room (FAR) recognized by the regulatory commission. The measurement distance was set to 3 meter for frequencies up to 18 GHz and 2 meter above 18 GHz. A logarithmic periodic antenna is used for the frequency range 30 MHz to 1 GHz. Horn antennas are used for frequency range 1 GHz to 40 GHz. The EUT is aligned within 3 dB beam width of the measurement antenna with three orthogonal axis measurements on the EUT.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 1.55 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 15°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software.

The measurements are performed in horizontal and vertical polarization of the measurement antennas. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies

Based on the exploratory measurements, the most critical frequencies are re-measured by main-taining the EUT's worst-case operation mode, cable position, etc.

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself over 3-orthogonal axis and the height for EUT with large dimensions or three axis scan for portable/small equipment.

On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.

Formula:

$$E_C = E_R + A_F + C_L + D_F - G_A \quad (1)$$

$$M = L_T - E_C \quad (2)$$

E_C = Electrical field – corrected value

E_R = Receiver reading

M = Margin

L_T = Limit

A_F = Antenna factor

C_L = Cable loss

D_F = Distance correction factor (if used)

G_A = Gain of pre-amplifier (if used)

All units are dB-units, positive margin means value is below limit.

4.2.2 Sample calculation

Raw-Value [dBuV/m]	Antenna factor	Distance Correction [dB]	Cable Loss + Preamplifier	Resulting correction value [dB]	Final result [dBuV/m]	Remarks
29.37	41.20	--	24.28	16.92	46.3	CableLoss and PreAmp data in one data correction file

Remark: This calculation is based on an example value at 10 GHz

4.2.3 Measurement Location

Test site	CETECOM GmbH Essen
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4.2.4 Limit

Radiated emissions limits (3 meters)				
Frequency Range [MHz]	Limit [μ V/m]	Limit [dB μ V/m]	Detector	RBW / VBW [kHz]
Above 1000	500	54	Average	1000 / 3000
Above 1000	5000	74	Peak	1000 / 3000

4.2.5 Result

Diagram	Set-up	Mode	Maximum Level [dB μ V/m] Frequency Range 1 – 18 GHz	Result
4.01	1	1	47.56	PASSED

Remark: for more information and graphical plot see annex A1 [CETECOM_TR21-1-0171401T03a_C01_A1](#)

Diagram	Set-up	Mode	Maximum Level [dB μ V/m] Frequency Range 18 – 26.5 GHz	Result
4.02	1	1	64.19	PASSED

Remark: for more information and graphical plot see annex A1 [CETECOM_TR21-1-0171401T03a_C01_A1](#)

4.3 Equipment lists

ID	Description	Manufacturer	SerNo	CheckType	Last Check	Interval	Next Check
	120901 - SAC - Radiated Emission <1GHz			calchk	cal: 07-21-2015 chk: 07-27-2021	cal: 10Y chk: 12M	cal: July 2025 chk: July 2022
20574	Biconilog Hybrid Antenna BTA-L	Frankonia GmbH / Heideck	980026L	cal	cal: 06-15-2022	cal: 36M	cal: June 2025
20482	filter matrix Filter matrix SAR 1	CETECOM GmbH	-	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20442	Semi Anechoic Chamber	ETS-Lindgren GmbH / Taufkirchen	-	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20620	Test Receiver ESU26	Rohde & Schwarz Messgerätebau GmbH / Memmingen	100362	cal	cal: 06-08-2022	cal: 12M	cal: June 2023
	120904 - FAC1 - Radiated Emissions			chk	chk: 06-11-2021	chk: 12M	chk: June 2022
20558	Fully Anechoic Chamber 1	ETS-Lindgren GmbH / Taufkirchen	-	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20020	Horn Antenna 3115 (Subst 1)	EMCO Elektronik GmbH	9107-3699	calchk	cal: 08-17-2021 chk: 04-20-2013	cal: 36M chk: 12M	cal: August 2024
20302	Horn Antenna BBHA9170 (Meas 1)	Schwarzbeck Mess-Elektronik OHG / Schönau	155	cpu	chk: 04-15-2020	chk: 12M	
20720	Measurement Software EMC32 [FAC]	Rohde & Schwarz Messgerätebau GmbH	V10.xx	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20690	Spectrum Analyzer FSU	Rohde & Schwarz Messgerätebau GmbH	100302/026	cal	cal: 05-20-2021	cal: 24M	cal: May 2023

4.3.1 Legend

Note / remarks	Interval of calibration & Verification
12M	12 months
24M	24 months
36M	36 months
10Y	10 Years

Abbreviation Check Type	Description
cnn	Calibration and verification not necessary
cal	Calibration
calchk	Calibration plus intermediate Verification
chk	Verification
cpu	Verification before usage

5 Results from external laboratory

None

-

6 Opinions and interpretations

None

-

7 List of abbreviations

None

-

8 Measurement Uncertainty valid for conducted/radiated measurements

The reported uncertainties are calculated based on the standard uncertainty multiplied with the appropriate coverage factor **k**, such that a confidence level of approximately 95% is achieved. For uncertainty determination, each component used in the concrete measurement set-up was taken in account and its contribution to the overall uncertainty according its statistical distribution calculated.

Measurement type	Frequency range of measurement		Calculated Uncertainty based on confidence level of 95.54%	Remarks
	Start [MHz]	Stop [MHz]		
Magnetic field strength	0.009	30	4.86	Magnetic loop antenna, Pre-amp on
RF-Output power (eirp) Unwanted emissions (eirp) [dB]	30	100	4.57	without Pre-Amp
	30	100	4.91	with PreAmp
	100	1000	4.02	without Pre-Amp
	100	1000	4.26	with PreAmp
	1000	18000	4.36	without Pre-Amp
	1000	18000	5.23	with PreAmp
	18000	33000	4.92	Schwarzbeck BBHA9170 (#20302) Antenna set-up non-waveguide antenna)
	33000	50000	4.17	Set-up for Q-Band (WR-22), non-wave guide antenna
	40000	60000	4.69	Set-up U-Band (WR-19), non-waveguide antenna
	50000	75000	4.06	External Mixer set-up V-Band (WR-15)
	75000	110000	4.17	External Mixer set-up W-Band (WR-6)
	90000	140000	5.49	External Mixer set-up F-Band (WR-8)
	140000	225000	6.22	External Mixer set-up G-Band (WR-5)
	225000	325000	7.04	External Mixer set-up (WR-3)
325000	500000	8.84	External Mixer set-up (WR-2.2)	
Radiated Blocking [dB]	1000	18000	2.85	Typical set-up with microwave generator and antenna, value for 7GHz calculated
	18000	33000	4.66	Typical set-up with microwave generator and antenna
	33000	50000	3.48	WR-22 set-up
	50000	75000	3.73	WR-15 set-up
	75000	110000	4.26	WR-6 set-up
Frequency Error [kHz]	40000	77000	276.19	calculated for 77 GHz (FMCW) carrier
	6000	7000	33.92	calculated for 6.5GHz UWB Ch.5
TS 8997 conducted Parameters	30	6000	1.11	1. Power measurement with Fast-sampling-detector
	30	6000	1.20	2. Power measurement with Spectrum-Analyzer
	30	6000	1.20	3. Power Spectrum-Density measurement
	30	7500	1.20	4. Conducted Spurious emissions:
	0.009	30	2.56	5. Conducted Spurious emissions:
	2.4	2.48	1.95 ppm	6a. Bandwidth / 2-Marker Method for 2.4GHz ISM
	5.18	5.825	7.180 ppm	6b. Bandwidth / 2-Marker Method for 5GHz WLAN
	5.18	5.825	1.099 ppm	7 Frequency (Marker method) for 5GHz WLAN
	30	6000	0.11561µs	8 Medium-Utilization factor / Timing
	30	6000	1.85	9 Blocking-Level of companion device
30	6000	1.62	9 Blocking Generator level	
Conducted emissions	0.009	30	3.57	

9 Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	2022-Jul-22
C01	Updated EUT model name and applicant's address.	2022-Dec-23
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End Of Test Report