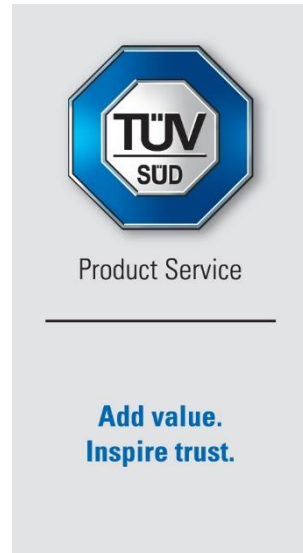


Report on the FCC and IC Testing of the
Siemens AG
RFID UHF Reader
Model: SIMATIC RF650R FCC
In accordance with FCC 47 CFR Part 15 C
(partly), RSS-247 (partly) and ISED RSS-
GEN

Prepared for: Siemens AG
Gleiwitzer Str. 555
90475 Nürnberg
Germany

FCC ID: NXW-RF600R2
IC: 267X-RF600R2



COMMERCIAL-IN-CONFIDENCE

Date: 2023-01-10
Document Number: TR-713256859-00 | Revision 1

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Alex Fink	2023-01-10	 SIGN-ID 745350
Authorised Signatory	Matthias Stumpe	2023-01-11	 SIGN-ID 745525

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures described on test pages.
All reported testing was carried out on a sample equipment to demonstrate limited compliance with with FCC 47 CFR Part 15 C and RSS-247, Issue 2, February 2017.

The sample tested was found to comply with the requirements in the tested parts.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Alex Fink	2023-01-10	 SIGN-ID 745350

Laboratory Accreditation Laboratory recognition Industry Canada test site registration
DAkKS Reg. No. D-PL-11321-11-03 Registration No. BNetzA-CAB-16/21-15 3050A-2
DAkKS Reg. No. D-PL-11321-11-04

Executive Statement:

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15 C:2021 and RSS-247, Issue 2, February 2017 and ISED RSS-Gen:2018 + A1:2019 + A2:2021 in the tested parts

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Product Service

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1 Report Summary

1.1 Modification Report

Alterations and additions of this report will be issued to the holders of each copy in the form of a complete document.

<i>Issue</i>	<i>Description of changes</i>	<i>Date of Issue</i>
0	First Issue	2022-07-04
1	Antenna information added	2023-01-10

Table 1: Report of Modifications

1.2 Introduction

Applicant	Siemens AG Gleiwitzer Str. 555 90475 Nürnberg Germany
Manufacturer	Siemens AG
Model Number(s)	SIMATIC RF650R FCC
Serial Number(s)	S VPM7005427
MLFB(s)	6GT2811-6AB20-1AA0
Software Version(s)	V3.3.0
Number of Samples Tested	1
Test Specification(s) / Issue / Date	FCC 47 CFR Part 15 C: 2021, RSS-247, Issue 2, February 2017 and ISED RSS-Gen, Issue 5, Amd. 1: 2019
Test Plan/Issue/Date	---
Order Number	5623478
Date	2022-04-06
Date of Receipt of EUT	2022-05-13
Start of Test	2022-06-10
Finish of Test	2022-06-10
Name of Engineer(s)	Alex Fink
Related Document(s)	ANSI C63.10:2013



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15 C, ISED RSS-247 and RSS-Gen is shown below.

<i>Section</i>	<i>Specification Clause</i>	<i>Test Description</i>	<i>Result</i>
UHF-RFID Reader continuously reading			
2.1	15.247(d), 15.205, 15.209	Spurious Emissions	Pass
2.2	15.247(b)(3)	Output Power	Pass
2.3	15.247(d)	Frequency Band Edge	Pass

Table 2: Results according to FCC 47 CFR Part 15 C

<i>Section</i>	<i>Specification Clause</i>	<i>Test Description</i>	<i>Result</i>
UHF-RFID Reader continuously reading			
2.1	5.5 / 6.2.4.2	Spurious Emissions	Pass
2.2	5.4 d. / 6.2.4.1	Output Power	Pass
2.3	5.5 / 6.2.4.2	Frequency Band Edge	Pass

Table 3: Results according to ISED RSS-Gen



1.4 Product Information

1.4.1 Technical Description

The EUT is a UHF-RFID Reader. Which can read active and passive tags in the frequency range from 902 to 928 MHz.

<i>Supply Voltage:</i>	100 - 240 V
<i>Supply Frequency:</i>	50/60 Hz

1.4.2 Antenna information

<i>Model name</i>	RF662A
<i>Area of application</i>	The SIMATIC RF662A is a universal UHF antenna with high range for industrial applications in confined installation conditions.
<i>Frequency range</i>	902 MHz to 928 MHz
<i>Read range</i>	Max. 8.0 m
<i>Polarization</i>	Circular
<i>Antenna gain</i>	≤ 6 dBi

1.5 Test Configuration

The EUT was supplied by a DC power supply. External RFID Antenna was connected to the antenna port. RFID Reader was reading continuously.



Product Service

1.6 EUT Modifications Record

The table below details modifications made to the EUT during the test program.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As supplied by the customer	Not Applicable	Not Applicable

Table 4

1.7 Test Location

TÜV SÜD Product Service conducted the following tests at our Straubing test laboratory:

Test Name	Name of Engineer(s)
Radiated Emissions	Alex Fink

Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany



Product Service

2 Test Details

2.1 Radiated Emissions

2.1.1 Specification Reference

FCC 47 CFR Part 15 C, Clauses 15.205, and 15.209
ISED RSS-247, Clause 5.5
ISED RSS-Gen, Clauses 8.9 and 8.10

2.1.2 Equipment under Test and Modification State

SIMATIC RF650R FCC; S/N: S VPM7005427 - Modification state 0

2.1.3 Date of Test

2022-06-10

2.1.4 Environmental Conditions

Ambient Temperature	23 °C
Relative Humidity	52 %



2.1.5 Specification Limits

<i>Required Specification Limits (Class A)</i>		
<i>Frequency Range (MHz)</i>	<i>Field strength at 10 m distance</i>	
	<i>($\mu\text{V/m}$)</i>	<i>(dB$\mu\text{V/m}$)</i>
30 – 88	90	39
88 – 216	150	43.5
126 – 960	210	46.4
above 960	300	49.5

Table 5 § 15.109, Class A emission limits

<i>Required Specification Limits (Class B)</i>		
<i>Frequency Range (MHz)</i>	<i>Field strength at 3 m distance</i>	
	<i>($\mu\text{V/m}$)</i>	<i>(dB$\mu\text{V/m}$)</i>
30 – 88	100	40
88 – 216	150	43.5
126 – 960	200	46
above 960	500	54

Table 6 § 15.109, Class B emission limits

<i>General radiated emission limits:</i>					
<i>Frequency Range (MHz)</i>	<i>Test distance (m)</i>	<i>Field strength</i>		<i>Field strength</i>	
		<i>($\mu\text{A/m}$)</i>	<i>(dB$\mu\text{A/m}$)</i>	<i>($\mu\text{V/m}$)</i>	<i>(dB$\mu\text{V/m}$)</i>
0.009 – 0.49	300	$6.37 / f$	$20*\lg(6.37 / f)$	$2400 / f$	$20*\lg(2400 / f)$
0.49 – 1.705	30	$63.7 / f$	$20*\lg(63.7 / f)$	$24000 / f$	$20*\lg(24000 / f)$
1.705 - 30	30	0.08	$20*\lg(0.08 / f)$	30	$20*\lg(30 / f)$
30 – 88	3	---	---	100	40
88 – 216	3	--	---	150	43.5
126 – 960	3	--	---	200	46
above 960	3	--	---	500	54

Note 1: f in kHz

Table 7 General radiated emission limits acc. To § 15.209

2.1.6 Test Method

The test was performed according to ANSI C63.10, sections 11.11 and 11.12

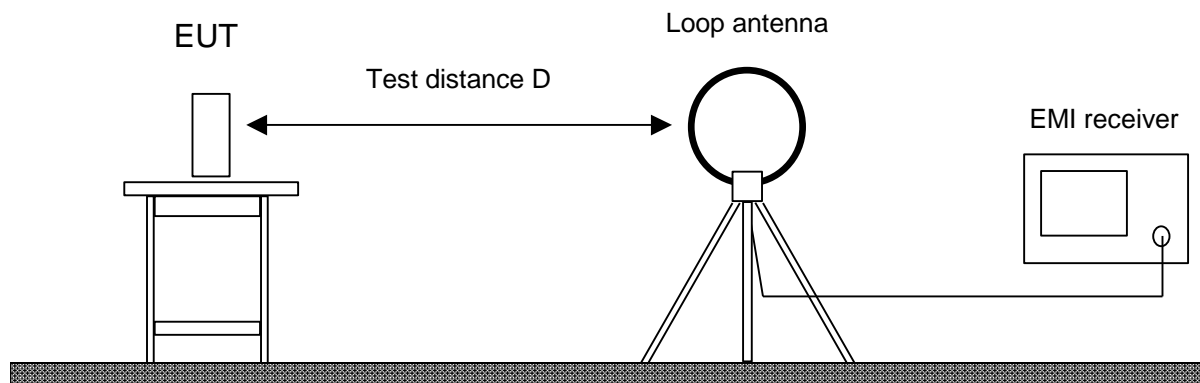
Prescans are performed in six positions of the EUT to get the full spectrum of emission caused by the EUT with the measuring antenna raised and lowered from 1 m to 4 m with vertical and horizontal polarisation to find the combination of table position, antenna height and antenna polarisation for the maximum emission levels.

Data reduction is applied to these results to select those levels having less margin than 10 dB or exceeding the limit using subranges and limited number of maximums.

Further maximisation for adjusting the maximum position is following.

Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

2.1.6.1 Frequency range 9 kHz – 30 MHz

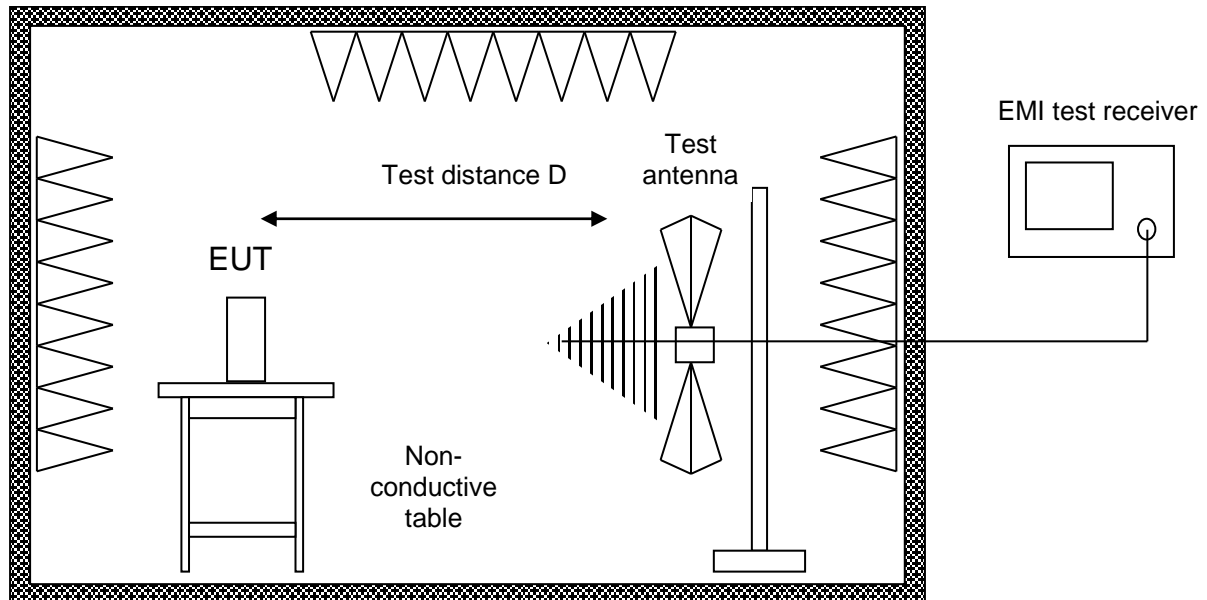


The EUT was placed on a non-conductive table, 0.8 m above the ground.

Radiated emissions in the frequency 9 kHz – 30 MHz is measured within a semi-anechoic room with an active loop antenna with the measurement detector set to peak. Additionally in the frequency range 9 kHz to 490 kHz an average detector was used. The measurement bandwidth of the receiver was set to 300 Hz in the frequency range 9 kHz to 150 kHz and 10 kHz in the frequency range 150 kHz to 30 MHz. Prescans were performed in six positions of the EUT.

For final measurements the detector was set to CISPR quasi-peak and in addition to CISPR average in the frequency range 9 kHz to 490 kHz with a resolution bandwidth 200 Hz in the frequency range 9 kHz to 150 kHz and 9 kHz in the frequency range 150 kHz to 30 MHz. Final tests were performed immediately after a final frequency and zoom (for drifting disturbances) and maximum adjustment.

2.1.6.2 Frequency range 30 MHz – 1 GHz



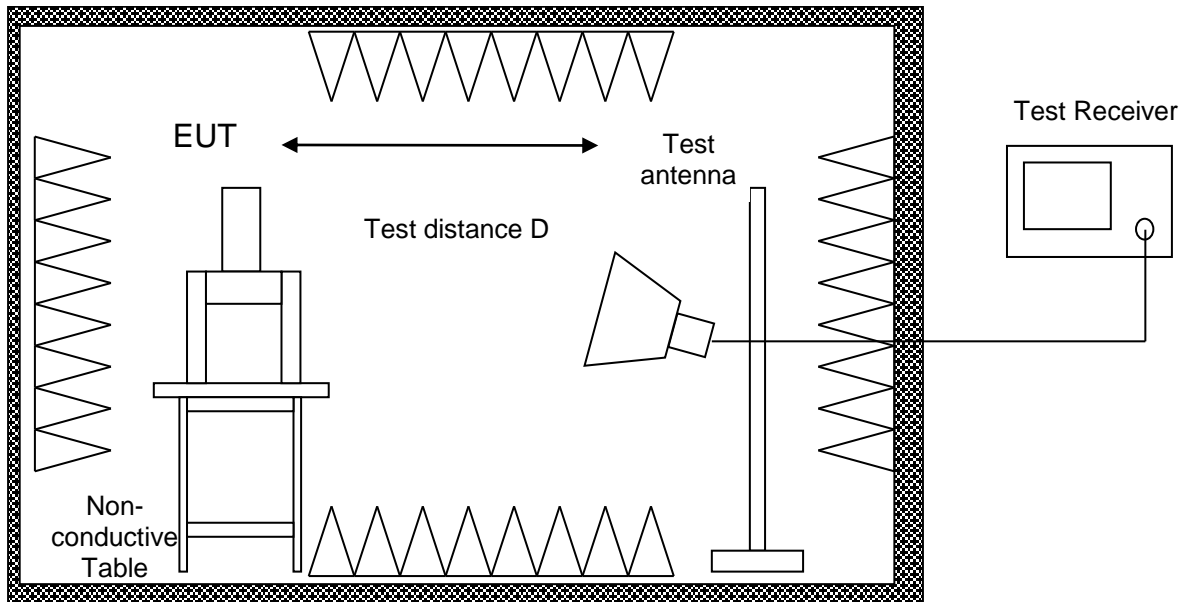
Alternate test site (semi anechoic room)

The EUT was placed on a non-conductive table, 0.8 m above the ground plane. Radiated emissions in the frequency range 30 MHz – 1 GHz is measured within a semi-anechoic room with groundplane complying with the NSA requirements of ANSI C63.4. for alternative test sites. A linear polarised logarithmic periodic antenna combined with a 4:1 broadband dipole (“Trilog broadband antenna”) is used.

For prescan tests the test receiver is set to peak-detector with a bandwidth of 120 kHz.

With the measurement bandwidth of the test receiver set to 120 kHz CISPR quasi-peak detector is selected for final measurements following immediately after a final frequency zoom (for drifting disturbances) and maximum adjustment.

2.1.6.3 Frequency range above 1 GHz



Fully anechoic room

The EUT was placed on a non-conductive table, 1.5 m above the ground plane

Radiated emission tests above 1 GHz are performed in a fully anechoic room with the S_{VSWR} requirements of ANSI C63.4. Measurements are performed both in the horizontal and vertical planes of polarisation using a test receiver with the detector function set to peak and average and the resolution bandwidth set to 1 MHz. Testing above 1 GHz is performed with horn antennas with the EUT in boresight of the antenna.

For prescan tests the test receiver is set to peak- and average-detector with a bandwidth of 1 MHz.

With the measurement bandwidth of the test receiver set to 1 MHz and peak- and CISPR average-detector is selected for final measurements following immediately after a final frequency zoom (for drifting disturbances) and maximum adjustment.



Product Service

2.1.7 Test Results

<i>Frequency range</i>	<i>Limit applied</i>	<i>Test distance</i>
9 kHz – 30 MHz	§15.209; RSS-GEN	3 m
30 MHz – 1 GHz	§15.209; RSS-GEN	3 m
1 GHz – 4 GHz	§15.209; RSS-GEN	3 m
4 GHz – 10 GHz	§15.209; RSS-GEN	1 m

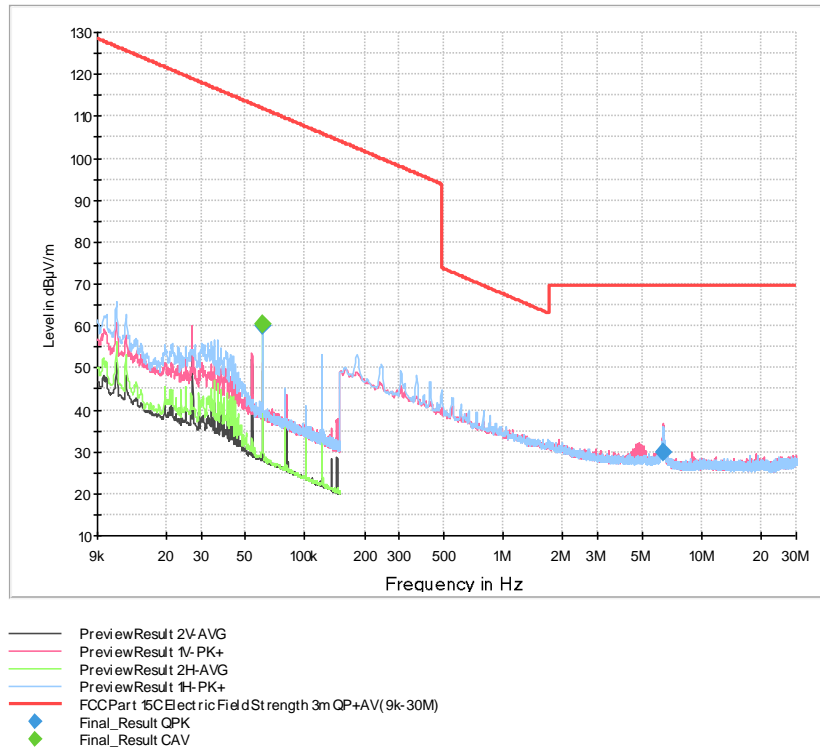
Table 8

Sample calculation:

$$\text{Final Value (dB}\mu\text{V/m)} = \text{Reading Value (dB}\mu\text{V)} + (\text{Cable attenuation (dB)} \\ + \text{Antenna Transducer (dB(1/m))})$$

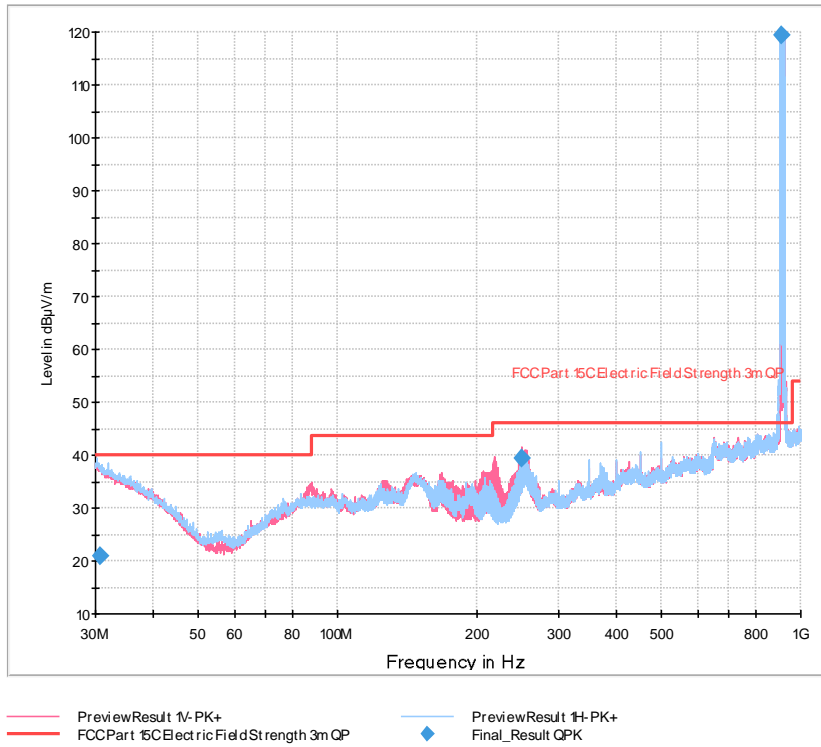


SIMATIC RF650R with antenna RF662A



Final Results:

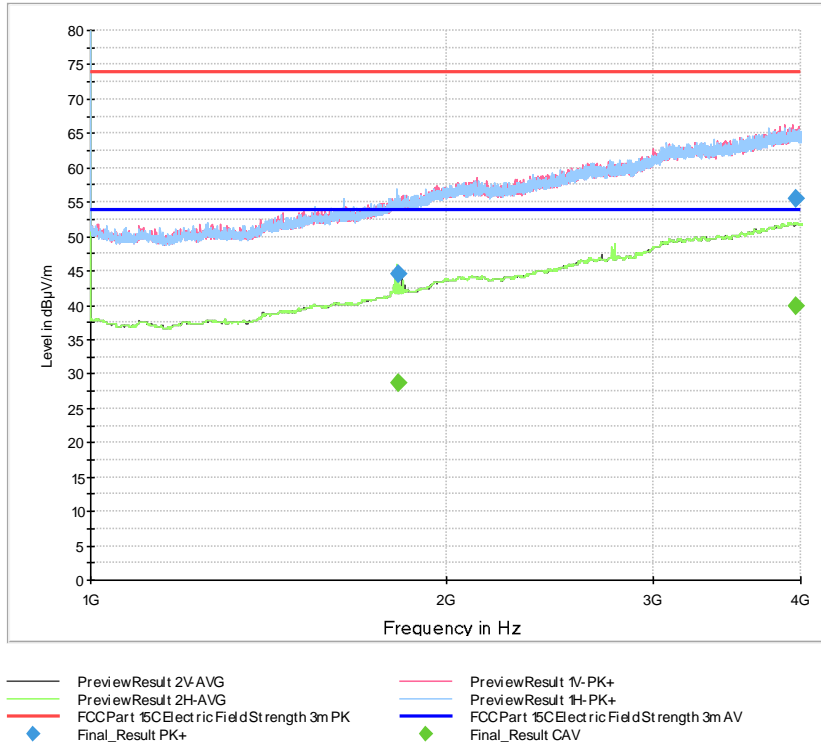
Frequency MHz	QuasiPeak dBµV/m	CAverage dBµV/m	Limit dBµV/m	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB/m
0.061100	---	60.61	---	---	1000.0	0.200	100.0	H	0.0	19.3
0.061100	60.07	---	111.88	51.81	1000.0	0.200	100.0	H	0.0	19.3
6.375750	29.97	---	69.54	39.57	1000.0	9.000	100.0	V	-60.0	19.1



Final Results:

Frequency MHz	QuasiPeak dBµV/m	Limit dBµV/m	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB/m
30.750000	20.83	40.00	19.17	1000.0	120.000	271.0	H	19.0	25.0
249.990000	39.50	46.02	6.52	1000.0	120.000	100.0	V	-8.0	17.6
909.720000	119.53	#1	#1	1000.0	120.000	212.0	H	-25.0	30.9

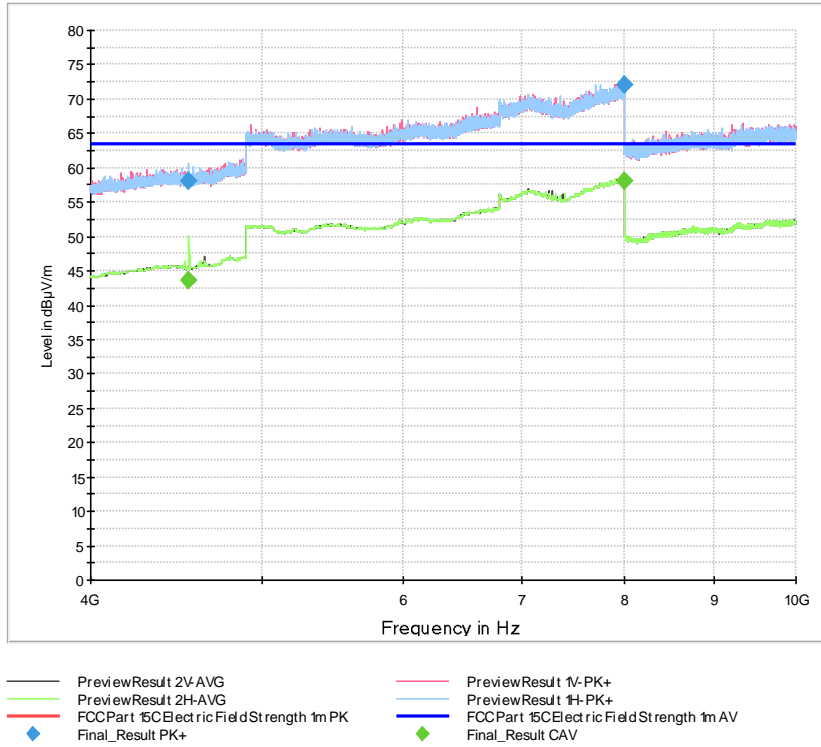
Note #1: intentional radiation



Final Results:

Frequency MHz	Max- Peak dBµV/m	CAver- age dBµV/m	Limit dBµV/m	Mar- gin dB	Meas. Time ms	Band- width kHz	Height cm	Pol	Azimuth deg	Corr. dB/m
1823.250000	---	28.69	53.98	25.29	1000.0	1000.000	125.0	H	-105.0	31.3
1823.250000	44.51	---	73.98	29.47	1000.0	1000.000	125.0	H	-105.0	31.3
3958.500000	---	39.95	53.98	14.03	1000.0	1000.000	100.0	H	-172.0	39.6
3958.500000	55.42	---	73.98	18.55	1000.0	1000.000	100.0	H	-172.0	39.6

*Prescan was measured with 10 dB attenuation.



Final Results:

Frequency MHz	Max- Peak dBµV/m	CAver- age dBµV/m	Limit dBµV/m	Mar- gin dB	Meas. Time ms	Band- width kHz	Height cm	Pol	Azi- muth deg	Corr. dB/m
4543.750000	58.15	---	83.50	25.35	1000.0	1000.000	200.0	H	-16.0	42.3
4543.750000	---	43.61	63.50	19.89	1000.0	1000.000	200.0	H	-16.0	42.3
7994.750000	72.01	---	83.50	11.49	1000.0	1000.000	150.0	V	-22.0	48.5
7994.750000	---	58.07	63.50	5.43	1000.0	1000.000	150.0	V	-22.0	48.5



2.1.8 Test Location and Test Equipment

The test was carried out in semi anechoic room No. 11

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2023-04-30
ULTRALOG antenna	Rohde & Schwarz	HL562E	39969	36	2025-03-31
Fixed attenuator	Aeroflex	Model 6 dB	39632	36	2022-11-30
Double ridged horn antenna	Rohde & Schwarz	HF907	40089	24	2023-02-28
Semi anechoic room	Frankonia	Cabin No. 11	42961	36	2024-09-30
EMC measurement software	Rohde & Schwarz	EMC32 Emission - V10.60.20	42986	---	---

Table 9



2.2 Output Power

2.2.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.247(b)(3)
ISED RSS-247, Clause 5.4 d. / 6.2.4.1

2.2.2 Equipment under Test and Modification State

SIMATIC RF650R FCC; S/N: S VPM7005427 - Modification state 0

2.2.3 Date of Test

2022-06-10

2.2.4 Environmental Conditions

Ambient Temperature	23 °C
Relative Humidity	52 %

2.2.5 Specification Limits

The maximum conducted output power shall not exceed 1 W (30 dBm).
The e.i.r.p. shall not exceed 4 W (36 dBm).

2.2.6 Test Method

The test was performed according to ANSI C63.10, section 11.9



2.2.7 Test Results

<i>Frequency Channel</i>	<i>Detector</i>	<i>EIRP (dBm)</i>	<i>Limit (dBm)</i>
910.8 MHz	Peak	30.2	36.0

Table 10: Radiated Output Power

2.2.8 Test Location and Test Equipment

The test was carried out in semi anechoic room No. 11

Instrument	Manufacturer	Type No	TE No	Calibra- tion Pe- riod (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2023-04-30
ULTRALOG antenna	Rohde & Schwarz	HL562E	39969	36	2025-03-31
Fixed attenuator	Aeroflex	Model 6 dB	39632	36	2022-11-30
Semi anechoic room	Frankonia	Cabin No. 11	42961	36	2024-09-30

Table 11



Product Service

2.3 Frequency Band Edge

2.3.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.247(d)
ISED RSS-247, Clause 5.5 / 6.2.4.2

2.3.2 Equipment under Test and Modification State

SIMATIC RF650R FCC; S/N: S VPM7005427; Modification state 0

2.3.3 Date of Test

2022-06-10

2.3.4 Environmental Conditions

Ambient Temperature	23 °C
Relative Humidity	52 %



2.3.5 Specification Limits

In any 100 kHz bandwidth outside the frequency band in which the device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power, based on either conducted or radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted, the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits is not required.

In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

ISED RSS-247 Clause 6.2.4.2

The power and e.i.r.p. of the equipment unwanted emission shall be measured in peak value. However, the equipment is restricted to comply with the provisions in RSS-Gen with respect to emissions falling within restricted frequency bands.

Devices operating in the band 5725 MHz – 5850 MHz shall have e.i.r.p. of unwanted emissions comply with the following:

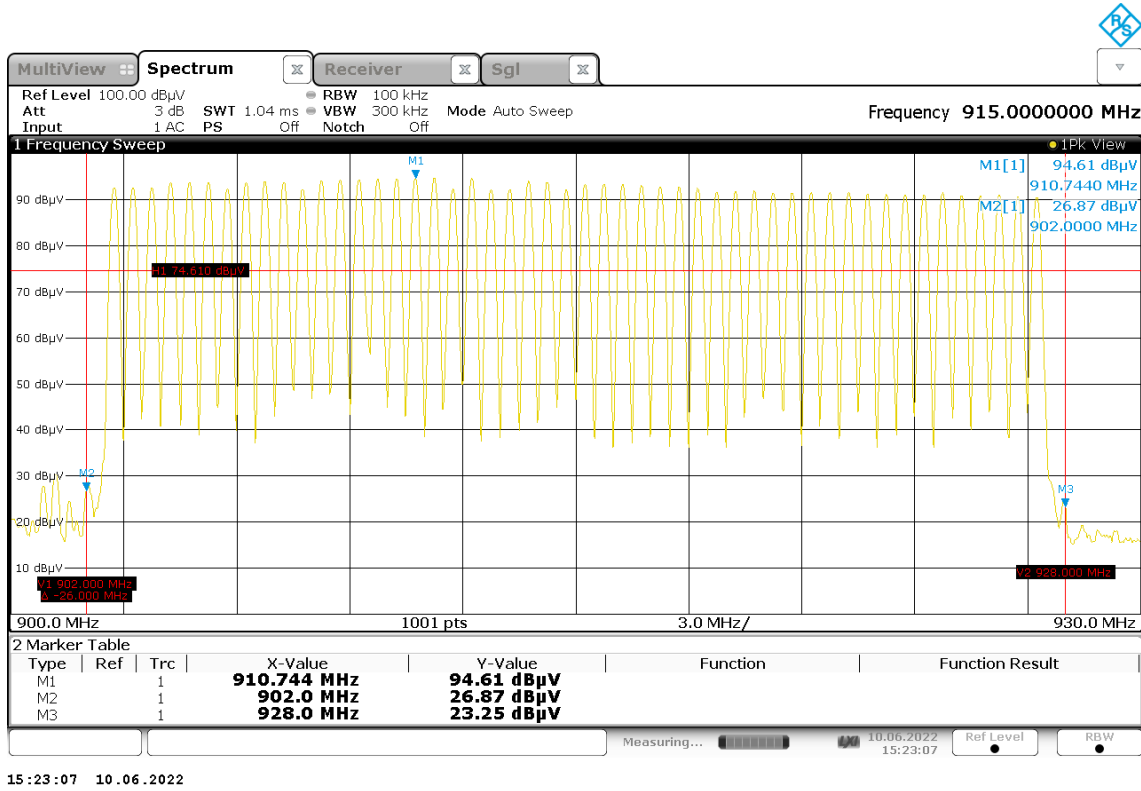
- a. 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges;
- b. 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;
- c. 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm at 75 MHz above or below the band edges; and
- d. -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

2.3.6 Test Method

The test was performed according to ANSI C63.10, sections 11.11



2.3.7 Test Results



2.3.8 Test Location and Test Equipment

The test was carried out in semi anechoic room No. 11

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2023-04-30
ULTRALOG antenna	Rohde & Schwarz	HL562E	39969	36	2025-03-31
Fixed attenuator	Aeroflex	Model 6 dB	39632	36	2022-11-30
Semi anechoic room	Frankonia	Cabin No. 11	42961	36	2024-09-30

Table 12



Product Service

3 Photos of test setups

See Annex A TR-713256859-00 for test setup photographs and Annex B TR-713256859-00 for external photographs.



4 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

The measurement uncertainty in the laboratory is less than or equal to the maximum measurement uncertainty according to CISPR16-4-2: 2011 + A1 + A2 + Cor1 (U_{CISPR}). This normative regulation means that the measured value is also the value to be assessed in relation to the limit value.

<i>Radio Interference Emission Testing</i>		
<i>Test Name</i>	<i>kp</i>	<i>Expanded Uncertainty</i>
Conducted Voltage Emission		
9 kHz to 150 kHz (50Ω/50μH AMN)	2	± 3.8 dB
150 kHz to 30 MHz (50Ω/50μH AMN)	2	± 3.4 dB
100 kHz to 200 MHz (50Ω/5μH AMN)	2	± 3.6 dB
Discontinuous Conducted Emission		
9 kHz to 150 kHz (50Ω/50μH AMN)	2	± 3.8 dB
150 kHz to 30 MHz (50Ω/50μH AMN)	2	± 3.4 dB
Conducted Current Emission		
9 kHz to 200 MHz	2	± 3.5 dB
Magnetic Field strength		
9 kHz to 30 MHz (with loop antenna)	2	± 3.9 dB
9 kHz to 30 MHz (large-loop antenna 2 m)	2	± 3.5 dB
Radiated Emission		
30 MHz to 300 MHz	2	± 4.9 dB
300 MHz to 1 GHz	2	± 5.0 dB
1 GHz to 6 GHz	2	± 4.6 dB
Test distance 10 m		
30 MHz to 300 MHz	2	± 4.9 dB
300 MHz to 1 GHz	2	± 4.9 dB
The expanded uncertainty reported according to to CISPR16-4-2: 2011 + A1 + A2 + Cor1 is based on a standard uncertainty multiplied by a coverage factor of $k_p = 2$, providing a level of confidence of $p = 95.45\%$		

Table 13 Measurement uncertainty based on CISPR 16-4-2



<i>Radio Interference Emission Testing</i>		
<i>Test Name</i>	<i>kp</i>	<i>Expanded Uncertainty</i>
Occupied Bandwidth	2	± 5 %
Conducted Power		
9 kHz ≤ f < 30 MHz	2	± 1.0 dB
30 MHz ≤ f < 1 GHz	2	± 1.5 dB
1 GHz ≤ f ≤ 40 GHz	2	± 2.5 dB
1 MS/s power sensor (TS8997)	2	± 1.5 dB
Occupied Bandwidth	2	± 5 %
Power Spectral Density	2	± 3.0 dB
Radiated Power		
9 kHz ≤ f < 26.5 GHz	2	± 5.6 dB
26.5 GHz ≤ f < 60 GHz	2	± 8.0 dB
60 GHz ≤ f < 325 GHz	2	± 10 dB
Conducted Spurious Emissions	2	± 3.0 dB
Radiated Spurious Emissions	2	± 6.0 dB
Voltage		
DC	2	± 1.0 %
AC	2	± 2.0 %
Time (automatic)	2	± 5 %
Frequency	2	± 10 ⁻⁷
The expanded uncertainty reported according to to ETSI TR 100 028:2001 is based on a standard uncertainty multiplied by a coverage factor of $k_p = 2$, providing a level of confidence of $p = 95.45\%$		

Table 14 Measurement uncertainty based on ETSI TR 100 028