Report on the FCC and IC Testing of the Siemens AG Access Control Reader Model: Simatic RF1140R In accordance with FCC 47 CFR Part 15 C and ISED RSS-210 and ISED RSS-Gen

Product Service

Add value.
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Prepared for: Siemens AG
DI PA DCP R&D 1
Gleiwitzer Str. 555
90475 Nürnberg, Germany

COMMERCIAL-IN-CONFIDENCE

FCC ID: NXW-RF1140R
IC: 267X-RF1140R

Date: 2023-02-09
Document Number: TR-713276724-02 | Revision 1

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Martin Steindl	2023-07-04	Steindl Martin SIGN-ID 807387
Authorised Signatory	Matthias Stumpe	2023-07-05	Stumpe SIGN-ID 807981

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

Engineering Statement:

This measurement shown in this report were made in accordance with the procedures described on test pages.
All reporded testing was carried out on a sample equipment to demonstrate limited compilance with with FCC 47 CFR Part 15 C and ISED RSS-210 and RSS-GEN.
The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Martin Steindl	2023-07-04	Steindl Martin SIGN-ID 807390

Laboratory Accreditation	Laboratory recognition	Industry Canada test site registration
DAkkS Reg. No. D-PL-11321-11-02 DAkkS Reg. No. D-PL-11321-11-03	Registration No. BNetzA-CAB-16/21-15	3050A-2

Executive Statement:

A sample of this product was tested and found to be compilant with FCC 47 CFR Part 15 C:2021 and ISED RSS- 210:2019 and ISED RSS Gen:2019

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Product Service

Content

Product Service

1 Report Summary

1.1 Modification Report

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

Revision	*Description of changes*	*Date of Issue*
0	First Issue	2023-02-09
1	Added spectrum mask and calculation of additional correction Added IDs for FCC and IC, deleted reference to obsolete module Altered 125 kHz rule to RSS-210. Updated picture of marking plate	2023-07-04

Table 1: Report of Modifications

1.2 Introduction

Applicant	Siemens AG DI PA DCP R&D 1 Gleiwitzer Str. 555 90475 Nürnberg, Germany
Manufacturer	Siemens AG 76181 Karlsruhe, Germany
Model Number(s)	Simatic RF1140R
FCC ID:	NXW-RF1140R
IC:	267X-RF1140R
Serial Number(s)	Prototype
Hardware Version(s)	Prototype
Software Version(s)	Prototype
Number of Samples Tested	2
Test Specification(s) /	FCC 47 CFR Part 15 C : 2019 and
Issue / Date	ISED RSS-210, Issue 10, Amd. 1 : 2019 ISED RSS-Gen, Issue 5, Amd. 1 : 2019
Test Plan/Issue/Date	---
Order Number	9707342710
Date	2022-10-20
Date of Receipt of EUT	2023-01-09
Start of Test	2023-01-10
Finish of Test	2023-02-03
Name of Engineer(s)	M. Steindl; A. Fink
Related Document(s)	ANSI C63.10:2013

Product Service

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15 C and ISED RSS-210 and RSS-Gen is shown below.

Sections	*Specification Clause*	*Test Description*	*Result*
	15.203	Antenna requirement	Pass, Integral antenna
2.1, 3.1	15.215(c)	Bandwidth of Signal	Pass
2.2, 3.2	15.209, 15.225	Radiated Emissions	Pass
2.3, 3.3	15.225(e)	Frequency Tolerance	Pass

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

Section	*Specification Clause*	*Test Description*	*Result*
2.2, 3.2	7.3, 7.7	Radiated Emission	Pass

Table 3: Results according to ISED RSS-210

Section	*Specification Clause*	*Test Description*	*Result*
2.1, 3.1	6.7	Bandwidth of Signal	Pass
2.2, 3.2	8.9, 8.10	Radiated Emissions	Pass
2.3, 3.3	6.11	Frequency Tolerance	Pass

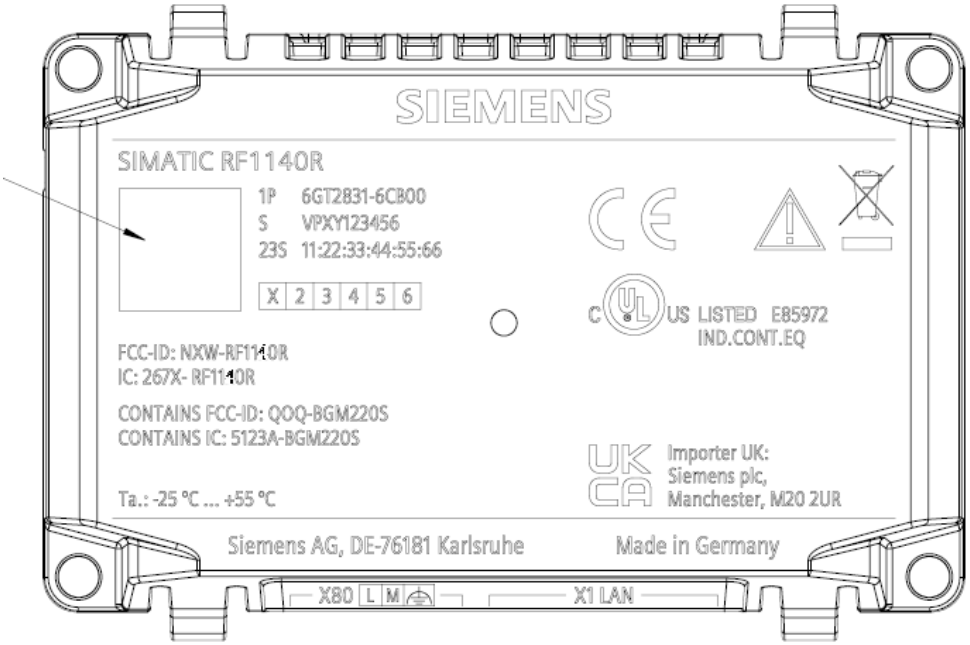
Table 4: Results according to ISED RSS-Gen

Product Service

1.4 Product Information

1.4.1 Technical Description

Frequency Band:	125 kHz; 13.110 – 14010 MHz
Emission designator:	A1D
Supply Voltage:	24 V / PoE
Supply Frequency:	0 Hz
Highest clock frequency (non-radio part):	1000 MHz



Marking plate

1.4.2 EUT Ports / Cables identification

Port	*Max Cable Length specified*	*Usage*	*Screened*
DC supply	N/A	DC supply	No
Ethernet	N/A	Telecommunication	Yes

Table 5

Product Service

1.4.3 List of support devices

Description	*Type designation*	*Serial No. or ID*	*Manufacturer*
Switching Power Supply	POE20U-56(G)	Rev. C	Phihong

Table 6

1.4.4 Modules in EUT

Type designation	*Manufacturer*	*FCC ID*	*IC*
BGM220S22A	Silicon Labs	QOQ-BGM220S	5123A-BGM220S

Table 7

1.5 Test Configuration

The applicant provided a test software to control the EUT over ethernet interface.

1.6 Modes of Operation

The test was performed with maximum power reading a transponder tag for 125 kHz and 13.56 MHz separately

1.7 EUT Modifications Record

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

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As supplied by the customer	Not Applicable	Not Applicable
1	Modification acc. to documentation of applicant	Siemens AG	2023-02-03

Table 8

Product Service

1.8 Test Location

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

Test Name	Name of Engineer(s)
Bandwidth of Signal	M. Steindl
Radiated Emissions	M. Steindl; A. Fink
Frequency Tolerance	M. Steindl

Office Address:
Äußere Frühlingstraße 45
94315 Straubing
Germany

Product Service

2 Test Details for 125 kHz

2.1 Bandwidth of Signal

2.1.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.215(c)
ISED RSS-Gen, Clause 6.7

2.1.2 Equipment under Test and Modification State

Simatic RF1140R; Modification State 0

2.1.3 Date of Test

2023-02-03

2.1.4 Environmental Conditions

Ambient Temperature	20 °C
Relative Humidity	35 %

2.1.5 Specification Limits

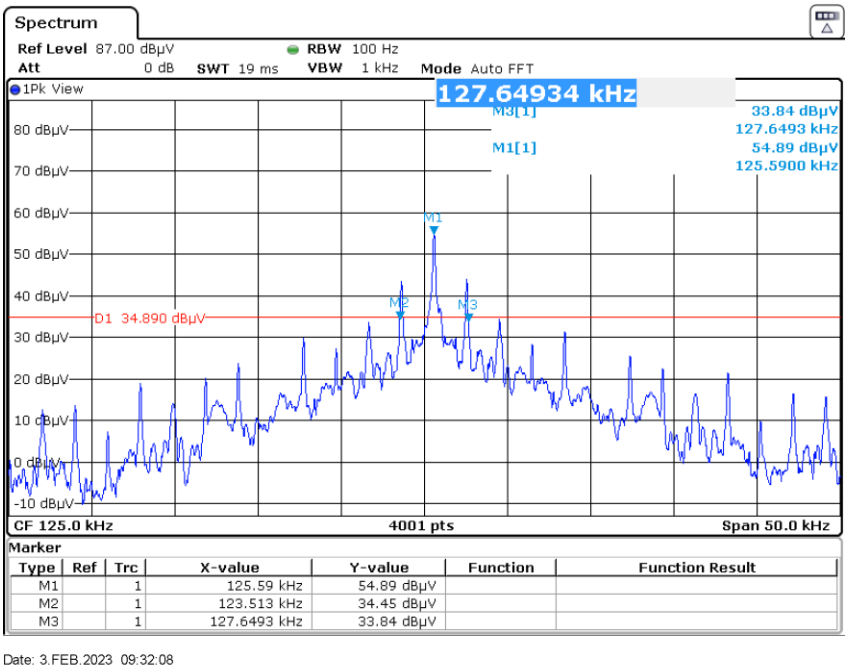
No limitation – Bandwidth noted

2.1.6 Test Method

The test was performed according to ANSI C63.10, clauses 6.9
See section 3.2 of this test report for details.

Product Service

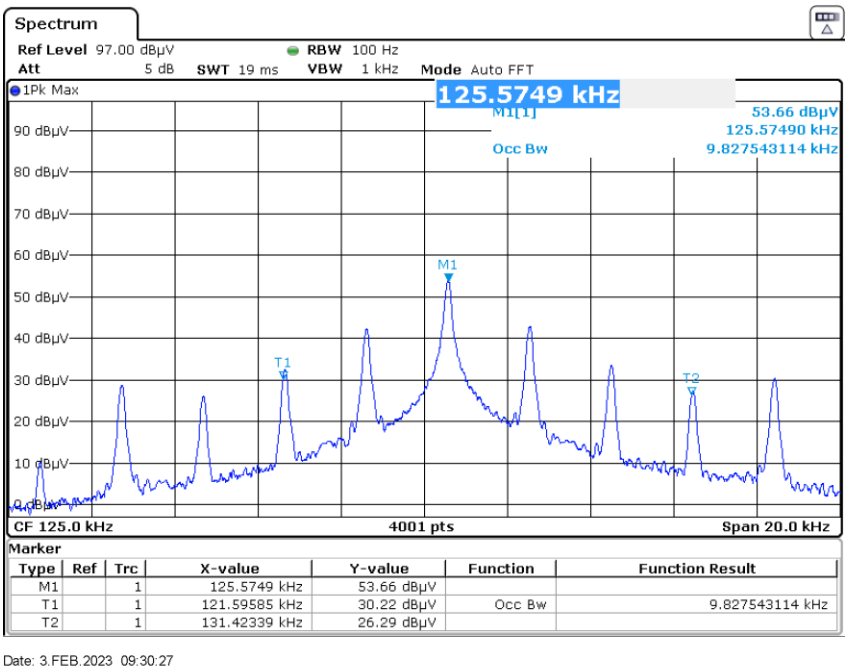
2.1.7 Test Results



Center frequency	*20 dB Bandwidth*
125.6 kHz	4.1363 kHz

Table 9: 20 dB bandwidth

Product Service



Centre Frequency	*99% Bandwidth*
125.6 kHz	9.8275 kHz

Table 10: 99% bandwidth

2.1.8 Test Location and Test Equipment

The test was carried out in radio test laboratory

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and spectrum analyzer	FSV40	FSV40	20219	24	2024-02-29

Table 11

Product Service

2.2 Radiated Emissions

2.2.1 Specification Reference

FCC 47 CFR Part 15 C, Clauses 15.205 and 15.209
ISED RSS-210, Clause 7.3
ISED RSS-Gen, Clauses 8.9 and 8.10

2.2.2 Equipment under Test and Modification State

Simatic RF1140R; Modification State 0

2.2.3 Date of Test

2023-02-03

2.2.4 Environmental Conditions

Ambient Temperature	20 °C
Relative Humidity	35 %

Product Service

2.2.5 Specification Limits

General radiated emission limits:					
Frequency Range (MHz)	*Test distance (m)*	*Field strength*		*Field strength*	
		(µA/m)	*(dBµA/m)*	*(µV/m)*	*(dBµV/m)*
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 11 General radiated emission limits

At frequencies at or above 30 MHz, measurements may be performed at distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field meas-urements are appropri-ate 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. Measurements shall not be performed at a distance greater than 30 m, unless it can be further demonstrated that measurements at a distance of 30 m or less are impractical. When performing measurements at a dis-tance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements.

At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regula-tions; however, an attempts should be made to avoid making measurements in the near field. Pending the develop-ment of an appropriate measurement procedure for measurements performed below 30 MHz, when performing meas-urements at a closer distance than specified, the results shall be extrapolated to the specified distance by either mak-ing measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

2.2.6 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.

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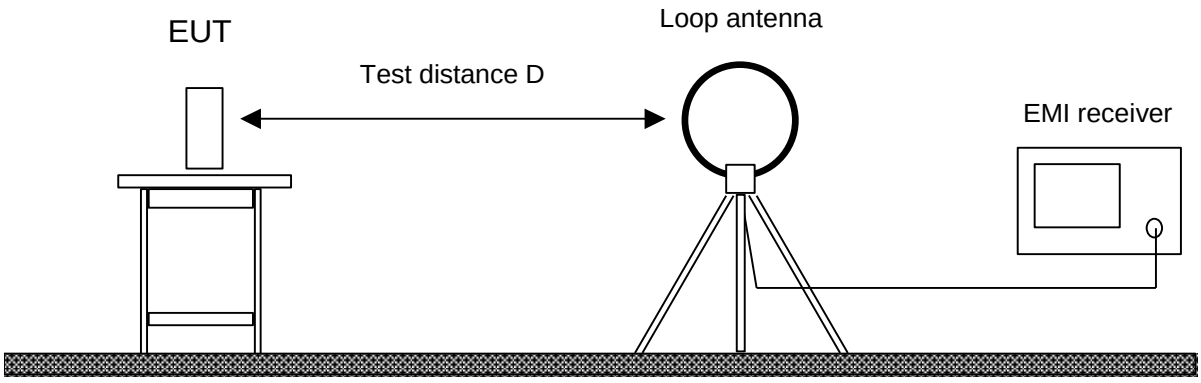
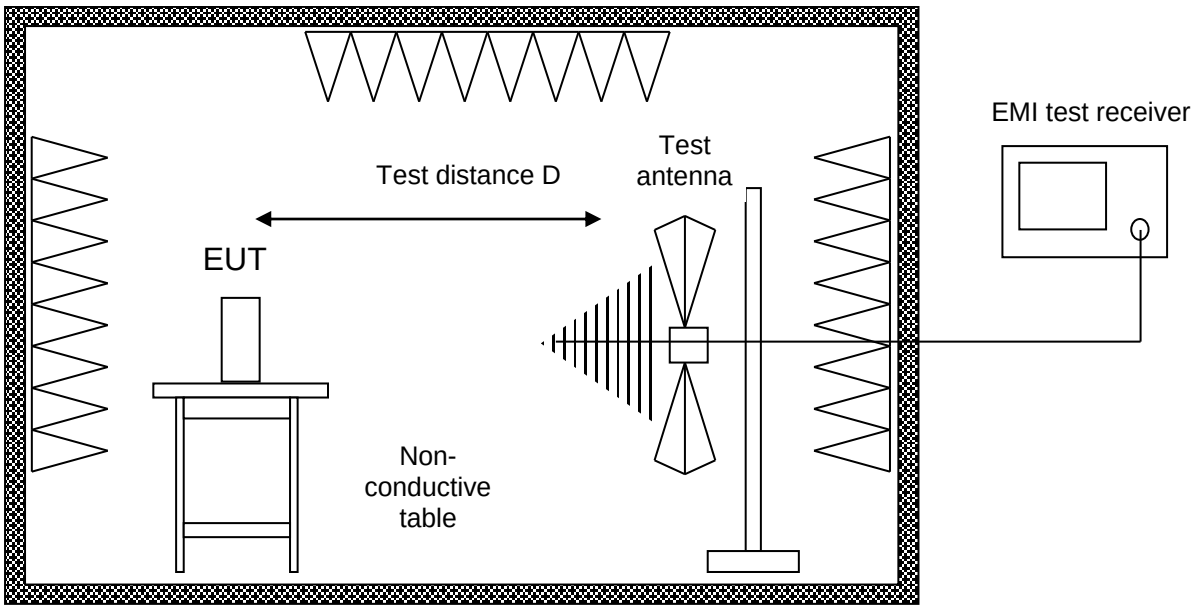
2.2.6.1 Frequency range 9 kHz – 30 MHz



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. In addition in the frequency range 9 kHz to 490 kHz also 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.

2.2.6.2 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

Product Service

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.

2.2.7 Test Results

Frequency range	*Limit applied*	*Test distance*
9 kHz – 1 GHz	15.209	3 m

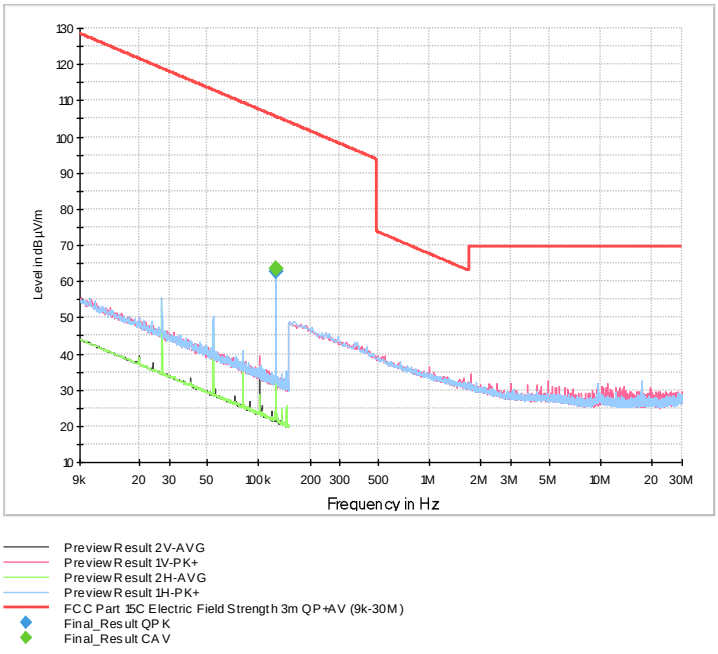
Table 12

Sample calculation:

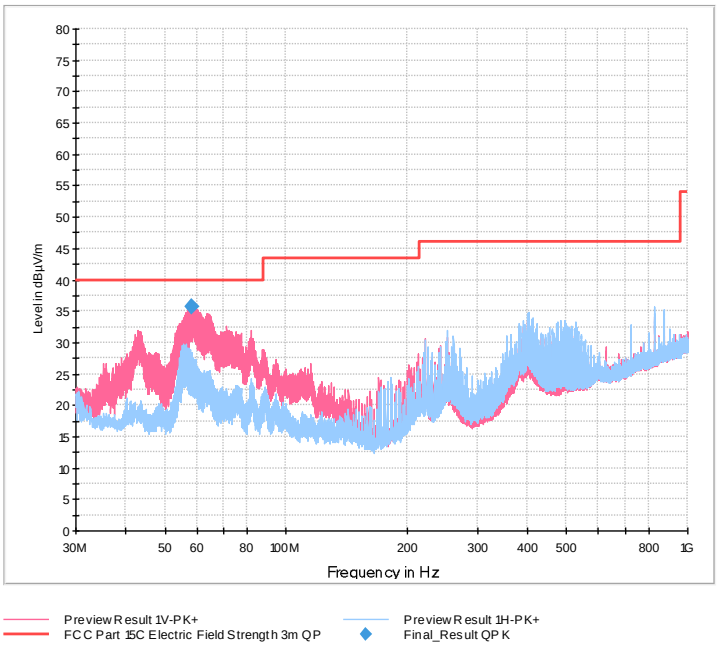
Final Value (dBµV/m) = Reading Value (dBµV) + (Cable attenuation (dB) + Antenna Transducer (dB(1/m)))

Additional correction of limit in the frequency range 9 – 490 kHz (300 m to 3 m): +80.0 dB
Additional correction of limit in the frequency range 490 kHz – 30 MHz (30 m to 3 m): +40.0 dB

Product Service



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
0.1257		63.33	125.62	62.79	1000.0	0.200	100.0	H	11.0	19.3
0.1257	62.83		105.62	42.79	1000.0	0.200	100.0	H	11.0	19.3



Frequency MHz	QuasiPeak dBµV/m	Limit dBµV/m	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB/m
58.410000	35.81	40.00	4.19	1000.0	120.000	100.0	V	-128.0	13.7

Product Service

2.2.8 Test Location and Test Equipment

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

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMC test receiver	Rohde & Schwarz	ESW44	39897	12	2023-04-30
Loop antenna	Schwarzbeck	FMZB 1519B	44334	36	2023-01-31
ULTRALOG antenna	Rohde & Schwarz	HL562E	39969	36	2025-03-31
Fixed attenuator	Aeroflex	Model. 6 dB	39632	36	2026-01-31
Semi anechoic room	Frankonia	Cabin No. 11	42961		
EMC measurement software	Rohde & Schwarz	EMC 32 V11.50	42986		

Table 13

Product Service

2.3 Temperature Stability

2.3.1 Specification Reference

ISED RSS-Gen, Clause 6.11

2.3.2 Equipment under Test and Modification State

Simatic RF1140R; Modification State 0

2.3.3 Date of Test

2023-02-03

2.3.4 Environmental Conditions

Ambient Temperature	20 °C
Relative Humidity	35 %

2.3.5 Specification Limits

The fundamental emissions of the radio apparatus should be kept within at least the central 80 % of its permitted operating frequency band in order to minimize the possibility of out-of-band operation.
In addition, its occupied bands shall be entirely outside the restricted bands and the prohibited TV bands, unless otherwise indicated

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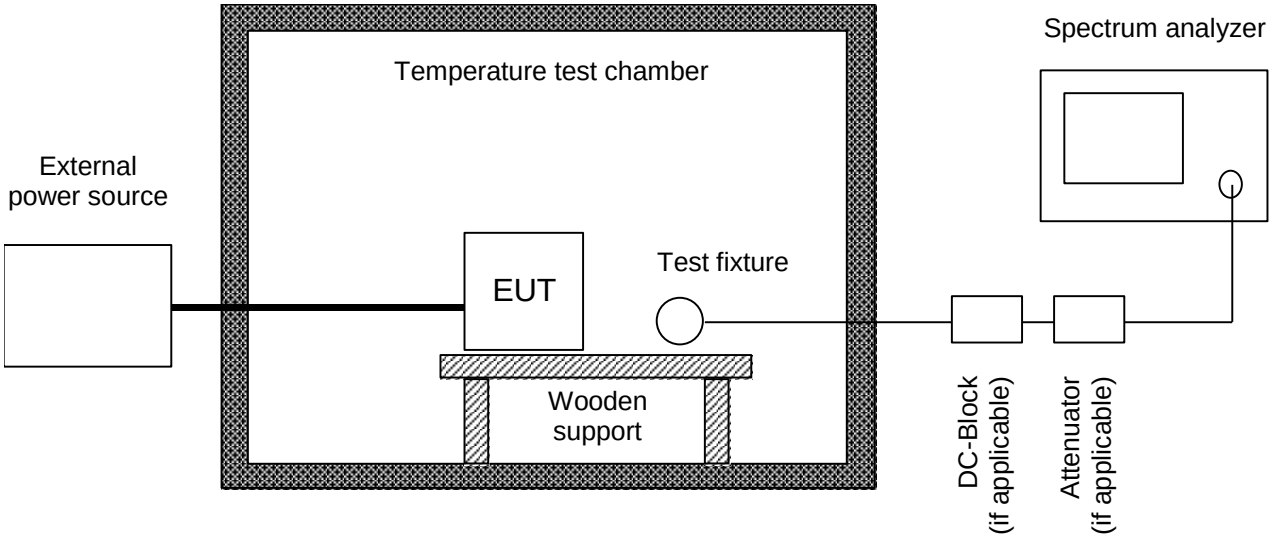
2.3.6 Test Method

The test was performed according to ANSI C63.10, section 6.8.



The frequency tolerance of the carrier signal is measured over a temperature variation of -20 °C to +50 °C at normal supply voltage, and for a variation in the primary supply voltage from 85 % to 115 % of the rates supply voltage at a temperature of 20 °C. Temperature and voltage range may vary if the manufacturer states another temperature or voltage range.
If the EUT provides an antenna connector the spectrum analyzer is connected to this port. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as a DC block and appropriate (50 Ω) attenuators. In case where the EUT does not provide an antenna connector or a test fixture is used.
For battery operated equipment, the test is performed using a new battery. Alternatively, an external supply voltage can be used and is at least set to:

- The maximum battery voltage as delivered by a new battery or 115 % of the battery nominal voltage;
- The battery nominal voltage
- 85 % of the battery nominal voltage
- The battery operating end point voltage which shall be specified by the equipment manufacturer.

The EUT is operating providing an unmodulated carrier for frequency error tests. The peak detector of the spectrum analyzer is selected and resolution as well as video bandwidth are set to values appropriate to shape of the spectrum of the EUT. The frequency counter mode of the spectrum analyzer is used to maximize the accuracy of the measured frequency tolerance.
If an unmodulated carrier is not available a significant and stable point of the spectrum is selected and the span is reduced to a value that delivers an accuracy which shall be better than 1 % of the maximum frequency tolerance allowed for the carrier signal. This method may be performed as long as the margin to the frequency tolerance is larger than the uncertainty of the measured frequency tolerance.

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2.3.7 Test Results

Temperature	*Supply Voltage*	*Frequency*	*Frequency drift*	
-20 °C	24 V	125.420000 kHz	-0.318 kHz	-0.25 %
-10 °C	24 V	125.521000 kHz	-0.217 kHz	-0.17 %
0 °C	24 V	125.637000 kHz	-0.101 kHz	-0.08 %
10 °C	24 V	125.680000 kHz	-0.058 kHz	-0.05 %
20 °C	21.6 V	125.513500 kHz	-0.225 kHz	-0.18 %
20 °C	24 V	125.738000 kHz	0.000 kHz	0.00 %
20 °C	PoE	125.606700 kHz	-0.131 kHz	-0.10 %
20 °C	26.4V	125.574000 kHz	-0.164 kHz	-0.13 %
30 °C	24 V	125.753000 kHz	0.015 kHz	0.01 %
40 °C	24 V	125.753000 kHz	0.015 kHz	0.01 %
50 °C	24 V	125.753000 kHz	0.015 kHz	0.01 %

Table 14

2.3.8 Test Location and Test Equipment

The test was carried out in radio test laboratory

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and spectrum analyzer	FSV40	FSV40	20219	24	2024-02-29
Temperature test chamber	Feutron	KPK200-2	19868	24	2023-02-28

Table 15

Product Service

3 Test Details for 13.56 MHz

3.1 Bandwidth of Signal

3.1.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.215(c)
ISED RSS-Gen, Clause 6.7

3.1.2 Equipment under Test and Modification State

Simatic RF1140R; Modification State 0

3.1.3 Date of Test

2023-02-03

3.1.4 Environmental Conditions

Ambient Temperature	20 °C
Relative Humidity	35 %

3.1.5 Specification Limits

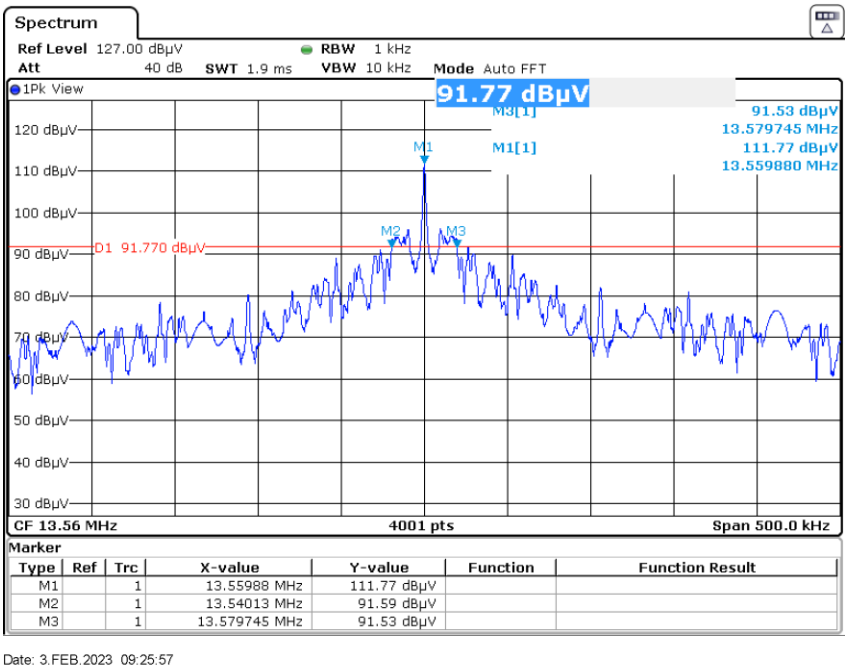
No limitation – Bandwidth noted

3.1.6 Test Method

The test was performed according to ANSI C63.10, clauses 6.9
See section 3.2 of this test report for details.

Product Service

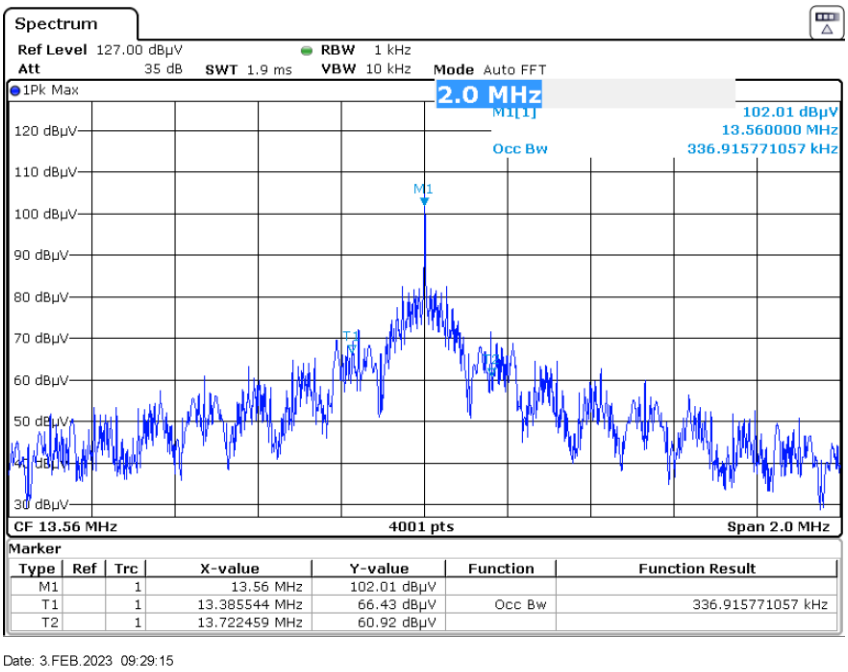
3.1.7 Test Results



Center frequency	*20 dB Bandwidth*
13.56 MHz	39.615 kHz

Table 16: 20 dB bandwidth

Product Service



Centre Frequency	*99% Bandwidth*
13.56 MHz	336.917 kHz

Table 17: 99% bandwidth

3.1.8 Test Location and Test Equipment

The test was carried out in radio test laboratory

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and spectrum analyzer	FSV40	FSV40	20219	24	2024-02-29

Table 18

Product Service

3.2 Radiated Emissions

3.2.1 Specification Reference

FCC 47 CFR Part 15 C, Clauses 15.205, 15.209 and 15.225
ISED RSS-210, Clause 7.7 and B.6
ISED RSS-Gen, Clauses 8.9 and 8.10

3.2.2 Equipment under Test and Modification State

Simatic RF1140R; Modification State 0
Simatic RF1140R; Modification State 1

3.2.3 Date of Test

2023-02-03 and 2023-02-02

3.2.4 Environmental Conditions

Ambient Temperature	20 °C
Relative Humidity	35 %

Product Service

3.2.5 Specification Limits

Radiated emission limits:					
Frequency Range	*Test distance*	*Field strength*		*Field strength*	
(MHz)	*(m)*	*(µA/m)*	*(dBµA/m)*	*(µV/m)*	*(dBµV/m)*
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 – 13.110	30	0.08	-21.94	30	29.54
13.110 – 13.410	30	0.283	-11.0	106	40.5
13.410 – 13.553	30	0.891	-1.0	334	50.5
13.553 – 13.567	30	42.26	32.5	15848	84
13.567 – 13.710	30	0.891	-1.0	334	50.5
13.710 – 14.010	30	0.283	-11.0	106	40.5
14.010 - 30	30	0.08	-21.94	30	29.54
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 19 Radiated emission limits

At frequencies at or above 30 MHz, measurements may be performed at distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field meas-urements are appropri-ate 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. Measurements shall not be performed at a distance greater than 30 m, unless it can be further demonstrated that measurements at a distance of 30 m or less are impractical. When performing measurements at a dis-tance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements.

At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regula-tions; however, an attempts should be made to avoid making measurements in the near field. Pending the develop-ment of an appropriate measurement procedure for measurements performed below 30 MHz, when performing meas-urements at a closer distance than specified, the results shall be extrapolated to the specified distance by either mak-ing measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

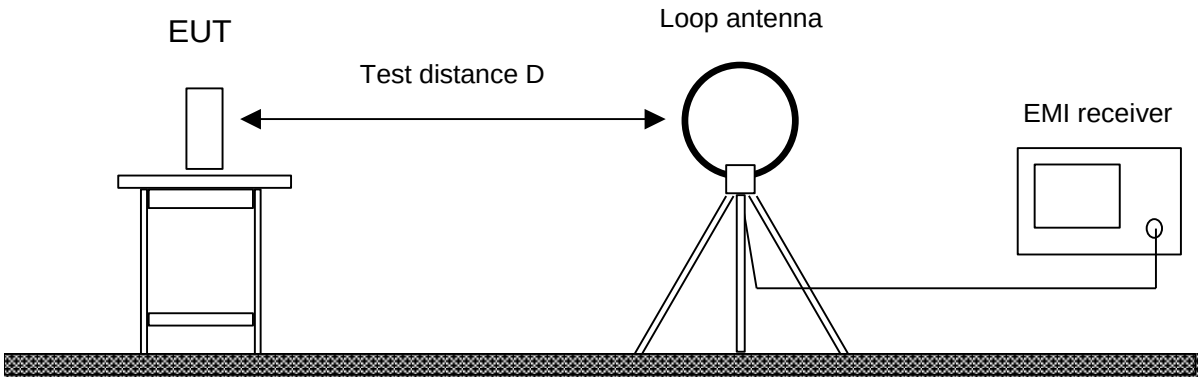
Product Service

3.2.6 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.

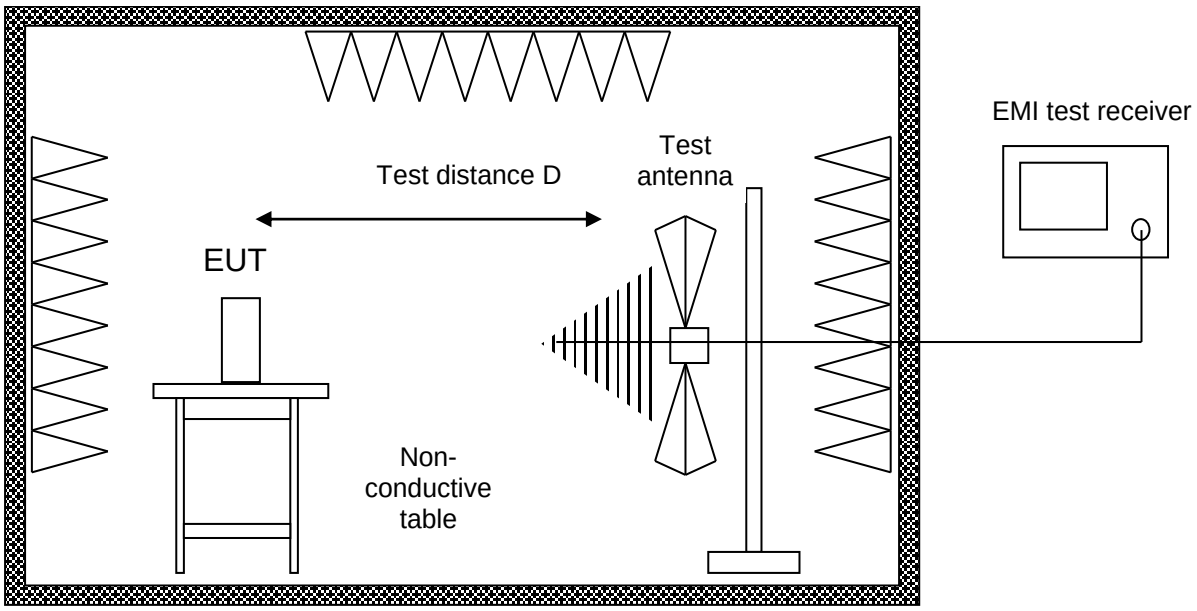
3.2.6.1 Frequency range 9 kHz – 30 MHz



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. In addition in the frequency range 9 kHz to 490 kHz also 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.

Product Service

3.2.6.2 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.

3.2.7 Test Results

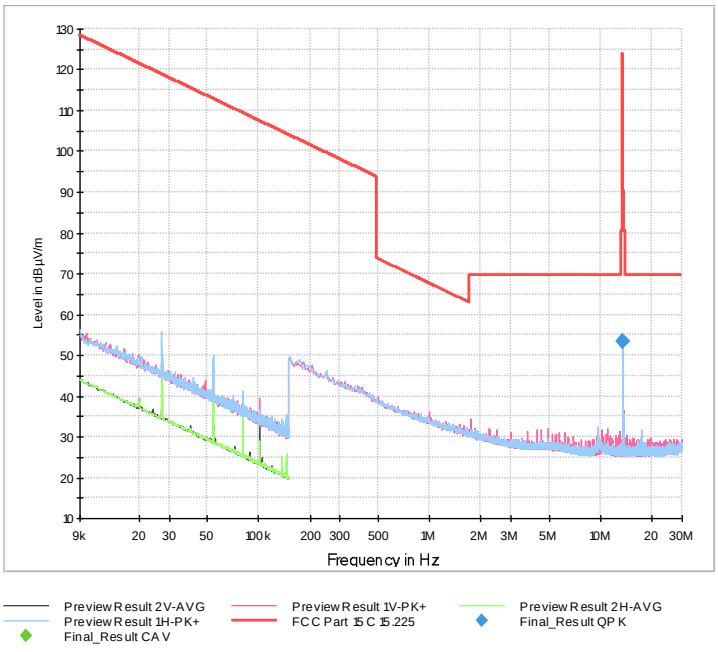
Frequency range	*Limit applied*	*Test distance*
9 kHz – 1 GHz	15.209	3 m

Table 20

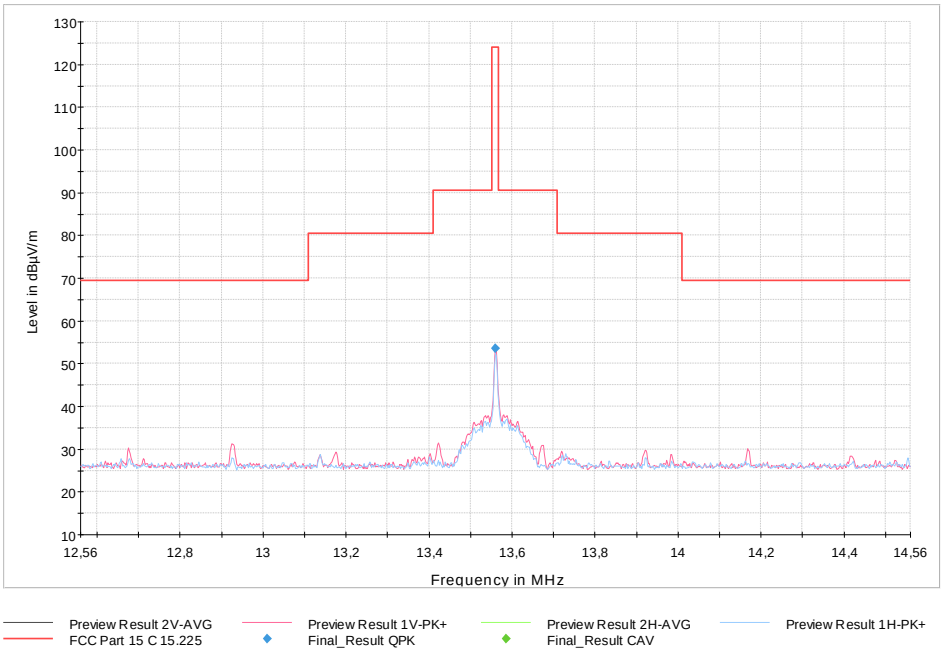
Sample calculation:
Final Value (dBµV/m) = Reading Value (dBµV) + (Cable attenuation (dB) + Antenna Transducer (dB(1/m)))

Additional correction of limit in the frequency range 9 – 490 kHz (300 m to 3 m): +80.0 dB
Additional correction of limit in the frequency range 490 kHz – 30 MHz (30 m to 3 m): +40.0 dB

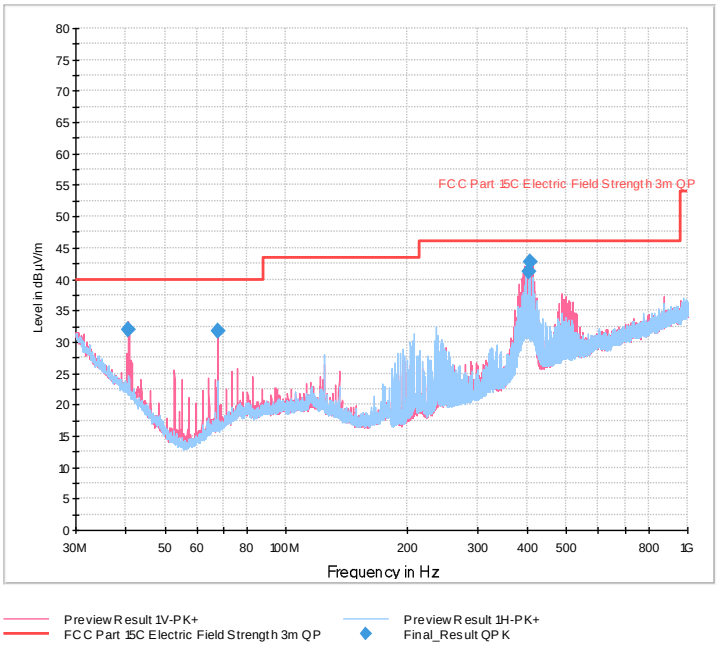
Product Service



Frequency MHz	Qua-siPeak 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
13.560000	53.54		124.00	70.46	1000.0	9.000	100.0	V	67.0	18.9



Product Service



Frequency MHz	*Qua-siPeak dBµV/m*	*Limit dBµV/m*	*Mar-gin dB*	*Meas. Time ms*	*Band-width kHz*	*Height cm*	*Pol*	*Azi-muth deg*	*Corr. dB/m*
40.680000	32.03	40.00	7.97	1000.0	120.000	102.0	V	-14.0	19.2
67.800000	31.79	40.00	8.21	1000.0	120.000	124.0	V	-173.0	14.0
402.090000	41.11	46.02	4.91	1000.0	120.000	121.0	V	-7.0	22.4
404.430000	42.71	46.02	3.31	1000.0	120.000	122.0	V	19.0	22.4

3.2.8 Test Location and Test Equipment

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

Instrument	Manufacturer	Type No	TE No	Calibra-tion Pe-riod (months)	Calibration Due
EMC test receiver	Rohde & Schwarz	ESW44	39897	12	2023-04-30
Loop antenna	Schwarzbeck	FMZB 1519B	44334	36	2023-01-31
ULTRALOG antenna	Rohde & Schwarz	HL562E	39969	36	2025-03-31
Fixed attenuator	Aeroflex	Model. 6 dB	39632	36	2026-01-31
Semi anechoic room	Frankonia	Cabin No. 11	42961		
EMC measurement software	Rohde & Schwarz	EMC 32 V11.50	42986		

Table 21

Product Service

3.3 Temperature Stability

3.3.1 Specification Reference

FCC 47 CFR Part 15 E, Clause 15.225(e)
ISSED RSS-210, Clause B.6 b.
ISED RSS-Gen, Clause 6.11

3.3.2 Equipment under Test and Modification State

Simatic RF1140R; Modification State 0

3.3.3 Date of Test

2023-02-03

3.3.4 Environmental Conditions

Ambient Temperature	20 °C
Relative Humidity	35 %

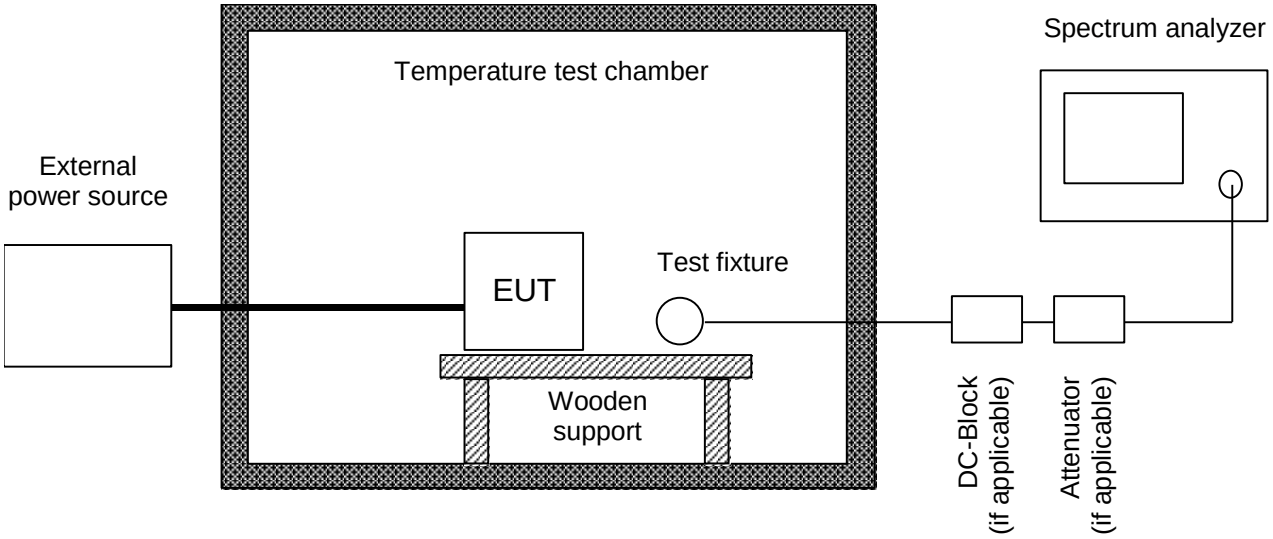
3.3.5 Specification Limits

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 +50 °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. For battery operated equipment, the equipment tests shall be performed using a new battery.

Product Service

3.3.6 Test Method

The test was performed according to ANSI C63.10, section 6.8.



The frequency tolerance of the carrier signal is measured over a temperature variation of -20 °C to +50 °C at normal supply voltage, and for a variation in the primary supply voltage from 85 % to 115 % of the rates supply voltage at a temperature of 20 °C. Temperature and voltage range may vary if the manufacturer states another temperature or voltage range.
If the EUT provides an antenna connector the spectrum analyzer is connected to this port. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as a DC block and appropriate (50 Ω) attenuators. In case where the EUT does not provide an antenna connector or a test fixture is used.
For battery operated equipment, the test is performed using a new battery. Alternatively, an external supply voltage can be used and is at least set to:

- The maximum battery voltage as delivered by a new battery or 115 % of the battery nominal voltage;
- The battery nominal voltage
- 85 % of the battery nominal voltage
- The battery operating end point voltage which shall be specified by the equipment manufacturer.

The EUT is operating providing an unmodulated carrier for frequency error tests. The peak detector of the spectrum analyzer is selected and resolution as well as video bandwidth are set to values appropriate to shape of the spectrum of the EUT. The frequency counter mode of the spectrum analyzer is used to maximize the accuracy of the measured frequency tolerance.
If an unmodulated carrier is not available a significant and stable point of the spectrum is selected and the span is reduced to a value that delivers an accuracy which shall be better than 1 % of the maximum frequency tolerance allowed for the carrier signal. This method may be performed as long as the margin to the frequency tolerance is larger than the uncertainty of the measured frequency tolerance.

Product Service

3.3.7 Test Results

Temperature	*Supply Voltage*	*Frequency*	*Frequency drift*	
-20 °C	24 V	13.560622 MHz	0.029 kHz	2.14 ppm
-10 °C	24 V	13.560644 MHz	0.051 kHz	3.74 ppm
0 °C	24 V	13.560637 MHz	0.043 kHz	3.21 ppm
10 °C	24 V	13.560608 MHz	0.014 kHz	1.07 ppm
20 °C	21.6 V	13.560587 MHz	-0.007 kHz	-0.49 ppm
20 °C	24 V	13.560593 MHz	0.000 kHz	0.00 ppm
20 °C	PoE	13.560636 MHz	0.043 kHz	3.15 ppm
20 °C	26.4V	13.560575 MHz	-0.019 kHz	-1.39 ppm
30 °C	24 V	13.560586 MHz	-0.007 kHz	-0.53 ppm
40 °C	24 V	13.560601 MHz	0.007 kHz	0.54 ppm
50 °C	24 V	13.560622 MHz	0.029 kHz	2.14 ppm

Table 22

3.3.8 Test Location and Test Equipment

The test was carried out in radio test laboratory

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and spectrum analyzer	FSV40	FSV40	20219	24	2024-02-29
Temperature test chamber	Feutron	KPK200-2	19868	24	2023-02-28

Table 23

Product Service

4 Measurement Uncertainty

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

Radio Interference Emission Testing		
Test Name	*kp*	*Expanded Uncertainty*
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 Fieldstrength		
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 kp = 2, providing a level of confidence of p = 95.45%		

Table 24 Measurement uncertainty based on CISPR 16-4-2

Product Service

Radio Interference Emission Testing		
Test Name	*kp*	*Expanded Uncertainty*
Occupied Bandwdith	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		
25 MHz – 6 GHz	1.96	±4.4 dB
1 GHz – 18 GHz	1.96	±4.7 dB
18 GHz – 40 GHz	1.96	±4.9 dB
40 GHz – 325 GHz	1.96	±6.1 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 kp = 2, providing a level of confidence of p = 95.45%		

Table 25 Measurement uncertainty based on ETSI TR 100 028

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}) and as specified in the test report below. This normative regulation means that the measured value is also the value to be assessed in relation to the limit value.

Product Service

Test Name	*Expanded Uncertainty*
Occupied Bandwidth	±5 %
Conducted Power	
9 kHz ≤ f < 30 MHz	±1.0 dB
30 MHz ≤ f < 1 GHz	±1.5 dB
1 GHz ≤ f ≤ 40 GHz	±2.5 dB
1 MS/s power sensor (2.4 / 5 GHz band)	±1.5 dB
Power Spectral Density	±3.0 dB
Radiated Power	
25 MHz – 26.5 GHz	±6.0 dB
26.5 GHz – 66 GHz	±8.0 dB
40 GHz – 325 GHz	±10.0 dB
Conducted Spurious Emissions	±3.0 dB
Radiated Field Strength 9 kHz – 40 GHz	±6.0 dB
Voltage	
DC	± 1.0 %
AC	± 2.0 %
Time (automatic)	± 5 %
Frequency	± 10^{-7}

Table 26 Decision Rule: Maximum allowed measurement uncertainty