



Product Service

Report on the FCC and IC Testing of the SIEMENS AG

Model: SIMATIC RF360R

In accordance with FCC 47 CFR Part 15C and
ISED Canada RSS-210 and ISED Canada RSS-
GEN

Prepared for: SIEMENS AG
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D-90475 Nürnberg

FCC ID: NXW-RF360R
IC: 267X-RF360R



COMMERCIAL-IN-CONFIDENCE

Date: 2020-04-30
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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
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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 FCC 47 CFR Part 15C and ISED Canada RSS-210 and ISED Canada RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Michael Ingerl	2020-04-30	 SIGN-ID 354049

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Laboratory Accreditation

DAkKS Reg. No. D-PL-11321-11-02

Laboratory recognition

Registration No. BNetzA-CAB-16/21-15

ISED Canada test site registration

3050A-2

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C, ISED Canada RSS-210 and ISED Canada RSS-GEN, Issue 10 (12-2019) and Issue 05 (03-2019).



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1 Report Summary

1.1 Report Modification Record

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

Issue	Description of Change	Date of Issue
1	First Issue	2020-04-30

Table 1

1.2 Introduction

Applicant	SIEMENS AG
Manufacturer	SIEMENS AG
Model Number(s)	SIMATIC RF360R
Serial Number(s)	---
Hardware Version(s)	---
Software Version(s)	---
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C, ISED Canada RSS-210 and ISED Canada RSS-GEN, Issue 10 (12-2019) and Issue 05 (03-2019), FCC rule Part 2.1093, KDB 447498 D01, RSS-102 Issue 5
Test Plan/Issue/Date	---
Order Number	5228561
Date of Receipt of EUT	2020-03-06
Start of Test	2020-03-09
Finish of Test	2020-04-20
Name of Engineer(s)	Michael Ingerl
Related Document(s)	ANSI C63.10 (2013) ANSI C63.4 (2014)



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C and ISED Canada RSS-210, ISED Canada RSS-GEN, FCC rule Part 2.1093, KDB 447498 D01 and RSS-102 Issue 5 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: 24V DC Powered – Continuous transmitting				
2.1	15.225 (a)(b)(c)(d), B.1 to B.9, 6.5 and 6.6.	Field Strength of any Emission	Pass	ANSI C63.10 (2013)
2.2	15.225 (e), B.1 to B.9 and 6.11.	Frequency Tolerance Under Temperature Variations	Pass	ANSI C63.10 (2013)
2.3	15.215 (c), N/A and 6.7	20 dB Bandwidth	Pass	ANSI C63.10 (2013)
2.4	15.205, 7.1 and 8.10	Restricted Band Edges	Pass	ANSI C63.10 (2013)
2.5	15.207 and 8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2013)
2.6	15.107 and 6.1	Exposure of Humans to RF Fields and SAR exclusion threshold	Pass	ANSI C63.4 (2014)

Table 2



1.4 Product Information

1.4.1 Technical Description

Equipment characteristics	
Type designation:	SIMATIC RF360R
Type of equipment:	RFID Reader
Application ¹ :	Inductive Applications
Equipment class:	Equipment for fixed use
Kind of equipment	Transceiver
Operating Frequency:	13.56 MHz
Channel spacing:	Wideband
Number of RF channels:	1
Antenna:	Integrated Antenna
Type(s) of Modulation (e.g. BPSK, FSK, ASK, ...)	ASK
Temperature Range:	0 C to 55 C
Power supply:	DC supplied Nominal: 24 V Minimum: 18 V Maximum: 30 V Nominal frequency: DC

1.5 Deviations from the Standard

None



1.6 EUT Modification 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

Table 3

1.7 Test Location

TÜV SÜD Product Service conducted the following tests at our Straubing Test Laboratory.

Test Name	Name of Engineer(s)
Configuration and Mode: 24V DC Powered – Continuous transmitting	
Field Strength of any Emission	Michael Ingerl
Frequency Tolerance Under Temperature Variations	Michael Ingerl
20 dB Bandwidth	Michael Ingerl
Restricted Band Edges	Michael Ingerl
AC Power Line Conducted Emissions	Michael Ingerl
Exposure of Humans to RF Fields and SAR exclusion threshold	Michael Ingerl

Table 4

Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany



2 Test Details

2.1 Field Strength of any Emission

2.1.1 Specification Reference

FCC 47 CFR Part 15C, ISED Canada RSS-210 and ISED Canada RSS-GEN, Clause 15.225 (a)(b)(c)(d), B.1 to B.9, 6.5 and 6.6.

2.1.2 Equipment Under Test and Modification State

SIMATIC RF360R, S/N: --- - Modification State 0

2.1.3 Date of Test

2020-03-09 and 2020-04-02

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.3, 6.4 and 6.5.

Measurements were made at a distance of 3 m. The limit lines shown on the plot were extrapolated from either 300 m or 30 m to the measurement distance of 3 m in accordance with ANSI C63.10 Clause 6.4.4.2.

2.1.5 Environmental Conditions

Ambient Temperature	21,0 °C
Relative Humidity	32,0 %

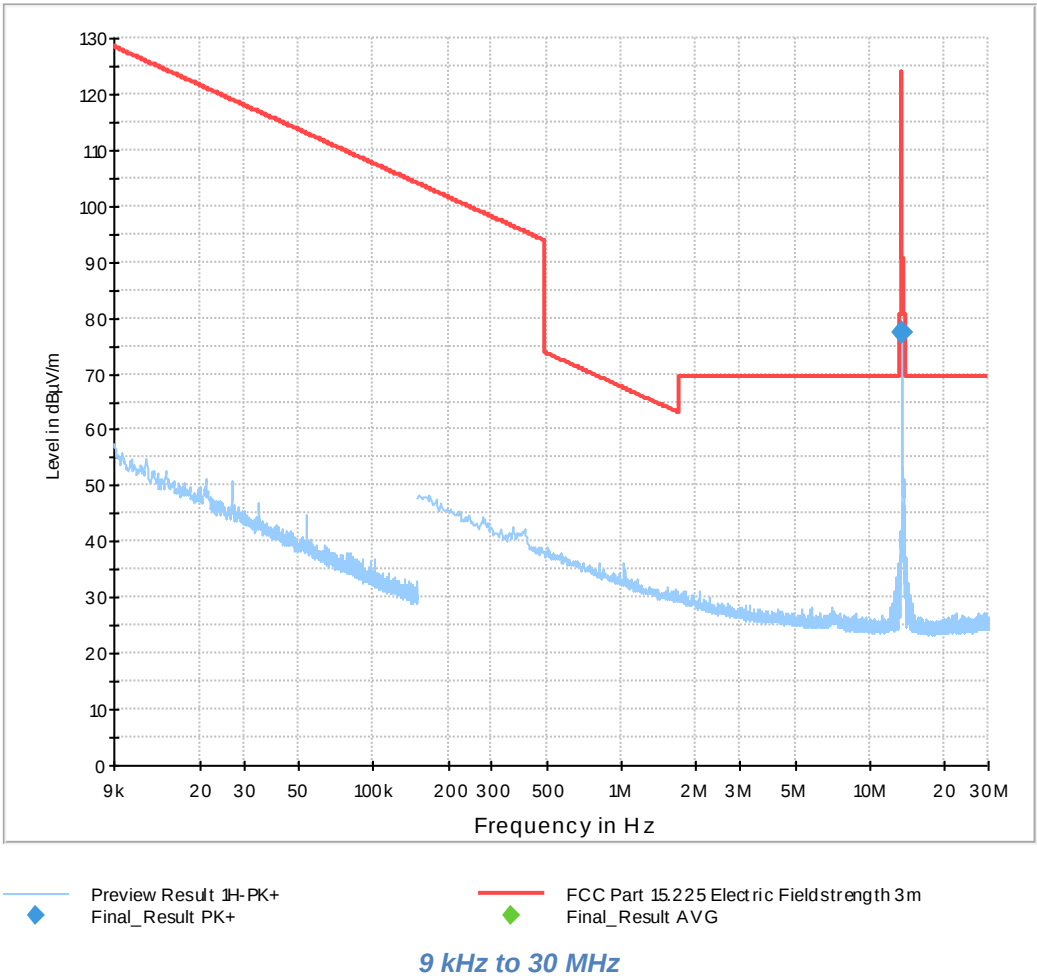
2.1.6 Test Results

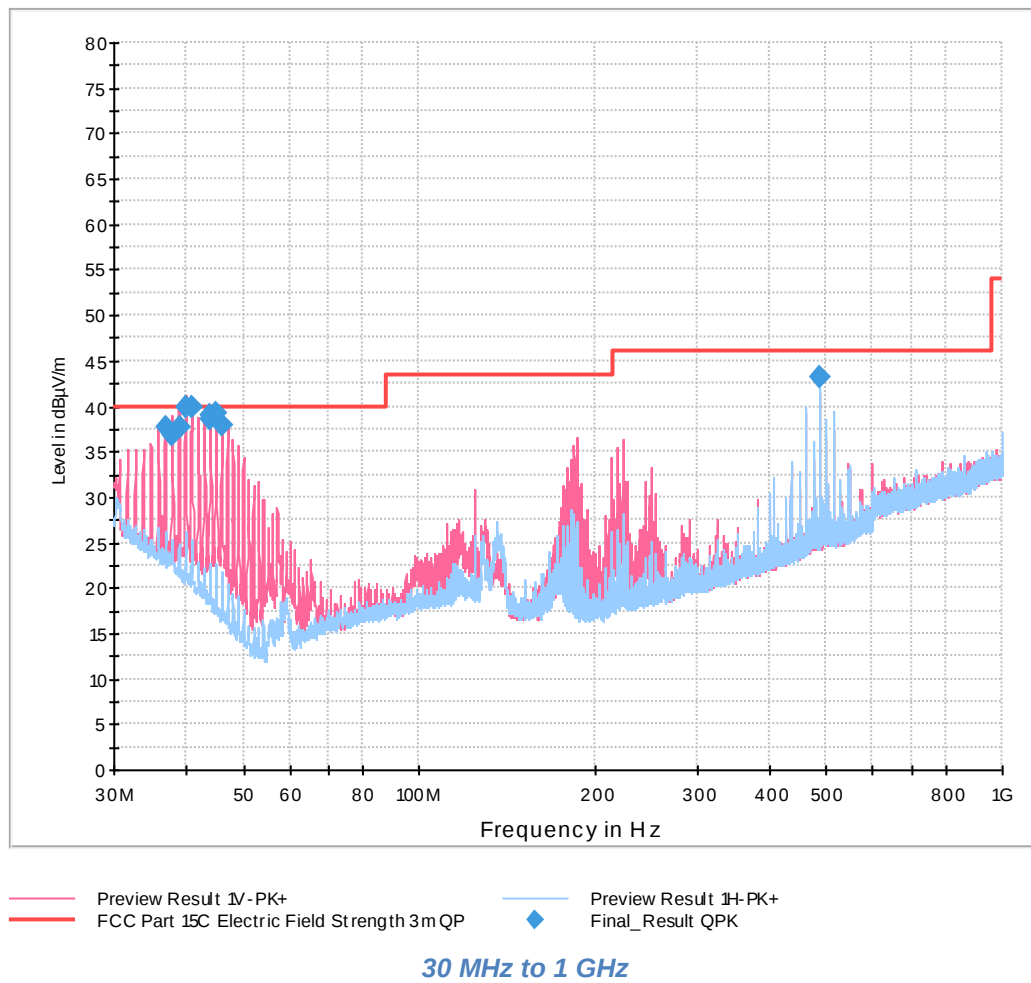
24V DC Powered – Continuous transmitting



1. Orthogonal axis

Frequency MHz	Quasi-Peak Level (dBµV/m) at 3 m	Quasi-Peak Level (dBµV/m) at 30 m
13.56	77.30	37.30





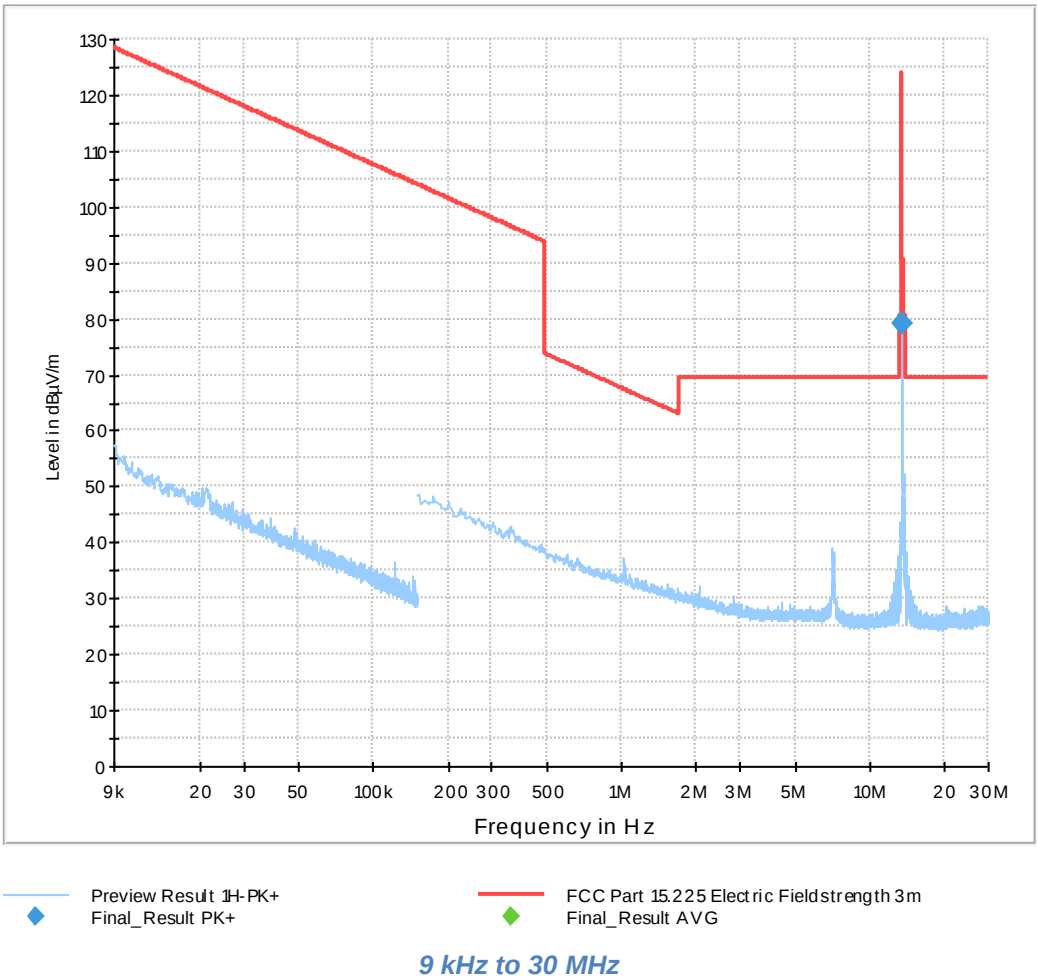
Final Results 1:

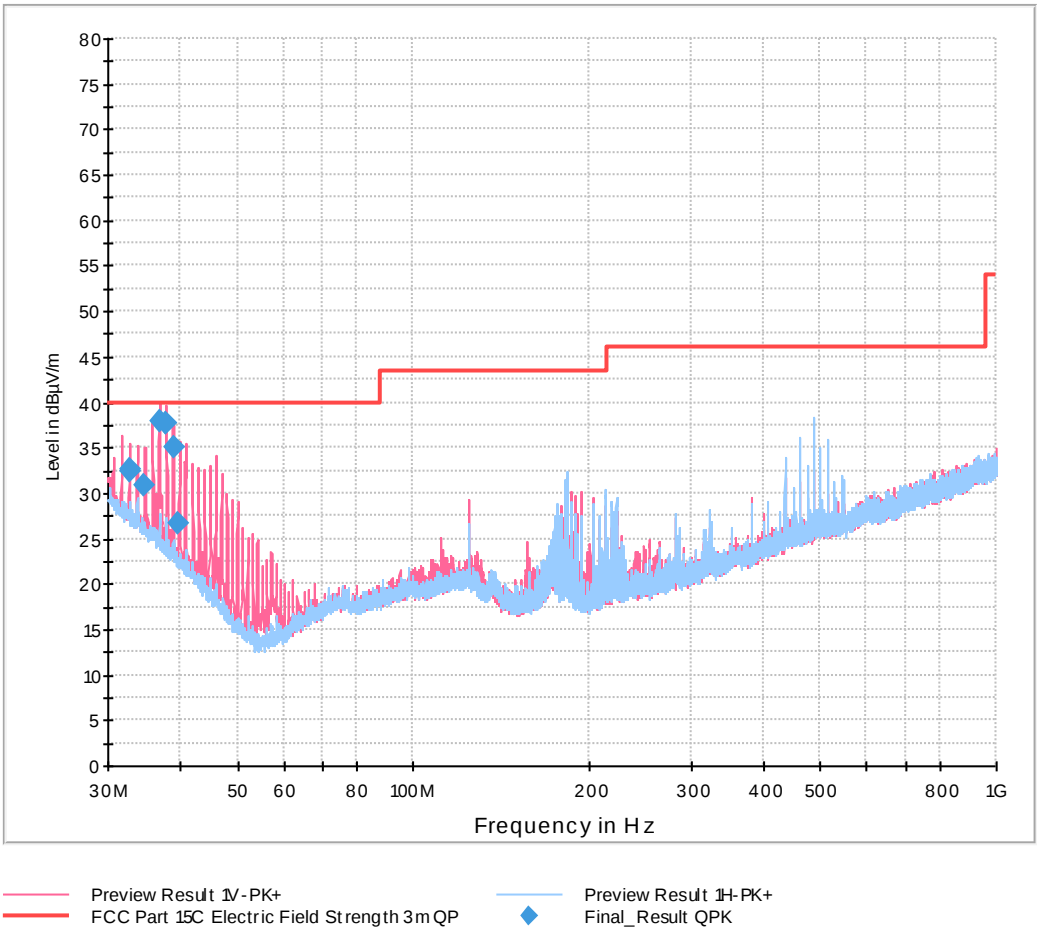
Frequency MHz	QuasiPeak dBµV/m	Limit dBµV/m	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB/m
36.750000	37.62	40.00	2.38	1000.0	120.000	100.0	V	-7.0	22.2
37.770000	36.91	40.00	3.09	1000.0	120.000	104.0	V	157.0	21.6
38.820000	37.73	40.00	2.27	1000.0	120.000	100.0	V	215.0	21.0
39.810000	39.80	40.00	0.20	1000.0	120.000	100.0	V	214.0	20.4
40.830000	39.89	40.00	0.11	1000.0	120.000	103.0	V	162.0	19.8
43.890000	38.46	40.00	1.54	1000.0	120.000	100.0	V	20.0	17.7
43.920000	38.92	40.00	1.08	1000.0	120.000	102.0	V	211.0	17.7
44.940000	39.27	40.00	0.73	1000.0	120.000	100.0	V	163.0	17.0
45.960000	37.96	40.00	2.04	1000.0	120.000	100.0	V	22.0	16.3
488.130000	43.11	46.02	2.91	1000.0	120.000	103.0	H	-91.0	23.6



2. Orthogonal axis

Frequency MHz	Quasi-Peak Level (dBµV/m) at 3 m	Quasi-Peak Level (dBµV/m) at 30 m
13.56	79.10	39.10





30 MHz to 1 GHz

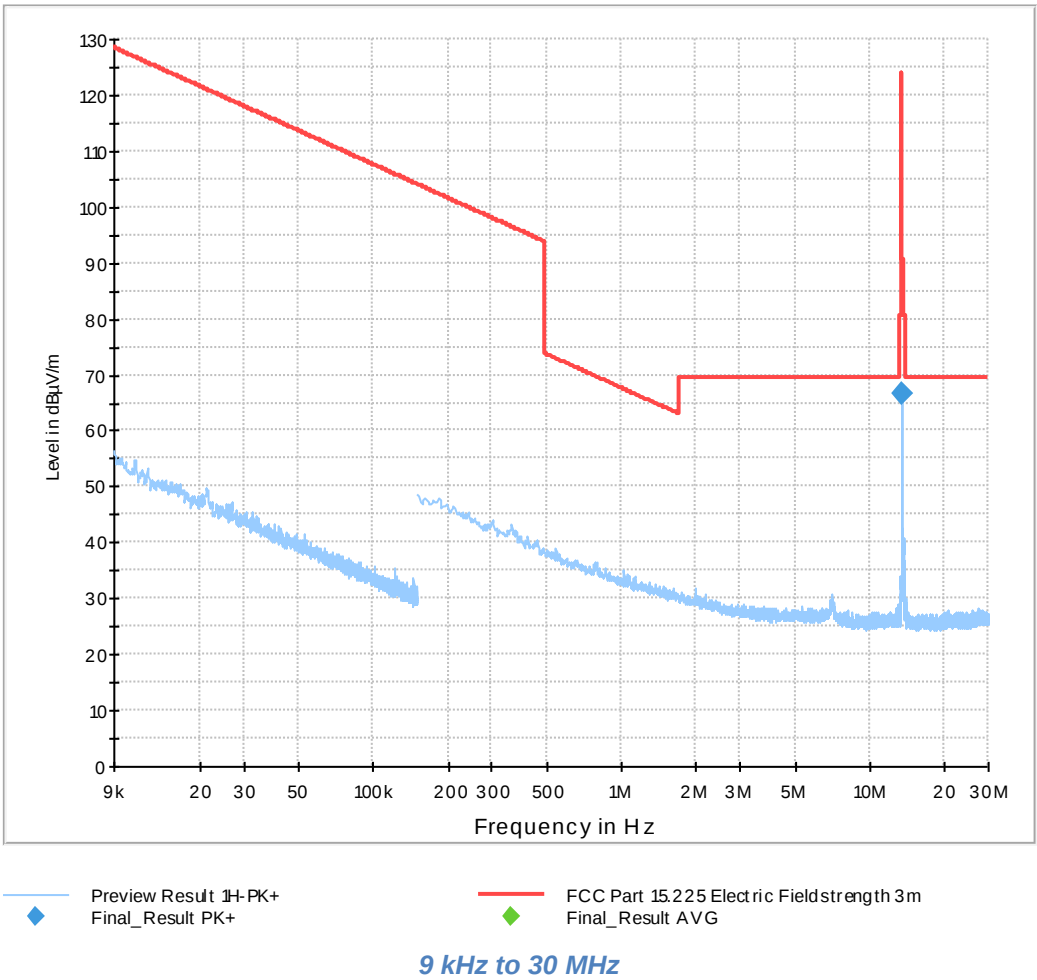
Final Results 1:

Frequency	QuasiPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
MHz	dBµV/m	dBµV/m	dB	ms	kHz	cm		deg	dB/m
32.670000	32.33	40.00	7.67	1000.0	120.000	111.0	V	-5.0	24.4
32.700000	32.57	40.00	7.43	1000.0	120.000	100.0	V	10.0	24.4
34.710000	30.81	40.00	9.19	1000.0	120.000	102.0	V	-28.0	23.3
36.780000	37.98	40.00	2.02	1000.0	120.000	100.0	V	-10.0	22.2
37.770000	37.68	40.00	2.32	1000.0	120.000	102.0	V	11.0	21.6
37.800000	37.63	40.00	2.37	1000.0	120.000	102.0	V	-73.0	21.6
38.820000	34.96	40.00	5.04	1000.0	120.000	100.0	V	-76.0	21.0
39.660000	26.56	40.00	13.44	1000.0	120.000	139.0	V	-124.0	20.5



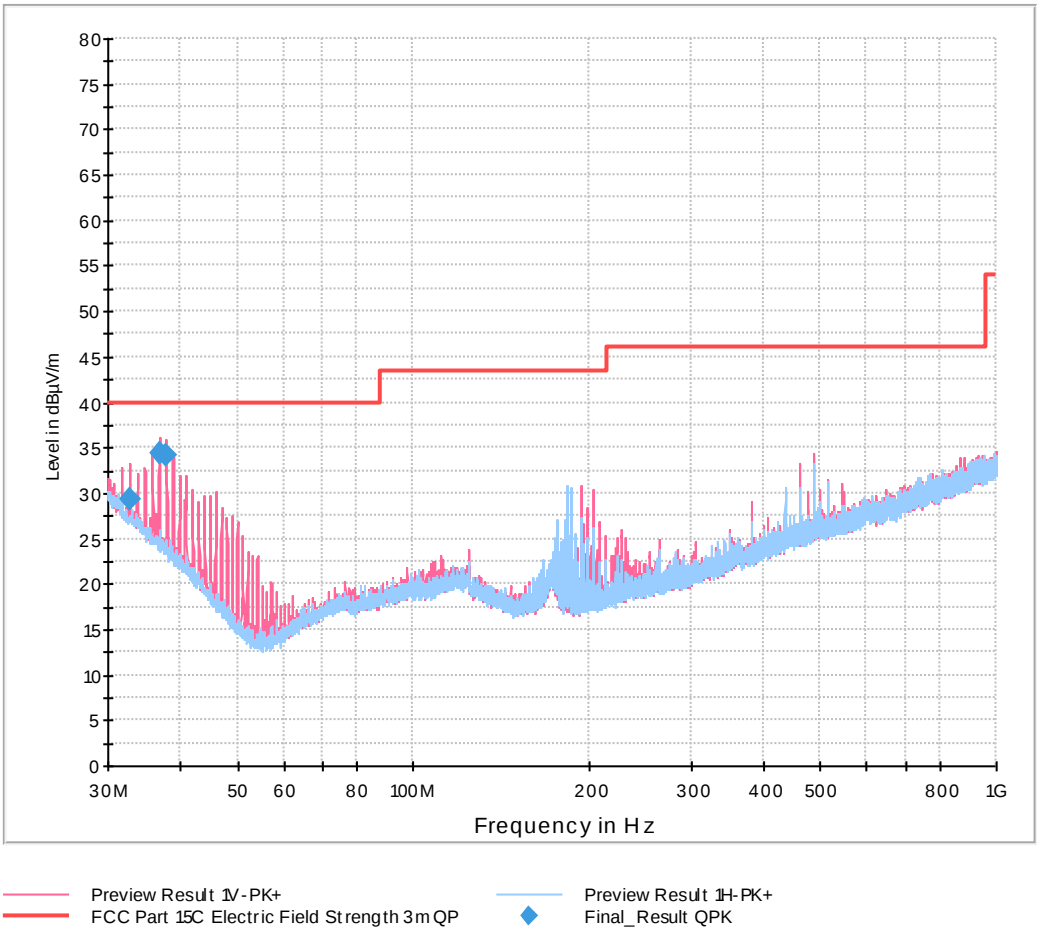
3. Orthogonal axis

Frequency MHz	Quasi-Peak Level (dBµV/m) at 3 m	Quasi-Peak Level (dBµV/m) at 30 m
13.56	66.65	26.70





Product Service



30 MHz to 1 GHz

Final Results 1:

Frequency MHz	QuasiPeak dBµV/m	Limit dBµV/m	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB/m
32.670000	29.37	40.00	10.63	1000.0	120.000	111.0	V	-47.0	24.4
36.780000	34.36	40.00	5.64	1000.0	120.000	100.0	V	14.0	22.2
37.800000	34.22	40.00	5.78	1000.0	120.000	100.0	V	-74.0	21.6



FCC 47 CFR Part 15, Limit Clause 15.225 (a)(b)(c)(d)

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 m.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 m.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 m.

(d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)
0.009 to 0.490	2400/F (kHz)	300
0.490 to 1.705	24000/F (kHz)	30
1705 to 30	30	30
30 to 88	100**	3
88 to 216	150**	3
216 to 960	200**	3
Above 960	500	5

Table 5 - FCC Radiated Emission Limit



ISED Canada RSS-210, Limit Clause B.6

The field strength of any emission shall not exceed the following limits:

- (a) 15.848 mW/m (84 dBμV/m) at 30 m, within the band 13.553 – 13.567 MHz.
- (b) 334 μV/m (50.5 dBμV/m) at 30 m, within the bands 13.410 – 13.553 MHz and 13.567 – 13.710 MHz.
- (c) 106 μV/m (40.5 dBμV/m) at 30 m, within the bands 13.110 – 13.410 MHz and 13.710 – 14.010 MHz.
- (d) RSS-GEN general field strength limits for frequencies outside the band 13.110 – 14.010 MHz.

ISED Canada RSS-GEN, Limit Clause

Frequency	Electric Field Strength (μV/m)	Magnetic Field Strength (H-Field) (μA/m)	Measurement Distance (m)
9 - 490 kHz	2,400/F (F in kHz)	2,400/377F (F in kHz)	300
490 - 1,705 kHz	24,000/F (F in kHz)	24,000/377F (F in kHz)	30
1,705 kHz - 30 MHz	30	N/A	30

Table 6 - ISED Canada Radiated Emission Limit - Less than 30 MHz

Frequency (MHz)	Field Strength (μV/m at 3 m)
30 - 88	100
88 - 216	150
216 - 960	200
> 960	500

Table 7 - ISED Canada Radiated Emission Limit - 30 MHz to 1 GHz

2.1.7 Test Location and Test Equipment Used

This test was carried out in a Semi anechoic room - cabin no. 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde&Schwarz	ESW44	39897	12	2021-03-31
ULTRALOG antenna	Rohde&Schwarz	HL562E	39969	36	2022-11-30
Loop antenna	Schwarzbeck	FMZB 1519B	44334	36	2023-01-31
EMC measurement software	Rohde&Schwarz	EMC32 V10.50.10	42986	N/A	N/A

Table 8

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable



2.2 Frequency Tolerance Under Temperature Variations

2.2.1 Specification Reference

FCC 47 CFR Part 15C, ISED Canada RSS-210 and ISED Canada RSS-GEN, Clause 15.225 (e), B.1 to B.9 and 6.11.

2.2.2 Equipment Under Test and Modification State

SIMATIC RF360R, S/N: --- - Modification State 0

2.2.3 Date of Test

2020-03-11 – 2020-03-12

2.2.4 Test Method

2.2.5 Environmental Conditions

Ambient Temperature 23,0 °C
Relative Humidity 31,0 %

2.2.6 Test Results

24V DC Powered – Continuous transmitting

Temperature	Voltage	Measured Frequency (MHz)	Frequency Deviation (%)	Frequency Error (ppm)
-20.0 °C	24.0V	13.559571	0.003266	32.661
-10.0 °C	24.0V	13.559662	0.003934	39.335
0.0 °C	24.0V	13.559198	0.000518	5.181
+10.0 °C	24.0V	13.559172	0.000325	3.249
+20.0 °C	24.0V	13.559128	0.000000	0.000
+30.0 °C	24.0V	13.559426	0.002198	21.982
+40.0 °C	24.0V	13.559450	0.002371	23.715
+50.0 °C	24.0V	13.559486	0.002641	26.412

Table 9 - Frequency Tolerance Under Temperature Variation

Temperature	Voltage	Measured Frequency (MHz)	Frequency Deviation (%)	Frequency Error (ppm)
+20.0 °C	20.4V	13.559493	0.002690	26.896
+20.0 °C	24.0V	13.559128	0.000000	0.000
+20.0 °C	27.6V	13.559441	0.002309	23.093

Table 10 - Frequency Tolerance Under Voltage Variation



FCC 47 CFR Part 15, Limit Clause 15.225 (e)

The frequency tolerance of the carrier signal shall be maintained within ± 0.01 % of the operating frequency.

ISED Canada RSS-210, Limit Clause B.6

Carrier frequency stability shall be maintained to $\pm 0.01\%$ (± 100 ppm)

2.2.7 Test Location and Test Equipment Used

This test was carried out in Non shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSV40	20219	12	2021-01-31
Climatic test chamber	Feutron Klimasimulation	KPK200-2	19868	18	2021-08-31

Table 11

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



2.3 20 dB Bandwidth

2.3.1 Specification Reference

FCC 47 CFR Part 15C, ISED Canada RSS-210 and ISED Canada RSS-GEN, Clause 15.215 (c), N/A and 6.7

2.3.2 Equipment Under Test and Modification State

SIMATIC RF360R, S/N: --- - Modification State 0

2.3.3 Date of Test

2020-03-11

2.3.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.9.1.

2.3.5 Environmental Conditions

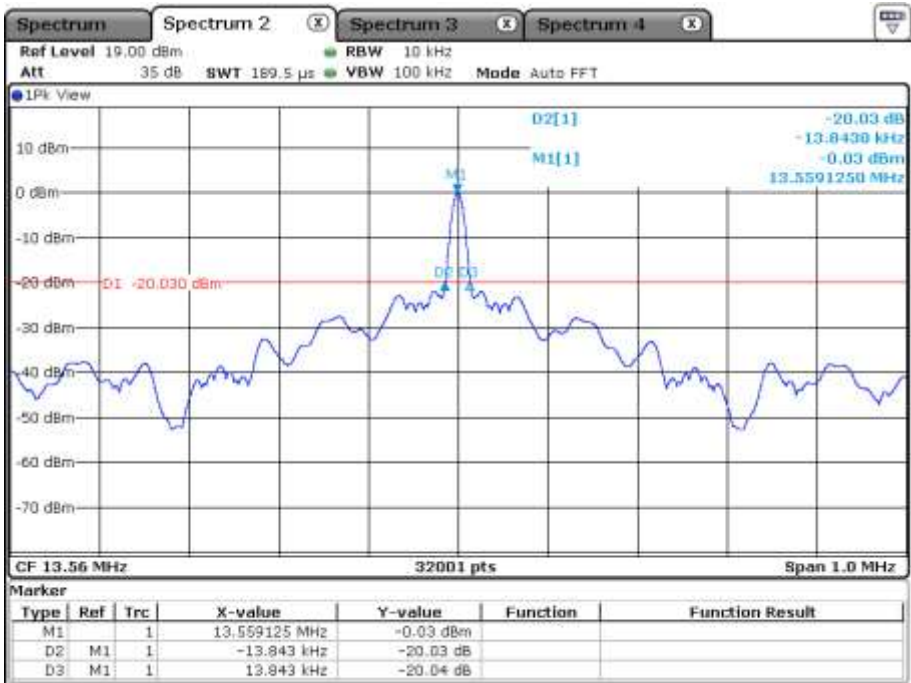
Ambient Temperature 23,0 °C
Relative Humidity 31,0 %

2.3.6 Test Results

24V DC Powered – Continuous transmitting

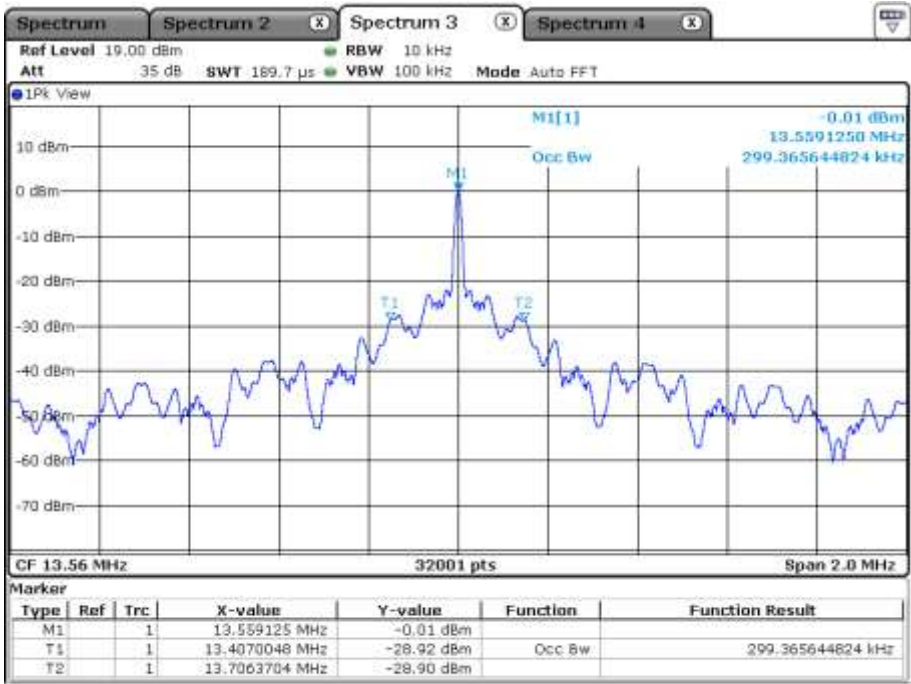
Frequency (MHz)	20 dB Bandwidth (Hz)	99% Occupied Bandwidth (Hz)	F _{LOWER} (MHz)	F _{UPPER} (MHz)
13.56	27686	299366	13.545282	13.572968

Table 12



Date: 11 MAR 2020 14:57:08

Figure 1 - 20 dB Bandwidth



Date: 11 MAR 2020 14:58:22

Figure 2 - 99% Occupied Bandwidth



FCC 47 CFR Part 15, Limit Clause 15.215 (c)

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.

ISED Canada RSS 210 and ISED Canada RSS GEN, Limit Clause

None specified.

2.3.7 Test Location and Test Equipment Used

This test was carried out in Non shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSV40	20219	12	2021-01-31
Climatic test chamber	Feutron Klimasimulation	KPK200-2	19868	18	2021-08-31

Table 13

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



2.4 Restricted Band Edges

2.4.1 Specification Reference

FCC 47 CFR Part 15C, ISED Canada RSS-210 and ISED Canada RSS-GEN, Clause 15.205, 7.1 and 8.10

2.4.2 Equipment Under Test and Modification State

SIMATIC RF360R, S/N: --- - Modification State 0

2.4.3 Date of Test

2020-03-09 and 2020-04-02

2.4.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.13.1.

Plots for average measurements were taken in accordance with ANSI C63.10 clause 4.1.4.2.3.

Final average measurements were taken in accordance with ANSI C63.10 clause 4.1.4.2.2.

2.4.5 Environmental Conditions

Ambient Temperature	21,0 °C
Relative Humidity	32,0 %

2.4.6 Test Results

No restricted band in the range



FCC 47 CFR Part 15, Limit Clause 15.205

	Peak (dBμV/m)	Average (dBμV/m)
Restricted Bands of Operation	74	54

Table 14

ISED Canada RSS-GEN, Limit Clause 8.9

Frequency (MHz)	Field Strength (μV/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960*	500

Table 15

*Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

2.4.7 Test Location and Test Equipment Used

This test was carried out in a Semi anechoic room - cabin no. 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde&Schwarz	ESW44	39897	12	2021-03-31
ULTRALOG antenna	Rohde&Schwarz	HL562E	39969	36	2022-11-30
Loop antenna	Schwarzbeck	FMZB 1519B	44334	36	2023-01-31
EMC measurement software	Rohde&Schwarz	EMC32 V10.50.10	42986	N/A	N/A

Table 16

TU - Traceability Unscheduled
 O/P Mon – Output Monitored using calibrated equipment
 N/A - Not Applicable



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2.5 AC Power Line Conducted Emissions

2.5.1 Specification Reference

FCC 47 CFR Part 15C, ISED Canada RSS-210 and ISED Canada RSS-GEN, Clause 15.207, N/A and 8.8

2.5.2 Equipment Under Test and Modification State

SIMATIC RF360R, S/N: --- - Modification State 0

2.5.3 Date of Test

2020-04-20

2.5.4 Test Method

2.5.5 Environmental Conditions

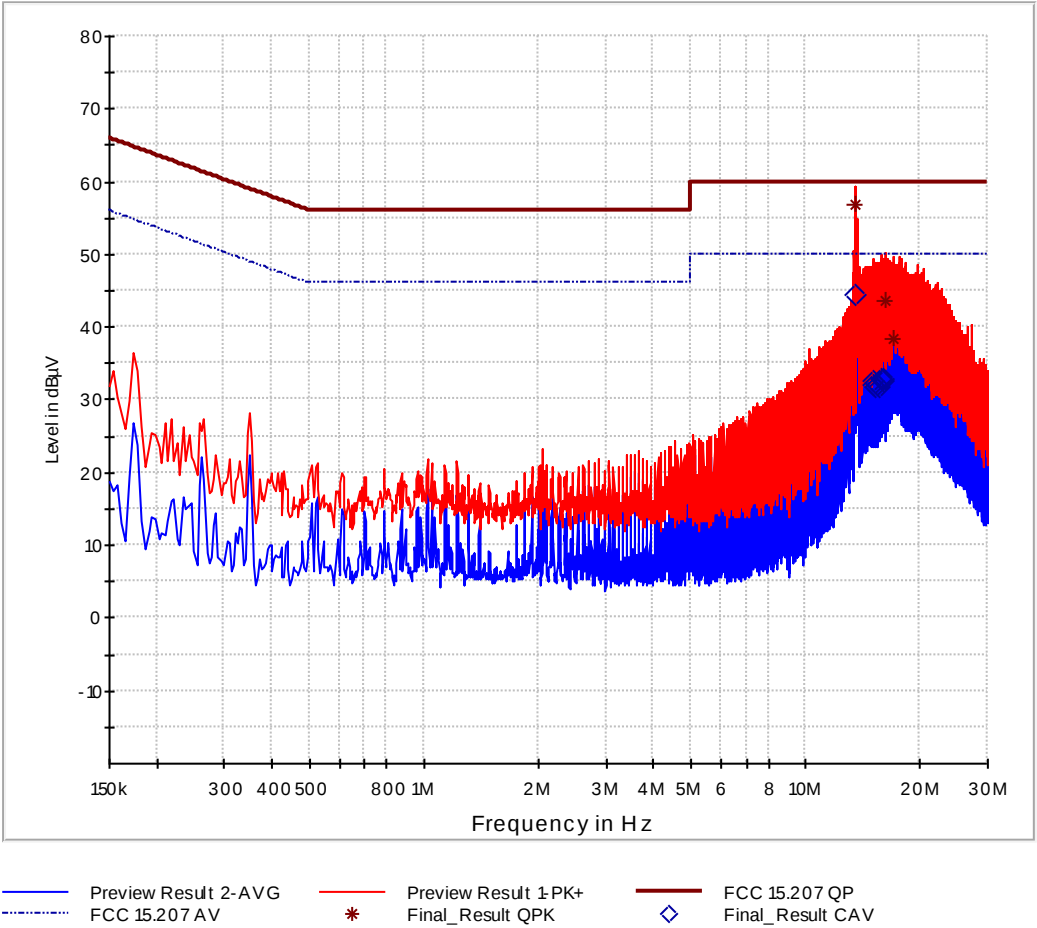
Ambient Temperature	23,0 °C
Relative Humidity	30,0 %

2.5.6 Test Results

24V DC Powered – Continuous transmitting



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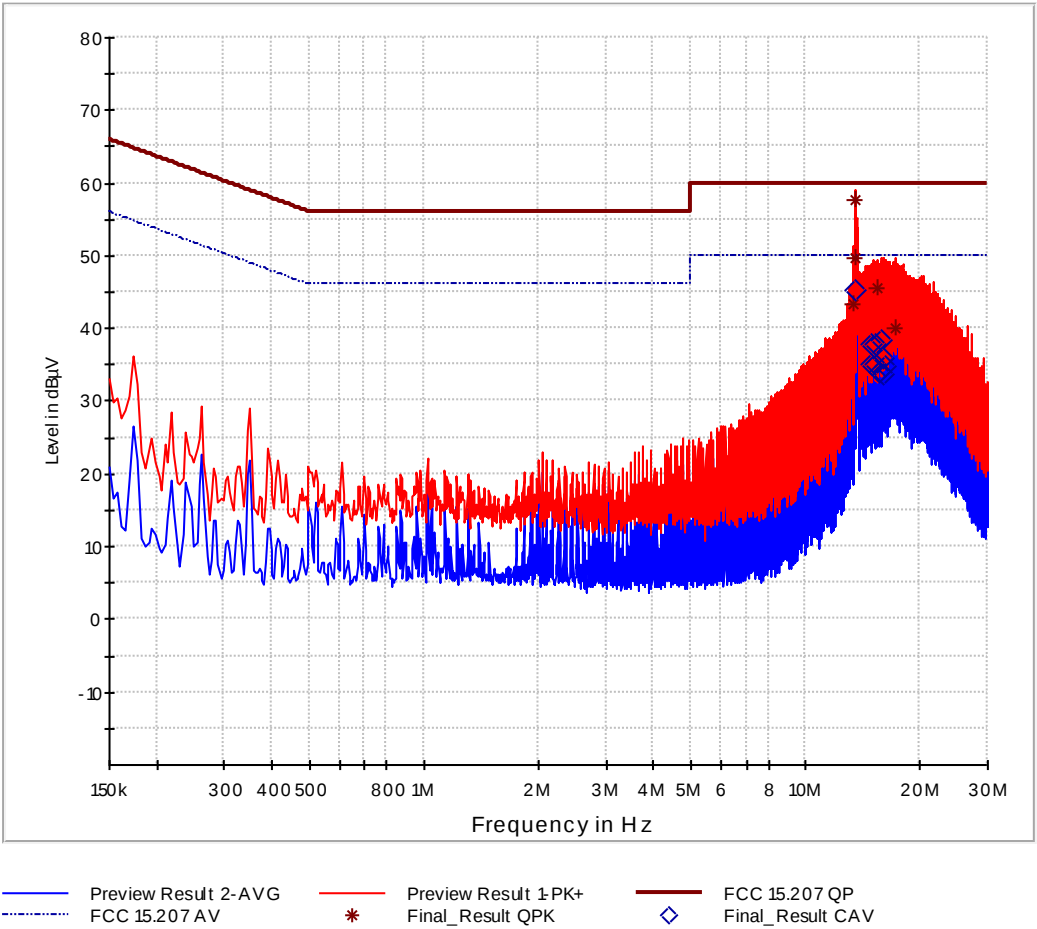
Final Results 1:

Frequency	QuasiPeak	CAverage	Limit	Margin	Meas. Time	Bandwidth	Line	Corr.
MHz	dBµV	dBµV	dBµV	dB	ms	kHz		dB
13.558000	---	44.54	50.00	5.46	1000.0	9.000	L1	10.2
13.558000	56.97	---	60.00	3.03	1000.0	9.000	L1	10.2
15.010000	---	32.74	50.00	17.26	1000.0	9.000	L1	10.2
15.098000	---	32.12	50.00	17.88	1000.0	9.000	L1	10.2
15.186000	---	31.80	50.00	18.20	1000.0	9.000	L1	10.2
15.622000	---	31.90	50.00	18.10	1000.0	9.000	L1	10.3
15.882000	---	32.93	50.00	17.07	1000.0	9.000	L1	10.3
15.970000	---	32.93	50.00	17.07	1000.0	9.000	L1	10.3
16.058000	---	32.56	50.00	17.44	1000.0	9.000	L1	10.3
16.230000	43.69	---	60.00	16.31	1000.0	9.000	L1	10.3
17.018000	38.36	---	60.00	21.64	1000.0	9.000	L1	10.3

Line L1 - 150 kHz to 30 MHz



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Final Results 1:

Frequency MHz	QuasiPeak dBµV	CAverage dBµV	Limit dBµV	Margin dB	Meas. Time ms	Bandwidth kHz	Line	Corr. dB
13.414000	43.34	---	60.00	16.66	1000.0	9.000	N	10.2
13.498000	49.71	---	60.00	10.29	1000.0	9.000	N	10.2
13.558000	---	45.38	50.00	4.62	1000.0	9.000	N	10.2
13.558000	57.82	---	60.00	2.18	1000.0	9.000	N	10.2
14.806000	---	37.82	50.00	12.18	1000.0	9.000	N	10.2
14.894000	---	35.21	50.00	14.79	1000.0	9.000	N	10.2
15.154000	---	37.88	50.00	12.12	1000.0	9.000	N	10.2
15.242000	---	35.05	50.00	14.95	1000.0	9.000	N	10.2
15.414000	45.68	---	60.00	14.32	1000.0	9.000	N	10.2
15.678000	---	33.86	50.00	16.14	1000.0	9.000	N	10.3
15.850000	---	38.42	50.00	11.58	1000.0	9.000	N	10.3
15.938000	---	36.01	50.00	13.99	1000.0	9.000	N	10.3
16.026000	---	33.74	50.00	16.26	1000.0	9.000	N	10.3
16.286000	---	34.88	50.00	15.12	1000.0	9.000	N	10.3
17.246000	40.08	---	60.00	19.92	1000.0	9.000	N	10.3

Line N - 150 kHz to 30 MHz



FCC 47 CFR Part 15, Limit Clause 15.207 and ISED Canada RSS-GEN, Limit Clause 8.8

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

Table 17

*Decreases with the logarithm of the frequency.

2.5.7 Test Location and Test Equipment Used

This test was carried out in Shielded room - cabin no. 4.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESCI3	19730	18	2020-11-30
V-network	Rohde & Schwarz	ENV216	39908	12	2021-03-31
EMC measurement software	Rohde & Schwarz	EMC32 V10.60.00	44377	N/A	N/A

Table 18

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable



Product Service

2.6 Exposure of Humans to RF Fields and SAR exclusion threshold

2.6.1 Specification Reference

ISED Canada RSS-102 Issue 5, section 2.5
KDB 447498 D01 V06, section 4.3.1 c)

2.6.2 Equipment Under Test and Modification State

SIMATIC RF360R, S/N: --- - Modification State 0

2.6.3 Date of Test

2020-03-09 and 2020-04-02

2.6.4 Test Results

24V DC Powered – Continuous transmitting



Exposure of Humans to RF Fields	Applicable	Declared by applicant	Measured	Exemption
The antenna is				
☐ detachable				
The conducted output power (CP in watts) is measured at the antenna connector: $CP = \dots\dots\dots \text{ W}$ The effective isotropic radiated power (EIRP in watts) is calculated using ☐ the numerical antenna gain: $G = \dots\dots\dots$ $EIRP = G \cdot CP \Rightarrow EIRP = \dots\dots\dots \text{ W}$ ☐ the field strength² in V/m: $FS = \dots\dots\dots \text{ V/m}$ $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP = \dots\dots\dots \text{ W}$ with: Distance between the antennas in m: $D = \dots\dots\dots \text{ m}$			☐	
☒ not detachable				
A field strength measurement is used to determine the effective isotropic radiated power (EIRP in watts) given by: (Field strength from chapter 2.1) $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP = 14.87 \text{ } \mu\text{W}$ with: Field strength in V/m: $FS = 0.007$ Distance between the two antennas in m: $D = 3$			☒	☒
Selection of output power				
The output power TP is the higher of the conducted or effective isotropic radiated power (e.i.r.p.): $TP = 14.87 \text{ } \mu\text{W}$				

² The conversion formula is valid only for properly matched antennas. In other cases the transmitter output power may have to be measured by a terminated measurement when applying the exemption clauses. If an open area test site is used for field strength measurement, the effect due to the metal ground reflecting plane should be subtracted from the maximum field strength value in order to reference it to free space, before calculating TP.



Exposure of Humans to RF Fields (continued)	Applicable	Declared by applicant	Measured	Exemption
Separation distance between the user and the transmitting device is				
☒ less than or equal to 20 cm		☒		
☐ greater than 20 cm				
Transmitting device is				
☐ in the vicinity of the human head		☐		
☐ body-worn				



SAR evaluation														
SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in the table. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in the table, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required. For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.														
Frequency (MHz)	Exemption limits (mW) ³ at separation distance of													
	≤5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	≥50 mm				
≤300 ⁴	71	101	132	162	193	223	254	284	315	345				
450	52	70	88	106	123	141	159	177	195	213				
835	17	30	42	55	67	80	92	105	117	130				
1900	7	10	18	34	60	99	153	225	316	431				
2450	4	7	15	30	52	83	123	173	235	309				
3500	2	6	16	32	55	86	124	170	225	290				
5800	1	6	15	27	41	56	71	85	97	106				
Carrier frequency: f = 13.56 MHz Distance: d = 5 mm Transmitter output power: TP = 14.87 μW Limit: TP_{limit} = 71 mW														☒
☐ SAR evaluation is documented in test report no. ...														

³ The exemption limit in the table are based on measurements and simulations on half-wave dipole antennas at separation distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from a linear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from a third order polynomial fit.

⁴ Transmitters operating between 3 kHz and 10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in ISED CANADA RSS-102, issue 5, section 4.



SAR Exclusion threshold

Maximum Radiated Fields Strength: (see chapter 2.1.6 of this test report)	79.1 dBμV/m (at 3 m distance and 13.56 MHz)
Calculated Equivalent Radiated Power:	14.87 μW (e.i.r.p.) < 100 μW
Minimum separation distance:	5 mm (≤ 50 mm)
1-g numeric threshold:	$(100 \mu\text{W} / 5 \text{ mm}) \cdot \sqrt{(0.01356 \text{ GHz})} = 0.0023$
1-g numeric threshold limit:	0.25

Note 1: For test distances below 5 mm according to 4.3.1 c) the test distance is fixed to 5 mm.

$$EIRP = \frac{(FS \cdot D)^2}{30}$$

2.6.5 Test Location and Test Equipment Used

This test was carried out in a Semi anechoic room - cabin no. 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde&Schwarz	ESW44	39897	12	2021-03-31
ULTRALOG antenna	Rohde&Schwarz	HL562E	39969	36	2022-11-30
Loop antenna	Schwarzbeck	FMZB 1519B	44334	36	2023-01-31
EMC measurement software	Rohde&Schwarz	EMC32 V10.50.10	42986	N/A	N/A

Table 19

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2021-03-31
ULTRALOG antenna	Rohde & Schwarz	HL562E	39969	36	2022-11-30
Loop antenna	Schwarzbeck	FMZB 1519B	44334	36	2023-01-31
EMC measurement software	Rohde & Schwarz	EMC32 V10.50.10	42986	N/A	N/A
EMI test receiver	Rohde & Schwarz	ESCI3	19730	18	2020-11-30
V-network	Rohde & Schwarz	ENV216	39908	12	2021-03-31
EMC measurement software	Rohde & Schwarz	EMC32 V10.60.00	44377	N/A	N/A
Spectrum Analyzer	Rohde & Schwarz	FSV40	20219	12	2021-01-31
Climatic test chamber	Feutron Klimasimulation	KPK200-2	19868	18	2021-08-31

Table 20

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



4 Measurement Uncertainty

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

Radio Testing			
Test Name	kp	Expanded Uncertainty	Note
Occupied Bandwidth	2.0	$\pm 1.14 \%$	2
RF-Frequency error	1.96	$\pm 1 \cdot 10^{-7}$	7
RF-Power, conducted carrier	2	$\pm 0.079 \text{ dB}$	2
RF-Power uncertainty for given BER	1.96	$+0.94 \text{ dB} / -1.05$	7
RF power, conducted, spurious emissions	1.96	$+1.4 \text{ dB} / -1.6 \text{ dB}$	7
RF power, radiated			
25 MHz – 4 GHz	1.96	$+3.6 \text{ dB} / -5.2 \text{ dB}$	8
1 GHz – 18 GHz	1.96	$+3.8 \text{ dB} / -5.6 \text{ dB}$	8
18 GHz – 26.5 GHz	1.96	$+3.4 \text{ dB} / -4.5 \text{ dB}$	8
40 GHz – 170 GHz	1.96	$+4.2 \text{ dB} / -7.1 \text{ dB}$	8
Spectral Power Density, conducted	2.0	$\pm 0.53 \text{ dB}$	2
Maximum frequency deviation			
300 Hz – 6 kHz	2	$\pm 2.89 \%$	2
6 kHz – 25 kHz	2	$\pm 0.2 \text{ dB}$	2
Maximum frequency deviation for FM	2	$\pm 2.89 \%$	2
Adjacent channel power 25 MHz – 1 GHz	2	$\pm 2.31 \%$	2
Temperature	2	$\pm 0.39 \text{ K}$	4
(Relative) Humidity	2	$\pm 2.28 \%$	2
DC- and low frequency AC voltage			
DC voltage	2	$\pm 0.01 \%$	2
AC voltage up to 1 kHz	2	$\pm 1.2 \%$	2
Time	2	$\pm 0.6 \%$	2

Table 21



Radio Interference Emission Testing			
Test Name	kp	Expanded Uncertainty	Note
Conducted Voltage Emission			
9 kHz to 150 kHz (50Ω/50μH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50μH AMN)	2	± 3.4 dB	1
100 kHz to 200 MHz (50Ω/5μH AMN)	2	± 3.6 dB	1
Discontinuous Conducted Emission			
9 kHz to 150 kHz (50Ω/50μH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50μH AMN)	2	± 3.4 dB	1
Conducted Current Emission			
9 kHz to 200 MHz	2	± 3.5 dB	1
Magnetic Fieldstrength			
9 kHz to 30 MHz (with loop antenna)	2	± 3.9 dB	1
9 kHz to 30 MHz (large-loop antenna 2 m)	2	± 3.5 dB	1
Radiated Emission			
Test distance 1 m (ALSE)			
9 kHz to 150 kHz	2	± 4.6 dB	1
150 kHz to 30 MHz	2	± 4.1 dB	1
30 MHz to 200 MHz	2	± 5.2 dB	1
200 MHz to 2 GHz	2	± 4.4 dB	1
2 GHz to 3 GHz	2	± 4.6 dB	1
Test distance 3 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 5.0 dB	1
1 GHz to 6 GHz	2	± 4.6 dB	1
Test distance 10 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 4.9 dB	1
Radio Interference Power			
30 MHz to 300 MHz	2	± 3.5 dB	1
Harmonic Current Emissions			4
Voltage Changes, Voltage Fluctuations and Flicker			4

Table 22



Immunity Testing			
Test Name	kp	Expanded Uncertainty	Note
Electrostatic Discharges			4
Radiated RF-Field			
Pre-calibrated field level	2	+32.2 / -24.3 %	5
Dynamic feedback field level	2.05	+21.2 / -17.5 %	3
Electrical Fast Transients (EFT) / Bursts			4
Surges			4
Conducted Disturbances, induced by RF-Fields			
via CDN	2	+15.1 / -13.1 %	6
via EM clamp	2	+42.6 / -29.9 %	6
via current clamp	2	+43.9 / -30.5 %	6
Power Frequency Magnetic Field	2	+20.7 / -17.1 %	2
Pulse Magnetic Field			4
Voltage Dips, Short Interruptions and Voltage Variations			4
Oscillatory Waves			4
Conducted Low Frequency Disturbances			
Voltage setting	2	± 0.9 %	2
Frequency setting	2	± 0.1 %	2
Electrical Transient Transmission in Road Vehicles			4

Table 23



Note 1:

The expanded uncertainty reported according to CISPR 16-4-2:2003-11 is based on a standard uncertainty multiplied by a coverage factor of $k_p = 2$, providing a level of confidence of $p = 95.45\%$

Note 2:

The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of $k_p = 2$, providing a level of confidence of $p = 95.45\%$

Note 3:

The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of $k_p = 2.05$, providing a level of confidence of $p = 95.45\%$

Note 4:

It has been demonstrated that the used test equipment meets the specified requirements in the standard with at least a 95% confidence.

Note 5:

The expanded uncertainty reported according to IEC 61000-4-3 is based on a standard uncertainty multiplied by a coverage factor of $k_p = 2$, providing a level of confidence of $p = 95.45\%$

Note 6:

The expanded uncertainty reported according to IEC 61000-4-6 is based on a standard uncertainty multiplied by a coverage factor of $k_p = 2$, providing a level of confidence of $p = 95.45\%$

Note 7:

The expanded uncertainty reported according to ETSI TR 100 028 V1.4.1 (all parts) is based on a standard uncertainty multiplied by a coverage factor of $k_p = 1.96$, providing a level of confidence of $p = 95.45\%$

Note 8:

The expanded uncertainty reported according to ETSI TR 102 273 V1.2.1 (all parts) is based on a standard uncertainty multiplied by a coverage factor of $k_p = 1.96$, providing a level of confidence of $p = 95.45\%$