

Report on the FCC Testing of the Siemens AG

Model: SIMATIC RTLS4060T

In accordance with FCC 47 CFR Part 15F

Prepared for: Siemens AG
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Germany

FCC ID: NXW4060T



COMMERCIAL-IN-CONFIDENCE

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Project Management	Martin Steindl	2020-05-14	 SIGN-ID 357648
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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. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Martin Steindl	2020-05-14	 SIGN-ID 357649

Laboratory Accreditation

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

Laboratory recognition

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

ISED test site registration

3050A-2

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15F

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External photos 4 pages



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	2019-10-23
2	Removed redundant ISED references. Corrected typo on page 4 Removed Siemens article number from model designation Corrected RF Exposure exemption for 6.5 GHz frequency	2020-03-05
3	Added test protocol "Cease of Transmission"	2020-05-14

Table 1

1.2 Introduction

Applicant	Siemens AG
Manufacturer	Siemens AG
Model Number	SIMATIC RTLS4060T
Siemens Article Number:	6GT2700-6DE13
Serial Number(s)	---
Hardware Version(s)	0613
Software Version(s)	2.1.4
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15E.
Test Plan/Issue/Date	---
Order Number	5121883
Date	2018-07-30
Date of Receipt of EUT	2018-11-19
Start of Test	2019-01-07
Finish of Test	2019-09-09
Name of Engineer(s)	Michael Ingerl, Martin Steindl
Related Document(s)	ANSI C63.10 (2013)



1.3 Technical data of EUT

Connection of antenna: ☐ Detachable ☒ Not detachable
Type of power supply: ☐ AC ☒ DC
Nominal Voltage: 24V
Minimum Voltage: 8V
Maximum Voltage: 30V

1.4 Configuration Mode(s)

1. Configuration Mode-1

Transmitting continuously on selected Channel



1.5 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C and 15E is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: Configuration Mode-1				
2.1	47 CFR, § 15.207	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2013)
2.2	47 CFR § 15.503(d)	Emission Bandwidth	Pass	ANSI C63.10 (2013)
2.3	47 CFR § 15.519(e) and § 15.521	Peak Power	Pass	ANSI C63.10 (2013)
2.4	47 CFR § 15.519(c) and (d)	Radiated Emissions	Pass	ANSI C63.10 (2013)
2.5	47 CFR § 15.519(a)(1)	Cease of Transmission	Pass	ANSI C63.10 (2013)
2.6	KDB 447498 D01 V06, section 4.3 a)	RF Exposure	Pass	ANSI C63.10 (2013)

Table 2



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
Serial Number: ---			
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: Configuration Mode-1	
AC Power Line Conducted Emissions	Michael Ingerl
Emission Bandwidth	Martin Steindl
Peak Power	Martin Steindl
Radiated Emissions	Martin Steindl
Cease of Transmission	Martin Steindl
RF Exposure	Martin Steindl

Table 4

Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany

2 Test Details

2.1 AC Power Line Conducted Emissions

2.1.1 Specification Reference

FCC 47 CFR Part 15C. Clause 15.207

2.1.2 Equipment Under Test and Modification State

SIMATIC RTLS4060T. S/N: --- - Modification State 0

2.1.3 Date of Test

2019-01-07

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10. clause 6.2.

Conducted emission tests in the frequency range 150 kHz to 30 MHz are performed using Line Impedance Stabilization Networks (LISNs). To simplify testing with quasi-peak and average detector the following procedure is used:

First the whole spectrum of emission caused by the equipment under test (EUT) is recorded with detector set to peak using CISPR bandwidth of 10 kHz. After that all emission levels having less margin than 10 dB to or exceeding the average limit are retested with detector set to quasi-peak. If average limit is kept with quasi-peak levels no additional scan with average detector is necessary. In cases of emission levels between quasi-peak and average limit an additional scan with detector set to average is performed.

According to ANSI C63.4. section 13.1.3.1. testing of intentional radiators with detachable antenna shall be performed using a suitable dummy load connected to the antenna output terminals. Otherwise, the tests shall be made with the antenna connected and, if adjustable, fully extended. Testing with dummy load may be necessary to distinguish (unintentional) conducted emissions on the supply lines from (intentional) emissions radiated by the antenna and coupling directly to supply lines and/or LISN. Usage of dummy load has to be stated in the appropriate test record(s) and notes should be added to clarify the test setup.

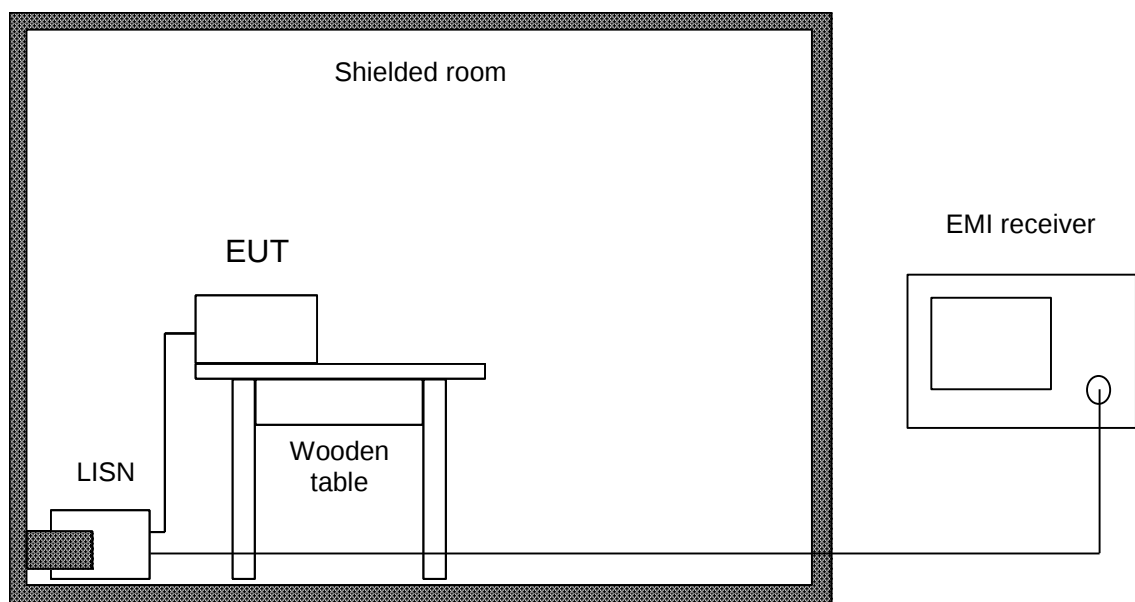


Figure 1 – Test setup for AC mains conducted emissions



2.1.5 Environmental Conditions

Ambient Temperature 21 °C
 Relative Humidity 30 %

2.1.6 Test Results

Configuration Mode-1

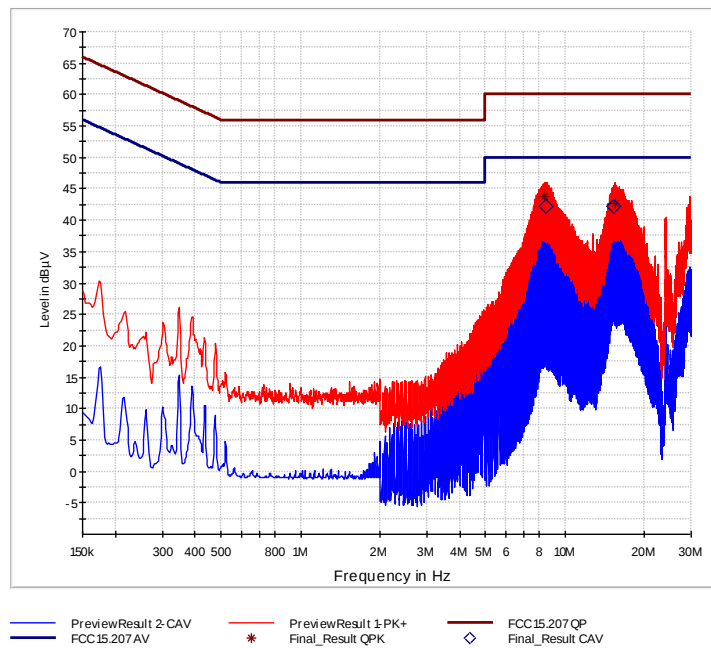


Figure 2 - Live Line - 150 kHz to 30 MHz

Frequency MHz	QuasiPeak dBμV	CAverage dBμV	Limit dBμV	Margin dB	Meas. Time ms	Bandwidth kHz	Line	PE	Corr. dB
8.344500	43.82	---	60.00	16.18	1000.0	9.000	L1	GND	0.0
8.517750	---	42.16	50.00	7.84	1000.0	9.000	L1	GND	0.0
15.252000	---	42.17	50.00	7.83	1000.0	9.000	L1	GND	0.4
15.560250	42.69	---	60.00	17.31	1000.0	9.000	L1	GND	0.4



Product Service

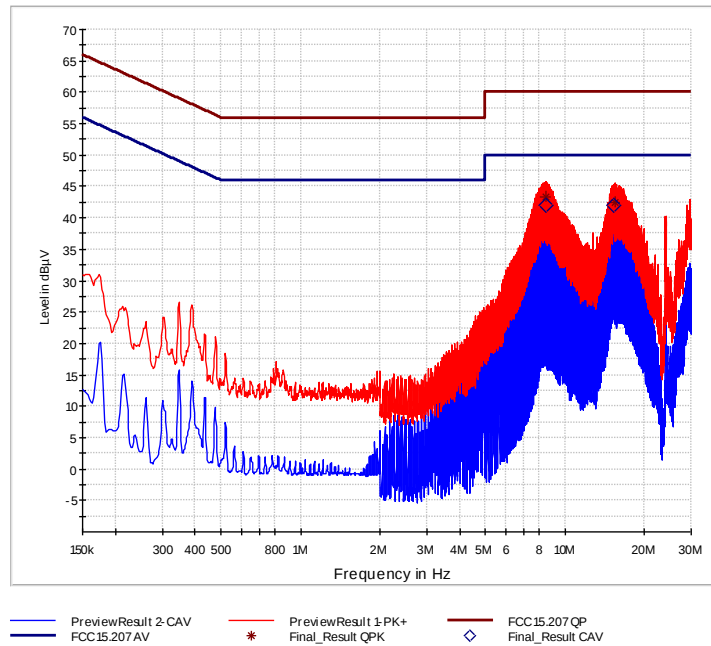


Figure 3 - Neutral Line - 150 kHz to 30 MHz

Frequency MHz	QuasiPeak dBµV	CAverage dBµV	Limit dBµV	Margin dB	Meas. Time ms	Bandwidth kHz	Line	PE	Corr. dB
8.432250	43.42	---	60.00	16.58	1000.0	9.000	N	GND	0.0
8.517750	---	41.97	50.00	8.03	1000.0	9.000	N	GND	0.0
15.252000	---	42.11	50.00	7.89	1000.0	9.000	N	GND	0.4
15.470250	42.48	---	60.00	17.52	1000.0	9.000	N	GND	0.4

Sample calculation of final values:

Final Value (dBµV) = Reading Value (dBµV) + Correction Factor (dB)



FCC 47 CFR Part 15. Limit Clause 15.207

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 5

*Decreases with the logarithm of the frequency.

2.1.7 Test Location and Test Equipment Used

This test was carried out in Shielded room - cabin no. 9.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESU8	19904	12	2019-12-31
V-network	Rohde & Schwarz	ESH 3-Z5	18919	36	2019-10-31
EMC Measurement Software	Rohde&Schwarz	EMC32 V9.26.01	20090	N/A	N/A

Table 6

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



Product Service

2.2 Emission Bandwidth

2.2.1 Specification Reference

FCC 47 CFR Part 15F. Clause §15.503(d)

2.2.2 Equipment Under Test and Modification State

SIMATIC RTLS4060T. S/N: --- - Modification State 0

2.2.3 Date of Test

2019-09-09

2.2.4 Test Method

This test was performed in accordance with ANSI C63.10. clause 10.1
The test was performed as radiated emission test.

2.2.5 Environmental Conditions

Ambient Temperature	23 °C
Relative Humidity	48 %



2.2.6 Test Results

UWB Channel	-10 dB bandwidth	-10 dB fractional bandwidth	-10 dB bandwidth limit	-10 dB fractional bandwidth limit
2	715.0 MHz	0.18	> 500 MHz	> 0.20
5	677.5 MHz	0.10	> 500 MHz	> 0.20

Fractional bandwidth not evaluated since bandwidth is greater than 500 MHz.

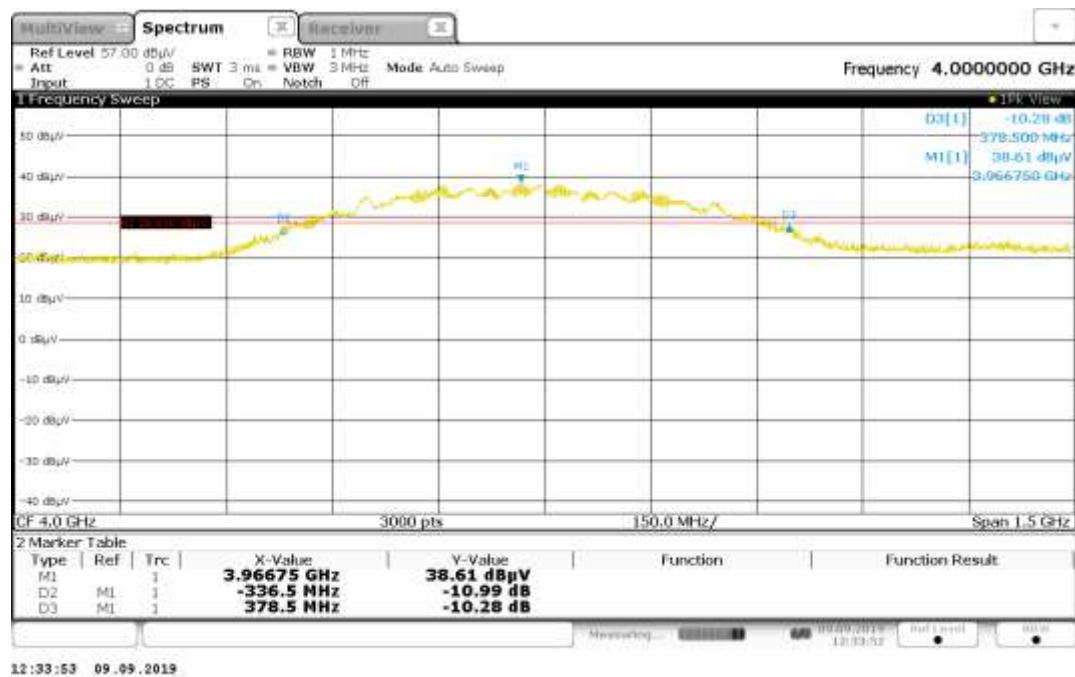


Figure 4 – -10 dB bandwidth, Channel 2



Figure 5 – -10 dB bandwidth, Channel 5



FCC 47 CFR Part 15. Limit Clause 15.503(d)

A *UBW device* is an intentional radiator that has either a *-10 dB bandwidth* ($f_H - f_L$) of at least 500 MHz or a *-10 dB fractional bandwidth* ($\frac{2(f_H - f_L)}{(f_H + f_L)}$) greater than 0.2

2.2.7 Test Location and Test Equipment Used

This test was carried out in shielded room No. 11

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2020-02
Double ridged horn antenna	Rohde & Schwarz	HF907	40089	24	2021-02
Semi anechoic room	Frankonia				
EMC Measurement Software	Rohde & Schwarz	EMC32 V10.50.10	19893	N/A	N/A

Table 7

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



2.3 Peak Power

2.3.1 Specification Reference

FCC 47 CFR Part 15E, Clauses § 15.519(e) and § 15.521

2.3.2 Equipment Under Test and Modification State

SIMATIC RTLS4060T. S/N: --- - Modification State 0

2.3.3 Date of Test

2019-09-09

2.3.4 Test Method

The test was performed in accordance with ANSI C63.10. clause 10.3.5
The test was performed according to description in section 18

2.3.5 Environmental Conditions

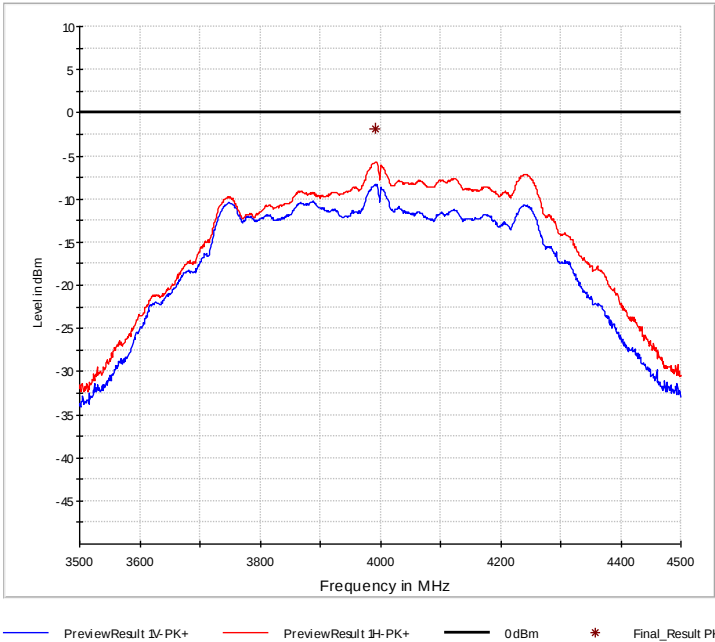
Ambient Temperature	23 °C
Relative Humidity	48 %



Product Service

2.3.6 Test Results

Radiated emissions for channel 2:

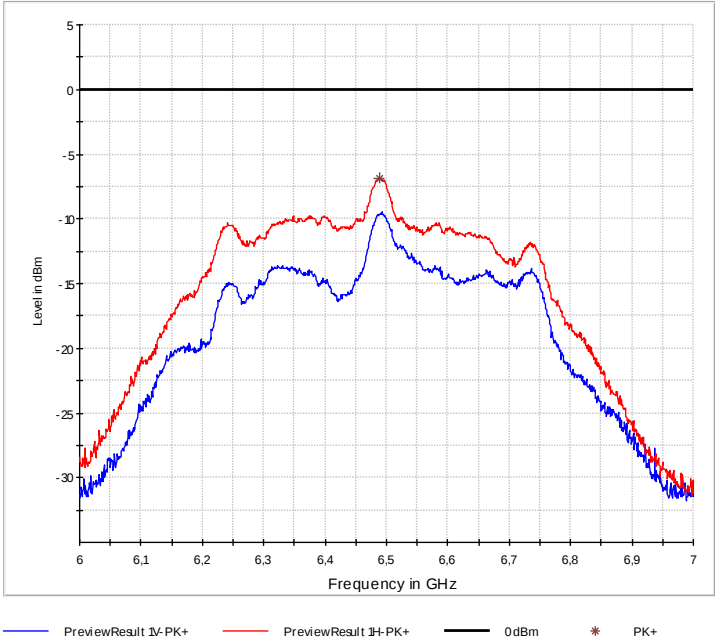


Frequency	MaxPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
MHz	dBm	dBm	dB	Ms	kHz	cm		deg	dB
3993.000000	-1.90	-41.30	-39.40	1000	50000	167	H	-24	-66.8



Product Service

Radiated emissions for channel 5:



Frequency	MaxPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
MHz	dBm	dBm	dB	Ms	kHz	cm		deg	dB
6489.565000	-6.88	0.00	6.88	1000	50000	150	H	120	-63.2



FCC 47 CFR Part 15. Limit Clause 15.519(e)

For UWB devices where the frequency at which the highest radiation occurs, $f_M = \frac{f_H + f_L}{2}$, is above 960 MHz, there is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on f_M . That limit is 0 dBm EIRP.

2.3.7 Test Location and Test Equipment Used

This test was carried out in shielded room No. 11

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2020-02
Double ridged horn antenna	Rohde & Schwarz	HF907	40089	24	2021-02
Semi anechoic room	Frankonia				
EMC Measurement Software	Rohde & Schwarz	EMC32 V10.50.10	19893	N/A	N/A

Table 8

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



Product Service

2.4 Radiated Emissions

2.4.1 Specification Reference

FCC 47 CFR Part 15E, Clauses § 15.519(c) and (d)

2.4.2 Equipment Under Test and Modification State

SIMATIC RTLS4060T. S/N: --- - Modification State 0

2.4.3 Date of Test

2019-09-05 to 2019-09-09

2.4.4 Test Method

Testing was performed in accordance with ANSI C63.10-2013 clause 10.2 and 10.3

Radiated emission in the frequency range 30 MHz to 1 GHz is measured within a semi-anechoic room with ground plane complying with the NSA requirements of ANSI C63.4 for alternative test sites. A linear polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna") is used. The measurement bandwidth of the test receiver is set to 120 kHz with quasi-peak detector selected.

If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit.

Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

Hand-held or body-worn devices are tested in the position producing the highest emission relative to the limit as verified by prescans in fully anechoic room.

If no prescan in a fully anechoic room is used first a peak scan is performed in four positions to get the whole spectrum of emission caused by EUT with the measuring antenna raised and lowered from 1 to 4 m to find table position, antenna height and antenna polarization for the maximum emission levels.

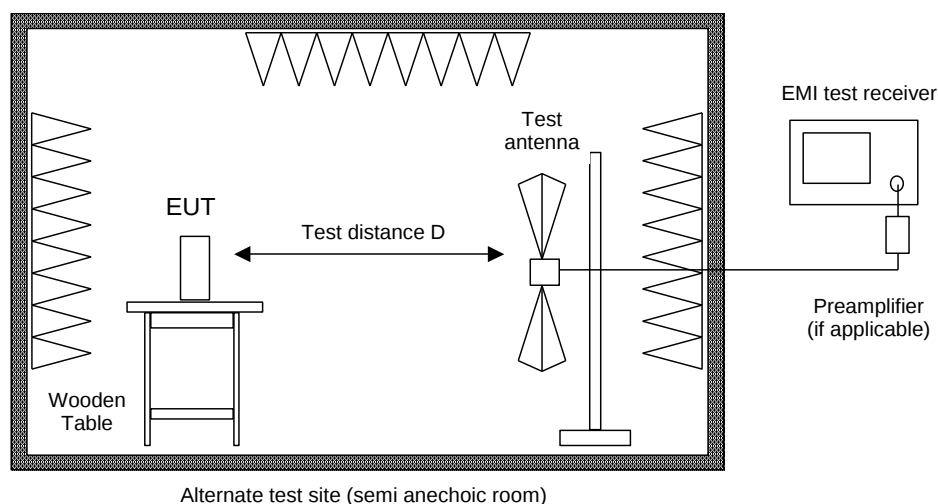
Data reduction is applied to these results to select those levels having less margin than 10 dB to or exceeding the limit using subranges and limited number of maximums. Further maximization is following.

With detector of the test receiver set to quasi-peak final measurements are performed immediately after frequency zoom (for drifting disturbances) and maximum adjustment.

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

In cases where prescans in a fully anechoic room are taken (e. g. if EUT is operating for a short time only or battery is discharged quickly) final measurements with quasi-peak detector are performed manually at frequencies indicated by prescan with EUT rotating all around and receiving antenna raising and lowering within 1 meter to 4 meters to find the maximum levels of emission. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

For measuring emissions of intentional radiators and receivers a test distance D of 3 meters is selected. Testing of unintentional radiators is performed at a distance of 10 meters. If limits specified for 3 meters shall be used for measurements performed at 10 meters distance the limits are calculated according to CFR 47 Part 15 section 15.31(d) and (f)(1) using an inverse linear-distance extrapolation factor of 20 dB/decade.



Radiated emission in fully or semi anechoic room is measured in the frequency range from 1 GHz to the maximum frequency as specified in CFR 47 Part 15 section 15.33.

Measurements are made in both the horizontal and vertical planes of polarization using a spectrum analyzer with the detector function set to peak and resolution as well as video bandwidth set 1 MHz (above 1 GHz).

All tests below 10.6 GHz are performed at a test distance D of 1 meters. For higher frequencies the test distance may be reduced (e.g. to 0.5 meter) due to the sensitivity of the measuring instrument(s) and the test results are calculated according to CFR 47 Part 15 section 15.31(f)(1) using an extrapolation factor of 20 dB/decade. If required, preamplifiers are used for the whole frequency range. Special care is taken to avoid overload, using appropriate attenuators and filters, if necessary.

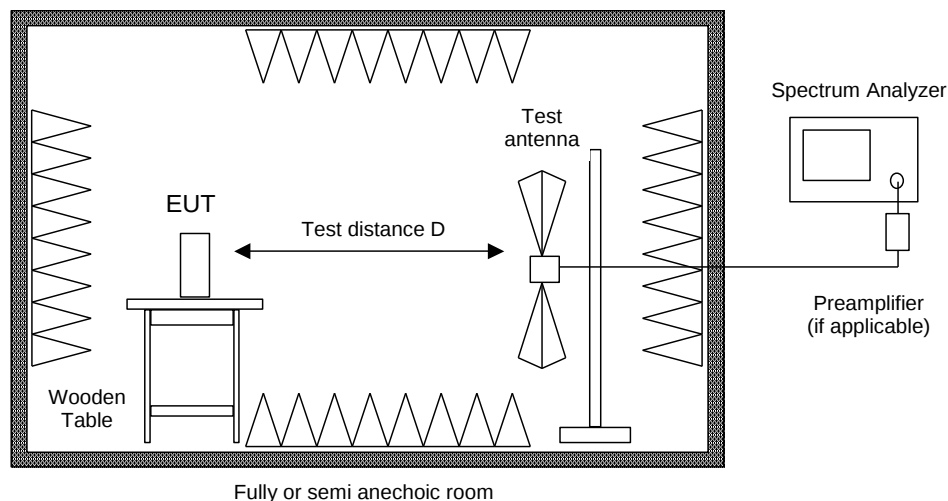
If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit.

Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.

During testing the EUT is rotated all around to find the maximum levels of emissions. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

For final testing below 1 GHz a semi anechoic room complying with the NSA requirements of ANSI C63.4 for alternative test sites is used (see 6.5). If prescans are recorded in fully anechoic room they are indicated appropriately.



2.4.5 Environmental Conditions

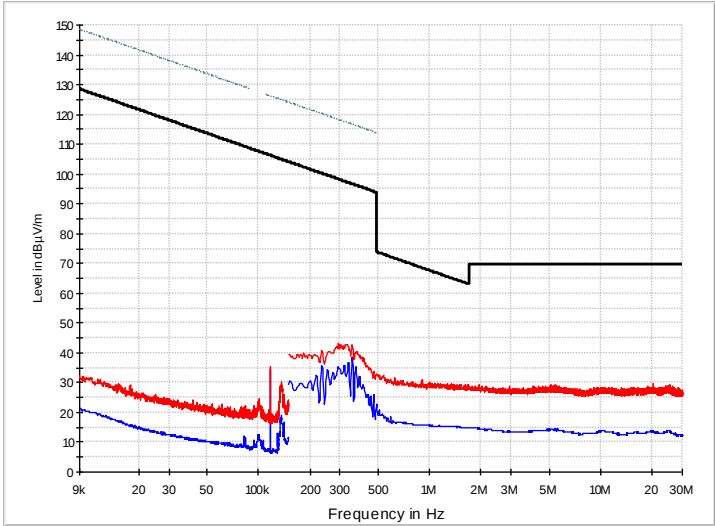
Ambient Temperature	23 °C
Relative Humidity	48 %



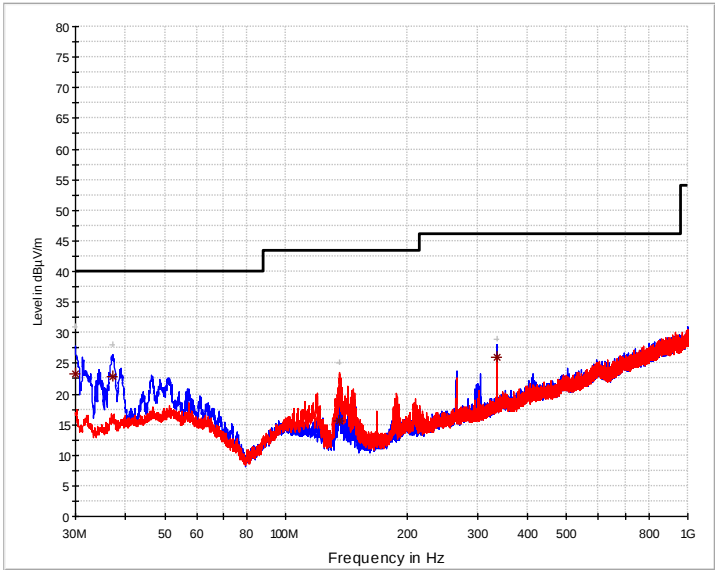
Product Service

2.4.6 Test Results

Radiated emissions for channel 2:



PreviewResult 2-AVG
PreviewResult 1-PK+
FCCPart 15CElectric Field Strength3mQP+AV(9k-30M)
FCCPart 15CElectric Field Strength3mPK(9k-30M)
Final_Result QPK
Final_Result CAV

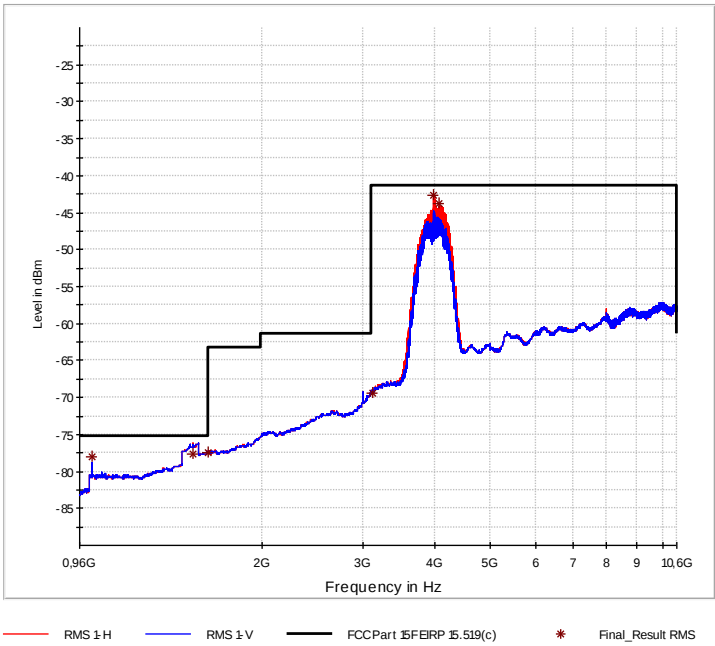


PreviewResult 1A-PK+
Critical_FreqsPK+
Final_Result QPK
PreviewResult 1B-PK+
FCCPart 15CElectric Field Strength3mQP

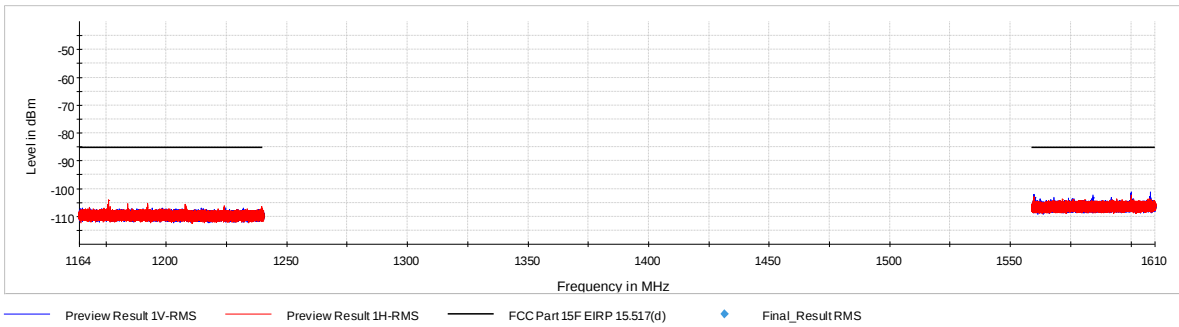
Frequency	QuasiPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
MHz	dBµV/m	dBµV/m	dB	ms	kHz	cm		deg	dB/m
30.000000	23.35	40.00	16.65	1000	120	122	V	-2	10.6
37.020000	22.88	40.00	17.12	1000	120	102	V	-151	11.8
136.050000	15.55	43.50	27.95	1000	120	193	H	-42	8.9
335.940000	25.96	46.02	20.06	1000	120	159	V	0	15.9



Product Service

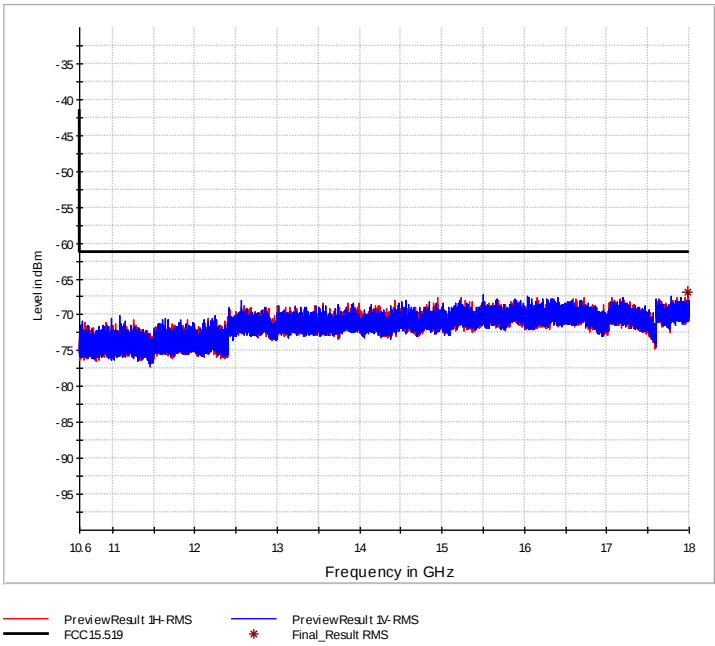


Frequency MHz	RMS dBm	Limit dBm	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB
1007.960000	-78.10	-75.30	2.80	1000	1000	128	V	-70	-77.9
1511.940000	-77.61	-75.30	2.31	1000	1000	138	H	132	-75.8
1609.700000	-77.47	-75.30	2.17	1000	1000	152	H	-4	-75.2
3112.005000	-69.34	-41.30	28.04	1000	1000	125	V	171	-68.9
3993.522500	-42.69	-41.30	1.39	1000	1000	182	H	-121	-66.8
4083.084000	-43.79	-41.30	2.49	1000	1000	182	H	-122	-66.6

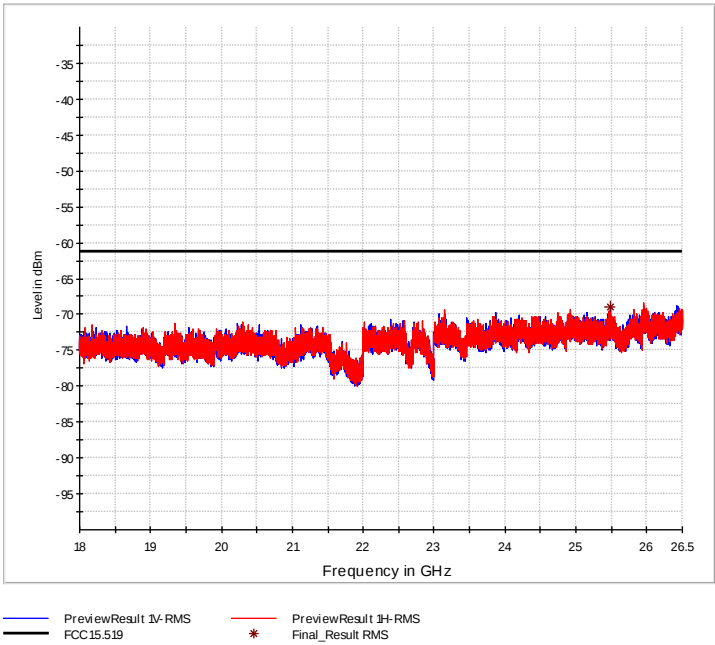




Product Service



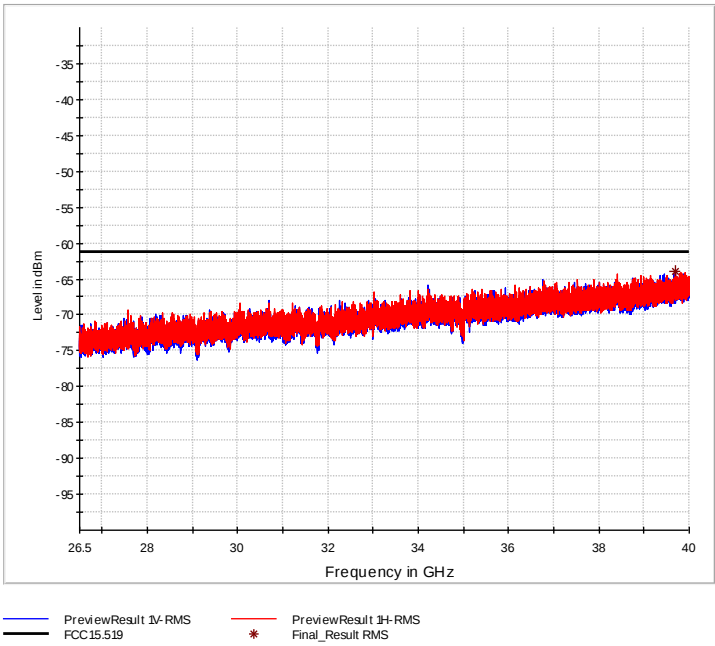
Frequency MHz	RMS dBm	Limit dBm	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB
17984.133333	-66.90	-61.30	5.60	5	1000	150	H	20	-78



Frequency MHz	RMS dBm	Limit dBm	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB
25478.583333	-68.88	-61.30	7.58	20	1000	150	V	269	-82



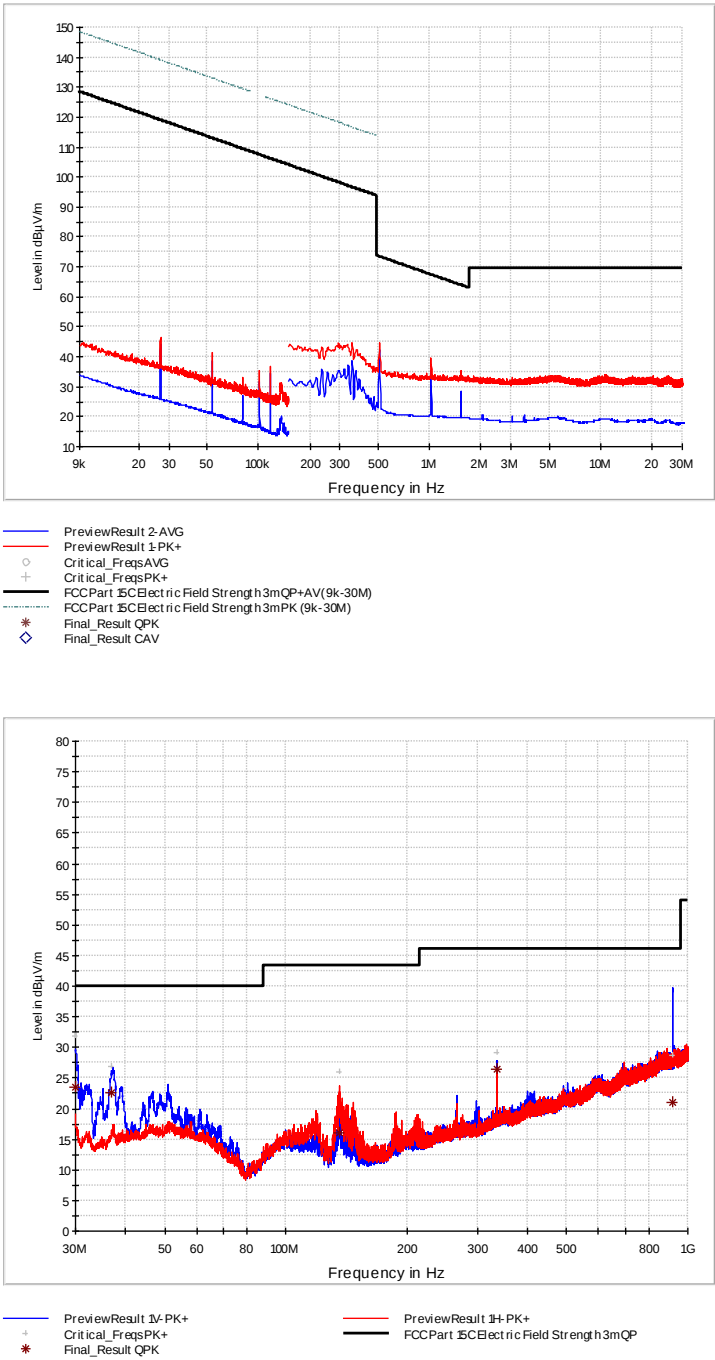
Product Service



Frequency MHz	RMS dBm	Limit dBm	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB
39681.303571	-63.90	-61.30	2.60	20	1000	150	H	161	-81.1



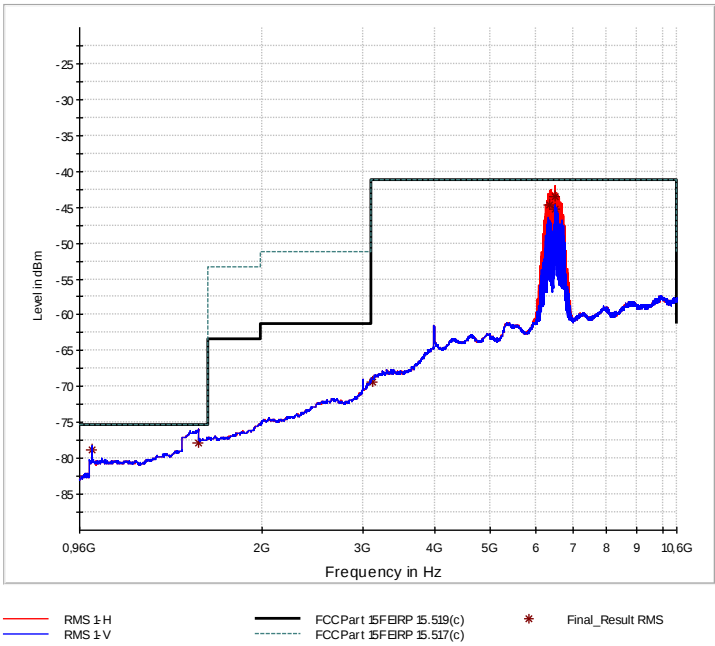
Radiated emissions for channel 5:



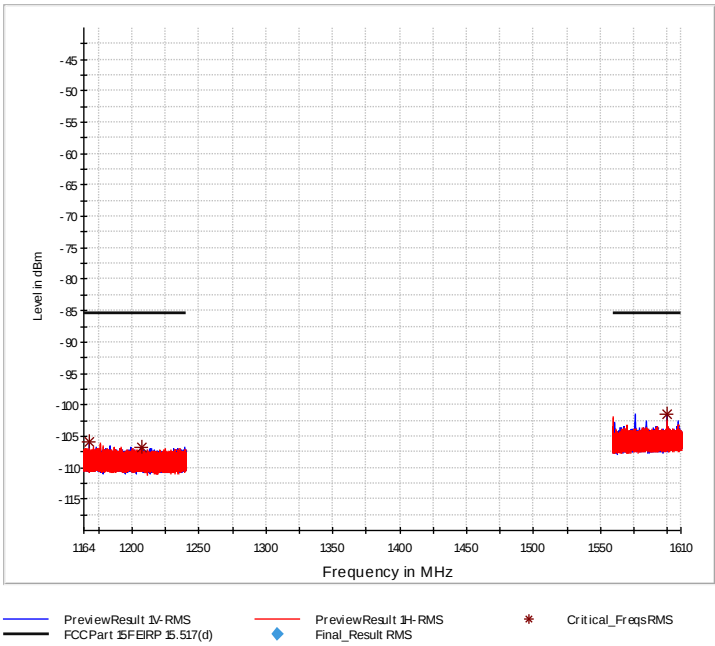
Frequency	QuasiPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
MHz	dBµV/m	dBµV/m	dB	ms	kHz	cm		deg	dB/m
30.060000	23.53	40.00	16.47	1000	120	118	V	-60	10.6
36.990000	22.68	40.00	17.32	1000	120	116	V	66	11.7
135.690000	16.04	43.50	27.46	1000	120	168	H	-30	9.0
335.970000	26.47	46.02	19.55	1000	120	140	V	3	15.9
915.570000	20.93	46.02	25.09	1000	120	387	V	47	24.6



Product Service

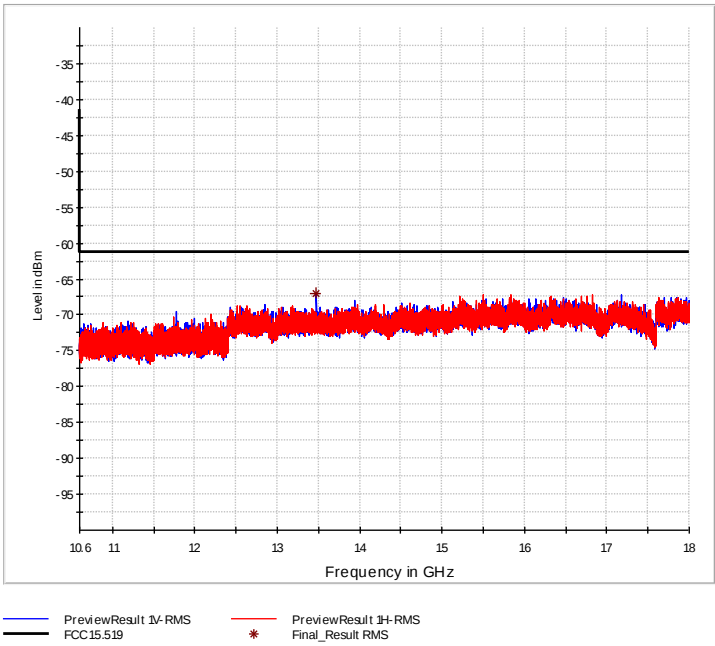


Frequency MHz	RMS dBm	Limit dBm	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB
1007.960000	-78.82	-75.30	3.52	1000	1000	100	V	-62	-77.9
1549.759000	-77.89	-75.30	2.59	1000	1000	175	H	-74	-75.5
3112.234000	-69.33	-41.30	28.03	1000	1000	225	H	193	-68.9
6360.790000	-44.59	-41.30	3.29	1000	1000	150	H	64	-63.5
6489.552500	-43.49	-41.30	2.19	1000	1000	153	H	62	-63.1
6493.626000	-45.31	-41.30	4.01	1000	1000	151	H	62	-63.1

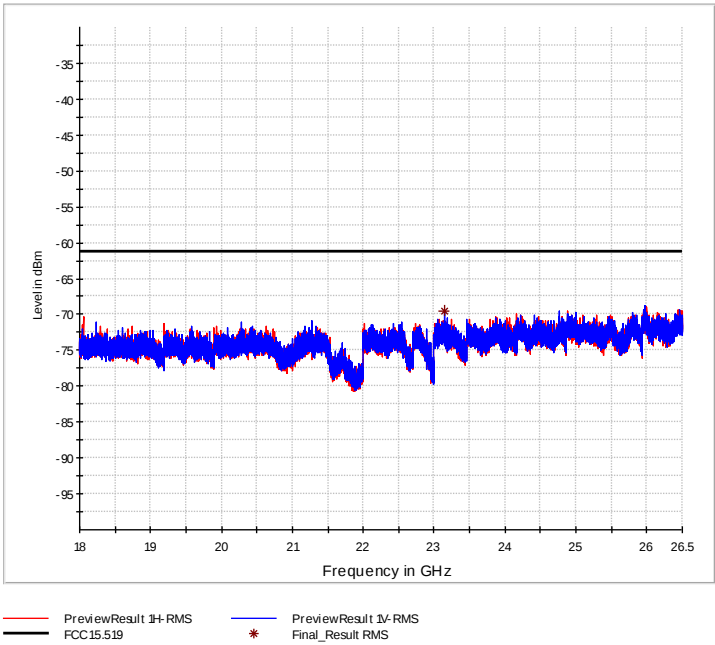




Product Service



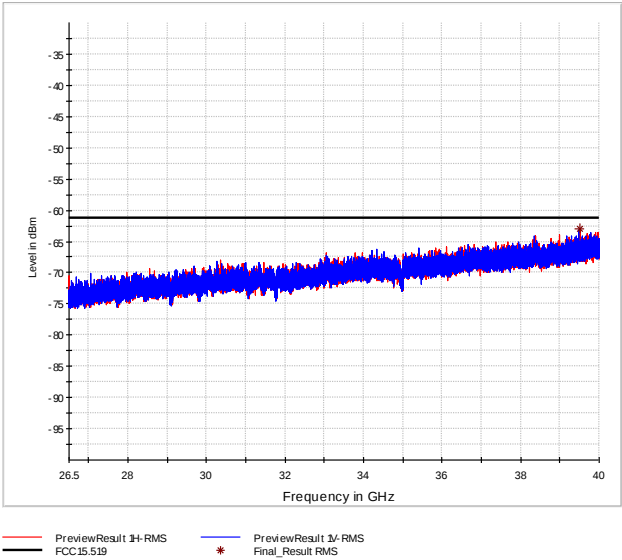
Frequency MHz	RMS dBm	Limit dBm	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB
13477.533333	-67.08	-61.30	5.78	5	1000	150	V	226	-78.2



Frequency MHz	RMS dBm	Limit dBm	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB
23146.277778	-69.52	-61.30	8.22	20	1000	150	V	324	-82.1



Product Service



Frequency MHz	RMS dBm	Limit dBm	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB
39499.535714	-63.07	-61.30	1.77	20	1000	150	H	12	-81



Sample calculation of final values:

Final Value (dBμV/m) = Reading Value (dBμV) + Antenna Correction Factor (dB/m)
 + Cable Correction Factor (dB)

The EIRP values at and above 960 MHz were calculated according to ANSI C63.10, equation (22) (section 9.5):

$$EIRP = E_{Meas} + 20 \log_{10}(d_{Meas}) - 104.7 \text{ dB/m}$$

FCC 47 CFR Part 15, Limit Clauses 15.519(c) and (d) and

The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the levels in § 15.209:

Frequency	Fieldstrength		Measurement distance
9 kHz – 490 kHz	$2400/f_{(kHz)} \mu\text{V/m}$	$67.6 \text{ dB}\mu\text{V/m} - 20 \log_{10}(f_{(kHz)})$	300 m
490 kHz – 1.705 MHz	$24000/f_{(kHz)} \mu\text{V/m}$	$87.6 \text{ dB}\mu\text{V/m} - 20 \log_{10}(f_{(kHz)})$	30 m
1.705 MHz – 30 MHz	30 μV/m	29.5 dBμV/m	30 m
30 MHz – 88 MHz	100 μV/m	40.0 dBμV/m	3 m
88 MHz – 216 MHz	150 μV/m	43.5 dBμV/m	3 m
216 MHz – 960 MHz	200 μV/m	46.0 dBμV/m	3 m

The radiated emissions above 960 MHz shall not exceed the following average (rms) limits when measured using a resolution bandwidth of 1 MHz:

Frequency	EIRP
960 MHz – 1610 MHz	-75.3 dBm
1610 MHz – 1990 MHz	-63.3 dBm
1990 MHz – 3.1 GHz	-61.3 dBm
3.1 GHz – 10.6 GHz	-41.3 dBm
Above 10.6 GHz	-61.3 dBm

In addition to the radiated emission limits above, UWB transmitters shall not exceed the following average (rms) limits when measured using a resolution bandwidth of no less than 1 kHz

Frequency	EIRP
1164 MHz – 1240 MHz	-85.3 dBm
1559 MHz – 1620 MHz	-85.3 dBm



2.4.7 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8 and a non-shielded-room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
TRILOG Antenna (4dB)	Schwarzbeck	VULB 9162	20116	36	2022-01-31
Double ridged horn antenna	Rohde & Schwarz	HF907	40089	24	2021-02
Horn antenna	EMCO	3160-09	19125	N/A	N/A
Horn antenna	EMCO	3160-10	19442	N/A	N/A
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2020-02
Signal and Spectrum Analysator	Rohde & Schwarz GmbH & Co. KG	FSV40 for TS8997	20219	12	2020-01-31
EMC Measurement Software	Rohde & Schwarz	EMC32 V10.50.10	19893	N/A	N/A

Table 9

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



2.5 Cease of Transmission

2.5.1 Specification Reference

FCC 47 CFR Part 15E, Clauses § 15.519(a)(1)

2.5.2 Equipment Under Test and Modification State

SIMATIC RTLS4060T . S/N: --- - Modification State 1

2.5.3 Date of Test

2020-03-31

2.5.4 Test Method

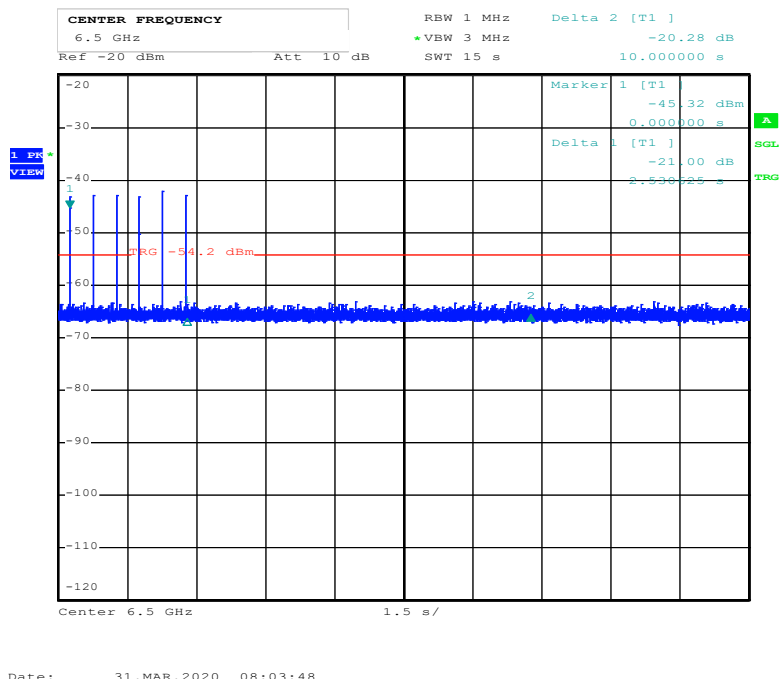
The EUT was connected to an associated receiver (Wireless Mesh Gateway) and the EUT was set to continuous transmission (parameter IF2_AnchorLimit was set to 0). The associated receiver was turned off at 0 s (Marker 1). The RF output of the EUT was observed with a spectrum analyser set to zero-span at 6.5 GHz (center frequency of UWB channel).

2.5.5 Environmental Conditions

Ambient Temperature	21 °C
Relative Humidity	24 %



2.5.6 Test Results



The EUT shuts off within 2.53 s, which is shorter than 10 s. The requirement is fulfilled.

47 CFR, § 15.519(a)(1)

The device is to transmit only when it is sending information to an associated receiver. The device shall cease transmission of information within 10 s unless it receives an acknowledgement from the associated receiver that its transmission is being received. An acknowledgment of reception must continue to be received by the UWB device at least every 10 s or the UWB device shall cease transmitting any information other than periodic signals used for the establishment or re-establishment of a communication link with an associated receiver.

2.5.7 Test Location and Test Equipment Used

This test was carried out in fully anechoic room - cabin No. 2

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Horn antenna	EMCO	3160-06	18873	O/P	
Spectrum analysator	Rohde & Schwarz	FSP30	19533	12	2020-08

Table 10

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



2.6 RF Exposure

2.6.1 Specification Reference

KDB 447498 D01, V06; section 4.3 a)

2.6.2 Equipment Under Test and Modification State

SIMATIC RTLS4060T, S/N: --- - Modification State 0

2.6.3 Date of Test

2019-09-09

2.6.4 Test Results

Carrier frequency:	f	=	4 GHz				
Distance:	d	=	5 mm				
Transmitter output power:	TP	=	53.7 nW (-42.7 dBm)				
SAR Threshold			$2.1 \cdot 10^{-8}$				
SAR Threshold Limit:			3.0				☒

Note: The 6487.565 MHz UWB radio is exempt from SAR based on the output power (0.205 mW) being less than 1 mW.

Limit definition:

For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1 g- and 10 g-SAR test exclusion thresholds are determined by the following:

$\sqrt{(f, \text{GHz})(\text{max power of channel, mW}) / (\text{min test separation distance, mm})} \leq 3.0$ for 1 g-SAR and ≤ 7.5 for 10 g SAR.

2.6.5 Test Location and Test Equipment Used

This test was carried out in 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	2020-02
Double ridged horn antenna	Rohde & Schwarz	HF907	40089	24	2021-02
EMC Measurement Software	Rohde & Schwarz	EMC32 V10.50.10	19893	N/A	N/A

Table 11



Product Service

3 Photographs

3.1 Photographs of EUT

For external photos please refer to Annex B of this test report.

3.2 Photographs of EUT

For test setup photos please refer to Annex A of this test report.



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 12



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 13



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 14

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 $p = 95.45\%$