Report on the FCC and IC Testing of the Siemens AG SIMATIC RTLS PCB OEM PULSE In accordance with FCC 47 CFR Part 15F

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

FCC ID: NXWOEMPULSE

Product Service

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COMMERCIAL-IN-CONFIDENCE

Date: 2020-03-06
Document Number: TR-72654-64463-06 | Issue: 01

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Alex Fink	2020-03-06	SIGN-ID 335601
Authorised Signatory	Matthias Stumpe	2020-03-06	SIGN-ID 335634

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 15F. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Alex Fink	2020-03-06	SIGN-ID 335601

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

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

Trade Register Munich
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Information pursuant to Section 2(1)
DL-InfoV (Germany) at
www.tuev-sued.com/imprint

Managing Directors:
Dr. Peter Havel (CEO)
Dr. Jens Butenandt
Patrick van Welij

Phone: +49 (0) 9421 55 22-0
Fax: +49 (0) 9421 55 22-99
www.tuev-sued.de

TÜV SÜD Product Service GmbH
Äußere Frühlingstraße 45
94315 Straubing
Germany

Product Service

Contents

Product Service

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	2020-03-06

Table 1

1.2 Introduction

Applicant	Siemens AG
Manufacturer	Siemens AG
Model Number(s)	SIMATIC RTLS PCB OEM PULSE
MLFB	6GT2700-8AF03 6GT2700-8AF13 6GT2700-8AF23 6GT2700-8AF33
Serial Number(s)	A56709 (radiated)
Hardware Version(s)	0622
Software Version(s)	WEGA TDO4 2.1.0
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15F
Test Plan/Issue/Date	---
Order Number Date	5121883 2018-07-30
Date of Receipt of EUT	2018-11-19
Start of Test	2019-09-20
Finish of Test	2020-02-13
Name of Engineer(s)	Alex 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 15F.

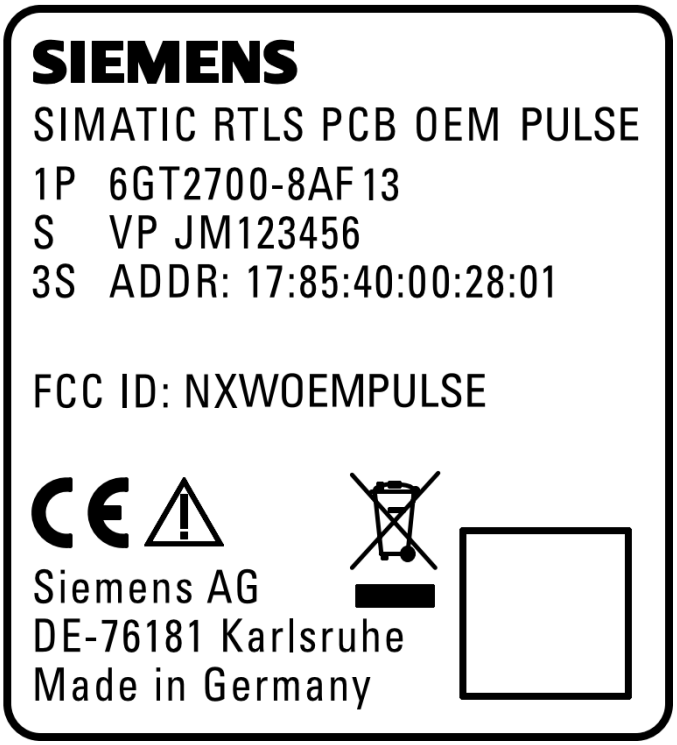
Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: Continuously Transmitting				
2.1	15.503 (a) (d) and 15.519 (b)	UWB Bandwidth	Pass	ANSI C63.10 (2013)
2.2	15.519 (c)	Radiated Emissions 30 MHz to 40 GHz	Pass	ANSI C63.10 (2013)
2.3	15.519 (d)	Radiated Emissions in the GPS Bands	Pass	ANSI C63.10 (2013)
2.4	15.519 (e)	Peak Emissions in a 50 MHz Bandwidth	Pass	ANSI C63.10 (2013)
2.5	15.207	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2013)
2.6	15.519 (a)	Signal deactivation	Pass	ANSI C63.10 (2013)

Table 2

Product Service

1.4 Application Form

Eigenschaften des Prüflings: ***Equipment characteristics:***				
Type of equipment:	SIMATIC RTLS TRANSPONDER			
Type designation:	SIMATIC RTLS PCB OEM PULSE			
M	6GT2700-8AF03 6GT2700-8AF13 6GT2700-8AF23 6GT2700-8AF33			
Parts of the system:	Transponder			
Intended use	Communication and Real Time Location System			
Hardware Version:	0622			
Software Version:	WEGA TDO4 2.1.0			
Intended area of use	☐ residential environment (home) ☒ industrial environment	☐ vehicle (automotive)		
Power supply:	☐ AC Nominal: Minimum: Maximum: Nominal frequency: Hz	☒ DC Nominal: 3.3 V Minimum:3.2 V Maximum: 3.4 V	☐ Batterie Nominal: Max.	
Dimensions (in cm)	4.4 x 2.4 x 0.75 cm [W x H x D]			
General requirements according to RED:	☒ Funk / *Radio*	☒ Sicherheit / *Safety*	☒ EMV / *EMC*	☒ EMF
Application:	Short Range Devices			
Kind of equipment:	Transceiver			
Frequency band:	UWB: 3100 – 4800 MHz (EU, USA), UWB: 6000 - 7000 MHz (EU, USA), UWB: 6240 – 6739.2 MHz (Canada and China)			
Number of RF-channels:	2 (Channel 2, without DAA, Center 3993.6 MHz) (Channel 5, without DAA, Center 6489.6 MHz)			
Channel spacing	UWB: 499.2 MHz			
Rated Carrier Power:	UWB: -14.31 dBm			
Type(s) of Modulation (e.g. BPSK, FSK, ASK, …)	UWB: BPSK with BPM			
Type of radio transmission / Use of frequency spectrum (e.g. DSSS, OFDM,.)	UWB: BPM-BPSK			
Number / Type of Antenna(s)	1 external PCB antenna with UFL Connector			

Antenna Gain	2 dBi
Minimum Distance of the Antenna to the human body	> 20 cm
Nominal Temperature & Temperature Range:	20°C / 0 °C to +50 °C
Marking plate	

Test configuration:

Channel	2 or 5
Puls Repetition Frequency	16 MHz
Data Rate	850k
Preamble Code	3 for Channel 2; 10 for Channel 5
Preamble Length	256
Tx-Power Attenuation	5

Product Service

1.4.1 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 SIMATIC RTLS PCB OEM PULSE, S/N: A56709	Not Applicable	Not Applicable

Table 3

1.5 Test Location

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

Test Name	Name of Engineer(s)
Configuration and Mode: Continuously Transmitting	
UWB Bandwidth	Alex Fink
Radiated Emissions 30 MHz to 40 GHz	Alex Fink
Radiated Emissions in the GPS Bands	Alex Fink
Peak Emissions in a 50 MHz Bandwidth	Alex Fink
AC Power Line Conducted Emissions	Alex Fink
Signal deactivation	Alex Fink

Table 4

Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany

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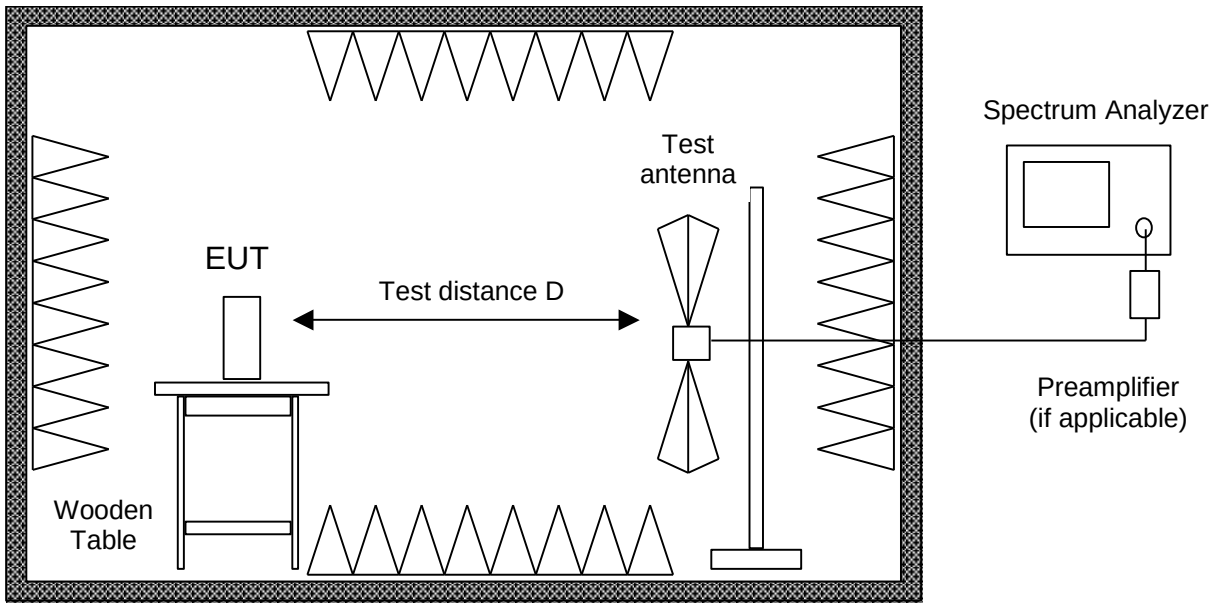
2 Test Setups

2.1.1.1 Radiated Emission in Fully or Semi Anechoic Room



Fully or semi anechoic room

Radiated emission in fully or semi anechoic room is measured in the frequency range from 30 MHz 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 to 100 kHz (below 1 GHz) or 1 MHz (above 1 GHz).

Testing up to 1 GHz is performed with a linear polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna"). For testing above 1 GHz horn antennas are used.

All tests below 8.2 GHz are performed at a test distance D of 3 meters. For higher frequencies the test distance may be reduced (e.g. to 1 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 2.1.1.2). If prescans are recorded in fully anechoic room they are indicated appropriately.

According to section 13 of KDB558074 the requirement for radiated emissions on the band edges was performed with a reduced bandwidth of 100 kHz instead of 1 MHz.

Product Service

Radiated emission in the frequency range 9 kHz to 30 MHz is measured using an active loop antenna. First the whole spectrum of emission caused by the equipment is recorded at a distance of 3 meters in a fully or semi anechoic room with the detector of the spectrum analyzer or EMI receiver set to peak. This configuration is also used for recording the spectrum of intentional radiators.

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.

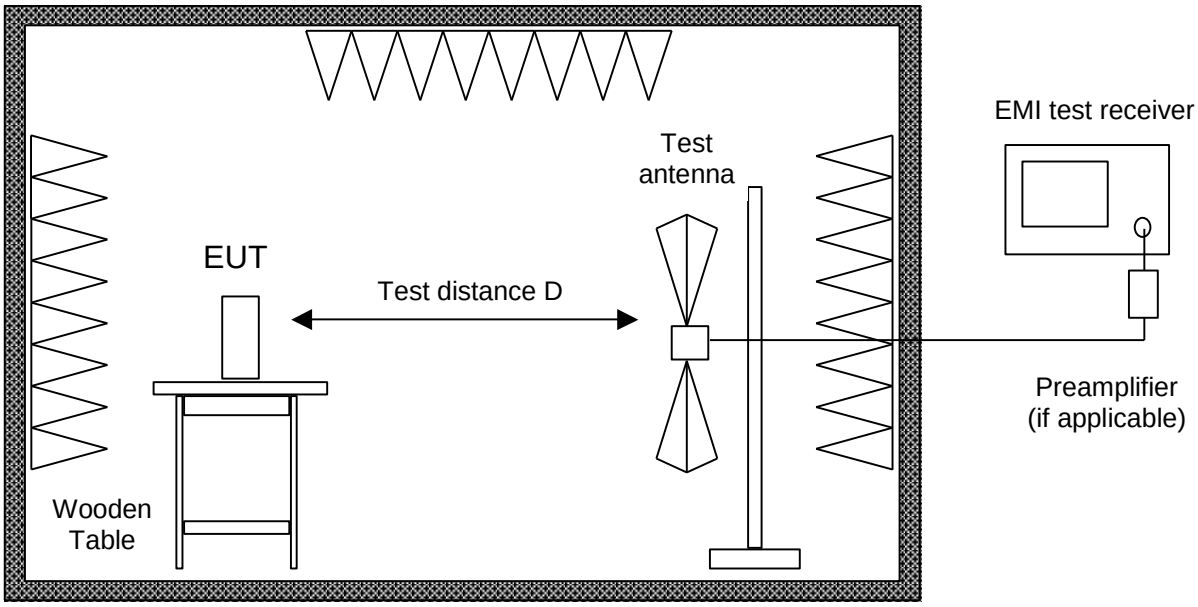
EUT is rotated all around to find the maximum levels of emissions. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.
If worst case emission of the EUT cannot be recorded with EUT in standard position and loop antenna in vertical polarization the EUT (or the radiating part of the EUT) is rotated by 90 degrees instead of changing the loop antenna to horizontal polarization. This procedure is selected to minimize the influence of the environment (e.g. effects caused by the floor especially with longer distances).

Final measurement is performed at a test distance D of 30 meters using an open field test site. In case the regulation requires testing at other distances, the result is extrapolated by either making measurements at an additional distance D of 10 meters to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). In cases of very low emissions measurements are performed at shorter distances and results are extrapolated to the required distance. The provisions of CFR 47 Part 15 sections 15.31(d) and (f)(2) apply. According to CFR 47 Part 15 section 15.209(d) final measurement is performed with detector function set to quasi-peak except for the frequency bands 9 to 90 kHz and 110 to 490 kHz where, for non-pulsed operation, average detector is employed.

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.

Product Service

2.1.1.2 Radiated Emission at Alternative Test Site



Alternate test site (semi anechoic room)

Radiated emission in the frequency range 30 MHz to 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 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 dircharged 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

Product Service

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.

Product Service

3 Test Details

3.1 UWB Bandwidth

3.1.1 Specification Reference

FCC 47 CFR Part 15F, Clause 15.503 (a) (d) and 15.519 (b)

3.1.2 Equipment Under Test and Modification State

SIMATIC RTLS PCB OEM PULSE, S/N: A56709 - Modification State 0

3.1.3 Date of Test

2019-11-04

3.1.4 Test Method

Test according to FCC title 47 part 15 §15.519 (b) and ANSI C63.10-2013, 10.1

3.1.5 Environmental Conditions

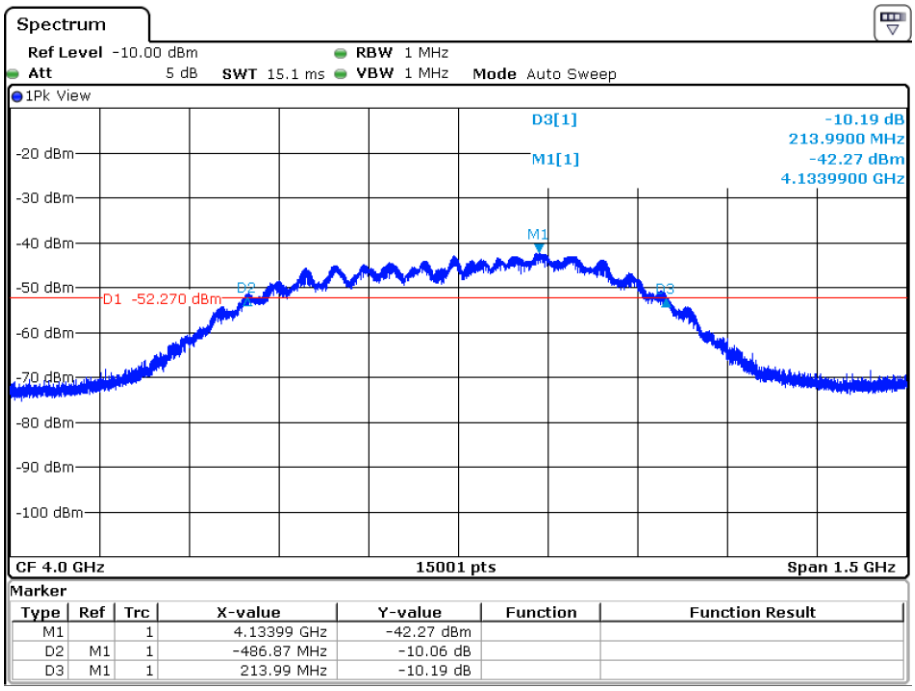
Ambient Temperature	21.0 °C
Relative Humidity	35.0 %

3.1.6 Test Results

Channel	f_L [GHz]	f_H [GHz]	f_M [GHz]	OBW [MHz]	f_C [GHz]	Result
Ch 2 [Lowest]	3.65	4.35	4.13	701	4.00	PASS
Ch 5 [Highest]	6.14	6.82	6.49	682	6.48	PASS

Product Service

Transmission on Channel 2



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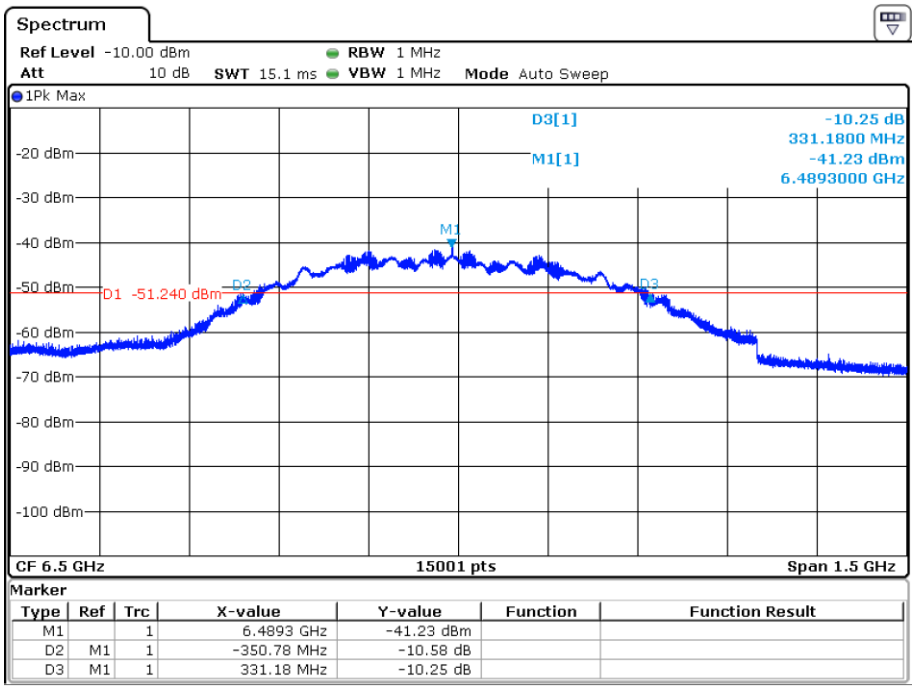
Transmission on Channel 5



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Product Service

FCC 47 CFR Part 15, Limit Clause 15.519 (b) and ANSI C63.10-2013 10.1

The UWB bandwidth of a device operating under the provisions of this section shall be contained between 3,100 MHz and 10,600 MHz and at any point in time and has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.

3.1.7 Test Location and Test Equipment Used

Radiated Tests were carried out in FAR No.11

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2020-02-29
Horn Antenna	EMCO	3115	19383	36	2020-02-29
Semi Anechoic Room	Frankonia	Cabin No. 11	42961	N/A	N/A

Table 5

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

Product Service

3.2 Radiated Emissions 30 MHz to 40 GHz

3.2.1 Specification Reference

FCC 47 CFR Part 15F, Clause 15.519 (c)

3.2.2 Equipment Under Test and Modification State

SIMATIC RTLS PCB OEM PULSE, S/N: A56709 - Modification State 0

3.2.3 Date of Test

2019-09-20 to 2019-09-25

3.2.4 Test Method

Test below 960 MHz was performed in accordance with ANSI C63.10, clause 6.10.5.

Plots for average measurements were taken in accordance with ANSI C63.10 clause 4.1.4.2.3. These are shown for information purposes and were used to determine the worst case measurement point. Final average measurements were then taken in accordance with ANSI C63.10 clause 4.1.4.2.2. to obtain the measurement result recorded in the test results tables.

The following conversion can be applied to convert from dBµV/m to µV/m:
10^(Field Strength in dBµV/m/20).

Test above 960 MHz was performed in accordance with FCC title 47 part 15 §15.519 (c) and ANSI C63.10-2013, 10.3

Frequency range	Measurement distance (m)
1 GHz to 3100 MHz	0.25 m
3100 MHz to 18 GHz	0.50 m
18 GHz to 40 GHz	0.05 m

3.2.5 Environmental Conditions

Ambient Temperature	25.0 °C
Relative Humidity	53.0 %

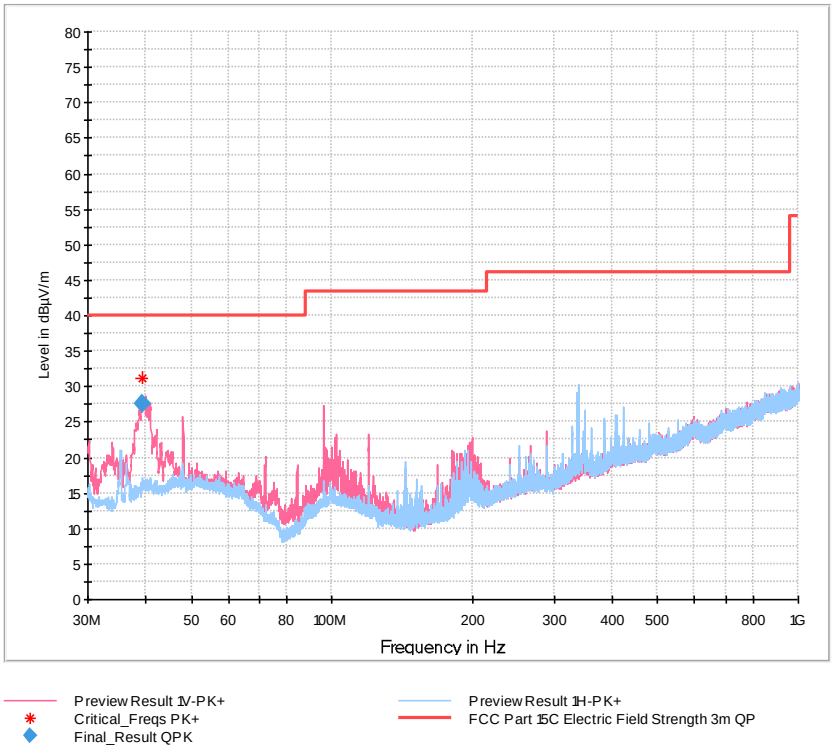
3.2.6 Test Results

Sample calculation of final values:

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

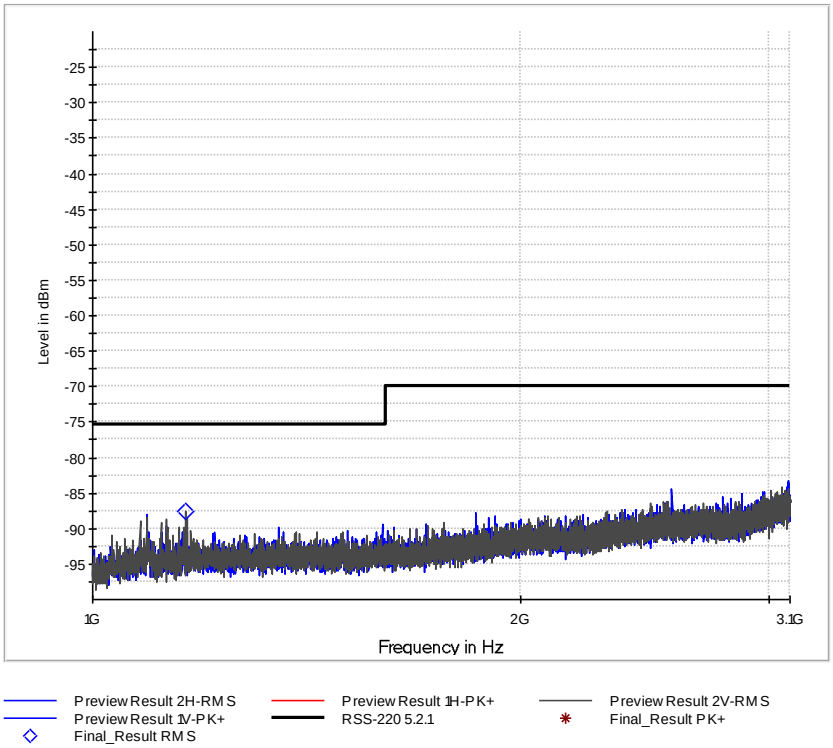
Product Service

1.orthogonal axis, xz plane - channel 2



Final Results :

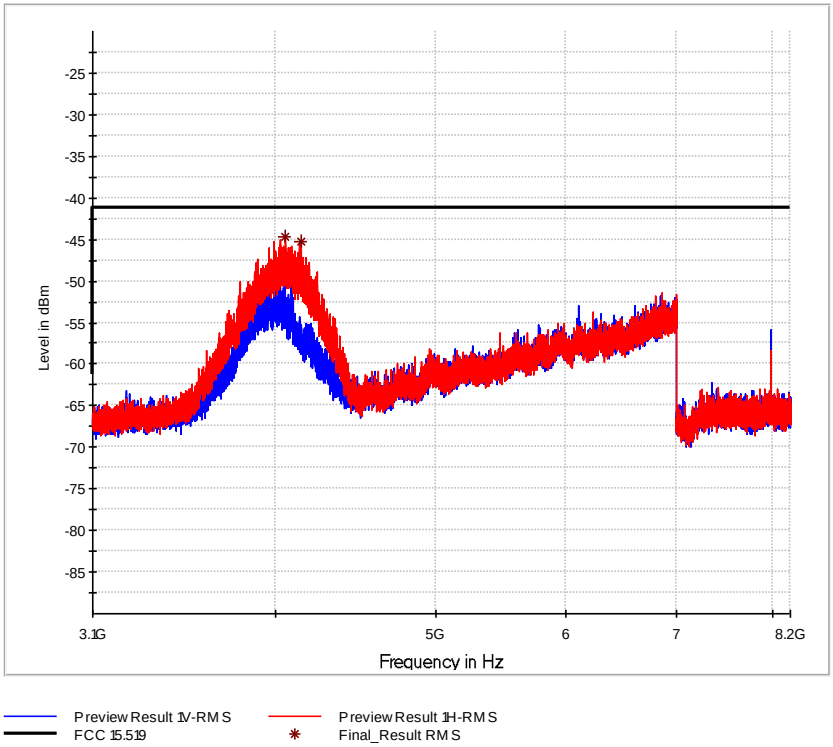
Frequency *MHz*	*QuasiPeak* *dBµV/m*	*Limit* *dBµV/m*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB/m*
39.210000	27.60	40.00	12.40	1000.0	120.000	105.0	V	-156.0	12.6



Final Results:

Frequency *MHz*	*MaxPeak* *dBm*	*RMS* *dBm*	*Limit* *dBm*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
1161.718750	---	-87.62	-75.3	12.32	2.5	1000.000	150.0	V	65.0	-99

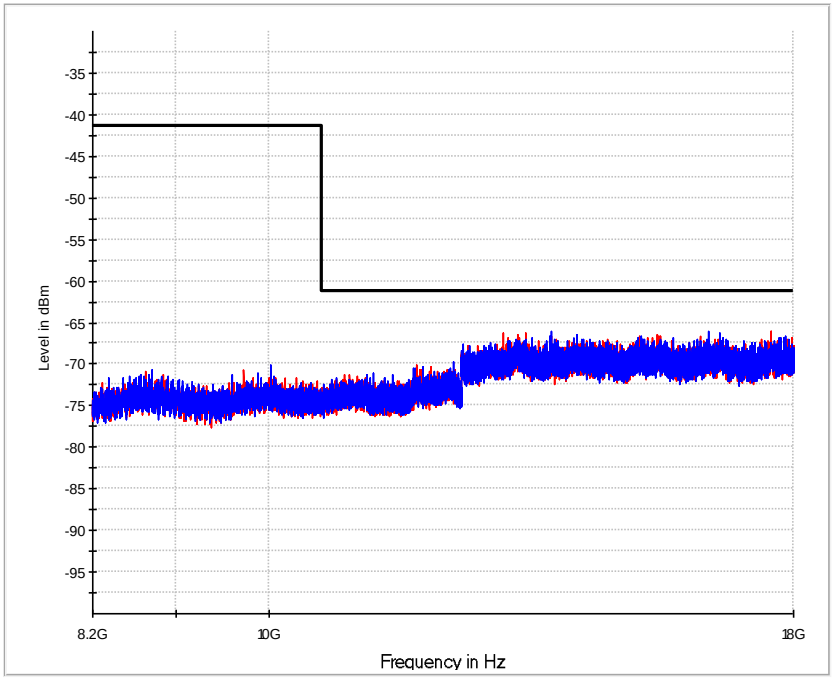
Product Service

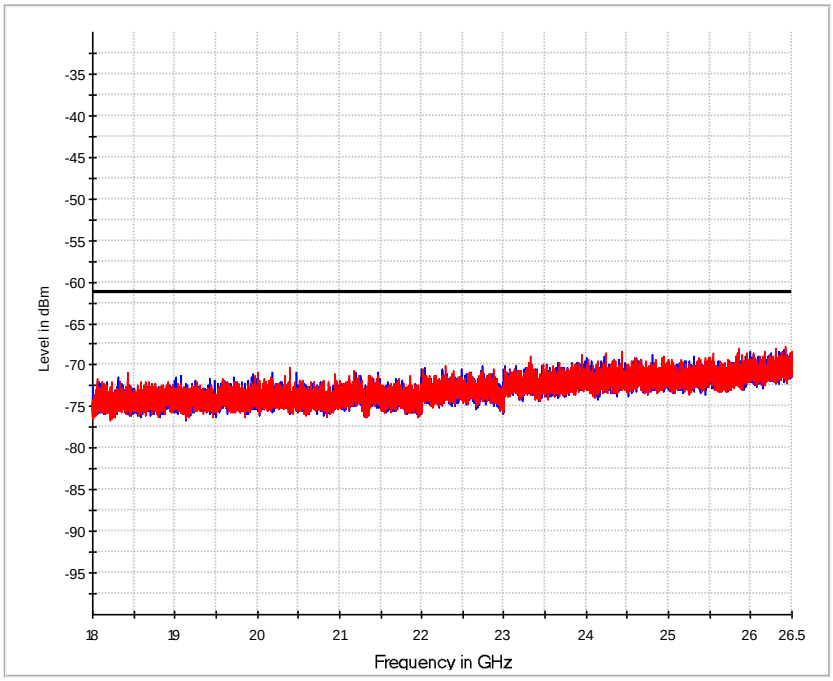


Final Results:

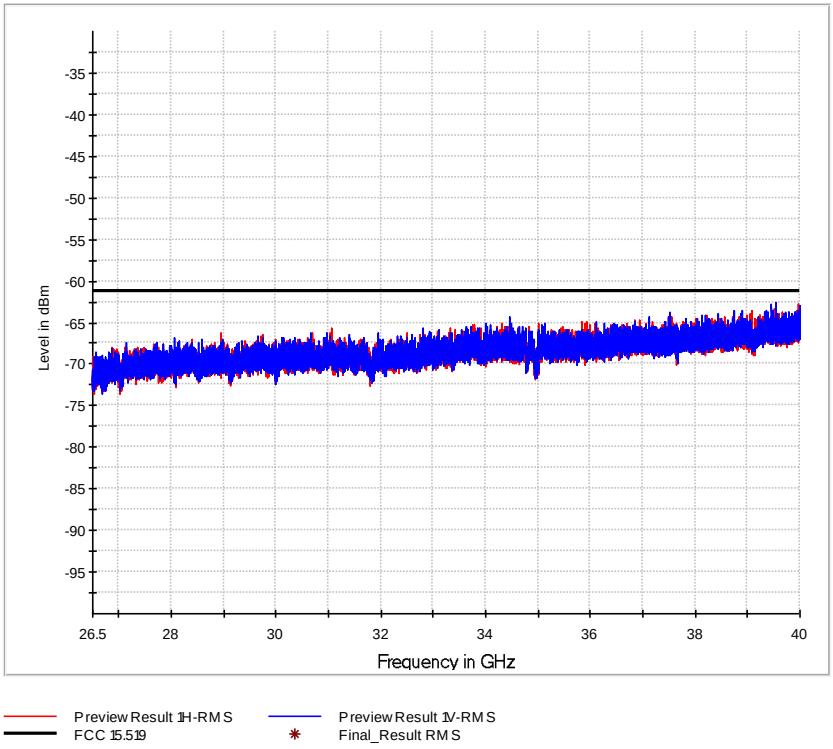
Frequency MHz	*RMS dBm*	*Limit dBm*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Height cm*	*Pol*	*Azimuth deg*	*Corr. dB*
4058.481250	-44.61	-41.30	3.31	5.0	1000.000	150.0	H	171.0	-77.0
4144.225000	-45.22	-41.30	3.92	5.0	1000.000	150.0	H	171.0	-77.3

Product Service



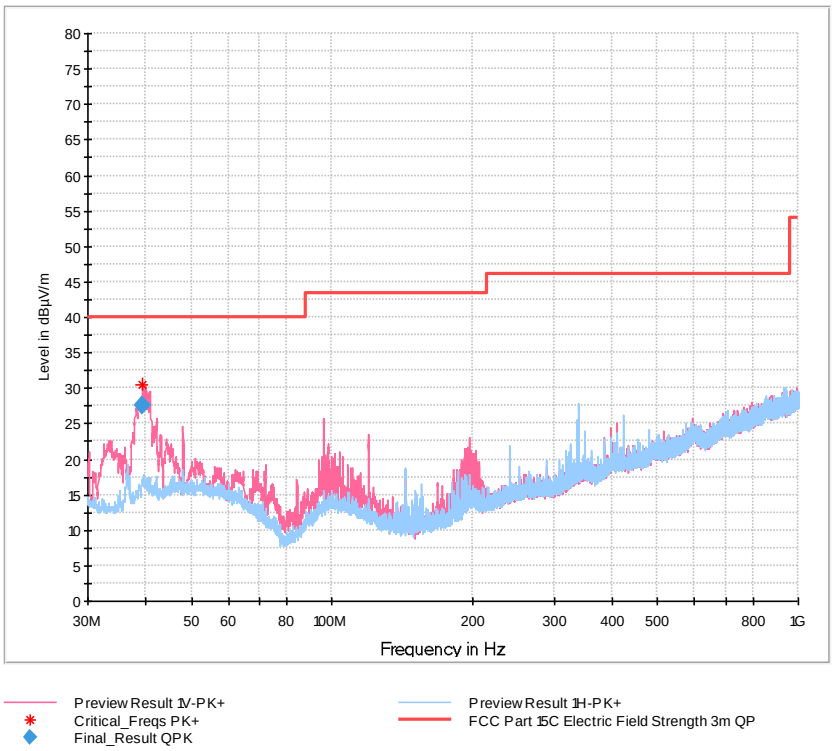


Product Service



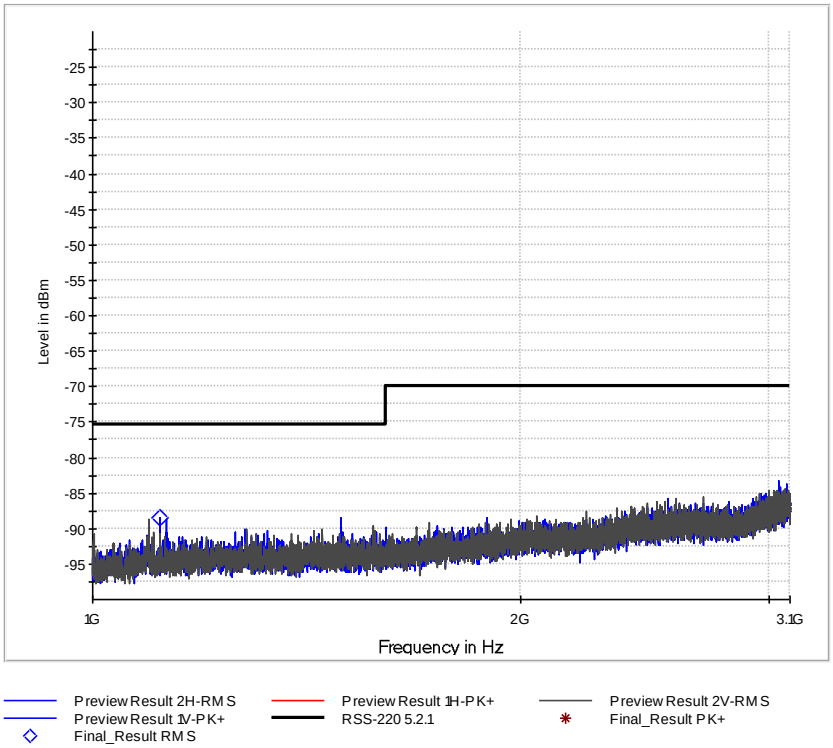
Product Service

1.orthogonal axis, xz plane - channel 5



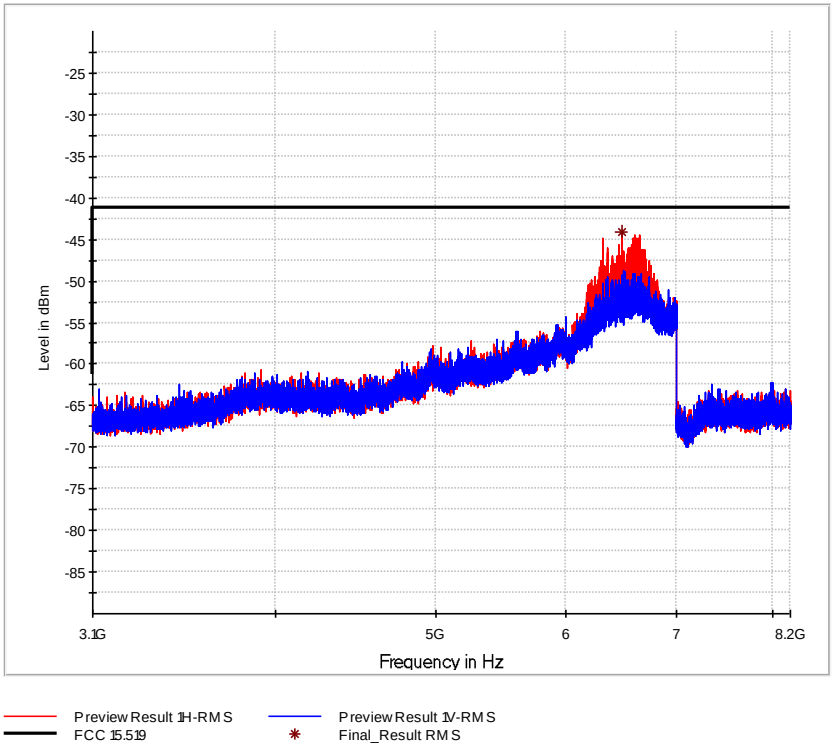
Final Results:

Frequency *MHz*	*QuasiPeak* *dBµV/m*	*Limit* *dBµV/m*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
39.240000	27.65	40.00	12.35	1000.0	120.000	100.0	V	-49.0	12.6



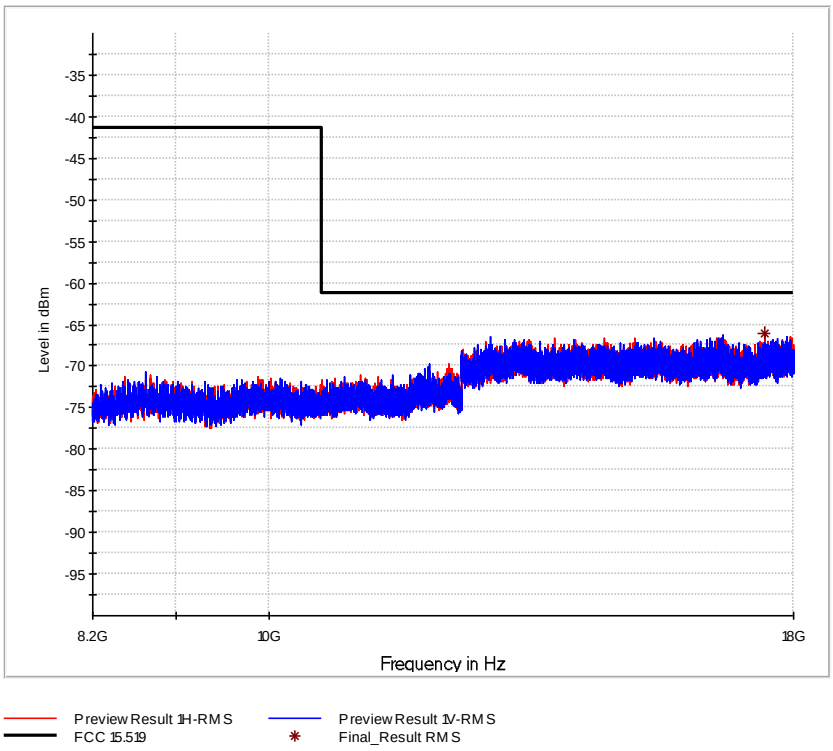
Final Results:

Frequency *MHz*	*MaxPeak* *dBm*	*RMS* *dBm*	*Limit* *dBm*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
1115.781250	---	-88.40	-75.3	12.80	2.5	1000.000	150.0	H	341.0	-100



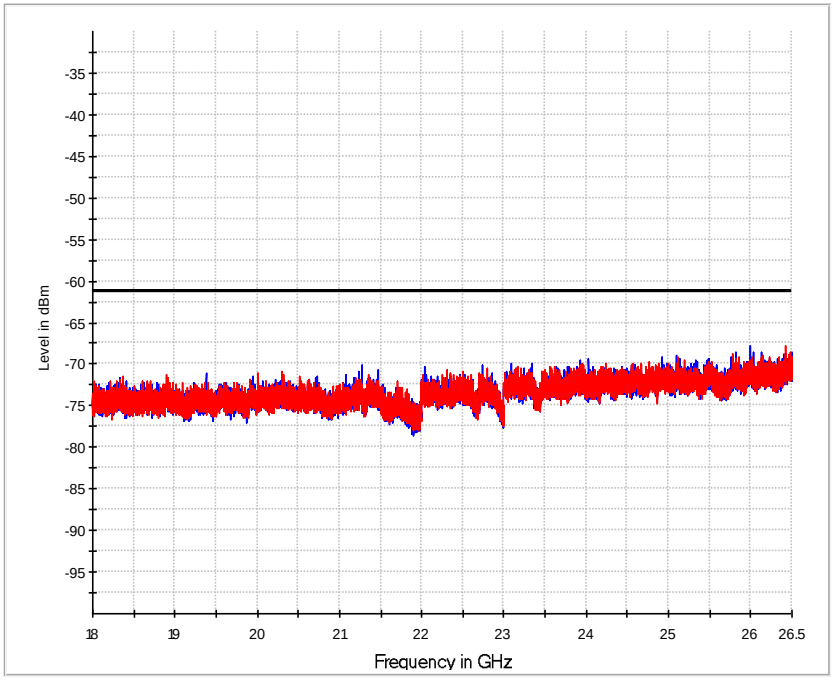
Final Results:

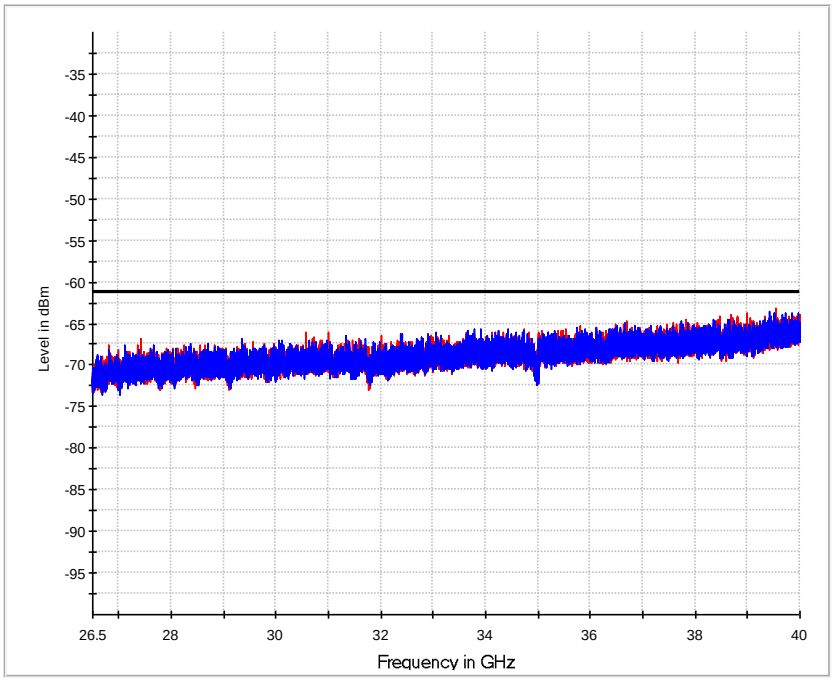
Frequency *MHz*	*RMS* *dBm*	*Limit* *dBm*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
6489.587500	-44.03	-41.30	2.73	5.0	1000.000	150.0	H	146.0	-74.8



Final Results:

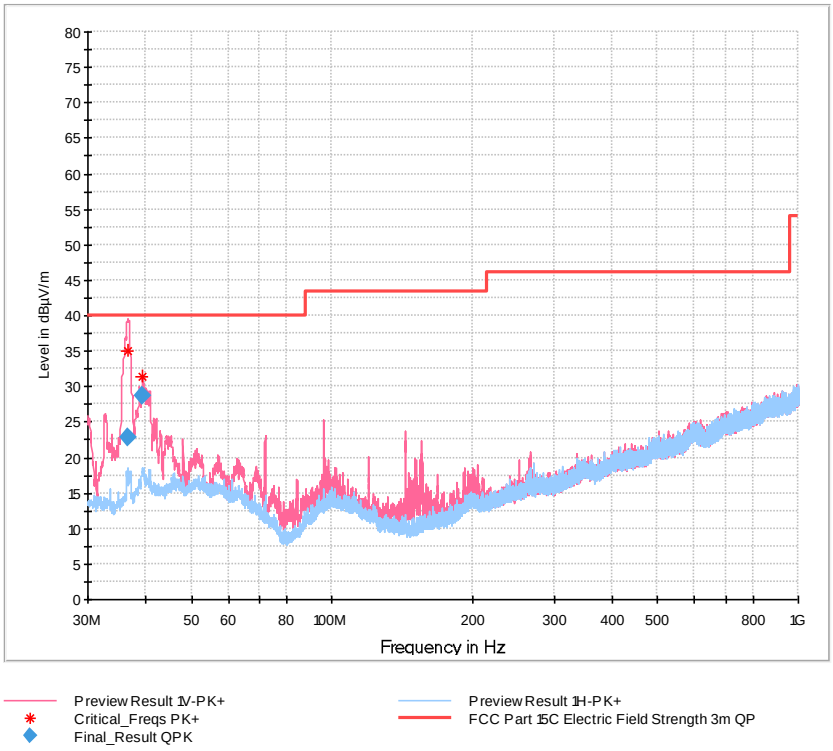
Frequency MHz	*RMS dBm*	*Limit dBm*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Height cm*	*Pol*	*Azimuth deg*	*Corr. dB*
17431.133333	-66.11	-61.30	4.81	2.5	1000.000	150.0	H	147.0	-78


-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
Level in dBm
18
19
20
21
22
23
24
25
26
26.5
Frequency in GHz
Preview Result 1V-RMS
Preview Result 1H-RMS
FCC 15.519
Final_Result RMS


-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
Level in dBm
26.5
28
30
32
34
36
38
40
Frequency in GHz
Preview Result 1H-RMS
Preview Result 1V-RMS
FCC 15.519
Final_Result RMS

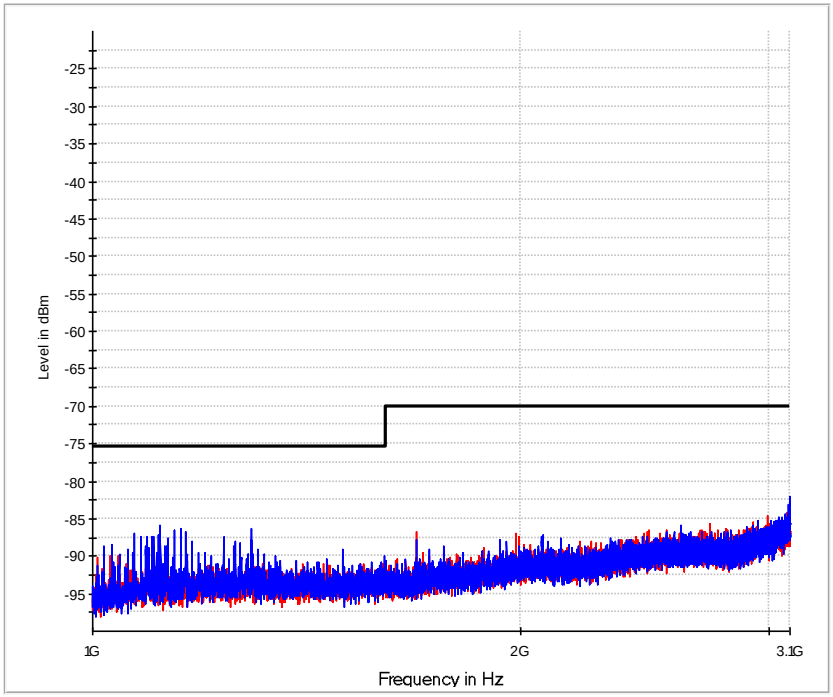
Product Service

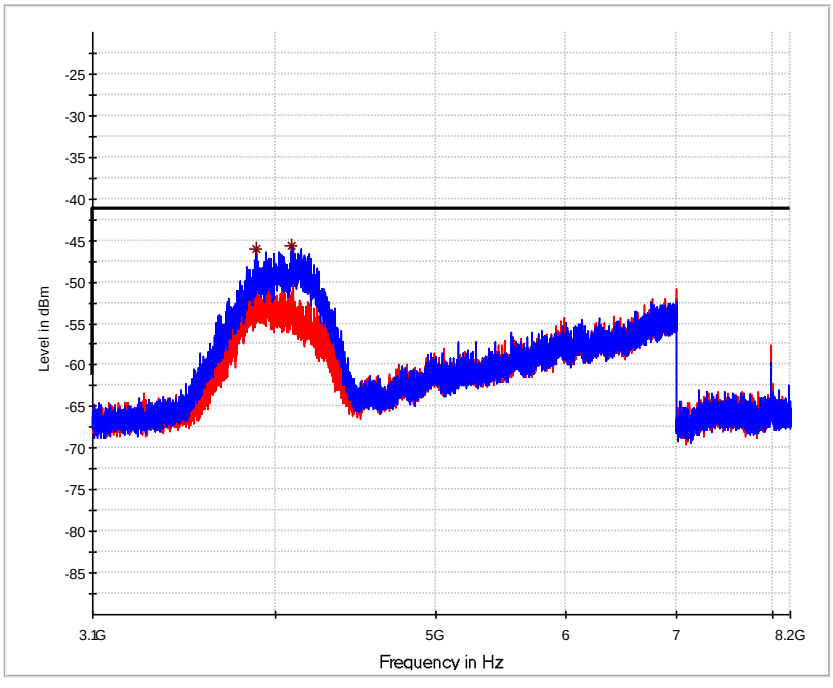
2.orthogonal axis, xy plane - channel 2



Final Results:

Frequency *MHz*	*QuasiPeak* *dBµV/m*	*Limit* *dBµV/m*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
36.570000	22.89	40.00	17.11	1000.0	120.000	185.0	V	25.0	11.6
39.270000	28.74	40.00	11.26	1000.0	120.000	102.0	V	60.0	12.6

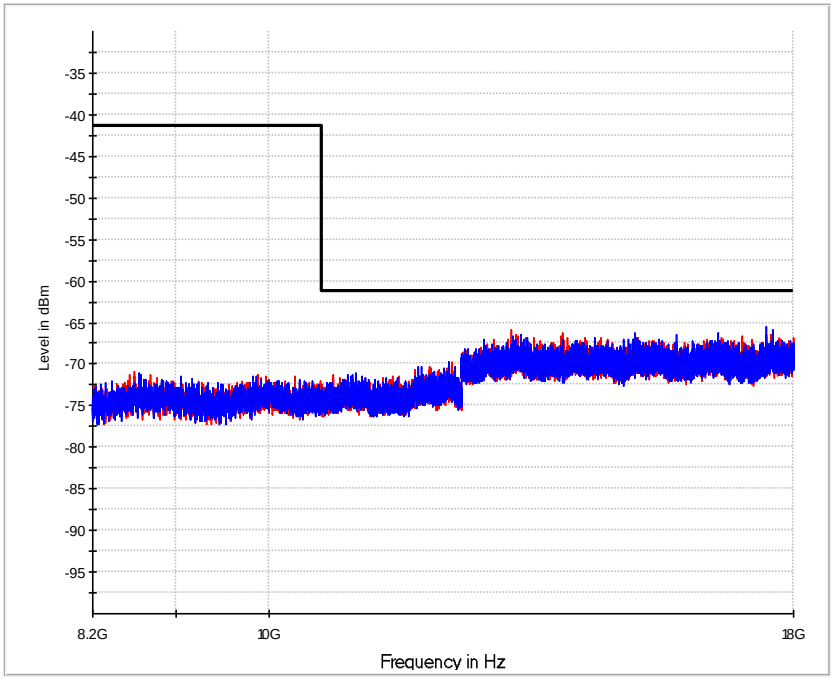

-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
Level in dBm
1G
2G
3.1G
Frequency in Hz
Preview Result 1H-RMS
Preview Result 1V-RMS
RSS-220 5.2.1

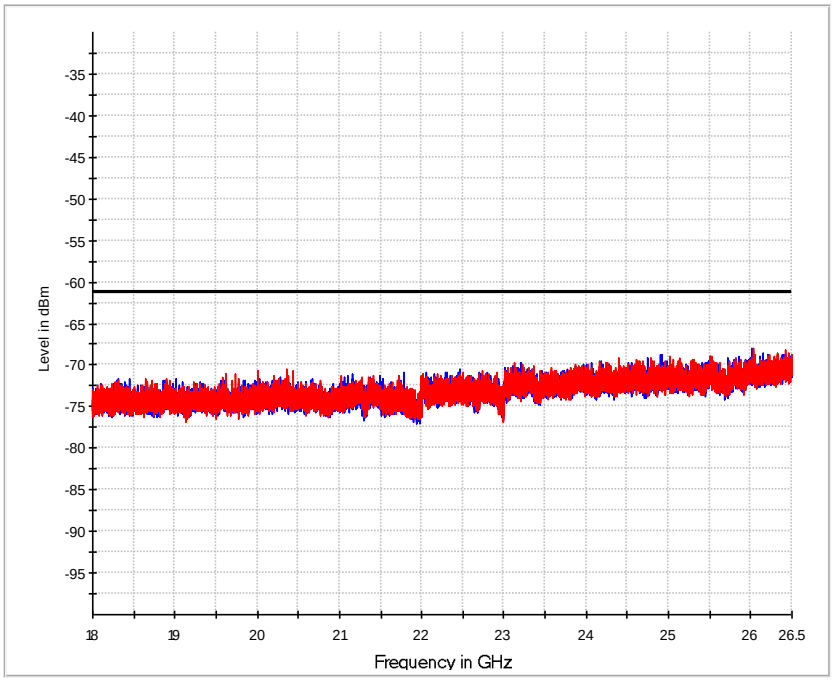

-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
Level in dBm
3.1G
5G
6
7
8.2G
Frequency in Hz
Preview Result 1H-RMS
FCC 15.519
Preview Result 1V-RMS
Final_Result RMS

Product Service

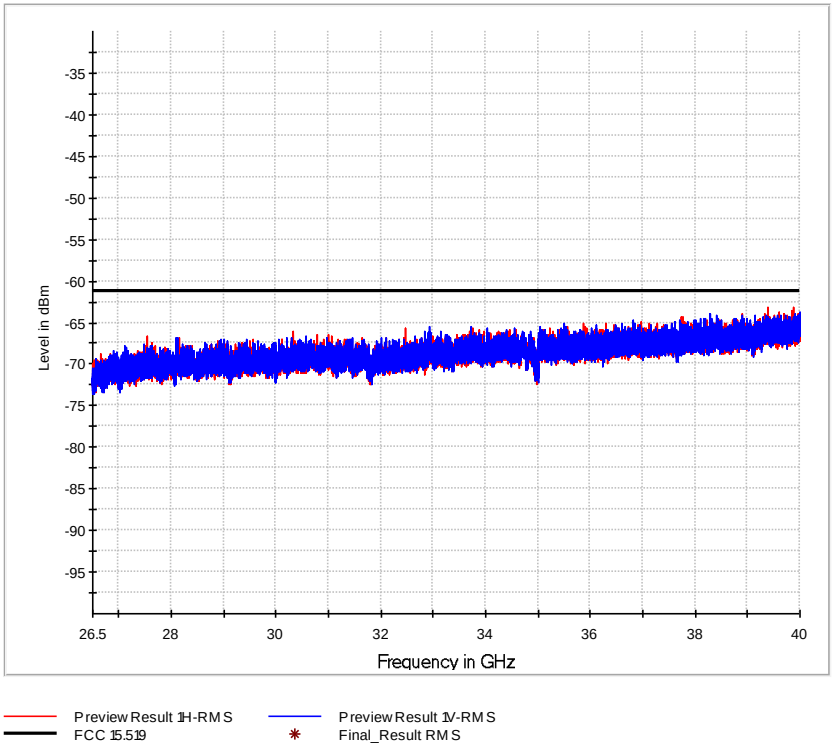
Final Results:

Frequency MHz	*RMS dBm*	*Limit dBm*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Height cm*	*Pol*	*Azimuth deg*	*Corr. dB*
3894.962500	-46.09	-41.30	4.79	5.0	1000.000	150.0	V	89.0	-76.9
4091.312500	-45.60	-41.30	4.30	5.0	1000.000	150.0	V	145.0	-77.2


-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
Level in dBm
8.2G
10G
18G
Frequency in Hz
Preview Result 1H-RMS
FCC 15.519
Preview Result 1V-RMS
Final_Result RMS

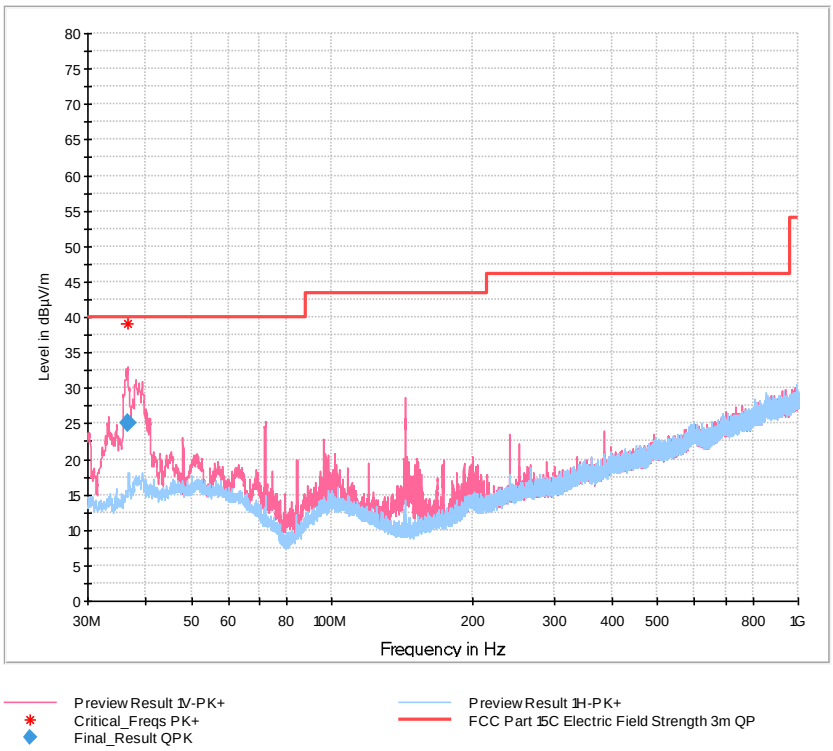

-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
Level in dBm
18
19
20
21
22
23
24
25
26
26.5
Frequency in GHz
Preview Result 1V-RMS
FCC 15.519
Preview Result 1H-RMS
Final_Result RMS

Product Service



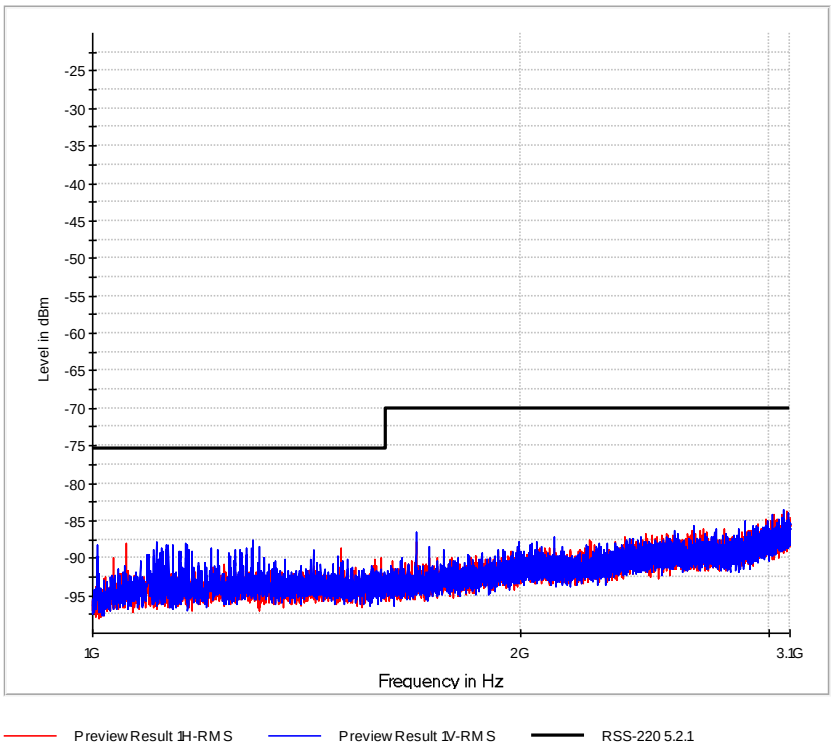
Product Service

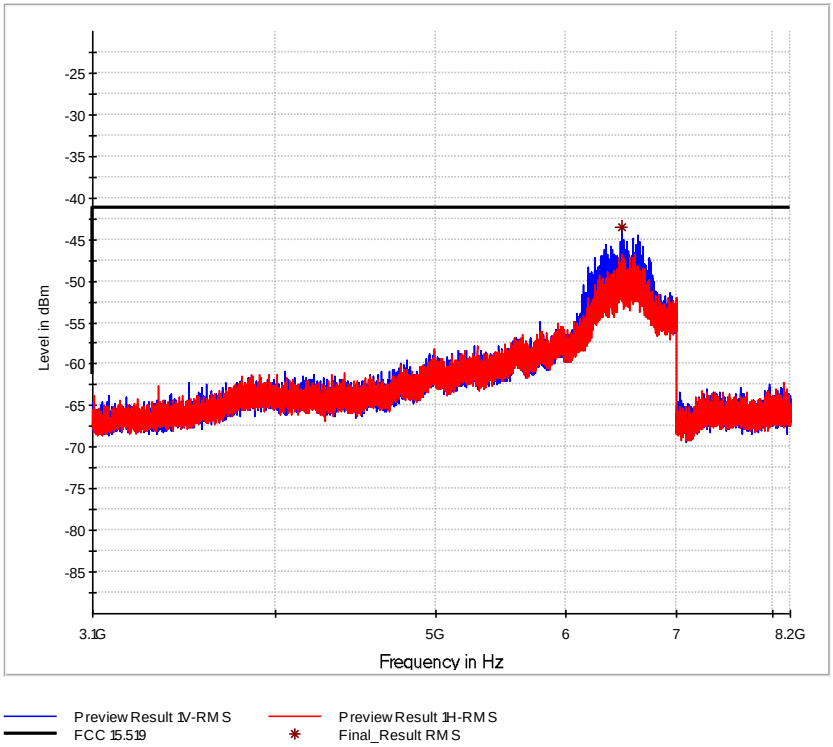
2.orthogonal axis, xy plane - channel 5



Final Results:

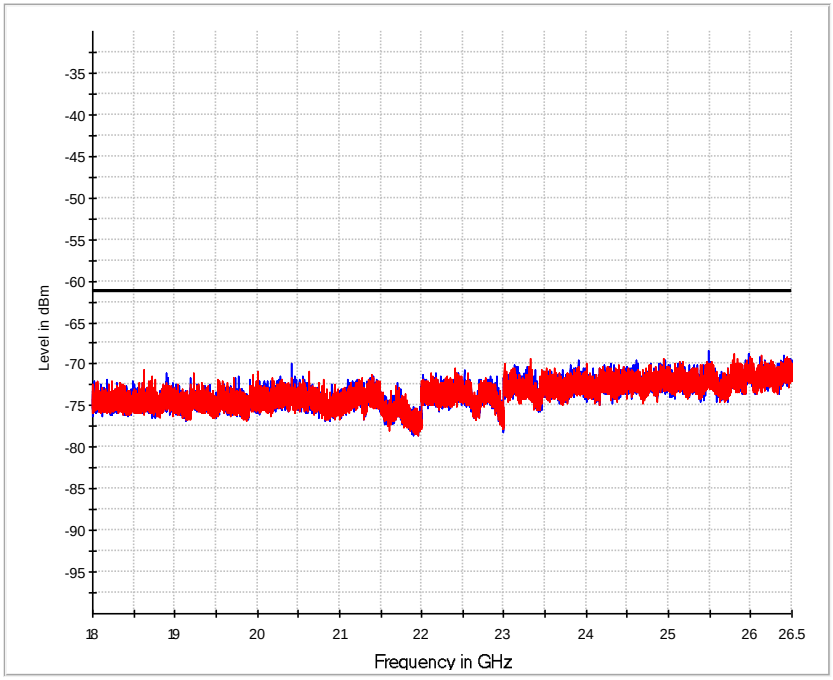
Frequency *MHz*	*QuasiPeak* *dBµV/m*	*Limit* *dBµV/m*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
36.510000	25.06	40.00	14.94	1000.0	120.000	189.0	V	32.0	11.5

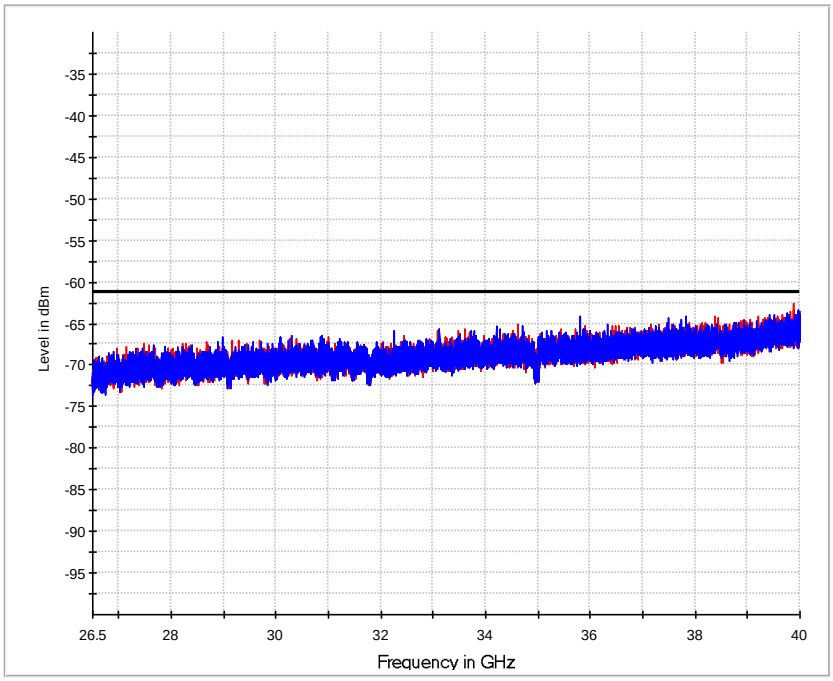

-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
Level in dBm
1G
2G
3.1G
Frequency in Hz
Preview Result 1H-RMS
Preview Result 1V-RMS
RSS-220 5.2.1



Final Results:

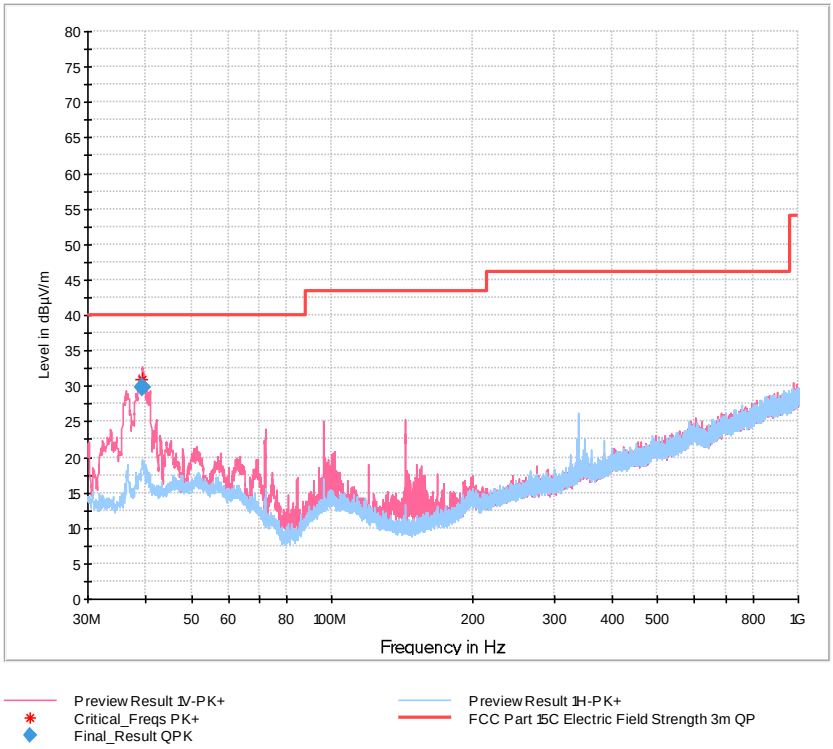
Frequency *MHz*	*RMS* *dBm*	*Limit* *dBm*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
6489.906250	-43.58	-41.30	2.28	5.0	1000.000	150.0	V	144.0	-74.8


Level in dBm
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
18
19
20
21
22
23
24
25
26
26.5
Frequency in GHz
Preview Result 1V-RMS
FCC 15.519
Preview Result 1H-RMS
Final_Result RMS


Level in dBm
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
26.5
28
30
32
34
36
38
40
Frequency in GHz
Preview Result 1H-RMS
FCC 15.519
Preview Result 1V-RMS
Final_Result RMS

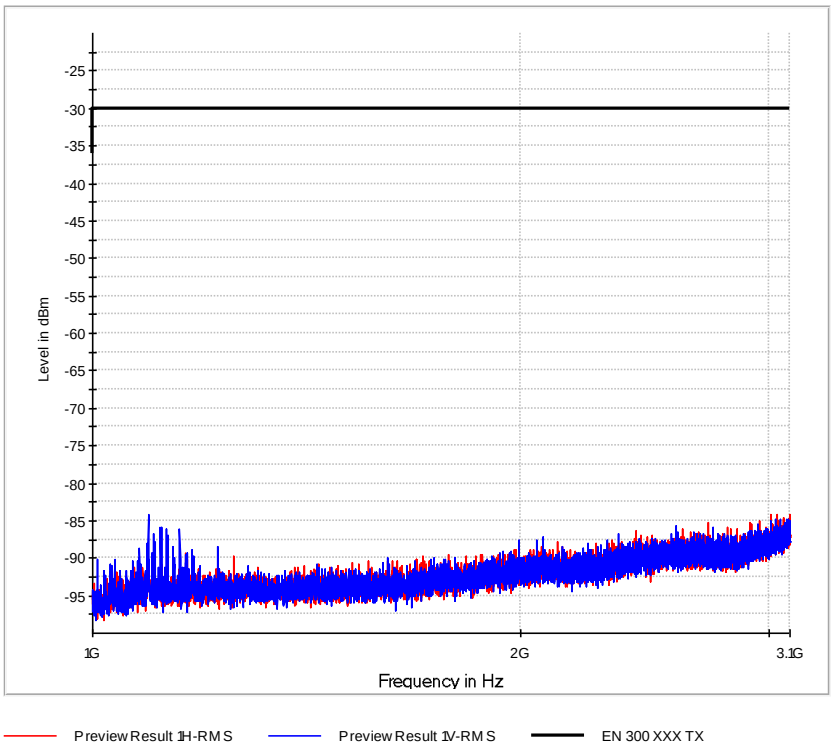
Product Service

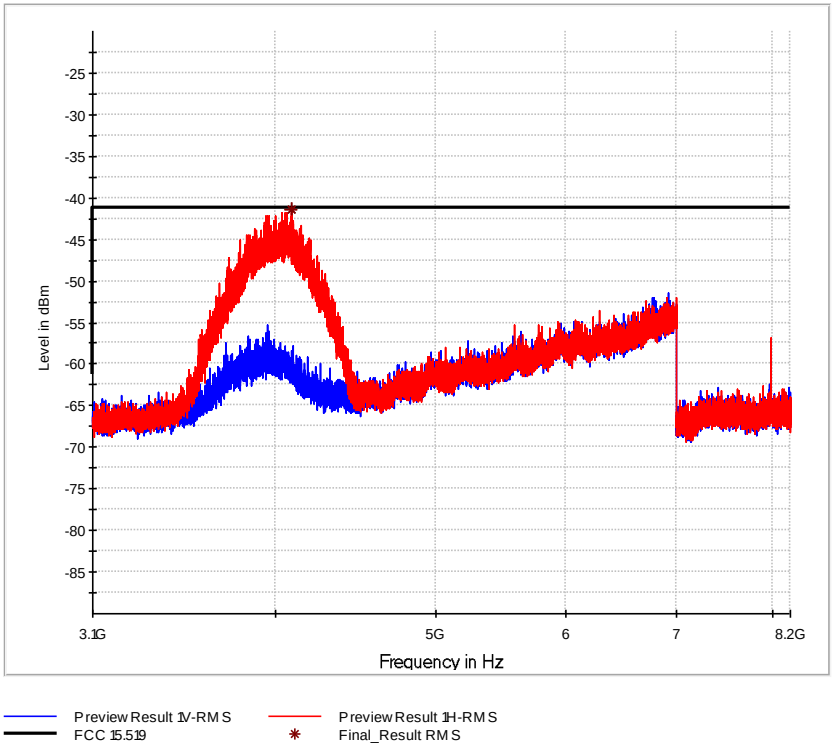
3.orthogonal axis, yz plane - channel 2



Final Results:

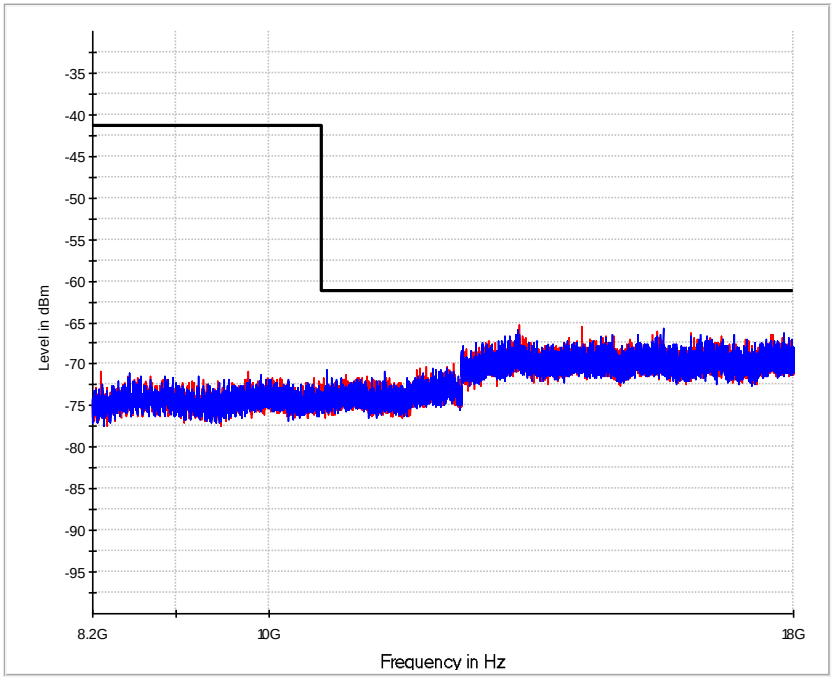
Frequency *MHz*	*QuasiPeak* *dBµV/m*	*Limit* *dBµV/m*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
39.210000	29.90	40.00	10.10	1000.0	120.000	100.0	V	145.0	12.6

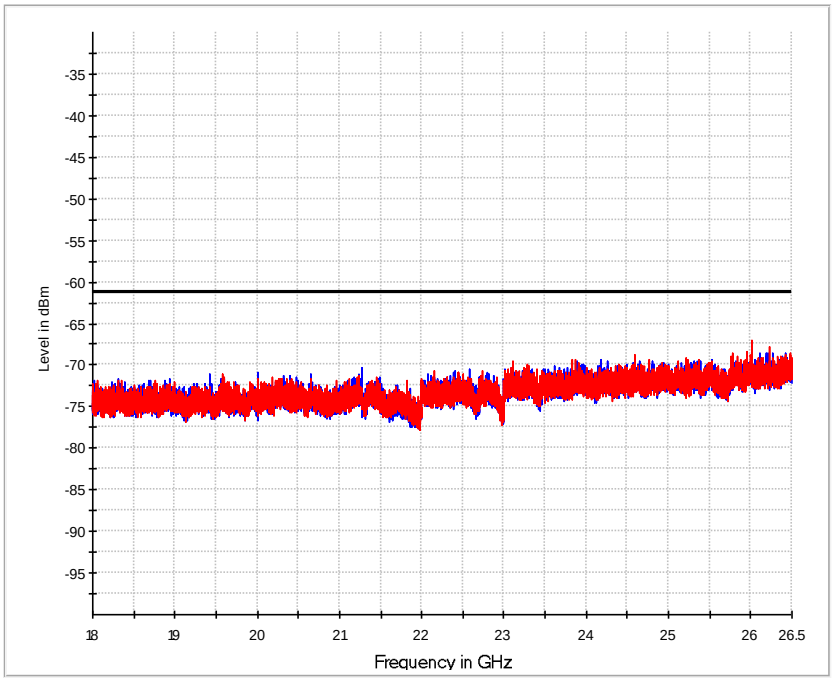

-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
Level in dBm
1G
2G
3.1G
Frequency in Hz
Preview Result 1H-RMS
Preview Result 1V-RMS
EN 300 XXX TX

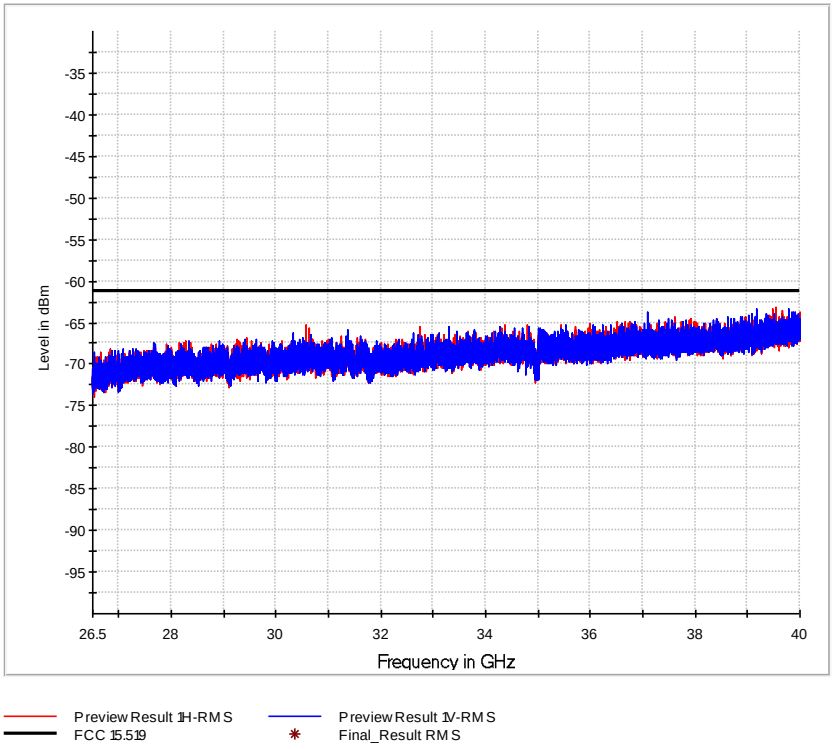


Final Results:

Frequency MHz	*RMS dBm*	*Limit dBm*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Height cm*	*Pol*	*Azimuth deg*	*Corr. dB*
4093.225000	-41.46	-41.30	0.16	5.0	1000.000	150.0	H	102.0	-77.2
4093.225000	-41.46	-41.30	0.16	5.0	1000.000	150.0	H	102.0	-77.2

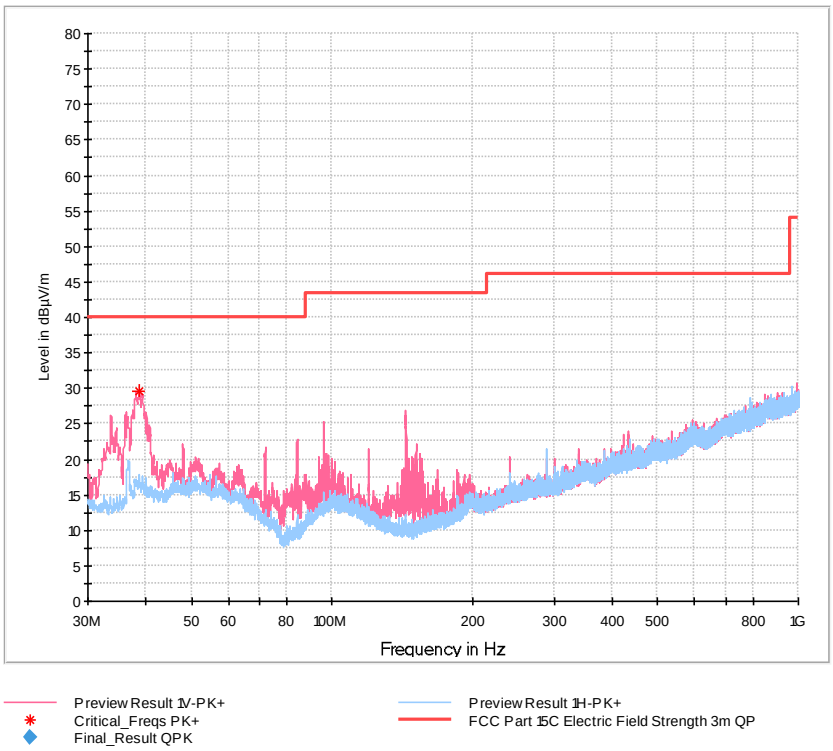

-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
Level in dBm
8.2G
10G
18G
Frequency in Hz
Preview Result 1H-RMS
FCC 15.519
Preview Result 1V-RMS
Final_Result RMS

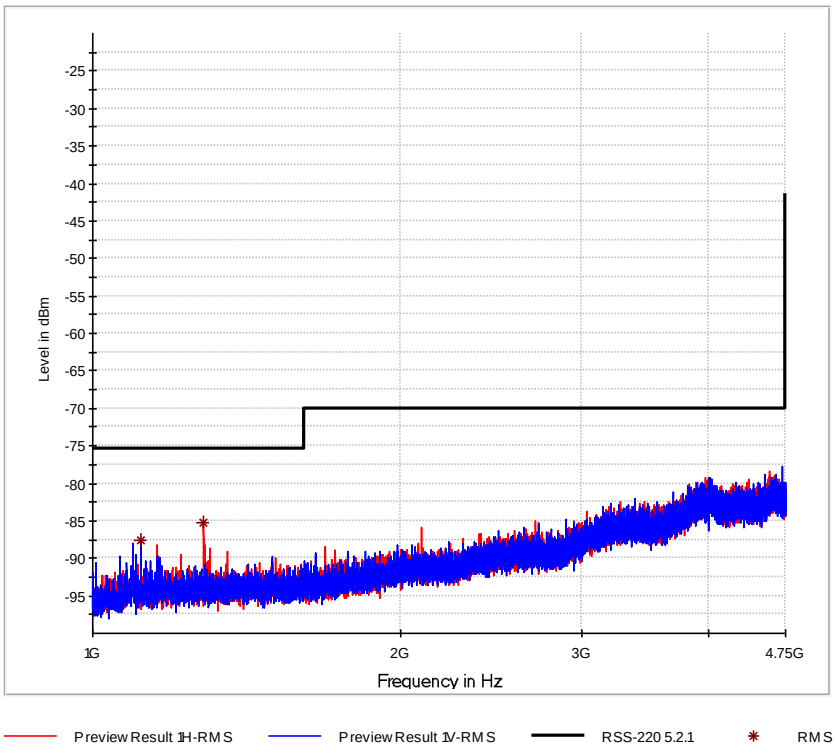

-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
Level in dBm
18
19
20
21
22
23
24
25
26
26.5
Frequency in GHz
Preview Result 1V-RMS
FCC 15.519
Preview Result 1H-RMS
Final_Result RMS


-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
Level in dBm
26.5
28
30
32
34
36
38
40
Frequency in GHz
Preview Result 1H-RMS
FCC 15.519
Preview Result 1V-RMS
Final_Result RMS

Product Service

3.orthogonal axis, yz plane - channel 5

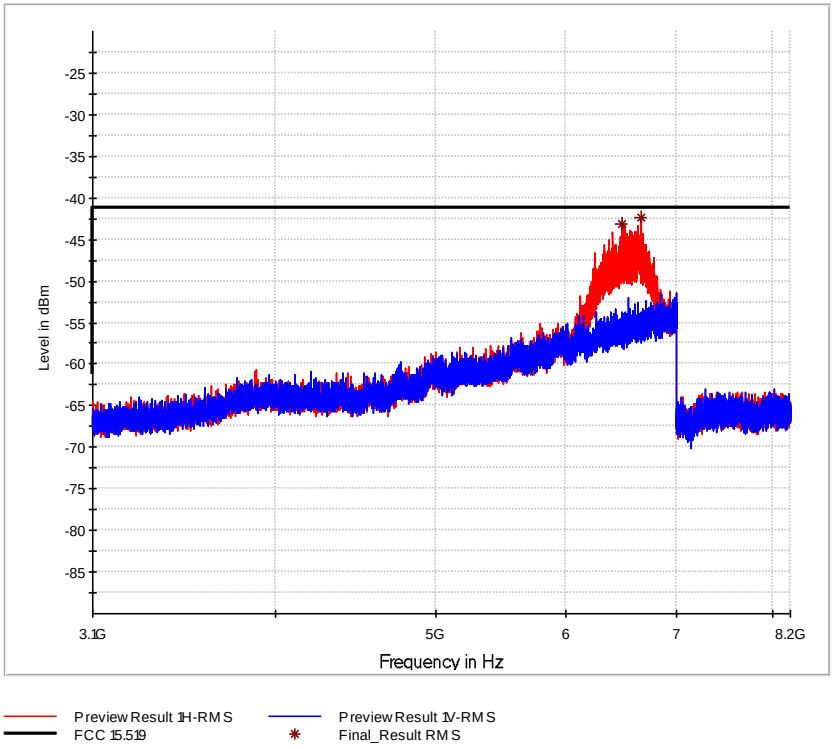




Final Results:

Frequency MHz	*RMS dBm*	*Limit dBm*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Height cm*	*Pol*	*Azimuth deg*	*Corr. dB*
1113.671875	-87.60	-75.30	12.30	2.5	1000.000	150.0	V	66.0	-99.6
1284.531250	-85.27	-75.30	9.97	2.5	1000.000	150.0	H	123.0	-99.0

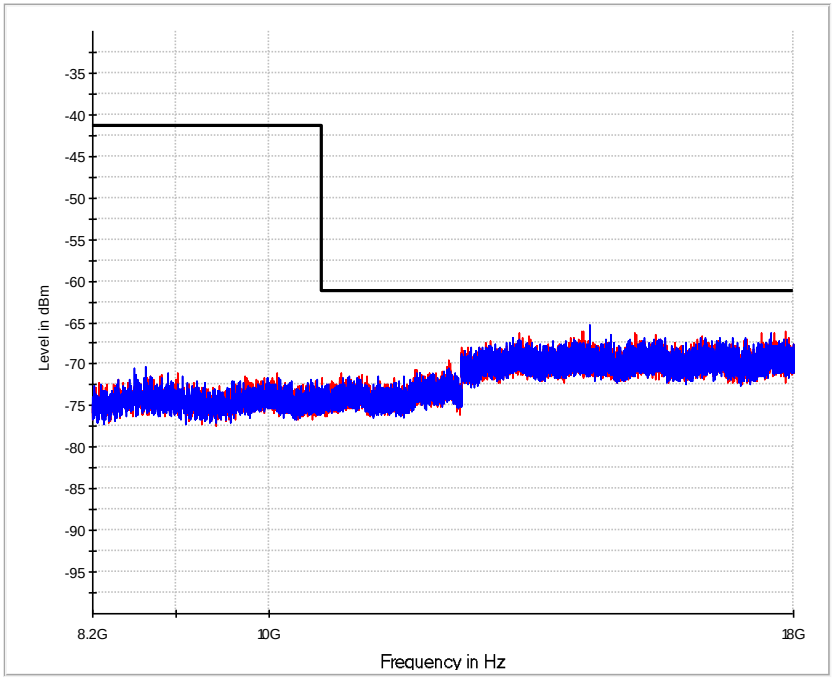
Product Service



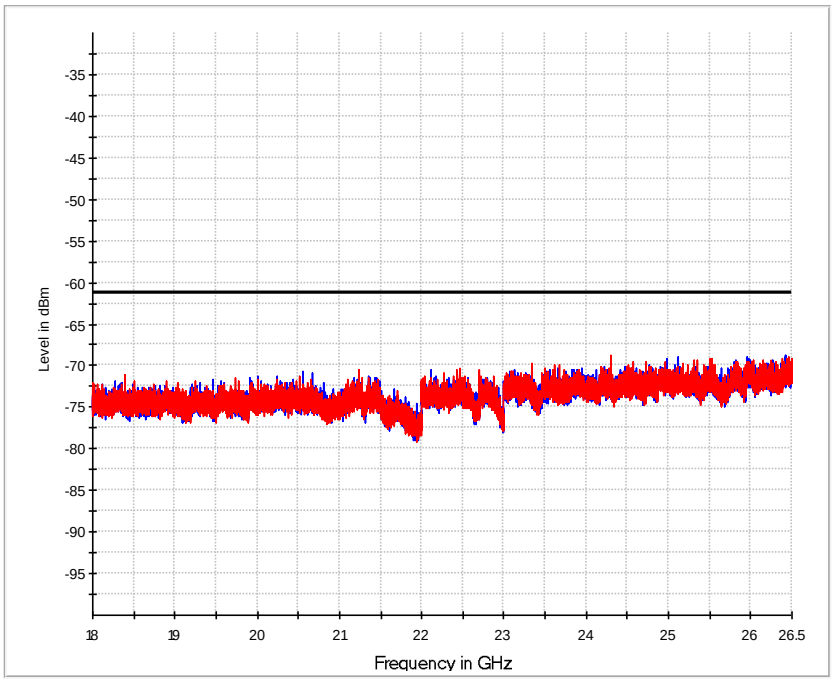
Final Results:

Frequency *MHz*	*RMS* *dBm*	*Limit* *dBm*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
6487.037500	-43.17	-41.30	1.87	5.0	1000.000	150.0	H	52.0	-74.8
6661.393750	-42.43	-41.30	1.13	5.0	1000.000	150.0	H	164.0	-74.1

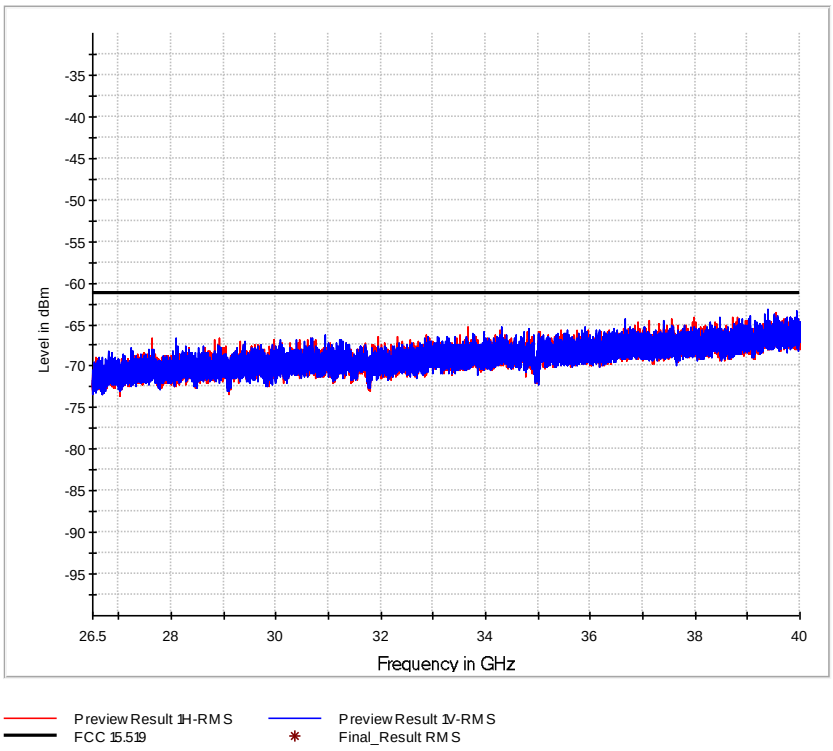
Product Service



Preview Result 1H-RMS
FCC 15.519
Preview Result 1V-RMS
Final_Result RMS



Preview Result 1V-RMS
FCC 15.519
Preview Result 1H-RMS
Final_Result RMS


-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
Level in dBm
26.5
28
30
32
34
36
38
40
Frequency in GHz
Preview Result 1H-RMS
FCC 15.519
Preview Result 1V-RMS
Final_Result RMS

FCC 47 CFR Part 15, Limit Clause 15.209

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

Table 6

FCC 47 CFR Part 15, Limit Clause 15.519 (c)

The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency (MHz)	EIRP (dBm)
960 to 1610	-75.3
1610 to 1990	-53.3
1990 to 3100	-51.3
3100 to 10600	-41.3
Above 10600	-51.3

3.2.7 Test Location and Test Equipment Used

Radiated Tests were carried out in FAR No.11

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2020-02-29
TRILOG Antenna	Schwarzbeck	VULB 9163	19691	24	2020-12-31
Horn Antenna	EMCO	3115	19383	24	2020-02-29
Horn Antenna	EMCO	3160-09	19125	N/A	N/A
Horn Antenna	EMCO	3160-10	19442	N/A	N/A
Semi Anechoic Room	Frankonia	Cabin No. 11	42961	N/A	N/A
EMC measurement software	Rohde & Schwarz	EMC32 Emission K11 - V10.50.10	42986	N/A	N/A

Table 7

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

Product Service

3.3 Radiated Emissions in the GPS Bands

3.3.1 Specification Reference

FCC 47 CFR Part 15F, 15.519 (d)

3.3.2 Equipment Under Test and Modification State

SIMATIC RTLS PCB OEM PULSE, S/N: A56709 - Modification State 0

3.3.3 Date of Test

2019-09-26

3.3.4 Test Method

Test according to FCC title 47 part 15 §15.519 (d) and ANSI C63.10-2013, 10.1

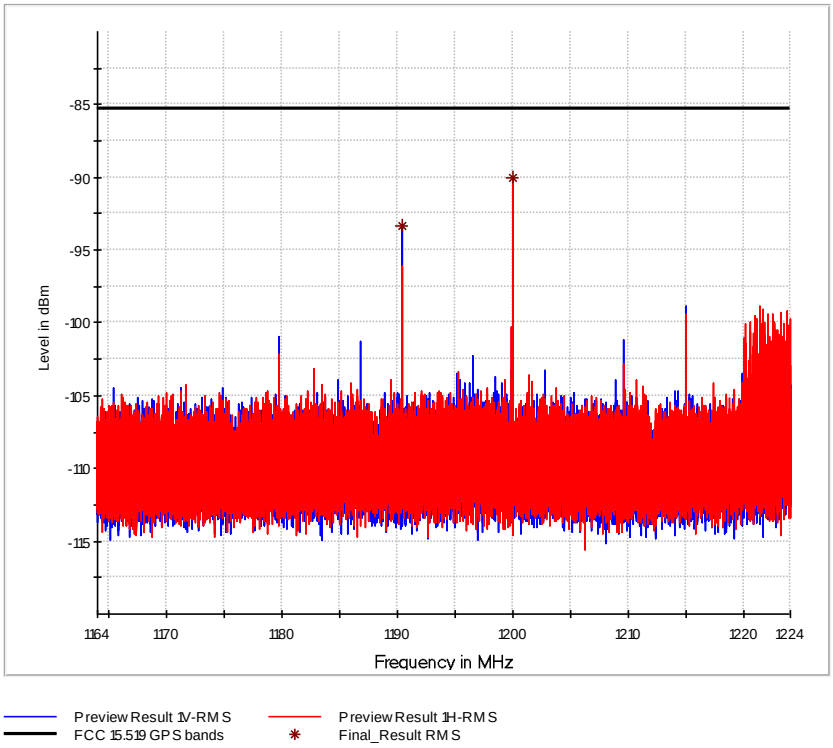
Radiated emissions in the GPS bands were only evaluated in the 1. orthogonal axis (xz plane), The plane with the highest emissions.

3.3.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	53.0 %

3.3.6 Test Results

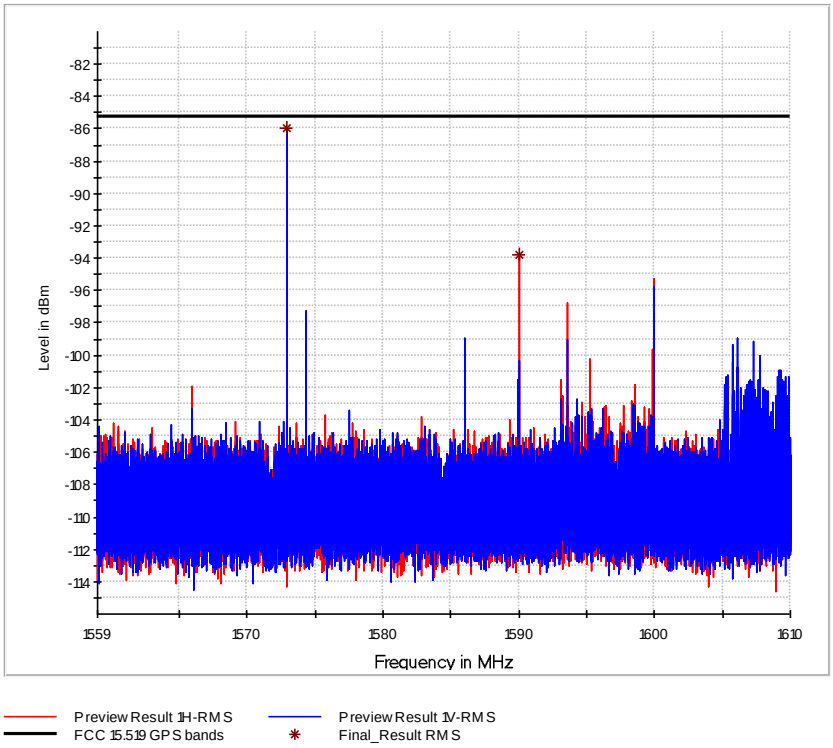
Transmission on Channel 2, GPS band from 1164 MHz to 1240 MHz



Final Results:

Frequency MHz	*RMS dBm*	*Limit dBm*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Height cm*	*Pol*	*Azimuth deg*	*Corr. dB*
1190.399500	-93.35	-85.30	8.05	2.5	1.000	150.0	V	0.0	-84.6
1200.000000	-89.99	-85.30	4.69	2.5	1.000	150.0	H	273.0	-84.5

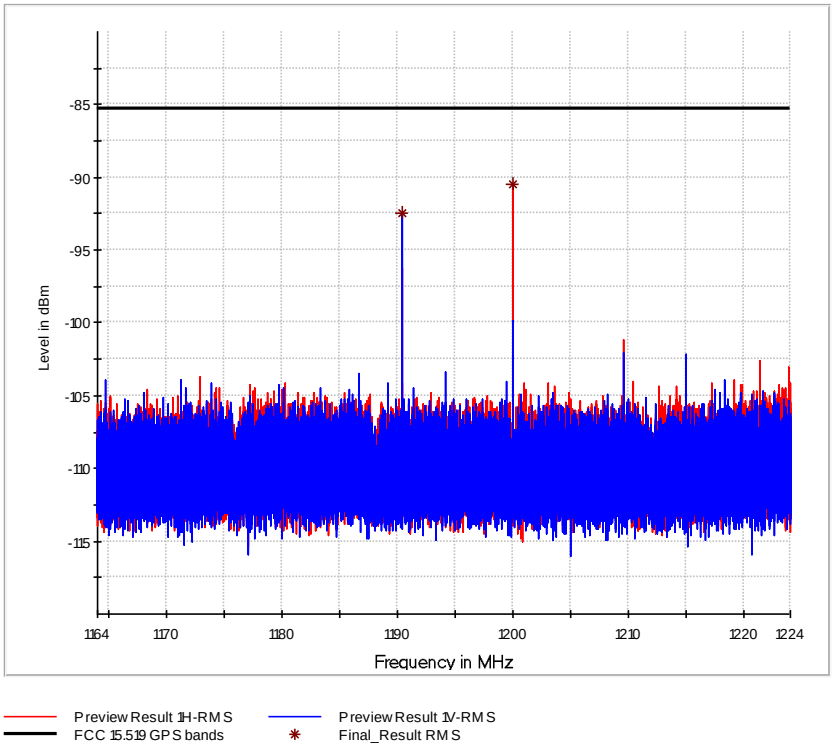
Transmission on Channel 2, GPS band from 1559 MHz to 1610 MHz



Final Results:

Frequency MHz	*RMS dBm*	*Limit dBm*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Height cm*	*Pol*	*Azimuth deg*	*Corr. dB*
1572.876080	-85.94	-85.30	0.64	2.5	1.000	150.0	V	100.0	-84
1590.004430	-93.76	-85.30	8.46	2.5	1.000	150.0	H	326.0	-84

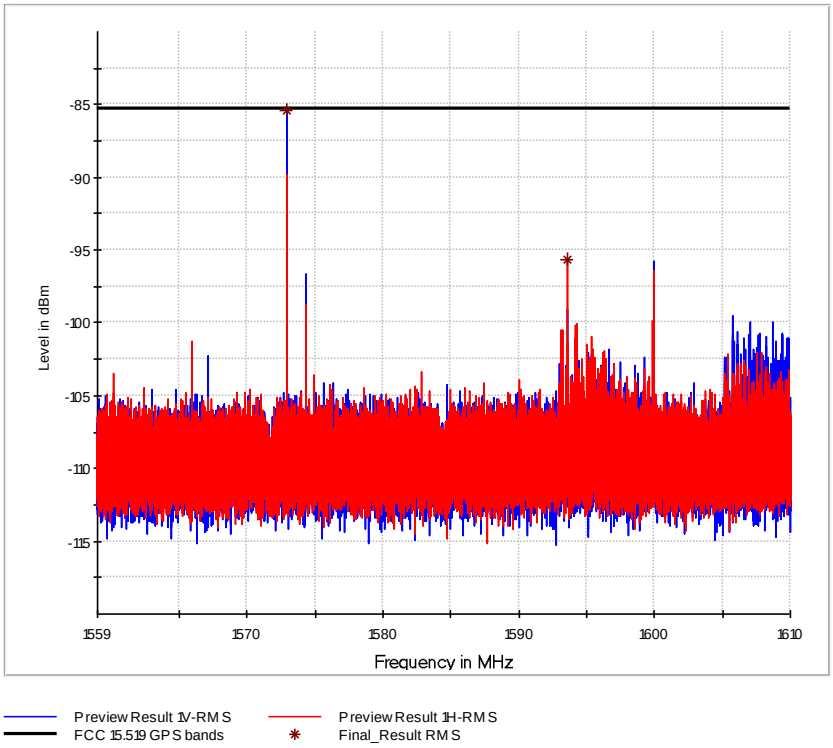
Transmission on Channel 5, GPS band from 1164 MHz to 1240 MHz



Final Results:

Frequency MHz	*RMS dBm*	*Limit dBm*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Height cm*	*Pol*	*Azimuth deg*	*Corr. dB*
1190.399500	-92.49	-85.30	7.19	2.5	1.000	150.0	V	81.0	-85
1200.000000	-90.42	-85.30	5.12	2.5	1.000	150.0	H	0.0	-84

Transmission on Channel 5, GPS band from 1559 MHz to 1610 MHz



Final Results:

Frequency MHz	*RMS dBm*	*Limit dBm*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Height cm*	*Pol*	*Azimuth deg*	*Corr. dB*
1572.876080	-85.39	-85.30	0.09	2.5	1.000	150.0	V	118.0	-84.3
1593.599420	-95.70	-85.30	10.40	2.5	1.000	150.0	H	299.0	-84.3

Product Service

FCC 47 CFR Part 15, Limit Clause 15.519 (d) and ANSI C63.10-2013 10.3

UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency (MHz)	EIRP (dBm)
1164 to 1240	-85.3
1559 to 1610	-85.3

3.3.7 Test Location and Test Equipment Used

Radiated Tests were carried out in FAR No.11

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2020-02-29
Horn Antenna	EMCO	3115	19383	24	2020-02-29
Semi Anechoic Room	Frankonia	Cabin No. 11	42961	N/A	N/A
EMC measurement software	Rohde & Schwarz	EMC32 Emission K11 - 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

Product Service

3.4 Peak Emissions in a 50 MHz Bandwidth

3.4.1 Specification Reference

FCC 47 CFR Part 15F, Clause 15.519 (e)

3.4.2 Equipment Under Test and Modification State

SIMATIC RTLS PCB OEM PULSE, S/N: A56709 - Modification State 0

3.4.3 Date of Test

2019-09-23

3.4.4 Test Method

Test according to FCC title 47 part 15 §15.519 (e) and ANSI C63.10-2013, 10.1

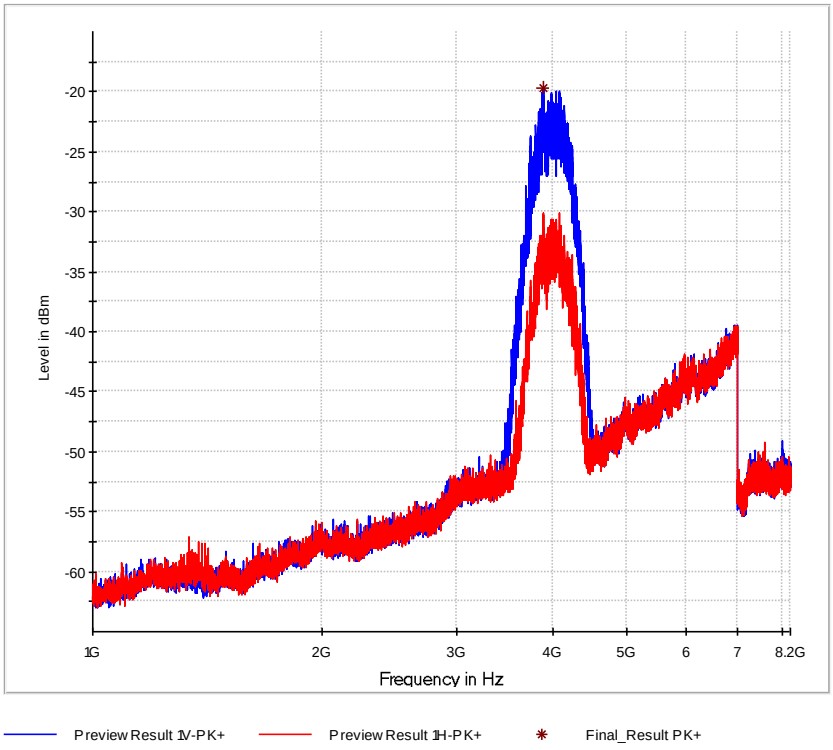
3.4.5 Environmental Conditions

Ambient Temperature	23.0 °C
Relative Humidity	51.0 %

3.4.6 Test Results

Center frequency [GHz]	Frequency with highest emission [GHz]	Maximum value of peak power		Limit [dBm / 50MHz]	Result
		tested [dBm / 10MHz]	*calculated* [dBm / 50MHz]		
Ch 2 [Lowest]	3.89	-19.68	-5.96	< 0	PASS
Ch 5 [Highest]	6.49	-21.36	-7.36	< 0	PASS

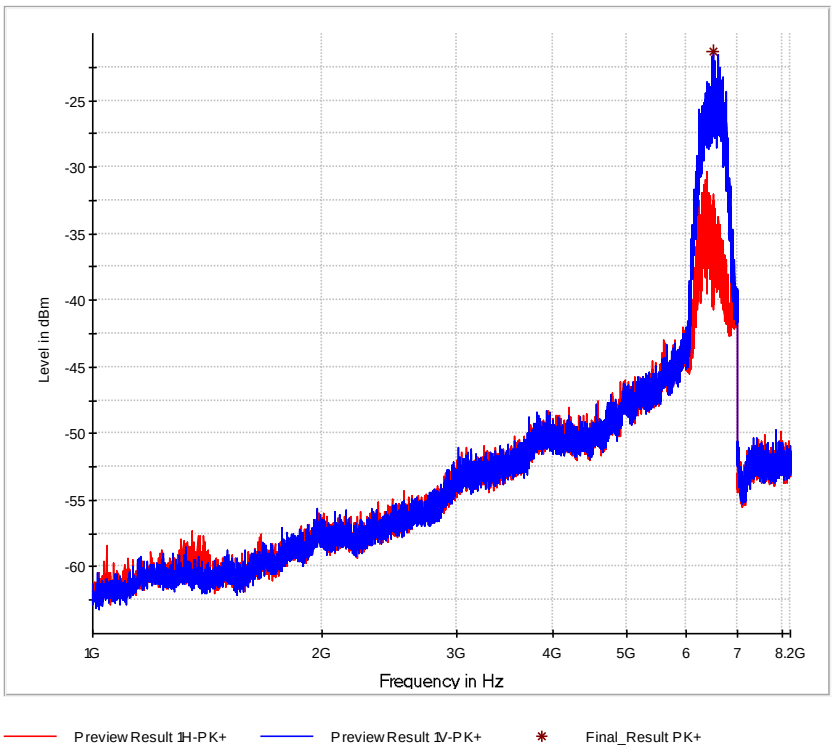
Transmission on Channel 2



Final Results:

Frequency *MHz*	*MaxPeak* *dBm*	*Limit* *dBm*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
3888.100000	-19.68	---	---	5.0	10000.000	150.0	V	79.0	-76.9

Transmission on Channel 5



Final Results

Frequency *MHz*	*MaxPeak* *dBm*	*Limit* *dBm*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
6485.950000	-21.36	---	---	5.0	10000.000	150.0	V	89.0	-74.8

Limit Clause FCC 47 CFR Part 15, 15.519 (e), 15.521 (g)

There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, fM. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in §15.521.

Frequency (MHz)	EIRP (dBm) within 50 MHz
3100 to 10600	0

If a resolution bandwidth other than 50 MHz is employed, the peak EIRP limit shall be 20 log (RBW/50) dBm where RBW is the resolution bandwidth in megahertz that is employed.

Frequency (MHz)	EIRP (dBm) within 10 MHz
3100 to 10600	-14

3.4.7 Test Location and Test Equipment Used

Radiated Tests were carried out in FAR No.11

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2020-02-29
Horn Antenna	EMCO	3115	19383	36	2020-02-29
Semi Anechoic Room	Frankonia	Cabin No. 11	42961	N/A	N/A
EMC measurement software	Rohde & Schwarz	EMC32 Emission K11 - V10.50.10	42986	N/A	N/A

Table 9

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

Product Service

3.5 AC Power Line Conducted Emissions

3.5.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.207

3.5.2 Equipment Under Test and Modification State

SIMATIC RTLS PCB OEM PULSE, S/N: A56709 - Modification State 0

3.5.3 Date of Test

2019-09-23

3.5.4 Test Method

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

3.5.5 Environmental Conditions

Ambient Temperature	24.0 °C
Relative Humidity	56.0 %

Product Service

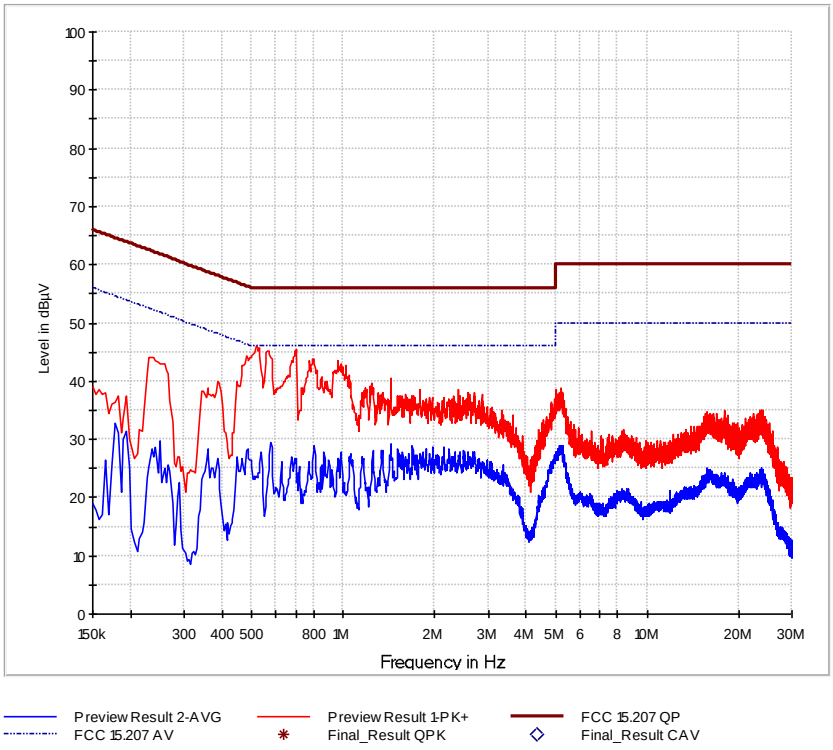
3.5.6 Test Results

Results for Configuration and Mode: no transmission - Normal operation mode by serial USB adapter.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Line Under Test: AC mains Live and Neutral



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 10

*Decreases with the logarithm of the frequency.

3.5.7 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	2020-11-31
V-network	Rohde & Schwarz	ENV216	39911	12	2020-02-29
EMC measurement software	Rohde & Schwarz	EMC32 Emission K4 - V10.60.00	44317	N/A	N/A

Table 11

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

Product Service

3.6 Signal deactivation

3.6.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.519 (a)

3.6.2 Equipment Under Test and Modification State

SIMATIC RTLS PCB OEM PULSE, S/N: A56709 - Modification State 0

3.6.3 Date of Test

2020-02-13

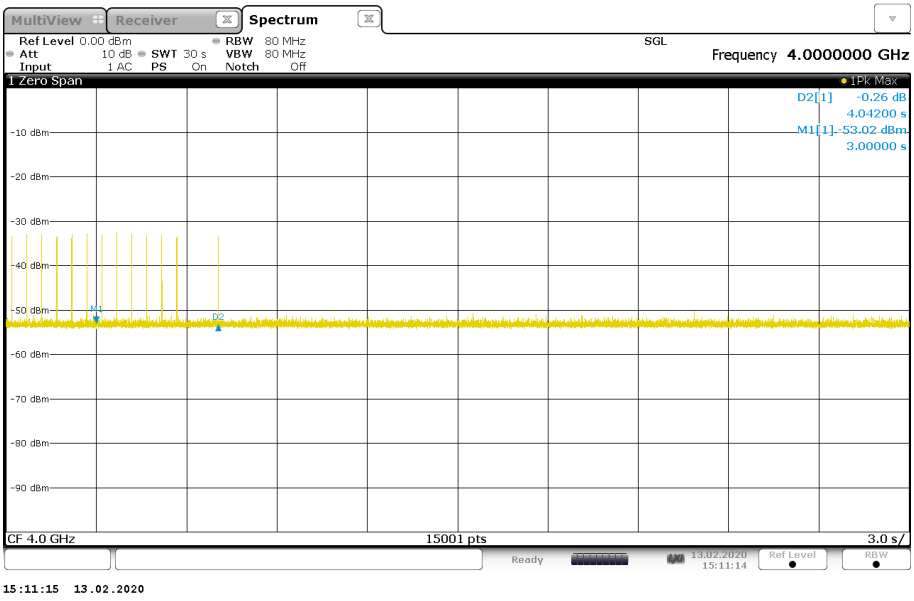
3.6.4 Test Method

3.6.5 Environmental Conditions

Ambient Temperature	23.0 °C
Relative Humidity	50.0 %

3.6.6 Test Results

Product Service



Description:

Associated receiver (Wireless Mesh Gateway) was turned off at 3 seconds (Marker 1)
Device under test, SIMATIC RTLS PCB OEM PULSE, stopped transmission after 4.042 seconds (Marker 2).

Result:

The requirement is fulfilled.

Product Service

FCC 47 CFR Part 15, Limit Clause 15.519 (a)

A UWB device operating under the provisions of this section shall transmit only when it is sending information to an associated receiver. The UWB intentional radiator shall cease transmission within 10 seconds 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 intentional radiator at least every 10 seconds or the UWB device must cease transmitting.

3.6.7 Test Location and Test Equipment Used

Radiated Tests were carried out in FAR No.11

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2020-02-29
Horn Antenna	EMCO	3115	19383	36	2020-02-29
Semi Anechoic Room	Frankonia	Cabin No. 11	42961	N/A	N/A
EMC measurement software	Rohde & Schwarz	EMC32 Emission K11 - V10.50.10	42986	N/A	N/A

Table 12

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

Product Service

4 Photographs

See Annex A.

Product Service

5 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	±1.14 %	2
RF-Frequency error	1.96	±1 · 10-7	7
RF-Power, conducted carrier	2	±0.079 dB	2
RF-Power uncertainty for given BER	1.96	+0.94 dB / -1.05	7
RF power, conducted, spurious emissions	1.96	+1.4 dB / -1.6 dB	7
RF power, radiated			
25 MHz – 4 GHz	1.96	+3.6 dB / -5.2 dB	8
1 GHz – 18 GHz	1.96	+3.8 dB / -5.6 dB	8
18 GHz – 26.5 GHz	1.96	+3.4 dB / -4.5 dB	8
40 GHz – 170 GHz	1.96	+4.2 dB / -7.1 dB	8
Spectral Power Density, conducted	2.0	±0.53 dB	2
Maximum frequency deviation			
300 Hz – 6 kHz	2	±2,89 %	2
6 kHz – 25 kHz	2	±0.2 dB	2
Maximum frequency deviation for FM	2	±2,89 %	2
Adjacent channel power 25 MHz – 1 GHz	2	±2.31 %	2
Temperature	2	±0.39 K	4
(Relative) Humidity	2	±2.28 %	2
DC- and low frequency AC voltage			
DC voltage	2	±0.01 %	2
AC voltage up to 1 kHz	2	±1.2 %	2
Time	2	±0.6 %	2

Table 13

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 14

Product Service

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		a	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 15

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 kp = 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 kp = 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 kp = 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 kp = 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 kp = 2, providing a level of confidence of p = 95.45%
Note 7:
The expanded uncertainty reported according ETSI TR 100 028 V1.4.1 (all parts) to is based on a standard uncertainty multiplied by a coverage factor of kp = 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 kp = 1.96, providing a level of confidence of p = 95.45%