Report on the FCC and IC Testing of the Siemens Aktiengesellschaft Model: SIMATIC RTLS4083T In accordance with FCC 47 CFR Part 15 C and ISED RSS-247 and ISED RSS-GEN

Product Service

Add value.
Inspire trust.

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

FCC ID: SCF4083T02
IC: 267X-4083T02

COMMERCIAL-IN-CONFIDENCE

Date: 2021-06-18
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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	M. Steindl	2021-06-18	Steindl Martin SIGN-ID 521816
Authorised Signatory	M. Stumpe	2021-06-18	Stumpe SIGN-ID 521952

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

Engineering Statement:

This measurement shown in this report were made in accordance with the procedures described on test pages.
All reporded testing was carried out on a sample equipment to demonstrate limited compilance with with FCC 47 CFR Part 15 C and ISED RSS-247 and RSS-GEN.
The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	M. Steindl	2021-06-18	Steindl Martin SIGN-ID 521819

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

Executive Statement:

A sample of this product was tested and found to be compilant with FCC 47 CFR Part 15 C:2020 and ISED RSS-247:2017 and RSS-GEN:2021

ACCREDITATION

Our BNetzA Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our BNetzA Accreditation. Results of tests not covered by our BNetzA Accreditation Schedule are marked NBA (Not BNetzA Accredited).

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Product Service

Content

Product Service

1 Report Summary

1.1 Modification Report

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

Issue	*Description of changes*	*Date of Issue*
1	First Issue	2021-04-21
2	Replaced results for conducted tests. Changed abbreviation AG to Aktiengesellschaft Added Machine-Readable Product-Designator (MLFB) and hardware- and software-versions.	2021-05-11
3	Updated Technical Description in section 1.4.1	2021-06-18

Table 1: Report of Modifications

1.2 Introduction

Applicant	Siemens Aktiengesellschaft
Manufacturer	Siemens Aktiengesellschaft
Model Number(s)	SIMATIC RTLS4083T
MLFB, FCC version	6GT2700-5DC13
MLFB, ISED version	6GT2700-5DC33
Serial Number(s)	
Hardware Version(s)	0615 FS:02
Software Version(s)	2.1.10
Number of Samples Tested	2
Test Specification(s) /	FCC 47 CFR Part 15 C : 2021
Issue / Date	ISED RSS-247, Issue 2 : 2017
	ISED RSS-GEN, Issue 5, Amendment 1: 2019, Amendment 2: 2021
Test Plan/Issue/Date	---
Order Number	9705983967
Date	2020-10-30
Date of Receipt of EUT	2020-11-19
Start of Test	
Finish of Test	
Name of Engineer(s)	M. Steindl
Related Document(s)	ANSI C63.10: 2013
	FCC 47 CFR Part 2 J : 2019
	KDB 558074 D01 V05R02
	ISED RSS-102, Issue 5, 2015

Product Service

1.3 Brief Summary of Results

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

Section	*Specification Clause*	*Test Description*	*Result*
Transmitting continuously			
---	15.203, 15.247(b)	Antenna requirement	Integrated antennas
2.1	15.247(a)(2)	Emission Bandwidth	Pass
2.2	15.247(b)(3)	Output Power	Pass
2.3	15.247(e)	Power Spectral Density	Pass
2.4	15.247(d)	Frequency Band Edge	Pass
2.5	15.247(d), 15.205, 15.209	Spurious Emissions	Pass
---	15.207	Conducted Emissions on Mains Terminals	Not applicable, battery supply
2.7	15.247(i)	RF Exposure	Pass

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

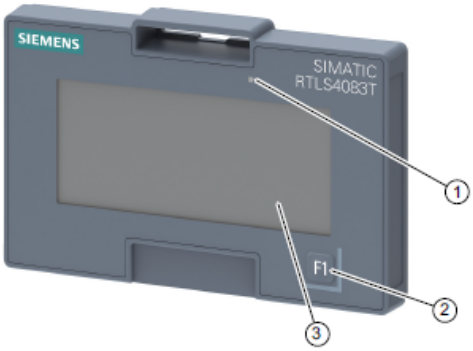
Section	*Specification Clause*	*Test Description*	*Result*
Transmitting continuously			
2.1	5.2 a.	Emission Bandwidth	Pass
2.2	5.4 d.	Output Power	Pass
2.3	5.2 b.	Power Spectral Density	Pass
2.4	5.5	Frequency Band Edge	Pass
2.5	5.5	Spurious Emissions	Pass

Table 3: Results according to ISED RSS-247

Section	*Specification Clause*	*Test Description*	*Result*
Transmitting continuously			
2.1	6.7	Emission Bandwidth	Pass
2.5	8.9, 8.10	Spurious Emissions	Pass
2.6	8.11	Frequency Stability	Pass
---	8.8	Conducted Emissions on Mains Terminals	Not applicable, battery supply
2.7	3.4	RF Exposure	Pass

Table 4: Results according to RSS-Gen

1.4 Product Information

SIMATIC RTLS4083T	Characteristics	
	Design	① Status indicators (LED) ② F1 function key ③ display
	General	The transponder is a mobile device for localization in the RTLS locaing system. It sends data to gateways to determine its position. The gateways transmit the data to the Locating Manager Server. Information can be transmitted to the transponder via a programming interface on the Locating Manager and shown on the display.
	Area of application	The device is designed for an operating temperature of 0 ... +50 °C. If you only need localization without change of the display information, the lower temperature limit can be lowered to -10 °C. The device is protected from water spray on all sides (IP54).

1.4.1 Technical Description

Product name	SIMATIC RTLS4083T
PULSE radio frequencies (localization)	
Wireless method	IEEE 802.15.4-2015 HRP UWB
Transmission speed	850 Kbps
Operating frequency rated value	3993.6 MHz (UWB channel 2; CE, FCC) 6489.6 MHz (UWB channel 5; CE, IC, CMIIT)
Bandwidth	499.2 MHz
Frequency range	3100 MHz ... 4800 MHz (CE, FCC) 6000 MHz ... 7000 MHz (CE, IC, CMIIT)
Transmit power	0.037 mW (-41.3 dBm/MHz)
Range	Maximum 30 m
Accuracy of the localization	0.2 m
Antennas	Built-in UWB antenna

Product Service

PHASE radio frequencies (communication and optional localization)	
Wireless method	IEEE 802.15.4
Transmission speed	1 Mbit/s
Operating frequency rated value	2400 ... 2480 MHz ISM band
Bandwidth	2 MHz; data transmission on 802.15.4; channels configurable
Frequency range	2400 MHz ... 2483.5 MHz
Transmit power	Maximum 2.5 mW (configurable)
Range	Maximum 50 m
Accuracy of the localization	1 m
Antennas	Built-in 2.4 GHz antenna

Supply voltage, power consumption	
Supply voltage	3.7 V lithium ion rechargeable battery (1900 mAh)
Service life (at 20 °C)	Standby: 1 year Operation: 100% UWB localization at 1 second: 6 months Display updates every 10 seconds without localization: 25 days

Ambient temperature	
• During operation	• -10 ... +50 °C
• During storage	• -10 ... +50 °C
• During transport	• -10 ... +50 °C
• During display operation	• 0 ... +40 °C
• During charging	• +10 ... +40 °C

Design, dimensions, weights and connectors	
Dimensions (L x W x H)	95 x 62 x 13 mm
Weight	85 g
Degree of protection	IP54
Method of securing	Mounting clips
Enclosure	Plastic housing
Color	Titanium gray

Product Service

1.5 Test Configuration

The test was performed with the EUT in stand alone mode. Radiated emissions were performed in three orthogonal axes.

1.6 Modes of Operation

The EUT was operated to transmit on lowest (channel 11, 2405 MHz), highest (channel 26, 2480 MHz) and a middle (channel 18, 2440 MHz) with normal test modulation.

1.7 Deviations from Standard

No deviations from standard.

1.8 EUT Modifications Record

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

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

Table 5

Product Service

1.9 Test Location

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

Test Name	*Name of Engineer(s)*
Emission bandwidth	M. Steindl
Output Power	M. Steindl
Power Spectral Density	M. Steindl
Frequency Band Edge	M. Steindl
Spurious Emissions	M. Steindl
Frequency Stability	M. Steindl
RF Exposure	M. Steindl

Office Address:
Äußere Frühlingstraße 45
94315 Straubing
Germany

Product Service

2 Test Details

2.1 Emission Bandwidth

2.1.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.247(a)(2)
ISED RSS-247, Clause 5.2 a.
ISED RSS-Gen, Clause 6.7

2.1.2 Equipment under Test and Modification State

SIMATIC RTLS4083T; S/N A50499; Modification state 0

2.1.3 Date of Test

2021-04-28

2.1.4 Environmental Conditions

Ambient Temperature	22 °C
Relative Humidity	27 %

2.1.5 Specification Limits

For systems using digital modulation techniques, operating in the 902 MHz – 928 MHz, 2400 MHz – 2483.5 MHz and/or 5725 MHz – 5850 MHz bands, the minimum 6 dB bandwidth shall be at least 500 kHz

ISED RSS-GEN:
The occupied (99 %) bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSS.

2.1.6 Test Method

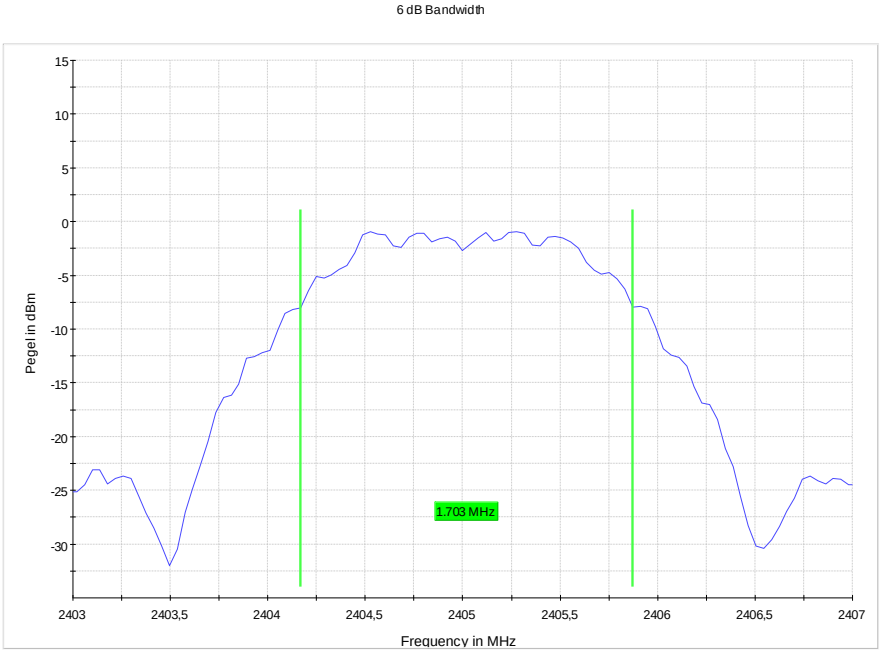
The test was performed according to ANSI C63.10, clauses 6.9.3 and 11.8.1

Product Service

2.1.7 Test Results

Frequency Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2405	1.70297	0.500	2404.168317	2405.871287
2440	1.70297	0.500	2439.168317	2440.871287
2480	1.70297	0.500	2479.168317	2480.871287

Table 6: 6 dB bandwidth



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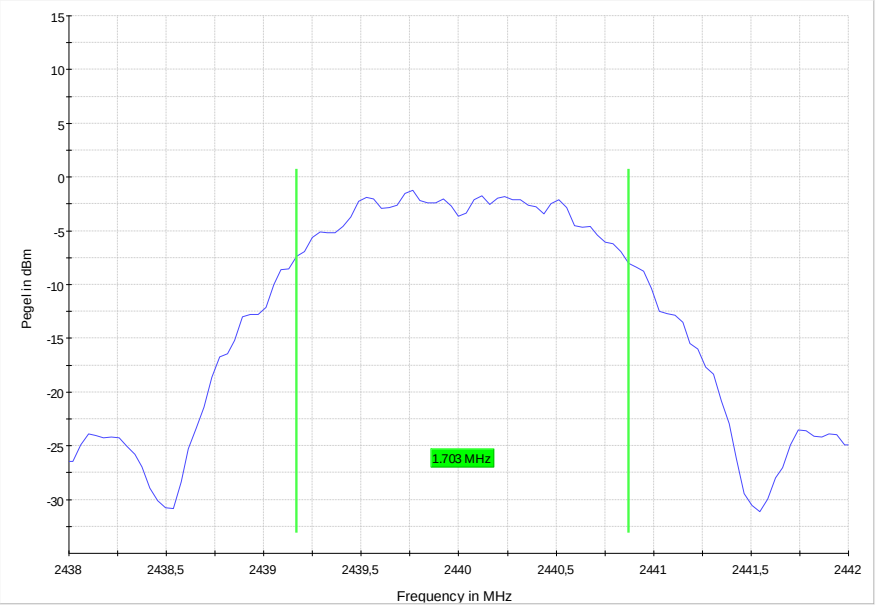
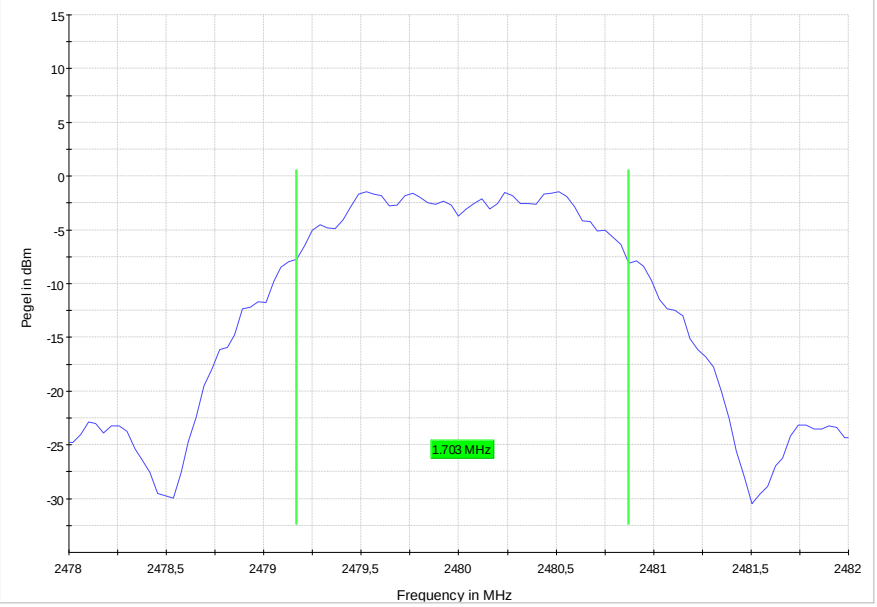
6 dB Bandwidth

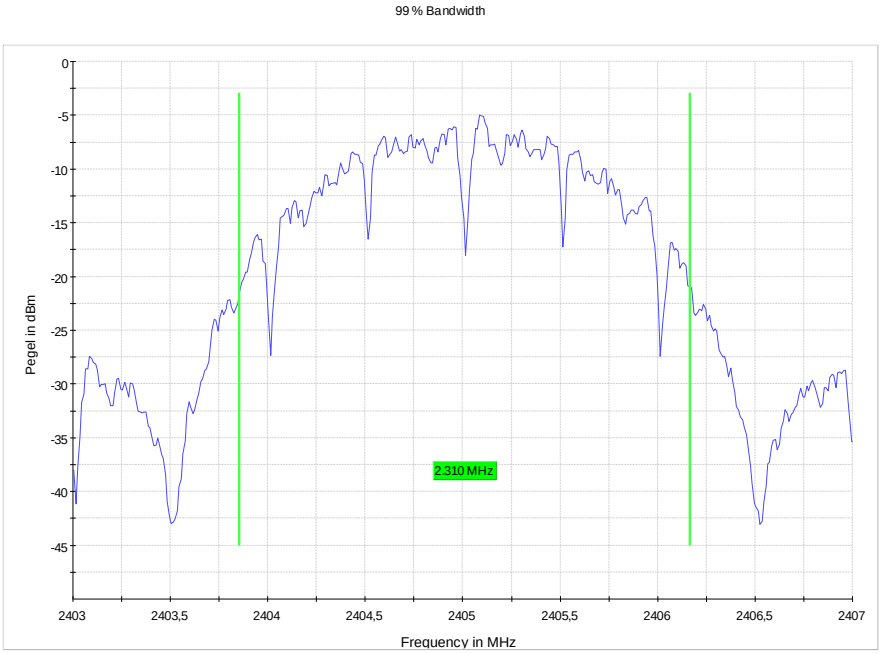


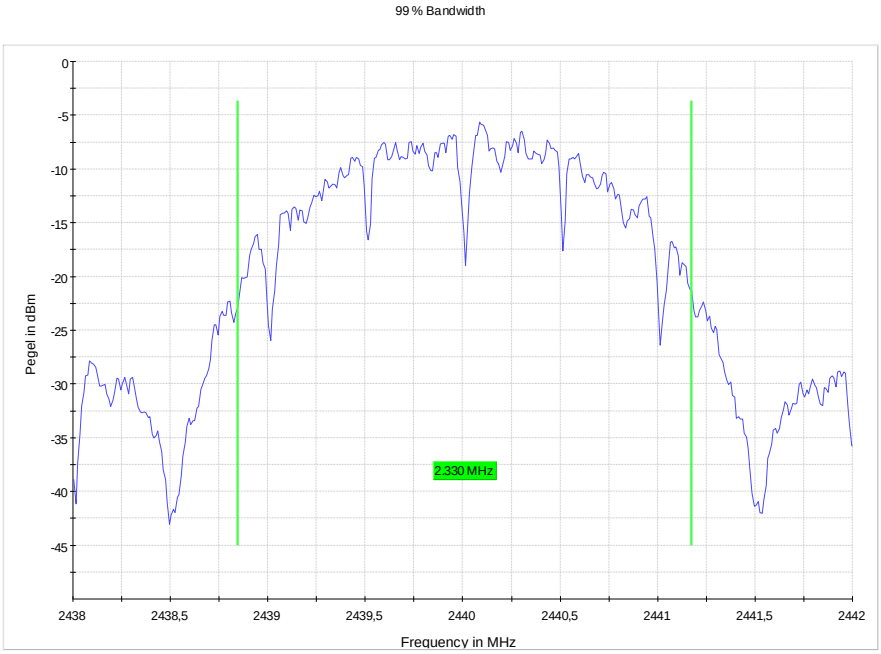
6 dB Bandwidth



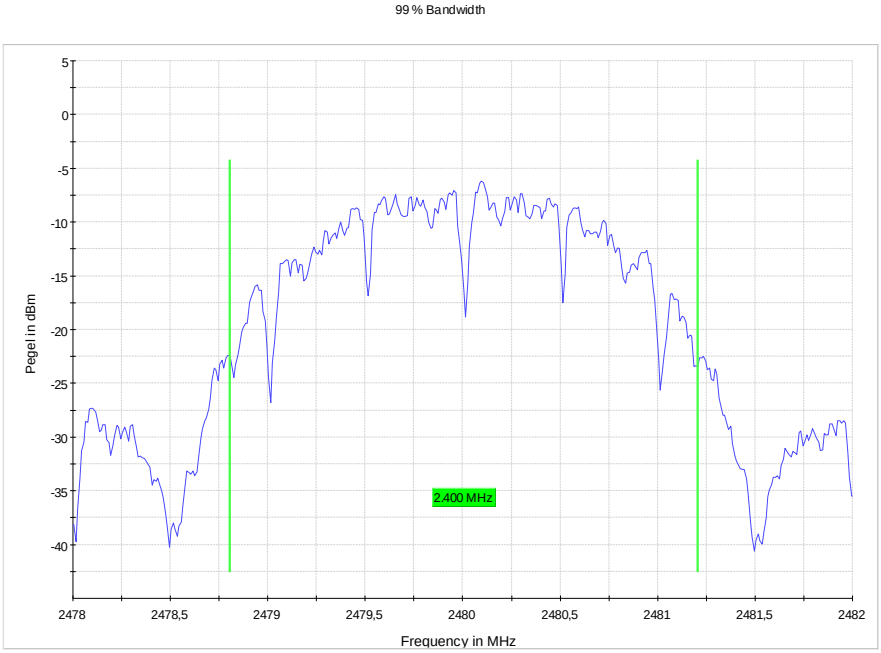
Frequency Channel	99% Bandwidth (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2405	2.310	2403.885	2406.165
2440	2.330	2438.845	2441.175
2480	2.400	2478.805	2481.205

Table 7: 99% bandwidth





Product Service



2.1.8 Test Location and Test Equipment

The test was carried out in radio test lab

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSV40	20219	24	2022-01-31
EMC measurement software	Rohde & Schwarz	EMC32 V10.50.00	44381	N/A	

Table 8

Product Service

2.2 Output Power

2.2.1 Specification Reference

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

2.2.2 Equipment under Test and Modification State

SIMATIC RTLS4083T; S/N A50499; Modification state 0

2.2.3 Date of Test

2021-04-28

2.2.4 Environmental Conditions

Ambient Temperature	22 °C
Relative Humidity	27 %

2.2.5 Specification Limits

The maximum conducted output power shall not exceed 1 W (30 dBm).

2.2.6 Test Method

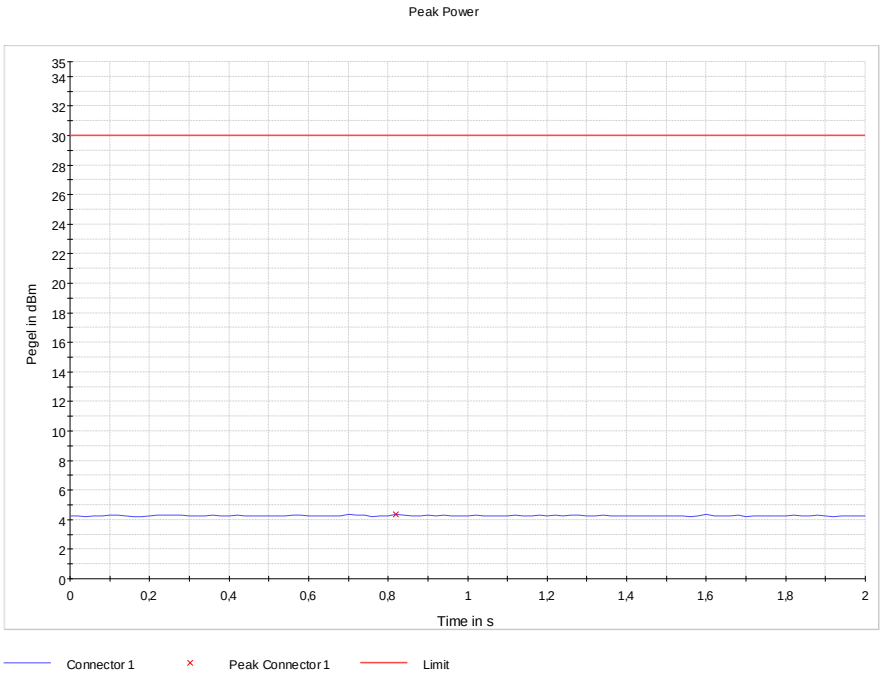
The test was performed according to ANSI C63.10, section 11.9

Product Service

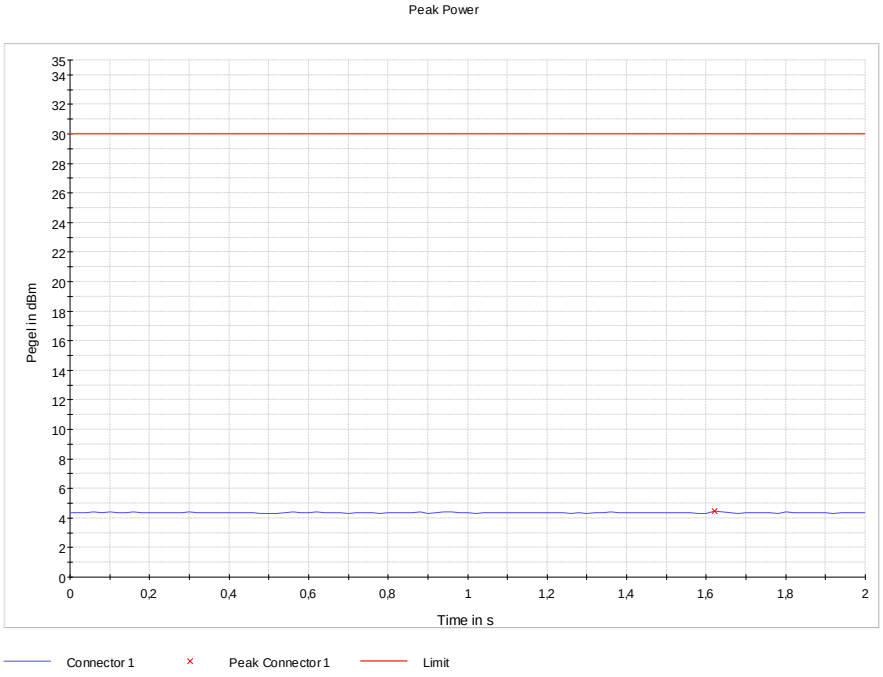
2.2.7 Test Results

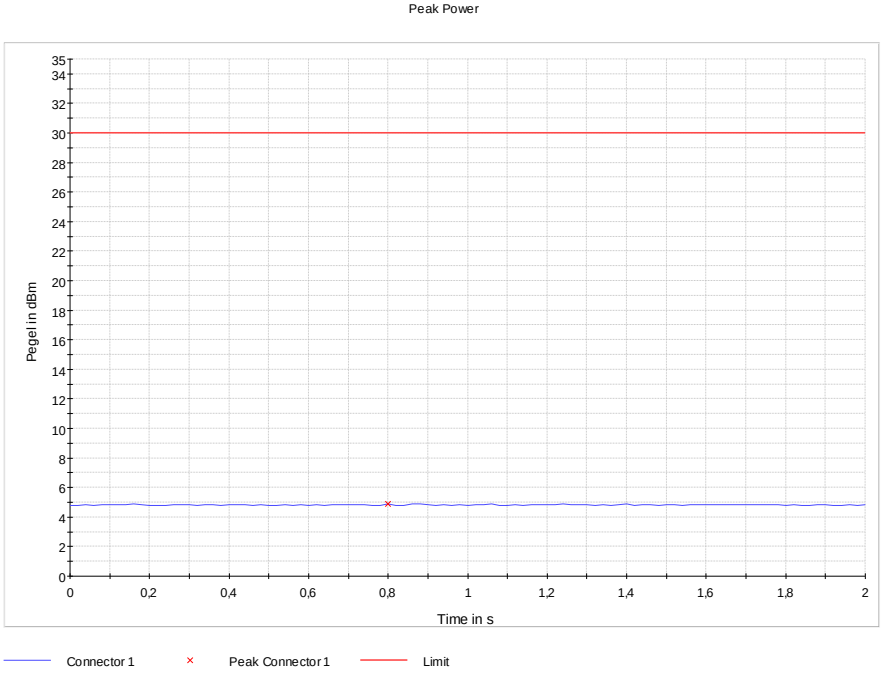
Frequency Channel	*Detector*	*Conducted Output Power (dBm)*	*Limit (dBm)*
2405	PK	4.9	30.0
2440	PK	4.5	30.0
2480	PK	4.4	30.0

Table 9: Conducted Output Power



Product Service





Product Service

2.2.8 Test Location and Test Equipment

The test was carried out in radio test lab

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSV40	20219	24	2022-01-31
EMC measurement software	Rohde & Schwarz	EMC32 V10.50.00	44381	N/A	

Table 10

Product Service

2.3 Power Spectral Density

2.3.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.247(e)
ISED RSS-247, Clause 5.2 b.

2.3.2 Equipment under Test and Modification State

SIMATIC RTLS4083T; S/N A50499; Modification state 0

2.3.3 Date of Test

2021-04-28

2.3.4 Environmental Conditions

Ambient Temperature	22 °C
Relative Humidity	27 %

2.3.5 Specification Limits

FCC 47 CFR, section 15.257(e)
ISED RSS-247, Clause 5.2.(b)
The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
The same method (detector) of determining the conducted output power shall be used to determine the power spectral density.

2.3.6 Test Method

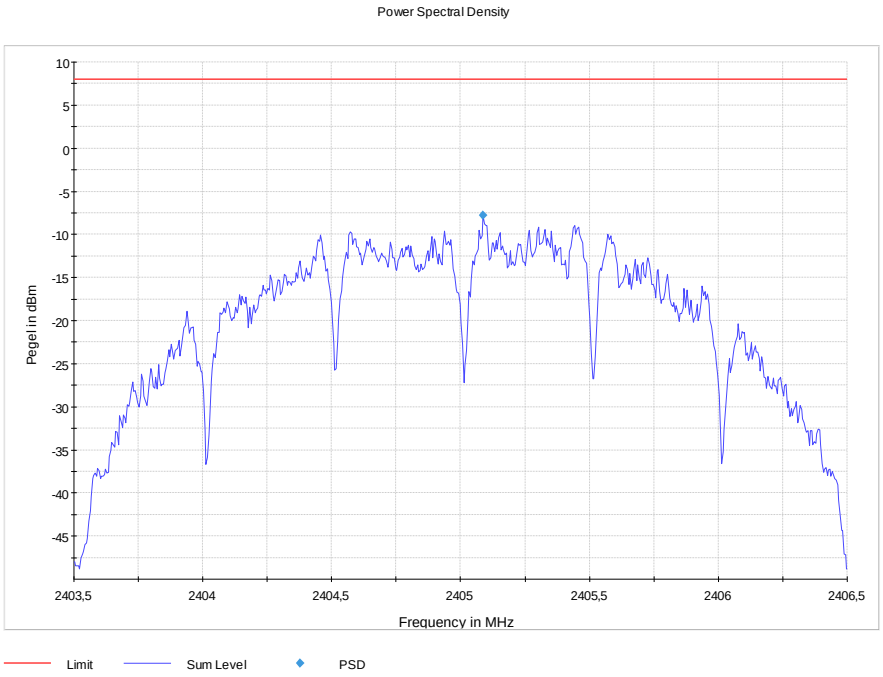
The test was performed according to ANSI C63.10, section 11.10

Product Service

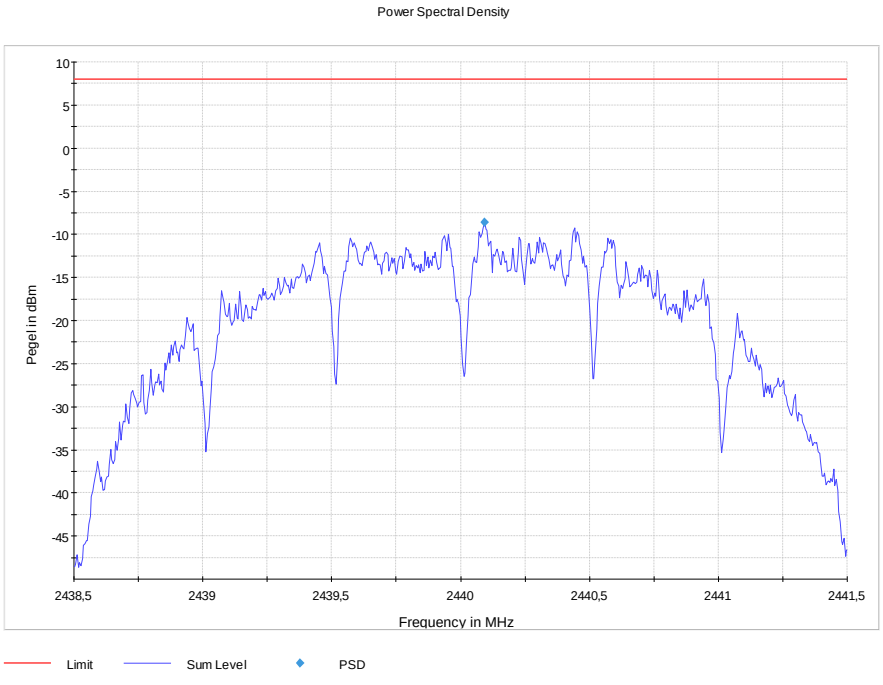
2.3.7 Test Results

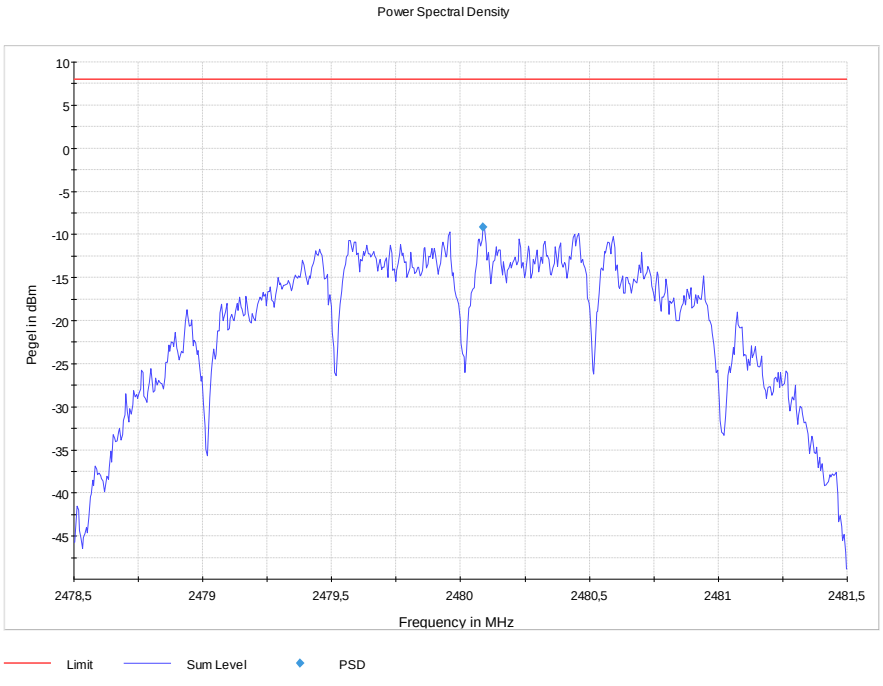
Frequency Channel	Detector	Spectral Power Density (dBm)	Limit (dBm)
2405	PK	-6.893	8.0
2440	PK	-7.538	8.0
2480	PK	-8.228	8.0

Table 11: Spectral Power Density



Product Service





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2.3.8 Test Location and Test Equipment

The test was carried out in radio test lab

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSV40	20219	24	2022-01-31
EMC measurement software	Rohde & Schwarz	EMC32 V10.50.00	44381	N/A	

Table 12

Product Service

2.4 Frequency Band Edge

2.4.1 Specification Reference

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

2.4.2 Equipment under Test and Modification State

SIMATIC RTLS4083T; S/N A50499; Modification state 0

2.4.3 Date of Test

2021-04-28

2.4.4 Environmental Conditions

Ambient Temperature	22 °C
Relative Humidity	27 %

2.4.5 Specification Limits

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

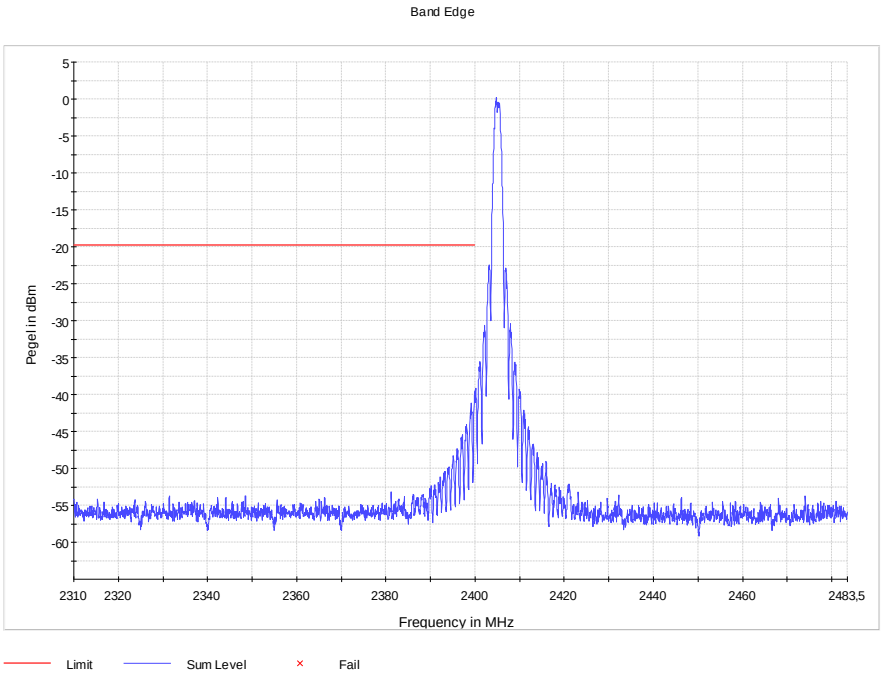
2.4.6 Test Method

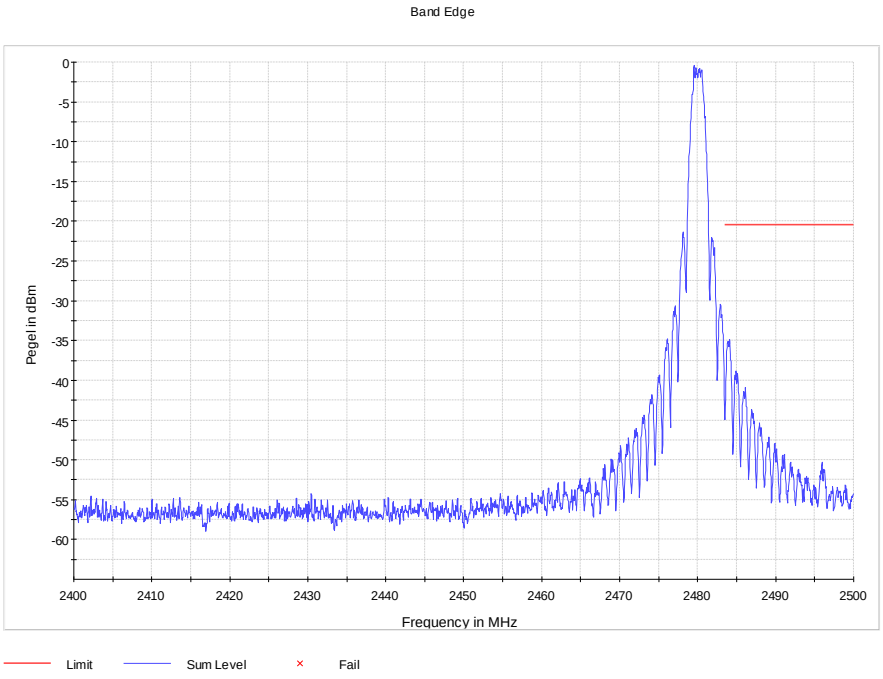
The test was performed according to ANSI C63.10, sections 11.11

Product Service

2.4.7 Test Results

Traces are below limits. See plots for details.





Product Service

2.4.8 Test Location and Test Equipment

The test was carried out in radio test lab

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSV40	20219	24	2022-01-31
EMC measurement software	Rohde & Schwarz	EMC32 V10.50.00	44381	N/A	

Table 13

Product Service

2.5 Spurious emissions

2.5.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.205, 15.209, 15.247(d)
ISED RSS-247, Clause 5.5
ISED RSS-Gen, Clauses 8.9 and 8.10

2.5.2 Equipment under Test and Modification State

SIMATIC RTLS4083T; S/N A50499; Modification state 0

2.5.3 Date of Test

2021-04-14 to 2021-04-21; 2021-04-28

2.5.4 Environmental Conditions

Ambient Temperature	977 °C
Relative Humidity	23 %

2.5.5 Specification Limits

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

Product Service

General radiated emission limits:					
Frequency Range	*Test distance*	*Field strength*		*Field strength*	
(MHz)	*(m)*	*(µA/m)*	*(dBµA/m)*	*(µV/m)*	*(dBµV/m)*
0.009 – 0.49	300	6.37 / *f*	20*lg(6.37 / *f*)	2400 / *f*	20*lg(2400 / *f*)
0.49 – 1.705	30	63.7 / *f*	20*lg(63.7 / *f*)	24000 / *f*	20*lg(24000 / *f*)
1.705 - 30	30	0.08	20*lg(0.08 / *f*)	30	20*lg(30 / *f*)
30 – 88	3	---	--	100	40
88 – 216	3	--	--	150	43.5
126 – 960	3	--	--	200	46
above 960	3	--	--	500	54
Note 1: *f* in kHz					

Table 14 General radiated emission limits

ISED RSS-247 Clause 6.2.4.2

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

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

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

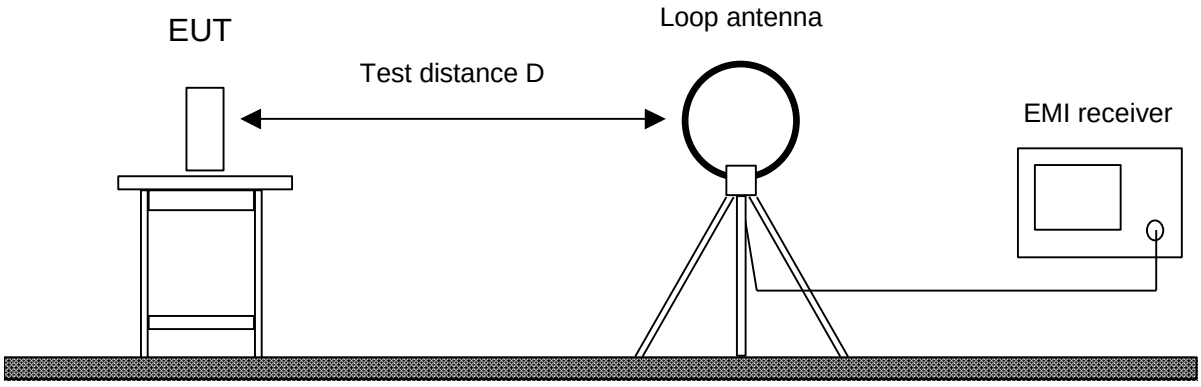
Product Service

2.5.6 Test Method

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

Prescans are performed in six positions of the EUT to get the full spectrum of emission caused by the EUT with the measuring antenna raised and lowered from 1 m to 4 m with vertical and horizontal polarisation to find the combination of table position, antenna height and antenna polarisation for the maximum emission levels.
Data reduction is applied to these results to select those levels having less margin than 10 dB or exceeding the limit using subranges and limited number of maximums.
Further maximisation for adjusting the maximum position is following.
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

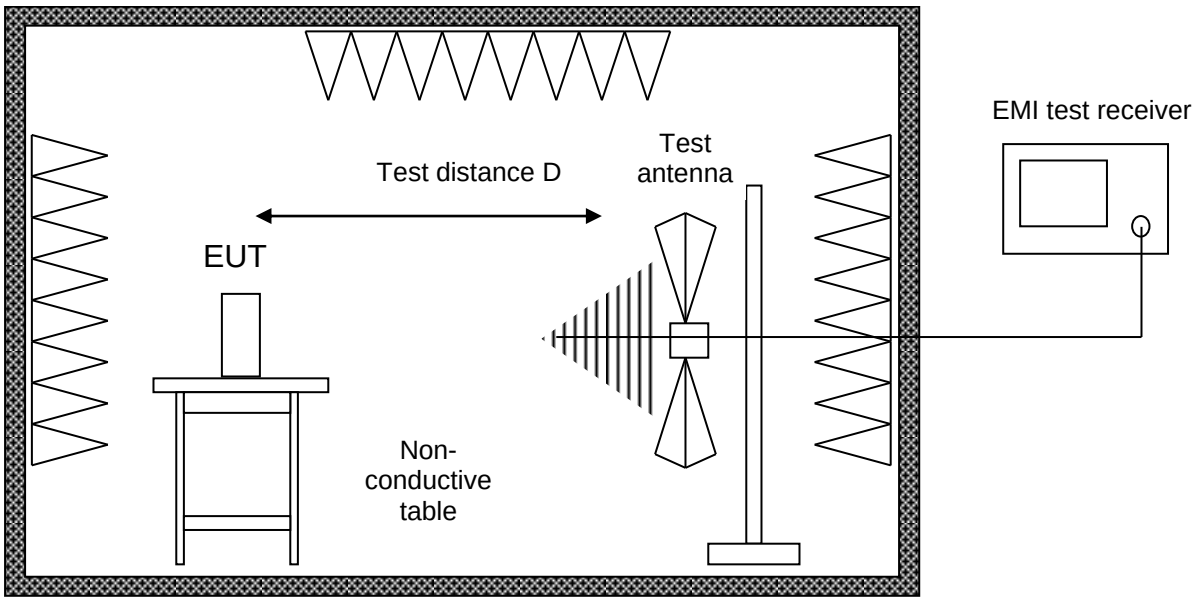
2.5.6.1 Frequency range 9 kHz – 30 MHz



The EUT was placed on a non-conductive table, 0.8 m above the ground.
Radiated emissions in the frequency 9 kHz – 30 MHz is measured within a semi-anechoic room with an active loop antenna with the measurement detector set to peak. In addition in the frequency range 9 kHz to 490 kHz also an average detector was used. The measurement bandwidth of the receiver was set to 300 Hz in the frequency range 9 kHz to 150 kHz and 10 kHz in the frequency range 150 kHz to 30 MHz. Prescans were performed in six positions of the EUT.
For final measurements the detector was set to CISPR quasi-peak and in addition to CISPR average in the frequency range 9 kHz to 490 kHz with a resolution bandwidth 200 Hz in the frequency range 9 kHz to 150 kHz and 9 kHz in the frequency range 150 kHz to 30 MHz. Final tests were performed immediately after a final frequency and zoom (for drifting disturbances) and maximum adjustment.

Product Service

2.5.6.2 Frequency range 30 MHz – 1 GHz

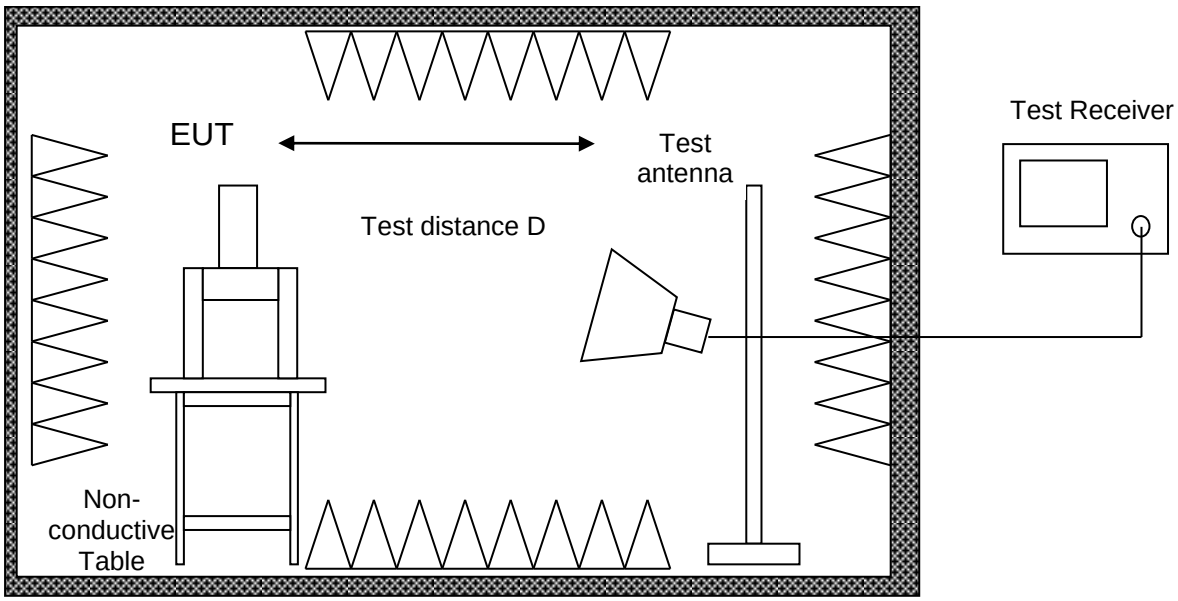


Alternate test site (semi anechoic room)

The EUT was placed on a non-conductive table, 0.8 m above the ground plane
Radiated emissions in the frequency range 30 MHz – 1 GHz is measured within a semi-anechoic room with groundplane complying with the NSA requirements of ANSI C63.4. for alternative test sites. A linear polarised logarithmic periodic antenna combined with a 4:1 broadband dipole (“Trilog broadband antenna”) is used.
For prescan tests the test receiver is set to peak-detector with a bandwidth of 120 kHz.
With the measurement bandwidth of the test receiver set to 120 kHz CISPR quasi-peak detector is selected for final measurements following immediately after a final frequency zoom (for drifting disturbances) and maximum adjustment.

Product Service

2.5.6.3 Frequency range above 1 GHz



Fully anechoic room

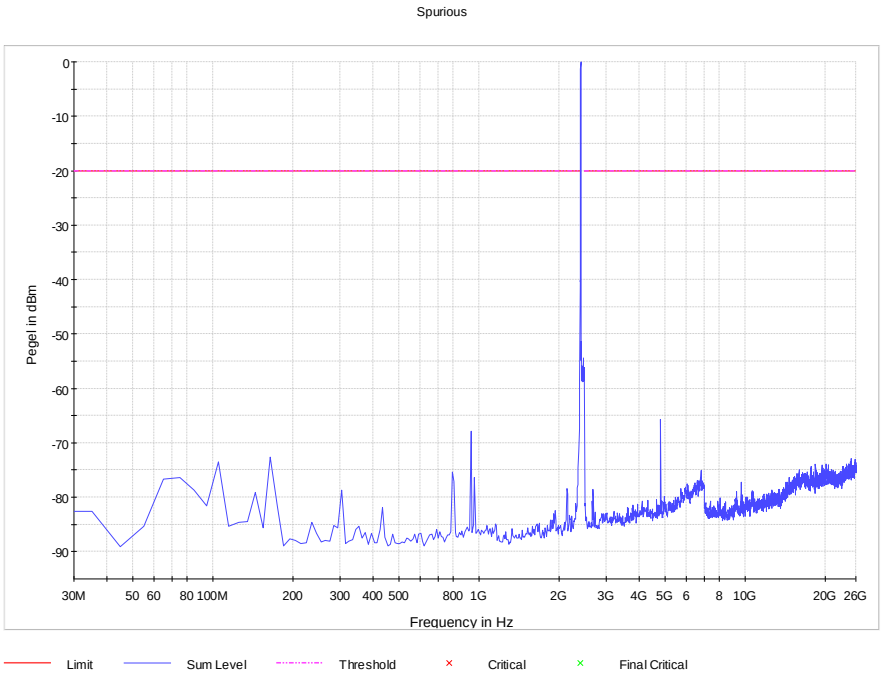
The EUT was placed on a non-conductive table, 1.5 m above the ground plane
Radiated emission tests above 1 GHz are performed in a fully anechoic room with the S_{VSWR} requirements of ANSI C63.4. Measurements are performed both in the horizontal and vertical planes of polarisation using a test receiver with the detector function set to peak and average and the resolution bandwidth set to 1 MHz. Testing above 1 GHz is performed with horn antennas with the EUT in boresight of the antenna.
For prescan tests the test receiver is set to peak- and average-detector with a bandwidth of 1 MHz. With the measurement bandwidth of the test receiver set to 1 MHz and peak- and CISPR average-detector is selected for final measurements following immediately after a final frequency zoom (for drifting disturbances) and maximum adjustment.

Product Service

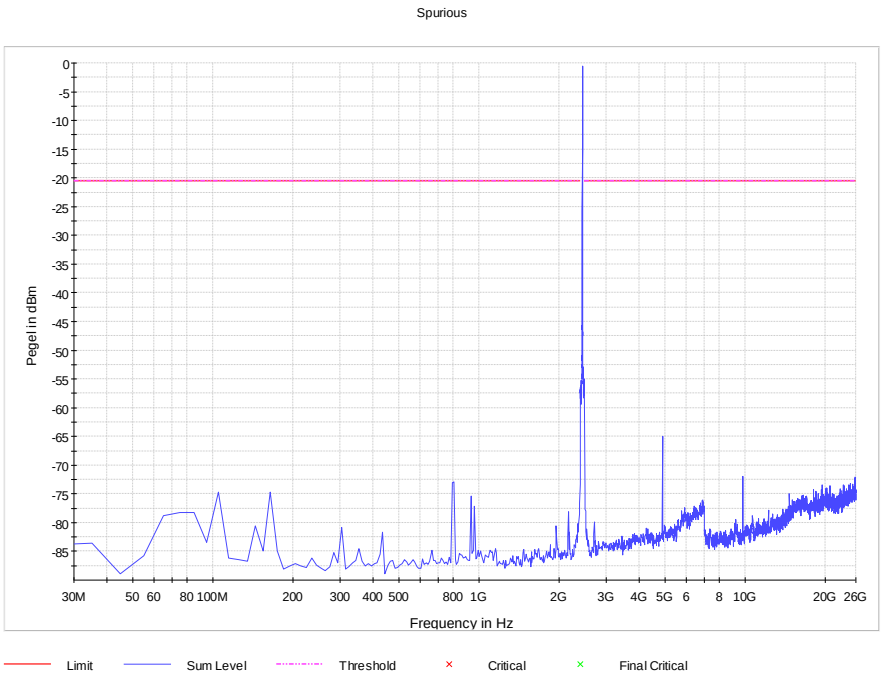
2.5.7 Test Results

2.5.7.1 Conducted measurements

All emissions except carrier show more than 20 dB margin to the limit; no values noted.

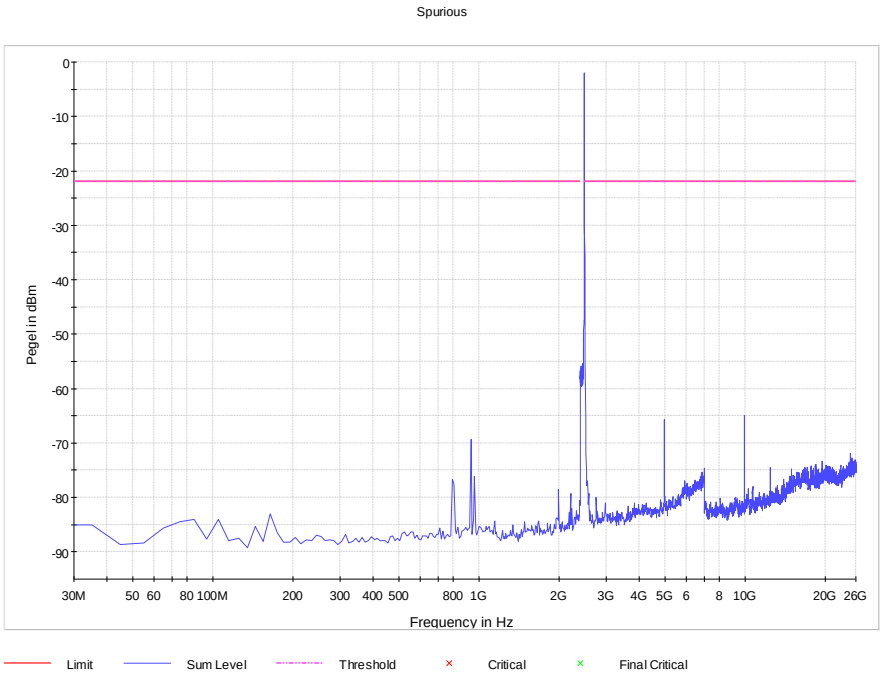


Transmitting on channel 11 (2405 MHz)



Transmitting on channel 18 (2440 MHz)

Product Service



Transmitting on channel 26 (2480 MHz)

2.5.7.2 Radiated measurements

Except carrier no emissions above noise level. For details refer to full test plots in annex.

Frequency range	*Test distance*
9 kHz – 12 GHz	3 m
12 GHz – 18 GHz	1 m
18 GHz – 25 GHz	3 m

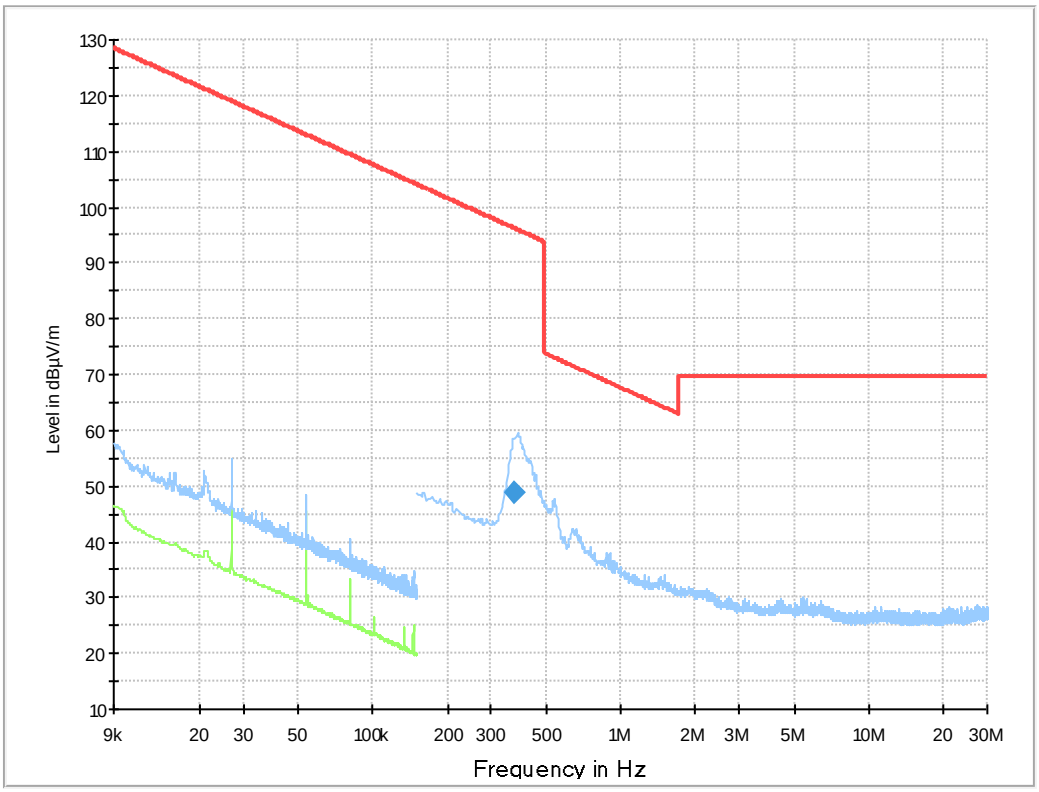
Table 15 Test distances

Sample calculation:

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

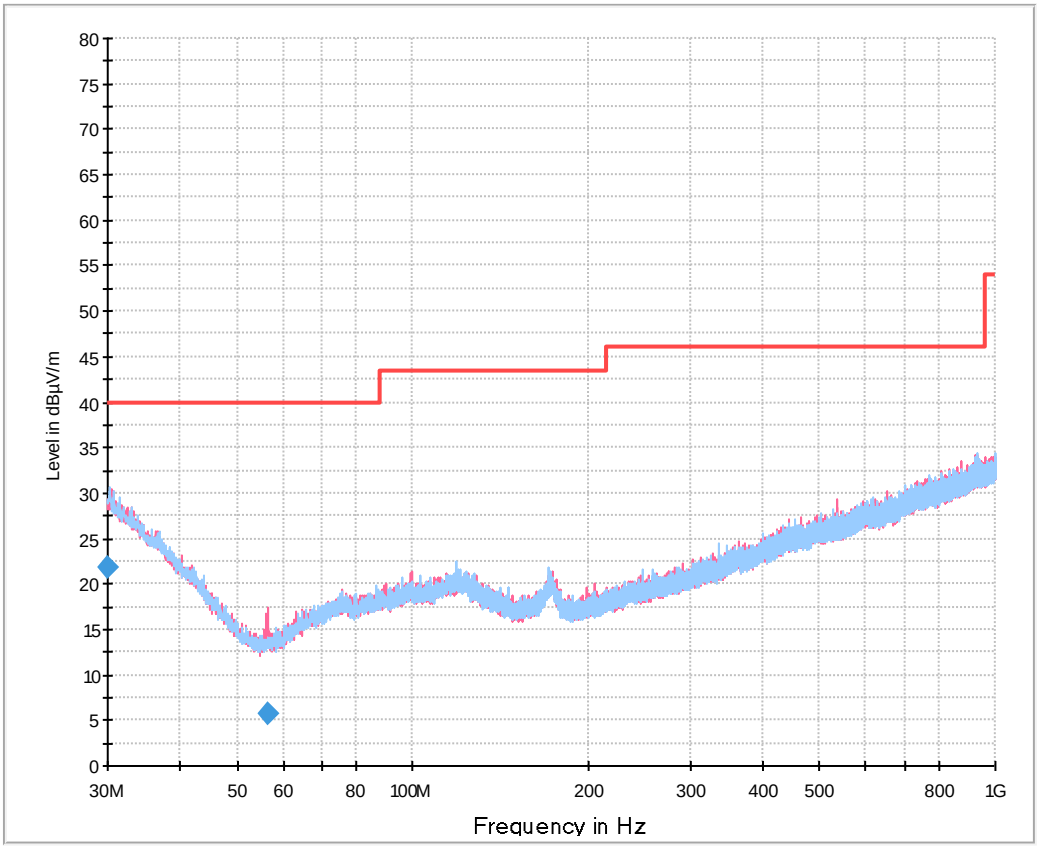
Product Service

2.5.7.2.1 EUT flat on table (Axis X)



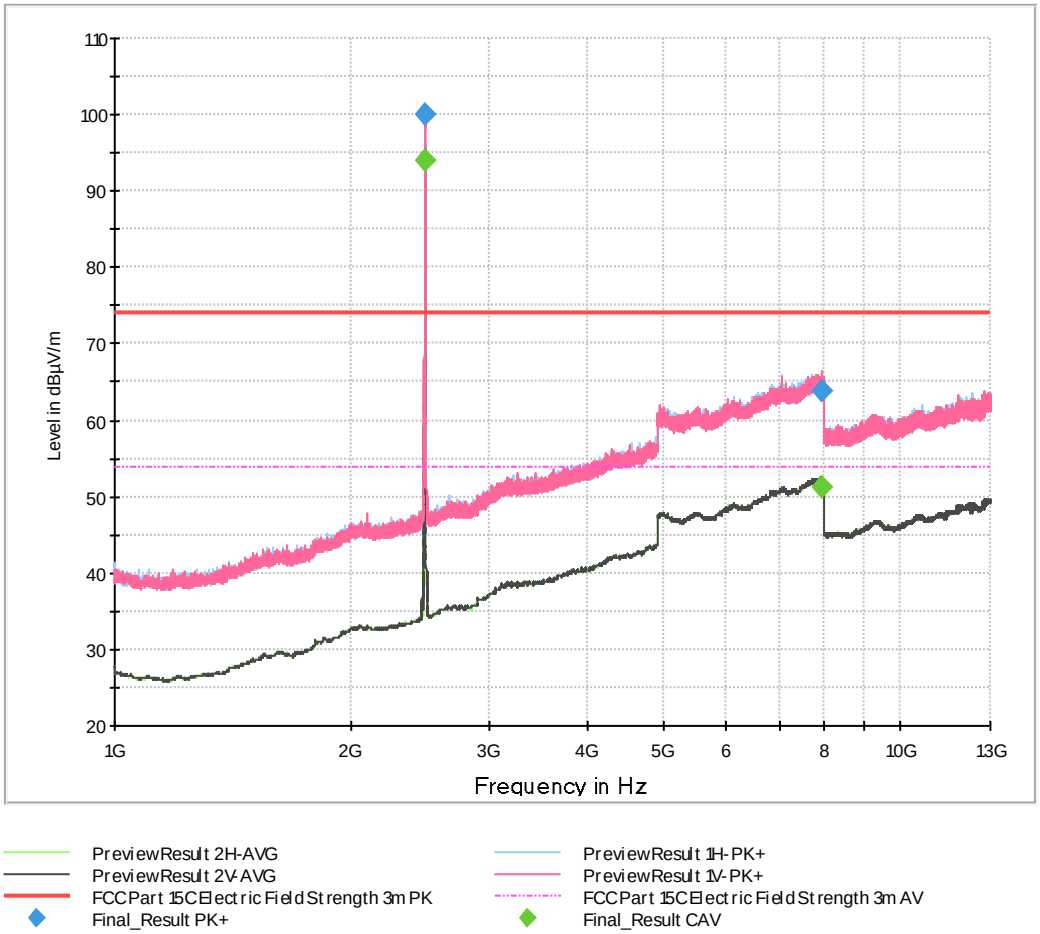
Frequency MHz	QuasiPeak dBµV/m	CAverage dBµV/m	Limit dBµV/m	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB
0.370500	48.89		96.23	47.34	1000.0	9.000	100.0	H	7.0	19.2

Product Service



Frequency MHz	*Qua-siPeak dBµV/m*	*Limit dBµV/m*	*Mar-gin dB*	*Meas. Time ms*	*Band-width kHz*	*Height cm*	*Pol*	*Azi-muth deg*	*Corr. dB/m*
30.060000	21.71	40.00	18.29	1000.0	120.000	236.0	H	168.0	25.8
56.550000	5.80	40.00	34.20	1000.0	120.000	115.0	V	-64.0	11.9

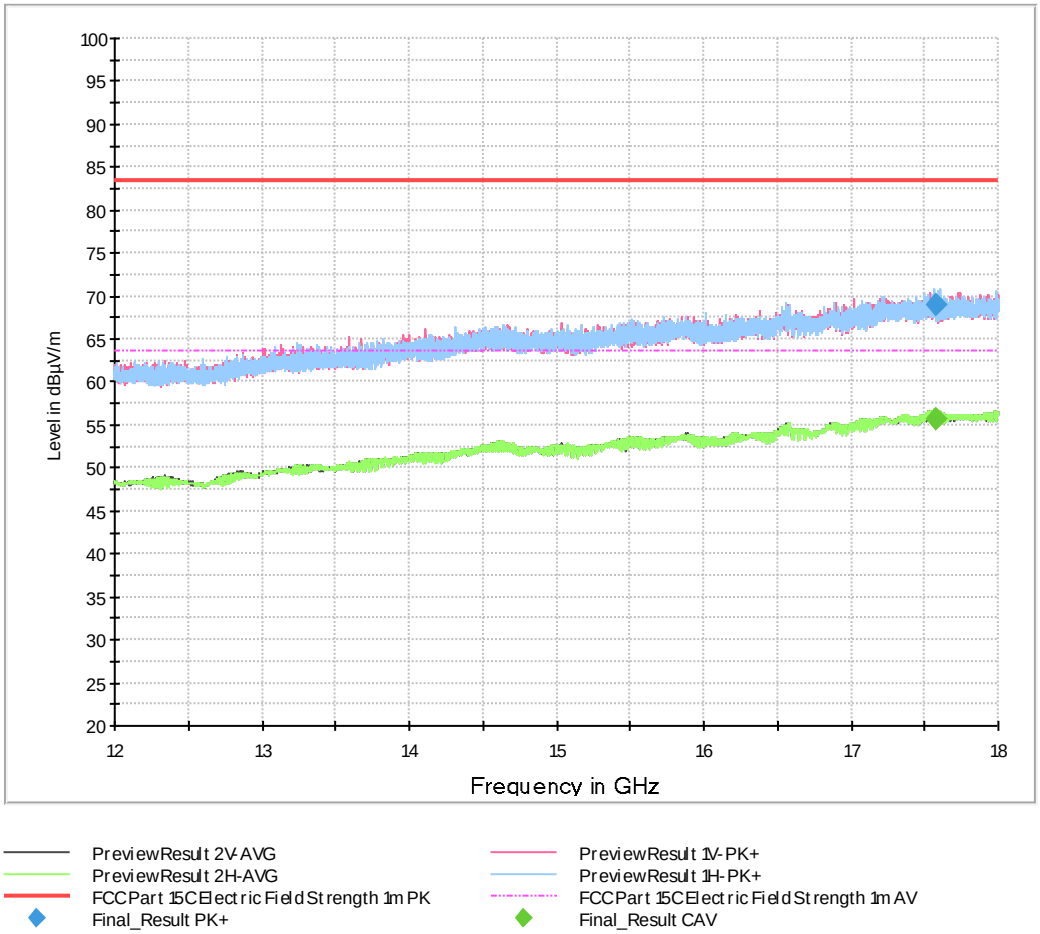
Product Service



Frequency MHz	*Max-Peak dBµV/m*	*CAver-age dBµV/m*	*Limit dBµV/m*	*Margin dB*	*Meas. Time ms*	*Band-width kHz*	*Height cm*	*Pol*	*Azi-muth deg*	*Corr. dB/m*
2479.500000	100.15		***		1000.0	1000.000	155.0	V	114.0	32.9
2479.500000		94.12	***		1000.0	1000.000	155.0	V	114.0	32.9
7947.000000	63.82		73.98	10.16	1000.0	1000.000	302.0	V	-44.0	43.4
7947.000000		51.35	53.98	2.63	1000.0	1000.000	302.0	V	-44.0	43.4

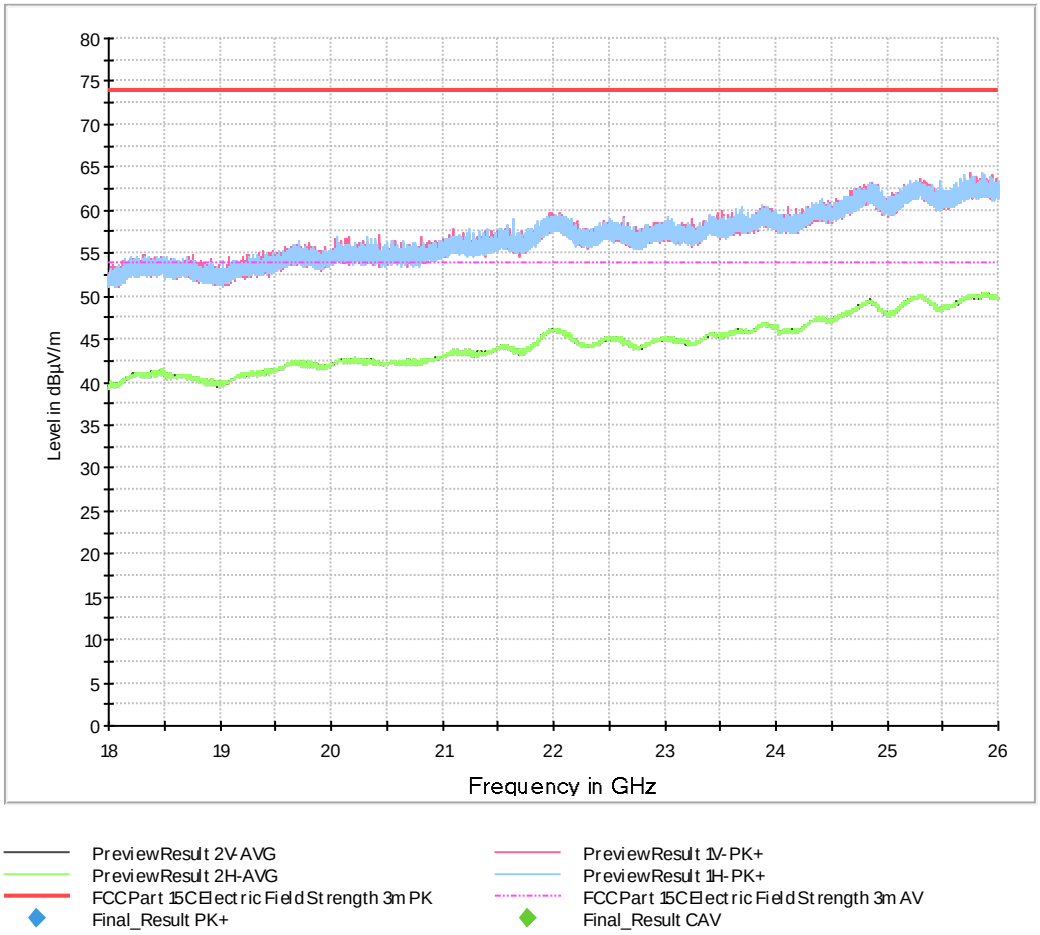
***: Carrier, not evaluated as spurious emission

Product Service



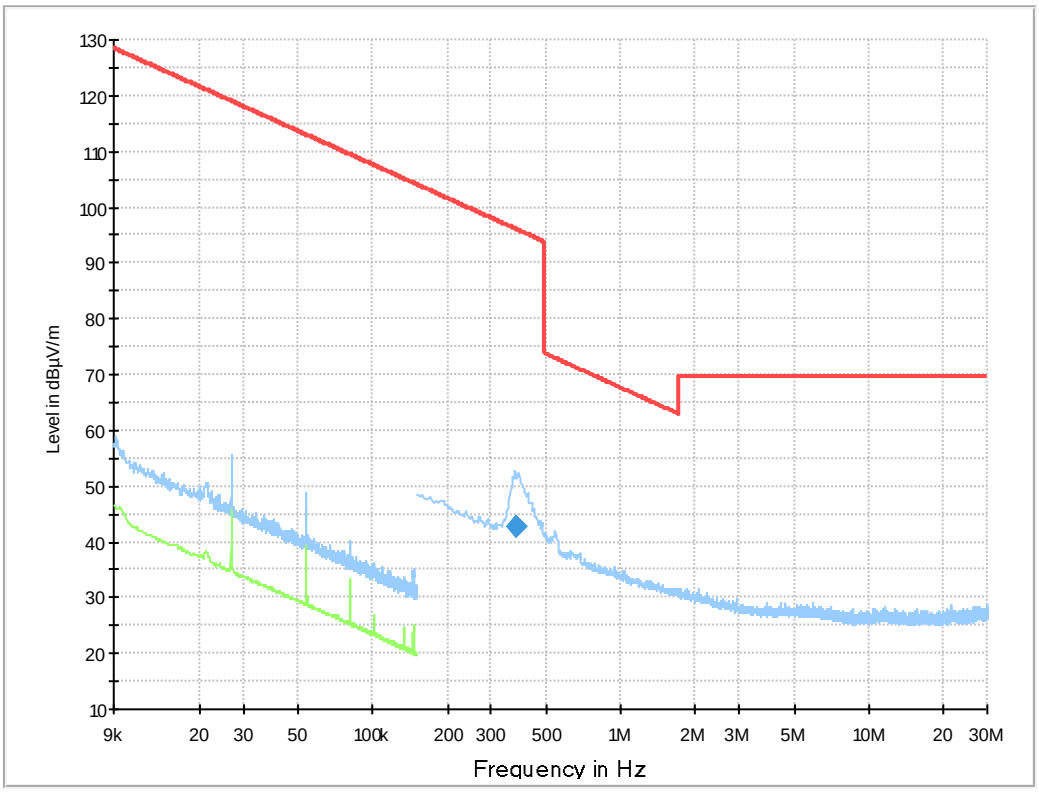
Frequency MHz	*Max-Peak dBµV/m*	*CAver-age dBµV/m*	*Limit dBµV/m*	*Mar-gin dB*	*Meas. Time ms*	*Band-width kHz*	*Height cm*	*Pol*	*Azi-muth deg*	*Corr. dB/m*
17573.750000		55.76	63.50	7.74	1000.0	1000.000	125.0	H	-37.0	54.4
17573.750000	69.03		83.50	14.47	1000.0	1000.000	125.0	H	-37.0	54.4

Product Service



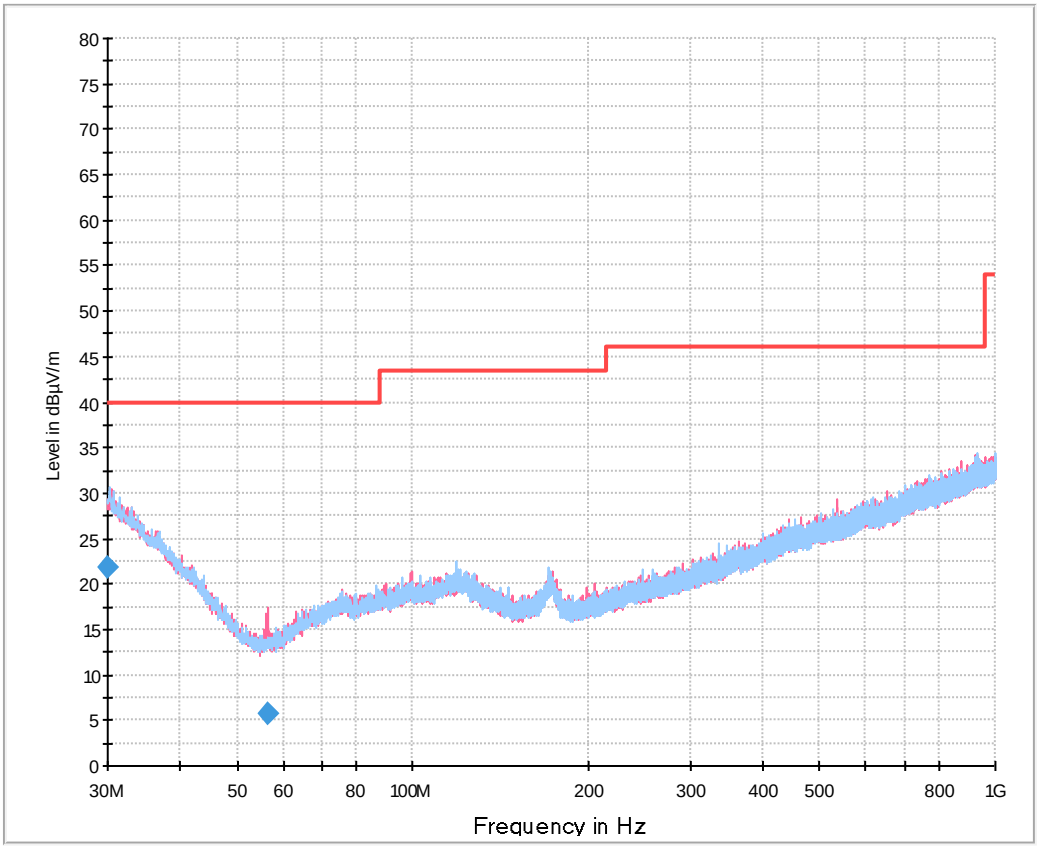
Product Service

2.5.7.2.2 EUT on long side (Axis Y)



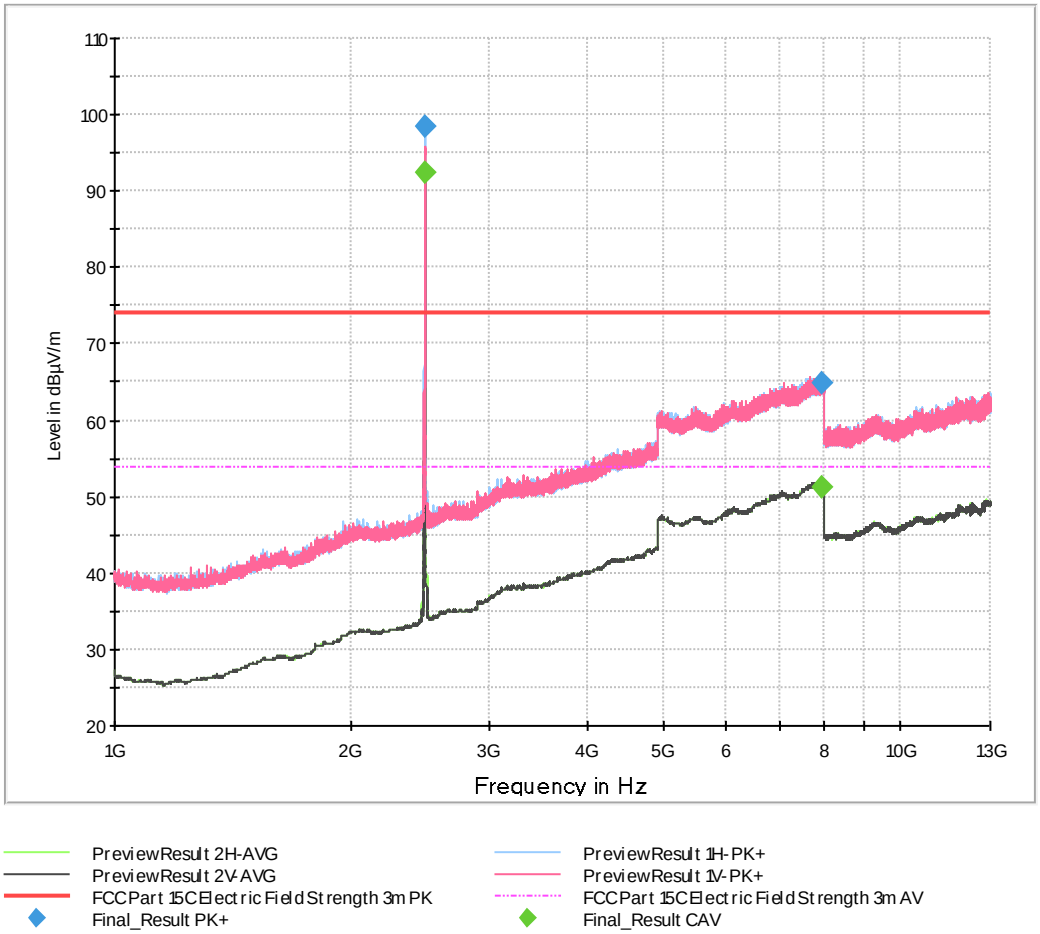
Frequency MHz	*QuasiPeak dBµV/m*	*CAverage dBµV/m*	*Limit dBµV/m*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Height cm*	*Pol*	*Azimuth deg*	*Corr. dB*
0.381750	42.82		95.97	53.15	1000.0	9.000	100.0	H	154.0	19.2

Product Service



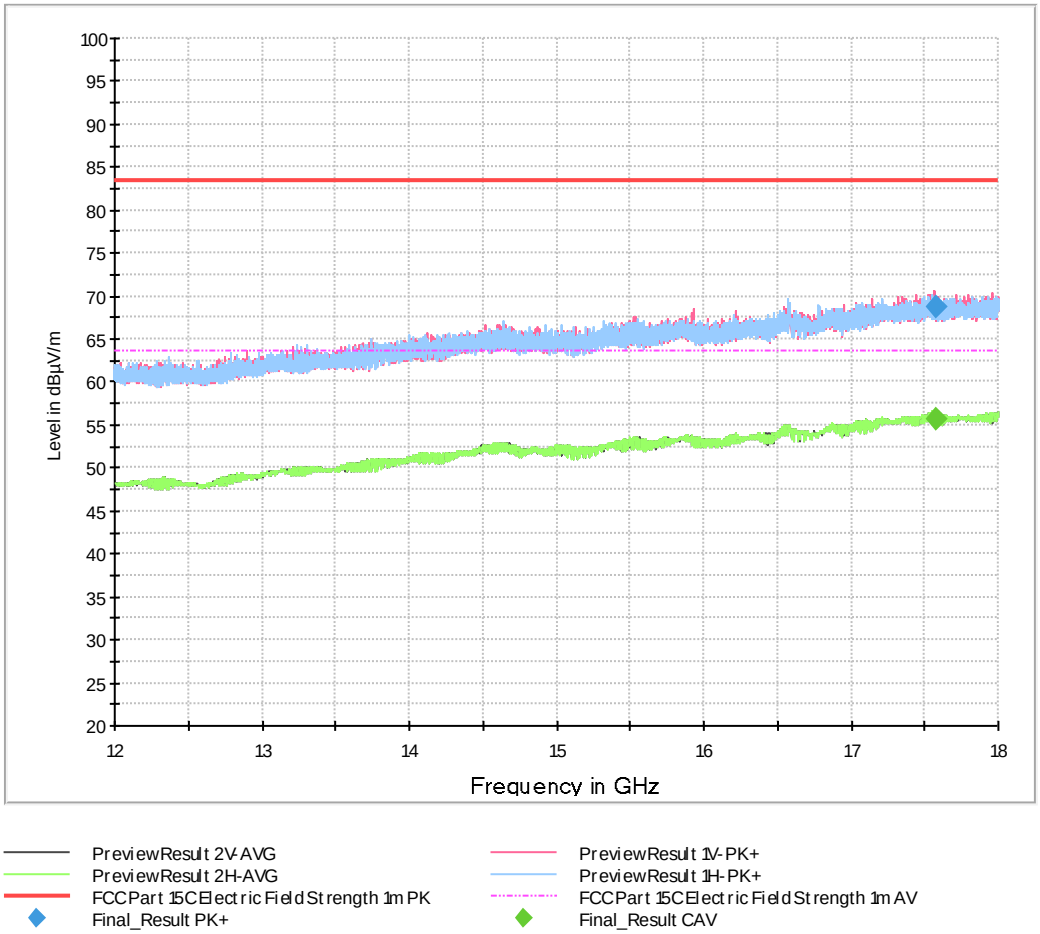
Frequency MHz	Qua-siPeak dBµV/m	Limit dBµV/m	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azi-muth deg	Corr. dB/m
30.060000	21.71	40.00	18.29	1000.0	120.000	236.0	H	168.0	25.8
56.550000	5.80	40.00	34.20	1000.0	120.000	115.0	V	-64.0	11.9

Product Service



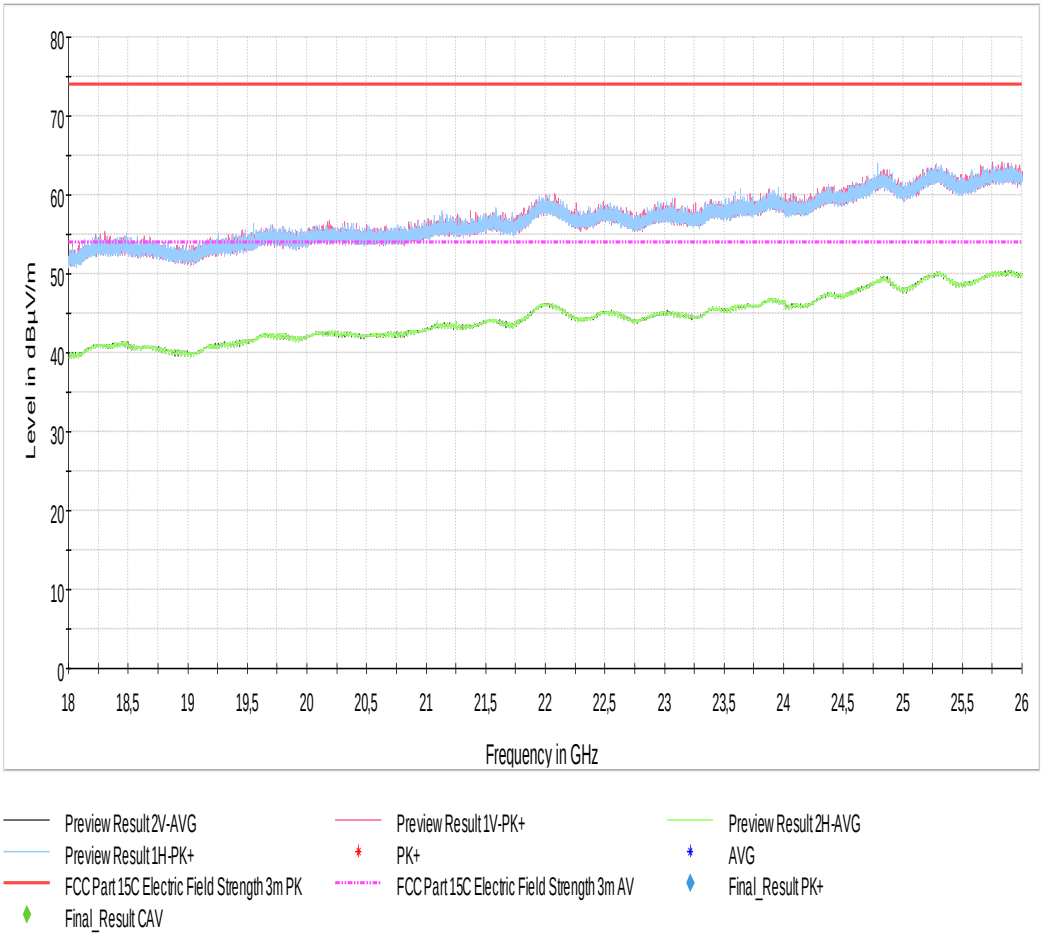
Frequency MHz	*Max-Peak dBµV/m*	*CAver-age dBµV/m*	*Limit dBµV/m*	*Margin dB*	*Meas. Time ms*	*Band-width kHz*	*Height cm*	*Pol*	*Azi-muth deg*	*Corr. dB/m*
2479.500000		92.53	53.98	-38.55	1000.0	1000.000	145.0	H	-60.0	32.9
2479.500000	98.56		73.98	-24.58	1000.0	1000.000	145.0	H	-60.0	32.9
7959.500000		51.27	53.98	2.71	1000.0	1000.000	295.0	V	225.0	43.4
7959.500000	64.79		73.98	9.19	1000.0	1000.000	295.0	V	225.0	43.4

Product Service



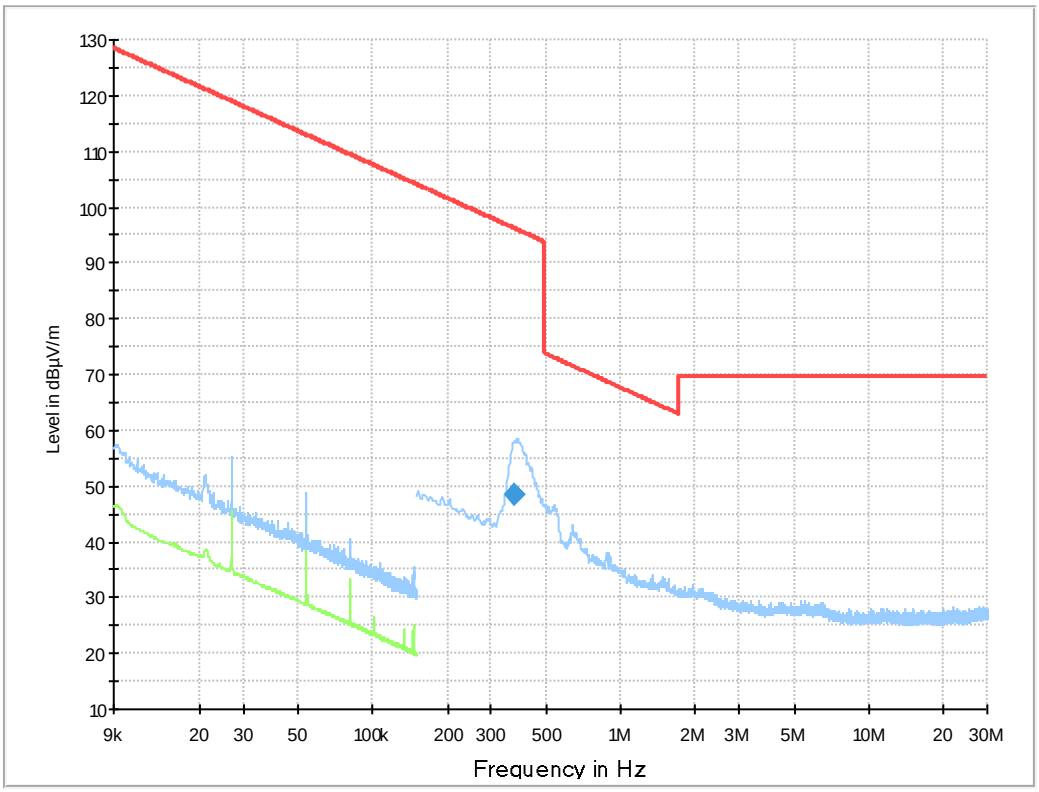
Frequency MHz	*Max-Peak dBµV/m*	*CAver-age dBµV/m*	*Limit dBµV/m*	*Mar-gin dB*	*Meas. Time ms*	*Band-width kHz*	*Height cm*	*Pol*	*Azi-muth deg*	*Corr. dB/m*
17573.500000		55.80	63.50	7.70	1000.0	1000.000	143.0	V	7.0	54.4
17573.500000	68.78		83.50	14.72	1000.0	1000.000	143.0	V	7.0	54.4

Product Service



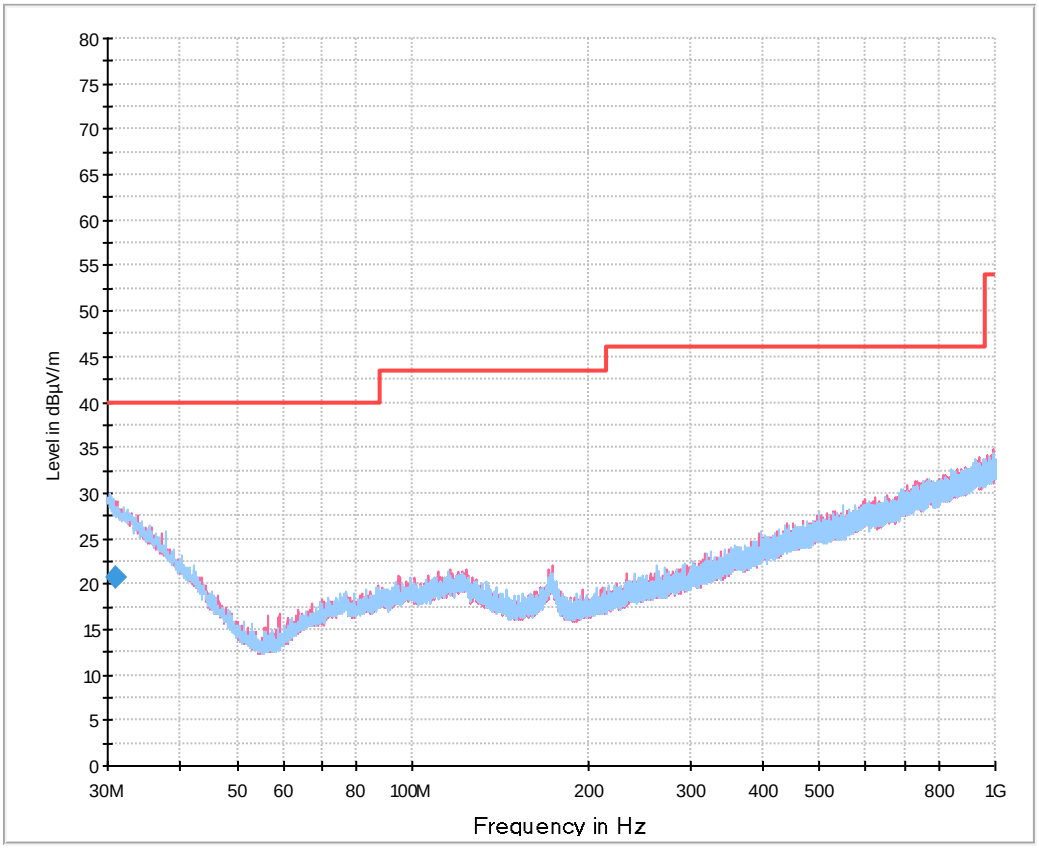
Product Service

2.5.7.2.3 EUT on short side / upright (Axis Z)



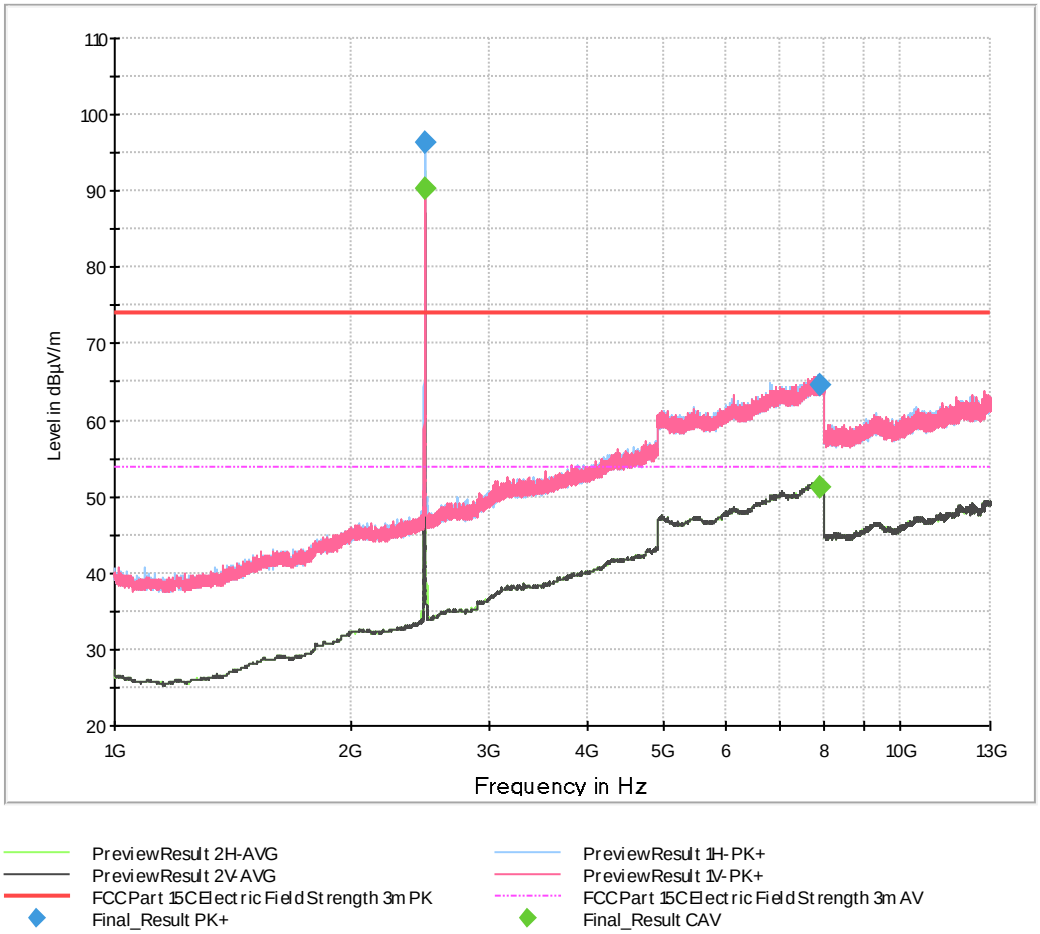
Frequency MHz	QuasiPeak dBµV/m	CAverage dBµV/m	Limit dBµV/m	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB
0.370500	48.36		96.23	47.87	1000.0	9.000	100.0	H	23.0	19.2

Product Service



Frequency MHz	Qua-siPeak dBµV/m	Limit dBµV/m	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azi-muth deg	Corr. dB/m
31.020000	20.81	40.00	19.19	1000.0	120.000	128.0	H	101.0	25.3

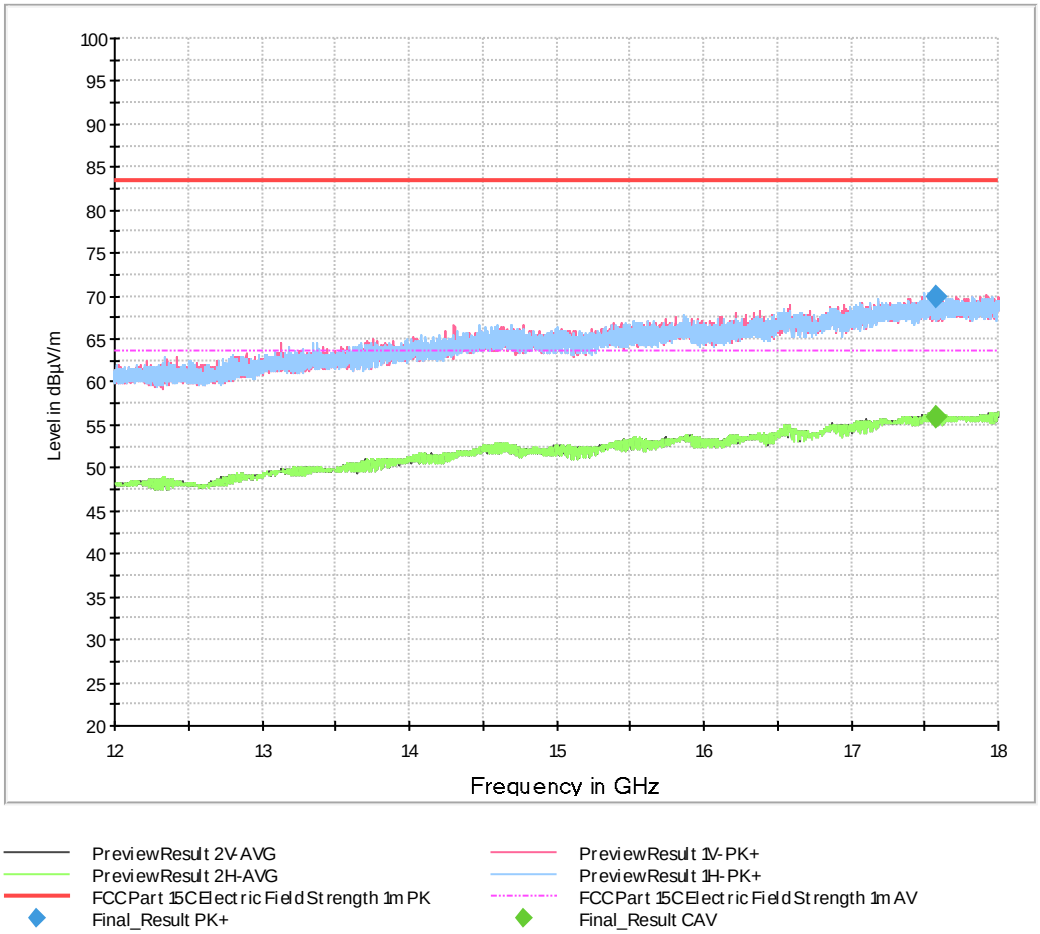
Product Service



Frequency MHz	*Max-Peak dBµV/m*	*CAver-age dBµV/m*	*Limit dBµV/m*	*Mar-gin dB*	*Meas. Time ms*	*Band-width kHz*	*Height cm*	*Pol*	*Azimuth deg*	*Corr. dB/m*
2479.500000		90.38	***		1000.0	1000.000	152.0	H	-57.0	32.9
2479.500000	96.37		***		1000.0	1000.000	152.0	H	-57.0	32.9
7891.750000		51.25	53.98	2.73	1000.0	1000.000	152.0	H	-110.0	43.4
7891.750000	64.61		73.98	9.37	1000.0	1000.000	152.0	H	-110.0	43.4

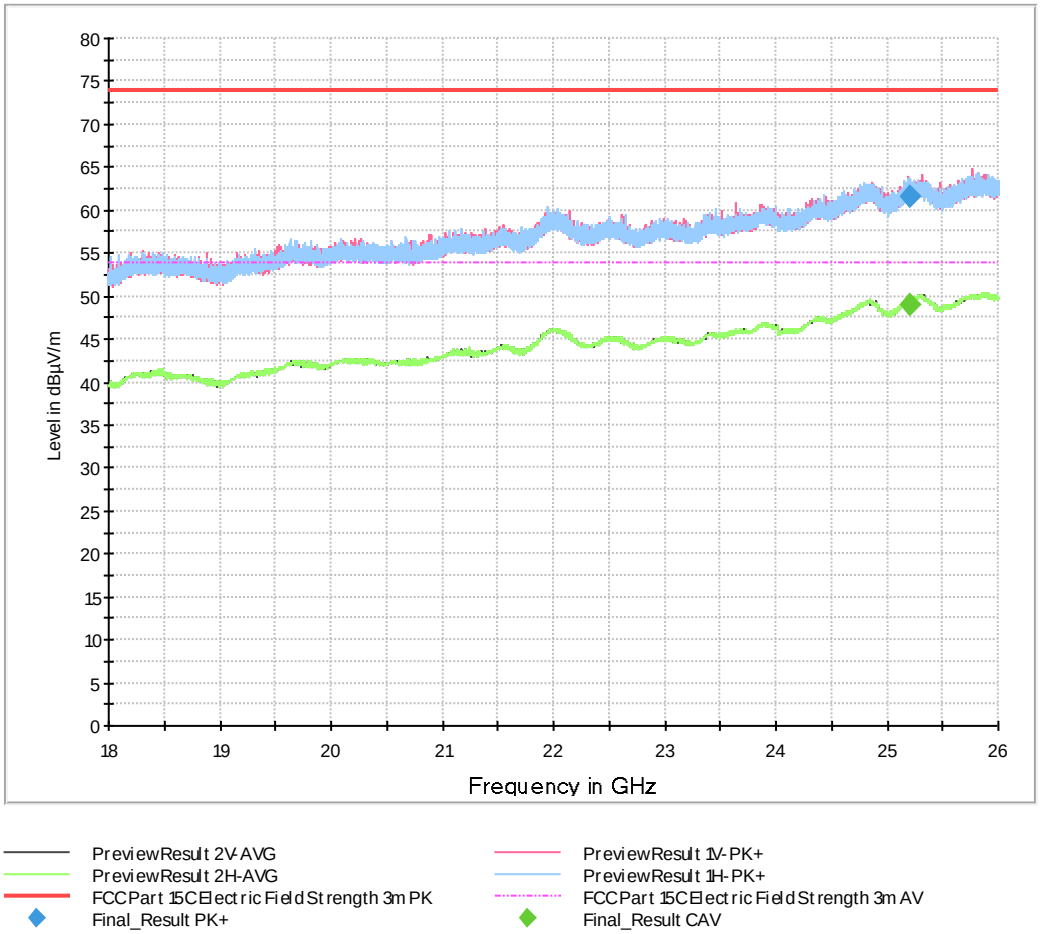
***: Carrier, not evaluated as spurious emission

Product Service



Frequency MHz	Max-Peak dBµV/m	CAver-age dBµV/m	Limit dBµV/m	Mar-gin dB	Meas. Time ms	Band-width kHz	Height cm	Pol	Azi-muth deg	Corr. dB/m
17573.250000		55.89	63.50	7.61	1000.0	1000.000	125.0	V	2.0	54.4
17573.250000	69.80		83.50	13.70	1000.0	1000.000	125.0	V	2.0	54.4

Product Service



Frequency MHz	Max-Peak dBµV/m	CAver-age dBµV/m	Limit dBµV/m	Mar-gin dB	Meas. Time ms	Band-width kHz	Height cm	Pol	Azi-muth deg	Corr. dB/m
25206.500000		48.92	53.98	5.06	1000.0	1000.000	125.0	H	240.0	30.2
25206.500000	61.68		73.98	12.30	1000.0	1000.000	125.0	H	240.0	30.2

Product Service

2.5.8 Test Location and Test Equipment

The conducted test was carried out in radio test lab
The radiate test was carried out in semi anechoic room No. 11

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSV40	20219	24	2022-01-31
EMC measurement software	Rohde & Schwarz	EMC32 V10.50.00	44381	N/A	
EMC measurement software	Rohde & Schwarz	EMC32 V10.50.10	44382	N/A	
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2021-03-31
Loop antenna	Schwarzbeck	FMZB 1519B	44334	36	2023-01-31
ULTRALOG Antenna	Rohde & Schwarz	HL562E	39969	36	2022-11-31
Double ridged Horn Antenna	Rohde & Schwarz	HF907	40089	24	2021-02-28
Horn Antenna with Preamplifier	Rohde & Schwarz	LB-180400H-KF + TS-LNA1840	43661	12	2021-12-31
EMC measurement software	Rohde & Schwarz	EMC32 V10.40.00	44375	---	

Table 16

Product Service

2.6 Temperature Stability

2.6.1 Specification Reference

ISED RSS-Gen, Clause 6.11, 8.11

2.6.2 Equipment under Test and Modification State

SIMATIC RTLS4083T; S/N A50499; Modification state 0

2.6.3 Date of Test

2020-01-20

2.6.4 Environmental Conditions

Ambient Temperature	22 °C
Relative Humidity	29 %

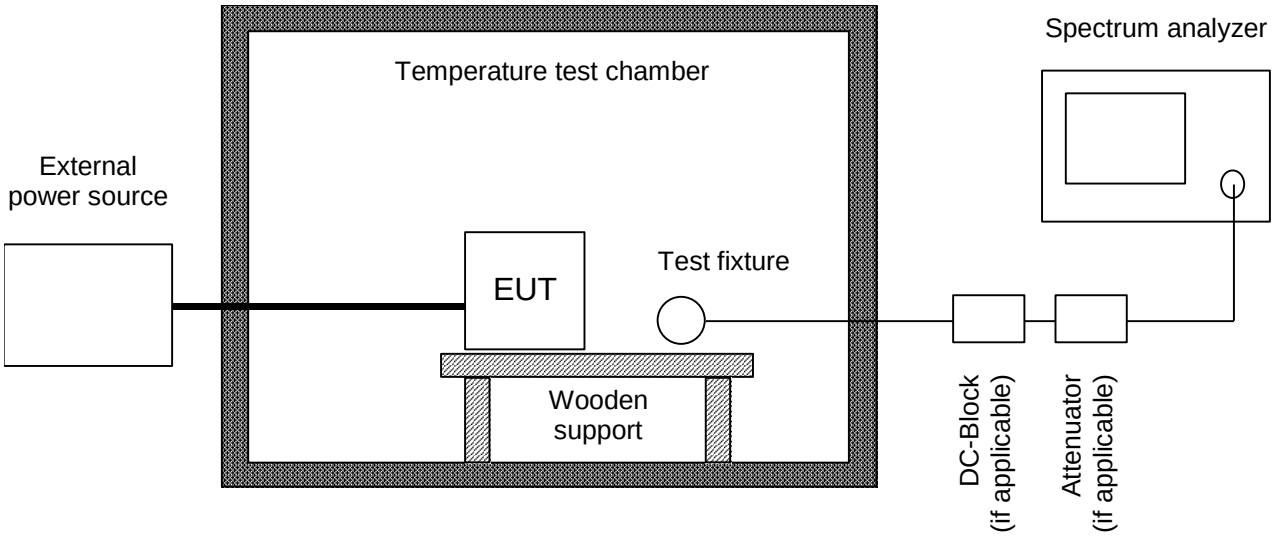
2.6.5 Specification Limits

If the stability of the license-exempt radio apparatus is not specified in the applicable RSS, the fundamental emissions of the radio apparatus should be kept within at least the central 80 % of its permitted operating frequency band in order to minimize the possiblilty of out-of-band operation. In additions, its occupied bandwidth shall be entirely outside the resitricted bands and the prohibited TV bands of 85 MHz – 72 MHz, 76 MHz – 88 MHz, 174 MHz – 216 MHz, and 470 MHz – 602 MHz, unless otherwise indicated.

Product Service

2.6.6 Test Method

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



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

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

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

Product Service

2.6.7 Test Results

The test was performed with a new battery at 3 V

Temperature	*Supply Voltage*	*Frequency (MHz)*	*Frequency drift (ppm)*
-20 °C	3 V	2405.5257991	7.46
-10 °C	3 V	2405.5268230	7.89
0 °C	3 V	2405.5240859	6.75
10 °C	3 V	2405.5178733	4.17
20 °C	3 V	2405.5078474	0.00
30 °C	3 V	2405.4976268	-4.25
40 °C	3 V	2405.4854667	-9.30
50 °C	3 V	2405.4740588	-14.05

Table 17: 2405 MHz

Temperature	*Supply Voltage*	*Frequency (MHz)*	*Frequency drift (ppm)*
-20 °C	3 V	2440.5261794	7.38
-10 °C	3 V	2440.5272080	7.80
0 °C	3 V	2440.5245296	6.70
10 °C	3 V	2440.5178053	3.95
20 °C	3 V	2440.5081660	0.00
30 °C	3 V	2440.4970790	-4.54
40 °C	3 V	2440.4854893	-9.29
50 °C	3 V	2440.4733811	-14.25

Table 18: 2440 MHz

Temperature	*Supply Voltage*	*Frequency (MHz)*	*Frequency drift (ppm)*
-20 °C	3 V	2480.5265396	7.19
-10 °C	3 V	2480.5276493	7.64
0 °C	3 V	2480.5250835	6.61
10 °C	3 V	2480.5178873	3.71
20 °C	3 V	2480.5086936	0.00
30 °C	3 V	2480.4967895	-4.80
40 °C	3 V	2480.4855751	-9.32
50 °C	3 V	2480.4726201	-14.54

Table 19: 2480 MHz

Product Service

2.6.8 Test Location and Test Equipment

The test was carried out in radio test lab

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSV40	20219	24	2022-01-31
Climatic Test chamber	Feutron	KPK200-2	19868	36	2023-02-28

Table 20

Product Service

2.7 RF Exposure

2.7.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.247(i)
FCC 47 CFR Part 2 J, Clause 2.1093
KDB 447498 D01 V06, section 4.3.1
ISED RSS-Gen, Clause 3.4
ISED RSS-102, Clause

2.7.2 Equipment under Test and Modification State

SIMATIC RTLS4083T; S/N A50499; Modification state 0

2.7.3 Date of Test

2021-04-14

2.7.4 Environmental Conditions

Ambient Temperature	22 °C
Relative Humidity	29 %

2.7.5 Test Method

Estimation is based on output power test.
For details please refer to section 2.2.6 of this test report.

2.7.6 Specification Limits

FCC 47 CFR Part 15 C, Clause 15.247(i)
Systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy levels in excess of the Comission's guideline.

Acc. to KDB 477498, Clause 4.3.1:
The 1 g and 10 g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separations distances ≤ 50 mm are determined by:

$$\frac{max.\ power\ of\ channel, incl.\ tune-up\ tol., mW}{min.\ test\ separation\ distance, mm} \cdot \sqrt{f, GHz} \leq \begin{Bmatrix} 3.0\ \ for\ 1\ g \\ 7.5\ for\ 10\ g \end{Bmatrix}\ extremity\ SAR$$

1. *f* (GHz) is the RF channel frequency in GHz;
2. Power and distance are rounded to the nearest mW and mm before calculation;
3. The result is rounded to one decimal place for comparison;
4. 3.0 and 7.5 are referred to as the numeric thresholds

Product Service

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied.

ISED RSS-102, Clause 2.5.1

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)[1] 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 [2]	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

[1] The excemption limit in the table are based on measurements and simulations on half-wave dipole antennas at separaton 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 alinear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from athird order polynomial fit.

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

Product Service

2.7.7 Test Results

Maximum conducted power:	4.9 dBm
Antenna gain:	2 dBi
Carrier Power e.i.r.p. (calculated):	6.9 dBm

KDB 477498, Clause 4.3.1

Maximum output power:	6.9 dBm = 4.9 mW
Minimum test separation distance:	2 cm = 20 mm
Frequency:	2405 MHz
SAR test exclusion threshold (calculated):	0.4
Limit (1 g SAR):	3.0
Limit (10 g SAR):	7.5
Test Result:	

ISED RSS-Gen, Clause 3.4

Frequency:	2405 MHz
Test distance:	2 cm
Carrier Power (e.i.r.p.):	6.9 dBm = 4.9 mW
Exemption limit:	30 mW
Test Result:	Pass

Product Service

3 Measurement Uncertainty

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

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

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

Table 21 Measurement uncertainty based on CISPR 16-4-2

Radio Interference Emission Testing		
Test Name	*kp*	*Expanded Uncertainty*
Occupied Bandwdith	2	± 5 %
Conducted Power		
9 kHz ≤ f < 30 MHz	2	± 1.0 dB
30 MHz ≤ f < 1 GHz	2	± 1.5 dB
1 GHz ≤ f ≤ 40 GHz	2	± 2.5 dB
1 MS/s power sensor (TS8997)	2	± 1.5 dB
Occupied Bandwidth	2	± 5 %
Power Spectral Density	2	± 3.0 dB
Radiated Power		
9 kHz ≤ f < 26.5 GHz	2	± 6.5 dB
26.5 GHz ≤ f < 60 GHz	2	± 8.0 dB
60 GHz ≤ f < 325 GHz	2	± 10 dB
Conducted Spurious Emissions	2	± 3.0 dB
Radiated Spurious Emissions	2	± 6.0 dB
Voltage		
DC	2	± 1.0 %
AC	2	± 2.0 %
Time (automatic)	2	± 5 %
Frequency	2	± 10^{-7}
The expanded uncertainty reported according to to ETSI TR 100 028:2001 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%		

Table 22 Measurement uncertainty based on ETSI TR 100 028