Report on the FCC and IC Testing of the MinebeaMitsumi Technology Center Europe GmbH

Model: SV21-T-EOU

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

Product Service

Add value.
Inspire trust.

Prepared for: MinebeaMitsumi Technology Center
Europe GmbH
Minebea-Weg 1
78052 Villingen-Schwenningen
Germany

FCC ID: 2BB7N-SV21TEOU
IC: 30980-SV21TEOU

COMMERCIAL-IN-CONFIDENCE

Date: 2023-12-05
Document Number: 713301756-00 | Revision: 0

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Michael Ingerl	2023-12-05	SIGN-ID 859781
Authorised Signatory	Alex Fink	2023-12-05	SIGN-ID 859797

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

Engineering Statement:

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

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Michael Ingerl	2023-12-05	SIGN-ID 859782

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 compliant with FCC 47 CFR Part 15 C:2021 and ISED RSS210:2020 and RSS-GEN:2019

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	2023-12-05

Table 1: Report of Modifications

1.2 Introduction

Applicant	MinebeaMitsumi Technology Center Europe GmbH
Manufacturer	MinebeaMitsumi Technology Center Europe GmbH
Model Number(s)	SV21-T-EOU
Serial Number(s)	1830960310003
Hardware Version(s)	---
Software Version(s)	---
Number of Samples Tested	1
Test Specification(s) /	FCC 47 CFR Part 15 C : 2022
Issue / Date	ISED RSS-210, Issue 10, Amendment 1 :2020 ISED RSS-GEN, Issue 5, Amendment 2 :2021
Test Plan/Issue/Date	---
Order Number	BA30069-8A84
Date of Receipt of EUT	2023-07-17
Start of Test	2023-07-19
Finish of Test	2023-07-21
Name of Engineer(s)	Michael Ingerl
Related Document(s)	ANSI C63.4: 2014 ANSI C63.10: 2013

Product Service

1.3 Brief Summary of Results

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

Section	*Specification Clause*	*Test Description*	*Result*
Configuration Mode: Power Supplied with 5V DC - Transmitting continuously			
2.1	15.203	Antenna requirement	Pass
2.2	15.231(c)	Bandwidth of momentary signals	Pass
2.3	15.231(a)	Periodic operation requirement	Pass
2.5	15.231(b), 15.205, 15.209	Radiated Emissions	Pass
2.6	15.207	Conducted Emissions on Mains Terminals	Pass

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

Section	*Specification Clause*	*Test Description*	*Result*
Configuration Mode: Power Supplied with 5V DC - Transmitting continuously			
2.2	A1.3	Bandwidth of momentary signals	Pass
2.3	A.1.1	Periodic operation requirement	Pass
2.5	A1.2	Radiated Emissions	Pass

Table 3: Results according to ISED RSS-210

Section	*Specification Clause*	*Test Description*	*Result*
Configuration Mode: Power Supplied with 5V DC - Transmitting continuously			
2.2	6.7	Bandwidth of momentary signals	Pass
2.5	8.9, 8.10	Spurious Emissions	Pass
2.4	6.11	Temperature Stability	Pass
2.6	8.8	Conducted Emissions on Mains Terminals	Pass

Table 4: Results according to RSS-Gen

Product Service

1.4 Product Information

1.4.1 Technical Description

The EUT is a Wireless valve actuator

Frequency Band	902.875 MHz
Number of frequency channels:	1
Supply Voltage:	5 V
Supply Frequency:	DC

1.5 Test Configuration

Power Supplied with 5V DC

1.6 Modes of Operation

Transmitting continuously

1.7 Deviations from Standard

None

1.8 EUT Modifications Record

The table below details modifications made to the EUT during the test program.
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)
Configuration Mode: Power Supplied with 5V DC - Transmitting continuously	
Antenna requirement	Michael Ingerl
Bandwidth of momentary signals	Michael Ingerl
Periodic operation requirement	Michael Ingerl
Radiated Emissions	Michael Ingerl
Conducted Emissions on Mains Terminals	Michael Ingerl
Temperature Stability	Michael Ingerl

Office Address:
Äußere Frühlingstraße 45
94315 Straubing
Germany

Product Service

2 Test Details

2.1 Antenna requirement

2.1.1 Specification Reference

FCC 47 CFR Part 15 C, Clauses 15.203

2.1.2 Equipment under Test and Modification State

SV21-T-EOU; S/N 1830960310003; Modification state: 0

2.1.3 Date of Test

2023-07-19

2.1.4 Specification Limits

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some fields disturbance sensors, or to other intentional radiators which must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits are not exceeded.

2.1.5 Test Results

The EUT has a internal antenna and cannot be replaced by the user.

The EUT complied with the requirements of this section.

Product Service

2.2 Bandwidth of Momentary Signals

2.2.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.231(c)
ISED RSS-210, Clause A.1.3
ISED RSS-Gen, Clause 6.7

2.2.2 Equipment under Test and Modification State

SV21-T-EOU; S/N 1830960310003; Modification state: 0

2.2.3 Date of Test

2023-07-19

2.2.4 Environmental Conditions

Ambient Temperature	23 °C
Relative Humidity	37 %

2.2.5 Specification Limits

FCC 47 CFR, clause 15.231(c)
The bandwidth of the emission shall be no wider than 0.25 % of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall no wider than 0.5 % of the centre frequency. Bandwidth is determined at the points 20 dB down from the modulation carrier.

ISED RSS-210 Issue 10, Amd. 1; clause A1.3
The occupied bandwidth of the momentary devices shall be less than or equal to 0.25 % of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the occupied bandwidth shall be less than or equal to 0.5 % of the center frequency.

2.2.6 Test Method

The test was performed according to ANSI C63.10, clauses 6.9
See section 2.5.6 of this test report for details.

Product Service

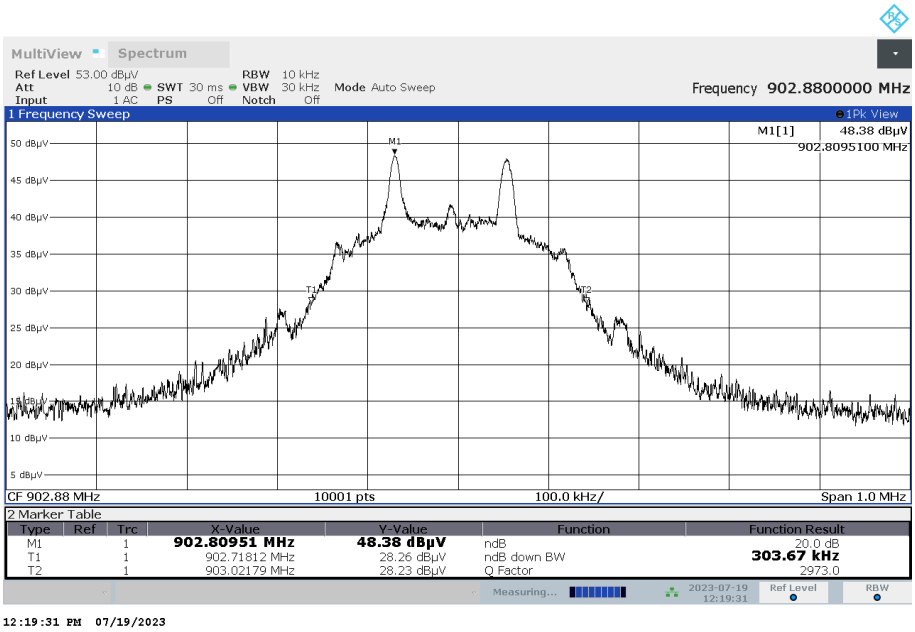
2.2.7 Test Results

Center frequency	20 dB Bandwidth (MHz)	Limit
902.875 MHz	0.30367	2.25 MHz

Table 6: 20 dB bandwidth

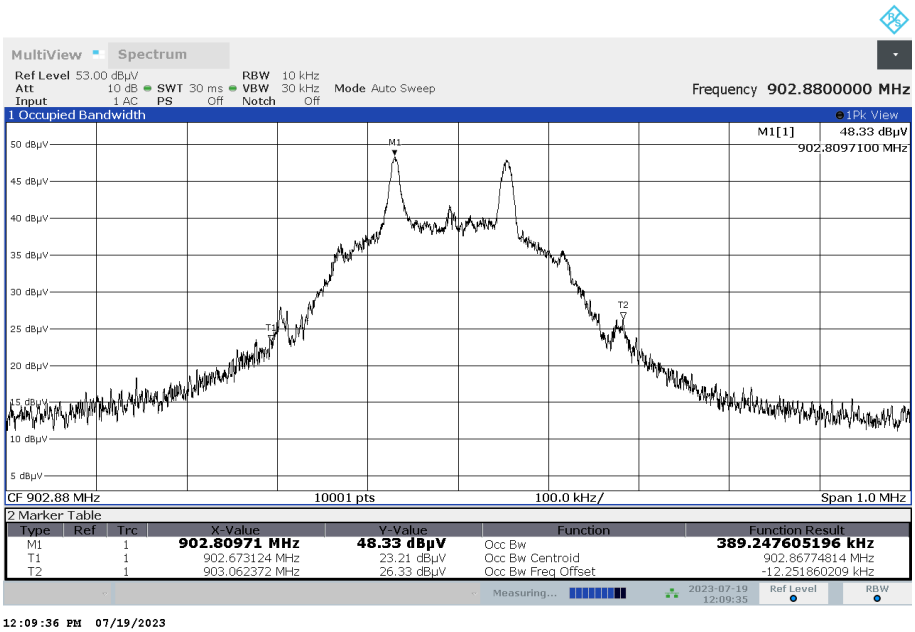
Centre Frequency	99% Bandwidth (MHz)	Limit
902.875 MHz	0.38924	2.25 MHz

Table 7: 99% bandwidth



20dB Bandwidth

Product Service



99% Bandwidth

2.2.8 Test Location and Test Equipment

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

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2024-04-30
EMC measurement software	Rohde & Schwarz	EMC32 Emission K11 – V11.50	42986	---	---
Semi anechoic room	Rohde & Schwarz	No. 11	---	---	---
ULTRALOG Antenna	Rohde & Schwarz	HL562E	38401	36	2026-01-31

Product Service

2.3 Periodic Operation Requirement

2.3.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.231(a)
ISED RSS-210, Clause A.1.1

2.3.2 Equipment under Test and Modification State

SV21-T-EOU; S/N 1830960310003; Modification state: 0

2.3.3 Date of Test

2023-07-19

2.3.4 Environmental Conditions

Ambient Temperature	23 °C
Relative Humidity	37 %

2.3.5 Test Method

The test was performed using a spectrum analysator in zero-span-mode with the frequency set to the center frequency of the transmitter and the resolution bandwidth set to a value greater of the emission bandwidth to cover the full output power of the transmitter. Sweep time and sweep points were set to values given a reasonable resolution of test results.

Product Service

2.3.6 Specification Limits

FCC 47 CFR 15.231(a) and ISED RSS-210 A1.1

1. A manually operated transmitter shall employ a push-to-operate switch that will automatically deactivate the transmitter within not more than5 s of being released.
2. A transmitter activated automatically shall cease transmission within 5 s after activation.
3. Periodic transmissions at regular predetermined intervals are not permitted (except as defined in FCC 47 CFR 15.231(b) and ISED RSS-210 A1.1.4). However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour (2 s/h) for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed 2 s/h.
4. Intentional radiators which are employed for radio control purposes during emergencies involving fire, security of goods (e.g. burglar alarms), and safety-of-life, when activated to signal an alarm, may operate during the pendency of the alarm condition.

Product Service

2.3.7 Test Results

General information on transmitter:

The transmitter is used for	
☐ Security or safety applications	☐ Declared by applicant
☒ other applications	☒ Declared by applicant
The transmitter is operated	
☐ manually	☐ Declared by applicant [1]
☒ automatically	☒ Declared by applicant
Periodic operation according to CFR 47 Part 15, clause 15.231(a) ISED RSS-210, Issue 10, Amd. 1, section A1.1	
☒ Only control signals are sent and there is no continuous transmission.	☒ Declared by applicant
☐ A manually operated transmitter employs a switch that will automatically deactivate the transmitter within not more than 5 s of being released.	☐ Test performed ☐ Passed
☒ A transmitter activated automatically ceased transmission within 5 s after activation	☒ Test performed ☒ Passed
☐ Periodic transmissions at regular predetermined intervals are:	
☐ not performed	☐ Declared by applicant
☒ performed with total time of two seconds per hour or less (for polling or supervision transmissions to determine system integrity of transmitters used in security or safety applications)	☐ Declared by applicant ☒ Test performed ☒ Passed

2.3.8 Test Location and Test Equipment

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

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2024-04-30
EMC measurement software	Rohde & Schwarz	EMC32 Emission K11 – V11.50	42986	---	---
Semi anechoic room	Rohde & Schwarz	No. 11	---	---	---
ULTRALOG Antenna	Rohde & Schwarz	HL562E	38401	36	2026-01-31

[1] Please refer to external photos in annex for details.

Product Service

2.4 Temperature Stability

2.4.1 Specification Reference

ISED RSS-Gen, Clause 6.11, 8.11

2.4.2 Equipment under Test and Modification State

SV21-T-EOU; S/N 1830960310003; Modification state: 0

2.4.3 Date of Test

2023-07-19

2.4.4 Environmental Conditions

Ambient Temperature	23 °C
Relative Humidity	37 %

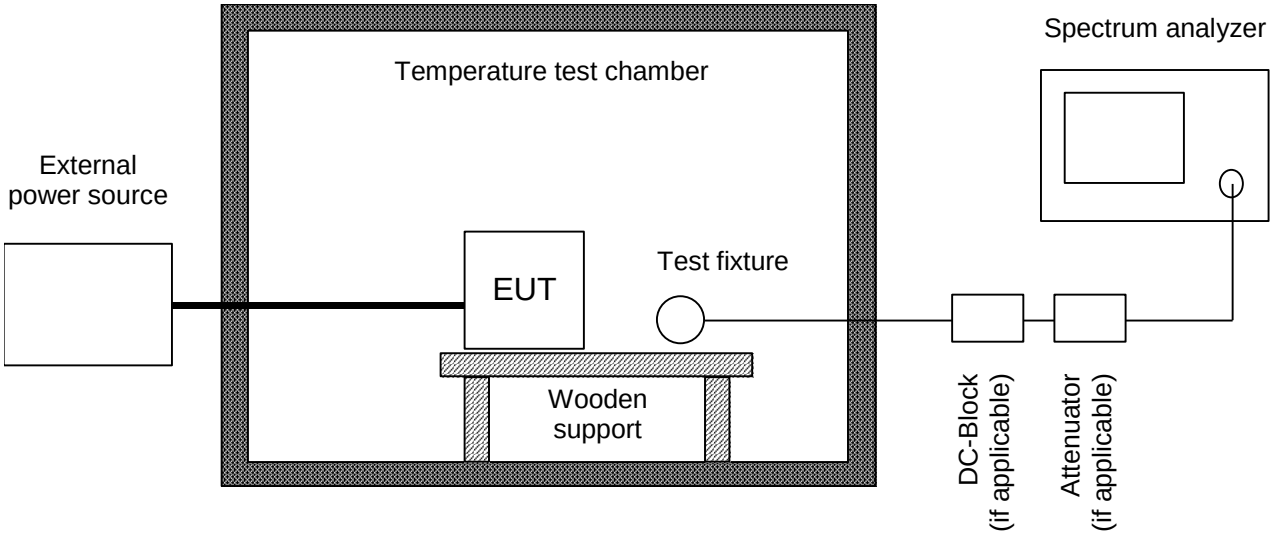
2.4.5 Specification Limits

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 possibility of out-of-band operation. In additions, its occupied bandwidth shall be entirely outside the restricted 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

2.4.6 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

2.4.7 Test Results

Temperature	Voltage	Frequency (MHz)	Frequency Deviation (%)
-20.0 °C	5 V DC	902.875	0.0041
-10.0 °C	5 V DC	902.875	0.0041
0.0 °C	5 V DC	902.875	0.0044
+10.0 °C	5 V DC	902.875	0.0043
+20.0 °C	5 V DC	902.875	0.0042
+30.0 °C	5 V DC	902.875	0.0041
+40.0 °C	5 V DC	902.875	0.0047
+50.0 °C	5 V DC	902.875	0.0041

Table 8 - Frequency Tolerance Under Temperature Variation

Temperature	Voltage	Frequency (MHz)	Frequency Deviation (%)
+20.0 °C	4.25 V DC	902.875	0.0050
+20.0 °C	5 V DC	902.875	0.0042
+20.0 °C	5.75 V DC	902.875	0.0052

Table 9 - Frequency Tolerance Under Voltage Variation

2.4.8 Test Location and Test Equipment

This test was carried out in a non shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and Spectrum Analysator	Rohde & Schwarz	FSV40	20219	12	2024-02-29
Temperature test chamber	Feutron	KPK200-2	19868	18	2024-08-31

Product Service

2.5 Radiated emissions

2.5.1 Specification Reference

FCC 47 CFR Part 15 C, Clauses 15.205, 15.209 and 15.231(b)
ISED RSS-231, Clause A.1.1
ISED RSS-Gen, Clauses 8.9 and 8.10

2.5.2 Equipment under Test and Modification State

SV21-T-EOU; S/N 1830960310003; Modification state: 0

2.5.3 Date of Test

2023-07-21

2.5.4 Environmental Conditions

Ambient Temperature	21 °C
Relative Humidity	39 %

Product Service

2.5.5 Specification Limits

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 10 General radiated emission limits

FCC 47 CFR Part 15 C, Clause 15.231(a); ISED RSS-231, Clause A.1.1

Frequency Range	*Field strength of fundamental*		*Field strength of spurious emissions*	
(MHz)	*(µV/m)*	*(dBµV/m)*	*(µV/m)*	*(dBµV/m)*
40.66 – 40.70	2500	67.96	225	47.96
70 – 130	1250	61.94	125	41.94
130 – 174	1250 – 3750 *	61.94 – 71.48 *	125 – 375 *	41.94 – 51.48 *
174 – 260	3750	71.48	375	51.48
260 – 470	3750 – 12500 *	71.48 – 81.94 *	375 – 1250 *	51.48 – 61.94 *
Above 470	12500	81.94	1250	61.94

* linear interpolation

The above field strength limits are specified at a distance of 3 m. The tighter limits apply at the band edges.

Intentional radiators shall demonstrate compliance with the limits above based on the (linear) average value of the measured emissions. As an alternative, compliance with these limits may be based on the use of measurement instrumentations with a CISPR quasi-peak detector. If average emission measurements are employed, the provisions for averaging pulsed emissions and for limiting peak emissions apply.

The limits on the field strength of the spurious emissions in the table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or alternatively, CISPR quasi-peak) limits shown in this table or to the general spurious emission limits, whichever limit permits a higher field strength.

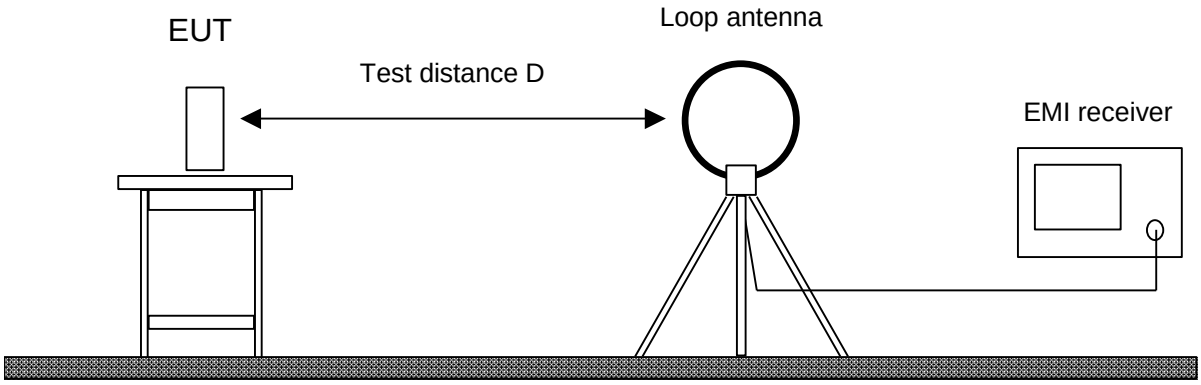
Product Service

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.

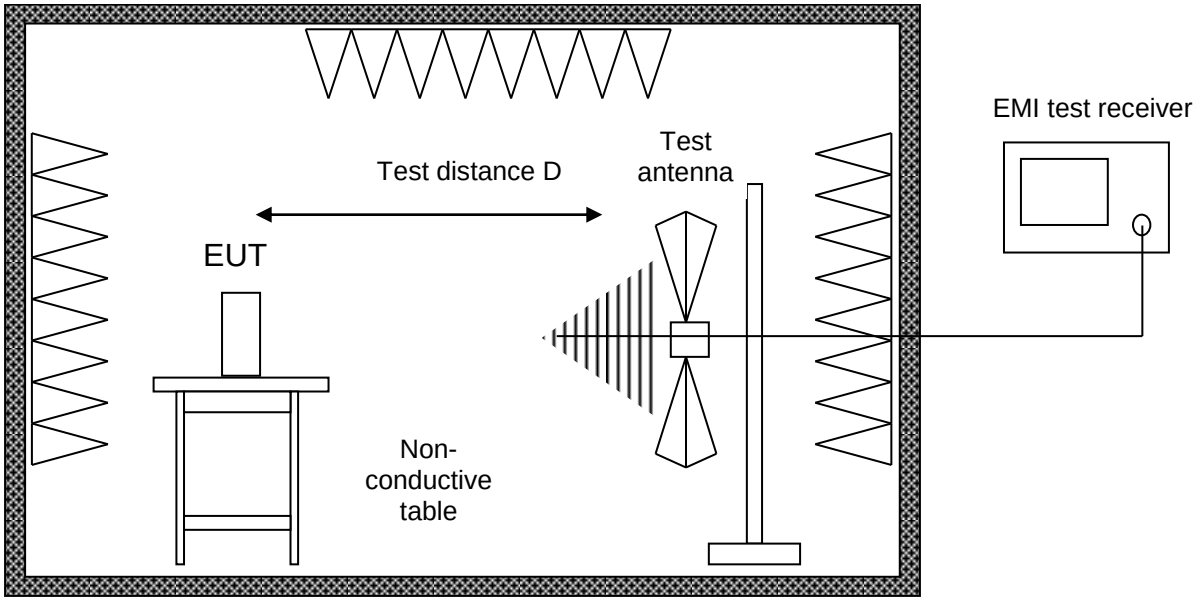
2.5.6.1 Frequency range 9 kHz – 30 MHz



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

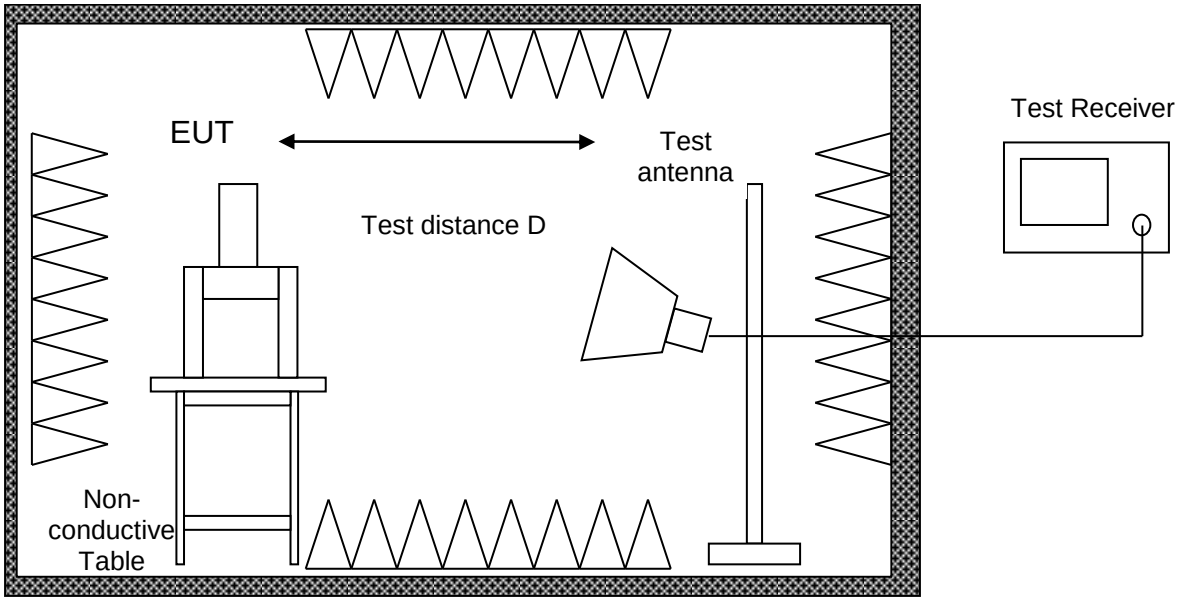


Alternate test site (semi anechoic room)

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

Frequency range	*Limit applied*	*Test distance*
9kHz – 1GHz	15.209	3m
1GHz - 10GHz	15.209	1m

Table 11

Sample calculation:

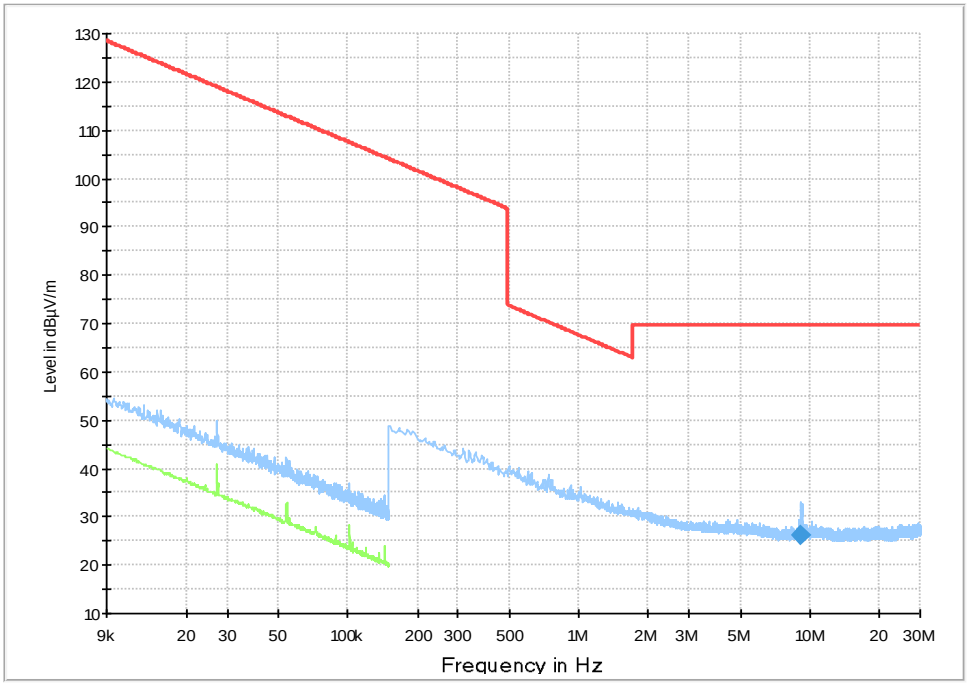
Final Value (dBµV/m) = Reading Value (dBµV) + (Cable attenuation (dB) + Antenna Transducer (dB(1/m)))

Additional correction of limit in the frequency range 9 – 490 kHz (300 m to 3 m): +80.0 dB
Additional correction of limit in the frequency range 490 kHz – 30 MHz (30 m to 3 m): +40.0 dB
Additional correction of limit in the frequency ranges above 1 GHz (3 m to 1 m): +9.54 dB

Note: Only the worst case position of the EUT is in this Test Result.

Product Service

Frequency range 9 kHz – 30 MHz:

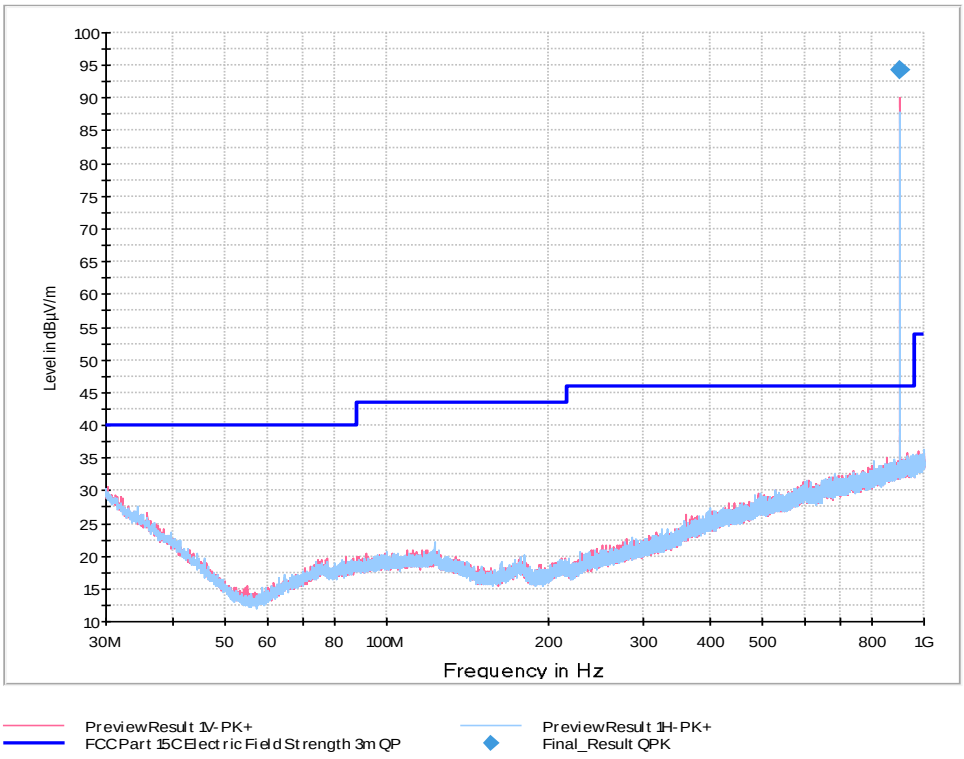


Final Results 1:

Frequency MHz	*QuasiPeak dBµV/m*	*Limit dBµV/m*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Height cm*	*Pol*	*Azimuth deg*	*Corr. dB*
9.197250	26.32	69.54	43.22	1000.0	9.000	100.0	H	0.0	19.3

Product Service

Frequency range 30 MHz – 1 GHz:



Final Results 1:

Frequency *MHz*	*Peak* *dBµV/m*	*Average* *dBµV/m*	*Limit* *dBµV/m*	*Mar-gin* *dB*	*Meas. Time* *ms*	*Band-width* *kHz*	*Height* *cm*	*Pol*	*Azi-muth* *deg*	*Corr.* *dB*
902.820000	94.25	---	#1 101.93	7.68	1000.0	120.000	105.0	V	113.0	30.4
902.820000	---	#2 63.67	81.93	18.26	1000.0	120.000	105.0	V	113.0	30.4

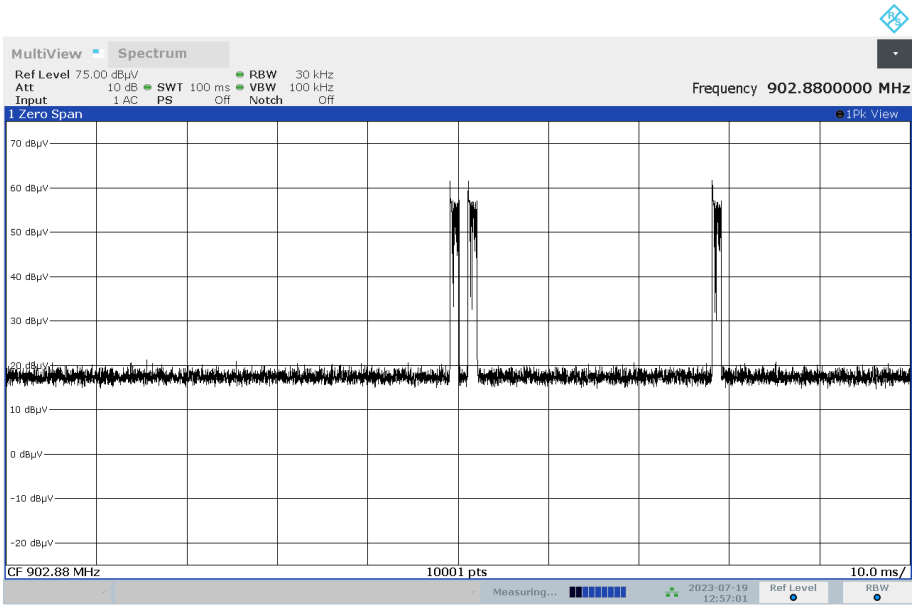
#1 §15.35(b) specifies a 20 dB maximum between the peak and average measurements; therefore, a +20.0 dB averaging factor will be used.

#2 For the average value the provisions in §15.35(c) apply by reduce 30.58 dB.
94.25 dBµV/m – 30.58 dB = 63.67 dBµV/m. (Details see below)

Product Service

Pulsed Emission Averaging Factor

The EUT is a pulsed transmitter.
Therefore, the method of §15.35 for averaging a pulsed emission may be used.
A timing diagram of the pulsed transmission, plots of the pulse train, and the average factor calculations are shown below:



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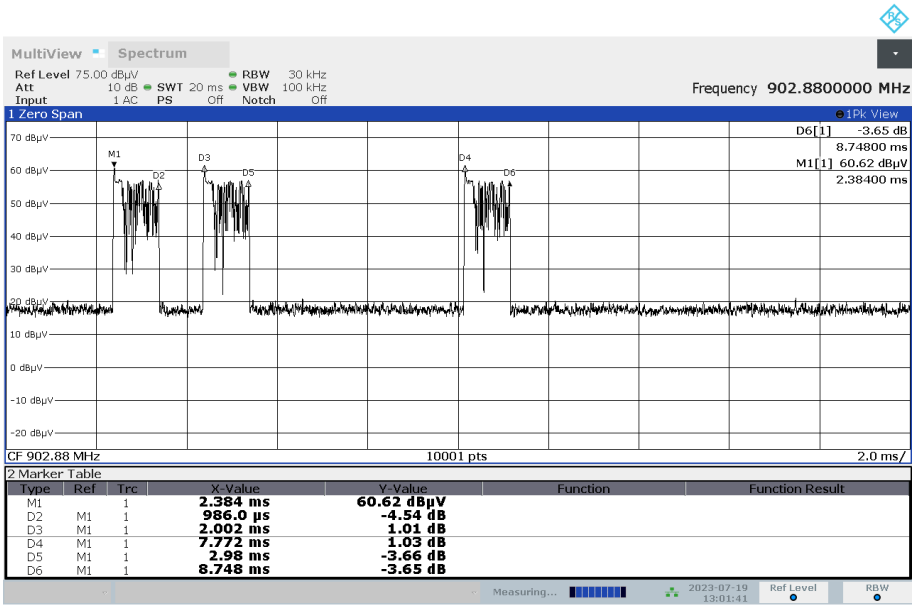

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Product Service

Average factor calculation

From the plots there are 3 pulses transmitted in 100 milliseconds.
The maximum time for averaging the emission using FCC §15.35(c) is 100 ms.
The Average Factor will be calculated using 100 ms as specified in FCC §15.35(c).

The Average Factor is calculated by the equation:

Average Factor = 20 log (on time/pulse train time)

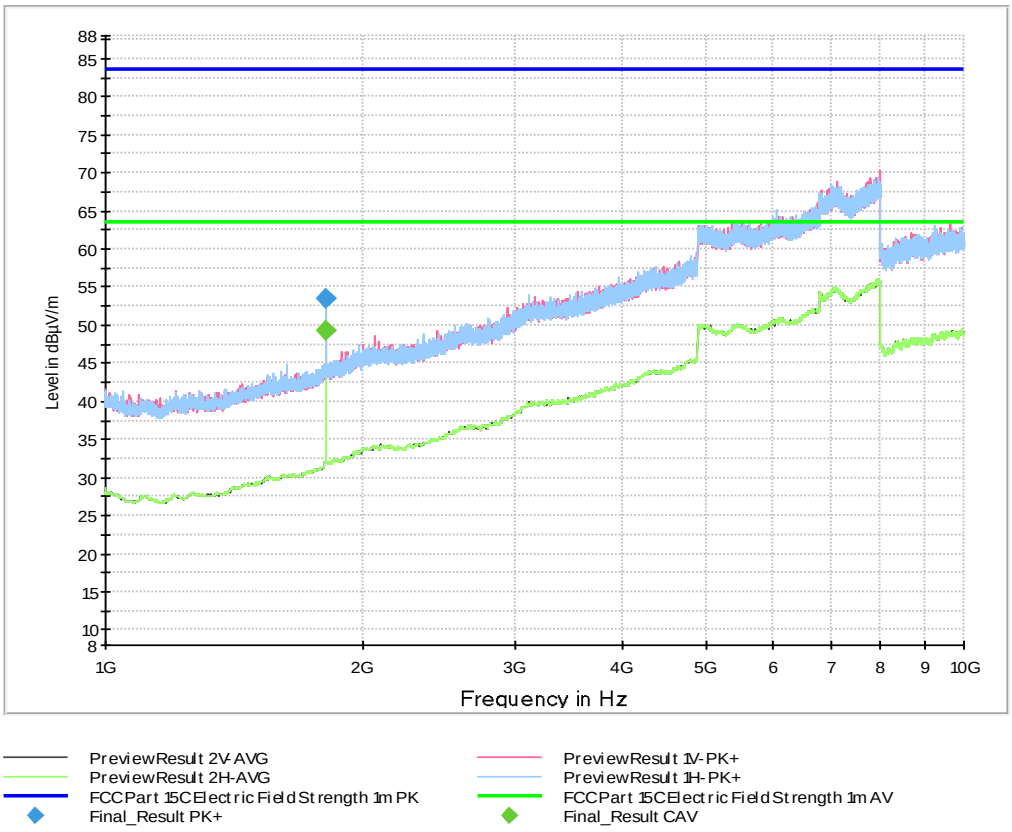
Pulse train time = 100 ms per FCC §15.35(c)

On time = 0.986 ms x 3 = 2.958 ms

Average Factor = 20 log (2.958 / 100)
= 30.58 dB

Product Service

Frequency range 1 GHz – 10 GHz:



Final Results 1:

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*
1805.750000	---	49.38	63.50	14.12	1000.0	1000.000	150.0	H	-5.0	31.3
1805.750000	53.46	---	83.50	30.04	1000.0	1000.000	150.0	H	-5.0	31.3

Product Service

2.5.8 Test Location and Test Equipment

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

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2024-04-30
Loop antenna	Schwarzbeck	FMZB 1519 B	44334	36	2024-01-31
ULTRALOG Antenna	Rohde & Schwarz	HL562E	38401	36	2026-01-31
Horn antenna	Rohde & Schwarz	HF907	40089	24	2024-10-31
Semi anechoic room	Rohde & Schwarz	No. 11	---	---	---
EMC measurement software	Rohde & Schwarz	EMC32 Emission K11 – V11.50	42986	---	---

Product Service

2.6 Conducted Emissions on Mains Terminals

2.6.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.207
ISED RSS-Gen, Clause 8.8

2.6.2 Equipment under Test and Modification State

SV21-T-EOU; S/N 1830960310003; Modification state: 0

2.6.3 Date of Test

2023-07-20

2.6.4 Environmental Conditions

Ambient Temperature	22 °C
Relative Humidity	34 %

2.6.5 Specification Limits

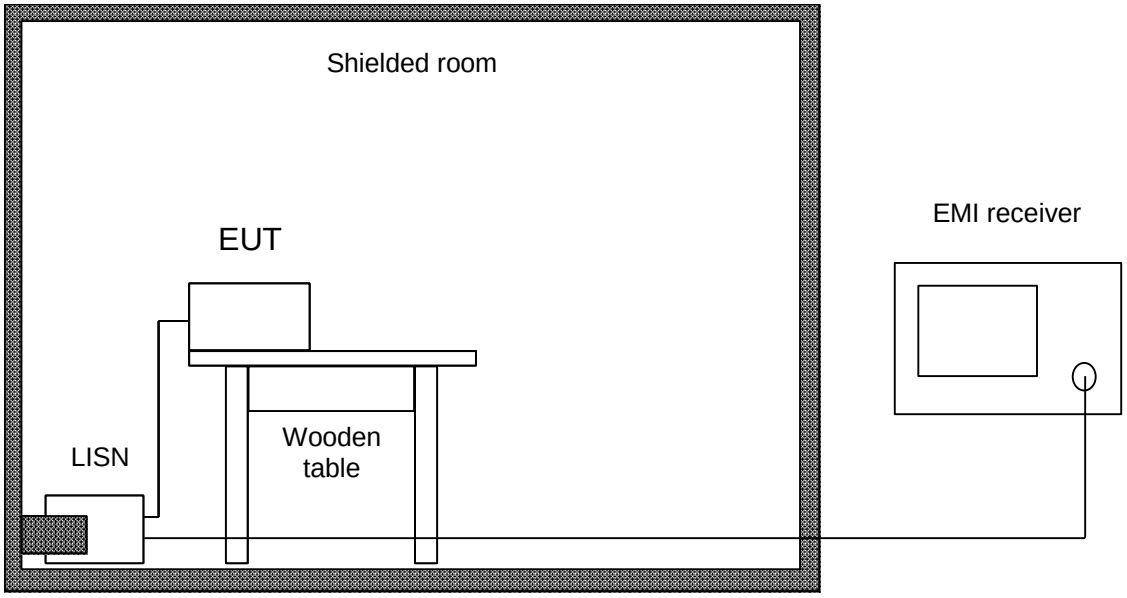
Required Specification Limits			
Line Under Test	*Frequency Range (MHz)*	*Quasi-peak (dBµV)*	*Average (dBµV)*
AC Power Port	0.15 to 0.5	66 to 56*	56 to 46*
	0.5 to 5	56	46
	5 to 30	60	50
Supplementary information: *Decreases with the logarithm of the frequency.			

Table 12 Emission limits

Product Service

2.6.6 Test Method

The test was performed according to ANSI C63.10, section 6.2.



The EUT was placed on a non-conductive table 0.8 m above a reference ground plane and 0.4 m away from a vertical coupling plane
All power was connected to the EUT through an Line Impedance Stabilization Network (LISN). Conducted disturbance voltage measurements on mains lines were made at the output of the LISN. The LISN was placed 0.8 m from the boundary of the EUT and bounded to the reference ground plane. To simplify testing with quasi-peak and linear average (cispr-average) detector the following procedure is used:
First the whole spectrum of emission caused by the equipment under test (EUT) is recorded with the detectors set to peak and average using CISPR bandwidth of 10 kHz. After that all emission levels having less margin than 10 dB to or exceeding the average limit are retested with the detectors set to quasi-peak and average. If the average limit is kept with quasi-peak levels measurement with average detector is optional. In cases of emission levels between quasi-peak and average limit an additional measurement with average detector has to be performed.
According to ANSI C63.10, section 6.2.5, testing of intentional radiators with frequencies below 30 MHz shall be performed using a suitable dummy load connected to the antenna output terminals. Otherwise the tests shall be performed with the integral or a representative antenna and, if adjustable, fully extended. Testing with a dummy load may be necessary to distinguish (unintentional) conducted emissions on the supply lines form (intentional) emissions radiated by the antenna and coupling directly to supply lines and/or LISN. The usage of a dummy load has to be stated in the appropriate test record(s) and notes should be added to clarify the test setup.

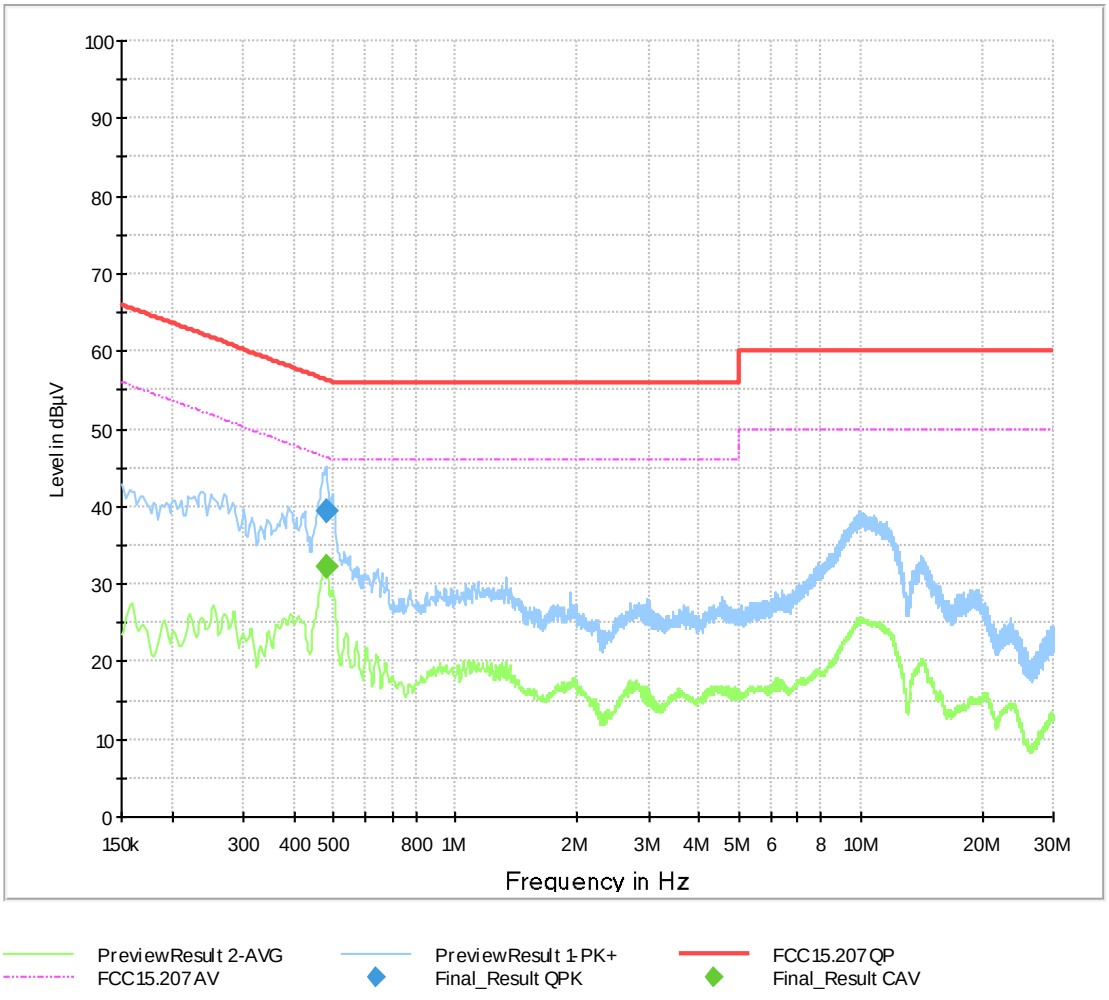
Product Service

2.6.7 Test Results

Sample calculation:

Final Value (dBµV) = Reading Value (dBµV) + (Cable attenuation (dB) + LISN Transducer (dB))

Line L1 and N:



Final Results 1:

Frequency MHz	*QuasiPeak dBµV*	*CAverage dBµV*	*Limit dBµV*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Line*	*Filter*	*Corr. dB*
0.480750	---	32.28	46.33	14.05	1000.0	9.000	L1	ON	10.0
0.480750	39.30	---	56.33	17.03	1000.0	9.000	L1	ON	10.0

Product Service

2.6.8 Test Location and Test Equipment

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

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz GmbH & Co. KG	ESU8	19904	12	2024-02-29
V-network	Rohde & Schwarz GmbH & Co. KG	ENV216	39908	12	2024-05-31
EMC measurement soft-ware	Rohde & Schwarz GmbH & Co. KG	EMC32 Immunity K9 – V10.60.20	44380	---	---
Shielded room	Albatross Projects GmbH	Cabin no. 9	21083	---	---

Product Service

3 Measurement Uncertainty

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

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

Table 13 Measurement uncertainty based on CISPR 16-4-2

Product Service

Radio Interference Emission Testing		
Test Name	*kp*	*Expanded Uncertainty*
Occupied Bandwdith	2	± 5 %
Conducted Power		
9 kHz ≤ f < 30 MHz	2	± 1.0 dB
30 MHz ≤ f < 1 GHz	2	± 1.5 dB
1 GHz ≤ f ≤ 40 GHz	2	± 2.5 dB
1 MS/s power sensor (TS8997)	2	± 1.5 dB
Occupied Bandwidth	2	± 5 %
Power Spectral Density	2	± 3.0 dB
Radiated Power		
25 MHz – 6 GHz	1.96	±4.4 dB
1 GHz – 18 GHz	1.96	±4.7 dB
18 GHz – 40 GHz	1.96	±4.9 dB
40 GHz – 325 GHz	1.96	±6.1 dB
Conducted Spurious Emissions	2	± 3.0 dB
Radiated Spurious Emissions	2	± 6.0 dB
Voltage		
DC	2	± 1.0 %
AC	2	± 2.0 %
Time (automatic)	2	± 5 %
Frequency	2	± 10^{-7}
The expanded uncertainty reported according to to ETSI TR 100 028:2001 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%		

Table 14 Measurement uncertainty based on ETSI TR 100 028

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

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

Table 15 Decision Rule: Maximum allowed measurement uncertainty