Report on the FCC and IC Testing of the Agrident GmbH Mobile RFID Reader for electronic animal identification Model: APR600 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:

Agrident GmbH
Steinklippenstr. 10
30890 Barsinghausen
Germany

COMMERCIAL-IN-CONFIDENCE

FCC ID: QG2APRGEN3
IC: 6252A-APRGEN3

Date: 2021-04-15
Document Number: TR-09774-99586-01 | Edition 6

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Martin Steindl	2021-04-15	Steindl Martin SIGN-ID 494451
Authorised Signatory	Markus Biberger	2021-04-16	SIGN-ID 495006

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	Martin Steindl	2021-04-15	Steindl Martin SIGN-ID 494452

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:2019 and ISED RSS-210:2019 and ISED RSS-Gen:2019

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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	2021-02-03
2	Added external antenna as optional accessory. Clarified description internal antenna description in technical description. Corrected typos in table of cables, date of test. Corrected manufacturer of antennas. Added details and corrected results on SPR-002 testing.	2021-02-25
3	Added electric field strength to SPR-002	2021-03-05
4	Extention of RF-Exposure calculation	2021-03-19
5	Added photo of distance of 2.4 GHz antenna to surface to annex C; updated KDB 477498 evaluation	2021-04-09
6	Added comment on page 33. Deleted summary table on page 36.	2021-04-15

Table 1: Report of Modifications

1.2 Introduction

Applicant	Agrident GmbH Steinklippenstr. 10 30890 Barsinghausen Germany
Manufacturer	Agrident GmbH
Model Number(s)	APR 600
Product Number(s)	1621 (APR600 Agrident) 1625 (APR600 Allflex)
Accessory:	AEA675 external antenna
Serial Number(s)	1605000602 (tested APR 600), 5018001003 (AEA675)
Hardware Version(s)	N/A
Software Version(s)	N/A
Number of Samples Tested	1
Test Specification(s) / Issue / Date	FCC 47 CFR Part 15 C : 2019 and ISED RSS-210, Issue 10, Amd. 1 : 2019 ISED RSS-Gen, Issue 5, Amd. 1 : 2019 ISED RSS-102, Issue 5, Amd. 1 : 2021
Test Plan/Issue/Date	N/A
Order Number Date	E-Mail 2020-10-22
Date of Receipt of EUT	2020-12-21
Start of Test	2021-01-27
Finish of Test	2021-02-02
Name of Engineer(s)	P. Müller, M. Steindl
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 15 C and ISED RSS-210 and RSS-Gen is shown below.

Section	*Specification Clause*	*Test Description*	*Result*
2.1	15.203	Antenna requirement	Pass
2.2	15.215(c)	Bandwidth of Signal	Pass
2.3	15.207	Conducted Disturbance at Mains Terminal	Pass
2.5	15.209	Radiated Disturbance	Pass

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

Section	*Specification Clause*	*Test Description*	*Result*
2.3	7.3	Radiated Emissions	Pass
2.5	7.3	AC Power Line Conducted Emissions	Pass

Table 3: Results according to ISED RSS-210

Section	*Specification Clause*	*Test Description*	*Result*
2.2	6.7	Bandwidth of Signal	Pass
2.4	8.11	Temperature Stability	Pass
2.5	8.8	AC Power Line Conducted Emissions	Pass
2.3	8.9, 8.10	Radiated Emissions	Pass

Table 4: Results according to ISED RSS-Gen

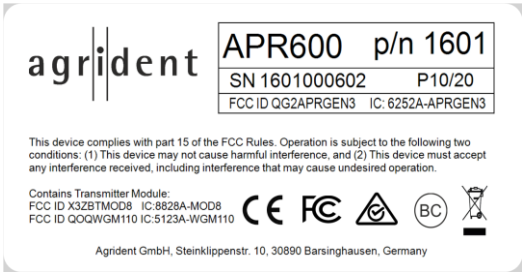
Product Service

1.4 Product Information

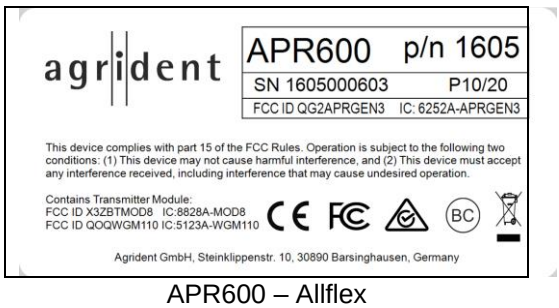
1.4.1 Technical Description

The APR600, for both brands Agrident and Allflex, is a fully integrated ISO 11764/11875 RFID reader for both HDX and FDX-B. It is powered by an integrated Li-Ion battery, rechargeable via USB port. The APR600 has integrated antennas for all radio and a connector for an optional external Antenna AEA675 for RFID.

Frequency	134.2 kHz
Number of frequency channels:	1
Emission designator:	2k8A1D
Supply Voltage:[1]	120 V
Supply Frequency:[1]	60 Hz
Highest clock frequency (non-radio part):	62.00 MHz



APR600 – Agrident



APR600 – Allflex

AEA675
optional external antenna

[1] For external USB-charger

Product Service

1.4.2 List of Antennas

Manufacturer	*Model*	*Antenna im-pedance*	*Antenna Type*	*Antenna gain*
Agrident	Integrated antenna	N/A	Inductive coil	N/A
Agrident	AEA675	N/A	Inductive ferrite coil	N/A

Table 5: List of antennas

1.4.3 EUT Ports / Cables identification

Port	Max Cable Length specified	Usage	Screened
APR600			
Antenna	1.5 m	Signal IO	No
USB charging	1.05 m	DC supply / Signal IO	Yes

Table 6

Product Service

1.5 Test Configuration

The EUT was configured as stand alone equipment.
The EUT was tested with internal and external antenna. Full test scope was performed for maximum emission.

1.6 Modes of Operation

The EUT was configured to read a RFID tag continuously.

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 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 7

1.9 Test Location

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

Test Name	Name of Engineer(s)
APR600	
Conducted Disturbance at Mains Terminal	M. Steindl
Radiated Emissions	P. Müller, M. Steindl

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

APR600 ; S/N 1605000602; Modification state 0

2.1.3 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.

2.1.4 Test Results

Manufacturer	*Model*	*Antenna gain*	*Impedance*	*Connector*	*Result*
Agrident	Integrated antenna	N/A	N/A	Internal	Pass
Agrident	AEA675	N/A	N/A	Custom	Pass

Product Service

2.2 Bandwidth of Signal

2.2.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.215(c)
ISED RSS-Gen, Clause 6.7

2.2.2 Equipment under Test and Modification State

APR600 ; S/N 1605000602; Modification state 0

2.2.3 Date of Test

2021-02-01

2.2.4 Environmental Conditions

Ambient Temperature	18 °C
Relative Humidity	31 %

2.2.5 Specification Limits

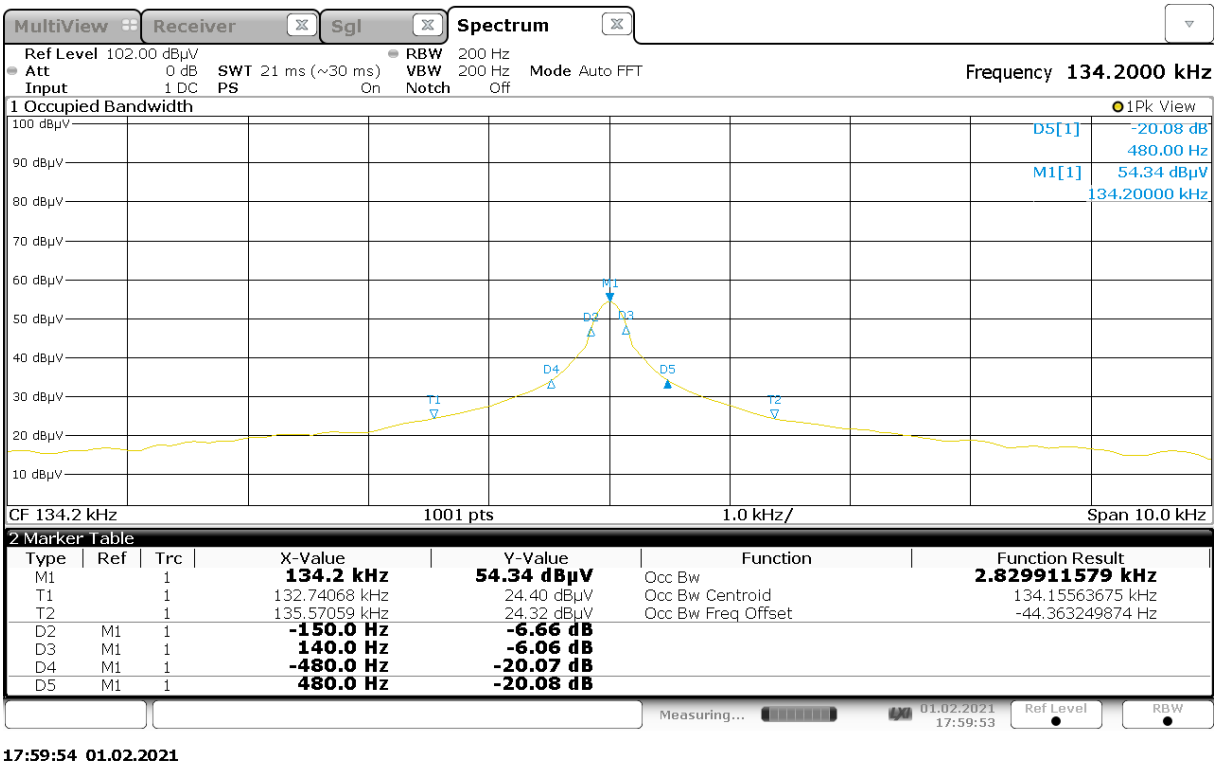
No limitation – Bandwidth noted

2.2.6 Test Method

The test was performed according to ANSI C63.10, clauses 6.9
See section 2.3 of this test report for details.

Product Service

2.2.7 Test Results



17:59:54 01.02.2021

Center frequency	*20 dB Bandwidth*
134.2 kHz	960 kHz

Table 8: 20 dB bandwidth

Centre Frequency	*99% Bandwidth*
134.2 kHz	2.83 kHz

Table 9: 99% bandwidth

Product Service

2.2.8 Test Location and Test Equipment

The test was carried out in Semi-anechoic room No. 8

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2021-09
Loop antenna	Rohde & Schwarz	HFH2-Z2	18876	36	2022-12

Table 10

Product Service

2.3 Radiated Emissions

2.3.1 Specification Reference

FCC 47 CFR Part 15 C, Clauses 15.205, and 15.209
ISED RSS-210, Clause 7.7
ISED RSS-Gen, Clauses 8.9 and 8.10

2.3.2 Equipment under Test and Modification State

APR600 ; S/N 1605000602; Modification state 0
With and without external antenna AEA675

2.3.3 Date of Test

2021-01-27 to 2021-02-01

2.3.4 Environmental Conditions

Ambient Temperature	23 °C / 18 °C
Relative Humidity	28 % / 31 %

Product Service

2.3.5 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 11 General radiated emission limits

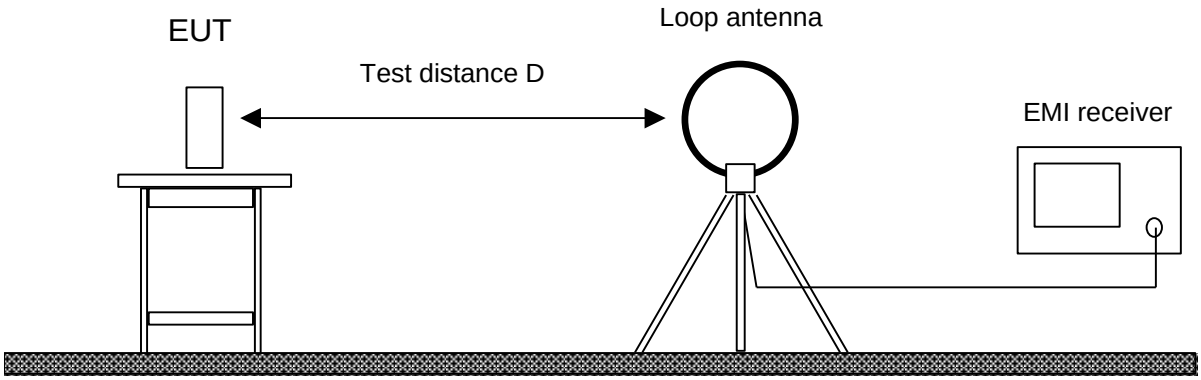
Product Service

2.3.6 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.

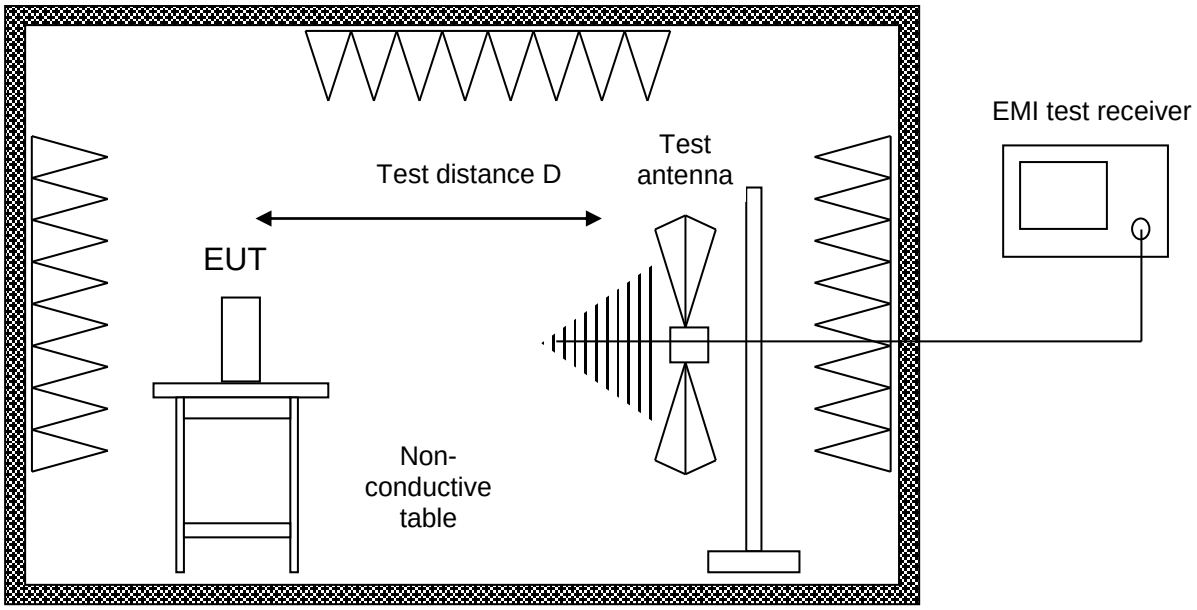
2.3.6.1 Frequency range 9 kHz – 30 MHz



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

2.3.6.2 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.

2.3.7 Test Results

Frequency range	*Limit applied*	*Test distance*
9 kHz – 30 MHz	15.209	3 m for internal antenna 10 m for external antenna
30 MHz – 1 GHz	15.209	3 m

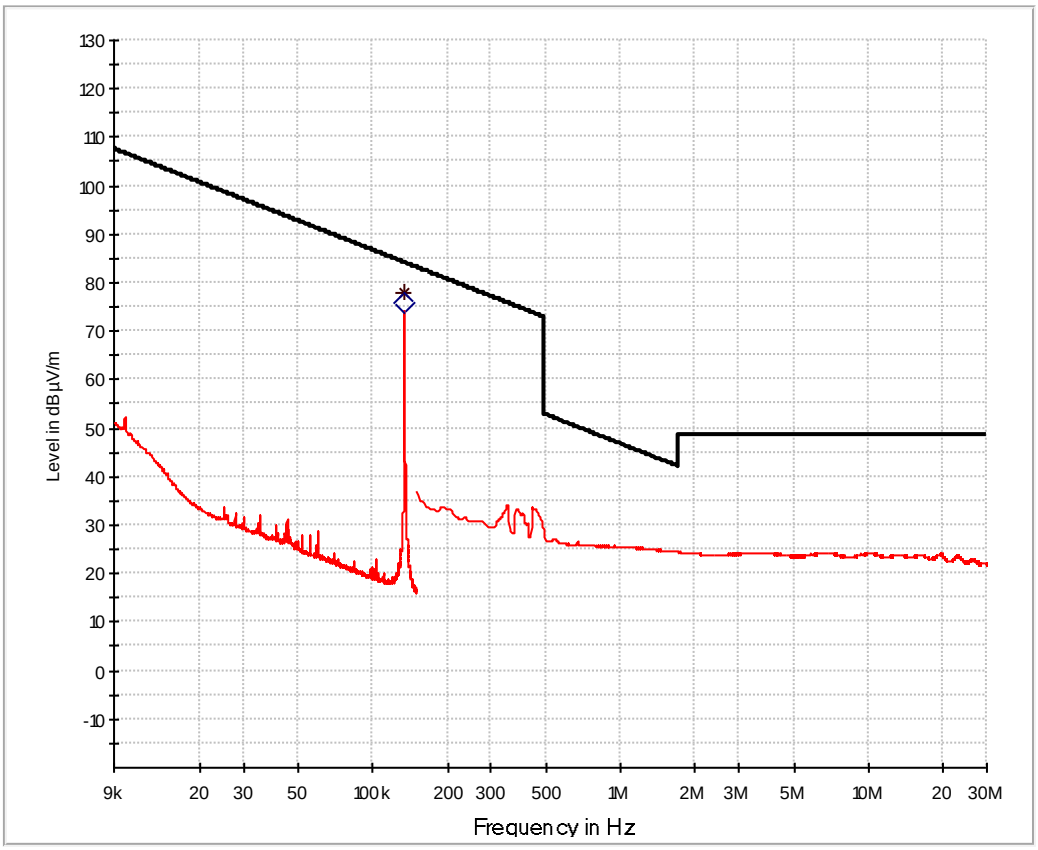
Table 12

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

Product Service

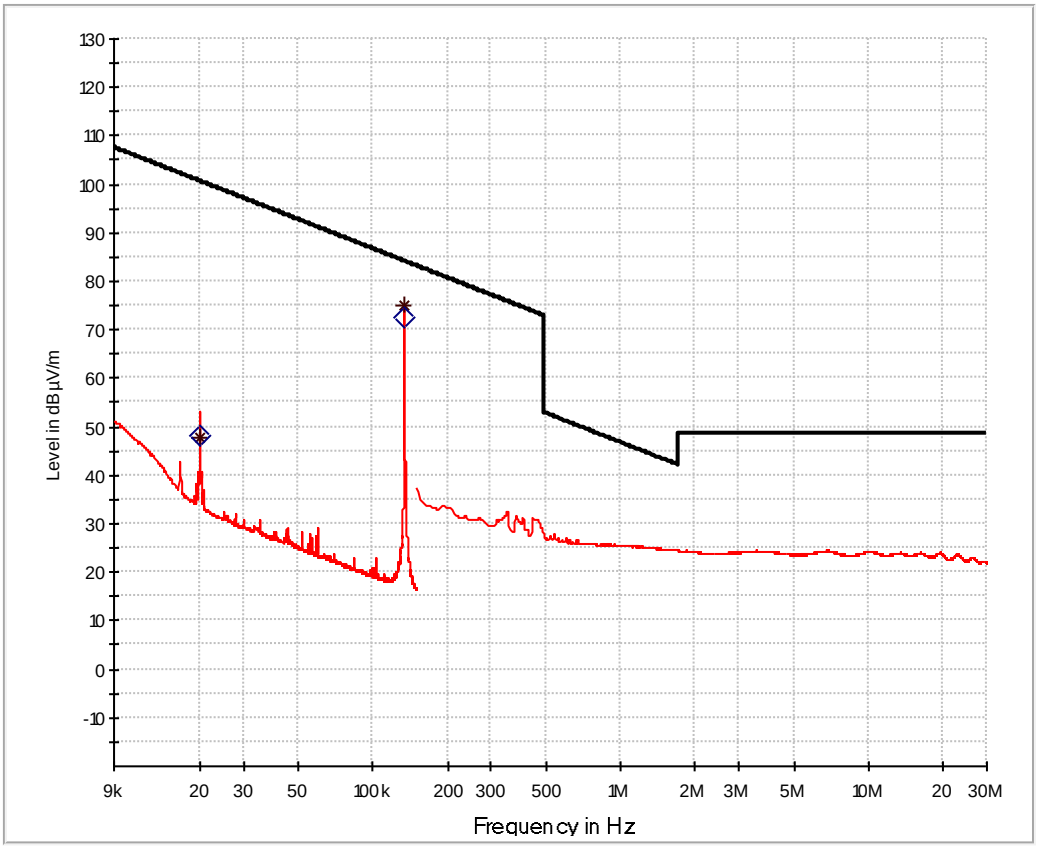
External Antenna:

Frequency range 9 kHz – 30 MHz:

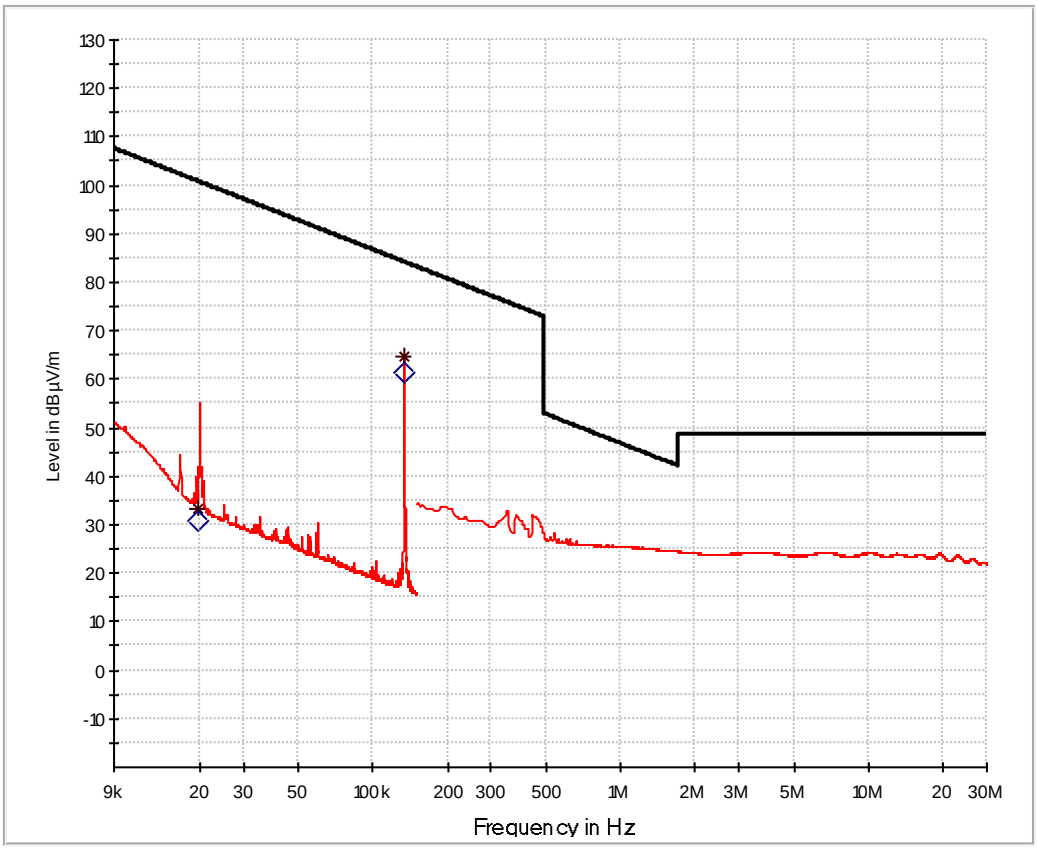


Frequency MHz	Peak dBµV/m	CAverage dBµV/m	Limit dBµV/m	Margin dB	Meas. Time ms	Bandwidth kHz	Pol	Azimuth deg	Corr. dB/m
0.134200		75.80	84.14	8.34	1000.0	0.200	H	70.0	19.8
0.134200	78.00		104.14	26.14	1000.0	0.300	H	70.0	19.8

Product Service



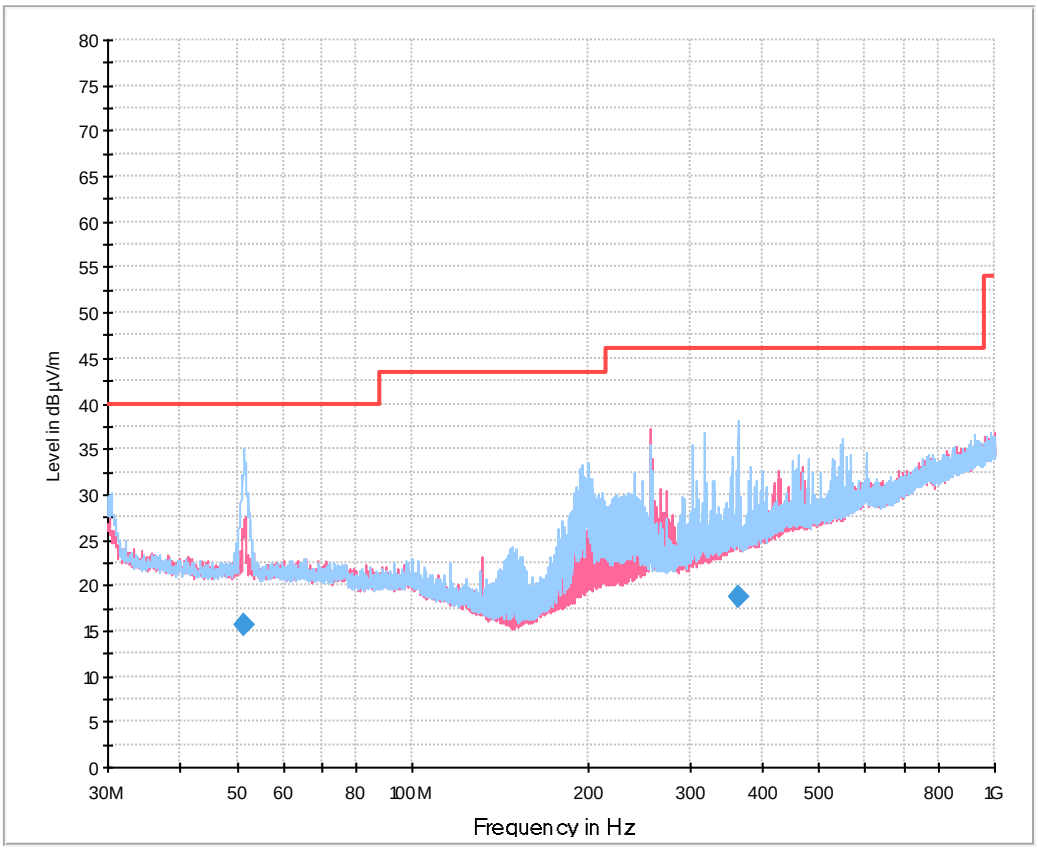
Frequency *MHz*	*Peak* *dBµV/m*	*CAverage* *dBµV/m*	*Limit* *dBµV/m*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Pol*	*Azimuth* *deg*	*Corr.* *dB/m*
0.020050	47.74		100.65	52.91	1000.0	0.200	V	113.0	20.9
0.020050		48.08	100.65	52.57	1000.0	0.200	V	113.0	20.9
0.134200	74.90		84.14	9.23	1000.0	0.300	H	69.0	19.8
0.134200		72.60	84.14	11.54	1000.0	0.200	H	69.0	19.8



Frequency MHz	Peak dBµV/m	CAverage dBµV/m	Limit dBµV/m	Margin dB	Meas. Time ms	Bandwidth kHz	Pol	Azimuth deg	Corr. dB/m
0.019550	33.47		100.87	67.40	1000.0	0.200	V	194.0	21.0
0.019550		31.00	100.87	69.87	1000.0	0.200	V	194.0	21.0
0.134200	64.90		84.14	19.24	1000.0	0.300	V	-20.0	19.8
0.134200		61.50	84.14	21.64	1000.0	0.200	V	-20.0	19.8

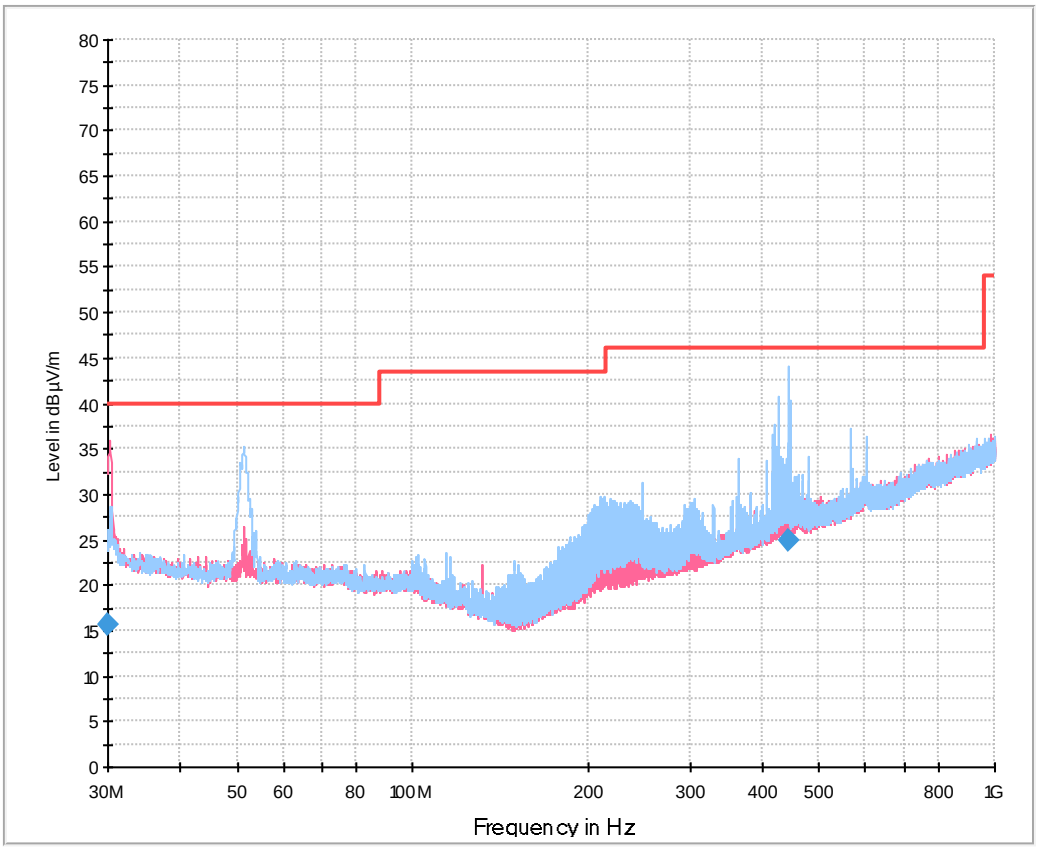
Product Service

Frequency range 30 MHz – 1 GHz:



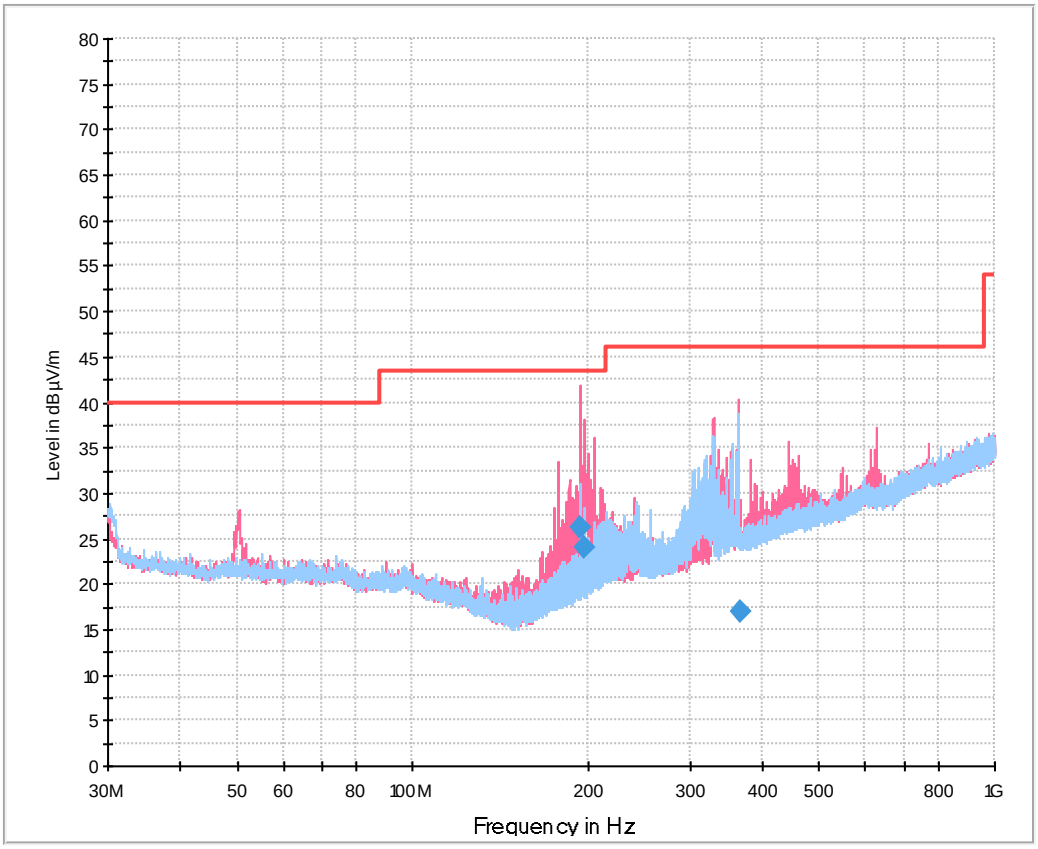
Frequency *MHz*	*QuasiPeak* *dBµV/m*	*Limit* *dBµV/m*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB/m*
51.420000	15.67	40.00	24.33	1000.0	120.000	355.0	H	130.0	19.8
363.360000	18.82	46.02	27.20	1000.0	120.000	242.0	H	66.0	22.5

Product Service



Frequency *MHz*	*QuasiPeak* *dBµV/m*	*Limit* *dBµV/m*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
30.000000	15.58	40.00	24.42	1000.0	120.000	172.0	V	0.0	19.7
441.540000	24.87	46.02	21.15	1000.0	120.000	192.0	H	-74.0	24.1

Product Service

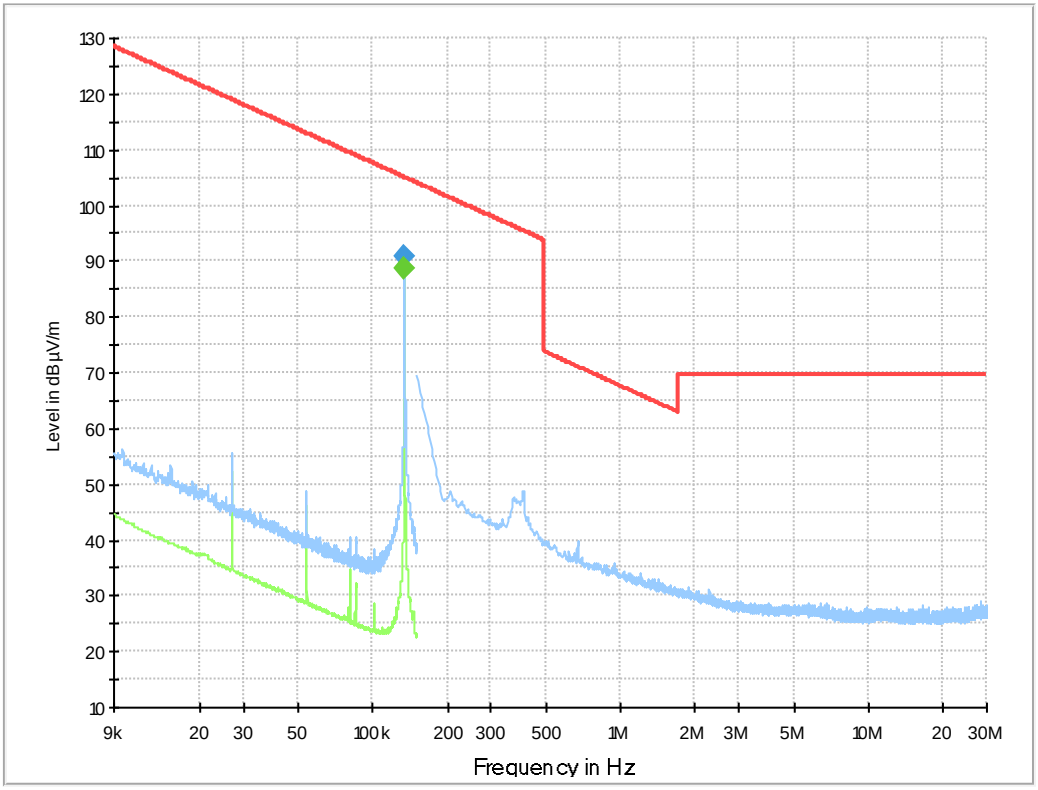


Frequency *MHz*	*QuasiPeak* *dBµV/m*	*Limit* *dBµV/m*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
194.460000	26.28	43.50	17.22	1000.0	120.000	203.0	V	-92.0	17.3
197.280000	23.97	43.50	19.53	1000.0	120.000	250.0	V	-70.0	17.5
364.740000	16.87	46.02	29.15	1000.0	120.000	201.0	V	90.0	22.6

Product Service

Internal Antenna:

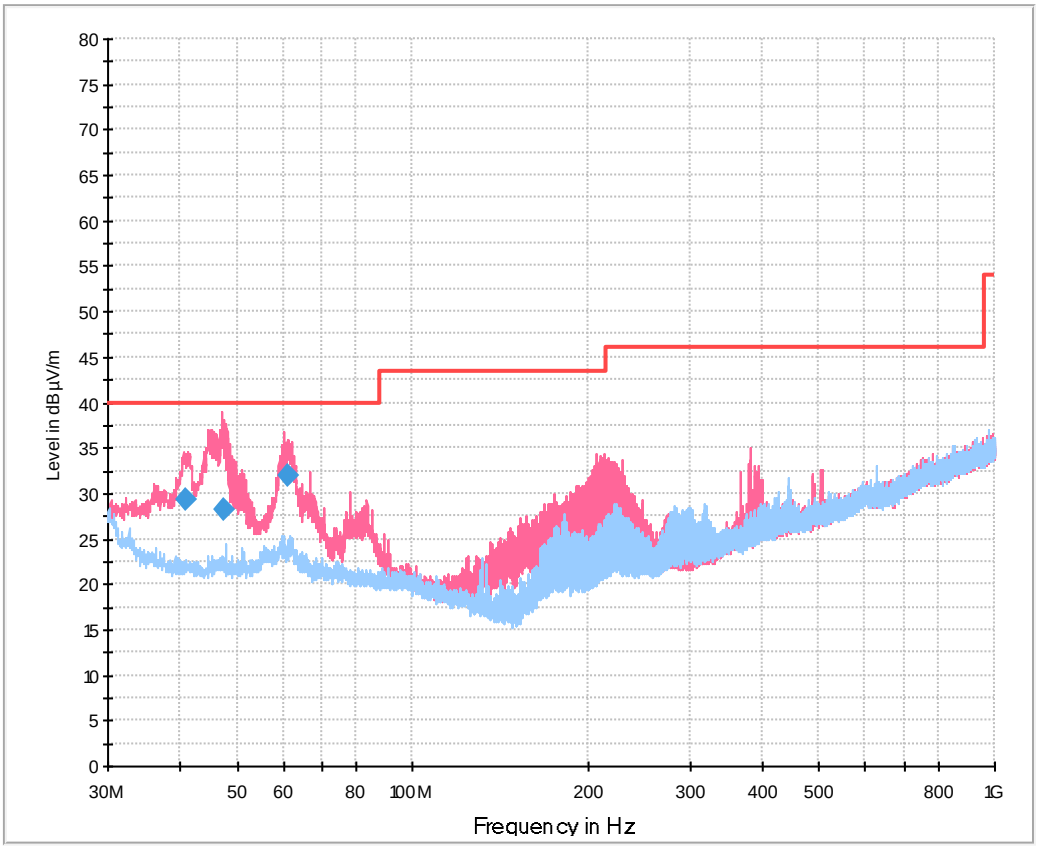
Frequency range 9 kHz – 30 MHz:



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*
0.134200		88.62	105.05	16.43	1000.0	0.200	100.0	H	140.0	19.3
0.134200	90.71		125.05	34.34	1000.0	0.200	100.0	H	140.0	19.3

Product Service

Frequency range 30 MHz – 1 GHz:



Frequency *MHz*	*QuasiPeak* *dBµV/m*	*Limit* *dBµV/m*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
40.920000	29.26	40.00	10.74	1000.0	120.000	100.0	V	-83.0	19.8
47.640000	28.21	40.00	11.79	1000.0	120.000	115.0	V	170.0	19.8
60.930000	31.98	40.00	8.02	1000.0	120.000	121.0	V	236.0	19.4

Product Service

2.3.8 Test Location and Test Equipment

The test was carried out in semi anechoic rooms No. 8 and No. 11

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2021-09
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2021-03
Loop antenna	Rohde & Schwarz	HFH2-Z2	18876	36	2022-12
Loop antenna	Schwarzbeck	FMZB 1519B	44334	36	2023-01
ULTRALOG Antenna	Rohde & Schwarz	HL562E	39969	36	2020-11
EMI test software	Rohde & Schwarz	EMC32 V10.50.10			

Table 13

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

APR600 ; S/N 1605000602; Modification state 0

2.4.3 Date of Test

2021-02-02

2.4.4 Environmental Conditions

Ambient Temperature	22 °C
Relative Humidity	31 %

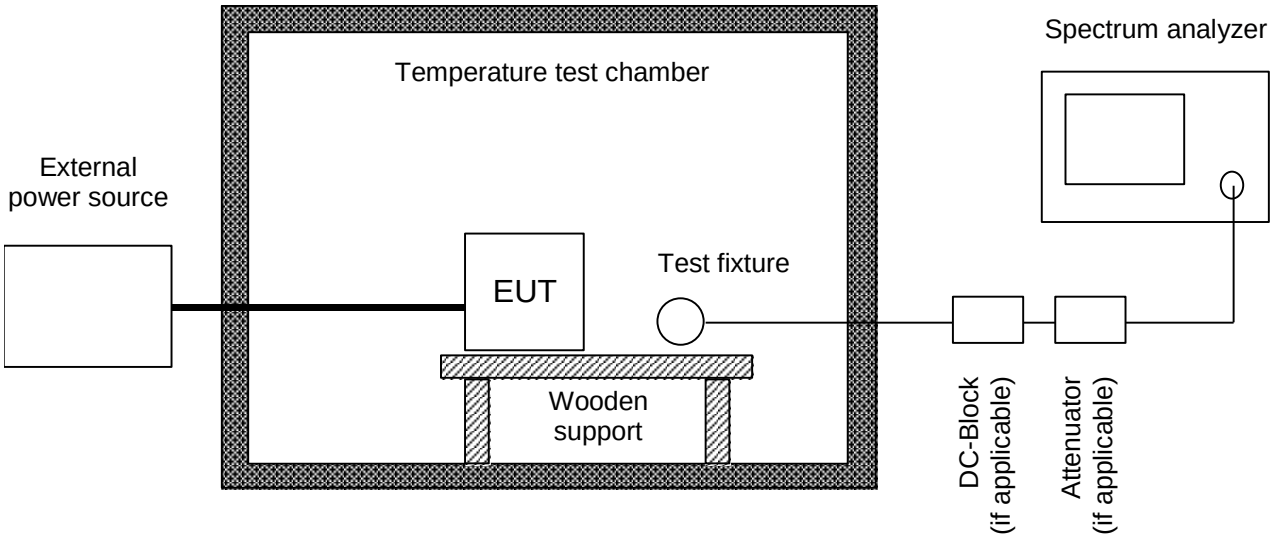
2.4.5 Specification Limits

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.

The test was performed with a fully charged battery.

Product Service

2.4.7 Test Results

Temperature	*Frequency (kHz)*	*Frequency drift (Hz)*
-20	134.1997	-0.5
-10	134.1940	-6.2
0	134.2047	+4.2
10	134.2000	0.2
20	134.2002	0.0
30	134.1987	-1.5
40	134.2005	+0.3
50	134.1929	-7.3

Table 14

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
Signal and spectrum analysator	Rohde & Schwarz	FSV40	20219	24	2022-01
Climatic test chamber	Feutron	KPK200-2	19868	36	2023-02

Table 15

Product Service

2.5 Conducted Emissions on Mains Terminals

2.5.1 Specification Reference

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

2.5.2 Equipment under Test and Modification State

APR600 ; S/N 1605000602; Modification state 0

2.5.3 Date of Test

2021-02-02

2.5.4 Environmental Conditions

Ambient Temperature	22 °C
Relative Humidity	31 %

2.5.5 Specification Limits

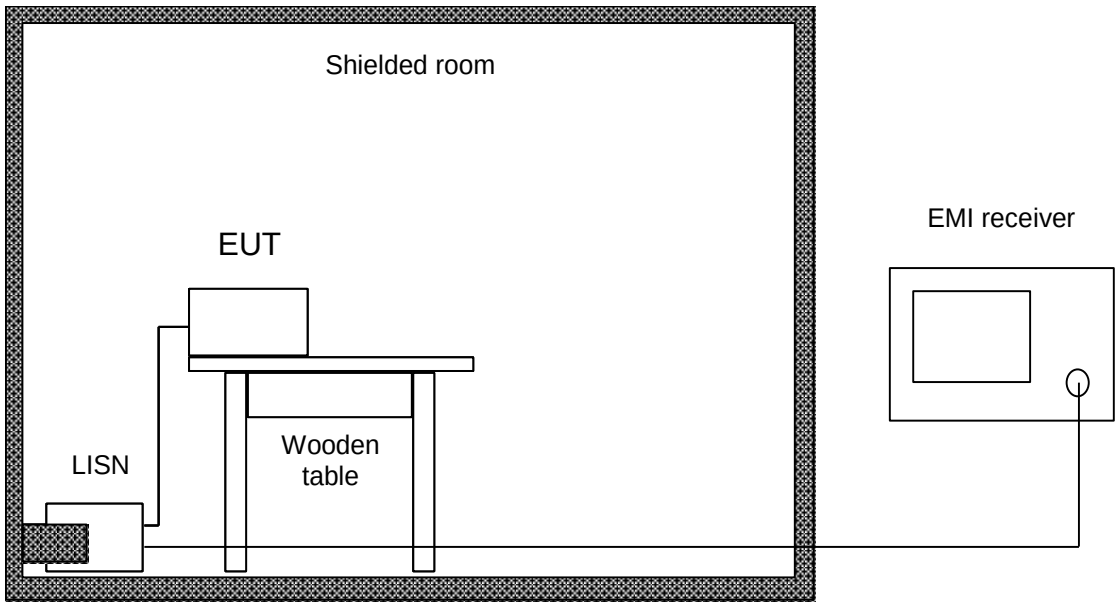
Required Specification Limits			
Line Under Test	*Frequency Range (MHz)*	*Quasi-peak (dBµV)*	*Average (dBµV)*
AC Power Port	0.15 to 0.5	66 to 56*	56 to 46*
	0.5 to 5	56	46
	5 to 30	60	50
Supplementary information: *Decreases with the logarithm of the frequency.			

Table 16 Emission limits

Product Service

2.5.6 Test Method

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



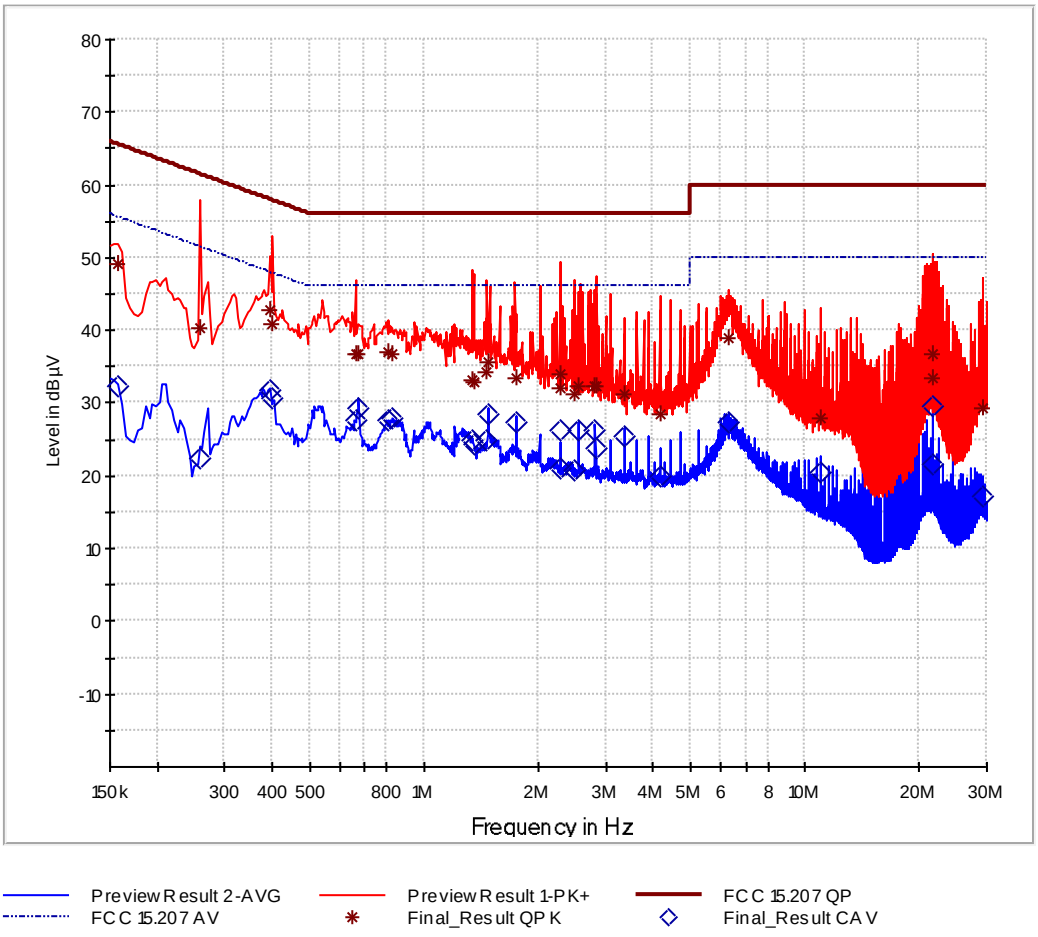
The EUT was placed on a non-conductive table 0.8 m above a reference ground plane and 0.4 m away from a vertical coupling plane>
All power was connected to the EUT through an Line Impedance Stabilization Network (LISN). Conducted disturbance voltage measurements on mains lines were made at the output 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.

Product Service

2.5.7 Test Results

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

Line L1:

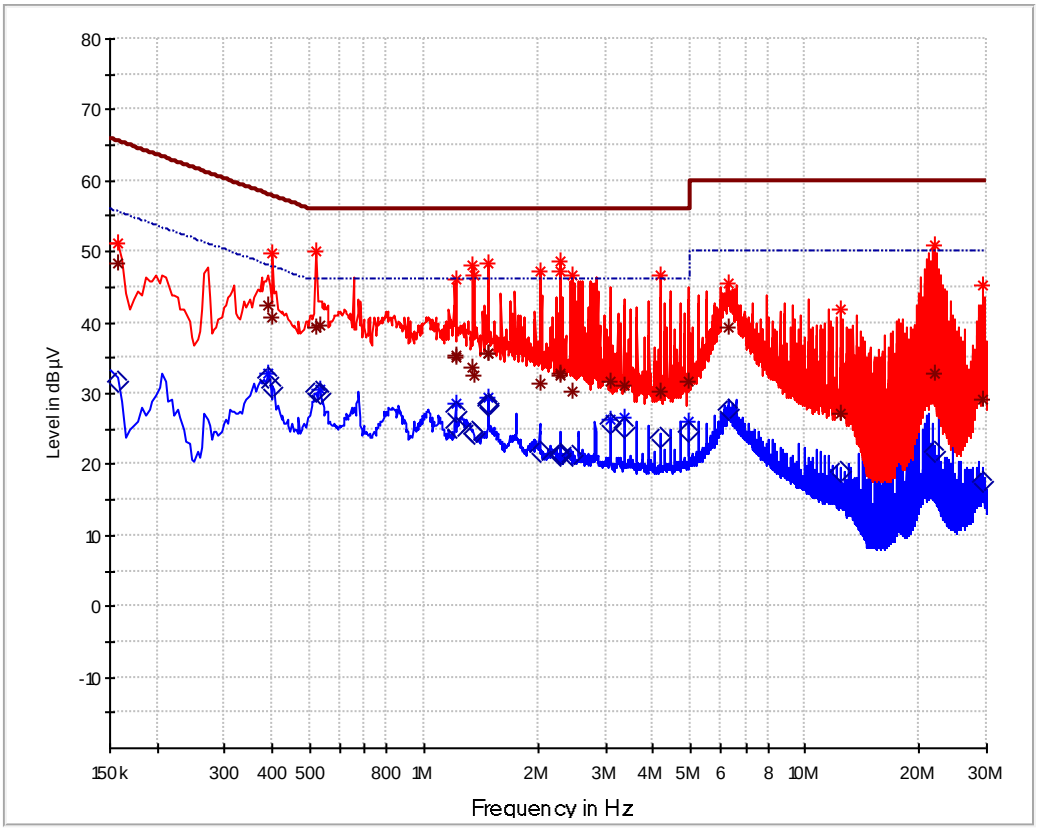


Product Service

Frequency MHz	QuasiPeak dBµV	CAverage dBµV	Limit dBµV	Margin dB	Meas. Time ms	Bandwidth kHz	Corr. dB
0.158000		32.26	55.57	23.31	1000.0	9.000	10.0
0.158000	49.18		65.57	16.39	1000.0	9.000	10.0
0.258000		22.48	51.50	29.02	1000.0	9.000	10.0
0.258000	40.30		61.50	21.20	1000.0	9.000	10.0
0.394000		31.74	47.98	16.24	1000.0	9.000	10.0
0.394000	42.82		57.98	15.16	1000.0	9.000	10.0
0.402000		30.79	47.81	17.02	1000.0	9.000	10.0
0.402000	40.91		57.81	16.90	1000.0	9.000	10.0
0.662000		27.62	46.00	18.38	1000.0	9.000	10.1
0.662000	36.88		56.00	19.12	1000.0	9.000	10.1
0.674000		29.31	46.00	16.69	1000.0	9.000	10.1
0.674000	36.87		56.00	19.13	1000.0	9.000	10.1
0.810000		27.63	46.00	18.37	1000.0	9.000	10.1
0.810000	36.89		56.00	19.11	1000.0	9.000	10.1
0.830000		27.82	46.00	18.18	1000.0	9.000	10.1
0.830000	36.67		56.00	19.33	1000.0	9.000	10.1
1.338000		24.97	46.00	21.03	1000.0	9.000	10.1
1.338000	33.21		56.00	22.79	1000.0	9.000	10.1
1.350000		24.47	46.00	21.53	1000.0	9.000	10.1
1.350000	33.03		56.00	22.97	1000.0	9.000	10.1
1.466000		24.89	46.00	21.11	1000.0	9.000	10.1
1.466000	34.28		56.00	21.72	1000.0	9.000	10.1
1.478000		28.42	46.00	17.58	1000.0	9.000	10.1
1.478000	35.53		56.00	20.47	1000.0	9.000	10.1
1.746000		27.28	46.00	18.72	1000.0	9.000	10.1
1.746000	33.31		56.00	22.69	1000.0	9.000	10.1
2.282000		26.19	46.00	19.81	1000.0	9.000	10.1
2.282000	33.95		56.00	22.05	1000.0	9.000	10.1
2.294000		21.07	46.00	24.93	1000.0	9.000	10.1
2.294000	31.94		56.00	24.06	1000.0	9.000	10.1
2.474000		20.82	46.00	25.18	1000.0	9.000	10.1
2.474000	31.23		56.00	24.77	1000.0	9.000	10.1
2.550000		26.24	46.00	19.76	1000.0	9.000	10.1
2.550000	32.34		56.00	23.66	1000.0	9.000	10.1
2.818000		26.15	46.00	19.85	1000.0	9.000	10.1
2.818000	32.37		56.00	23.63	1000.0	9.000	10.1
2.822000		23.86	46.00	22.14	1000.0	9.000	10.1
2.822000	32.47		56.00	23.53	1000.0	9.000	10.1
3.354000		25.32	46.00	20.68	1000.0	9.000	10.1
3.354000	31.12		56.00	24.88	1000.0	9.000	10.1
4.170000		19.96	46.00	26.04	1000.0	9.000	10.2
4.170000	28.46		56.00	27.54	1000.0	9.000	10.2
6.274000		27.39	50.00	22.61	1000.0	9.000	10.2
6.274000	39.01		60.00	20.99	1000.0	9.000	10.2
11.002000		20.48	50.00	29.52	1000.0	9.000	10.2
11.002000	27.96		60.00	32.04	1000.0	9.000	10.2
21.606000		29.52	50.00	20.48	1000.0	9.000	10.4
21.606000	36.79		60.00	23.21	1000.0	9.000	10.4
21.742000		21.64	50.00	28.36	1000.0	9.000	10.4
21.742000	33.38		60.00	26.62	1000.0	9.000	10.4
29.390000		17.20	50.00	32.80	1000.0	9.000	10.4
29.390000	29.38		60.00	30.62	1000.0	9.000	10.4

Line N:

Product Service



Frequency *MHz*	*QuasiPeak* *dBµV*	*CAverage* *dBµV*	*Limit* *dBµV*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Corr.* *dB*
0.158000		31.60	55.57	23.97	1000.0	9.000	10.0
0.158000	48.42		65.57	17.15	1000.0	9.000	10.0
0.390000		32.15	48.06	15.91	1000.0	9.000	10.0
0.390000	42.47		58.06	15.59	1000.0	9.000	10.0
0.402000		30.72	47.81	17.09	1000.0	9.000	10.0
0.402000	40.87		57.81	16.94	1000.0	9.000	10.0
0.522000		30.38	46.00	15.62	1000.0	9.000	10.0
0.522000	39.22		56.00	16.78	1000.0	9.000	10.0
0.534000		30.10	46.00	15.90	1000.0	9.000	10.0
0.534000	39.49		56.00	16.51	1000.0	9.000	10.0
1.210000		27.55	46.00	18.45	1000.0	9.000	10.1
1.210000	35.46		56.00	20.54	1000.0	9.000	10.1
1.218000		25.23	46.00	20.77	1000.0	9.000	10.1
1.218000	35.01		56.00	20.99	1000.0	9.000	10.1
1.346000		24.74	46.00	21.26	1000.0	9.000	10.1
1.346000	33.61		56.00	22.39	1000.0	9.000	10.1
1.354000		24.28	46.00	21.72	1000.0	9.000	10.1
1.354000	32.57		56.00	23.43	1000.0	9.000	10.1
1.474000		28.24	46.00	17.76	1000.0	9.000	10.1
1.474000	35.63		56.00	20.37	1000.0	9.000	10.1
1.478000		28.48	46.00	17.52	1000.0	9.000	10.1
1.478000	35.57		56.00	20.43	1000.0	9.000	10.1
2.026000		21.92	46.00	24.08	1000.0	9.000	10.1

Frequency *MHz*	*QuasiPeak* *dBµV*	*CAverage* *dBµV*	*Limit* *dBµV*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Corr.* *dB*
2.026000	31.55		56.00	24.45	1000.0	9.000	10.1
2.274000		21.48	46.00	24.52	1000.0	9.000	10.1
2.274000	32.65		56.00	23.35	1000.0	9.000	10.1
2.290000		21.17	46.00	24.83	1000.0	9.000	10.1
2.290000	32.88		56.00	23.12	1000.0	9.000	10.1
2.450000		21.31	46.00	24.69	1000.0	9.000	10.1
2.450000	30.29		56.00	25.71	1000.0	9.000	10.1
3.086000		25.71	46.00	20.29	1000.0	9.000	10.1
3.086000	31.80		56.00	24.20	1000.0	9.000	10.1
3.354000		25.30	46.00	20.70	1000.0	9.000	10.1
3.354000	31.21		56.00	24.79	1000.0	9.000	10.1
4.158000		23.82	46.00	22.18	1000.0	9.000	10.2
4.158000	30.30		56.00	25.70	1000.0	9.000	10.2
4.966000		24.71	46.00	21.29	1000.0	9.000	10.2
4.966000	31.72		56.00	24.28	1000.0	9.000	10.2
6.314000		27.83	50.00	22.17	1000.0	9.000	10.2
6.314000	39.32		60.00	20.68	1000.0	9.000	10.2
12.346000		18.94	50.00	31.06	1000.0	9.000	10.2
12.346000	27.13		60.00	32.87	1000.0	9.000	10.2
22.010000		21.78	50.00	28.22	1000.0	9.000	10.4
22.010000	32.94		60.00	27.06	1000.0	9.000	10.4
29.126000		17.49	50.00	32.51	1000.0	9.000	10.4
29.126000	29.06		60.00	30.94	1000.0	9.000	10.4

2.5.8 Test Location and Test Equipment

The test was carried out in shielded room No. 4

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESCI	19740	24	2022-05
V-network	Rohde & Schwarz	ENV216	39908	12	2021-03
EMI test software	Rohde & Schwarz	EMC32 V10.60.00			

Table 17

Product Service

2.6 RF Exposure

2.6.1 Specification Reference

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

2.6.2 Equipment under Test and Modification State

APR600 ; S/N 1605000602; Modification state 0
Estimation for external and internal antenna

2.6.3 Date of Test

2021-02-02

2.6.4 Environmental Conditions

Ambient Temperature	22 °C
Relative Humidity	31 %

2.6.5 Test Method

Estimation is based on output power test. During radiated emission tests both WiFi and BLE were transmitting simultaneously.
For details please refer to section 2.3 of this test report.
For details on placing of 2.4 GHz antenna, please refer to section C.1 of annex C.

Product Service

2.6.6 Specification Limits

FCC 47 CFR Part 15 C
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:

a) 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

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.

b) For 100 MHz to 6 GHz and test separation distances > 50 mm, the 1 g- and 10 g-SAR test exclusion thresholds are determined by the following:
   1) 100 MHz – 1500 MHz:
   {[Power allowed at numeric threshold for 50 mm in step a)] + [(test separation distance – 50 mm) · (f_{MHz} / 150)]} mW
   2) 1500 MHz – 6 GHz:
   {[Power allowed at numeric threshold for 50 mm in step a)] + [(test separation distance – 50 mm) · 10]} mW

c) For frequencies below 100 MHz, the following may be considered for SAR test exclusion:
   1) For test separation distances > 50 mm and < 200 mm:
   The power threshold at the corresponding test separation distance at 100 MHz in step b) is multiplied by *[1 + lg(100/f_{MHz})]*.
   2) For test separation distances ≤ 50 mm, the power threshold determined by the equation in c) 1) for 50 mm and 100 MHz is multiplied by ½.
   3) SAR measurement procedures are not established below 100 MHz.

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.:

Product Service

Frequency (MHz)	Exemption limits (mW)[2] 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 [3]	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

Exposure Condition	*Relaxation Factor*	*Electric Field (V/m r.m.s.)*	*Magnetic Field (A/m r.m.s.)*
Whole Body / Torso / Head	1.0	83	90
Leg	1.5	124.5	135
Arm	2.5	207.5	225
Hand / Foot	5.0	415	450

Table 18 Limb Exposure Limit Relaxation

[2] The exemption 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 a third order polynomial fit.

[3] 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

2.6.7 Test Results

$$EIRP = P_{tx} \cdot G_{tx} = \frac{4\,\pi\,d^2\,E^2}{Z_0}$$

E = 112.3 dBµV/m = 412.1 mV/m
d = 3 m
EIRP = 50.9 mW´
Note: Fieldstrength measurement based on 3 m test with external antenna.

FCC 47 CFR Part 15 C

Maximum output power:	50.9 mW
Minimum test separation distance:	5 mm
Frequency:	134.2 kHz
Limit (1 g SAR):	91.82 mW
Limit (10 g SAR):	229.59 mW
Test Result:	**Pass**

ISED RSS-Gen, Clause 3.4

Frequency:	134.2 kHz
Test distance:	5 mm
Carrier Power (e.i.r.p.):	50.9 mW
Exemption limit:	71 mW
Test Result:	**Pass**

ISED RSS-102, Clause 4, Table 4
ISED SPR-002, Table 2

Frequency:	134.2 kHz	
Test distance:	5 mm	
RF field strength (measured):	3.86 A/m	26.37 V/m
Field strength limit:	90 A/m	83 V/m
Test Result:	**Pass**	**Pass**

Product Service

RFID Evaluation:

Exposure of Humans to RF Fields	Applicable	Declared by applicant	Measured	Exemption
The antenna is				
☐ detachable				
The conducted output power (CP in watts) is measured at the antenna connector: CP = **..... W**			☐	
The effective isotropic radiated power (EIRP in watts) is calculated using				
☐ the numerical antenna gain: G = **.....** $EIRP = G \cdot CP \Rightarrow EIRP$ = **..... W**		☐		
☐ the field strength[4] in V/m: FS = **..... V/m** $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = **..... W**			☐	
with: Distance between the antennas in m: D = **..... m**			☐	
☒ not detachable				
A field strength measurement is used to determine the effective isotropic radiated power (EIRP in watts) given by: $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = **0.217 mW**				
with: Field strength in V/m: FS = **88.6 dBµV/m** = **0.269 µV/m**			☒	
Distance between the two antennas in m: D = **3 m**			☒	
Selection of output power				
The output power TP is the higher of the conducted or effective isotropic radiated power (e.i.r.p.): TP = **0.217 mW**				

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

Product Service

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

Product Service

SAR evaluation														
SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in the table. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in the table, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required. For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.														
Frequency (MHz)	Exemption limits (mW)[5] 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 [6]	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				

[5] 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.

[6] 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

Carrier frequency:	*f*	=	**134.2 kHz**			
Distance:	*d*	=	**5 mm**			
Transmitter output power:	*TP*	=	**0.217 mW**			
Limit:	TP_{limit}	=	**71 mW**			☒
☐ SAR evaluation is documented in test report no. …						

Specifications:	RSS-102, Issue 5, Section 4, Table 4, Uncontrolled Environment SPR-002, Issue 1
Operation mode:	7.2 V Battery Supply - Continuously reading RFID Tag
Comment:	The nerve stimulation exposure limit is defined for the frequency range 3 kHz to 10 MHz, only. Thus, the carrier at 134.2 kHz was evaluated, only.

Test procedure:	IEC 62269-1, Section 4.2 “Measurement to show accordance to the reference levels”
Test distance:	Direct contact to EUT
Limit:	*Frequency Range (MHz)* / *Electric Field (V/m_{rms})* / *Magnetic Field (A/m_{rms})* / *Peference Periode (min)* 0.003 – 10 / 83 / 90 / Instantaneous 0.1 – 10 / --- / 0.73 / f / 6 1.1 - 10 / $87/f^{0.5}$ / --- / 6 *f* in MHz
Test positions:	All surfaces: The antenna was moved all over the equipment under test using a test distance as stated above.

Measured maximum value *(V/m)*	Maximum Limit at 134.2 kHz *(V/m)*	Margin to reference value *(V/m)*
26.37	83.00	56.63

Measured maximum value *(A/m)*	Maximum Limit at 134.2 kHz *(A/m)*	Margin to reference value *(A/m)*
3.86	90.00	86.14

Product Service

Wifi Evaluation

acc. to KDB 447498 D01:

Maximum measured Radiated Power (EIRP) Pmax: 16.4 dBm = 44 mW
On basis of module certification

Compliance Boundary d:	10 mm
Frequency f:	2472 MHz = 2.472 GHz
Numeric Threshold (Pmax / d) $(f)^{0.5}$	6.9
Numeric Threshold Limit (1 g SAR):	7.5

Pass

Product Service

acc. to IC RSS-GEN Issue 4, section 3.2 and IC RSS-102, Issue 5, section 2.5:

Exposure of Humans to RF Fields	Applicable	Declared by applicant	Measured	Exemption
The antenna is				
☐ detachable				
The conducted output power (CP in watts) is measured at the antenna connector: CP =			☐	
The effective isotropic radiated power (EIRP in watts) is calculated using				
☐ the numerical antenna gain: G $EIRP = G \cdot CP \Rightarrow EIRP$		☐		
☐ the field strength[7] in V/m: FS = ... V/m			☐	
$EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ =				
with:				
Distance between the antennas in m: D =		☐		
☒ not detachable				
A field strength measurement is used to determine the effective isotropic radiated power (EIRP in watts) given by: $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ (10.5 dBm measured) = **772.9 n**				
with:				
Field strength in V/m: FS **= 66.11 dBµV/m = 1.605 mV/m**			☒	
Distance between the two antennas in m: D = **3 m**			☒	
Selection of output power				
The output power TP is the higher of the conducted or effective isotropic radiated power (e.i.r.p.): TP = **772.9 nW**				

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

Product Service

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

Product Service

SAR evaluation				
SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in the table. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in the table, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required. For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.				
Frequency (MHz)	Exemption limits (mW)[8] at separation distance of			

Frequency (MHz)	≤5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	≥50 mm
450	52	70	88	106	123	141	159	177	195	213
835	17	30	42	55	67	80	92	105	117	130
1900	7	10	18	34	60	99	153	225	316	431
2450	4	7	15	30	52	83	123	173	235	309
3500	2	6	16	32	55	86	124	170	225	290
5800	1	6	15	27	41	56	71	85	97	106

Carrier frequency:	f	=	2472 MHz	
Distance:	d	=	10 mm	☒
Transmitter output power:	TP	=	772.9 nW	
Limit:	TP_{limit}	=	17.5 mW	☒

[8] The exemption 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 a linear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from a third order polynomial fit.

Product Service

Bluetooth Evaluation

acc. to KDB 447498 D01:

Maximum measured Radiated Power (EIRP) Pmax: On basis of module certification	12.0 dBm = 15.9 mW
Compliance Boundary d:	10 mm
Frequency f:	2472 MHz = 2.472 GHz
Numeric Threshold (Pmax / d) $(f)^{0.5}$	2.5
Numeric Threshold Limit (10 g SAR):	7.5

Pass

Product Service

acc. to IC RSS-GEN Issue 4, section 3.2 and IC RSS-102, Issue 5, section 2.5:

Exposure of Humans to RF Fields	Applicable	Declared by applicant	Measured	Exemption
The antenna is				
☐ detachable				
The conducted output power (CP in watts) is measured at the antenna connector: CP =			☐	
The effective isotropic radiated power (EIRP in watts) is calculated using				
☐ the numerical antenna gain: G $EIRP = G \cdot CP \Rightarrow EIRP$		☐		
☐ the field strength[9] in V/m: FS = ... V/m			☐	
$EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ =				
with:				
Distance between the antennas in m: D =		☐		
☒ not detachable				
A field strength measurement is used to determine the effective isotropic radiated power (EIRP in watts) given by: $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ (10.5 dBm measured) = **772.9 n**				
with:				
Field strength in V/m: FS **= 66.11 dBµV/m = 1.605 mV/m**			☒	
Distance between the two antennas in m: D = **3 m**			☒	
Selection of output power				
The output power TP is the higher of the conducted or effective isotropic radiated power (e.i.r.p.): TP = **772.9 nW**				

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

Product Service

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

Product Service

SAR evaluation				
SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in the table. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in the table, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required. For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.				

Frequency (MHz)	Exemption limits (mW)[10] at separation distance of									
	≤5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	≥50 mm
450	52	70	88	106	123	141	159	177	195	213
835	17	30	42	55	67	80	92	105	117	130
1900	7	10	18	34	60	99	153	225	316	431
2450	4	7	15	30	52	83	123	173	235	309
3500	2	6	16	32	55	86	124	170	225	290
5800	1	6	15	27	41	56	71	85	97	106

Carrier frequency:	f	=	2472 MHz	
Distance:	d	=	10 mm	☒
Transmitter output power:	TP	=	772.9 nW	
Limit:	TP_{limit}	=	17.5 mW	☒

[10] 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 a linear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from a third order polynomial fit.

Product Service

2.6.8 Test Location and Test Equipment

The test was carried out in shielded room No. 4 and semi anechoic room No. 11

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2021-03
Loop antenna	Rohde & Schwarz	HFH2-Z2	18876	36	2022-12
Electromagnetic radiation meter	Narda	EMR-200	19590	36	2022-11
Electric field probe	Narda	Type 8.3	19591	36	2022-11
Magnetic field probe	Narda	Type 12.1	19592	36	2022-11

Table 19

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 20 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		
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 21 Measurement uncertainty based on ETSI TR 100 028