Report on the FCC and IC Testing of the Makita Corporation Rechargeable Wall Scanner. Model: DWD181 In accordance with CFR 47, Part 15, Subpart F and ISED RSS-GEN Issue 5, RSS-220 Issue 1

Product Service

Choose certainty. Add value.

Prepared for: Makita Corporation
3-11-8, Sumiyoshi-cho, Anjo, Aichi 446-8502
Japan

FCC ID: TR2DWD181
IC : 6390A-DWD181

COMMERCIAL-IN-CONFIDENCE

Date: 2020-01-23
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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Martin Steindl	2020-01-22	Steindl Martin
Authorised Signatory	Matthias Stumpe	2020-01-23	Stump

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

ENGINEERING STATEMENT
The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with CFR 47, Part 15, Subpart F and ISED RSS-Gen Issue 5 March 2019 Amendment 1, RSS-220 Issue 1 Amendment 1 July 2018. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Martin Steindl	2020-01-22	Steindl Martin

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 SUMMARY
A sample of this product was tested and found to be compliant with CFR 47, Part 15, Subpart F and ISED RSS-Gen Issue 5 March 2019 Amendment 1, RSS-220 Issue 1 Amendment 1 July 2018.

Product Service

Contents

Product Service

1 Report Summary

1.1 Report Modification Record

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

Issue	Description of Change	Date of Issue
1	First Issue	2020-01-15
2	Corrected typos Set product type to rechargeable wall scanner Corrected result for	2020-01-16
3	Corrected typo “subpart C” to “subpart F”	2020-01-22

Table 1

1.2 Introduction

Applicant	Makita Corporation, 3-11-8, Sumiyoshi-cho, Anjo, Aichi 446-8502 Japan
Manufacturer	OMRON 46, AZA-NOGOSHI, OKUCHO, ICHINOMIYA-CITY, AICHI Japan
Model Number(s)	DWD181
Serial Number(s)	00005608, 00005610
Hardware Version(s)	N/A
Software Version(s)	01.00.00.1656
Number of Samples Tested	1
Test Specification/Issue/Date	CFR 47, Part 15, Subpart F ISED RSS-Gen Issue 5 Amendment 1 March 2019 RSS-220 Issue 1 Amendment 1 March 2018
Test Plan/Issue/Date	---
Order Number Date	73579268
Date of Receipt of EUT	2019-11-26
Start of Test	2019-12-04
Finish of Test	2019-12-12
Name of Engineer(s)	Martin 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 CFR 47, Part 15, Subpart F / ISED RSS-220 Issue 1 Amendment 1 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: Transmitting continuously and waiting for badge (RFID card)				
2.1	15.509(a) 6.2.1(a)	UWB bandwidth	Pass	ANSI C63.10 (2013)
2.2	15.509(d) 3.4 and 6.2.1(d)	Radiated emissions	Pass	ANSI C63.10 (2013)
2.3	15.509(e) 3.4 and 6.2.1(e)	Radiated emissions in GPS bands	Pass	ANSI C63.10 (2013)
2.4	15.509(f) 6.2.1(g)	Highest radiated emission	Pass	ANSI C63.10 (2013)
2.5	15.509(b) 6.2.1(b)	Transmission duration	Pass	ANSI C63.10 (2013)
2.7	---	Radio frequency exposure	Pass	

Table 2

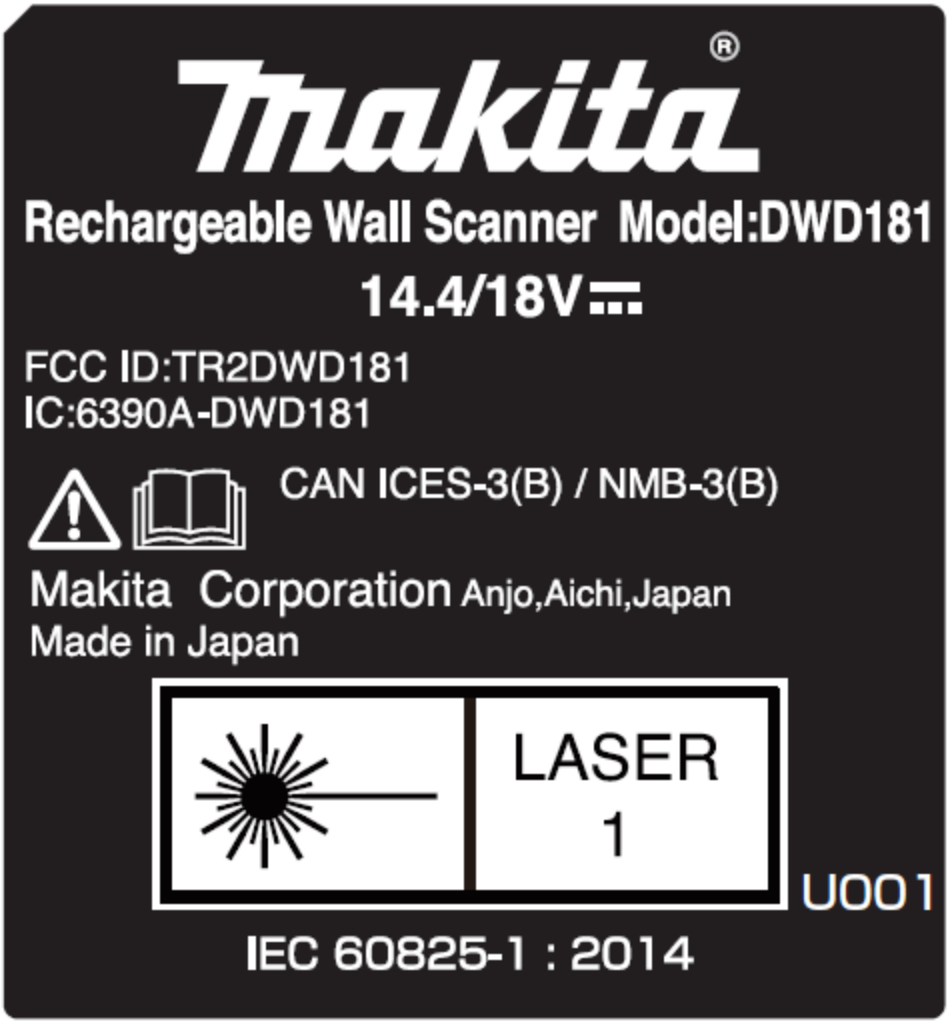
Product Service

1.4 Product Information

1.4.1 Technical Description

The DWD181 is a wall scanner with rechargeable battery. It is intended to check the locations of iron bars, plastic pipes and wired buried in concrete, and of wooden materials and such behind walls.

Marking Plate



Product Service

1.5 Deviations from the Standard

none

1.6 EUT Modification Record

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

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
EUT: DWD181 - Serial Number: 00005608 Continuous transmitting for radiated emissions			
0	As supplied by the customer	Not Applicable	Not Applicable
EUT: DWD181 - Serial Number:0000565610 Deactivation test			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

Product Service

1.7 Test Location

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

Test Name	***Name of Engineer(s)***
All configurations - Normal operation mode	
UWB bandwidth	M. Steindl
Radiated emissions	M. Steindl
Radiated emissions in GPS bands	M. Steindl
Highest radiated emission	M. Steindl
Transmission duration	M. Steindl
Radio frequency exposure	M. Steindl

Table 4

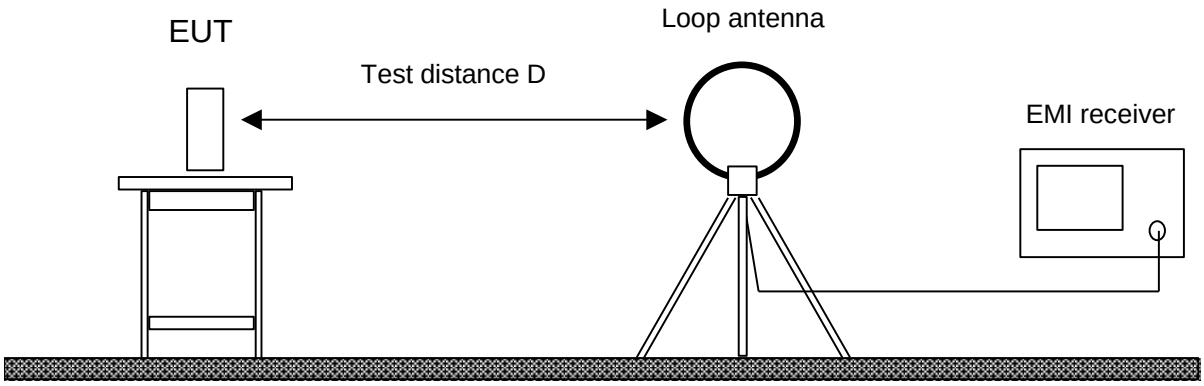
Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany

Product Service

1.8 Details on test methods

1.8.1 Radiated emission measurement 9 kHz – 30 MHz



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

In accordance with ANSI C63.10, section 10.2 the EUT was placed on a block of absorbing material

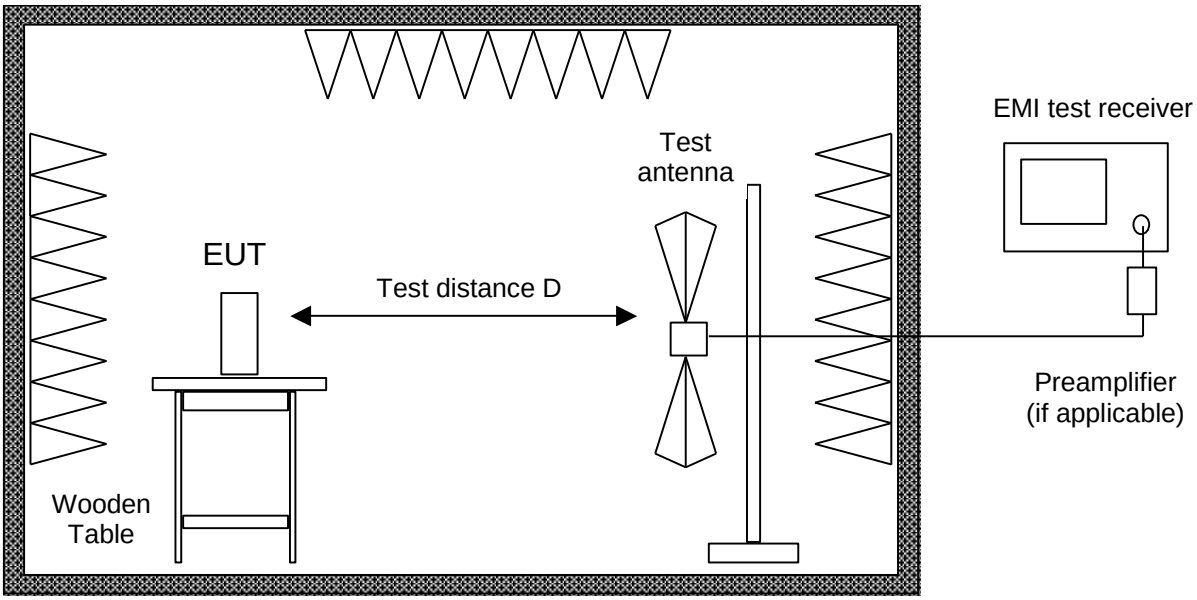
EUT is rotated all around to find the maximum levels of emissions. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.
If worst case emission of the EUT cannot be recorded with EUT in standard position and loop antenna in vertical polarization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

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

If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

Product Service

1.8.2 Radiated emission measurement 30 MHz – 1 GHz



Alternate test site (semi anechoic room)

Radiated emission in the frequency range 30 MHz to 1 GHz is measured within a semi-anechoic room with groundplane complying with the NSA requirements of ANSI C63.4 respectively ANSI C63.10 for alternative test sites. A linear polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna") is used. The measurement bandwidth of the test receiver is set to 120 kHz with quasi-peak detector selected.

If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

In accordance with ANSI C63.10, section 10.2 the EUT was placed on a block of absorbing material

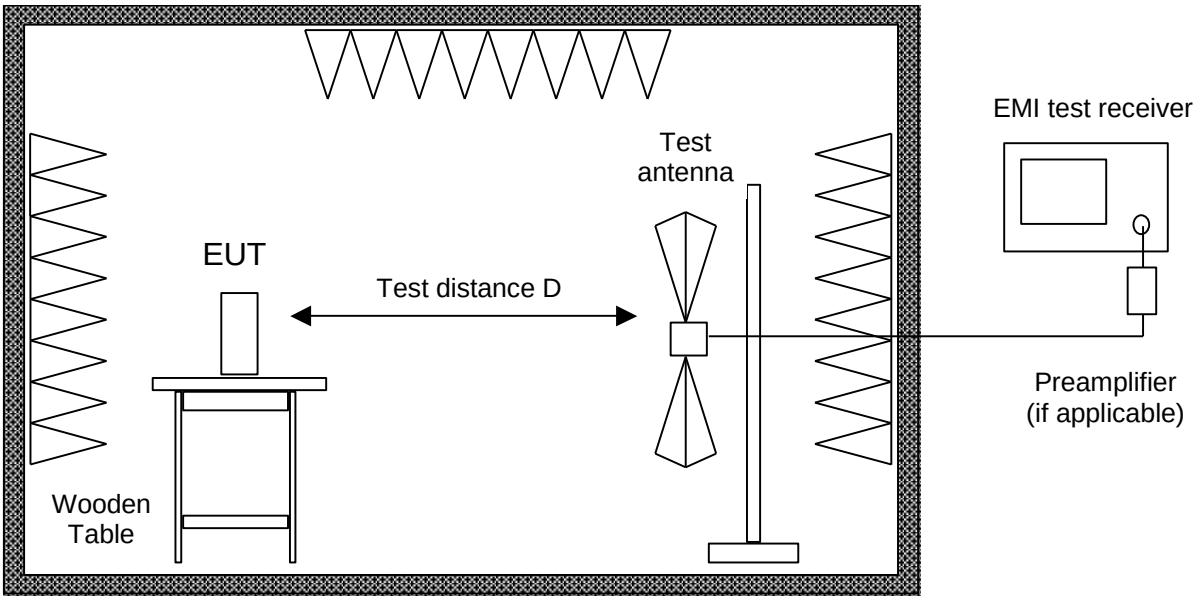
If no prescan in a fully anechoic room is used first a peak scan is performed in four positions to get the whole spectrum of emission caused by EUT with the measuring antenna raised and lowered from 1 to 4 m to find table position, antenna height and antenna polarization for the maximum emission levels.
Data reduction is applied to these results to select those levels having less margin than 10 dB to or exceeding the limit using subranges and limited number of maximums. Further maximization is following.
With detector of the test receiver set to quasi-peak final measurements are performed immediately after frequency zoom (for drifting disturbances) and maximum adjustment.
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

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

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

Product Service

1.8.3 Radiated emission measurement 1 GHz – 18 GHz



Alternate test site (semi anechoic room)

Radiated emission in the frequency range 30 MHz to 1 GHz is measured within a semi-anechoic room with groundplane complying with the NSA requirements of ANSI C63.4 respectively ANSI C63.10 for alternative test sites. A linear polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna") is used. The measurement bandwidth of the test receiver is set to 120 kHz with quasi-peak detector selected.

If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

In accordance with ANSI C63.10, section 10.2 the EUT was placed on a block of absorbing material

If no prescan in a fully anechoic room is used first a peak scan is performed in four positions to get the whole spectrum of emission caused by EUT with the measuring antenna raised and lowered from 1 to 4 m to find table position, antenna height and antenna polarization for the maximum emission levels.
Data reduction is applied to these results to select those levels having less margin than 10 dB to or exceeding the limit using subranges and limited number of maximums. Further maximization is following.
With detector of the test receiver set to quasi-peak final measurements are performed immediately after frequency zoom (for drifting disturbances) and maximum adjustment.
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

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

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

Product Service

2 Test Details

2.1 UWB Bandwidth

2.1.1 Specification Reference

FCC 47 CFR Part 15 F, Clause 15.509(a)
ISED RSS-220, sections 2 and 6.2.1(a)

2.1.2 Equipment Under Test and Modification State

DWD181 S/N: 00005608 - Modification State 0

2.1.3 Date of Test

2019-12-10

2.1.4 Test Method

The test was performed in accordance with
ANSI C63.10
For details please refer to test method of radiated emissions.

2.1.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	31.0 %

2.1.6 Test Results

For test plots, please refer to section 1. of Annex 2

Frequency of maximum UWB emission:	f_M = 757.5 MHz
Lowest frequency at which the power spectral density of the UWB transmission is -10 dB relative to f_M:	f_L = 740.4 MHz
Highest frequency at which the power spectral density of the UWB transmission is -10 dB relative to f_M:	f_H = 2027.2 MHz
Center frequency of the -10 dB bandwidth:	$f_C = (f_H + f_L)/2$ = 1383.8 MHz
-10 dB bandwidth:	$B_{-10} = f_H - f_L$ = 1286.8 MHz
-10 dB fractional bandwidth:	$\mu_{-10} = 2 (f_H - f_L) / (f_H + f_L)$ = 0.9299
Lowest frequency at which the 99 % emission bandwidth:	f_L = 732.76 MHz
Highest frequency at which the 99 % emission bandwidth:	f_H = 2881.78 MHz
99 % emission bandwidth:	2.149.019083 GHz

Product Service

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

Ultra-wideband (UWB) transmitter: An intentional radiator, at any point in time, has a fractional bandwidth μ_{-10} equal to or greater than 0.20 or has a UWB bandwidth B_{-10} equal or greater than 500 MHz, regardless the fractional bandwidth.

ISED RSS-220, Issue 1 Amendment 1, section 2 and 6.2.1(a)

The UWB device is an intentional radiator that has either a *-10 dB bandwidth* of at least 500 MHz or a *-10 dB fractional bandwidth* μ_{-10} greater than 0.2.
The -10 dB UWB bandwidth for GPR or an in-wall radar imaging device shall be entirely below 10.6 GHz.

ISED RSS-GEN, Issue 5 Amendment 1, section 6.7

The occupied bandwidth ("99 % emission bandwidth") shall be reported for all equipment in addition to the specific bandwidth requirement in the applicable RSSs.

2.1.7 Test Location and Test Equipment Used

This test was carried out in Semi Anechoic Room no. 11.

T-ID	Designation	Type	Serial number	Last Cal.	Next Cal.	Manufacturer
39897	EMI test receiver	ESW44	101814	29.2.2019	29.2.2020	Rohde & Schwarz GmbH & Co. KG
40089	Double ridged horn antenna	HF907	102777	08.02.2019	28.02.2021	Rohde & Schwarz GmbH & Co. KG
42961	Semi anechoic room	Cabin no. 11		29.08.2019	31.08.2022	Frankonia
44382	EMC measurement software	EMC32 Immunity K11 - V10.50.10		N/A		Rohde & Schwarz GmbH & Co. KG

Product Service

2.2 Radiated emissions

2.2.1 Specification Reference

FCC 47 CFR Part 15F. Clause 15.509(d)
ISED RSS-220, sections 3.4 and 6.2.1(d)

2.2.2 Equipment Under Test and Modification State

DWD181 S/N: 00005608 - Modification State 0

2.2.3 Date of Test

2019-12-04 to 2019-12-09

2.2.4 Test Method

The test was performed in accordance with
ANSI C63.10
RSS-211

2.2.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	31.0 %

Product Service

2.2.6 Test Results

For plots please refer to section 2 of Annex 2.

Frequency *MHz*	*QuasiPeak* *dBµV/m*	*Limit* *dBµV/m*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB/m*
34.290000	15.7	40.0	24.3	1000	120	111	V	93	18.6
386.790000	31.1	46.0	14.9	1000	120	182	V	45	24.7
409.260000	28.6	46.0	17.4	1000	120	158	V	32	25.3
439.260000	27.1	46.0	18.9	1000	120	160	V	59	25.5
600.720000	28.1	46.0	17.9	1000	120	113	V	164	28.9
938.640000	29.7	46.0	16.3	1000	120	273	H	-40	32.6

Frequency *MHz*	*RMS* *dBm*	*Limit* *dBm*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
1508.957500	-65.8	-65.3	0.4	1000	1000	300	H	-164	-66.3

FCC 47 CFR Part 15. Limit Clause 15.509 (d)

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

Frequency (MHz)	*Field strength (µV/m)*	*Measurement distance (m)*
0.009 – 0.490	2400 / f(kHz)	300
0.490 – 1.705	24000 / f(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3

Note: The emission limits for the bands 9 – 90 kHz and 110 – 490 kHz are based on measuring employing an average detector.

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

Frequency (MHz)	*EIRP in dBm*
960 – 1610	-65.3
1610 – 1990	-53.3
1990 – 3100	-51.3
3100 – 106000	-41.3
above 106000	-51.3

ISED RSS-220. Limit Clauses 3.4 and 6.2.1(d)

Radiated emissions at or below 960 MHz for all subclasses of UWB devices shall not exceed the following limits. Measurements of radiated emissions at an below 960 MHz are to be made using a CISPR quasi-peak detector. CISPR measurement bandwidth specifications are to be used.

Frequency (MHz)	*Field strength (µV/m)*	*Measurement distance (m)*
0.009 – 0.490	2400 / f(kHz)	300
0.490 – 1.705	24000 / f(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3

Note: The emission limits for the bands 9 – 90 kHz and 110 – 490 kHz are based on measuring employing an average detector.

Radiated emissions above 960 MHz from a device shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency (MHz)	*EIRP in dBm*
960 – 1610 MHz	-65.3 dBm
1610 – 1990 MHz	-53.3 dBm
1990 – 3100 MHz	-51.3 dBm
3100 – 106000 MHz	-41.3 dBm
above 106000 MHz	-51.3 dBm

Product Service

2.2.7 Test Location and Test Equipment Used

This test was carried out in Semi Anechoic Room no. 11.

T-ID	Designation	Type	Serial number	Last Cal.	Next Cal.	Manufacturer
39897	EMI test receiver	ESW44	101814	29.2.2019	29.2.2020	Rohde & Schwarz GmbH & Co. KG
39632	Fixed attenuator	Model:1 6dB	CK2164	07.11.2019	30.11.2022	Aeroflex / Weinschel, Inc.
39969	ULTRALOG Antenna	HL562E	101062	07.11.2019	30.11.2022	Rohde & Schwarz GmbH & Co. KG
40089	Double ridged horn antenna	HF907	102777	08.02.2019	28.02.2021	Rohde & Schwarz GmbH & Co. KG
42961	Semi anechoic room	Cabin no. 11		29.08.2019	31.08.2022	Frankonia
44334	Loop antenna	FMZB 1519 B	00160	29.08.2019	31.08.2022	SCHWARZBECK MESS-ELEKTRONIK
44382	EMC measurement software	EMC32 Immunity K11 - V10.50.10		N/A		Rohde & Schwarz GmbH & Co. KG

Product Service

2.3 Radiated emissions in GPS bands

2.3.1 Specification Reference

FCC 47 CFR Part 15C. Clause 15.509(e)
ISED RSS-220, section 6.2.1 e.

2.3.2 Equipment Under Test and Modification State

DWD181 S/N: 00005608 - Modification State 0

2.3.3 Date of Test

2019-12-09

2.3.4 Test Method

The test was performed in accordance with
ANSI C63.10
RSS-211
For details please refer to test method of radiated emissions.

2.3.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	31.0 %

Product Service

2.3.6 Test Results

For plots please refer to section 3 of Annex 2

Frequency MHz	*RMS dBm*	*Limit dBm*	*Margin dB*	*Bandwidth kHz*	*Height cm*	*Pol*	*Azimuth deg*	*Corr. dB*
1199.695750	-87.0	-75.3	11.7	1	150.0	H	30.0	-68.5
1572.934750	-81.1	-75.3	5.8	1	150.0	H	-30.0	-65.8
1599.594750	-80.9	-75.3	5.6	1	150.0	H	-30.0	-65.7

FCC 47 CFR Part 15. Limit Clause 15.509 (e)
In addition to the radiated emission limits, UWB transmitters operating under the provision of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency (MHz)	*EIRP in dBm*
1164 – 1240	-75.3
1559 – 1610	-75.3

RSS-220, section 6.2.1 e.
In addition; radiated emissions shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz. The measurement shall demonstrate compliance with the stated limits at whatever resolution bandwidth is used.

Frequency (MHz)	*EIRP in dBm*
1164 – 1240 MHz	-75.3 dBm
1559 – 1610 MHz	-75.3 dBm

2.3.7 Test Location and Test Equipment Used

This test was carried out in Semi Anechoic Room no. 11.

T-ID	Designation	Type	Serial number	Last Cal.	Next Cal.	Manufacturer
39897	EMI test receiver	ESW44	101814	29.2.2019	29.2.2020	Rohde & Schwarz GmbH & Co. KG
40089	Double ridged horn antenna	HF907	102777	08.02.2019	28.02.2021	Rohde & Schwarz GmbH & Co. KG
42961	Semi anechoic room	Cabin no. 11		29.08.2019	31.08.2022	Frankonia
44382	EMC measurement software	EMC32 Immunity K11 - V10.50.10		N/A		Rohde & Schwarz GmbH & Co. KG

Product Service

2.4 Highest radiated emission

2.4.1 Specification Reference

FCC 47 CFR Part 15C. Clause 15.509(f)
ISED RSS-220 section 6.2.1 (g)

2.4.2 Equipment Under Test and Modification State

DWD181 S/N: 00005608 - Modification State 0

2.4.3 Date of Test

2019-12-09

2.4.4 Test Method

The test was performed in accordance with
ANSI C63.10
For details please refer to test method of radiated emissions.

2.4.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	31.0 %

Product Service

2.4.6 Test result

For plots please refer to section 4 of annex 2

Maximum EIRP emission in any 50 MHz bandwidth above 960 MHz: -22.34 dBm

FCC 47 CFR Part 15. Limit Clause 15.509 (f)
For UWB devices where the frequency at which the highest emission occurs, f_M, is above 960 MHz, there is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on f_M. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in § 15.521.

RSS-220, section 6.2.1 e.
The peak level of the transmission shall not exceed the peak equivalent of the average limit contained within any 50 MHz bandwidth, as defined in section 4 of the Annex (of the standard).

2.4.7 Test Location and Test Equipment Used

This test was carried out in Semi Anechoic Room no. 11.

T-ID	Designation	Type	Serial number	Last Cal.	Next Cal.	Manufacturer
39897	EMI test receiver	ESW44	101814	29.2.2019	29.2.2020	Rohde & Schwarz GmbH & Co. KG
40089	Double ridged horn antenna	HF907	102777	08.02.2019	28.02.2021	Rohde & Schwarz GmbH & Co. KG
42961	Semi anechoic room	Cabin no. 11		29.08.2019	31.08.2022	Frankonia
44382	EMC measurement software	EMC32 Immunity K11 - V10.50.10		N/A		Rohde & Schwarz GmbH & Co. KG

Product Service

2.5 Transmission duration

2.5.1 Specification Reference

FCC 47 CFR Part 15C. Clause 15.509(b)
ISED RSS-220 section 6.2.1 (b)

2.5.2 Equipment Under Test and Modification State

DWD181 S/N: 00005610 - Modification State 0

2.5.3 Date of Test

2019-12-10

2.5.4 Test Method

The test was performed in accordance with
ANSI C63.10
For details please refer to test method of radiated emissions.

2.5.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	31.0 %

Product Service

2.5.6 Test result

The EUT consists of a roll-switch deactivating the transmitter in less than 10 s.

For plots please refer to section 5 of annex 2.

FCC 47 CFR Part 15. Limit Clause 15.509 (b)
A GPR that is designed to be operated while being hand held and a wall imaging system shall contain a manually operated switch that causes the transmitter to cease operation within 10 seconds of being released by the operator. I Lieu of a switch located to the imaging system, it is permissible to operate an imaging system by remote control provided the imaging system ceases transmission within 10 seconds of the remote switch being released by the operator.

ISED RSS-220, section 6.2.1 b.
A device operating under the provisions of this section shall contain a mechanism that deactivates the equipment when normal use is interrupted. For manually operated hand-held devices, this mechanism shall contain a manual switch that causes the transmitter to cease operation within 10 seconds of being released by the operator. In Lieu of remotely/computer controlled equipment with a switch located on the radar imaging device, it is permissible to operate the device by a remote control unit provided that deactivation takes place within 10 seconds of the remote switch being released by the operator.

2.5.7 Test Location and Test Equipment Used

This test was carried out in Semi Anechoic Room no. 11.

T-ID	Designation	Type	Serial number	Last Cal.	Next Cal.	Manufacturer
39897	EMI test receiver	ESW44	101814	29.2.2019	29.2.2020	Rohde & Schwarz GmbH & Co. KG
40089	Double ridged horn antenna	HF907	102777	08.02.2019	28.02.2021	Rohde & Schwarz GmbH & Co. KG
42961	Semi anechoic room	Cabin no. 11		29.08.2019	31.08.2022	Frankonia
44382	EMC measurement software	EMC32 Immunity K11 - V10.50.10		N/A		Rohde & Schwarz GmbH & Co. KG

Product Service

2.6 Radio frequency exposure

2.6.1 Specification Reference

KDB 447498 D01 V06, section 4.3.1 a)
ISED RSS-102 section 2.5.1

2.6.2 Equipment Under Test and Modification State

DWD181 S/N: 00005608 - Modification State 0

2.6.3 Date of Test

2019-12-12

2.6.4 Test Method

The test was performed in accordance with
ANSI C63.10

2.6.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	31.0 %

Product Service

2.6.6 Test result

Maximum EIRP (peak):	EIRP = -22.3 dBm = 5.83 µW
Minimum separation distance:	D = 5 mm = 0.5 cm
Power Density:	(0.00583 mW / 5 mm) √(3.5 GHz) = 0.0022
FCC Limit:	3.00

Maximum EIRP (peak):	EIRP = -22.3 dBm = 5.83 µW
Minimum separation distance:	D = 5 mm = 0.5 cm
ISED Limit:	2 mW (based on the limit for 3500 MHz)

Product Service

3 Measurement Uncertainty

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

Radio Testing			
Test Name	kp	Expanded Uncertainty	Note
Occupied Bandwidth	2.0	±1.14 %	2
RF-Frequency error	1.96	±1 · 10-7	7
RF-Power. conducted carrier	2	±0.079 dB	2
RF-Power uncertainty for given BER	1.96	+0.94 dB / -1.05	7
RF power. conducted. spurious emissions	1.96	+1.4 dB / -1.6 dB	7
RF power. radiated			
25 MHz – 4 GHz	1.96	+3.6 dB / -5.2 dB	8
1 GHz – 18 GHz	1.96	+3.8 dB / -5.6 dB	8
18 GHz – 26.5 GHz	1.96	+3.4 dB / -4.5 dB	8
40 GHz – 170 GHz	1.96	+4.2 dB / -7.1 dB	8
Spectral Power Density. conducted	2.0	±0.53 dB	2
Maximum frequency deviation			
300 Hz – 6 kHz	2	±2.89 %	2
6 kHz – 25 kHz	2	±0.2 dB	2
Maximum frequency deviation for FM	2	±2.89 %	2
Adjacent channel power 25 MHz – 1 GHz	2	±2.31 %	2
Temperature	2	±0.39 K	4
(Relative) Humidity	2	±2.28 %	2
DC- and low frequency AC voltage			
DC voltage	2	±0.01 %	2
AC voltage up to 1 kHz	2	±1.2 %	2
Time	2	±0.6 %	2

Table 5

Product Service

Radio Interference Emission Testing			
Test Name	kp	Expanded Uncertainty	Note
Conducted Voltage Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
100 kHz to 200 MHz (50Ω/5µH AMN)	2	± 3.6 dB	1
Discontinuous Conducted Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
Conducted Current Emission			
9 kHz to 200 MHz	2	± 3.5 dB	1
Magnetic Fieldstrength			
9 kHz to 30 MHz (with loop antenna)	2	± 3.9 dB	1
9 kHz to 30 MHz (large-loop antenna 2 m)	2	± 3.5 dB	1
Radiated Emission			
Test distance 1 m (ALSE)			
9 kHz to 150 kHz	2	± 4.6 dB	1
150 kHz to 30 MHz	2	± 4.1 dB	1
30 MHz to 200 MHz	2	± 5.2 dB	1
200 MHz to 2 GHz	2	± 4.4 dB	1
2 GHz to 3 GHz	2	± 4.6 dB	1
Test distance 3 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 5.0 dB	1
1 GHz to 6 GHz	2	± 4.6 dB	1
Test distance 10 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 4.9 dB	1
Radio Interference Power			
30 MHz to 300 MHz	2	± 3.5 dB	1
Harmonic Current Emissions			4
Voltage Changes. Voltage Fluctuations and Flicker			4

Table 6

Immunity Testing			
Test Name	kp	Expanded Uncertainty	Note
Electrostatic Discharges			4
Radiated RF-Field			
Pre-calibrated field level	2	+32.2 / -24.3 %	5
Dynamic feedback field level	2.05	+21.2 / -17.5 %	3
Electrical Fast Transients (EFT) / Bursts			4
Surges			4
Conducted Disturbances. induced by RF-Fields			
via CDN	2	+15.1 / -13.1 %	6
via EM clamp	2	+42.6 / -29.9 %	6
via current clamp	2	+43.9 / -30.5 %	6
Power Frequency Magnetic Field	2	+20.7 / -17.1 %	2
Pulse Magnetic Field			4
Voltage Dips. Short Interruptions and Voltage Variations			4
Oscillatory Waves			4
Conducted Low Frequency Disturbances			
Voltage setting	2	± 0.9 %	2
Frequency setting	2	± 0.1 %	2
Electrical Transient Transmission in Road Vehicles			4

Table 7

Note 1:
The expanded uncertainty reported according to CISPR 16-4-2:2003-11 is based on a standard uncertainty multiplied by a coverage factor of kp = 2. providing a level of confidence of p = 95.45%
Note 2:
The expanded uncertainty reported according to UKAS Lab 34 (Edition 1. 2002-08) is based on a standard uncertainty multiplied by a coverage factor of kp = 2. providing a level of confidence of p = 95.45%
Note 3:
The expanded uncertainty reported according to UKAS Lab 34 (Edition 1. 2002-08) is based on a standard uncertainty multiplied by a coverage factor of kp = 2.05. providing a level of confidence of p = 95.45%
Note 4:
It has been demonstrated that the used test equipment meets the specified requirements in the standard with at least a 95%confidence.
Note 5:
The expanded uncertainty reported according to IEC 61000-4-3 is based on a standard uncertainty multiplied by a coverage factor of kp = 2. providing a level of confidence of p = 95.45%
Note 6:
The expanded uncertainty reported according to IEC 61000-4-6 is based on a standard uncertainty multiplied by a coverage factor of kp = 2. providing a level of confidence of p = 95.45%
Note 7:
The expanded uncertainty reported according ETSI TR 100 028 V1.4.1 (all parts) to is based on a standard uncertainty multiplied by a coverage factor of kp = 1.96. providing a level of confidence of p = 95.45%
Note 8:
The expanded uncertainty reported according to ETSI TR 102 273 V1.2.1 (all parts) is based on a standard uncertainty multiplied by a coverage factor of kp = 1.96. providing a level of confidence of p = 95.45%