Report on the FCC and IC Testing of the Moticon ReGo AG Sensor insole for measuring the plantar pressure at the sole of foot and the acceleration and rotation of the foot in three axes.. Model: Insole3 In accordance with FCC 47 CFR Part 15C and ISED Canada RSS-247 and ISED Canada RSS-GEN

Product Service

Choose certainty.
Add value.

Prepared for: Moticon ReGo AG
Machtlfinger Straße 21
81379 München / Munich
Germany

FCC ID: 2ATHI-INSOLE3
IC: 25109-INSOLE3

COMMERCIAL-IN-CONFIDENCE

Date: 2019-10-10
Document Number: TR-23154-59576-04 | Issue: 02

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Martin Steindl	2019-10-10	Steindl Martin
Authorised Signatory	Matthias Stumpe	2019-10-10	Stumpe

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

ENGINEERING STATEMENT
The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C and ISED Canada RSS-247 and ISED Canada 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	2019-10-10	Steindl Martin

Laboratory Accreditation	Laboratory recognition	ISED 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 FCC 47 CFR Part 15C, ISED Canada RSS-247 and ISED Canada RSS-GEN:2016 and Issue 2 (2017-02) and Issue 4 (2014-11).

Trade Register Munich
HRB 85742
VAT ID No. DE129484267
Information pursuant to Section 2(1) DL-InfoV (Germany) at www.tuev-sued.com/imprint

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

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

TÜV SÜD Product Service GmbH
Äußere Frühlingstraße 45
94315 Straubing
Germany

Product Service

Contents

Product Service

1 Report Summary

1.1 Report Modification Record

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

Issue	Description of Change	Date of Issue
1	First Issue	2019-05-22
2	Extracted test setup photos, EUT photos and plots taken during test in annexes I, II and II. Corrected corrupted internal references	2019-10-10

Table 1

1.2 Introduction

Applicant	Moticon ReGo AG
Manufacturer	Moticon ReGo AG
Model Number(s)	Insole3
Serial Number(s)	SN4602 and Conducted Sample
Hardware Version(s)	03.00.0
Software Version(s)	00.00.02 (33365019a499b040d84c0ba53719ee0c8841563c)
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C, ISED Canada RSS-247 and ISED Canada RSS-GEN:2016 and Issue 2 (2017-02) and Issue 4 (2014-11)
Test Plan/Issue/Date	---
Order Number Date	po190048 2019-04-05
Date of Receipt of EUT	2019-05-14
Start of Test	2019-05-15
Finish of Test	2019-05-17
Name of Engineer(s)	Martin Steindl
Related Document(s)	ANSI C63.10 (2013) KDB 662911 D01 v02r02

Product Service

1.3 Brief Summary of Results

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

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: Radiated Tests Transmitting Continuously				
2.1	15.247 (d), 15.205, 5.5 and 6.13	Spurious Radiated Emissions	Pass	ANSI C63.10 (2013)
2.7	15.205 N/A and 8.10	Restricted Band Edges	Pass	ANSI C63.10 (2013)
Configuration and Mode: Conducted Tests Transmitting continuously				
2.2	15.247 (b), 5.4 and 6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2013) KDB 662911 D01 v02r02
2.3	15.247 (e), 5.2 and 6.12	Power Spectral Density	Pass	ANSI C63.10 (2013) KDB 662911 D01 v02r02
2.4	15.247 (a)(2), 5.2 and 6.6	Emission Bandwidth	Pass	ANSI C63.10 (2013)
2.5	15.247 (d), 5.5 and N/A	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.6	15.247 (d) and 5.5	Spurious Conducted Emissions	Pass	ANSI C63.10 (2013)

Table 2

Product Service

1.4 Application Form

Test sample basic information

General information (for report)	
Order number (your PO number)	po190048
Applicant (incl. address and contact person)	Moticon ReGo AG, Machtlfinger Str. 21, 81379 München. Contact: Dr.-Ing. Robert Vilzmann
Manufacturer (when different to applicant)	
Name and address of factory(ies)	Machtlfinger Str. 21, 81379 München

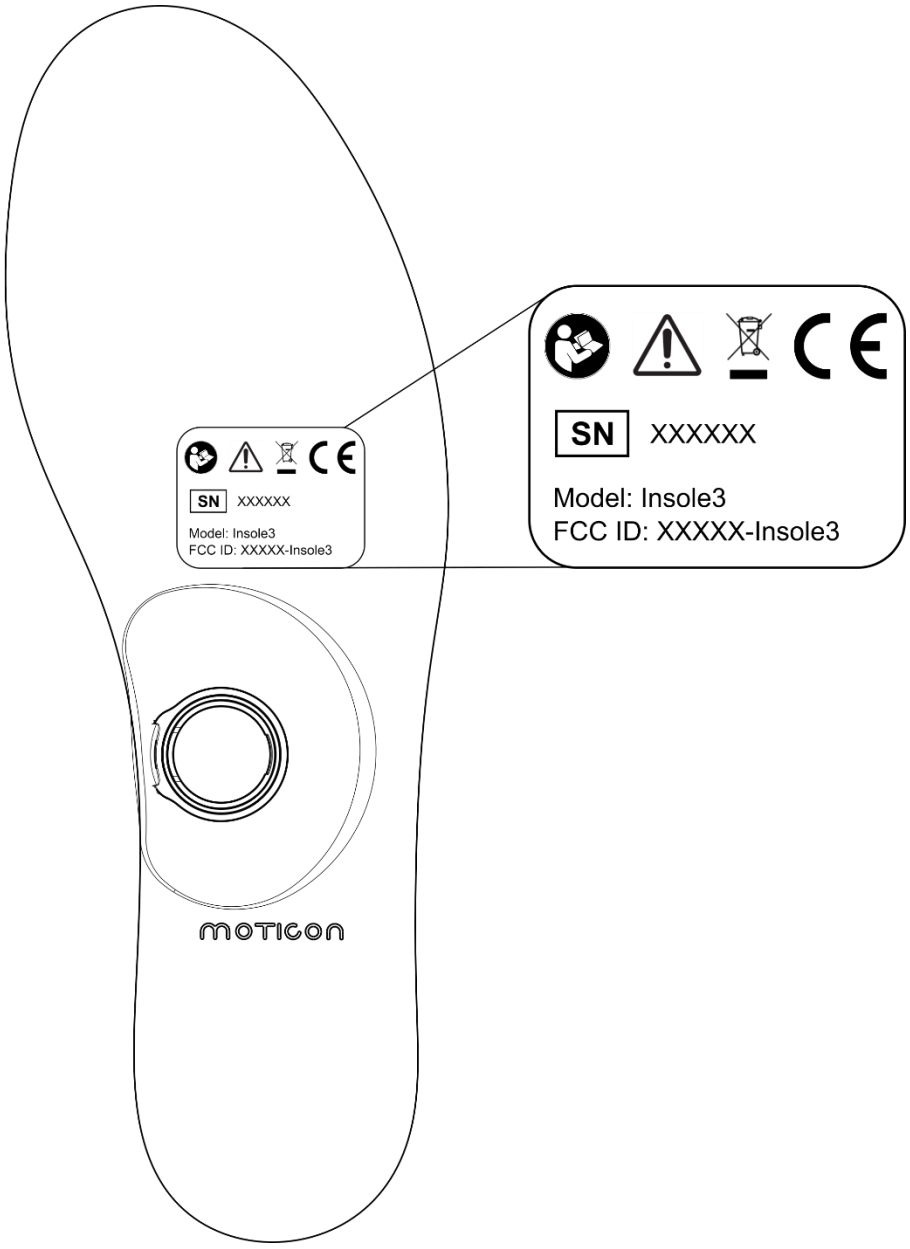
Equipment characteristics:			
Type of equipment:	Sensor insole for measuring the plantar pressure at the sole of foot, and the acceleration and rotation of the foot in three axes.		
Type designation*:	Insole3		
Parts of the system:	Sensor insole, battery lid, PD2032 rechargeable coin cell		
Version of EUT: In case of already tested products please describe the differences to the original sample	Hardware version: 03.00.00 Software version: 00.00.02 (33365019a499b040d84c0ba53719ee0c8841563c) Software version for HF test modes (no productive version): 5c25e0409b52c3f3bdaf1b1f19b685a6e1c2bf88		
Serial number:	SN4758, SN4602 (with programming adapter)		
Power supply:	☐ AC Nominal: V Minimum: V Maximum: V Nominal frequency: Hz	☐ DC Nominal: V Minimum: V Maximum: V	☒ Battery Nominal: 3.7 V
Necessary Pre-Fuse / RCCB (FI) in installation: (Please specify type and value)	n/a		

Product Service

Terminal connection (AC and/or DC)	☐ Schuko Plug 16 A ☐ CEE 16 A ☐ CEE 32 A ☐ CEE 63 A ☐ Terminal Block, specify maximum Voltage/Current/Power per connection Point:
highest frequency generated or used within the EUT	32 MHz ☒ < 108 MHz

Product Service

Marking plate (may only be a draft)



Operating mode(s) // Methods of Observation	
Operating mode(s) for emission tests:	According to norm: - Continuous sending with modulation at fixed channels - Receive mode
Operating mode(s) for immunity tests:	Data transmission mode including both measured force and IMU data.
Methods of observation during immunity tests	Continuous data reception and display by the connected smartphone. Compliance with acceptance criteria (below) is indicated in the smartphone app user interface as “pass” or “fail”. Acceptance criteria: - No connection break, or automatic reconnect after connection break, as required by norm Where measurement function is critical according to norm: - Measured force range (MAX – MIN) < 500 N - Measured acceleration range per axis (MAX – MIN) < 4 g - Measured angular rate range per axis (MAX – MIN) < 500 dps

Product Service

List of ports and cables					
No.	*Description*	*Classification*[1]	*Cable type*	*Cable length used*	*Cable length maximum*[2]
A1	No ports or cables	ac power	Unshielded	. m	. m
D1		dc power	Unshielded	. m	. m
S1		signal/control port	Shielded	. m	. m
S2		signal/control port	Unshielded	. m	. m
S3		signal/control port	Unshielded	. m	. m

List of devices connected to EUT				
No.	*Description*	*Type designation*	*Serial no. or ID*	*Manufacturer*
1	No connected devices			
2				
3				

List of support devices				
No.	*Description*	*Type designation*	*Serial no. or ID*	*Manufacturer*
1	Smartphone	Galaxy A7 (2018) SM-A750FZKUDBT	RF8M40S2R7W IMEI: 355424104502797	Samsung
2	Laptop	Aspire E5-574 N15Q1	NXG36EV009610097087600	Acer
3	Radio board	nRF52840-Preview-DK PCA10056	683597698 and 683108518	NORDIC Semiconductor

[1] Ports shall be classified as ac power, dc power or signal/control port.
[2] As specified by applicant

Product Service

1.4.1 Technical Description

Sensor insole for measuring the plantar pressure at the sole of foot and the acceleration and rotation of the foot in three axes.

Type of service:	Bluetooth Low Energy
Adaptity:	Adaptive System
FHSS / other:	Other type of broadband transmission
Frequency range:	2402 MHz – 2480 MHz
Number of channels:	40
Channel separation:	2 MHz
Modulation type(s):	1 MHz and 2 MHz

1.5 EUT Modification Record

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

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

Table 3

1.6 Test Location

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

Test Name	Name of Engineer(s)
Configuration and Mode: Radiated Tests Transmitting Continuously	
Spurious Radiated Emissions	Martin Steindl
Restricted Band Edges	Martin Steindl
Configuration and Mode: Conducted Tests Transmitting Continuously	
Maximum Conducted Output Power	Martin Steindl
Power Spectral Density	Martin Steindl
Emission Bandwidth	Martin Steindl
Authorised Band Edges	Martin Steindl
Spurious Conducted Emissions	Martin Steindl

Table 4

Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany

Product Service

2 Test Details

2.1 Spurious Radiated Emissions

2.1.1 Specification Reference

FCC 47 CFR Part 15C, ISED Canada RSS-247 and ISED Canada RSS-GEN, Clause 15.247 (d), 15.205, 5.5 and 6.13

2.1.2 Equipment Under Test and Modification State

Insole3, S/N: SN4602 - Modification State 0

2.1.3 Date of Test

2019-05-16 to 2019-05-17

2.1.4 Test Method

Testing was performed in accordance with ANSI C63.10-2013 clause 6.3, 6.5 and 6.6.

Plots for average measurements were taken in accordance with ANSI C63.10-2013 clause 4.1.4.2.3 to characterize the EUT. Where emissions were detected, final average measurements were taken in accordance with ANSI C63.10-2013 clause 4.1.4.2.2.

The plots shown are the characterization of the EUT. The limits on the plots represent the most stringent case for restricted bands, (54/74 dBuV/m) when compared to 20 dBc outside restricted bands. The limits shown have been used as a threshold to determine where further measurements are necessary. Where results are within 10 dB of the limits shown on the plots, further investigation was carried out and reported in results tables.

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

2.1.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	39.0 %

Product Service

2.1.6 Test Results

Radiated Tests Transmitting Continuously

Frequency (MHz)	Antenna Polarization	Detector	Receiver Reading (dBµV)	Correction Factor (dB/m)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
925.980	vertical	Quasi-Peak	0.0	26.3		18.7	71.0	52.3
2359.000	horizontal	Average	0.0	32.3		28.2	54.0	25.8
2359.000	horizontal	Peak	0.0	32.3		42.1	74.0	31.9
2359.250	horizontal	Average	0.0	32.3		38.8	54.0	15.2
2359.250	horizontal	Peak	0.0	32.3		49.2	74.0	24.8
2359.500	vertical	Peak	0.0	32.3		51.1	74.0	22.8
2402.000	vertical	Average	0.0	32.5		91.0		
2402.000	vertical	Peak	0.0	32.5		92.1		
2402.250	horizontal	Average	0.0	32.5		28.2	71.0	42.8
2402.250	horizontal	Peak	0.0	32.5		42.0	74.0	32.0
2444.500	horizontal	Average	0.0	32.7		42.4	71.0	28.6
2444.500	horizontal	Peak	0.0	32.7		52.3	74.0	21.7
2445.000	horizontal	Average	0.0	32.7		28.3	71.0	42.6
2445.000	horizontal	Peak	0.0	32.7		41.7	74.0	32.3
4804.250	horizontal	Average	0.0	39.9		53.7	54.0	**0.3**
4804.250	horizontal	Peak	0.0	39.9		59.2	74.0	14.8
4804.750	horizontal	Average	0.0	39.9		51.7	54.0	2.3
4804.750	horizontal	Peak	0.0	39.9		60.4	74.0	13.6
7205.750	horizontal	Average	0.0	43.8		45.8	71.0	25.2
7205.750	horizontal	Peak	0.0	43.8		56.7	74.0	17.3
7206.750	vertical	Average	0.0	43.8		46.7	71.0	24.3
7206.750	vertical	Peak	0.0	43.8		56.9	74.0	17.1
9609.625	vertical	Average	0.0	37.0		50.8	71.0	20.1
9609.625	vertical	Peak	0.0	37.0		54.8	83.5	28.7
12008.875	vertical	Peak	0.0	38.0		60.6	83.5	22.9
12009.400	vertical	Average	0.0	38.0		58.8	63.5	4.7
12009.400	horizontal	Peak	0.0	37.6		61.0	83.5	22.5
12012.025	vertical	Average	0.0	37.6		58.5	63.5	5.0
21705.625	vertical	Average	0.0	40.3		50.5	71.0	20.5
21705.625	vertical	Peak	0.0	40.3		57.0	89.5	32.5

See section 1.1 of Annex III for plots

Product Service

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in 15.209(a)

ISED Canada RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

2.1.7 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
TRILOG Antenna	Schwarzbeck	VULB 9162	20116	36	2022-01
Loop antenna	Rohde & Schwarz	HFH2-Z2	18876	36	2019-07
Double ridged horn antenna	Rohde & Schwarz	HF907	19933	24	2019-06
Horn antenna	EMCO	3160-09	19125	O/P	
Horn antenna	EMCO	3160-10	19442	O/P	
EMI test receiver	Rohde & Schwarz	ESW44	39897	24	2020-02
Semi anechoic room	Albatross	Cabin No. 9	19917	36	2020-09
EMC test software	Rohde & Schwarz	EMC 32	19719	N/A	

Table 5

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

Product Service

2.2 Maximum Conducted Output Power

2.2.1 Specification Reference

FCC 47 CFR Part 15C, ISED Canada RSS-247 and ISED Canada RSS-GEN, Clause 15.247 (b), 5.4 and 6.12

2.2.2 Equipment Under Test and Modification State

Insole3, S/N: Conducted Sample - Modification State 0

2.2.3 Date of Test

2019-05-15

2.2.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.9.1.1.

2.2.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	39.0 %

2.2.6 Test Results

DUT Modulation	DUT Frequency	Peak Power (dBm)	Limit Max (dBm)
1 MHz	2402 MHz	-5.2	30.0
1 MHz	2440 MHz	-2.1	30.0
1 MHz	2480 MHz	-2.4	30.0
2 MHz	2402 MHz	-4.4	30.0
2 MHz	2440 MHz	-1.8	30.0
2 MHz	2480 MHz	-1.3	30.0

See section 1.2 of Annex III for plots

2.2.7 Test Location and Test Equipment Used

This test was carried out in Non shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Spectrum Analysator	Rohde & Schwarz	FSV40	20219	12	2020-01

Table 6

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

Product Service

2.3 Power Spectral Density

2.3.1 Specification Reference

FCC 47 CFR Part 15C, ISED Canada RSS-247 and ISED Canada RSS-GEN, Clause 15.247 (e), 5.2 and 6.12

2.3.2 Equipment Under Test and Modification State

Insole3, S/N: Conducted Sample - Modification State 0

2.3.3 Date of Test

2019-05-15

2.3.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.10.2.

2.3.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	39.0 %

2.3.6 Test Results

DUT Modulation	DUT Frequency	Peak Power Spectral Density (dBm)	Limit Max (dBm)
1 MHz	2402 MHz	-15.05	8.0
1 MHz	2440 MHz	-11.96	8.0
1 MHz	2480 MHz	-12.40	8.0
2 MHz	2402 MHz	-18.39	8.0
2 MHz	2440 MHz	-15.80	8.0
2 MHz	2480 MHz	-15.40	8.0

See section 1.3 of Annex III for plots

2.3.7 Test Location and Test Equipment Used

This test was carried out in Non shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Spectrum Analysator	Rohde & Schwarz	FSV40	20219	12	2020-01

Table 7

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

Product Service

2.4 Emission Bandwidth

2.4.1 Specification Reference

FCC 47 CFR Part 15C, ISED Canada RSS-247 and ISED Canada RSS-GEN, Clause 15.247 (a)(2), 5.2 and 6.6

2.4.2 Equipment Under Test and Modification State

Insole3, S/N: Conducted Sample - Modification State 0

2.4.3 Date of Test

2019-05-15

2.4.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.8.2.

2.4.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	39.0 %

2.4.6 Test Results

DUT Modulation	DUT Frequency	6 dB Bandwidth (kHz)	Min. Limit (kHz)	Band Edge left (MHz)	Band Edge right (MHz)
1 MHz	2402 MHz	792.080	500	2401.564356	2402.356436
1 MHz	2440 MHz	792.080	500	2439.564356	2440.356436
1 MHz	2480 MHz	792.080	500	2479.564356	2480.356436
2 MHz	2402 MHz	1.346534	500	2401.287129	2402.633633
2 MHz	2440 MHz	1.386138	500	2439.287129	2440.673267
2 MHz	2480 MHz	1.346534	500	2479.287129	2480.633663

See section 1.4.1 of Annex III for plots

DUT Modulation	DUT Frequency	99 % Bandwidth (kHz)	Band Edge left (MHz)	Band Edge right (MHz)
1 MHz	2402 MHz	1.050000	2401.455000	2402.495000
1 MHz	2440 MHz	1.070000	2439.435000	2440.505000
1 MHz	2480 MHz	1.070000	2479.435000	2480.505000
2 MHz	2402 MHz	2.040000	2400.955000	2402.995000
2 MHz	2440 MHz	2.060000	2438.935000	2440.995000
2 MHz	2480 MHz	2.060000	2478.935000	2480.995000

See section 1.4.2 of Annex III for plots

2.4.7 Test Location and Test Equipment Used

This test was carried out in Non shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Spectrum Analysator	Rohde & Schwarz	FSV40	20219	12	2020-01

Table 8

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

Product Service

2.5 Authorised Band Edges

2.5.1 Specification Reference

FCC 47 CFR Part 15C, ISED Canada RSS-247 and ISED Canada RSS-GEN, Clause 15.247 (d), 5.5 and N/A

2.5.2 Equipment Under Test and Modification State

Insole3, S/N: Conducted Sample - Modification State 0

2.5.3 Date of Test

2019-05-15

2.5.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.10.4.

2.5.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	39.0 %

2.5.6 Test Results

DUT Modulation	DUT Frequency	Inband Peak (dBm)	Outband Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)
1 MHz	2402 MHz	-7.1	2359.775	-53.7	-27.1	26.5
1 MHz	2480 MHz	-4.3	2484.375	-60.7	-24.3	36.4
2 MHz	2402 MHz	-9.0	2399.975	-39.6	-29.0	10.6
2 MHz	2480 MHz	-5.8	2483.676	-58.3	-25.8	32.5

See section 1.5 of Annex III for plots

2.5.7 Test Location and Test Equipment Used

This test was carried out in Non shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Spectrum Analysator	Rohde & Schwarz	FSV40	20219	12	2020-01

Table 9

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

Product Service

2.6 Spurious Conducted Emissions

2.6.1 Specification Reference

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

2.6.2 Equipment Under Test and Modification State

Insole3, S/N: Conducted Sample - Modification State 0

2.6.3 Date of Test

2019-05-15

2.6.4 Test Method

WLAN and other
The test was performed in accordance with KDB 558074 D01 v03r02, clause 11.0.

Bluetooth
The test was performed in accordance with ANSI C63.10.

2.6.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	39.0 %

2.6.6 Test Results

All spurious emissions showed more than 10 dB margin to the limit, no values noted.

See section of Annex III 1.6 for plots.

2.6.7 Test Location and Test Equipment Used

This test was carried out in Non shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Spectrum Analysator	Rohde & Schwarz	FSV40	20219	12	2020-01

Table 10

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

Product Service

2.7 Restricted Band Edges

2.7.1 Specification Reference

FCC 47 CFR Part 15C, ISED Canada RSS-247 and ISED Canada RSS-GEN, Clause 15.205 N/A and 8.10

2.7.2 Equipment Under Test and Modification State

Insole3, S/N: SN4602 - Modification State 0

2.7.3 Date of Test

2019-05-16 to 2019-05-17

2.7.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.10.5.

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

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

2.7.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	39.0 %

Product Service

2.7.6 Test Results

Radiated Tests Transmitting Continuously

See radiated spurious emissions, section 2.1 of this test report and section 1.1 of Annex III, for details

FCC 47 CFR Part 15, Limit Clause 15.209

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

Table 11

ISED Canada RSS-GEN, Limit Clause 8.9

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

Table 12

*Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

Product Service

2.8 Exposure of Humans to RF Fields

2.8.1 Specification Reference

ISED Canada RSS-GEN Issue 4, section 3.2

2.8.2 Guide

ISED Canada RSS-102 Issue 5, section 2.5 and

2.8.3 Equipment Under Test and Modification State

Model: DAC Universal; Type: MK IV, S/N: 1044 - Modification State 0

2.8.4 Date of Test

2019-05-16 to 2019-05-17

2.8.5 Test Method

This test was performed in accordance with ISED Canada RSS-102, Issue 5, chapter 2.5
Test according to RSS-102 is based on test results according to section of this report.

2.8.6 Test Result

$$EIRP = \frac{(FS \cdot D)^2}{30}$$

In accordance with ISED Canada RSS-102, Issue 5, chapter 2.5:

Maximum Radiated Fields Strength: (see chapter 2.1 of this test report)	92.1 dBµV/m = 40.27 mV (at 3 m distance and 2402 MHz)
Calculated Equivalent Radiated Power:	486.5 µW (e.i.r.p.)
Minimum separation distance:	≤ 5 mm
SAR Evaluation Exemption Limit:	4 mW

2.8.7 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8 and radio lab.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Double ridged horn antenna	Rohde & Schwarz	HF907	19933	24	2019-06
EMI test receiver	Rohde & Schwarz	ESW44	39897	24	2020-02

Table 13

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

Product Service

2.9 SAR exclusion threshold

2.9.1 Specification Reference

KDB 447498 D01 V06, section 4.3.1 a)

2.9.2 Equipment Under Test and Modification State

Model: DAC Universal; Type: MK IV, S/N: 1044 - Modification State 0

2.9.3 Date of Test

2019-05-16 to 2019-05-17

2.9.4 Test Method

Carrier level is based on test result according to section 2.1 of this report.

2.9.5 Test Result

Maximum Radiated Fields Strength: (see chapter 2.1 of this test report)	92.1 dBµV/m = 40.27 mV (at 3 m distance and 2402 MHz)
Calculated Equivalent Radiated Power:	486.5 µW (e.i.r.p.) < 0.1 mW
Minimum separation distance:	5 mm (≤ 50 mm)
1-g numeric threshold:	(1 mW / 5 mm) · √(2.402 GHz) = 0.3
1-g numeric threshold limit:	3.0

Note 1:For test distances below 5 mm according to 4.3.1 a) the test distance is fixed to 5 mm.

$$EIRP = \frac{(FS \cdot D)^2}{30}$$

2.9.6 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Double ridged horn antenna	Rohde & Schwarz	HF907	19933	24	2019-06
EMI test receiver	Rohde & Schwarz	ESW44	39897	24	2020-02

Table 14

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

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 15

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 16

Product Service

Immunity Testing			
Test Name	kp	Expanded Uncertainty	Note
Electrostatic Discharges			4
Radiated RF-Field			
Pre-calibrated field level	2	+32.2 / -24.3 %	5
Dynamic feedback field level	2.05	+21.2 / -17.5 %	3
Electrical Fast Transients (EFT) / Bursts			4
Surges			4
Conducted Disturbances, induced by RF-Fields			
via CDN	2	+15.1 / -13.1 %	6
via EM clamp	2	+42.6 / -29.9 %	6
via current clamp	2	+43.9 / -30.5 %	6
Power Frequency Magnetic Field	2	+20.7 / -17.1 %	2
Pulse Magnetic Field			4
Voltage Dips, Short Interruptions and Voltage Variations			4
Oscillatory Waves			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 17

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%