RADIO TEST REPORT

No. 1811796STO-001, Ed. 4

RF Performance

EQUIPMENT UNDER TEST

Equipment:	Robotic Feed Pusher
Type/Model:	DeLaval OptiDuo
Manufacturer:	DeLaval International AB

SUMMARY

Referring to the emission limits, and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards:

47 CFR Part 15 (2015): Subpart C: Intentional radiators. Section 15.209

47 CFR Part 15 (2015): Subpart B: unintentional radiators. Section 15.109

RSS-GEN Issue 5 (2018): General requirements of compliance of radio apparatus (2018).

RSS-210 Issue 9 Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment (2016)

AS/NZS 4268:2017

For details, see clause 2 – 4.

Date of issue: 2018-12-20

Tested by: Usman Ul-haq

Matti Virkki

Approved by: Stefan Andersson

Revision History

Edition	Date	Description	Changes
1	2018-10-18	First release	
2	2018-11-09	Second release	Corrected unit in 9k-30M QP table from dBµV/m to dBµA/m
3	2018-11-13	Third release	Added AS/NZS to frontpage and standards
4	2018-12-20	Fourth release	Corrected measuring distance from 3 to 10 m in chapter 5.2 for 9 kHz – 30 MHz

CONTENTS

1. CLIENT INFORMATION

The EUT has been tested by request of

Company	DeLaval Operations Sp Robotnicza 72 PL-53-608 Wroclaw Poland
Name of contact	Lukasz Knec Phone +48 (71) 77 48 820

2. EQUIPMENT UNDER TEST (EUT)

2.1 Identification of the EUT

Equipment:	Robotic Feed Pusher
Type/Model:	DeLaval OptiDuo
Brand name:	DeLaval
Serial number:	No Visible serial number
Manufacturer:	DeLaval International AB

Transmitter frequency range:	133,2 kHz
Receiver frequency range:	133,2 kHz
Radio Technique	RFID

Frequency agile or hopping:	☐ Yes	☒ No
Antenna:	☐ Internal antenna	☒ External antenna
Antenna connector:	☐ None, internal antenna	☒ Yes, V19-G-2M-PUR-ABG
Type of modulation:	No modulation	
Temperature range:	☒ Category I (General): -20°C to +55°C ☐ Category II (Portable equipment): -10°C to +55°C ☐ Category III (Equipment for normal indoor use): +5°C to +35°C ☐ Other: <-20°C to +55°C	
Power rating:		
Transmitter standby mode supported:	☒ Yes	☐ No

2.2 Additional information about the EUT

The EUT consists of the following units:

Unit	Serial number
Control Box	No visible serial number
Safety Switch	No visible serial number
Terminal	No visible serial number
Main Switch	No visible serial number
Transponder	No visible serial number

2.3 Peripheral equipment

Peripheral equipment is equipment needed for correct operation of the EUT, but not included as part of the testing and evaluation of the EUT.

Equipment	Type / Model	Manufacturer	Serial no.
DC power supply	B60-1T	Oltronix	S-7234

3. TEST SPECIFICATIONS

3.1 Standards

Requirements:
47 CFR Part 15: Radio frequency device, Subpart C: Intentional radiators.

47 CFR Part 15: Radio frequency device, Subpart B: Unintentional radiators.

RSS-GEN Issue 5: General requirements of compliance of radio apparatus (2018).

RSS-210 Issue 9 Licence-exempt Radio Apparatus (All Frequency Bands):
Category I Equipment (2016)

AS/NZS 4268:2017

Test methods:
ANSI C63.10-2013: American National Standard for testing Unlicensed Wireless Devices

3.2 Additions, deviations and exclusions from standards and accreditation

No additions, deviations or exclusions have been made from standards and accreditation.

3.3 Test site

Measurements were performed at:

Intertek Semko AB.
Torshamnsgatan 43,
Box 1103
SE-164 22 Kista

Intertek Semko AB is a FCC listed test site with site registration number 90913
Intertek Semko AB is a FCC accredited conformity assessment body with designation number SE0002
Intertek Semko AB is an Industry Canada listed test facility with IC assigned code 2042G

Measurement chambers

Measurement Chamber	Type of chamber	IC Site filing #
STORA HALLEN	Semi-anechoic 10 m and 3 m	2042G-2

3.4 Mode of operation during the test

The EUT was tested with 24 VDC.
The EUT was tested in a way that emits most disturbances during emission. The antenna was placed leaning against a stand with a transponder taped to it. The EUT only has one mode of operation.
The EUT was placed on a table with antenna in stand-up position with transponder attached.

4. TEST SUMMARY

The results in this report apply only to sample tested:

Standard	Description	Result
	Emission	
FCC Part 15.209 **RSS-GEN, 8.9** **RSS-210, 2.5.1**	**Radiated emission of electromagnetic fields in the frequency range 9 kHz - 30 MHz** The EUT complies with the limits. The margin to the limit was at least 4.2 dB at 0.133 MHz See clause 6.5.	**PASS**
FCC Part 15.109 **RSS-GEN, 8.9** **RSS-210 2.5.1**	**Radiated emission of electromagnetic fields in the frequency range 30 – 1000 MHz** The EUT complies with the limits. The margin to the limit was at least 0.8 dB at 150.210 MHz See clause 6.6.	**PASS**
RSS-GEN, 6.6	**Occupied bandwidth** RSS-GEN has no limit for 99% occupied band width	**PASS**

5. RADIATED RF EMISSION IN THE FREQUENCY-RANGE 0.009 MHZ TO 1 GHZ

Date of test:	2018-08-13	**Test location:**	Stora Hallen
EUT Serial:	No visible serial number	**Ambient temp:**	23°C
Tested by:	Usman Ul-haq	**Relative humidity:**	44%
Test result:	Pass	**Margin:**	0.79 dB

5.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10 and ANSI C63.4

The EUT was set up in order to emit maximum disturbances.
The EUT was placed on an insulating support 0.8 m above the turntable which is part of the reference ground plane.
Overview sweeps were performed with the measurement receiver in max-hold mode and the peak detector activated.

5.2 Test conditions

Test set-up: **9 kHz to 30 MHz**

Test receiver set-up:		
Preview test:	Peak,	RBW 200 Hz / 9 kHz. VBW 30 kHz
Final test:	Quasi-Peak,	RBW 200 Hz / 9 kHz
	Average	RBW 200 Hz / 9 kHz
Measuring distance:	10 m	
Measuring angle:	0 – 359°	
Antenna		
Height above ground plane:	1 m	
orientation:	2 orthogonal axis	
Type:	Loop	

Test set-up: **30 MHz to 1000 MHz**

Test receiver set-up:		
Preview test:	Peak,	RBW 120 kHz. VBW 1 MHz
Final test:	Quasi-Peak,	RBW 120 kHz
Measuring distance:	10 m	
Measuring angle:	0 – 359°	
Antenna		
Height above ground plane:	1 – 4 m	
Polarisation:	Vertical and Horizontal	
Type:	Bilog	

5.3 Radiated Emission requirements

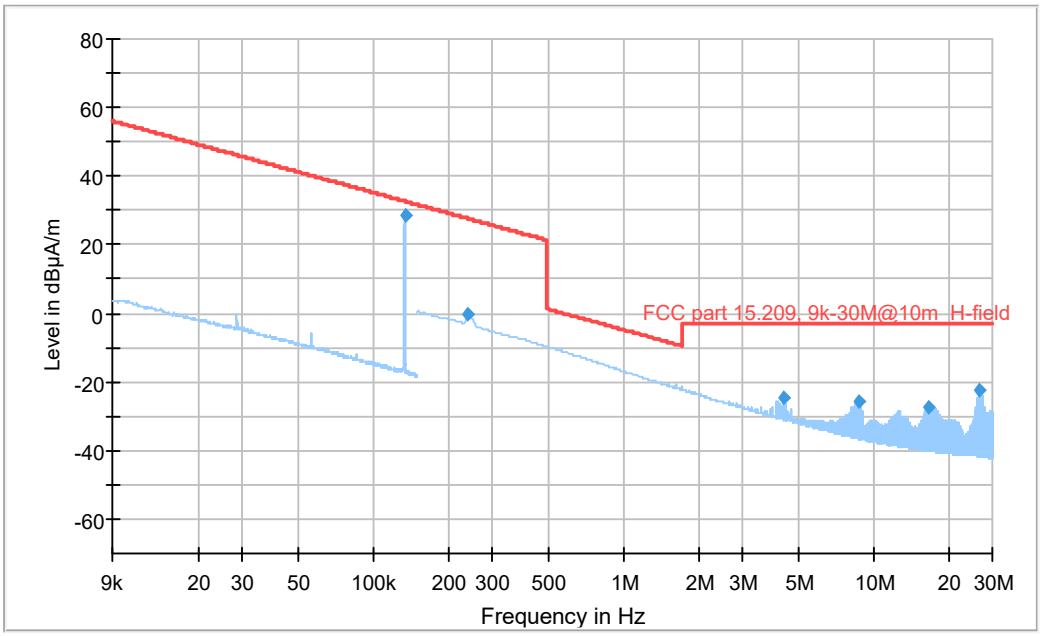
The EUT shall meet the limits for the standards.
Reference: CFR 47 §15.209, §15.109, RSS-Gen

Limits for general radiated emission

Frequency range [MHz]	Field strength at 3 m (dBμV/m)	Field strength at 10 m (dBμV/m)	Detector (dBμV/m)
0.009 – 0.09	-	107.6 –87.6	Average
0.09 – 0.110	-	87.6 – 85.9	Quasi Peak
0.110 – 0.490	-	85.9- 72.9	Average
0.490 – 1.705	-	68.1 – 42.1	Quasi Peak
1.735 – 30	30	49.1	Quasi Peak
30 – 88	40.0	29.5	Quasi Peak
88 – 216	43.5	33.0	Quasi Peak
216 – 960	46.0	35.5	Quasi Peak
960 – 1000	54.0	43.5	Quasi Peak
Above 1000	54.0 / 74.0	-	Average / Peak

The values for each measurement distance are given using an extrapolation factor of 20 dB/decade above 30 MHz and 40 dB/decade below 30 MHz according to §15.31(f)(1), §15.31(f)(2) and RSS-GEN sections 6.4 and 6.5.

5.4 Test results 9 kHz – 30 MHz



Diagram, Peak overview sweep, 0.009 – 30 MHz at 10 m distance.

Measurement results, Quasi Peak

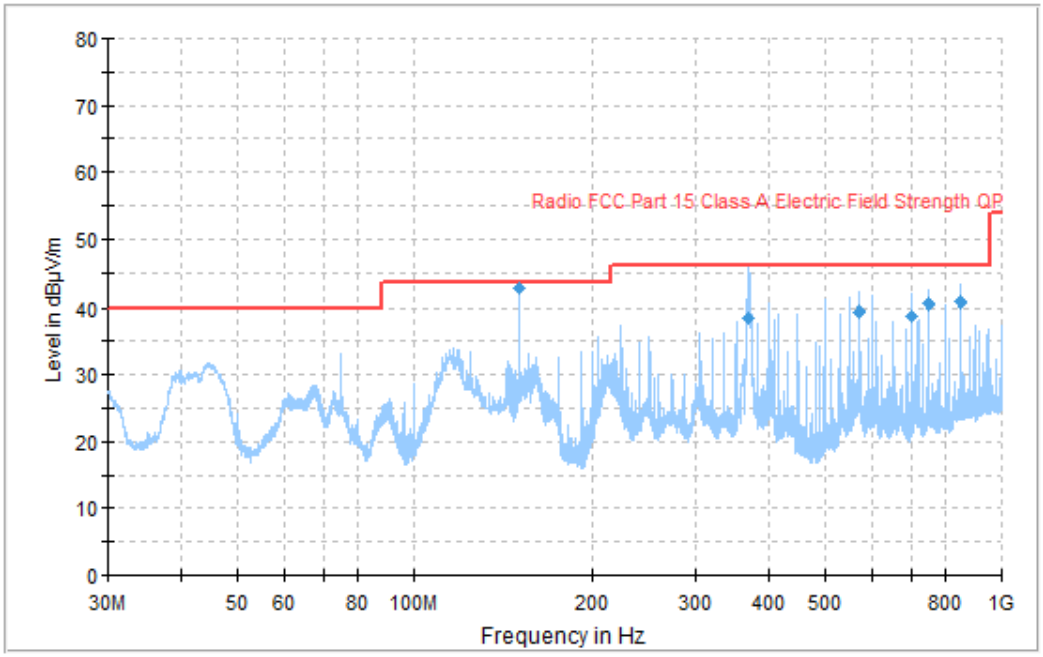
Frequency [MHz]	Level [dBµA/m]	Level [dBµV/m]	Limit [dBµA/m]	Polarization H/V	Margin [dB]
0.133	28.5	80.0	32.7	H	4.2
0.240	-0.1	51.4	27.6	V	27.7
4.369	-24.5	27.0	-2.9	H	21.6
8.738	-25.1	26.4	-2.9	H	23.1
16.562	-27.2	24.3	-2.9	H	24.3
26.797	-22.1	29.4	-2.9	V	19.2

Result [dBµV/m] = Analyser reading [dBµA] + Antenna factor [1/m] - Amplifier gain [dB] + 51.5 dB dBµA to dBµV conversion + Cable loss [dB]

Quasi Peak is always greater than average so because quasi peak is below the limit, so is the average.

5.5 Test results 30 MHz – 1000 MHz

Diagram, Peak overview sweep, 30 – 1000 MHz at 10 m distance.



Measurement results, Quasi Peak

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]
150.210	42.7	43.5	V	0.8
370.080	38.3	46.0	H	7.7
571.200	39.2	46.0	H	6.8
699.960	38.7	46.0	H	7.3
749.970	40.5	46.0	H	5.6
849.960	40.8	46.0	H	5.2

Result [dBµV/m] = Analyser reading [dBµV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

6. OCCUPIED BANDWIDTH

Date of test:	2018-08-16	**Test location:**	Wireless Center
EUT Serial:	No visible serial	**Ambient temp:**	23°C
Tested by:	Usman Ul-haq	**Relative humidity:**	44%
Test result:	Pass	**Margin:**	NA

6.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10 and RSS-GEN.

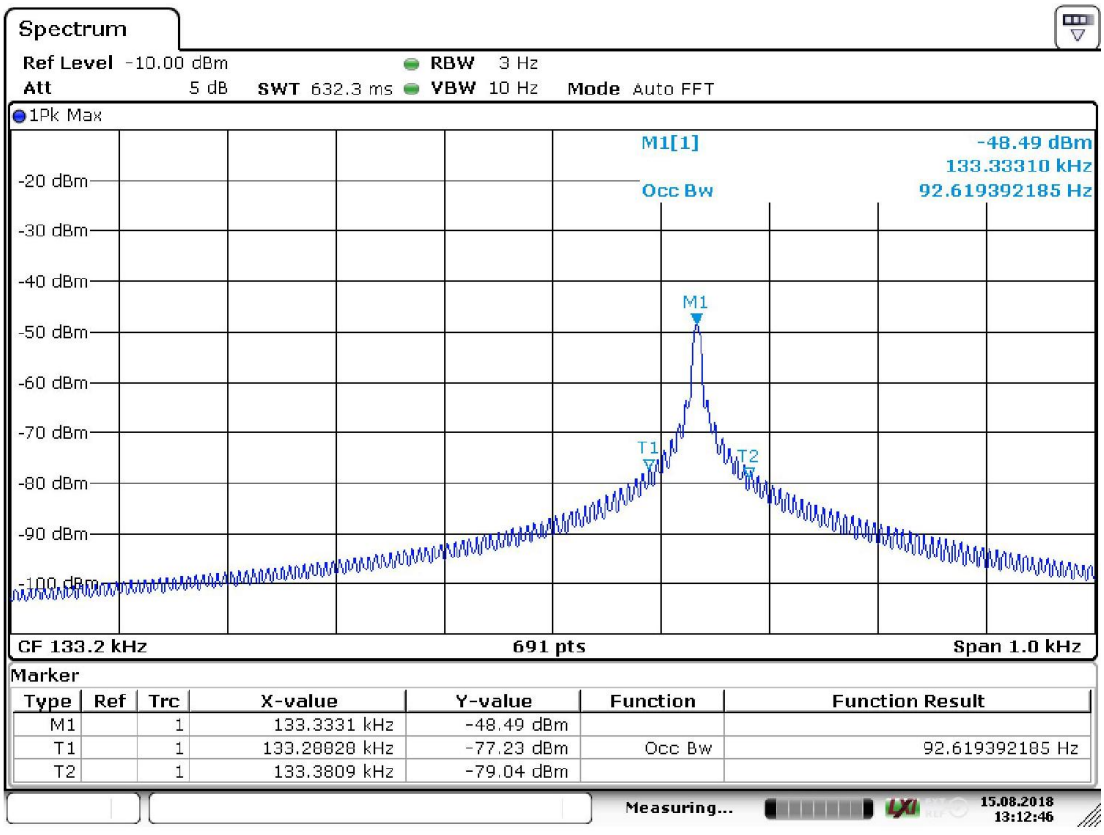
Spectrum analyser with occupied bandwidth measurement function is used to determine the occupied bandwidth.

6.2 Test conditions

Detector: Peak
RBW 1 – 5 % of span 1 kHz
VBV 3 x RBW
Span > OBW

The EUT was set up in order to emit maximum disturbances.

6.3 Test results



Date: 15.AUG.2018 13:12:47

Screenshot: Occupied bandwidth Measurement

7. TEST EQUIPMENT

Stora Hallen

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. date	Cal. interval
Measurement software	Rohde & Schwarz	EMC32 - 10.35.02	--	--	--
Receiver	Rohde & Schwarz	ESW 44	33890	2018-02-22	1 year
Loop antenna	Chase	EMCO	8853	2015-10-26	3 years
BiLog antenna	Chase	CBL6111A	971	2017-09-20	3 years

Wireless Center

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. date	Cal. interval
Measurement software	Rohde & Schwarz	EMC32 - 10.35.02	--	--	--
Signal analyzer:	Rohde & Schwarz	FSV	32594	7 / 2014	1 year
10 dB Attenuator:	Huber+Suhner	5910_N-50-010	32696		

8. MEASUREMENT UNCERTAINTY

Continuous conducted disturbances with AMN in the frequency range 9 kHz to 30 MHz ± 3.7 dB

Measurement uncertainty for radiated disturbance

Uncertainty for the frequency range 0.09 to 30 MHz at 10 m	± 3.2 dB
Uncertainty for the frequency range 30 to 1000 MHz at 3 m	± 5.1 dB
Uncertainty for the frequency range 30 to 1000 MHz at 10 m	± 5.0 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2:2011.
The measurement uncertainty is given with a confidence of 95 %.

9. TEST SET UP AND EUT PHOTOS

EUT photos are in separate document 1811796STO-001 Annex 1.
Test set up photos are in separate document 1811796STO-001 Annex 2.