FCC Part 1 Subpart I
FCC Part 2 Subpart J
INDUSTRY CANADA RSS 102 ISSUE 5

RF EXPOSURE REPORT

FOR

RF ID Reader

MODEL NUMBER: HD5000

FCC ID: YGP5000-01
IC: 9016A-HD5000A

REPORT NUMBER: 10766018B

ISSUE DATE: 2017-05-01

Prepared for
CROWN EQUIPMENT CORP
44 SOUTH WASHINGTON STREET
NEW BREMEN, OH 45869 USA

Prepared by
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Revision History

Rev.	Issue Date	Revisions	Revised By
--	2015-10-09	Initial Issue	Bart Mucha
1	2017-05-01	Updated Customer Address. Correct IC Company Number to 9016A. Updated antenna gain to new spec (5dBi), and resultant separation distance.	Richard Jankovics

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: CROWN EQUIPMENT CORP
44 SOUTH WASHINGTON STREET
NEW BREMEN, OH 45869 USA

EUT DESCRIPTION: RF ID Reader

MODEL: HD5000

SERIAL NUMBER: Non serialized

DATE TESTED: August 20, 2015 – September 21, 2015

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 1 SUBPART I & PART 2 SUBPART J	Pass
INDUSTRY CANADA RSS 102 ISSUE 3	Pass

UL Verification Services Inc. calculated the RF Exposure of the above equipment in accordance with the requirements set forth in the above standards, using test results reported in the test report documents referenced below and/or documentation furnished by the applicant. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations of these calculations. The results show that the equipment is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Verification Services Inc. By:

Michael Ferrer
EMC Engineer
UL LLC

Calculated By:

Bart Mucha
EMC Engineer
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2. TEST METHODOLOGY

All calculations were made in accordance with FCC OET Bulletin 65 Edition 97-01 and IC Safety Code 6.

3. REFERENCES

All measurements were made as documented in test report UL LLC Order#10766018A.

Output power and Antenna gain data is excerpted from the applicable test reports and documentation provided by the applicant. Duty cycle was assumed worst case 100%

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 333 Pfingsten Road, Northbrook, IL 60062 USA.

UL NBK is accredited by NVLAP, Laboratory Code 100414-0.

5. MAXIMUM PERMISSIBLE RF EXPOSURE

5.1. FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f^2)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f^2)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density
NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

5.2. IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 4, when averaged spatially and over time.

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003-10[21]	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

TABLE 5: Reference Levels for Electric Field Strength, Magnetic Field Strength and Power Density in Uncontrolled Environments

Frequency (MHz)	Electric Field Strength (E_{RL}), (V/m, RMS)	Magnetic Field Strength (H_{RL}), (A/m, RMS)	Power Density (S_{RL}), (W/m^2)	Reference Period (minutes)
10–20	27.46	0.0728	2	6
20–48	$58.07 / f^{0.25}$	$0.1540 / f^{0.25}$	$8.944 / f^{0.5}$	6
48–300	22.06	0.05852	1.291	6
300–6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000–15000	61.4	0.163	10	6
15000–150000	61.4	0.163	10	$616000 / f^{1.2}$
150000–300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000 / f^{1.2}$

Frequency, f, is in MHz.

* above table is from IC Safety Code 6, 2015

5.3. EQUATIONS

POWER DENSITY

Power density is given by:

S = EIRP / (4 * Pi * D^2)

Where

S = Power density in mW/cm^2
EIRP = Equivalent Isotropic Radiated Power in mW
D = Separation distance in cm

Power density in units of mW/cm^2 is converted to units of W/m^2 by multiplying by 10.

DISTANCE

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

Where

D = Separation distance in cm
EIRP = Equivalent Isotropic Radiated Power in mW
S = Power density in mW/cm^2

MIMO AND COLOCATED TRANSMITTERS (IDENTICAL LIMIT FOR ALL TRANSMITTERS)

For multiple chain devices, and colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the EIRP (in linear units) of each transmitter.

Total EIRP = (EIRP1) + (EIRP2) + ... + (EIRPn)

where

EIRPx = Source-based time-averaged EIRP of chain x or transmitter x

The total EIRP is then used to calculate the Power Density or the Distance as applicable.

5.4. LIMITS AND EXEMPTION

FIXED LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = .61 mW/cm^2
From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 2.8 W/m^2

INDUSTRY CANADA EXEMPTION

RSS-102 Clause 2.5.2 RF exposure evaluation is required if the separation distance between the user and the device's radiating element is greater than 20 cm. See section 5.2 for limits.

6. RF EXPOSURE RESULTS

The device has two antenna outputs and each antenna output is connected to separate antennas.

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

Multiple chain or colocated transmitters									
Band	**Mode**	**Chain for MIMO**	**Separation Distance (cm)**	**Output Peak Power (dBm)**	**Antenna Gain (dBi)**	**Duty Cycle (%)**	**EIRP (mW)**	**FCC Power Density (mW/cm^2)**	**IC Density (W/m^2)**
915.25	Ant 1	1	45.0	30.00	5.00	100.0	3162.3	0.124	1.24
902.75	Ant 2	2	45.0	30.00	5.00	100.0	3162.3	0.124	1.24
Combined			45				6324.6	0.249	2.49

The above calculation is based on using the most conservative power output and its presented as worst case condition.

Band MHz	**Mode**	**FCC Limit (mW/cm^2)**	**IC Limit (W/m^2)**	**Output Peak Power (dBm)**	**Antenna Gain (dBi)**	**EIRP (dBm)**	**Duty Cycle (%)**	**EIRP (mW)**	**Separatio Distance FCC (cm)**	**Separati Distance IC (m)**
902-928, 915.25	Ant 1	0.61	2.8	30.00	5.00	35.00	100.0	3162.3	20.32	0.30
902-928, 902.75	Ant 2	0.61	2.8	30.00	5.00	35.00	100.0	3162.3	20.32	0.30
Combined		0.61	2.8			38.01	100.0	6324.6	28.73	0.42

The above table shows the minimum separation distance from all persons when device is in use. Per statement under the first table, because the antennas will never be closer than 45 cm apart the minimum safe distance for safe RF Exposure levels is 45 cm. The most conservative power level was used.

Notes:

1) For MPE the new KDB 447498 requires the calculations to use the maximum rated power; that power should be declared by the manufacturer, and should not be lower than the measured power. If the power has a tolerance then we also need to check that the measured power is within the tolerance.
2) The output power in the tables above is the maximum power per chain among various channels and various modes within the specific band.
3) The antenna gain in the tables above is the maximum antenna gain among various channels within the specified band.

END OF REPORT