Test Report



Bureau Veritas Consumer Product Services

Report No	EW0235-3 Issue 3
Client	Hanchett Entry Systems, Inc.
Address	10027 S. 51st Street, Suite 102, Phoenix AZ 85044
Product Description FCC ID IC PMN Model/HVIN FVIN HMN	RFID Reader Module VC3-DR100V3 7160A-DR100V3 DR100-V3 DR100-V3 N/A DR100
Equipment Type Equipment Code	Part 15 Low Power Transmitter Below 1705kHz DCD
Standards	CFR Title 47 FCC Part 15.209, ISED Canada RSS-210 Issue 10 Section 7.3
Test Dates FCC Test Firm DN Canada CABID	Jun 28, 2022 to Feb 22, 2023 US1028 US0106
Prepared by	Haiyan Xu – Wireless Engineer
Authorized by	Yunus Faziloglu – Wireless Manager
Issue Date	Mar 16, 2023

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Form Final Report REV 2-16-07 (DW)



Summary and Test Methodology

This test report supports a "Limited Modular Approval" certification application for the RFID Reader Module (Model: DR100-V3) operating pursuant to:

CFR Title 47 FCC Part 15.209, ISED Canada RSS-210 Issue 10 Section 7.3 This report contains test data for the 125kHz RFID radio portion of this EUT.

The EUT is the RFID Reader Module (Model: DR100-V3). It communicates reading activity to a remote unit over the 2.4GHz band. It was tested inside the Aperio V3 Wireless Door Relay (Host Model: DR100). The RFID Reader Module (Model: DR100-V3) also contains a 13.56MHz RFID radio and a Zigbee radio. 125kHz transmitter has an integral antenna. The Host Model DR100 operating voltage is 24VDC, and the RFID Reader Module (Model: DR100-V3) operating voltage is 3VDC.

In addition, DR100 host includes a previously certified Bluetooth Low Energy module with FCC ID: Y88-MBM1CC2640 and IC: 9504A-MBM1CC2640.

Lowest clock frequency in the device (used/generated): 32.768kHz

A support laptop was used to control the RFID transmitter. PuTTy (software) was used on this laptop to enable/disable transmitters and set transmission channels.

For spurious emissions, 125kHz RFID radio was tested with unmodulated carrier due to the fact that modulated mode had large mutes between pulses making it unsuitable for maximizing emissions. For fundamental field strength and 99% emission bandwidth measurements, unmodulated carrier was used to maximize the fundamental, but final measurements were performed with modulation enabled.

EUT was supplied with an "RFID windmill" test fixture to present RFID tags to the EUT during unintentional emissions testing in order to simulate normal operation of periodic tag reading. This fixture was not exercised during radio testing.

All tests were performed in accordance with the following measurement procedures: ANSI C63.10-2013 RSS-Gen Issue 5

_				
Freq. (MHz)	RBW	VBW	Pre-scan	Final
0.009-0.15	200Hz	1kHz	Peak	Quasi Peak
0.15-30	9kHz	30kHz	Peak	Quasi Peak
30-1000	120kHz	300kHz	Peak	Quasi Peak

Following bandwidths were used during testing:

If peak measurements were below the applicable limit, QPk measurements were not performed.

The environmental conditions during testing are documented on the associated data tables. We found that the product complied with the requirements above without modification. Test sample was received in good condition.





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Compliance Statement

RSS-GEN	RSP-100	RSS 210	Part 15	Comments
6.4			15.15(b)	There are no controls accessible to the user that
				varies the output power.
	3.1		15.19	The label is shown in the label exhibit.
	3.2		15.21	Information to the user is shown in the instruction
				manual exhibit.
			15.27	No special accessories are required for compliance.
3.2			15.31	The EUT was tested in accordance with the
				measurement standards in this section.
6.13.2			15.33	Frequency range was investigated according to this
				section, unless noted in specific rule section under
				which the equipment operates.
6.13.1			15.35	The EUT emissions were measured using the
				measurement detector and bandwidth specified in
				this section, unless noted in specific rule section
				under which the equipment operates.
6.8			15.203	The antenna for this device is an integral antenna.
8.10		7.3	15.205	Fundamental is not in a restricted band and the
8.9			15.209	spurious and harmonic emissions in the restricted
				bands comply with the general emission limits of
				15.209 or RSS-Gen as applicable.
8.8			15.207	Complies with applicable AC line conducted
				emission limits.
6.7				99% emission bandwidth plot is provided.

Modifications Required for Compliance

None.

Testing Notes

RSS-GEN Table 6 H-field limits are 51.5dB lower than FCC 15.209(a) E-field limits. Measurements are performed in terms of magnetic field and converted to electric field using the free space impedance of 377Ω (E-field = H-field +51.5). Therefore resulting pass/fail margin would be the same if an E-field reading is compared to an E-field limit or an H-field reading is compared to an H-field limit.





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Test Results

Fundamental

Test setup and procedures can be found on the next page.

Radiated	Emissi	ons Tal	ole									
Date:	Date: 28-Jun-22Company: Assa AbloyWork Order: W0235									W0235		
Engineer:	Engineer: Ryan M. Brown EUT Desc: DR100 Door Relay EUT Operating Voltage/Frequency: 24V DC								24V DC			
Temp:	Temp: 23.3 Humidity: 47% Pressure: 1011											
	Frequency Range: 125Khz Fundamental Measurement Distance: 3 m											
Notes:	Notes: Peak Readings EUT Max Freq: 2480											
A					C-hl-	Adiustad					FCC 15.20	9
Antenna	Fraguanay	Booding	Freamp	Antenna	Cable	Adjusted	Limit	Morgin	Beault	Limit	Morgin	Begult
(0° - 90°)	(MHz)	(dBuV)	(dB)	(dB/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(Pass/Fail)	(dBuV/m)	(dB)	(Pass/Fail)
Para	0.125	51.4	29.4	50.1	0.3	72.4	(dBp1))	(05)	(1 400/1 411)	105.6	-33.2	Pass
Perp	0.125	47.5	29.4	50.1	0.3	68.5				105.6	-37.1	Pass
Para to Floor	0.125	41.1	29.4	50.1	0.3	62.1				105.6	-43.5	Pass
Tab	le Result:	Pass	by	-33.2	dB				W	orst Freq:	0.125	MHz
Test Site:	EMI Chamber	2	Cable 1:	Asset #26	32			Cable 2: Asset #2610 Cable 3: Asset # 24			Asset # 2474	
Analyzer:	2093		Preamp:	8447F_2				Antenna:	Lg Loop		Preselector:	
CSsoft Radiate Adjusted Readi	Ssoft Radiated Emissions Calculator v 1.017.222 Copyright Curtis-Straus LLC 2000 djusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor											

Throughout this report, limit conversion below 30MHz is done by using the square of an inverse linear distance extrapolation factor (40 dB/decade) as allowed in FCC 15.31(f)(2). Limit(3m) = Limit(30m) + 40*log(30/3) = Limit(30m) + 40 Limit (2m) = Limit (200m) + 40*log(200/2) = Limit (200m) + 80

Limit(3m) = Limit(300m) + 40*log(300/3) = Limit(300m) + 80

Test Equipment Used

Rev. 6/20/2022								
Spectrum Analyzers / Receivers /Preselectors	Range		Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2093 WIXE EIVII Receiver	20112-20.30112	119030A	Agnerit	10131210181	2093	1	3/1/2023	3/1/2022
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Range	Asset	Cat	Calibration Due	Calibrated on
EMI Chamber 2	719150	2762A-7	A-0015	30-1000MHz	1686	Ι	12/5/2022	12/5/2020
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
8447F Rental PA	9KHz-1.3GHz	84477F	HP	3113A05395		Ш	10/18/2022	10/18/2021
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Large Loop	20Hz-5MHz	6511	EMCO	9704-1154	67	I	8/21/2022	8/21/2020
Meteorological Meters/Chambers		MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	1	11/23/2022	11/23/2020
Asset #2657		1235C97	Control Company	200435369	2657	Ι	7/23/2022	7/23/2020
Cables	Range		Mfr			Cat	Calibration Due	Calibrated on
Asset #2474	9KHz-18GHz		MegaPhase			Ш	11/9/2022	11/9/2021
Asset #2610	9KHz-18GHz		Pasternack			Ш	3/16/2023	3/16/2022
Asset #2682	9KHz-18GHz		Pasternack			П	6/17/2023	6/17/2022

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.





Radiated Spurious Emissions

Test Procedures

- a. The EUT was placed on the top of a rotating table 1.5 meters (above 1GHz) and 0.8 meters (below 1GHz) above the ground at a 3 meters semi-anechoic chamber.
- b. For below 30MHz, a loop antenna with its lowest point 1m above the ground was placed 3m away from the EUT and it was rotated 0 and 90 degrees around its vertical axis.
- c. In 30MHz-1GHz range, a BiConiLog antenna was mounted on a variable-height antenna tower and placed 3m away from the EUT. Antenna height was varied from 1 meter to 4 meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna were investigated. The table was rotated 360 degrees to determine the position of the highest radiation.

Setup below 30MHz













9KHz – 150KHz Parallel















0.15 - 1MHz Parallel







0.15 - 1MHz Perpendicular







1 - 30MHz Parallel







1 - 30MHz Perpendicular





Work Order - W0235 Bureau Veritas Consumer Product Services Inc. Radiated Emissions Electric Field 3m Distance EUT Power Input - 24VDC Test Site - Chamber 2 Top Peaks Vertical 30-1000MHz Conditions - 22.2°C; 30.8%RH; 1004.6mBar Notes: 125KHz No Modulation Test Engineer - Ryan M. Brown 0 Date of Test - 2-2-2023 Adjusted Lim1: Peak Correction Peak FCC_pt15_20 Lim1 Test Antenna Turntable Frequency Reading Amplitude 9 Lim1 Margin Results Worst Margin Lim1 Height Azimuth Factor (dBµV) (dB/m) (dBµV/m) (dB) (Pass/Fail) (degrees) (MHz) (dBµV/m) (dB) (cm) PASS 315 30.194 31.8 1.9 33.8 -6.2 -6.2 100 40 858.986 29.2 4.6 33.8 46 -12.2 PASS 150 0 200 135 892.645 29.4 4.9 34.3 46 -11.7 PASS 916.047 29.2 5.5 34.7 46 -11.3 PASS 200 315 959.066 29 6.1 35.1 46 -10.9 PASS 200 135 993.089 35.3 -18.7 PASS 250 315 28.8 6.5 54





30-1000MHz Vertical





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20 20 10 10 30M Corr Factor = Ant + Cab + Filter + Presel + Atten - Presenp. Adjusted Amplitude = Raw Reading + Corr Factor. Tile Version: 7.4.4.12, Profile Version 15 May, 2019.

30-1000MHz Horizontal





Test Equipment Used (0.009-30MHz)

Rev. 8/17/2022								
Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2093 MXE EMI Receiver	20Hz-26.5GHz	N9038A	Agilent	MY51210181	2093	I	3/7/2023	3/7/2022
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Range	Asset	Cat	Calibration Due	Calibrated on
EMI Chamber 2	719150	2762A-7	A-0015	30-1000MHz	1686	I	12/5/2022	12/5/2020
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
8447F Rental PA	9KHz-1.3GHz	84477F	HP	3113A05395		Ш	10/18/2022	10/18/2021
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Small Loop	10kHz-30MHz	PLA-130/A	ARA	1024	755	I	8/25/2022	8/25/2020
Large Loop	20Hz-5MHz	6511	EMCO	9704-1154	67	I	8/21/2022	8/21/2020
Meteorological Meters/Chambers		MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	11/23/2022	11/23/2020
Asset #2656		1235C97	Control Company	200435359	2656	I.	8/23/2022	7/23/2020
Cables	Range		Mfr			Cat	Calibration Due	Calibrated on
Asset #2474	9KHz-18GHz		MegaPhase			Ш	11/9/2022	11/9/2021
Asset #2610	9KHz-18GHz		Pasternack			Ш	3/16/2023	3/16/2022
Asset #2583	9KHz-18GHz		Pasternack			Ш	2/17/2023	2/17/2022

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

Test Equipment Used (30-1000MHz) Rev. 1/30/2023

Spectrum Analyzers / Receivers /Preselectors Rental MXE EMI Receiver(1168255)	Range 20Hz-8.4GHz	MN N9038A	Mfr Agilent	SN MY53290009	Asset 1168255	Cat I	Calibration Due 8/12/2023	Calibrated on 8/12/2022
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Range	Asset	Cat	Calibration Due	Calibrated on
EMI Chamber 2	719150	2762A-7	A-0015	30-1000MHz	1686	I.	12/28/2024	12/28/2022
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
8447F Rental PA	9KHz-1.3GHz	84477F	HP	3113A05395		П	10/17/2023	10/17/2022
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Red-Brown Bilog	30-2000MHz	JB1	Sunol	A0032406	1218	I	4/28/2023	4/28/2021
Meteorological Meters/Chambers		MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	1	12/15/2025	12/15/2022
Asset 2707		SD700	EXTECH	A.115171	2707	I	1/13/2025	1/13/2023
Cables	Range		Mfr			Cat	Calibration Due	Calibrated on
Asset #2456	9KHz-18GHz		MegaPhase			П	11/1/2023	11/1/2022
Asset #2468	9KHz-18GHz		MegaPhase			П	11/1/2023	11/1/2022
Asset #2682	9KHz-18GHz		Pasternack			П	10/6/2023	10/6/2022





AC Line Conducted Emissions

Test Procedures

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) were not recorded. RBW of 9kHz and VBW of 30kHz were used during measurement.

Setup



Note: 1.Support units were connected to second LISN. 2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes







0.15-30MHz Line







0.15 – 30MHz Neutral





Test Equipment Used

Rev. 8/26/2022								
Spectrum Analyzers / Receivers / Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Rental EXA Signal Analyzer(1118472)	9KHz-26.5GHz	N9010A-526;K	AT	MY51170010	1118472	I.	10/27/2022	10/27/2021
Rental EXA Signal Analyzer(1118473)	9KHz-26.5GHz	N9010A-526;N	AT	MY51170076	1118473	I	8/5/2022	8/5/2021
LISNs/Measurement Probes	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
LISN Asset 2092	9KHz-30MHz	NNLK 8121	Schwarzbeck	NNLK 8121-662	2092	Т	10/25/2022	10/25/2021
Conducted Test Sites (Mains / Telco)	FCC Code		VCCI Code			Cat	Calibration Due	Calibrated on
CEMI 1	719150		A-0015			Ш	NA	NA
CEMI 5	719150		A-0015			111	NA	NA
Meteorological Meters/Chambers		MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Weather Clock (Pressure Only)		BA 928	Oregon Scientific	C3166-1	831	I	11/23/2022	11/23/2020
Asset #2657		1235C97	Control Company	200435369	2657	I	8/18/2025	8/18/2022
Asset #2657		1235C97	Control Company	200435369	2657	Т	8/23/2022	7/23/2020
Cables	Range		Mfr			Cat	Calibration Due	Calibrated on
CEMI-02	9kHz - 2GHz		C-S			Ш	2/17/2023	2/17/2022
CEMI-15	9kHz - 2GHz		C-S			Ш	2/17/2023	2/17/2022
Attenuators	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
20dB ATT(A#2506)	9kHz-2GHz	PE7014-20	Pasternack	2016	2506		8/3/2023	8/3/2022
20dB ATT(A#2506)	9kHz-2GHz	PE7014-20	Pasternack	2016	2506		8/4/2022	8/4/2021

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.





99% Occupied Bandwidth

REQUIREMENT

When an occupied bandwidth is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is its 99% emission bandwidth, as calculated or measured. [RSS-GEN Issue 5 Section 6.7].

RESULT:

The plot below was generated using a peak max hold detector. 99% OBW = 148.35Hz



Date: 22.FEB.2023 10:23:16

Test Equipment Used

Rev. 2/17/2023								
Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
FSV40 Spectrum Analyzer	10Hz-40GHz	FSV40	ROHDE & SCHWARZ	101551	2200	I	10/11/2023	10/11/2022
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2615 Active Loop Antenna	9KHz-30MHz	6502	EMCO	2049	2615	I	1/18/2025	1/18/2023
Cables	Range		Mfr			Cat	Calibration Due	Calibrated on
Asset #2594	9KHz-40GHz		Carlisle			П	1/17/2024	1/17/2023
l equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.								





Measurement Uncertainty

The listed uncertainties are the worst-case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results. Values for measurement uncertainty are calculated per ETSI TR 100 028 (2001).

Measurement	Expanded Uncertainty k=2	Maximum allowable uncertainty
Radio frequency (@ 2.4GHz)	3.23 x 10 ⁻⁸	1 x 10 ⁻⁷
RF power, conducted	0.40dB	0.75dB
Maximum frequency deviation: Within 300Hz and 6kHz of audio frequency / Within 6kHz and 25kHz of audio frequency	3.4% 0.3dB	5% 3dB
Adjacent channel power	1.9dB	3dB
Conducted spurious emission of transmitter, valid up to 12.75GHz	2.39dB	3dB
Conducted emission of receivers	1.3dB	3dB
Radiated emission of transmitter, valid up to 26.5GHz	3.9dB	6dB
Radiated emission of transmitter, valid up to 80GHz	3.3dB	6dB
Radiated emission of receiver, valid up to 26.5GHz	3.9dB	6dB
Radiated emission of receiver, valid up to 80GHz	3.3dB	6dB
Humidity	2.37%	5%
Temperature	0.7°C	1.0°C
Time	4.1%	10%
RF Power Density, Conducted	0.4dB	3dB
DC and low frequency voltages	1.3%	3%
Voltage (AC, <10kHz)	1.3%	2%
Voltage (DC)	0.62%	1%
The above reflects a 95% confidence level		

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.





Document Revision History

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED	ISSUED BY	APPROVED BY
1	Original release	Jan 3, 2023	нх	YF
2	Added Radiated and Conducted Emissions Data Revised 99% OBW Data	Feb 22, 2023	RMB	YF
3	Updates to address TCB comments: Measurement procedures listed on Pg 3 Limit conversion definitions below 30MHz added to Pg 5 RSE procedure and setup details added to Pg 6 PLCE procedure and setup details added to Pg 16	Mar 16, 2023	RMB	YF

END OF REPORT



