Product Specification and User Manual
RFID GEN3 System

ORIGIN

Originator	Guy Gingras	Date	2022-09-14
Last modified	Guy Gingras	Date	2022-10-14

RELEASE HISTORY

Release	Modifications	Date	Changes made by
1	Initial Release – Based on 1001114151-06	2022-09-14	Guy Gingras
2	Modification to FCC / IC statement	2022-10-14	Guy Gingras

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Manufacturer Information

Manufacturer's Name: KONGSBERG Inc.

Manufacturer's Address: 90, 28e rue, PO Box 10034, Shawinigan, QC, G9T 5K7 Canada

Product Name: RFID GEN3 System

Model Name: 1001316154 and 1001316155

Product Name: BRP RF/DESS Post

Model Name: 1001385887

Brand: KONGSBERG AUTOMOTIVE

FCC Compliance Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC SAR Statement

This equipment has been tested and meets applicable limits for radio frequency (RF) exposure. Specific Absorption Rate (SAR) refers to the rate at which the body absorbs RF energy. The SAR limit is 1.6 W/kg when averaged over 1g of tissue. Maintain a distance of 60mm from the body to ensure compliance with RF exposure requirements.

ISED Compliance Statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

(1) This device may not cause interference.

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

(1) l'appareil ne doit pas produire de brouillage;

(2) l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

ISED SAR Statement

This equipment has been tested and meets applicable limits for radio frequency (RF) exposure. Specific Absorption Rate (SAR) refers to the rate at which the body absorbs RF energy. The SAR limit is 1.6 W/kg when averaged over 1g of tissue. Maintain a distance of 60mm from the body to ensure compliance with RF exposure requirements.

Cet équipement a été testé et respecte les limites applicables pour l'exposition aux radiofréquences (RF). Le taux d'absorption spécifique (SAR) fait référence au taux auquel le corps absorbe l'énergie RF. La limite DAS est de 1,6 W/kg. en moyenne sur 1g de tissu. Maintenez une distance de 60 mm par rapport au corps pour garantir la conformité aux exigences d'exposition aux radiofréquences.

IFETEL Statement:

“La operación de este equipo está sujeta a las siguientes dos condiciones: (1) es posible que este equipo o dispositivo no cause interferencia perjudicial y (2) este equipo o dispositivo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.”

Taiwan Statement

The following text “Without permission granted by the NCC, any company, enterprise, or user is not allowed to change frequency, enhance transmitting power or alter original characteristic as well as performance to a approved low power radio-frequency devices. The low power radio-frequency devices shall not influence aircraft security and interfere legal communications; If found, the user shall cease operating immediately until no interference is achieved. The said legal communications means radio communications is operated in compliance with the Telecommunications Management Act.The low power radio-frequency devices must be susceptible with the interference from legal communications or ISM radio wave radiated devices.”

取得審驗證明之低功率射頻器材，非經核准，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。低功率射頻器材之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前述合法通信，指依電信管理法規定作業之無線電通信。低功率射頻器材須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

Applicable Standard and Regulations

- ISO/IEC 15693-1:2000 Identification cards — Contactless integrated circuit(s) cards — Vicinity cards — Part 1: Physical characteristics.
- ISO/IEC 15693-2:2006 Identification cards — Contactless integrated circuit cards — Vicinity cards — Part 2: Air interface and initialization.
- ISO/IEC 15693-3:2009 Identification cards — Contactless integrated circuit cards — Vicinity cards — Part 3: Anticollision and transmission protocol.
- Maxim 1-Wire protocol – DS2401, 195860 rev 5/11, May 2011.
- ISO 11898-1:2015 – Road vehicles – Controller Area Network (CAN) – Part 1: Data link layer and physical signalling
- SSCC/11 Snowmobile Safety and Certification Committee
- ISO 13590 Small craft - Personal watercraft - Construction and system installation requirements
- USCG 33 CFR Title 33, Part 183
- ISO 8846 Small craft -- Electrical devices -- Protection against ignition of surrounding flammable gases
- IN 40050 Protection of electrical equipment against contact, foreign bodies & water.
- EN 55012:2007 Vehicles, boats and internal combustion engines – Radio disturbance characteristics – Limits and methods of measurement for the protection of off-board receivers (CISPR 12:2007)
- EN 55025:2003 Vehicles, boats and internal combustion engines — Radio disturbance characteristics — Limits and methods of measurement for the protection of off-board receivers (CISPR 25:2003).
- EN 61000-6-1:2007 Electromagnetic Compatibility – Generic immunity Standard, Part 1: Residential, Commercial and Light Industry
- IEC 61000-4-2, Edition 2.0, 2008 Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test
- IEC 61000-4-6, Edition 3.2, 2010 Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields

- ISO 7637 (2011) Road vehicles Electrical disturbances from conduction and coupling
- RSS-GEN General Requirements and Information for the Certification of Radio Apparatus
- RSS-210 License-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
- FCC 47 CFR Part 15 Subpart C Federal Communications Commission. Part 15 Radio Frequency Devices. Radiated Emission Limits
- ETSI EN 300 330-2 Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD)
- ETSI EN 60950-1 Information technology equipment - Safety - Part 1: General requirements
- TRD-16-0030 BRP Unified Diagnostic Services (UDS)
- 003-00-01 BRP Engineering Specification. Exposure to solvents
- 003-00-02 BRP Engineering Specification Exposure to salt water
- 003-00-03 BRP Engineering Specification Exposure to ozone
- 003-00-04 BRP Engineering Specification Exposure to solar radiation
- 003-00-05A BRP Engineering Specification Plastic materials' exposure to the environment
- 090-01-01a BRP Engineering Specification Decals

References

- Technical requirement document "TRD-12-0016 Ski-Doo DESS key Rev 2.pdf"
- Technical requirement document “TRD-18-0019 RF-CAN DESS post MY21 V02.pdf"
- 000001 FO-QA-029 KA SKIDOO 600 ETEC Capacitor Grounding Return Problems
- 000002 FO-QA-029 KA RFID DESS Grounding Problems
- 000003 FO-QA-029 KA SKIDOO TUNDRA 600 ETEC Harness Problems
- 000004 FO-QA-029 KA SKIDOO TUNDRA 600 ETEC Radiation Problems
- Test Plan and Results “111550 - DVP&R PV1.xslx” (1001390470)

Terminology

Terms and abbreviations	Description
MOWP	Megatech One Wire Protocol
CAN	Controller Area Network
ECU	Electronic Control Unit
Tag	ISO15693 compliant transponder
Antenna	Guide for wave transmission
PCB	Printed Circuit Board
Hz	Hertz
Hall effect sensor	Sensor affected by magnetic change.
UID	Unique IDentifier

Table 1: Terminology

1 General information

This document contains the functional and electrical specifications for the RFID DESS System GEN3. The product is available in two variants of communication interface: a CAN or a MOWP. The MOWP based device replaces previous generation of the RFID Post.

Mechanical details are found on the product drawings listed in Table 2.

Software and communication details are found in the software specification (1001392597).

Drawing numbers, Kongsberg and customer part numbers are listed in the table below.

Part Description	Generic Drawing Number	Kongsberg Part Number	Customer Part Number
RFID Post CAN	1001317030	1001316154	710008832
RFID Post MOWP		1001316155	515179305
RFID Key	1000634541, 1001365040	Multiple variant	Multiple variant
RFID Key Swift	1000969331, 1001365039	Multiple variant	Multiple variant

Table 2: RFID GEN3 System Part Numbers

Functional and communication specifications are valid for the softwares listed below.

Software	Software Part Number
Bootloader	1001355747_01_00
Application	1001355750_01_00
Calibration	1001377768_01_00

Table 3: RFID GEN3 System Software

2 RFID GEN3 System Overview

The RFID System is composed of 2 parts, the RFID Key and the RFID Post. Details about these are provided in section 0and 0 respectively.

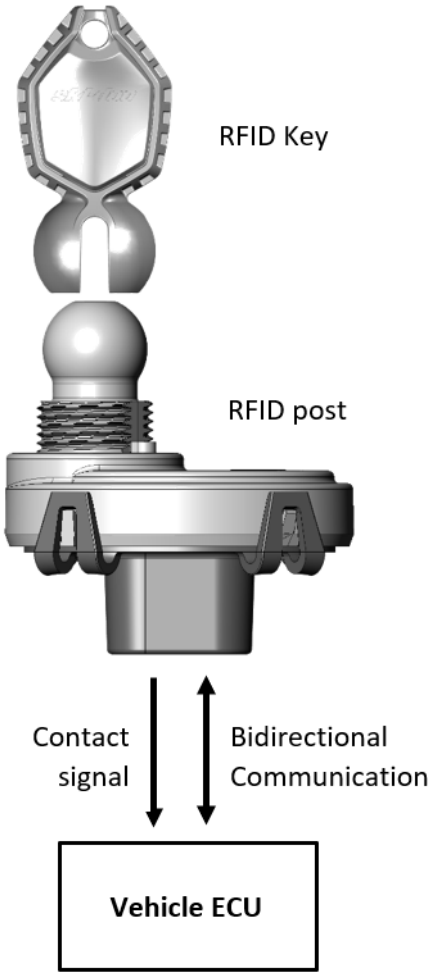

Figure 1: RFID Key and Post System

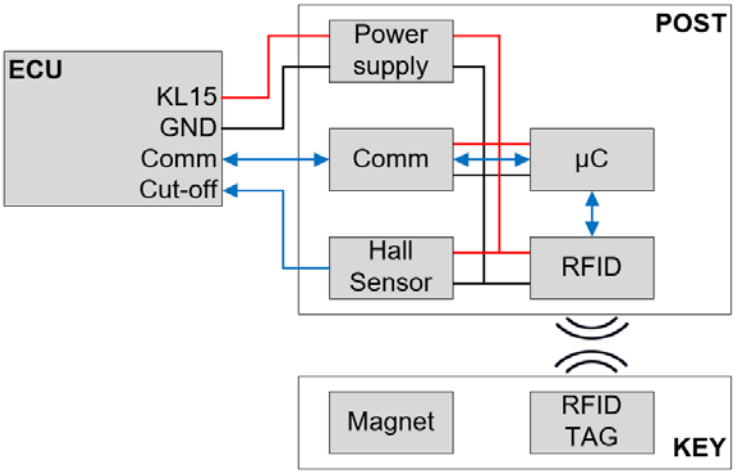

Figure 2: RFID DESS System Block Diagram

The vehicle ECU powers the RFID Post from the positive switched battery connection (KL15). Once powered, the RFID Post senses the RFID Key's magnet using its internal hall sensor. The hall sensor's output is pulled low if a magnetic field is sensed, allowing the vehicle engine to start. At the same time, the RFID Post's microcontroller (µC) activates the RFID initiator/reader, powering the RFID Key's tag, allowing it to send it's UID. A message is then transmitted to the ECU through a bidirectional communication link. Refer to section 3.4 for additional details about RFID tag reading sequence.

2.1 RFID Key

As illustrated in Figure 3, the RFID Key is composed of a plastic housing, 2 trim caps (not shown), a magnet, a RFID tag and a spacer. The last 3 elements are contained in an intermediate shell (not shown), needed to seal them from the external environment.

The tag is ISO15693 compliant.

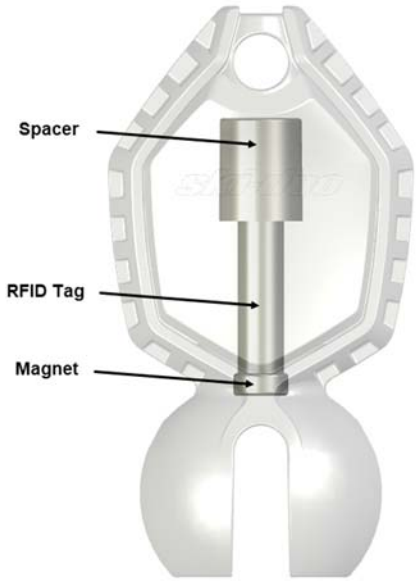

Figure 3: RFID DESS Key Composition

2.2 RFID DESS Post

As illustrated in Figure 4 and Figure 5, the Post is composed of a plastic cover, an O-ring, a main PCB, a header, a secondary PCB and a plastic housing.

The plastic cover, plastic housing and O-ring protect the internals from the external environment.

The cover provides a mechanical mating interface for a connector. The CAN variant has a 5-pin connector, the MOWP variant has a 4-pin connector. Those overmolded pins are providing the electrical path between the main PCB and the vehicle's harness connected to the ECU.

The secondary PCB is mounted to the main PCB using a 3-pin header. The secondary PCB holds the hall sensor. The main PCB holds the remaining electronics needed for operation: power supply, microcontroller, communication transceiver, contact output circuitry, RFID initiator/reader and antenna.

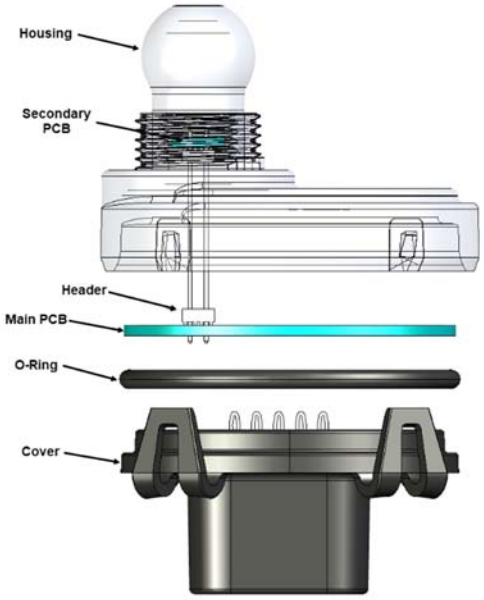

Figure 4: RFID GEN3 Post - CAN

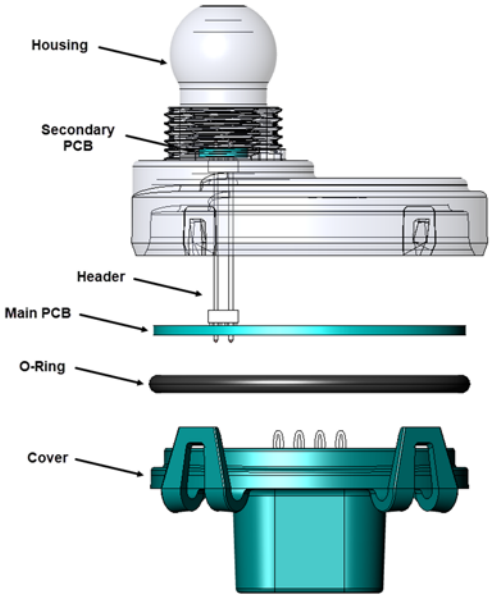

Figure 5: RFID GEN3 Post - MOWP

3 RFID GEN3 Functional Specification

3.1 Bidirectional Communication

3.1.1 CAN variant

The RFID Post is designed to exchange information via CAN protocol with the ECU. Refer to software specification.

3.1.2 MOWP variant

The RFID Post is designed to exchange information via Maxim 1-Wire protocol with the ECU. It is also possible to communicate with the module using a MPI2.5 CAN-to-MOWP converter for diagnostics purposes.

3.2 Cut-off System

The RFID DESS Post's contact output serves as a Fail-Safe Cut-off system, based on a non-contact magnetic switch, that sends a stop signal to the vehicle engine in case of a key disconnection (i.e: driver fell-off of vehicle).

3.2.1 Cut-off System override

The CAN variant offer the possibility to override the Cut-off system (i.e. activate the Contact output) through a CAN command. Refer to the software specification for details.

Figure 6 show a representation of the circuit, where HALL_SIGNAL is the control signal from the hall sensor that is activated when a key is attached to the base station, and where the µc_HALL_OVERRIDE is the control signal from the microcontroller. The CONTACT_OUT is directly connected to the output pin B (CONTACT). Q3 is not populated in the MOWP variant.

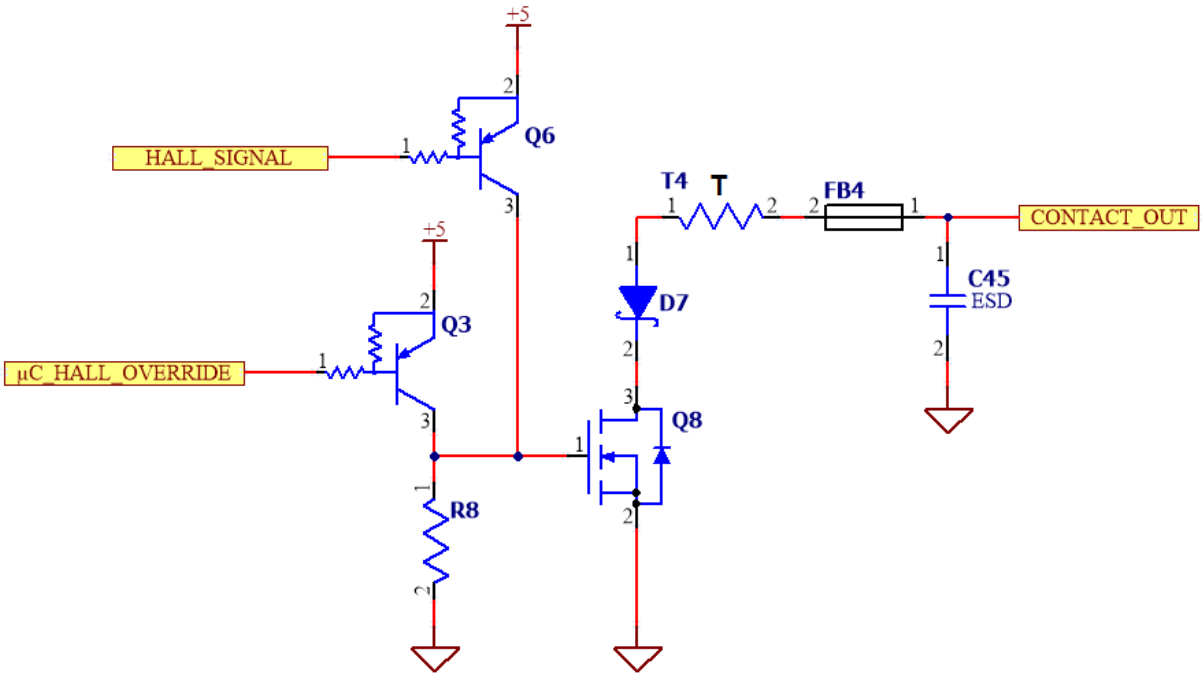

Figure 6: Cut-off System

3.3 Operating and Storage Temperature

The RFID DESS System has an operating and storage temperature range of -40°C to +85°C.

3.4 RFID Tag Reading Sequence

Figure 7 shows the sequence performed by the RFID Post's microcontroller to acquire the UID from power up. This sequence takes less than 500ms to be completed. The communication between the tag and the RFID is compliant with the wireless protocol ISO15693.

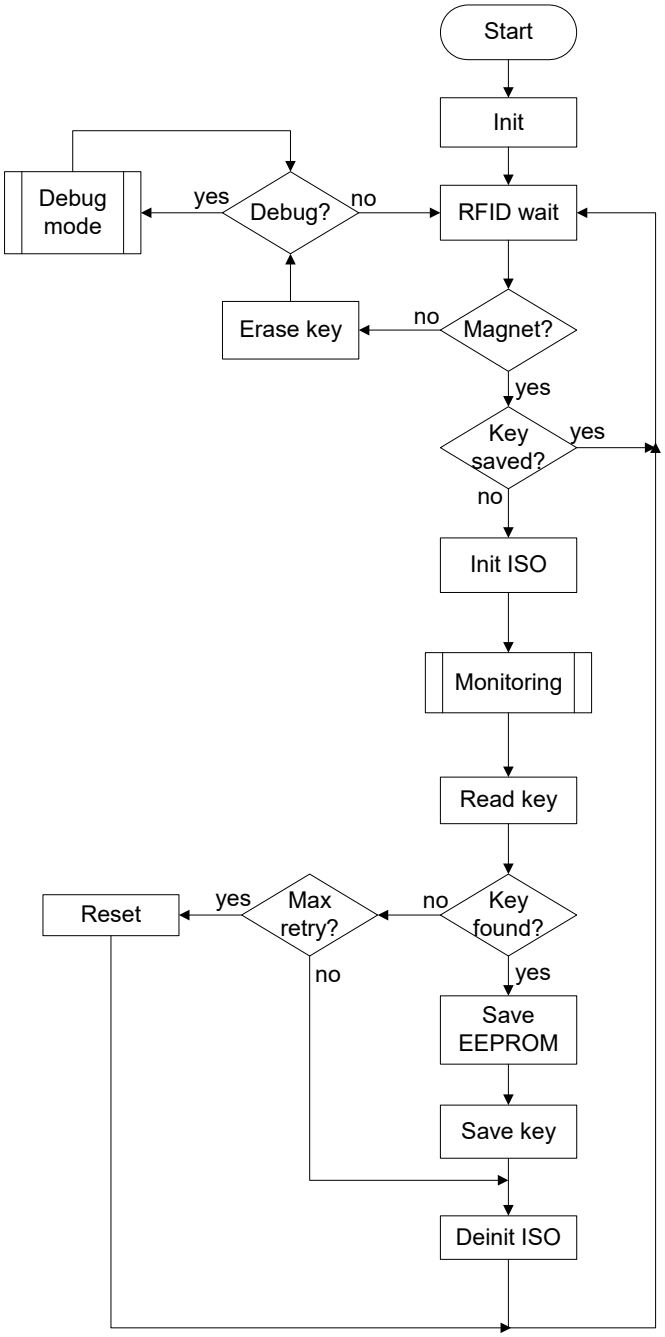

Figure 7: UID Reading Sequence.

4 RFID GEN3 Electrical Specification

4.1 Connector

The electrical connection between the RFID Post shall use the sealed connector Delphi GT 150 series. Refer to product drawing for more details.

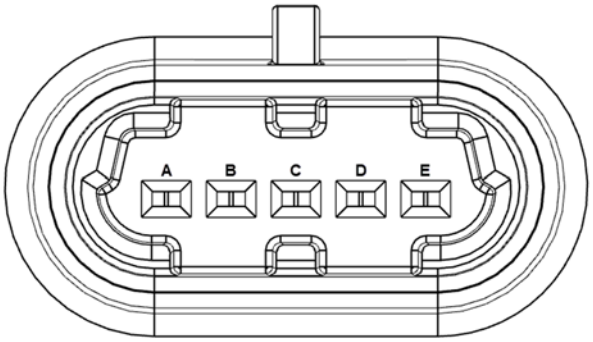

Figure 8: CAN Variant Connector

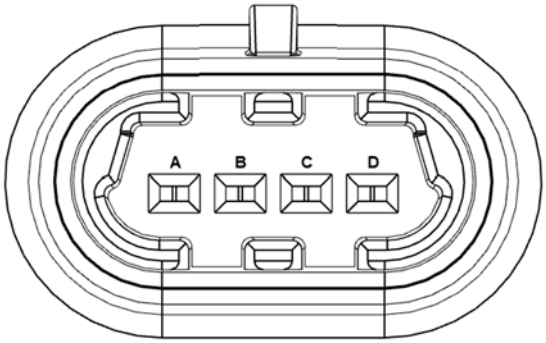

Figure 9: MOWP Variant Connector

The following table outlines the RFID Post's pinout.

Pin	CAN Variant – Pin Name	MOWP Variant – Pin Name	Type
A	GND	GND	Power
B	CONTACT	CONTACT	Signal
C	CAN Lo	1-WIRE/MOWP	Communication
D	VBATT	VBATT	Power
E	CAN H	-	Communication

Table 4: RFID GEN3 Post Pinout

4.1.1 Pin A: GND

This pin is used as the RFID Post power return, to be connected to the vehicle's main ground.

Characteristic	Unit	Minimum	Nominal	Maximum
Voltage, absolute maximum rating (steady state)	V	-18	---	18

Table 5: GND Characteristics.

4.1.2 Pin B: CONTACT

This pin is used as an engine cut-off signal, pulled low to activate engine.

Characteristic	Unit	Minimum	Nominal	Maximum
Voltage, absolute maximum rating (steady state)	V	-18	---	18
Voltage, operating	V	6	12	18
Low level when triggered	V	0	---	0.4

Table 6: CONTACT Characteristics.

4.1.3 Pin C: CAN LO

This pin is used for communication with an ECU or a diagnostic tool.

Characteristic	Unit	Minimum	Nominal	Maximum
Voltage, absolute maximum rating (steady state)	V	-18	---	18
Voltage, operating	V		5	
Dominant state	V	0.5	---	2.25
Recessive state	V	2	2.5	3

Table 7: CAN LO Characteristics.

4.1.4 Pin C: 1-WIRE / MOWP

This pin is used for communication with an ECU or a diagnostic tool.

Characteristic	Unit	Minimum	Nominal	Maximum
Voltage, absolute maximum rating (steady state)	V	-18	---	18
Voltage, operating	V		5	
Logic level	V	Low: 1.45	---	High: 3.25

Table 8: 1-WIRE / MOWP Characteristics.

4.1.5 Pin D: VBATT

This pin is used to supply power to the RFID Post, to be connected to the vehicle's positive switched battery connection (KL15).

Characteristic	Unit	Minimum	Nominal	Maximum
Voltage, absolute maximum rating (steady state)	V	-18	---	18
Voltage, operating	V	6*	---	18
DC current	mA	20	27, 160	200

Table 9: VBATT Characteristics.

**The Key reading have been demonstrated at an operating voltage of 6V at room temperature. The Key reading performance is not guaranteed during starting voltage pulse or similar events due to possible interference with the RF communication.*

4.1.6 Pin E: CAN HI

This pin is used for communication with an ECU or a diagnostic tool.

Characteristic	Unit	Minimum	Nominal	Maximum
Voltage, absolute maximum rating (steady state)	V	-18	---	18
Voltage, operating	V		5	
Dominant state	V	2.75	---	4.5
Recessive state	V	2	2.5	3

Table 10: CAN HI Characteristics.

5 RF Specifications

The RFID Post has the following RF performance over temperature.

Characteristic	Unit	Minimum	Nominal	Maximum
RF Output Power	W	0	---	0.4
Operating Frequency	MHz	13.55	13.56	13.57
Frequency Stability	ppm	-90	-	+90

Table 11: RF Characteristics

The antenna is built-in the PCB and cannot be replaced without modifying the PCB. No external antenna can be connected to this device. RF circuit is matched for internal antenna only.

6 Antenna specification

Antenna type: non-detachable antenna to intentional radiator

Antenna gain: 29.54dBi

Technology: RFID (RFID key and RFID post)

Modulation: AM

Channel spacing: N/A

7 Localization and Installation on Vehicle

The RFID GEN3 System shall be installed as the previous DESS System generation. The RFID Post should be secured to the vehicle's body using the Post retaining ring 278 002 963. The Post's sphere and thread must protrude out of the vehicle's body and be accessible by the operator, while the Post's main body shall be inside the vehicle's body.

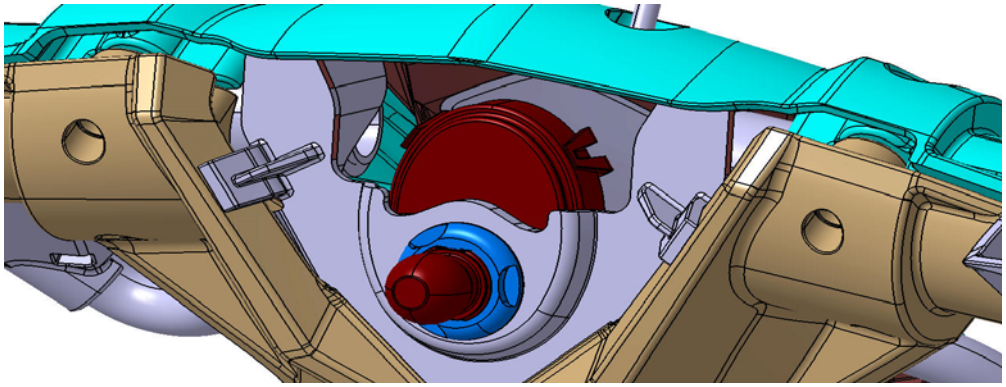

Figure 10: Example of Vehicle Installation

7.1 Metallic Materials.

The RFID Post shall be located away from any metallic material of the body works; 5 cm of clearance in any direction shall be observed. In cases this cannot be respected, the intended mounting position shall be validated by a performance measurement using the diagnostic tool described in section 8.

7.2 Noise Sources Identifications

The RFID Post shall be located away from vehicle radiated sources. A minimum of 15 cm in any direction between a radiated noise source and the RFID GEN3 System is recommended. This intended position shall be validated in any new vehicle or configuration change, using the diagnostic tool described in section 8.

The following documents shall be used as references for RFID GEN3 Post vehicle localisation and Noise interference reduction guidelines.

000001 FO-QA-029-KA Skidoo 600 ETEC Capacitor Grounding Return Problems
000002 FO-QA-029-KA RFID DESS Grounding Problems
000003 FO-QA-029-KA SKIDOO TUNDRA 600 ETEC Harness Problems
000004 FO-QA-029-KA SKIDOO TUNDRA 600 ETEC Radiation Problems

8 Diagnostic Tool

KA has designed a tool to analyze performance using the RFID Post. This tool allows the monitoring of performance of the RF transmission between the RFID Key and Post in real time. This tool can be used to diagnose conducted noise, radiated noise or transmission perturbations due to proximity of metallic materials. This tool shall be used to validate intended mounting position of the RFID GEN3 System on any new vehicle or change in the configuration of an existing one.

8.1 CAN Variant

All the tool listed above are build-in the CAN variant software and readings are available through the diagnostic tool (CADET or BUDS). No special device/equipment is needed. The base station is connected to diagnostic tool using a standard CAN to USB interface.

8.2 MOWP Variant

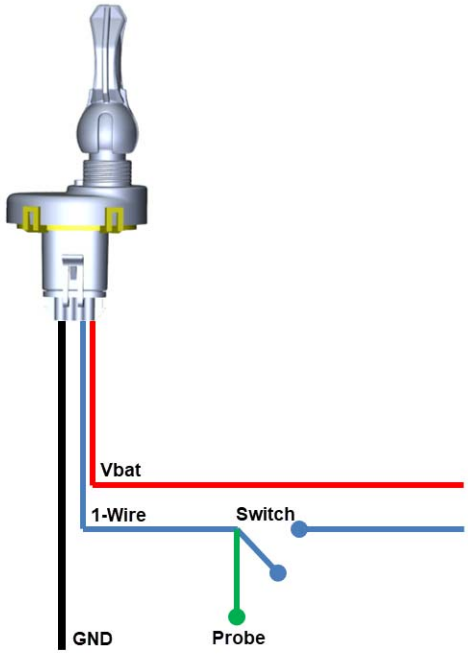

Figure 11: RFID Diagnostic Tool

The diagnostic tool reads the RFID tag every 30 ms. In case of reading error, the probe wire will be pulled low during a period of 30 ms. The probe wire can be monitored using an oscilloscope having a minimum bandwidth of 100 MHz.

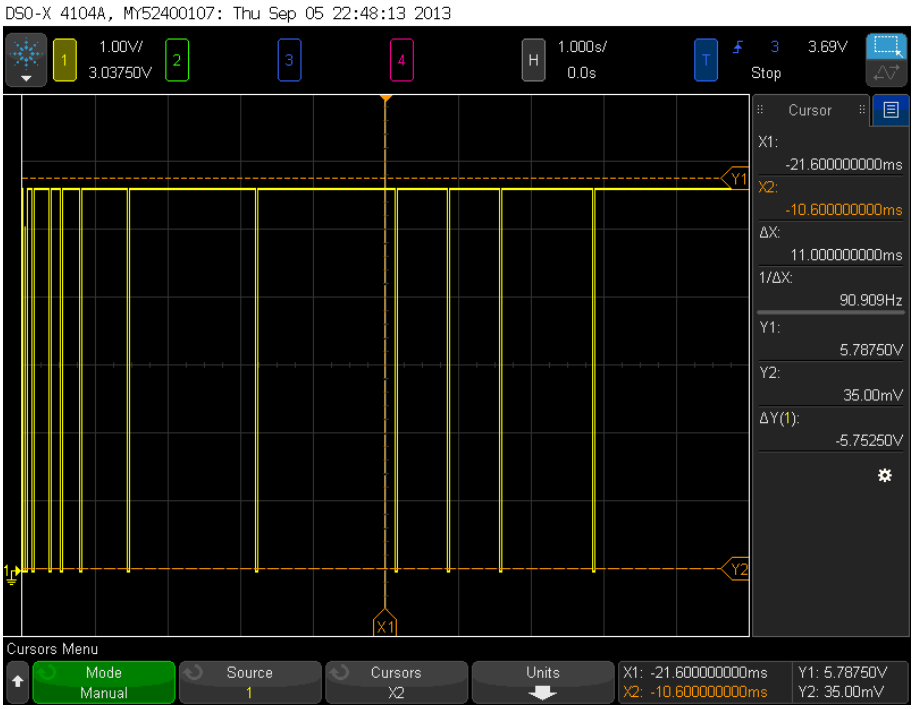

Figure 12: Example of probe wire output

At power up, the RFID diagnostic tool will send the RFID tag's UID over the 1-wire interface. This last approximately five (5) seconds. During this period, the switch allows a temporary connection of the 1-Wire output to the vehicle's ECU for it to authenticate the RFID Key. This allows testing while the vehicle is normal operation.

Note: This unit should be used only for diagnostic or troubleshooting purposes, it is not intended to be used to perform regular driving or test driving as several safety features are disabled. KA will not be held responsible for any problem resulting in using the diagnostic tool against KA's recommendation.

8.2.1 Radiated Noise Validation

The main purpose of this validation is to determine whether the RFID GEN3 System is in the presence of a radiated noise source that could potentially affect the transmission of the RF transmission between the RFID Key and Post. The vehicle under test shall be started in regular operation. The RF Diagnostic tool should be connected as shown in the Figure 13.

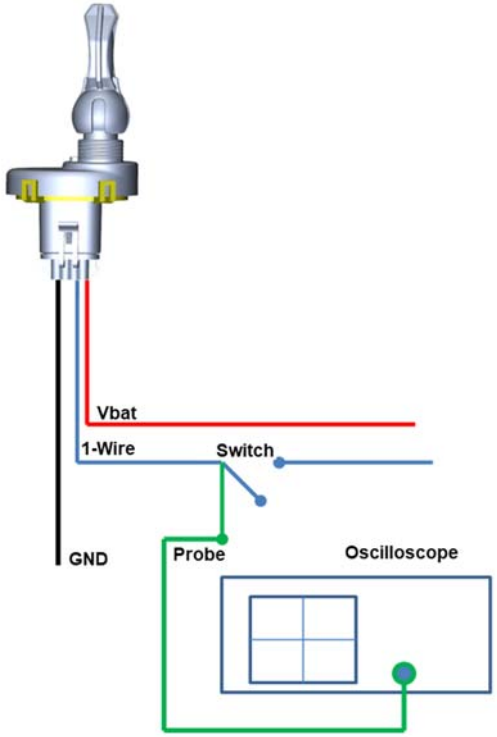

Figure 13: Configuration for Radiated Noise Validation.

Once the system is powered-up and the vehicle is started, the diagnostic tool can be used to monitor whether noise sources could be affecting the performance of the RFID GEN3 System. The document *000004 FO-QA-029-KA SKIDOO TUNDRA 600 ETEC Radiation Problems*, can be used as guidance for measurement or noise source identification.

8.2.2 Metallic Presence Validation

The main purpose of this validation is to determine whether the RFID GEN3 System is in the presence of a metallic material that could affect the RF transmission between the RFID Key and Post. The vehicle engine and other electrical devices must be completely off. The RF Diagnostic tool should be connected as shown in the Figure 13.

Once the system is powered-up, the diagnostic tool can be used to monitor whether metallic materials are affecting the performance of the RFID signal. The procedure described in the document *000004 FO-QA-029-KA SKIDOO TUNDRA 600 ETEC Radiation Problem*, can be used as guidance for measurement and metallic materials identification.

8.2.3 Conducted Noise Validation

The main purpose of this validation is to determine whether the RFID GEN3 System is in the presence of a conducted noise source that could potentially affect the RF transmission between the RFID Key and Post. The vehicle under test shall be started with the diagnostic tool. The RF Diagnostic tool should be connected as shown in the Figure 14.

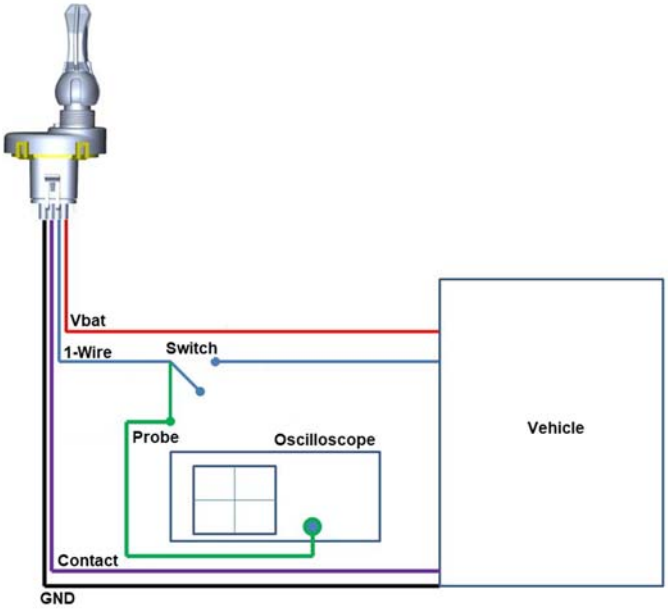

Figure 14: Configuration for Noise Validation Performance

Once the system is powered-up and the vehicle is started, the diagnostic tool can be used to monitor whether conducted noise could be affecting the performance of the RFID signal. The following documents can be used as a guidance for measurement or source identification:

000001 FO-QA-029-KA Skidoo 600 ETEC Capacitor Grounding Return Problems
000002 FO-QA-029-KA RFID DESS Grounding Problems
000003 FO-QA-029-KA SKIDOO TUNDRA 600 ETEC Harness Problems

It is recommended to use an isolation transformer to power the Oscilloscope to avoid ground noise signals that could affect the measurement.

8.3 Performance Criteria

It is recommended that no errors should be observed during the period of 1 minute (59400 transmissions) to validate that no perturbations could affect the RF performance of any RFID GEN3 System.

9 Validation plan

The product meets the requirements laid out in the Technical Requirement Document as detailed in the test plan 111550 - DVP&R PV1.xslx.

10 International RF certification

Product 1001316154 and 1001316155 have been certified in the following countries or regions:

Canada, USA, Europe, UK, Mexico City, Cayman Islands, Costa Rica, Peru, Brazil, Chile, Uruguay, Israel, South Africa, Russia, China, Hong Kong, Taiwan, Japan, Sri Lanka, Australia, New Zealand, Bahamas, Haiti, Curacao, Panama, Colombia, Ecuador, Paraguay, Argentina, Mongolia, Thailand, Philippines, Singapore, Indonesia, South Korea.

Certification details can be obtained from BRP website using the QR code on the product label.