



CSL CS469-2 EPC Class 1 Gen 2 RFID Fixed Reader

User's Manual

Version 0.0

CSL: The One-Stop-Shop for RFID Solutions

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2 FCC Statement

FCC NOTICE: To comply with FCC part 15 rules in the United States, the system must be professionally installed to ensure compliance with the Part 15 certification. It is the responsibility of the operator and professional installer to ensure that only certified systems are deployed in the United States. The use of the system in any other combination is expressly forbidden.

3 Introduction

3.1 Product Package

3.1.1 Basic Package Content

The reader package contains:

- Fixed reader
- 4 port switch
- RF cables (two cables to support two installation topologies)
- USB cable
- GPIO cable
- 12V switching power supply
- Extended mounting stud and nuts
- Plastic caps for connectors and cables

3.1.2 Product Specifications



Fig 1-1 CS469-2 Reader

Features:

- ISO 18000-6C and EPCglobal Class 1 Gen 2 UHF RFID protocol compliant including dense reader mode
- Ultra long read range – peak at 9 meters for UPM Dogbone RFID tag
- Ultra high read rate – peak at 300 tags per second
- Sophisticated data handling for efficient management of large streams of tag data.
- Highly configurable buffering and tag filtering modes to eliminate the redundant tag data so as to reduce LAN traffic and server loading
- 400 kbps tag-to-reader data rate profile
- Robust performance in dense-reader environments
- Excellent in transmit and receive mode – generates a different combination of unique reader-to-tag command rate, tag-to-reader backscatter rate, modulation format, and backscatter type
- Configurable parameters offer maximum throughput and optimal performance
- Supports all Gen 2 commands, including write, lock and kill

Specifications:

Physical Characteristics:	Length: 27 cm; Width: 16 cm; Height: 2.4 cm; Weight: 700g
Environment:	Operating Temp: -20 ⁰ C to 50 ⁰ C Storage Temp: -40 ⁰ C to 85 ⁰ C Humidity: 5% to 95% non-condensing
Power:	12 Volt supplied via an AC/DC adaptor or IEEE 802.3af compliant Power Over Ethernet enabled power source
RFID Frequency Ranges:	902-928 MHz band
Interfaces	LAN TCP/IP (Configurable to use fixed IP address or DHCP)
Maximum Tag Read Rate:	300 tag/sec.
Maximum Speed of Tag:	660 ft/min
Accessories:	<ul style="list-style-type: none">• USB cable• GPIO cable• 12V switching power supply• Plastic caps for connectors and cables
Order Code:	CS469-2
Restrictions on Use:	Approvals, features and parameters may vary depending on country legislation and may change without notice

4 Installation

4.1 Devices

The CSL CS469-2 fixed RFID Reader is an EPCglobal Class 1 Gen 2 reader product.



Figure 4-1 CS469-2 Reader Top View

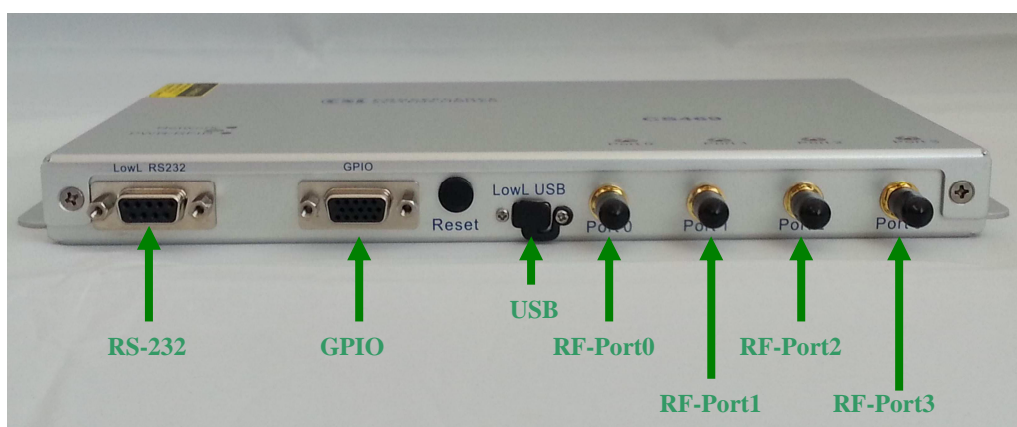


Figure 4-2 CS469-2 Reader Front View

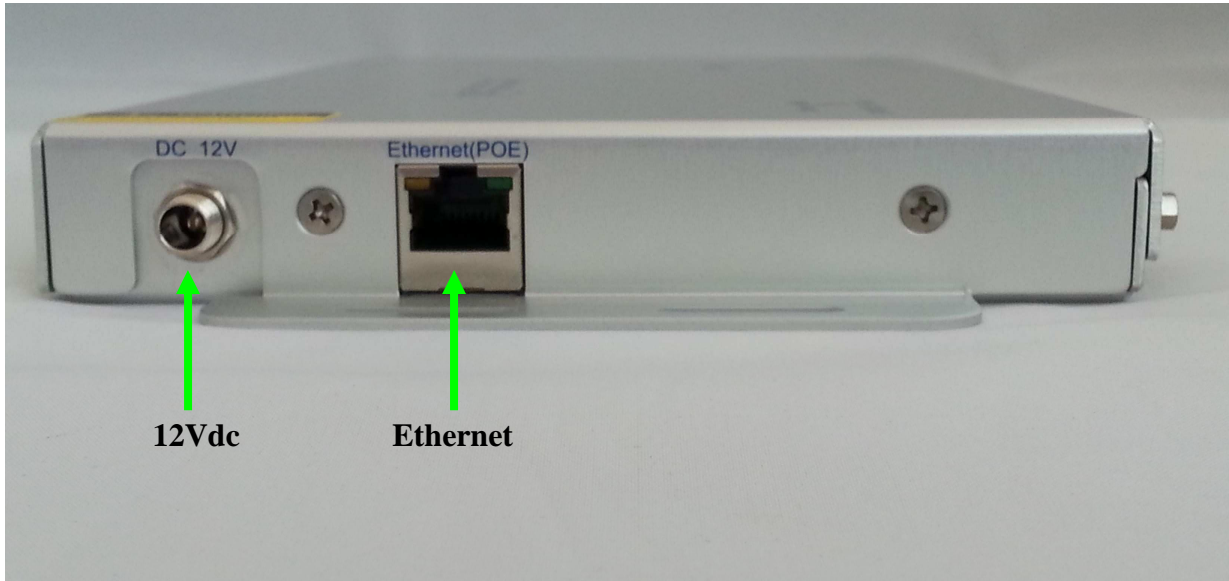


Figure 4-3 CS469-2 Reader Side View

4.2 Operating Setup

4.2.1 CS469-2 operates in POE mode.

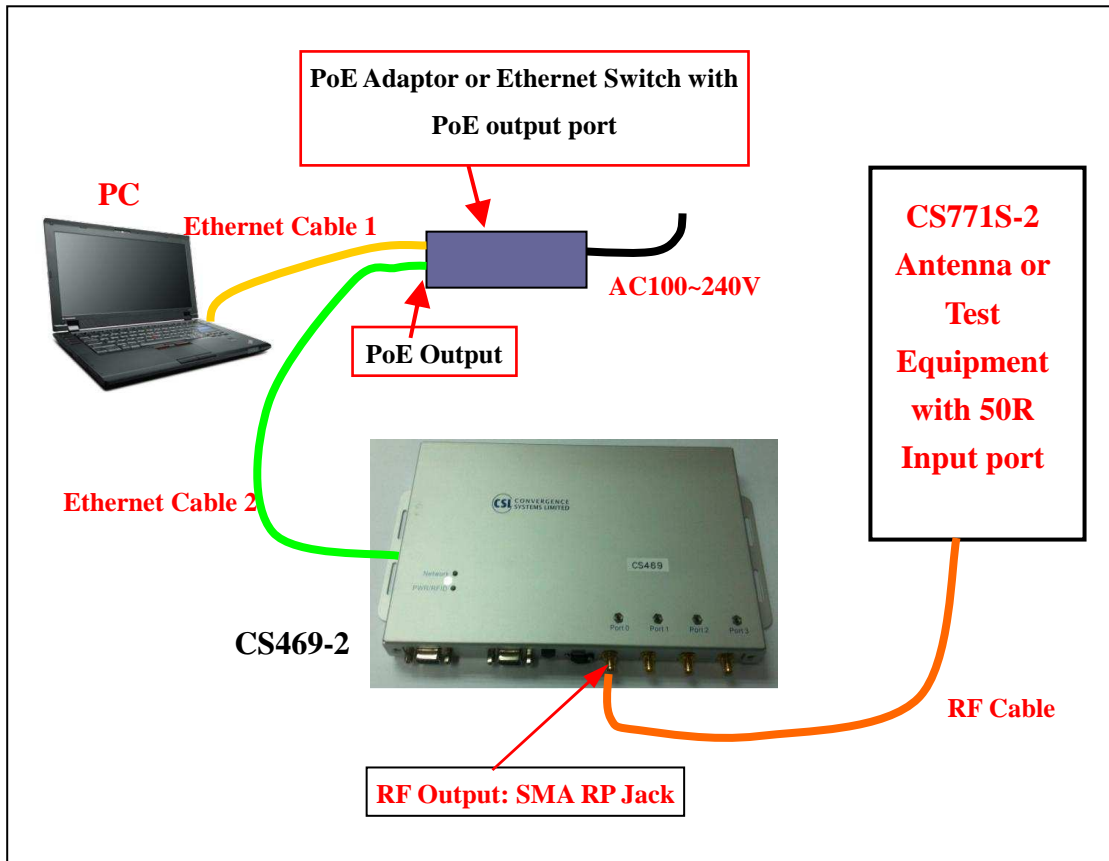


Figure 4-4 POE mode Setup

The reader is connected to POE enabled power source's output port via the cable provided in the package.

4.2.2 CS469-2 operates in 12V adaptor mode

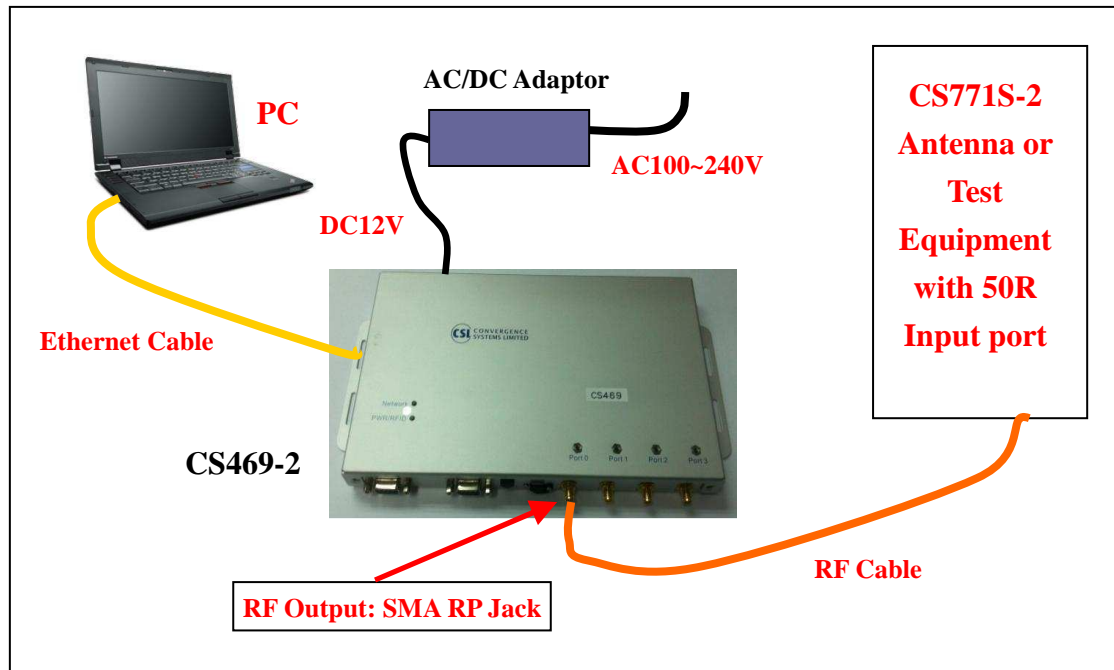


Figure 4-5 12V power adaptor mode Setup

The reader is directly connected to a host computer via the cable provided in the package.

5 Regulatory Information

5.1 Federal Communications Commission

Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter. This product must be installed by a professional technician/installer.

5.2 Maximum Permissible Exposure (MPE)

5.2.1 Introduction

This section has been prepared on behalf of CSL FHSS RFID Device to show compliance with the RF exposure requirements as defined in FCC §1.1307.

5.2.2 Requirements

Three different categories of transmitters are defined by the FCC in OET Bulletin 65. These categories are fixed installation, mobile, and portable and are defined as follows:

- **Fixed Installations:** fixed location means that the device, including its antenna, is physically secured at a permanent location and is not able to be easily moved to another location. Additionally, distance to humans from the antenna is maintained to at least 2 meters.
- **Mobile Devices:** a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to be generally used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structures and the body of the user or nearby persons. Transmitters designed to be used by consumers or workers that can be easily re-located, such as a wireless modem operating in a laptop computer, are considered mobile devices if they meet the 20 centimeter separation requirement. The FCC rules for evaluating mobile devices for RF compliance are found in 47 CFR §2.1091.
- **Portable Devices:** a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user. Portable device requirements are found in Section 2.1093 of the FCC's Rules (47 CFR§2.1093).

This CSL RFID device with 5dBiC antenna (CS771S-2) is considered a fixed installation as it is used for the purpose of reading tags.

The FCC also categorizes the use of the device as based upon the user's awareness and ability to exercise control over his or her exposure. The two categories defined are Occupational/Controlled Exposure and General Population/Uncontrolled Exposure. These two categories are defined as follows:

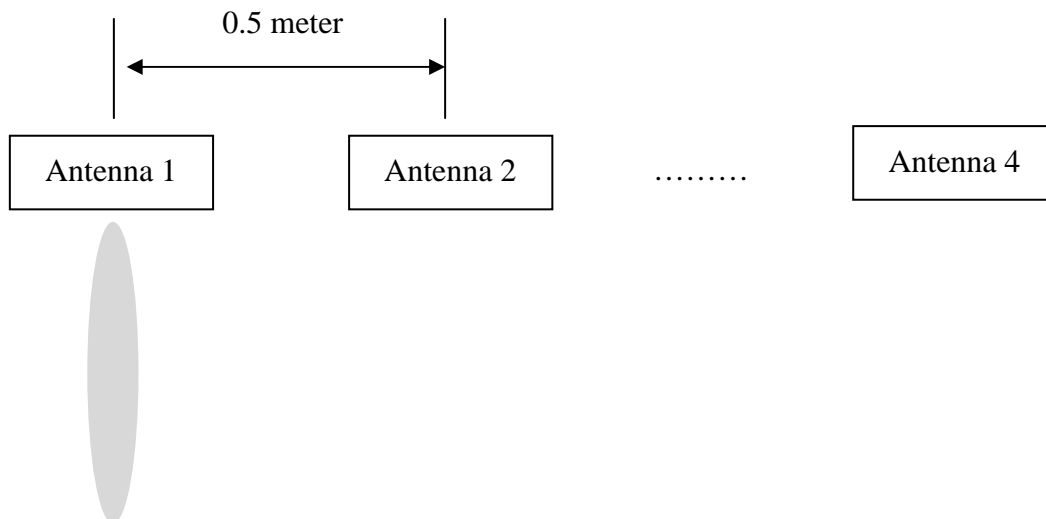
- Occupational/Controlled Exposure: In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means. Awareness of the potential for RF exposure in a workplace or similar environment can be provided through specific training as part of a RF safety program. If appropriate, warning signs and labels can also be used to establish such awareness by providing prominent information on the risk of potential exposure and instructions on methods to minimize such exposure risks.
- General Population/Uncontrolled Exposure: The general population / uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category, and the general population/uncontrolled exposure limits apply to these devices.

CS469-2 is a 4 port reader where the ports are switched on in time one by one. At any time only 1 port is switched on and the RF power comes out only at that port. The rest of the ports are turned off so that no energy comes out from the other ports.

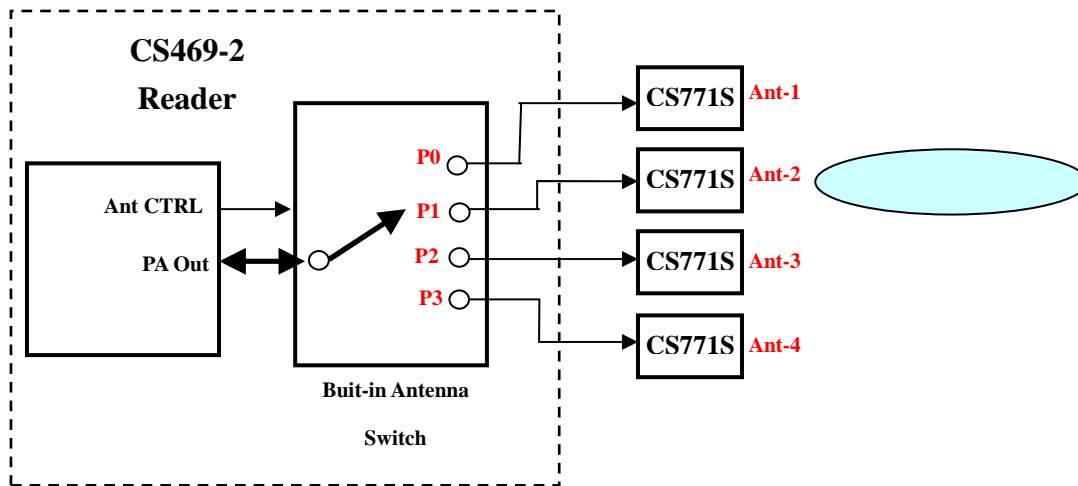
The control logic of the antenna is shown as below table

Time Slot	Antenna Port Status			
	P0	P1	P2	P3
1	On	Off	Off	Off
2	Off	On	Off	Off
3	Off	Off	On	Off
4	Off	Off	Off	On

The Antenna should be set up 0.5 meter apart is shown as below:



Energy coming out of 1 antenna (note that CS469-2 is switched on in time one by one so that at any 1 moment in time ONLY 1 antenna is turned on)



The CS469-2 switch is at time slot-2 at this moment. The port-1 is turned on. So only Ant-2 is active for transmitting the power at this moment.

The distance between each antenna should be 50cm or more

Appendix A. RFID Basics

Passive tag RFID technology involves the reader, the antenna and the tag.

The reader sends out energy in the relevant frequency band to the antenna via RF cables, and the antenna radiates the energy out. This energy impinges on an RFID tag.

The RFID tag consists of an antenna coupled to an RFID IC. This IC converts the AC voltage it receives at the antenna port to DC voltage that in turn is used to empower the digital circuit inside.

The digital circuit then turns on and off some components connected to the antenna port, thereby changing its scattering behavior, in a pre-designed clock rate.

This changing of antenna port parameters then causes a “modulation” of the back-scattered RF energy.

This modulated back-scattered energy is detected by the reader and the modulation is captured and analyzed.

Appendix B. Operation Profiles

Region 2: FCC

Profile	0	1	2	3	4	5
R-T Modulation	DSB-ASK	DSB-ASK	PR-ASK	PR-ASK	DSB-ASK	PR-ASK
Tari (μ s)	25.00	12.50	25.00	25.00	6.25	25.00
R-T speed (kbps)	40	80	40	40	160	40
PIE	2:1	2:1	1.5:1	1.5:1	1.5:1	1.5:1
Pulse Width (μ S)	12.50	6.25	12.50	12.50	3.13	12.50
T-R LF (kbps)	40	160	250	300	400	250
T-R Modulation	FM0	Miller-2	Miller-4	Miller-4	FM0	Miller-2
Divide Ratio	8	8	64/3	64/3	8	64/3
T-R Data Rate (kbps)	40	80	62.5	75	400	125

Appendix C. RF channels

Region 2: FCC

Channel number	Frequency (MHz)	Channel number	Frequency (MHz)	Channel number	Frequency (MHz)
1	902.75	18	911.25	35	919.75
2	903.25	19	911.75	36	920.25
3	903.75	20	912.25	37	920.75
4	904.25	21	912.75	38	921.25
5	904.75	22	913.25	39	921.75
6	905.25	23	913.75	40	922.25
7	905.75	24	914.25	41	922.75
8	906.25	25	914.75	42	923.25
9	906.75	26	915.25	43	923.75
10	907.25	27	915.75	44	924.25
11	907.75	28	916.25	45	924.75
12	908.25	29	916.75	46	925.25
13	908.75	30	917.25	47	925.75
14	909.25	31	917.75	48	926.25
15	909.75	32	918.25	49	926.75
16	910.25	33	918.75	50	927.25
17	910.75	34	919.25		