

CS108 RFID Sled Handheld Reader User Manual



CSL: The One-Stop-Shop for RFID Solutions

1 Contents

1	C	ONTENTS	.2
2	R	EGULATORY REGIONS	.5
	2.1	FCC STATEMENT AND IC STATEMENT	5
	2.2	EUROPEAN CE	7
	2.3	Hong Kong OFCA	7
	2.4	Australia AS	7
	2.5	New Zealand NZ	7
3	11	NTRODUCTION	.8
	3.1	CS108 RFID SLED HANDHELD READER	.8
	3.2	Product Packaging	11
	3.2.3	Package Contents	11
	3.3	PRODUCT SPECIFICATIONS	12
	3.4	Product Accessories	14
4	G	ETTING STARTED	15
	4.1		15
	4.2	UNPACKING	15
	4.3	Features	16
	4.4	SETTING UP CS108	21
	4.5	INSTALLING THE BATTERY	22
	4.6	REMOVING THE BATTERY	24
	4.7	Power Up the Reader	24
	4.8	BLUETOOTH PAIRING WITH MOBILE DEVICES	25
	4.9	CHARGING THE CS108	25
	4.9.1	DIRECT CHARGING CS108	25
	4.9.2	CHARGING CS108B BATTERY USING AN EXTERNAL CHARGER CS108C	26
	4.10	DOWNLOADING APPLICATION SOFTWARE	27
	4.11	DOWNLOADING APPLICATION SOFTWARE SOURCE CODES	31
	4.12	TRIGGER BUTTON VS TOUCH SCREEN USAGE	32
5	11	NTRODUCTION	33
	5.1	SOFTWARE APPLICATIONS	33
	5.1.1	DEMO JAVA SOFTWARE FOR ANDROID	34
	5.1.1.1	Installing the Demo Android Java Software	34

5.1.1.1.1	INSTALLING FROM GOOGLE PLAY	34
5.1.1.1.2	DOWNLOAD APK FROM CSL WEBSITE	35
5.1.1.2	STARTING THE ANDROID JAVA DEMO SOFTWARE	38
5.1.1.3	SEARCHING AND CONNECTING TO (PAIRING WITH) THE CS108	40
5.1.1.4	Settings	43
5.1.1.5	RFID INVENTORY	46
5.1.1.6	BARCODE INVENTORY	49
5.1.1.7	RFID READ AND WRITE MEMORY BANKS	52
5.1.1.8	GEIGER SEARCH	57
5.1.1.9	Filter: Pre Filter	62
5.1.1.10	FILTER: POST FILTER	66
5.1.1.11	Security	70
5.1.1.12	Register Tag	76
5.1.1.13	SPECIAL FUNCTIONS	77
5.1.1.14	Exiting the Software	82
5.1.1.15	TRULY EXITING THE SOFTWARE	83
5.1.1.16	Source Codes	84
5.1.2 DE	EMO C# SOFTWARE FOR IPHONE AND ANDROID	85
5.1.2.1	Installing the iPhone and Android Software	85
5.1.2.1.1	INSTALLING IPHONE APP FROM APP STORE	86
5.1.2.1.2	INSTALLING ANDROID APP FROM GOOGLE PLAY	87
5.1.2.2	STARTING THE IPHONE SOFTWARE	88
5.1.2.3	MAIN MENU	90
5.1.2.4	Searching and Connecting to CS108 (Pairing)	91
5.1.2.5	Settings	94
5.1.2.6	RFID INVENTORY	98
5.1.2.7	BARCODE INVENTORY	100
5.1.2.8	RFID READ AND WRITE MEMORY BANKS	102
5.1.2.9	GEIGER SEARCH	106
5.1.2.10	RFID FILTER: PRE FILTER	109
5.1.2.11	RFID FILTER: POST FILTER	110
5.1.2.12	Security	111
5.1.2.13	Register Tags	115
5.1.2.14	SPECIAL FUNCTIONS	116
5.1.2.15	Multi Bank Inventory	117
5.1.2.16	Phase and Channel Inventory	120
5.1.2.17	Periodic Read	122
5.1.2.18	Exiting the Software	124
5.1.2.19	TRULY EXITING THE SOFTWARE	125

5.1.2.20 Source Codes	126
5.2 SOFTWARE ON A PC – CONNECTING VIA USB	127
APPENDIX A. FEDERAL COMMUNICATIONS COMMISSION COMPLIANCE	128
APPENDIX B: READER MODES (LINK PROFILES)	129
APPENDIX C: SESSIONS	130
APPENDIX D: TAG POPULATION AND Q	131
APPENDIX E: QUERY ALGORITHM	132
APPENDIX F: TARGET	133
APPENDIX G: SECURITY	134
APPENDIX H: MODELS & REGULATORY REGION	136
APPENDIX I: TECHNICAL SUPPORT	137

2 Regulatory Regions

CS108 is offered as various models, using the format of CS108-N where N is of various values, each covering one or more different regulatory regions.

For example, CS108-2 covers the regulatory region of FCC, which includes USA, Canada, Mexico and other Latin America Countries that use the FCC frequency range.

The following is a model table with N as index, for CS108-N, and the corresponding frequency band and regulatory regions:

N =1:	865-868 MHz for Europe ETSI, Russia, Mid-East countries,				
	865-867 MHz for India				
N =2:	902-928 MHz, FCC, for USA, Canada and Mexico. Hopping frequencies locked				
N =2 AS:	920-926 MHz, Australia. Hopping frequencies locked				
N =2 NZ:	921.5-928 MHz, New Zealand. Hopping frequencies locked				
N=2 OFCA:	920-925 MHz, Hong Kong. Hopping frequencies locked				
N=2 RW: 920-928 MHz, Rest of the World, e.g. Philippines, Brazil, Peru, Uruguay					
	any other countries that use sub or partial sections of the FCC frequency range				
N =4:	922-928 MHz, Taiwan				
N =7:	920-925 MHz, China				
N =8:	916.7-920.9 MHz, Japan				
N =9:	915-921 MHz, Europe Upper Band				

Some regulatory regions require the CS108 User Manual to contain some statement. Here are those statements.

2.1 FCC Statement and IC Statement

FCC STATEMENT

1. 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.

(2) This device must accept any interference received, including interference that may cause

undesired operation.

2. Changes or modifications not expressly approved by the party responsible for compliance could

void the user's authority to operate the equipment.

NOTE: 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 or more 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

IC STATEMENT

IC Notice to Canadian Users

This device complies with industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) This device may not cause harmful interference

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

This device complies with RSS-247 of industry Canada. Operation is subject to the condition that this

device does not cause harmful interference.

This Class B digital apparatus complies with Canadian ICES-003(Cet appareil numérique de classe B est conforme à la norme NMB-003 du Canada).

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 5mm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

2.2 European CE

In Europe, 865-868 MHz band is allowed in all countries. The upper band of 915-921 MHz is however only ratified in a subset of the EU countries.

2.3 Hong Kong OFCA

Hong Kong Government requires the frequency of operation to be limited to within the frequency band allocated in Hong Kong: 920-925 MHz.

2.4 Australia AS

Australia Government requires the frequency of operation to be limited to within the frequency band allocated in Hong Kong: 920-926 MHz.

2.5 New Zealand NZ

New Zealand Government requires the frequency of operation to be limited to within the frequency band allocated in Hong Kong: 921.5-928 MHz.

3 Introduction

3.1 CS108 RFID Sled Handheld Reader

The CS108 RFID sled handheld reader is designed to work with an off-the-shelf smart phone (such as an iPhone or Android phone) or laptop/tablet via a Bluetooth Low Energy (Bluetooth 4.0/4.1/4.2) connection, where the application on the smart phone/laptop/tablet would control the CS108 reader to perform RFID tag reading or barcode scanning. The tag data is collected in the smart phone or laptop/tablet and can then be manipulated or transferred to other locations on the Internet Cloud for further processing.

Below photo shows the smart phone and CS108 working together during operation:



Note: The Smart phone App directly searches and pairs with CS108. There is no need to first pair with the CS108 via the normal Bluetooth Device connection page of the OS. Therefore, install the App on your smart device first and then search and connect the CS108 from inside the App.

The CS108 can be controlled via Bluetooth 4.0/4.1/4.2 from a laptop or tablet. Below is an example where it is accessed from a tablet running Linux Operating System:



The CS108 can also be controlled via its USB connection by a PC (tethered). In this case, the Bluetooth connection is not used. The control commands enter via the USB cable. The application is on the PC.

Photo below shows the CS108 handheld reader connected via USB cable to (and controlled by) a PC.



Host Platform	Interface Physical Media	Protocol of Host Platform			
Apple iPhone	Air	Bluetooth 4.0 or 4.1 or 4.2			
Apple iPad	Air	Bluetooth 4.0 or 4.1 or 4.2			
Apple iPod Touch	Air	Bluetooth 4.0 or 4.1			
Android Phone	Air	Bluetooth 4.0 or 4.1 or 4.2			
Android Tablet	Air	Bluetooth 4.0 or 4.1 or 4.2			
Windows 10* Laptop with BLE	Air	Bluetooth 4.0 or 4.1 or 4.2			
Windows 10* Tablet with BLE	Air	Bluetooth 4.0 or 4.1 or 4.2			
Windows 10* Mobile Phone	Air	Bluetooth 4.0 or 4.1 or 4.2			
Linux PC or Laptop or Tablet	Air	Bluetooth 4.0 or 4.1 or 4.2			
Windows PC or Laptop	USB cable	USB			
Linux PC or Laptop	USB cable	USB			
Android Phone with OTG	OTG USB cable	USB			
Android Tablet with OTG	OTG USB cable	USB			

In summary, the following, are the various host platforms and connections combinations. (BLE is Bluetooth Low Energy, including Bluetooth 4.0, 4.1, 4.2)

*Note that for Microsoft Windows OS platforms, to connect, using Bluetooth Low Energy (BLE), it needs to be Windows 10 (or later) because the BLE native driver is only available beginning with Windows 10.

3.2 **Product Packaging**

Package Contents 3.2.1

The reader package contains 5 items:

- CS108: 1)
 - Sled Handheld RFID Reader CS108USBCtoACable:
- 2) 3) CS108B:
- 4) CS108QSG:

USB cable, USB Type C to Type A, 1 pc Battery, 3400 mAh, 1 pc Quick Start Guide **Regulatory Guide**

5) CS108RG

3.3 **Product Specifications**



Figure 3-1 CS108 Reader

Features:

- ISO 18000-6C EPC Global Class 1 Gen 2 UHF RFID protocol compliant including dense reader mode
- Ultra-long read range Best in Class up to 18 meters for Monza R6 Dogbone tag (read range dependent on tag model, tag IC, reader antenna and environmental conditions)
- Robust performance in dense-reading environments
- Multiple reader modes (link profiles) with different reader to tag data rate and tag-to-reader backscatter rate, modulation format, and backscatter type for different business scenario and physical environment.
- Highly Configurable for maximum throughput and optimal performance
- Supports all Gen 2 commands, including Write, Lock and Kill

Physical Characteristics:	Length: 16.1 cm (6.3"); Width: 9.0 cm (3.5");					
	Height: 16.1 cm (6.3"); Weight: 650 grams (22.9oz)					
	Weight includes battery					
Environment:	Operating Temp: -20° C to 50° C (-4° F to $+ 122^{\circ}$ F)					
	Storage Temp: -40° C to 85° C (-40° F to $+ 185^{\circ}$ F)					
	Humidity: 5% to 95% non-condensing					
	Enclosure: IP-54					
Antenna:	2.7 dBi Gain internal patch antenna					
RF Power:	Internal conducted power					
	0 - 30 dBm in 0.1 dB increments.					
EIRP Power:	32.7 dBm					
RFID Frequency Ranges:	902-928 MHz band and subset					
	865-868 MHz band and subset					
Interfaces	Bluetooth 4.0 (BLE)					
	USB					
Accessories:	USB cable					
Restrictions on Use:	Approvals, features and parameters may vary depending on country legislation and may change without notice					

Specifications:

Г

3.4 **Product Accessories**

There are 3 accessories for the CS108 RFID sled handheld reader:

1) CS108 Spare Battery

Each CS108 comes with 1 battery in the product shipment box. Additional batteries are available for purchase. P/N: CS108B

2) CS108 USB C to A Cable

Each CS108 comes with 1 cable in the product shipment box. Additional cbles are available for purchase. P/N: CS108USBCtoACable.

3) CS108C Charger

A dual slot external battery charger is available for charging additional spare CS108 batteries. P/N: CS108C



4 Getting Started

4.1 Introduction

This chapter explains how to set up CS108 for the first time.

4.2 Unpacking

Open the box, removing all protective plastic bags and save the shipping container for later storage or shipment.

Check that the following items are in the box:

- 1. CS108 RFID Sled Handheld Reader
- 2. CS108B 3400 mAh battery
- 3. USB Type C to Type A cable
- 4. Quick Start Guide
- 5. Regulatory Guide

4.3 Features

The CSL CS108 RFID sled handheld Reader is an EPC Global Class 1 Gen 2 compliant product.

Below is the front view of the CS108 reader. The 2D barcode module is located at the top. The RFID reader module is in the front, with a forward facing embedded patch antenna..



Figure 4-1 CS108 Reader Front View

Below is the left side view of the CS108 reader. There are 5 LEDs on this side, from left to right, respectively:

- 1) RFID Power On
- 2) Status
- 3) Barcode Power On
- 4) Charging
- 5) External Power connected

On the sled handle, there is a trigger used by the operator to start and stop the reading of RFID tags or barcodes.



Figure 4-2 CS108 Reader Left Side View

Below is a view of the right side of the CS108 reader. There are 2 combination button/LED on this side.

The right button/LED is for the main power and the LED lights up **GREEN** meaning power is on. Press the button continuously for 3 seconds, then release to power on (must release before it powers on). To power off when the reader is on, press the button continuously for 3 seconds, then release the button to power off.

The left button/LED is for the Bluetooth pairing, and the LED lights up BLUE meaning Bluetooth is connected. When first powered up, the Bluetooth LED will automatically start flashing indicating it is now discoverable by a smart device nearby. From the Application on the smart device, one can then connect to the CS108. After connection, the LED will stop blinking and remain lit.

At any time, to stop the Bluetooth connection, press the Bluetooth button continuously for 3 seconds until the LED turns off. To restart the Bluetooth and pair with a device, press the button continuously until the Bluetooth LED starts flashing and reconnect via the application.



Figure 4-3 CS108 Reader Right Side View

Below is the rear view of the CS108 reader. Here the USB Type C socket is on the left, allowing the user to connect the CS108 to a PC for control, or to a USB power source to recharge the battery inside the CS108. On the right side is the Reset button, at this time it has not been activated to cause a factory reset on the unit.



Figure 4-4 CS108 Reader Rear Side View

One can connect the CS108 to either a smart phone or other smart device, including laptop PC via Bluetooth for control and data collection, or to a PC via USB cable for control and data collection.



4.4 Setting up CS108

To use the CS108 for the first time, carry out the steps described in the following sections.

4.5 Installing the battery

To install the battery,

- 1. Rotate the two silver latches at the back of the top cover.
- 2. Slide back the cover.
- 3. Install the battery by inserting the front battery teeth in the corresponding slots at the front of the battery compartment and aligning the copper connectors at the bottom right section of the battery with its counter-connectors. Snap it in place making sure it is underneath the blue locking mechanism.
- 4. Slide the cover back into place.
- 5. Rotate the two silver latches until fully closed.









4.6 Removing the battery

- 1. Rotate fully backwards the two silver latches at the back of the top cover.
- 2. Slide back the cover.
- 3. Press down on the blue locking mechanism at the back to pop out the battery.

4.7 **Power Up the Reader**

- 1. Make sure the battery is inserted properly and is charged..
- 2. Press the power button on the right side of the reader continuously for 3 seconds then release.
- 3. After you release the button, the Green Power LED will light up and the Blue Bluetooth LED will begin a slow blink.
- 4. The reader is now turned on and ready for Bluetooth pairing.



4.8 Bluetooth Pairing with Mobile Devices

- 1. When you power up the CS108 reader, the Bluetooth LED will automatically flash blue, meaning it is now discoverable by smart devices nearby. **NOTE:** the CS108 uses only the Bluetooth Low Energy protocol, therefore smart devices must have Bluetooth 4.0/4.1/4.2 to be able to connect to the CS108.
- 2. With the Bluetooth LED flashing, you can search, discover and connect the CS108 to the CSL Demo App or customer written app. NOTE that you can only connect to the CS108 via the CSL Demo App or customer written application. You cannot connect the CS108 Bluetooth via the standard Bluetooth pairing function of the OS of the smart device.

4.9 Charging the CS108

4.9.1 Direct Charging CS108

The CS108 can be directly charged by inserting a USB cable with the following plugs:

- 1) USB Type C plug on one side
- 2) USB Type A plug on the other side
- 3) The above Type A plug connecting to a USB charger with the traditional Type A socket. The charger can be 1A or 2A.

2 LEDs will light up:

- 1) "Ext. Power" LED: Green LED. Whenever the CS108 is connected to an external power supply, this Green LED will light up.
- 2) "Charging" LED: Red LED. When the battery is heavily drained, this red LED will be bright. When the battery is completely recharged, this red LED will be very dim. Do not be alarmed if you connect the USB cable and this LED is very dim. It just means the battery is fully charged



4.9.2 Charging CS108B battery using an external charger CS108C

For intensive operations, one can purchase the optional CS108C external charger. With this charger, you can charge 2 CS108B batteries simultaneously:



4.10 Downloading Application Software

To download the C# Demo application software for iPhone, please go to the Apple App Store and search for "cs108 rfid reader".



To download the C# Android App, please go to Google Play to download:



To download Android Java App, please go to Google Play to download.



For Linux and Windows App, please go to <u>www.convergence.com.hk</u> "Downloads and Support" then "CS108 Sled Handheld" to download the respective software and documentation.

C companyation + 1+					-	. 9	10
← → O integration				±	= 1	1 0	1.444
	The second		Android API Specifications				1
	Linna i Java						
	CB100 Linux (and Oldermille Datus App (et al. 1000; plumon Contex)	of 0.3 (Aug 2017)	CS108 Unior Java Research Dates App. and 104				
	CETTE Burrach Unio and API Specifications VI & 2017 07 12 and	Ad 2017	CS108 Blactorh Linux Janua API Specifications				1
	50% · C#						
	C0100-X05 S# Bhartooth Damo App (Heristien)	ef 0.13 (Dec 3017)	Planet depertured bare App Sizes				
	CB-HR OIL OF Research SDR (Rearys Dates)	(1.0.12 (Dec 3017)	Saw Bhaircoth Poradar Clabs Library API dacument				
	CHIER BARRARY (DEPC) APS Seechaatines (FLS 2017 DE 12 per	10 av 2017	CE100 Beatooth IOS PCL API Spectfratione				1
	Andreid - 128						
	CETTE Avenue CE Burnetti Full Forsterin Dene Age (Tetaber)	91.8.12 (Se	c 3(ri7) You can ann estail doechy fray Gogai Fray				
	423188 Admit CP Rismont Fail Esection SOR (Scores Estin)	v1 8-18 Ele	c 3017) See Blactoryn Portable Dien Library AP1 doluneet				
	CETTE Avenue CA Blacketh 15 seconds ferenticy Conner Aug (19)	vt.8.1 (Nov	2017) CS100 Anthore C# Blastown 10				

4.11 Downloading Application Software Source Codes

For developers who need to download source codes and modify those for their own use, they can go to the Downloads & Support section of <u>www.convergence.com.hk</u> and then choose the reader CS108 Sled Handheld. There you can download all the source codes, reference manuals and other information for use.

Cl compressioner: × 1+				 	~ 31	-	B	1
← → 0 → → → → → → → → → → → → → → → → →				食	-	Z.	0	
DOWNLOADS & SUPPORT GRUD GRUD GRUD GRUD GRUD GRUD GRUD GRUD	Harr + Dysettativ & Report - CE135 CS103 User's Manual File Bate Rete CS1 CE105 fiel Inschool House User's Manual CS1 CE105 fiel Inschool House User's Manual Demo App, Software Development Kit and Reference Manual Android + Java							
	COAD Autom Jaco Bastanti SDA (Banne Claim)	e1 1 15 (Nev 2017	Bluetosth Denis Agg Bluetosth Denis Agg Bluetosth Arvbrod AP1 datateen					
	CT-106 Brannath Andrew 60% Spectromenes 5% & 2017 FE FE per	May 2017	C.8.108 Millionsofth Anthroad AP1 Specifications					
	Linus : Java							
	CSYMD Lance Anna Riversanth Dreev Aug and SOM (Roance Carbon)	vt.0.2 (843-28	 CS108 Linux Jave Baselowik Dene App and SDK 					
	CO YOR Deartrack Lasar Janua API Spatche street V13 (01/10/113 g	Ar 2017	CS:100 Biootooth Lanon Java API Baec Rications					

4.12 Trigger Button vs Touch Screen Usage

Using a Demo App provided by Convergence Systems Limited, one can start and stop an RFID inventory or Barcode Reading using either the Start/Stop button inside the CSL Demo App via the LCD touch screen of the smart device, or use the Trigger on the sled handle.

In the CSL Demo Apps, pressing the trigger initiates a <u>continuous</u> RFID or Barcode scanning process. One can then terminate this process upon releasing of the trigger. You need to press the Trigger and KEEP PRESSING, for the reader to be continuously reading RFID tags or scanning barcodes, depending which reading mode you are in. The moment you release the trigger, the RFID inventory or barcode scanning will stop.

If you do not use the Trigger, you can use the Start/Stop button on the CSL Demo App via the LCD touch screen of your smart device. When you press the Start button, the CSL Demo App will start continuous RFID inventory or barcode reading. To stop, just press on the Stop button.

5 Introduction

5.1 Software Applications

The CS108 offers standard demo applications with source codes freely downloadable from Convergence website (<u>www.convergence.com.hk</u>) for iPhone, iPAD, Android Phone, Android Tablet, Linux Tablet and Windows 10 PC/laptop. For iPhone and iPAD, you can install the application from Apple's App Store. The source code for iPhone and iPAD are available from <u>www.convergence.com.hk</u> For Android phone and tablet, you can directly download the .apk install file and also source codes from <u>www.convergence.com.hk</u>. You can also download the Android Demo App directly from Google Play. You can download the Linux and Windows 10 App, installer and source codes from <u>www.convergence.com.hk</u>

	Interface	
Host Platform	Physical Media	Protocol of Host Platform
Apple iPhone	Air	Bluetooth 4.0 or 4.1 or 4.2
Apple iPad	Air	Bluetooth 4.0 or 4.1 or 4.2
Apple iPod Touch	Air	Bluetooth 4.0 or 4.1
Android Phone	Air	Bluetooth 4.0 or 4.1 or 4.2
Android Tablet	Air	Bluetooth 4.0 or 4.1 or 4.2
Windows 10* Laptop with BLE	Air	Bluetooth 4.0 or 4.1 or 4.2
Windows 10* Tablet with BLE	Air	Bluetooth 4.0 or 4.1 or 4.2
Windows 10* Mobile Phone	Air	Bluetooth 4.0 or 4.1 or 4.2
Linux PC or Laptop or Tablet	Air	Bluetooth 4.0 or 4.1 or 4.2
Windows PC or Laptop	USB cable	USB
Linux PC or Laptop	USB cable	USB
Android Phone with OTG	OTG USB cable	USB
Android Tablet with OTG	OTG USB cable	USB

5.1.1 DEMO JAVA SOFTWARE FOR ANDROID

5.1.1.1 Installing the Demo Android Java Software

There are 2 ways to install the Demo Android Java App:

- 1) Install directly from Google Play
- 2) Download the APK from Convergence website.

5.1.1.1.1 Installing from Google Play



5.1.1.1.2 Download APK from CSL website

Download the APK from Convergence website. Save the .apk file to the Download folder.

You can directly download that to your Android phone as long as your Android phone is connected to the Internet.

See below:



Select and press the APK and start the installation process:

0 🗊 🖬 🖬 🗲 🔟 12:16

Open


Once installed, start the App and you should see the following:

Emergency calls only 🔯	🕸 🗊 🛱 🖬 10:09 AM
Convergence Syste	ems 100% 📃
Read/Write	Inventory
Register Tag	Special Functions
Geiger Search	Settings
Security	Filters
Con	nect
\triangleleft (

5.1.1.2 Starting the Android Java Demo Software

The CS108 Android Java Demo App icon should appear on your Android device screen as "CS108ADemo"



Open the Android Java Demo App and you should see the following screen:

Emergency calls only 📓	🕸 🕞 🛱 🖬 10:09 AM
Convergence Syste	ems 100% 📃
Read/Write	Inventory
Register Tag	Special Functions
Geiger Search	Settings
Security	Filters
Con	nect
\triangleleft (

5.1.1.3 Searching and Connecting to (Pairing with) the CS108

To start searching and connecting to (pairing with) a CS108 nearby, press the Connect button at the bottom of the menu. Please make sure that you have powered ON the CS108 you are trying to connect with and the blue Bluetooth LED is blinking. Also make sure the Bluetooth on your Android phone is turned on.



After a few seconds, you should see on the Demo App screen all the CS108 units nearby available for pairing.



Select the one you want to connect to by pressing on the row of the screen corresponding to the reader you want to connect with.



After that you should see the check box to the right of the reader name ticked. Press on the screen again to connect to the chosen reader. If you have multiple CS108 readers they should be set to different names. (see Settings)

5.1.1.4 Settings

Once connected to the reader, set up the reader's parameters in the Settings page:

Emergency calls only 📟	🕸 🗊 🛜 🖬 📰 10:09 AM
Convergence Syste	ems 100% 📃
Read/Write	Inventory
Register Tag	Special Functions
Geiger Search	Settings
Security	Filters
Con	nect
\triangleleft (

The Settings/Operation menu, has configuration for the Regulatory Region, Frequency Order, Fixed Channel, Power, Tag Population, Q (override), Session, Target, Query Algorithm, and Reader Mode/ Link Profile

Emergency calls only	9 🖬 … 🖇	0 1 1	💌 11:15 AN		
Setting			97% E		
OPERATION AD	MINISTRATI	ON			
Regulatory region	U	SA/Canada	а		
Frequency order	Frequency hopping				
Fixed channel		0			
Power(0-300dBm)		300			
Tag population	30				
Q(0-15)	6	0	verride		
Session	S	1			
Target	A				
Query algorithm	D	ynamic			
Reader mode / Link profile	1: Range/I	Dense read	ler		
	SAVE				
\triangleleft	0				

Please refer to Appendix B, C, D, E, F, for the definitions and uses of Reader Modes/Link Profiles, Sessions, Tag Population and Q, Query Algorithms, and Target.

Note that it is strongly recommended for the user to select a Tag Population that is close to the number of RFID tags the reader will see while reading directly in front of it. If inventorying a warehouse consisting of a large tag population, say 2000, do not set 2000 as the Tag Population, as the reader cannot "see" all 2000 tags at once. Instead set the Tag Population to 50, 100, etc.... The default is 30.

The Power is default set to 300, meaning 30 dBm (1 Watt). This is the internal conducted power before it enters the antenna. The antenna gain is 2.7 dBi. Depending on environment, a lower power may get better read results. Experiment with different power settings to see

which one provides best results.

After making changes to the Settings page you must press the SAVE button to apply the changes.

Regulatory region	USA/Ca	inada
Frequency order	Frequer	ncy hopping
Fixed channel		0
Power(0-300dBm)		300
Tag population	30	
Q(0-15)	6	Override
Session	S1	
Target	А	
Query algorithm	Fixed	
Reader mode / Link profile	1: Range/Dense	reader

5.1.1.5 **RFID Inventory**

To do an inventory of RFID tags, select the "Inventory" button:



Press the Start button or Press the Trigger to start the inventory and then the ID(s) of the RFID tags will be listed as shown below. The first column is the number of reads of that tag ID, second column is the RFID tag EPC ID, the last column is the RSSI of the tag. On the upper right, you can also see the current battery level in red font.

Emer	gency calls only 🔳 🛙	\$10	- 	11 :	29 AM
In	ventory	CLEAR	SORT		≡
	RFID		BARCO	DDE	
1	300833B2DDD90	1400000099	98		38.9
1	88201702300000	000000002	3		39.6
1	1081000000000	000000004	3		42.1
1	10800000000000	000000003	0		37.1
1	88201702000000	000000002	0		51.7
2	10800000000000	000000071	2		39.6
3	88201701000000	000000001	0		37.1
3	1081000000000	000000002	2		41.0
1	10800000000000	000000002	A		44.1
Run ti	10000000000000000000000000000000000000	00000004	7	Γ3	.842 V
Uni	que tag: 54	Stop	To Ra	tal:2 ate:3	.03 32
	\bigtriangledown	0			

A high frequency tone will be heard when a new RFID tag is read and a low frequency tone will be heard when a tag is read again.

A summary of tags read appears at the bottom of the screen: number of Unique Tags, Total Number of Tags Read, Read Rate, and Run Time.

At any point, if you want to stop reading, just press the Stop button or release the Trigger.

If you stop inventory and start again, the previous list will remain and new tags are added at the top of the list. If you want to start a new list, press the Clear button at the bottom to clear the list.

Emer	gency o	calls only		* ()	† ∎	11:	28 AM
In	vento	ory		CLEAR	SORT		Ξ
		RFID			BARC	DDE	
1	4897	024518	7980000	000000	2		62.1
1	4897	024518	7980000	000000	4		62.1
1	2017	130000	0000000	000000	1		42.1
1	E280	116060	0002053	03BD49	C		49.2
1	1080	000000	0000000	000002	1		48.2
1	1081	000000	0000000	000003	3		50.1
1	1111	000000	0000000	000000	0		44.9
1	1080	000000	0000000	000004	1		42.1
1	8820	170320	0000000	000003	2		39.6
ר ≀un ti	me: 1 s	sec	იიიიიი	000000	7		30 c 8.969 V
Uni	que 27	tag:	St	art	To R	otal: ate:2	40 27
		\triangleleft	(C			

5.1.1.6 Barcode Inventory

To scan a Barcode press the Inventory button:



Then press the BARCODE SCAN button on the upper right hand of the screen:



Press the START button on the touch screen or Pull the Trigger. The red LED of the barcode reader will light to help you aim the CS108 barcode scanner to the barcode. A focused circular aiming dot will appear. This indicates the optimal reading distance between the CS108 and the barcode.



Once the barcode is read, you can press the Stop button or release the Trigger.

5.1.1.7 RFID Read and Write memory banks

To read and write specific memory banks of an RFID tag. Press the Read/Write button:

Emergency calls only 📓	\$ (C) 🗢 🞝 📷 10:09 AM
Convergence Syst	tems 100% 🗄
Read/Write	Inventory
Register	Special
Tag	Functions
Geiger Search	Settings
Security	Filters
Cor	inect
\triangleleft	

The screen below appears displaying Bank 0 (Reserved), Bank 1 (EPC), Bank 2 (TID Memory) and Bank 3 (User Memory) of the EPC tag. Select at least one bank to read or write. Note that Bank 2, TID bank, can only be read and cannot be written, as defined by EPC Global Standard.

Reau/	Write				•
/	Т	ag Patte	m		
assword			00	000000	0
Reser	ved Memory				
Kill PW	Password	Acce	ss PW	Pas	sword
EPC					
PC	PC val	ue	EPC h	as bits	1
EPC		Tag P	attern		
	emory Offse	et O	S	ze	2
	D	ata Datta			
	.D.	ata matik	9611		
User M	/lemory	Offset	0	Size	2
User N	Memory D	Offset ata Patte	0	Size	2
User M	Memory D wer(0-300dE	Offset ata Patto 3m)	0 Ern	Size	2
User M Antenna po	Memory D wer(0-300df	Offset ata Patto 3m)	o ern W	Size 300	2

Enter a Tag Pattern to select a specific tag for Read/Write operations.

If you do not input anything, in the Tag Pattern input box, (see circle) the reader will read whatever tag it sees. You can input a string of hex number to select the specific tag. The whole EPC ID, or a partial string can be entered for the pattern; the remaining being wild card.

Emergency c	alls only … 🖇	0\$	n 100	% 📖	11:52 AM
Read /	Write				• E
	19DEC16000	00000	000000	003	>
Password			00	00000	0
Reser	ved Memory				
Kill PW	Password	Acce	ss PW	Pas	sword
EPC					
PC	PC value		EPC ha	as bit	S
EPC	6	Tag Pa	attern		
🗌 TID M	emory Offset	0	Siz	ze	2
	Data	Patte	m		
User N	femory Of	fset	0	Size	2
	Data	Patte	m		
Antenna po	wer(0-300dBm)		300	
R	EAD	_	W	RITE	
	\triangleleft	0	٢		

Alternatively, a Tag Pattern for a Read/Write operation can be selected from the Inventory page. Select a tag by pressing the line of the tag desired, and it will be highlighted.

Emer	rgency calls only …	\$0\$	i 100% 🗐	11 :	54 AM
In	ventory	CLEAR	SORT		Ξ
	RFID		BARCO	DDE	
1	88201702100000	0000000002	1		41.6
1	48970245187980	000000000000000000000000000000000000000	0		41.0
1 PC=3	1081000000000 3000, CRC16=5D4D	000000003	0	~	39.6
4	88201701200000	000000000	2		37.1
2	500000000000000000000000000000000000000	0000054D6	1		39.6
2	300833B2DDD90	140000009	98		39.6
2	88201702300000	0000000002	3		39.6
2	1081000000000	000000004	3		38.1
6	108000000000000	000000003	0		39.6
	5	START			
	\triangleleft	0			

Return to the Main Menu and select the Read/Write function. The selected Tag ID will be displayed in the Tag Pattern field.

Read /	Write				•
	10810000	000000	000000	030	
assword			00	00000	0
Reser	ved Memory				
Kill PW	Password	Acc	ess PW	Pas	sword
EPC					
PC	3000)	EPC h	as 96 b	oits
EPC		Tag P	attern		
	emory Offs	et 0	Si	ze	2
	D	sta Patt	em		
User M	/lemory	Offset	0	Size	2
	D	ata Patt	em		
vntenna po	wer(0-300dl	Bm)		300	
32.91			14	DIT	÷
R	EAD			NIL	

You can now Read or Write any specific memory banks.

5.1.1.8 Geiger Search

A tag search is done with the Geiger Search function:



Select a tag from the Inventory function or manually enter the tag ID to be searched.



Press Start. Continuous reading will begin showing the RSSI, as well as, a beeping a tone if the Tone box is selected. The Threshold can be adjusted to limit the tone.

Emergency calls only	y 🗷 📓 📕	* 🗟 🖬 🔳	🕽 3:39 PM
Geiger searc	ch	5	
0	50		100
	-	_	
	49.2		
E2801	16060000205	079F6CDD	
Tone	Thresh	old =	
Antenna power(0-3	300dBm)	300	
Run time: 3 sec E2	80116060000	205079F6CDI	0 3.710 V
	Start	Tota Rat	al:48 e:23
\triangleleft	0		

The tag can now be searched for using the beeping sound. If the Tone box is enabled, it will become faster and faster as the RSSI increases. When you are really close to the tag a long beep will replace the tone.

Another way to home in on a tag is to first do an inventory of the whole area, without knowing the exact location of the tag. Then select the tag with the ID you are looking for by selecting that line.

Emer	gency calls onl	y 🐼 📖 🗾	%	G 📖 3	42 PM
In	ventory	CLEA	r sof	RT (543)	Ξ
	RFID		ВА	RCODE	
2	9093942017	07060000000	09F		53.6
2	9093942017	07060000000	0C5		40.3
1	9093942017	07060000000	069		38.1
2	9093942017	07060000000	065		49.2
2	108000000	000000000000000000000000000000000000000	713		44.1
2	E280116060	000205079F6	CDD	\checkmark	49.2
PC=3	1000, CRC16=				
1	108000000	000000000000000000000000000000000000000	032		45.7
2	108000000	000000000000000000000000000000000000000	033		45.7
2	9093942017	07060000000	075		51.7
Run ti	me: 3 sec			-	3.731 V
Uni	que tag: 103	Start		Total: Rate:	182 72
	\bigtriangledown	0			

Then, return to Main Menu and enter the Geiger Search function, the ID will already be in the Input field, and you can start the Geiger Search:

Emergency calls on	ly 🗷 🗟 🏓	\$ † ∎	3:39 PM
Geiger sear	ch	5	3%
0	50		100
	10.0		
	49.2	-	
E280 ⁻	16060000205	5079F6CDD	
Tone	Thresh	old =	
Antenna power(0-	-300dBm)	300	
Run time: 3 sec E2	280116060000 Start	0205079F6CDI Tota	o 3.710 V al:48
		Rat	e:23
\triangleleft	0		

To stop, press the Stop button, and the search will end.

5.1.1.9 Filter: Pre Filter

A Pre-Filter, i.e. a select filter, to have only a certain group of tags respond to the reader's query can be added. To implement this, select the Filters function:



On the Pre-Filter page, enter the Tag Pattern used to filter the desired tag(s) population. The tag pattern does not need to be from the beginning of the EPC bank. An Offset can be entered, the default offset is 0. After entering the data, check the Enable filter box and then press the SAVE button.

Emergency calls only	🕯 🕕 🛜 🖬 100% 🎫 12:22 PM
Filters	75% =
PRE-FILTER	POST-FILTER
Mask data	Tag Pattern
Offset (bits)	0
Memory Bank	EPC *
Action	Match(assert SL), else(deassert SL)
Target	SL *
Enable Filter	
	SAVE
\bigtriangledown	0 🗆

Emergency calls only 💀 …	🕏 🕕 🎓 🖬 100% 💽 1:47 PM
Filters	55% Ξ
PRE-FILTER	POST-FILTER
Mask data	19DEC160
Offset (bits)	0
Memory Bank	EPC *
Action	Match(assert SL),
Target	SL +
Enable Filter	
SA	AVE
\triangleleft (\circ \Box

P 🔺 🖷	0 🗟 🖳 + 100 2:18
Filters	
PRE-FILTER	POST-FILTER
Mask data	19DEC16
Offset (bits)	0
match on ~EPC (not EPC)	
Enable Filter	\checkmark
SA	VE
5 €	

5.1.1.10 Filter: Post Filter

Inventoried tags can be further selected using the Post Filter:

Emergency calls only 😹	≵IŪI 奈 🖬 📰) 10:09 AM
Convergence Syste	ems 1006 🗧
Read/Write	Inventory
Register Tag	Special Functions
Geiger Search	Settings
Security	Filters
Con	nect
\triangleleft (

On the Post-Filter page, enter the Tag Pattern used to filter the desired tag(s) population. The tag pattern does not need to be from the beginning of the EPC bank. An Offset can be entered, the default offset is 0. After entering the data, check the Enable filter box and then press the SAVE button.

Ý 🔺 🖷	() 😤 📴 ul 🗲 🔟 2:14
Filters	
PRE-FILTER	POST-FILTER
Mask data	
Offset (bits)	0
match on ~EPC (not EPC)	
Enable Filter	
SA	VE
5 6	

P 🔺 🖷	0 क ∎ ≁⊡∞ 2:18
Filters	
PRE-FILTER	POST-FILTER
Mask data	19DEC16
Offset (bits)	0
match on ~EPC (not EPC)	
Enable Filter	\checkmark
SA	VE
5 (

Ý 🛕 🖷	0 🗊 📴 📶 🗲 💷 2:15
Filters	
PRE-FILTER	POST-FILTER
Mask data	19DEC16
Offset (bits)	0
match on ~EPC (not EPC)	
Enable Filter	\checkmark
Saved ne	w setting.
SA	VE
5 6	

5.1.1.11 Security

Security features, such as Locking or Killing can be added to the EPC of tags. To enable these features, go to Security page:



LOCK Tag Patte Password	KILL m 00000000	
Tag Patte	0000000	
Password	0000000	
KIII PW U	0000000	
	nchanged 👻	
Access PW U	nchanged ¬	
EPC U	nchanged -	
TID Memory U	nchanged 🔹	
User Memory U	nchanged 🔹	
Antenna power(0-300dBm)	300	

You can either Lock or Kill a tag. Here is the procedure for locking a tag:

For locking a tag there are 5 possible actions to choose from,

- 1) Unchanged (no action)
- 2) Unlock
- 3) Permanent Unlock
- 4) Lock
- 5) Permanent Lock

LOCK	KILL	
Tag Pa	attern	_
Password	0000000	
Kill PW	Unchanged	•
Access PW	Unchanged	4
EPC	Unlock	•
TID Memory	Permanent Unlock	
User Memory Antenna power(0-300dBm)	Lock	*
	Permanent Lock	Γ

You can lock, unlock, permanently lock, and permanently unlock a memory bank of the tag. The detailed definitions of these 4 operations can be found in the EPC Global standards document which can be found at the EPC Global website:

<u>https://www.gs1.org/epcrfid/epc-rfid-uhf-air-interface-protocol/2-0-1</u>. On the page, press the button showing the latest air interface protocol and download the pdf file. More details can be found on Appendix G.




After a successful operation, the following screen is diplayed.

Emergency calls only 💵 🛢 🏮	🕸 🛜 🖬 페 3:28 PM
Security	53%
LOCK	KILL
709394222222	22222222222
Password	0000001
Kill PW	Lock 👻
Access PW	Unchanged 👻
EPC	Permanent Lock 👻
TID Memory	Unchanged -
User Memory	Unchanged 👻
Antenna power(0-300dBm)	300
APP	PLY
\triangleleft C	

Reminder: The Lock password must be non-zero for you to be able to implement any security action. This is an EPC Global Standards definition and requirement.

Pressing KILL at the top of the screen presents the feature for killing a tag. Note it asks you to enter the Kill password immediately:



After entering the correct password, press KILL button at the bottom of the screen, the tag will be killed. During the process, the word "KILL" will be changed to "KILLING", and , if successful, a "Success" message will pop up above the bar.

Reminder: The Kill password must be non-zero for you to be able to implement any security action. This is an EPC Global Standard definition and requirement.

5.1.1.12 Register Tag

Register Tag is a section of the CS108 Demo Application page allowing the user to scan a barcode, and then write that information into a specific memory bank of an RFID tag. That information is often saved in a certain section of the EPC memory bank, or in the USER memory bank. This section allows you to select which memory bank and which offset location to write that information to. Moreover, it allows you to set a tag mask so that it would only write to tags with a certain tag pattern.

🕆 🔘 🖺 🔺 🎽 🖗 🖷	0 🗟 🗟 📶 🗲 🖅 10:28
Register tag	E
Step 1: Read Barcoo	le
Read	Tag Pattern
Step 2: Select tag m	ask
EPC - Offset	0
Tag P	attem
Step 3: Write to Ban	k
EPC · Offset	0
Password	Password
Antenna power(0-300dBm)	300
WR	ITE
↑) ŵ	

5.1.1.13 Special Functions

This section of the CS108 Demo Application offers user some additional special functions available with the CS108.

Emergency calls only 🔛	🕸 🕕 🤝 🕼 📰 10:09 AM
Convergence Syste	ems ioox 📃
Read/Write	Inventory
Register Tag	Special Functions
Geiger Search	Settings
Security	Filters
Con	nect
\triangleleft \subset	

Multibank inventory is a special function that allows the RFID inventory of multiple tag memory banks at the same time.

Emergency ca	lls only 📧	* * 101 %	100)% 📷	2:34 PM
Special		CLEAF	R SOR	T 49	E
MULT	IBANK		01	HER	
Bank	EPC	▼ Offset	0	Size	2
🗌 Bank	EPC	▼ Offset	0	Size	2
No Tag Fo	ound				
	ŝ	START			
	\triangleleft	0	Ċ]	

Select the bank, offset and size (in words) that you want to inventory. You can choose up to 2 extra banks.

Emergency ca	lls only 🔢	\$0\$ī	100% 🎫 2:36 PM
Special		CLEAR	SORT 49% =
MULT	IBANK		OTHER
🛃 Bank	EPC	▼ Offset 0	Size 2
🗌 Bank	TID	▼ Offset 0	Size 2
No Tag Fo	User		
		START	
	\triangleleft	0	

Emergency ca	lls only 🛚		\$0\$	> G a 1	00% 🔤	2:36 PM
Special			CLEAR	s s	DRT 🙀	Ξ
MULT	IBANK			į	OTHER	
🛃 Bank	TID	×	Offset	0	Size	2
🗌 Bank	EPC	*	Offset	0	Size	2
No Tag Fo	bund					
		ST	ART			
		51				
	\bigtriangledown		0			

Now you can press the START button:

You will now see the RFID tags' EPC bank, TID bank, as well as the phase and frequency channel of reading:

Emergency ca	alls only 🛙	- * *] 🗟 🖸	100% 💌	2:36 PM
Special		CL	EAR S	ORT 28	• =
MULT	IBANK			OTHER	
🗹 Bank	TID	▼ Off	set 0	Size	2
🗌 Bank	EPC	Of	set 0	Size	2
1 70999 PC=3000, CR TID=E200680	9400000 C16=759	000000 D	000005	Ph 925	57.0 ase=62 5.25MHz
1 C1600 PC=3400, CR TID=E280113	0000000 C16=A21 30	000000 : 07	220002	Ph: 925	39.6 ase=-15 5.25MHz
2 10800000000000000000000000000000000000					48.2 ase=-6 5.25MHz
1 1001100210031004100519C6 41.0 PC=3000, CRC16=36C7 Phase=-47 TID=E2003412 909.25MHz					41.0 ase=-47 9.25MHz
Run time: 7 se	ec				3.573 V
Unique t 52	ag:	Sto	р	Tota Rate	l:166 e:21
	\triangleleft	0			

5.1.1.14 Exiting the Software

By pressing the Home button, middle CIRCLE icon on the LCD touch screen at the bottom, one can exit the software. Note that using this method for exiting the demo application does not completely stop the application, the application is placed in a sleep mode.



5.1.1.15 Truly Exiting the Software

To truly exit the software, press the SQUARE button, and then you will see the following screen:



At this point, you can truly exit the software by pressing the 'X' to close the app.

5.1.1.16 Source Codes

Source code for this application, tools and manuals are available on Convergence Systems Limited website:

www.convergence.com.hk

5.1.2 DEMO C# SOFTWARE FOR iPHONE and Android

5.1.2.1 Installing the iPhone and Android Software

The C# code applies to both the iPhone and Android phone. The same code can be deployed to multiple platforms. This is a powerful development in the world of smart phone Apps. Visual Studio 2017 was used to compile the applications.

The iPhone version App can be installed from the Apple App Store. The Android version App can be installed from Google Play.

The Android software can also be installed by downloading the APK file from the CSL website.

5.1.2.1.1 Installing iPhone App from App Store

The released CS108 C# iPhone App can be installed from the Apple's App Store:

11:42 AM	\$ 91%
CS108 RFID R CSL>	eader (8+)
Reviews	Related
8 AM 8 100% - +	
Special Func	
Settings	
RFID Filter	
	II:42 AM

5.1.2.1.2 Installing Android App from Google Play

The CS108 C# Android App can be installed from Google Play:



The CS108 C# Android App can also be installed by downloading the APK installer from the CSL website and then copied to the Android phone for installation.

5.1.2.2 Starting the iPhone Software

Since the User Interface is the same for C# Demo App on iPhone and Android, here we will only focus on the iPhone version:

With the CS108 App for iPhone installed, you will see the following icon on your iPhone:



Press the icon to start the CS108 iPhone App.

No SIM 🗢	1:21 PM	¥ 100% 📟	
CS108 RFID Reader (1.0.7)			
Read/Write	lr	nventory	
Register Tag	Spo	ecial Func	
Geiger Search	5	Settings	
Security	R	FID Filter	
Press to Scan/Connect Reader			

5.1.2.3 Main Menu

The Main Menu will launch when you start the CS108 iPhone App. There are 8 function buttons and 1 connection button. The text color on the connection button indicates whether a CS108 reader is connected (blue text) or disconnected (red text).

To connect, press the button with text "Press to Scan/Connect Reader" to begin searching and making a connection to CS108 reader.

No SIM 🗢	1:21 PM	≵ 100% ■		
CS10	CS108 RFID Reader (1.0.7)			
Read/W	rite	Inventory		
Register	Tag	Special Func		
Geiger Se	arch	Settings		
Securit	зy	RFID Filter		
Press to Scan/Connect Reader				

5.1.2.4 Searching and Connecting to CS108 (Pairing)

The search and connect screen will search for CS108s nearby and list them. Please make sure the CS108 Blue LED Bluetooth button is flashing, meaning the CS108 is ready for discovery by the iPhone. Note: the system Bluetooth device connection is not used to make the CS108 connection on an iPhone OS. The CS108 Application provides this functionality.

No SIM 穼	1:21 PM	\$ 100%
< Back	List of CS108 Detec	ted
CSL SAN	MPLE #102	-90
	551-4155-5745-00414055	5445
CSL SAN	MPLE #13	-62
3095a007-b	ba18-51b1-863d-ffde38597	'e8f
CS108 F	Reader	-70
42cc57c6-e	969-9a3d-34f4-76cf7955	3cab
2		
3a3e98f1-2t	813-6041-6c52-7683a996	af5b
Co	onnect to previous	Stop Scan 🛼
	Scan for devices	

You can refresh the search process by swiping DOWNWARD and then releasing

Once you select a particular reader by pressing your finger onto that selection, then a pop up window will ask you if you want to connect to that reader. Press "Ok" to connect.



After that, the software will automatically return to main menu screen of the application.

*Note the Reader Name is very useful to distinguish between various readers on the screen. To change name, go to Settings > Administration and edit the Reader Name field. For help see section 5.1.2.5 Settings.

After successfully connecting a CS108, the red text in the connection button will change to blue text and shows the connected reader name.

No SIM 🗢	1:23 PM	M \$ 100% 🔜 🗄	
CS108 RFID Reader (1.0.7)			
Read/Wri	te	Inventory	
Register T	āg	Special Func	
Geiger Sea	irch	Settings	
Security	,	RFID Filter	
Connected to CS108 Reader/Select Another			
CS108 Bat. 100%	6		

5.1.2.5 Settings

After connecting, the Settings page allows you to edit the RFID operation parameters and administration parameters.

Operation Settings:

No SIM 穼	1	:23 PM	∦ 100% 💷 +
< CS108 RF	ID Reader	r (1.0.7)	
Regulatory Region		USACa	nada
Frequency Order		Норр	ing
Fixed Channel		902.	75
Power	300		
Tag population	30		
Q Override	6		Override
Session		S1	
Target		A	
Query Algorithm		DYNAN	AICQ
ReaderMode /LinkProfile	1. 1	Range/Den	se Reader
	S	AVE	
51	3		{ 2 }}
Opera	tion		Administration

- 1. Regulatory Region is the specific area/country where the unit is to be used.
- 2. Frequency Order is how the frequency channels are to be traversed: Hopping, Fixed or Agile.

- 3. Fixed Channel is the specific frequency channel to be used when Frequency Order is set to Fixed.
- 4. Power is the conducted power entering the antenna, the value is 10 times the dBm value desired. For example, 300 means 30 dBm. i.e. (300/10) dBm.
- 5. Tag Population is the approximate number of tags to be typically inventoried.
- 6. The Q Override value is automatically set when you enter the Tag Population value. This value can be overwritten by pressing the "Override" button and editing the Q value. To return to the default value, press 'Reset' Appendix D describes this in detail.
- 7. Session is the EPC defined session for querying the tags. For detailed explanations of Session please refer to Appendix C.
- 8. Target is the EPC defined query target of the tag status flag, A, B, or A/B Toggle. For a detailed explanation of Target. Please refer to Appendix F
- 9. Query Algorithm is either DynamicQ or FixedQ. A detailed explanation is found in Appendix E.
- 10. Reader Mode or Link Profile is either 0, 1, 2, or 3. Detailed explanation is found in Appendix B.

After changing parameters, press "SAVE" button. A beep will confirm the successful save.

Administration Settings:

•••• csl. ᅙ		11:50 AM	\$ 90% 🔳	
< Back				
Reader Model	: CS1	08-1		
Reader Name	CS108 Reader 9D476A			
Battery Level Format	Percentage			
Inventory Aler	t Sour	nd 🌔		
Inventory Delay Time	30			
Ва	rcode	Reset to Trigge	er mode	
Reset S	Softwar	e/Reader to De	fault Setting	
	Ge	et Serial Numbe	er	
Shortcut				
Function		min Time	max Time	
INVENTO	RY	0	500	
BARCO	DE	500	10000	
		SAVE		
ر Operati	a ori		Administration	

- 1. Reader Model is the model of the reader, for example, CS108-1 for 865-868 MHz band or CS108-2 for 902-928MHz
- 2. Reader Name is an editable name for the reader. You can change the name of the reader for

easier management at sites where you have multiple CS108 units. After the name is changed, you need to power off and power on the CS108 for the name to be effective.

- 3. Battery Level Format defines how you want to view the battery level, either in absolute voltage or in percentage.
- 4. Inventory Alert Sound enables or disables the sound during inventory. During inventory, there are 2 different pitches of sound: high pitch means a new unique tag has been read. Low pitch means a tag that has been read before has been read again. Also, the rate of beeping is proportional to the rate of tag reads received.
- 5. Inventory Delay Time is an internal data control. Do not change.
- 6. Barcode Reset to Continuous Mode is a special function button to reset the barcode to continuous mode. This button may need to be pressed after firmware upgrades and is an artifact of this being Demo software for both users and developers. If the barcode has been inadvertently set to trigger mode, this button resets it.
- 7. Reset Software/Reader to Default Setting is a special function button to reset the configuration setting to the default values.
- 8. Get Serial Number gets the Product Serial Number. It is also on the paper label on the back of the reader.
- 9. Shortcut defines the short cut sled trigger timing. The values are in msec. This is short cut method to select either RFID inventory or barcode reader. When the user is in the main page already, then this short cut trigger control will work. In this default setting, if the user continuously presses the trigger for 0 to 500 msec and then releases it, he will jump to the RFID inventory page. If he keeps on pressing the trigger past 500 msec and releases it before 10,000 msec (10 seconds), then he will jump to the barcode reading page. The Min and Max value ranges are 0 and 30,000 msec (30 seconds).
- 10. The Save Button MUST be pressed to make value changes effective.

5.1.2.6 RFID Inventory

From the Main Menu press the Inventory button to go to the demo Inventory screen. At the bottom of the screen you can select RFID Inventory or Barcode Scan,

RFID Inventory is the default. Press the sled trigger or press Start on the application screen. The RFID tags read will be displayed as shown in the second image below.

•••• csl. 🔶	12:12 PM	🕉 87% 페 🕨
< Back		
EPC		RSSI
-		
	Start Inventory	
	Clear	
	Os	
0 tags	CS108 Bat. 82%	0 tags/s
	2	
RFID Inv	entory Bard	ode Scan

	•••• csl. 🗢	12:06 PM	\$ 889	% ***
	< Back			
	EPC		RSSI	
	909394201707060	0000000A2	â3 43	
	909493201707060	0000007D	44	
	909394201707060	000000A3	42	
	1080000000000000	0000002A	45	
	909394201707060	00000070	42	
	909394201707060	0000006B	43	
	E28011606000020	5079F6CDD	42	
	909394201707060	00000097	40	
	909493201707060	00000085	40	
	1080000000000000000	00000021	42	
		Stop Inventory	L	
Total		otop intentori	Elapsed	Rea
Inique		Clear	Time (sec)	Rate
Tags 🛛	4	1s		K
	77 tags	CS108 Bat. 82%	68	tags/s
	C		IIIB Succession France	
	REID Invento	лу	DRICCOR SCHI	

A high frequency tone will be heard when a new RFID tag is read and a low frequency tone will be heard when a tag is read again. NOTE: Make sure the sound part of the iPhone is not muted and the volume is not set too low.

A summary of tags read appears at the bottom of the screen: Total Unique Tags, Read Rate, and Elapse Time.

If you stop inventory and start again, the previous list will remain and new tags are added to it at the top. If you want to start a new list, then you can press the Clear button to clear the list.

5.1.2.7 Barcode Inventory

To inventory Barcodes, select Barcode Scan at the bottom of the screen.

Pull the sled trigger or press Start on the application screen to activate the scanner.

There is a registration/target dot to aim the scanner. A high tone will be heard when a new Barcode is scanned and a low tone will be heard when a barcode is read again.

Previous scans can be cleared by pressing the Clear text button on the screen.

No SIM 🗢	1:27 PM	∦ 100% 💼 ≁
CS108 RFID	Reader (1.0.7)	
2		
· · · · · · · · · · · · · · · · · · ·		
() .		
-		
	Charl Care	
	Start Scar	
	Clear	
	orcur	
(2000)		-
e		
RFID Invent	ory	Barcode Scan

No SIM 🗢	1:27 PM	∦ 100% 페 +
CS108 RFIE) Reader (1.0.7)	
747464122434	l.	1
DVSM-PC58U	2VB	1
	Stop Scan	
	Clear	
P		

5.1.2.8 RFID Read and Write memory banks

The Read / Write functions allows read/write of specific memory bank inside an RFID tag. You should be knowledgeable about these functions prior to using them.

NO SIN T		1:27 PM	∦ 100% 📖 +		
< Back		Read Write			
Selected EPC	690515	59811139400	0000000		
Access PWD	00000	0000000			
O PC	:	3400			
EPC Leng EP 6905159	th 96 bit C 8111394	s	0		
AC	C PWD				
КІІ	L PWD				
Т	D-UID	Offset=0 Wo	ord=2		
	SER	Offset=0 Wo	ord=2		
P	lead		Write		

When reading and writing, the status character "**R**"eading or "**W**"riting will be displayed on the right hand side of the screen.

No SIM 🗢		1:30	PM	*	100% 🚺	•+
< Back		Read	Write			
Selected EPC	690515	598111	394000	0000	000	
Access PWD	00000	000				
PC	>	3400	0			R
EPC Leng	th 96 bit	S				
EP	C					
6905159	8111394	0000	000000			R
	C PWD					
К	LL PWD					
ОТ	D-UID	Offse	t=0 Wor	d=2		
E200341	2					
	SER	Offse	t=0 Wor	d=2		
R	Read			Write	e	T
	icau			vviru	5	

At the end of the operation, you can see result "O"K or "E"rror on the right hand side:

		1:30 PM	∦ 100%	• +
< Back		Read Write		
Selected EPC	690515	5981113940	000000000	
Access PWD	0000000			
PC PC	2	3400		0
EPC Leng	th 96 bit °C	S		
6905159	8111394	000000000	00	0
	C PWD			
() кі	LL PWD			
П	D-UID	Offset=0 W	/ord=2	
E200341	2			
	SER	Offset=0 W	/ord=2	
F	lead		Write	

No SIM 🗢		1:30 PM	∦ 100%	• +
< Back		Read Writ	e	
Selected EPC	690515	598111394	0000000000	
Access PWD	00000	000		
PC PC)	3400		E
EPC Leng	th 96 bit PC	S		
6905159	8111394	100000000	000	E
	C PWD			
К	LL PWD			
	D-UID	Offset=0	Word=2	
E200341	2			
	SER	Offset=0	Word=2	
F	Read		Write	

5.1.2.9 Geiger Search

The Geiger Search function enables 'searching for' and 'homing in on' a tag. .

First, go to the Inventory page and inventory the tag, then select that tag. A pop up window asks if you want to select that tag for subsequent Read/Write operation or Geiger Search operation. Press OK.

No SIM 🗢	1:26	PM	¥ 100% 💼 +
< CS108	RFID Reader (1.0.7)	
EPC			RSSI
909394201	7070600000000	52	46
909394201	7070600000000	6C	40
909394201	7070600000000	71	36
690515981	11394000000000	0	58
80000003			55
909394	Selected Tag for	t Tag Read/Write an	nd
909493	Geiger	search	
909493	Cancel	OK	
909493201	7070600000000	B1	40
909394201	7070600000000	6D	37
	Start In	ventory	
	Cle	ear	
11 tags	CS108 Ba	it. 100%	2 tags/s
RFI	D Inventory	(i	de Scan

Now return to Main Menu (Swipe from left) and then enter the Geiger Search menu. The tag ID will already be displayed. Press Start to begin Geiger Search.

Geiger	
7060000000070	
1	
0	
)	
300	
RSSI	
Start	
	1 0 300 RSSI Start

You can also directly type in the tag ID into the Selected EPC box.

After pressing the "Start" button, you can see the RSSI and hear an audible beep when the tag is within range. The beep will become faster as you get closer to the tag. When you are very close to the tag, the beep becomes very long.

No SIM 🗢	4:26 PM	¥ 85% 🔳
K Back	Geiger	
Selected EPC		
9093942017	707060000000070	
Profile (0-3)	1	
Toggle		
Q value	0	
Power	300	
	46	
	Stop	

Press 'Stop' to exit the Geiger Counter function.
5.1.2.10 RFID Filter: Pre Filter

The RFID Filter function includes 2 types of filter: pre-filter and post-filter. When you enter the Filter page, on the bottom you can choose to enable either the pre-filter or the post-filter, or both together.

Pre-filter creates a pre-filter Tag Pattern that will be used to "select" the tags that you want to display in the Inventory page. The tag pattern can be offset and doesn't need to be from the beginning of the EPC bank. The default offset is 0, edit the value in the field. After completing all fields, set the Enable switch and press the SAVE button.

No SIM 🗢	4:26 PM	* 85% 🔳
CS108 RFID	Reader (C# 1.0.14)	
Mask data		
Offset (bits)		
0		
Enable Filter		
\bigcirc		
	SAVE	
Destriker		InstEllter

5.1.2.11 RFID Filter: Post Filter

Post Filter contains parameters for filtering AFTER the tags are inventoried by the reader:

No SIM 🗢	3:57 PM	* 89% 페
CS108 RFID	Reader (1.0.13)	
Mask data		
Offset (bits)		
0		
Select not ma	tch MASK	
\bigcirc		
Enable Filter		
\bigcirc		
	SAVE	
PreFilter	6	PostFilter

It is possible to implement both the pre-filter and post-filter functions together.

5.1.2.12 Security

Security involves implementing memory lock on certain banks of the tag. You need to be careful administrating a lock function to a tag. If you lock a memory bank and forget the password to unlock it, then the specific part of the memory cannot be read or written anymore.

No SIM 🗢	1:32 PM	¥ 100% 💷 +	
< Back	Security		
Selected EPC	690515981113940000000000		
Access PWD	0000000		
EPC	UNCHANO	GED	
ACC PWD	UNCHAN	GED	
KILL PWD	UNCHANG	GED	
TID	UNCHAN	GED	
USER	UNCHAN	GED	
	Apply Security	/	

Touching the select box with the "UNCHANGED" text will display 5 choices on the screen: UNLOCK, PERM_UNLOCK, LOCK, PERM_LOCK, UNCHANGED. These are the 5 actions you can choose for each of the memory banks inside the RFID tag.

•••• csl. 🗢	12:53 PM	\$ 81% 📖)
< Back	Security	
Selected EPC		
Access PWD	0000000	
EPC	UNCHANGED	
ACC PWD	UNCHANGED	
KILL PWD	UNCHANGED	
TID	UNCHANGED	
	UNLOCK	
	PERM_UNLOCK	
	LOCK	
	PERM_LOCK	
	UNCHANGED	
	Cancel	

You can lock, unlock, permanently lock, and permanently unlock a memory bank of the tag. The detailed definitions of these 4 operations can be found in the EPC Global document which can be found on the EPC Global website:

<u>https://www.gs1.org/epcrfid/epc-rfid-uhf-air-interface-protocol/2-0-1</u>. Once there, press the button showing the latest air interface protocol and mouse click to get the pdf file. More details can be found on Appendix G.





After Applying the changes the resulting Success or Fail message will be displayed on the bottom of the screen.

No SIM 奈	1:33 PM	∦ 100% === +		
< Back	ack Security			
Selected EPC	690515981113940000000000			
Access PWD	0000000			
EPC	UNCHAN	GED		
ACC PWD	UNCHAN	GED		
KILL PWD	UNCHAN	GED		
TID	UNCHAN	GED		
USER	UNCHAN	GED		
	Apply Security	/		
	FAIL			

5.1.2.13 Register Tags

Register Tag is a section of the CS108 Demo Application page allowing the user to scan a barcode, and then write that information into a specific memory bank of an RFID tag. That information is often saved in a certain section of the EPC memory bank, or in the USER memory bank. This section allows you to select which memory bank and which offset location to write that information to. Moreover, it allows you to set a tag mask so that it would only write to tags with a certain tag pattern.

No SIM 🗢	1:33 PM	\$ 100% 🛑 🗲
< Back	Register Tag	
Step 1: Read	l Barcode	
Barcode Read	E Contraction of the second se	
Step 2: Sele	ct tag mask Offset	(bit) 0
EPC		Select
Step 3: Write	e to Bank Offset(w	ord) 0
EPC	Write	
	Automatic	
Last Write Ta	ag Result NA	
Write Tag Co	ount <mark>0</mark>	

5.1.2.14 Special Functions

Special functions for specific application scenarios are provided in this page. Three special functions are available at this time. More will be added in the future.



5.1.2.15 Multi Bank Inventory

This is a special feature. You can inventory one or two additional banks in inventory, as well as the EPC data.

Select the bank, offset and count (in words: 1 word is 2 bytes; 1 byte is 8 bits; 1 byte can be represented by 2 hex numbers) that you want displayed in the inventory.

No SIM 🗢		3:59 PM	\$ 89% 🔳
K Back	5	Special Functions	
	N	/ulti Bank Inventory	
C	First Ex	tra Bank	
Bank		TID (Bank 2)	
Offset	0		
Count	2		
0	Second	l Extra Bank	
Bank		User (Bank 3)	
Offset	0		
Count	1		
		ОК	

No SIM 🗢	1:34 PM	∦ 100% == •≁
< Back	Multi Bank Inventory	
EPC		RSSI
17		
	Start Inventory	
	Clear	
0 tags	CS108 Bat. 100%	0 tags/s

No SIM 🗢	1:34 PM	∦ 100% == •≁
< Back	Multi Bank Inventory	/
EPC		RSSI
6905159811	1394000000000	66
E200		
80000003		54
E200		
9093942017	0706000000052	52
E280		
7099994000	000000000000000000000000000000000000000	44
E200		
30352A9050	0007D0011E1A301	42
E280		
7099994000	80000000000008	36
E200		
1081000000	0000000000040	40
E280		
-		
	Stop Inventory	
	Clear	
7 tags	CS108 Bat. 100%	5 tags/s

5.1.2.16 Phase and Channel Inventory

The page shows the inventory with RSSI, operation frequency and phase data.

No SIM 🗢	1:34 PM	*	100% 💷 🔸
< Back	RFID Inventory		
EPC	RSSI	Freq	Phase
	Start Inventory	/	
	Clear		
0 tags	CS108 Bat. 100%		0 tags/s

No SIM 🗢 1:34	I PM	\$ 10)0% 💼 🗲
Kerk RFID In	ventory	'	
EPC	RSSI	Freq	Phase
6905159811139400000000 0	70	919.75	-21
8000003	60	911.75	36
909394201707060000000 52	55	911.75	0
709999400000000000000000000000000000000	44	907.75	37
30352A9050007D0011E1A30 1	40	923.75	-23
300833B2DDD9014000000 00	42	913.75	-44
10810000000000000000000000000000000000	42	903.75	-10
0000000000000015A00000 02	39	908.75	45
Start In	ventor	у	
Cle	ear		
8 tags CS108 Ba	t. 100%		3 tags/s

5.1.2.17 Periodic Read

In some business scenarios, you do not do continuous reading but instead do a periodic reading of tags. You can set the read time and waiting time (no read). The Program will show you the battery level and tag rate per cycle.

No SIM 🗢	1:35 PM	\$ 100% 🛑 / +
< Back	Periodic Read	
Read 10	seconds	
No Read 10	seconds	
	Start	

No SIM 🗢	1:36 PM	🗱 100% 📖 +
< Back	Periodic Read	
Read 10	seconds	
No Read 10	seconds	
	Stop	
Round 3 26/10/17 13:36:01 26/10/17 13:35:51 26/10/17 13:35:41 26/10/17 13:35:31 26/10/17 13:35:21 26/10/17 13:35:11, 26/10/17 13:35:11,	,RND=3,Tag=62,4.085v, ,Start Round 3,4.09v ,RND=2,Tag=54,4.085v, ,Start Round 2,4.09v ,RND=1,Tag=56,4.085v,I Start Round 1,4.09v Start Test	ET=0 ET=0 ET=0

5.1.2.18 Exiting the Software

The user can exit the software by simply pressing the Home button. However, this is only sending the App to the background. See the next section on how to exit the application.

5.1.2.19 Truly Exiting the Software

On the iPhone OS, when you press the iPhone Home button, the Application is not really closed, only moved into the background.

To fully exit the software, double click the Home button, and then the CS108 demo App will show as one of the Applications in the background, select the CS108 App and then use a finger to drag/swipe it upward and out of the phone to truly exit the software.

5.1.2.20 Source Codes

Source code for this demo application, other files and documents are available on Convergence Systems Limited website:

http://www.convergence.com.hk/downloads-support-2/cs108/

5.2 Software on a PC – connecting via USB

The CS108 can also be controlled via the USB cable. In this case the mobile phone is not required and Bluetooth is not turned on.

Below is the screen capture of an application on a PC controlling CS108. Everything is self-explanatory in the application:

HD	Lana a			Annaector		
Index	PC	EPC		RSSI	Count	
0	3000	3005FB63ABEEAFC1EC88851A	61.6	345		
1	3000	E2806810000003901BFF799			16	
2	3000	E28068100000039028E1D84			97	
3	3000	300833B2DDD901400000ABCD			53	
4	3E00	00800080B0443C0000001208DD3A6B21		40	22	_1
5	3000	E28068100000039012CCDEF		38.4	24	
6	3000	1A1A1A1A1A1A1A1A1A1A1A		40.8	38	
7	3000	E28068100000039012C94B3		38.4	21	
8	3000	E28068100000039012CCDFF		43.2	30	
9	3000	AAAB0000000000000000000000000000000000		37.6	13	
10	3000	E28068100000039028E62E7		36.8	31	
11	3000	300833B2DDD906C00000000		45.6	16	
12	3000	AAAAAAAAAAAAAAAAAAAAAAA		38.4	3	
13	3000	E280116060000205303BCABC		42.4	22	
¢				1.22		>
Pow	er On	Power Off Start Inventory Stop I	Inventory Clear			
ettings ower:	300 0	320				
hannel:	0 0	hopping; 1-50 = fixed channel				
rofile:	1 0	3 Set	Get Version			
0:						
tenna Cy tenna Cy	vole End Pao vole End Pao	ret. set.		^		

Figure 5-1 PC Application Screen – controlling CS108 via USB

Source code of the PC App for the CS108 is also available for download from Convergence website: <u>www.convergence.com.hk</u>

Appendix A. Federal Communications Commission Compliance

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 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 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 or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Consult the dealer or an qualified radio/TV technician for assistance

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 (such as co-located antennas transmitting the same information) is expressly forbidden.

This Class B digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

Note:

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

Appendix B: Reader Modes (Link Profiles)

There are 4 link profiles in the CS108: 0, 1, 2, 3. Only 1 profile is active at any time in the CS108. The purpose of each link profile is explained below. These definitions correspond to different application or physical scenarios. The user should try out each profile to see which one gives best performance.

Reader Mode/	0	1	2	3
Link Profile				
Definition	Rest Multinath	Longest Read	Read Range	Maximum
Definition	Eading	Dongo Dongo	and	Throughput
	rauing	Range, Dense		Throughput
	Resistance	Reader Mode	Throughput,	
			Dense Reader	
			Mode	
R-T Modulation	DSB-ASK	PR-ASK	PR-ASK	DSB-ASK
Tari (µs)	25.00	25.00	25.00	6.25
Х	1.00	0.50	0.50	0.50
PW (Pulse Width in usec)	12.50	12.50	12.50	3.13
RTcal (usec)	75.00	62.50	62.50	15.63
TRcal (usec)	200.00	85.33	71.11	20.00
DR (Divide Ratio)	8	64/3	64/3	8
T-R Modulation	FM0	Miller-4	Miller-4	FM0
TRExt	1	1	1	1
Link Frequency(LF)	40	250	300	400
(KHz)				
Data Rate (Kbps)	40	62.5	75	400

Appendix C: Sessions

Session is a concept of the EPC Global Standard to allow a tag to respond to multiple readers inventorying it at the same time, each using a different session number.

There are 4 possible sessions: S0, S1, S2, S3.

The user however has to be careful because these 4 sessions have different behaviors, notably how the tag flag "persists" in time. A tag, before being inventoried or when just after being powered on, has a flag of State A. When it is inventoried, the flag will go to State B. The tag flag will stay in State B until the tag powers off or the persistence time is up.

A reader can declare it only wants to inventory flag A, so that after a tag is inventoried and its flag gone to State B, it will no longer respond to further inventory rounds – until the end of the persistence time.

Now for S0, S1, S2 and S3, the persistence times are DIFFERENT! Because of that, one has to be very careful in choosing which session to use.

Session	Tag Flags Persistence Time
S0	Tag Energized: indefinite Tag Not Energized: none
S1	Tag Energized: 0.5 second < Persistence Time < 5 secondsTag Not Energized: 0.5 second < Persistence Time < 5 seconds
S2	Tag Energized: indefinite Tag Not Energized: 2 seconds < Persistence Time
\$3	Tag Energized: indefiniteTag Not Energized: 2 seconds < Persistence Time

Appendix D: Tag Population and Q

Tag Population is the RFID tag population that is to be inventoried. To be more precise, it is the population of tags that can be "seen" by the RFID reader.

Q is an EPC Global Standard concept related to the way a group of tags is inventoried. When a reader broadcasts its desire to inventory tags, it sends out a Q value. The tag will, based on that Q, calculate a certain number and define that as the number of repeated inventories the reader will do. Basically, the relationship of Inventory Repeats and Q is:

Inventory Repeats = 2^{Q}

The tag will then choose by random a certain number less than this Inventory Repeats. When the reader starts doing inventory, the tag will then respond at that repeat number.

In other words, the Inventory Repeats should correspond to Tag Population:

Tag Population = Inventory Repeats = 2^{Q}

For example, if there are 8 tags, then in theory the Q can be 3, and if each tag chooses a number different from that of the other 7 (miraculously, of course), then the 8 tags will be inventoried in an orderly manner in turn.

Of course this will never happen, as the tags will easily choose a number the same as that of another one, and a collision will occur.

Therefore, it is a normal practice to have a bigger Q, such as 4 in this case, so that the 8 tags would have a lower chance of choosing the same number.

Therefore, reversing the equation, ideally, we can have:

Q = INTEGER(LOG₂(Tag Population))

But in reality, we need some headroom, so that:

 $Q = INTEGER(LOG_2(Tag Population x 2)+1$

Appendix E: Query Algorithm

There are 2 types of Query Algorithm: Fixed Q and Dynamic Q.

For Fixed Q, the Q value does not change. In other words, the expected Tag Population does not change.

For Dynamic Q, the Q value changes adaptively: when there are a lot of inventory repeats where no tags respond, the reader will interpret that there are not that many RFID tags in the front environment, and hence it is more efficient to change the Q to a smaller value. When there are a lot of inventory repeats where the reader receives data but they do not satisfy checksum, meaning there is heavy collision, then the reader will interpret that there are too many RFID tags in the environment and hence it is better to increase the value of Q. Dynamic Q algorithm is a way to allow the RFID reader to adapt to different amount of RFID tags being seen by the reader. The idea is that if there are a smaller number of tags in the environment, then the Q can be reduced and the reader can collect all the tag data faster.

Appendix F: Target

Target here actually refers to the target flag that the reader wants to inventory. There are 2 possible flags of an RFID tag: State A and State B.

When an RFID tag is first powered up, it has a flag of State A. After it is inventoried, the state of the flag becomes State B.

The tag will only go back to State A if either it is powered off and powered on again, or if its persistence time has run up (See Appendix B).

For each round of inventory, the reader sends out a notification to the environment which tag flag state it wants to inventory. It can inventory State A, or it can inventory State A and State B alternatively from one round of inventory to the next round of inventory.

In theory, it is a good thing to inventory only State A. The reason being that those tags that have been inventoried should not respond again, and will hence quickly reduce the amount of collisions between tags. Generally in practice if you set inventory to State A only, the inventory of large amount of tags can be faster.

The only catch is that when a tag responds to the reader, it does not know another tag is colliding with it. It sends out the response and thinks it has done the job, hence transitioning to flag State B. So in such a case, the tag will not respond to further inventory queries by the reader, even though its response has been lost due to collisions. Because of that, sometimes the user will set the inventory to target State A in one inventory round, and then State B in the next round, and vice versa, and so on. This is called A/B Toggle or A & B Dual Target or simply Dual Target.

Appendix G: Security

There are 4 actions you can apply on the memory inside an RFID tag:

- 1) Lock
- 2) Unlock
- 3) Permanent Lock
- 4) Permanent Unlock

You can obtain an EPC Global document which can be downloaded from the EPC Global website that explains this:

https://www.gs1.org/epcrfid/epc-rfid-uhf-air-interface-protocol/2-0-1.

Once there, press the button showing the latest air interface protocol document and click on it to get the pdf file.





For the Access Password and Kill Password the security locking affects both reading and writing.

For the EPC memory bank and the User memory bank, the security locking affects only writing.

For the TID memory bank, since we are the user and not the manufacturing vendor, there is no security action that can be applied. It has been permanently unlocked in the factory and it cannot be changed.

Appendix H: Models & Regulatory Region

There are various models, denoted by the alphanumeric key to the right of the dash after the "CS108-", here denoted by "N". The applicable regulatory regions for each model are described below:

865-868 MHz for Europe ETSI, Russia, Mid-East countries,	
865-867 MHz for India	
902-928 MHz, FCC, for USA, Canada and Mexico. Hopping frequencies locked	
920-926 MHz, Australia. Hopping frequencies locked	
921.5-928 MHz, New Zealand. Hopping frequencies locked	
920-925 MHz, Hong Kong. Hopping frequencies locked	
920-928 MHz, Rest of the World, e.g. Philippines, Brazil, Peru, Uruguay, etc.	
922-928 MHz, Taiwan	
920-925 MHz, China	
916.7-920.9 MHz, Japan	
915-921 MHz, Europe Upper Band	

Appendix I: Technical Support

All technical support should be sent to the following email:

info@convergence.com.hk