CS108-2 EPC Class 1 Gen 2 RFID Sled Handheld Reader User's Manual

Version 5.0

CSL: The One-Stop-Shop for RFID Solutions

1 Content

2 FCC and IC Statement

FCC NOTICE:

To comply with FCC Parts 15 rules in the United States, the system must be professionally installed to ensure compliance with the Parts 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.

IC Notice (Industry Canada):

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.

3 Introduction

3.1 CS108-2 RFID Sled Handheld RFID Reader

The CS108-2 Sled handheld RFID reader is a reader designed to work with an off-the-shelf smart phone (such as iPhone or Android phone) via Bluetooth connection, where the application on the smart phone would control the CS108-2 reader to perform RFID tag reading or barcode reading.

Below photo shows the smart phone separately handled by the user during operation:

Note: Smart phone and CS108 can only be paired via the App provided. They DO NOT pair via the normal Bluetooth Device connection page of the OS. Therefore, install the App first and pair the CS108 from inside the App.

Below photo shows the smart phone mounted (detachable) on top of the CS108-2 reader during operation:

CS108-2 can also be controlled via the USB connection by a PC. In this case, the Bluetooth connection is not used. The control commands enter via the USB cable. The application is on a PC.

Below photo show the CS108-2 handheld reader connected via USB cable to (and controlled by) a PC.

3.2 Product Package

3.2.1 Basic Package Content

The reader package contains:

- Handheld reader
- USB cable
- Battery – 1 piece, inside the reader

3.3 Product Specification

Figure 3-1 CS108-2 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 more than 18 meters for Monza R6 Dogbone tag
- 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 wireless LAN traffic and server loading
- 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: 16.1 cm; Width: 9.0 cm; Height: 16.1 cm; Weight: 595 grams
Environment:	Operating Temp: -20^0C to 50^0C Storage Temp: -40^0C to 85^0C Humidity: 5% to 95% non-condensing Enclosure: IP-54
Antenna:	2.7 dBi Gain internal patch antenna
RF Power:	Internal conducted power 30 dBm
EIRP Power:	32.7 dBm
RFID Frequency Ranges:	902-928 MHz band
Interfaces	Bluetooth 4.0 USB
Accessories:	USB cable
Order Code:	CS108-2
Restrictions on Use:	Approvals, features and parameters may vary depending on country legislation and may change without notice

4 Introduction

4.1 Basic Hardware

The CSL CS108-2 handheld RFID Reader is an EPCglobal Class 1 Gen 2 handheld reader product.

Below is the front view of the CS108-2 reader. The barcode lies in a compartment at the top. The RFID reader is in the front box, with the embedded patch antenna inside the cover facing forward.

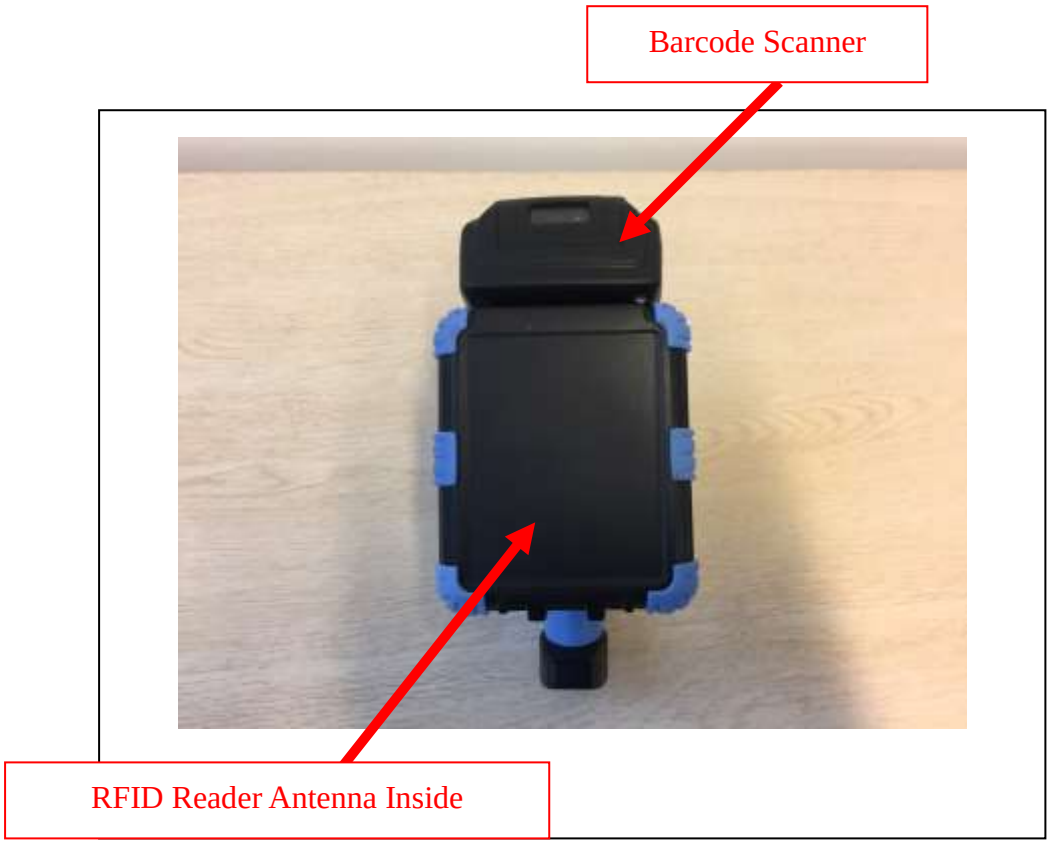


Figure 4-1 CS108-2 Reader Front View

Below is the left side view of the CS108-2 reader. There are 5 LEDs on this side, from left to right, representing respectively:

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

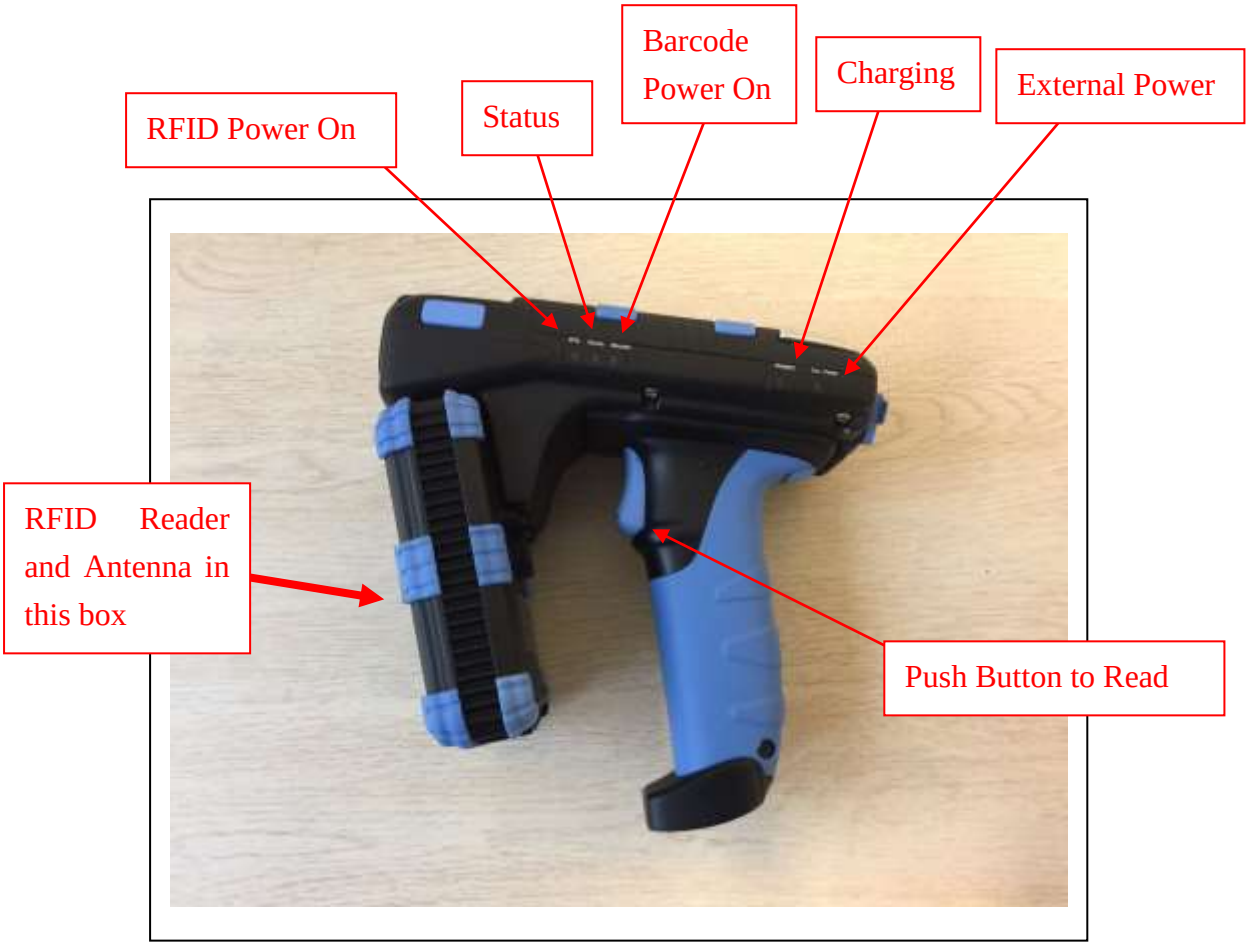


Figure 4-2 CS108-2 Reader Left Side View

Below is the right side of the CS108-2 reader. There are 2 buttons/LEDs here.

The left button/LED is for Bluetooth pairing, and the LED lighting up meaning Bluetooth is connected.

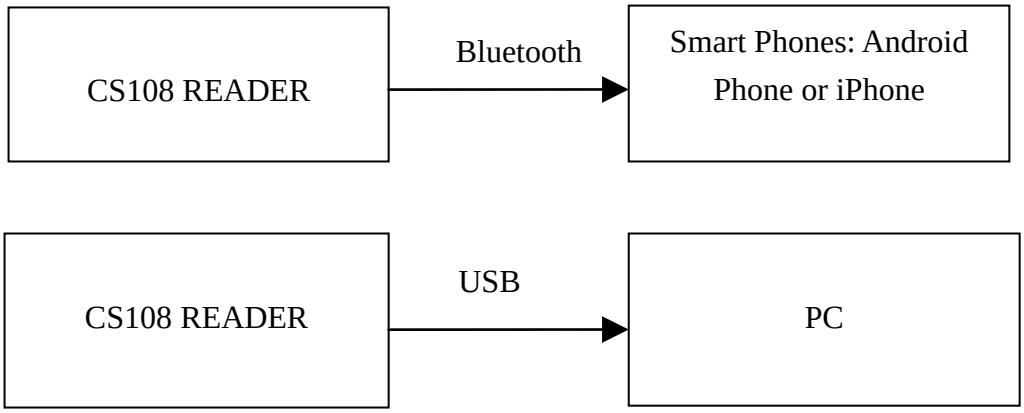
The right button/LED is for main power, with LED lighting up meaning power is on. Press the button continuously for 3 seconds, then release to power on. When the reader is on, press the button continuously for 3 seconds, then release to power off.

Figure 4-3 CS108-2 Reader Right SideView

Below is the rear view of the CS108-2 reader. Here the USB Type C socket is on the left, allowing the user to connect CS108-2 to a PC for control, or to a USB power source to recharge the battery inside the CS108-2. A reset button is on the right, this is for resetting the CS108-2.

Figure 4-4 CS108-2 Reader Rear SideView

Based on this, one can see the CS108-2 can be connected to either a smart phone via Bluetooth for control and data collection, or to a PC via USB cable for control and data collection.



4.2 Power Up Sequence

The reader can be turned on to run RFID and Barcode operation in a most simple manner:

1. Insert battery into the body of the handheld reader with the top plastic cover removed. Also, make sure it is in the correct direction in terms of front and back. The battery connectors should be at the back of the reader. Put the cover back once battery is inserted.
2. Press the power button on the right side of the reader continuously for 3 seconds then release.
3. After you release the finger, then the Blue LED should lit up.
4. The reader is now turned on.

4.3 Bluetooth Turn On for Discovery Sequence

1. Press the Bluetooth button on the right side of the reader continuously until the blue LED starts flashing. Do not release your finger, you need to press UNTIL the Blue LED lit up. Because of that, press the button in a way such that the LED is not obstructed by your pressing finger.
2. The reader is now discoverable by smart phone App. Note that only the CSL App can connect to the CS108. The generic Bluetooth Device Search of the OS cannot connect to CS108.

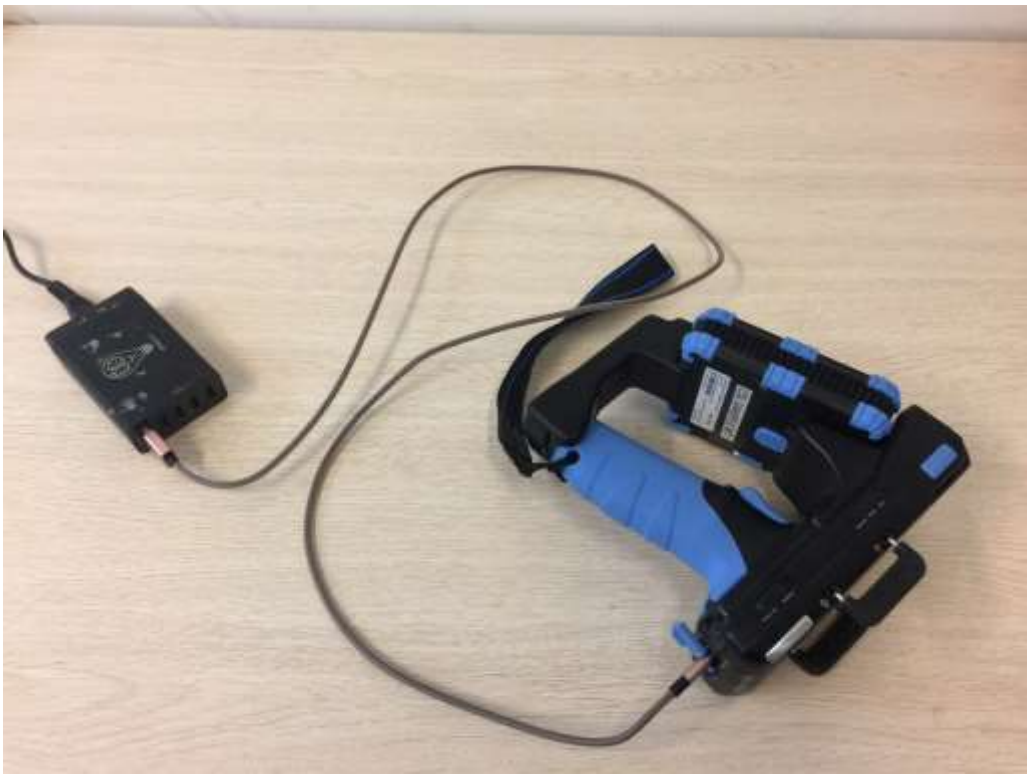
4.4 Charging the CS108

The CS108 can be 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

2 LEDs will light up:

1) "Ext. Power" LED: Blue LED. Whenever the USB is connected with power supply, this blue LED will light up.
2) "Charging" LED: Red LED. When battery is heavily drained, this red LED will be bright. When battery is completely recharged, this red LED will be very dim. So if you connect the USB cable and this LED is very dim, do not be alarmed. It just means the battery is pretty full already.



4.5 Software on Smart Phones

The reader comes with standard demo application for iPhone and Android Phone, install the application from App Store or Google Play correspondingly, then double click the icon “CS108 Demo App” to start.

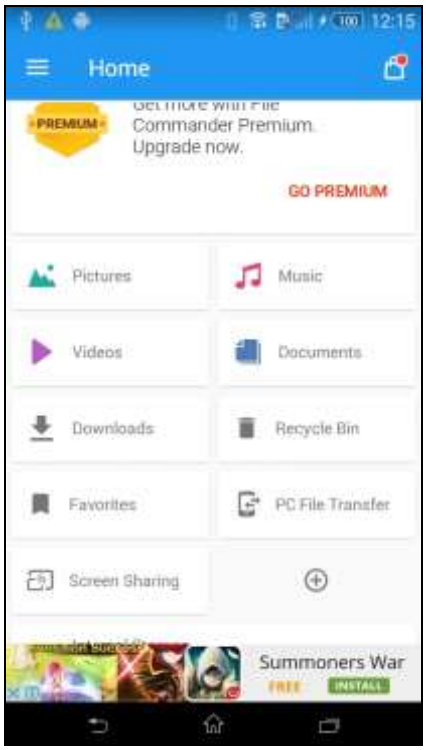
4.5.1 Software on Android Phone

4.5.1.1 Installing the Android Software

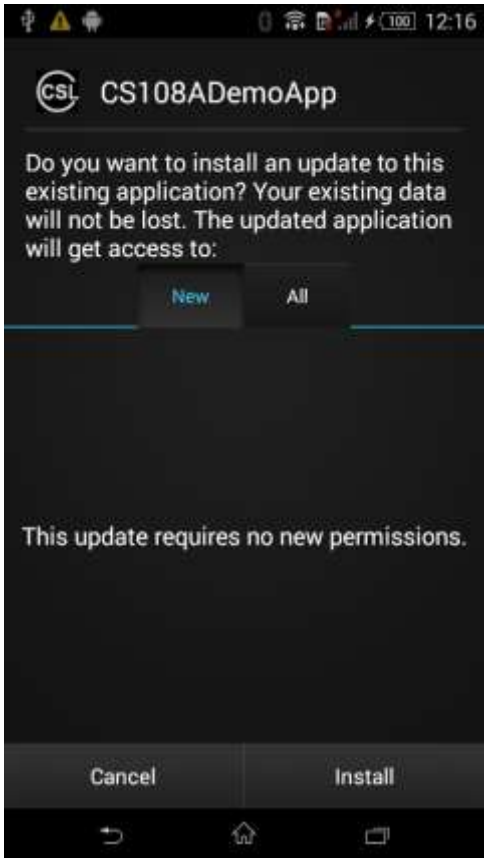
Download the APK from Convergence website. Save that to the Download folder.

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:



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

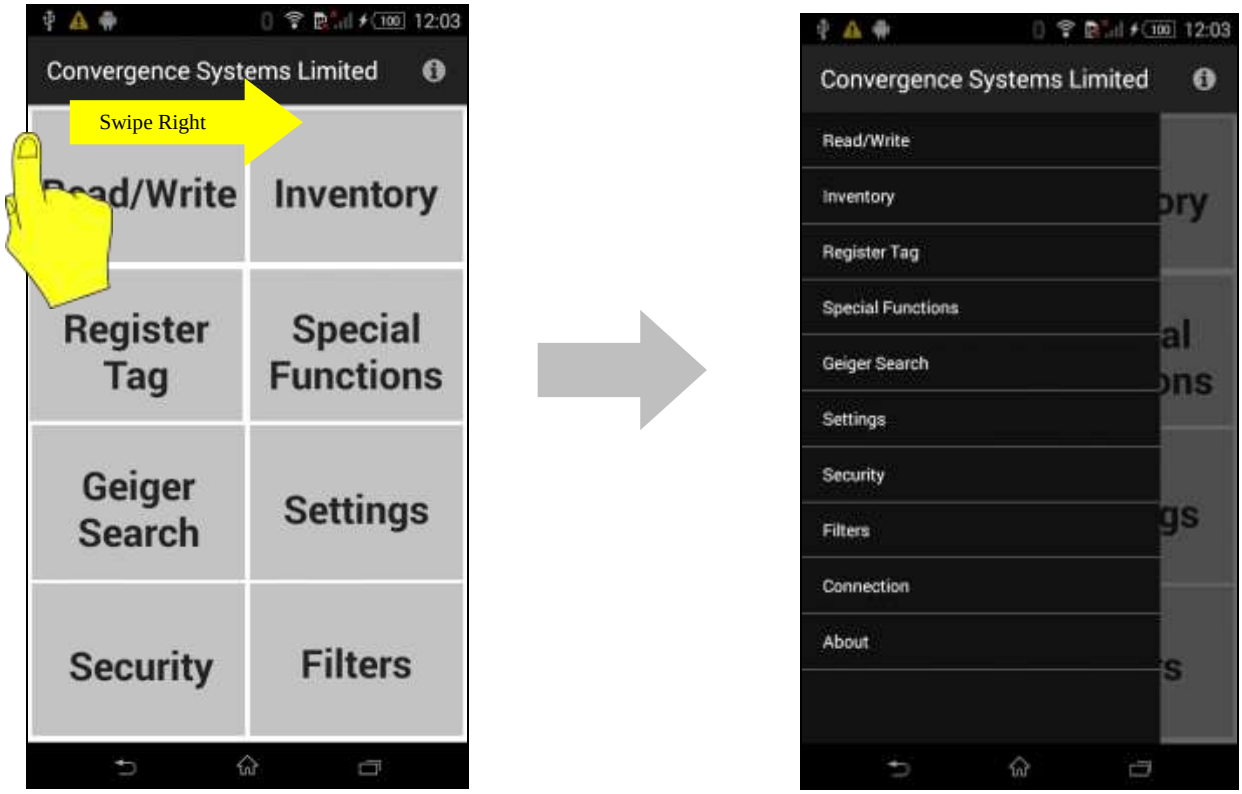
4.5.1.2 Starting the Android Software

The CS108 Android App icon is as follows.

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

4.5.1.3 Searching and Connecting to (Pairing with) CS108

To start searching and connecting to (pairing with) a CS108 nearby, use the finger to SWIPE the screen from the LEFT edge to invoke the menu:



Please make sure the CS108 Bluetooth button has been pressed until the Blue LED is flashing, meaning the CS108 is ready for discovery by Smart Phones nearby.

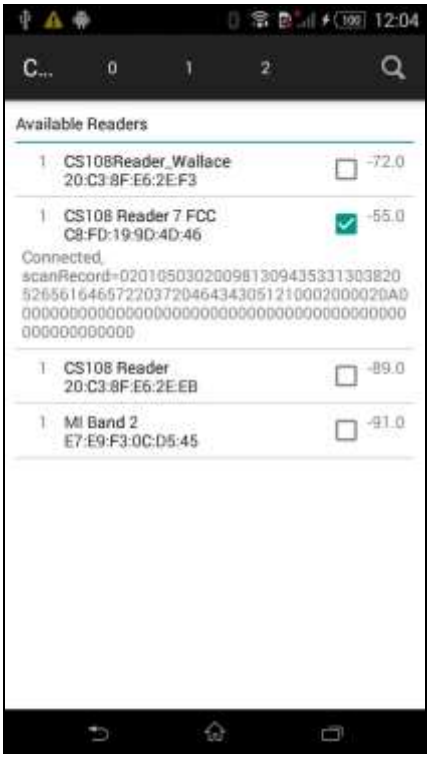
After that, select the line “Connection” to start the search and connect to CS108 process:

Note the Search icon to the upper right of the page, press that icon:

Then you should see all the available CS108 nearby:

Select the one you want to connect to and press it first to select it and then press it again to start the connection process (IN OTHER WORDS, YOU NEED TO PRESS 2 TIMES):

After that you should see “Connected” below the reader title:

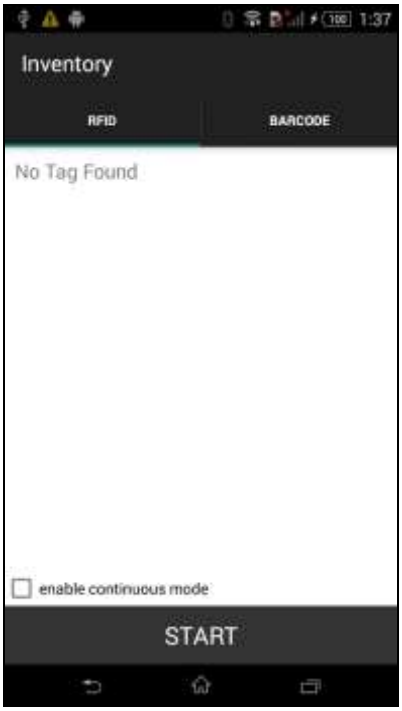


Note: If you have multiple CS108, you should set them to different names to distinguish one from another.

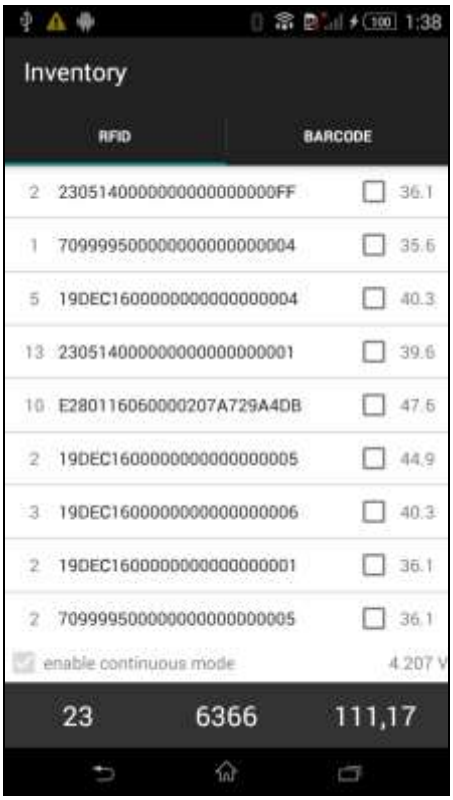
4.5.1.4 RFID Inventory

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

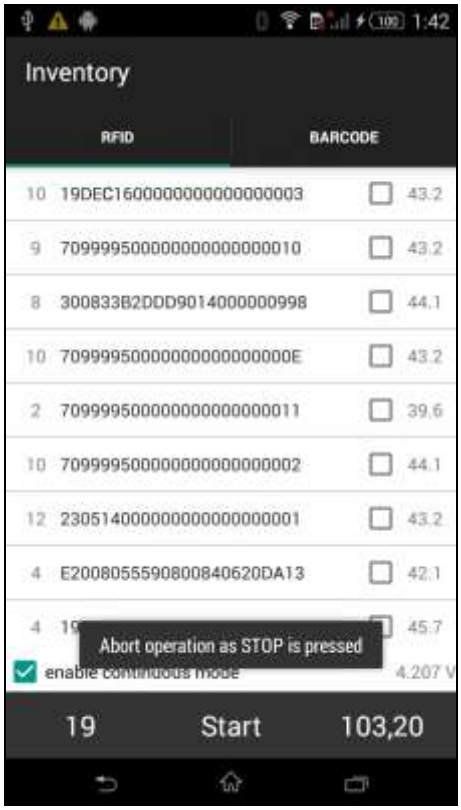
Click the “enable continuous mode” box for continuous inventory:



Wait for the CS108 to start inventory and then you should see the RFID tags ID as shown below. The first column is the number of reads of that tag ID, second column is the RFID tag EPC ID, last column is the RSSI of the tag return. On the lower right, you can also see the battery voltage at that point. When fully charged, it is around 4.2 Volts. The unit should run to about 3.3 Volts before it stops.



At any point, if you want to stop, just press the middle center location (here showing 6366) which is the location of the original start button, and the reader will stop inventory of RFID tags and the screen will become like the following, where the Start button appears again:



4.5.1.5 Barcode Inventory

To do a barcode inventory, go to Inventory button:

Then press the BARCODE button:

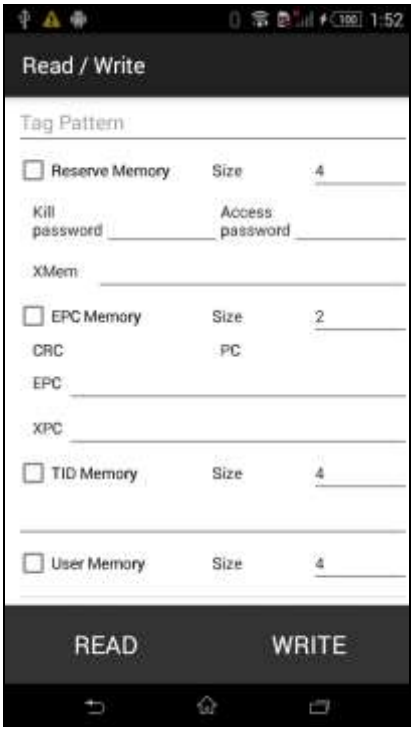
Press the START button. At this point, the red LED of the barcode reader should lit up to help you aim your CS108 barcode reader onto the barcode. A focused circular dot should appear. That is where the distance of the barcode should be with respect to the reader.

Once the barcode is read, you can now Stop.

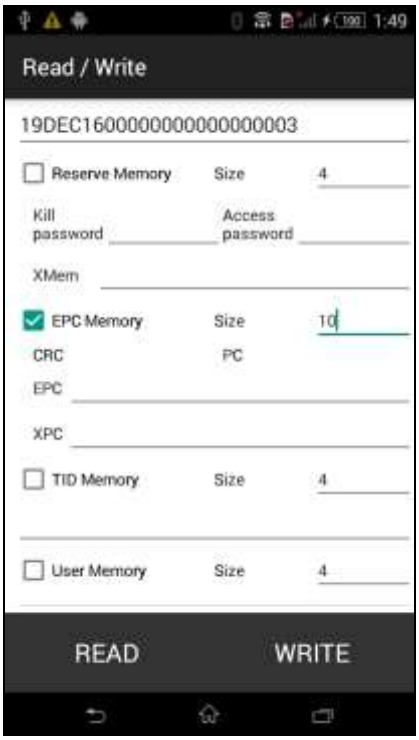
4.5.1.6 RFID Read and Write memory banks

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

You will now see this. You see the Bank 0, 1, 2, 3 of the EPC tag. Select at least one bank to read or write. Note that Bank 2, TID bank, cannot be written, as defined by EPC.

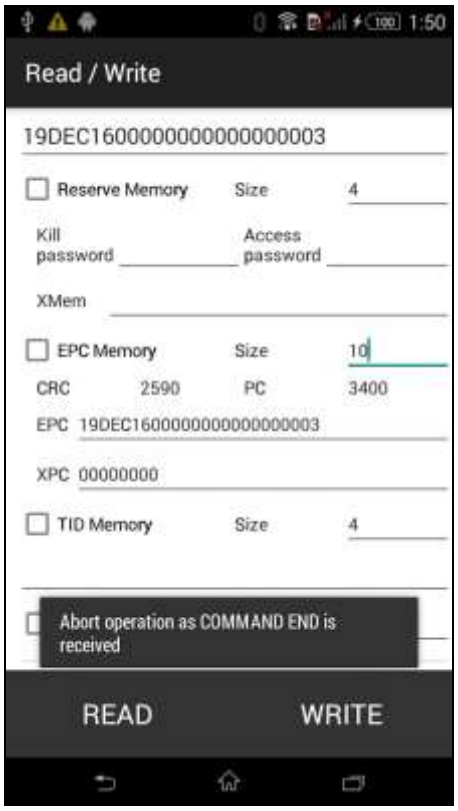


On the Tag Pattern input box, if you do not input anything, the reader will simply read whatever tag that it sees. You can input a string of hex number to select the pattern. You can either input the whole EPC ID, or part of it to denote a pattern, with the remaining being wild card.



Another way to do a Read/Write is to first go to Inventory page to inventory the tag. Then select one by ticking the box on the third column.

After that, return to Main Menu and then go to Read/Write page. Then you will see that particular selected ID already in the Tag Pattern box:

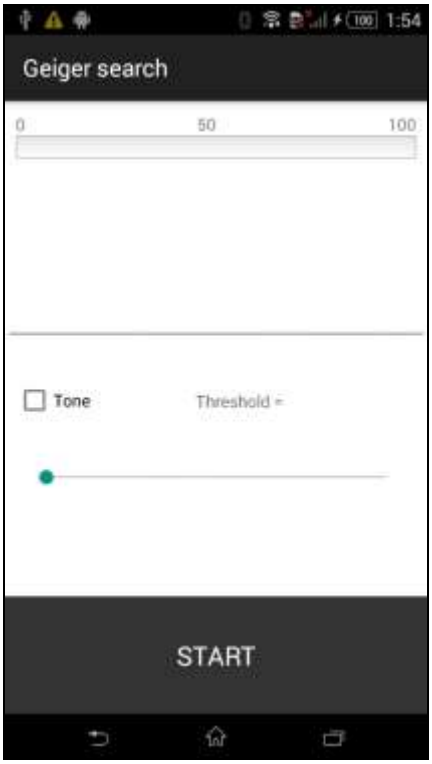


At this point you can read or write any specific banks.

4.5.1.7 Geiger Search

One can do a tag search by going to the Geiger Search page:

Input the tag ID on the line:



Press Start. It will then keep reading that tag and show the RSSI, as well as beeping a tone by selecting the Tone box and also setting the Threshold to emit sound.

One can now use this method to home in onto a tag (in other words, to the asset tagged with that particular tag)

Another way to zero in on a tag that is in an area 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 that you want to home in onto by ticking the box on the third column:

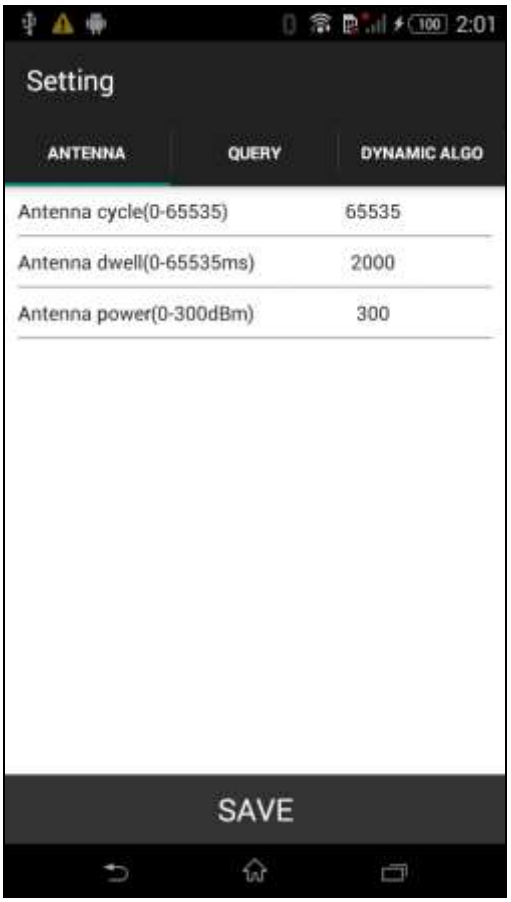
After that, return to Main Menu and then enter the Geiger Search page, now that ID will already be in the Input space, and you can start the Geiger Search:

To Stop, just press the location of the Start button, here covered by “7949”, and the search will stop.

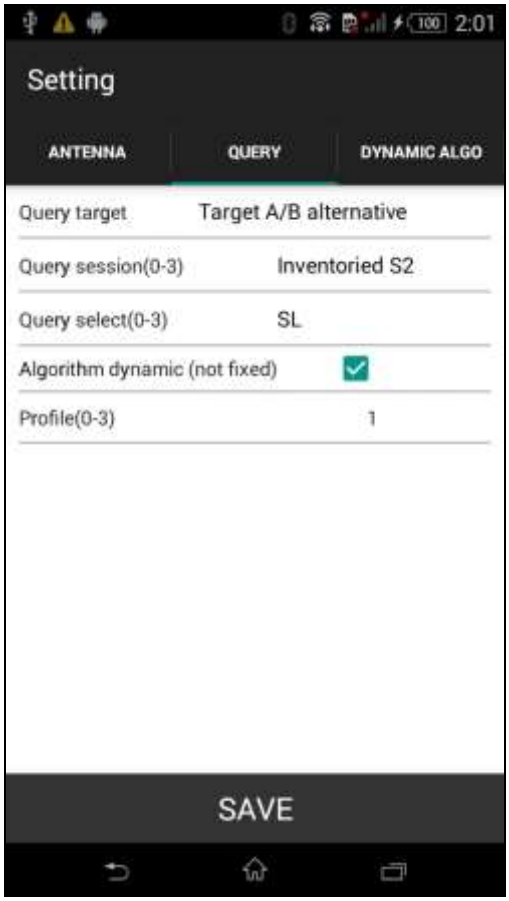
4.5.1.8 Setup

One can set up the reader's parameters in the Settings page:

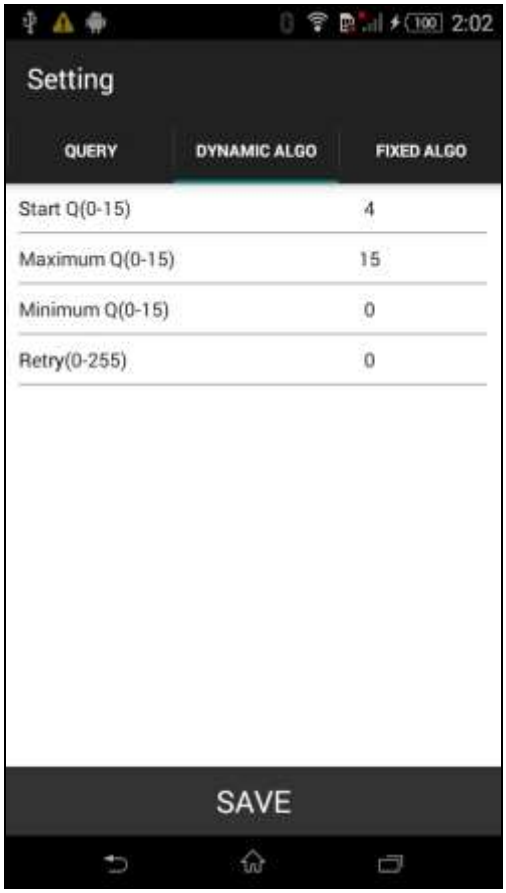
In the Antenna menu, one can define the Antenna Cycle (65535 means continuous read), Antenna Dwell Time (2000 means 2 seconds). Antenna Power (300 means 30 dBm).



In the Query menu, one can define the Query Target, Query Session, Query Select, Q Algorithm, and Link Profile (See Appendix B). For definitions of the above, please read the EPC Air Interface Protocol document.

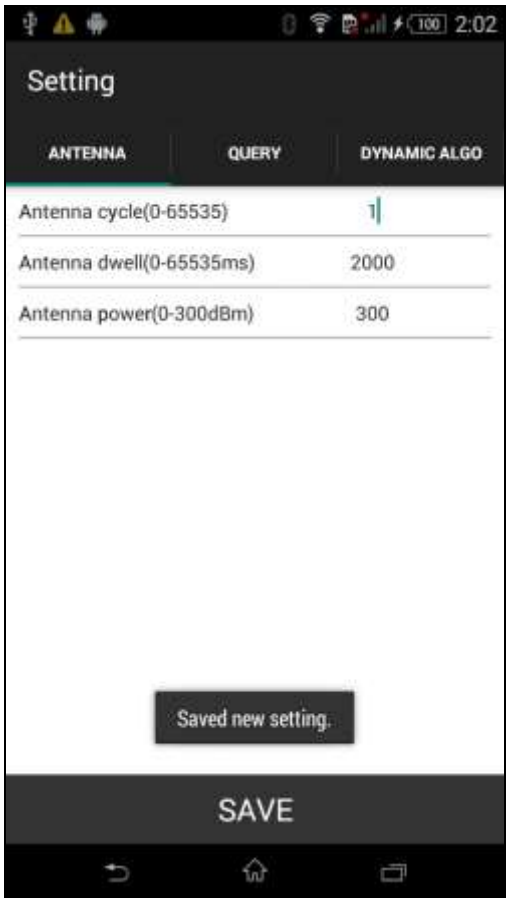


The Dynamic Algo menu contains the setting for Dynamic Q algorithm.



The Fixed Algo menu contains the parameters for Fixed Q algorithm:

Whatever changes one has made, one must press the SAVE button.

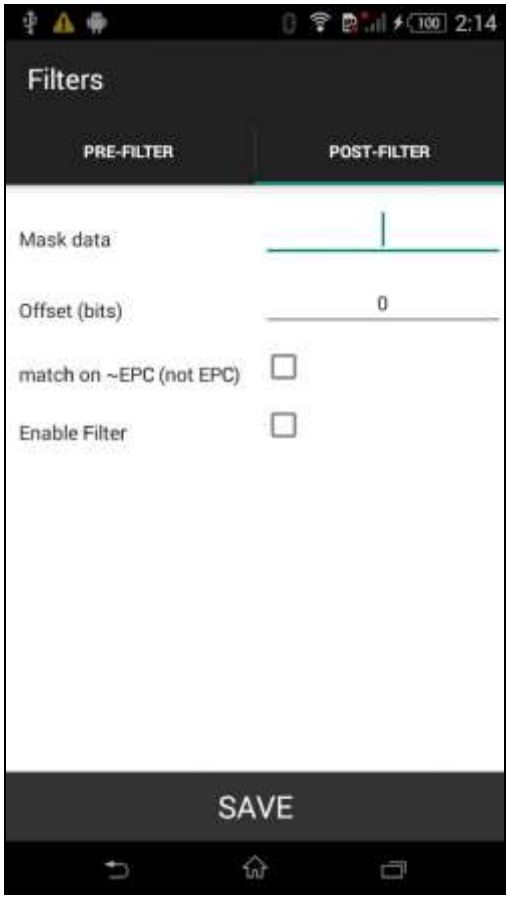


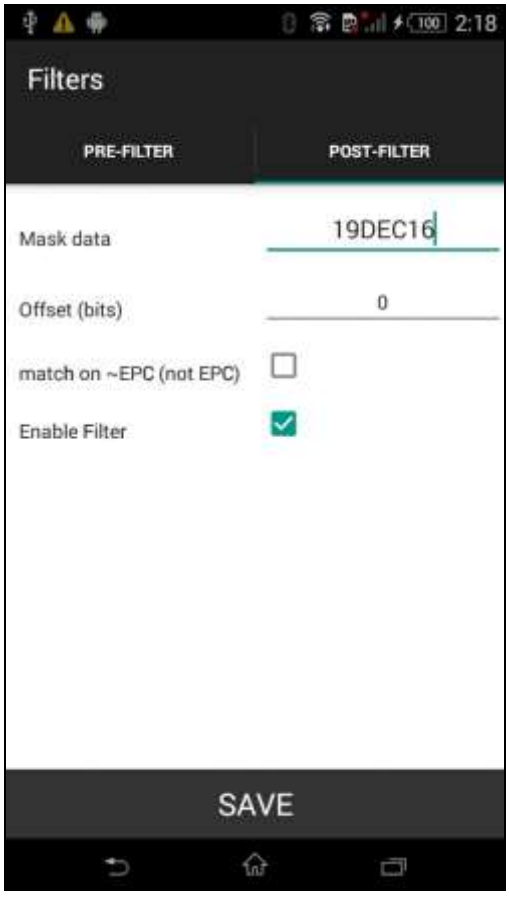
4.5.1.9 Filter: Pre Filter

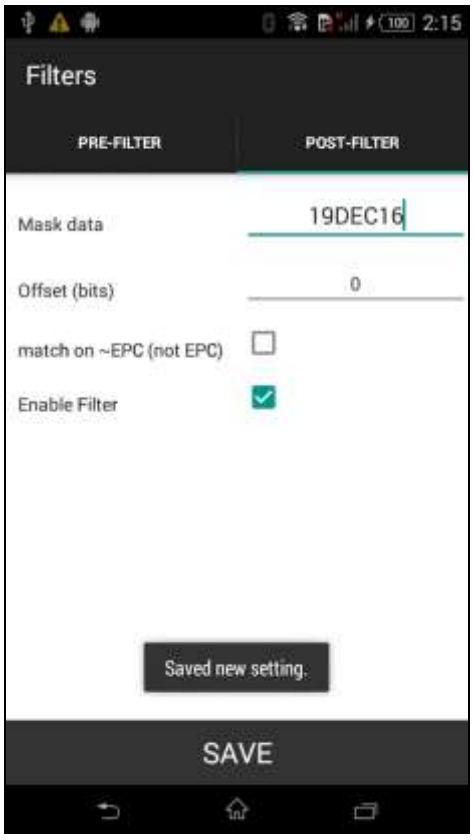
One can add a pre-filter, i.e., a Select Filter, to only have a certain group of tags respond to the reader's query. To implement this, go to the Filters page:

4.5.1.10 Filter: Post Filter

One can filter the inventoried tags further using the Post Filter:



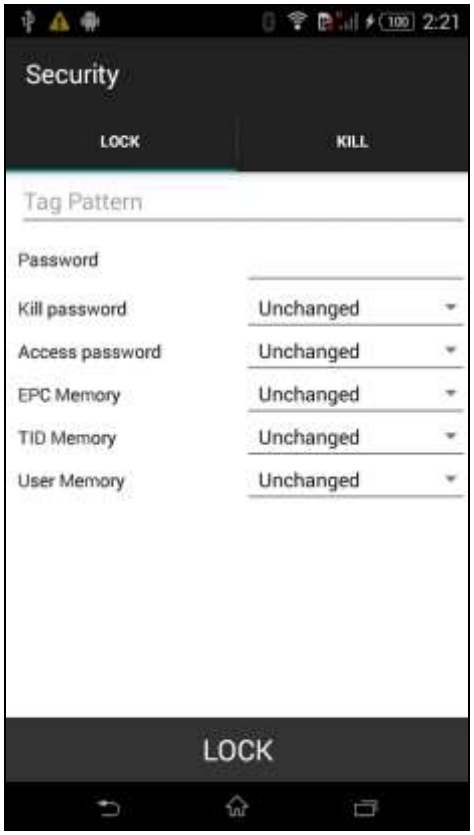




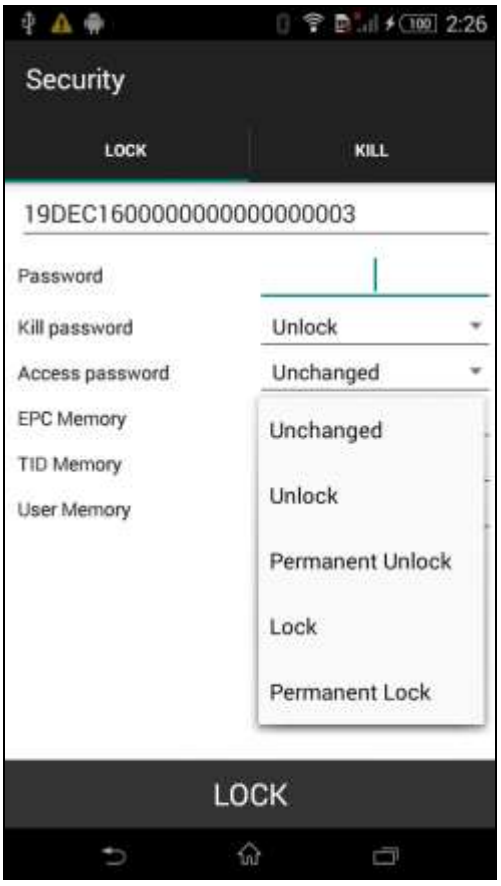
4.5.1.11 Security

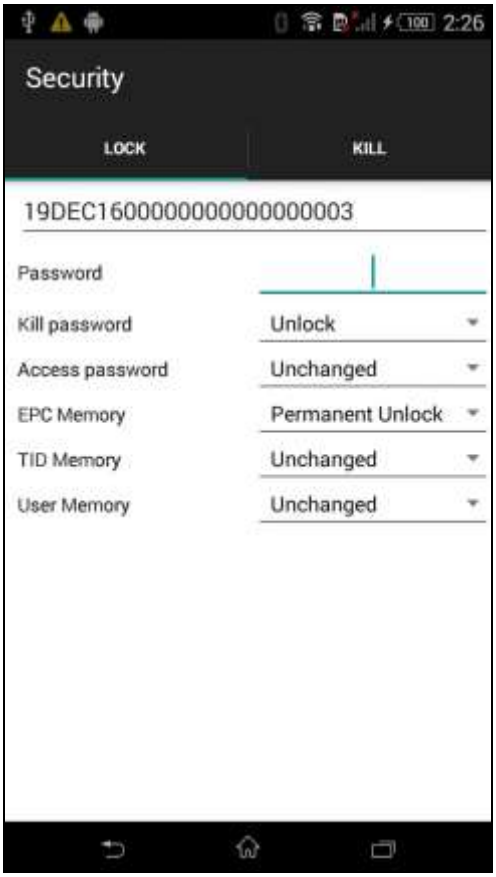
One can add security action, such as Locking or Killing, to the EPC tags. Go to Security page:

You can either lock or kill a tag. Here is locking a tag:

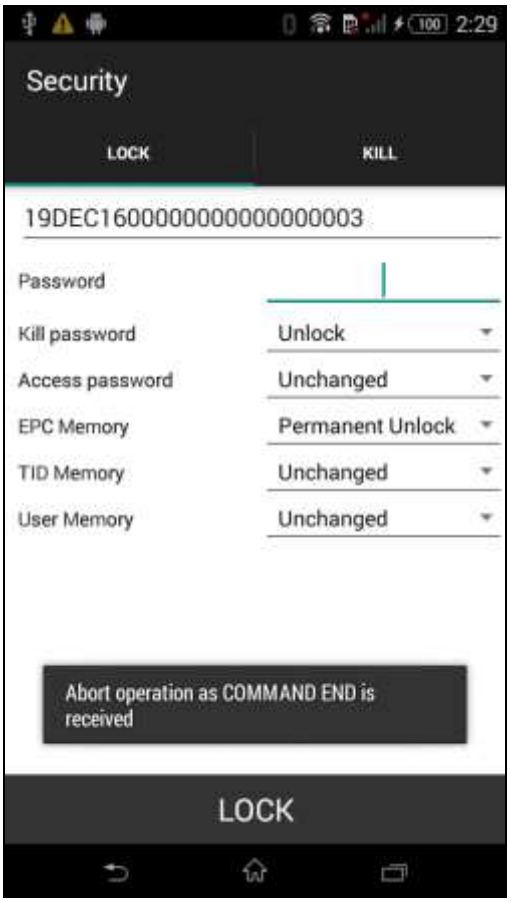


Here is killing a tag. Note it asks you for the Kill password immediately:





After a successful operation, here is the screen pop up. Command End means successful implementation of the lock command.



4.5.1.12 Register Tags

TBD

4.5.1.13 Special Functions

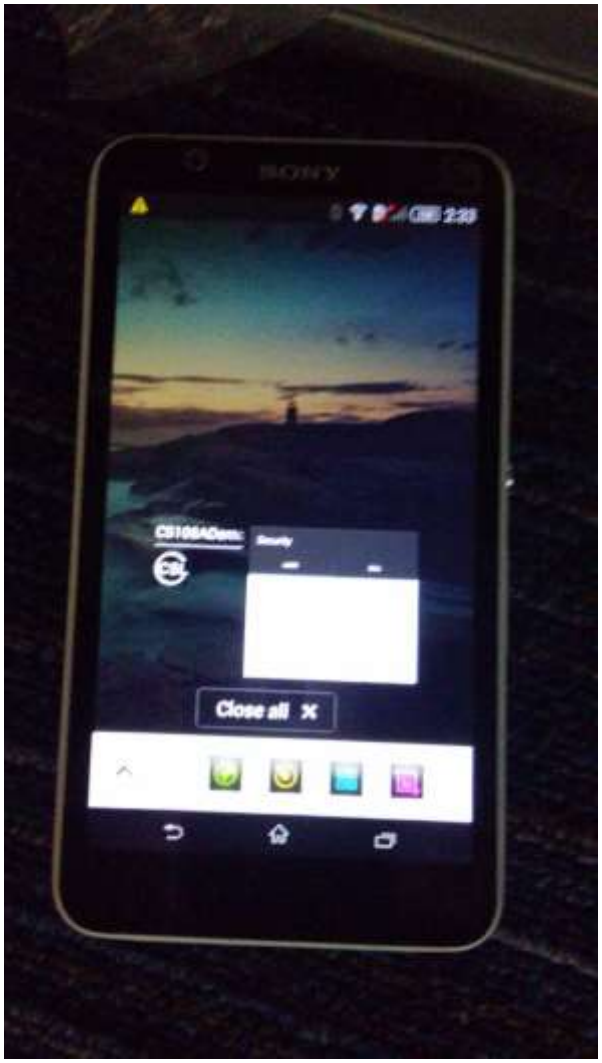
TBD

4.5.1.14 Exiting the Software

By pressing the Home button, middle icon of the menu at the bottom, one can exit the software. Note that the software is not really completely stopped, as is well known by smart phone users. The software is really only sleeping.

4.5.1.15 Truly Exiting the Software

To truly exit the software, press the lower right hand side button (folder view), and then you will see the following screen:



At this point, you can truly exit the software by pressing your finger on the software and drag it out of the smart phone.

4.5.1.16 Source Codes

Source codes of this application are available on Convergence Systems Limited website:

www.convergence.com.hk

4.5.2 Software on iPhone

4.5.2.1 Installing the iPhone Software

Formal CS108 App:

The formal CS108 iPhone App can be downloaded from App Store. However, at this point, since the software is still in beta stage, it is not available on App Store yet.

Beta Stage CS108 App:

In Beta stage the App is downloaded using TestFlight. TestFlight is a free software from Apple for distribution of Beta software. After installing it, then you can download beta software. The process is as follows:

1) Download and install TestFlight from App Store. TestFlight is free of charge software from Apple Inc.
2) Send user's Apple ID to Convergence support team. Apple ID is an email address. Make sure that email address is real and you can receive that email.
3) Convergence support team will submit the Apple ID to Apple and the new software, and a special email will be sent to the email address of the Apple ID to invite you to join iTunes Connect. The following is an example email. Click the "activate your account" in your email to participate in iTunes Connect.

Hi Albert,

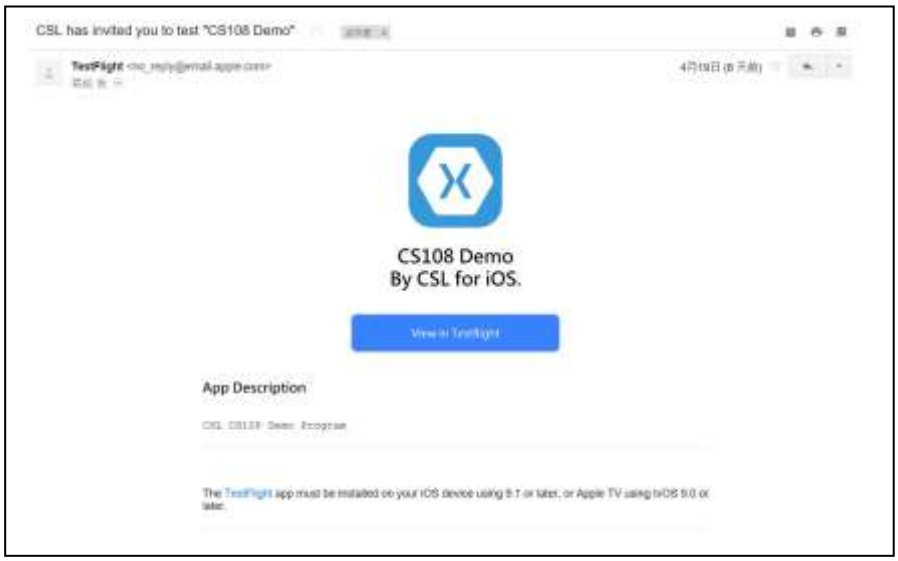
CONVERGENCE SYSTEMS LIMITED invited you to join iTunes Connect. To get started, activate your account. Sign in with your Apple ID, or if you don't have one, click the link to create an Apple ID.

If you have any questions, contact us.

Regards, The iTunes Store team

4) After that, you will receive another email inviting you to participate in the test. Open that email, and click the link inside to acknowledge to Apple. Note that your opened email

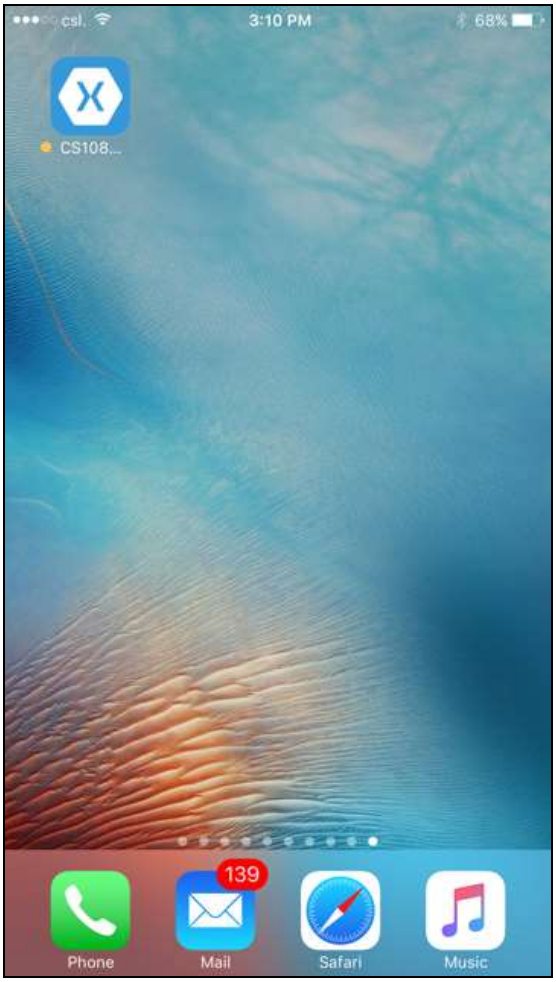
needs to be in the iPhone in order to immediately “view in TestFlight”.



5) After that the new beta software will appear inside TestFlight. Open TestFlight to find out this application is there.
6) You can then download and then open that App.
7) After that you can start using the CS108 iPhone App.

4.5.2.2 Starting the iPhone Software

With the CS108 App for iPhone installed, you will see an icon in your iPhone:



Now press that icon to start the CS108 iPhone App.

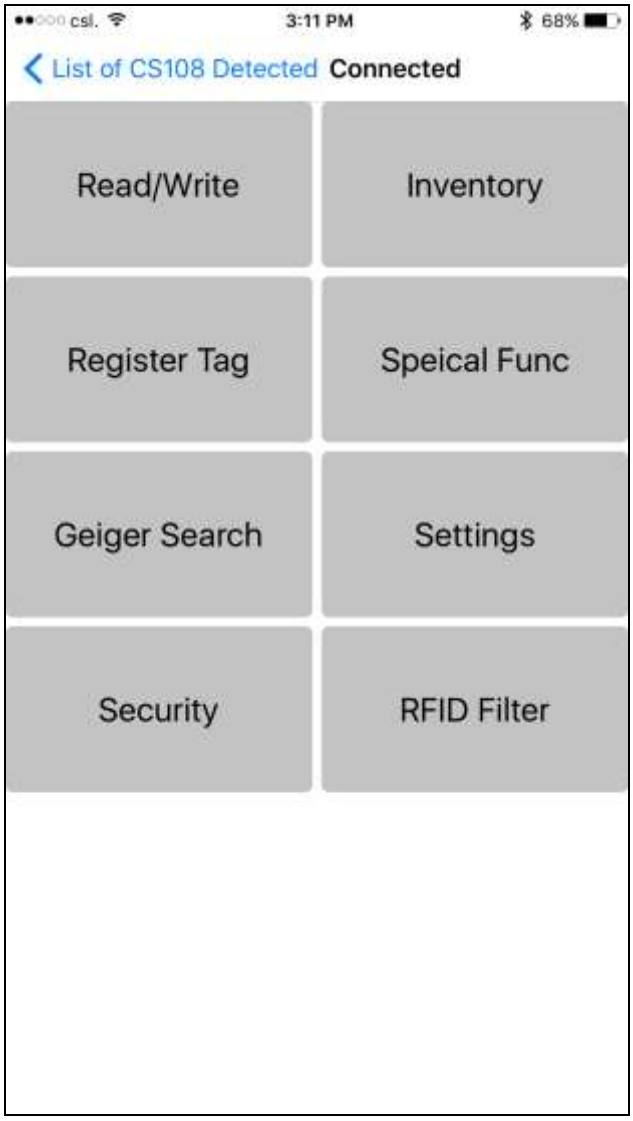
4.5.2.3 Searching and Connecting to (Pairing with) CS108

The first thing you will see when you start the CS108 iPhone App is the search and connect screen. The search and connect screen starts immediately when you start the App. It will search for CS108 nearby and list them out. Please make sure the CS108 Bluetooth button has been pressed until the Blue LED is flashing, meaning the CS108 is ready for discovery by Smart Phones nearby.

You can refresh the search process by using a finger to swipe the whole menu DOWNWARD and then release. (This is a typical method in iPhone environment)

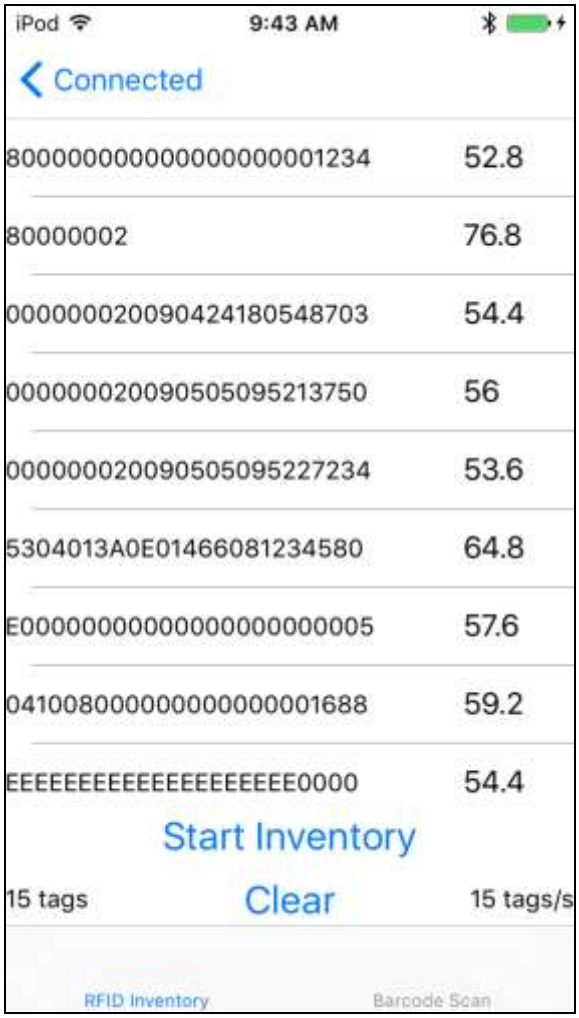
Once you select a particular reader, then a pop up window will ask you if you want to connect to that reader. Type “Ok” to connect.

After that, you will enter the main screen of the application:

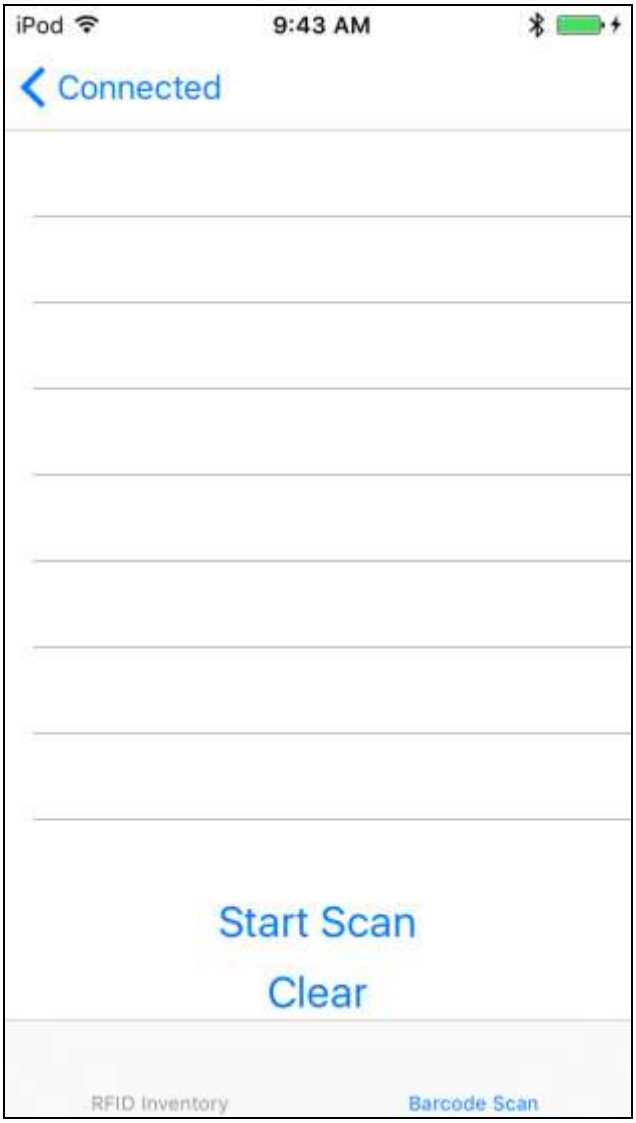


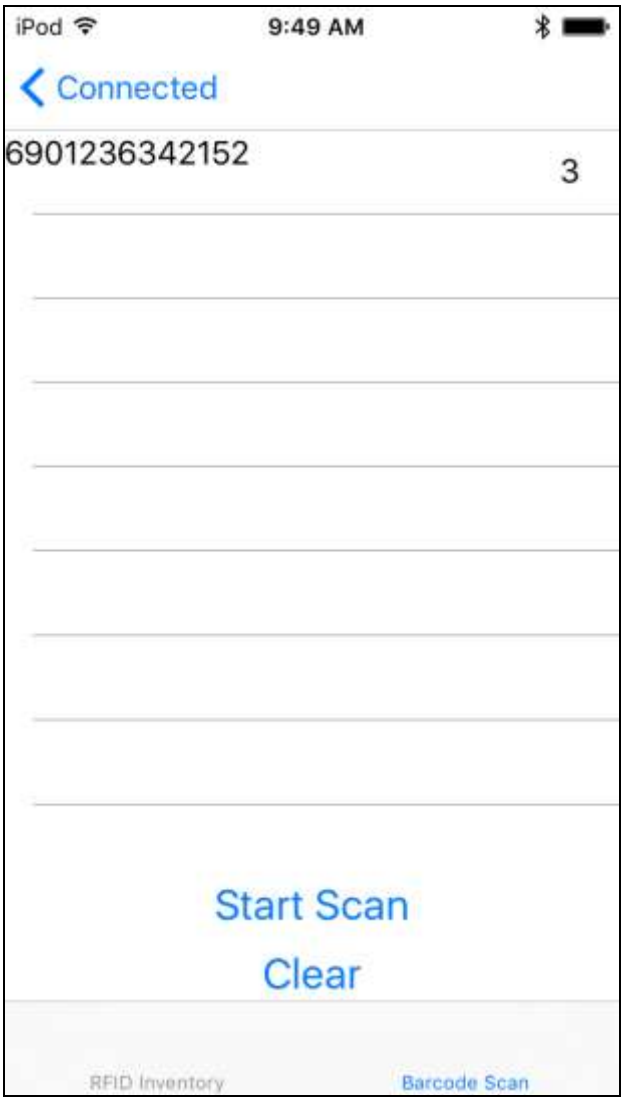
4.5.2.4 RFID Inventory

Press the Inventory button to go to the Inventory page. You can either read RFID tag or barcode, selected at the bottom of the App.



4.5.2.5 Barcode Inventory





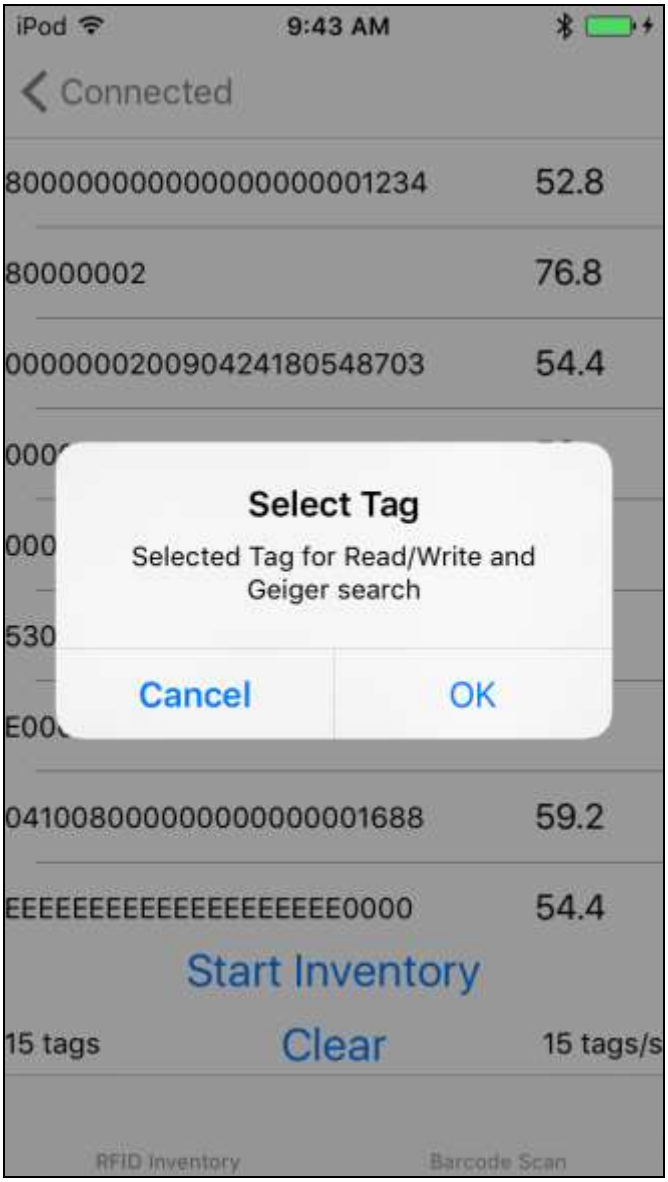
4.5.2.6 RFID Read and Write memory banks

TBD

4.5.2.7 Geiger Search

One can search and home in onto a tag using the Geiger Search page.

First you go to 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 here.



Now return to Main Menu and then enter the Geiger Search menu. The tag ID would already be there. Press Start to begin Geiger Search.

4.5.2.8 Setup

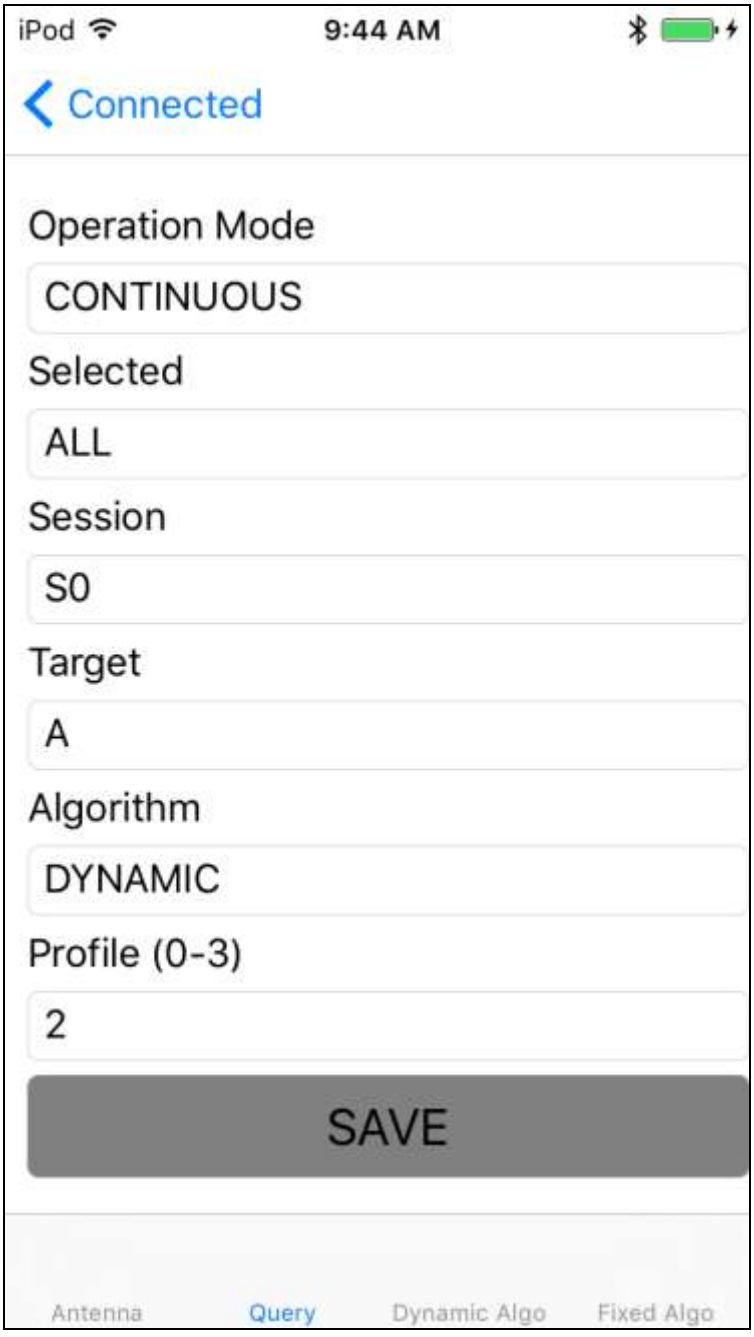
One can go to Setup page to edit the operation parameters.

In Antenna page, Inventory Delay Time is a smart phone specific Bluetooth operation parameters. DO NOT CHANGE THIS VALUE OF 15.

Dwell Time is the time of antenna port operation. 2000 means 2 seconds.

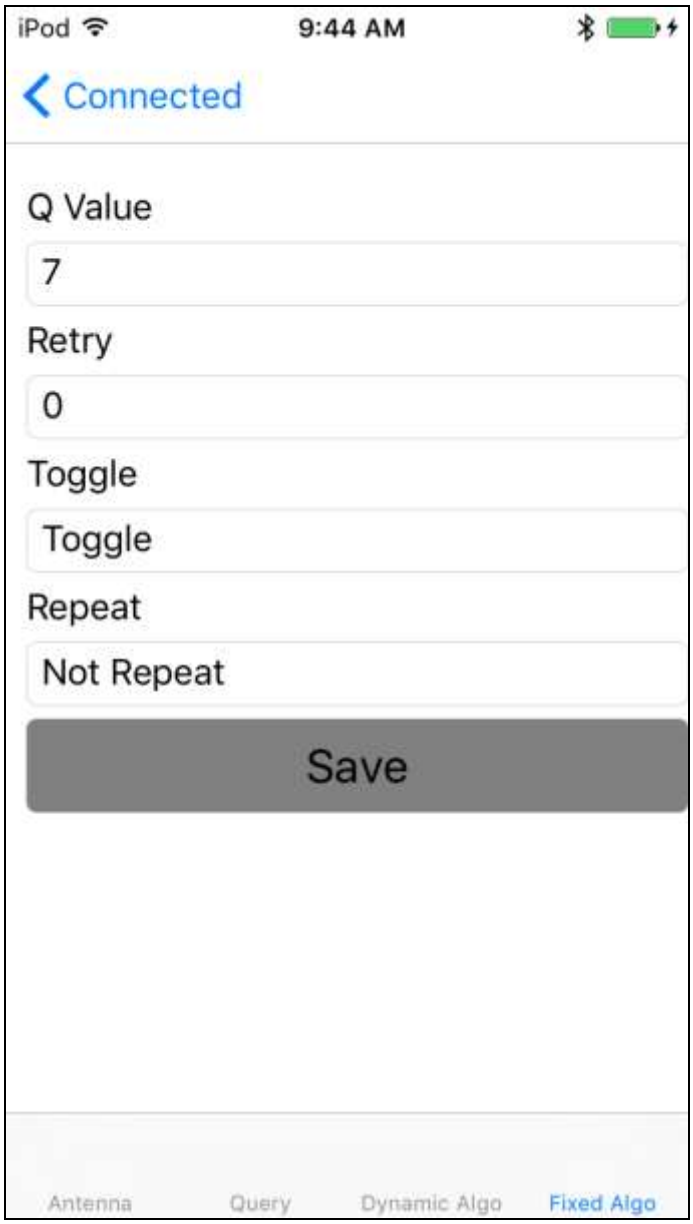
Power is 300, meaning 30 dBm.

Query page contains all the query setting. Refer to EPC Air Interface protocol document for details.



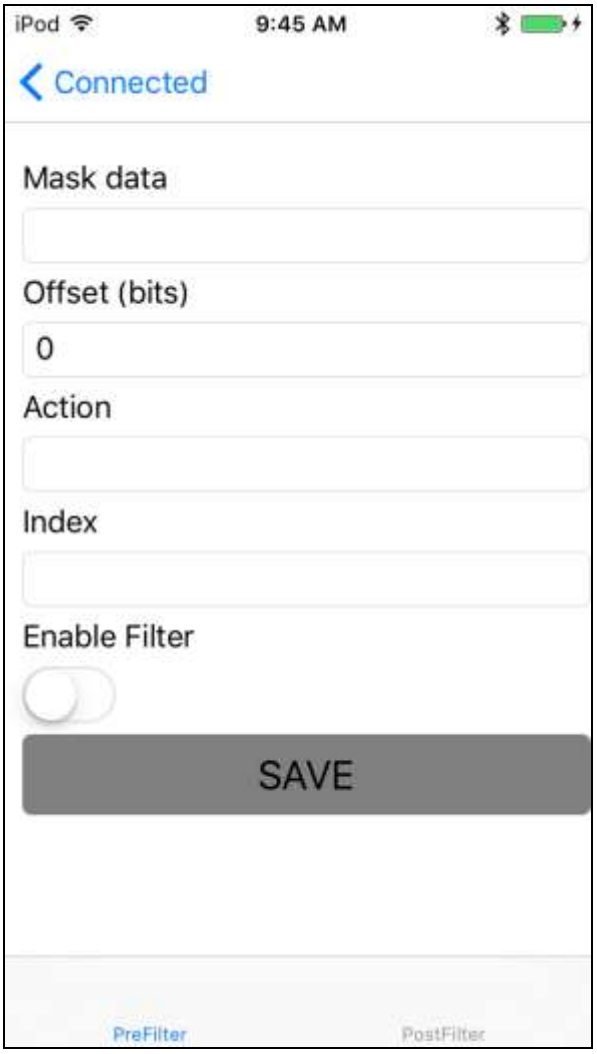
Dynamic Algo contains the parameters for Dynamic Q algorithm:

Fixed Algo contains the parameters for Fixed Q algorithm:



4.5.2.9 Filter: Pre Filter

Pre-filter page contains the settings for Select Filter:



4.5.2.10 Filter: Post Filter

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

4.5.2.11 Security

TBD

4.5.2.12 Register Tags

TBD

4.5.2.13 Special Functions

TBD

4.5.2.14 Exiting the Software

One can exit the software by simply pressing the Home button. However, as smart phone users know, this is only sending the App to sleep.

4.5.2.15 Truly Exiting the Software

To truly exit the software, one needs to double click the Home button, and then the CS108 demo App will show as one of the pages piled. Select that page and then use finger to drag it out of the phone to truly exit the software.

4.5.2.16 Source Codes

Source codes of this application are available on Convergence Systems Limited website:

www.convergence.com.hk

4.6 Software on PC

The CS108-2 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 PC controlling CS108-2. Everything is self-explanatory in the application:

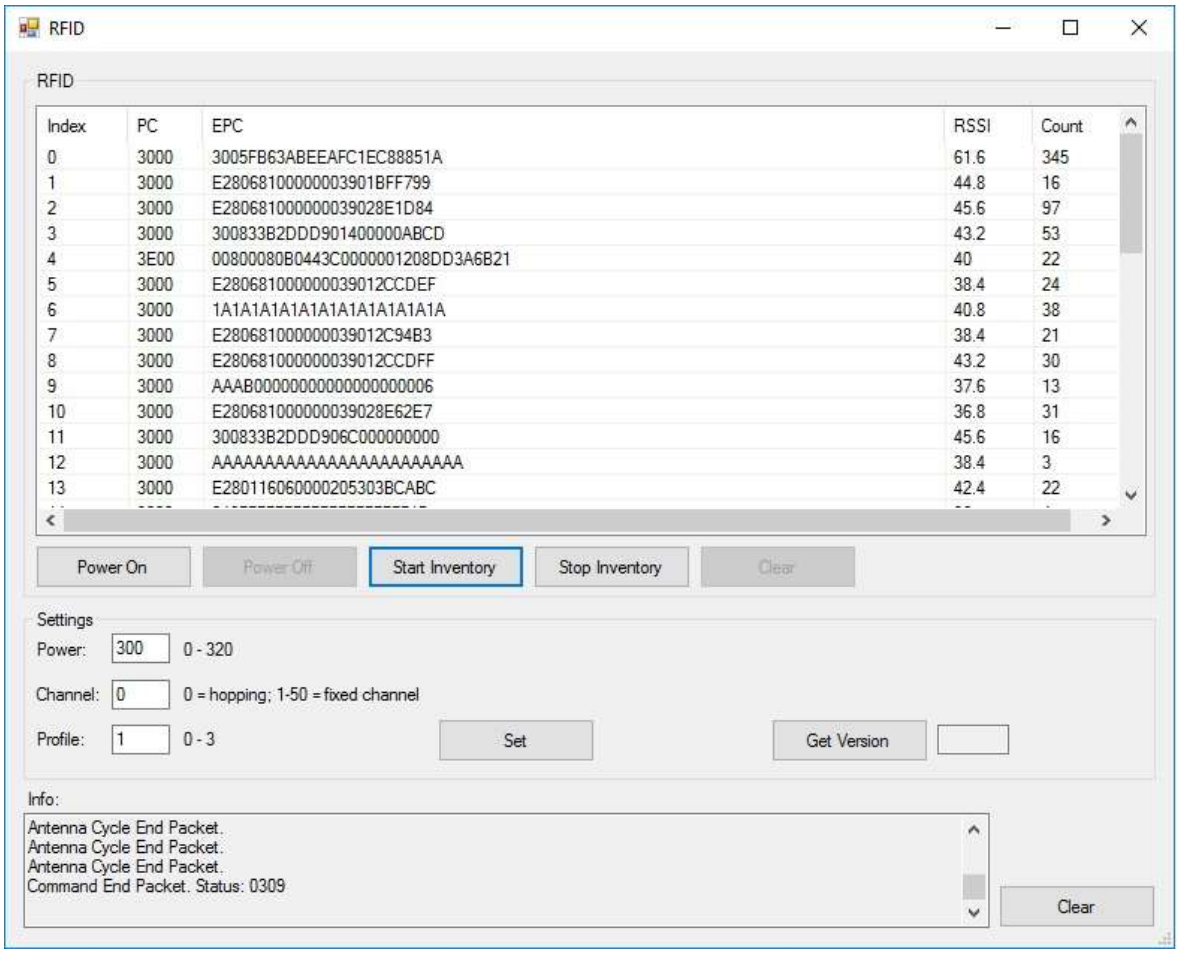


Figure 4-5 PC Application Screen – controlling CS108-2 via USB

Source codes of the PC App for CS108 is also available for download from Convergence website: www.convergence.com.hk

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. Link Profiles of CS108 RFID Reading

Link Profile	0	1	2	3
R-T Modulation	DSB-ASK	PR-ASK	PR-ASK	DSB-ASK
Tari (μs)	25.00	25.00	25.00	6.25
X	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
LF (kbps)	40	250	300	400
Data Rate (kbps)	40	62.5	75	400