Capturing the Value of EPC Gen 2 Custom Commands

Abstract

This white paper highlights the EPC Gen 2 Custom Commands functions available in NXP's G2X series of integrated circuits and supported by Sirit's Infinity 510 UHF reader. These products are compliant to the EPC Gen 2 standard, while also offering features that may allow users to capture additional value from an RFID application. This document includes details on the implementation of EPC Gen 2 custom commands within NXP's G2X chips and Sirit's Infinity 510 reader and provides use-case scenarios as examples of potential supplementary benefits to RFID end-users.

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Introduction

As a standard, EPC Gen 2 is being readily adopted by users both inside and outside the retail supply chain. Many of these RFID users are enjoying the benefits and planning expanded roll-outs, while others are seeking features beyond just a unique identifier. The EPC standard allows for additional functionality via "custom commands," which can bring added value to an RFID application and allow users to achieve a return on investment more quickly. The custom commands that NXP's UCODE G2X chips incorporate provide enhanced features sought by many market sectors including retail, pharmaceuticals, recorded media, apparel, and asset management. This set of new capabilities are crucial to meet the ever-increasing requirements of customers who implement RFID solutions that go far beyond compliance tagging.

This document describes the unique set of custom commands which are implemented in the newest UHF UCODE G2XM and UCODE G2XL transponder ICs from NXP Semiconductors and the extended user memory of 512 bits available in the G2XM chips. It outlines versatile use cases to which these extended features represent a compelling added value in an RFID application.

The enhanced features are:

Custom Commands:

- Electronic Article Surveillance
- Read Protect
- Calibrate
- 512-bit dedicated user memory (in G2XM)

This set of custom commands is supported by Sirit's Infinity 510 through a firmware upgrade (v. 2.0). The IN510 is the first EPC certified RFID reader able to execute these new features. In order to facilitate simple utilization, the commands are organized into logical groups within Sirit's command interface. Detailed instructions are available in the IN510s Protocol Reference Guide.

1. Electronic Article Surveillance (EAS)

1.1. Implementation

Electronic Article surveillance is a security feature controlled by a single bit that is either in the "on" or "off" state. In order to avoid misuse of this feature, the change of the state of the EAS alarm is protected by a 32-bit access password. Activating or deactivating the EAS alarm can be done repeatedly.

One of the key factors in implementing the EAS Alarm function is a very fast transponder response time. This is accomplished by not requiring the entire anti-collision algorithm and "read" sequence to be executed. In addition, the Select, Query, Acknowledge commands and the random number generation sequence do not have to be executed. This ensures the fastest possible indication of EAS status between the interrogator and the transponder chip.

The EAS alarm function can be activated or deactivated by the business application via the software interface of the INfinity 510. The INfinity 510 provides a new configuration set-up option ("easalarm") which enables the continuous transmission of EAS Alarm commands. This feature provides an easy to deploy solution for EAS gate applications. A new sample Python script is provided with the 2.0 firmware upgrade which demonstrates how to integrate the EAS Alarm functionality with the reader's digital outputs. Visual and audible alarms associated with an EAS gate are controlled through these digital outputs. The reader can autonomously report an "event.tag.alarm" for each tag discovered in the "easalarm" state.

1.2. Application Examples

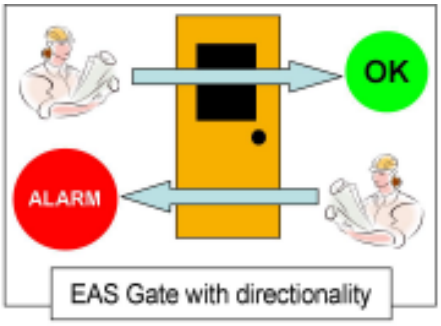
Retail Store

Retailers face a serious theft problem which subsequently leads to a financial loss. Store theft has been an on-going problem, with a variety of solutions brought to market over the past thirty years. In order to minimize that loss, EAS gates are installed at the exit to detect stolen items. Today, detection gates operate in a different frequency range compared to the EPC tag. This poses unnecessary additional cost to retailers since this function can now be accomplished by utilizing the EAS function in the NXP G2X chips and the Sirit reader.

It would be much more efficient to have the RFID tag serve as both a product identifier and EAS device, allowing the tag do the entire job. The UCODE G2X transponder chips were designed specifically to accomplish both functions, thus reducing cost, while providing additional value.

The EAS feature is designed to increase theft protection by triggering an alarm if an item is being moved out of the store without having been purchased. The EAS alarm function and the standard reader-to-tag communications operate in the same frequency range and utilize the same air interface.

Along with the standard EPC data, the retailer can program the RFID tag to activate the EAS function and password protection feature. At the point of sale (POS), the EAS alarm can be deactivated with a simple command using the appropriate password when the item is purchased. Customers can leave the store without being bothered with false alarms as is seen in other EAS systems in operation today.



Airport Security

Security at airports is of paramount importance. The EAS feature of the UCODE G2X chips represent a means to further enhance the security level when it comes to cargo or luggage. As passenger baggage or freight shipments are received, an RFID-enabled label or tag can be attached to the article. Checked baggage or freight that has been properly screened will have the EAS alarm deactivated.

In case the article has bypassed the security check, the EAS alarm stays activated. Thus, it is possible to easily distinguish between items which have passed the security control and those which might pose a risk if the article has bypassed the security procedures. By installing EAS detection gates through which each piece of luggage or freight must be moved, airport security agents can ensure that only security-checked articles get loaded onto the aircraft.

Sirit's Infinity 510 is able to fully support the EAS function in either the retail or airport security application. Multiple antennas can be attached to the reader in a portal configuration.

2. Read Protect

2.1. Implementation

The Read Protect feature was designed to protect from unauthorized reading of an EPC Gen 2 tag. As is the case with all the UCODE custom commands, this function is also protected by a 32-bit password.

When the Read Protect feature is activated, the UCODE G2X transponder replies with "zeros" in place of its electronic product code (EPC) content. The Tag Identifier (TID) and user memory are also inaccessible.

This password-protected feature enables reading of the memory content for authorized personnel only. Hence, it is impossible to identify the contents of the data by hiding what is stored in the TID and user memory of the transponder. The chip, however, still reacts upon Select or Query, but does not reveal any data to the reader.

2.2. Application Examples

Unauthorized readout of the RFID transponder memory content has raised privacy concerns from both retailers and consumers The issue of consumer privacy in RFID applications has received a great deal of attention from consumer groups and has garnered high visibility through the media. Therefore, it is necessary to provide counter measures which enhance consumer privacy and eliminate the concerns when consumer-sensitive data like pharmaceuticals are involved. The Read Protect custom command of UCODE G2X represents a simple and efficient solution to prevent unauthorized reading of EPC tag data.

Masking the EPC number of the transponder IC also brings a significant advantage in supply chain applications. Warehouses and distribution centers have to deal with a large number of items. Therefore, it might also be the case that a large number of unused tagged items are in close proximity to the reader field, resulting in false positive reads.

The occurrence of such false positive reads can be eliminated by activating the Read Protect command on all unused tagged items. The reply which the reader obtains from those tags is only "zeros" for the EPC content, which makes it simple to distinguish between items to be screened and those that are unused. The use of this command can also be easily activated in the Infinity 510's software interface.

3. Calibrate

3.1. Implementation

Measurement and evaluation of tag-to-reader communication is important in the design of both tags and readers. This feature can also play an important role in testing read performance in real world applications. The execution of the Calibrate custom command prompts the UCODE G2XL chip to continuously send a stream of data containing zeros. The UCODE G2XM chip replies with a constant stream of user memory data when the 512-bit user memory command is utilized.

3.2. Application Examples

By having a continuous stream of data, the UCODE G2X chips make it easier to evaluate and fine tune the reader to tag communication. This continuous data stream not only eases the frequency spectrum evaluation of the tag backscatter signal strength, it also allows a more accurate assessment of tag-to-reader performance. This function is especially valuable in the design and development of RFID tag antennas.

System integrators can also use the calibrate feature in evaluating the performance of an overall RFID implementation. Radio frequency reflections and disturbances caused by nearby objects can be more effectively and reliably examined when tags provide a continuous data stream. The outcome of such measurements should ultimately lead to an improvement in tag-to-reader performance and a more robust system.

4. 512-bit Dedicated User Memory

4.1. Implementation

While the EPC standard continues to be adopted and embraced in various markets and in a wide range of applications beyond the retail supply chain, users of RFID technology continuously seek functionality that matches their requirements. Using the EPC number as an identifier certainly provides benefits, but there are many applications that require additional memory on the tag in order to more fully meet the needs of many users.

Utilizing advanced EEPROM technology, UCODE G2XM chips offer 512 bits of user memory which is the largest memory available on the market today. These ICs are specified for up to 10,000 read/write cycles, along with 10 years of data retention.

The Sirit INfinity 510 reader is capable of addressing the entire UCODE G2XM dedicated user memory space of 512-bits. Again, this function is activated through the IN510s reader management tool. The reader can be configured to automatically collect the user data contents during the inventory cycle. In addition, there are specific commands to read and write the user data contents which can be invoked at any time in the user's business processes.

4.2. Application Examples

By having 512-bits of dedicated user memory, the G2XM chip allows the storage of additional item information and opens up new application areas. This available memory can be used to customize an application and allows users the flexibility that a standard EPC chip cannot fulfil.

In the retail sector, extended memory can hold shipping information, warranty information, expiration date for perishable goods, product authentication features, along with other data that is pertinent to a retail product. The additional data is password protected and can be updated at various read points from the manufacturing process, into the supply chain, and through to the point of purchase.

Automotive spare part tagging, production control and industrial asset tracking may also utilize the dedicated user memory for various processes. History and event files can be stored on the tag and may be updated on a continuous basis. A pure license plate Gen 2 tag cannot offer the additional functionality and flexibility offered by the use of extended memory.

5. INfinity 510 Implementation of Custom Commands

Sirit's INfinity 510 communicates with RFID tags through an air interface based on the standard EPCglobal Gen 2 protocol. Like all read and write functions, the NXP custom commands are sent from the reader to the tag, and the tag executes these instructions.

As mentioned previously, the commands are organized into logical groups within Sirit's command interface. The chart below shows details on the specific commands sent by the IN510 and executed by the NXP chips. Detailed instructions about the implementation of the custom commands are available in the INfinity 510s Protocol Reference Guide.

NXP Air Interface Command	IN510 Command Interface
ReadProtect	modem.protocol.isoc.nxp.read_protect(tag_id, pwd, antenna)
ResetReadProtect	modem.protocol.isoc.nxp.reset_protect(tag_id, pwd, antenna)
Change EAS	modem.protocol.isoc.nxp.change_eas(tag_id, pwd, reset_eas|set_eas, antenna)
EASAlarm	modem.protocol.isoc.nxp.eas_alarm(antenna)
Calibrate	modem.protocol.isoc.nxp.calibrate(tag_id, pwd, antenna)

6. Summary

The EPC Gen 2 standard provides a foundation upon which many additional features can be built. There are numerous applications that require a simple unique identifier which Gen 2 provides. There are, however, many other applications that require additional functionality.

Gen 2 focused technology and applications will continue to evolve and improve. The G2X chips comprise the next generation in the advancement of RFID and Gen 2 technology. The release of these products is an important milestone in the growth and development of the RFID market. The usage and application of the additional features in the G2X series of Gen 2 chips and supported by the IN510 is only constrained by the creativity of application developers, providing a toolkit that far exceeds current competitive product offerings.

When you combine the performance of Sirit's INfinity 510 featuring proprietary tag acquisition algorithms and dense reader mode performance enhancements with the added functionality, increased sensitivity and signal interference management within NXP's G2X chips, end-users can expect better performance and more flexibility than provided by competitive solutions.

Company Background

About NXP Semiconductors

NXP is a top-ten semiconductor company founded by Philips more than 50 years ago. Headquartered in Europe, the company has 37,000 employees working in more than 20 countries and posted sales of EUR 5 billion in 2006. NXP creates semiconductors, system solutions and software that deliver better sensory experiences in mobile phones, personal media players, TVs, set-top boxes, identification applications, cars and a wide range of other electronic devices.

For more information about NXP's products, visit www.nxp.com

About Sirit

Sirit Inc. (TSX: SI) is a leading provider of Radio Frequency Identification (RFID) technology worldwide. Harnessing the power of Sirit's enabling-RFID technology, customers are able to more rapidly bring high quality RFID solutions to the market with reduced initial engineering costs. Sirit's products are built on more than 14 years of RF domain expertise addressing multiple frequencies (LF/HF/UHF), multiple protocols and are compliant with global standards. Sirit's broad portfolio of products and capabilities are easily customized to address new and traditional RFID market applications including Supply Chain & Logistics, Cashless Payment (including Electronic Tolling), Access Control, Automatic Vehicle Identification, Near Field Communications, Inventory Control & Management, Asset Tracking and Product Authentication.

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