## MaxReader Development Kit

Capture, transmit and store more data with F-RAM high-performance wireless memory

EPC Gen2 Wireless Protocol (860MHz – 960MHz)



**Quick Reference Guide** 

# **Quick Reference Guide**

## MaxReader Development Kit MaxArias Gen2 Reader Platform



Guide Version 1.06 March 2012

### **STEP 1: Kit Contents**

#### Please ensure that you have received all items shown below.



Item	Description
[1]	Kit sleeve
[2]	USB mini-B cable
[3]	6-position 0.100" pitch DSPI cable
[4]	DC power supply
[5]	Power adapters**
[6]	MaxReader Quick Startup Guide
[7]	CD with software, drivers & user manuals
[8]	RFID UHF reader (MaxReader)
[9]	WM72016-EVAL MaxArias evaluation board (2)
[10]	½-wave antenna (packaged under DSPI cable)



### **STEP 2: MaxReader Board**

Please familiarize yourself with the MaxReader PCB layout.



[1]	CONNECTOR – USB mini B	[10]	LED – RF Power ON
[2]	BUTTON – Reset (hard)	[11]	AS3992 RFIC
[3]	CONNECTOR – Test	[12]	CIRCULATOR
[4]	LED – FPGA Ready	[13]	SMA ANTENNA CONNECTOR
[5]	DSPI BUS, PIN 1	[14]	HEAT SINK (bottom ×2)
[6]	CONNECTOR – DSPI	[15]	CONNECTOR – Power 5V
[7]	LED – DSPI Link	[16]	BUZZER (bottom)
[8]	LED – Tag Detect	[17]	LED –Power ON
[9]	LED – Authenticated	[18]	BUTTON – Reset (serial port)



IMPORTANT NOTE: Please connect the supplied ½ -wave dipole antenna to the reader's SMA connector prior to applying power to the reader.

### **STEP 3: USB Driver**

Apply power to the reader by plugging in the supplied 5V power supply to the MaxReader's power connector [14].

Prior to connecting MaxReader to your computer, please ensure that you have located or downloaded the latest FTDI Virtual COM Port (VCP) driver, either on the supplied CD or the internet:

#### <u>CD</u>:

Drivers will be located in the Apps\_Drivers\CDM20814\_WHQL\_Certified directory on the supplied CD-ROM.

Internet:

Updated FTDI drivers can be downloaded from: <u>www.ftdichip.com/Drivers/VCP.htm</u>

The current tested version of the FTDI Virtual COM Port (VCP) driver for Windows is: v2.08.14. For Mac OS, the current version is v2.2.16.



### **STEP 4: Connecting the USB Cable**

Connect the Gen2 MaxReader to your computer using the USB cable supplied in your development kit.

**Computer:** 



#### MaxReader:





### **STEP 5: USB Driver Install**

Your computer must install a USB driver to support the interface to the MaxReader.

<u>Allow your computer to automatically install the required FTDI</u> <u>USB driver</u>. Once the driver has been installed correctly, MaxReader's buzzer should emit a short rising chirp.

In the event that the serial port driver does not correctly install, manual installation of the USB VCP driver is required. Please refer to the User Guide for GUI document supplied on the CD-ROM for manual installation instructions.

#### **IMPORTANT NOTE:**

The MaxReader Development Kit comes with a Graphical User Interface (GUI). This GUI is designed to facilitate command manipulation between MaxReader and the WM72016 Evaluation Board. Please refer to page 19 for instructions on how to use the GUI.

If additional assistance is required, please e-mail: <u>MaxArias@Ramtron.com</u>.



### STEP 6: WM72016 Evaluation Board

Please familiarize yourself with the MaxArias evaluation board layout.



[1]	IC – Schottky diode (polarity protection)
[2]	IC – MaxArias WM72016
[3]	PORT – DSPI
[4]	DSPI bus connector "pin 1"

IMPORTANT NOTE: Metal surfaces, metal desk brackets, and other metal objects may negatively impact the performance on the PHY communication link between the MaxReader and the WM72016 evaluation board. Other types of materials may also have a positive or negative effect on the reader's RF field. In this case, a performance improvement will be seen by distancing the reader and evaluation tag from the object(s) in question.



### **STEP 7: MaxReader RF Field Orientation**

Place the WM72016 evaluation tag in the reader's RF zone as shown below (power supply cable not shown). Ensure that the polarity of the reader's antenna is the same as the antenna on the WM72016 evaluation board.





### **STEP 8: Terminal Setup**

Your computer's interface to MaxReader is performed through a host terminal. Several terminals are readily available for a variety of systems, such as HyperTerminal (from Hilgraeve, Inc.) and PuTTY using Windows and Terminal using Mac OS.

**HyperTerminal** 

Windows XP	HyperTerminal is natively available on your
	computer.
Windows 7	HyperTerminal may be downloaded online at
	www.hilgraeve.com.

Refer to STEP 8a to configure HyperTerminal.

#### <u>PuTTY</u>

PuTTY is a free open-source terminal client for your Windows XP or Windows 7 computer. The PuTTY client terminal may be downloaded online at <u>www.PuTTY.org</u>.

**Refer to STEP 8b to configure PuTTY.** 

NOTE: Some Windows 7 users may experience difficulties with HyperTerminal and may prefer PuTTY client software.



#### <u>Mac OS</u>

Mac OS has a built-in terminal client which can be used for command line communication with MaxReader. A sample AppleScript "maxterm.zip" to configure and launch the terminal is available on the MaxReader Development Kit landing page: <u>www.ramtron.com/go/MaxReaderDevKit</u>.



### **STEP 8a: HyperTerminal Setup**

1. Open HyperTerminal window on your computer.

```
Windows XP:
```

Start → All Programs → Accessories → Communications → HyperTerminal

Windows 7:

Download HyperTerminal at: <u>www.hilgraeve.com</u> and start application.

- 2. Enter name of terminal and select OK.
- 3. In the "Connect To" window, select the COM port that is connected to your MaxReader. The COM port your MaxReader is connected to can be determined from your computer's Device Manager.

Start → Control Panel → System → Hardware → Device Manager



The MaxReader is identified as "USB Serial Port" as shown above.



4. Set the COM port properties and settings as shown below.

COM34 Properties		? 🔀	BamBam Properties			?
Port Settings			Connect To Settings			
Bits per second:	460800		Function, arrow, and	ctrl keys a ○ <u>W</u> i	ict as ndows keys	]
 Data bits:	8	~	Backspace key send	ds O Ctr	l+ <u>H</u> , Space, Ctrl+H	]
Parity:	None	~	Emulation: ANSIW	~	Terminal <u>S</u> etup	]
<u>S</u> top bits:	1	~	Tel <u>n</u> et terminal ID:	VT100		]
Elow control:	Hardware		Backscroll buffer lines:	500 onnecting	or disconnecting	
	<u>R</u> estore	Defaults	Input Translation.		ASCII Setup	
0	K Cancel	Apply		ſ	ок с	Cancel

5. Set the ASCII setup as shown below.

ASCII Setup 🔹 💽 🔀
ASCII Sending
Send line ends with line feeds
Echo typed characters locally
Line delay: 0 milliseconds.
Character delay: 0 milliseconds.
ASCII Receiving           Append line feeds to incoming line ends           Eorce incoming data to 7-bit ASCII           Wrap lines that exceed terminal width
OK Cancel

HyperTerminal is now configured.



#### **STEP 8b: PuTTY Setup**

1. Start PuTTY application. The client software should appear as shown below.

Category:		
Session	Basic options for your Pul	TTY session
Session     Logging     Terminal     Keyboard     Bell     Features     Vindow     Appearance     Behaviour     Translation     Selection     Colours     Connection     Data     Proxy     Telnet     Rlogin     SSH     Serial	Specify the destination you want to Host Name (or IP address) Connection type: O Raw O Ielnet O Rlogin ( Load, save or delete a stored sessi Saved Sessions Default Settings	connect to Port 22 ● SSH ○ Serial on Load Save
	Close <u>w</u> indow on exit: Always Never ③ On	Ly on clean exit

2. Set the serial port definitions as shown below. The COM port MaxReader utilizes is found in your computer's Device Manager as described in STEP 6a.





- 3. Under menu item "Terminal → Keyboard", ensure that "Control-H" is used as the backspace key.
- 4. Complete PuTTY configuration by:
  - a. Selecting the Session category.
  - b. Select the "Serial" connection type.
  - c. Entering a configuration name.
  - d. Saving the configuration.

Category:	
😑 Session 🛑	Basic options for your PuTTY session
<ul> <li>Logging</li> <li>Terminal</li> <li>Keyboard</li> <li>Bell</li> </ul>	Specify the destination you want to connect to Serial line Speed COM1 460800
Bell     Features     Features     Appearance     Behaviour     Translation     Selection     Colours     Connection     Data     Proxy     Telnet     Rlogin     SSH     SSH     Serial	Connection type: <u>Raw</u> <u>Ielnet</u> Rlogin <u>SSH</u> Seria Load, save or delete a stored session Saved Sessions MaxReader Default Settings MaxReader <u>Load</u> <u>Load</u> <u>Save</u> <u>Default Settings</u> <u>MaxReader</u> <u>Default Settings</u> <u>Load</u> <u>Save</u> <u>Default Settings</u> <u>Load</u>
	Close <u>w</u> indow on exit: Always Never Only on clean exit

Upon saving the configuration, the configuration name should appear in a list of stored sessions as shown. The configuration can be recalled at any time by loading a previously saved session.



#### STEP 8c: Mac OS Setup

1. Download the maxterm AppleScript from the MaxArias web site as indicated above. Double click the icon to launch the AppleScript editor. You should see the following:



2. Click the Run button to launch the script. A terminal will open for use with the CLI.



- 3. The Terminal may be hidden at launch if a Terminal session was not already active.
- 4. Follow the CLI instruction below.
- 5. When the CLI session is complete, type <ctrl>a<ctrl>\ to release the maxReader and close the session.

### **STEP 9: Starting Communications**

In the HyperTerminal window, connect to the MaxReader selecting the icon as shown below. In PuTTY, select the configuration name followed by the OPEN button at the bottom of the window.





Press ENTER several times until the Ramtron CLI banner is displayed as shown below.

BamBam - HyperTerminal	
jle ⊑dit yjew ⊆all Iransfer Help	
) 🛎 🐵 💈 🖻 🖆	
CLI:	
RAMTRON INTERNATIONAL COMMAND LINE INTERPRETTER	
CLI:	
noerted 0:00:07 ANSTW 460800 8-N-1 SCROLL CAPS NUM Capture Print echo	



### **STEP 10: Initialize Gen2 MaxReader** Hardware

Initialize the MaxReader and enable RF power by entering the following CLI commands:

#### ASINIT RFON

BamBam - HyperTerminat	
Eile Edit View Call Iranster Help D Call and Same Same Same Same Same Same Same Same	
CLI:	
RAMTRON INTERNATIONAL COMMAND LINE INTERPRETTER	
CLI: asinit CLI: rfon CLI:	
Connected 0:10:07 ANSIW 460800 8-N-1 SCROLL CAPS NUM Capture Print echo	



### STEP 11: Querying the WM72016 Eval Board

The MaxArias WM72016 evaluation tag may now be queried by the MaxReader. Enter the following CLI command in the HyperTerminal to read the Gen2 EPC identifier.

#### **G2QRY**

🕽 BamBam - HyperTerminal 🧾 🗔 🗖 🔀		
Eile Edit View ⊆all Iransfer Help		
	<b>[^</b>	
С <u>л</u> т.		
RAMTRON INTERNATIONAL		
COMMAND LINE INTERPRETTER		
CLI: asinit		
CLI: rfon		
CLI:		
:3400_111122223003400450052643_F821		
Connected 0:17:07 ANSIW 460800 8-N-1 SCROLL CAPS NUM Capture Print echo		

The MaxReader may also be put into a continuous-query scan mode to allow a determination of how well the WM72016 evaluation board responds in its current environment. This is done with one of several CLI commands as shown below. Press ENTER to exit continuous-query scan mode.

#### G2CQRY, G2SCAN, G2FASTSCAN

Once the evaluation board has responded with its EPC identifier (using G2QRY), further commands can be performed to read and write the tag's memory – refer to the MaxReader CLI User Guide for details. When the Gen2 interface is not in use, disable RF power using the following CLI command:

#### **RFOFF**



### **STEP 12: Connecting the DSPI Interface**

The DSPI serial interface on the MaxArias WM72016 evaluation board connects to the MaxReader DSPI port with the supplied 6position ribbon cable as shown below. If the cable is connected correctly, the DSPI link LED will be lit.

Please note pin1 connectivity.

- 1. Signal 1 on the DSPI cable is a dark color and high-lighted as shown below.
- 2. Pin 1 on the WM72016 evaluation board is labeled as "GND" and has a printed box around it on the silk screen as described in STEP 6
- 3. Pin 1 on the MaxReader is the left-most pin on the DSPI connector when viewed with the USB connector to the left, as shown in STEP 2. In addition, pin 1 can be identified by a square solder pad on the opposite side of the MaxReader.



Please refer to the MaxReader CLI User Guide for detail on DSPI commands.



### Support

A Command Line Interpreter (CLI) User Guide has been included with the evaluation kit software package. Please refer to the guide for details on the complete CLI instruction set.

Additional assistance may be obtained by e-mailing: <u>MaxArias@Ramtron.com</u>

#### **Notes**

- 1. Prior to writing data to the WM72016, please review the datasheet regarding the device's memory map.
- 2. Please familiarize yourself with the various WM72016 memory banks, function registers and internal address pointers.
- 3. Normal user application data is written to the WM72016 starting at the memory location highlighted in GREEN, and terminating at the memory location highlighted in RED.

DSPI Address	Gen-2 Memory Bank	Gen-2 Address	Word Pointer (EBV8)	Description
0x000- 0x003	RESERVED	0x000	0x00	Kill Password[31:16]
0x004- 0x00D	EPC	0x000	0x00	CRC
0x010- 0x013	TID	0x000	0x00	TID - Word 0: x <b>E201</b>
0x016	USER	0x002	0x02	Control/Status Register
0x017	USER	0x003	0x03	Working Stored Address Register
0x018	USER	0x004	0x04	-
0x019	USER	0x005	0x05	
0x01A	USER	0x006	0x06	USER Memory - Start
0x3FB	USER	0x3E7	0x8767	16k Memory: END (BLK_SIZE > 16 wrds/blk)

### **Graphical User Interface (GUI) Set Up**

- **1.** Connect the MaxReader to the host computer using a USB cable.
- 2. Connect the Power Supply to the reader and to an available wall outlet
- 3. Double click the MaxArias.exe icon. The window below will appear.
- 4. If the drivers have been installed correctly, MaxReader will emit a short rising tone. When the USB interface is disconnected MaxReader will emit a short falling tone.

	Action	Data			
] Query 📃 Continuous	GD STOP Scanfif	Address	Write Data	Read Data	*
Write Memory 🔲 160kbps	🔲 show all	0x0000	0xXXXX	0xXXXX	
Deed Mensen : Receiver	Correst Search	0x0001	0xXXXXX	0xXXXXX	
Read Memory 🔄 Speaker		0x0002	DxXXXXX	0xXXXX	
<b>T</b> 1 III		0x0003	0xXXXX	0xXXXX	
Inrottie	Query Statistics:	0x0004	DxXXXXX	0xXXXXX	
	quory oranonos:	0x0005	0xXXXX	0xXXXX	
	0/0	0x0006	DxXXXXX	0xXXXXX	
ddressing		0x0007	0xXXXX	0xXXXX	
ad ocomb	Tag(s) Detected:	0x0008	0xXXXXX	0xXXXXX	
Start Address 06	5.7	0x0009	0xXXXX	0xXXXX	
Stop Address 17		0x000A	DxXXXXX	0xXXXX	
		0x000B	0xXXXX	0xXXXX	
		0x000C	0xXXXX	0xXXXXX	
)ata Source		0x000D	DxXXXX	0xXXXX	
		0x000E	0xXXXX	0xXXXX	
Ose Address	Write Statistics	0x000F	DxXXXXX	0xXXXXX	
Random	mile Statistics	0x0010	0xXXXX	0xXXXX	
Ilser Data File:		0x0011	0xXXXXX	0xXXXXX	
O oser Data The.		0x0012	0xXXXX	0xXXXX	-
	<u></u>	0x0013	(IxXXXX	(bxXXXX	
come to MaxReader		0x0013 ∢	fhcXXXXX III	DxXXXXX +	



#### **Operation Examples**

#### Example #1: Simple Query

In this example MaxReader has been setup to continuously perform GEN2 QUERY command. Note that the MaxReader has detected a tag shown in the "Tag(s) Detected" field and has been successfully read/identified (queried) 100% of the time. Each time a tag is successfully queried, the "Query Statistics" will improve.

570P Scankir	Address	Write Data	Read Data	*
show all	0x0007	0xXXXX	0xXXXX	
Chart search	0x0008	0xXXXXX	0xXXXX	
Libar	0x0009	0xXXXXX	0xXXXX	
	0x000A	0xXXXX	0xXXXX	
Query Statistics:	0x000B	0xXXXX	0xXXXX	
quoiy otationoo.	0x000C	DxXXXXX	0xXXXX	
510/511 %100	0x000D	0xXXXX	0xXXXX	
	0x000E	0xXXXX	0xXXXX	
Tag(s) Detected:	0x000F	0xXXXX	0xXXXX	
2400 100120022002400450050444 2000	0x0010	DxXXXXX	0xXXXX	
3400_10012002300340045005644A_2D98	0x0011	DxXXXXX	0xXXXX	
	0x0012	DxXXXX	0xXXXX	
	0x0013	0xXXXX	0xXXXX	
L	0x0014	0xXXXXX	0xXXXX	
	0x0015	0xXXXXX	0xXXXXX	
Write Statistics	0x0016	0xXXXXX	0xXXXX	
	0x0017	0xXXXX	0xXXXX	
	0x0018	0xXXXX	0xXXXX	
	0x0019	UKXXXX	UxXXXX	-
<u> </u>	0x001A	INXXXX	(MXXXX)	
	Clear search Query Statistics: 510/511 %100 Tag(s) Detected: 4000_10012002300340045005644A_2098 Write Statistics	Clear         search         6x0009           Query Statistics:         6x0002           510/511         %100         6x0002           Tag(s) Detected:         6x0001         6x0001           3400_10012002300340045005644A_2D98         6x0012         6x0012           Write Statistics         6x0015         6x0016           Write Statistics         6x0017         6x0018           0x0018         6x0015         6x0015	Deer         search         bx0008         bx00003           Query Statistics:         bx0009         bx0000X           510/511         %100         bx0002         bx0000           Tag(s) Detected:         bx0001         bx0000X         bx0000X           5400_10012002300340045005644A_2098         bx0001         bx0000X         bx0000X           Write Statistics         bx0011         bx0000X         bx0000X           bx0011         bx0000X         bx0000X         bx0000X           bx0011         bx0000X         bx0000X         bx0000X           bx0011         bx0000X         bx0000X         bx0000X           bx0011         bx0000X         bx0000X         bx00011           bx0011         bx0000X         bx0000X         bx00011           bx0011         bx0000X         bx00011         bx0000X           bx0011         bx0000X         bx00011         bx0000X           bx00114         bx0000X         bx00015         bx000X           bx0015         bx000X         bx0017         bx000X           bx0018         bx000X         bx0019         bx00XX	Deer         search         b.0008         b.00003         b.00000           Query Statistics:         b.00004         b.00003         b.00003           510/5111 %100         b.00002         b.00003         b.00003           Tag(s) Detected:         b.0000         b.00003         b.00003           10012002300340045005644A_2D98         b.0001         b.00002         b.00002           Write Statistics         b.0011         b.00002         b.00002           words         b.00005         b.00002         b.00002           b.0011         b.00002         b.00002         b.00002           b.00115         b.00002         b.00002         b.00002           b.00116         b.00002         b.00002         b.00002           b.00116         b.00002         b.00002         b.00002           b.00116         b.00002         b.00



#### Example #2: Simple Read

In this next example, start address is still 0x10 and the end address is now 0x20. The "Data" window shows the entire memory contents of the WM72016 Evaluation Board with addresses 0x10 to 0x20 being read.

etup	Action	Data		
Query 🔽 Continuous	GO STOP ScanRF	Address	Write Data	Read Data
Write Memory 🔲 160kbps	🗖 show all	0x000F	0xXXXX	0xXXXXX
	Course search	0x0010	0xXXXXX	0x0029
Read Memory 🔄 Speaker	Liear	0x0011	0xXXXXX	0x0030
		0x0012	0xXXXX	0xF417
Throttle	Query Statistics	0x0013	0xXXXX	0xF612
	Query Statistics.	0x0014	0xXXXX	0xC3A1
	146/146 %100	0x0015	0xXXXXX	0x422A
ddressing		0x0016	0xXXXX	0x2B98
uuroosing	Tag(s) Detected:	0x0017	0xXXXX	0xA848
Start Address 10		0x0018	0xXXXX	0xF05E
Stop Address 20	3400_10012002300340045005644A_2D98	0x0019	0xXXXX	0xF76C
Stop Address 20		0x001A	0xXXXXX	0xAE8D
		0x001B	0xXXXX	0xFA80
ata Source		0x001C	0xXXXX	0xC7E1
		0x001D	0xXXXX	0x9BB4
O Use Address	Write Statistics	0x001E	0xXXXX	0x08AB
Random	write Statistics	0x001F	0xXXXX	0x7B34
© U D-+- Cil		0x0020	DxXXXXX	0x8A35
O User Data File:		0x0021	0xXXXX	0xXXXX
		0x0022	0xXXXX	0xXXXX
rt Address set to 010 p Address set to 00F p Address set to 020				E
				•



#### Example #3: Simple Write

In this next example a WRITE command will be used to show data being written to a specific memory location. The same address range as the example above (0x10 to 0x20) will be written to. Note the read data is displayed next to the write data in the "Data" window.

Setup	Action	Data		
🔲 Query 💿 Continuous	GO STOP ScanRF	Address	Write Data	Read Data
Write Memory 🔲 160kbps	🗖 show all	0x000F	0xXXXX	0xXXXX
	Com search	0x0010	0xAA07	0xXXXX
Read Memory Speaker	Liear	0x0011	0x52BF	0xXXXX
<b>-</b>		0x0012	0xFA33	0xXXXX
I hrottle	Query Statistics	0x0013	0x7162	0xXXXX
	quory oransitos:	0x0014	0x2F7A	0xXXXX
	66/66 %100	0x0015	0x07F6	0xXXXX
Addressing		0x0016	0xC916	0xXXXX
Add cooling	Tag(s) Detected:	0x0017	0xF909	0xXXXX
Start Address 10		0x0018	0x3603	0xXXXX
Stop Address 20	3400_10012002300340045005644A_2D98	0x0019	0x6A1F	0xXXXX
		0x001A	0x2D5B	0xXXXXX
		0x001B	0x7F45	0xXXXXX
Data Source		0x001C	0x58EB	0xXXXXX
		0x001D	0x86CA	DxXXXXX
O Use Address	Write Statistics	0x001E	0x2D86	DxXXXXX
Random	Hille Statistics	0x001F	0xF0AB	DxXXXXX
Usor Data Fila:	Wrote 256 bits in 22.501mS	0×0020	0x7D86	DxXXXXX
Oser Data The.		0x0021	0xXXXXX	DxXXXXX
		0x0022	0xXXXXX	0xXXXXX
Welcome to MaxReader				,
ntitalizing reader Ready Start Address set to 010 Stop Address set to 020				
4				Þ



#### Warning



The circulator housing and heat sinks (see page 3) can become hot during continuous use of the MaxReader board. Please take precaution to avoid skin contact with these components.



### **About Ramtron International Corp.**

Ramtron International Corporation, headquartered in Colorado Springs, Colorado, is a *fabless* semiconductor company that designs, develops and markets specialized semiconductor memory and integrated semiconductor solutions used in a wide range of product applications and markets worldwide.

Ramtron pioneered the integration of ferroelectric materials into semiconductor products that enabled a new class of nonvolatile memory, called ferroelectric random access memory, or F-RAM. Ramtron's ferroelectric memories combine high-speed performance of Random Access Memory (RAM) with true nonvolatile storage that delivers the ability to save data without power. Since commercializing the technology, Ramtron has sold hundreds of millions of F-RAM devices into demanding applications such as automotive safety and entertainment systems, portable medical devices, industrial process control systems, smart electricity meters, and consumer printer cartridges. As the most power-efficient of any nonvolatile memory technology on the market, F-RAM products promise to pave the way for the development of ultra-efficient battery powered products and energy harvesting applications, among others. For more information, visit <u>www.ramtron.com</u>.

