RX211 User manual

Document Reference: RX211 V1.5 Access Reader User Manual

Date: 19th of March 2012

ABBREVIATIONS

Abbreviation	Meaning
CR	Carriage Return
EOM	End of Message
I/O	Input/Input
ID	Identity
LF	Line Feed
LSB	Least Significant Bit/Byte
m	Meter
mm	Millimetre
MSB	Most Significant Bit/Byte
NC	No Connection
PC	Personal Computer
Pwr	Power
RF	Radio Frequency
RFID	Radio Frequency Identification
Rx	Receive
SOM	Start of Message
TBA	To be Announced
Tx	Transmit
UPS	Uninterruptible Power Supply
RSSI	Received Signal Strength Indicator
PCB	Printed Circuit Board

1 Product Compatibility

The RX210, RX211 and IPSU are cat5 Patch lead friendly products.

The Cat5 patch lead family of products are not in any way compatible with the legacy wiring loom products and can cause them damage.

The RX211 should only ever be used with the RX210 and IPSU and must be connected using standard cat5 patch cable.

Never mix or try to connect up an RX210, RX211 or IPSU with legacy wiring or legacy readers.

Failure to comply with this statement will damage the products and will not be covered by the terms of the warranty.

If you are in any doubt please contact your local Wavetrend representative.

For clarity the products are clearly identified below

Legacy Wiring Family

RX202

RX201

PSU300

Cat5 Patch Lead Friendly Family

RX210

RX211

IPSU

2   Overview

The RX211 is Wavetrend's new multi-role access control reader, combining local data base management , Wiegand functionality and relay control in a single product.

The Reader is used in the system to perform the following functions:

- Receive, decode and validate data from Wavetrend L series and Wavetrend L series+ tags.

- Output relevant tag data via USB or via the Reader Network.

- Control two sets of relays autonomously or from user input.

- Actively filter tags and activate relays based on a reader stored database.

- Anti collision functionality without a PC host

- Mustering of tags in and out based on reader stored database.

The Reader is used in the system to perform the following functions:

- Receive, decode and validate data from Wavetrend L

- Output relevant tag data via USB or via the Reader Network.

The Reader comprises the following functionality and properties

- RF Module (RF Receiver and Demodulator).

- Micro-controller

- LED indicators on the output connectors.

- Micro USB socket

- 2.5mm Power plug

The RX210 Reader can be used with the following Wavetrend Antennas AN-100 / 200 / 300 / 400 and any other 433MHz antenna that has a 50 Ohm termination   resistance

2.1 New Generation reader Properties

The RX202/RX210 and RX211 family are significantly different from there predecessor the RX201.

These differences are summarised here and explained in more detail throughout the manual.

Front End Filtering

The RX202/RX210/RX211 utilise front end RF filtering allowing them to work extremely effectively in noisy RF environments including in direct proximity to other 433MHZ emitters including TETRA band.

RSSI Response

The RX202/RX210/RX211 have a linear calibrated response which includes operation at both High and Low gain modes.
The sensitivity of the new readers is vastly superior to the RX201 and allows both greater read range at large distances and also RSSI granularity allowing readers to used for reading tags as close up as 10cm.
This close reading ability has obsoleted the requirement for PROX readers in the new product range , instead the user may simply apply a suitable RSSI filter.

Buffer Size

The RX202/RX210 and RX211 have a larger buffer size of 9 tags compared to the RX201 which was 5 Tags.

RJ45 Connection

In the event that a user connected up an RX201 incorrectly there was a high chance that the damage could be caused to the reader.
All of the RJ45 connections on the RX202/RX210 and RX211 are protected by self resetting fuses. In the event that the user makes a mistake and miss connects the reader , these fuses will set and the reader will appear to be dead. Check the connection then allow the reader 2 seconds to reset.

USB Connection

All the new generation of readers support configuration over USB.
Before you get excited and plug it in please install the FTDI drivers first as detailed later in the manual. This connection can be used for standalone applications.

No Nulls

One of the criticisms of the RX201 network configuration was that in auto poll the system always reported NULL TAG packets when a reader that had an empty tag buffer was polled. There is now an option to turn this off in the Protocol setting. Please note this option is only available for autopoll, a manually polled reader will always respond back with a full or empty tag packet as its ACK.

TTL

TTL is not supported by the RX202/RX210/RX211 Readers

2.2 Functional Diagram

The L-RX211 Reader has the following functional structure.

```
                        ┌──────────────┐
                        │  RF Receiver │
                        └──────┬───────┘
                               ↕
┌──────────────┐        ┌──────────────┐        ┌──────────────┐
│    Memory    │◄──────►│ Microprocessor│◄──────►│  Indication  │
└──────────────┘        │  Controller  │        └──────────────┘
                        └──────┬───────┘
          ┌────────────────────┼────────────────────┐
          ↓                    ↓                     ↓
┌──────────────┐        ┌──────────────┐        ┌──────────────┐
│  RJ45 RS232  │        │  RJ45 RS485  │        │   USB Port   │
└──────────────┘        └──────────────┘        └──────────────┘
```
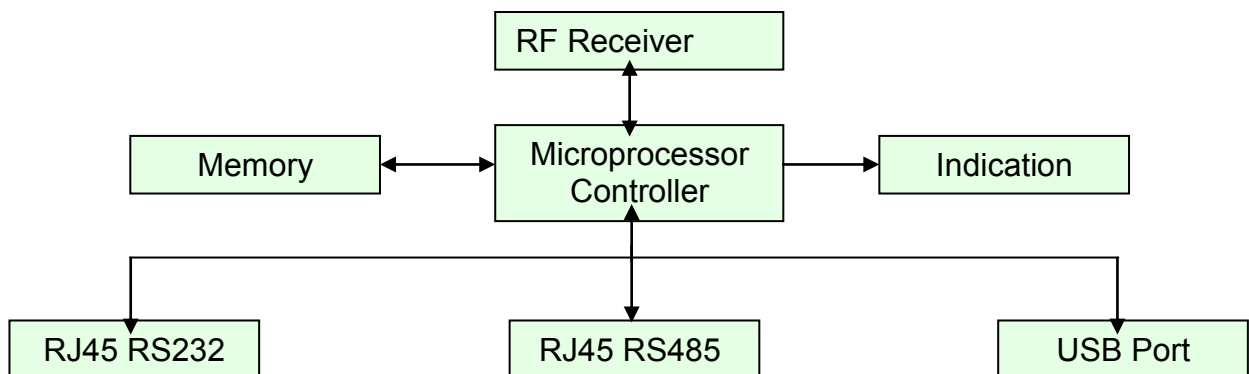
This receiver consists of a microprocessor controller with onboard firmware that communicates directly with the RF Receiver module and connects to the outside world via 3 interfaces. The RS232 and RS485 share the single RJ45 on the bottom of the reader, the USB socket is located on the top of the reader.

3   Hardware Configurations.

Wavetrend recommend the following configuration methods

Single reader over USB for Demo Purposes and Single reader Deployments

The RX211 when used as a standalone unit can draw power over the USB .

USB lead

RX211
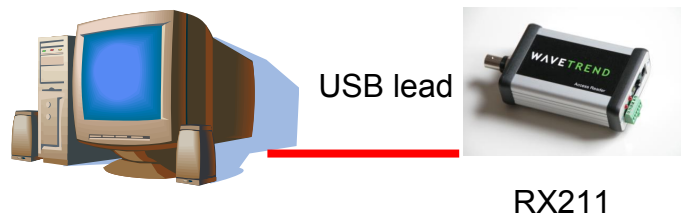
Reader Network USB Host to RS485
The IPSU supports USB, RS232 and RS485 allowing it power up to 8 readers over RS485* Dependent on cable lengths.

In order to power longer cable runs with more readers an IPSU can be added in line to provide extra power or individual readers can be powered through their 2.5mm Jack plugs.

USB lead   IPSU   Cat 5 Patch   RS485   RX210

Reader Network USB Host to RS485 with RX211
An RX211 can be deployed on its own or on the end of a network of RX210's

USB lead   IPSU   Cat 5 Patch   RS485   RX210   RX211

In the event that the RX211 is being used as the last reader on a RX210 network the RX211 will behave in the same way as if it was the last RX210 on the end of a network.
For all details of RX210 network configuration please consult the RX210 manual.

4 Protocols and Addressing

The RX211 can be used a standalone reader or as part of an RX210 network , data flowing on this networks have a specific packet format. This format is defined as follows:

4.1 Command Packets

0xA	Data	Network	Receiver	Node	Command	Data	Checksum

All bytes are HEX Values

1.	Header	1 Byte [0xAA]
2.	Length	1 Byte (Number of Bytes in data section)
3.	Network ID	1 Byte
4.	Receiver ID	1 Byte
5.	Node ID	1 Byte
6.	Command	1 Byte
7.	Data	Up to 64 Bytes of Data
8.	Checksum	1 Byte

CHECKSUM = [Length] XOR [Receiver ID] XOR [Token ID] XOR [Command ID] XOR [Data]…XOR [Data]

4.2 Response Packets

0x5	Data	Network	Receiver	Node	Command	Data	Checksum

All bytes are HEX values.

9.	Header	1 Byte [0x55]
10.	Length	1 Byte (Number of Bytes in data section)
11.	Network ID	1 Byte
12.	Receiver ID	1 Byte
13.	Node ID	1 Byte
14.	Command	1 Byte
15.	Data	Up to 64 Bytes of Data
16.	Checksum	1 Byte (XOR from Length to Last Data Byte),

CHECKSUM = [Length] XOR [Receiver ID] XOR [Token ID] XOR [Command ID] XOR [Data]…XOR [Data]

Command and Response packets are essentially identical except for the header character. This different header character enables equipment receiving all the data to differentiate between command and response packets. Since the RS232 port presents all the data at all times, it will be necessary here to be able to differentiate between these packets.

4.3   Addressing Techniques

The addressing system for these networks has been made as flexible as possible. This will allow for various configurations and keep the system open for later expansion etc.

When addressing a reader, there are 3 addresses to take into account:-

1. Network ID - Identifies the network (used in multi-network configurations)

2. Reader ID - User defined address for a specific reader - Permanent address defined by the user

3. Node ID   - Hardware address. This address is defined by the readers' position on the network

All three of these bytes are settable in the header bytes of the command packet.
If a zero is placed into any of these positions, it is an indication to the firmware to ignore this parameter, and only use the remaining addresses to determine the reader being addressed.
If a value of 255 is placed into any of these addresses, it is an indication to the reader that this command is being broadcast to that appropriate level. A 255 value in the Network ID byte means that the command is being broadcast over all the networks. Whereas, a 255 in either the Receiver ID bytes or Node ID bytes means that the command is being broadcast to all the readers in that network.
Node ID addresses take priority over Receiver ID addresses. That is, a valid Node ID address will be accepted before a valid Receiver ID.
When commands are broadcast, there is no response packet generated. The only exception for this is the Reset Network Command.

A simple flow diagram for this logic would be as follows:
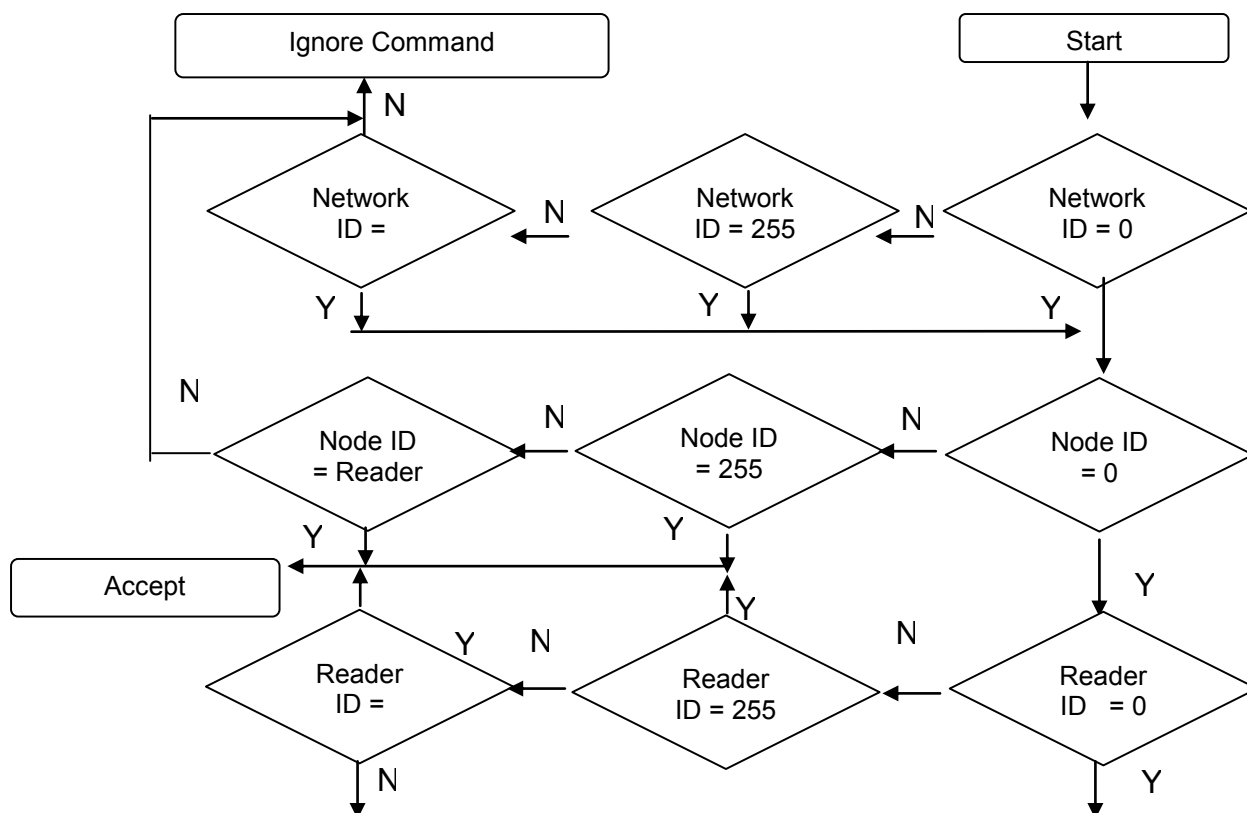
Some examples would be as follows:-

0	0	0	Invalid - will have no response
0	12	0	Access Reader with Reader ID = 12
0	0	5	Access Reader 5 on the network
0	12	5	Access Reader 5 on the network. Reader ID address is ignored
1	0	0	Invalid - will have no response
1	4	0	Access Reader with Reader ID = 4 on Network 1
1	0	123	Access Reader 123 on the Network 1
255	12	0	Access all Readers with Reader ID = 12 on all the networks
255	0	45	Access Reader 45 on all the Networks
255	255	0	Access all possible readers
255	0	255	Access all possible readers
0	255	255	Access all possible readers
			Etc …

5   Commands

The RX211 is a multirole reader that can be deployed for large range of tasks.
Some of the these application such as Door entry control for an example require additional levels of security.
Wavetrend has split the RX211 command set into non secure commands and secure commands which are password protected, I.e. the user must be logged onto the reader with a valid password to access these settings.
In order to access the full command set the RX211 must be licensed as detailed in the following chapter.

These commands are listed in the following table.

5.1   Command shortlist

Shortlist of commands and requests (Command ID's):

Command	Command Code	Response	Login required
RESET NET	0x00	Reply Packet	No
ENABLE AUTO POLL	0x01	Reply Packet	No
DISABLE AUTO POLL	0x02	Reply Packet	No
PING	0x03	Reply Packet + Error Number	No
SET NETWORK ID	0x04	Reply Packet	No
SET READER ID	0x05	Reply Packet	No
GET TAG PACKET	0x06	Tag Packet	No
SET RSSI	0x07	Reply Packet	No
GET RSSI	0x08	Reply Packet + RSSI threshold	No
SET SITE CODE	0x09	Reply Packet	No
GET SITE CODE	0x0A	Reply Packet + Site Code	No
SET GAIN	0x0B	Reply Packet	No
GET GAIN	0x0C	Reply Packet + Gain Setting	No
SET ALARM FILTER	0x0D	Reply Packet	No
GET ALARM FILTER	0x0E	Reply Packet + Filter setting	No
GET INVALID TAGS	0x0F	Reply Packet + Counter	No
GET VOLTAGE	0x10	Reply Packet + Voltage	No
START EN CALC	0x11	Reply Packet	No
GET EN RESULT	0x12	Reply Packet + Result	No
SET TAG TIMEOUT	0x1D	Reply Packet	Yes
GET TAG TIMEOUT	0x1E	Reply Packet + Timeout setting	No
SET HEART BEAT	0x18	Reply Packet	Yes
GET HEART BEAT	0X19	Reply Packet + Heart beat setting	No
SET DATABASE	0x24	Reply Packet	Yes
GET DATABASE	0x25	Reply Packet + Database setting	No
WRITE DATABASE	0x26	Reply Packet	Yes
VERIFY DATABASE	0x27	Reply Packet + data base verification	No
CLEAR DATABASE	0x28	Reply Packet	Yes
SAVE DATABASE	0x29	Reply Packet	Yes
TRIGGER IO	0x2A	Reply Packet	Yes
SET IO 0	0x2B	Reply Packet	Yes
GET IO 0	0x2C	Reply Packet + IO 0 settings	No
SET IO 1	0x2D	Reply Packet	Yes
GET IO 1	0x2E	Reply Packet + IO1 settings	No

CLEAR TAG LIST	0x31	Reply Packet	Yes
SET TAG LIFE	0x32	Reply Packet	Yes
GET TAG LIFE	0x33	Reply Packet + tag life setting	No
SET DEFAULT	0x35	Reply Packet	Yes
SET WIEGAND	0x3B	Reply Packet	Yes
GET WIEGAND	0x3C	Reply Packet + Wiegand setting	No
SET PROTOCOL	0x40	Reply Packet	No
GET PROTOCOL	0x41	Reply Packet + Protocol setting	No
SET INFO	0xF0	Reply Packet	No
GET INFO	0xF1	Reply Packet + Info data	No
SET BAUD RATE	0xFE	No Reply – Broadcast only	No
GET VERSION	0xFF	Reply Packet + Version Data	No

5.2   Command Details

Reset Network Command

The function of this command is to reset the entire network, and re-establish the NODE ID addresses. The NODE ID address in the command packet should hold a 255 (broadcast value) to ensure that the entire network enters into the reset sequence. Only reader 1 will respond with the reply packet. This is the only condition under which a response is sent from a broadcast command.
Note: receiving a reset network reply packet at any point where no reset command was sent, will imply that a spontaneous reset has occurred. This would probably be as the result of a power problem.

Command

0xA	0x0	0x00	0x00	0xFF	0x00	Checksum

Response

0x5	0x00	Network	Receiver	0x01	0x00	Checksum

Start / Enabling Polling Mode Command

The function of this command is to set Reader 1 into an Automatic Polling sequence. It sets the Auto Polling flag in the Data EEPROM to enable Auto Polling after power up.
It will establish the size of the network by sending out tag requests until such time that it gets no response. This will determine the number of readers on the network. Once this has been established, it will sequentially poll each reader indefinitely. Data responses from the readers pass through reader 1 and onto the PC. Readers without a valid tag will respond with an empty packet of data. This will enable the monitoring software to determine if any readers are no longer responding. This command can be addressed directly to reader 1, or on a broadcast basis. When broadcasting, any reader that is not Reader 1, will disable its Auto Polling flag in its Data EEPROM to avoid any problems in the future because of incorrect parameters.
This command is used to restart the Auto Polling if it has been stopped by a break character. (See Auto Polling section)

Command

0xA	0x00	Network	Receiver	Node ID	0x01	Checksum

Response

0x5	0x00	Network	Receiver	Node ID	0x01	Checksum

Disable Auto Polling Command

The function of this command is to disable future Auto Polling after power up by resetting the Auto Polling flag in the Data EEPROM. This command can be addressed directly to reader 1, or on a broadcast basis.

Command

0xA	0x00	Network	Receiver	Node ID	0x02	Checksum

Response

0x5	0x00	Network	Receiver	Node ID	0x02	Checksum

Ping Reader Command

The Ping Command is simply used to check if a reader is on the network and responding correctly. It can be used to read back Network ID's, Reader ID's and Node ID's. Inserted into the response from a Ping Command is and Error Number. This number refers to the last error the respective reader has experienced. Once read, this number is cleared.
To clear all the errors on all the readers, simply broadcast a Ping Command.

Command

0xA	0x00	Network	Receiver	Node ID	0x03	Checksum

Response

0x5	0x01	Network	Receiver	Node ID	0x03	Error	Checksum

Error Numbers are as follows:

0	No errors encountered
1	Unknown reader command received
2	Tag Table underflow error
3	Command Packet checksum error
4	RF Module - Unknown command response
5	RF Module - Unknown general response
6	RF Module - Re-sync failure
7	RF Module - Command response failure
8	RF Module - Receive response failure
9	No response packet received from polled reader

Set Network ID Command

The function of this command is to assign the Network ID as well as commit it to the Data EEPROM.

Command

0XA	0x01	Network	Receiver	Node ID	0x04	New Network	Checksum

Response

0X5	0x00	Network	Receiver	Node ID	0x04	Checksum

Reader ID Command

The function of this command is to assign the Reader ID as well as commit it to the Data EEPROM.

Command

0XA	0x01	Network	Receiver	Node ID	0x05	New Reader ID	Checksum

Response

0x5	0x00	Network	Receiver	Node ID	0x05	Checksum

Get Tag Packet Command

This will be the most used command on any system. Its function to request a Tag from the reader if there is one ready for sending. A tag is removed from the tag buffer, and returned with this command, making room for a new tag.
New tags from the RF Module are written over existing tags in the Tag Buffer in order to keep the data fresh.
Should no tag be ready for sending, and empty packet is sent back. That is, no data in the Data field.

Command

0XA	0x00	Network	Receiver	Node ID	0x06	Checksum

Response (empty)

0x5	0x00	Network	Receiver	Node ID	0x06	Checksum

Response (Tag Packet)

0x5	Data Length	Network	Receiver	Node	0x06	Dat	Checksum

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The Data Field would have this format:

1	!
2	*
3	*
4	Interval
5	Reed Switch Counter
6	Firmware version
7	B
8	C
9	Movement switch counter
10	Age byte MSB
11	Age byte
12	Age byte
13	Age byte LSB
14	Site code MSB
15	Site code
16	Site code LSB
17	Tag ID MSB
18	Tag ID
19	Tag ID
20	Tag ID LSB
21	Type of tag flag
22	Reader ID
23	RSSI signal strength
24	Checksum
25	20H (reserved)
26	Alarm byte
27	Node ID
28	Network ID
29	Reader Set RSSI Value
30	Firmware Version
31	LF
32	CR

Set RSSI Value Command

This command will set the RSSI value and commit it to the Data EEPROM. It also initiates an RF Module reset and writes the new value to the RF Module. Broadcasts here are useful to set all the readers to their most sensitive etc. The RSSI Value ranges from 0 to 255. 0 being the most sensitive.

Command

0xA	0x01	Network	Receiver	Node ID	0x07	New RSSI	Checksum

Response

0x5	0x00	Network	Receiver	Node ID	0x07	Checksum

Get RSSI Value Command

This command will return the RSSI value it is currently using, and defined in the Data EEPROM.

Command

0xA	0x00	Network	Receiver	Node ID	0x08	Checksum

Response

0X5	0x01	Network	Receiver	Node ID	0x08	RSSI	Checksum

Set Site Code Command

The Site Code or Site Code is a group of 3 bytes assigned to each tag. Its function is to enable the reader to filter out any tags that it receives that is not part of the site it is monitoring. These values are committed to the Data EEPROM.
When a Site Code of 0 value is assigned, then all the tags read are reported.
Entering a separate code, will result in any tags other than those meeting this code to be rejected by the reader.

Command

0xA	0x03	Network	Receiver	Node	0x0	Site	Site 2	Site 3	Checksum

Response

0x5	0x00	Network	Receiver	Node ID	0x09	Checksum

Get Site Code Command

This command will return the active Site Codes.

Command

0xA	0x00	Network	Receiver	Node	0x0A	Checksum

Response

0x5	0x0	Network	Receiver	Node	0x0	Site	Site 2	Site 3	Checksum

Set Receiver Gain Command

This command will set the RF Module into its 2 different gain levels.

Command

0xA	0x01	Network	Receiver	Node	0x0B	Gain	Checksum

Gain = 0   (Low Gain Mode – Short range reader)
Gain = 1   (High Gain Mode – Long range reader)

Response

0x5	0x00	Network	Receiver	Node ID	0x0B	Checksum

Get Receiver Gain Command

This command will return the Receiver Gain Mode.

Command

0xA	0x00	Network	Receiver	Node	0x0C	Checksum

Response

0x5	0x0	Network	Receiver	Node	0x0	Gain	Checksum

Gain = 0   (Low Gain Mode – Short range reader)
Gain = 1   (High Gain Mode – Long range reader)

Set Alarm Tag Filter Status Command

This command will filter out tags with a specific Alarm condition.

Command

0xA	0x01	Network	Receiver	Node	0x0D	Status	Checksum

Status = 0   - Report all tags
Status = 1   - Report only tags with an Alarm condition
Status = 2   - Report only tags without any Alarm condition

Response

0x5	0x00	Network	Receiver	Node ID	0x0D	Checksum

Get Alarm Tag Filter Status Command

This command will return the current Alarm tag filtering status.

Command

0xA	0x00	Network	Receiver	Node	0x0E	Checksum

Response

0x5	0x0	Network	Receiver	Node	0x0	Statu	Checksum

Status = 0   - Report all tags
Status = 1   - Report only tags with an Alarm condition
Status = 2   - Report only tags without any Alarm condition

Get Invalid Tag Count

This command will return the number of Invalid Tags received by the RF module since the last read. This data is calculated by the RF Module and is a direct interpretation of tag collisions or read failures. This is a 2 byte value.

Command

0xA	0x00	Network	Receiver	Node	0x0F	Checksum

Response

0x5	0x0	Network	Receiver	Node	0x0	Count_	Count_	Checksum

Count_H – Counter High Byte
Count_L – Counter Low Byte

Get Power Supply Voltage

This command will return the voltage of the power supply at this reader. It is a single byte and represents the power in 0.1 voltage increments. Eg   Value 131 = 13.1 Volts Returns the voltage that the reader is receiving, via either its RJ45 ports or via the 2.5mm power socket. It will not return the voltage that it is receiving via the USB socket if this option is being used.

Command

0xA	0x00	Network	Receiver	Node	0x10	Checksum

Response

0x5	0x0	Network	Receiver	Node	0x1	Voltage	Checksum

Start Environmental Noise Level Value Calculation

This command will set the reader into an evaluation mode in order to calculate the environmental white noise level at 433.92 MHz. The unit will remain in evaluation mode for a time period of 40 seconds. During this period no tag transmissions will be decoded. Once the calculation has been completed, the reader will resume normal operation.

Command

0xA	0x00	Network	Receiver	Node	0x11	Checksum

Response

0x5	0x00	Network	Receiver	Node	0x11	Checksum

Get Environmental Noise Level Value

This command will retrieve the calculated value (between 0 and 255) of the environmental white noise level. Take note that this command can only follow after the *Start Environmental Noise Level Value Calculation*. If a command is send down to the unit, while still in evaluation mode, the reader will cancel the calculation process, reset and continue normal operation.

Command

0xA	0x00	Network	Receiver	Node	0x12	Checksum

Response

0x5	0x0	Network	Receiver	Node	0x1	Noise	Checksum

Reset Network Baud Rate Command

This command will reset the network Baud Rate. <u>It will only accept a broadcast command and there is no response sent.</u> Changes are immediate will result in communications loss if the PC does not change its baud rate accordingly.

Command

0xA	0x01	0xFF	0xFF	0xFF	0xFF	Rate	Checksum

Rate 0 = 115200 baud
Rate 1 = 57600 baud
Rate 2 = 38800 baud
Rate 3 = 19200 baud
Rate 4 = 9600 baud

Get Receiver Version Information Command

This command will return the Receiver Version Information. These include
Controller Firmware Version
RF Module Firmware Version
Controller Hardware Version
RF Module Hardware Version

RF Module versions are read directly from the module itself. This data is in the following format:

Value = 13 = Version 1.3

Command

0xA	0x00	Network	Receiver	Node	0xFF	Checksum

Response

0x5	0x0	Network	Receiver	Node	0xF	CFV	RFV	CH	RH	Checksum

CFV - Controller Firmware Version
RFV - RF Module Firmware Version

CHV - Controller Hardware Version
RHV - RF Module Hardware Version

Set Protocol

The RX202, RX210 and RX211 support the L series+ protocol as well as the existing L series protocol. The Set Protocol has 3 options
Command

0xAA	0x02	Network ID	Reader ID	Node ID	0x40	Data	Checksum

Data (2 bytes): Protocol: 0 = legacy, 1 = no nulls, 2 = L-Plus
          RS 232 enable: 0 = OFF, 1 = ON

Response

0x55	0x00	Network ID	Reader ID	Node ID	0x40	Checksum

1) **Legacy,** the reader will receive - standard L series tag packets and will generate Null tag packets in the event that no tags are within range.
Null packets are empty tag packets that some Legacy software uses as a form of heartbeat to check the network is operating.
2) **No Nulls,** the reader will receive - standard L series tag packets. No Nulls will be generated, only for Autopoll .
3) **L Series**+ Not Implemented yet.

Get Protocol

Returns the Protocol setting
Command

0xAA	0x00	Network ID	Reader ID	Node ID	0x41	Checksum

Response

0x55	0x02	Network ID	Reader ID	Node ID	0x41	Protocol	Checksum

Data (2 bytes): Protocol: 0 = legacy, 1 = no nulls, 2 = L-Plus
          RS 232 enable: 0 = OFF, 1 = ON

Set Info

The serial readers are part of the larger Wavetrend Reader family, some of which include GPS. In order to harmonize the software interface between the serial readers and the GPS enabled RX1310 the command allows the user to set the following fields

1) Latitude (4 bytes)
2) Longitude (4bytes)
3) User Data (10 bytes)

0xAA	0x12	Network ID	Reader ID	Node ID	0xF0	Data	Checksum

Data (18 bytes): Location: Latitude – 4 bytes
Longitude – 4 bytes
User Data: 10 bytes

Response

0x55	0x00	Network ID	Reader ID	Node ID	0xF0	Checksum

Get Info

Returns the Set Info settings as well as the following values
Model number (1 byte): 1= RX210, 2 =RX211, 3 = RX202
Reader serial number (4bytes)
Location: Latitude (4bytes), Longitude (4bytes)
User Data (10bytes)

0xAA	0x00	Network ID	Reader ID	Node ID	0xF1	Checksum

Response

0x55	0x17	Network ID	Reader ID	Node ID	0xF1	Data	Checksum

Data (57 bytes): Model number:(1 byte): 1= RX210, 2 =RX211, 3 = RX202
Status:bit 0: Not used
bit 1: Not used
bit 2: Autopol setting
bit 3: Gain setting
bit 4: Not used
bit 5: Not used
bit 6: RS232 enable setting
bit 7: Not used
Serial number (4 bytes)
Location: Latitude – 4 bytes

Longitude – 4 bytes
User Data: 10 bytes
RSSI threshold: 1 byte
Site code filter: 3 byte
Alarm filter: 1 byte
Network Voltage: 1 byte
Not used: 21 bytes
Protocol (1 byte):0 = legacy, 1 = no nulls, 2 = L-Plus
Controller Firmware Version (1 byte)
RF Module Firmware Version (1 byte)
Controller Hardware Version (1 byte)
RF Module Hardware Version (1 byte)

Status

The Status tab command shows the user all of the reader settings in response to the Get Info command, displayed below in Wavetrend Analyser.

Set Tag timeout

The RX211 supports tag buffering and alerts for up to 300 tags, in order to buffer tags the value of Set Tag timeout must be set higher than its default value of 0, its range is 0-3600 seconds.

Set Tag Timeout - 1Dh (47) – Password Protected

Command

0xAA	0x02	Network ID	Reader ID	Node ID	0x1D	Data	Checksum

Data (2bytes: MSB, LSB): 0x0000 – 0x0E10; Tag timeout in seconds (1-3600 sec) 0 means infinite timeout

Response

0x55	0x00	Network ID	Reader ID	Node ID	0x1D	Checksum

Once set the reader will register the tag to its internal lookup table, the tag will remain in the table provided that it is seen again before the tag timeout period has elapsed. If it is seen with in the period the timeout counter will be reset.

The tag time out command can be used in unison with the **SET IO** commands, the first seen and last seen tag events can be used to trigger the relay IO's.

Each received transmission from the tag will be displayed by analyser regardless of the time out state.

This functionality would often be used for applications such as barrier control where the user may want the barrier to raise on a first seen event but not to raise again for a time out period .

I.e. if the barrier raised on every transmission and the tag was set to 1.5 secs beacon rate, although amusing the barrier would not be overly useful.

Get Tag timeout

Returns the tag time out value

Clear Tag list

Clears the internal tag list.

Clear Tag List - 31h (49) – Password Protected

Command

0xAA	0x00	Network ID	Reader ID	Node ID	0x31	Checksum

Response

0x55	0x00	Network ID	Reader ID	Node ID	0x31	Checksum

Set Wiegand

This command has two settings
   1) Fast , In this mode the pulses are 50 µs with a 2ms pulse interval.
   2) Slow , In this mode the pulses are 100 µs with a 1 ms pulse interval.

Set Wiegand - 3Bh (34) – Password Protected
Command

0xAA	0x02	Network ID	Reader ID	Node ID	0x3B	Mode	Delay	Checksum

Mode: 0 = Slow, 1 = Fast
Delay: 0x01 – 0xFF; Delay between Wiegand transmissions in 1/10 seconds

Response

0x55	0x00	Network ID	Reader ID	Node ID	0x3B	Checksum

Get Wiegand

Returns the Wiegand setting

Get Wiegand - 3Ch (35)

Command

0xAA	0x00	Network ID	Reader ID	Node ID	0x3C	Checksum

Response

0x55	0x02	Network ID	Reader ID	Node ID	0x3C	Mode	Delay	Checksum

Mode: 0 = Slow, 1 = Fast
Delay: 0x01 – 0xFF

Trigger IO

Allows the user to manually Trigger IO's , the user has a choice of either relay

   1) On Zero, Trigger Relay 0
   2) On One , Trigger Relay 1

Trigger IO - 2Ah (42) – Password Protected

Command

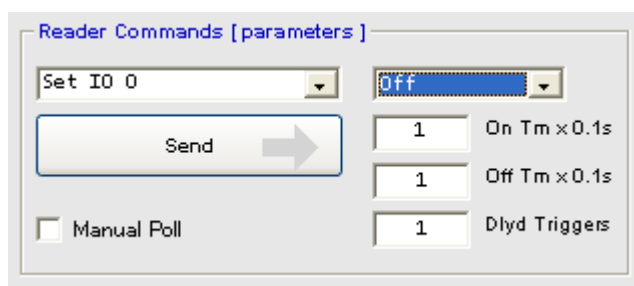| 0xAA	0x01	Network ID	Reader ID	Node ID	0x2A	IO	Checksum

IO: 0 = IO 0, 1 = IO 1

Response

0x55	0x00	Network ID	Reader ID	Node ID	0x2A	Checksum

Set IO 0

This command allows the user to control both the events and the response of the relay IO 0. The responses are shown below include

      1) **Time On** in 0.1 second steps ,
      2) **Time Off in** 0.1 second steps ,
      3) **Delayed Triggers** , on 0.1 second steps

The events are as follows

Off, the relays are not being triggered by an event
First Seen, the first time a tag is written to the tag table the relay will activate
Last Seen. If a tag has time expired and been removed from the tag list the relay will activate
Alarm , if a tag is seen in alarm , motion , tamper or both the relay will activate.
Tag life, If a tag that has exceeded the tag life is detected the relay will activate.
Muster In, The Relay will stay switched on while all of the tags in the Readers database are within read range.
Muster Out, The Relay will stay switched on if all of the tags in the Readers database are not being read.

Set IO 0 - 2Bh (43) – Password Protected

Command

0xAA	0x04	Network ID	Reader ID	Node ID	0x2B	mode	ON	OFF	Delay	Checksum

Mode: 0 = Off, 1= First Seen, 2 = Last Seen, 3 = Alarm, 4 = Tag Life, 5 = Muster in,
      6 = Muster out

On: 0x01 – 0xFF; time in 1/10 seconds

OFF: 0x00 – 0xFF; time in 1/10 seconds

Delay: 0x00 – 0xFF; number of stored delayed triggers

Response

0x55	0x00	Network ID	Reader ID	Node ID	0x2B	Checksum

Get IO 0

Returns the IO setting of IO 0

Get IO 0 - 2Ch (44)

Command

0xAA	0x00	Network ID	Reader ID	Node ID	0x2C	Checksum

Response

0x55	0x04	Network ID	Reader ID	Node ID	0x2C	mode	ON	OFF	Delay	Checksum

Mode: 0 = Off, 1= First Seen, 2 = Last Seen, 3 = Alarm, 4 = Tag Life, 5 = Muster in,
        6 = Muster out

On: 0x01 – 0xFF; time in 1/10 seconds

OFF: 0x00 – 0xFF; time in 1/10 seconds

Delay: 0x00 – 0xFF; number of stored delayed triggers

Set IO 1

Exactly the same as Set IO 0 for the second relay

Set IO 1 - 2Dh (45) – Password Protected

Command

0xAA	0x04	Network ID	Reader ID	Node ID	0x2D	mode	ON	OFF	Delay	Checksum

Mode: 0 = Off, 1= First Seen, 2 = Last Seen, 3 = Alarm, 4 = Tag Life, 5 = Muster in,
        6 = Muster out

On: 0x01 – 0xFF; time in 1/10 seconds

OFF: 0x00 – 0xFF; time in 1/10 seconds

Delay: 0x00 – 0xFF; number of stored delayed triggers

Response

0x55	0x00	Network ID	Reader ID	Node ID	0x2D	Checksum

Get IO 1

Returns the IO setting of IO 1

Get IO 1 - 2Eh (46)

Command

0xAA	0x00	Network ID	Reader ID	Node ID	0x2E	Checksum

Response

0x55	0x04	Network ID	Reader ID	Node ID	0x2E	mode	ON	OFF	Delay	Checksum

Mode: 0 = Off, 1= First Seen, 2 = Last Seen, 3 = Alarm, 4 = Tag Life, 5 = Muster in,
       6 = Muster out
On: 0x01 – 0xFF; time in 1/10 seconds
OFF: 0x00 – 0xFF; time in 1/10 seconds
Delay: 0x00 – 0xFF; number of stored delayed triggers

Set Tag life

The life expectancy of Wavetrend is dependent on a number of factors including
battery size , number of sensors , beacon rate and environmental conditions.
These are detailed in the battery manual , this setting allows the user to input a value
in seconds . that if exceeded which when combined with the corresponding IO trigger
can activate the RX211 relays.

Set Tag Life - 32h (50) – Password Protected

Command

0xAA	0x04	Network ID	Reader ID	Node ID	0x32	Data	Checksum

Data (4 bytes: MSB, byte 2, byte 1, LSB): 0x00000001 – 0xFFFFFFFF; Tag life -
compare to age count

Response

0x55	0x00	Network ID	Reader ID	Node ID	0x32	Checksum

Get Tag life

Returns the Set Tag Life value.

Get Tag Life - 33h (51)

Command

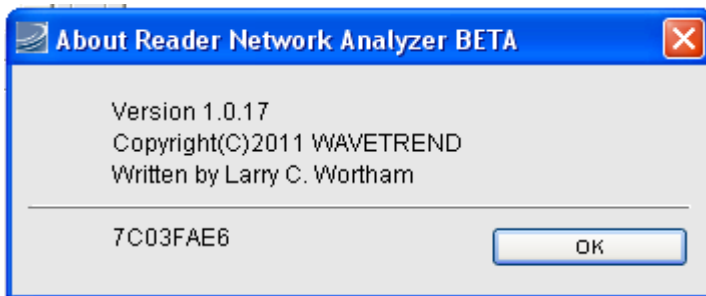| 0xAA	0x00	Network ID	Reader ID	Node ID	0x33	Checksum

Response

| 0x55	0x04	Network ID	Reader ID	Node ID	0x33	Data	Checksum

Data (4 bytes: MSB, byte 2, byte 1, LSB): 0x00000001 – 0xFFFFFFFF;   Tag life - compare to most significant 2 bytes of age count

6 Licensing the RX211

In order to obtain the license key from Wavetrend , click the about tab and the About pane will be displayed.

Copy down the key that is displayed to the left of the OK button and include it in email to your Wavetrend Representative who will mail you back a text file.
Open the file using Notepad and copy and paste the text into the registration box.
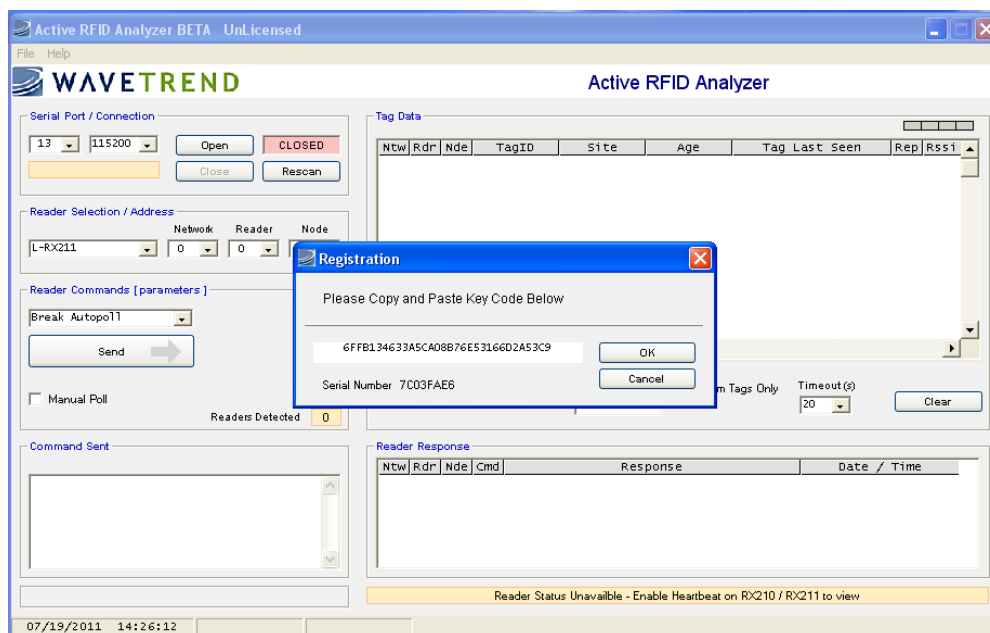
The UNLISCENSED description from the top bar will now be removed and full access is provided to the RX211 Data Base functionality.

7   RX211 Data Base Commands

As an additional layer of security the RX211 features a reader Password that can be used to prevent attempts to wipe or upload the reader Database.
The default password is 0000, this can be changed using the Set Password command to any numerical password from 1-12 digits long.

If the user does not set a password the Login and Logout functionality is effectively disabled and the reader will assume a permanently logged in state.

Set Password

Enables the user to set a numerical password up to 12 numerical characters long.

Login

Allows the user to login to the reader.
If the user incorrectly logs in 10 times the reader will be locked disabling access to the DB commands.

Logout

Logs the user out of the reader .

Set Default

This command is only available to a logged in user , it returns all of the RX211 settings to their factory default with the exception of the Password.

Set DB Mode

Enables the readers Internal Data base which stores up to 300 tags.
The RX211 can store up to 300 tag IDs complete with site code and IO information for both relays.
In essence this is a 300 unique tag ID filter that can operate the relays independently for each tag ID.
For instance the reader could be configured to open two barriers , the first 150 tags could have access to barrier 1 the second 150 to barrier 1 and 2. All of this intelligent operation is built into the reader it does not need external software in order to operate.

With DB mode set , if the reader receives a tag ID that is not in the DB it will not report it.

Get DB Mode

Returns the value of DB mode ON/OFF

Add DB Record (RAM)

Allows the user to add a single record to the database, this operation can be repeated up to the 300 tag capacity of the DB. This command updates the DB in the RAM partition of the reader memory. If power is disconnected from the reader and SAVE DB command has not been sent this entrée will be lost

Verify DB

This command returns the number of Records stored in the DB and verifies the checksum.

Clear DB

Clears the contents of the RX211 data base.

Save DB (EEPROM)

Allows the user to save all amendments to the reader's permanent EEPROM memory.

8   Data Base management Tools

The Active RFID analyser allows the user to batch down load upload and create DB
entrees for the RX211, these options are found in the File menu.

8.1   Create Database

On selection of this option the Create database window will appear, here the user can
automatically generate a sequential list of 300 tag IDs for a single site code.
The Out 0 and Out 1 commands refer to the relay outputs, A value of 1 will activate
the selected relay on the detection of the corresponding tag, a Value of 0 leaves the
relay inactive.

Create RX211 Database

Tag List

Recs to generate	10	Total Records	10

ID Start   1000000

Site Code   4278612   Out 0   Out 1   1   0

| Rec	TagID	Site	Out0	Out1
1	1000000	4278612	1	0
2	1000001	4278612	1	0
3	1000002	4278612	1	0
4	1000003	4278612	1	0
5	1000004	4278612	1	0
6	1000005	4278612	1	0
7	1000006	4278612	1	0
8	1000007	4278612	1	0
9	1000008	4278612	1	0
10	1000009	4278612	1	0

Clear List   Generate   Save

Cancel

Once the table has been populated it should be saved.

The user does not have to use Create Database in order to generate the DB, the
open data base command supports Excel CSV import allowing the user to generate
any permutation of Tag ID, Site Code or Relay output that they require.

8.2 Open Database

In order to upload the data base to the reader the user must first select their CSV file using the file manager.
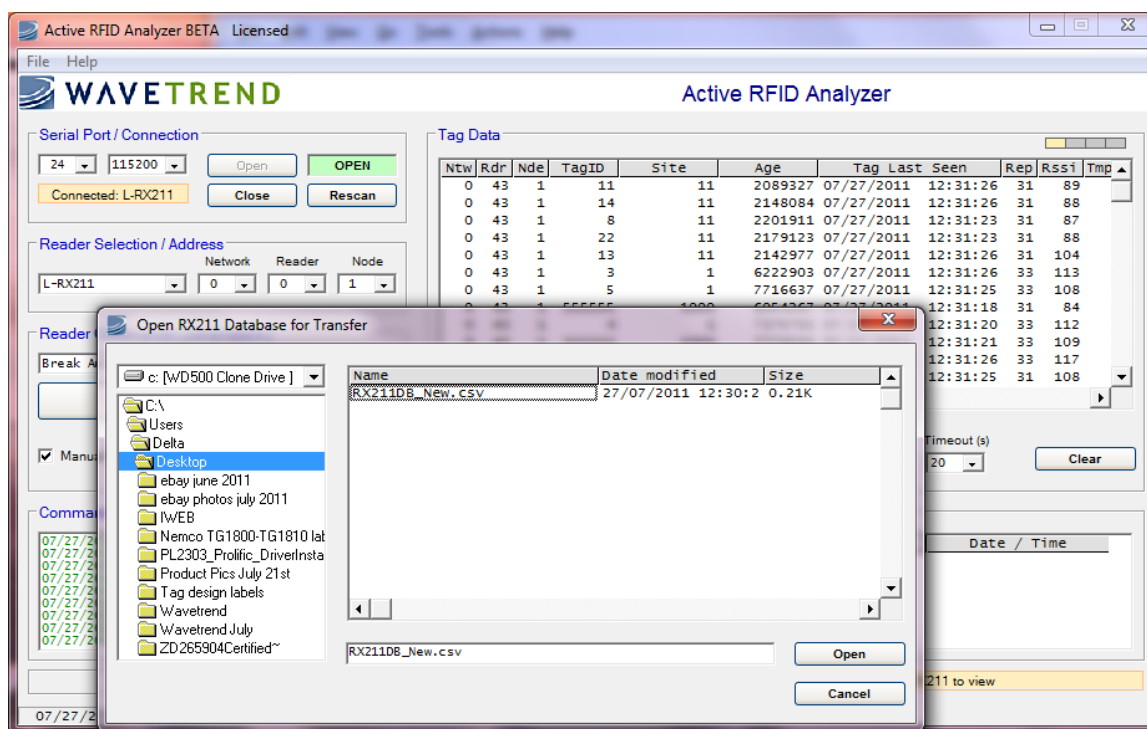

The User must then acknowledge the Transfer file request, the file will then be uploaded to the reader, a successful upload is acknowledged
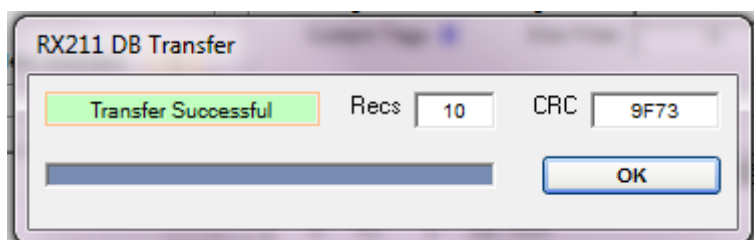
9   Unlocking the RX211

In the event that the user has incorrectly entered the reader password 10 times the unit will enter the locked state preventing all access to the database functionality.

If this occurs the user must contact their local Wavetrend representative and include in the email , the original DB licensing key.
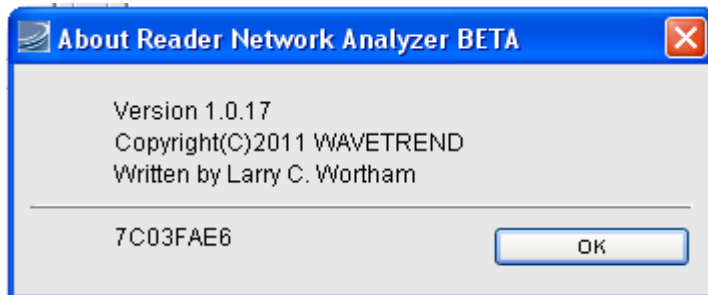
A second licensing key will be issued, this key activates the Reader Unlock tab in Active Analyser. This tab can be found under the Help Dropdown.
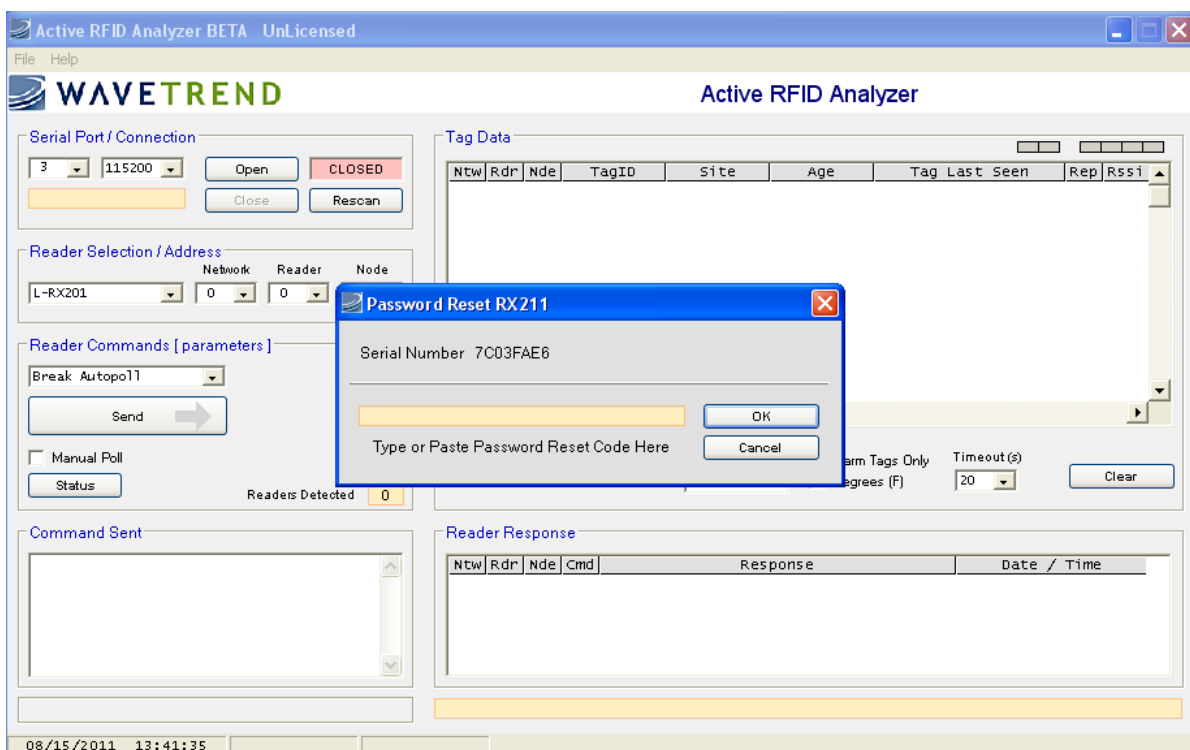
The reader Unlock tab will only be activated once per valid key entry , please ensure that the correct reader is connected before Password Reset is used.

On unlock all of the readers settings will cleared to the original factory settings. Once unlocked the reader should be powered down and powered back up before use.

10 Interfaces and Connections

10.1 Interfaces

The interface standards are as follows:
- Interface   Serial RS232 / RS485

- Baud   115 kB/s, 57.6 kB/s, 38.4 kB/s, 19.2 kB/s, 9.6 kB/s Selectable via program port

- Parity   None

- Start bit   1

- Stop   1

- Data Bits 8

10.2 RS232

The Default setting for RS232 is ON , in the event that it has been turned off
the reader must be first connected up using either 485 or the USB port.
This functionality is supported by Wavetrend Analyser, first connect the RX211 to the
PC over the USB and open Analyser.
Analyser will automatically connect and detect the reader type. The RS232
connectivity can be turned ON or OFF by ticking the option in the Ser Protocol tab as
below.
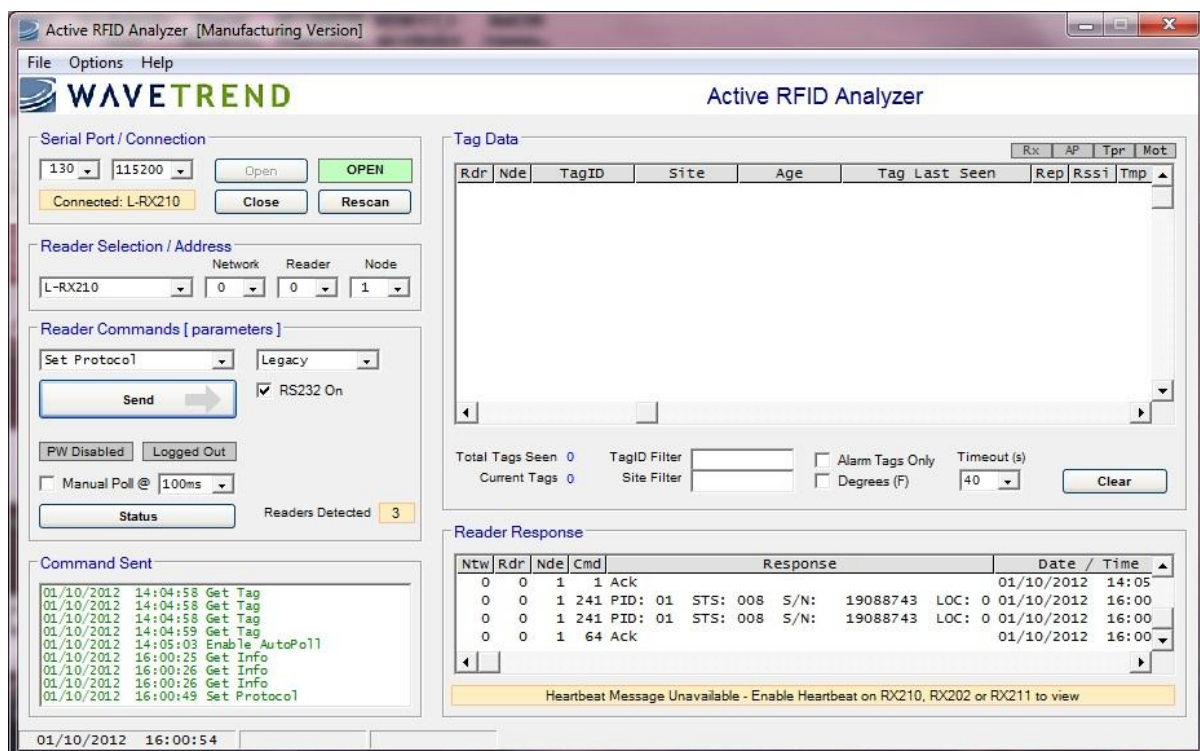
10.3 Connections

The RX211 has 1X RJ45 connectors, a 2.5mm Power socket and two sets of switchable relay contacts on the back.

The Connections are configured as follows

RX211			
R485 Port		Relay Block	
1	RS232 – RX	1	C1
2	RS232 – TX	2	NO1
3	Vin	3	NC1
4	Wiegand 0	4	C2
5	Wiegand 1	5	NO2
6	Gnd	6	NC2
7	RS485 +		
8	RS485 -		

Standard Cat 5 cabling must be used for connecting the RX211.

10.4 USB Connection.
The USB port can be found on the top of the reader , it accepts a standard USB B micro plug.

Before accessing the reader via the port the user must pre install the latest FTDI drivers for their operating system. These can be downloaded from the following URL.
 www.**ftdi**chip.com.

11 Diagnostics

11.1 Diagnostic LEDS

The 4 LED's on the RJ45 connectors indicate functions of the system and are used entirely for diagnostic purposes. Their assignments are as follows (from left to right):

Tag RX	Orang	Valid Tag received from the RF Module
System	Green	Indicates that the system communications are Idle and OK

11.2 Relay LEDS

The left hand red LED will flash when the RX211 receives a relay switch command to Relay 2 and the right hand red LED will flash on relay switch command to Relay 1.

11.3 Relay Contacts

The RX211 relay contacts are Switching contacts and are not powered,. They are rated at 2A.

12 Specifications

Environmental	
▪ Operating temperature	: -40°C to +85°C
▪ Storage temperature	: -20°C to +70°C
▪ Humidity	: 5% to 90% (non condensing)

Physical	
▪ Size	: 105 mm x 58mm x 28mm
▪ Weight (unit)	: 118 grams
▪ Colour	: Aluminium Grey
▪ Material	: Aluminium
▪ Connections	: 1 x RJ45 socket
	: 1 Mini USB type socket
	: 2.5mm Power socket
	: 2 pairs of relay contacts C,NO,NC

Radio Frequency	
▪ Receive Frequency	: 433.92 MHz
▪ Modulation	: ASK
▪ Sensitivity	:-94 dB
▪ RF Input	: 50 Ohm BNC

Electrical	
▪ Supply Voltage	: 7V ~ 16Vdc
▪ Max. current consumption	: 20 ma
▪ Relay contacts Max Current	: 2A

Protocol Specification	
▪ Standard Data Rate	: 9,600 ~ 115,200 (baud rate)
▪ Interface	: RJ45 connectors

13 Certification

The following standards applied in accordance with Article 5 of the directive, 1999/5/EC:

- EN 300 220-1 V1.2.1 (1997-11)

- ETS 300 683 (1997-03).

Summary of tests:

Test Type	
Effective radiated power	25 MHz-4 GHz
EN55022	Radiated emissions 30 MHz – 1 GHz
EN55022	Conducted emissions 150 kHz – 30
EN61000-4-3	Radiated immunity 80 MHz – 1 GHz, excl 433.92 MHz $\pm$ 20 MHz
EN61000-4-4	Electrical fast transients
EN61000-4-2	Electrostatic discharge
EN61000-4-6	Conducted immunity 150 kHz – 80

The RX211 has been tested and certified to meet FCC Part 15 1.01 for unintentional radiators.

The RX211 is produced in the USA to ROHS standards and contains no Lead