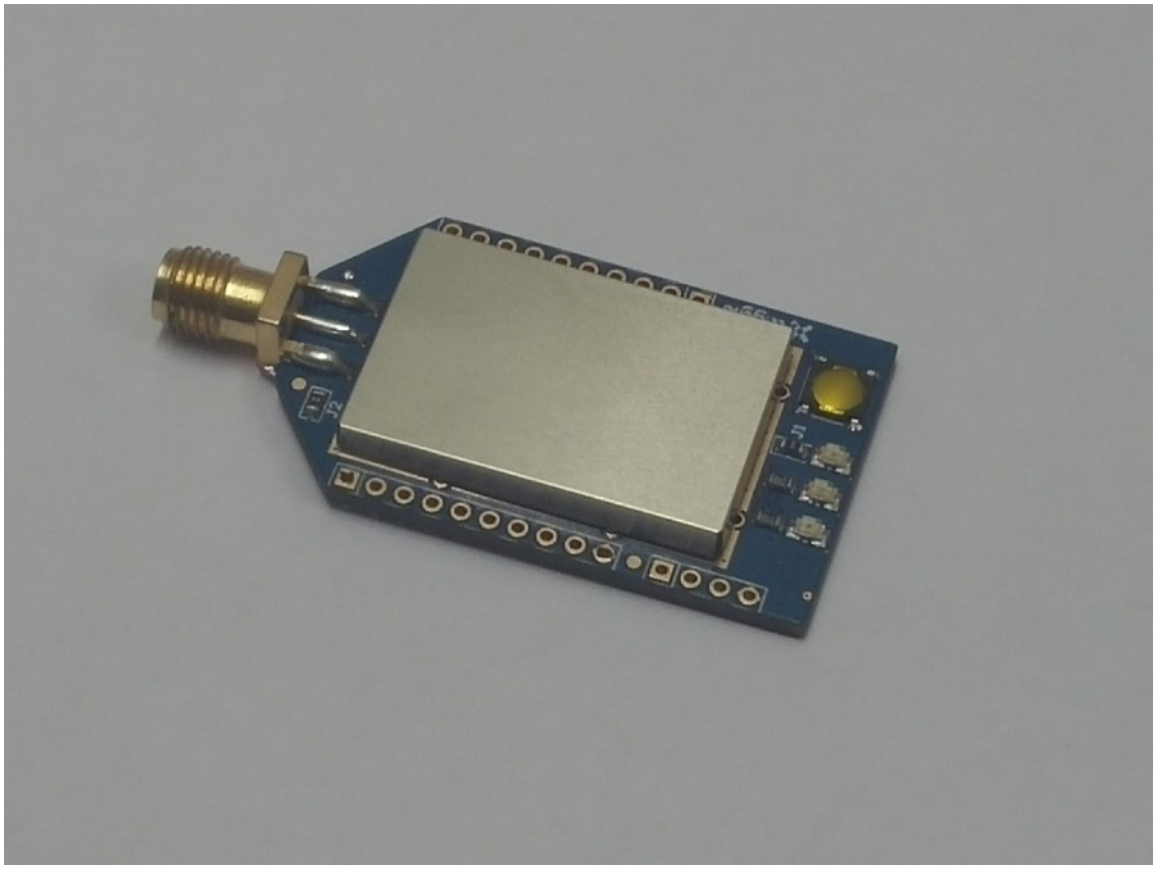
Corella User Reference Manual



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Contents

Revision History....3
1. Functional Description....4
2. Quick Setup....4
3. Hardware....5
   3.1. Absolute Maximum Ratings....5
   3.2. Electrical Characteristics....5
   3.3. Pinout 6
   3.4. Mechanical Outline....7
   3.5. Low Power mode....7
   3.6. Compatibility with Popular Development Systems....9
4. Data....10
   4.1. Serial Port Set Up....10
   4.2. Corella Packet Format....10
5. AT Commands....11
   5.1. AT (Attention)....11
   5.2. AT+STATUS....11
   5.3. AT+SEND....12
   5.4. AT+VERSION....13
   5.5. AT+ID 13
   5.6. AT+DIAGNOSTICS....14
   5.7. AT+LEDS....15
6. Serial Communication Example....16
   6.1. AT 16
   6.2. Status 16
   6.3. Send Packet....16
   6.4. Version 16
   6.5. Diagnostics....16
   6.6. ID 16
   6.7. LEDS 16
7. Application Examples....17
   7.1. Raspberry Pi Setup....17
   7.2. Arduino Setup....17

Revision History

Revision	Date	Details
0.1	5-Dec-2017	Initial draft
0.2	6-Dec-2017	Modifications by RAK
0.3	28-March -2018	Update for REV A. Pin layout, Mechanical drawing and low power section altered. Power consumption data pending firmware release. Cleaned up obsolete AT command sections.
0.4	5-May 2018	Updated AT commands and packet format, input electrical Characteristic values. Updated Low power mode section and updated compatible devices section.
1.0	3-May 2018	First Release

1. Functional Description

The Corella Low Power Wide Area Network (LPWAN) module allows developers to connect a range of IoT devices to the Taggle network.

The Taggle network is an LPWAN solution based on world leading Australian developed technology operating in the 916-928MHz Low Interference Potential Device (LIPD) class licence band, which has been developed by Taggle Systems to provide one of the lowest cost, lowest power, longest range, and highest capacity LPWAN solutions available. The Taggle network is based on one-way transmissions from endpoint nodes to the Taggle receiver network, and is particularly well suited to battery powered endpoint applications with low data rate requirements, such as automatic meter reading, wireless sensors for smart agriculture and environmental monitoring, and cost sensitive smart city applications.

Corella is based on the popular XBee module format, and provides a single serial port with a simple "AT" command style interface to allow rapid integration of the module into both lab prototypes and volume production IoT devices. The module has a single radio transmit output via an SMA connector, and can be supplied with a 2dBi ½ wave dipole antenna to enable rapid connection to the Taggle network.

All receive functions are handled seamlessly by the Taggle network, with the user's receive data presented via a custom web portal. A range of data plans are available depending on the number of endpoints connected to the Taggle network and the frequency of messages per endpoint.

2. Quick Setup

1. Firmly screw on antenna.
2. Connect device through correct pins, refer to section 3.3
    a. When powered, observe the green power LED indicating a power connection.
3. Press TX test button to transmit a Taggle test packet.
    a. Observe the flashing Blue LED which indicates payload is transmitting and should deactivate after roughly 10 seconds.
    b. Once the blue LED has stopped flashing this indicates the transmit period has concluded and Corella is now ready to transmit another packet. Note that while the blue LED is flashing Corella's Tx functionality is withheld and any send commands will not be processed.

    Note: Wait time remaining can be queried through serial communication using simple AT commands outlined in Section 5, AT Commands.
4. Go to the Taggle Corella portal www.taggle.com.au/Corella
   and input the user name/Taggle ID and password provided with the Corella unit.
5. Check to confirm your first data packet.
   This may take up to 15 seconds to process.

3. Hardware

3.1. Absolute Maximum Ratings

⚠ **The revision A Corella module is compatible with 3.3V systems only**.

Connection to 5V systems such as Arduino or Beagle Bone will require an interface shield to provide appropriate IO level translation and power supply regulation.

Symbol	Parameter	Min	Max	Unit
V_{DD}	Supply Voltage		3.8	V
DIN	Data input	-0.3	$V_{DD}+0.3$	V
DOUT	Data output	-0.3	$V_{DD}+0.3$	V
RST	Reset input	-0.3	$V_{DD}+0.3$	V

Table 1 Absolute Maximum Ratings

3.2. Electrical Characteristics

Symbol	Parameter	Min	Nom	Max	Unit
V_{DD}	Supply Voltage	2.8	3.3	3.8	V
V_{IL}	Voltage input low			0.3* V_{DD}	V
V_{IH}	Voltage Input High	0.7* V_{DD}			V
V_{OL}	Voltage output Low			0.3* V_{DD}	V
V_{OH}	Voltage output High	0.75* V_{DD}			V
T_{AMB}	Operating Temperature Range*	-20	25	70	°C
I_A	Awake current		2.2	2.4	mA
I_{Tx}	Transmit Current		95	110	mA
Iq	Quiescent Current	TBA	2		uA

Table 2 Electrical Characteristics

* Electrical characteristics measurements were taken in low power mode refer to section 3.5. Nominal sleep current in default mode is approximately 1.5mA

3.3. Pinout

PIN	SYMBOL	DESCRIPTION
1	3V3	Power Supply Input
2	DOUT	Data Output.
3	DIN	Data Input.
4	None	Not Connected
5	RST	Reset Input Active Low
6-9	None	Not Connected
10	GND	Ground
11-20	None	Not Connected
L1 L3 L5	LINK 0 LINK 1 LINK 2	General purpose Input pins. Not supported in Revision A.

Figure 1 Module Bottom View

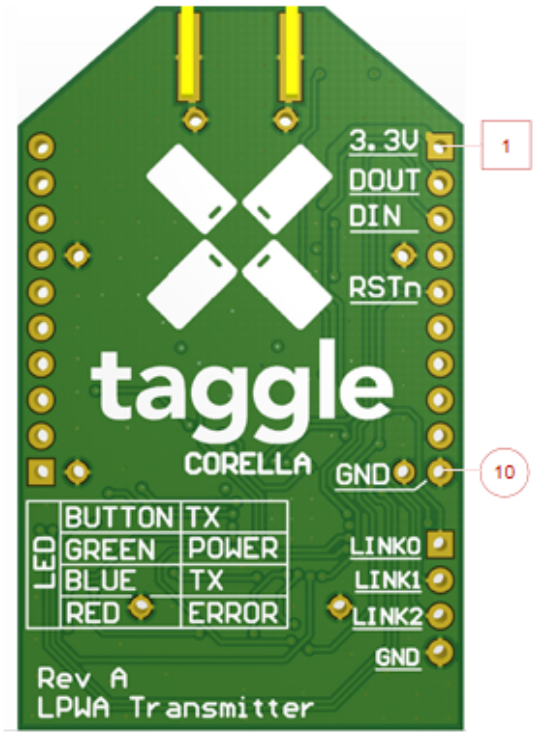

Table 3 Corella Pinout

3.4. Mechanical Outline

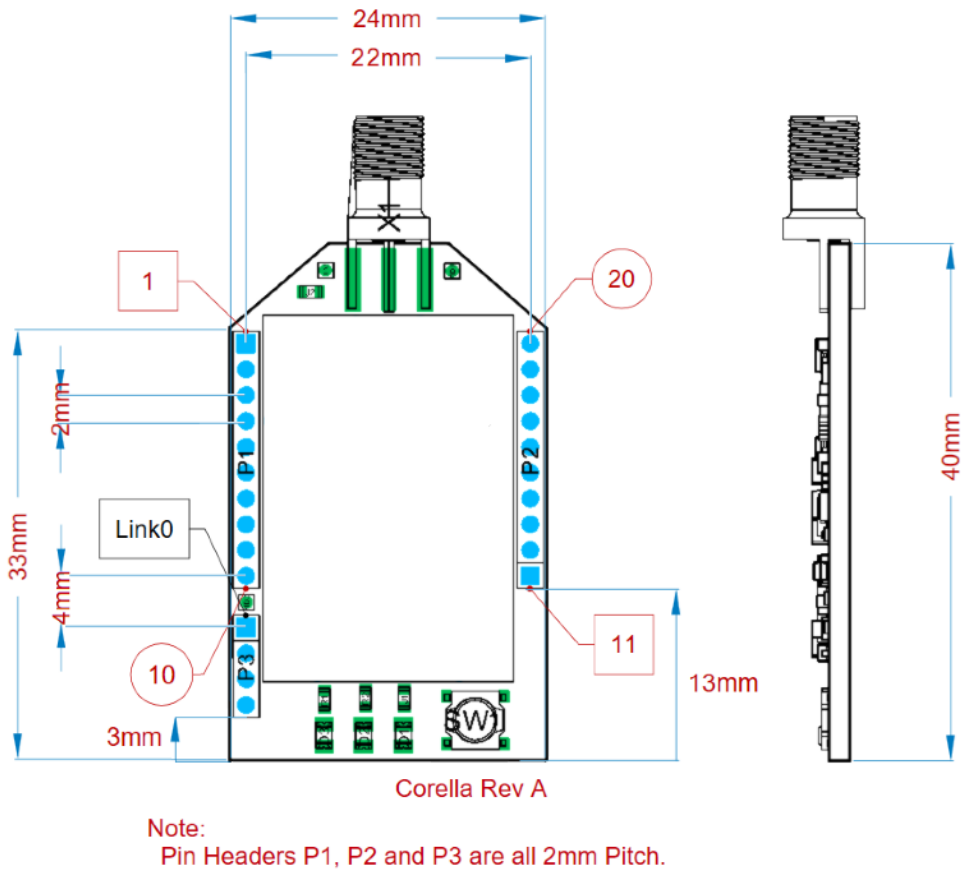

Figure 2 Corella Dimensions

3.5. Low Power mode

The default configuration will nominally consume 1.5mA during sleep mode. The main power draw is from the green power LED and the voltage overload protection circuit. These features can be disabled by removal of the two jumper resistors shown below. This will significantly reduce the power consumption resulting in a nominal sleep current of approximately 2uA.

Removal of the jumper resistor J1 shown in Figure 3 will deactivate the green power led and reduce Corella sleep current to approximately 95 uA. Deactivating the flashing red and blue LEDs can be achieved through AT commands, referred to in section 5.7 AT+LEDS .

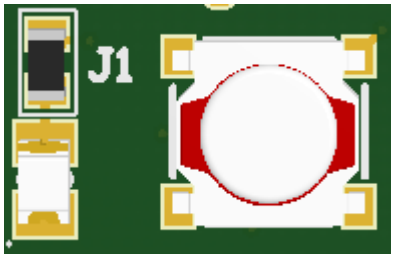

Figure 3 – Power LED resistor

Resistor J2 links enables the voltage protection circuit, which has a leakage current of approximately 93 uA. Removal of J2 will prevent leakage current and significantly reduce power consumption resulting in a sleep current of approximately 2.2uA.

Caution should be taken when removing J2 as the device will no longer be protected from over voltage on the power supply input.

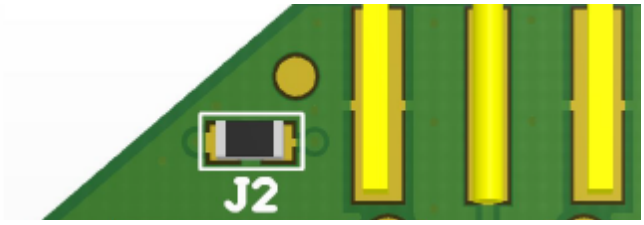

Figure 4 – Crowbar Circuit

3.6. Compatibility with Popular Development Systems

Device	Compatible	Compatible Shields
Raspberry Pi	Yes, can be connected directly with wires. View example in section 7.1 Raspberry Pi	None yet that have been verified by Taggle Systems.
Arduino Uno	Not directly, Arduino uses TTL (5V logic levels) which may damage the Corella module. Voltage translation is required. View section 7.2 Arduino	The Taggle Corella Arduino shield converts all input voltage levels to allow full compatibility between the Arduino Uno and the Corella Module. 

Table 4 Compatibility Reference Table

4. Data

4.1. Serial Port Set Up

Rev A module: 9600 Baud, no parity, 1 stop bit, no flow control
(**9600 Baud - 8N1**)

4.2. Corella Packet Format

Field	**Packet ID**	**User Payload**											
Byte	0 (4 bits)	1	2	3	4	5	6	7	8	9	10	11	12

User Payload – Fixed 12 Bytes of User Data (Using AT+SEND command).
Packet ID – ASCII character between '1' and '9'.

5. AT Commands

- Commands and response all terminate with **\r\n**

Supported Commands

5.1. AT (Attention)

ATTENTION	
Commands	Response
AT Description Debugging commands to check for active serial communication	**OK**

5.2. AT+STATUS

STATUS	
Commands	Response
Query: **AT+STATUS? /r/n** Description Corella allows for a maximum of one payload to be sent every 10 seconds. Status refers to the wait time remaining in seconds before another packet may be sent.	**WAIT [SECONDS] SEC/r/n** Parameter: SECONDS • 1-byte integer representing remaining wait time in seconds

5.3. AT+SEND

SEND	
Commands	**Response**
Set: AT+SEND=[<PACKET ID>,<DATA>] Description Transmits the user's data payload. Parameter: **PACKET ID** • 1 ASCII character • Packet ID must be in the range of 1-9 Parameter: **DATA** Users Data: • Up to 12-bytes	**AT+SEND=[< PACKET ID >,<DATA>]**

5.4. AT+VERSION

VERSION	
Commands	Response
Query: **AT+VERSION?** Description Used to check current Corella, hardware, and software version.	**AT+VERSION=TAGGLE SYSTEM/r/n** **HW=V.X/r/n** **FW=V.X/r/n**

5.5. AT+ID

TAGGLE ID	
Commands	Response
Query: **AT+ID?** Description Requests Corella's unique device ID which will be used to match the data from the Corella module to our Taggle Network.	**AT+ID=[TAGGLE ID]/r/n** Parameter: TAGGLE ID • 5-byte integer representing device ID

5.6. AT+DIAGNOSTICS

DIAGNOSTICS	
Commands	Response
Query: **AT+DIAGNOSTICS?** Description Requests the devices internal diagnostics which includes temperature of the device in degrees Celsius and the supply voltage in Volts.	**AT+DIAGNOSTICS=OK** **TEMPERATURE=[TEMP]** **BATTERY= [VOLTAGE]** Parameter: TEMP • 16-bit integer representing temperature of the Corella MCU Parameter: VOLTAGE • 16-bit integer representing the current source voltage

5.7. AT+LEDS

CONFIG	
Commands	Response
Set: **AT+LEDS=[STATE]** Default State is on. Description • Turn Corellas status LEDs on and off. Status LEDs provide feedback to the user allowing for easy understanding of their Corella modules current transmit state. In embedded environments, the user may wish to turn off the LEDS to reduce power consumption and extend battery life. **Note**: The green Power LED cannot be turned off through software and if the user wishes to extend battery life further they should refer to section 3.6 Extended battery life. Parameter: **STATE** Users Data: • ASCII string either "ON" or "OFF".	**LEDS [STATE]** Parameter: STATE • String of Chars "ON" turns on LEDs "OFF" turns off LEDs

6. Serial Communication Example

The following is a print out of serial communications conducted using a terminal interface.

6.1. AT

```
[TX] - AT<CR><LF>

[RX] - OK<CR><LF>
```

6.2. Status

```
[TX] - AT+STATUS?<CR><LF>

[RX] - OK<CR><LF>
```

6.3. Send Packet

```
[TX] - AT+SEND=1,123456789123<CR><LF>

[RX] - OK<CR><LF>
```

6.4. Version

```
[RX] - MAX TEMP=32<CR><LF>
       MIN TEMP=32<CR><LF>
       BATTERY=3.81V<CR><LF>
```

6.5. Diagnostics

```
[RX] - MAX TEMP=32<CR><LF>
MIN TEMP=32<CR><LF>
BATTERY=3.81V<CR><LF>
```

6.6. ID

```
[TX] - AT+ID?<CR><LF>

[RX] - 130127<CR><LF>
```

6.7. LEDS

```
[TX] - AT+LEDS=ON<CR><LF>

[RX] - LEDS ON<CR><LF>
```

7. Application Examples

7.1. Raspberry Pi Setup

For detailed information and existing Library refer to -TBA

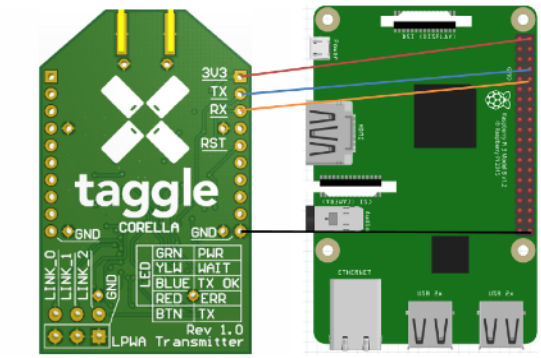

Figure 5 - Corella to R-PI suggested connection

Corella to Raspberry Pi connection example	
Corella PIN	Raspberry Pi pin
Pin 1 - 3V3	Pin 1 - 3.3V PWR
Pin 2 - DOUT	Pin 10 -UART0 RX
Pin 3 - DIN	Pin 8 - UART0 TX
Pin 10- GND	Pin 39 - GND

Table 5 – Corella to R-Pi Pin connection

7.2. Arduino Setup

The Corella Arduino Shield is asymmetrical and will only fit properly using the correct orientation. The Corella should be fitted to the shield as shown with the antenna SMA connector overhanging the edge of the board.

Figure 6 - Arduino fitted to Corella Arduino Shield