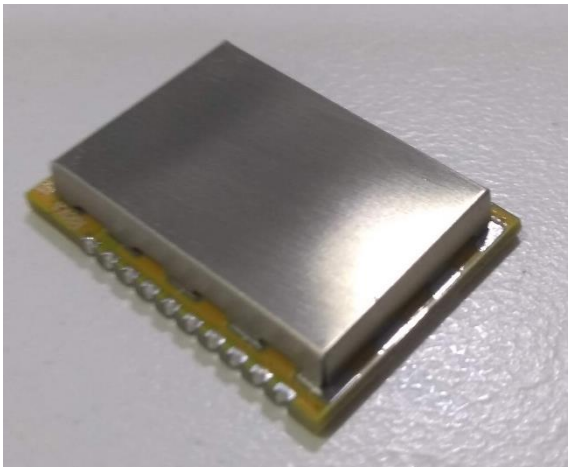
Birdirra Module
Operation Manual



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Revision History

Revision	Date	Author	Notes
A	7-Feb-2020	M Markotany	
B	11- Feb-2020	M Markotany	Changes to Pinout – GPIO_0 and Awake_n Changes made to electrical characteristics - All current measurements General changes to layout considerations and antenna suggestions.
C	11-Feb-2020	R Keaney	General update
C.1	12-Feb-2020	M Markotany	Updated Pinout diagram and table.
C.2	16-Mar-2020	R Keaney	Added FCC Compliance section
C.3	17-April-2020	R Keaney	Added IC Compliance section, renamed from “Datasheet” to Operation Manual
C.4	01-May-2020	R Keaney	Clarified sections around antenna types and antenna selection, added PCB layout details.

1 Functional Description

The Birdirra 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.

Birdirra provides a single serial port with simple 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 and can be powered directly from 3.6V Li-$SOCl_2$ batteries.

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 Radio Compliance

2.1 FCC

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

Warning: Any changes or modifications not expressively approved by Taggle Systems could void the user's authority to operate this equipment.

This equipment is a Limited Certified Transmitter Module. If (1) the module's FCC ID is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module: "Contains Transmitter Module FCC ID: S7R-BIRDIRRA" or "Contains FCC ID: S7R-BIRDIRRA" must be used. The host OEM user manual must also contain clear instructions on how end users can find and/or access the module and the FCC ID.

2.2 Industry Canada

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This equipment is a Limited Certified Transmitter Module. If (1) the module's IC ID is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the IC ID of the module is visible; then an additional permanent label referring to the enclosed module: "Contains Transmitter Module IC: 25706-BIRDIRRA" must be used. The host OEM user manual must also contain clear instructions on how end users can find and/or access the module and the IC ID.

3 Hardware

3.1 Electrical Characteristics

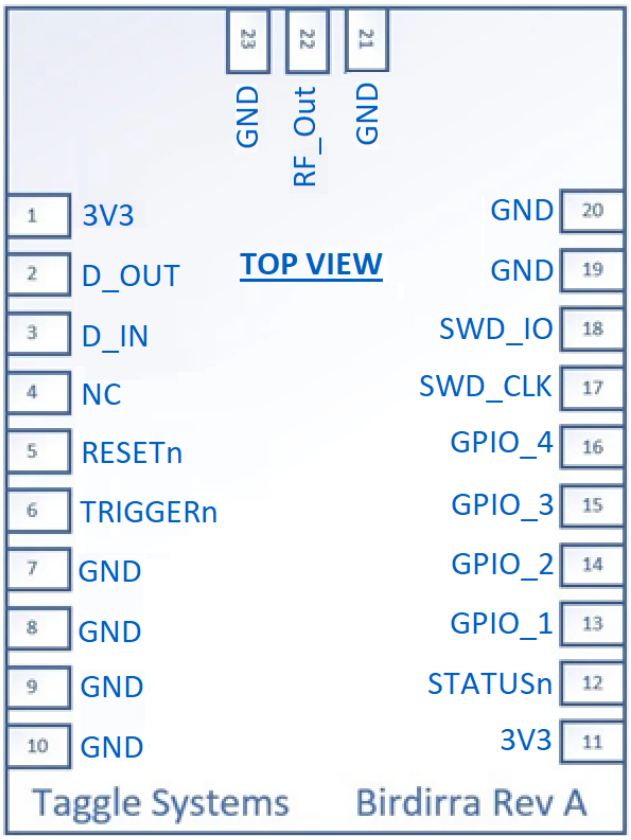
3.1.1 Absolute Maximum Ratings

Symbol	Parameter	Min	Nominal	Max	Unit
3V3	Power Supply	0	-	3.8	V
I/O Voltage	IO Pins	-0.3		V_{DD} + 0.3	V
T_{AMB}	Ambient Temperature Range	-20	-	80	°C

3.1.2 General Operating Conditions

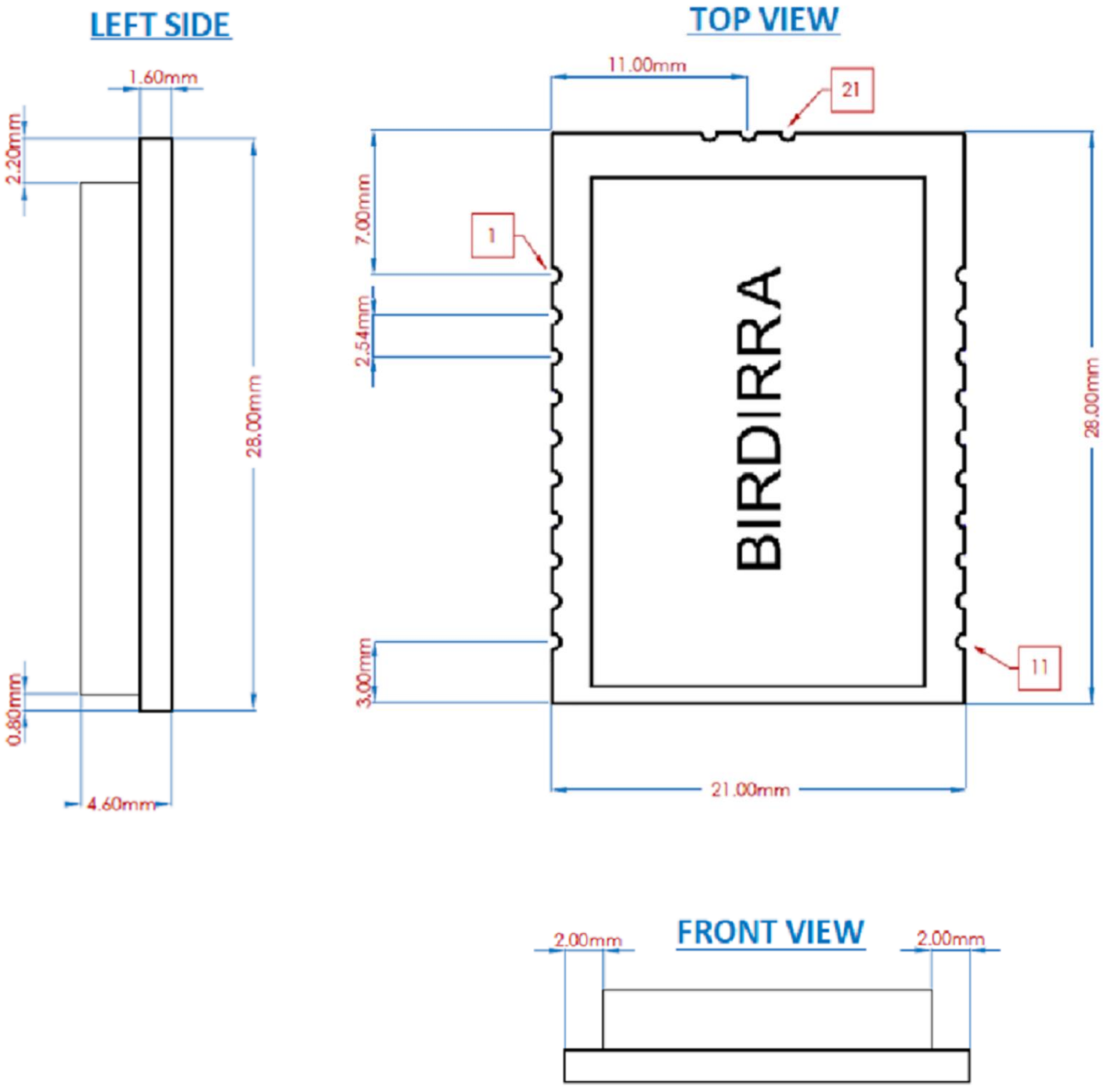
Symbol	Parameter	Min	Nominal	Max	Unit
3V3	Power Supply	2.8	3.3	3.7	V
V_{IL}	Voltage input low			0.3* V_{DD}	V
V_{IH}	Voltage Input High	0.7* V_{DD}			V
V_{OL}	Voltage output Low			0.3* V_{DD}	V
V_{OH}	Voltage output High	0.75* V_{DD}			V
I_i	Current in Initialisation mode		6.3		mA at 25 °C
			6.5		mA at 50 °C
			6.8		mA at 80 °C
I_A	Current while in Active mode		480		uA at 25 °C
			550		uA at 50 °C
			560		uA at 80 °C
I_{Tx}	Current During Transmission	78	90	120	mA at 25 °C
			87.5		mA at 50 °C
			79.5		mA at 80 °C
Iq	Quiescent Current	3.1	3.6	6.1	uA at 25 °C
		3.7	4	7.9	uA at 50 °C
		5	6.7	10	uA at 80 °C
RFcentre	RF Centre Frequency		922.0		MHz
RFout	RF Output power	13	14	15	dBm

3.2 Pinout

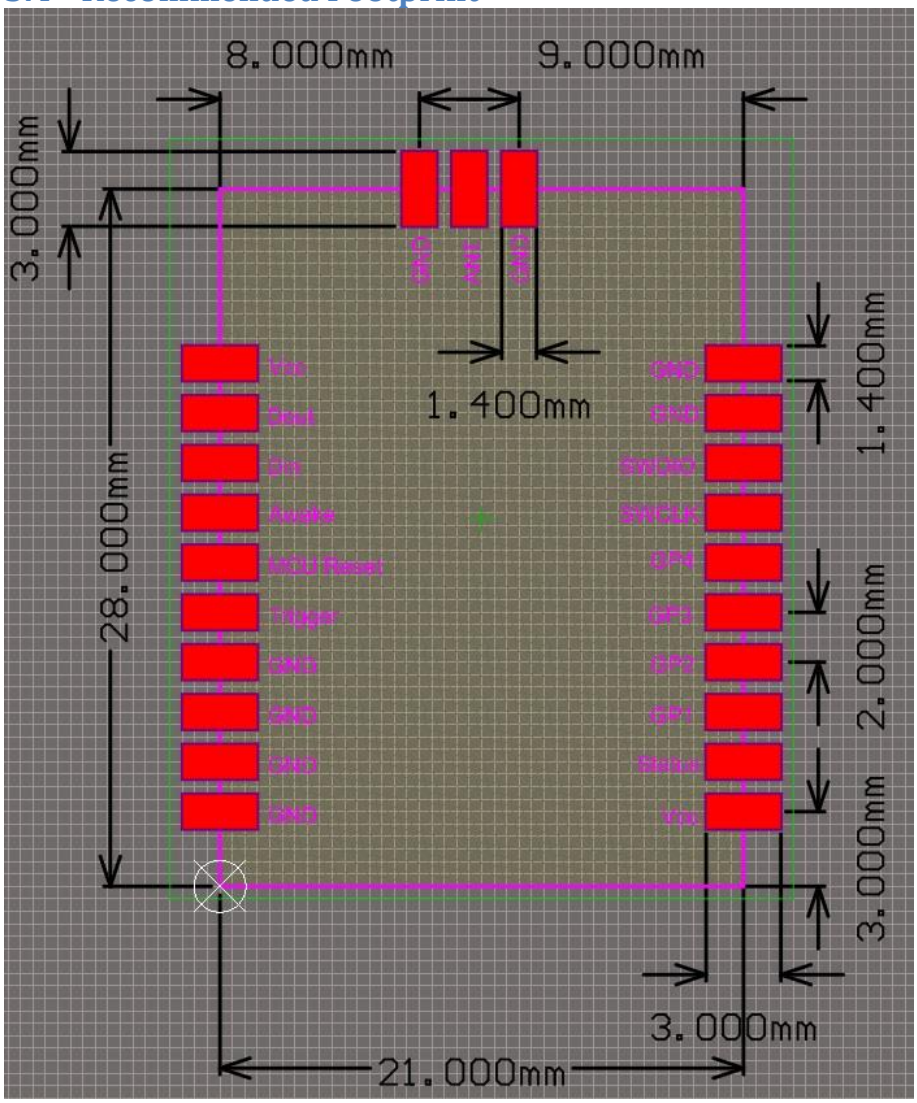


Pin	Symbol	Description
1,11	3V3	Voltage Supply Input
2	D_OUT	Serial Data Output.
3	D_IN	Serial Data Input.
4	NC	Reserved for testing, leave unconnected
5	RESETn	MCU_Reset Active Low Input
6	TRIGGERn	Trigger Radio Transmission Active Low Input
7,8,9,10 19,20,21,23	GND	Ground
12	STATUSn	Module awake status Active Low Output
13 14 15 16	GPIO_1 GPIO_2 GPIO_3 GPIO_4	General Purpose Input/Output
17 18	SWD_IO SWD_CLK	Programming Pins Reserved for firmware Updates
22	RF_Out	RF output to Antenna

3.3 Mechanical Dimensions



3.4 Recommended Footprint



3.5 UART Settings

- 9600 Baud
- 8 bits
- No Parity
- 1 Stop Bit

4 Recommended Antennas

The Birdirra module has a single RF output port for connection to the antenna. The module transmits a 14dBm, 9.6MHz wide signal on a single channel at 922.00MHz

4.1 Embedded Antennas

For host systems where the antenna will be embedded inside the host, the recommended antenna is a Pulse Larsen type W3796 surface mount embedded antenna, which should be mounted on the same printed circuit board assembly (PCBA) as the Birdirra Module.

Designers should consult the Pulse Larsen application guide for recommended component placement and antenna matching.

4.2 Connectorized Antennas

For host systems where the antenna is external to the host, the recommended antennas are:

1. SMA Dipole - ANT-916-CW-HWR-SMA - Linx Technologies Inc, 916 MHz dipole (1/2 wave) 1.2dBi
2. SMA Monopole – ANT-GHEL2-SMA - RF Solutions, 920MHz Monopole (1/4 wave) 2.0 dBi

5 Host Integration Instructions

The Birdirra Module is a Limited Certified Transmitter Module (CTM) which is certified for use in Australia and North America under FCC part 15.247 rules for Direct Sequence Spread Spectrum (DSSS) radios and FCC part 15.212 rules for Limited Modular Transmitters (and the equivalent ACMA and ISED regulations).

The Birdirra Module is only approved for the specific FCC and IC rules listed above. The host system manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification.

The Birdirra module is designed for use in mobile or fixed devices where the device will be used at least 20cm from nearby persons.

To ensure compliance with radio emissions limits system integrators should only use one of the recommended antennas listed in section 4 and follow the implementation guidelines below:

5.1 Module PCB Placement

The host PCB should use a minimum of 4 layers with at least one layer used as a dedicated ground plane. The Birdirra module should be mounted over a solid ground fill, with no PCB traces other than power routed directly underneath the module. The trace from the RF_Output port should be 50 Ohm. The Ground pins of the module should be connected directly to the dedicated internal ground plane PCB layer.

5.2 Embedded Antenna Implementation

For host systems using an embedded antenna, the recommended antenna is a Pulse Larsen type W3796. For best results the antenna should be placed on the edge of the host PCBA and connected to the Birdirra module using the matching circuit shown in Figure 1.

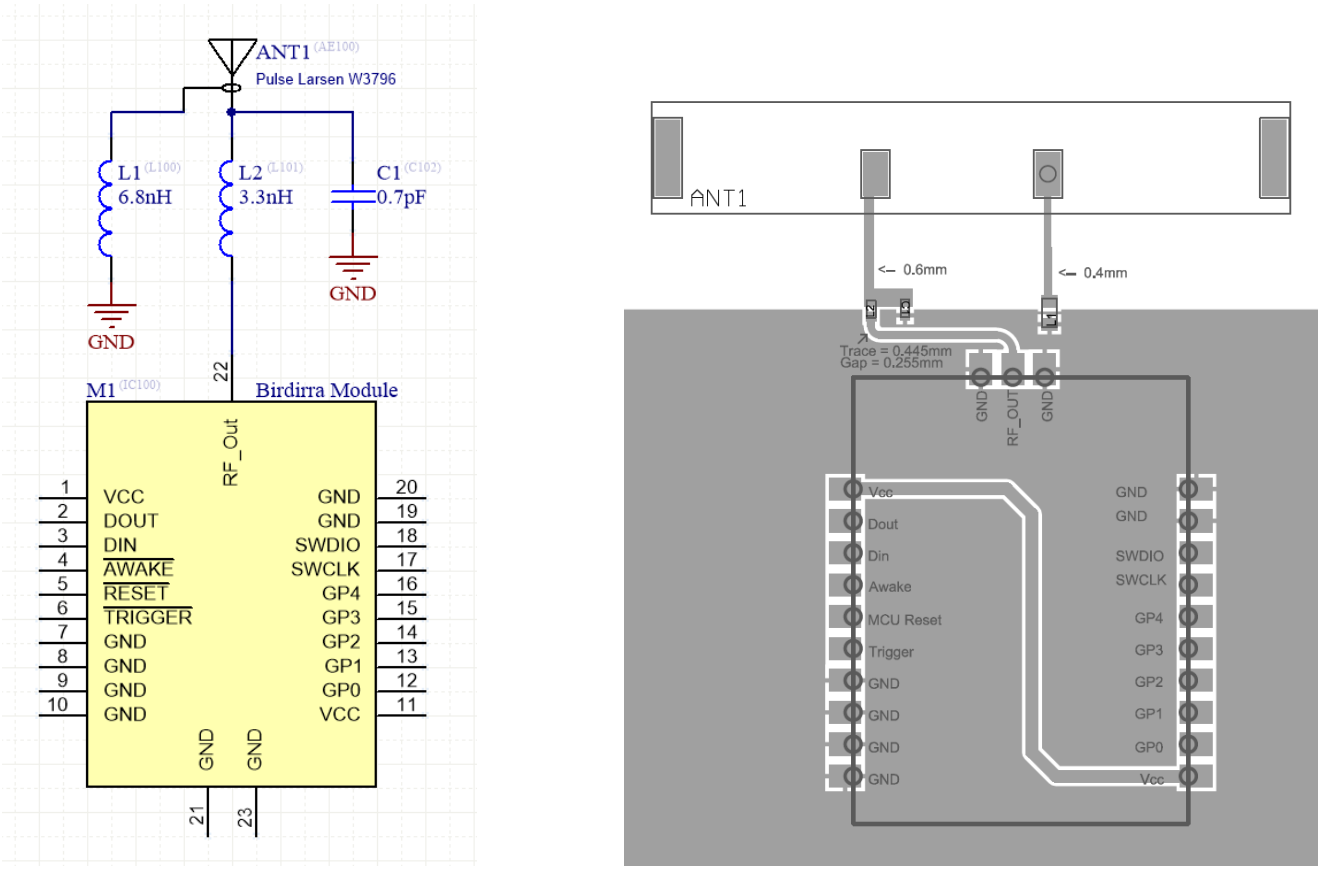


Figure 1 Embedded Antenna Matching Circuit and PCB Layout

Ground fill should be poured around and underneath the module, but no ground fill or internal ground planes should be placed underneath the antenna. The trace from the Rf_Out port of the Module to the antenna should be implemented as a 50R co-planar waveguide. The example shown uses a trace width of 0.445mm with a 0.25mm spacing to the ground fill, assuming a PCB dielectric constant of 4.3 and a dielectric thickness of

0.25mm. Designers should ensure the appropriate trace width and ground fill spacing are implemented for the PCB layer stack used to ensure the RF_Out trace impedance is maintained at 50R +/- 5%

5.3 Connectorized Antenna Implementation

For host systems using a connectorized antenna the recommended types are listed in section 4.2

The RF_Out port of the module should be routed to a PCB mount 50R coaxial cable connector located as close as possible to the module. The trace from the RF_Out port of the module to the antenna connector should 50R impedance.

5.4 Alternative Antenna Implementations

The module output power is14dBm and has been certified using a 2dBi gain omni-directional antenna. Therefor the recommended maximum antenna gain is 2dBi.

If the host system uses a connectorized antenna other than the recommended types, a unique antenna connector such as a reverse polarity SMA connector should be deployed.