Connect One
The Device Networking Authority

iW-SMG3SMTS
Pico WiReach

Version 1.3.1

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WARNING: THE Pico WiReach G3 SMTS IS AN RF MODULE INTENDED FOR EMBEDDING IN A HOST DEVICE. LOCAL RELEVANT RF REGULATIONS SUCH AS ALLOWED FREQUENCIES AND USAGE IN COMMERCIAL FLIGHTS MUST BE OBSERVED. SAFETY INSTRUCTIONS MUST BE INCLUDED IN THE MANUALS OF THE HOST DEVICE. CONNECT ONE Ltd. ASSUMES NO LIABILITY FOR CUSTOMER FAILURE TO COMPLY WITH THESE PRECAUTIONS.

This section is pending for approvals from FCC and IC

Modifications
The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Option could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC rules.
This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

Exposure Information to Radio Frequency Energy
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

" *Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.*"
" *Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.*"
" *This radio transmitter (iW-SmG3SMTS-EX or -OB) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.*"
" *Le présent émetteur radio (iW-SmG3SMTS-EX or -OB) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et aya un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.*"
" *This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.*"
" *Le présent appareil est conforme aux CNR d'Industrie 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, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*"

Antennas: Air Wave (EA-79F); Tekfun C. (M04-SR); YC Communication (Q24-24W); Pulse (W1030). Maximum Gain all: 2dBi.

Table of Contents

Revision History

Version	Date	Description
1.0	May 18th 2016	Initial version
1.1	June 4th 2016	Change Pin names
1.2	September 8th 2016	Release version 1
1.3	October 10th 2016	Adding security features
1.3.1	October 10th 2016	Fixing AT+I commands Adding security feature

1. Introduction

1) General Description

iW-SMG3SMTS™ is a secure Serial-to-Wireless LAN device module that can perform as a WLAN client or Access Point to connect serial devices to 802.11b/g/n Wireless LANs. It includes an ARM 32-bit Cortex-M4 CPU and a Broadcom BCM43362 WiFi chipset. It is packaged in a 28x20x2.8 mm RoHS-compliant module with an onboard antenna option.

iW-SMG3SMTS™ offers and supports many features among them:

- Wi-Fi client and access point modes
- Ten simultaneous TCP/UDP sockets
- Two listening sockets
- Webserver with two websites
- SMTP and POP3 clients
- DHCP client/server
- POP3 SMTP client with MIME attachment
- FTP client
- Security gap between the application and the network

iW-SMG3SMTS™ supports the SSL3/TLS1.2 protocol for secure sockets, HTTPS, FTPS and secure web server. On the WLAN interface it supports: WEP (station mode only), WPA and WPA2 WiFi encryption and Enterprise level security.

iW-SMG3SMTS™ minimizes the need to redesign the host device hardware. It features a surface mount footprint providing for low-cost placement on a host PCB with provisions for an on-board or external antenna.

Connect One's high-level AT+i™ API eliminates the need to add WiFi drivers, security and networking protocols and tasks to the host application.

The EVMB evaluation kit, together with the EVM- iW-SMG3SMTS -OB daughter board provides an easy environment for testing the iW-SMG3SMTS™ prior to designing it into your product.

2) Hardware Description

Size:	28 x 20 x 2.8 mm
Core CPU:	ARM 32-bit Cortex-M4 CPU, 100MHz
Operating Voltage:	+3.3V+/-10%
Operating Humidity:	95% maximum (non-condensing)
Operating Temperature Range:	-20°C to +70°C
	-4°F to 158°F
Power Consumption (max):	Transmit – 420mA@B Mode, 370mA@G Mode, 365mA@N Mode
	Receive – 170mA
Antenna:	Onboard PCB Antenna 2DBi or U.FL RF Connector
Connection:	38 SMT pads
Host Interface:	Serial, SPI

3) Performance Specifications

Host Data Rate:	Up to 1.5Mbps in serial mode
Serial Data Format (AT+i mode):	Asynchronous character; binary; 8 data bits; no parity; 1 stop bit
Flow Control:	Hardware (-RTS, -CTS) and software flow control.

4) Internet Protocols

ARP, ICMP, IP, UDP, TCP, DHCP, DNS, NTP, SMTP, POP3, MIME, HTTP And FTP

5) Security Protocols

SSL3/TLS1.2, HTTPS, FTPS, RSA, AES-128/256, 3DES, RC-4, SHA-1, SHA-2, MD-5, WEP (station mode only), WPA and WPA2

6) Application Program Interface (API)

Connect One's AT+i protocol

7) Wireless Specifications

Standards supported:	IEEE 802.11b/g/n
Frequency:	Europe: 2.412-2.472GHz
	USA: 2.412-2.462GHz
	Japan: 2.412–2.484GHz
Channels:	Europe: 13 channels
	USA: 11 channels
	Japan: 14 channels

8) Certification

<u>The below is pending certification approval</u>

Radio & EMC:

USA

FCC Modular Approval

CFR Title 47 FCC Part 15, Subpart B and C

Canada

Industry Canada Module Approval

Industry Canada ICES-003, RSS-Gen, RSS-210

EU

EN 300 328

EN 301 489

Safety:

UL 60950

CAN/CSA-C22.2 No. 60950

EN 60950, Low Voltage Directive

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION. THE MANUFACTURER IS NOT RESPONSIBLE FOR ANY RADIO OR TV INTERFERENCE CAUSED BY UNAUTHORIZED MODIFICATIONS TO THIS EQUIPMENT. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT

9) Installation Requirements

The iW-SMG3SMTS™ must be installed within a full-enclosure device that is safety certified.

2. Features

1) Security

Acts as a security gap between the host application and the network

One secure SSL3/TLS1.2 socket

Provides WEP (client mode only), WPA and WPA2 Wireless LAN security

Enterprise level security

Supports multiple Certificate Authorities and both client-side and server-side authentication

Secure FTP and HTTP clients (over SSL3)

Secure Web Server

2) Protocols

Up to 10 simultaneous TCP/UDP sockets and two listening sockets

HTTP client

HTTP web server with two on-chip websites: configuration site and application site

FTP clients

DHCP client and server

POP3 or SMTP client allows sending and receiving textual and binary email with MIME attachments

3) Additional Features

Supports infrastructure Wireless LAN networks

Local firmware update

Remote configuration and firmware update over the Internet

Note: For a detailed description of all available features, see the *AT+i Programmer's Manual*.

3. Typical Applications

Adding IP communications over WiFi to serial embedded devices.

Adding SSL security to M2M solutions.

Full Internet Controller mode – allowing simple MCU to use the iW-SMG3SMTS™ rich protocol and application capabilities to perform complex Internet operations such as E-mail, FTP, SSL, embedded Web server and others. It also acts as a firewall, providing a security gap between the application and the network.

4. AT+i Command Set

The iW-SMG3SMTS is configured and controlled using proprietary AT+i protocol. You can create a quick configuration using our AT+i Configuration Wizard located in Connect One's website http://www.connectone.com. In addition, the AT+i Programmer's Manual includes commends description and format of the entire AT+i command set.

Please refer to Appendix B for examples of module configuration using AT+i command set.

5. Layout and Pin Description

1) Layout
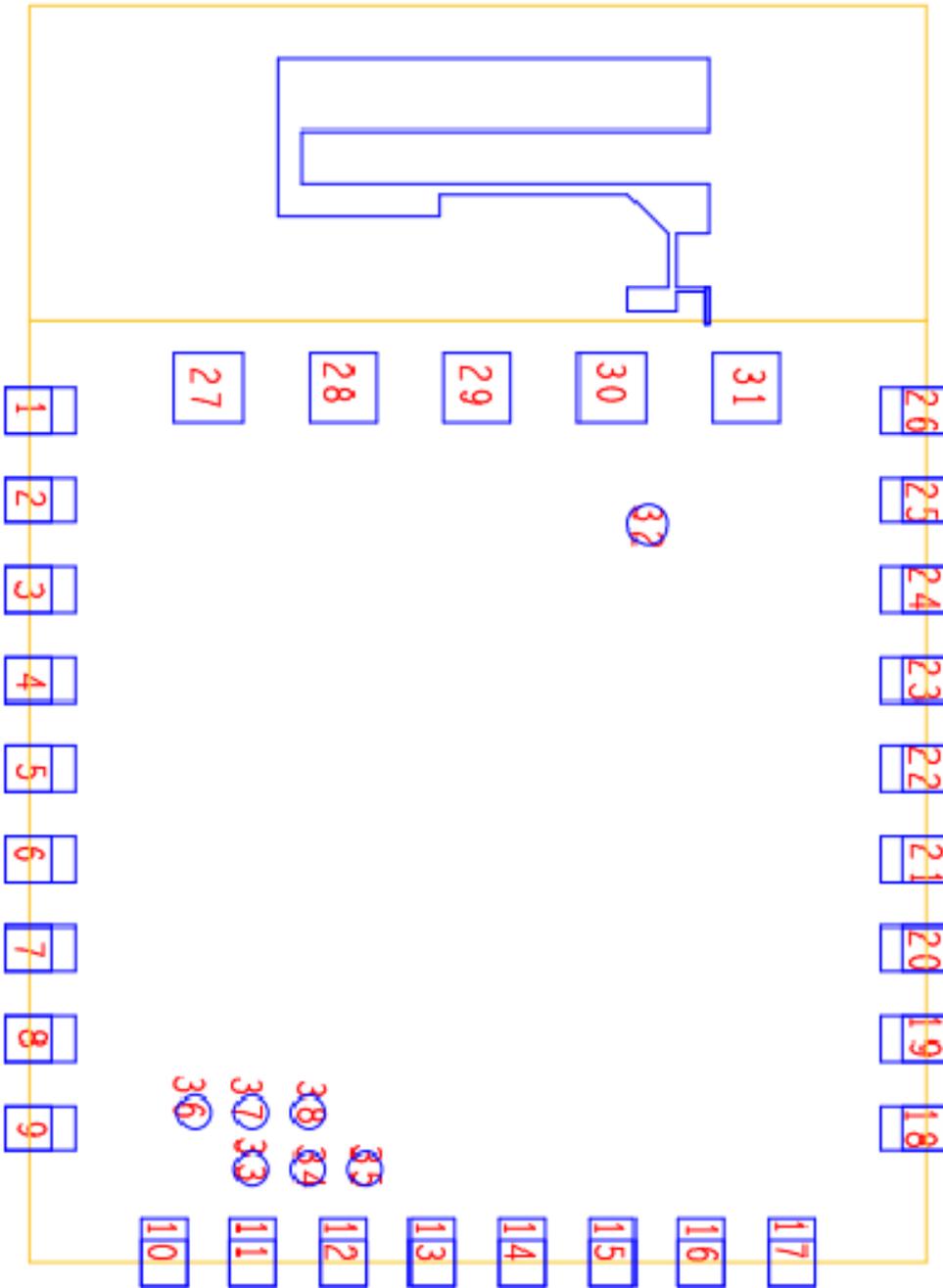
2) Pin Functional Description

| Pin	Signal	Type	Description
1	nSPI_CS	Input	SPI Host Chip Select for host
2	SPI_MOSI/ nRTS	Input/ Output	SPI Slave in for host master out on SPI Mode. Request To Send on UART Mode
3	SPI_MISO	Output	SPI Slave Out for host master in
4	Test		Not Connected. For ConnectOne Testing
5	RTC_CLK	Input	32.768K CLK IN
6	nRF_LED	Output	RF LED indicator. Must add serial resistor.
7	MSEL	Input	Mode Select – Rescue and force F/W update
8	VDD	Power	VDD
9	GND	Power	Ground
10	GND	Power	Ground
11	N.C.		Not Connected
12	N.C.		Not Connected
13	nReset	Input	Reset Module
14	GND	Power	Ground
15	TXD	Output	UART Transmit
16	RXD	Input	UART Receive
17	VDD	Power	VDD
18	GND	Power	Ground
19	N.C.		Not Connected
20	I2C_RESET	Output	Reset external sensors. (Reserved for future use)
21	I2C_CLK	Output	I2C clock - external sensors (Reserved for future use)
22	I2C_DATA	I/O	I2C Data - external sensors (Reserved for future use)
23	GND	Power	Ground
24	SPI_CLK	Input	SPI Clock for host (Max 12MHz)
25	SPI_INT/ HOST_SEL	I/O	On Reset, if this pin is HIGH (connected to VDD), the HOST interface is serial (UART), otherwise the HOST interface is SPI
26	ACH	Input	Analog Input

27	GND	Power	Ground
28	GND	Power	Ground
29	GND	Power	Ground
30	GND	Power	Ground
31	GND	Power	Ground
32	RF_LED_TEST	I/O	Not Connected. For ConnectOne Testing. The main board under RF test pad area should be clear or empty.
33	PIO03	I/O	General In/Output Port
34	PIO04	I/O	General In/Output Port
35	PIO05	I/O	General In/Output Port
36	nCTS	Input	Clear To Send on UART Mode
37	Readiness	Output	iChip Ready status line. See AT+I programmers manual.
38	DATA_RDY	Output	Data ready. Signals incoming Internet data.

6. Interfaces

1) Serial Interface

RXD →	16
TXD ←	15
nCTS →	36
nRTS ←	2
VDD →	25

iW-SMG3SMTS

2) SPI Interface

nSPI_CS →	1
SPI_CLK →	24
SPI_MISO ←	3
SPI_MOSI →	2
SPI_INT ←	25

iW-SMG3SMTS
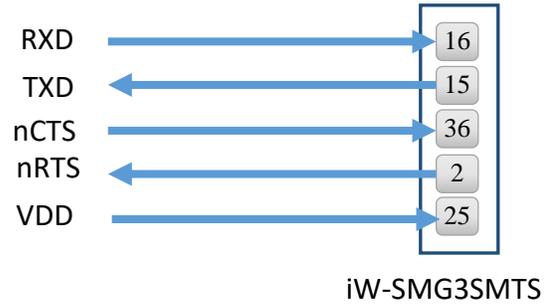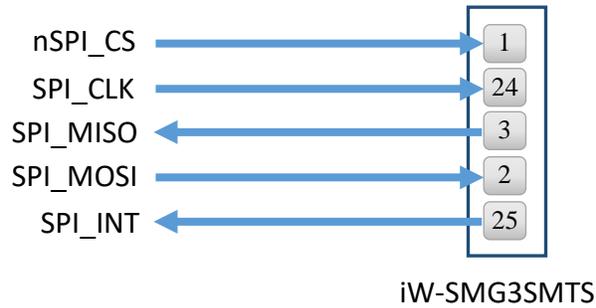
Note: If SPI is not used connect pin 25 to VDD and leave all other signals N.C

7. Electrical Specifications

1) Absolute Maximum Ratings

| Parameter	Rating
Voltage at any pin with respect to ground	-0.3V to +3.6V
Operating Temperature	-20°C to +70°C -4°F to +158°F
Storage Temperature	-40°C to +85°C -40°F to +185°F
Voltage ripple	+/- 2%

2) DC Operating Characteristics

Parameter	Min	Typical	Max	Units
VDD	3.0	3.3	3.6	Volts
High Level Input	0.7*VDD		VDD +0.3	Volts
Low Level Input	-0.3		0.3VDD	Volts
High Level Output @8mA	VDD -0.4			Volts
Low Level Output @8mA			0.4	Volts
Input Leakage Current			+/- 1	µA
Power Supply Current from VDD (Tx. Mode)			420mAmp	mA
Power Supply Current from VDD (Rcv. Mode)			170mAmp	mA
Power Supply Current from VDD (Power Save Mode)			TBD*	mA
Input Capacitance		5		pF
Radio Frequency Range	2.412		2.484	GHz

- Power save mode is not yet supported by the Firmware

3) AC Operating Characteristics
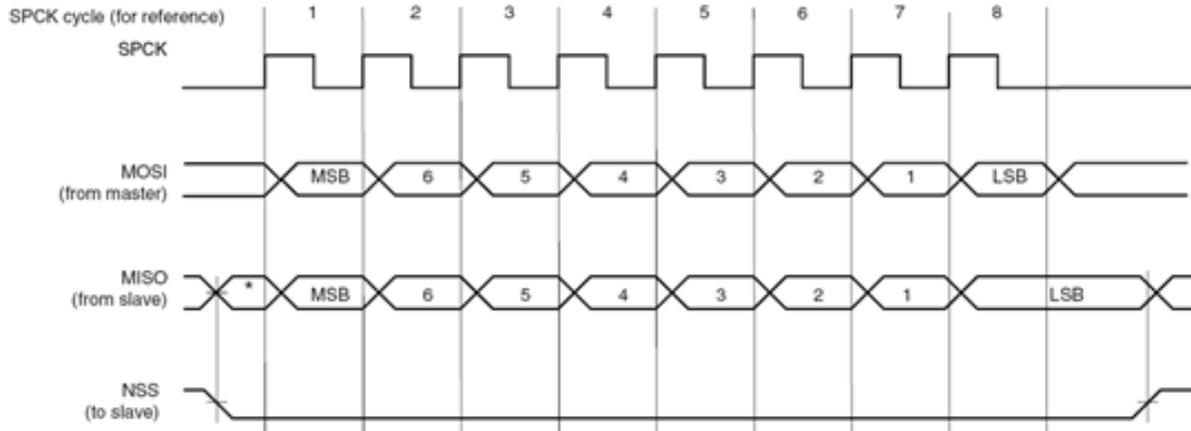
4) Transmit Specification

Item	Condition		Min	Typ	Max	Unit
Transmit Power Levels	802.11@1M		14.5	16.5	18.5	dBm
	802.11@1M		14.5	16.5	18.5	dBm
	802.11@6M		13	15	17	dBm
	802.11@54M		11	13	15	dBm
	802.11@MCS0		12.5	14.5	16.5	dBm
	802.11@MCS7		10	12	14	dBm
Transmit Error vector Magnitude	802.11b	1Mbps		-10		dB
		11Mbps		-10		dB
	802.11g	6Mbps		-5		dB
		54Mbps		-25		dB
	802.11n	HT20M@MCS0		-5		dB
		HT20M@MCS0		-28		dB

5) Receive Specifications

Item	Condition	Min	Typ	Max	Unit
Receiver Minimum Input Level Sensitivity	802.11b Data Rate = 1Mbps PER < 8%		-94	-82	dBm
	802.11b Data Rate = 11Mbps PER < 8%		-86	-76	dBm
	802.11g Data Rate = 6Mbps PER <10%		-88	-82	dBm
	802.11g Data Rate = 54Mbps PER <10%		-72	-65	dBm
	802.11n MCS0 PER <10%		-87	-82	dBm
	802.11n MCS7 PER <10%		-70	-64	dBm

8. On Board Antenna

1) S Parameter
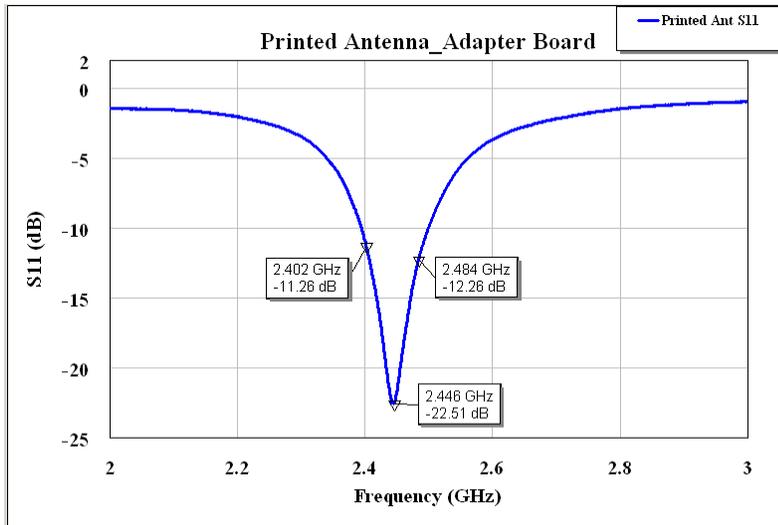
2) Smith Chart
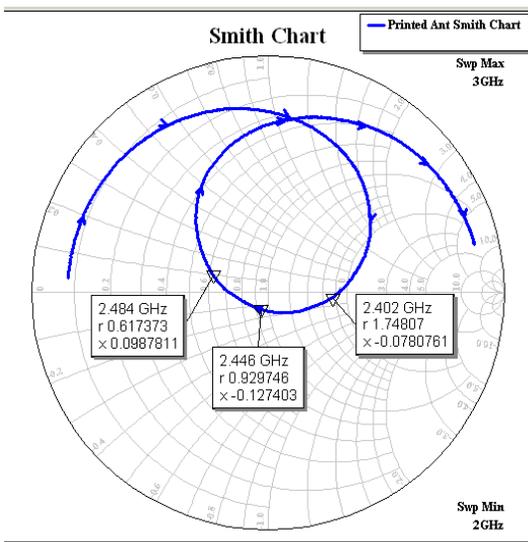
3) Efficiency
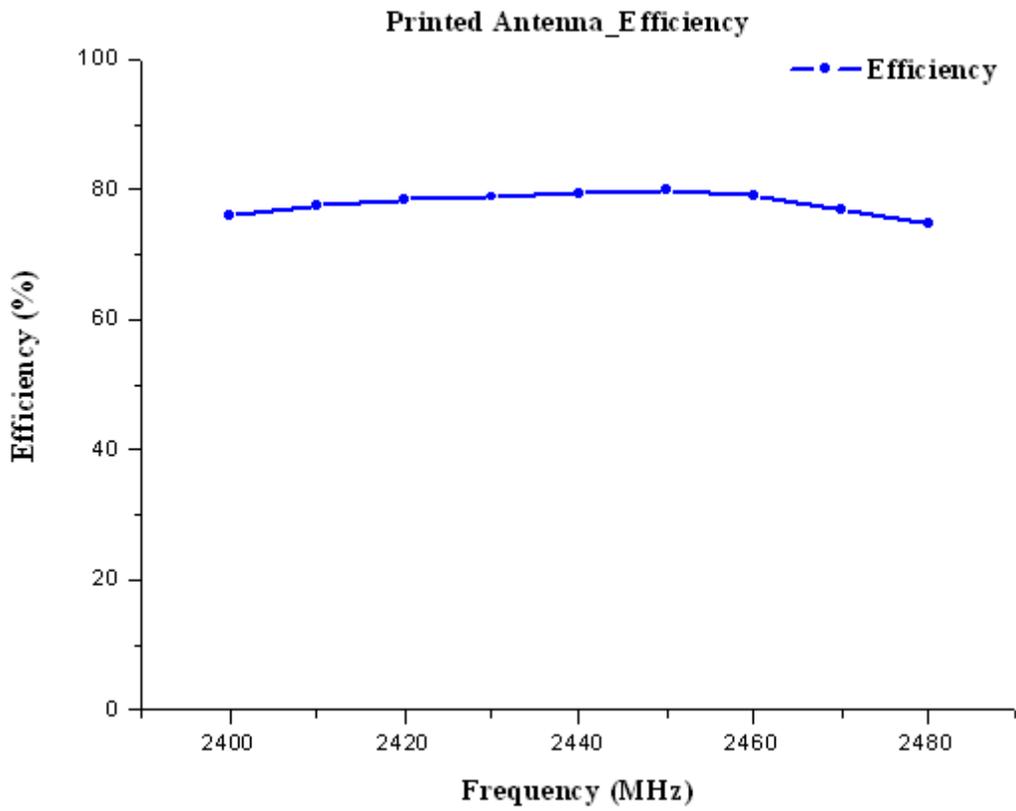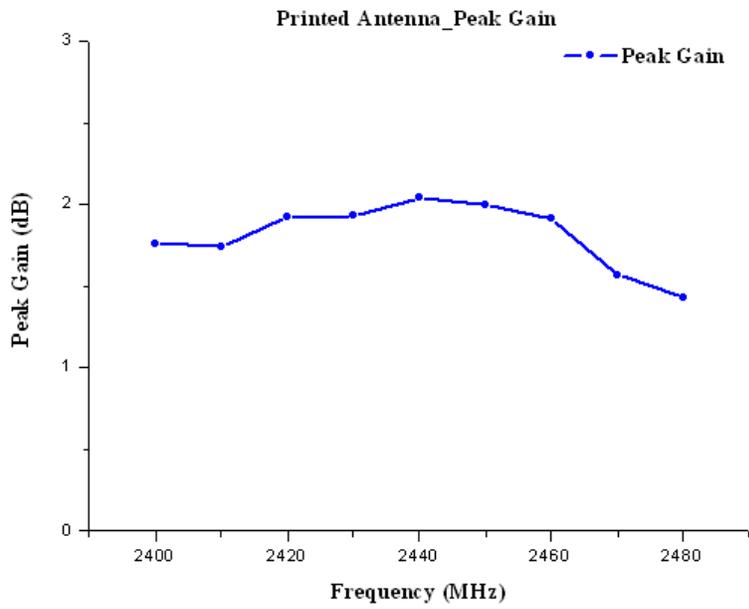
4) Numerical Data

Frequency (MHz)	2400	2410	2420	2430	2440	2450	2460	2470	2480
Average Gain (dBi)	-1.20	-1.11	-1.06	-1.03	-1.00	-0.98	-1.02	-1.14	-1.25
Peak Gain (dBi)	1.76	1.74	1.92	1.93	2.04	2.00	1.91	1.57	1.43
Efficiency (%)	75.88	77.51	78.40	78.92	79.51	79.88	79.11	76.98	74.93

5) Radiation Pattern(2440MHz)
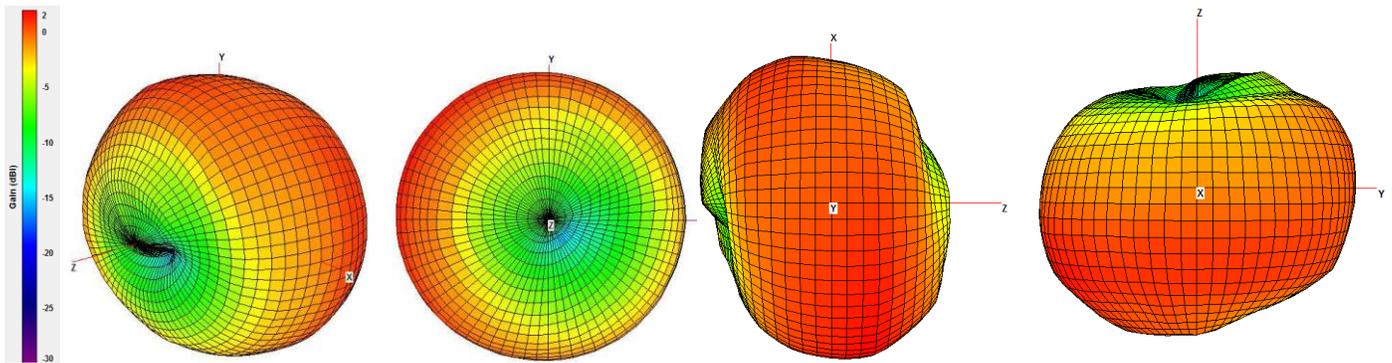
3D pattern   *3D x-y plane*   *3D x-z plane*   *3D y-z plane*

9. Mechanical Dimension

2.5mm

28.00

16

2

6.20

3.045

13.095

19.50

3

12

2

1

3

3

2.10

1.26

1.27

2.54

0.69

3.69

1.26

3

14

20

3

2

pad:1.5x1.5mm

via=0.8mm

Top pad:1.0x0.5mm
Bot pad:1.0x1.0mm

unit:mm

10.   PCB Footprint Design Recommendation

1) Host PCB Footprint
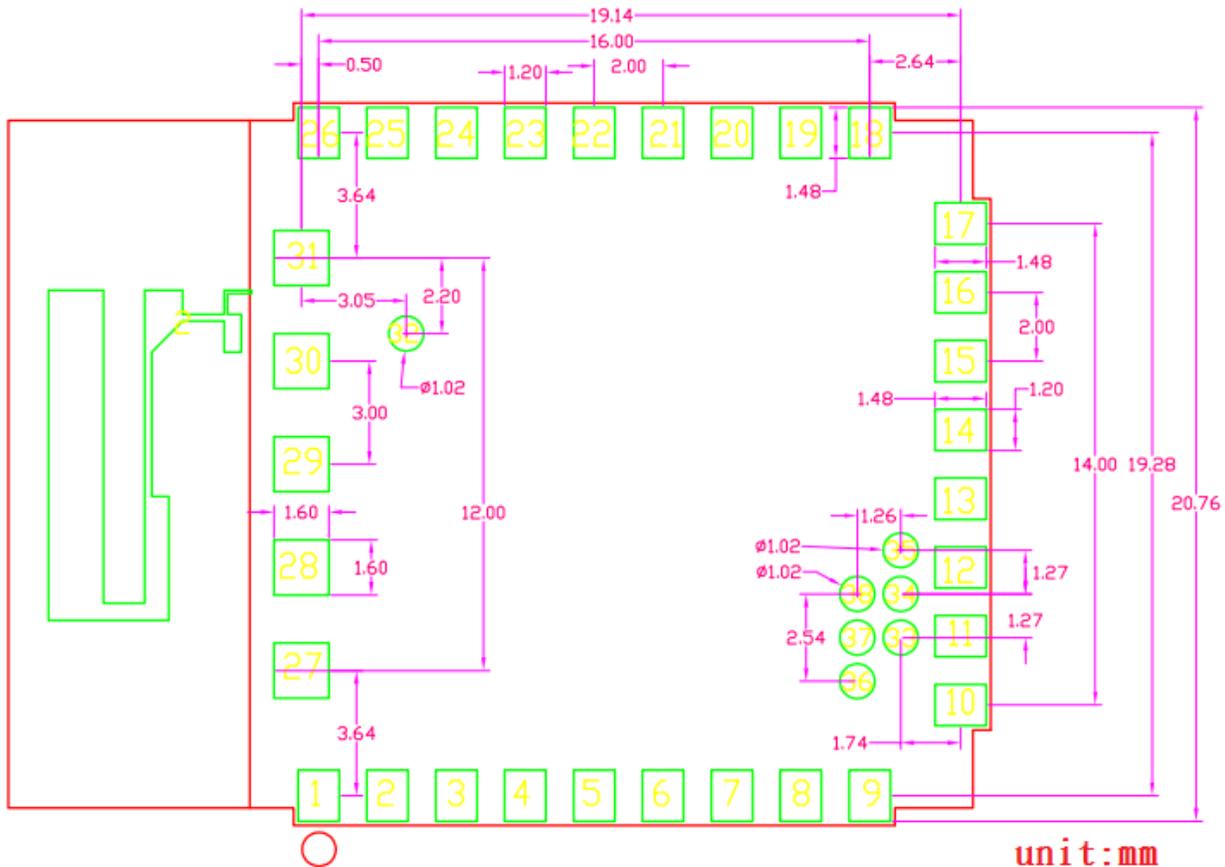
2) Antenna Clearance Requirements

- Main board antenna area under module printed antenna should be clear or empty.
- No signals, GND or power traces can be routed in antenna area for each layers of main board.
- Any metal lid, power trace or metal components should be placed far away from antenna area on main board.
- Keep GND plane as large as you can on main board.

11.   Evaluation Board

The EVMB evaluation kit with the EVM-iW-SMG3SMT-OB daughter board, enables you to evaluate the iW-SMG3SMT without changing anything in your current development environment. Using a simple Windows-based application on a PC, you can issue AT+i commands.

AT+i commands are used to configure parameter values into iChip's flash memory and activate Internet tasks such as email send, sockets, FTP sessions, configuration, and more.

A full description of AT+i commands can be found in the *AT+i Programmer's Manual* on Connect One's website.

To help you evaluate the iW-SMG3SMTS™, Connect One supplies the iChip Config Utility. This is a Windows-based application that contains intuitive dialog boxes to fully configure the module. It doesn't require any knowledge of AT+i commands. It also contains local firmware update tools. The iChip Config Utility allows you to perform specific Internet communication tasks such as sending and receiving emails, activating iChip's websites and more. The latest iChip Config Utility version and user manual can be found on Connect One's website under the Support section.

On board connectors allow a choice of Host interfaces:

- RS232 COM port
- SPI

12.   Ordering Information

Part Number	Description
iW-SMG3SMTS-OB	External Antenna
iW-SMG3SMTS-EX	On Board Antenna
EVM-iW-SMG3SMTS-OB	Evaluation Module for Pico WiReach with On-board antenna

Appendix A - Internet Protocol Compliance

iW-SMG3SMT complies with the Internet standards listed in the following table

RFC 768	User datagram protocol (UDP)
RFC 791	Internet protocol (IP)
RFC 792	ICMP – Internet control message protocol
RFC 793	Transmission control protocol (TCP)
RFC 821	Simple mail transfer protocol (SMTP)
RFC 822	Standard for the format of ARPA Internet text messages
RFC 826	Ethernet address resolution protocol (ARP)
RFC 959	File transfer protocol (FTP)
RFC 1034	Domain names (DNS) - concepts and facilities
RFC 1035	Domain names (DNS) - implementation and specification
RFC 1321	MD5 message digest algorithm
RFC 1939	Post office protocol - version 3 (POP3)
RFC 1957	Some observations on the implementations of the post office protocol (POP3)
RFC 2030	Simple network time protocol (SNTP)
RFC 2045	Multipurpose Internet mail extensions (MIME) part one: internet message body format
RFC 2046	MIME part two: media types
RFC 2047	MIME part three: message header extensions for non-ASCII text
RFC 2048	MIME part four: registration procedures
RFC 2049	MIME part five: conformance criteria and examples
RFC 2068	Hypertext transfer protocol HTTP/1.1
RFC 2131	Dynamic host configuration protocol (DHCP)
RFC 2132	DHCP options (only relevant parts)
RFC 2228	FTP security extensions
RFC 2246	The TLS protocol version 1.0

Appendix B – AT+I Configuration Examples

Automatically connect to a specific Access Point:

AT+iFD   (restore to factory defaults)

AT+iBDRF=9   (fix baud rate to 115200 after power cycle)

AT+iRP20   (list visible networks)

AT+iWLSI=My_WiFi

AT+iWST0=4   (WPA2 security)

AT+iWPP0=<WPA2 passphrase>

AT+iAWS=1   (enable website upon reboot)

AT+iDOWN   (reboot to apply settings)

Create an Access Point to allow connection from mobile devices:

AT+iFD   (restore to factory defaults)

AT+iBDRF=9   (fix baud rate to 115200 after power cycle)

AT+iWLSI=My_AP

AT+iDIP=10.0.0.1   (IP address)

AT+iDPSZ=8   (Enable internal DHCP server, up to 8 clients)

AT+iWST0=0   (open security)

AT+iAWS=1   (enable website upon reboot)

AT+iSTAP=1   (switch to Access Point mode)

AT+iDOWN   (reboot to apply settings)