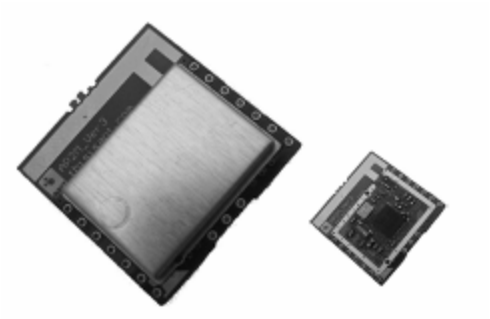
AP2 RF Transceiver Module

FEATURES

- 2.4GHz worldwide ISM band
- 78 selectable RF channels (2403 to 2480MHz)
- 20mm x 20mm drop-in module
- Ultra low power operation
- Simple sync/async serial interface
- Integrated F antenna
- On board 32.768 kHz crystal oscillator
- Broadcast, acknowledged, or burst data transmissions
- ANT channel combined message rate up to 190Hz (8byte data payload)
- Minimum message rate per ANT channel 0.5Hz
- Burst transfer rate up to 20Kbps (true data throughput)
- Up to 8 ANT channels
- Up to 3 public, managed and/or private network keys
- 1 Mbps RF data rate
- 1.9V to 3.6V supply voltage range
- -40°C to +85°C operating temperature
- Pin compatible with AP1 and AT3 modules
- Radio regulatory approval for major markets (pending)
- RoHS compliant



FAMILY MEMBERS

ANTAP281M4IB – 8 ANT channels; surface mount

ANTAP281M5IB – 8 ANT channels; Molex connector

ANT NETWORK CONFIGURATIONS

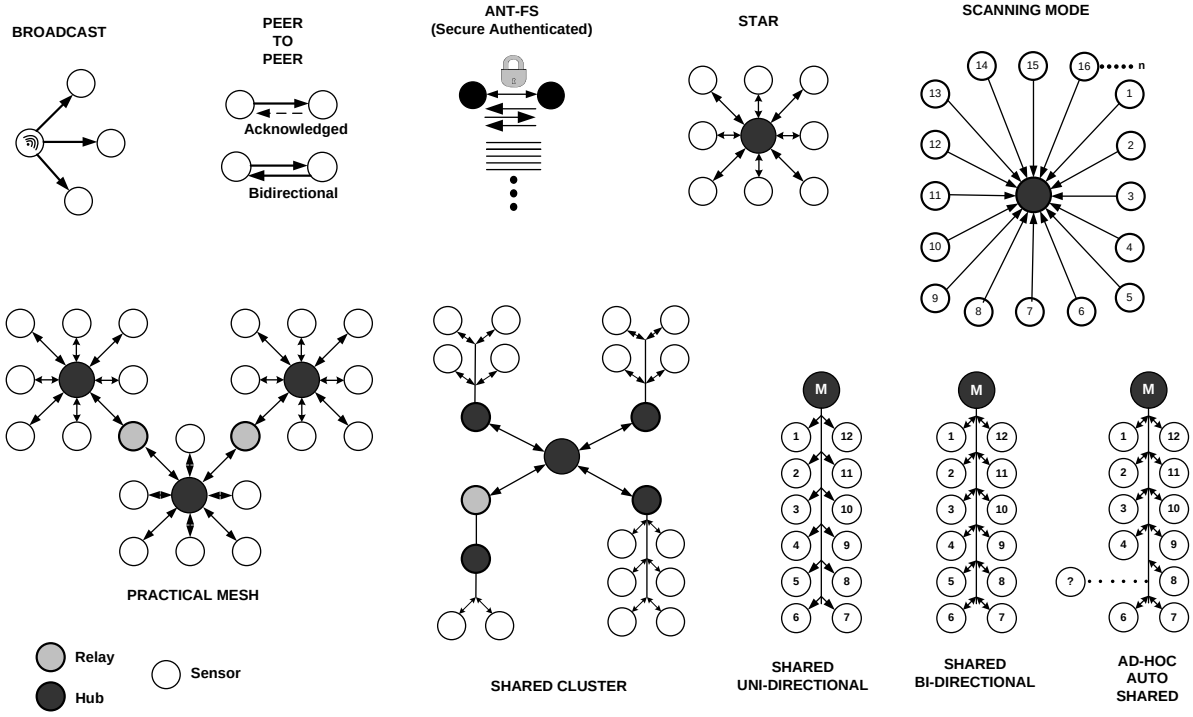


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TABLE OF CONTENTS

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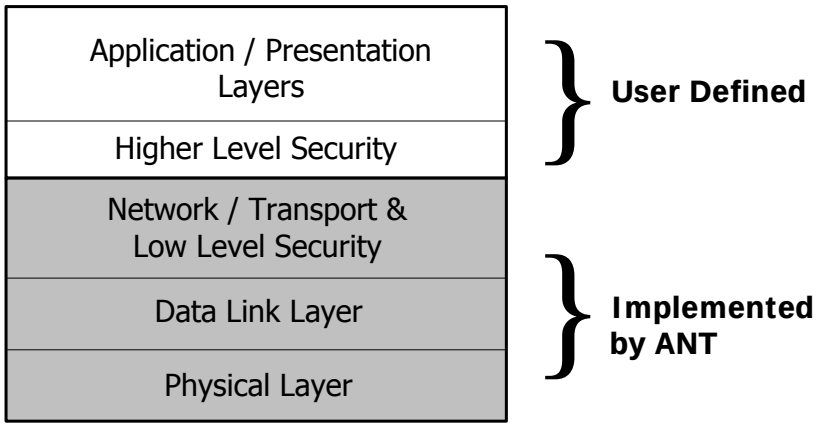
ANT™ Overview

ANT™ is a practical wireless sensor network protocol running on 2.4 GHz ISM band. Designed for ultra low power, ease of use, efficiency and scalability, ANT easily handles peer-to-peer, star, tree and practical mesh topologies. ANT provides reliable data communications, flexible and adaptive network operation and cross-talk immunity. ANT's protocol stack is extremely compact, requiring minimal microcontroller resources and considerably reducing system costs.

ANT provides carefree handling of the Physical, Network, and Transport OSI layers. In addition, it incorporates key low-level security features that form the foundation for user-defined, sophisticated, network-security implementations. ANT ensures adequate user control while considerably lightening computational burden in providing a simple yet effective wireless networking solution.



ANT supports public, managed and private network architectures with 2^{32} uniquely addressable devices possible, ensuring that each device can be uniquely identified from each other in the same network.

ANT is proven with an installed base of over four million nodes in ultra low power sensor network applications in sport, fitness, home and industrial automation. The ANT solutions are available in chips, chipsets and modules to suit a wide variety of application needs.

Incorporated in AP2 product family are several ANT core stack enhancements:

- Background scanning
- Continuous scanning mode
- High density node support
- Improved channel search
- Channel ID management
- Improved transmission power control
- Frequency agility
- Proximity acquisition

The complete description of ANT message protocol is found in the document "ANT Message Protocol and Usage". The serial interface details are provided in the document "Interfacing with ANT General Purpose Chipsets and Modules". Both documents are available on www.thisisant.com.

1 ANT AP2 Module

The ANT AP2 module is a drop-in module based on the reference design of nRF24AP2, a new generation of ANT system on chip family from Nordic Semiconductor. An F antenna is integrated on the small-sized 20mm by 20mm board. The module has been certified to comply with radio regulation or standards covering global markets include North America, Europe, Japan and Australia. The integrated module eases the burden for application and system developers from extensive RF and antenna design, and regulatory compliance testing, allowing quicker time to market. Able to support 8 ANT channels, the module is ideal to build control or hub nodes of a wireless sensor network.

AP2 modules are currently available in the following varieties.

Module	ANT chip Used	Description
ANTAP281M4IB	nRF24AP2-8ch	Surface mountable, 8 ANT channels, 20x20mm, industrial temperature range
ANTAP281M5IB	nRF24AP2-8ch	With Molex connector, 8 ANT channels, 20x20mm, industrial temperature range

1.1 Interface

The module may be connected to the user's host controller using the 17 pin-out assignment (surface mount) style or the 20-pin Molex header connection style provided below:

Surface Mount Pin	Molex Header Pin	Pin Name	Async Mode	Sync Mode	Description
1	6	TEST	TEST (Tie to GND)	TEST (Tie to GND)	Tie to Ground
2	10	$\overline{RST}$	$\overline{RST}$	$\overline{RST}$	Reset the device
3	1	V_{CC}	V_{CC}	V_{CC}	Power supply source
4	19	GND	GND	GND	Power supply ground
5	8	NC	NC	NC	No connection
6	17	$\overline{SUSPEND}$ / $\overline{SRDY}$	$\overline{SUSPEND}$	$\overline{SRDY}$	Async -> Suspend control Sync -> Serial port ready
7	15	SLEEP/ $\overline{MRDY}$	SLEEP	$\overline{MRDY}$	Async -> Sleep mode enable Sync -> Message ready indication
8	13	NC	NC	NC	No connection
9	11	PORTSEL	PORTSEL (Tie to GND)	PORTSEL (Tie to V_{CC})	Asynchronous or synchronous port select
10	7	BR2/SCLK	BR2	SCLK	Async -> Baud rate selection Sync -> Clock output signal
11	4	TXD0/SOUT	TXD0	SOUT	Async -> transmit data signal Sync -> Data output
12	3	RXD0/SIN	RXD0	SIN	Async -> Receive data signal Sync -> Data input
13	5	BR1/SFLOW	BR1	SFLOW	Async -> Baud rate selection Sync -> Bit or byte flow control select
14	9	BR3	BR3	Tie to GND	Async -> Baud rate selection Sync - > Not used, tie to ground
15	14	RESERVERD2	Tie to GND	Tie to GND	Reserved Pin, Tie to ground
16	12	RESERVERD1	Tie to GND	Tie to GND	Reserved Pin, Tie to ground
17	2	RTS/SEN	RTS	SEN	Async -> Request to send Sync -> Serial enable signal
	16,18,20	NC	NC	NC	No connection

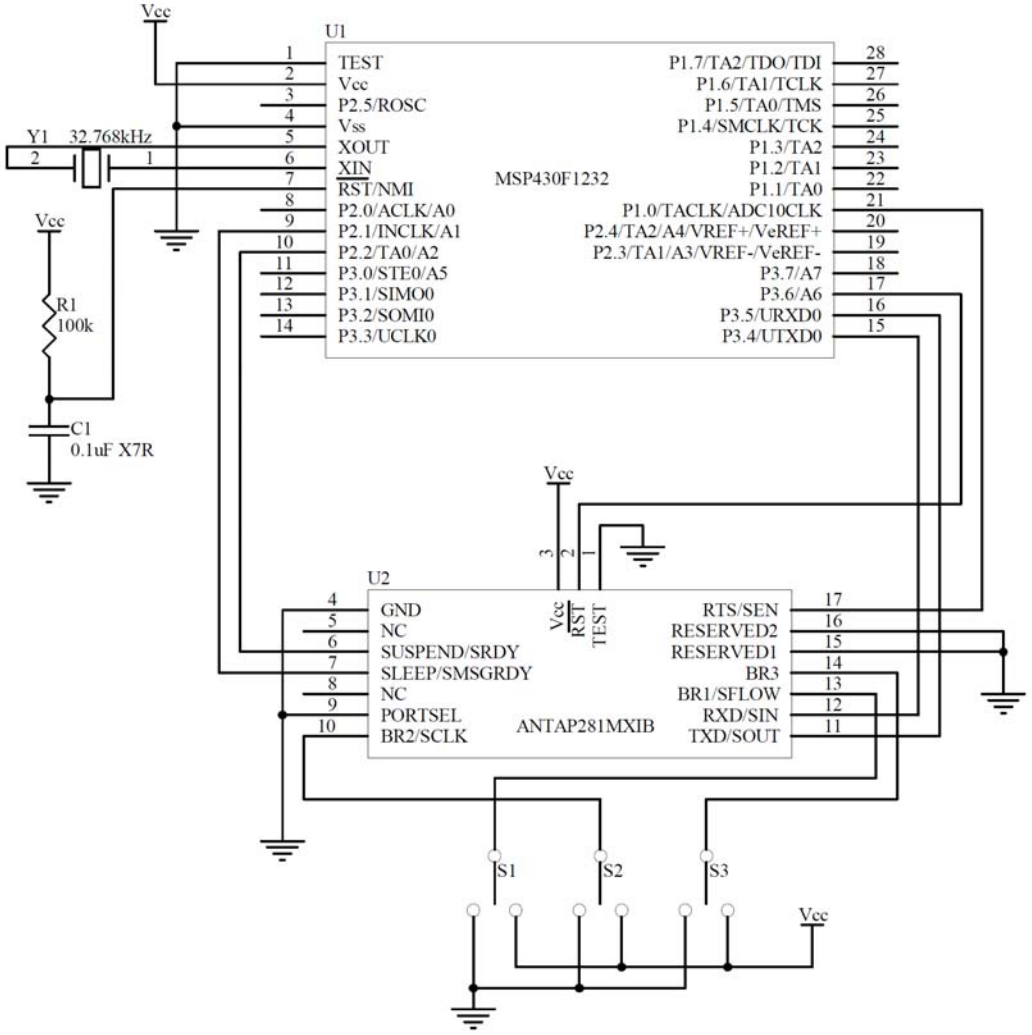
The baud rate of the asynchronous communication is controlled by the speed select signals BR1, BR2 and BR3. The table below shows the relationship between the states of the speed select signals and the corresponding baud rates.

BR3	BR2	BR1	Baud Rate
0	0	0	4800
0	1	0	19200
0	0	1	38400
0	1	1	50000
1	0	0	1200
1	1	0	2400
1	0	1	9600
1	1	1	57600

1.2 Application MCU connection

Please refer to "Interfacing with ANT General Purpose Chipsets and Modules" and "nRF24AP2 Product Specification" section 5 "Host Interface". The following sample designs show the proper electrical connectivity of an ANT AP2 module to an application microcontroller, using TI MSP430F1232 as example.

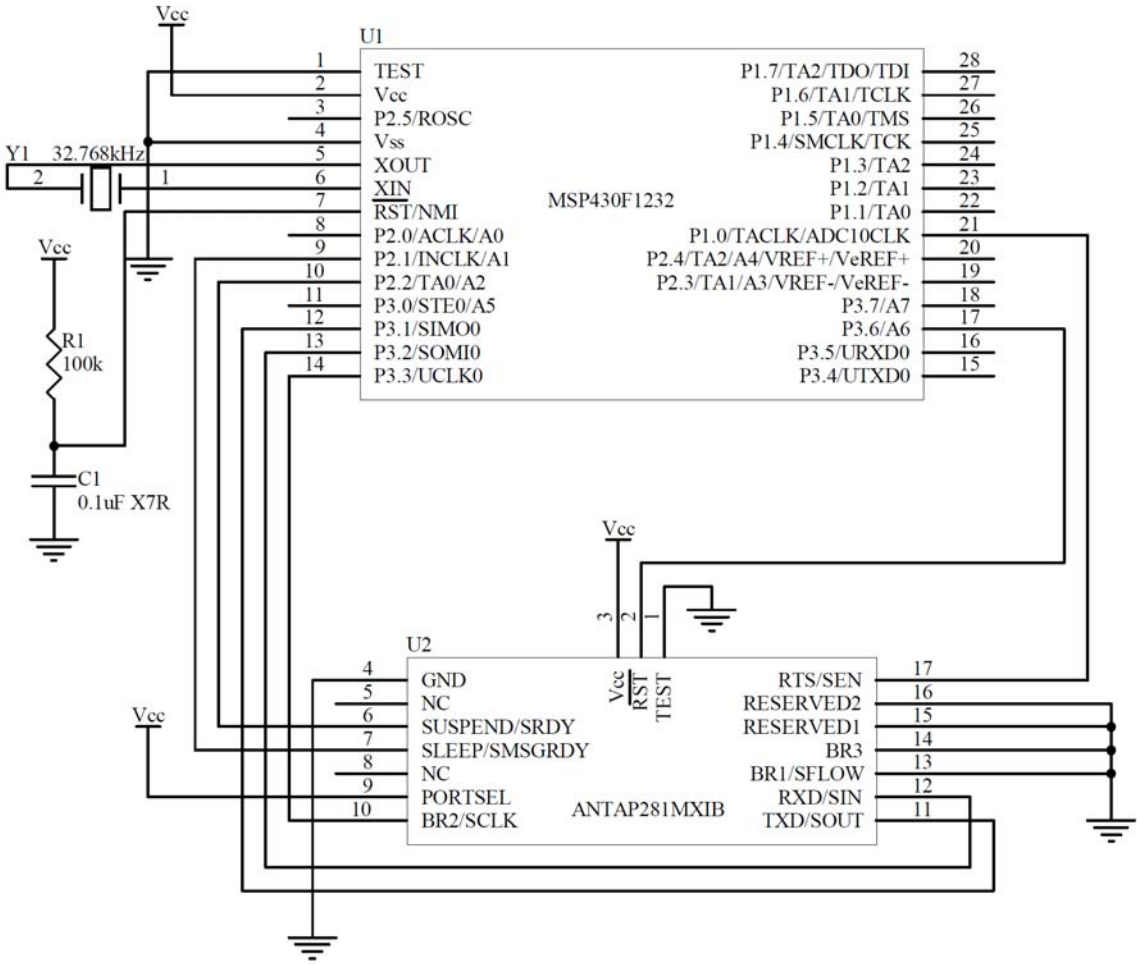
1.2.1 Async Mode



Notes:

- Module RXD and TXD connected directly to hardware USART of microcontroller.
- Switches on baud rate selection pins (BR1, BR2 and BR3) are for ease of use only. They can be connected directly to the logic level of interest.
- RTS can be connected to an interrupt pin for convenience in some applications. (Interrupt pins located on Port 1&2 on the MSP430F1232)

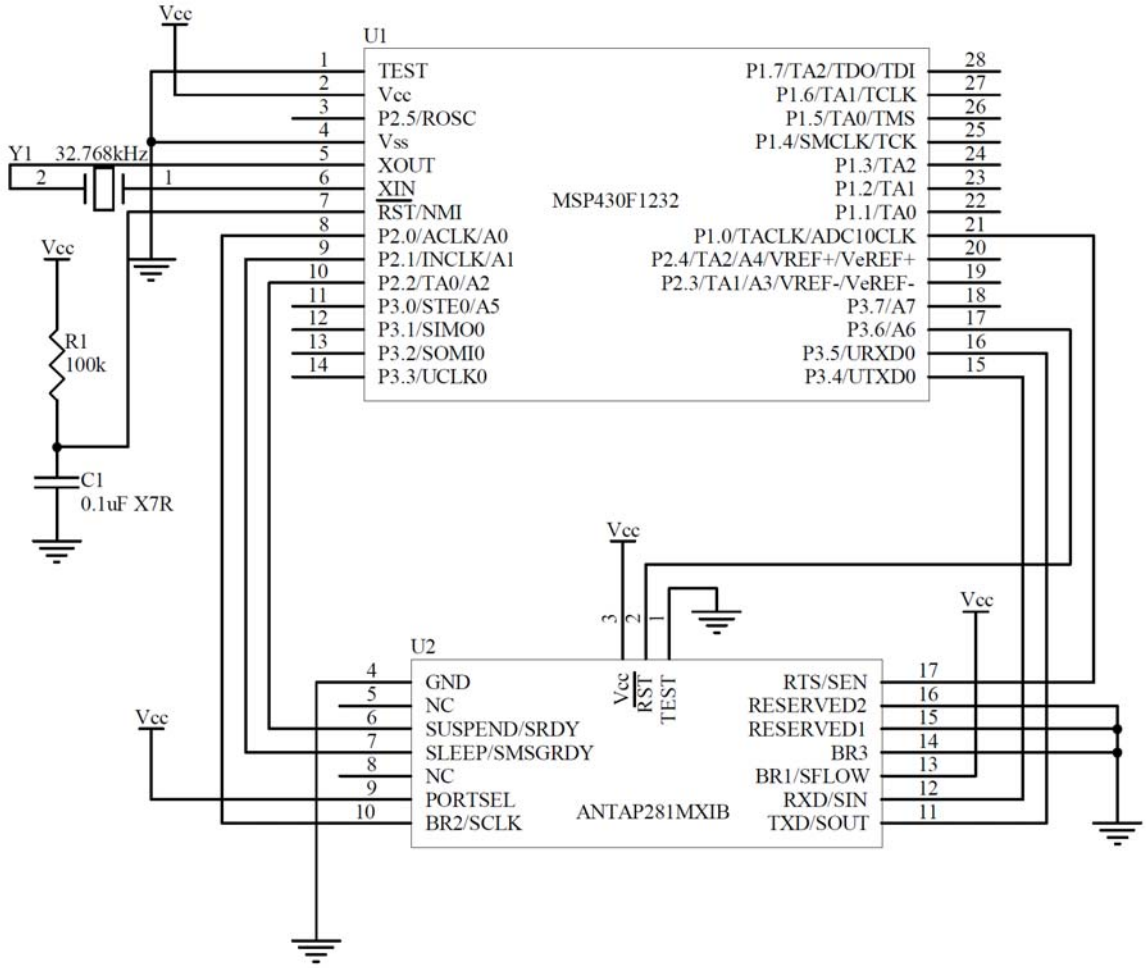
1.2.2 Byte Sync Mode



Notes:

- Module SOUT, SIN, and SCLK connected directly to hardware USART of microcontroller.
- $\overline{\text{SEN}}$ needs to be on an interrupt capable I/O pin on the microcontroller. (Interrupt pins located on Port 1&2 on the MSP430F1232)

1.2.3 Bit Sync Mode



Notes:

- All interface signals are connected directly to I/O pins on the microcontroller.
- SCLK and $\overline{\text{SEN}}$ need to be on an interrupt capable I/O pin on the microcontroller. (Interrupt pins located on Port 1&2 on the MSP430F1232)

1.3 Mounting Guideline

Refer to the recommended footprint drawing in section 4.

It is best to position the AP2 module so that the copper keepout area is on the edge or over hanging the edge of the mating PCB. If the copper keepout layer is completely within the boundaries of the PCB, the ground plane should not fully surround the copper keepout. If this is not possible, the copper keepout should be made much larger to prevent RF degradation. The ground plane is recommended to extend to the full size of the mating PCB, with the exception of the copper keepout.

To connect to M5IB type of AP2 module, the mating socket is Molex 52991-0208.

1.4 Reflow Guideline

Follow the guideline below if AP281M4IB modules go through reflow oven.

Peak solder joint/pad temperatures exceeding 240ºC are not recommended. If possible, pre-heat the assembly within the oven profile for ~30 seconds at ~150 ºC. Follow the solder paste manufacturer's recommendations, especially regarding temperature ramp rate and the time above liquidus.

2 Regulatory Approval

(When this revision of document is published, the certification testing is in process and regulatory approvals are pending.)

The ANT AP2 module has received regulatory approvals for modular devices in the United States (FCC), Canada (IC), Europe (ETSI), Japan (ARIB), Australia and New Zealand. Such approvals allow the user to place the module inside a finished product and, in usual case, not require regulatory testing for an intentional radiator, provided no changes or modifications are made to the module circuitry. This does not preclude the possibility that some other form of authorization or testing may be required for the finished product. Changes or modifications could void the user's authority to operate the equipment. The end user must comply with all of the instructions provided by the Grantee, which indicate installation and/or operating conditions necessary for compliance.

2.1 United States

The AP2 module has been tested and found to comply with Part 15 of the FCC interference limits for Class B devices. Operation is subject to the following two (2) 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.

This equipment generates uses and can radiate radio frequency energy and may cause harmful interference to radio communications if not installed and used in accordance with the instructions. 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 of the following measures:

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

This product does not contain any user-serviceable parts. Unauthorized repairs or modifications could result in permanent damage to the equipment, and void your warranty and your authority to operate this device under Part 15 regulations.

The AP2 module is labeled with its own FCC ID, O6R1695 (note: First Character is the letter O, not the # 0.) If the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: O6R1695" or "Contains FCC ID: O6R1695". Any similar wording that expresses the same meaning may be used.

2.2 Industry Canada Compliance

The AP2 module has been certified for use in Canada under Industry Canada (IC) Radio standards Specification (RSS) RSS-210 and RSS-Gen. 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.

To comply with Industry Canada regulations, it is required that product containing the AP2 module display a label referring to the enclosed module. This exterior label can use wording similar to the following: "Contains IC: 3797A-1695"

This information shall be affixed in such a manner as not to be removable except by destruction or defacement. The size of the lettering shall be legible without the aid of magnification but is not required to be larger than 8-point font size. If the device is too small to meet this condition, the information can be included in the user manual upon agreement with Industry Canada.

2.3 CE Declaration of Conformity

The AP2 module is declared to be in conformance with the essential requirements and other relevant provisions of Directive 1999/5/EC, as a low-powered unlicensed transmitter:

- EN 60950-1:2006 Safety of Information Technology Equipment
- EN 300 440-2 v 1.1.2 Electromagnetic compatibility and Radio Spectrum Matters (ERM): Short range devices.
- EN 301 489-3 v 1.4.1 Electromagnetic compatibility and Radio Spectrum Matters (ERM): Short range devices.
- EN 61000-6-1 Generic Immunity Standard

2.4 Japan

The AP281M5IB module has been tested and granted certification to comply with ARIB STD-T66.

2.5 Australia & New Zealand

The AP2 module has been tested and found to comply with AS/NZS 4268:2003, Radio equipment and systems – Short range devices.

3 Electrical Specifications

Absolute Maximum Ratings	
Voltage applied at V_{CC} to V_{SS}	-0.3V to +3.6V
Input voltage at any pin	-0.3V to V_{CC} + 0.3V; max +3.6V
Operating temperature	-40ºC to +85ºC
Storage temperature	-40ºC to +85ºC

Note: Stress exceeding one or more of the above maximum ratings may cause permanent damage.

Conditions: V_{CC} = +3.0V, V_{SS} = 0V, T_A = - 40ºC to +85ºC

Symbol	Parameter (condition)	Notes	Min	Typ.	Max	Units
	Operating conditions					
V_{CC}	Supply voltage		1.9	3.0	3.6	V
T_A	Operating temperature		-40		+85	ºC
	Digital input pin					
V_{IH}	HIGH level input voltage		$0.7V_{CC}$		V_{CC}	V
V_{IL}	LOW level input voltage		V_{SS}		$0.3V_{CC}$	V
	Digital output pin					
V_{OH}	HIGH level output voltage (I_{OH}=-0.5mA)		V_{CC} - 0.3		V_{CC}	V
V_{OL}	LOW level output voltage (I_{OL}=0.5mA)		V_{SS}		0.3	V
	General RF conditions					
f_{OP}	Operating frequency	1)	2400	2403-2480	2483.5	MHz
PLL_{res}	PLL Programming resolution			1		MHz
f_{XTAL}	Crystal frequency			16		MHz
Δf	Frequency deviation			±160		kHz
R_{GFSK}	Air data rate in each burst on-air			1		Mbps
$F_{CHANNEL}$	Non-overlapping channel spacing			1		MHz
	Transmitter operation					
P_{RF}	Maximum output power	2)		0	+4	dBm
P_{RFC}	RF power control range		16	18	20	dB
P_{RFCR}	RF power accuracy				±4	dB
P_{BW}	20dB bandwidth for modulated carrier			950	1100	kHz
$P_{RF1.1}$	1st adjacent channel transmit power 1MHz				-20	dBc
$P_{RF2.1}$	2nd adjacent channel transmit power 2MHz				-40	dBc
	Receiver operation					
RX_{MAX}	Maximum received signal at <0.1% BER			0		dBm
RX_{SENS}	Sensitivity at 0.1% BER			-85		dBm
C/I_{CO}	C/I co-channel			9		dBc
C/I_{1ST}	1st adjacent channel selectivity C/I 1MHz			8		dBc
C/I_{2ND}	2nd adjacent channel selectivity C/I 2MHz			-20		dBc
C/I_{3RD}	3rd adjacent channel selectivity C/I 3MHz			-30		dBc
	Current Consumption					
$I_{DeepSleep}$	Deep sleep command			0.5		µA
I_{Idle}	No active channels – no communications			2.0		µA
$I_{Suspend}$	Asynchronous suspend activated			2.0		µA
I_{Base_32kXO}	Base Active current (32.768 KHz crystal oscillator or external clock source)			3.0		µA
$I_{Base\_32kSynt}$	Base Active current (using internal synthesized clock source)			0.1		mA
I_{PeakTX}	Peak Tx current @ 0dBm output power	3)		15		mA
$I_{PeakTX-6}$	Peak Tx current @ -6dBm output power	3)		13		mA
$I_{PeakTX-12}$	Peak Tx current @ -12dBm output power	3)		11		mA

Symbol	Parameter (condition)	Notes	Min	Typ.	Max	Units
$I_{PeakTX-18}$	Supply peak current @ -18dBm output power	3)		11		mA
I_{PeakRx}	Peak Rx current	4)		17		mA
I_{search}	Search current			2.9		mA
$I_{Msg\_Rx\_ByteSync}$	Average current / Rx message in byte sync mode			17		µA
$I_{Msg\_Rx\_BitSync}$	Average current / Rx message in bit sync mode			30		µA
$I_{Msg\_Rx\_57600}$	Average current / Rx message in async mode at 57600 baud			20		µA
$I_{Msg\_Rx\_50000}$	Average current / Rx message in async mode at 50000 baud			20		µA
$I_{Msg\_Rx\_38400}$	Average current / Rx message in async mode at 38400 baud			23		µA
$I_{Msg\_Rx\_19200}$	Average current / Rx message in async mode at 19200 baud			30		µA
$I_{Msg\_Rx\_9600}$	Average current / Rx message in async mode at 9600 baud			48		µA
$I_{Msg\_Rx\_4800}$	Average RF current / Rx message in async mode at 4800 baud			83		µA
$I_{Msg\_TxAck\_ByteSync}$	Average current / Acknowledged Tx message in byte sync mode			36		µA
$I_{Msg\_TxAck\_BitSync}$	Average current / Acknowledged Tx message in bit sync mode			48		µA
$I_{Msg\_TxAck\_57600}$	Average current / Acknowledged Tx message in async mode at 57600 baud			42		µA
$I_{Msg\_TxAck\_50000}$	Average current / Acknowledged Tx message in async mode at 50000 baud			40		µA
$I_{Msg\_TxAck\_38400}$	Average current / Acknowledged Tx message in async mode at 38400 baud			44		µA
$I_{Msg\_TxAck\_19200}$	Average current / Acknowledged Tx message in async mode at 19200 baud			55		µA
$I_{Msg\_TxAck\_9600}$	Average current / Acknowledged Tx message in async mode at 9600 baud			78		µA
$I_{Msg\_TxAck\_4800}$	Average current / Acknowledged Tx message in async mode at 4800 baud			132		µA
$I_{Msg\_RxAck\_ByteSync}$	Average current / Acknowledged Rx message in byte sync mode			20		µA
$I_{Msg\_RxAck\_BitSync}$	Average current / Acknowledged Rx message in bit sync mode			34		µA
$I_{Msg\_RxAck\_57600}$	Average current / Acknowledged Rx message in async mode at 57600 baud			22		µA
$I_{Msg\_RxAck\_50000}$	Average current / Acknowledged Rx message in async mode at 50000 baud			22		µA
$I_{Msg\_RxAck\_38400}$	Average current / Acknowledged Rx message in async mode at 38400 baud			27		µA
$I_{Msg\_RxAck\_19200}$	Average current / Acknowledged Rx message in async mode at 19200 baud			33		µA
$I_{Msg\_RxAck\_9600}$	Average current / Acknowledged Rx message in async mode at 9600 baud			53		µA
$I_{Msg\_RxAck\_4800}$	Average current / Acknowledged Rx message in async mode at 4800 baud			86		µA
$I_{Msg\_Tx\_ByteSync}$	Average current / Tx-only message in byte sync mode	5)		13		µA
$I_{Msg\_Tx\_BitSync}$	Average current / Tx-only message in bit sync mode	5)		28		µA
$I_{Msg\_Tx\_57600}$	Average current / Tx-only message in async mode at 57600 baud	5) 6)		23		µA
$I_{Msg\_Tx\_50000}$	Average current / Tx-only message in async mode at 50000 baud	5) 6)		19		µA

Symbol	Parameter (condition)	Notes	Min	Typ.	Max	Units
$I_{Msg\_Tx\_38400}$	Average current / Tx-only message in async mode at 38400 baud	5) 6)		21		µA
$I_{Msg\_Tx\_19200}$	Average current / Tx-only message in async mode at 19200 baud	5) 6)		30		µA
$I_{Msg\_Tx\_9600}$	Average current / Tx-only message in async mode at 9600 baud	5) 6)		63		µA
$I_{Msg\_Tx\_4800}$	Average current / Tx-only message in async mode at 4800 baud	5) 6)		108		µA
$I_{Msg\_TR\_ByteSync}$	Average current / Tx message in byte sync mode			24		µA
$I_{Msg\_TR\_BitSync}$	Average current / Tx message in bit sync mode			36		µA
$I_{Msg\_TR\_57600}$	Average current / Tx message in async mode at 57600 baud	6)		33		µA
$I_{Msg\_TR\_50000}$	Average current / Tx message in async mode at 50000 baud	6)		31		µA
$I_{Msg\_TR\_38400}$	Average current / Tx message in async mode at 38400 baud	6)		32		µA
$I_{Msg\_TR\_19200}$	Average current / Tx message in async mode at 19200 baud	6)		42		µA
$I_{Msg\_TR\_9600}$	Average current / Tx message in async mode at 9600 baud	6)		70		µA
$I_{Msg\_TR\_4800}$	Average current / Tx message in async mode at 4800 baud	6)		120		µA
I_{Ave}	Broadcast Tx-only @ 0.5Hz in byte sync mode	5) 7)		12		µA
I_{Ave}	Broadcast Tx-only @ 2Hz in byte sync mode	5) 7)		48		µA
I_{Ave}	Broadcast Rx @ 0.5Hz in byte sync mode	7)		8.5		µA
I_{Ave}	Broadcast Rx @ 2Hz in byte sync mode	7)		34		µA
I_{Ave}	Acknowledged Tx @ 0.5Hz in byte sync mode	7)		18		µA
I_{Ave}	Acknowledged Tx @ 2Hz in byte sync mode	7)		72		µA
I_{Ave}	Acknowledged Rx @ 0.5Hz in byte sync mode	7)		10		µA
I_{Ave}	Acknowledged Rx @ 2Hz in byte sync mode	7)		40		µA
I_{Ave}	Burst continuous @ 20kbps in byte sync mode	7) 8)		4.75		mA
I_{Ave}	Burst continuous @ 7.5kbps in bit sync mode	7) 8)		4		mA
I_{Ave}	Burst continuous @ 20kbps in async mode at 57600 baud	7) 8)		5.9		mA
I_{Ave}	Burst continuous @ 20kbps in async mode at 50000 baud	7) 8)		4.9		mA
I_{Ave}	Burst continuous @ 13.8kbps in async mode at 38400 baud	7) 8)		4.7		mA
I_{Ave}	Burst continuous @ 8.4kbps in async mode at 19200 baud	7) 8)		4.2		mA

Usable band is determined by local regulations
Maximum output power with 0dBm output power setting. Antenna load impedance = 15Ω +j88Ω
Time of maximum Tx only current is typical 300µs and maximum 350µs
Time of maximum current consumption in RX is typical 500µs and maximum 1ms
Transmit only operation provides no ANT channel management across the air channel and is not recommended for normal operation
Asynchronous serial messages contained two 0 pad bytes, thereby adding to the average current. Values will be lower without the use of 0 pad bytes
Does not include base current. See current calculation examples below
Value calculated assuming that external 32.768 kHz crystal oscillator is used

Example Current Calculations:

1. Transmit channel with Broadcast data at 4Hz with a bit synchronous serial interface and external source of 32.768kHZ clock.

$$I_{ave} = (I_{Msg\_TR\_BitSync} * Message\_Rate) + I_{Base\_32KXO}$$

= (36µA/message * 4messages) + 3.0 µA

= 147 µA

2. Receive channel with Acknowledged data at 2Hz with an asynchronous serial interface at 57600 baud and internal synthesized 32.768kHZ clock.

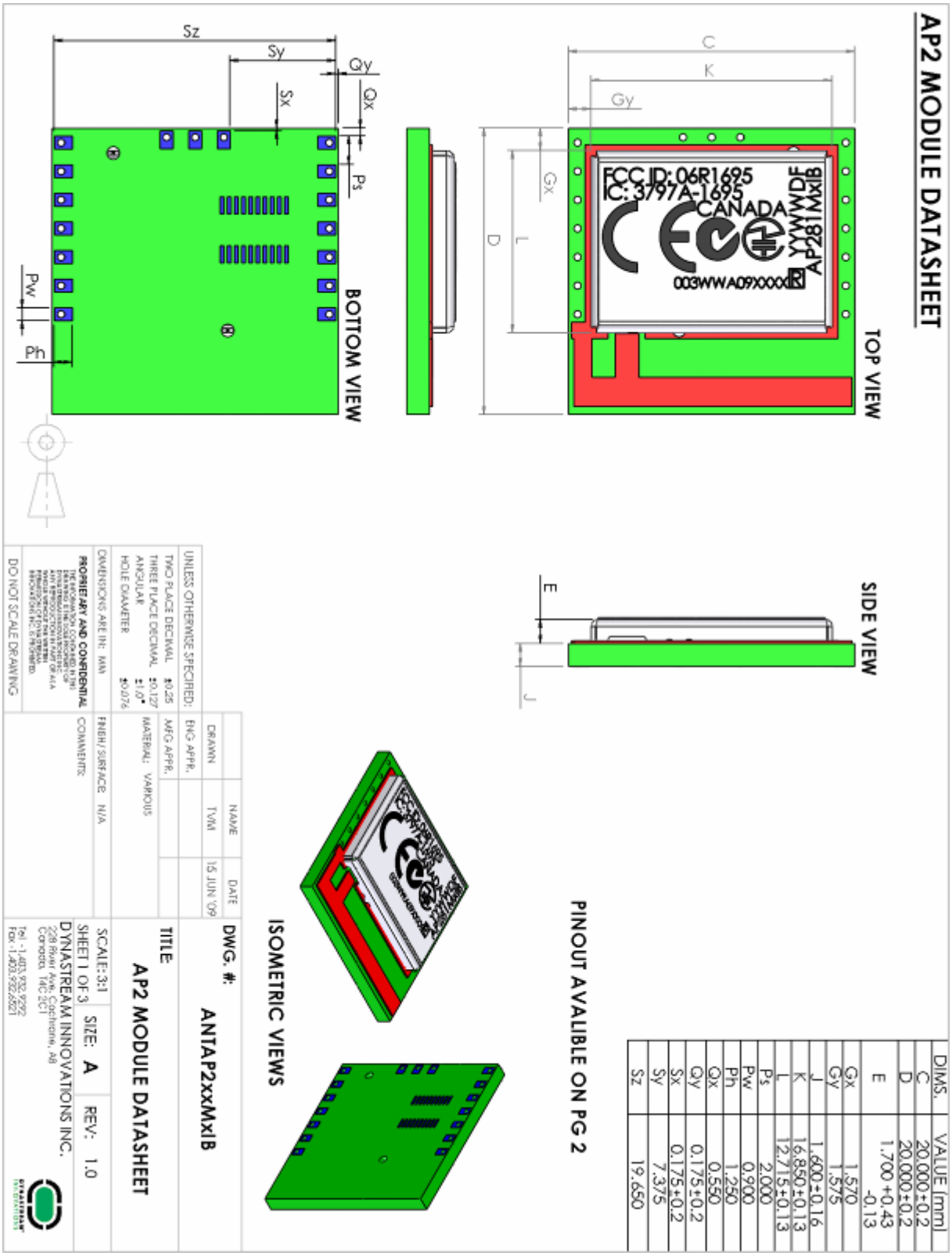
I_{ave} = ($I_{Msg\_Ack\_Rx\_57600}$ * Message_Rate) + $I_{Base\_32kSynt}$

= (22 µA/message * 2messages) + 100 µA

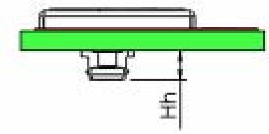
= 144 µA

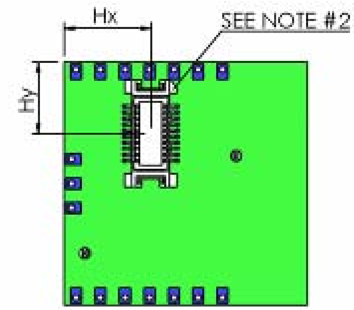
An online power consumption estimator is provided here: http://www.thisisant.com/calculator

4 Mechanical Drawings



DIMS.	VALUE (mm)
Hh	2.435
Hx	7.102
Hy	5.878





ANTAP2xxM5IB

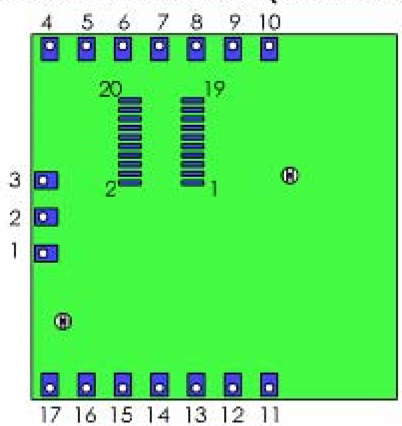
NOTES:

1. AVOID PLACING METAL COMPONENTS NEAR THE PRINTED ANTENNA OF THE AP2. HAVING METAL OBJECTS / LARGE GROUND PLANES IN THIS AREA CAN REDUCE THE RF PERFORMANCE

2. AP2 DEVELOPMENT MODULES COME WITH A STANDARD MOLEX HEADER
   - AP2 MALE HEADER IS MOLEX P/N 537480208
   - MATING FEMALE HEADER IS MOLEX P/N 529910208
   - ANGLED FEATURE ON HEADER DOES NOT VISUALLY REPRESENT PIN 1. FOLLOW PINOUT BELOW FOR PIN NUMBERING AND ORIENTATION

3. FOR ANTAP2xxMxIB, THE LAST x VALUE REPRESENTS THE PLACEMENT OF OPTIONAL HEADER:
   - ANTAP2xxM4IB - SMT VERSION OF MODULE
   - ANTAP2xxM5IB - VERSION WITH MOLEX HEADER

ANTAP2xxMxIB PINOUT (BOTTOM VIEW)



DWG. #: ANTAP2xxMxIB

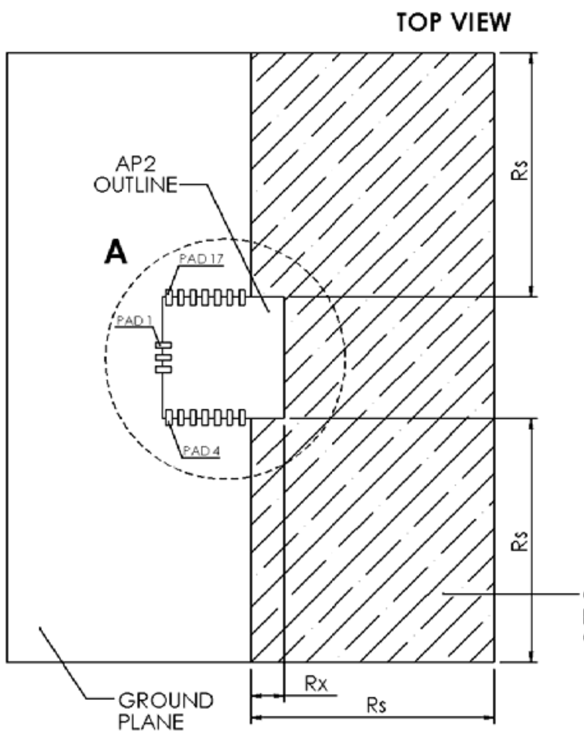
SCALE: 2:1
SHEET 2 OF 3
SIZE: A
REV: 1.0

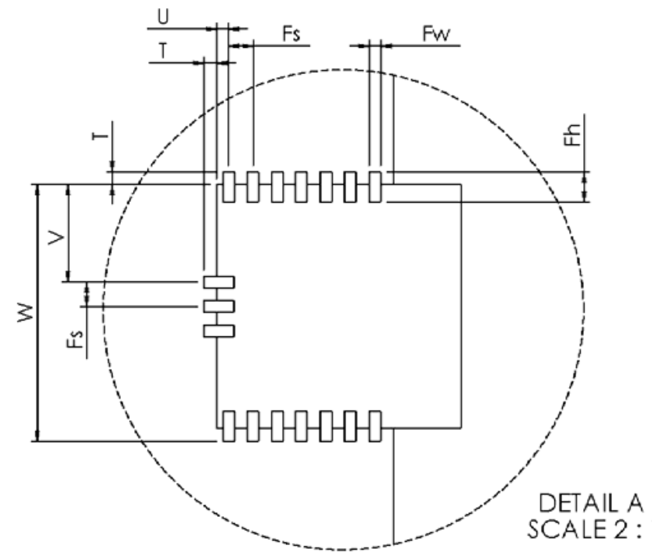
RECOMMENDED SURFACE MOUNT FOOTPRINT FOR MATING AP2xxM4IB

DIMS.	VALUE (mm)
Rs	40.000 min
Rx	5.500
T	1.070
U	1.000
V	8.000
W	21.070
Fw	0.950
Fh	2.500
Fs	2.000

MATING PCB NOTES:

1. IT IS RECOMMENDED THAT THE GROUND PLANE IS EXTENDED TO THE FULL SIZE OF THE MATING PCB, WITH THE EXCEPTION OF THE COPPER KEEPOUT.
2. IT IS BEST TO POSITION THE AP2 SO THAT THE COPPER KEEPOUT IS ON THE EDGE OR OVER HANGING THE EDGE OF THE MATING PCB. IF THE COPPER KEEPOUT LAYER IS COMPLETELY WITHIN THE BOUNDARIES OF THE PCB, THE GROUND PLANE SHOULD NOT FULLY SURROUND THE COPPER KEEPOUT. IF THIS IS NOT POSSIBLE, THE COPPER KEEPOUT SHOULD BE MADE MUCH LARGER TO PREVENT RF DEGRADATION.
3. FOR DEVELOPMENT APPLICATIONS, THE FOOTPRINT FOR FEMALE HEADER (MOLEX P/N 529910208) SHOULD FOLLOW THE SUGGESTED FOOTPRINT DESIGN PROVIDED BY THE COMPONENT MANUFACTURER.





DWG. #:	ANTAP2xxMxIB	
SCALE: 3:1 SHEET 3 OF 3	SIZE: A	REV: 1.0

5 Technical Support

The AP2 module takes the reference design of nRF24AP2 from Nordic Semiconductor. Users can seek technical support, esp. about hardware, from Nordic Semiconductor, www.nordicsemi.no. Users can also seek application support from Dynastream Innovations, www.thisisant.com.

5.1 ANT Forum

Users are encouraged to participate to the ANT forum moderated by the application engineering team of Dynastream Innovations for any engineering discussions. Join the ANT forum is free and open. To access ANT forum, click www.thisisant.com/antforum

5.2 Public Technical References

Documents:

1. nRF24AP2 Product Specification, Nordic semiconductor
2. ANT Message Protocol and Usage, Dynastream Innovations
3. Interfacing with ANT General Purpose Chipsets and Modules, Dynastream Innovations

Software:

4. ANT DLL

The above documents and software are available on www.thisisant.com or www.nordicsemi.no

5.3 ANT Developer's Zone

ANT development software, Application notes, reference designs and source codes are found in the ANT developer's zone. http://www.thisisant.com/pages/support/developer-zone

ANT developer's zone is accessible to registered owners of ANT development kit.