



Revised Date: Jan. 16, 2007

## QRZ-3000A-PA ZigBee Transceiver

### Description

The QRZ-3000A-PA is a miniature 2.4 GHz Direct Sequence Spread Spectrum ZigBee transceiver. It includes all RF hardware and a micro-controller to manage the communications link. The micro-controller manages all communications task including configuration, data packaging, and clear channel selection. The result is a complete wireless data communications solution.

The QRZ-3000A-PA package is unique because of its small form factor (49.5 x 40 mm<sup>2</sup>), It has an on-board chip antenna and the availability of external dipole antenna SMA connector. No competitive products can offer a solution as flexible, convenient, and easy to integrate,

There are four QRZ-3000 models; the QRZ-3000 with the on-board chip antenna and dipole antenna SMA connector, the QRZ-3000-PA with power amplifier, low noise amplifier and dipole antenna SMA connector. The power amplifier enhances the transmission power and low noise amplifier increase receiving signal sensitivity. The power amplifier, low noise amplifier while the QRZ-3000 lowers system cost and simplifies integration. Development Kits are available for each version. Two pin-compatible variants are also available, the QRZ-3000A and QRZ-3000A-PA, for applications with pre-loaded transceiver program requirements. The QRZ-3000A is same hardware as QRZ-3000 with pre-loaded transceiver program. The QRZ-3000A-PA is same hardware as QRZ-3000-PA with pre-loaded transceiver program.

### Models

- QRZ-3000: Includes on-board chip antenna and Dipole Antenna Connector
- QRZ-3000-PA: Includes Power Amplifier, Low Noise Amplifier and Dipole Antenna Connector
- QRZ-3000A: Transceiver program pre-loaded QRZ-3000
- QRZ-3000A-PA: Transceiver program pre-loaded QRZ-3000A
- QRZ-2200K: 2 nodes Development Kit
- QRZ-2400K: 4 nodes Development Kit

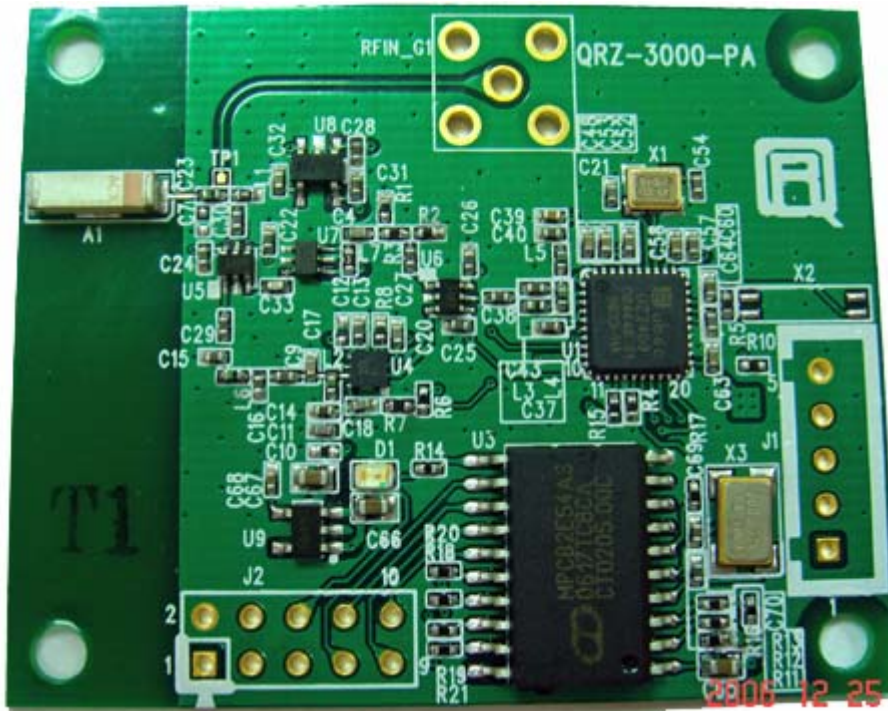
### Features

- 49.5 x 40 mm<sup>2</sup> PCBA package with 2 connectors
- Utilizes globally available 2.4 GHz ISM band
- Control and Configuration with AT commands.
- 65535 unique node addresses, IDs allow multiple large networks to coexist.
- Programmable Transmit Power Output, max. 15 dBm
- Complete IEEE 802.15.4 spec compliant

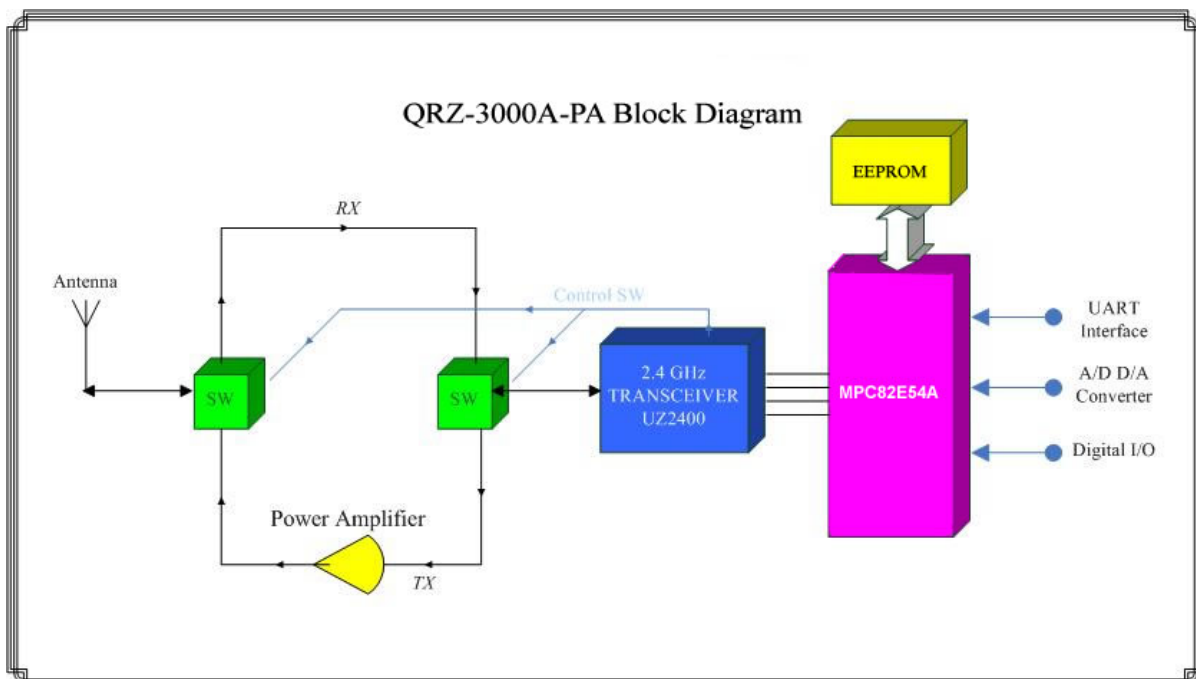


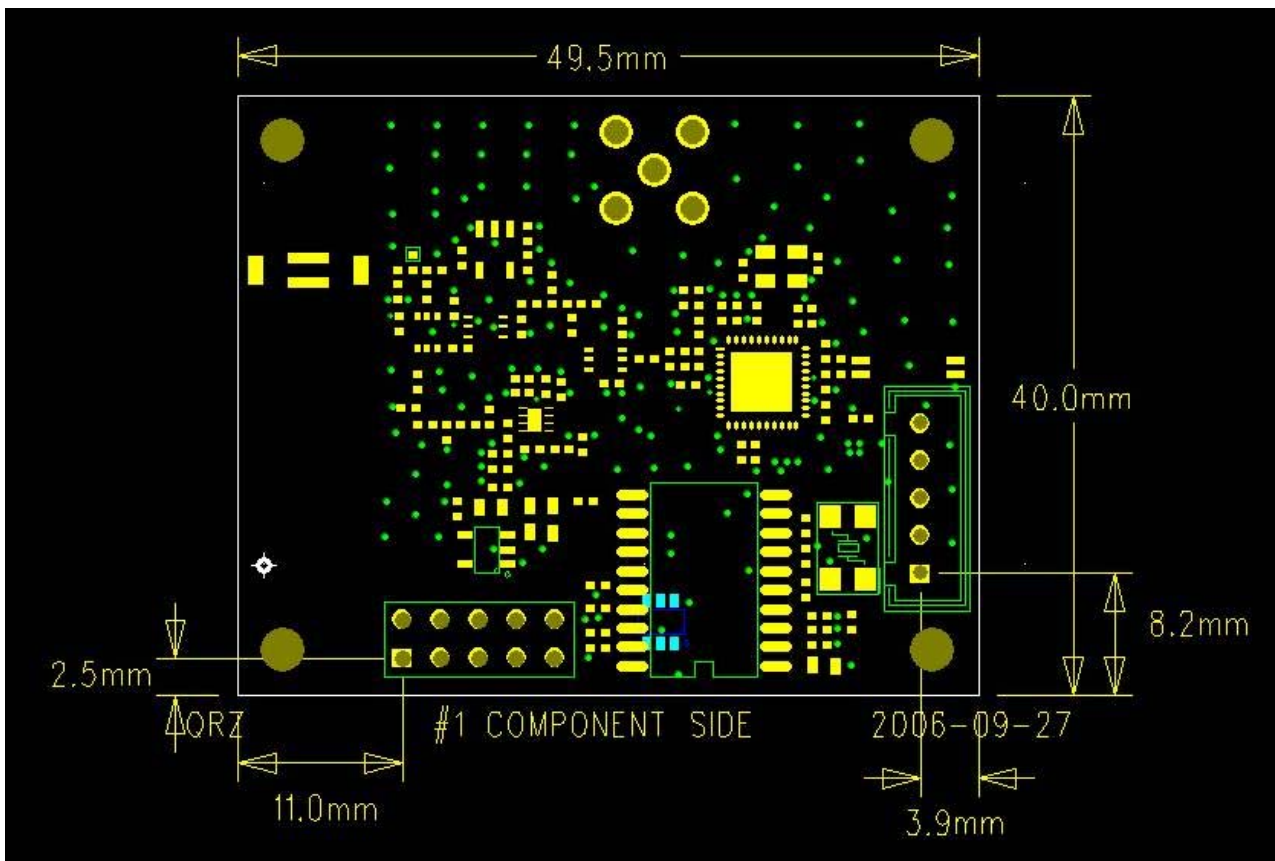
- Typical Receiver Sensitivity –95 dBm
- Typical Throughput rate 250,000 bps
- Obstructed signal range to 500 meters @ 15 dBm
- Multiple Low Power Operating modes

### QRZ-3000A-PA ZigBee Transceiver Module



### QRZ-3000A-PA MECHANICAL SPECIFICATIONS





Note : The thickness of PCB board (including PCB and components) is 3.632 mm

### Using the QRZ-3000A-PA Power Saving Modes

The QRZ-3000A-PA includes several low power operating modes to permit the most efficient use of the available power. Below are descriptions of the available selections.

**ACTIVE:** In Active Mode, all QRZ-3000A-PA circuits are powered and available for immediate action. This includes the RF receiver which actively monitors the air for an incoming communications request. Two sub-modes are classified as TX-ACTIVE and RX-ACTIVE. The current consumption of TX-ACTIVE is 22 mA while RX-ACTIVE is 18 mA.

**IDLE:** In Idle mode, all QRZ-3000A-PA RF circuits are shut down but the communications controller remains active to accept AT commands. The QRZ-3000A-PA cannot respond to incoming RF communications requests in Power-Down mode. If a transmit RF or receive RF command is received, The QRZ-3000A-PA can activate the RF section in under 200 microseconds. Current draw in Idle Mode is less than 7.5 milliamps.

**STANDBY:** In Standby mode, all QRZ-3000A-PA RF, MAC and Base Band circuits are powered-down with sleep clock remains active to minimize power consumption. The



QRZ-3000A-PA cannot accept commands or respond to incoming RF communications requests from Standby mode. Any input on TXD awakens the transceiver. Current draw in Standby Mode is less than 3.5 uA.

**DEEP SLEEP:** In Deep Sleep Mode, all QRZ-3000A-PA circuits are shutdown except digital-side power. Current draw in Deep Sleep Mode is only 2 uA.

**WAKE-UP:** QRZ-3000A-PA has two wake-up modes: timed wake-up and immediate wake-up. Timed wake-up has two sub-modes: beacon and non-beacon modes. However, if programmer sets both “main counter” and “remain counter” zero, QRZ-3000A-PA will not wake up without immediate wake-up. QRZ-3000A-PA can be wakened up externally. It can also be wakened up by setting internal register.

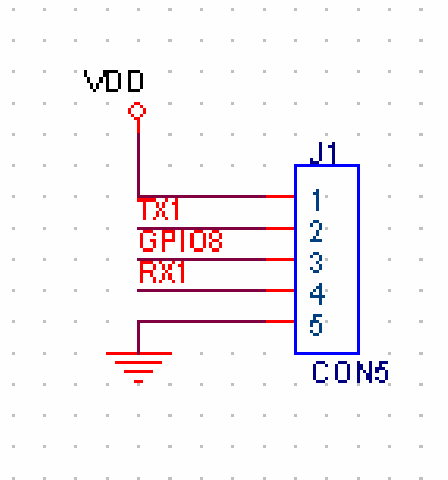
### QRZ-3000A-PA CONNECTORS PIN CONFIGURATION

QRZ-3000A-PA uses Megawin MPC82E54A as MCU. It is an 8051 base MCU and reserves 10 GPIO pins for external controlling by application. Each pin can be a general I/O pin and programmed it by user directly. Furthermore, most of these pins can be used as special purpose function. Thereof TX, RX pins can be programmed as UART for data communication. For example, user is easy to connect these pins with RS485 transceivers such as 75176, MAX485, or programs to a 10-bit ADC, or PCA.

QRZ-3000A-PA ZigBee transceiver provides J1, J2 two connectors for application usage. The J1 connector circuit and pin configuration show as below in which VDD and GND are used for power supply. The TX and RX are used for UART transmitting and receiving data. But TX and RX are used in pair. That means you can't use TX or RX only and use another pin as GPIO. The pin 3 is a MCU GPIO pin and defined as port 1.3. In programming stage, TX, VDD and GND of J1 are also defined as Megawin ISP programming interface for downloading the program



### Connector J1 Pin Configuration



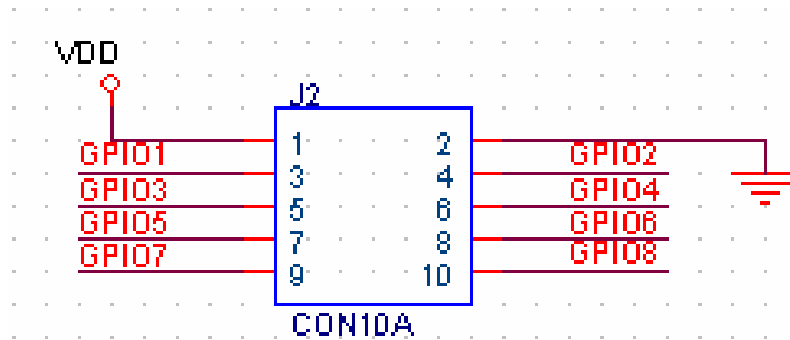
### Connector J1 Pin Configuration

Signal	Pin	Description
VDD	1	3.3 Volt power for the QRZ-3000A-PA
TX	2	GPIO, also used as UART TX, transmit Data is the data input to the QRZ-3000A-PA
RX	3	GPIO, also used as UART RX, received Data is the data output from the QRZ-3000A-PA.
P1.3	4	GPIO8, also used as ADC3, this pin is same pin as J2 pin 10
GND	5	Common voltage reference for the QRZ-3000A-PA

The J2 connector circuit and the pin configuration show as below in which VDD and GND are used for power supply. The pin 3 to P10 are MCU GPIO pins and defined as port 1.0~port 1.3, port3.3~port3.5, port3.7 respectively. These GPIO pins can interface with other devices such as sensor, LED, host controller, push button, joystick or power relays through a 5x2 connector. All of these GPIO pins can be programmed as other functions such as external interrupt, 10-bit ADC (3 sets), timer (16-bit), PGA(Programmable Counter Array) etc. The detail function definitions have showed as below.



### Connector J2 Pin Configuration



### Connector J2 Pin Configuration

Signal	Pin	Description
VDD	1	3.3 Volt power for the QRZ-3000A-PA
GND	2	Common voltage reference for the QRZ-3000A-PA
GPIO1	3	GPIO port 3.3, may be programmed as either a digital input or digital output. It also can be programmed as external interrupt
GPIO2	4	GPIO port 3.4, may be programmed as either a digital input or digital output. It also can be programmed as external clock input to PCA as alternative clock input to timer-0
GPIO3	5	GPIO port 3.5, may be programmed as either a digital input or digital output. It also can be programmed as external clock input to PCA as alternative clock input to timer-1
GPIO4	6	GPIO port 3.7, may be programmed as either a digital input or digital output. It also can be programmed as external clock input to PCA
GPIO5	7	GPIO port 1.0, may be programmed as either a digital input or digital output. It also can be programmed as analog to digital converter (ADC0)
GPIO6	8	GPIO port 1.1, may be programmed as either a digital input or digital output. It also can be programmed as analog to digital converter (ADC1)
GPIO7	9	GPIO port 1.2, may be programmed as either a digital input or digital output. It also can be programmed as analog to digital converter (ADC2)
GPIO8	10	GPIO port 1.3, may be programmed as either a digital input or digital output. It also can be programmed as analog to digital converter (ADC3)



Absolute Maximum Rating	
VCC	3.6V
Storage temperature	-40°C to +120°C
Operating temperature Range	-30°C to +80°C

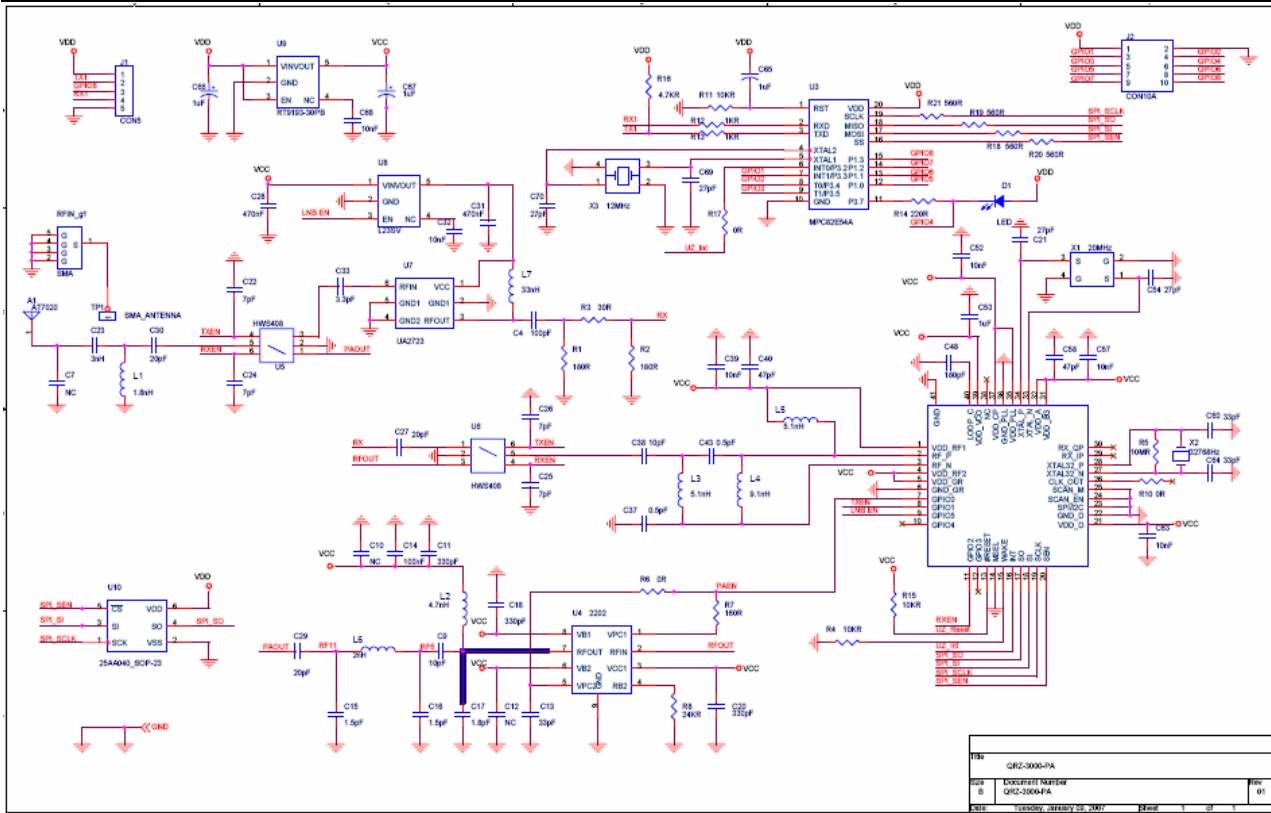
WARNING: Exceeding any of these ratings will void the warranty and may damage the device

### QRZ-3000A-PA ELECTRICAL SPECIFICATIONS

Parameters	Min	Typ	Max	Units
Supply Voltage for RF, analog and digital circuits	2.4		3.6	V
Supply Voltage for Digital I/O	2.4	3.3	3.6	V
Current Consumption				
ACTIVE TX Mode @ 15 dBm		77		mA
ACTIVE RX Mode		18		mA
IDLE Mode		7.5		mA
STANDBY Mode		3.5		uA
DEEP SLEEP Mode		2		uA
Output Power	-23.75	15		dBm
Wireless Receive Sensitivity		-95		dBm
Range thru no Physical Obstructions @ 15 dBm		500		meter
Selectable Channels		16		channel
Frequency Band	2.400		2.4835	GHz
Antenna Output Impedance		50		Ohms



**QRZ-3000A-PA CIRCUIT DIAGRAM**



**PART LIST OF QRZ-3000A-PA CIRCUIT DIAGRAM**

Item	Quantity	Reference	Part	Description
1	1	A1	AT7020	LCC8
2	1	C4	100pF	0402
3	1	C7	NC	0402
4	1	C9	10pF	0402
5	2	C10,C12	NC	0402
6	3	C11,C18,C20	330pF	0402
7	1	C13	33pF	0402
8	1	C14	100nF	0402
9	2	C16,C15	1.5pF	0402
10	1	C17	1.8pF	0402
11	2	C21,C54	27pF	0402
12	4	C22,C24,C25,C26	7pF	0402
13	1	C23	3nH	0402
14	2	C27,C29	20pF	0402
15	2	C31,C28	470nF	0402

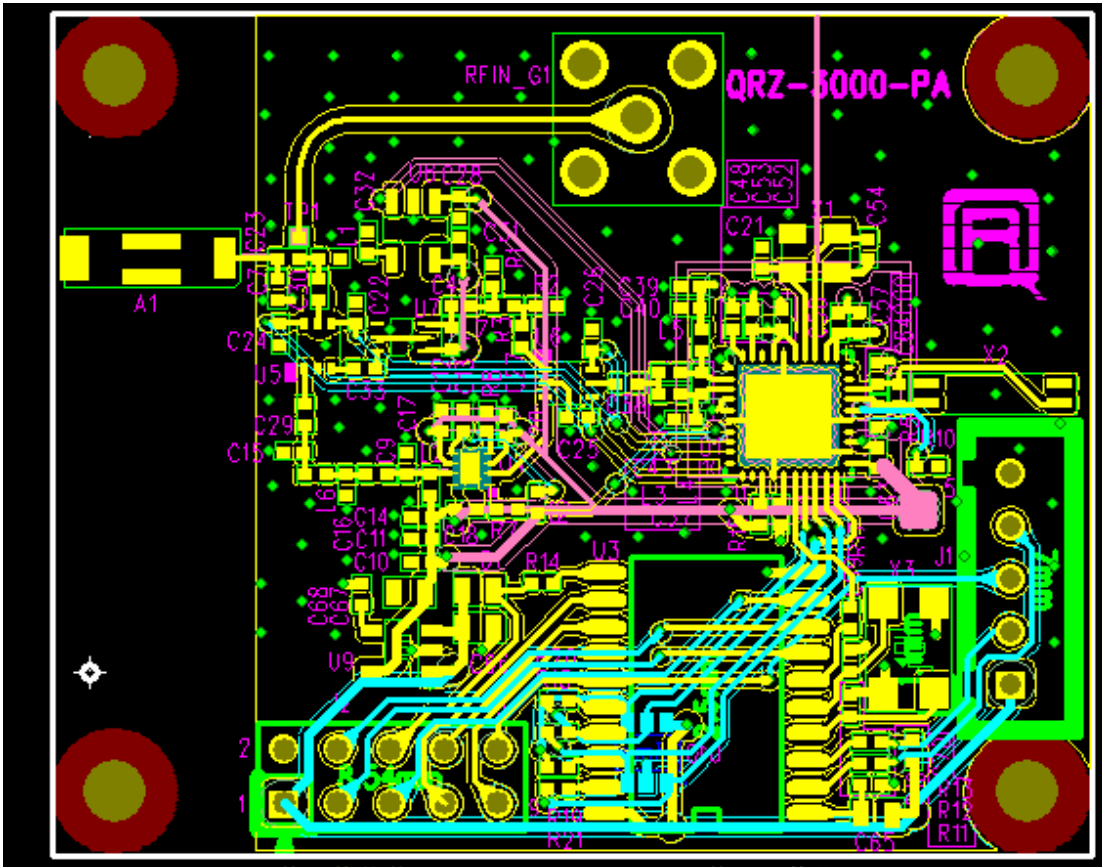


16	1	C30	20pF	0402
17	1	C32	10nF	0402
18	1	C33	3.3pF	0402
19	2	C37,C43	0.5pF	0402
20	1	C38	10pF	0402
21	4	C39,C52,C58,C63	10nF	0402
22	2	C57,C40	47pF	0402
23	1	C48	180pF	0402
24	1	C53	1uF	0402
25	2	C60,C64	33pF	0402
26	3	C65,C66,C67	1uF	0805
27	1	C68	10nF	0402
28	2	C69,C70	27pF	0402
29	1	D1	LED	0805
30	1	J1	CON5	WAFER-A2501WV-5P
31	1	J2	CON10A	HD5X2_2.54
32	1	L1	1.8nH	0402
33	1	L2	4.7nH	0402
34	2	L5,L3	5.1nH	0402
35	1	L4	9.1nH	0402
36	1	L6	2nH	0402
37	1	L7	33nH	0402
38	1	RFIN_g1	SMA	
39	2	R2,R1	180R	0402
40	1	R3	30R	0402
41	1	R4	10KR	0402
42	1	R5	10MR	0402
43	2	R6,R17	0R	0402
44	1	R7	160R	0402
45	1	R8	24KR	0402
46	1	R10	0R	0402
47	2	R15,R11	10KR	0402
48	2	R12,R13	1KR	0402
49	1	R14	220R	0402
50	1	R16	4.7KR	0402
51	4	R18,R19,R20,R21	560R	0402

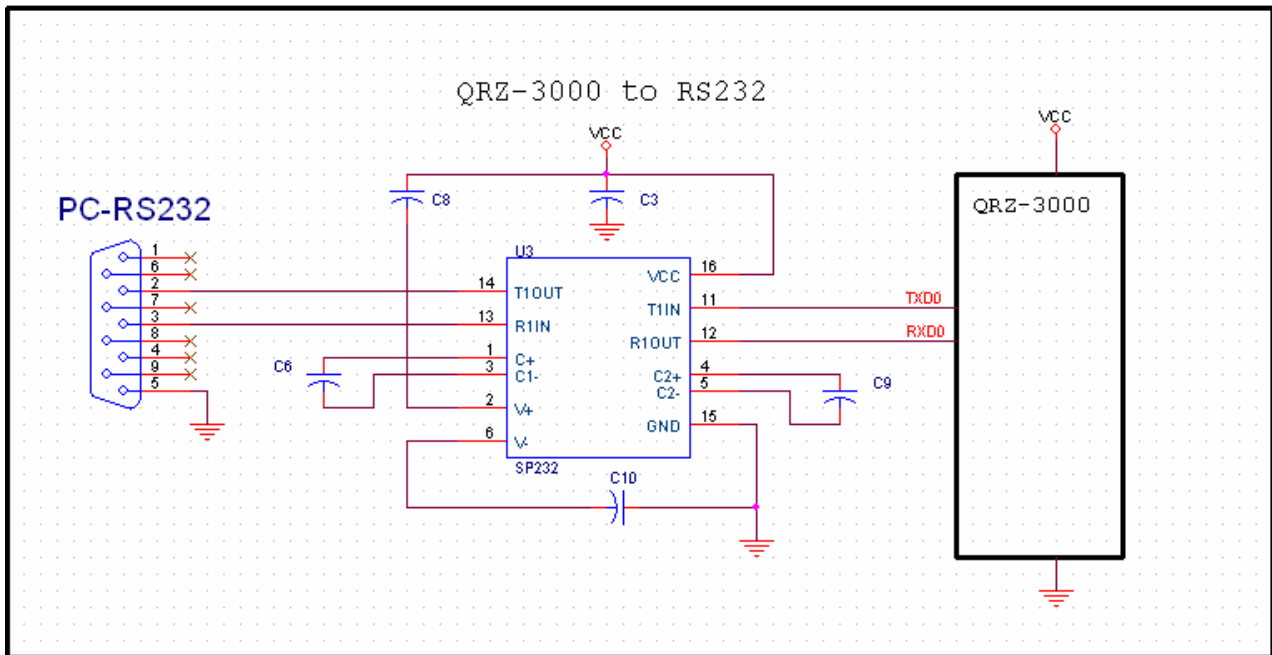


52	1	TP1	SMA_ANTENNA	TP24S
53	1	U1	UZ2400	QFP40-0.5
54	1	U3	MPC82E54A	SOP20-7.5_1.27
55	1	U4	UP2202	2_2_8LEAD
56	2	U6,U5	HWS408	AS179
57	1	U7	UA2723	SOT363
58	1	U8	L23SV	SOT23-5
59	1	U9	RT9193-30PB	SOT-23-5
60	1	U10	25AA040_SOP-23	SOT-23-6
61	1	X1	20MHz	CX_101F
62	1	X2	32768Hz	OSC2
63	1	X3	12MHz	XTAL-5X3.2-4P_S

**QRZ-3000A-PA PCB LAYOUT**



**QRZ-3000A-PA APPLICATION CIRCUIT DIAGRAM**



### QRZ-3000A-PA AT COMMANDS

#### QRZ-3000A-PA AT Command Format

Each command follows a standard command format as described below. Commands are accepted at data rates from 1200 to 115,200 bps. The default serial data rate is 9600 bps

**Header** --- Each command begins with 0x88000088. The prefix identifies the commands sent to the QRZ-3000A-PA by matching the pattern of command header "0x88000088".

**Command Byte** --- Each commands is only one byte after command header, the detail command definition is described as below.

**Command Length** --- In case of command follow by parameters, the command length will define the parameter length in this byte.

**Command Parameters** --- Command parameters will be added after command length,

**Tail** --- Each command ends with 0xCCFFFFCC. The postfix identifies the commands sent to the QRZ-3000A-PA by matching the pattern of command postfix "0xCCFFFFCC".

The total command packet is no longer than 240 bytes.

Command Format	Data Type	Value	Description
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Header	UINT32	0x88000088	Command Header
CMD	UINT8	Define as below	Command Byte
CMD Length	UINT8	variable	Command Length
Parameters	UINT8	variable	Command Parameters
Tail	UINT32	0xCCFFFFCC	Command Tail

### Command Byte Definition

0x01 : Set Router Parameters  
 0x02 : Set Router Parameters ACK  
 0x03 : Get Router Parameters  
 0x04 : Get Router Parameters ACK  
 0x05 : Set Device Parameters  
 0x06 : Set Device Parameters ACK  
 0x07 : Get Device Parameters  
 0x08 : Get Device Parameters ACK  
 0x09 : Set Coordinator Parameters  
 0x0A : Set Coordinator Parameters ACK  
 0x0B : Get Coordinator Parameters  
 0x0C : Get Coordinator Parameters ACK  
 0x13 : Get Software Version  
 0x14 : Get Software Version ACK  
 0x15 : Clear Parameters  
 0x16 : Clear Parameters ACK  
 0x17 : Set Fixed Parameters  
 0x18 : Set Fixed Parameters ACK  
 0x19 : Get Fixed Parameters  
 0x1A : Get Fixed Parameters ACK  
 0x1B : Set Network Configuration  
 0x1C : Set Network Configuration ACK  
 0x1D : Get Network Configuration  
 0x1F : Get Network Configuration ACK  
 0x20 : Set Sensor Parameters  
 0x21 : Set Sensor Parameters ACK  
 0x22 : Get Sensor Parameters  
 0x23 : Get Sensor Parameters ACK  
 0x40 : Send Data Upload With Address  
 0x41 : Send Data Download With Address



- 0x42 : Send Data Upload by Broadcast
- 0x43 : Send Data Download by Broadcast
- 0x60 : Request Router to Set Parameters
- 0x61 : Request Device to Set Parameters
- 0x62 : Device Send Sensor Data to Coordinator
- 0x63 : Device Send Sensor Data ACK
- 0x67 : Raw Data Transfer
- 0x68 : Get System Status
- 0x69 : Get System Status ACK
- 0x6A : System Re-Start
- 0x6B : Check Connection Status

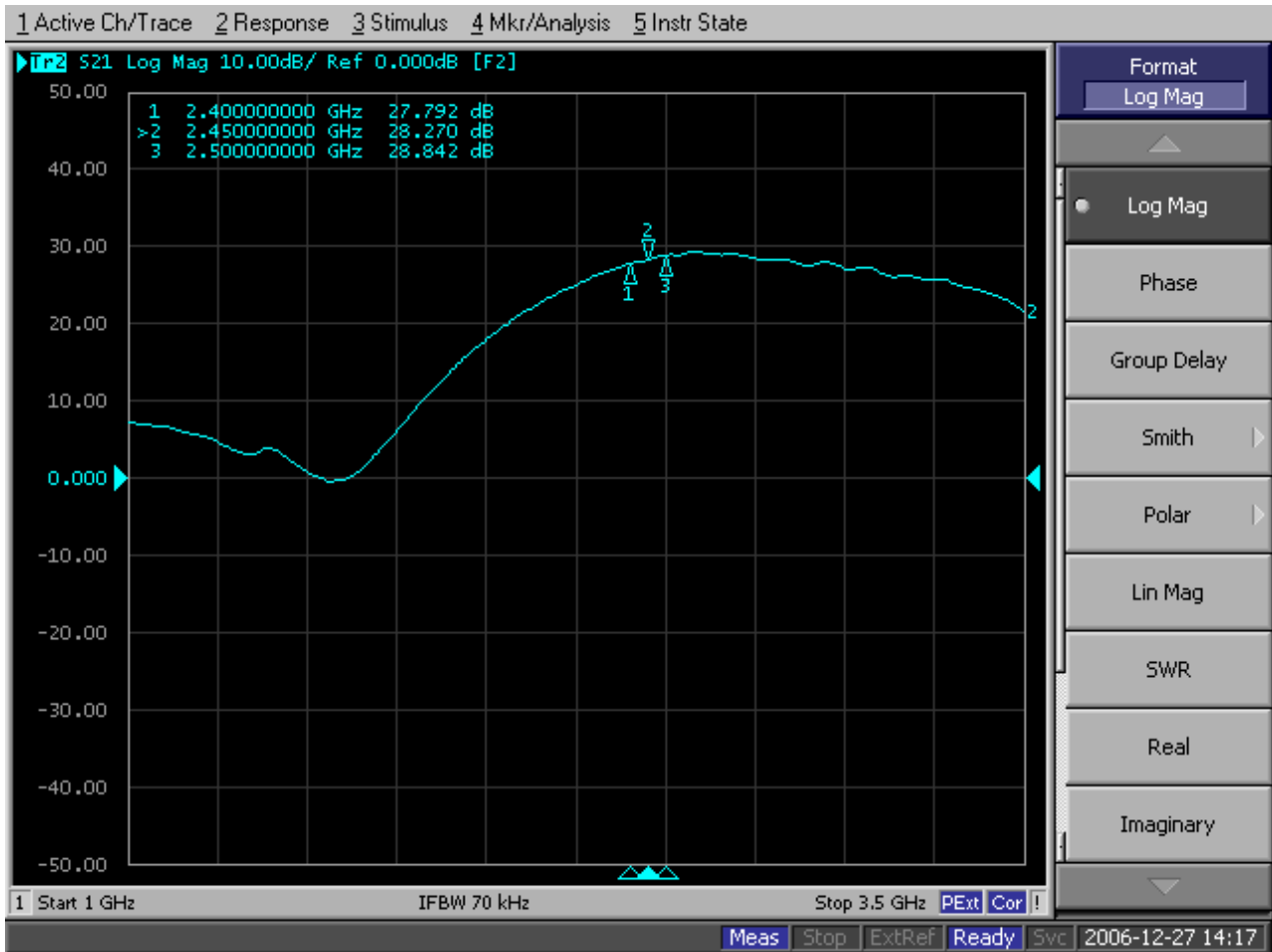
## RF PERFORMANCE

For an RF power amplifier, the performance degrades when output power reaches the non-linearity region. The maximum linear power of PA depends on P1dB point and signal complexity such as modulation, data length and data rate. For UP2202, linear gain is around 27dB and P1dB output power is 26 dBm. To optimize the maximum output power, the output power of UZ2400 (that is, the input power of UP2202) should be adjusted for various system needs.



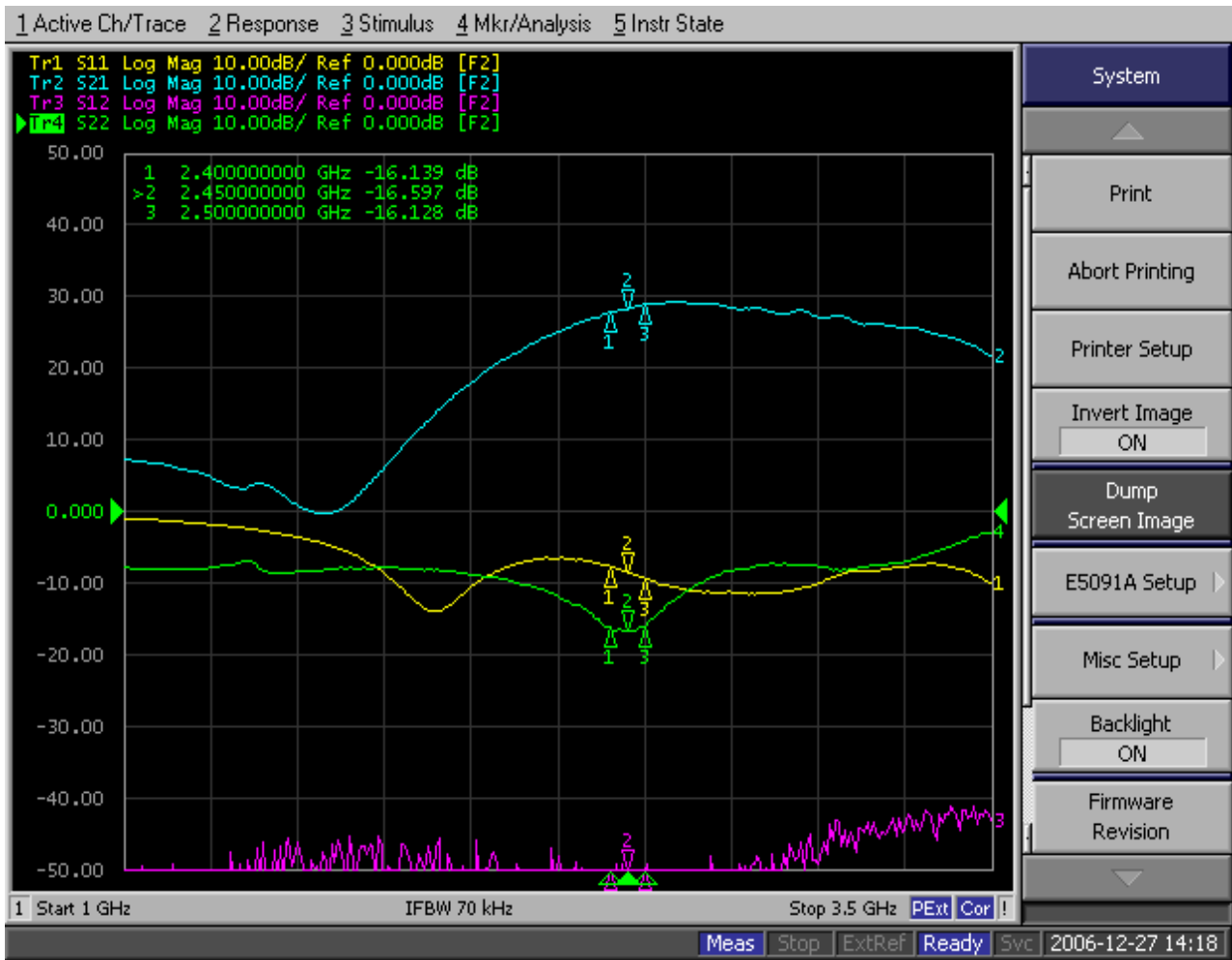
RF PERFORMANCE TEST DATA

Maximum PA output power 28.79dB





Return Loss: -16.5dB



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