▣ IEEE 802.15.4 RF Module Specification Sheet

File No.: 110527A003
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Manual

Model Number	RP-M100A
Part Number	AT-M100A
Specification.	IEEE802.15.4 RF Module
Date	MAY 27. 2011
Remarks	

REVISION HISTORY

NO	REASON	DESCRIPTION OF CHANGES	REMARKS	DATE
1	New	RP-M100A Manual For Approval first releases	Ver.1.1	2010.02.22
2	Rev 1	Update of “Specification For Approval”	Ver. 2.0	2011.05.27

1. SPECIFICATION

1.1 Scope

This specification is applied to IEEE802.15.4 ZigBee Transceiver Module

This module has Chip Antenna and embeds 16MHz X-TAL and Single chip SOC.

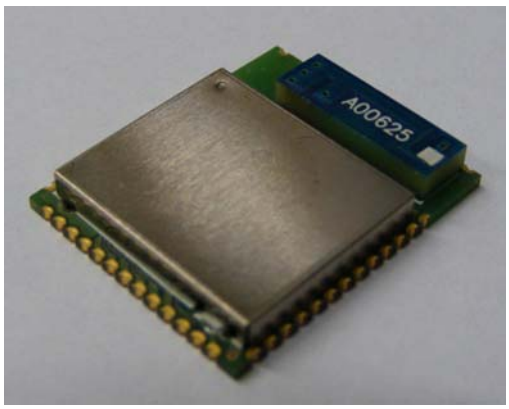
1.2 Description

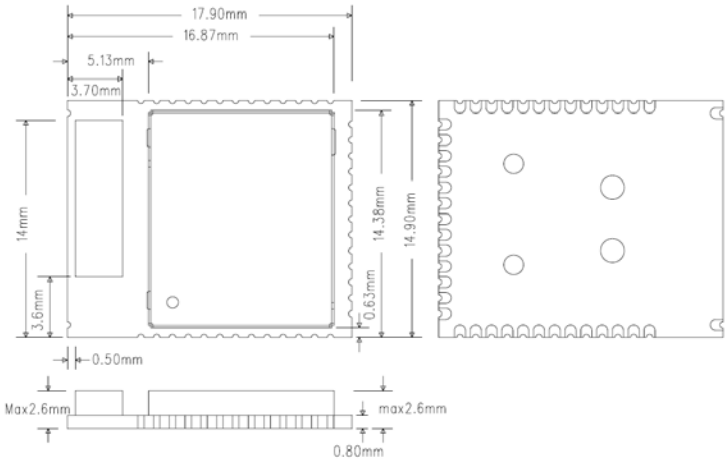
Item	Description
Application	Transceiver Module
Frequency Range	2.4 ~ 2.4835 GHz
Technical Standard	IEEE802.15.4
Type	SMD Type
Size	17.9 x 14.9 x 2.6 mm

1.3 Appearance

Unit :mm

1) Out line





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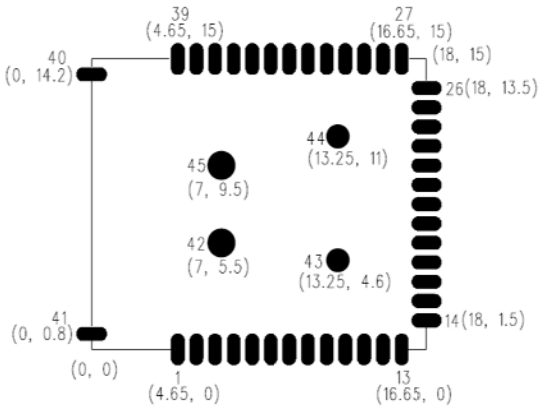
2) Pcb drawing (top view).



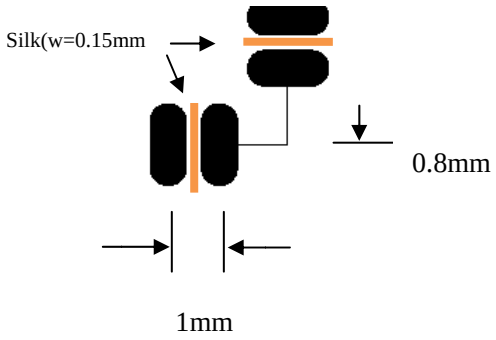
Pads of pin 1~41 ; (W*L: 0.7*1.6mm)

Pads of pin 42,45 ; (R=0.75, Circle)

Pads of pin 43,44 ; (R=0.625, Circle)

"Soldermask opening of 42~45 pins should be enough about 25~50% against these pads size".

NOTE) Silk paste inserting for Short protection, when soldering



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1.4 Absolute maximum ratings

Symbol	Parameter	Rating	Unit
V_{DD}	Chip core supply voltage	-0.3 to 1.65	V
V_{DDIO}	I/O supply voltage(3V_IN)	-0.3 to 3.3	V
RF_{IN}	**Input RF level**	**10**	**dBm**
T_{STG}	Storage Temperature	-40 to 85	℃
ESD	HBM(JESD22-A114-F)	2000	V
	MM(JESD22-A115-A)	150	V
	CDM(JESD22-C101-E)	500	V

1.5 DC Characteristics

Symbol	Parameter	Min	Typ.	Max	Unit
V_{DD}	**Chip core supply voltage (AVDD_1.5V,DVDD_1.5V)**	**1.35**	**1.5**	**1.65**	**V**
V_{DDIO}	I/O supply voltage(3V_IN)	**1.35(*)**	**3.0**	**3.3**	**V**
V_{IH}	**High level input voltage**	**0.7x V_{DDIO}**		**V_{DDIO}**	**V**
V_{IL}	**Low level input voltage**	**0**		**0.3x V_{DDIO}**	**V**
V_{OH}	**High level output voltage**	**V_{DDIO} -0.5**		**V_{DDIO}**	**V**
V_{OL}	**Low level output voltage**	**0**		**0.4**	**V**
T_A	**Air temperature**	**-40**		**85**	℃

(*) : MSV=”L”, min 1.9V(regulator drop voltage), 3VIN=2.7~3.3V is Recommended.

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1.6 Electrical specifications

(Condition: EVM Board RF Conduction, at 25℃, 3V_IN=3.0V, VDD(AVDD,DVDD=1.5V,X-tal 16MHz)

1.6.1 Current Consumption and timing characteristics

Parameter	Min	Typ.	Max	Unit
Current Consumption				
Active MCU without RX/TX operation (AES, Peripheral, SADC Disabled)		4.6		mA
Active MCU with TX Mode (AES, Peripheral, SADC Disabled) @ +8dBm output power @+0dBm output power		 45.0 32.5		mA
Active MCU with RX Mode (AES, Peripheral, SADC Disabled)		35		mA
PM1(BOD Off)		25	90	uA
PM2		1.7		uA
PM3		0.3		uA
AES		3.1		mA
Peripheral		2.6		mA
Sensor ADC		1		mA

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1.6.2 RF Characteristics (Fc=2450MHz)

Parameter	Min	Typ	Max	Unit
RF Frequency Range	2400		2483.5	MHz
Spurious radiation @30MHz ~ 1000MHz @1GHz ~ 12.75GHz		 -65 -70		dBm
Received RF Bandwidth		2		MHz
Channel Bandwidth		5		MHz
Receiver Sensitivity (PER≤1%,Packet length of 22-byte) Normal mode (250 kbps) Turbo mode (500 kbps) Premium mode (1000 kbps)		 -98 -95 -91		dBm
Adjacent Channel Rejection +5MHz -5MHz		 50 49		dB
Alternate Channel Rejection +10MHz -10MHz		 55 54		dB
Co-Channel Rejection		-8		dB
Blocking / Desensitization +5MHz / -5MHz +10MHz / -10MHz +20MHz / -20MHz +30MHz / -30MHz +50MHz / -50MHz		 -53 / -52 -48 / -46 -44 / -40 -43 / -38 -41 / -37		dBm

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Parameter	Min	Typ	Max	Unit
TX output power		5.5	8	dBm
Transmit chip rate		2000		kChips/s
Spurious Emission(30Hz~1GHz)		-50		dBm
Spurious Emission(1GHz~2.5GHz)		-40		dBm
Spurious Emission(2.5GHz~12.7GHz)		-50		dBm
2nd Harmonics		-50		dBm
3nd Harmonics		-65		dBm
Frequency Error Tolerance	-100		+100	KHz
Error Vector Magnitude(EVM)		10	35	%
Saturation(Maximum Input Level)		5		dBm
RSSI Dynamic Range		90		dB
RSSI Accuracy		±1.2	+6/-3	dB
RSSI Linearity		±0.2	±6	dB
RSSI Average Time		128		usec
Frequency Synthesizer				
Phase Noise (Unmodulated carrier) @±100KHz offset @±1MHz offset @±2MHz offset @±3MHz offset @±5MHz offset		 -75 -106 -112 -119 -129		dBc/Hz
PLL Lock Time		110		us
PLL Jitter		16		Psec

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1.6.2.1 Antenna Description

Parameter	Description
Chip Antenna (used in RP-M100A)	
Model Name	ISM-SWC-01
Frequency	2400 ~ 2500 (MHz)
Bandwidth	100 (MHz)
Gain(max)	-0.97dBi
Connector	Chip
Dipole Antenna (used in RP-M110A)	
Model Name	WE-2400TO
Frequency	2400~24835 (MHz)
Bandwidth	83.5 (MHz)
Gain(max)	1.98 dBi
Connector	Reverrse SMA male

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1.6.3 16MHz Crystal Oscillator & On-chip RC Regulator & ADC & On-chip Voltage Regulator

Parameter	Min	Typ	Max	Unit
16MHz Crystal Oscillator				
Crystal Frequency		16		MHz
Crystal Frequency Accuracy Requirement	-20		+20	ppm
ESR			80	Ω
C_0			3	pF
C_L		9		pF
On-chip RC Regulator				
Frequency		32.78		KHz
Sensor ADC				
Number of Bits		12		bits
Conversion Time		256		usec
Differential Nonlinearity(DNL)		±16		LSB
Integral Nonlinearity(INL)		±16		LSB
SINAD(Sine Input)		51.0		dB
On-chip Voltage Regulator				
Supply range for Regulator	1.9	3.0	3.6	V
Regulated Output		1.5		V
Maximum Current			140	mA
No Load Current		15		uA
Start-up Time		260		usec

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1.7 Electrical Interface

Terminal	NAME	Interface	I/O	Description
1	ACH0	Analog	I/O	Sensor ADC input
2	ACH1	Analog	I/O	Sensor ADC input
3	ACH2	Analog	I/O	Sensor ADC input
4	ACH3	Analog	I/O	Sensor ADC input
5	AVDD_1.5V	Power	I/O	1.5V Power Supply input/output
6	AGND	Ground	-	RF Ground
7	MS0	Digital	I	Mode select
8	MS1	Digital	I	Mode select
9	MS2	Digital	I	Mode select
10	MSV	Digital	I	Mode select of voltage(0=1.5V)
11	RESETB	Digital	I	Reset (Active Low)
12	3V_IN	Power	I	3V Power supply
13	DGND	Ground	-	Ground for digital core and I/O
14	P1[7]	Digital	O	Port P1.7GPO/P0AND/TRSW
15	P1[6]	Digital	B	Port P1.6/TRSWB
16	P1[5]	Digital	B	Port P1.5
17	P1[4]	Digital	B	Port P1.4 /QUADZB/Sleep Timer OSC Buffer Input.
18	P1[3]	Digital	B	Port P1.3/QUADZA/Sleep Timer OSC Buffer Output/RTCLKOUT
19	P1[2]	Digital	B	Port P1.2
20	P1[1]	Digital	B	Port P1.1/TXD1
21	P1[0]	Digital	B	Port P1.0/RXD1
22	P3[7]	Digital	B	Port P3.7/12mA Drive capability /PWM3/CTS1/SPICSN(slave only)
23	P3[6]	Digital	B	Port P3.6/12 mA Drive capability /PWM2/RTS1/SPICLK

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Terminal	NAME	Interface	I/O	Description
24	P3[5]	Digital	B	Port P3.5/T1/CTS0/QUADYB/SPIDO
25	P3[4]	Digital	B	Port P3.4/T0/RTS0/QUADYA/SPIDI
26	P3[3]	Digital	B	Port P3.3/INT1(active low)
27	P3[2]	Digital	B	Port P3.2/INT0(active low)
28	P3[1]	Digital	B	Port P3.1/TXD0/QUADXB
29	P3[0]	Digital	B	Port P3.0/RXD0/QUADXA
30	DGND	Ground	-	Ground for digital core and I/O
31	DVDD_1.5V	Power	I/O	1.5V Power Supply input/output
32	P0[7]	Digital	B	Port P0.7/I2STX_MCLK
33	P0[6]	Digital	B	Port P0.6/I2STX_BCLK
34	P0[5]	Digital	B	Port P0.5/I2STX_LRCK
35	P0[4]	Digital	B	Port P0.4/I2STX_DO
36	P0[3]	Digital	B	Port P0.3/I2SRX_MCLK
37	P0[2]	Digital	B	Port P0.2/I2SRX_BCLK
38	P0[1]	Digital	B	Port P0.1/I2SRX_LRCK
39	P0[0]	Digital	B	Port P0.0/I2SRX_DI
40	NC	NC	-	No Connection
41	NC	NC	-	No Connection
42	AGND	Ground	-	RF Ground
43	DGND	Ground	-	Ground for digital core and I/O
44	DGND	Ground	-	Ground for digital core and I/O
45	AGND	Ground	-	RF Ground

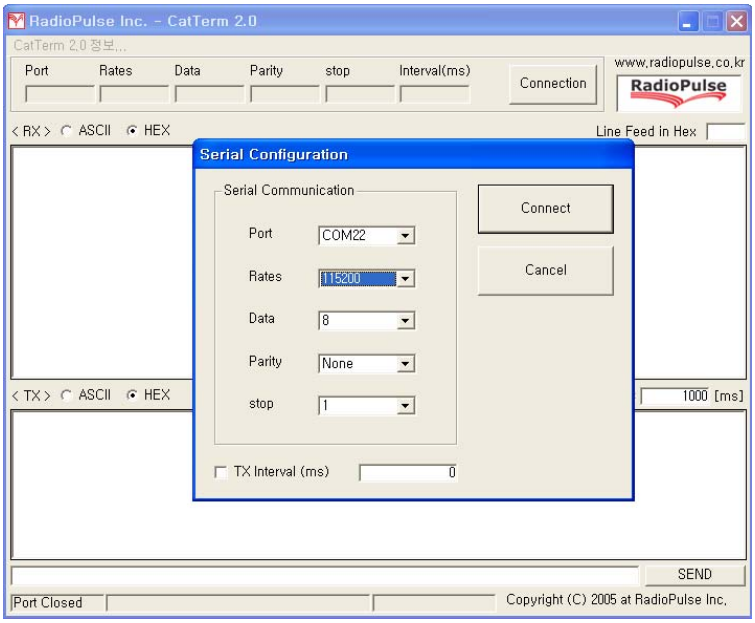
2. Operation

1) After you stick RP-M100A in ADPTER -PCIB , connect ADPTER -PCIB to your PC using the USB cable as shown below figure.

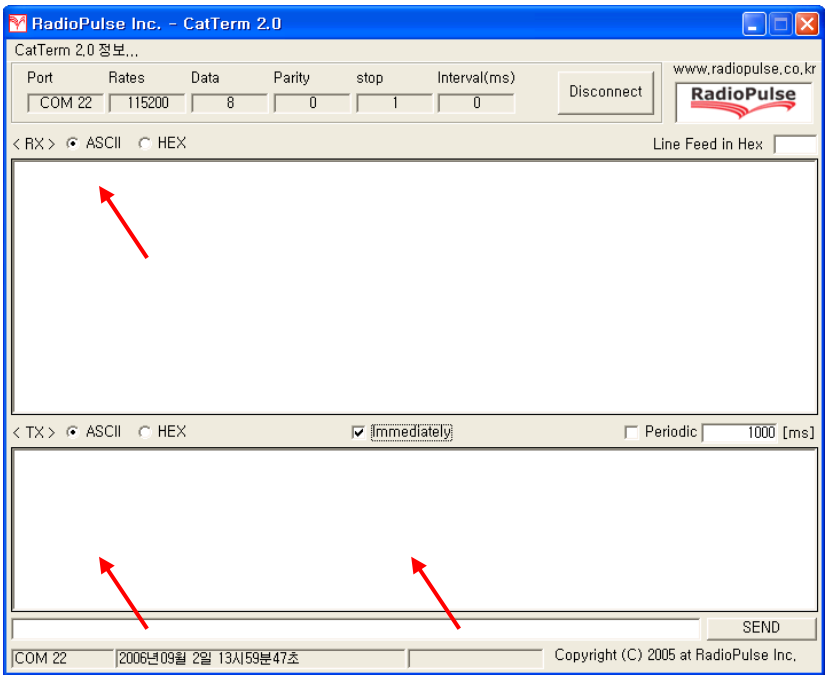
2) Move '2. Power switch(Figure1)' in 'USB' position to power up.

3) Check if '3. USB Power LED(Figure1)' stays on.
(=> To initialize LM2400-R, press the '4. Reset switch(Figure1)'.)

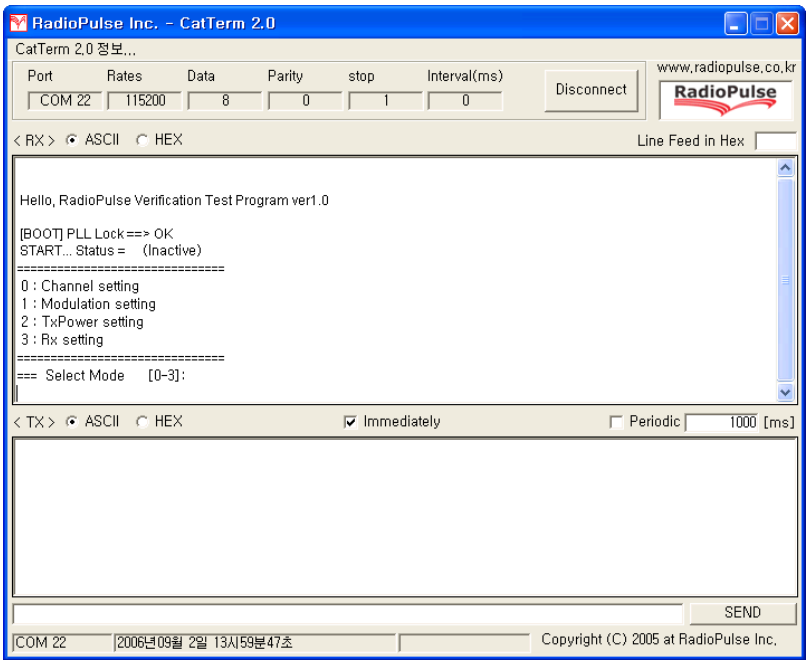
4) After the CatTerm 2.0 (Serial Terminal Program) is installed, run this program.
And then press the 'Connect' button to configure the serial port as shown below figure.
(In setting the COM port, after you install the driver of the CP2102(USB chip),
select the COM port which is setted automatically.



5) If you press the “Connect” button, stay in the connection status.
In the <RX>,<TX> window, select the ASCII and the Immediately option.

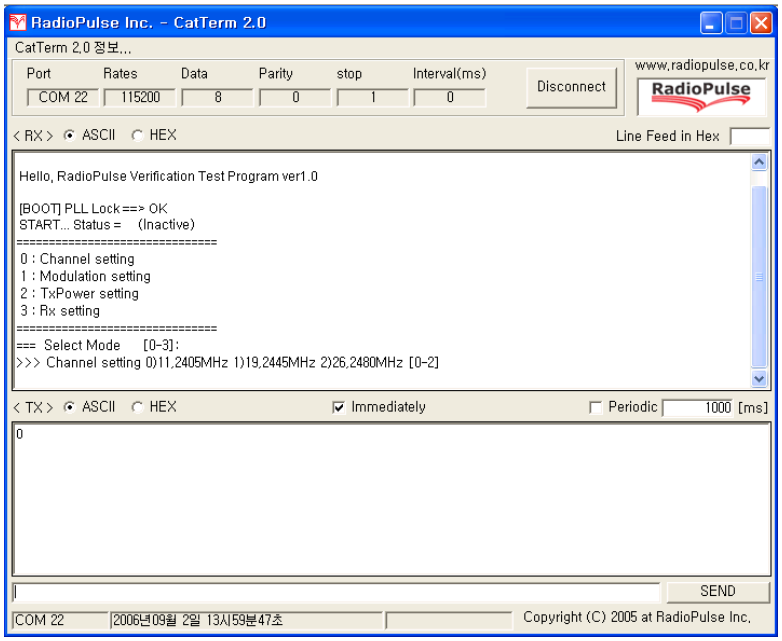


6) If you press the ‘4. Reset switch(Figure 1)’, the selection menu appears in the window.



7) The description of menu is as shown below the table. If you want to select one, put the number in command line of TX window.

0	Channel setting	>>> Channel setting 0)11,2405MHz 1)19,2445MHz 2)26,2480MHz [0-2]: ---------- 0) channel 11 (2405MHz) 1) channel 19 (2445MHz) 2) channel 26 (2480MHz) or channel 25(2475MHz)
1	Modulation setting	>>> Modulation setting 0)No Modulation 1)Modulation [0-1]: ---------- ☞ Caution) **In LM2400-PR module, when you switch between 'Unmodulation' and 'Modulation', you should select 'Normal' before 'Unmodulation' or 'Modulation'.** Ex) 'Unmodulation' -> 'Normal' ->'Modulation'
2	TxPower setting	>>> TxPower setting (refer the tx power table [0x77-0x]: ---------- => Refer to below 'Transmit Power by PowerLevel' table ☞ Caution) **In the <TX> window, select the HEX option.**
3	Rx setting	>>> Rx Mode setting 0)Rx Mode OFF 1) Rx Mode ON [0-1]: ---------- 0) When the Rx Mode is OFF, stays in TX status. 1) When the Rx Mode is ON, stays in RX status.



```
//-------------------------------------------------------------------------------
// Transmit Power by PowerLevel ( +5dBm Module Base )
//-------------------------------------------------------------------------------
//          :   0   :   1   :   2   :   3   :   4   :   5   :   6   :   7   :
//-------------------------------------------------------------------------------
//  0x7n    : -38.4 :  -4.6 :  -0.7 :   1.3 :   2.6 :   3.7 :   4.4 :   5.0 :
//  0x6n    : -39.1 :  -5.2 :  -1.2 :   0.9 :   2.2 :   3.3 :   4.1 :   4.8 :
//  0x5n    : -40.1 :  -6.3 :  -2.2 :   0.1 :   1.5 :   2.6 :   3.5 :   4.2 :
//  0x4n    : -41.1 :  -7.2 :  -3.1 :   0.7 :   0.9 :   2.0 :   2.9 :   3.8 :
//  0x3n    : -41.9 :  -8.9 :  -4.7 :  -2.2 :  -0.4 :   0.9 :   1.9 :   2.7 :
//  0x2n    : -45.4 : -12.5 :  -7.8 :  -5.0 :  -3.1 :  -1.5 :  -0.3 :   0.7 :
//  0x1n    : -47.9 : -15.9 : -10.9 :  -7.7 :  -5.5 :  -3.7 :  -2.2 :  -1.0 :
//  0x0n    : -50.9 : -33.4 : -29.4 : -27.4 : -25.9 : -24.9 : -23.9 : -23.2 :
//-------------------------------------------------------------------------------
```

[TX power table]

☞ ex) In 5.0dBm, the hex value of TX power is 0x77. In -38.4dBm, 0x70.

3. Reliability

3.1 Reliability

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No.	Test item	Test condition
1	Reflow Thermal Cycle	Normal Pbfree reflow Condition.2 times
2	Thermal Shock Cycle	30min. at -40℃, 30min. at 85℃ , 100Cycles Recovery Time 2hours
3	Vibration Test	50Hz -> 500Hz -> 50Hz , 15min/Cycle X,Y,Z : Each 12 times [Total : 9hours]
4	High Temperature Storage Test	96 hours at 85℃±2℃, Recovery Time 2hours
5	Low Temperature Storage Test	96 hours at -40℃±2℃, Recovery Time 2hours
6	High Temperature & Humidity Storage Test	96 hours at 60℃±2℃ & 95%RH±2%RH. Recovery Time 2hours
7	Operating Temperature TEST	96hours at -40℃,85℃
8	High Temperature & Humidity Operating Test	24hours at 60℃ & 85%±2%RH.
9	Drop Test	Height min 76 ㎝, All sides onto Iron plate(T=min2mm).
10	ESD	HBM : ±2000V MM : 150V CDM : 500V

3.2 Antenna

1) Specification of Antenna

(Condition: Application Board_40.0 x 40.0 x1.2t mm)

ITEM	UNIT	MIN	TYP	MAX
Frequency	MHz	2400		2500
V.S.W.R				2.0
Gain(AVG)	dBi	-2		
Maximum input power	W			1
Characteristics TYPE	Meander IFA			
Polarization	Vertical			
Radiated Pattern	Omni-directional			
Impendence	50			
SIZE	10.5X3.5X1.7tmm			

2) Antenna matching for Application Board

; Board design for the optimization of the antenna is necessary confirm of “AAC”

FCC Information to User

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 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 con-nected.
• Consult the dealer or an experienced radio/TV technician for help.

Caution

Modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Compliance Information : 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

RF exposure compliance:

The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

To comply with FCC RF exposure compliance requirements, the antenna used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operate in conjunction with any other antenna or transmitter."
As such, the radio component of this device is intended only for OEM integrators under the following two conditions: The antenna must be installed such that 20 cm is maintained between the antenna and users.
The transmitter module may not be co-located with any other transmitter or antenna.
As long as the two conditions above are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end product for any additional compliance requirements required with this module installed (e.g., digital device emissions, PC peripheral requirements).
In the event that these conditions cannot be met (for example, co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling
The final end product must be labeled in a visible area with the following :
"Contains Transmitter Module FCC ID: UNTRP-M100A".
The radio component is an integral part of the RP-M100A and cannot be removed.