FIBOCOM
Perfect Wireless Connection

H330 LGA Serials Module Hardware User Manual

Version: V1.0.8

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Revision History

Version	Date	Remarks
V1.0.0	2012-05-30	Initial Version
V1.0.1	2012-07-06	Update product model No.
V1.0.2	2012-08-08	Update Mechanical, PCB Design, Pin Out
V1.0.3	2012-11-26	Modify Pin description and incorrect specifications
V1.0.4	2013-01-09	Update the name of the document; add reliability features
V1.0.5	2013-01-24	Update the document name
V1.0.6	2013-05-02	Update the name of the manual Add UART_R1 Add model comparisons Update the current specification

V1.0.7	2013-07-01	Add two models Add comparison on voice
V1.0.8	2013-09-13	SMI is updated to a output pin; update section 5.4.1; Update Figure5-2, Figure5-4; Update description of RTC Add section 5.8.3 Update section 5.3.2.3 WAKE_UP

Applicability Table

No.	Type	Note
1	H330-Q50-00	
2	H330-Q30-00	
3	H330-A30-00	
4	H330-A50-00	
5	H330-A30-20	
6	H330-A50-20	

Here are the module comparisons:

Model No.	GSM/GPRS/EDGE Band(MHz)	WCDMA Band(MHz)	Diversity	Voice	HSDPA (Mbps)	HSUPA (Mbps)
H330-Q50-00	850/900/1800/1900	850/900/1900/2100	NO	YES	21	5.76
H330-Q30-00	850/900/1800/1900	850/900/1900/2100	NO	YES	7.2	5.76
H330-A30-00	900/1800	900/2100	NO	YES	7.2	5.76
H330-A50-00	900/1800	900/2100	NO	YES	21	5.76
H330-A30-20	900/1800	900/2100	NO	NO	7.2	5.76
H330-A50-20	900/1800	900/2100	NO	NO	21	5.76

Contents

1 Preface

1.1 Scope

This manual provides the electrical, mechanical and environmental requirements for properly integrating the H330 serials wireless communications module. This manual gives a complete set of hardware features and functions that may be provided by H330, ensures the users can quickly and conveniently develop wireless communications using H330 Module.

1.2 Standards

- 3GPP TS 27.007 -v6.9.0: AT command set for User Equipment (UE)
- 3GPP TS 27.005 -v6.0.1: Use of Data Terminal Equipment -Data Circuit terminating Equipment (DTE-DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)
- 3GPP TS 23.040 -v6.9.0: Technical realization of Short Message Service (SMS)
- 3GPP TS 24.011 -v6.1.0: Point- to - Point (PP) Short Message Service (SMS) support on mobile radio interface
- 3GPP TS 27.010 -v6.0.0: Terminal Equipment to User Equipment (TE-UE) multiplexer protocol
- 3GPP TS 27.060 -v6.0.0: Packet domain; Mobile Station (MS) supporting Packet Switched services
- 3GPP TS 25.304-v6.10.0: User Equipment (UE) procedures in idle mode and procedures for cell reselection in connected mode
- 3GPP TS 25.308 -v6.4.0: High Speed Downlink Packet Access (HSDPA); Overall description; Stage 2
- 3GPP TS 25.309 -v6.6.0: FDD enhanced uplink; Overall description; Stage 2
- 3GPP TS 23.038 -v6.1.0: Alphabets and language - specific information
- 3GPP TS 21.111 -v6.3.0: USIM and IC card requirements
- 3GPP TS 31.111 -v6.11.0 "USIM Application Toolkit (USAT)"
- 3GPP TS 45.002 -v6.12.0: Multiplexing and multiple access on the radio path
- 3GPP TS 51.014 -v4.5.0: Specification of the SIM Application Toolkit for the Subscriber Identity Module - Mobile Equipment (SIM-ME) interface
- 3GPP TS 51.010 -1 -v6.7.0: Mobile Station (MS) conformance specification; Part 1: Conformance specification
- 3GPP TS 22.004 -v6.0.0: General on supplementary services
- 3GPP TS 23.090 -v6.1.0: Unstructured Supplementary Service Data (USSD); Stage 2
- 3GPP TS 24.008 v6.19, Mobile radio interface Layer 3 specification;

2 Introduction

2.1 Description

H330 serials are highly integrated 3G wireless communication modules, support GSM / GPRS / EDGE and UMTS / HSDPA / HSUPA / HSPA+.

2.2 Specifications

Specifications	
Bands	UMTS (WCDMA/FDD): 850/900/1900/2100 MHz or 900/2100MHz
	GSM/GPRS/EDGE: 850/900/1800/1900 MHz or 900/1800MHz
Data	UMTS/HSDPA/HSUPA 3GPP release 7
	HSUPA 5.76Mbps (Cat 6)
	HSDPA 21Mbps (Cat 14) or 7.2Mbps (Cat 8)
	GSM 3GPP release 7
	EDGE (E-GPRS) multi-slot class 33 (296kbps DL, 236.8kbps UL)
	GPRS multi-slot class 33 (67kbps DL, 53.6kbps UL)
Physical	Dimension: 33.8mm x 27.8mm x 2.45mm
	Interface: LGA
	Weight: <5.5 grams
Environment	Operating Temperature: -30℃ ~ +85℃
	Storage Temperature: -40℃ ~ +85℃
Performance	
Operating Voltage	Voltage: 3.3V ~ 4.2V Normal: 3.8V
Operating Current (Typical Value)	2mA (Sleep Mode)
	3G Idle: 13mA
	3G Talk: 500mA
	2G Talk: 260mA (GSM PCL5)
Tx Power (Typical Value)	Class 4 (2W) : 850/900 MHz, GSM
	Class 1 (1W) : 1800/1900 MHz, GSM
	Class E2 (0.5W) : 850/900 MHz, EDGE
	Class E2 (0.4W) : 1800/1900 MHz, EDGE
	Class 3 (0.25W) : 850/900/1900/2100 MHz, WCDMA

Rx Sensitivity (Typical Value)	UMTS/HSPA: -109dBm
	GSM: -108dBm
Interfaces	
Connectors	Main Antenna
	Diversity Antenna (some models doesn't support)
Connectivity	1 x USB 2.0
	2 x UART
	MUX Over UART1
	Multiple Profiles over USB
	SPI Support (not supported so far)
	I2C Support
	I2S Support
	PCM, HSIC, GPIO, A/D, RTC
Data Features	
Protocol Stack	Embedded TCP/IP and UDP/IP protocol stack
EDGE	Multi-slot class 33(5 Down; 4 Up; 6 Total)
	Coding Scheme MCS1~9
GPRS	Multi-slot class 33(5 Down; 4 Up; 6 Total)
	Coding Scheme CS1~4
CSD	UMTS(14.4kbps), GSM(9.6kbps)
USSD	Support
SMS	MO / MT Text and PDU modes
	Cell broadcast
Voice Features	Analog Audio and Digital Audio
	Voice coders: EFR/HR/FR/AMR
Audio Control	Gain Control, Echo Suppression, Noise Suppression, Side Tone
Character Set	IRA
	GSM
	UCS2
	HEX
AT Commands	FIBOCOM proprietary AT commands

	GSM 07.05
	GSM 07.07
Accessories	Firmware Loader Tool over USB/UART
	User Manual
	Developer Kit

2.3 Appearance

The following picture shows the H330 Wireless Communication Module.

Top view:

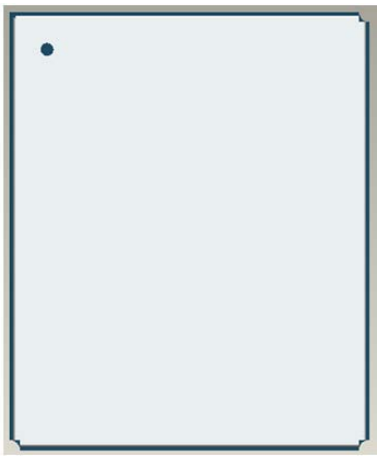


Figure 2-1 Top View

Bottom view:

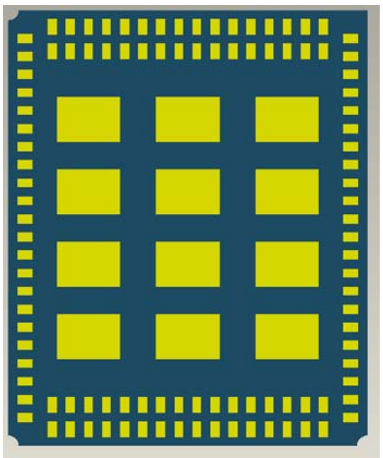


Figure 2-2 Bottom View

3 Mechanical

3.1 Dimensions

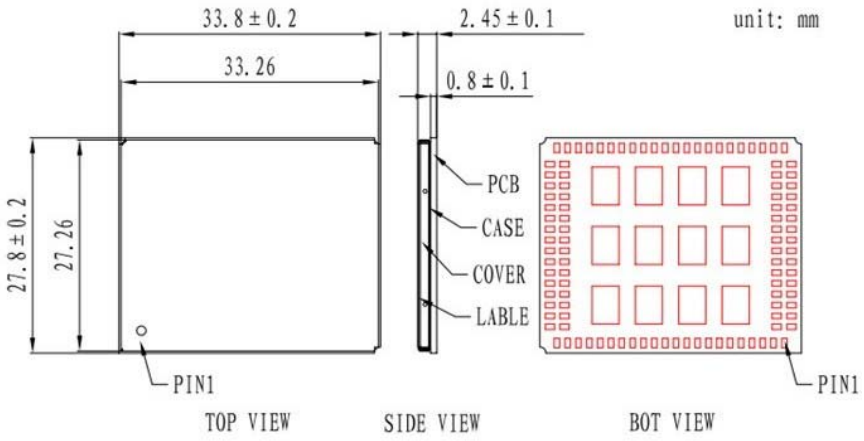


Figure 3-1 Mechanical Specifications

3.2 PCB Layout Design

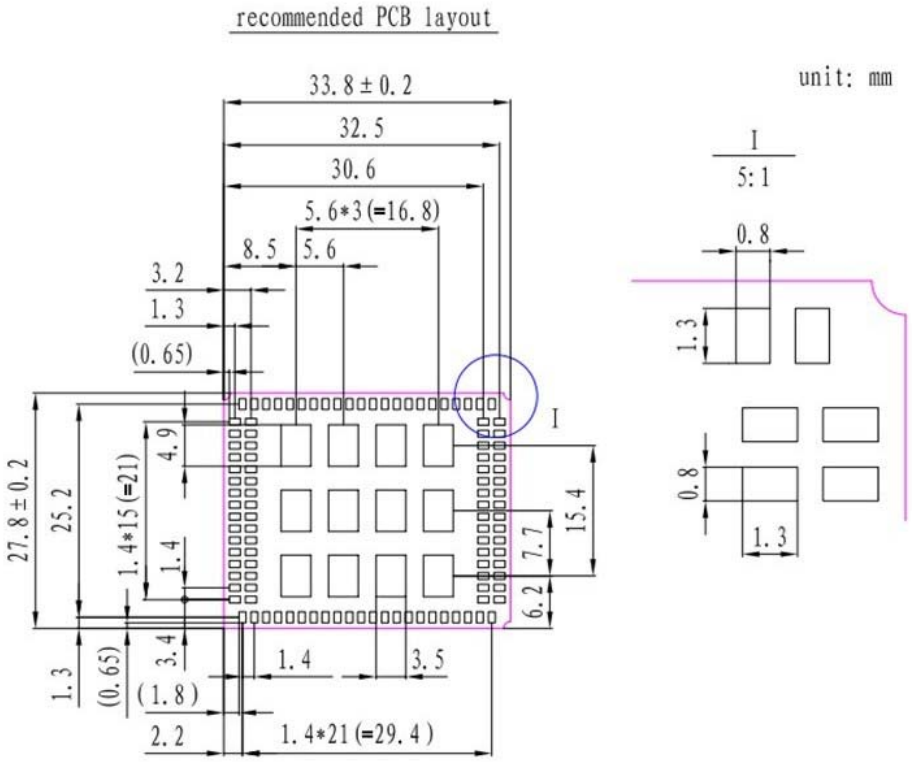


Figure 3-2 Recommended PCB Layout

4 Hardware Overview

4.1 Block Diagram

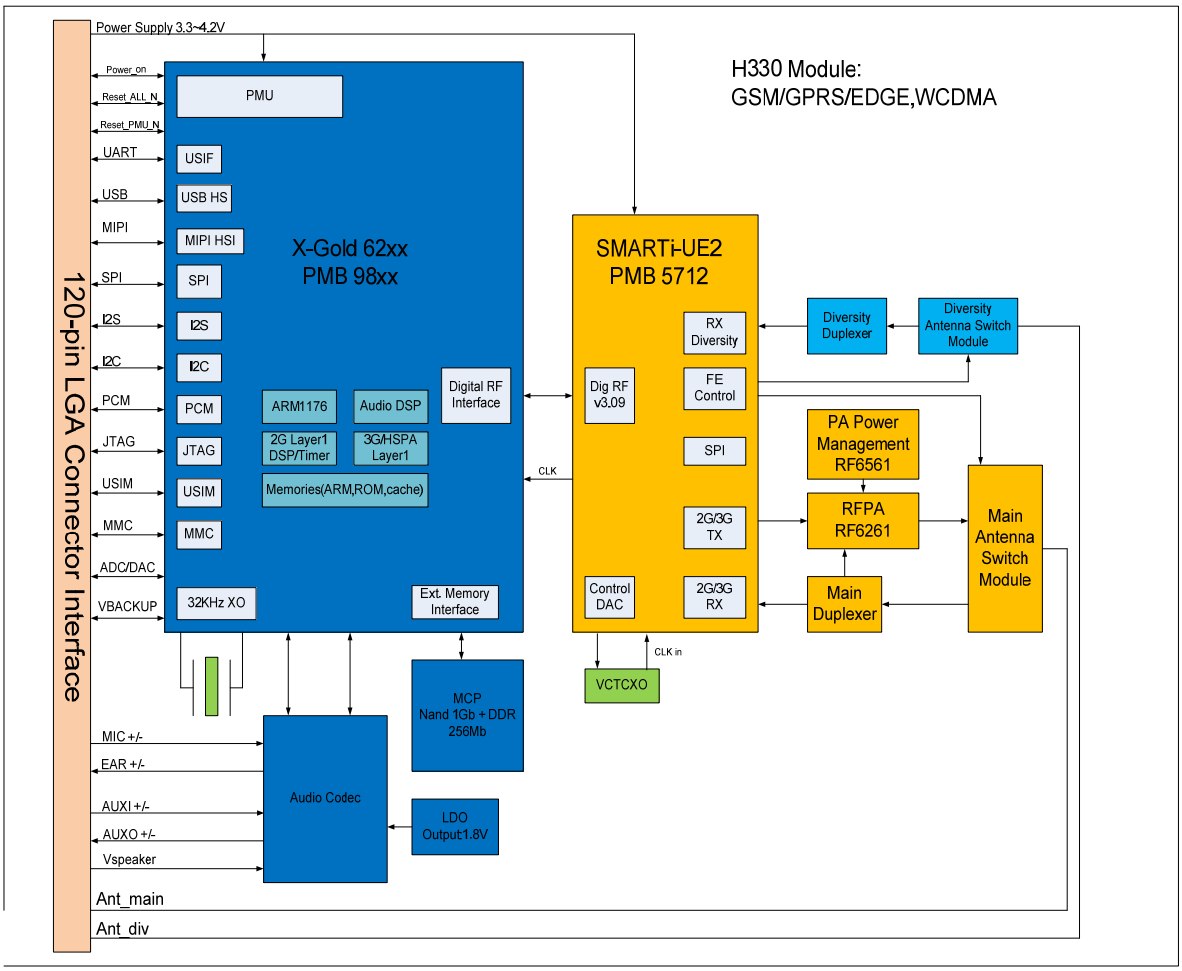
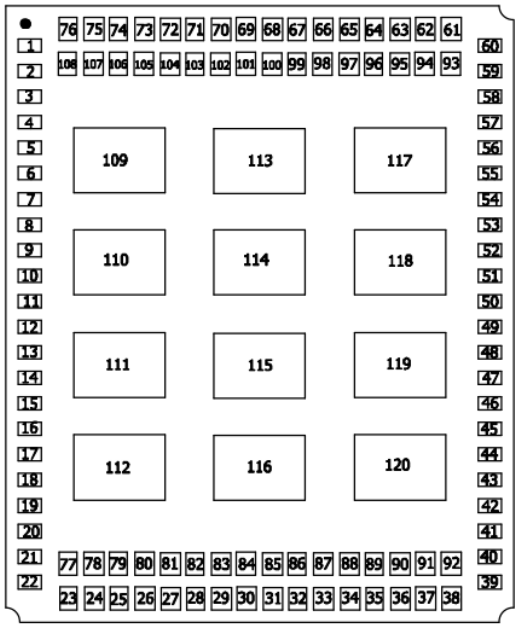


Figure 4-1 Block Diagram

4.2 Pin Definition

4.2.1 Pin Map



TOP (View)

Figure 4-2 Pin Definition

4.2.2 Pin Description

The logic electrical lever of H330 is 1.8V. The following table shows H330 pin description:

Pin#	Pin Name	I/O	Description
Power Supply			
59	VBAT	I	Module main power input, voltage range: 3.3V ~ 4.2V
60	VBAT	I	
61	VBAT	I	
62	VBAT	I	
64	VPA	O	Power supply indicator for RF PA
1	VTRX	O	Power supply indicator for RF transceiver
46	VIO	O	1.8V voltage output inside module
47	VRTC	I/O	Backup battery power input.

Power ON/OFF Signal			
48	POWER_OFF	I	Power off signal
49	POWER_ON	I	Power on signal
Reset Signal			
77	RESET_ALL_N	I	External reset signal
USIM			
4	USIM_CD	I	USIM card insert detected. Low activity
5	USIM_VCC	O	USIM card supplies the power, 1.8V or 3.3V
6	USIM_RST	O	USIM card reset
7	USIM_CLK	O	USIM card clock
8	USIM_DATA	I/O	USIM card data
High Speed SIM			
9	USIM_D+		High Speed SIM card USB data line+ (not supported)
10	USIM_D-		High Speed SIM card USB data line- (not supported)
Audio			
13	AUXO+	O	Speaker output signal+
14	AUXO-	O	Speaker output signal-
15	EAR-	O	Earphone output signal -
16	EAR+	O	Earphone output signal+
17	MIC+	I	Main MIC input signal +
18	MIC-	I	Main MIC input signal-
19	AUXI-	I	Auxiliary MIC input signal -
20	AUXI+	I	Auxiliary MIC input signal +
21	AGND	GND	Audio GND
22	VSPK	I	Audio codec speaker part power supply, connect to VBAT
I²S			

11	I2S2_CLK1	O	I2S2 Clock SCLK1
24	I2S2_CLK0	O	I2S2 I Clock SCLK0 (I2S2 use CLK0 by default)
25	I2S2_WA0	O	I2S2 word alignment select
26	I2S2_TX	O	I2S2 transmit line
27	I2S2_RX	I	I2S2 receive line
USB			
31	USB_DP	I/O	USB data line+
32	USB_DM	I/O	USB data line-
33	USB_ID	—	USB ID line
34	VUSB	I	USB Power Input
92	USB_TEST	—	USB TEST line
I²C			
28	I2C_SDA	I/O	I2C data line
29	I2C_SCL	O	I2C clock line
UART1			
35	UART1_RI	O	UART1 Ring Indicator
36	UART1_DSR	I	UART1 DTE Ready
37	UART1_DTR	O	UART1 DCE Ready
38	UART1_DCD	O	UART1 Carrier Detect
39	UART1_CTS	I	UART1 Clear To Send
40	UART1_RTS	O	UART1 Request To Send
41	UART1_TXD	O	UART1 Transmitted Data
42	UART1_RXD	I	UART1 Received Data
UART2			
45	UART2_TXD	O	UART2 Transmitted Data
44	UART2_RXD	I	UART2 Received Data

ADC			
50	ADC2		Analog digital converter 2 (not supported)
51	ADC1		Analog digital converter 1 (not supported)
EINT			
56	WAKE_UP	I	External wake-up interrupt, Low activity.
57	EINT2	I	External interrupt, Low activity.
USB HSIC			
90	HSIC_USB_DATA		HSIC USB data signal (not supported)
91	HSIC_USB_STRB		HSIC USB pulse signal (not supported)
Antenna			
67	ANT_MAIN	I	Main antenna interface, 50 ohm Impedance
71	ANT_DIV	I	Only supported by some models
Others			
3	DSP_AUDIO_IN1	I	1. DSP audio input 2. GPIO: only supported by some models
54	CLKOUT0	O	Digital audio clock output
89	SMI	O	Sleep Mode Indicator
86	LPG	O	Status Indicator
Not Connect			
23	NC		
55	NC		
52	NC		
53	NC		
73	NC		
74	NC		
75	NC		

76	NC		
78	NC		
79	NC		
80	NC		
81	NC		
82	NC		
83	NC		
84	NC		
85	NC		
87	NC		
88	NC		
94	NC		
95	NC		
96	NC		
101	NC		
105	NC		
106	NC		
107	NC		
108	NC		
GND			
2	GND		
12	GND		
30	GND		
43	GND		
58	GND		
63	GND		

65	GND		
66	GND		
68	GND		
69	GND		
70	GND		
72	GND		
93	GND		
97	GND		
98	GND		
99	GND		
100	GND		
102	GND		
103	GND		
104	GND		
109	GND		
110	GND		
111	GND		
112	GND		
113	GND		
114	GND		
115	GND		
116	GND		
117	GND		
118	GND		
119	GND		
120	GND		

5 Hardware Interface

5.1 Power Interface

5.1.1 VBAT

H330 module requires a 3.3 V~ 4.2V DC power supply to provide 2A as GSM transmitter maximum current.

Input power supply requirements:

Parameter	Minimum Value	Recommended Value	Maximum Value	Unit
VBAT	3.3	3.8	4.2	V

Note:

1. Supply voltage fluctuations should be lower than 300mV.

2. Supply voltage drop minimum value should be higher than 3.3V.

Filter capacitor description:

Recommended capacitor	Application	Description
1000uF	GSM Transmit current serge	Minimizes power supply losses during transmit bursts. Use maximum possible value.
10nF, 100nF	Digital signal to noise	Filtering interference from clock and data sources
8.2pF, 10pF	1800/1900/2100 MHz GSM bands	Filters transmission EMI.
33pF, 39pF	850/900 MHz GSM bands	Filters transmission EMI.

5.1.2 Power Consumption

Parameter	Description	Condition		Typical Value	Unit
I off	RTC mode			60	uA
I idle	Idle mode	GSM		13	mA
		WCDMA		13	mA
I sleep	Low power mode	DRX	2	2	mA
		DRX	5	2	
		DRX	9	2	
$I_{GSM-RMS}$	GSM voice - 1 TX slot 1 Rx slot	GSM850 PCL	5	230	mA
			10	80	

			15	50	
			19	46	
		EGSM900 PCL	5	240	
			10	83	
			15	50	
			19	47	
		DCS1800 PCL	0	156	
			5	71	
			10	49	
			15	46	
		PCS1900 PCL	0	165	
			5	70	
			10	50	
			15	46	
$I_{GPRS-RMS}$	GPRS Class 33 - 4 TX slot 1 Rx slot	GSM850 PCL	5	355	mA
			10	216	
			15	108	
			19	94	
		EGSM900 PCL	5	383	
			10	225	
			15	108	
			19	94	
		DCS1800 PCL	0	259	
			5	180	
			10	103	
			15	95	

		PCS1900 PCL	0	266	
			5	182	
			10	103	
			15	95	
$I_{EGPRS-RMS}$	EGPRS Class 33 - 4 TX slot 1 Rx slot	GSM850 PCL	8	522	mA
			14	145	
			19	95	
		EGSM900 PCL	8	522	
			14	150	
			19	95	
		DCS1800 PCL	2	484	
			9	117	
			15	103	
		PCS1900 PCL	2	493	
			9	118	
			15	103	
$I_{GSM-MAX}$	Peak current During TX slot	GSM850 PCL	5	1655	mA
			10	473	
			15	193	
			19	148	
		EGSM900 PCL	5	1715	
			10	536	
			15	208	
			19	147	
		DCS1800 PCL	0	1050	
			5	464	

			10	199	
			15	138	
		PCS1900 PCL	0	1100	
			5	489	
			10	203	
			15	139	
$I_{WCDMA-RMS}$	WCDMA	Band5 (850)	24dBm	387	mA
			0dBm	127	
			-24dBm	121	
			-50dBm	119	
		Band2 (1900)	24dBm	439	
			0dBm	130	
			-24dBm	123	
			-50dBm	121	
		Band1 (2100)	24dBm	475	
			0dBm	131	
			-24dBm	121	
			-50dBm	119	
		Band8 (900)	24dBm	384	
			0dBm	127	
			-24dBm	123	
			-50dBm	121	

5.1.3 VIO

VIO is power supply for the digital portion of the circuit inside of the module; it can be used for indicating signal of the module. VIO can be used as a reference level of the module digital signal.

Parameter	Minimum Value	Recommended Value	Maximum Value	Unit
VIO @working	1.773	1.8	1.827	V

5.1.4 VRTC

VRTC supplies power for RTC clock inside the module, can be connected to external RTC battery.

Parameter	Minimum Value	Recommended Value	Maximum Value	Unit
VRTC output voltage	1.71	1.8	1.89	V
VRTC input voltage (RTC is working)	0.5	1.8	1.89	V
VRTC input current (RTC is working)			1	uA

VRTC Reference design:

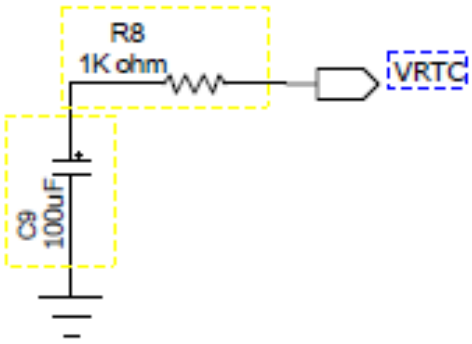


Figure 5-1 VRTC Reference Design

Note:

- R8 is the current-limiting resistance in order to ensure VRTC working normally. When it is working fine, R8≥1kohm
- VRTC Current consumption < 2uA;
- C9 value can affect RTC hold time.

  You can refer to the following formula to calculate the RTC hold time:

  T= (1.8-0.5)*C/1=1.3C, unit: s

  For example: If C9 use 100uF capacitance, the RTC can hold about 130s.

5.2 ON/OFF and Reset

5.2.1 Pin Definition

H330 wireless communication module has three control signals: power on, off and reset the module.

Pin Definition:

Pin#	Pin Name	Electrical Level	Description
48	POWER_OFF	CMOS 1.8V	Power off signal
49	POWER_ON	CMOS 1.8V	Power on signal
77	RESET_ALL_N	CMOS 1.8V	External reset signal input

5.2.2 Power ON Signal

After the module is powered on, users can lower down the POWER_ON signal, then module boots up.

The following table shows the burst timing:

Parameter	Condition	Minimum Value	Typical Value	Maximum Value	Unit
Pulse Width		100	300	3000	ms

Timing control:

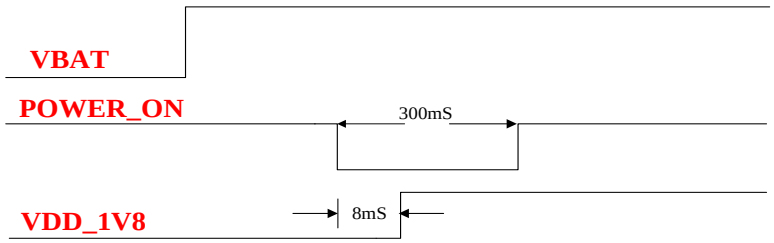


Figure 5-2 Timing Control

Reference design:

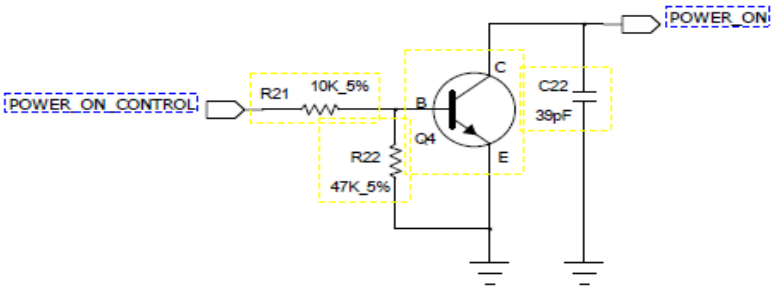


Figure 5-3 POWER_ON Reference Design

5.2.3 Power off Signal

After lower down POWER_OFF signal, module changes to shutdown status.

Parameter	Condition	Minimum Value	Typical Value	Maximum Value	Unit
Pulse Width		100	300	3000	ms

Timing control:

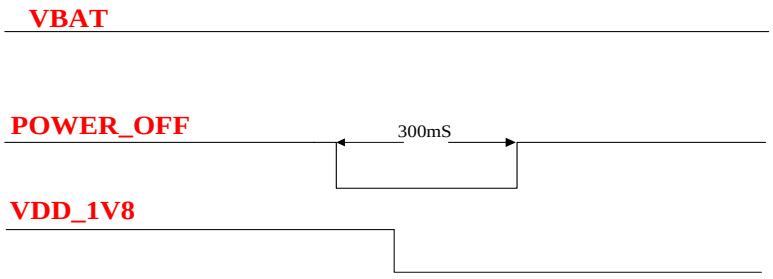


Figure 5-4 Timing Control

Reference design:

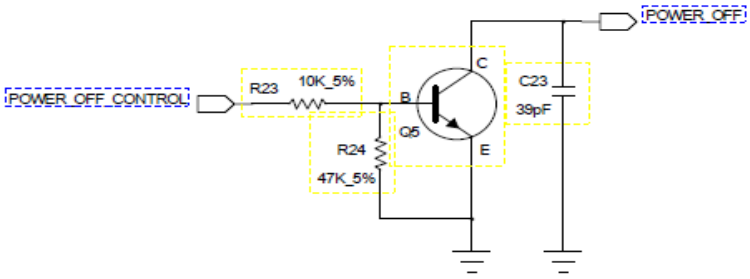


Figure 5-5 POWER_OFF Reference Design

5.2.4 Reset Signal

H330 wireless communication module supports external reset; it can restore the module to default settings through Reset signal.

When Reset signal is Active Low by 100ms, the module will reset. When users reset the module, PMU inside the module is still on.

Note: Reset signal is sensitive, when PCB layout, please keep it away from radio frequency interference, add debouncing capacitor near the module end is recommended.

Parameters	Condition	Minimum Value	Typical Value	Maximum Value	Unit
Pulse Width		100	300	3000	ms

Recommended design:

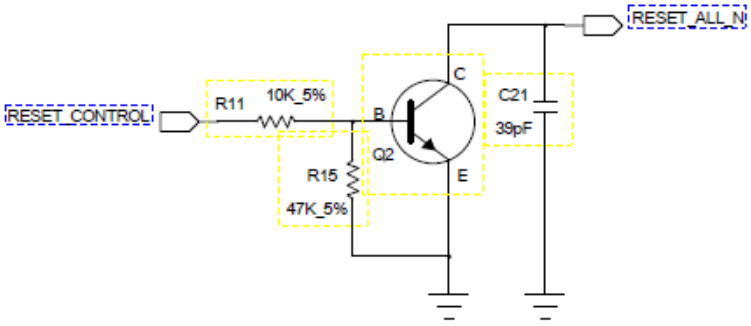


Figure 5-6 Reset Recommended Design

5.3 Indicator Signal

5.3.1 Pin Description

Pin#	Pin Name	Description
86	LPG	Work mode indicator
89	SMI	Sleep Mode Indicator
56	WAKE_UP	Wake up module
1	VTRX	Power supply indicator for transceiver
64	VPA	Power supply indicator for RF PA

5.3.2 Indicator Description

5.3.2.1 LPG Signal

LPG signal description:

Status	Mode
idle(unregistered)	600ms high level, 600ms low level
idle(registered)	75ms high level, 3S low level
Call	low level
Data communicating	75ms high level, 75ms low level
Sleep	high level

Note: High level voltage is 1.8V.

5.3.2.2 SMI

Module Mode	Mode
Sleep Mode	2.5S High; 100ms Low
Other Mode	low level

5.3.2.3 WAKE_UP

WAKE_UP is used for waking up the module which is in Sleep mode, it is high level by default, low level activated.

Module Mode	WAKE_UP Signal	Description
Sleep	Low level	Wake up module, switch from Sleep to Idle
	High level	Stay in Sleep mode
Idle/Call	Low/High level	Module is in Idle/Call mode

5.3.2.4 Others

Pin Name	Electrical Level	Description
VTRX	1.8V	RF Transceiver PMU work indicator
VPA	0-4.3V	It works in Tx mode, when the low power it is about 0.65V, when the max. power it is about 4.3V, other mode it is 0V

Note: Only Indicates signal.

5.4 USB Interface

5.4.1 USB Interface Description

Pin#	Pin Name	I/O	Description
31	USB_DP	I/O	USB signal+
32	USB_DM	I/O	USB signal-
33	USB_ID	—	USB ID signal (NC is recommended)
34	VUSB	I	USB power input
92	USB_TEST	—	USB TEST signal(NC is recommended)

H330 wireless communication module supports USB 2.0. Install the corresponding USB driver before use on PC. After H330 wireless communication module plugged into the PC, the USB can map seven ports:

- One 3G Modem/AT port for data operation
- Three ports for sending AT Command
- Two ports for trace
- One port is reserved

5.4.2 USB Interface Application

Reference Design:

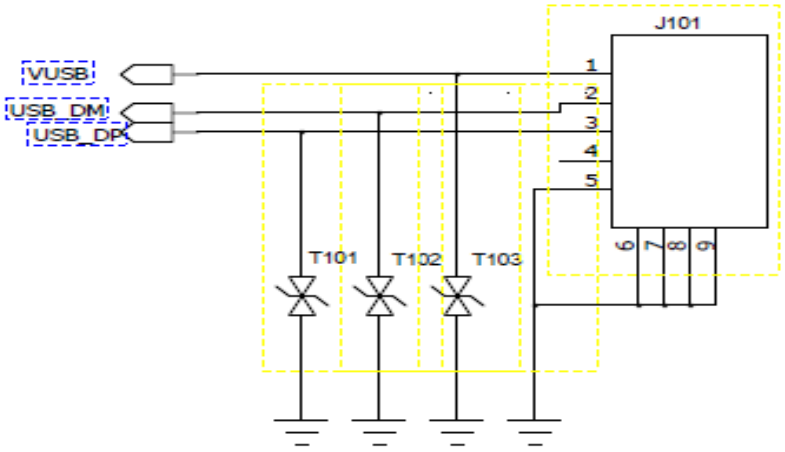


Figure 5-7 USB Interface Reference Design

T101 and T102 should be low capacitor TVS, it is below 1 pF. No special requirement for T103.

VUSB is USB power supply, Recommend power supply range is 2.5V ~ 5.25V.

VUSB should be connect to a level (2.5V ~ 5.25V) or USB cannot be recognized.

USB_DP and USB_DM are high speed lines, the highest transmit speed is 480 Mbps.

PCB Layout notice:

Note:

- USB_DP and USB_DM lines need equal length, parallel, as short as possible.
- The input and output need GND isolation.
- The layout design of this circuit on the AP board should comply with the USB 2.0 high speed protocol, with differential lining and impedance control to 90 ohm.

5.5 UART Interface

5.5.1 UART Interface Description

H330 wireless communication module provides two UART, one is 8 wire serial bus interface, and the other is a 2 wire serial bus interface.

8 wire serial bus interface (UART1) supports flow control; users can download software or send/receive AT through UART1. 2 wire serial bus interface (UART2) supports a few AT Commands.

Note: UART2 only supports some common query functions.

UART1 and UART2 signal description:

UART1			
Pin#	**Pin Name**	**I/O**	**Description**
35	UART1_RI	O	UART1 Ring Indicator
36	UART1_DSR	I	UART1 DTE Ready
37	UART1_DTR	O	UART1 DCE Ready
38	UART1_DCD	O	UART1 Carrier Detect
39	UART1_CTS	I	UART1 Clear to send
40	UART1_RTS	O	UART1 Request to send
41	UART1_TXD	O	UART1 Transmitted Data
42	UART1_RXD	I	UART1 Received Data
UART2			
Pin#	**Pin Name**	**I/O**	**Description**
44	UART2_RXD	I	UART2 Transmitted Data
45	UART2_TXD	O	UART2 Received Data

5.5.2 UART Design

The following table show the signal direction when H330 wireless communication module (DCE) UART1 connects to PC (DTE):

Application MCU(DTE)	Signal Direction	H330 Module (DCE)
RXD	←	UART1_TXD
TXD	→	UART1_RXD
RTS	→	UART1_CTS
CTS	←	UART1_RTS

DSR	←	UART1_DTR
DTR	→	UART1_DSR
RI	←	UART1_RI
DCD	←	UART1_DCD

The following table shows the signal direction when H330 wireless communication module (DCE) UART2 connects to PC (DTE):

Application MCU(DTE)	Signal Direction	H330 Module (DCE)
RXD	←	UART2_TXD
TXD	→	UART2_RXD

Note: H330 wireless communication module UART high level is 1.8V, please use external level shifter if connect to 2.8V or 3.3V IO interface.

When design:

Level shift from 1.8V to 3.3V, SN74LVC2G07 is recommended.

When UART1 communicating with PC, first shift from 1.8V to 3.3V, and then uses SP3238 to shift.

When UART2 communicating with PC, first shift from 1.8V to 3.3V, and then uses SPIEX3232EEA to shift level.

Notice the signal direction when shift level.

5.5.3 Ring Indicator

UART1_R1 is used for indicating incoming call and SMS, sending pulse to host application program.

Module Mode	Status
Default status	Low level
Ringing	1s high level, 1s low level, cycling
Incoming message	150ms pulse

5.6 USIM

H330 wireless communication module supports USIM and high speed SIM card, does not support 8 line smart USIM yet.

5.6.1 USIM Interface

Pin#	Pin Name	I/O	Description
5	USIM_VCC	O	USIM power supply output
6	USIM_RST	O	USIM Reset signal
7	USIM_CLK	O	USIM clock signal
8	USIM_IO	I/O	USIM data signal
12	GND	GND	USIM ground
4	USIM_CD	I	USIM insert detect signal High level indicates SIM card is not inserted Low level indicates SIM card is inserted

5.6.2 USIM Design

Reference design:

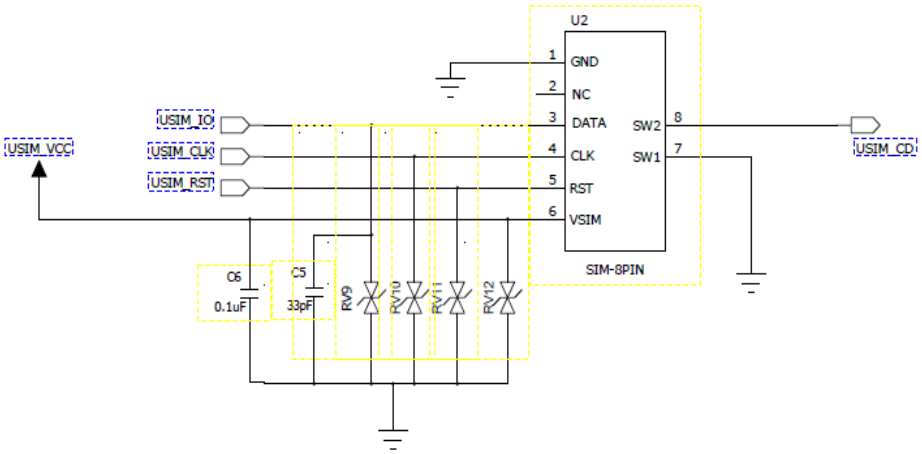


Figure 5-8 USIM Interface Reference Circuit

Note:

- For better EMC performance, SIM card position should be close to module
- Filtering capacitor should be close to SIM card pin
- The interface need add ESD protection, ESD should be close to SIM card pin
- USIM_IO is already pulled up inside the module,
- USIM_CD support SIM hot plug, low level is effective, if low level is detected, this means SIM card is inserted.

5.6.3 USIM Design Notice

The SIM interface and signals design is extremely important for proper operation of the SIM card.

There are several design guidelines that must be followed:

- The layout signals of the SIM card should be away from any possible EMI interference sources, such as the RF antenna and digital switching signals.
- To ensure signal integrity, the length between SIM interface signals and module should not exceed 100 mm
- To avoid crosstalk between USIM_CLK and USIM_IO, it is recommended to route them separately on the application board, and preferably isolated by a surrounding ground plane.
- The SIM card signals should be protected from ESD using very low capacitance protective elements (like Zener diode). The recommended part no of ESD is AVR-M1005C080MTAAB (TDK). ESD component should layout with SIM hold closely.

5.6.4 USIM Hot Plug

H330 supports SIM hot plug.

5.6.4.1 Hardware Connection

SIM hot plug function interacts with USIM_CD signal.

When no SIM card, USIM_CD is high level; insert SIM, USIM_CD is low level.

As shown in Figure5-8, USIM_CD connect U2 Pin8 (SW2), Pin7 (SW1) connect GND.
When no SIM card, SW2 is high level; Insert SIM, SW2 connect SW1,USIM_CD is pulled down

5.6.4.2 Software Design

"+MSMPD" AT command defines the SIM card status detection feature.

When set AT+MSMPD=0, the SIM detected feature deactivated. Module does not detect USIM_CD signal.

When set AT+MSMPD=1, the SIM detected feature activated. USIM_CD pin can test whether SIM card is onsite or not.

SIM_CD is Low level, SIM card is onsite, and module registers the network automatically.

SIM_CD is High level or not connected, SIM card is offsite and module drops out the network.

Note: The +MSMPD default value is "0".

5.7 Analog Audio

5.7.1 Audio Interface Signal Description

The H330 audio interface supports two channel audio signals input and two channel audio signal output.

Pin#	Pin Name	I/O	Description
13	AUXO+	O	Audio channel2 output +
14	AUXO-	O	Audio channel2 output -
15	EAR-	O	Audio channel1 earphone signal output-
16	EAR+	O	Audio channel1 earphone signal output+
17	MIC+	I	Audio channel1 MIC signal input+
18	MIC-	I	Audio channel1 MIC signal input-
19	AUXI-	I	Audio channel2 MIC signal input -
20	AUXI+	I	Audio channel2 MIC signal input +
21	AGND	GND	Audio GND
22	VSPK	I	Audio codec speaker part power supply, connect to VBAT

5.7.2 Audio Description

The audio input and output channels are differential interfaces. And have prefect performance at RF Spurious suppression. When connect to the handset, need external audio amplifier.

In PCB Layout, the differential lines need equal length, parallel, as short as possible, for a better performance, the input and output need GND Isolation and the interface need to add ESD protection.

5.7.2.1 Audio Channel 1

Audio channel 1 interface use differential lines, it can be used for handling calls

Audio channel 1: MIC input characteristic:

Parameter	Test conditions	Minimum Value	Typical Value	Maximum Value	Unit
Bias voltage	No load		2.5	2.6	V
Gain	Programmable，steps gain:2dB	0		16	dB
Load resistance			2.2		Kohm

Audio channel 1: EAR output characteristic:

Parameter	Test conditions	Minimum Value	Typical Value	Maximum Value	Unit
Output voltage	No load			1.4	Vpp
Load resistance			32		ohm
DC Bias voltage			1		V

5.7.2.2 Audio Channel 2

Audio channel 2 interface use differential lines, Can be use as Hands-free.

Note: The downstream of Audio channel 2 cannot work until VSPK power supply is normal.

The VSPK can be straight connected to VBAT.

Audio channel 2: AUXI input characteristic:

Parameter	Test conditions	Minimum Value	Typical Value	Maximum Value	Unit
Bias voltage	No load		2.5	2.6	V
Gain	Programmable，steps gain:2dB	0		32	dB
Load resistance			2.2		Kohm

Audio channel 2: AUXO output characteristic:

Parameter	Test conditions	Minimum Value	Typical Value	Maximum Value	Unit
Out voltage	No load			3.8	Vpp
Load resistance			8		ohm

5.8 Digital Audio

H330 supports digital audio I2S interface, this interface supports normal I2S mode and PCM mode. The level of I2S interface is 1.8V. I2S signal description:

Pin#	Pin Name	I/O	Description
18	I2S2_CLK0	O	Bit Clock
14	I2S2_WA0	O	Frame clock(LRCK)
15	I2S2_TX	O	Serial data output
16	I2S2_RX	I	Serial data input

20	I2C_DATA	I/O	I2C data line
19	I2C_SCL	O	I2C clock line
38	CLKOUT0	O	26MHz clock output

5.8.1 I2S

H330	Signal Direction	Audio CODEC I2S Port
I2S2_CLK0	→	I2S_CLK
I2S2_WA0	→	I2S_LRCK
I2S2_RX	←	I2S_SDIN
I2S2_TX	→	I2S_SDOUT
CLKOUT0	→	I2S_MCLK

5.8.2 I2C

H330	Signal Direction	Audio CODEC I2C Port
I2C_SDA	↔	I2C_SDA
I2C_SCL	→	I2C_SCL

Note:

- I2S can work in master mode or slave mode
- It supports various audio sample rates (48 KHz, 44.1 KHz, 32 KHz, 24 KHz, 22.5 KHz, 16 KHz, 12 KHz, 11.025 KHz and 8 KHz).

5.8.3 PCM Mode Interface

H330	Signal Direction	Audio CODEC PCM Port
I2S2_CLK0 (PCM_CLK, PCM clock signal)	→	PCM_CLK (PCM clock signal)
I2S2_WA0 (PCM_SYNC, PCM frame synchronization signal)	→	PCM_SYNC (PCM frame synchronization signal)
I2S2_RX (PCM_DIN, PCM data input)	←	PCM_DOUT (PCM data output)
I2S2_TX (PCM_DOUT, PCM data output)	→	PCM_DIN (PCM data input)

Note:

- PCM mode can configured to master mode and slave mode
- It supports short frame synchronization for 16 bit, 32bit, 48bit and 64bit.
- Supports sending data in burst mode and continuous mode
- It supports various audio sample rates (48 KHz, 44.1 KHz, 32 KHz, 24 KHz, 22.5 KHz, 16 KHz, 12 KHz, 11.025 KHz and 8 KHz).

5.9 Others

The module does not support interface like GPIO、MIPI、MMC、DAC yet.

6 Electrical and Environmental Features

6.1 Electrical Features

This table shows the electrical features range of H330.

Parameter	Minimum Value	Maximum Value	Unit
VBAT	0	4.2	V
Digital Signal	0	1.9	V

6.2 Environmental Features

This table shows the environmental features of H330.

Parameter	Minimum Value	Maximum Value	Unit
Operational Temperature	-30	+85	℃
Storage Temperature	-40	+85	℃

7 RF Interface

Please refer to the model comparisons in chapter 2 for more information.

7.1 Operation Frequency Band

7.1.1 Main Antenna

Operating Band	Tx	Rx
UMTS 2100 (Band I IMT)	1920–1980 MHz	2110–2170 MHz
UMTS 1900 (Band II PCS)	1850–1910 MHz	1930–1990 MHz
UMTS 850 (Band V CLR)	824–849 MHz	869–894 MHz
UMTS 900 (Band VIII GSM)	880–915 MHz	925–960 MHz
GSM 850	824–849 MHz	869–894 MHz
GSM 900	880–915 MHz	925–960 MHz
DCS 1800	1710–1785 MHz	1805–1880 MHz
PCS 1900	1850–1910 MHz	1930–1990 MHz

7.1.2 Diversity Antenna

Operating Band	Rx
UMTS 2100 (Band I IMT)	2110–2170 MHz
UMTS 1900 (Band II PCS)	1930–1990 MHz
UMTS 850 (Band V CLR)	869–894 MHz
UMTS 900 (Band VIII GSM)	925–960 MHz

7.2 RF PCB Design

7.2.1 Layout Guideline

As H330 does not have a RF connector, so for RF line, microstrip line is recommended. The shorter the better, insert loss is less than 0.2dB; impedance is less than 50ohm.

It is recommended to mount H330 module and antenna connector to the same side of layout.

Add a π-type circuit (two parallel device ground pin directly to the main land) for antenna matching.

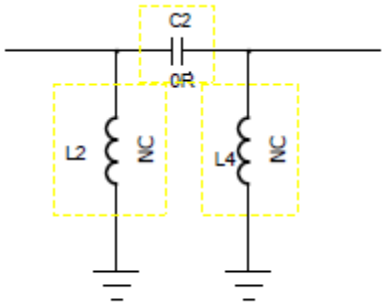


Figure 7-1π-type Circuit

7.2.2 Impedance

The RF lines impedance should not exceed 50 ohm.

7.3 Antenna Design

7.3.1 Main Antenna Design Requirements

(1) Antenna Efficiency

Antenna efficiency is the ratio between antenna input power and radiation power. The radiation power of an antenna is always lower than the input power due to the following factors: return loss, material loss, and coupling loss.

Efficiency of the master antenna > 40% (–4dB)

(2) S11 or VSWR

S11 (return loss) indicates the degree to which the input impedance of an antenna matches the reference impedance (50 ohm). S11 shows the resonance feature and impedance bandwidth of an antenna. Voltage standing wave ratio (VSWR) is another expression of S11. S11 relates to the antenna efficiency. S11 can be measured by vector analyzer.

S11 of the master antenna < –10 dB

(3) Polarization

The polarization of an antenna is the orientation of the electric field vector that rotates with time in the direction of maximum radiation.

Linear polarization is recommended: it would be better if the polarization direction of diversity antenna is different from main antenna.

(4) Radiation Pattern

Radiation pattern refers to the directional dependence of the strength of the radio waves from the antenna or other source.

The radiation pattern of half wave dipole antennas is the best for wireless terminals. If it is built-in antenna, PIFA antenna is recommended:

Antenna area (H x W x L): 6mm x 10mm x 100mm. PIFA or IFA antenna is recommended.

Radiation Pattern: Omni directional

(5) Gain and Directivity

The directivity of the antenna is the electromagnetic field strength of the electromagnetic wave in each direction. An antenna's power gain is a key performance figure which combines the antenna's directivity and electrical efficiency.

Recommended antenna gain ≤ 2.5dBi

(6) Interference

Besides the antenna performance, the interference on the PCB board also affects the radio performance (especially the TIS) of the module. To guarantee high performance of the module, the interference sources on the user board must be properly controlled. On the PCB board, there are various interference sources that can affect the module, such as the speaker, LCD, CPU, FPC trace and audio circuits, the power supply should be far away from antenna, notice isolation, shield and filtering processing issues.

(7) TRP/TIS

TRP (Total Radiated Power):

- W850/W900/W1900/W2100>19dBm
- GSM850>28dBm
- GSM900>28dBm
- DCS1800>25dBm
- PCS1900>25dBm

TIS (Total Isotropic Sensitivity) :

- W850/W900<-102dBm
- W1700/W1900/W2100<-103dBm
- GSM850<-102dBm
- GSM900<-102dBm
- DCS1800/PCS1900<-102dBm

7.3.2 Diversity Antenna Design

Diversity reception function of H330 is optional, please add a diversity antenna if you want to use this function. The design methods of diversity antenna and main antenna are the same, its efficiency indicators allows to reduce 3dB. The isolation between main antenna and diversity antenna should be higher than 12dB.