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The work principle of FT901 cordless phone

1. Handset

The handset of FT901 cordless phone consist of MCU (TMP87PH47U), Spread Spectrum/TDD processor (L9002VX2), CODEC (L9320), LCD, keypad, RF module and charge. Refer to "FT901 cordless phone Handset Block diagram" .

1.1 RF/Voice

Time Division Duplex (TDD) communication is implemented in RF module under the control of MCU and Spread Spectrum/TDD processor.

1.1.1 Voice Receive

RF module receives 900 MHz high frequency signal from the base unit, performs low noise pre-amplifying, frequency mixing, filtering and demodulating to the signal, then transmits spread spectrum digital signal to DEMOD-OUT pin. The signal is refined and sent to RX-DATA pin of L9002VX2. L9002VX2 performs de-spreading to the signal and changes it back to ADPCM signal, transmits the ADPCM signal to DR pin of L9320. The signal is decoded, filtered and amplified by L9320, then drives the RECEIVER to sound.

1.1.2 Voice transmit

The voice signal is changed to electronic signal through the MICROPHONE. The electronic signal is then amplified, filtered and coded to ADPCM signal by L9320. The ADPCM signal is sent to DT pin of L9002VX2. L9002VX2 builds the signal to frames, spreads spectrum of the signal and transmits it to RF module. RF module performs FSK modulating, stimulating and power amplifying to the signal and transmits it to the base unit through the antenna.

1.2   MCU

1.2.1 Battery Voltage Detect

Resistor R12 and R17 make up battery voltage dividing circuit, and the divided voltage is sent to MCU. MCU performs A/D converting to the voltage and educes measured value. Software compares the measured value with the threshold value and displays the battery strength in 3 levels. The LCD displays 3-level if the battery voltage is higher than 3.72v; it displays 2-level if the battery voltage ranges between 3.6v and 3.72v; it displays 1-level if the battery voltage ranges between 3.5v and 3.6v, and the handset sounds low power alert, LCD displays "Low battery". The low power alert signal is generated every 60s. The handset will shut off automatically when the battery voltage is lower than 3.5v.

1.2.2 RF Transmit Power Automatically Regulate

L9002VX2 has a function of error code detection. MCU reads error code value from frame error code register of L9002VX2 register, controls high 4 bits of L9002VX2 PB port and adjust output voltage of PWR-CTRL pin according to the error code value. Thus the transmit power of RF module is regulated automatically.

2. Base Unit

Base unit of FT901 cordless phone is mainly made up of MCU (TMP87PH47U), Spread Spectrum/TDD processor (L9002VX2), CODEC (L9320), CID receiver (NW6003), 2-line/4-line conversion and sidetone elimination, ring detection, off hook/on hook controller, over-voltage/over-current protection, RF module, power service and charge detection. Please refer to "FT901 cordless phone Base Block Diagram ".

2.1 RF/voice

Time Division Duplex (TDD) communication is implemented in RF module through the control of MCU and Spread Spectrum/TDD processor.

2.1.1 Incoming telephone call

Voice signal from the telephone exchange is sent to CODEC after 2-line/4-line conversion. The signal is amplified, filtered and coded to ADPCM signal in CODEC. The ADPCM signal is sent to DT pin of L9002VX2, built to frames and spread spectrum in the processor, then sent to RF module. The signal is transmitted to handset from antenna after FSK modulation, stimulation and power amplifying in RF module.

2.1.2 Outgoing Telephone Call

The 900MHz high frequency signal from handset is converted to spread spectrum digital signal and output to pin DEMOD-OUT after low noise pre-amplifying, frequency mixing, filtering and demodulation in RF module. The digital spread spectrum signal is refined and sent to RX-DATA pin of L9002VX2. L9002VX2 de-spreads the signal and converts it back to ADPCM signal, then sends it to DR pin of L9320. L9320 decodes it to analog signal, filters and amplifies the signal and sends it to sidetone elimination circuit to eliminate sidetone. Then the voice signal is sent to telephone exchange through telephone line after 2-line/4-line conversion.

2.2 Telephone Network

2.2.1 Telephone Interface

Telephone interface part has a function of over current/over voltage protection, fuse F1 functions as over current protection, voltage sensitive resistor VR1 functions as over voltage protection. Transformer BT1 and photoelectric coupler U5 (KP4010) isolate high voltage and low voltage. Transformer BT1 functions as 2-line/4-line conversion, photoelectric coupler U5 (KP4010) functions as off hook/on hook controller and pulse dialing. Diode D3~D6 functions as polarity adjustment.

2.2.2 Ring Detect

Ring from telephone exchange forms a loop through capacitor C54, ZD4, ZD1, R38, U9 and R40. Photoelectric coupler U9 (PC 817) opens during positive half cycle and closes during negative half cycle. Therefore the 4th pin of the photoelectric coupler U9 (PC817) gets the pulse signal whose frequency is the same with ring. The pulse signal enters PC6 port of L9002VX2, MCU reads the status of PC6 port, when the port is 0, ring is detected.

2.2.3 Sidetone Elimination

Sidetone elimination circuit is mainly made up of Q4, R70, R86, R80, R37, C61,

R82, C64 and R83. Transmitting signal enters base of Q4 and is amplified by Q4. Its voltage is divided through R83, R82, C64, C61 and R27. Because the signal phase of emitter and collector of Q4 is opposite, the positive phase signal amplitude and negative phase signal amplitude of connect point between R86 and R80 are almost counteracted, a transmit signal with little amplitude comes into being. Thus the sidetone is eliminated.

2.2.4 CID Receive

The CID information from telephone exchange is coupled and clamped by C49, C66, then sent to NW6003 for amplifying and decoding. Then the CID data is read by MCU from NW6003.

2.3 MCU

2.3.1 Charge

When handset is placed in charge slot, 9V power, handset and resistor R96 form a loop. A voltage is generated at the two ends of R96. The voltage makes Q3 and Q5 conduct, thus MCU can read status of charge detect output through PC2 port of L9002VX2.

2.3.2 LED Indication

There are 3 LED indicators on base unit: a power indicator, an IN-USE indicator and a charge indicator.

When the base unit is powered on, the power indicator lights. Otherwise it is dim.

When the base unit is in the state of off-hook, IN-USE LED lights. Otherwise it is dim.

When handset is placed in base unit for charging, the charge LED lights. When handset is removed from charge slot, the LED is dim.

2.3.3 RF Transmit Power Automatically Regulate

L9002VX2 has a function of error code detection. MCU reads error code value from frame error code register of L9002VX2 register, controls high 4 bits of L9002VX2 PB port and adjust output voltage of PWR-CTRL pin according to the error code value. Thus the transmit power of RF module is regulated automatically.

FT901 Cordless Phone

Channel Frequency for both Tx and Rx

Channel	Channel Frequency(MHz)	Channel	Channel Frequency(MHz)
1	903.936	16	915.456
2	904.704	17	916.224
3	905.472	18	916.992
4	906.240	19	917.760
5	907.008	20	918.528
6	907.776	21	919.296
7	908.544	22	920.064
8	909.312	23	920.832
9	910.080	24	921.600
10	910.848	25	922.368
11	911.616	26	923.136
12	912.384	27	923.904
13	913.152	28	924.672
14	913.920	29	925.440
15	914.688	30	926.208

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FT901 Cordless Phone

RF Module Specifications

1. General Specification

NO.	Item	Specification
1	Frequency range	902MHz-928MHz
2	Total number of channel	30channels
3	Nominal antenna impedance	50 ohms
4	Intermediate frequency	110.592MHz
5	Modulation system	0.5GFSK
6	TX Deviation	400KHz
7	Operating voltage	3.7V
8	PLL Reference (Clock)	19.2MHz

2. Environment Specification

NO.	Item	Specification
1	Operating temperature	0℃ to 50℃
2	Storage temperature	-20℃ to 70℃
3	Efficient humidity	Less than 85%
4	Storage humidity	Less than 90%

3. Manufacturing Specification

NO.	Parameter	Specification				Conditions
		Min.	Typ.	Max.	Unit	
1	TX Power	17	20		dBm	-Conduction Status -Antenna Removed
2	TX Frequency Accuracy	-50	0	100	KHz	
3	Frequency Deviation	350	400	500	KHz	
4	RX Sensitivity		-99	-97	dBm	

4. Test Carrier Frequency :   914.688MHz