

## **C600 CIRCUIT DESCRIPTION**

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## **1. Introduction**

C600 is a 40 channel (2.4GHz) cordless telephone with CID (type I and II) and Message Waiting features..

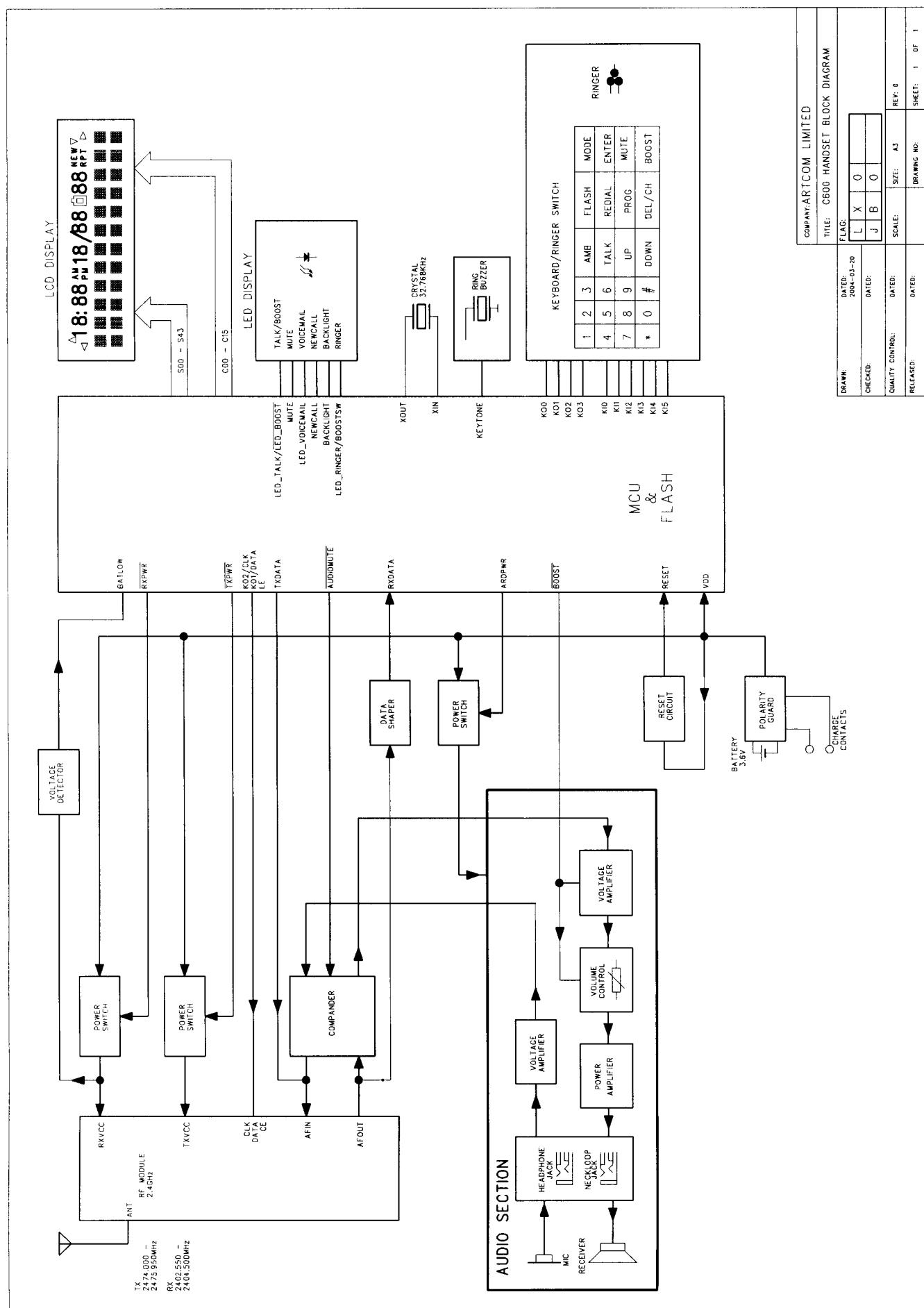
This unit is made up of two parts:

- a. A Handset unit.
- b. A Base unit.

## **2. Functional Blocks of C600 Handset**

The block diagram of C600 handset unit is as shown below. It is made up of the following parts:

- 2.1 Keyboard Matrix, Switches and Function LED
- 2.2 MCU and MCU Interface
- 2.3 RF Module
- 2.4 Compander
- 2.5 Data Shaper
- 2.6 Charge and Control
- 2.7 Low Battery Detector
- 2.8 Buzzer
- 2.9 Audio Circuit



### **3. C600 Handset Unit Circuit Block Description**

#### **3.1 Keyboard Matrix, Switches and Function LED**

The keyboard consists of the following keys:

- MUTE – turns on/off handset microphone
- UP/DOWN – for menu operation
- MODE – for menu operation
- TALK – for On/Off hook control
- ENTER – for voice mail operation
- PROG – for memory program and dialing
- 1, 2, 3, 4, 5, 6, 7, 8, 9, \*, 0, # – numeric keys
- FLASH — provides timed On/Off hook function
- AMB – one touch memory key
- RD/P – redials the last number or provides a pause during dialing

The push switches consist of the followings:

- BOOST – for On/Off the receiver amplifier gain
- CH/DEL – for changing RF channel and CID/Memory operation

The function of the slide switch:

- RINGER ON/OFF – turns On/Off buzzer sound.

The keyboard, push switches and slide switch are connected to Pins 84 to 94 and pin 97 of the MCU (MCU1).

The jacks consist of the following:

- HEADSET – for connection of an external microphone and receiver
- NECKLOOP – for connection of an external receiver

The function LEDs consist of the followings:

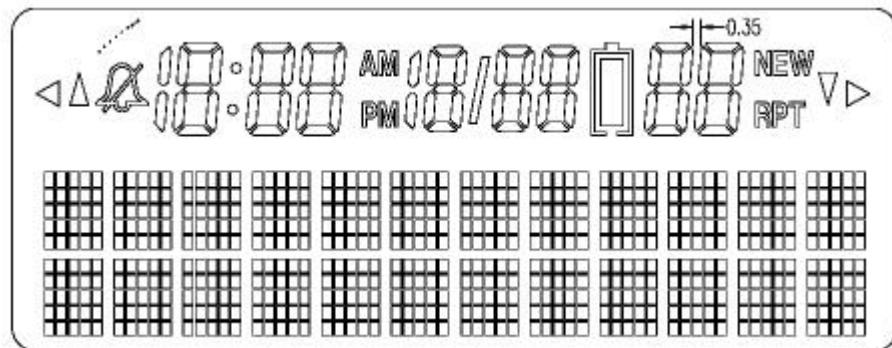
- MICMUTE (LED19 - Red) – Located under the “MUTE” key. It is On/Off when microphone is Off/On.
- BOOST (LED13 – RED) – Located under the “TALK” key. It is On/Off when the receiver amplifier extra gain is On/Off.
- INUSE (LED13 – GREEN) – Located under the “TALK” key. It is On/Off when the handset is Off-hook/On-hook.
- BACKLIGHT (LED1 – LED12 - Green) – Located under the keyboard. On for a short time when any key is pressed
- LCD backlight (LED20, LED21 – Green) – On for a short time when

any key is pressed

- NEWCALL (LED18 - Red) – Located under the “MODE” key.  
Flashes when there is incoming caller ID information to be reviewed.
- VOICEMAIL (LED17 - Blue) – Located under the “ENTER” key.  
Blinks when there is voice mail available.
- RINGER (LED16 - Red) – Located in the handset antenna. Flashes when the telephone line rings. Steady on/off when handset is off-hook/on-hook.

These LEDs are controlled by pins 66, 91, 96, 98 and 99 of MCU.

The display format of the LCD is as shown below.



The display is controlled by pins 12 – 65 of MCU.

### 3.2 MCU and MCU Interface

The controller of the handset is MCU1. The frequency of the crystal used is 32.768 KHz. It controls the functions of the handset through the keyboard interface and signals from the base unit. The data to and from the base goes through pin 69 (data from base) and pin 71 (data to base).

The phone number memories are stored in U13.

### 3.3 RF Section

For operation and frequency see RF module section.

It receives the PLL data through pins 4, 5, 6 from MCU pins 95, 93 and 94.

The antenna located at the top of the unit and is permanent attached to RF module through a copper wire.

### 3.4 Compander

A compander U11 is used for improving the S/N of transmit and receive audio signals.

### **3.5 Data Shaper**

The information which sent from base unit is recovered by the amplifier Q25 and Q26.

### **3.6 Charge and Control**

ZD2, D14, D15, D16, D17, D21, D22 provide over-voltage and polarity protection during battery charging. The charge signal is detected by pin 87 of the MCU. When the handset is put into the base cradle, a negative pulse is sent to pin 74 of the MCU.

### **3.7 Low Battery Detector**

The battery voltage is detected by U3-A and Q21. The signal is sent to pin 67 of MCU.

### **3.8 Buzzer**

Q3 is the buzzer signal amplifier and driven by the MCU pins 72.

### **3.9 Audio Circuit**

The main MCU controls the audio amplifier supply through Q20 and ARDPWR (pin 90). In addition, it also checks “MUTE” key and the “BOOST” switch.

The incoming speech is received through the RF module, the compander U11, the amplifier U4-A (LM358) and U2 (KA8602). When the “BOOST” function is on, Q5, Q11, Q12, Q13 and Q15 are off, inserting extra gain in the audio path. The high frequency is boosted with the increase in volume setting.

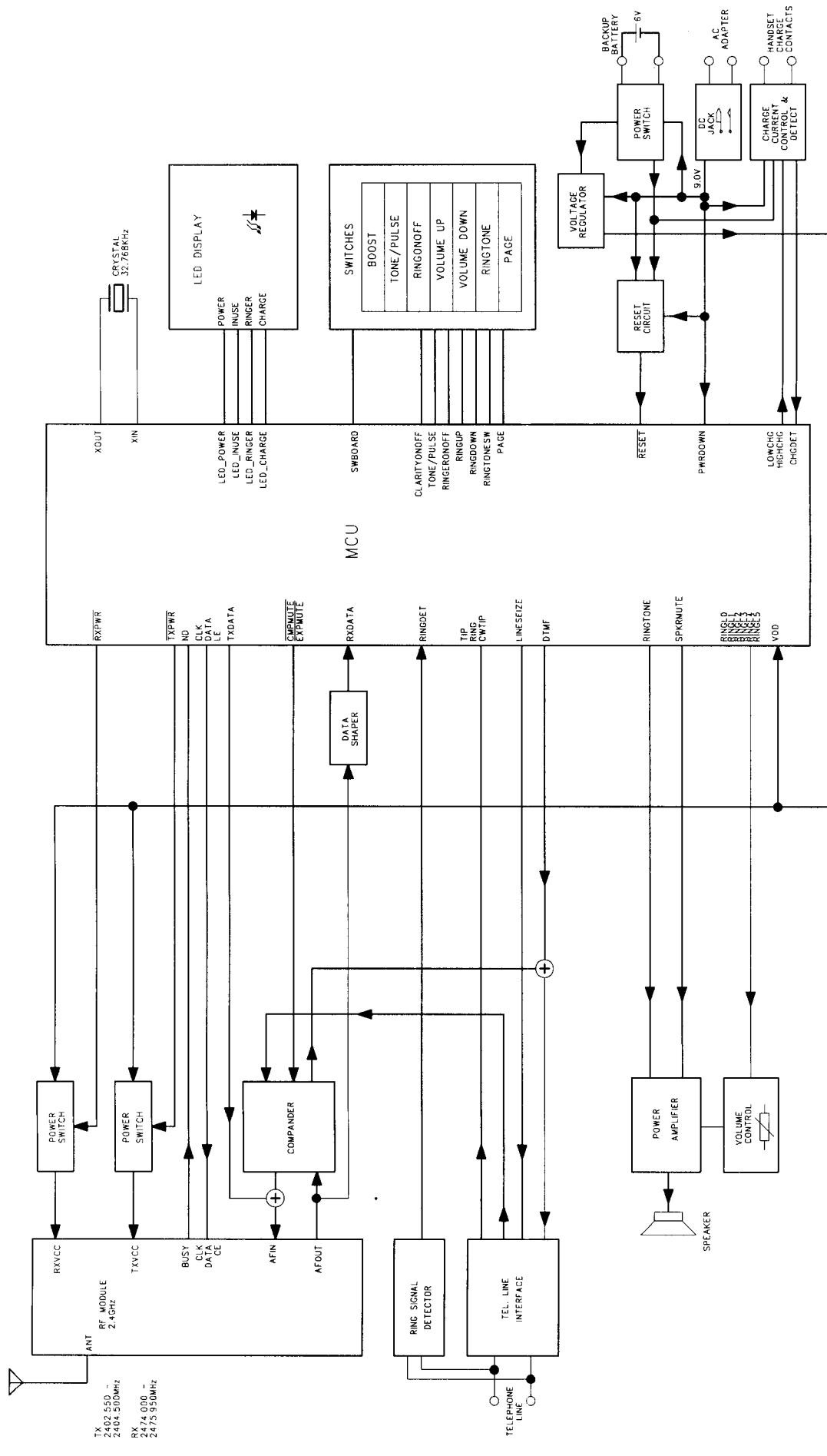
Speech signal is picked up by the internal microphone MIC1 and send to the telephone line through amplifier U4-B (LM358), the compander U11 and the RF module. The MCU1 looks at the “MUTE” key to turn on/off the compander U11 and LED19.

The headset jack is for external receiver and microphone. The neckloop jack is for external audio devices.

#### **4. Functional Blocks of C600 Base Unit**

The block diagram of C600 base unit is as shown below. It is made up of the following parts:

- Power Supply
- MCU and MCU Interface
- RF Module
- Compander
- Data Shaper
- Charge and Control
- Telephone Line Interface
- Ring Signal Detector
- Base Ringer
- Keyboard Matrix, Switches and Function LED



COMPANY: ARTCOM LIMITED

**TITLE: C600 BASE BLOCK DIAGRAM**

DRAMA	DATED:	2004-03-20	FLAG:	
CHEKED:	L	X	0	
	J	B	0	
QUALITY CONTROL:	DATED:		SCALE:	A3
RELEASED:	DX TED:		SIZE:	REV: 0
			DRAWING NO:	SHEET: 1 of 1

## **5. C600 Base Unit Circuit Block Description**

### **5.1 Power Supply**

The base unit is powered by an AC adapter (9V dc). The voltage regulator (BU3) regulates the input DC to 5V. This provides power to every part of the unit. When there is no AC power, BQ18 and BQ19 are turned on to connect the backup batteries to power the base while BZD2 controls the regulated battery output voltage to approximately 5V. The backup batteries voltage is checked periodically by U1A and this signal is connected to pin 39 of the MCU.

### **5.2 MCU and MCU Interface**

The controller of the base is BMCUX1 and controls the function of the unit.

On the telephone side,

- A. It monitors telephone line ring signal at pin 7.
- B. It monitors parallel phone hook status (MEI) at pin 5 through U1-B (LM358).
- C. Decodes CID (Type 1 and Type II) and Message Waiting signals through pin 8 and pin 9.
- D. It provides DTMF signal at pin 2.

The keyboard interface is provided by pins 17 – 24.

It communicates with the handset through the RF module. PLL data to the RF module BMD1 is sent through pins 29, 37 and 44.

The data between Handset and Base is via the pin 41 (data from handset) and pin 43 (data to handset) through the RF module.

The transmitter and receiver powers are controlled by the signals from U6-pin5 and U6-pin6 which are programmed by BMCUX1.

The frequency of the crystal used is 32.768 KHz.

### **5.3 RF Module**

For operation and frequency see RF module section..

It receives the PLL data through pins 4, 5, 6 from MCU pins 44, 29 and 37.

The antenna located inside the base of the unit is permanent attached to RF module.

### **5.4 Compander**

The compander BU1 is used for improving the S/N of the transmit and receive audio signals.

### **5.5 Data Shaper**

The information sent from handset unit is recovered by the amplifier BQ28 and BQ29.

### **5.6 Charge and Control**

BQ4 detects the handset charging current and sends signal to MCU pin 38. BQ2, BQ13, BQ36 and BQ16 control the charging current delivered to the handset. Resistors BR108 and BR109 provide current limiting function. BQ20 and BQ5 detect the 9V supply and send a negative pulse to MCU pin 40 if the 9V supply fails.

### **5.7 Telephone Line Interface**

BL1, BL2, BF1, BVAR1, BR149 and BC61 provide telephone line surge protection. BQ3, BD24, BD25, BD26, BD27, BU6 provide telephone On/Off hook function. BD3, BR34 and BT1 line transformer are the audio interface to the telephone line. The transformer BT1 is also used for telephone line isolation.

### **5.8 Ring Signal Detector**

BL1, BC57, BR31, BZD6, BZD5, BD2, BU5, BF1 and BL2 form the ring signal detector. The signal is sent to pin 7 of MCU.

### **5.9 Base Ringer**

BU11 and speaker BSPK1 provide base ringer sound output. MCU pin 42 provides ringer tones (six types), and this is set by MCU pin 20 (RING STYLE). The level is controlled by pin 18 (VOLUME UP), or pin 19 (VOLUME DOWN). The MCU then sets the output pins 15, 1 – 5 of U2 (74HC595) which controls transistors BQ30 – BQ35.

### **5.10 Keyboard Matrix, Switches and Function LEDs**

The keyboard and switches consist of the followings:

- PAGE – for base to page handset
- STYLE – for changing Ringer sound frequency
- VOLUME DOWN – for reducing Ringer sound output volume
- VOLUME UP – for increasing Ringer output sound volume
- RINGER CONTROL ON/OFF – turns On/Off the ringer output
- BOOST ON/OFF – turns On/Off handset receiver extra gain
- T/P – for selecting Tone or Pulse mode dialing

The switches are connected to pins 17 - 24 of MCU (BMCU1).

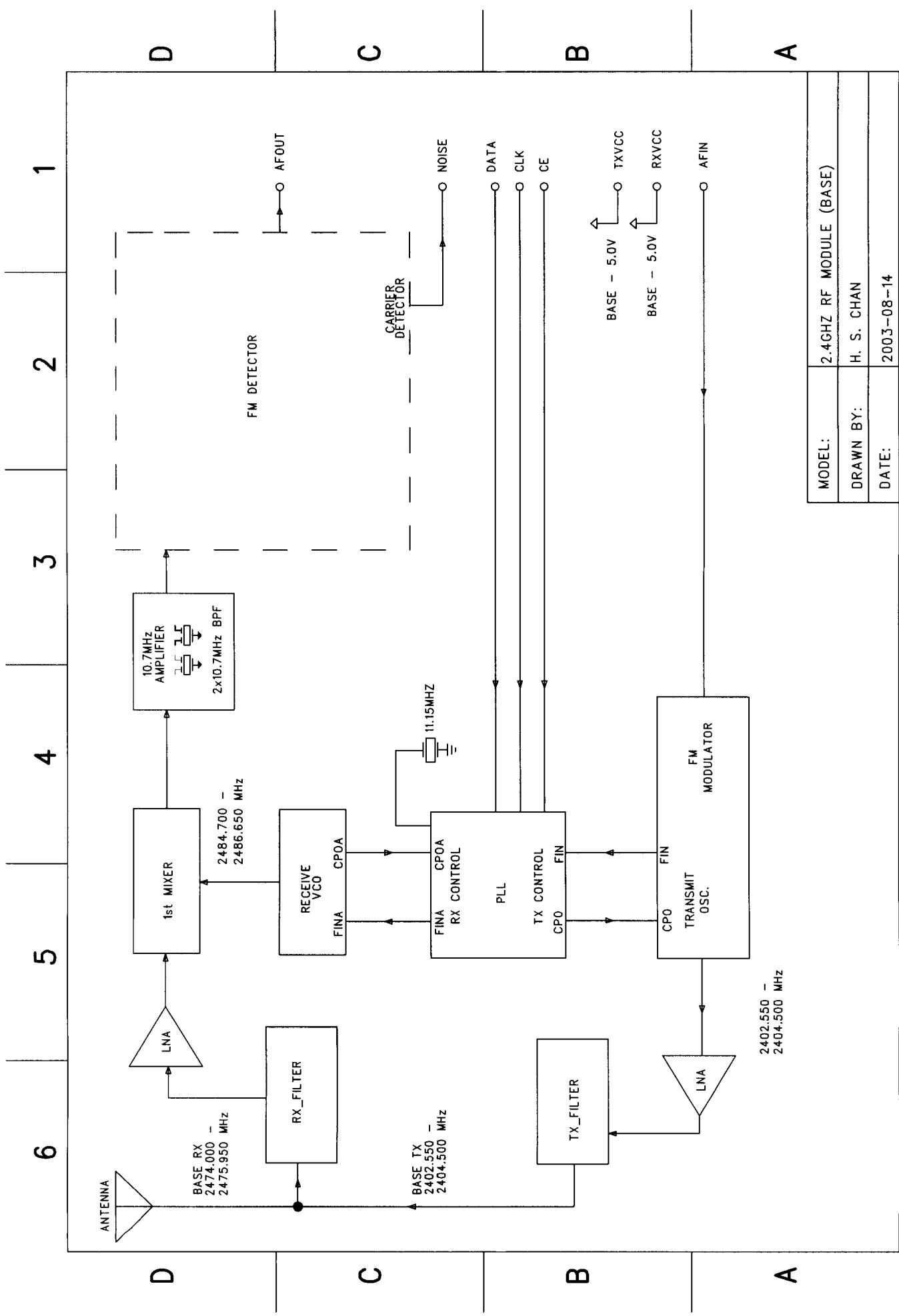
The function LEDs consist of the followings:

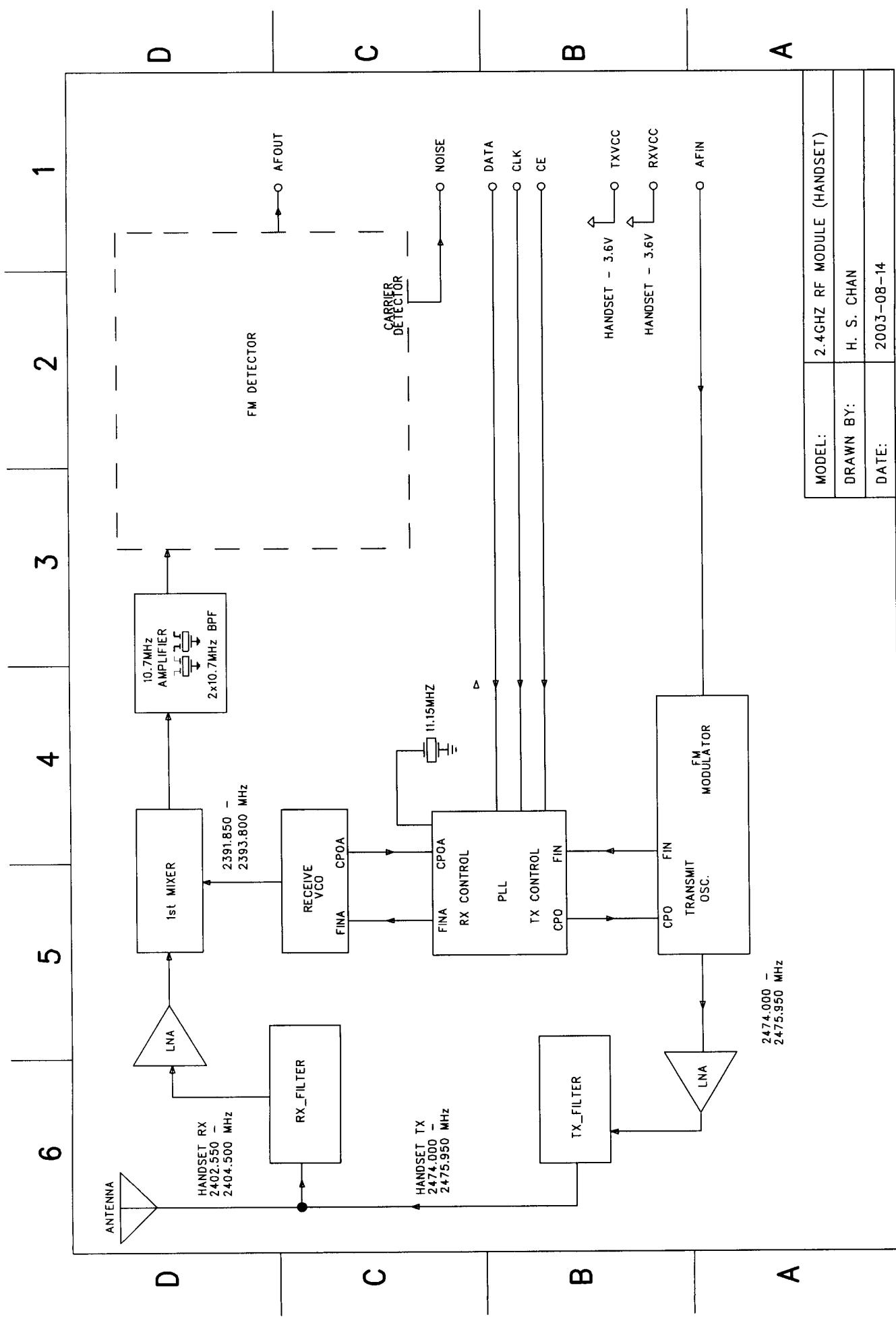
- **RINGER** (BLED6, BLED7 – Red) – Located under the red lens. They are controlled by transistor BQ11 and pin 36 of MCU (BMCU1).
- **INUSE** (BLED21 – Green) – Green when C600 is talking to the telephone line. It is controlled by transistor BQ6 and pin 15 of U6 which is set by BMCU1.
- **CHARGE** (BLED31 – Red) – Red when handset is the cradle. It is controlled by transistor BQ10 and pin 7 of U6 which is set by BMCU1.
- **POWER** (BLED11, BLED12 – Red/Green) – Indicates base power conditions. This is controlled by transistors BQ23, BQ27 and U6-pin 1 which is set by MCU1.
  - Green – when the base is powered by AC adapter and good batteries.
  - Red – when the base is powered by AC adapter only.
  - Blinking Red/Green – when the base is powered AC adapter with bad batteries.
  - Blinking Red – when the base is powered by good batteries only.
  - Flashing Red – when the base is powered by batteries and the battery voltage is low.

## **6. Functional Blocks of the RF Modules**

The block diagram of RF Module is as shown below. It is made up of the following parts:

- 6.1 Power Supply
- 6.2 PLL and MCU Interface
- 6.3 RF Transmitter
- 6.4 RF Receiver
- 6.5 Audio Detector





MODEL:	2.4GHz RF MODULE (HANDSET)
DRAWN BY:	H. S. CHAN
DATE:	2003-08-14

## **7. RF Module Circuit Block Description**

### **7.1 Power Supply**

The RF transmitter (Q6, Q7, and Q1) receives power from TXVCC. This voltage is 5V for the base unit and 3.6V for the handset unit. For the base unit, TXVCC is enabled only during TALK or RINGING mode. For the handset unit, TXVCC is enabled only during TALK mode.

The RF receiver (Q3) receives power from RXVCC. This voltage is 5V for the base unit and 3.6V for the handset unit.

For the base unit, RXVCC is enabled all the time when there is AC power. When running on backup batteries, it is on only while scanning for “TALK” signal from the handset.

For the handset unit, RXVCC is enabled only during TALK or scanning for ringing signal from the base unit.

### **7.2 PLL and MCU Interface**

The frequencies of the RF transmitter and RF local oscillator are controlled by a PLL IC (U1). It receives the frequency data through DATA, CLK and CE signal lines from the MCU. The basic clock frequency of the PLL is derived from an 11.15MHz crystal (X1) inside the RF module.

### **7.3 RF Transmitter**

The RF transmitter frequency for the base is 2402.550 MHz – 2404.500 MHz and the handset is 2474.000 MHz – 2475.950 MHz.

The RF transmitter signal is derived from Q1. The transmit frequency is controlled by the signal pin CPO of the PLL IC (U1). The PLL samples the RF frequency through FIN. The audio input signal AFIN is fed to this RF oscillator through the FM modulator VD1.

The RF oscillator output is amplified through the LNA (Q6, Q7) and coupled to the RF antenna through the TX\_FILTER (DF1).

### **7.4 RF Receiver**

The incoming RF signal is coupled from the antenna through RX\_FILTER (DF2) to a LNA (Q3) where it is amplified and fed to the 1<sup>st</sup> mixer (Q4). The frequency of the receiver local oscillator (Q2) is controlled by the signal pin CPOA of the PLL IC (U1). The PLL samples the local oscillator RF frequency through signal pin FINA.

For the base unit, the local oscillator frequency is (RF + 10.7MHz).

For the handset unit, the local oscillator frequency is (RF – 10.7MHz).

## 7.5 Audio Detector

The audio detector receives the incoming signal from the 10.7MHz amplifier and filter (Q5, Q8). The audio signal is recovered by a FM detector (handset U2 , base U4) and amplified by Q9 to AFOUT. The quality of the incoming RF signal is indicated by logic output NOISE.

## 12. RF Channels

RF CHANNEL	HANDSET (KHz)		BASE (KHz)	
	TX	RX	TX	RX
01	2,474,000	2,391,850	2,402,550	2,484,700
02	2,474,050	2,391,900	2,402,600	2,484,750
03	2,474,100	2,391,950	2,402,650	2,484,800
04	2,474,150	2,392,000	2,402,700	2,484,850
05	2,474,200	2,392,050	2,402,750	2,484,900
06	2,474,250	2,392,100	2,402,800	2,484,950
07	2,474,300	2,392,150	2,402,850	2,485,000
08	2,474,350	2,392,200	2,402,900	2,485,050
09	2,474,400	2,392,250	2,402,950	2,485,100
10	2,474,450	2,392,300	2,403,000	2,485,150
11	2,474,500	2,392,350	2,403,050	2,485,200
12	2,474,550	2,392,400	2,403,100	2,485,250
13	2,474,600	2,392,450	2,403,150	2,485,300
14	2,474,650	2,392,500	2,403,200	2,485,350
15	2,474,700	2,392,550	2,403,250	2,485,400
16	2,474,750	2,392,600	2,403,300	2,485,450
17	2,474,800	2,392,650	2,403,350	2,485,500
18	2,474,850	2,392,700	2,403,400	2,485,550
19	2,474,900	2,392,750	2,403,450	2,485,600
20	2,474,950	2,392,800	2,403,500	2,485,650
21	2,475,000	2,392,850	2,403,550	2,485,700
22	2,475,050	2,392,900	2,403,600	2,485,750
23	2,475,100	2,392,950	2,403,650	2,485,800
24	2,475,150	2,393,000	2,403,700	2,485,850
25	2,475,200	2,393,050	2,403,750	2,485,900
26	2,475,250	2,393,100	2,403,800	2,485,950
27	2,475,300	2,393,150	2,403,850	2,486,000
28	2,475,350	2,393,200	2,403,900	2,486,050
29	2,475,400	2,393,250	2,403,950	2,486,100
30	2,475,450	2,393,300	2,404,000	2,486,150
31	2,475,500	2,393,350	2,404,050	2,486,200
32	2,475,550	2,393,400	2,404,100	2,486,250
33	2,475,600	2,393,450	2,404,150	2,486,300
34	2,475,650	2,393,500	2,404,200	2,486,350
35	2,475,700	2,393,550	2,404,250	2,486,400
36	2,475,750	2,393,600	2,404,300	2,486,450
37	2,475,800	2,393,650	2,404,350	2,486,500
38	2,475,850	2,393,700	2,404,400	2,486,550
39	2,475,900	2,393,750	2,404,450	2,486,600
40	2,475,950	2,393,800	2,404,500	2,486,650