

## **W435 Circuit Description**

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## **1. Introduction**

The model W435 is a 40 channel (902 MHz - 928 MHz) cordless telephone.

This unit is made up of two parts:

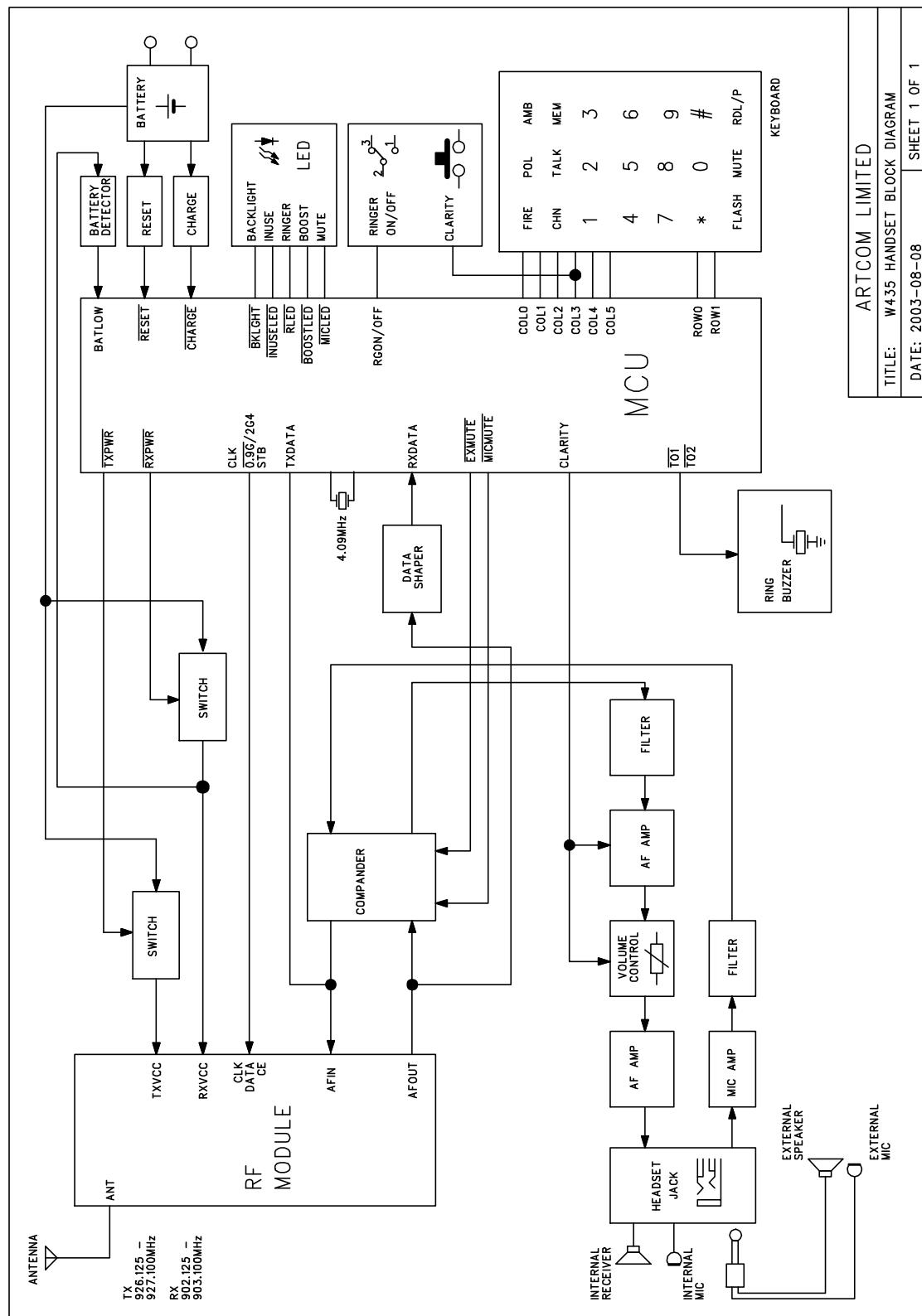
- a. A Handset unit.
- b. A Base unit.

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

The block diagram of W435 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

## W435 Handset Unit Block Diagram



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

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

The keyboard consists of the following keys:

- FIRE – one touch memory key
- POL – one touch memory key
- AMB – one touch memory key
- CH – for changing RF carrier frequency
- TALK – for On/Off hook control
- MEM – for memory program and dialing
- 1, 2, 3, 4, 5, 6, 7, 8, 9, \*, 0, # – numeric keys
- FLASH – provides timed On/Off hook function
- MUTE – turns Off/On the handset microphone
- RD/P – redials the last number or provides a pause during dialing.

The keyboard is connected to Pins 19 to 26 the MCU (U3).

The switches consist of the followings:

- BOOST CLARITY POWER – for On/Off the receiver amplifier gain
- RINGER ON/OFF – turns On/Off the ringer buzzer

They are connected to pins 24 and 21 of MCU.

The function LEDs consist of the followings:

- MICMUTE (LED2 - Red) – Located under the “MUTE” key. On/Off when microphone is Off/On
- INUSE (LED17 – Green; LED4, LED6 and LED18 - Red) – Located under the “TALK” key and the handset antenna. On/Off when telephone is Off-hook/On-hook
- BOOST (LED17 – RED) – Located under the “TALK” key. On/Off when the receiver amplifier extra gain is On/Off
- BACKLIGHT (LED3, LED5, LED7, LED8, LED9, LED10, LED11, LED12, LED13, LED14, LED15, LED16 – Green) – Located under the keyboard. On for a short time when any key is pressed
- RINGER (LED4, LED6 and LED18 - Red) – Located in the handset antenna. Flashes when the telephone line rings

These LEDs are controlled by pins 7, 9, 10, 11 and 12 of MCU.

#### **3.2 MCU and MCU Interface**

The controller of the handset is U3. 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 31 (data from base) and pin 34 (data to base).

### **3.3 RF Module**

For operation and frequency see RF module section.

It receives the PLL data through pins 5, 6, 7 from MCU pins 1, 43 and 44.

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

### **3.4 Comander**

A compander U5 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 Q7 and Q9.

### **3.6 Charge and Control**

ZD1, D5, D6, D7, D9, D10, D11, Q5 provide polarity and over-voltage protection during battery charging. The charge signal is detected by pin 29 of the MCU.

When the handset is put into the base cradle, a negative pulse is sent to pin 14 of the MCU.

### **3.7 Low Battery Detector**

The battery voltage is detected by U4D and the signal is sent to pin 4 of MCU.

### **3.8 Buzzer**

Q2 is the buzzer signal amplifier and driven by the MCU pins 2, 32, 33.

### **3.9 Audio Circuit**

Speech signal is picked up by the internal microphone M1 and sent to the telephone line through amplifier U4C, the compander U5 and the RF module.

The incoming speech is received through the RF module, the compander, the amplifier U4A and U1. When BOOST is On, extra gain is inserted in this audio path.

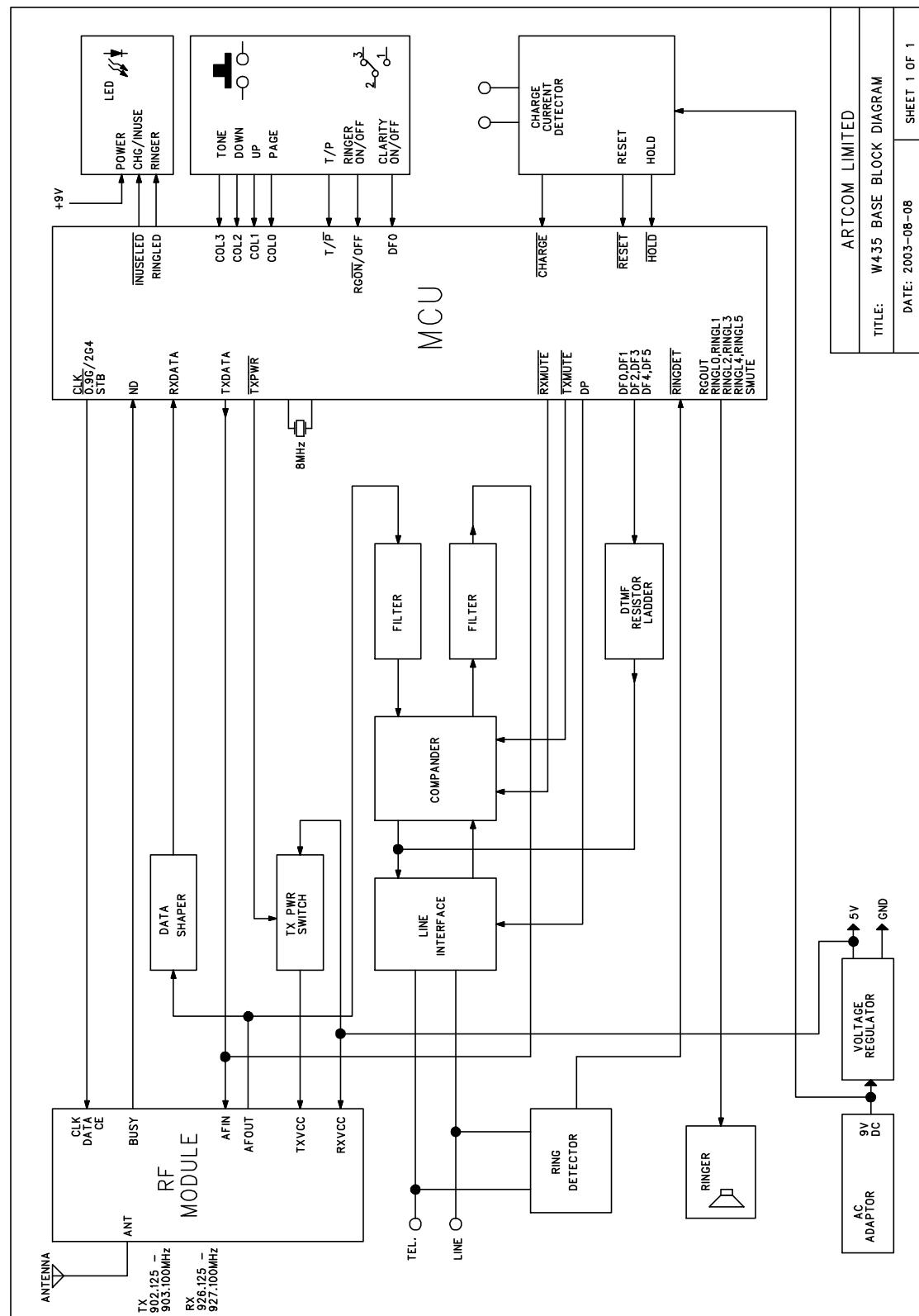
The headset jack is for external speaker and microphone.

#### **4. Functional Blocks of the Base unit**

The block diagram of W435 base unit is as shown below. It is made up of the following parts:

- 4.1 Power Supply
- 4.2 MCU and MCU Interface
- 4.3 RF Module
- 4.4 Compander
- 4.5 Data Shaper
- 4.6 Charge and Control
- 4.7 Telephone Line Interface
- 4.8 Ring Signal Detector
- 4.9 Base Ringer
- 4.10 Keyboard Matrix, Switches and Function LED

## W435 Base Unit Block Diagram



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

### **5.1 Power Supply**

The base unit is powered by an AC adapter (9V dc).

The voltage regulator (BU5) regulates the input DC to 5V. This provides power to every part of the unit.

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

The controller of the base is BU2 and controls the function of the unit.

It communicates with the handset through the RF module. PLL data to the RF module BMD1 is sent through pins 1, 43 and 44. The data between Handset and Base is via the pin 31 (data from handset) and pin 34 (data to handset) through the RF module. The transmitter power is controlled by the signal from pin 35 of MCU.

The MCU monitors ring signal from telephone line through the telephone line interface at pin 29. MCU pins 19 to 24 provide DTMF signal through a resistor ladder connected at these pins. The keyboard interface is provided by pins 8 to 12.

### **5.3 RF Module**

For operation and frequency see RF module section..

It receives the PLL data through pins 5, 6, 7 from MCU pins 1, 43 and 44.

The antenna (~130mm total length) partly located inside the plastic rod at the side the unit is permanent attached to RF module.

### **5.4 Comander**

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

### **5.5 Data Shaper**

The information sent from handset unit is recovered by the amplifier BQ2 and BQ3.

### **5.6 Charge and Control**

BQ15 detects the handset charging current and sends signal to MCU pin 30.

BQ14 detects the 9V supply and sends a negative pulse to MCU pin 14.

## **5.7 Telephone Line Interface**

BL3, BL4, BR119 and BC69 provide telephone line surge protection.

BQ7, BD12, BD13, BD14, BD15, BC69, BU7 provide telephone On/Off hook function. BD2, BR118 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**

BL3, BC68, BR116, BZD2, BZD3, BD11, BU6, BR119 and BL4 form the ring signal detector. The signal is sent to pin 29 of MCU.

## **5.9 Base Ringer**

Base ringer sound output is provided by BU3 and speaker BSP1. MCU pin 2 provides the ringer output signal and the level is controlled by pins 38, 39, 36, 32, 27 and 28.

## **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
- RING CONTROL ON/OFF – turns On/Off the ringer buzzer
- CLARITY ON/OFF – turns On/Off handset receiver extra gain
- T/P – for selecting Tone or Pulse mode dialing

They are connected to pins 3, 8 – 12 and 19 of MCU (BU2).

The visual ringing signal is provided by LEDs BLED3, BLED4, BLED5, BLED6, BLED7, BLED8, BLED9 and BLED10 (Red) and located under the charge cradle lens. They are controlled by pin 5 of MCU and transistor BQ4.

BLED1 (Green) is used for indicating “INUSE” when the telephone is in use or “CHARGING” when handset is in cradle.

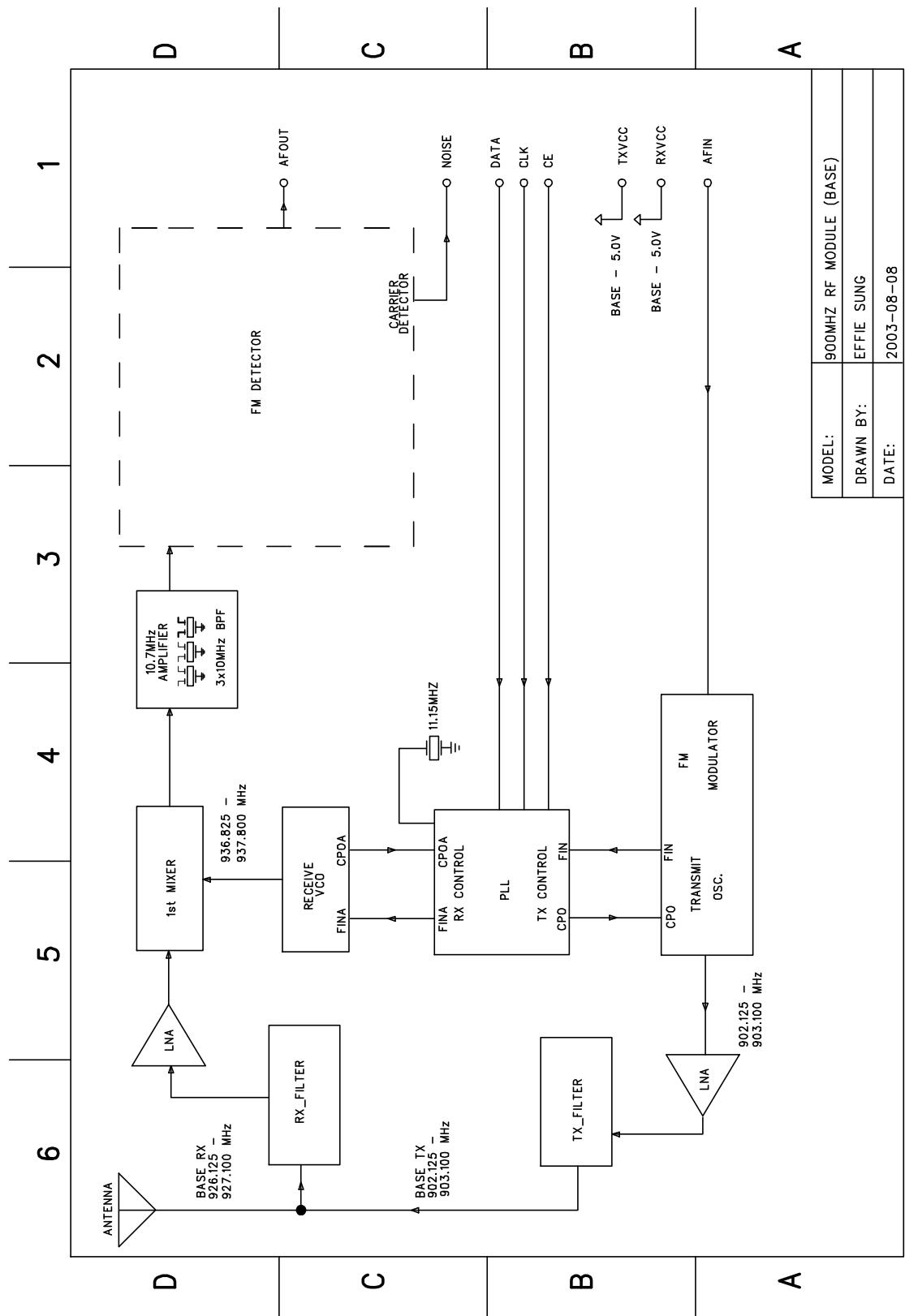
BLED2 (Red) is on when the base unit is powered by the AC adapter.

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

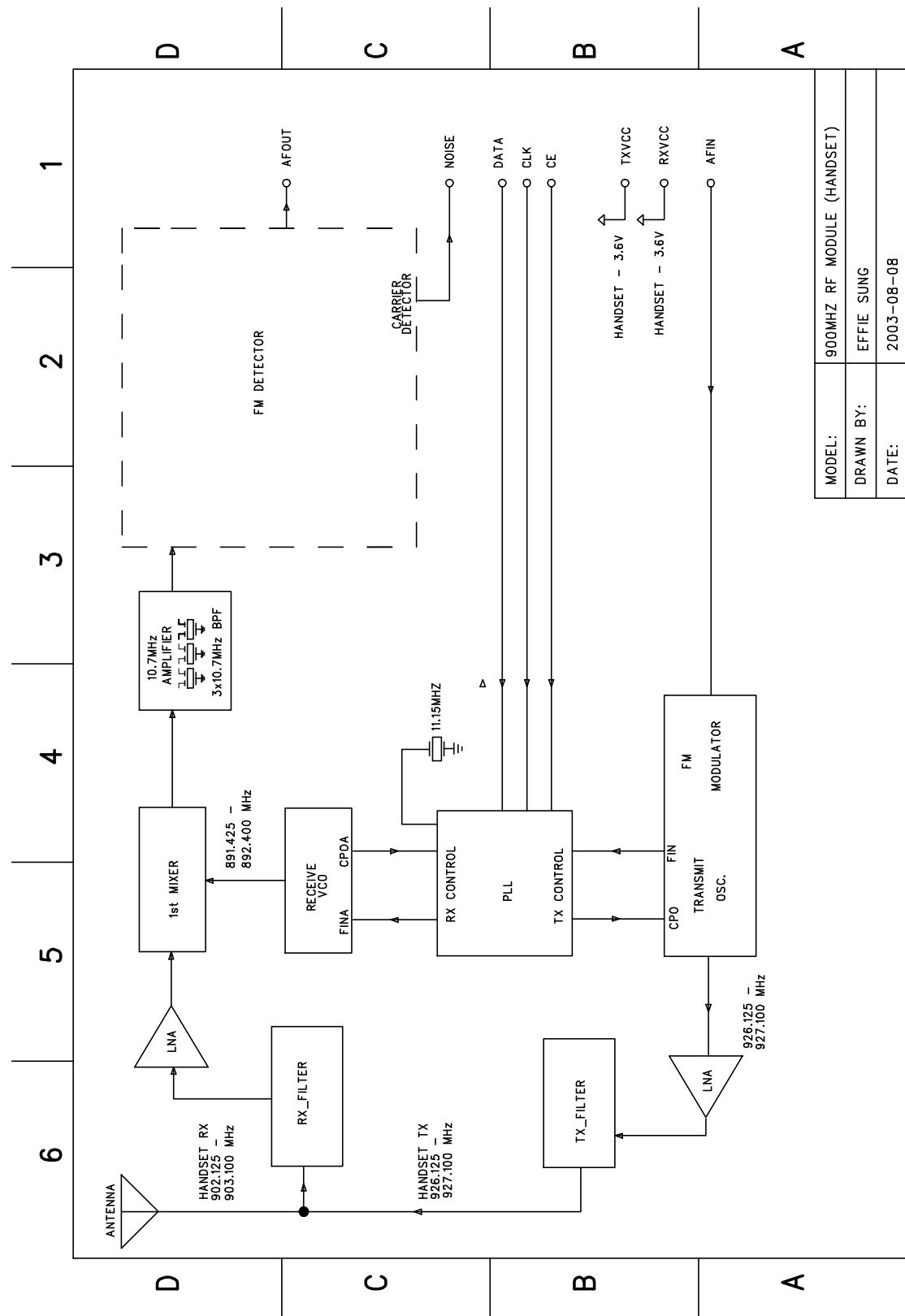
The block diagram of RF Module is as shown below. It is made up of the following parts:

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

## RF Module (Base) Block Diagram



RF Module (Handset) Block Diagram



## 7. RF Module Circuit Block Description

### 7.1 Power Supply

The RF transmitter 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 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. 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. The MCU transmit PLL data through DATA, CLK and CE signal lines. The basic clock frequency of the PLL is derived from an 11.15MHz crystal inside the RF module.

### 7.3 RF Transmitter

The RF transmit frequency for the base is 902.125 MHz – 903.100 MHz and the handset is 926.125 MHz – 927.100 MHz.

The RF transmitter oscillator frequency is controlled by the PLL through CPO. The PLL samples the RF frequency through FIN. The audio input signal AFIN is fed to this RF oscillator through the FM modulator.

The RF oscillator output is amplified through the LNA and coupled to the RF antenna through the TX\_FILTER.

### 7.4 RF Receiver

The incoming RF signal is coupled from the antenna through RX\_FILTER to a LNA where it is amplified and fed to the 1<sup>st</sup> mixer. The receiver local oscillator frequency is controlled by the PLL through CPOA. The PLL samples the local oscillator RF frequency through 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 filter. The audio signal is recovered from a FM detector to AFOUT. The quality of the

incoming RF signal is indicated by logic output NOISE.

### Channel Frequency

Channel	Base Tx	Handset Tx
1	902.125	926.125
2	902.150	926.150
3	902.175	926.175
4	902.200	926.200
5	902.225	926.225
6	902.250	926.250
7	902.275	926.275
8	902.300	926.300
9	902.325	926.325
10	902.350	926.350
11	902.375	926.375
12	902.400	926.400
13	902.425	926.425
14	902.450	926.450
15	902.475	926.475
16	902.500	926.500
17	902.525	926.525
18	902.550	926.500
19	902.575	926.575
20	902.600	926.600
21	902.625	926.625
22	902.650	926.650
23	902.675	926.675
24	902.700	926.700
25	902.725	926.725
26	902.750	926.750
27	902.775	926.775
28	902.800	926.800
29	902.825	926.825
30	902.850	926.850
31	902.875	926.875
32	902.900	926.900
33	902.925	926.925
34	902.950	926.950
35	902.975	926.975
36	903.000	927.000
37	903.025	927.025
38	903.050	927.050
39	903.075	927.075
40	903.100	927.100