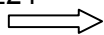
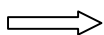
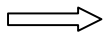


Circuit Description of Digital Cordless Telephone (XG-2500)

The XG-2500 Digital Cordless Telephone with caller ID is 2400MHz band(ISM BAND) Digital Cordless Telephone and Time Division Duplex (TDD) System. It performs Transmission and reception through the TDD ANTENNA of the RF module. It has 40 channels and General RF specifications are below.

■ Remote & Base

- | | |
|--|--|
| 1. Frequency (BASE & PORTABLE) | : 2404.8MHz ~ 2475.0MHz |
| 2. Antenna | : Time Division Duplex |
| 3. Number of Channel | : 40 Channels |
| 4. Channel Space | : 1.8MHz |
| 5. Receiver Sensitivity(BER) | : Less than 0.1%@ -104dBm |
| 6. RF Output Power | : Automatic RF Power Control
High – Power Mode : 14 ± 2
Medium-Power Mode : 4 ± 2
Low-Power Mode : -8.5 ± 2 |
| 7. Processing Gain | : 10.8dB |
| 8. Type of Modulation | : DBPSK |
| 9. Speech Coder | : 32kbps ADPCM |
| 10. Symbol Rate | : 1.2Mbps |
| 11. ID Code | : More than 2E24 |
| 12. Battery Capacity | : Capacity  230mAh (3.7V)
: Talk Time  2 Hours
: Standby Time  7 Days |
| 13. Power Supply Voltage for Remote Battery | : 3.7V Li-polymer 230mAh |
| 14. Power Supply Voltage Adaptor for Base unit | : 9VDC / 300mA |

BASE Station and Handset unit

- 1.1 Power supply and Regulator circuit (Base station)
 - AC/DC adaptor converts 120V AC/60Hz to DC 9V 300mA supplies 9V DC to the base unit.
 - Regulated voltages used U5(S7805D)
- 1.1.1 Power supply and Regulator circuit (Handset unit)

Supply the Battery 3.7V 230mAh Li-polymer and voltage regulator U3 (3.0V output)
- 1.2 Park Detect and Battery Charger
 - When the handset is parked, the charge signal is connected between the battery charger circuit (Q5, Q6) and the handset battery.
Current will flow to charge the battery and turn on the Q7 TR ON.
Q7 will set the PARK(Pin 25) signal low, which will inform the base station that

the handset is parked.

trickle charged Li-polymer is use, the Nominal charge current must be close to but less than 0.1C. Nominal charge current should be 100~120mA for the battery.

1.3 Speech circuit (Base station)

1.3.1 FS1, VAR1(Varistor) is for surge protection and there are RF interference protection components L1, L2 and C55.

1.3.2 U1, C1, R1 and ZD1 are for ringer circuitry.

When the base unit receives a ring signal, a pulse on pin 4 of U1 inputs pin 4 of U3.

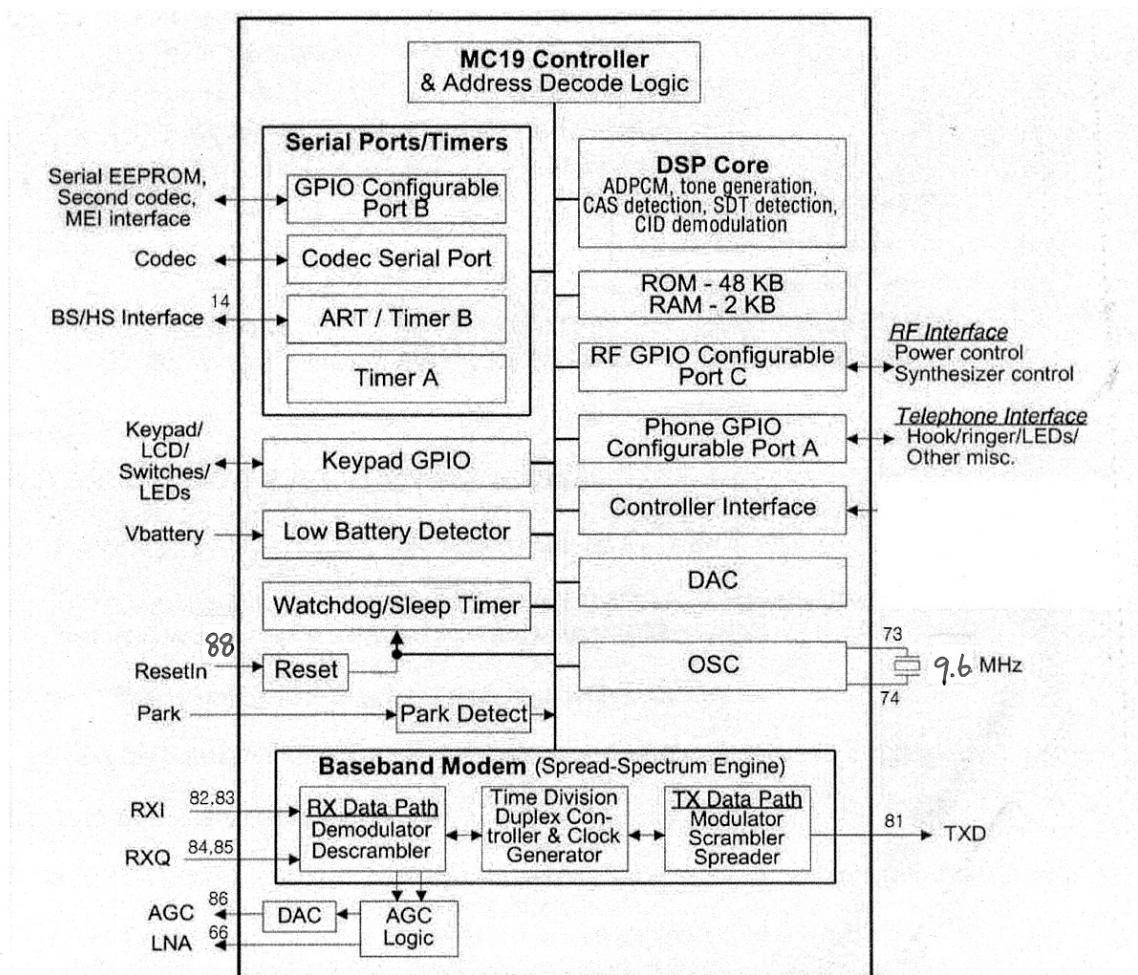
1.3.3 When there is an audio signal on telephone line, the audio signal through U7A applies Pin 37 of U3 (Baseband chipset IC) for convert analog signal to digital signal.

When converted signal outputs from pin80 of U3 TXDAC and send to the RF module.

1.3.4 Receive signal from handset is detected by RF module then De-modulation by the U3. Pin 81(RXIP), 82(RXIN), 83(RXQP), 84(RXQN) reserved audio signal output to keep proper level. The audio level is adjusted by U7 and supplies to telephone line.

1.3.5 U3 Baseband Chip ASIC Block Diagram Fig 1

Figure1-U3 BASEBAND ASIC

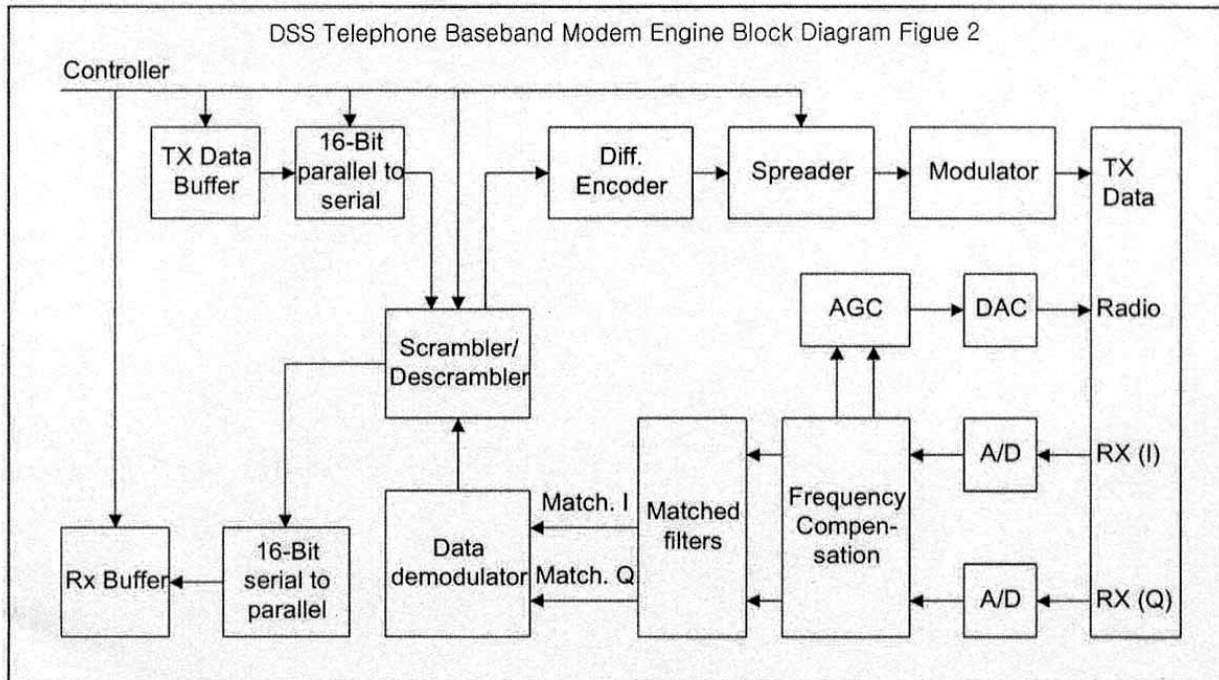


The Partitioning of the U3 Baseband ASIC logic blocks is show in Figure1. Detailed information on Each of these block follows.

1.3.5.1 Microcontroller

The microcontroller is the 65C02 based MC19 CPU.

1.3.5.2 Baseband Modem – A block diagram of the baseband Modem is shown in Figure 2.



- **Transmitter/Receiver Data Paths.** The transmit data path is comprised of a parallel-to serial converter, scrambler, differential encoder, spreader and modulator. The receive data path is comprised of analog to digital converters, a matched filter with frequency compensation, data demodulator, descrambler and serial to parallel converter.
- **Scrambler / Descrambler.** A16 bit code randomizes the voice and supervisory data for transmission and reception. More than 64K scramble codes are available from the 16 bit maximal length pseudo noise sequence generator.
- **Differential Encoder.** Data is differentially encoded.
- **Modulation.** BPSK modulation is used.
- **Receiver A/D Converters.** Baseband I/Q signal from the radio are sampled at 2.4GHz and converted to digital with 3 bit flash A/D converters.
- **Frequency Compensation.** Frequency compensation circuit allow use of high PPM crystals.
- **Data Demodulations.** Matched filter outputs are differentially demodulated using dot product detection.
- **Matched Filters.** The spreading code is removed from the received digitized I/Q signals with matched filters.
- **AGC.(Pin87)** The signal energy is compared to a programmable threshold and scaled with programmable gain. The digital AGC value is output to the radio by an 8 bit D/A converter.

- **ID Detector.(Pin 24)** A 16 bit code program a 32 bit ID word which is used during acquisition to verify the RF link and initialize from timing.
- **RF Control Functions.** The U3 Baseband ASIC four GPIOs are for the RF synthesizer serial Interface.
In addition, the 9.6 MHz REFOSC signal is used as the synthesizer reference clock.
Furthermore, two GPIOs are used to control the RF power amplifier output level,
One GPIO is used to control the LNA gain setting and two dedicated signals are used to control switching of the RF transmit and Receive modes.
- **External Interface Functions**
 - General Purpose I/O Pins, Keypad/ Switch/LED display , Asynchronous receiver/ transmitter (ART), Park Detector. etc.**
 - Serial EEPROM interface.** The U3 Baseband ASIC supports the use of industry standard microwire or I²C serial EEPROM.
 - Ringer/Buzzer interface. The U3 Baseband ASIC provides several options for generating ringer tones.
 - LED Indicator Interface. The U3 Baseband ASIC provides the LED indicators.
(Phone, Page/Intercom, Charge, Out of range/Low battery)

1.3.6 Switches (Base Station only)

The switch input are available using the KEYPAD control pins to scan the switches and GPIOC0 (Pin 5) to detect a closed switch, using a method similar to the keypad matrix scanning.
The base station circuit interface for the RINGER ON/OFF switch (Not used)

1.3.7 KEYPAD (Handset only)

The keypad is controlled by 14 pins (8 bidirectional control and 6 read inputs).

1.3.8 Asynchronous Receiver / Transmitter (ART)

This block can be configured as either as Asynchronous Receiver Transmitter (ART) or as a standard time the logic controls the two-pin asynchronous serial port of the ASIC.
It can be used for base/handset communication and for the tester interface, and parallel to serial conversion on data characters received from the controller.

1.3.9 Audio Coprocessor. The Audio coprocessor is to the microcontroller via the data and memorymapped registers. It runs at 9.6MHz crystal frequency and consists of :

- **ADPCM Codec.** Compresses 14 bit linear samples to 4 bits at an 8kbps rate.
Using the ITU 726 32kbps ADPCM audio compression algorithm.
- **Dual tone generator** Three programmable signal generator that produce either alerting tones or that conform to DTMF signaling specifications.

1.3.10 9.6MHz Crystal Oscillator (U3 – Pin4, Pin5)

This oscillator is used to generate the system reference clock. This oscillator needs to generate an accurate clock frequency from a crystal source. Nomal operation is at 9.6MHz.
The audio coprocessor uses this 9.6MHz clock. This clock is divided by 2 to generate a 9.6MHz reference clock for the rest of system.

1.3.11 Low Battery Detector (U1 – Pin80) – Handset only.

The Baseband ASIC (U3) provides an analog to digital converter (ADC) input to allow the ASIC to monitor the battery voltage at the handset.

1.3.12 Power on Reset (U1 – Pin77)

The power on reset block uses a voltage detector to compare the RESETI input voltage with an on chip reference voltage to generate reset and the RESETOP output signal. The threshold for reset going active is 1.257V +/- 36mV, and for reset going inactive, is 1.35V +/- 36mV.

1.3.13 RX Data ADCs (U3 – Pin 81, 82, 83, 84)

The U3 ASIC takes baseband In-phase and Quadrature (I/Q) analog samples from the RF transceiver and processes them to demodulate data. The basic functionality for the analog calls is to quantize and sample the signal using a 3 bit ADC for the I/Q received signals. The inputs are differentially received.

1.3.14 AGC DAC (U3 – Pin87)

An 8 bit DAC is used the AGC control for the baseband amplifiers, in the RF transceiver, to control the amplitude level of the RX data input to the ASIC.

1.3.15 TX DAC Output (U3 – Pin80)

The TX data DAC output is used as the transmit data output to the RF transceiver. A DAC is used to regulate the transmit output power level, when the power supply varies, to maintain constant output power. The power has three levels : two levels for data modulation and a third level for maintaining DC level during the receive periods.

1.3.16 Audio Codec description

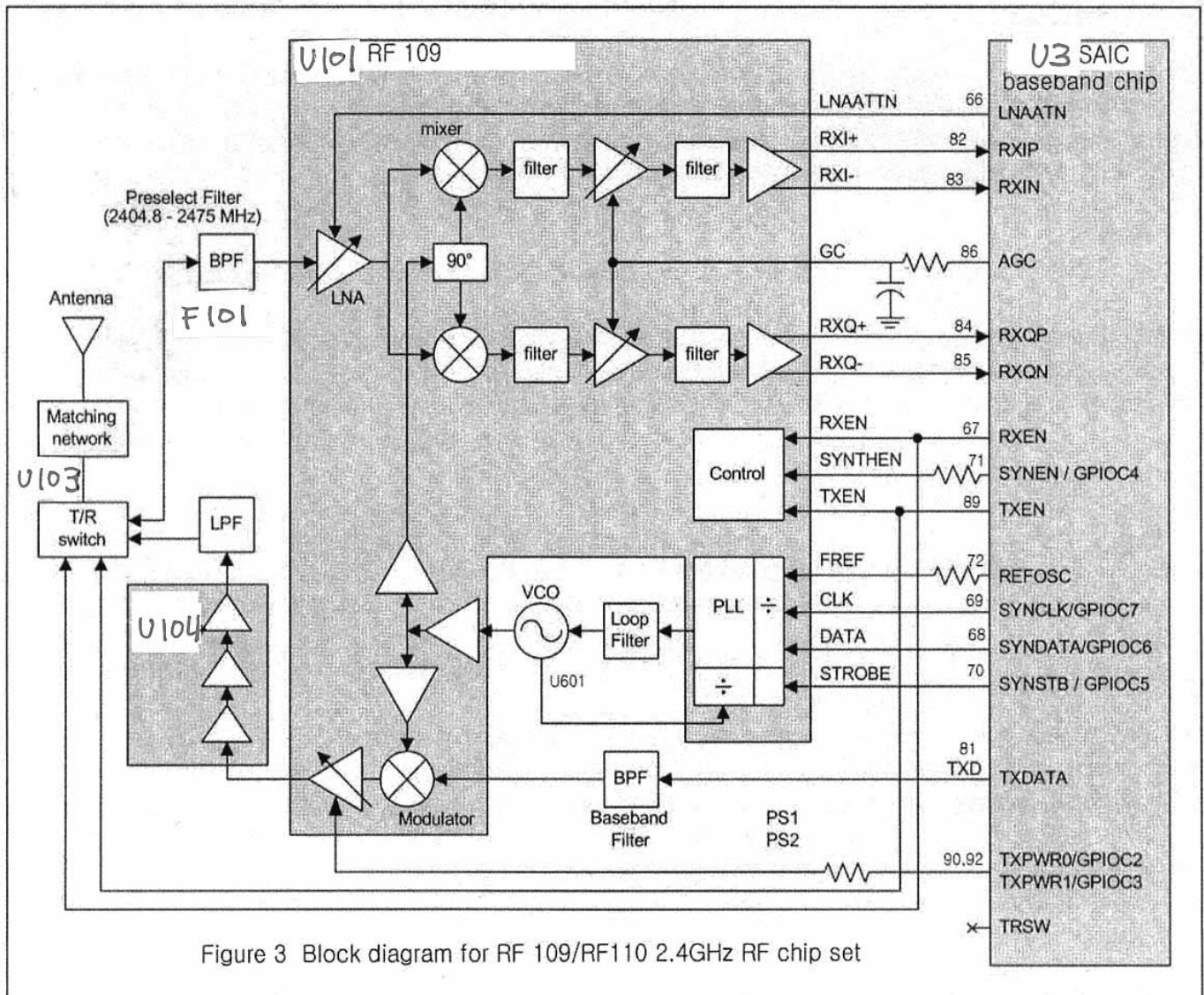
The Audio codec is a monolithic CMOS integrated circuit operation. It consists of an ADC encoder path and a DAC decoder path with digital filtering and analog signal processing circuits to realize a complete ITU G.714 compatible voice frequency liner coder/ decoder. The word rate to and from the device is 8k words per second per channel.

- **Encoder path description.** There are two inputs to the encoder, MICIN (Pin 38,39-Handset) and LINEIN (Pin 37-Base station), which are biased at AGND.
The microphone input, MICIN(Pin 38, 39), is a differential input.
LINEIN is a Single ended input.
An electret microphone may be AC coupled (C13) into MICIN and powered from the MICBIAS (Pin 40) source provided.
- **Decoder Path Description.** The codec provides two sets of analog output which may independently enabled or disabled. SPKOP and SPKRON from a differential output capable of driving a 150ohm resistive loaded.
The codec's SPKOP and SPKRON differential outputs will drive the telephone line Interface directly and to drive DTMF tones.

1.4 RF module circuit (Base)

RF Module : RF109 (U101) Transceiver and RF110 (U104) RF Power Amplifier.

- RF Module Description (Base) -



The U101 and U104 are 2.4GHz RF chip set, U3 Baseband chip to form a complete 2.4GHz ISM band DSS cordless telephone.

The U101 is a transceiver IC, and the U104 is a class AB Power amplifier.

- 1.4.1 Transmit path** The baseband digital data input signal is shaped by external B.P.F (baseband filter)
The shaping of the baseband data determines the spectral sharp of the Transmitted RF signal. For the 2.4 GHz telephone system, the typical 3dB cutoff frequency is about 22KHz (highpass) and 820KHz (lowpass).
- The U104 power amplifier (PA) inputs and outputs are differential RF signal. Impedance matching network are between the PA output and the RF lowpass filters.
The U104 output with a phase difference of 180 degrees between the two branches.
The differential output of the U104 are converted to a single ended signal, 50ohm load, using the balun circuit.
The system is automatically selectable High power, Medium power, Low power output modes. Depending on the distance between base station and handset, the system automatically sets the desired power mode.
- 1.4.2 Receive Path** The signal is received at the antenna and passes through the U103. Transmit / Receiver switch and RF bandpass filter(F101).
The filter should have a 3dB passband range from 2404.8 to 2475MHz.
- The output of the bandpass filter is AC coupled to the LNA (Low Noise Amplifier) of the U101 Pin 11.
The U101 downconverts the RF signal into In phase and Quadrature baseband Signals. The differential I/Q baseband signal are DC coupled to the U3 ASIC Pin 81, 82, 83, and 84 inputs.
- 1.4.3 Transmit / Receive Switch** The transmit and receive function of the radio are enabled by RXEN and TXEN control signals the U3 ASIC.
- 1.4.4 Lo Oscillator** The LO signal oscillator by a programmable PLL frequency synthesizer in the U101 and external 2.4GHz VCO to U601.
- 1.4.5 Antenna Part**

1.5 RF module circuit (Handy)

RF Module : RF109 (U101) Transceiver and HF24009J(U201) RF Power Amplifier.

- RF Module Description (Handy) -

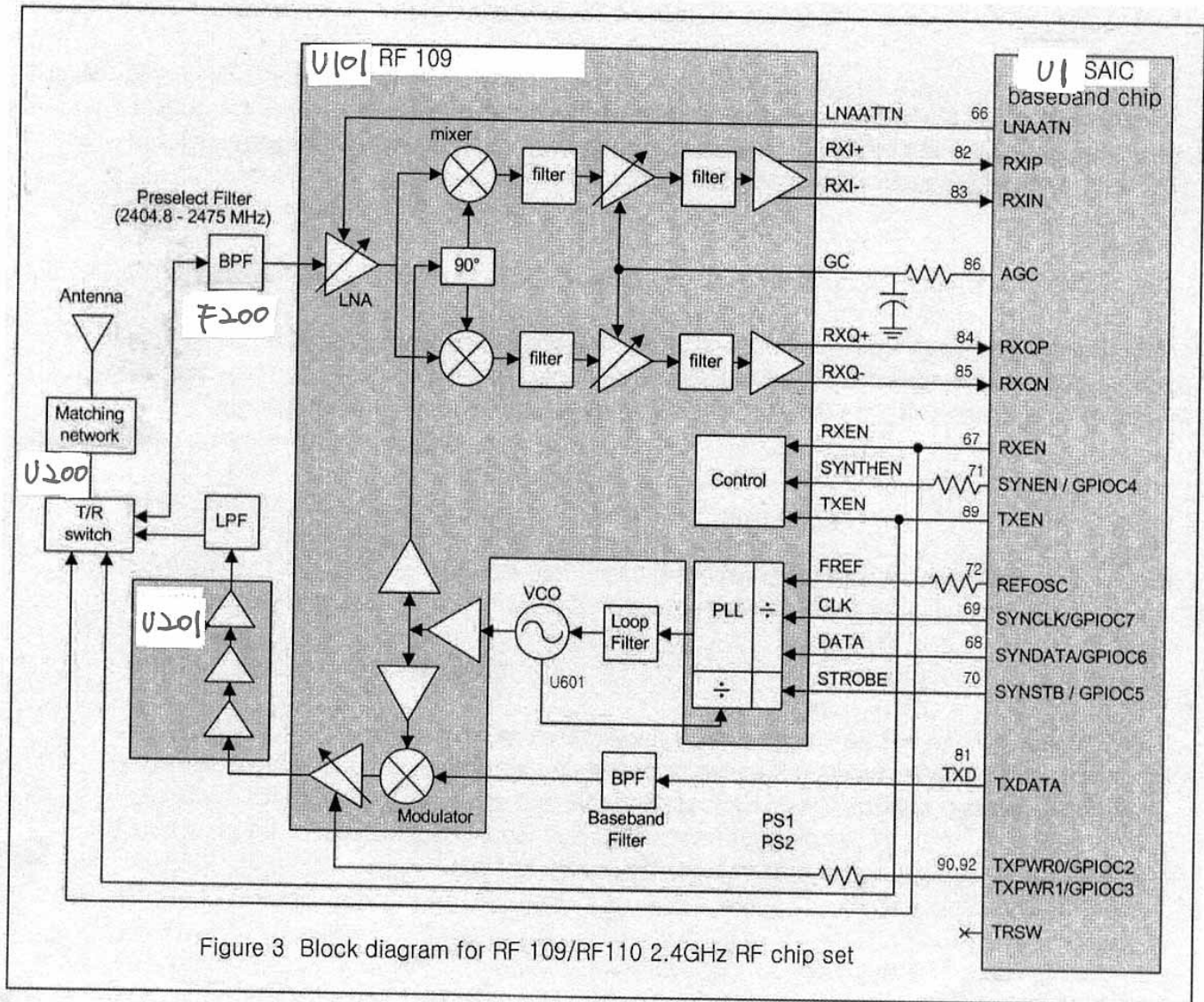


Figure 3 Block diagram for RF 109/RF110 2.4GHz RF chip set

The U101 and U201 are 2.4GHz RF chip set, U1 Baseband chip to form a complete 2.4GHz ISM band DSS cordless telephone.

The U101 is a transceiver IC, and the U201 is a class AB Power amplifier.

- 1.5.1 Transmit path** The baseband digital data input signal is shaped by external B.P.F (baseband filter)
The shaping of the baseband data determines the spectral sharp of the Transmitted RF signal. For the 2.4 GHz telephone system, the typical 3dB cutoff frequency is about 22KHz (highpass) and 820KHz (lowpass).
- The U201 power amplifier (PA) inputs and outputs are differential RF signal. Impedance matching network are between the PA output and the RF lowpass filters.
The U201 output with a phase difference of 180 degrees between the two branches.
The differential output of the U201 are converted to a single ended signal, 50ohm load, using the balun circuit.
The system is automatically selectable High power, Medium power, Low power output modes. Depending on the distance between base station and handset, the system automatically sets the desired power mode.
- 1.5.2 Receive Path** The signal is received at the antenna and passes through the U200. Transmit / Receiver switch and RF bandpass filter.(F200)
The filter should have a 3dB passband range from 2404.8 to 2475MHz.
- The output of the bandpass filter is AC coupled to the LNA (Low Noise Amplifier) of the U101 Pin 11.
The U101 downconverts the RF signal into In phase and Quadrature baseband Signals. The differential I/Q baseband signal are DC coupled to the U1 ASIC Pin 81, 82, 83, and 84 inputs.
- 1.5.3 Transmit / Receive Switch** The transmit and receive function of the radio are enabled by RXEN and TXEN control signals the U1 ASIC.
- 1.5.4 Lo Oscillator** The LO signal oscillator by a programmable PLL frequency synthesizer in the U101 and external 2.4GHz VCO to U601.
- 1.5.5 Antenna Part**