3.3.1 MB1501 Chip (Fujitsu Microelectronics inc.)

The Fujitsu MB1501series chip contains:

- 1.1 GHz two modulus prescaler that can select either 64/65 or 128/129 divide ratio
- Control signal generator
- 16-bit shift register
- 15-bit latch
- 1-bit switch counter
- Phase comparator
- Charge pump
- Crystal oscillator
- 19-bit shift register
- 18-bit latch
- Programmable divider

This chip has major electrical characteristics: the power supply current typ. min 15mA, Vcc +5V, Vp +8V.

3.3.2 TXO225B

The synthesizer uses a 12.8 MHz reference from the TXO225B 12.8 MHz. It provides operating temperature stability of synthesizer ±2.5ppm -30°C to 75°C. The SSB phase noise on 10 kHz is -145 dBc/Hz, the power supply is +3V ±5% and its current is 2 mA.

3.3.3 Passive loop filters

The passive loop filters provide the DC steering voltage for the VCO/Rx &VCO/Tx as well as filtering of spurious signal from the phase detector.

3.3.4 VCO/Tx- Rx

The Clapp circuit configuration is used for high stability oscillation in the VCO/Rx* and VCO/Tx with which the resonator is isolated from the load.

*Rem. VCO Rx is oscillate the high side band frequency's relative to carrier frequency.

3.3.5 Tx/Buffer Amplifier

The Tx/buffer amplifier, MAR7SM, provides isolation VCO/Tx from load .The amplifier specification has the frequency range DC-2 GHz. The gain is 16 dB, the 1 dB output compression is +5.5 dBm, the input no damage is +13 dBm, the NF is 5 dB and DC power at pin 3 is 22 mA, + 3.5V.

3.3.6 Rx/Buffer Amplifier

The Rx/buffer amplifier, MAR8SM, provides isolation VCO/Rx from the load and raises gain to level +13 dBm. This amplifier has the following specification: frequency range DC-2 GHz, the gain is 22 dB, the 1 dB output compression is +12.5 dBm, the input no damage is +13 dBm, the NF is 3.3 dB and DC power at pin 3 is 36 mA, + 7.8V.

3.3.7 Feedback Buffer Amplifier

The feedback buffer amplifier, MAR7SM, provides isolation from the load to the input 8 Fin of the MB1501 chip.

3.4 Power Supplies

The following voltage levels are necessary for major blocks of the BSR100:

- +12.5 Vb for the output power amplifier, the driver and antenna switch feeds.
- +8V for the driver and predriver feeds.
- +5V for the digital block, modulator chip, and active audio filter supply.
- +8 Vs and +5Vs for the synthesizer feed.
- +8 Vr and +5 Vr for the RF, IF amplifiers, and MC 3372D chip feeds.

To provide the noise junction between the electrical feed circuits of the transceiver blocks, and so that the supply voltage is sufficiently clean and stable, the Power Supply contains five LP2951 low-dropout micro power-voltage regulators.

The following voltages come through switch transistors to the cascades of BSR100: +8V, +8 Vv (from the 8 Vv and 8V regulators), and +12.5 Vb (from VB port).

Under the following conditions, BSR operations stops:

- When there is an error in the output voltage from the regulators (bus error), an error signal is sent to the micro-controller and operation stops.
- When the battery output voltage is at a low Vb voltage level, the +8 Vv voltage regulator sends a "dead battery" signal to the micro-controller and operation stops.

In Tx mode, the +8v voltage is sent through switch transistors to the driver and predriver cascades of the transmitter .The +VB voltage through switch transistors is sent to the antenna switch. The voltage +8Vv is sent through switch transistors to VCO\Tx and to the buffer amplifier.

3.5 Micro-Controller

The micro-controller, AT 89C52, is the original member of the MCS@-51 family. The main features of the AT 89C52 are:

- 8-bit CPU optimized for control applications.
- Extensive Boolean processing (single-bit logic) capabilities.
- 64K program memory address space.
- 8K bytes of on-chip Data Memory.
- 256 bytes of on-chip Data RAM.
- 32 bi-directional and individually addressable I/O lines.
- Two 16-bit timer/counters, full duplex.
- UART
- 6-source/5-vector interrupt structure with two priority levels
- On-chip clock oscillator

The micro-controller operates with an external E2PROM. The Gup10™ external computer program is used to change the receiver, transmitting frequency, time out timer, and PTT Delay.

The input serial data (from the laptop/PC) is sent to the micro-controller through the external communication connector. The micro-controller produces Clock,

Data, and Load Enable signals on pins: 9,10, and 11 of the MB1501 chip. It uses the lock detection signal to determine phase comparator output. When level on its port is low, the phase is locked. While the phase difference of Fr and Fp exists, the output level goes high.

The PTT1 external signal is used to configure the Tx/Rx modes. If the PTT1 level is "0," Tx mode is active. When the Lock Detector bus is "0," the micro-controller through ~ 40 msec shows PTT2 = "0," and the transmitter is in Tx mode. Conversely, if the PTT1 level is "1," Rx mode is active. When the Lock Detector bus is "0," the micro-controller shows PTT2 "1," and the transmitter is in Rx mode.

The micro-controller uses the Channel monitor signals for the channel busy determination. It makes signals for the Led indications (see description of self-test LEDs).

4 Software Description

4.1 Function

The BSR Software allows BSR100 to function as a two-way radio in the following modes:

- Rx Mode: receives the RF signal and provides a low frequency Audio Out signal for connection to the external Decoder.
- Tx Mode: triggered by an External PTT signal from the Encoder.

The PTT signal initiates the PLL Synthesizer programming. Data for the frequency programming is saved in the E2PROM.

After the transmitter frequency is entered correctly into the Synthesizer and the PLL is locked, the Synthesizer issues an LD signal. After the Micro detects that the LD is active, it issues a signal PTT2. It then turns the antenna switch to Tx and powers ON the pre-driver and driver of the BSRU to transmit the applied Audio IN signal.

4.2 Programmable Parameters

BSR communicates with the General Utility Program (GUP) and the Automatic Tester with the help of MICRO's UART. UART has been preset in the install module to: 9600 baud; Non Parity; 8-bit data; 1 stop bit.

It is possible to program the following parameter values:

- Transmit frequency
- Receive frequency
- Tx time out (Tx time out is the maximum permitted time of continuous transmission. After this time, PTT2 is deactivated, regardless of external PTT signals).

4.3 Troubleshooting and Symptoms

If any problems appear, the software detects the source and switches off the corresponding block to prevent any damage.

There are 4 inputs and 4 outputs in the Micro to control BSR blocks.

Block	Feedback	Control
RF & IF Amplifiers	8VR sense	SDR

Synthesizer	8VS sense	SDS
VCOs of RX and TX	8VV sense	SDV
Predriver & Driver	8.7VR sense	SDT

For diagnostic and repair purposes, the BSR has a diagnostic mode. The diagnostic mode is disabled by default, but can be activated by tripping P2.7 of the Micro to LOW. Diagnostic mode enables BSR blocks to be analyzed separately, using special PC Software for technicians.

4.3.1 Trouble LEDs

The following problems are indicated by the LEDs listed below:

Trouble	Signal	Indication
Overload	OVL	Two short (200 msec) PTT Led flashes, repeated periodically every 2 seconds.
Predriver/Driver fault	8.7 VR	Three short PTT Led flashes, repeated periodically every 2 seconds.
Tx was interrupted by Tx Time-out timer	-	One short PTT Led flash every 2 seconds.
No PLL Lock	LD	Four short PTT Led flashes, repeated periodically every 2 seconds.
Dead Battery	8 VV Sense	Power LED (continuous red light).

5 Programming Guide

- Self-Test LEDs
- Gup10 Utility Program
- Troubleshooting

5.1 Self-Test LEDs

The Self-Test LEDs detect current mode and any BSR100 transceiver problems (see Table 1).

LED Indicator	Status
LED PTT	
ON (red)	Tx mode
OFF	Rx mode
1 flash	Time out timer
2 flashes	Overload (optional)
3 flashes	Predriver/Driver
4 flashes	PLL
4 flashes	Synthesizer
Power LED	
Green	Normal
Red	Dead Battery
CM LED	
Green	Channel Free
Red	Channel Busy

Flashes red/green	RF/IF Amplifiers

Table 1: Self-Test LEDs

In addition to the signals in Table 1, there is an error-status word in the Gup10 Utility Program.

5.2 Gup10™ Utility Program

Using KP's Gup10 Utility Program, the BSR100 parameter values listed below can be programmed or modified. An RSINT001 adapter connects between BSR 100 and a PC *(see Figure 2)*.

- Transmit frequency (MHz)
- Receiver frequency (MHz)
- Tx time out (0-240 sec.)

Gup10 allows the status of different internal blocks to be checked.

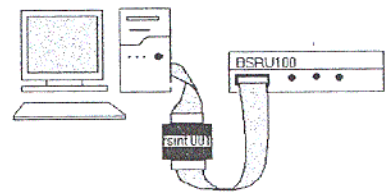


Figure 2: BSR100 to PC Connection Configuration

5.2.1 Operating Instructions

- Connect BSR100 to Gup10 (utility program)
- Load Parameter Values
- Change Parameter Values
- Update Parameter Value Changes
- Confirm Parameter Value Changes
- Activate Self Test

5.2.1.1 Connecting BSR100 to Gup10

1. Connect BSR100 to a PC using the RSINT001 adapter (see Figure 3).

2. Click **Start➢Programs➢KP Utilities➢Gup10.**

The **Gup10** main screen displays, showing the device type, version, and suitable default parameters.

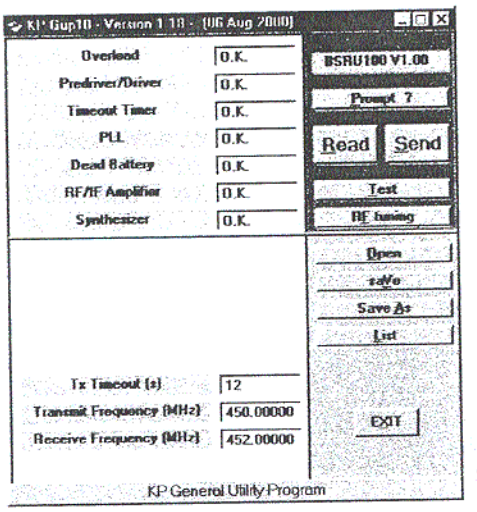


Figure 3: Gup10 Main Screen

5.2.1.2 Loading Parameter Values

Parameter values must be loaded after connecting the Gup10 utility software.

To Load Parameter Values:

1. From the Gup10 main screen, click **Prompt ?** (Alt P).

2. Click **Read** (Alt R). The name of the device type, version, and suitable parameters are displayed. It is also possible to read the status of internal blocks (OK/Fail).

5.2.1.3 Changing Parameter Values

Parameter values can be changed, as follows:

- Type the new parameter value in the designated parameter text box.

5.2.1.4 Updating Parameter Value Changes

1. Click **Send** (Alt S). The **Send Warning** dialog box displays "Are you sure?"

2. Choose one:

   - To update parameter changes, Click **Yes,** or

   - To return to the Gup10 main screen without updating changes, Click **No.**

After sending new parameters, BSR100 activates self test.

5.2.1.5 Confirming Parameter Value Changes

Ensure that any parameter value changes made are updated, as follows:

- From the Gup10 main screen, click **Read** (Alt R). The Gup10 main screen displays the updated parameter values.

5.2.1.6 Continuous Transmission for a Predefined Time (Tx time out)

- To activate continuous transmission for a predefined time (Tx time out), click the RF tuning button (Alt F).

5.3 Troubleshooting

- See Figure 3 for diagnostic results.

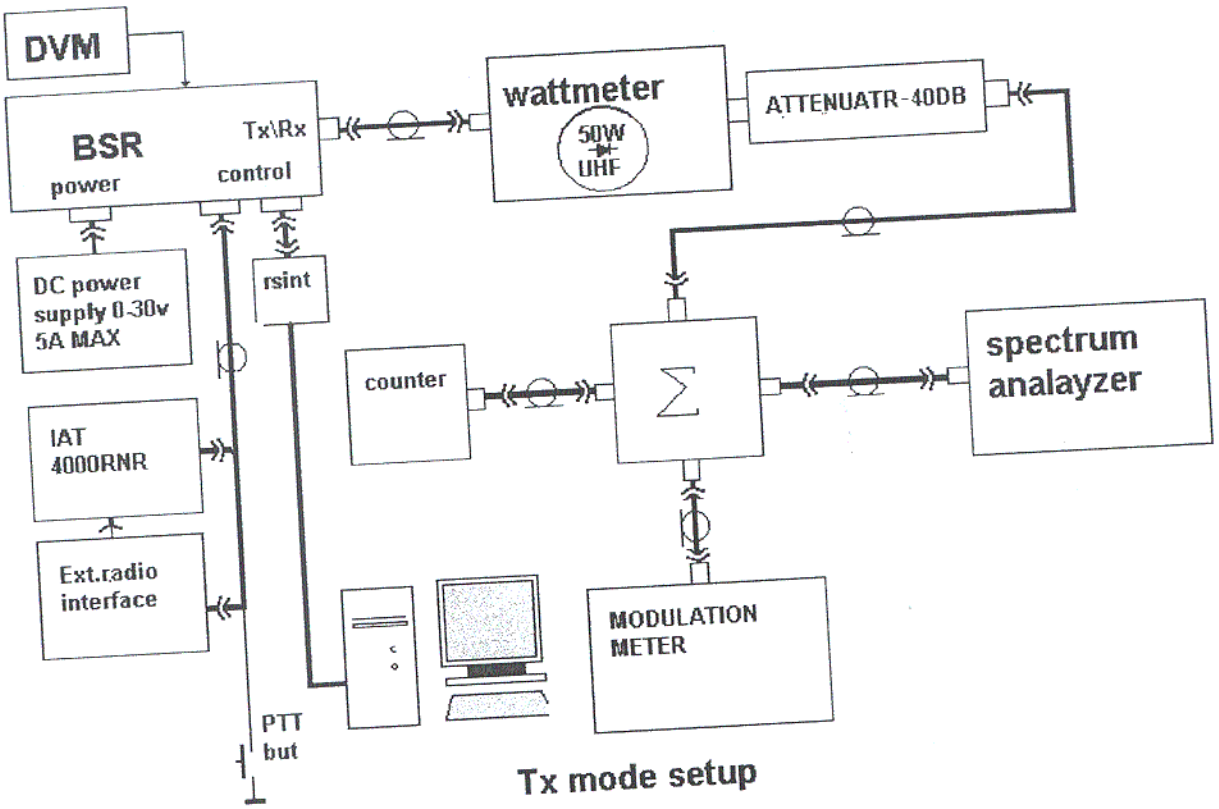
- On-Screen HELP: To view a brief explanation of any BSR100™ parameter, click the required parameter text box. The cursor will appear in the designated text box, and the valid parameter range, with a brief explanation, displays at the bottom of the screen.

6 Manufacturer Testing Setup Diagram

6.1 Measuring and Auxiliary Equipment

To make the necessary calibrations, according to the regulations for BSR100, it is necessary to use the following measuring and auxiliary equipment:

- Spectrum analyzer
- Oscilioscope
- Signal generator
- Sinadder
- Multimeter
- DC power supply 12.5V, 0-10A
- Wattmeter
- Modulation meter
- Assembly cables



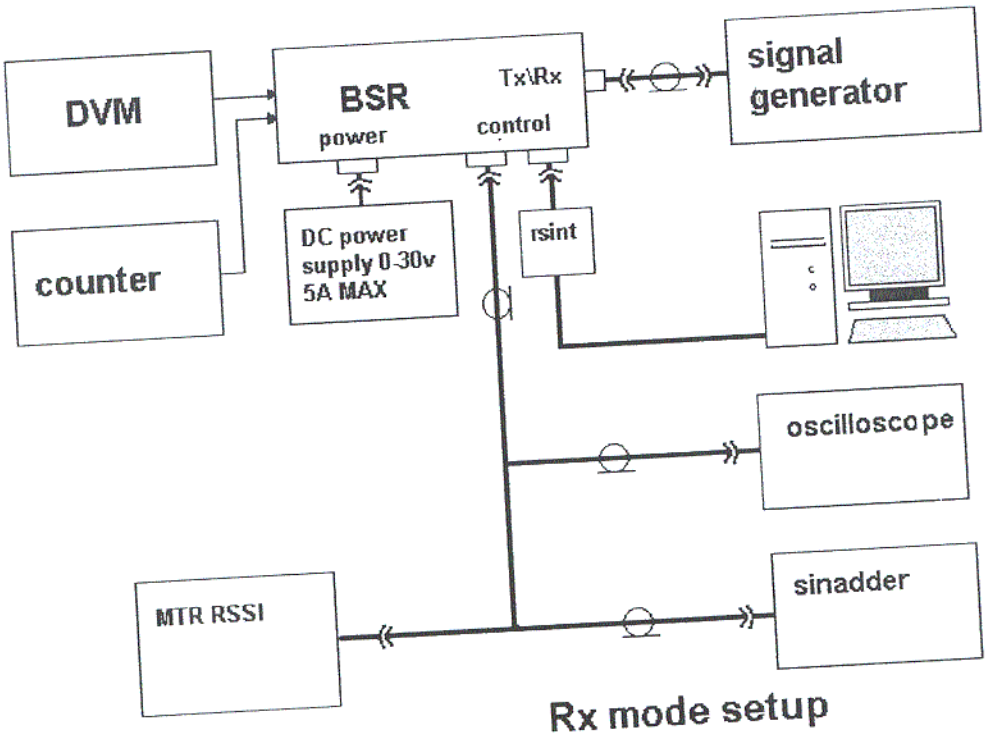


Figure 4: Manufacturing Testing Setup Diagram