Technogram

Affects: No. 11: Servicing the RF2000 Radio Modem

1.0 Issue

Your SAFECOM network components (e.g., RF2000 Radio Modem, SAFECOM Radio Repeater, etc.) should be checked for alignment at least annually, preferably biannually. A SAFECOM Field Engineer can be scheduled to perform this procedure for you on a fee-for-service basis. The SAFECOM Field Engineer will check out and align all of your SAFECOM Repeaters and your RF2000 Radio Modems, and perform classes on:

- Correct Radio Communicator Installation Procedure
- ST1000 Software Central Station Operator Training
- Salesman Training (oriented toward SAFECOM Radio Communicator features, advantages, and benefits)

As an alternative, Bosch Security Systems is providing you with this ***SAFECOM Central Station RF2000 Maintenance Procedure Checklist*** to allow you to contract with a competent, local radio dealer to perform this function.

If you ever experienced an RF2000 Radio Modem failure, you probably found that the RF2000 is not easily serviced by most local radio providers because of its proprietary functions. This Technogram should provide any local radio shop (with qualified RF technicians and equipment) with the information they need to align, diagnose, and correct possible problems with any SAFECOM RF2000 Radio Modem in the field.

The first section is a general description of the SAFECOM RF2000 Radio Modem. The second section is a step-by-step alignment procedure. Each step shows:

- The factory specifications and tolerances for proper operation
- A space for the technician performing this service to enter his actual test findings **before** and **after** re-alignment.

If you choose to have a local radio dealer perform this service, please insist that he run through the entire checklist and fill it out. Then mail the completed checklist to Bosch Security Systems (ATTN: SAFECOM). This checklist enables us to provide you and your local radio dealer with a higher level of service and support.

2.0 General Overview: The RF2000 Radio Modem

The SAFECOM RF2000 Radio Modem transmits and receives digitally encoded messages via the SAFECOM network. The RF2000 is the "head end" or "gateway" to the system. It is the vital link between the SAFECOM SC9001 Computer and the SAFECOM network. The RF2000 translates serial RS232 information sent from the SC9001 Computer into the proprietary message format suitable for radio transmission.

It also translates radio format messages from the units in the field back into RS232 serial data for processing by the SC9001 Computer.

Generally, the area of desired coverage is directly proportional to the number of RF2000s installed (*i.e.*, more RF2000s equal greater area of desired coverage). The RF2000 is located and installed adjacent to the SC9001 base station computer. The RF2000 is directly connected to the SC9001 via a 5-conductor RS232 data line not exceeding 50 ft. (15 m) in total length.

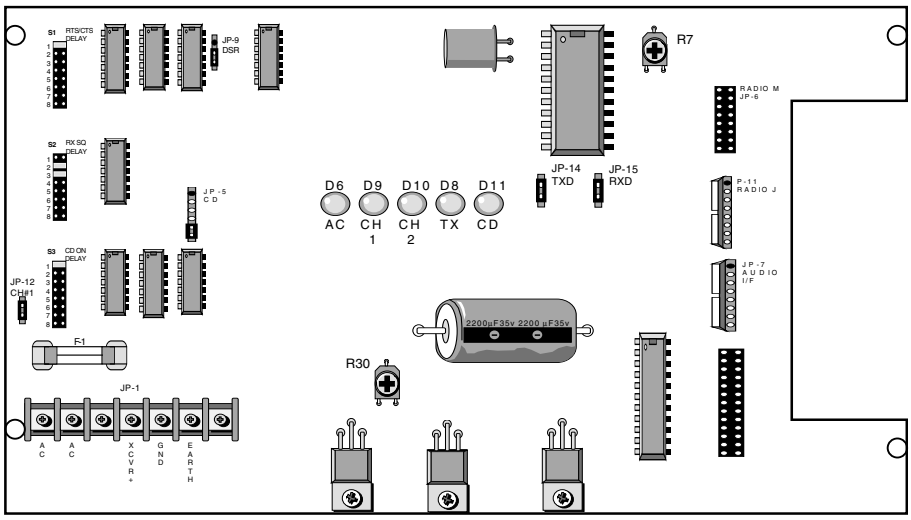

Figure 1: RF2000 Main Circuit Board

3.0 RF2000 Radio Modem Main Circuit Board

Internal to the RF2000 Radio Modem enclosure is the RF2000PWA board. It is secured in the enclosure with four screws and mounted on four 1 in. (25 mm) standoffs. Refer to *Figure 1* (page 1) and *Table 1*.

Item	Name	Description
D6	AC LED Indicator	The AC LED indicator illuminates to indicate that AC is applied to the RF2000 circuit board. The AC POWER LED indicator on the front panel of the RF2000 enclosure provides a duplicate visual indication.
D9	CH1 LED Indicator	The Ch1 LED indicator illuminates to indicate the RF2000 is configured with a jumper to only transmit on one radio frequency and receive on one radio frequency. The ability of the RF2000 to transmit on more than one radio frequency is possible. However, the standard configuration for SAFECOM use is single channel usage. Therefore, the CH1 LED indicator should be illuminated at all times when power is applied.
D10	CH2 LED Indicator	The CH2 LED indicator is not functional at this time. It is provided for future expansion to multiple RF channel configurations.
D8	XMIT LED Indicator	The XMIT LED indicator illuminates when the radio transceiver in the RF2000 is transmitting a SAFECOM RF signal. The TRANSMIT LED indicator on the front panel of the RF2000 enclosure provides a duplicate visual indication.
D11	CD LED Indicator	The Carrier Detect (CD) LED indicator illuminates when the radio transceiver in the RF2000 is receiving RF signals. This indication may or may not be a result of receiving SAFECOM message signals. Excessive noise, other radio users, and interference can cause this LED to illuminate and possibly report a **Channel Busy** indication to the SC9001 Base Station Computer.
F-1	Protection Fuse	The fuse F-1 provides RF2000 circuit protection and fire prevention in the event of a radio transceiver circuit failure (such as a transceiver locked in the Transmit function). Replacement of this fuse must meet the following specifications: 1 AMP, 250 V.
JP6	Radio M	This interface connector is designed to allow the SAFECOM RF2000 to interface with a Motorola radio transceiver. This is used sparingly for international applications. Most SAFECOM systems **do not use** this radio interface.
JP7	Audio Interface	This header is used to allow the operator to install an external speaker. This allows the operator to audibly monitor the radio frequency. This ability can be very useful when it is necessary to identify noisy radio conditions, possible interference, and/or general diagnostics of the SAFECOM system. The pins necessary to utilize this function are identified below: • PINS 1, 2, and 3 are the On/Off contact switches. Placing a shorting jumper across Pins 1 and 2 turns the audio output of JP7 Off. Placing a shorting jumper across Pins 2 and 3 turns the audio of JP7 On. If desired, an SPST switch can be placed across Pins 1 and 2 to allow easy enabling or disabling of this audio output. • PINS 4 and 5 are for connecting JP7 directly to the external speaker (not supplied by Bosch Security Systems). • PINS 6, 7, and 8 are for controlling the audio output level to the external speaker (volume control).
JP8	DCE	Data Communications Equipment - This header is connected to the external DB-25 female connector on the RF2000 enclosure. It is connected via a small 25-conductor ribbon cable. If removed, remember to align the red strip on the ribbon connector with PIN 1 of JP8. This header is the RS232 interface that allows the SC9001 Base Station Computer to communicate and control the RF2000.
JP9	DSR	Data Set Ready - This header is not functional at this time. It is reserved for future expansion. However, a shorting jumper must be installed to allow the RF2000 to operate properly.
JP10	TAMPR	This header is not functional at this time. It is reserved for future expansion. However, a shorting jumper must be installed on both Pins 1 and 2 **and** 3 and 4 to allow the RF2000 to operate properly.
JP11	Radio J	This header is used to allow the RF2000 to interface with a JOHNSON 3470 transceiver, TEKK KS-960 transceiver, or a SAFECOM TR-450 transceiver. This is the main radio interface connector between the RF2000 board and the radio transceiver.

Table 1: RF2000 Main Circuit Board Details

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Item	Name	Description
JP12	CH#1	This header is not functional at this time. It is reserved for future expansion. However, a shorting jumper must be installed to allow the RF2000 to operate properly.
JP 13	LEDs	This header provides an interface to the front mounted panel LED indicators. It provides a duplicate indication of **AC Power, Transmit**, and **Receive** functions.
JP 14	TXD	This header is not functional at this time. It is reserved for future expansion. However, a shorting jumper must be installed to allow the RF2000 to operate properly.
JP15	RXD	This header is not functional at this time. It is reserved for future expansion. However, a shorting jumper must be installed to allow the RF2000 to operate properly.
R7	Modulation	This is a 10 kΩ POT used to set the maximum transmit modulation deviation. This level is set at Bosch Security Systems and should not require adjustment.
R30	Transceiver Power Supply	This is a 500 Ω POT used to set the power supply voltage for the radio transceiver. This level is set at Bosch Security Systems and should not require adjustment.

Table 1 (cont'd.): RF2000 Main Circuit Board Details

4.0 RF 2000 Radio Modem Maintenance Procedure Checklist

IMPORTANT

Note to technician: Please enter all actual readings for Steps 1 through 4 in Table 2 *on page 4.*

This alignment procedure is to be performed by qualified RF technical personnel only. The qualified technician must have the proper equipment necessary to complete all of the following tests before attempting any test on the SAFECOM RF2000 Radio Modem.

Equipment Required

- Radio Service Monitor (IFR Model 1200 or 1500, or equivalent)
- Watt meter (e.g., Bird Type with min. 25 W slug)
- Sinad Meter
- Volt/Ohm Multimeter
- RF Test Jumpers (50 Ω)

4.1 Step 1 - Checking Output Power of the RF2000

Refer to the diagram of the JP-11 Radio Transceiver Interface Connector (*Figure 2*). Using a small wire jumper, preferably with test probe clips, tie one side of the jumper to ground on the main RF2000 board (negative side of capacitor C-5, terminal 6 of terminal block JP-1, or PIN 8 of radio interface connector JP-11). Place an inline watt meter between the RF antenna connector of the RF2000 and the system antenna. Set the watt meter to measure **Fwd Power**. To key the transmitter, placed the other side of your test jumper to PIN 3 of the radio interface connector JP-11. This applies a ground to the PTT (push to talk) input of the radio transceiver. With the radio keyed, observe the watt meter. The output of the RF2000 should be about 2 W. Tolerance is (/-) 0.4 W.

Enter results into *Table 2* on page 4.

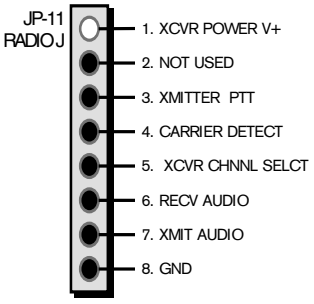

Figure 2: JP-11 Radio Transceiver Interface Connector

IMPORTANT

Do not key the transmitter for periods exceeding 20 seconds. Damage to the transmitter may result. Do not key the transmitter without a proper load installed (antenna, dummy load, or attenuator).

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4.2 Step 2 - Testing the Antenna System

Refer to the diagram of the JP-11 Radio Transceiver Interface Connector (*Figure 2* on page 3). Using a small wire jumper, preferably with test probe clips, tie one side of the jumper to ground on the main RF2000 board (negative side of capacitor C-5, terminal 6 of terminal block JP-1, or PIN 8 of radio interface connector JP-11). Place an inline watt meter between the RF antenna connector of the RF2000 and the system antenna. Set the watt meter to measure **Reverse Power**. To key the transmitter, place the other side of your test jumper to PIN 3 of the radio interface connector JP-11. This applies a ground to the PTT (push to talk) input of the radio transceiver. With the radio keyed, observe the watt meter. The reverse power reading should not be higher than 0.1 W to 0.25 W. Any higher reading may indicate an antenna system problem.

Enter results into *Table 2*.

IMPORTANT

Do not key the transmitter for periods exceeding 20 seconds. Damage to the transmitter may result. Do not key the transmitter without a proper load installed (antenna, dummy load, or attenuator).

4.3 Step 3 - Testing the Transmitter Frequency Error

Refer to the diagram of the JP-11 Radio Transceiver Interface Connector (*Figure 2* on page 3). Using a small wire jumper, preferably with test probe clips, tie one side of the jumper to ground on the main RF2000 board (negative side of capacitor C-5, terminal 6 of terminal block JP-1, or PIN 8 of radio interface connector JP-11). Using a service monitor, spectrum analyzer, or frequency counter, set to monitor the output transmit frequency. To key the transmitter, place the other side of your test jumper to PIN 3 of the radio interface connector JP-11. This applies a ground to the PTT (push to talk) input of the radio transceiver. With the radio keyed, observe the service monitor, spectrum analyzer, or frequency counter. The transmitter frequency should be within (+/-) 500 Hz.

Enter results into *Table 2*.

IMPORTANT

Do not key the transmitter for periods exceeding 20 seconds. Damage to the transmitter may result. Do not key the transmitter without a proper load installed (antenna, dummy load, or attenuator).

4.4 Step 4 - Verifying the Receiver If Frequency

Calculate the first mixer frequency. The first mixer frequency is calculated by taking the receive frequency (in MHz) and subtracting 21.4 (the intermediate frequency).

Example:

460.9875	MHz	Receive Frequency in MHz
- 21.4		Subtract 21.4 (the intermediate frequency)
439.5875	MHz	First mixer Frequency of the Repeater

Tolerance for this measurement is (+/-) 300 Hz. This first mixer frequency can be monitored from the antenna jack on the top of the RF2000.

Enter results into *Table 2*.

If any of the above tests performed do not conform to factory specifications, the bad RF2000 Radio Modem should be sent to Bosch Security Systems for service. All dealers should have a spare RF2000 Radio Modem in the event of a primary failure.

Step	Measurement	Measurement Results	
1	Forward Power		W
2	Reflected Power		W
3	Transmit Freq. Error		Hz
4	Frequency Error		Hz

Table 2: Measurement Results for Steps 1 through 4