

Equipment List

The following table lists the equipment required to perform the 700 MHz Base Station Factory Test Procedure.

| CHECKLIST OF REQUIRED MATERIAL FOR PRELIMINARY TESTING OF THE <i>IP</i> Series BASE STATION | | |
|---|--|-------------------------------------|
| NO. | REQUIRED TOOLS | <input checked="" type="checkbox"/> |
| 1 | Calibrated Base Station System – Consisting of the following components: (1) Appropriate version <i>IP</i> Series Base Station to be tested (2) Desktop or laptop computer configured as an Internet Protocol Network Controller (IPNC) (3) Corresponding <i>IP</i> Series Mobile radio (If an 700 MHz base station, use IP8 mobile radio) (4) Desktop or laptop computer with two (2) available serial ports and Microsoft Windows 95 or greater and <i>IP</i> MobileNet Dial-Up Networking, <i>IP</i> Message software (SLIP2IPMN.exe), and HyperTerminal for base station installed | <input type="checkbox"/> |
| 2 | Comm Test Set (HP 8920A or B) | <input type="checkbox"/> |
| 3 | High Frequency Probe (85024A) | <input type="checkbox"/> |
| 4 | Power Supply for 85024A Probe (HP1122A) | <input type="checkbox"/> |
| 5 | Four (4) Channel Scope (Tektronix TDS 460A) | <input type="checkbox"/> |
| 6 | General Purpose Scope Probe | <input type="checkbox"/> |
| 7 | Digital multi-meter Tektronix Fluke (DMM912 77) | <input type="checkbox"/> |
| 8 | DC power supply with ammeter, 13.8V, 12 amps or more (Astron VS12M or equivalent) | <input type="checkbox"/> |
| 9 | 100-watt dummy load/attenuator (Pasternack PE7021-40 or equivalent) | <input type="checkbox"/> |
| 10 | Four (4) antennas (generic mag mounts) tuned to frequency or transceiver | <input type="checkbox"/> |
| 11 | Serial cable DB9M – DB9F connectors (generic) | <input type="checkbox"/> |
| 12 | Input/Output (I/O) Board (IPMN p/n: 502-80081) | <input type="checkbox"/> |
| 13 | <i>IP</i> Series Base Station power cable specified for use with the specific base station being used | <input type="checkbox"/> |
| 14 | Three (3) serial DB9F-DB9M Null Modem cables | <input type="checkbox"/> |

Programming and Configuring the Base Station



Important! The base station's IP address must be known prior to performing the procedures in this section.

The programming procedure should be performed when it is necessary to upgrade a base station's Firmware or to change the operating parameters to suit client needs.

Viewing the Base Station's Configuration Data

Step 1 At the HyperTerminal window, type in the appropriate password and press **[ENTER]**.

Step 2 Type **?** and press **[ENTER]**. The following example displays in the HyperTerminal window:

```
[From: 172.16.23.1] Host serial = 115200,N,8,1, timeout=200
[From: 172.16.23.1] Terminal serial = 9600,N,8,1, timeout=200
[From: 172.16.23.1] IPNC = 172.16.23.200
[From: 172.16.23.1] RF IP Address = 172.16.23.1
[From: 172.16.23.1] Tunnel Address = 172.16.23.2, Netmask = 255.255.0.0
[From: 172.16.23.1] Host interface = SLIP, no split frames, with status messages
[From: 172.16.23.1] tunnel = 0
[From: 172.16.23.1] Injection = LOW SIDE, 45.0000 MHz
[From: 172.16.23.1] channel spacing = 25000
[From: 172.16.23.1] Reference Frequency = 16.800000 MHz
[From: 172.16.23.1] Channel Tx freq Rx freq Inj freq
[From: 172.16.23.1] Frequency=0, 775.000000 805.000000 760.000000
[From: 172.16.23.1] Channel = 0
[From: 172.16.23.1] Serial number: undefined
[From: 172.16.23.1] TX Power = 0
[From: 172.16.23.1] TX quiet time = 5
[From: 172.16.23.1] Symbol sync time = 10 milliseconds, 0 extra inter-split-frame count
[From: 172.16.23.1] TX tail time = 5
[From: 172.16.23.1] Radio data rate = 32000
[From: 172.16.23.1] Carrier detect delay time = 5 milliseconds
[From: 172.16.23.1] Station ID = ABC123
[From: 172.16.23.1] Station ID time = 10 minutes
[From: 172.16.23.1] Polarity = TX-, RX+
[From: 172.16.23.1] allow crc errors = 0
[From: 172.16.23.1] RSSI step = 25 (=8dBm)
[From: 172.16.23.1] default gateway = 0.0.0.0
[From: 172.16.23.1] Ethernet address = 00:08:ce:00:00:00
[From: 172.16.23.1] Base station number = 27
[From: 172.16.23.1] SNMP interval = 60 seconds
[From: 172.16.23.1] num timeslots = 16
[From: 172.16.23.1] timeslot period = 992ms
[From: 172.16.23.1] timeslots per voice packet = 4
[From: 172.16.23.1] noise = -117dBm, -118dBm, -116dBm
[From: 172.16.23.1] DHCP Relay Agent = disable
[From: 172.16.23.1] 12dB SINAD = -113dBm (85 on RX0)
[From: 172.16.23.1] 12dB SINAD = -108dBm (61 on RX1)
[From: 172.16.23.1] 12dB SINAD = -112dBm (90 on RX2)
[From: 172.16.23.1] 30dB S/N = -106dBm (104 on RX0)
[From: 172.16.23.1] 30dB S/N = -102dBm (73 on RX1)
[From: 172.16.23.1] 30dB S/N = -105dBm (111 on RX2)
[From: 172.16.23.1] 40dB S/N = -90dBm (141 on RX0)
[From: 172.16.23.1] 40dB S/N = -87dBm (11)
[From: 172.16.23.1] 40dB S/N = -89dBm (145 on RX2)
[From: 172.16.23.1] -40dBm = (229 on RX0)
[From: 172.16.23.1] -40dBm = (203 on RX1)
[From: 172.16.23.1] -40dBm = (228 on RX2)
[From: 172.16.23.1] -120dBm = (0)
[From: 172.16.23.1] -110dBm = (85)
[From: 172.16.23.1] -100dBm = (104)
[From: 172.16.23.1] -90dBm = (141)
[From: 172.16.23.1] -80dBm = (229)
[From: 172.16.23.1] -70dBm = (255)
[From: 172.16.23.1] Modem FEC = on
[From: 172.16.23.1] RX in progress message = 1
[From: 172.16.23.1] MTU = 1500
[From: 172.16.23.1] IPNC query period = 0 secs
[From: 172.16.23.1] Symbol sync time = 10 milliseconds, 0 extra inter-split-frame count
[From: 172.16.23.1] 02Sep2004 10:33:06.309 (PST), calibration=357
[From: 172.16.23.1] uptime = 0h:03m:30s
[From: 172.16.23.1] Firmware Rev. 34-01.0.001 x8, Aug 31 2004 - 16:01:44
[From: 172.16.23.1] Test Mode = 0
[From: 172.16.23.1] Temp period = 2s
[From: 172.16.23.1] Temp Maximum = 80C
[From: 172.16.23.1] CRC EEPROM = 3736
[From: 172.16.23.1] diversity speed = 3
[From: 172.16.23.1] receiver = auto
[From: 172.16.23.1] Receiver Hysteresis = 0
```

Adjustment / Alignment Procedures

Make appropriate notations of any items that require attention during this procedure. This information is needed later during the repair process.

Startup

- Step 1** Remove the base station cover placing the screws in a location where they will not be misplaced.
- Step 2** Connect the base station to the appropriate components.
- Step 3** Power up the base station and computer. The power supply ammeter must read 1.2 amps or less with a 13.8 VDC input.

Receiver Injection

- Step 1** Connect the base station to gps antenna and wait until the frequencies of OCXO and VCTCXOs are corrected and the error is below 0.1 ppm. You can check the error by typing gpsstatus.
- Step 2** Using the high frequency prob,at AL7 check the amplitude of the signal. The amplitude of the injection frequency should read approximately 0 dBm \pm 1 dBm.

Receiver

- Step 1** **Using the high frequency probe, monitor the 44.545 MHz second injection frequency at AU4 pin 3, adjust trimmer capacitor (C22) to the center of the oscillator's oscillation range. The amplitude level of pin 3 of AU4 should read between +5 and +10 dBm.**
- Step 2** Inject an on-frequency signal at a level of -80 dBm, modulated with a 1 KHz test tone at ± 5.0 KHz deviation into the receiver under test.
- Step 3** Check the receiver's sensitivity, verifying that the SINAD is 12 dB or better at a maximum level of -119 dBm (-120 is typical).

Diversity Reception

- Step 1** Inject an on-frequency signal at a level equal to Receiver 1 12dB SINAD level, modulated with a 1 KHz test tone at ± 5.0 KHz deviation into Receiver 1.
- Step 2** While monitoring TP1 with the digital multi-meter, adjust RSSI1 low adjust potentiometer (R12) for a reading of 0.750 VDC ± 10 mV.
- Step 3** Increase the amplitude of the signal by 50 dBm.
- Step 4** While monitoring TP1 with the digital multi-meter, adjust RSSI1 high adjust potentiometer (R11) for a reading of 2.75 VDC ± 10 mV.



Adjustments R11 and R12 are interactive adjustments, therefore continue adjustments until the DC voltage at TP1 is 0.750 VDC for the receiver's 12 dB SINAD level and 2.75 VDC for a 50 dBm increase from the receiver's 12 dB SINAD level.

- Step 5** Inject an on-frequency signal at a level equal to Receiver 2 12dB SINAD level, modulated with a 1 KHz test tone at ± 5.0 KHz deviation into Receiver 2.
- Step 6** While monitoring TP2 with the digital multi-meter, adjust RSSI1 low adjust potentiometer (R10) for a reading of 0.750 VDC ± 10 mV.
- Step 7** Increase the amplitude of the signal by 50 dBm.
- Step 8** While monitoring TP2 with the digital multi-meter, adjust RSSI1 high adjust potentiometer (R9) for a reading of 2.75 VDC ± 10 mV.



Adjustments R9 and R10 are interactive adjustments, therefore continue adjustments until the DC voltage at TP2 is 0.750 VDC for the receiver's 12 dB SINAD level and 2.75 VDC for a 50 dBm increase from the receiver's 12 dB SINAD level.

- Step 9** Inject an on-frequency signal at a level equal to Receiver 3 12dB SINAD level, modulated with a 1 KHz test tone at ± 5.0 KHz deviation into Receiver 3.
- Step 10** While monitoring TP3 with the digital multi-meter, adjust RSSI1 low adjust potentiometer (R33) for a reading of 0.750 VDC ± 10 mV.
- Step 11** Increase the amplitude of the signal by 50 dBm.
- Step 12** While monitoring TP3 with the digital multi-meter, adjust RSSI1 high adjust potentiometer (R35) for a reading of 2.75 VDC ± 10 mV.



Adjustments R33 and R35 are interactive adjustments, therefore continue adjustments until the DC voltage at TP3 is 0.750 VDC for the receiver's 12 dB SINAD level and 2.75 VDC for a 50 dBm increase from the receiver's 12 dB SINAD level.

- Step 13** Inject on-frequency signal at a level of -80 dBm, modulated with a 1 KHz test tone at ± 5.0 KHz deviation into Receiver 1.

Step 14 While monitoring the AC voltage at RXMOD1, pin 4 of AU6C adjust audio 1 AC adjustment potentiometer (R72) for 350 mVRMS (± 1 mV).

Step 15 While monitoring the DC voltage at RXMOD1, pin4 of AU6C adjust audio 1 DC adjustment potentiometer (R57) for 2.500 VDC (± 1 mV).



The audio AC and DC adjustments are interactive, therefore continue adjusting ARV1 for 350 mVRMS and ARV2 for 2.500 VDC until further adjustments are no longer required.

Step 16 Inject on-frequency signal at a level of -80 dBm, modulated with a 1 KHz test tone at ± 5.0 KHz deviation into Receiver 2.

Step 17 While monitoring the AC voltage at RXMOD2, pin4 of BU6C adjust audio 1 AC adjustment potentiometer (BRV1) for 350 mVRMS (± 1 mV).

Step 18 While monitoring the DC voltage at RXMOD2, pin4 of BU6C adjust audio 1 DC adjustment potentiometer (BRV2) for 2.500 VDC (± 1 mV).



The audio AC and DC adjustments are interactive, therefore continue adjusting BRV1 for 350 mVRMS and BRV2 for 2.500 VDC until further adjustments are no longer required.

Step 19 Inject on-frequency signal at a level of -80 dBm, modulated with a 1 KHz test tone at ± 5.0 KHz deviation into Receiver 3.

Step 20 While monitoring the AC voltage at RXMOD3, pin4 of CU6C adjust audio 1 AC adjustment potentiometer (CRV1) for 350 mVRMS (± 1 mV).

Step 21 While monitoring the DC voltage at RXMOD3, pin4 of CU6C adjust audio 1 DC adjustment potentiometer (CRV2) for 2.500 VDC (± 1 mV).



The audio AC and DC adjustments are interactive, therefore continue adjusting CRV1 for 350 mVRMS and CRV2 for 2.500 VDC until further adjustments are no longer required.

Step 22 Adjust the carrier detect potentiometer (R74) to illuminate a level of -116 dBm.?

Receive Data

Step 1 Using a calibrated mobile radio, generate uplink data messages using the **X=1400,19** command in the *IPMessage* Utility program.

Step 2 Attach an antenna to one of the base station's receiver ports and verify on the base station monitor screen (HyperTerminal) that the received message data quality are consistently 240 and higher for 1400 character messages. Repeat test for each receiver.

Exciter

Step 1 Using the **X=1400,19** command, generate data messages so the transmit power and frequency can be checked.

Step 2 **Step 3** Connect the base stations' transmit port to the HP communication test set.

Step 4 While transmitting data messages using the **X=1400,19** command, adjust the following:

- RV2 for ± 5 KHz deviation



Transmit output power should be approximately 1mWatt. The REFMOD adjustment needs to be made while the base station is transmitting real data messages to and from a mobile radio. This is most easily done using the ping command to ping the IPNC from a mobile radio. This will cause the base station to repeatedly send data messages and will facilitate the REFMOD adjustment.

Step 5 Connect the base station to the IPNC.

Step 6 Using a calibrated mobile radio operating on the base station's channel, adjust RV1 for consistent data quality readings of 248 (as observed on the mobile radio's attached PC *IPMessage* window). Access the MSDOS prompt and ping using the following command:

```
>;ping 192.168.3.3 -t -l 500 -w 2000
```



This command will ping the IPNC continuously with a 500-character test message. Press **[Ctrl]+C** to stop the ping.

Power Amplifier

Step 1 Connect the base station's transmit port to the communication test set.

Step 2 Using the **X=1400,19** command, generate data messages.

Step 3 Slowly increase the base station output power by turning the power control potentiometer clockwise until the power noted in Step 2.



Do not exceed 40 watts output power, as this will reduce the life of the amplifier module. If the base station uses a power amplifier, output power must be set to achieve power output specified for the specific base station installation.

Step 4 Perform a close visual inspection of the base station paying close attention to manufacturing related problems such as loose screws, solder practices, etc.