for
Manual No. 68P81033C65-O
"BPR 2000" Series Radio Pagers

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

REVISION DETAILS

1. Replace the Model Chart on page ii (EPF-11743) with the attached Model Chart (EPF-11743-A).
2. Correct the last two sentences of paragraph 4.a.(2) on page 3 as follows:
   Resistors R1 and R2 provide dc bias stability for Q1. The amplified signal is then coupled from the collector of Q1 to high conversion module U1 by C8 and an impedance matching network consisting of T1, C9, and L2.

MODEL CHART

MODEL NUMBER (see note below)	DESCRIPTION
A_*_BGB1568B (A/N)	TONE-ALERT, LOW BAND
A_*_BGC1568B (A/N)	TONE-ALERT, LOW BAND
A_*_BGB2568B (A/N)	TONE-AND-VOICE, LOW BAND
A_*_BGC2568B (A/N)	TONE-AND-VOICE, LOW BAND
A_*_BGB3568B (A/N)	SILENT ALERT, LOW BAND
A_*_BGC3568B (A/N)	SILENT ALERT, LOW BAND
A_*_BGB1568B (A/N)	TONE ALERT, HIGHBAND
A_*_BGC1568B (A/N)	TONE ALERT, HIGHBAND
A_*_BGB2568B (A/N)	TONE-AND-VOICE, HIGHBAND
A_*_BGC2568B (A/N)	TONE-AND-VOICE, HIGHBAND
A_*_BGB3568B (A/N)	SILENT ALERT, HIGHBAND
A_*_BGC3568B (A/N)	SILENT ALERT, HIGHBAND

A_*_BGB1568B (A/N)	A_*_BGC1568B (A/N)	A_*_BGB2568B (A/N)	A_*_BGC2568B (A/N)	A_*_BGB3568B (A/N)	A_*_BGC3568B (A/N)	A_*_BGB1568B (A/N)	A_*_BGC1568B (A/N)	A_*_BGB2568B (A/N)	A_*_BGC2568B (A/N)	A_*_BGB3568B (A/N)	A_*_BGC3568B (A/N)	ITEM NO.	DESCRIPTION
A	A	A	A	A	A							KXN6086AA	1ST OSCILLATOR CRYSTAL (33-37MHz)
A	A	A	A	A	A			A	A			KXN6086AB	1ST OSCILLATOR CRYSTAL (37-148MHz)
						X	X	A	A	X	X	KXN6086AC	1ST OSCILLATOR CRYSTAL (148-174MHz)
		X	X					X	X			NHN6313A	HOUSING, COVER AND CLIP KIT
				X	X					X	X	NHN6337A	HOUSING, COVER AND CLIP KIT
X	X					X	X					NHN6338A	HOUSING, COVER AND CLIP KIT
X	X	X	X	X	X	X	X	X	X	X	X	NLN5666A	NAME AND CODE KIT
X	X	X	X	X	X	X	X	X	X	X	X	NLN5672A	SERIAL PLATE KIT
X	X	X	X	X	X	X	X	X	X	X	X	NLN5674A	CODE PLUG (UNPROGRAMMED)
X	X	X	X	X	X	X	X	X	X	X	X	NLN7021A	LABEL KIT
A	A											NRB1931BL	RECEIVER BOARD (33-37MHz)
A	A											NRB1932BL	RECEIVER BOARD (40-45MHz)
A	A											NRB1933BL	RECEIVER BOARD (45-50MHz)
		A	A									NRB1321BL	RECEIVER BOARD (33-37MHz)
		A	A									NRB1322BL	RECEIVER BOARD (40-45MHz)
		A	A									NRB1323BL	RECEIVER BOARD (45-48MHz)
				A	A							NRB1951BL	RECEIVER BOARD (33-37MHz)
				A	A							NRB1952BL	RECEIVER BOARD (40-45MHz)
				A	A							NRB1953BL	RECEIVER BOARD (45-48MHz)
						A	A					NRD1712BN	RECEIVER BOARD (138-148MHz)
						A	A					NRD1713BN	RECEIVER BOARD (148-152MHz)
						A	A					NRD1714BN	RECEIVER BOARD (152-159MHz)
						A	A					NRD1715BN	RECEIVER BOARD (159-167MHz)
						A	A					NRD1716BN	RECEIVER BOARD (167-174MHz)
								A	A			NRD1723BL	RECEIVER BOARD (148-152MHz)
								A	A			NRD1724BL	RECEIVER BOARD (152-159MHz)
								A	A			NRD1725BL	RECEIVER BOARD (159-167MHz)
								A	A			NRD1726BL	RECEIVER BOARD (167-174MHz)
										A	A	NRD1862BN	RECEIVER BOARD (138-148MHz)
										A	A	NRD1863BN	RECEIVER BOARD (148-152MHz)
										A	A	NRD1864BN	RECEIVER BOARD (152-159MHz)
										A	A	NRD1865BN	RECEIVER BOARD (159-167MHz)
										A	A	NRD1866BN	RECEIVER BOARD (167-174MHz)
								A	A			NRD1690BL	RECEIVER BOARD (138-143MHz)
								A	A			NRD1691BL	RECEIVER BOARD (143-148MHz)
A	A	A	A	A	A	A	A	A	A	A	A	NXN6119A	2ND OSCILLATOR CRYSTAL (17.865MHz)
A	A	A	A	A	A	A	A	A	A	A	A	NXN6120A	2ND OSCILLATOR CRYSTAL (17.935MHz)
A	A	A	A	A	A							NXN6137A	2ND OSCILLATOR CRYSTAL (14.54MHz)
A	A	A	A	A	A							NXN6138A	2ND OSCILLATOR CRYSTAL (14.61MHz)

EPF-11743-B

NOTE: MODELS ENDING IN (A) HAVE NLN8278A ALKALINE BATTERY SUPPLIED.
MODELS ENDING IN (N) HAVE NLN7057A NICKEL-CADMIUM BATTERY SUPPLIED.

*THESE TWO DIGITS OF THE MODEL NUMBER INDICATE THE OPERATING FREQUENCY OF THE PAGER.

KEY: X = INCLUDED **A** = ALTERNATE ITEM SUPPLIED, Choice depends on Carrier Frequency

Manual No. 68P81033C65-0
BPR 2000 Series Decimal Digital Radio Pagers
Theory/Maintenance Manual

FMR-1117
Issue- 1

1. GENERAL

The purpose of this manual revision is to supply information concerning the uhf version of the BPR 2000 Series Decimal Digital Radio Pagers. Since most of the circuitry in the uhf models of this pager is the same as that described in the manual for the vhf models, only that information pertinent to the rf circuits is given here. Additional information is available in the uhf service manual (No. 68P81018C70).

2. DESCRIPTION

The primary differences between the uhf and vhf pagers are changes in the rf stage of the receiver circuit. Refer to the uhf service manual's schematic diagram (ITEM REVISIONS CHART) for a list of the new circuit boards used to implement operation in the uhf band. Also, a tripler stage (U8) has been added that works in conjunction with a different first oscillator crystal (KXN6095A) to produce the first i-f frequency at 17.9MHz. All other features and options are the same as in the vhf-band pager.

3. THEORY OF OPERATION

Refer to the schematic diagram in the BPR 2000 uhf service manual (68P81018C70).

a. Antenna and RF Amplifier (UHF Models)

The antenna system for the pager is formed by wire loops L1A and L1B. Matching the antenna impedance to the input of the rf amplifier is provided by inductor L9 and capacitors C1,C2,C3 and C9. Variable capacitor C3 tunes the pager to the center of the operating frequency. The rf signal is coupled through C9 to the input of rf amplifier Q1. Connected from the base of Q1 to ground is protective diode CR1. Due to the input characteristics of Q1, negative static discharge pulses of sufficient amplitude could damage the rf amplifier. The diode, however, becomes forward biased when any sufficiently large negative voltage is present at the base of Q1, and clamps that voltage to ground, preventing damage to the rf amplifier. The rf signal is amplified approximately 6dB by the amplifier.

Neutralization of the rf stage is obtained by feeding a portion of the signal developed across C12, C6 and L2 back to the base of Q1 via the parallel combination of C5 and R1. Resistors R1 and R3 provide dc bias stability for Q1. The amplified signal from the collector of Q1 is passed through coupling capacitor C7 and coil L7, via the tuned circuit consisting of coils L2, L3 and L4. It is then applied to the mixer input of the high conversion module (U1 pin 9). Impedance matching to the mixer is provided by coils L4 and L7. The antenna circuitry, along with the tuned circuits formed by L2, L3 and L4, provides image and spurious response protection.

b. <u>High Conversion Module, U1 and Tripler Module, U8 (UHF Models only)</u>

The amplified rf signal is converted to a lower i-f frequency signal by mixing with the output of the injection tripler (U8). The basic oscillator frequency (f_o) is determined by crystal Y1. Warping inductor L5, along with the first oscillator (part of U1), form a parallel resonant tank circuit tuned to the third harmonic of the basic oscillator frequency. The third harmonic frequency ($3f_o$) at U1 pin 3 is routed to the tripler module (U8) pin 1. The output of the tripler at U8 pin 7 is tuned to three times the input signal, or nine times the basic oscillator frequency, and fine-tuned by trimmer capacitor C13. This injection signal ($9f_o$) is coupled to the input of the mixer (U1 pin 9), via capacitor C15, and then mixed with the amplified incoming signal to provide the first i-f frequency of 17.9MHz.

4. MAINTENANCE

Refer to "Paging Sensitivity Check" page 9 and change step 7 to read:

(7) Reduce the rf signal level out of the FM signal generator to the lowest level that produces an alert tone on three successive trials. This level should be less than 10uV (vhf models) or less than 15uV (uhf models).

Refer to "Receiver Circuit Checks" page 10 and change step 1 to read:

(1) Mixer Injection Voltage Measurements
Refer to the circuit board component layout diagram in the service manual for the location of test points.

(a_1) First Mixer Injection (VHF Models)
Check the first (high) mixer injection voltage with the pager turned on. The rf millivoltmeter connected to TP2 should indicate about 45mV. This indicates that the oscillator and the multiplier circuits are functional.

(a_2) First Mixer Injection (UHF Models)
The high impedance probe used to measure mixer injection in vhf models offers too much capacitance at the uhf frequencies and could load down

the front end rf stages, resulting in inaccurate readings. Therefore, a different test procedure (mixer ΔI) is recommended for checking the first mixer/tripler circuit in uhf models.

Mixer ΔI is a formulated percentage measurement that represents the amount of current change at the mixer's output (U1 pin 7) when the first oscillator is on, then disabled. Mixer ΔI is defined by the following equation:

$$\text{Mixer}\,\Delta I = \frac{V\ off - V\ on}{1 - V\ off} \times 100\%$$

where: V off is the voltage at U1 pin 7 with Y1 disabled (U8 pin 3 grounded)

V on is the voltage at U1 pin 7 with Y1 enabled (U8 pin 3 not grounded)

The difference in voltage (V off - V on) at U1 pin 7 should be approximately 30mV. With a properly functioning mixer/tripler circuit, mixer ΔI should be between 8 and 15%.

b. Check the second (low) mixer injection voltage with the pager turned on. The rf millivoltmeter connected to U2 pin 20 should indicate an oscillator output of about 40mV.

If either or both of the mixer injection voltage measurements cannot be obtained, it indicates that either one or both of the local oscillators in the pager are not working properly. In this case, troubleshoot the oscillator circuits by checking the dc voltages given in the service manual schematic diagram and then checking for a defective component; refer to the Receiver Troubleshooting Chart. If the injection voltages are normal, proceed with the stage gain measurements.