UNCLASSIFIED

TECHNICAL MANUAL

for

GENERAL PURPOSE RECEIVER

MODEL DDR-7A

SYSTEM

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, ONTARIO

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IN-330-S ISSUE DATE: 15 MARCH 1964

NOTICE

THE TECHNICAL MATERIEL CORPORATION
COMMUNICATIONS ENGINEERS
700 FENIMORE ROAD MAMARONECK, N. Y.

Warranty

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes*, fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.
2. That the defect is not the result of damage incurred in shipment from or to the factory.
3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.
4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

Electron tubes* furnished by TMC, but manufactured by others, bear only the warranty given by such other manufacturers. Electron tube warranty claims should be made directly to the manufacturer of such tubes.

TMC's obligation under this warranty is limited to the repair or replacement of defective parts with the exceptions noted above.

At TMC's option any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid. No parts or equipment shall be returned to TMC, unless a return authorization is issued by TMC.

No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

*Electron tubes also include semi-conductor devices.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

PROCEDURE FOR ORDERING REPLACEMENT PARTS

When ordering replacement parts, the following information must be included in the order as applicable:

1. Quantity Required.
2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

THE TECHNICAL MATERIEL CORPORATION
Engineering Services Department
700 Fenimore Road
Mamaroneck, New York

RECORD OF CORRECTIONS MADE

Change No.	Date of Change	Date Entered	Entered By

FOREWORD

TMC's General Purpose Receiver, Model DDR-7A, consists of eight major components as follows:

Qty	Component
2	GPR-92 Communications Receiver
2	TRX-1 Stabilized Crystal Oscillator
1	SBS-1 Sideband Selector
1	AFC-2A Automatic Frequency Control
1	LSP-11 Speaker Panel
1	DCP-2 Power Control Panel

These eight basic units are also included in various TMC receiver systems as well as in the DDR-7A. To satisfy this condition most practically, individual manuals on each unit are written, then combined, as required, to cover any receiver system. The DDR-7A manual is made up of individual manuals as described in Table of Contents, Model DDR-7A.

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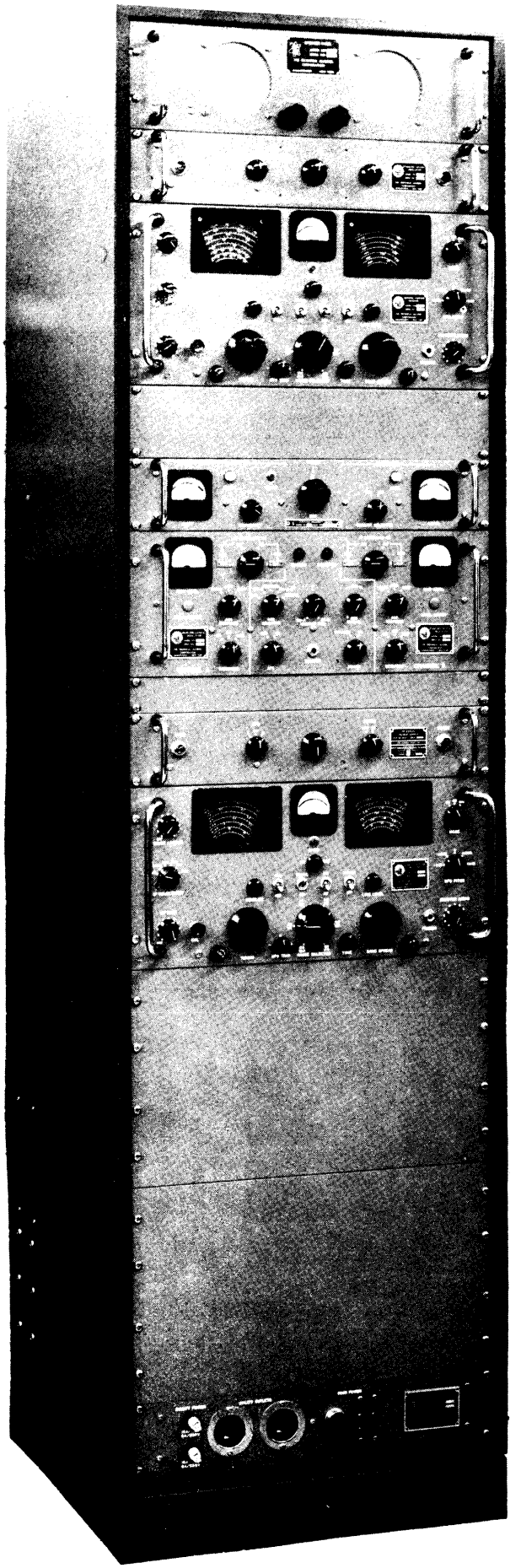

FIGURE 1-1. General Purpose Receiver, Model DDR-7A

SECTION 1

GENERAL DESCRIPTION

1-1 FUNCTION

a. GENERAL - Model DDR-7A General Purpose Receiver (figure 1-1) receives CW, MCW, AM, SSB, ISB, and FSK transmissions. The input frequency range is 0.54 to 32.3 mc in six bands. Two selectable sideband filter widths enable reception of a 3.5 kc or 7.5 kc single sideband or two 3.5 kc or 7.5 kc isolated sidebands. In 7.5 kc isolated sideband reception, each sideband is routed to an audio output channel; each channel may be further divided into two discrete voice channels (making a total of four voice channels) by an external demultiplexer similar to TMC Model RMX-2 in associated receiving equipment, if desired.

Reception of an AM signal is greatly improved by utilizing the SSB tuning facilities inherent in the DDR-7A. Effectively, the intelligence is derived from one sideband alone, discarding the carrier and the other sideband and thus filtering out many adjacent noise frequencies.

An automatic frequency control locks onto the received carrier and is effective for all sideband signals containing a carrier suppressed down to as much as 30db below PEP (peak envelope power). Compensation for a combined transmitter/receiver frequency drift corrects the product detector for sideband signals to produce audio to within 1 cps of the original transmitted tone. In the event of temporary carrier fade, a memory circuit keeps the product detector oscillator stable until the carrier returns.

Sideband reception of AM and MCW also enables the use of the automatic frequency control feature, eliminating the need for constant monitoring due to frequency drift.

In FSK (frequency shift keying) reception, the audio output mark and space center frequency may be adjusted to any frequency required to operate a frequency shift converter.

For SSB and ISB transmitted without a carrier and for FSK transmission, a precision crystal oscillator (TMC Model TRX-1) supplies the necessary stability in HFO and IFO required for reception. For SSB and ISB transmitted with a partial carrier and for MCW and AM, the TRX-1 Oscillator is not required since it can be supplanted by the automatic frequency control feature (TMC Model AFC-2A) which compensates for combined transmitter/receiver frequency drift. In this case, the internal continuously variable HFO may be used, affording a continuous tuning through the entire input frequency range. CW transmission may be received with the Model GPR-92 Receiver alone, or with the TRX-1 added for greater stability, if required.

A variety of AGC systems are available with response speeds for all modes of transmission.

Each of the two audio channel outputs is connected to a speaker and to a low-level output suitable for driving any 600-ohm impedance load requiring up to 1 mw of input power.

b. COMPONENTS - Model GPR-92 Communications Receiver is used to tune in the signal in its r-f stage and convert it to the i-f stage.

Model TRX-1 Stabilized Crystal Oscillator supplies the highly stable HFO and IFO injection frequencies to the GPR-92.

Model SBS-1 Sideband Selector is used to pick one or both sidebands out of the signal in the i-f stage and convert them to audio intelligence. Or it may be used to process the entire AM envelope in the conventional manner through a diode detector if the AM signal is exceptionally weak.

Model AFC-2A Automatic Frequency Control is used in sideband reception with partial carrier and in MCW and AM to compensate for transmitted frequency drift.

An additional GPR-92 Communications Receiver and TRX-1 Crystal Oscillator are included in the rack for quick replacement of these components into the system in an emergency. Existing cabling in the rack permits this change to be made without moving the components.

1-2 PHYSICAL DESCRIPTION

The complete DDR-7A system is contained in a single 18-ga. steel rack equipped with drawer slides for all components except the LSP-11 and DCP-2 units. A full length servicing door on the back provides access to all interconnecting cabling. The rack contains its own forced-air cooling system consisting of two intake blowers mounted on the door. The intake aperture on the door and the exhaust aperture in the top of the rack are equipped with removable air filters. The SBS-1 unit contains its own blower.

TABLE 1-1. ELECTRICAL CHARACTERISTICS, DDR-7A

Frequency Range:	0.54 - 32.3 megacycles in six bands:

Band	Range (mc)
1	0.54 - 1.4
2	1.4 - 3.3
3	3.3 - 5.6
4	5.6 - 9.5
5	9.5 - 17.5
6	17.3 - 32.3

Types of Reception:	AM, SSB, ISB, CW, MCW and FSK*
Input Bandpass Width:	15 kc maximum.

*With appropriate frequency shift converter.

TABLE 1-1. ELECTRICAL CHARACTERISTICS, DDR-7A (Cont'd.)

Frequency Stability:	1 part in 10^6 per day in environmental temperature of 0 to 50° C.
Automatic Frequency Control:	In sideband reception, with carrier suppressed to a maximum of 30 db, AFC compensates for a maximum drift rate of 10 cps/second over a maximum range of ± 1000 cps in the receiver i-f. Audio output is maintained to within 1 cps error.
Audio Output Connections:	-- Two speakers, channels A and B. -- Two 0-1 mw 600 ohm telephone line outputs, channels A and B, 3.5 or 7.5 kc width for each channel (terminal block). -- Headset monitor jack at GPR-92. -- Headset monitor jack at SBS-1 for channel A or B.
Noise Factor and Sensitivity:	6 db or better from 2-30 mcs. A 1-microvolt input signal at 7.5 kc bandwidth will provide at least 15 db signal + noise to noise ratio.
Image Ratio:	Average 80 db.
IF Rejection:	Better than 80 db from 2 to 30 mcs.
Antenna Input Connection:	Type BNC jack for a nominal 70 ohm unbalanced transmission line.
Bandpass Filtering:	a. r-f: Selectable in 15-kc, 7.5-kc, 3-kc, 2-kc, 1-kc and 0.5-kc bandwidths. b. i-f: Selectable in 3.5-kc and 7.5-kc upper and/or lower sidebands.
Carrier Reinsertion (Sideband Reception):	a. AFC adjusted transmitted carrier (for carrier suppressed to a maximum of 30 db). b. Artificial crystal-controlled carrier (for carrier suppressed to below 30 db).

TABLE 1-1. ELECTRICAL CHARACTERISTICS, DDR-7A (Cont'd.)

Unwanted Sideband Rejection:	Undesired sidebands, removed more than 250 cps from the carrier, are attenuated at least 60 db below PEP.
Inband Distortion:	45 db below PEP.
Cross Channel Distortion:	60 db below PEP.
Audio Distortion:	45 db below PEP.
Monitoring:	a. r-f stage, signal level indicator in GPR-92 b. i-f stage, CARRIER LEVEL meter and CARRIER FADE light in AFC-2A. c. i-f stage, CARRIER DRIFT meter and CARRIER DRIFT ALARM light in AFC-2A.

SECTION 2

INSTALLATION

2-1 INTRODUCTION

Each DDR-7A General Purpose Receiver has been tested as a complete system before shipment. Upon shipment it is disassembled and packed into crates. It is only necessary to unpack and reassemble the equipment as outlined in the following paragraphs. Recalibration of the individual modular units is not necessary.

2-2 INITIAL INSPECTION

The complete DDR-7A will arrive disassembled in crates. Inspect each crate and its contents immediately for possible damage. Unpack the equipment carefully. Inspect all packing material for parts which may have been shipped as "loose items". With respect to damage to the equipment for which the carrier is liable, the Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

2-3 RACK INSTALLATION

a. LOCATION - In selecting the receiver location, choose a room with adequate ventilation. A clearance of about two feet at the rear of the rack is needed for opening the door for servicing.

b. INSTALLATION - The four threaded holes on the top side of the rack and the four eyebolts included in the shipment are for lifting the rack with a crane hoist. The base-mounted rack (as shown in figure 1-1) is bolted to its own base. In the shock-mounted model, the four threaded holes in the two channel-stiffeners in the bottom of the rack are for the four shock mounts at the bottom. The two holes in the rear rack wall near the top edge are for the two top shock mounts. To install the shock-mounted model, use the base shock-mount holes as a template for drilling in the floor or mounting base. Assemble the receiver as described in paragraph 2-5

and hoist it onto the four base mounts. Allow the receiver to settle with its own weight. Then install the two top shock mounts, using the two top holes in the rack as a template for drilling holes in the structure.

2-4 MODIFICATION FOR 230V LINE

a. GENERAL - The DDR-7A is factory wired for 115 VAC 50/60 cps, single phase line voltage unless specified otherwise on order. If line voltage is 230 VAC 50/60 cps, single phase, refer to paragraphs 2-4b through 2-4g for modification of DDR-7A wired for 115 VAC.

b. TRX-1 - Relocate jumpers at T103 transformer primary as shown in figure 2-1a. Replace 1-amp fuse cartridge (F101, located on the rear chassis) with a 0.5-amp fuse cartridge (TMC part number FU-102-.5). Perform these changes on both TRX-1 units.

c. GPR-92 - Relocate jumpers at T101 transformer primary as shown in figure 2-1b. Replace 1.5-amp fuse cartridge (F101, located on the rear chassis) with a 0.75-amp fuse cartridge (TMC part number FU-102-.75). Perform these changes on both GPR-92 units.

d. AFC-2A - Relocate jumpers at E5001 and E5002 oven terminal blocks as shown in figure 2-1c.

e. SBS-1 - Relocate jumpers at T7001 and T7003 transformer primaries as shown in figure 2-1d. Replace 6-amp fuse cartridge (F7002, located on the rear chassis) with a 3-amp fuse cartridge (TMC part number FU-102-3).

f. DCP-2 - Remove jumper at TB2 terminal block as shown in figure 2-1e. If receptacle J1 (on rear chassis) is being used, replace 15-amp fuse cartridge (F1, located on rear chassis) with an 8-amp fuse cartridge (TMC part number FU-102-8). If either UTILITY OUTLET receptacle on the DCP-2 front panel is being utilized, replace 15-amp fuse cartridge with an 8-amp fuse cartridge (TMC part number FU-102-8).

g. RACK BLOWERS - Relocate jumpers at rack blower terminal block as shown in figure 2-1f.

2-5 ASSEMBLY OF RECEIVER

Install components as shown in Figure 1-1 and make cable connections as described in figure A in Appendix of this manual. In some cases, some of the smaller parts may be partially assembled in shipment. The LSP-11 and DCP-2 units are shipped installed in the rack. The GPR-92, AFC-2A, TRX-1 and SBS-1 units are slide mounted; the track portion of the slides arrive installed in the rack. Referring to figure 2-2, follow this general procedure for installing slide-mounting units:

(1) Set the component in position on the tracks.
(2) Slide the component on the tracks until the release button catches.
(3) Press the release buttons and push the component into the rack until the release buttons engage in the holes in the equipment.
(4) When all the components have been installed and cabled, press the release buttons and push the component into the rack.

2-6 CONNECTION OF EXTERNAL EQUIPMENT

a. INTRODUCTION - Figure 2-3 illustrates all external equipment connections possible with DDR-7A. The following paragraphs describe each connection.

b. ANTENNA INPUT - The input impedance at J104 antenna jack on the GPR-92 receiver chassis rear has been designed to match an unbalanced 70-ohm transmission line. A mating series BNC, type UG-360/U plug is included in shipment. Leave sufficient length in the transmission line to switch the connection down to the lower GPR-92 receiver when substituting this unit into the systems (see paragraph 2-8).

c. SPEAKER OUTPUT - To use LSP-11 speaker outputs, check to ensure that two conductors run from SBS-1 terminals 2, 4, 12 and 14 (on terminal block E6800) to terminal block TB-101 on LSP-11, as shown in Figure 2-3. Remove jumpers between terminal 4 and 5 and between terminals 14 and 15 on SBS-1 terminal block E6800. If there are no loads connected across terminals 1 and 3 (Channel A, 1 mw, 600 ohm output) or terminals 4 and 6 (Channel B, 1 mw, 600 ohm output) on rack terminal

block TB703 (see paragraph 2-6d), install two 680-ohm, 2W resistors across these terminals (one resistor for each channel). This will provide the proper indication readings on the SBS-1 CH A LINE LEVEL and CH B LINE LEVEL meters when operating the equipment.

d. TELEPHONE LINE OUTPUT - A 0-1 mw, unbalanced, 600-ohm impedance connection is available for channels A and B audio outputs on rack terminal block TB703. This connection is generally suitable for telephone line installations and, in addition may be used to drive any similarly rated load. Terminals 4 through 6 are for CHANNEL A output; terminals 1 through 3 are for CHANNEL B. If either output is not used, install a 680-ohm, 2-watt resistor across the terminals (1 and 3 or 4 and 6).

e. HIGH LEVEL OUTPUT - If it is preferred to drive some other high-level (0-1 watt) 600-ohm loads at Channel A and B outputs rather than the speakers in LSP-11 Speaker Panel, the speakers may be disconnected at SBS-1 E6800 terminal block and replaced by the loads. In this case, the same procedure is followed as for the connection of the speakers.

f. LINE VOLTAGE INPUT - Connect 115 VAC, 50/60 cps, single phase source to DDR-7A at J707 receptacle in the lower left corner of the rack back wall (looking from rear). The mating plug is included in the shipment. (See paragraph 2-4 for modifications for 230V line source.)

2-7 CRYSTAL INSTALLATION

a. CRYSTAL REQUIREMENT - When using the TRX-1 Stabilized Crystal Oscillator in lieu of the internal HFO, IFO and BFO oscillators present in the GPR-92 receiver, it is necessary to insert crystals in the TRX-1 HFO, IFO and BFO circuits. In SSB and ISB with no transmitted carrier, and FSK reception the high stability of the TRX-1 is required, particularly when the DDR-7A is driving associated equip-

ment where constant monitoring is not practical. Since the carrier frequency to be received determines the selection of the TRX-1 HFO crystal frequency, the ten selectable HFO crystals are not supplied with the TRX-1 unless specified on the customer's order. The IFO crystal, 3.5 mc type CR-27/U, required for operation of the TRX-1 with a GPR-92 receiver, is supplied in the DDR-7A shipment. The two BFO crystals, one of which determines the audio output tone in CW reception when the GPR-92 and TRX-1 Units are used alone, are not included in shipment unless specified on the order.

b. CRYSTAL SELECTION AND INSTALLATION -

(1) HFO FOR CW, MCW, AM, SSB AND ISB - The TRX-1 has ten selectable HFO crystal positions. Since each crystal frequency determines the frequency of the carrier* that may be received, this affords ten frequencies that may be tuned in. To determine the HFO crystal frequency, use the following formulas:

If F_{hfo} = HFO crystal frequency (in mc)
If F_c = carrier frequency (in mc)
When F_c falls between 0.54 and 5.6 mc: --
$F_{hfo} = F_c + 0.455$ mc
When F_c falls between 5.6 mc and 32.3 mc: --
$F_{hfo} = F_c + 3.955$ mc

Use type CR-27/U quartz crystals with parallel resonant frequency ratings, mounted in HC-6/U plug-in holders. Crystal assemblies of this type may be ordered from Technical Materiel Corporation. Specify the frequency and that it is to be rated at parallel resonance. Mark the corresponding carrier frequencies to be had by crystal selection on the white blanks surrounding the TRX-1 HFO selector switch. It is advisable that two sets of crystals be installed--one for the upper and one for the lower auxiliary TRX-1.

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*This applies to all modes of reception, including signals with suppressed carriers.

(2) HFO FOR FSK - The TRX-1 HFO crystal frequency for receiving FSK (frequency shift keying) transmission is calculated in a different manner than that for CW, MCW, AM, SSB and ISB. The TRX-1 HFO frequency for FSK ultimately produces a center audio frequency at the SBS-1 output to drive an external frequency shift converter. A frequency shift converter is defined here as a component which translates mark and space audio frequencies into the necessary d-c pulse values to operate standard RTTY (radio teletype) equipment. The "center frequency" (which is theoretical and not transmitted) is the frequency half-way between the space and mark frequencies. In its audio stage, the center frequency is the operating frequency in most frequency shift converters, thereby permitting an adjustment in the converter to different shift values.

TRX-1 HFO crystals for use in the DDR-7A receiver when tuning in FSK are determined on the basis of the r-f center frequency, the frequency shift converter operating center frequency, the maximum total frequency shift to be received and, consequently, which width sideband filter (3.5 or 7.5 kc) can be used in the SBS-1 unit. The first procedure is to determine a selection of two formulas based on F_c (the r-f center frequency): --

Where F_c = transmitted r-f center frequency (in kc)
Where F_{hfo} = HFO crystal frequency (in kc)
Where F_{ac} = Operating audio center frequency of converter (in kc)
When F_c = .54 mc to 5.6 mc
$F_{hfo} = F_c + 455$ kc $+ F_{ac}$ (when 3.5-kc or 7.5-kc LSB filter is used)
$F_{hfo} = F_c + 455$ kc $- F_{ac}$ (when 3.5-kc or 7.5 kc USB filter is used)
When F_c = 5.6 mc to 32.3 mc
$F_{hfo} = F_c + 3{,}955$ kc $+ F_{ac}$ (when 3.5-kc or 7.5-kc LSB filter is used)
$F_{hfo} = F_c + 3{,}955$ kc $- F_{ac}$ (when 3.5-kc or 7.5-kc USB filter is used)

The next procedure is to select which of the four filters to use. Either an upper or lower sideband filter may be used but the sideband width (3.5-kc or 7.5-kc) determines the total frequency shift that the DDR-7A will pass. The sideband width is determined by knowing the value of F_{ac} and the maximum frequency shift to be passed. Figure 2-4 shows the total maximum shift that may be passed by the DDR-7A for any given F_{ac} value for each sideband filter width. To finally determine the

HFO crystal frequency, the optional choice between upper or lower sideband filter must be made. It should be remembered, however, that the frequency shift converter may have a shift limitation also and, if it is smaller than that of the DDR-7A, it will be the determining factor.

EXAMPLE: - It is intended to receive an FSK signal, the transmitted center frequency of which is 15 mc. The total frequency shift (from space to mark) is 850 cps. The frequency shift converter has a maximum frequency shift capacity of 1 kc and a center operating frequency of 3.5 kc. The HFO crystal frequency and sideband filter combination are determined as follows:

Since F_c = 15 mc, F_{hfo} may equal either F_c + 3,955 kc + F_{ac} (with a 3.5- or 7.5-kc LSB filter) or F_c + 3,955 kc - F_{ac} (with a 3.5- or 7.5-kc USB filter). Referring to figure 2-4 it is seen that, with a converter with a center frequency of 3.5 kc, the DDR-7A will pass only a 15 cps maximum total shift when using the 3.5 kc width filter. When using a 7.5 kc width filter, however, a 6.7-kc maximum total shift may be passed. Therefore the filter to use is the 7.5 kc one. An optional choice is now made to use the lower sideband filter and the resulting HFO crystal frequency becomes F_c + 3,955 kc + F_{ac}, or 18.9585 mc, to be used with the 7.5 kc LSB filter. The corresponding white blank on the TRX-1 HFO selector switch is marked "15 MC, 1 kc max Δ, 7.5 KC LSB". This will serve as a reference when tuning in FSK signals in accordance with table 3-10.

(3) BFO - There are two crystal sockets XY111 and XY112 in the TRX-1 BFO circuit, affording a selection of two frequencies with the A and B positions of the BFO switch, respectively. For purposes of tuning the DDR-7A to sideband signals transmitted without carrier, install a 455-kc crystal in socket XY111. This crystal is used for tuning in the r-f stage by using a headset at the GPR-92 audio output. When a CW signal is to be received using the GPR-92 and TRX-1 units only, a BFO crystal is required in crystal socket XY112 to produce an audio

tone when beat with the 455-kc carrier. To determine the BFO crystal frequency, use either of the following formulas: --

When F_{bfo} = BFO crystal frequency (in kc)
When F_t = audio tone (in kc)

$$F_{bfo} = 455 \text{ kc} + F_t \quad \underline{\text{or}}$$
$$F_{bfo} = 455 \text{ kc} - F_t$$

Use type CR-45/U quartz crystals with parallel resonance frequency ratings, mounted in HC-6/U plug-in holders.

2-8 SUBSTITUTION OF AUXILIARY GPR-92 AND TRX-1

The DDR-7A interconnecting cabling is adaptable for a quick connection of the extra GPR-92 Receiver and TRX-1 Crystal Oscillator into the system, in the event of failure of the two units normally connected into the system. Coaxial cable TMC#RG-59/U (see figure 2-5) normally connects to upper GPR-92 Receiver J109 IF OUT jack and runs to J6801 on the SBS-1 unit receptacle. Upon substitution of the lower GPR-92 and TRX-1 units, cable RG-59/U has sufficient slack to enable bringing it down to J109 IF OUT jack on the lower GPR-92 unit. The necessary connections between the lower GPR-92 and TRX-1 units are already in (see lower cable CA-748 in figure A, Appendix). In addition, reroute antenna input lead to J104 jack on lower GPR-92.

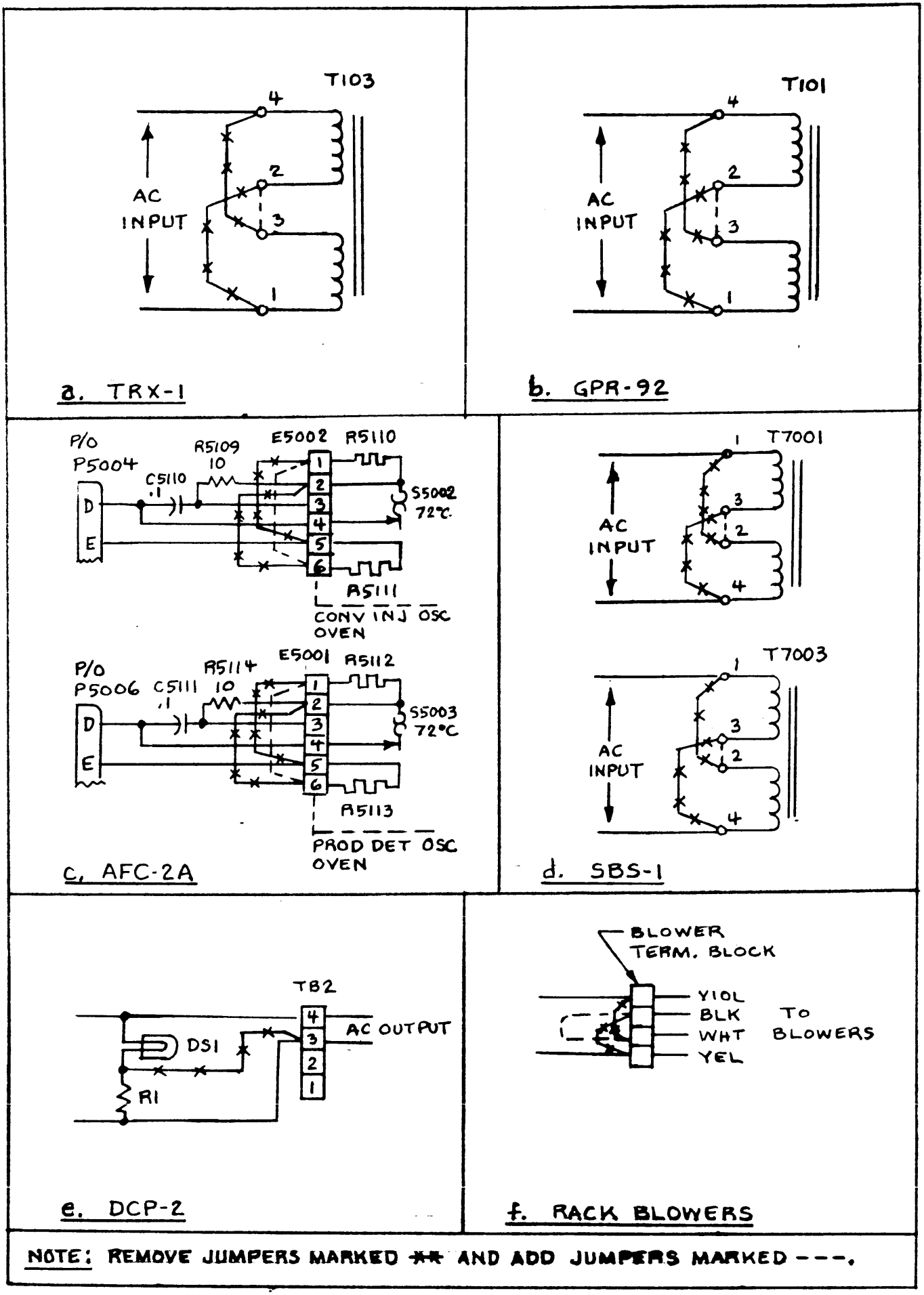
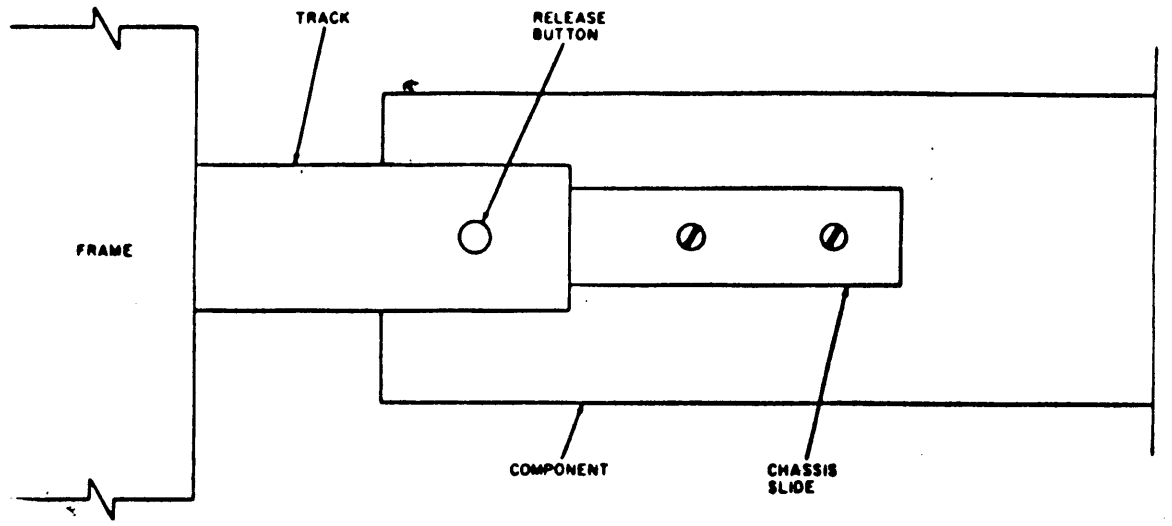
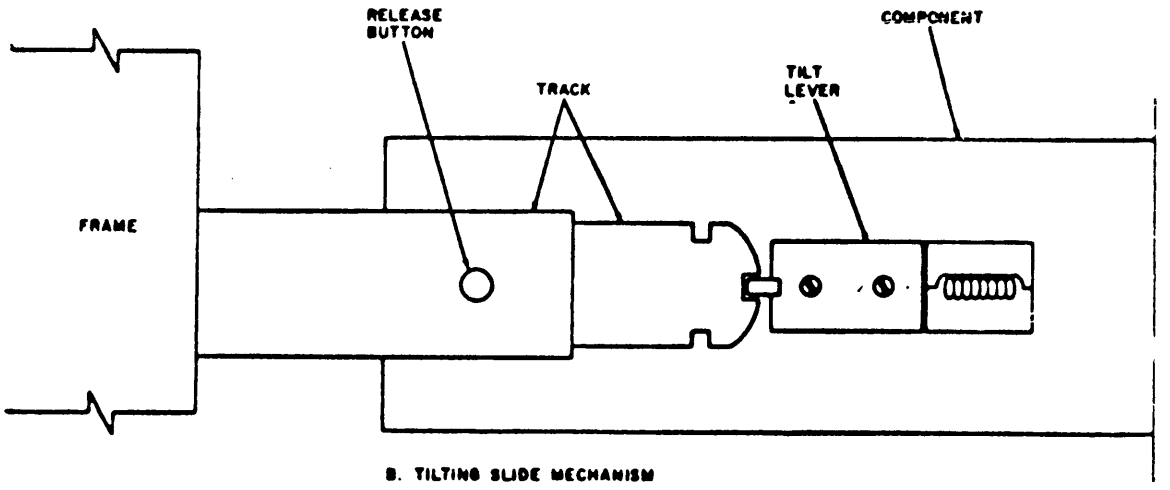


FIGURE 2-1. MODIFICATIONS FOR 230VAC LINE, DDR-7A



A. NON-TILTING SLIDE MECHANISM



B. TILTING SLIDE MECHANISM

FIGURE 2-2. SLIDE-MOUNTING DETAILS

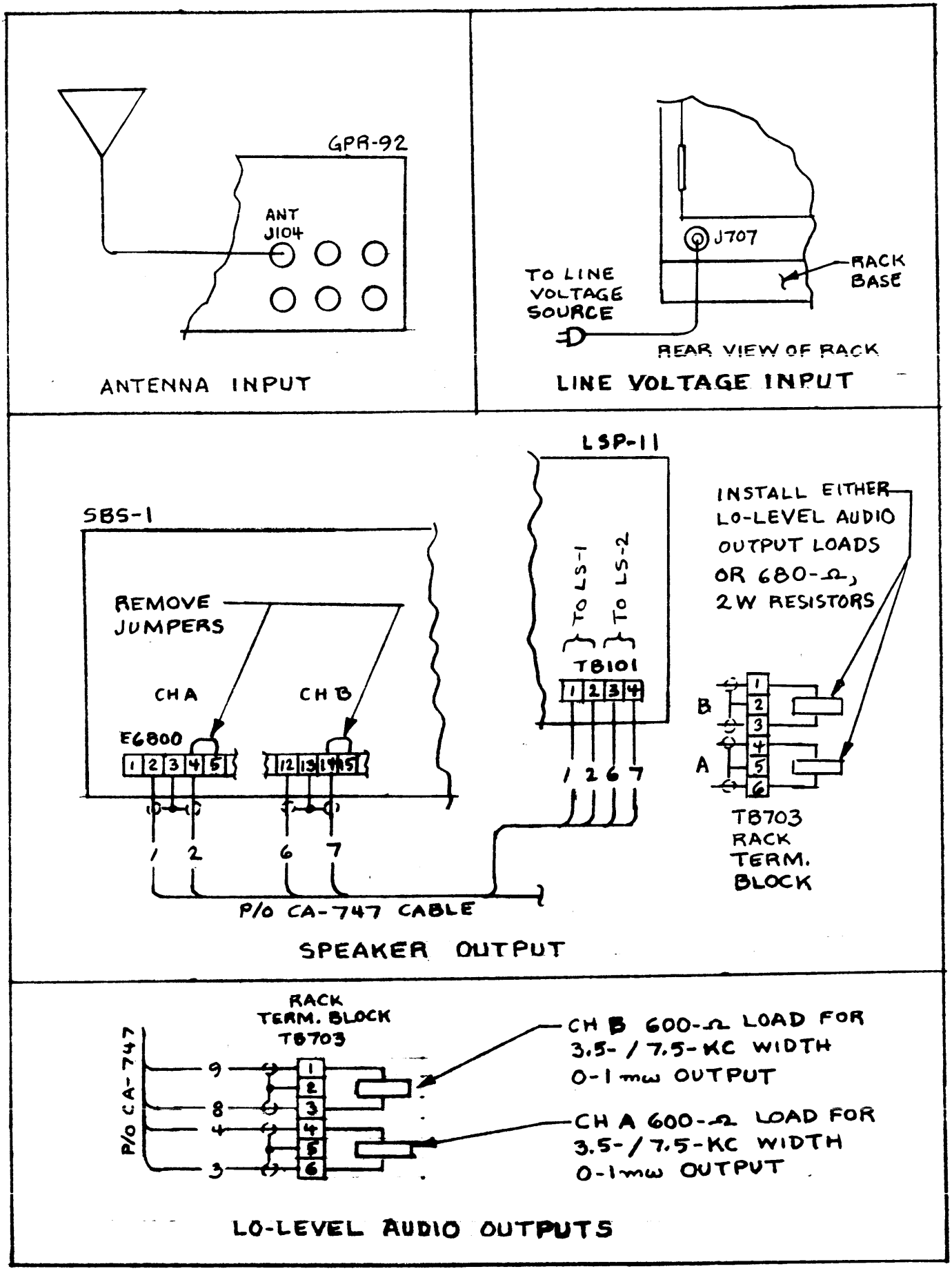


FIGURE 2-3. CONNECTION DIAGRAM, EXTERNAL EQUIPMENT TO DDR-7A

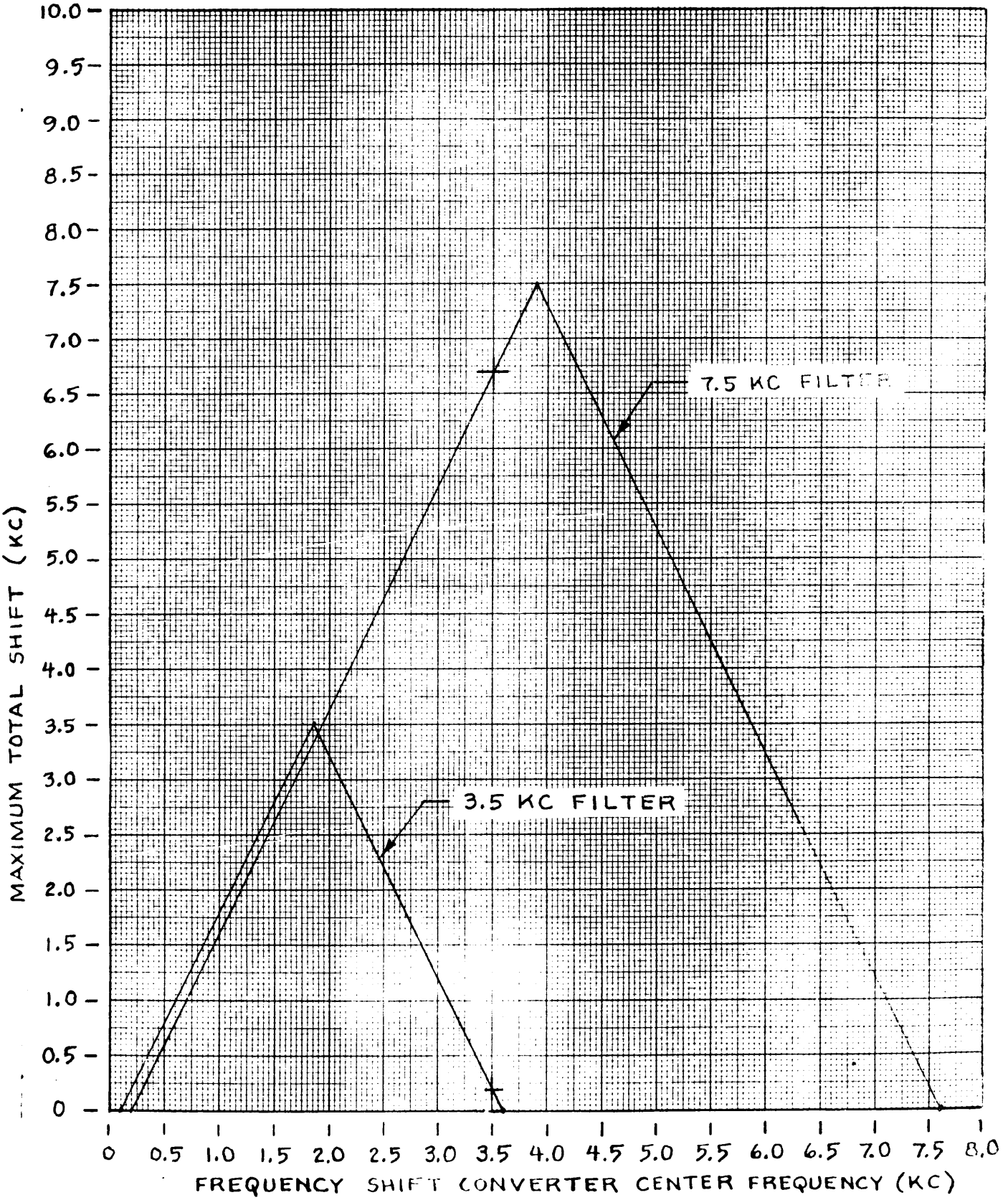
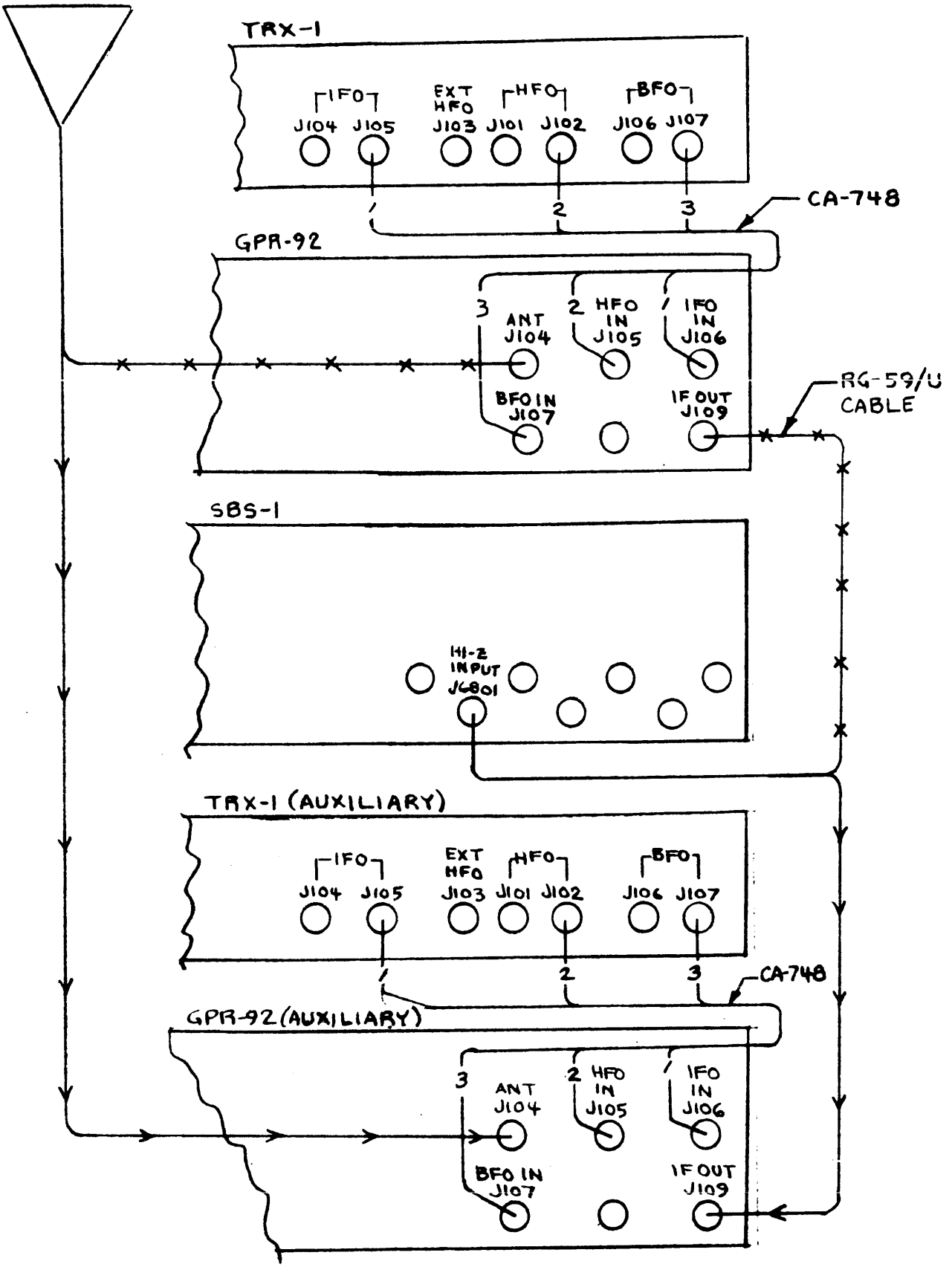


FIGURE 2-4. FSK CONVERTER CENTER FREQUENCY VS. DDR-7A SHIFT CAPABILITIES



CABLE LEGEND:

——— EXISTING CABLING TO REMAIN

—×—×— PORTION OF CABLE TO BE REROUTED

———→ REROUTED CABLE PATH

FIGURE 2-5. CONNECTION DIAGRAM, AUXILIARY GPR-92 AND TRX-1

SECTION 3

OPERATOR'S SECTION

3-1 INTRODUCTION

a. GENERAL - Before tuning up the DDR-7A for the first time, it is advisable that the operator become familiar with the following characteristics and capabilities of the equipment:

1 - Functions of components

2 - Functions of controls

b. FUNCTIONS OF COMPONENTS - The DDR-7A (see figure 3-1) is a receiver system consisting of a Model GPR-92 Communications Receiver, a Model TRX-1 Stabilized Crystal Oscillator, a Model SBS-1 Sideband Selector, a Model AFC-2A Automatic Frequency Control, and two speakers in Model LSP-11 Speaker Panel. The GPR-92 is used to tune in the signal in the r-f stage and convert it into a 455-kc i-f stage. The 455-kc i-f is routed to the SBS-1 unit where the signal is converted into a 250-kc i-f and then routed to the SBS-1 filter section. In sideband reception the filter section attenuates the carrier and one sideband and passes the desired sideband. This output of the filter section is then processed by a product detector and the resulting audio may be routed out of CHANNEL A or CHANNEL B SBS-1 audio outputs. Each channel has a high-level and low-level output. Speakers LS-1 and LS-2 on LSP-11 Speaker Panel are driven by SBS-1 CHANNELS A and B high level outputs, respectively. Terminals 4 through 6 and 1 through 3 on rack terminal block TB703 are connected to SBS-1 CHANNELS A and B low level outputs, respectively--generally used for telephone line connections. The upper sideband may be received on CHANNEL A and the lower sideband on CHANNEL B or vice-versa, as selected by the SBS-1 panel controls. In ISB reception one sideband is routed to each channel.

The TRX-1 Oscillator is used for the required highly stable HFO and IFO for sideband reception in which the carrier is fully suppressed. For this type of signal, an artificial carrier is generated in the SBS-1 250-kc i-f stage and used in the product detector to produce the audio when mixed with the sideband. For sideband signals containing a partial carrier, the carrier is routed through the AFC-2A Automatic Frequency Control where it is processed for frequency drift compensation before it is re-introduced at the SBS-1 product detector. This process allows wide fluctuations in the carrier frequency (from the effects of transmitter and/or receiver) without distortion of the audio from the product detector. It also permits a monitoring for excessive continual frequency drift and compensates for momentary carrier fades which sometimes occur in partial carrier sideband transmission.

AM signals, unless extremely weak, are greatly improved by processing them in the same way as described for sideband signals. By selecting one sideband, adjacent noise frequencies, usually accompanying and distorting the intelligence, can be cut out by the filters. When the AM signal is very weak, the entire modulated envelope, representing the carrier and at least one sideband, is required to utilize all of the transmitted power. In this case the SBS-1 can be detuned by changing the GPR-92 HFO frequency slightly in order to slide the carrier and one sideband through the SBS-1 filter (see Slot Tuning paragraph 3-2 d). The carrier and sideband are then routed to a conventional AM diode detector in the SBS-1 for the production of the audio signal.

For CW and MCW reception where a headset is used for the output, it is usually more convenient to use the GPR-92 alone (with the TRX-1 for greater stability, if required). The TRX-1, however, affords a selection of only ten frequencies whereas, using the GPR-92 alone, with its continuously variable HFO, any frequency in the 0.54 to 32.3 mc range may be tuned in.

In FSK reception the TRX-1 is required for the necessary frequency stability, since the AFC-2A Automatic Frequency Control cannot be used. The GPR-92 is tuned to the center frequency, (half-way between mark and space frequencies) and the TRX-1 HFO crystal frequency is selected to ultimately produce mark and space frequencies in the SBS-1 that will slide through the SBS-1 sideband filters and produce the required audio output frequencies necessary to operate a specific frequency shift converter (see paragraph 2-7 b (2).

c. FUNCTIONS OF CONTROLS - Refer briefly to Operator's Section of each component manual (GPR-92, TRX-1, etc.) for functions of controls. The EXT/INT switch on GPR-92 set to EXT position connects TRX-1 HFO, IFO and BFO outputs into the GPR-92. Setting the switch to INT disconnects the TRX-1 HFO, IFO and BFO outputs and the GPR-92 is then connected to its own internal oscillators. The AFC switch on the SBS-1 connects the AFC-2A unit to the SBS-1 when set to ON and disconnects it in the OFF position. CHANNEL A output controls on the SBS-1 control the audio outputs to LS-1 speaker on LSP-11 Speaker Panel and low level output terminals 4 through 6 on rack terminal block TB703. CHANNEL B controls correspond with speaker LS-2 and terminals 1 through 3. Audio controls on the GPR-92 are ineffective when using the SBS-1 unit, except when monitoring the r-f stage tuning.

3-2 TUNING PROCEDURES

a. TUNING TABLES - Tables 3-1 through 3-10 describe tuning procedures for the ten main modes of reception available with the DDR-7A. As the operator becomes more familiar with the DDR-7A's capabilities it will become evident that there are many other modes of transmission and reception also available but not so frequently used. The tables serve as a guide to receiving the more common types of transmission. The SBS-1 Sideband Selector unit has two audio channel outputs (A and B); either one or both channel outputs may be used, as desired, for channeling intelligence from each mode of transmission. For purposes of simplification,

Tables 3-1 through 3-10 describe procedure in terms of using one specific channel.

b. BANDSPREAD - Bandspread of the r-f stage is accomplished with the GPR-92 BANDSPREAD knob and movable dial. This control acts as a vernier adjustment for the GPR-92 TUNING control. Calibration markings on the BANDSPREAD dial are set up in the following six amateur bands:

Band (meters)	Frequency Range (mc)
10-11	26.8 - 30.0
15	20.5 - 21.8
20	13.9 - 14.5
40	6.85 - 7.40
80	3.45 - 4.10
160	1.80 - 2.00

Although the calibration markings are presented for convenience in tuning in the amateur bands, the BANDSPREAD control may be used over the entire range of the receiver.

Example 1: To tune in an amateur frequency of 27.1 megacycles:

(1) Set BANDSPREAD control to "100" on BANDSPREAD LOG scale.

(2) Set TUNING control to "10-11M" mark on TUNING LOG scale.

(3) Bring BANDSPREAD reading down to "27.1" on 10-11M scale.

Example 2: To tune in a frequency of 17 megacycles:

(1) Set BANDSPREAD control to "100" on BANDSPREAD LOG scale.

(2) Set TUNING control to "17.5 mc"* on TUNING 9.4-17.8 scale.

(3) Using headset as a monitor, slowly decrease BANDSPREAD reading to area around "50" on LOG scale for best reception.

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*By referring to the amateur band calibrations on the BANDSPREAD dial, it is seen that 17 mc falls between the 20-meter (13.9-14.5 mc) and 15-meter (20.5-21.8 mc) bands. Since the 20-meter adjustment gives an 0.6-mc adjustment and the 15-meter gives a 1.3 mc adjustment, by interpolation, the BANDSPREAD control will give approximately 0.9 mc of adjustment in the 17-mc area. Therefore, placing the TUNING dial at 17.45 (or 17.5) and the BANDSPREAD at the high end of the range should place 17 mc approximately in the middle of the total BANDSPREAD adjustment.

Once a station has been tuned in, the operator may record TUNING and BAND-SPREAD LOG scale settings for future tuning to that frequency.

c. SLOT TUNING METHOD - Tables 3-1 through 3-10 spell out specific settings of DDR-7A tuning controls to bring in the common types of transmission. However, in order to familiarize the operator with the flexible tuning features of the DDR-7A and the resulting capability of multiple simultaneous reception from more than one type of transmission, DDR-7A tuning theory is reduced to a simple analogy, referred to here as "slot tuning".

Figure 3-2 is a series of diagrams illustrating the "slot tuning" or relative positioning of GPR-92 and SBS-1 pass-bands in order to receive the common types of transmission with a high degree of selectivity. In these diagrams, the GPR-92 and SBS-1 units are represented by movable slots and their positions are shown in relation to the stationary frequency spectrum of the transmitted signal.

In the "slot tuning" analogy, tuning a DDR-7A receiver system may be interpreted as follows:

(1) The GPR "slot" is one of variable length, adjusted by the GPR IF SELECTIVITY switch. When the switch is set in the 15-kc, 7.5-kc, 3-kc, 2-kc, 1-kc and .5-kc positions, the slot is adjusted to the corresponding lengths.

(2) The GPR "slot" is "moved" up and down the stationary transmitted frequency spectrum by increasing and decreasing, respectively, the GPR TUNING and BANDSPREAD frequency settings.

(3) The SBS lower sideband "slot" comes in two lengths, 3.5 and 7.5 kc, selected by the SBS IF BANDWIDTH KC switches for Channels A or B output. The upper sideband 3.5-kc and 7.5-kc "slots" are similarly selected.

(4) The SBS sideband "slots" are positioned along the stationary transmitted frequency spectrum to pass the sidebands and reject the carrier frequency (F_c) by setting the TRX-1 HFO output at F_c+455 kc (when F_c falls within 0.54- to 5.6-mc range) or at F_c+3,955 kc (when F_c falls within 5.6- to 32.3-mc range). When the TRX-1 is not used and GPR-92 internal oscillators are used, tuning the GPR-92 to F_c also positions the SBS "slot" to pick up a sideband.

(5) The SBS sideband "slot" (either upper sideband or lower) is "moved" up the stationary transmitted frequency spectrum by increasing the TRX-1 HFO output frequency from the point set in (4). The "slot" is moved down the spectrum by decreasing the TRX-1 HFO output frequency. Each change in the TRX-1 HFO frequency is directly reflected by the same amount of change in the SBS slot position. (Example: A 500-cps increase in the TRX-1 HFO moves the SBS slot 500 cps up the transmitted frequency spectrum.)

(6) With the TRX-1 Oscillator switched out of the system, de-tuning the GPR-92 from F_c also moves the SBS "slot". This method is not used, however, since there are disadvantages to de-tuning the GPR-92.

(7) The AFC "slot", which is approximately 50 cps long, may be considered attached to the SBS "slot" and moves with it. When the SBS slot is positioned to pass a sideband the AFC slot is automatically positioned in the area of the spectrum containing the carrier (F_c).

(8) After the SBS "slot" has been positioned to pick up a sideband, the AFC "slot", since it is only 50 cps long, needs a fine adjustment in order to pick up the carrier (F_c). This is done with the AFC-2A TUNING KCS knob which provides an adjustment of 3kc in either direction from "0". However, moving the AFC "slot" also moves the SBS slot in the same direction. Turning the AFC-2A TUNING KCS knob towards plus (+) moves the AFC and SBS slots downward; turning the knob towards minus (-) moves the slots upward.

It will be noted that, in all arrangements shown in figure 3-2, the GPR "slot" is centered directly on the carrier (F_c), even though the carrier is often transmitted at a partially suppressed level or there is no carrier at all.

d. SLOT TUNING VS. RECEPTION MODE - Figure 3-2A shows slot positioning for picking up a lower sideband of 3-kc width transmitted with a partial carrier. With partial carrier transmissions, the TRX-1 Oscillator is not used since the AFC-2A unit compensates for frequency drift in the receiver as well as in the transmitted signal. In addition, using the GPR-92 internal HFO in place of the TRX-1 HFO gives the DDR-7A a continuous tuning feature through the entire input range of

frequencies. In figure 3-2A, the GPR-92 is tuned to F_c, centering the GPR slot on F_c. This automatically positions the SBS 3.5 L slot to pass the lower sideband only and the AFC slot to pick up the carrier (F_c). Figure 3-2B shows the corresponding arrangement for upper sideband reception. Figure 3-2C shows the arrangement for receiving a 6-kc width lower sideband with partial carrier. The GPR slot is again centered on F_c and the SBS lower sideband slot is selected at a 7.5-kc length. The corresponding diagram for 6-kc width upper sideband reception is shown in figure 3-2D. Figure 3-2E shows the arrangement for ISB reception of two 3-kc channels of separate intelligence transmitted with partial carrier. In this diagram, each sideband goes to one of the two channels. Figure 3-2F shows the corresponding arrangement for ISB reception of two 6-kc bands. Figure 3-2G shows the slot arrangement for receiving a 3-kc lower sideband signal transmitted without a carrier. Since there is no carrier, the AFC-2A unit cannot be used and the added frequency stability of the TRX-1 is now required. The GPR-92 is tuned to F_c, centering the GPR on F_c. The TRX-1 HFC is set for F_c +455 kc (when F_c=0.54 to 5.6 mc) or F_c +3,955 kc (when F_c=5.6 to 32.3 mc). This positions the SBS slot to pass the sideband only. Corresponding slot positions for upper sideband transmitted without carrier is shown in figure 3-2H. Figures 3-2I and 3-2J show conditions for receiving the wider sideband signals without carrier. Figure 3-2K shows tuning methods for receiving a 6-kc wide ISB signal transmitted without carrier. Figure 3-2L is the corresponding arrangement for receiving a 12-kc wide ISB transmission without carrier. Figure 3-2M shows how the sideband tuning feature in the DDR-7A may be utilized to pick up the intelligence from the lower sideband of a 6-kc wide AM signal. Since the carrier is present, the AFC-2A unit may be used and the TRX-1 is not required. The GPR slot is centered on F_c which centers the

SBS slot to pick up the lower sideband and the AFC slot to pick up the carrier. Figure 3-2N shows the slot pattern for obtaining intelligence from the upper sideband of the same signal. Figures 3-2(O) and 3-2P show arrangements for wide-band AM transmission. Figures 3-2Q and 3-2R show slot positions when a narrow-band AM transmission is processed in the conventional manner through a diode detector in the SBS-1 unit. One sideband and carrier is routed to the detector. To do this, the SBS slot must be moved over to include the carrier. Since the SBS slot movement moves the AFC slot away from F_c, the AFC-2A unit cannot be used; however the AFC feature is not required since the carrier-to-sideband relationship remains the same through the diode detector. The AFC slot is moved by means of the AFC-2A TUNING/KCS knob, thereby moving the SBS slot with it. This method is used to eliminate the need for changing the TRX-1 HFO crystal value in order to move the SBS slot. This tuning method is only used when the transmitted AM signal is so weak that the full power present in the carrier must be utilized. Figures 3-2S and 3-2T are the corresponding patterns for weak wide-band AM transmission. Figure 3-2U illustrates slot appearance when the GPR is used alone to pick up a CW signal, using the headset at GPR as the output. The GPR slot is adjusted down to a 0.5-kc length to filter out adjacent frequencies. With this arrangement the pitch of the audio tone may be changed by means of the GPR BFO PITCH knob. Figure 3-2V shows the conditions when a higher frequency stability is desired and the TRX-1 is also used. The GPR BFO PITCH control is now inoperative; the audio tone depends on the BFO crystal installed in the TRX-1 (see paragraph 2-7b(3)). Figure 3-2W adds in the SBS unit for receiving the CW transmission if it is desired to take the output from the SBS. The SBS slot must now be moved over by adjustment of the TRX-1 HFO to pass the carrier (F_c). For this illustration, the 3.5 L slot is used and moved up by 1 kc by increasing the TRX-1 HFO by 1 kc. The carrier is routed through the SBS product detector where, in its 250 kc i-f stage, it now

appears as 249 kc. Since the product detector injection frequency is 250 kc, a 1 kc audio tone is produced. If a 2-kc or 3-kc tone is preferred, the TRX-1 HFO may be set 2 or 3 kc higher, respectively. Figure 3-2X shows the appearance of the GPR slot when the GPR is used alone to pick up MCW transmission using the GPR headset for output. In this case, both sideband tones and carrier are picked up and processed through the GPR AM diode detector by setting the GPR MODE switch to AM. The audio tone produced is the modulating tone transmitted. This tone may not be altered by de-tuning the GPR BANDSPREAD control. Figure 3-2Y shows the conditions present when the TRX-1 is switched into the circuit for greater stability. Setting the TRX-1 HFO frequency to that shown in the figure will produce the original modulating tone. Changing the TRX-1 HFO frequency will not change the tone. Figure 3-2Z adds the SBS into the system when it is required to use the SBS output in MCW reception. The intelligence is contained in either sideband tone, F_c-1 kc or F_c+1 kc; as a result the SBS slot may be positioned as for sideband reception and one tone may be picked up. Figure 3-2Z illustrates the lower sideband tone, F_c-1 kc. The AFC may now be used to compensate for transmitted carrier drift. Figure 3-2AA shows the arrangement for picking up the upper sideband tone. It can be seen, however, that tone adjustment by changing the TRX-1 HFO is not possible without losing the AFC feature, since moving the SBS slot also moves the AFC slot. Figure 3-2AB shows the slot arrangement for receiving an FSK signal with an 850 cps shift and the TRX-1 HFO tuned to produce a 2,550 cps center frequency at the audio output. Slots may be arranged for different shifts and different audio center frequencies, if necessary. The GPR and SBS slots are adjusted to pass these frequencies and also to produce a certain center frequency by frequency translation as described in paragraph 2-7b(3).

TABLE 3-1. TUNE-UP PROCEDURE FOR CW (USING GPR-92 ALONE)

STEP	MODULE	OPERATION
1	SBS-1	POWER switch to STANDBY.
2	DCP-2	MAIN POWER switch to ON. MAIN POWER lamp will light. TRX-1 OVEN lamp and SBS-1 STANDBY lamp will light. Rack blower will start.
3	GPR-92	Preliminary Settings: - MONITOR AUDIO knob fully CCW. LINE LEVEL knob to mid-position. RF GAIN knob fully CW. TUNING and BANDSPREAD dials will light up. ANT TUNE knob to vertical position. SEND/RECEIVE switch to RECEIVE. INT/EXT switch to INT. NOISE LIMITER knob to OFF. LIMITER switch to OFF. SQUELCH knob fully CCW. AVC/MANUAL switch to MANUAL.
4	GPR-92	Coarse Tuning: - BFO PITCH knob to +1.5 KC. MODE switch to CW. RANGE SELECTOR switch for frequency to be received. IF SELECTIVITY switch to 15 KC. HFO TRIM knob to 0. TUNING and BAND-SPREAD knobs for frequency to be received.
5	GPR-92	Fine Tuning: - Insert headset at PHONES jack. Adjust LINE LEVEL and MONITOR AUDIO knobs for usable signal level. Readjust BANDSPREAD knob to obtain desired signal. Hold down RF/AF button and adjust ANT TUNE knob for peak reading on meter. Release button. Set IF SELECTIVITY switch for cleanest tone at headset. Readjust MONITOR AUDIO knob for desirable volume and BFO PITCH knob for best listening tone.

TABLE 3-2. TUNE-UP PROCEDURE FOR CW (USING GPR-92 AND TRX-1)

STEP	MODULE	OPERATION
1	SBS-1	POWER switch to STANDBY.
2	DCP-2	MAIN POWER switch to ON. MAIN POWER lamp will light. TRX-1 OVEN lamp and SBS-1 STANDBY lamp will light. Rack blower will start.
3	TRX-1	POWER switch to STANDBY. Allow 30 minutes for oven stabilization before proceeding with Step 6.
4	GPR-92	Preliminary Settings: - MONITOR AUDIO knob fully CCW. LINE LEVEL knob to mid-position. RF GAIN knob fully CW. TUNING and BANDSPREAD dials will light up. ANT TUNE knob to vertical position. SEND/RECEIVE switch to RECEIVE. INT/EXT switch to EXT. NOISE LIMITER knob to OFF. LIMITER switch to OFF. SQUELCH knob fully CCW. AVC/MANUAL switch to MANUAL.
5	GPR-92	Coarse Tuning: - MODE switch to CW. RANGE SELECTOR switch for frequency to be received (F_c). IF SELECTIVITY switch to 15 KC. TUNING and BANDSPREAD knobs for frequency to be received (F_c).
6	TRX-1	POWER switch to ON. POWER lamps will light. HFO switch for frequency to be received.* BFO switch to B.**
7	GPR-92	Fine Tuning: - Insert headset at PHONES jack. Adjust LINE LEVEL and MONITOR AUDIO knobs for usable signal level. Readjust BANDSPREAD knob to obtain desired signal. Hold down RF/AF button and adjust ANT TUNE knob for peak reading on meter. Release button. Set IF SELECTIVITY switch for cleanest tone at headset. Readjust MONITOR AUDIO knob for desirable volume.

*TRX-1 HFO crystal to equal F_c + 455 kc (when F_c = 0.54 to 5.6 mc) or F_c + 3,955 kc (when F_c = 5.6 to 32.3 mc).

**TRX-1 BFO crystal in XY112 to equal 455 kc $\pm$ tone desired.

TABLE 3-3. TUNE-UP PROCEDURE FOR MCW (USING GPR-92 ALONE)

STEP	MODULE	OPERATION
1	SBS-1	POWER switch to STANDBY.
2	DCP-2	MAIN POWER switch to ON. MAIN POWER lamp will light. TRX-1 OVEN lamp and SBS-1 STANDBY lamp will light. Rack blower will start.
3	GPR-92	Preliminary Settings: - MONITOR AUDIO knob fully CCW. LINE LEVEL knob to mid-position. RF GAIN knob fully CW. TUNING and BANDSPREAD dials will light up. ANT TUNE knob to vertical position. SEND/RECEIVE switch to RECEIVE. INT/EXT switch to INT. NOISE LIMITER knob to OFF. LIMITER switch to OFF. SQUELCH knob fully CCW. AVC/MANUAL switch to MANUAL.
4	GPR-92	Coarse Tuning: - MODE switch to AM. RANGE SELECTOR switch for frequency to be received. IF SELECTIVITY switch to 15 KC. HFO TRIM knob to 0. TUNING and BANDSPREAD knobs for frequency to be received.
5	GPR-92	Fine Tuning: - Insert headset at PHONES jack. Adjust LINE LEVEL and MONITOR AUDIO knobs for usable signal level. Readjust BANDSPREAD knob to obtain desired signal. Hold down RF/AF button and adjust ANT TUNE knob for peak reading on meter. Release button. Set IF SELECTIVITY switch for cleanest tone at headset. Set LIMITER/OFF switch to LIMITER or OFF (for best results). AVC/MANUAL to AVC. Readjust MONITOR AUDIO knob for desirable volume.

TABLE 3-4. TUNE-UP PROCEDURE FOR MCW (USING GPR-92, SBS-1 AND AFC-2A WITH CHANNEL A OUTPUT)

STEP	MODULE	OPERATION
1	LSP-11	If speaker output is to be used, set LS-1 INCR knob fully CW and LS-2 INCR knob fully CCW.
2	SBS-1	POWER switch to STANDBY.
3	DCP-2	MAIN POWER switch to ON. MAIN POWER lamp will light. TRX-1 OVEN lamp and SBS-1 STANDBY lamp will light. Rack blower will start.
4	GPR-92	Preliminary Settings: - MONITOR AUDIO knob fully CCW. LINE LEVEL knob to mid-position. RF GAIN knob fully CW. TUNING and BANDSPREAD dials will light up. ANT TUNE knob to vertical position. SEND/RECEIVE switch to RECEIVE. INT/EXT switch to INT. NOISE LIMITER knob to OFF. LIMITER switch to OFF. SQUELCH knob fully CCW. AVC/MANUAL switch to MANUAL.
5	GPR-92	Coarse Tuning: - MODE switch to AM. RANGE SELECTOR switch for frequency to be received. IF SELECTIVITY switch to 15 KC. HFO TRIM knob to 0. TUNING and BANDSPREAD knobs for frequency to be received.
6	GPR-92	Fine Tuning: - Insert headset at PHONES jack. Adjust LINE LEVEL and MONITOR AUDIO knobs for usable signal level. Readjust BANDSPREAD knob to obtain desired signal. Hold down RF/AF button and adjust ANT TUNE knob for peak reading on meter. Release button. Set IF SELECTIVITY switch for cleanest tone at headset. MANUAL/AVC switch to AVC. LINE LEVEL knob fully CCW.
7	SBS-1	POWER switch to ON. STANDBY lamp will go out. After 60 seconds, POWER ON lamp will light and SBS-1 blower will start. AFC switch to OFF. CHANNEL A LEVEL ADJUST knob to mid-position. CHANNEL B LEVEL ADJUST knob fully CCW. CHANNEL A IF BANDWIDTH KC switch to 3.5L. CHANNEL A DETECTION switch to CW. AGC SELECTOR switch to A. CHANNEL A AGC RESPONSE switch to SLOW. Insert headset at MONITOR jack and adjust MONITOR GAIN knob to obtain usable volume of 1-kc tone on headset.

TABLE 3-4. TUNE-UP PROCEDURE FOR MCW (USING GPR-92, SBS-1 AND AFC-2A WITH CHANNEL A OUTPUT) (CONT'D)

STEP	MODULE	OPERATION
8	AFC-2A	CARRIER SELECTOR switch to OSC. TUNING/KCS knob to 0. SENSITIVITY knob to mid-position.
9	SBS-1	AFC switch to ON.
10	AFC-2A	Observe LEVEL meter. Hold down RESET button and adjust TUNING/KCS knob to obtain peak reading. Release RESET button. Monitor 1-kc tone with headset at SBS-1 MONITOR jack. When keying starts, observe LEVEL meter. Needle will remain steady through keying if AFC-2A is locked on carrier. If needle is not steady, AFC-2A is locked on a sideband tone; in this case, repeat Step 10 until it locks onto the carrier.
11	SBS-1	Listen to signal at headset. Set CHANNEL A IF BANDWIDTH KC switch to 3.5U and compare signal with switch setting at 3.5L. Choose clearest signal setting. Adjust CHANNEL A LEVEL ADJUST knob for proper output level.

TABLE 3-5. TUNE-UP PROCEDURE FOR SSB WITH PARTIAL CARRIER* (USING GPR-92, SBS-1 AND AFC-2A WITH CHANNEL A OUTPUT)

STEP	MODULE	OPERATION
1	LSP-11	If speaker output is to be used, set LS-1 INCR knob fully CW and LS-2 INCR knob fully CCW.
2	SBS-1	POWER switch to STANDBY.
3	DCP-2	MAIN POWER switch to ON. MAIN POWER lamp will light. TRX-1 OVEN lamp and SBS-1 STANDBY lamp will light. Rack blower will start.
4	GPR-92	Preliminary Settings: - MONITOR AUDIO knob fully CCW. LINE LEVEL knob to mid-position. RF GAIN knob fully CW. TUNING and BANDSPREAD dials will light up. ANT TUNE knob to vertical position. SEND/RECEIVE switch to RECEIVE. INT/EXT switch to INT. NOISE LIMITER knob to OFF. SQUELCH knob fully CCW. AVC/MANUAL switch to MANUAL.
5	GPR-92	Coarse Tuning: - MODE switch to SSB. HFO TRIM knob to O. BFO PITCH know to O. RANGE SELECTOR switch for frequency to be received. TUNING and BANDSPREAD knobs for frequency to be received. IF SELECTIVITY switch to 15 KC.
6	GPR-92	Fine Tuning: - Insert headset at PHONES jack. Adjust LINE LEVEL and MONITOR AUDIO knobs for usable signal level. Readjust BANDSPREAD knob to obtain desired signal and to eliminate "beat" note or to bring it to as low a tone as possible. (Note: Beat is produced by carrier and GPR-92 BFO while GPR-92 is detuned.) Hold down RF/AF button and adjust ANT TUNE knob for peak reading on meter. Release button. LINE LEVEL knob fully CCW.
7	SBS-1	POWER switch to ON. STANDBY lamp will go out. After 60 seconds, POWER ON lamp will light and SBS-1 blower will start. AFC switch to OFF. CHANNEL A LEVEL ADJUST knob to mid-position. CHANNEL B LEVEL ADJUST knob fully CCW. CHANNEL A IF BANDWIDTH KC switch to 3.5L, 7.5L, 7.5U or 3.5U, depending on which sideband is being transmitted and its width. CHANNEL A DETECTION switch to SSB. AGC SELECTOR switch to A. CHANNEL A AGC RESPONSE switch to SLOW. Insert headset at MONITOR jack and adjust MONITOR GAIN knob toward

TABLE 3-5. TUNE-UP PROCEDURE FOR SSB WITH PARTIAL CARRIER* (USING GPR-92, SBS-1 AND AFC-2A WITH CHANNEL A OUTPUT) (CONT'D)

STEP	MODULE	OPERATION
7 (Cont'd)	SBS-1	"A" to obtain usable volume of signal on headset.
8	AFC-2A	CARRIER SELECTOR switch to OSC. TUNING/KCS knob to C. SENSITIVITY knob fully CW.
9	SBS-1	AFC switch to ON.
10	AFC-2A	Observe LEVEL meter. Hold down RESET button and adjust TUNING/KCS knob to obtain peak reading. Release RESET button. Monitor signal with headset at SBS-1 MONITOR jack. Observe DRIFT meter. DRIFT meter needle will remain steady through signal tone variations if AFC-2A is locked on carrier. If needle is not steady, AFC-2A is locked on the sideband; in this case, repeat Step 10 until it locks onto the carrier.
11	SBS-1	Adjust CHANNEL A LEVEL ADJUST knob for proper output level.

*SSB transmitted with a carrier suppressed no lower than 30db below PEP.

TABLE 3-6. TUNE-UP PROCEDURE FOR SSB WITH FULLY SUPPRESSED CARRIER (USING GPR-92, TRX-1 AND SBS-1 WITH CHANNEL A OUTPUT)

STEP	MODULE	OPERATION
1	LSP-11	If speaker output is to be used, set LS-1 INCR knob fully CW and LS-2 INCR knob fully CCW.
2	SBS-1	POWER switch to STANDBY.
3	DCP-2	MAIN POWER switch to ON. MAIN POWER lamp will light. TRX-1 OVEN lamp and SBS-1 STANDBY lamp will light. Rack blower will start.
4	TRX-1	POWER switch to STANDBY. Allow 30 minutes for oven stabilization before proceeding with Step 7.
5	GPR-92	Preliminary Settings: - MONITOR AUDIO knob fully CCW. LINE LEVEL knob to mid-position. RF GAIN knob fully CW. TUNING and BANDSPREAD dials will light up. ANT TUNE knob to vertical position. SEND/RECEIVE switch to RECEIVE. INT/EXT switch to EXT. NOISE LIMITER knob to OFF. LIMITER switch to OFF. SQUELCH knob fully CCW. AVC/MANUAL switch to MANUAL.
6	GPR-92	Coarse Tuning: - MODE switch to SSB. RANGE SELECTOR switch for frequency to be received. IF SELECTIVITY switch to 7.5 KC (for 3-kc sideband) or 15 KC (for 6-kc sideband). TUNING and BANDSPREAD knobs for frequency of suppressed carrier (F_c).
7	TRX-1	POWER switch to ON. POWER lamp will light. HFO switch for frequency to be received.* BFO switch to A.**

*TRX-1 HFO crystal to equal F_c + 455 kc (when F_c = 0.54 to 5.6 mc) or F_c + 3,955 kc (when F_c = 5.6 to 32.3 mc).

**TRX-1 BFO crystal in XY111 socket to equal 455 kc.

TABLE 3-6. TUNE-UP PROCEDURE FOR SSB WITH FULLY SUPPRESSED CARRIER (USING GPR-92, TRX-1 AND SBS-1 WITH CHANNEL A OUTPUT) (CONT'D)

STEP	MODULE	OPERATION
8	GPR-92	1st Fine Tuning: - Insert headset at PHONES jack. Adjust LINE LEVEL and MONITOR AUDIO knobs for usable signal level. Readjust BANDSPREAD knob to obtain desired signal. For a lower sideband transmission, increase BANDSPREAD frequency setting as high as possible to still receive signal on headset. For an upper sideband transmission, decrease BANDSPREAD frequency setting as low as possible to still receive signal. Hold down RF/AF button and adjust ANT TUNE knob to obtain maximum reading on meter. Release button. LINE LEVEL knob fully CCW.
9	SBS-1	POWER switch to ON. STANDBY lamp will go out. After 60 seconds, POWER ON lamp will light and SBS-1 blower will start. AFC switch to OFF. CHANNEL A LEVEL ADJUST knob to mid-position. CHANNEL B LEVEL ADJUST knob fully CCW. CHANNEL A IF BANDWIDTH KC switch to 3.5L, 7.5L, 7.5U or 3.5U, depending on which sideband is being transmitted and its width. CHANNEL A DETECTION switch to SSB. AGC SELECTOR switch to A. CHANNEL A AGC RESPONSE switch to SLOW. Insert headset at MONITOR jack and adjust MONITOR GAIN knob to obtain usable volume of signal on headset.
10	GPR-92	2nd Fine Tuning: - Readjust BANDSPREAD knob to obtain entire sideband (from low to high tones) at headset at SBS-1 for clearest signal.
11	SBS-1	Adjust CHANNEL A LEVEL ADJUST knob for proper output level.

TABLE 3-7. TUNE-UP PROCEDURE FOR ISB WITH PARTIAL CARRIER* (USING GPR-92, SBS-1, AND AFC-2A WITH LSB TO CHANNEL A AND USB TO CHANNEL B)

STEP	MODULE	OPERATION
1	LSP-11	LS-1 and LS-2 INCR knobs both fully CCW.
2	SBS-1	POWER switch to STANDBY.
3	DCP-2	MAIN POWER switch to ON. MAIN POWER lamp will light. TRX-1 OVEN lamp and SBS-1 STANDBY lamp will light. Rack blower will start.
4	GPR-92	Preliminary Settings: - MONITOR AUDIO knob fully CCW. LINE LEVEL knob to mid-position. RF GAIN knob fully CW. TUNING and BANDSPREAD dials will light up. ANT TUNE knob to vertical position. SEND/RECEIVE switch to RECEIVE. INT/EXT switch to INT. NOISE LIMITER knob to OFF. SQUELCH knob fully CCW. AVC/MANUAL switch to MANUAL.
5	GPR-92	Coarse Tuning: - MODE switch to SSB. HFO TRIM knob to 0. BFO PITCH knob to 0. RANGE SELECTOR switch for frequency to be received. TUNING and BANDSPREAD knobs for frequency to be received. IF SELECTIVITY switch to 15 KC.
6	GPR-92	Fine Tuning: - Insert headset at PHONES jack. Adjust LINE LEVEL and MONITOR AUDIO knobs for usable signal level. Adjust BANDSPREAD knob so that both signals can be heard. Set IF SELECTIVITY to .5 KC. Readjust BANDSPREAD knob and turn up LINE LEVEL and MONITOR AUDIO knobs to obtain "beat" note. Again adjust BANDSPREAD knob to eliminate beat note or to bring it to as low a tone as possible. (Note: Beat is produced by carrier and GPR-92 BFO while GPR-92 is detuned.) Set IF SELECTIVITY to 15 KC. Hold down RF/AF button and readjust LINE LEVEL knob to obtain usable reading on meter. Then adjust ANT TUNE knob for peak reading on meter. Release button.

TABLE 3-7. TUNE-UP PROCEDURE FOR ISB WITH PARTIAL CARRIER* (USING GPR-92, SBS-1, AND AFC-2A WITH LSB TO CHANNEL A AND USB TO CHANNEL B) (CONT'D)

STEP	MODULE	OPERATION
7	SBS-1	POWER switch to ON. STANDBY lamp will go out. After 60 seconds, POWER ON lamp will light and SBS-1 blower will start. AFC switch to OFF. CHANNEL A and B LEVEL ADJUST knobs to mid-positions. CHANNEL A IF BANDWIDTH KC switch to 3.5L or 7.5L depending on sideband width. CHANNEL B IF BANDWIDTH KC switch to 3.5U or 7.5U, depending on sideband width. CHANNEL A and B DETECTION switches to SSB. AGC SELECTOR switch to AB. CHANNEL A and B AGC RESPONSE switches to SLOW. Insert headset at MONITOR jack. Adjust MONITOR GAIN knob toward "A" to obtain lower sideband signal on headset; then adjust knob toward "B" to obtain upper sideband signal. Both signals should be complete (including high and low tones); if not, re-adjust GPR-92 BANDSPREAD knob until both signals come through clearly.
8	AFC-2A	CARRIER SELECTOR switch to OSC. TUNING/KCS knob to 0. SENSITIVITY knob fully CW.
9	SBS-1	AFC switch to ON.
10	AFC-2A	Observe LEVEL meter. Hold down RESET button and adjust TUNING/KCS knob to obtain peak reading. Release RESET button. Monitor one of the sidebands at SBS-1 MONITOR jack by turning MONITOR GAIN knob toward A or B. Observe DRIFT meter. DRIFT meter needle will remain steady through signal tone variations if AFC-2A is locked on carrier. If needle is not steady, AFC-2A is locked onto a sideband; in this case, repeat Step 10 until it locks onto the carrier.
11	SBS-1	Adjust CHANNEL A and B LEVEL ADJUST knobs for proper output levels.

*ISB transmitted with a carrier suppressed no lower than 30db below PEP.

TABLE 3-8. TUNE-UP PROCEDURE FOR ISB WITH FULLY SUPPRESSED CARRIER (USING GPR-92, TRX-1 AND SBS-1 WITH LSB TO CHANNEL A AND USB TO CHANNEL B)

STEP	MODULE	OPERATION
1	LSP-11	LS-1 and LS-2 INCR knobs both fully CCW.
2	SBS-1	POWER switch to STANDBY.
3	DCP-2	MAIN POWER switch to ON. MAIN POWER lamp will light. TRX-1 OVEN lamp and SBS-1 STANDBY lamp will light. Rack blower will start.
4	TRX-1	POWER switch to STANDBY. Allow 30 minutes for oven stabilization before proceeding with Step 7.
5	GPR-92	Preliminary Settings: - MONITOR AUDIO knob fully CCW. LINE LEVEL knob to mid-position. RF GAIN knob fully CW. TUNING and BANDSPREAD dials will light up. ANT TUNE knob to vertical position. SEND/RECEIVE switch to RECEIVE. INT/EXT switch to EXT. NOISE LIMITER knob to OFF. LIMITER switch to OFF. SQUELCH knob fully CCW. AVC/MANUAL switch to MANUAL.
6	GPR-92	Coarse Tuning: - MODE switch to SSB. RANGE SELECTOR switch for frequency of suppressed carrier (F_c). IF SELECTIVITY switch to 7.5 KC (for two 3-kc sidebands) or 15 KC (for two 6-kc sidebands). TUNING and BANDSPREAD knobs for F_c.
7	TRX-1	POWER switch to ON. POWER lamp will light. HFO switch for frequency to be received.* BFO switch to A.**

*TRX-1 HFO crystal to equal F_c + 455 kc (when F_c = 0.54 to 5.6 mc) or F_c + 3,955 kc (when F_c = 5.6 to 32.3 mc).

**TRX-1 BFO crystal in XY111 socket to equal 455 kc.

TABLE 3-8. TUNE-UP PROCEDURE FOR ISB WITH FULLY SUPPRESSED CARRIER (USING GPR-92, TRX-1 AND SBS-1 WITH LSB TO CHANNEL A AND USB TO CHANNEL B) (CONT'D)

STEP	MODULE	OPERATION
8	GPR-92	Fine Tuning: - Insert headset at PHONES jack. Adjust LINE LEVEL and MONITOR AUDIO knobs for usable signal level. Adjust BANDSPREAD knob so that both signals can be heard. Hold down RF/AF button and adjust ANT TUNE knob for peak reading on meter. Release button.
9	SBS-1	POWER switch to ON. STANDBY lamp will go out. After 60 seconds, POWER ON lamp will light and SBS-1 blower will start. AFC switch to OFF. CHANNEL A and B LEVEL ADJUST knobs to mid-positions. CHANNEL A IF BANDWIDTH KC switch to 3.5L or 7.5L, depending on sideband width. CHANNEL B IF BANDWIDTH KC switch to 3.5U or 7.5U, depending on sideband width. CHANNEL A and B DETECTION switches to SSB. AGC SELECTOR switch to AB. CHANNEL A and B AGC RESPONSE switches to SLOW. Insert headset at MONITOR jack. Adjust MONITOR GAIN knob toward "A" to obtain lower sideband signal on headset; then adjust knob toward "B" to obtain upper sideband signal. Both signals should be complete (including high and low tones); if not, readjust GPR-92 BANDSPREAD knob until both signals come through clearly. Adjust CHANNEL A and B LEVEL ADJUST knobs for proper output levels.

TABLE 3-9. TUNE-UP PROCEDURE FOR AM (SSB RECEPTION, USING GPR-92 SBS-1 AFC-2A WITH CHANNEL A OUTPUT)

STEP	MODULE	OPERATION
1	LSP-11	If speaker is to be used, set LS-1 INCR knob fully CW and LS-2 INCR knob fully CCW.
2	SBS-1	POWER switch to STANDBY.
3	DCP-2	MAIN POWER switch to ON. MAIN POWER lamp will light. TRX-1 OVEN lamp and SBS-1 STANDBY lamp will light. Rack blower will start.
4	GPR-92	Preliminary Settings: - MONITOR AUDIO knob fully CCW. LINE LEVEL knob to mid-position. RF GAIN knob fully CW. TUNING and BANDSPREAD dials will light up. ANT TUNE knob to vertical position. SEND/RECEIVE switch to RECEIVE. INT/EXT switch to INT. NOISE LIMITER knob to OFF. SQUELCH knob fully CCW. AVC/MANUAL switch to MANUAL.
5	GPR-92	Coarse Tuning: - MODE switch to AM. HFO TRIM knob to 0. RANGE SELECTOR switch for frequency to be received. TUNING and BANDSPREAD knobs for frequency to be received. IF SELECTIVITY switch to 7.5 KC.
6	GPR-92	Fine Tuning: - Insert headset at PHONES jack. Adjust LINE LEVEL and MONITOR AUDIO knobs for usable signal level. Readjust BANDSPREAD knob to obtain desired signal. Hold down RF/AF button and adjust ANT TUNE knob for peak reading on meter. Release button. LINE LEVEL knob fully CCW. AVC/MANUAL switch to AVC.
7	SBS-1	POWER switch to ON. STANDBY lamp will go out. After 60 seconds, POWER ON lamp will light and SBS-1 blower will start. AFC switch to OFF. CHANNEL A LEVEL ADJUST knob fully CW. CHANNEL B LEVEL ADJUST knob fully CCW. CHANNEL A IF BANDWIDTH KC switch to 3.5L. CHANNEL A DETECTION switch to SSB. AGC SELECTOR switch to A. CHANNEL A AGC RESPONSE switch to SLOW. Insert headset at MONITOR jack and adjust MONITOR GAIN knob toward "A" to obtain usable volume of signal on headset.

TABLE 3-9. TUNE-UP PROCEDURE FOR AM (SSB RECEPTION, USING GPR-92 AND AFC-2A WITH CHANNEL A OUTPUT) (CONT'D)

STEP	MODULE	OPERATION
8	AFC-2A	CARRIER SELECTOR switch to OSC. TUNING/KCS knob to 0. SENSITIVITY knob to mid-position.
9	SBS-I-1A	AFC switch to ON.
10	AFC-2A	Observe LEVEL meter. Hold down RESET button and adjust TUNING/KCS knob to obtain peak reading. Release RESET button. Monitor signal with headset at SBS-1 MONITOR jack. Observe DRIFT meter. DRIFT meter needle will remain steady through signal tone variations if AFC-2A is locked on carrier. If needle is not steady, AFC-2A is locked on the sideband; in this case, repeat Step 10 until it locks onto carrier.
11	SBS-1	Set CHANNEL A IF BANDWIDTH KC switch to 3.5U and compare signal at headset with 3.5L setting. Select best signal. Adjust CHANNEL A LEVEL ADJUST knob for proper output level.

TABLE 3-10. TUNE-UP PROCEDURE FOR FSK (USING GPR-92, TRX-1 AND SBS-1 WITH CHANNEL A OUTPUT)

STEP	MODULE	OPERATION
1	LSP-11	LS-1 and LS-2 INCR knobs both fully CCW.
2	SBS-1	POWER switch to STANDBY.
3	DCP-2	MAIN POWER switch to ON. MAIN POWER lamp will light. TRX-1 OVEN lamp and SBS-1 STANDBY lamp will light. Rack blower will start.
4	TRX-1	POWER switch to STANDBY. Allow 30 minutes for oven stabilization before proceeding with Step 7.
5	GPR-92	Preliminary Settings: - MONITOR AUDIO knob fully CCW. LINE LEVEL knob to mid-position. RF GAIN knob fully CW. TUNING and BANDSPREAD dials will light up. ANT TUNE knob to vertical position. SEND/RECEIVE switch to RECEIVE. INT/EXT switch to EXT. NOISE LIMITER knob to OFF. LIMITER switch to OFF. SQUELCH knob fully CCW. AVC/MANUAL switch to MANUAL.
6	GPR-92	Coarse Tuning: - MODE switch to CW. RANGE SELECTOR switch for center frequency. IF SELECTIVITY switch for frequency shift. TUNING and BANDSPREAD knobs for center frequency.
7	TRX-1	POWER switch to ON. POWER lamp will light. HFO switch for center frequency.* BFO switch to A.**
8	GPR-92	Fine Tuning: - Insert headset at PHONES jack. Adjust LINE LEVEL and MONITOR AUDIO knobs for usable signal level. Readjust BANDSPREAD knob to obtain the mark and space audio tones on the headset. Hold down RF/AF button and adjust ANT TUNE knob for peak reading on meter. Release button.

*TRX-1 HFO crystal selected per paragraph 2-7b(2).

**TRX-1 BFO crystal in XY111 to equal 455 kc.

TABLE 3-10. TUNE-UP PROCEDURE FOR FSK (USING GPR-92, TRX-1 AND SBS-1 WITH CHANNEL A OUTPUT) (CONT'D)

STEP	MODULE	OPERATION
9	SBS-1	POWER switch to ON. STANDBY lamp will go out. After 60 seconds, POWER ON lamp will light and SBS-1 blower will start. AFC switch to OFF. CHANNEL A LEVEL ADJUST knob to mid-position. CHANNEL B LEVEL ADJUST knob fully CCW. CHANNEL A IF BANDWIDTH KC switch to position determined by TRX-1 HFO crystal selection (see paragraph 2-7b(2).). CHANNEL A DETECTION switch to CW. AGC SELECTOR switch to A. CHANNEL A AGC RESPONSE switch to SLOW. Insert headset at MONITOR jack and adjust MONITOR GAIN knob to obtain usable volume of mark and space tones on headset. Adjust CHANNEL A LEVEL ADJUST knob for proper operating level of teletype equipment and observe teletype equipment. If mark and space test signal appears in headset but teletype equipment does not operate, the transmitted frequencies may be off slightly. In this case, perform Steps 10 through 12. If teletype equipment is operating, however, proceed to Step 13.
10*	AFC-2A	SENSIVITY knob fully CCW. CARRIER SELECTOR switch to OSC. TUNING/KCS knob to 0.
11*	SBS-1	AFC switch to ON.
12*	AFC-2A	Monitor signal on SBS-1 headset and observe teletype equipment. Adjust TUNING/KCS knob slowly to either plus (+) or minus (-) direction until teletype equipment starts to operate. Do not lose signal at headset.
13	GPR-92	Set IF SELECTIVITY switch to smallest value that will still give clear, strong signal results at teletype equipment. This will depend on input frequency characteristics of the frequency shift converter being used.

*Steps 10 through 12 do not effect an automatic frequency control for the DDR-7A, but serve to bring the audio output frequencies into the proper input value for the frequency shift converter.

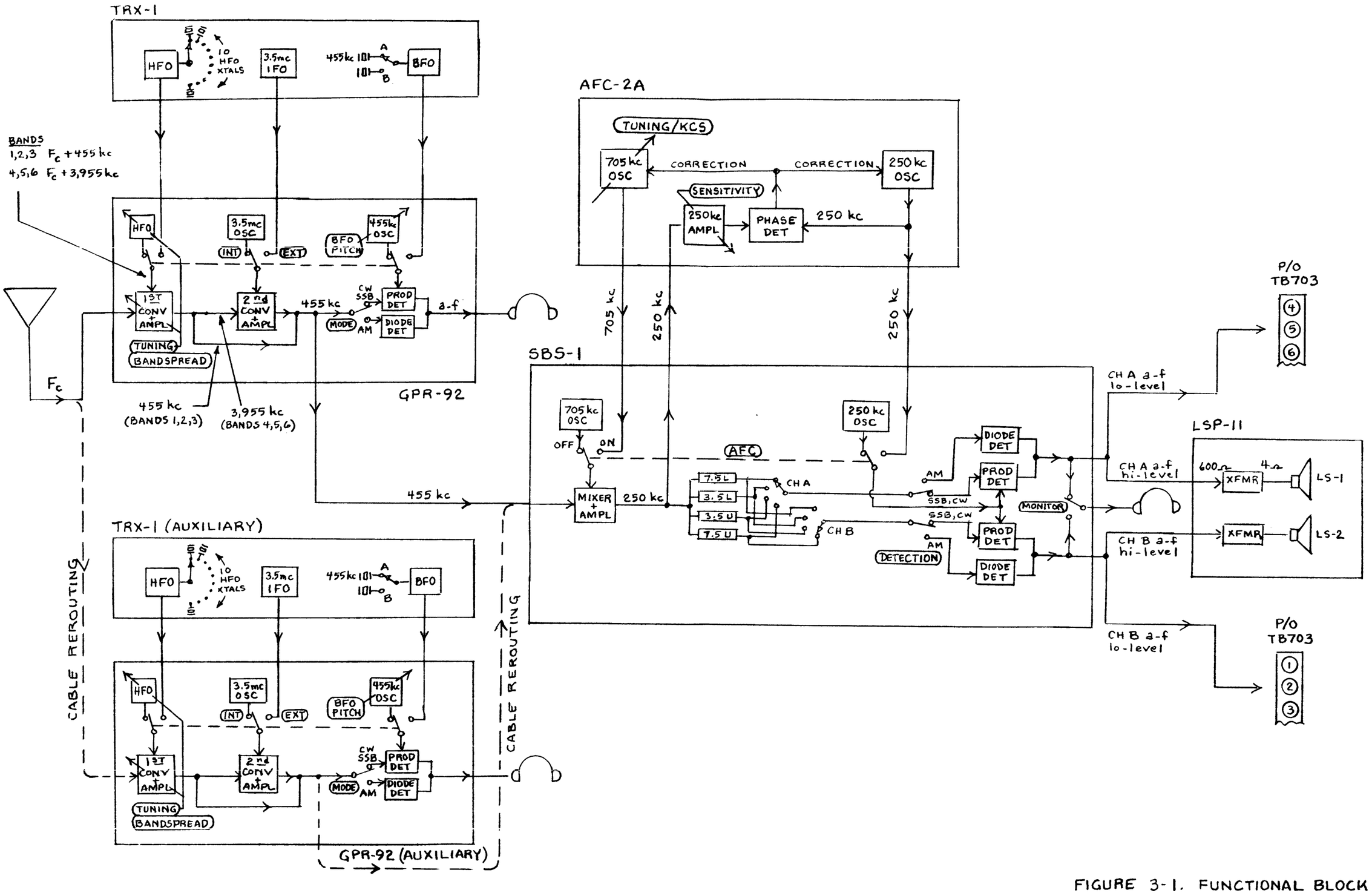


FIGURE 3-1. FUNCTIONAL BLOCK DIAGRAM, DDR-7A

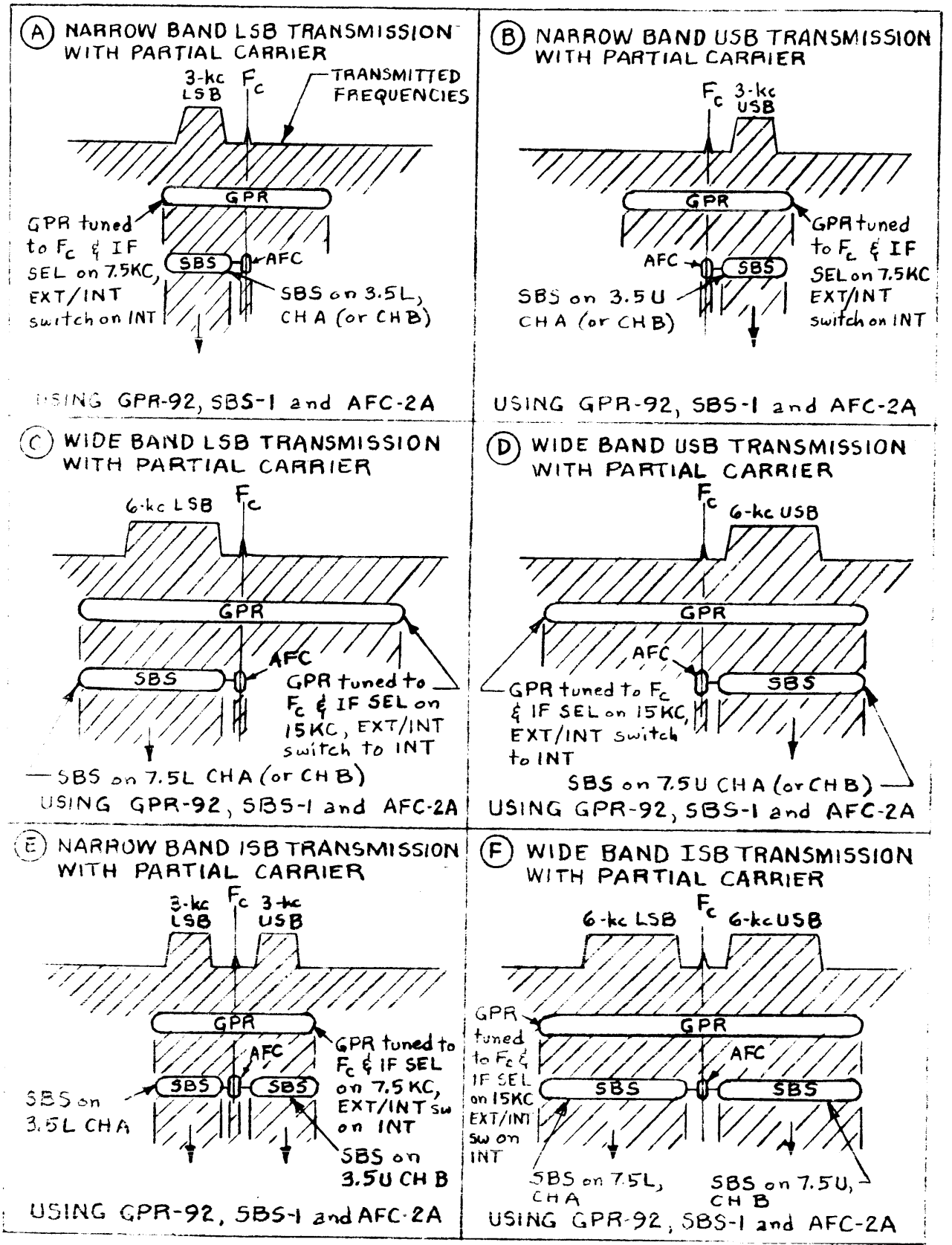
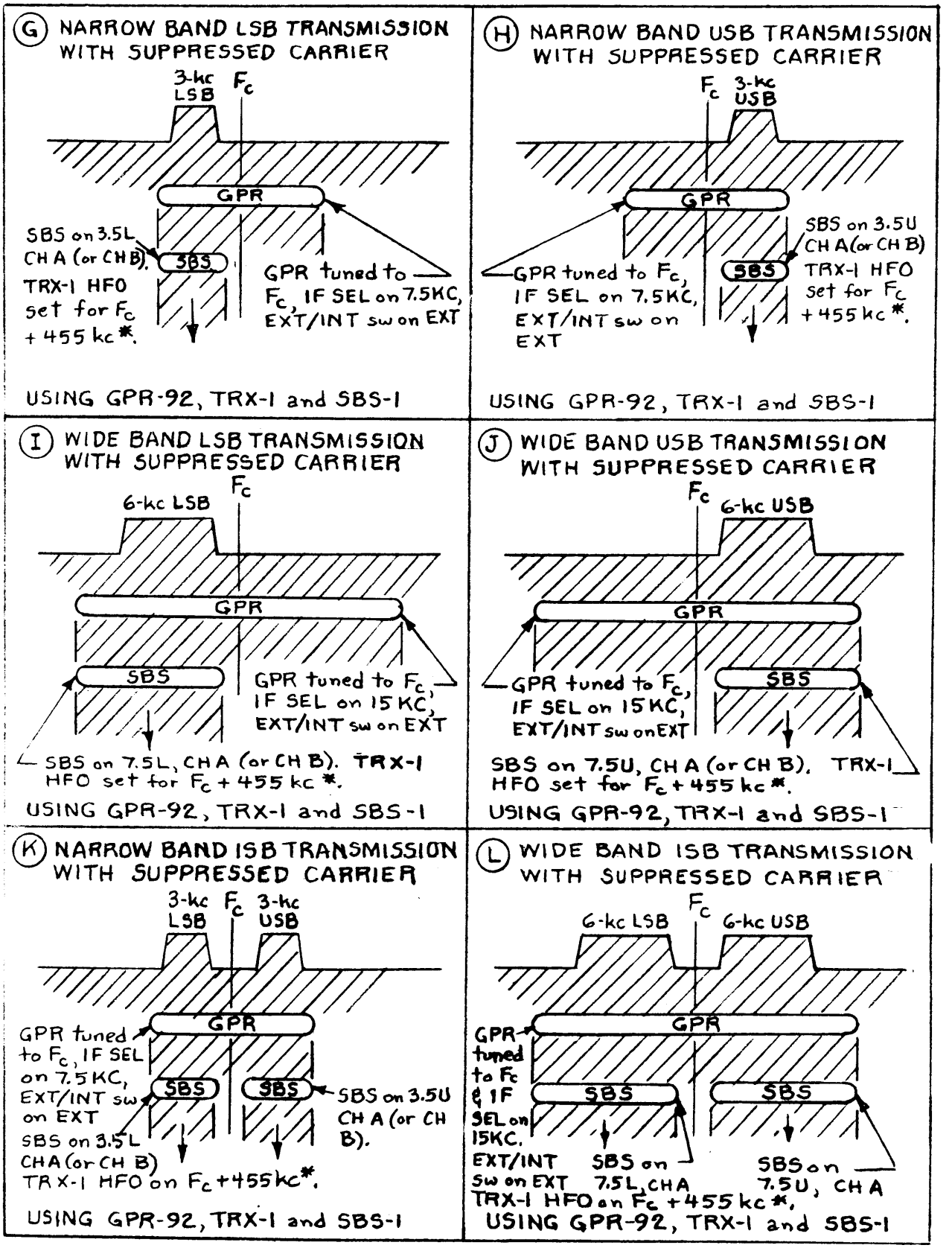
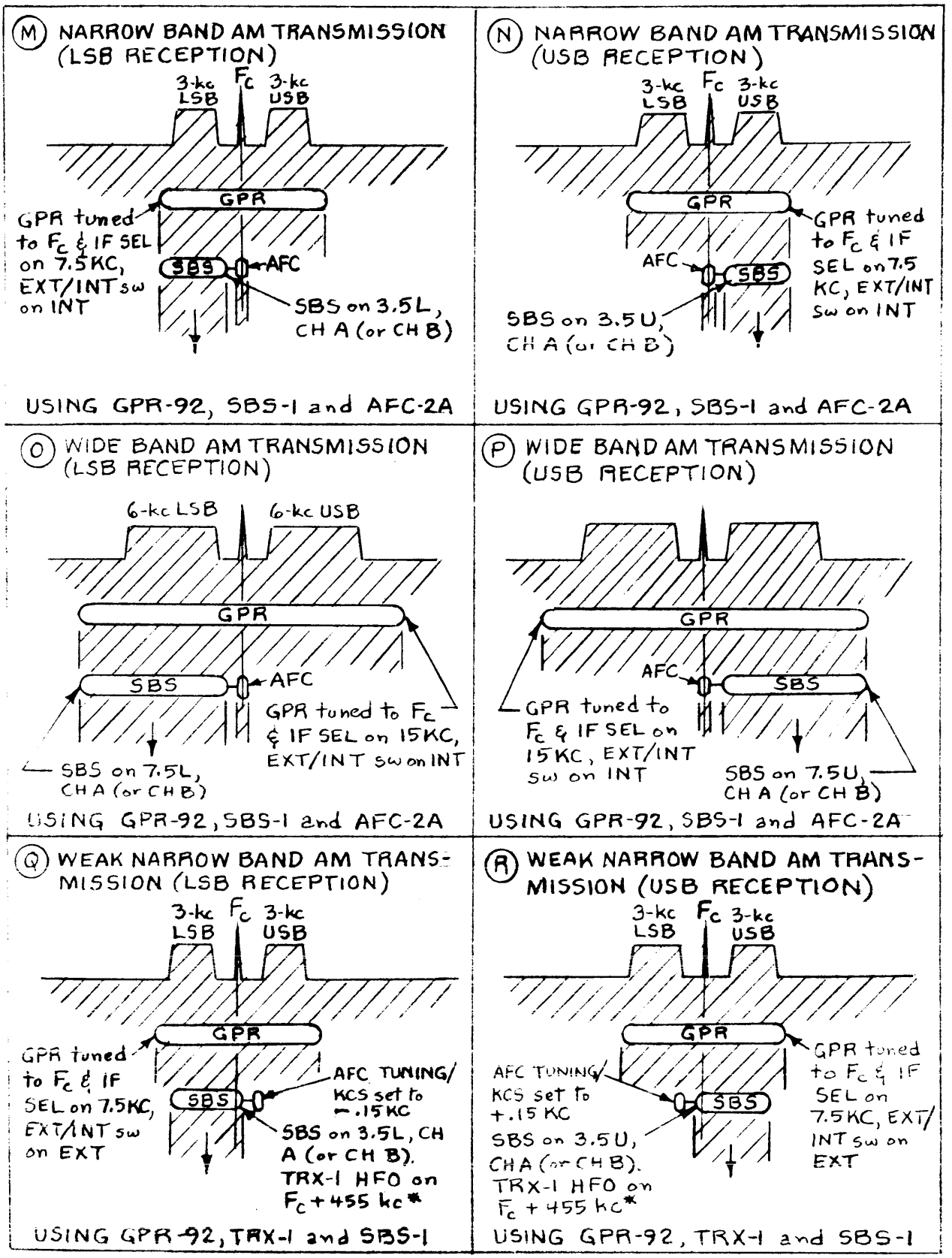


FIGURE 3-2. SLOT TUNING DIAGRAMS, DDR-7A (SHEET 1 OF 5)



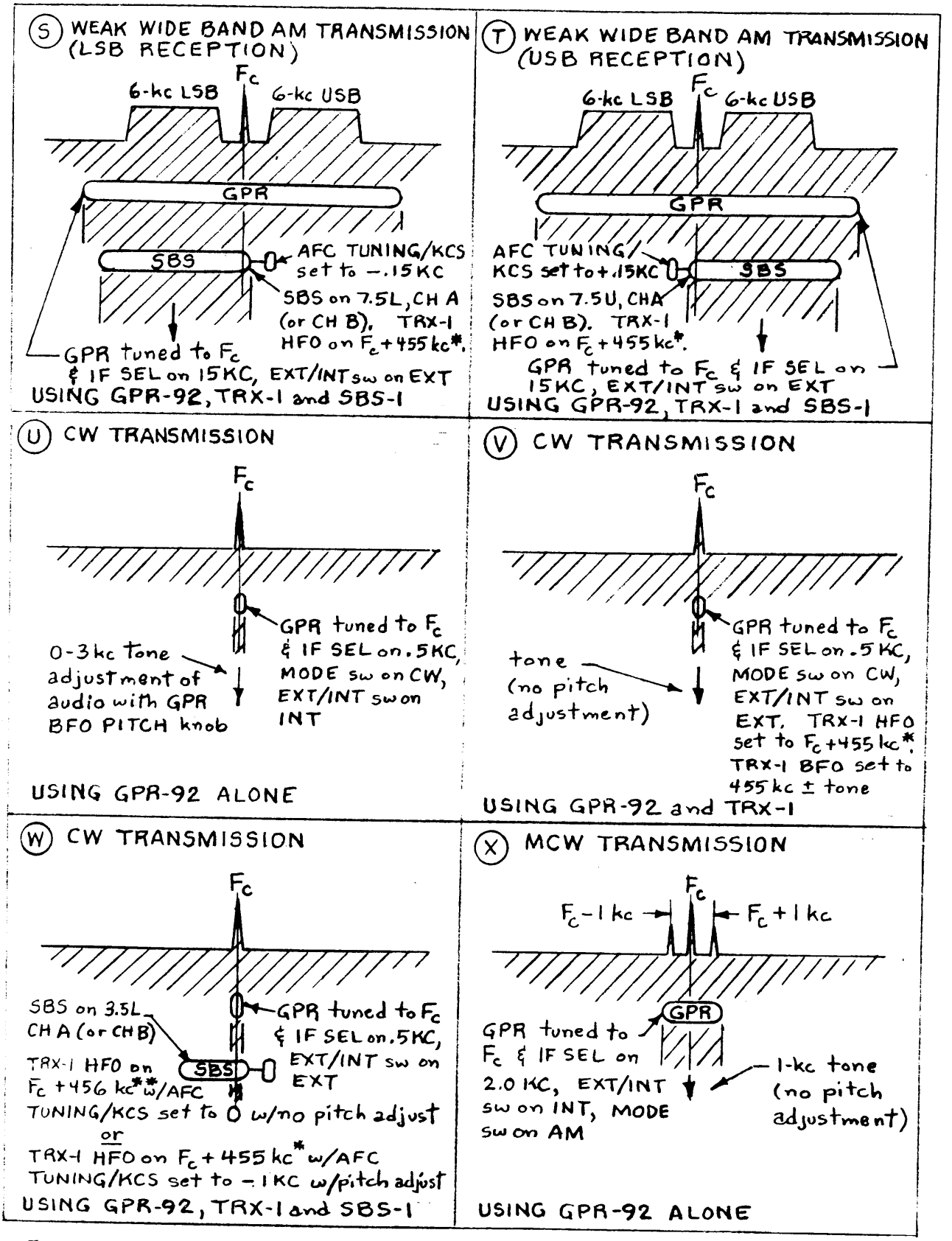
* F_c + 455 kc when F_c = .54 mc to 5.6mc. F_c + 3,955 kc when F_c = 5.6 mc to 32.3 mc

FIGURE 3-2. SLOT TUNING DIAGRAMS, DDR-7A (SHEET 2 OF 5)



* F_c + 455 kc when F_c = .54mc to 5.6mc. F_c + 3,955 kc when F_c = 5.6mc to 32.3 mc

FIGURE 3-2. SLOT TUNING DIAGRAMS, DDR-7A (SHEET 3 OF 5)

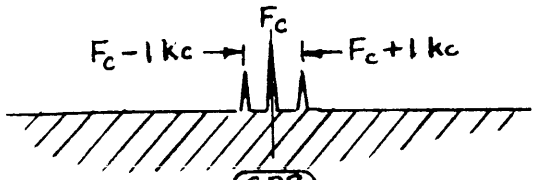


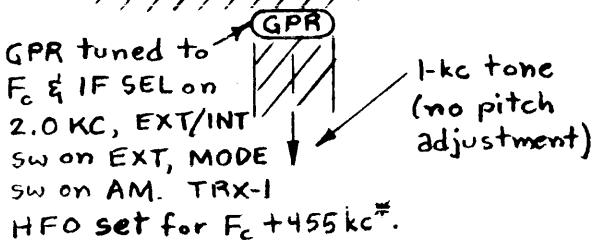
* Fc+455 kc when Fc=.54 mc to 5.6 mc. Fc+3,955 kc when Fc=5.6 mc to 32.3 mc

** Fc+456 kc when Fc=.54 mc to 5.6 mc. Fc+3,956 kc when Fc=5.6 mc to 32.3 mc

FIGURE 3-2. SLOT TUNING DIAGRAMS, DDR-7A (SHEET 4 OF 5)

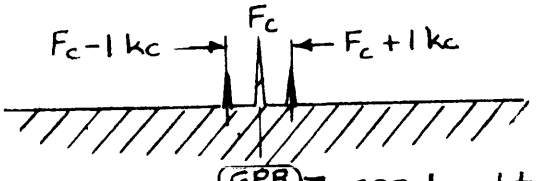
(Y) MCW TRANSMISSION

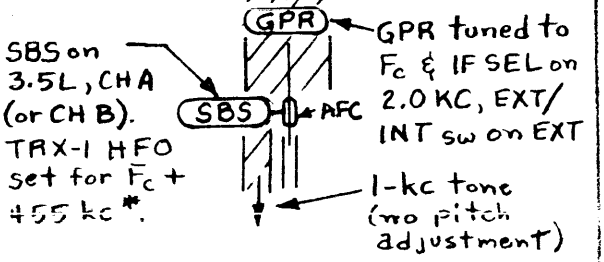




USING GPR-92 and TRX-1

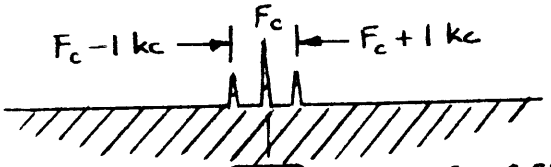
(Z) MCW TRANSMISSION

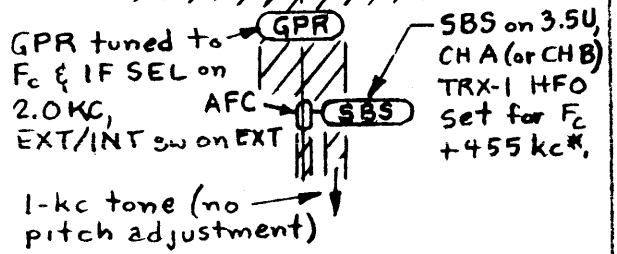




USING GPR-92, TRX-1, SBS-1 and AFC-2A

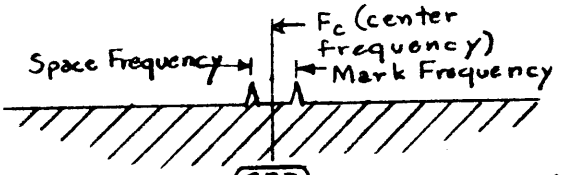
(AA) MCW TRANSMISSION

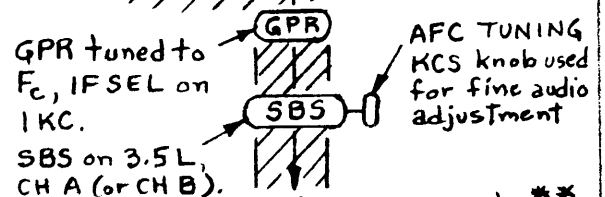




USING GPR-92, TRX-1, SBS-1 and AFC-2A

(AB) FSK TRANSMISSION (with 850 cps shift and 2,550 cps converter center frequency)





USING GPR-92, TRX-1, SBS-1 and AFC-2A

* Fc +455 kc when Fc = .54 mc to 5.6 mc. Fc+3,955 kc when Fc = 5.6 mc to 32.3 mc

** Fc + 457.550 kc when Fc = .54 mc to 5.6 mc. Fc + 3,957.550 kc when Fc = 5.6 mc to 32.3 mc

FIGURE 3-2. SLOT TUNING DIAGRAMS, DDR-7A (SHEET 5 OF 5)