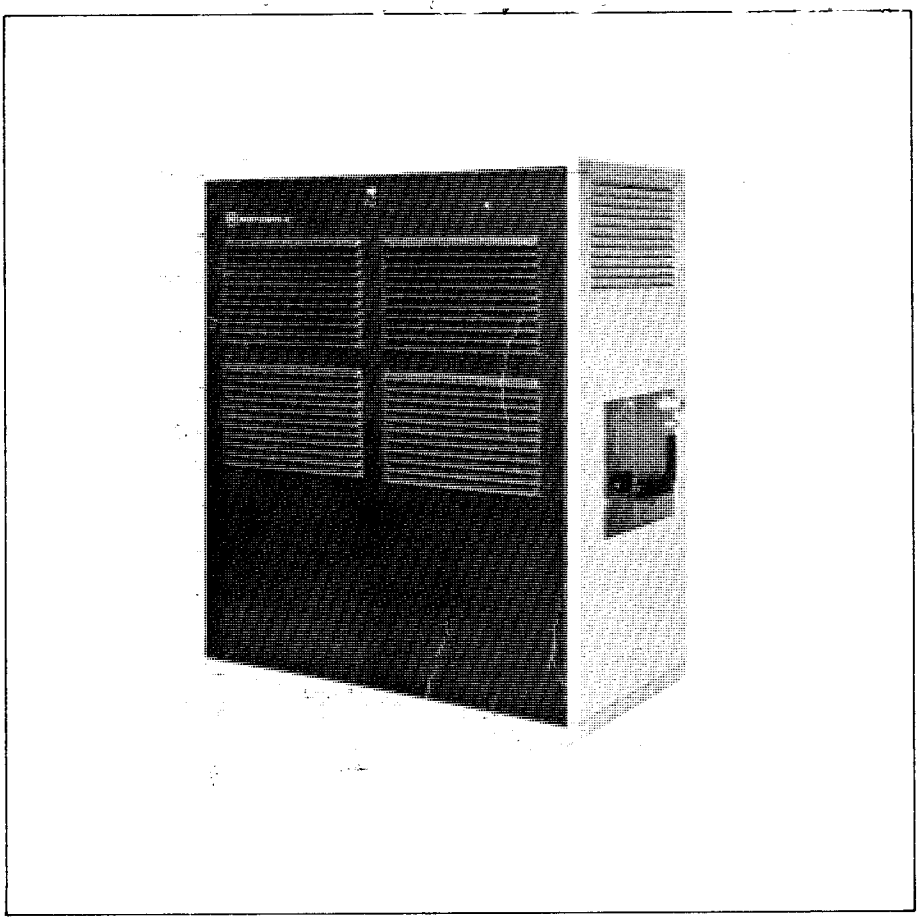
MOTOROLA

MSR 2000™

VHF Base and Repeater Stations

132-174 MHz



MUST BE USED WITH

Associated Control and Audio Instruction Manual
68P81061E40

THIS MANUAL HAS BEEN
DISCONTINUED

68P81061E50-C

MOTOROLA INC.
Communications Sector

MSR 2000
VHF BASE AND REPEATER STATIONS
132-174 MHz

CONTENTS

SECTION *NUMBER*

DESCRIPTION

INSTALLATION

technical writing services
1301 E. Algonquin Road, Schaumburg, IL 60196

68P81061E50-C
9/30/85- UP

MAINTENANCE

RECEIVER

TRANSMITTER

POWER SUPPLY

ACCESSORIES

INTERMITTENT DUTY STATION PERFORMANCE SPECIFICATIONS

GENERAL

Model	Frequency (MHz)	Minimum RF Output Power	Maximum PA Final Input Power	Input Voltage	A.C. Input Current			
					Standard Supply		Battery Charging*** Supply	
					Stby	Xmit	Stby	Xmit
C73GRB C73GSB*	146-174	110 W**	290 W	120 V ac +10% -20%; 60 Hz Standard	1A	5.5A	1.5-2A	5.5A

No. of Frequencies	Single and two-frequency stations (dc and tone remote) Four-frequency stations (tone remote)
Squelch Options	Carrier squelch, *Private-Line* coded squelch, and *Digital Private-Line* coded squelch
Metering	Optional internal-mounted meter used to measure all essential circuits for tuning and checking.

*Fully Optionable Models **Variable Down to 60 W ***Does Not Include Battery Charging Current

TRANSMITTER 146-174 MHz

RF Output Power	110/60 watts intermittent duty (cont. variable)
Output Impedance	50 ohms
Oscillator Frequency Stability	Channel element maintains oscillator frequency within ± .0005% (± .0002% optional) from -30°C to +60°C ambient (+25°C reference)
Transmitter Sideband Noise	-90 dB @30 kHz -105 dB @1 MHz
Spurious & Harmonics	More than 85 dB below carrier
Modulation	15F2 and 16F3: ±5 kHz for 100% at 1000 Hz.
Audio Sensitivity	Remote telephone line: -20 dBm max. for 60% max. dev. at 1000 Hz.
FM Noise	55 dB below 60% system dev. at 1000 Hz
Audio Response	+1, -3 dB from 6 dB/octave pre-emphasis, 300-3000 Hz, referenced to 1000 Hz
Audio Distortion	Less than 2% at 1000 Hz; 60% system dev.
FCC Designation	ABZ89FC3632 (± .0005% stability) ABZ89FC3132C (± .0002% stability) Licensable under parts 22, 74, 81, and 90 of FCC Rules.

RECEIVER 146-174 MHz

Channel Spacing	30 kHz/25 kHz	
EIA Modulation Acceptance	±7 kHz minimum	
Oscillator Frequency Stability	Channel element maintains oscillator frequency within ± .0005% (± .0002% optional) from -30°C to +60°C ambient (+25°C reference)	
Sensitivity 20 dB Quieting EIA SINAD	**Without Preamp** Less than 0.5 uV Less than 0.35 uV	**With Preamp** Less than 0.25 uV Less than 0.20 uV
Intermodulation — EIA SINAD	-85 dB	-80 dB
Selectivity — EIA SINAD	-100 dB (-95 dB with preamp)	
Spurious & Image Rejection	100 dB minimum	100 dB minimum
Squelch Sensitivity Carrier Squelch Tone-Coded Squelch	0.2 uV or less at threshold 0.2 uV or less	0.10 uV or less at threshold 0.10 uV or less
Audio Characteristics Remote Control Models	**Telephone Line:** Output: +11 dBm @600 ohms Response: +1, -3 dB Distortion: 3% @1000 Hz Hum & Noise: -55 dB **For local service audio:** Output Available: 1 W @8 ohms Response: +2, -8 dB Distortion: 5% @1000 Hz Hum & Noise: -55 dB	
FCC Receiver Certification Number	ABZ89FR3633	

Meets EIA Specifications per RS152B, RS204B, and RS220A.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

GRB "A" SUFFIX MODELS [BASIC]
GSB "A" SUFFIX MODELS [FULLY OPTIONABLE]
MODEL CHART
FOR
MSR 2000
INTERMITTENT DUTY
BASE/REPEATER (RT) STATIONS
146-174 MHz 110 W RF POWER OUTPUT
EARLIER VERSION

MODEL	DESCRIPTION
KLN6209A	*VIBRASPONDER* RESONANT REED
KXN1086B	RECEIVE ELEMENT (10.7 MHz I-F) 5 PPM
KXN1068BA	RECEIVE ELEMENT (10.8 MHz I-F) 5 PPM
KXN1088A	TRANSMIT ELEMENT 5 PPM
TKN8234B	STATION INTERCONNECT CABLE
TKN8286A	TWO-WIRE LINE CABLE
TKN8288A	PA POWER/EXCITER CABLE
TKN8289A	NON-DUPLEXER CABLES
TLD2532A	110 W PA
TLD9232A	SIMPLEX EXCITER
TLD9242A	DUPLEX EXCITER
TLN2443A	GUARD TONE DECODER MODULE
TLN2444A	C2-R2 F2 TONE DECODER MODULE
TLN2472A	BASIC CHASSIS
TLN2473A	FULLY OPTIONABLE CHASSIS (1 REC)
TLN2474A	FULLY OPTIONABLE CHASSIS (2 REC)
TLN2475A	FULLY OPTIONABLE CHASSIS (REPEATER RT)
TPN1191A	STANDARD POWER SUPPLY
TRD6172A	RECEIVER 10.7 MHz NON-FILTERED
TRD6182A	RECEIVER 10.7 MHz FILTERED
TRD6192A	RECEIVER 10.8 MHz FILTERED
TRD6210A	2 RECEIVER COUPLER
TRN5068A	R1 AUDIO BOARD
TRN5070A	R2 AUDIO BOARD
TRN5071A	R2 AUDIO PL BOARD
TRN5072A	R2 AUDIO DPL BOARD
TRN5073A	DUPLEX PL BOARD
TRN5074A	SIMPLEX PL TA-RA BOARD
TRN5076A	DUPLEX DPL BOARD
TRN5077A	SIMPLEX DPL, TA-RA BOARD
TRN5122A	ANTENNA RELAY
TRN5236A	1 RECEIVER, 2-WIRE AUDIO; LINE DRIVER MODULE
TRN5237A	2 RECEIVER, 2-WIRE AUDIO; LINE DRIVER MODULE
TRN5240A	F1 PL CONTROL MODULE
TRN5254A	F1 CARRIER SQUELCH CONTROL MODULE
TRN5255A	C2-R2 CONTROL MODULE
TRN5256A	F2-R2 MUTE CONTROL MODULE
TRN5295A	CMOS TIME-OUT TIMER
TRN5296A	4-FREQUENCY CONTROL MODULE
TRN5320A	F1 PL TONE DECODER MODULE
TRN5321A	STATION CONTROL MODULE
TRN5322A	F1 TONE DECODER MODULE
TRN5324A	SQUELCH GATE MODULE
TRN5325A	F2 TONE DECODER MODULE
TRN5327A	4F F1 TONE DECODER MODULE
TRN5328A	4F F1-PL TONE DECODER MODULE
TRN5350A	SIMPLEX JUNCTION BOX
TRN5351A	DUPLEX JUNCTION BOX
TRN5352A	RF PLASTIC PLUG
TRN5353A	D-TYPE CONNECTOR PLASTIC PLUG
TRN5355A	BATTERY PLASTIC PLUG
TLN2515A	FULLY OPTIONABLE CHASSIS (4-FREQ.)
TRN5423A	24" CABINET HARDWARE
TRN5425A	24" CABINET SHELL
TRN5427A	110 V POWER CORD
TRN5428A	INTERMITTENT PA HARDWARE
TRN5429A	BASIC COVERS
TRN5430A	OPTIONAL COVERS
TRN5431A	REPEATER COVERS
TRN5443A	DUPLEX RF COVER
TRN6005A	DPL CODE PLUG

STATION MODEL	TYPE OF SQUELCH	T1 = ONE XMIT FREQ. T2 = TWO XMIT FREQS. R1 = ONE RCVR. FREQ. R2 = TWO RCVR. FREQS. 2R = TWO RCVRS. — ONE FREQ. EACH	CONTROL TYPE
BASE STATIONS			
C73GRB-1105A	CARRIER	T1-R1	DC
C73GRB-1106A	CARRIER	T1-R1	TONE
C73GRB-1115A	CARRIER	T2-R1	DC
C73GRB-1116A	CARRIER	T2-R1	TONE
C73GRB-1125A	CARRIER	T2-R2	DC
C73GRB-1126A	CARRIER	T2-R2	TONE
C73GRB-3105A	PL	T1-R1	DC
C73GRB-3106A	PL	T1-R1	TONE
C73GRB-3115A	PL	T2-R1	DC
C73GRB-3116A	PL	T2-R1	TONE
C73GRB-3125A	PL	T2-R2	DC
C73GRB-3126A	PL	T2-R2	TONE
C73GRB-6105A	DPL	T1-R1	DC
C73GRB-6106A	DPL	T1-R1	TONE
C73GRB-6115A	DPL	T2-R1	DC
C73GRB-6116A	DPL	T2-R1	TONE
C73GRB-6125A	DPL	T2-R2	DC
C73GRB-6126A	DPL	T2-R2	TONE
C73GSB-1105A	CARRIER	T1-R1	DC
C73GSB-1106A	CARRIER	T1-R1	TONE
C73GSB-1115A	CARRIER	T2-R1	DC
C73GSB-1116A	CARRIER	T2-R1	TONE
C73GSB-1125A	CARRIER	T2-R2	DC
C73GSB-1126A	CARRIER	T2-R2	TONE
C73GSB-1145A	CARRIER	T2-2R	DC
C73GSB-1146A	CARRIER	T2-2R	TONE
C73GSB-1196A	CARRIER	T4-R4	TONE
C73GSB-3105A	PL	T1-R1	DC
C73GSB-3106A	PL	T1-R1	TONE
C73GSB-3115A	PL	T2-R1	DC
C73GSB-3116A	PL	T2-R1	TONE
C73GSB-3125A	PL	T2-R2	DC
C73GSB-3126A	PL	T2-R2	TONE
C73GSB-3145A	PL	T2-2R	DC
C73GSB-3146A	PL	T2-2R	TONE
C73GSB-3196A	PL	T4-R4	TONE
C73GSB-6105A	DPL	T1-R1	DC
C73GSB-6106A	DPL	T1-R1	TONE
C73GSB-6115A	DPL	T2-R1	DC
C73GSB-6116A	DPL	T2-R1	TONE
C73GSB-6125A	DPL	T2-R2	DC
C73GSB-6126A	DPL	T2-R2	TONE
C73GSB-6145A	DPL	T2-2R	DC
C73GSB-6146A	DPL	T2-2R	TONE
C73GSB-6196A	DPL	T4-R4	TONE
REPEATER (RT) STATIONS			
C73GSB-1105AT	CARRIER	T1-R1	DC
C73GSB-1106AT	CARRIER	T1-R1	TONE
C73GSB-3105AT	PL	T1-R1	DC
C73GSB-3106AT	PL	T1-R1	TONE
C73GSB-6105AT	DPL	T1-R1	DC
C73GSB-6106AT	DPL	T1-R1	TONE

CODE:

- ● = ONE ITEM SUPPLIED
- 2 = INDICATES QUANTITY SUPPLIED
- ★ = USED IN PLACE OF ONE 10.7 MHz I-F RECEIVER ON TWO RECEIVER STATIONS WITH CERTAIN FREQUENCY COMBINATIONS

C73GRB-6105A

- 5 = DC REMOTE CONTROL
- 6 = TONE REMOTE CONTROL
- 0 = T1-R1
- 1 = T2-R1
- 2 = T2-R2
- 4 = T2-2R (2 RECEIVERS)
- 9 = T4-R4
- 6 = *DIGITAL PRIVATE-LINE* BINARY CODED SQUELCH
- 7 = 110 W RF OUTPUT

EPS-34367-B

MODEL BREAKDOWN CHART

FOR

MSR 2000

INTERMITTENT DUTY

BASE/REPEATER (RT) STATIONS

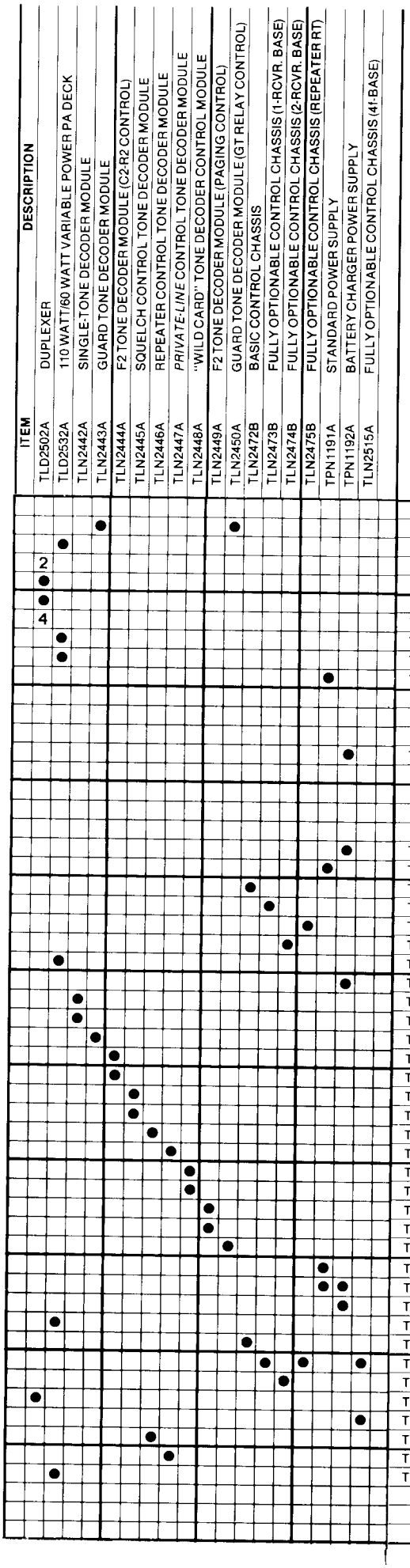
146-174 MHz 110 W RF POWER OUTPUT

EARLIER VERSION

CODE:

● = ONE ITEM SUPPLIED

2,4= INDICATES QUANTITY SUPPLIED



ITEM	DESCRIPTION
KLN6209A	*VIBRASPONDER* RESONANT REED
TFD6452A	HARMONIC FILTER
TKN6471A	CABLE
TKN8292A	CABLE
TKN8293A	CABLE
TLD8392A	FILTER CIRCUIT
TLD9252A	POWER AMPLIFIER BOARD
TLD9272A	POWER CONTROL BOARD
TPN1189A	AUXILIARY REGULATOR CHASSIS
INCLDS.	TRN5119A AUXILIARY REGULATOR BOARD
INCLDS.	TRN5297A HARDWARE KIT
INCLDS.	TRN5299A CHASSIS KIT
TPN1190A	AUXILIARY REGULATOR CHASSIS WITH BATTERY OPTION
INCLDS.	TRN5119A AUXILIARY REGULATOR BOARD
INCLDS.	TRN5120A BATTERY REVERT CONTROL BOARD
INCLDS.	TRN5298A HARDWARE
INCLDS.	TRN5299A CHASSIS
TPN6137A	BATTERY CHARGER BOARD
TPN6138A	DISTRIBUTION BOARD
TRN5081A,B	BACKPLANE INTERCONNECT BOARD (BASIC)
TRN5082A,B	BACKPLANE INTERCONNECT BOARD (1-RECEIVER)
TRN5083A,B	BACKPLANE INTERCONNECT BOARD (DUPLEX)
TRN5084A,B	BACKPLANE INTERCONNECT BOARD (2-RECEIVERS)
TRN5141A	PA HARDWARE
TRN5153A	BATTERY CHARGER HARDWARE
TRN5305A	TONE DECODER BOARD, SINGLE-TONE CONTROL
TRN5306A	SINGLE-TONE CONTROL PANEL
TRN5307A	TONE DECODER MODULE, GT
TRN5308A	TONE DECODER BOARD, C2-R2 CONTROL
TRN5309A	C2-R2 CONTROL PANEL
TRN5310A	TONE DECODER BOARD
TRN5311A	SQUELCH CONTROL PANEL
TRN5312A	REPEATER CONTROL PANEL
TRN5313A	*PRIVATE-LINE* CONTROL PANEL
TRN5315A	TONE DECODER BOARD, "WILD CARD" CONTROL
TRN5316A	"WILD CARD" CONTROL PANEL
TRN5317A	TONE DECODER BOARD, PAGING CONTROL
TRN5318A	PAGING CONTROL PANEL
TRN5319A	TONE DECODER MODULE, GT RELAY CONTROL
TRN5335A	INTERCONNECT HARDWARE
TRN5336A	500 WATT POWER SUPPLY HARDWARE
TRN5362A	INTERCONNECT HARDWARE
TRN5378A	CLOSING HARDWARE
TRN5432A	HARDWARE (BASIC)
TRN5433A	HARDWARE (1-RECEIVER)
TRN5434A	HARDWARE (2-RECEIVERS)
TRN5445A	HARDWARE, MTG (DUPLEXER)
TRN5462A,B	BACKPLANE INTERCONNECT BOARD
TRN5464A	TONE DECODER BOARD
TRN5465A	TONE DECODER BOARD
TKN8313A	CABLE INTERNAL PA

EPS-34543-C

GRB "B" SUFFIX MODELS (BASIC)
GSB "B" MODELS
(FULLY OPTIONABLE)
MODEL CHART
FOR
MSR 2000
INTERMITTENT DUTY
BASE REPEATER (RT) STATIONS
146-174MHZ 110 WATT RF POWER OUTPUT
LATER VERSION

CODE:

- ● = ONE ITEM SUPPLIED
- 2 = INDICATES QUANTITY SUPPLIED
- ⁄ = USED IN PLACE OF ONE 10.7MHZ I-F RECEIVER STATIONS WITH CERTAIN FREQUENCY COMBINATIONS

C73GRB-6105A

- 5 = DC REMOTE CONTROL
- 6 = TONE REMOTE CONTROL
- 0 = T1-R1
- 1 = T2-R1
- 2 = T2-R2
- 4 = T2-2R (2 RECEIVERS)
- 9 = T4-R4
- 6 = *DIGITAL PRIVATE-LINE* BINARY CODED SQUELCH
- 7 = 110 WATT RF OUTPUT

STATION MODEL	TYPE OF SQUELCH	T1= ONE XMIT FREQ. T2 =TWO XMIT FREQS. R1 =ONE RCVR. FREQ. R2 =TWO RCVR. FREQS. 2R =TWO RCVRS. - ONE FREQ. EACH	CONTROL TYPE
BASE STATIONS			
C73GRB-1105B	CARRIER	T1-R1	DC
C73GRB-1106B	CARRIER	T1-R1	TONE
C73GRB-1115B	CARRIER	T2-R1	DC
C73GRB-1116B	CARRIER	T2-R1	TONE
C73GRB-1125B	CARRIER	T2-R2	DC
C73GRB-1126B	CARRIER	T2-R2	TONE
C73GRB-3105B	PL	T1-R1	DC
C73GRB-3106B	PL	T1-R1	TONE
C73GRB-3115B	PL	T2-R1	DC
C73GRB-3116B	PL	T2-R1	TONE
C73GRB-3125B	PL	T2-R2	DC
C73GRB-3126B	PL	T2-R2	TONE
C73GRB-6105B	DPL	T1-R1	DC
C73GRB-6106B	DPL	T1-R1	TONE
C73GRB-6115B	DPL	T2-R1	DC
C73GRB-6116B	DPL	T2-R1	TONE
C73GRB-6125B	DPL	T2-R2	DC
C73GRB-6126B	DPL	T2-R2	TONE
C73GSB-1105B	CARRIER	T1-R1	DC
C73GSB-1106B	CARRIER	T1-R1	TONE
C73GSB-1115B	CARRIER	T2-R1	DC
C73GSB-1116B	CARRIER	T2-R1	TONE
C73GSB-1125B	CARRIER	T2-R2	DC
C73GSB-1126B	CARRIER	T2-R2	TONE
C73GSB-1145B	CARRIER	T2-2R	DC
C73GSB-1146B	CARRIER	T2-2R	TONE
C73GSB-1196B	CARRIER	T4-R4	TONE
C73GSB-3105B	PL	T1-R1	DC
C73GSB-3106B	PL	T1-R1	TONE
C73GSB-3115B	PL	T2-R1	DC
C73GSB-3116B	PL	T2-R1	TONE
C73GSB-3125B	PL	T2-R2	DC
C73GSB-3126B	PL	T2-R2	TONE
C73GSB-3145B	PL	T2-2R	DC
C73GSB-3146B	PL	T2-2R	TONE
C73GSB-3196B	PL	T4-R4	TONE
C73GSB-6105B	DPL	T1-R1	DC
C73GSB-6106B	DPL	T1-R1	TONE
C73GSB-6115B	DPL	T2-R1	DC
C73GSB-6116B	DPL	T2-R1	TONE
C73GSB-6125B	DPL	T2-R2	DC
C73GSB-6126B	DPL	T2-R2	TONE
C73GSB-6145B	DPL	T2-2R	DC
C73GSB-6146B	DPL	T2-2R	TONE
C73GSB-6196B	DPL	T4-R4	TONE
REPEATER (RT) STATIONS			
C73GSB-1105BT	CARRIER	T1-R1	DC
C73GSB-1106BT	CARRIER	T1-R1	TONE
C73GSB-3105BT	PL	T1-R1	DC
C73GSB-3106BT	PL	T1-R1	TONE
C73GSB-6105BT	DPL	T1-R1	DC
C73GSB-6106BT	DPL	T1-R1	TONE

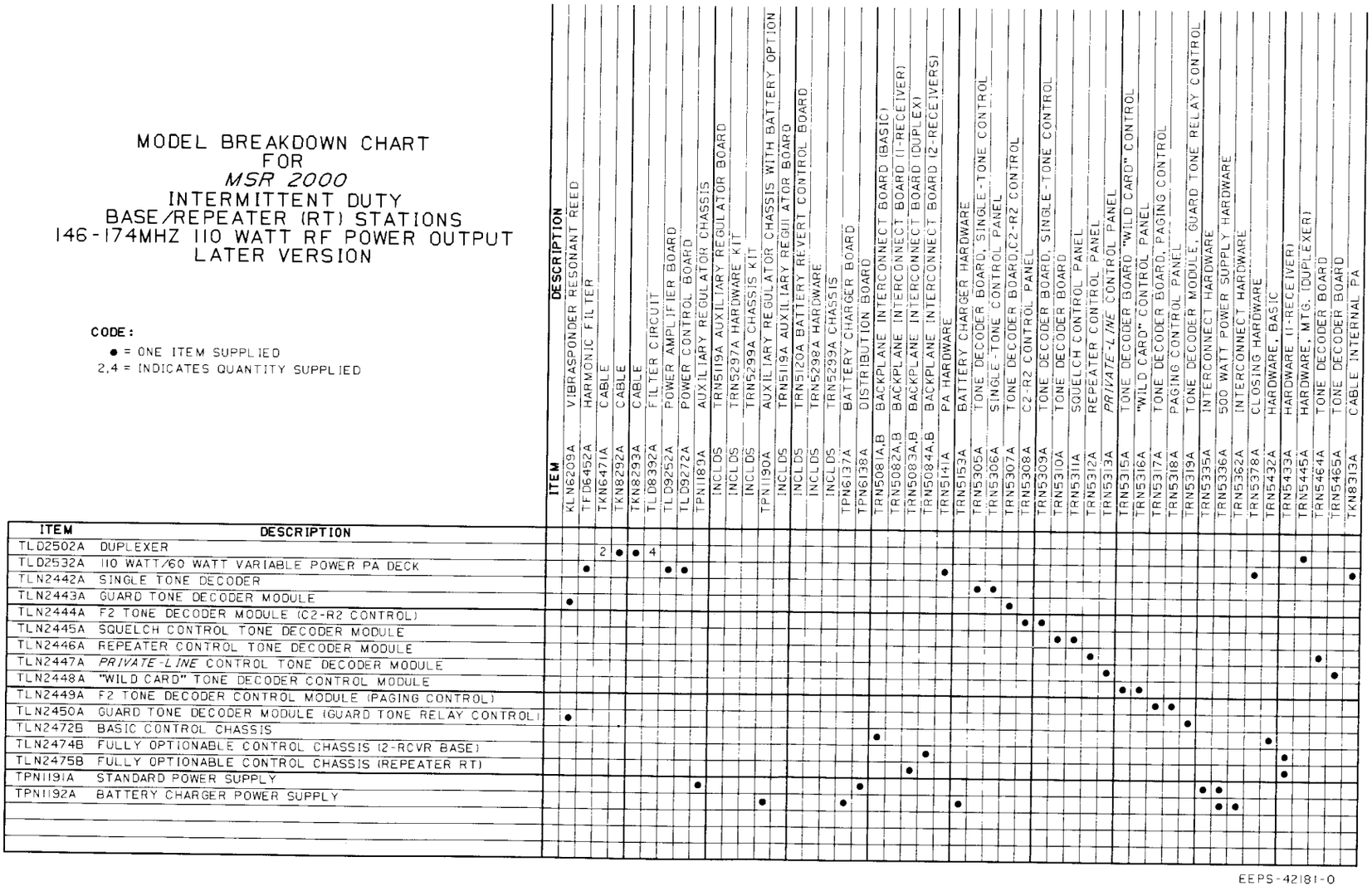
MODEL	DESCRIPTION
KLN6209A	VIBRASPONDER RESONANT REED
KXN1086B	RECEIVE ELEMENT (10.7MHZ I-F) 5PPM
KXN1068BA	RECEIVE ELEMENT (10.8MHZ I-F) 5PPM
KXN1088A	TRANSMIT ELEMENT 5PPM
TKN8234B	STATION INTERCONNECT CABLE
TKN8286A	TWO-WIRE LINE CABLE
TKN8288A	PA POWER/EXCITER CABLE
TKN8289A	NON-DUPLEXER CABLES
TLD2532A	110 W PA
TLD9232A	SIMPLEX EXCITER
TLD9242A	DUPLEX EXCITER
TLN2443A	GUARD TONE DECODER MODULE
TLN2444A	C2-R2 F2 TONE DECODER MODULE
TLN2472A	BASIC CHASSIS
TLN2474A	FULLY OPTIONABLE CHASSIS (2 REC)
TLN2475A	FULLY OPTIONABLE CHASSIS (REPEATER RT)
TPN1191A	STANDARD POWER SUPPLY
TRD6292A	RECEIVER 10.7MHZ NON-FILTERED
TRD6302A	RECEIVER 10.7MHZ FILTERED
TRD6312A	RECEIVER 10.8MHZ FILTERED
TRD621CA	2 RECEIVER COUPLER
TRN9688A	R1 AUDIO BOARD
TRN9690A	R2 AUDIO BOARD
TRN9691A	R2 AUDIO PL BOARD
TRN9692A	R2 AUDIO DPL BOARD
TRN5073A	DUPLEX PL BOARD
TRN5074A	SIMPLEX PL TA-RA BOARD
TRN5076A	DUPLEX DPL BOARD
TRN5077A	SIMPLEX DPL, TA-RA BOARD
TRN5864A	ANTENNA RELAY
TRN5236A	1 RECEIVER, 2-WIRE AUDIO; LINE DRIVER MODULE
TRN5237A	2 RECEIVER, 2-WIRE AUDIO; LINE DRIVER MODULE
TRN5240A	F1 PL CONTROL MODULE
TRN5254A	F1 CARRIER SQUELCH CONTROL MODULE
TRN5255A	C2-R2 CONTROL MODULE
TRN5256A	F2-R2 MUTE CONTROL MODULE
TRN5295A	CMOS TIME-OUT TIMER
TRN5296A	4-FREQUENCY CONTROL MODULE
TRN5320A	F1 PL TONE DECODER MODULE
TRN5321A	STATION CONTROL MODULE
TRN5322A	F1 TONE DECODER MODULE
TRN5324A	SQUELCH GATE MODULE
TRN5325A	F2 TONE DECODER MODULE
TRN5327A	4F F1 TONE DECODER MODULE
TRN5328A	4F F1-PL TONE DECODER MODULE
TRN5350A	SIMPLEX JUNCTION BOX
TRN5351A	DUPLEX JUNCTION BOX
TRN5352A	RF PLASTIC PLUG
TRN5353A	D-TYPE CONNECTOR PLASTIC PLUG
TRN5355A	BATTERY PLASTIC PLUG
TRN5423A	24" CABINET HARDWARE
TRN5425A	24" CABINET SHELL
TRN5427A	110 V POWER CORD
TRN5428A	INTERMITTENT PA HARDWARE
TRN5429A	BASIC COVERS
TRN5430A	OPTIONAL COVERS
TRN5431A	REPEATER COVERS
TRN5443A	DUPLEX RF COVER
TRN6005A	DPL CODE PLUG
TRN9415A	HARDWARE OPT CONTROL R2

MODEL BREAKDOWN CHART
FOR
MSR 2000
INTERMITTENT DUTY
BASE/REPEATER (RT) STATIONS
146-174MHZ 110 WATT RF POWER OUTPUT
LATER VERSION

CODE:

● = ONE ITEM SUPPLIED

2,4 = INDICATES QUANTITY SUPPLIED

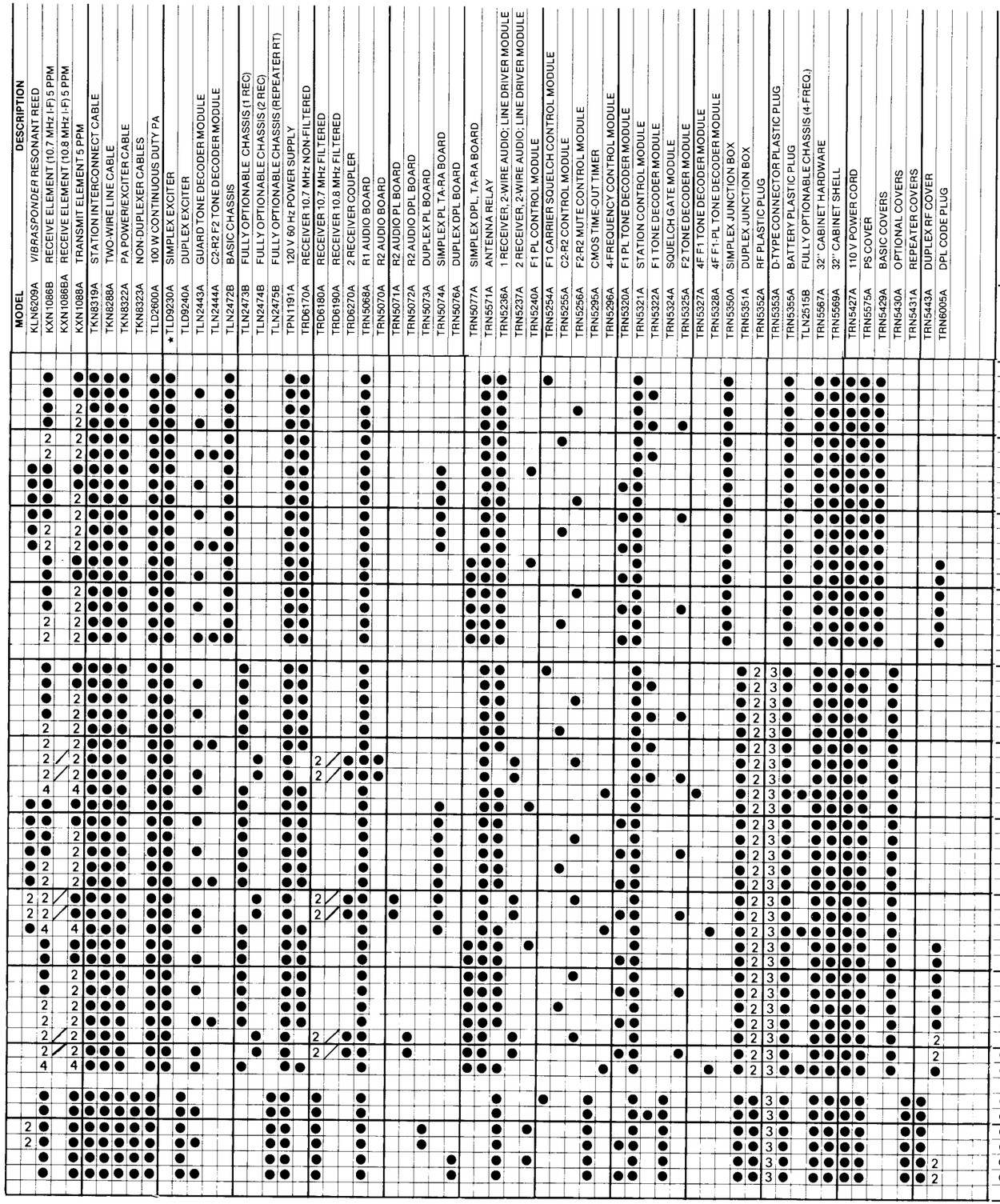


ITEM	DESCRIPTION
TLD2502A	DUPLEXER
TLD2532A	110 WATT/60 WATT VARIABLE POWER PA DECK
TLN2442A	SINGLE TONE DECODER
TLN2443A	GUARD TONE DECODER MODULE
TLN2444A	F2 TONE DECODER MODULE (C2-R2 CONTROL)
TLN2445A	SQUELCH CONTROL TONE DECODER MODULE
TLN2446A	REPEATER CONTROL TONE DECODER MODULE
TLN2447A	*PRIVATE-LINE* CONTROL TONE DECODER MODULE
TLN2448A	"WILD CARD" TONE DECODER CONTROL MODULE
TLN2449A	F2 TONE DECODER CONTROL MODULE (PAGING CONTROL)
TLN2450A	GUARD TONE DECODER MODULE (GUARD TONE RELAY CONTROL)
TLN2472B	BASIC CONTROL CHASSIS
TLN2474B	FULLY OPTIONABLE CONTROL CHASSIS (2-RCVR BASE)
TLN2475B	FULLY OPTIONABLE CONTROL CHASSIS (REPEATER RT)
TPN1191A	STANDARD POWER SUPPLY
TPN1192A	BATTERY CHARGER POWER SUPPLY

ITEM	DESCRIPTION
KLN6209A	VIBRASPONDER RESONANT REED
TFD6452A	HARMONIC FILTER
TKN6471A	CABLE
TKN8292A	CABLE
TKN8293A	CABLE
TLD8392A	FILTER CIRCUIT
TLD9252A	POWER AMPLIFIER BOARD
TLD9272A	POWER CONTROL BOARD
TPN1189A	AUXILIARY REGULATOR CHASSIS
INCLDS	TRN5119A AUXILIARY REGULATOR BOARD
INCLDS	TRN5297A HARDWARE KIT
INCLDS	TRN5299A CHASSIS KIT
TPN1190A	AUXILIARY REGULATOR CHASSIS WITH BATTERY OPTION
INCLDS	TRN5119A AUXILIARY REGULATOR BOARD
INCLDS	TRN5120A BATTERY REVERT CONTROL BOARD
INCLDS	TRN5298A HARDWARE
INCLDS	TRN5299A CHASSIS
TPN6137A	BATTERY CHARGER BOARD
TPN6138A	DISTRIBUTION BOARD
TRN5081A,B	BACKPLANE INTERCONNECT BOARD (BASIC)
TRN5082A,B	BACKPLANE INTERCONNECT BOARD (1-RECEIVER)
TRN5083A,B	BACKPLANE INTERCONNECT BOARD (DUPLEX)
TRN5084A,B	BACKPLANE INTERCONNECT BOARD (2-RECEIVERS)
TRN5141A	PA HARDWARE
TRN5153A	BATTERY CHARGER HARDWARE
TRN5305A	TONE DECODER BOARD, SINGLE-TONE CONTROL
TRN5306A	SINGLE-TONE CONTROL PANEL
TRN5307A	TONE DECODER BOARD,C2-R2 CONTROL
TRN5308A	C2-R2 CONTROL PANEL
TRN5309A	TONE DECODER BOARD, SINGLE-TONE CONTROL
TRN5310A	TONE DECODER BOARD
TRN5311A	SQUELCH CONTROL PANEL
TRN5312A	REPEATER CONTROL PANEL
TRN5313A	*PRIVATE-LINE* CONTROL PANEL
TRN5315A	TONE DECODER BOARD "WILD CARD" CONTROL
TRN5316A	"WILD CARD" CONTROL PANEL
TRN5317A	TONE DECODER BOARD, PAGING CONTROL
TRN5318A	PAGING CONTROL PANEL
TRN5319A	TONE DECODER MODULE, GUARD TONE RELAY CONTROL
TRN5335A	INTERCONNECT HARDWARE
TRN5336A	500 WATT POWER SUPPLY HARDWARE
TRN5362A	INTERCONNECT HARDWARE
TRN5378A	CLOSING HARDWARE
TRN5432A	HARDWARE, BASIC
TRN5433A	HARDWARE (1-RECEIVER)
TRN5445A	HARDWARE, MTG. (DUPLEXER)
TRN5464A	TONE DECODER BOARD
TRN5465A	TONE DECODER BOARD
TKN8313A	CABLE INTERNAL PA

EEPS-42181-O

KRB "A" SUFFIX MODELS [BASIC]
KSB "A" SUFFIX MODELS [FULLY OPTIONABLE]
MODEL CHART
FOR
MSR 2000
CONTINUOUS DUTY
BASE/REPEATER (RT) STATIONS
132-174 MHz 100 W RF POWER OUTPUT
EARLIER VERSION



STATION MODEL	TYPE OF SQUELCH	T1 = ONE XMIT FREQ. T2 = TWO XMIT FREQS. R1 = ONE RCVR. FREQ. R2 = TWO RCVR. FREQS. 2R = TWO RCVRS. — ONE FREQ. EACH	CONTROL TYPE
		BASE STATIONS	
C73KRB-1105A	CARRIER	T1-R1	DC
C73KRB-1106A	CARRIER	T1-R1	TONE
C73KRB-1115A	CARRIER	T2-R1	DC
C73KRB-1116A	CARRIER	T2-R1	TONE
C73KRB-1125A	CARRIER	T2-R2	DC
C73KRB-1126A	CARRIER	T2-R2	TONE
C73KRB-3105A	PL	T1-R1	DC
C73KRB-3106A	PL	T1-R1	TONE
C73KRB-3115A	PL	T2-R1	DC
C73KRB-3116A	PL	T2-R1	TONE
C73KRB-3125A	PL	T2-R2	DC
C73KRB-3126A	PL	T2-R2	TONE
C73KRB-6105A	DPL	T1-R1	DC
C73KRB-6106A	DPL	T1-R1	TONE
C73KRB-6115A	DPL	T2-R1	DC
C73KRB-6116A	DPL	T2-R1	TONE
C73KRB-6125A	DPL	T2-R2	DC
C73KRB-6126A	DPL	T2-R2	TONE
C73KSB-1105A	CARRIER	T1-R1	DC
C73KSB-1106A	CARRIER	T1-R1	TONE
C73KSB-1115A	CARRIER	T2-R1	DC
C73KSB-1116A	CARRIER	T2-R1	TONE
C73KSB-1125A	CARRIER	T2-R2	DC
C73KSB-1126A	CARRIER	T2-R2	TONE
C73KSB-1145A	CARRIER	T2-2R	DC
C73KSB-1146A	CARRIER	T2-2R	TONE
C73KSB-1196A	CARRIER	T4-R4	TONE
C73KSB-3105A	PL	T1-R1	DC
C73KSB-3106A	PL	T1-R1	TONE
C73KSB-3115A	PL	T2-R1	DC
C73KSB-3116A	PL	T2-R1	TONE
C73KSB-3125A	PL	T2-R2	DC
C73KSB-3126A	PL	T2-R2	TONE
C73KSB-3145A	PL	T2-2R	DC
C73KSB-3146A	PL	T2-2R	TONE
C73KSB-3196A	PL	T4-R4	TONE
C73KSB-6105A	DPL	T1-R1	DC
C73KSB-6106A	DPL	T1-R1	TONE
C73KSB-6115A	DPL	T2-R1	DC
C73KSB-6116A	DPL	T2-R1	TONE
C73KSB-6125A	DPL	T2-R2	DC
C73KSB-6126A	DPL	T2-R2	TONE
C73KSB-6145A	DPL	T2-2R	DC
C73KSB-6146A	DPL	T2-2R	TONE
C73KSB-6196A	DPL	T4-R4	TONE
		REPEATER (RT) STATIONS	
C73KSB-1105AT	CARRIER	T1-R1	DC
C73KSB-1106AT	CARRIER	T1-R1	TONE
C73KSB-3105AT	PL	T1-R1	DC
C73KSB-3106AT	PL	T1-R1	TONE
C73KSB-6105AT	DPL	T1-R1	DC
C73KSB-6106AT	DPL	T1-R1	TONE

EPS-35286-A

CODE:

- ● = ONE ITEM SUPPLIED
- 2 = INDICATES QUANTITY SUPPLIED
- / = USED IN PLACE OF ONE 10.7 MHz I-F RECEIVER ON TWO RECEIVER STATIONS WITH CERTAIN FREQUENCY COMBINATIONS
- ★ = INDICATES A MODEL SERIES, SPECIFIC MODEL DEPENDS ON CARRIER FREQUENCY.

C73KRB-6105A

- 5 = DC REMOTE CONTROL
- 6 = TONE REMOTE CONTROL
- 0 = T1-R1
- 1 = T2-R1
- 2 = T2-R2
- 4 = T2-2R (2 RECEIVERS)
- 9 = T4-R4
- 6 = *DIGITAL PRIVATE-LINE* BINARY CODED SQUELCH
- 7 = 110 W RF OUTPUT

MODEL BREAKDOWN CHART

FOR

MSR 2000

CONTINUOUS DUTY

BASE/REPEATER (RT) STATIONS

132-174 MHz 100 WATT POWER OUTPUT

EARLIER VERSION

CODE:

● = ONE ITEM SUPPLIED

2,4 = INDICATES QUANTITY SUPPLIED

ITEM	DESCRIPTION
KLN6209A	*VIBRASPONDER* RESONANT REED
TFD6101A	HARMONIC FILTER, 132-150.8 MHz
TFD6102A	HARMONIC FILTER, 150.8-174 MHz
TKN6471A	CABLE
TKN8292A	CABLE
TKN8293A	CABLE
TLD5952A	POWER AMPLIFIER BOARD 132-150.8 MHz
TLD5953A	POWER AMPLIFIER BOARD 150.8-162 MHz
TLD5954A	POWER AMPLIFIER BOARD 162-174 MHz
TLD5960A	POWER CONTROL BOARD
TLD8392A	FILTER CIRCUIT
TLN2424A	POWER AMPLIFIER INPUT BRACKET ASSEMBLY
INCLDS	TRN5566A PA INPUT BRACKET
INCLDS	TRN5585A EXCITER CONTROL VOLTAGE REGULATOR
INCLDS	TKN8336A PA CABLE KIT
TPN1189A	AUXILIARY REGULATOR CHASSIS
INCLDS	TRN5119A AUXILIARY REGULATOR BOARD
INCLDS	TRN5297A HARDWARE KIT
INCLDS	TRN5299A CHASSIS KIT
TPN1190A	AUXILIARY REGULATOR CHASSIS WITH BATTERY OPTION
INCLDS	TRN5119A AUXILIARY REGULATOR BOARD
INCLDS	TRN5120A BATTERY REVERT CONTROL BOARD
INCLDS	TRN5298A HARDWARE
INCLDS	TRN5299A CHASSIS
TPN6137A	BATTERY CHARGER BOARD
TPN6138A	DISTRIBUTION BOARD
TRN5081A,B	BACKPLANE INTERCONNECT BOARD (BASIC)
TRN5082A,B	BACKPLANE INTERCONNECT BOARD (1-RECEIVER)
TRN5083A,B	BACKPLANE INTERCONNECT BOARD (DUPLEX)
TRN5084A,B	BACKPLANE INTERCONNECT BOARD (2-RECEIVERS)
TRN5153A	BATTERY CHARGER HARDWARE
TRN5305A	TONE DECODER BOARD, SINGLE-TONE CONTROL
TRN5306A	SINGLE-TONE CONTROL PANEL
TRN5307A	TONE DECODER MODULE, GUARD TONE
TRN5308A	TONE DECODER BOARD, C2-R2 CONTROL
TRN5309A	C2-R2 CONTROL PANEL
TRN5310A	TONE DECODER BOARD
TRN5311A	SQUELCH CONTROL PANEL
TRN5312A	REPEATER CONTROL PANEL
TRN5313A	*PRIVATE-LINE* CONTROL PANEL
TRN5315A	TONE DECODER BOARD "WILD CARD" CONTROL
TRN5316A	"WILD CARD" CONTROL PANEL
TRN5317A	TONE DECODER BOARD, PAGING CONTROL
TRN5318A	PAGING CONTROL PANEL
TRN5319A	TONE DECODER MODULE, GUARD TONE RELAY CONTROL
TRN5335A	INTERCONNECT HARDWARE
TRN5336A	500 WATT POWER SUPPLY HARDWARE
TRN5362A	INTERCONNECT HARDWARE
TRN5432A	HARDWARE, BASIC
TRN5433A	HARDWARE (1-RECEIVER)
TRN5434A	HARDWARE (2-RECEIVERS)
TRN5435A	HARDWARE (DUPLEX)
TRN5445A	HARDWARE (DUPLEXER MOUNTING)
TRN5462A,B	BACKPLANE INTERCONNECT BOARD
TRN5464A	TONE DECODER BOARD
TRN5465A	TONE DECODER BOARD
TRN5577A	PA CASTING & HARDWARE
TRN5586A	PA HARDWARE
TRN8069A	SUPPRESSION NETWORK

ITEM	DESCRIPTION
TLD2502A	DUPLEXER
TLD2601A	100 WATT/50 WATT VARIABLE PA DECK, 132-150.8 MHz
TLD2602A	100 WATT/50 WATT VARIABLE PA DECK, 150.8-162 MHz
TLD2603A	100 WATT/50 WATT VARIABLE PA DECK, 162-174 MHz
TLN2442A	SINGLE TONE DECODER MODULE
TLN2443A	GUARD TONE DECODER MODULE
TLN2444A	F2 TONE DECODER MODULE (C2-R2 CONTROL)
TLN2445A	SQUELCH CONTROL TONE DECODER MODULE
TLN2446A	REPEATER CONTROL TONE DECODER MODULE
TLN2447A	*PRIVATE-LINE* CONTROL TONE DECODER MODULE
TLN2448A	"WILD CARD" TONE DECODER CONTROL MODULE
TLN2449A	F2 TONE DECODER MODULE (PAGING CONTROL)
TLN2450A	GUARD TONE DECODER MODULE (GUARD TONE RELAY CONTROL)
TLN2472B	BASIC CONTROL CHASSIS
TLN2473B	FULLY OPTIONABLE CONTROL CHASSIS (1-RCVR BASE)
TLN2474B	FULLY OPTIONABLE CONTROL CHASSIS (2-RCVR BASE)
TLN2475B	FULLY OPTIONABLE CONTROL CHASSIS (REPEATER RT)
TLN2515B	FULLY OPTIONABLE CONTROL CHASSIS (4 FREQUENCY BASE)
TPN1191A	STANDARD POWER SUPPLY
TPN1192A	BATTERY CHARGER POWER SUPPLY

EPS-35239-A

KRB "B" SUFFIX MODELS (BASIC)
KSB "B" SUFFIX MODELS
(FULLY OPTIONABLE)
MODEL CHART
FOR
MSR 2000
CONTINUOUS DUTY
BASE/REPEATER (RT) STATIONS
132-174MHZ 110 WATT RF POWER OUTPUT
LATER VERSION

CODE:

- ● = ONE ITEM SUPPLIED
- 2 = INDICATES QUANTITY SUPPLIED
- / = USED IN PLACE OF ONE 10.7MHZ I-F RECEIVER ON TWO RECEIVER STATIONS WITH CERTAIN FREQUENCY COMBINATIONS
- ✦ = INDICATES A MODEL SERIES, SPECIFIC MODEL DEPENDS ON CARRIER FREQUENCY.

C73KRB-6105

- 6 5 — DC REMOTE CONTROL / TONE REMOTE CONTROL
- 0 1 2 3 4 — T1-R1 / T2-R1 / T2-R2 / T2-2R (2 RECEIVERS) / T4-R4
- 6 — *DIGITAL PRIVATE-LINE* BINARY CODED SQUELCH
- 7 — 110 WATT RF OUTPUT

STATION MODEL	TYPE OF SQUELCH	T1= ONE XMIT FREQ. T2 =TWO XMIT FREQS. R1 =ONE RCVR. FREQ. R2 =TWO RCVR. FREQS. 2R =TWO RCVRS.- ONE FREQ. EACH	CONTROL TYPE
BASE STATIONS			
C73KRB-1105B	CARRIER	T1-R1	DC
C73KRB-1106B	CARRIER	T1-R1	TONE
C73KRB-1115B	CARRIER	T2-R1	DC
C73KRB-1116B	CARRIER	T2-R1	TONE
C73KRB-1125B	CARRIER	T2-R2	DC
C73KRB-1126B	CARRIER	T2-R2	TONE
C73KRB-3105B	PL	T1-R1	DC
C73KRB-3106B	PL	T1-R1	TONE
C73KRB-3115B	PL	T2-R1	DC
C73KRB-3116B	PL	T2-R1	TONE
C73KRB-3125B	PL	T2-R2	DC
C73KRB-3126B	PL	T2-R2	TONE
C73KRB-6105B	DPL	T1-R1	DC
C73KRB-6106B	DPL	T1-R1	TONE
C73KRB-6115B	DPL	T2-R1	DC
C73KRB-6116B	DPL	T2-R1	TONE
C73KRB-6125B	DPL	T2-R2	DC
C73KRB-6126B	DPL	T2-R2	TONE
C73KSB-1105B	CARRIER	T1-R1	DC
C73KSB-1106B	CARRIER	T1-R1	TONE
C73KSB-1115B	CARRIER	T2-R1	DC
C73KSB-1116B	CARRIER	T2-R1	TONE
C73KSB-1125B	CARRIER	T2-R2	DC
C73KSB-1126B	CARRIER	T2-R2	TONE
C73KSB-1145B	CARRIER	T2-2R	DC
C73KSB-1146B	CARRIER	T2-2R	TONE
C73KSB-1196B	CARRIER	T4-R4	TONE
C73KSB-3105B	PL	T1-R1	DC
C73KSB-3106B	PL	T1-R1	TONE
C73KSB-3115B	PL	T2-R1	DC
C73KSB-3116B	PL	T2-R1	TONE
C73KSB-3125B	PL	T2-R2	DC
C73KSB-3126B	PL	T2-R2	TONE
C73KSB-3145B	PL	T2-2R	DC
C73KSB-3146B	PL	T2-2R	TONE
C73KSB-3196B	PL	T4-R4	TONE
C73KSB-6105B	DPL	T1-R1	DC
C73KSB-6106B	DPL	T1-R1	TONE
C73KSB-6115B	DPL	T2-R1	DC
C73KSB-6116B	DPL	T2-R1	TONE
C73KSB-6125B	DPL	T2-R2	DC
C73KSB-6126B	DPL	T2-R2	TONE
C73KSB-6145B	DPL	T2-2R	DC
C73KSB-6146B	DPL	T2-2R	TONE
C73KSB-6196B	DPL	T4-R4	TONE
REPEATER (RT) STATIONS			
C73KSB-1105BT	CARRIER	T1-R1	DC
C73KSB-1106BT	CARRIER	T1-R1	TONE
C73KSB-3105BT	PL	T1-R1	DC
C73KSB-3106BT	PL	T1-R1	TONE
C73KSB-6105BT	DPL	T1-R1	DC
C73KSB-6106BT	DPL	T1-R1	TONE

MODEL	DESCRIPTION
KLN6209A	VIBRASPONDER RESONANT REED
KXN1086B	RECEIVE ELEMENT (10.7MHZ I-F) 5PPM
KXN1086BA	RECEIVE ELEMENT (10.8MHZ I-F) 5PPM
KXN1088A	TRANSIT ELEMENT 5PPM
TKN8319A	STATION INTERCONNECT CABLE
TKN8288A	TWO-WIRE LINE CABLE
TKN8322A	PA POWER/EXCITER CABLE
TKN8323A	NON-DUPLEXER CABLES
TLD2600A	100 W CONTINUOUS DUTY PA
✦TLD9230A	SIMPLEX EXCITER
TLD9240A	DUPLEX EXCITER
TLN2443A	GUARD TONE DECODER MODULE
TLN2444A	C2-R2 F2 TONE DECODER MODULE
TLN2472B	BASIC CHASSIS
TLN2474B	FULLY OPTIONABLE CHASSIS (2 REC)
TLN2475B	FULLY OPTIONABLE CHASSIS (REPEATER RT)
TPN1191A	120 V, 60 HZ POWER SUPPLY
TR0628OA	RECEIVER 10.7MHZ NON-FILTERED
TR0630OA	RECEIVER 10.7MHZ FILTERED
TR0631OA	RECEIVER 10.8MHZ FILTERED
TRD6270A	2 RECEIVER COUPLER
TRN9688A	R1 AUDIO BOARD
TRN9690A	R2 AUDIO BOARD
TRN9691A	R2 AUDIO PL BOARD
TRN9692A	R2 AUDIO DPL BOARD
TRN5073A	DUPLEX PL BOARD
TRN5074A	SIMPLEX PL TA-RA BOARD
TRN5076A	DUPLEX DPL BOARD
TRN5077A	SIMPLEX DPL, TA-RA BOARD
TRN5571A	ANTENNA RELAY
TRN5236A	1 RECEIVER, 2-WIRE AUDIO: LINE DRIVER MODULE
TRN5237A	2 RECEIVER, 2-WIRE AUDIO: LINE DRIVER MODULE
TRN5240A	F1 PL CONTROL MODULE
TRN5254A	F1 CARRIER SQUELCH CONTROL MODULE
TRN5255A	C2-R2 CONTROL MODULE
TRN5256A	F2-R2 MUTE CONTROL MODULE
TRN5295A	CMOS TIME-OUT TIMER
TRN5296A	4-FREQUENCY CONTROL MODULE
TRN5320A	F1 PL TONE DECODER MODULE
TRN5321A	STATION CONTROL MODULE
TRN5322A	F1 TONE DECODER MODULE
TRN5324A	SQUELCH GATE MODULE
TRN5325A	F2 TONE DECODER MODULE
TRN5327A	4F F1 TONE DECODER MODULE
TRN5328A	4F F1-PL TONE DECODER MODULE
TRN5350A	SIMPLEX JUNCTION BOX
TRN5351A	DUPLEX JUNCTION BOX
TRN5352A	RF PLASTIC PLUG
TRN5353A	D-TYPE CONNECTOR PLASTIC PLUG
TRN5355A	BATTERY PLASTIC PLUG
TRN5567A	32" CABINET HARDWARE
TRN5569A	32" CABINET SHELL
TRN5427A	110 V POWER CORD
TRN5575A	PS COVER
TRN5429A	BASIC COVERS
TRN5430A	OPTIONAL COVERS
TRN5431A	REPEATER COVERS
TRN5443A	DUPLEX RF COVER
TRN6005A	DPL CODE PLUG
TRN9415A	HARDWARE OPT CONTROL R2

MODEL BREAKDOWN CHART
FOR
MSR 2000
CONTINUOUS DUTY
BASE/REPEATER (RT) STATIONS
132-174MHZ 100 WATT POWER OUTPUT
LATER VERSION

CODE:

● = ONE ITEM SUPPLIED

2,4 = INDICATES QUANTITY SUPPLIED

ITEM	DESCRIPTION	KLN6209A	TFD6101A	TFD6102A	TKN6471A	TKN8292A	TKN8293A	TLD5952A	TLD5953A	TLD5954A	TLD5960A	TLD8392A	TLN2424A	INCLDS	INCLDS	TKN8336A	TPN1189A	INCLDS	INCLDS	INCLDS	TPN1190A	INCLDS	INCLDS	INCLDS	INCLDS	TPN6137A	TPN6138A	TRN5081AB	TRN5083AB	TRN5084AB	TRN5153A	TRN5305A	TRN5306A	TRN5307A	TRN5308A	TRN5309A	TRN5310A	TRN5311A	TRN5312A	TRN5313A	TRN5315A	TRN5316A	TRN5317A	TRN5318A	TRN5319A	TRN5335A	TRN5336A	TRN5362A	TRN5432A	TRN5435A	TRN5445A	TRN5464A	TRN5465A	TRN5577A	TRN5586A	TRN8069A
TLD2502A	DUPLEXER				2	●	●				4																																														
TLD2601A	100 WATT/50 WATT VARIABLE PA DECK, 132-150.8MHZ		●					●			●		●																																												
TLD2602A	100 WATT/50 WATT VARIABLE PA DECK, 150.8-162MHZ			●					●		●		●																																												
TLD2603A	100 WATT/50 WATT VARIABLE PA DECK, 162-174MHZ			●						●	●		●																																												
TLN2442A	SINGLE TONE DECODER MODULE																															●	●																						
TLN2443A	GUARD TONE DECODER MODULE	●																															●																						
TLN2444A	F2 TONE DECODER MODULE (C2-R2 CONTROL)																																	●																					
TLN2445A	SQUELCH CONTROL TONE DECODER MODULE																																		●	●																			
TLN2446A	REPEATER CONTROL TONE DECODER																																				●	●																	
TLN2447A	*PRIVATE-LINE* CONTROL TONE DECODER MODULE																																						●	●															
TLN2448A	"WILD CARD" TONE DECODER CONTROL MODULE																																								●	●													
TLN2449A	F2 TONE DECODER MODULE (PAGING CONTROL)																																										●	●											
TLN2450A	GUARD TONE DECODER MODULE (GUARD TONE RELAY CONTROL)	●																																											●										
TLN2472B	BASIC CONTROL CHASSIS																																												●									
TLN2474B	FULLY OPTIONABLE CONTROL CHASSIS (2-RCVR BASE)																																													●								
TLN2475B	FULLY OPTIONABLE CONTROL CHASSIS (REPEATER RT)																																														●							
TPN1191A	STANDARD POWER SUPPLY																																															●						
TPN1192A	BATTERY CHARGER POWER SUPPLY																																																●	●				

EEPS-42593-0

MSR 2000 VHF INTERMITTENT DUTY STATIONS OPTION CHART

Option	Add	Delete	Description
C11AB	TRN5295A	—	Time-Out Timer
C12AG	HLD4052A	—	Receiver Preamplifier
C13AA	TLN2445A	—	Remote Squelch Control
C14AF	TLN2447A	—	Receive PL Tone On/Off
C15AA	TLN2448A	—	"Wild Card" Option
C28AN	TPN1192A TKN8295A TRN5155A	TPN1191A TRN5355A —	Battery Revert
C28AU	TKN8295A TPN1226A TRN5155A	TPN1222A TRN5355A —	Battery Revert
C28AV	TPN1227A TKN8295A TRN5155A	TPN1223A TRN5355A —	Battery Revert
C31DU	—	TRD6172A	Omit Receiver (146-174 MHz)
C31EK	—	TRD6292A	Omit Receiver (146-174 MHz)
C50AC	—	—	Decreased RF Power Output for Maritime Operation (146-174 MHz)
C56AC	TRN5326A	TRN5325A	Tone Mute Second Receiver (F2-R2)
C63AK	TRN5239A	TRN5240A	DC Transmit PL On/Off
C63AL	TLN2449A	—	Tone Transmit PL On/Off
C71AB	—	TMN6054A	Omit Microphone
C75AB	—	TRN5295A	Omit Time-Out Timer
C83AC	— — — —	TLN2443A TRN5322A TRN5236A TKN8286A	Omit Wire Line Control (Carrier Squelch, Tone Stations)
C84AC	— — — —	TLN2443A TRN5320A TRN5236A TKN8286A	Omit Wire Line Control (PL/DPL, Tone Stations)
C85AB	— — —	TRN5254A TRN5236A TKN8286A	Omit Wire Line Control (Carrier Squelch, DC Stations)
C86AC	— — —	TRN5240A TRN5236A TKN8286A	Omit Wire Line Control (PL/DPL, DC Stations)
C92AA	TRN9086A TBN6386A TRN5426A	TRN9085A TBN6385A TRN5425A	29" Cabinet
C113AA	TMN6054A	—	Dynamic Microphone
C116BP	TRD6182A TRN5431A TRN5443A	TRN6172A TRN5430A —	Shield Kit (One Receiver)
C116BQ	TRN5474A TRN5443A TRD6182A	TRN5429A TRD6172A —	Shield Kit (Basic)
C116CB	TRD6302A TRN5431A TRN5443A	TRN6292A TRN5430A —	Shield Kit (One Receiver)
C116CC	TRN5474A TRN5443A TRD6302A	TRN5429A TRD6292A —	Shield Kit (Basic)
C140AD	—	—	"AND" Squelch
C143AD	TRN5257A	TRN5254A	Repeater Control (Carrier Squelch, DC Stations)
C143AE	TRN5257A	TRN5240A	Repeater Control (PL/DPL, DC Stations)
C143AF	TLN2446A	—	Repeater Control (Tone Stations)

MSR 2000 VHF INTERMITTENT DUTY STATIONS OPTION CHART (Cont'd.)

Option	Add	Delete	Description
C144AH	TRN5235A TKN8287A	TRN5236A TKN8286A	4-Wire Line Audio (One Receiver)
C144AJ	TRN5235A TKN8287A	TRN5237A TKN8286A	4-Wire Line Audio (Two Receivers)
C149CV	TRN9689A TMN6054A TRN5080A	TRN9688A — —	Intercom, Metering and Microphone
C149DA	TRN9689A TMN6054A TRN5080A	TRN9688A TRN5353A —	Intercom, Metering and Microphone
C150AH	TRN5324A TKN8281A	TRN5254A TRN5353A	RA Base (Carrier Squelch, DC Stations)
C150AJ	TRN5324A TKN8281A	TRN5240A TRN5353A	RA Base (PL/DPL, DC Stations)
C150AK	TRN5324A TKN8281A	— —	RA Base (Tone Station)
C158AB	TRN5292A TRN5330A (4)KLN6210A	— — KLN6209A	Multi PL Encoder (Rptr)
C158AE	TRN5292A TRN5330A (4)KLN6210A	— — KLN6209A	Multi PL Encoder (Base)
C181AG	TBN6386A TKN8475A TLD2622A TRN5352A TRN5426A TRN9086A	TBN6385A TKN8289A — — TRN5425A TRN9085A	Add 2 Can Duplexer (148-174 MHz)
C182AH	TRN9086A TBN6386A TRN5426A TKN8290A TLD2502A TRN5352A	TRN9085A TBN6385A TRN5425A TKN8289A — —	Add Duplexer (148-174 MHz)
C226AH	TRN5069A TRN5079A	TRN5068A —	Intercom Only
C226AL	TRN9689A TRN5079A	TRN9688A —	Intercom Only
C257AD	TPN1222A TRN9109A TRN9114A TRN9209A	TPN1191A TRN5442A TRN5350A —	Multi-Voltage, 50 Hz, Basic
C257AE	TPN1222A TRN9109A TRN9113A TRN9209A	TPN1191A TRN5442A TRN5351A —	Multi-Voltage, 50 Hz, Fully Optionable
C261AC	(4)TLN8381A TRN5329A	— —	Multi PL Decoder
C261AH	(4)TLN8381A TRN6329A	KLN6209A	Multi PL Decoder Rptr
C262AE	TRN5292A TRN5329A (4)KLN6210A (4)TLN8381A	(2)KLN6209A — — —	Multi PL Repeater
C263AB	TRN5329A TRN5292A TRN5330A (4)KLN6210A (4)TLN8381A	KLN6209A — — — —	Multi PL Encoder/Decoder

MSR 2000 VHF INTERMITTENT DUTY STATIONS OPTION CHART (Cont'd.)

Option	Add	Delete	Description
C266AA	—	KLN6210A	Omit One Vibrasender Reed
C267AA	—	TLN8381A	Omit One Vibrasponder Reed
C269AP	TRN5293A TRN5294A TKN8287A	TRN5236A TKN8286A —	*Spectra-TAC* Operation (Base)
C269AQ	TRN5293A TRN5294A TKN8287A TRN5331A	TLN5236A TKN8286A TRN5324A —	*Spectra-TAC* Operation (Rptr)
C276AA	TRN5075A KLN6209A	TRN5074A —	Simplex PL TA-RB
C276AB	TRN5078A TRN6005A	TRN5077A —	Simplex DPL TA-RB
C323AA	—	TRN5427A	Omit Power Cord
C501AJ	—	KXN1088A	Omit One Transmit Element
C502AH	—	(2)KXN1088A	Omit Two Transmit Elements
C503AE	—	(3)KXN1088A	Omit Three Transmit Elements
C504AE	—	(4)KXN1088A	Omit Four Transmit Elements
C521AR	—	KXN1086B	Omit One Receive Element
C522AM	—	(2)KXN1086B	Omit Two Receive Elements
C523AH	—	(3)KXN1086B	Omit Three Receive Elements
C524AJ	—	(4)KXN1086B	Omit Four Receive Elements
C576AA	TLN2442A	—	Single-Tone Decoder
C601AC	KXN1095A	KXN1088A	One 2PPM Transmit Element
C602AB	(2)KXN1095A	(2)KXN1088A	Two 2PPM Transmit Elements
C603AB	(3)KXN1095A	(3)KXN1088A	Three 2PPM Transmit Elements
C604AC	(4)KXN1095A	(4)KXN1088A	Four 2PPM Transmit Elements
C621AC	KXN1112AA	KXN1086B	One 2PPM Receive Element
C622AB	(2)KXN1112AA	(2)KXN1086B	Two 2PPM Receive Elements
C623AB	(3)KXN1112AA	(3)KXN1086B	Three 2PPM Receive Elements
C624AB	(4)KXN1112AA	(4)KXN1086B	Four 2PPM Receive Elements
C681AB	TPN1223A TRN9114A TRN9110A TRN9210A	TPN1191A TRN5350A TRN5442A —	Multi-Voltage, 60 Hz, Basic
C681AC	TPN1223A TRN9110A TRN9113A TRN9210A	TPN1191A TRN5442A TRN5351A —	Multi-Voltage, 60 Hz, Fully Optionable
C691AA	TRN5972A	TRN5427A	European Power Cord
C692AA	TRN5971A	TRN5427A	United Kingdom Power Cord

CONTINUOUS DUTY STATION PERFORMANCE SPECIFICATIONS

GENERAL

Model	Frequency (MHz)	Minimum RF Output Power	Maximum PA Final Input Power	Input Voltage	A.C. Input Current			
					Standard Supply		Battery Charging*** Supply	
					Stby	Xmit	Stby	Xmit
C73KRB C73KSB*	136-174	100 W**	200 W	120 V ac +10% -20%; 60 Hz Standard	1A	4.6A	1.5-2A	4.6A

No. of Frequencies	Single and two-frequency stations (dc and tone remote) Four-frequency stations (tone remote)
Squelch Options	Carrier squelch, *Private-Line* coded squelch, and *Digital Private-Line* coded squelch
Metering	Optional internal-mounted meter used to measure all essential circuits for tuning and checking.

*Fully Optionable Models **Variable Down to 60 W ***Does Not Include Battery Charging Current

TRANSMITTER 136-174 MHz

RF Output Power	110/50 watts intermittent duty (cont. variable)
Output Impedance	50 ohms
Oscillator Frequency Stability	Channel element maintains oscillator frequency within ± .0005% (± .0002% optional) from -30°C to +60°C ambient (+25°C reference)
Transmitter Sideband Noise	-90 dB @ ± 30 kHz -105 dB @ ± 1 MHz
Spurious & Harmonics	More than 85 dB below carrier
Modulation	15F2 and 16F3: ± 5 kHz for 100% at 1000 Hz.
Audio Sensitivity	Remote telephone line: -20 dBm max. for 60% max. dev. at 1000 Hz.
FM Noise	55 dB below 60% system dev. at 1000 Hz
Audio Response	+1, -3 dB from 6 dB/octave pre-emphasis, 300-3000 Hz, referenced to 1000 Hz
Audio Distortion	Less than 2% at 1000 Hz; 60% system dev.
FCC Designation	ABZ89FC3640 (± .0005% stability) ABZ89FC3641C (± .0002% stability) Licensable under parts 22, 74, 81, and 90 of FCC Rules.

RECEIVER 132-174 MHz

Channel Spacing	30 kHz/25 kHz	
EIA Modulation Acceptance	± 7 kHz minimum	
Oscillator Frequency Stability	Channel element maintains oscillator frequency within ± .0005% (± .0002% optional) from -30°C to +60°C ambient (+25°C reference)	
Sensitivity 20 dB Quieting EIA SINAD	**Without Preamp** Less than 0.5 uV Less than 0.35 uV	**With Preamp** Less than 0.25 uV Less than 0.20 uV
Intermodulation — EIA SINAD	-85 dB	-80 dB
Selectivity — EIA SINAD	-100 dB (-95 dB with preamp)	
Spurious & Image Rejection	100 dB minimum	100 dB minimum
Squelch Sensitivity Carrier Squelch Tone-Coded Squelch	0.2 uV or less at threshold 0.2 uV or less	0.10 uV or less at threshold 0.10 uV or less
Audio Characteristics Remote Control Models	**Telephone Line:** Output: +11 dBm @600 ohms Response: +1, -3 dB Distortion: 3% @1000 Hz Hum & Noise: -55 dB **For local service audio:** Output Available: 1 W @8 ohms Response: +2, -8 dB Distortion: 5% @1000 Hz Hum & Noise: -55 dB	
FCC Receiver Certification Number	ABZ89FR3633	

Meets EIA Specifications per RS152B, RS204B, and RS220A.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

MSR 2000 VHF CONTINUOUS DUTY STATIONS OPTION CHART

Option	Add	Delete	Description
C11AB	TRN5295A	—	Time-Out Timer
C12AG	HLD4052A	—	Receiver Preamplifier (146-174 MHz)
C12AH	HLD4051A	—	Receiver Preamplifier (132-150.8 MHz)
C13AA	TLN2445A	—	Remote Squelch Control
C14AF	TLN2447A	—	Receive PL Tone On/Off
C15AA	TLN2448A	—	"Wild Card" Option
C28AN	TPN1192A TKN8295A TRN5155A	TPN1191A TRN5355A —	Battery Revert
C28AU	TPN1226A TKN8295A TRN5155A	TPN1222A TRN5355A	Battery Revert
C28AV	TPN1227A TKN8295A TRN5155A	TPN1223A TRN5355A	Battery Revert
C31DY	— —	TRD6171A TRD6172A	Omit Receiver (132-150.8 MHz) Omit Receiver (146-174 MHz)
C31EL	— —	TRD6291A TRD6292A	Omit Receiver (132-150.8 MHz) Omit Receiver (146-174 MHz)
C50AC	—	—	Decreased RF Power Output for Maritime Operation (132-174 MHz)
C52AA	TRN5568A TRN5570A	TRN5567A TRN5569A	37" Cabinet
C56AC	TRN5326A	TRN5325A	Tone Mute Second Receiver (F2-R2)
C63AK	TRN5239A	TRN5240A	DC Transmit PL On/Off
C63AL	TLN2449A	—	Tone Transmit PL On/Off
C71AB	—	TMN6054A	Omit Microphone
C75AB	—	TRN5295A	Omit Time-Out Timer
C83AC	— — — —	TLN2443A TRN5322A TRN5236A TKN8286A	Omit Wire Line Control (Carrier Squelch, Tone Stations)
C84AC	— — — —	TLN2443A TRN5320A TRN5236A TKN8286A	Omit Wire Line Control (PL/DPL, Tone Stations)
C85AB	— — —	TRN5254A TRN5236A TKN8286A	Omit Wire Line Control (Carrier Squelch, DC Stations)
C86AC	— — —	TRN5240A TRN5236A TKN8286A	Omit Wire Line Control (PL/DPL, DC Stations)
C113AA	TMN6054A	—	Dynamic Microphone
C116BP	TRD6182A TRN5431A TRN5443A	TRN6172A TRN5430A —	Shield Kit (One Receiver)
C116BQ	TRN5474A TRN5443A TRD6182A	TRN5429A TRD6172A —	Shield Kit (Basic)
C116BT	TRD6181A TRN5431A TRN5443A	TRD6171A TRN5430A —	Shield Kit (146-174 MHz)
C116BU	TRD6181A TRN5443A TRN5474A	TRD6171A TRN5429A —	Shield Kit (132-150.8 MHz)
C116CB	TRD6302A TRN5431A TRN5443A	TRN6292A TRN5430A —	Shield Kit (One Receiver)
C116CC	TRN5474A TRN5443A TRD6302A	TRN5429A TRD6292A	Shield Kit (Basic)

MSR 2000 VHF CONTINUOUS DUTY STATIONS OPTION CHART (Cont'd.)

Option	Add	Delete	Description
C116CD	TRD6301A TRN5431A TRN5443A	TRD6291A TRN5430A —	Shield Kit (146-174 MHz)
C116CE	TRD6301A TRN5443A TRN5474A	TRD6291A TRN5429A —	Shield Kit (132-150.8 MHz)
C140AD	—	—	"AND" Squelch
C143AD	TRN5257A	TRN5254A	Repeater Control (Carrier Squelch, DC Stations)
C143AE	TRN5257A	TRN5240A	Repeater Control (PL/DPL, DC Stations)
C143AF	TLN2446A	—	Repeater Control (Tone Stations)
C144AH	TRN5235A TKN8287A	TRN5236A TKN8286A	4-Wire Line Audio (One Receiver) w/o EIA Rack Mounting
C144AJ	TRN5235A TKN8287A	TRN5237A TKN8286A	4-Wire Line Audio (Two Receivers) w/o EIA Rack Mounting
C149CV	TRN9689A TMN6054A TRN5080A	TRN9688A — —	Intercom, Metering and Microphone
C149DA	TRN9689A TMN6054A TRN5080A	TRN9688A	Intercom, Metering and Microphone
C150AH	TRN5324A TKN8281A	TRN5254A TRN5353A	RA Base (Carrier Squelch, DC Stations)
C150AJ	TRN5324A TKN8281A	TRN5240A TRN5353A	RA Base (PL/DPL, DC Stations)
C150AK	TRN5324A TKN8281A	— TRN5353A	RA Base (Tone Station)
C158AB	TRN5292A TRN5330A (4)KLN6210A	— — KLN6209A	Multi PL Encoder (Rptr)
C158AE	TRN5292A TRN5330A (4)KLN6210A	— — KLN6209A	Multi PL Encoder (Base)
C164	—	—	EIA Rack Mounting (see Instruction Manual 68P81112E95)
C181AH	TBN6394A TKN8324A TLD2622A TRN5352A TRN5568A TRN5570A	TBN6393A TKN8323A — — TRN5567A TRN5569A	Add 2 Can Duplexer (148-174 MHz)
C182AJ	TKN8324A TLD2502A TRN5352A TRN5568A TRN5570A	TRN8323A — — TRN5567A TRN5569A	Add Duplexer (148-174 MHz)
C226AH	TRN5069A TRN5079A	TRN5068A —	Intercom Only
C226AL	TRN9689A TRN5079A	TRN9689A —	Intercom Only
C257AD	TPN1222A TRN9109A TRN9114A TRN9209A	TPN1191A TRN5442A TRN5350A —	Multi-Voltage, 50 Hz, Basic
C257AE	TPN1222A TRN9109A TRN9113A TRN9209A	TPN1191A TRN5442A TRN5351A —	Multi-Voltage, 50 Hz, Fully Optionable
C261AC	(4)TLN8381A TRN5329A	— —	Multi PL Decoder
C261AH	(4)TLN8381A TRN5329A	KLN6209A —	Multi PL Decoder RPTR

MSR 2000 VHF CONTINUOUS DUTY STATIONS OPTION CHART (Cont'd.)

Option	Add	Delete	Description
C262AE	TRN5292A TRN5329A (4)KLN6210A (4)TLN8381A	(2)KLN6209A — — —	Multi PL Repeater
C263AB	TRN5329A TRN5292A TRN5330A (4)KLN6210A (4)TLN8381A	KLN6209A — — — —	Multi PL Encoder/Decoder
C266AA	—	KLN6210A	Omit One Vibrasender Reed
C267AA	—	TLN8381A	Omit One Vibrasponder Reed
C269AP	TRN5293A TRN5294A TKN8287A	TRN5236A TKN8286A —	*Spectra-TAC* Operation (Basic)
C269AQ	TRN5293A TRN5294A TKN8287A TRN5331A	TLN5236A TKN8286A TRN5324A —	*Spectra-TAC* Operation (Rptr)
C276AA	TRN5075A KLN6209A	TRN5074A —	Simplex PL TA-RB
C276AB	TRN5078A TRN6005A	TRN5077A —	Simplex DPL TA-RB
C323AA	—	TRN5427A	Omit Power Cord
C501AJ	—	KXN1088A	Omit One Transmit Element
C502AH	—	(2)KXN1088A	Omit Two Transmit Elements
C503AE	—	(3)KXN1088A	Omit Three Transmit Elements
C504AE	—	(4)KXN1088A	Omit Four Transmit Elements
C521AR	—	KXN1086B	Omit One Receive Element
C522AM	—	(2)KXN1086B	Omit Two Receive Elements
C523AH	—	(3)KXN1086B	Omit Three Receive Elements
C524AJ	—	(4)KXN1086B	Omit Four Receive Elements
C576AA	TLN2442A	—	Single-Tone Decoder
C601AE	KXN1095A	KXN1088A	One 2PPM Transmit Element
C602AC	(2)KXN1095A	(2)KXN1088A	Two 2PPM Transmit Elements
C603AC	(3)KXN1095A	(3)KXN1088A	Three 2PPM Transmit Elements
C604AD	(4)KXN1095A	(4)KXN1088A	Four 2PPM Transmit Elements
C621AC	KXN1112AA	KXN1086B	One 2PPM Receive Element
C622AB	(2)KXN1112AA	(2)KXN1086B	Two 2PPM Receive Elements
C623AB	(3)KXN1112AA	(3)KXN1086B	Three 2PPM Receive Elements
C624AB	(4)KXN1112AA	(4)KXN1086B	Four 2PPM Receive Elements
C681AB	TPN1223A TRN9114A TRN9110A TRN9210A	TPN1191A TRN5350A TRN5442A —	Multi-Voltage, 60 Hz, Basic
C681AC	TPN1223A TRN9110A TRN9210A TRN9113A	TRN1191A TRN5442A TRN5351A —	Multi-Voltage, 60 Hz, Fully Optionable
C691AA	TRN5972A	TRN5427A	European Power Cord
C692AA	TRN5971A	TRN5427A	United Kingdom Power Cord

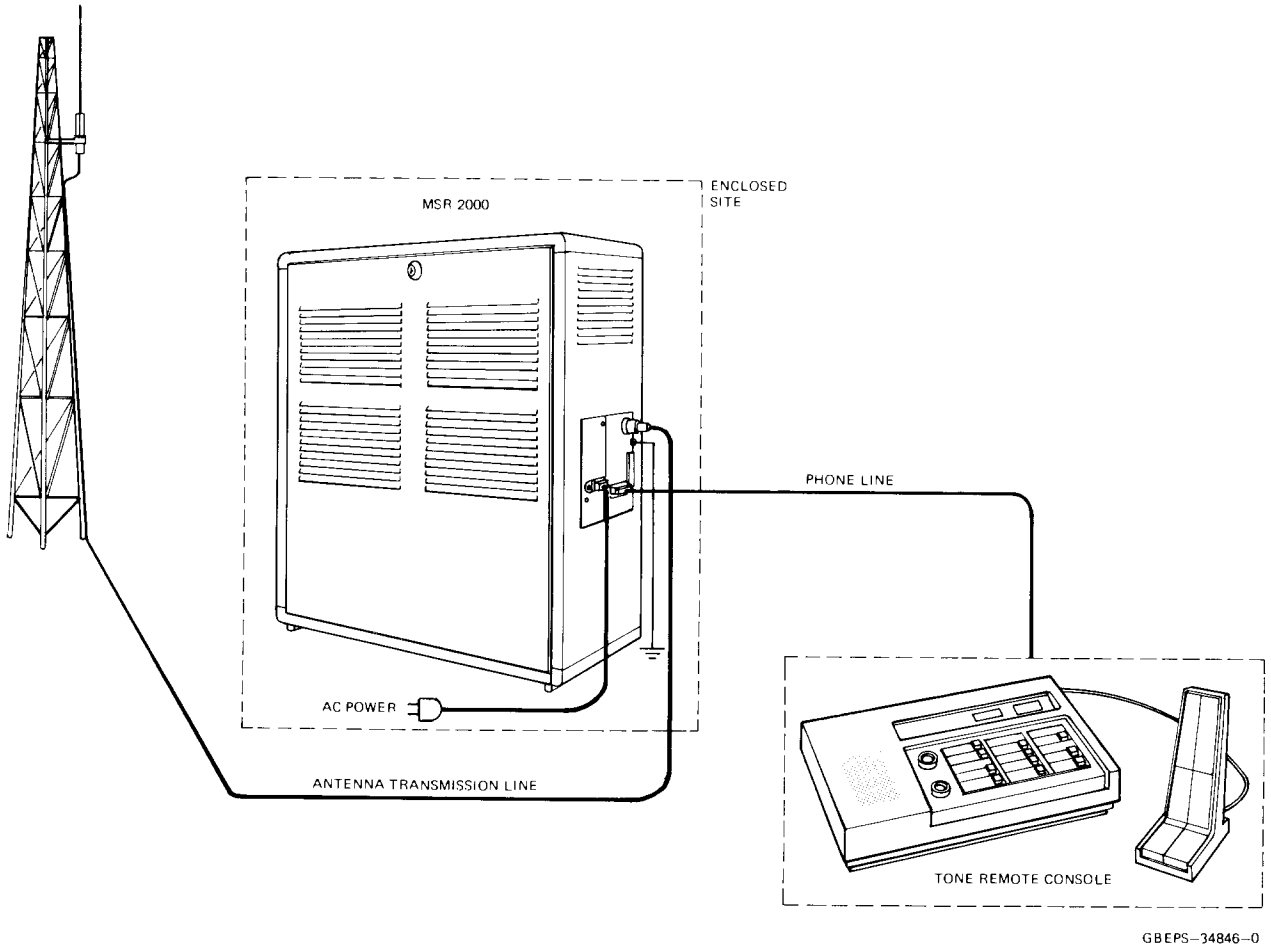


Figure 1. Typical System Configuration

1. MANUAL USAGE

This manual describes all aspects of the *MSR 2000* radio station with the exception of remote control and station applications. Separate Control and Audio manual 68P81061E40 describes how these stations are remotely controlled and outlines the various types of base and repeater stations and their applications.

2. INTRODUCTION

The Motorola *MSR 2000* is a free standing, all solid state base station radio. It is dc or tone remote controllable and is available in either a basic or optionable version.

The basic version of the *MSR 2000* station provides the same quality and performance specifications as the

optionable version. The basic version is intended for those systems that require little change or expansion in the future. See Figure 2.

The optionable version of the *MSR 2000* station satisfies more complex applications requirements. It also has more capacity for future expansion. It has capabilities for tone control of T4R4 channels, repeater application, and two receivers. See Figure 3.

The *MSR 2000* VHF High Band station is available in either continuous or intermittent duty models. Basic or fully optionable models are available for either duty cycle.

3. STATION COMPONENT DESCRIPTION
(Refer to Figure 4.)

3.1 TRANSMITTER

The transmitter generates a frequency modulated rf carrier signal that is delivered to the antenna output connector, part of the station junction box. The transmitter consists of the following items:

- Channel Element — An unheated, temperature-compensated crystal oscillator plug-in module (channel element) provides a stable fundamental rf frequency for the transmitter. One channel element is used for each transmitter frequency.

- Exciter — The exciter provides the low power excitation signal for the power amplifier. An "IDC" (Instantaneous Deviation Control) circuit amplifies and limits audio signals from the control line to prevent over deviation. Amplified audio is applied to the channel element to produce direct FM modulation. Multipliers in the exciter multiply the channel element frequency to generate the desired output frequency signal(s). A controlled amplifier stage regulates the amount of signal drive to prevent over-dissipation in the final amplifier stages of the power amplifier. In continuous duty stations, an adjustable voltage regulator is used to set the output level of the controlled amplifier stage on the exciter to a certain set level. In intermittent duty stations, a variable voltage from the power control board continuously regulates the output level of the controlled amplifier stage on the exciter.

- Power Amplifier — The low power output of the exciter is amplified to the rated power output of the transmitter in this solid-state power amplifier. Class C amplifiers are used which are cut off until signal drive is applied.

- Power Control Board — In intermittent duty stations, the power control board automatically and instantaneously regulates the transmitter output power. It maintains output power should source voltage vary, and progressively reduces power when the VSWR increases. The output of the board is applied to controlled amplifier stages in the exciter. In continuous duty stations, the power control board performs the same functions as in intermittent duty stations except that the output of the board controls the controlled amplifier stage on the power amplifier.

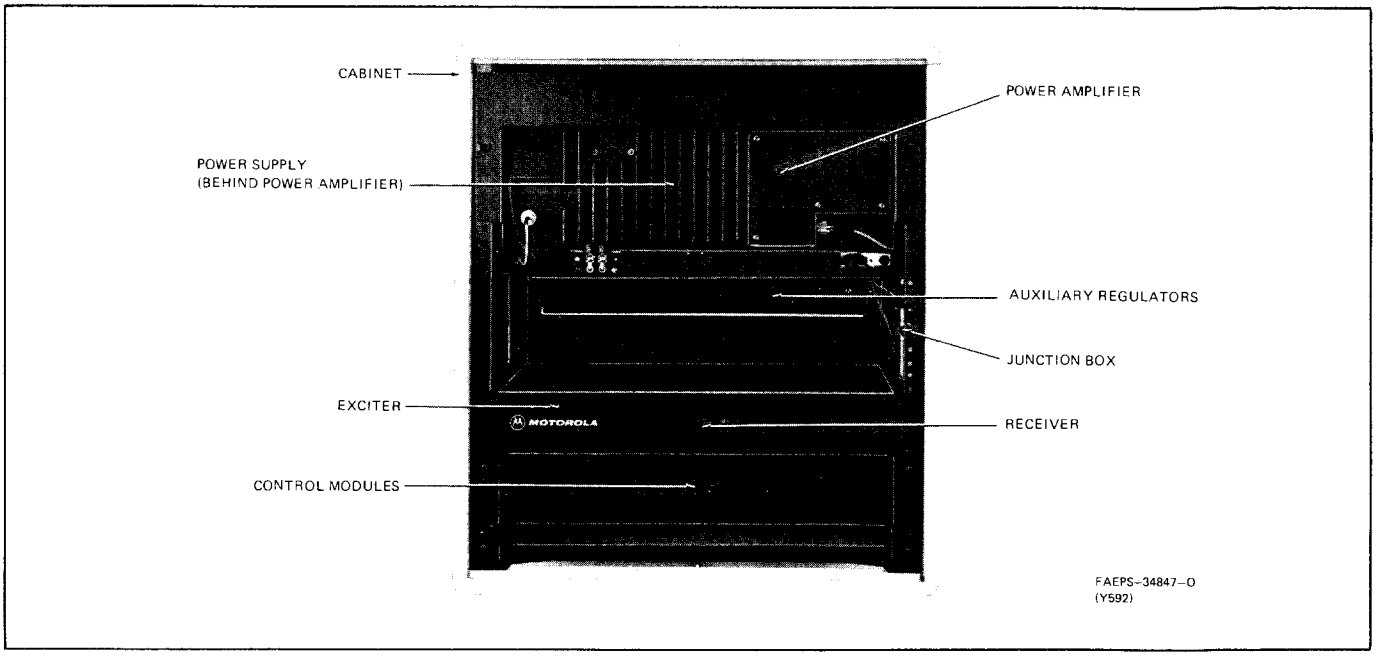


Figure 2. Basic Version of MSR 2000 Base Station

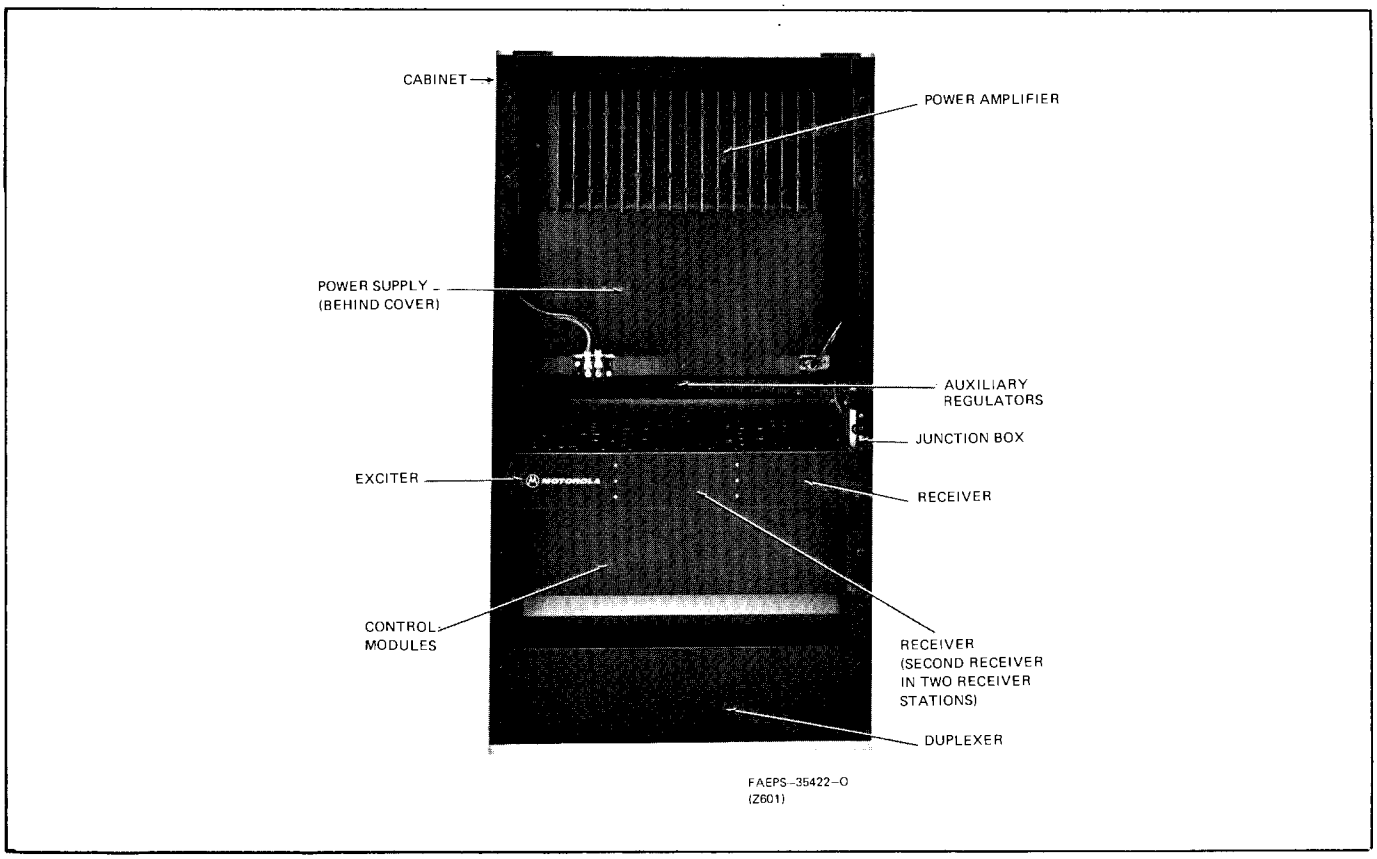


Figure 3. Optionable Version of Continuous Duty MSR 2000 Base Station (Repeater Model With Duplexer Option Shown)

3.2 RECEIVER

The receiver accepts rf carrier signals on a specific channel and provides voice audio in the 300-3000 Hz range. The receiver consists of the following items:

- Channel Element — A plug-in crystal oscillator module (channel element) provides stable frequency control for the frequency of operation. One channel element is required for each receiver frequency.
- Receiver RF & I-F Board — The single-conversion superheterodyne FM receiver includes a preselector (comprised of five cavities) and five crystal filters for excellent selectivity. Two integrated circuit i-f amplifiers and limiters give high sensitivity. A single chip quadrature detector demodulates the audio directly from a 10.7 MHz i-f signal.
- R1 Audio Board — The R1 audio board contains the carrier squelch circuitry and the 1 watt service audio amplifier. When no messages are being received, the squelch circuit turns off the audio amplifiers to eliminate annoying noise in the speaker. A squelch tail eliminator circuit prevents the noise burst at the end of a message for strong signals. For weak signals, the circuit is automatically inhibited to prevent loss of portions of messages. The service audio power amplifier consists of a single chip mounted on the R1 audio board.
- Receiver VOLUME and SQUELCH controls are located on the R1 audio board. The RECEIVER VOLUME control only affects local speaker operation (when used).

NOTE

The SQUELCH control affects local and remote operation.

3.3 POWER SUPPLY

The power supply normally installed in these stations, utilizes a ferro-resonant (constant voltage) transformer and provides all the voltages necessary for operating the station. It automatically corrects for changes in load and input voltage thus maintaining a constant voltage output. An optional supply is available which provides automatic emergency power (+12 V) reverting.

4. UNIQUE FEATURES

Both the basic and optionable versions of the *MSR 2000* offer the following design features:

- Front Side Access of All Modules — Major modules tilt forward or slide out so that all necessary test points and metering sockets can be easily reached from the front of the enclosure.

- External Junction Box — AC power, antenna, 12 V dc battery revert option, auxiliary control, and phone line connections are made to an external junction box. No drilling or cutouts are required through the cabinet skin to access internal connections.

- Cooler Operation — Flow-through ventilation and "top-of-the-cabinet" mounting for both the PA and power supply result in cooler operating temperatures, thereby improving station reliablity. Air intake is through the front door of the *MSR 2000* and exits on both sides, allowing cooler operation when stacking stations.

- Smaller Size — The *MSR 2000*, at 24 inches high, is much shorter than its predecessor stations, resulting in more space available at the site when stacking stations.

- One-Piece Wrap-Around Sides and Back — The one-piece vinyl clad steel wrapper used for the *MSR 2000* cabinet provides sealed-back enclosure for greater station security, and allows back-to-back installation configurations without the need for access corridors to the rear of the station. No access corridors can result in greater site densities and improved space utilization.

5. OPTIONS

5.1 The following options are available for either the basic or optionable version of the *MSR 2000* station.

- Time-Out Timer (C11 Option)

  This limits transmissions to one of five pre-set time periods. These time periods are 1/2, 1, 2, 4, and 8 minutes. The time period desired for a particular system is determined by the user by means of two jumpers. One jumper determines the time period for console-generated transmissions and the second determines the repeat time of a mobile. This module is standard in all RT repeater models.

- RF Preamplifier (C12 Option)

  The preamplifier doubles the usable sensitivity of the base station receiver, although this sensitivity can be fully realized only in low-noise, interference-free areas.

- 120 V AC/12 V DC With Charge, Alarm, Auto-Revert (C28 Option)

  A 12 volt battery can be floated at the output of the station power supply for emergency power use. The battery will provide station power when the AC line fails. When the AC line is functioning it provides float-charging for the battery. Power supply senses station switchover from 120 V ac to 12 V dc operation when loss of primary power occurs and alerts user via audio alarm.

- Service Intercom and Speaker (C226 Option)

  Provides line intercom facilities to simplify servicing of the remote station.

- Test Mic (C113 Option)

  Applies to option C226.

- DC Metering With Intercom and Mic (C149 Option)

  Provides metering of transmitter and receiver circuits and line intercom facilities (remote control only) to simplify servicing of the remote station.

- Transmit PL On/Off for Paging (C63 and C276 Option)

  C63 Option. This module allows any single frequency base station with *Private-Line* squelch to transmit with or without the PL tone on the transmitter at the operator's discretion. A standard paging encoder automatically actuates this function when used in conjunction with a tone console equipped with the corresponding option. This option is not available with the four-frequency remote station.

  C276 Option allows transmit code to be different than receive code. Available for both PL and DPL.

- Delete Channel Elements
- Omit Receiver (C31 Option)

- TFN1017A or TFN1018A Crystal Filter (Field Install)

  An rf crystal filter adds extra selectivity to the receiver to improve intermodulation protection and desensitization performance.

- AND Squelch (C140 Option)

  AND Squelch operation is a means of using both the carrier squelch AND PL tone-coded squelches to operate the receiver. This allows the user to vary the coded squelch sensitivity with the squelch control. It is especially recommended for use in mixed systems where some PL transmitters do not send a reverse burst at the end of each transmission. This results in an annoying squelch tail as the reed coasts to a stop. AND squelch is not recommended for normal PL performance when the mobile may be in a fading area.

- 2 ppm stability on transmit and receive

- Four-Wire Audio Line Driver (C144 Option)

  Provides separate audio line capability for duplex operation or two-receiver audio routing.

- 50-Watt Maritime Operation (C50 Option)
- Indoor Cabinet 29" (C92 Option)

  This option is applicable to intermittent duty stations only.

- Indoor Cabinet 37" (C52 Option)

  This option is applicable to continuous duty stations only.

- TLN5935A Extender Card
- Shield & Filter Kits (C116 Option)

  Provides full filtering of all leads and shield covers for base stations only. Included on repeater and two-receiver models as a standard feature.

5.2 The following options are available for only the optionable version of *MSR 2000* stations.

- 4-Reed Multiple *Private-Line* (C158, C261, C262, C263 Options)

  Provide 4 PL code capability and are equipped with a full set of *Vibrasender* and/or *Vibrasponder* resonant reeds.

- TLN2442A Singletone Decoder

  This module may be used for additional security for repeaters or for repeater selection in multiple-repeater systems. By addition of the TLN4151A Relay Kit, other functions can be controlled by this module. This option is not available with the four-frequency remote station.

- Mute 2nd Receiver (C56 Option)

  Allows the user to "mute and unmute" 2nd receiver for extended periods of time. Remember, R1 automatically mutes R2 (R1 priority) when R1 is "active" in the standard two-frequency transmit, two-receiver stations.

- Remote Squelch Set (C13 Option)

  Allows selection of station receiver squelch to either of two pre-adjusted settings.

- Wild Card (C15 Option)

  This module may be used for any electrically operated function. It provides transistor switch outputs, or, with the addition of one or two relay kits (TLN4151A) will provide two form "C" dry contact outputs. These Wild Card outputs can be used to turn on and off any auxiliary equipment the user may have at or near his base station site. Remember, these functions are done by remote control from his console.

- 4-Cavity Duplexer (C182 Option)

  This option, when ordered with a repeater model, provides an in-cabinet 4-cavity duplexer. Cabinet supplied is 29 inches for intermittent duty or 37" for continuous duty and included in this option (132-174 MHz).

- Receiver PL On/Off (C14 Option)

  Provides remote control of receive PL on/off. With receive PL off, station reverts to carrier squelch operation.

- *Spectra-TAC* Encoder (C269 Option)

  Includes 4-wire audio. Encoder module sends a status tone down control lines when receiver is squelched. This signal is used by the comparator in a *Spectra-TAC* system to effect voting of receivers.

- TKN8281A External Interface Cable

  This ten-conductor cable allows routing of available control signals from back of rf control card cage to auxiliary control connector on station junction box.

NOTE

Some of the options described above are not compatible with other options. Option compatibility is computer assigned at the factory. Contact your local Motorola representative for further information.

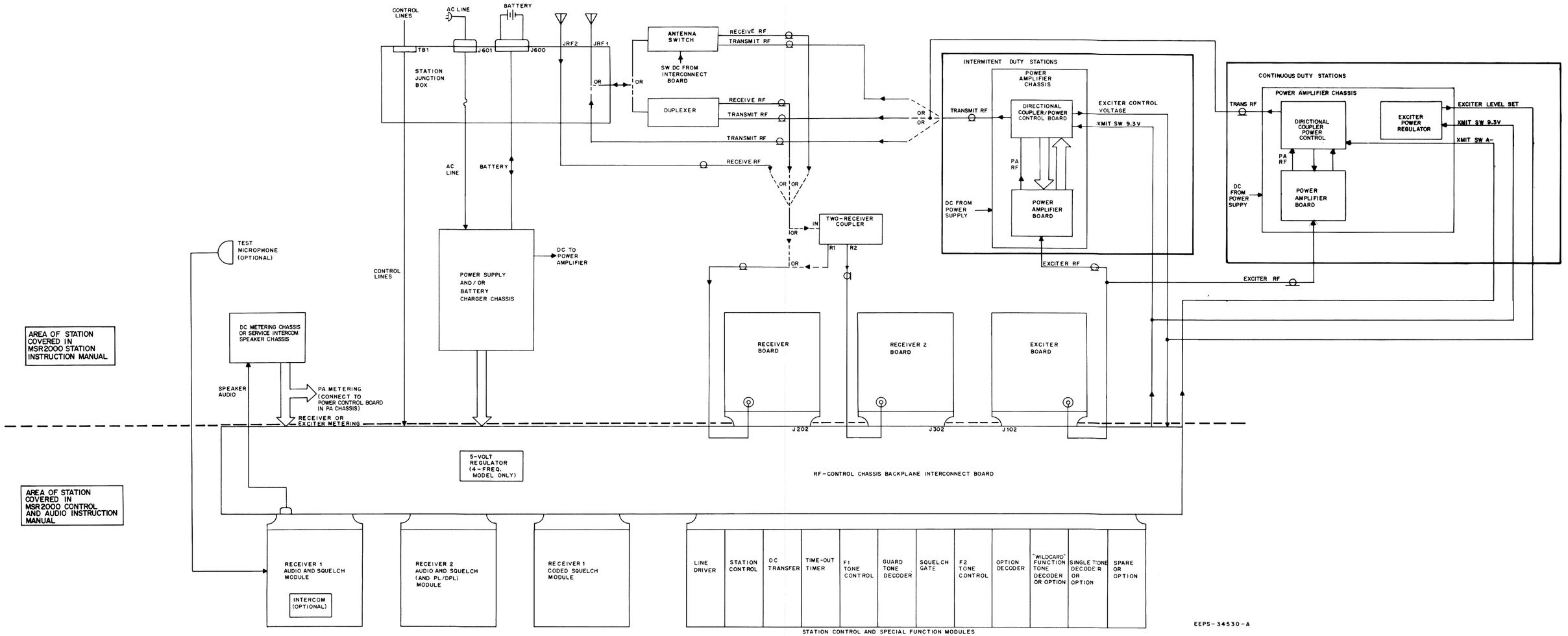


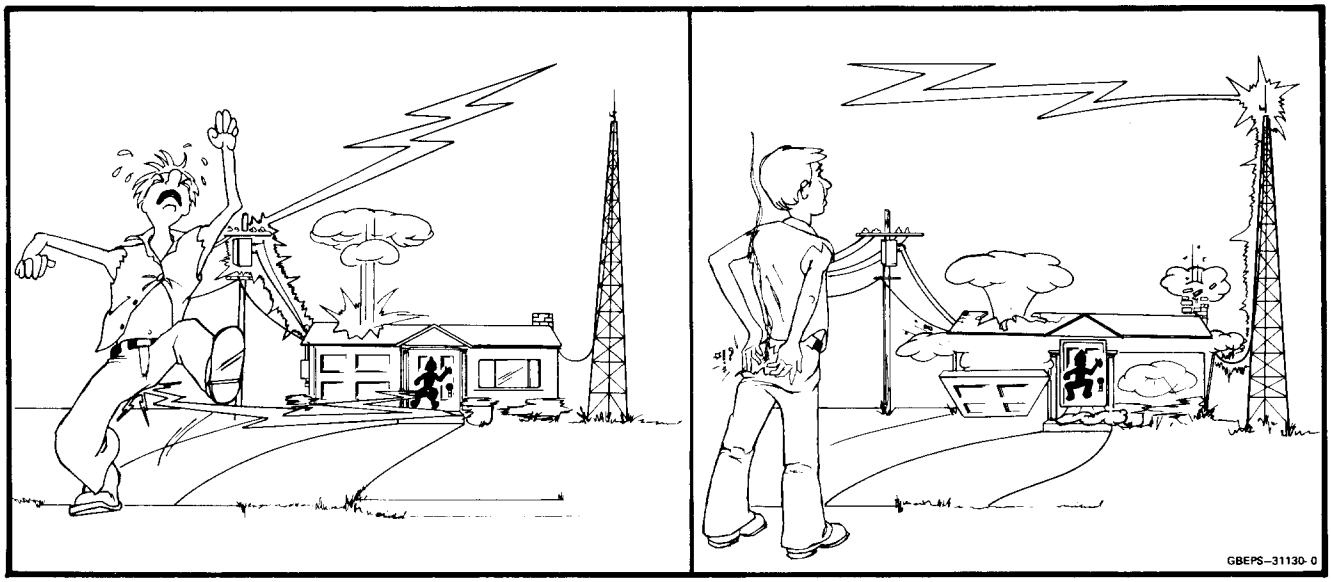
Figure 4. Simplified Block Diagram

MOTOROLA INC.
Communications Group

LIGHTNING PROTECTION RECOMMENDATIONS

The conditions that make a site desirable for two-way radio are the same as those that make a site an excellent target for lightning. Proper lightning protection can completely prevent equipment damage in all but the most severe strikes and even then keep the equipment damage at a minimum. Lightning protection basically consists of preventing the strike from entering the equipment room and then preventing damage to the equipment from induced voltages and currents on power and control lines to the equipment. The following suggestions will help protect valuable radio facilities. Some products already incorporate certain suppressors as standard equipment. In these cases, additional protection is not normally required, unless dictated by unique site considerations. When such unique situations occur, consult the appropriate area office for further information.

- Keep the tower grounding resistance as low as possible. The lightning stroke current belongs in the tower structure and grounding system, not on the transmission line.
- Use at least eight-foot long copper clad ground rods. Multiple ground rods are better than one especially in dry climate or sandy-rocky soil areas.
- Bring the transmission line off the tower with the sharpest bend permitted by the manufacturer's specifications and make a solid bond between the tower and transmission line sheath just prior to the bend. The sharp bend acts as a spot impedance to the extremely high strike current. This shunts more of the strike current into the tower ground rather than into the equipment. Use no more or no less than the minimum bend radius wherever the transmission line changes direction and introduce a change of direction at every reasonable opportunity. Then, ground the transmission line sheath at the antenna side of each bend in the transmission line.
- Provide additional grounding to the transmission line sheath wherever possible. Make it a point to ground the transmission line where it is supported on poles and where it enters a building.



Unprotected power/control lines and antenna installations can be hazardous to equipment and personnel.

technical writing services
1301 E. Algonquin Road, Schaumburg, Il. 60196

68P81111E17-B
7/12/82 -UP

- It is wise to take at least part of the transmission line through a length of grounded conduit.

- ***Bond all equipment cabinets together to a single point.*** Then, ground that point to a grounding rod network using as short and as straight a ground wire as possible. If bends in the ground wire are necessary, make them as large a radius as practical.

- Transmission lines should be brought into the equipment cabinets adjacent to the single point ground connection where a good low impedance bond can be made with the transmission line sheath.

- Install a gas tube protector between the equipment cabinet ground and AC-neutral where it enters the equipment cabinet. Install gas tube protectors where the control lines enter the building and at the point of entry into the equipment cabinet. Also, install gas tube protectors wherever control lines enter a building and install additional protectors as close to the remote control console as possible.

- Keep ground wires from gas tube protectors to ground rods or perimeter grounds as straight and short as possible. Avoid sharp bends in ground wires.

- Never bundle a ground wire with any other cabling or wiring. Also, never run a ground wire along any metal wall, along any electrical conduit, or inside a conduit.

Remember, the lower impedance the grounding system is in relation to the equipment being protected, the greater the protection afforded to the equipment. Keep the lightning strike current in the grounding network; not running through the equipment to ground.

RECOMMENDED PROTECTORS

The devices listed below are available from your local Motorola Parts Center. Other devices are available from different manufacturers for special applications and may be used in place of those listed herein. Installation instructions are generally packed with each device. The following listing contains phone line suppressors, ac line surge protectors, coaxial cable in-line lightning arrestors, and coaxial cable ground clamp kits. Refer to the Motorola Buyers Guide for additional information.

PHONE LINE SUPPRESSORS

TRN8187A Single Line Suppressor, 3-electrode gas tube protector

TRN4589A Dual Line Suppressor, 3-electrode gas tube protector

RRX4021B Single Line Suppressor, 3-electrode gas tube protector

AC LINE SURGE PROTECTORS

TLN4399A AC Line Surge Protector, 117 V ac line, 7/8" x 14 conduit hole mounting

TLN5920A AC Line Surge Protector, 240 V ac line, 7/8" x 14 conduit hole mounting

RRX4017A AC Line Surge Protector, 117 V ac, 10 Amp, single phase, screw terminal connector block

RRX4018A AC Line Surge Protector, 117 V ac, 10 Amp, single phase, 3-prong plug and receptacle

RRX4019A AC Line Surge Protector, 117 V ac, 15 Amp, single phase, 3-prong plug and receptacle

RRX4020A AC Line Surge Protector, 220/240 V ac, 30 Amp, single phase

COAXIAL CABLE IN-LINE LIGHTNING ARRESTORS

RRX4024 UHF type connector
RRX4025 "N" type connector
RRX4032 Tower Mount Kit

COAXIAL CABLE GROUND CLAMP KITS

ST-788 For 1/2" jacketed heliax and pipe or grounding rod

ST-853 For 7/8" jacketed heliax and pipe or grounding rod

ST-789 For 1/2" unjacketed heliax, includes bushings for better contact without collapsing line

ST-790 For 7/8" unjacketed heliax, includes bushings for better contact without collapsing line

INSTALLATION
MSR 2000

1. FCC REQUIREMENTS

IMPORTANT

FCC regulations state that:

1. Radio transmitters may be tuned or adjusted only by persons holding a general class commercial radiotelephone operator's license or by personnel working under their immediate supervision.

2. The rf power output of a radio transmitter shall be no more than that required for satisfactory technical operation considering the area to be covered and local conditions.

3. The frequency, deviation, and power of a base station transmitter must be maintained within specified limits. (It is recommended, therefore, that these three parameters be checked before the station is placed in service.)

REMEMBER

The efficiency of the equipment depends upon a good installation.

2. INSPECTION

Inspect the equipment thoroughly as soon as possible after delivery. If any part of the equipment has been damaged in transit, report the extent of damage to the transportation company immediately.

3. PLANNING THE INSTALLATION

Since a good installation is important to obtain the best possible performance of the communications system, carefully plan the installation before actual work is started. Location of the station in relation to power, control lines, the antenna, and convenience and access for servicing should be considered. The cabinet dimensional detail diagrams show the size of the various cabinets for planning the space requirements. Read the entire procedure and the many suggestions offered to help you plan your installation. Make sure all tools, equipment and facilities are available when the installation is begun.

4. VENTILATION

The radio equipment is operated without forced ventilation. The cabinets have been designed with vents which allow outside air to be drawn in through louvered openings in the door and expelled through an opening in the cabinet wrapper (sides). The heated air rising in the cabinet causes a natural draft. Therefore, it is essential that the openings be kept free of obstructions so the air flow will not be restricted. Also, site installations require that adjacent cabinets be located a minimum of six inches from all vents.

NOTE

Sufficient clearance must also be provided at the front of the cabinet to allow for servicing and component removal.

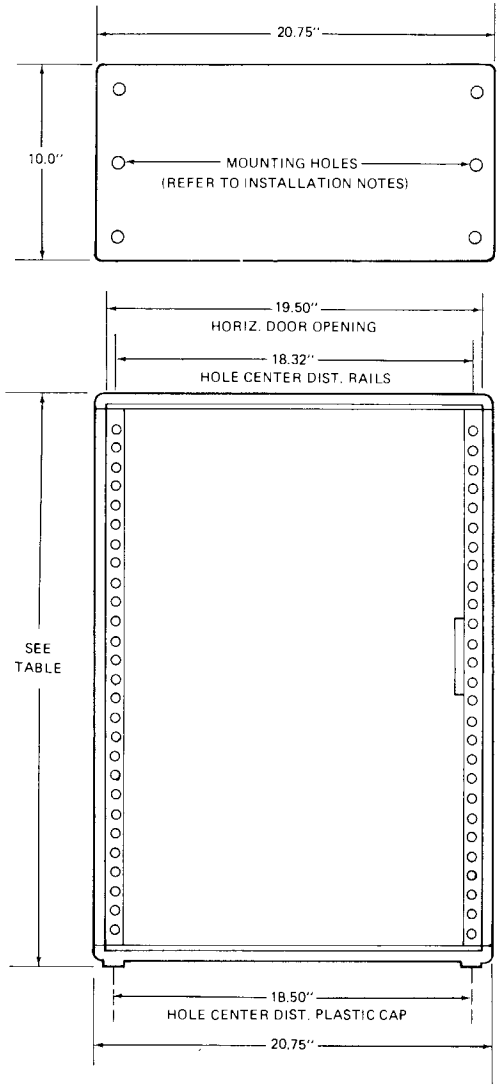
Refer to Figure 1 for cabinet dimensional details.

5. INSTALLATION OF 24-, 29-, 32-, AND 37-INCH INDOOR *MSR 2000* CABINETS

5.1 Refer to Figure 1 for cabinet dimensional details.

5.2 The cabinet should be located on a solid, level surface convenient to the power source and the rf transmission line. The rf transmission line should be kept as short as possible to minimize line losses.

5.3 All antenna power and control lines are connected at the junction box located on the right side of the cabinet.



CABINET TOP BOLTS

QTY.	PART NO.	DESCRIPTION
4	0310943J41	M8 X 16 MM TORX® BOLT
2	0310943J45	M8 X 40 MM TORX® BOLT

HEIGHT DIMENSION TABLE

CABINET SIZE	HEIGHT DIMENSION
24–INCH	24.04 INCHES
29–INCH	29.29 INCHES
32–INCH	32.04 INCHES
37–INCH	37.29 INCHES

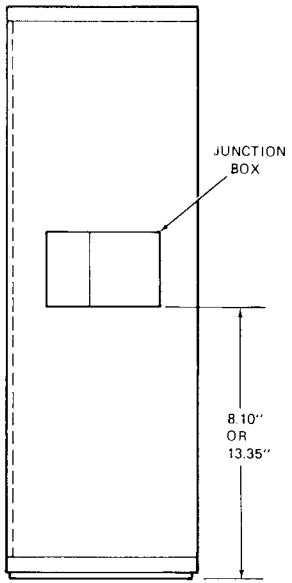


Figure 1. Cabinet Dimensional Details

INSTALLATION NOTES

LOCATION

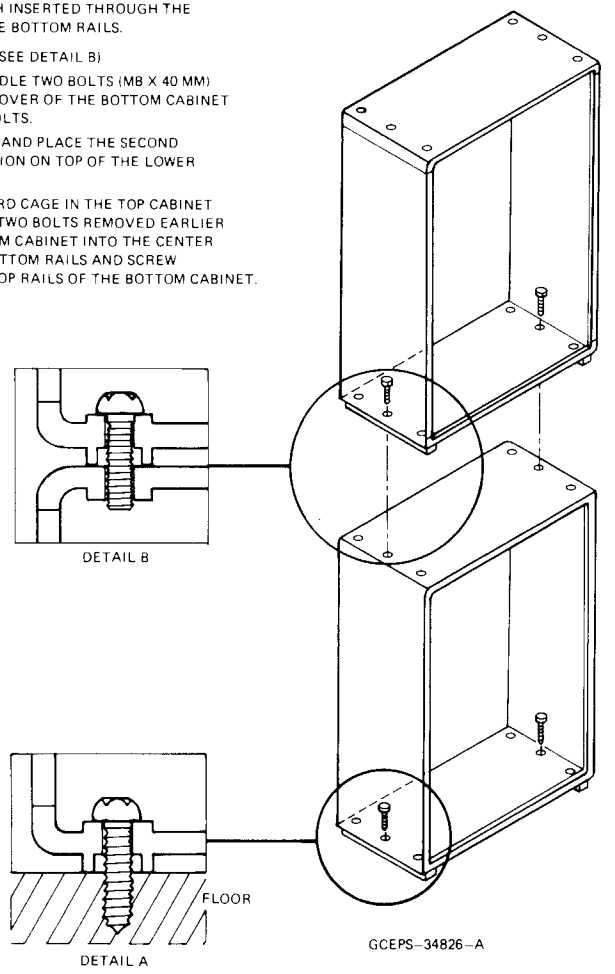
CABINET REQUIRES A MINIMUM OF 6–INCHES CLEARANCE BETWEEN LOUVERED SIDE–PANELS AND EXISTING SURFACES FOR PROPER VENTILATION. ALLOW A MINIMUM OF 12–INCHES ACCESS SPACE AT THE CABINET DOOR.

FIXED MOUNTING (SEE DETAIL A)

IF DESIRED (BUT NOT NECESSARY UNLESS STACKING CABINETS), THE CABINET CAN BE SECURED TO THE FLOOR USING TWO M8 OR 5/16" BOLTS OF THE APPROPRIATE LENGTH INSERTED THROUGH THE CENTER HOLES OF THE BOTTOM RAILS.

STACKING CABINETS (SEE DETAIL B)

- REMOVE THE MIDDLE TWO BOLTS (M8 X 40 MM) FROM THE TOP COVER OF THE BOTTOM CABINET AND SAVE THE BOLTS.
- CAREFULLY LIFT AND PLACE THE SECOND CABINET IN POSITION ON TOP OF THE LOWER CABINET.
- TILT OUT THE CARD CAGE IN THE TOP CABINET AND INSERT THE TWO BOLTS REMOVED EARLIER FROM THE BOTTOM CABINET INTO THE CENTER HOLES OF THE BOTTOM RAILS AND SCREW THEM INTO THE TOP RAILS OF THE BOTTOM CABINET.



CAUTION

It is recommended that no additional holes be drilled into the cabinet.

5.4 Refer to Figure 1 for mounting and stacking details.

NOTE

In stacking configurations, the transmitter hum and noise may degrade up to 10 dB if the station directly below has a battery revert power supply (C28 option).

6. ANTENNA CONNECTIONS

6.1 The antennas and transmission lines are not part of the station. Therefore, antenna installation instructions are not included in this section. Follow the instructions shipped with the antenna for applicable information.

6.2 In its primary application, the station is used for communications with mobile radios. Thus, antennas having omni-directional characteristics are desirable. However, if the station is located at the outer perimeter of a communications area, or if it is to be used for communications with a fixed station, an antenna with specific directional characteristics may be more suitable. FCC requirements may also dictate the type of antenna to be used.

6.3 All coaxial antenna cables connect to UHF coaxial connectors located on the junction box. For repeater stations without the optional duplexer, two antennas are required; one for the transmitter and one for the receiver. For repeater stations with the optional duplexer, only one antenna is required. Refer to Figure 2 for antenna connection details.

7. AC INPUT POWER AND GROUND CONNECTIONS

7.1 INTRODUCTION

7.1.1 All stations should have a separate power circuit from a 10-ampere (minimum), 120-volt ac, 60 Hz power source. The power lines should be installed in accordance with local electrical codes. A substantial earth ground must be provided as close to and in as straight a

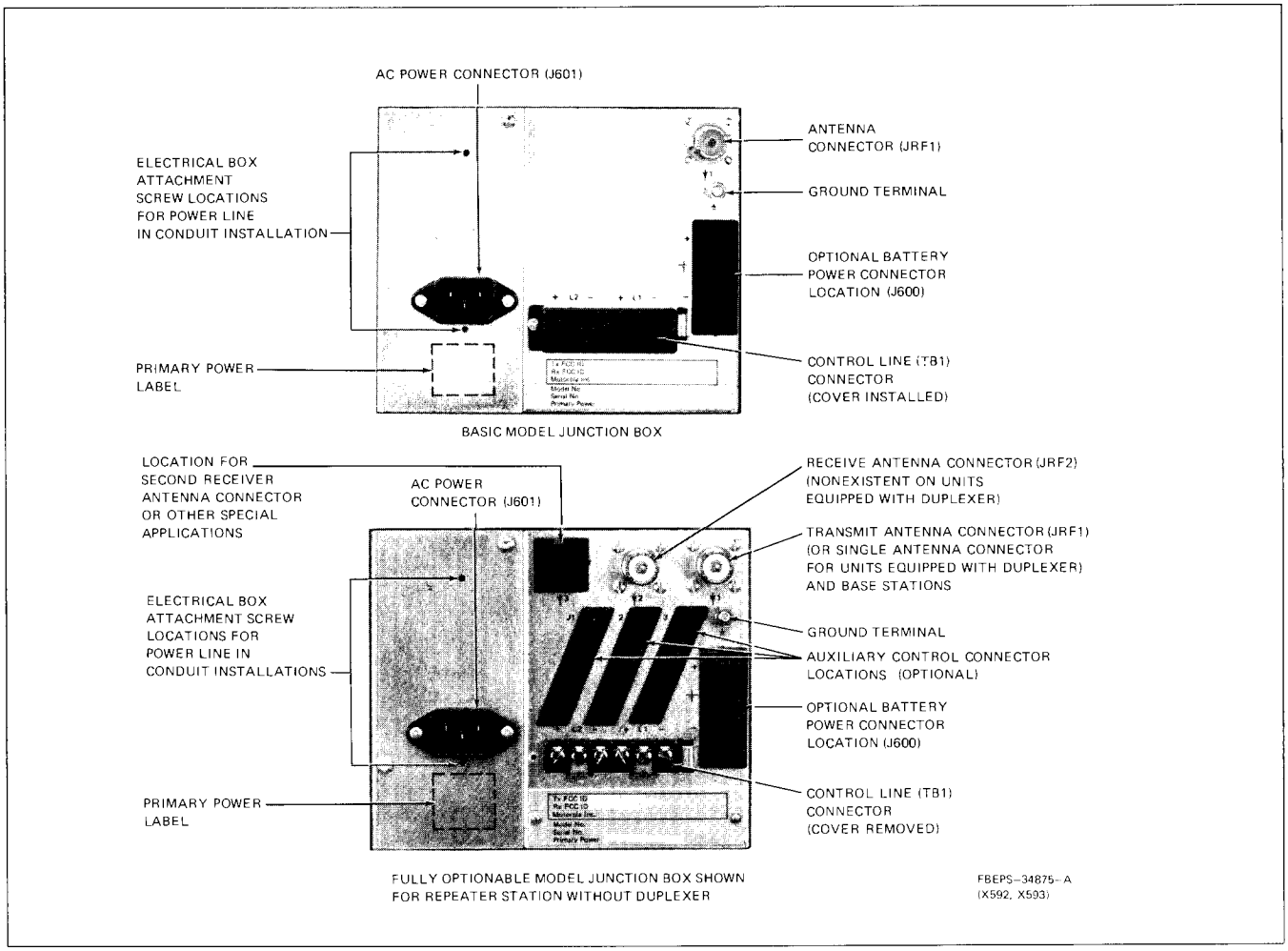


Figure 2. External Connection Details

line as possible with the ground terminal provided on the junction box. Do NOT consider the electrical outlet box as a substantial ground. Refer to the Lightning Protection Recommendation sheet, 68P81111E17 in this installation section for additional grounding recommendations.

7.1.2 The primary ac power line may be installed prior to installation of the cabinet and terminated near the location chosen for the station if the power line cord supplied with the station is to be used. If the station power is to be supplied by conduit wiring, the station must be installed first. Separate procedures are provided for each type of installation in the following.

7.2 STATION INSTALLATION USING POWER LINE CORD SUPPLIED WITH THE STATION

Step 1. Install the station as described in paragraph 5.

Step 2. Connect the female plug of three-wire ac line cord to the power connector on the junction box. See Figure 2.

Step 3. Connect the male plug of the three-wire ac line cord to the wall outlet provided near the station.

Step 4. Connect the ground terminal on the junction box to a substantial earth ground located as close as possible to the station and in as straight a line as possible with the ground terminal.

NOTE

A power ON-OFF switch is not provided on the station, therefore, the equipment is immediately operational when the power cord is plugged into a live ac outlet.

WARNING

Even if a three wire grounded primary ac power source is available, the radio equipment **must be grounded** separately to prevent electrical shock hazards and provide lightning protection.

7.3 STATION INSTALLATION USING CONDUIT FOR PRIMARY POWER CONNECTION

The *MSR 2000* junction box has provisions which allow ac power connection to the station using conduit. The following installation procedure is recommended.

Step 1. Remove the two screws attaching the ac input connector (J611) to the junction box and carefully pull the connector away from the junction box.

Step 2. Cut the wires as close as possible to the ac input connector (J611).

Step 3. Strip the insulation from the wires a sufficient length to allow connection to the incoming power leads.

Step 4. Attach a 4-1/8" × 2-3/8" × 1-1/2" electrical box (Appleton Catalogue No. 184-E universal code 69351 or equivalent box extension ring, not supplied) to the junction box using two #6-32 × 5/16" long self tapping washer head screws in the holes provided. See Figure 2.

Step 5. Attach the conduit to the electrical box and make the electrical connections. (It may be desirable to provide an ON-OFF switch or convenience outlet on the electrical box).

NOTE

The primary power wire colors used in the *MSR 2000* conform to international standards. Refer to the following cross reference table as required.

Power Connection	International STD Wire Color	US Standard Wire Color
Live	Brown	Black
Neutral	Blue	White
Ground	Green/Yellow	Green

Step 6. Attach a suitable cover to the electrical box.

8. OPTIONAL DC INPUT POWER CONNECTIONS

Connection of the optional dc input power requires assembly of the TRN5155A External Battery Cable Kit. This kit includes a fuse block assembly that must be mounted to the base station along with wires and terminals that must be assembled and connected to the external battery. Install as follows:

Step 1. Determine the length of black #8 gauge wire required to run from P605 directly to the battery negative terminal. Route and cut the black wire to length. A ring tongue lug is provided to facilitate connecting the wire to the battery.

NOTE

The TRN5155A External Battery Cable kit contains 10 feet of red and black #8 gauge wire. Runs longer than 10 feet are not recommended for efficient battery operation. If runs longer than 10 feet are necessary, increase the wire gauge by 3 AWG for each increase of 10 feet in run length.

Step 2. Make sure all power is disconnected from the station.

WARNING
Refer to Power Supply section for proper battery voltage setting before connecting the station to the battery.

Step 3. Connect the blue connector (P605, part of the TRN5155A External Battery Cable Kit) into the optional battery power connector (J605) located on the junction box. See Figure 2.

Step 4. Remove the fuse from the fuse holder and mount the fuse holder (supplied with the TRN5155A kit) to the battery rack as close as possible to the battery using the two 8 × 1-1/4" tapping screws provided.

Step 5. Determine the length of red #8 gauge wire required to run from P605 to the fuse block. Route and cut the red wire to length. Attach the red wire to the fuse block.

Step 6. Use the cut off piece of red wire to connect the fuse block to the battery. A ring tongue lug is provided to facilitate connecting the wire to the battery. After checking that all connections are secure and that polarity is proper, install the fuse removed in Step 4.

9. OPTIONAL MODE JUMPERING

9.1 GENERAL

9.1.1 Many station modes of operation are determined by jumper connections at the time of installation and are described in the following paragraphs.

9.1.2 Additional jumpers used with the station are identified and described in applicable sections elsewhere within this instruction manual.

9.2 TIME-OUT TIMER MODULE

Base stations or repeaters equipped with a time-out timer module prevent unintentional continuous transmission. The timing jumpers on the module may be connected for 1/2, 1, 2, 4 or 8 **minute** operation. In repeaters, the time-out timer will reset each time a new input signal arrives at the station, whether or not the dropout delay generator has shut off the transmitter. Repeater time-out time and line transmit time periods may be selected independently with the repeater select jumper and the line select jumper.

9.3 SQUELCH GATE

In repeater stations, the dropout delay generator in the squelch gate module prevents the transmitter from shutting off during loss or excessive fade of input signal for the length of time preset. The jumper can be set for 0, 1, 2, 4 or 8 **second** operation.

9.4 TWO-RECEIVER STATIONS

9.4.1 Stations equipped with two receivers can be connected for receiver #1 priority or receiver #2 priority if desired. A signal received on the priority receiver automatically mutes the other receiver. These jumpers are located on the line driver module.

Receiver #1 priority — JU18 OUT
JU24 IN
Receiver #2 priority — JU18 IN
JU24 OUT

9.4.2 Jumpers in the line driver module also allow receiver #2 to be partially muted (audio attenuation) if desired, rather than the full muting as shipped from the factory. Attenuation of 10 dB, 20 dB or 30 dB in respect to the unmuted condition are possible by jumper connections as follows.

30 dB attenuation — JU25, 26 IN
JU27 OUT
20 dB attenuation — JU25 IN
JU26, 27 OUT
10 dB attenuation — JU25, 26 & 27 OUT

9.4.3 Receiver #2 mute attenuation is a standard feature of dc controlled stations and optional on tone control.

10. CONTROL LINE CONNECTIONS

10.1 INTRODUCTION

10.1.1 The station can be controlled from a remote point over wire line circuits. Simplex audio is used, meaning that the remote point can send audio to the station or receive audio from the station, but not both at the same time. Therefore, a single audio pair will suffice. For dc remote control operation, the wire line must provide dc continuity for carrying the dc control currents. This must be the same pair that carries the transmit audio. For tone remote control operation the audio pair also carries the audio control tones.

10.1.2 Four-wire audio operation, wherein transmitter audio and receiver audio are carried on separate wire pairs, is possible with the optional line driver/4-wire, 2-receiver audio module (this module is also used in 4-wire, single receiver application). In such operation, line 1 is the transmit pair and line 2 is the receive pair.

10.1.3 In stations with two receivers and four-wire audio, jumpers can be arranged to use line 2 to carry the audio from receiver #2 only if desired.

10.2 LINE SPECIFICATIONS

The audio wire line(s) must meet the following specifications for acceptable radio communications. Verify the characteristics of leased telephone lines with the company providing the service before installation.

10.2.1 DC Remote Control Operation

Audio Line Requirements
1. Frequency Response:
   500 to 2500 Hz
2. Impedance:
   600-ohm balanced line

DC Line Requirements
1. DC resistance 0 to 8000 ohms
2. Must have dc continuity

10.2.2 Tone Remote Control Operation

Frequency response: 500 to 2500 Hz
Frequency translation error: ± 10 Hz max.
Impedance; 600-ohm balanced line
Signal-to-noise: 35 dB min.

Chart of Maximum Input and Loss

Phone-Company Specified Maximum Input	Maximum Phone Line Loss Usable with Remotely-Controlled Radio
5 vu (11 dBm)	29 dB
0 vu (6 dBm)	24 dB
-8 vu (-2 dBm)	16 dB

10.3 INSTALLATION

10.3.1 General

The control line may be installed prior to installation of the cabinet and terminated near the location chosen for the station. Conduit or two-wire cable can be used from this termination to the station junction box control line connector.

10.3.2 Specific Connection Information

Connect the 600-ohm lines to the screw terminals on the junction box control line connector as shown in Figure 2. (In 2-wire applications, use line 1 connections.)

10.3.3 DC Control Line Levels

When the dc control line is initially connected, it must be tested to assure that its loop resistance is low enough to allow sufficient current for remote operation. Use the following test procedure.

Step 1. Connect a dc milliammeter in series with the dc control line.

Step 2. Have the operator press the push-to-talk switch at the remote control console.

Step 3. The current must be at least + 5.5 mA to key the transmitter and at least + 10 mA for two-frequency transmitters. Check to see that the current is positive and not negative and that the station is actually keyed. Adjust the remote control console for F1 line current until + 5.5 mA is achieved. For a two-frequency transmitter, adjust the remote control console for F2 line current of 10 to 12 mA. If the line loop resistance is too high, the maximum line current from the console will not key the transmitter. There are two alternatives to correct this problem.

- Use a pair of lines having lower resistance while maintaining proper audio response, or
- Use an alternate pair of lines with lower resistance to carry dc current only. This pair need not have good audio loss or response characteristics.

Adjust the line current for *Private-Line* disable at the remote control console for -2.5 mA, if a *Private-Line* model is being adjusted.

10.3.4 Tone Control Line Levels

The control tone levels for the remotely controlled functions are adjusted at the remote control console. No additional adjustments are required.

11. CONTROL LINE LEVEL ADJUSTMENT

11.1 GENERAL INFORMATION

11.1.1 Most telephone companies limit the maximum signal amplitude which they will allow on their lines. The most common maximum level is 0 vu (volume units); check the telephone company for the maximum level to be used on your lines. Adjust the audio levels to the maximum permissible level which will give the best signal-to-noise ratio. For lines not subject to telephone company restrictions, set line level to + 5 vu.

11.1.2 The vu is the measurement for speech and can be measured only with a vu meter. This meter has special ballistics to control the rise and fall time and the overshoot of speech signal voltage. Since speech signals fluctuate so rapidly, special metering techniques are required. The pointer of a vu meter responds to a series of "kicks" or deflections of varying amplitude. Over a period of time, a majority of peaks will reach approximately the same level. There will be a few very strong peaks which will exceed this level and a few peaks of lower level. These are ignored and the measured speech level equals the majority of the "kicks" or peaks reached. Measurements show that the instantaneous peaks of a speech signal are about 10 dB higher than the vu value (the instantaneous peaks of a 0 vu speech signal will equal the peaks of a sine wave signal of ± 10 dBm magnitude). Of course, a sine wave signal of ± 10 dBm would produce a much greater volume because every cycle of the signal goes to peak amplitude.

11.1.3 Adjustment of the audio line levels is very difficult using actual speech signals which fluctuate so greatly. A sine wave signal (1000 Hz continuous tone, for example) is much easier to use for adjustments.

However, sine wave signals are measured in dBm and the telephone company specifies the maximum signal level in vu. THERE IS NO CONVERSION FROM VU TO DBM OR VICE VERSA when measuring speech. Speech cannot be measured in dBm or converted into dBm. The dBm is a unit to measure the sine wave power as referenced to 1 milliwatt of power. The power of a speech signal of a particular vu is not defined and is different for different speakers. IT IS POSSIBLE TO **CALIBRATE** A VU METER BY USING A SINE WAVE SIGNAL ON THE 600-OHM LINE, THEN MEASURING THE SAME SIGNAL IN DBM WITH A VOLTMETER. On a 600-ohm line, a sine wave signal that will produce a 0 vu reading will measure 0 dBm on a voltmeter. This does not mean that 0 vu is equal to 0 dBm. Remember, the peaks of an actual 0 vu **speech** signal will have instantaneous peaks of + 10 dBm amplitude.

11.1.4 We would normally conclude that sine wave signal levels would be adjusted 10 dB higher than the vu level specified for the line. EXPERIMENTAL MEASUREMENTS HAVE PROVEN THAT SINE WAVE SIGNAL LINE LEVELS SHOULD BE 6 DB HIGHER THAN THE VU LEVEL SPECIFIED FOR THE LINE (+5 vu speech level should be adjusted for +11 dBm tone level; 0 vu speech level should be adjusted for +6 dBm tone level).

600-Ohm Line VU, dBm, and Voltage Equivalency Chart

If Maximum Speech Level For Line Is	Adjust Tone Line Level For (1 mW ref)	Voltage Equivalent
+5 vu	+11 dBm	2.78 V
+2 vu	+8 dBm	1.94 V
0 vu	+6 dBm	1.54 V
-2 vu	+4 dBm	1.22 V
-4 vu	+2 dBm	0.97 V
-6 vu	0 dBm	0.77 V
-8 vu	-2 dBm	0.61 V
-10 vu	-4 dBm	0.48 V
-12 vu	-6 dBm	0.38 V
-14 vu	-8 dBm	0.30 V
-16 vu	-10 dBm	0.24 V
-18 vu	-12 dBm	0.19 V
-20 vu	-14 dBm	0.15 V
-22 vu	-16 dBm	0.12 V
-24 vu	-18 dBm	0.09 V
-26 vu	-20 dBm	0.07 V

11.2 ADJUSTMENTS

11.2.1 General

11.2.1.1 A local speaker at the station may be used for testing and level settings. If the station is equipped with built-in metering, it includes a local speaker. If not, the speaker in a Motorola portable test set may be used by connecting the test set to the control receptacle on the unified chassis interconnect board. Otherwise, a mobile speaker can be connected to the local speaker pins (pins 22 and 23 of R1 audio module on the unified chassis interconnect board). The receiver VOLUME control sets the audio level at the local speaker only.

11.2.1.2 Exciter audio should be measured at the input to the exciter and adjusted for the sensitivity value stamped on the exciters sensitivity label located on the inside of the control card cover. This level should be measured at pins 11 and 12 of the exciter board plug.

11.2.1.3 *Private-Line* receivers must be PL disabled during adjustments by using the PL DISABLE switch on the station control module. In *Private-Line* repeaters, the squelch gate must also be set for carrier squelch operation during adjustments by connecting jumper JU14 to the active pin and JU15 to the dummy pin. Be sure to return the jumpers to the PL condition after adjustments are complete.

11.2.1.4 If the station is equipped with a single-tone decoder module for repeater access, unplug the single-tone decoder during adjustments.

11.2.2 Repeater Level Setting

Step 1. Set the receiver SQUELCH control at squelch threshold.

Step 2. Inject an on-frequency carrier signal into the receiver antenna input. Adjust the signal level to 20 dB quieting.

Step 3. Adjust the REPEATER SQUELCH KEY control (squelch gate module) so the transmitter just keys.

Step 4. Modulate the receiver input with a 1000 Hz tone at ±5 kHz deviation. Adjust the REPEATER LEVEL control (squelch gate module) so the exciter audio input (measured at pins 11 and 12 of the exciter board) is the value stamped on the exciter sensitivity label (modulator sensitivity +6 dB or approximately ±5 kHz transmitter deviation.

Step 5. On PL repeaters, return jumpers JU14 and JU15 to the PL condition.

11.2.3 Wire Line Controlled Base Stations and Repeater Stations

11.2.3.1 Determine the maximum allowable audio level permitted on the lines and set line audio level to this amplitude. Refer to the 600 ohm, vu, dBm and voltage equivalency chart for tone levels to be used.

NOTE

The following procedures assume the +5 vu speech level (+11 dBm tone level). For other speech levels, use a tone level 6 dB higher than the vu level (for 0 vu use +6 dBm); refer to the equivalency chart. On some lines, tone levels are not permitted

NOTE (Cont'd.)

to exceed the speech levels, even for short test tones (for example, maximum speech level of 0 vu and maximum tone level of 0 dBm). When such regulations apply, use the special procedures for low level test tone.

11.2.3.2 As mentioned previously, the lines used to carry audio have an ac impedance of 600 ohms. The amplitude of signals is most conveniently measured in dBm. Zero dBm is equal to 1 milliwatt across 600 ohms. Most audio voltmeters, such as the Motorola transistorized ac voltmeter, are calibrated to read directly in dBm when measuring across a 600-ohm impedance. Never use a volt-ohm meter or a multimeter.

Step 1. Apply a 1000 Hz audio tone to the remote control console at a level sufficient to drive the amplifier into compression. Adjust the output of the remote control console for +11 dBm (or maximum allowable audio level) at its output terminals. If the level at the station is above 0 dBm, remove JU1 on the station control module.

Step 2. Adjust the XCTR LEVEL control (state control module) so the exciter audio input (measured at pin 11 and 12 of the exciter board) equals the value stamped on the exciter. (Modulator sensitivity plus 3 dB or approximately +5 kHz transmitter deviation.)

Step 3. Remove the 1000 Hz audio tone.

Step 4. Set the receiver SQUELCH control for squelch threshold.

Step 5. Inject a 1000 mV carrier frequency signal into the antenna input of the receiver. Modulate the signal with a 1000 Hz tone at +kHz deviation.

Step 6. Adjust the LINE 1 OUTPUT/line driver module) for +11 dBm (2.8 V) or maximum allowable audio level as measured with an audio voltmeter across the line 1 terminals. If four-wire audio operation is used, with the receiver output applied to line 2, adjust the LINE 2 OUTPUT control while measuring across the line 2 terminals.

Step 7. If the station has two receivers, both feeding to line 1, set the LINE 1 OUTPUT control as specified with a +5 kHz modulated carrier signal injected into receiver 1. Next, inject a ±5 kHz modulated carrier into receiver 2. If the line output on the voltmeter changes by more than 2 dBm, readjust the potentiometer on the receiver 2 audio and squelch board to match the receiver 1 reading.

Step 8. If the station has two receivers, each on a different line, adjust LINE 1 OUTPUT with a modulated carrier injected into receiver 1, and adjust LINE 2 OUTPUT with a modulated carrier injected into receiver 2.

11.2.4 Special Procedure for Low Level Test Tone

NOTE

The following procedure is written for the vu speech level and 0 dBm test tone level, but other levels may be used by substituting appropriate levels (levels across the 600-ohm load should be 6 dB higher than the specified line level).

Step 1. Terminate the remote control console in a 600-ohm load resistor rather than the line.

Step 2. Apply a 1000 Hz audio tone to remote control console at a level sufficient to drive the amplifier into compression.

Step 3. Connect an audio voltmeter across the 600 ohm load resistor and adjust the line output for +6 dBm.

Step 4. Reduce the 1000 Hz audio tone input until the voltmeter reads 0 dBm.

Step 5. Remove the 600 ohm load resistor and reconnect the line. Readjust the line output for 0 dBm across the line. Do not change the 1000 Hz tone level.

Step 6. Connect the audio voltmeter to the exciter audio input at the station and adjust the XCTR LEVEL control for 6 dB less than the value stamped on the exciter.

Step 7. Disconnect the line at the station and connect a 600 ohm load resistor in its place.

Step 8. Apply a 1000 uV carrier signal to the receiver antenna terminal from an FM signal generator. Modulate the carrier signal with a 1000 Hz tone at ±5 kHz deviation.

Step 9. Connect an audio voltmeter across the 600 ohm load resistor and adjust the LINE 1 OUTPUT control for +6 dBm.

Step 10. Reduce the deviation until the voltmeter reads 0 dBm.

Step 11. Remove the 600 ohm load resistor and reconnect the line. Readjust the LINE 1 OUTPUT for 0 dBm as measured across the line.