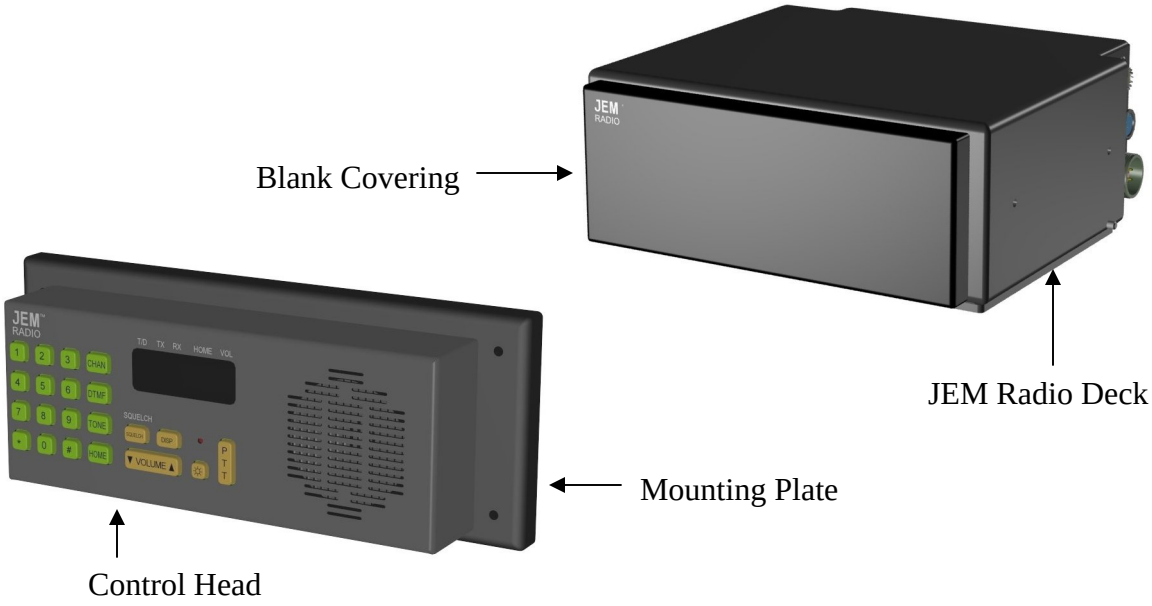
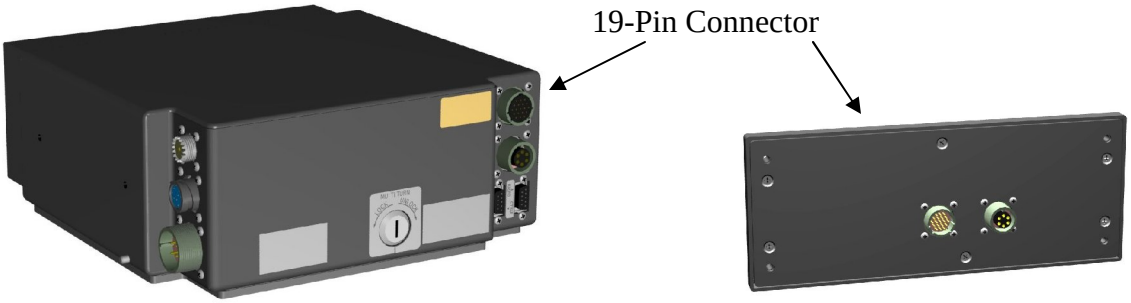
JEM RADIO
User Guide

This JEM Radio is based around the Kenwood TK-7180 with all the form, fit and function of the AAR requirements. This clean cab radio (JEM Radio) is designed to function as a one or two piece. The one piece JEM Radio is pictured above.

To make the JEM Radio into a two-piece radio, the control head is removed from the front of the deck and a blank installed in its place. The control head is inserted onto a remote mounting plate and installed into the standard AAR opening in the locomotive throttle stand. The deck may be mounted under the floor. A data/power cable is routed from a 19-pin connector on the back of the deck to the 19-pin connector on the back of the remote control head. The JEM Radio is then operated as before.



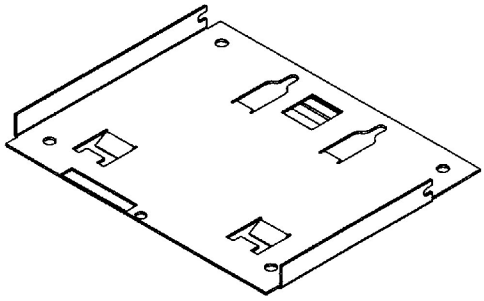
(719) 574-5541 JEM Communications, Inc. (402) 334-2923

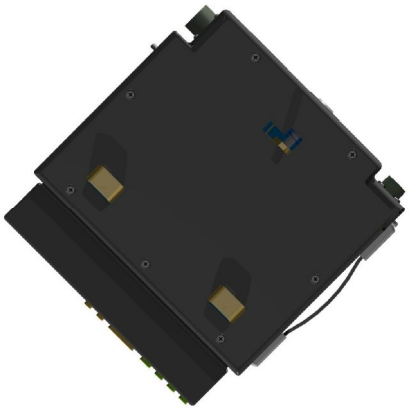


JEM Radio Rear:
19-Pin Connector Upper Right

Control Head Mounting Plate:
19-Pin Connector Left

The Remote Control Head has threaded holes in each corner of the mounting plate that meet up with the recommended AAR mounting holes. The mounting screws are inserted from outside the enclosure to secure the Remote Control Head in place.





JEM-BRKT

An AAR JEM-BRKT radio mounting plate for the JEM Radio may also be ordered from JEM Communications, Inc. This mounting plate may be installed in the throttle stand, under the floor or wherever needed.

It is important to also note at this point that the carrying handle for the JEM Radio may be installed on either side of the radio. With the JEM Radio in the upright position and facing the control head the handle is on the left side in the above views. Mounting holes are also on the right side of the case to install the handle.

Following is a list of the functions on the **JEM Radio**:

Channel Entry: 

The JEM Radio supports both narrow (12.5 kHz) and wide (25 kHz) band channel pairs. A narrow band channel is selected by hitting the CHAN 

button and entering 6 digits (3 digits for TX and then 3 digits for RX). Valid narrow band channels include (001 – 097) and (101 – 196). For example, narrow band channel 084 is the same frequency as wide band channel 84 and narrow band channel 184 selects the frequency between channels 084 and 085. A wide band channel is selected by hitting the CHAN button and entering 4 digits (2 digits for TX and then 2 digits for RX). After entering 4 digits, the radio will wait approximately 3 seconds before accepting the entry as a wide band channel pair. Or the CHAN button can be hit immediately after entering the four (4) digits and the JEM Radio will go to those two wide band channels without delay. Valid wide band channels in the US include (01 – 97). Every wide band channel has the equivalent narrow band channel frequency. It is not possible to enter a mixed narrow/wide band TX/RX pair. The TX and RX channels must both be either wide or narrow band. Check the chart at the end of this guide to see the frequency for each transmit or receive channel.

Volume: 

The volume of the front panel speaker is selectable between 1 and 20. Press and hold the VOLUME rocker switch 

to the right to increase or to the left to decrease the volume. A tone will sound each time the volume changes to indicate loudness. The volume button can be held down to quickly change values.

DTMF Tones: 

	1209 Hz	1336 Hz	1477 Hz
697 Hz	1	2	3
770 Hz	4	5	6
852 Hz	7	8	9
941 Hz	*	0	#

DTMF tones can be sent by hitting the number keys as well as the '#' and '*' key. The number keys will not send DTMF tones when in the channel or tone selection mode. Sequenced DTMF tones can be sent by first hitting the DTMF 

button and then hitting the number keys in succession to select a number sequence. The T/D field of the VF display will change to D and the first number selected. Each following number pressed will send the corresponding DTMF tone but the display will not change.

Single Tones: 

Single tones can be sent by first hitting the TONE  button and then hitting a number key to select a predefined signal tone frequency. The T/D field of the VF display will change to T and the number to show the keypad selection. The frequency of the tone will also be displayed on the bottom line of the VF display. The keypad buttons *, 0 and # are invalid selections. Each successive tone must be preceded by the TONE button. The table to the right is a typical example of the number buttons vs each tone. The frequency of each tone may be set as desired in the Kenwood radio via the KPG-89DK Field Programming Unit software.

Button	Tone (Hz)
1	900
2	1478
3	1748
4	1800
5	1900
6	2200
7	2400
8	2600
9	2800

Home Channels: 

Home channels can be selected by hitting the HOME  key and then hitting the one (1), two (2) or three (3) number keys to select a predefined TX, RX pair. The currently selected home channel will be displayed in the Home area of the VF display. 1 thru 500 Home Channels may be set up in the JEM Radio with the JEM Radio Config software. When the Home Channels are configured for one radio, then that configuration may be saved as a file to be written into other JEM Radios.

For single digit home channels you may simply hit the HOME  key and corresponding number for the desired TX, RX pair, wait 3-4 seconds and the JEM Radio will set it up. For a double digit home channel the same applies; hit the HOME  key and then the corresponding double digit number for the desired TX, RX pair, wait 3-4 seconds for the JEM Radio to respond. To not have to wait for the 3-4 seconds delay, simply hit the Home key again after entering the single or double digits. The currently selected single, double or triple digit home channel will be displayed in the Home area of the VF display.

Revert to Last TX-RX Channel Pair:

For those roads that operate with two (2) primary TX-RX channel pairs the 'Revert to Last TX-RX Channel Pair' key sequence may be very desirable. First set up the two channel pairs. Example: [CHAN] 7272 [CHAN] would set up the 1st channel pair that could be considered a road channel. Next enter [CHAN] 4809 [CHAN] for the 2nd channel pair as a dispatcher channel. While in dispatcher channel the operator may hit the HOME  key and then # key. The JEM Radio will Revert to the road channel TX-RX pair of 72 72. While in the road channel the operator may now hit the HOME  key and then the # key and the JEM Radio will Revert to the dispatcher channel TX-RX pair of 48 09. And then hit HOME  key and # key to revert back to the road channel. Etc.

Brightness Control: 

The brightness of the VF display can be set to 4 intensities by pushing the brightness button  . The keypad is constantly backlit as long as power is supplied to the radio. Depressing the button  for more than three (3) seconds displays the software version in the control head.

TX, BSY Indication:

A small TX or BSY will appear in the lower right of the VF display to indicate radio status. TX indicates the radio is transmitting. BSY indicates the radio is receiving a transmission or that the control head is busy programming the TK-7180 radio.

PTT: 

The PTT button 

is pressed to transmit voice messages via the front panel microphone.

Squelch: 

The SQUELCH button 

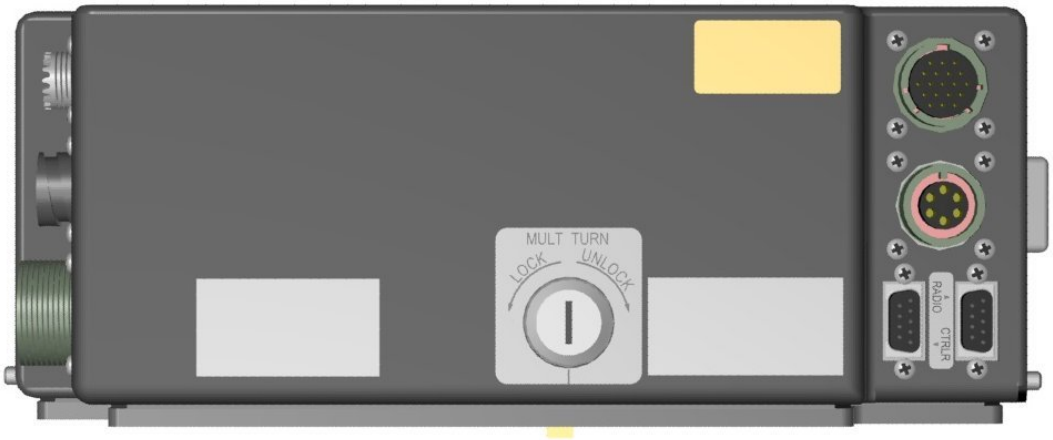
is used to adjust the receive sensitivity of the JEM Radio. Pushing SQUELCH will change the setting from ‘0’ to ‘9’ and around again. A setting of ‘0’ means the radio is wide open and any signal on the receive channel will be heard while a setting of ‘9’ means a stronger signal needs to be received before it is heard. A squelch setting of ‘4’ is the recommended initial setting. Depending on the other radio you are communicating with and other radio traffic in the area, you will need to adjust the squelch up or down to achieve the desired communication without having to listen to a lot of unnecessary radio traffic. Respectively, if you are not receiving any radio communication, you will need to adjust the squelch down until you are starting to hear voice traffic. Typical measurements for squelch opening in the JEM Radio for a setting of ‘1’ is -125.5 dBm or 0.12 uV and -118.3 dBm or 0.27 uV for a squelch setting of ‘9’.

ANI Option:

The JEM Radio has an ANI option available. It can be optioned and programmed to operate in FleetSync®, GE Star® or MDC-1200® modes. The ID range has been extended for the MDC-1200® to DEEE and for the GE Star® to 16,383. This option provides an Automatic Numeric Identification (ANI) of a specific radio transmitter each time the microphone press-to-talk (PTT) switch is activated.

JEM Radio Programming:

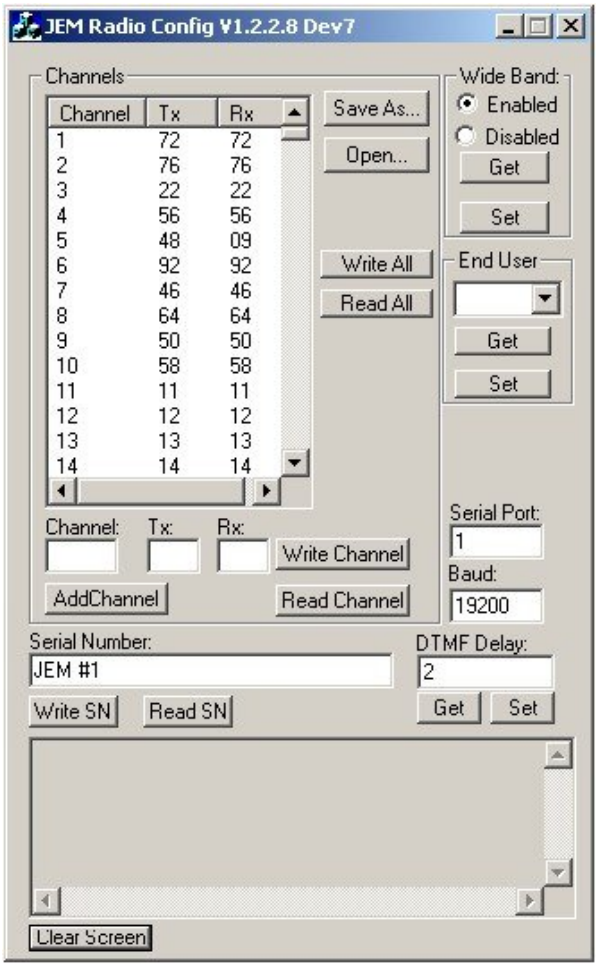
On the rear of the JEM Radio are two (2) DB-9 connectors. One DB-9 is to set up the parameters in the control head and the other is for the Kenwood Radio. The connector for the control head is toward the inside and the connector for the radio is to the outside as pictured below. The COM Port settings are 19.2 kbps, 8bits, none & 1.



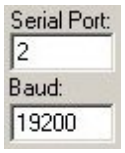
JEM Radio Config Software:

JEM Radio Config is a Windows based software package to configure the parameters in the JEM Radio control head. To the right is a screen shot of the programming software window. This software communicates to the JEM Radio control head via the DB-9 connector on the rear of the radio deck. The DB-9 is towards the inside of the radio.

With this configuration software the user will be able to disable the manual selection of wide band channels for the JEM Radio in the future, produce a list of home channels or program the radio from a file previously saved, enter a unique serial number and set the minimum transmit time for DTMF digits being sent.



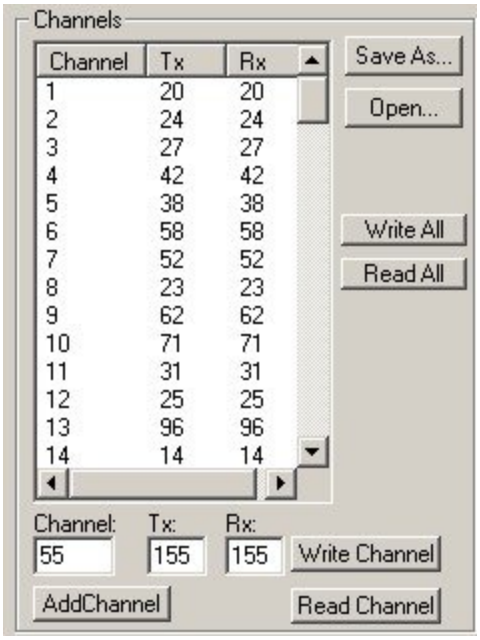
The **Serial Port** is the number of the COM port used on the PC loaded with the JEM Radio Config software. The baud rate set in the JEM Radio is 19.2 kHz.



In the upper right of the screen is a **Wide Band Enable** or **Disable selection**. When the time comes that the JEM Radio will be allowed to operate ONLY with narrow band channels, **Disabled** must be selected and the **Set** button activated. This will not allow any user to set a wide band channel. All channels will then need to be three (3) digit or narrow band values. The **Get** button will display what is set in the JEM Radio.

The **End User** window will indicate which railroad this JEM Radio is set up for. The **Get** button will read that information from the control head of the radio and place it in the window.

Channels indicates HOME CHANNELS. There are 500 Home Channels and they can all be set up with this **JEM Radio Config** software.



A **Channel** list must be made in the first JEM Radio for a railroad. After the first list is produced you may **Save As…** the home channels list as your file name. And, then you may **OPEN…** that list (file) and write all 500 home channels into succeeding JEM Radios.

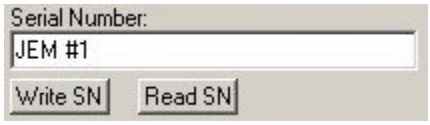
To make the first list, a home channel number is written into the **Channel** box, the AAR Tx number written into the **Tx** box, the AAR Rx number written into the **Rx** box and the **AddChannel** button pushed. The process continues until all of the home channels have been entered. The list of **Channe**l #, **Tx** # & **Rx** # may be viewed in the window above. The slide bar on the side may be used to view the entire list from 1 to 500. When the list is complete, the **Write All** button writes all 500 home channels to the JEM Radio control head. The **Read All** button reads all 500 home channels from the JEM Radio control into the Channel list on the window.

To write one home channel to the JEM Radio control head directly, write the channel # in the **Channel** box, the Tx # in the **Tx** box, the Rx # in the **Rx** box and push the **Write Channel** button. At this point when you also push the **AddChannel** button it will update the **Channel** list in the window above.

To read a specific home channel setting in a JEM Radio control head, set the channel # in the **Channel** box and push the **ReadChannel** button. This will read the channel information out of the control head and place it in the respective boxes.

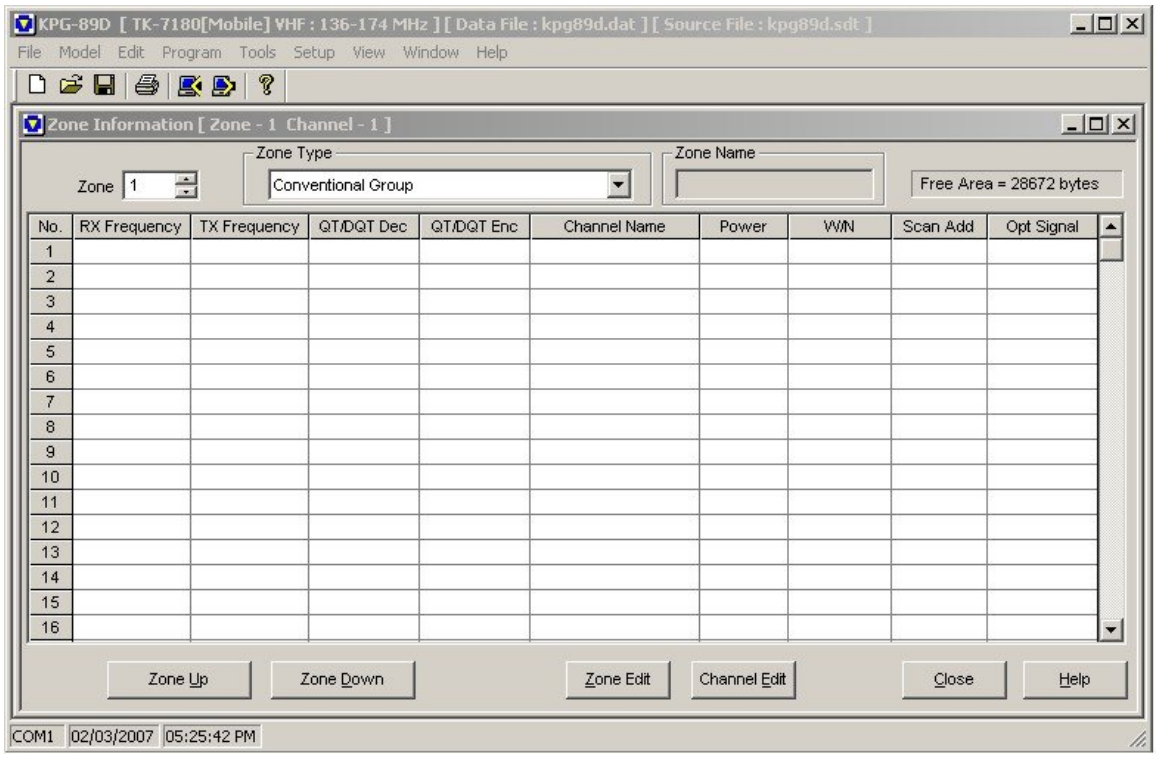
500 Home Channels allows the railroads to set up all of the combinations Tx and Rx numbers that is needed. An example would be for Home Channels 7 thru 97 be set to wide band 07 thru 97 respectively for Tx and Rx and then set Home Channels 107 thru 196 to narrow band 107 thru 196 respectively for Tx and Rx while setting Home Channels 207 thru 297 to narrow band channels 007 thru 097 respectively.

A **DTMF Delay** parameter may be programmed into the JEM Radio. This translates into the minimum transmit length of a DTMF digit that is sent. The number in the window translates to the number x 100 ms increments of minimum transmit time. i.e. 1=100 ms; 2=200ms; 3=300ms; etc.
This is provided for some detectors that may require a minimum burst of DTMF.



A unique **Serial Number** may also be stored in the JEM Radio. This is intended for future applications so that users may provide a communications path to a locomotive and determine the identification number of the JEM Radio being utilized.

Kenwood KPG-89DK Field Programming Unit software:



This software is utilized to set up the parameters in the Kenwood TK-7180 radio.

Following is a chart of the AAR Railroad Industry 160 MHz Channel Plan:

AAR Railroad Industry 160 MHZ Channel Plan

WIDE AAR	25 KHZ FREQ.	Narrow AAR	12.5 KHZ FREQ.	WIDE AAR	25 KHZ FREQ.	Narrow AAR	12.5 KHZ FREQ.
01	159.5700	001	159.5700	21	160.4250	021	160.4250
02	159.8100	002	159.8100			121	160.4325
03	159.9300	003	159.9300	22	160.4400	022	160.4400
04	160.0500	004	160.0500			122	160.4475
05	160.1850	005	160.1850	23	160.4550	023	160.4550
06	160.2000	006	160.2000			123	160.4625
07	160.2150	007	160.2150	24	160.4700	024	160.4700
		107	160.2225			124	160.4775
08	160.2300	008	160.2300	25	160.4850	025	160.4850
		108	160.2375			125	160.4925
09	160.2450	009	160.2450	26	160.5000	026	160.5000
		109	160.2525			126	160.5075
10	160.2600	010	160.2600	27	160.5150	027	160.5150
		110	160.2675			127	160.5225
11	160.2750	011	160.2750	28	160.5300	028	160.5300
		111	160.2825			128	160.5375
12	160.2900	012	160.2900	29	160.5450	029	160.5450
		112	160.2975			129	160.5525
13	160.3050	013	160.3050	30	160.5600	030	160.5600
		113	160.3125			130	160.5675
14	160.3200	014	160.3200	31	160.5750	031	160.5750
		114	160.3275			131	160.5825
15	160.3350	015	160.3350	32	160.5900	032	160.5900
		115	160.3425			132	160.5975
16	160.3500	016	160.3500	33	160.6050	033	160.6050
		116	160.3575			133	160.6125
17	160.3650	017	160.3650	34	160.6200	034	160.6200
		117	160.3725			134	160.6275
18	160.3800	018	160.3800	35	160.6350	035	160.6350
		118	160.3875			135	160.6425
19	160.3950	019	160.3950	36	160.6500	036	160.6500
		119	160.4025			136	160.6575
20	160.4100	020	160.4100	37	160.6650	037	160.6650
		120	160.4175			137	160.6725

WIDE AAR	25 KHZ FREQ.	Narrow AAR	12.5 KHZ FREQ.
38	160.6800	038	160.6800
		138	160.6875
39	160.6950	039	160.6950
		139	160.7025
40	160.7100	040	160.7100
		140	160.7175
41	160.7250	041	160.7250
		141	160.7325
42	160.7400	042	160.7400
		142	160.7475
43	160.7550	043	160.7550
		143	160.7625
44	160.7700	044	160.7700
		144	160.7775
45	160.7850	045	160.7850
		145	160.7925
46	160.8000	046	160.8000
		146	160.8075
47	160.8150	047	160.8150
		147	160.8225
48	160.8300	048	160.8300
		148	160.8375
49	160.8450	049	160.8450
		149	160.8525
50	160.8600	050	160.8600
		150	160.8675
51	160.8750	051	160.8750
		151	160.8825
52	160.8900	052	160.8900
		152	160.8975
53	160.9050	053	160.9050
		153	160.9125
54	160.9200	054	160.9200
		154	160.9275
55	160.9350	055	160.9350
		155	160.9425
56	160.9500	056	160.9500
		156	160.9575

WIDE AAR	25 KHZ FREQ.	Narrow AAR	12.5 KHZ FREQ.
57	160.9650	057	160.9650
		157	160.9725
58	160.9800	058	160.9800
		158	160.9875
59	160.9950	059	160.9950
		159	161.0025
60	161.0100	060	161.0100
		160	161.0175
61	161.0250	061	161.0250
		161	161.0325
62	161.0400	062	161.0400
		162	161.0475
63	161.0550	063	161.0550
		163	161.0625
64	161.0700	064	161.0700
		164	161.0775
65	161.0850	064	161.0850
		165	161.0925
66	161.1000	066	161.1000
		166	161.1075
67	161.1150	067	161.1150
		167	161.1225
68	161.1300	068	161.1300
		168	161.1375
69	161.1450	069	161.1450
		169	161.1525
70	161.1600	070	161.1600
		170	161.1675
71	161.1750	071	161.1750
		171	161.1825
72	161.1900	072	161.1900
		172	161.1975
73	161.2050	073	161.2050
		173	161.2125
74	161.2200	074	161.2200
		174	161.2275
75	161.2350	075	161.2350
		175	161.2425

WIDE AAR	25 KHZ FREQ.	Narrow AAR	12.5 KHZ FREQ.
76	161.2500	076	161.2500
		176	161.2575
77	161.2650	077	161.2650
		177	161.2725
78	161.2800	078	161.2800
		178	161.2875
79	161.2950	079	161.2950
		179	161.3025
80	161.3100	080	161.3100
		180	161.3175
81	161.3250	081	161.3250
		181	161.3325
82	161.3400	082	161.3400
		182	161.3475
83	161.3550	083	161.3550
		183	161.3625
84	161.3700	084	161.3700
		184	161.3775
85	161.3850	085	161.3850
		185	161.3925
86	161.4000	086	161.4000
		186	161.4075

WIDE AAR	25 KHZ FREQ.	Narrow AAR	12.5 KHZ FREQ.
87	161.4150	087	161.4150
		187	161.4225
88	161.4300	088	161.4300
		188	161.4375
89	161.4450	089	161.4450
		189	161.4525
90	161.4600	090	161.4600
		190	161.4675
91	161.4750	091	161.4750
		191	161.4825
92	161.4900	092	161.4900
		192	161.4975
93	161.5050	093	161.5050
		193	161.5125
94	161.5200	094	161.5200
		194	161.5275
95	161.5350	095	161.5350
		195	161.5425
96	161.5500	096	161.5500
		196	161.5575
97	161.5650	097	161.5650

JEM RADIO Cable Connectors

Remote Control Head Connector (19-Pin)

Pin	Signal	Pin	Signal
A	Audio Out	M	Speaker -
E	GND	N	Speaker +
F	Hook 1	S	RXF 232
J	Vcc	T	TXF 232
K	Vcc	U	PTT 1
L	Mic Audio 3	V	Mic Panel

Power Connector (4-Pin)

Pin	Signal	Description
*A	+74 Vdc	Primary isolated input voltage
B	-13.6 Vdc	Radio common (chassis)
*C	-74 Vdc	Primary isolated input voltage
D	+13.6 Vdc	Regulated radio voltage input

* Only one supply voltage can be used at a time.

Rear Handset Connector (6-Pin)

Pin	Signal	Description
A	Mic Audio	Modulation input from handset microphone
B	Mic Gnd	Mic Audio return (common with radio chassis)
C	PTT	Push-To-Talk input
D	PTT Gnd	PTT return path (common with radio chassis)
E	Receive Audio	Audio input to receiver element in handset
F	Hook Switch	Optional input connected to the handset cradle switch

Accessories Connector (12-Pin)

Pin	Signal	Description
A	Remote Mic	Remote microphone audio input
B	Mic Ground	Remote microphone ground
C	Remote PTT	Input signal for remote transmit activation
D	PTT Return	PTT reference (common)
E	Remote Audio	Low level audio output
F	+ 13.6 Vdc	Low power (1Amp max)
H	Audio Return	Remote audio common
J	13.6 Vdc Return	13.6 Vdc common (chassis)
K	#	Do Not Use
L	#	Do Not Use
M	External Speaker	Remote speaker
N	External Speaker	Remote speaker return

JEM RADIO Specifications

GENERAL	
Frequency Range	159.5700 – 161.565 MHz
Channel Spacing:	
Wide -	25 kHz
Narrow -	12.5 kHz
Duty Cycle	Transmit: 20%
Operating Temp Range	-22° F to +140° F (-30° C to +60° C)
Frequency Stability	±0.00025 %
Antenna Impedance	50 Ω
FCC ID Type 1	K4437303110
FCC Compliance	FCC parts 22, 74, 90 & 90.210
IC Certification Type 1	282F-37303110

RECEIVER	(Measurements made per EIA/TIA-603)
Sensitivity (12 dB SINAD):	
Wide -	0.25 μV
Narrow -	0.28 μV
Selectivity:	
Wide -	80 dB
Narrow -	70 dB
Intermod Distortion:	
Wide / Narrow -	75 dB (±50, 100 kHz
Spurious Response	90 dB
Audio Output	15 Watt 4 Ω with less than 5% distortion

TRANSMITTER	(Measurements made per EIA/TIA-603)
RF Power Output	50 W
Type of Emission:	
Wide -	16KØF3E
Narrow -	11KØF3E
Spurious Response	80 dB
FM Hum & Noise:	
Wide -	50 dB
Narrow -	45 dB
Microphone Impedance	600Ω
Audio Distortion	3%

JEM Communications, Inc. Warranty Policy

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. ALL WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.

It is the Policy of JEM Communications to warranty the JEM Radio for a period of three years from the date of shipment. This warranty covers defects in factory material and workmanship only. JEM will not be responsible for defects caused by abuse, acts of God or other reasons beyond our control.

The responsibility of JEM under this Warranty will be to repair or replace at no cost to the customer any JEM Radio returned to JEM. JEM will not be responsible for any other costs associated with defective material unless specifically agreed to in writing.

The coverage under this Warranty for the JEM Radio only extends to JEM Radios that are purchased by the different railroads and/or railways. Any defects caused by customer supplied materials and/or products are not covered.

For JEM Radio Warranty and/or Repair: Call JEM Communications, Inc. at 719-574-5541 for a RA Number

Ship to: JEM Communications Repair Facility
1555 Paonia Street
Colorado Springs, CO 80915