Parts list and Tuning Procedures

This exhibit contains a list of the semiconductor devices used in the transceiver and the test equipment and tuning procedures for maintaining the transceiver.

- Exhibit 10A Function of RF Semiconductors and Other Active Devices
- Exhibit 10B List of Recommended Test Equipment for Servicing
- Exhibit 10C Tuning Procedures

Function of RF Semiconductors & Other Active Devices

NUMBER AFFEICATION Including Ladifield CR1 48-80154K03 CLIPPER 444-474 MHZ MMBD353 CR2 48-80142L01 RF SWITCH 444-474 MHZ MMBV3401 CR3 48-80142L01 RF PIN SWITCH 444-474 MHZ MMBV3401 CR4 48-80142L01 RF PIN SWITCH 444-474 MHZ MMBV3401 CR6 48-80142L01 RF PIN SWITCH 444-474 MHZ MMBV3401 CR7 48-80142L01 RF PIN SWITCH 444-474 MHZ MMBV3401 CR7 48-80142L01 RF PIN SWITCH 444-474 MHZ MMBV3401 CR7 48-80142L01 RF PIN SWITCH 444-474 MHZ MMBD353 CR51 48-80154K03 CLIPPER 448-80 MMBD353 ISV232 CR151 48-62824C03 RX VCO FREQ CONTROL 399.15-429.15 MHZ MMBD7000 CR202 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHZ MMBD7000 CR2					
CR1 48-80154K03 CLIPPER 444-474 HHz MMBD353 CR2 48-80142L01 RF SWITCH 444-474 MHZ MMBV3401 CR4 48-80142L01 RF PIN SWITCH 444-474 MHZ MMBV3401 CR4 48-80142L01 RF PIN SWITCH 444-474 MHZ MMBV3401 CR4 48-80142L01 RF PIN SWITCH 444-474 MHZ MMBV3401 CR6 48-80142L01 RF PIN SWITCH 444-474 MHZ MMBV3401 CR6 48-80142L01 RF PIN SWITCH 444-474 MHZ MMBV3401 CR6 48-80142L01 RF PIN SWITCH 444-474 MHZ MMBV3401 CR8 48-80939010 DC SWITCH DC 1N15711 DC 1N15711 CR51 48-62824C03 RX VCO FREQ CONTROL 399.15-429.15 MHz 1SV232 1SV232 CR201 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR202 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR		NOMBER	AFFEICATION	INLQUENCI	
GR1 48-80142L01 RF SWITCH 444-474 MMBV3401 CR2 48-80142L01 RF SWITCH 444-474 MMBV3401 CR3 48-80142L01 RF PIN SWITCH 444-474 MMBV3401 CR4 48-80142L01 RF PIN SWITCH 444-474 MMBV3401 CR4 48-80142L01 RF PIN SWITCH 444-474 MMBV3401 CR6 48-80142L01 RF PIN SWITCH 444-474 MMBV3401 CR6 48-80142L01 RF PIN SWITCH 444-474 MMBV3401 CR7 48-80142L01 RF PIN SWITCH 444-474 MMBV3401 CR7 48-80154K03 CLIPPER 44.85 MMBD353 CR151 48-680142L01 RX VCO FREQ CONTROL 399.15-429.15 MMZ CR152 48-6824C03 RX VCO AGC 399.15-429.15 MME 15V232 CR153 48-80154K02 RX VCO AGC 399.15-429.15 MME MMBD7000 CR201 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000	CR1	18-80151K03		444-474 MHz	MMRD353
CR2 48-80142L01 RF PIN SWITCH 444-474 MINEV3401 CR4 48-80142L01 RF PIN SWITCH 444-474 MINEV3401 CR4 48-80142L01 RF PIN SWITCH 444-474 MINEV3401 CR6 48-80142L01 RF PIN SWITCH 444-474 MINEV3401 CR6 48-80142L01 RF PIN SWITCH 444-474 MINEV3401 CR6 48-80154K03 CLIPPER 444-474 MINE V3401 CR51 48-62824C03 RX VCO FREQ CONTROL 399.15-429.15 MIZ CR152 48-62824C03 RX VCO FREQ CONTROL 399.15-429.15 MIZ ISV232 CR154 48-62824C03 RX VCO FREQ CONTROL 399.15-429.15 MIZ ISV232 CR154 48-62824C03 RX VCO GREC 0.5 MIZ MINBD7000 CR201 48-13833C07 VOLTAGE MULTIPLIER 1.05 MIZ MIBD7000 CR204 48-80154K02 TX VCO FREQ CONTROL 444-474 MIZ ISV232 CR251 48-62824C03 TX VCO FREQ CO	CP2	48-801421 01		444-474 MHz	MMB\/3401
GR3 48-50142L01 RF PIN SWITCH 444-474 MILZ MIMBV3401 CR4 48-80142L01 RF PIN SWITCH 444-474 MHz MMBV3401 CR6 48-80142L01 RF PIN SWITCH 444-474 MHz MMBV3401 CR6 48-80142L01 RF PIN SWITCH 444-474 MHz MMBV3401 CR7 48-80142L01 RF PIN SWITCH 444-474 MHz MMBV3401 CR7 48-80142L01 RF PIN SWITCH 444-474 MHz MMBV3401 CR7 48-80142L01 RF PIN SWITCH 444-474 MHz MMBD353 CR1 48-80154K03 CLIPPER DC 1N15711 SV232 CR151 48-62824C03 RX VCO FREQ CONTROL 399.15-429.15 MHz SV232 CR152 48-62824C03 RX VCO AGC 399.15-429.15 MHz MMBD7000 CR202 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR203 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz		40-00142101		444-474 WILZ	
CR4 48-50142L01 RF PIN SWITCH 444-474 MINE V3401 CR5 48-80142L01 RF PIN SWITCH 444-474 MHz MMBV3401 CR7 48-80142L01 RF PIN SWITCH 444-474 MHz MMBV3401 CR7 48-80142L01 RF PIN SWITCH 444-474 MHz MMBV3401 CR8 48-80939T01 DC SWITCH DC 1N15711 CR51 48-62824C03 RX VCO FREQ CONTROL 399.15-429.15 MHz SV232 CR151 48-62824C03 RX VCO FREQ CONTROL 399.15-429.15 MHz MMBD7000 CR201 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR202 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR203 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR204 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR205 48-62824C03 TX VCO FREQ CONTROL 444-474 MHz SV232<		40-00142L01		444-474 IVINZ	
CRS 48-80142L01 RF PIN SWITCH 444-474 MHz MMBV3401 CR6 48-80142L01 RF PIN SWITCH 444-474 MHz MMBV3401 CR7 48-80142L01 RF PIN SWITCH 444-474 MHz MMBV3401 CR8 48-80142L01 RF PIN SWITCH 444-474 MHz MMBV3401 CR8 48-80154K03 CLIPPER 44.85 MHz MMBD353 CR151 48-62824C03 RX VCO FREQ CONTROL 399.15-429.15 MHz ISV232 CR152 48-62824C03 RX VCO AGC 399.15-429.15 MHz ISV232 CR153 48-80154K02 RX VCO AGC 399.15-429.15 MHz MMBD7000 CR204 48-1383307 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR203 48-1383307 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR204 48-1383307 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR204 48-1383307 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR213 48-62824C03 TX VCO FREQ CONTROL 444-474 MHz ISV232		40-00142L01			
CR0 48-80142L01 RF PIN SWITCH 444-474 MHz MMBV3401 CR1 48-80142L01 RF PIN SWITCH 444-474 MHz MMBV3401 CR8 48-80142L01 RF PIN SWITCH DC 1N15711 CR51 48-80154K03 CLIPPER 44.85 MHz MMBD353 CR151 48-62824C03 RX VCO FREQ CONTROL 399.15-429.15 MHz 1SV232 CR153 48-80154K02 RX VCO FREQ CONTROL 399.15-429.15 MHz 1SV232 CR153 48-80154K02 RX VCO AGC 399.15-429.15 MHz 1SV232 CR201 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR202 48-13833C07 VOLTAGE MULTIPLIER 1.68 MHz MMBD7000 CR204 48-63124C03 TX VCO AGC 444-474 MHz 1SV232 CR254 48-62824C03 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR254 48-62824C03 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR254 48-65129M76 DC WITCH DC MMBD914		48-80142L01			
CR7 48-80132L01 RF PIN SWITCH 444-4/4 MHz MMBU3401 CR8 48-80939T01 DC SWITCH DC 1N15711 CR51 48-80154K03 CLIPPER 44.85 MHz MMBD353 CR151 48-62824C03 RX VCO FREQ CONTROL 399.15-429.15 MHz 1SV232 CR152 48-62824C03 RX VCO FREQ CONTROL 399.15-429.15 MHz BAS7004TA CR202 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR203 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR204 48-13833C07 VOLTAGE MULTIPLIER 1.68 MHz MMBD7000 CR204 48-13833C07 VOLTAGE CONTROL 444-474 MHz BAS7004TA CR205 48-62824C03 TX VCO FREQ CONTROL 444-474 MHz ISV232 CR251 48-62824C01 TX VCO FREQ CONTROL 444-474 MHz ISV232 CR253 48-62824C03 TX VCO FREQ CONTROL 444-474 MHz ISV232 CR254 48-62824C01 TX VCO FREQ CONTROL 444-474 MHz ISV23	CR6	48-80142L01	RF PIN SWITCH	444-474 MHZ	MMBV3401
CR8 48-80939101 DC SWITCH DC 1N15711 CR51 48-80154K03 CLIPPER 44.85 MHz MMBD353 CR151 48-62824C03 RX VCO FREQ CONTROL 399.15-429.15 MHz 1SV232 CR152 48-60154K02 RX VCO FREQ CONTROL 399.15-429.15 MHz 1SV232 CR153 48-80154K02 RX VCO AGC 399.15-429.15 MHz 1SV232 CR201 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR203 48-13833C07 VOLTAGE MULTIPLIER 1.68 MHz MMBD7000 CR204 48-62824C03 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR251 48-62824C03 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR252 48-62824C01 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR253 48-62824C03 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR254 48-62824C01 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR253 48-62824C01 TX VCO FREQ CONTROL 444-474 MHz 1S	CR7	48-80142L01	RF PIN SWITCH	444-474 MHz	MMBV3401
CR5148-80154K03CLIPPER44.85 MHzMMBD353CR15148-62824C03RX VCO FREQ CONTROL RX VCO FREQ CONTROL 48-08154K02399.15-429.15 MHz 399.15-429.15 MHz1SV232 BAS7004TACR20148-13833C07VOLTAGE MULTIPLIER VOLTAGE MULTIPLIER 48-80154K021.05 MHz 1.05 MHzMMBD7000 MMBD7000 16.8 MHzCR20348-13833C07VOLTAGE MULTIPLIER VOLTAGE MULTIPLIER 48-80154K021.05 MHz 1.05 MHzMMBD7000 MBD7000 16.8 MHzCR20448-38634C03TX VCO FREQ CONTROL 48-62824C03444-474 MHz 48-62824C031SV232 48-62824C03CR25148-62824C03TX VCO FREQ CONTROL 48-62824C01444-474 MHz 48-05129M761SV232 444-474 MHz1SV232 444-474 MHzCR40148-05129M76 48-05129M76SHORT CIRCUIT PROTECTION DC SWITCHDC DC MMBD914MMBD914 DCCR45148-05129M76 48-05129M76DC SWITCH DC SWITCHDC MMBD914MMBD914 DCCR45148-05129M76 48-05129M76DC SWITCH DC SWITCHDC MMBD914CR65148-13833C07ESD PROTECTION ESD PROTECTION AUDIOAUDIO AUDIOMMBD7000 MMBD7000CR65248-13833C07ESD PROTECTION ESD PROTECTION AUDIOAUDIO AUDIOMMBD7000 MMBD7000CR65148-80339T01SWITCH5 kHz1N15711CR90148-13833C07ESD PROTECTION ESD PROTECTION AUDIODC AUDIOMMBD7000 MMBD7000CR65248-13833C07ESD PROTECTION ESD PROTECTIONDC MMBD7000<	CR8	48-80939101	DC SWITCH	DC	1N15711
CR151 48-62824C03 RX VCO FREQ CONTROL 399.15-429.15 MHz 1SV232 CR152 48-6814002 RX VCO AGC 399.15-429.15 MHz 1SV232 CR153 48-80154K02 RX VCO AGC 399.15-429.15 MHz 1SV232 CR201 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR203 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR204 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR204 48-13833C07 VOLAGE MULTIPLIER 1.05 MHz MMBD7000 CR204 48-13833C07 VOLAGE MULTIPLIER 1.05 MHz MMBD7000 CR204 48-05124K02 TX VCO AGC 444-474 MHz ISV232 CR252 48-62824C03 TX VCO FREQ CONTROL 444-474 MHz ISV232 CR403 48-05129M76 SHORT CIRCUIT PROTECTION DC MMBD914 CR403 48-05129M76 DC SWITCH DC MMBD914 CR452 48-05129M76 DC SWITCH DC MMBD914	CR51	48-80154K03	CLIPPER	44.85 MHz	MMBD353
CR152 48-62824C03 RX VCO FREQ CONTROL 399.15-429.15 MHz 15V232 CR153 48-80154K02 RX VCO AGC 399.15-429.15 MHz BAS7004TA CR201 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR202 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR203 48-13833C07 VOLTAGE MULTIPLIER 1.68 MHz MMBD7000 CR204 48-13833C07 VOLTAGE MULTIPLIER 1.68 MHz MMBD7000 CR204 48-0154K02 TX VCO AGC 444-474 MHz BAS7004TA CR251 48-62824C03 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR252 48-62824C01 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR253 48-62824C01 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR401 48-05129M76 SHORT CIRCUIT PROTECTION DC MMBD914 CR402 48-05129M76 DC SWITCH DC MMBD914 CR451 48-05129M76 DC SWITCH DC MMBD7000 <td>CR151</td> <td>48-62824C03</td> <td>RX VCO FREQ CONTROL</td> <td>399.15-429.15 MHz</td> <td>1SV232</td>	CR151	48-62824C03	RX VCO FREQ CONTROL	399.15-429.15 MHz	1SV232
CR153 48-80154K02 RX VCO AGC 399.15-429.15 MHz BAS7004TA CR201 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR203 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR204 48-3833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR204 48-3833C07 VOLTAGE MULTIPLIER 1.68 MHz MMBD7000 CR205 48-62824C03 TX VCO AGC 444-474 MHz 1SV232 CR252 48-62824C03 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR253 48-62824C01 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR254 48-62824C01 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR254 48-63129M76 SHORT CIRCUIT PROTECTION DC MMBD914 CR403 48-05129M76 DC SWITCH DC MMBD914 CR451 48-05129M76 DC SWITCH DC MMBD914 CR452 48-05129M76 DC SWITCH DC MMBD7000 CR452	CR152	48-62824C03	RX VCO FREQ CONTROL	399.15-429.15 MHz	1SV232
CR201 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR202 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR203 48-13833C07 VOLTAGE MULTIPLIER 1.68 MHz MMBD7000 CR204 48-80154K02 TX VCO AGC 444-474 MHz BAS7004TA CR251 48-62824C03 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR252 48-62824C01 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR253 48-62824C01 TX VCO MODULATOR 444-474 MHz 1SV232 CR401 48-05129M76 SHORT CIRCUIT PROTECTION DC MMBD914 CR402 48-05129M76 DC SWITCH DC MMBD914 CR451 48-05129M76 DC SWITCH DC MMBD914 CR452 48-05129M76 DC SWITCH DC MMBD7000 CR651 48-13833C07 ESD PROTECTION AUDIO MMBD7000 CR652 48-13833C07 ESD PROTECTION AUDIO MMBD7000 CR653	CR153	48-80154K02	RX VCO AGC	399.15-429.15 MHz	BAS7004TA
CR202 48-13833C07 VOLTAGE MULTIPLIER 1.05 MHz MMBD7000 CR203 48-13833C07 VOLTAGE MULTIPLIER 16.8 MHz MMBD7000 CR206 48-80154K02 TX VCO AGC 444-474 MHz BAS7004TA CR251 48-62824C03 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR252 48-62824C01 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR253 48-62824C01 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR253 48-62824C01 TX VCO MODULATOR 444-474 MHz 1SV232 CR401 48-05129M76 SHORT CIRCUIT PROTECTION DC MMBD914 CR403 48-05129M76 DC SWITCH DC MMBD914 CR451 48-05129M76 DC SWITCH DC MMBD914 CR451 48-05129M76 DC SWITCH DC MMBD914 CR651 48-13833C07 ESD PROTECTION AUDIO MMBD7000 CR652 48-13833C07 ESD PROTECTION AUDIO MMBD7000 CR653	CR201	48-13833C07	VOLTAGE MULTIPLIER	1.05 MHz	MMBD7000
CR203 CR20648-13833C07 48-80154K02VOLTAGE MULTIPLIER TX VCO AGC16.8 MHz 444-474 MHzMMBD7000 BAS7004TACR206 CR25248-62824C03 48-62824C01TX VCO FREQ CONTROL TX VCO FREQ CONTROL TX VCO FREQ CONTROL 444-474 MHz444-474 MHz 1SV232 444-474 MHz1SV232 1SV229CR401 CR402 CR403 48-05129M76SHORT CIRCUIT PROTECTION DC SWITCH DC SWITCHDC DC MMBD914 DCMMBD914 MBD914CR451 CR452 48-05129M76SHORT CIRCUIT PROTECTION DC SWITCH DC SWITCHDC DC MMBD914MMBD914 MBD914CR451 CR452 48-05129M76DC SWITCH TEMPERATURE COMPENSATION DC SWITCHDC MMBD914MMBD914 MBD914CR451 CR452 48-05129M76ESD PROTECTION ESD PROTECTION ESD PROTECTION AUDIOAUDIO MMBD7000 MMBD7000MMBD7000 MMBD7000CR651 CR653 48-13833C07ESD PROTECTION ESD PROTECTION ESD PROTECTION CR653 48-13833C07DC SUTCHMMBD7000 MMBD7000CR801 CR902 48-05129M76ESD PROTECTION ESD PROTECTION ESD PROTECTION CR902 48-13833C07DC SUTCHMMBD7000 MMBD7000CR801 CR903 48-13833C07ESD PROTECTION ESD PROTECTION CR902 48-05129M76DC SWITCHMMBD7000 MMBD7000CR804 CR903 48-0326E07TRANSIENT SUPPRESSOR FAMPEIAS CONTROLDC MMBD7000MR2535LQ1 48-13827A24 48-13824A17 RF AMPLIFIER Q2 48-13824A17RF AMPLIFIER FAMP BIAS CONTROL444-474 MHz MRF5812 MMBT3906	CR202	48-13833C07	VOLTAGE MULTIPLIER	1.05 MHz	MMBD7000
CR206 48-80154K02 TX VCO AGC 444-474 MHz BAS7004TA CR251 48-62824C03 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR252 48-62824C01 TX VCO FREQ CONTROL 444-474 MHz 1SV232 CR253 48-62824C01 TX VCO MODULATOR 444-474 MHz 1SV232 CR253 48-62824C01 TX VCO MODULATOR 444-474 MHz 1SV232 CR401 48-05129M76 SHORT CIRCUIT PROTECTION DC MMBD914 CR402 48-83654H02 TEMPERATURE COMPENSATION DC MMBD914 CR403 48-05129M76 DC SWITCH DC MMBD914 CR451 48-05129M76 DC SWITCH DC MMBD914 CR452 48-05129M76 DC SWITCH DC MMBD914 CR651 48-13833C07 ESD PROTECTION AUDIO MMBD7000 CR652 48-13833C07 ESD PROTECTION AUDIO MMBD7000 CR651 48-13833C07 ESD PROTECTION AUDIO MMBD7000 CR801 48-080	CR203	48-13833C07	VOLTAGE MULTIPLIER	16.8 MHz	MMBD7000
CR25148-62824C03TX VCO FREQ CONTROL TX VCO FREQ CONTROL 448-62824C01444-474 MHz TX VCO MODULATOR1SV232 444-474 MHz 444-474 MHzCR25248-62824C01TX VCO FREQ CONTROL TX VCO MODULATOR444-474 MHz 444-474 MHz1SV232 1SV229CR40148-05129M76SHORT CIRCUIT PROTECTION TEMPERATURE COMPENSATION DC MMBD914DCMMBD914 DCCR40348-05129M76DC SWITCH TEMPERATURE COMPENSATION DCDCMMBD914 MBD914CR45148-05129M76DC SWITCH TEMPERATURE COMPENSATION DCDCMMBD914 MBD914CR45248-05129M76DC SWITCH TEMPERATURE COMPENSATIONDCMMBD914 DCCR65148-13833C07ESD PROTECTION ESD PROTECTION 48-13833C07AUDIOMMBD7000 MMBD7000CR80148-80939T01SWITCH5 kHz1N15711CR90148-13833C07ESD PROTECTION ESD PROTECTION AUDIODCMMBD7000 MMBD7000CR80148-05129M76DC SWITCH ESD PROTECTION AUDIODCMMBD7000 MMBD7000CR65348-13833C07ESD PROTECTION ESD PROTECTION AUDIODCMMBD7000 MMBD7000CR90248-05129M76DC SWITCH ESD PROTECTION AUDIODCMMBD7000 MMBD7000CR90348-13833C07ESD PROTECTION ESD PROTECTIONDCMMBD7000 AUDIOCR90448-03128M76DC SWITCH ESD PROTECTIONDCMMBD7000CR90348-13833C07ESD PROTECTION ESD PROTECTIONDCMMBD7000 AUDIOCR2	CR206	48-80154K02	TX VCO AGC	444-474 MHz	BAS7004TA
CR25248-62824C03TX VCO FREQ CONTROL TX VCO MODULATOR444-474 MHz1SV232 444-474 MHzCR25348-62824C01TX VCO MODULATOR444-474 MHz1SV229CR40148-05129M76SHORT CIRCUIT PROTECTION TEMPERATURE COMPENSATION DC SWITCHDCMMBD914 DCCR40348-05129M76DC SWITCH DC SWITCHDCMMBD914 DCCR45148-05129M76DC SWITCH TEMPERATURE COMPENSATION DC SWITCHDCMMBD914 DCCR45148-05129M76DC SWITCH TEMPERATURE COMPENSATION DC SWITCHDCMMBD914 DCCR65148-13833C07ESD PROTECTION ESD PROTECTION ESD PROTECTION ESD PROTECTIONAUDIO AUDIOMMBD7000 MMBD7000CR65348-80939T01SWITCH5 kHz1N15711CR90148-13833C07ESD PROTECTION ESD PROTECTION ESD PROTECTIONDCMMBD7000 MMBD7000CR80148-80939T01SWITCH5 kHz1N15711CR90148-13833C07ESD PROTECTION ESD PROTECTIONDCMMBD7000 MMBD7000CR268048-80236E07TRANSIENT SUPPRESSORDCMR2535LQ148-13827A24RF AMPLIFIER RF AMP BIAS CONTROL444-474 MHzMRF5812 MMBT3906	CR251	48-62824C03	TX VCO FREQ CONTROL	444-474 MHz	1SV232
CR25348-62824C01TX VCO MODULATOR444-474 MHz1SV229CR40148-05129M76SHORT CIRCUIT PROTECTION TEMPERATURE COMPENSATION DC SWITCHDCMMBD914CR40348-05129M76DC SWITCHDCMMBD914CR40448-05129M76DC SWITCHDCMMBD914CR45148-05129M76DC SWITCHDCMMBD914CR45248-05129M76DC SWITCHDCMMBD914CR45348-05129M76DC SWITCHDCMMBD914CR45448-05129M76DC SWITCHDCMMBD914CR65148-13833C07ESD PROTECTIONAUDIOMMBD7000CR65248-13833C07ESD PROTECTIONAUDIOMMBD7000CR65348-13833C07ESD PROTECTIONAUDIOMMBD7000CR80148-80939T01SWITCH5 kHz1N15711CR90148-13833C07ESD PROTECTIONDCMMBD7000CR90248-05129M76DC SWITCHDCMMBD7000CR80148-80236E07TRANSIENT SUPPRESSORDCMR2535LQ148-13827A24RF AMPLIFIER444-474 MHzMRF5812Q248-13827A24RF AMPLIFIER444-474 MHzMRF5812Q248-13827A24RF AMPLIFIER444-474 MHzMRF5812Q248-13827A24RF AMPLIFIER444-474 MHzMRF5812Q248-13827A24RF AMPLIFIER444-474 MHzMRF5812Q248-13827A24RF AMPLIFIER444-474 MHzMRF5812Q2 <td< td=""><td>CR252</td><td>48-62824C03</td><td>TX VCO FREQ CONTROL</td><td>444-474 MHz</td><td>1SV232</td></td<>	CR252	48-62824C03	TX VCO FREQ CONTROL	444-474 MHz	1SV232
CR401 CR402 (R403 48-05129M76 (R403 48-05129M76 (R403 48-05129M76SHORT CIRCUIT PROTECTION TEMPERATURE COMPENSATION DC SWITCHDCMMBD914 DCCR405 (R405 (R405) (R405)48-05129M76 (DC SWITCH)DC SWITCH (DC SWITCH)DCMMBD914 DCCR451 (R452) (R452)48-05129M76 (R452)DC SWITCH (DC SWITCH)DCMMBD914 DCCR451 (CR452) (R452)48-05129M76 (R452)DC SWITCH (TEMPERATURE COMPENSATION)DCMMBD914 DCCR651 (R452) (R453)48-13833C07 (R50)ESD PROTECTION (ESD PROTECTION)AUDIO (AUDIO)MMBD7000 (MMBD7000)CR653 (R453) (R451)SWITCH5 kHz1N15711CR901 (R48-13833C07) (R50)SWITCHDC (SD PROTECTION)MMBD7000 (MMBD7000)CR801 (R48-13833C07) (R50)ESD PROTECTION (SD PROTECTION)DC (MMBD7000)MMBD7000 (MMBD7000)CR801 (R48-13833C07) (R50)ESD PROTECTION (SD PROTECTION)DC (MMBD7000)MMBD7000 (MMBD7000)CR801 (R48-13833C07) (R50)ESD PROTECTION (SD PROTECTION)DC (MMBD7000)MMBD7000 (MMBD7000)CR902 (R48-13833C07) (R50)ESD PROTECTION (SD PROTECTION)DC (MMBD7000)MMBD7000 (MMBD7000)CR2680 (R2680) (R48-80236E07)TRANSIENT SUPPRESSOR (R AMPLIFIER) (R AMP BIAS CONTROL)DC (A44-474 MHz)MRF5812 (MMBT3906)	CR253	48-62824C01	TX VCO MODULATOR	444-474 MHz	1SV229
CR40248-83654H02TEMPERATURE COMPENSATION DC SWITCH DC SWITCHDCMMBD914CR40348-05129M76DC SWITCHDCMMBD914CR45148-05129M76DC SWITCHDCMMBD914CR45248-05129M76DC SWITCHDCMMBD914CR45248-05129M76DC SWITCHDCMMBD914CR65148-13833C07ESD PROTECTIONAUDIOMMBD7000CR65248-13833C07ESD PROTECTIONAUDIOMMBD7000CR65348-13833C07ESD PROTECTIONAUDIOMMBD7000CR80148-80939T01SWITCH5 kHz1N15711CR90148-13833C07ESD PROTECTIONDCMMBD7000CR90248-05129M76DC SWITCHDCMMBD7000CR80148-13833C07ESD PROTECTIONDCMMBD7000CR90248-05129M76DC SWITCHDCMMBD7000CR90348-13833C07ESD PROTECTIONDCMMBD7000CR268048-80236E07TRANSIENT SUPPRESSORDCMR2535LQ148-13827A24RF AMPLIFIER444-474 MHzMRF5812Q248-13824A17RF AMPLIFIER444-474 MHzMRF5812Q248-13824A17RF AMPLIFIER444-474 MHzMRF5812MMBT3906MAB24A17RF AMPLIFIER444-474 MHzMRF5812Q248-13824A17RF AMPLIFIER444-474 MHzMRF5812Q248-13824A17RF AMPLIFIER444-474 MHzMRF5812Q248-13824A17<	CR401	48-05129M76	SHORT CIRCUIT PROTECTION	DC	MMBD914
CR403 CR40548-05129M76DC SWITCH DC SWITCHDCMMBD914 MMBD914CR451 CR45248-05129M76DC SWITCH TEMPERATURE COMPENSATIONDCMMBD914 DCCR651 CR652 48-13833C07 CR65348-13833C07 ESD PROTECTION ESD PROTECTION ESD PROTECTION ESD PROTECTIONAUDIO AUDIO AUDIO AUDIO MMBD7000 MMBD7000CR801 CR801 48-13833C07SWITCH5 kHz1N15711CR901 CR902 48-13833C07 48-13833C07ESD PROTECTION ESD PROTECTION DC SWITCHDC S kHzMMBD7000 MMBD7000 DC DC DC MMBD7000CR2680 Q2 Q2 48-80236E07TRANSIENT SUPPRESSOR RF AMPLIFIER RF AMPLIFIER RF AMP BIAS CONTROLDC Au44-474 MHz DCMRF5812 MMBT3906	CR402	48-83654H02	TEMPERATURE COMPENSATION	DC	
CR40548-05129M76DC SWITCHDCMMBD914CR45148-05129M76DC SWITCH TEMPERATURE COMPENSATIONDCMMBD914CR65148-05129M76TEMPERATURE COMPENSATIONDCMMBD914CR65148-13833C07ESD PROTECTION ESD PROTECTION ESD PROTECTIONAUDIO AUDIO AUDIOMMBD7000 MMBD7000CR80148-80939T01SWITCH5 kHz1N15711CR90148-13833C07ESD PROTECTION ESD PROTECTION DC SWITCHDCMMBD7000 MMBD7000CR90248-05129M76ESD PROTECTION DC SWITCH ESD PROTECTIONDCMMBD7000 MMBD7000CR268048-80236E07TRANSIENT SUPPRESSORDCMR2535LQ148-13827A24 48-13824A17RF AMPLIFIER RF AMP BIAS CONTROL444-474 MHz DCMRF5812 MMBT3906	CR403	48-05129M76	DC SWITCH	DC	MMBD914
CR451 CR45248-05129M76DC SWITCH TEMPERATURE COMPENSATIONDCMMBD914 DCCR651 CR65248-13833C07 48-13833C07ESD PROTECTION ESD PROTECTION ESD PROTECTIONAUDIO AUDIO AUDIO AUDIOMMBD7000 MMBD7000CR801 CR80148-80939T01SWITCH5 kHz1N15711CR901 CR902 CR90348-13833C07 48-13833C07ESD PROTECTION ESD PROTECTION DC SWITCH ESD PROTECTIONDC DC DC S kHzMMBD7000 MMBD7000CR268048-80236E07TRANSIENT SUPPRESSORDCMR2535LQ1 Q2 Q2 48-13824A17RF AMPLIFIER RF AMP BIAS CONTROL444-474 MHz DCMRF5812 MMBT3906	CR405	48-05129M76	DC SWITCH	DC	MMBD914
CR45248-05129M76TEMPERATURE COMPENSATIONDCMMBD914CR65148-13833C07ESD PROTECTIONAUDIOMMBD7000CR65248-13833C07ESD PROTECTIONAUDIOMMBD7000CR65348-13833C07ESD PROTECTIONAUDIOMMBD7000CR80148-80939T01SWITCH5 kHz1N15711CR90148-13833C07ESD PROTECTIONDCMMBD7000CR90248-05129M76ESD PROTECTIONDCMMBD7000CR90348-13833C07ESD PROTECTIONDCMMBD7000CR268048-80236E07TRANSIENT SUPPRESSORDCMR2535LQ148-13827A24RF AMPLIFIER RF AMP BIAS CONTROL444-474 MHz DCMRF5812 MMBT3906	CR451	48-05129M76	DC SWITCH	DC	MMBD914
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CR65118 1080001EDD FROTECTIONAUDIOMMBD7000CR65248-13833C07ESD PROTECTIONAUDIOMMBD7000CR65348-13833C07ESD PROTECTIONAUDIOMMBD7000CR80148-80939T01SWITCH5 kHz1N15711CR90148-13833C07ESD PROTECTIONDCMMBD7000CR90248-05129M76DC SWITCHDCMMBD7000CR90348-13833C07ESD PROTECTIONDCMMBD7000CR268048-80236E07TRANSIENT SUPPRESSORDCMR2535LQ148-13827A24RF AMPLIFIER444-474 MHzMRF5812Q248-13824A17RF AMP BIAS CONTROLDCMMBT3906	CR651	48-13833007	ESD PROTECTION		
CR652HS 13633C07ESD PROTECTIONAUDIOMMBD7000CR80148-13833C07ESD PROTECTION5 kHz1N15711CR90148-13833C07ESD PROTECTIONDCMMBD7000CR90248-05129M76DC SWITCHDCMMBD7000CR90348-13833C07ESD PROTECTIONDCMMBD7000CR268048-80236E07TRANSIENT SUPPRESSORDCMR2535LQ148-13827A24RF AMPLIFIER444-474 MHzMRF5812Q248-13824A17RF AMP BIAS CONTROLDCMMBT3906	CR652	48-13833C07	ESD PROTECTION	AUDIO	MMBD7000
CR80148-80939T01SWITCH5 kHz1N15711CR90148-13833C07ESD PROTECTIONDCMMBD7000CR90248-05129M76DC SWITCHDCMMBD914CR90348-13833C07ESD PROTECTIONDCMMBD7000CR268048-80236E07TRANSIENT SUPPRESSORDCMR2535LQ148-13827A24RF AMPLIFIER RF AMP BIAS CONTROL444-474 MHz DCMRF5812 MMBT3906	CR653	48-13833C07	ESD PROTECTION	AUDIO	MMBD7000
CR90148-13833C07ESD PROTECTION DC SWITCHDCMMBD7000 DCCR90248-05129M76DC SWITCHDCMMBD914 5 kHzCR90348-13833C07ESD PROTECTION5 kHzMMBD7000CR268048-80236E07TRANSIENT SUPPRESSORDCMR2535LQ148-13827A24RF AMPLIFIER RF AMP BIAS CONTROL444-474 MHzMRF5812 DC	CR801	48-80939T01	SWITCH	5 kHz	1N15711
CR90248-05129M76DC SWITCHDCMMBD914CR90348-13833C07ESD PROTECTION5 kHzMMBD7000CR268048-80236E07TRANSIENT SUPPRESSORDCMR2535LQ148-13827A24RF AMPLIFIER444-474 MHzMRF5812Q248-13824A17RF AMP BIAS CONTROLDCMMBT3906	CR901	48-13833007		DC	
CR903 48-13833C07 ESD PROTECTION 5 kHz MMBD7000 CR2680 48-80236E07 TRANSIENT SUPPRESSOR DC MR2535L Q1 48-13827A24 RF AMPLIFIER 444-474 MHz MRF5812 Q2 48-13824A17 RF AMP BIAS CONTROL DC MMBT3906	CR902	48-05129M76	DC SWITCH	DC	MMRD914
CR268048-80236E07TRANSIENT SUPPRESSORDCMR2535LQ148-13827A24RF AMPLIFIER444-474 MHzMRF5812Q248-13824A17RF AMP BIAS CONTROLDCMMBT3906	CR903	48-13833C07	ESD PROTECTION	5 kHz	MMBD7000
Q1 48-13827A24 RF AMPLIFIER 444-474 MHz MRF5812 Q2 48-13824A17 RF AMP BIAS CONTROL DC MMBT3906	CR2680	48-80236E07	TRANSIENT SUPPRESSOR	DC	MR2535L
Q2 48-13824A17 RF AMP BIAS CONTROL DC MMBT3906	01	48-13827424		444-474 MH7	MRF5812
	Q2	48-13824A17	RF AMP BIAS CONTROL	DC	MMBT3906

REF NUMBE	PART R NUMBER	CIRCUIT APPLICATION	OPERATING FREQUENCY	INDUSTRY EQUIVALENT
Q51	48-13827A07	I-F AMPLIFIER	44.85 MHz	MMBR941
Q52	48-13827A07	SECOND LOCAL OSCILLATOR	44.395 MHz	MMBR941
Q53	48-80947V01	DC SWITCH	DC	DTC144W
Q54	48-80947V01	DC SWITCH	DC	DTC144W
Q101	48-13824A17	CHARGE PUMP	6.25 kHz	MMBT3906
Q102	48-80214G02	CHARGE PUMP	6.25 kHz	MMBT3904
Q103	48-13824A17	LOCK DETECTOR	DC	MMBT3906
Q104 Q105	48-80947V01 48-80214G02	LEVEL SHIFTER	DC 6.25 kHz	MMBT3904
0454	40.054001400		200 45 420 45 MU	
Q151 0152	48-05128100		399.15-429.15 MHz	
Q152	40-13027AU7		399.15-429.15 MHZ	
Q153	48-13827A07	RX VCO FEEDBACK BUFFER	399.15-429.15 MHz	MMBR941
Q201	48-13824A17	VOLTAGE MULTIPLIER	16.8 MHz	MMBT3906
Q202	48-80214G02	VOLTAGE MULTIPLIER	16.8 MHz	MMBT3904
Q203	48-80494U01	LOCK DETECTOR	5 kHz	DTA144W
Q204	48-80947V01	DC SWITCH	DC	DTC144W
Q251	48-05128M66	TX VCO	444-474 MHz	MMBFU310
Q252	48-13827A07	TX VCO FIRST BUFFER	444-474 MHz	MMBR941
Q253	48-13827A07	TX VCO SECOND BUFFER	444-474 MHz	MMBR941
Q254	48-13827A07	TX VCO FEEDBACK BUFFER	444-474 MHz	MMBR941
Q276	48-80214G02	DC FILTER	DC	MMBT3904
Q401	48-00869619	REGULATOR PASS DEVICE	DC	MJE371
Q402	48-80214G02		DC	MMB13904
Q403	48-80214L03	DC SWITCH	DC	BCW68G
Q404	48-80214G02	DCSWITCH	DC	MIMB13904
Q451	48-00869619	POWER CONTROL PASS DEVICE	DC	MJE371
Q452	48-80214G02	POWER CONTROL DRIVER	DC	MMBT3904
Q453	48-80214G02	CURRENT AMPLIFIER	DC	MMBT3904
Q501	48-80947V01	DC SWITCH	DC	DTC144W
Q901	48-80947V01	DC SWITCH	DC	DTC144W
Q902	48-80214L03	DC SWITCH	DC	BCW68G
Q903	48-80947V01	DC SWITCH	DC	DTC144W
Q904	48-80947V01	DC SWITCH	DC	DTC144W
Q905	48-80947V01	DC SWITCH	DC	DTC144W
Q906	48-80947V01	DC SWITCH	DC	DIC144W
Q907	48-80947V01			DIC144W
C000	48-80947V01			
Q909	48-8094/VU1			
0011	40-00947 001			
0010	40-00347 101			
REF	PART	CIRCUIT		
NUMBE	R NUMBER	APPLICATION	FREQUENCY	EQUIVALENT

Q913	48-80494U01	DC SWITCH	DC	DTA144W
Q918	48-80947V01	DC SWITCH	DC	DTC144W
Q919	48-80947V01	DC SWITCH	DC	DTC144W
Q2610	48-02245J24	RF BUFFER STAGE	444-474 MHz	BFG35
Q2620	48-80225C09	GAIN CONTROLLED DRIVER	444-474 MHz	MRF630
Q2630	48-80225C19	RF PA FINAL AMPLIFIER	444-474 MHz	MRF654
U1 U2 U3 U4	51-80470U01 48-09939C04 48-09939C04 48-09939C04	DOUBLE BALANCED MIXER DC SWITCH DC SWITCH DC SWITCH DC SWITCH	44.85-474 MHz DC DC DC	LRFMS-1A-17 UMC3TL UMC3TL UMC3TL
U51	51-80605E02	RECEIVER SYSTEM	44.85 MHz/455 kHz	CUSTOM
U52	51-05663U35	RF SWITCH	455 kHz	4066B
U53	51-05663U35	RF SWITCH	455 kHz	4066B
U101	51-80154R02	RX SYNTHESIZER	16.8-429.15 MHz	MB15A02PF
U201	51-05457W72	TX SYNTHESIZER	1.05-474 MHz	CUSTOM
U202	51-80404C05	REFERENCE OSCILLATOR	16.8 MHz	CUSTOM
U251	48-09939C04	DC SWITCH	DC	UMC3TL
U252	48-09939C04	DC SWITCH	DC	UMC3TL
U301	51-05469E65	5V REGULATOR	DC	LP2951C
U302	51-13806A35	SHIFT REGISTER	5 kHz	MC14094B
U401	51-02198J22	ERROR/DC AMPLIFIER	DC	4558
U402	51-80942T01	5V REGULATOR W/RESET	DC	LV387
U451	51-02198J22	ERROR/DC AMPLIFIER	DC	4558
U452	05-05226P38	D/A CONVERTER	5 kHz	CUSTOM
U501	51-09699X01	AUDIO POWER AMPLIFIER	AUDIO	TDA1519C
U551 U552 U553 U554 U555 U556 U557 U558 U559 U559 U560 U561	51-80604E01 51-62852A09 51-80932W01 51-80932W01 51-02198J22 51-80932W01 51-05663U35 51-05663U35 51-05663U35 51-84704M60 51-84704M60 51-80932W01	RX AUDIO FILTER AUDIO LIMITER AUDIO AMP/FILTER AUDIO AMP/INVERTER AUDIO AMPLIFIER AUDIO AMPLIFIER AUDIO SWITCH AUDIO SWITCH AUDIO SWITCH AUDIO SWITCH AUDIO SWITCH AUDIO AMPLIFIER	2.1 MHz AUDIO AUDIO AUDIO AUDIO AUDIO AUDIO AUDIO AUDIO AUDIO AUDIO	CUSTOM LMC7101 LM2904 4558 LM2904 4066B 4066B 4066B 4053B 4053B LM2904
U562	51-13811A35	AUDIO COMPANDER	AUDIO	MC33111

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FCC ID: ABZ99FT4024

REF	PART	CIRCUIT	OPERATING	INDUSTRY
NUMBE	R NUMBER	APPLICATION	FREQUENCY	EQUIVALENT
U601	51-80516U01	DATA CENTER SLICER	AUDIO	TA75S393F
U651	51-80604E01	AUDIO FILTER	2.1 MHz	CUSTOM
U652	51-80932W01	AUDIO AMP/SUMMER	AUDIO	LM2904
U653	51-84704M60	AUDIO SWITCH	AUDIO	4053B
U654	51-05663U35	AUDIO SWITCH	AUDIO	4066B
U655	51-05416G61	NOR GATE	DC	TC7S00F
U656	48-09939C04	DC SWITCH	DC	UMC3TL
U801	51-80489U01	MICROCOMPUTER	8.4 MHz	MC68HC11KA4
VR401	48-83461E40	VOLTAGE REFERENCE	DC	1N5231
VR402	48-80140L06	VOLTAGE REGULATOR	DC	MMBZ5231
VR551	48-80140L15	ESD PROTECTION	DC	MMBZ5240
VR553	48-80140L15	ESD PROTECTION	DC	MMBZ5240
VR901	48-80948\/01	ESD PROTECTION	DC	MMB75254
VR902	48-80948V01	ESD PROTECTION	DC	MMBZ5254
VR903	48-80948V01	ESD PROTECTION	DC	MMBZ5254
VR904	48-80948V01	ESD PROTECTION	DC	MMBZ5254
VR905	48-80948V01	ESD PROTECTION	DC	MMBZ5254
VR906	48-80948V01	ESD PROTECTION	DC	MMBZ5254
VR907	48-80948V01	ESD PROTECTION	DC	MMBZ5254
VR908	48-80948V01	ESD PROTECTION	DC	MMBZ5254
VR909	48-80948V01	ESD PROTECTION	DC	MMBZ5254
VR910	48-80948V01	ESD PROTECTION	DC	MMBZ5254

COMMENTS: The Motorola designators are special code numbers for active devices used in Motorola radios. These devices are either identical or derived from the device family listed under Industry Equivalent, by the manufacturer or are proprietary to Motorola. Service people do not have access to any cross-references or given any information on proprietary devices and are prevented from making unauthorized substitution.

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Instrument	Recommended Type	Application
RF Signal Generator *	HP 8656B or equivalent	Receiver Measurements
Modulation Analyzer *	HP 8901B or equivalent	Frequency and Deviation Measurements
Audio Analyzer *	HP 8903A or equivalent	Receiver Measurements
Power Meter *	HP 438A or equivalent	Transmitter Power Output
Power Sensor *	HP 8482A or equivalent	Transmitter Power Output
DC Power Supply	0-20 volts at 15 amps	
Attenuator Pad *	50 Ω , 75 Watts, 30 dB	Transmitter Measurements
DC Ammeter	30 mA to 20 A	Current Drain Measurements
Computer	IBM PC, PC/XT or PC/AT	Radio Alignment
Radio Interface Box (RIB)	HLN9214	Computer to Radio Interface
Cable	HKN9215 or HKN9216	RIB to Computer
Cable	HKN9217	RIB to Radio
Software	HVN9054	Radio Alignment

List of Recommended Test Equipment for Servicing

* These items can be replaced by a Motorola 2000 Series Communications System Analyzer or equivalent piece of integrated communications test equipment.

TUNING PROCEDURE

This exhibit contains the tuning procedure in the same general format as will appear in the service manual.

All transmitter adjustments are performed by electronic means. The transmitter contains no electromechanical components for the purpose of transmitter tuning or adjustment.

The tuning elements that are used for transmitter adjustment are:

Location	Type of Element	Function
U801	Microcomputer	Monitors Output of Power Limiting Circuit and Supplies data to Attenuators, Temperature Compensated Crystal Oscillator, and Digital to Analog Converter for Transmitter Modulation, Frequency and Power Adjustment
U201	Programmable Attenuator	VCO Modulation Sensitivity
U201	Programmable Attenuator	Reference Modulation Sensitivity
U651	Programmable Attenuator	Deviation Adjustment
U202	Temperature Compensated Crystal Oscillator	Transmitter Frequency Adjustment
U452	Digital to Analog Converter	Transmitter Power Adjustment

The value of a particular tuning element is determined by data sent to that tuning element by microcomputer U801. This data is generated by the microcomputer based on tuning information that is stored in the microcomputer's Electrically Erasable Programmable Read Only Memory (EEPROM).

Tuning information is stored in the EEPROM during factory adjustment or by qualified field service facilities, using the attached procedure and recommended test equipment.

TUNING PROCEDURE

The tuning procedure assumes that an integrated piece of test equipment is being used. This test equipment is usually referred to as a Communications Systems Analyzer (CSA) and combines the functions of many separate pieces of test equipment. The Radio Service Software (RSS) allows a Service Technician to electronically adjust or calibrate the radio without opening the radio housing to gain access to manual controls (potentiometers, variable capacitors, etc.).

Adjustments versus Calibration

The term "Adjustment" is the ability, through the RSS, to adjust the coarse output power, the maximum deviation and the frequency of the reference oscillator of the transmitter. Adjustments are performed at a single frequency that is normally at the center of the operating range.

The term "Calibration" is the ability, through the RSS, to adjust the RF output power and the maximum system deviation of the transmitter on eight frequency points that span the entire bandwidth of the radio.

When the radio is calibrated at the factory, it will perform within specification on any customer frequency within the frequency band. Therefore, any further adjustment or calibration should not be necessary in the field. The only exception is the alignment of the reference oscillator. Due to the aging characteristics of quartz crystals, the frequency of the oscillator may change over time. This requires that the frequency of the reference oscillator must be periodically readjusted.

Periodic adjustment is not necessary for the output power and the maximum deviation of the transmitter. These operational characteristics of the transmitter do not change over time. It is not recommended to use the adjustment windows for output power and deviation unless absolutely necessary. If an output power adjustment greater than 10 percent is encountered, then the test equipment, cables and antenna loads should be verified as not being defective. If the maximum deviation adjustment is greater than 10 percent, the test equipment should be checked. If the radio is operating beyond these limits, it is recommended that the calibration be performed instead of adjustment.

The procedures for Adjustment and Calibration are explained in the next paragraphs.

A. Test Setup and Initial Reading of Radio Data

- 1. Connect the radio to an IBM® PC or compatible computer using the Radio Interface Box (RIB) and the appropriate cables.
- 2. Connect the "RF In/Out" of the CSA to the antenna connector of the radio.
- 3. Connect the CSA "Mod Out" port to the audio input connector of the breakout box in the cable from the RIB to the radio
- 4. Turn on power to all equipment.
- 5. Set the radio to the lowest customer frequency via the front panel "Up/Down" channel pushbuttons of the radio.
- 6. Start the Radio Service Software (RSS) for the radio.
- 7. Select **Service** from the menu bar.
- 8. Click on "Read Radio for Service".
- 9. After the radio is read, again select **Service** from the menu bar. The adjustments and calibrations for the radio are shown in Figure 7.1.

-				мото	ROLA Radius 122	5 Radio Service Software
<u>F</u> ile	⊻iew	<u>R</u> adio	<u>S</u> ervice	<u>W</u> indow	<u>H</u> elp	
			<u>R</u> ead R	adio for Se	rvice	1
	یا لیے ا		Fine Tra	ansmit Pow	ver Adjustment	
			Coarse	Transmit F		
			<u>R</u> eceive	Receive Level Set Adjustment		
			Transm	Transmit Deviation Adjustment		
			Transm	Transmit <u>F</u> requency Warp		
			<u>S</u> quelct	n Adjustme	nt	
			Transm	it <u>D</u> eviatio	n Calibration	
			<u>B</u> lank B	}oard Initia	lization	
			Tuning	<u>W</u> izard		
			<u>P</u> rint Ali	ignment Su	ımmary	

Figure 7.1 – Adjustments and Calibrations

B. Transmitter Deviation Adjustment

The Transmit Deviation Adjustment allows adjustment of the maximum deviation. This adjustment affects all of the frequencies within the operating bandwidth of the radio.

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1. Select "Transmit Deviation Adjustment" from the Service dropdown menu. The service adjustment window is shown in Figure 7.2.

Transmit Deviation Adjustment					
Transmit Frequency 456.900 MHz					
Relative Value					
<u>₩</u> rite <u>C</u> lose <u>P</u> rint					

Figure 7.2 – Transmit Deviation Adjustment

- 2. Adjust the output level of the "Mod Out" of the CSA to 800 mV rms.
- 3. Key the transmitter by clicking the "Transmitter" button; the button will change to display "On" when the transmitter turns on.
- 4. Measure the maximum deviation of the transmitter with the CSA.
- 5. Unkey the transmitter by clicking the Transmitter button; the button will change to display "Off" when the transmitter turns off.
- 6. Use the right Relative Value arrow button to increase the maximum deviation. Use the left Relative Value arrow button to decrease the maximum deviation.
- 7. Perform steps 3 to 6 until the correct deviation is obtained. If the radio cannot be adjusted for rated deviation and the Relative Value is at a maximum or a minimum value, refer to the service manual for the radio for repair procedures.
- 8. Click the Write button to save the new value to the radio.
- 9. Click the Close button to exit the Transmitter Deviation Adjustment.

C. Transmit Deviation Calibration

The Transmit Deviation calibration window allows adjustment of the maximum deviation at eight (8) frequency points across the operating bandwidth of the radio. The window displays the frequency to which the transmitter has been programmed by the RSS and a relative scale for the value of the maximum deviation at each frequency.

1. Select "Transmit Deviation Calibration" from the Service dropdown menu. The service adjustment window is shown in Figure 7.3.

Transmit Deviation C	alibration
Transmit Frequency 444.000 MHz	Transmitter
Dev 0 Dev1 Dev2 Dev3 Dev4 Dev5 49 47 46 46 45 44 + + + + + + +	Dev6 Dev7 • Dev 0 43 Dev 1 • • Obev 2 • • Obev 3 • • Obev 5 • • Obev 7
<u>W</u> rite <u>C</u>lose	Print

Figure 7.3 – Transmit Deviation Calibration

- 2. For full calibration, start with "Dev 0".
- 3. Adjust the output level of the "Mod Out" of the CSA to 800 mV rms.
- 4. Key the transmitter by clicking the Transmitter button; the button will change to display "On" when the transmitter turns on.
- 5. Measure the maximum deviation of the transmitter with the CSA.
- 6. Unkey the transmitter by clicking the Transmitter button; the button will change to display "Off" when the transmitter turns off.
- 7. Use the up arrow button to increase the maximum deviation. Use the down arrow button to decrease the maximum deviation.
- 8. Perform steps 4 to 7 until the correct deviation is obtained. If the radio cannot be adjusted for rated deviation and the value displayed in the "Dev" window is at the maximum or the minimum, refer to the service manual for the radio for repair procedures.
- 9. After the correct maximum deviation is attained for the first tuning point, "Dev 0", click on the "Dev 1" selector.
- 10. Perform steps 4 to 8 for each tuning point ("Dev 0" through "Dev 7).
- 11. Click the Write button to save the new values to the radio.
- 12. Click the Close button to exit the Transmit Deviation Calibration.

D. Transmit Frequency Adjustment (Warp)

The Transmit Frequency Warp window allows adjustment of the frequency of the 16.8 MHz reference oscillator (TXCO). The window displays a relative scale of the alignment range available and the current position of the alignment inside that range.

1. Select "Transmit Frequency Warp" from the Service dropdown menu. The service adjustment window is shown in Figure 7.4.

💻 🛛 Transmit Frequ	uency Warp					
Transmit Frequency 456.900 MHz						
Relative Value 134 + +						
<u>₩</u> rite <u>C</u> lose	<u>P</u> rint					

Figure 7.4 – Transmit Frequency Warp

- 2. Key the transmitter by clicking the "Transmitter" button; the button will change to display "On" when the transmitter turns on.
- 3. Measure the frequency of the transmitter with the CSA.
- 4. Unkey the transmitter by clicking the Transmitter button; the button will change to display "Off" when the transmitter turns off.
- 5. Use the right Relative Value arrow button to increase the frequency. Use the left Relative Value arrow button to decrease the frequency.
- 6. Perform steps 3 to 6 until the frequency is obtained. If the radio cannot be adjusted to the correct frequency and the Relative Value is at a maximum or a minimum value, refer to the service manual for the radio for repair procedures.
- 7. Click the Write button to save the new value to the radio.
- 8. Click the Close button to exit the Transmitter Deviation Adjustment.

E. Coarse Transmit Power Adjustment

The Coarse Transmitter Power Adjustment window allows electronic adjustment of the RF output power of the transmitter. The window displays a relative scale of the range available and the current position of the alignment within that range. The RF output power can be adjusted to two different values, Low Power and High Power. Each channel of operation may be assigned either the Low or the High value. Use the following procedure to adjust the coarse power settings.

1. Select "Coarse Transmit Power Adjustment" from the Service dropdown menu. The service adjustment window is shown in Figure 7.5.

Coarse Transmit P Transmit Frequency 456.900 MHz	ower Adjustment Transmitter Off
Low Power 37 • • •	Power Level • Low O High
High Power 43 + +	
<u>Write</u> <u>C</u> lose	<u>P</u> rint

Figure 7.5 – Coarse Transmit Power Adjustment

- 2. Key the transmitter by clicking the "Transmitter" button; the button will change to display "On" when the transmitter turns on.
- 3. Measure the RF output power of the transmitter with the CSA.
- 4. Unkey the transmitter by clicking the Transmitter button; the button will change to display "Off" when the transmitter turns off.
- 5. Use the right Relative Value arrow button to increase the RF output power. Use the left Relative Value arrow button to decrease the RF output power.
- 6. Perform steps 3 to 6 until the desired RF output power is obtained for the Low Power setting. If the radio cannot be adjusted to the desired RF output power and the relative value is at a maximum or a minimum, refer to the service manual for the radio for repair procedures.
- 7. When the desired Low Power setting is obtained, click on the High selector button under Power Level.
- 8. Repeat steps 2 to 6 until the desired RF output power is obtained.
- 9. Click the Write button to save the new values to the radio.
- 10. Click the Close button to exit the Coarse Transmitter Power Adjustment.

F. Fine Transmit Power Calibration

The Fine Transmitter Power Calibration window allows adjusting the RF output power of the transmitter across the operating bandwidth of the radio. The window displays the relative value within the allowable range for each of eight tuning points. Calibration is done for both the Low Power and the High Power settings. Use the following procedure to calibrate the fine power settings.

1. Select "Fine Transmit Power Adjustment" from the Service dropdown menu. The service adjustment window is shown in Figure 7.6.

Fine Transmit Power Adjustment						
Transmit Frequency 444.000 MHz	Transmitter Off					
Low 0 Low 1 Low 2 Low 3 Low 4 Low 5 101 98 92 96 101 101 104 + + + + + + + + + + + + High 0 High 1 High 2 High 3 High 4 High 5 1 98 97 97 101 101 104 +	Low 6 102 98 Low 7 Low 1 Low 2 Low 2 Low 3 Low 4 Low 5 Low 6 Low 6 Low 7 High 6 High 7 100 High 1 High 1 High 4 High 5 High 6					

Figure 7.6 – Fine Transmitter Power Calibration

- 2. For full calibration, start with "Low 0".
- 3. Key the transmitter by clicking the Transmitter button; the button will change to display "On" when the transmitter turns on.
- 4. Measure the RF output power of the transmitter with the CSA.
- 5. Unkey the transmitter by clicking the Transmitter button; the button will change to display "Off" when the transmitter turns off.
- 6. Use the up arrow button to increase the RF output power. Use the down arrow button to decrease the RF output power.
- 7. Perform steps 4 to 7 until the desired RF output power is obtained. If the radio cannot be adjusted for the desired RF output power and the value displayed in the "Low" window is at the maximum or the minimum, refer to the service manual for the radio for repair procedures.
- 8. After the correct RF output power is attained for the first tuning point, "Low 0", click on the "Low 1" selector.
- 9. Perform steps 3 to 7 for each tuning point ("Low 0" through "Low 7).
- 10. After the Low Power calibration has been completed, click on the "High 0" selector button.
- 11. Repeat steps 3 to 9 for each of the High Power tuning points ("High 0" through "High 7).
- 12. Click the Write button to save the new values to the radio.
- 13. Click the Close button to exit the Fine Transmit Power Calibration.