General Telephone MC5 Owner's Manual

General Radiotelephone Co., Burbank, California, U.S.A.

MODEL MC5

Instruction Guide & Service Notes

Dear Customer:

You are about to operate the worlds most advanced 11 meter two-way radio. In order to obtain the most out of this equipment, I suggest that you read the following instructions before attaching your unit to antenna or power source.

As always, the new features in the MC5 for 1962 were designed to comply with your ideas and requests which were tabulated throughout 1961. Your questions and comments regarding the MC5 will certainly be appreciated.

Charles Messenger, 11W4165
Chief Engineer

1. Size: 4-1/2"H x 8-1/4"W x 11"D
   Power: Self-contained 3-way supply for operation from 6, 12, 115 volts.

2. Tube Complement:

V1-6BS8	RF Amplifier	X1-IN295	Mixer Diode
V2-6BH6	1st I.F.	X2-IN295	Detector
V3-6BH6	2nd I.F.	X3-IN8200	Noise Clipper
V4-6EA8	1st Audio & Squelch	X4-IN295	Meter Rect.
V5-6EA8	Trans. & Rec. Osc.	X5-U215	Power Supply
V6-6EM5	R.F. Power Amp.	X6-U215	Power Supply
V7-6BQ5	Modulator	X7-U215	Power Supply
PL-#44	Pilot Light	X8-U215	Power Supply
Vibrator	Gen.V60 or Mallory 1610	X9-ZD6	Zener Noise Clamp

3. Mechanical:
   Cabinet: Heavy gauge Steel, finished in scuff resistant Black Baked Wrinkle Front panel is .091 thick Aluminum alloy with corrosion resistant gold Anodized finish. All tube sockets have phosphor bronze contacts and are ceramic and mica-filled bakelite. Chassis: Copper, Cadmium, and iridite plated over 18 gauge steel. Front Panel Controls: Volume/on-off switch; Receiver selector switch for four fixed crystal receive positions plus twenty-two tunable channels. Transmitter selector switch for six internal crystals plus one external crystal socket. Squelch control; local-distant switch; tone signal switch. Internal Controls: "S" meter zero control, output tuning, output loading.

4. Receiver: Tuneable Superheterodyne. Range 26.965 thru 27.225 mc. Selectivity 6KC. at points 6db. down. Sensitivity better than .5 uv. for noise 6db. down. Dial calibrated in 10 KC increments. Local oscillator stability better than ± .005% after 10 minute warmup. Two section tuning capacitor tunes and tracks Mixer and Oscillator. 4:1 ratio Ball Bearing Planetary reduction dial drive. Visual tuning indication by "S" Meter in balanced bridge circuit. I.F. frequency is 452 KC. First Noise Clipper is series gated type and is fed to Zener Diode shunt type noise clamp.

5. Transmitter: Modified Collpitts Oscillator using fundamental type crystals. RF Power Amplifier limited to 5 watts input power to plate. Produces over 3 watts of useable power at antenna from pi-network coupling. Microphone is high efficiency Ceramic in Chrome Plated Metal housing and comes with Neoprene Coil-Cord and PL68 Plug. Has push-to-talk switch.

6. Power Supply: Utilizes a bridge circuit of 4 silicon diodes. Filtering by two section electrolytic plug-in Capacitor and Choke. Fuse for 115 VAC operation is located within chassis. Fuses for 12 Volt (7-1/2A) and 6 Volt (10A) operation are in fuseholders of respective power cords. If fuse blows, under no circumstance should larger sizes be put in. This may damage vibrator or other components, thereby voiding warranty.

7. Operating Procedure: Before applying power to unit, make sure that correct power cord for voltage source is used. Set should be turned off while engaging power connector. Before connecting to 6 or 12 volt mobile source, check voltage at battery. It should not exceed 6.6 or 13.3 volts respectively. Many of the newer model cars have been adjusted to as high as 14.5 volts at the regulator. This presents a severe burden on mobile equipment and it would be proper to readjust the regulator. Before turning on unit see that the power plug is covering ALL 18 PINS of power connector. After attaching antenna, turn set on and note that "S" meter needle should rise beyond the top and gradually fall near zero as set worms up. DO NOT under any condition operate transmitter without antenna or dummy load. Tunable receiver will stabilize in about eight minutes, although set may actually be used within one minute. Turn squelch control counter-clockwise and turn volume control clockwise until a rushing sound is heard in speaker. Select desired transmit channel by use of transmit selector switch. The receive selector switch may be set in any of its five position, of which one is tunable throughout the band while the other four are fixed crystal selections. Communications may be established in two ways. The first would be by a voice call, utilizing the microphone; or initial communication may be established by pressing the tone signal button in center of panel. Pressing this button actuates transmitter while generating its own tone carrier which may be easily recognized at the receiving end by the listener. The local-distant switch provides for two combinations of receiver sensitivity, in the 'distant' position, receiver operates at highest possible gain and will be found to be suitable in remote areas and in mobile operation. For most commercial uses, particularly where short-range communication is desired without the annoyance of very weak, distant signals which may be unreadable, the local-distant switch should be placed in the 'local' position. When operating in this manner, noise level will drop to the very minimum and signals below readable levels will not be heard; however, no sacrafice will be made in receiving clear, local transmissions. In extremely noisy areas, the squelch control may be used. First, tune in the channel to be monitored, and with volume control at a normal or higher level, tune squelch control clockwise just far enough to kill background noise level. When signal is received, it will automatically reopen the squelch circuit, allowing for normal reception. Satisfactory performance is very much dependent upon proper antenna installation. When in doubt as to operating the set or as to performance, consult your local FCC licensed technician or the factory. Important! Do not attempt to operate transmitter without antenna or dummy load connected.

8. Antennas: Antennas should be chosen for the particular service and conditions under which the equipment will be used. There is no "best" antenna for all purposes. Citizens Band is intended for local communications; hence, it would be desirable for most short-range commercial purposes to concentrate all power availabe within its useable area rather than to disburse signals in an attempt to get ranges greater than those suited for this purpose. For consistent local cummunications, two-points of importance are: Hold signal at low angle of radiation to concentrate power in area covered, and avoid pickup of unwanted distant stations. The most suitable type of antenna for this purpose would be the coaxial antenna. When great distances are to be covered, a ground-plane type of antenna may be used at some sacrifice to local reception and transmission.

For best results in mobile operation, antenna should be mounted in the center of the roof. This presents two problems. Will it upset the looks of the vehicle due to large size? Second, will it be able to strike low branches, etc., without breaking? In order to use this type of antenna without upsetting physical appearance of vehicle, the base loading coil or transformer should be fairly small in size and the whip should be reasonably short and thin. The antenna should be removable without the use of tools at any time. One type specifically suited for this mode of operation is the General type RMT 40 inch stainless steel whip, which is taper-ground to prevent swaying and provides excellant resiliency. (Comes complete with roof mount, $19.95 net). Its base has a very small matching transformer and has a link coupled primary with an adjustable secondary coil for tuning the antenna to optimum output for each particular vehicle. The advantages of link coupling will provide somewhat better matching to coaxial cable and less likely to have a high standing wave ratio using random length of feed line. The alternate type of antenna would be a base loaded whip, of which there are several makes. However, many of them are of the telescoping variety, hence will not flex when striking low objects and break off. Those of the solid variety are usually not taper-ground and will tend to sway, causing mobile fading. The base coil on this type of antenna should be molded into or wound on a threaded form to prevent detuning due to coil movement from vibration, temperature, etc. It should be as small as possible for purposes of looks and flexibility. When installing any type of antenna, be sure to ground the shield of the cable at the antenna termination point, whether it be roof, body or bumper mounted. Installation should be made using proper equipment such as the General 615 SWR Meter, grid dip meter for tuning antenna to actual frequency, etc. The finest equipment will fall short of its maximum capabilities without proper antenna choice and technically correct installation procedure.

9. Mounting: Mount set so that ventilation holes are not completely blocked at top and bottom. Excess heat due to poor mounting will cause high degree of receiver drift and may damage set. Cabinet has six threaded mounting points built in for various types of mounts. The General quick change Hood Mount now available and may be used beneath or above the unit. It incorporates swivel joints for angular positioning and is suitable for mounting under dash or on transmission hump.

10. Transmitter Operation: Transmit selector switch provides for any of six preselected transmitter channels. No manipulation of panel settings is necessary once channels are chosen and controls adjusted. The push-to-talk button on microphone is all that is necessary to go "On the Air." The microphone should be held no closer than four inches from the mouth. Shouting or speaking closely into the microphone will NOT add volume at the receiving end, but only deteriorates the quality of the signal being received. This unit is designed with high level modulation, assuring optimum talk power when using a normal tone of voice.

11. Basic Receiver Circuit: The RF Amplifier, V1 is grid fed through light capacity coupling from the transmitter pi-network in its first stage. It is then followed by cascoded grounded-grid circuit in second section of V1. This combination provides optimum S/N ratio along with HIGH-LEVEL RF AMP-LIFICATION. Signals are fed through L3 coil into mixer crystal. Local oscillator signals from V5A are injected into X4 mixer crystal and sum difference of 452.1 is then fed into V2 and V3 I.F.amplifiers. Signals then detected across X2 Diode are fed into series gated noise clipper X3. Note that RF Plate Coil has no fixed capacity across primary winding. Coil resonates using tube capacity only. This combination provides for excellent impedance match to the plate circuit while providing a fairly flat response across the band. The secondary of this coil, however, is tuned and tracked utilizing high 'Q' winding for optimum selectivity and proper impedance match to the mixer crystal. In comparing the diode crystal mixer with conventional tube circuits, a typical mixer circuit using 6BE6 tube has an overall gain of 1:1. Overall gain of crystal mixer circuit is only .7; however, noise normally generated by mixer tube is down 80%. therefore, signal to noise ratio is excellent. To makeup for this slight loss in gain, the signal is then fed through two stages of I.F. Amplifications. The second and third transformers each having a 'Q' of 165, provide additional gain while maintaining excellent selectivity characteristics. Detection takes place through a Germanium Crystal Diode. This is followed by a series Gated Silicon Diode Noise Clipper. The audio from this point is then fed across a zener diode noise clamp to remove noise peaks that override carrier modulation. Squelch circuit utilizes triode section of V4, 6EA8. Bias developed by AVC Circuit is used to operate squelch amplifier, which in turn 'keys' audio amplifier bias from cut-off to normal operating mode when signal is received. Squelch control may be varied gradually to achieve almost any keying level, without the sudden cut-off characteristics found in most other squelch circuits.

12. Crystal Controlled Receiver: Note that local oscillator operates as Hartley oscillator in the tunable mode. When selector switch is turned for fixed crystal operation, crystal is shunted from grid to plate, which blocks tunable oscillator and functions as fixed frequency oscillator regardless of dial setting. Crystal feedback is provided by 150 OHM Resistor in Plate of V5. Crystals used operate 452.1 KC, below the received frequency. During tunable use, terminal drift of dial calibrations will be reached within eight minutes, after which receiver should be stable within 5KC throughout long-operating periods. All capacitors in the tuned circuits have been carefully chosen to provide low drift and optimum stability. The oscillator coil is especially treated for minimum drift. Use third overtone crystals for Receiver only. General type "P".

13. "S" Meter: The "S" Meter functions as part of a balanced resistance bridge in the screen circuits of the first and second I.F. Stages. The "S" Meter control is adjusted for a zero or null voltage at the meter. When signals are received and AVC Voltage is developed and fed back to the I.F. Grids, the screen voltage of both I.F.'s rises due to the lowering of plate current caused by the AVC bias applied. Inability to zero the "S" Meter will usually be caused by the following: If Meter rises to top of scale and will not drop, this would indicate that the screen voltage is too high due to insufficient or no current drain, due to either a dead I.F. Tube (6BH6) or open associated components. If "S" Meter falls below scale and cannot be adjusted by the control to zero, this indicates excessive current drain in the I.F. System, which would be due to shorted 6BH6 or By-Pass Condenser in the I.F. Circuits. Another cause of meter reading below zero or failing to show an indications with a received signal would be a shorted 6BS8 RF Amplifier, in which case the AVC Voltage being shorted at this point would prevent the bias from being applied to the first and second I.F. Stages, consequently failure of "S" Meter to read above zero. The "S" Meter adjustment should be made with antenna disconnected and set warmed up for at least ten minutes, at which time "S" control, which is located alongside speaker, should be set for the zero mark. Squelch control should be fully counter-clockwise when adjusting "S" Meter for zero control. Further adjustments should not be necessary except in the event of replacement of I.F. Tubes or repairs.

14. Receiver Alignment Procedure: The I.F. Frequency used is 452.1 KC. The reasons for this choice are explained as follows: In order to be able to utilize crystals which are being used in most other receivers, we have shifted the I.F. Frequency to this point to compensate for the relatively high input capacity of the tunable circuit. When receiving weak signals, the I.F. Band Width is broad enough so that a slight mistuning will not cause them to be lost, while higher signal strength automatically sharpens the selectivity, assuring no adjacent channel interference due to the narrow band width provided. It is necessary to have two low frequency stages for optimum selectivity. Image rejection is accomplished by use of tuned circuits throughout and a high "Q" Mixer Section, which is tuned and tracked with the Oscillator within 10%, assuring high image rejection and selectivity characteristics unparalleled by any receiver ever produced for this type of use.

The I.F. Alignment may be done in two ways. It may be done by setting signal generator at 452.1KC. Crystals being used should be checked on frequency meter before attempting to utilize them for alignment purposes, as a deviation of as little as 500 cycles will be noted when receiving stations using crystal positions due to the extreme selectivity of the tuned circuits. Do not in any case attempt to adjust I.F.'s using the tunable mode of operation. Always use a crystal known to be correct. For alternate signal source, a frequency meter (Lampkin or similar) may be used to generate an exact known carrier. If I.F. slugs are sealed, do not force. Drop small amount of acetone into top of can and wait five minutes. They will then rotate freely. All receiver alignment should be made with set lying flat on steel or aluminum plate to stimulate cabinet capacity. After alignment, Oscillator Coil and Tracking Capacitor may have to be altered very slightly after installing in cabinet. This may be done through perforations at the top of cabinet.

It is suggested that a nylon or stainless steel alignment tool be used. Tip should not be ground too sharp as ill fit in slug could possibly crack same. Note that several coil slugs in transmitter and receiver are of the hollow variety. In order to avoid possible cracking, use a fresh alignment wrench with sharp sides. Loose fit allows wrench to slip, causing damage to coil slugs. When ordering coil slugs for possible replacement, specify particular coil by name or number since each has particular grade of iron or Ceramic for each function. Stock slugs of usual radio variety are generally very poor replacements.

It is necessary to use well calibrated or preferably crystal controlled test equipment. I.F. alignment should be made in a convention manner at 452.1 KC. It is not necessary to use external indicating devices during alignment, since the self-contained "S" Meter serves that purpose. Light coupling between signal source and set should be made at the function of crystal mixer X1 and "A" of input I.F. Transformer. It is important to note that the second and third I.F. Transformers will peak at 2 points with slug within the coil or above the coil. Peaking either slug inwardly tends to overcouple transformers more closely, thereby flattening pass band. If slugs are peaked to outside points, bandwidth will become narrow, consequently, selective.

15. Dial Calibration: After completing a rough I.F. alignment, it is necessary to tune and track the dial before we can proceed with the exact I.F. alignment to ensure optimum selectivity and achieve center frequency operation using receive crystals. It is not necessary to remove the set from the cabinet to align the dial but if desired, it may be removed and placed on a metal sheet to simulate cabinet capacity. Dial calibration cannot be performed with the set lying on its side or on a non-metallic base. Obtain a source of three channel frequencies, namely, 1, 11, and 22. A transmitter operating into a dummy load or a frequency meter will suffice. Turn the selector knob so that the pointer is on channel 11. Inject a channel 11 signal and using a very thin screwdriver, carefully adjust L-9, Rec. Osc. coil, for maximum "S" reading. Only minute amount of movement of the coil slug is necessary to shift the dial a large distance. Do not turn the slug to the extremes, as this may result in reception of an image rather than the fundamental frequency. Turn the selector to channel 1. If it can be reached, memorize where it was noted on the dial. Now inject a channel 22 signal and find its peak with selector. If either one and/or the other is beyond the limits of the dial, this would indicate that tracking is spread too wide. In order to narrow it, adjust C-68 padder, which is located immediately behind variable. Turn shaft counter-clockwise one or two turns to narrow the tracking. This will shift the oscillator also, hence reset the center dial again for channel 11 peaking. If the channels are somewhat compressed as for example, channel 1 is on channel 1 but channel 22 is one channel 18 of the dial, we would have to spread our dial tracking hence the reverse, turn C-68 inward and repeat adjustment with L-9. Tracking procedure is exactly the same as would be performed on any standard broadcast receiver. After approximate dial tracking is accomplished, insert a known good receive crystal in any of the sockets and turn the crystal selector switch to receive crystal position. Feed in a signal of the same channel and adjust L-3 mixer coil for a peak on the "S" Meter.

Do not readjust L-9 or C68 during this operation. Now we may get an exact I.F. peaking to match the crystal being used. Adjust the incoming signal for approximately a half scale reading on the "S" Meter. Peak the top slugs of L-5 and L-6 (2nd and 3rd I.F. cans) for peak signal. Do not adjust the peak at the inner limits of the coil. Always find the peak nearest the outside.
Now that we have achieved an exact I.F. alignment, go back and adjust the unit to its tunable mode and with the set in its cabinet tightly bolted, reach through the top and repeat the first and second steps adjusting L-9 and C-35 for exact dial tracking. During the first ten minutes of operation, some drift will be noted; therefore, the set should be warm before attempting to make a signal calibration touchup.

16. Chassis Removal: To remove set, unscrew mounting feet and place set right side up. Grip front left panel guard with right hand. Place left hand over top of cabinet with fingers folded under power connector. Raise rear of chassis slightly to clear cabinet reenforcement plates while pulling forward with right hand. When handling chassis, do not touch receiver section coils, as this may upset dial calibrations when replaced.

17. Transmitter Circuit: V-5A (6EA8) pentode oscillator circuit utilizes fundamental crystals, which are designated as General type "D". Oscillator tank circuit is capacity coupled to V-6 (6EM5) power amplifier. Plate voltage of V-6 is adjusted for a maximum of 5 watts input at factory. DC components in plate of V-6 is isolated from the Pi-network and antenna by a 2.5KV ceramic capacitor. The Plate tuning of the power amplifier is accomplished by C-67 trimmer, which is accessible through hole at the bottom center of the cabinet. L-12 Pi-network matches impedance of RF amplifier into loads from 35-50 Ohms. Antenna loading is adjusted by C-37 which is located at bottom of cabinet just beneath antenna connector. Matching network is designed to provide a fairly flat response across the band, thereby eliminating the need for readjustment when changing channels.

Although the following paragraph deals with transmitter circuitry and alignment procedure, note that this information is for the benefit of those holding second class or higher radio-telephone licenses. Any adjustment or repair made in the transmitter circuits wherein frequency or power may be altered, is strictly illegal unless performed by authorized technicians. In reference to the following conversion notes for higher power, please note that at present it is absolutely forbidden to use more than 5 watts input to the final plate of transmitter. This rule does not apply to units shipped outside the United States or for use on other bands.

18. Transmitter Alignment and Power Measurements: Transmitter alignment should be made in the following manner. Couple antenna output into Model 615 General Standing Wave Ratio Bridge or similar equipment and insert internal or external 50 Ohm dummy load. Depress microphone button and observe watt reading on bridge. Peak transmitter oscillator coil L-14 for maximum output and adjust exactly 1/4 turn counter-clockwise from this peak. This coil is accessible through top of cabinet. This adjustment need only be made if tubes are replaced. Frequency measurements should be made if additional crystals are added to the transmitter, as each crystal inserted adds some capacity across the entire circuit.

This adjustment may be made only with a frequency meter using C-64 padder, which is located just behind the crystal selector switch. C-64 should be adjusted for mean frequency of all the crystals in the unit. The plate tuning adjustment C-67 may be peaked using either external indications or the self-contained meter and should be varied very slowly, as this is a critical adjustment. No attempt should be made to adjust C-37 antenna loading by means of the internal meter. This should be done only with an external watt meter or field strength meter, as peaks indicated on the internal meter may not coincide with the true power output, as reflected power may be giving false indications. When operating under foreign license or on other bands, simply place a jumper wire across R-31 (3800 OHM resistor). This will raise the plate voltage so that the unit will have approximately 1316 watts of input depending upon the line voltage and the condition of the particular power tube used. Power input to the final amplifier may be determined by disconnecting the brown wire from the modulation transformer which terminates at the RFC adjacent to V-6. Insert a 0-100MA. meter in series with the RF plate choke. True plate input power may be determined by multiplying the reading taken in MA x the voltage to ground at this point. If plate input power exceeds 15 watts, damage to 6EM5 may result and downward modulation may be noted. Low harmonic radiation is assured through proper cabinet bonding, conservative operation, and proper Pi tank design. Harmonic radiation will be well below the legal maximum if set is operated in cabinet with all four feet properly fastened. Screen resistor R51 (39K) should never be altered. This would overload tube and lower efficiency. When transmitting, a 150 Ohm Resistor is added across the 470 Ohm cathode resistor of 6BQ5 to increase modulation level.

19. Finding Transmitter Troubles: When loss of RF output and/or modulation are noted, follow the steps outlined herein to ascertain the particular section in which the trouble may be found. The first step would be to determine whether or not the transmitter oscillator is functioning and if it is supplying sufficient grid drive to V-6 RF power amplifier. Solder a 47K 1/2w resistor to pin #6 of V-6 to isolate the test equipment from this point. Connect a VTVM using the 0-50 volt scale with positive ground and negative probe. Insert dummy load at transmitter output to prevent excess voltages from being developed in the final tank circuit. Depress microphone button to actuate transmitter and read the negative voltage being developed at V-6. If no negative voltage is apparent, the oscillator is not functioning, in which case it will be necessary to disconnect the lead wire from the screen of V-6, which is at pin #1. This will prevent excess plate current being drawn by the power amplifier due to the lack of drive. Grid drive should be at least 11 volts negative. If no grid drive is present, check oscillator screen voltage, grid bias, 6EA8 oscillator and crystals. When sufficient drive is known to be available and RF output is still not functioning, this would indicate failure of the power amplifier circuit. Check for screen and plate current by inserting MA meter in series with the screen and then the plate choke. If no voltage is available at this point to ground, it would indicate an open modulation transformer. If no current is being drawn at all during the transmit cycle, this would indicate that the cathode is possibly open due to bad contact points in the relay. This may be checked by manually grounding pin #7 of the power amplifier to ground and observing the sharp rise in plate current. The following table will outline approximate voltages at the listed check points of the transmitter to assist in

localizing troubles or failures:

20. TRANSMITTER VOLTAGE TABLE

Measured with VTVM. May vary 10% due to line variations. All voltages measured from chassis ground unless specified otherwise. Read with PTT Button depressed and dummy load across antenna.

Pin No.	V6-6BQ5	V6-6EM5	V5-6EA8
1		+110	
2	0		-6.5
3	+8		-240
4			
5		6VAC	
6		-15	+300
7	+290		
8			
9	+300	+170 at 5 W input	

POWER SUPPLY IN TRANSMIT POSITION

Negative to ground	-28 volts
Positive to ground	+310 volts
AC to Bridge	270 RMS volts

21. Tone Signal Device: The tone signal generator utilizes two type NE-960 lamps, which serve as the pulse and tone generator. They are essentially in series but each having a different capacitor across it, oscillates at a different frequency. One oscillates in the neighborhood of 500 CPS while the second is at a very low frequency and intermittently keys the 500 CPS tone on and off. The output of this generator is then fed through a 470 MMF capacitor to the screen of V-4 audio amplifier where it is impressed upon the modulation system. Tone signals may be varied somewhat to suit a particular need by changing the value of C-48, which is located and attached to the tone signal switch.

22. Power Supply: The power supply is designed to operate from 6, 12, or 115 volts input. High voltage DC is supplied by use of a bridge circuit consisting of four 750 MA., 600V silicon diodes. The negative leg returns to ground through R-46 and R-47 to provide a negative source for operating the relay during the transmit position and serves as a dropping resistor to lower the overall voltage during the receive mode. Two sectional filter capacitors for primary and secondary filtering are plug-in type with octal sockets for easy removal. Operation at 6 or 12 volts is made possible by the use of independent primary windings for each voltage utilizing the General V-60 heavy-duty vibrator. The power transformer is fabricated to assure the highest possible operating efficiency for its size. High temperature wire insulation is used throughout. Power consumption for each voltage is as follows: 117V A.C. at 80W; 6V D.C. at 9 Amps; and 12V D.C. at 4 1/2 Amps. The 115 Volt primary is internally fused with a 1-1/2 Amp fuse located immediately behind the power connector plug. The 6 and 12

volt cords are independently fused by fuseholders in their respective hot leads. In the 6V and 115V operating condition, all the filaments in the unit are connected in parallel. When operating from a 12 volt source, the filaments are automatically connected in a series-parallel arrangement to divide the voltages evenly. This necessitates using exact replacements for pilot light and tubes to prevent possible filament current imbalance. The 6 or 12 volt power cords have self-contained ignition hash filters. Chassis has three iron core R.F. chokes for vibrator hash filtering, assuring quiet operation with virtually no electrical power supply noise when operating from a D.C. source. Battery polarity does not have to be observed, but rather correct cable hook-up, fastening the fuse to the hot lead and the ground lead to solid ground. Operating at 6 volts with a 12 volt cord or vice versa will damage the unit; hence, examination should be made prior to final connection.

Caution: Always visually observe or feel with fingertips for correct mating of the power plug. It is possible to shift the plug one or more rows of pins away from correct center, possibly preventing operation of blowing fuses. UNDER NO CIRCUMSTANCES SHOULD THE SET BE OVER-FUSED. Blowing a fuse will be caused solely by defective components in unit. Set should be checked out in its entirety before replacing fuse. If unit is run at a higher rated plate input power than 5 watts or some other band or for export use, the fuses for 6 and 12 volts may be changed to 10 and 15 amps respectively. The internal fusing remains the same.

23. Care of the Finishes: Cabinets with Baked Wrinkle finishes may be restored to their original lustre by use of household ammonia and towel. Anodized aluminum panel may be cleaned using damp cloth and detergent. No abrasives should be used on Panel lettering or Dial glass. Dial glass should be cleaned from outside using kleenex and water or vinegar. Inner surface of Dial glass may be cleaned by bending a pipe cleaner in half and twisting the sharp ends. Slide loop behind glass and gently brush surface. Chassis surface should require very little care other than occasional dusting. In the event of slippage of channel selector, do not use oil or other lubricants. Insert small amount of "No-Slip" Dial Compound into Planetary Drive Bearing at front of capacitor with wooden match or eye dropper. This will re-engage ball bearings. The Transmit and Receive numerals may be written directly upon the Panel using pencil or India Ink of the Nonwaterproof variety. Ball-point pens tend to dig in and scratch the anodized surface. Black plastic numerals may be obtained at any stationary store. Just ask for "Artype" or similar.

24. Crystals: Transmitter crystals should be of the fundamental type. Use only "D" fundamental crystals in the transmitter circuit of the MC4. The receiver utilizes 3rd overtone crystals type "P" which are in green anodized cases. These are similar to those used in MC2 and MC3 models. Do not attempt to use overtone crystals in the transmitter circuit. Your General Radiotelephone Company distributor can supply the correct crystals, which are unconditionally guaranteed for one year. They net for $2.95 each. If not available in your area, write directly to the factory.

25. External Speaker Plug: An auxiliary audio output connector is provided at the rear of the set for use with 3-6 Ohm voice coils. Insertion of remote speaker plug automatically disables internal speakers.

RECEIVER VOLTAGE TABLE

Measured to chassis with VTVM. No signal input - "S" Meter at "O", squelch counter-clockwise.

Pin	V1-RF	V2 1st IF	V3 2nd IF	V4 Squelch Audio	V5 Rec. Os.	V7 Audio
1	+140	0	0	+55	+130	--
2	0	+2 v.	+2	+52	--	--
3	+1.5	--	--	+78	--	+12
4	--	--	--	--	--	--
5	--	+280	+290	--	--	--
6	+240	+180	+180	+140	--	--
7	+140	--	--	+50	--	+285
8	+180	--	--	+11	--	+280
9	--	--	--	0	-7	+290

POWER SUPPLY IN RECEIVE POSITION

Measured at plug-in filter in Power Supply Section

Pin 3 to Ground	-	+295 volts
Pin 1 to Ground	-	-80 volts
Pin 5 to Ground	-	+300 volts
Bias Tap on R45	-	-7.5 volts

WARRANTY

All parts except vibrators and cabinets are warrantied for a period of 90 days from date of purchase. Said warranty becomes void upon failure to return warranty registration within 7 days from date of purchase. Parts replacements will be made subject to examination by General Radiotelephone. Parts becoming defective from other than normal use or removed from units that have been otherwise modified to a point which in the opinion of the Company does not constitute normal use, thereby voids any obligation to make repair and/or replacement of said part. Transformer and associated components which have been permanently damaged beyond repair due to obvious defeat of recommended fuse protection are not subject to warranty replacement. Sealed relay is guaranteed unconditionally without time limit to original purchaser only. All repairs and/or replacements will be made F.O.B. factory only. General Radiotelephone assumes no liability for loss or damage in transit either to or from factory in uninsured parcels or due to improper packing. All sets returned to factory for repair must be in suitable container for shipment. When units received are not packaged properly to prevent damage upon return, the Company reserves the right to use and charge for packaging materials. This warranty is non transferable.

- -

Date of Purchase ____________________

Model # ____________________

Serial # ____________________

Purchased from ____

Address ____

Sold to ____

Address ____

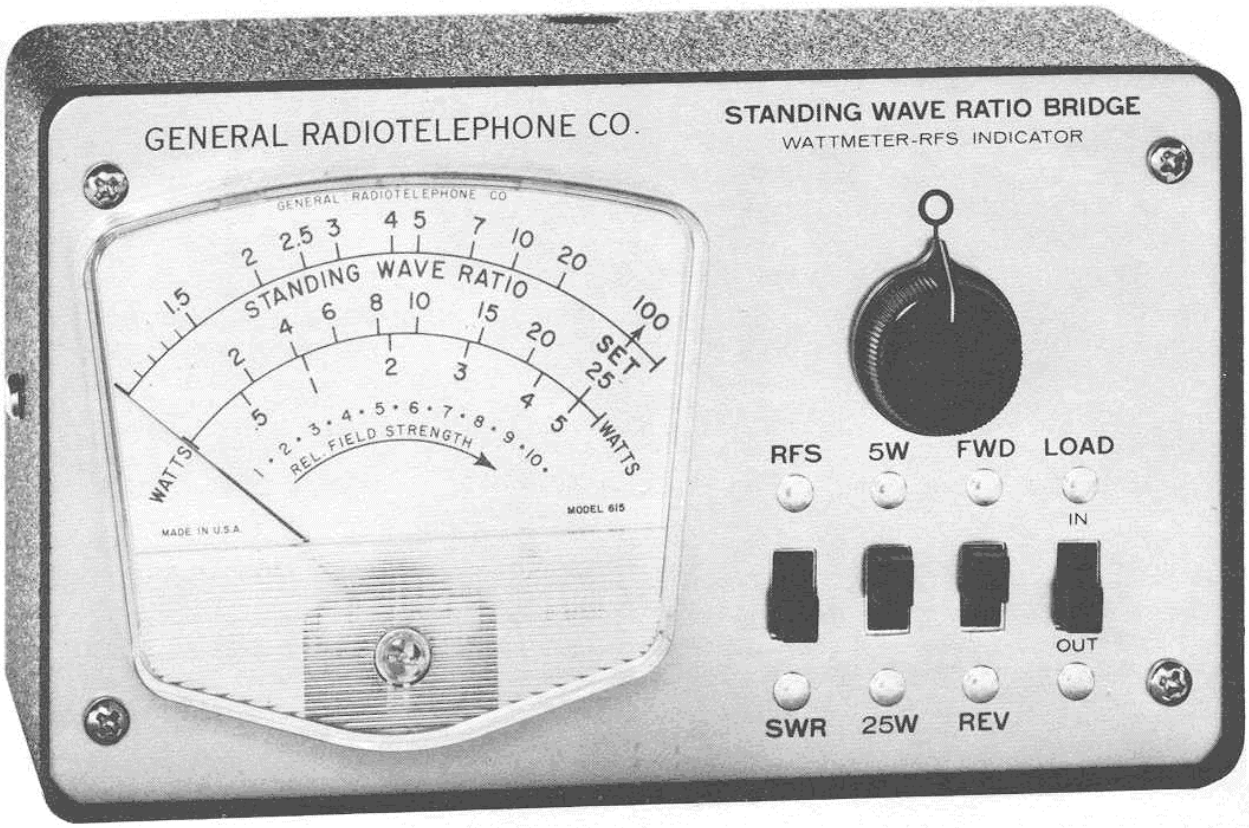
City - State ____

Call Leter ____________________

Please put my name on your mailing list for any future service notes and new products. I have read the warranty certificate.

Signed ________________________

FOR CALIBRATING AND CHECKING PERFORMANCE OF ANY
TRANSCEIVER FROM 27 MC TO 54 MC



THE GENERAL MODEL 615 MULTIFUNCTION BRIDGE is a single precision instrument that measures - true power - standing wave ratio - relative field strength.

In-line monitoring of any equipment in the 27 to 54 MC range. Complete with built in 30 watt dummy load for test bench and final check out use. Accurate to 5%.

FUNCTIONS: Direct readings of forward and reverse power for VSWR. Reads true-power to 52 ohm load in two ranges of 5 and 25 watts. Shows relative field strength using telescoping antenna.

SPECIFICATIONS: Self-contained 52 ohm, 30 watt, GLOBAR dummy load. Flat loading within 3db. to 50 MC. Meter 1 Mil. movement with 4 scales for all functions. Couplings are Silver plated SO-239 COAX connectors. Unit may be left in line during operation at all times. Accurate transmitter adjustments and continuous monitoring of power.

RANGES: VSWR-27 to 54 MC. Scaled 0 to 100 with Calibrate-Set mark, Watts -- Two separate scales for 5 and 25 watts.

RFS: Relative Field Strength Meter Calibrated 0 to 10 with sensitivity control.

MECHANICAL: Size -- 7"W x 4-1/8"H x 3-3/4"D. WT. 4 lbs. Shpg. WT. 6 lbs. Cabinet - Black wrinkle finish. Panel - Gold anodized solid aluminum. Controls -- 4 Slide -- Switch functions and one Rotary Control. Warranted for 90 days against defects. FOB Burbank. Net Price -- $39.95.

GENERAL RADIOTELEPHONE COMPANY is now delivering a complete line of FM transceivers in the 150 MC to 175 MC range.

Until brochures are ready, I hope my following descriptions will convey our enthusiasm for this fine product on to you. Price of these units are: FM 60, $349; FM 120, $449; and 250W amplifier, $499. F.O.B. Burbank.

The simplicity of circuit design which incorporates 11 tubes and 1 Nuvistor provide for greater reliability, clean and simple operation, flexibility and versatility in either the mobile or base station installation. Eighty-five per cent of the problems in radio communications are caused by tube failure. As our equipment has 1/3 to 1/2 less tubes than any other unit marketed today, you can see that the amount of service expense will become negligible.

These new, easy to install units are considerably reduced in size and cost, but not performance, with specifications for the Commercial VHF Two-Way equipment and split channel operation in the 150 to 174 MC Band. FCC type acceptance under part numbers 10, 11, 16, and 21 meet all 1963 FCC specifications.

The FM 60 has a power output of 15 watts. The low battery drain of this unit makes it ideal for mobile portable operation. It is a self-contained power operation in the 6V - 12V - 115V.

The FM 120 has a power output of 30 watts. This unit was designed for base station installation, but may also be used for mobile and portable installation. It has a self-contained transistor power supply of 12V-115V.

A remote control head is available for the FM 60 and FM 120. This head contains a speaker and necessary controls for the operation of the transceiver.

The FM 500 is a 250 watt base station Linear Amplifier with complete plug-in accessories for the FM 60 and FM 120. The FM 500 has fully automatic electronic switching circuit. The sizes of the FM 60, FM 120, and FM 500 are $4\frac{1}{4}$H x $8\frac{1}{4}$W x $10\frac{1}{2}$D.

Battery save switch is provided on the FM 60 and FM 120 for low current drain in receive position. Complete circuitry design for Tone Squelch adaptors is provided for in the FM 60 and FM 120, and control head.