APPENDIX 5

USERS MANUAL

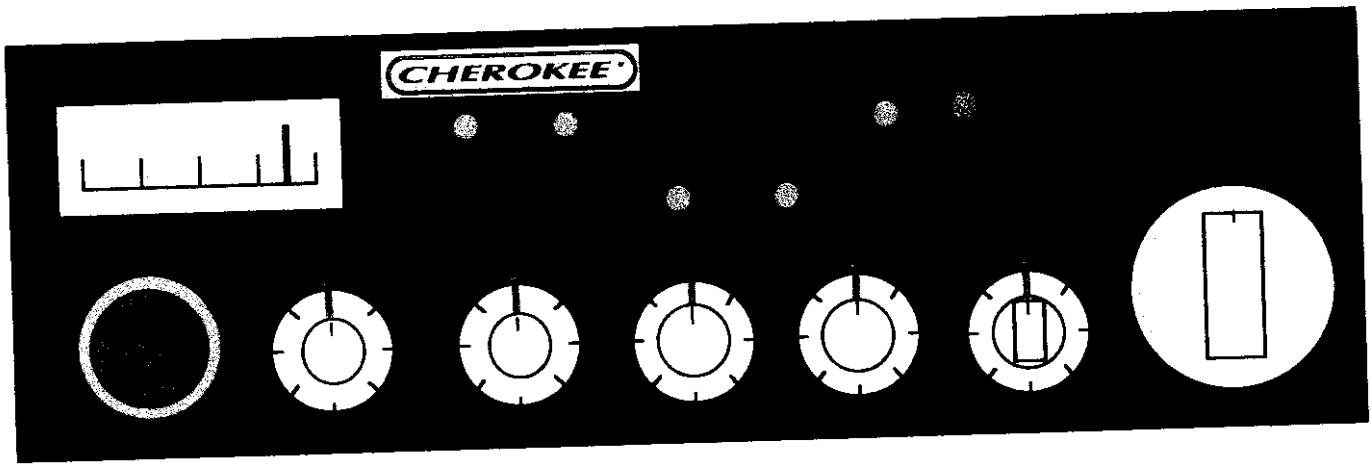
TWENTY-TWO (22) PAGE USERS MANUAL FOLLOWS THIS SHEET

FCC ID: MGPNR-100

OPERATING MANUAL

CHEROKEE™

40 Channels
Citizen Band
Two-Way Mobile Radio



Model : NR100

TABLE OF CONTENTS ..... PAGE

Revision Notes

Revision 0	First Issue	Y.O. Leung	16-Feb-99

INTRODUCTION

Congratulations on your purchase of the CHEROKEE NR-100 Citizen Band mobile radio. Your CHEROKEE radio is designed to provide trouble-free service and advanced user features to make it the premier choice in radio communications.

THE CB STORY

The Citizens Band lies between the short-wave broadcast and 10-meter Amateur radio bands, and was established by law in 1949. The Class D two-way communications service was opened in 1959. (CB also includes a Class A citizen band and Class C remote control frequencies.) FCC regulations permit only "transmissions" (One party to another) rather than "broadcast" (to a wide audience). Thus advertising is not allowed on CB Channels because that is "broadcasting".

!! WARNING !!

Replacement or substitution of transistors, regular diodes or other parts of a unique nature, with parts other than those recommended by Cherokee Electronics, may cause violation of the technical regulations of Part 95 of the FCC Rules, or violation of Type Acceptance requirements of Part 2 of the Rules.

All transmitter adjustments other than the front panel controls must be made by, or under the supervision of, the holder of an FCC – issued General Radiotelephone Operator's License.

LICENSING

Citizens Band (CB) Radio operators do not required to obtain a FCC license to operate their CB equipment or provide station identification. Nevertheless, an operator of a CB radio station is still required to comply with the communication act and with the rules of CB Radio Operation.

SPECIFICATIONS

GERNERAL

Frequency Range:	26.965MHz to 27.405MHz (40 Channels)
Frequency Control:	Phase Locked Loop (PLL) Synthesizer
Frequency Tolerance:	0.005%
Frequency Stability:	0.001%
Operating Temperature Range:	-20 Degrees F to +120 Degrees F
Microphone:	Plug-in Dynamic; with push to talk switch & coiled cord
Input Voltage:	13.8V DC nominal, 15.9V Max., 11.7V Min Positive or Negative Ground
Current Consumption:	Transmit: AM full modulation, 2.4 Amps Max. Receive: Squelched, 0.6 Amps Max. Receive: Maximum Audio Output, 1.0 Amps Max
Size:	2-3/8" (Height) x 7-3/16" (Width) x 9-1/8" (Depth)
Weight:	3.75 lb. Net, 5.73 lb. Gross with shipping box
Antenna Connector:	UHF, SO239
Meter (3 in 1):	Illuminated; Indicates relative output power, received signal strength and SWR
Front Panel Illumination	Electro-Luminescent Lamp Panel

TRANSMITTER

Power Output:	AM: 4 Watts
Modulation:	High Level Class B, Amplitude Modulation
Spurious Level:	-50dB
Frequency Response:	450-2500Hz
Output Impedance:	50 ohms, unbalanced.
Output Indicators:	Meter shows relative RF output power and SWR Transmit LED glows red when transmitter is in operation

RECEIVER

Sensitivity:	AM: 1.0uV for 10dB (S+N)/N at greater than 0.5 Watts audio output.
Spurious Emission:	-67dB
Image Rejection:	60dB
IF Frequency:	AM: 10.695MHz first IF, 455KHz 2nd IF
Adjacent Channel Rejection:	42dB at 10KHz
RF Gain Control:	45dB adjustable for optimum signal reception
Automatic Gain Control (AGC):	Less than 10dB change in audio output for inputs from 10 to 100,000uV.
Squelch:	Adjustable; threshold 0.5uV
ANL:	Switchable
Noise Blanker:	RF Type
Audio Output Power:	4 Watts into 8 ohms Max.
Audio Frequency Response:	300 to 2800 Hz
Built-in Loudspeaker:	8 ohms, round
External Loudspeaker (Not Supplied):	8 ohms; disable internal speaker when connected.

INSTALLATION

LOCATION

Plan the location of the transceiver and microphone bracket before starting the installation. Select a location that is convenient for operation and does not interfere with the driver or passenger in the vehicle. In automobiles, the transceiver is usually mounted below the dash panel, with the microphone bracket beside it.

CONNECTIONS

Your transceiver is supplied with a universal-mounting bracket. When mounting the bracket and radio to your car, make sure it is mechanically strong. Also provide a good electrical connection to the chassis of the vehicle. Proceed as follows to mount the transceiver:

1. After you have determined the most convenient location in your vehicle, hold the transceiver with mounting bracket in the exact location desired. Before drilling holes for desired position, make sure nothing will interfere the mounting position and the mounting bolts.

2. Connect the end of the antenna cable to the receptacle of antenna connector on the rear panel. Make sire the antenna connector has the proper type PL-259 plug to connect to the radio. Ensure that the antenna plug is screwed in tightly.

3. Connect the supplied DC cord, with the fused red wire to +13.8V DC source, and the black wire to a –13.8V source respectively. For automobile installation, connect power source directly from the spare terminal of the car's fuse box, or directly to the battery terminals.

   This will help to avoid any interference from existing wiring system of the automobile, and will minimize voltage drop caused by other circuits in the same wiring system and allow. This will also allow you to operate your transceiver anytime without starting the engine or turning on the ignition key.

4. To mount your Mic. Holder near your transceiver, we recommend the Mic Holder be placed under the dash, so the Mic is readily accessible.

IGNITION NOISE INTERFERENCE

Use of a mobile receiver at low signal level is limited by the presence of electrical noise. The primary source of noise in automobile installation is from the generator and ignition system in the vehicle. Under most operating conditions, when signal level is adequate, the background noise does not present a serious problem.

Even though the transceiver has ANL and NB controls, in some vehicles the ignition interference may be high enough to significantly effect the performance of the radio communications. The electrical noise may come from several sources. Many possibility exits and variation between vehicles require different solutions to reduce the noise level.

Note:
WHEN EXTREMELY LOW LEVEL SIGNALS ARE BEING RECEIVED, THE TRANSCEIVER MAY OPERATE WITH VEHICLE ENGINE TURNED OFF. THE UNIT REQUIRES VERY LITTLE CURRENT AND THEREFORE WILL NOT SIGNIFICANTLY DISCHARGE THE VEHICLE BATTERY.

ANTENNA

A vertically polarized, quarter-wavelength whip antenna provides the most reliable operation and greatest range. Shorter, loaded type whip antennas are more attractive, compact and adequate for applications where the maximum possible distance is not required. Also, the loaded whips do not present the problems of height imposed by a full quarter-wavelength whip.

Mobile whip antennas utilize the metal body of the vehicle as a ground plane. When mounted at a corner of the vehicle they are directional, in the direction of the body of the vehicle. For all practical purpose, however, the radiation pattern is non-directional. The slight directional characteristic will be observed only at extreme distances. A standard antenna connector (type SO 239) is provided on the transceiver to easy connection to the standard PL-259 cable termination.

If the transceiver is not mounted on the metal surface, it is necessary to run a separate ground wire from the unit to a good metal electrical ground in the vehicle. When installed in a boat, the transceiver will not operate at maximum efficiency without a ground plane, unless the vessel has a steel hull.

Before installing the transceiver in a boat, consult your dealer for information regarding an adequate grounding system and prevention of electrolysis between fittings in the hull and water.

TUNING THE ANTENNA FOR OPTIMUM SWR

Since there is such a wide vanity of base and mobile antennas, this section will strictly concern itself to the various types of mobile adjustable antennas.

Because the antenna length is directly related to the channel frequency, it must be tuned to resonate optimally on all 40 channels of the transceiver. CH1 requires a longer antenna than CH40, because it is lower in frequency.

Due to the various methods of adjusting antennas for proper SWR, we have chosen what we think is the optimum method.

!! WARNING !!

CONTINUOUS OPERATION OF THIS TRANSMITTER WITH GREATER THAN 4:1 VSWR ANTENNA MISMATCH MAY RESULT IN RF AMPLIFIER DAMAGE

A. Antenna with adjustment screws (set screws)

1. Starts with the antenna extended and tighten the setscrew tight enough so that the antenna can be lightly tapped with your finger for easy adjustment.

2. Set your transceiver to Channel 20. Press PTT (push-to-talk) switch, and tap the antenna shorter.

   The SWR meter will show a lower reading each time the antenna is tapped. By continuing to shorten the antenna you will notice the SWR reading will reach a lowest point and than start to rise again, this means the optimum tuning being pressed for center operating frequency of your transceiver.

B. Antennas which must be cut to proper length

1. Follow the same procedure as above, but adjust the length by cutting in 1/8 inch increments until a good match is obtained.

2. Be very careful not to cut too much at one time, as once it is cut, it can no longer be lengthen.

3. The whip is easily cut by filing a notch all the way around and breaking the piece off with pliers.

TIPS FOR ANTENNA ADJUSTMENT – If you have difficulties in adjusting your antenna, check the following:

A. All doors of the vehicle must be closed when adjusting the antenna.
B. Make sure the antenna base is grounded.
C. Check your coaxial cable routing to make sure it is not pinched when routed into the car.
D. Try a different location on your car, keeping in mind the radiation pattern you wish.
E. Is the antenna perfectly vertical?
F. Try a different location in your neighborhood. Stay away from large metal objects when adjusting. Such as metal telephone or light poles, and fences, etc.

EXTERNAL SPEAKER

The external speaker jack "EXT. SPK" on the rear panel, is used for remote receiver monitoring. The external speaker should have 8 ohms impedance and be able to handle at least 4 watts. When the external speaker is plugged in, the internal speaker is disconnected.

NOTE: THERE WILL BE NO AUDIO OUTPUT FROM THE "EXT SPK" JACK WHILE IN PA MODE OF OPERATION

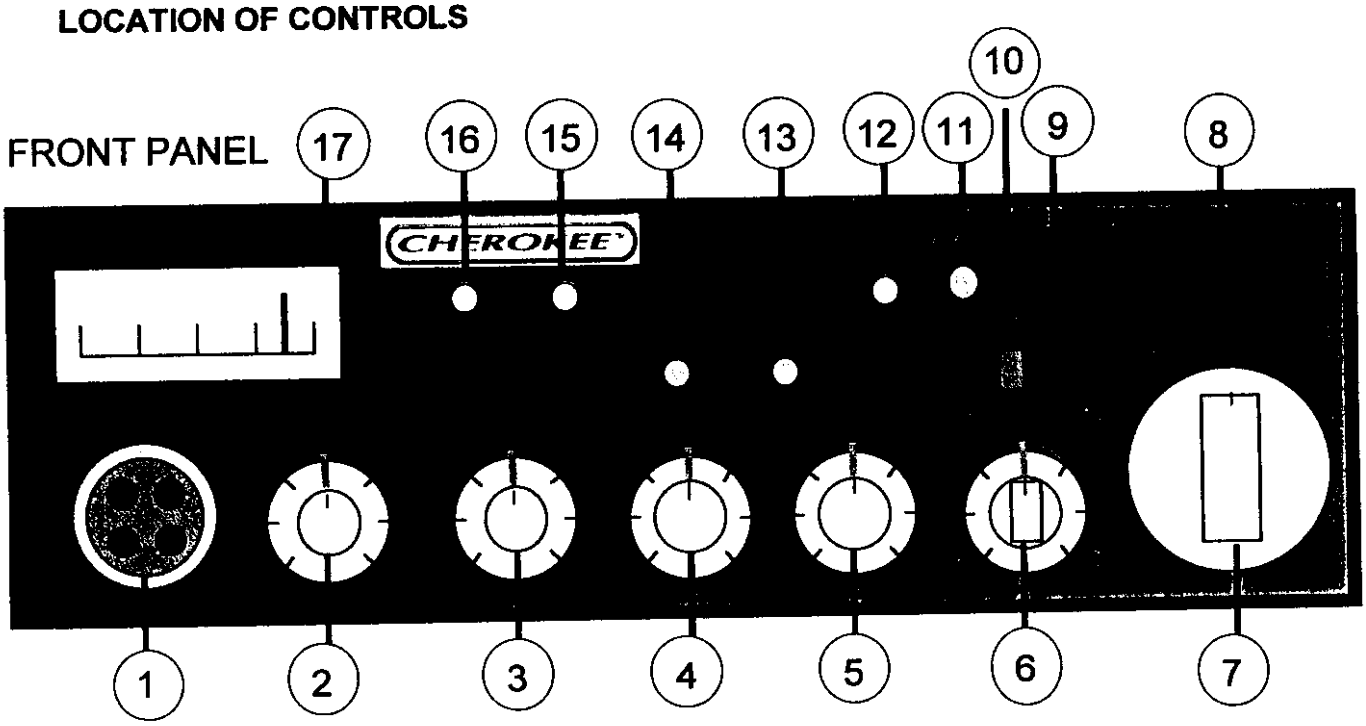
PA SPEAKER

The PA speaker jack "PA SPK" on the rear panel, is to be connected to a Loudspeaker outside of the vehicle, so that it could be used as a "Loud Hailer" to broadcast your speech to someone nearby when the PA feature is selected on the radio. The PA speaker should have 8 ohms impedance and be able to handle at least 4 watts. Use weatherproof "Horn" type loudspeakers to get best results.

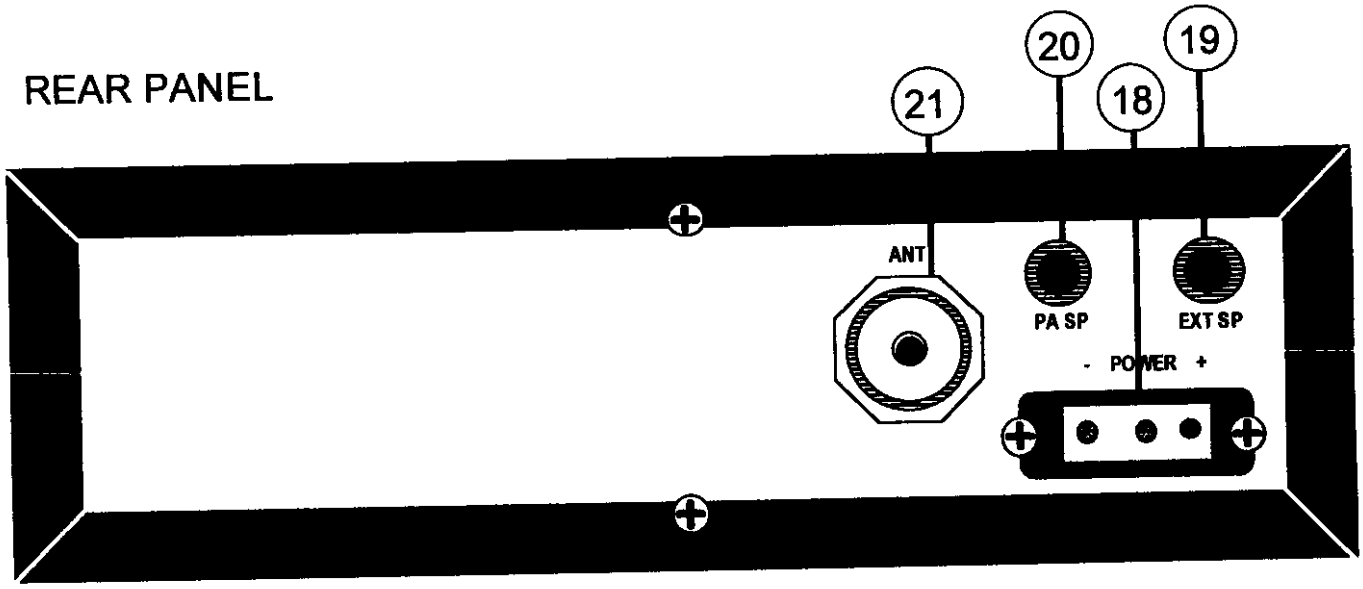
NOTE: THE RADIO WILL NEITHER TRANSMIT NOR RECEIVE WHEN THE "PA" FEATURE IS SELECTED

LOCATION OF CONTROLS

FRONT PANEL



REAR PANEL



1. MIC CONNECTOR
2. MIC GAIN
3. RF GAIN
4. CLEAR TUNE
5. SWR CAL
6. ON/OFF - VOLUME - SQ
7. CHANNEL SELECTOR
8. CHANNEL DISPLAY
9. RX/TX LED INDICATOR
10. EL LIGHT DIMMER
11. CD LED INDICATOR
12. MODE SW (RB/CB/PA)
13. CD SW (CDS/CDT/NOR)
14. DIRECT CHANNEL SW
15. NB/ANL SW
16. SWR SW (S/SWR/CAL)
17. INDICATOR METER
18. DC POWER SOCKET
19. EXT SPEAKER JACK
20. PA SPEAKER JACK
21 ANTENNA JACK

OPERATION

CONTROL FUNCTIONS

FRONT PANEL

1. MICROPHONE JACK
   4-pin, standard screw-on microphone connection. Front panel mounted for easy access. Must be connected to transmit.

2. MIC GAIN
   Adjust the microphone gain in the transmit and PA modes. This controls the gain to extent that full talk power is available several inches away from the microphone.

3. RF GAIN
   Used to reduce the gain of the RF amplifier under strong signal condition. Adjust this control to get best receiver signal to noise performance in the "Clear Drive" mode.

4. CLEAR TUNE
   Allows variation of the received frequency a few KHz above and below the fixed CB channels. It may also be used to optimize the receiving signals by tuning out interference signals in the adjacent channels.

5. SWR CAL
   In order to achieve maximum radiated power and the longest range, it is important that your antenna be properly adjusted and matches to the receiver. The Built-in SWR (Standing Wave Ratio) meter lets you easily measure the antenna condition. To operate this function, connect the antenna to the transceiver RF output connector. Select a channel near the middle of the band such as CH20 or the channel you plan to use most frequently. Turn the power on and set the meter function switch to the CAL position. Press and hold the microphone push to talk button and using the SWR CAL control, adjust the meter to read the CAL position indicated on the meter. Then, without releasing the microphone button, switch the meter function switch to SWR position and read the SWR indicated. The lower the figure, the better, with 1 being ideal. Generally speaking, readings up to 3 is acceptable, but over 3 indicate that you are losing radiated power and antenna adjustment is required.

6. OFF/ON VOLUME (inner dual concentric)
Turn clockwise to supply power to the unit and to set the desired listening level. During normal operation, the VOLUME control is used to adjust the audio output level obtained either at the radio's internal speaker or the external speaker, if used. Turn fully counterclockwise to turn the unit OFF.
SQUELCH (outer dual concentric)
This control is used to cut off or eliminate receiver background noise in the absence of an incoming signal. For maximum receiver sensitivity it is desired that the control be adjusted only to the point where the receiver background noise or ambient background noises is eliminated. Turn fully counterclockwise then slowly clockwise until the receiver noise disappears. Any signal to be received must now be slightly stronger than the average received noise. Further clockwise rotation will increase the threshold level, which a signal must overcome in order to be heard. Only strong signals will be heard at a maximum clockwise setting.

7. CHANNEL SELECTOR
This rotary switch selects any one channel desired. The selected channel appears on the LED readout directly above the Channel Selector Knob.

8. CHANNEL INDICATOR
Numbered LED indicates the selected channel you wish to operate on.

9. RX/TX INDICATOR
The receive/transmit LED indicator is located next to the channel indicator. The LED will be green when in receive mode and turns red when transmit.

10. EL LAMP DIMMER SWITCH
This switch is used to select the two intensity level of the E.L. Back lighted Front Panel – Bright and Dim.

11. "CLEAR DRIVE" INDICATOR (CD)
The "Clear Drive" LED indicator will turn on when CDS or CDT operation is selected.

12. MODE Switch (RB/CB/PA)
This switch is used to select the operating modes of the radio:
RB = Operate the CB radio with Roger Beep. This enables the "Roger Beep" to indicate the end of a transmission, so that others could use the channel immediately.
CB = Operate the CB radio (Normal operation)
PA = Operate the unit in PA mode. The voice pickup up by the microphone will be amplified and sent to the PA loudspeaker when the PTT is activated. The radio would neither transmit nor receive in this mode of operation.

13. "CLEAR DRIVE" SWITCH (CDS/CDT/NOR)
This switch is used to enable the "Clear Drive" audio compander circuit of the radio to provide clear and low noise communications between similarly equipped units
CDS – "Clear Drive System" Makes full use of the Compander feature. Select this when both the transmitting unit and receiving unit are using Compander.
CDT – "Clear Drive Transmit" Select this to increase the clarity of your own transmission while communicating with others that does not have a Compander. The receiver Compander in the unit will be disabled in this mode to match the non-compressed recited signals.
NOR – Normal CB Operation without using the Compander.

14. DIRECT CHANNEL SWITCH (CH19/CH9/NOR)
This switch is used to set the radio direct to Channel 19 (the channel being used by most professional drivers), Channel 9 (the official Emergency Channel), or allow the user to select any of the 40 CB channels with the rotary Channel Selector.

15. NB+ANL/ANL/OFF SWITCH
This switch is used to select different noise cancellation circuits for received signals. ANL (Automatic Noise Limiter) turns on the noise reduction circuit to improve the sound of the incoming transmission, and NB (RF Noise Blanker) is very effective for repetitive impulse noise such as ignition interference.

16. SRF/CAL/SWR SELECTOR
This switch controls the operating mode of the indicator meter. The meter will show Received Signal Strength and RF output power level on SRF position. When calibrating the SWR meter, this selector shall be put to CAL position. When reading SWR after calibration, the selector shall be put to SWR position.

17. INDICATOR METER
This meter is controlled by the SRF/CAL/SWR selector to indicates relative received signal strength and transmitter RF output power, SWR Calibration level or SWR level of the transmitter.

REAR PANEL

18. POWER CONNECTOR
Accepts the DC Power supply cable with built-in fuse (4 Amps) shipped with the radio. Connects to 13.8V DC Power supply.

19. EXT. SP
Accepts 4 to 8 Ohms, 5-Watts external loudspeaker. When external loudspeaker is connected to this jack, the built-in loudspeaker is disconnected automatically.

20. PA SP
Accepts 4 to 8 Ohms, 5 Watts PA loudspeaker, activates when PA mode is selected.

21. ANTENNA CONNECTOR
Accepts type PL-259 RF plug. To be connected to a 27MHz 50 Ohms antenna through a 50 Ohms coaxial cable.

OPERATION PROCEDURE TO RECEIVE

1. Be sure that power supply, microphone and antenna are properly connected before turning on the radio.
2. Turn the radio ON by rotating the Volume control clockwise.
3. Select desire mode of operation (Clear Drive / Roger Beep / ANL etc).
4. Select desire channel to operate.
5. Turn the RF Gain control fully clockwise for maximum gain.
6. Adjust the squelch control to hear the background noise.
7. Adjust volume control for a comfortable listening level.
8. Re-adjust squelch control clockwise until the background noise JUST disappeared (when there is no activities on the channel). Leave the squelch control at this setting. The receiver will remain quiet until a signal is received. Do not advance the control too far, or some of the weaker signals will not be received.
9. Re-adjust the RF Gain control to get best receiver signal to noise performance when operating in Clear Drive (CDS).

OPERATING PROCEDURE TO TRANSMIT

!! Caution !!

Be sure a suitable antenna is properly connected to the radio before transmitting. Prolonged transmitting without an antenna or a poorly matched antenna could cause damage to the transmitter.

1. The radio is properly set up for receive as in the previous paragraph.
2. Set the Mic gain control fully clockwise
Listen on the channel to ensure that it is clear, hold the microphone two inches from the mouth and speak clearly in a normal voice.
3. The SRF meter will indicate relative power output while you are transmitting.

FREQUENCY RANGE

The NR-100 transceiver represents one of the most advanced mobile radio in the Citizens Radio Service. This unit features advanced Phase Lock Loop (PLL) circuitry providing complete coverage of all 40 channels as shown below.

CB Channel	Channel Freq. in MHz	CB Channel	Channel Freq. in MHz
1	26.965	21	27.215
2	26.975	22	27.225
3	26.985	23	27.255
4	27.005	24	27.235
5	27.015	25	27.245
6	27.025	26	27.265
7	27.035	27	27.275
8	27.055	28	27.285
9	27.065	29	27.295
10	27.075	30	27.305
11	27.085	31	27.315
12	27.105	32	27.325
13	27.115	33	27.335
14	27.125	34	27.345
15	27.135	35	27.355
16	27.155	36	27.365
17	27.165	37	27.375
18	27.175	38	27.385
19	27.185	39	27.395
20	27.205	40	27.405

COMPANDER OPERATION

NR-100 radios are equipped with an audio compander circuit to enhance audio performance. The circuit is ON when the "Clear Drive." Switch on the front panel is set to "CDS" or "CDT".

The Compander comprised of two circuits, a Compressor for transmit audio and an Expander for received audio. The Compressor reduces the dynamic range of the transmit audio by increasing gain for low level signals and decreasing gain for the higher level signals. A reversed process is conducted by the Expander, which increases circuit gain for high level signals and reduces gain for low-level signals.

When the Compander is used in both the transmitter and receiver (CDS), the dynamic range of the audio signal can be preserved and the noise induced in the transmission path is highly reduced.

When Compressor is only used in the transmitter end (CDT), and no Expander is used in the receiver, the receiver will observe a compressed audio signal similar to those from a very high gain microphone but without overload/clipping distortion at high signal levels.

When the Expander is used in the receiver (CDS) and the compressor is not present in the transmitter end. The Expander reference level is set at around 12dB SINAD output of the receiver such that the noisy signal at marginal reception levels are suppressed, while the strong and clear signals are boosted. The user might find the received voice levels be exaggerated in some cases.

10 CODES

Citizens Band operators have largely adopted the "10-code" for standard questions and answers. Its use permits faster communications and better understanding in noisy areas. The following table lists some of the more common codes and their meanings.

10 CODES AND THEIR MEANING

10-1	Receiving poorly
10-2	Receiving well
10-3	Stop transmitting
10-4	OK, message received
10-5	Relay message
10-6	Busy, stand by
10-7	Out of service, leaving air
10-8	In service, subject to call
10-9	Repeat message
10-10	Transmission completed standing by
10-11	Talking too rapidly
10-12	Visitors present
10-13	Advise Weather/Road conditions
10-16	Make pick up at
10-17	Urgent business
10-18	Anything for us
10-19	Nothing for you, return to base 1
10-20	My location is
10-21	Call by telephone
10-22	Report in person to
10-23	Stand by
10-24	Completed last assignment
10-25	Can you contact
10-26	Disregard last information
10-27	I am moving to channel
10-28	Identify your station
10-29	Time is up for contact
10-30	Does not conform to FCC rules
10-32	I will give you a radio check
10-33	EMERGENCY TRAFFIC
10-34	Trouble at this station
10-35	Confidential information
10-36	Correct time is
10-37	Wrecker needed at
10-38	Ambulance needed at
10-39	Your messaged delivered
10-41	Please turn to channel
10-42	Traffic accident at
10-43	Traffic tie up at
10-44	I have a message for you
10-45	All units within range please report
10-50	Break channel
10-60	What is the next message number?
10-62	Unable to copy, use phone
10-63	Net directed to
10-64	Net clear
10-65	Awaiting your next message/assignment
10-67	All units comply
10-70	Fire at
10-71	Proceed with transmission in sequence
10-77	Negative contact
10-81	Reserve hotel room for
10-82	Reserve room for
10-84	My telephone number is
10-85	My address
10-91	Talk closer to mike
10-93	Check my frequency on this channel
10-94	Please give me a long count
10-99	Mission completed, all units secure
10-200	Police needed at

A Few Rules That Should Be Obeyed

1. You are not allowed to carry on a conversation with another station for more than five minutes at a time without taking a one-minute break to give others a chance to use the channel.
2. You are not allowed to blast others off the air by overpowering them with illegally amplified transmitter power or illegally high antennas.
3. You can't use CB to promote illegal activities.
4. You are not allowed to use profanity.
5. You may not play music in your CB.
6. You may not use your CB to sell merchandise or professional service.

How Your CB Can Serve You

- Warn of traffic tie ups ahead
- Provide weather and road information
- Provide fast help in the event of emergency or break down
- Suggest good spots to eat or sleep
- Make long trips more interesting and help you keep awake
- Provide direct contact with your office or home
- Make friends for you as you travel
- Provide "local information" to find your destination
- Help law enforcement officers by reporting drunk or reckless drivers

The Highway Patrol has said that drunk drivers, wrong-way drivers and speeders reported by CBers is "amazing." Even the "Smokey Beat" warnings don't shake their beliefs that "the potential benefits of CB radio to law enforcement are so great that they far outweigh the disadvantages" In regard to CB radar warnings to other CBers, the Highway patrol has said, "We've overheard warnings being relayed to truckers long after our operating have! been discontinued...so we actually receive a residual benefit from these warnings."

Use Channel 9 For Emergency Messages Only

The FCC gives the following examples of permitted and prohibited types of communications for use on Channel 9. These are guidelines and are not intended to be all-inclusive.

Permitted: "A tornado sighted six miles of town."

Not Permitted: "This is observation post number 10. No tornado sighted."

MAINTENANCE AND ADJUSTMENT

The Cherokee NR-100 transceiver is specifically designed for the environment encountered in a mobile installation. Should a failure occur, however, replace parts only with identical parts. Do not substitute. Refer to the schematic diagram and parts list in the Service Manual.

If problem occurs when operating your radio, review the operating instruction to ensure that proper procedures were allowed. If the problem persist, refer to WARRANTY SERVICE INSTRUCTION section in this manual.

!! FCC WARNING !!

All transmitter adjustments other than those provided on the front panel by the manufacturer must be made by or under the supervision of the holder of an FCC-issued general radio telephone operator's license. TAMPERING, MODIFICATION OR OTHER CHANGES WHICH ALTER THE TRANSMITTER POWER OR FREQUENCY ARE A VIOLATION OF FEDERAL LAW.

PRESS-TO-TALK MICROPHONE SHIPPED WITH THE RADIO

A low impedance (500 Ohms) dynamic microphone is shipped with the radio. The Push-To-Talk (PTT) switch on the microphone controls the operation of the transmitter and the receiver. Press the switch and the to transmit and release the PTT switch to receive.

ALTERNATE MICROPHONES AND INSTALLATION

For best results, the user should select a low-impedance dynamic type microphone or a transistorized microphone. Transistorized type microphones have a low output characteristic. The microphones must be provided with a four-wire cable. See Figure 1 - microphone-wiring schematic for details.

If the microphone to be used is supplied with a pre-cut cable, they must be reconfigured as follows:

1. Cut the wires so that they extend 7/16" beyond the plastic insulating jacket of the microphone cable. See Figure 2 for details.
2. All wires should be cut to the same length. Strip the ends of each wire 1/8" and tin the exposed wires.

Before beginning the actual wiring, read carefully, the circuit and wiring information provide with the microphone you selected. Keep the exposed wire

lengths to a minimum to avoid short circuit when the microphone plug is reassembled.

MICROPHONE PLUG REASSEMBLING

1. Remove the retaining screw.
2. Unscrew the housing from the pin receptacle body
3. Loosen the two cable clamp retainer screws
4. Feed the microphone cable through the housing. Knurled ring and washers as shown in Figure 3.
5. The wires must now be soldered to the pins as indicated in Figure 1. Wiring table. If a vise or clamping tool is available, it should be used to hold the pin receptacle during the soldering operation, so that both hands are free to do the soldering job. Alternatively, the pin receptacle can be held in a stationary position by inserting it into the microphone jack on the front panel. The number of the pins of the microphone plug is shown in Figure 2 as viewed from the back of the plug. Before soldering the wires, pre-tin the wire receptacles of each pin on the plug.

Be sure that the housing and the knurling ring of Figure 3 are pushed back onto the microphone cable before starting to solder. If the washer is not captive to the pin receptacle, make sure that it is [placed on the threaded portion of the receptacle before soldering.

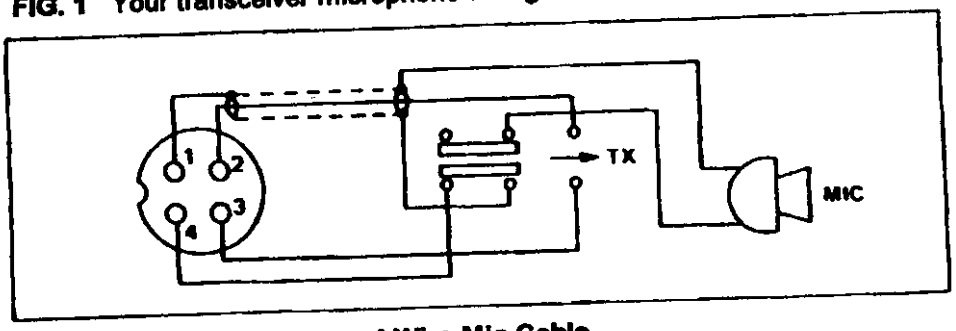
If the microphone jack is used to hold the pin receptacle when soldering, best results are obtained when the connection to pins 1 and 3 are made first and then the connections to pins 2, 4 and 5. Use minimum amount of solder and be careful to prevent excessive solder accumulation on the pins, which could cause a short circuit between pins and the microphone plug housing.

6. When all soldering connection to the pins of the microphone plug are completed, push the knurling ring and the housing forward and screw the housing onto the threaded portion of the pin receptacle. Note the location of the screw clearance hole in the plug housing with respect to the threaded hole in the pin receptacle. When the housing is completely threaded into the pin receptacle, a final fraction of turn either clockwise or counterclockwise may be required to align the screw hole with the threaded hole in the pin receptacle. When these are aligned, the retaining screw is then screwed into place to secure the housing to the pin receptacle.

7. The two cable clamp retainer screws should now be tightened to secure the housing to the microphone cord. If the cutting direction have been carefully followed, the cable clamp should secure to the insulating jacket of the microphone cable. Upon completion of the microphone plug wiring, connect and secure the microphone plug in the transceiver.

ALTERNATE MICROPHONES SCHEMATIC.

FIG. 1 Your transceiver microphone wiring schematic.



4 Wire Mic.Cable

Pin Number	:	1	2	3	4
Mic Cable Lead	:	AF shield	AF lead	Tx control	Rx control

FIG. 2
Mic plug pin number viewed from rear of pin receptacle

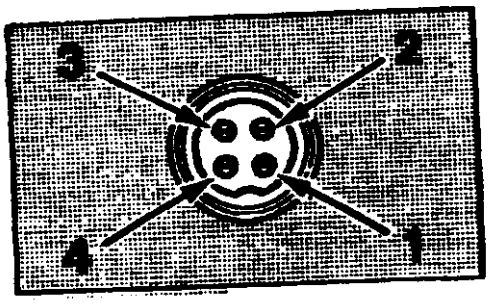
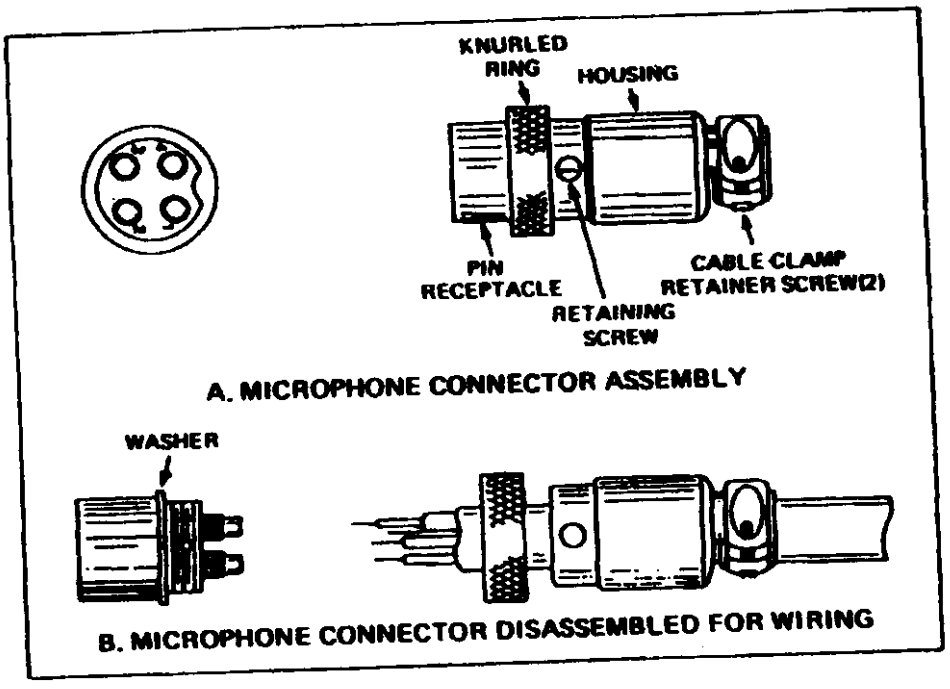


FIG.3
Microphone plug wiring.



WARRANTY

Limited One Year Warranty

WIRELESS MARKETING CORPORATION warrants that its Cherokee citizens band (CB) radio, and the component parts thereof, will be free of defects in workmanship and materials for period of one (1) year from the date of first consumer purchase. This warranty may be enforced by the first consumer purchaser, provided that the product is utilized within the U.S.A.

Wireless Marketing will, without charge, repair or replace, at it's option, defective citizens band (CB) products or component parts upon delivery to the Wireless Factory Service Department, accompanied by proof of the date of first consumer purchase, such as a duplicated copy of a sales receipt.

You must pay any initial shipping charges required to ship the product for warranty service, but the return charges will be at Cherokee expense, if the product is repaired or replaced under warranty. For further details concerning procedures for obtaining service, see the "If You Need Service" section of the Owner s Manual.

Exclusions: This limited warranty does not apply; 1) to any product damaged by accident; 2) in the event of misuse or abuse of the product in as a result of unauthorized alterations or repairs; 3) if the serial number has been altered, defaced or removed; 4) if the owner of the product resides outside the U.S.A.

All implied warranties, including warranties of merchantability and fitness for a particular purpose are limited in duration to the length of this warranty.

Cherokee shall not be liable for any incidental, consequential or other damages; including, without limitation, damages resulting from loss of use or cost of installation.

Some states do not allow limitations on how long an implied warranty lasts and/or do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation may not apply to you.

WIRELESS MARKETING CORPORATION
1212 Remington Road
Schaumburg, IL 60173
Ph: 1-800-259-0959
Fax: 1-847-839-0016
E-Mail Address: wrlmkt@sprynet.com
Website: http://www.wirelessmarketing.com

**For additional information about your new CB radio:
call the toll free Cherokee Consumer Information Hotline,
Monday- Friday, 8:00am- 5:00pm, CST.
(Please have the model and serial number ready)**

**1-800-259-0959
(In the U.S. and Canada ONLY)**

If You Think You Need Service, Call 1-800-259-0959

You may be asked to send your unit to the Cherokee factory. It will be necessary to furnish the following, in order to have the product serviced and returned.

I. For Warranty Repair, include some form of proof-of-purchase, such as a mechanical reproduction or carbon or a sales receipt. If you send the original receipt it cannot be returned.

2. Send the entire product. Must include CB unit and microphone.

3. Enclose a description of what is happening with the unit. Include a typed or clearly printed name and address of where the unit is to be returned.

4. Pack unit securely to prevent damage in transit. If possible, use the original packing material.

5. **Ship prepaid and insured by way of a traceable carrier (to avoid loss in transit) such as United Parcel Service (UPS), Roadway Parcel Service (RPS) or First Class Insured Mail to Cherokee Factory Service, Wireless Marketing Corporation, 1212 Remington Road, Schaumburg, IL 60173. Cherokee is not responsible for units not received if package has not been properly insured.**

6. If the unit is in warranty upon receipt of your unit it will either be repaired or exchanged depending on the model. Please allow approximately 3 to 4 weeks before contacting us for status. If the unit is out of warranty a letter will automatically be sent informing you of the repair charge or replacement charge. If you have any questions, please call 1-800-259-0959 for assistance.

If you received the Cherokee product as a gift and do not have the proof of purchase information necessary for service, include the following information, with the product: Clearly printed or typed name and address. **Date, month and year you received the gift.** Model number, where purchased (if Possible) - store name and location.

APPENDIX 6

ALIGNMENT PROCEDURE

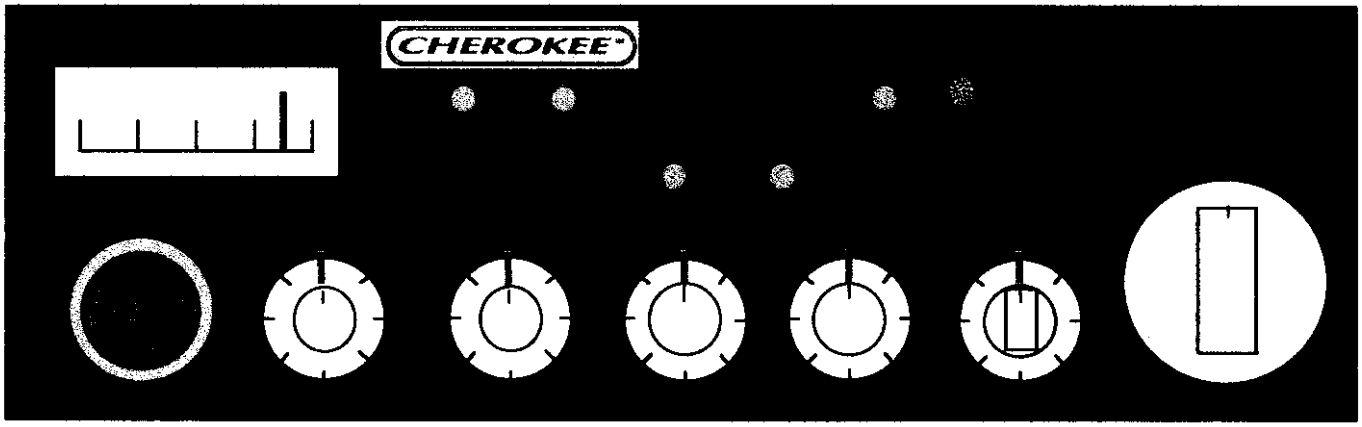
FOURTEEN (14) PAGE ALIGNMENT PROCEDURE FOLLOWS THIS SHEET

FCC ID: MGPNR-100

SERVICE MANUAL

CHEROKEE™

40 Channels
Citizen Band
Two-Way Mobile Radio



Model : NR100

TABLE OF CONTENTS

CONTENT ..... PAGE

Revision Notes:

Revision 0	First Issue	Y.O. Leung	16 Feb 1999

Model Numbers:

NR100 - 40 Channels AM CB Radio with "Clear Drive" Compander and E.L. Back Light Front Panel

SPECIFICATIONS

GERNERAL

Frequency Range:	26.965MHz to 27.405MHz (40 Channels)
Frequency Control:	Phase Locked Loop (PLL) Synthesizer
Frequency Tolerance:	0.005%
Frequency Stability:	0.001%
Operating Temperature Range:	-20 Degrees F to +120 Degrees F
Microphone:	Plug-in Dynamic; with push to talk switch & coiled cord
Input Voltage:	13.8V DC nominal, 15.9V Max., 11.7V Min Positive or Negative Ground
Current Consumption:	Transmit: AM full modulation, 2.4 Amps Max. Receive: Squelched, 0.6 Amps Max. Receive: Maximum Audio Output, 1.0 Amps Max
Size:	2-3/8" (Height) x 7-3/16" (Width) x 9-1/8" (Depth)
Weight:	3.75 lb. Net, 5.73 lb. Gross with shipping box
Antenna Connector:	UHF, SO239
Meter (3 in 1):	Illuminated; Indicates relative output power, received signal strength and SWR
Front Panel Illumination	Electro-Luminescent Lamp Panel

TRANSMITTER

Power Output:	AM: 4 Watts
Modulation:	High Level Class B, Amplitude Modulation
Spurious Level:	-50dB
Frequency Response:	450-2500Hz
Output Impedance:	50 ohms, unbalanced.
Output Indicators:	Meter shows relative RF output power and SWR Transmit LED glows red when transmitter is in operation

RECEIVER

Sensitivity:	AM: 1.0uV for 10dB (S+N)/N at greater than 0.5 Watts audio output.
Spurious Emission:	-67dB
Image Rejection:	60dB
IF Frequency:	AM: 10.695MHz first IF, 455KHz 2nd IF
Adjacent Channel Rejection:	42dB at 10KHz
RF Gain Control:	45dB adjustable for optimum signal reception
Automatic Gain Control (AGC):	Less than 10dB change in audio output for inputs from 10 to 100,000uV.
Squelch:	Adjustable; threshold 0.5uV
ANL:	Switchable
Noise Blanker:	RF Type
Audio Output Power:	4 Watts into 8 ohms Max.
Audio Frequency Response:	300 to 2800 Hz
Built-in Loudspeaker:	8 ohms, round
External Loudspeaker (Not Supplied):	8 ohms; disable internal speaker when connected.

THEORY OF OPERATION

INTRODUCTION

The NR100 40 channels Citizen Band Mobile Transceiver is constructed with a Phase Locked Loop frequency synthesizer to generate suitable RF signals for the double conversion receiver and the AM transmitter circuits.

The NR100 Block Diagram shall be used in associate with the following circuit description.

FREQUENCY GENERATION

A. PLL CIRCUITRY

PLL is an abbreviation of the Phase-Locked-Loop. An MC45106 PLL integrated circuit, working together with a transistor Voltage Controlled Oscillator (VCO), a microprocessor controlled channel selector, and a down conversion mixer circuit TA-7310 to form a closed loop feedback circuit to generate suitable RF frequencies required for a 40 channel 27MHz CB operation.

TR24 is a Crystal Oscillator to generate the reference frequency of 10.24MHz. This signal is fed into IC5's reference frequency counter (pin 3) to obtain a phase comparison reference frequency of 10KHz to its phase detector.

TR25 and Varicap Diodes D94 and D30 formed a Voltage Controlled Oscillator. The control voltage is obtained from the phase detector output (pin 7) of IC5 Oscillator to operate in a frequency range of 16.27 ~ 16.71MHz. The output of the VCO is buffered by TR26 to fed the receiver and transmitter circuit.

IC10 TA7310P consists of an amplifier, an oscillator and a mixer. The oscillator is a crystal oscillator operated in a frequency trimmed by inductors and a varicap to provide different offset frequency settings in AM (14.010MHz), The output frequencies could be further trimmed by VR507 and varicap D124 in Receive Mode for "Clear Tune" operation.

Part of the VCO output is coupled to the buffer amplifier in IC10 (pin 7). It is then mixed with the 14.010MHz oscillator output to provide the PLL programmable divider input frequency of 2.26 ~ 2.70MHz at pin 6. The signal is fed to pin 2 of IC5 through a low pass filter circuit.

A microprocessor controlled channel switch circuit is employed to provide the division ratio to IC5 (pins 10 ~ 18) with correspondence to the channel number (1 ~ 40) selected by the user. The PLL input frequency (2.26 ~ 2.70MHz) is divided by the division ratio set by the channel selector to phase compare with the 10KHz reference frequency. Any phase difference will result in a change of DC voltage output to the VCO. When the VCO frequency reaches the desired value, the DC output to the VCO stabilizes and the loop is in "locked" condition.

The Lock Detector output (pin 8) of IC5 is used to inhibit the transmitter PTT and receiver audio circuits to ensure the radio always operate on the correct channel frequencies.

Both the PLL and CPU Integrated Circuits are molded in epoxy and are not serviceable by the users.

B. 10.695MHZ SECOND OFFSET OSCILLATOR

TR-30 is a crystal oscillator operates at a center frequency of 10.695MHz to provides off-set frequency to L44 of the Tx mixer (IC9), which mixes with PLL VCO output to provide correct transmitting spot frequencies in AM operation.

C. FREQUENCY CALCULATIONS

The VCO frequency is obtained from the following calculation;

$$f_{VCO} = f_{off\text{-}set} + N f_r$$

Where

f_{VCO} = VCO frequency.

N = Programming Code for divider output.

f_r = Reference Frequency step, 10 KHz (0.01 MHz)

i.e. At channel #1, the corresponding N code is 226

f_{VCO} = 14.010 + 226 x 0.01 = 16.270 MHz

Since the mixer output determined by two factors: The second offset oscillator output and the PLL/VCO output.

1) Transmitter Operation

The VCO output is mixed with the second off-set oscillator signal and applied to the Tx mixer IC9 through band pass filters L43 and L44.

- For channel 1, the output of Tx mixer is 16.270 + 10.695 MHz = 26.965 MHz (Ch 1 Tx frequency).

2) Receiver Operation

The output frequencies of PLL and offset oscillators remained the same for Rx operation.

For channel 1, the receiving frequency is 26.965 MHz

- Signal at 1st Local Oscillator Mixer is 26.965 – 16.270 MHz = 10.695 MHz (First IF)
- Signal at 2nd Local Oscillator Mixer is 10.695 – 10.240 MHz = 455 KHz (Second IF)
- Signal is detected by diodes at 455 KHz to recover audio

CIRCUIT DESCRIPTION

A. Power Supply Circuits

13.8V DC supplied from the DC Power connector at the back of the radio are protected against reversed connection by D93, and filtered by an AF choke T1. This supplies voltage directly to the audio power amplifier IC8, AM Modulator TR51 and the 8V regulator TR41.

Two transistor switches TR38 and TR37 turns on and off under the control of IC4 (pin7) to supply voltage to the transmitter and receiver circuits. The Tx/Rx LED will grow in red on transmit and green during receive.

B. Channel Selector

The channel selector circuit is divided into two parts. The pulsed rotary encoder switch SW701 with the LED display and its driver circuits in one board. The CPU IC701, PLL IC707 and its associated driver circuits are located in another PCB and are molded in epoxy. Only 40 Citizen Band Channels are mask programmed into the CPU. No extra or spare leads on the CPU/PLL are accessible by the users.

When the channel switch (SW701) is turned clockwise, it sends a pulse to pin 3 or IC701. The CPU will find in its memory look-up table the correct PLL programmable divider division ratio and increment the channel number by 1, the action will revert to decrement when the channel switch is turned anti-clockwise. The data output are latched by IC704 and IC705 to drive the channel display LEDs, and latched by IC706 as the PLL division ratio for use by IC707.

A EEPROM in the CPU circuit will hold the information of last channel selected, so that the same channel will come back automatically after the radio is switch back on after being turned off.

C. Frequency Synthesizer

Please refer to the previous sections for detailed description.

D. AM Modulation, Power Control and ALC

Input from the microphone is controlled by the Mic-Gain potentiometer VR505 and amplified by IC4. The amplified signal is used to drive the AM Modulator circuit consists of TR49 & 51.

There are two signals at the base of TR49, the DC voltage controlled by VR13 (RF Power Level Adjust), and the AF level from pin 1 of IC4. The DC bias controls the operating point of the Darlington pair transistors TR50 & 51 to provide power supply to the RF Power transistors TR43 & 44, which controls the RF Carrier Power output of the radio. The AF signal is amplified and superimposed on the DC bias to create high level AM Modulation in TR43 & 44.

The maximum modulation is regulated by the Automatic Level Control (ALC) circuit consists of TR53, TR34 and TR32.

TR53 is a comparator circuit with setpoint adjusted by VR14. When TR53 conducts, the signal is half wave rectified by D83 to drive the current amplifier TR34, which in turn drives TR32 on and shunt down the Mic Audio signal at the input of IC4. The RC circuit (C135, R176 ~ 178) at the base of TR32 ensures the smooth operation of the ALC.

When the modulator overmodulates, AC voltages at emitter of TR53 will increase, and TR53 will conduct more during the negative cycle of the modulation signal, which increases the collector current of TR53 and turn TR43/TR32 on. The audio signal is shunted, input to the modulator decreases until it reaches the Modulation Limit set point of VR14.

E. Receiver Circuits

RF signal from the antenna is coupled to the receiver circuit by C43, the signal passes through a pair of PIN fast switching diodes (D15/16), which are biased with AGC and a fixed voltages to protect the receiver front end from transmitter output and other excessively strong signals.

The signal is then amplified by a low noise MOSFET (TR51), passes a bandpass filter (L7 ~ L8) and mixed with the first local oscillator signal in TR18. The resultant first IF signal of 10.695MHz goes through a series of filter circuits, including those used for Noise Blanker operation, and come to the second mixer.

The IF signal is mixed with 10.240MHz second local oscillator frequency to product 455KHz second IF. The second IF signal is filtered and amplified by two stages of amplifiers (TR9, TR10 and 11), and then coupled to a diode detector (D23 & 24) for demodulation.

The demodulated audio signal is amplified by TR15 and routed to the audio power amplifier IC8 via the volume control VR502. The audio amplifier is muted by voltages from D80 when Tx is active.

The output of IF amplifiers are also connected to an IC amplifier circuit (IC1) to provide Signal Meter DC voltages (pins 5 ~ 7), and the operation of Squelch Circuit (pins 8 ~ 10 & TR16). IC1 also provide AGC voltages (pins 1 ~ 3 & pins 12 ~ 14) to the receiver front end and the PIN protection diode D16.

The Noise Blanker taps noise signal from the first IF filter network (L10 ~ L12), amplify the signal by TR1 ~ TR3, demodulate it by D1 and D2. The detected noise level is further amplified by TR5 & TR6 to control TR7, which shunts the signal output level in the IF filter network (L12). The IF gain for the noise signal is therefore reduced.

F. Transmitter Circuit

The RF signals generated from the PLL and the second offset oscillator / balanced mixer are assembled at RF Mixer IC9 to provide the final transmitting signal. The signal passes through a bandpass filter (L40 & 42) to two stages of RF pre-drivers (TR45 & 46), RF driver TR44, the final stage amplifier TR43, a low pass filter network and then to the antenna.

Modulated voltages only apply to the collectors of TR43 and TR44. Please refer to the previous sections for detail description of frequency generation and modulation.

The output signal is picked up by D86 & D87 to give relative RF output power meter indication, and a Standing Wave Ratio (SWR) sampling circuit consists of D401 and D402 provides the SWR meter indication feature.

G. Compander and PA Bridge Circuit

The NR100 radio is equipped with a Compander circuit, which will be marketed under the trademark of "Clear Drive". The feature could be enabled or turned off by a front panel switch labeled as "C.D."

The Compander circuit consists of IC901 is employed. The circuit can be divided into three parts:

- Compressor
- Low Pass Audio Filter
- Expander

Transmit audio from the microphone is routed to pin 8 of IC901for amplification, and then to the internal Compressor circuit for audio processing. Output from the Compressor (pin 3) is routed

through an active three pole low pass filter (pins 1 & 2) to the Mic Gain control. All the excessive high frequency signals are suppressed by the filter before transmission.

The reference level of the compressor is set by R905 to around 5mV microphone input. R901 is inserted into the circuit to obtain suitable modulation level.

Received audio from the detector is sent to pin 15 for amplification, and then to the internal Expander circuit for audio processing. The reference level is set by R908 to around 12dB SINAD, the output is taken from pin 19 and is connected to the Volume control on the front panel.

Pin 12 of IC901 provides the bypass feature. When a high level is present, both the Compressor and the Expander are operative. When pin 12 is connected to ground potential, both the Compressor and the Expander are bypassed – All the audio level passes through IC901 without getting any level processing.

The PA amplifier circuit is integrated into the Compander circuit PCB, which consists of TR901 and some R-C circuits. This amplifier bridges between the microphone and audio amplifier input circuit. TR901 is normally off during CB radio operation, and would become active when the PA feature is selected on the front panel.

H. Electro-Luminescent Back Light Front Panel

The NR100 radio is fit with a colored Electro-Luminescent (E.L.) back light front panel. The E.L. panel is driven by a single transistor audio frequency DC-AC inverter TR351. The intensity of the E.L. panel is achieved by limiting the current input to the inverter with the Dimmer switch S514. The operating frequency of the inverter is in the range of 1KHz.

ALIGNMENT PROCEDURE

MEASUREMENT CONDITION

The following sections describes the alignment procedure for the NR100 mobile transceiver under following reference environment conditions:

Temperature:	25 Degrees C (77 Degrees F)
Relative Humidity:	65%
Power Supply Voltage:	13.8V +/- 3%

TEST EQUIPMENT / TOOLS REQUIRED

The following list of equipment are recommended for use in setting up the radio properly. Please ensure that all test equipment are calibrated according to the manufacturer's instructions.

- 50 ohm resistive load for the antenna output with 20 Watts power rating
- Frequency Counter 30MHz, +/-100Hz tolerance, high input impedance and high sensitivity
- HF Signal Generator, 30MHz with AM modulation, and RF output attenuators
- Oscilloscope, 100MHz, high input impedance
- Digital multi-meter
- 8 ohms 5 Watts resistor as Loudspeaker load
- Audio signal generators, 10Hz to 20KHz, 600 Ohms impedance with attenuators (2nd sets Optional)
- RF Wattmeter, 50 ohms 15 Watts, thermocoupled
- Regulated DC Power Supply, 13.8V 5A
- Dummy Microphone plugs
- VTVM, 0.1mV sensitivity
- Circuit Diagram for NR100
- PCB Layout for NR100
- Tuning tools for the RF/IF transformers and the VR potentiometers
- Spectrum Analyzer (Optional)

PLL CIRCUIT ALIGNMENT

Connect the radio to 13.8V DC power supply, terminate the antenna terminal by a 50ohm 20W dummy load. Turn on the frequency counter, oscilloscope, digital multimeter and the radio, wait 30 minutes before adjusting any frequency determining components.

A. Reference Oscillator Frequency

Check [10.2400 MHz]

1. Connect the frequency counter to pin terminal between **C-83** and **C-85**.
2. Check counter reads 10.2400 MHz.
3. Tolerance within ±200 Hz is acceptable. Otherwise replace the 10.24MHz crystal. (If frequency error is more than ± 500Hz, change **C-81** for other values for freq. Correction)

B. Second Offset Frequency Oscillator

Check 10.695MHz [AM]

1. Connect frequency counter to **TP-6 (C73/D27).**
2. **10.695MHz AM operation:**
   Set the mode selector to AM, and press PTT key switch to transmit, adjust **L-26** to obtain 10.695MHz (+0, or -100Hz) on the frequency counter.

C. PLL Mixer IC Input Level Adjustment

1. Set the "Clear Tune" control to center position. Set channel selector to CH 20.
2. Connect Oscilloscope to **TP-4** between **C-106** and **L-50.**
3. Adjust **L-22** for maximum RF to the Mixer input.

D. PLL VCO Adjustment

1. Set the "Clear Tune" Control to centerposition. Set channel selector to CH 20.
2. Connect Oscilloscope to **TP-3** at **R74.**
3. Adjust L-18 for maximum VCO RF output.
4. Connect DC voltmeter to **TP-2** between **R-116** and **R-117.**
5. Adjust **L-17** to obtain DC 3V ± 0.1V VCO Control Voltage.

E. PLL Off-set Frequency Adjustment

Set the radio to Receiving Mode :

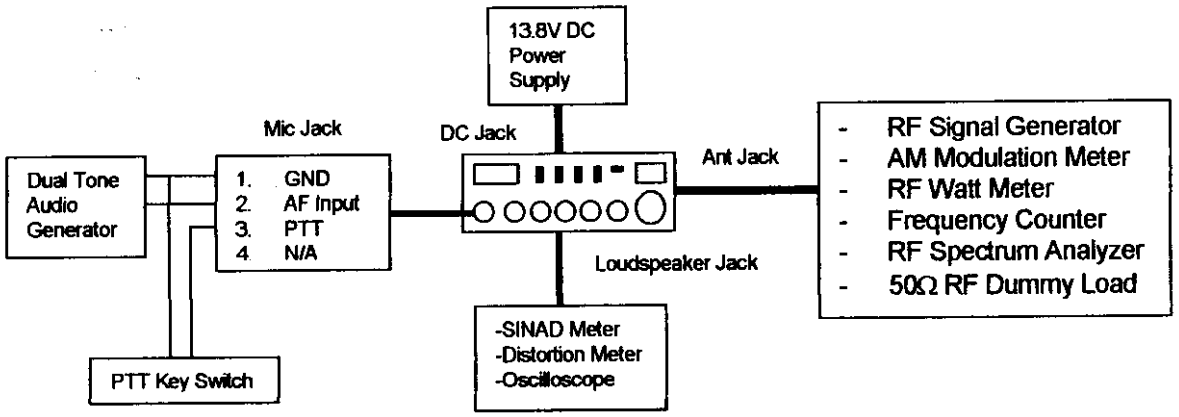
1. Connect frequency counter to **TP-3** at **R74.**
2. Set the "Clear Tune" Control to center position.
3. Set channel selector to CH. 20.
4. Adjust **L-20** for **16.510 MHz** ± 50Hz.

TRANSMITTER ALIGNMENT

Note: Unless otherwise specified, adjust Mic Gain control on the front panel to fully clockwise position for all following tests.

A. Test Set-Up

Set up test equipment with the NR100 radio as indicated below:



B. AM RF Power Output Adjustment

1. Set mode selector to AM.
2. Select the channel selector to CH-20.
3. Press PTT to transmit.
4. Adjust L33 for maximum RF Power output
5. Adjust **VR-13** for 4W RF Power output. (Without modulation)

C. AM Modulation Adjustment

1. Apply 1KHz 50mV rms. AF signal to Microphone input connector pin 2.
2. Activate PTT to transmit. Compander OFF. Adjust VR-14 for 90% modulation.

D. Compander Functional Test - Transmitter

1. Apply 1KHz 2mV rms. AF signal to Microphone input connector pin 2.
2. Activate PTT to transmit. Compander OFF.
3. Observe modulation level between 20-80%.
4. Switch Compander to ON
5. Observe the modulation level increases to around 90%.
6. Increase signal generator level from 2mV to 100mV, Compander ON.
7. Observe the modulation level remains to be less than 100%.

E. Advanced Test Procedures for Modulation

Following advanced test procedure requires optional/advanced test equipment setup by experienced technical person, and is not normally required in a field repair environment.

i) AM Modulation Monitor

- Apply 1KHz 50mV rms. AF signal to Microphone input connector pin 2 of the radio, and to the Y input (Usually marked as Timebase) of the oscilloscope.
- Monitor RF output waveform with X input (usually marked as CH1) of the oscilloscope.
- Activate PTT to transmit. Compander OFF.
- Confirm the AM Modulation displayed in the oscilloscope is less than 100% as in Fig iA.

FIG iA - AM Modulation Monitor

Modulation Level = (a-b) x 100% ÷ (a+b)

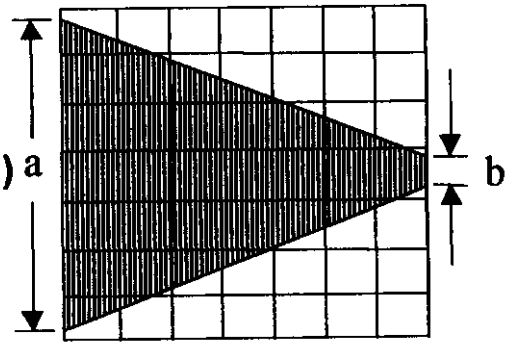


FIG iB - No Modulation

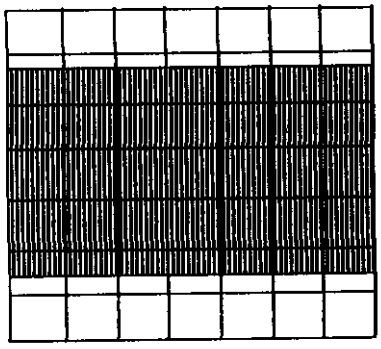


FIG iC - 100% Modulation

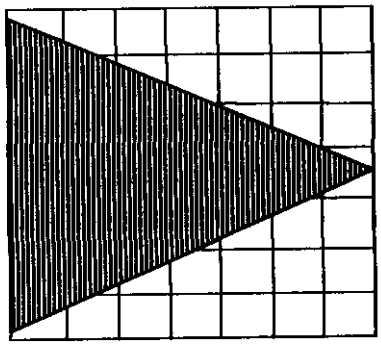
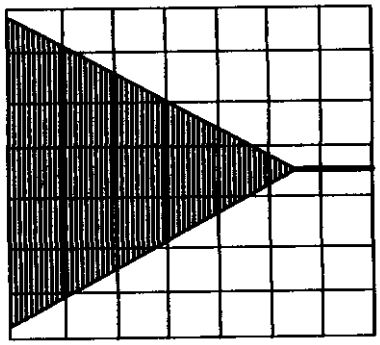


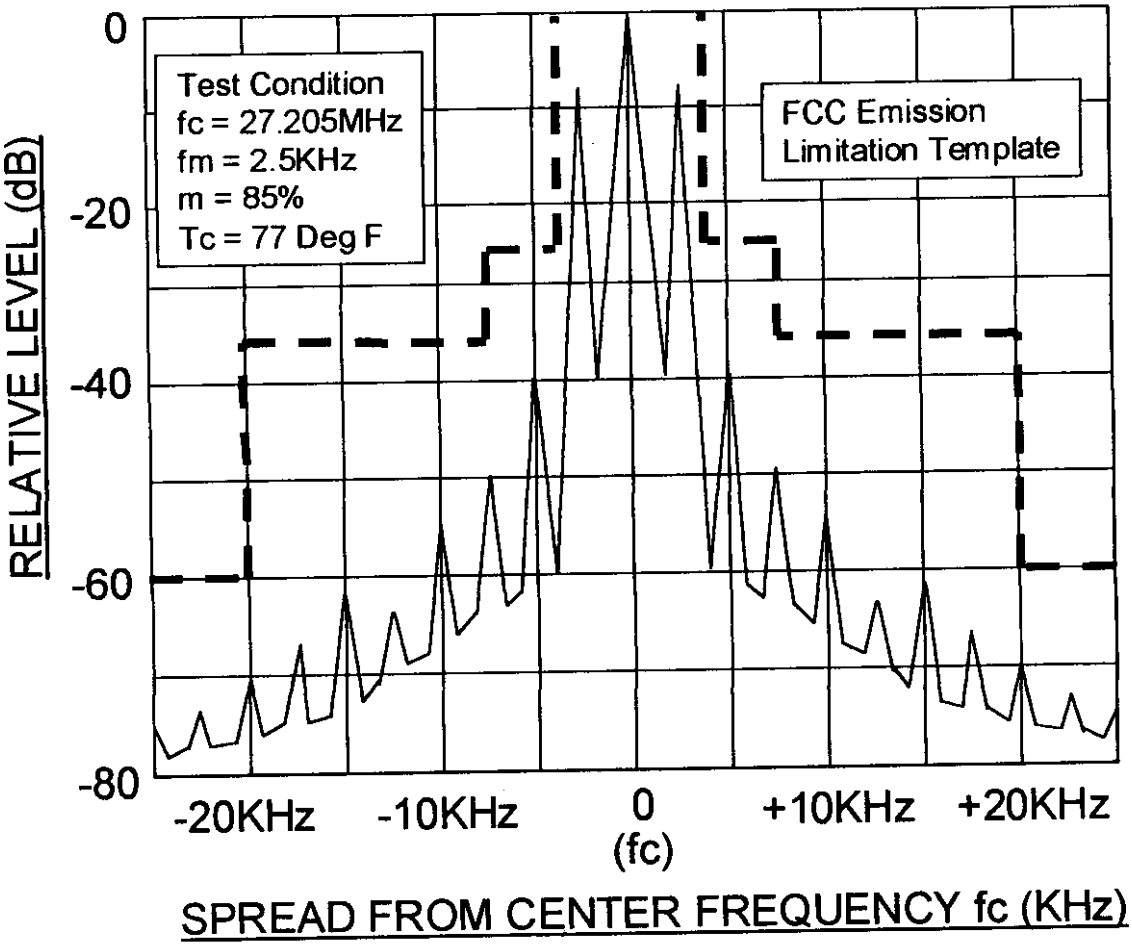
FIG iD - Over Modulation >100%



ii) FCC Emission Limitation Check

- Set up equipment as in i) AM Modulation Monitor Test, Compander OFF.
- Couple the Spectrum Analyzer input to the RF Dummy Load
- Apply 2.5KHz 50mV rms. audio tones signal to the Microphone input connector pin 2.
- Activate PTT to transmit, adjust AM Modulation level to 85% (see Fig iA).
- Observe on the Spectrum Analyzer that the Radio's RF output are within the FCC limits
- Repeat test with Compander ON.

85% MODULATION SPECTRUM EMISSION LIMITATION TEST



APPENDIX 7

CIRCUITS AND DEVICES TO STABILIZE FREQUENCY

All 40 channels of transmitting, and receiving, frequencies are provided by PLL (Phase Locked Loop) circuitry.

The purpose of the PLL is to provide a multiple number of frequencies from a VCO (Voltage Controlled Oscillator) with quartz crystal accuracy and stability locked to crystal oscillator reference frequency.

The reference crystal oscillator frequency is 10.24 MHz.

APPENDIX 8

1. Circuits For Suppression Of Spurious Radiation

The tuning circuit between the output of final amp Q603 and antenna, 4-stage PI: network consisting of L33, C166, C165, L62, C161, L61, C160, L31, C158, C340, and L63 suppress spurious emissions.

This network also serves to match the impedance between TX power amp and the antenna.

2. AM Modulation

Input from the microphone is controlled by the Mic-Gain potentiometer VR505 and amplified by IC4. The amplified signal is used to drive the AM Modulator circuit consists of TR49 & 51.

There are two signals at the base of TR49, the DC voltage controlled by VR13 (RF Power Level Adjust), and the AF level from pin 1 of IC4. The DC bias controls the operating point of the Darlington pair transistors TR50 & 51 to provide power supply to the RF Power transistors TR43 & 44, which controls the RF Carrier Power output of the radio. The AF signal is amplified and superimposed on the DC bias to create high level AM Modulation in TR43 & 44.

The maximum modulation is regulated by the Automatic Level Control (ALC) circuit consists of TR53, TR34 and TR32.

TR53 is a comparator circuit with setpoint adjusted by VR14. When TR53 conducts, the signal is half wave rectified by D83 to drive the current amplifier TR34, which in turn drives TR32 on and shunt down the Mic Audio signal at the input of IC4. The RC circuit (C135, R176 ~ 178) at the base of TR32 ensures the smooth operation of the ALC.

When the modulator overmodulates, AC voltages at emitter of TR53 will increase, and TR 53 will conduct more during the negative cycle of the modulation signal, which increases the collector current of TR53 and turn TR43/TR32 on. The audio signal is shunted, input to the modulator decreases until it reaches the Modulation Limit set point of VR14.

APPENDIX 9

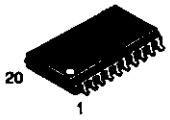
PLL DATA SHEETS

FIVE (5) PAGES FOR MC145106 PLL FOLLOW THIS SHEET

MC145106

PLL Frequency Synthesizer
CMOS

P SUFFIX
PLASTIC DIP
CASE 707



DW SUFFIX
SOG PACKAGE
CASE 751D

ORDERING INFORMATION

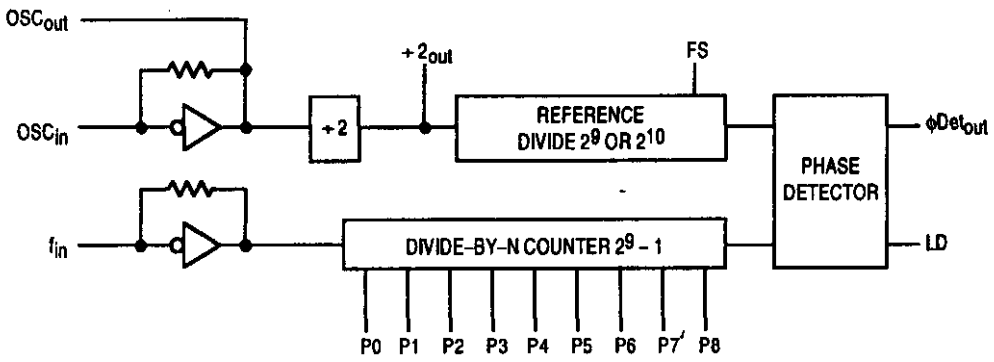
MC145106P	Plastic DIP
MC145106DW	SOG Package

The MC145106 is a phase–locked loop (PLL) frequency synthesizer constructed in CMOS on a single monolithic structure. This synthesizer finds applications in such areas as CB and FM transceivers. The device contains an oscillator/amplifier, a 2^{10} or 2^{11} divider chain for the oscillator signal, a programmable divider chain for the input signal, and a phase detector. The MC145106 has circuitry for a 10.24 MHz oscillator or may operate with an external signal. The circuit provides a 5.12 MHz output signal, which can be used for frequency tripling. A 2^9 programmable divider divides the input signal frequency for channel selection. The inputs to the programmable divider are standard ground–to–supply binary signals. Pull–down resistors on these inputs normally set these inputs to ground enabling these programmable inputs to be controlled from a mechanical switch or electronic circuitry.

The phase detector may control a VCO and yields a high level signal when input frequency is low, and a low level signal when input frequency is high. An out–of–lock signal is provided from the on–chip lock detector with a "0" level for the out–of–lock condition.

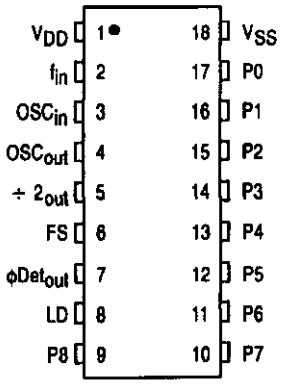
- Single Power Supply
- Wide Supply Range: 4.5 to 12 V
- Provision for 10.24 MHz Crystal Oscillator
- 5.12 MHz Output
- Programmable Division Binary Input Selects up to 2^9
- On–Chip Pull–Down Resistors on Programmable Divider Inputs
- Selectable Reference Divider, 2^{10} or 2^{11} (Including ÷ 2)
- Three–State Phase Detector
- See Application Note AN535 and Article Reprint AR254
- Chip Complexity: 880 FETs or 220 Equivalent Gates
- See the MC145151–2 and MC145152–2 for Higher Performance and Added Flexibility

BLOCK DIAGRAM

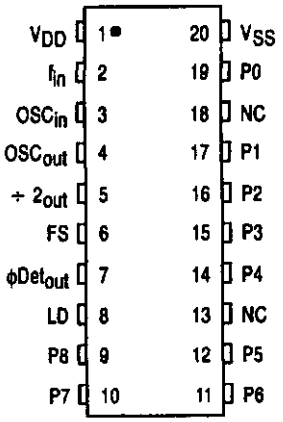


PIN ASSIGNMENTS

PLASTIC DIP



SOG PACKAGE



NC = NO CONNECTION

MAXIMUM RATINGS (Voltages Referenced to V_{SS})

Parameter	Symbol	Value	Unit
DC Supply Voltage	V_{DD}	− 0.5 to + 12	V
Input Voltage, All Inputs	V_{in}	− 0.5 to V_{DD} + 0.5	V
DC Input Current, per Pin	I	± 10	mA
Operating Temperature Range	T_A	− 40 to + 85	°C
Storage Temperature Range	T_{stg}	− 65 to + 150	°C

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation it is recommended that V_{in} and V_{out} be constrained to the range $V_{SS} \le (V_{in}$ or $V_{out}) \le V_{DD}$.

ELECTRICAL CHARACTERISTICS (T_A = 25°C Unless Otherwise Stated, Voltages Referenced to V_{SS})

Characteristic		Symbol	V_{DD} Vdc	All Types			Unit
				Min	Typ*	Max	
Power Supply Voltage Range		V_{DD}	—	4.5	—	12	V
Supply Current		I_{DD}	5.0	—	6	10	mA
			10	—	20	35	
			12	—	28	50	
Input Voltage	"0" Level	V_{IL}	5.0	—	—	1.5	V
			10	—	—	3.0	
			12	—	—	3.6	
	"1" Level	V_{IH}	5.0	3.5	—	—	
			10	7.0	—	—	
			12	8.4	—	—	
Input Current	"0" Level	I_{in}	5.0	−5.0	−20	−50	µA
FS, Pull–Up Resistor Source Current)			10	−15	−60	−150	
			12	−20	−80	−200	
(P0 – P8)			5.0	—	—	−0.3	
			10	—	—	−0.3	
			12	—	—	−0.3	
(FS)	"1" Level		5.0	—	—	0.3	
			10	—	—	0.3	
			12	—	—	0.3	
(P0 – P8, Pull–Down Resistor Sink Current)			5.0	7.5	30	75	
			10	22.5	90	225	
			12	30	120	300	
(OSC_{in}, f_{in})	"0" Level		5.0	−2.0	−6.0	−15	
			10	−6.0	−25	−62	
			12	−9.0	−37	−92	
(OSC_{in}, f_{in})	"1" Level		5.0	2.0	6.0	15	
			10	6.0	25	62	
			12	9.0	37	92	
Output Drive Current		I_{OH}					mA
(V_O = 4.5 V)	Source		5.0	−0.7	−1.4	—	
(V_O = 9.5 V)			10	−1.1	−2.2	—	
(V_O = 11.5 V)			12	−1.5	−3.0	—	
(V_O = 0.5 V)	Sink	I_{OL}	5.0	0.9	1.8	—	
(V_O = 0.5 V)			10	1.4	2.8	—	
(V_O = 0.5 V)			12	2.0	4.0	—	
Input Amplitude		—					V p–p
(f_{in} @ 4.0 MHz)			—	1.0	0.2	—	Sine
(OSC_{in} @ 10.24 MHz)			—	1.5	0.3	—	
Input Resistance		R_{in}					MΩ
(OSC_{in}, f_{in})			5.0	—	1.0	—	
			10	—	0.5	—	
			12	—	—	—	
Input Capacitance		C_{in}	—	—	6.0	—	pF
(OSC_{in}, f_{in})							
Three–State Leakage Current		I_{OZ}	5.0	—	—	1.0	µA
(ϕDet_{out})			10	—	—	1.0	
			12	—	—	1.0	
Input Frequency		f_{in}	4.5	0	—	4.0	MHz
(– 40 to + 85°C)			12	0	—	4.0	
Oscillator Frequency		OSC_{in}	4.5	0.1	—	10.24	MHz
(– 40 to + 85°C)			12	0.1	—	10.24	

*Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

TYPICAL CHARACTERISTICS*

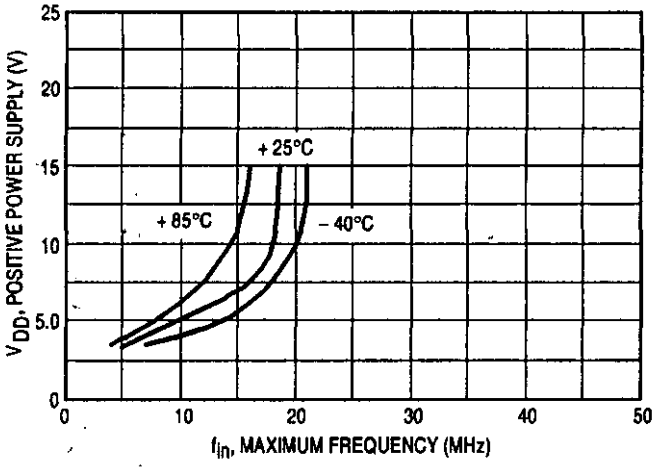


Figure 1. Maximum Divider Input Frequency versus Supply Voltage

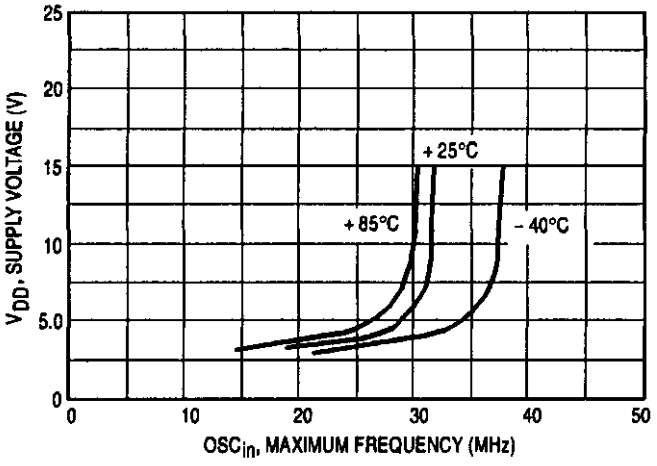


Figure 2. Maximum Oscillator Input Frequency versus Supply Voltage

* Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

TRUTH TABLE

Selection									
P8	P7	P6	P5	P4	P3	P2	P1	P0	Divide by N
0	0	0	0	0	0	0	0	0	2*
0	0	0	0	0	0	0	0	1	3*
0	0	0	0	0	0	0	1	0	2
0	0	0	0	0	0	0	1	1	3
0	0	0	0	0	0	1	0	0	4
•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•
0	1	1	1	1	1	1	1	1	255
•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•
1	1	1	1	1	1	1	1	1	511

1: Voltage level = V_{DD}.
0: Voltage level = 0 or open circuit input.
* The binary setting of 00000000 and 00000001 on P8 to P0 results in a 2 and 3 division which is not in the $2^N - 1$ sequence. When pin is not connected the logic signal on that pin can be treated as a "0".

PIN DESCRIPTIONS

P0 – P8
Programmable Inputs (PDIP — Pins 17 – 9; SOG — Pins 19, 17 – 14, 12 – 9)

Programmable divider inputs (binary).

f_{in}
Frequency Input (PDIP, SOG — Pin 2)

Frequency input to programmable divider (derived from VCO).

OSC_{in}, OSC_{out}
Oscillator Input and Oscillator Output (PDIP, SOG — Pins 3, 4)

Oscillator/amplifier input and output terminals.

LD
Lock Detector (PDIP, SOG — Pin 8)

LD is high when loop is locked, pulses low when out–of–lock.

ϕDet_{out} (PDIP, SOG — Pin 7)

Signal for control of external VCO, output high when f_{in}/N is less than the reference frequency; output low when f_{in}/N is greater than the reference frequency. Reference frequency is the divided down oscillator — input frequency typically 5.0 or 10 kHz.

NOTE

Phase Detector Gain = $V_{DD}/4\pi$.

FS
Reference Oscillator Frequency Division Select (PDIP, SOG — Pin 6)

When using 10.24 MHz OSC frequency, this control selects 10 kHz, a "0" selects 5.0 kHz.

$\div 2_{out}$ (PDIP, SOG — Pin 5)

Reference OSC frequency divided by 2 output; when using 10.24 MHz OSC frequency, this output is 5.12 MHz for frequency tripling applications.

V_{DD}
Positive Power Supply (PDIP, SOG — Pin 1)

V_{SS}
Ground (PDIP — Pin 18, SOG — Pin 20)

PLL SYNTHESIZER APPLICATIONS

The MC145106 is well suited for applications in CB radios because of the channelized frequency requirements. A typical 40 channel CB transceiver synthesizer, using a single crystal reference, is shown in Figure 3 for receiver IF values of 10.695 MHz and 455 kHz.

In addition to applications in CB radios, the MC145106 can be used as a synthesizer for several other systems. Various frequency spectrums can be achieved through the use of proper offset, prescaling, and loop programming techniques. In general, 300 – 400 channels can be synthesized using a single loop, with many additional channels available when multiple loop approaches are employed. Figures 4 and 5 are examples of some possibilities.

In the aircraft synthesizer of Figure 5, the VHF loop (top) will provide a 50 kHz, 360 channel system with 10.7 MHz R/T offset when only the 11.0500 MHz (transmit) and 12.1200 MHz (receive) frequencies are provided to mixer #1. When these signals are provided with crystal oscillators, the result is a three crystal 360 channel, 50 kHz step synthesizer. When using the offset loop (bottom) in Figure 5 to provide the indicated injection frequencies for mixer #1 (two for transmit and two for receive) 360 additional channels are possible. This results in a 720–channel, 25 kHz step synthesizer which requires only two crystals and provides R/T offset capability. The receive offset value is determined by the 11.31 MHz crystal frequency and is 10.7 MHz for the example.

The VHF marine synthesizer in Figure 4 depicts a single loop approach for FM transceivers. The VCO operates on frequency during transmit and is offset downward during receive. The offset corresponds to the receive IF (10.7 MHz) for channels having identical receive/transmit frequencies (simplex), and is (10.7 – 4.6 = 6.1) MHz for duplex channels. Carrier modulation is introduced in the loop during transmit.

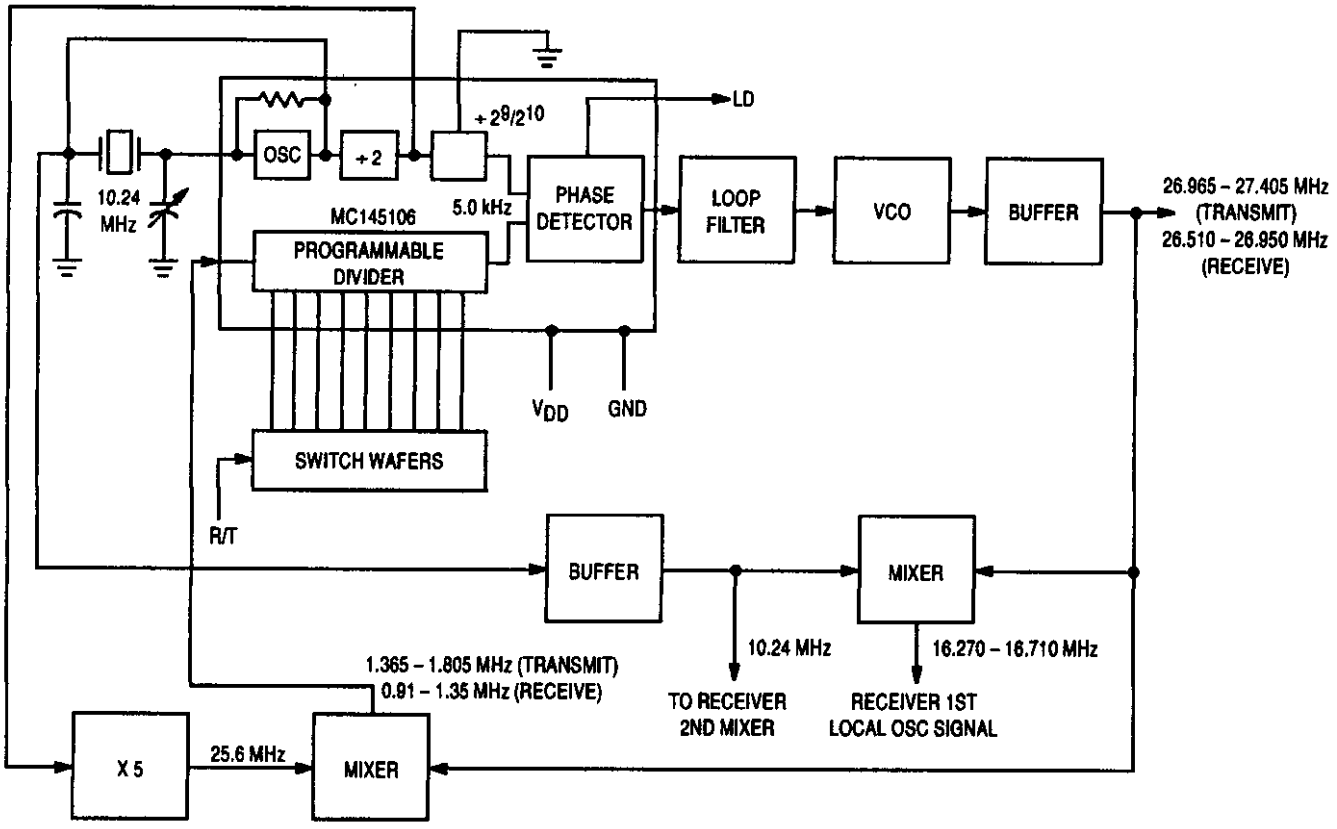


Figure 3. Single Crystal CB Synthesizer Featuring On–Frequency VCO During Transmit

APPENDIX 10

FINAL RF AMPLIFIER DATA SHEETS

THREE (3) PAGES FOR KTC2078 FOLLOW THIS SHEET

Parts Specification

C.B. Mobile Transceiver

2SC1969 TR-43 NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1969 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on HF band mobile radio applications.

FEATURES

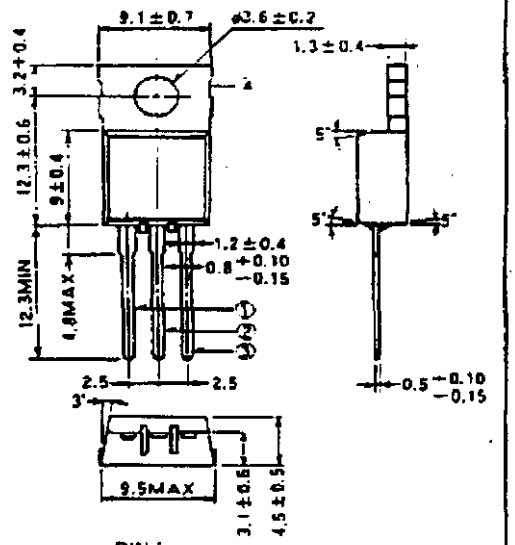
- High power gain: $G_{pe} \geqq 12dB$
  @V_{CC} = 12V, P_O = 16W, f = 27MHz
- Emitter ballasted construction for high reliaiblity and good performances.
- TO-220 package similarly is combinient for mounting.
- Ability of withstanding infinite load VSWR when operated at V_{CC} = 16V, P_O = 20W, f = 27MHz.

APPLICATION

10 to 14 watts output power class AB amplifiers applications in HF band.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		60	V
V_{EBO}	Emitter to base voltage		5	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	25	V
I_C	Collector current		6	A
P_C	Collector dissipation	T_a = 25°C	1.7	W
		T_C = 25°C	20	W
T_j	Junction temperature		150	°C
T_{stg}	Storage temperature		−55 to 150	°C
$R_{th\text{-}a}$	Thermal resistance	Junction to ambient	73.5	°C/W
$R_{th\text{-}c}$		Junction to case	6.25	°C/W

Note: Above parameters are guaranteed independently.

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E = 5mA, I_C = 0	5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C = 1mA, I_E = 0	60			V
$V_{(BR)CES}$	Collector to emitter breakdown voltage	I_C = 10mA, R_{BE} = ∞	25			V
I_{CBO}	Collector cutoff current	V_{CB} = 30V, I_E = 0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB} = 4V, I_C = 0			100	μA
h_{FE}	DC forward current gain*	V_{CE} = 12V, I_C = 10mA	10	50	180	—
P_O	Output power	V_{CC} = 12V, P_{in} = 1w, f = 27MHz	16	18		W
η_C	Collector efficiency		60	70		%

Note: *Pulse test: P_W = 150μs, duty = 5%.
Above parameters, ratings, limits and conditions are subject to change

Item	X	A	B	C	D
h_{FE}	10-25	20-45	35-70	55-110	90-180

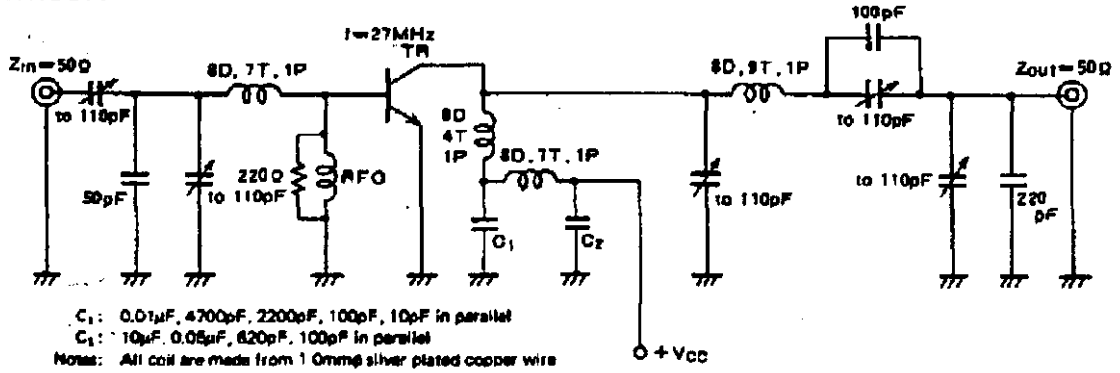
Parts Specification

C.B. Mobile Transceiver

2SC1969

NPN EPITAXIAL PLANAR TYPE

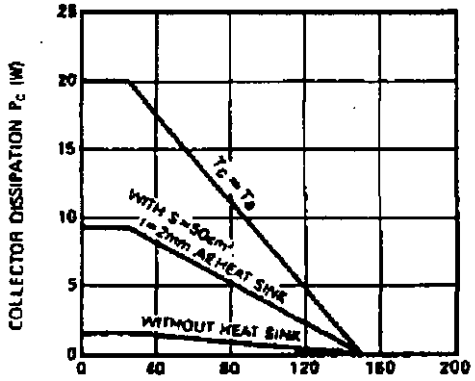
TEST CIRCUIT



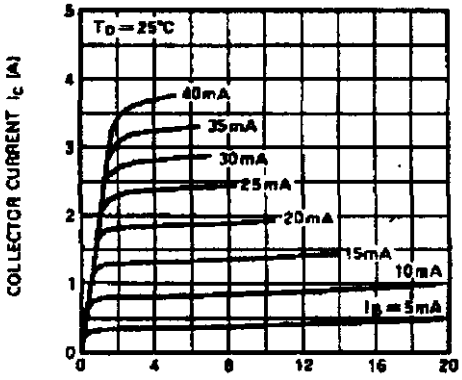
C_1: 0.01μF, 4700pF, 2200pF, 100pF, 10pF in parallel
C_2: 10μF, 0.05μF, 620pF, 100pF in parallel
Notes: All coil are made from 1.0mmφ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

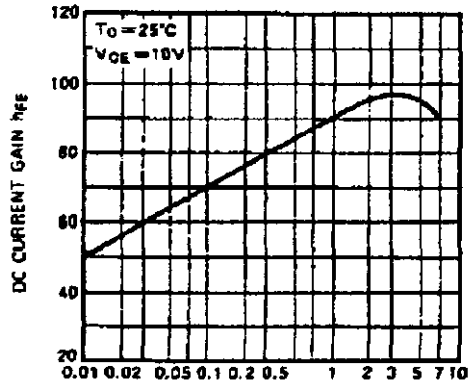
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



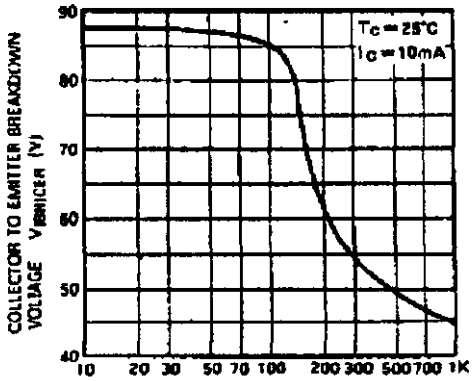
COLLECTOR CURRENT VS. COLLECTOR TO EMITTER VOLTAGE



DC CURRENT GAIN VS. COLLECTOR CURRENT



COLLECTOR TO EMITTER BREAKDOWN VOLTAGE VS. BASE TO EMITTER RESISTANCE

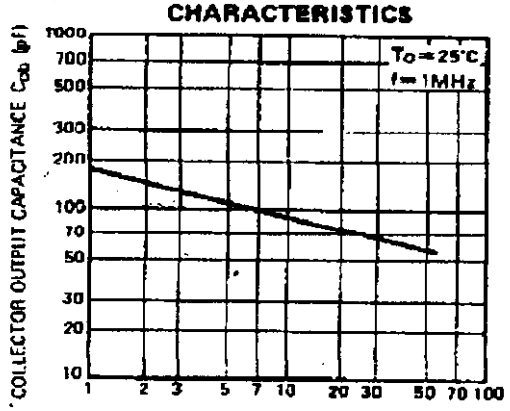


Parts Specification

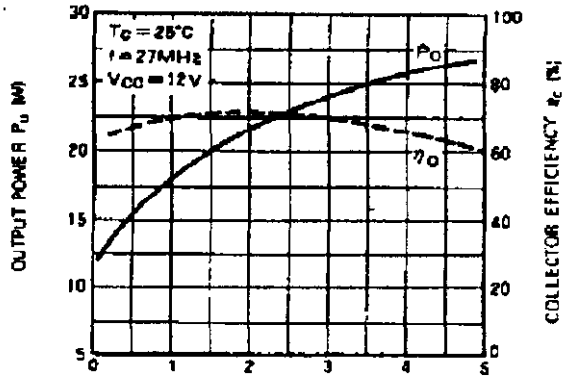
C.B. Mobile Transceiver

2SC1969 — **NPN EPITAXIAL PLANAR TYPE**

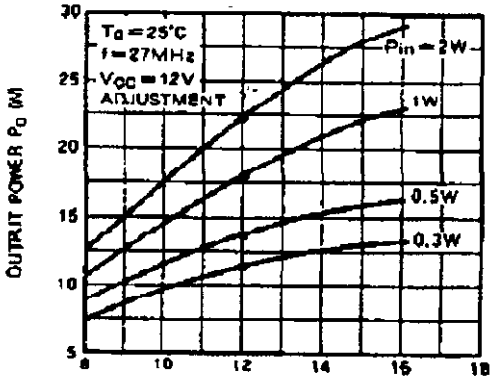
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



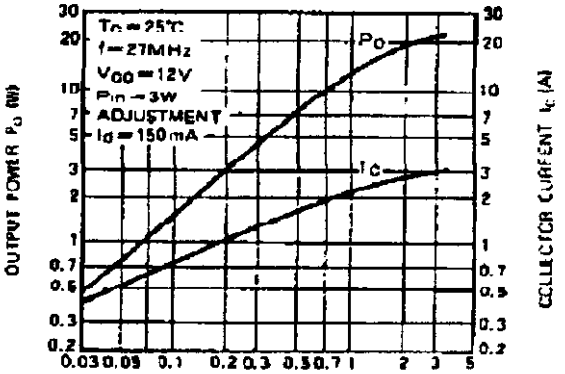
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



IN CASE AB OPERATING OUTPUT POWER COLLECTOR CURRENT VS. INPUT POWER



THIRD ORDER INTERMODULATION DISTORTION VS. OUTPUT POWER