BCM-220 User Manual

By BridgeCom Systems, Inc.

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TABLE OF CONTENTS

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CHAPTER 1: INTRODUCTION

Welcome

Thank you for purchasing the BCM-220 mobile two-way radio. The goal of the BCM-220 is to provide a cost-effective, feature rich, easy-to-use mobile radio for users of the 220 amateur radio spectrum. This Owner's Manual will acquaint you with the features and operation of the BCM-220. Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. Carefully read this manual in order to properly operate the radio before use.

Safety, Warnings, and Precautions:

Government law restricts the operation of unlicensed radio transmitters within government controlled territories. Illegal operation is punishable by fine or imprisonment or both. Refer service to qualified technicians only.

EXPLOSIVE ATMOSPHERIC HAZARDS (GASES, DUST, FUMES, etc.)
Shut OFF the BCM-220 while refueling or while parked at gasoline stations. Do not carry spare fuel containers in the trunk of your vehicle if your transceiver is mounted in the trunk area.

INJURY FROM RADIO FREQUENCY TRANSMISSIONS
Do not operate your BCM-220 when somebody is either touching the antenna or standing within two to three feet of it to avoid the possibility of radio frequency burns or related physical injury.

- Do NOT attempt to configure your transceiver while driving.

- The BCM-220 is designed for 13.8V DC Power. Do not use a 24V battery to power the BCM-220.

- Do not place the BCM-220 in excessively dusty, humid, or wet areas.

- As much as possible, keep the BCM-220 away from RF interfering devices.

- Do not transmit with HIGH output power for extended periods. The transceiver may overheat.

- If an abnormal order or smoke is detected coming from the BCM-220, turn OFF the radios or unplug the power immediately. Contact BridgeCom Systems TechSupport.

- Do not operate the transceiver when vehicle engine is stopped for extended periods. The vehicle engine may not start due to low battery.

- Do not use incompatible accessories from other manufactures. It could result in damage and or malfunction to the accessory and or to the radio. Only use BridgeCom Systems approved accessories.

Unpacking and Radio Preparation:

Electronic equipment (e.g. electronic fuel injection, anti-skid braking, and cruise control) in your vehicle may malfunction if not properly protected from the RF energy generated when the BCM-220 is transmitting. Enlist the aid of a knowledgeable Ham or vehicle mechanic in determining if the equipment will perform normally while transmitting.

Vehicle Power Cable Connection:

- The BCM-220 operates on 12V negative ground systems only! Check the battery polarity and voltage of vehicle before installing the transceiver. Decide whether to power the radio from the vehicle "HOT" wire line or the ignition key enabled ACC or ON wire.

- Check for an existing hole that is conveniently located in the firewall. This will allow for the power cable to easily pass through.

- If no hole exists, use a circle cutter to drill a hole, then install a rubber grommet.

- Run the power cable though the firewall and into the engine compartment.

- Connect the red lead to the (+) battery terminal and the black lead to the negative (-) battery terminal.

- Place the fuse as close to the battery as possible.

- Coil the surplus cable and secure it with a retaining band.

- Be sure to leave enough slack in the cables so the transceiver can be removed for servicing while keeping the power applied.

Install procedure for inside the vehicle:

For passenger safety, install the BCM-220 securely using the supplied mounting bracket and screw set. This will ensure the radio will not break loose in the event of a collision.

- Mark the position of the hole in the dash, using the mounting bracket as a template.

- Using a 4.2mm (5/32 inch) drill bit, drill the holes, then attach the mounting bracket using the supplied screws. Mount the transceiver within easy reach of the user and where there is sufficient space at the rear of the transceiver for cable connections.

- Connect the antenna and the supplied power cable to the radio.

- Slide the transceiver into the mounting bracket and secure it using the supplied hex-headed screws.

- Mount the microphone hanger in a location where it will be within easy reach of the user.

- The microphone and microphone cable should be mounted in a place where they will not interfere with the safe operation of the vehicle.

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FUSE REPLACEMENT: When replacing the fuse in the DC power cable, be sure to replace it with a fuse of the same value (15A). Never replace a fuse with one that is rated with a higher value.

We recommend that you identify the items listed in the following packing list. If you find that all the items are not present, please contact us.

Item	Quantity
BCM-220 Mobile Radio	1
DC Power Cable w/15A Fuse	1
Mounting Bracket	1
DTMF Microphone	1
Microphone Hanger (w/screws)	1
Screw Set: • 5x16 mm self-tapping screw • Hex-headed screw w/washer • Spring Washer • Flat Washer	4 4 4 4
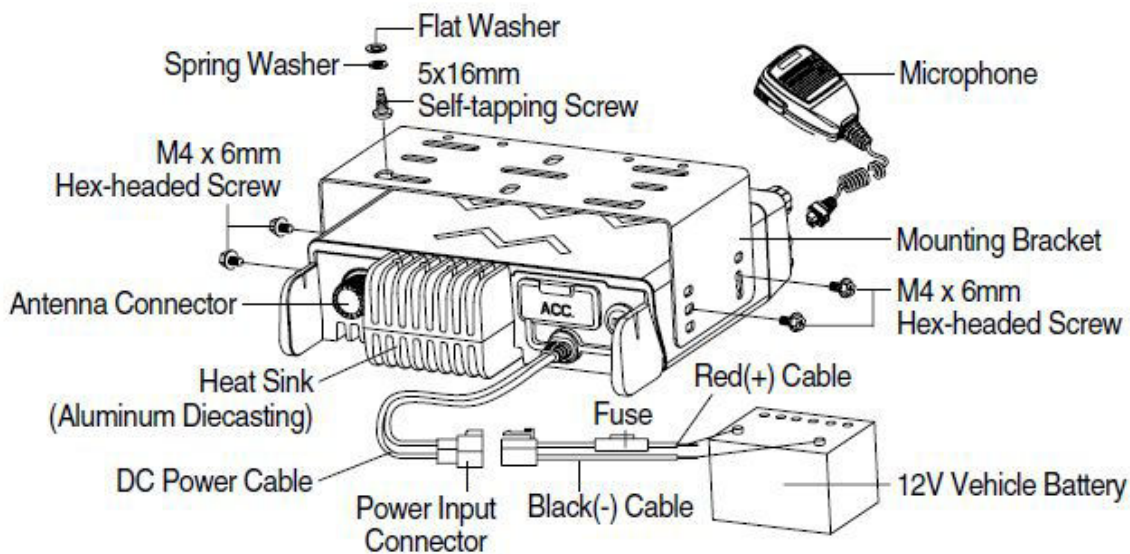
Image 1: Radio Connections and bracket mounting.

Connecting the Microphone:
- Insert the microphone plug into jack on the front panel of the transceiver. Be sure the tab on the microphone plug is facing the left hand side.
- Mount the microphone on the microphone hanger where it will be within easy reach of the user.
- To remove the microphone plug, press the tab on the connector while pulling the plug out of the transceiver jack.

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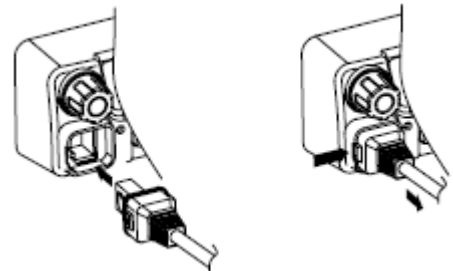
SPECIFICATIONS:

General	BCM-220
Number of Channels:	250
Working Voltage:	13.8 V DC +/- 15%
Channel Spacing:	25kHz/12.5kHz
Weight:	2.4 lbs
Frequency Range:	219.0-220.0 (Data) and 222.0 – 224.995 MHz
Dimensions (H x W x D):	1.75 x 6.5 x 6.75" (45 x 165 x 171.5 mm)
Frequency Stability:	+/- 1.5 ppm (-30 to +60 C)
Operating Temperature:	-30° C to +60° C
Antenna Connector:	PL-259
Antenna Impedance:	50Ω
Current Drain:	With 13.8 V Desktop Supply – Transmit Mode – 30 W ~ 6.7 Amps DC Transmit Mode – 5 W ~ 2.5 Amps DC Receive Standby mode - 180 mA DC Receive Mode front Audio spkr out Max ~ 400 mA DC
TRANSMITTER	
RF Output	Programmable – 5W / 10W / 20W / 30W
Maximum Deviation:	+/- 5kHz (25 kHz) +/- 2.5 kHz (12.5 kHz)
Spurious and Harmonic	70dB
FM Hum and Noise	40dB (12.5 kHz), 45 dB (25 kHz)
Audio Distortion	3% Maximum with 1 kHz Modulation
Audio Freq Response	+1, -3dB from 6dB/Octave pre-emphasis from 300 ~ 3000 Hz
Output Impedance	50 ohms
RECEIVER	
Sensitivity	0.25 uV 12 dB SINAD
Squelch Sensitivity	0.22 uV 10 dB SINAD
Selectivity	65 dB (12.5 kHz), 70 dB (25 kHz)
Spurious and Harmonic Rejection	75dB
FM Hum and Noise	40dB (12.5 kHz), 45 dB (25 kHz)
Audio Output Power	4 Watts across 4 Ohm Load
Audio Distortion	Less than 5% at rated output
Audio Freq Response	1, -3dB from 6dB/Octave de-emphasis from 300 ~ 3000 Hz
IF Frequencies	21.4 MHz and 455 kHz
Input Impedance	50 ohms

In our on-going commitment to quality specifications are subject to change without notice.

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Features

- High Quality Mitsubishi 30 Watt Amplifier Module (RA30H2127M)

- Selectable power – 5W / 10W / 20W / 30W

- 250 Channels

- Narrow and Wide Band Operation

- High Quality Heavy-Duty DTMF microphone

- Commercial grade construction

- 128 x 32 Dot Matrix Graphic LCD

- DSUB15 Accessory Connector

- 4W Front-Mounted Speaker

- External Speaker Port

- Selectable Squelch Level (1-9)

- CSQ, CTCSS, and DCS Encode / Decode

- Programmable COS function (Active Low – Carrier or Valid Decode)

- Time-Out Timer

- VFO Scan and Memory Scan

- Memory Store and Delete

- Front Panel Alignment of TX Voice, Sub Audible , and DTMF Tone Deviation

- Windows-Based Programmer and Flash upgrade utility

… and many more!
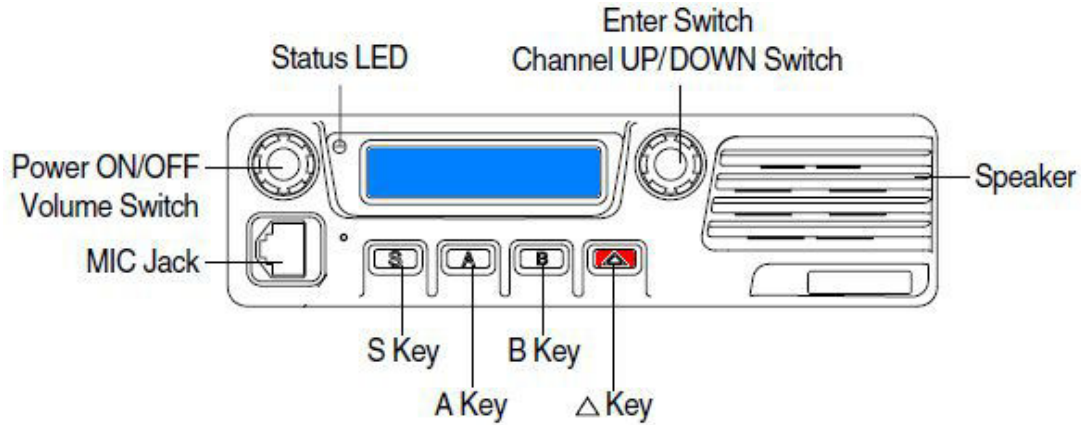
Image 2: BCM Radio Front
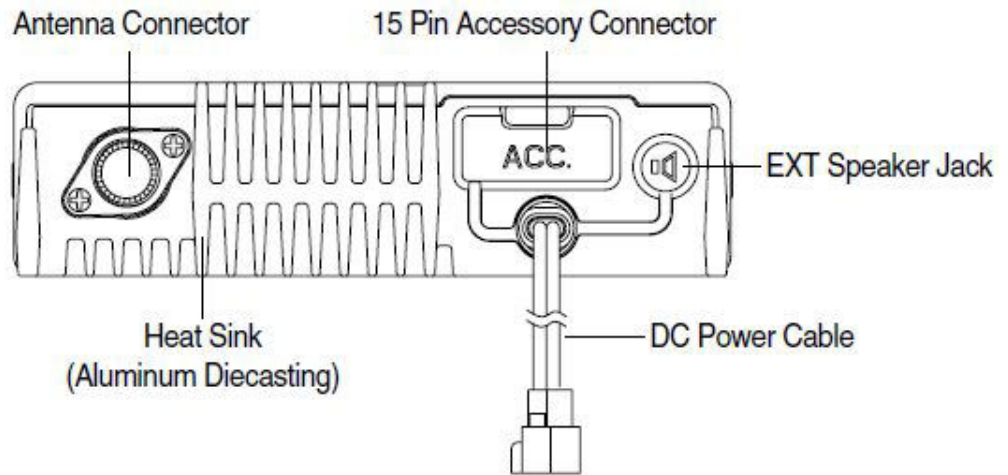
Image 3: BCM Radio Rear
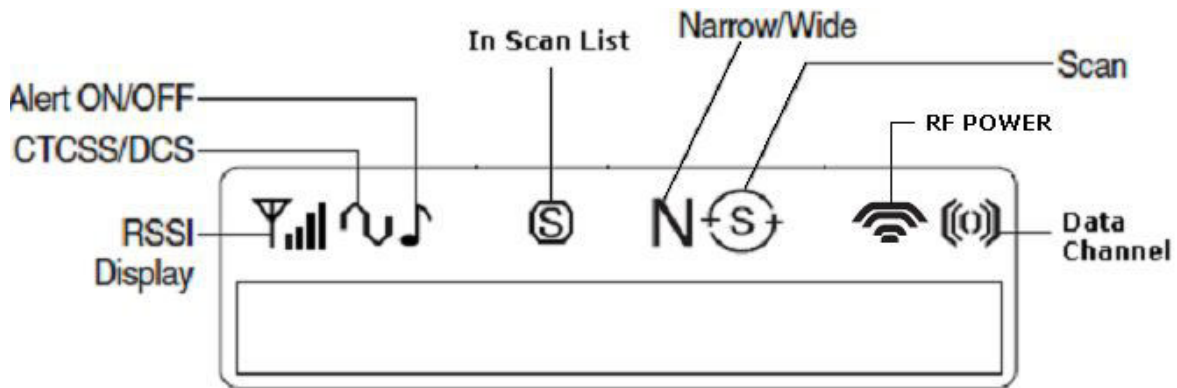
Image 4: BCM Radio Display LCD Icons

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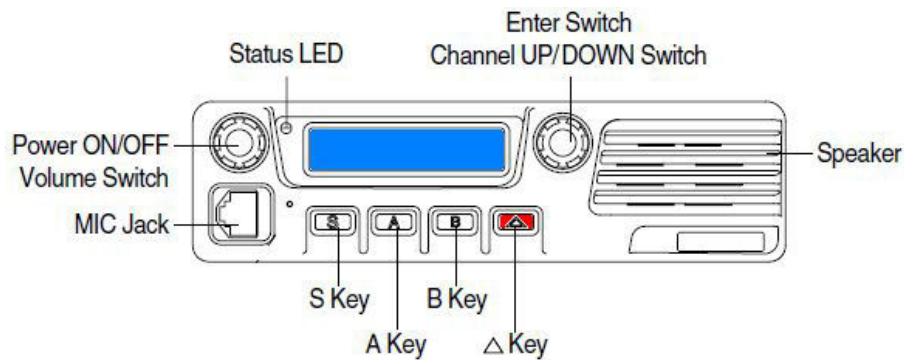
1. After power is applied, the radio is turned on by pressing and holding the volume control knob for approx 2 seconds. The radio defaults to VFO mode and the RX frequency is displayed. The volume control knob is located on the left side of the radio. Once turned on, the radio will cycle through displaying Model name, Firmware Version, and Channel name or Frequency depending on Mode. The associated icons will be displayed as well.
2. To increase/decrease the audio volume level, rotate the POWER/VOL knob.
3. To power down the radio, press-and-hold the POWER/VOL knob for approximately two seconds.

Front Panel Keypad:

The two knobs on the radio are push-button style rotary knobs.
Knob on left: Volume Control Knob, Power On/OFF Bush Button,
Knob on right: Channel Up/Down and Enter switch via push button.
S-Key: Enter/Exit Scan mode.
A-Key: Enter/Exit Alignment mode.
B-Key: Enter/Exit Menu Mode
∧**-Key**: Momentary Monitor On/OFF

Tri-Colored Status LED:

RED – Transmit / YELLOW – Receive / GREEN – Valid DECODE

DTMF Microphone Keypad:

The BCM-220 sports a 15-button DTMF (0-9, A,B,C) keypad for operating the radio.
The DTMF keys allow for entering frequencies while the radio is in VFO mode.

- DTMF Button A: Switching between VFO mode and memory mode.
- DTMF Button B: Channel DOWN
- DTMF Button C: Channel UP

CHAPTER 4: QUICK START – GET ME ON THE AIR!

We've made effort to make this radio as easy to use as possible. Therefore, by way of example this quick start procedure should quickly get you on the air talking on your favorite repeater system.

For this procedure, the radio must be in VFO mode. This is observed by noting a frequency on the display. Typically, a memory channel will have alpha characters associated with the channel in the display. Pressing the 'A' button on the DTMF mic or pressing-and-releasing the SELECT knob will toggle between VFO and Memory mode. Make sure you're in VFO mode.

Programming for use with a 220 MHz repeater:

In North America, the general split for most 220 repeaters is 1.6 MHz.

Setting RX Frequency:

To enter the desired RX frequency, simply key the frequency into the radio using the DTMF keypad. For example: Your repeater transmits on 224.140 MHz and receives on 222.540 MHz and uses a CTCSS tone of 114.8 Hz on the input and output. To enter 224.14 MHz, use the DTMF Mic keypad. Key in:

2 – 2 – 4 – 1 – 4

The radio will confirm programming with finishing out the remaining zeros a 'good' confirm beep.

OFFSET for TX

To enter the 1.6 MHz OFFSET from the RX frequency, follow this procedure:

1. On the Front Panel, press-and-release the 'B' button to access the radio's personality menu. The FREQ STEP SIZE will be displayed.

2. Rotate the select knob clockwise until FREQ OFFSET: is on the top line of the display. The bottom line of the display will be the current OFFSET.

3. Press-and-release the SELECT knob to enter change mode. A good confirm beep should be heard.

4. Rotate the SELECT knob clockwise or counter clockwise to view –1.6 MHz, 0 MHz, or +1.6 MHz. In our example of 222.54 we want to choose a -1.6 MHz offset so rotate the SELECT knob to choose - 1.6 MHz.

5. Then press-and-release the SELECT knob. A good confirm beep should be heard.

6. To exit personality MENU mode, press-and-release the "B" button. The radio should revert back to displaying the VFO frequency.

The radio is now ready to operate in DUPLEX mode. It will receive on 224.14 MHz and transmit on 222.54 MHz.

RX CTCSS/DCS Entry

1. Press the "B" button to access the personality menu. Rotate the SELECT knob until RX SQUELCH: is displayed.

2. Press the SELECT knob to access the menu item select. Rotate the SELECT knob until 114.8 is on the display. Press the SELECT knob to select 114.8. A beep should be heard.

TX CTCSS/DCS Entry

1. Rotate the SELECT knob until TX SQUELCH is displayed.

2. Press the SELECT knob to access the menu item select. Rotate the SELECT knob until 114.8 is displayed. Press the SELECT knob to select and store 114.8. A beep should be heard.

3. To exit the personality menu, press and release the "B" button. The radio will return to VFO mode with the RX frequency displayed.   In addition, the SINE wave icon will be displayed indicating the radio is programmed to decode CTCSS/DCS.

You should now be able to communicate radio-to-radio through your local 220 MHz repeater! The remainder of this manual will acquaint you with many of the features of the BCM-220. Enjoy!

■ **TX**

1. Press PTT and face the microphone before talking. The LED should turn RED indicating TX. To ensure good voice quality, the distance between your mouth and the microphone should be between 2.5 and 5 cm.

2. Release PTT to put radio back in receive (RX).

■ **RX**

1. Upon power up, the radio defaults to a pre-programmed or default RX Frequency.

2. When radio is receiving a valid call, the speaker un-mutes and the green LED lights.

3. Certain conditions may be required for the radio to un-mute and receive. For example, proper CTCSS/DCS signal decode might be required in order for the radio to un-mute. In addition, the receiving signal must be strong enough to break the squelch (SQL) setting.

4. CTCSS/DCS signaling is a special squelch protocol and can help to ignore unwanted calls on the channel. CTCSS/DCS is programmed on a per channel basis. To communicate using CTCSS/DCS, other radios must have the same signaling in their radios.

Working Modes

- **Frequency Mode (VFO)**

  To change to VFO mode press the SELECT knob button or press the "A" button on the DTMF microphone. In this mode you can use the DTMF mic keypad to enter the desired RX Frequency on which you would like to communicate. You can also step up/down in frequency by pressing the 'B' and 'C' buttons on the DTMF mic or simply rotating the SELECT knob. The step size up and down is determined by FREQ STEP SIZE programming.

- **Memory Mode**

  To change to MEMORY mode press the SELECT knob button or press the "A" button on the DTMF microphone. In this mode you rotate the SELECT knob to step through the pre-programmed channels. The names of the channels will be displayed. You can also step through the pre-programmed channels by using the "B" and "C" on the DTMF microphone.

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- **Alignment Mode**

  To enter the Alignment Menu mode, press the 'A' button on the radio control head. From this menu you can adjust SQUELCH level, RF output power, TX Voice Dev, TX Sub Dev, DTMF Tone Deviation, and Channel Spacing. To exit the alignment mode menu simply press the 'A' button.

- **Radio Personality Menu Mode**

  To enter the radio personality menu mode, press the 'B' button on the radio control head. From the this menu you can adjust the FREQ STEP SIZE, RX SQUELCH, TX SQUELCH, FREQ OFFSET, SCAN UNMUTE condition, SCAN SPEED time, SCAN HANG time, SCAN WAIT SIG time, STUCK MIC TIME, and BEEP TONES. To exit the radio personality menu simply press the 'B' button.

Chapter 6: HOW-TO Function GUIDE:

• VFO Frequency Entry

All VFO frequency entry is done using the DTMF Keypad microphone. The precision of RX frequency you are allowed to enter is based on the FREQ STEP SIZE. For example, if the FREQ STEP SIZE is 10,000 Hz, then you need to enter the first 5 digits of the frequency. If it is 12500, then you need to enter the first 6 digits. Once the required number of digits entered is satisfied, a good beep is emitted and the radio programs the PLL. As the frequency is entered, only certain numbers are allowed in certain of the frequency fields. For example, each frequency entry must start with a '2'. If the wrong digit is entered in the current field, the radio will emit a 'bad' beep. If an entry is not made within 3 seconds of each other, the entry times out and the previous frequency is displayed.

• Storing a Channel to Memory

Channel frequencies are stored in VFO mode only. The VFO power setting at the time of storage is what is stored for the memory channel.

While the RX frequency to store is displayed, Press-and-hold the SELECT button for approx 2 seconds. The moment the SELECT button is pressed, the radio will enter memory mode and display the current memory channel. However, if the SELECT button is held, the radio will emit a 'good' beep and redisplay and store the VFO channel in memory and append "-MEM" to the entry.   The channel is stored in the nearest vacant channel space at the top of the memory map. You are now in Memory mode. To return to VFO mode, press the SELECT button.

• Deleting a Channel from Memory

Deleting a channel is done only in Memory mode.

While in memory mode and on the memory channel you'd like to delete, press and hold the SELECT button for approx 2 seconds. The moment the SELECT button is pressed a good beep is emitted and the radio enters VFO mode. The radio displays the VFO frequency. However, continue to hold the SELECT button until another good 'beep' is emitted. At this point the memory channel is deleted from memory.   You are now in VFO mode. To return to MEMORY mode, press the SELECT button.

• Sending DTMF tones while Transmitting

Simply PTT the radio and press the 0-9, A, B, and C while transmitting. The DTMF tones will modulate the carrier.

RADIO ALIGNMENT

- ### Setting SQUELCH (SQL)

The purpose of the squelch control is to mute the speaker when no signals are present. With the squelch level (1-9) correctly set, the speaker will only un-mute when there is a sufficient signal present. The higher the squelch level, the stronger the signals must be to un-mute the speaker. The appropriate squelch level depends on the ambient RF noise conditions.

1. Press the 'A' button on the control head. SQUELCH will be seen on the top line of the display with the current value on the bottom line.

2. Press the SELECT button and rotate the SELECT knob to the value you want. It is advised a service monitor generating signal be used to set the SQUELCH level to your liking. Observe the YELLOW led and the speaker muting and un-muting as you adjust this setting.

3. Press the SELECT button to confirm and store the desired setting. To exit the ALIGNMENT menu press the 'A' button.

- ### Changing Power Level

The BCM-220 supports four programmable TX Power output settings: 5W, 10W, 20W, and 30W. TX power is adjusted by accessing the alignment menu.   The TX Power level applies to VFO mode only. The memory channels have their own TX Power level. Power level indicated by the POWER LEVEL ICON on the display.

1. Make sure the radio is in VFO mode. To set the TX Power level, access the Alignment menu by pressing the 'A' button on the control head. The word SQUELCH is displayed.

2. Rotate the SELECT knob clockwise one tick and the word RF POWER is displayed along with the current POWER setting.

3. Press the SELECT knob to adjust the TX POWER level. A good beep is emitted.

4. Rotate the SELECT knob to your desired power level. If PTT is pressed, you should be able to confirm the setting on your power meter.

5. Once the desired setting is confirmed, press the SELECT button. A good beep is emitted.

6. To exit the alignment menu, press the 'A' button on the control head and the radio will revert back to VFO mode.

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- **Changing TX VOICE DEVIATION**

The BCM-220 allows for optimizing the TX Voice Deviation levels. The settings are from 0-7. Where Deviation increases from 0 to 7. The voice deviation level is a radio wide setting applied to both VFO and Memory channels. It is recommended a service monitor be used to adjust this setting.

1. Make sure the radio is in VFO mode. Press the 'A' button the control head to access the alignment menu.

2. Rotate the SELECT knob until TX VOICE DEV is displayed on the top line and the current level is displayed on the bottom line.

3. Press the SELECT button to allow for changing the TX VOICE DEV. A good beep will be emitted.

4. PTT the radio and speak "FIVE" into the microphone and adjust the overall TX deviation while observing the effect on a service monitor. Keep in mind, the radio will transmit the programmed VFO TX CTCSS/DCS signal while adjusting the deviation.

5. Once the desired value is obtained, press the SELECT to go back to the menu. A good beep is emitted.

6. To exit the alignment menu, press the 'A' button on the control head and the radio will revert back to VFO mode. A good beep is emitted.

- **Changing TX CTCSS/DCS Deviation**

The BCM-220 allows for optimizing the TX CTCSS/DCS Deviation levels. The settings are from 0-7. Where deviation increases from 0 to 7. The TX CTCSS/DCS deviation level is a radio wide setting applied to both VFO and Memory channels. It is recommended a service monitor be used to adjust this setting.

1. Make sure the radio is in VFO mode. Press the 'A' button the control head to access the alignment menu.

2. Rotate the SELECT knob until TX SUB DEV is displayed on the top line and the current level is displayed on the bottom line.

3. Press the SELECT button to allow for changing the TX SUB DEV. A good beep will be emitted.

4. PTT the radio and adjust the overall TX SUB Dev while observing the effect on a service monitor. Keep in mind, the radio will transmit the programmed VFO TX CTCSS/DCS signal while adjusting the deviation. If there's no signal present there may be no TX Signal set. This will need to

be done by selecting a CTCSS tone from the TX Signal option in the personality menu. (See section for changing TX CTCSS/DCS)

5. Once the desired value is obtained, press the SELECT to go back to the menu. A good beep is emitted.

6. To exit the alignment menu, press the 'A' button on the control head and the radio will revert back to VFO mode. A good beep is emitted.

- **Changing DTMF Tone Deviation**

The BCM-220 allows changing the TX DTMF tone Deviation level. The settings are from 0-7. Where deviation increases from 0 to 7. The TX DTMF deviation level is a radio wide setting applied to both VFO and Memory channels. It is recommended a service monitor be used to adjust this setting.

1. Make sure the radio is in VFO mode. Press the 'A' button the control head to access the alignment menu.

2. Rotate the SELECT knob until DTMF TONE DEV is displayed on the top line and the current level is displayed on the bottom line.

3. Press the SELECT button to allow for changing the DTMF TONE DEV. A good beep will be emitted.

4. PTT the radio and press a DTMF key on the microphone. Adjust the DTMF Dev while observing the effect on a service monitor. Keep in mind, the radio will transmit the programmed VFO TX CTCSS/DCS signal while adjusting the deviation. If there's no signal present there may be no TX Signal set. This may need to be done by selecting a CTCSS tone from the TX Signal option in the personality menu. (See section for changing TX CTCSS/DCS)

5. Once the desired value is obtained, press the SELECT to go back to the menu. A good beep is emitted.

6. To exit the alignment menu, press the 'A' button on the control head and the radio will revert back to VFO mode. A good beep is emitted.

- **Changing Channel Spacing**

The BCM-220 can operate in either WIDE or NARROW band. The channel spacing setting applies only to VFO channels. Memory channel's spacing is defined using the BCM programmer. To change the channel spacing, do the following.

1. Make sure the radio is in VFO mode. Press the 'A' button the control head to access the alignment menu. A good beep is emitted.

2.   Rotate the SELECT knob until CHANNEL SPACING: is displayed on the top line and the current channel spacing is displayed on the bottom line.

3.   Press the SELECT button to allow for changing the channel spacing. A good beep will be emitted.

4.   Rotate the SELECT button to change to either WIDE or NARROW. Press the SELECT knob to store and go back to the menu.

5.   To exit the alignment menu, press the 'A' button on the control head and the radio will revert back to VFO mode. A good beep is emitted.

The radio will display the channel space setting on the top line of the display with a 'N' or 'W' icon.

PERSONALITY SETTINGS

•   **Changing Frequency Step Size**

In VFO mode, the BCM-220 allows for changing the step size as you step through and scan VFO frequencies. The step sizes available are: 5kHz, 10kHz, 12.5kHz, 15kHz, 20kHz, 25kHz, and 30kHz.

1.   Make sure the radio is in VFO mode. Press the 'B' button the control head to access the personality menu. A good beep is emitted.

2.   FREQ STEP SIZE is displayed on the top line and the current step is displayed. Press the SELECT button to allow for changing the step size. A good beep is emitted.

3.   Rotate the SELECT knob until the desired step size is obtained. Press the SELECT button to store the step size and re-enter the personality menu. A good beep is emitted.

4.   To exit the personality menu, press the 'B' button on the control head and the radio will revert back to VFO mode. A good beep is emitted.

•   **Changing RX SIGNAL**

In VFO mode, the BCM-220 can be programmed to un-mute on CARRIER, CTCSS, or DCS signaling. This menu item allows for programming the RX Signal.

1.   Make sure the radio is in VFO mode. Press the 'B' button the control head to access the personality menu. A good beep is emitted.

2.   FREQ STEP SIZE is displayed on the top line. Rotate the SELECT knob until the word RX SIGNAL is displayed on the top line.

3.   Press the SELECT button to allow for changing the RX SIGNAL. A good beep is emitted.

4.   Rotate the SELECT knob until the desired RX signal is desired. Press the SELECT button to store the RX Signal and re-enter the personality menu. A good beep is emitted.

5.   To exit the personality menu, press the 'B' button on the control head and the radio will revert back to VFO mode. A good beep is emitted.

- **Changing TX SIGNAL**

In VFO mode, the BCM-220 can be programmed to transmit no-tone, CTCSS, or DCS signaling. This menu item allows for programming the TX Signal.

1.   Make sure the radio is in VFO mode. Press the 'B' button the control head to access the personality menu. A good beep is emitted.

2.   FREQ STEP SIZE is displayed on the top line. Rotate the SELECT knob until the word TX SIGNAL is displayed on the top line.

3.   Press the SELECT button to allow for changing the TX SIGNAL. A good beep is emitted.

4.   Rotate the SELECT knob until the desired TX signal is desired. Press the SELECT button to store the TX Signal and re-enter the personality menu. A good beep is emitted.

5.   To exit the personality menu, press the 'B' button on the control head and the radio will revert back to VFO mode. A good beep is emitted.

- **Changing the FREQUENCY OFFSET**
The BCM-220 provides an easy way to make a quick selection of the 1.6 MHz TX offset required by repeaters: -1.6 MHz, 0 Hz, and +1.6 MHz. In VFO mode, when PTT is pressed, the radio adds the offset to the selected frequency. If the TX frequency is out of range (222.0-224.995), a bad beep is emitted. Otherwise, the call is permitted. To change the frequency offset, follow these steps:

1.   Make sure the radio is in VFO mode. Press the 'B' button on the control head to access the personality menu. A good beep is emitted.

2.   Rotate the SELECT knob until FREQ OFFSET is displayed on the top line and the current offset is displayed on the bottom line.

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3. Press the SELECT button to be able to change the OFFSET. A good beep is emitted.

4. Rotate the SELECT knob clockwise or counter clockwise to find your desired offset. Once found, press the SELECT knob. A good beep is emitted and control goes back to the menu.

5. To exit the personality menu, press the 'B' button on the control head and the radio will revert back to VFO mode. A good beep is emitted.

- **Change the BEEP Tones ON/OFF**

The Beep Alert tones can be toggles ON or OFF.

1. Make sure the radio is in VFO mode. Press the 'B' button on the control head to access the personality menu. If Beeps Tones are ON, a good beep is emitted.

2. Rotate the SELECT knob until BEEP TONES is displayed on the top line and ON or OFF is displayed on the bottom line.

3. Press the SELECT button to be able to change the status.

4. Rotate the SELECT knob CW to turn ON, rotate the SELECT knob CCW to turn OFF. Press the SELECT knob to exit the selection process. If beeps are ON, a good beep is emitted and control goes back to the menu. The note icon will be illuminated on the display when BEEP TONES are ON.

5. To exit the personality menu, press the 'B' button on the control head and the radio will revert back to VFO mode. A good beep is emitted.

- **TX Time Out Time (TOT)**

In the event the radio is keyed too long, this timer will cause the radio turn off the RF PA. For example if the Mic is mistakenly left in the seat wedged against something where the PTT button is pressed. This timer will prevent the radio from transmitting too long.

1. Make sure the radio is in VFO mode. Press the 'B' button on the control head to access the personality menu. A good beep is emitted.

2. Rotate the SELECT knob until "TX TIME OUT s" is displayed on the top line and the current value is displayed on the bottom line. The value is displayed in seconds.

3. Press the SELECT button to be able to change the time.

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SYSTEMS

4.   Rotate the SELECT knob to the number of seconds desired for TX length before timeout. Once achieved, press the SELECT knob to go back to the menu. A good beep is emitted.

5.   To exit the personality menu, press the 'B' button on the control head and the radio will revert back to VFO mode. A good beep is emitted.

SCAN OPERATION

The BCM-220 supports two scanning modes. VFO Scan and Memory Scan. Scan is enabled/disabled by pressing the 'S' button on the control head. When scan is enabled, the rotating 'circled S' icon is illuminated on the top line of the display. The radio will then begin traversing the channels at the programmed scan speed.

Scanning direction is determined by rotating the SELECT knob one tick clockwise/counter-clockwise as the radio scans. The default direction is UP.

When carrier is detected on a scanned channel, the radio will pause scanning. In VFO Scan or Memory Scan mode, if the un-mute condition is selected to be CARRIER, the radio will defeat the RX SIGNAL requirement and un-mute the radio. Otherwise, the radio will wait for the Scan Hang Signal Time looking for the programmed RX SIGNAL (CTCSS or DCS).

Responding to a call by pressing PTT exits scan mode. When the conversation is over, scan is re-started by pressing the 'S' button on the control head.

To exit scan, press the SCAN button or simply press the PTT button on the microphone.

In memory scan, to determine if a channel is in the scan list, an "S" icon is displayed on the top line along with the channel name.

- **Deleting memory channels from scan list**
To add a channel to the scan list, press-and-hold the 'A' button for approx 2 seconds until the 'S' icon is displayed on the top line. A good beep is emitted upon addition.

- **Adding memory channels to the scan list**
To delete a channel from the scan list, make sure it's in the scan list, press-and-hold the 'A' button for approx 2 seconds until the 'S' icon disappears from the top line. A good beep is emitted upon deletion.

- **Changing Un-mute condition**

This determines what condition allows the radio to un-mute in VFO or MEM Scan mode. The radio may have a RX Signal programmed; yet you may want to use the radio to scan for carrier as you drive into different areas. Having this condition set to un-mute on carrier will allow for defeating the RX Signal option as you look for working stations.

1. Make sure the radio is in VFO mode. Press the 'B' button on the control head to access the personality menu. A good beep is emitted.

2. Rotate the SELECT knob until "SCAN UNMUTE" is displayed on the top line and the current setting is displayed on the bottom line.

3. Press the SELECT button to be able to change the setting.

4. Rotate the SELECT knob to CARRIER or VALID SIG DECODE. Once achieved, press the SELECT knob to go back to the menu. A good beep is emitted.

5. To exit the personality menu, press the 'B' button on the control head and the radio will revert back to VFO mode. A good beep is emitted.

- **Changing Scan Speed Time**

The Scan Speed determines the rate at which the radio scans VFO channels or memory channels. A recommended value here is 125 ms.

1. Make sure the radio is in VFO mode. Press the 'B' button on the control head to access the personality menu. A good beep is emitted.

2. Rotate the SELECT knob until "SCAN SPEED - ms" is displayed on the top line and the current scan speed is displayed on the bottom line.

3. Press the SELECT button to be able to change the scan speed.

4. Rotate the SELECT knob to the desired scan speed. Once achieved, press the SELECT knob to go back to the menu. A good beep is emitted.

5. To exit the personality menu, press the 'B' button on the control head and the radio will revert back to VFO mode. A good beep is emitted.

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- **Changing Scan Hang Time**

The Scan Hang Time is the time spent on the scanned channel after a valid call is received. Make this time long enough to give opportunity to respond to the scanned call.

1. Make sure the radio is in VFO mode. Press the 'B' button on the control head to access the personality menu. A good beep is emitted.

2. Rotate the SELECT knob until "SCAN HANG - ms" is displayed on the top line and the current scan hang time is displayed on the bottom line.

3. Press the SELECT button to be able to change the scan hang time.

4. Rotate the SELECT knob to the desired scan hang time. Once achieved, press the SELECT knob to go back to the menu. A good beep is emitted.

5. To exit the personality menu, press the 'B' button on the control head and the radio will revert back to VFO mode. A good beep is emitted.

- **Changing Scan Wait For Signal Time**

The Scan wait for Signal Time is the amount of time the radio will wait looking for valid signal decode after carrier is detected on the scanned channel. When this timer expires, the radio resumes scan. A recommended value here is 450 ms.

1. Make sure the radio is in VFO mode. Press the 'B' button on the control head to access the personality menu. A good beep is emitted.

2. Rotate the SELECT knob until "SCAN WAIT SIG - ms" is displayed on the top line and the current scan wait time is displayed on the bottom line.

3. Press the SELECT button to be able to change the scan wait time.

4. Rotate the SELECT knob to the desired scan wait time. Once achieved, press the SELECT knob to go back to the menu. A good beep is emitted.

5. To exit the personality menu, press the 'B' button on the control head and the radio will revert back to VFO mode. A good beep is emitted.
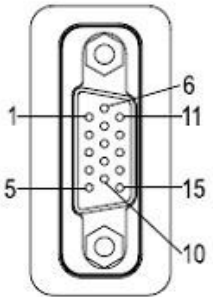
The BCM-220 works in the 219.0-220.0 MHz region designated for data in the United States and 222.0-224.995 MHz. Channels assigned to 219.0 -220.0 can be set up and designated as DATA ONLY using the BCM Programming software. Frequencies 219.0-220.0 MHz are only set up for use in memory mode and thus require the BCM Window's based programmer. Voice transmission from the microphone is not permitted in 219-220 MHz. Data ONLY channels are identified on the LCD display by viewing a 'squared I' icon in the right corner of the display.

Interfacing a TNC or any data device to the BCM-220, requires use of the 15 pin D-SUB accessory connector. The following table denotes the pin out for what signals are to be applied to the correct pins.
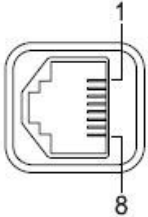
PIN	Signal
2	TX Data Input – (0-3V)
8	External PTT 3.3V: Active LOW
9	RX Audio Flat 100mV Output
10	COS Out – Carrier Off: 3.3V – On: 0V
15	GND

Pin 2 is AC coupled to the TCXO with a 4.7-uF capacitor. Therefore, direct access to the modulator is given. This allows for transmitting a broader bandwidth signals.

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SYSTEMS

APPENDIX A: Terminal Description

Pin No	Pin Name	Description	Specification	I/O	Remark
1	RSSI	RECEIVER STRENGTH	0.6~1.4V	O	
2		BROADBAND DATA INPUT			
	LSP		R12 is selection	I	
3	EXT_SPK	Loudspeaker Output	4Ω, 4Watt	O	
4	AF_OUT	Audio Output	500mV	O	
5	EXT_MIC	Audio Input	5kΩ	I	
6	TXD/FCN1	TX Serial Data	3.3V TTL	O	
7	RXD/FCN2	RX Serial Data	3.3V TTL	I	
8	EXT_PTT	External PTT	3.3V(H) : PTT OFF 0V(L) : PTT ON	I/O	
9	F_AUDIO	IF IC Output	100mV	O	
10	COR/COS	Squelch Output	S.Q ON : 0V S.Q OFF : 3.3V	O	
11	EXT/INPUT	Programmable (TBD)	High Impedance	I/O	
12	DC+5V	DC Power Supply	DC+5V Max 100mA	O	
13	HR1	(TBD)	Max 3A	O	
14	HR2	(TBD)	Max 3A	O	
15	GND	Ground	Ground	-	

Microphone Jack

Pin No	Pin Name	Description	Specification	I/O	Remark
1	MBL	Backlight of Microphone	-	O	
2	DC+13.6V	DC Power Output	13.6 ±5%	O	
3	GND	Ground	Ground	-	
4	PTT/TXD0	PTT/PC Serial Data	3.3V TTL	I	
5	ME	MIC Ground	MIC Ground	-	
6	MIC	MIC Signal Input	600 Ω	I	
7	HOOK/RXD0	HOOK/PC Serial Data	3.3V TTL	I	
8	DM	MIC Data Detection	High Impedance	I/O	

Appendix B: CTCSS/DCS Tables

Available CTCSS Tones

67.0	107.2	165.5
71.9	110.9	173.8
74.4	114.8	179.9
77.0	118.8	186.2
79.7	123.0	192.8
82.5	127.3	203.5
85.4	131.8	210.7
88.5	136.5	218.1
91.5	141.3	225.7
94.8	146.2	233.6
97.4	151.4	241.8
100.0	156.7	250.3
103.5	162.2	

Available DCS CODES (each code can be inverted as noted by an 'i' next to field in LCD display)

023	073	156	261	365	503	654
025	074	162	263	371	506	662
026	114	165	265	411	516	664
031	115	172	271	412	532	703
032	116	174	306	413	546	712
043	125	205	311	423	565	723
047	131	223	315	431	606	731
051	132	226	331	432	612	732
054	134	243	343	445	624	734
065	143	244	346	464	627	743
071	152	245	351	465	631	754
072	155	251	364	466	632	

BridgeCom SYSTEMS

WARRANTY AND SERVICE

Limited Warranty

This product is warranted by BridgeCom Systems, Inc. to be free of defects in materials and workmanship for a period of **one year** from the date of purchase. If a defective part causes this product to operate improperly during the one-year warranty period, we will service it to the original owner free of charge if shipped to BridgeCom Systems at the owner's expense. This warranty does not apply to any parts damaged due to improper use or violation of instructions. It does not extend to damage incurred by misuse or abuse, unauthorized modifications, natural causes such as lightning, fire, floods, and other such catastrophes; nor to damage caused by environmental extremes, such as power surges and/or transients, theft, or accidents.

All warranties must be performed at BridgeCom Systems, Inc. No credit will be given for unauthorized repair work attempted by the customer.

BridgeCom Systems, Inc. will repair or replace the equipment and return to the customer freight pre-paid, within the continental United States. Equipment found not to be defective will be returned at the customer's expense, and it will include the cost to ship, test, and return the equipment.

Equipment returned for repair must have a return merchandise authorization (RMA) number. To obtain an RMA contact our Technical Support Department at (816)-532-8451 or email techsupport@BridgeComSystems.com. All returned equipment must have the RMA number listed on the outside of the shipping container.

Ship all returns to:
    BridgeCom Systems, Inc. Attn:Repair
    102 NE State Route 92 Hwy
    Suite C
    Smithville, MO 64089

Out of warranty repairs and service charges are billed at the current hourly rate plus parts.
PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

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FCC Statements

Warning and Compliance Statement:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference including received interference that may cause undesired operation.

WARNING: Modification of this device to receive cellular radiotelephone service signals is prohibited under FCC rules and Federal Law.

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NOTES:

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Printed in United States of America