maxon

A World of Communications

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Marketing			Comments:	
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Portable Radio

SP-200

Features List &

Documents

	Project: SP-200	Operation Description
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Contents

1. Operation Mode

This section provides general descriptions of the operating modes of the SP-200 Radio.

1.1 Power Off Mode

The SP-200 shall enter Off mode when the On/Off Volume knob is rotated to the most counter-clockwise position, beyond the detent. Upon entering Off mode, the radio shall store its current channel(if Power On Channel function is disabled via PC programmer).

1.2 Power On Mode

The SP-200 shall enter Power-On mode when the On/Off Volume knob is rotated clockwise beyond the detent. Upon entry of the Power-On mode, the radio shall perform the power-on alert to indicate that it has been turned on. In the Power-On mode, the radio shall restore the operational setting stored when it was last turned off(if Power On Channel function is disabled via PC programmer).

1.3 RX Mode

The SP-200 shall enter the RX mode when the user is not transmitting and the scan function is not active. In this mode, the receive function is performed. There shall be 4 conditions in this mode.

1.3.1 No Carrier Mode

In this mode, the LED shall not be lit and there shall be no audio present.

1.3.2 Un-muted Busy Mode

In this mode, the LED shall be lit for yellow and there shall be audio present.

1.3.3 Muted Busy Mode

In this mode, the LED shall be lit for yellow and there shall not be audio present.

1.3.4 Correct Call Mode

In this mode, the LED shall be lit for green and there shall be audio present. Any audio present shall be heard through the radio's speaker.

1.4 TX Mode

The SP-200 Radio enter the TX mode, when PTT(Push-To-Talk) button is press and hold. In this mode, the radio shall transmit the audio on the selected channel. The speaker shall be muted and no alert tones shall be given. The radio shall exit this mode when the user releases the PTT button, the Time-Out-Timer expires, or the radio is turned off.

1.5 Scan Mode

The SP-200 Radio shall enter the scan mode, when scan function is enabled by user.

1.6 Priority Scan Mode

The SP-200 Radio shall enter the priority scan mode, when priority scan function is enabled by user.

2. Alerts and Alert messages

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This section describes the various audible alerts and LED/LCD alert messages the SP-200 shall give to the user for each condition.
Notes : All LED or audible alerts can be globally disabled via PC programming. All of the following descriptions assume both LED and audible alerts are enabled.

2.1 Power On

Upon power-on, the SP-200 radio shall emit 50msec 800Hz, 50msec 1100Hz, 50msec 140Hz, 50msec 160Hz, 50msec 2000Hz tones.

2.2 Button

The SP-200 radio shall emit a 50msec 1000Hz tone each time an any button is pressed.

2.3 Busy

If a channel is busy, the LED shall glow yellow.

2.4 Correct call

If a channel has sub tone option, LED shall glow green for the duration of the correct call.

2.5 Transmit

While PTT is pressed, the LED shall glow red for the duration of the transmission.

2.6 Scan

While the radio is scanning, the LED shall flash green as the radio scans. The radio display current scanning channel on LCD.

2.7 Scan Delete

If monitor button is pressed in the scan mode, the radio is delete scanned-channel at scan list. And the radio shall emit a 1000Hz tone for 250msec. The radio display "_d" message on LCD.

2.8 Scan All Delete

If all channel is deleted at scan list in scan mode, the radio shall emit two 250msec 1000Hz tone. And the radio display "Ad" message on LCD.

2.9 Time-Out-Timer

Five seconds prior the Time-Out-Timer time out, the radio shall emit a 1000Hz 250msec tone to alert the user. Once the Time-Out-Timer expires, the radio shall emit the Transmit Not Available alert (a 1000Hz 250msec tone). And the radio display "to" message on LCD.

2.10 TX Penalty

If the user attempts to transmit when the TX Inhibit time expires, the radio shall emit the Penalty alert (three 1000Hz 250msec tone). And the radio display "Pt" message on LCD.

2.11 TX Penalty End

The SP-200 radio shall emit a 1000Hz 250msec tone.

2.12 EEPROM Error

If the radio detects an error in the EEPROM, the radio shall emit a 1000Hz 250msec tone. And the radio display "Er" message on LCD.

2.13 PLL Unlock Error

When the PLL is out of lock, the radio shall emit two 1000Hz 150msec tones. And the radio display "UL" message on LCD.

2.14 Low Battery

Upon detection of a low battery condition, the radio shall emit three 1000Hz 250msec tones. And the radio display "LC" message on LCD.

2.15 Programming

When the programmer is reading programmed data from the radio, the radio display " r " message on LCD. And the LED shall flash red. When the programmer is writing data to the radio, the radio display " w" message on LCD. And the LED shall flash green.

2.16 Busy Lock Out

If the user attempts to transmit when the radio is busy or correct call, the radio shall emit a 1000Hz 250msec tone. And the radio display "bL" message on LCD(if Busy Channel Lock Out function is enabled via PC programmer).

2.17 TX Inhibit / Receive Only

If the user attempts to transmit when the SCAN-TX option is Normal-scan TX or Receive-Only/No-TX, the radio shall emit two 1000Hz 250msec tones and display "_h" or "rO" message on LCD.

2.18 Auto Test

In the auto test mode, the radio display " A" message on LCD.

3. Features

3.1 Software Version/Revision Display

Press and hold both Up and Down buttons. The radio is display the software version and revision number on LCD. First digit is version number and 2nd digit is revision number.

3.2 Channel Spacing

The radio shall be capable of programmable channel spacing. Each channel can be programmed via the PC programmer to have 12.5KHz, 20KHz, or 25KHz channel spacing.

3.3 Output Power

The radio shall be capable of programmable output power. Each channel can be programmed via PC programmer to have either a high or low output power. And the calibration software can program the high and low output power level from 1 to 5 Watts.

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3.4 Power save

The radio shall be capable of power save parameters. The power save parameters can be programmed via the PC programmer. The power save on time (RX off time) can be programmed to be from 0.1 to 4.0 seconds in 0.1 second increments. The power save off time (RX on time) can be programmed to be from 0.05 to 0.2 seconds in 0.01 second increments. The power save delay time (time before the power save begins or resumes) can be programmed to be 1 to 8 seconds in 1 second increments.

3.5 Low Battery

Upon detection of low battery condition, the radio shall emit three beeps repeatedly, with display message of " LC " on LCD. Radio continuously flashes the red LED for the duration of 200msec to indicate a low battery condition. When detected of low battery condition, the radio shall transmit the audio. If transmission is attempted after release PTT button, no transmissions shall be allowed and then low battery alert shall be given and displayed " LC " message on LCD. When detected of low battery condition, the radio shall be receive.

3.6 Transmit Time-Out-Timer/TX Penalty

The radio shall have a programmable transmit Time-Out-Timer(TOT). This timer shall prevent the user from transmitting for extended periods of time, which may damage the radio. The Time-Out-Timer period can be programmed via PC programmer from 0 to 990 second in 10 seconds increments. At five seconds before the Time-Out-Timer time-out, the radio shall emit a single beep of 1KHz and duration of 250msec to alert the user. Once the Time-Out-Timer expires, the radio shall emit the Transmit Not Available alert and displayed " Pt " message on LCD if PTT is pressed. The TX Inhibit feature may be used in conjunction with the Time-Out-Timer. The TX Inhibit feature shall prevent the user from transmitting again for a period of time after the Time-Out-Timer expires. The TX Inhibit time-out can be programmable via PC programmer from 0 to 75 seconds in 5 seconds increments. If the user attempts to transmit before the TX Inhibit time-out occurs, a Transmit Not Available alert shall be given and displayed " Pt " message on LCD.

3.7 Squelch Options

The radio shall support three different squelch options: CTCSS, DCS, Squelch defeat(Monitor). Each channel shall have its squelch option set during dealer programming. For each transmit operation, the squelch option shall be implemented if the channel is deemed not busy.

3.7.1 CTCSS

The radio shall support the 38 TIA/EIA standard CTCSS tones and non-standard CTCSS tones ranging from 50Hz to 260Hz in 0.1Hz increments. All the tones shall be set up during dealer programming.

• TX operation : Upon pressing PTT, the radio shall encode the channel's programmed CTCSS tone and enter TX mode. The tone shall last for the duration of the transmission.
• End of TX operation : Upon leaving TX mode, the radio may employ dealer programmable squelch tail elimination functions.
• RX operation : When the proper CTCSS tone is decoded, the radio shall enter correct call state from busy state. When the proper CTCSS tone is no longer being decoded, the radio shall enter busy state from correct call state.

3.7.2 DCS

The Radio shall support the encoding and decoding of 83 TIA/EIA normal and inverted DCS data.

• TX operation : Upon the pressing of PTT, the radio shall encode the programmed DCS bit pattern for the selected channel and enter TX mode. The data shall last for the duration of the transmission.

• End of TX operation : Upon leaving TX mode, the radio may employ squelch tail elimination. This shall be done by sending a turn off code.
• RX operation : The radio shall decode the incoming data stream to determine if there is a match with the pre-programmed DCS data. If the DCS data is properly decoded, the radio shall enter correct call state from busy state. When the proper DCS data is longer being decoded, the radio shall enter busy state from correct call state.

3.7.3 Squelch Defeat (Monitor) operation

If a Monitor button is dealer-programmed for Monitor operation, Monitor button shall function as push on/release off. By pressing the monitor button, the user shall defeat the programmed squelch operation and enter correct call status on the selected channel. When the user releases the monitor button, the radio shall enter busy and resume programmed squelch operation.

3.8 Busy Channel Lockout/Marked Idle

These features shall be dealer-programmable on/off. These features shall not be defeated when scan is enabled.

• Busy Channel Lockout On : Upon PTT being pressed, if carrier is present, the radio shall not exit RX mode to enter TX mode. The Transmit Not Available alert shall be given.
• Busy Channel Lockout Off : Upon PTT being pressed, the radio shall enter TX mode regardless of the presence of carrier.
• Marked Idle On : If the Busy Channel Lockout is on and carrier is detected, the radio shall be permitted to enter TX mode if the RX squelch option is valid.

3.9 Priority Look Back

This dealer-programmable option shall place the radio in a state where it shall periodically look back to a pre-programmed priority channel.

• RX : The radio shall receives calls on its selected channel and priority channel. While the radio is receiving a call on its selected channel, it shall look for carrier on its priority channel for the pre-programmed priority look back time. If a call is detected on the priority channel, the radio shall leave the current channel call and receive the priority call. After the priority call has ended, the radio shall remain on the priority channel for the pre-programmed priority look back time. When the priority look back timer expires, the radio shall go back to the selected channel and resume priority look back operation.
• TX : The user may only initiate new transmissions on the selected channel. The user may transmit on the priority channel only after receiving a call on the priority channel.

3.10 Scan Function

During programming of the radio, any channel can be selected as a scanned channel. The scan list will be activated by switching to the channel that was selected as the scan list channel during programming of the system parameters. The user shall active scanning by selecting the scanned channel for current channel. While the radio is scanning, the LED shall flash green as the radio scans. Once the radio has enabled scan, the radio shall traverse through the pre-programmed scan list. The time spent on receiving a channel in the scan list is referred to as the scan speed time. When an incoming call is detected and decoded, scanning shall stop and the radio shall enter Un-muted Busy Mode or Correct Call Mode. After the call has ended, the radio shall enter Un-muted Busy Mode or Correct Call Mode for a pre-programmed period of scan wait time. If the radio receives a call from the same caller before the scan wait time expires, the radio shall re-enter Un-muted Busy Mode or Correct Call Mode and the scan wait time shall be reset. If the user is permitted to respond to the caller, the scan wait time shall be reset. When the scan wait time expires, the radio shall resume scanning.

3.10.1 RX Only/No TX

No transmissions shall be allowed. If transmission is attempted, the Transmit Not Available alert shall be given.

3.10.2 Normal Scan TX

When the radio receives a call on scanned channel, transmission shall be allowed on scanned channel. When the radio not receives a call on scanning channel, transmission shall not be allowed.

3.10.3 Priority Scan TX

When the radio receives a call on scanned channel, transmission shall be allowed on scanned channel. The user shall only initiate a new transmission on the priority channel. If priority channel isn't selected, transmissions shall not be allowed.

3.10.4 Priority Only TX

The user shall only transmit on the priority channel. If priority channel isn't selected, transmissions shall not be allowed.

3.11 Scan Delete Function

If a channel in the scan list is constantly being scanned to, the user can temporarily delete the channel from scan list by pressing the monitor button. This process can only be initiated when scan is active and the radio is Un-muted Busy Mode or Correct Call Mode on the channel to be deleted.

3.12 Programming & Cloning

3.12.1 Programming

The SP-200 radios require the QPA-4000 programming cable. With the 25 pin "D" type connector installed on the computer, take the other end of the programming cable and insert it in the receptacle located on the opposite side of the PTT on the radio.

1. Reading

(1) Ensure that radio's power switch is in the "OFF" position.
(2) Connect the programming cable through mic jack.
(3) Place the radio in the data read mode by holding the radio's monitor switch and then turning radio power switch to the "ON" position. Release the monitor switch on the first led flash(In this time, the radio display "_r" message on LCD).
(4) Press the radio's monitor switch. The LED shall glow red and programming will be start.
(5) After programming, the radio resets and works normally with programmed frequency.

1. Writing

(1) Ensure that radio's power switch is in the "OFF" position.
(2) Connect the programming cable through mic jack.
(3) Place the radio in the data write mode by holding the radio's monitor switch and then turning radio power switch to the "ON" position. Release the monitor switch on second led flash(In this time, the radio display "_w" message on LCD).
(4) Press the radio's monitor switch. The LED shall glow green and programming will be start.
(5) After programming, the radio resets and works normally with re-programmed frequency.

3.12.2 Cloning

The SP-200 radios require the QPA-4001 cloning cable. The frequencies and functions can be programmed from radio to radio by using a cloning cable.

(1) Ensure that both radio's power switches are in the "OFF" position.

(2) Place the master radio(the radio which already has desired program information in the EEPROM) in the data master mode by holding the radio's monitor switch and then turning radio power switch to the "ON" position(the yellow LED on the radio flashes). Release the monitor switch on the fourth led flash(In this time, the radio display "_m" message on LCD).

(3) Place the slave radio(the radio which is not programmed, or has program information that will be revised) into data slave mode by holding the radio's monitor switch and then turning the radio power switch to the "ON" position(the yellow LED on the radio flashes). Release the monitor switch on the third led flash(In this time, the radio display "_S" message on LCD).

(4) Connect the cloning cable through mic jack.

(5) Press the slave radio's monitor switch. The LED shall glow green.

(6) Press the master radio's monitor switch. The LED shall glow red. And Cloning will start.

(7) After cloning, the slave radio resets and works normally with re-programmed frequency, and the master radio display "_m" message on LCD. Press monitor switch, and then the radio will repeat step 6).

(8) For cloning other radios, repeat step 3) through 7).

APPENDIX 6

TRANSMITTER ALIGNMENT

ONE (1) PAGE ALIGNMENT PROCEDURE FOLLOW THIS SHEET

TRANSMITTER TUNE-UP PROCEDURE
FCC ID: F3JSP200V2

APPENDIX 6

ALIGNMENT PROCEDURE

The SP200 U/V Receiver is designed for broad band covering UHF(440 to 470 MHz) and VHF(148-174MHz) and should require no special alignment, unless repairs are performed on the receiver portion.

The only alignment normally required is to squelch circuit, Apply a signal that produes 10dB SINAD, reduce the input to -130dBm, close the squelch control(RV2,RV4) until the receiver mutes.
Increase the signal to 10dB SINAD reading reference level and adjust RV2 or RV4 until the squelch opens. In high noise environment, some users may prefer to have the squelch opening set somewhat tighter, e.g.:12 to 14dB SINAD.

Should repairs be required, the following procedures should be applied:

VCO

1. Set the unit to the lowest transmitter frequency, 440MHz(UHF), 148MHz(VHF) and adjust the VCO L203 to 3 volts.
2. Set the unit to the highest transmitter frequency, 470MHz(UHF), 174MHz(VHF) and check that the VCO voltage is below 11 volts. Adjust L203 for 3.0 volts.
3. Set the unit to the lowest receiver frequency, 440MHz(UHF), 148MHz(VHF) and adjust the VCO C208 to 2 volts.
4. Set the unit to the highest receiver frequency 470MHz(UHF), 174(VHF) and check that the VCO voltage is below 11 volts. if voltage is above 11volts, adjust C208 for 11volts or less.

* Note : use TP1 to measure the voltage.

Transmitter

Connect the unit to a Service Monitor with the power meter setting to the 5 W scale (or autorange)

TCXO

Set the channel selector to the mid-range frequency 455 MHz, adjust CT1, for a reading of 445 MHz +/- 200Hz. For the VHF data radio, adjust the CT1 and set the frequency within the required range.

APC

1. Adjust RV1 for fixing up High Power(5W)
2. Adjust RV3 for fixing up Low Power(1W)

APPENDIX 7

CIRCUITS AND DEVICES TO STABILIZE FREQUENCY

A 12.8 MHz referenced TCXO PLL circuit establishes and stabilizes output frequency.

APPENDIX 8

CIRCUITS TO SUPPRESS SPURIOUS RADIATION,
LIMIT MODULATION AND CONTROL POWER

TRANSMITTER STAGE HARMONIC FILTER

L7, L8, L11, C73, C74, C75 and C76 form a 7th order Cheby-shev low pass filter. Unwanted harmonics are reduced by -65 dBc.

AUTOMATIC POWER CONTROL

The APC circuit consists of the R109, variable resistor RV1, IC3, and transistor Q19, Q21, and Q22. The supply current is monitored by difference voltage on R109 (0.1 ohm) which is through for it. If the current is varied by RF power output or other reasons, it produces some bias voltage by IC3A and Q19. The differential signal at the output of IC3 is passed to Q21 and Q22 that produces a constant power output to the antenna. RV1 is used to adjust the RF power level.

MICROPHONE AUDIO CIRCUIT

The TX audio from the internal mic or external mic is applied to ASIL (Audio Signal Processor) IC406 that performs the audio gain limiter and low-pass filter functions.