Section (B)

Technical Description:

Model 6327 is a 12 VDC gel cell battery powered repeater. It contains a receiver board mounted in an RF enclosure. It also contains a transmitter and duplexes mounted on a metal plate. Controls are mounted on metal front panel. The output of the duplexer utilizes a ¼ wave whip antenna.

Repeater Specifications:

General

Power input:	*11-13.6VDC*
Current Consumption:	*.66 A at 2W fixed output*
Package	*Pelican*
Temperature range	*-30 to 60C*
Distortion:	*<5% at 1KHZ, 2KHZ deviation*

RECEIVER

Sensitivity	*12 dB Sinad at 1 UV*
Number of channels	*Two*
Channel spread	*500 kHz maximum*
Frequency control	*Crystal*
Frequency range	*150-174 MHz*
Modulation	*FM*
Spurious	*-70 dB*
Image Response:	*-70 dB*
Bandwidth	*12.5 kHz*
Squelch	*Carrier activated*
Outputs:	*Line*
	Speaker
	Headset
Indicators:	*Power*
	Carrier
	Charge

TRANSMITTER

Emission	*12K0F3E*
Number of channels	*1 standard*
Frequency control	*crystal*
Modulation	*FM*
Modulation sensitivity	*3 kHz deviation for one Volt RMS*
Frequency Response	*300-3KHZ (-62 dB oct low pass filter)*
Power Output	*2 watts Maximum, fixed*
Spurious Output	*-60 dBc Maximum*
Frequency Stability	*2.5PPM*
Duty Cycle	*Continuous*
FCCID: FLC200010	FCC ID: FLC200010R

Transmitter Circuit Description

General

The Swintek 6327 VHF repeater utilizes a single board, crystal controlled, FM modulated, 2.0 watt transmitter. It features 300-3000 kHz, Toko active low pass filter with an attenuation 35 dB per octave above 3 kHz. Connection to the transmitter circuit board is made through a 10-pin male header connector,J100, mounted on the circuit board. The keyline input, (PIN 8) keys the transmitter when it's input voltage exceeds 2 VDC.

Crystal Oscillator

QI6 and associated circuitry form a Colpitts oscillator on a frequency set by the crystal Y6 This crystal oscillates on the fundamental frequency between 15.1 to 19.3 MHz.

Variable inductor L33 adjust the crystal frequency of the transmitter. C102 and RT3 are temperature compensating components and will be matched by the factory to the crystal being used.

D10 is a varactor diode used to frequency modulate the oscillator. Audio enters the transmitter through J100; pin 1. With the received audio in full limiting, the input audio signal is passed through U20 low pass active filter. R72 is adjust for a maximum deviation of 3 kHz and sealed.

Buffer & First Tripper

The signal of the oscillator QI6 is coupled to Q8, which acts as a buffer amplifier. The signal is then fed through Q9 which amplifies the signal and triples it's frequency (45.3 to 57.9 MHz) with the aid of the tuned circuit of L17 and C61.

Second Tripper

Q10 amplifies the signal from the bandpass filter of the previous stage and triples the frequency Again. L19, L21, and associated components tune its collector circuit between 136 to 174 MHz.

Pre-Driver

The signal from Q10 is fed to Q11 where the signal is amplified and further filtered to reduce spurious output emissions. Filtering is accomplished through components L22, C75, C76, and L23. R48 and R51 bias the base of Q1l at O.8V.

Driver

The signal from Q11 is fed to the base of QI2 where the signal is further amplified and filtered to reduce spurious output emissions. Filtering is accomplished through components L24, C78, C80. 081, L25, and L26.

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Final Amplifier

L24, L25, L28, and associated components match the output of QI2 to the final amplifier transistor Q13. Q13 amplifies the signal to +33 dbm (2.0 watts). Q13 is rated for up to 4 watts of continuous power. This rugged duty cycle assures a long pass element life. L27, C84, C86 and C85 math the output of Q13 to a 50 ohms load.

MODULATION LIMITING CIRCUITRY

The peak to peak audio frequency voltage being applied to the modulator is hard limited at a maximum of one volts peak to peak by a diode clamp circuit. This signal is then passed through an active Toko low pass filter to remove all frequencies above 3kHz at a slope of 35 dB per octave. The output of the filter is then adjusted to a maximum deviation of three kHz by means of R72 which is then sealed with epoxy.

Harmonic Filter

L27, L29, L36, and associated components form a 3-pole bandpass filter centered at approximately 150MHz. Harmonic signal are filtered from Q13 and the transmit signal is passed the RF output jack J8

Power Control

C89 sample the power level. D7 & D8 rectifies this level to a voltage proportional to the power level. R57 divides the voltage and sends it to Q15. Q15 acts like a clamp; If the base voltage is above 0.7V it draws current away from Q14's base, reducing the voltage to Q12 thereby reducing the drive to Q13 which reduces the power output. With the input voltage set to 13.6 VDC the power output is adjusted to 2 watt maximum. Adjustment pot is then sealed

Voltage Regulator

When the XT-key input is keyed to ON, JIOO; pin 8 goes high. Q17 conducts, causing pin 3 of U9 to go low. This enables U9 to provide a regulated, +7.5VDC when the transmitter is keyed.

EXTERNAL INTERFACE CONNECTOR (JI00)

Pin Number	Function
1)	Data or Audio Input
2)	(not used)
3)	Ground
4)	Ground
5)	(Not Used)
6)	(Not used)
7)	Ground
8)	TX Keyline (PTT)
10)	10-13.6 VDC

TRANSMITTER CRYSTAL SPECIFICATIONS

VHF Transmitter Crystal

Specification ID	XT-19T
Function	Colpitts Oscillator
Formula	F=Fc/9
Crystal Frequency Range	(FX) 15.1 MHz to 9.3 MHz
Carrier Frequency Range	(F0) 150 MHz to 172 MHz
Holder Type	HC-18/U
Mode	Fundamental
Frequency Tolerance	± 10 PPM
Stability (--20 degrees C to +60C)	± 5.0 PPM
Upper Turn Point (±7 degrees C)	45 degrees C
Series Resistance	20 Ohm max.
Load Capacitance	56pF
Temperature	(See Frequency Band information)
Aging	<5ppm typical

Receiver

Q12 is a GA low noise amplifier. L31 is a dual cavity helical resonator which minimizes I/O spurious signals. The 96-RB PC assembly is assembled for the frequency range of 150-172 MHz. U8 and Q4 are the RF mixer and 1st IF when used for UHF applications. The VHF configuration connects the output of Q12 to the input of RF amplifier U4. U4 is coupled to U2 which is the VHF mixer. Local OSC Q4 is a colpits configuration and C27 adjust its center frequency. C38, C82 and C83 are adjusted for best overall SINAD.

IF amplifier

The output of the mixer utilizes an IF frequency of 10.7 MHz. The Local Oscillator is crystal controlled, series, HC-18. The frequency of the crystal being Flo = (Fr-10.7)/3 in MHz. An optional 2nd osc is provided for dual frequency operation. Although the channel separation is limited to 200 kHz due to the helical RF front end required by the duplexer. The IF output is furthered amplified by limiting amplifier U3. The output of U3 is passed trough an eight pole ECS 12.5 kHz monolithic, bandpass crystal filter comprised of X8, X9 and X10. The output of U3 is applied to demodulator U1. L18, L20, and L21 are tuned for minimum signal distortion. L2 is tuned for maximum recovered audio.

Squelch

The RSSI signal developed by U1 is buffered by Q5 and output to the squelch pot.

Audio Amp

Q7 and Q6 form a 20 dB pre-amplifier. The output is supplied to audio processor/switch U6. The Rssi signal goes hi when receiving an in-band carrier, Q9 squelch transistor will go low turning off Q10. This allows the gate on Q6 to go high, passing the signal to line output which is 1 VRMS

Headset Amplifier

A portion of the line input it supplied to the Volume pot, The output of the volume pot is coupled to U7 which is the balanced AF power amplifier for the speaker and Headset output.

Low Voltage Indicator

Q8 and associated circuitry form a low voltage indictor. When the input voltage falls below 11.5 VDC the power led will blink. Q11 is a 5 VDC regulator used for all circuits on the receiver PC Board.

Tune Up Procedure

A. *Connect a through-line wattmeter to the output of the duplexes. Connect a 30dB pad to the output of the wattmeter and the output of the pad to a spectrum analyzer.*

B. *Key the transmitter on by adjusting front panel squelch pot fully counter clockwise and monitor the voltage at TP-5 on the transmitter pc board. Adjust L17 and L18 (the first tripper) for a peak voltage reading at TP-5. Adjust R57 fully counter-clockwise. To avoid overheating the transmitter, only key it when testing or alignment is to be done, and not-keyed in-between tests.*

C. *Adjust L20 and L19 (the second tripper) for a dip in DC voltage at TP-7*

D. *While monitoring the spectrum analyzer, adjust C84, C86 and the duplexes for maximum carrier signal.*

E. *Adjust C81 for maximum carrier signal.*

F. *While monitoring the spectrum analyzer, readjust L17, L 18, L19 and L20 for maximum carrier signal with minimum spurious content.*

G. *Peak C76, C81, C85, and C86 for maximum power output with minimum spurious signals*

H. *Inject a 1kHz audio tone at 10dbv RMS, 50 ohm or less source impedance., into J7 (pin #2, red wire) With the low pass filter input in full limiting adjust the deviation pot (R72) for a maximum deviation of 3 KHZ. Seal the pot*

I. *Adjust R57 so as to obtain 2.0 watts power output and seal*

j. *Remove audio test signal. Connect duplexes output with 30 db pad to FM generator*

k. *Connect SINAD meter and scope to J13, line output.*

L. *With squelch open adjust FM generator modulation to 3 kHz*
Remove audio generator from J7 and connect DbV meter.
At 3KC deviation the audio output signal should be 1 VRMS and just beginning to peak clip

M. *Adjust receiver board frequency adjustment for best SINAD.*
L31,C102,C82,C73,C103,C29,L15,L20,L21 and L2 for best SINAD. Adjust L31 and L101 helical traps. Adjust duplexes for best SINAD.

N. *Re-check G through I for minimum spurious, deviation and power output.*

O. *When finished. Repeater should provide an output into 50 Ohms of 2 watts, at 3KHZ deviation. The receiver sensitivity should be 12 dB SINAD at –120 dBm. If not, re-do all of the above.*