LBI-30854E
****
(REPLACES LBI-4143)

***Mobile* Communications**

CHANNEL GUARD ENCODER/DECODER 19D430740G1 TONE REJECT FILTER 19D430740G4

Maintenance Manual

Ericsson GE Mobile Communications Inc.
Mountain View Road • Lynchburg, Virginia 24502

Printed in U.S.A.

LBI-30854

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ILLUSTRATIONS

SPECIFICATIONS*

Used With	MASTR® Executive II
Tone Frequencies	71.9 Hz to 203.5 Hz
Frequency Stability	±0.5%
Temperature Range	-30°C to +60°C (-22°F to +140°F)
Power Requirements	+10.0 VDC, 35 mA

WARNING

Although the highest DC voltage in the unit is supplied by the vehicle battery, high current may be drawn under short circuit conditions. These currents can possible heat metal objects such as tools, rings, watchbands, etc. enough to cause burns. Be careful when working near energized circuits.

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

DESCRIPTION

Channel Guard 19D430740 is a continuous tone encoder/decoder for operation on tone frequencies in the 71.9 Hz to 203.5 Hz range. The encoder provides tone-coded modulation to the transmitter. The decoder operates in conjunction with the receiver to inhibit all calls that are not tone coded with the proper Channel Guard frequency.

The Channel Guard circuit consists of discrete components providing PTT switch and receiver mute switch; and four thick-film integrated circuit modules consisting of Decode Module U1001, Encode Module U1002, Frequency Switchable Selective Amplifier (FSSA) AR1001 and plug-in Versatone Network FL1001.

Tone Reject Filter 19D430740G4 is avail-able for use in a non-Channel Guard mobile or station receiving calls that are tone modulated.

For a functional diagram of the Channel Guard Encoder/Decoder refer to the trouble-shooting procedures.

Typical diagrams of the Versatone Network, Phase Inverting Amplifier, Encode Limiter, Low Pass Filter, Decode Limiter, Amplifier and Threshold detector are provided in Figures 2 through 7. References to symbol numbers mentioned in the following text are found on the Schematic Diagram, Outline Diagram and Parts List.

OPERATION

A Channel Guard MONITOR switch (S702), located on the microphone hookswitch, controls the operation of the Channel Guard decode circuitry. When the switch is moved to the MON position, the Channel Guard decode function is disabled, allowing all calls to be heard. The encode function is controlled by the PTT switch and is enabled only when the PTT switch is operated. All transmitted calls are tone coded with the Channel Guard frequency.

CIRCUIT ANALYSIS

Frequency Switchable Selective Amplifier

Frequency Switchable Selective Amplifier (FSSA) AR1001 is a highly stable active bandpass filter for the 71.9 Hz to 203.5 Hz frequency range. The selectivity of the filter is shifted across the bandpass frequency range by switching Versatone Networks in the filter circuit (See Figure 1)

In Figure 1, the gain of the FSSA is shown as a function of the tone frequency. The Tone Frequency is determined by the Tone Network connected in the FSSA circuit. When Tone Network A is in the circuit, the maximum gain occurs at FA. When Tone Network B is in the circuit, the maximum gain occurs in FB.

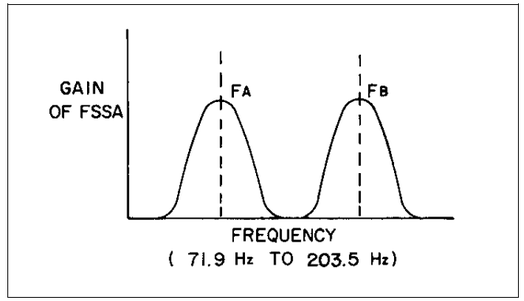


Figure 1 - Gain vs Frequency

Tone Network

Versatone Network FL1001 is a precision resistor network with associated switching transistors. A typical Versatone Network is shown in Figure 2. Pins 3, 4 and 5 of the network are connected to ground.

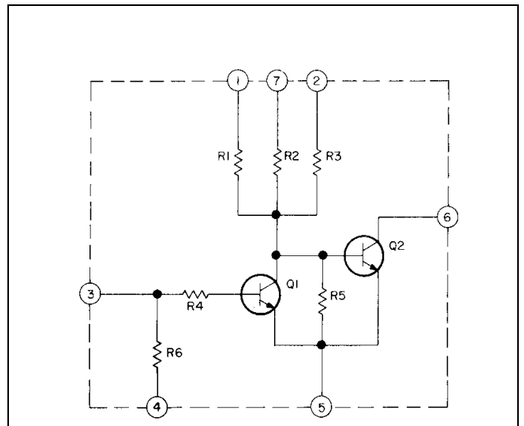


Figure 2 - Typical Versatone Network

LBI-30854

Encode

Keying the transmitter applies +10 volts to PTT switch Q1001, turning it on. With Q1001 on, 10 volts is applied to the 5.4 volt regulator which supplies power to the tone encode circuits.

The Channel Guard encode tone is generated by coupling the output of FSSA bandpass filter AR1001 back to its input through a phase inverting amplifier circuit and a limiter circuit. The output of the FSSA is coupled from AR1001-1 to the input of the phase inverting amplifier at U1002-9. A typical phase inverting amplifier circuit is shown in Figure 3.

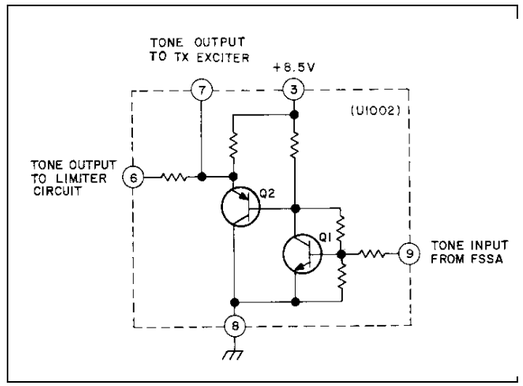


Figure 3 - Typical Phase Inverting Amplifier

Amplifier Q1 provides 180° phase shift of the tone frequency at the output of emitter follower Q2. The output of the phase inverting amplifier circuit is coupled from U1002-6 to the input of the limiter circuit at U1002-5. A typical limiter circuit is shown in Figure 4.

Limiting network CR1, CR2, R8, R9 and R10 sets the tone output coupled from U1002-4 to the input of the FSSA (AR1001-12) at 53 milli-volts peak to peak.

The limiter circuit is also used as an encode switch. Keying the transmitter applies +5.4 Volts to U1002-2. This forward biases Limiter diodes CR1 and CR2 and momentarily turns Q3 on. Forward biasing CR1 and CR2 allows the circuit to oscillate. Momentarily turning Q3 on starts the circuit oscillating. The tone frequency is determined by the tone network connected in the FSSA circuit.

The tone output of the encoder circuit is taken from U1002-7 and coupled through tone output amplifier Q1002 and modulation adjustment R1015 to the transmitter exciter.

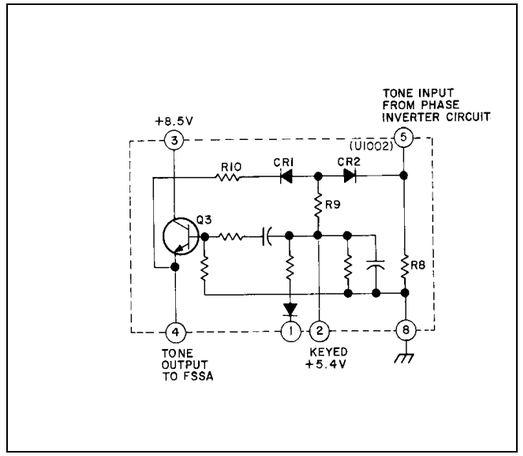


Figure 4 - Typical Encode Limiter Circuit

Decode

Audio, containing the correct frequency from J1001-4 (Tone In), is coupled to Pin 1 of Decode Module U1001. Pin 1 of U1001 is the input of an active, three stage, low pass filter. The low pass filter attenuates frequencies over 205 Hz. A typical low pass filter is shown in Figure 5. The output of the low pass filter at U1001-15 is applied to U1001-14. U1001-14 is the input of a limiter circuit, limiting the output at U1001-13 to 55 millivolts peak to peak. A typical limiter circuit is shown in Figure 6. The output from the limiter is coupled to Pin 12 of FSSA AR1001. Since the tone is the proper frequency the FSSA will allow it to pass. The output of the FSSA is coupled from AR1001-1 to U1001-3. U1001-3 is the input to an amplifier circuit. The output of the amplifier at U1001-4 is coupled to the input of a threshold detector at U1001-6. A typical amplifier and threshold detector circuit is shown in Figure 7. When a tone is present, Q6 will conduct causing Q7 to conduct and +8.5 VDC to appear on the output of the threshold detector circuit (U1001-10).

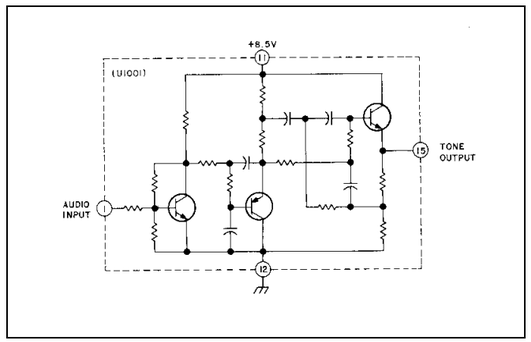


Figure 5 - Typical Low Pass Filter

In the decode mode, when the tone decoder in U1001 detects the channel guard frequency, Q1004 turns on. The grounds of CG Disable lead to the SAS board and allows the receiver to turn on.

Audio from the SAS board is connected to the tone reject filter via J1001-6. The tone reject filter consists of L1001, R1014 and capacitors C1025 through C1028.

The tone rejection filter connected in parallel with the VOLUME control bypasses the tone to ground, thereby attenuating the tone level reaching the audio circuits.

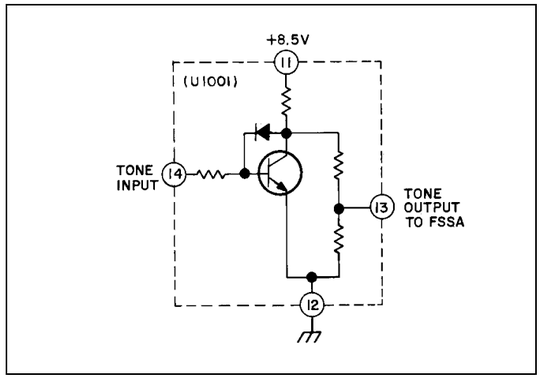


Figure 6 - Typical Decode Limiter Circuit

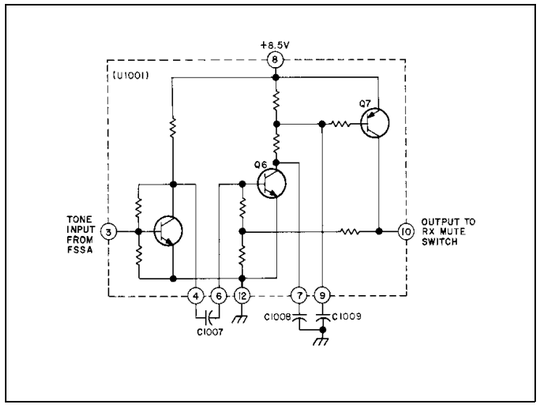
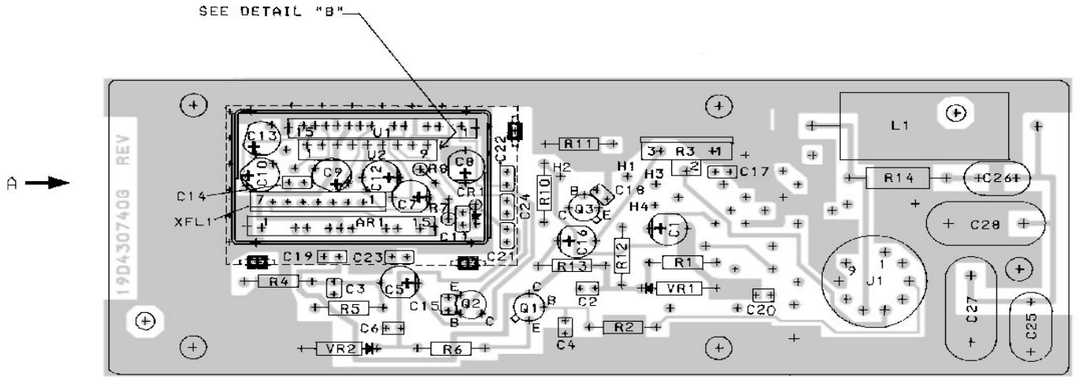


Figure 7 - Typical Amplifier and Threshold Detector Circuit

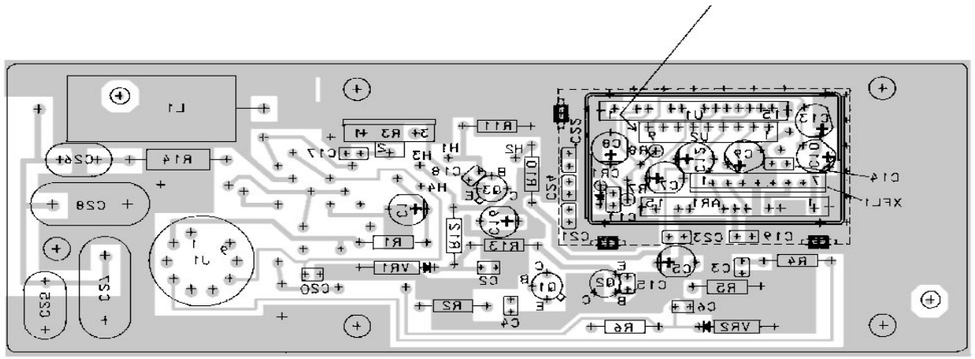
STANDARD TONE FREQUENCIES (Hz)				
71.9	88.5	107.2	131.8	162.2
74.4	91.5	110.9	136.5	167.9
77.0	94.8	114.8	141.3	173.8
79.7	97.4	118.8	146.2	179.9
82.5	100.0	123.0	151.4	186.2
85.4	103.5	127.3	156.7	192.8

ENCODER/DECODER
19D430740G1
COMPONENT SIDE



(19D430829, Rev. 0)
(19A142862, Sh. 1, Rev. 0)

SOLDER SIDE



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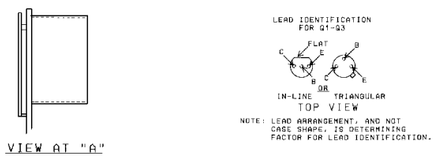
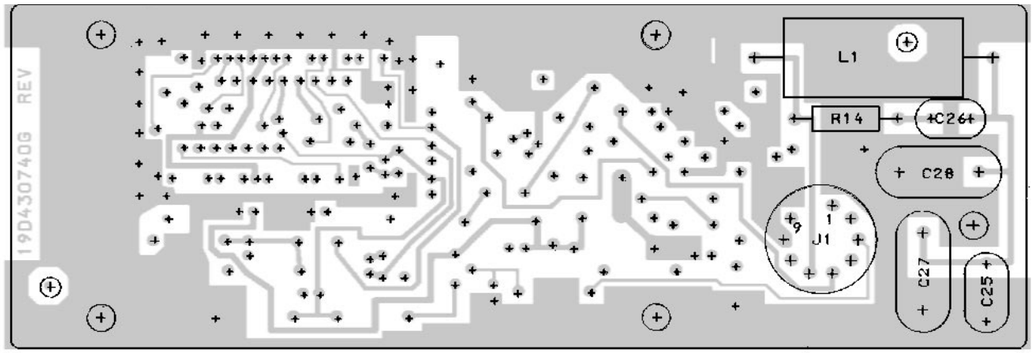
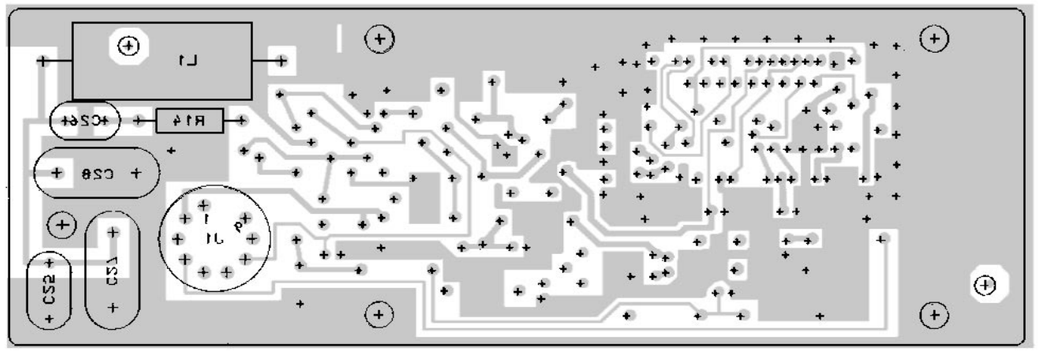


TONE REJECT FILTER
19D430740G4
COMPONENT SIDE



(19D430832, Rev. 0)
(19A142862, Sh. 1, Rev. 0)

SOLDER SIDE



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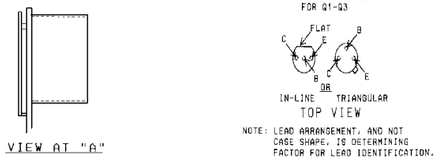
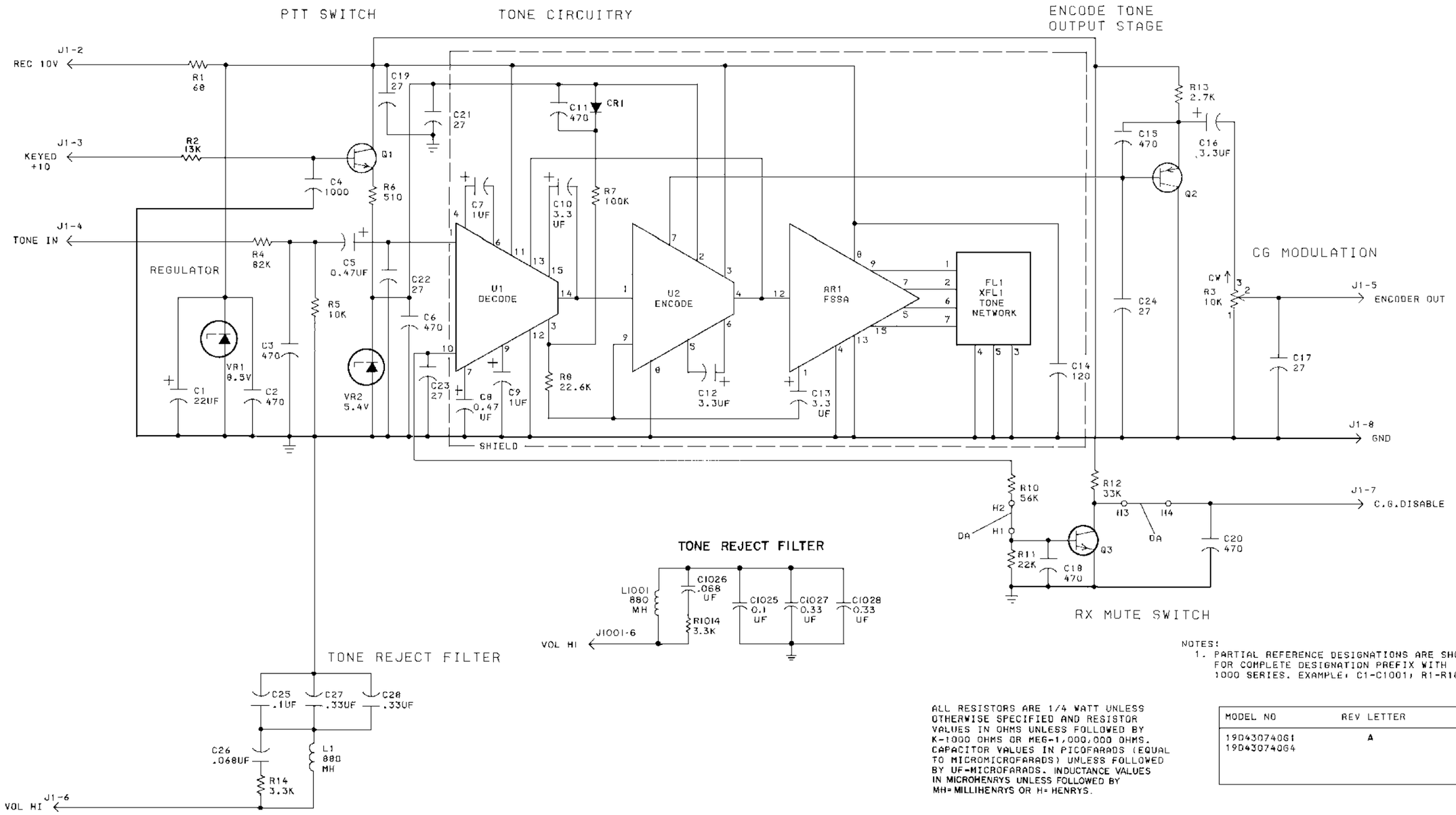


CHANNEL GUARD ENCODER/DECODER
19D430740G1 & G4



NOTES:
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH 1000 SERIES. EXAMPLE: C1-C1001; R1-R1001.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

MODEL NO	REV LETTER
19D430740G1 19D430740G4	A

CHANNEL GUARD ENCODER/DECODER

19D430740G1 & G4

CHANNEL GUARD
SINGLE TONE ENCODE/DECODE
19D430740G1 ENCODE/DECODE
19D430740G4 TONE FILTER ONLY

SYMBOL	PART NO.	DESCRIPTION
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
AR1001	19D417833G1	Selective Amplifier. (Used in G1).
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1001	19A134202P6	Tantalum: 22 µF ±20%, 15 VDCW. (Used in G1).
C1002 and C1003	19A116192P2	Ceramic: 470 pF ±20%, 50 VDCW; sim to Erie 811-A050-W5R-471M. (Used in G1).
C1004	19A116192P13	Ceramic: 1000 pF ±10%, 50 VDCW; sim to Erie 8121-A050-W5R-102K. (Used in G1).
C1005	19A134202P12	Tantalum: 0.47 µF ±20%, 35 VDCW. (Used in G1).
C1006	19A116192P2	Ceramic: 470 pF ±20%, 50 VDCW; sim to Erie 811-A050-W5R-471M. (Used in G1).
C1007	19A134202P14	Tantalum: 1 µF ±20%, 35 VDCW. (Used in G1).
C1008	19A134202P12	Tantalum: 0.47 µF ±20%, 35 VDCW. (Used in G1).
C1009	19A134202P14	Tantalum: 1 µF ±20%, 35 VDCW. (Used in G1).
C1010	19A134202P5	Tantalum: 3.3 µF ±20%, 15 VDCW. (Used in G1).
C1011	19A116192P2	Ceramic: 470 pF ±20%, 50 VDCW; sim to Erie 811-A050-W5R-471M. (Used in G1).
C1012 and C1013	19A134202P5	Tantalum: 3.3 µF ±20%, 15 VDCW. (Used in G1).
C1014	19A700226P68	Ceramic: 120 pF ±5%, 100 VDCW, temp coef -750 PPM. (Used in G1).
C1015	19A116192P2	Ceramic: 470 pF ±20%, 50 VDCW; sim to Erie 811-A050-W5R-471M. (Used in G1).
C1016	19A134202P5	Tantalum: 3.3 µF ±20%, 15 VDCW. (Used in G1).
C1017	19A116114P10044	Ceramic: 27 pF ±5%, 100 VDCW; temp. coef -3300 PPM. (Used in G1).
C1018	19A116192P2	Ceramic: 470 pF ±20%, 50 VDCW; sim to Erie 811-A050-W5R-471M. (Used in G1).
C1019	19A116114P10044	Ceramic: 27 pF ±5%, 100 VDCW; temp. coef -3300 PPM. (Used in G1).
C1020	19A116192P2	Ceramic: 470 pF ±20%, 50 VDCW; sim to Erie 811-A050-W5R-471M. (Used in G1).
C1021 thru C1024	19A116114P10044	Ceramic: 27 pF ±5%, 100 VDCW; temp. coef -3300 PPM. (Used in G1).
C1024		
C1025	19A116080P107	Polyester: 0.1 µF ±10%, 50 VDCW.
C1026	19A701371P12	Polyester: 0.068 µF ±5%, 50 VDCW.
C1027 and C1028	19A116080P110	Polyester: 0.33 µF ±10%, 50 VDCW.
		- - - - - - - - - - DIODES - - - - - - - - - -
CR1001	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV. (Used in G1).
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1001	19A115690P1	Reactor: 880 MH ±10%, sim to Artted AC5672.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	PART NO.	DESCRIPTION
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1001	19A700023P1	Silicon, NPN: sim to 2N3904. (Used in G1).
Q1002	19A700022P1	Silicon, PNP: sim to 2N3906. (Used in G1).
Q1003	19A700023P1	Silicon, NPN: sim to 2N3904. (Used in G1).
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1001	19A700106P35	Composition: 68 ohms ± 5%, 1/4 w. (Used in G1).
R1002	3R152P133J	Composition: 13K ohms ±5%, 1/4 w. (Used in G1).
R1003	19B209358P106	Variable: 10K ohms ±5;, 1/4 w; sim to CTS X-201 (Used in G1).
R1004	19A700106P109	Composition: 82K ohms ± 5%, 1/4 w. (Used in G1).
R1005	19A700106P87	Composition: 10K ohms ± 5%, 1/4 w. (Used in G1).
R1006	3R152P511J	Composition: 510 ohms ± 5%, 1/4 w. (Used in G1).
R1007	19A700106P111	Composition: 100K ohms ± 5%, 1/4 w. (Used in G1).
R1008	19A701250P335	Metal film: 22.6K ohms ±1%, 250 VDCW, 1/4 w. (Used in G1).
R1010	19A700106P105	Composition: 56K ohms ± 5%, 1/4 w. (Used in G1).
R1011	19A700106P95	Composition: 22K ohms ± 5%, 1/4 w. (Used in G1).
R1012	19A700106P99	Composition: 33K ohms ± 5%, 1/4 w. (Used in G1).
R1013	19A700106P73	Composition: 2.7K ohms ± 5%, 1/4 w. (Used in G1).
R1014	19A700113P75	Composition: 3.3K ohms ± 5%, 1/2 w.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
U1001	19D417763G1	Decoder. (Used in G1).
U1002	19C321133G1	Encoder. (Used in G1).
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1001	4036887P9	Silicon, zener. (Used in G1).
VR1002	4036887P5	Silicon, zener: 5.4 Volts. (Used in G1).
		- - - - - - - - - - FUSE SOCKETS - - - - - - - -
XF1001	19C320299G1	Connector. Includes: 19D416714P1 Shell. 19B219681P1 Contact, electrical. (Used in G1).
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
3	19B227839G1	CAN (Used in G1).
4	19B227844G1	Shield (Used in G1).
5	19A701883P4	Contact, electrical; sim to AMP 86444-1. (Used in G1).
12	19A129811P2	Insulator. (Used in G1).
		- - - - - - - - - - - FILTERS - - - - - - - - - -
FL1001	19A115250P1	CALLED FOR ON INDEX (Used in G1).
		- - - - - - - - - - JACKS- - - - - - - - - -
J1001	19B209303P1	Plug, phenolic: 9 pins.

W601 - CABLE ASSEMBLY
19B226872G1 STATION
19B226872G2 MOBILE

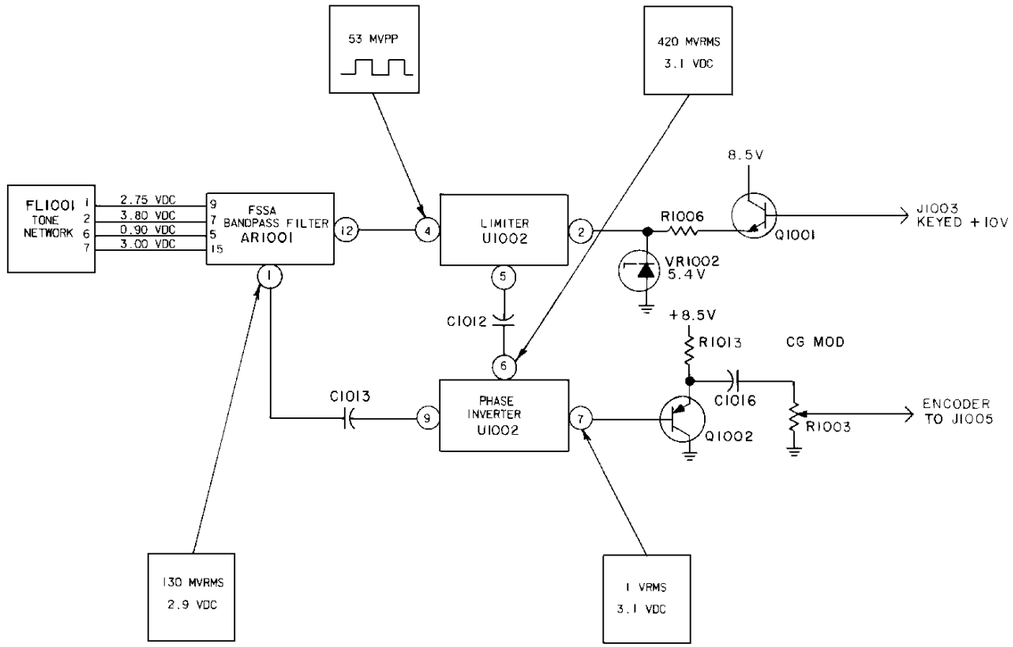
SYMBOL	PART NO.	DESCRIPTION
		- - - - - - - - - - PLUGS - - - - - - - - - -
P601	19B209341P2	Socket, tube: 9 pins; sim to EBY Corp. 9713-349-02 (W/O Saddle).
P907		Connector. Includes:
	19A11656P81	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108, (Quantity 7).
	19A116781P5	Contact electrical: wire range No. 18-24 AWG; sim to Molex 08-50-0106. (Quantity 1).
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19A122138P1	Knob.
	19A134048P1	Wood screw, phillips head: No. 4, 1/2 inch long. (Secures knob to P601).

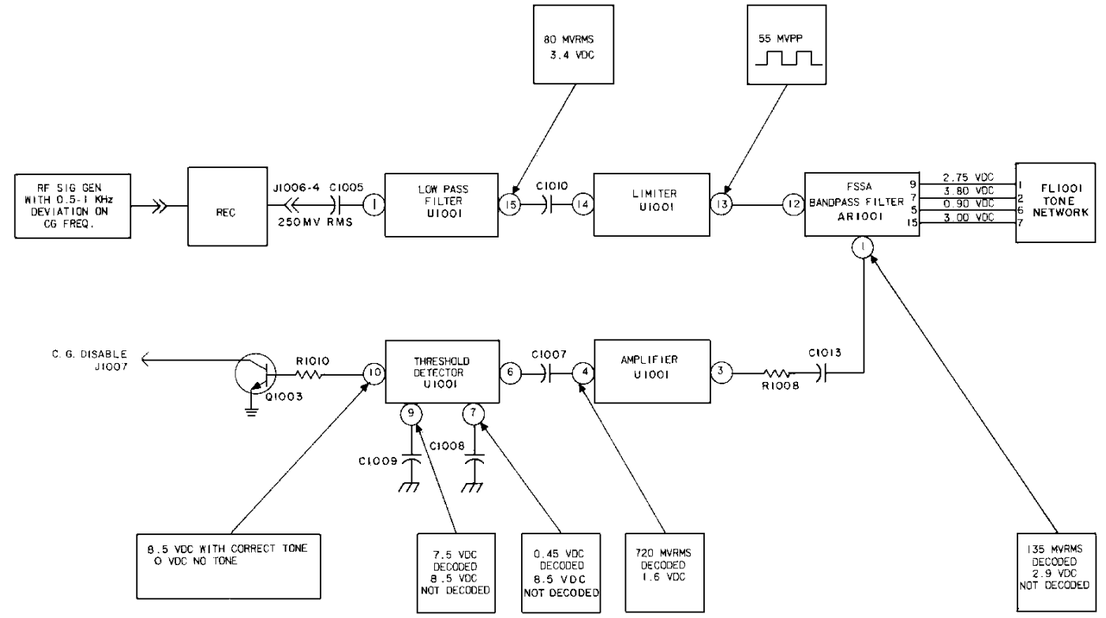
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter," which is stamped after the model number of the unit.The revision stamped on the unit includes all previous revisions Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - 19D43174001
To eliminate frequency shift of 2 PPM ICOMS in UHF station applications. Moved R2 from a base shunt to I to the base of Q1.





RC-3896

SYMPTOM	PROCEDURE
Unit will not decode.	1. Check the 3.1 VDC at U1002-7. 2. If reading is correct, check Mod. Adj. R1003 then check the transmitter oscillator module. 3. If reading is not correct, check voltage readings on connections between the time network FL1001 and AR1001. 4. If the readings between the tone network and AR1001 are incorrect, insure good contact between the tone network and the network socket.. 5. If readings are correct, check readings at AR1001-1, U1002-6 and U1002-4.

ENCODER CHANNEL GUARD

19D430800

SYMPTOM	PROCEDURE
Unit will not decode.	1. Disable Channel Guard and check for proper receiver operation. 2. If the receiver operates properly, enable the Channel Guard. Apply the proper Channel Guard tone to the radio and check for 8.5 VDC at U1001-10. 3. If reading is not correct, check voltage readings on connections between the time network FL1001 and AR1001. 4. If the readings between the tone network and AR1001 are incorrect, insure good contact between the tone network and the network socket. 5. If readings are correct, check readings at U1001-15, U1001-13, AR1001-1, U1001-4, U1001-7 and U1001-9.

DECODER CHANNEL GUARD

19D430800

LBI-30854

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