SECTION 403-323-100
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AT&TCo Standard

HIGH SEAS AND OVERSEAS RADIO
B3 PRIVACY DEVICE
DESCRIPTION

1. GENERAL

1.01 The B-3 Privacy consists of two independent copper-oxide modulators to both of which a vacuum-tube oscillator supplies a carrier tone of such frequency that the speech band passing through each modulator is inverted around the center point of the band. Single-tube amplifiers compensate for the loss in the modulators and provide such additional gain as may be required.

1.02 One modulator with or without its amplifier is connected in the transmitting path and the other modulator with or without its amplifier is connected in the receiving path of the 4-wire portion of a circuit, for example, in a radiotelephone control terminal. Outgoing normal speech coming from the subscriber becomes inverted so as to be unintelligible to the casual listener. Incoming inverted speech, where the distant terminal has the same type of privacy equipment (that is, the inverter type with the same oscillator carrier frequency), is restored by the privacy to produce normal speech.

1.03 The privacy apparatus is self-contained on a 12-1/4 inch metal panel and requires only a source of 105-125 volt, 50-60 cps a-c power for its operation. Terminal strips provide for a flexible arrangement of the modulators and amplifiers and of the repeating coils which may be used to balance the input or output of the unbalanced modulators.

2. CIRCUIT DESCRIPTION

2.01 The schematic circuit of the privacy is shown in Figure 2, page 6. Two oscillator frequencies, involving only different oscillator tuning condensers, and two types of modulator filters are available. Where it is desired to transmit a speech band of 250-2750 cps, a 3000-cps oscillator frequency is used so that the lower side-band of the modulator output will invert this band around the 1500-cps point. Where the speech band is 250-3000 cps, a 3250-cps oscillator frequency is used so that this band is inverted around the 1625-cps point. The same inversion point must be used at both ends of a circuit. The 250-2750 cps speech band is more generally used.

Note: In a few cases, privacy panels originally made for an inversion point frequency of 1625 cps have been converted for operation at a 1500-cps inversion point frequency by changing the oscillator frequency from 3250 to 3000 cps. This change was made by replacing the AN11 condenser originally used as condenser H by an AL6 condenser. The original 130E filters were retained.

2.02 The high-stability vacuum-tube oscillator, common to both modulators, consists of a 311A vacuum tube OSC whose output frequency is determined by fixed condenser H and variable condenser OSC which provides for adjustment of the output frequency to compensate for aging of the oscillator elements. The oscillator output is connected to each modulator at the midpoints of the repeating coil windings between which each varistor is connected; and an adjustable condenser and potentiometer are used to balance the carrier in the two paths of the modulator so that no appreciable amount of carrier is present in the output of this circuit.

2.03 The transmitting and receiving circuits in the privacy are practically identical. By means of straps on the T and R terminal blocks each amplifier may be connected so as to come after or before its associated modulator. In the first case, the input may be connected directly to the unbalanced modulator circuit and so be unbalanced or it may first be balanced by a repeating coil. In the second case, the unbalanced modulator circuit may be used directly as an unbalanced output circuit or a repeating coil may be added so as to give a balanced output circuit. The groups of straps for these alternative arrangements are as follows:

Amplifier After Modulator: Input	On T Terminal Strip: Strap from	Amplifier Before Modulator: Output	On T Terminal Strip: Strap from
Balanced	9 to 11	Balanced	17 to 11
	10 12		18 12
	13 15		13 9
	14 16		14 10
	3 5		5 3
	4 6		6 4
Unbalanced	3 to 11	Unbalanced	17 to 11
	4 12		18 12
	13 15		13 3
	14 16		14 4

Amplifier After Modulator On R Terminal Strip			Amplifier Before Modulator On R Terminal Strip		
Input	Strap from		Output	Strap from	
Balanced	(13	to 15	Balanced	(17	to 11
	(14	16		(18	12
	(5	11		(13	5
	(6	12		(14	6
	(3	7		(7	3
	(4	9		(9	4
Unbalanced	(13	to 15	Unbalanced	(17	to 11
	(14	16		(18	12
	(3	11		(13	3
	(4	12		(14	4

2.04 The description of the transmitting circuit as shown on the schematic drawing will serve to illustrate the general features of both circuits: The speech band passes through the repeating coil T, if the input is to be balanced, and through the low-pass filter T IN which cuts off at the upper limit of the speech band and allows only the speech band to pass through repeating coil T IN to the varistor T. In this varistor, the carrier supplied from the oscillator is modulated by the speech band; and upper and lower sidebands result. The amount of carrier passing through the repeating coil T OUT is kept to a minimum by balancing the amplitude and phase of the carrier currents flowing in windings 4-3 and 7-8. Condenser K and potentiometer T BAL are used to secure a close balance. The two sidebands pass through the repeating coil T OUT but the upper sideband is attenuated by the low-pass filter T OUT so that only the lower sideband passes to the amplifier. This lower sideband is inverted with respect to the original speech band since the lower frequency limit of the speech band is now represented by the upper limit of the lower sideband and vice versa. It may be said that original speech frequencies spaced equally above and below the mid-point of the speech band have been interchanged.

2.05 The negative feed-back amplifier consists of a 310A vacuum tube T, an adjustable input to its grid by means of the taps on the input transformer TA IN, which give gain adjustments in 4-db steps over a range of about 15 to 35 db, and a finer gain adjustment by means of the potentiometer T GAIN, which controls the amount of negative feedback and has a gain range of about 5 db.

2.06 The distant terminal of the circuit must also have the inverter type of privacy with the same oscillator carrier frequency. The inverted speech band which comes to it is re-inverted in the receiving modulator and sent to the distant subscriber in its normal condition.

2.07 The power supply consists of transformer P, some of whose flexible leads have been brought out to a terminal block. On this block, terminals 4 to 8 serve as input taps so that connections of the a-c power supply may be made in accordance with the average voltage of that supply. There are four output windings: One (O-W, Y, Y-W) provides approximately 475 volts a-c (mid-point grounded) across the full-wave 274A rectifier tube RECT whose nominal 132-volt d-c filtered output is the plate and screen grid supply for the vacuum tubes; another (BR-W, O) provides the 5-volt a-c filament supply for the RECT tube; the third (G-W, BR) provides the 24-volt a-c supply for the heaters of the vacuum tubes; and the fourth (W, BK-W) provides a 45-volt a-c supply which may be used for operating relays in associated apparatus, if required.

3. EQUIPMENT FEATURES

3.01 Photograph A, page 4, shows the front and rear views of the 12-1/4 inch metal panel designed for standard relay rack mounting. The basic panel is List 1 of J68317A. The filters and the condenser for adjusting the oscillator frequency depend upon the speech band to be passed: for a 250-2750 cps speech band, 130A filters and an AL6 condenser are provided as List 2; and for a 250-3000 cps speech band, 130B filters and an AN11 condenser are provided as List 3. If a 94H repeating coil R is required, it is provided as List 4 and mounted in the space provided below the OSC tube, as shown in the photograph. Six pairs of jacks are provided for testing. Apparatus that is adjustable from the front is designated on the front.

3.02 On the rear of the panel a cover with a warning sign is provided for the power supply unit to prevent contact with the high voltages developed in this unit. There are three holes in the cover: The large hole gives access to the prong base to which the external a-c power lead is connected; the two small holes provide for the insertion of 0.6-amp. FUSTAT plugs in the FUSTAT assemblies shown in the photograph. Blown fuses may thus be replaced without removing the cover.

3.03 The external circuit connections to the privacy unit are made at the T and R terminal strips. The a-c power connection is made by means of a 15-ft. KS-7586 2-conductor rubber-covered cord. One end of this cord is equipped with a non-polarized

plug cap for insertion in an a-c power outlet. The other end of the cord is equipped with a receptacle that is passed part way through the cover hole to engage with the prongs of the base receptacle seen in the photograph.

3.04 The following vacuum tubes are used in the privacy unit:

WE Type	Quantity	Circuit Designation
274A	1	RECT
310A	2	T, R
311A	1	OSC
Total	4	

3.05 The 105-125 V., 50-60 cps, a-c power load of the privacy unit is about 50 watts.

4. TRANSMISSION CHARACTERISTICS

4.01 A typical gain-frequency characteristic of the privacy unit arranged for 250-2750 cps speech band is shown in Figure 1, page 5.

4.02 Some pertinent data on the operation of the modulators and amplifiers are as follows:

Modulators	
Max. Input Volume	+6 vu
Nominal Loss	10 db
Max. Output Volume	-4 vu
Carrier Leak at Output when properly adjusted	-50 dbm or less
Amplifiers	
Nominal Max. Gain	34 db
Nominal Min. Gain	12 db
Max. Output Volume	+11 vu

Circuit Input Volume vu	Circuit With Amplifier After Modulator: Nominal Output Volume Available vu	Circuit With Amplifier After Modulator: Nominal Carrier Leak After Adjustment Measured at +6 vu Point dbm	Circuit With Amplifier Before Modulator: Nominal Output Volume Available vu	Circuit With Amplifier Before Modulator: Nominal Carrier Leak After Adjustment Measured at +6 vu Point dbm
-60	-	-	-58 to -36	+14 to -8
-50	-	-	-48 to -26	+4 to -18
-40	-	-	-38 to -16	-6 to -28
-30	-28 to -6	-4	-28 to -6	-16 to -38
-20	-18 to +4	-14	-18 to -4	-26 to -40
-10	-8 to +11	-24	-8 to -4	-36 to -40
0	+2 to +11	-34	-	-
+6	+8 to +11	-40	-	-

4.03 The above table indicates the nominal carrier leak at a +6 vu point for various operating conditions. Where a choice is available, the arrangement providing the lowest carrier leak should, of course, be chosen. For example, if an input volume of -30 vu is available and an output volume of -10 vu is desired, the carrier leak will be -4 dbm (or less) if the amplifier is placed after the modulator and -34 dbm (or less) if the amplifier is placed before the modulator; the latter arrangement would, of course, be chosen.

4.04 The noise at the outputs of the privacy unit is less than 45 db above reference noise (message weighting).

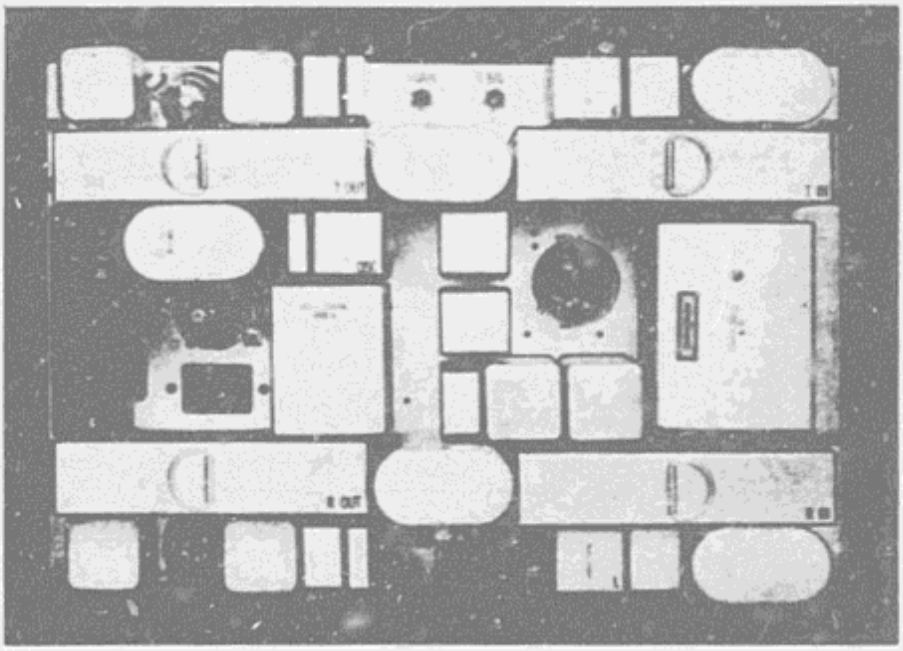
5. PHOTOGRAPHS, FIGURES, AND REFERENCES

(A) Photograph

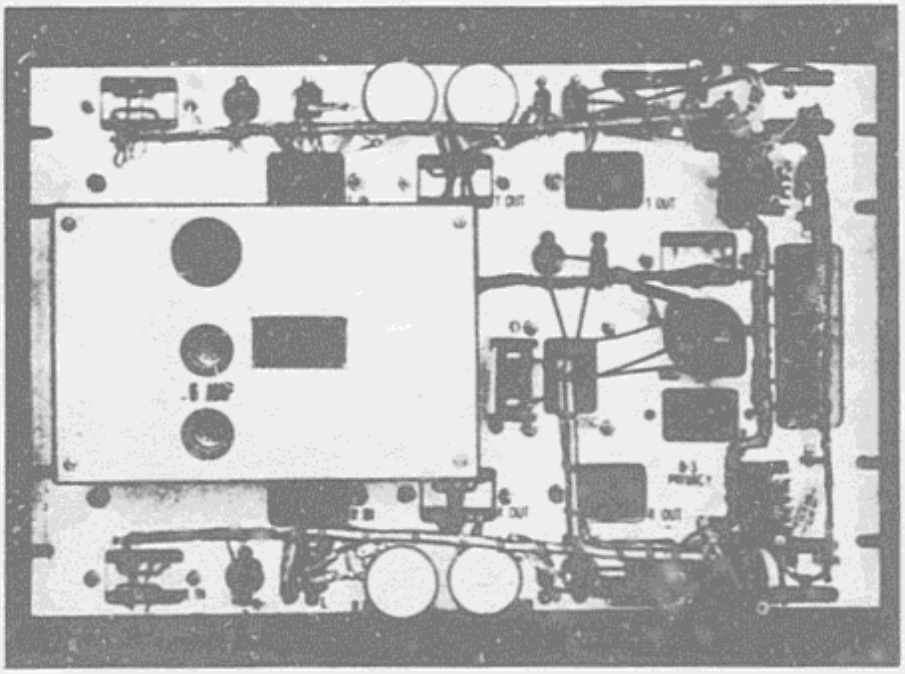
(B) Figures

(C) Drawings For Reference

ED-61947-01 B-3 Privacy Assembly
T-59022-30 B-3 Privacy Wiring Diagram

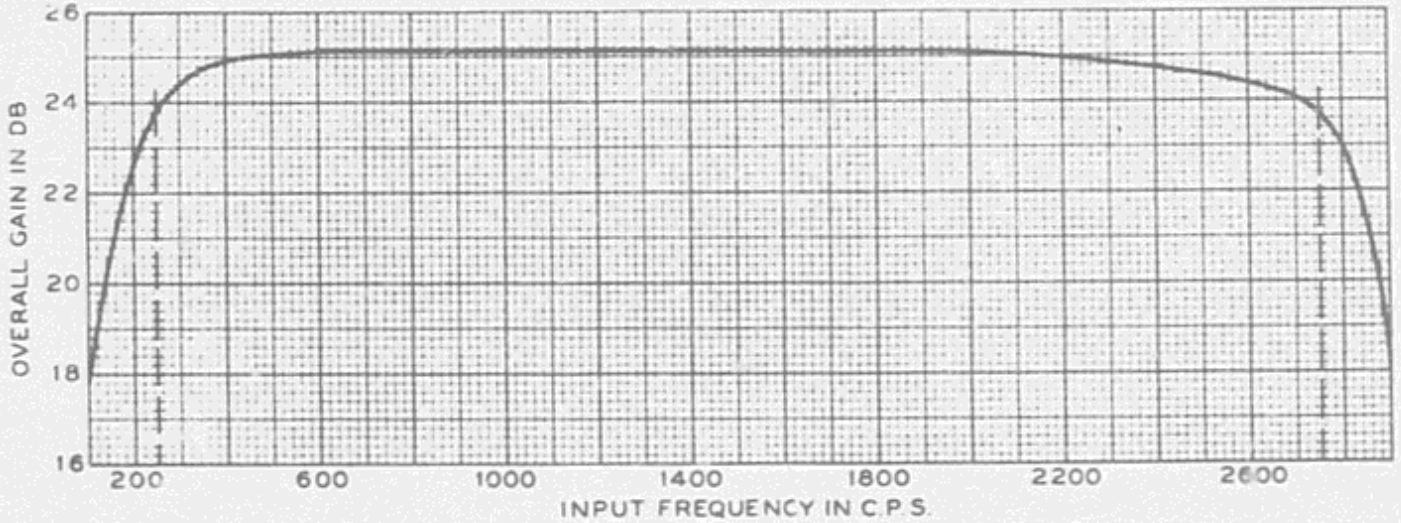


FRONT VIEW



REAR VIEW

Photo A – B3 Privacy Device



SPEECH BAND 250-2750 C.P.S.
AMPLIFIER SET AT MAXIMUM GAIN

Fig. 1 – Typical Gain v Frequency Characteristic

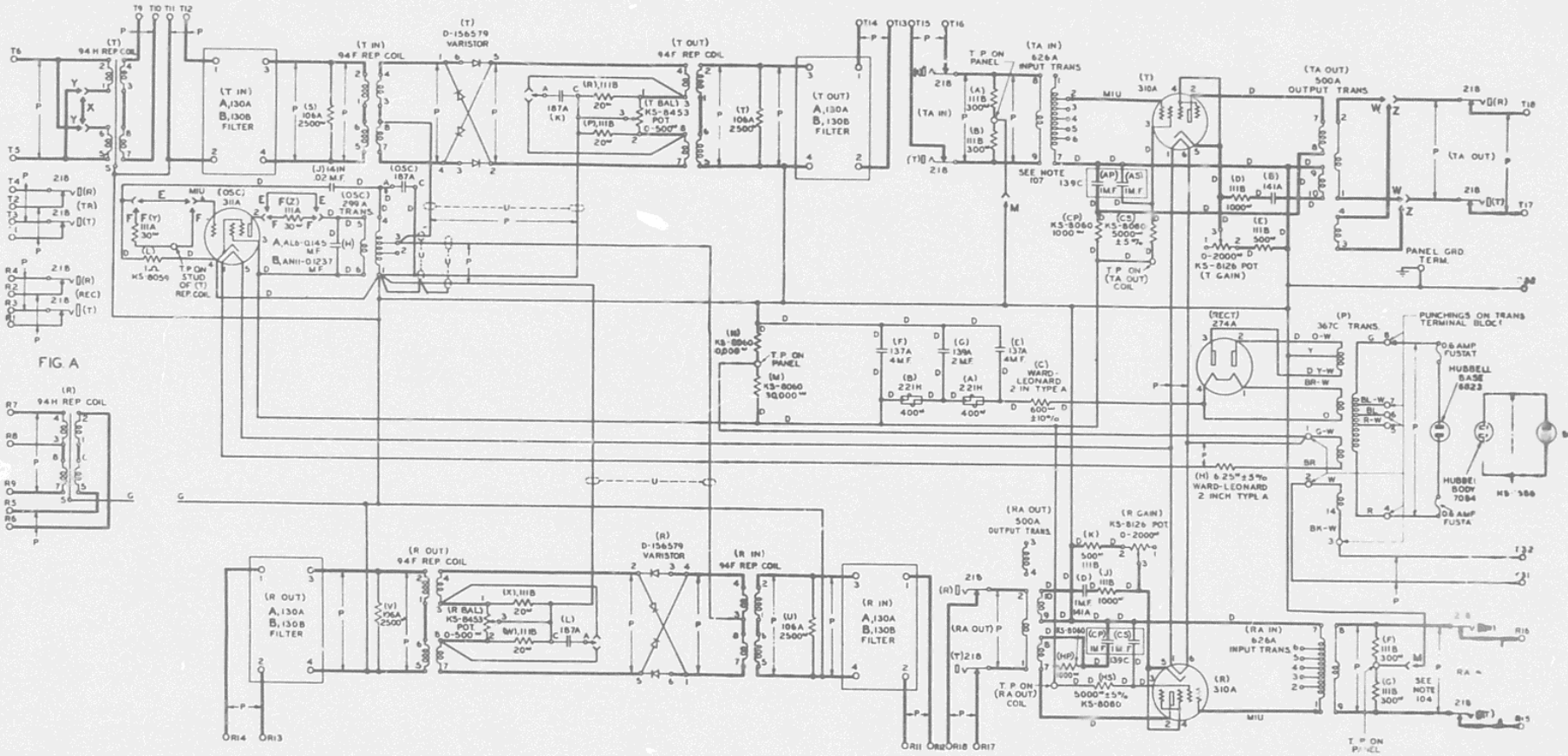


FIG. A

Fig. 2 – Typical Scheme