KIT-248 ... S952

TMC SPECIFICATION																												NO. S 952
REV:	A	B	C	D	E	F	G																					
COMPILED:					CHECKED:					APPD:																		SHEET 1 OF 18
TITLE:																												
typed by vab 3/31/66																												

KIT-248

MATERIAL AND INSTRUCTIONS FOR CONVERTING

SBE-2 TO SBE-2A

I. PURPOSE:

To covert TMC Model SBE-2 to SBE-2A.

II. MATERIALS SUPPLIED:

ITEM NO.	SYMBOL	QTY.	TMC PART NUMBER	DESCRIPTION
1	C142, 143, 144, 145	4	CN-111-3	Capacitors
2	R189, 244	2	RC20GF102J	Resistors
3	C265	1	CC100-33	Capacitor
4	CR104,105	2	1N100	Diodes, Crystal
5	S106E	1	A-4253	Ass'y, Wafer, Switch
6	--	2 x 10"	MWC22(7)U4	Wire, Yellow
7	--	2	TE-117-33	Spacer
8	--	8"	RG174/U	Coax. cable
9	--	6"	MWC22(7)U5	Wire, Green
10	--	1	NP362-55	Plate, Modif.
11	Z107	1	NW127	Network
12	--	1	PM691FF7.750	Shaft, Switch
13	--	2	SCBP044OBN26	Screws
14	--	2"	MWC22(7)U0	Wire, Black
15	DELETED			
16	C-131	1	CC21SL1R5C	Capacitor
17	T107- T108	2	A1444	LF Transformer
18	R246, 247, 248, 249	4	RC20GF471J	Resistors
19	CR110	1	1N3070	Diode, Crystal
20	L135	1	CL275-823	RF Choke
21	C264	1	CM20D162G	Capacitor
22	--	1	TE115-1	Standoff Insulator

ITEM NO.	SYMBOL	QTY	TMC PART NUMBER	DESCRIPTION
23	--	1	NTH0256BN6	Nut, Hex
24	--	1	LWS02MRN	Washer, Split
25	V102, 103	2	6C4	Tube, Electron
26	--	4"	MWC22(7)U1	Wire, Brown
27	--	16"	MWC22(7)U91	Wire, Wht/Brn.
28	C141	1	CV11C300	Cap. Var. Cer. 4-30pf.
29	--	1	LA107-8-J105	Band, Mkr, Cbl.
30	--	1	LA107-8-J106	Band, Mkr, Cbl.
31	R157, 158	2	RC20GF100J	Resistors
32	R134, 184	2	RC20GF106J	Resistors
33	R155, 156	2	RC32GF104J	Resistors
34	CR106	1	1N463	Semicond. Dev. diode
35	--	10	WS109-17	Washers, Fiber
36	C277	1	CC100-28	Capacitor, Disc
37	--	1	GR-157	Gear, Spur
38	--	10"	PX104-2-034	Insulation Sleeving
39	--	1	CK965	Schematic, SBE-2A

Tools to be supplied by installing activity.

III. PROCEDURE:

1. Turn off power and move SBE-2 to work bench.

2. Remove all covers except HFO cover.

3. Place band switch (S106) in BAND 2-4 MCS.

4. Remove C142, C143, C144 and C145 located on CR101 and CR102 Terminals 6 and 8. Replace with Item 1 (Capacitors).

5. Remove R179 and R180 (1K ohm Resistors) connected between terminals

III. PROCEDURE - Cont'd

5 and 7 of CR101 and CR102 respectively.

6. Connect one (1) Item 2 (R244) between Pins 4 and 5 of XCR102.

7. Connect Item 3 (C265) between Pin 4 and 7 of XCR102.

8. Remove shielded lead from junction of R171 and R172, and input of Z106. Cut back to cable trunk.

9. Remove shielded lead from Pin 2 of XV108 and out put of Z106. Cut back to cable trunk.

10. Using Item 6 run one yellow wire from terminal 2 of Z106 to Pin 2 of XV108 and the other yellow wire from Pin 1 of Z106 to the junction of R171 and R172. Keep these wires separated and against the chassis.

11. Locate resistor R238 inside rear chassis lip under E101 pin 10. (5.1 Meg. mounted between 2 standoffs). Connect Item 36 (.1 capacitor) between ground lug and end of resistor carrying White/Violet lead.

12. At XV109 Pin 7, remove C258 (7-45pf) and T108 transformer entirely. Note orientation.

13. Replace T108 with one (1) Item 17, (A1444). Red and Black coded terminals to ground.

14. Connect jumper using item 9 (green wire), between T108 Blue coded terminal and Pin 7 of XV109.

15. Remove CR104 and CR105 on rear Terminal Board. Replace with (2) Item 4, (1N100). Heat sink diodes and observe polarity.

16. Remove R134 and R184 on same rear Terminal Board. Replace with Item 32, (10 Meg. resistors).

17. Remove coax from wiper, (output) of S106A and ground. Pull through access hole.

III. PROCEDURE - Cont'd

18. Remove shaft of S106A (Bandswitch). Replace with new shaft, Item 12. This is accomplished by loosining the two (2) set screws on the rear of the shaft coupler located in the first RF section. It may be necessary to first rotate the bandswitch to loosen one of the screws but then put the switch back to 2-4 MCS band. Carefully withdraw theshaft being certain not to change the wafer orientation. Replacement with Item 12 is in reverse order of above procedure.

19. Mount Item 5 (A4253), on the rear of S106 with the 3.3 microhenry chokes facing Z101. Use Items 7 and 35 as spacers. Replace existing mounting screws with Item 13. (See Fig. A).

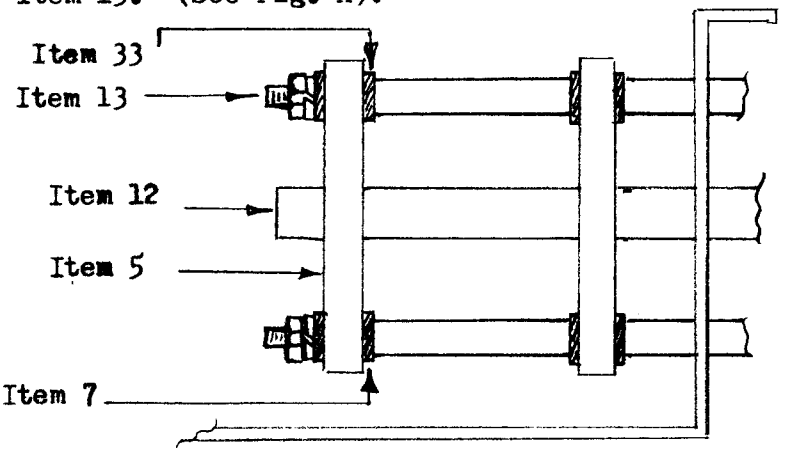


FIGURE A

20. Connect Item 8 from output wiper of S106A to input wiper (top contact) if Item 5 (S106E) - Shield to common ring around Item 5.

21. Shorten and dress lead removed from S106A in Step 17 above to reach output wiper of Item 5 (bottom contact) (S106E). Shield to common ring around Item 5.

22. Remove R189 and C260 located at Pin 8 of XV109. Replace R189 with one (1) Item 2, (1K ohm). C260 no longer used.

23. Remove shield over Output Pot R205. Romove Z107 (A1454) and replace with item 11 (NW-127). Terminal 1 is ground. J110 of NW-127 must face right

III. PROCEDURE - Cont'd

sideplate. Using Item 14 (black wire), jumper "Hi-Side" of R205 (Terminal connected to Pin 2 of Z107). to wiper of R205 (terminal connected to L116).

24. Remove C141 (3-12pf. var. cap.) located below R205. Replace with item 28 (4-30 pf. var. cap.).

25. Locate Teminal Board PX-385 under chassis near T109, T110.

(a) Remove R155, R156 (22K), replace with Item 33 (100K, 1W).

(b) Remove R157, R158 (1.2K), replace with item 31 (10 ohm, $\frac{1}{2}$W).

(c) Remove R165, R165 (47K), discard.

(d) Remove CR106 (1N303), note polarity.

(e) Remove C131 (510pf), located at XV114 Pin 5.

26. Mount Item 34 (1N463), at CR106. Heat sink. Banded side (+) faces bottom cover.

27. Mount Item 16 (1.5pf. cap.) between T110 (Blue coded terminal) and anode (-) side of CR106.

28. Replace Transformer T107, (A1444) with Item 17. Note orientation.

29. Replace shield over Output Pot R205.

30. Remove the two (2) leads between CR101 treminals 2 and 3, and Z101. Replace these two leads with two (2) of Item 18, (470 ohm resistors). Cover resistor leads with Item 38 (sleeving) as necessary.

31. Repeat Step 30 with CR102 and Z102 using two resistors of Item 18 for replacement.

32. Remove Z105 (17KC Oscillator Can) from its socket and remove outer cover.

33. Replace CR110 inside Can with Item 19 (1N3070 Diode). Heat sink and observe polarity.

34. Replace cover of Z105 and place back in its socket.

III. PROCEDURE - Cont'd

35. Drill a 3/32" hole half way vetween XV101 and T105, one half inch from existing standoff insulator.

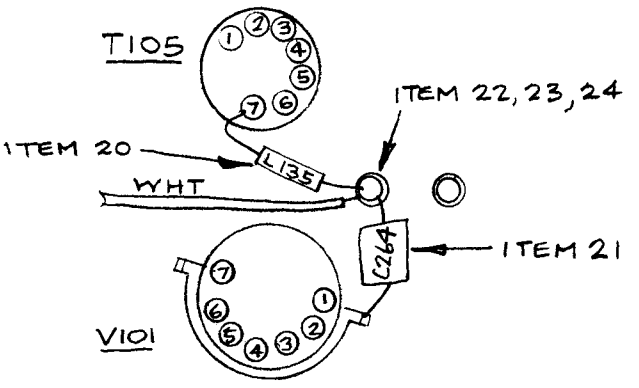
36. Mount Item 22 with Items 23 and 24 as shown in Fig. B.

37. Unsolder white lead from Terminal 7 of T105 and solder it to standoff insulator just mounted.

38. Solder L135 (Item 20) between terminal 7 of T105 and standoff insulator.

39. Solder Item 21 (C264 capacitor) from standoff insulator to ground lug.

Fig. B



40. Remove V102 and V103 (6AB4's) and replace with Item 25, 6C4's.

41. Remove jumpers between Pin 3 of Z103 and Pin 3 of Z104 and between Pin 3 of Z104 and Pin 5 of Z105. Install Item 26 (brown wire) between Pin 3 of Z103 and Pin 5 of Z105. This removes Z104 from 6.3 volt line of J109 Pin A.

42. Install Item 27 (white/brown wire) between feed-thru capacitor C247 (near R130) and Pin 3 of Z104. Run Item 27 thru existing hole in rear separator plate and lace to existing cable harness that runs under S106D and S106E. This connects Z104 to 6.3 volt line of J109 Pin B.

43. Turn Main Tuning Dial counter-clockwise (CCW) to Calibration mark at left of 2 MC. Check for full mesh of 3 gang capacitor. With a pair of needle nose pliers, firmly grasp the two plates of anti-back lash gear engaging the fiber gear at a point clear of the anti-backlash springs. Maintain this

III. PROCEDURE - Cont'd

pressure while removing and replacing fiber gear with Item 37 (GR-157) spur gear. A N_o. 6 Allen wrench (on RF Cover) is required. Above procedure will maintain anti-backlash feature and not affect calibration.

44. Install Item 29 (cable marker J105) on coax cable at J105.

45. Install Item 30 (cable marker J106) on coax cable at J106.

46. When all of the above steps are completed the unit should comply with CK965 (Item 39). Affix Item 10 (nameplate) to front panel of SBE at convenient location.

47. Realign the SBE-2A in accordance with the following procedure.

IV. ALIGNMENT AND TUNING PROCEDURES

A. TEST EQUIPMENT REQUIRED

Hewlett Packard Model 606A	or Equivalent	RF Singal Generator
Hewlett Packard Model 524-C	or Equivalent	Frequency Counter
Ballantine Model 314	or Equivalent	A.C. Voltmeter
Hewlett Packard Model 410B	or Equivalent	VTVM
Hewlett Packard Model 200CD	or Equivalent	Audio Generator
PTE-3 Analyzer	or Equivalent	Spectrum Analyzer
Heath Kit Model AV-3	or Equivalent	VTVM
Crystal TMC Type CR-27/U		2.000 MC
Crystal TMC Type CR-27/U		4.000 MC
Crystal TMC Type CR-27/U		2.270 MC
Crystal TMC Type CR-27/U		4.270 MC
One 70-ohm, 2 watt resistor		
One 1 megohm, $\frac{1}{2}$ watt resistor		
One 5 pf capacitor		

B. PRELIMINARY

1. Check to insure that the RF and MF dial calibration marks line up with the Red line at the counter clockwise dial stop.

2. Connect the 70 ohm load to the RF output connector J103.

3. Place test crystals in the oven as follows:

POSITION	FREQUENCY
1	2.0 mc
2	4.0 mc
3	2.27 mc
4	4.27 mc

4. Connect the unit to the power supply and apply AC power. The Oven and Dial lamps should light up. After a 24 hr. warmup period proceed with the tests below.

5. With the Meter Switch in the CAL. position, adjust the CAL. potentiometer for Zero reading of Meter.

C. 17KC OSCILLATOR CHECK

1. With the VTVM at Pin 4 of T105, measure Output Voltage. The reading should be between .9 and 2.4 volts.

2. With the frequency Counter check the frequency of the 17KC ± 8.5 cps at 70° C.

D. 287KC OSCILLATOR CHECK

1. With the VTVM at Pin 8 of Z103 or at the arm of R113, measure the Output Voltage. The reading should be between .7 and 1.5 volts.

2. Remove the VTVM and connect the frequency counter to Pin 8 of Z103 or the arm of R113. Adjust C-120 as necessary to bring 287 kc ± 57.4 cps at 70° C.

E. MODULATOR TESTS

1. LSB Carrier Balance

a. LSB, USB Switches is OFF

b. Carrier insert fully CCW, minimum.

c. Connect AC Voltmeter across output of Z101(LSB) filter.

d. Adjust R110 for minimum indication on AC Voltmeter.

e. Repeat above test for Z102(USB) filter and R112.

2. 287KC Modulator and 270 KC Amplifier

a. LSB-USB Controls off

b. Remove 12AU7 from top of Z103.

c. Set R113 Potentiometer and C259 to MID position.

d. Connect RF signal generator thru a 5.pf capacitor to Pin 7 of V109.

e. Connect AC VTVM to secondary of T108.

f. Set RF signal generator to 270KC exactly. Use a sufficient level of signal to observe a reading on the AC VTVM.

g. Peak top and bottom slug of T108.

h. Connect AC VTVM to Pin 2 of V113.

i. Peak top slug of T107.

j. Remove signal generator.

k. Reinsert 12AU7 on top of Z103.

l. Carrier insert minimum, CCW.

m. Connect VTVM to Pin 7 of V109B and balance out 287KC completely with R113 and C259.

n. Lock nuts.

F. M. F. ALIGNMENT-INJECTION-CARRIER BALANCE

1. Mid frequency alignment

a. At the mixer grid of V113, there may appear two frequencies; a 270KC frequency, (carrier inserted), and a VMO injection frequency. At the band extremes, the following table applies.

XTAL OR VMO	DIAL READING	LF	RESULTING FREQUENCIES
2000 kc	2.0	270 kc	1.73 mc
4000 kc	4.0	270 kc	3.73 mc

b. The mid frequency is aligned so that the proper product is chosen when the dial is set to the VMO of XTAL frequency; that is, when a 2000 kc xtal is injected, the MF dial is set to 2.0 mc but the actual frequency is 1.73 mc which is the difference between 2000 kc xtal and the 270 KC LF. With this(in mind), preliminary alignment may be accomplished by using the 2000 kc xtals (or VMO).

c. Before aligning the MF, see that the tuning capacitors are in full mesh when the dial is set to the marker on the MF dial.

d. Remove P107 from J110 on Z107. Connect VTVM to pin 2 of Z107. Unbalanced injection with R130, MF balance control.

e. Select xtal position 1(2000 kc). Set MF dial to 2.27mc. Tune T109 and T110 for maximum output.

f. Select xtal position 2(4000 kc). Set MF dial to 4.27 mc. Tune trimmers C140 and C141 for maximum output.

g. This preliminary alignment will ensure subsequent selection of the proper mixer product on the MF dial.

2. CARRIER BALANCE

a. Select xtal position 1(2000 kc).

b. MF dial to 2.27 mc.

c. Carrier insert CCW, adjust R130 for minimum carrier as indicated by observing meter in MF position. Lock R130. Reconnect P107 to J110.

d. Correct MF alignment will be indicated when a signal indication is noted on the MF dial at 2.0 mc and 2.54 mc with carrier inserted and xtal position 1.

e. Insert full carrier. Select xtal position 1(2000 kc). Set MF dial to 2.0 mc. Tune T109 and T110 for maximum output. Slelct xtal position 2(4000 kc). Set MF dial to 4.0 mc. Tune C140 and C141 for maximum output in each case reduce the carrier to insure that proper mixer product has been selected. Repeat until band is tracked. Lock slugs with spintite tools.

3. PRELIMINARY RF AMPLIFIER ALIGNMENT

a. Before alignment, check full meshing of capacitors C181 against dial marking at low frequency end of dial.

b. Channel 1 and 2 selector switches OFF.

c. XTAL switch position 3(2.270 mc). Carrier insert set for maximum,cw.

d. MF tuning tuned at 2.270 mc. Meter in MF position.

e. RF output terminated in 70 ohm load.

f. RF voltmeter across 70 ohm load.

g. In subsequent RF alignment tests, the drive should be sufficiently low to preclude broad response meter indications.

4. 2-4 MC BAND ALIGNMENT

a. Output tuning bandswitch to 2-4 MC band.

b. Band MC switch to band 0. MF tuning to 2.27 mc. Meter in MF position.

c. RF tuning tuned to 2 mc, RF meter switch in RF output position.

d. Tune T116 and T120 for maximum output.

e. XTAL POSITION 4(4.270 mc), carrier inserted and MF tuning tuned to 4.270 mc on MF meter position.

f. RF tuning tuned to 4.0 mc. Meter in RF position.

g. Peak C191 and C179 for maximum output.

h. Repeat above steps to insure proper band alignment with reduced drive to insure sharp tuning peaks.

5. 4-8 MC BAND

a. Output tuning bandswitch to 4-8 MC band.

b. Tune MF to 4.270 mc, output tuning tuned to 4 mc, RF meter switch in RF output position.

c. Tune T113, T117 and T121 for maximum output.

d. Carrier insert ccw, minimum carrier.

e. MF XTAL switch in VMO position (remains in this position for subsequent RF band alignment).

f. Band MC switch in band 4.(8 MC).

g. Output tuning tuned to 8 MC.

h. Peak capacitors C203, C192 and C180 for maximum output.

i. Repeat above procedure to insure proper band alignment with reduced drive to insure sharp tuning peaks.

6. 8-16 MC BAND

a. Output tuning bandswitch to 8-16 MC band.

b. Output tuning tuned to 8 mc. Meter switch in RF position.

c. Alternately tune control "A" and "B" of Z107 for minimum indication on RF output meter.

d. Band MC switch to band 0.

e. Set XTAL selector switch to position 3 (2.270 mc).

f. With carrier inserted, tune MF to 2.270 mc as indicated on meter in MF position.

g. Audio generator connected to terminals 6-8 of E101. Carrier insert to ccw; LSB or USB gain set for 100% on MF meter.

h. Set RF bandswitch to 2-4 MC range. Tune output amplifier to 2 mc. Observe VTVM.

i. Check for 4.2 V nimimum across 70 ohm load.

j. The above output voltage test procedure must be repeated in two (2) megacycle increments from 2 through 32 mc each time checking that a minimum 4.2 volt RF output is obtained across the 70 ohm load.

k. When performing above tests, insure dial calibration is correct.

7. 16-32 MC BAND ALIGNMENT

a. Set RF bandswitch to 16-32 MC.

b. Set dial and generator to 16 mc.

c. Tune T114, T118 and T112 for maximum output.

d. Set dial and generator to 32 MC.

e. Tune C201, C189 and C177 for maximum output.

f. Repeat until ends of band are tracked.

g. When aligned, check RF sensitivity.

	INPUT	METER READING
16 MC	.09	plus 2 db
32 MC	.06	plus 2 db

If difficulty is encountered in this test, the following stage gains should be checked.

	16 MC	32 MC
Gen. Out.	.09	.06
Plate 6AH6	2.0	1.2
Grid 6CL6	1.25	.73
Plate 6CL6	25.0	13
Grid 6146	14.0	8.6
Plate 6146	72.0	83
Output Tap	14.0	14

G. OVERALL TESTS AND REQUIREMENTS

1. Power Output and Signal to Distortion Test.

a. This test will be made on one frequency selected at random in each one of the four bands.

b. Connect the two test tones from the PTE analyzer with a twisted shielded pair to Channel 1 input, terminals 6 and 8 of E101 with the shield, connected to terminals 7 and 5. Connect the analyzer RF input monitor jack J102.

c. With the USB selector set to Channel 1 and USB gain set to 100% MF meter, tune the unit to the selected output frequency for an output of 4.12 RF volts across the 70 ohm load. Aligned T107 and T108 at 2 MHZ carrier and decrease Spurs and Side Tones for minimum.

d. Setup and adjust the PTE as follows to measure the S/D in the USB.

(a) Gain fully clockwise.
(b) Amplitude scale switch to LOG.
(c) CAL OSC to OFF.

e. IF attenuator to 20 db position.

f. Sweep seletor to 14 kc.

g. AFC to OFF.

h. The VOX in the PTE should be adjusted for a frequency 500 kc higher than the signal frequency to be displayed. The two tone test signal should be set these peaks to the center of the analyzer.

i. Adjust input attenuator switches so that two tone test signal peaks are as close as possible to the 0 line or slightly above. With the gain control, set these peaks to the 0 line on the analyzer.

j. Place IF attenuator switch to 0 position, thus expanding the 0 to 40 db scale to 0 to 60. Note the odd order distortion products.

Requirement: The S/D must be at least 45 db below either tone of a standard two tone test for 250 MW PEP output as viewed on a PTE analyzer.

2. CARRIER SUPPRESSION

a. This test will be performed on the same frequencies as the test in paragraph 1 above and with the same general PTE setup.

b. Turn USB and LSB switches to OFF; no AF input.

c. Tune the unit to the desired frequency with carrier insert drive for 250 MW PEP output. Carrier presentation in center of analyzer and peak adjusted to the 0 line with IF 20 db attenuator IN.

d. Set IF attenuator switch to 0 and place carrier insert fully ccw, carrier drive at minimum. Note level of the remaining carrier on analyzer.

e. Adjust R109 and C119 of Z106 for maximum carrier suppression.

Requirement; Maximum carrier suppression must be at least 55 db below the test signal at 250 MW PEP.

3. UNWANTED SIDEBAND REJECTION

a. This test will be performed on the same frequencies as the test in paragraph 1 above and with the same general PTE setup.

b. Connect 500 cycle AF to terminals 6 and 8 of E101. USB channel 1 adjusted for -6 db and unit tuned to desired frequency for 250 MW PEP. PTE sweep at 14 kc; adjusted presentation of 500 cycle tone signal to 0 line on alalyzer with IF 20 db attenuator IN.

c. Set LSB to Channel 1. This will provide a dual 500 cycle tone signal presentation. Note position of the LSB 500 cycle tone signal and then place LSB to OFF.

d. Set IF 20 db attenuator to 0 and read the level of the 500 cycle tone appearing as an unwanted signal in the LSB.

e. Repeat the above test for the LSB.

Requirement: Unwanted sideband rejection shall be at least 60 db below 500 cycle tone test signal for 250 MW PEP, both USB and LSB.

4. 2nd HARMONIC SUPPRESSION

a. This test will be performed on a frequency in the 4-8 mc band.

b. Set both LSB and USB OFF and tune the unit with carrier drive to 250 MW PEP; output at the 2nd harmonic of the fundamental frequency to be measured. (Example: If desired frequency to be measured is 4 mc, the unit would be tuned to 8 mc).

c. Adjust presentation on PTE with IF 20 db attenuator IN and signal peak on 0 line. Leave all PTE cantrols at their present settings.

d. Tune the unit to the fundamental frequency at the same output as above.

e. Set the IF 20 db attenuator to 0. The 2nd harmonic component will now be presented on the analyzer. Note the level of this 2nd harmonic signal.

Requirement: The 2nd harmonic shall be at least 40 db below the level of the fundamental frequency at 250 MW PEP output.

5. OVERALL-FREQUENCY RESPONSE TEST

a. Set up AF generator to approximately the cinter frequency of the bandpass spectrum (1650) at .05V output connected to terminals 6 and 8 of E101 with shielded twisted pair, shield connected to 7 and 5. Monitor AF generator output with Heath kit AV-3VTVM. Output should be constant.

b. With the MF XTAL switch in position 4, tune to 4 mc output frequency with USB OFF and Carrier insert at minimum.

c. Connect VTVM across 70 ohm load.

d. Advance LSB gain control to -6 db and adjust RF output for center scale reading on VTVM.

e. Maintaining constant output from the AF generator vary the frequency from 350 cycles to 3300 cycles, noting the maximum and minimum RF output readings across 70 ohm load.

f. Repeat above test for the USB with AF generator connected to terminals 10 and 12 on E101 with the ground shield tied to terminal 11 and 14.

Requirements: The difference between the maximum and minimum readings in step 5 above shall not exceed 3 db for LSB and USB.

REVISION SHEET

THE TECHNICAL MATERIEL CORP.
MAMARONECK NEW YORK

S-952
LIST NO.

DATE	REV.	SHEET	EMN #	DESCRIPTION	APP.
5/5/62		1 of 3		O= ORIGINAL RELEASE FOR PRODUCTION.	
8/24/65	A	all	14722	Revised per EMN.	
10/18/65	B	ALL	15016	Revised per EMN	
12/20/65	C	2,4	15462	Revised per EMN	
4/7/66	D	all	16076	Revised per EMN	
4/29/66	E	16	16183	Revised per EMN	
5/27/66	F	ALL	16304	Revised per EMN	
10/13/66	G	ALL	17025	Revised per EMN	