PRELIMINARY

TECHNICAL MANUAL

for

SIDEBAND EXCITER SYSTEM

MODEL SBG-4

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, ONTARIO

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FOREWORD

TMC manufactures a series of four channel independent Sideband exciter systems whose mode of operation, and emission modes varies from manual to remote. The exciter units vary from model to model in order to meet varying field requirements. To satisfy this condition most practically, individual manuals on each exciter unit are written; then combined as required to cover any over-all exciter. In this way the "building block" manuals may be assembled in many arrangements in order to fully describe a great many specific exciter equipments.

The following colloquial terms are used in this preliminary manual for each type of SBG-4 system.

SBG(M)4	Manually Operated exciter system
SBG(A)4	Provides frequency, and bandswitch information to enable a companion auto-tuned transmitter.
SBG(R)4	Completely automatic and remoted operation can be via a variety of sources.

SECTION 1

GENERAL INFORMATION

1-1 FUNCTIONAL DESCRIPTION

Sideband Generator, SBG-4 (figure 1-1) is a solid state synthesized four channel independent sideband exciter unit designed particularly to accomodate the high capacity, multichannel voice, teletype, data and FAX requirements. The Sideband Generator (hereinafter referred to as the SBG) is used for an exciter and provides 250 milliwatt rf output over a range of 1.6 MHz to 29.9999 MHz. Standard BNC connectors located on the rear panel of the SBG interface, the RF output rf monitor, 1 MHz output and 1 MHz monitor. Provisions are also included on the rear panel to permit the selection of the SBG's internal 1 MHz standard as a reference, or the selection of an external 1 MHz standard such as the CSS-2.

Optional capabilities of the SBG include provisions for remote operation of the digital frequency selector and mode selector.

1-2 PHYSICAL DESCRIPTION

a. The SBG consists of two modular units, sideband exciter model CMR-4 and RF frequency translator model CHG. The majority of the electronic components which constitute the SBG are mounted on printed circuit boards which plug into the modular unit chassis. Small size, versatility and operational simplicity of this exciter make is especially suitable for transportable applications. The overall dimensions are 12 1/4 inches high, 19 inches wide and 20 inches deep. Overall weight of the SBG is approximately 65 lbs. and designed for installation in a standard 19 inch wide equipment rack. All operating controls are mounted on the front panels for ease of operation. Removable top and bottom protective covers are provided on the chassis in addition to tilt-lock slide mechanisms to facilitate ease in maintenance.

b. Sideband Exciter, CMR-4

The CMR accepts four discrete designated 600 ohm balanced or unbalanced channels and uses frequency-division multiplexing to generate the basic four-channel ISB signal, centered about 1.75 MHz; the CHG mixes this with an internally-generated variable-frequency injection signal of high stability, to produce a 1.6 to 29.99999 MHz exciter output range. The CHG also provides the CMR with a 1-MHz standard reference input, which the CMR uses to obtain its various internal signals.

The CMR portion of the SBG contains circuitry to permit a choice of transmitter keying sources, selected by a front-panel switch. Keying sources include hand key (CW), Push-to-talk (PTT), voice-operated crossover (VOX), and direct manual keying (NORM). Of particular interest is the CMR's VOX circuitry, which automatically disables a channel in the absence of an audio input to that channel, thus preventing transmission of background noise, during inactive periods. Also controllable from the front panel are channel power level, carrier insertion, and metering functions.

1-3 SBG APPLICATIONS

The SBG Four Channel Independent Sideband Exciter is designed particularly to accommodate the high capacity, multi-channel voice, teletype, data and FAX requirements of critical commercial and government point-to-point and tactical circuits. It is readily adaptable however to the less sophisticated single channel CW, FSK, FAX, USB or LSB requirements of back-up or other circuits where frequency allocations or operational needs dictate.

The small size, versatility and operational simplicity of this Exciter make it especially suitable for transportable applications. Radio operators will immediately appreciate the ease of operation. Output frequencies are easily set up without any calculation, and are displayed clearly in digital form. No tuning or peaking is required.

By the use of the four seperate and discrete voice-frequency channels may be transmitted simultaneously by a single transmitter.

Idle Channel Squelch and VOX control are particularly valuable for intermittent channel usage, to preclude idle channel noise transmission, by the transmitter, when a channel is not in use. VOX reactivation of the idle channel is automatic and virtually instantaneous whenever the idle channel is activated. When all four voice-frequency channels are inactive for a preset period of time, and Exciter Standby circuit can be activated to place an entire transmitter in the Standby condition pending reactivation of a channel. The idle Channel Squelch feature is particularly valuable with modern transmitters having an automatic power output level control, inasmuch as the total average transmitter output power remains the same whenever channels are inactivated, thus increasing the output power per activated channel. The SBG-4 Series Exciter has an ALDC input which can be employed with an associated linear amplifier to maintain constant drive level and prevent over-modulation of the amplifier during input level changes.

As indicated by the foregoing, the SBG is an exceptionally versatile, simple and functionally adaptable unit. It is an ideal unit for updating and stabilizing older SSB transmitters with higher stability.

1-4 TECHNICAL SPECIFICATIONS

FREQUENCY RANGE	1.6 - 29.9999 MHz in 100 Hz increments. Remote tuning available - See OPTIONS.
FREQUENCY PRESENTATION	Direct Reading, digital.
MODES OF OPERATION	ISB, SSB, AM, AME, CW; FSK and FAX
OUTPUT POWER	Continuously adjustable from 0 to 250 milliwatts PEP for any mode of operation.
OUTPUT IMPEDANCE	50 ohms nominal.

FREQUENCY STABILITY	1 Part in 10^8 per day with ambient temperature change of 15 degrees within the range of 0-50 degrees Centigrade.
METERING	Built-in multi-meter permits monitoring RF Output and critical RF circuits. VU meter permits monitoring channel input levels.
TUNING	Digital frequency selection is made by front panel controls.
SIGNAL DISTORTION RATIO	Distortion products are at least 40 db below either tone of a two tone test at 100 mw.
UNWANTED SIDEBAND REJECTION	A signal at 500 Hz is at least 60 db down from PEP in the unwanted sideband.
SPURIOUS SIGNALS	Spurious signals greater than 120 Hz removed from the carrier are at least 60 db below full PEP output.
HUM AND NOISE LEVEL	Noise level is at least 60 db below either tone of a two tone test.
CARRIER SUPPRESSION	0, -3, -6, -20, -30 db and FULL (-55 db).
ALDC	Accepts 0 to approximately -11 Volts DC from ALDC circuit of an associated linear amplifier to improve linearity, limit distortion and deliver a relatively constant output level during high modulation peaks or load changes.
AUDIO INPUT CHANNELS	Four, designated A1, A2, B1, B2.
CHANNEL INPUT IMPEDANCE	600 ohms, balanced or unbalanced.
CHANNEL RESPONSE	Passband filter ripple within $\pm$1 db, 350-3040 Hz on direct and 350-3040 Hz on translated (outboard) channels.
SUB-CARRIER FREQUENCY	6290 Hz from Carrier Frequency, synthesized. Also available with 6250 Hz CCIR subcarrier frequency.
CHANNEL PRIORITY CONTROL	Power allocation for each channel controllable from 5% to 100% by individual front panel controls.
SQUELCH AND VOX	Inactive channels automatically disabled to prevent transmission of noise. VOX control on each channel reactivates channel when audio input exceeds -20 dbm.
INPUT DYNAMIC RANGE	-20 dbm to +5 dbm.

ENVIRONMENTAL CONDITIONS	Designed to operate in any ambient temperature between 0 degrees Centigrade and +50 degrees Centigrade, and any value of humidity up to 95%.
INSTALLATION DATA	Size: 12 1/4 inches high x 19 inches wide x 20 inches deep. Weight: Approximately 65 lbs.
PRIMARY POWER	115/230 Volts + 10%, 50/60 Hz, Single Phase, 100 Watts.
LOOSE ITEMS	
OPTIONS AND ACCESSORIES	
REMOTE OPERATIONS	May be equipped for remote operation of the digital frequency selector and mode selection. Please consult your "TMC" representative for the most economical solution to your remote control requirement.

SECTION 2

INSTALLATION

2-1. UNPACKING AND HANDLING

Each modular unit comprising the SBG section has been thoroughly inspected and tested at the factory before shipment. Upon arrival of the equipment, inspect each packing case and its contents immediately for possible damage. Unpack the equipment carefully. Inspect all packing material for parts which may have been shipped as loose items.

With respect to damage to the equipment for which the carrier is liable, The Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

2-2. INSTALLATION

All of the units used in the SBG section are equipped with standard width 19-inch front panels. These units can be mounted in an equipment rack when used to comprise a transmitting system. See associated system manuals that illustrate electrical interconnections of the SBG modular units into a system. Refer to the individual technical and sub-system manuals for detailed connection and installation procedures.

a. INSTALLATION OF MODULAR UNITS. - Refer to figure 1-1 for modular units used. All major units when used in a transmitter are slide-mounted on pull-out, or tilt-lock drawer slides. To install any slide-mounted unit in its compartment, see figure 2-1 and proceed as follows:

1. Untape or unstrap cable assemblies and all other components fastened to the rack frame for shipment.

CAUTION

Start by installing bottom units first in order to avoid rack tipping over from extended center of gravity.

2. Pull center section of associated compartment track out until it locks in an extended position.

3. Position slide mechanisms of modular unit in tracks and ease modular unit forward into rack until release buttons engage holes in track.

4. Make necessary cable and electrical connections as shown in figure 2-2. To prevent cables from snagging, utilize the cable retractors, located at the inside-rear of the rack.

5. Depress release buttons and slide modular unit completely into compartment.

6. Secure front panel of modular unit to rack with screws and washers.

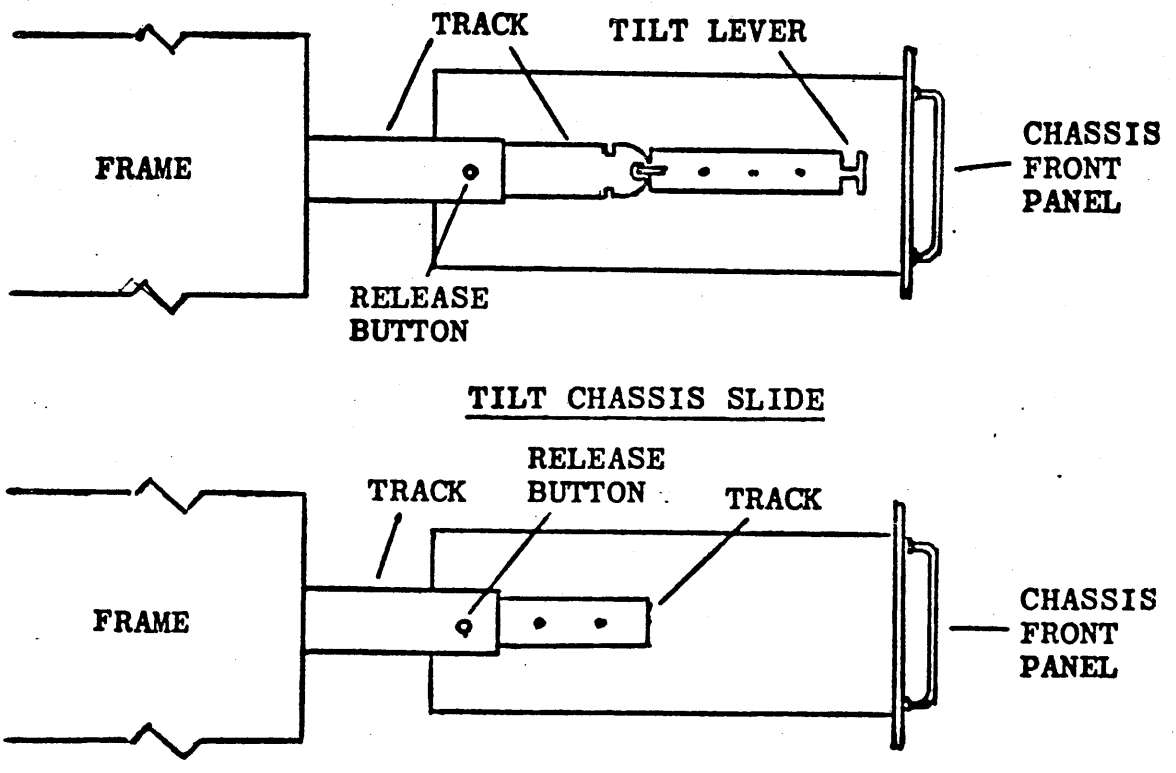


Figure 2-1. Slide Mounting Details

2-3. POWER REQUIREMENTS

The SBG is designed to operate from a single phase power source of 115VAC/230VAC ± 10%, 50/60 Hz. Mating coaxial fittings (BNC) and power cords are supplied as loose items. Equipment normally leaves the factory wired for 115VAC unless otherwise specified, for 230 VAC operation refer to the individual modular manuals supplied (CMR-4 and CHG( ) 4) for transformer wiring changes.

2-4. ELECTRICAL CONNECTIONS

All electrical connections to the SBG are made at the units rear panel. Refer to figure 2-2 for typical wiring interconnections. Table 2-1 indicates rear panel designations and functions of each rear panel connected.

NOTE

The SBG is normally interfaced with an associated linear amplifier to form a transmitting system, however when the SBG is not part of an existing system interconnecting cabling between the CMR and CHGmust be assembled. To make up interconnect cabling refer to figure 2-3.

TABLE 2-1. EXTERNAL ELECTRICAL CONNECTIONS

Emission Mode	Connect to Terminal	Designation
CW	TB1002 Term #9 & 10 (term #10 to ground)	KEY
AM	TB1001 Term #1 & 3, 9 & 11	A1 & B1
AME	TB1001 Term #1 & 3 or 9 & 11	A1 or B1
USB	TB1001 Term #1 & 3	A1
LSB	TB1001 Term #9 & 11.	B1
Tone FSK, FAX	TB1001 Rerm 1 & 3	A1
4 Channel ISB	TB1001 Term #1&3, 5&7, 9&11, 13&15	A1, A2
2 Channel ISB	TB1001 Term #1 &3, Term #9 & 11	A1 & B1
PTT	TB1002 Term #3 & 4	PTT

TABLE 2-2. SBG INTERCONNECTIONS (refer to figure 2-

CHG		CMR	
Connect from	Designation	Connect to	Designation
J126	IF IN	J1014	RF OUTPUT
J120	IMC OUT	J1013	IMC INPUT
J124	RF OUTPUT	(RF input of associated transmitter)	
J123	ALDC	(ALDC input of associated transmitter)	
J122	EXT STD	External 1 MC Standard	

Note above jacks are all BNC connectors.

2-5. PRE-OPERATIONAL CHECKOUT PROCEDURE

The following pre-operational checkout procedure should be performed after the exciter final installation is completed; all interconnect and input power cables connected (see figure 2-2.)

a. PRELIMINARY EXCITER SETUP (refer to figure 3-1 for control and indicator location)

1)	RF OUTPUT Control (2) max ccw	
2)	ON/STANDBY switch (7) ON	POWER indicator should light. (5)
3)	Set FREQUENCY KNOBS (1) to 20000 mc	
4)	Rotate METER switch (3) to Q1, Q2, and Q3 positions and observe the MONITOR meter indicator for indications as marked on meter face (4). Leave METER switch in RF position after checking Q thru Q3.	Q1 position, meter indicates at or near Q1 mark on meter Q2 position, meter indicates at or near Q2 mark on meter Q3 position, meter indicates at or near Q3 mark on meter face.
5)	Power ON switch (14) ON CHANNEL PRIORITY controls (17) to 0 (A1, B1, B2, A2)	POWER indicator (12) lights
6)	Set CARRIER SUPPRESSION switch to 0 (16) and MODE switch to NORM (15)	
7)	Adjust RF OUTPUT control (2) for 1/4 scale reading on MONITOR meter (4)	

8) Apply an audio signal between 350 to 3040 Hz, at a level of no less than -25dbm or greater than +5dbm to channel A1 600 ohm input.	Only A1 CHANNEL ACTIVITY indicator(11) should light and INPUT LEVEL meter will indicate input level when METER FUNCTION switch (18) is in A1 position.
9) Apply audio as above to channels A2, B1 and B2	CHANNEL ACTIVITY indicator of each should light or INPUT LEVEL should indicate the presence of audio in the corresponding positions.
10) Rotate A1 CHANNEL PRIORITY control (17) clockwise and observe a notable increase in the reading on MONITOR meter (3).	MONITOR meter (4) readings increase with clockwise rotater of CHANNEL PRIORITY control.

NOTE

CHANNEL PRIORITY control is only active providing CHANNEL ACTIVITY indicator is lit.

11) Check A2, B1 and B2 CHANNEL PRIORITY controls as above.

12)	Place MODE switch (15) to VOX position and voice modulate Channel A1 (audio level must be at least -25dbm).	A1 CHANNEL ACTIVITY indicator will light with the presence of audio.
13)	Voice modulate Channels A2, B, and B2 observing the same indications for A1 only with the associated CHANNEL ACTIVITY indicator and METER FUNCTION.	

NOTE

Reduce RF OUTPUT (counterclockwise rotation of RF OUTPUT control (2)) to avoid pegging MONITOR meter indicator.

14)	Place MODE switch to PTT position. Connect external PUSH-TO-TALK device to terminal 4 on TB1002. Activate PTT and active channel indicator will light upon activator of PTT.	INPUT LEVEL meter will indicate level of audio input in active channel.

15) Place MODE switch to CW position

Connect external key to terminal 9 on TB1002. Close CW key, adjust RF OUTPUT control (2) for a 1/2 scale reading on MONITOR meter (4). Operate CW key slowly and observe monitor meter variations as key is operated.

This completes the SBG preliminary checkout procedure.

b. SHUTDOWN PROCEDURE

RF OUTPUT (2) max counterclockwise

ON/STANDBY (9) STANDBY

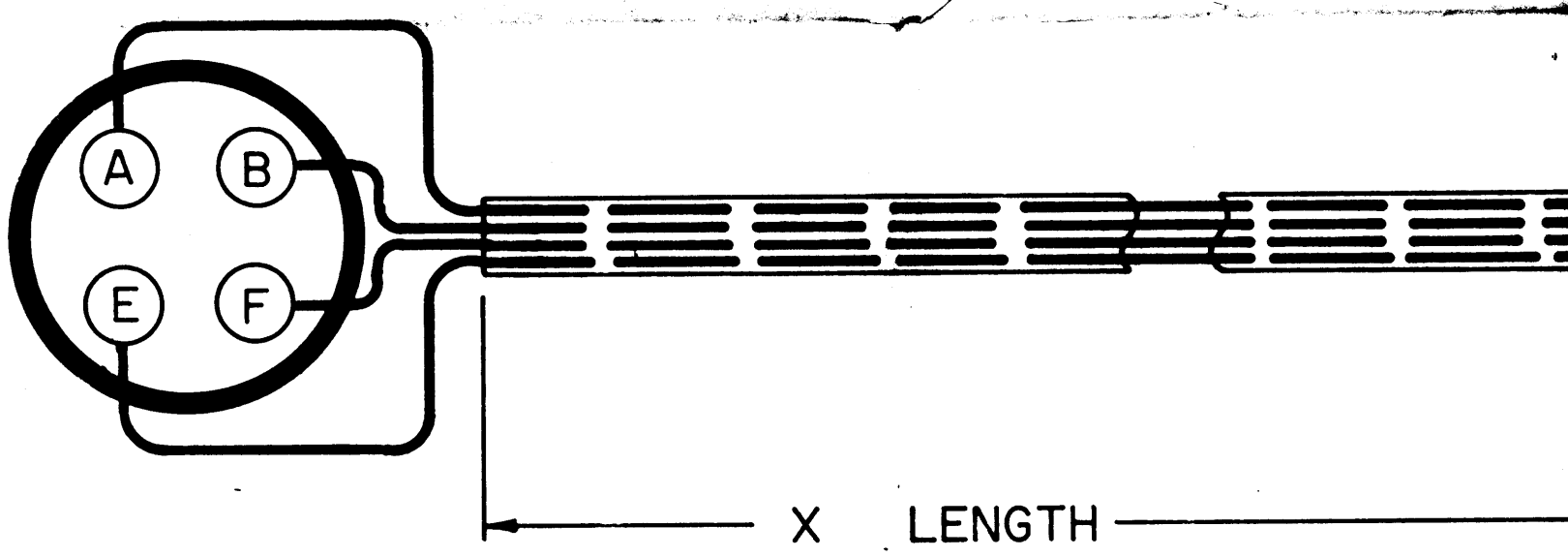
CHANNEL PRIORITY - 0

POWER OFF (down)

System operating procedures for the various mode of emission are presented in section three of this manual.

INTERCONNECTING CABLE A8

J119 CHGM-4



NOTE: CABLES REQUIRED BUT NOT SUPPLIED

QTY / UNIT	MODEL USED ON	ASS'Y NO.

APPLICATION

CODE

UNLESS OTHE
DIMENSIONS
AND INCLUDE CI
OR PLATI

TOLER

DECIMALS
.X ± .05
.XX ± .01
.XXX ± .005

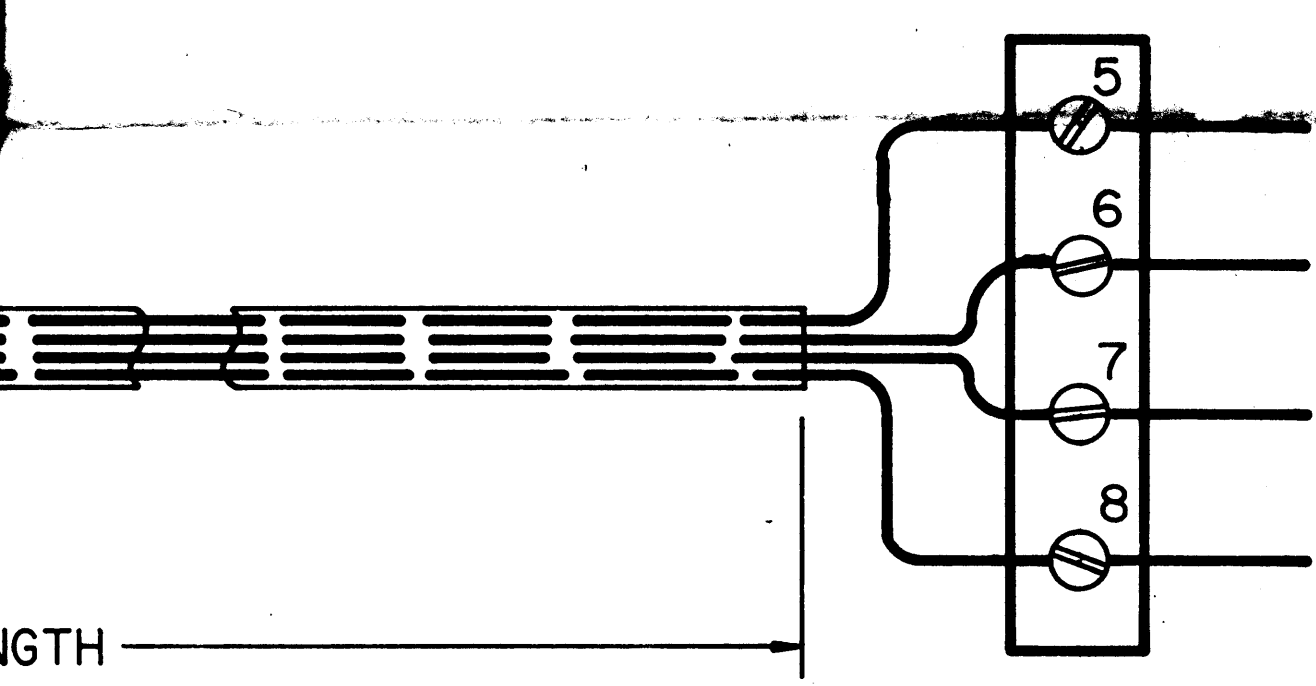
MATERIAL

FINISH

REVISIONS							
E.M.N.NO	DRAFT	CHKD	ZONE	LTR	DESCRIPTION	DATE	APP

CABLE ASSEMBLY

TB 1002 TERMINAL BD.



TB	J119
5	A
6	B
7	F
8	E

NOT SUPPLIED

QTY. REQ.	ITEM	PART NO.	DESCRIPTION	S

LIST OF MATERIAL

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND INCLUDE CHEMICALLY APPLIED OR PLATED FINISHES

TOLERANCES ON

DECIMALS	FRACTIONS
.X ± .05	± 1/64
.XX ± .01	ANGLES
.XXX ± .005	± 0° -30'

MATERIAL

FINISH

	DATE
FINAL APPROVAL	
MECH. DES.	
ELECT. DES.	
CHECKED	
DRAWN	

THE TECHNICAL MATERIEL CORP.
MAMARONECK, NEW YORK

SIZE	CODE IDENT NO.	DWG NO.
C	82679	

SCALE

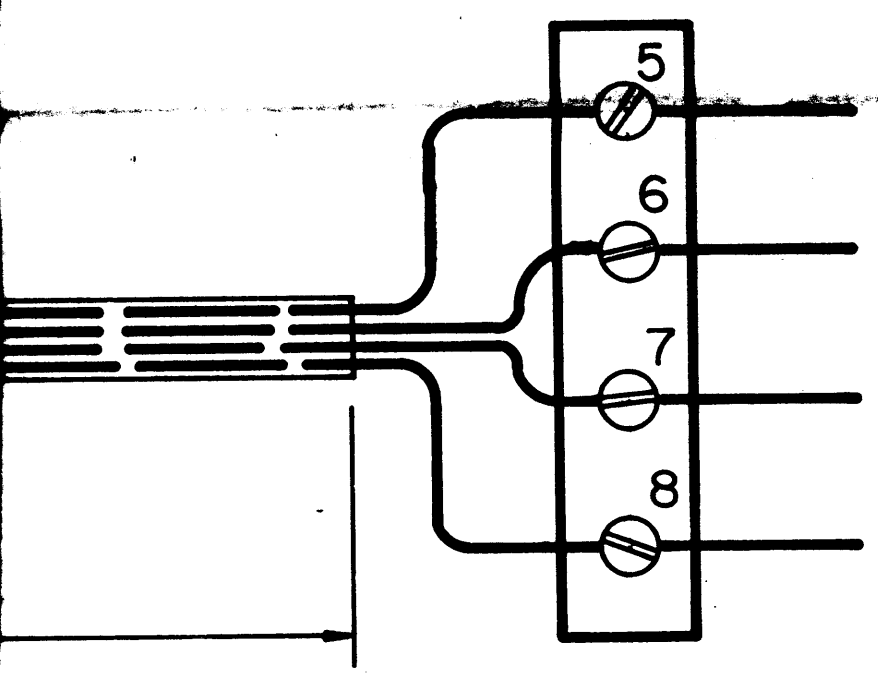
SHEET OF

ASS'Y NO.

REVISIONS							
E.M.N.NO	DRAFT	CHKD	ZONE	LTR	DESCRIPTION	DATE	APPROVED

ASSEMBLY

TB 1002 TERMINAL BD.



TB	J119
5	A
6	B
7	F
8	E

QTY. REQ.	ITEM	PART NO.	DESCRIPTION	SYMBOL

LIST OF MATERIAL

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES INCLUDE CHEMICALLY APPLIED OR PLATED FINISHES

TOLERANCES ON

DECIMALS
.XX ± .05
.XX ± .01
.XXX ± .005

FRACTIONS
± 1/64
ANGLES
± 0° -30'

MATERIAL

FINISH

FINAL APPROVAL	DATE	
MECH. DES.	DATE	
ELECT. DES.	DATE	
CHECKED	DATE	
DRAWN	DATE	

THE TECHNICAL MATERIEL CORP.
MAMARONECK, NEW YORK

SIZE	CODE IDENT NO.	DWG NO.	ISSUE
C	82679		

SCALE | SHEET OF

D C B A

2 1

8 7 6

D

C

B

CHG-( )

CMR-4

IMc
J120
P3079

OUT

ALDC J123

J116

AC

P3074

P3075

IF
IN
J126

P3076

J121
MON

EXT

STD

RF

OUT

MON

P3077
J124

B+
F1003

B-
F1002

AC
F1001

DC
F1004

AC
POWER

J1011
P3071

IMc
INPUT

J1013
P3072

6 | 5 | 4

J121
MON

EXT

J122
P3081

STD

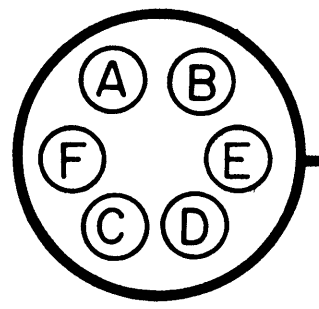
RF

MON

P3077
J124

P 3078
J125

J119



AC
F1001

DC
F1004

TB1001
E3022

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	AI		GND		A2		GND		BI		GND		B2		GND		
	600Ω				600Ω				600Ω				600Ω				

IMc

RF

INPUT

J1013
P3072

OUTPUT

J1014
P3073

(J119)

A B F E

PTT

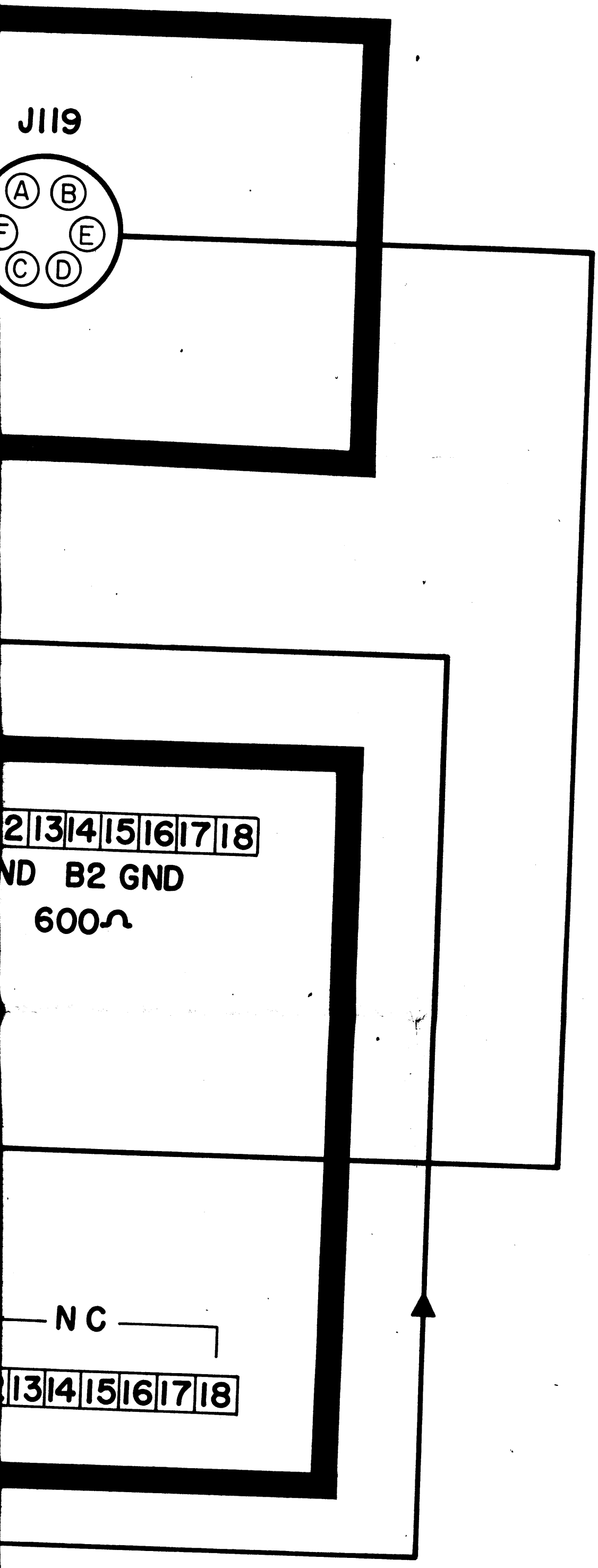
CW
KEY

NC

TB1002
E3021

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

E.M.N.NO	DRAFT	CHKD	ZONE	LTR	REVISION DESCRIPTION



SBG-4 WIRIN
INTERCONNEC

OPER. MODES	CONN TO TERMS.	DES
CW	9&10	TB10
AME	1&3,9&11	TB10
USB	1&3	TB10
LSB	9&11	TB10
ISB	1&3,5&7 9&11 13&15	TB10

3	2	1

E.M.N.NO	DRAFT	CHKD	REVISIONS ZONE	LTR	DESCRIPTION	DATE	APPROVED

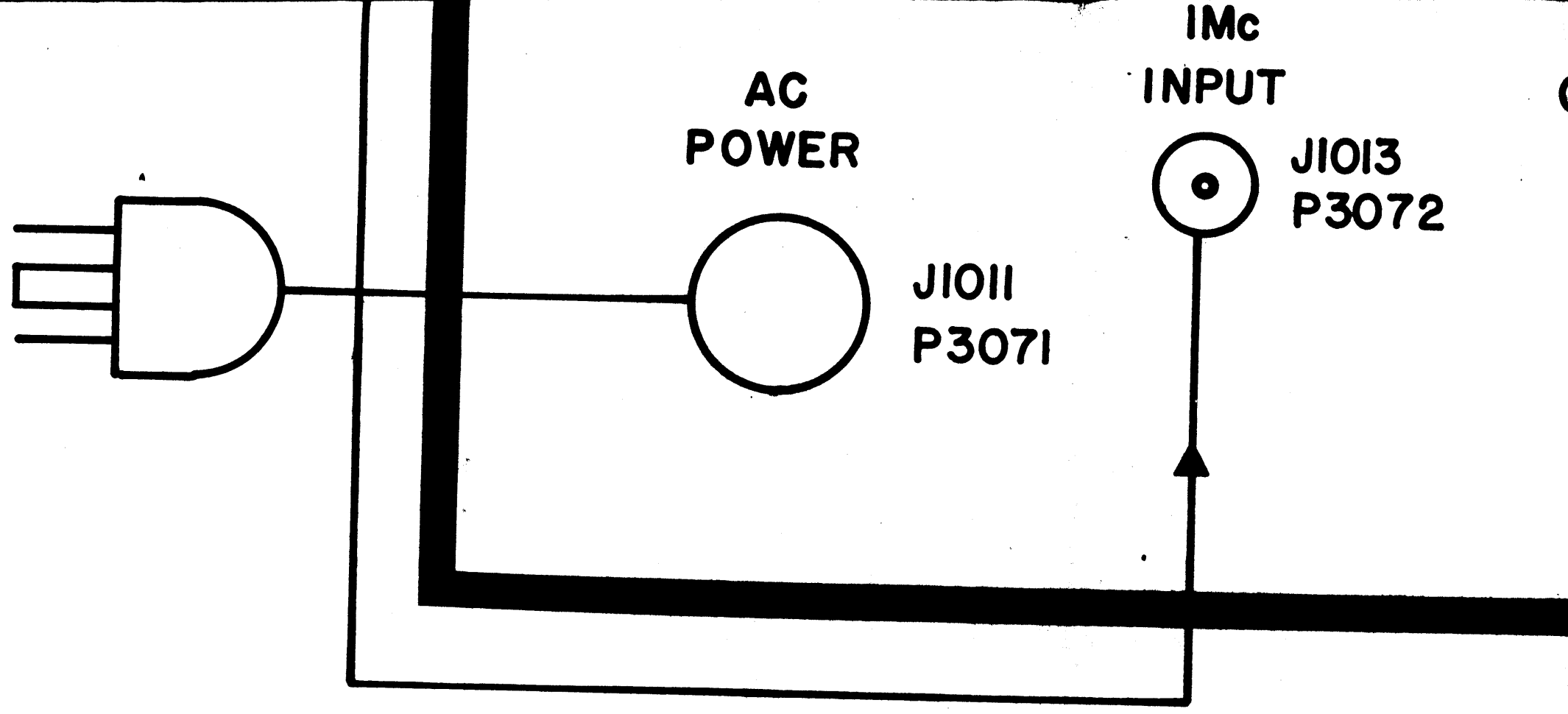
SBG-4 WIRING INTERCONNECT

OPER. MODES	CONN. TO TERMS.	DEST.
CW	9&10	TB1002
AME	1&3,9&11	TB1001
USB	1&3	TB1001
LSB	9&11	TB1001
ISB	1&3,5&7 9&11 13&15	TB1001

D

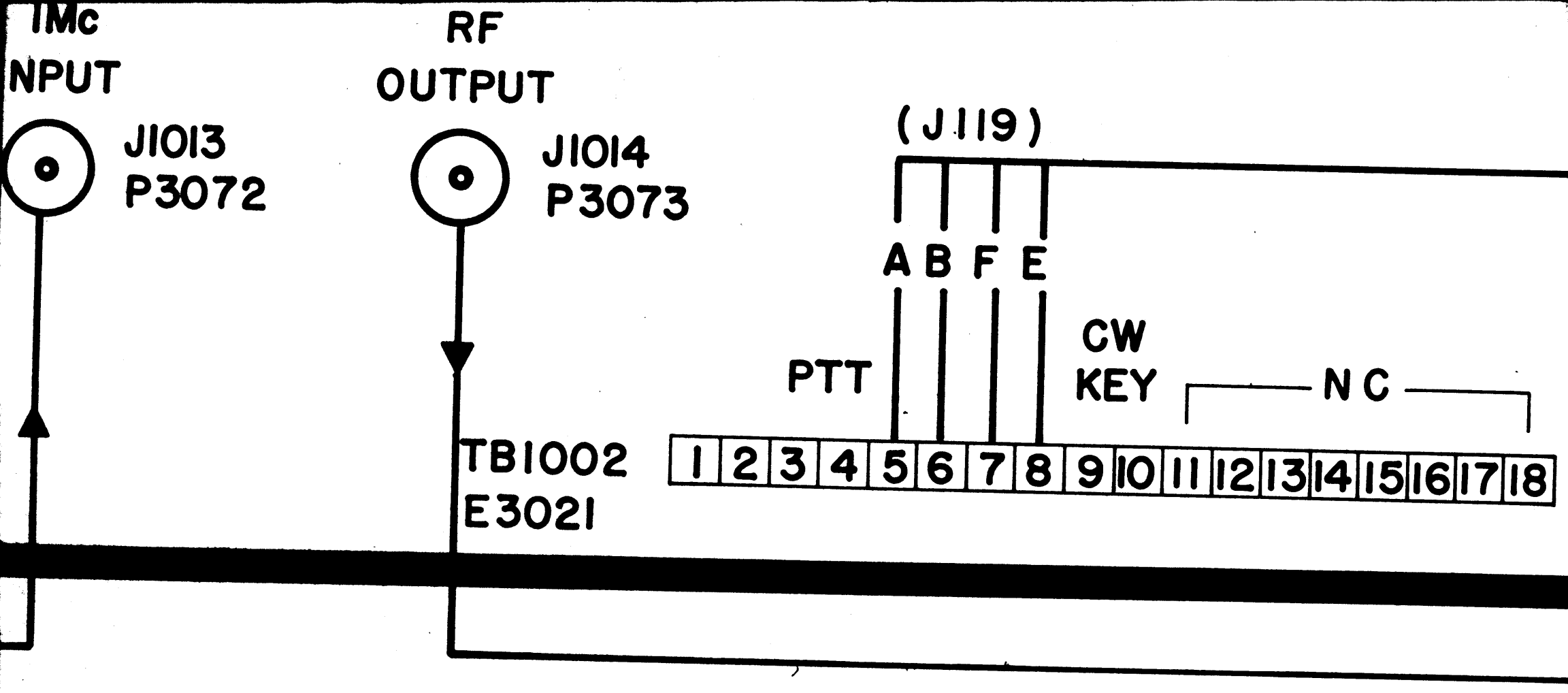
C

B



B

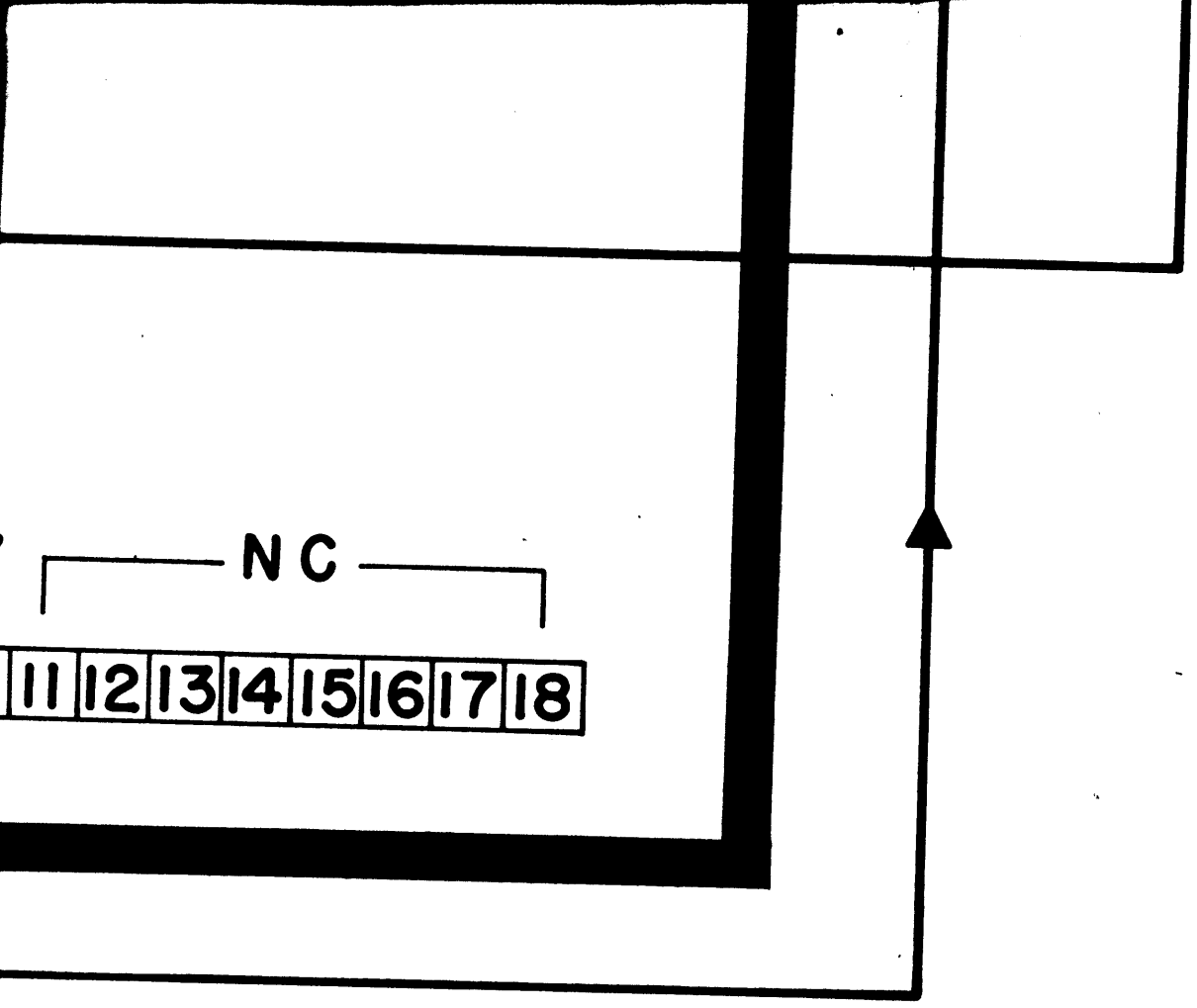
A



QTY / UNIT	MODEL USED ON
APPLICATION	
CODE	

6 5 4

LSB	9&11
ISB	1&3,5&7 9&11 13&15



QTY. REQ.	ITEM	PART NO.	DI

LIST OF MATERI

UNIT	MODEL USED ON	ASS'Y NO.
APPLICATION		
	CODE	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND INCLUDE CHEMICALLY APPLIED OR PLATED FINISHES

TOLERANCES ON

DECIMALS
.X ± .05
.XX ± .01
.XXX ± .005

FRACTIONS
± 1/64

ANGLES
± 0° -30'

MATERIAL

FINISH

FINAL APPROVAL		DATE
MECH. DES.		DATE
ELECT. DES.		DATE
CHECKED		DATE
DRAWN		DATE

THE TECH
MAM

SIZE	CODE IDENT NO.	DW
D	82679	
SCALE		

4 3 2

LSB	9&11	TB1001
ISB	1&3, 5&7 9&11 13&15	TB1001

B

QTY. REQ.	ITEM	PART NO.	DESCRIPTION	SYMBOL

LIST OF MATERIAL

ESS OTHERWISE SPECIFIED
ENSIONS ARE IN INCHES
CLUDE CHEMICALLY APPLIED
OR PLATED FINISHES

TOLERANCES ON

MALS	FRACTIONS
.05	± 1/64
.01	ANGLES
.005	± 0° -30'

AL

FINAL APPROVAL		DATE
MECH. DES.		DATE
ELECT. DES.		DATE
CHECKED		DATE
DRAWN		DATE

THE TECHNICAL MATERIEL CORP.
MAMARONECK, NEW YORK

A

SIZE	CODE IDENT NO.	DWG NO.	ISSUE
D	82679		

SCALE | SHEET OF

3 2 1

SECTION 3

OPERATOR'S SECTION

3-1. SBG OPERATION

a. The SBG consists of the CMR and CHG units. The actual signal to be eventually transmitted is generated in the CMR; it is in this unit that the degree of carrier suppression and mode of keying are selected. Channel power allocations (so-called "Channel Priorities") are also selected in the CMR. Output of a carrier frequency of 1.75 MHz is fed from the CMR to the CHG. The CHG mixes the 1.75 MHz intelligence with variable-frequency RF supplied by its internal synthesizer, to produce intelligence at the desired output frequency. Output frequency is selected at the CHG, and is directly displayed in its six frequency-selection switch indicator windows. An associated linear amplifier is also set at the CHG.

The following paragraphs provide detailed operating procedures for the CMR-CHG combination. Before operating these units be sure that all primary power connections to the system have been made.

b. CMR - Controls and indicators for the CMR are as follows:

TABLE 3-1. CONTROLS AND INDICATORS, CMR

NAME	FIG. 3-1 REF.	FUNCTION
CHANNEL ACTIVITY (4 indicators; 1 per channel)	11	Illuminates to indicate activity within channel(s).
STANDBY	13	Illuminates to indicate no activity on any channel (all channels inactive).

POWER	12	Illuminates to indicate application of primary power to CMR.
Power Switch (marked ON)	14	Applies or removes CMR's primary power.
MODE	15	Selects one of four keying sources for CMR: CW, PTT, VOX, NORM.
CARRIER SUPPRESSION (db)	16	Selects one of six degrees of carrier suppression: 0db, -3db, -6db, -20db, -30db, FULL (-55db).
CHANNEL PRIORITY (4 controls; 1 per channel)	17	Apportions total transmitter power among the four channels as desired: calibrated in percent of total available power.
METER FUNCTION	18	Switches INPUT LEVEL (dbm) meter to one of four channels: A1, A2, B1, B2.
INPUT LEVEL (dbm)	19	Indicates input level (dbm) of particular channel selected by METER FUNCTION switch.

NOTE

Before operating CMR, ensure that CHG has had adequate warm-up time: approximately 30 minutes should suffice, and that CHG POWER switch is set to ON position (up).

c. CHG - 3.1. - Controls and indicators for the CHG are as follows:

TABLE 3-2. CONTROLS AND INDICATORS, CHG

NAME	FIG. 3-1	FUNCTION
10MHz, 1MHz, 100KHz, 10KHz, 1KHz, 100Hz	1	Selects output frequency of CHG, and therefore, of entire 10K. Six switches: decade arrangement from 100Hz (minimum increment) to 10MHz (maximum increment).
RF OUTPUT	2	Varies maximum RF output of CHG from 0 to 250 mw; functions as drive control for 10K.
METER	3	Switches MONITOR meter (ref. 4 below) into collector circuits of RF amplifiers Q1, Q2, and Q3, and to RF output of CHG. Four positions: Q1, Q2, Q3, RF.
MONITOR	4	Indicates collector current of RF amplifiers Q1, Q2, Q3; also indicates relative RF output of CHG. Switched by METER (ref. 3 above).
LINE	6	Line fuses; protect both sides of primary power input line. 1.0 amp each.
STANDBY; POWER (2 separate indicators)	5	Indicate position of ON/STANDBY switch (ref. 7 below), and, therefore, condition of CHG.

ON/STANDBY (2) positions of same switch)	7	Applies or removes B+ from all circuits except Ovenized Oscillator Z301; Z301 receives power at all times, as long as primary AC is applied to unit.

3-2. SBG OPERATING PROCEDURE

This section enables the operator to produce a useable signal of the desired frequency and emission mode from the SBG.

a. Full-carrier (tune-up). This provides a steady, unmodulated carrier of continuously-variable amplitude at the desired operating frequency for use during system tune-up. To produce this "key-down" condition, do the following:

CMR( ) 4

Control	Position
power switch	ON
MODE	NORM
CARRIER SUPPRESSION(db)	0
CHANNEL PRIORITY (All four controls)	0

Control	Position
ON/STANDBY	ON
frequency selector switches	set to desired operating frequency.
METER	RF
RF OUTPUT	vary as necessary to obtain proper drive to associated linear amplifier.

Those controls which are not listed are, in effect, electrically by-passed in the given mode.

NOTE

Once having tuned the SBG on a carrier, reduce RF OUTPUT of the CHG to minimum (RF OUTPUT control full CCW). At this point, a fairly accurate estimate must be made of the total number of modulating tones to be contained in the entire transmitted spectrum. RF OUTPUT must then be increased no further than the point at which average power is such as to produce the linear amplifier rated PEP output.

In view of the above note, the following operational procedures will omit direct mention of RF OUTPUT control settings. Bear in mind, however, that this control must be adjusted for each mode of operation, in accordance with the note.

b. CW Operation. Simply set the SBG as previously described for Full Carrier tune-up, with the following exception: set CMR MODE switch to CW.

SBG may now be keyed via external CW key connections.

Audio and keying input connections to the SBG for the various modulated modes are made at the CMR rear panel (TB1001 & TB1002). See figure 2-

Figure 3-4 shows a four-channel ISB spectrum:

Figure 3-4. Four-channel ISB spectrum centered at 1.75 MHz.

Notice the channel labelling; this corresponds to the labelling on the CMR's CHANNEL PRIORITY controls. Each CHANNEL PRIORITY control adjusts power level of its associated channel, and is calibrated in percent of total available power. Therefore, the sum of the dial calibrations on all four controls should never exceed 100 (and should equal 100 only under full carrier suppression), representing total use of all available power. Thus, if it is desired to allocate, for example, 50 percent of total transmitter power to channel A1, and 25 percent to A2, then the total of channels B1 and B2 settings must not exceed 25 percent, or the remaining "unused" power (assuming full suppression).

Note that both inboard channels (A1 and B1) are the "normal" upper sideband

and lower sideband, respectively, of the 1.75 MHz center frequency. Outboard channels A2 and B2 are the multiplexed channels.

3-3. SBG MODULATION MODES

The following paragraphs describe the SBG operation for the various modulated modes: Full carrier suppression is assumed; partial carrier operation will be discussed subsequently.

a. Upper Sideband (A1). Set SBG controls as follows:

CMR

Control	Position
Power Switch	ON
CARRIER SUPPRESSION	FULL
MODE	VOX or PTT, as desired
CHANNEL PRIORITY:	as follows:
A1	100
A2	0
B1	0
B2	0
METER FUNCTION	A1

CHG

Set CHG as described under Full Carrier tune-up operation.

Key SBG and apply audio input (if VOX is used, merely apply audio): A1 channel activity indicator should illuminate, and INPUT LEVEL (dbm) meter should indicate presence of audio.

b. Lower Sideband (B1).

Set as for USB, with the following exceptions:

CHANNEL PRIORITY:	
A1	0
A2	0
B1	100
B2	0
METER FUNCTION	B1

CHG

Set CHG as described under Full Carrier tune-up operation.

Key SBG and apply audio input (if VOX is used, merely apply audio): CHANNEL ACTIVITY indicator B1 should illuminate, and INPUT LEVEL (dbm) meter should indicate variations in average incoming audio level.

c. Independent Sideband (A1 and B1). For two-channel ISB (inboard channels used, to conserve spectrum space), set the SBG as follows:

CMR

Control	Position
power switch	ON
MODE	VOX or PTT, as desired
CARRIER SUPPRESSION (db)	FULL
CHANNEL PRIORITY:	as follows:
A1	50
A2	0
B1	50
B2	0
METER FUNCTION	A1 or B1, as necessary or desired.

CHG

Set CHG as described under Full Carrier tune-up operation.

Key SBG and apply audio (if VOX is used, merely apply audio) to A1 and B1 inputs: CHANNEL ACTIVITY indicators A1 and B1 should illuminate, and INPUT LEVEL (dbm) meter should vary with average audio input level.

The above operating procedure assigned equal priorities (power allocations) to each channel. However, it is sometimes desirable to assign different power levels to each sideband channel, particularly when the most important (or highest-priority) channel carries complex modulation (eg. - 16-tone VFTG)), resulting in a low average power, compared to a lower-priority channel, carrying, say, relatively simple modulation, and enjoying a higher average power. The situation created, therefore, is precisely the opposite of that which is desired: the high priority channel carries less average power than the lower-priority channel.

To correct this situation, power may be reapportioned according to channel priority and/or complexity of modulation. CHANNEL PRIORITY controls are merely adjusted to establish proper priority and/or allocations. Thus, instead of setting both A1 and B1 CHANNEL PRIORITY controls to 50, it may be necessary or desirable to use a ratio other than 50-50 (1:1). Simply set the CHANNEL PRIORITY controls to obtain desired priority or power-per-channel: this will necessitate a determination of relative peak-to-average rations between channels; if one channel, for example, has a peak-to-average ratio of 4 to 1 and the other channel has a peak-to-average ratio of 3 to 1, the relative ratio between channels is 4 to 3. CHANNEL PRIORITY controls are then set inversely to the between-channel ratio. Thus, in the case of a 4:3 between-channel ratio, the controls are adjusted to produce an inverse, or 3:4 power allocation ratio. This will restore power balance

between channels. Once having achieved a 1:1 power ration between channels, the operator may then proceed to establish any desired ratio; a 1:1 ratio provides a convenient starting point, and allows the operator to visualize the power ratio between channels.

d. Independent Sideband (A1, A2, B1, B2). For four-channel ISB, set the SBG as follows:

CMR

Control	Position
power switch	ON
MODE	VOX or PTT, as necessary or desired
CARRIER SUPPRESSION (db)	FULL
CHANNEL PRIORITY:	as follows:
A1	25
A2	25
B1	25
B2	25
METER FUNCTION	A1, A2, B1, B2 as necessary or desired

CHG

Set CHG as described under Full Carrier tune-up operation.

Key the SBG and apply audio (if VOX is used, merely apply audio) to A1, A2, B1, and B2 channel inputs. All CHANNEL ACTIVITY indicators should illuminate, if all channels are simultaneously active; only active channels will cause their respective CHANNEL ACTIVITY indicators to illuminate. INPUT LEVEL (dbm) meter will indicate variations in average level of the channel to which it is switched.

Channel priorities for four-channel ISB operation may be assigned in similar manner to two-channel priority assignments. However, note that initial power balance becomes a two-step operation: 1. By the method previously described, balance A1 and A2; similarly, balance B1 and B2. 2. Then, Balance both LSB channels ("B" channels) against both USB channels ("A" channels); when balancing, take care not to disturb the ratio already established between inboard and outboard channels of a given sideband (step 1 above).

e. AME Operation. AM Equivalent, or AME, consists of a single sideband plus a -6db carrier. It is indistinguishable to the ear from conventional AM, but uses only half the spectrum space, and enjoys a 6db sideband power advantage over AM (3db of this advantage results from elimination of one sideband, and 3db is the result of carrier reduction of 3db from the -3db conventional AM carrier); this results in a Total Intelligence Power (so-called "talk power") advantage of 3db, for the AME mode.

AME operation with the SBG is accomplished as follows: First, determine which sideband is to be transmitter; then simply set the SBG as for SSB transmission of the desired sideband, with the following exceptions:

Unit	Control	Position
CMR	CARRIER SUPPRESSION(db)	6
CMR	CHANNEL PRIORITY	either A1 or B1, depending on desired sideband: 50.

Proceed as for single-sideband, suppressed-carrier operation: all further control settings and procedures are identical to those for SSB.

In those communications circuits that utilize Automatic Frequency Control (AFC) to maintain proper receiver tuning, it is usually necessary to insert a reduced or partially-suppressed pilot carrier at the transmitter, to provide a lock point for the receiver's AFC circuitry. Also, certain types of AGC circuits intended for use in multi-channel applications make use of a re-inserted pilot carrier, for proper operation.

The SBG may be operated in any of the single- or multi-channel modes previously described (for which full suppression was assumed), using reduced or only partially-suppressed carrier. Reduced carrier is defined as a carrier greater than 6db but less than 26db below full CW carrier; a carrier greater than 26db below a full CW carrier is defined as a Suppressed Carrier. The term "partially-suppressed carrier" is peculiar to this text, and is defined as a carrier greater than 26db below full CW carrier, but less than the greatest suppression of which the system is capable (in this case,55db). Full carrier is defined as a carrier 6db or less below full CW carrier.

f. PARTIAL or REDUCED CARRIER OPERATION. To operate the SBG with reduced- or partially-suppressed carrier, simply set the controls for the particular emission mode desired, as if the carrier were fully suppressed, with the following exception:

Unit	Control	Position
CMR	CARRIER SUPPRESSION(db)	either 20 or 30, as necessary or desired (20 position inserts a -20db carrier; 30 inserts a carrier -30db from full CW).

Theoretically, the partial reinsertion of a carrier would require a slight reduction in CHANNEL PRIORITY controls, since a certain amount of total available power is being used to generate the pilot carrier, and cannot, therefore, be called upon to produce sideband intelligence without overdriving the system. However, when calculated in terms of percentage of total available power, a -20db (worst-case) carrier amounts to only one percent of total power; this is negligible, for all practical purposes, and is well beyond the readability and resettability limits of the CHANNEL PRIORITY controls and their respective calibrations.