

**TECHNICAL  
MANUAL**

FM-40H3 40KW FM TRANSMITTER

**HARRIS  
INTERTYPE  
CORPORATION**

**GATES<sup>®</sup>**  
A DIVISION OF HARRIS-INTERTYPE

## **WARRANTY**

Seller warrants new equipment manufactured by Gates Radio Company against defects in material or workmanship at the time for delivery thereof, that develop under normal use within a period of one year (6 months on moving parts) from the date of shipment, of which Purchaser gives Seller prompt written notice. Other manufacturers' equipment, if any, including electron tubes, and towers shall carry only such manufacturers' standard warranty.

Seller's sole responsibility for any breach of the foregoing provision of this contract, with respect to any equipment or parts not conforming to the warranty or the description herein contained, is at its option, (a) to repair or replace such equipment or parts upon the return thereof f.o.b. Seller's factory within the period aforesaid, or (b) to accept the return thereof f.o.b. Purchaser's point of installation, whereupon Seller shall either (1) issue a credit to Purchaser's account hereunder in an amount equal to an equitable portion of the total contract price, without interest, or (2) if the total contract price has been paid, refund to Purchaser an equitable portion thereof, without interest.

If the Equipment is described as used, it is sold as is and where is. If the contract covers equipment not owned by Seller at this date it is sold subject to Seller's acquisition of possession and title.

Seller assumes no responsibility for design characteristics of special equipment manufactured to specifications supplied by or on behalf of Purchaser.

Seller shall not be liable for any expense whether for repairs, replacements, material, service or otherwise, incurred by Purchaser or modifications made by Purchaser to the Equipment without prior written consent of Seller.

EXCEPT AS SET FORTH HEREIN, AND EXCEPT AS TO TITLE, THERE ARE NO WARRANTIES, OR ANY AFFIRMATIONS OF FACT OR PROMISES BY SELLER, WITH REFERENCE TO THE EQUIPMENT, OR TO MERCHANTABILITY, INFRINGEMENT, OR OTHERWISE, WHICH EXTEND BEYOND THE DESCRIPTION OF THE EQUIPMENT ON THE FACE HEREOF.

## **RETURNS AND EXCHANGES**

Do not return any merchandise without our written approval and Return Authorization. We will provide special shipping instructions and a code number that will assure proper handling and prompt issuance of credit. Please furnish complete details as to circumstances and reasons when requesting return of merchandise. Custom built equipment or merchandise specially ordered for you is not returnable. Where return is at the request of, or for the convenience of the customer, a restocking fee of 15% will be charged. All returned merchandise must be sent freight prepaid and properly insured by the customer. When writing to Gates Radio Company about your order, it will be helpful if you specify the Gates Factory Order Number or Invoice Number.

## **WARRANTY ADJUSTMENTS**

In the event of equipment failure during the warranty period, replacement or repair parts may be provided in accordance with the provisions of the Gates Warranty. In most cases you will be required to return the defective merchandise or part to Gates f.o.b. Quincy, Illinois for replacement or repair. Cost of repair parts or replacement merchandise will be billed to your account at the time of shipment and compensating credit will be issued to offset the charge when the defective items are returned.

## **MODIFICATIONS**

Gates reserves the right to modify the design and specifications of the equipment shown in this catalog without notice or to withdraw any item from sale provided, however, that any modifications shall not adversely affect the performance of the equipment so modified.

INTRODUCTION

This Technical Manual provides the necessary information for application, installation, operation, adjustment, and maintenance of the Model FM-40H3, 40 KW FM TRANSMITTER.

WARNING

EXTREMELY DANGEROUS VOLTAGES EXIST IN THIS TRANSMITTER

Do not make adjustments inside the transmitter with the high voltage on. De-energize the transmitter when making repairs. Do not bypass the interlocks. Do not do any servicing alone. Always ground circuits with a shorting stick before touching.

DO NOT TAKE CHANCES WITH LETHAL VOLTAGES!!



## SAFETY NOTICE

WARNING: THE CURRENTS AND VOLTAGES IN THIS EQUIPMENT ARE DANGEROUS AND UNDER CERTAIN CONDITIONS, COULD BE FATAL.

This Manual is intended as general guidance for trained and qualified installation, operating, maintenance and service personnel who are familiar with and aware of the dangers inherent to handling potentially hazardous electrical and/or electronic circuits. It is not intended to contain a complete statement of all safety precautions which should be observed by personnel in using this or other electronic equipment.

THE INSTALLATION, OPERATION, MAINTENANCE AND SERVICING OF THIS EQUIPMENT INVOLVES RISKS TO BOTH PERSONNEL AND EQUIPMENT, AND MUST BE PERFORMED ONLY BY PROPERLY TRAINED AND EXPERIENCED PERSONNEL EXERCISING DUE CARE. PERSONNEL MUST FAMILIARIZE THEMSELVES WITH SAFETY REQUIREMENTS, SAFE HANDLING AND OPERATING PRACTICE, AND RELATED FIRST-AID PROCEDURES (E.G., FOR ELECTRICAL BURNS AND ELECTRICAL SHOCK).

Gates shall not be responsible for injury or damage resulting from improper installation, operation, maintenance or servicing, or from the use of improperly trained or inexperienced personnel in the performance of such tasks, or from the failure of persons engaged in such tasks to exercise due care.

As with all electronic equipment, care should be taken to avoid electrical shock in all circuits where substantial currents or voltages may be present, either thru design or short circuit. Caution should also be observed in lifting and hoisting equipment, especially regarding large structures, during installation.

## LIABILITY LIMITATION

The procedures outlined in this Manual are based on the information available at the time of publication and should permit the specified use with minimum risk. However, the manufacturer cannot assume liability with respect to technical application of the contents and shall, under no circumstances, be responsible for damage or injury (whether to person or property) resulting from its use.

The manufacturer is specifically not liable for any damage or injury arising out of failure to follow the instructions in this Manual or failure to exercise due care and caution during installation, operation, maintenance and service of this equipment.

## CAUTIONARY NOTICE

Always disconnect power before opening covers, doors, enclosures, gates, panels or shields. Always use grounding sticks and short out high voltage points before servicing. Never make internal adjustments, perform maintenance or service when alone or when tired.

Never remove, short-circuit or tamper with interlock switches on access covers, doors, enclosures, gates, panels or shields. Keep away from live circuits, know your equipment and don't take chances. Proper training of experienced personnel and observing the above guidelines will help assure safe and continued operation of this equipment.



TABLE OF CONTENTS

SECTION	PAGE
INTRODUCTION.....	i
WARNING.....	i
1. DESCRIPTION .....	1-1
1.1 General .....	1-1
1.2 Additional Equipment.....	1-1
2. INSTALLATION.....	2-1
2.1 Damage Claim Information .....	2-1
2.2 Unpacking and Inspection.....	2-1
2.3 Unpacking Check List.....	2-1
2.4 Installation .....	2-1
2.5 Power Requirements &Connections.....	2-1
2.6 Transmitter Power Requirements & Connections.....	2-1
2.7 Audio Connections.....	2-1
2.8 Control and RF Interconnections.....	2-1
3. OPERATION & ADJUSTMENT .....	3-1
3.1 Transmitter Modification .....	3-1
3.2 Front Panel Controls .....	3-1
3.3 Turn-On Procedure .....	3-2
3.4 Remote Control.....	3-5
4. CIRCUIT DESCRIPTION.....	4-1
4.1 TE-3 FM Exciter .....	4-1
4.2 IPA .....	4-1
4.3 600 V. DC Power Supply .....	4-1
4.4 Control Panel .....	4-1
4.5 Power Output/VSWR Panel .....	4-2
5. PARTS LIST .....	5-1
5.1 Center Cubicle.....	5-1
5.2 Power Output/VSWR Control Panel.....	5-2
5.3 Control Panel .....	5-3
5.4 IPA .....	5-4
5.5 RF Output Accessories.....	5-7
6. SCHEMATICS & DRAWINGS	
Interconnecting Wiring	828 5379 001
R.F. Output Metering Unit.....	810 9390 001
Block Diagram .....	827 8140 001
Power Output/VSWR Panel .....	838 9176 001
Control Panel .....	838 9119 001
IPA .....	838 5477 001
Installation Drawing.....	842 6577 001
Center Cubicle .....	842 9391 001

994 6746 103





## SECTION 1 - DESCRIPTION

### 1.1 General.

The center cubicle contains the following assemblies:

- 1) Rejected power and total power output meters.
- 2) Power output/VSWR panel.
- 3) Control panel.
- 4) IPA panel.
- 5) TE-3 FM Exciter.
- 6) 600 V. DC power supply.

Dimensions of the cubicle are 29 inches wide, 78 inches high and 33 inches deep. The front door swing is 29 inches.

### 1.2 Additional Equipment

The description and operation of the RF output circuitry of the transmitters are included in this instruction book.

## SECTION 2 - INSTALLATION

- 2.1 **Damage Claim Information**  
In case of damage, notify the delivering carrier at once. After the carrier has approved the damage report, order new part(s) from Gates Division, Harris-Intertype Corporation using the parts list for description and individual identification.
- 2.2 **Unpacking and Inspection**  
The containers and packing should be removed only after a careful examination of the outside of the carton for indications of possible mishandling.
- Retain packing material until installation is complete and system is placed in operation.
- 2.3 **Unpacking Check List**  
Certain components of the transmitters and center cubicle have been removed for shipment and are packed separately to insure safe handling. Refer to the Packing Check List which accompanies transmitters and the center cubicle.
- 2.4 **Installation**  
Refer to the TE-3 Exciter technical manual which is part of the transmitter instruction book for the exciter module installation.
- Position the center cubicle between the FM-20H3 transmitter cabinets. The transmitter designated A must be on the left side of the center cubicle as viewed from the front.
- Install the transmitters' RF output circuitry as shown on the Installation Drawing - 842 6577 001. DO NOT rely on the top of the transmitter for support of the low pass filter.
- 2.5 **Power Requirements & Connections**  
A 230 V. AC, 60 Hz, single phase, 3-wire fuse or circuit breaker protected power source capable of approximately 6A is required.
- Connect the input power to terminals 1, 2 (common) and 3 of the fuseblock on the base of the cubicle.
- 2.6 **Transmitter Power requirements & Connections**  
Refer to the transmitter instruction book for the AC input supply requirements and the high voltage power supply interconnections instructions.
- 2.7 **Audio Connections**  
Refer to the TE-3 FM Exciter technical manual for the audio input connections.
- 2.8 **Control and RF Interconnections**  
Refer to drawing 828 5379 001 and 842 9391 001.
- On the top of the center cubicle there are three groups of wires.

Connect the three groups of wires to the transmitters and RF accessories as indicated on the drawings.

The transmitters RF input coax cables (RG/188) should be routed in the vertical wire channel adjacent to the front access door hinge in each transmitter and then connected to the IPA input on the RF enclosure.

SECTION 3 - OPERATION & ADJUSTMENT

- 3.1 Transmitter Modification  
Refer to the Addenda Sheet in the transmitter instruction book.
- 3.2 Front Panel Controls  
The following table gives the identification and function of the front panel controls and meters.

<u>IDENTIFICATION</u>	<u>TYPE</u>	<u>FUNCTION</u>
<u>Cabinet Meter Panel</u>		
M1	DC Microammeter	REJECTED POWER
M2	DC Microammeter	FORWARD POWER
<u>Power Output/VSWR Control Panel</u>		
S1	3-position Knob Controlled Switch	REJECTED POWER Meter Function
S2	3-position Knob Controlled Switch	FORWARD POWER Meter Function
R1	Potentiometer	REJECTED POWER Calibrate Adjust
R2	Potentiometer	REJECTED VSWR Calibrate Adjust
R3	Potentiometer	FORWARD POWER Calibrate Adjust
R4	Potentiometer	FORWARD VSWR Calibrate Adjust
<u>Control Panel</u>		
DS1	Pilot Light	Indicates Filament ON
DS2	Pilot Light	Momentary Indicates Plate ON
F1	Indicating Fuseholder	Indicates IPA Plate Control Fuse Open
S1	Pushbutton Switch	FILAMENT OFF
S2	Pushbutton Switch	FILAMENT ON
S3	Pushbutton Switch	PLATE OFF
S4	Pushbutton Switch	PLATE ON
S5	Toggle Switch	REMOTE/LOCAL

994-6777-103

<u>IDENTIFICATION</u>	<u>TYPE</u>	<u>FUNCTION</u>
<u>IPA Panel</u>		
C15	Knob Controlled Variable Capacitor	IPA OUTPUT LOADING
DS1	Pilot Light	Indicates PLATE ON
DS2	Pilot Light	Indicates FIL ON
F1	Indicating Fuseholder	Indicates Plate Fuse Open
F2	Indicating Fuseholder	Indicates Filament Fuse Open
L4	Screwdriver Adjust Variable Inductor	IPA PLATE TUNING
M1	Milliammeter	IPA Parameter
R14	Potentiometer	FILAMENT ADJUST
S1	Toggle Switch	PLATE ON
S2	Toggle Switch	FILAMENT ON
S3	Toggle Switch	Multimeter Function Selector
TP1	Jack (Test)	SCREEN GRID
TP2	Jack (Test)	CONTROL GRID.
TP3	Jack (Test)	CATHODE
TP4	Jack (Test)	GROUND
TP5	Jack (Test)	FILAMENT VOLTAGE
TP6	Jack (Test)	FILAMENT VOLTAGE

#### TE-3 FM Exciter

Refer to the exciter technical manual which is part of the FM-20H3 instruction book.

#### 10kW Dummy Load

Refer to the instruction manual of the load. Note the change in the control wiring per the center cubicle drawing

### 3.3 Turn-On Procedure

Position the REMOTE/LOCAL switches on the control panel and the transmitters to LOCAL.

Push the FILAMENT ON switch on the control panel. The indicator in the switch should light. This switch will control the AC power input to the sub-assemblies in the center cubicle if their respective switches are left in the ON position.

Turn ON the POWER switch on the power supply of the TE-3 Exciter.

Also turn ON the FILAMENT switch on the IPA panel. The indicator above the switch should light.

Using an iron vane AC voltmeter check the IPA filament voltage at the test points on the IPA panel. If necessary, vary the FILAMENT ADJUST FOR A 6 V. AC reading.

Refer to Section 3.2 - Turn-On Procedure in the TE-3 Exciter technical manual to determine if the exciter is functioning normally.

Check to be sure the IPA fan is ON.

A 30 second time relay on the remote control panel prevents the IPA plate to be turned ON immediately after its filament is turned ON.

The function of the multimeter on the IPA panel is determined by the toggle switch directly below the meter. The parameters indicated are:

<u>SWITCH POSITION</u>	<u>FUNCTION</u>	<u>SCALE</u>	<u>MULTIPLIER</u>
Down	Cathode Current (mA)	0-25	10
Up	Power Output (Watts)	0-25	1

Check the IPA cathode current on the meter. The indication should be 15 to 25 mA.

The plate voltage of the IPA should not be turned ON until the exciter is operating.

Push ON the filament voltage of both transmitters.

Turn ON the IPA PLATE switch of the IPA panel. The indicator above the switch should light.

The IPA PLATE TUNING is locked. Adjust the IPA OUTPUT LOADING for a peak in power output as read on the IPA multimeter.

Refer to the Test Data Sheets for the IPA parameters readings as read during final test at the Gates factory.

Adjust both transmitters IPA GRID TUNING for maximum grid currents as read on the transmitters meters.

Energize the plate supplies of Transmitter A by pushing the PLATE ON pushbutton. Proceed with tuning the transmitter as indicated in its instruction book.

Check the VSWR on the POWER OUTPUT meter of Transmitter A as follows:

- 1) Position the POWER OUTPUT/VSWR selector switch to VSWR CALIBRATE.
- 2) Set the meter for maximum or full scale deflection using the VSWR CALIBRATE Control.
- 3) Turn the selector switch to VSWR and read the reflected wave.

If the VSWR is greater than 1.2:1 turn OFF the transmitter and determine the source of the problem and repair as necessary.

On the POWER OUTPUT/VSWR control panel in the center cubicle position both S1 and S2 function switches to FORWARD POWER.

The center cubicle FORWARD POWER meter should read approximately 20 to 25%. The center cubicle REJECTED POWER meter should read approximately 100%.

Check the VSWR (1.2:1) on both the REJECTED POWER meter and the FORWARD POWER meter with the appropriate controls on the POWER OUTPUT/VSWR control panel in the center cubicle. Reset the switches to FORWARD POWER position.

After it is determined the Transmitter A is operating normally, turn OFF the plate voltage.

Energize the plate supplies of Transmitter B by pushing its PLATE ON pushbutton. Proceed with checking Transmitter B as instructed for Transmitter A above.

The operation of both transmitters must be satisfactory and the VSWR checks 1.2:1 or less before proceeding.

Energize the plate supplies of Transmitter A.

If both transmitters have equal power output and the RF signal phase relationship is correct the FORWARD POWER meter on the center cubicle should read 100%. At the same time the REJECTED POWER meter should be zero.

Adjust both transmitters for equal power output.

The REJECTED POWER meter indication should go through a null as the Transmitter B IPA GRID TUNING is adjusted for the correct phase relationship between the transmitters. The null should occur very close to the maximum power output.

The other tuning controls on the transmitters will also affect the REJECTED POWER meter indication.

Since the transmitters were checked into a 50 ohm resistive load any system with a mismatch will probably change the tuning. Therefore, the recorded Test Data knob readings may not agree with actual operation at your rated power level.

The POWER RAISE/POWER LOWER switch on each transmitter is used to compensate for any change in power output due to AC line voltage variations. Therefore, both transmitters will have to be changed to achieve the desired power output with minimum rejected power.

Refer to the Test Data sheets of your transmitters for the performance readings you can expect when operating at your designated power output.

For local shutdown of the individual units of the system, turn OFF the plate supplies of the transmitters first, then the IPA PLATE, the transmitter's filament voltage, the Exciter and the IPA filament voltage - in that order.

An alternate method is to turn OFF the plate supplies of the transmitters first, then push the FILAMENT OFF switch on the control panel and then turn OFF the transmitter's filaments.

The units in the center cubicle are ready to be turned ON again by pushing the FILAMENT ON switch if the individual switches of the Exciter and IPA are left in the ON position.

The transmitters may be controlled by the switches on the control panel in the center cubicle.

Position the LOCAL/REMOTE switches on the transmitters only to the REMOTE position.

Push the FILAMENT ON switch on the control panel. The sub-assemblies in the center cubicle and the transmitter's filaments should be turned ON.

After the IPA in the center cubicle is operating (30 second time delay) push the PLATE ON switch on the control panel.

The plate voltage of both transmitters will be energized simultaneously.

The system may be turned OFF by pushing the PLATE OFF switch and then the FILAMENT OFF switch on the control panel.

### 3.4

#### Remote Control

Remote control of the ON/OFF functions of transmitters and center cubicle are possible by the proper connections to the terminal boards on the control panel.

Momentary contact closures is required for FILAMENT ON, FILAMENT OFF, PLATE ON and PLATE OFF.

Remote control contact closures between the following terminals are required for the control functions:

FILAMENT ON	TB1-4	and	TB1-3.
FILAMENT OFF	TB1-4	and	TB1-2.
PLATE ON	TB1-4	and	TB2-11.
PLATE OFF	TB1-4	and	TB2-12

994-6742-103



Relay K4 on the control panel will have to be energized continuously through the Fail/Safe contacts of the remote control equipment. Normally, the contacts of K4 are connected in the filament control circuitry, however they may be moved to the plate control circuitry by changing the wiring to terminal boards TB-1 and TB-2. The changes are:

For Transmitter A -

1. Remove jumper between TB2-2 and TB2-3.
2. Move wire 26 from TB2-4 to TB2-2.
3. Move wire 23 from TB2-5 to TB2-3.
4. Connect jumper between TB2-4 to TB2-5.

For Transmitter B -

1. Remove jumper between TB1-10 and TB1-11.
2. Move wire 34 from TB1-12 to TB1-10.
3. Move wire 21 from TB2-8 to TB1-11.
4. Connect jumper between TB1-12 to TB2-8.

When the LOCAL/REMOTE switch on the control panel is in REMOTE the filament ON/OFF circuitry can only be controlled remotely. However, the plate ON/OFF circuitry can still be controlled by the PLATE ON/OFF switches on the control panel.

The power output RAISE/LOWER function is still controlled by the individual transmitter circuitry as explained in the transmitter instruction book. The 6 VDC relay circuitry may be bypassed with jumpers as follows:

- RAISE function: jumper TB4-4 to TB4-6.
- LOWER function: jumper TB4-3 to TB4-5.

Since the RAISE/LOWER local and remote circuits are in parallel, they should not be operated simultaneously.

Remote metering of each transmitter is available as explained in the transmitter instruction book. Also, in the center cubicle there are two RF Remote Metering units for remotely metering the rejected power of the high power hybrid coupler and the total forward power to the antenna.

994-6740-103

## SECTION 4 - CIRCUIT DESCRIPTION

4.1 TE-3 FM Exciter  
Refer to the exciter technical manual which is part of the FM-20H3 instruction book.

4.2 IPA  
The IPA stage is used to amplify the RF output (2 W.) of the exciter to the level required to drive the transmitters.

They use a 4X150A tube in a RF grounded cathode amplifier circuit. The plate circuit is inductively tuned and the loading changed with a variable capacitor.

A sample of the RF output is rectified and used for the meter indication. The meter is calibrated for 20 when the RF output is 20 W.

The grid circuit is inductively tuned and locked at the Gates factory. Since the circuit is several megahertz wide it will not require any field adjustment. The variable inductors are accessible only with the IPA cover off.

The screen grid voltage is zener regulated from the 600 V. DC power supply.

Filament voltage can be measured at the test jacks (2) on the IPA panel. An iron vane AC voltmeter should be used to set the voltage at 6 V. AC by varying the IPA FILAMENT ADJUST.

Four other marked test jacks are on the IPA panel for voltage measurements of various tube parameters.

4.3 600 V. DC Power Supply  
The 600 V. DC power supply is used to provide the screen grid voltage and the plate voltage for the IPA. The supply is a single phase, full wave circuit with a single section choke input filter.

Primary taps on the transformer can be changed to compensate for the lower input line voltage. Below 215 V. AC the transformer 208 V. tap should be used.

4.4 Control Panel  
The switches and relays on this panel will control the low voltage and high voltage control circuits of the center cubicle and the transmitters.

Switches S1 and S2 control latching relay K1 in the LOCAL mode.

As K1-2 is energized, voltage will be applied to the TE-3 FM exciter and the IPA filaments of the center cubicle if their switches are in the ON position. After a 30 second time delay, K3 is energized and the voltage to the IPA plate will be turned ON. Also, if the transmitters are in REMOTE, their low voltage circuits will be energized.

Relay K1 is controlled by external contacts if S5 is in REMOTE.

Switches S3 and S4 control momentary relays K5 and K6 to operate the high voltage control circuits simultaneously of both transmitters if the transmitters are in REMOTE.

Relays K5 and K6 can be controlled by external contacts (the contacts would be in parallel with S3 and S4) if S5 is in REMOTE.

The voltage applied to the FAIL/SAFE relay K4 is determined by switch S5. In LOCAL control K4 is energized by the internal circuit. In REMOTE, K4 will be energized through the FAIL/SAFE contacts in the remote control equipment.

Two sets of contacts of K4 are connected to terminal boards TB1 and TB2. The contacts may be connected to either the filament ON/OFF or the plate ON/OFF control circuits of each transmitter. The contacts are normally connected in the filament circuit at the factory.

#### 4.5 Power Output/VSWR Panel

One set of controls on this panel is used with the REJECTED POWER meter and the directional coupler mounted at the REJECT POWER output of the Pi/2 hybrid coupler.

The other set of controls is used with the FORWARD POWER meter and the directional coupler mounted at the FORWARD POWER output of the Pi/2 hybrid coupler.

The REJECTED POWER meter was calibrated for 100% meter reading when 1/4 tested power output was connected to the reject dummy load.

The FORWARD POWER meter was calibrated for 100% meter reading at tested power output.

VSWR caused by the antenna or dummy loads can be determined by using the appropriate controls as follows:

1. Position the POWER OUTPUT/VSWR selector switch to VSWR CALIBRATE.
2. Set the meter for maximum or full scale deflection using the VSWR CALIBRATE control.
3. Turn the selector switch to VSWR and read the reflected wave.

994-6742-103

## FM HARMONICS IN THE TV BAND

The sharp upsurge in FM broadcasting has in some instances developed unlooked for interference with local TV reception. In every instance this interference is in so-called fringe areas for TV reception and where the strength of the TV signal is weak enough that outside highly directional home TV antennas are necessary. ----- When this condition develops, the TV viewer quickly learns from his service man that the local FM station is the offender. ----- The FM broadcaster is immediately deluged with requests to eliminate the interference. In some instances CATV (Community Antenna Television) systems are also offended as they pick up weak distant TV stations. ----- What is the FM broadcaster's responsibility? Answer: To meet FCC rules and regulations as related to harmonic radiation of his FM equipment but not to guarantee perfect TV reception.

Below is a chart showing the picture and sound frequencies of TV stations between Channels 7-13 inclusive. Channels 2-6 are not shown. FM harmonics do not fall in these Channels. In fact, commercial FM station harmonics will affect only Channels 8 and above ----- look at the chart.

<u>TV Channel</u>	<u>Picture Frequency Band ---Mc---</u>	<u>Sound Frequency</u>
7	175.25 to 179.50	197.75
8	181.25 to 185.50	185.75
9	187.25 to 191.50	191.75
10	193.25 to 197.50	197.75
11	199.25 to 203.50	203.75
12	205.25 to 209.50	209.75
13	211.25 to 215.50	215.75

The frequency range for commercial FM broadcasting is 92.1 Mc to 107.9 Mc: --- To determine the second harmonic of your FM frequency, just multiply your frequency by 2. Example: If your frequency is 99.9 Mc, multiplied by 2 would make a second harmonic of 199.8 Mc. By consulting the above chart, you will note the second harmonic falls in the picture portion of the TV Channel 11.

### Correct FM Harmonic Radiation

The FCC stipulates that transmitters of 3000 watts power and over must have a harmonic attenuation of 80 db. For 1000 watts, 73 db., and for 250 watts, 66.9 db. All reputable manufacturers design their FM transmitters to meet or exceed these specifications.

### Fringe Area TV Strength Versus FM Harmonics

Let's take a typical FM station that radiates 70,000 microvolts per meter at 1 mile. At 80 db. harmonic attenuation (as called for by FCC), this station will radiate approximately 7 microvolts per meter at 1 mile on the second harmonic. In the case of our Channel 11 example, it is estimated that a fringe area TV station from 60 to 90 miles distance would have a signal strength of from 5 to 25 microvolts per meter. It can then be easily understood that a 7 microvolt signal, well within FCC specifications, would definitely interfere with the TV signal, yet with the FM broadcaster's equipment performing normally.

This is sometimes further aggravated by the FM station being located between the TV station and the TV receivers. In this instance the TV antennas are focussed not only on the TV station but your FM station as well. The home TV antennas are beamed at your legal second harmonic as well as the fringe TV station.

### What To Do

When interference occurs, it will develop ragged horizontal lines on the TV picture varying with the FM program content. If the TV sound portion is interfered with (usually not the case), then the FM signal will be heard in addition to the TV sound.

1. It is not up to the FM broadcaster to go on the defensive. He did not put the TV station 75 miles away nor did he select the TV Channel. ---- In most instances the condition is a natural phenomena that neither you, the TV station, nor the FCC can correct.
2. Do not adjust the FM harmonic or "T" notch filters supplied with the FM transmitter. These are factory adjusted and most FM stations do not have the expensive equipment necessary for correct adjustment. Tampering with this calibrated adjustment will probably make the condition worse.
3. Do not rely on TV service men's types of measuring equipment. They are not built to accurately measure harmonics and invariably give erroneous readings that invite the CATV or local service men's association to say "I told you so." Remember it is difficult to radiate harmonics if the equipment is built to suppress the harmonics and it is.
4. In many instances interference may be caused by overloading on the front end of the TV receiver. This problem usually occurs when the receiver is located close to the FM transmitter. This problem can be overcome by installing a trap tuned to the frequency of the FM carrier. The TV service man can and must learn how to do this. In most cases it works, while in some instances, if not properly installed or tuned, it will not completely eliminate the interference. In one case where interference of this type existed, a TV station put traps for the fundamental FM frequency on nearly every TV set in town. Not the FM transmitter.

### Summary

The FCC is well acquainted with this nation-wide problem. If TV viewers write FCC, complaining about your FM station, remember the FCC has received a few thousand similar letters. ----- It is not the obligation of the FM broadcaster to assure fringe area reception of a TV station any more than is the obligation of the TV station to assure the FM broadcaster perfect reception in his TV city.

Probably your installation will not have problems as outlined above. If they do exist, don't blame the equipment. Every transmitting device puts out a second harmonic, even the TV stations. The fact that these harmonics legally fall into the spectrum of a TV station many miles distant is coincidental, but not your fault.

## SECTION 5 - PARTS LIST

## 5.1 CENTER CUBICLE

<u>SYMBOL</u>	<u>DESCRIPTION</u>	<u>GATES PART NO.</u>
C1	Cap., .01 uF, 1 kV	516 0082 000
C2	Same as C1	
C3	Cap., .25 uF, 1 kV	510 0329 000
C4	Cap., 220 uF, 450 V.	524 0155 000
C5	Same as C4	
CR1	Diode, 5 kV, PIV: 400 mA	384 0268 000
CR2	Same as CR1	
F1	Fuse, 6A.	398 0181 000
F2	Same as F1	
K1	Relay, 115 V. AC Coil, DPDT	574 0040 000
L1	Inductor, 10 Hy	476 0244 000
M1	Meter, 0-200 uA Movement % Po/VSWR Scales	632 0667 000
M2	Same as M1	
R1	Res., 15 k ohm, 10 W.	542 0099 000
R2	Sames as R1	
R5	Res., dummy load, 50 W.	740 0087 000
S1	Switch, Micro; SPDT	604 0147 000
S2	Same as S1	
T1	Transformer, 230 V, pri. 1400 V. Sec. CT	472 0454 000
XF1/2	Fuseholder	402 0015 000
	Pi/2 Hybrid Coupler, 50 ohm, 100 W.	620 0623 000

CS 994 6746 103

5.2 POWER OUTPUT/VSWR PANEL

<u>SYMBOL</u>	<u>DESCRIPTION</u>	<u>GATES PART NO.</u>
R1	Pot., 10 k ohm, 2 W.	550 0067 000
R2	Pot., 10 k ohm, 2 W.	914 9092 001
R3	Same as R1	
R4	Same as R2	
S1	Switch, rotary, 3 pole, 3 pos.	914 9091 001
S2	Same as S1	
TB1	Terminal Board, 6 place	614 0006 000

CS 994 6746 103

## 5.3 CONTROL PANEL

<u>SYMBOL</u>	<u>DESCRIPTION</u>	<u>GATES PART NO.</u>
DS1	Light pilot #387	396 0169 000
DS2	Same as DS1	
F1	Fuse, 1/4A. Slo Blo	398 0045 000
K1	Relay, latching 4PDT	574 0062 000
K2	Relay, time delay, 30 second	576 0091 000
K3	Relay, 4PDT	574 0224 000
K4	Same as K3	
K5	Same as K3	
K6	Same as K3	
R1	Res., 2.5k ohm, 8W	542 0038 000
R2	Same as R1	
S1	Switch, push button momentary	604 0516 000
S2	Same as S1	
S3	Same as S1	
S4	Same as S1	
S5	Switch, toggle, DPDT	604 0032 000
TB1	Terminal Board, 13 phase	614 0013 000
TB2	Same as TB1	
XF1	Fuseholder, indicating	402 0074 000
XK1	Socket, octal	404 0016 000



## 5.4 IPA

<u>SYMBOL</u>	<u>DESCRIPTION</u>	<u>GATES PART NO.</u>
B1	Fan, 115 V. AC, 43 CFM	430 0040 000
C1	Cap., feedthru; 1000 pF.	516 0361 000
C2	Same as C1	
C3	Same as C1	
C4	Same as C1	
C5	Same as C1	
C6	Same as C1	
C7	Cap., 1000 pF $\pm 5\%$	500 0852 000
C8	Cap., feedthru; 1000 pF	516 0450 000
C9	Cap., 1000 pF	516 0457 000
C10	Same as C9	
C11	Same as C9	
C12	Same as C9	
C13	Same as C1	
C14	Cap., 500 pF, 5 kV	516 0205 000
C15	Cap., variable; 5-100 pF	520 0155 000
C16	Cap., variable; 3-12 pF	518 0012 000
C17	Cap., .01 uF, 1 kV	516 0082 000
CR1	Diode, zener; 200 V, 10 W 1N3015A	386 0155 000
CR2	Diode, 1N914	384 0134 000
DS1	Pilot Light, red	406 0388 000
DS2	Pilot Light, amber	406 0389 000
F1	Fuse, 1A. S10-B1o	398 0054 000
F2	Fuse, 1/4 A. S1o-B1o	398 0045 000

<u>SYMBOL</u>	<u>DESCRIPTION</u>	<u>GATES PART NO.</u>
J1	Receptacle, BNC	612 0317 000
J2	Same as J1	
L1	Inductor, variable	914 9991 001
L2	Inductor, variable	914 9992 001
L3	Choke, rf; 7 uH	494 0004 000
L4	Inductor, variable	914 9993 001
M1	Multimeter, 1 mA DC movement	632 0696 000
R1	Res., 470 ohm, <u>+5%</u> , 2 W.	540 0603 000
R2	Res., 10 ohm, <u>+5%</u> , 2 W.	540 0563 000
R3	Same as R2	
R4	Res., 100 ohm, <u>+5%</u> , 4 W.	544 1613 000
R5	Same as R4	
R6	Res., 1000 ohm, <u>+5%</u> , 2 W.	540 0611 000
R7	Same as R1	
R8	Res., 390 ohm, <u>+</u> %, 2 W.	540 0601 000
R9	Res., 100 ohm, 10 W.	542 0060 000
R10	Res., 15 k ohm, 25 W.	542 0193 000
R11	Same as R6	
R12	Res., 24 k ohm, <u>+5%</u> , 1/2 W.	540 0082 000
R13	Res., 820 k ohm, <u>+5%</u> , 1/2 W.	540 0047 000
R14	Pot., 50 ohm, 2 W.	550 0054 000
R15	Res., Slide Wire, 150 ohm, 10 W.	552 0013 000
R16	Res., 0.36 ohm, 2 W.	548 0370 000
R17	Res., 110 k ohm, <u>+5%</u> , 1/2 W.	540 0098 000
S1	Switch, toggle, DPDT	604 0032 000

CS 994 6742 103

<u>SYMBOL</u>	<u>DESCRIPTION</u>	<u>GATES PART NO.</u>
S2	Same as S1	
S3	Same as S1	
T1	Transformer, 115 V. AC, pri 6.3 V. AC sec.	472 0090 000
TB1	Terminal Board, 8 place	614 0008 000
TP1	Test Point, white	612 0312 000
TP2	Same as TP1	
TP3	Same as TP1	
TP4	Test Point, black	612 0311 000
TP5	Same as TP1	
TP6	Same as TP1	
V1	Tube, 4X150B	374 0018 000
XCH1	Chimney, tube; SK606	404 0073 000
XF1	Fuseholder, indicating	402 0074 000
XF2	Same as XF1	
XV1	Socket, tube; SK600A	404 0251 000

CS 994 6746 103

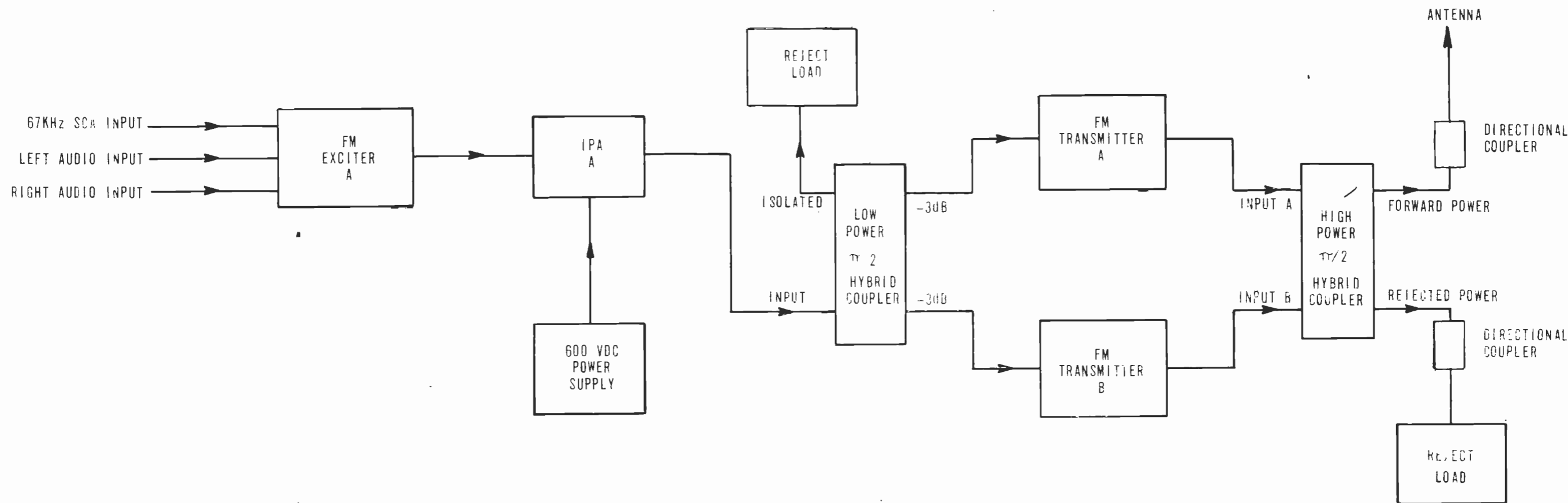
5.5 RF OUTPUT ACCESSORIES

<u>SYMBOL</u>	<u>DESCRIPTION</u>	<u>GATES PART NO.</u>
DC3	Directional Coupler,	937 8778 009
DC4	Same as DC3	
	Elbow, 90° miter, 3-1/8" EIA flange	620 0056 000
	Pi/2 Hybrid Coupler, 50 ohm	620 0675 000
	Dummy Load, 10 kW, 50 ohm	700 0084 000
	Transmission Line 12 7/8" long	2 pieces
	Transmission Line 45 1/2" long	1 piece

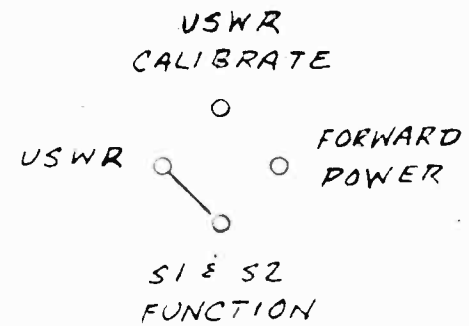
CS 994 674~~4~~ 103



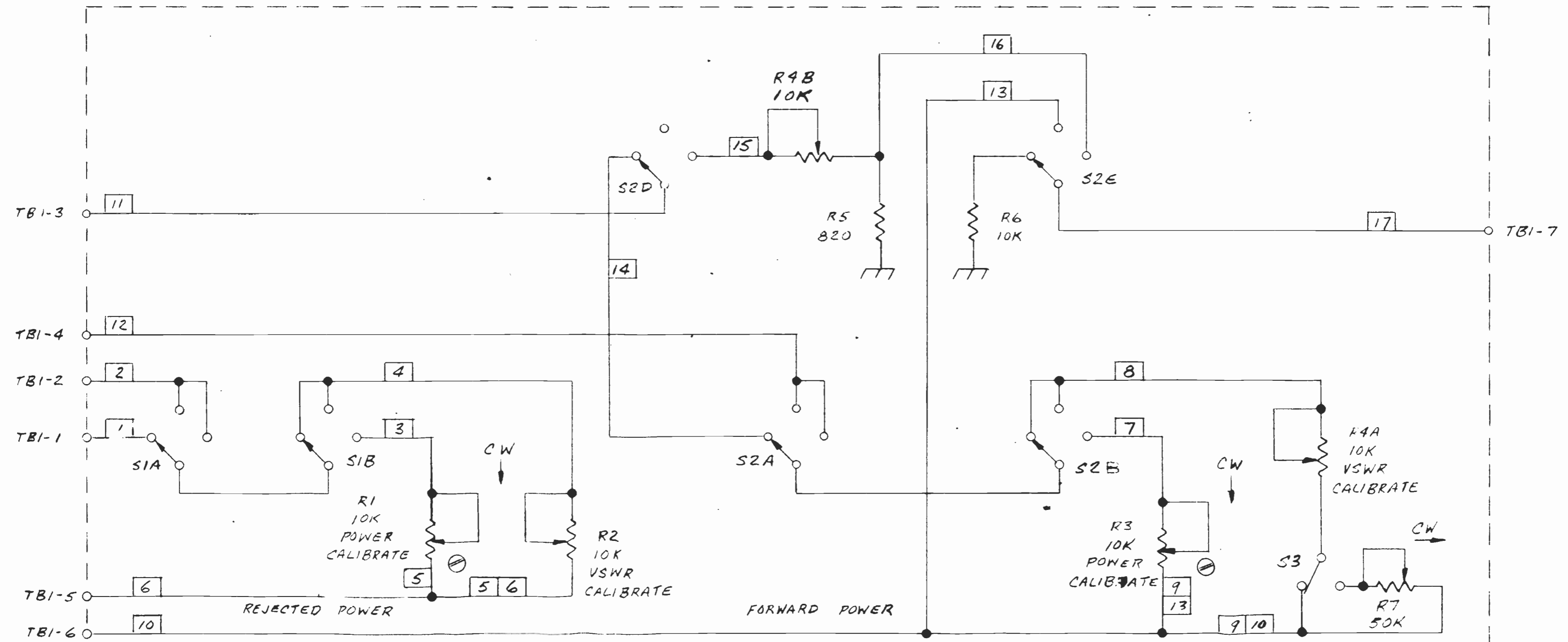
LTR	DATE	REVISION	DFTM	ENG	ECN
A	4-26-71	REVISED	HR		



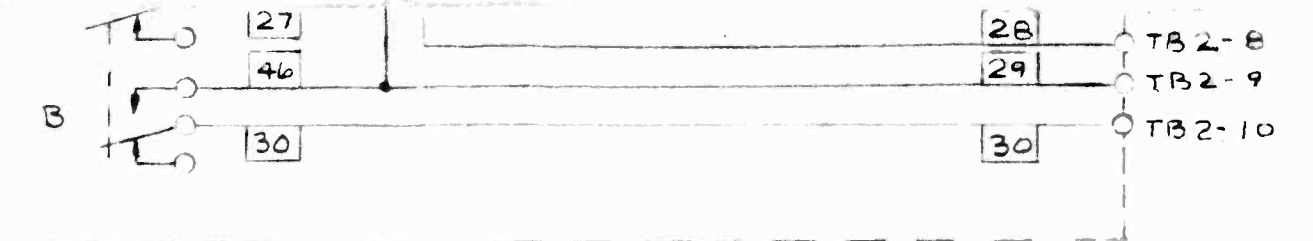
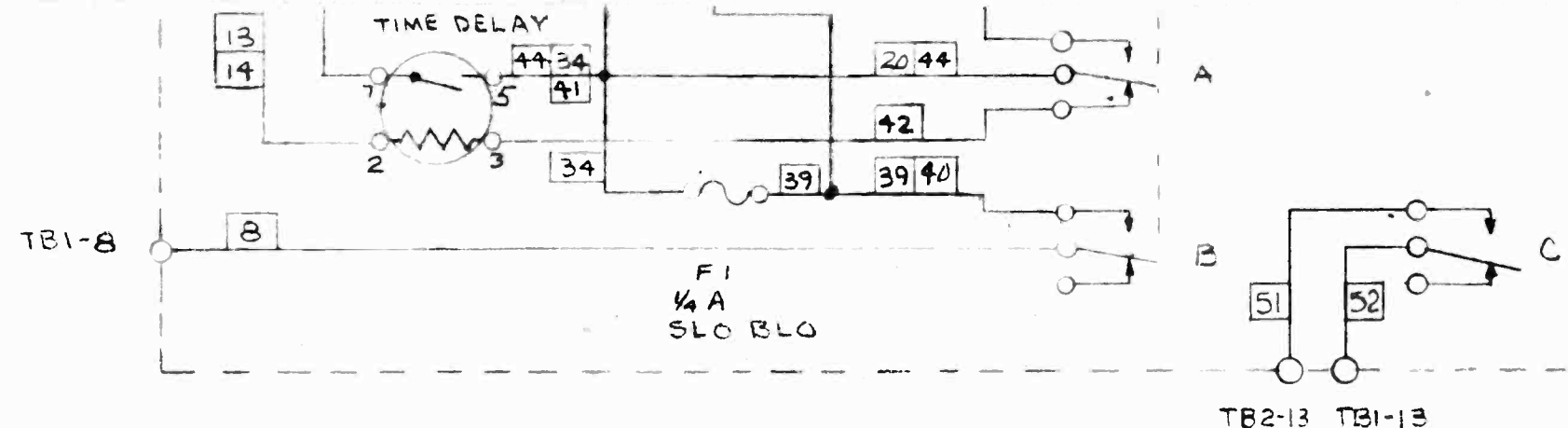
<b>HARRIS</b>	<b>GATES RADIO COMPANY</b>		
<b>INTERTYPE</b>	QUINCY, ILLINOIS		
<b>CORPORATION</b>			
TITLE BLOCK DIAGRAM DUAL FM TRANSMITTERS			
DFTM 3-22-71 <i>Lahman</i>	PROJ. ENG. 3-22-71 <i>Anderson</i>	DWG NO. 827 8140 001	



QTY. PART 001	ITEM	PART NUMBER	DESCRIPTION
TOL. UNLESS NOTED DECIMALS X ± .030 XX ± .015 XXX ± .005 ANGLES ± 1° ALL ✓ INDICATES 125 MICRO INCH.		<b>HARRIS</b> <b>INTERTYPE</b> <b>CORPORATION</b>	<b>GATES RADIO COMPANY</b> QUINCY, ILLINOIS
DR. BY	B. MAAS 1-26-73	TITLE	
CHKD	J. Knoll 2/9/73	SCHEMATIC	
M.E.		POWER OUTPUT/USWR PANEL	
PROJ. ENG.	2-9-73 F J Anderson	DUAL FM TRANSMITTER	
MFG.		REF. DWG.	SCALE
NEXT ASSY	MAT'L.	FIN.	DWG. NO.
USED ON	994-6746-103		838-9176-001





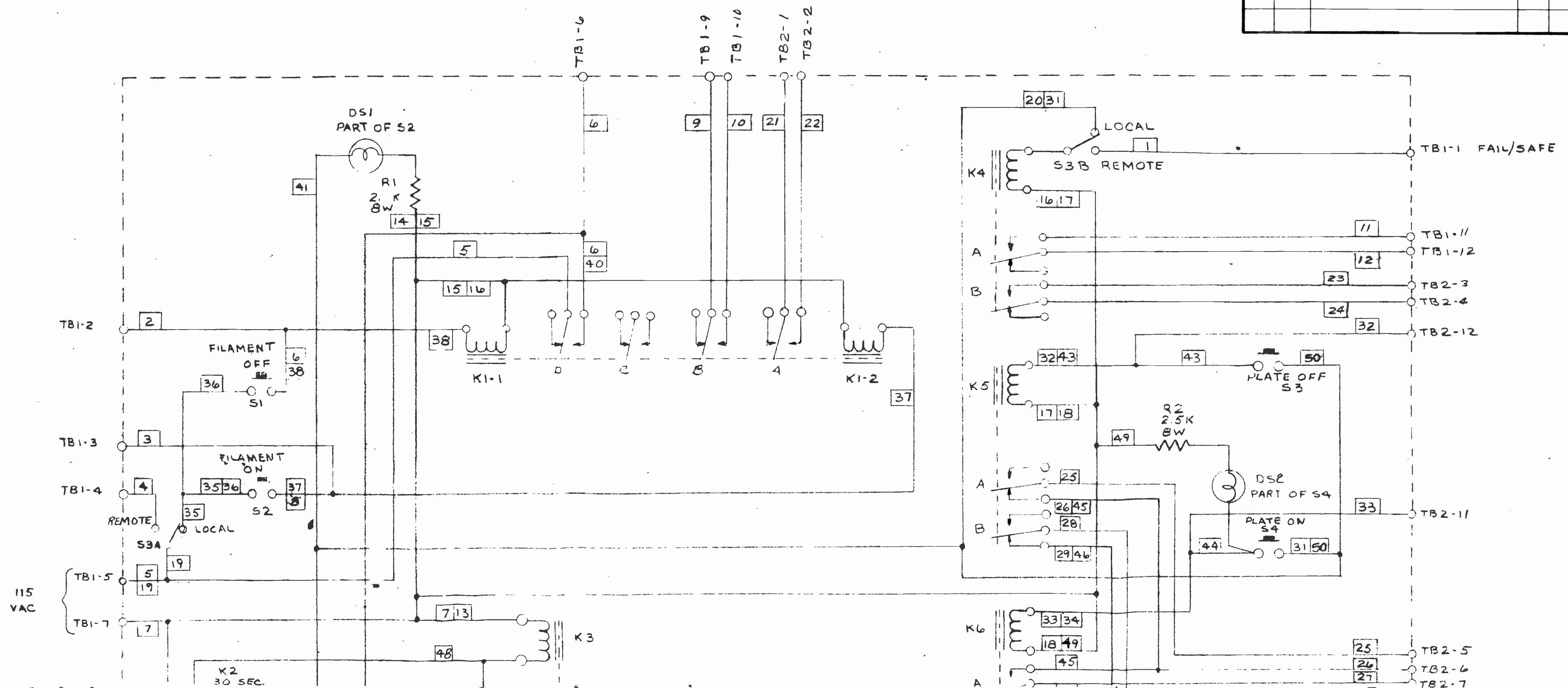


HOLE	QTY.	DESCRIPTION

QTY. PART 001	ITEM	PART NUMBER	IND	FUNC CODE	DESCRIPTION	U M	CONT NO.
	7						
	6						
	5						
	4						
	3						
	2						
	1						

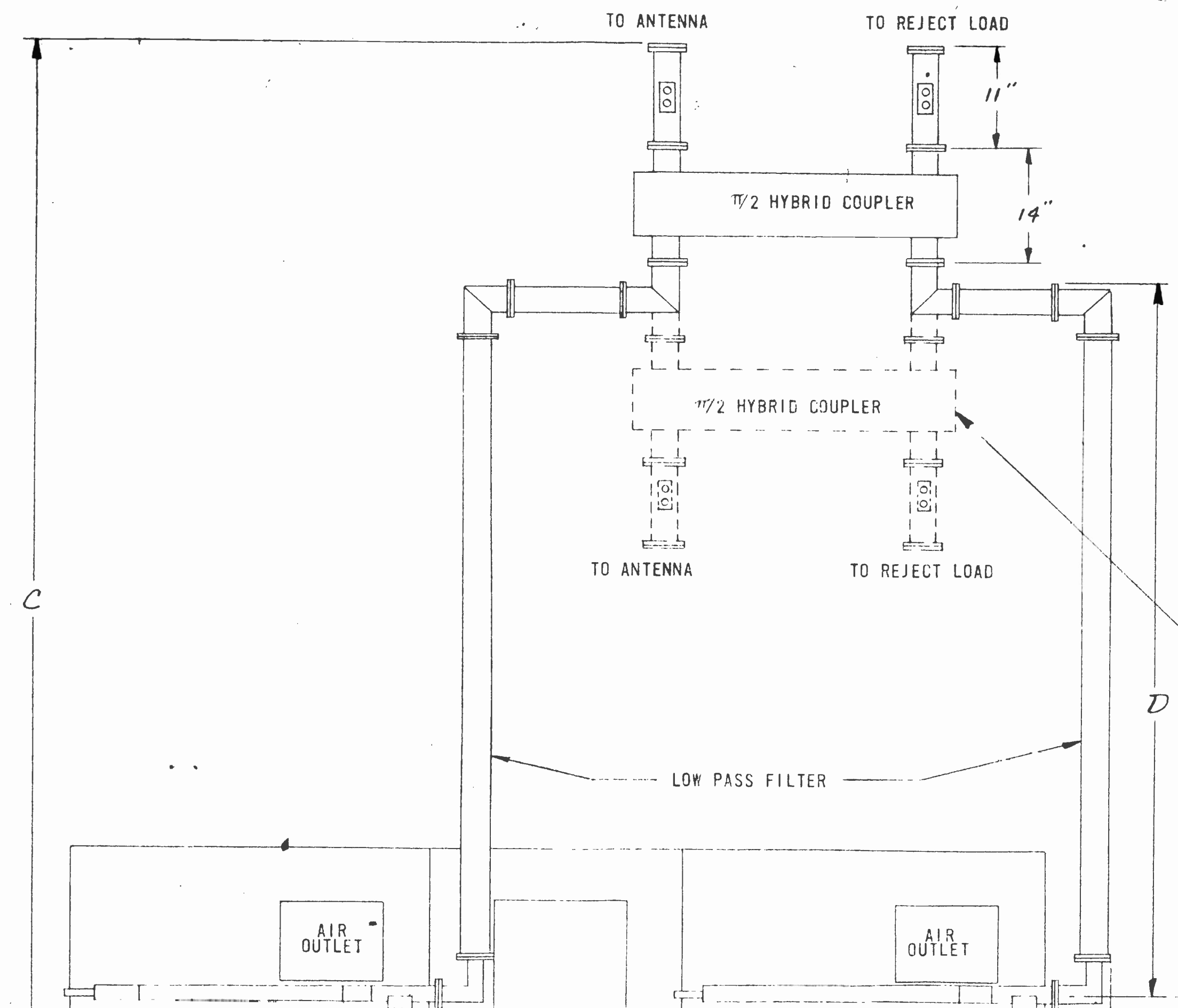
TOL. UNLESS NOTED DECIMALS X ±.030 XX ±.015 XXX ±.005 ANGLES ±1° ALL √ INDICATES 125 MICRO INCH.		HARRIS INTERTYPE CORPORATION		GATES RADIO COMPANY QUINCY, ILLINOIS	
DR. BY S. REIS 12 26 72		TITLE SCHEMATIC CONTROL PANEL		DUAL FM TRANSMITTER	
CHKD. J. Brill 1/19/72 M.E.		REF. DWG.		SCALE	
PROJ. ENG. 7-22-73 FJ Anderson MFG.		NEXT ASSY		MAT'L.	
USED ON 994-7082-101		FIN.		DWG. NO. 838-9119-001	

LTR.	DATE	REVISION	ENG.	DFTM	ECN
A	2/19/73	REVISED FOR MARKED PRT		MAC	

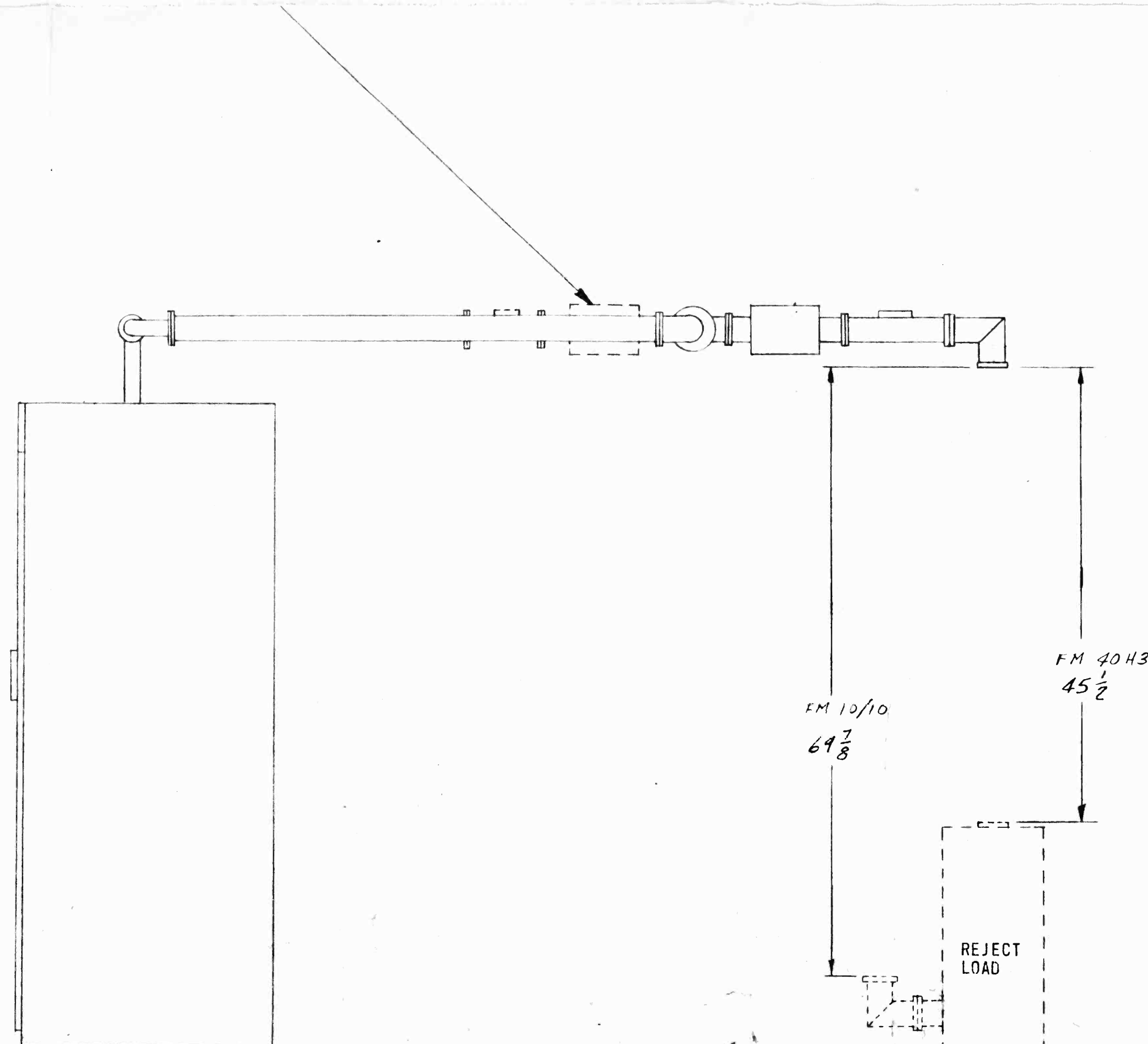
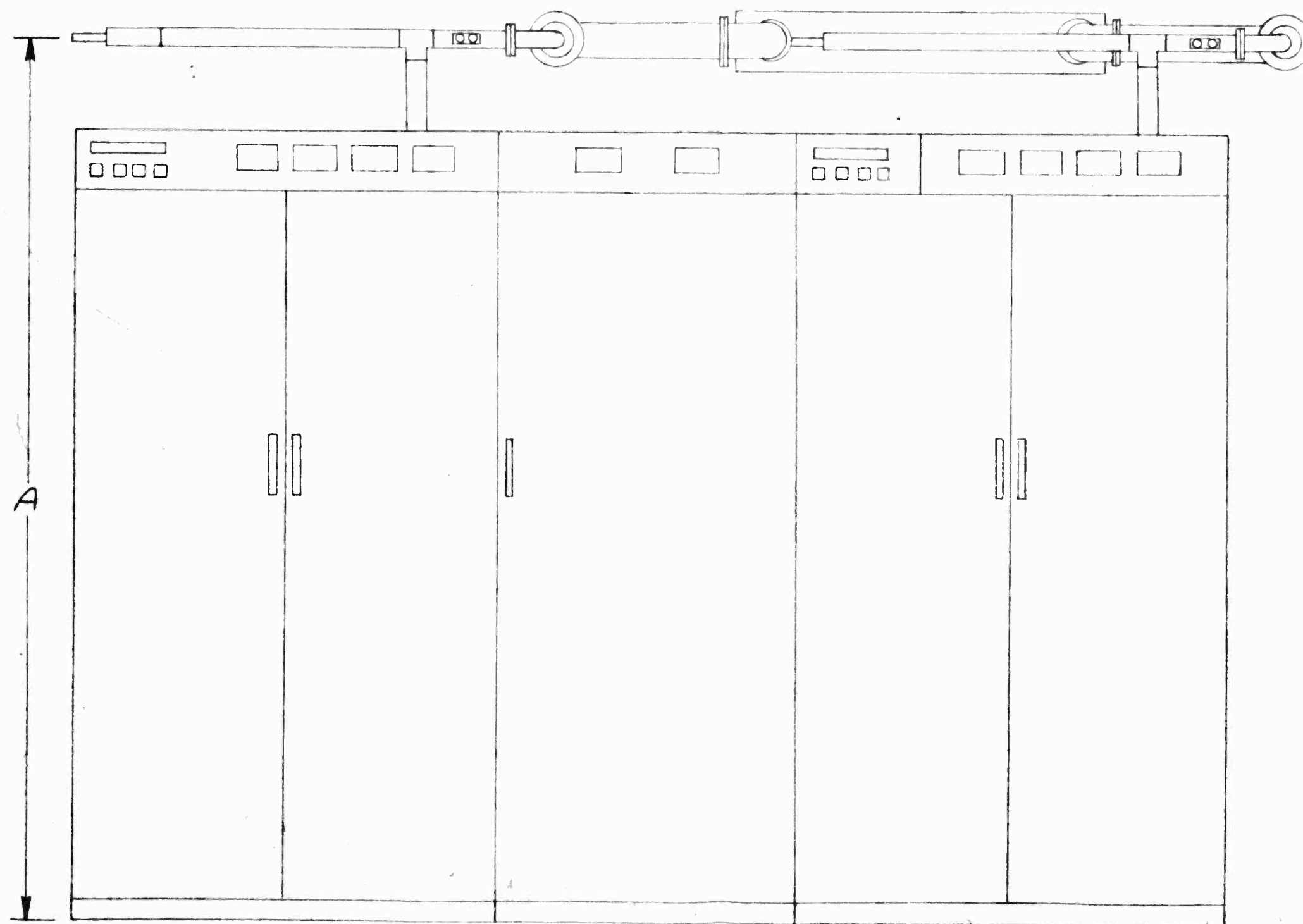
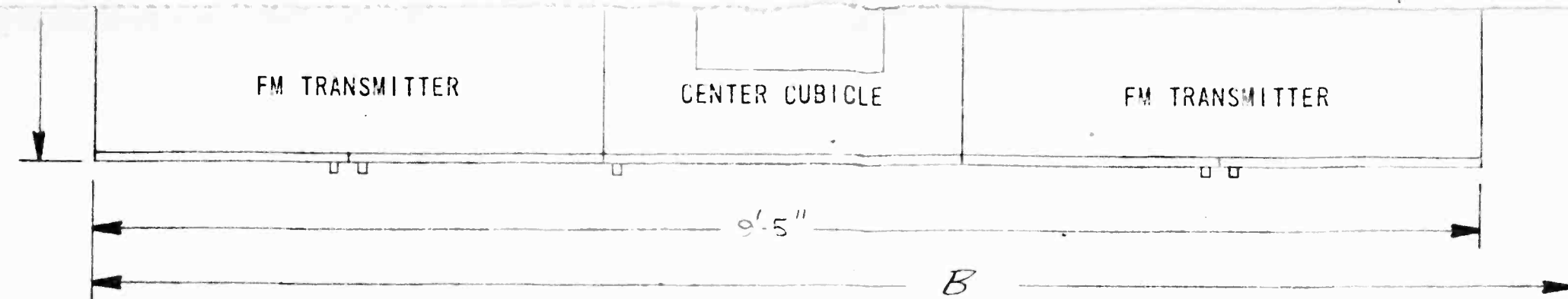


NO.	DATE	REVISION	DFTM	ENG	ECN
A	2-27-73	TABULATED			

	A	B	C	D	LOW PASS FILTER SIZE
FM10/10 H3	7'2"	9'9 1/4"	9'11 1/4"	6'9"	3 1/8" EIA
FM40 H3	7'3 1/8"	10'1 1/8"	10'9 3/16"	7'7"	6 1/8" EIA



π/2 HYBRID COUPLER MAY BE ROTATED



NOTE: POWER SUPPLIES FOR FM 40H3 NOT SHOWN

QTY	ITEM	PART NUMBER	DESCRIPTION
<small>TOL. UNLESS NOTED FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES ± 1° FOLD DIMENSIONS ± 1/32 ALL INDICATES 125 MICRO INCH.</small>			<b>HARRIS</b> <b>INTERTYPE</b> <b>GATES RADIO COMPANY</b> QUINCY, ILLINOIS <small>CORPORATION</small>
DFTM. <i>H. Rossen 4-26-71</i> CHRD. <i>J. Krull 4/29/71</i> M.E. PROJ. ENG. <i>J. Anderson 4-29-71</i>			
NEXT ASSY		MAT'L	SCALE
USED ON			DWG. NO. 842 6577 001

1/2-V

## **HOME OFFICE AND MAIN PLANT**

**QUINCY, ILLINOIS 62301**  
123 Hampshire Street  
Phone: 222-8200, Area 217  
Telex: 403416

## **DISTRICT OFFICES**

**NEW YORK, NEW YORK 10016**  
130 East 34th Street  
Phone: 889-0790, Area 212

**WASHINGTON, D. C. 20005**  
730 Federal Building  
1522 K Street, N. W.  
Phone: 223-5508, Area 202

**LOS ANGELES, CALIFORNIA 90007**  
1945 South Figueroa  
Phone: 747-7129, Area 213

## **SERVICE CENTERS**

**NEW YORK, NEW YORK 10016**  
130 East 34th Street  
Phone: 889-0790, Area 212

**HOUSTON, TEXAS 77027**  
4019 Richmond Avenue  
Phone: 623-6655, Area 713

## **CANADIAN SALES GATES (CANADA)**

Division of Harris-Intertype (Canada) Ltd.

**MONTREAL OFFICE**  
212 Brunswick Boulevard  
Pointe-Claire, Quebec, Canada  
Phone: 695-3751, Area 514

**TORONTO OFFICE**  
19 Lesmill Road  
Don Mills, Ontario, Canada  
Phone: 447-7234, Area 416

## **INTERNATIONAL SALES OFFICE**

**NEW YORK, NEW YORK 10016**  
130 East 34 Street  
Phone: 725-9800, Area 212  
Cable: Garadcom  
Telex: 127397

**GATES DIVISION**

**HARRIS-INTERTYPE CORPORATION**

123 HAMPSHIRE STREET • QUINCY, ILLINOIS 62301 U.S.A.

## **HOME OFFICE AND MAIN PLANT**

**QUINCY, ILLINOIS 62301**  
123 Hampshire Street  
Phone: 222-8200, Area 217  
Telex: 403416

## **DISTRICT OFFICES**

**NEW YORK, NEW YORK 10016**  
130 East 34th Street  
Phone: 889-0790, Area 212

**WASHINGTON, D. C. 20005**  
730 Federal Building  
1522 K Street, N. W.  
Phone: 223-5508, Area 202

**LOS ANGELES, CALIFORNIA 90007**  
1945 South Figueroa  
Phone: 747-7129, Area 213

## **SERVICE CENTERS**

**NEW YORK, NEW YORK 10016**  
130 East 34th Street  
Phone: 889-0790, Area 212

**HOUSTON, TEXAS 77027**  
4019 Richmond Avenue  
Phone: 623-6655, Area 713

## **CANADIAN SALES GATES (CANADA)**

Division of Harris-Intertype (Canada) Ltd.

**MONTREAL OFFICE**  
212 Brunswick Boulevard  
Pointe-Claire, Quebec, Canada  
Phone: 695-3751, Area 514

**TORONTO OFFICE**  
19 Lesmill Road  
Don Mills, Ontario, Canada  
Phone: 447-7234, Area 416

## **INTERNATIONAL SALES OFFICE**

**NEW YORK, NEW YORK 10016**  
130 East 34 Street  
Phone: 725-9800, Area 212  
Cable: Garadcom  
Telex: 127397

**GATES DIVISION**

**HARRIS-INTERTYPE CORPORATION**

123 HAMPSHIRE STREET • QUINCY, ILLINOIS 62301 U.S.A.