MICROWAVE ANTENNAS
KS-15676 HORN-REFLECTOR AND WAVEGUIDE SYSTEM
INSTALLATION
ORIENTATION USING ED-59410-70 TRANSDUCER

CONTENTS PAGE

1. GENERAL

1.01 This section describes the orientation of KS-15676 antenna and associated waveguide assemblies using the ED-59410-70 transducer.

1.02 The following procedure is used to orient KS-15676 antennas, using 4-kmc test signals, so that both horizontally and vertically polarized waves can be transmitted and received. In the method described, a test signal is sent from the transmitting antenna at one radio station to the receiving antenna at the next radio station. First, the transmitting antenna is oriented for maximum received test signal; second, the receiving antenna is oriented for maximum received test signal; third, the receiving antenna is oriented for minimum received test signal from the cross-polarized component; and fourth, the mode transducer at the base of the circular-waveguide run is oriented for illumination of the antenna with vertical polarization. These orientations should be made during periods when fading is less than 1 db. The transmitting and receiving equipments in the stations must have passed acceptance tests. Fig. 5 shows the steps to follow in orienting antennas and waveguide components.

Note: At the rotatable flanges used during orientation alignment and employing an O ring gasket, the application of a small amount of petroleum jelly is recommended to facilitate a smooth action. Care should be exercised to avoid any application of the jelly on the inside of the waveguide.

1.03 The following tools and apparatus are required at ***each repeater station:***

QUANTITY	DESCRIPTION
2	ED-59410-70 Transducers
2	KS-5783, L4 Flexible Waveguides
1	ED-59450-70 Mode Filter*
1	ED-59449-70 Azimuth Scale
1	ED-45465-01, G2 Cable Assembly (6 feet)
1	KS-15676, L12 Azimuth Adjusting Screw
2	ED-45466-01, G1 Transducers
1	P-38B664 Circular-waveguide Wrench
1	P-38B665 Rectangular-waveguide Wrench
1	J68340A, L3 or L4 Test Bay or J68345A, L1 or L2 Test Set
1	KS-15658 Noise-figure Test Set
1	J68340N or J68340E Power Meter (J68345A Test Set applications only)

* Paint this filter a distinctive color, and mark the vane locations with a line on the outside.

QUANTITY	DESCRIPTION
1	KS-14191 Attenuator (J68345A, L2 Test Set applications only)
1	Adjustable Open-end Wrench with 3-inch capacity
2	Ratchet Wrenches with 3/8-inch square drive
1	1/2-inch Socket with 3/8-inch square drive
1	7/16-inch Socket with 3/8-inch square drive
1	3/8-inch Socket with 3/8-inch square drive
1	5/16-inch Socket with 3/8-inch square drive
1	1/4-inch Socket with 3/8-inch square drive
1	1/2-inch, twelve-point Box Wrench
1	7/16-inch, twelve-point Box Wrench
20	Regular SF hex head 1/4-20 Bolts, 1-3/4 inches long for rectangular-waveguide flange
16	Regular SF hex head 5/16-18 Bolts, 1-3/4 inches long for circular-waveguide flange
Misc	IF Patch Cords
1	BNC Connector
1	358A Plug
7	No. 5-849B Pinchclamps, heavy duty, castaloy, cylinder-type — Fisher Scientific Company, 633 Greenwich Street, New York, N.Y.
1	Standard Black Pressure Gauge, Fig. 633S, US Gauge Company, lower 1/4 Standard Male Pipe Thread, 2-1/2 dial, 0 to 15 inches water
1	No. 5499 Schrader Chuck
Misc	Spare Round- and Rectangular-waveguide Gaskets
	Telephone Communication System between station-to-station radio bays and from station radio bays to antenna decks. Provide flexibility in telephone connection to antenna decks for reuse at base of the towers at the lower end of the circular-waveguide run.

Caution: Communication lines between the antenna decks and the radio bays should be run inside the tower structure.

2. CONNECTION AND ALIGNMENT OF WAVEGUIDE TEST EQUIPMENT

2.01 The connection of the waveguide test assemblies required for orienting the antennas is shown in Fig. 1. The following paragraphs cover the setting up of this testing arrangement.

2.02 Align the mode filter FL1 and the mode transducer MT3 before they are connected into the waveguide run, Fig. 1, as follows:

(1) Disconnect and remove transducer MT3 from the waveguide run.

(2) Disconnect and remove the ED-59455-70 tuning section. Attach the wood protecting covers supplied with the mode filter to the tuning section and store the tuning section in a manner that will prevent damage. The tuning section will be installed again after the antenna has been oriented.

(3) Using eight 5/16-18 bolts 1-3/4 inches long, loosely connect transducer MT3 to the mode filter FL1. Sight through the transducer and rotate it until the vane in the mode filter is parallel with the wide face of the rectangular end. Tighten the bolts connecting the transducer and mode filter.

Note: The position of the vane in the mode filter is also indicated on the outside of that unit.

2.03 ***Align transducer MT3 initially as follows:***

(1) Using eight 5/16-18 bolts 1-1/4 inches long, loosely connect the mode filter FL1 to the circular-waveguide run. Using the P-38B664 wrench on the free ends of the bolts between the transducer and the mode filter, rotate the combination so that the wide face of the rectangular waveguide is parallel to the face of the radio tower. Tighten the bolts between the mode filter and the circular-waveguide run.

(2) Using ten 1/4-20 bolts 1-3/4 inches long, connect the transducer MT3 to the KS-5783 flexible rectangular waveguide leading to the repeater equipment.

2.04 Align the mode transducer MT1 for illumination of the antenna with ***horizontal polarization*** as follows:

(1) Using eight 5/16-18 bolts 1-1/4 inches long, loosely connect the test mode transducer MT1 to the feed horn. Drop enough bolts through the bolt holes in the rectangular flange at the other end to furnish a purchase for the P-38B665 wrench.

Caution: Do not injure the face of the rectangular flange on the transducer.

(2) Sight through the rectangular flange on the transducer up into the antenna. Rotate, using the P-38B665 wrench, until the wide face of the rectangular opening is parallel to the seam between the reflector halves of the antenna. This seam is parallel to the direction of transmission between antennas. Tighten the bolts between the transducer and the feed horn.

2.05 Install transducer MT2 and the flexible rectangular waveguide as follows:

(1) Using eight 5/16-18 bolts 1-1/4 inches long, loosely connect MT2 to the circular-waveguide run.

(2) Using 1/4-20 bolts 1-1/4 inches long, connect the two sections of KS-5783 flexible waveguide in tandem. Using 1/4-20 bolts 1-3/4 inches long, connect the assembly of the two KS-5783 flexible waveguides to MT1 and MT2, as shown in Fig. 1.

(3) Using the P-38B665 wrench on the free ends of the bolts in the rectangular flange on the transducer MT2, rotate MT2 so that the wide face of the rectangular waveguide is parallel to the same face of the radio tower that was used in 2.03 (1) to align MT3.

(4) Tighten the bolts holding the transducer MT2 to the circular-waveguide run.

2.06 ***Applying Air Pressure:*** The weather cover of the antenna must be expanded so that the characteristics of the antenna are the same as they will be when the antenna is in use.

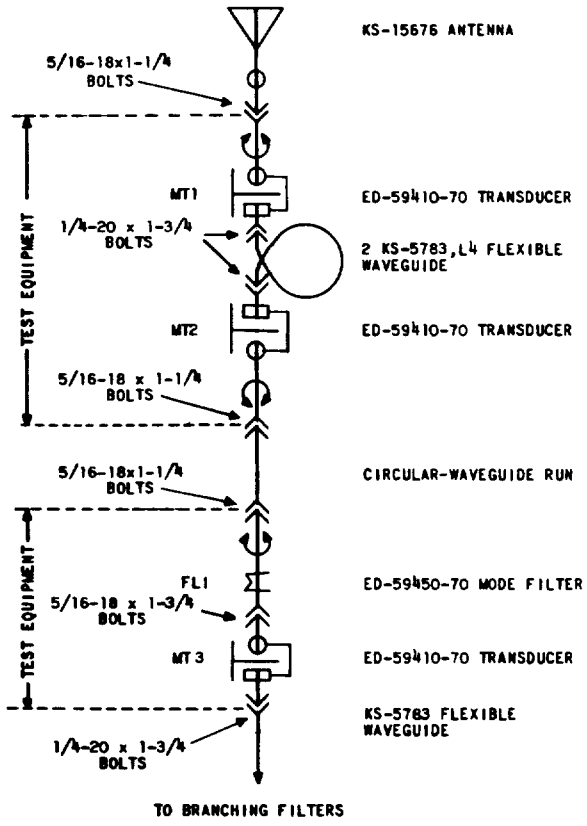


Fig. 1 – Waveguide Assemblies Connected to Antenna and Waveguide Run

(1) Be sure that the KS-16001 air supply in the station is connected to the antenna which is under test, through the waveguide pressure window.

(2) Turn the switch on the KS-16001 air supply to the ON position. Check to see that the exhaust cap has been removed from the dehydrator unit and that the unit is operating properly.

(3) Connect the 0- to 15-inch pressure gauge to the Schrader chuck. Attach the combination to the spare valve on the waveguide pressure window.

Requirement: Gauge shall read at least 4 inches of water after air blower has been on 3 minutes.

If pressure does not build up, the plastic air lines to the other pressure windows may be closed off with pinch clamps in order to locate any excessive leak. Closing off the air lines shall be performed as follows:

(a) Read and record the pressure on the lines to be closed off.

(b) Close off the lines with pinch clamps.

(c) Read and record the pressure at 5-minute intervals during the period the pinch clamps are applied. When any line shows an increase in pressure, pinch clamps must be removed from that line immediately. The pinch clamps should be removed from any line which shows no change in pressure.

Caution: Do not interfere with the air supply of other antennas if they are in use. Where waveguide runs and antennas are exposed to the direct rays of the sun, pressures sufficient to damage the weather cover can build up in a short time if no relief is provided. The design of the KS-16001 air supply unit provides protection from excessive air pressure regardless of the position of the switch; however, when pinch clamps are applied to the air lines, this protection no longer exists to those guides and antennas closed off. In order to reduce the possibility of damage, the pinch clamps should be removed when conditions are such that pressure readings cannot be made at frequent intervals.

3. TEST SETUP AT TRANSMITTING STATION

3.01 To send a test signal using the J68340A test bay, proceed as follows:

(1) Connect the ED-63773 cable assembly, as shown in Fig. 2, to the input of the TD-2 repeater which feeds the transmitting antenna being aligned.

(2) Adjust the frequency of the J68340H RF oscillator to the midband receiver frequency for the channel selected. The adjustment of the oscillator frequency should be made in accordance with the instructions contained in Section 104-400-300, Single Frequency Output.

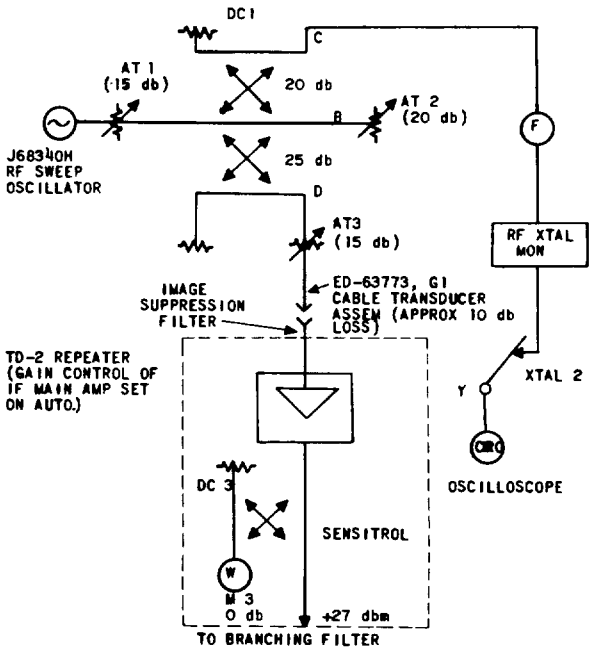


Fig. 2 – Transmitting Equipment Arrangement — Using J68340A Test Bay

(3) Adjust the AUTO control on the receiver control panel to obtain a 0-db reference reading on the output-power sensitrol meter M3, thus obtaining a test signal level of +27 dbm into the transmitting branch filter.

3.02 To send a test signal using the J68345A test set, proceed as follows:

(1) Connect the 35-db output of the J68345A test set to the input of the TD-2 repeater which feeds the transmitting antenna being aligned, as shown in Fig. 3.

(2) Adjust the frequency of the J68345C RF oscillator to the midband receiver frequency for the channel selected. The adjustment of the frequency should be made in accordance with the instructions contained in 104-410-300. The SWEEP should be in the OFF Section position.

(3) Adjust the AUTO control on the receiver control panel to obtain a 0-db reference

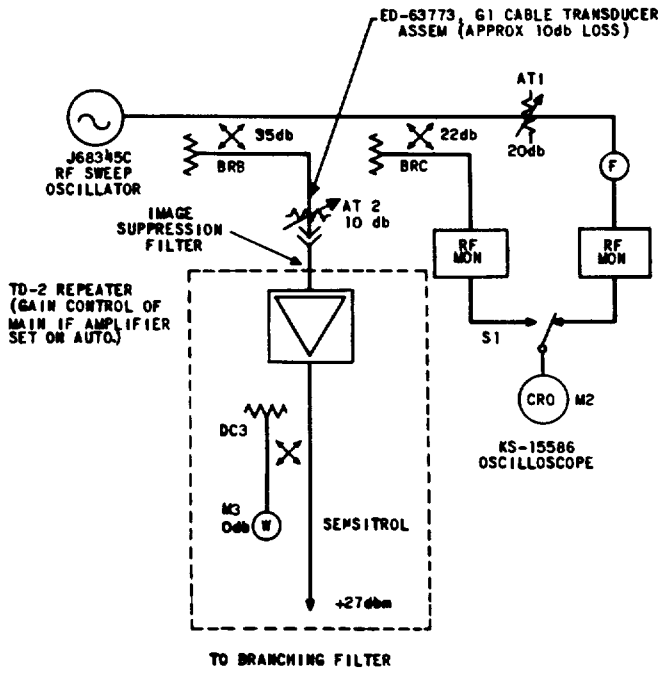


Fig. 3 – Transmitting Equipment Arrangement — Using J68345A Test Set

reading on the output-power sensitrol meter M3, thus obtaining a test signal level of +27 dbm into the transmitting branch filter.

4. TEST SETUP AT RECEIVING STATION

4.01 To receive a test signal using either the J68340A test bay or the J68345A test set, proceed as follows:

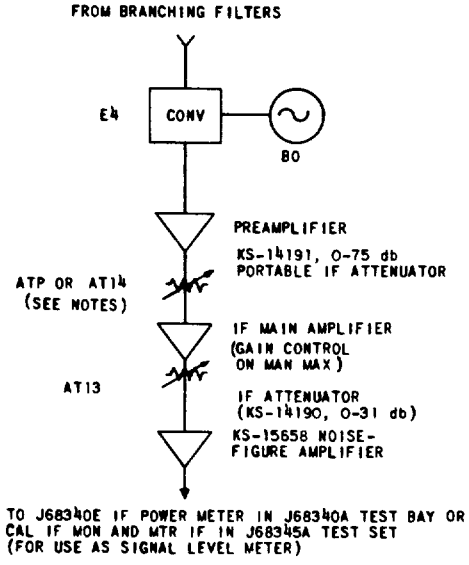
(1) Connect the receiving test equipment as shown in Fig. 4. The noise-figure amplifier is a part of the KS-15658 test set.

(2) Set AT13 at 18 db and the KS-14191 portable IF attenuator ATP or AT14 at 35 db before connecting into the circuit to avoid overloading of the IF power indicating meter. The main IF amplifier gain control should be set for maximum gain.

(3) With AT13 at 18 db, adjust ATP or AT14 for an IF power meter reading of 0 dbm when the signal is being received from the distant transmitting antenna. Adjust AT13 as required to compensate for the larger attenuation steps of ATP or AT14. In general, it is desirable to keep as much attenuation in AT13 as possible, reducing the attenuation in ATP or AT14 first.

5. ANTENNA ORIENTATION

5.01 The sequence of steps used in orienting the antennas and the waveguide compo-



NOTES:

1. ATP - PORTABLE ATTENUATOR REQUIRED IN PLACE OF AT14 IN J68345A, L2 APPLICATIONS.

Fig. 4 – Receiving Equipment Arrangement — Using J68340A Test Bay or J68345A Test Set

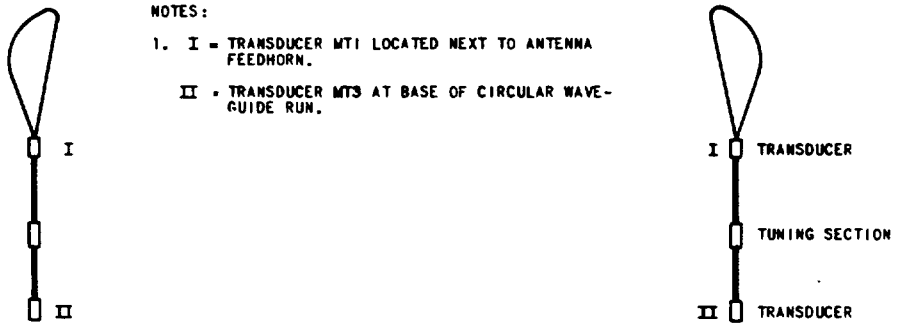
nents is illustrated in Fig. 5. The details of these steps are covered in the text which follows. All data taken should be recorded for future reference. The final received signal level measurement, as well as the calculated received signal level, should be posted at the station.

5.02 ***The transmitting antenna,*** first, is oriented for a maximum received signal at the distant receiving station.

Caution: Minor lobes on these antennas will be found approximately 2.5 degrees each side of the main lobe.

5.03 ***In Azimuth:***

(1) Install the antenna azimuth adjusting screw at a convenient location between the circular mounting ring and the mounting frame as covered in Section 402-421-202 and shown in Fig. 6 of this section.



	STEP NO.	ACTION	STATION A: POLARITY OF RADIO WAVE	STATION A: DETERMINED AT POINT	DIRECTION OF TRANSMISSION	STATION B: POLARITY OF RADIO WAVE	STATION B: DETERMINED AT POINT	ACTION
ANTENNA ALIGNMENT	1.	ALIGN ANTENNA FOR MAXIMUM SIGNAL AT STATION B.	H	I	→	H	I	MEASURE SIGNAL LEVEL.
	2.	—	H	I	→	H	I	ALIGN ANTENNA FOR MAXIMUM RECEIVED SIGNAL.
	3.	—	H	I	→	V	I	ORIENT TRANSDUCER(I) & ANTENNA FOR MINIMUM RECEIVED SIGNAL. MEASURE SIGNAL LEVEL.
	4.	—	H	I	→	H	I	ORIENT TRANSDUCER (I) FOR MAXIMUM RECEIVED SIGNAL.
	5.	—	H	I	→	H	I	MEASURE PATH LOSS; COMPUTE CROSS-POLARIZATION DISCRIMINATION.
	6.	PERMANENTLY FASTEN ANTENNA.						PERMANENTLY FASTEN ANTENNA; INSTALL CIRCULAR FLEXIBLE WAVEGUIDE.
TRANSDUCER & TUNING SECTION ORIENTATION	7.	—	H	I	→	H	II	REMOVE MODE FILTER; ORIENT TRANSDUCER (II) FOR MAXIMUM SIGNAL.
	8.	—	H	I	→	V	II	ORIENT TRANSDUCER (II) AND TUNING SECTION FOR MINIMUM RECEIVED SIGNAL. LOCK ALL WAVEGUIDE FLANGES.
	9.	INSTALL CIRCULAR FLEX GUIDE, REMOVE MODE FILTER; ORIENT COUPLER FOR MAXIMUM RECEIVED SIGNAL AT STATION B.	V	II	→	V	II	MEASURE SIGNAL LEVEL.
	10.	ORIENT TUNING SECTION AND COUPLER FOR MINIMUM RECEIVED SIGNAL AT STATION B. ROTATE MT3 90 DEGREES. LOCK ALL WAVEGUIDE FLANGES. RECHECK PATH LOSS.	H	II	→	V	II	MEASURE SIGNAL LEVEL.
	11.	RESTORE WAVEGUIDE CONNECTIONS TO NORMAL.	V	II	→	V	II	RESTORE WAVEGUIDE CONNECTIONS TO NORMAL.

Fig. 5 – Steps in Orienting Antennas and Waveguide Components Using ED-59410-70 Transducers

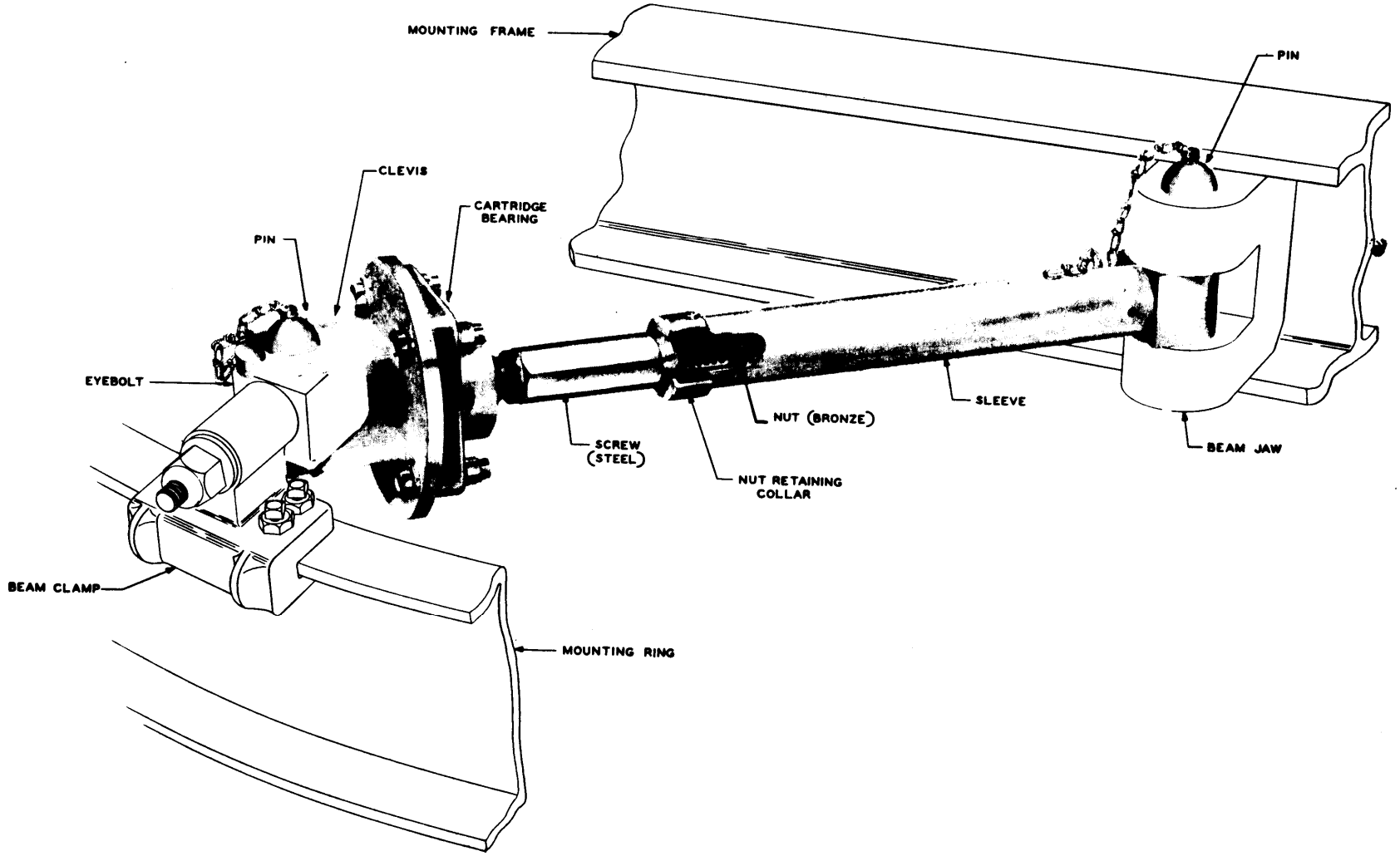


Fig. 6 – Azimuth Adjusting Screw

(2) The remaining mounting clamp assemblies, shown in Fig. 7, should be loosened so that the mounting frame is free to turn on the mounting ring.

(3) Apply lubricant to the top surface of the circular mounting ring in such a manner that the area of contact between the ring and mounting frame will obtain lubrication during adjustment.

(4) Install the azimuth scale to the circular mounting ring at a point convenient to the azimuth adjusting screw.

(5) Adjust the four guide wheels on the mounting frame for minimum clearance, without binding, between the wheels and the circular mounting ring.

Caution: Failure to adjust the guide wheels properly will cause excessive play between the mounting frame and ring, leading to false azimuth scale readings during adjustment.

(6) Watch the signal level meter, indicated in Fig. 4, at the receiving station. It will be necessary to adjust the IF attenuators as required so that the meter reads on scale. Turn the azimuth adjusting screw to rotate the antenna through the maximum received test signal (main lobe) and through one lobe each side of the main lobe for positive identification. The side lobes in general will produce a signal level approximately 12 db down from the main lobe and be spaced about 2.5 degrees from the main lobe. Record the readings of the azimuth scale for points about 4 db down (equal within ±0.25 db) on opposite sides of the position observed for maximum received signal. The difference on the azimuth scale between these two readings should be about 2.5 degrees.

(7) Using the azimuth adjusting screw, orient the antenna so that the azimuth scale indicates a reading halfway between the two points obtained in (6).

(8) Tighten the three mounting clamp assemblies to the mounting ring to secure the azimuth adjustment. Remove the azimuth adjusting tool and reassemble and secure the mounting clamp.

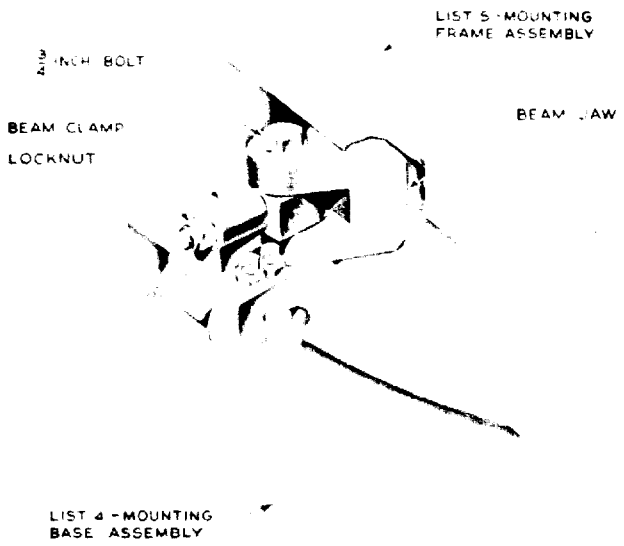


Fig. 7 – KS-15676 Horn — Reflector Antenna Mounting Clamp Assembly

5.04 ***In Elevation***

(1) Loosen the locking nuts on the tilt-control assembly. Watching the signal level meter at the receiving end, adjust the tilt-control turnbuckle so that it rotates the antenna through the maximum received signal (main lobe) and through one lobe above and below the main lobe for positive identification. Record the complete number of turns of the turnbuckle between points about 6 db down (but equal within ±0.25 db) on the two sides of the position for maximum received signal. The difference should be about nine turns.

(2) Using the turnbuckle, adjust the orientation of the antenna halfway between, accurate to 1/4 turn of the turnbuckle.

(3) Tighten the locking nuts on the tilt-control assembly.

5.05 ***The receiving antenna,*** next, is oriented for the maximum received test signal.

5.06 ***In azimuth*** follow the procedure outlined in 5.03, but do not remove the azimuth adjusting screw at this time.

5.07 ***In elevation*** follow the procedure outlined in 5.04.

5.08 ***The receiving antenna*** is next oriented for the minimum received test signal from the cross-polarized component as follows:

(1) Loosen the bolts in the circular flange between the transducer MT1, shown in Fig. 1, and the feed horn. Rotate the transducer to the approximate position for the minimum received test signal.

Caution: This tuning point is very sharp. Adjust slowly or it will be missed completely.

(2) Tighten the bolts finger tight, but loose enough so that the transducer may be rotated with the P-38B665 wrench. Using this wrench, adjust the transducer to the correct position for the minimum received test signal.

Caution: In making this adjustment, it will be found helpful if any mechanical sidethrust at the rotary joint is reduced to a minimum while rotating the transducer.

(3) Readjust the IF attenuators so that the signal level meter reads 0 dbm when the test signal is being received from the transmitting antenna. Record the sum of the IF attenuator settings as H1. H1 will be compared with P1 obtained in (6).

(4) Loosen the bolts in the circular flange between the transducer MT1, Fig. 1, and the feed horn. Rotate the transducer to the approximate position for maximum received test signal.

(5) Tighten the bolts finger tight but loose enough so that the transducer may be rotated with the P-38B665 wrench. Using the wrench, adjust the transducer to the correct position for maximum received test signal.

(6) Set the IF attenuators so that the signal level meter reads 0 dbm when the test signal is being received from the transmitting antenna. Record the sum of the IF attenuator settings as P1.

Requirement: The difference between H1 and P1 shall be at least 40 db.

If this requirement is not met, loosen the mounting clamp assemblies on the receiving antenna frame. Repeat the tests listed in 5.08 (1) through (6), but in (2), after adjusting the transducer for minimum received signal, adjust the azimuth adjusting screw in the direction which causes the minimum received test signal to decrease in magnitude. Limit this adjustment to a maximum change of ± 0.3 degree. Although the required difference between maximum and minimum signals is 40 db, a greater difference is desirable.

(7) Tighten the mounting clamp assemblies on the receiving antenna frame. Remove the azimuth adjusting screw and reassemble the mounting clamp and tighten.

6. CHECK BETWEEN MEASURED RECEIVED SIGNAL POWER AND THEORETICAL RECEIVED POWER

6.01 ***Procedure:***

(1) Measure the maximum received signal power as outlined in Section 410-100-510 for antenna orientation. Record this value as RL1.

Note: If the ED-45465 cable assembly and ED-45466 transducers are being used in the waveguide runs, their loss will not normally be included in the final circuit, and the received signal power measured in (1) should be increased by 2.0 db for each set of transducer cable assemblies used.

(2) Calculate the theoretical value of received power for the path being measured as in succeeding steps.

(3) From Table A, find the received power from waveguide to waveguide, for a frequency of 3950 mc.

(4) From Table B, column 2, find the correction for two KS-15676 antennas for the frequency of the test signal.

(5) From Table B, column 3, find the attenuation per foot for the circular waveguide. Multiply by the total number of feet of circular waveguide for both transmitting and receiving antenna runs.

(6) From Table B, column 4 or 5, find the attenuation per foot for the rectangular waveguide. Multiply by the total number of feet of rectangular waveguide for both transmitting and receiving runs.

(7) Add the loss for the branching filters included between the transmitting and receiving equipment. See Fig. 8 for representative figures of this loss. It will be noted that

each successive channel filter adds 0.2 db loss to the basic channel No. 1 loss of 0.5 db. Should a channel-dropping filter be omitted at a station because that channel is not equipped, the resultant loss becomes 0.2 db less than that shown in Fig. 8 for the particular channel being measured. For example: If channel 4 is being measured, with channels 1 and 2 equipped, and channel 3 not, then the branching filter loss becomes 0.9 db.

TABLE A*

NORMAL RECEIVED SIGNAL USING TWO KS-15676 ANTENNAS

ANTENNA SEPARATION	RECEIVED SIGNAL	ANTENNA SEPARATION	RECEIVED SIGNAL	ANTENNA SEPARATION	RECEIVED SIGNAL
miles	dbm	miles	dbm	miles	dbm
7	−19.5	20	−28.6	42	−35.0
8	−20.6	21	−29.0	44	−35.4
9	−21.6	22	−29.4	46	−35.8
10	−22.5	23	−29.8	48	−36.2
11	−23.3	24	−30.2	50	−36.5
12	−24.1	26	−30.8	52	−36.9
13	−24.8	28	−31.5	54	−37.2
14	−25.5	30	−32.1	56	−37.5
15	−26.1	32	−32.7	58	−37.8
16	−26.6	34	−33.2	60	−38.1
17	−27.1	36	−33.7	62	−38.4
18	−27.6	38	−34.2	64	−38.7
19	−28.1	40	−34.6	66	−38.9

* Applies if transmitting power is +27 dbm at a frequency of 3950 mc. Neglects waveguide and filter loss.

TABLE B

CORRECTIONS FOR DIFFERENT FREQUENCIES

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5
FREQUENCY	CORRECTION FOR TWO KS-15676 ANTENNA	ATTENUATION OF 2.812 CIRCULAR WAVEGUIDE	ATTENUATION OF COPPER WR229 RECTANGULAR WAVEGUIDE	ATTENUATION OF BRASS WR229 RECTANGULAR WAVEGUIDE
mc	db	db	db per foot	db
3730	−1.1	0.0040	0.0089	0.0124
3830	−0.7	0.0039	0.0087	0.0121
3890	−0.4	0.0039	0.0086	0.0119
3950	0.0	0.0038	0.0084	0.0117
4010	+0.4	0.0038	0.0083	0.0116
4070	+0.8	0.0037	0.0082	0.0115
4130	+1.2	0.0037	0.00815	0.0114
4170	+1.6	0.0037	0.0081	0.0113

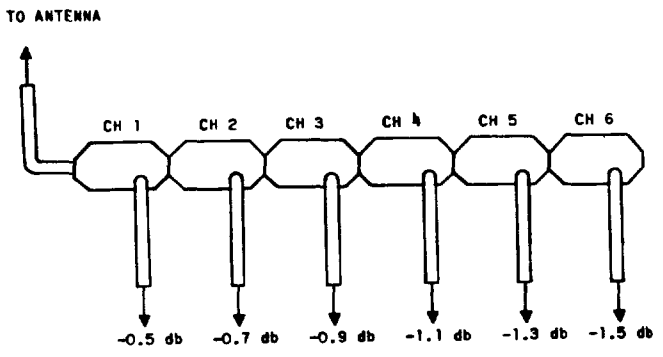


Fig. 8 – Branching Filter Loss Versus Channel Number

(8) Obtain the algebraic sum of (3) through (7) and designate as P3, the calculated received power.

Requirement: P3 and RL1 shall not differ by more than 3 db.

(9) ***Example of a calculation of P3***

Conditions:

Path Length	26 miles
Test Frequency (Channel 2)	4010 mc
Waveguide runs:	
Transmitting Antenna:	
Circular Waveguide	269 feet
Rectangular Waveguide	54 feet
Receiving Antenna:	
Circular Waveguide	175 feet
Rectangular Waveguide	42 feet
Branching Filters:	2 at each end

Calculation:

Step		
(3)	Received power (26 miles)	−30.8 dbm
(4)	Antenna correction (4010 mc)	+0.4 db
(5)	Circular waveguide (444 by 0.0038)	−1.7 db
(6)	Rectangular waveguide (96 by 0.0083, copper)	−0.8 db
(7)	Branching filters Channel 2 — (2 filters at each end)	−1.4 db
(8)	***Calculated Received Power (P3)***	−34.3 dbm

(10) After the antenna and transducer at each end of the circuit have been aligned as covered in Parts 2, 3, 4, and 5 and the requirement in Part 6 has been met, a check should be made to tighten, if necessary, the mounting clamp assemblies to the mounting ring and the lock nuts on the tilt-control assemblies.

7. FLEXIBLE-WAVEGUIDE INSTALLATION AND CROSS-POLARIZATION CHECK

7.01 *At the Receiving Antenna*

(1) After the receiving antenna has been oriented in accordance with Part 5, replace the KS-5783 flexible rectangular waveguide with KS-15690 flexible circular waveguide. KS-15690, List 1 flexible circular waveguide, having a length of 8 feet, is used to connect the rigid circular waveguide to the bottom of the KS-15676, List 3 feed horn. This is shown on ED-59393-01. There may be several flexible waveguides in the crate which will be marked as follows:

(Number in crate) — KS-15690, L———

FLEXIBLE CIRCULAR WAVEGUIDE.

(2) The attachment of the upper flange of the flexible waveguide to the feed horn is accomplished by using an 0 ring gasket, and the bolts, nuts, and lockwashers supplied with the flexible waveguide. No wafer is required for the joint at this end.

(3) In order to attach the flexible waveguide to the rigid waveguide, proceed as follows:

(a) Always bring the rigid waveguide up to meet the lower flange of the flexible waveguide. Do this by adjusting the four 3/4-inch square nuts in order to raise the split plate which supports the waveguide run. This is accomplished by loosening the locking nuts on top of the split plate and alternately turning, by the same amount, each of the four square nuts which support the plate.

Caution: The flexible circular waveguide is not extensible and should never be forced down to meet the rigid waveguide.

(b) When the adjustment is complete, each of the nuts shall have been raised the same amount and the locking nuts shall be secured again.

Caution: Never take more than a quarter turn at any time on any of the square nuts which support the split plate.

(c) Before making up the lower joint, form the flexible waveguide into a smooth curve so that its lower flange is parallel to and in contact with the upper flange of the rigid waveguide. A precise setting is necessary to avoid strain on the flexible waveguide.

(d) Make up the joint between the flexible and the rigid circular waveguide using an O ring gasket, a thin wafer, four of the bolts supplied with the flexible waveguide, and the four bolts supplied with the split plate of the hanger assembly. Use the nuts and lockwashers supplied with these bolts.

Note: If the elevation of the antenna is changed at any time after the flexible circular waveguide has been installed, readjustment of the hanger plate is required. Before making a change in elevation adjustment, the bolts should be removed from the joint, and the split plate should be lowered to allow the lower flange of the flexible waveguide to move freely. When the adjustment is completed, a new setting of the split plate should be made as described in (3) above, after which the joint may be made up again.

7.02 ***Cross-polarization Check and Final Orientation of Transducer MT3 — Station B***

Note: Stations A and B are shown in Fig. 5. Station B was called receiving antenna during antenna orientation.

(1) Move the telephone from the antenna deck and relocate it at the bottom of the waveguide run. The man orienting MT3 now may communicate with the man at the receiving equipment.

(2) Remove the mode filter FL1 from its place in the test setup shown in Fig. 1.

(3) Using eight 5/16-18 bolts 1-1/4 inches long, reconnect the ED-59455-70 tuning section to the base of the circular waveguide run in place of the mode filter FL1 as shown in Fig. 9.

(4) Using eight 5/16-18 bolts 1-1/4 inches long, loosely connect transducer MT3 to the tuning section as shown in Fig. 9. Rotate MT3 to the approximate position for the maximum received test signal.

(5) Now tighten the bolts finger tight, but loose enough so that MT3 may be rotated with a P-38B665 wrench. Using this wrench, adjust MT3 to the correct position for the maximum received test signal.

(6) Set the IF attenuators so that the signal level meter reads 0 dbm when the signal is being received from the transmitting antenna. Record the sum of the IF attenuator settings.

(7) Next loosen the bolts and rotate transducer MT3 to the approximate position for minimum received test signal.

(8) Tighten the bolts finger tight, but loose enough so that MT3 may be rotated with a P-38B665 wrench. Using this wrench, adjust MT3 to the correct position for the minimum received test signal.

(9) Set the IF attenuators so that the signal level reads +0 dbm when the signal is being received from the transmitting antenna. Record the sum of the settings for the minimum test signal as received in (8).

Requirement: The difference between the maximum and minimum received test signals shall be at least 30 db. If this requirement is not met, rotate the ED-59455-70 tuning section about 15 degrees and repeat the tests listed in (4) through (9). Continue to rotate the tuning section to new positions until the requirement in (9) is met. Tighten the bolts in the flanges joining the tuning section to the circular-waveguide run.

(10) Leave MT3 in the position for the minimum received test signal. Remove the 5/16-18 bolts 1-3/4 inches long, and replace and tighten the 5/16-18 bolts 1-1/4 inches long, between MT3 and the ED-59455-70 tuning

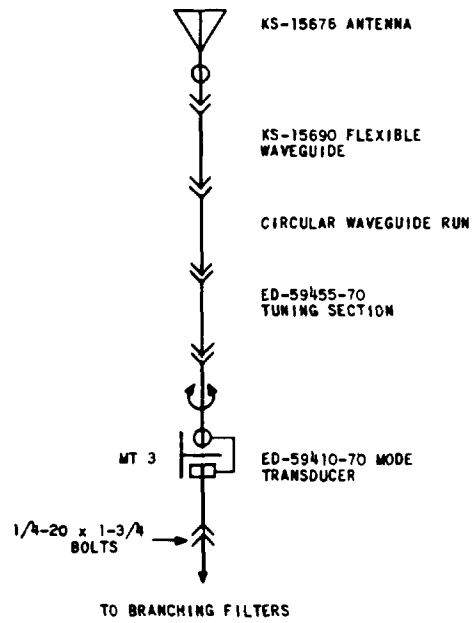


Fig. 9 – Orienting the Transducer and the Tuning Section

section without disturbing the orientation of the MT3. Remove the 1/4-20 bolts 1-3/4 inches long, and replace and tighten the 1/4-20 bolts 1-1/4 inches long, between MT3 and the KS-5783 flexible rectangular waveguide.

7.03 ***At the Transmitting Antenna:*** In order to install the flexible waveguide at the transmitting antenna, follow the instructions given in 7.01 (3).

7.04 ***Cross-polarization Check and Final Orientation of Transducer MT3 — Station A***

Note: Stations A and B are shown in Fig. 5. Station B was called receiving antenna during antenna orientation. Follow 7.02, (1) through (10). Then continue as follows:

(1) With transducer MT3 in position for the minimum received test signal, mark MT3 and the mating tuning section in such a way that this position will not be forgotten. This probably can be done best by making a pencil mark on the waveguide portion of MT3 and another on the waveguide portion of the tuning section in line with a bolt.

(2) Rotate MT3 90 degrees, the angular distance between the center lines of bolts that are two holes apart. Remove the 5/16-18 bolts 1-3/4 inches long, and replace and tighten the 5/16-18 bolts 1-1/4 inches long, between MT3 and the circular-waveguide run without disturbing the orientation of MT3. Remove the 1/4-20 bolts 1-3/4 inches long, and replace and tighten the 1/4-20 bolts 1-1/4 inches long, between MT3 and the KS-5783 flexible waveguide.

(3) Recheck the path loss by following the instructions given in Part 6.

7.05 ***Removal of Test Equipment:*** Disconnect the test equipment from the TD-2 equipment, and restore the TD-2 equipment to working order as follows:

(1) At both stations, remove pinch clamps from the air lines, remove the air gauge from the pressure window, set the manual gain control switch on the IF main amplifier to AUTOMATIC, and recover the telephones on the special network.

(2) At the transmitting station (station A), disconnect the oscillator from the transmitting equipment and reconnect the converter to the branching filter.

(3) At the receiving station (station B), disconnect the test equipment from the receiving equipment, and reconnect the receiving equipment.