ADJUSTMENT PROCEDURE FOR MASTR® STATION DUPLEXERS 19D402955P3 THRU P11

LBI3971D
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(DF8388)

CONTENTS

This instruction contains the procedure for changing the operating frequency of Mastr station duplexers 19D402955P3 thru P11. The duplexers are used in repeater stations to permit the simultaneous transmission and reception of RF signals using a single antenna. Duplexers 19D42955P3-9 are used in medium power stations (up to 100 watts), and duplexers 19D402955P10, 11 are used in stations up to 250 watts.

In duplex applications, the transmitter and receiver operate on different frequencies. The frequency range, frequency separation, dB rejection and insertion loss for each duplexer is shown in Table 1.

These units operate as band-reject duplexers, with a transmitter branch and receiver branch. Each branch includes tuneable cavities that are used in conjunction with the transmitter or receiver to attenuate (reject) a specific undesired signal while passing other signals with minimum loss.

Either branch may be used for the transmitter or receiver, depending on the operating frequencies. The cavities in tuning ports 4, 5, and 6 are tuned for maximum rejection of the low frequency and minimum attenuation of the high frequency. The cavities in tuning ports 1, 2, and 3 are tuned for maximum rejection of the high frequency and minimum attenuation of the low frequency. The frequency response of each branch of the duplexer is symmetrical as shown by the typical high frequency and low frequency notch response in Figure 1.

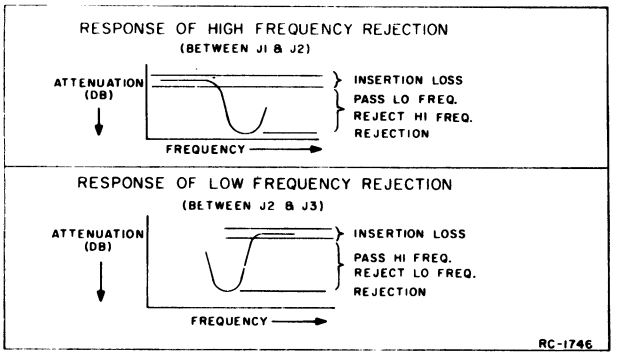

Figure 1 - Typical Duplexer Notch Response

ADJUSTMENT PROCEDURE

The adjustment procedure consists of re-tuning the duplexer for maximum high-frequency and low-frequency rejection, making the system connections, and measuring the insertion loss. The following equipment is required for making the adjustments:

Table 1 - Duplexer Frequencies

Duplexer Part No.	Tunable Range	Transmitter-Receiver Frequency Separation		Rejection (Minimum)	Insertion Loss (Maximum)
		Minimum	Maximum		
19D402955P3	150-162 MHz	3 to 12 MHz		45 dB	1 dB
19D402955P4	160-174 MHz	3 to 14 MHz		45 dB	1 dB
19D402955P5	150-162 MHz	2 to 12 MHz		55 dB	1.5 dB
19D402955P6	160-174 MHz	2 to 14 MHz		55 dB	1.5 dB
19D402955P7	450-470 MHz	5 to 20 MHz		45 dB	1 dB
19D402955P8	450-470 MHz	3 to 20 MHz		65 dB	1.2 dB
19D402955P9	450-470 MHz	5 to 20 MHz		45 dB	1 dB
19D402955P10	450-512 MHz	3 to 20 MHz		45 dB	1.5 dB
19D402955P11	450-512 MHz	3 to 20 MHz		65 dB	1.5 dB

- A signal generator (M560 or equivalent) and a 6 dB pad
- A receiver on each operating frequency (or one capable of being tuned to each of the operating frequencies).
- A 50-ohm load
- A wattmeter
- A 20,000 ohms-per-volt meter (GE Test Set Model 4EX3A10, 4EX8K11 or equivalent)
- A frequency counter may be used to set the signal generator on frequency.

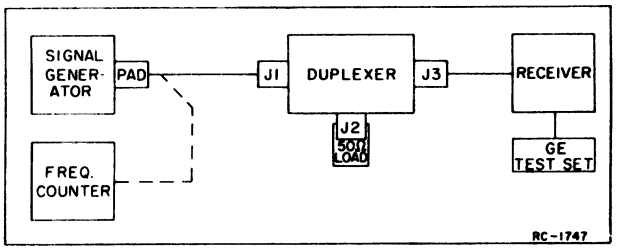

Figure 2 - Test Set-Up

HIGH-AND LOW-FREQUENCY REJECTION

Connect the test equipment as shown in Figure 2, and make the following adjustments:

1. Use a receiver aligned to the lowest operating frequency and set the signal generator on the receiver frequency. Increase the generator output until a reading is obtained at the receiver limiter. Do not saturate the limiter.
2. Remove the plug-buttons from tuning ports 4, 5 and 6 (see Fig. 3). Then loosen the locking nuts on the cavities to be tuned.
3. Tune the cavities for minimum limiter reading. Increase the generator output as necessary to obtain a good null. Tighten the locking nuts and replace the plug buttons after tuning.
4. Set the signal generator output for a reference reading on the limiter meter. Note this reading on the generator dB scale.
5. Disconnect the cables from J1 and J3. Connect the signal generator to the receiver, using a suitable coaxial adaptor.
6. Decrease the signal generator output until the reference limiter meter reading is recovered. Note this reading on the generator dB scale.
7. The difference between the two readings is the dB rejection, and should be equal to or greater than the readings shown in the following chart:

DUPLEXER	REJECTION (MIN)
19D402955P3 & P4	45 dB
" P5 & P6	55 dB
" P7, P9, & P10	45 dB
" P8 & P11	65 dB

8. Using a receiver aligned on the highest operating frequency, re-connect the signal generator to J1 and the receiver to J3. Set the generator on the new operating frequency and increase the output until a reading is obtained at the receiver limiter. Do not saturate the limiter.
9. Repeat Steps 2 through 7, tuning the cavities in ports 1, 2 and 3.

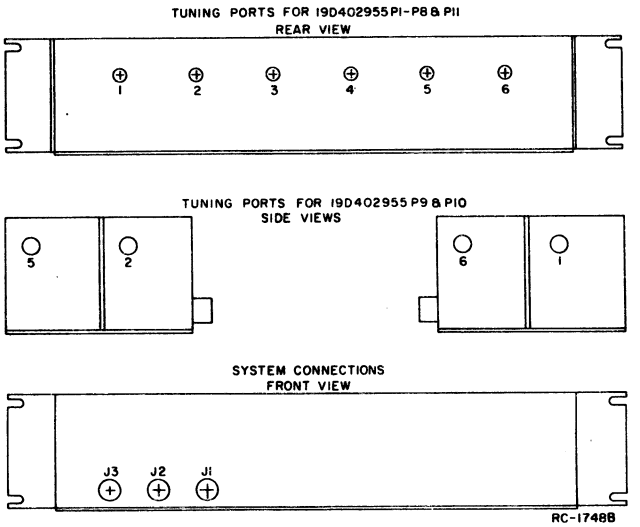

Figure 3 - Duplexer Outline Diagram

SYSTEM CONNECTIONS

After completing the high- and low-frequency rejection adjustments, connect the transmitter, receiver and antenna cables using the applicable method as follows:

- If the receiver frequency is Higher than the transmitter frequency, connect the cables as follows (see Fig. 3):

  J1 - Transmitter
  J2 - Antenna
  J3 - Receiver

- If the receiver frequency is lower than the transmitter frequency, connect the cables as follows:

J1 - Receiver
J2 - Antenna
J3 - Transmitter

INSERTION LOSS

After re-tuning the cavities on the new frequencies, check the transmitter and receiver insertion loss according to the following procedure.

Transmitter To Antenna

1. Connect a wattmeter to J2 (Antenna) on the duplexer. Adjust the transmitter for maximum power output, and note the wattmeter reading (P1).

2. Disconnect the wattmeter from J2 and connect it to the output of the transmitter. Adjust the transmitter for maximum power output, and note the wattmeter reading (P2).

3. The insertion loss is the difference (in dB) between the two readings. This difference can be determined by the following formula:

$$10 \log_{10} \frac{P1}{P2}$$

Receiver To Antenna

1. Connect a signal generator to J2, and set a reference on the receiver limiter meter. Note this reading (V1).

2. Disconnect the signal generator from J2 and connect it to the receiver input.

3. Decrease the generator output until the limiter meter reading is the same as the reading obtained in Step 1 and note the reading (V2).

4. The insertion loss is the difference between the two readings, and can be red from the generator dB scale or determined by the following formula:

$$20 \log_{10} \frac{V1}{V2}$$

The insertion loss for both the transmitter and receiver should not exceed the readings shown in the following chart:

Duplexer No.	Insertion Loss(dB)
19D402955 P3 & P4	1.0 dB
19D402955 P5 & P6 P10 & P11	1.5 dB
19D402955 P7 & P9	1.0 dB
19D402955 P8	1.2 dB

TRANSMITTER AND RECEIVER CABLES

Two cables are supplied with the duplexer: a 13 inch transmitter cable, and a 20-3/4 inch receiver cable. The cables are specially shielded to prevent RF coupling. The cable lengths have been selected to provide proper matching between the transmitter and receiver and the duplexer cavities.

In most cases, it will not be necessary to change the length of the transmitter or receiver cables when changing frequency. Replacement cables are listed in the following Parts List.

PARTS LIST	
19B205895G5	Tx antenna cable. Includes the following:
19B209044P16	RF cable RG-303/U approx 13 inches.
19B209018P5	Connector (to duplexer)
7104941P17	Connector (to transmitter)
19B205895G6	Receiver antenna cable. Includes the following:
19B209044P16	RF cable RG-303/U approx 20-3/4 inches.
19B209018P5	Connector (to duplexer)
7104941P17	Connector (to receiver)

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