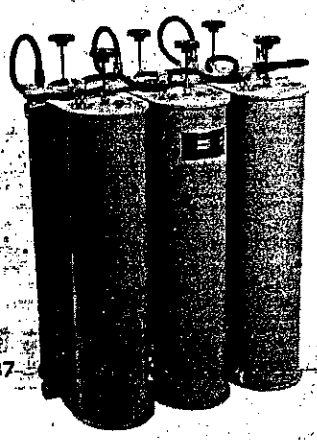
WP-637
WP-638

WACOM PRODUCTS

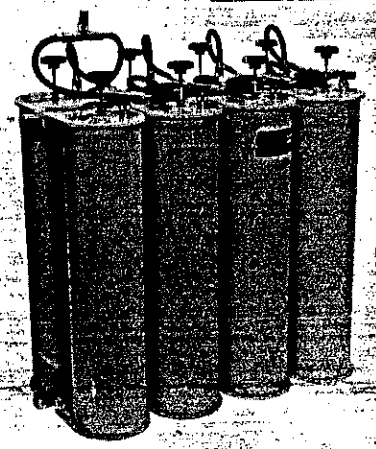
BAND-REJECT DUPLEXERS

MIN. FREQ. SPACING: 300 KHz POWER: TO 350 WATTS

144-174 MHz



WP-637



WP-638

THESE BAND-REJECT TYPE DUPLEXERS are designed for use in duplex systems when the transmit and receive frequencies are close spaced. Temperature compensated, these models provide rated performance while handling transmitter powers up to 350 watts. The duplexers are also suitable for combining two transmitters or two simplex systems into a common antenna system. Optional items include a weather-resistant steel cabinet, and a duplexer installation kit for interconnecting the duplexer to the Tx and Rx chassis with double shielded coaxial cable.

MODEL WP-637 is designed for use with duplex stations operating in the 144-174 MHz band when the separation between transmit and receive frequencies is 0.5 MHz or more. It consists of six high Q, quarter-wave coaxial cavities interconnected in a band-reject duplexer configuration with double shielded coaxial cable. Duplex response curves on the back illustrate the typical insertion loss and isolation provided by the duplexer when operated at minimum frequency separation. As the separation becomes greater, the isolation remains the same but the insertion loss at the desired frequencies will be less. Model WP-204 weather-resistant steel cabinet is available as an optional item.

MODEL WP-638 is similar to the above model but, for improved isolation, includes four cavity filters in each section of the duplexer. Because of its greater isolation, this model is generally suitable for use with most duplex stations when the separation between transmit and receive frequencies is 0.3 MHz or more. It is commonly used at greater frequency spacing (0.5, 0.6 MHz) when the particular duplex station in use requires greater isolation than that provided by the six cavity model. Duplex response curves on the back illustrate the typical insertion loss and isolation provided by the duplexer when operated at 0.5 MHz frequency separation. As the separation is decreased, the isolation will remain the same but the insertion loss at the duplex frequencies will be greater. Model WP-205 weather-resistant steel cabinet is available as an optional item.

CONSTRUCTION: To assure top performance and long life, quality materials are used throughout the duplexer. Cavity end plates and outer conductor are made of chromated aluminum; coupling loops are made of copper; both sections of cavity center conductor are made of silver plated copper. Galvanic corrosion is minimized by the use of similar materials or by passivating the dissimilar materials in contact.

FREQUENCY STABILITY of the duplexer is excellent. Since the resonant frequency of each cavity is determined by the length of the cavity center conductor, a threaded rod of "Invar" - a metal with nearly zero coefficient of expansion - is used to control the center conductor length. The duplexer will remain tuned over an extremely wide temperature range.

TUNING: The duplexer is factory tuned to the exact Tx and Rx frequencies prior to shipment from the factory and no further field adjustment is normally required. If desired, the duplexer can be field-tuned to new frequencies if appropriate measuring equipment is available.

INSTALLATION: The duplexer can be mounted in any position but is normally mounted vertically, with the tuning rods up. Double-shielded coaxial cable (RG-9, RG-142) must be used to interconnect these duplexers to the transmitter and receiver chassis if maximum isolation is to be maintained. A suitable duplexer installation kit (No. 30090) is available as an optional item.

WACOM PRODUCTS, INC.
6701 LANDMARK DR. • P.O. BOX 7307 • WACO, TEXAS 76710 • (817) 776-4444

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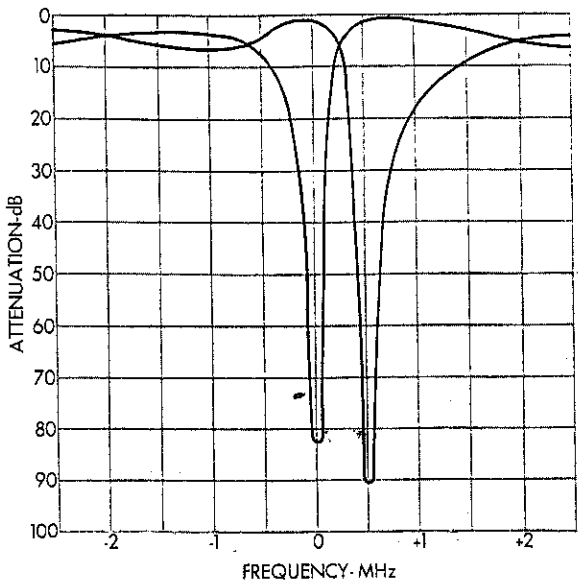
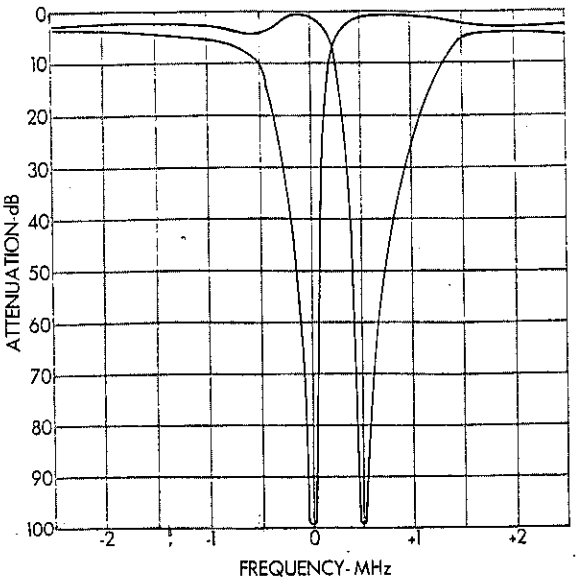
TYPICAL DUPLEX RESPONSE CURVES



Model WP-637



Model WP-638

ELECTRICAL DATA

	Model WP-637	Model WP-638
Tuning Range	144-174 MHz	144-174 MHz
Minimum Frequency Separation	0.5 MHz or more	0.3 MHz or more
Maximum Power Input (continuous duty)	350 watts	350 watts
Insertion Loss (Tx and Rx)		
at 0.3 MHz separation	Not Applicable	2.2 dB
at 0.5 MHz separation	1.2 dB	1.2 dB
at 0.6 MHz separation	0.8 dB	1.0 dB
Isolation (Tx to Rx)		
at Tx frequency	80 dB	95 dB
at Rx frequency	80 dB	95 dB
Maximum VSWR (Ref. 50 ohms)	1.5 to 1	1.5 to 1
Temperature Range	-30°C to +60°C	-30°C to +60°C
Number of Cavity Filters	6	8

MECHANICAL DATA

	Model WP-637	Model WP-638
Duplexer Dimensions (D x W x H) with tuning rods fully extended	13" x 19" x 29"	13" x 25" x 29"
Connector Terminations (Tx, Rx, Ant)	UHF Female	UHF Female
Finish	Gray enamel	Gray enamel
Net Weight	38 lbs.	52 lbs.
Shipping Weight	45 lbs.	64 lbs.
Optional Weather Resistant Cabinet	WP-204	WP-205
Dimensions, cabinet, (D x W x H)	14" x 19¼" x 30"	14" x 25½" x 30"
Net weight (cabinet only)	50 lbs.	67 lbs.
Shipping Weight (cabinet only)	75 lbs.	90 lbs.

ORDERING INFORMATION

Model WP-637 Duplexer with Tx on_____MHz and Rx on_____MHz
Model WP-638 Duplexer with Tx on_____MHz and Rx on_____MHz
Model WP-204 Optional Weather Resistant Cabinet for WP-637
Model WP-205 Optional Weather Resistant Cabinet for WP-638

When ordering specify exact Tx and Rx frequency.

INSTALLATION & ALIGNMENT PROCEDURES

CLOSE SPACED DUPLEXERS

Model WP-637	Model WP-650
140-180 MHz	220-300 MHz

HIGHLIGHTS

(1) The duplexer is factory tuned to the exact frequencies appearing on the decal. No further field tuning or adjustment should be required.

(2) The duplexer can be mounted in any position but is usually mounted vertically (tuning rods up).

(3) The transmitter and receiver input ports are indicated by a "Tx" and "Rx" decal and the antenna connection is designated by a "Ant" decal.

(4) The duplexer cable harness includes cables which are critical in length. Do not change.

(5) IMPORTANT: To maintain maximum isolation, use double-shielded coaxial cable (RG-9 or RG-142) to connect the duplexer to the Tx and Rx chassis.

(6) With some transmitters, the length of the cable from the transmitter chassis to the Tx input of the duplexer might have to be optimized because of impedance mismatch. (See instructions).

GENERAL

Model WP-637 is a 6-cavity band-reject duplexer designed for use with duplex stations operating in the 140-180 MHz band when the frequency separation between transmitter and receiver is 0.5 MHz or more. Model WP-640 is a 6-cavity duplexer designed for use with duplex stations operating in the 200-300 MHz band when the Tx and Rx frequency separation is 1.0 MHz or more. Either model is also suitable for combining two transmitters or two simplex stations into a common antenna system.

INSTALLATION

The duplexer can be mounted in any convenient location in or near the duplex station but the interconnect cables should be kept as short as possible to minimize losses. The interconnect cables between the duplexer and the transmitter and receiver chassis must be the double-shielded type (RG-9 or RG-142) in order to maintian maximum isolation.

As shipped from the factory, the three input connectors on the duplexer are labled with "Tx", "Rx", and "Ant" decals to designate the appropriate connections. In these instructions, the three input connectors are marked

"Low Frequency Input", High Frequency Input" and "Antenna". If the transmit frequency is lower than the receive frequency, the transmitter should be connected to the connector marked "Low Frequency Input" and the receiver connected to the connector marked "High Frequency Input". If the transmit frequency is higher than the receive frequency, the transmitter should be connected to the connector marked "High Frequency Input" and the receiver connected to the input marked "Low Frequency Input". The antenna should always be connected to the connector near the center of the duplexer cabinet. Either the transmitter or receiver (which ever one operates on the lower duplex frequency) should always be connected to the middle connector marked "Low Frequency Input".

FIELD ALIGNMENT

The duplexer is factory-tuned to the exact operating frequencies prior to shipment from the factory. No further field tuning or adjustment is normally required. If it becomes necessary to change the operating frequencies of the duplexer, it may be returned to the factory for re-tuning or it can be field-tuned if the following equipment is available.

1. A 50 ohm signal generator (with 6 dB pad) capable of producing a signal at the transmit and receive frequencies.
2. A receiver tuned to the desired transmit frequency.
3. A receiver tuned to the desired receive frequency.
4. Two 50 ohm, 3 or 6 dB pads.

FIELD ALIGNMENT PROCEDURE, USING RECEIVERS

1. Connect the equipment as shown in Fig. 1.
2. Tune the signal generator to the higher of the two duplex frequencies and check the discriminator of Receiver #1 to determine that the signal generator is exactly on frequency.
3. Loosen lock-shaft nut and tune #1, #2 and #3 cavities, one at a time, for a minimum reading on the second limiter of Receiver #1. (Clockwise rotation of the tuning rod decreases the resonant frequency of the cavity).
4. Tighten the lock-shaft nut after tuning each cavity.
5. Tune the signal generator to the lower of the two duplex frequencies and check the discriminator of the Receiver #2 to make sure the signal generator is exactly on frequency.
6. Tune #4, #5 and #6 cavities, one at a time for minimum reading on the second limiter of Receiver #2.
7. Tighten the lock-shaft nut after tuning each cavity.
8. The duplexer is now properly tuned to the two duplex frequencies.
9. Connect duplexer to transmitter, receiver and antenna as outlined in the INSTALLATION paragraph of these instructions.

CABLE LENGTH BETWEEN TRANSMITTER AND DUPLEXER

The length of the coaxial cable between the transmitter and duplexer might be a critical length with some transmitters because of an impedance mismatch. In this event, the length of cable will have to be optimized. The need for this optimization will be apparent if the output power of the transmitter is reduced by more than the amount absorbed in the duplexer due to insertion loss. (Note that ½ dB insertion loss = transmitter power loss of 11%; 1 dB = 20%; 1.5 dB = 29%; 2 dB = 37%; 3 dB = 50%).

The optimum length of cable between the transmitter and the duplexer can be found by the following procedure:

(1) Tune the transmitter into a 50 ohm dummy load (or its antenna) according to the instruction book.

(2) Insert the duplexer between the transmitter and dummy load (or antenna). If there is an impedence mismatch, the duplexer will detune the transmitter and the cable should be optimized.

(3) Cut a length of RG-9 or RG-142 type cable to the approximate length that will be required to interconnect the transmitter to the duplexer. Attach connectors and connect to transmitter.

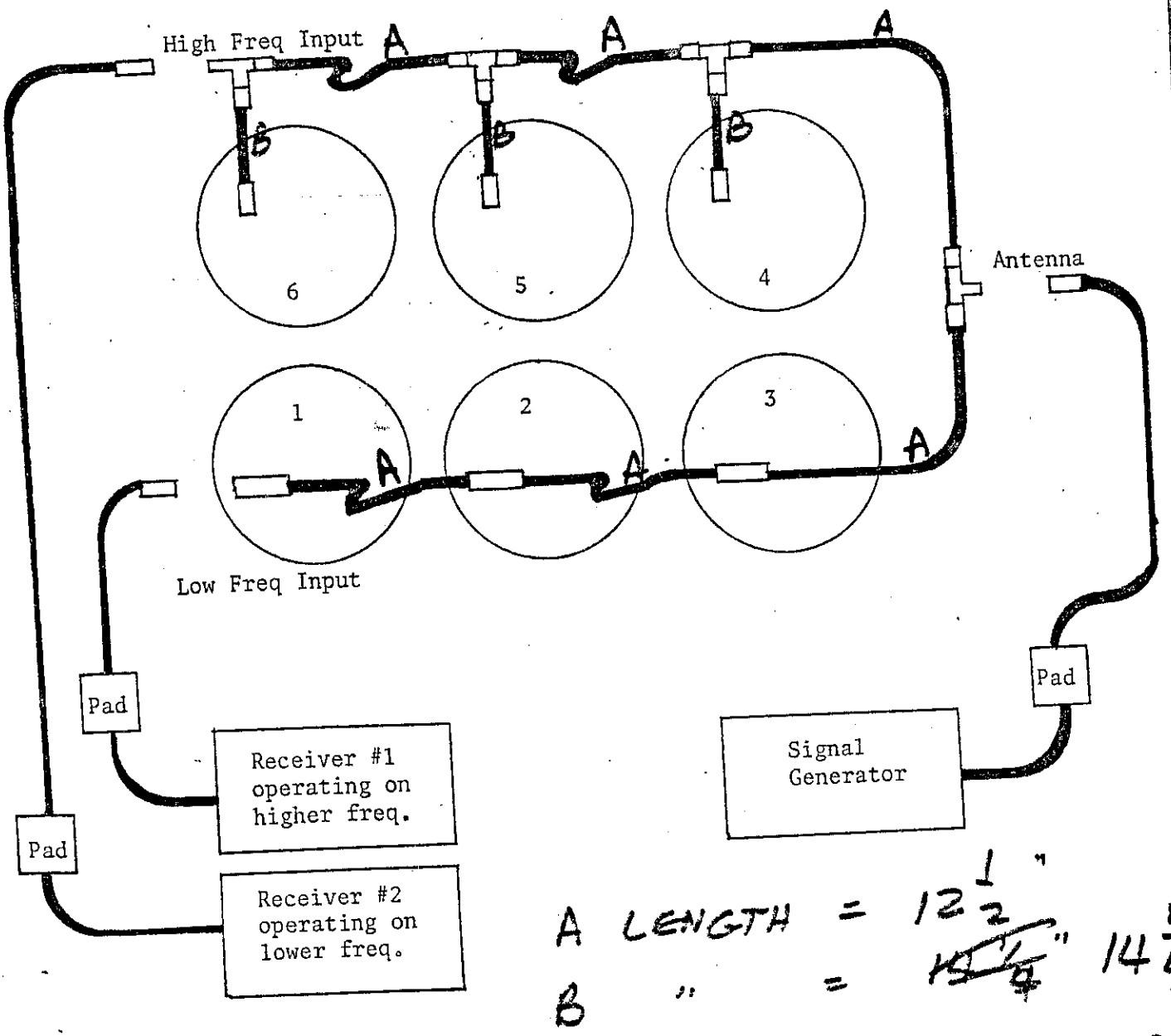
(4) Using short lengths of of coaxial cable (approximately 4") or UG-646 right elbow connectors, graudally increase the length of the above coaxial cable between the transmitter and duplexer over a half-wavelength (at the operating frequency) until the optimum length (no detuning effect) is found. (Note: A UG-646 elbow is equal to approximately 1½" of RG-9 or RG-142 type cable). A half-wavelength (cable) at the operating frequency can be found by:

$$\text{Length (in inches) of } \tfrac{1}{2} \text{ wavelength (cable)} = \frac{3894}{\text{Freq. in MHz of Tx}}$$

Example: At 152.03 MHz, ½ wavelength (cable) equals 25.61 inches. Therefore, the random length of cable, (above paragraph 3) should be increased approximately 4" at a time, and the transmitter-duplexer match checked at each length, until a total of 26" of additional cable has been tried. At some length within this 26", the match will be optimized and that length should be noted.

(5) When the proper cable length is found, replace the longer cable length (paragraph 3) and the short length of cable and the UG-646 elbows (paragraph 4) with one continuous length of cable of equivalent electrical length.. The cable length is now optimized.

Fig. 1 FIELD ALIGNMENT LAYOUT 144 - 148 MHz



A LENGTH = $12\frac{1}{2}$"

B " = ~~15 1/4~~ " $14\frac{1}{4}$

TIP-TIP

Cavities 1, 2 and 3 are tuned to the higher frequency. As such, they pass the lower frequency and reject (absorb) energy at the higher frequency.

Cavities 4, 5 and 6 are tuned to the lower frequency. As such, they pass the higher frequency and reject (absorb) energy at the lower frequency.