Instruction Manual for 21-Series T-Pass® Filters (except 800 MHz)

Manual Part Number

7-9040

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Warranty

This warranty applies for one year from shipping date.

TX RX Systems Inc. warrants its products to be free from defect in material and workmanship at the time of shipment. Our obligation under warranty is limited to replacement or repair, at our option, of any such products that shall have been defective at the time of manufacture. **TX RX Systems Inc.** reserves the right to replace with merchandise of equal performance although not identical in every way to that originally sold. **TX RX Systems Inc.** is not liable for damage caused by lightning or other natural disasters. No product will be accepted for repair or replacement without our prior written approval. The purchaser must prepay all shipping charges on returned products. **TX RX Systems Inc.** shall in no event be liable for consequential damages, installation costs or expense of any nature resulting from the purchase or use of products, whether or not they are used in accordance with instructions. This warranty is in lieu of all other warranties, either expressed or implied, including any implied warranty or merchantability of fitness. No representative is authorized to assume for **TX RX Systems Inc.** any other liability or warranty than set forth above in connection with our products or services.

TERMS AND CONDITIONS OF SALE

PRICES AND TERMS:
Prices are FOB seller's plant in Angola, NY domestic packaging only, and are subject to change without notice. Federal, State and local sales or excise taxes are not included in prices. When Net 30 terms are applicable, payment is due within 30 days of invoice date. All orders are subject to a $100.00 net minimum.

QUOTATIONS:
Only written quotations are valid.

ACCEPTANCE OF ORDERS:
Acceptance of orders is valid only when so acknowledged in writing by the seller.

SHIPPING:
Unless otherwise agreed at the time the order is placed, seller reserves the right to make partial shipments for which payment shall be made in accordance with seller's stated terms. Shipments are made with transportation charges collect unless otherwise specified by the buyer. Seller's best judgement will be used in routing, except that buyer's routing is used where practicable. The seller is not responsible for selection of most economical or timeliest routing.

CLAIMS:
All claims for damage or loss in transit must be made promptly by the buyer against the carrier. All claims for shortages must be made within 30 days after date of shipment of material from the seller's plant.

SPECIFICATION CHANGES OR MODIFICATIONS:
All designs and specifications of seller's products are subject to change without notice provided the changes or modifications do not affect performance.

RETURN MATERIAL:
Product or material may be returned for credit only after written authorization from the seller, as to which seller shall have sole discretion. In the event of such authorization, credit given shall not exceed 80 percent of the original purchase. In no case will Seller authorize return of material more than 90 days after shipment from Seller's plant. Credit for returned material is issued by the Seller only to the original purchaser.

ORDER CANCELLATION OR ALTERATION:
Cancellation or alteration of acknowledged orders by the buyer will be accepted only on terms that protect the seller against loss.

NON WARRANTY REPAIRS AND RETURN WORK:
Consult seller's plant for pricing. Buyer must prepay all transportation charges to seller's plant. Standard shipping policy set forth above shall apply with respect to return shipment from TX RX Systems Inc. to buyer.

DISCLAIMER

Product part numbering in photographs and drawings is accurate at time of printing. Part number labels on TX RX products supersede part numbers given within this manual. Information is subject to change without notice.

Manual Part Number 7-9040

First Printing: May 1986

Version Number	Version Date
1	5/10/86
2	5/24/89
3	12/13/91

Symbols Commonly Used

WARNING

ESD Elecrostatic Discharge

CAUTION or ATTENTION

Hot Surface

High Voltage

Electrical Shock Hazard

Use Safety Glasses

Important Information

TECH-AID NO.79001

CONVERSION ASSEMBLY NOMENCLATURE AND BASIC TUNING ADJUSTMENTS

6 5/8 AND 10 IN. DIA. FILTERS 66-512 MHZ

BANDPASS T-PASS™ VARI-NOTCH® SERIES NOTCH™

GENERAL

The information provided in this Tech-Aid is basic to most filter and Multicoupler systems. Measurement circuits and test equipment for tuning the various filters are provided in Tech-Aid 79002. Specific system tuning instructions will contain the particular electrical and mechanical data applicable to that system, supported by Tech-Aids 79001 and 79002.

DESCRIPTION OF FILTER CONVERTIBILITY

All 6 5/8" and 10" Dia. filters have two 1.5" Dia. openings in the top of the cavity which, with the proper conversion assemblies, will allow the cavity to function as any one of four basic filter types, these being Bandpass, T-Pass™, Vari-Notch® and Series Notch™. All conversion assemblies are interchangeable between 6 5/8" and 10" dia. cavities. Indexing labels are provided for all assemblies to allow logging and field resetability to specific performance levels. This calibration data is provided on individual filter labeling or in specific system instruction manuals. The purpose of this Tech-Aid is to identify the basic tuning adjustments and calibration procedures for ready reference. T-Pass™, and Series Notch™ are trademarks for Patent Pending designs in the United States and Canada. Vari-Notch is the registered trademark of a line of highly efficient pseudo-bandpass filters, constructed under TX RX Systems patent number 4186359.

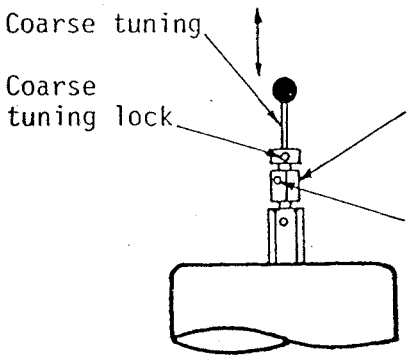
FUNDAMENTAL CAVITY "RESONANCE" OR FREQUENCY ADJUSTMENT

The adjustment of cavity resonance may control the pass or the reject frequency, depending on the circuit design. The central cavity probe adjusts cavity resonance. On later designs, an inductive fine tuning rod, ¼" in dia. provides a smooth, sliding vernier control. Earlier designs use a threaded tuning bolt mechanism. Both are detailed below.

FINE TUNING USING DUAL TUNING BOLTS

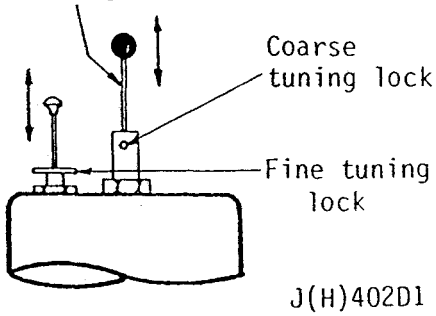
(lefthand/righthand threads for non-rotating plunger)

With coarse tuning locked and tension screws loosened, rotate fine tuning bolt for fine longitudinal travel of tuning plunger.



INDUCTIVE FINE TUNING

Fine tuning usually set mid-range of 4" travel at VHF and 3" travel at UHF Sliding coarse tuning rod.



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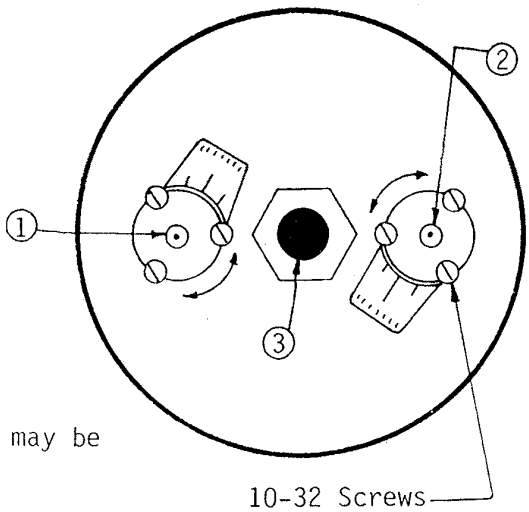
pg.1

BANDPASS

① ② Input/Output Loop Assemblies. Loosen three 10-32 screws and rotate Loop Assembly for desired insertion loss. (See Note below).

③ Adjust cavity probe (and/or fine inductive tuning, if provided) for minimum loss.



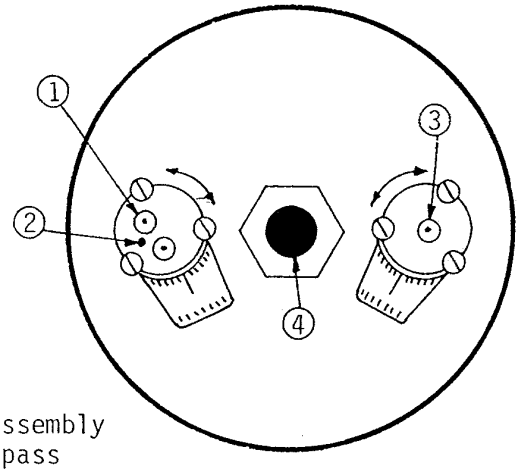
Cavity must be retuned after insertion loss adjustments, as coupling changes also change cavity resonant frequency. Raising loss lowers resonant frequency, and vice-versa.

NOTE: Loop settings for desired insertion loss may be calibrated in one of two ways:

1. The insertion loss label is calibrated at 0.5, 1.0 and 3.0 dB.

2. The insertion loss label is an index label and the loss settings are keyed to various index numbers on the label. These index settings are noted on the cavity.

T-PASS™



① T-Pass Conversion Assembly, antenna thruline connectors for channel interconnection into main antenna line.

② Red dot terminal normally faces toward antenna connection of system. Double red dots mean assembly is bi-directional, having no preferred port for best VSWR. Placing system terminating stub on non-red dot port (if not bi-directional) of T-Pass assembly allows cavity to be tuned as a standard bandpass filter. Settings for the relative calibration index label are available for specific T-Pass filter models for 0.5 and 1.0 dB loss. All T-Pass filters are calibrated for 1.0 dB loss at 10 on the relative index label. Assembly rotation adjusts insertion loss.

③ Standard Bandpass Loop assembly, calibrated at 0.5, 1.0 and 3.0 dB loss.

④ Adjust cavity probe for minimum insertion loss, once insertion loss calibration has been made. Filter response for various cavity losses follows standard bandpass filter performance data.

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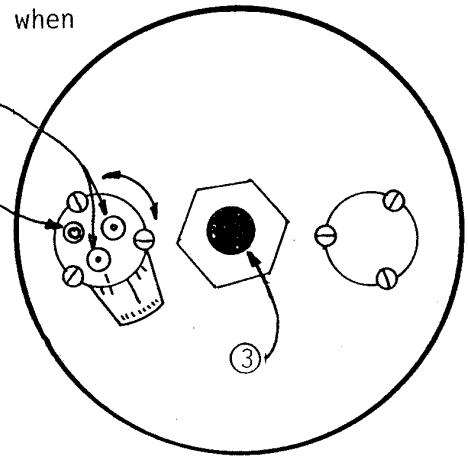
VARI-NOTCH®

Pat. No. 4186359

Note: Insulated tuning tool required when tuning notch



① Input/Output connectors on Vari-Notch conversion assembly.

② Air variable capacitor adjusts notch frequency. Red half of rotor adjacent barrel stripe indicates full capacity.

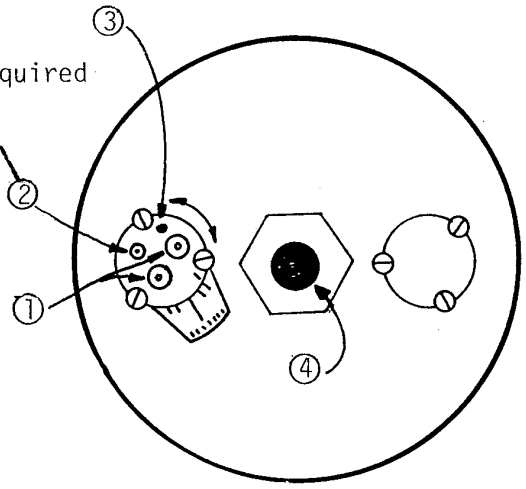
③ Cavity probe, and related fine tuning controls, adjusts pass frequency.

Rotation of Vari-Notch Assembly adjusts insertion loss. Relative index label is used to log specific filter performance. Standard calibration is 0.6 loss at index setting of 15, calibrated at center of filter tuning range.
Most frequency bands have high pass and low pass Vari-Notch assemblies, though all assemblies tune high and low pass to some degree.
When tuning filter, always make notch adjustment last, as notch tends to track with pass band (cavity) tuning.

② On UHF models (400 MHz and over) capacitor access barrel is omitted and a 6-32 screw is removed from plate for access to piston trimmer under plate. Use small insulated tuning tool.

SERIES NOTCH™

Note: Insulated tuning tool required when tuning passband



① Input/Output connectors on Series Notch conversion assembly.

② Air variable capacitor adjusts pass band insertion loss. Red half of rotor adjacent barrel stripe indicates full capacity.

③ Red dot indicates input terminal for best VSWR. In multiple cavity systems, non-red dot port connects to next S/N red dot terminal.

④ Cavity probe, and related fine tuning controls, adjust notch frequency.
Rotation of Series Notch assembly adjusts notch depth, 15 to 25+ db. The relative calibration index label is used to log specific filter performance. Standard calibration is at 15 db at high end of frequency band, with index at 0.
Increasing index value increases depth of notch.
SERIES NOTCH conversion assemblies are supplied in high pass and low pass models. Low pass assemblies also tune symetrical pass band responses.

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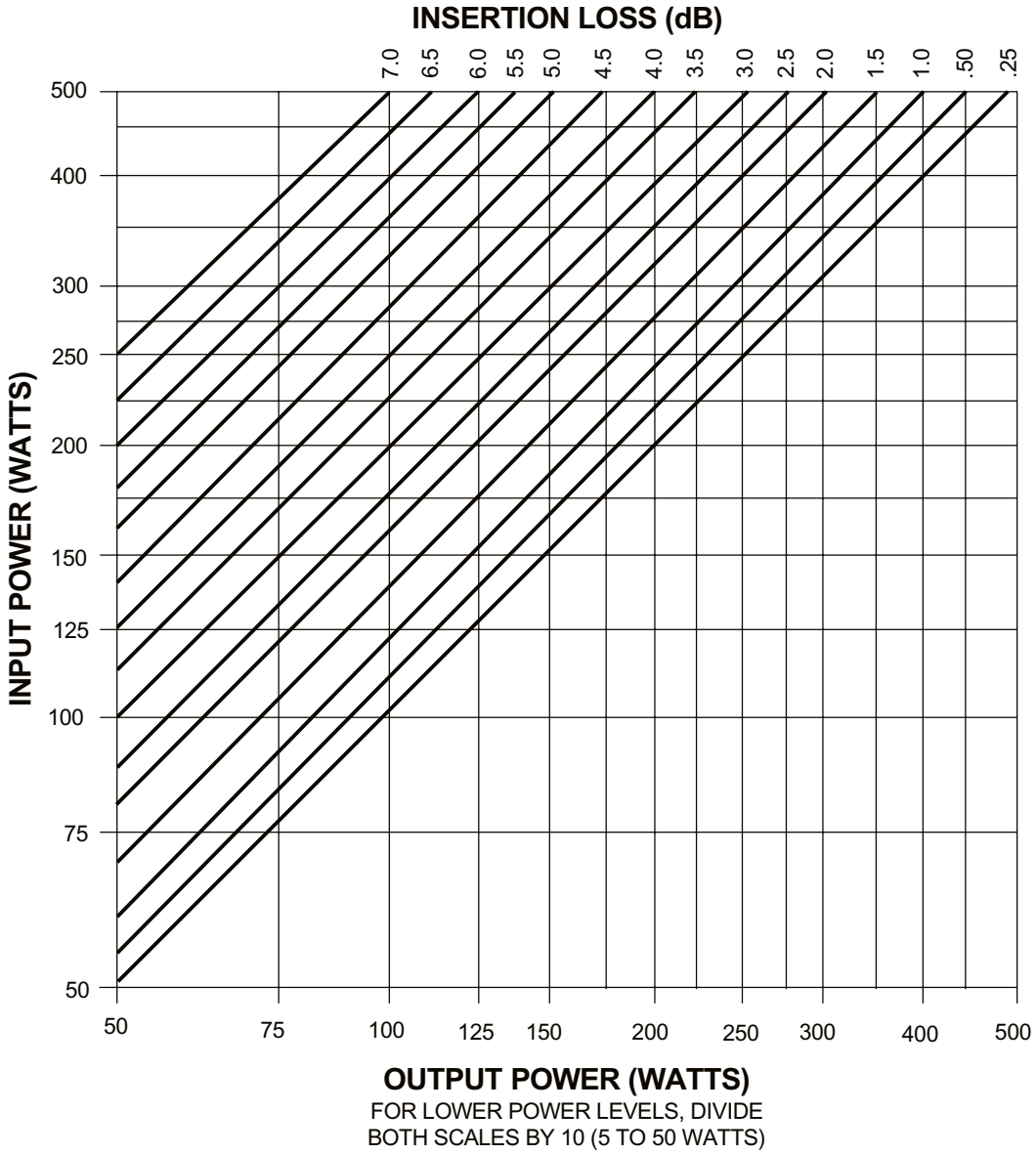
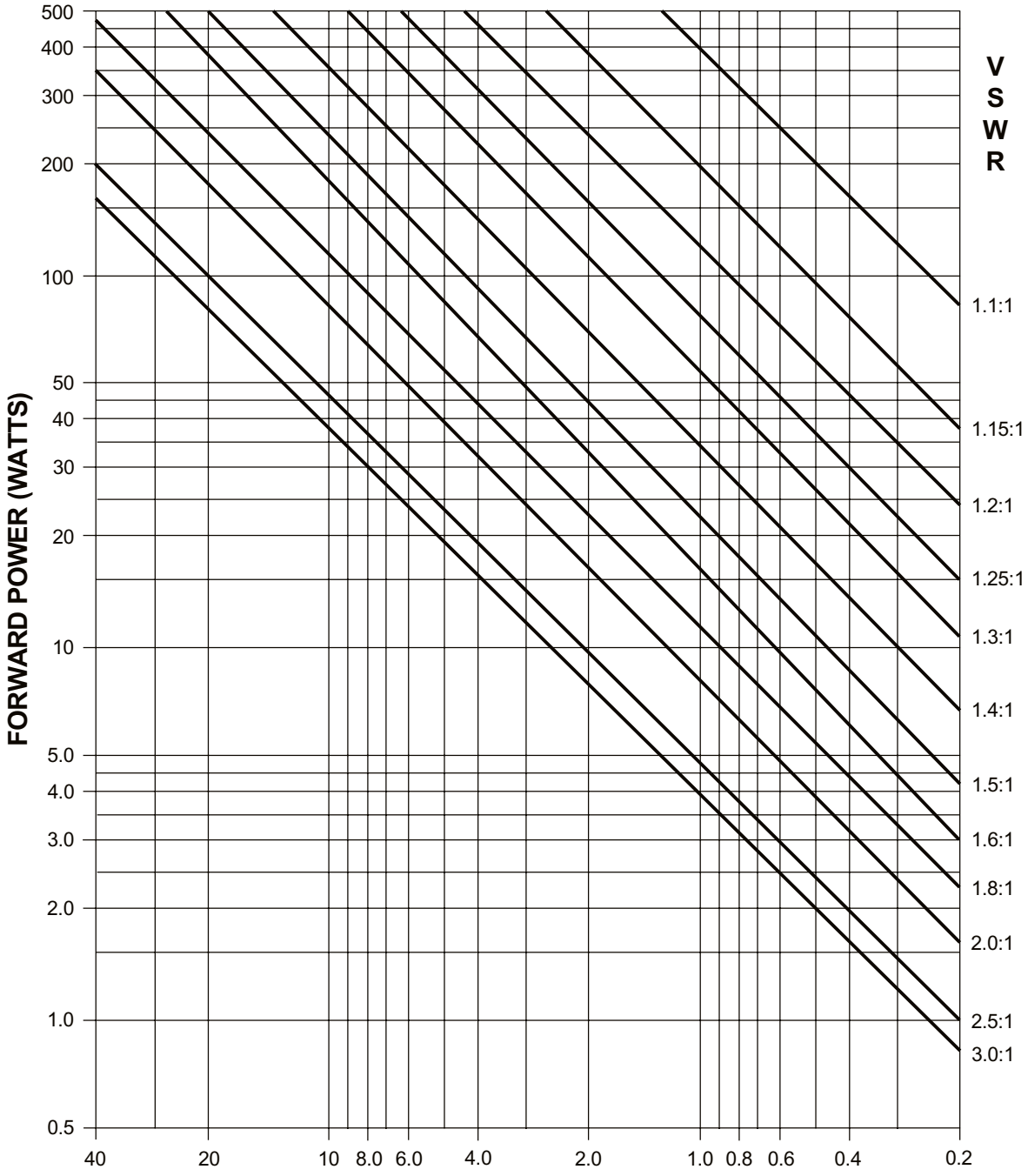
POWER IN/OUT
VS.
INSERTION LOSS

The graph below offers a convenient means of determining the insertion loss of filters, duplexers, multicouplers and related products. The graph on the back page will allow you to quickly determine VSWR. It should be remembered that the field accuracy of wattmeter readings is subject to considerable variance due to RF connector VSWR and basic wattmeter accuracy, particularly at low end scale readings. However, allowing for these variances, these graphs should prove to be a useful reference.



POWER FWD./REV.
VS.
VSWR



FOR OTHER POWER LEVELS, MULTIPLY
BOTH SCALES BY THE SAME MULTIPLIER

Power Ratio and Voltage Ratio to Decibel Conversion Chart

Example-- Given a gain of +9.1 dB or a loss of -9.1 dB

Loss or Gain	Power Ratio	Voltage Ratio
+9.1 dB	8.13	2.85
-9.1 dB	0.12	0.35

← - dB + →

Voltage Ratio	Power Ratio	dB	Voltage Ratio	Power Ratio
1	1	0	1	1
0.99	0.98	0.1	1.01	1.02
0.98	0.96	0.2	1.02	1.05
0.97	0.93	0.3	1.04	1.07
0.96	0.91	0.4	1.05	1.1
0.94	0.89	0.5	1.06	1.12
0.93	0.87	0.6	1.07	1.15
0.92	0.85	0.7	1.08	1.18
0.91	0.83	0.8	1.1	1.2
0.9	0.81	0.9	1.11	1.23
0.89	0.79	1	1.12	1.26
0.88	0.78	1.1	1.14	1.29
0.87	0.76	1.2	1.15	1.32
0.86	0.74	1.3	1.16	1.35
0.85	0.72	1.4	1.18	1.38
0.84	0.71	1.5	1.19	1.41
0.83	0.69	1.6	1.2	1.45
0.82	0.68	1.7	1.22	1.48
0.81	0.66	1.8	1.23	1.51
0.8	0.65	1.9	1.25	1.55
0.79	0.63	2	1.26	1.59
0.79	0.62	2.1	1.27	1.62
0.78	0.6	2.2	1.29	1.66
0.77	0.59	2.3	1.3	1.7
0.76	0.58	2.4	1.32	1.74
0.75	0.56	2.5	1.33	1.78
0.74	0.55	2.6	1.35	1.82
0.73	0.54	2.7	1.37	1.86
0.72	0.53	2.8	1.38	1.91
0.72	0.51	2.9	1.4	1.95
0.71	0.5	3	1.41	2
0.7	0.49	3.1	1.43	2.04
0.69	0.48	3.2	1.45	2.09
0.68	0.47	3.3	1.46	2.14
0.68	0.46	3.4	1.48	2.19
0.67	0.45	3.5	1.5	2.24
0.66	0.44	3.6	1.51	2.29
0.65	0.43	3.7	1.53	2.34
0.65	0.42	3.8	1.55	2.4
0.64	0.41	3.9	1.57	2.46
0.63	0.4	4	1.59	2.51
0.62	0.39	4.1	1.6	2.57
0.62	0.38	4.2	1.62	2.63
0.61	0.37	4.3	1.64	2.69
0.6	0.36	4.4	1.66	2.75
0.6	0.36	4.5	1.68	2.82
0.59	0.35	4.6	1.7	2.88
0.58	0.34	4.7	1.72	2.95
0.58	0.33	4.8	1.74	3.02
0.57	0.32	4.9	1.76	3.09

← - dB + →

Voltage Ratio	Power Ratio	dB	Voltage Ratio	Power Ratio
0.56	0.32	5	1.78	3.16
0.56	0.31	5.1	1.8	3.24
0.55	0.3	5.2	1.82	3.31
0.54	0.3	5.3	1.84	3.39
0.54	0.29	5.4	1.86	3.47
0.53	0.28	5.5	1.88	3.55
0.53	0.28	5.6	1.91	3.63
0.52	0.27	5.7	1.93	3.72
0.51	0.26	5.8	1.95	3.8
0.51	0.26	5.9	1.97	3.89
0.5	0.25	6	2	3.98
0.5	0.25	6.1	2.02	4.07
0.49	0.24	6.2	2.04	4.17
0.48	0.23	6.3	2.07	4.27
0.48	0.23	6.4	2.09	4.37
0.47	0.22	6.5	2.11	4.47
0.47	0.22	6.6	2.14	4.57
0.46	0.21	6.7	2.16	4.68
0.46	0.21	6.8	2.19	4.79
0.45	0.2	6.9	2.21	4.9
0.45	0.2	7	2.24	5.01
0.44	0.2	7.1	2.27	5.13
0.44	0.19	7.2	2.29	5.25
0.43	0.19	7.3	2.32	5.37
0.43	0.18	7.4	2.34	5.5
0.42	0.18	7.5	2.37	5.62
0.42	0.17	7.6	2.4	5.75
0.41	0.17	7.7	2.43	5.89
0.41	0.17	7.8	2.46	6.03
0.4	0.16	7.9	2.48	6.17
0.4	0.16	8	2.51	6.31
0.39	0.16	8.1	2.54	6.46
0.39	0.15	8.2	2.57	6.61
0.39	0.15	8.3	2.6	6.76
0.38	0.15	8.4	2.63	6.92
0.38	0.14	8.5	2.66	7.08
0.37	0.14	8.6	2.69	7.24
0.37	0.14	8.7	2.72	7.41
0.36	0.13	8.8	2.75	7.59
0.36	0.13	8.9	2.79	7.76
0.36	0.13	9	2.82	7.94
0.35	0.12	9.1	2.85	8.13
0.35	0.12	9.2	2.88	8.32
0.34	0.12	9.3	2.92	8.51
0.34	0.12	9.4	2.95	8.71
0.34	0.11	9.5	2.99	8.91
0.33	0.11	9.6	3.02	9.12
0.33	0.11	9.7	3.06	9.33
0.32	0.11	9.8	3.09	9.55
0.32	0.1	9.9	3.13	9.77

Return Loss vs. VSWR

Return Loss	VSWR
30	1.06
25	1.11
20	1.20
19	1.25
18	1.28
17	1.33
16	1.37
15	1.43
14	1.50
13	1.57
12	1.67
11	1.78
10	1.92
9	2.10

Watts to dBm

Watts	dBm
300	54.8
250	54.0
200	53.0
150	51.8
100	50.0
75	48.8
50	47.0
25	44.0
20	43.0
15	41.8
10	40.0
5	37.0
4	36.0
3	34.8
2	33.0
1	30.0

dBm = 10log P/1mW
Where P = power (Watt)

Insertion Loss

Input Power (Watts)

Insertion Loss	50	75	100	125	150	200	250	300
3	25	38	50	63	75	100	125	150
2.5	28	42	56	70	84	112	141	169
2	32	47	63	79	95	126	158	189
1.5	35	53	71	88	106	142	177	212
1	40	60	79	99	119	159	199	238
.5	45	67	89	111	134	178	223	267

Output Power (Watts)

Free Space Loss

Distance (miles)

Frequency (MHz)	.25	.50	.75	1	2	5	10	15
150	68	74	78	80	86	94	100	104
220	71	77	81	83	89	97	103	107
460	78	84	87	90	96	104	110	113
860	83	89	93	95	101	109	115	119
940	84	90	94	96	102	110	116	120
1920	90	96	100	102	108	116	122	126

Free Space Loss (dB)
Free space loss = 36.6 + 20log D + 20log F
Where D = distance in miles and F = frequency in MHz

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