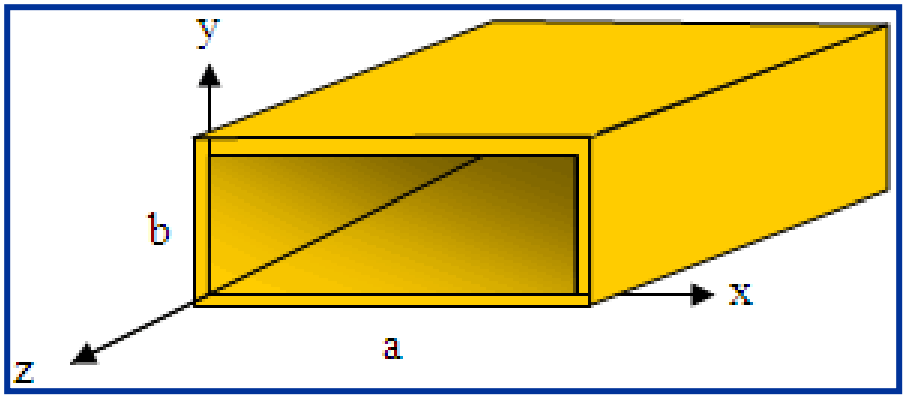
Quick Start User Manual: WRguide



1.0 Getting Ready:

The software product you purchased is located inside a ZIP file that you can open, by following these steps:

1. Double-click on the ZIP file you purchased. This action starts the ZIP Wizard application, which contains the software product.
2. The ZIP Wizard automatically opens the software product you purchased and stores it inside your computer.
3. Once the software product is unzipped, right-click on the application's *filename* and single-click: "Extract". This action will extract all files located inside the software product and store them inside your computer:
    a. *WRguide.exe*: The executable software product.
    b. *WRguide.DEF*: Default Data File read by *WRguide.exe*
    c. *Quick Start User Manual*: This User Manual.
    d. *License*: License Agreement for the software product.
4. NOTE: All files unzipped inside your computer must be located in the same file folder, since several Data Files are read by the executable software product.
5. Open the License Agreement so you know the terms & conditions for using the software product. Return the software product for a full refund if you do not agree with those terms & conditions, as stated in the License Agreement.
6. Open the Default Data File: *WRguide.DEF* using Notepad and read the description contained inside.

Once the above software files are extracted and stored inside your computer, just double-click on the executable file to start using the product.

2.0 How I Works:

Software product: *WRguide.exe* performs Electrical Synthesis, Dimensional Synthesis and Frequency Analysis of any Rectangular Waveguide Transmission Line.

The executable file: *WRguide.exe* reads the Default Data File: *WRguide.DEF* each time you start the program. As such, you can change Data Entries inside *WRguide.DEF* to suite your

most common Rectangular Waveguide Transmission Line designs, using the guidelines written in *WRguide.DEF*.

When you start using the software product, you are asked to enter key design parameters for your Rectangular Waveguide Transmission Line. If you press <ENTER> on your computer's keyboard, the software product uses the Data Entry from your Default Data File: *WRguide.DEF* for that design parameter. As such, you can change any/all Data Entries in *WRguide.DEF* suite your most common Rectangular Waveguide designs, without having to enter those values when asked by the executable file: *WRguide.exe*. Just press <ENTER> on your computer's keyboard and your Default Data values are used for that Data entry by the software product.

Figure 2-1 shows the baseline data entries for Default Data file: WRguide.DEF.

Certain design parameters have a "default answer", shown as an asterisk (*), which enables you to press <ENTER> on your keyboard, if that "default answer" (= *) is your selection.

Lastly, all Data entries (including Default Data entries) are included in the Output Data format so you know the basis for your Synthesis and for your Analysis of Rectangular Waveguide Transmission Lines.

Most data entries are straight-forward and easy to understand for those skill-at-the-art of RF/microwave design…….and those not-so-skilled. So, let us know where improvements are needed as you operate the software product.

3.0 Screen Shots: Input Data

Screen-shots for User Input Data entry are shown in Figures 3-1 and Figure 3- 2 for Dimensional Synthesis and for Frequency Analysis of your Rectangular Waveguide Transmission Lines, respectively. Input Data entry is intuitive and straight-forward for the User.

4.0 Screen Shots: Output Data

Screen-shots of Output Data calculated by the software product are shown in Figures 4-1 and Figure 4-2 for Dimensional Synthesis and for Frequency Analysis of your Rectangular Waveguide Transmission Lines, respectively.

The Output Data from the software product can be stored in a User-defined filename:

A. Enter a *filename*.**xls** for storage in a spreadsheet.
B. Enter *filename*.**doc** for Output Data storage in a word processor.
C. Enter *filename*.**txt** for Output Data storage as a text file.

The Output Data files can be used for presentations to your Customers, e-mails to your colleagues, and for graphical plots of your Output Data.

5.0 User Data Files:

For the Analysis Option, the software product reads a User's Input Data filename to analyze the Frequency response of physical dimensions planned for manufacture of your Rectangular Waveguide Transmission Line.

You can create any number of User Input Data files, each of which defines the actual physical dimensions of your Rectangular Waveguide Transmission Lines. Once created, you can enter that Input Data filename when asked by the software product, for Frequency Analysis and for comparison with actual measured swept-frequency data for that design.

6.0 Software Bugs

Every effort has been applied to minimize "software bugs" inside the software product. Yet, we invite all Users to notify us if you find one. Many thanks!

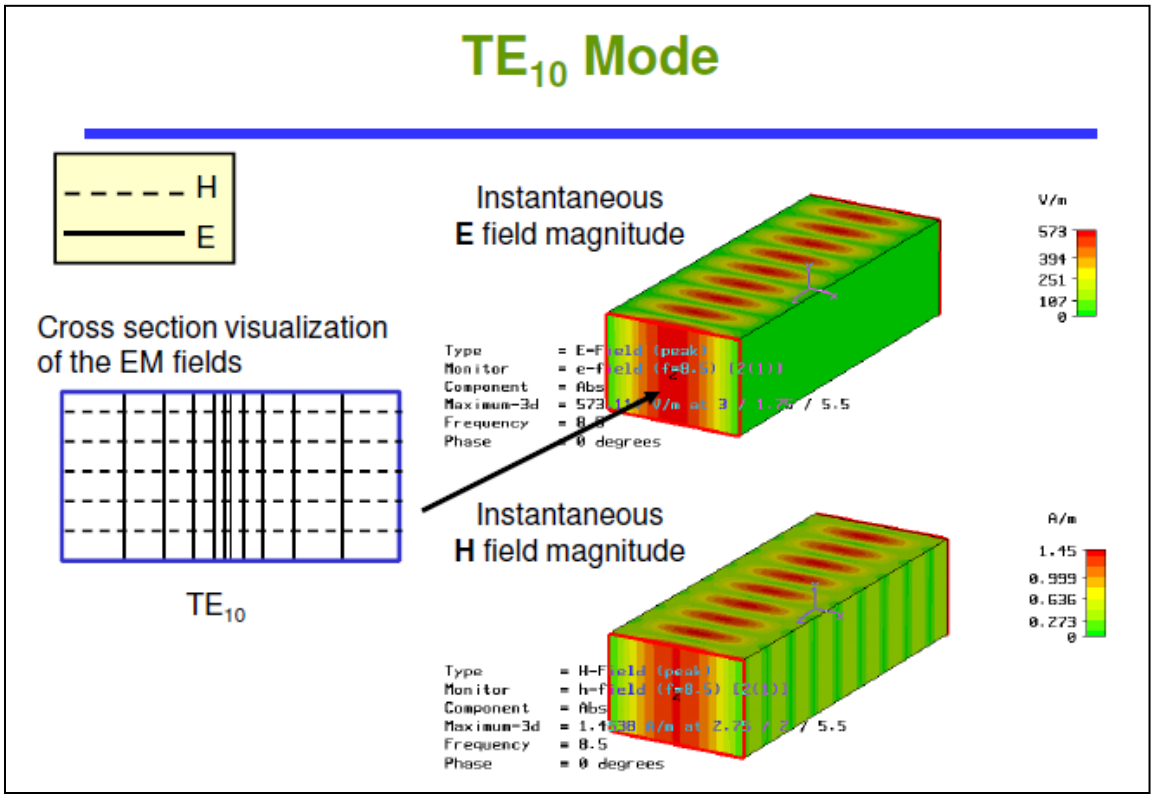
Inside the software product, you will find "User-friendly Error Traps", which identify errors in your Data Entry. The software product notifies you when an error is detected and asks for a different Data Entry, so the software product performs within the proper technical bounds for the technology.

7.0 Customer Satisfaction:

Many thanks for purchasing our RF/microwave CAE software product. We hope you find the product useful in your high frequency designs, both in Synthesis of your designs and in Analysis of your designs. Please let us know where our software product can be improved, and what your needs are for another software product you could use. . . . .. perhaps we can develop that software product for you.

Our best regards. . . . . .

Atlanta RF



Waveguide Size		MIL-W-85	Material	Operating Frequency Range	TE10 Cutoff Freq	RF Power Rating (One Atmosphere)		Theoretical Loss	Inside Dimensions	Wall Thickness
EIA W/G	JAN W/G	(Dash No)	Alloy	(GHz)	(GHz)	CW(kW)	Peak(kW)	(dB/100ft)	(Inches)	(Inches)
WR430	RG104/U	1-027	Copper	1.70-2.60	1.375	95	18230	.393-.261	4.300x2.150	0.08
	RG105/U	1-030	Aluminum					.590-.392		
WR340	RG112/U	1-033	Copper	2.20-3.30	1.737	58.5	11870	.533-.371	3.400x1.700	0.08
	RG113/U	1-036	Aluminum					.801-.557		
WR284	RG48/U	1-039	Copper	2.60-3.95	2.08	45	7650	.742-.508	2.840x1.340	0.08
	RG75/U	1-042	Aluminum			36		1.116-.764		
WR229	RG340/U	1-045	Copper	3.30-4.90	2.577	30	5480	.946-.671	2.290x1.145	0.064
	RG341/U	1-048	Aluminum			24		1.422-1.009		
WR187	RG49/U	1-051	Copper	3.95-5.85	3.156	18	3300	1.395-.967	1.872x.872	0.064
	RG95/U	1-054	Aluminum			14.5		2.097-1.454		
WR159	RG343/U	1-057	Copper	4.90-7.05	3.705	15	2790	1.533-1.160	1.590x.795	0.064
	RG344/U	1-060	Aluminum			12		2.334-1.744		
WR137	RG50/U	1-063	Copper	5.85-8.20	4.285	10	1980	1.987-1.562	1.372x.622	0.064
	RG106/U	1-066	Aluminum			8		2.955-2.348		
WR112	RG51/U	1-069	Copper	7.05-10.00	5.26	6	1280	2.776-2.154	1.122x.497	0.064
	RG68/U	1-072	Aluminum			4.8		4.173-3.238		
WR102	-	1-156	Copper	7.00-11.00	5.786	5	1020	3.516-2.217	1.020x.510	0.64
	RG320/U	1-158	Aluminum			4		5.285-3.333		
WR90	RG52/U	1-075	Copper	8.20-12.40	6.56	3	760	4.238-2.995	.900x.400	0.05
	RG67/U	1-078	Aluminum			2.4		6.506-4.502		
WR75	RG346/U	1-081	Copper	10.00-15.00	7.869	2.8	620	5.121-3.577	.750x.375	0.05
	RG347/U	1-084	Aluminum			2.2		7.698-5.377		
WR62	RG91/U	1-087	Copper	12.40-18.00	9.49	1.8	460	6.451-4.743	.622x.311	0.04
	RG349/U	1-091	Aluminum			1.4		9.700-7.131		
WR51	RG352/U	1-094	Copper	15.00-22.00	11.54	1.2	310	8.812-6.384	.510x.255	0.04
	RG351/U	1-098	Aluminum			1		13.250-9.598		
WR42	RG53/U	1-100	Copper	18.00-26.50	14.08	0.8	170	13.80-10.13	.420x.170	0.04
	RG121/U	1-104	Aluminum			0.6		20.74-15.23		
WR34	RG354/U	1-107	Copper	22.00-33.00	17.28	0.6	140	16.86-11.73	.340x.170	0.04
	RG355/U	1-111	Aluminum			0.5		25.35-17.63		
WR28	RG271/U	3-007	Copper	26.50-40.00	21.1	0.5	100	23.02-15.77	.280x.140	0.04
	-	3-009	Aluminum			0.4		34.46-23.59		
WR22	RG272/U	3-011	Copper	33.00-50.00	26.35	0.4	60	32.44-22.05	.224x.112	0.04
WR19	RG358/U	3-015	Copper	40.00-60.00	30.69	0.3	50	39.81-28.60	.188x.094	0.04

Standard Rectangular Waveguide Sizes

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WRguide.DEF contains all Default Data values read by Program: WRguide.exe.
  0.9                :A    = Waveguide Width.....................Inches
  0.4                :B    = Waveguide Height....................Inches
 10.0                :F    = Operating Frequency.................GHz
 13.0                :Fmax = Analysis Stop  Frequency............GHz
  7.0                :Fmin  = Analysis Start Frequency...........GHz
  0.5                :Fstep = Analysis Frequency Step Size.......GHz
  1.0                :IZ   = Selects Impedance type: Z(P,I), Z(V,I) or Z(P,V)
  4.0                :RES  = Conductor's Resistivity.....................Micro-Ohm-cm
  0.45               :S    = Width of Central Region.....................Inches
125.0                :SR    = Conductor's RMS Surface Roughness..Micro-Inches
300.0                :Zmax = Maximum Impedance (Synthesis)……..Ohms
 50.0                :Zmin  = Minimum Impedance (Synthesis).....Ohms
200.0                :Zo    = Desired Impedance (Synthesis).....Ohms
 25.0                :Zstep = Impedance Step Size (Synthesis)……..Ohms
WRguide.DAT          :FN    = Default filename for your Output Data storage
                     |
                     |____ The first 20 characters are read by WRguide.exe

This Default Data File: WRguide.DEF is read by RF/microwave software product:
WRguide.exe when you start the program. As such, the executable file
(WRguide.exe) and this Default Data File (WRguide.DEF) must be located in
the same Folder or Subfolder in your computer.

The executable program (WRguide.exe) reads the first 20 characters in each
line from WRguide.DEF, so keep those first 20 characters for data, and do not
shorten any line in this Default Data File: WRguide.DEF.

The User is invited to change any/all data values in WRguide.DEF to data
values you commonly use for your RF/microwave designs in Rectangular Waveguide
Transmission Lines, so you do not have to enter data values when prompted by
WRguide.exe (just press ENTER on your computer's keyboard and your Default
Data values will be assigned to that data entry).

NOTE: The default data values shown above are for standard WR-90 Rectangular
Waveguide operating across its Frequency Range: 8.2 to 12.4 GHz.

Thank you for choosing Atlanta RF for your RF/microwave CAE software products.
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Figure 2-1: Baseline data entries (and Instructions) in **Default Data file**: WRguide.DEF

RF/Microwave Computer-Aided Engineering Software.
Program: WRguide (v. 1.0) Date: 10/16/2012

This program performs Impedance ANALYSIS versus Frequency and
Dimensional SYNTHESIS for Rectangular Waveguide transmission lines.

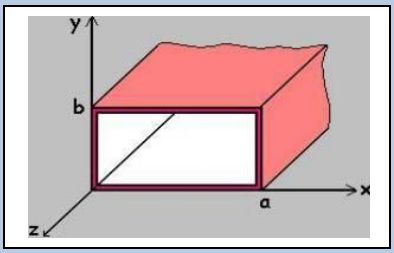
Please select a Program FUNCTION:
*1 : ANALYSIS of Impedances from known Dimensions.
2 : SYNTHESIS of Dimensions from known Impedances.
Program FUNCTION selected = **2**

User Data Entries are shown in **RED text**

Please select a SYNTHESIS OPTION:
*Option 1: Dimensional Synthesis versus Impedances.
Option 2: Dimensional Synthesis with Frequency Analysis.
Option 3: Dimensional Synthesis with Sensitivity Analysis.
Synthesis OPTION selected = **2**

Select METHOD for Dimensional SYNTHESIS versus Impedance:
*1 = Synthesis of Waveguide Height, B.
2 = Synthesis of Waveguide Width , A.
Synthesis METHOD selected = **1**

Please enter the following DIMENSIONAL DATA:
-Waveguide Width (A), Inches =
-Conductor Resistivity(RES), Micro-Ohm-cm:
1 = Silver-plated (RES=1.6)
2 = Copper (RES=1.7)
3 = Gold-plated (RES=2.5)
*4 = 6061 Aluminum (RES=4.0)
5 = Brass (RES=7.0)
6 = Steel (RES=11.8)
Conductor Resistivity selected = **4**
-RMS Surface Roughness (SR),Micro-Inches:
1 = 250 micro-inch (Milling)
*2 = 125 micro=inch (Extrusion)
3 = 63 micro-inch (Grinding)
4 = 32 micro-inch (Polished)
RMS Surface Roughness selected = **2**



Please enter Frequency range for IMPEDANCE ANALYSIS:
-Waveguide`s TE10 Cutoff Freq = 6.5571 GHz for a W/G width = 0.900”
-Analysis Start Frequency, GHz = **7.0**
-Waveguide`s TE20 Cutoff Freq = 13.1143 GHz for a W/G width = 0.900”
-Analysis Stop Frequency, GHz = **13.0**
-Analysis Step Frequency, GHz = **0.5**

Enter Operating FREQUENCY where IMPEDANCE level exists:
-Operating Frequency,GHz = **10.0**
-Impedance at 10.000GHz, Ohms = **200.0**

Select Guide Impedance for SYNTHESIS:
*1 = Power-Current Impedance: Z(P,I).
2 = Voltage-Current Impedance: Z(V,I).
3 = Power-Voltage Impedance: Z(P,V).
Guide IMPEDANCE selected = **1**

Is Output Data STORAGE desired? (1=YES) = **1**
Enter a FILENAME (up to 20 characters) for Output Data storage:
-Enter: Filename.xls for storage in a spreadsheet
-Enter: Filename.doc for storage in a word processor
-Enter: Filename.txt for storage as a text document
Enter your FILENAME for Output Data Storage: **WRguide.SYN.DAT**

Figure 3-1: Typical Input Data entry for **Dimensional Synthesis** in WRguide.exe

RF/Microwave Computer-Aided Engineering Software.
Program: WRguide (v. 1.0) Date: 10/16/2012

This program performs Impedance ANALYSIS versus Frequency and
Dimensional SYNTHESIS for Rectangular Waveguide transmission lines.

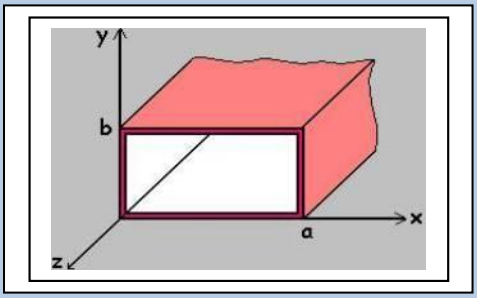
Please select a Program FUNCTION:
*1 : ANALYSIS of Impedances from known Dimensions.
2 : SYNTHESIS of Dimensions from known Impedances.
Program FUNCTION selected =**1**

Please select an Analysis OPTION:
*Option 1: Impedance Analysis versus Frequency.
Option 2: Sensitivity Analysis versus Frequency.
Option 3: TE(m,n) Mode Analysis versus Frequency.
Analysis OPTION selected = **1**

User Data Entries are shown in **RED text**

Design Parameters for popular Rectangular Waveguide:

W/G Size	Low Freq GHz	High Freq GHz	W/G Width (A)	W/G Height (B)	Common Wall (T)
WR-284	2.60	3.95	2.840"	1.340"	0.080"
WR-229	3.30	4.90	2.290"	1.145"	0.640"
WR-187	3.95	5.85	1.872"	0.872"	0.064"
WR-137	5.85	8.20	1.372"	0.622"	0.064"
WR-112	7.05	10.00	1.122"	0.497"	0.064"
WR-90	8.20	12.40	0.900"	0.400"	0.050"
WR-75	10.00	15.00	0.750"	0.375"	0.050"
WR-62	12.40	18.00	0.622"	0.311"	0.040"
WR-42	18.00	26.50	0.420"	0.170"	0.040"
WR-28	26.50	40.00	0.280"	0.140"	0.040"



Please enter the following DIMENSIONAL DATA:
-Waveguide Width (A), Inches = **0.9**
-Waveguide Height (B), Inches = **0.4**
-Conductor Resistivity(RES), Micro-Ohm-cm:
1 = Silver-plated (RES=1.6)
2 = Copper (RES=1.7)
3 = Gold-plated (RES=2.5)
*4 = 6061 Aluminum (RES=4.0)
5 = Brass (RES=7.0)
6 = Steel (RES=11.8)
Conductor Resistivity selected = **4**
-RMS Surface Roughness (SR),Micro-Inches:
1 = 250 micro-inch (Milling)
*2 = 125 micro=inch (Extrusion)
3 = 63 micro-inch (Grinding)
4 = 32 micro-inch (Polished)
RMS Surface Roughness selected = **2**

Please enter Width for Percentage Power Calculation:
-Width of Central Region (S), Inches = **0.45**

Please enter Frequency range for IMPEDANCE ANALYSIS:
-Waveguide`s TE10 Cutoff Freq = 6.5571 GHz for a W/G width = 0.900”
-Analysis Start Frequency, GHz = **7.0**
-Waveguide`s TE20 Cutoff Freq = 13.1143 GHz for a W/G width = 0.900”
-Analysis Stop Frequency, GHz = **13.0**
-Analysis Step Frequency, GHz = **0.5**

Figure 3-2: Typical Input Data entry for **Frequency Analysis** in WRguide.exe

WRguide (v. 1.0) Date:10/16/2012 at 9:28:32 Hours
Copyright 2012 Atlanta RF Software (www.AtlantaRF.com)
RF/Microwave Computer-Aided Engineering Design Data For
Rectangular Waveguide Transmission Lines:

A = 0.9000" W/G Height Synthesis RES = 4.0000
B = 0.2924" ========== SR =125.000 u"
LC10 = 1.8000" (OPTION 2) FC10 = 6.557 GHz
FC20 = 13.114 GHz

Z(P,I) = 200.00 Ohms
at 10.000 GHz.

Frequency (GHz)	Wavelength Free-Sp (In.)	Wavelength Guide (In.)	Guide Impedances Z(P,I) (Ohms)	Guide Impedances Z(V,I) (Ohms)	Guide Impedances Z(P,V) (Ohms)	Total Loss (dB/Ft)	Peak Power (kW)
7.0000	1.6861	4.8169	431.38	549.25	699.33	0.2226	82.92
7.5000	1.5737	3.2420	311.08	396.08	504.30	0.1595	114.99
8.0000	1.4754	2.5754	263.59	335.61	427.31	0.1348	135.71
8.5000	1.3886	2.1822	237.31	302.15	384.71	0.1214	150.73
9.0000	1.3114	1.9146	220.45	280.69	357.38	0.1132	162.26
9.5000	1.2424	1.7170	208.68	265.70	338.30	0.1077	171.41
10.0000	1.1803	1.5633	200.00	254.65	324.23	0.1039	178.85
10.5000	1.1241	1.4392	193.34	246.16	313.42	0.1013	185.02
11.0000	1.0730	1.3364	188.07	239.46	304.89	0.0995	190.20
11.5000	1.0263	1.2493	183.81	234.03	297.98	0.0982	194.61
12.0000	0.9836	1.1744	180.30	229.56	292.29	0.0973	198.39
12.5000	0.9442	1.1091	177.36	225.83	287.53	0.0968	201.68
13.0000	0.9079	1.0515	174.88	222.66	283.50	0.0965	204.54
Infinity			151.00	192.26	244.79		236.89

Output data stored in User filename: WRguide-SYN.DAT

Figure 4-1: Typical Output Data for **Dimensional Synthesis** from WRguide.exe

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WRguide (v. 1.0) Date:10/16/2012 at 9:27:51 Hours

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RF/Microwave Computer-Aided Engineering Design Data For

Rectangular Waveguide Transmission Lines:

A = 0.9000" Impedance Analysis RES = 4.0000

B = 0.4000" ==================== SR =125.000 u"

LC10 = 1.8000" (OPTION 1) FC10 = 6.557 GHz

FC20 = 13.114 GHz

Frequency (GHz)	Wavelength Free-Sp (In.)	Wavelength Guide (In.)	Guide Impedances Z(P,I) (Ohms)	Guide Impedances Z(V,I) (Ohms)	Guide Impedances Z(P,V) (Ohms)	Total Loss (dB/Ft)	Peak Power (kW)
7.0000	1.6861	4.8169	590.12	751.36	956.66	0.1845	113.43
7.5000	1.5737	3.2420	425.55	541.82	689.87	0.1308	157.30
8.0000	1.4754	2.5754	360.58	459.10	584.55	0.1095	185.64
8.5000	1.3886	2.1822	324.63	413.33	526.27	0.0979	206.20
9.0000	1.3114	1.9146	301.57	383.97	488.89	0.0905	221.97
9.5000	1.2424	1.7170	285.47	363.47	462.79	0.0856	234.48
10.0000	1.1803	1.5633	273.59	348.35	443.53	0.0821	244.66
10.5000	1.1241	1.4392	264.48	336.74	428.75	0.0796	253.10
11.0000	1.0730	1.3364	257.27	327.57	417.07	0.0777	260.18
11.5000	1.0263	1.2493	251.44	320.15	407.63	0.0764	266.21
12.0000	0.9836	1.1744	246.64	314.04	399.84	0.0754	271.40
12.5000	0.9442	1.1091	242.63	308.92	393.33	0.0747	275.89
13.0000	0.9079	1.0515	239.23	304.59	387.82	0.0743	279.81
Infinity		206.57	263.01	334.87	324.05		

In Central Region of S = 0.450", Percent Power = 81.83%

Output data stored in User filename: WRguide-ANA.DAT

Figure 4-2: Typical Output Data for **Impedance Analysis** from WRguide.exe