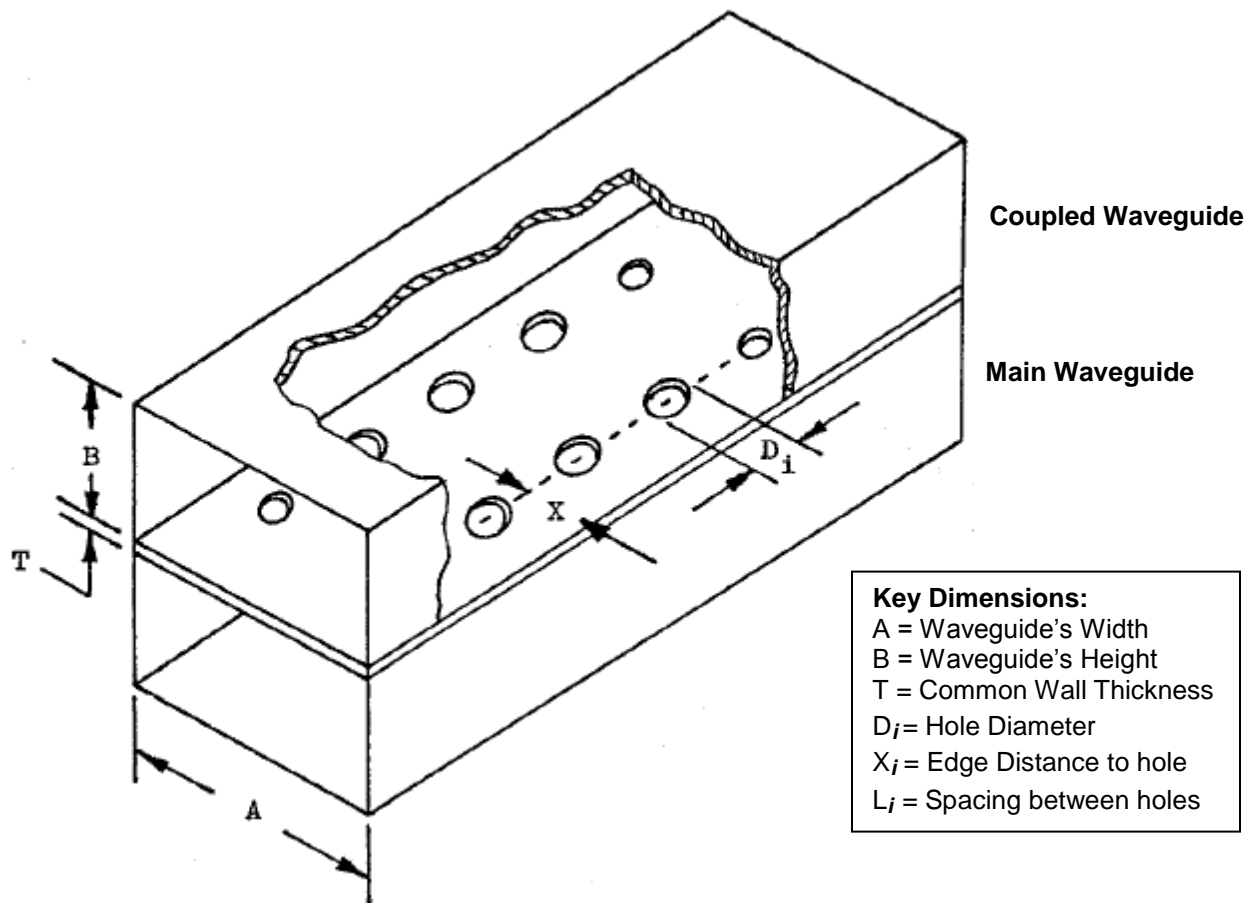


## Quick Start User Manual: WGcoupler



### Key Dimensions:

A = Waveguide's Width

B = Waveguide's Height

T = Common Wall Thickness

D<sub>i</sub> = Hole Diameter

X<sub>i</sub> = Edge Distance to hole

L<sub>i</sub> = Spacing between holes

### 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. *WGCoupler.exe*: The executable software product.
  - b. *WGcoupler.DEF*: Default Data File read by *WGCoupler.exe*
  - c. *HOLES.DAT*: Default Data File contains dimensional data for a Coupler.
  - d. *Quick Start User Manual*: This User Manual.
  - e. *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: *WGcoupler.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: *WGcoupler.exe* performs Electrical Synthesis, Dimensional Synthesis and Frequency Analysis of multi-hole Topwall Couplers constructed in any Rectangular Waveguide.

The executable file: *WGcoupler.exe* reads the Default Data File: *WGcoupler.DEF* each time you start the program. As such, you can change Data Entries inside *WGcoupler.DEF* to suite your most common Topwall Coupler designs, using the guidelines written in *WGcoupler.DEF*.

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

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 Waveguide Multi-hole Topwall Coupler, respectively.

#### 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 Waveguide Multi-hole Topwall Coupler, 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 Waveguide Topwall Coupler. Figure 5-1 shows a typical User Data File: *HOLES.DAT*, which defines a 6-hole 30 dB Topwall Coupler constructed in standard WR-90 Rectangular Waveguide.

You can create any number of User Input Data files, each of which defines the actual physical dimensions of your Waveguide Topwall Couplers. 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 Coupler.

When the software product performs Dimensional **Synthesis** of your Waveguide Topwall Coupler, the physical dimensions of each coupling hole may not conform to standard drill sizes commonly found in a manufacturing process. As such, the User's Data File can define the closest drill size for each hole and apply those actual drill sizes as the hole size in your User-defined Data File. Then, you can determine how your "actual" Waveguide Topwall Coupler will perform when those "actual" drill-size holes are used to fabricate the Coupler, by performing a Frequency **Analysis** of your "actual" Waveguide Topwall Coupler.

#### 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, like: Entering an operating frequency located **below** the waveguide's TE10 cut-off frequency, or an operating frequency located **above** the waveguide's TE20 cut-off frequency. 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

	M =	2	3	4	5	6	7	8	9	10	11	12	13	14
N														
2		3	4	5	6	7	8	9	10	11	12	13	14	15
3		5	7	9	11	13	15	17	19	21	23	25	27	29
4		6	8	10	12	14	16	18	20	22	24	26	28	30
5		8	11	14	17	20	23	26	29	32	35	38	41	44
6		9	12	15	18	21	24	27	30	33	36	39	42	45
7		11	15	19	23	27	31	35	39	43	47			
8		12	16	20	24	28	32	36	40	44	48			
9		14	19	24	29	34	39	44	49					
10		15	20	25	30	35	40	45	50					
11		17	23	29	35	41	47							
12		18	24	30	36	42	48							
13		20	27	34	41	48								
14		21	28	35	42	49								
15		23	31	39	47									
16		24	32	40	48									
17		26	35	44										
18		27	36	45										
19		29	39	49										
20		30	40	50										
21		32	43											
22		33	44											
23		35	47											
24		36	48											
25		38												
26		39												

Where:  
 N = Number of Holes in each Array.  
 M = Number of Arrays to be Superimposed

NOTE:  
**WGcoupler** limits the Total Number of holes in the composite array to Quantity = 50 holes, maximum.

**Total Number of Coupling Holes in an N x M Superimposed Array**

Waveguide Size		MIL-W-85 (Dash No)	Material Alloy	Operating Frequency Range (GHz)	TE10 Cutoff Freq (GHz)	RF Power Rating (One Atmosphere)		Theoretical Loss (dB/100ft)	Inside Dimensions (Inches)	Wall Thickness (Inches)
EIA W/G	JAN W/G					CW(kW)	Peak(kW)			
WR430	RG104/U	1-027	Copper	1.70-2.60	1.375	95.0	18230	.393-.261	4.300x2.150	0.08
		RG105/U	1-030							
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							
WR284	RG48/U	1-039	Copper	2.60-3.95	2.08	45.0	7650	.742-.508	2.840x1.340	0.08
		RG75/U	1-042							
WR229	RG340/U	1-045	Copper	3.30-4.90	2.577	30.0	5480	.946-.671	2.290x1.145	0.064
		RG341/U	1-048							
WR187	RG49/U	1-051	Copper	3.95-5.85	3.156	18.0	3300	1.395-.967	1.872x.872	0.064
		RG95/U	1-054							
WR159	RG343/U	1-057	Copper	4.90-7.05	3.705	15.0	2790	1.533-1.160	1.590x.795	0.064
		RG344/U	1-060							
WR137	RG50/U	1-063	Copper	5.85-8.20	4.285	10.0	1980	1.987-1.562	1.372x.622	0.064
		RG106/U	1-066							
WR112	RG51/U	1-069	Copper	7.05-10.00	5.26	6.0	1280	2.776-2.154	1.122x.497	0.064
		RG68/U	1-072							
WR102	-	1-156	Copper	7.00-11.00	5.786	5.0	1020	3.516-2.217	1.020x.510	0.64
		RG320/U	1-158							
WR90	RG52/U	1-075	Copper	8.20-12.40	6.56	3.0	760	4.238-2.995	.900x.400	0.05
		RG67/U	1-078							
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							
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							
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							
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							
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							
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							
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

WGcoupler.DEF contains all Default Data values read by Program: WGcoupler.exe

30.0	:COUP	= Midband Coupling Factor.....dB
6.0	:N	= Number of Coupling Sections in Coupler
6.0	:HOLES	= Number of Holes in each Coupling Array.
6.0	:ARRAYS	= Number of Coupling Arrays to be Superimposed.
2.0	:PAIRS	= One (= 1.0) or a pair (= 2.0) of Holes in Array.
0.9	:A	= Rectangular Waveguide Width.....Inches
8.2	:Flow	= Lowest Operating Frequency (Synthesis).....GHz
10.687	:Fo	= Design Center Frequency (Analysis).....GHz
12.4	:Fhigh	= Highest Operating Frequency (Synthesis).....GHz
0.4	:B	= Waveguide Height.....Inches
0.05	:T	= Thickness of Common Wall.....Inches
0.198	:X	= Edge Distance to Aperture.....Inches
8.0	:Fstart	= Analysis Start Frequency.....GHz
13.0	:Fstop	= Analysis Stop Frequency.....GHz
0.25	:Fstep	= Analysis Step Frequency.....GHz
4.0	:RES	= Conductor's Resistivity.....Micro-Ohm-cm
125.0	:SR1	= RMS Surface Roughness.....Micro-inches
WGcoupler.DAT	:FN.DAT	= Default filename for your Dimensional Output Data Storage
WGcoupler.FRE	:FN.FRE	= Default filename for your Frequency Output Data Storage
HOLES.DAT	:HOLES.DAT	= Default filename for reading your Coupler's hole diameters, edge distance (X) and longitudinal spacings.
		    _____ The first 20 characters are read by WGcoupler.exe

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

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

The User is invited to change any/all data values in WGcoupler.DEF to data values you commonly use for your RF/microwave designs of Waveguide Topwall Couplers, so you do not have to enter data values when prompted by WGcoupler.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 a 30dB coupler in standard WR-90 Rectangular Waveguide.

Thank you for choosing Atlanta RF for your RF/microwave CAE software products.

Figure 2-1: Baseline data entries (and Instructions) in **Default Data file**: WGcoupler.DEF

Copyright 2012 Atlanta RF Software (www.AtlantaRF.com)  
 RF/Microwave Computer-Aided Engineering Software.  
 Program: WGcoupler (v. 1.0) Date: 10/16/2012

This program performs Electrical SYNTHESIS, Dimensional SYNTHESIS  
 and Frequency ANALYSIS for Waveguide Multi-hole Topwall Couplers.

Please select a Program FUNCTION:

1 = ANALYSIS of Topwall Coupler Dimensions.

\*2 = SYNTHESIS of Topwall Coupler Dimensions.

Program FUNCTION selected = **2**

Please enter the following Design Data:

-Select an Array TYPE for your Coupler:

\*1 = Chebyshev Array.

2 = Binomial Array.

Array TYPE selected for your Coupler= **1**

-Select an Array CONFIGURATION for your Coupler:

\*1 = One Array of Coupling Apertures.

2 = Superimposed Array of Apertures.

Array CONFIGURATION of Coupler selected = **1**

-Midband Coupling Factor (Co), dB = **30.0**

-Number of Coupling Elements (N) = **6.0**

-Width of Waveguide (A), Inches = **0.900**

-Waveguide's TE<sub>10</sub> Cut-off Frequency = 6.557 GHz

-Lowest Operating Frequency, GHz = **8.2**

-Waveguide's TE<sub>20</sub> Cut-off Frequency = 13.114 GHz

-Highest Operating Frequency, GHz = **12.4**

-Select the longitudinal spacing correction:

\*1 = Use the recommended 6.25%.

2 = No correction applied.

3 = User enters value.

Spacing correction selected = **1**

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:

-Height of Waveguide (B), Inches = **0.4**

-Common Wall Thickness (T), Inches = **0.05**

-When T=0, Edge Distance to Hole (X)

for best coupling flatness is near = 0.2016 Inches.

-Edge Distance to Hole (X), Inches = **0.201**

-One(=1) or Pair(=2\*) of Holes/Array= **2**

Is Output Data STORAGE desired?(1=Yes)=

-Enter FILENAME (up to 20 characters) for Dimensional Synthesis 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: **WGcoupler-SYN.DAT**

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

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

Copyright 2012 Atlanta RF Software (www.AtlantaRF.com)  
 RF/Microwave Computer-Aided Engineering Software.  
 Program: WGcoupler (v. 1.0) Date: 10/16/2012

This program performs Electrical SYNTHESIS, Dimensional SYNTHESIS  
 and Frequency ANALYSIS for Waveguide Multi-hole Topwall Couplers.

Please select a Program FUNCTION:

1 = ANALYSIS of Topwall Coupler Dimensions.

\*2 = SYNTHESIS of Topwall Coupler Dimensions.

Program FUNCTION selected = **1**

Please select an Analysis OPTION:

\*Option 1 : Analysis of Circuit Elements from Dimensions.

Option 2 : Frequency Analysis from Coupler Dimensions.

Analysis OPTION selected = **2**

Suboption 1 : User enters Aperture Dimensions.

\*Suboption 2 : User enters Data Filename for Dimensions.

SUBOPTION selected = **2**

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

Enter a FILENAME (up to 20 characters) that contains your  
 Aperture Dimensions for your Coupler : **HOLES.DAT**

Attempting to read User Data File: HOLES.DAT .....Completed.

Please enter the following Design Data:

-Number of Coupling Elements (N) = **6**

-Width of Waveguide (A), Inches = **0.9**

-Height of Waveguide (B), Inches = **0.4**

-Common Wall Thickness (T), Inches = **0.05**

-One(=1) or Pair(=2\*) of Holes/Array = **2**

Please enter a Frequency Range for Coupler Response:

-Waveguide's TE10 Cut-off Freq = 6.557 GHz

-Analysis Start Frequency, GHz = **7.0**

-Waveguide's TE20 Cut-off Freq = 13.114 GHz

-Analysis Stop Frequency, GHz = **13.0**

-Analysis Step Frequency, GHz = **0.5**

Please enter Material Parameters for your Coupler:

-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**

Is Output Data STORAGE desired?(1=Yes)=

-Enter FILENAME (up to 20 characters) for Frequency Analysis 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: **WGcoupler-ANA.DAT**

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



-----  
 WGcoupler (v. 1.0) Date:10/16/2012 at 13:24:42Hours  
 Copyright 2012 Atlanta RF Software (www.AtlantaRF.com)  
 RF/Microwave Computer-Aided Engineering Design Data For  
 Waveguide Multihole Topwall Directional Couplers.

Electrical and Dimensional Synthesis of the 30.000 dB  
 Waveguide Multihole Topwall Coupler having a Chebyshev  
 coupling distribution with a single-line array of two-  
 hole apertures results in the following design data:

Dimensions:	Wavelengths:	Design Frequencies:
=====	=====	=====
A = 0.9000"	TE10 = 1.8000"	TE10 = 6.5571 GHz
B = 0.4000"	Llow = 2.3971"	Flow = 8.2000 GHz
T = 0.0500"	LGo = 1.5281"	Fo = 10.1320 GHz
	Lhigh= 1.1215"	Fhigh= 12.4000 GHz

Aper- ture #	Voltage Coupling Coeff.	Aperture Dimensions:			Equivalent Lumped Circuit Elements at Fo= 10.132GHz		
		Diameter Inches	Spacing Inches	Edge Inches	X/Zo	BY/Yo	BZ/Yo
1	0.00149075	0.1397	0.4068	0.2016	0.001045	0.000589	-0.001034
2	0.00528671	0.1903	0.4068	0.2016	0.003877	0.002395	-0.003804
3	0.00903642	0.2180	0.4068	0.2016	0.006737	0.004272	-0.006571
4	0.00903642	0.2180	0.4068	0.2016	0.006737	0.004272	-0.006571
5	0.00528671	0.1903	0.4068	0.2016	0.003877	0.002395	-0.003804
6	0.00149075	0.1397	0.0000	0.2016	0.001045	0.000589	-0.001034

Quarter Wavelength = 0.3820 Inches at 10.1320 GHz.  
 Minimum length of Coupler = 2.174 Inches.

-----  
 Dimensional Data stored in User filename = WGcoupler-SYN.DAT .

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

-----  
 WGcoupler (v. 1.0) Date:10/16/2012 at 13:28:43Hours  
 Copyright 2012 Atlanta RF Software (www.AtlantaRF.com)  
 RF/Microwave Computer-Aided Engineering Design Data For  
 Waveguide Multihole Topwall Directional Couplers.

Frequency ANALYSIS of the 0.00 dB Waveguide Coupler having  
 6 pairs of Circular Apertures formed from a User-input type  
 User-input array results in the following 4-port response:

Dimensions:	Wavelengths:	Design Frequencies:
=====	=====	=====
A = 0.9000"	TE10 = 1.8000"	TE10 = 6.5571 GHz
B = 0.4000"	Llow = 0.0000"	Flow = 0.0000 GHz
T = 0.0500"	LGo = 0.0000"	Fo = 0.0000 GHz
	Lhigh = 0.0000"	Fhigh= 0.0000 GHz

Analysis Frequency (MHz)	Input Port VSWR	Input Port Phase	Thru Port dB	Thru Port Phase	Coupled Port dB	Coupled Port Phase	Isolated Port dB	Isolated Port Phase
8000.00	1.000	29.15	0.0207	114.84	29.660	-155.16	71.13	25.96
8250.00	1.002	-178.65	0.0194	92.43	30.025	-177.57	67.99	-1.48
8500.00	1.003	160.74	0.0183	71.15	30.300	161.15	71.58	-27.58
8750.00	1.003	140.69	0.0176	50.76	30.507	140.76	83.18	-76.57
9000.00	1.003	121.29	0.0170	31.09	30.660	121.09	77.53	137.81
9250.00	1.002	102.46	0.0165	12.03	30.771	102.03	71.98	109.33
9500.00	1.002	84.14	0.0161	-6.52	30.848	83.48	70.23	88.14
9750.00	1.001	66.24	0.0157	-24.63	30.897	65.37	70.21	68.81
10000.00	1.001	48.74	0.0155	-42.37	30.922	47.63	71.46	50.38
10250.00	1.001	31.57	0.0153	-59.78	30.927	30.22	74.09	32.58
10500.00	1.000	14.79	0.0151	-76.90	30.915	13.10	79.43	15.25
10750.00	1.000	172.81	0.0150	-93.77	30.888	-3.77	117.27	165.65
11000.00	1.000	160.76	0.0149	-110.40	30.849	-20.40	77.85	161.24
11250.00	1.001	144.54	0.0149	-126.83	30.798	-36.83	71.17	144.85
11500.00	1.001	128.38	0.0148	-143.07	30.738	-53.07	66.95	128.63
11750.00	1.001	112.35	0.0148	-159.15	30.669	-69.15	63.81	112.58
12000.00	1.002	96.47	0.0148	-175.07	30.593	-85.07	61.35	96.68
12250.00	1.002	80.72	0.0148	169.15	30.510	-100.85	59.44	80.92
12500.00	1.003	65.11	0.0149	153.50	30.421	-116.50	58.06	65.30
12750.00	1.003	49.61	0.0149	137.96	30.326	-132.03	57.27	49.80
13000.00	1.003	34.22	0.0150	122.54	30.227	-147.46	57.21	34.43

RES = 4.000 Micro-Ohm-cm. SR = 125.00 Micro-Inches.

Quarter Wavelength = 0.0000 Inches at 0.0000 GHz.  
 Minimum length of Coupler = 1.886 Inches.

-----  
 Frequency Analysis stored in User filename = WGcoupler-ANA.DAT .

Figure 4-2: Typical Output Data for **Frequency Analysis** from WGcoupler.exe