TD-00036

CROSS REFERENCE FOR HOLLOW METALLIC WAVEGUIDES

1 Introduction

This document cross-references the designations of common waveguides with ordinary rectangular, reduced-height rectangular, cylindrical and double ridge cross section. In addition to waveguide designations we provide inner dimensions (without corner radii and tolerances), nominal frequency ranges, cut-off frequencies and letter frequency band designations.

2 References

[1] IEC 60153-2: 1974, “Hollow metallic waveguides, Part 2: Relevant specifications for ordinary rectangular waveguides”, *Standard of the International Electrotechnical Commission*, January 1974.

[2] EIA RS-261-B, “Rectangular Waveguides (WR3 to WR2300)”, *Standard of the Electronic Industries Association of the United States of America*, May 1979.

[3] MOD UK DEF-5351, “Specification for Tubing, Waveguide”; *Standard of the Ministry of Defence of the United Kingdom*, June 1959, incorporating Amendments Nos. 1 (1960) to 6 (1974).

[4] MIL-DTL-85/1G, “Waveguides, Rigid, Rectangular”, *Detail Specification of the Department of Defense of the United States of America*, March 2009.

[5] MIL-DTL-85/2E “Waveguides, Rigid, Rectangular (Heavy Wall)”, *Detail Specification of the Department of Defense of the United States of America*, March 2009.

[6] MIL-DTL-85/3D, “Waveguides, Rigid, Rectangular (Millimeter Wavelength)”, *Detail Specification of the Department of Defense of the United States of America*, April 2012.

[7] IEEE Std 1785.1-2012, “Rectangular metallic waveguides and their interfaces for frequencies of 110 GHz and above, Part 1: Frequency bands and waveguide dimensions”, *Standard of the Institute of Electrical and Electronics Engineers*, March 2013.

[8] Hesler, J.L., Kerr, A.R., Grammer, W. and Wollack, E., “Recommendations for Waveguide Interfaces to 1 THz”, *Proc. 18th Int. Symp. on Space THz Tech.*, Pasadena, California, USA, March 2007.

[9] IEC 60153-3: 1964, “Hollow metallic waveguides, Part 3: Relevant specifications for flat rectangular waveguides”, *Standard of the International Electrotechnical Commission*, January 1964.

[10] IEC 60153-6: 1967 + A1: 1977, “Hollow metallic waveguides, Part 6: Relevant specifications for medium flat rectangular waveguides”, *Standard of the International Electrotechnical Commission*, January 1967, and Amendment 1, May 1977.

[11] MIL-W-85/4C, “Waveguides, Rigid, Rectangular, Reduced Height”, Military Specification of the Department of Defense of the United States of America, December 1981.

[12] IEC 60153-4: 1973, “Hollow metallic waveguides, Part 4: Relevant specifications for circular waveguides”, *Standard of the International Electrotechnical Commission*, January 1973.

[13] TIA/EIA-200-A, “Circular Waveguides”, *Standard of the Telecommunications Industry Association of the United States of America*, March 1965.

[14] MIL-W-23068, “Waveguides, Rigid, Circular”, *Military Specification of the Department of Defense of the United States of America*, October 1961.

[15] MIL-W-23351/4C, “Waveguides, Double Ridge (Bandwidth Ratio 2.4:1)”, *Detail Specification of the Department of Defense of the United States of America*, January 2009.

[16] MIL-W-23351/2B, “Waveguides, Double Ridge (Bandwidth Ratio 3.6:1)”, *Military Specification of the Department of Defense of the United States of America*, October 1977.

[17] EIA RS-304, “Ridge Waveguides”, *Standard of the Electronic Industries Association of the United States of America*, February 1965.

The standards marked in gray are either cancelled ([3], [11], [14]) or withdrawn and not superseded ([2], [13], [17]). Nevertheless the waveguide designations defined therein are still in use.

3 Ordinary rectangular waveguides

Waveguide designations				Basic inner dimensions		Frequencies		Letter band designations ***
IEC [1]	EIA [2]	UK [3]	MIL PIN [4, 5, 6]	Metric [1]	Imperial [1]	Nominal range [1]	TE_{10} cut-off *	
-	-	-	-	mm	inches	GHz	GHz	-
R 3	WR 2300	WG 00	M85/1-001, 002, 161	584.20 x 292.10	23.000 x 11.500	0.32 - 0.49	0.257	-
R 4	WR 2100	WG 0	M85/1-003, 004, 162	533.40 x 266.70	21.000 x 10.500	0.35 - 0.53	0.281	-
R 5	WR 1800	WG 1	M85/1-005, 006, 163	457.20 x 228.60	18.000 x 9.000	0.41 - 0.62	0.328	-
R 6	WR 1500	WG 2	M85/1-007, 008, 164	381.00 x 190.50	15.000 x 7.500	0.49 - 0.75	0.393	-
R 8	WR 1150	WG 3	M85/1-009, 010, 165	292.10 x 146.05	11.500 x 5.750	0.64 - 0.98	0.513	-
R 9	WR 975	WG 4	M85/1-011, 012, 166	247.65 x 123.82	9.750 x 4.875	0.76 - 1.15	0.605	-
R 12	WR 770	WG 5	M85/1-013, 014, 167	195.58 x 97.79	7.700 x 3.850	0.96 - 1.46	0.766	-
R 14	WR 650	WG 6	M85/1-015, 017, 018, 019, 020, 168	165.10 x 82.55	6.500 x 3.250	1.13 - 1.73	0.908	**L**
R 18	WR 510	WG 7	M85/1-021, 023, 024, 025, 026, 169	129.54 x 64.77	5.100 x 2.550	1.45 - 2.20	1.157	-
R 22	WR 430	WG 8	M85/1-027, 029, 030, 031, 032, 170	109.22 x 54.61	4.300 x 2.150	1.72 - 2.61	1.372	Ls, R
R 26	WR 340	WG 9A	M85/1-033, 035, 036, 037, 038, 171	86.36 x 43.18	3.400 x 1.700	2.17 - 3.30	1.736	-
R 32	WR 284	WG 10	M85/1-039, 041, 042, 043, 044, 172 M85/2-001, 002, 004	72.14 x 34.04	2.840 x 1.340	2.60 - 3.95	2.078	**S**
R 40	WR 229	WG 11A	M85/1-045, 047, 048, 049, 050, 173	58.17 x 29.08	2.290 x 1.145	3.22 - 4.90	2.577	-

Waveguide designations				Basic inner dimensions		Frequencies		Letter band designations ***
IEC [1]	EIA [2]	UK [3]	MIL PIN [4, 5, 6]	Metric [1]	Imperial [1]	Nominal range [1]	TE_{10} cut-off *	
-	-	-	-	mm	inches	GHz	GHz	-
R 48	WR 187	WG 12	M85/1-051, 053, 054, 055, 056, 174 M85/2-003, 005, 006	47.549 x 22.149	1.872 x 0.872	3.94 - 5.99	3.152	**C**, G
R 58	WR 159	WG 13	M85/1-057, 059, 060, 061, 062, 175	40.386 x 20.193	1.590 x 0.795	4.64 - 7.05	3.712	C
R 70	WR 137	WG 14	M85/1-063, 065, 066, 067, 068, 176	34.849 x 15.799	1.372 x 0.622	5.38 - 8.17	4.301	Xn, J
R 84	WR 112	WG 15	M85/1-069, 071, 072, 073, 074, 177 M85/2-007	28.499 x 12.624	1.122 x 0.497	6.57 - 9.99	5.260	Xb, H
R 100	WR 90	WG 16	M85/1-075, 077, 078, 079, 080, 178 M85/2-008, 009	22.860 x 10.160	0.900 x 0.400	8.20 - 12.5	6.557	**X**
R 120	WR 75	WG 17	M85/1-081, 083, 084, 085, 086, 179	19.050 x 9.525	0.750 x 0.375	9.84 - 15.0	7.869	M
R 140	WR 62	WG 18	M85/1-087, 089, 090, 091, 092, 093, 180	15.799 x 7.899	0.622 x 0.311	11.9 - 18.0	9.488	**Ku**, P
R 180	WR 51	WG 19	M85/1-094, 096, 097, 098, 099, 181	12.954 x 6.477	0.510 x 0.255	14.5 - 22.0	11.571	N
R 220	WR 42	WG 20	M85/1-100, 102, 103, 104, 105, 106, 182	10.668 x 4.318	0.420 x 0.170	17.6 - 26.7	14.051	**K**
R 260	WR 34	WG 21	M85/1-107, 109, 110, 111, 112, 113, 183	8.636 x 4.318	0.340 x 0.170	21.7 - 33.0	17.357	-
R 320	WR 28	WG 22	M85/3-006, 007, 008, 009	7.112 x 3.556	0.280 x 0.140	26.3 - 40.0	21.077	**Ka**, R
R 400	WR 22	WG 23	M85/3-010, 011, 012, 013	5.690 x 2.845	0.224 x 0.112	32.9 - 50.1	26.344	**Q**
R 500	WR 19	WG 24	M85/3-014, 015, 016	4.775 x 2.388	0.188 x 0.094	39.2 - 59.6	31.392	**U**
R 620	WR 15	WG 25	M85/3-017, 018	3.759 x 1.880	0.148 x 0.074	49.8 - 75.8	39.877	**V**

Waveguide designations				Basic inner dimensions		Frequencies		Letter band designations ***
IEC [1]	EIA [2]	UK [3]	MIL PIN [4, 5, 6]	Metric [1]	Imperial [1]	Nominal range [1]	TE_{10} cut-off *	
-	-	-	-	mm	inches	GHz	GHz	-
R 740	WR 12	WG 26	M85/3-020, 021	3.0988 x 1.5494	0.122 x 0.061	60.5 - 91.9	48.372	**E**
R 900	WR 10	WG 27	M85/3-023, 024	2.5400 x 1.2700	0.1000 x 0.0500	73.8 - 112	59.014	**W**
R 1200	WR 8	WG 28	M85/3-026, 027	2.0320 x 1.0160	0.0800 x 0.0400	92.2 - 140	73.768	**F**
R 1400	WR 7 **	WG 29	M85/3-029, 030	1.6510 x 0.8255	0.0650 x 0.0325	113 - 173	90.791	**D**
R 1800	WR 5	WG 30	M85/3-032, 033	1.2954 x 0.6477	0.0510 x 0.0255	145 - 220	115.71	**G**
R 2200	WR 4	WG 31	M85/3-035, 036	1.0922 x 0.5461	0.0430 x 0.0215	172 - 261	137.24	**Y**
R 2600	WR 3	WG 32	M85/3-038, 039	0.8636 x 0.4318	0.0340 x 0.0170	217 - 330	173.57	**H**, J

* The TE_{10} cut-off frequency is given by $f_c = c_0/(2a)$ with $c_0 = 299792458\ ms^{-1}$ and the waveguide width a.
** The waveguide WR 7 is sometimes misleadingly referred to as WR-06 (e.g. in [6]).
*** Bold characters indicate classic band designations. Standard characters indicate other common band designations.

4 Ordinary rectangular waveguides for millimeter and sub-millimeter waves

Waveguide designations						Inner dimensions		Frequencies	
IEEE [7]	IEC [1]	EIA [2]	Hesler [8]	UK [3]	MIL PIN [6]	Width [7]	Height [7]	Nominal range [7]	TE_{10} cut-off [7]
-	-	-	-	-	-	µm	µm	GHz	GHz
WM-2540	R 900	WR 10	WR 10	WG 27	M85/3-023, 024	2540	1270	75 - 110	59.014
WM-2032	R 1200	WR 8	WR 8	WG 28	M85/3-026, 027	2032	1016	90 - 140	73.768
WM-1651	R 1400	WR 7 **	WR 6.5	WG 29	M85/3-029, 030	1651	825.5	110 - 170	90.791
WM-1295	R 1800 *	WR 5 *	WR 5.1 *	WG 30 *	M85/3-032 *, 033 *	1295	647.5	140 - 220	115.75
WM-1092	R 2200 *	WR 4 *	WR 4.3 *	WG 31 *	M85/3-035 *, 036 *	1092	546	170 - 260	137.27
WM-864	R 2600 *	WR 3 *	WR 3.4 *	WG 32 *	M85/3-038 *, 039 *	864	432	220 - 330	173.49
WM-710	-	-	WR 2.8 *	-	-	710	355	260 - 400	211.12
WM-570	-	-	WR 2.2 *	-	-	570	285	330 - 500	262.98
WM-470	-	-	WR 1.9 *	-	-	470	235	400 - 600	318.93
WM-380	-	-	WR 1.5 *	-	-	380	190	500 - 750	394.46
WM-310	-	-	WR 1.2 *	-	-	310	155	600 - 900	483.54
WM-250	-	-	WR 1.0 *	-	-	250	125	750 - 1100	599.58
WM-200	-	-	(WR 0.8 *)	-	-	200	100	900 - 1400	749.48
WM-164	-	-	(WR 0.65 *)	-	-	164	82	1100 - 1700	914.00
WM-130	-	-	(WR 0.51 *)	-	-	130	65	1400 - 2200	1153.0
WM-106	-	-	-	-	-	106	53	1700 - 2600	1414.1
WM-86	-	-	-	-	-	86	43	2200 - 3300	1743.0
(WM-71)	-	-	-	-	-	71	35.5	2600 - 4000	2111.2
(WM-57)	-	-	-	-	-	57	28.5	3300 - 5000	2629.8

* The nominal internal dimensions of this waveguide differ slightly from those of the corresponding WM waveguide.
** The waveguide WR 7 is sometimes misleadingly referred to as WR-06 (e.g. in [6]).

5 Rectangular waveguides of reduced height

Waveguide designations			Basic inner dimensions		Frequencies		Letter band designations ***
IEC [9, 10]	½ EIA *	MIL PIN [11]	Metric	Imperial	Nominal range [1, 9, 10]	TE_{10} cut-off **	
-	-	-	mm	inches	GHz	GHz	-
-	½ WR 2300	-	584.20 x 146.05 [2]	23.000 x 5.750 [2]	0.32 - 0.49	0.257	-
-	½ WR 2100	-	533.40 x 133.35 [2]	21.000 x 5.250 [2]	0.35 - 0.53	0.281	-
-	½ WR 1800	-	457.20 x 114.30 [2]	18.000 x 4.500 [2]	0.41 - 0.62	0.328	-
-	½ WR 1500	-	381.00 x 145.25 [2]	15.000 x 3.750 [2]	0.49 - 0.75	0.393	-
-	½ WR 1150	-	292.10 x 73.025 [2]	11.500 x 2.875 [2]	0.64 - 0.98	0.513	-
-	≈ ½ WR 975	M85/4-009, 010, 011, 012, 013, 014, 021, 022	247.65 x 61.87 [11]	9.750 x 2.436 [11]	0.76 - 1.15	0.605	-
M 12	½ WR 770	-	195.58 x 48.90 [10]	7.700 x 1.925 [10]	0.96 - 1.46	0.766	-
M 14	½ WR 650	-	165.10 x 41.30 [10]	6.500 x 1.626 [10]	1.14 - 1.73	0.908	**L**
M 18	½ WR 510	-	129.54 x 32.40 [10]	5.100 x 1.276 [10]	1.45 - 2.20	1.157	-
M 22	½ WR 430	-	109.22 x 27,30 [10]	4.300 x 1.075 [10]	1.72 - 2.61	1.372	Ls, R
F 22	-	-	109.22 x 13.100 [9]	4.300 x 0.5157 [9]			
M 26	½ WR 340	-	86.360 x 21.600 [10]	3.4000 x 0.8504 [10]	2.17 - 3.30	1.736	-
F 26	-	-	86.36 x 10.400 [9]	3.400 x 0.4094 [9]			
-	-	M85/4-001, 002, 007	72.14 x 25.50 [11]	2.840 x 1.004 [11]	2.60 - 3.95	2.078	**S**
M 32	-	-	72.136 x 18.000 [10]	2.8400 x 0.7087 [10]			
-	½ WR 284	M85/4-015, 016, 017	72.14 x 17.02 [11]	2.840 x 0.670 [11]			
F 32	-	-	72.14 x 8.600 [9]	2.840 x 0.3386 [9]			
M 40	≈ ½ WR 229	-	58.166 x 14.500 [10]	2.2900 x 0.5709 [10]	3.22 - 4.90	2.577	-
F 40	-	-	58.17 x 7.000 [9]	2.2900 x 0.2756 [9]			
M(F) 45 = F 45	-	-	50.800 x 16.942 [10]	2.0000 x 0.6670 [10]	3.68 - 5.60	2.951	-

Waveguide designations			Basic inner dimensions		Frequencies		Letter band designations ***
IEC [9, 10]	½ EIA *	MIL PIN [11]	Metric	Imperial	Nominal range [1, 9, 10]	TE_{10} cut-off **	
-	-	-	mm	inches	GHz	GHz	-
M 48	-	-	47.549 x 11.900 [10]	1.8720 x 0.4685 [10]	3.94 - 5.99	3.152	**C**, G
-	½ WR 187	-	47.55 x 11.075 [2]	1.872 x 0.436 [2]			
-	-	M85/4-018, 019, 020	47.55 x 9.45 [11]	1.872 x 0.372 [11]			
F 48	-	-	47.55 x 5.700 [9]	1.872 x 0.2244 [9]			
M 58	½ WR 159	-	40.386 x 10.100 [10]	1.5900 x 0.3976 [10]	4.64 - 7.05	3.712	C
F 58	-	-	40.39 x 5.000 [9]	1.5900 x 0.1969 [9]			
-	-	M85/4-003, 004, 008	34.85 x 12.37 [11]	1.372 x 0.487 [11]	5.38 - 8.17	4.301	Xn, J
M 70	-	-	34.849 x 8.700 [10]	1.3720 x 0.3425 [10]			
-	½ WR 137	-	34.85 x 7.90 [2]	1.372 x 0.311 [2]			
F 70	-	-	34.85 x 5.000 [9]	1.3720 x 0.1969 [9]			
-	½ WR 112	M85/4-030, 031	28.50 x 6.32 [11]	1.122 x 0.249 [11]	6.57 - 9.99	5.260	Xb, H
F 84	-	-	28.499 x 5.000 [9]	1.1220 x 0.1969 [9]			
-	½ WR 90	M85/4-034, 035, 036, 037	22.86 x 5.08 [11]	0.90 x 0.20 [11]	8.20 - 12.5	6.557	**X**
M(F) 100 = F 100	-	-	22.860 x 5.000 [10]	0.9000 x 0.1969 [10]			

* The waveguide designations listed here, e.g. “1/2 WR 90”, are composed of the EIA designations as per [2] and the prefix “½” to indicate a bisection of the original heights. Other common designations are “WR 90 Half Height” and “WR 90 H/H”.

** The TE_{10} cut-off frequency is given by $f_c = c_0/(2a)$ with $c_0 = 299792458$ ms^{-1} and the waveguide width a.

*** Bold characters indicate classic band designations. Standard characters indicate other common band designations.

6 Circular waveguides

Waveguide designations				Inner diameters		Frequencies			
IEC * [12]	EIA [13]	UK [3]	MIL Type ** [14]	Metric [12]	Imperial [12, 13]	TE_{11} range *** [13]	TE_{11} cut-off [12]	TM_{01} cut-off [12]	TE_{21} cut-off [12]
-	-	-	-	mm	inches	GHz	GHz	GHz	GHz
C 3.3	WC 2551	CG 1	WRC 312U14	647.9	25.508	0.312 - 0.427	0.27	0.35	0.45
C 4	WC 2179	CG 2	WRC 365U14	553.5	21.791	0.365 - 0.500	0.32	0.41	0.53
C 4.5	WC 1862	CG 3	WRC 427U14	472.8	18.616	0.427 - 0.586	0.37	0.48	0.62
C 5.3	WC 1590	CG 4	WRC 500U14	403.9	15.903	0.500 - 0.686	0.43	0.57	0.72
C 6.2	WC 1359	CG 5	WRC 586U14	345.1	13.585	0.586 - 0.803	0.51	0.66	0.84
C 7	WC 1161	CG 6	WRC 686U14	294.79	11.606	0.686 - 0.939	0.60	0.78	0.99
C 8	WC 992	CG 7	WRC 803U14	251.84	9.915	0.803 - 1.10	0.70	0.91	1.16
C 10	WC 847	CG 8	WRC 939U14	215.14	8.470	0.939 - 1.29	0.82	1.07	1.35
C 12	WC 724	CG 9	WRC 110D14	183.77	7.235	1.10 - 1.51	0.96	1.25	1.59
C 14	WC 618	CG 10	WRC 129D14	157.00	6.181	1.29 - 1.76	1.12	1.46	1.86
C 16	WC 528	CG 11	WRC 151D14	134.11	5.280	1.51 - 2.07	1.31	1.71	2.17
C 18	WC 451	CG 12	WRC 176D14	114.58	4.511	1.76 - 2.42	1.53	2.00	2.54
C 22	WC 385	CG 13	WRC 207D14	97.87	3.853	2.07 - 2.83	1.79	2.34	2.98
C 25	WC 329	CG 14	WRC 242D14	83.62	3.292	2.42 - 3.31	2.10	2.74	3.49
C 30	WC 281	CG 15	WRC 283D14	71.42	2.812	2.83 - 3.88	2.46	3.21	4.08
C 35	WC 240	CG 16	WRC 331D14	61.04	2.403	3.31 - 4.54	2.88	3.76	4.77
C 40	WC 205	CG 17	WRC 389D14	51.99	$2.047 \approx 2\ ^{3}/_{64}$	3.89 - 5.33	3.38	4.41	5.61
C 48	WC 175	CG 18	WRC 454D14	44.45	$1.750 = 1\ ^{3}/_{4}$	4.54 - 6.23	3.95	5.16	6.56
C 56	WC 150	CG 19	WRC 530D14	38.10	$1.500 = 1\ ^{1}/_{2}$	5.30 - 7.27	4.61	6.02	7.65
C 65	WC 128	CG 20	WRC 621D14	32.537	$1.281 \approx 1\ ^{9}/_{32}$	6.21 - 8.51	5.40	7.05	8.96
C 76	WC 109	CG 21	WRC 727D14	27.788	$1.094 \approx 1\ ^{3}/_{32}$	7.27 - 9.97	6.32	8.26	10.5

Waveguide designations				Inner diameters		Frequencies			
IEC * [12]	EIA [13]	UK [3]	MIL Type ** [14]	Metric [12]	Imperial [12, 13]	TE_{11} range *** [13]	TE_{11} cut-off [12]	TM_{01} cut-off [12]	TE_{21} cut-off [12]
-	-	-	-	mm	inches	GHz	GHz	GHz	GHz
C 89	WC 94	CG 22	WRC 849D14	23.825	0.938 ≈ $^{15}/_{16}$	8.49 - 11.6	7.37	9.63	12.2
C 104	WC 80	CG 23	WRC 997D14	20.244	0.797 ≈ $^{51}/_{64}$	9.97 - 13.7	8.68	11.3	14.4
C 120	WC 69	CG 24	WRC 116C14	17.475	0.688 ≈ $^{11}/_{16}$	11.6 - 15.9	10.0	13.1	16.7
C 140	WC 59	CG 25	WRC 134C14	15.088	0.594 ≈ $^{19}/_{32}$	13.4 - 18.4	11.6	15.2	19.3
C 165	WC 50	CG 26	WRC 159C14	12.700	0.500 = $^{1}/_{2}$	15.9 - 21.8	13.8	18.1	22.9
C 190	WC 44	CG 27	WRC 182C14	11.125	0.438 ≈ $^{7}/_{16}$	18.2 - 24.9	15.8	20.6	26.2
C 220	WC 38	CG 28	WRC 212C14	9.525	0.375 = $^{3}/_{8}$	21.2 - 29.1	18.4	24.1	30.6
C 255	WC 33	CG 29	WRC 243C14	8.331	0.328 ≈ $^{21}/_{64}$	24.3 - 33.2	21.1	27.5	35.0
C 290	WC 28	CG 30	WRC 283C14	7.137	0.281 ≈ $^{9}/_{32}$	28.3 - 38.8	24.6	32.2	40.8
C 330	WC 25	CG 31	WRC 318C14	6.350	0.250 = $^{1}/_{4}$	31.8 - 43.6	27.7	36.1	45.9
C 380	WC 22	CG 32	WRC 364C14	5.563	0.219 ≈ $^{7}/_{32}$	36.4 - 49.8	31.6	41.3	52.4
C 430	WC 19	CG 33	WRC 424C14	4.775	0.188 ≈ $^{3}/_{16}$	42.4 - 58.1	36.8	48.1	61.0
C 495	WC 17	CG 34	WRC 463C14	4.369	0.172 ≈ $^{11}/_{64}$	46.3 - 63.5	40.2	52.5	66.7
C 580	WC 14	CG 35	WRC 566C14	3.581	0.141 ≈ $^{9}/_{64}$	56.6 - 77.5	49.1	64.1	81.4
C 660	WC 13	CG 36	WRC 635C14	3.175	0.125 = $^{1}/_{8}$	63.5 - 87.2	55.3	72.3	91.8
C 765	WC 11	CG 37	WRC 727C14	2.769	0.109 ≈ $^{7}/_{64}$	72.7 - 99.7	63.5	82.9	105
C 890	WC 9	CG 38	WRC 848C14	2.388	0.094 ≈ $^{3}/_{32}$	84.8 - 116	73.6	96.1	122

* This column shows the preferred waveguide types only. Intermediate sizes are given in [12].

** An additional letter added to the MIL type designation indicates material as:
A – Aluminum alloy; B – Brass; C – Copper; M – Magnesium-base alloy; S – Silver alloy. E.g. WRC 312U14A.

*** The specified TE_{11} frequency range is within 1.15 times the TE_{11} cut-off frequency and 0.95 times the TE_{21} cut-off frequency.

7 Circular waveguides for frequencies of 100 GHz and above

For circular waveguides intended for frequencies of 100 GHz and above we were not able to find a written standard. Various companies (e.g. Cernex, Custom Microwave, Ducommun, Millitech, Quinstar, Spinner, TRG) have defined proprietary waveguide sizes which over the years became a quasi-standard. The following table compiles the most often used waveguide sizes. The waveguide designation used here pursues the well-established EIA designation scheme [13]. **Bold values** of the inner diameter indicate original unrounded values.

Waveguide designations				Inner diameters		Frequencies			
IEC [12]	pursued EIA (EIA [13])	UK [3]	MIL Type [14]	Metric	Imperial	TE_{11} range *	TE_{11} cut-off **	TM_{01} cut-off ***	TE_{21} cut-off ****
-	-	-	-	mm	inches	GHz	GHz	GHz	GHz
C 890	WC 9.4 (WC 9)	CG 38	WRC 848C14	2.388	**0.094** ≈ $^{3}/_{32}$	84.6 - 116	73.6	96.1	122
-	WC 8.9	-	-	2.261	**0.089** ≈ $^{91}/_{1024}$	89.4 - 122	77.7	102	129
-	WC 8.2	-	-	2.083	**0.082** ≈ $^{21}/_{256}$	97.0 - 133	84.4	110	140
-	WC 7.9	-	-	**2.000**	0.07874 ≈ $^{81}/_{1024}$	101 - 138	87.9	115	146
-	WC 7.5	-	-	1.905	**0.075** = $^{3}/_{40}$	106 - 145	92.2	120	153
-	WC 7.3	-	-	1.854	**0.073** ≈ $^{75}/_{1024}$	109 - 149	94.8	124	157
-	WC 6.7	-	-	1.702	**0.067** ≈ $^{69}/_{1024}$	119 - 163	103	135	171
-	WC 5.9	-	-	**1.500**	0.05906 ≈ $^{15}/_{256}$	135 - 185	117	153	194
-	WC 5.8	-	-	1.473	**0.058** ≈ $^{59}/_{1024}$	137 - 188	119	156	198
-	WC 4.9	-	-	1.245	**0.049** ≈ $^{25}/_{512}$	162 - 222	141	184	234
-	WC 4.5	-	-	1.143	**0.045** ≈ $^{23}/_{512}$	177 - 242	154	201	255
-	WC 3.9	-	-	0.991	**0.039** ≈ $^{5}/_{128}$	204 - 280	177	232	294

* The specified TE_{11} frequency range is within 1.15 times the TE_{11} cut-off frequency and 0.95 times the TE_{21} cut-off frequency.
** The TE_{11} cut-off frequency is given by $f_c = 1.8412\ c_0/(\pi d)$ with $c_0 = 299792458\ ms^{-1}$ and the waveguide diameter d.
*** The TM_{01} cut-off frequency is given by $f_c = 2.4048\ c_0/(\pi d)$ with $c_0 = 299792458\ ms^{-1}$ and the waveguide diameter d.
**** The TE_{21} cut-off frequency is given by $f_c = 3.0542\ c_0/(\pi d)$ with $c_0 = 299792458\ ms^{-1}$ and the waveguide diameter d.

8 Double ridge waveguides with bandwidth ratio of 2.4:1

Waveguide designations			Basic inner dimensions								Frequencies [15]	
MIL [15]		EIA [17]	Metric [15]				Imperial [15]				Nominal range	TE_{10} cutoff
Type *	PIN		Width	Height	Gap	Ridge	Width	Height	Gap	Ridge		
-	-	-	mm	mm	mm	mm	in.	in.	in.	in.	GHz	GHz
WRD 175U24 A, B, C, S	M23351/4- 001, 002, 003, 004	WD 2970-742	753.54	350.39	148.92	188.39	29.667	13.795	5.863	7.417	0.175 - 0.420	0.146
WRD 267U24 A, B, C, S	M23351/4- 005, 006, 007, 008	WD 1940-486	493.47	229.46	97.51	123.37	19.428	9.034	3.839	4.857	0.267 - 0.640	0.222
WRD 420U24 A, B, C, S	M23351/4- 009, 010, 011, 012	WD 1230-308	313.26	145.72	61.90	78.31	12.33	5.737	2.437	3.083	0.420 - 1.000	0.350
WRD 640U24 A, B, C, S	M23351/4- 013, 014, 015, 016	WD 810-203	205.74	95.68	40.67	51.44	8.100	3.767	1.601	2.025	0.640 - 1.530	0.533
WRD 840U24 A, B, C, S	M23351/4- 017, 018, 019, 020	WD 617-154	156.64	72.85	30.96	39.17	6.167	2.868	1.219	1.542	0.840 - 2.000	0.700
WRD 150D24 A, B, C, S	M23351/4- 021, 022, 023, 024	WD 346-86	87.76	40.82	17.348	21.946	3.455	1.607	0.683	0.864	1.500 - 3.600	1.249
WRD 200D24 A, B, C, S	M23351/4- 025, 026, 027, 028	WD 259-65	69.79	30.61	13.00	16.46	2.590	1.205	0.512	0.648	2.000 - 4.800	1.666
WRD 350D24 A, B, C, S	M23351/4- 029, 030, 031, 032	WD 148-37	37.59	17.48	7.417	9.398	1.480	0.688	0.292	0.370	3.500 - 8.200	2.915
WRD 475D24 A, B, C, S	M23351/4- 033, 034, 035, 036	WD 109-27	27.69	12.48	5.46	6.91	1.090	0.506	0.215	0.272	4.750 - 11.000	3.961
WRD 750D24 A, B, C, S	M23351/4- 037, 038, 039, 040	WD 69-17	17.55	8.15	3.45	4.39	0.691	0.321	0.136	0.173	7.500 - 18.000	6.239
WRD 110C24 A, B, C, S	M23351/4- 041, 042, 043, 044	WD 47-12	11.96	5.56	2.362	2.997	0.471	0.219	0.093	0.118	11.000 - 26.500	9.363
WRD 180C24 A, B, C, S	M23351/4- 045, 046, 047, 048	WD 29-7	7.32	3.40	1.448	1.829	0.288	0.134	0.057	0.072	18.000 - 40.000	14.995
DR 19 **	M23351/4- 049, 050, 051, 052	-	26.04	12.06	4.85	6.50	1.025	0.475	0.191	0.256	4.750 - 11.000	4.086

* The additional letter added to the MIL type designation indicates material as: A – Aluminum alloy; B – Copper alloy (Brass); C – Copper; S – Silver alloy.

** The MIL specification [15] does not list a type designation for this waveguide. Commonly the designation DR 19 is in use.

9 Double ridge waveguides with bandwidth ratio of 3.6:1

Waveguide designations			Basic inner dimensions								Frequencies [16]	
MIL [16]		EIA [17]	Metric [16]				Imperial [16]				Nominal range	TE_{10} cutoff
Type *	PIN		Width	Height	Gap	Ridge	Width	Height	Gap	Ridge		
-	-	-	mm	mm	mm	mm	in.	in.	in.	in.	GHz	GHz
WRD 108U36 A, B, C, S	M23351/2- 001, 002, 003, 004	WD 3460-866	879.80	378.31	73.76	219.96	34.638	14.894	2.904	8.660	0.108 - 0.390	0.092
WRD 270U36 A, B, C, S	M23351/2- 005, 006, 007, 008	WD 1390-348	353.47	152.00	29.64	88.37	13.916	5.984	1.167	3.479	0.270 - 0.970	0.229
WRD 390U36 A, B, C, S	M23351/2- 009, 010, 011, 012	WD 963-241	244.55	105.16	20.498	61.14	9.628	4.140	0.807	2.407	0.390 - 1.40	0.331
WRD 970U36 A, B, C, S	M23351/2- 013, 014, 015, 016	WD 388-97	98.48	42.34	8.255	24.613	3.877	1.667	0.325	0.969	0.970 - 3.50	0.822
WRD 140D36 A, B, C, S	M23351/2- 017, 018, 019, 020	WD 269-67	68.25	29.34	5.72	17.07	2.687	1.155	0.225	0.672	1.40 - 5.00	1.186
WRD 350D36 A, B, C, S	M23351/2- 021, 022, 023, 024	WD 107-27	27.28	11.73	2.29	6.83	1.074	0.462	0.090	0.269	3.50 - 12.40	2.966
WRD 500D36 A, B, C, S	M23351/2- 025, 026, 027, 028	WD 75-19	19.10	8.20	1.60	4.78	0.752	0.323	0.063	0.188	5.00 - 18.00	4.237
WRD 124C36 A, B, C, S	M23351/2- 029, 030, 031, 032	WD 30-8	7.70	3.30	0.64	1.93	0.303	0.130	0.025	0.076	12.40 - 40.00	10.508

* The additional letter added to the MIL type designation indicates material as: A – Aluminum alloy; B – Copper alloy (Brass); C – Copper; S – Silver alloy.

10 Double ridge waveguides with miscellaneous bandwidth ratios

Waveguide designations		Bandwidth ratio	Basic inner dimensions								Frequencies	
			Metric				Imperial				Nominal range	TE_{10} cutoff
Type *	Material **		Width	Height	Gap	Ridge	Width	Height	Gap	Ridge		
-	-	-	mm	mm	mm	mm	in.	in.	in.	in.	GHz	GHz
WRD 250D30	A, B, C, S	3.0:1	42.037	18.161	3.810	11.176	1.655	0.715	0.150	0.440	2.60 - 7.80	2.093
WRD 580D28	A, B, C, S	2.8:1	19.812	9.398	3.048	5.080	0.780	0.370	0.120	0.200	5.80 - 16.00	4.892
WRD 650D28	A, B, C, S	2.8:1	18.288	8.153	2.565	4.394	0.720	0.321	0.101	0.173	6.50 - 18.00	5.348
WRD 700D26	A, B, C, S	2.6:1	17.424	7.874	2.667	4.394	0.686	0.310	0.105	0.173	7.00 - 18.50	5.679

* The type designations listed here are in common use. They pursue the well-established MIL designations given in [15] and [16]. Nevertheless we were not able to find a corresponding standard document.

** A – Aluminum alloy; B – Copper alloy (Brass); C – Copper; S – Silver alloy.