

## Table of Contents

<b>Preface</b> . . . . .	xi
<b>Introduction</b> . . . . .	xvii
<b>Chapter 1. Reminders and General Points</b> . . . . .	1
1.1. Lines . . . . .	1
1.1.1. Bifilar lines . . . . .	1
1.1.2. Coaxial lines . . . . .	2
1.2. Adaptation and stationary waves . . . . .	4
1.3. Smith chart . . . . .	6
1.4. Power in a line . . . . .	6
1.5. Line sections . . . . .	7
1.6. Lines with losses . . . . .	9
<b>Chapter 2. Measurements in HF</b> . . . . .	11
2.1. Material . . . . .	11
2.2. The power bench. . . . .	11
2.2.1. The measurements to carry out . . . . .	11
2.2.2. Bench configuration . . . . .	13
2.3. Measurements on the network analyzer . . . . .	14
2.3.1. Measurement principles . . . . .	14
2.3.2. Measurement errors . . . . .	16
2.3.3. The measurement attenuator . . . . .	19
<b>Chapter 3. Resonant Cavities</b> . . . . .	25
3.1. Resonance. . . . .	25
3.2. Coaxial cavities . . . . .	28

3.3. Quarter-wave cavities . . . . .	29
3.3.1. Excitation . . . . .	29
3.3.2. Possible shapes . . . . .	31
3.3.3. Lines of force . . . . .	32
3.3.4. Equivalence criterion. . . . .	33
3.3.5. Electric length. . . . .	36
3.3.6. Conditions for optimal $Q_0$ . . . . .	38
3.3.7. Refutation of the method . . . . .	40
3.3.8. Calculation of $Q_0$ . . . . .	43
<b>Chapter 4. Fabrication and Tuning of Cavities . . . . .</b>	<b>47</b>
4.1. Standard structures . . . . .	47
4.1.1. Band-pass . . . . .	47
4.1.2. Reject . . . . .	48
4.1.3. Pass-reject . . . . .	50
4.2. Materials . . . . .	53
4.2.1. The thin metal sheet . . . . .	53
4.2.2. Extrusion. . . . .	55
4.3. Assembly . . . . .	56
4.4. Temperature stability . . . . .	58
4.4.1. Compensation for ambient temperature. . . . .	58
4.4.2. Compensation for internal heating . . . . .	62
4.4.3. Various remarks. Humidity effects . . . . .	64
4.5. Cavity tuning. . . . .	70
4.5.1. Insertion loss and selectivity . . . . .	70
4.5.2. Loop tuning . . . . .	75
4.5.3. Frequency tuning . . . . .	78
<b>Chapter 5. The Band-pass Filter . . . . .</b>	<b>83</b>
5.1. The band-pass function . . . . .	83
5.2. Calculation of a Tchebycheff band-pass . . . . .	85
5.3. Technologies . . . . .	87
5.3.1. Planar circuits . . . . .	87
5.3.2. Ceramic filters. . . . .	89
5.3.3. Dielectric air filters. . . . .	92
<b>Chapter 6. The Comblin Filter . . . . .</b>	<b>97</b>
6.1. Architecture. . . . .	97
6.1.1. General structure . . . . .	97
6.1.2. Fastening the tubes . . . . .	99
6.1.3. Housing, tuning, stability in temperature . . . . .	101

6.2. Dimension calculations. Dishal's Method . . . . .	105
6.2.1. Parameterization . . . . .	105
6.2.2. The modified method . . . . .	108
6.3. Tuning of filters . . . . .	114
6.3.1. General rules. . . . .	114
6.3.2. Elliptization of the Tchebycheffs. . . . .	118
6.3.3. Mechanical model . . . . .	122
6.3.4. Abundances of the mechanical model. . . . .	124
<b>Chapter 7. Channel Multiplexing . . . . .</b>	<b>129</b>
7.1. Definitions . . . . .	129
7.2. The duplexer . . . . .	129
7.2.1. The pass-reject duplexer. . . . .	130
7.2.2. The band-pass duplexer . . . . .	134
7.3. The combiner. . . . .	140
7.3.1. The nodal-point combiner. . . . .	141
7.3.2. The series combiner . . . . .	143
7.3.3. Harness adjustment. . . . .	144
7.3.4. Secondary harness . . . . .	148
7.3.5. Projected losses . . . . .	148
7.3.6. Optimal Q . . . . .	154
<b>Chapter 8. Auxiliary Devices . . . . .</b>	<b>157</b>
8.1. Introduction. . . . .	157
8.2. Circulators . . . . .	157
8.2.1. Operating principle . . . . .	157
8.2.2. Usage . . . . .	160
8.2.3. Characterization. . . . .	162
8.3. The antenna alarms . . . . .	165
8.3.1. Detection alarm . . . . .	166
8.3.2. Thermal alarm. . . . .	167
8.4. Loads and attenuators. . . . .	170
8.4.1. Loads . . . . .	170
8.4.2. Reminders concerning the transmission of heat . . . . .	174
8.4.3. Attenuators. . . . .	176
8.5. Reception amplifiers . . . . .	177
8.5.1. Introduction . . . . .	177
8.5.2. Intercept point. . . . .	182
8.5.3. Noise factor . . . . .	184
8.6. The impedance adaptor . . . . .	186
8.7. The 2nd harmonic rejecter . . . . .	186

<b>Chapter 9. Directive Couplers</b> . . . . .	189
9.1. Introduction . . . . .	189
9.2. Technologies . . . . .	191
9.3. The hybrid transformer . . . . .	194
9.4. The 180° hybrid ring . . . . .	196
9.5. The wireline . . . . .	198
9.6. The “groundless” coupler . . . . .	199
9.7. The “catnose” coupler . . . . .	201
9.8. Discrete-elements coupler . . . . .	202
9.9. Numerical data . . . . .	204
9.10. Applications . . . . .	210
<b>Chapter 10. Helical Resonators</b> . . . . .	213
10.1. Introduction . . . . .	213
10.2. Functioning . . . . .	214
10.3. Structures . . . . .	215
10.4. Tapping and coupling . . . . .	219
10.5. Quality coefficient . . . . .	220
10.6. Set-up rules . . . . .	223
10.7. Applications . . . . .	224
<b>Chapter 11. Multicouplers</b> . . . . .	225
11.1. Transmitter multicouplers (TX) . . . . .	225
11.1.1. Choice of the technology . . . . .	225
11.1.2. Cascading hybrid TX multicouplers . . . . .	226
11.1.3. TX multicoupler with degressive coupling . . . . .	227
11.1.4. Cavity TX multicouplers . . . . .	228
11.1.5. TX multicoupler with directive filters . . . . .	233
11.2. Receiver multicouplers (RX) . . . . .	235
11.3. TX/RX multicouplers . . . . .	236
11.4. TMA . . . . .	240
11.5. Power and intermodulations . . . . .	243
11.5.1 Limit power . . . . .	243
11.5.2. Intermodulations . . . . .	249
11.6. Multiband coupling . . . . .	254
<b>Chapter 12. Utilities</b> . . . . .	257
12.1. BASIC programs . . . . .	257
12.2. Varia . . . . .	264

<b>Chapter 13. Various Questions and Exploratory Ways</b> . . . . .	271
13.1. The coupler without intrinsic loss . . . . .	271
13.2. Infinite rejection band-pass. . . . .	275
13.3. Helix TX multicoupler . . . . .	276
13.4. Conclusion . . . . .	278
<b>Bibliography</b> . . . . .	281
<b>Index</b> . . . . .	283