

Contents

1	Introduction to Modulation	1
1.1	Background	1
1.2	Modulation by Analog Signals	3
1.2.1	AM, FM, and PM	3
1.2.2	AM and FM Bandwidth at a Glance	4
1.3	Modulation by Digital Signal	5
1.3.1	Amplitude Shift Keying (ASK) Modulation	5
1.3.2	Frequency Shift Keying (FSK) Modulation	6
1.3.3	Phase Shift Keying (PSK) Modulation	7
1.4	Bandwidth Occupancy in Digital Modulation	7
1.4.1	Spectral Response of the Encoded Data	8
1.4.2	Spectral Response of the Carrier Frequency Before Modulation	9
1.4.3	ASK Bandwidth at a Glance	10
1.4.4	FSK Bandwidth at a Glance	11
1.4.5	BPSK Bandwidth at a Glance	12
1.5	Conclusions	14
	References	15
2	Amplitude Modulation (AM)	17
2.1	Introduction	17
2.2	Amplitude Modulation	19
2.3	AM Spectrum and Bandwidth	20
2.3.1	Spectral Response of the Input Modulating Signal	20
2.3.2	Spectral Response of the Carrier Frequency	21
2.3.3	AM Spectrum and Bandwidth	21
2.3.4	AM Response Due to Low and High Modulating Signals	23
2.3.5	AM Demodulation	24
2.3.6	Drawbacks in AM	24

2.4	Double Sideband-Suppressed Carrier (DSBSC)	25
2.4.1	DSBSC Modulation.	25
2.4.2	Generation of DSBSC Signal	26
2.4.3	DSBSC Spectrum and Bandwidth	27
2.4.4	DSBSC Drawbacks	28
2.5	Single Sideband (SSB) Modulation	29
2.5.1	Why SSB Modulation?	29
2.5.2	Generation of SSB-Modulated Signal.	29
2.5.3	SSB Spectrum and Bandwidth	30
2.6	Conclusions	32
	References	32
3	Frequency Modulation (FM)	33
3.1	Introduction	33
3.2	Frequency Modulation (FM).	34
3.2.1	Background	34
3.2.2	The Basic FM	35
3.3	FM Spectrum and Bandwidth	37
3.3.1	Spectral Response of the Input Modulating Signal.	37
3.3.2	Spectral Response of the Carrier Frequency	38
3.3.3	FM Spectrum	39
3.3.4	Carson's Rule and FM Bandwidth.	40
3.3.5	Bessel Function and FM Bandwidth	41
3.3.6	FM Bandwidth Dilemma	42
3.4	Conclusions	44
	References	44
4	Amplitude Shift Keying (ASK)	45
4.1	Introduction	45
4.2	ASK Modulation.	46
4.3	ASK Demodulation	48
4.4	ASK Bandwidth	49
4.4.1	Spectral Response of the Encoded Data	49
4.4.2	Spectral Response of the Carrier Frequency Before Modulation.	51
4.4.3	ASK Bandwidth at a Glance.	51
4.5	BER Performance	53
4.6	Conclusions	54
	References	55
5	Frequency Shift Keying (FSK)	57
5.1	Introduction	57
5.2	Frequency Shift Keying (FSK) Modulation.	58
5.3	Frequency Shift Keying (FSK) Demodulation	60

- 5.4 FSK Bandwidth. 61
 - 5.4.1 Spectral Response of the Encoded Data 61
 - 5.4.2 Spectral Response of the Carrier Frequency Before Modulation. 63
 - 5.4.3 FSK Bandwidth at a Glance 63
- 5.5 BER Performance 65
- 5.6 Conclusions 67
- References 67
- 6 Phase Shift Keying (PSK) 69**
 - 6.1 Introduction 69
 - 6.2 Binary Phase Shift Keying (BPSK) 70
 - 6.2.1 BPSK Modulation. 70
 - 6.2.2 BPSK Demodulation 73
 - 6.3 QPSK Modulation 74
 - 6.4 8PSK Modulation 75
 - 6.5 16PSK Modulation 75
 - 6.6 PSK Spectrum and Bandwidth 77
 - 6.6.1 Spectral Response of the Encoded Data 77
 - 6.6.2 Spectral Response of the Carrier Before Modulation 79
 - 6.6.3 BPSK Spectrum 79
 - 6.7 Conclusions 82
 - References 82
- 7 N-Ary Coded Modulation. 85**
 - 7.1 Introduction 85
 - 7.2 N-Ary Convolutional Coding and M-Ary Modulation 86
 - 7.2.1 Background 86
 - 7.2.2 Generation of Complementary Convolutional Codes 86
 - 7.2.3 2-Ary Convolutional Coding with QPSK Modulation 88
 - 7.2.4 4-Ary Convolutional Coding with 16PSK Modulation 89
 - 7.3 N-Ary Convolutional Decoder. 91
 - 7.3.1 Correlation Receiver 91
 - 7.3.2 Error Correction Capabilities of N-Ary Convolutional Codes 93
 - 7.4 N-Ary Orthogonal Coding and M-Ary Modulation 94
 - 7.4.1 Background 94
 - 7.4.2 Orthogonal Codes 95
 - 7.4.3 2-Ary Orthogonal Coding with QPSK Modulation 95
 - 7.4.4 4-Ary Orthogonal Coding with 16PSK Modulation 97
 - 7.4.5 2-Ary Orthogonal Decoding 97
 - 7.4.6 4-Ary Orthogonal Decoding 99
 - 7.4.7 Error Correction Capabilities of N-Ary Orthogonal Codes 99
 - 7.5 Conclusions 103
 - References 104



<http://www.springer.com/978-3-319-41200-9>

Radio Frequency Modulation Made Easy

Faruque, S.

2017, IX, 104 p. 68 illus., 36 illus. in color., Softcover

ISBN: 978-3-319-41200-9