Amateur Radio Exam Preparation Guide

Your Name

December 29, 2024

Contents

1 Commission Rules **5**
- 1.1 Frequency Privileges and Signal Regulations . . . 5
- 1.2 Station Restrictions and Special Operations . . . 5
- 1.3 Automatic and Remote Control . . . 5
- 1.4 Amateur Space and Earth Stations . . . 5
- 1.5 Volunteer Examiner Program . . . 5

2 Operating Procedures **7**
- 2.1 Miscellaneous Rules . . . 7
- 2.2 Amateur Radio in Space . . . 7
- 2.3 Television Practices . . . 7
- 2.4 Contest and DX Operating . . . 7
- 2.5 Operating Methods: Digital Modes . . . 7
- 2.6 Operating Methods: HF Digital Modes . . . 8

3 Radio Wave Propagation **9**
- 3.1 Electromagnetic Waves and Specialized Propagation . . . 9
- 3.2 Transequatorial and Long-Path Propagation . . . 9
- 3.3 Propagation Prediction and Reporting . . . 9

4 Amateur Practices **11**
- 4.1 Test Equipment . . . 11
  - 4.1.1 Oscilloscopes . . . 11
  - 4.1.2 Spectrum Analyzers . . . 11
  - 4.1.3 Antenna Analyzers . . . 11
  - 4.1.4 Frequency Counters . . . 11
- 4.2 Measurement Techniques and Limitations . . . 11
- 4.3 Receiver Performance . . . 11
- 4.4 Receiver Performance Characteristics . . . 12
- 4.5 Noise and Interference . . . 12

5 Electrical Principles **13**
- 5.1 Resonance and Q . . . 13
- 5.2 Time Constants and Phase Relationships . . . 13

5.3 Coordinate Systems and Phasors . . . 13
5.4 RF Effects in Components and Circuits . . . 13

6 Circuit Components **15**
6.1 Semiconductor Materials and Devices . . . 15
6.2 Diodes . . . 15
6.2.1 Zener Diodes . . . 15
6.2.2 Schottky Diodes . . . 15
6.2.3 Varactor Diodes . . . 15
6.2.4 PIN Diodes . . . 15
6.2.5 Point-Contact Diodes . . . 15
6.2.6 Diode Applications . . . 15
6.3 Digital ICs . . . 16
6.3.1 Logic Gates . . . 16
6.3.2 Comparators and Hysteresis . . . 16
6.3.3 Tri-State Logic . . . 16
6.3.4 BiCMOS Logic . . . 16
6.3.5 CMOS Logic . . . 16
6.3.6 Field-Programmable Gate Arrays (FPGAs) . . . 16
6.4 Inductors . . . 16
6.4.1 Core Materials and Permeability . . . 16
6.4.2 Transformers . . . 16
6.4.3 Ferrite Beads and Parasitic Suppression . . . 16
6.5 Piezoelectricity . . . 16
6.5.1 Piezoelectric Effect . . . 16
6.5.2 Quartz Crystals . . . 17
6.6 Semiconductor Materials and Packages for RF Use . . . 17
6.7 Electro-Optical Technology . . . 17

7 SUBELEMENT E7 - PRACTICAL CIRCUITS **19**
7.1 Digital Circuit Essentials . . . 19
7.1.1 Introduction to Digital Circuits . . . 19
7.1.2 Bistable Circuits . . . 19
7.1.3 Counters and Frequency Division . . . 19
7.1.4 Multivibrators . . . 19
7.1.5 Logic Gates . . . 19
7.1.6 Truth Tables and Positive Logic . . . 19
7.2 Amplifier Basics . . . 19
7.2.1 Class AB and Class D Amplifiers . . . 19
7.2.2 RF Switching Amplifiers . . . 20
7.2.3 Class A Amplifiers . . . 20
7.2.4 Oscillations and Grounded-Grid Amplifiers . . . 20
7.2.5 Class C Amplifiers and Efficiency . . . 20
7.2.6 Emitter Followers and Biasing . . . 20
7.3 Network Element Configurations . . . 20
7.3.1 Low-Pass and High-Pass Filters . . . 20

7.3.2 Pi-L Networks and Impedance Matching 20
7.3.3 Filter Types 20
7.3.4 Helical and Crystal Lattice Filters 20
7.3.5 Cavity Filters and Shape Factor 20
7.4 Voltage Regulator Mechanics 20
7.4.1 Linear and Switchmode Regulators 20
7.4.2 Voltage References and Three-Terminal Regulators 21
7.4.3 Linear Voltage Regulator Circuits 21
7.4.4 Battery Operating Time and Power Supplies 21
7.4.5 Solar Panel Inverters and Dropout Voltage 21
7.4.6 Power Dissipation and Filter Capacitors 21
7.5 Radio Communication Essentials 21
7.5.1 FM Signal Generation and Reactance Modulators 21
7.5.2 Frequency Discriminators and SSB Signals 21
7.5.3 Pre-emphasis and De-emphasis 21
7.5.4 Baseband and Mixers 21
7.5.5 Detectors and Demodulation 21
7.6 Key Terms in Software-Defined Radio and Digital Signal Processing 22
7.6.1 Direct Sampling and Adaptive Filters 22
7.6.2 Hilbert-Transform Filters and SSB Generation 22
7.6.3 Sampling and Fast Fourier Transform 22
7.6.4 Decimation and Anti-Aliasing Filters 22
7.6.5 SDR Bandwidth and Signal Level 22
7.6.6 FIR Filters and Taps 22
7.7 Op-Amp Essentials 22
7.7.1 Op-Amp Characteristics 22
7.7.2 Op-Amp Filters and Stability 22
7.7.3 Gain-Bandwidth and Voltage Gain 22
7.7.4 Operational Amplifier Definition 22
7.8 Oscillator Insights 23
7.8.1 Oscillator Circuits 23
7.8.2 Microphonics and Phase-Locked Loops 23
7.8.3 Colpitts and Pierce Oscillators 23
7.8.4 Frequency Synthesis and Direct Digital Synthesizers . . . 23
7.8.5 Crystal Oscillators and Stability 23

8 SUBELEMENT E8 - SIGNALS AND EMISSIONS 25
8.1 Signal Processing Essentials 25
8.1.1 Fourier Analysis and Analog-to-Digital Conversion 25
8.1.2 Time Domain and Dither 25
8.1.3 RMS Measurements and PEP-to-Average Power 25
8.1.4 Direct Sampling and Resolution 25
8.1.5 Total Harmonic Distortion 25
8.2 Modulation Secrets Revealed 26
8.2.1 FM Modulation Index and Deviation Ratio 26
8.2.2 Orthogonal Frequency-Division Multiplexing 26

8.2.3 Frequency Division Multiplexing 26
8.3 Transmission Insights 26
8.3.1 Quadrature Amplitude Modulation 26
8.3.2 Symbol Rate and PSK Signals 26
8.3.3 Bandwidth of Various Signals 26
8.3.4 Error Correction and Digital Codes 26
8.3.5 Baud Rate and CW Signal Bandwidth 26
8.3.6 Constellation Diagrams and Mesh Networks 26
8.4 Spread Spectrum Unveiled 26
8.4.1 Spread Spectrum Techniques 26
8.4.2 Key Clicks and Parity Bits 27
8.4.3 AFSK Signals and Distortion 27
8.4.4 Baudot and ASCII Codes 27

9 SUBELEMENT E9 - ANTENNAS AND TRANSMISSION LINES 29
9.1 Antenna Essentials 29
9.1.1 Isotropic Radiators and Effective Radiated Power 29
9.1.2 Feed Point Impedance and Ground Gain 29
9.1.3 Antenna Efficiency and Ground Losses 29
9.1.4 Gain Comparison and Fresnel Zones 29
9.2 Antenna Patterns Unveiled 29
9.2.1 Beamwidth and Front-to-Back Ratio 29
9.2.2 Elevation Patterns and Far Field 30
9.2.3 Method of Moments Analysis 30
9.3 Antenna Patterns and Impedances 30
9.3.1 Radiation Patterns of Vertical Antennas 30
9.3.2 Long Wire and Off-Center-Fed Dipoles 30
9.3.3 Terminated Rhombic and Folded Dipoles 30
9.3.4 G5RV and Zepp Antennas 30
9.3.5 Extended Double Zepp and Polarization Effects 30
9.4 Antenna Insights 30
9.4.1 Parabolic Reflectors and Circular Polarization 30
9.4.2 Loading Coils and Electrically Short Antennas 30
9.4.3 Yagi Antennas and Radiation Resistance 30
9.5 Matching Antenna Mechanics 31
9.5.1 Gamma and Beta Matches 31
9.5.2 Q-Section and Wilkinson Divider 31
9.5.3 Shunt Feeding and Phasing Lines 31
9.6 Transmission Line Essentials 31
9.6.1 Velocity Factor and Electrical Length 31
9.6.2 Transmission Line Impedance 31
9.7 Charting Impedances 31
9.7.1 Smith Chart Basics 31
9.7.2 Smith Chart Components 31
9.8 Essential Antenna Design Insights 31
9.8.1 Beverage Antennas and Directivity 31

9.8.2 Small-Loop and Sense Antennas 31
9.8.3 Cardioid Patterns and Loop Antennas 32

10 SUBELEMENT E0 - SAFETY **33**
10.1 Related Principles 33
10.1.1 Grounding and RF Exposure 33
10.1.2 Microwave Hazards and MPE Limits 33
10.1.3 Tower Safety and SAR 33
10.1.4 RF Exposure Evaluations 33
10.1.5 Climbing Safety 33

Chapter 1

Commission Rules

1.1 Frequency Privileges and Signal Regulations

- Question IDs: E1A01, E1A02, E1A03, E1A04, E1A05, E1A06, E1A07, E1A08, E1A09, E1A10, E1A11

1.2 Station Restrictions and Special Operations

- Question IDs: E1B01, E1B02, E1B03, E1B04, E1B05, E1B06, E1B07, E1B08, E1B09, E1B10, E1B11

1.3 Automatic and Remote Control

- Question IDs: E1C01, E1C02, E1C03, E1C04, E1C05, E1C06, E1C07, E1C08, E1C09, E1C10, E1C11, E1C12

1.4 Amateur Space and Earth Stations

- Question IDs: E1D01, E1D02, E1D03, E1D04, E1D05, E1D06, E1D07, E1D08, E1D09, E1D10, E1D11, E1D12

1.5 Volunteer Examiner Program

- Question IDs: E1E01, E1E02, E1E03, E1E04, E1E05, E1E06, E1E07, E1E08, E1E09, E1E10, E1E11

Chapter 2

Operating Procedures

2.1 Miscellaneous Rules

- Question IDs: E1F01, E1F02, E1F03, E1F04, E1F05, E1F06, E1F07, E1F08, E1F09, E1F10, E1F11

2.2 Amateur Radio in Space

- Question IDs: E2A01, E2A02, E2A03, E2A04, E2A05, E2A06, E2A07, E2A08, E2A09, E2A10, E2A11, E2A12

2.3 Television Practices

- Question IDs: E2B01, E2B02, E2B03, E2B04, E2B05, E2B06, E2B07, E2B08, E2B09, E2B10, E2B11, E2B12

2.4 Contest and DX Operating

- Question IDs: E2C01, E2C02, E2C03, E2C04, E2C05, E2C06, E2C07, E2C08, E2C09, E2C10, E2C11, E2C12

2.5 Operating Methods: Digital Modes

- Question IDs: E2D01, E2D02, E2D03, E2D04, E2D05, E2D06, E2D07, E2D08, E2D09, E2D10, E2D11

2.6 Operating Methods: HF Digital Modes

- Question IDs: E2E01, E2E02, E2E03, E2E04, E2E05, E2E06, E2E07, E2E08, E2E09, E2E10, E2E11, E2E12, E2E13

Chapter 3

Radio Wave Propagation

3.1 Electromagnetic Waves and Specialized Propagation

- Question IDs: E3A01, E3A02, E3A03, E3A04, E3A05, E3A06, E3A07, E3A08, E3A09, E3A10, E3A11, E3A12, E3A13, E3A14

3.2 Transequatorial and Long-Path Propagation

- Question IDs: E3B01, E3B02, E3B03, E3B04, E3B05, E3B06, E3B07, E3B08, E3B09, E3B10, E3B11, E3B12, E3B13

3.3 Propagation Prediction and Reporting

- Question IDs: E3C01, E3C02, E3C03, E3C04, E3C05, E3C06, E3C07, E3C08, E3C09, E3C10, E3C11, E3C12

Chapter 4

Amateur Practices

4.1 Test Equipment

4.1.1 Oscilloscopes

- Question IDs: E4A01, E4A04, E4A06, E4A09, E4A10

4.1.2 Spectrum Analyzers

- Question IDs: E4A02, E4A03

4.1.3 Antenna Analyzers

- Question IDs: E4A07, E4A08, E4A11

4.1.4 Frequency Counters

- Question IDs: E4A05

4.2 Measurement Techniques and Limitations

- Question IDs: E4B01, E4B02, E4B03, E4B04, E4B05, E4B06, E4B07, E4B08, E4B09, E4B10, E4B11

4.3 Receiver Performance

- Question IDs: E4C01, E4C02, E4C03, E4C04, E4C05, E4C06, E4C07, E4C08, E4C09, E4C10, E4C11, E4C12, E4C13, E4C14

4.4 Receiver Performance Characteristics

- Question IDs: E4D01, E4D02, E4D03, E4D04, E4D05, E4D06, E4D07, E4D08, E4D09, E4D10, E4D11, E4D12, E4D13, E4D14

4.5 Noise and Interference

- Question IDs: E4E01, E4E02, E4E03, E4E04, E4E05, E4E06, E4E07, E4E08, E4E09, E4E10, E4E11, E4E12, E4E13, E4E14

Chapter 5

Electrical Principles

5.1 Resonance and Q

- Question IDs: E5A01, E5A02, E5A03, E5A04, E5A05, E5A06, E5A07, E5A08, E5A09, E5A10, E5A11, E5A12, E5A13

5.2 Time Constants and Phase Relationships

- Question IDs: E5B01, E5B02, E5B03, E5B04, E5B05, E5B06, E5B07, E5B08, E5B09, E5B10, E5B11, E5B12

5.3 Coordinate Systems and Phasors

- Question IDs: E5C01, E5C02, E5C03, E5C04, E5C05, E5C06, E5C07, E5C08, E5C09, E5C10, E5C11, E5C12

5.4 RF Effects in Components and Circuits

- Question IDs: E5D01, E5D02, E5D03, E5D04, E5D05, E5D06, E5D07, E5D08, E5D09, E5D10, E5D11, E5D12

Chapter 6

Circuit Components

6.1 Semiconductor Materials and Devices

- Question IDs: E6A01, E6A02, E6A03, E6A04, E6A05, E6A06, E6A07, E6A08, E6A09, E6A10, E6A11, E6A12

6.2 Diodes

6.2.1 Zener Diodes

- Question IDs: E6B01, E6B03

6.2.2 Schottky Diodes

- Question IDs: E6B02, E6B06, E6B08

6.2.3 Varactor Diodes

- Question IDs: E6B04

6.2.4 PIN Diodes

- Question IDs: E6B05, E6B11

6.2.5 Point-Contact Diodes

- Question IDs: E6B09

6.2.6 Diode Applications

- Question IDs: E6B07, E6B10

6.3 Digital ICs

6.3.1 Logic Gates

- Question IDs: E6C07, E6C08, E6C10, E6C11

6.3.2 Comparators and Hysteresis

- Question IDs: E6C01, E6C02

6.3.3 Tri-State Logic

- Question IDs: E6C03

6.3.4 BiCMOS Logic

- Question IDs: E6C04

6.3.5 CMOS Logic

- Question IDs: E6C05, E6C06

6.3.6 Field-Programmable Gate Arrays (FPGAs)

- Question IDs: E6C09

6.4 Inductors

6.4.1 Core Materials and Permeability

- Question IDs: E6D04, E6D05, E6D06, E6D08, E6D10, E6D11, E6D12

6.4.2 Transformers

- Question IDs: E6D07

6.4.3 Ferrite Beads and Parasitic Suppression

- Question IDs: E6D09

6.5 Piezoelectricity

6.5.1 Piezoelectric Effect

- Question IDs: E6D01, E6D03

6.5.2 Quartz Crystals

- Question IDs: E6D02

6.6 Semiconductor Materials and Packages for RF Use

- Question IDs: E6E01, E6E02, E6E03, E6E04, E6E05, E6E06, E6E07, E6E08, E6E09, E6E10, E6E11, E6E12

6.7 Electro-Optical Technology

- Question IDs: E6F01, E6F02, E6F03, E6F04, E6F05, E6F06, E6F07, E6F08, E6F09, E6F10, E6F11

Chapter 7

SUBELEMENT E7 - PRACTICAL CIRCUITS

7.1 Digital Circuit Essentials

7.1.1 Introduction to Digital Circuits

7.1.2 Bistable Circuits

- E7A01

7.1.3 Counters and Frequency Division

- E7A02, E7A03, E7A04

7.1.4 Multivibrators

- E7A05, E7A06

7.1.5 Logic Gates

- E7A07, E7A08, E7A09

7.1.6 Truth Tables and Positive Logic

- E7A10, E7A11

7.2 Amplifier Basics

7.2.1 Class AB and Class D Amplifiers

- E7B01, E7B02

7.2.2 RF Switching Amplifiers

- E7B03

7.2.3 Class A Amplifiers

- E7B04

7.2.4 Oscillations and Grounded-Grid Amplifiers

- E7B05, E7B06

7.2.5 Class C Amplifiers and Efficiency

- E7B07, E7B08

7.2.6 Emitter Followers and Biasing

- E7B09, E7B10, E7B11, E7B12

7.3 Network Element Configurations

7.3.1 Low-Pass and High-Pass Filters

- E7C01, E7C02

7.3.2 Pi-L Networks and Impedance Matching

- E7C03, E7C04

7.3.3 Filter Types

- E7C05, E7C06, E7C07

7.3.4 Helical and Crystal Lattice Filters

- E7C08, E7C09

7.3.5 Cavity Filters and Shape Factor

- E7C10, E7C11

7.4 Voltage Regulator Mechanics

7.4.1 Linear and Switchmode Regulators

- E7D01, E7D02

7.4.2 Voltage References and Three-Terminal Regulators

- E7D03, E7D04, E7D05

7.4.3 Linear Voltage Regulator Circuits

- E7D06, E7D07, E7D08

7.4.4 Battery Operating Time and Power Supplies

- E7D09, E7D10

7.4.5 Solar Panel Inverters and Dropout Voltage

- E7D11, E7D12

7.4.6 Power Dissipation and Filter Capacitors

- E7D13, E7D14, E7D15

7.5 Radio Communication Essentials

7.5.1 FM Signal Generation and Reactance Modulators

- E7E01, E7E02

7.5.2 Frequency Discriminators and SSB Signals

- E7E03, E7E04

7.5.3 Pre-emphasis and De-emphasis

- E7E05, E7E06

7.5.4 Baseband and Mixers

- E7E07, E7E08, E7E09

7.5.5 Detectors and Demodulation

- E7E10, E7E11

7.6 Key Terms in Software-Defined Radio and Digital Signal Processing

7.6.1 Direct Sampling and Adaptive Filters

- E7F01, E7F02

7.6.2 Hilbert-Transform Filters and SSB Generation

- E7F03, E7F04

7.6.3 Sampling and Fast Fourier Transform

- E7F05, E7F06, E7F07

7.6.4 Decimation and Anti-Aliasing Filters

- E7F08, E7F09

7.6.5 SDR Bandwidth and Signal Level

- E7F10, E7F11

7.6.6 FIR Filters and Taps

- E7F12, E7F13, E7F14

7.7 Op-Amp Essentials

7.7.1 Op-Amp Characteristics

- E7G01, E7G03, E7G04

7.7.2 Op-Amp Filters and Stability

- E7G02, E7G05

7.7.3 Gain-Bandwidth and Voltage Gain

- E7G06, E7G07, E7G08, E7G09, E7G10, E7G11

7.7.4 Operational Amplifier Definition

- E7G12

7.8 Oscillator Insights

7.8.1 Oscillator Circuits

- E7H01

7.8.2 Microphonics and Phase-Locked Loops

- E7H02, E7H03

7.8.3 Colpitts and Pierce Oscillators

- E7H04, E7H05

7.8.4 Frequency Synthesis and Direct Digital Synthesizers

- E7H06, E7H09, E7H10, E7H11

7.8.5 Crystal Oscillators and Stability

- E7H07, E7H08, E7H12, E7H13

Chapter 8

SUBELEMENT E8 - SIGNALS AND EMISSIONS

8.1 Signal Processing Essentials

8.1.1 Fourier Analysis and Analog-to-Digital Conversion

- E8A01, E8A02

8.1.2 Time Domain and Dither

- E8A03, E8A04

8.1.3 RMS Measurements and PEP-to-Average Power

- E8A05, E8A06, E8A07

8.1.4 Direct Sampling and Resolution

- E8A08, E8A09, E8A10

8.1.5 Total Harmonic Distortion

- E8A11

8.2 Modulation Secrets Revealed

8.2.1 FM Modulation Index and Deviation Ratio

- E8B01, E8B02, E8B03, E8B04, E8B05, E8B06, E8B09

8.2.2 Orthogonal Frequency-Division Multiplexing

- E8B07, E8B08

8.2.3 Frequency Division Multiplexing

- E8B10, E8B11

8.3 Transmission Insights

8.3.1 Quadrature Amplitude Modulation

- E8C01

8.3.2 Symbol Rate and PSK Signals

- E8C02, E8C03, E8C04

8.3.3 Bandwidth of Various Signals

- E8C05, E8C06, E8C07

8.3.4 Error Correction and Digital Codes

- E8C08, E8C09, E8C10

8.3.5 Baud Rate and CW Signal Bandwidth

- E8C11, E8C12

8.3.6 Constellation Diagrams and Mesh Networks

- E8C13, E8C14, E8C15

8.4 Spread Spectrum Unveiled

8.4.1 Spread Spectrum Techniques

- E8D01, E8D02, E8D03

8.4.2 Key Clicks and Parity Bits

- E8D04, E8D05, E8D06

8.4.3 AFSK Signals and Distortion

- E8D07, E8D08, E8D09

8.4.4 Baudot and ASCII Codes

- E8D10, E8D11

Chapter 9

SUBELEMENT E9 - ANTENNAS AND TRANSMISSION LINES

9.1 Antenna Essentials

9.1.1 Isotropic Radiators and Effective Radiated Power

- E9A01, E9A02, E9A03

9.1.2 Feed Point Impedance and Ground Gain

- E9A04, E9A05

9.1.3 Antenna Efficiency and Ground Losses

- E9A06, E9A07, E9A09, E9A10, E9A11

9.1.4 Gain Comparison and Fresnel Zones

- E9A08, E9A12

9.2 Antenna Patterns Unveiled

9.2.1 Beamwidth and Front-to-Back Ratio

- E9B01, E9B02, E9B03, E9B04

9.2.2 Elevation Patterns and Far Field

- E9B05, E9B06, E9B07, E9B08

9.2.3 Method of Moments Analysis

- E9B09, E9B10, E9B11

9.3 Antenna Patterns and Impedances

9.3.1 Radiation Patterns of Vertical Antennas

- E9C01, E9C02, E9C03

9.3.2 Long Wire and Off-Center-Fed Dipoles

- E9C04, E9C05

9.3.3 Terminated Rhombic and Folded Dipoles

- E9C06, E9C07, E9C08

9.3.4 G5RV and Zepp Antennas

- E9C09, E9C10

9.3.5 Extended Double Zepp and Polarization Effects

- E9C11, E9C12, E9C13, E9C14

9.4 Antenna Insights

9.4.1 Parabolic Reflectors and Circular Polarization

- E9D01, E9D02

9.4.2 Loading Coils and Electrically Short Antennas

- E9D03, E9D04, E9D05, E9D06, E9D07, E9D08, E9D09, E9D10

9.4.3 Yagi Antennas and Radiation Resistance

- E9D11, E9D12

9.5 Matching Antenna Mechanics

9.5.1 Gamma and Beta Matches

- E9E01, E9E02, E9E03, E9E04, E9E05

9.5.2 Q-Section and Wilkinson Divider

- E9E06, E9E07, E9E08

9.5.3 Shunt Feeding and Phasing Lines

- E9E09, E9E11

9.6 Transmission Line Essentials

9.6.1 Velocity Factor and Electrical Length

- E9F01, E9F02, E9F03

9.6.2 Transmission Line Impedance

- E9F04, E9F05, E9F06, E9F07, E9F08, E9F09, E9F10, E9F11, E9F12

9.7 Charting Impedances

9.7.1 Smith Chart Basics

- E9G01, E9G02, E9G03, E9G04, E9G05

9.7.2 Smith Chart Components

- E9G06, E9G07, E9G08, E9G09, E9G10, E9G11

9.8 Essential Antenna Design Insights

9.8.1 Beverage Antennas and Directivity

- E9H01, E9H02, E9H03, E9H06, E9H07

9.8.2 Small-Loop and Sense Antennas

- E9H04, E9H05, E9H08

9.8.3 Cardioid Patterns and Loop Antennas

- E9H09, E9H10, E9H11

Chapter 10

SUBELEMENT E0 - SAFETY

10.1 Related Principles

10.1.1 Grounding and RF Exposure

- E0A01, E0A02, E0A03, E0A04

10.1.2 Microwave Hazards and MPE Limits

- E0A05, E0A06

10.1.3 Tower Safety and SAR

- E0A07, E0A08

10.1.4 RF Exposure Evaluations

- E0A09, E0A10

10.1.5 Climbing Safety

- E0A11, E0A12