IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tentative Table of Contents for D0.1 | | | | |
| Date: 2020-09-21 | | | | |
| Author: | | | | |
| Name | Affiliation | Address | Phone | Email |
| Edward Au | Huawei Technologies | 303 Terry Fox Drive, Suite 400, Ottawa, Ontario K2K 3J1 |  |  |

##### This submission presents a tentative table of contents for D0.1.

Contents

Contents 7

List of Figures 15

List of Tables 17

Editorial Notes 19

3. Definitions, acronyms, and abbreviations 21

3.1 Definitions 21

3.2 Definitions specific to IEEE 802.11 21

3.4 Abbreviations and acronyms 21

4. General description 23

4.3 Components of the IEEE Std 802.11 architecture 23

4.3.15bExtremely high throughput (EHT) STA 23

4.3.19 Wireless network management 23

4.3.19.2 BSS max idle period management 23

4.3.19.23aMLD max idle period management 23

4.5 Overview of the services 23

4.5.3 Connectivity-related services 23

4.5.3.1 General 23

4.5.3.2 Mobility types 23

4.5.3.3 Association 24

4.5.3.4 Reassociation 25

4.5.3.5 Disassociation 26

4.5.10a NS/EP priority access 26

6. Layer management 29

6.3 MLME SAP interface 29

6.3.7 Associate 29

6.3.7.3 MLME-ASSOCIATE.confirm 29

6.3.7.3.2Semantics of the service primitive 29

6.3.7.5 MLME-ASSOCIATE.response 29

6.3.7.5.2Semantics of the service primitive 29

6.3.8.3 MLME-REASSOCIATE.confirm 30

6.3.8.3.2Semantics of the service primitive 30

6.3.8.5 MLME-REASSOCIATE.response 30

6.3.8.5.2Semantics of the service primitive 30

9. Frame formats 31

9.2 MAC frame formats 31

9.3 Format of individual frame types 31

9.3.1 Control frames 31

9.3.1.2 RTS frame format 31

9.3.1.5 PS-Poll frame format 31

9.3.1.5.1General 31

9.3.1.6 CF-End frame format 31

9.3.1.7 BlockAckReq frame format 32

9.3.1.7.1Overview 32

9.3.1.8 BlockAck frame format 32

9.3.1.8.2Compressed BlockAck variant 32

9.3.1.8.7Multi-STA BlockAck variant 33

9.3.1.19 VHT/HE/EHT NDP Announcement frame format 34

9.3.1.22 Trigger frame format 35

9.3.1.22.1General 35

9.3.3 (PV0) Management frames 35

9.3.3.2 Beacon frame format 35

9.3.3.5 Association Request frame format 35

9.3.3.6 Association Response frame format 35

9.3.3.7 Reassociation Request frame format 36

9.3.3.8 Reassociation Response frame format 36

9.3.3.9 Probe Request frame format 36

9.3.3.10 Probe Response frame format 36

9.4 Management and Extension frame body components 37

9.4.1 Fields that are not elements 37

9.4.1.5 Current AP Address field 37

9.4.1.9 Status Code field 37

9.4.1.11 Action field 37

9.4.2 Elements 37

9.4.2.1 General 37

9.4.2.5 TIM element 38

9.4.2.5.1General 38

9.4.2.6 Extended Capabilities element 39

9.4.2.61 Link Identifier element 39

9.4.2.139 ADDBA Extension element 40

9.4.2.170 Reduced Neighbor Report element 41

9.4.2.170.2Neighbor AP Information field ………………………………... 41

9.4.2.240 Non-Inheritance element ……………………………………………………43

9.4.2.247aEHT Operation element 43

9.4.2.247bMulti-Link element 43

9.6.34a NS/EP Priority Access Action frame details 45

9.6.34a.1 General 45

9.6.34a.2 NS/EP Priority Access Request frame format 45

9.6.34a.3 NS/EP Priority Access Response frame format 46

10. MAC sublayer functional description 47

10.3 DCF 47

10.3.2 Procedures common to the DCF and EDCAF 47

10.3.2.9 CTS and DMG CTS procedure 47

10.25Block acknowledgment (block ack) 49

10.25.2Setup and modification of the block ack parameters 49

10.66aPriority Access support for NS/EP services 50

11. MLME 51

11.1 Synchronization 51

11.1.3 Maintaining synchronization 51

11.1.3.8 Multiple BSSID procedure 51

11.1.3.8.1General 51

11.2 Power management 51

11.2.3 Power management in a non-DMG infrastructure network 51

11.2.3.5 Power management with APSD 51

11.2.3.5.1Power management with APSD procedures 51

11.3 STA/MLD authentication and association 51

11.3.1 State variables 51

11.3.2 State transition diagram for nonmesh STAs or MLDs 52

11.3.3 Frame filtering based on STA or MLD state 53

11.3.4 Authentication and deauthentication 55

11.3.4.1 General 55

11.3.4.2 Authentication—originating STA or MLD 55

11.3.4.3 Authentication—destination STA or MLD 56

11.3.4.4 Deauthentication—originating STA or MLD 56

11.3.4.5 Deauthentication—destination STA or MLD 57

11.3.5 Association, reassociation, and disassociation

58

11.3.5.1 General 58

11.3.5.2 Non-AP and non-PCP STA association initiation procedures 58

11.3.5.3 AP or PCP association receipt procedures 60

11.3.5.4 Non-AP and non-PCP STA reassociation initiation procedures 62

11.3.5.5 AP or PCP reassociation receipt procedures 65

11.3.5.6 Non-AP and non-PCP STA disassociation initiation procedures 67

11.3.5.7 Non-AP and non-PCP STA disassociation receipt procedure 68

11.3.5.8 AP or PCP disassociation initiation procedure 68

11.3.5.9 AP or PCP disassociation receipt procedure 69

11.21Wireless network management procedures 69

11.21.13BSS max idle period management 69

12. Security 71

12.3 Pre-RSNA security methods 71

12.3.3 Pre-RSNA authentication 71

12.3.3.1 Overview 71

12.3.3.2 Open System authentication 71

12.3.3.2.1General 71

12.4 Authentication using a password 72

12.4.1 SAE overview 72

12.4.3 Representation of a password 73

12.4.4 Finite cyclic groups 73

12.4.4.1 General 73

12.4.4.2 Elliptic curve cryptography (ECC) groups 74

12.4.4.2.3 Hash-to-curve generation of the password element with ECC groups 74

12.4.4.3 Finite field cryptography (FFC) groups 74

12.4.4.3.3Direct Generation of the password element with FFC groups 74

12.4.5 SAE protocol 74

12.4.5.2 PWE and secret generation 74

12.4.5.4 Processing of a peer’s SAE Commit message 75

12.4.6 Anti-clogging tokens 76

12.4.8 SAE finite state machine 76

12.4.8.3 Events and output 76

12.4.8.3.1Parent process events and output 76

12.5 RSNA confidentiality and integrity protocols 76

12.5.3 CTR with CBC-MAC protocol (CCMP) 76

12.5.3.3 CCMP cryptographic encapsulation 76

12.5.3.3.2PN processing 76

12.5.3.3.7CCM originator processing 76

12.5.5 GCM protocol (GCMP) 77

12.5.5.1 GCMP overview 77

12.5.5.3 GCMP cryptographic encapsulation 77

12.5.5.3.6GCM originator processing 77

12.6 RSNA security association management 77

12.6.1 Security associations 77

12.6.1.1 Security association definitions 77

12.6.1.1.2PMKSA 77

12.6.1.1.6PTKSA 77

12.7 Keys and key distribution 78

12.7.1 Key hierarchy 78

12.7.1.1 General 78

12.7.1.3 Pairwise key hierarchy 78

12.7.2 EAPOL-Key frames 79

12.7.5 Nonce generation 81

12.7.6 4-way handshake 81

12.7.6.4 4-way handshake message 3 81

26. High efficiency (HE) MAC specification 83

26.17HE BSS operation 83

26.17.7Co-hosted BSSID set

83

33. Extremely high throughput (EHT) MAC specification 85

33.1 Introduction 85

33.2 Channel access 85

33.2.1 TXOP 85

33.2.1.1 Bandwidth signaling 85

33.2.1.2 Preamble Puncturing ………………………………………………………...85

33.2.1.2.1General ……………………………………………………………85

33.2.1.2.2EHT\_INACTIVE\_SUBCHANNELS …………………………….85

33.3 EHT BSS operation 85

33.3.1 EHT BSS 6 GHz operation 85

33.4 Multi-link operation 85

33.4.1 General 85

33.4.2 Multi-link device addressing 85

33.4.3 Discovery of an AP MLD 86

33.4.3.1 AP behavior 86

33.4.3.2 MLD probing 87

33.4.3.3 Multi-link element usage rules in the context of discovery 87

33.4.4 Multi-link (re)setup 87

33.4.4.1 Container for Multi-link Information 87

33.4.4.1.1General 87

33.4.4.1.2Complete or partial per-STA profile 87

33.4.4.1.3Inheritance in a per-STA profile 87

33.4.4.2 Multi-link (re)setup procedure 88

33.4.4.3 Multi-link security 89

33.4.4.4 Multi-link tear down procedure 89

33.4.4.5 Usage and Rules of Multi-link element in the context of multi-link setup 89

33.4.5 Link management 90

33.4.5.1 TID-to-link mapping 90

33.4.5.1.1General 90

33.4.5.1.2Default mapping mode 91

33.4.5.1.3Negotiation of TID-to-link mapping 91

33.4.5.1.4Power state after enablement 91

33.4.5.1.5Use of More Data subfield by an MLD 91

33.4.5.2 Dynamic link transitions 91

33.4.5.3 Multi-link retransmit procedures 92

33.4.6 Multi-link block ack 92

33.4.6.1 Multi-link BlockAck procedure 92

33.4.6.1.1General 92

33.4.6.2 EHT acknowledgment procedure 93

33.4.6.2.1Overview 93

33.4.6.2.2Negotiation of block ack bitmap lengths 94

33.4.7 Multi-link power management 94

33.4.7.1 General 94

33.4.7.2 Basic BSS operation 95

33.4.7.3 MLD max idle period management 95

33.4.7.4 BSS parameter critical update procedure 96

33.4.7.5 Traffic indication 96

33.4.8 Multi-link device individual addressed data delivery without BA negotiation 96

33.4.8.1 General 96

33.4.8.2 Transmitter requirements 96

33.4.8.3 Receiver requirements 96

33.4.9 Multi-link group addressed frame delivery 97

33.4.9.1 Beacon transmission 97

33.4.9.2 Group addressed management frame 97

33.4.9.3 Group addressed data frame 97

33.4.10Multi-link channel access 97

33.4.10.1 General 97

33.4.10.2 Simultaneous transmission and reception (STR) 97

33.4.10.3 Nonsimultaneous transmission and reception (NSTR) 98

33.4.10.4 Capability signaling 98

33.4.10.5 PPDU end time alignment 98

33.4.11Setting TXVECTOR parameters for an EHT PPDU 100

33.4.11.1 STA\_ID 100

33.4.12Enhanced multi-link single radio operation 100

33.4.13Enhanced multi-link multi-radio operation 100

33.4.14NSTR Soft AP MLD operation 100

33.4.14.1 General 100

33.4.15Multi-BSSID 100

33.5 Multi-AP operation 101

33.5.1 Introduction 101

33.5.2 Setup 101

33.5.3 Channel sounding 101

33.5.4 Coordinated transmission 101

34. Extremely high throughput (EHT) PHY specification 103

34.1 Introduction 103

34.1.1 Introduction to the EHT PHY 103

34.1.2 Scope 108

34.1.3 EHT PHY functions 108

34.1.3.1 General 108

34.1.3.2 PHY management entity (PLME) 108

34.1.3.3 Service specification method 108

34.1.4 PPDU formats 108

34.2 EHT PHY service interface 109

34.2.1 Introduction 109

34.2.2 TXVECTOR and RXVECTOR parameters 109

34.2.3 TRIGVECTOR parameters 118

34.2.4 PHY CONFIG\_VECTOR 118

34.2.5 Effect of CH\_BANDWIDTH parameter on PPDU format 119

34.2.6 Support for non-HT, HT, VHT, and HE formats 119

34.2.6.1 General 119

34.2.6.2 Support for non-HT format 120

34.2.6.3 Support for HT format 122

34.2.6.4 Support for VHT format 123

34.2.6.5 Support for HE format 123

34.3 EHT PHY 124

34.3.1 Introduction 124

34.3.2 Subcarrier and resource allocation 124

34.3.2.1 General 124

34.3.2.2 Subcarriers and resource allocation for wideband 124

34.3.2.3 Support of wide bandwidth OFDM operation 131

34.3.2.4 Subcarriers and resource allocation for multiple RUs 133

34.3.2.4.1General 133

34.3.2.4.2Small size multiple RUs 133

34.3.2.4.3Large size multiple RUs 133

34.3.2.5 Pilot subcarriers

133

34.3.3 MU-MIMO 133

34.3.3.1 DL MU-MIMO 133

34.3.3.1.1Supported RU sizes in DL MU-MIMO 133

34.3.3.1.2Maximum number of spatial streams in an EHT MU PPDU 133

34.3.3.2 UL MU-MIMO 133

34.3.3.2.1Introduction 133

34.3.3.2.2Supported RU sizes in UL MU-MIMO 133

34.3.3.2.3UL MU-MIMO EHT-LTF mode 134

34.3.3.2.4Maximum number of spatial streams in UL MU-MIMO 134

34.3.3.3 Maximum number of users in MU-MIMO 134

34.3.4 EHT PPDU formats 134

34.3.5 Transmitter block diagram 136

34.3.6 Overview of the PPDU encoding process 142

34.3.6.1 General 142

34.3.6.2 Construction of L-STF 142

34.3.6.3 Construction of L-LTF 142

34.3.6.4 Construction of L-SIG 142

34.3.6.5 Construction of RL-SIG 143

34.3.6.6 Construction of U-SIG 144

34.3.6.7 Construction of EHT-SIG 144

34.3.6.8 Construction of EHT-STF 144

34.3.6.9 Construction of EHT-LTF 144

34.3.6.10 Construction of Data field in an EHT PPDU 144

34.3.7 EHT modulation and coding schemes (EHT-MCSs) 144

34.3.8 EHT-SIG modulation and coding schemes (EHT-SIG-MCSs)

144

34.3.9 Timing-related parameters 144

34.3.10Mathematical description of signals 151

34.3.10.1 Notation 151

34.3.10.2 Subcarrier indices in use 152

34.3.10.3 Channel frequencies 152

34.3.10.4 Transmitted signal 154

34.3.11EHT preamble 162

34.3.11.1 Introduction 162

34.3.11.2 Cyclic shift 162

34.3.11.2.1Cyclic shift for pre-EHT modulated fields 162

34.3.11.2.2Cyclic shift for EHT modulated fields 162

34.3.11.3 L-STF 162

34.3.11.4 L-LTF 163

34.3.11.5 L-SIG 164

34.3.11.6 RL-SIG 166

34.3.11.7 U-SIG 166

34.3.11.7.1General 166

34.3.11.7.2Content 166

34.3.11.7.3CRC computation 168

34.3.11.7.4Encoding and modulation 169

34.3.11.8 EHT-SIG 170

34.3.11.8.1General 170

34.3.11.8.2EHT-SIG content channels 170

34.3.11.8.3Comment field for noncompressed mode 171

34.3.11.8.4Comment field for compressed mode 176

34.3.11.8.5User Specific field 176

34.3.11.8.6Encoding and modulation 185

34.3.11.9 EHT-STF 190

34.3.11.10EHT-LTF 194

34.3.11.11Preamble punctured EHT PPDU 194

34.3.11.11.1General 194

34.3.11.11.2Preamble puncturing for PPDUs transmitted to a single user (TBD) 194

34.3.11.11.3 Preamble puncturing for PPDUs transmitted to multiple users (TBD) 195

34.3.12Data field 195

34.3.12.1 SERVICE field 195

34.3.12.2 EHT PHY DATA scrambler and descrambler 195

34.3.12.3 Coding 196

34.3.12.3.1General 196

34.3.12.3.2BCC coding 196

34.3.12.3.3LDPC coding 196

34.3.12.3.4EHT PPDU padding process 196

34.3.12.3.5Encoding process for an EHT MU PPDU 197

34.3.12.3.6Encoding process for an EHT TB PPDU 201

34.3.12.4 Segment parser 202

34.3.12.5 BCC interleavers 206

34.3.12.6 LDPC tone mapper 207

34.3.12.7 Constellation mapping 209

34.3.12.8 Pilot subcarriers 212

34.3.12.9 OFDM modulation 217

34.3.13Packet extension 217

34.3.14Transmit requirements for PPDUs sent in response to a triggering frame 221

34.3.15Beamforming 221

34.3.15.1 General 221

34.3.15.2 EHT beamforming feedback matrix V 222

34.3.15.3 EHT CQI feedback 223

34.3.16EHT Sounding NDP 223

34.3.17Transmit specification 223

34.3.17.1 Transmit spectral mask 223

34.3.17.1.1General 226

34.3.17.1.2Additional restrictions for preamble puncturing 226

34.3.17.2 Spectral flatness 226

34.3.17.3 Transmit center frequency and symbol clock frequency tolerance 226

34.3.17.4 Modulation accuracy 227

34.3.17.4.1Introduction to modulation accuracy tests 227

34.3.17.4.2Transmit center frequency leakage 227

34.3.17.4.3Transmitter constellation error 227

34.3.17.4.4Transmitter modulation accuracy (EVM) test 228

34.3.18Receiver specification 235

34.3.18.1 General 235

34.3.18.2 Receiver minimum input sensitivity 236

34.3.18.3 Adjacent channel rejection 236

34.3.18.4 Nonadjacent channel rejection 238

34.3.18.5 Receiver maximum input level 239

34.3.19EHT transmit procedure 239

34.3.20EHT receive procedure 239

34.3.21Channel numbering 239

34.3.22Regulatory requirements 239

34.4 EHT PLME 240

34.4.1 PLME\_SAP sublayer management primitives 240

34.4.2 PHY MIB 244

34.4.3 TXTIME and PSDU\_LENGTH calculation 245

34.4.4 EHT PHY 248

34.5 Parameters for EHT-MCSs 248

Annex B 265

B.4

PICS proforma—IEEE Std 802.11-<year> 265

Annex C 267

C.3

MIB Detail 267

Annex E 269

E.1

Country information and operating classes 269

Annex AA 271

AA.1

Introduction 271

AA.2 Examples illustrating the relationship between profile periodicity and DTIM interval 271