



**IEEE Standard for
Local and metropolitan area networks**

Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems

**Amendment 2: Physical and Medium Access
Control Layers for Combined Fixed and Mobile
Operation in Licensed Bands**

and

Corrigendum 1

**IEEE Computer Society
and the
IEEE Microwave Theory and Techniques Society**

Sponsored by the
LAN/MAN Standards Committee

IEEE
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IEEE Std 802.16™-2004/Cor1-2005**
(Amendment and Corrigendum to
IEEE Std 802.16-2004)

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IEEE-SA Standards Board

Abstract: This document updates and expands IEEE Std 802.16-2004 to allow for mobile subscriber stations.

Keywords: fixed broadband wireless access network, metropolitan area network, microwave, mobile broadband wireless access network, WirelessMAN® standards

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Introduction

This introduction is not part of IEEE Std 802.16e-2005 and IEEE Std 802.16-2004/Cor 1-2005, IEEE Standard for Local and Metropolitan Area Networks Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems—Amendment 2: Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands and Corrigendum.

This amendment updates and expands IEEE Std 802.16 to allow for mobile as well as fixed (stationary) subscriber stations. As of the publication date, the current applicable version of IEEE Std 802.16 is IEEE Std 802.16-2004, as amended by IEEE 802.16f-2005 and IEEE 802.16e-2005. The published amendment includes additional material developed not as part of the IEEE 802.16e project but instead as part of the corrigendum project IEEE 802.16-2004/Cor 1, applicable only to fixed systems. Because the work was completed at nearly the same time, the two approved documents were merged prior to publication. Additional standards projects to further develop IEEE Std 802.16 are underway.

Conformance test methodology

The multipart conformance test documents for IEEE Std 802.16 by "IEEE Standard 802.16/ConformanceXX". For example, the first part of the conformance specification for IEEE 802.16 is designated "IEEE Standard 802.16/Conformance01."

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Contents

1.Overview.....	1
1.1 Scope.....	1
1.2 Purpose.....	2
1.3 Frequency bands	2
1.3.3 License-exempt frequencies below 11 GHz (primarily 5–6 GHz)	2
1.3.4 Air interface nomenclature and PHY compliance	3
1.4 Reference model	3
1.4.1 Handover process.....	3
2.References.....	5
3.Definitions	7
4.Abbreviations and acronyms	11
5.Service-specific CS.....	13
5.1 ATM CS.....	13
5.1.2 Data/Control plane	13
5.1.2.2 Classification	13
5.1.2.2.1 VP-switched mode.....	13
5.1.2.2.2 VC-switched mode	13
5.2 Packet CS.....	13
5.2.2 Classification	13
5.2.3 PHS	13
5.2.3.1 PHS operation	13
5.2.3.2 PHS signaling	14
5.2.4 IEEE Std 802.3/Ethernet-specific part.....	14
5.2.4.1 IEEE Std 802.3/Ethernet CS PDU format	14
5.2.4.2 IEEE Std 802.3/Ethernet CS classifiers.....	14
5.2.5 IEEE Std 802.1Q-19982003 virtual local area network (VLAN) specific part.....	15
5.2.5.1 IEEE Std 802.1Q-19982003 VLAN CS PDU format.....	15
5.2.5.2 IEEE Std 802.1Q-19982003 CS classifiers	15
5.2.6 IP specific part	15
5.2.6.1 IP CS PDU format	15
5.2.7 IP-Header-compression-specific part	15
5.2.7.1 Compressed-IP-Header CS PDU	16
5.2.7.2 Compressed-IP-Header classifiers.....	16
6.MAC common part sublayer.....	17
6.1 PMP	17
6.3 Data/Control plane	17
6.3.1 Addressing and connections	17
6.3.1.1 PMP	17
6.3.2 MAC PDU formats	18
6.3.2.1 MAC header formats	18
6.3.2.1.1 Generic MAC header.....	19
6.3.2.1.2 MAC header without payload.....	21
6.3.2.2 MAC subheaders and special payloads	36
6.3.2.2.2 Grant Management subheader	37
6.3.2.2.3 Packing subheader	38

6.3.2.2.4	ARQ feedback.....	38
6.3.2.2.6	FAST-FEEDBACK allocation subheader	38
6.3.2.2.7	Extended subheader format	38
6.3.2.3	MAC Mmanagement messages	44
6.3.2.3.1	Downlink Channel Descriptor (DCD) message.....	47
6.3.2.3.2	Downlink map (DL-MAP) message	47
6.3.2.3.4	Uplink map (UL-MAP) message.....	49
6.3.2.3.5	Ranging request (RNG-REQ) message	50
6.3.2.3.6	Ranging Response (RNG-RSP) message	53
6.3.2.3.7	Registration request (REG-REQ) message.....	55
6.3.2.3.8	Registration Response (REG-RSP) message.....	56
6.3.2.3.9	Privacy key management (PKM) messages (PKM-REQ/PKM-RSP).....	58
6.3.2.3.10	DSA-REQ message.....	72
6.3.2.3.11	DSA-RSP message	72
6.3.2.3.12	DSA-ACK message	73
6.3.2.3.13	DSC Request (DSC-REQ) message	74
6.3.2.3.14	DSC Response (DSC-RSP) message.....	74
6.3.2.3.15	DSC Acknowledge (DSC-ACK) message.....	74
6.3.2.3.16	DSD-REQ message.....	74
6.3.2.3.17	DSD-RSP message	75
6.3.2.3.20	Downlink Burst Profile Change Request (DBPC-REQ) message.....	75
6.3.2.3.21	Downlink Burst Profile Change Response (DBPC-RSP) message	75
6.3.2.3.22	Reset Command (RES-CMD) message.....	75
6.3.2.3.23	SS basic capability request (SBC-REQ) message	75
6.3.2.3.24	SS basic capability response (SBC-RSP) message.....	76
6.3.2.3.26	De/Re-register command (DREG-CMD) message.....	76
6.3.2.3.28	Config File TFTP Complete (TFTP-CPLT) message.....	78
6.3.2.3.32	ARQ Reset message.....	78
6.3.2.3.33	Channel measurement Report Request/Response (REP-REQ/RSP)	79
6.3.2.3.34	Fast Power Control (FPC) message	80
6.3.2.3.41	AAS Beam Select message.....	80
6.3.2.3.42	SS De-registration Request (DREG-REQ) message	80
6.3.2.3.43	H-ARQ HARQ MAP message	82
6.3.2.3.44	Sleep Request message (MOB_SLP-REQ)	112
6.3.2.3.45	Sleep Response message (MOB_SLP-RSP).....	114
6.3.2.3.46	Traffic Indication message (MOB_TRF-IND)	118
6.3.2.3.47	Neighbor Advertisement (MOB_NBR-ADV) message	120
6.3.2.3.48	Scanning Interval Allocation Request (MOB_SCN-REQ) message.....	126
6.3.2.3.49	Scanning Interval Allocation Response (MOB_SCN-RSP) message	128
6.3.2.3.50	Scanning Result Report (MOB_SCN-REP) message.....	131
6.3.2.3.51	Association Result Report (MOB_ASC-REP) message.....	135
6.3.2.3.52	BS HO Request (MOB_BSHO-REQ) message.....	137
6.3.2.3.53	MS HO Request (MOB_MSHO-REQ) message.....	145
6.3.2.3.54	BS HO Response (MOB_BSHO-RSP) message.....	149
6.3.2.3.55	HO Indication (MOB_HO-IND) message.....	157
6.3.2.3.56	BS Broadcast Paging (MOB_PAG-ADV) message	160
6.3.2.3.57	Multicast Broadcast Service Map (MBS_MAP) message.....	161
6.3.2.3.58	Power control mode change request (PMC_REQ) message	166
6.3.2.3.59	Power control mode change response (PMC_RSP) message.....	167
6.3.2.3.60	OFDMA Sub downlink/uplink map (SUB-DL-UL-MAP) message	169
6.3.2.3.61	MIMO precoding setup/tear-down	172
6.3.3	Construction and transmission of MAC PDUs.....	172
6.3.3.3	Fragmentation	172
6.3.3.3.1	Non-ARQ Connections.....	173

6.3.3.4	Packing.....	173
6.3.3.4.2	Packing for ARQ-enabled connections.....	173
6.3.3.5	CRC calculation.....	173
6.3.3.5.1	CRC32 calculation for SC, SCa, and OFDM mode	173
6.3.3.5.2	CRC32 calculation for OFDMA mode.....	174
6.3.4	ARQ mechanism.....	175
6.3.4.2	ARQ Feedback IE format	175
6.3.4.3	ARQ parameters	176
6.3.4.3.4	ARQ_RETRY_TIMEOUT	176
6.3.4.6	ARQ operation.....	176
6.3.4.6.2	Transmitter state machine.....	176
6.3.4.6.3	Receiver state machine	179
6.3.5	Scheduling services.....	179
6.3.5.2	Uplink request/grant scheduling	182
6.3.5.2.1	UGS	182
6.3.5.2.2	rtPS.....	183
6.3.5.2.3	nrtPS.....	184
6.3.5.2.4	BE service	184
6.3.6	Bandwidth allocation and request mechanisms	184
6.3.6.1	Requests	184
6.3.6.3	Polling.....	185
6.3.6.3.1	Unicast	185
6.3.7	MAC support of PHY	185
6.3.7.4	UL-MAP	185
6.3.7.4.3	Uplink interval definition.....	185
6.3.7.5	Map relevance and synchronization	185
6.3.7.5.3	WirelessMAN-OFDM PHY	186
6.3.7.6	Optional MAC AAS Ssupport of WirelessMAN-SCa, OFDM, and OFDMA.....	186
6.3.7.6.1	AAS MAC services	186
6.3.7.6.4	Alerting the BS about presence of a new SS in an AAS system	186
6.3.8	Contention resolution.....	186
6.3.9	Network entry and initialization	186
6.3.9.1	Scanning and synchronization to the downlink	187
6.3.9.2	Obtain downlink parameters.....	187
6.3.9.3	Obtain uplink parameters.....	187
6.3.9.5	Initial ranging and automatic adjustments	188
6.3.9.5.1	Contention-based Initial ranging and automatic adjustments.....	188
6.3.9.6	Ranging parameter adjustment	189
6.3.9.7	Negotiate basic capabilities	192
6.3.9.8	SS authorization and key exchange	193
6.3.9.9	Registration.....	194
6.3.9.10	Establish IP connectivity	194
6.3.9.15	Forcing MSs to perform Network Entry at once	195
6.3.10	Ranging	195
6.3.10.1	Downlink burst profile management	195
6.3.10.2	Uplink periodic ranging	198
6.3.10.3	OFDMA-based ranging	200
6.3.10.3.1	Contention-based initial ranging and automatic adjustments	201
6.3.10.3.2	Periodic ranging and automatic adjustments	207
6.3.10.3.3	CDMA handover ranging and automatic adjustment	208
6.3.13	Establishment of multicast and broadcast transport connections	209
6.3.14	QoS	209
6.3.14.1	Theory of operation	209
6.3.14.2	Service flows.....	209

6.3.14.3	Object model.....	209
6.3.14.4	Service classes	211
6.3.14.4.1	Global service flows	211
6.3.14.7	Service Flow Creation	214
6.3.14.7.1	Dynamic service flow creation	214
6.3.14.9	Service flow management.....	214
6.3.14.9.2	Dynamic Service Flow state transitions.....	214
6.3.14.9.3	DSA	214
6.3.14.9.4	DSC.....	214
6.3.14.9.5	Connection release.....	215
6.3.15	DFS for license-exempt operation Procedures for shared frequency band usage	215
6.3.15.1	Introduction.....	215
6.3.15.2	Testing channels for primary other users (including specific spectrum users).....	216
6.3.15.3	Discontinuing operations after detecting primary specific spectrum users	217
6.3.15.4	Detecting primary specific spectrum users	217
6.3.15.5	Scheduling for channel testing.....	217
6.3.15.6	Requesting and reporting of measurements.....	217
6.3.15.7	Selecting and advertising a new channel	218
6.3.17	MAC support for H-ARQ HARQ.....	218
6.3.17.1	Subpacket generation.....	220
6.3.17.2	DL/UL ACK/NAK signaling.....	221
6.3.17.3	H-ARQ HARQ parameter signaling.....	221
6.3.18	DL CINR report operation	221
6.3.18.1	DL CINR report with REP-RSP MAC message	221
6.3.18.2	Periodic CINR report with fast-feedback (CQICH) channel.....	222
6.3.19	optional Band AMC operations using 6-bit CQICH encoding	224
6.3.19.1	Call flows for mode transitions between normal subchannel and band AMC	224
6.3.19.2	Conditions of transition triggering.....	225
6.3.20	Data delivery services for mobile network	225
6.3.20.1	Types of data delivery services.....	225
6.3.20.1.1	Unsolicited grant service (UGS).....	226
6.3.20.1.2	Real-Time Variable Rate (RT-VR) service	226
6.3.20.1.3	Non-Real-Time Variable Rate (NRT-VR) service	227
6.3.20.1.4	Best Effort (BE) service.....	227
6.3.20.1.5	Extended Real-Time Variable Rate (ERT-VR) service.....	227
6.3.21	Sleep mode for mobility-supporting MS	228
6.3.21.1	Introduction.....	228
6.3.21.2	Power Saving Classes of type I.....	230
6.3.21.3	Power Saving Classes of type II	231
6.3.21.4	Power Saving Classes of type III	232
6.3.21.5	Periodic Ranging in sleep mode	233
6.3.21.6	MDHO/FBSS Diversity Set Maintenance in sleep mode.....	234
6.3.22	MAC layer handover procedures	234
6.3.22.1	Network topology acquisition.....	234
6.3.22.1.1	Network topology advertisement.....	234
6.3.22.1.2	MS scanning of neighbor BSs	234
6.3.22.1.3	Association procedure.....	236
6.3.22.2	HO process.....	238
6.3.22.2.1	Cell reselection	241
6.3.22.2.2	HO decision and initiation	241
6.3.22.2.3	HO cancellation	243
6.3.22.2.4	Use of scanning and association results.....	243
6.3.22.2.5	Termination with the Serving BS	243
6.3.22.2.6	Drops during HO	244

6.3.22.2.7	Network entry/re-entry	244
6.3.22.2.8	MS-Assisted coordination of DL transmission at Target BS for HO	246
6.3.22.2.9	HO process.....	247
6.3.22.3	Macro diversity handover and fast BS switching	250
6.3.22.3.1	MDHO decision and initiation.....	251
6.3.22.3.2	FBSS decision and initiation.....	252
6.3.22.3.3	Diversity Set update for MDHO/FBSS	253
6.3.22.3.4	Anchor BS update for MDHO/FBSS.....	254
6.3.22.3.5	MS-Assisted coordination of DL transmission at new Anchor BS	256
6.3.23	Multicast and broadcast services (MBS)	257
6.3.23.1	Single-BS Access.....	257
6.3.23.2	Multi-BS Access	257
6.3.23.2.1	Establishment and maintenance of multicast and broadcast services.....	258
6.3.23.2.2	Performance enhancement with macro diversity	259
6.3.23.2.3	Power saving operation.....	259
6.3.23.2.4	Multicast and broadcast zone (MBS_Zone)	259
6.3.24	MS Idle Mode (optional)	259
6.3.24.1	MS Idle Mode Initiation	261
6.3.24.2	Cell selection.....	262
6.3.24.3	MS Broadcast Paging Message time synchronization.....	262
6.3.24.4	MS Paging Unavailable Interval.....	262
6.3.24.5	MS Paging Listening Interval	262
6.3.24.6	BS Broadcast Paging message.....	263
6.3.24.7	Paging Availability Mode termination	264
6.3.24.7.1	MS side	264
6.3.24.7.2	BS side	265
6.3.24.8	Location Update.....	265
6.3.24.8.1	Location Update conditions	265
6.3.24.8.2	Location Update Process	266
6.3.24.9	Network Re-Entry from Idle Mode	267
7.	Security sublayer.....	269
7.1	Architecture	269
7.1.1	Packet data encryption Secure encapsulation of MPDUs.....	270
7.1.2	Key management protocol	270
7.1.3	Authentication protocol	271
7.1.3.1	PKM RSA authentication	271
7.1.3.2	PKM EAP authentication.....	272
7.2	PKM protocol	272
7.2.1	PKM Version 1	272
7.2.1.1	Security Associations.....	272
7.2.1.3	SS authorization and AK exchange overview	273
7.2.1.3.1	Authorization via RSA authentication protocol.....	273
7.2.1.4	TEK exchange overview.....	274
7.2.1.4.1	TEK exchange overview for PMP topology.....	274
7.2.1.4.2	TEK exchange overview for Mesh mode	274
7.2.1.5	Security capabilities selection.....	274
7.2.1.6	Authorization state machine	274
7.2.1.6.1	States.....	274
7.2.1.6.2	Messages.....	274
7.2.1.6.3	Events.....	274
7.2.1.6.4	Parameters.....	274
7.2.1.6.5	Actions	275

7.2.1.7	TEK state machine	275
7.2.1.7.1	States	275
7.2.1.7.2	Messages	275
7.2.1.7.3	Events	275
7.2.1.7.4	Parameters	275
7.2.1.7.5	Actions	275
7.2.2	PKM Version 2	275
7.2.2.1	TEK exchange overview for PMP topology	275
7.2.2.2	Key derivation	276
7.2.2.2.1	RSA-based authorization	276
7.2.2.2.2	EAP authentication	277
7.2.2.2.3	Authorization Key (AK) derivation	278
7.2.2.2.4	Key Encryption Key (KEK) derivation	279
7.2.2.2.5	Group Key Encryption Key (GKEK) derivation	279
7.2.2.2.6	Traffic Encryption Key (TEK)	279
7.2.2.2.7	Group Traffic Encryption Key (GTEK)	279
7.2.2.2.8	MBS Traffic Key (MTK)	279
7.2.2.2.9	Message authentication keys (HMAC/CMAC) and KEK derivation	280
7.2.2.2.10	Key hierarchy	280
7.2.2.2.11	Maintenance of PMK and AK	285
7.2.2.2.12	PKMv2 PMK and AK switching methods	285
7.2.2.3	Associations	285
7.2.2.3.1	Security associations	285
7.2.2.3.2	Group Security Association	286
7.2.2.3.3	MBS Group Security Association	286
7.2.2.4	Security context	286
7.2.2.4.1	AK context	287
7.2.2.4.2	GKEK context	288
7.2.2.4.3	PMK context	288
7.2.2.4.4	PAK context	289
7.2.2.5	TEK state machine	289
7.2.2.5.1	States	291
7.2.2.5.2	Messages	292
7.2.2.5.3	Events	292
7.2.2.5.4	Parameters	293
7.2.2.5.5	Actions	293
7.3	Key Usage	296
7.5	Cryptographic methods	297
7.5.1	Data Encryption methods	297
7.5.1.1	Data encryption with DES in CBC mode	297
7.5.1.2	Data encryption with AES in CCM mode	298
7.5.1.2.1	PDU Ppayload Fformat	298
7.5.1.2.2	PN (Packet Number)	298
7.5.1.2.3	CCM Aalgorithm	299
7.5.1.2.5	AES-CCM Mode example encrypted MPDUs	300
7.5.1.3	Data encryption with AES in CTR mode	301
7.5.1.3.1	Encrypted MBS PDU payload format	301
7.5.1.4	Data encryption with AES in CBC mode	302
7.5.1.4.1	CBC IV generation	302
7.5.1.2.4	Receive Processing Rules	304
7.5.2.4	Encryption of TEK-128 with AES Key Wrap	304
7.5.3	Calculation of HMAC-Digests	304
7.5.4	Derivation of TEKs, KEKs, and message authentication keys	304
7.5.4.2	3-DES KEKs	304

7.5.4.4	Cipher-based MAC (CMAC).....	305
7.5.4.4.1	Calculation of CMAC Value	305
7.5.4.5	Derivation of TEKs, KEKs, message authentication keys and GKEKs in PKMv2 ..	306
7.5.4.5.1	AES KEKs in PKMv2	306
7.5.4.5.2	Encryption of GKEK in PKMv2	306
7.5.4.6	Key derivation functions for PKMv2	308
7.5.4.6.1	Dot16KDF for PKMv2	308
7.6.1.4.3	BS certificate.....	309
7.6.1.6	tbsCertificate.issuerUniqueID and tbsCertificate.subjectUniqueID	309
7.7	Pre-Authentication	309
7.8	PKMv2.....	309
7.8.1	PKMv2 SA-TEK 3-way handshake.....	309
7.8.2	BS and SS RSA mutual authentication and AK exchange overview	311
7.8.3	Multicast Broadcast Service (MBS) support	312
7.8.3.1	MBS security associations	312
7.8.3.2	MBS Key Management	313
7.8.3.2.1	MBS Authorization Key (MAK) establishment	313
7.8.3.2.2	MGTEK establishment	313
7.8.3.2.3	MBS Traffic Key establishment	313
7.9	Optional multicast and broadcast rekeying algorithm (MBRA).....	313
7.9.1	MBRA flow	313
7.9.1.1	BS usage of GTEK	315
7.9.1.2	SS usage of GTEK	316
7.9.2	Messages.....	316
7.9.3	Encryption of GKEK	316
7.9.4	Message authentication keys for the Key Update Command message	316
8.PHY		317
8.1	WirelessMAN-SC PHY specification	317
8.1.3	Duplexing techniques and PHY Type parameter encodings	317
8.1.3.2	TDD operation	317
8.1.3.2.1	TTG.....	317
8.1.3.2.2	RTG	317
8.1.4	Downlink PHY	317
8.1.4.1	Downlink subframe.....	317
8.1.4.1.2	Frame control section.....	317
8.1.9	Channel quality measurements	317
8.1.9.2	RSSI mean and standard deviation	317
8.2	WirelessMAN-SCa PHY	318
8.2.1	Transmit processing	318
8.2.1.5	Duplex framing	318
8.2.1.5.1	FDD	318
8.2.1.5.2	TDD	318
8.2.1.8	Compressed FCH maps	319
8.2.1.8.2	Compressed UL-MAP	319
8.2.1.9	MAP message fields and IEs	319
8.2.1.9.3	UL-MAP IE formats	319
8.2.2	Channel quality measurements	319
8.2.2.2	RSSI mean and standard deviation	319
8.3	WirelessMAN-OFDM PHY Layer.....	320
8.3.2	OFDM symbol parameters and transmitted signal	320
8.3.2.4	Parameters of transmitted signal	320
8.3.3	Channel coding	320

8.3.3.1	Randomization	320
8.3.3.2	FEC	321
8.3.3.2.1	Concatenated Reed–Solomon-convolutional code (RS-CC)	321
8.3.3.4	Modulation	322
8.3.3.4.2	Pilot modulation	322
8.3.3.5	Example OFDM uplink RS-CC encoding	322
8.3.3.5.3	Subchannelization (1 subchannel)	322
8.3.3.6	Preamble structure and modulation	323
8.3.5	Frame structure	323
8.3.5.1	PMP	323
8.3.5.1.1	PMP DL subchannelization zone	327
8.3.5.2	PMP-AAS Zone	329
8.3.5.5	Burst Pprofile format	331
8.3.6	MAP message fields and IEs	331
8.3.6.2	DL-MAP IE format	331
8.3.6.2.1	DIUC allocations	332
8.3.6.2.3	Channel measurement IE format	332
8.3.6.2.8	DL-MAP dummy IE format	332
8.3.6.2.9	DL SUBCH_IE format	333
8.3.6.3	UL-MAP IE format	333
8.3.6.3.1	UIUC allocations	333
8.3.6.3.3	Subchannelized network entry IE	333
8.3.6.3.5	UL-MAP power control IE format	334
8.3.6.3.7	UL-MAP Physical Modifier IE	334
8.3.6.3.8	UL-MAP dummy IE format	334
8.3.6.3.9	Fast_Ranging_IE	335
8.3.6.3.10	UL-MAP Fast tracking information element	335
8.3.6.6	Compressed private maps	336
8.3.6.6.1	Compressed private DL-MAP	337
8.3.6.6.2	Compressed Private UL-MAP	338
8.3.6.7	Reduced private maps	339
8.3.6.7.1	Reduced private DL-MAP	340
8.3.6.7.2	Reduced private UL-MAP	342
8.3.7	Control mechanisms	343
8.3.7.2	Ranging	343
8.3.7.2.1	Initial Ranging in AAS systems	345
8.3.7.3	Bandwidth requesting	346
8.3.7.3.2	Full Contention transmission	346
8.3.7.4	Power control	347
8.3.7.4.1	Closed loop power control mode	347
8.3.7.4.2	Open Loop Power Control Mode (Optional)	347
8.3.8	Transmit diversity: Sspace-Ttime Ccoding (optional)	349
8.3.9	Channel quality measurements	349
8.3.9.2	RSSI mean and standard deviation	349
8.3.9.3	CINR mean and standard deviation	350
8.3.10	Transmitter requirements	350
8.3.10.1	Transmit power level control	350
8.3.10.2	Transmitter spectral flatness	350
8.3.11	Receiver requirements	351
8.3.11.1	Receiver sensitivity	351
8.3.11.2	Receiver adjacent and alternate channel rejection	352
8.3.12	Frequency and timing requirements	352
8.4	WirelessMAN-OFDMA PHY layer	353
8.4.1	Introduction	353

8.4.2	OFDMA symbol description, symbol parameters and transmitted signal	353
8.4.2.3	Primitive parameters	353
8.4.3	OFDMA basic terms definition	353
8.4.3.1	Slot and Ddata Rregion	353
8.4.3.4	OFDMA data mapping	354
8.4.4	Frame structure	356
8.4.4.2	PMP frame structure	356
8.4.4.3	DL Fframe Pprefix	358
8.4.4.4	Allocation of subchannels for FCH and DL-MAP, and logical subchannel numbering	361
8.4.4.5	Uplink transmission allocations	361
8.4.4.6	Optional Diversity-Map ScanAAS support	363
8.4.4.6.1	AAS frame structure	363
8.4.4.6.2	AAS-DLFP Format Optional Diversity-Map scan	364
8.4.4.6.3	AAS Diversity-Scan Map network entry procedure	367
8.4.4.6.4	AAS preambles	367
8.4.4.7	Optional Direct Signaling Method	370
8.4.5	Map message fields and IEs	370
8.4.5.3	DL-MAP IE format	370
8.4.5.3.1	DIUC allocation	372
8.4.5.3.2	DL-MAP extended IE format	373
8.4.5.3.3	AAS downlink IE format	374
8.4.5.3.4	Transmit diversity (TD)Space-Time Coding (STC)/DL_Zone switch IE format	376
8.4.5.3.6	Data location in another BS IE	379
8.4.5.3.7	CID Switch IE	380
8.4.5.3.8	MIMO DL basic IE format	380
8.4.5.3.9	MIMO DL Enhanced IE format	384
8.4.5.3.10	H-ARQ HARQ and Sub-MAP Pointer IE	386
8.4.5.3.11	DL-MAP Physical modifier IE	387
8.4.5.3.12	Multicast and Broadcast Service MAP IE (MBS_MAP_IE)	389
8.4.5.3.13	DL PUSC Burst Allocation in Other Segment IE	391
8.4.5.3.14	HO anchor active DL MAP IE	392
8.4.5.3.15	HO active anchor DL MAP IE	393
8.4.5.3.16	HO CID Translation MAP IE	394
8.4.5.3.17	MIMO in another BS IE	395
8.4.5.3.18	Macro-MIMO DL Basic IE format	396
8.4.5.3.19	UL noise and interference level IE format	397
8.4.5.3.20	Dedicated DL control IE	399
8.4.5.3.21	HARQ DL MAP IE	403
8.4.5.3.22	DL HARQ ACK IE	419
8.4.5.3.23	Enhanced DL MAP IE	420
8.4.5.3.24	Closed-loop MIMO DL enhanced IE format	421
8.4.5.3.25	Broadcast Control Pointer IE	423
8.4.5.3.26	AAS_SDMA_DL_IE format	424
8.4.5.3.27	PUSC ASCA Allocation	427
8.4.5.4	UL-MAP IE format	428
8.4.5.4.1	UIUC Allocation	430
8.4.5.4.2	PAPR reduction/Safety zone/Sounding zone allocation IE	431
8.4.5.4.3	CDMA allocation UL-MAP IE format	432
8.4.5.4.4	UL-MAP extended IE format	432
8.4.5.4.5	Power Control IE format	434
8.4.5.4.6	AAS uplink IE format	435
8.4.5.4.7	UL Zone switch IE format	436

8.4.5.4.8	Mini-subchannel allocation IE.....	437
8.4.5.4.9	FAST-FEEDBACK message mapping.....	438
8.4.5.4.10	FAST_FEEDBACK Fast-feedback channels	439
8.4.5.4.11	MIMO UL Basic IE format	466
8.4.5.4.12	CQICH Allocation IE Format.....	468
8.4.5.4.13	UL ACK channel	471
8.4.5.4.14	UL-MAP Physical Modifier IE.....	473
8.4.5.4.15	UL allocation start IE.....	475
8.4.5.4.16	CQICH Enhanced Allocation IE format.....	475
8.4.5.4.17	UL PUSC Burst Allocation in Other Segment IE.....	477
8.4.5.4.18	HO anchor active UL MAP IE	478
8.4.5.4.19	HO active anchor UL MAP IE	479
8.4.5.4.20	MIMO UL Enhanced IE format.....	479
8.4.5.4.21	OFDMA Fast_Ranging_IE format IE.....	480
8.4.5.4.22	UL-MAP_Fast_Tracking_IE	482
8.4.5.4.23	Anchor BS Switch IE.....	483
8.4.5.4.24	HARQ UL MAP IE	485
8.4.5.4.25	HARQ ACK Region Allocation IE	496
8.4.5.4.26	UL_Sounding_Command_IE	497
8.4.5.4.27	AAS_SDMA_UL_IE format	498
8.4.5.4.28	Feedback polling IE.....	500
8.4.5.5	Burst profile format	502
8.4.5.6	Compressed maps	503
8.4.5.6.1	Compressed DL-MAP	504
8.4.5.6.2	Compressed UL-MAP	505
8.4.5.7	AAS-FBCK-REQ/RSP message bodies	505
8.4.5.8	Reduced AAS private maps	506
8.4.5.8.1	Reduced AAS private DL-MAP	506
8.4.5.8.2	Reduced AAS private UL-MAP	510
8.4.6	OFDMA subcarrier allocations.....	513
8.4.6.1	Downlink	513
8.4.6.1.1	Preamble	513
8.4.6.1.2	Symbol structure	527
8.4.6.2	Uplink	539
8.4.6.2.1	Symbol structure for subchannel (PUSC).....	541
8.4.6.2.2	Partitioning of subcarriers into subchannels in the uplink.....	541
8.4.6.2.3	Uplink permutation example	542
8.4.6.2.4	Partition a subchannel to mini-subchannels.....	542
8.4.6.2.5	Additional optional symbol structure for PUSC.....	543
8.4.6.2.6	Data subchannel rotation scheme	546
8.4.6.2.7	Optional uplink channel sounding in TDD systems	547
8.4.6.3	Optional adjacent subcarrier permutations for AAS and AMC.....	557
8.4.6.3.1	AMC optional permutation	560
8.4.6.3.2	Band-AMC operation in normal DL/UL-MAP	562
8.4.6.3.3	AMC support for SDMA	563
8.4.6.4	Optional permutations for PUSC.....	564
8.4.6.4.1	Optional permutation for PUSC adjacent subcarrier allocation (PUSC-ASCA).....	564
8.4.6.4.1.2	Allocation using distributed clusters.....	566
8.4.6.4.1.2.1	Allocation of subcarriers to subchannels.....	566
8.4.6.8	Optional reduced AAS private maps	566
8.4.7	OFDMA ranging.....	567
8.4.7.1	Initial-ranging/handover-ranging transmissions	567
8.4.7.3	Ranging codes.....	569

8.4.7.4	Ranging and BW request opportunity size	570
8.4.8	Transmit diversitySpace-Time Coding (optional)	570
8.4.8.1	Transmit diversitySTC using two antennas	570
8.4.8.1.1	Multiple input single output channel estimation and synchronization	571
8.4.8.1.2	Space time coding using two antennas	571
8.4.8.1.3	Frequency hopping diversity coding (FHDC)	573
8.4.8.1.4	STC/FHDC configurations	573
8.4.8.1.5	Uplink using STC	573
8.4.8.2	Transmit diversitySTC for four antennas	575
8.4.8.2.1	STC for four antennas using PUSC	575
8.4.8.2.2	STC for four antennas using FUSC	576
8.4.8.2.3	STC configurations	577
8.4.8.2.4	MIMO Macro diversity handover based macro-diversity transmission	577
8.4.8.3	STC for the optional zones in the downlink	578
8.4.8.3.1	Symbol structure for optional AMC and optional FUSC	580
8.4.8.3.2	Symbol structure for the optional PUSC-ASCA	586
8.4.8.3.3	Transmission schemes for 2-antenna BS in DL.....	587
8.4.8.3.4	Transmission schemes for 3-antenna BS in DL.....	587
8.4.8.3.5	Transmission schemes for 4-antenna BS	591
8.4.8.3.6	MIMO precoding	596
8.4.8.4	STC for the optional zones in the uplink	597
8.4.8.4.1	Allocation of pilot subcarriers	598
8.4.8.4.2	Allocation of data subchannels	598
8.4.8.4.3	Transmission schemes for 2-antenna MS in UL.....	599
8.4.8.5	MIMO midamble	599
8.4.8.5.1	Midamble Sequence for PUSC	601
8.4.8.5.2	Midamble Sequence for FUSC and optional FUSC	601
8.4.8.9	STC subpacket combining	614
8.4.9	Channel coding	615
8.4.9.1	Randomization	616
8.4.9.2	Encoding	617
8.4.9.2.1	Convolutional coding (CC).....	617
8.4.9.2.2	Block Turbo Ccoding (optional).....	618
8.4.9.2.3	Convolutional turbo codes (optional)	619
8.4.9.2.5	Low Density Parity Check code (optional).....	626
8.4.9.3	Interleaving	631
8.4.9.3.1	Optional interleaver for CC	631
8.4.9.4	Modulation.....	631
8.4.9.4.1	Permutation definition Subcarrier randomization.....	631
8.4.9.4.2	Data modulation.....	632
8.4.9.4.3	Pilot modulation.....	633
8.4.9.5	Repetition.....	634
8.4.9.6	Zone boosting	634
8.4.9.7	Multiple HARQ (optional).....	634
8.4.9.7.1	Generic Chase HARQ.....	635
8.4.9.7.2	CC Incremental Redundancy HARQ.....	635
8.4.10	Control mechanisms	636
8.4.10.3	Power Ccontrol	636
8.4.10.3.1	Closed loop power control.....	637
8.4.10.3.2	Optional open loop power control	638
8.4.11	Channel quality measurements	640
8.4.11.2	RSSI mean and standard deviation	640
8.4.11.3	CINR mean and standard deviation	640
8.4.11.4	Optional Frequency Selectivity Characterization	642

8.4.12	Transmitter requirements	642
8.4.12.2	Transmitter spectral flatness	642
8.4.12.3	Transmitter constellation error and test method	643
8.4.12.3.1	RMS constellation error measurement for BS (downlink)	643
8.4.12.3.2	RMS constellation error measurement for SS	644
8.4.12.3.3	Calculation of RMS constellation error	644
8.4.12.3.4	Unmodulated subcarrier errors for SS	645
8.4.12.4	Transmitter reference timing accuracy	645
8.4.13	Receiver requirements	646
8.4.13.1	OFDMA PHY requirements for enhanced handover performance	646
8.4.13.1.1	Receiver sensitivity	646
8.4.13.1.2	MS uplink transmit time tracking accuracy	647
8.4.13.1.3	MS autonomous neighbor cell scanning	647
8.4.13.2	Receiver adjacent and alternatenon-adjacent channel rejection	647
8.4.13.3	Receiver maximum input signal	648
8.4.13.3.1	SS receiver maximum input signal	648
8.4.13.3.2	BS receiver maximum input signal	648
8.4.14	Frequency control requirements	648
8.4.14.1	Center frequency and symbol clock frequency tolerance	648
8.4.15	Optional HARQ support	648
8.4.15.1	Optional Chase HARQ support	649
8.4.15.1.1	HARQ Retransmission process	649
8.4.15.1.2	CRC	649
8.4.15.1.3	Concurrent transmission of UL HARQ bursts	649
8.4.15.1.4	Encoding	650
8.4.15.2	Optional IR HARQ for CC (convolutional code)	650
9.	Configuration	651
9.1	SS IP addressing used on secondary management connection	651
9.1.2	Mobile IP v4 fields used by the MS	651
10.	Parameters and constants	653
10.1	Global values	653
10.2	PKM parameter values	658
10.3	PHY-specific values	658
10.3.3	WirelessMAN-OFDM parameters and constant definitions	658
10.3.3.1	Uplink Allocation Start Time	658
10.3.4	WirelessMAN-OFDMA parameters and constant definitions	658
10.3.4.1	Uplink Allocation Start Time	658
10.4	Well-known addresses and identifiers	659
11.	TLV Encodings	661
11.1	Common encodings	661
11.1.1	Current transmit power	661
11.1.2	Authentication Tuples	661
11.1.2.1	HMAC Tuple	661
11.1.2.2	CMAC Tuple	661
11.1.2.3	Short-HMAC Tuple	662
11.1.3	MAC version encoding	663
11.1.5	Vendor ID encoding	663
11.1.6	Vendor-specific information	664
11.1.7	MOB-NBR-ADV message encodings	664

11.3 UCD management message encodings	665
11.3.1 UCD channel encodings	665
11.3.1.1 Uplink burst profile encodings	671
11.4 DCD management message encodings	672
11.4.1 DCD channel encodings	672
11.4.2 Downlink burst profile encodings	676
11.5 RNG-REQ message encodings	678
11.6 RNG-RSP management message encodings	679
11.6.1 SA Challenge Tuple	683
11.7 REG-REQ/RSP management message encodings	684
11.7.2 SS management support	685
11.7.6 Number of uplink CIDs supported	685
11.7.6.1 Number of uplink transport CIDs supported	685
11.7.6.2 Number of downlink transport CIDs supported	686
11.7.7 Convergence sublayer capabilities	686
11.7.7.1 Classification/PHS options and SDU encapsulation support	686
11.7.7.3 PHS support	686
11.7.8 SS capabilities encodings	687
11.7.8.10 Maximum MAC data per frame support	687
11.7.8.10.1 Maximum amount of MAC level data per DL frame	687
11.7.8.10.2 Maximum amount of MAC level data per UL frame	688
11.7.8.11 Packing support	688
11.7.8.12 MAC Extended rtPS support	688
11.7.8.13 Maximum number of bursts transmitted concurrently to the MS	688
11.7.9 SS MAC Address	689
11.7.10 CID update encodings	689
11.7.10.1 Compressed CID update encodings	690
11.7.11 Method for allocating IP address for the secondary management connection	690
11.7.12 Handover supported	690
11.7.13 HO Support	691
11.7.13.1 System Resource_Retain_Time	691
11.7.13.2 HO Process Optimization MS Timer	691
11.7.13.3 MS Handover Retransmission Timer	691
11.7.14 Mobility parameters support	692
11.7.14.1 Mobility features supported	692
11.7.15 Sleep mode recovery time	692
11.7.16 MS-PREV-IP-ADDR	692
11.7.17 SKIP-ADDR-ACQUISITION	693
11.7.18 SAID update encodings	693
11.7.19 Total number of provisioned service flow	693
11.7.20 Idle Mode	694
11.7.20.1 Idle Mode Timeout	694
11.7.20.2 Paging Interval Length	694
11.7.21 SA TEK Update	694
11.7.22 GKEK Parameters	695
11.7.23 ARQ-ACK Type	696
11.7.24 HO parameters processing time	696
11.7.25 MAC header and extended subheader support	696
11.7.26 SN Reporting Base	697
11.8 SBC-REQ/RSP management message encodings	698
11.8.2 Capabilities for construction and transmission of MAC PDUs	698
11.8.3 Physical parameters supported	698
11.8.3.6 WirelessMAN-OFDM specific parameters	698
11.8.3.6.2 OFDM SS demodulator	698

11.8.3.6.3	OFDM SS modulator	698
11.8.3.6.6	OFDM private map support	699
11.8.3.7	WirelessMAN-OFDMA specific parameters	699
11.8.3.7.1	OFDMA MS FFT sizes.....	699
11.8.3.7.2	OFDMA SS demodulator	699
11.8.3.7.3	OFDMA SS modulator	700
11.8.3.7.4	OFDMA SS Ppermutation support	700
11.8.3.7.5	OFDMA SS demodulator for MIMO support	701
11.8.3.7.6	OFDMA SS MIMO uplink support	702
11.8.3.7.7	OFDMA AAS private map support	702
11.8.3.7.8	OFDMA AAS capabilities.....	703
11.8.3.7.9	OFDMA SS CINR measurement capability	704
11.8.3.7.10	OFDM SS uplink power control support.....	704
11.8.3.7.11	OFDMA SS uplink power control support	704
11.8.3.7.12	OFDMA MAP Capability.....	704
11.8.3.7.13	Uplink control channel support.....	705
11.8.3.7.14	OFDMA MS CSIT capability.....	705
11.8.3.7.15	Maximum number of burst per frame capability in HARQ.....	706
11.8.3.7.16	OFDMA SS Modulator for MIMO Support	707
11.8.3.7.17	SDMA Pilot capability.....	707
11.8.3.7.18	OFDMA Multiple Downlink Burst Profile Capability	707
11.8.3.7.19	HARQ buffer capability.....	708
11.8.4	Security Negotiation Parameters	709
11.8.4.1	PKM Version Support	709
11.8.4.2	Authorization policy support	710
11.8.4.3	MAC (Message Authentication Code) Mode	711
11.8.4.4	PN window size	712
11.8.5	Power save class types capability	712
11.8.6	Extension capability.....	713
11.8.7	HO Trigger metric support	713
11.8.8	Association type support.....	713
11.9	PKM-REQ/RSP management message encodings	714
11.9.3	TEK.....	715
11.9.4	Key lifetime	715
11.9.5	Key-Sequence-Number.....	716
11.9.6	HMAC Digest	716
11.9.6.1	Short-HMAC Digest	716
11.9.7	SAID	716
11.9.8	TEK parameters	716
11.9.13	Security capabilities.....	717
11.9.14	Cryptographic suite.....	718
11.9.16	Version.....	719
11.9.17	SA-Descriptor	719
11.9.19	PKM configuration settings.....	720
11.9.20	Nonce.....	720
11.9.21	SS_RANDOM	720
11.9.22	BS_RANDOM.....	720
11.9.23	Pre-PAK.....	721
11.9.24	BS-Certificate	721
11.9.25	SigBS	721
11.9.26	MS-MAC address	722
11.9.27	CMAC Digest	722
11.9.28	Key Push Modes	723
11.9.29	Key Push Counter	724

11.9.30	GKEK (Group Key Encryption Key)	724
11.9.31	SigSS	724
11.9.32	AKID	724
11.9.33	EAP payload	725
11.9.34	Auth result code	725
11.9.35	SA service type	725
11.9.36	PKMv2 configuration settings	725
11.9.37	Frame number	726
11.11	REP-REQ management message encodings	726
11.12	REP-RSP management message encodings	728
11.13	Service flow management encodings	733
11.13.4	QoS parameter set type	735
11.13.5	Traffic priority	736
11.13.6	Maximum sustained traffic rate	736
11.13.8	Minimum reserved traffic rate	737
11.13.11	Service flow Uplink grant scheduling type	737
11.13.12	Request/transmission policy	738
11.13.14	Maximum latency	738
11.13.17	Target SAID	739
11.13.18	ARQ TLVs for ARQ-enabled connections	739
11.13.18.8	ARQ_BLOCK_SIZE	739
11.13.18.9	RECEIVER_ARQ_ACK_PROCESSING_TIME	739
11.13.19	CS specific service flow encodings	740
11.13.19.1	CS specification	740
11.13.19.2	CS parameter encoding rules	740
11.13.19.3	Packet CS encodings for configuration and MAC messaging	741
11.13.19.3.3	Classifier error parameter set	741
11.13.19.3.4	Packet classification rule	741
11.13.19.3.6	PHS error parameter set	744
11.13.19.3.8	IPv6 Flow label	744
11.13.19.4	ATM CS Encodings for Cconfiguration and MAC Mmessaging	745
11.13.19.4.2	ATM Classifier TLV	745
11.13.19.4.4	ATM Classifier Error Parameter Set	745
11.13.20	Unsolicited grant interval	745
11.13.21	Unsolicited polling interval	745
11.13.22	FSN size	746
11.13.23	MBS service	746
11.13.24	Global Service Class Name	746
11.13.25	Type of Data Delivery Services	747
11.13.26	SDU Inter-arrival Interval	747
11.13.27	Time Base	747
11.13.28	Traffic Indication Preference	747
11.13.29	MBS zone identifier assignment	748
11.13.30	Paging preference	748
11.13.31	SN Feedback Enabled	748
11.13.32	HARQ Service Flows	749
11.13.33	CID allocation for Active BSs	749
11.13.34	Authorization Token	749
11.13.35	HARQ Channel mapping	750
11.13.36	PDU SN extended subheader for HARQ reordering	750
11.13.37	MBS contents IDs	751
11.14	DREG-CMD/REQ message encodings	752
11.15	Handover management encodings	753
11.15.1	Resource_Retain_Time	753

11.16	Sleep mode management encodings	754
11.16.1	SLPID_Update	754
11.16.2	Next Periodic Ranging	754
11.17	MOB_PAG-ADV management message encodings	755
11.17.1	CDMA code and transmission opportunity assignment	755
11.17.2	Page-Response Window	755
11.17.3	Enabled-Action-Triggered	755
11.18	MOB_NBR-ADV management message encodings	756
11.18.1	PHY Mode ID	756
11.19	MOB_SCN-REP message encodings	758
12.	System profiles	759
12.1	WirelessMAN-SC (10–66 GHz) system profiles	759
12.1.1	WirelessMAN-SC MAC system profiles	759
12.1.1.3	Conventions for MAC Mmanagement messages for profiles profM1 and profM2	759
12.1.1.4	MAC Management message Pparameter Ttransmission Oorder	759
12.1.1.4.3	UCD	759
12.1.1.4.7	REG-REQ	759
12.1.1.4.20	DSA-RSP—BS Initiated Sservice Aaddition	759
12.1.1.4.23	DSC-RSP—BS Initiated Sservice Cchange	760
12.1.1.6	Message parameters specific to profM2	760
12.1.1.6.1	Packet CS Pparameters for DSA-REQ—BS Initiated	760
12.1.1.6.2	Packet CS Pparameters for DSA-RSP—BS Initiated	761
12.1.1.6.3	Packet CS Parameters for DSC-REQ—BS Initiated	761
12.1.1.6.4	Packet CS Parameters for DSC-RSP—BS Initiated	762
12.2	WirelessMAN-SCa and WirelessHUMAN(-SCa) system profiles	762
12.2.3	WirelessMAN-SCa Physical Layer (PHY) Profiles	762
12.2.3.2	Specific PHY profiles	762
12.2.3.2.3	WirelessHUMAN-specific PHY profile features	762
12.2.4	WirelessMAN-SCa RF profiles	762
12.2.4.3	RF profiles for 10 MHz channelization	762
12.3	WirelessMAN-OFDM and WirelessHUMAN(-OFDM) system profiles	762
12.3.1	WirelessMAN-OFDM and WirelessHUMAN(-OFDM) MAC profiles	762
12.3.1.1	ProfM3_PMP: Basic Packet PMP MAC System Profile	762
12.3.1.1.2	MAC Management Message Parameter Transmission Order	762
12.3.1.2	ProfM3_Mesh: Basic Packet Mesh MAC system profile	763
12.3.2	WirelessMAN-OFDM and WirelessHUMAN(-OFDM) Physical Layer Profiles	763
12.3.2.4	ProfP3_3: WirelessMAN-OFDM PHY profile for 3 MHz channelization	763
12.3.2.5	ProfP3_5.5: WirelessMAN-OFDM PHY profile for 5.5 MHz channelization	764
12.3.2.6	profP3_10: WirelessHUMAN(-OFDM) PHY profile for 10 MHz channelization	764
12.3.3	WirelessMAN-OFDM RF profiles	764
12.4	WirelessMAN-OFDMA and WirelessHUMAN(-OFDMA) system profiles	765
12.4.2	WirelessMAN-OFDMA and WirelessHUMAN(-OFDMA) MAC Pprofiles	765
12.4.2.1	Basic Ppacket PMP MAC Pprofile	765
12.4.2.1.1	Conventions for MAC Mmanagement Mmessages	765
12.4.2.1.2	MAC Mmanagement Mmessage Pparameter Ttransmission Oorder	765
12.4.3	WirelessMAN-OFDMA and WirelessHUMAN(-OFDMA) System PHY Pprofiles	766
12.4.3.1	Common Ffeatures of PHY Pprofiles	766
12.4.3.1.4	WirelessHUMAN PHY Pprofiles Ffeatures	766
12.4.3.1.5	Minimum performance requirements	766
12.4.3.2	WirelessMAN-OFDMA 1.25 MHz channel basic PHY Pprofile	768
12.4.3.3	WirelessMAN-OFDMA 3.5 MHz channel basic PHY Pprofile	769

12.4.3.4	WirelessMAN-OFDMA 7 MHz channel basic PHY Pprofile.....	769
12.4.3.5	WirelessMAN-OFDMA 8.75 MHz channel basic PHY Pprofile.....	770
12.4.3.6	WirelessMAN-OFDMA 14 MHz channel basic PHY Pprofile.....	770
12.4.3.7	WirelessMAN-OFDMA 17.5 MHz channel basic PHY Pprofile.....	771
12.4.3.8	WirelessMAN-OFDMA 28 MHz channel basic PHY Pprofile.....	771
12.4.3.9	WirelessHUMAN(-OFDMA) 10 MHz channel basic PHY Pprofile	771
12.4.3.10	WirelessHUMAN(-OFDMA) 20 MHz channel basic PHY Pprofile	771
12.4.4	WirelessMAN-OFDMA RF profiles	771
Annex A (informative) Bibliography		773
Annex B (informative) Supporting material for frequencies below 11 GHz.....		775
Annex C (informative) Example MAC common part sublayer service definition		777
Annex D (informative) Messages sequence charts (MSCs)		779
Annex E (informative) Block diagrams		789
Annex F (informative) Test vectors.....		795
Annex G (informative) Network model for mobile communications		815
Annex H (informative) LDPC direct encoding.....		819

List of Figures

Figure 11—PHS signaling example	14
Figure 17a—IP CS PDU format with Compressed-IP-Header and without header suppression	16
Figure 17b—IP CS PDU format with both Compressed-IP-Header and header suppression	16
Figure 19—Generic MAC header format	19
Figure 19a—MAC signaling header type I format	21
Figure 20a—Bandwidth request and UL Tx Power Report header format	22
Figure 20b—Bandwidth request and CINR report	23
Figure 20c—CQICH allocation request	25
Figure 20d—PHY channel report header	26
Figure 20e—Bandwidth request and uplink sleep control header	27
Figure 20f—SN report header format	28
Figure 20g—MAC signaling header type II format	30
Figure 20h—Feedback header with CID field	31
Figure 20i—Feedback header without CID field	31
Figure 20j—MIMO Channel Feedback header with CID field	34
Figure 20k—MIMO Channel Feedback header without CID field	34
Figure 20l—Extended subheader group format	39
Figure 23a—Downlink HARQ subframe structure	94
Figure 23b—Sub-MAP Burst	169
Figure 34—ARQ Reset message dialog—transmitter initiated	177
Figure 35—ARQ Reset message dialog—receiver initiated	178
Figure 36—ARQ block reception	179
Figure 58—Obtaining uplink parameters	188
Figure 66—Wait for SBC-RSP—SS	192
Figure 67—Negotiate Basic Capabilities—BS	193
Figure 70—Registration—BS	194
Figure 79—Transition to a more robust operational burst profile	196
Figure 80—Transition to a less robust operational burst profile	196
Figure 80a—State transition diagram for downlink burst profile management—SS	197
Figure 80b—State transition diagram for downlink burst profile management—SS	199
Figure 82—Periodic Ranging receiver processing—BS	199
Figure 84—Periodic Ranging—SS	200
Figure 87—CDMA Initial Ranging—SS	206
Figure 90—Periodic CDMA ranging—SS	208
Figure 95—Theory of Operation Object Model	210
Figure 130—Construction of HARQ encoder packet	219
Figure 130a—Example of sleep mode operations with two power saving classes	230
Figure 130b—HO and initial network entry	240
Figure 130c—Example of cell selection with ranging	241
Figure 130d—MS initiating handover with the BS	247
Figure 130e—locally initiated transaction MOB_BSHO-RSP pending state flow diagram	248
Figure 130f—Typical MS listening state flow diagram	249
Figure 130g—locally initiated transaction MOB_BSHO-RSP pending state flow diagram	250
Figure 130h—Fast anchor BS selection mechanism	256
Figure 130i—Paging-groups example	260
Figure 130j—Security sublayer	270
Figure 130k—AK from PAK only (from RSA-based authorization)	281
Figure 130l—AK from PAK and PMK (RSA-based and EAP-based authorization)	282
Figure 130m—AK from PMK (from EAP-based authorization)	282
Figure 130n—AK with PMK and PMK2 (EAP-based authorization and Authenticated EAP-based authorization)	283
Figure 130o—HMAC/CMAC/KEK derivation from AK	283

Figure 130p—MTK key derivation from MAK	284
Figure 130q—HMAC/CMAC authentication key derivation from EIK	284
Figure 131—TEK state machine flow diagram	290
Figure 134—TEK management in BS and SS	297
Figure 135—Encrypted payload format in AES-CCM mode	298
Figure 135a—Nonce N Construction	299
Figure 136—Initial CCM Block B_0	299
Figure 137—Construction of counter blocks Ctrj	300
Figure 137a—MBS MAC PDU Ciphertext payload format	301
Figure 137b—Residual termination block processing with CTS	302
Figure 137c—CBC IV generation	303
Figure 137d—MBRA management	315
Figure 197—PRBS generator for data randomization	320
Figure 198—OFDM randomizer downlink initialization vector for burst #2...N	321
Figure 199—OFDM randomizer uplink initialization vector	321
Figure 204—PRBS generator for pilot modulation	322
Figure 207—Example of OFDM frame structure with TDD	324
Figure 208—Example of OFDM frame structure with FDD	325
Figure 208a—Format of DL subchannelization zone	327
Figure 209—Structure of AAS Zone	330
Figure 210a—Subchannelized Initial Ranging—SS (part 1a)	344
Figure 210b—Subchannelized Initial Ranging —SS (part 1b)	345
Figure 216—Example of mapping OFDMA slots to subchannels and symbols in the downlink (in PUSC mode)	355
Figure 217—Example of mapping OFDMA slots to subchannels and symbols in the uplink	356
Figure 218—Example of an OFDMA frame (with only mandatory zone) in TDD mode	357
Figure 219—Illustration of OFDMA frame with multiple zones	358
Figure 222a—Example of rectangular allocation rules	362
Figure 224—AAS Diversity Map Frame Structure	364
Figure 224a—Example of UL AAS allocation with integer number of slots in duration	368
Figure 229a—Burst allocations in DL AAS Zone	376
Figure 230—Reduced CID decoding	402
Figure 229a—HARQ downlink allocation	404
Figure 230—Mapping order of FAST-FEEDBACK messages to the FAST-FEEDBACK region	438
Figure 230a—Post processed CINR for MIMO region	441
Figure 231a—Subcarrier mapping of Fast-feedback modulation symbols for PUSC	447
Figure 231b—Subcarrier mapping of Fast-feedback modulation symbols for optional PUSC	447
Figure 231c—Mapping of MIMO coefficients for quantized precoding weights for enhanced fast MIMO feedback payload bits	449
Figure 231d—Mapping of the payload bit sequence to a Fast-feedback channel	454
Figure 231e—Subcarrier mapping of Primary Fast-feedback modulation symbol for PUSC	455
Figure 231f—Subcarrier mapping of secondary Fast-feedback modulation symbols for PUSC	457
Figure 231a—Subcarrier mapping of UL ACK modulation symbols for PUSC	473
Figure 231b—Subcarrier mapping of UL ACK modulation symbols for optional PUSC	473
Figure 233a—Common SYNC symbol structure (frequency domain)	526
Figure 233b—Common SYNC symbol structure (time domain)	526
Figure 234—Cluster structure	529
Figure 238a—Pilot patterns for AAS mode in AMC zone	564
Figure 239—I-Initial-ranging/handover-ranging transmission for OFDMA	568
Figure 240—Initial-ranging handover-ranging transmission for OFDMA, using two consecutive initial ranging codes	568
Figure 243—PRBS generator for ranging code generation	569
Figure 243a—Ranging/BW request opportunities	570
Figure 245—Cluster structure for STC PUSC using 2 Antennas	572

Figure 247—STC usage with FUSC	573
Figure 249—Mapping of data subcarriers in STTD mode	574
Figure 249a—Pilot Patterns in UL PUSC tile	575
Figure 251—Cluster structure for STC PUSC using 4 antennas	576
Figure 251a—STC usage with FUSC.....	577
Figure 251a—Example of STC for optional zones in DL (matrix A for 2, 3, or 4 Tx and matrix B for 3 or 4 Tx).....	578
Figure 251b—Example of matrix B with horizontal encoding for 3 or 4 Tx BS for optional zones in DL	579
Figure 251c—Example of matrix C with vertical encoding for 2, 3, or 4 Tx BS for optional zones in DL	579
Figure 251d—Example of matrix C with horizontal encoding for 2, 3 or 4 Tx BS for optional zones in DL	580
Figure 251e—Pilot allocation for 2-antenna BS for the optional FUSC and the optional AMC zones	581
Figure 251f—Pilot allocation for 3-antenna BS for the optional FUSC and the optional AMC zones	581
Figure 251g—Pilot allocation for 4-antenna BS for the optional FUSC and the optional AMC zones.....	582
Figure 251h—Data mapping in the optional AMC Zone with 2 Tx antenna and matrix A	583
Figure 251i—Data mapping in the optional AMC zone with 2 Tx antenna and matrix B.....	584
Figure 251j—Data mapping with CC in the optional AMC Zone with 4 Tx antenna and Matrix A	585
Figure 251k—Uplink pilot allocation for 2-antenna MS for the optional PUSC zones.....	598
Figure 251l—Uplink data mapping for 2-antenna SS with matrix A for the optional PUSC permutation	599
Figure 251m—Midamble FUSC structure (frequency domain).....	600
Figure 251n—Midamble PUSC structure (frequency domain)	600
Figure 252—Channel coding process for regular and repetition coding transmission.....	615
Figure 253—PRBS generator for data randomization.....	616
Figure 254a—Creation of the OFDMA randomizer initialization vector for HARQ	616
Figure 260—PRBS generator of the randomization	623
Figure 262—PRBS generator for pilot modulation.....	631
Figure D.1—Example Neighbor BS advertisement and scanning (without association) by MS request ...	780
Figure D.2—Example Neighbor BS advertisement and scanning (with non-coordinated association) by MS request	781
Figure D.3—Example Neighbor BS advertisement and scanning (without association) by BS request ...	782
Figure D.4—Example Neighbor BS advertisement and scanning (with association) by BS request	783
Figure D.5—Example Macro Diversity HO (Diversity Set Update: Add).....	784
Figure D.6—Example Macro Diversity HO (Diversity Set Update: Drop)	785
Figure D.7—Example sleep mode — MS initiated.....	786
Figure D.8—Example sleep mode — BS initiated.....	787
Figure D.9—Sleep mode—MS initiating awakening	788
Figure E.1—MS initiated HO process block diagram as seen by MS	790
Figure E.2—MS initiated HO process block diagram as seen by serving BS where final target BS is selected by serving BS	791
Figure E.3—BS Initiated HO process block diagram as seen by MS	792
Figure E.4—BS Initiated HO process block diagram as seen by serving BS	793
Figure G.1—Network model example.....	816
Figure G.2—Logical network reference model, control plane.....	816
Figure H.1—Block diagram of the encoder architecture for the block LDPC code.....	822

List of Tables

Table 1—Air interface nomenclature	3
Table 4a—MAC Header HT and EC fields encoding	19
Table 5—Generic MAC header fields	20
Table 5a— Type field encodings for MAC signaling header Type I	20
Table 6—Type encodings	20
Table 7a—Description of fields BR and UL Tx Power Report header	23
Table 7b—Description of the fields of BR and CINR report header	24
Table 7c—Description of the fields of CQICH allocation request header	25
Table 7d—PHY channel report header fields	26
Table 7e—Bandwidth control and uplink sleep control header	28
Table 7f—SN report header fields	29
Table 7g—Type field encodings for MAC signaling header type II	30
Table 7h—Description of the fields of Feedback header	32
Table 7i—Feedback type and feedback content	32
Table 7j—Description of MIMO Channel Feedback header fields	34
Table 9—Grant Management subheader format	37
Table 10—Grant management subheader fields	37
Table 13a—Extended subheader group format	40
Table 13b—Description of extended subheaders types (DL)	40
Table 13c—Description of extended subheaders types (UL)	40
Table 13d—SDU SN extended subheader format	41
Table 13e—DL Sleep control extended subheader format	41
Table 13f—Feedback request extended subheader format	42
Table 13g—MIMO mode Feedback extended subheader format	42
Table 13h—UL Tx Power Report extended subheader format	43
Table 13i—Description of Mini-Feedback extended subheaders (UL)	43
Table 13j—Description of SN request extended subheader	43
Table 13k—PDU (short) SN extended subheader	44
Table 13l—PDU SN (long) extended subheader	44
Table 14—MAC Management messages	44
Table 15—DCD message format	47
Table 16—DL-MAP message format	48
Table 18—UL-MAP message format	49
Table 19—RNG-REQ message format	50
Table 26—PKM message codes	60
Table 37a— PKMv2 RSA-Request attributes	61
Table 37b— PKMv2 RSA-Reply attributes	62
Table 37c—PKMv2 RSA-Reject attributes	62
Table 37d—PKMv2 RSA-Acknowledgement attributes	63
Table 37e—EAP-Start attributes	63
Table 37f—PKMv2 EAP Transfer attributes	64
Table 37g—PKMv2 Authenticated EAP message attributes	64
Table 37h—PKMv2 SA-TEK-Challenge message attributes	65
Table 37i—PKMv2 SA-TEK-Request message attributes	66
Table 37j—PKMv2 SA-TEK-Response message attributes	66
Table 37k—PKMv2 Key Request attributes	67
Table 37l—PKMv2 Key-Reply attributes	68
Table 37m—PKMv2 Key-Reject attributes	69
Table 37n—PKMv2 SA-Addition attributes	69
Table 37o—PKMv2 TEK-Invalid attributes	70
Table 37p—PKMv2 Group Key update command attributes	70
Table 37q—PKMv2 EAP Complete attributes	72

Table 37r—PKMv2 Authenticated EAP Start attribute	72
Table 55—Action codes and actions	76
Table 61—ARQ Reset message format	78
Table 87—DREG-REQ message format	80
Table 91—Format configuration IE	82
Table 94—H-ARQHARQ_Control_IE format	85
Table 95—H-ARQCQICH_Control IE format	86
Table 95a—Threshold Values	87
Table 96—H-ARQHARQ Compact_DL-MAP IE format for normal subchannel	87
Table 97—H-ARQ HARQ Compact_DL-MAP IE format for band AMC	89
Table 98—HARQ Compact_DL-MAP IE format for safety	91
Table 99—H-ARQ HARQ Compact_DL-MAP IE format for DIUC subchannel	92
Table 101a—DL-MAP Subtypes	94
Table 101b—MIMO Compact_DL-MAP IE	95
Table 101c—SDMA Compact_DL-MAP IE format	99
Table 101d—HARQ Compact_DL-MAP IE format for switch HARQ mode	100
Table 101e—HARQ Compact MBS_MAP_IE format for extension	101
Table 102—H-ARQ HARQ Compact_UL-MAP IE format for normal subchannel	102
Table 103—H-ARQ HARQ Compact_UL-MAP IE format for band AMC	103
Table 104—H-ARQ HARQ Compact_UL-MAP IE format for safety	105
Table 105—H-ARQ Compact_UL-MAP IE format for UIUC subchannel	106
Table 108a—UL-MAP subtypes	108
Table 109—H-ARQ HARQ Compact_UL-MAP IE format for allocation start offset	109
Table 109a—MIMO Compact UL-MAP IE format	110
Table 109b—SDMA Compact UL-MAP IE format	111
Table 109c—Sleep-Request (MOB_SLP-REQ) message format	112
Table 109d—Sleep-Response (MOB_SLP-RSP) message format	114
Table 109e—Traffic-Indication (MOB_TRF-IND) message format	118
Table 109f—MOB_NBR-ADV message format	120
Table 109g—Bit-by-bit definition of PHY Profile ID of the BS	125
Table 109h—MOB_SCN-REQ message format	126
Table 109i—MOB_SCN-RSP message format	128
Table 109j—MOB_SCN-REP message format	132
Table 109k—MOB_ASC-REP message format	135
Table 109l—MOB_BSHO-REQ message format	137
Table 109m—MOB_MSHO-REQ message format	145
Table 109n—MOB_BSHO-RSP message format	149
Table 109o—MOB_HO-IND message format	157
Table 109p—BS Broadcast Paging (MOB_PAG-ADV) message format	160
Table 109q—MBS_MAP	161
Table 109r—MBS_MAP_Type	162
Table 109s—MBS_DATA_IE	163
Table 109t—Extended_MBS_DATA_IE	164
Table 109u—MBS_DATA_Time_Diversity_IE	165
Table 109v—PMC_REQ message format	167
Table 109w—PMC_RSP message format	168
Table 109x—SUB-DL-UL-MAP message format	170
Table 109y—Setup/Tear-down of long-term MIMO precoding (PRC-LT-CTRL) message format	172
Table 111a—Example of QoS parameters providing a scheduling service to support real-time constant bit-rate data streams	180
Table 111b—Example of QoS parameters providing a scheduling service to support real-time variable-rate data streams	181
Table 111c—Example of QoS parameters providing a scheduling service to support delay-tolerant variable-rate data streams	181

Table 111d—Example of QoS parameters providing a scheduling service to support best-effort data streams	182
Table 121—CDMA initial Ranging and automatic adjustments procedure	201
Table 124a—Global service flow class name information field parameters	211
Table 124b—Traffic rate and burst values	212
Table 124c—Maximum latency values	213
Table 132a—Type of data delivery services	225
Table 132b—Unsolicited grant service parameters	226
Table 132c—Real-Time Variable Rate service parameters	226
Table 132d—Non Real-Time variable rate service parameters	227
Table 132e—Best Effort service parameters	227
Table 132f—Extended Real-Time Variable Rate service parameters	228
Table 133a—AK Context in PKMv2	287
Table 133b—GKEK Context	288
Table 133c—PMK context	288
Table 133d—PAK context	289
Table 134—TEK FSM state transition matrix	291
Table 207a—SCa fast ranging extended IE format	319
Table 225—OFDM downlink frame prefix format	326
Table 225a—DL Subchannel index table	328
Table 225b—SBCH_DLFP	328
Table 225c—SBCH_DL_MAP_IE	329
Table 244—OFDM DL-MAP dummy IE format	332
Table 244a—DL SUBCH_IE format	333
Table 253—OFDM UL-MAP dummy IE format	334
Table 253a—OFDM Fast_Ranging_IE format	335
Table 253b—UL fast tracking information element	336
Table 258a—Compressed Private DL-MAP message format	337
Table 258b—Compressed Private UL-MAP message format	339
Table 258c—Reduced private DL-MAP message format	340
Table 258d—Reduced private UL-MAP message format	342
Table 260—OFDM SBCH_AAS_NW_ENTRY_REQ format	346
Table 262a—Normalized CINR per modulation (BER = 1e-6)	348
Table 263—Allowed relative constellation error versus data rate	350
Table 266—Receiver SNR assumptions	352
Table 268—OFDMA downlink Frame Prefix format for all FFT sizes except 128	359
Table 268a—Subchannel index of the six subchannel groups	360
Table 268b—OFDMA downlink frame prefix format for 128 FFT	360
Table 269—AAS-DLFP Sstructure, Diversity-Map Sscan	365
Table 270—Structure of AAS_COMP_DL_IE ()	366
Table 275—OFDMA DL-MAP_IE format	370
Table 276—OFDMA DIUC values	372
Table 277a—Extended DIUC Code Assignment for DIUC=15	373
Table 277b—OFDMA DL-MAP extended-2 IE format	373
Table 277c—Extended-2 DIUC code assignment for DIUC=14	374
Table 278—OFDMA downlink AAS downlink IE	375
Table 279—OFDMA downlink STC_DL_ZoneTD_ZONE IE format	377
Table 281—OFDMA Data location in another BS IE	379
Table 283—MIMO DL basic IE format	380
Table 283a—DL MIMO operation modes	382
Table 284—MIMO DL enhanced IE format	384
Table 285—H-ARQ HARQ MAP and Sub-MAP pointer IE format	386
Table 286—OFDMA DL-MAP Physical Modifier IE format	388
Table 286a—Multicast and Broadcast Service MAP IE	389

Table 286b—DL PUSC Burst Allocation in Other Segment IE	391
Table 286c—HO anchor active DL MAP IE.....	392
Table 286d—HO active anchor DL MAP IE	393
Table 286e—HO CID Translation MAP IE	394
Table 286f—MIMO in another BS IE.....	395
Table 286g—Macro MIMO DL Basic IE().....	396
Table 286h—UL interference and noise level extended IE.....	397
Table 286i—Dedicated DL control IE format.....	399
Table 286j—RCID_IE format	401
Table 286k—Skip IE	403
Table 286l—HARQ DL MAP IE format	404
Table 286m—DL HARQ Chase sub-burst IE format	406
Table 286n—DL HARQ IR CTC sub-burst IE format.....	408
Table 286o—DL HARQ IR CC sub-burst IE format.....	409
Table 286p—MIMO DL Chase HARQ sub-burst IE format	411
Table 286q—MIMO DL IR HARQ Sub-Burst IE format.....	412
Table 286r—MIMO DL IR HARQ for CC Sub-Burst IE format	414
Table 286s—MIMO DL STC HARQ Sub-Burst IE format.....	415
Table 286t—Dedicated MIMO DL Control IE format.....	416
Table 286u—HARQ_ACK IE.....	419
Table 286v—Enhanced DL MAP IE.....	420
Table 286w—Closed-loop MIMO DL enhanced IE	421
Table 286x—Broadcast Control Pointer IE format	423
Table 286y—AAS_SDMA_DL_IE.....	424
Table 286z—PUSC ASCA Allocation	427
Table 287—OFDMA UL-MAP IE format	428
Table 288—OFDMA UIUC values.....	430
Table 289—PAPR reduction, and safety zone, and sounding zone allocation IE format	431
Table 290—CDMA Allocation IE format	432
Table 290a—Extended UIUC Code Assignment for UIUC=15	433
Table 290b—UL-MAP extended-2 IE format.....	433
Table 290c—Extended-2 UIUC Code Assignment for UIUC=11	434
Table 292—OFDMA Power Control IE.....	434
Table 293—OFDMA uplink AAS uplink IE.....	435
Table 294—OFDMA uplink ZONE IE format.....	436
Table 295—Mini-subchannel allocation IE format	437
Table 295a—FAST-FEEDBACK allocation IE format	438
Table 298—Encoding of payload bits for Fast-feedback slot	442
Table 298a—Encoding of payload bits for secondary Fast-feedback slot	443
Table 298b—Effective CINR feedback encoding	443
Table 298c— 3-bit MIMO Fast-feedback channel subcarrier modulation.....	444
Table 298d—Enhanced Fast-feedback channel subcarrier modulation.....	445
Table 298e—Orthogonal Modulation Index in FAST_FEEDBACK Fast-feedback Cchannel	446
Table 298f—Encoding of payload bits for MIMO Mode Feedback with Enhanced Fast-feedback Channel.....	450
Table 298g—Interpretation of code words 0b101110-0b110110 in Table 298f in the case of using antenna grouping	451
Table 298h—Interpretation of code words 0b101110-0b110110 in Table 298f in the case of using antenna selection	451
Table 298j—Encoding of payload bits for Fast-feedback slot	452
Table 298i—Interpretation of code words 0b101110-0b110110 in Table 298f in the case of using reduced precoding matrix codebook	452
Table 298k—Secondary Fast-feedback channel subcarrier modulation with 4 bit	456
Table 298l—Orthogonal Modulation Index in Secondary Fast-feedback Channel.....	456

Table 298m—V(2,1,3).....	457
Table 298n—V(3,1,3).....	458
Table 298o—V(4,1,3)	458
Table 298p—Generating parameters for V(3,1,6) and V(4,1,6).....	459
Table 298q—Operations to generate codebooks	460
Table 298r—3-bit 2x2 codebook V(2,2,3)	460
Table 298s—3-bit 4x3 codebook V(4,3,3)	461
Table 298t—3-bit 4x4 codebook V(4,4,3).....	462
Table 298u—6 bit, 3x1 Codebook V(3,1,6)	463
Table 299—MIMO UL basic IE format	466
Table 299a—MIMO_UL_Basic_IE operation modes.....	468
Table 300—CQICH alloc IE format.....	468
Table 301—ACK channel subcarrier modulation	471
Table 301a—Orthogonal Modulation Index in UL ACK Channel	472
Table 302—OFDMA UL-MAP Physical Modifier IE format	474
Table 302a—UL allocation start IE format test.....	475
Table 302b—CQICH Enhanced allocation IE format	475
Table 302c—UL PUSC Burst Allocation in Other Segment IE.....	477
Table 302d—HO anchor active UL MAP IE	478
Table 302e—HO active anchor UL MAP IE.....	479
Table 302f—MIMO UL Enhanced IE	480
Table 302g—OFDMA Fast_Ranging_IE format IE	481
Table 302h—UL-MAP_Fast_Tracking_IE	482
Table 302i—Anchor_BS_switch_IE format	483
Table 302j—HARQ UL MAP IE	485
Table 302k—UL HARQ Chase sub-burst IE format.....	487
Table 302l—UL HARQ IR CTC sub-burst IE format	488
Table 302m—UL HARQ IR CC sub-burst IE format	489
Table 302n—MIMO UL Chase HARQ sub-burst IE format	490
Table 302o—MIMO UL IR HARQ sub-burst IE format.....	491
Table 302p—MIMO UL IR HARQ for CC sub-burst IE format	493
Table 302q—MIMO UL STC HARQ sub-burst IE format.....	494
Table 302r—Dedicated UL control IE format.....	495
Table 302s—Dedicated MIMO UL control IE format	496
Table 302t—HARQ ACKCH region allocation IE	497
Table 302u—AAS_SDMA_UL_IE.....	498
Table 302v—Feedback polling IE format	500
Table 304a—OFDMA Downlink_Burst_Profile TLV format for multiple FEC types	502
Table 304b—OFDMA Uplink_Burst_Profile TLV format for multiple FEC types	503
Table 305—Compressed DL-MAP message format	504
Table 308a—Reduced AAS private DL-MAP message format.....	507
Table 308b—Reduced AAS private UL-MAP message format.....	511
Table 309—Preamble modulation series per segment and IDcell for the 2k FFT mode	514
Table 309a—Preamble modulation series per segment and IDcell for the 1K FFT mode.....	515
Table 309b—Preamble modulation series per segment and IDcell for the 512 FFT mode	520
Table 309c—Preamble modulation series per segment and IDcell for the 128 FFT mode.....	524
Table 309d—Common SYNC sequence	527
Table 310—OFDMA downlink subcarrier allocations—PUSC	527
Table 310a—1024-FFT OFDMA downlink carrier allocations—PUSC	528
Table 310b—512-FFT OFDMA downlink carrier allocations—PUSC.....	528
Table 310c—128-FFT OFDMA downlink carrier allocations—PUSC	529
Table 311—OFDMA downlink subcarrier allocations	531
Table 311a—1024-FFT OFDMA downlink carrier allocations—FUSC	531
Table 311b—512-FFT OFDMA downlink carrier allocations—FUSC.....	533

Table 311c—128-FFT OFDMA downlink carrier allocations—FUSC	534
Table 312—OFDMA optional FUSC downlink subcarrier allocation	535
Table 312a—1024-FFT OFDMA downlink carrier allocations—Optional FUSC	536
Table 312b—512-FFT OFDMA downlink carrier allocations—Optional FUSC	536
Table 312c—128-FFT OFDMA downlink carrier allocations—Optional FUSC	537
Table 313a—Basic permutation sequences for diversity subcarrier allocations	538
Table 314a—1024-FFT OFDMA uplink subcarrier allocations for PUSC	540
Table 314b—512-FFT OFDMA uplink subcarrier allocations for PUSC	540
Table 314c—128-FFT OFDMA uplink subcarrier allocations for PUSC	541
Table 315—OFDMA uplink subcarrier allocations	543
Table 315a—Optional 1024-FFT OFDMA uplink subcarrier allocations	544
Table 315b—Optional 512-FFT OFDMA uplink subcarrier allocations	544
Table 315c—Optional 128-FFT OFDMA uplink subcarrier allocations	545
Table 315d—UL_Sounding_Command_IE()	548
Table 315e—Golay sequence of length 2048 bits	552
Table 315f—Length dependent offsets in the Golay sequence of Table 316b	553
Table 315g—Offsets for the decimated pilots method	554
Table 316—OFDMA AAS subcarrier allocations	559
Table 316a—1024-FFT OFDMA AMC subcarrier allocations	560
Table 316b—512-FFT OFDMA AMC subcarrier allocations	561
Table 316c—128-FFT OFDMA AMC subcarrier allocations	561
Table 316d—Allocation of subcarriers to subchannels	565
Table 316e—Cluster permutation base	565
Table 316f—Enhanced 3 Tx Matrix C with Antenna Grouping	591
Table 316g—Mapping of Pre-coding matrix and CQICH for 4 Tx Matrix C with Antenna Selection	595
Table 316h—Feedback for long-term precoding in MAC feedback header message	597
Table 316i—Feedback for life span of short-term precoding in MAC feedback header message 0b01001	597
Table 316j—Nr [The length of sequence R(r)]	601
Table 316k—Permutation ($l = 0, 1, 2, \dots, 127$)	602
Table 316l—PAPR reduction sequence for BS with 2 antennas (2048 point FFT)	603
Table 316m—PAPR reduction sequence for BS with 2 antennas (1024 point FFT)	605
Table 316n—PAPR reduction sequence for BS with 2 antennas (512 point FFT)	607
Table 316o—Permutation ($l = 0, 1, 2, \dots, 47$)	608
Table 316p—PAPR Reduction Sequence for BS with 2 Antennas (128 point FFT)	609
Table 316q—Permutation ($l = 0, 1, 2, \dots, 95$)	611
Table 316r—PAPR reduction sequence for BS with 3 or 4 antennas (512 point FFT)	611
Table 316s—Permutation ($l = 0, 1, 2, \dots, 23$)	612
Table 316t—PAPR reduction sequence for BS with 3 or 4 antennas (128 point FFT)	613
Table 316u—STC subpacket combining (2-transmit antenna case)	614
Table 316v—STC subpacket combining (3-transmit antenna case)	614
Table 316w—STC subpacket combining (4-transmit antenna case)	615
Table 317—SubchannelSlots concatenation rule	617
Table 320a—Puncture pattern definition for HARQ	618
Table 322—Useful data payload for a subchannel	618
Table 323—Optional channel coding per modulation	618
Table 324—SubchannelSlots concatenation rule for CTC	620
Table 326—Optimal CTC channel coding per modulation	620
Table 327—Optimal CTC channel coding per modulation when supporting HARQ	620
Table 329—Parameters for the subblock interleavers	622
Table 331—Transmission format and modulation level for DL	624
Table 333—Transmission format and modulation level for UL	625
Table 333a—LDPC block sizes and code rates	629
Table 333b—Parameter ‘j’ for LDPC	630

Table 333c—HARQ Modes definition	634
Table 333d—Companded subchannels	635
Table 334—Normalized C/N per modulation	636
Table 336—Allowed relative constellation error versus data rate.....	643
Table 338—Receiver SNR and Eb/N0 assumptions	647
Table 342—Parameters and constants	653
Table 343—Operational ranges for privacy configuration settings.....	658
Table 345—CIDs	659
Table 348a—CMAC Tuple definition	662
Table 348b—CMAC Tuple definition.....	662
Table 348c—Short-HMAC Tuple definition.....	662
Table 348d—Short-HMAC Tuple definition	663
Table 348e—MOB-NBR-ADV encodings.....	664
Table 348f—Neighbor BS Trigger TLV description	665
Table 348g—Neighbor BS Trigger; Type/Function/Action.....	665
Table 349—UCD channel encodings	666
Table 353—UCD PHY-specific channel encodings—WirelessMAN-OFDMA	667
Table 357—UCD burst profile encodings WirelessMAN-OFDMA	671
Table 358—DCD channel encoding.....	672
Table 358—DCD channel encoding.....	673
Table 358a—Trigger TLV description	675
Table 358b—Trigger; Type/function/action description.....	676
Table 363—DCD burst profile encodings—WirelessMAN-OFDMA	677
Table 364—RNG-REQ message encodings.....	678
Table 364a—Power saving class parameters.....	679
Table 367—RNG-RSP message encodings.....	680
Table 367—RNG-RSP message encodings.....	680
Table 369a—REG-REQ/RSP management message encodings.....	684
Table 370—PKM attribute types	714
Table 371a—TEK encryption algorithm identifiers	715
Table 372—TEK-parameters subattributes	717
Table 374—Security-capabilities subattributes	717
Table 375—Data encryption algorithm identifiers.....	718
Table 376—Data authentication algorithm identifiers	718
Table 377—TEK encryption algorithm identifiers.....	718
Table 378—Allowed cryptographic suites	719
Table 383—SA-Descriptor subattributes.....	719
Table 383—Service flow encodings.....	734
Table 384a—Phy Mode ID fields description for OFDM PHY	756
Table 384b—Phy Mode ID fields description for OFDMA PHY	757
Table 402a—Optional feature requirements profM3_mesh	763
Table 404—Minimum Performance basic requirements.....	763
Table 408—Minimum Performance requirements for profP3_3	763
Table 409—Minimum Performance requirements for profP3_5.5	764
Table 410—Minimum Performance requirements for profP3_10	764
Table 411—Profile definitions	765
Table 413—Minimum performance requirements for all profiles	766
Table 414—Minimum performance requirements for OFDMA_ProfP1	768
Table 415—Minimum performance requirements for OFDMA_ProfP2	769
Table 416—Minimum performance requirements for OFDMA_ProfP3	769
Table 418—Minimum performance requirements for OFDMA_ProfP5	770
Table G.1—Mobility related entities	815
Table G.2—Reference points at the control plane.....	817

**IEEE Standard for
Local and metropolitan area networks**

**Part 16: Air Interface for Fixed and Mobile
Broadband Wireless Access Systems**

**Amendment 2: Physical and Medium Access
Control Layers for Combined Fixed and Mobile
Operation in Licensed Bands**

and

Corrigendum 1

NOTE—The editing instructions contained in this amendment/corrigendum define how to merge the material contained herein into the existing base standard IEEE Std 802.16™-2004.

The editing instructions are shown ***bold italic***. Four editing instructions are used: ***change***, ***delete***, ***insert***, and ***replace***. ***Change*** is used to make small corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed by using strike through (to remove old material) and underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. ***Replace*** is used to make large changes in existing text, subclauses, tables, or figures by removing existing material and replacing it with new material. Editorial notes will not be carried over into future editions because the changes will be incorporated into the base standard.

1. Overview

1.1 Scope

This document provides enhancements to IEEE Std 802.16-2004 to support subscriber stations moving at vehicular speeds and thereby specifies a system for combined fixed and mobile broadband wireless access. Functions to support higher layer handover between base stations or sectors are specified. Operation is limited to licensed bands suitable for mobility below 6 GHz. Fixed IEEE 802.16 subscriber capabilities are not compromised. In addition to mobility enhancements, this document contains substantive corrections to IEEE 802.16-2004 regarding fixed operation

1.2 Purpose

This standard will increase the market for broadband wireless access solutions by taking advantage of the inherent mobility of wireless media. It will fill the gap between very high data rate wireless local area networks and very high mobility cellular systems. It will support fixed and mobile services for both enterprise and consumer markets.

1.3 Frequency bands

1.3.3 License-exempt frequencies below 11 GHz (primarily 5–6 GHz)

Change the subclause as indicated:

The physical environment for the license-exempt bands below 11 GHz is similar to that of the licensed bands in the same frequency range, as described in 1.3.2. However, the license-exempt nature introduces additional interference and co-existence issues, whereas regulatory constraints limit the allowed radiated power. In addition to the features described in 1.3.2, the PHY and MAC introduce mechanisms ~~such as dynamic frequency selection (DFS)~~ to facilitate the detection and avoidance of interference and the prevention of harmful interference into other users including specific spectrum users identified by regulation. This includes a mechanism for regulatory compliance called dynamic frequency selection (DFS).

It is recognized that some administrations require notification of terminal location for certain services in some license-exempt bands, which is a form of licensing. Conversely, it is possible to have uncoordinated usage within a licensed allocation. In these and other similar cases the pertinent issues for license-exempt usage remain as described in the preceding paragraph.

In the context of this standard, the use of the term “license-exempt frequencies” or “license-exempt bands” should be taken to mean the situation where licensing authorities do not coordinate individual assignments to operators, regardless of whether the spectrum in question has a particular regulatory status as license-exempt or licensed.

1.3.4 Air interface nomenclature and PHY compliance

Delete the fourth column of Table 1 and make additional changes as indicated:

Table 1—Air interface nomenclature

Designation	Applicability	PHY specification	Options	Duplexing alternative
WirelessMAN-SC™	10–66 GHz	8.1	—	TDD FDD
WirelessMAN-SCa™	Below 11 GHz licensed bands	8.2	AAS (6.3.7.6) ARQ (6.3.4) STC (8.2.1.4.3) <u>mobile</u>	TDD FDD
WirelessMAN-OFDM™	Below 11 GHz licensed bands	8.3	AAS (6.3.7.6) ARQ (6.3.4) Mesh (6.3.6.6) STC (8.3.8) <u>mobile</u>	TDD FDD
WirelessMAN-OFDMA	Below 11 GHz licensed bands	8.4	AAS (6.3.7.6, <u>8.4.4.6</u>) ARQ (6.3.4) <u>HARQ (6.3.17)</u> STC (8.4.8) <u>mobile</u>	TDD FDD
WirelessHUMAN™	Below 11 GHz license-exempt bands	[8.2, 8.3 or 8.4] and 8.5	AAS (6.3.7.6) ARQ (6.3.4) Mesh (6.3.6.6) (with 8.3 only) STC (8.2.1.4.3/8.3.8/8.4.8)	TDD

Change the last paragraph as indicated:

Implementations of this standard for license-exempt frequencies below 11 GHz (such as those listed in B.1) shall comply with the WirelessMAN-SCa PHY as described in 8.2, the WirelessMAN-OFDM PHY as described in 8.3, or the WirelessMAN-OFDMA PHY as described in 8.4. They shall further comply with the DFS protocols (6.3.15) (where mandated by regulation) and with 8.5.

1.4 Reference model

Insert the following new subclause into 1.4:

1.4.1 Handover process

The handover (HO) process in which an MS migrates from the air-interface provided by one BS to the air-interface provided by another BS is defined in 6.3.22.2.

2. References

Insert the following references:

FIPS 197, Advanced Encryption Standard (AES).¹

IEEE Std 802.16™-2004, IEEE Standard for Local and metropolitan area networks: Part 16: Air Interface for Fixed Broadband Wireless Access Systems.^{2, 3}

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¹FIPS publications are available from the National Technical Information Service (NTIS), U. S. Dept. of Commerce, 5285 Port Royal Rd., Springfield, VA 22161 (<http://www.ntis.org/>).

²IEEE publications are available from the Institute of Electrical and Electronics Engineers, Inc., 445 Hoes Lane, Piscataway, NJ 08854, USA (<http://standards.ieee.org/>).

³The IEEE standards or products referred to in this clause are trademarks of the Institute of Electrical and Electronics Engineers, Inc.

⁴ITU-T publications are available from the International Telecommunications Union, Place des Nations, CH-1211, Geneva 20, Switzerland/Suisse (<http://www.itu.int/>).

3. Definitions

Change the following definitions as indicated:

3.4 bandwidth stealing: The use, by a subscriber station (SS), of a portion of the bandwidth allocated in response to a Bandwidth Request for a connection to send ~~another a~~ Bandwidth Request ~~rather than sending data or data for any of its connections.~~ *See also 6.3.6.*

3.12 connection: A unidirectional mapping between base station (BS) and subscriber station (SS) medium access control (MAC) peers ~~for the purpose of transporting a service flow's traffic.~~ Connections are identified by a connection identifier (CID). ~~All traffic is carried on a connection, even for service flows that implement connectionless protocols, such as Internet Protocol (IP).~~ The MAC defines two kinds of connections: management connections and transport connections. *See also: connection identifier.*

3.13 connection identifier (CID): A 16-bit value that identifies a transport connection or a uplink (UL)/downlink (DL) pair of associated management connections (i.e., belonging to the same subscriber station (SS)) to equivalent peers in the MAC of the base station (BS) and subscriber station (SS). The connection identifier (CID) address space is common (i.e., shared) between UL and DL and Table 345 specifies how it is partitioned among the different types of connections. It maps to a service flow identifier (SFID), which defines the Quality of Service (QoS) parameters of the service flow associated with that connection. Security associations (SAs) also exist between keying material and CIDs. *See also: connection service flow identifier.*

3.21 dynamic frequency selection (DFS): The ability of a system to switch to different physical RF channels ~~between transmit and receive activity~~ based on channel measurement criteria to conform to particular regulatory requirements.

3.27 initial ranging connection identifier: A management connection used by the subscriber station (SS) and the base station (BS) during the initial ranging process. The initial ranging connection is identified by a well-known connection identifier (CID) (see Table 345) that is used by a subscriber station (SS) during the initial ranging process. This CID is defined as constant value within the protocol since an SS has no addressing information available until the initial ranging process is complete.

3.36 payload header suppression index (PHSI): An 8-bit ~~mask that indicates which bytes in the Payload Header Suppression Field (PHSF) to suppress and which bytes to not suppress.~~ value that references the payload header suppression (PHS) Rule.

3.45 BS receive/transmit transition gap (RTG): A gap between the last sample of the uplink burst and the first sample of the subsequent downlink burst at the antenna port of the base station (BS) in a time division duplex (TDD) transceiver. This gap allows time for the base station (BS) to switch from receive to transmit mode ~~and SSs to switch from transmit to receive mode.~~ During this gap, the BS ~~and SS are~~ is not transmitting modulated data but simply allowing the BS transmitter carrier to ramp up; and the transmit/receive (Tx/Rx) antenna switch to actuate, ~~and the SS receiver sections to activate.~~ Not applicable for frequency division duplex (FDD) systems.

3.60 transport connection: A connection used to transport user data. It does not include any traffic over either the basic, primary or secondary management connections. A fragmentable transport connection is a connection that allows fragmentation of service data units (SDUs).

3.61 transport connection identifier: A unique identifier taken from the connection identifier (CID) address space that uniquely identifies the transport connection. All user data traffic is carried on transport connections, even for service flows that implement connectionless protocols, such as Internet Protocol (IP). An active or admitted service flow (identified by an service flow id (SFID)) maps to a transport connection identifier (transport CID) assigned by the BS.

3.63 BS transmit/receive transition gap (TTG): A gap between the last sample of the downlink burst and the first sample of the subsequent uplink burst at the antenna port of the base station (BS) in a time division duplex (TDD) transceiver. This gap allows time for the base station (BS) to switch from transmit to receive mode ~~and SSs to switch from receive to transmit mode~~. During this gap, the BS ~~and SS are~~ is not transmitting modulated data but simply allowing the BS transmitter carrier to ramp down, the transmit/receive (Tx/Rx) antenna switch to actuate, and the BS receiver section to activate. Not applicable for frequency division duplex (FDD) systems.

Insert new subclauses under 3.5 as follows:

3.5 base station (BS):

3.5.1 neighbor BS: For any mobile station (MS), a neighbor BS is a base station (BS) (other than the serving BS) whose downlink transmission can be received by the mobile station (MS).

3.5.2 serving BS: For any mobile station (MS), the serving BS is the base station (BS) with which the mobile station (MS) has most recently completed registration at initial network-entry or during a handover (HO).

3.5.3 target BS: The base station (BS) that a mobile station (MS) intends to be registered with at the end of a handover (HO).

3.5.4 active BS: An active BS is informed of the mobile station (MS) capabilities, security parameters, service flows and full MAC context information. For macro diversity handover (MDHO), the mobile station (MS) transmits/receives data to/from all active BSs in the diversity set.

Insert new definitions as follows:

3.71 adjacent subcarrier allocation: A permutation where the subcarriers are located adjacent to each other.

3.72 anchor BS: For macro diversity handover (MDHO) or fast BS switching (FBSS) supporting mobile station (MS)s, this is a base station (BS) where the mobile station (MS) is registered, synchronized, performs ranging and monitors the downlink (DL) for control information. For fast BS switching (FBSS) supporting mobile station (MS), this is the serving BS that is designated to transmit/receive data to/from the mobile station (MS) at a given frame.

3.73 backbone network: Communication mechanism by which two or more base station (BS)s communicate to each other, and may also include communication with other networks. The method of communication for backbone networks is outside the scope of this standard.

3.74 broadcast connection: The management connection used by the base station (BS) to send medium access control (MAC) management messages on a downlink to all subscriber station (SS). The broadcast connection is identified by a well-known connection identifier (CID) (see Table 345). A fragmentable broadcast connection is a connection that allows fragmentation of broadcast MAC management messages.

3.75 diversity set: The diversity set contains a list of active BSs to the mobile station (MS). The diversity set is managed by the mobile station (MS) and base station (BS). The diversity set is applicable to macro diversity handover (MDHO) and fast BS switching (FBSS).

3.76 frequency assignment (FA) index: A network specific logical frequency assignment (FA) index assignment. FA index assignment is used in combination with operator specific configuration information provided to the mobile station (MS) in a method outside the scope of this standard.