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Minimum Operational Performance Standards (MOPS) for the Aeronautical Mobile Airport Communication System (AeroMACS)

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Prepared by: SC-223

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FOREWORD

This report was prepared by RTCA Special Committee 223 (SC-203) and approved by the RTCA Program Management Committee (PMC) on February 20, 2014.

RTCA, Incorporated is a not-for-profit corporation formed to advance the art and science of aviation and aviation electronic systems for the benefit of the public. The organization functions as a Federal advisory committee, and develops consensus-based recommendations on contemporary aviation issues. RTCA's objectives include but are not limited to:

- coalescing aviation system user and provider technical requirements in a manner that helps government and industry meet their mutual objectives and responsibilities;

- analyzing and recommending solutions to the system technical issues that aviation faces as it continues to pursue increased safety, system capacity and efficiency;

- developing consensus on the application of pertinent technology to fulfill user and provider requirements, including development of minimum operational performance standards for electronic systems and equipment that support aviation; and

- assisting in developing the appropriate technical material upon which positions for the International Civil Aviation Organization and the International Telecommunication Union and other appropriate international organizations can be based.

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1 PURPOSE AND SCOPE

1.1 Introduction

This document contains Minimum Operational Performance Standards for both the Airborne Component and Ground Based base station of the Aeronautical Mobile Airport Communication System (AeroMACS).

Compliance with these standards is recommended as one means of assuring that the equipment will perform its intended function(s) satisfactorily under all conditions normally encountered in routine aeronautical operation. Any regulatory application of this document is the sole responsibility of appropriate governmental agencies. These standards specify system characteristics that should be useful to designers, manufacturers, installers and users of the equipment.

Section 1 of this document provides information needed to understand the rationale for equipment characteristics and requirements stated in the remaining sections. It describes typical equipment operations and operational goals, as envisioned by the members of Special Committee 223 and Working Group 82, and establishes the basis for the standards stated in Sections 2 through 3. Definitions and assumptions essential to proper understanding of this document are also provided in this section.

Section 2 contains the Minimum Performance Standards for the equipment. These standards specify the required performance under standard environmental conditions. Also included are recommended bench test procedures necessary to demonstrate equipment compliance with the stated minimum requirements.

Section 3 describes the performance required for installed equipment. Tests for the installed equipment are included when performance cannot be adequately determined through bench testing.

Section 4 describes the operational performance characteristics for equipment installations and defines conditions that will assure the equipment user that operations can be conducted safely and reliably in the expected operational environment.

Appendix A - List of abbreviations and acronyms

Appendix B – Requirement Applicability

Appendix C – Example receiver sensitivity calculation

This document considers an equipment configuration consisting of AeroMACS radio and modem from antenna interface to the network interface. This MOPS addresses both Airborne Mobile Station and Ground Base Station components of the AeroMACS system.

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1.2 System Overview – AeroMACS

This section provides an overview of Aeronautical Mobile Airport Communications System (AeroMACS) broadband communications system. AeroMACS is based on a specific commercial WiMax Forum profile, which is based on the IEEE 802.16 standard.

The 2005 amendment to the IEEE 802.16 2004 standard for local and metropolitan area networks, IEEE 802.16e, was recommended for aeronautical wireless mobile data communications on the airport surface. The recommendation resulted from technology assessment studies conducted under the Future Communications System study (FCS) jointly conducted by U.S. and Europe. International harmonization was carried out over multiple meetings of ICAO's Aeronautical Communications Panel (ACP) Communications Working Groups (WGC-8 through WGC-11) and Working Group Technology (WGT) to establish common solutions for future A/G data communications in the 2020 timeframe. An underlying objective of the FCS technology assessment was to maximize existing technologies and standards and minimize any modifications to each. This approach leveraged existing commercial industry resources invested in developing and standardizing the technology and can expedite ICAO approval as an international aviation standard.

AeroMACS is based on the IEEE 802.16-2009 standard, Part 16: Air Interface for Broadband Wireless Access Systems [1]. This standard is well suited for implementation below 11-GHz. The amendment for mobility uses 512 sub-carrier (in 5-MHz channel) scalable orthogonal frequency division multiple access (S-OFDMA) modulation and supports multiple channel bandwidths from 1.25- to 20-MHz, with peak duplex data rates above 50-Mbps. Some of the features of the IEEE 802.16 mobile standard that makes it attractive for use on the airport surface are highlighted in Table 1 - Features of IEEE 802.16 desirable for implementation of AeroMACS networks below.

Table 1 - Features of IEEE 802.16 desirable for implementation of AeroMACS networks

• **Mobility**	Supports vehicle speeds of up to 120 km/hr , sufficient for aircraft taxiing and emergency surface vehicle speeds
• **Range**	Covers up to ~10 km in line-of-sight (LOS) communications, sufficient to cover most airports
• **Link Obstruction Tolerance**	Exploits multipath to enable non line-of-site (NLOS) communications
• **Quality of Service (QoS)**	Enables QoS based on throughput rate, packet error rate deletion, scheduling, time delay and jitter, resource management
• **Scalability**	Includes flexible bandwidth and channelization options to enables network growth on demand
• **Security**	Includes mechanisms for authentication, authorization, encryption, digital certificates, and fast handovers
• **Privacy**	Supports private Virtual Local Area Networks (VLANs)
• **Open Sourced**	Leverages modern communications technologies and supports modern Internet-based network protocols
• **Cost Efficiency**	Via commercial standards and components, industry capabilities, and reduced physical infrastructure

AeroMACS is based on a specific WiMAX Forum® profile of the IEEE 802.16 standard. This enables the aviation community to leverage extensive international standards collaboration and commercially-provided components and services.[1] The AeroMACS profile closely follows the format and substance of profiles developed by the WiMAX Forum® for commercial and industrial use. The WiMAX Forum® is an industry consortium whose primary technical function is to develop the technical specifications underlying WiMAX Forum Certified™ products.

The profile is expected to be incorporated as one of several WiMAX Forum Certified™ profiles.

An AeroMACS based on the WiMAX™ standard for local area networks can potentially support a wide variety of data, video, and voice communications and information exchanges among mobile users at the airport. The airport Communications, Navigation, and Surveillance (CNS) infrastructure that supports Air Traffic Management (ATM) and Air Traffic Control (ATC) on the airport surface can also benefit from secure wireless communications with improved availability and diversity. A wideband communications network can enable sharing of graphical data and near real-time video to significantly increase situational awareness, improve surface traffic movement to reduce congestion and delays, and help prevent runway incursions. AeroMACS can provide temporary communications capabilities during construction or outages, and reduce the cost of connectivity. A broadband wireless communications system like AeroMACS can enhance collaborative decision making, ease updating of large databases, provide up-to-date weather graphics and aeronautical information (Aeronautical Information and Meteorological Services), and enable aircraft access to System Wide Information Management (SWIM) services and delivery of time-critical advisory information to the cockpit.

1.2.1 Document Hierarchy

This document has precedence over the referenced documents here-in such as WiMAX, IEEE Standards etc. Where an "optional" and/or "recommended" requirement is stated in either a referenced WiMAX or IEEE standard and the corresponding requirement in these MOPS is a "Shall" statement the MOPS requirement will be adhered to. The AeroMACS PICS and CRSL referenced in this document define the test procedures for AeroMACS.

Within this document the following conventions are used:

INFORMATIVE – Used when the corresponding paragraphs of reference [1] contain no requirements however, that material should be consulted for overall understanding. .

IO-MIMO – Requirements that are labeled [IO-MIMO] are MIMO requirements and are not required for all AeroMACS implementations. If however a choice has been made to implement these optional MIMO capabilities they must meet the requirements as defined by this document and will require additional test procedures beyond what is specified within this document.

IO-ETH – Requirements that are labeled [IO-ETH] are Ethernet I/O requirements and are not required for all AeroMACS implementations. If however, a choice has been made to implement these optional Ethernet I/O capabilities, they must meet the requirements as defined by this document and will require additional test procedures beyond what is specified within this document.

[1] WMF-T32-001-R010v09 - WiMAX Forum® Network Architecture - Architecture Tenets, Reference Model and Reference Points Part 0 - Release 1.0, available from < http://www.wimaxforum.org/resources/documents/technical/release >

IO-64QAM – Requirements that are labeled [IO-64QAM] are 64-QAM requirements and are not required for all AeroMACS implementations. If however, a choice has been made to implement these optional 64-QAM capabilities, they must meet the requirements as defined by this document and will require additional test procedures beyond what is specified within this document.

IO-CM – Requirements that are labeled [IO-CM] are Compressed Maps requirements and are not required for all AeroMACS implementations. If however, a choice has been made to implement these optional Compressed Maps capabilities, they must meet the requirements as defined by this document and will require additional test procedures beyond what is specified within this document.

IO-IPV6 – Requirements that are labeled [IO-IPV6] are IP version 6 requirements and are not required for all AeroMACS implementations. If however, a choice has been made to implement these optional IP Version 6 capabilities, they must meet the requirements as defined by this document and will require additional test procedures beyond what is specified within this document.

NA – Indicates that the sections is not applicable to AeroMACS and hence are not requirements on the implementation.

Requirements that are stated in the form of "AeroMACS shall ... "are applicable to both the Airborne MS and Ground BS components of AeroMACS. Requirements that are stated in the form of "The AeroMACS MS shall,,," or "The AeroMACS BS shall …" are applicable only to the MS or BS as indicated.

1.3 Operational Application(s)

The community of potential AeroMACS users in an airport environment varies with the size of the airport facility. Airport Authority, Airlines and Civil Aviation Authority are principal airport tenants that deliver services and have a need to transport application information over a wireless network. User applications for transport over AeroMACS have been classified in 5 different functional domain categories. The functional domains are:

- Air Traffic Management/Air Traffic Control
- Aeronautical Information Services and Meteorological Data (AIS/MET)
- Aircraft Owner / Operator
- Airport Authority
- Airport Infrastructure

Applications identified and categorized in these 5 domains may have different performance characteristics, security needs, and quality of service requirements. The type of information content for each application ranges from live video streaming to low throughput system monitoring data exchanges.

Several applications belonging to different functional domains have been identified for consideration. Following is a sample of potential applications that can be transported over AeroMACS. Digital Notice to Airmen (D-NOTAM), the next generation NOTAM, are created and transmitted by government agencies to alert pilots of hazards in the NAS. D-NOTAM has been identified as a strong candidate application for transport over AeroMACS. Digital Taxi-Graphical and digital Air Traffic Information System (D-ATIS) are applications that are currently transported using ACARS. Both D_Taxi and D-ATIS have been noted as candidates for implementation over AeroMACS. Future applications such as 4D Trajectory Data Link (4DTRAD) leverage advanced avionics to manage the end-to-end aircraft trajectory. 4DTRAD for surface movement application is under consideration for transport over the

AeroMACS network. Airport Infrastructure equipment such Airport Surface Detection Equipment (ASDE-X) has long been identified as an application that could benefit from a wireless communications technology.

Mobile stations support both mobile and stationary applications on the airport surface. The following sections describe some potential examples of each. Operation in the RF Physical domain will be identical for all mobile stations.

1.3.1 Mobile Applications Examples

- ATC Communications with any aircraft anywhere on the airport surface.
  - ATC communications with any vehicle in the airport movement area (runway and taxiways)
  - Tower Data Link System (TDLS) for flight clearances
  - Loading FMS via CMU with 4D trajectories and modifications
- AOC, Advisory, and non-ATS voice/data between airlines and pilot
  - Collaborative decision making and 4D trajectory negotiations
  - EFB data, GPS and AIS updates; hazards advisories; NOTAMS
  - Surface management, gate and ramp control
  - Graphical weather corresponding to 4D trajectory
- Mobile SWIM and airport surface users
  - Publish and subscribe; receive/"listen" only
  - Fire, safety, snow removal, de-icing (in movement area)
  - Airport operations security; security video from cockpit and cabin

1.4 Intended Function

The equipment shall perform its intended function, as defined by the manufacturer, and its proper use shall not create a hazard to the users of the airspace.

1.5 Operational Goals

The operational goal of the AeroMACS system is to provide advanced data communication means to augment the current existing capabilities on the airport surface.

1.6 Assumptions

This document is written to address both the Airborne and Ground components of the system and has been written from the perspective of a single LRU design approach. This choice was made for convenience of authorship and in no way intended to restrict the possible design solutions. Final solutions may be single LRU, multiple LRU, or Cabinet Based IMA in nature.

1.7 Test Procedures

The test procedures specified in this document are intended to be used as one means of demonstrating compliance with the performance requirements defined in Section 2.2. Although specific test procedures are cited, it is recognized that other methods may be preferred. These alternate procedures may be used if they provide at least equivalent information. In such cases, the procedures cited herein should be used as one criterion in evaluating the acceptability of the alternate procedures. Users of this document should not infer performance requirements based on Test Procedures.

The order of tests specified suggests that the equipment be subjected to a succession of tests as it moves from design and design qualification, into operational use. For example, compliance with the requirements of Section 2 shall have been demonstrated as a precondition to satisfactory completion of the installed system tests of Section 3.

a. Environmental Tests

Environmental test requirements are specified in Subsection 2.3. The procedures and their associated limits are intended to provide a laboratory means of determining the electrical and mechanical performance of the equipment under environmental conditions expected to be encountered in actual operations.

b. Bench Tests

Bench test procedures are specified in Subsection 2.4. These tests provide a laboratory means of demonstrating compliance with the requirements of Subsection 2.2. Test results may be used by equipment manufacturers as design guidance, for monitoring manufacturing compliance and, in certain cases, for obtaining formal approval of equipment design.

c. Installed Equipment Considerations

Tests for the installed equipment are included when performance cannot be adequately determined through bench testing.

The installed equipment test procedures and their associated limits are specified in Section 3. Although bench and environmental test procedures are not included in the installed equipment test, their successful completion is a precondition to completion of the installed test. In certain instances, however, installed equipment test may be used in lieu of bench test simulation of such factors as power supply characteristics, Interference from or to other equipment installed on the aircraft, etc. Installed tests are normally performed under two conditions:

1. With the aircraft on the ground and using simulated or operational system inputs.
2. With the aircraft inflight using operational system inputs appropriate to the equipment under test.

Test results may be used to demonstrate functional performance in the intended operational environment.

d. Operational Tests

The operational tests are specified in Section 4. These test procedures and their associated limits are intended to be conducted by operating personnel as one means of ensuring that the equipment is functioning properly and can be reliably used for its intended function(s).

1.8 Definition of Terms

- Aerodrome: A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.
- Adaptive modulation: A system's ability to communicate with another system using multiple burst profiles and a system's ability to subsequently communicate with multiple systems using different burst profiles.
- BS (Base Station): A generalized equipment set providing connectivity, management, and control of the subscriber station (SS).
- BER (Bit Error Rate): number of bit errors divided by the total number of transferred bits during a studied time interval - measured after error decoder.
- Burst profile: Set of parameters that describe the uplink (UL) or downlink (DL) transmission properties associated with an interval usage code. Each profile contains parameters such as modulation type, forward error correction (FEC) type, preamble length, guard times, etc
- CPDLC: The ATN application Controller Pilot Data Link Communications
- Data transit delay. In accordance with ISO 8348, the average value of the statistical distribution of data delays. This delay represents the subnetwork delay and does not include the connection establishment.
- Downlink: The transmission direction from the base station (BS) to the mobile station (MS).
- FA (Frequency assignment): A logical assignment of downlink (DL) center frequency and channel bandwidth programmed to the base station (BS).
- HO (Handover): The process in which a mobile station (MS) migrates from the air-interface provided by one base station (BS) to the air-interface provided by another BS. A break-before-make HO is where service with the target BS starts after a disconnection of service with the previous serving BS.
- MS (Mobile Station): A station in the mobile service intended to be used while in motion or during halts at unspecified points. An MS is always a subscriber station (SS) unless specifically stated otherwise in this standard.
- N (Network): The word "network" and its abbreviation "N" in ISO 8348 are replaced by the word "subnetwork" and its abbreviation "SN", respectively, whenever they appear in relation to the subnetwork layer packet data performance.
- Network Entry Time: The time from when the SS first attempts to determine the channel to tx on (e.g. scanning) until the first network user pdu can be sent. Note: does not include time for self test or other power up functions.
- PtP (Point-to-point): A mode of operation whereby a link exists between two network entities.
- Residual error rate: The ratio of incorrect, lost and duplicate subnetwork service data units (SNSDUs) to the total number of SNSDUs that were sent.
- SF (Service flow): A unidirectional flow of medium access control layer (MAC) service data units (SDUs) on a connection that is provided a particular quality of service (QoS).
- SS (Subscriber Station): A generalized equipment set providing connectivity between subscriber equipment and a base station (BS).
- SN (Subnetwork): See Network (N)
- SDU (Service data unit): The data unit exchanged between two adjacent protocol layers. On the downward direction, it is the data unit received from the previous higher layer. On the upward direction, it is the data unit sent to the next higher layer.
- SNSDU (Subnetwork service data unit): An amount of subnetwork user data, the identity of which is preserved from one end of a subnetwork connection to the other.

- TDD (Time division duplex): A duplex scheme where uplink (UL) and downlink (DL) transmissions occur at different times but may share the same frequency.
- Uplink: The direction from a mobile station (MS) to the base station (BS).

1.9 Anticipated Future Growth

None specified.

1.10 Reference Documents

This document uses shorthand references to other documents. The references and full identification of the applicable documents are as given below. The reference documents of the exact data and issue, including changes, apply unless otherwise noted.

1. IEEE 802.16-2009, IEEE Standard for Local and metropolitan area networks Part 16: Air Interface for Broadband Wireless Access Systems
2. WMF-T24-nnn-Rnnn-vnn, WiMAX Forum ® AeroMACS Protocol Implementation Conformance Statement (PICS) Proforma

   ***Note**: See Proprietary Dislaimer in section 1.1)*
3. EUROCAE ED-12B / RTCA DO-178B, Software Considerations in Airborne Systems and Equipment Certification (December 1, 1992)
4. WMF-T32-003-R010v05, WiMAX Forum® Network Architecture : Architecture Tenets, Reference Model and Reference Points (2009-03-19)
5. WiMAX Forum® AeroMACS Certification Requirements Status List (CRSL) Version n.n.n (Note: See Proprietary Dislaimer in section 1.1)
6. EUROCAE ED-14G / RTCA DO-160G Environmental Conditions and Test Procedures for Airborne Equipment (December 8, 2010)
7. RTCA DO-345, Aeronautical Mobile Airport Communications System Profile, October 8, 2013
8. ProfileSimon, et al., "EAP-TLS Authentication Protocol", RFC 5216, March 2008
9. International Telecommunication Union, "Information technology - Open systems interconnection - The Directory: Public-key and attribute certificate frameworks", ITU-T Recommendation X.509 | ISO/IEC 9594-8, 11/2008
10. Internet Protocol, RCF 791, September 1981
11. Internet Protocol, Version 6, RFC 2460, December 1998

2 MINIMUM PERFORMANCE STANDARDS

2.1 General Design Requirements

2.1.1 Effect of Test

The equipment shall be designed so that the application of specified test procedures shall not be detrimental to equipment performance following the application of the tests, except as specifically allowed.

2.1.2 Intended Function

The equipment shall perform its intended function(s), as defined by the manufacturer, and its proper use shall not create a hazard to other users of the National Airspace System.

2.1.3 ITU Regulations and Federal Communications Commission Rules

The equipment shall comply with the relevant International Telecommunications Union (ITU-R) Radio Regulations and FCC Regulations or such other requirements as applicable.

2.1.4 Equipment Classes

This AeroMACS MOPS defines two equipment classes Base Stations (BS) which are stations that are installed at fixed locations on the airport surface, and Airborne Mobile Stations (MS) which are mobile stations that are installed within an aircraft.

2.1.5 Airborne - General Design Requirements

2.1.5.1 Software Management

If the equipment design is implemented using digital computer techniques, the computer software package(s) shall follow guidelines contained in RTCA document DO-178B "Software Considerations in Aircraft Systems and Equipment Certification." The equivalent of later editions of DO-178(B) may be used with the agreement of the authority.

2.1.5.2 Airworthiness

In the design and manufacture of the equipment, the manufacturer shall provide for installation so as not to impair the airworthiness of the aircraft.

2.1.5.3 Fire Protection

All materials used shall be self-extinguishing except for small parts (such as knobs, fasteners, seals, grommets, and small electrical parts) that would not contribute significantly to the propagation of a fire.

Note: One means of showing compliance is contained in Federal Aviation Regulations (FAR), Part 25, Appendix F and/or Part 23 Appendix F.

2.1.5.4 Operation of Controls

The equipment shall be designed so that controls intended for use during flight cannot be operated in any position, combination or sequence that would result in a condition detrimental to the reliability of the equipment or operation of the aircraft.

2.1.5.5 Design Assurance

Design Assurance Levels (DAL) should be adequate to mitigate the failure classification appropriate to the contribution of the equipment to the aircraft level failure in the aircraft in which it is to be installed. The DAL appropriate for a given hazard classification is not the same for all aircraft types and, the contribution of the equipment to an aircraft level failure may vary depending on the aircraft and other installed equipment.

2.1.5.5.1 Accessibility of Controls

Controls that do not require adjustment during flight shall not be readily accessible to flight personnel.

2.1.5.5.2 Display of Navigation Facility Identification

NA

2.1.6 Ground – General Design Requirements

2.1.6.1 Controls and indicators

The user shall not have access to any control which, if wrongly set, might impair the technical characteristics of the equipment.

2.2 Equipment Performance – Standard Conditions

2.2.1 AeroMACS Operating Frequency Band

AeroMACS shall be tunable across the band 5000 MHz to 5150MHz, in 250 kHz steps with reference channel of 5145 MHz.

The reference channel only identifies a channel whose center frequency is included in the list of center frequencies that are to be tuned by AeroMACS and is a reference point for the identification of all other center frequencies that may be tuned by AeroMACS using the channel step size.

Note: The core AeroMACS band is 5091-5150 MHz.

Note: Channels can be assigned in the sub-bands:

5000-5030 MHz based on national regulations,

5030-5091 MHz depending on frequency planning defined at ICAO level considering other Aeronautical applications.

Note: The 250kHz step size will allow AeroMACS to gracefully move away from any interference source such as MLS, AMT, or Military users located in the 5000-5150 MHz band.

2.2.2 Supported Channel Bandwidth

AeroMACS shall implement only the 5 MHz bandwidth, with the corresponding FFT sizes of 512 points.

2.2.3 Reserved

NA

2.2.4 Reserved

NA

2.2.5 Service-specific CS

[INFORMATIVE]

2.2.5.1 ATM CS

NA

2.2.5.2 Packet CS

[INFORMATIVE]

2.2.5.2.1 MAC SDU format

AeroMACS shall implement the MAC SDU format as described in [1], para 5.2.1.

2.2.5.2.2 Classification

AeroMACS shall follow the classification rules – for the AeroMACS specific classification rules selected in the profiles as described in [1], para 5.2.2.

2.2.5.2.3 Payload header suppression (PHS)

AeroMACS shall implement PHS as described in [1], para 5.2.3.

2.2.5.2.3.1 PHS operation

AeroMACS shall implement PHS operation as described in [1,] para 5.2.3.1.

2.2.5.2.3.2 PHS signaling

AeroMACS shall implement PHS signaling as described in [1], para 5.2.3.2.

2.2.5.2.4 IEEE 802.3/Ethernet-specific part

[IO-ETH] If implementing the [IO-ETH] option, AeroMACS shall Implement IEEE 802.3/Ethernet as defined in ref [1] para 5.2.4.

Note: Ethernet CS can optionally be implemented in the MS, the BS or both.

2.2.5.2.4.1 IEEE 802.3/Ethernet CS PDU format

[IO-ETH] If implementing the [IO-ETH] option, AeroMACS shall implement IEEE 802.3/Ethernet CS PDU format as defined in [1], para 5.2.4.1.

2.2.5.2.4.2 IEEE 802.3/Ethernet CS classification rules

[IO-ETH] If implementing the [IO-ETH] option, AeroMACS shall implement IEEE 802.3/Ethernet CS classification rules as defined in ref [1], para 5.2.4.2.

2.2.5.2.5 IP specific part

AeroMACS shall implement IETF RFC 791 [10] as defined in ref [1], para 5.2.5.

[IO-IPV6] if implementing the [IO-IPV6] option, AeroMACS shall implement IETF RFC 2460 [xx] as defined in ref [1], para 5.2.5

2.2.5.2.5.1 IP CS PDU format

AeroMACS shall implement the IP CS PDU format as defined in [1], para 5.2.5.1.

Note: ROHC is NA for AeroMACS.

2.2.5.2.5.2 IP classification rules

AeroMACS shall implement the IP classification rules as described in [1], para 5.2.5.2.

2.2.5.3 Generic Packet Convergence Sublayer (GPCS)

NA

2.2.6 MAC common part sub-layer

2.2.6.1 Point to multipoint (PMP) operation overview

[INFORMATIVE]

2.2.6.2 Reserved

2.2.6.3 Data and Control Plane

2.2.6.3.1 Addressing and connections

2.2.6.3.1.1 Point-to-multipoint (PMP)

AeroMACS shall implement the PMP functions as defined in [1], para 6.3.1.1.

2.2.6.3.2 MAC PDU formats

AeroMACS shall implement the MAC PDU formats as defined in [1], para 6.3.2.

2.2.6.3.2.1 MAC header formats

AeroMACS shall implement the MAC header formats as defined in [1], para 6.3.2.1.

2.2.6.3.2.1.1 Generic MAC header

AeroMACS shall implement the generic MAC header format as defined in [1], para 6.3.2.1.1.

2.2.6.3.2.1.2 MAC header without payload

[INFORMATIVE]

####### 2.2.6.3.2.1.2.1 MAC signaling header type I

AeroMACS shall implement the MAC signaling header type I as defined in [1], para 6.3.2.1.2.1.

######## 2.2.6.3.2.1.2.1.1 Bandwidth request (BR) header

AeroMACS shall implement BR request header as defined in [1], para 6.3.2.1.2.1.1.

######## 2.2.6.3.2.1.2.1.2 Bandwidth request and UL Tx power report header

AeroMACS shall implement bandwidth request and UL Tx report header as defined in [1], para 6.3.2.1.2.1.2.

######## 2.2.6.3.2.1.2.1.3 BR and CINR report header

NA

######## 2.2.6.3.2.1.2.1.4 CQICH allocation request header

NA

2.2.6.3.2.1.2.1.5 PHY channel report header

NA

2.2.6.3.2.1.2.1.6 BR and UL sleep control header

NA

2.2.6.3.2.1.2.1.7 SN report header

NA

2.2.6.3.2.1.2.2 MAC signaling header type II

NA

2.2.6.3.2.1.2.2.1 Feedback header

NA

2.2.6.3.2.1.2.2.2 MIMO channel feedback header

NA

2.2.6.3.2.2 MAC subheaders and special payloads

[INFORMATIVE]

2.2.6.3.2.2.1 Fragmentation subheader (FSH)

AeroMACS shall implement Fragmentation subheader as defined in [1], para 6.3.2.2.1.

2.2.6.3.2.2.2 Grant management subheader (GMSH)

AeroMACS shall implement Grant management sub header as defined in [1], para 6.3.2.2.2.

2.2.6.3.2.2.3 Packing subheader (PSH)

AeroMACS shall implement Packing of variable-length SDUs as defined in [1], para 6.3.2.2.3.

2.2.6.3.2.2.4 ARQ/Feedback

NA

2.2.6.3.2.2.5 Reserved

NA

2.2.6.3.2.2.6 Fast-feedback allocation subheader (FFSH)

NA

2.2.6.3.2.2.7 Extended subheader format

NA

2.2.6.3.2.2.7.1 SDU SN extended subheader

NA

2.2.6.3.2.2.7.2 DL sleep control extended subheader

NA

2.2.6.3.2.2.7.3 Feedback request extended subheader

NA

2.2.6.3.2.2.7.4 MIMO mode feedback extended subheader

NA

2.2.6.3.2.2.7.5 UL Tx power report extended subheader

.NA

2.2.6.3.2.2.7.6 Mini-feedback extended subheader

NA

2.2.6.3.2.2.7.7 SN request extended subheader

NA

2.2.6.3.2.2.7.8 PDU SN extended subheader

NA

2.2.6.3.2.2.7.9 ertPS resumption bitmap extended subheader

NA

2.2.6.3.2.2.7.10 Persistent Allocation Error Event

NA

2.2.6.3.2.3 MAC management messages

AeroMACS shall implement the MAC management messages as defined in [1], para 6.3.2.3.

The Type Length Value(s) (TLV) for each of the MAC management message shall be as defined in [2] or equivalent.

2.2.6.3.2.3.1 DCD (DL channel descriptor) message

AeroMACS shall implement the DCD message as defined in [1], para 6.3.2.3.1.

2.2.6.3.2.3.2 DL-MAP (Downlink map) message

AeroMACS shall implement the DL-MAP message as defined in [1], para 6.3.2.3.2.

2.2.6.3.2.3.3 UCD (UL channel descriptor) message

AeroMACS shall implement the UCD message as defined in [1], para 6.3.2.3.3.

2.2.6.3.2.3.4 UL-MAP (UL map) message

AeroMACS shall implement the UL-MAP message as defined in [1], para 6.3.2.3.4.

2.2.6.3.2.3.5 RNG-REQ (ranging request) message

AeroMACS shall implement the RNG-REQ message as defined in [1], para 6.3.2.3.5.

2.2.6.3.2.3.6 RNG-RSP (ranging response) message

AeroMACS shall implement RNG-RSP message as defined in [1], para 6.3.2.3.6.

2.2.6.3.2.3.7 REG-REQ (registration request) message

AeroMACS shall implement REG-REQ message as defined in [1], para 6.3.2.3.7.

2.2.6.3.2.3.8 REG-RSP (registration response) message

AeroMACS shall implement REG-RSP message as defined in [1], para 6.3.2.3.8.

2.2.6.3.2.3.9 Privacy key management (PKM) messages (PKM-REQ/PKM-RSP)

AeroMACS shall implement PKM messages as defined in [1], para 6.3.2.3.9.

Note: MIH Initial Request ([1], para 6.3.2.3.9.26), MIH Acknowledge ([1], para 6.3.2.3.9.27), and MIH Comeback Response ([1], para 6.3.2.3.9.28) are NA for AeroMACS.

2.2.6.3.2.3.10 DSA-REQ message

AeroMACS shall implement the DSA-REQ message as defined in [1], para 6.3.2.3.10.

2.2.6.3.2.3.10.1 MS-Initiated DSA

NA

2.2.6.3.2.3.10.2 BS-Initiated DSA

AeroMACS shall implement BS-Initiated DSA as defined in [1], para 6.3.2.3.10.2.

2.2.6.3.2.3.11 DSA-RSP message

AeroMACS shall implement the DSA-RSP message as defined in [1] para 6.3.2.3.11.

2.2.6.3.2.3.11.1 MS-Initiated DSA

NA

2.2.6.3.2.3.11.2 BS-Initiated DSA

AeroMACS shall implement BS-Initiated DSA as defined in [1], para 6.3.2.3.11.2.

2.2.6.3.2.3.12 DSA-ACK message

AeroMACS shall implement the DSA-ACK message as defined in [1] para 6.3.2.3.12.

2.2.6.3.2.3.13 DSC-REQ (DSC request) message

AeroMACS shall implement the DSA-REQ message as defined in [1], para 6.3.2.3.13.

Note: Only the BS is allowed to dynamically change the parameters of an existing service flow.

2.2.6.3.2.3.14 DSC-RSP (DSC response) message

AeroMACS shall implement the DSC-RSP message as defined in [1], para 6.3.2.3.14.

2.2.6.3.2.3.15 DSC-ACK (DSC acknowledge) message

AeroMACS shall implement the DSC-ACK message as defined in [1], para 6.3.2.3.15.

2.2.6.3.2.3.16 DSD-REQ message

AeroMACS shall implement the DSD-REQ message as defined in [1], para 6.3.2.3.16.

Note: Only the BS is allowed to delete an existing service flow.

2.2.6.3.2.3.17 DSD-RSP message

AeroMACS shall implement the DSD_RSP message as defined in [1], para 6.3.2.3.17.

2.2.6.3.2.3.18 MCA-REQ (multicast polling assignment request) message

NA

2.2.6.3.2.3.19 MCA-RSP (multicast polling assignment response) message

NA

2.2.6.3.2.3.20 DBPC-REQ (DL burst profile change request) message

NA

2.2.6.3.2.3.21 DBPC-RSP (DL burst profile change response) message

NA

2.2.6.3.2.3.22 RES-CMD (reset command) message

NA

2.2.6.3.2.3.23 SBC-REQ (SS basic capability request) message

AeroMACS shall implement SBC-REQ message as defined in [1], para 6.3.2.3.23.

2.2.6.3.2.3.24 SBC-RSP (SS basic capability response) message

AeroMACS shall implement SBC-RSP message as defined in [1], para 6.3.2.3.24.

2.2.6.3.2.3.25 CLK-CMP (clock comparison) message

NA

2.2.6.3.2.3.26 DREG-CMD (de/reregister command) message

AeroMACS shall implement the DREG-CMD message as defined in [1], para 6.3.2.3.26.

2.2.6.3.2.3.27 DSX-RVD (DSx received) message

NA

2.2.6.3.2.3.28 TFTP-CPLT (Config File TFTP complete) message

NA

2.2.6.3.2.3.29 TFTP-RSP (Config File TFTP complete response) message

NA

2.2.6.3.2.3.30 ARQ-Feedback message

AeroMACS shall implement the ARQ-Feedback message as defined in [1], para 6.3.2.3.30.

2.2.6.3.2.3.31 ARQ-Discard message

AeroMACS shall implement the ARQ-Discard message as defined in [1], para 6.3.2.3.31.

2.2.6.3.2.3.32 ARQ-Reset message

AeroMACS shall implement the ARQ-Reset message as defined in [1], para 6.3.2.3.32.

2.2.6.3.2.3.33 Channel Measurement REP-REQ/RSP (report request/response)

AeroMACS shall implement Channel Measurement REP-REQ/RSP as defined in [1], para 6.3.2.3.33

2.2.6.3.2.3.34 FPC (fast power control) message

NA

2.2.6.3.2.3.35 AAS-FBCK-REQ/RSP (AAS channel feedback request/response) messages

NA

2.2.6.3.2.3.36 AAS_Beam_Select message

NA

2.2.6.3.2.3.37 DREG-REQ (SS deregistration request) message

AeroMACS shall implement the DREG-REQ message as defined in [1], para 6.3.2.3.37.

2.2.6.3.2.3.38 HARQ MAP message

NA

2.2.6.3.2.3.39 MOB_SLP-REQ (sleep request) message

NA

2.2.6.3.2.3.40 MOB_SLP-RSP (sleep response) message

NA

2.2.6.3.2.3.41 MOB_TRF-IND (traffic indication) message

NA

2.2.6.3.2.3.42 MOB_NBR-ADV (neighbor advertisement) message

AeroMACS shall implement MOB_NBR-ADV message as defined in [1], para 6.3.2.3.42.

2.2.6.3.2.3.43 MOB_SCN-REQ (scanning interval allocation request) message

AeroMACS shall implement MOB_SCN-REQ message as defined in [1], para 6.3.2.3.43.

AeroMACS shall implement support for BS index as defined in [1], para 6.3.2.3.43.

AeroMACS shall implement scanning for cell selection as defined in [1], para 6.3.2.3.43.

AeroMACS shall implement MS Requests for Scanning Interval Allocations from the BS as defined in [1], para 6.3.2.3.43.

2.2.6.3.2.3.44 MOB_SCN-RSP (scanning interval allocation response) message

AeroMACS shall MOB_SCN-RSP message as defined in [1], para 6.3.2.3.44.

AeroMACS shall implement Support for BS index as defined in [1], para 6.3.2.3.44.

AeroMACS shall implement Scanning for cell selection as defined in [1], para 6.3.2.3.44.

2.2.6.3.2.3.45 MOB_SCN-REP (scanning result report) message

The MS shall implement MOB_SCN-REP as defined in [1], para 6.3.2.3.45

2.2.6.3.2.3.46 MOB_ASC-REP (association result report) message

NA

2.2.6.3.2.3.47 MOB_BSHO-REQ (BS HO request) message

NA

2.2.6.3.2.3.48 MOB_MSHO-REQ (MS HO request) message

AeroMACS shall implement MOB_MSHO-REQ message as defined in [1], para 6.3.2.3.48.

2.2.6.3.2.3.49 MOB_BSHO-RSP (BS HO response) message

AeroMACS shall implement MOB_BSHO-RSP message as defined in [1], para 6.3.2.3.49.

2.2.6.3.2.3.50 MOB_HO-IND (HO indication) message

AeroMACS shall implement MOB_HO-IND message as defined in [1], para 6.3.2.3.50.

2.2.6.3.2.3.51 MOB_PAG-ADV (BS broadcast paging) message

NA

2.2.6.3.2.3.52 MBS_MAP (multicast and broadcast service map) message

NA

2.2.6.3.2.3.53 PMC_REQ (power control mode change request) message

AeroMACS shall implement the PMC_REQ message as defined in [1], para 6.3.2.3.53.

2.2.6.3.2.3.54 PMC_RSP (power control mode change response) message

AeroMACS shall implement the PMC_RSP message as defined in [1], para 6.3.2.3.54.

2.2.6.3.2.3.55 OFDMA SUB-DL-UL-MAP message

NA

2.2.6.3.2.3.56 MIMO precoding setup/tear-down messages

NA

2.2.6.3.2.3.57 MIH Payload Transfer (MOB_MIH-MSG) message

NA

2.2.6.3.2.3.58 Service Identity Information (SII-ADV) message

AeroMACS shall implement Service Identity Information (SII-ADV) messages as defined in [1], para 6.3.2.3.58.

2.2.6.3.2.3.59 Location Based Services (LBS-ADV) message

NA

2.2.6.3.3 Construction and transmission of MAC PDUs

[INFORMATIVE]

2.2.6.3.3.1 Conventions

AeroMACS shall implement data transmissions according to the rules as defined in [1], para 6.3.3.1.

2.2.6.3.3.2 Concatenation

AeroMACS shall implement concatenation of multiple MAC PDUs as defined in [1], para 6.3.3.2.

2.2.6.3.3.3 Fragmentation

AeroMACS shall implement fragmentation of MAC PDUs as defined in [1], para 6.3.3.3.

2.2.6.3.3.3.1 Non-ARQ connections

AeroMACS shall implement fragmentation for non-ARQ connections as desfined in [1], para 6.3.3.3.1.

2.2.6.3.3.3.2 ARQ-enabled connections

AeroMACS shall implement ARQ-enabled connections as defined in [1], para 6.3.3.3.2.

2.2.6.3.3.4 Packing

[INFORMATIVE]

2.2.6.3.3.4.1 Packing for non-ARQ connections

[INFORMATIVE]

2.2.6.3.3.4.1.1 Packing fixed-length MAC SDUs

NA

2.2.6.3.3.4.1.2 Packing variable-length MAC SDUs

AeroMACS shall implement packing of variable-length MAC SDUs as defined in [1], para 6.3.3.4.1.2.

2.2.6.3.3.4.2 Packing for ARQ-enabled connections

AeroMACS shall implement packing of ARQ-enabled connections as defined in [1], para 6.3.3.4.2.

2.2.6.3.3.4.3 Packing ARQ Feedback IEs

AeroMACS shall implement packing of ARQ feedback IEs as defined in [1], para 6.3.3.4.3.

2.2.6.3.3.5 CRC calculation

[INFORMATIVE]

2.2.6.3.3.5.1 CRC32 calculation for SC and OFDM mode

NA

2.2.6.3.3.5.2 CRC32 calculation for OFDMA mode

AeroMACS shall implement CRC32 calculation for OFMDA mode as defined in [1], para 6.3.3.5.2.

2.2.6.3.3.5.2.1 CRC32 test vectors for OFDMA mode

[INFORMATIVE]

2.2.6.3.3.6 Encryption of MAC PDUs

AeroMACS shall implement encryption of MAC PDUs as defined in [1], para 6.3.3.6.

2.2.6.3.3.7 Padding

AeroMACS shall implement padding as defined in [1], para 6.3.3.7.

2.2.6.3.4 ARQ mechanisms

[INFORMATIVE]

2.2.6.3.4.1 ARQ block usage

AeroMACS shall implement the ARQ block usage as defined in [1], para 6.3.4.1.

2.2.6.3.4.2 ARQ Feedback IE format

AeroMACS shall comply with the format defined in [1], para 6.3.4.2, using the following ARQ ACK definitions:

Table 2 - ARQ Ack definitions

ARQ ACK type	Definition
0	NA
1	Mandatory
2	Mandatory
3	NA

Note: ARQ ACK type 0 is not supported by the WiMax forum.

2.2.6.3.4.2.1 ARQ Feedback IE format with extended capability

NA

2.2.6.3.4.3 ARQ parameters

2.2.6.3.4.3.1 ARQ_BSN_MODULUS

AeroMACS shall implement ARQ_BSN_MODULIS as defined in [1], para 6.3.4.3.1.

2.2.6.3.4.3.2 ARQ_WINDOW_SIZE

AeroMACS shall implement ARQ_WINDOW_SIZE as defined in [1], para 6.3.4.3.2.

2.2.6.3.4.3.3 ARQ_BLOCK_LIFETIME

AeroMACS shall implement ARQ_BLOCK_LIFETIME as defined in [1], para 6.3.4.3.3.

2.2.6.3.4.3.4 ARQ_RETRY_TIMEOUT

AeroMACS shall implement ARQ_RETRY_TIMEOUT as defined in [1], para 6.3.4.3.4.

2.2.6.3.4.3.5 ARQ_SYNC_LOSS_TIMEOUT

AeroMACS shall implement ARQ_SYNC_LOSS_TIMEOUT as defined in [1], para 6.3.4.3.5.

2.2.6.3.4.3.6 ARQ_RX_PURGE_TIMEOUT

AeroMACS shall implement ARQ_RX_PURGE_TIMEOUT as defined in [1], para 6.3.4.3.6.

2.2.6.3.4.3.7 ARQ_BLOCK_SIZE

AeroMACS shall implement ARQ_BLOCK_SIZE as defined in [1], para 6.3.4.3.7.

2.2.6.3.4.4 ARQ procedures

2.2.6.3.4.4.1 ARQ state machine variables

AeroMACS shall implement ARQ state machine variables as defined in [1], para 6.3.4.4.1.

2.2.6.3.4.4.1.1 Transmitter variables

AeroMACS shall implement transmitter variables as defined in [1], para 6.3.4.4.1.1.

2.2.6.3.4.4.1.2 Receiver variables

AeroMACS shall implement the receiver variables as defined in [1], para 6.3.4.4.1.2.

2.2.6.3.4.5 ARQ-enabled connection setup and negotiation

AeroMACS shall implement ARQ-enabled connection setup and negotiation as defined in [1], para 6.3.4.5.

2.2.6.3.4.6 ARQ operation

2.2.6.3.4.6.1 Sequence number comparison

AeroMACS shall implement ARQ operation with sequence number comparison as defined in [1], para 6.3.4.6.1.

2.2.6.3.4.6.2 Transmitter state machine

AeroMACS shall implement ARQ operation with transmitter state machine as defined in [1], para 6.3.4.6.2.

2.2.6.3.4.6.3 Receiver state machine

AeroMACS shall implement ARQ operation with receiver state machine as defined in [1], para 6.3.4.6.3.

2.2.6.3.5 Scheduling services

[INFORMATIVE]

2.2.6.3.5.1 Outbound transmission scheduling

[INFORMATIVE]

2.2.6.3.5.2 UL request/grant scheduling

[INFORMATIVE]

2.2.6.3.5.2.1 Unsolicited grant service (UGS)

AeroMACS shall implement unsolicited grant service (IGS) as defined in [1], para 6.3.5.2.1.

2.2.6.3.5.2.2 Real-time polling service (rtPS)

AeroMACS shall implement Real Time Variable rate (RT-VR) as defined in [1], para 6.3.5.2.2.

2.2.6.3.5.2.2.1 Extended rtPS

AeroMACS shall implement extended real time variable rate as defined in [1], para 6.3.5.2.2.1.

2.2.6.3.5.2.3 Non-real-time polling service (nrtPS)

AeroMACS shall implement Non-Real Time- Variable Rate (NRT-VR) as defined in [1], para 6.3.5.2.3.

2.2.6.3.5.2.4 Best effort (BE) service

AeroMACS shall implement Best Effort (BE) services as defined in [1], para 6.3.5.2.4.

2.2.6.3.6 Bandwidth allocation and request mechanisms

[INFORMATIVE]

> *Note: AeroMACS initiates two dedicated CIDs for the purpose of sending and receiving management messages (i.e. basic and primary management connection).*

2.2.6.3.6.1 Requests

AeroMACS shall implement aggregate and incremental bandwidth requests (BE) as defined in [1], para 6.3.6.1.

2.2.6.3.6.2 Grants

AeroMACS shall implement Grants as defined in [1], para 6.3.6.2.

2.2.6.3.6.3 Polling

AeroMACS shall implement Polling as defined in [1], para 6.3.6.3.

2.2.6.3.6.3.1 Unicast polling

AeroMACS shall implement unicast polling as described in [1], para 6.3.6.3.1.

2.2.6.3.6.3.2 Multicast and broadcast polling

NA

2.2.6.3.6.3.3 PM bit

AeroMACS shall implement PM bit as defined in [1], para 6.3.6.3.3.

2.2.6.3.6.4 Contention-based focused BRs for WirelessMAN-OFDM

NA

2.2.6.3.6.5 Contention-based CDMA BRs for WirelessMAN-OFDMA

AeroMACS shall implement Contention-based CDMA BRs for WirelessMAN-OFDMA as defined in [1], para 6.3.6.5.

2.2.6.3.7 MAC support of PHY

[INFORMATIVE]

2.2.6.3.7.1 Frequency division duplexing (FDD)

NA

2.2.6.3.7.2 Time division duplexing (TDD)

AeroMACS shall implement TDD as defined in [1], para 6.3.7.2.

2.2.6.3.7.3 DL-MAP message

[INFORMATIVE]

2.2.6.3.7.4 UL-MAP message

[INFORMATIVE]

2.2.6.3.7.4.1 UL timing

[INFORMATIVE]

2.2.6.3.7.4.2 UL allocations

[INFORMATIVE]

2.2.6.3.7.4.3 UL interval definition

[INFORMATIVE]

2.2.6.3.7.4.3.1 Request IE

NA

2.2.6.3.7.4.3.2 Initial ranging IE

NA

2.2.6.3.7.4.3.3 Data Grant Burst Type IEs

NA

2.2.6.3.7.4.3.4 End of Map IE

NA

2.2.6.3.7.4.3.5 Gap IE

NA

2.2.6.3.7.5 Map relevance and synchronization

[INFORMATIVE]

2.2.6.3.7.5.1 WirelessMAN-SC PHY

NA

2.2.6.3.7.5.2 WirelessMAN-OFDM PHY

NA

2.2.6.3.7.5.3 WirelessMAN-OFDMA PHY

AeroMACS shall implement WirelessMAN-OFDMA PHY as defined in [1], para 6.3.7.5.3.

2.2.6.3.7.6 Optional MAC AAS support of OFDM and OFDMA

2.2.6.3.7.6.1 AAS MAC services

NA

2.2.6.3.7.6.2 MAC control functions

NA

2.2.6.3.7.6.3 AAS DL synchronization

NA

2.2.6.3.7.6.4 Alerting the BS about presence of a new SS in an AAS system

NA

2.2.6.3.7.6.5 FDD/TDD support

NA

2.2.6.3.7.6.6 Requesting bandwidth

NA

2.2.6.3.8 Contention resolution

AeroMACS shall implement contention resolution as defined in [1], para 6.3.8.

2.2.6.3.8.1 Transmission opportunities

AeroMACS shall implement transmission opportunities as defined in [1], para 6.3.8.1.

2.2.6.3.9 Network entry and initialization

AeroMACS shall implement the network entry and initialization procedure as defined in [1], para 6.3.9.

2.2.6.3.9.1 Scanning and synchronization to the DL

AeroMACS shall implement scanning and synchronization to the DL as defined in [1], para 6.3.9.1.

2.2.6.3.9.2 Obtain DL parameters

AeroMACS shall implement obtain DL parameters as defined in [1], para 6.3.9.2.

2.2.6.3.9.3 Obtain UL parameters

AeroMACS shall implement obtain UL parameters as defined in [1], para 6.3.9.3.

2.2.6.3.9.4 Message flows during scanning and UL parameter acquisition

[INFORMATIVE]

2.2.6.3.9.5 Initial ranging and automatic adjustments

AeroMACS shall implement initial ranging and automatic adjustments as defined in [1], para 6.3.9.5.

2.2.6.3.9.5.1 Contention-based initial ranging and automatic adjustments

AeroMACS shall implement contention based initial ranging and automatic adjustments as defined in [1], para 6.3.9.5.1.

2.2.6.3.9.6 Ranging parameter adjustment

AeroMACS shall implement Ranging parameter adjustment as defined in [1], para 6.3.9.6.

2.2.6.3.9.7 Negotiate basic capabilities

AeroMACS shall implement Negotiate basic capabilities as defined in [1], para 6.3.9.7.

2.2.6.3.9.8 SS authorization and key exchange

AeroMACS shall implement SS authorization and key exchange as defined in [1], para 6.3.9.8.

2.2.6.3.9.9 Registration

AeroMACS shall implement the registration process, by which the MS is allowed into the network, as defined in [1], para 6.3.9.9.

2.2.6.3.9.9.1 IP version negotiation

Aero MACS shall implement IP version negotiation as defined in [4], para 7.2 or equivalent.

Note: AeroMACS uses transport connection identifier (TCID).

2.2.6.3.9.10 Establishing IP connectivity

AeroMACS shall implement Establishing IP connectivity as defined in [4], para 7.2 or equivalent.

Note: AeroMACS uses transport connection identifier (TCID).

2.2.6.3.9.11 Establishing time of day

NA

2.2.6.3.9.12 Transferring operational parameters

AeroMACS shall implement Transferring operational parameters as defined in [4], para 7.2 or equivalent.

Note: AeroMACS uses transport connection identifier (TCID).

2.2.6.3.9.13 Establishing provisioned connections

AeroMACS shall implement Establishing provisioned connections as defined in [4], para 7.2 or equivalent.

Note: AeroMACS uses transport connection identifier (TCID).

2.2.6.3.9.14 Forcing MSs to perform network entry at once

NA

2.2.6.3.10 Ranging

[INFORMATIVE]

2.2.6.3.10.1 DL burst profile management

NA

2.2.6.3.10.2 UL periodic ranging

NA.

2.2.6.3.10.3 OFDMA-based ranging

AeroMACS shall implement the OFDMA-based ranging procedure as defined in [1], para 6.3.10.3.

2.2.6.3.10.3.1 Contention-based initial ranging and automatic adjustments

AeroMACS shall implement contention-based initial ranging and automatic adjustments as defined in [1], para 6.3.10.3.1.

2.2.6.3.10.3.2 Periodic ranging and automatic adjustments

AeroMACS shall implement periodic ranging and automatic adjustments as defined in [1], para 6.3.10.3.2.

2.2.6.3.10.4 CDMA HO ranging and automatic adjustment

AeroMACS shall implement CDMA HO ranging as defined in [1], para 6.3.10.4.

2.2.6.3.10.4.1 Dedicated ranging and automatic adjustments

NA

2.2.6.3.11 Update of channel descriptors

AeroMACS shall implement updates of channel descriptors as defined in [1], para 6.3.11.

2.2.6.3.12 Assigning SSs to multicast groups

NA

2.2.6.3.13 Establishment of multicast connections

NA

2.2.6.3.14 Quality of Service

[INFORMATIVE]

2.2.6.3.14.1 Theory of operation

[INFORMATIVE]

2.2.6.3.14.2 Service flows

[INFORMATIVE]

2.2.6.3.14.3 Object models

[INFORMATIVE]

2.2.6.3.14.4 Service classes

[INFORMATIVE]

2.2.6.3.14.4.1 Global service classes

[INFORMATIVE]

2.2.6.3.14.5 Authorization

[INFORMATIVE]

2.2.6.3.14.6 Types of service flows

[INFORMATIVE]

2.2.6.3.14.6.1 Provisioned service flows

[INFORMATIVE]

2.2.6.3.14.6.2 Admitted service flows

[INFORMATIVE]

2.2.6.3.14.6.3 Active service flows

[INFORMATIVE]

2.2.6.3.14.7 Service flow creation

[INFORMATIVE]

2.2.6.3.14.7.1 Dynamic service flow creation

2.2.6.3.14.7.1.1 Dynamic service flow creation – SS-initiated

NA

2.2.6.3.14.7.1.2 Dynamic service flow creation – BS-initiated

AeroMACS shall implement BS-initiated dymanic service flow creation as defined in [1], para 6.3.14.7.1.2.

2.2.6.3.14.8 Dynamic service flow modification and deletion

[INFORMATIVE]

2.2.6.3.14.9 Service flow management

2.2.6.3.14.9.1 Overview

[INFORMATIVE]

2.2.6.3.14.9.2 Dynamic service flow state transitions

[INFORMATIVE]

2.2.6.3.14.9.3 Dynamic service addition (DSA)

2.2.6.3.14.9.3.1 SS-initiated DSA

NA

2.2.6.3.14.9.3.2 BS-initiated DSA

AeroMACS shall implement BS-initiated DSA as defined in [1], para 6.3.14.9.3.2.

2.2.6.3.14.9.3.3 DSA state transition diagrams

[INFORMATIVE]

2.2.6.3.14.9.4 Dynamic service change (DSC)

[INFORMATIVE]

2.2.6.3.14.9.4.1 SS-initiated DSC

NA

2.2.6.3.14.9.4.2 BS-initiated DSC

AeroMACS shall implement BS-initiated DSC as defined in [1], para 6.3.14.9.4.2.

2.2.6.3.14.9.4.3 DSC state transition diagrams

[INFORMATIVE]

2.2.6.3.14.9.5 Connection release

[INFORMATIVE]

2.2.6.3.14.9.5.1 SS-initiated DSD

NA

2.2.6.3.14.9.5.2 BS-initiated DSD

AeroMACS shall implement BS-initiated DSD as defined in [1], para 6.3.14.5.2.

2.2.6.3.14.9.5.3 DSD state transition diagrams

[INFORMATIVE]

2.2.6.3.15 Procedures for shared frequency band usage

NA

2.2.6.3.16 MAC support for HARQ

AeroMACS shall implement MAC support for HARQ, as defined in [1], para 6.3.16.

Note: HARQ support for Channel Mapping is NA.

2.2.6.3.16.1 Subpacket generation

AeroMACS shall implement subpacket generation, as defined in [1], para 6.3.16.1

2.2.6.3.16.2 DL/UL ACK/NAK signaling

AeroMACS shall implement DL/UL ACK/NAK signaling, as defined in [1], para 6.3.16.2

2.2.6.3.16.3 HARQ parameter signaling

AeroMACS shall implement HARQ parameter signaling, as defined in [1], para 6.3.16.3

2.2.6.3.17 DL CINR report operation

AeroMACS shall implement DL CINR report operation using physical CNIR, as defined in [1], para 6.3.17.

2.2.6.3.17.1 DL CINR report with REP-RSP MAC message

AeroMACS shall implement DL CINR report with REP-RSP MAC message, as defined in [1], para 6.3.17.1.

2.2.6.3.17.2 Periodic CINR report with fast-feedback (CQICH) channel

AeroMACS shall implement Periodic CINR report with fast-feedback (CQICH) channel as defined in [1], para 6.3.17.2.

2.2.6.3.17.2.1 Conditions of transition triggering

NA

2.2.6.3.18 Optional band AMC operations using 6-bit CQICH encoding

NA

2.2.6.3.19 Data delivery services for mobile network

[INFORMATIVE]

2.2.6.3.19.1 Types of data delivery services

[INFORMATIVE]

2.2.6.3.19.1.1 Unsolicited grant service (UGS)

AeroMACS shall implement Unsolicited grant service (UGS), as defined in [1], para 6.3.19.1.1.

2.2.6.3.19.1.2 Real-time variable-rate (RT-VR) service

AeroMACS shall implement Real-time variable-rate (RT-VR) service, as defined in [1], para 6.3.19.1.2.

2.2.6.3.19.1.3 Non-real time variable-rate (NRT-VR) service

AeroMACS shall implement Non-real time variable-rate (NRT-VR) service, as defined in [1], para 6.3.19.1.3.

2.2.6.3.19.1.4 Best effort (BE) service

AeroMACS shall implement Best effort (BE) service, as defined in [1], para 6.3.19.1.4.

2.2.6.3.19.1.5 Extended real-time variable-rate (ERT-VR) service

AeroMACS shall implement Extended real-time variable-rate (ERT-VR) service, as defined in [1], para 6.3.19.1.5.

2.2.6.3.20 Sleep mode for mobility-supporting MS

NA

2.2.6.3.21 MAC HO procedures

[INFORMATIVE]

2.2.6.3.21.1 Network topology acquisition

[INFORMATIVE]

2.2.6.3.21.1.1 Network topology advertisement

AeroMACS shall implement Network topology advertisement, as defined in [1], para 6.3.21.1.1.

2.2.6.3.21.1.2 MS scanning of neighbor BSs

AeroMACS shall implement MS scanning of neighbor BSs, as defined in [1], para 6.3.21.1.2.

2.2.6.3.21.1.3 Association procedure

NA

2.2.6.3.21.2 HO process

AeroMACS shall implement HO process, as defined in [1], para 6.3.21.2.

2.2.6.3.21.2.1 Cell reselection

AeroMACS shall implement Cell reselection, as defined in [1], para 6.3.21.2.1.

2.2.6.3.21.2.2 HO decision and initiation

AeroMACS shall implement HO decision and initiation, as defined in [1], para 6.3.21.2.2.

2.2.6.3.21.2.3 HO cancellation

AeroMACS shall implement HO cancellation, as defined in [1], para 6.3.21.2.3.

2.2.6.3.21.2.4 Fast ranging

AeroMACS shall implement fast ranging, as defined in [1] para, 6.3.21.2.4.

2.2.6.3.21.2.5 Termination with the serving BS

AeroMACS shall implement Termination with the serving BS, as defined in [1], para 6.3.21.2.5.

2.2.6.3.21.2.6 Drops during HO

AeroMACS shall implement Drops during HO, as defined in [1], para 6.3.21.2.6

2.2.6.3.21.2.7 Network entry/reentry

AeroMACS shall implement Network entry/reentry, as defined in [1], para 6.3.21.2.7

2.2.6.3.21.2.8 MS-assisted coordination of DL transmission at target BS for HO

NA

2.2.6.3.21.2.8.1 Context management during optimized HO

[INFORMATIVE]

2.2.6.3.21.2.8.1.1 BS PHY settings

[INFORMATIVE]

2.2.6.3.21.2.8.1.2 BS Channel descriptor settings

[INFORMATIVE]

2.2.6.3.21.2.8.1.3 Ranging settings

[INFORMATIVE]

2.2.6.3.21.2.8.1.4 Basic capabilities settings

[INFORMATIVE]

2.2.6.3.21.2.8.1.5 Registration settings

[INFORMATIVE]

2.2.6.3.21.2.8.1.6 Service flows settings

[INFORMATIVE]

Power Saving Class settings are NA.

2.2.6.3.21.2.8.1.7 Scanning-dynamic and static context

[INFORMATIVE]

2.2.6.3.21.2.9 HO process

AeroMACS shall implement HO process, as defined in [1,] para 6.3.21.2.9.

2.2.6.3.21.2.10 HO optimization rules and scenarios

[INFORMATIVE]

2.2.6.3.21.2.11 Seamless HO

NA

2.2.6.3.21.3 Macro diversity handover (MDHO) and fast BS switching

NA

2.2.6.3.21.3.1 MDHO decision and initiation

NA

2.2.6.3.21.3.2 FBSS decision and initiation

NA

2.2.6.3.21.3.3 Diversity set update for MDHO/FBSS

NA

2.2.6.3.21.3.4 Anchor BS update for MDHO/FBSS

NA

2.2.6.3.21.3.5 MS-assisted coordination of DL transmission at new anchor BS

NA

2.2.6.3.22 Multicast and broadcast service (MBS)

NA

2.2.6.3.22.1 Establishment and maintenance of MBSs

NA

2.2.6.3.22.1.1 Inter-MBS Zone transition

NA

2.2.6.3.22.2 Performance enhancement with macro diversity

NA

2.2.6.3.22.3 Power saving operation

NA

2.2.6.3.22.4 Multicast and broadcast zone (MBS_Zone)

NA

2.2.6.3.23 MS idle mode (optional)

NA

2.2.6.3.23.1 MS idle mode initiation

NA

2.2.6.3.23.2 Cell selection

NA

2.2.6.3.23.3 MS Broadcast paging message time synchronization

NA

2.2.6.3.23.4 MS paging unavailable interval

NA

2.2.6.3.23.5 MS paging listening interval

NA

2.2.6.3.23.6 BS Broadcast paging message

NA

2.2.6.3.23.7 Paging availability mode termination

NA

2.2.6.3.23.7.1 MS side

NA

2.2.6.3.23.7.2 BS side

NA

2.2.6.3.23.8 Location update

NA

2.2.6.3.23.8.1 Location update conditions

NA

2.2.6.3.23.8.2 Location update process

NA

2.2.6.3.23.9 Network reentry from idle mode

NA

2.2.6.3.24 MIHF support

NA

2.2.6.3.25 Location Based Services

NA

2.2.6.3.25.1 Time Difference of Arrival (TDOA)

NA

2.2.6.3.26 Persistent Scheduling

NA

2.2.6.3.26.1 Persistent Region ID

NA

2.2.6.3.26.1.1 Downlink operation

NA

2.2.6.3.26.1.2 Uplink operation

NA

2.2.6.3.26.2 Resource shifting

NA

2.2.6.3.26.3 HARQ retransmission

NA

2.2.6.3.26.4 Error handling procedures

NA

2.2.6.3.26.4.1 Maximum Number of Persistent Allocations

NA

2.2.6.3.26.4.2 MAP ACK channel

NA

2.2.6.3.26.4.3 MAP NACK channel

NA

2.2.6.3.26.4.4 Error Correction Information

NA

2.2.6.3.26.4.5 Change indicator

NA

2.2.6.3.26.4.6 Retransmission flag

NA

2.2.6.3.26.4.7 Error recovery

NA

2.2.6.3.27 Emergency Service

NA

2.2.7 Security sublayer

[INFORMATIVE]

2.2.7.1 Architecture

[INFORMATIVE]

2.2.7.1.1 Secure encapsulation of MAC PDUs.

AeroMACS shall implement Secure encapsulation of MAC PDUS, as defined in [1], para 7.1.1.

2.2.7.1.2 Key Management Protocol

AeroMACS shall implement Key Management Protocol, as defined in [1], para 7.1.2.

2.2.7.1.3 Authentication Protocol

[INFORMATIVE]

2.2.7.1.3.1 PKM RSA Authentication

NA

2.2.7.1.3.2 PKM EAP Authentication

AeroMACS shall implement PKM EAP Authentication, as defined in [1], para 7.1.3.2.

AeroMACS shall implement EAP TLS Authentication protocol as defined in RFC 5216 [8].

AeroMACS shall implement mutual authentication between SS and Authenticator based on X.509 digital certificates [9] issued by trusted CAs.

2.2.7.1.4 Mapping of connections to SAs

AeroMACS shall implement the Mapping of connections to SAs, as defined in [1], para 7.1.4 items a and d.

The special transport connections shall be mapped to the Primary SA.

Note: Secondary management and multicast transport connections are NA.

2.2.7.1.5 Cryptographic suite

AeroMACS shall implement the cryptographic suite with value 0x020104 (CCM mode 128bits AES, CCM mode, AES key wrap with 128-bit key) as defined in [1], para 7.1.5 Table 601.

2.2.7.2 PKM protocol

[INFORMATIVE]

2.2.7.2.1 PKM Version1

NA

2.2.7.2.1.1 Security Associations

NA

2.2.7.2.1.2 SS authorization and AK exchange overview

NA

2.2.7.2.1.2.1 Authorization via RSA protocol

NA

2.2.7.2.1.3 TEK exchange overview

NA

2.2.7.2.1.3.1 TEK exchange overview for PMP topology

NA

2.2.7.2.1.4 Security Capability Selection

NA

2.2.7.2.1.5 Authorization State Machine

NA

2.2.7.2.1.5.1 States

NA

2.2.7.2.1.5.2 Messages

NA

2.2.7.2.1.5.3 Events

NA

2.2.7.2.1.5.4 Parameters

NA

2.2.7.2.1.5.5 Action

NA

2.2.7.2.1.6 TEK State Machine

NA

2.2.7.2.1.6.1 States

NA

2.2.7.2.1.6.2 Messages

NA

2.2.7.2.1.6.3 Events

NA

2.2.7.2.1.6.4 Parameters

NA

2.2.7.2.1.6.5 Action

NA

2.2.7.2.2 PKM Version 2

[INFORMATIVE]

2.2.7.2.2.1 TEK exchange overview for PMP topology

AeroMACS shall implement TEK exchange overview for PMP topology, as defined in [1], para 7.2.2.1.

AeroMACS shall prohibit the use of the “No Authorization” authorization policy for deployed systems.

2.2.7.2.2.2 Key Derivation

[INFORMATIVE]

2.2.7.2.2.2.1 RSA Based Authorization

NA

2.2.7.2.2.2.2 EAP Authentication

AeroMACS shall implement EAP Authentication, as defined in [1], para 7.2.2.2.2.

2.2.7.2.2.2.3 AK derivation

AeroMACS shall implement AK derivation, as defined in [1], para 7.2.2.2.3.

2.2.7.2.2.2.4 KEK derivation

AeroMACS shall implement KEK derivation, as defined in [1], para 7.2.2.2.4.

2.2.7.2.2.2.5 Group Key Encryption Key (GKEK)

NA

2.2.7.2.2.2.6 Traffic Encryption Key (TEK)

AeroMACS shall implement TEK derivation, as defined in [1], para 7.2.2.2.6.

2.2.7.2.2.2.6.1 Counter-based TEK Generation for HO

NA

2.2.7.2.2.2.7 Group Traffic Encryption Key (GTEK)

NA

2.2.7.2.2.2.8 MBS Traffic Encryption Key (MTK)

NA

2.2.7.2.2.2.9 Message authentication keys (HMAC/CMAC) and KEK derivation

[INFORMATIVE]

2.2.7.2.2.2.9.1 CMAC_KEY_COUNT_ management

AeroMACS shall implement CMAC_KEY_COUNT_ management, as defined in [1], para 7.2.2.2.9.1.

2.2.7.2.2.2.9.1.1 Maintenance of CMAC_KEY_COUNTM by the MS

The AeroMACS MS shall implement Maintenance of CMAC_KEY_COUNTM by the MS, as defined in [1], para 7.2.2.2.9.1.1.

2.2.7.2.2.2.9.1.1.1 CMAC_KEY_LOCK state

The AeroMACS MS shall implement CMAC_KEY_LOCK state, as defined in [1], para 7.2.2.2.9.1.1.1.

2.2.7.2.2.2.9.1.2 Processing of CMAC_KEY_COUNTB by the BS

The AeroMACS BS shall implement Processing of CMAC_KEY_COUNTB by the BS, as defined in [1] para 7.2.2.2.9.1.2.

2.2.7.2.2.2.9.2 Derivation of message authentication codes

AeroMACS shall implement Derivation of message authentication codes, as defined in [1], para 7.2.2.2.9.2.

Note: Derivation of HMAC code is NA for AeroMACS.

2.2.7.2.2.2.10 Key Hierarchy

[INFORMATIVE]

2.2.7.2.2.2.11 Maintenance of PMK and AK

AeroMACS shall implement Maintenance of PMK and AK, as defined in [1], para 7.2.2.2.11.

Note: Subsection c) Legacy mobile support is NA for AeroMACS.

Note: Subsection b) Derivation of HMAC code is NA for AeroMACS

2.2.7.2.2.2.12 PKMv2 PMK and AK switching methods

AeroMACS shall implement PKMv2 PMK and AK switching methods, as defined in [1], para 7.2.2.2.12.

2.2.7.2.2.3 Associations

[INFORMATIVE]

2.2.7.2.2.3.1 Security associations (SAs)

AeroMACS shall implement Security associations (SAs), as defined in [1], para 7.2.2.3.1.

2.2.7.2.2.3.2 Group security associations (GSAs)

NA

2.2.7.2.2.3.3 Multicast and broadcast service group security associations (MBSGSAs)

NA

2.2.7.2.2.4 Security context

[INFORMATIVE]

2.2.7.2.2.4.1 AK context

AeroMACS shall implement AK context, as defined in [1], para 7.2.2.4.1.

Note: Derivation of HMAC code is NA for AeroMACS.

2.2.7.2.2.4.2 GKEK context

NA

2.2.7.2.2.4.3 PMK context

AeroMACS shall implement PMK context, as defined in [1], para 7.2.2.4.3.

2.2.7.2.2.4.4 PAK context

NA

2.2.7.2.2.5 Authentication state machine

AeroMACS shall implement Authentication state machine, as defined in [1], para 7.2.2.5.

2.2.7.2.2.5.1 States

[INFORMATIVE]

2.2.7.2.2.5.2 Messages

AeroMACS shall implement Messages, as defined in [1], para 7.2.2.5.2.

2.2.7.2.2.5.3 Events

[INFORMATIVE]

2.2.7.2.2.5.4 Parameters

[INFORMATIVE]

2.2.7.2.2.5.5 Actions

AeroMACS shall implement Actions, as defined in [1], para 7.2.2.5.5.

2.2.7.2.2.6 TEK state machine

AeroMACS shall implement TEK state machine, as defined in [1], para 7.2.2.6.

2.2.7.2.2.6.1 States

[INFORMATIVE]

2.2.7.2.2.6.2 Messages

AeroMACS shall implement Messages, as defined in [1], para 7.2.2.6.2.

2.2.7.2.2.6.3 Events

[INFORMATIVE]

2.2.7.2.2.6.4 Parameters

[INFORMATIVE]

2.2.7.2.2.6.5 Actions

AeroMACS shall implement Actions, as defined in [1], para 7.2.2.6.5.

2.2.7.3 Dynamic SA creation and mapping

NA

2.2.7.3.1 Dynamic SA creation

NA

2.2.7.3.2 Dynamic SA mapping

NA

2.2.7.4 Key usage

2.2.7.4.1 BS key usage

[INFORMATIVE]

2.2.7.4.1.1 AK key lifetime

The AeroMACS BS shall implement AK key lifetime, as defined in [1], para 7.4.1.1, with the exception of PKMv1.

Note: PKM V1 procedure is NA for AeroMACS.

2.2.7.4.1.2 AK transition period on BS side

AeroMACS shall implement AK transition period on BS side, as defined in [1], para 7.4.1.2, with the exception of PKMv1.

Note: PKM V1 procedure is NA for AeroMACS.

2.2.7.4.1.3 BS usage of AK

The AeroMACS BS shall implement BS usage of AK as defined in [1], para 7.4.1.3, with the exception of PKMv1.

Note: PKM V1 procedure is NA for AeroMACS.

2.2.7.4.1.4 TEK lifetime

AeroMACS shall implement TEK lifetime, as defined in [1], para 7.4.1.4.

2.2.7.4.1.5 BS usage of TEK

AeroMACS shall implement BS usage of TEK, as defined in [1], para 7.4.1.5.

2.2.7.4.2 SS key usage

The AeroMACS MS shall implement SS key usage, as defined in [1], para 7.4.2, with the exception of PKMv1.

Note: PKMv1 is not applicable for AeroMACS.

2.2.7.4.2.1 SS reauthorization

AeroMACS shall implement SS reauthorization, as defined in [1], para 7.4.2.1, with the exception of PKMv1.

Note: PKMv1 is not applicable for AeroMACS.

2.2.7.4.2.2 SS usage of AK

The AeroMACS MS shall implement SS usage of AK, as defined in [1], para 7.4.2.2, with the exception of PKMv1.

2.2.7.4.2.3 SS usage of TEK

The AeroMACS MS shall implement SS usage of TEK, as defined in [1], para 7.4.2.3,

2.2.7.5 Cryptographic methods

AeroMACS shall implement Cryptographic methods, as defined in [1] para 7.5.

2.2.7.5.1 Data Encryption methods

[INFORMATIVE]

2.2.7.5.1.1 Data encryption with DES in CBC mode

NA

2.2.7.5.1.2 Data encryption with AES in CCM mode

AeroMACS shall implement Data encryption with AES in CCM mode as defined in [1], para 7.5.1.2.

2.2.7.5.1.2.1 PDU payload format

AeroMACS shall implement PDU payload format as defined in [1], para 7.5.1.2.1.

2.2.7.5.1.2.2 Packet number (PN)

AeroMACS shall implement Packet number (PN) as defined in [1], para 7.5.1.2.2.

2.2.7.5.1.2.3 CCM algorithm

AeroMACS shall implement CCM algorithm, as defined in [1], para 7.5.1.2.3.

2.2.7.5.1.2.4 Receive processing rules

AeroMACS shall implement Receive processing rules, as defined in [1], para 7.5.1.2.4.

2.2.7.5.1.2.5 AES-CCM mode example encrypted MAC PDUs

[INFORMATIVE]

2.2.7.5.1.3 Data encryption with AES in CTR mode

NA

2.2.7.5.1.3.1 Encrypted MBS PDU payload format

NA

2.2.7.5.1.4 Data encryption with AES in CBC mode

NA

2.2.7.5.1.4.1 CBC IV generation

NA

2.2.7.5.2 Encryption of TEK

[INFORMATIVE]

2.2.7.5.2.1 Encryption of TEK with 3-DES

NA

2.2.7.5.2.2 Encryption of TEK with RSA

NA

2.2.7.5.2.3 Encryption of TEK-128 with AES

NA

2.2.7.5.2.4 Encryption of TEK-128 with AES key wrap

AeroMACS shall implement Encryption of TEK-128 with AES key wrap as defined in [1], para 7.5.2.4.

2.2.7.5.3 Calculation of HMAC-Digests

NA

2.2.7.5.4 Derivation of TEKs, KEKs, and message authentication keys

AeroMACS shall implement Derivation of TEKs, KEKs, and message authentication keys, as defined in [1], para 7.5.4.

2.2.7.5.4.1 DES keys

NA

2.2.7.5.4.2 Key encryption keys (KEKs)

AeroMACS shall implement Key encryption keys (KEKs), as defined in [1], para 7.5.4.2 using TEK-128.

Note: Construction of 3-DES Keys is not applicable for AeroMACS.

2.2.7.5.4.3 HMAC authentication keys

NA

2.2.7.5.4.4 Cipher-based message authentication code (CMAC)

AeroMACS shall implement Cipher-based message authentication code (CMAC), as defined in ref [1] section 7.5.4.4.

2.2.7.5.4.4.1 Calculation of CMAC value

AeroMACS shall implement Calculation of CMAC value, as defined in [1], para 7.5.4.4.1.

2.2.7.5.4.5 Derivation of TEKs, KEKs, message authentication keys and GKEKs in PKMv2

2.2.7.5.4.5.1 AES KEKs in PKMv2

AeroMACS shall implement AES KEKs in PKMv2, as defined in [1], para 7.5.4.5.1.

2.2.7.5.4.5.2 Encryption of GKEK in PKMv2

NA

2.2.7.5.4.5.2.1 Encryption of GKEK with 3-DES in PKMv2

NA

2.2.7.5.4.5.2.2 Encryption of GKEK with RSA in PKMv2

NA

2.2.7.5.4.5.2.3 Encryption of GKEK with ECB mode AES in PKMv2

NA

2.2.7.5.4.5.2.4 Encryption of GKEK with AES key wrap in PKMv2

NA

2.2.7.5.4.6 Key derivation functions for PKMv2

2.2.7.5.4.6.1 Dot16KDF for PKMv2

NA

2.2.7.5.5 Public-key encryption of of AK

NA

2.2.7.5.6 Digital signatures

NA

2.2.7.6 Certificate profile

2.2.7.6.1 Certificate format

NA

2.2.7.6.1.1 tbsCertificate.validity.notBefore and tbsCertificate.validity.notAfter

NA

2.2.7.6.1.2 tbsCertificate.SerialNumber

NA

2.2.7.6.1.3 tbsCertificate.signature and signature Algorithm

NA

2.2.7.6.1.4 tbsCertificate.Issuer and tbsCertificate.subject

NA

2.2.7.6.1.4.1 Manufacturer Certificate

NA

2.2.7.6.1.4.2 SS certificate

NA

2.2.7.6.1.4.3 BS Certificate

NA

2.2.7.6.1.5 tbsCertificate.subjectPublicKeyInfo

NA

2.2.7.6.1.6 tbsCertificate.issuerUniqueID and tbsCertificate.subjectUniqueID

NA

2.2.7.6.1.7 tbsCertificate.extensions

2.2.7.6.1.7.1 SS certificate

NA

2.2.7.6.1.7.2 Manufacturer certificate

NA

2.2.7.6.1.8 Signature Value

NA

2.2.7.6.2 Certificate storage and management in the SS

A MS certificate shall be stored in MS memory.

The MS shall be capable of storing the trust chain that is used to authenticate the local MS certicate and peer identities.

The MS shall be capable of updating its trust chain of the CA that signed the MS certicate.

2.2.7.6.3 Certificate processing and management in the BS

NA

2.2.7.7 Preauthentication

[INFORMATIVE]

2.2.7.8 PKMv2

2.2.7.8.1 PKMv2 SA-TEK 3-way handshake

AeroMACS shall implement PKMv2 SA-TEK 3-way handshake, as defined in [1], para 7.8.1.

2.2.7.8.2 BS and SS RSA mutual authentication and AK exchange overview

NA

2.2.7.8.3 Multicast and broadcast service (MBS) support

NA

2.2.7.8.3.1 MBS security associations

NA

2.2.7.8.3.2 MBS key management

NA

2.2.7.8.3.2.1 MAK establishment

NA

2.2.7.8.3.2.2 MGTEK establishment

NA

2.2.7.8.3.2.3 MTK establishment

NA

2.2.7.9 Multicast and broadcast rekeying algorithm (MBRA)

NA

2.2.7.9.1 MBRA flow

NA

2.2.7.9.1.1 BS usage of GTEK

NA

2.2.7.9.1.2 SS usage of GTEK

NA

2.2.7.9.2 Messages

NA

2.2.7.9.3 Encryption of GKEK

NA

2.2.7.9.4 Message authentication keys for the Key Update Command message

NA

2.2.8 Physical layer

2.2.8.1 Wireless MAN-SC PHY specification

NA

2.2.8.2 Reserved

NA

2.2.8.3 WirelessMAN-OFDM PHY

NA

2.2.8.4 WirelessMAN-OFDMA PHY

2.2.8.4.1 Introduction

[INFORMATIVE]

2.2.8.4.2 OFDMA symbol description, symbol parameters and transmitted signal

2.2.8.4.2.1 Time domain description

AeroMACS shall implement the Time domain description as defined in [1], para 8.4.2.1.

2.2.8.4.2.2 Frequency domain description

[INFORMATIVE]

2.2.8.4.2.3 Primitive parameters

AeroMACS primitive parameters shall implement 5 MHz BW description as defined in [1], para 8.4.2.3.

2.2.8.4.2.4 Derived parameters

AeroMACS shall implement Derived parameters as defined in [1], para 8.4.2.4.

2.2.8.4.2.5 Transmitted signal

AeroMACS implement transmitted signal as defined in [1], para 8.4.2.5.

2.2.8.4.3 OFDMA basic terms definition

2.2.8.4.3.1 Slot and data region

AeroMACS shall implement slot and data region as defined in [1], para 8.4.3.1.

2.2.8.4.3.2 Segment

AeroMACS shall implement segment as defined in [1], para 8.4.3.2.

2.2.8.4.3.3 Permutation zone

AeroMACS shall implement permutation zone is defined in [1], para 8.4.3.3.

2.2.8.4.3.4 OFDMA data mapping

AeroMACS shall implement OFDMA data mapping as defined in [1], para 8.4.3.4.

2.2.8.4.4 Frame structure

[INFORMATIVE]

2.2.8.4.4.1 TDD frame structure

AeroMACS shall implement TDD frame structure as defined in [1], para 8.4.4.1.

2.2.8.4.4.2 FDD Frame Structure

NA

2.2.8.4.4.3 OFDMA Frame Parameters and Operations

AeroMACS shall implement OFDMA frame parameters and operations description as defined in [1], para 8.4.4.3.

2.2.8.4.4.4 DL frame prefix

AeroMACS shall implement DL frame prefix as defined in [1], para 8.4.4.4.

2.2.8.4.4.5 Allocation of subchannels for FCH and DL-MAP and logical subchannel numbering

AeroMACS shall implement Allocation of subchannels for FCH and DL-MAP and logical subchannel numbering as defined in [1], para 8.4.4.5.

2.2.8.4.4.6 UL transmission allocations

AeroMACS shall implement the TDD part of UL transmission allocations as defined in [1], para 8.4.4.6.

2.2.8.4.4.7 Optional AAS Support

NA

2.2.8.4.5 Map message fields and IEs

2.2.8.4.5.1 DL-MAP PHY Synchronization field

AeroMACS shall implement DL-MAP PHY Synchronization field as defined in [1], para 8.4.5.1.

2.2.8.4.5.2 Frame duration codes

AeroMACS shall implement frame duration code number 4 as specified in [1], para 8.4.5.2.

2.2.8.4.5.3 DL-MAP IE format

AeroMACS shall implement DL-MAP IE format as defined in [1], para 8.4.5.3.

2.2.8.4.5.3.1 DIUC allocation

AeroMACS shall implementshall the DIUC description as defined in [1], para 8.4.5.3.1.

2.2.8.4.5.3.2 DL-MAP Extended IE format

AeroMACS shall use the DL-MAP extended IE format for those elements defined in [1], para 8.4.5.3.2.

2.2.8.4.5.3.2.1 DL-MAP Extended IE encoding format

AeroMACS shall implement DL-MAP Extended IE encoding format as defined in [1], para 8.4.5.3.2.1.

2.2.8.4.5.3.2.2 DL-MAP Extended-2 IE encoding format

AeroMACS shall implement DL-MAP Extended-2 IE encoding format as defined in [1], 8.4.5.3.2.2

2.2.8.4.5.3.2.3 DL-MAP Extended-3 IE encoding format

NA

2.2.8.4.5.3.3 AAS DL IE format

NA

2.2.8.4.5.3.4 STC DL Zone IE format

[IO-MIMO] If implementing the [IO-MIMO] option, AeroMACS shall implement the STC DL zone IE format as described in [1], para 8.4.5.3.4.

Note: AeroMACS only implements MIMO Matrix A at the DL. Other MIMO options are NA.

2.2.8.4.5.3.5 Channel Measurement IE

NA

2.2.8.4.5.3.6 Data Location In Another BS IE

NA

2.2.8.4.5.3.7 CID Switch IE

AeroMACS shall implement the CID switch IE as defined in [1], para 8.4.5.3.7.

2.2.8.4.5.3.8 MIMO DL Basic IE format

[IO-MIMO] If implementing the [IO-MIMO] option, the AeroMACS BS shall implement the MIMO DL Basic IE format as defined in [1], para 8.4.5.3.8.

2.2.8.4.5.3.9 MIMO DL Enhanced IE

NA

2.2.8.4.5.3.10 HARQ and Sub-MAP Pointer IE

NA

2.2.8.4.5.3.11 DL-MAP Physical Modifier IE

NA

2.2.8.4.5.3.12 MBS MAP IE

NA

2.2.8.4.5.3.13 DL PUSC Burst Allocation in Other Segment IE

NA

2.2.8.4.5.3.14 HO Anchor Active DL MAP

NA

2.2.8.4.5.3.15 HO Active Anchor DL MAP

NA

2.2.8.4.5.3.16 HO CID Translation MAP IE

NA

2.2.8.4.5.3.17 MIMO in Another BS IE

NA

2.2.8.4.5.3.18 Macro-MIMO DL Basic IE

NA

2.2.8.4.5.3.19 UL Noise and Interference Level IE format

AeroMACS shall implement UL Noise and Interference Level IE format as defined in [1], para 8.4.5.3.19.

2.2.8.4.5.3.20 Dedicated DL Control IE

NA

2.2.8.4.5.3.21 HARQ DL MAP IE

AeroMACS shall implement HARQ DL MAP IE as defined in [1], para 8.4.5.3.21.

2.2.8.4.5.3.21.1 Dedicated MIMO DL Control IE format

NA

2.2.8.4.5.3.22 DL HARQ ACK IE

NA

2.2.8.4.5.3.23 Enhanced DL MAP IE

NA

2.2.8.4.5.3.24 Closed-loop MIMO DL enhanced IE

NA

2.2.8.4.5.3.25 Broadcast Control Pointer IE

NA

2.2.8.4.5.3.26 AAS SDMA DL IE format

NA

2.2.8.4.5.3.27 PUSC ASCA Allocation IE

NA

2.2.8.4.5.3.28 H-FDD Group Switch IE

NA

2.2.8.4.5.3.29 Persistent HARQ DL MAP Allocation IE

NA

2.2.8.4.5.3.30 Power Boosting IE

NA

2.2.8.4.5.3.31 Extended Broadcast Control Pointer IE

NA

2.2.8.4.5.4 UL-MAP IE format

AeroMACS shall implement UL MAP IE format as defined in [1], para 8.4.5.4.

2.2.8.4.5.4.1 UIUC allocation

AeroMACS shall implement UIUC allocation as defined in [1], para 8.4.5.4.1.

2.2.8.4.5.4.2 PAPR Reduction/Safety Zone/Sounding Zone Allocation IE

NA

2.2.8.4.5.4.3 CDMA Allocation UL-MAP IE format

AeroMACS shall implement CDMA Allocation UL MAP IE format as defined in [1], para 8.4.5.4.3.

2.2.8.4.5.4.4 UL-MAP Extended IE

2.2.8.4.5.4.4.1 UL-MAP Extended IE

AeroMACS shall implement UL-MAP Extended IE as defined in [1], para 8.4.5.4.4.1.

2.2.8.4.5.4.4.2 UL-MAP Extended-2 IE

AeroMACS shall implement UL-MAP Extended-2 IE as defined in [1], para 8.4.5.4.4.2.

2.2.8.4.5.4.4.3 UL-MAP Extended-3 IE

NA

2.2.8.4.5.4.5 Power Control IE format

AeroMACS shall implement the UL MAP IE format as defined in [1], para 8.4.5.4.5.

2.2.8.4.5.4.6 AAS UL IE format

NA

2.2.8.4.5.4.7 UL Zone Switch IE

NA

2.2.8.4.5.4.8 Mini-Subchannel Allocation IE

NA

2.2.8.4.5.4.9 Fast-Feedback Allocation IE

NA

2.2.8.4.5.4.10 MIMO UL Basic IE format

NA

2.2.8.4.5.4.11 CQICH Allocation IE Format

AeroMACS shall implement CQICH Allocation IE as defined in [1], para 8.4.5.4.11.

2.2.8.4.5.4.12 UL-MAP Physical Modifier IE

NA

2.2.8.4.5.4.13 UL Allocation Start IE

AeroMACS shall implement UL Allocation Start IE as defined in [1], para 8.4.5.4.13.

2.2.8.4.5.4.14 CQICH Enhanced Allocation IE

NA

2.2.8.4.5.4.15 UL PUSC Burst Allocation in Other Segment IE

NA

2.2.8.4.5.4.16 HO Anchor Active UL-MAP IE

NA

2.2.8.4.5.4.17 HO Active Anchor UL MAP IE

NA

2.2.8.4.5.4.18 MIMO UL Enhanced IE format

NA

2.2.8.4.5.4.19 OFDMA Fast Ranging IE

AeroMACS shall implement OFDMA Fast Ranging IE as defined in [1], para 8.4.5.4.19

2.2.8.4.5.4.20 UL-MAP Fast Tracking IE

NA

2.2.8.4.5.4.21 Anchor BS Switch IE

NA

2.2.8.4.5.4.22 HARQ UL-MAP IE

AeroMACS shall implement the HARQ UL MAP IE as defined in [1], para 8.4.5.4.22.

2.2.8.4.5.4.22.1 Dedicated UL Control IE

NA

2.2.8.4.5.4.22.2 Dedicated MIMO UL Control IE format

NA

2.2.8.4.5.4.23 HARQ ACK Region Allocation IE

AeroMACS shall implement HARQ ACK Region allocation IE as defined in [1], para 8.4.5.4.23

2.2.8.4.5.4.24 UL Sounding Command IE

NA

2.2.8.4.5.4.25 AAS SDMA UL IE format

NA

2.2.8.4.5.4.26 Feedback Polling IE feedback header not supported

NA

2.2.8.4.5.4.27 Uplink Power Control Bitmap IE

NA

2.2.8.4.5.4.28 Persistent HARQ UL MAP Allocation IE

NA

2.2.8.4.5.4.29 FDD Paired Allocation IE

NA

2.2.8.4.5.5 Burst profile format

AeroMACS shall implement Burst profile format description as defined in [1], para 8.4.5.5.

2.2.8.4.5.6 Compressed maps

The AeroMACS MS shall implement Compressed maps as defined in ref [1], para 8.4.5.6.

[IO-CM] If AeroMACS BS implements the [IO-CM] option, the AeroMACS BS shall implement Compressed maps as defined in [1], para 8.4.5.6.

2.2.8.4.5.6.1 Compressed DL-MAP

The AeroMACS MS shall implement Compressed DL-map as defined in [1], para 8.4.5.6.1.

[IO-CM] If the AeroMACS BS implements the [IO-CM] option, the AeroMACS BS shall implement Compressed DL-map as defined in [1], para 8.4.5.6.1.

2.2.8.4.5.6.2 Compressed UL-MAP

The AeroMACS MS shall implement Compressed UL-map as defined in [1], para 8.4.5.6.2.

[IO-CM] If the AeroMACS BS implements the [IO-CM] option, the AeroMACS BS shall implement Compressed UL-map as defined in [1], para 8.4.5.6.2.

2.2.8.4.5.7 AAS-FBCK-REQ/RSP message bodies

NA

2.2.8.4.5.8 Optional reduced AAS private maps

NA

2.2.8.4.5.9 Reduced AAS private maps

NA

2.2.8.4.5.9.1 Reduced AAS private DL-MAP

NA

2.2.8.4.5.9.2 Reduced AAS private UL-MAP

NA

2.2.8.4.6 OFDMA subcarrier allocations

AeroMACS shall implement OFDMA subcarrier allocation description as defined in [1], para 8.4.6.

2.2.8.4.6.1 Downlink (DL)

AeroMACS shall implement OFDMA DL subcarrier allocation description as defined in [1], para 8.4.6.1.

2.2.8.4.6.1.1 Preamble

AeroMACS shall implement the preamble description as defined in [1], para 8.4.6.1.1.

2.2.8.4.6.1.1.1 Common SYNC symbol (optional)

NA

2.2.8.4.6.1.1.2 Common SYNC symbol sequence

NA

2.2.8.4.6.1.2 Symbol structure

2.2.8.4.6.1.2.1 Symbol Structure for PUSC

AeroMACS shall implement Symbol Structure for PUSC as defined in [1], para 8.4.6.1.2.1.

2.2.8.4.6.1.2.1.1 DL subchannels subcarrier allocation in PUSC

AeroMACS shall implement DL subchannels subcarrier allocation in PUSC as defined in [1], para 8.4.6.1.2.1.1.

2.2.8.4.6.1.2.2 Symbol Structure for FUSC

NA

2.2.8.4.6.1.2.3 Additional optional symbol structure for FUSC

NA

2.2.8.4.6.1.2.4 Optional DL tile usage of subchannels – TUSC1

NA

2.2.8.4.6.1.2.5 Optional DL tile usage of subchannels – TUSC2

NA

2.2.8.4.6.1.2.6 TUSC1/TUSC2 Support for SDMA

NA

2.2.8.4.6.2 Uplink (UL)

AeroMACS shall implement Uplink (UL) as defined in [1], para 8.4.6.2.

2.2.8.4.6.2.1 Symbol structure for subchannel (PUSC)

AeroMACS shall implement Symbol structure for subchannel (PUSC) as defined in [1], para 8.4.6.2.1.

2.2.8.4.6.2.2 Partitioning of subcarriers into subchannels in the UL

AeroMACS shall implement Partitioning of subcarriers into subchannels as defined in [1], para 8.4.6.2.2.

2.2.8.4.6.2.3 UL permutation example

[INFORMATIVE]

2.2.8.4.6.2.4 Partition a slot to mini-subchannels

NA

2.2.8.4.6.2.5 Additional optional symbol structure for PUSC

NA

2.2.8.4.6.2.6 Data subchannel rotation scheme

NA

2.2.8.4.6.2.7 Optional UL channel sounding in TDD systems

NA

2.2.8.4.6.3 Optional adjacent subcarrier permutations for AMC

NA

2.2.8.4.6.4 Optional permutations for PUSC

NA

2.2.8.4.7 OFDMA ranging

AeroMACS shall implement OFDMA ranging using 6 subchannels as defined in [1], para 8.4.7.

Note: CDMA Code set 1 and 2 are NA.

2.2.8.4.7.1 Initial ranging and HO ranging transmissions

AeroMACS shall implement initial ranging and HO ranging transmissions using two symbols as defined in [1], para 8.4.7.1.

Note: Support for 4 symbols NA.

2.2.8.4.7.2 Periodic ranging and BR transmissions

AeroMACS shall implement Periodic ranging and BR transmissions with one symbol as defined in [1], para 8.4.7.2.

"Note: Support for 3 symbols is NA.

2.2.8.4.7.3 Ranging codes

AeroMACS shall implement ranging codes as defined in [1], para 8.4.7.3.

2.2.8.4.7.4 Ranging and BR opportunity size

AeroMACS shall implement ranging and BR opportunity size as defined in [1], para 8.4.7.4.

2.2.8.4.8 Space-time coding (STC)

2.2.8.4.8.1 STC using two antennas

[INFORMATIVE]

2.2.8.4.8.1.1 Multiple-input, single-output channel estimation and synchronization

[IO-MIMO] If implementing the [IO-MIMO] option, AeroMACS shall implement multiple-input, single-output channel estimation and synchronization as defined in [1], para 8.4.8.1.1.

2.2.8.4.8.1.2 STC using two antennas

2.2.8.4.8.1.2.1 STC encoding

[IO-MIMO] If implementing the [IO-MIMO] option, AeroMACS shall implement STC encoding with Matrix A as defined in [1], para 8.4.8.1.2.1

2.2.8.4.8.1.2.1.1 STC using 2 antennas in PUSC

[IO-MIMO] If implementing the [IO-MIMO] option, AeroMACS shall implement STC using 2 antennas in PUSC as defined in [1], para 8.4.8.1.2.1.1.

2.2.8.4.8.1.2.1.2 STC using 2 antennas in FUSC

NA

2.2.8.4.8.1.2.1.3 Data mapping

NA

2.2.8.4.8.1.2.2 STC decoding

[IO-MIMO] If implementing the [IO-MIMO] option, AeroMACS shall implement the STC decoding as defined in [1], para 8.4.8.1.2.2

2.2.8.4.8.1.3 Frequency hopping diversity coding (FHDC)

NA

2.2.8.4.8.1.4 STC/FHDC configurations

[IO-MIMO] If implementing the MIMO option, AeroMACS shall implement STC configuration Matrix A description as defined in [1], para 8.4.8.1.4.

Note: Matrix B is NA for AeroMACS.

2.2.8.4.8.1.5 UL using STC

NA

2.2.8.4.8.1.6 STC of two antennas using directivity through four antennas

NA

2.2.8.4.8.2 STC for four antennas

NA

2.2.8.4.8.2.1 STC for four antennas using PUSC

NA

2.2.8.4.8.2.2 STC for four antennas using FUSC

NA

2.2.8.4.8.2.3 STC configurations

NA

2.2.8.4.8.2.4 MIMO MDHO-based macro-diversity transmission

NA

2.2.8.4.8.3 STC for the optional zones in the DL

NA

2.2.8.4.8.3.1 Symbol structure for optional AMC and optional FUSC

NA

2.2.8.4.8.3.2 Symbol structure for the optional PUSC-ASCA

NA

2.2.8.4.8.3.3 Transmission schemes for 2-antenna BS in DL

NA

2.2.8.4.8.3.4 Transmission schemes for 3-antenna BS in DL

NA

2.2.8.4.8.3.5 Transmission schemes for 4-antenna BS

NA

2.2.8.4.8.3.6 MIMO precoding

NA

2.2.8.4.8.4 STC for the optional zones in the UL

NA

2.2.8.4.8.4.1 Allocation of pilot subcarriers

NA

2.2.8.4.8.4.2 Allocation of data subchannels

NA

2.2.8.4.8.4.3 Transmission schemes for 2-antenna MS in UL

NA

2.2.8.4.8.5 MIMO Midamble

NA

2.2.8.4.8.5.1 Midamble sequence

NA

2.2.8.4.8.5.1.1 PAPR reduction sequence for BS with two antennas

NA

2.2.8.4.8.5.1.2 PAPR reduction sequence for BS with three or four antennas

NA

2.2.8.4.8.6 STC subpacket combining

NA

2.2.8.4.8.7 Cyclic delay diversity (CDD)

NA

2.2.8.4.9 Channel coding

AeroMACS shall implement channel coding description as defined in [1], para 8.4.9.

2.2.8.4.9.1 Randomization

AeroMACS shall implement randomization as defined in [1], para 8.4.9.1.

2.2.8.4.9.2 Encoding

AeroMACS shall implement encoding as defined in [1], para 8.4.9.2.

2.2.8.4.9.2.1 Convolutional coding (CC)

AeroMACS shall implement CC with tail biting as defined in [1], para 8.4.9.2.1.

Note: Zero tailing as described in 8.4.9.2.4 is NA.

2.2.8.4.9.2.1.1 Incremental redundancy HARQ support (optional)

NA

2.2.8.4.9.2.2 Block turbo coding (BTC) (optional)

NA

2.2.8.4.9.2.3 Convolutional turbo codes (CTCs) (optional)

AeroMACS shall implement Convolutional turbo codes (CTCs) as defined in [1], para 8.4.9.2.3.

2.2.8.4.9.2.3.1 CTC encoder (Basic functionality)

AeroMACS shall implement CTC encoder as defined in [1], para 8.4.9.2.3.1.

2.2.8.4.9.2.3.2 CTC interleaver

AeroMACS shall implement CTC interleaver as defined in [1], para 8.4.9.2.3.2.

2.2.8.4.9.2.3.3 Determination of CTC circulation states

AeroMACS shall implement determination of CTC circulation states as defined in [1], para 8.4.9.2.3.3.

2.2.8.4.9.2.3.4 Subpacket generation

AeroMACS shall implement CTC subpacket generation as defined in [1], para 8.4.9.2.3.4.

2.2.8.4.9.2.3.4.1 Bit separation

AeroMACS shall implement CTC bit separation as defined in [1], para 8.4.9.2.3.4.1.

2.2.8.4.9.2.3.4.2 Subblock interleaving

AeroMACS shall implement CTC sublock interleaving as defined in [1], para 8.4.9.2.3.4.2.

2.2.8.4.9.2.3.4.3 Bit grouping

AeroMACS shall implement CTC bit grouping as defined in [1], para 8.4.9.2.3.4.3

2.2.8.4.9.2.3.4.4 Bit selection

AeroMACS shall implement CTC Bit selection as defined in [1], para 8.4.9.2.3.4.4

2.2.8.4.9.2.3.5 Optional IR HARQ support

NA

2.2.8.4.9.2.4 Zero tailed convolutional coding (optional)

NA

2.2.8.4.9.2.5 Low density parity check (LDPC) code (optional)

NA

2.2.8.4.9.3 Interleaving

AeroMACS shall implement interleaving as defined in [1], para 8.4.9.3.

2.2.8.4.9.3.1 Optional interleaver for convolutional coding

NA

2.2.8.4.9.4 Modulation

2.2.8.4.9.4.1 Subcarrier randomization

AeroMACS shall implement subcarrier randomization as defined in [1], para 8.4.9.4.1.

2.2.8.4.9.4.2 Data modulation

AeroMACS shall implement QPSK data modulation as defined in [1], para 8.4.9.4.2.

AeroMACS shall implement 16-QAM data modulation as defined in [1], para 8.4.9.4.2.

AeroMACS shall implement 64-QAM for the DL as defined in [1], para 8.4.9.4.2.

[IO-64QAM] If implementing the [IO-64QAM] option, AeroMACS shall implement 64-QAM UL as defined in [1] para 8.4.9.4.2.

2.2.8.4.9.4.3 Pilot modulation

AeroMACS shall implement pilot modulation as defined for PUSC in [1], para 8.4.9.4.3.

2.2.8.4.9.4.4 Example of OFDMA UL CC encoding is just an example

[INFORMATIVE]

2.2.8.4.9.5 Repetition

AeroMACS shall implement repetition as defined in [1], para 8.4.9.4.5.

2.2.8.4.9.6 Zone boosting

NA

2.2.8.4.9.7 Multiple HARQ (optional)

[INFORMATIVE]

2.2.8.4.9.7.1 Generic chase HARQ

AeroMACS shall implement generic HARQ as defined in [1], para 8.4.9.4.7.1.

2.2.8.4.9.7.2 CC-IR HARQ

NA

2.2.8.4.10 Control mechanisms

2.2.8.4.10.1 Synchronization

2.2.8.4.10.1.1 Network synchronization

The AeroMACS BS shall be synchronized as defined in [1], para 8.4.10.1.1.

2.2.8.4.10.1.2 SS synchronization

The AeroMACS MS shall implement SS synchronization as defined in [1], para 8.4.9.10.1.2.

2.2.8.4.10.2 Ranging

AeroMACS shall implement ranging as defined in [1], para 8.4.10.2.

2.2.8.4.10.3 Power control

AeroMACS shall implement power control mechanisms as defined in [1], para 8.4.10.3.

2.2.8.4.10.3.1 Closed-loop power control

AeroMACS shall implement closed-loop power control as defined in [1], para 8.4.10.3.1.

2.2.8.4.10.3.2 Optional open-loop power control

AeroMACS shall implement open-loop power control as defined in [1], para 8.4.10.3.2.

Note: Open loop active power control is NA

2.2.8.4.11 Fast-feedback channels

AeroMACS shall implement fast-feedback channels as defined in [1], para 8.4.11.

2.2.8.4.11.1 Fast DL measurement feedback

[IO-MIMO] If implementing the [IO- MIMO] option, AeroMACS shall implement Fast DL measurement feedback as defined in ref [1], para 8.4.11.

2.2.8.4.11.2 Fast MIMO feedback

NA

2.2.8.4.11.3 Mode selection feedback

NA

2.2.8.4.11.4 Effective CINR feedback for fast-feedback channel

NA

2.2.8.4.11.5 Enhanced fast-feedback channels

NA

2.2.8.4.11.6 Fast DL measurement feedback for enhanced fast-feedback channel

NA

2.2.8.4.11.7 Fast MIMO feedback of quantized precoding weight for enhanced fast-feedback channel

NA

2.2.8.4.11.8 MIMO mode feedback for enhanced fast-feedback channel

NA

2.2.8.4.11.9 Anchor BS report

NA

2.2.8.4.11.10 UEP fast-feedback

NA

2.2.8.4.11.11 Band AMC differential CINR feedback for enhanced fast-feedback channel

NA

2.2.8.4.11.12 Indication flag feedback

NA

2.2.8.4.11.13 Primary and secondary fast-feedback channels

NA

2.2.8.4.11.14 Extended rtPS BR

NA

2.2.8.4.11.15 MIMO feedback for Tx beamforming

NA

2.2.8.4.11.16 MAP ACK Channel

NA

2.2.8.4.11.17 MAP NACK Channel

NA

2.2.8.4.12 Channel quality measurements

2.2.8.4.12.1 Introduction

[INFORMATIVE]

2.2.8.4.12.2 RSSI mean and standard deviation

The AeroMACS MS receiver shall implement RSSI mean and standard deviation as defined in [1], para 8.4.12.2.

2.2.8.4.12.3 CINR mean and standard deviation

The AeroMACS MS receiver shall implement CINR mean and standard deviation only for preamble and pilot subcarriers as defined [1], para 8.4.12.3.

2.2.8.4.12.4 Optional frequency selectivity characterization

NA

2.2.8.4.13 Transmitter requirements

2.2.8.4.13.1 Tx power level control

AeroMACS shall implement TX power level control mechanism as defined in [1], para 8.4.13.1.

2.2.8.4.13.2 Transmitter spectral flatness

AeroMACS transmitters shall be designed to have spectral flatness as defined in [1], para 8.4.13.2.

2.2.8.4.13.3 Transmitter constellation error and test method

AeroMACS transmitters shall be designed to have constellation errors as defined in [1], para 8.4.13.3.

2.2.8.4.13.3.1 RMS constellation error measurement for BS (DL)

[INFORMATIVE]

2.2.8.4.13.3.2 RMS constellation error measurement for SS

[INFORMATIVE]

2.2.8.4.13.3.3 Calculation of RMS constellation error

[INFORMATIVE]

2.2.8.4.13.3.4 Unmodulated subcarrier errors for SS

[INFORMATIVE]

2.2.8.4.13.4 Transmitter reference timing accuracy

AeroMACS shall implement Transmitter reference timing accuracy as definded in [1], para 8.4.13.4.

2.2.8.4.14 Receiver requirements

[INFORMATIVE]

2.2.8.4.14.1 OFDMA PHY requirements for enhanced HO performance

2.2.8.4.14.1.1 Receiver sensitivity

AeroMACS shall implement Receiver sensitivity as defined in [1], para 8.4.14.1.1.

2.2.8.4.14.1.2 MS UL Tx time tracking accuracy

The AeroMACS MS shall implement MS UL Tx time tracking accuracy as defined in [1], para 8.4.14.1.2.

2.2.8.4.14.1.3 MS autonomous neighbor cell scanning

NA

2.2.8.4.14.2 Receiver adjacent and nonadjacent channel rejection

AeroMACS shall implement Receiver adjacent and non-adjacent channel rejection as defined in [1], para 8.4.14.2.

2.2.8.4.14.3 Receiver maximum input signal

2.2.8.4.14.3.1 SS receiver maximum input signal

The AeroMACS MS shall implement SS receiver maximum input signal as defined in [1], para 8.4.14.3.1.

2.2.8.4.14.3.2 BS receiver maximum input signal

The AeroMACS BS shall implement BS receiver maximum input signal as defined in [1], para 8.4.14.3.2.

2.2.8.4.14.4 Receiver maximum tolerable signal

2.2.8.4.14.4.1 SS receiver maximum tolerable signal

The AeroMACS MS shall implement SS receiver maximum tolerable signal of 0 dBm without damage.

2.2.8.4.14.4.2 BS receiver maximum tolerable signal

The AeroMACS BS shall implement BS receiver maximum tolerable signal of 0 dBm without damage.

2.2.8.4.15 Frequency control requirements

2.2.8.4.15.1 Center frequency and symbol clock frequency tolerance

AeroMACS shall implement center frequency and symbol clock frequency tolerance as defined in [1], para 8.4.15.1.

Measurements for BS shall be made under extreme test conditions as outlined in [1], para 2.3.2.1.4.2.

2.2.8.4.16 Optional HARQ support

[INFORMATIVE]

2.2.8.4.16.1 Optional Chase HARQ support

AeroMACS shall implement the optional Chase combining HARQ as defined in [1], para 8.4.16.1.

2.2.8.4.16.1.1 HARQ retransmission process

AeroMACS shall implement HARQ retransmission process as defined in [1], para 8.4.16.1.1.

2.2.8.4.16.1.2 CRC

AeroMACS shall implement CRC as defined in [1] para 8.4.16.1.2.

2.2.8.4.16.1.3 Concurrent transmission of UL HARQ bursts

AeroMACS shall implement Concurrent transmission of UL HARQ bursts as defined in [1], para 8.4.16.1.3.

Note: Per Connection HARQ is NA.

2.2.8.4.16.1.4 Encoding

AeroMACS shall implement Encoding as defined in [1], para 8.4.16.1.4.

2.2.8.4.16.2 Optional IR HARQ for convolutional code

NA

2.2.8.4.16.3 UL ACK channel

AeroMACS shall implement UL ACK channel as defined in [1], para 8.4.16.3.

2.2.9 AeroMACS Transmitter Output power

2.2.9.1 Downlink Output Power

The AeroMACS BS downlink power at the output port of the transmitter shall correspond to one of the following power classes as identified within the IEEE 802.16-2009 standard for QPSK:

Class identifier	Tx power (dBm)
Class 1	20 <PTx,max < =23
Class 2	23 <PTx,max <= 27
Class 3	27 <PTx,max < =30

Note: The output power maxima will be limited by regulatory action to limit interference to MSS feeder links and to conform to radiated emission limits.

Note: the values provided are average output power levels.

2.2.9.2 Uplink Output Power

The AeroMACS MS uplink power at the output port of the transmitter shall correspond to one of the following power classes as identified within the IEEE 802.16-2009 standard for QPSK

Class identifier	Tx power (dBm)
Class 1	20 <PTx,max <= 23
Class 2	23< PTx,max <= 27
Class 3	27< PTx,max <= 30

Note: The output power maxima will be limited by regulatory action to limit interference to MSS feeder links and to conform to radiated emission limits.

Note: the values provided are average output power levels.

2.2.10 AeroMACS Transmitter characteristics

2.2.10.1 Transmitter Spurious Emissions

Transmitter spurious emissions are here defined as any unwanted emissions falling in the defined frequency band of the table beneath. Transmitter spurious emissions shall comply with the values in Table 3-Transmitter spurious emissions below.

The following requirements are only applicable for frequencies, which are greater than 250% of the channel bandwidth away from the BS/MS operating centre frequency.

Table 3 - Transmitter spurious emissions

FREQUENCY BAND	MEASUREMENT BANDWIDTH	MAXIMUM LEVEL
30MHz < f < 1 GHz	100 kHz	-36 dBm

1GHz < f < 12.75 GHz	30kHz if 2.5xBW<=|fc-f|<10xBW	-30 dBm
	300kHz if 10xBW<=|fc-f|<12xBW	-30 dBm
	1MHz if 12xBW<=|fc-f|	-30dBm

Note: In the table, fc means the centre frequency and f means the frequency of the spurious emission. BW stands for the AeroMACS channel bandwidth of 5 MHz.

The above values shall apply to both MS and BS equipment.

All transmitter spurious emission shall be measured at the output of the equipment.

Note: These requirements are defined for the transmitter. Additional isolation may be required to comply with requirements in 3.1.6.

2.2.10.2 AeroMACS Transmitted Spectral Mask

The AeroMACS spectrum mask shall be as follows below.

The power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(1) On any frequency removed from the assigned frequency between 0–45% of the authorized bandwidth (BW): 0 dB.

(2) On any frequency removed from the assigned frequency between 45–50% of the authorized bandwidth: 568 log (%of (BW)/45) dB.

(3) On any frequency removed from the assigned frequency between 50–55% of the authorized bandwidth: 26 + 145 log (% of BW/50) dB.

(4) On any frequency removed from the assigned frequency between 55– 100% of the authorized bandwidth: 32 + 31 log (% of (BW)/55) dB.

(5) On any frequency removed from the assigned frequency between 100–150% of the authorized bandwidth: 40 +57 log (% of (BW)/100) dB.

(6) On any frequency removed from the assigned frequency between above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

Note: This spectral mask is valid up to +/-250% of the authorized bandwidth. Beyond the 250%

the Spurious Emissions requirements are as defined 2.2.13.1.

2.2.11 Receiver Spurious Emissions

The power of any spurious emissions shall not exceed the values as provided by the Table 4 - General Receiver Spurious Emission Requirements below:

Table 4 - General Receiver Spurious Emission Requirements

FREQUENCY BAND	MEASUREMENT BANDWIDTH	MAXIMUM LEVEL
30MHz < f < 1 GHz	100 kHz	-57 dBm
1GHz < f < 12.75 GHz	1 MHz	-47 dBm

Note: These requirements are defined for the receiver. Additional isolation may be required to comply with requirements in 3.1.6.

2.2.12 Transceiver Requirements

2.2.12.1 Doppler Velocity

AeroMACS shall operate with any Doppler velocity up to 50 nautical miles per hour.

2.2.12.2 Time Standard

All AeroMACS base stations shall maintain coordination using Universal Coordinated Time (UTC) epoch time.

NOTE: GNSS is one means to aquire UTC.

2.3 Equipment Performance – Environmental Conditions

2.3.1 Airborne (MS) Environmental Conditions

DO-160G Categories and Tests required based on installation location are contained in Table 5 - Airborne MS Environmental Conditions.

Table 5 - Airborne MS Environmental Conditions

DO-160G Section	Environment	Internal to Aircraft, Within Pressure Vessel	Internal to Aircraft, Outside Pressure Vessel	Antennas	Comments
4	Temperature and Altitude	A1	F2	F2	

5	Temperature Variation	C	B	A	
6	Humidity	A	B	C	
7	Operational Shocks and Crash Safety	A	A	A	See Note 1
8	Vibration	SB or SC	SC or SE	SC or SE	See Note 2
9	Explosion Proofness	X	X	X	
10	Waterproofness	X	W	S	
11	Fluids Susceptibility	X	F	F	
12	Sand and Dust	X	D	S	
13	Fungus Resistance	X	F	X	
14	Salt Spray	X	X	S	
15	Magnetic Effect	Z	C	NA	
16	Power Input AC	A(WF)	A(WF)	NA	Widest frequency range to cover worst case
16	Power Input DC	BZ	BZ	NA	
17	Voltage Spike	A	A	NA	
18	Audio Frequency Conducted Susceptibility AC	R(CF)	R(CF)	NA	

18	Audio Frequency Conducted Susceptibility DC	Z	Z	NA	
19	Induced Signal Susceptibility	[CCW]	[CCW]	NA	Widest frequency range and worst case coupling
20	RF Susceptibility	RR	RR	NA	
21	Emissions of RF Energy	M	M	NA	
22	Lightning Induced Transient Susceptibility (Metallic)	A3E3XX	A3E3XX	NA	
22	Lightning Induced Transient Susceptibility **(Composite)**	A3F3XX	A3F3XX	NA	
23	Lightning Direct Effects	XX	XX	XX2A	
24	Icing	X	A	C	
25	Electrostatic Discharge	A	A	NA	
26	Fire, Flammability	C	C	X	

Notes

1 Use category B for equipment installed in compartments or other areas of the aircraft where equipment detached during emergency landing could present a hazard to occupants, fuel systems or emergency evacuation equipment.

2 Use category SB for equipment attached to secondary structure (instrument panel, console, equipment rack, etc.) within aircraft. Use category SC for equipment attached to primary fuselage structure. Use category SE for equipment attached to or contained within the wing or horizontal/vertical stabilizers

2.3.2 Ground Base Station Environmental Conditions

2.3.2.1 Test conditions, power sources and ambient temperatures

2.3.2.1.1 Test power source

During testing, the equipment shall be supplied from a test power source capable of producing normal and extreme test voltages as specified in clauses 2.3.2.1.4.1.2, and 2.3.2.1.4.2.4.

The internal impedance of the test power source shall be low enough for its effect on the test results to be negligible.

For the purpose of testing the power source voltage shall be measured at the input terminals of the equipment.

During testing, the power source voltages shall be maintained within a tolerance of ±3 % relative to the voltage level at the beginning of each test.

2.3.2.1.2 Test channels

Test shall be carried out on at least three channels that represent the upper, lower, and mid-range frequencies.

2.3.2.1.3 General conditions of measurement

2.3.2.1.3.1 Receiver test signal arrangement

Test signal sources shall be connected to the receiver input in such a way that the impedance presented to the receiver input is 50 Ω ± 2 Ω, irrespective of whether one or more test signals are applied to the receiver simultaneously.

2.3.2.1.3.2 Performance check

Whit the equipment is being subjected to the normal or extreme test conditions, establish compliance with the requirements of the following clauses: 2.2.8.4.14.1.1 Receiver Sensitivity

2.2.9 AeroMACS Transmitter Output Power, and

2.2.8.4.15.1 Center frequency and symbol clock frequency tolerance.

2.3.2.1.4 Normal and extreme test conditions

Measurements shall be made under normal test conditions and also, where stated, under extreme test conditions.

2.3.2.1.4.1 Normal test conditions

2.3.2.1.4.1.1 Normal temperature and humidity

The normal temperature and humidity conditions for tests shall be a combination of temperature and humidity within the following ranges:

- temperature: +15 °C to +35 °C;
- relative humidity: 20 % to 75 %.

When it is impracticable to carry out the tests under these conditions, a note to this effect, stating the ambient temperature and relative humidity during the tests, shall be added to the test report.

2.3.2.1.4.1.2 Normal power sources

2.3.2.1.4.1.2.1 Mains voltage and frequency

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage.

For the purpose of the present document, the nominal voltage shall be the declared voltage or any of the declared voltages for which the equipment was designed.

The frequency of the test power source shall correspond to the appropriate AC mains.

2.3.2.1.4.1.2.2 Other power sources

For operation from other power sources, the normal test voltage shall be that declared by the equipment manufacturer.

2.3.2.1.4.2 Extreme test conditions

2.3.2.1.4.2.1 Extreme temperatures

For tests at extreme temperatures, measurements shall be made at a lower temperature of -10 °C and an upper temperature of +55 °C. This test shall be performed at the nominal supply voltage as defined in clause 2.3.2.1.4.1.2.1.

2.3.2.1.4.2.2 Procedure for tests at extreme temperatures

2.3.2.1.4.2.2.1 General

The equipment shall be switched off during the temperature stabilizing periods.

For tests at the upper temperature on equipment designed for continuous operation, the equipment shall be placed in the test chamber and left until thermal equilibrium is reached. The equipment shall then be switched on for 30 minutes before measurements are made. Transmitters shall be operated in the highest rated power transmit condition in that 30 minutes period before measurements are made.

For tests at the lower temperature, the equipment shall be left in the test chamber until thermal equilibrium is reached.

The equipment shall then be switched on for 1 minute in the standby or receive condition before measurements are made.

2.3.2.1.4.2.2.2 High temperature

- Place the equipment in a chamber and heat to 55 ºC (±3 ºC) and allow to stabilize for 1 hour.
- Switch on the equipment (transmitters shall be keyed).
- After 30 minutes carry out a performance check as detailed in clause 2.3.2.1.3.2.
- Switch off the equipment and allow the chamber to cool to room temperature over a 1 hour period.
- Allow time for the equipment to stabilize to normal room temperature and humidity before carrying out the next test.

2.3.2.1.4.2.2.3 Low temperature

- Place the equipment in a chamber and cool to -10 ºC (±3 ºC) for 2 hours.
- Switch on the equipment and maintain the chamber operating temperature at -10 ºC (±3 ºC).
- After 1 minute carry out a performance check as detailed in clause 2.3.2.1.3.2.
- Switch off the equipment and allow the chamber to rise to room temperature over a 1 hour period.
- Allow time for the equipment to stabilize to normal room temperature and for moisture to disperse before carrying out the next test.

2.3.2.1.4.2.3 Extreme values of test power sources

Mains voltage

The extreme test voltages shall be ±10 % of the value declared in clause 2.3.2.1.4.1.2.1.
The frequency of the test voltage shall be the nominal frequency of the supply as declared in clause 2.3.2.1.4.1.2.1.
This test shall be performed at the normal temperature and humidity as defined in clause 2.3.2.14.1.1.

2.3.2.1.4.2.4 Other power sources

For equipment using other power sources, or capable of being operated from a variety of power sources, the extreme

test voltages shall be those agreed between the equipment manufacturer and the testing laboratory and shall be recorded in the test report.

2.3.2.1.4.2.5 Performance check

With the equipment is being subjected to the extreme test conditions, establish compliance with the requirements of clause 2.3.2.1.3.2.

2.4 Equipment Test Procedures

2.4.1 Definition of Terms and Conditions of Test

The following are definitions of terms and the conditions under which the tests described in this subsection should be conducted.

a. Power Input Voltage – Unless otherwise specified, all tests shall be conducted with the power input voltage adjusted to design voltage, plus or minus 2%. The input voltage shall be measured at the input terminals of the equipment under test.

b. Power Input Frequency

1) In the case of equipment designed for operation form an AC source of essentially constant frequency (e.g., 400 Hz), the input frequency shall be adjusted to design frequency, plus or minus 2%.

2) In the case of equipment designed for operation form an AC source of variable frequency (e.g., 300 to 1,000 Hz), unless otherwise specified, tests shall be conducted with the input frequency adjusted to within 5% of a selected frequency and within the range for which the equipment is designed.

c. Adjustment of Equipment – The circuits of the equipment under test shall be properly aligned and otherwise adjusted in accordance with the manufacturer's recommended practices prior to application of the specified tests.

d. Test Equipment – All equipment used in the performance of the tests should be identified by make, model and serial number where appropriate, and its latest calibration date. When appropriate, all test equipment calibration standards should be traceable to national and/or international standards.

e. Test Instrument Precautions – Adequate precautions shall be taken during the test to prevent the introduction of errors resulting from the connection of voltmeters, oscilloscopes and other test instruments across the input and output impedances of the equipment under test.

f. Ambient Conditions – Unless otherwise specified, all tests shall be made within the following ambient conditions:

1) Temperature: +15 to +35 degrees C (+59 to +95 degrees F).

2) Relative Humidity: Not greater than 85%.

3) Ambient Pressure: 84 to 1-7 kPa (equivalent to +5,000 to –1,500 ft) (+1,525 to –460m).

g. Connected Loads – Unless otherwise specified, all tests shall be performed with the equipment connected to loads having the impedance values for which it is designed.

2.4.2 Test Procedures

The AeroMACS Protocol Implementation Conformance Statement (PICS) [2] or equivalent and Certification Requirements Status List (CRSL) [5] or equivalent contain the testing procedures required for AeroMACS.

3 INSTALLED EQUIPMENT PERFORMANCE

3.1 Equipment Installation

3.1.1 Dynamic Range

Operation of the equipment shall not be adversely affected by aircraft maneuvering under normal ground operations.

3.1.2 Interference Effects

The equipment shall not be the source of adversely conducted or radiated interference nor be adversely affected by conducted or radiated interference from other equipment or systems installed on the aircraft.

3.1.3 Aircraft Power Source

The equipment shall retain memory of variable data through aircraft power transfer, which occurs during normal operation. Typical power transfer involves switching from external power to internal power, either battery or APU generator, or to engine driven generator(s). The equipment shall not require reinitialization for power transfer (i.e. power loss) for a period up to 0.2 second maximum. Power transfer shall not latch a failure indication. Momentary failure indications, during switching, are allowed.

3.2 Installed Equipment Performance Requirements (MS)

The installed equipment shall meet the requirements stated in 2.1 and 2.2, as applicable in addition to, or as modified by, the requirements stated below.

3.2.1 Antenna Cables (MS)

3.2.1.1 Antenna Cable VSWR (MS)

With the antenna installed and connected to the antenna cable, the maximum VSWR should be less than or equal to 2:1 over 5000-5150 MHz.

3.2.2 Antenna Characteristics (MS)

The antenna should be predominantly vertical polarization over 5000-5150MHz. Response to horizontally polarized signals should be at least 10dB below the response to vertically polarized signals emanating from the same direction.

3.3 Conditions of Test

3.3.1 Ground Test Procedures

3.3.2 Verification of Dynamic Range

Within the AeroMACS station coverage, travel down a taxi way. At the end of the taxi way, complete at least one 360 degree turn, then return down the taxi way. Verify that AeroMACS performance is not significantly affected.

3.3.3 Interference Effects

With the equipment energized from the aircraft's electrical power generating system, individually operate each of the other electrically operated aircraft equipment and systems to determine that no significant conducted or radiated interference exists with installed equipment. Likewise, verify that operating installed equipment does not interfere with AeroMACS equipment. Evaluate all reasonable combinations of control setting and operating modes. Operate communications and navigation equipment on at least the low, high, and mid-band frequencies. If appropriate, repeat tests using the aircraft's emergency power, APU, and/or ground power.

3.3.4 Verification of Power Fluctuation

Under normal aircraft conditions, cycle the aircraft engine(s) through all normal power settings and verify proper operation of the equipment as specified by the equipment manufacturer. Exercise switching from external power to internal power, either battery or APU generator, or to engine driven generator(s) as appropriate.

3.3.5 Antenna Cables

3.3.5.1 Verification of Antenna Cable VSWR

With the antenna installed and connected to the antenna cable, measure VSWR at the cable end to be connected to the unit. The maximum VSWR should be less than or equal to 2:1 over 5000-5150 MHz.

3.3.6 Antenna Characteristics

Data supplied by the manufacturer or the appropriate testing can be performed to verify antenna performance.

4 EQUIPMENT OPERATIONAL PERFORMANCE CHARACTERISTICS

4.1 Required Operational Performance Requirements

To ensure that operation can be conducted safely and reliably in the expected operational environment, there are a specific minimum acceptable AeroMACS, equipment performance requirements that shall be met. The following paragraphs identify their requirements.

4.1.1 Power Inputs

Prior to flight, verify that the equipment is receiving primary input power necessary for proper conditions.

4.1.2 Displays

With the equipment operating, verify that the displays required for the selection and annunciation of various communication modes/functions of operation are operating and readable.

4.1.3 Communication Controls

Cockpit control(s) required for proper operation of the equipment shall be available for use.

4.1.4 Equipment Operating Functions

The equipment shall operate in each of its installed operating modes~~,~~ as appropriate to the installed equipment.

4.1.5 System Operational Indication

Communication failure of degradation below minimum acceptable performance shall be readily discernible.

4.1.6 Equipment Operating Limitations

Equipment operating limitations of the aircraft station should be contained in the aircraft flight manual.

4.2 Test Procedures for Operational Performance Requirements

Operation equipment tests may be conducted as part of normal pre-flight test. For those tests that can be run only in flight, procedures should be developed to perform these tests as early during the flight as possible to verify that the equipment is performing its intended function(s).

4.2.1 Power Input

With the aircraft's electrical power generating system operating, energize the equipment and verify that electrical power is available to the equipment.

4.2.2 Communication Displays

With the equipment operating, verify that the required display(s) are operations.

4.2.3 Communication Controls

The communications control(s) shall be operated, as required, to verify satisfactory equipment response.

4.2.4 Functional Operating Tests

Verify that the equipment performs its intended function(s) for each of the operating modes available to the operator and from available ground facilities.

Using the associated data link message entry and retrieval equipment, send a test message that will elicit a response, Check for the timeliness of the reply message, that the reply message is appropriate to the transmitted test message, and that the reply message has no apparent errors.

4.2.5 System Operational Indication

System operational readiness shall be monitored either by means of Built-In-Test-Equipment (BITE) and/or by suitable preflight tests contained in a check list of flight manual. All equipment failure annunciators shall be tested during pre-flight tests to verify proper operation.

4.2.6 Equipment Operating Limitations

Verify that any equipment operating limitations of the aircraft station are contained in the aircraft flight manual.

5 MEMBERSHIP

RTCA Special Committee 223

Minimum Operational Performance Standards (MOPS)
for the Aeronautical Mobile Airport Communication System (AeroMACS)

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APPENDIX A LIST OF ABBREVIATIONS AND ACRONYMS

3-DES	triple data encryption standard
4DTRAD	4D trajectory data link
AAS	adaptive antenna system
ACARS	aircraft communications addressing and reporting system
ACP	aeronautical communications panel
AeroMACS	Aeronautical Mobile Airport Communication System
AES	advanced encryption standard
AK	authorization key
ARNS	aeronautical radio navigation services
ARQ	automatic repeat request
AS	aeronautical security
ATC	air traffic control
ATM	aeronautical mobile service
ATM	asynchronous transfer mode
BE	best effort
BER	bit error ratio
BR	bandwidth request
BS	base station
BSN	block sequence number
BTC	block turbo code
BW	bandwidth (abbreviation used only in equations, tables, and figures)
CA	certification authority
CBC	cipher block chaining
CC	confirmation code
CCM	CTR mode with CBC-MAC
CDMA	code division multiple access
CID	connection identifier
CINR	carrier-to-interference-and-noise ratio
CIR	channel impulse response
CMAC	cipher-based message authentication code
CMU	communication management unit
CNS	commuications, navigation, and surveillance
CP	cyclic prefix
CPLD	controller pilot data link communications
CQI	channel quality information
CQICH	channel quality information channel
CRC	cyclic redundancy check
CRSL	certification requirements status list
CS	convergence sublayer
CTC	convolutional turbo code
CTR	counter mode encryption
D-NOTAM	digital notice to airmen
DAL	design assurance level
dBm	decibels relative to 1 mW
DCD	downlink channel descriptor
DES	data encryption standard

DIUC	downlink interval usage code
DL	downlink
DSA	dynamic service addition
DSC	dynamic service change
DSD	dynamic service deletion
DSx	dynamic service addition, change, or deletion
EAP	extensible authentication protocol
EC	encryption control
ECB	electronic code book
EDE	encrypt-decrypt-encrypt
EFB	electronic flight bag
EKS	encryption key sequence
FBSS	fast base station switching
FC	fragmentation control
FCC	federal communications commission
FCH	frame control header
FDD	frequency division duplex or duplexing
FEC	forward error correction
FFSH	fast-feedback allocation subheader
FFT	fast Fourier transform
FHDC	frequency hopping diversity coding
FMS	flight management system
FPC	fast power control
FSH	fragmentation subheader
FUSC	full usage of subchannels
GPCS	Generic Packet Convergence Sublayer
GKEK	group key encryption key
GMSH	grant management subheader
GPS	global positioning system
GS	guard symbol
GTEK	group traffic encryption key
HEC	header error check
H-FDD	half-duplex frequency division duplex
HMAC	hashed message authentication code
HO	handover
HT	header type
ICAO	international civil aviation organization
IE	information element
IEEE	institute of electrical and electronics engineers
IMA	integrated modular avionics
IP	internet protocol
ISO	international standards orgranization
IV	initialization vector
ITU	international telecommunications union
KEK	key encryption key
LAN	local area network
LBS	location based services
LDPC	low-density parity check
LFSR	linear feedback shift register

LLC	logical link control
LOS	line-of-sight
LRU	line replaceable unit
MAC	medium access control layer
MAK	MBS authorization key
MBS	multicast and broadcast service
MDHO	macro diversity handover
MGTEK	MBS group traffic encryption key
MIC	message integrity check
MIH	media independent handover
MIHF	MIH Function
MIMO	multiple input multiple output
MLS	microwave landing system
MOPS	Minimum Operational Performance Standards
MS	mobile station
N	network
NAS	network access server
NLOS	non-line-of-sight
NNI	network-to-network interface (or network node interface)
NOTAM	Notice to Airmen
nrtPS	non-real-time polling service
NSP	network service provider
OFDM	orthogonal frequency division multiplexing
OFDMA	orthogonal frequency division multiple access
PAK	primary authorization key
PAPR	peak to average power ratio
PDU	protocol data unit
PER	packet error ratio
PHS	payload header suppression
PHY	physical layer
PICS	protocol implementation conformance statement
PKM	privacy key management
PM	poll-me bit
PMK	pairwise master key
PMP	point-to-multipoint
PN	packet number
PS	physical slot
PSH	packing subheader
PTI	payload type indicator
PtP	point to point
PUSC	partial usage of subchannels
PUSC-ASCA	partial usage of subchannels – adjacent subcarrier allocation
Q	quadrature
QAM	quadrature amplitude modulation
QoS	quality of service
QPSK	quadrature phase-shift keying
RFC	request for comments
REQ	request
RF	radio frequency

RNG	ranging
ROHC	an IP-header-compression CS PDU format (IETF RFC 3095)
RS	Reed–Solomon
RSP	response
RSS	receive signal strength
RSSI	receive signal strength indicator
RTCA	Radio Technical Commission for Aeronautics
rtPS	real-time polling service
Rx	receive (abbreviation not used as verb)
SA	security association
SAR	synthetic aperture radar
SC	single carrier
SDMA	spatial division multiple access
SDU	service data unitSF service flow
SHA	secure hash algorithm
SI	slip indicator
SM	spatial multiplexing
SN	sequence number
SNR	signal-to-noise ratio
SNSDU	subnetwork service data class
SS	subscriber station
SSM	subscriber station management
STC	space time coding
SWIM	system wide information management
TCS	transmission convergence sublayer
TDD	time division duplex or duplexing
TDLS	tower data link service
TDOA	time difference of arrival
TEK	traffic encryption key
TFTP	Trivial File Transfer Protocol
TLV	type/length/value
TUSC	tile usage of subchannels
Tx	transmit (abbreviation not used as verb)
UCD	uplink channel descriptor
UEP	unequal error protection
UGS	unsolicited grant service
UIUC	uplink interval usage code
UL	uplink
UNI	user-to-network interface (or user-network interface)
UTC	universal coordinated time
VCI	virtual channel identifier
VLAN	virtual local area network
VSWR	voltage standing wave ratio
WiMAX™	wireless worldwide interoperability for microwave access
WirelessMAN	Wireless Metropolitan Area Networks

APPENDIX B REQUIREMENT APPLICABILITY

Table 6 - Requirements Applicability

Section	Description	MS Requirement	BS Requirement
2.1	General Design Requirements	NR	NR
2.1.1	Effect of Test	Y	Y
2.1.2	Intended Function	Y	Y
2.1.3	ITU Regulations and Federal Communications Commission Rules	Y	Y
2.1.4	Equipment Classes	NR	NR
2.1.5	Airborne - General Design Requirements	NR	NR
2.1.5.1	Software Management	Y	NA
2.1.5.2	Airworthiness	Y	NA
2.1.5.3	Fire Protection	Y	NA
2.1.5.4	Operation of Controls	Y	NA
2.1.5.5	Design Assurance	Y	NA
2.1.5.5.1	Accessibility of Controls	Y	NA
2.1.5.5.2	Display of Navigation Facility Identification	NA	NA
2.1.6	Ground – General Design Requirements	NR	NR
2.1.6.1	Controls and indicators	NA	Y
2.2	Equipment Performance – Standard Conditions	NR	NR
2.2.1	AeroMACS Operating Frequency Band	Y	Y
2.2.2	Supported Channel Bandwidth	Y	Y
2.2.3	Reserved	NR	NR
2.2.4	Reserved	NR	NR

Section	Description	MS Requirement	BS Requirement
2.2.5	Service-specific CS	I	I
2.2.5.1	ATM CS	NA	NA
2.2.5.2	Packet CS	I	I
2.2.5.2.1	MAC SDU format	Y	Y
2.2.5.2.2	Classification	Y	Y
2.2.5.2.3	Payload header suppression (PHS)	Y	Y
2.2.5.2.3.1	PHS operation	Y	Y
2.2.5.2.3.2	PHS signaling	Y	Y
2.2.5.2.4	IEEE 802.3/Ethernet-specific part	IO-ETH	IO-ETH
2.2.5.2.4.1	IEEE 802.3/Ethernet CS PDU format	IO-ETH	IO-ETH
2.2.5.2.4.2	IEEE 802.3/Ethernet CS classification rules	IO-ETH	IO-ETH
2.2.5.2.5	IP specific part	Y IO-IPV6	Y IO-IPV6
2.2.5.2.5.1	IP CS PDU format	Y	Y
2.2.5.2.5.2	IP classification rules	Y	Y
2.2.5.3	Generic Packet Convergence Sublayer (GPCS)	NA	NA
2.2.6	MAC common part sub-layer	NR	NR
2.2.6.1	Point to multipoint (PMP) operation overview	I	I
2.2.6.2	Reserved	NR	NR
2.2.6.3	Data and Control Plane	NR	NR
2.2.6.3.1	Addressing and connections	NR	NR
2.2.6.3.1.1	Point-to-multipoint (PMP)	Y	Y

Section	Description	MS Requirement	BS Requirement
2.2.6.3.2	MAC PDU formats	Y	Y
2.2.6.3.2.1	MAC header formats	Y	Y
2.2.6.3.2.1.1	Generic MAC header	Y	Y
2.2.6.3.2.1.2	MAC header without payload	I	I
2.2.6.3.2.1.2.1	MAC signaling header type I	Y	Y
2.2.6.3.2.1.2.1.1	Bandwidth request (BR) header	Y	Y
2.2.6.3.2.1.2.1.2	Bandwidth request and UL Tx power report header	Y	Y
2.2.6.3.2.1.2.1.3	BR and CINR report header	NA	NA
2.2.6.3.2.1.2.1.4	CQICH allocation request header	NA	NA
2.2.6.3.2.1.2.1.5	PHY channel report header	NA	NA
2.2.6.3.2.1.2.1.6	BR and UL sleep control header	NA	NA
2.2.6.3.2.1.2.1.7	SN report header	NA	NA
2.2.6.3.2.1.2.2	MAC signaling header type II	NA	NA
2.2.6.3.2.1.2.2.1	Feedback header	NA	NA
2.2.6.3.2.1.2.2.2	MIMO channel feedback header	NA	NA
2.2.6.3.2.2	MAC subheaders and special payloads	I	I
2.2.6.3.2.2.1	Fragmentation subheader (FSH)	Y	Y
2.2.6.3.2.2.2	Grant management subheader (GMSH)	Y	Y
2.2.6.3.2.2.3	Packing subheader (PSH)	Y	Y
2.2.6.3.2.2.4	ARQ/Feedback	NA	NA
2.2.6.3.2.2.5	Reserved	NA	NA
2.2.6.3.2.2.6	Fast-feedback allocation subheader (FFSH)	NA	NA

Section	Description	MS Requirement	BS Requirement
2.2.6.3.2.2.7	Extended subheader format	NA	NA
2.2.6.3.2.2.7.1	SDU SN extended subheader	NA	NA
2.2.6.3.2.2.7.2	DL sleep control extended subheader	NA	NA
2.2.6.3.2.2.7.3	Feedback request extended subheader	NA	NA
2.2.6.3.2.2.7.4	MIMO mode feedback extended subheader	NA	NA
2.2.6.3.2.2.7.5	UL Tx power report extended subheader	NA	NA
2.2.6.3.2.2.7.6	Mini-feedback extended subheader	NA	NA
2.2.6.3.2.2.7.7	SN request extended subheader	NA	NA
2.2.6.3.2.2.7.8	PDU SN extended subheader	NA	NA
2.2.6.3.2.2.7.9	ertPS resumption bitmap extended subheader	NA	NA
2.2.6.3.2.2.7.10	Persistent Allocation Error Event	NA	NA
2.2.6.3.2.3	MAC management messages	Y	Y
2.2.6.3.2.3.1	DCD (DL channel descriptor) message	Y	Y
2.2.6.3.2.3.2	DL-MAP (Downlink map) message	Y	Y
2.2.6.3.2.3.3	UCD (UL channel descriptor) message	Y	Y
2.2.6.3.2.3.4	UL-MAP (UL map) message	Y	Y
2.2.6.3.2.3.5	RNG-REQ (ranging request) message	Y	Y
2.2.6.3.2.3.6	RNG-RSP (ranging response) message	Y	Y
2.2.6.3.2.3.7	REG-REQ (registration request) message	Y	Y
2.2.6.3.2.3.8	REG-RSP (registration response) message	Y	Y
2.2.6.3.2.3.9	Privacy key management (PKM) messages (PKM-REQ/PKM-RSP)	Y	Y
2.2.6.3.2.3.10	DSA-REQ message	Y	Y

Section	Description	MS Requirement	BS Requirement
2.2.6.3.2.3.10.1	MS-Initiated DSA	NA	NA
2.2.6.3.2.3.10.2	BS-Initiated DSA	Y	Y
2.2.6.3.2.3.11	DSA-RSP message	Y	Y
2.2.6.3.2.3.11.1	MS-Initiated DSA	NA	NA
2.2.6.3.2.3.11.2	BS-Initiated DSA	Y	Y
2.2.6.3.2.3.12	DSA-ACK message	Y	Y
2.2.6.3.2.3.13	DSC-REQ (DSC request) message	Y	Y
2.2.6.3.2.3.14	DSC-RSP (DSC response) message	Y	Y
2.2.6.3.2.3.15	DSC-ACK (DSC acknowledge) message	Y	Y
2.2.6.3.2.3.16	DSD-REQ message	Y	Y
2.2.6.3.2.3.17	DSD-RSP message	Y	Y
2.2.6.3.2.3.18	MCA-REQ (multicast polling assignment request) message	NA	NA
2.2.6.3.2.3.19	MCA-RSP (multicast polling assignment response) message	NA	NA
2.2.6.3.2.3.20	DBPC-REQ (DL burst profile change request) message	NA	NA
2.2.6.3.2.3.21	DBPC-RSP (DL burst profile change response) message	NA	NA
2.2.6.3.2.3.22	RES-CMD (reset command) message	NA	NA
2.2.6.3.2.3.23	SBC-REQ (SS basic capability request) message	Y	Y
2.2.6.3.2.3.24	SBC-RSP (SS basic capability response) message	Y	Y
2.2.6.3.2.3.25	CLK-CMP (clock comparison) message	NA	NA

Section	Description	MS Requirement	BS Requirement
2.2.6.3.2.3.26	**DREG-CMD (de/reregister command) message**	**Y**	**Y**
2.2.6.3.2.3.27	**DSX-RVD (DSx received) message**	**NA**	**NA**
2.2.6.3.2.3.28	**TFTP-CPLT (Config File TFTP complete) message**	**NA**	**NA**
2.2.6.3.2.3.29	**TFTP-RSP (Config File TFTP complete response) message**	**NA**	**NA**
2.2.6.3.2.3.30	**ARQ-Feedback message**	**Y**	**Y**
2.2.6.3.2.3.31	**ARQ-Discard message**	**Y**	**Y**
2.2.6.3.2.3.32	**ARQ-Reset message**	**Y**	**Y**
2.2.6.3.2.3.33	**Channel Measurement REP-REQ/RSP (report request/response)**	**Y**	**Y**
2.2.6.3.2.3.34	**FPC (fast power control) message**	**NA**	**NA**
2.2.6.3.2.3.35	**AAS-FBCK-REQ/RSP (AAS channel feedback request/response) messages**	**NA**	**NA**
2.2.6.3.2.3.36	**AAS_Beam_Select message**	**NA**	**NA**
2.2.6.3.2.3.37	**DREG-REQ (SS deregistration request) message**	**Y**	**Y**
2.2.6.3.2.3.38	**HARQ MAP message**	**NA**	**NA**
2.2.6.3.2.3.39	**MOB_SLP-REQ (sleep request) message**	**NA**	**NA**
2.2.6.3.2.3.40	**MOB_SLP-RSP (sleep response) message**	**NA**	**NA**
2.2.6.3.2.3.41	**MOB_TRF-IND (traffic indication) message**	**NA**	**NA**
2.2.6.3.2.3.42	**MOB_NBR-ADV (neighbor advertisement) message**	**Y**	**Y**
2.2.6.3.2.3.43	**MOB_SCN-REQ (scanning interval allocation request) message**	**Y**	**Y**

Section	Description	MS Requirement	BS Requirement
2.2.6.3.2.3.44	MOB_SCN-RSP (scanning interval allocation response) message	Y	Y
2.2.6.3.2.3.45	MOB_SCN-REP (scanning result report) message	Y	Y
2.2.6.3.2.3.46	MOB_ASC-REP (association result report) message	NA	NA
2.2.6.3.2.3.47	MOB_BSHO-REQ (BS HO request) message	NA	NA
2.2.6.3.2.3.48	MOB_MSHO-REQ (MS HO request) message	Y	Y
2.2.6.3.2.3.49	MOB_BSHO-RSP (BS HO response) message	Y	Y
2.2.6.3.2.3.50	MOB_HO-IND (HO indication) message	Y	Y
2.2.6.3.2.3.51	MOB_PAG-ADV (BS broadcast paging) message	NA	NA
2.2.6.3.2.3.52	MBS_MAP (multicast and broadcast service map) message	NA	NA
2.2.6.3.2.3.53	PMC_REQ (power control mode change request) message	Y	Y
2.2.6.3.2.3.54	PMC_RSP (power control mode change response) message	Y	Y
2.2.6.3.2.3.55	OFDMA SUB-DL-UL-MAP message	NA	NA
2.2.6.3.2.3.56	MIMO precoding setup/tear-down messages	NA	NA
2.2.6.3.2.3.57	MIH Payload Transfer (MOB_MIH-MSG) message	NA	NA
2.2.6.3.2.3.58	Service Identity Information (SII-ADV) message	Y	Y
2.2.6.3.2.3.59	Location Based Services (LBS-ADV) message	NA	NA

Section	Description	MS Requirement	BS Requirement
2.2.6.3.3	Construction and transmission of MAC PDUs	I	I
2.2.6.3.3.1	Conventions	Y	Y
2.2.6.3.3.2	Concatenation	Y	Y
2.2.6.3.3.3	Fragmentation	Y	Y
2.2.6.3.3.3.1	Non-ARQ connections	Y	Y
2.2.6.3.3.3.2	ARQ-enabled connections	Y	Y
2.2.6.3.3.4	Packing	I	I
2.2.6.3.3.4.1	Packing for non-ARQ connections	I	I
2.2.6.3.3.4.1.1	Packing fixed-length MAC SDUs	NA	NA
2.2.6.3.3.4.1.2	Packing variable-length MAC SDUs	Y	Y
2.2.6.3.3.4.2	Packing for ARQ-enabled connections	Y	Y
2.2.6.3.3.4.3	Packing ARQ Feedback IEs	Y	Y
2.2.6.3.3.5	CRC calculation	I	I
2.2.6.3.3.5.1	CRC32 calculation for SC and OFDM mode	NA	NA
2.2.6.3.3.5.2	CRC32 calculation for OFDMA mode	Y	Y
2.2.6.3.3.5.2.1	CRC32 test vectors for OFDMA mode	I	I
2.2.6.3.3.6	Encryption of MAC PDUs	Y	Y
2.2.6.3.3.7	Padding	Y	Y
2.2.6.3.4	ARQ mechanisms	I	I
2.2.6.3.4.1	ARQ block usage	Y	Y
2.2.6.3.4.2	ARQ Feedback IE format	Y	Y

Section	Description	MS Requirement	BS Requirement
2.2.6.3.4.2.1	ARQ Feedback IE format with extended capability	NA	NA
2.2.6.3.4.3	ARQ parameters	NR	NR
2.2.6.3.4.3.1	ARQ_BSN_MODULUS	Y	Y
2.2.6.3.4.3.2	ARQ_WINDOW_SIZE	Y	Y
2.2.6.3.4.3.3	ARQ_BLOCK_LIFETIME	Y	Y
2.2.6.3.4.3.4	ARQ_RETRY_TIMEOUT	Y	Y
2.2.6.3.4.3.5	ARQ_SYNC_LOSS_TIMEOUT	Y	Y
2.2.6.3.4.3.6	ARQ_RX_PURGE_TIMEOUT	Y	Y
2.2.6.3.4.3.7	ARQ_BLOCK_SIZE	Y	Y
2.2.6.3.4.4	ARQ procedures	NR	NR
2.2.6.3.4.4.1	ARQ state machine variables	Y	Y
2.2.6.3.4.4.1.1	Transmitter variables	Y	Y
2.2.6.3.4.4.1.2	Receiver variables	Y	Y
2.2.6.3.4.5	ARQ-enabled connection setup and negotiation	Y	Y
2.2.6.3.4.6	ARQ operation	NR	NR
2.2.6.3.4.6.1	Sequence number comparison	Y	Y
2.2.6.3.4.6.2	Transmitter state machine	Y	Y
2.2.6.3.4.6.3	Receiver state machine	Y	Y
2.2.6.3.5	Scheduling services	I	I
2.2.6.3.5.1	Outbound transmission scheduling	I	I
2.2.6.3.5.2	UL request/grant scheduling	I	I
2.2.6.3.5.2.1	Unsolicited grant service (UGS)	Y	Y

Section	Description	MS Requirement	BS Requirement
2.2.6.3.5.2.2	Real-time polling service (rtPS)	Y	Y
2.2.6.3.5.2.2.1	Extended rtPS	Y	Y
2.2.6.3.5.2.3	Non-real-time polling service (nrtPS)	Y	Y
2.2.6.3.5.2.4	Best effort (BE) service	Y	Y
2.2.6.3.6	Bandwidth allocation and request mechanisms	I	I
2.2.6.3.6.1	Requests	Y	Y
2.2.6.3.6.2	Grants	Y	Y
2.2.6.3.6.3	Polling	Y	Y
2.2.6.3.6.3.1	Unicast polling	Y	Y
2.2.6.3.6.3.2	Multicast and broadcast polling	NA	NA
2.2.6.3.6.3.3	PM bit	Y	Y
2.2.6.3.6.4	Contention-based focused BRs for WirelessMAN-OFDM	NA	NA
2.2.6.3.6.5	Contention-based CDMA BRs for WirelessMAN-OFDMA	Y	Y
2.2.6.3.7	MAC support of PHY	I	I
2.2.6.3.7.1	Frequency division duplexing (FDD)	NA	NA
2.2.6.3.7.2	Time division duplexing (TDD)	Y	Y
2.2.6.3.7.3	DL-MAP message	I	I
2.2.6.3.7.4	UL-MAP message	I	I
2.2.6.3.7.4.1	UL timing	I	I
2.2.6.3.7.4.2	UL allocations	I	I
2.2.6.3.7.4.3	UL interval definition	I	I

Section	Description	MS Requirement	BS Requirement
2.2.6.3.7.4.3.1	Request IE	NA	NA
2.2.6.3.7.4.3.2	Initial ranging IE	NA	NA
2.2.6.3.7.4.3.3	Data Grant Burst Type IEs	NA	NA
2.2.6.3.7.4.3.4	End of Map IE	NA	NA
2.2.6.3.7.4.3.5	Gap IE	NA	NA
2.2.6.3.7.5	Map relevance and synchronization	I	I
2.2.6.3.7.5.1	WirelessMAN-SC PHY	NA	NA
2.2.6.3.7.5.2	WirelessMAN-OFDM PHY	NA	NA
2.2.6.3.7.5.3	WirelessMAN-OFDMA PHY	Y	Y
2.2.6.3.7.6	Optional MAC AAS support of OFDM and OFDMA	NR	NR
2.2.6.3.7.6.1	AAS MAC services	NA	NA
2.2.6.3.7.6.2	MAC control functions	NA	NA
2.2.6.3.7.6.3	AAS DL synchronization	NA	NA
2.2.6.3.7.6.4	Alerting the BS about presence of a new SS in an AAS system	NA	NA
2.2.6.3.7.6.5	FDD/TDD support	NA	NA
2.2.6.3.7.6.6	Requesting bandwidth	NA	NA
2.2.6.3.8	Contention resolution	Y	Y
2.2.6.3.8.1	Transmission opportunities	Y	Y
2.2.6.3.9	Network entry and initialization	Y	Y
2.2.6.3.9.1	Scanning and synchronization to the DL	Y	Y
2.2.6.3.9.2	Obtain DL parameters	Y	Y
2.2.6.3.9.3	Obtain UL parameters	Y	Y

Section	Description	MS Requirement	BS Requirement
2.2.6.3.9.4	Message flows during scanning and UL parameter acquisition	I	I
2.2.6.3.9.5	Initial ranging and automatic adjustments	Y	Y
2.2.6.3.9.5.1	Contention-based initial ranging and automatic adjustments	Y	Y
2.2.6.3.9.6	Ranging parameter adjustment	Y	Y
2.2.6.3.9.7	Negotiate basic capabilities	Y	Y
2.2.6.3.9.8	SS authorization and key exchange	Y	Y
2.2.6.3.9.9	Registration	Y	Y
2.2.6.3.9.9.1	IP version negotiation	Y	Y
2.2.6.3.9.10	Establishing IP connectivity	Y	Y
2.2.6.3.9.11	Establishing time of day	NA	NA
2.2.6.3.9.12	Transferring operational parameters	Y	Y
2.2.6.3.9.13	Establishing provisioned connections	Y	Y
2.2.6.3.9.14	Forcing MSs to perform network entry at once	NA	NA
2.2.6.3.10	Ranging	I	I
2.2.6.3.10.1	DL burst profile management	NA	NA
2.2.6.3.10.2	UL periodic ranging	NA	NA
2.2.6.3.10.3	OFDMA-based ranging	Y	Y
2.2.6.3.10.3.1	Contention-based initial ranging and automatic adjustments	Y	Y
2.2.6.3.10.3.2	Periodic ranging and automatic adjustments	Y	Y
2.2.6.3.10.4	CDMA HO ranging and automatic adjustment	Y	Y

Section	Description	MS Requirement	BS Requirement
2.2.6.3.10.4.1	Dedicated ranging and automatic adjustments	NA	NA
2.2.6.3.11	Update of channel descriptors	Y	Y
2.2.6.3.12	Assigning SSs to multicast groups	NA	NA
2.2.6.3.13	Establishment of multicast connections	NA	NA
2.2.6.3.14	Quality of Service	I	I
2.2.6.3.14.1	Theory of operation	I	I
2.2.6.3.14.2	Service flows	I	I
2.2.6.3.14.3	Object models	I	I
2.2.6.3.14.4	Service classes	I	I
2.2.6.3.14.4.1	Global service classes	I	I
2.2.6.3.14.5	Authorization	I	I
2.2.6.3.14.6	Types of service flows	I	I
2.2.6.3.14.6.1	Provisioned service flows	I	I
2.2.6.3.14.6.2	Admitted service flows	I	I
2.2.6.3.14.6.3	Active service flows	I	I
2.2.6.3.14.7	Service flow creation	I	I
2.2.6.3.14.7.1	Dynamic service flow creation	NR	NR
2.2.6.3.14.7.1.1	Dynamic service flow creation – SS-initiated	NA	NA
2.2.6.3.14.7.1.2	Dynamic service flow creation – BS-initiated	Y	Y
2.2.6.3.14.8	Dynamic service flow modification and deletion	I	I
2.2.6.3.14.9	Service flow management	NR	NR
2.2.6.3.14.9.1	Overview	I	I

Section	Description	MS Requirement	BS Requirement
2.2.6.3.14.9.2	Dynamic service flow state transitions	I	I
2.2.6.3.14.9.3	Dynamic service addition (DSA)	NR	NR
2.2.6.3.14.9.3.1	SS-initiated DSA	NA	NA
2.2.6.3.14.9.3.2	BS-initiated DSA	Y	Y
2.2.6.3.14.9.3.3	DSA state transition diagrams	I	I
2.2.6.3.14.9.4	Dynamic service change (DSC)	I	I
2.2.6.3.14.9.4.1	SS-initiated DSC	NA	NA
2.2.6.3.14.9.4.2	BS-initiated DSC	Y	Y
2.2.6.3.14.9.4.3	DSC state transition diagrams	I	I
2.2.6.3.14.9.5	Connection release	I	I
2.2.6.3.14.9.5.1	SS-initiated DSD	NA	NA
2.2.6.3.14.9.5.2	BS-initiated DSD	Y	Y
2.2.6.3.14.9.5.3	DSD state transition diagrams	I	I
2.2.6.3.15	Procedures for shared frequency band usage	NA	NA
2.2.6.3.16	MAC support for HARQ	Y	Y
2.2.6.3.16.1	Subpacket generation	Y	Y
2.2.6.3.16.2	DL/UL ACK/NAK signaling	Y	Y
2.2.6.3.16.3	HARQ parameter signaling	Y	Y
2.2.6.3.17	DL CINR report operation	Y	Y
2.2.6.3.17.1	DL CINR report with REP-RSP MAC message	Y	Y
2.2.6.3.17.2	Periodic CINR report with fast-feedback (CQICH) channel	Y	Y

Section	Description	MS Requirement	BS Requirement
2.2.6.3.17.2.1	Conditions of transition triggering	NA	NA
2.2.6.3.18	Optional band AMC operations using 6-bit CQICH encoding	NA	NA
2.2.6.3.19	Data delivery services for mobile network	I	I
2.2.6.3.19.1	Types of data delivery services	I	I
2.2.6.3.19.1.1	Unsolicited grant service (UGS)	Y	Y
2.2.6.3.19.1.2	Real-time variable-rate (RT-VR) service	Y	Y
2.2.6.3.19.1.3	Non-real time variable-rate (NRT-VR) service	Y	Y
2.2.6.3.19.1.4	Best effort (BE) service	Y	Y
2.2.6.3.19.1.5	Extended real-time variable-rate (ERT-VR) service	Y	Y
2.2.6.3.20	Sleep mode for mobility-supporting MS	NA	NA
2.2.6.3.21	MAC HO procedures	I	I
2.2.6.3.21.1	Network topology acquisition	I	I
2.2.6.3.21.1.1	Network topology advertisement	Y	Y
2.2.6.3.21.1.2	MS scanning of neighbor BSs	Y	Y
2.2.6.3.21.1.3	Association procedure	NA	NA
2.2.6.3.21.2	HO process	Y	Y
2.2.6.3.21.2.1	Cell reselection	Y	Y
2.2.6.3.21.2.2	HO decision and initiation	Y	Y
2.2.6.3.21.2.3	HO cancellation	Y	Y
2.2.6.3.21.2.4	Fast ranging	Y	Y
2.2.6.3.21.2.5	Termination with the serving BS	Y	Y

Section	Description	MS Requirement	BS Requirement
2.2.6.3.21.2.6	Drops during HO	Y	Y
2.2.6.3.21.2.7	Network entry/reentry	Y	Y
2.2.6.3.21.2.8	MS-assisted coordination of DL transmission at target BS for HO	NA	NA
2.2.6.3.21.2.8.1	Context management during optimized HO	I	I
2.2.6.3.21.2.8.1.1	BS PHY settings	I	I
2.2.6.3.21.2.8.1.2	BS Channel descriptor settings	I	I
2.2.6.3.21.2.8.1.3	Ranging settings	I	I
2.2.6.3.21.2.8.1.4	Basic capabilities settings	I	I
2.2.6.3.21.2.8.1.5	Registration settings	I	I
2.2.6.3.21.2.8.1.6	Service flows settings	I	I
2.2.6.3.21.2.8.1.7	Scanning-dynamic and static context	I	I
2.2.6.3.21.2.9	HO process	Y	Y
2.2.6.3.21.2.10	HO optimization rules and scenarios	I	I
2.2.6.3.21.2.11	Seamless HO	NA	NA
2.2.6.3.21.3	Macro diversity handover (MDHO) and fast BS switching	NA	NA
2.2.6.3.21.3.1	MDHO decision and initiation	NA	NA
2.2.6.3.21.3.2	FBSS decision and initiation	NA	NA
2.2.6.3.21.3.3	Diversity set update for MDHO/FBSS	NA	NA
2.2.6.3.21.3.4	Anchor BS update for MDHO/FBSS	NA	NA
2.2.6.3.21.3.5	MS-assisted coordination of DL transmission at new anchor BS	NA	NA
2.2.6.3.22	Multicast and broadcast service (MBS)	NA	NA

Section	Description	MS Requirement	BS Requirement
2.2.6.3.22.1	Establishment and maintenance of MBSs	NA	NA
2.2.6.3.22.1.1	Inter-MBS Zone transition	NA	NA
2.2.6.3.22.2	Performance enhancement with macro diversity	NA	NA
2.2.6.3.22.3	Power saving operation	NA	NA
2.2.6.3.22.4	Multicast and broadcast zone (MBS_Zone)	NA	NA
2.2.6.3.23	MS idle mode (optional)	NA	NA
2.2.6.3.23.1	MS idle mode initiation	NA	NA
2.2.6.3.23.2	Cell selection	NA	NA
2.2.6.3.23.3	MS Broadcast Paging message time synchronization	NA	NA
2.2.6.3.23.4	MS paging unavailable interval	NA	NA
2.2.6.3.23.5	MS paging listening interval	NA	NA
2.2.6.3.23.6	BS Broadcast Paging message	NA	NA
2.2.6.3.23.7	Paging availability mode termination	NA	NA
2.2.6.3.23.7.21	MS side	NA	NA
2.2.6.3.23.7.2	BS side	NA	NA
2.2.6.3.23.8	Location update	NA	NA
2.2.6.3.23.8.1	Location update conditions	NA	NA
2.2.6.3.23.8.2	Location update process	NA	NA
2.2.6.3.23.9	Network reentry from idle mode	NA	NA
2.2.6.3.24	MIHF support	NA	NA
2.2.6.3.25	Location Based Services	NA	NA
2.2.6.3.25.1	Time Difference of Arrival (TDOA)	NA	NA

Section	Description	MS Requirement	BS Requirement
2.2.6.3.26	**Persistent Scheduling**	**NA**	**NA**
2.2.6.3.26.1	**Persistent Region ID**	**NA**	**NA**
2.2.6.3.26.1.1	**Downlink operation**	**NA**	**NA**
2.2.6.3.26.1.2	**Uplink operation**	**NA**	**NA**
2.2.6.3.26.2	**Resource shifting**	**NA**	**NA**
2.2.6.3.26.3	**HARQ retransmission**	**NA**	**NA**
2.2.6.3.26.4	**Error handling procedures**	**NA**	**NA**
2.2.6.3.26.4.1	**Maximum Number of Persistent Allocations**	**NA**	**NA**
2.2.6.3.26.4.2	**MAP ACK channel**	**NA**	**NA**
2.2.6.3.26.4.3	**MAP NACK channel**	**NA**	**NA**
2.2.6.3.26.4.4	**Error Correction Information**	**NA**	**NA**
2.2.6.3.26.4.5	**Change indicator**	**NA**	**NA**
2.2.6.3.26.4.6	**Retransmission flag**	**NA**	**NA**
2.2.6.3.26.4.7	**Error recovery**	**NA**	**NA**
2.2.6.3.27	**Emergency Service**	**NA**	**NA**
2.2.7	**Security sublayer**	**I**	**I**
2.2.7.1	**Architecture**	**I**	**I**
2.2.7.1.1	**Secure encapsulation of MAC PDUs**	**Y**	**Y**
2.2.7.1.2	**Key Management Protocol**	**Y**	**Y**
2.2.7.1.3	**Authentication Protocol**	**I**	**I**
2.2.7.1.3.1	**PKM RSA Authentication**	**NA**	**NA**
2.2.7.1.3.2	**PKM EAP Authentication**	**Y**	**Y**
2.2.7.1.4	**Mapping of connections to SAs**	**Y**	**Y**

Section	Description	MS Requirement	BS Requirement
2.2.7.1.5	Cryptographic suite	Y	Y
2.2.7.2	PKM protocol	I	I
2.2.7.2.1	PKM Version1	NA	NA
2.2.7.2.1.1	Security Associations	NA	NA
2.2.7.2.1.2	SS authorization and AK exchange overview	NA	NA
2.2.7.2.1.2.1	Authorization via RSA protocol	NA	NA
2.2.7.2.1.3	TEK exchange overview	NA	NA
2.2.7.2.1.3.1	TEK exchange overview for PMP topology	NA	NA
2.2.7.2.1.4	Security Capability Selection	NA	NA
2.2.7.2.1.5	Authorization State Machine	NA	NA
2.2.7.2.1.5.1	States	NA	NA
2.2.7.2.1.5.2	Messages	NA	NA
2.2.7.2.1.5.3	Events	NA	NA
2.2.7.2.1.5.4	Parameters	NA	NA
2.2.7.2.1.5.5	Action	NA	NA
2.2.7.2.1.6	TEK State Machine	NA	NA
2.2.7.2.1.6.1	States	NA	NA
2.2.7.2.1.6.2	Messages	NA	NA
2.2.7.2.1.6.3	Events	NA	NA
2.2.7.2.1.6.4	Parameters	NA	NA
2.2.7.2.1.6.5	Action	NA	NA
2.2.7.2.2	PKM Version 2	I	I

Section	Description	MS Requirement	BS Requirement
2.2.7.2.2.1	TEK exchange overview for PMP topology	Y	Y
2.2.7.2.2.2	Key Derivation	I	I
2.2.7.2.2.2.1	RSA Based Authorization	NA	NA
2.2.7.2.2.2.2	EAP Authentication	Y	Y
2.2.7.2.2.2.3	AK derivation	Y	Y
2.2.7.2.2.2.4	KEK derivation	Y	Y
2.2.7.2.2.2.5	Group Key Encryption Key (GKEK)	NA	NA
2.2.7.2.2.2.6	Traffic Encryption Key(TEK)	Y	Y
2.2.7.2.2.2.6.1	Counter-based TEK Generation for HO	NA	NA
2.2.7.2.2.2.7	Group Traffic Encryption Key (GTEK)	NA	NA
2.2.7.2.2.2.8	MBS Traffic Encryption Key (MTK)	NA	NA
2.2.7.2.2.2.9	Message authentication keys (HMAC/CMAC) and KEK derivation	I	I
2.2.7.2.2.2.9.1	CMAC_KEY_COUNT_ management	Y	Y
2.2.7.2.2.2.9.1.1	Maintenance of CMAC_KEY_COUNTM by the MS	Y	NA
2.2.7.2.2.2.9.1.2	Processing of CMAC_KEY_COUNTB by the BS	Y	NA
2.2.7.2.2.2.9.1.2	Processing of CMAC_KEY_COUNTB by the BS	NA	Y
2.2.7.2.2.2.9.2	Derivation of message authentication codes	Y	Y
2.2.7.2.2.2.10	Key Hierarchy	I	I
2.2.7.2.2.2.11	Maintenance of PMK and AK	Y	Y
2.2.7.2.2.2.12	PKMv2 PMK and AK switching methods	Y	Y
2.2.7.2.2.3	Associations	I	I

Section	Description	MS Requirement	BS Requirement
2.2.7.2.2.3.1	Security associations (SAs)	Y	Y
2.2.7.2.2.3.2	Group security associations (GSAs)	NA	NA
2.2.7.2.2.3.3	Multicast and broadcast service group security associations (MBSGSAs)	NA	NA
2.2.7.2.2.4	Security context	I	I
2.2.7.2.2.4.1	AK context	Y	Y
2.2.7.2.2.4.2	GKEK context	NA	NA
2.2.7.2.2.4.3	PMK context	Y	Y
2.2.7.2.2.4.4	PAK context	NA	NA
2.2.7.2.2.5	Authentication state machine	Y	Y
2.2.7.2.2.5.1	States	I	I
2.2.7.2.2.5.2	Messages	Y	Y
2.2.7.2.2.5.3	Events	I	I
2.2.7.2.2.5.4	Parameters	I	I
2.2.7.2.2.5.5	Actions	Y	Y
2.2.7.2.2.6	TEK state machine	Y	Y
2.2.7.2.2.6.1	States	I	I
2.2.7.2.2.6.2	Messages	Y	Y
2.2.7.2.2.6.3	Events	I	I
2.2.7.2.2.6.4	Parameters	I	I
2.2.7.2.2.6.5	Actions	Y	Y
2.2.7.3	Dynamic SA creation and mapping	NA	NA
2.2.7.3.1	Dynamic SA creation	NA	NA

Section	Description	MS Requirement	BS Requirement
2.2.7.3.2	Dynamic SA mapping	NA	NA
2.2.7.4	Key usage	NR	NR
2.2.7.4.1	BS key usage	I	I
2.2.7.4.1.1	AK key lifetime	NA	Y
2.2.7.4.1.2	AK transition period on BS side	NA	Y
2.2.7.4.1.3	BS usage of AK	NA	Y
2.2.7.4.1.4	TEK lifetime	NA	Y
2.2.7.4.1.5	BS usage of TEK	NA	Y
2.2.7.4.2	SS key usage	Y	NA
2.2.7.4.2.1	SS reauthorization	Y	NA
2.2.7.4.2.2	SS usage of AK	Y	NA
2.2.7.4.2.3	SS usage of TEK	Y	NA
2.2.7.5	Cryptographic methods	Y	Y
2.2.7.5.1	Data Encryption methods	I	I
2.2.7.5.1.1	Data encryption with DES in CBC mode	NA	NA
2.2.7.5.1.2	Data encryption with AES in CCM mode	Y	Y
2.2.7.5.1.2.1	PDU payload format	Y	Y
2.2.7.5.1.2.2	Packet number (PN)	Y	Y
2.2.7.5.1.2.3	CCM algorithm	Y	Y
2.2.7.5.1.2.4	Receive processing rules	Y	Y
2.2.7.5.1.2.5	AES-CCM mode example encrypted MAC PDUs	I	I
2.2.7.5.1.3	Data encryption with AES in CTR mode	NA	NA

Section	Description	MS Requirement	BS Requirement
2.2.7.5.1.3.1	Encrypted MBS PDU payload format	NA	NA
2.2.7.5.1.4	Data encryption with AES in CBC mode	NA	NA
2.2.7.5.1.4.1	CBC IV generation	NA	NA
2.2.7.5.2	Encryption of TEK	I	I
2.2.7.5.2.1	Encryption of TEK with 3-DES	NA	NA
2.2.7.5.2.2	Encryption of TEK with RSA	NA	NA
2.2.7.5.2.3	Encryption of TEK-128 with AES	NA	NA
2.2.7.5.2.4	Encryption of TEK-128 with AES key wrap	Y	Y
2.2.7.5.3	Calculation of HMAC-Digests	NA	NA
2.2.7.5.4	Derivation of TEKs, KEKs, and message authentication keys	Y	Y
2.2.7.5.4.1	DES keys	NA	NA
2.2.7.5.4.2	Key encryption keys (KEKs)	Y	Y
2.2.7.5.4.3	HMAC authentication keys	NA	NA
2.2.7.5.4.4	Cipher-based message authentication code (CMAC)	Y	Y
2.2.7.5.4.4.1	Calculation of CMAC value	Y	Y
2.2.7.5.4.5	Derivation of TEKs, KEKs, message authentication keys and GKEKs in PKMv2	NR	NR
2.2.7.5.4.5.1	AES KEKs in PKMv2	Y	Y
2.2.7.5.4.5.2	Encryption of GKEK in PKMv2	NA	NA
2.2.7.5.4.5.2.1	Encryption of GKEK with 3-DES in PKMv2	NA	NA
2.2.7.5.4.5.2.2	Encryption of GKEK with RSA in PKMv2	NA	NA

Section	Description	MS Requirement	BS Requirement
2.2.7.5.4.5.2.3	Encryption of GKEK with ECB mode AES in PKMv2	NA	NA
2.2.7.5.4.5.2.4	Encryption of GKEK with AES key wrap in PKMv2	NA	NA
2.2.7.5.4.6	Key derivation functions for PKMv2	NR	NR
2.2.7.5.4.6.1	Dot16KDF for PKMv2	NA	NA
2.2.7.5.5	Public-key encryption of AK	NA	NA
2.2.7.5.6	Digital signatures	NA	NA
2.2.7.6	Certificate profile	NR	NR
2.2.7.6.1	Certificate format	NA	NA
2.2.7.6.1.1	tbsCertificate.validity.notBefore and tbsCertificate.validity.notAfter	NA	NA
2.2.7.6.1.2	tbsCertificate.SerialNumber	NA	NA
2.2.7.6.1.3	tbsCertificate.signature and Signature Algorithm	NA	NA
2.2.7.6.1.4	tbsCertificate.Issuer and tbsCertificate,subject	NA	NA
2.2.7.6.1.4.1	Manufacturer Certificate	NA	NA
2.2.7.6.1.4.2	SS certificate	NA	NA
2.2.7.6.1.4.3	BS Certificate	NA	NA
2.2.7.6.1.5	tbsCertificate.subjectPublicKeyInfo	NA	NA
2.2.7.6.1.6	tbsCertificate.issuerUniqueIDand tbsCertificate.subjectUniqueID	NA	NA
2.2.7.6.1.7	tbsCertificate.extensions	NR	NR
2.2.7.6.1.7.1	SS certificate	NA	NA
2.2.7.6.1.7.2	Manufacturer certificate	NA	NA

Section	Description	MS Requirement	BS Requirement
2.2.7.6.1.8	Signature Value	NA	NA
2.2.7.6.2	Certificate storage and management in the SS	Y	NA
2.2.7.6.3	Certificate processing and management in the BS	NA	NA
2.2.7.7	Preauthentication	I	I
2.2.7.8	PKMv2	NR	NR
2.2.7.8.1	PKMv2 SA-TEK 3-way handshake	Y	Y
2.2.7.8.2	BS and SS RSA mutual authentication and AK exchange overview	NA	NA
2.2.7.8.3	Multicast and broadcast service (MBS) support	NA	NA
2.2.7.8.3.1	MBS security associations	NA	NA
2.2.7.8.3.2	MBS key management	NA	NA
2.2.7.8.3.2.1	MAK establishment	NA	NA
2.2.7.8.3.2.2	MGTEK establishment	NA	NA
2.2.7.8.3.2.3	MTK establishment	NA	NA
2.2.7.9	Multicast and broadcast rekeying algorithm (MBRA)	NA	NA
2.2.7.9.1	MBRA flow	NA	NA
2.2.7.9.1.1	BS usage of GTEK	NA	NA
2.2.7.9.1.2	SS usage of GTEK	NA	NA
2.2.7.9.2	Messages	NA	NA
2.2.7.9.3	Encryption of GKEK	NA	NA
2.2.7.9.4	Message authentication keys for the Key Update Command message	NA	NA

Section	Description	MS Requirement	BS Requirement
2.2.8	Physical layer	NR	NR
2.2.8.1	Wireless MAN-SC PHY specification	NA	NA
2.2.8.2	Reserved	NA	NA
2.2.8.3	WirelessMAN-OFDM PHY	NA	NA
2.2.8.4	WirelessMAN-OFDMA PHY	NR	NR
2.2.8.4.1	Introduction	I	I
2.2.8.4.2	OFDMA symbol description, symbol parameters and transmitted signal	NR	NR
2.2.8.4.2.1	Time domain description	Y	Y
2.2.8.4.2.2	Frequency domain description	I	I
2.2.8.4.2.3	Primitive parameters	Y	Y
2.2.8.4.2.4	Derived parameters	Y	Y
2.2.8.4.2.5	Transmitted signal	Y	Y
2.2.8.4.3	OFDMA basic terms definition	NR	NR
2.2.8.4.3.1	Slot and data region	Y	Y
2.2.8.4.3.2	Segment	Y	Y
2.2.8.4.3.3	Permutation zone	Y	Y
2.2.8.4.3.4	OFDMA data mapping	Y	Y
2.2.8.4.4	Frame structure	I	I
2.2.8.4.4.1	TDD frame structure	Y	Y
2.2.8.4.4.2	FDD Frame Structure	NA	NA
2.2.8.4.4.3	OFDMA Frame Parameters and Operations	Y	Y
2.2.8.4.4.4	DL frame prefix	Y	Y

Section	Description	MS Requirement	BS Requirement
2.2.8.4.4.5	Allocation of subchannels for FCH and DL-MAP and logical subchannel numbering	Y	Y
2.2.8.4.4.6	UL transmission allocations	Y	Y
2.2.8.4.4.7	Optional AAS Support	NA	NA
2.2.8.4.5	Map message fields and IEs	NR	NR
2.2.8.4.5.1	DL-MAP PHY Synchronizati on field	Y	Y
2.2.8.4.5.2	Frame duration codes	Y	Y
2.2.8.4.5.3	DL-MAP IE format	Y	Y
2.2.8.4.5.3.1	DIUC allocation	Y	Y
2.2.8.4.5.3.2	DL-MAP Extended IE format	Y	Y
2.2.8.4.5.3.2.1	DL-MAP Extended IE encoding format	Y	Y
2.2.8.4.5.3.2.2	DL-MAP Extended-2 IE encoding format	Y	Y
2.2.8.4.5.3.2.3	DL-MAP Extended-3 IE encoding format	NA	NA
2.2.8.4.5.3.3	AAS DL IE format	NA	NA
2.2.8.4.5.3.4	STC DL Zone IE format	IO-MIMO	IO-MIMO
2.2.8.4.5.3.5	Channel Measurement IE	NA	NA
2.2.8.4.5.3.6	Data Location In Another BS IE	NA	NA
2.2.8.4.5.3.7	CID Switch IE	Y	Y
2.2.8.4.5.3.8	MIMO DL Basic IE format	IO-MIMO	IO-MIMO
2.2.8.4.5.3.9	MIMO DL Enhanced IE	NA	NA
2.2.8.4.5.3.10	HARQ and Sub-MAP Pointer IE	NA	NA
2.2.8.4.5.3.11	DL-MAP Physical Modifier IE	NA	NA
2.2.8.4.5.3.12	MBS MAP IE	NA	NA

Section	Description	MS Requirement	BS Requirement
2.2.8.4.5.3.13	DL PUSC Burst Allocation in Other Segment IE	NA	NA
2.2.8.4.5.3.14	HO Anchor Active DL MAP	NA	NA
2.2.8.4.5.3.15	HO Active Anchor DL MAP	NA	NA
2.2.8.4.5.3.16	HO CID Translation MAP IE	NA	NA
2.2.8.4.5.3.17	MIMO in Another BS IE	NA	NA
2.2.8.4.5.3.18	Macro-MIMO DL Basic IE	NA	NA
2.2.8.4.5.3.19	UL Noise and Interference Level IE format	Y	Y
2.2.8.4.5.3.20	Dedicated DL Control IE	NA	NA
2.2.8.4.5.3.21	HARQ DL MAP IE	Y	Y
2.2.8.4.5.3.21.1	Dedicated MIMO DL Control IE format	NA	NA
2.2.8.4.5.3.22	DL HARQ ACK IE	NA	NA
2.2.8.4.5.3.23	Enhanced DL MAP IE	NA	NA
2.2.8.4.5.3.24	Closed-loop MIMO DL enhanced IE	NA	NA
2.2.8.4.5.3.25	Broadcast Control Pointer IE	NA	NA
2.2.8.4.5.3.26	AAS SDMA DL IE format	NA	NA
2.2.8.4.5.3.27	PUSC ASCA Allocation IE	NA	NA
2.2.8.4.5.3.28	H-FDD Group Switch IE	NA	NA
2.2.8.4.5.3.29	Persistent HARQ DL MAP Allocation IE	NA	NA
2.2.8.4.5.3.30	Power Boosting IE	NA	NA
2.2.8.4.5.3.31	Extended Broadcast Control Pointer IE	NA	NA
2.2.8.4.5.4	UL-MAP IE format	Y	Y
2.2.8.4.5.4.1	UIUC allocation	Y	Y

Section	Description	MS Requirement	BS Requirement
2.2.8.4.5.4.2	PAPR Reduction/Safety Zone/Sounding Zone Allocation IE	NA	NA
2.2.8.4.5.4.3	CDMA Allocation UL-MAP IE format	Y	Y
2.2.8.4.5.4.4	UL-MAP Extended IE	NR	NR
2.2.8.4.5.4.4.1	UL-MAP Extended IE	Y	Y
2.2.8.4.5.4.4.2	UL-MAP Extended-2 IE	Y	Y
2.2.8.4.5.4.4.3	UL-MAP Extended-3 IE	NA	NA
2.2.8.4.5.4.5	Power Control IE format	Y	Y
2.2.8.4.5.4.6	AAS UL IE format	NA	NA
2.2.8.4.5.4.7	UL Zone Switch IE	NA	NA
2.2.8.4.5.4.8	Mini-Subchannel Allocation IE	NA	NA
2.2.8.4.5.4.9	Fast-Feedback Allocation IE	NA	NA
2.2.8.4.5.4.10	MIMO UL Basic IE format	NA	NA
2.2.8.4.5.4.11	CQICH Allocation IE Format	Y	Y
2.2.8.4.5.4.12	UL-MAP Physical Modifier IE	NA	NA
2.2.8.4.5.4.13	UL Allocation Start IE	Y	Y
2.2.8.4.5.4.14	CQICH Enhanced Allocation IE	NA	NA
2.2.8.4.5.4.15	UL PUSC Burst Allocation in Other Segment IE	NA	NA
2.2.8.4.5.4.16	HO Anchor Active UL-MAP IE	NA	NA
2.2.8.4.5.4.17	HO Active Anchor UL MAP IE	NA	NA
2.2.8.4.5.4.18	MIMO UL Enhanced IE format	NA	NA
2.2.8.4.5.4.19	OFDMA Fast Ranging IE	Y	Y
2.2.8.4.5.4.20	UL-MAP Fast Tracking IE	NA	NA

Section	Description	MS Requirement	BS Requirement
2.2.8.4.5.4.21	Anchor BS Switch IE	NA	NA
2.2.8.4.5.4.22	HARQ UL-MAP IE	Y	Y
2.2.8.4.5.4.22.1	Dedicated UL Control IE	NA	NA
2.2.8.4.5.4.22.2	Dedicated MIMO UL Control IE format	NA	NA
2.2.8.4.5.4.23	HARQ ACK Region Allocation IE	Y	Y
2.2.8.4.5.4.24	UL Sounding Command IE	NA	NA
2.2.8.4.5.4.25	AAS SDMA UL IE format	NA	NA
2.2.8.4.5.4.26	Feedback Polling IE feedback header not supported	NA	NA
2.2.8.4.5.4.27	Uplink Power Control Bitmap IE	NA	NA
2.2.8.4.5.4.28	Persistent HARQ UL MAP Allocation IE	NA	NA
2.2.8.4.5.4.29	FDD Paired Allocation IE	NA	NA
2.2.8.4.5.5	Burst profile format	Y	Y
2.2.8.4.5.6	Compressed maps	Y	IO-CM
2.2.8.4.5.6.1	Compressed DL-MAP	Y	IO-CM
2.2.8.4.5.6.2	Compressed UL-MAP	Y	IO-CM
2.2.8.4.5.7	AAS-FBCK-REQ/RSP message bodies	NA	NA
2.2.8.4.5.8	Optional reduced AAS private maps	NA	NA
2.2.8.4.5.9	Reduced AAS private maps	NA	NA
2.2.8.4.5.9.1	Reduced AAS private DL-MAP	NA	NA
2.2.8.4.5.9.2	Reduced AAS private UL-MAP	NA	NA
2.2.8.4.6	OFDMA subcarrier allocations	Y	Y
2.2.8.4.6.1	Downlink (DL)	Y	Y

Section	Description	MS Requirement	BS Requirement
2.2.8.4.6.1.1	Preamble	Y	Y
2.2.8.4.6.1.1.1	Common SYNC symbol (optional)	NA	NA
2.2.8.4.6.1.1.2	Common SYNC symbol sequence	NA	NA
2.2.8.4.6.1.2	Symbol structure	NR	NR
2.2.8.4.6.2.1	Symbol Structure for PUSC	Y	Y
2.2.8.4.6.1.2.1.1	DL subchannels subcarrier allocation in PUSC	Y	Y
2.2.8.4.6.1.2.2	Symbol Structure for FUSC	NA	NA
2.2.8.4.6.1.2.3	Additional optional symbol structure for FUSC	NA	NA
2.2.8.4.6.1.2.4	Optional DL tile usage of subchannels – TUSC1	NA	NA
2.2.8.4.6.1.2.5	Optional DL tile usage of subchannels – TUSC2	NA	NA
2.2.8.4.6.1.2.6	TUSC1/TUSC2 Support for SDMA	NA	NA
2.2.8.4.6.2	Uplink (UL)	Y	Y
2.2.8.4.6.2.1	Symbol structure for subchannel (PUSC)	Y	Y
2.2.8.4.6.2.2	Partitioning of subcarriers into subchannels in the UL	Y	Y
2.2.8.4.6.2.3	UL permutation example	I	I
2.2.8.4.6.2.4	Partition a slot to mini-subchannels	NA	NA
2.2.8.4.6.2.5	Additional optional symbol structure for PUSC	NA	NA
2.2.8.4.6.2.6	Data subchannel rotation scheme	NA	NA
2.2.8.4.6.2.67	Optional UL channel sounding in TDD systems	NA	NA

Section	Description	MS Requirement	BS Requirement
2.2.8.4.6.3	Optional adjacent subcarrier permutations for AMC	NA	NA
2.2.8.4.6.4	Optional permutations for PUSC	NA	NA
2.2.8.4.7	OFDMA ranging	Y	Y
2.2.8.4.7.1	Initial ranging and HO ranging transmissions	Y	Y
2.2.8.4.7.2	Periodic ranging and BR transmissions	Y	Y
2.2.8.4.7.3	Ranging codes	Y	Y
2.2.8.4.7.4	Ranging and BR opportunity size	Y	Y
2.2.8.4.8	Space-time coding (STC)	NR	NR
2.2.8.4.8.1	STC using two antennas	I	I
2.2.8.4.8.1.1	Multiple-input, single-output channel estimation and synchronization	IO-MIMO	IO-MIMO
2.2.8.4.8.1.2	STC using two antennas	NR	NR
2.2.8.4.8.1.2.1	STC encoding	IO-MIMO	IO-MIMO
2.2.8.4.8.1.2.1.1	STC using 2 antennas in PUSC	IO-MIMO	IO-MIMO
2.2.8.4.8.1.2.1.2	STC using 2 antennas in FUSC	NA	NA
2.2.8.4.8.1.2.1.3	Data mapping	NA	NA
2.2.8.4.8.1.2.2	STC decoding	IO-MIMO	IO-MIMO
2.2.8.4.8.1.3	Frequency hopping diversity coding (FHDC)	NA	NA
2.2.8.4.8.1.4	STC/FHDC configurations	IO-MIMO	IO-MIMO
2.2.8.4.8.1.5	UL using STC	NA	NA
2.2.8.4.8.1.6	STC of two antennas using directivity through four antennas	NA	NA

Section	Description	MS Requirement	BS Requirement
2.2.8.4.8.2	STC for four antennas	NA	NA
2.2.8.4.8.2.1	STC for four antennas using PUSC	NA	NA
2.2.8.4.8.2.2	STC for four antennas using FUSC	NA	NA
2.2.8.4.8.2.3	STC configurations	NA	NA
2.2.8.4.8.2.4	MIMO MDHO-based macro-diversity transmission	NA	NA
2.2.8.4.8.3	STC for the optional zones in the DL	NA	NA
2.2.8.4.8.3.1	Symbol structure for optional AMC and optional FUSC	NA	NA
2.2.8.4.8.3.2	Symbol structure for the optional PUSC-ASCA	NA	NA
2.2.8.4.8.3.3	Transmission schemes for 2-antenna BS in DL	NA	NA
2.2.8.4.8.3.4	Transmission schemes for 3-antenna BS in DL	NA	NA
2.2.8.4.8.3.5	Transmission schemes for 4-antenna BS	NA	NA
2.2.8.4.8.3.6	MIMO precoding	NA	NA
2.2.8.4.8.4	STC for the optional zones in the UL	NA	NA
2.2.8.4.8.4.1	Allocation of pilot subcarriers	NA	NA
2.2.8.4.8.4.2	Allocation of data subchannels	NA	NA
2.2.8.4.8.4.3	Transmission schemes for 2-antenna MS in UL	NA	NA
2.2.8.4.8.5	MIMO Midamble	NA	NA
2.2.8.4.8.5.1	Midamble sequence	NA	NA
2.2.8.4.8.5.1.1	PAPR reduction sequence for BS with two antennas	NA	NA

Section	Description	MS Requirement	BS Requirement
2.2.8.4.8.5.1.2	**PAPR reduction sequence for BS with three or four antennas**	**NA**	**NA**
2.2.8.4.8.6	**STC subpacket combining**	**NA**	**NA**
2.2.8.4.8.7	**Cyclic delay diversity (CDD)**	**NA**	**NA**
2.2.8.4.9	**Channel coding**	**Y**	**Y**
2.2.8.4.9.1	**Randomization**	**Y**	**Y**
2.2.8.4.9.2	**Encoding**	**Y**	**Y**
2.2.8.4.9.2.1	**Convolutional coding (CC)**	**Y**	**Y**
2.2.8.4.9.2.1.1	**Incremental redundancy HARQ support (optional)**	**NA**	**NA**
2.2.8.4.9.2.2	**Block turbo coding (BTC) (optional)**	**NA**	**NA**
2.2.8.4.9.2.3	**Convolutional turbo codes (CTCs) (optional)**	**Y**	**Y**
2.2.8.4.9.2.3.1	**CTC encoder (Basic functionality)**	**Y**	**Y**
2.2.8.4.9.2.3.2	**CTC interleaver (Basic functionality)**	**Y**	**Y**
2.2.8.4.9.2.3.3	**Determination of CTC circulation states (*Basic Functionality)***	**Y**	**Y**
2.2.8.4.9.2.3.4	**Subpacket generation(Basic functionality and also needed for HARQ)**	**Y**	**Y**
2.2.8.4.9.2.3.4.1	**Bit separation**	**Y**	**Y**
2.2.8.4.9.2.3.4.2	**Subblock interleaving**	**Y**	**Y**
2.2.8.4.9.2.3.4.3	**Bit grouping**	**Y**	**Y**
2.2.8.4.9.2.3.4.4	**Bit selection**	**Y**	**Y**
2.2.8.4.9.2.3.5	**Optional IR HARQ support**	**NA**	**NA**
2.2.8.4.9.2.4	**Zero tailed convolutional coding (optional)**	**NA**	**NA**

Section	Description	MS Requirement	BS Requirement
2.2.8.4.9.2.5	Low density parity check (LDPC) code (optional)	NA	NA
2.2.8.4.9.3	Interleaving	Y	Y
2.2.8.4.9.3.1	Optional interleaver for convolutional coding	NA	NA
2.2.8.4.9.4	Modulation	NR	NR
2.2.8.4.9.4.1	Subcarrier randomization	Y	Y
2.2.8.4.9.4.2	Data modulation	Y	Y
2.2.8.4.9.4.3	Pilot modulation	Y	Y
2.2.8.4.9.4.4	Example of OFDMA UL CC encoding is just an example	I	I
2.2.8.4.9.5	Repetition	Y	Y
2.2.8.4.9.6	Zone boosting	NA	NA
2.2.8.4.9.7	Multiple HARQ (optional)	I	I
2.2.8.4.9.7.1	Generic chase HARQ	Y	Y
2.2.8.4.9.7.2	CC-IR HARQ	NA	NA
2.2.8.4.10	Control mechanisms	NR	NR
2.2.8.4.10.1	Synchronization	NR	NR
2.2.8.4.10.1.1	Network synchronization	NA	Y
2.2.8.4.10.1.2	SS synchronization	Y	NA
2.2.8.4.10.2	Ranging	Y	Y
2.2.8.4.10.3	Power control	Y	Y
2.2.8.4.10.3.1	Closed-loop power control	Y	Y
2.2.8.4.10.3.2	Optional open-loop power control	Y	Y

Section	Description	MS Requirement	BS Requirement
2.2.8.4.11	**Fast-feedback channels**	**Y**	**Y**
2.2.8.4.11.1	**Fast DL measurement feedback – Base off of CCB output**	**IO-MIMO**	**IO-MIMO**
2.2.8.4.11.2	**Fast MIMO feedback**	**NA**	**NA**
2.2.8.4.11.3	**Mode selection feedback**	**NA**	**NA**
2.2.8.4.11.4	**Effective CINR feedback for fast-feedback channel**	**NA**	**NA**
2.2.8.4.11.5	**Enhanced fast-feedback channels**	**NA**	**NA**
2.2.8.4.11.6	**Fast DL measurement feedback for enhanced fast-feedback channel**	**NA**	**NA**
2.2.8.4.11.7	**Fast MIMO feedback of quantized precoding weight for enhanced fast-feedback channel**	**NA**	**NA**
2.2.8.4.11.8	**MIMO mode feedback for enhanced fast-feedback channel**	**NA**	**NA**
2.2.8.4.11.9	**Anchor BS report**	**NA**	**NA**
2.2.8.4.11.10	**UEP fast-feedback**	**NA**	**NA**
2.2.8.4.11.11	**Band AMC differential CINR feedback for enhanced fast-feedback channel**	**NA**	**NA**
2.2.8.4.11.12	**Indication flag feedback**	**NA**	**NA**
2.2.8.4.11.13	**Primary and secondary fast-feedback channels**	**NA**	**NA**
2.2.8.4.11.14	**Extended rtPS BR**	**NA**	**NA**
2.2.8.4.11.15	**MIMO feedback for Tx beamforming**	**NA**	**NA**
2.2.8.4.11.16	**MAP ACK Channel**	**NA**	**NA**
2.2.8.4.11.17	**MAP NACK Channel**	**NA**	**NA**
2.2.8.4.12	**Channel quality measurements**	**NR**	**NR**

Section	Description	MS Requirement	BS Requirement
2.2.8.4.12.1	Introduction	I	I
2.2.8.4.12.2	RSSI mean and standard deviation	Y	NA
2.2.8.4.12.3	CINR mean and standard deviation	Y	NA
2.2.8.4.12.4	Optional frequency selectivity characterization	NA	NA
2.2.8.4.13	Transmitter requirements	NR	NR
2.2.8.4.13.1	Tx power level control	Y	Y
2.2.8.4.13.2	Transmitter spectral flatness	Y	Y
2.2.8.4.13.3	Transmitter constellation error and test method	Y	Y
2.2.8.4.13.3.1	RMS constellation error measurement for BS (DL)	I	I
2.2.8.4.13.3.2	RMS constellation error measurement for SS	I	I
2.2.8.4.13.3.3	Calculation of RMS constellation error	I	I
2.2.8.4.13.3.4	Unmodulated subcarrier errors for SS	I	I
2.2.8.4.13.4	Transmitter reference timing accuracy	Y	Y
2.2.8.4.14	Receiver requirements	I	I
2.2.8.4.14.1	OFDMA PHY requirements for enhanced HO performance	NR	NR
2.2.8.4.14.1.1	Receiver sensitivity	Y	Y
2.2.8.4.14.1.2	MS UL Tx time tracking accuracy	Y	NA
2.2.8.4.14.1.3	MS autonomous neighbor cell scanning	NA	NA
2.2.8.4.14.2	Receiver adjacent and nonadjacent channel rejection	Y	Y
2.2.8.4.14.3	Receiver maximum input signal	NR	NR

Section	Description	MS Requirement	BS Requirement
2.2.8.4.14.3.1	SS receiver maximum input signal	Y	NA
2.2.8.4.14.3.2	BS receiver maximum input signal	NA	Y
2.2.8.4.14.4	Receiver maximum tolerable signal	NR	NR
2.2.8.4.14.4.1	SS receiver maximum tolerable signal	Y	NA
2.2.8.4.14.4.2	BS receiver maximum tolerable signal	NA	Y
2.2.8.4.15	Frequency control requirements	NR	NR
2.2.8.4.15.1	Center frequency and symbol clock frequency tolerance	Y	Y
2.2.8.4.16	Optional HARQ support	I	I
2.2.8.4.16.1.1	HARQ retransmission process	Y	Y
2.2.8.4.16.1.2	CRC	Y	Y
2.2.8.4.16.1.3	Concurrent transmission of UL HARQ bursts	Y	Y
2.2.8.4.16.1.4	Encoding	Y	Y
2.2.8.4.16.2	Optional IR HARQ for convolutional code	NA	NA
2.2.8.4.16.3	UL ACK channel	Y	Y
2.2.9	AeroMACS Transmitter Output power	NR	NR
2.2.9.1	Downlink HPA Output Power Maxima	NA	Y
2.2.9.2	Uplink HPA Output Power Maxima	Y	NA
2.2.10	AeroMACS Transmitter characteristics	NR	NR
2.2.10.1	Transmitter Spurious Emissions	Y	Y
2.2.10.2	AeroMACS Transmitted Spectral Mask	Y	Y
2.2.11	Receiver Spurious Emissions	Y	Y

Section	Description	MS Requirement	BS Requirement
2.2.12	**Transceiver Requirements**	**NR**	**NR**
2.2.12.1	**Doppler Velocity**	**Y**	**Y**
2.2.12.2	**Time Standard**	**Y**	**Y**

Y – Requirement
NA – Not Applicable
NR – No requirement
I - Informative

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APPENDIX C EXAMPLE RECEIVER SENSITIVITY CALCULATION

The sensitivity level is defined as the power level measured at the receiver input when the BER is equal to 1*10^-6.

Table 7 - Receiver Sensitivity is an example result of calculating the AeroMACS minimum receiver assuming CC with white Gaussian noise.

Table 7 - Receiver Sensitivity

Modulation scheme	Rep. Factor DL	Sensitivity DL	Sensitivity UL
64 qam 3/4	**1**	**-74.37 dBm**	**-74.50 dBm**
64 qam 2/3	**1**	**-76.37 dBm**	**-76.50 dBm**
16 qam 3/4	**1**	**-80.37 dBm**	**-80.50 dBm**
16 qam 1/2	**1**	**-83.87 dBm**	**-84.00 dBm**
qpsk 3/4	**1**	**-86.37 dBm**	**-86.50 dBm**
qpsk 1/2	**1**	**-89.50 dBm**	**-89.50 dBm**
qpsk 1/2 with repetition 2	**2**	**-92.37 dBm**	**-92.50 dBm**

AeroMACS minimum receiver sensitivity would be 2 dB lower than indicated in Table 7 - Receiver Sensitivity in case CTC is used.

The receiver sensitivity shall be as defined by the following formula:

$$RSS = -114 + SNR_{Rx} - 10 \times \log_{10}(R) + 10 \times \log_{10}\left(\frac{F_s \times N_{used} \times 10^6}{N_{FFT}}\right) + ImpLoss + NF \qquad (1)$$

Where:

- -114: is the thermal noise power term in dBm, referred to 1 MHz Bandwidth and 300 K temperature
- SNR_{Rx}: is the receiver SNR, it can be defined as the SNR necessary, at the demodulator input, to get the desired BER for the given modulation and coding rate.
- R : is the repetition factor
- Fs: is the sampling frequency in Hz
- NFFT: is the FFT size
- Nused: is the number of subcarrier used (FFT size – Number of guard band subcarriers – DC carrier)
- ImpLoss: is the implementation loss, which includes non-ideal receiver effects such as channel estimation errors, tracking errors, quantization errors, and phase noise. The assumed value is 5 dB.

- NF: is the receiver noise figure, referenced to the antenna port. The assumed value is 8 dB

The SNRrx depends on the modulation and coding scheme selected (a QPSK ½ needs a lower SNR than a 64 QAM ¾ to get the same BER). In case of Convolutional Coding the values defined are:

Table 8 - Receiver SNR Assumptions

Receiver SNR		
Modulation	**Coding rate**	**Receiver SNR (dB)**
QPSK	1/2	5
QPSK	3/4	8
16-QAM	1/2	10.5
16-QAM	3/4	14
64-QAM	1/2	16
64-QAM	2/3	18
64-QAM	3/4	20

The parameters in the PUSC mode are:

- Fs = 5.6 * 10^6
- Nused = 420 for DL and 408 for UL
- ImpLoss= 5
- NF = 8
- NFFT= 512
- SNR_{RX} = according to Table 8 Receiver SNR

Using the above parameters in the formula (1) we get the sensitivity values listed in Table 8 - Receiver SNR Assumptions.