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Comparison between MAC in ETSI and ARIB

This document compares the current status of the MAC specifications in ETSI and ARIB. The comparison is based on the documents [1],[2],[3],[4], [5] and [6].

[1] MAC Sub-layer Specification for 3G Mobile system, Version 1.0, ARIB SWG2/ST7
[2] UMTS YY.01, UE-UTRAN Radio Interface Protocol Architecture, ETSI SMG2
[3] UMTS YY.02, Layer 1 General Requirements, ETSI SMG2
[4] UMTS YY.03, Description of UE states and procedures in Connected Mode, ETSI SMG2
[5] UMTS YY.21, Description of the MAC protocol, ETSI SMG2
[6] Specification of Air-Interface for 3G Mobile System, Volume 3, ARIB

Sections	**ARIB**	**ETSI**	**Remarks**
ETSI:[5], Section 4 ARIB:[1], Section 2 and 3	**General Protocol Architecture, MAC Sub-layer Structure**		

	• MAC functional entities:
	  • MAFE
	  • ACFE
		• MAC entities:
		  • MAC-b
		  • MAC-p
		  • MAC-sy (TDD only)
		  • MAC-c
		  • MAC-sh
		  • MAC-d
			ARIB:
			Split into entities based on how time critical the included functions are.
			ETSI:
			Split into entities based on transport channel usage and data flow within MAC.

	MAC configuration by RRC	MAC configuration by RRC using MAC Control SAP	
ETSI: [2] Section 7.3 [5] Section 4.3 ARIB: [1], Section 3	**MAC Interface to LAC Logical Channels**	**MAC Interface to RLC Logical Channels**	
	• Broadcast Control Channel (BCCH)	• Broadcast Control Channel (BCCH)	ARIB specifies two types: BCCH-C and BCCH-V. ETSI does not distinguish between different types of BCCH
	• Paging Control Channel (PCCH)	• Paging Control Channel (PCCH)	In ETSI the PCCH can be used when the UE is in cell connected state
	• Common Control Channel (CCCH)	• Common Control Channel (CCCH)	In ETSI reference to the state of the RRC connection is given (... used by the UEs having no RRC connection with the network) [2]
	• Dedicated Control	• Dedicated Control	In ETSI reference to the

	Channel (DCCH)	Channel (DCCH)	state of the RRC is given (…established through RRC connection procedure) [2]
		• Synchronisation Control Channel (SCCH)	Only in ETSI. TDD specific
		• ODMA Common Control Channel (OCCCH)	Only in ETSI. Not discussed yet in relation with MAC model
		• ODMA Dedicated Control Channel (ODCCH)	Only in ETSI. Not discussed yet in relation with MAC model
	• Dedicated Traffic Channel (DTCH)	• Dedicated Traffic Channel (DTCH)	Only minor wording difference between descriptions
	• Multicast Channel (MCH)		In ARIB FFS
		• ODMA Dedicated Traffic Channel (ODTCH)	Only in ETSI. Not discussed yet in relation with MAC model
ETSI: [2] Section 7.2 [5] Section 4.3 ARIB: [1], Section 3, Layer 1 Specification	**MAC Interface to L1 / Transport Channels**		
	• Broadcast Channel (BCH)	• Broadcast Channel (BCH)	ARIB: Details given in Layer 1 Specification.
	• Paging Channel(PCH)	• Paging Channel(PCH)	ARIB: Details given in Layer 1 Specification.
	• Forward Access Channel(FACH)	• Forward Access Channel(FACH)	ARIB: Details given in Layer 1 Specification.
	• Random Access Channel (RACH)	• Random Access Channel (RACH)	ARIB: Details given in Layer 1 Specification.
		• Synchronisation Channel(SCH)	Only in ETSI. TDD only
		• Down-link Shared Channel (DSCH)	Only in ETSI. FDD based
		• ODMA Random Access Channel (ORACH)	Only in ETSI. Not discussed yet in relation with MAC model
	• Dedicated Channel (DCH)	• Dedicated Channel (DCH)	ARIB: Details given in Layer 1 Specification.
		• Fast Up-link Signalling Channel (FAUSCH)	Only in ETSI. FDD, not yet approved by L1
		• ODMA Dedicated Channel (ODCH)	Only in ETSI. Not discussed yet in relation with MAC model
ETSI: [2] Section 7.3 ARIB: [1] Section 3.3	**Mapping of logical channels to transport channels**		Same mapping except for: • MCH (in ARIB FFS) • FAUSCH, DSCH SCH and ODMA channels (only defined in ETSI)
ETSI: [2] Section 7.3 ARIB: [1] Section 4	**Services provided to upper layer**		
	• Data transfer	• Data transfer	Similar services, but more

			detailed description in ARIB
	• Reallocation of radio resources and MAC parameters	• Reallocation of radio resources and MAC parameters	Similar services, but more detailed description in ARIB
	• Reporting of measurements	• Reporting of measurements	Several details in ARIB available
		• Allocation/De-allocation of radio resources	ETSI only. TDD specific, FFS
ETSI: [2] Section 7.6 ARIB: [1] Section 2.2	**Protocol Termination Points**		
	Protocols are terminated within MS and BSS, no distinction between RNC and base stations termination points	Detailed discussion of protocol termination in UE, Node B, Controlling RNC and Serving RNC. Two cases (A and C) are defined for the first UMTS release.	Details are available in ARIB too
ETSI: [3] ARIB: [1] Section 5	**Services expected from physical layer**		The Services expected from L1 are very similar between ARIB and ETSI. Only those points where differences have been found are listed in this section
	Rate matching (data multiplexed on DCH)		This function is not explicitly listed in the ETSI document [2], but it is required for ETSI, too.
	Radio characteristic measurements including FER, SIR, Interference Power, etc.	Measurement reporting is FFS	
	The definition of *Transport Block Set Size* is based on the number of Transport Blocks.	The definition of *Transport Block Set Size* is based on the number of bits.	
		The *Transport Format* contains the dynamic attribute *Transmission Time Interval* (option for TDD)	TDD specific
ETSI: [2] Section 7.3 [5], Section 5 ARIB:[1] Section 6	**MAC functions**		The functions of MAC layer are similar between ARIB and ETSI in most cases, but different wording has often been used.
	General functions		
		Mapping between logical channels and transport channels	Explicit function in ETSI, implicitly defined in ARIB [1], Chapter 3
	Traffic Monitor Function	Traffic volume monitoring	May be moved to RLC in ETSI.
	Multiplexing Function	Multiplexing Function	The boxes C/D MUX, C/T MUX in the ETSI MAC model all correspond to the LID in ARIB. In this way they correspond to a LID

			hierarchically split into different levels. Not exact equivalence between LID (ARIB) and C/D, C/T (ETSI).
	Retransmission Function (FFS)		ARIB only, FFS
	MAC Header Handling		Not explicitly listed in ETSI. Can be seen as being part of other functions, e.g. Multiplexing Function, Identification of UEs on common transport channels.
	Access control function		In ETSI the access control function is provided by several MAC functions e.g. Priority Handling between UEs
	Common channel related functions		
	Scheduling of BCH	Scheduling of broadcast, paging and notification messages	Two types of BCCHs (BCCH-C and BCCH-V) in ARIB only.
	Scheduling of PCH		Definition of 288 paging groups in ARIB.
	Scheduling of ACK, control and user data transmission (FACH)		Described in detail in ARIB. Assumption that retransmissions are handled in MAC (FFS, only applicable for termination case C)
	Multiplexing / De-multiplexing of higher layer PDUs to/from FACH	Multiplexing/de-multiplexing of higher layer PDU's into/from transport blocks delivered to/from the physical layer on common transport channels	Same function but different wording
	In-band identification of MSs	Identification of UEs on common transport channels	Same function but different wording
	Scheduling of control and user data transmission (RACH)	Multiplexing/de-multiplexing of higher layer PDUs into/from transport blocks delivered to/from the physical layer on common transport channels	Described in detail in ARIB. In ETSI assumption that retransmissions are handled in MAC is FFS (only applicable for ETSI termination case C)
	Multiplexing / De-multiplexing of higher layer PDUs to/from RACH		Same function but different wording
	Control of DCH		
		Multiplexing/demultiplexing of higher layer PDUs into/from transport block sets delivered to/from the physical layer on dedicated transport channels	Function is implicitly covered in ARIB.
	Priority handling between data flows of one MS	Priority handling between data flows of one UE	Same function. Different wordings in descriptions.

	Other functions		
	Selection of appropriate transport format	Selection of appropriate Transport Format for each Transport Channel depending on instantaneous source rate	Same function. Different wordings in descriptions.
	Priority handling between data flows of different users by means of dynamic scheduling (for dedicated channels this part may be moved to RRC)	Priority handling between UEs by means of dynamic scheduling For FDD: common channels only For TDD: operation on dedicated channels FFS	Possibly for both common and dedicated channels in ARIB. Only for common channels in ETSI. Different wordings in descriptions.
		Constrained execution of open loop power control algorithms	ETSI only
		Routing of higher layer signalling (required in TDD mode)	ETSI only. TDD mode
		Maintenance of a MAC signalling connection between peer MAC entities (required in TDD mode)	ETSI only. TDD mode
		Monitoring the links of the assigned resources (TDD mode)	ETSI only. TDD mode
		Processing of messages received at common control channels (TDD mode), FFS	ETSI only. TDD mode, FFS
ETSI: [5] Section 8 ARIB: [1] Section 8	**Elements for layer to layer communication**		
ETSI: [3] Section 10 ARIB: Layer 1 specification [6]	Primitives between layers 1 and 2		
		PH-CONNECT	ETSI only
		PH-DISCONNECT	ETSI only
	PHY-DATA	PH-DATA	
	PHY-STATUS	PH-STATUS	
	PHY-ERROR		ARIB only
ETSI: [5] Section 8 ARIB: [1] Section 8	Primitives between MAC and LAC	Primitives between MAC and RLC	Definitions in ARIB available. No detailed definitions in ETSI.
ETSI: [5] Section 8 ARIB: [1] Section 8	Primitives between MAC and RRC	Primitives between MAC and RRC	Definitions in ARIB available. No detailed definitions in ETSI.

ETSI: [5] Section 9 ARIB: [1] Section 9	**Elements for peer-to-peer communication**		
	MAC Protocol data units		
	• MAC header for RACH/FACH	Given in the description for the MAC header for DTCH, DCCH and CCCH	
	• Special header format for FACH-ACK		No FACH-ACK described in ETSI
	• MAC header for DCH and BCH for the cases when several instances of a logical channel is mapped onto a transport channel	MAC header described for DTCH, DCCH and CCCH (some issues ffs e.g. BCH)	
	• No MAC header for PCH	MAC header PCH is ffs	
	• MAC header contains LID, RNTI	Inclusion of RNTI is covered. T field specified in ETSI contents C/D and C/T information	Not exact equivalence between LID (ARIB) and C/D, C/T (ETSI) and no identification of FACH-ack in ETSI
	MAC parameters		
ETSI: [2] Section 8.1	• RNTI	RNTI, exists in case of established RRC connection, further UE-Ids are FFS.	ARIB: assigned by BSS except for initial access were it is selected at random by MS. Range of values specified. ETSI: Assigned by UTRAN. Initial access FFS. No range of values specified.
	LID covers mainly by the MAC header		Not exact equivalence between LID (ARIB) and C/D, C/T (ETSI)
	NR (number of RNTI)		Only in ARIB
	RNTI field		Only in ARIB
ETSI:[2] Section 7.3.3 ARIB: [1] Section 9.3	MAC operation model	Data flows through Layer 2	General descriptions exist in both standards
ETSI:[4] Section 7.3.3 ARIB: [1] Section 9	MAC Protocol states	No MAC state machine in ETSI	Comparable content in [4] “Procedures in Connected Mode”
ETSI: [5] Section 11 ARIB: [1] Section 7	**Elementary Procedures**		
		Dynamic radio bearer control in packet data services	ETSI only, details FFS
	RACH Procedure		ARIB only. In ETSI assumption that retransmissions are handled in MAC is ffs (only applicable for ETSI termination case C).