SRS_MAC-hs| Version: 1.0.0

NEXP4

Software Requirement Specification
Medium Access Control Protocol (MAC-hs) for UE Side

NESPL/UMTS_UE/SRS_MAC-hs

Version_7.3.0

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Content

DOCUMENT CONTROL

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1. INTRODUCTION

1.1 Purpose

The main purpose of this document is to capture the Medium Access Control Layer Requirement for High Speed Downlink Shared Channel for UE as per 3GPP release 7.3.0.

1.2 Documents and Conventions

As per company standards.

1.3 Intended Audience

NEXG Integration Team.

1.4 Project Scope

To describe and demonstrate the Medium Access control hs on Release7.3.0 as per 3GPP Specification.

1.5 References

3GPP TS 25.321: “Medium Access Control Protocol Specification”.

3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

3GPP TS 33.102: "Security architecture".

3GPP TS 25.331: "Radio Resource Control (RRC) protocol specification".

3GPP TS 25.301: "Radio Interface Protocol Architecture"

3GPP TS 25.302: “Services provided by the physical layer”.

2. Overall Description

2.1 Productive Perceptive

NEXP 4 is a terminal which will support 3G, 4G technologies. Our software will reside in ARM 11 processor. The product will be supporting UMTS, HSPA, Wi -MAX. It will be having Physical layer Interface to Wi-MAX (OFDM, FDMA and MIMO) TX/RX and UMTS (WDCMA). Radio Bearer Control Procedure for State Transition is being designed here. The product is scheduled to be release in 2012.

2.2 Product Features

The products will Support Data Rates of the order of 2 Mbps to 50 Mbps. It will be having an interface to the peripherals likes of LCD screens, Audio/Video Interfaces.

2.3 Operating Environment

Currently simulating on Linux 12.04, final platform will be RTOS and ARM11 processor.

System Features.

Control of HS-DSCH transmission and reception

3.1 Network Operation

3.1.1 NES_MAC_HS_SRS_001_001_001

Req.ID	NES_MAC_HS _SRS_001_001_001
Summary	Scheduler Functionality
Description	1) Schedule all UE within a cell. 2) Provide Service priority Queues. 3) Determines the HARQ Entity and the queue to be serviced 4) Sets the TSN for new data blocks being transferred from the selected queue. 5) Indicates the Queue ID and TSN to the HARQ entity for each MAC-hs PDU to be transmitted 6) Schedules new transmissions and retransmissions 7) Determines the redundancy version 8) Determines the TDD HCSN

3.1.2 NES_MAC_HS_SRS_003_001_002

Req.ID	NES_MAC_HS _SRS_001_001_002
Summary	Schedule all UE within a cell
Description	Scheduler schedule to all the UE within the cell according to report and priority which UE has to be data sent.

3.1.3 NES_MAC_HS_SRS_003_001_003

Req.ID	NES_MAC_HS _SRS_001_001_003
Summary	Provide Service priority Queues
Description	It's schedules MAC-hs SDU based on upper layer information ,UE may be associated with more than one MAC-d flow and that MAC-d contain HS-DSCH MAC-d PDU for one or more priority.

3.1.4 NES_MAC_HS_SRS_003_001_004

Req.ID	NES_MAC_HS _SRS_003_001_004
Summary	Set Transmission Sequence Number (TSN) for new data block transferred for selecting queue.
Description	→When TSN = 0, for the first MAC-hs PDU transmitted for each Queue ID within an HS-DSCH. →When increment the TSN with one for each transmitted MAC-hs PDU on each Queue ID within an HS-DSCH.

3.1.5 NES_MAC_HS_SRS_003_001_005

Req.ID	NES_MAC_HS _SRS_003_001_005
Summary	Determines the redundancy version
Description	→The scheduler determines a suitable redundancy version for each transmitted and retransmitted MAC-hs PDU and indicates the redundancy version to lower layer.

3.1.6 NES_MAC_HS_SRS_003_001_006

Req.ID	NES_MAC_HS _SRS_003_001_006
Summary	Determines the HARQ Entity and the queue to be serviced
Description	→According to the transmission decide the HARQ entity and QUEUE ID on which this HARQ to be serviced.

3.1.7 NES_MAC_HS_SRS_003_001_007

Req.ID	NES_MAC_HS _SRS_003_001_007
Summary	Schedules new transmissions and retransmissions.
Description	According to status report from HARQ .Scheduler decide new transmission will be do or not, The new transmission can be take place or not and delay MAC-hs PDU may discard or not.

3.2.1 NES_MAC_HS_SRS_003_002_001

Req.ID	NES_MAC_HS _SRS_001_002_001
Summary	HARQ Entity Functionality
Description	1)Every UTRAN has HARQ entity per UE. 2) The HARQ entity sets the Queue ID in transmitted MAC-hs PDUs to the value indicated by the UTRAN Scheduler. 3) It sets the transmission sequence number (TSN) in transmitted MAC-hs PDUs to the value indicated by the UTRAN scheduler. 4) It sets the HARQ process identifier in transmitted MAC-hs PDUs. UTRAN should determine a suitable HARQ process to service the MAC-hs PDU and set the HARQ process identifier accordingly.

3.2.2 NES_MAC_HS_SRS_003_002_002

Req.ID	NES_MAC_HS _SRS_001_002_002
Summary	The HARQ process sets the New data indicator in transmitted MAC-hs PDU
Description	1) UTRAN will set the New Data Indicator to the value = 0 for the first MAC-hs PDU transmitted by a HARQ process. 2) New data Indicator will not be incremented; 3) It will increment the New Data Indicator with one each transmitted MAC-hs PDU containing new data. 4) When HARQ process received status messages. UTRAN should deliver received status messages to the scheduler.

3.3 UE Operation

3.3.1 NES_MAC_HS_SRS_003_003_001

Req.ID	NES_MAC_HS _SRS_003_003_001
Summary	HARQ Entity Functionality
Description	1) UE has one HARQ entity which processes the HARQ process identifiers received on the HS-SCCH transmissions associated with MAC-hs PDUs received on the HS-DSCH. 2) There are parallel HARQ processes used in the UE to support the HARQ entity. The number of HARQ processes is configured by upper layers and each received MAC-hs PDU shall be allocated to the HARQ process indicated by the HARQ process identifier of the MAC-hs PDU.

3.3.2 NES_MAC_HS_SRS_003_003_002

Req.ID	NES_MAC_HS _SRS_003_003_002
Summary	HARQ Process Functionality
Description	if the MAC-hs PDU is received within 5 sub-frames from the reception of the previous MAC-hs PDU intended for this HARQ process.

3.3.3 NES_MAC_HS_SRS_003_003_003

Req.ID	NES_MAC_HS _SRS_003_003_003
Summary	if the New Data Indicator has been incremented compared to the value in the previous received transmission in HARQ process or this is the first received transmission in the HARQ process .
Description	→it will replace the data currently in the soft buffer for this HARQ process with the received data. if the Transport Block Size index value is equal to 111111Then →It will generate a positive acknowledgement (ACK) of the data in this HARQ process. → discard the received data. → We assume that the data has been successfully.

3.3.4 NES_MAC_HS_SRS_003_003_004

Req.ID	NES_MAC_HS _SRS_003_003_004
Summary	if the New Data Indicator is identical to the value used in the previous received transmission in the HARQ process and Transport Block Size index value is equal to 111111
Description	→ Assume that the transport block size is identical to the last valid transport block size signalled for this HARQ process. 2.2) if the data has not yet been successfully decoded Then, → Combine the received data with the data currently in the soft buffer for this HARQ process. 2.3) if the transport block size is different from the last valid transport block size signalled for this HARQ process Then, → UE may replace the data currently in the soft buffer for this HARQ process with the received data. 2.4) if the data in the soft buffer has been successfully decoded and no error was detected Then →Deliver the decoded MAC-hs PDU to the reordering entity; → Generate a positive acknowledgement (ACK) of the data in this HARQ process.

3.3.5 NES_MAC_HS_SRS_003_003_005

Req.ID	NES_MAC_HS _SRS_003_003_005
Summary	Else if the New Data Indicator is not identical to the value used in the previous received transmission in the HARQ process and Transport Block Size index value is not equal to 111111
Description	→ Generate a negative acknowledgement (NAK) of the data in this HARQ process. → Schedule the generated positive or negative acknowledgement for transmission and the time of transmission. →Relative to the reception of data in a HARQ process is configured by upper layer.

3.3.6 NES_MAC_HS_SRS_003_003_006

Req.ID	NES_MAC_HS _SRS_003_003_006
Summary	Reordering Entity Parameters
Description	→Transmitter window size (TRANSMIT_WINDOW_SIZE) :- It is the size of the transmitter window according to parameter in the Node B and the value of the parameter is configured by higher layers. → Receiver window size (RECEIVE_WINDOW_SIZE) :- It is the size of the receiver window according to Parameter in the UE and the value of the parameter is configured by higher layers. →Timers **:-** The Re-ordering release timer T1 controls the stall avoidance in the UE reordering buffer as The value of T1 is configured by upper layers.

3.3.7 NES_MAC_HS_SRS_003_003_007

Req.ID	NES_MAC_HS _SRS_003_003_007
Summary	If no timer T1 is active
Description	→ The timer T1 shall be started when a MAC-hs PDU with TSN > next_expected_TSN is correctly received. → T1_TSN shall be set to the TSN of this MAC-hs PDU. 2) If a timer T1 is already active:- → No additional timer shall be started, i.e. only one timer T1 may be active at a given time. 3) The timer T1 shall be stopped if:- →The MAC-hs PDU with TSN = T1_TSN can be delivered to the disassembly entity before the timer expires.

3.3.8 NES_MAC_HS_SRS_003_003_008

Req.ID	NES_MAC_HS _SRS_003_003_008
Summary	When the timer T1expires and T1_TSN > next_expected_TSN
Description	→All correctly received MAC-hs PDUs with TSN > next_expected_TSN up to and including T1_TSN-1 shall be delivered to the disassembly entity. →all correctly received MAC-hs PDUs up to the next not received MAC-hs PDU shall be delivered to the disassembly entity. -→Next_expected_TSN shall be set to the TSN of the next not received MAC-hs PDU.

3.3.9 NES_MAC_HS_SRS_003_003_009

Req.ID	NES_MAC_HS _SRS_003_003_009
Summary	When the timer T1 is stopped or expires, and there still exist some received MAC-hs PDUs that can not be delivered to higher layer.
Description	→Timer T1 is started →Set T1_TSN to the highest TSN among those of the MAC-hs PDUs that can not be delivered.

3.3.10 NES_MAC_HS_SRS_003_003_010

Req.ID	NES_MAC_HS _SRS_003_003_010
Summary	Transmitter operation
Description	→After the transmitter has transmitted a MAC-hs PDU with TSN=SN, any MAC-hs PDU with TSN ≤ SN – TRANSMIT_WINDOW_SIZE should not be retransmitted to avoid sequence number ambiguity in the receiver.

3.3.11 NES_MAC_HS_SRS_003_003_011

Req.ID	NES_MAC_HS _SRS_003_003_011
Summary	Receiver operation -- When a MAC-hs PDU with TSN = SN is received
Description	if SN is within the receiver window :- → if SN < next_expected_TSN, or this MAC-hs PDU has previously been received →The MAC-hs PDU shall be discarded. → else The MAC-hs PDU shall be placed in the reordering buffer at the place indicated by the TSN.

3.3.12 NES_MAC_HS_SRS_003_003_012

Req.ID	NES_MAC_HS _SRS_003_003_012
Summary	if SN is outside the receiver window
Description	The received MAC-hs PDU shall be placed above the highest received TSN in the reordering buffer, at the position indicated by SN. →RcvWindow_UpperEdge shall be set to SN thus advancing the receiver window. →Any MAC-hs PDUs with TSN ≤ RcvWindow_UpperEdge RECEIVE_WINDOW_SIZE,outside the receiver window after its position is updated, shall be removed from the reordering buffer and be delivered to the disassembly entity. -→ if next_expected_TSN is below the updated receiver window →Next_expected_TSN shall be set to RcvWindow_UpperEdge – RECEIVE_WINDOW_SIZE + 1; →if the MAC-hs PDU with TSN = next_expected_TSN is stored in the reordering buffer. →All received MAC-hs PDUs with consecutive TSNs from next_expected_TSN (included) up to the first not received MAC-hs PDU shall be delivered to the disassembly entity. →Next_expected_TSN shall be advanced to the TSN of this first not received MAC-hs PDU.

3.3.13 NES_MAC_HS_SRS_003_003_013

Req.ID	NES_MAC_HS _SRS_003_003_013
Summary	In case a UE has insufficient memory to process a received MAC-hs PDU
Description	→Select TSN_flush such that: next_expected_TSN < TSN_flush _ RcvWindow_UpperEdge + 1. →Deliver all correctly received MAC-hs PDUs with TSN < TSN_flush to the disassembly entity. →if the MAC-hs PDU with TSN=TSN_flush has previously been received. →Deliver all received MAC-hs PDUs with consecutive TSNs from TSN_flush (included) up to the first not received MAC-hs PDU to the disassembly entity. →Advance next_expected_TSN to the TSN of this first not received MAC-hs PDU. →else Set next_expected_TSN to TSN_flush.

3.3.14 NES_MAC_HS_SRS_003_003_014

Req.ID	NES_MAC_HS _SRS_003_003_014
Summary	Disassembly Entity Functionality
Description	MAC-hs PDU that is delivered to the disassembly entity, the UE shall: →Remove any padding bits if present. →Remove the MAC-hs header. →Deliver the MAC-d PDUs in the MAC-hs PDU to MAC-d.

3.3.15 NES_MAC_HS_SRS_003_003_015

Req.ID	NES_MAC_HS _SRS_003_003_015
Summary	MAC-hs Reset -- If a reset of the MAC-hs entity is requested by upper layers, the UE shall at the activation time indicated by higher layers.
Description	→ It Will flush soft buffer for all configured HARQ processes. → It will stop all active re-ordering release timer (T1) and set all timer T1 to their initial value. →Start TSN with value 0 for the next transmission on every configured HARQ process. →Initialise the variables RcvWindow_UpperEdge and next_expected_TSN to their initial values. →Disassemble all MAC-hs PDUs in the re-ordering buffer and deliver all MAC-d PDUs to the MAC-d entity. →Flush the re-ordering buffer and then, →if the MAC-hs reset was initiated due to reception of the IE "MAC-hs reset indicator" by the upper layers. →Indicate to all AM RLC entities mapped on HS-DSCH to generate a status report.

3.3.16 NES_MAC_HS_SRS_003_003_016

Req.ID	NES_MAC_HS _SRS_001_001_001
Summary	HS-DSCH Bit Rate measurement
Description	→ MAC-hs entity measures the total number of MAC-d PDU bits whose transmission over the radio interface has been considered successful by MAC-hs in Node-B during the last measurement period, divided by the duration of the measurement period and period will be 100ms → When the cell portions are defined in a cell, the HS-DSCH Provided Bit Rate shall be measured for each cell portion.

6. EXTERNAL INTERFACE

5.1 Hardware Interface:

ARM 11 Processor.

5.2 Software Interface :-

Message Queue: Message queue is the IPC used to communicate between two unrelated processes. It exists independently of both the sending and receiving processes. Message queue use for sending a block of data from one process to another, each block of data having different type values independently. MSGMAX define maximum size in bytes of an individual message and MSGMNB defines the maximum size of a queue.

5.3 Communication Interface:

Message queue.

7. APPENDIX

➢**BCH**-Broadcast Channel

➢**BCCH**-Broadcast Control Channel

➢**CCCH**-Common Control Channel

➢**CTCH**-Common Traffic Channel

➢**DCCH**-Dedicated Control Channel

➢**DCH**-Dedicated Channel

➢**DSCH**-Downlink Shared Channel

➢**DTCH**-Dedicated Traffic Channel

➢**E-DCH**-Enhanced Dedicated Channel

➢**E-AGCH**-E-DCH Absolute Grant Channel

➢**FACH**-Forward Access Channel

➢**FDD**-Frequency Division Duplex

➢**HS-DSCH**-High Speed Downlink Shared Channel

➢**MAC**-Medium Access Control

➢**MBMS**-Multimedia Broadcast Multicast Service

➢**MCCH**-MBMS Point to Multipoint Control Channel

➢**MTCH**-MBMS Point to Multipoint Traffic Channel

➢**MSCH**-MBMS Point to Multipoint Scheduling Channel

➢**PCCH**-Paging Control Channel.

➢**PDU**-Packet Data Unit

➢**RRC**-Radio Resource Control

➢**RLC**-Radio Link Control

➢**SAP**-Service Access Point

➢**SDU**-Service Data Unit

➢**SHCCH**-Shared Channel Control Channel

➢**TDD**-Time Division Duplex

➢**TFCI**-Transport Format Combination Indicator

➢**TFI**-Transport Format Indicator

➢**TSN**-Transmission Sequence Number

➢**U**-User

➢**UE**-User Equipment

➢**UL**-Uplink

➢**UTRAN**-Universal Terrestrials Radio Access Network