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# Summary:

The following changes are suggested for the MAC simultor section of the simulation scneario document: **11-14- 0621- 04-00ax Simulation Scenarios.**

# Scenarios for calibration of MAC simulator

## Common parameters

|  |  |
| --- | --- |
| **PHY Parameter** | **SUGGESTED VALUES** |
| GI: | [long] |
| Data Preamble: | [11ac] |
| BW | 20 Mhz |

The following parameters are common to the MAC tests unless otherwise stated.

|  |  |
| --- | --- |
| **Parameter** | **SUGGESTED VALUES** |
| Aggregation | A-MPDU  max aggregation size =64  No A-MSDU  immediate BA  (aggregation is assumed to be ON) |
|  |  |
| Max number of retries | 10 |
| Rate adaptation | Fixed MCS |
| EDCA parameters | Default params for best effort (CWmin=15) |

The follwing parameters are common to the traffic model unless otherwise stated.

Transpot protocol- UDP

Traffic model: full buffer

## Test 1a: MAC overhead w/out RTS/CTS

Goal:

**designed to verify whether the simulator can correctly handle the basic frame exchange procedure, including AIFS+backoff procedure and A-MPDU+SIFS+BA sequence. Also to make sure the overheads are computed correctly.**

Assumptions:

Assumption is that PER is 0

Parameters:

MSDU length:[0:500:2000Bytes]

2 MPDU limit

RTS/CTS off

MCS = [0,8] ( to clarify, run a sweep over MSDU length once for MCS 0, and once for MCS 8.



Output metric:

(1) MAC layer Throughput

(2) Time trace of transmitting/Receiving event

CP1 ( check point 1) start of A-MPDU

CP2 end of A-MPDU

CP3 start of ACK

CP4 end of ACK

CP5 start of A-MPDU

|  |  |  |  |
| --- | --- | --- | --- |
| Test Items | Check points | Standard definition | Matching? |
| A-MPDU duration | Tcp2-Tcp1= | ceil((FrameLength\*8)/rate/OFDMsymbolduration) \* OFDMsymbolduration + PHY Header |  |
| SIFS | Tcp3-Tcp2=16 us | 16 us |  |
| ACK duration | Tcp4-Tcp3= | ceil((ACKFrameLength\*8)/rate/OFDMsymbolduration) \* OFDMsymbolduration + PHY Header |  |
| Defer & backoff duration | Tcp5-Tcp4= | DIFS(34 us)+backoff (CWmin)  =34us+n\*9us |  |

Tcp is the timestamp related with the corresponding simulation event on the check point (CP)

The following is an example calcultation of TPUT when the MSDU size is 1508, and MCS =0

* Number of MPDUs in AMPDU= 2
* Bytes per MPDU:
  + Bytes from application laye:1472
  + MAC header 30 bytes
  + FC=2;Duration=2;Addr1=6;Addr2=6;Addr3=6;SeqContrl=2;QoSCntrl=2; FCS=4
    - Note: Assuming HT control field is not used
  + MPDU delimiter 4 bytes
  + 2 bytes padding
* Bytes per AMPDU
  + Tail bits 1 bytes
  + Service Field 2 Bytes
* Total Bytes per AMPDU: 3091
* Duration of PPDU w/out preamble= 3091/6.5e6=3.804ms
* Duration of PPDU w/ preamble= 3.844ms
* Duration of ACK 68 us
* Expected time waiting for the Medium = 100.5 us (CWmin =15)
* Expected TPUT= 1472\*8\*2/(3.844ms+68us+16us+100.5us)
* (Note this is application layer tput)

## Test 1b: MAC overhead w RTS/CTS

Goal:

This test case is designed to further verify whether the simulator can correctly handle the frame exchange procedure with RTS/CTS protection based on test1a. It also tests whether the correct overhead computation with RTS /CTS.

Assumptions:

Assumption is that PER is 0

Parameters:

MSDU length:[0:500:2000Bytes]

2 MPDU limit

RTS/CTS ON

MCS = [0,8] ( to clarify, run a sweep over MSDU length once for MCS 0, and once for MCS 8.

Output metric:

1. MAC layer Throughput
2. Time trace of transmitting/Receiving event



CP1 ( check point 1) : start of RTS

CP2 : end of RTS

CP3: start of CTS

CP4: end of CTS

CP5: start of A-MPDU

CP6: end of A-MPDU

|  |  |  |  |
| --- | --- | --- | --- |
| Test Items | Check points | Standard definition | Matching? |
| RTS duration | Tcp2-Tcp1= | ceil((RTSFrameLength\*8)/rate/OFDMsymbolduration) \* OFDMsymbolduration + PHY Header |  |
| CTS duration | Tcp4-Tcp3= | ceil((CTSFrameLength\*8)/rate/OFDMsymbolduration) \* OFDMsymbolduration + PHY Header |  |
| Frame duration | Tcp6-Tcp5= | ceil((FrameLength\*8)/rate/OFDMsymbolduration) \* OFDMsymbolduration + PHY Header |  |

The following is an example TPUT calculation when MSDU size is 1508, and MCS =0

* Number of MPDUs in AMPDU= 2
* Bytes per MPDU:
  + Bytes from application layer:1472
  + L4 header: 36 bytes
  + MAC header 30 bytes
  + FC=2;Duration=2;Addr1=6;Addr2=6;Addr3=6;SeqContrl=2;QoSCntrl=2; FCS=4
  + MPDU delimiter 4 bytes
  + 2 bytes padding
* Bytes per AMPDU
  + Tail bits < 1 bytes
  + Service Field 2 Bytes
* Total Bytes per AMPDU: 3091
* Duration of PPDU w/out preamble= 3091/6.5e6=3.804ms
* Duration of PPDU w/ preamble= 3.844ms
* Duration of ACK 68 us
* Duration of RTS 52 us
* Duration of CTS 44 us
* SIFS= 16us
* Expected time waiting for the Medium = 100.5 us (CWmin =15)
* Expected TPUT= 1472\*8\*2/(3.844ms+68us+16us+100.5us + 52us+44us+2\*16us) (Note this is application layer TPUT)

## Test 2a: Deferral Test 1

(AP1 and STA2 are essentially co-located)

Goal:

This test case is designed to verify whether the simulator can correctly handle deferral procedure after collision happens without hidden nodes. It also checks whether deferral because of energy levels is happening correctly.

Assumptions:

All devices are within energy detect range of each other.

When AP1 and AP2 start to transmit on the same slot, both packets are lost (PER= 100%). Otherwise packets get through 100%. PER=0 %

Note:

AP1 and AP2 should defer to each other.

The only packet loss is due to collisions when backoffs end at same time

Parameters:

MSDU length:[0:500:2000Bytes]

2 MPDU limit

RTS/CTS [ OFF, ON]

MCS = [0]

Outputs:

MAC tput.

## Test 2b: Deferral Test 2

Goal:

This test case is designed to verify whether the simulator can correctly handle deferral procedure after collision happens with the existing of hidden nodes.

Assumptions:

AP1 and AP2 can not hear each other. ( ever)

* + Interference Assumptions:
    - If any part of an MPDU sees interference, that MPDU should fail
    - If any part of a data preamble sees interference, all MPDUs should fail
    - If an MPDU, or data premable sees no interference, it should pass
    - If an ACK overlaps with the transmission of an OBSS AP, the PER on the ACK should be 0. (i.e. the ACK should pass)
  + Backoff
    - If no ACK is received, the transmitter should double it’s CW.
    - If an ACK is received, the transmitter should reset its CW
    - If no MPDUs are decoded, no ACK should be sent.
    - After 10 missing ACKS, the CW should be reset.
  + PER definition
    - PER= 1-Acked data MPDUs/Total data MPDUs sent
      * ( TPUT can be computed from number of successfully ACKed MPDUs and the total time)

ACKed data MPDUs are measured by the transmitters

Parameters:

MSDU length:[1500Bytes]

RTS/CTS [ OFF]

MCS = [0]

Outputs:

MAC tput.

## Test 3 : NAV deferral ( note :should say test 3)

(AP1 and STA2 are essentially co-located)

Same as test 2b, but with RTS/CTS on.

Goal: This test is designed to test whether NAV deferral is happening properly.