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DENVER, CO
OCTOBER 17-20

2017 Fall Technical Forum
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Accurately Estimating D3.1 Channel Capacity

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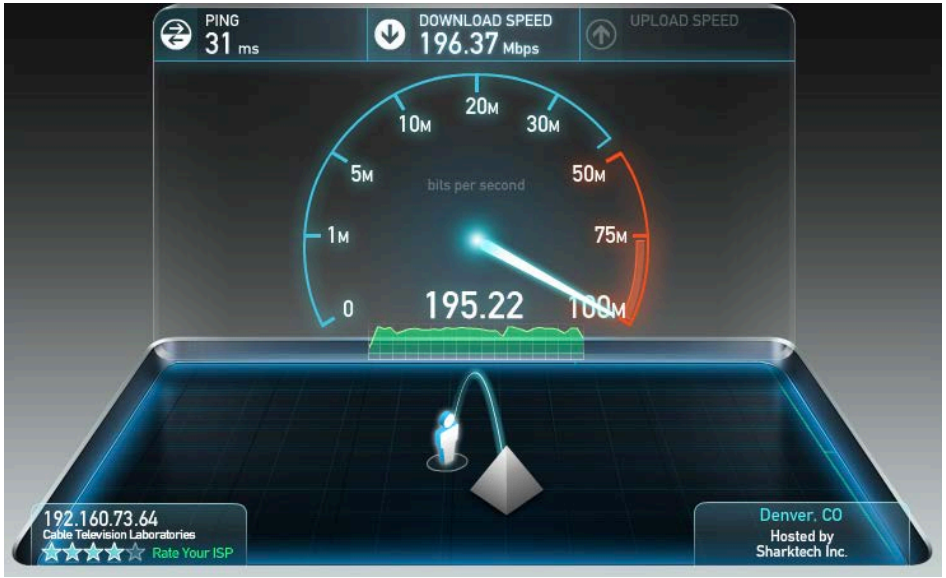
CableLabs

SCTE·ISBE CABLE-TEC EXPO 2017 | DENVER, CO OCTOBER 17-20

DOCSIS 3.1 Capacity

Multiple Modulation orders makes things complicated

Multiple profiles (DS & US)



Band Edges, Subcarriers, Symbol sizes, Cyclic Prefix

Parameter	Value	
Downstream master clock frequency	10.24 MHz	
Downstream Sampling Rate (fs)	204.8 MHz	
Downstream Elementary Period (Tsd)	1/(204.8 MHz)	
Channel bandwidths	24 MHz … 192 MHz	
IDFT size	4096	8192
Subcarrier spacing	50 kHz	25 kHz
FFT duration (Useful symbol duration) (Tu)	20 µs	40 µs
Maximum number of active subcarriers in signal (192 MHz channel -190 MHz used)	3800	7600
Maximum spacing between first and last active subcarrier	190 MHz	

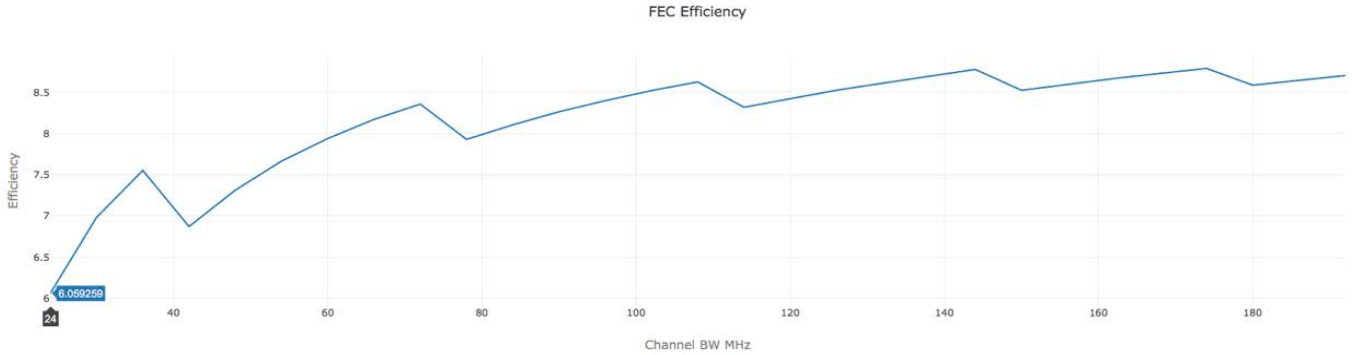
Cyclic Prefix (us)
0.9375 µs
1.25 µs
2.5 µs
3.75 µs
5 µs

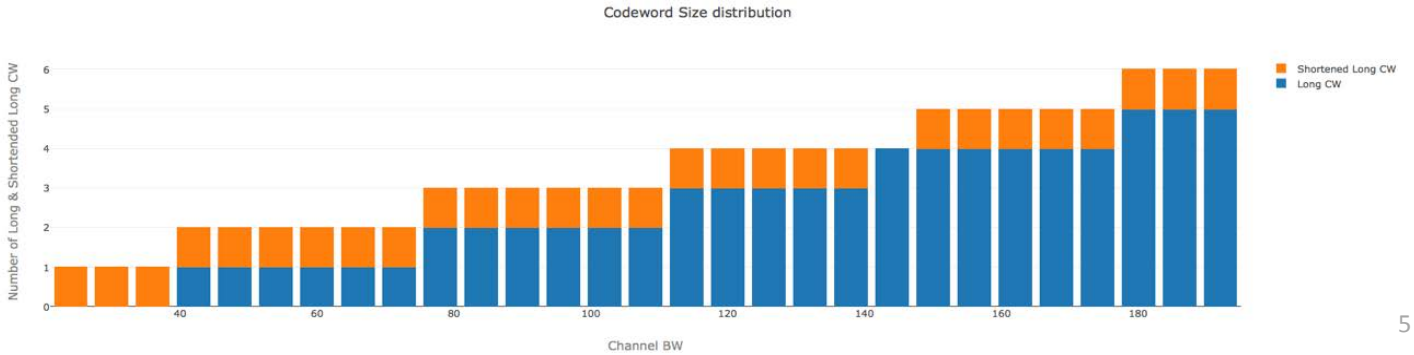
Downstream has PLC & Continuous & Scattered Pilots

DS FEC

Long

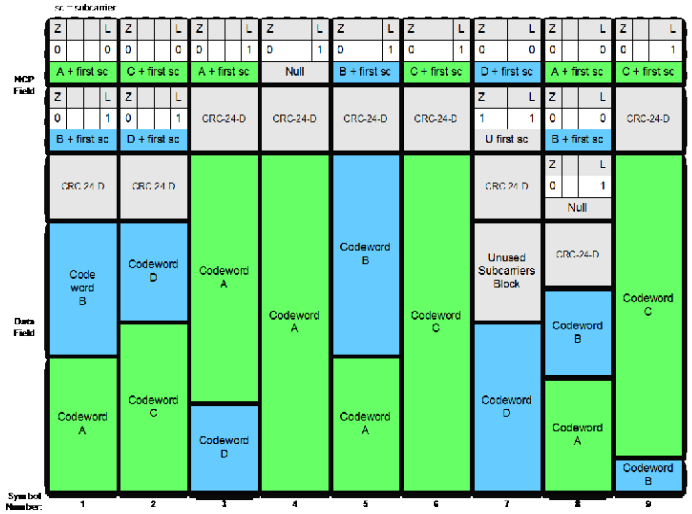
Shortended Long



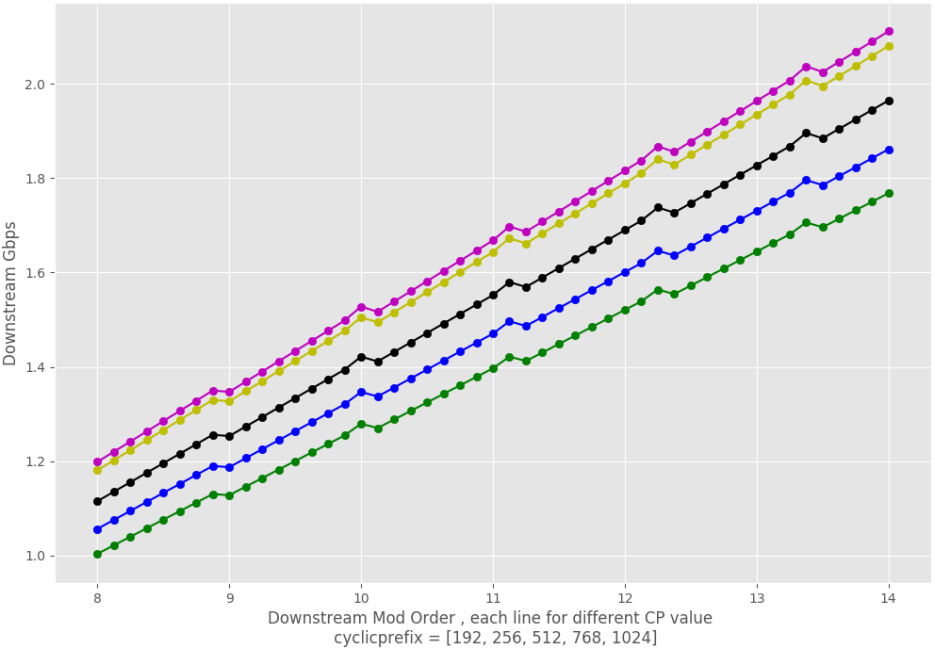


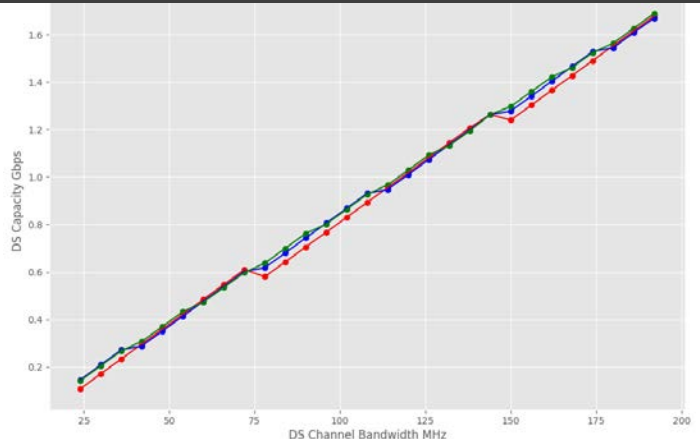
NCP, MMM overhead

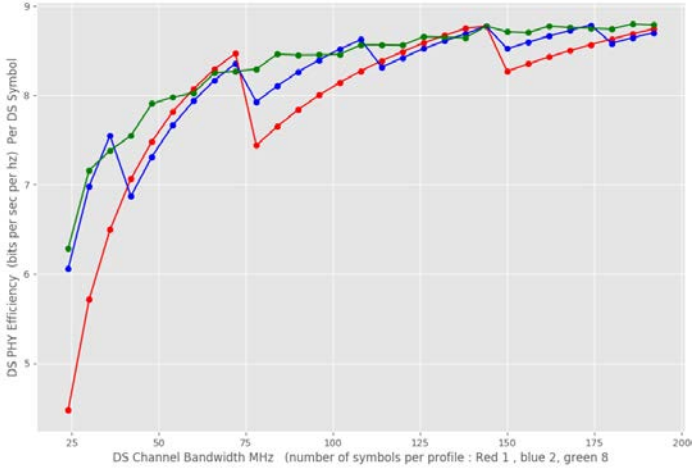
- MDDs, DPDs, OCDs, UCDs, Syncs, ~38Kbps.
- + MAPs → 2.4 Mbps.



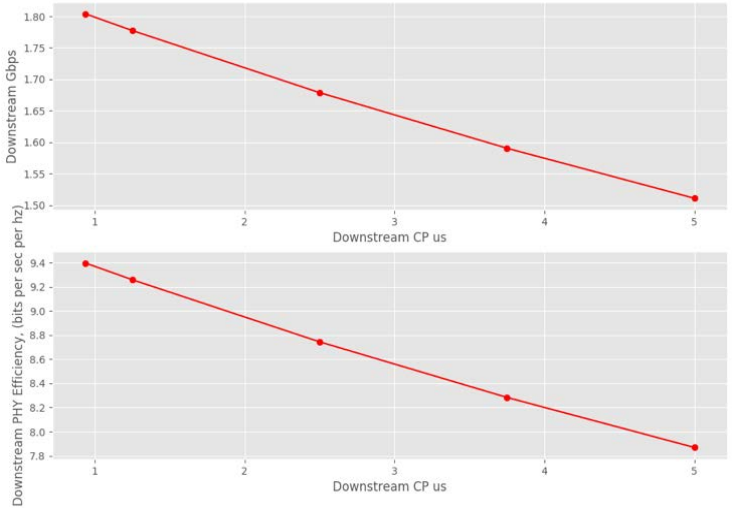
Capacity & PHY Rate Efficiency

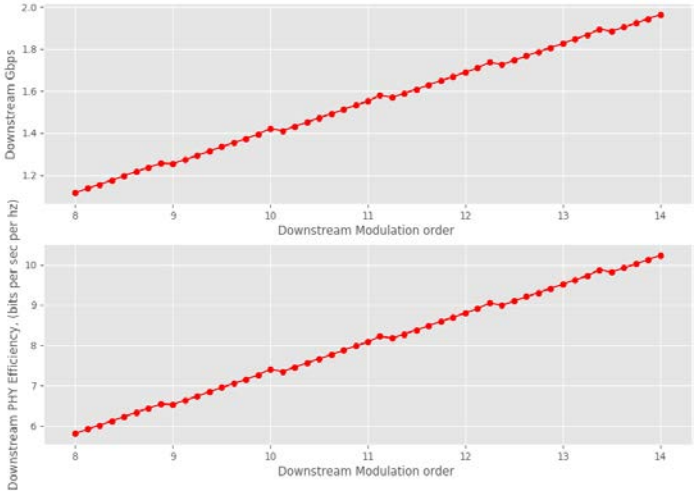






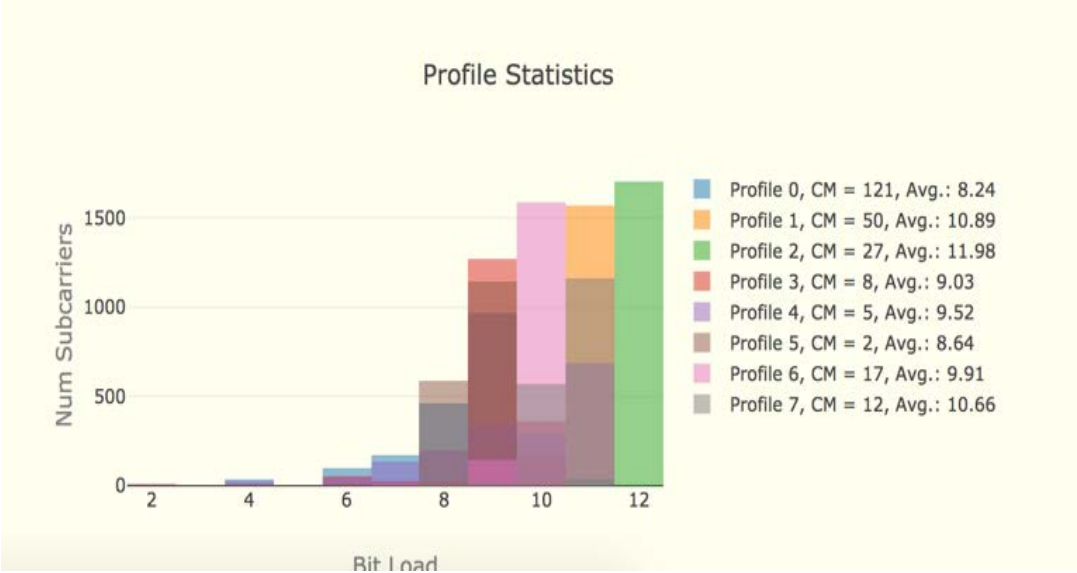
CP & Mouldation order





Multiple Profiles

Weighted average across all profiles and CMs



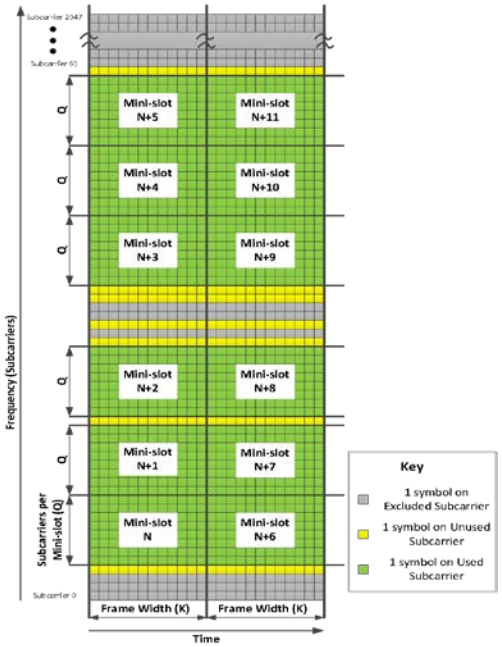
Band Edges, Subcarriers, Symbol sizes, Cyclic Prefix

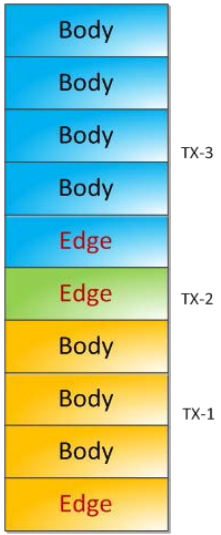
Parameter	Value	
Upstream Sampling Rate (fsu)	102.4 MHz	
Upstream Elementary Period Rate (Tsu)	1/102.4 MHz	
Channel bandwidths	10 MHz, …, 95 MHz	6.4 MHz, …, 95 MHz
IDFT size	2048	4096
Subcarrier spacing	50 kHz	25 kHz
FFT duration (Useful symbol duration) (Tu)	20 µs	40 µs
Maximum number of active subcarriers in signal (for 95 MHz channel) 1900 3800	1900	3800

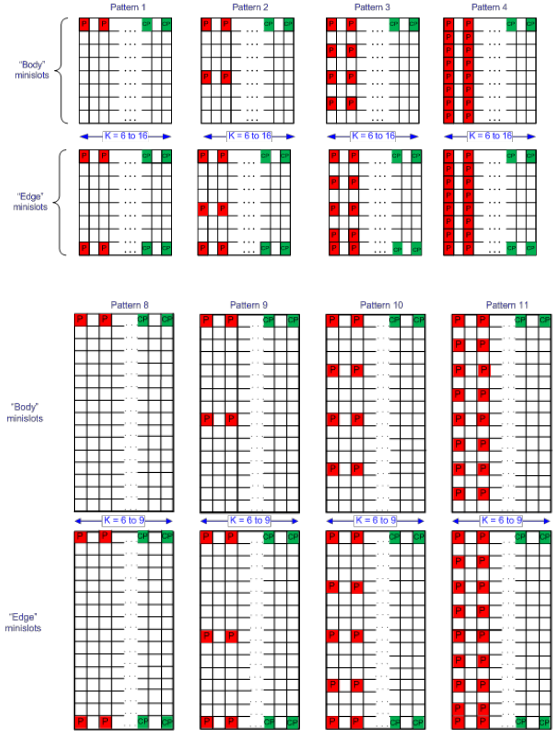
Cyclic Prefix (us)
0.9375 µs
1.25 µs
1.5625 µs
1.875 µs
2.1875 µs
2.5 µs
2.8125 µs
3.125 µs
3.75 µs
5.0 µs
6.25 µs

BPSK, QPSK, 8-QAM, 16-QAM, 32-QAM, 64-QAM, 128-QAM, 256-QAM, 512-QAM, 1024-QAM, 2048-QAM, and 4096-QAM

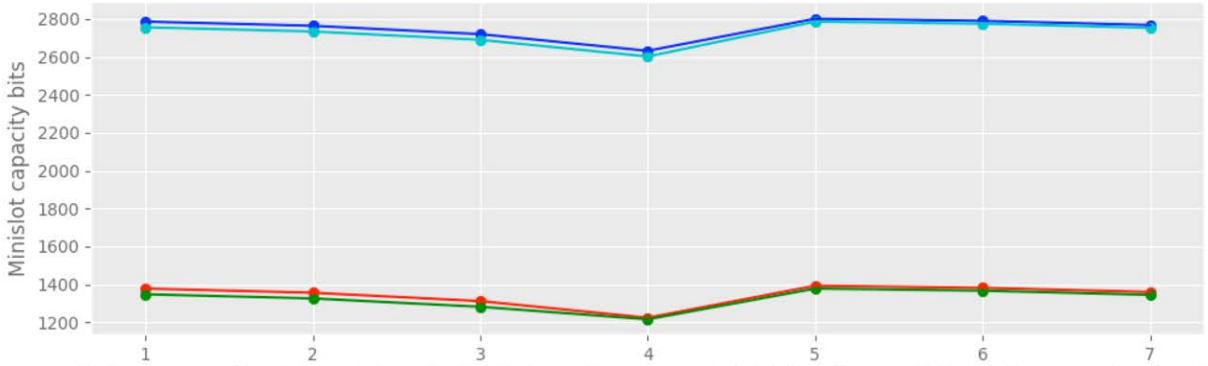
Frames Minislots & Pilots

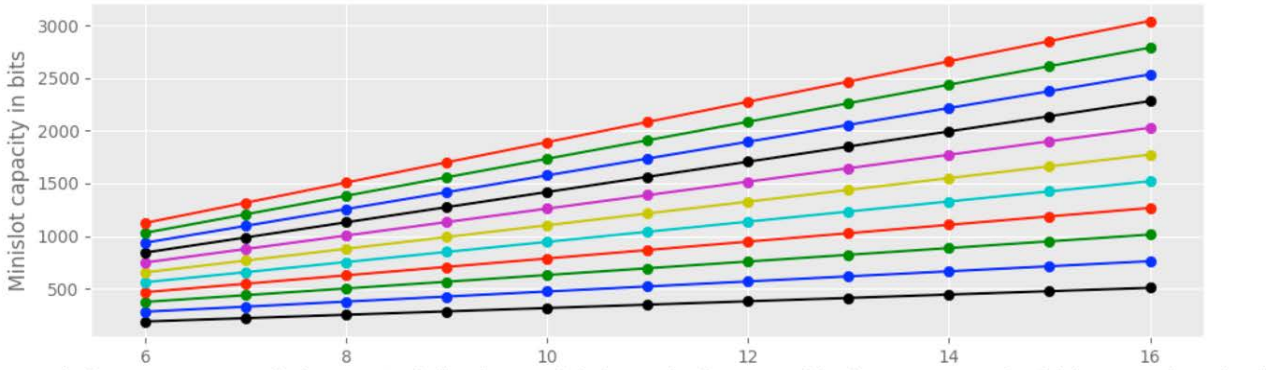




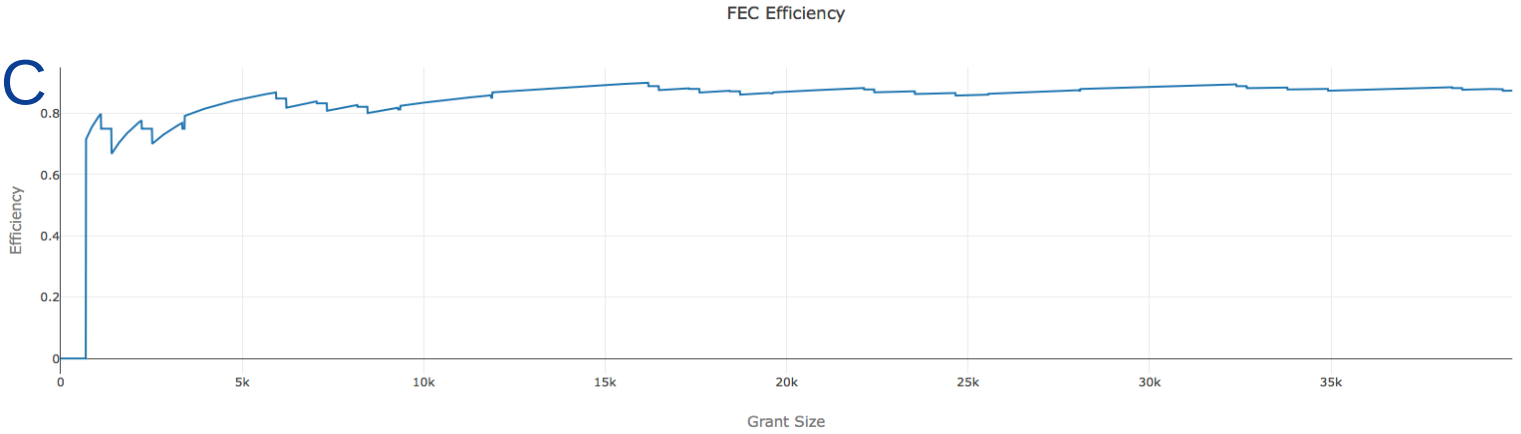


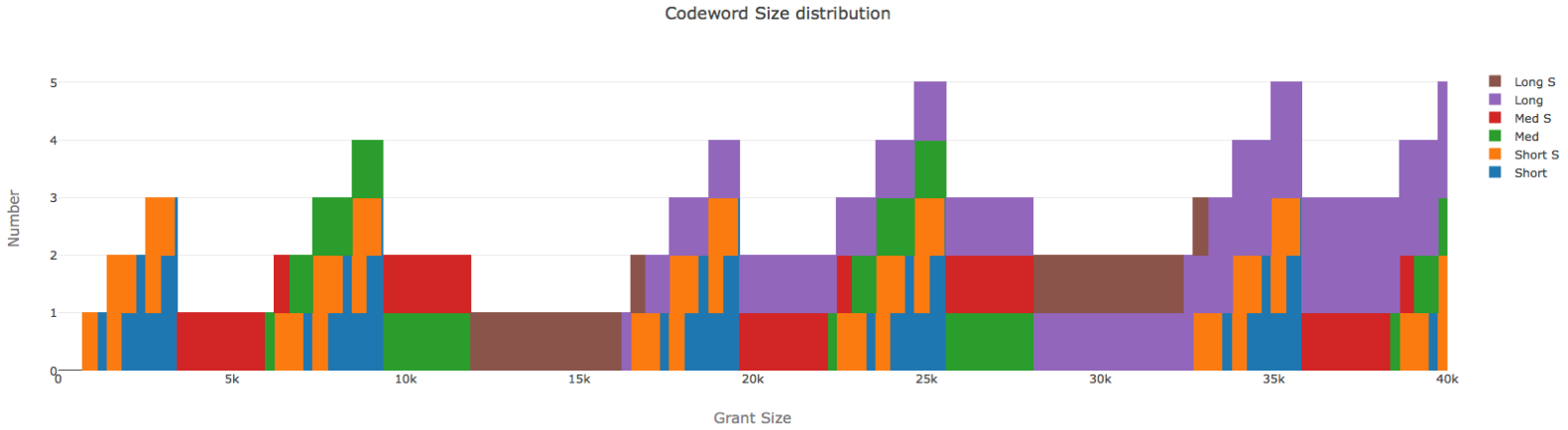
Minislot Capacity



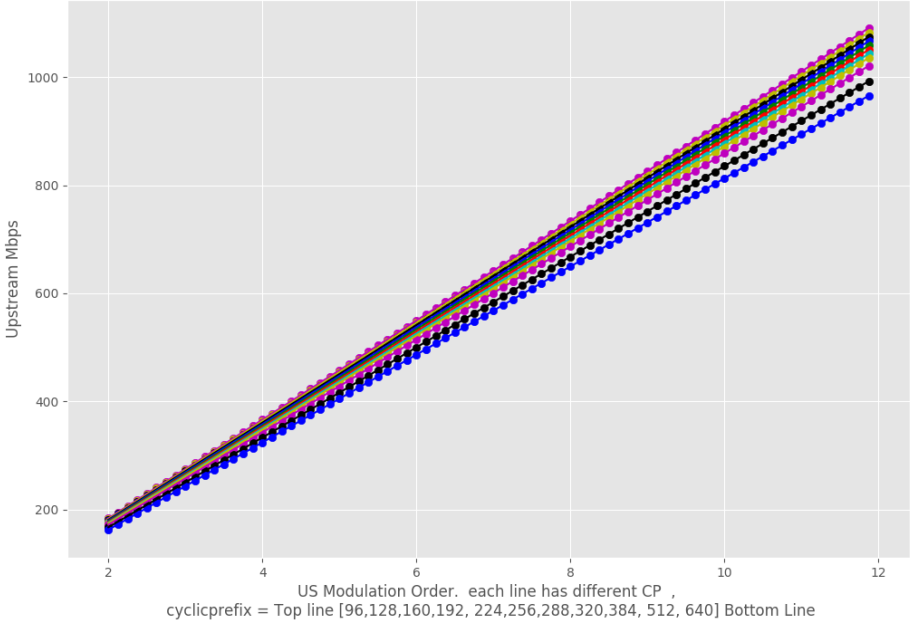


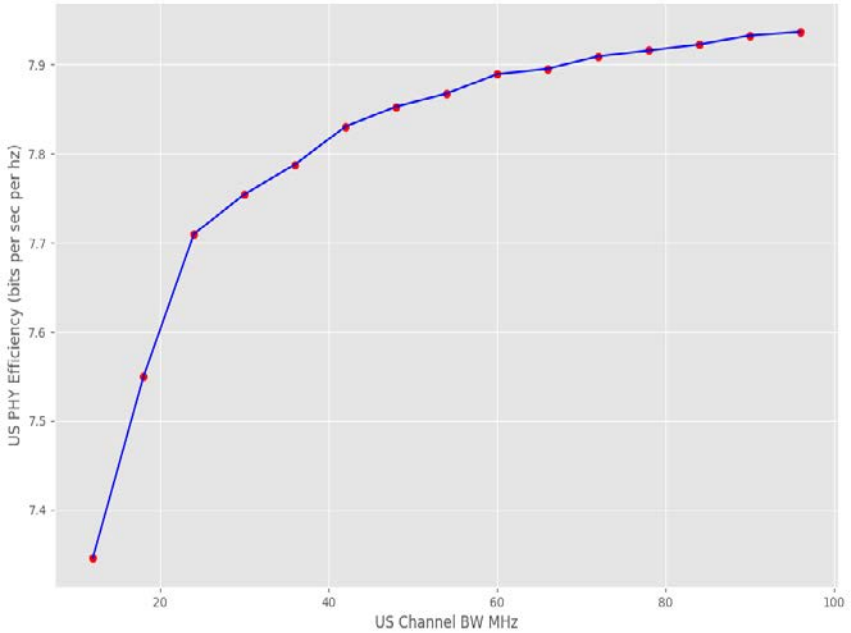
US FEC



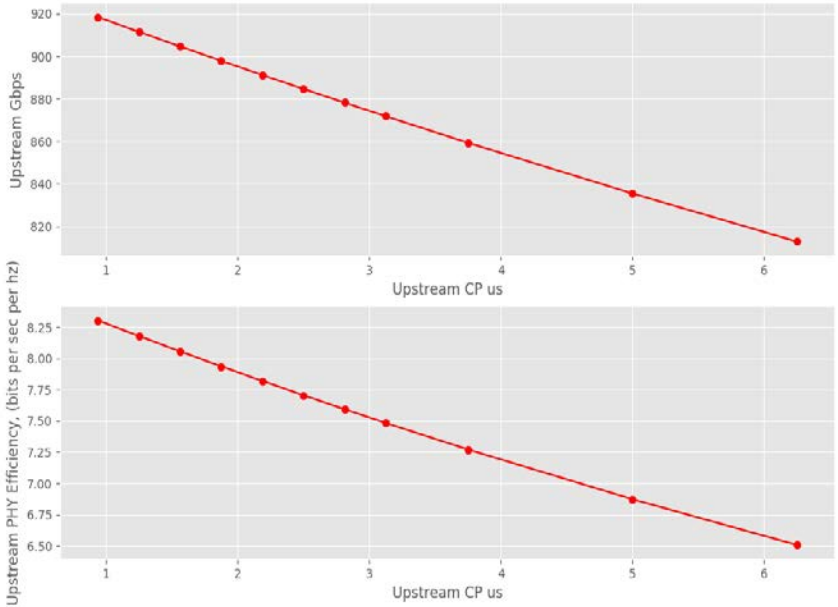


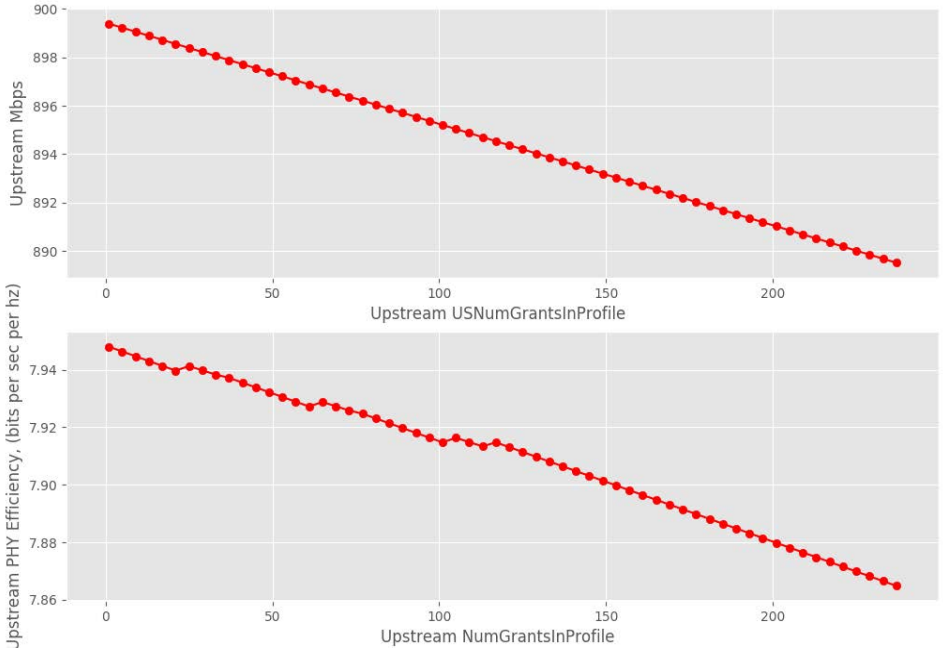
Capacity & PHY Rate Efficiency





Grant sizes



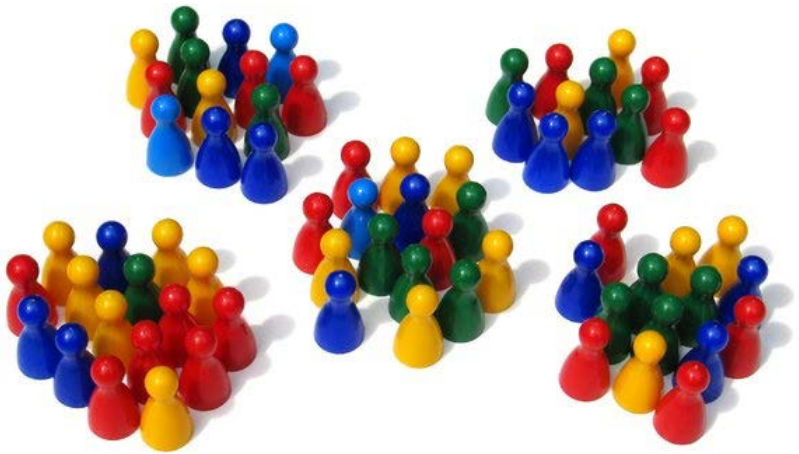


Multiple Profiles

Monte carlo simulations

Weighted average.

D3.1 Capacity Calculations :
Python scripts available



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THANK YOU!

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