



Opus Testing Results

Experiment 1 and 2

Question: Can Opus replace AMR-WB in Cellular Networks?

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Idea

- Use the same parameter settings as in a typical AMR-WB usage scenario.
- This includes
 - typical AMR-WB bit rates
 - CBR
 - 20ms frame size
 - DTX
 - voice and background noise
 - Not bit errors because Opus cannot cope with them

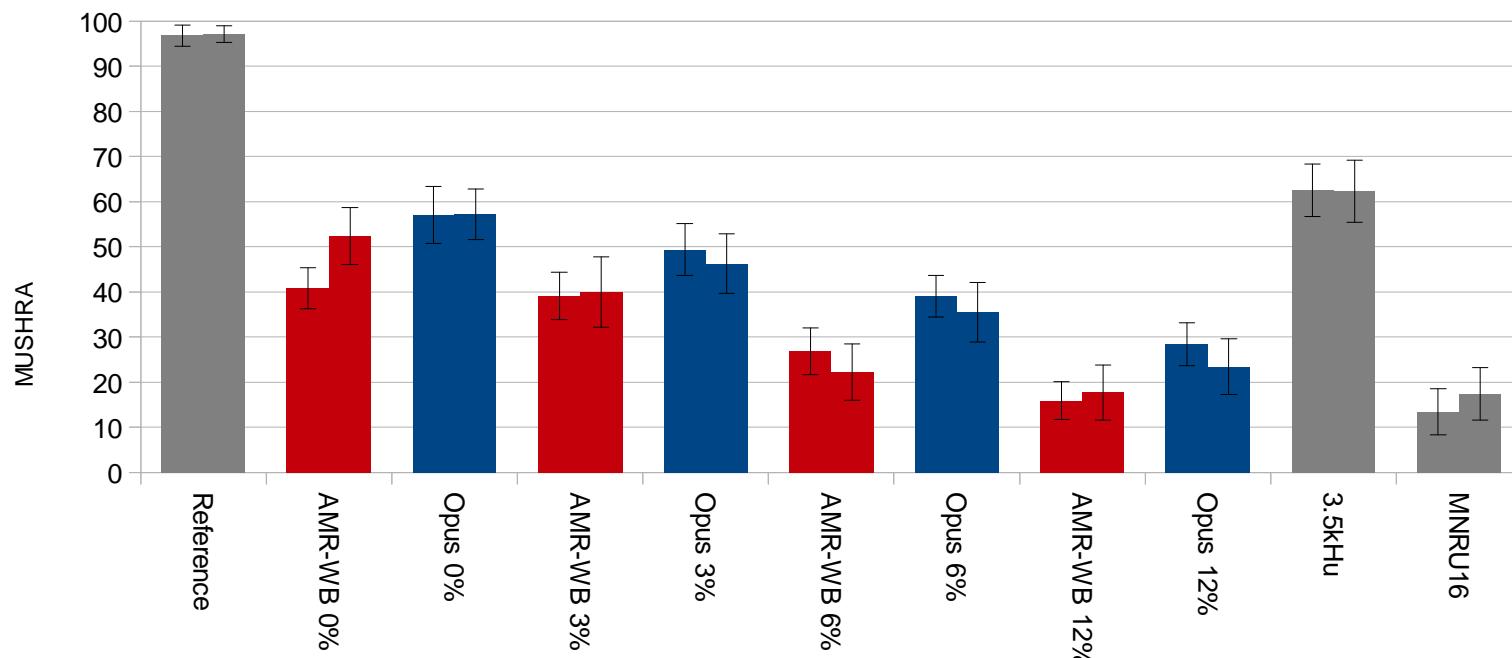
Experiment 1 - Conditions

Can Opus replace AMR-WB in cellular networks?

Main Codec Conditions		
Candidate Codecs	2	Opus and AMR-WB (both CBR)
Sampling rate	1	16 kHz
FERs	4	No error and 3, 6, and 12% random
Input level	1	-25 dbov (refer to ITU-T P.56 and G.191)
Bitrate	3	8.85 with DTX, 12.65 with DTX, 23.85 kbps with DTX
Noise	1	Clean speech

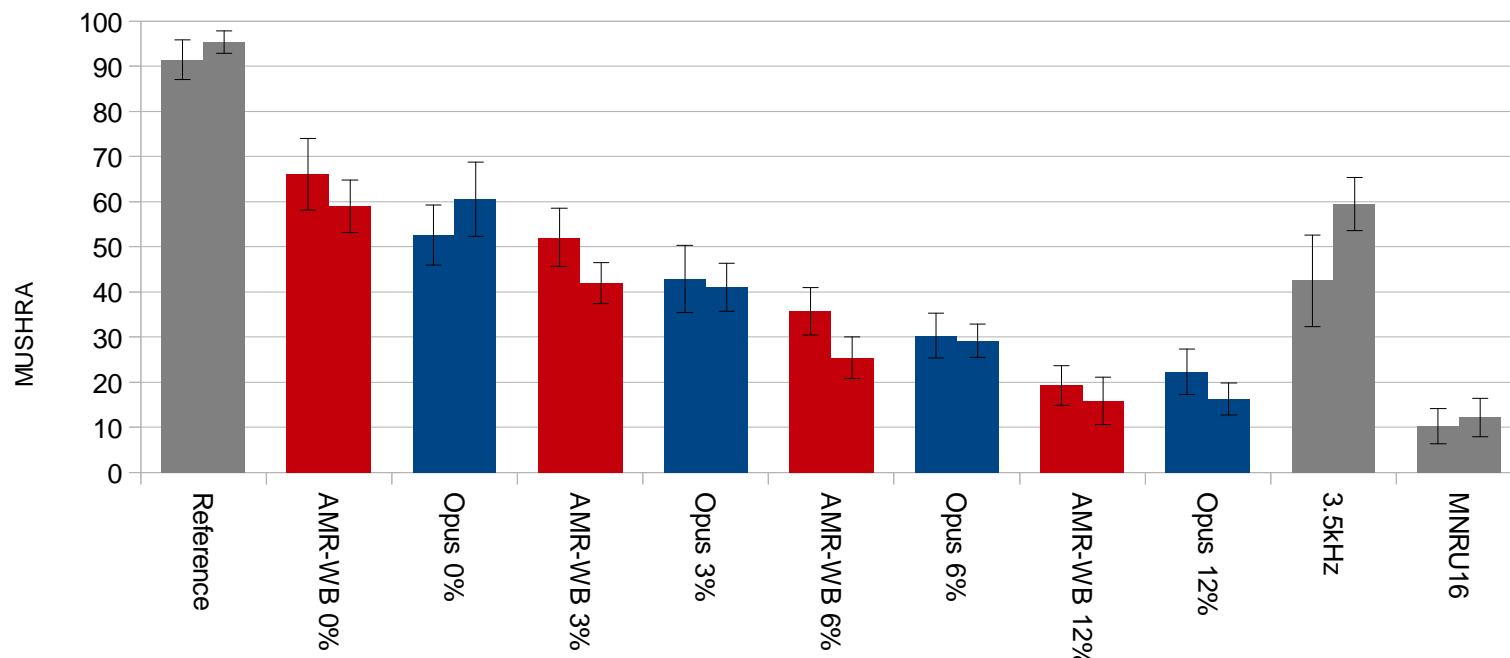
Experiment 1.1 and 1.2

Female (left) and male (right) voice, 16kHz, mono, 8850bps, each 19 subjects



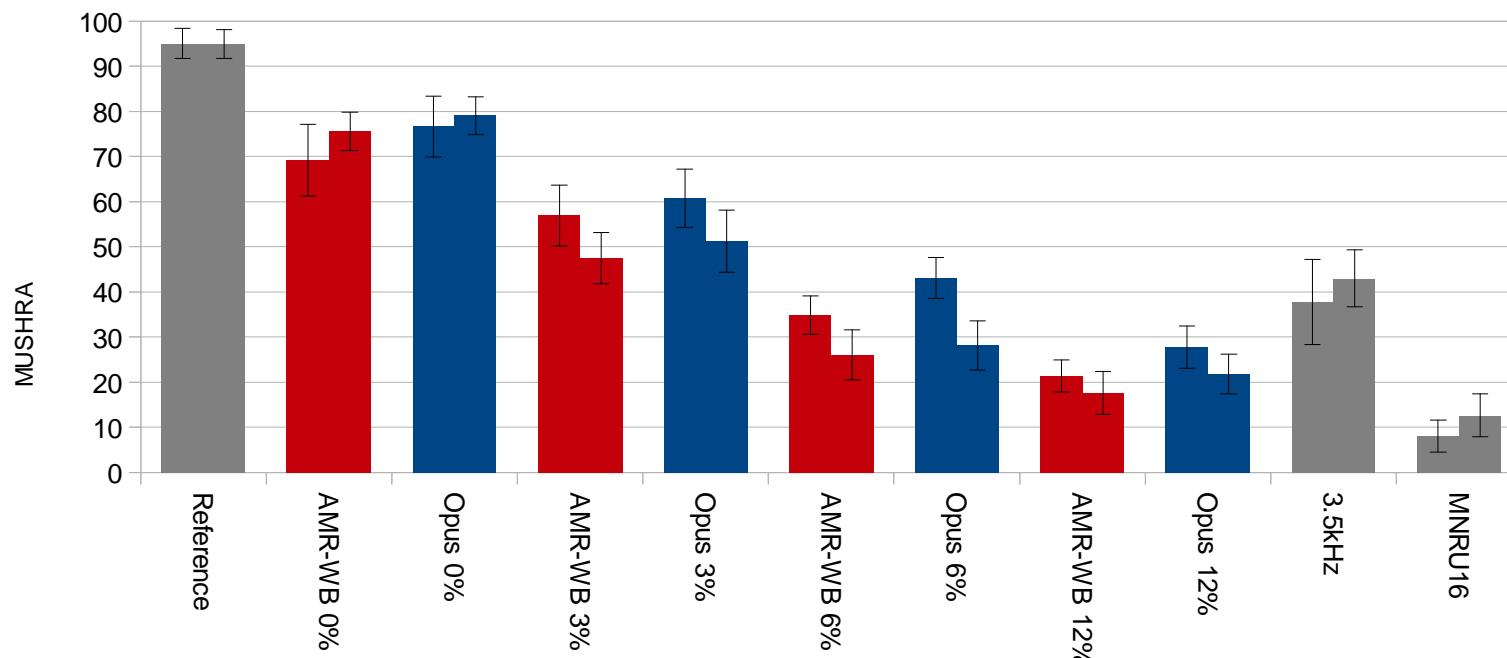
Experiment 1.3 and 1.4

Female (left) and male (right) voice, 16kHz, mono, 12650bps, 21/23 subjects



Experiment 1.5 and 1.6

Female (left) and male (right) voice, 16kHz, mono, 23850bps, 23/21 subjects



Experiment 1 - Conclusion

- Summary:
 - Opus better at bitrate 8850bps for female voice and all loss rates (except for 3% loss → no significant difference)
 - No significant difference at bitrate 8850bps for male voice except at 6% loss where Opus is better
 - All others no significant difference
- Conclusion:
 - Opus compresses clean speech and conceals packet loss at least as good as AMR-WB
 - But: Opus does not allow for bit errors

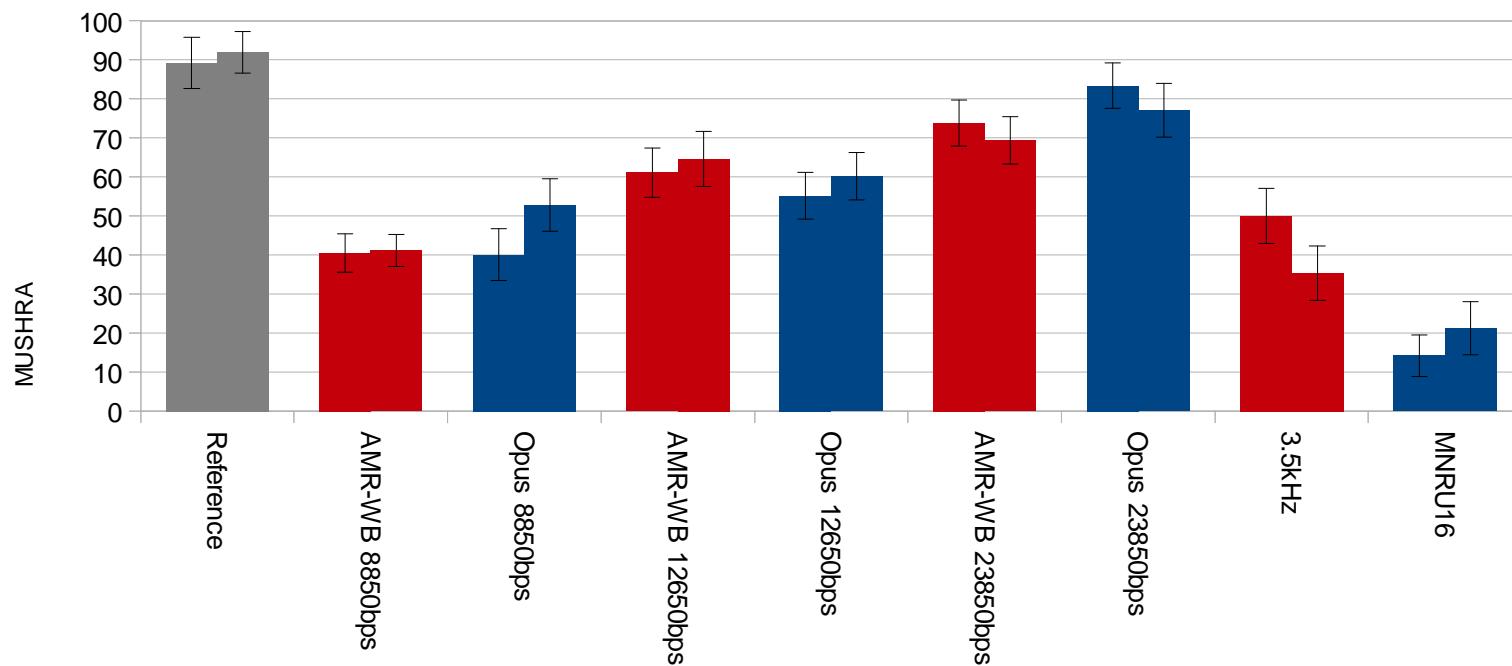
Experiment 2 - Conditions

Does Opus compress speech well in the presence of background noise compared to AMR-WB?

Main Codec Conditions		
Candidate Codecs	2	Opus and AMR-WB (CBR)
Sampling rate	1	16 kHz
FERs	2	No error and 6 % random error
Input level	1	-25 dbov
Bitrate	3	8.85 with DTX, 12.65 with DTX, and 23.85 kbps with DTX
Noise	2	Types of noises: Office, babble
Input Characteristic	1	Full band

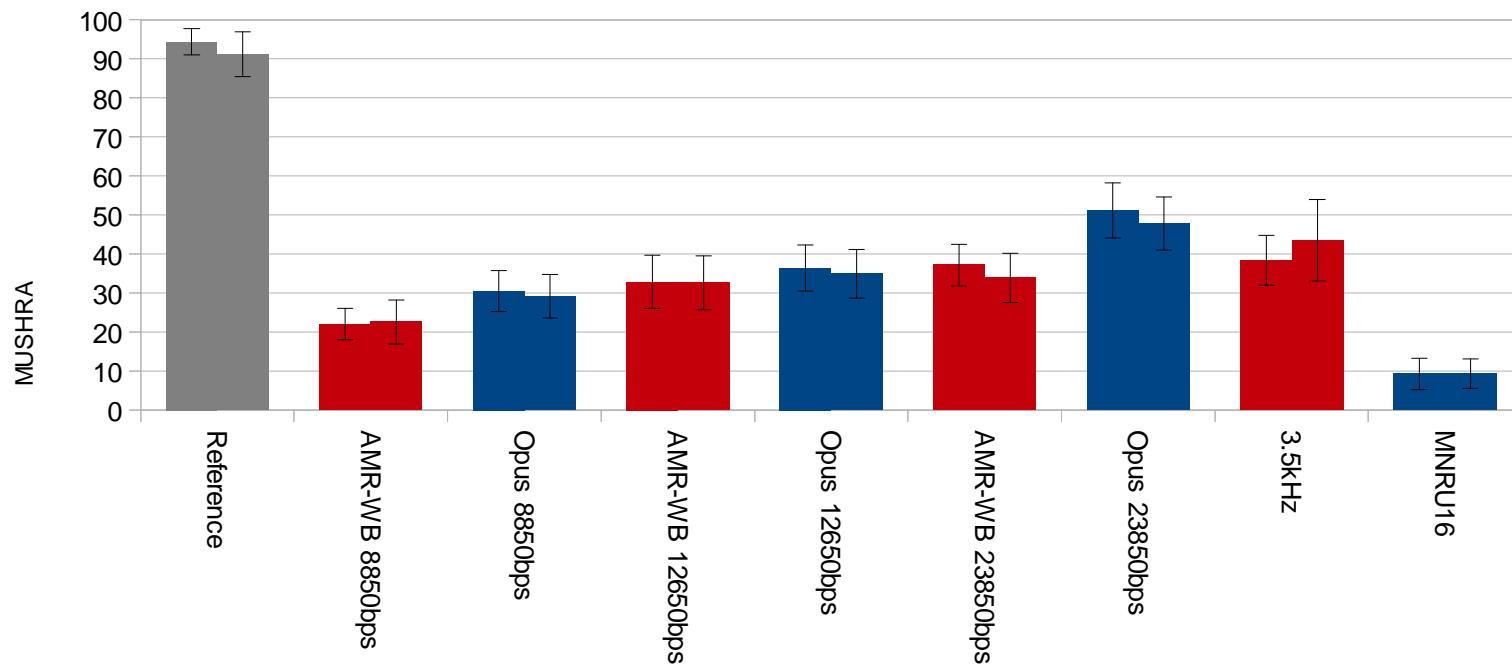
Experiment 2.1 and 2.2

Female voice, 16kHz, mono, babble (left) and office (right) noise, 0%, 17 and 21 subjects



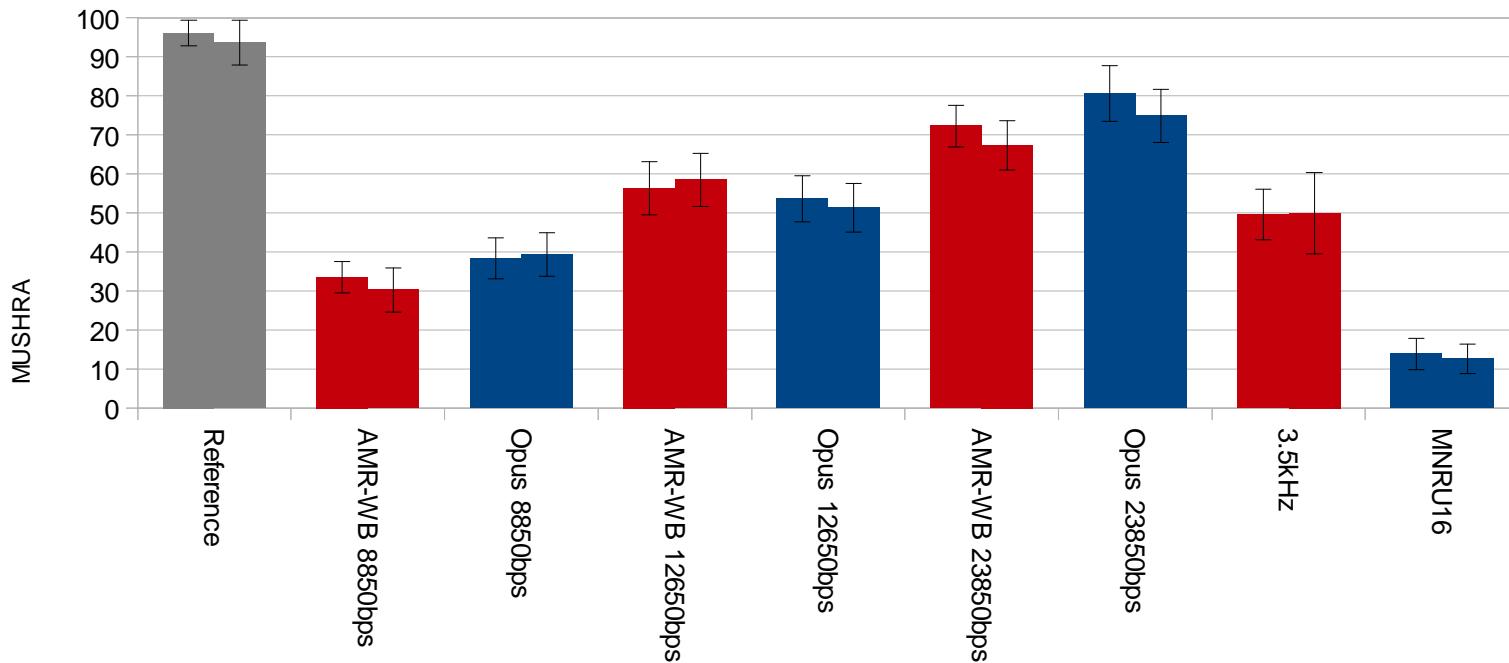
Experiment 2.3 and 2.4

Female voice, 16kHz, mono, babble (left) and office (right) noise, 6%, 17 and 21 subjects



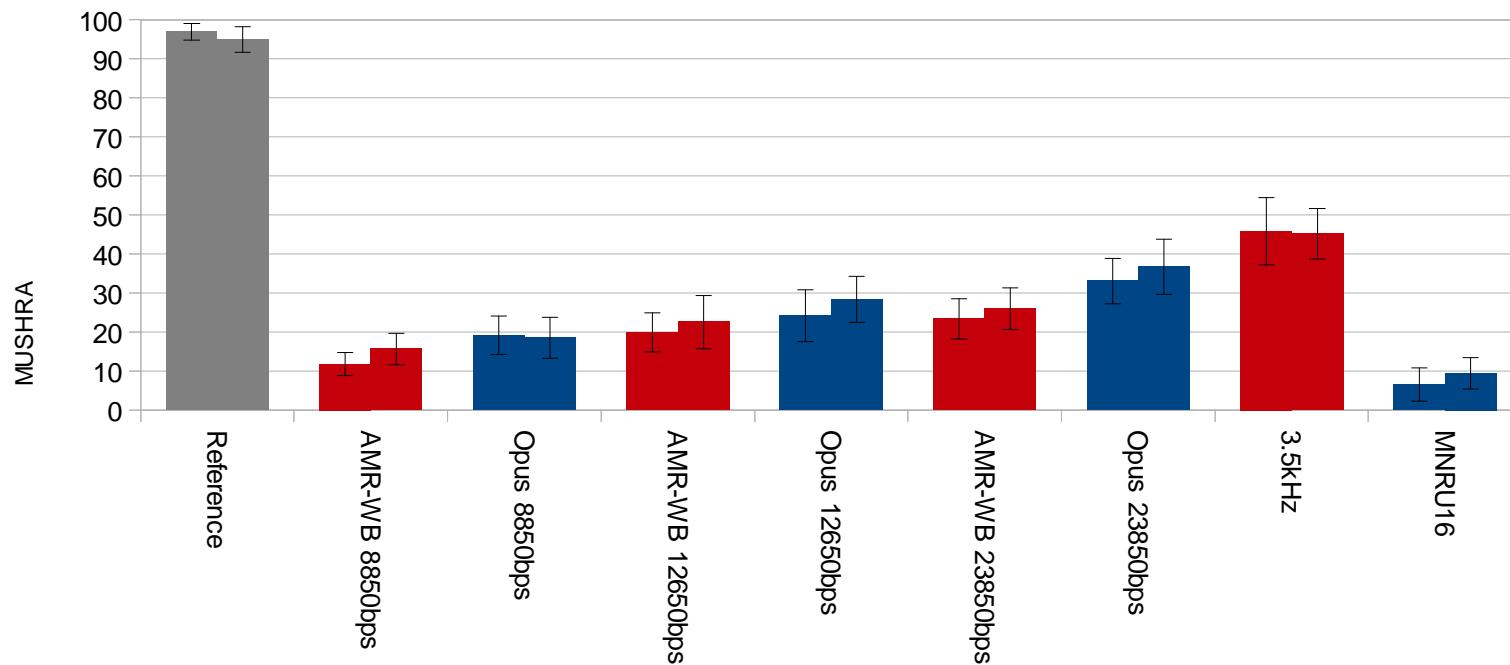
Experiment 2.5 and 2.6

Male voice, 16kHz, mono, babble (left) and office (right) noise, 0%, 19 and 16 subjects



Experiment 2.7 and 2.8

Male voice, 16kHz, mono, babble (left) and office (right) noise, 6%, 17 and 22 subjects



Experiment 2 - Summary

- Both codecs compress voice with background noise well.

Conclusion

- The results are based on 1386 individual
- In many of the studied cases, Opus is slightly better than AMR-WB
- However, as Opus is not tolerant to bit errors thus in a cellular network, more FEC on the wireless link is needed.

Result: On a Par