Initial LTE Voice Performance Indicators

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Presentation Materials

- All presentations can be downloaded from http://pscr.gov/agenda.php

- Send questions and/or comments at any time during the meeting to 700mhz@its.bldrdoc.gov

Motivation

- Project 25 uses the IMBE vocoder, VoLTE specifies the AMR vocoder.
  - How do the two compare?
  - What happens if we start to interconnect these two systems?

- IMBE = Improved Multi-Band Excitation defined in TIA 102.BABA

- AMR = Adaptive Multi-Rate defined by the Global System for Mobile Alliance (GSMA)

- VoLTE = Voice over Long Term Evolution defined by the GSMA in IR.92

Method

- Start with a simple study using objective measures (Perceptual Speech Quality Measure defined by ITU P.862)

- Compare single coding with AMR/IMBE transcodings

- See if directionality matters (i.e., which family of codec is first)

- See if transcoding causes significant reduction in quality
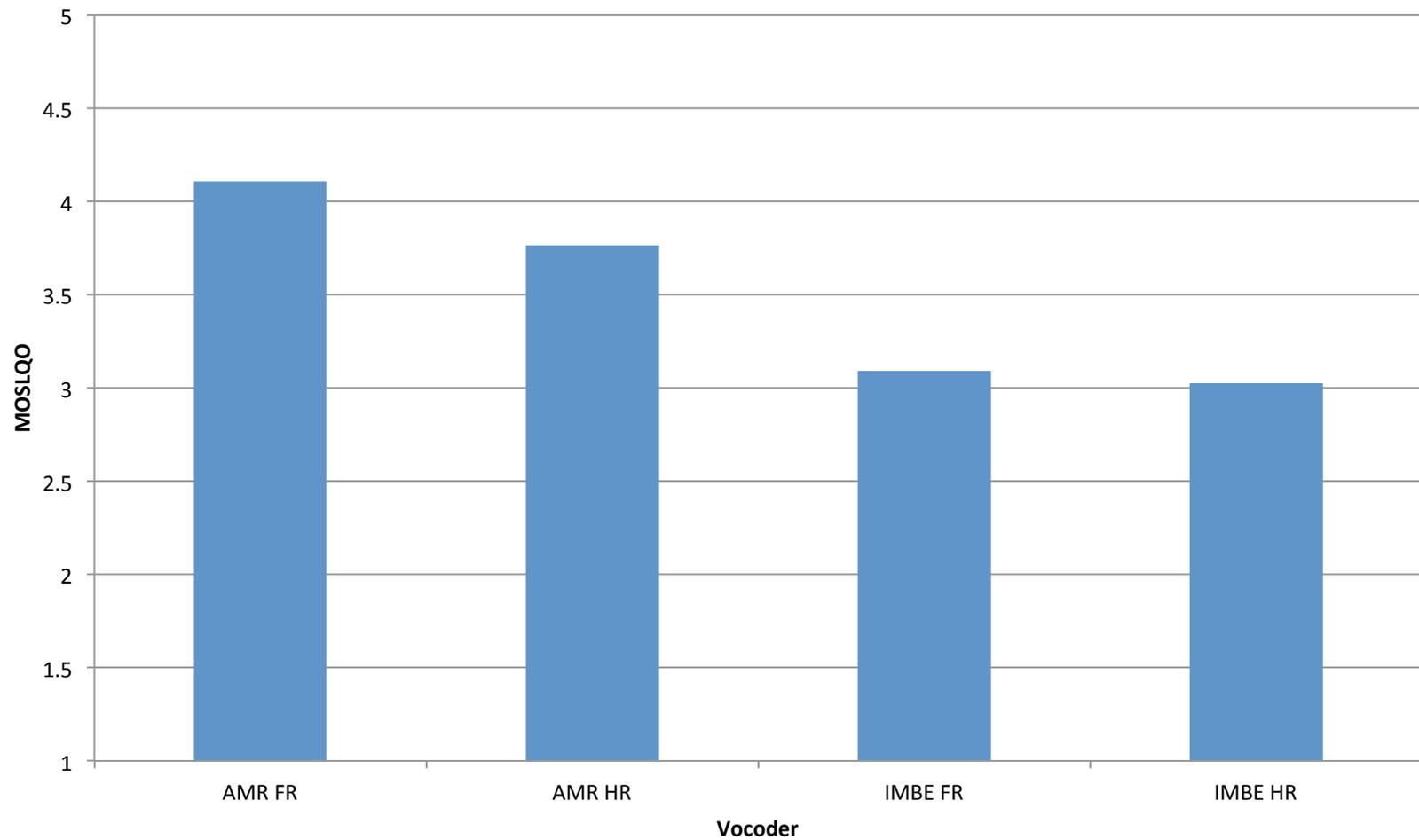
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Vocoders

- AMR Narrow Band Full Rate (AFR)
  - 12.2 kbps (mode 7)

- AMR Narrow Band Half Rate (AHR)
  - 7.4 kbps (mode 4)

- Project 25 IMBE Full Rate (IFR)
  - 4.4 kbps

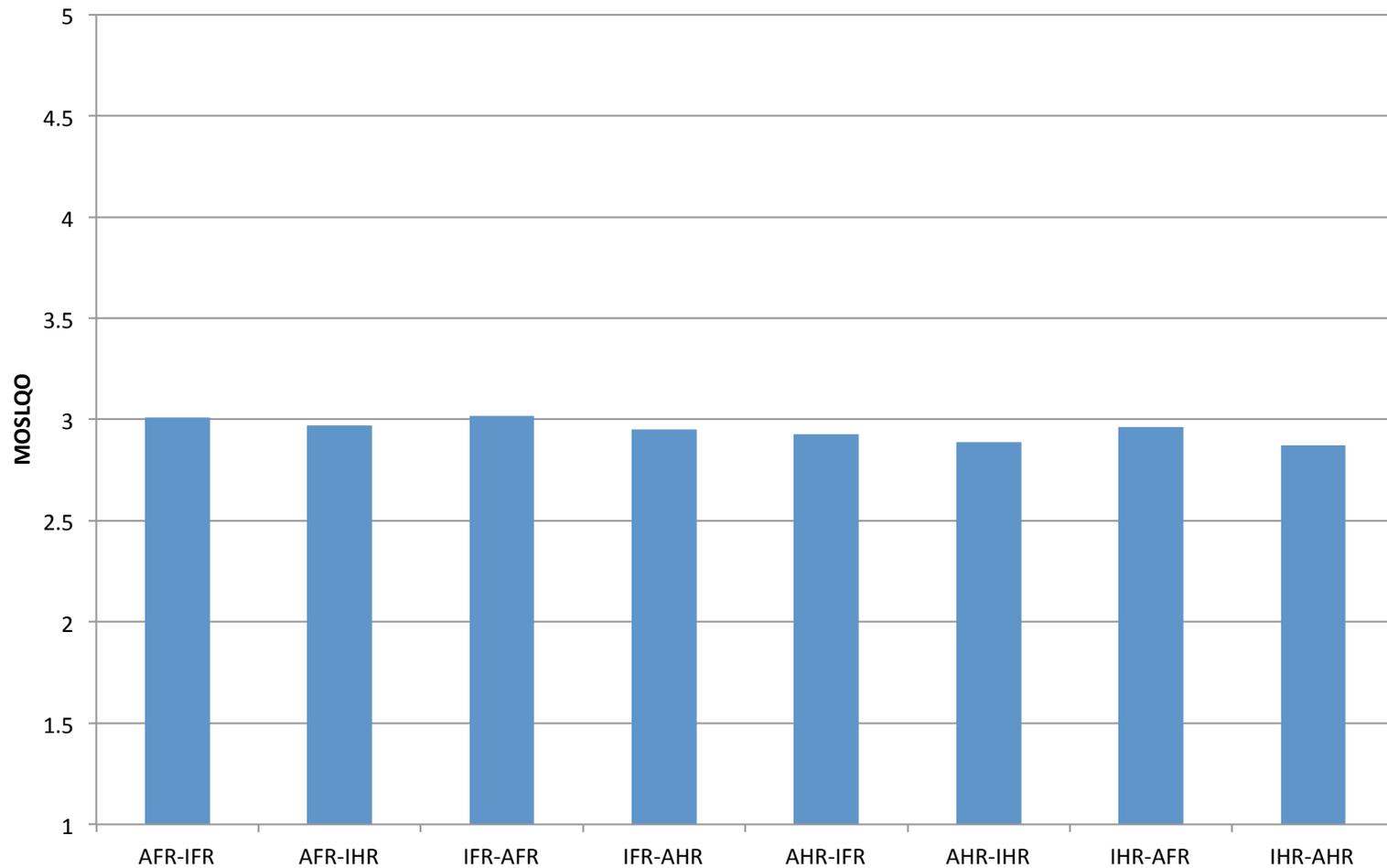- Project 25 IMBE Half Rate (IHR)
  - 2.45 kbps

List of Conditions

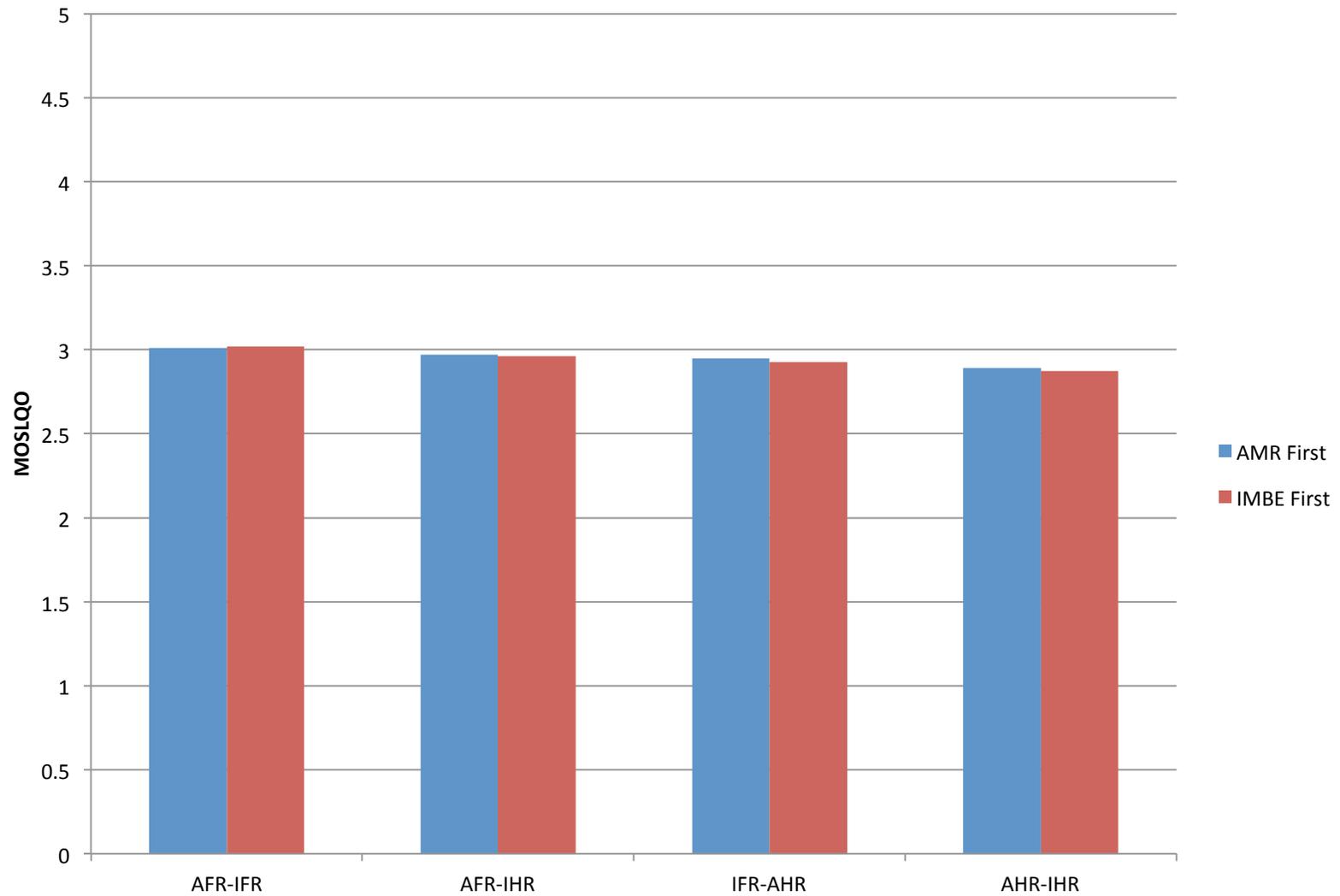| Condition Number	Description	Condition Number	Description
1	AFR	7	IFR -> AFR
2	AHR	8	IFR -> AHR
3	IFR	9	AHR -> IFR
4	IHR	10	AHR -> IHR
5	AFR -> IFR	11	IHR -> AFR
6	AFR -> IHR	12	IHR -> AHR

AMR and IMBE MOSLQO

AMR/IMBE Transcoding MOSLQO

Directionality Doesn't Matter

Forward and Backwards Transcoding Scores by Codec Pair

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Other Observations

- IMBE Full Rate is not significantly degraded by transcoding with AMR FR, but was by AMR HR

- IMBE Half Rate is not significantly degraded by transcoding with AMR FR, but was by AMR HR

- Even though analysis of variance indicated significance, the overall scores are still pretty close. (<0.2 MOSLQO)

Next Steps

- Conducting Background Noise Experiment
- Four Reference Systems
  - Analog 25 kHz, P25, AMR FR, AMR HR
- 7 noise environments
  - No BG noise
  - Mask (vox port), no BG noise
  - Mask (internal mic), no BG noise
  - Mask (vox port), PASS noise
  - Mask (internal mic), PASS noise
  - No Mask, night club noise
  - Mask (vox port), saw noise

Backup Slide

Results (The Details)

	AFR	AHR	IFR	IHR	AFR -> IFR	AFR -> IHR	IFR -> AFR	IFR -> AHR	AHR -> IFR	AHR -> IHR	IHR -> AFR	IHR -> AHR
AFR		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AHR	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IFR	Yes	Yes		No	No	Yes	No	Yes	Yes	Yes	Yes	Yes
IHR	Yes	Yes	No		No	No	No	No	No	Yes	No	Yes
AFR -> IFR	Yes	Yes	No	No		No	No	No	No	Yes	No	Yes
AFR -> IHR	Yes	Yes	Yes	No	No		No	No	No	No	No	No
IFR -> AFR	Yes	Yes	No	No	No	No		No	No	Yes	No	Yes
IFR -> AHR	Yes	Yes	Yes	No	No	No	No		No	No	No	No
AHR -> IFR	Yes	Yes	Yes	No	No	No	No	No		No	No	No
AHR -> IHR	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No		No	No
IHR -> AFR	Yes	Yes	Yes	No	No	No	No	No	No	No		No
IHR -> AHR	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	

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