



Presents
2006 IMTC Forum
ITU-T Workshop

A world map is visible in the background, split into two horizontal sections. The top section shows the continents of Africa, Europe, and Asia, while the bottom section shows South America and Australia. The map is overlaid on a grid of latitude and longitude lines.

**G.729EV: An 8-32 kbit/s scalable wideband
speech and audio coder bitstream
interoperable with G.729**

Presented by Christophe Beaugeant

**On behalf of ETRI, France Telecom,
Matsushita, Mindspeed, Siemens**



G.729EV Standardization history

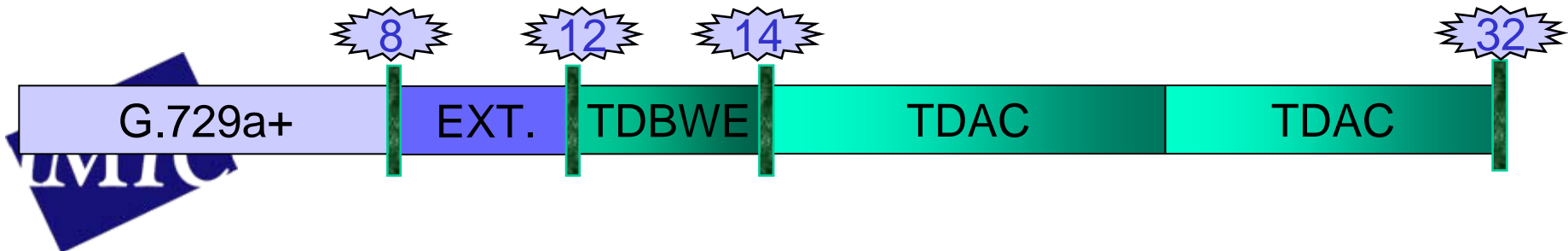
- Standardization work conducted in SG 16, WP 3, Question 10 (Rapporteur: Claude Lamblin)
- T0 (approval of Term of References) declared in November 2004
- Qualification test results in July 2005
 - ETRI, France Telecom, Matsushita, Mindspeed, Siemens and VoiceAge qualified
 - These companies collaborated together to provide a single candidate
- Optimization phase 08/05-01/06
- Quality assessment tests (02-03/06): G.729EV passed all the requirements.
- Current status: under AAP procedure at the ITU-T





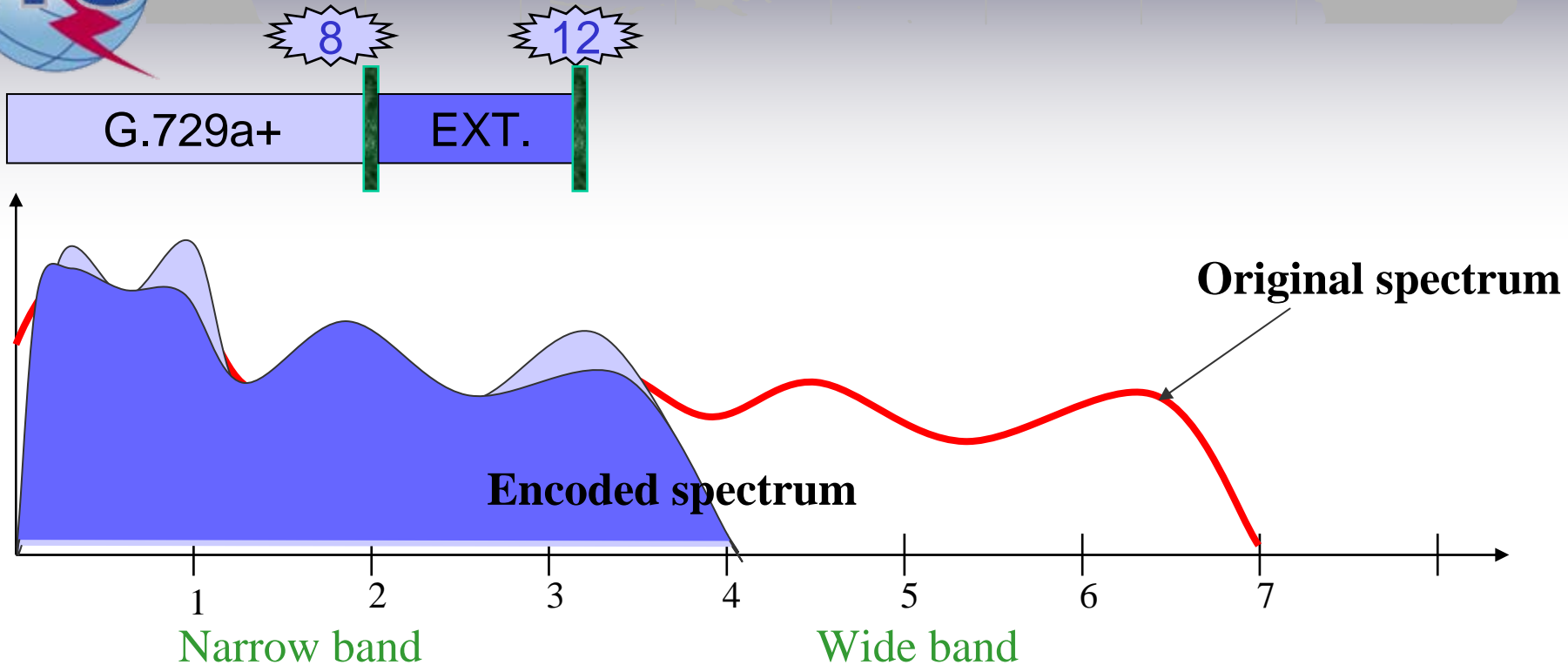
High level overview

- 8-32 kbit/s scalable wideband (50-7000 Hz) extension of G.729
 - Wideband: More natural voice, better intelligibility, enhance communication comfort
 - Scalability : flexibility; dynamic, simple and low cost bit rate adaptation
 - Robustness : packet loss protection and concealment integrated
- Build upon a three-stage structure, with 12 embedded layers:
 - layers 1-2 : CELP, 50-4000 Hz, 8 -12 kbit/s
 - Layer 3 : TDBWE, 50-7000 Hz, 14 kbit/s
 - Layers 4-12: TDAC, 50-7000 Hz, 14 to 32 kbit/s





G.729EV bitrate flexibility

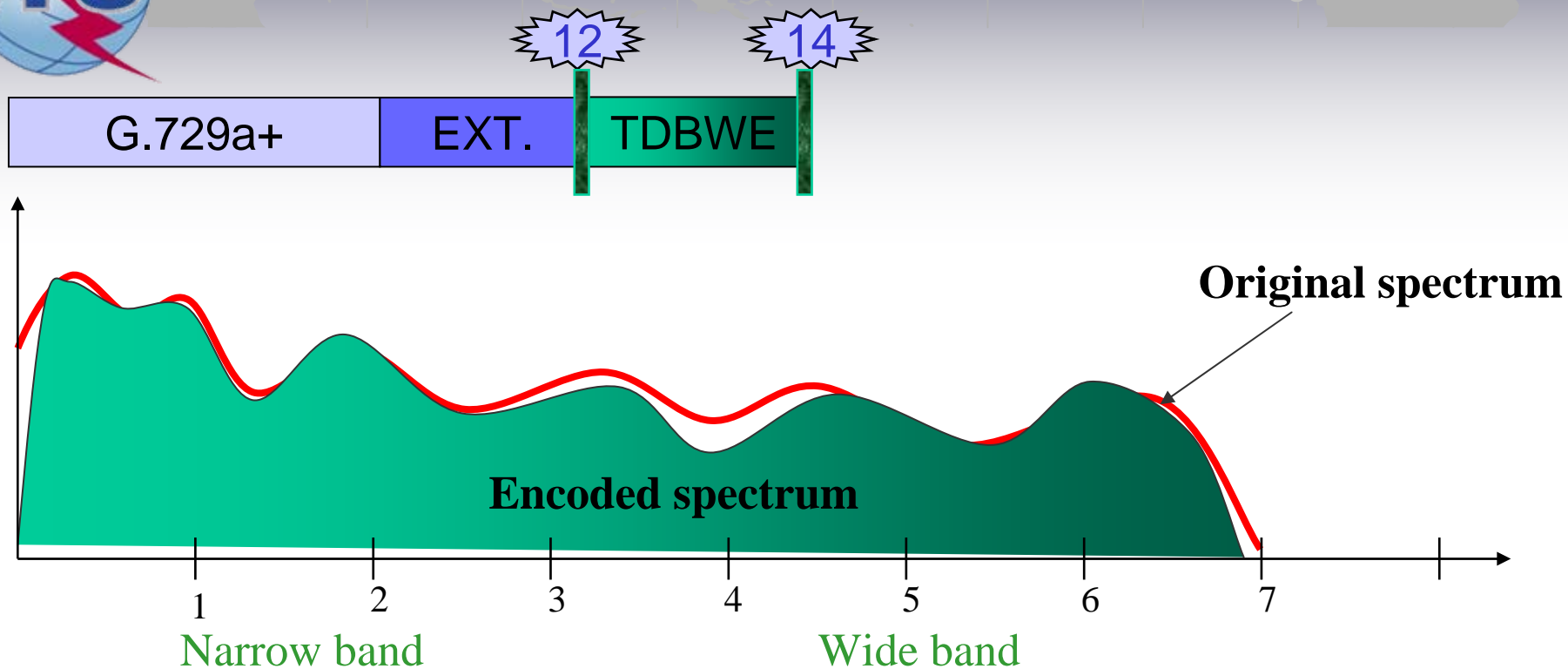


- Embedded CELP stage generates layers 1 and 2 : narrowband synthesis (50-4000 Hz) at 8 and 12 kbit/s.
- Layer 1 compliant with G.729 bitstream





G.729EV bitrate flexibility

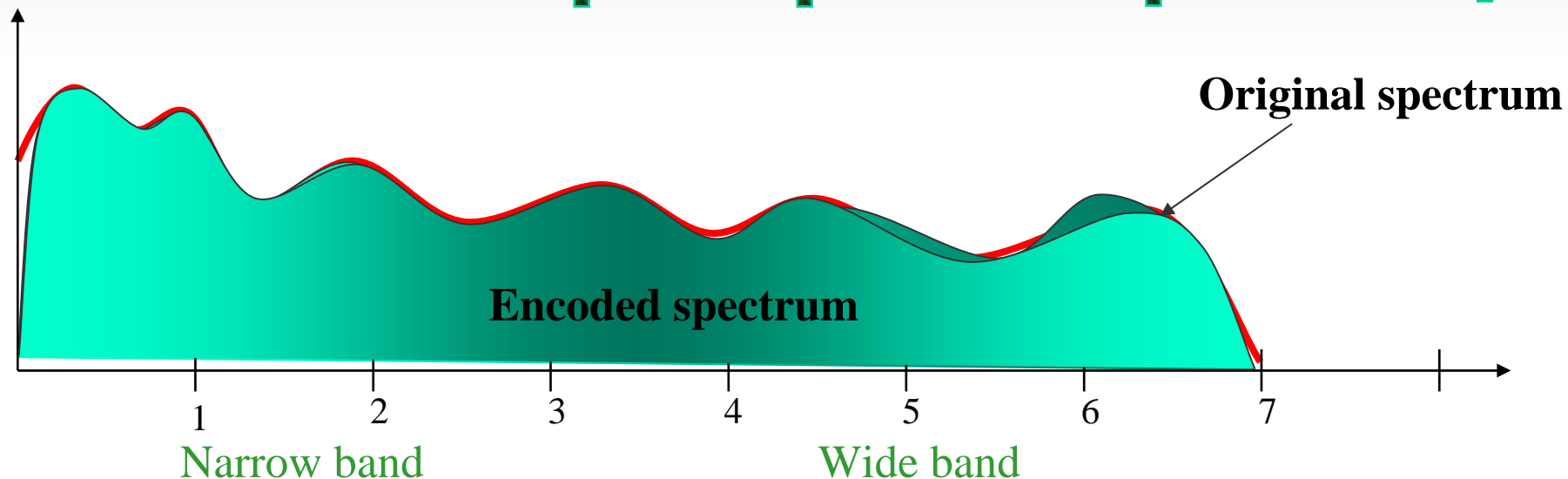
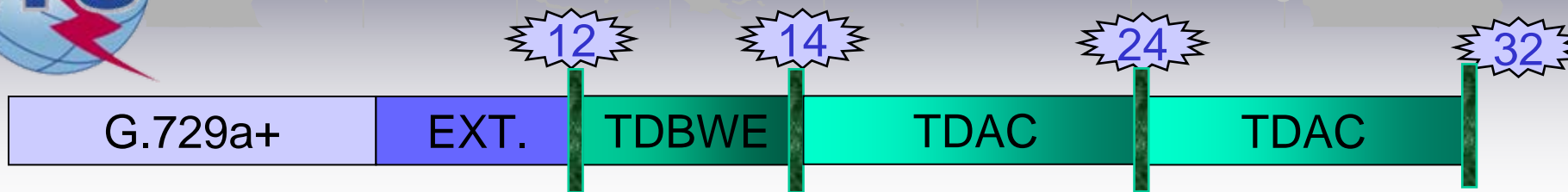


- Layer 3: Wideband Extension (TDBWE)
- Wideband output (50-7000 Hz) at 14 kbit/s





G.729EV bitrate flexibility

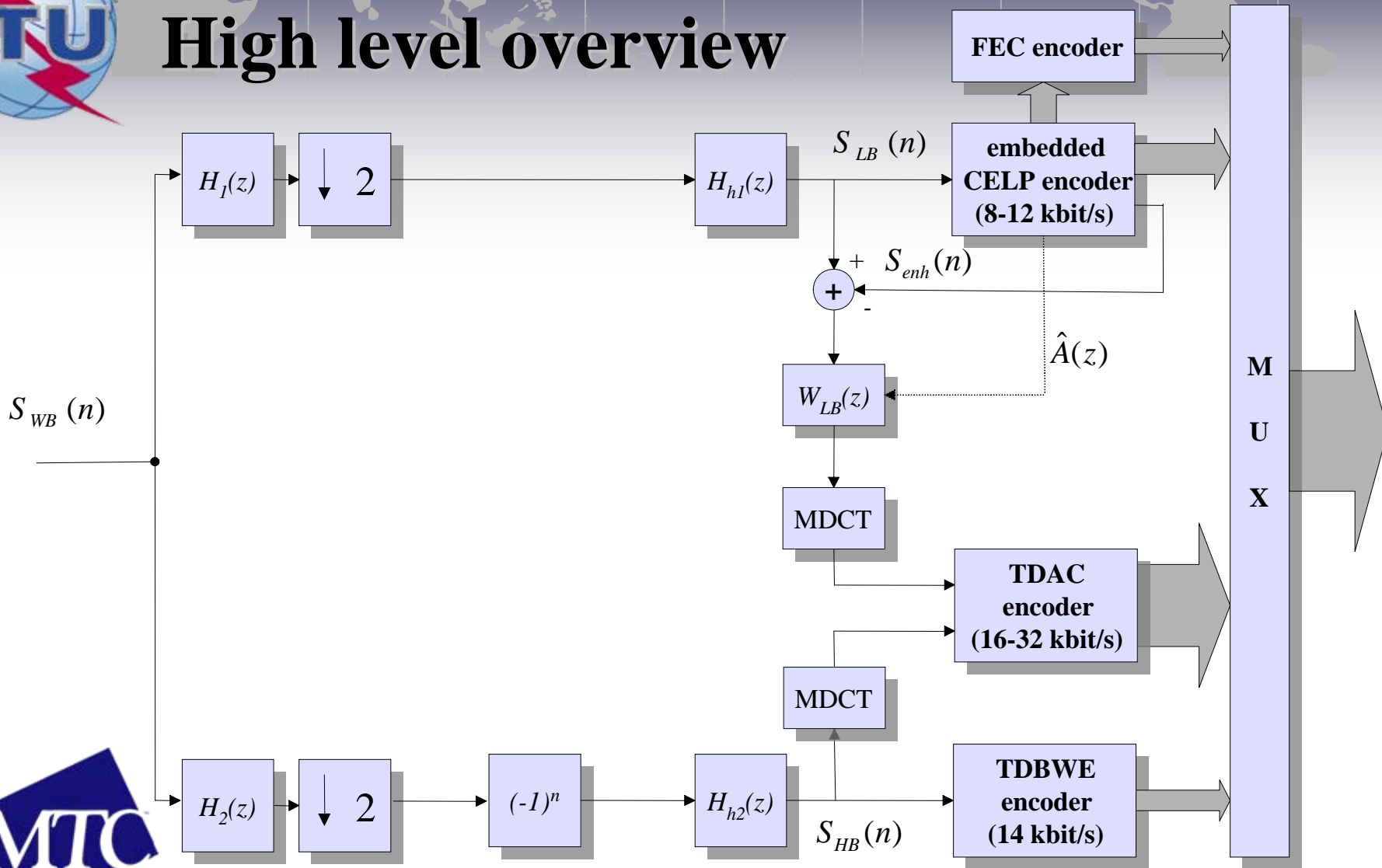


- Layers 4 to 12: Predictive transform coding referred as TDAC
- Quality improvement from 14 to 32 kbit/s.
- Encoding of the weighted CELP coding error in 50-4000 Hz band
- Encoding input signal in 4000-7000 Hz band.



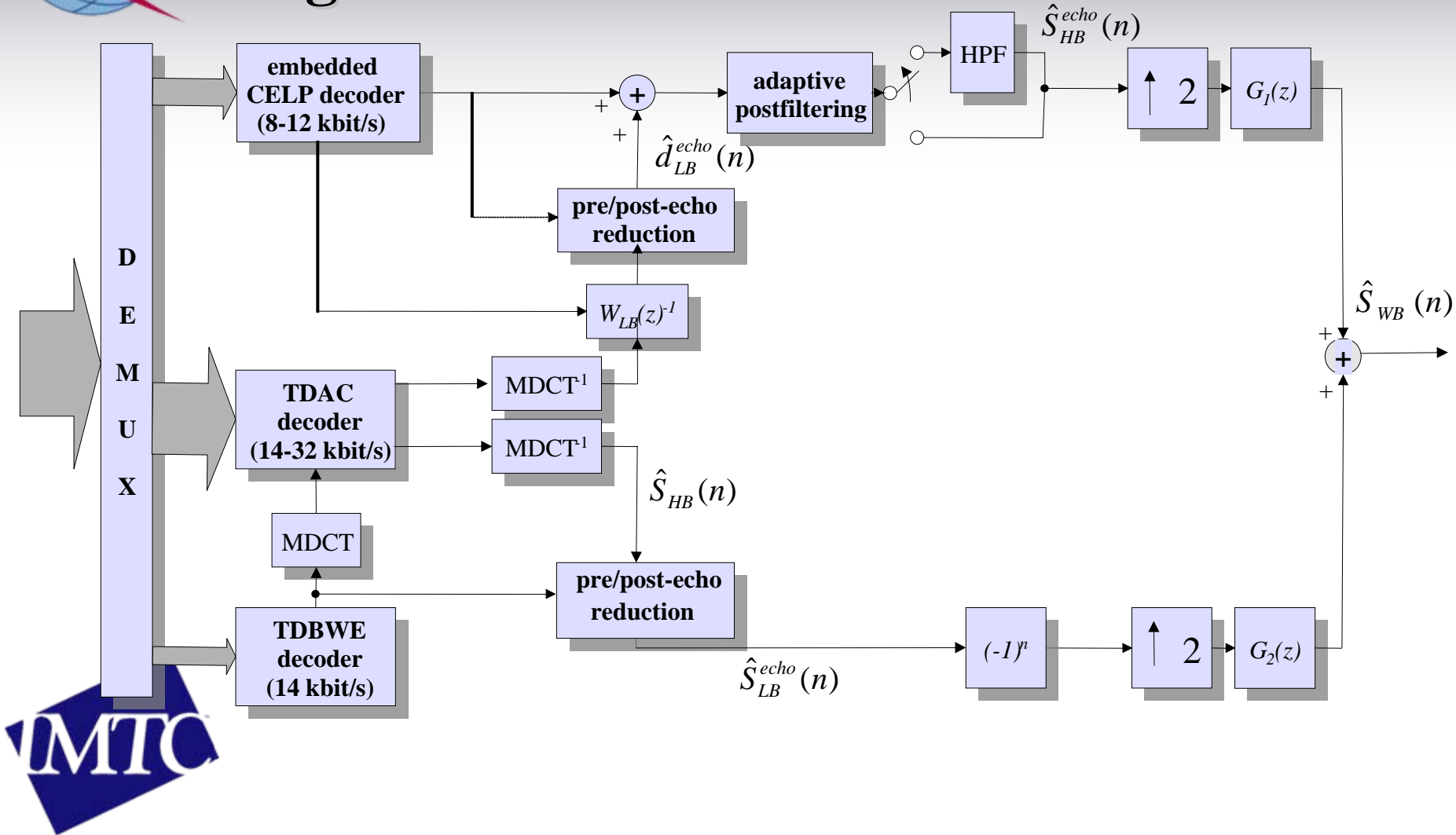


Encoder: High level overview





Decoder: High level overview





Quality of G.729EV

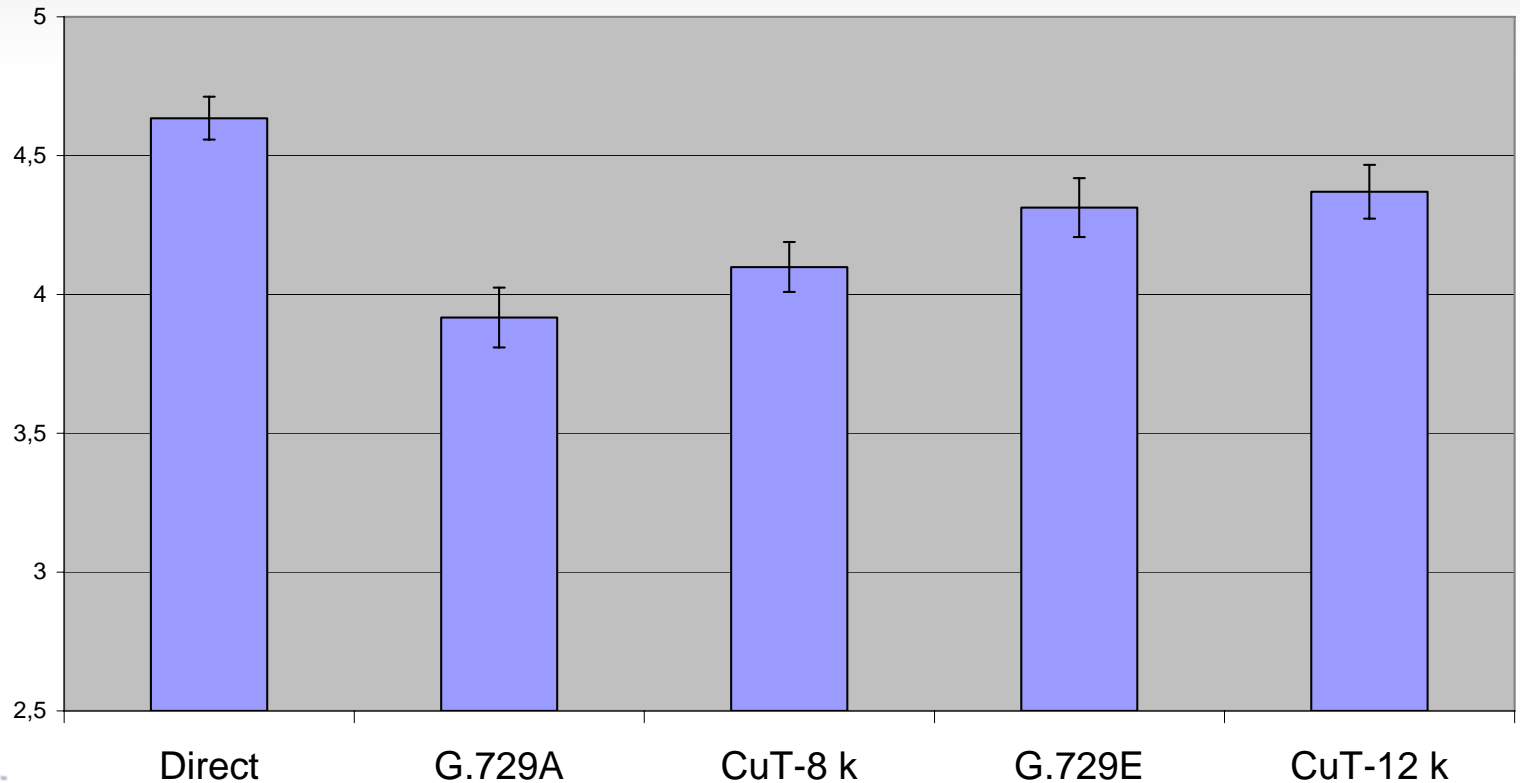
- Listening tests (02-03/06): G.729EV passed all the requirements.
- Advanced embedment of three technologies:
 - CELP : Good performance for Speech
 - Bandwidth Extension: reduced bit rate to switch to wideband
 - Transform Coding: high wideband quality with music and non speech signals
- Quality equivalent or better than other speech coding standard
 - Optimum "state of the art" wideband quality for all types of signals (including music) at 32 kbps
 - High wideband quality of speech maintained at 14 kbps
 - Narrow band "PSTN quality" at 12 kbps (equivalent to G711)





Subjective tests

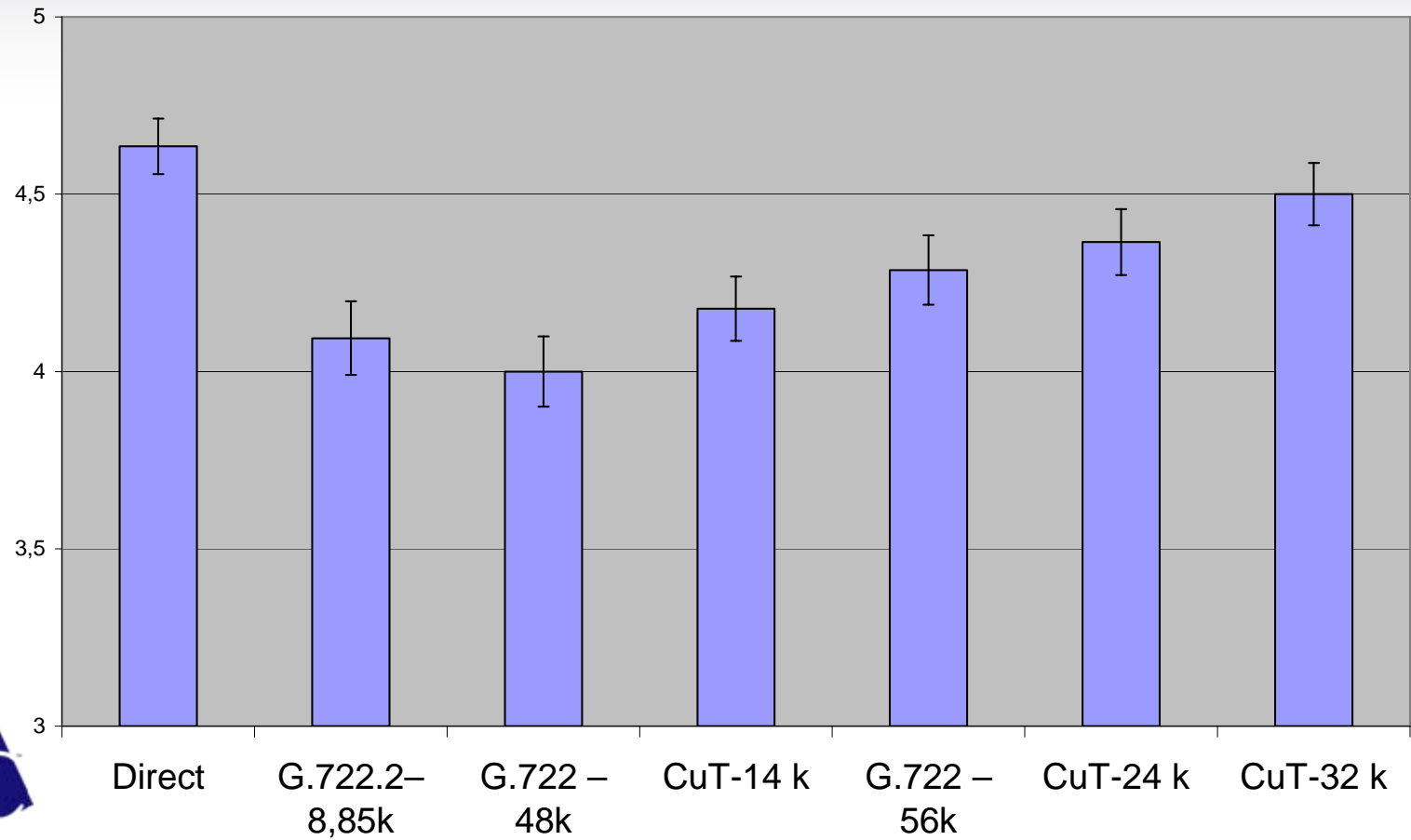
Clean speech in Narrowband in French





Subjective tests

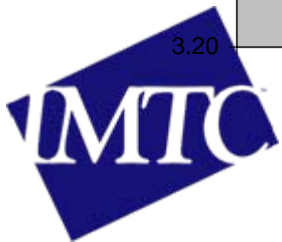
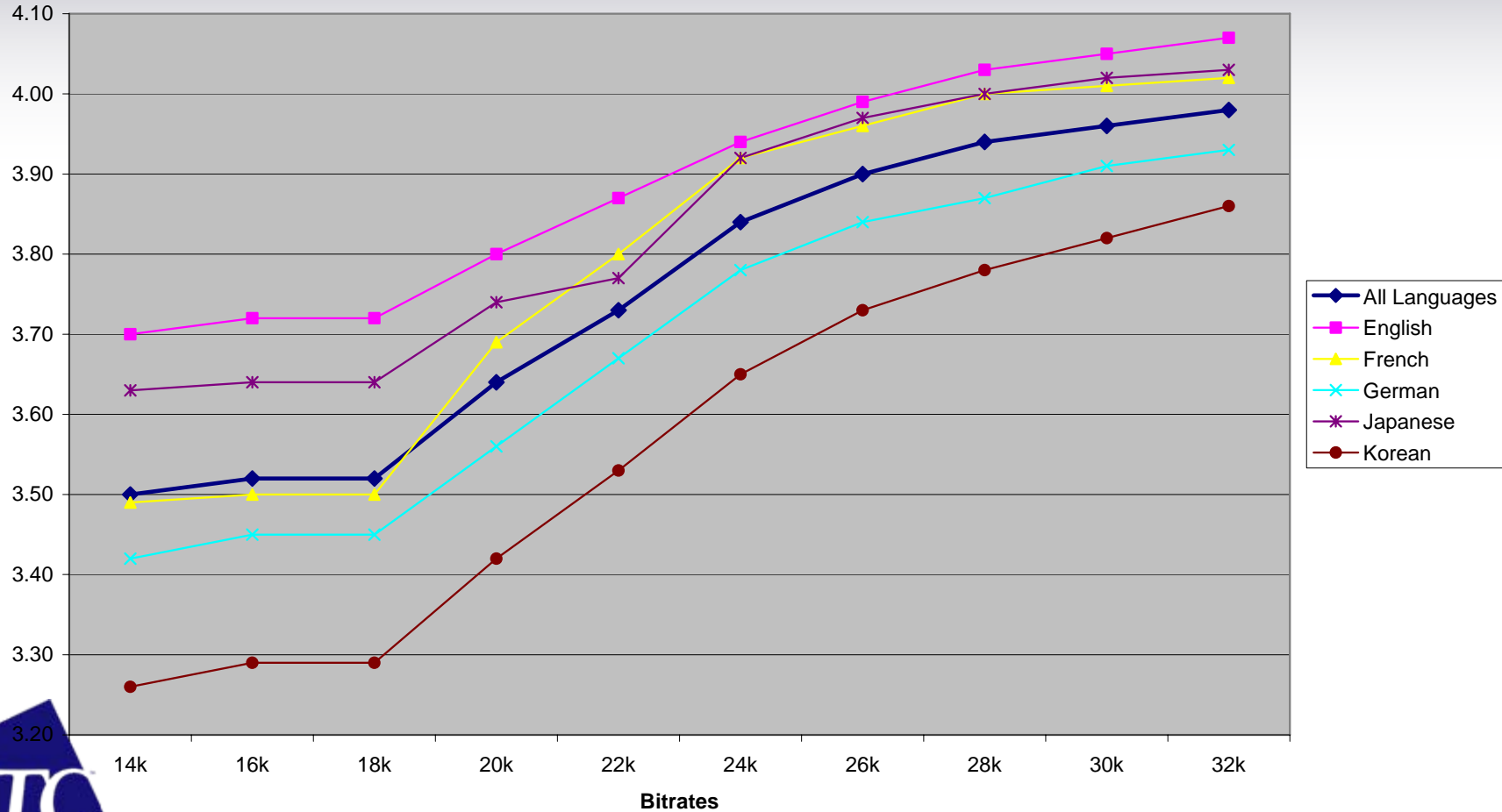
Wideband clean speech in French





Objective Measurement

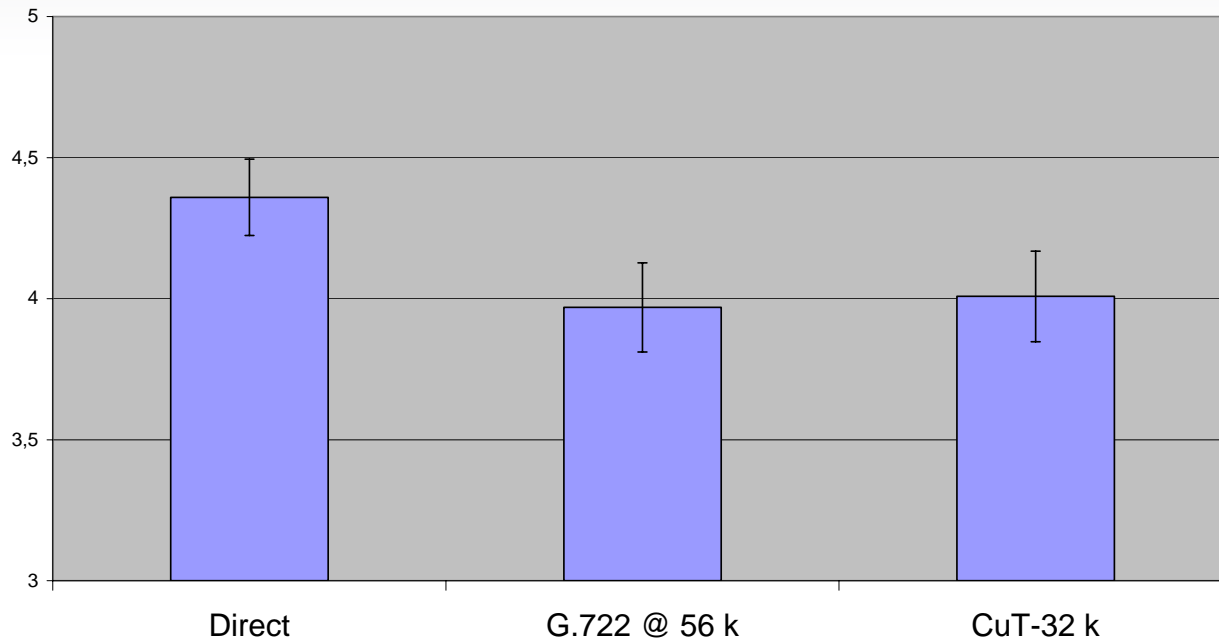
PESQ SCORES FOR CUT (MOS-LQO)





Subjective tests

Wideband music at 32 kbit/s





Complexity of G.729EV

- Complexity measured using ITU-T Software Tool Library STL2005 v2.1 .
- Complexity figures of the G.729EV coder (encoder/decoder).

Computational complexity	35.79 WMOPS
Static RAM	5 kwords
Scratch RAM	3.7 kwords
Data ROM	8.5 kwords
Program ROM	32 kwords
Delay	48.9375 ms
Low delay mode (narrow-band)	25 ms





Foreseen application

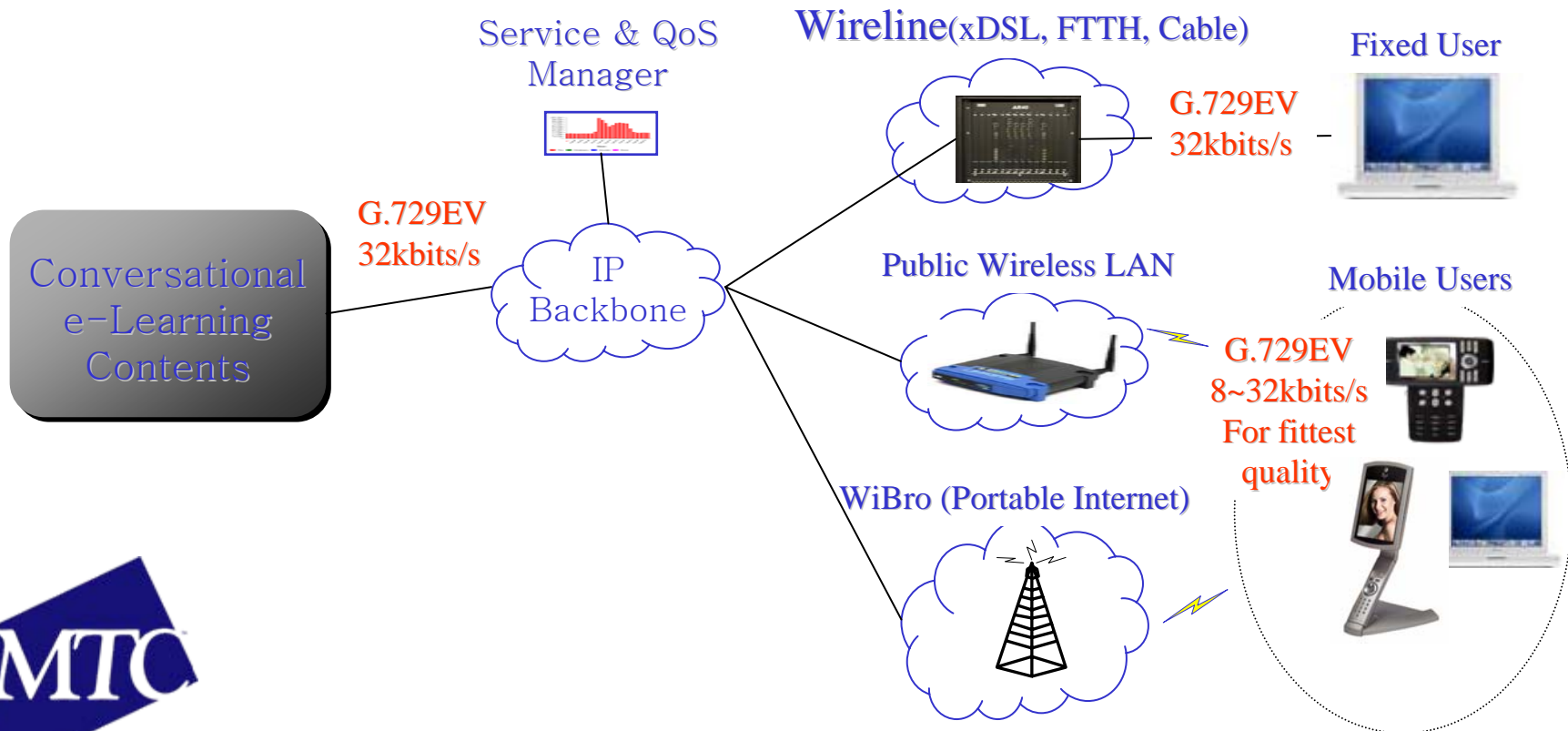
- Designed for packetized wideband voice (VoIP, VoATM, IP phone, private networks)
 - Applications requiring scalable wideband on top of G.729,
 - Easy integration with existing VoIP infrastructure and services, fast deployment
- Extension to Multimedia services (Videoconference, VOD...)
 - High quality with graceful degradation from WB (face-to-face) quality to NB (telephone) quality
- Advantage of Scalability:
 - Simple and low cost bit rate adaptation (very limited CPU)
 - Design for devices (gateways) that multiplex data/audio streams
 - Handling heterogeneous accesses/terminals
 - Optimization of bitrate to network capabilities (Network congestion)
 - Easy modification of bitrate by intelligent router (adjustment to network capabilities)
 - Voice messaging: capacity vs quality trade-off, access adaptation





WB VoIP & Conversational e-Learning service

- **Excellent voice quality** to fixed users
- **Fittest quality and service connectivity** to mobile users
- Trial service will be deployed by KT in Q3/2006

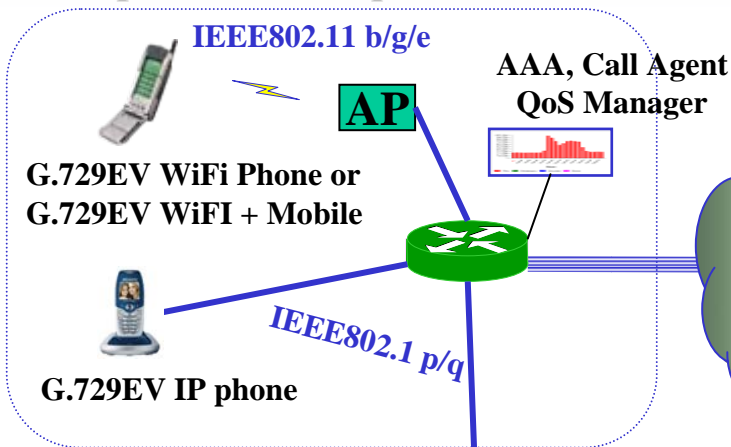




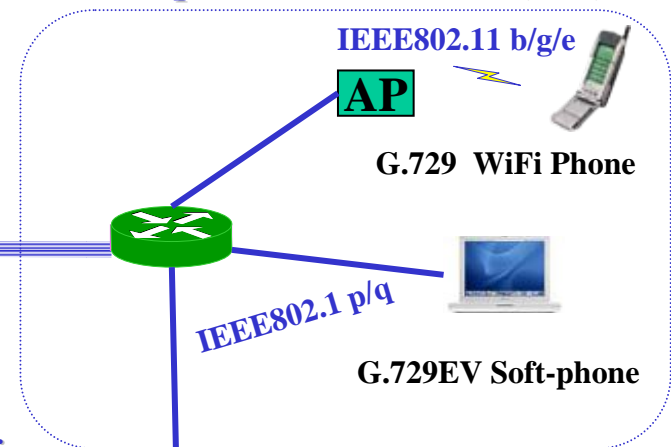
Enterprise Wideband VoIP

- Excellent voice quality among G.729EV terminals
- Seamless interoperability of legacy G.729 VoIP users and facilities
- Anticipated companies: Dacom, Netcodec, Essetel, Onnet,,

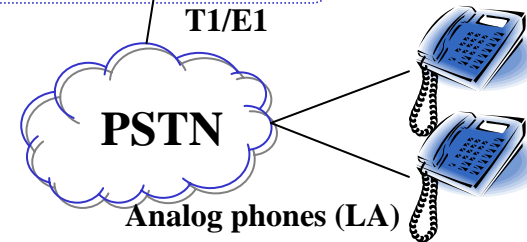
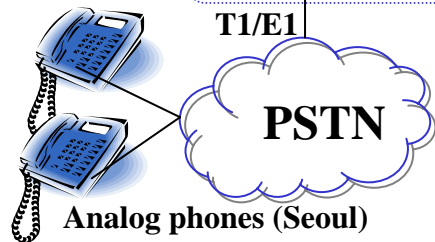
Enterprise – Headquarter (Seoul)



Enterprise – Branch A (LA)



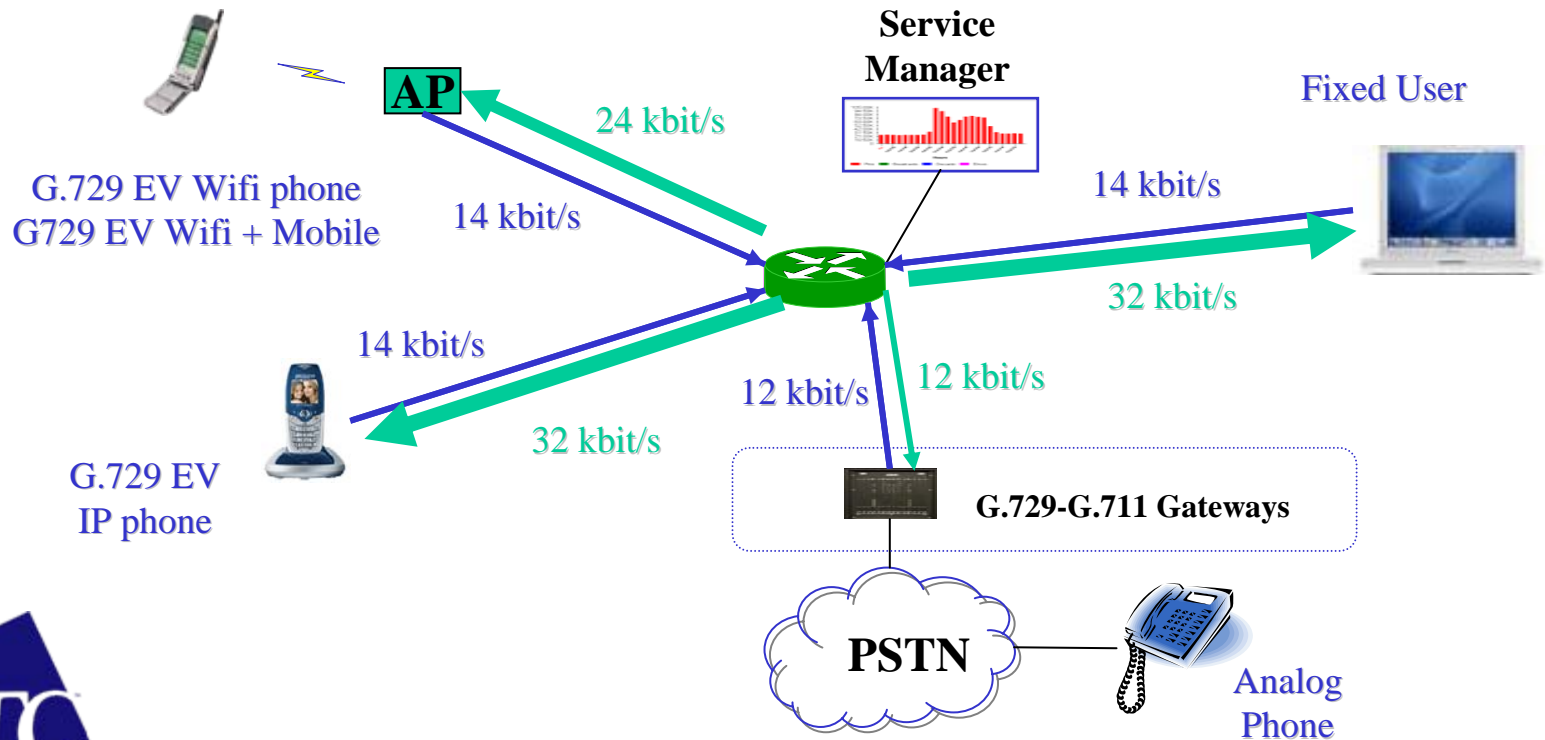
Existing VoIP Facilities





Intelligent service

- **Conference call with** heterogeneous terminals
- **Adaptability** to terminal capabilities
- **Adaptability** to Up-link / Downlink voice Quality requirement





Conclusion

- G729 EV : 8-32 kbit/s scalable codec for narrowband speech (8-12 kbit/s), wideband speech (12-32 kbit/s) and audio (32 kbit/s)
- Good quality compared to existing codecs
- Applications foreseen used the advantage of scalability
- Codecs obtained through collaboration of ETRI, France Telecom, Matsushita, Mindspeed, Siemens and VoiceAge.
- Quick development to fit to operators' needs in the field applications over IP
- Extension: Stereo coding, Super Wideband (32 kHz)





Back-up

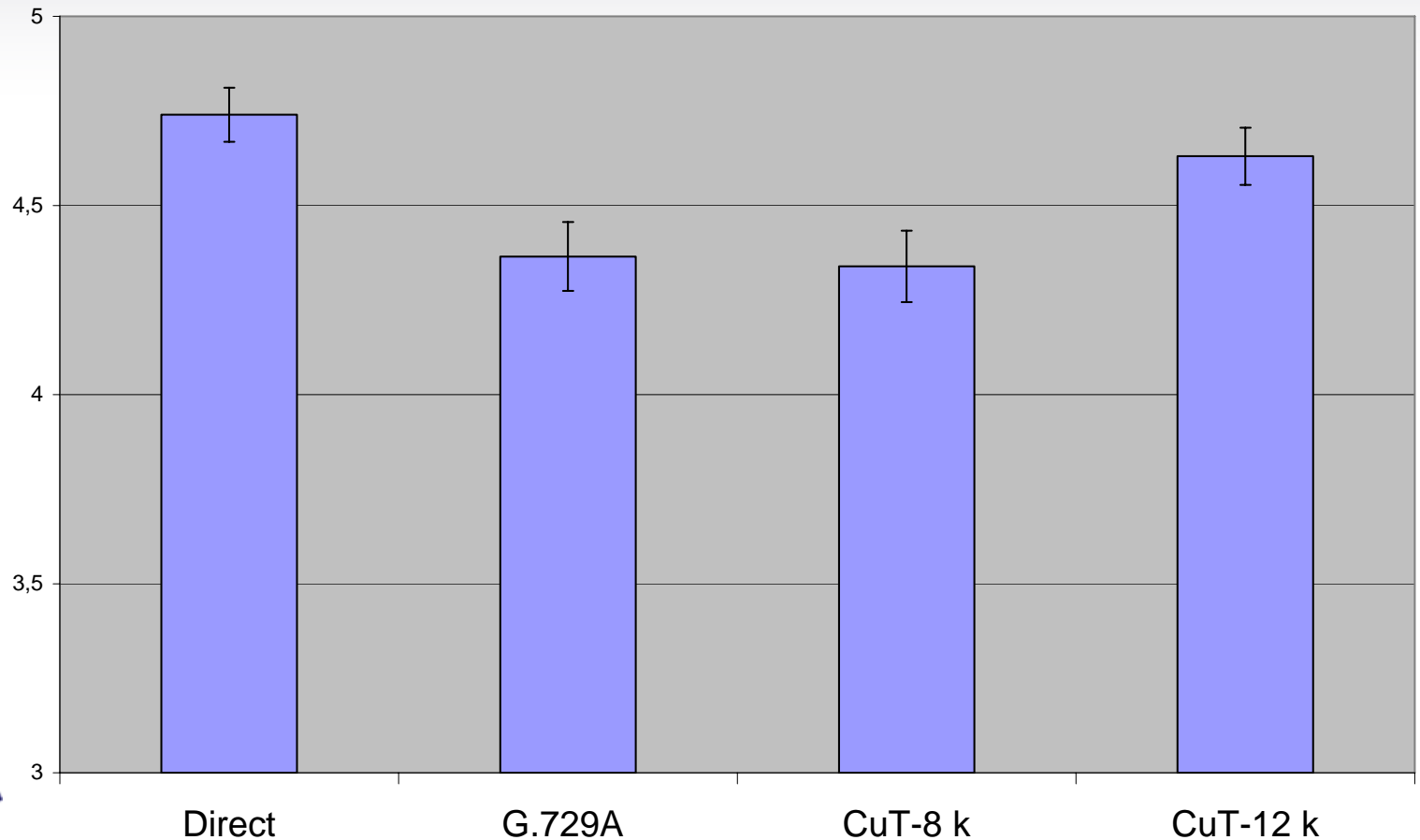


Joint IMTC Forum and ITU-T Workshop – “H.323, SIP: is H.325 next?” – 9-11 May 2006 – San Diego, CA, USA



Subjective tests

Interfering Talker Background noise at 15 dB in NB in German





Subjective tests

Interfering talker background noise at 15 dB in WB in English

