Canadian Evaluation Group

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Canadian Evaluation Group (CEG)

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Overview

- What the CEG evaluated
- Compliance tables
  - Services
  - Spectrum
  - Technical Performance

CEG – evaluation

- Anticipates evaluating:
  - IEEE P802.16m submission ✔
    - Both FDD and TDD modes/components ✔
- Participants
  - Manufacturers, Service providers, Universities and Research Institutions

CEG – procedure

- Used the self-evaluations
  - Description template
    - Gained an understanding of the radio interface
  - Compliance templates
    - Verified
  - Evaluated parameters as explained in Report M. 2135-1
    - Through “inspection,” “analysis” and “simulations”
  - Contributions on the above evaluations were made by participating organisations

CEG – commitment matrix

Institution	Chart summarizing the commitment of CEG participants in the evaluation activity														
	Peak Spectral Efficiency	Control Plane Latency	User Plane Latency	Handover			Bandwidth	Deployment in one identified IMT band	Channel bw scalability	Support wide range of services	Cell spectral efficiency	Cell-edge spectral efficiency	Mobility	VoIP capacity	Link budgets
				Intra-freq HO interruption time	Inter-freq HO interruption time	Inter-system									
	Analysis	Analysis	Analysis	Analysis		Inspection	Inspection	Inspection	Inspection	Inspection	Simulation	Simulation	Simulation	Simulation	Verification
Bell	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP					3GPP
Ericsson (CAN)	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP
Aviat Networks															IEEE
Huawei (CAN)	3GPP; IEEE	3GPP, IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP	3GPP	3GPP	3GPP	3GPP; IEEE
Intel (CAN)	IEEE	IEEE	IEEE	IEEE	IEEE	IEEE	IEEE	IEEE	IEEE	IEEE	IEEE	IEEE	IEEE	IEEE	IEEE
RIM	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP	3GPP	3GPP		3GPP
Rogers	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE					3GPP; IEEE
Telesat															
Telus	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP					3GPP
Carleton															3GPP; IEEE
INRS	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE
Memorial	IEEE										3GPP; IEEE	3GPP; IEEE	3GPP; IEEE		3GPP; IEEE
Univ. Laval															
Ottawa U.															
U-of-Tor	3GPP; IEEE	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP	3GPP			
Waterloo															
CRTC															
IC															
CRC	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE	3GPP; IEEE			3GPP; IEEE
Section Coordinator	Andy M.	Remi C.	Remi C.	Andy M.	Andy M.	Andy M.	P.F. Ng	P.F. Ng	P.F. Ng	Jose C.	Sofiene (3GPP) Remi (IEEE)	Sofiene (3GPP) Remi (IEEE)	Sofiene (3GPP) Remi (IEEE)	Sofiene (3GPP) Remi (IEEE)	Ivo (3GPP) Vishnu (IEEE)
Target Compl	Mar/2010	Mar/2010	Mar/2010	Mar/2010	Mar/2010	Mar/2010	Mar/2010	Mar/2010	Mar/2010	Mar/2010	May/2010	May/2010	May/2010	May/2010	Feb/2010

Simulation assumptions (1)

Parameter	Values used for evaluation
Deployment scenario	• Indoor hotspot • Urban micro-cell • Urban macro-cell • Rural macro-cell Parameters and assumptions not shown here for each scenario are shown in ITU guidelines [ITU-R Report M.2135].
Duplex method and bandwidths	FDD: 10+10 MHz for data & 5+5 MHz for VoIP for all except InH 20+20 MHz for data & 5+5 MHz for VoIP for InH TDD: 20 MHz for data & 10 MHz for VoIP for all except InH 40 MHz (2x20 MHz) for data & 10 MHz for VoIP for InH TDD DL-UL Ratio: 5 DL subframes & 3 UL subframes for data for all environments 4 DL subframes & 4 UL subframes for VoIP for all environments
Network synchronization	Synchronized
Handover margin	1.0 dB

Simulation assumptions (2)

Downlink transmission scheme	Data: Scheme for all environments: OL-SU-MIMO using 2x2 configuration Scheme for InH and UMi: 6-bit Transformed Codebook based MU-MIMO using 4x2 configuration; adaptive switching among rank-1 CL-SU-MIMO, two stream CL-MU-MIMO, three stream CL-MU-MIMO and four stream CL-MU-MIMO Scheme for UMa and RMa: MU-MIMO with long term beamforming using 4x2 configuration (20 ms reporting period for the long-term covariance matrix); adaptive switching among rank-1 CL-SU-MIMO, two stream CL-MU-MIMO, three stream CL-MU-MIMO and four stream CL-MU-MIMO VoIP: SU-MIMO with wideband beamforming using 4x2 configuration
Downlink scheduler	Proportional Fair for full buffer data and delay-weighted Proportional Fair with persistent scheduling for VoIP
Downlink link adaptation	Choice of 16 MCS schemes inclusive of coding rate and rate matching, see Section 11.13 of IEEE 802.16m-09/0034
CSI assumption at eNB	Based on feedback from Mobile Station
Downlink HARQ scheme	Incremental Redundancy Asynchronous, adaptive, 3 subframe ACK/NACK delay, maximum 4 HARQ retransmissions, minimum retransmission delay 3 subframes

Simulation assumptions (3)

Downlink receiver type	MMSE for both channel estimation and data detection
Uplink transmission scheme	Data Scheme for InH and UMi: 3-bit Codebook based MU- MIMO using 2x4 configuration; adaptive switching between single user and collaborative spatial multiplexing Scheme for UMa and RMa: MU-MIMO with long term beamforming using 2x4 configuration; adaptive switching between single-user and collaborative spatial multiplexing VoIP SU-MIMO using 2x4 configuration with SFBC + non-adaptive precoding
Uplink scheduler	Proportional Fair for full buffer data and delay-weighted Proportional Fair with persistent scheduling for VoIP
Uplink Power control	Open loop power control as described in 3.3.5.4 of IEEE 802.16m-09/0047; values for γ and SINRMIN should be chosen such that the average IoT meets the IMT-Advanced requirement
Uplink link adaptation	Choice of 16 MCS schemes inclusive of coding rate and rate matching, see Section 11.13 of IEEE 802.16m-09/0034
Uplink HARQ scheme	Incremental Redundancy Synchronous, non-adaptive, 3 subframe ACK/NACK delay, maximum 4 HARQ retransmissions, minimum retransmission delay 3 subframes

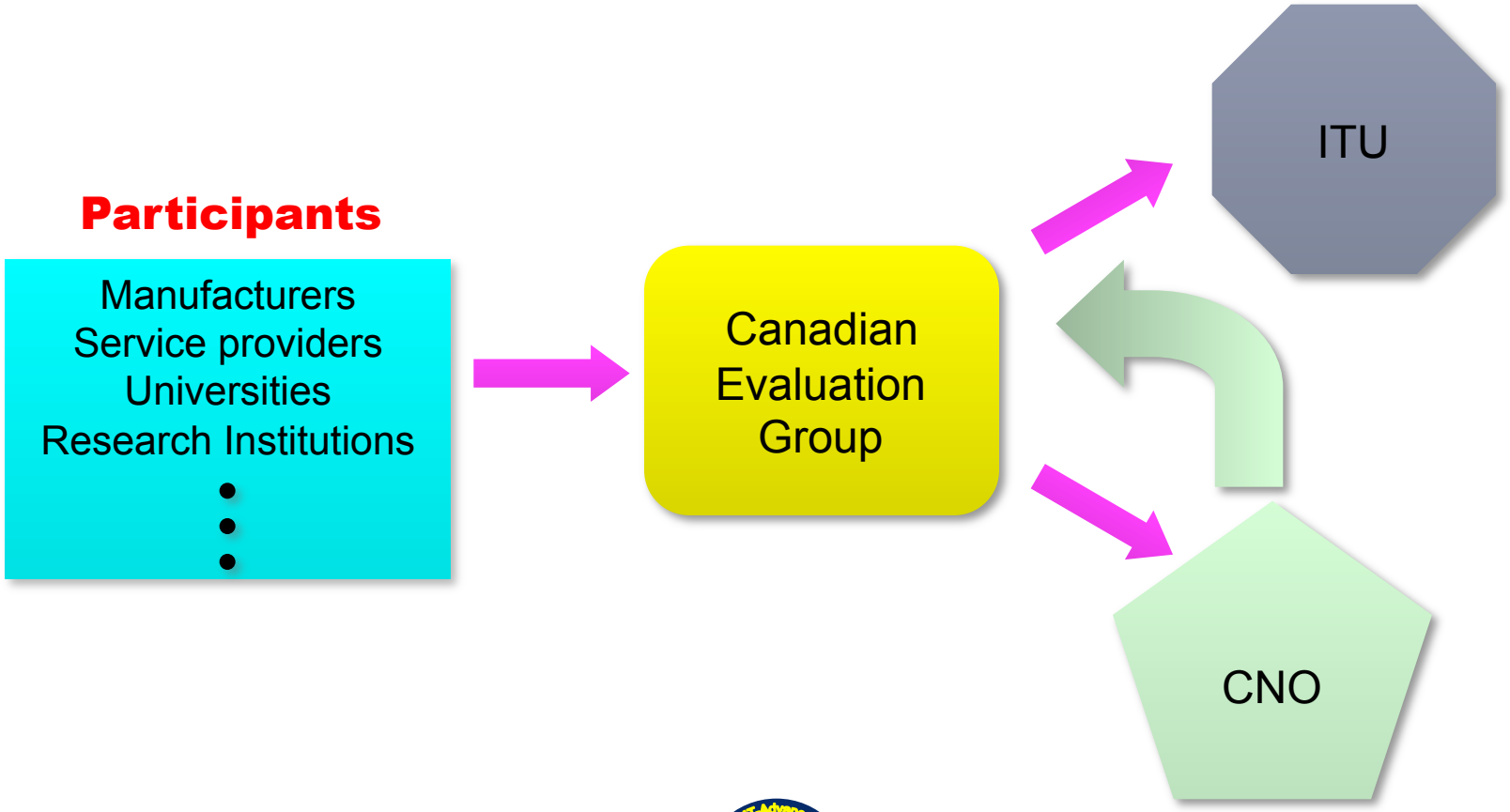
Simulation assumptions (4)

Uplink receiver type	MMSE for both channel estimation and data detection
Antenna configuration base station	DL: 4x2, BS: co-polarized, 4λ spacing (illustration for 4 Tx: | | | |)
Antenna configuration UE	UL: 2x4, MS: Vertical polarized, 0.5λ spacing
Channel estimation (Uplink and downlink)	Channel estimation error modeling included for both uplink and downlink simulations (for both data and VoIP simulations)
Control channel and reference signal overhead, Acknowledgements etc.	Control channel overhead modeling included for both uplink and downlink (for both data and VoIP simulations)
Feedback and control channel errors	Feedback and control channel error modeling included for both uplink and downlink (for both data and VoIP simulations)

Compliance Template for Services – IEEE (FDD, TDD)

4.2.4.1.1	**Support of a wide range of services** Does the proposal support a wide range of services?: If bullets 4.2.4.1.1.1 - 4.2.4.1.1.3 are marked as "yes" then 4.2.4.1.1 is a "yes". √ YES / NO	See Section 9.8 of the Final Report.
4.2.4.1.1.1	**Ability to support basic conversational service class** Is the proposal able to support basic conversational service class?: √ YES / NO	See Section 9.8 of the Final Report.
4.2.4.1.1.2	**Support of rich conversational service class** Is the proposal able to support rich conversational service class?: √ YES / NO	See Section 9.8 of the Final Report.
4.2.4.1.1.3	**Support of conversational low delay service class** Is the proposal able to support conversational low-delay service class?: √ YES / NO	See Section 9.8 of the Final Report.

CEG – process


Participants
Manufacturers
Service providers
Universities
Research Institutions
Canadian Evaluation Group
ITU
CNO

Simulation results - how

- Each study had different antenna configurations
- Could not average over the results – obviously – so decided to stick with the median (or average of 2 middle values when # of results was even)

CEG – additional methods

- No additional methods were used
- However, the CEG did evaluate the link budgets in detail – the spread-sheets verifying the information provided by the IEEE candidate will be presented in the Final Report

Summary

- All parameters for evaluation (by inspection, analysis or simulation) have been examined
- Most meet the minimum requirements (remainder at Vietnam WP5D meeting)
- Over 10 organizations contributed to evaluation activity
  - Mix of Industry, Regulators, Academia