WINNER+
IMT-Advanced Evaluation Group

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on behalf of WINNER+

http://projects.celtic-initiative.org/winner+/WINNER+ Evaluation Group.html

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WINNER+ evaluation program for the 3GPP LTE-based proposal

- Full evaluation of 3GPP LTE-based proposal
  - Both FDD and TDD components
  - ITU-R assumptions used
  - ITU-R compliance templates and link budgets completed
  - Guidelines on ITU-R IMT-Advanced web page taken into account
  - 3GPP proposed configurations applied

High level approach

- Analysis of proposal
- Analytical and inspection evaluation
- Calibration of environment simulations within WINNER+
- Performance calibration within WINNER+ using material provided by proponents, e.g. for 3GPP LTE Rel 8
- Choice of subset of 3GPP antenna configuration to study
- Simulation of chosen technologies and configurations
- Prepare
  - Preliminary Evaluation Report (submitted to ITU-R WP5D #7) and
  - Final Evaluation Report (to be submitted to ITU-R WP5D # 8)

Preliminary Evaluation Report

- Preliminary Evaluation Report submitted to 7th ITU-R WP5D meeting in Turin, Italy

Characteristic for evaluation	Method	RITs, Link Directions, Test Environments
Cell spectral efficiency	Simulation (system level)	FDD / TDD, DL / UL, InH, UMi, UMa, RMa
Peak spectral efficiency	Analytical	FDD / TDD, DL / UL
Bandwidth	Inspection	
Cell edge user spectral efficiency	Simulation (system level)	FDD / TDD, DL / UL, InH, UMi, UMa, RMa
Control plane latency	Analytical	FDD / TDD, DL / UL
User plane latency	Analytical	FDD / TDD, DL / UL
Mobility	Simulation (system and link level)	FDD / TDD, InH, UMi, UMa, RMa
Intra- and inter-frequency handover interruption time	Analytical	FDD / TDD, DL / UL
Inter-system handover	Inspection	
VoIP capacity	Simulation (system level)	FDD / TDD, InH, UMi, UMa, RMa
Deployment possible in at least one of the identified IMT bands	Inspection	
Channel bandwidth scalability	Inspection	
Support for a wide range of services	Inspection	

Result summary in Preliminary Evaluation Report I

- Peak spectral efficiency
  - ☞ WINNER+ concludes that peak spectral efficiency requirements for both DL and UL for both FDD RIT and TDD RIT are verified for the maximum antenna configuration specified in Report ITU-R M.2135.
- Bandwidth & Channel bandwidth scalability
  - ☞ Both the FDD RIT and the TDD RIT fulfil the requirement to support a scalable bandwidth up to and including 40 MHz. With aggregated multiple components bandwidth up to 100 MHz can be supported.
  - ☞ Both the FDD RIT and the TDD RIT fulfil the requirement to support of at least three bandwidth values.
- Control plane latency and User plane latency
  - ☞ It is can be concluded that the user plane latency requirements for FDD RIT and TDD RIT are fulfilled.
- Intra- and inter-frequency handover interruption time
  - ☞ WINNER+ concludes that both the FDD RIT and TDD RIT fulfil the handover interruption time requirements.

Result summary in Preliminary Evaluation Report II

- Inter-system handover
  - ☞ WINNER+ concludes that inter system handover between the proposal FDD and TDD RITs and another system is supported, fulfilling the corresponding requirement.
- Deployment possible in at least one of the identified IMT bands
  - ☞ It is clear that the proposal supports usage of at least one IMT spectrum band and thus, that the requirement is fulfilled.
- Support for a wide range of services
  - ☞ Hence, WINNER+ concludes that the service requirements are fulfilled for the FDD RIT and the TDD RIT.

Final Evaluation Report

- Final Evaluation Report to be submitted to 8th ITU-R WP5D meeting in Da Nang, Vietnam, will include in addition simulation results

Characteristic for evaluation	Method	RITs, Link Directions, Test Environments
Cell spectral efficiency	Simulation (system level)	FDD / TDD, DL / UL, InH, UMi, UMa, RMa
Peak spectral efficiency	Analytical	FDD / TDD, DL / UL
Bandwidth	Inspection	
Cell edge user spectral efficiency	Simulation (system level)	FDD / TDD, DL / UL, InH, UMi, UMa, RMa
Control plane latency	Analytical	FDD / TDD, DL / UL
User plane latency	Analytical	FDD / TDD, DL / UL
Mobility	Simulation (system and link level)	FDD / TDD, InH, UMi, UMa, RMa
Intra- and inter-frequency handover interruption time	Analytical	FDD / TDD, DL / UL
Inter-system handover	Inspection	
VoIP capacity	Simulation (system level)	FDD / TDD, InH, UMi, UMa, RMa
Deployment possible in at least one of the identified IMT bands	Inspection	
Channel bandwidth scalability	Inspection	
Support for a wide range of services	Inspection	

LTE Rel-8 parameters for calibration purposes

- One step in the calibration work is to evaluate LTE Rel-8 under 'simple' but common assumptions
- The focus is not on optimizing performance but on the calibration of the simulation tools
- 3GPP defined a reference LTE Rel-8 setup during the LTE-Advanced evaluation work
  - Beneficial to use the same parameters values
  - The 3GPP reference evaluation assumptions (and the results thereof) are available in 3GPP TR 36.814 http://www.3gpp.org/ftp/Specs/html-info/36814.htm

Proposal: Parameters for LTE Rel-8 I

Parameter	Value
General	Parameters and assumptions not explicitly stated here according to ITU guidelines M.2135 and 3GPP specifications
Duplex method	FDD
Network synchronization	Synchronized
Handover margin	1dB
Downlink transmission scheme	1x2 SIMO
Downlink scheduler	Round robin with full bandwidth allocation
Downlink link adaptation	Wideband CQI, no PMI on PUCCH (mode 1-0) 5ms periodicity, 6ms delay total (measurement in subframe n is used in subframe n+6) CQI measurement error: None MCSs based on LTE transport formats [5]
Downlink HARQ	Maximum four transmissions
Downlink receiver type	MRC
Uplink transmission scheme	1x2 SIMO
Uplink scheduler	Frequency Domain Multiplexing – non-channel dependent, share available bandwidth between users connected to the cell, all users get resources in every uplink subframe. With M users and Nrb PRBs available, Mh=mod(Nrb,M) users get floor(Nrb/M)+1 PRBs whereas Ml=M-Mh users get floor(Nrb/M) PRBs

Source: 3GPP TS 36.213: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (Release 8)"

Proposal: Parameters for LTE Rel-8 II

Uplink Power control	P0 = -106dBm, alpha = 1.0
Uplink Link adaptation	Based on delayed measurements. Ideal channel estimate from UL transmission in subframe n can be used for rate adaptation in subframe n+7 MCSs based on LTE transport formats [5]
Uplink HARQ	Maximum four transmissions Proponent to specify IR or CC
Uplink receiver type	MMSE in frequency domain, MRC over antennas (no intercell interference rejection)
Antenna configuration	Vertically polarized antennas 0.5 wavelength separation at UE, 10 wavelength separation at basestation
Channel estimation	Ideal, both demodulation and sounding
Control Channel overhead, Acknowledgements etc.	LTE: L=3 symbols for DL CCHs, M=4 resource blocks for UL CCH, overhead for demodulation reference signals,
BS antenna downtilt	ITU Indoor, indoor hotspot scenario (InH): N/A ITU Microcellular, urban micro-cell scenario (Umi): 12deg ITU Base coverage urban, Urban macro-cell scenario (Uma): 12deg ITU High speed, Rural macro-cell scenario (Rma): 6 deg Case 1 3GPP 3D: 15 deg Case 1 3GPP 2D: N/A
Feeder loss	0dB, except for the ITU scenarios in step 1a where a feeder loss of 2dB is used.
Channel model	According to ITU for ITU scenarios SCM urban macro high spread for 3GPP case 1
Intercell interference modeling	Explicit

Source: 3GPP TS 36.213: “Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (Release 8)”

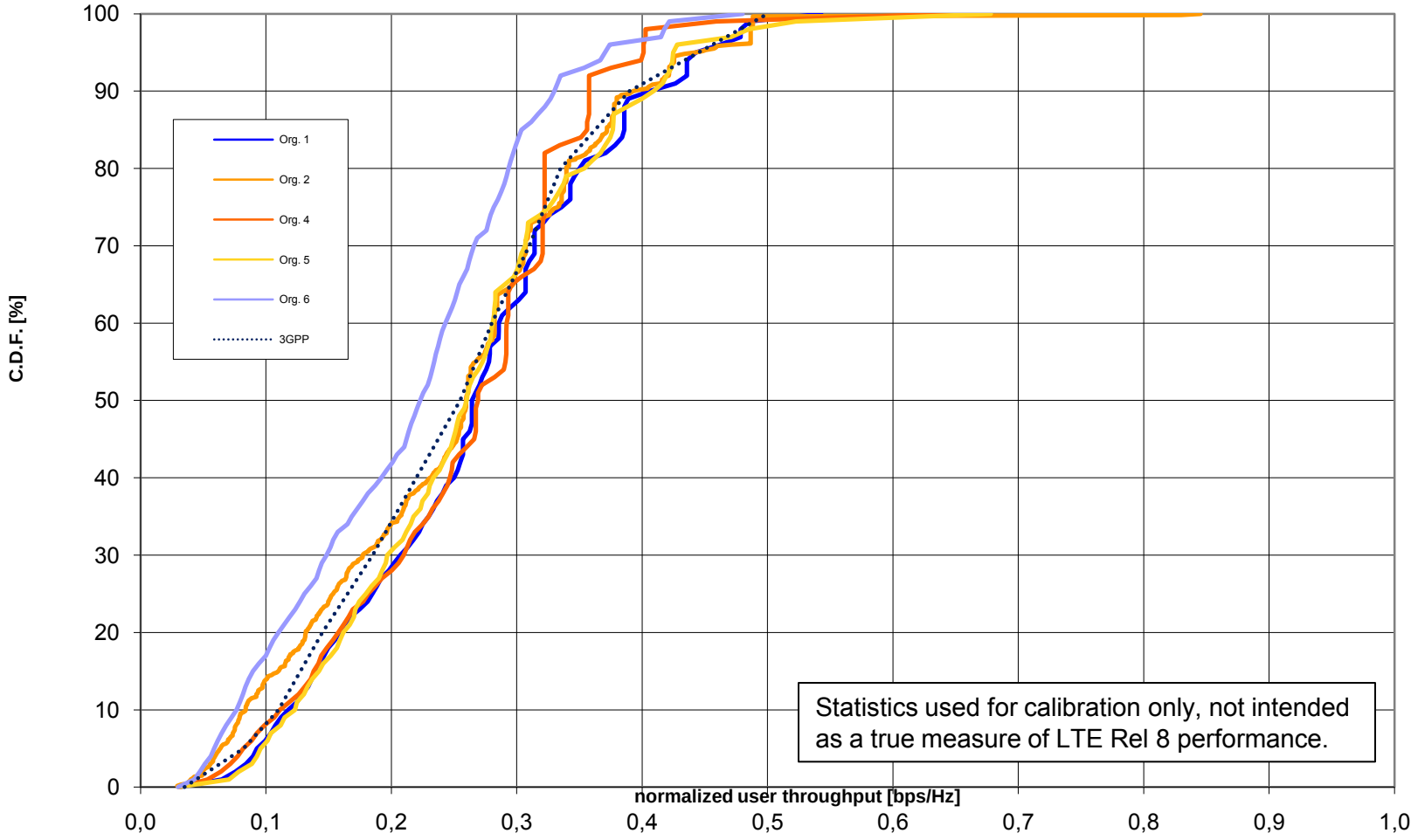
Calibration metrics

- Average SINR (per UE) distribution [dB]
- Normalized user throughput distribution [bps/Hz]
- The resulting statistics will be used for comparison between WINNER+ partners only, and will not be intended as a true measure of LTE Rel 8 performance.

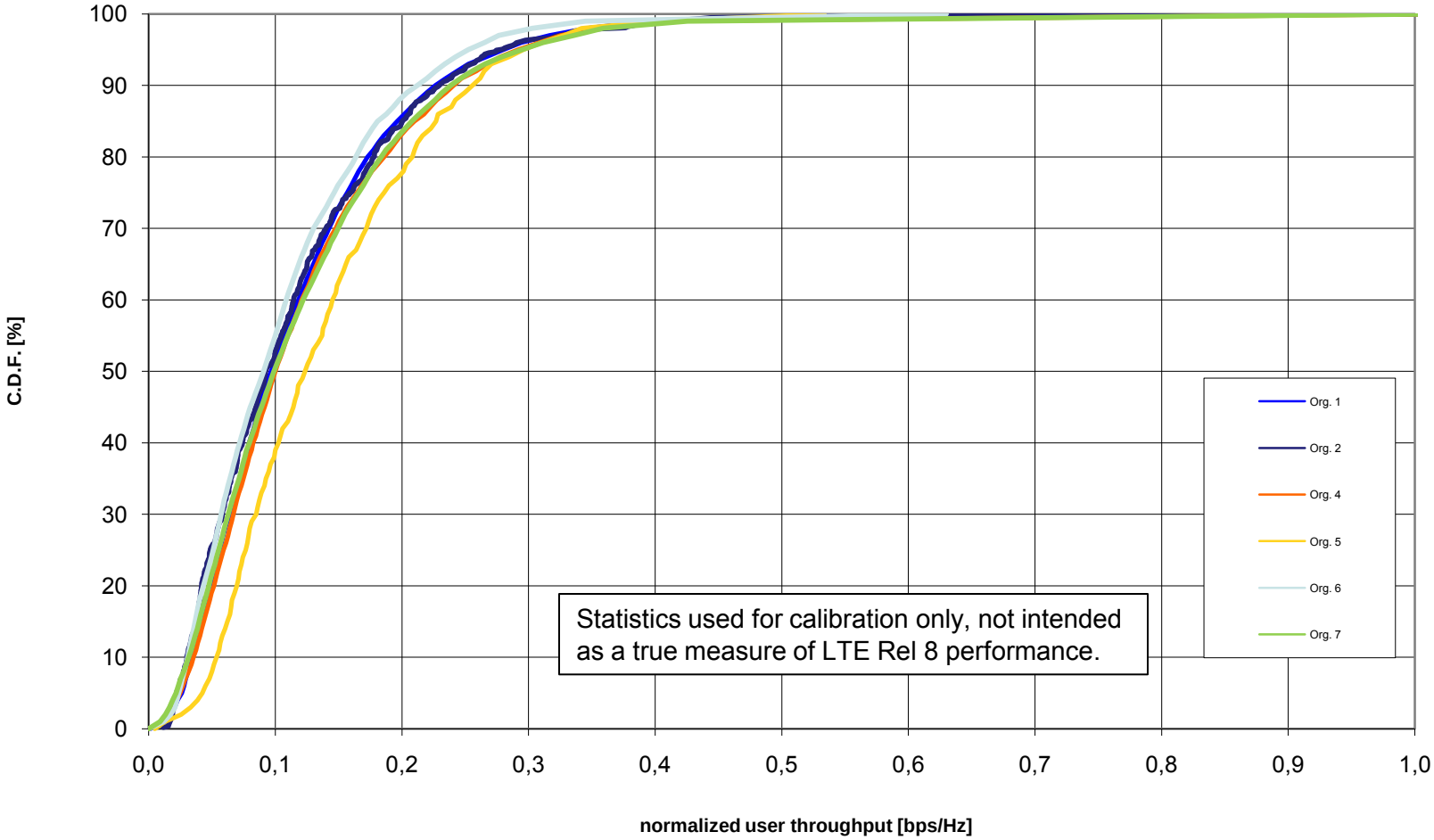
Calibrated scenarios

- Rel-8 User Throughput – InH DL
- Rel-8 User Throughput – UMi DL
- Rel-8 User Throughput – UMa DL
- Rel-8 User Throughput – RMa DL
- Rel-8 User Throughput – InH UL
- Rel-8 User Throughput – UMi UL
- Rel-8 User Throughput – UMa UL
- Rel-8 User Throughput – RMa UL

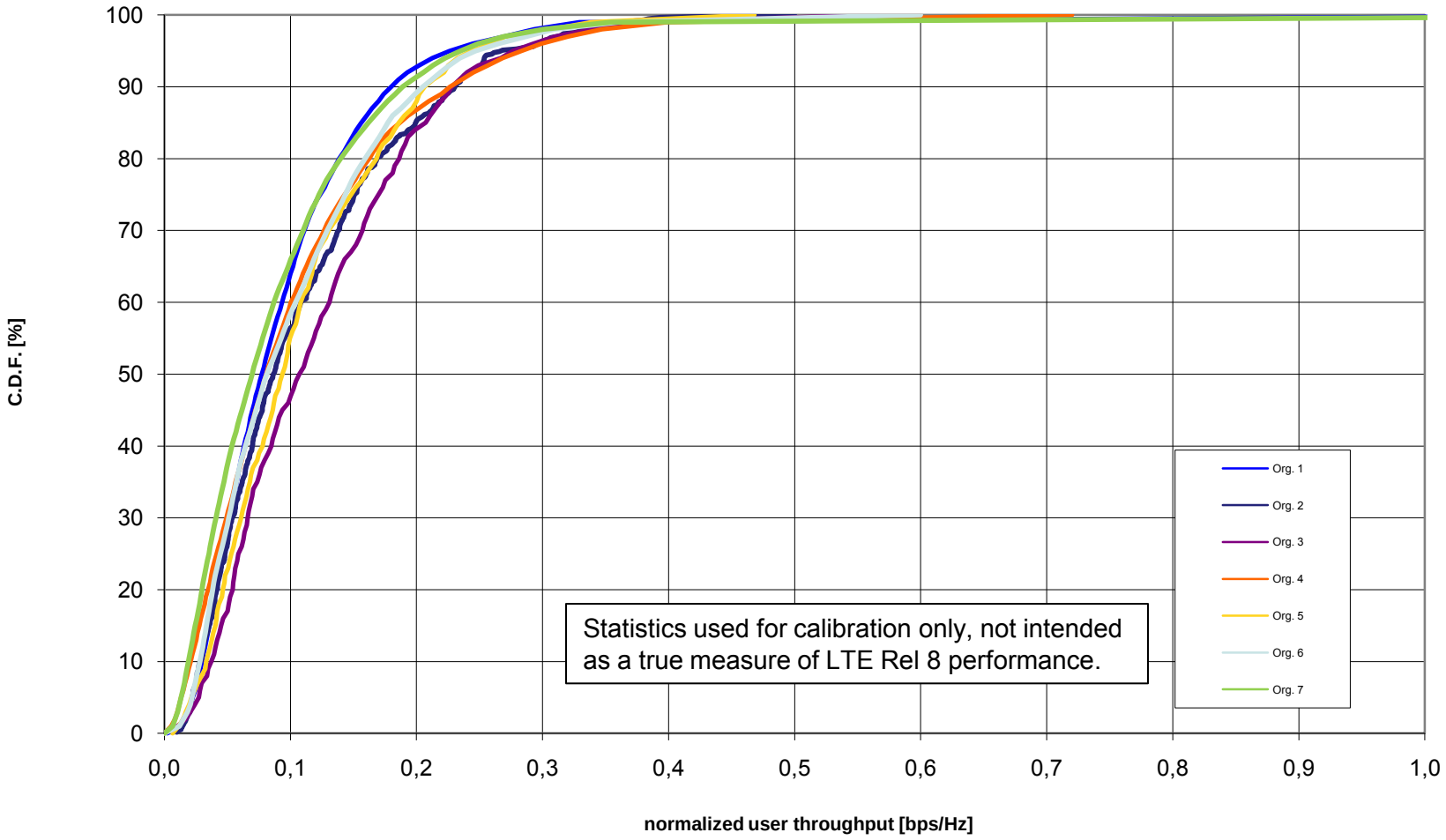
Rel-8 User Throughput – InH DL



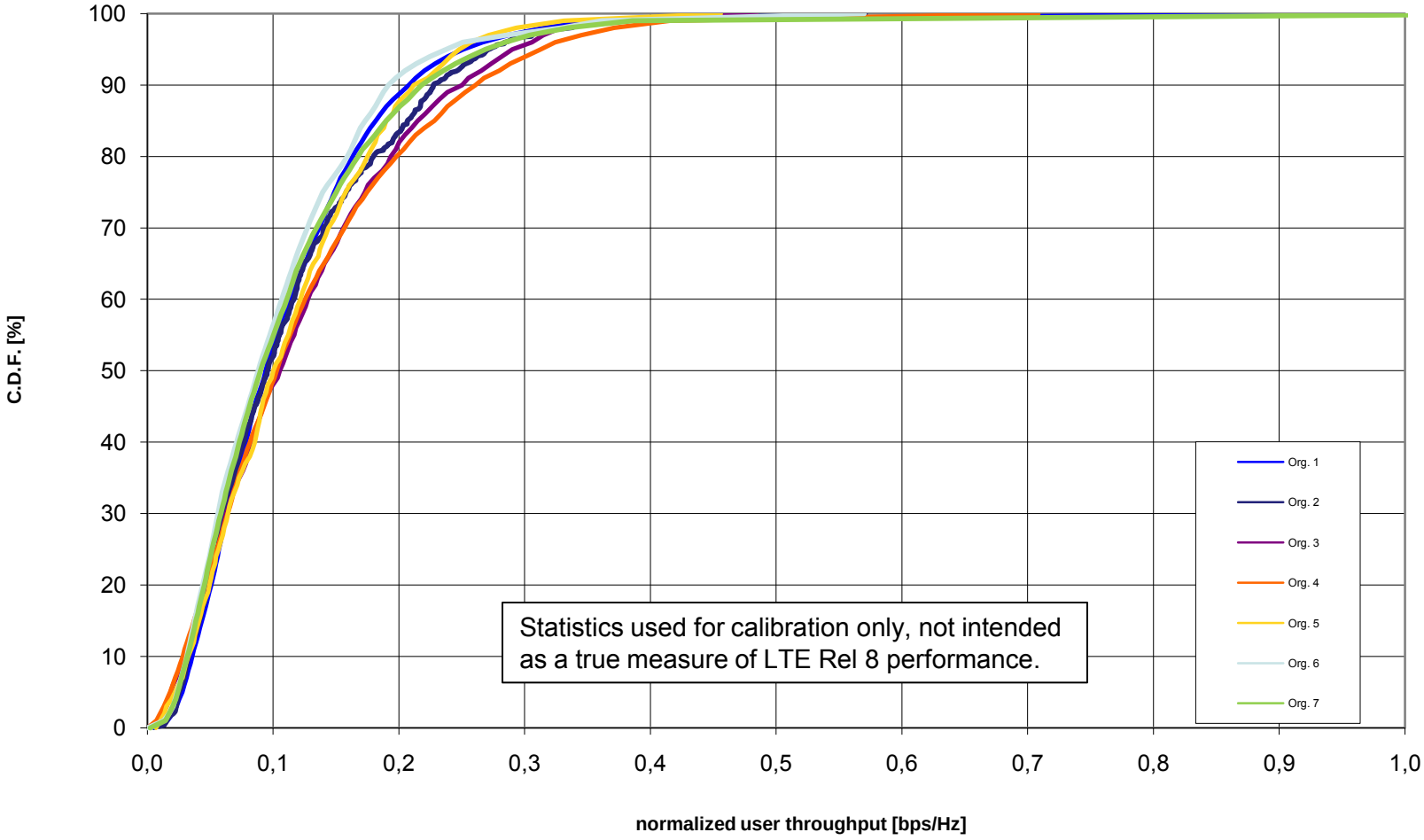
Rel-8 User Throughput – UMi DL



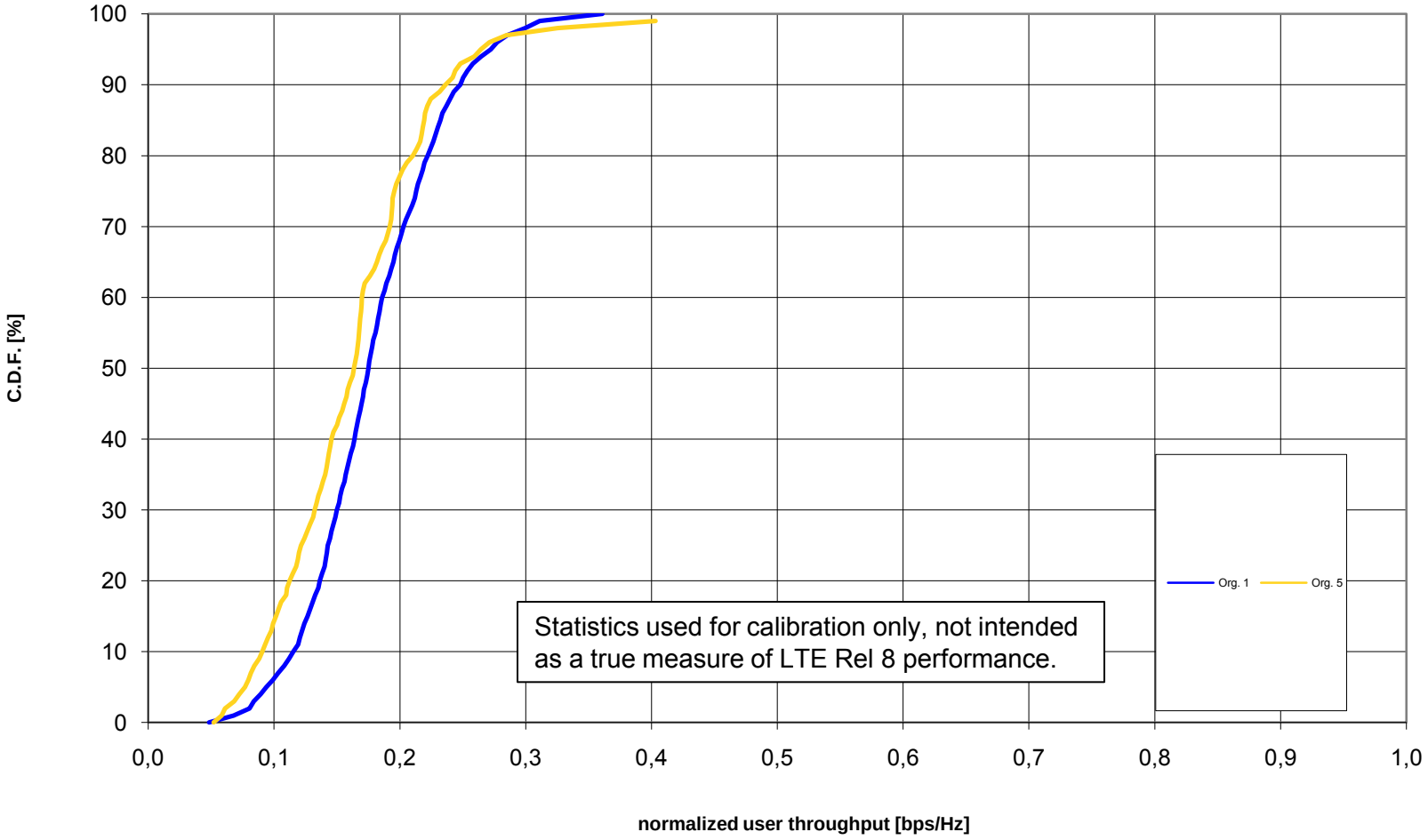
Rel-8 User Throughput – UMa DL



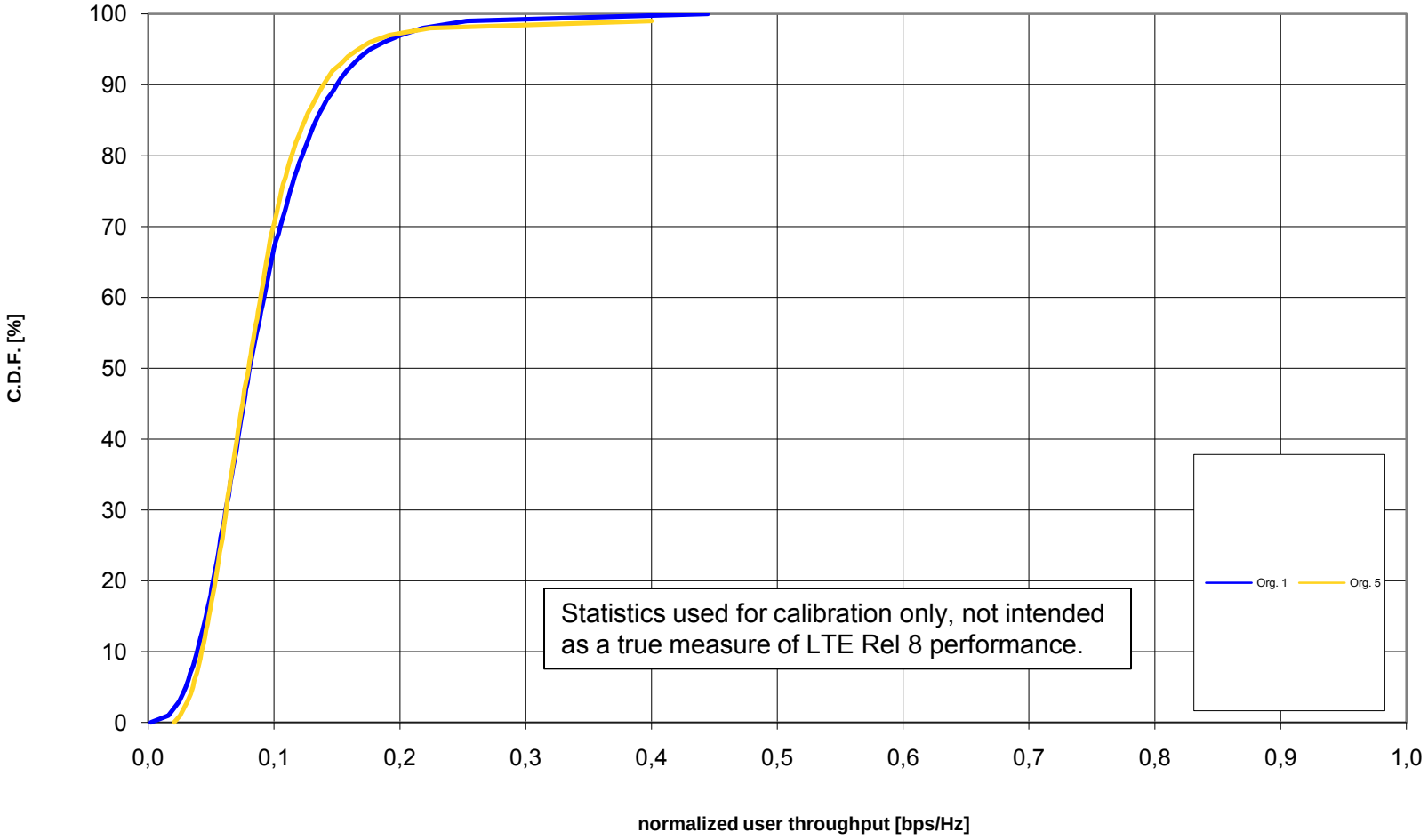
Rel-8 User Throughput – RMa DL



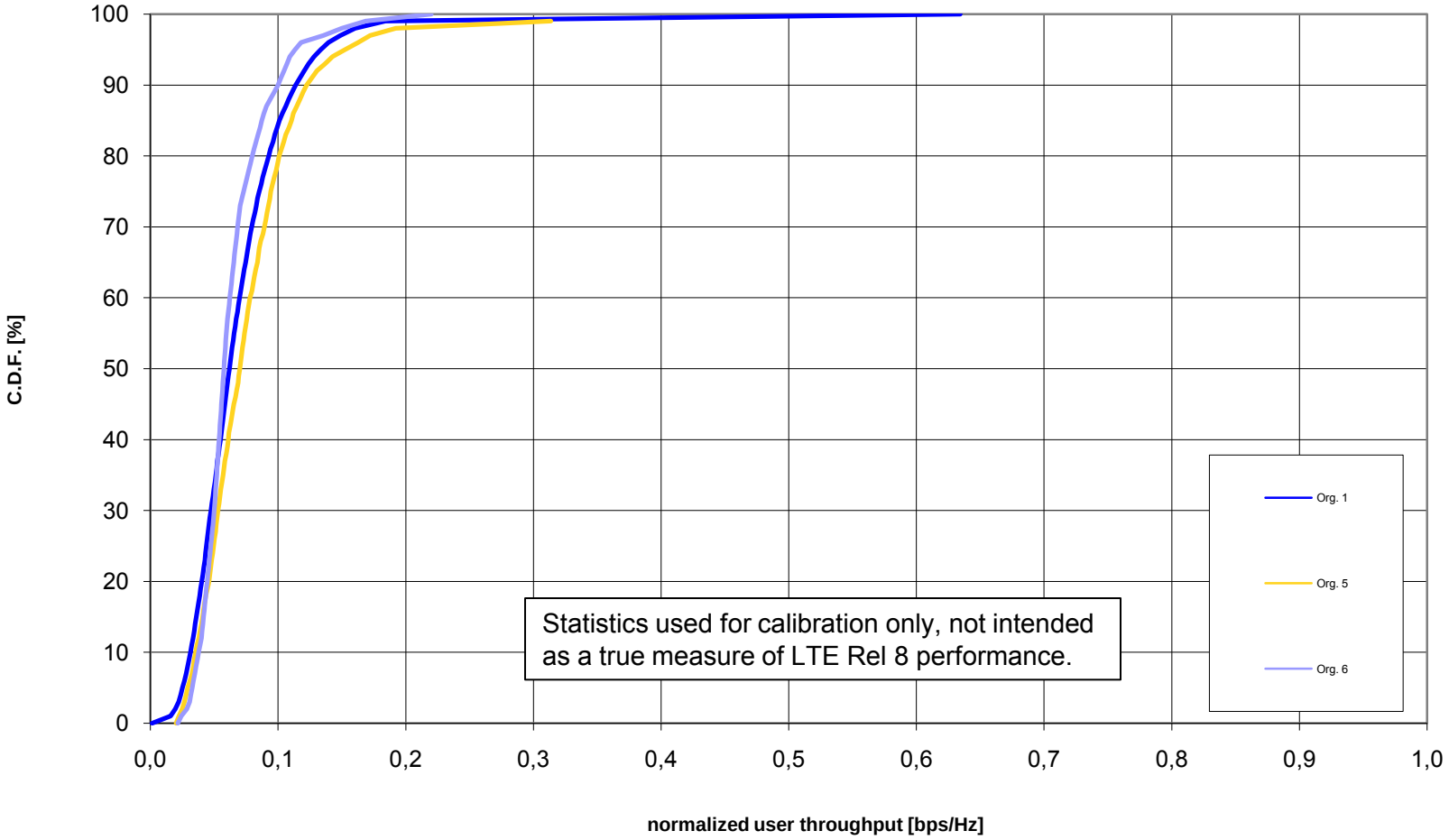
Rel-8 User Throughput – InH UL



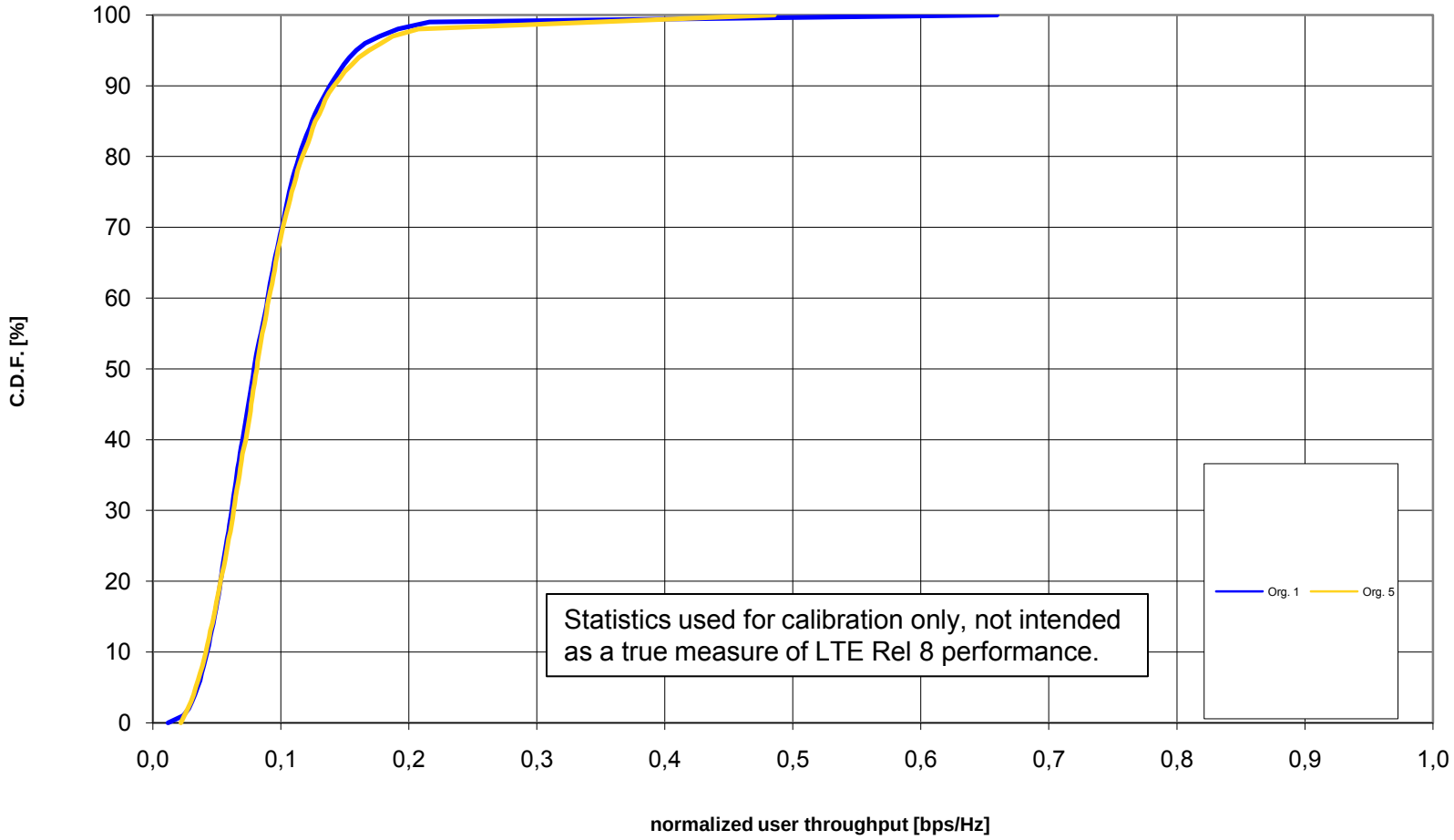
Rel-8 User Throughput – UMi UL



Rel-8 User Throughput – UMa UL



Rel-8 User Throughput – RMa UL



Conclusions

- Preliminary Evaluation Report submitted to ITU-R WP5D 7th meeting
- Analytical and inspection evaluation done
- Feedback from ITU-R WP5D 7th meeting on peak spectral efficiency taken into account for Final Evaluation Report
- Calibration of link and system level simulators of different WINNER+ members under preparation by using Rel-8 results as benchmark
- Good alignment of simulators achieved
- Simulation results of required test cases will be submitted as part of Final Evaluation Report to ITU-R WP5D 8th meeting

References

- For structure, partner list, background and history see the WINNER+ presentation from ITU-R IMT-Advanced Workshop #3: http://groups.itu.int/Default.aspx?tabid=721&DMXModule=1154&EntryId=186&Command=Core_Download
- WINNER+ evaluation home page: http://projects.celtic-initiative.org/winner+/WINNER+%20Evaluation%20Group.html
- WINNER+ calibration document (living document): http://projects.celtic-initiative.org/winner+/WINNER+%20and%20ITU-R%20EG%20documents/Calibration%20for%20IMT-Advanced%20Evaluations.pdf

Thank you!