Spectrum allocation from a propagation perspective

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Outline

1. Frequency bands for 5G
2. ITU Working Groups
3. Propagation measurements and models for new and updated ITU recommendations
4. Future plans for 6G frequency bands and propagation studies

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WRC15/WRC19 frequency bands

WRC15 Band (GHz)	Bandwidth (GHz)
24.25-27.5	3.25
31.8-33.4	1.6
37-43.5	6.5
45.5-50.2 45.5-47, 47.2-48.2	4.7 1.5, 1
50.4-52.6	2.4
66-76 66-71	10 5
81-86	5

With 14.75 GHz harmonized worldwide, ~ 85% of global harmonization

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ITU-R Study Group 3

Working Party 3J (WP 3J) - Propagation fundamentals

Working Party 3K (WP 3K) - Point-to-area propagation

Working Party 3M (WP 3M) - Point-to-point and Earth-space propagation

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5G Use Scenarios: outdoor/indoor

P2P and P2MP

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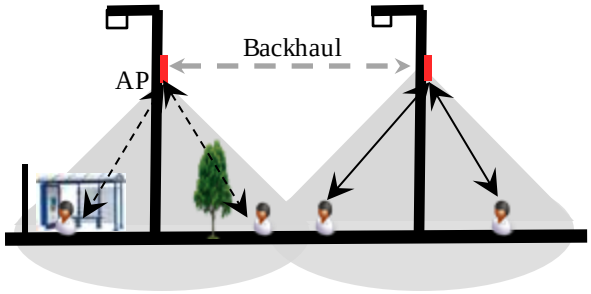
Use Scenarios: outdoor/indoor

Street canyon

Open square



Backhaul

Shopping mall

Exhibition

Conference room

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ITU-R Study Group 3 Correspondence Groups

CG 3K-6: ITU-R P.1238-10 and ITU-R P. 1411-10 Model harmonization of path loss models (Samsung Korea)

CG 3J-3K-3M-8: ITU-R P. 2109-1 Building entry loss model (UK)

CG 3K-3M-12: ITU-R P. 2108-0 Clutter loss prediction (Ofcom, Intel)

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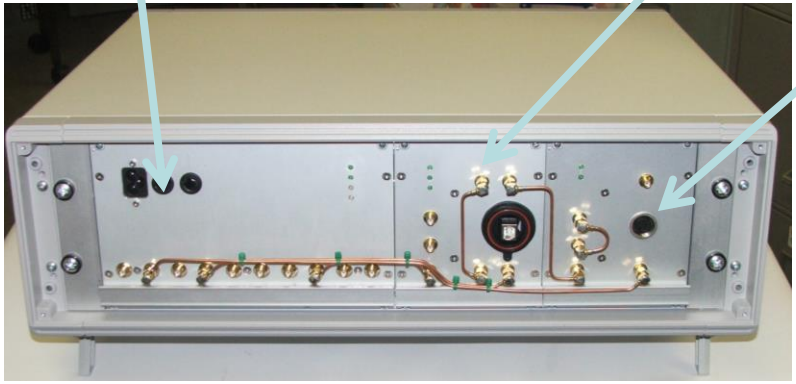
Durham Channel Sounder

Rubidium unit

DDS and 2.2-2.95 GHz



4.4-5.9 GHz and

14.5-16 GHz

25-30 GHz,
36-41 GHz
50-75 GHz
60-90 GHz

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CG 3K-6: ITU-R P. 1411-10:

Harmonization of path loss model

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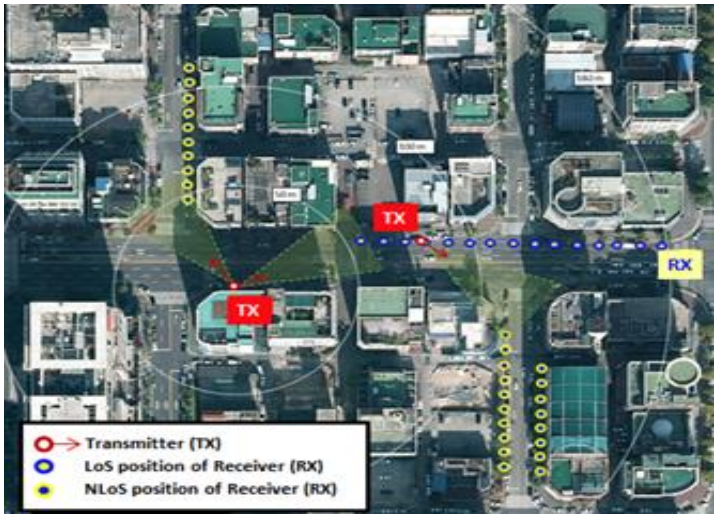
Environments: UK, Japan, Korea



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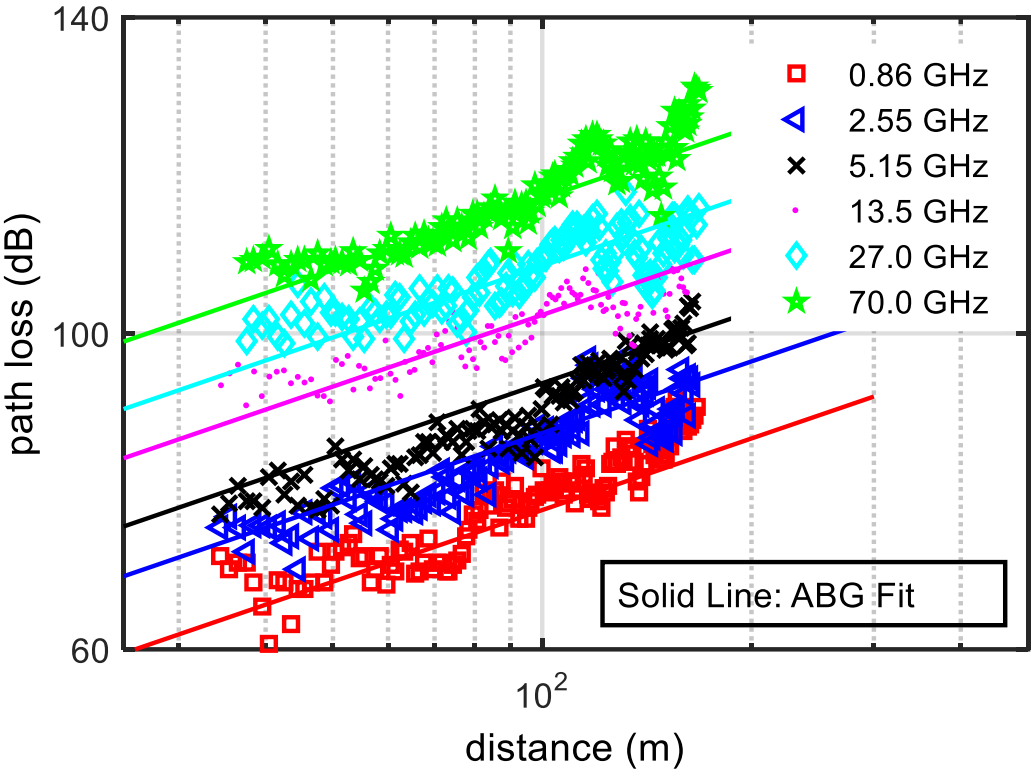
Multi-band Residential NLOS Measurements



AGB

(α, β, γ, σ)

3.01, 18.8, 2.07, 3.07

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Adopted model for below rooftop

Frequency range (GHz)	Distance range (m)	Type of environment	LoS/ NLoS	α	β	γ	σ
0.8-73	5-660	Urban high-rise, Urban low-rise/ Suburban	LoS	2.12	29.2	2.11	5.06
0.8-38	30-715	Urban high-rise	NLoS	4.00	10.2	2.36	7.60
10-73	30-250	Urban low-rise/ Suburban	NLoS	5.06	-4.68	2.02	9.33
0.8-73	30-170	Residential	NLoS	3.01	18.8	2.07	3.07

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ITU-R 1238-10 measurement scenarios

Indoor Ceiling height to user,
Tx=2.35 m, Rx=1.5 m

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CG 3J-3K-3M-8: ITU-R P. 2109-1 Building entry loss model

Building classification

- Thermally-efficient: metallised glass, foil-backed panels
- Traditional' buildings without such materials

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Type of properties measured

Traditional

Modern

Victorian House

80s build

Üserhuus

Weinerberger-E4

Building Research Establishment (BRE) in Watford, UK

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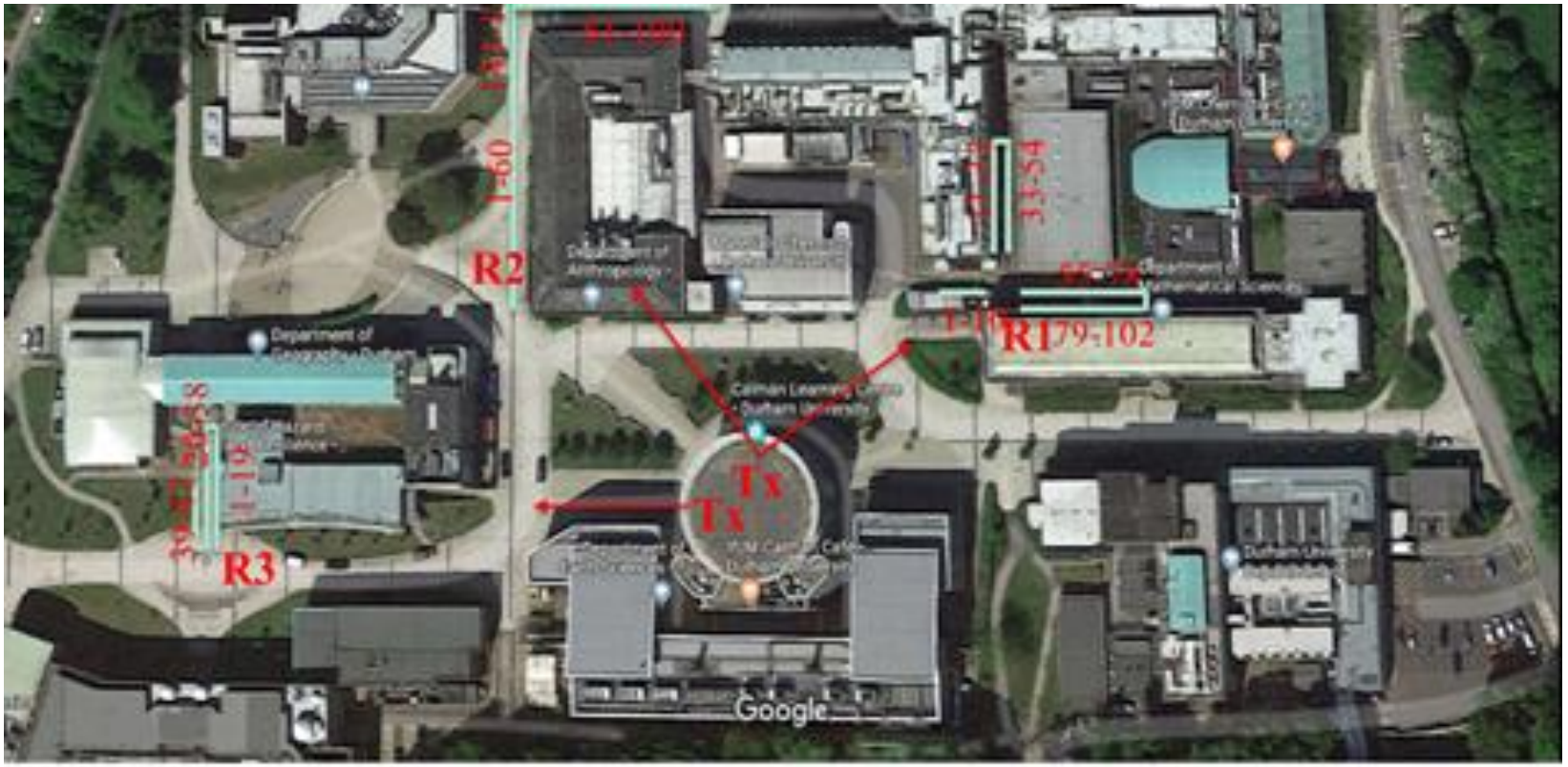
CG 3K-3M-12: Clutter loss prediction
ITU-R P. 2108 Clutter Loss Measurements UK



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Combined Clutter Loss and BEL

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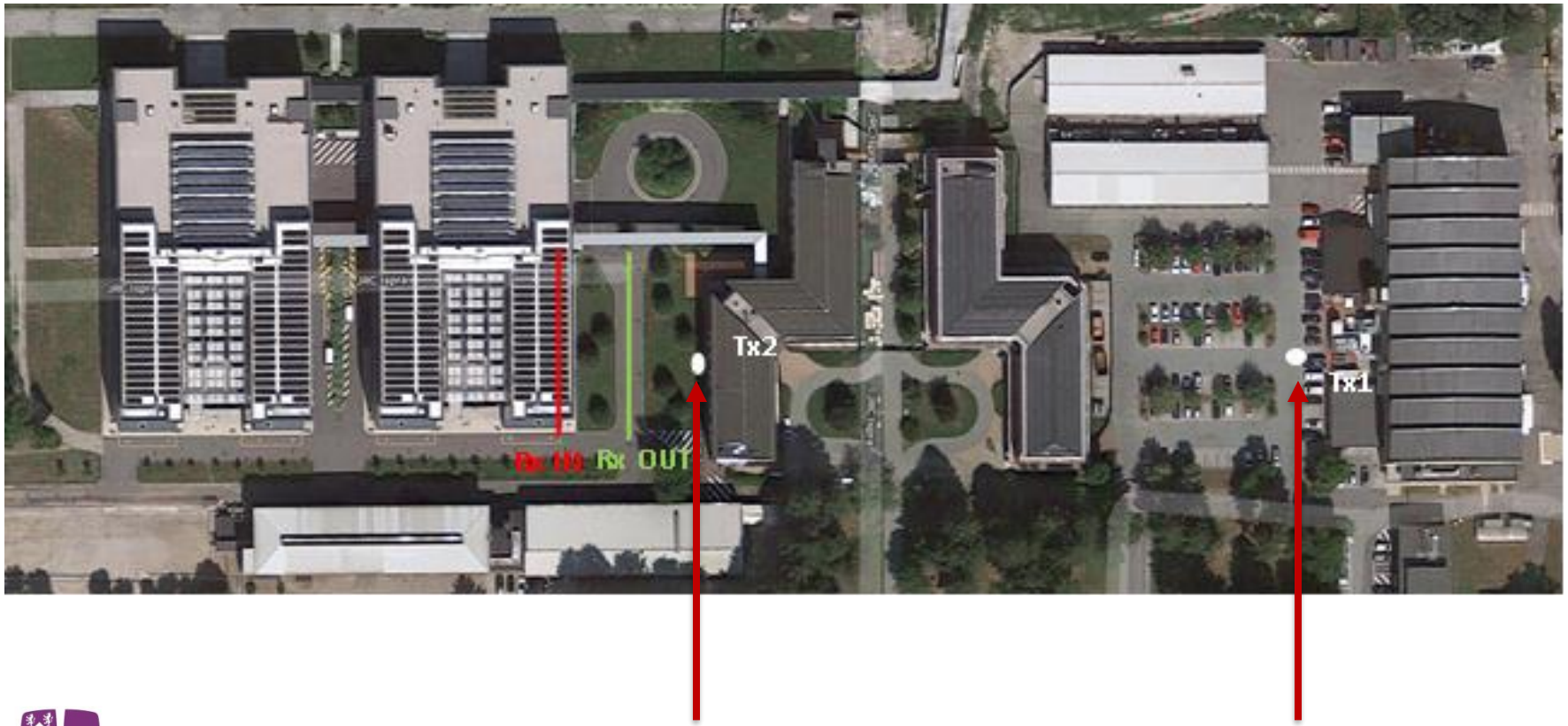
Combined Clutter Loss and BEL Wideband Measurement Scenario



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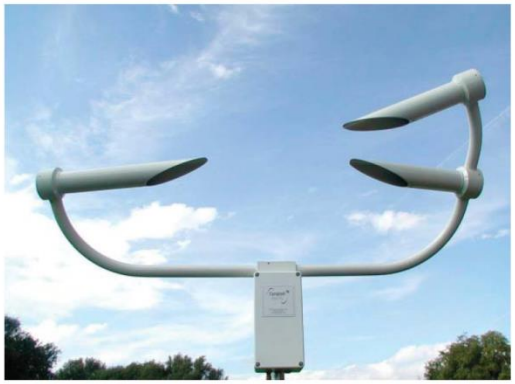
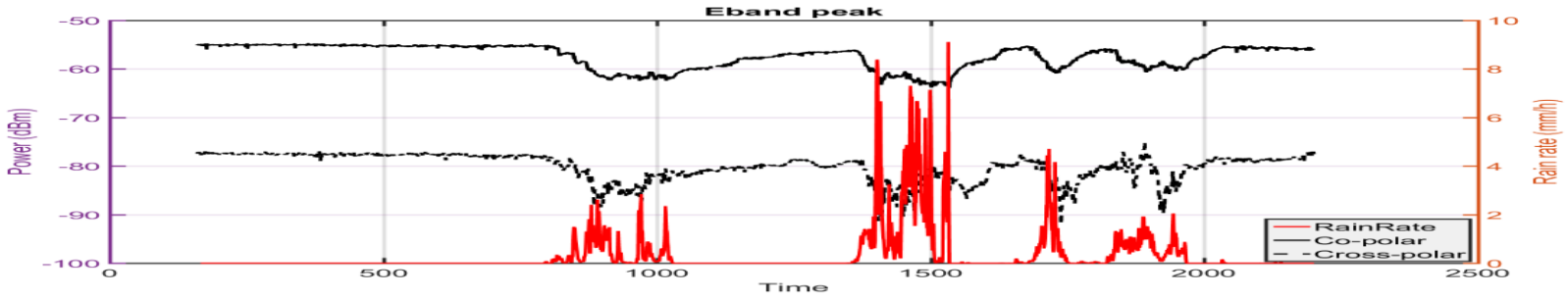
Impact of precipitation





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Future plans: 5G/6G

- **WRC23:** 140-170 GHz, and 235-300 GHz

- **Models**: Indoor, outdoor, Precipitation measurements

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