Microwave technologies in practice

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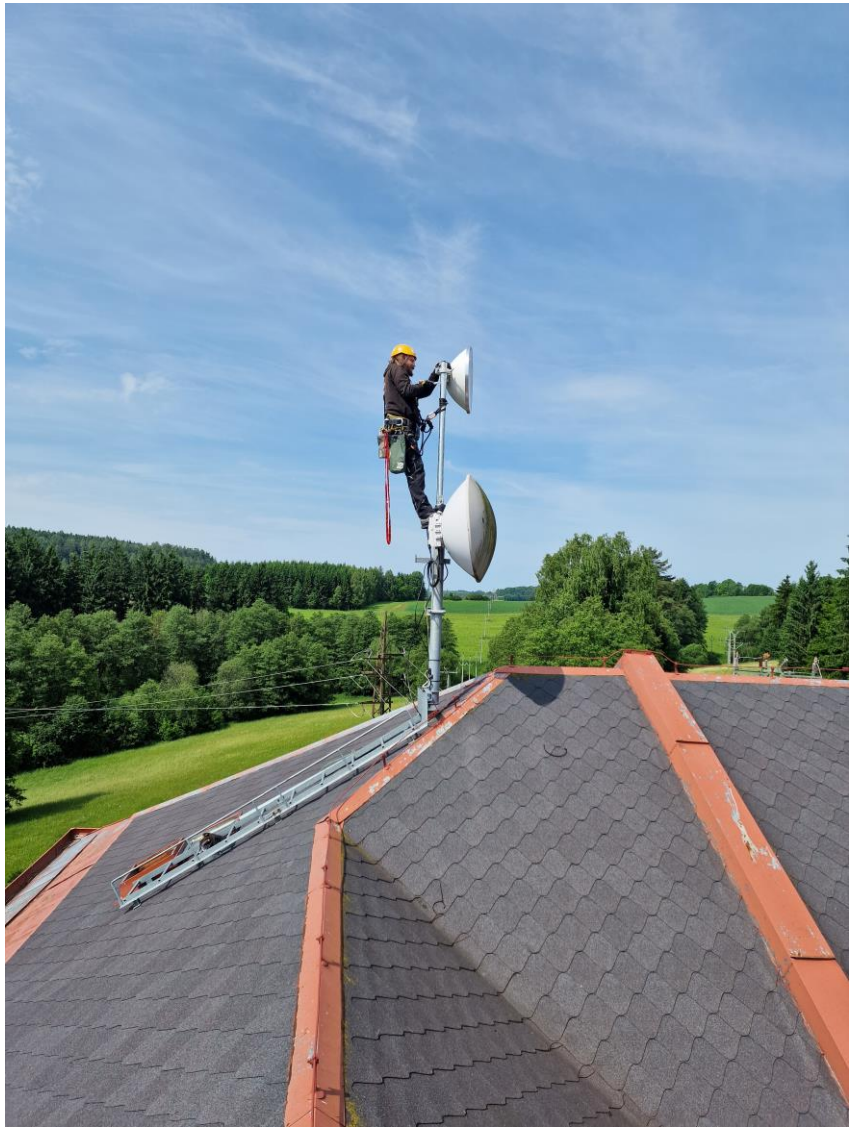
VanCo.cz

Introduction

- In telco 25+ years
- Based in CZ, covering middle Europe
- Distribution of all tier one manufactures – Aviat, Ceragon, Ericsson, RACOM, SAF, SIAE
- More than 10 000 MW links installed, more than 20 000 links sold



Is there a future for MW links?

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YES

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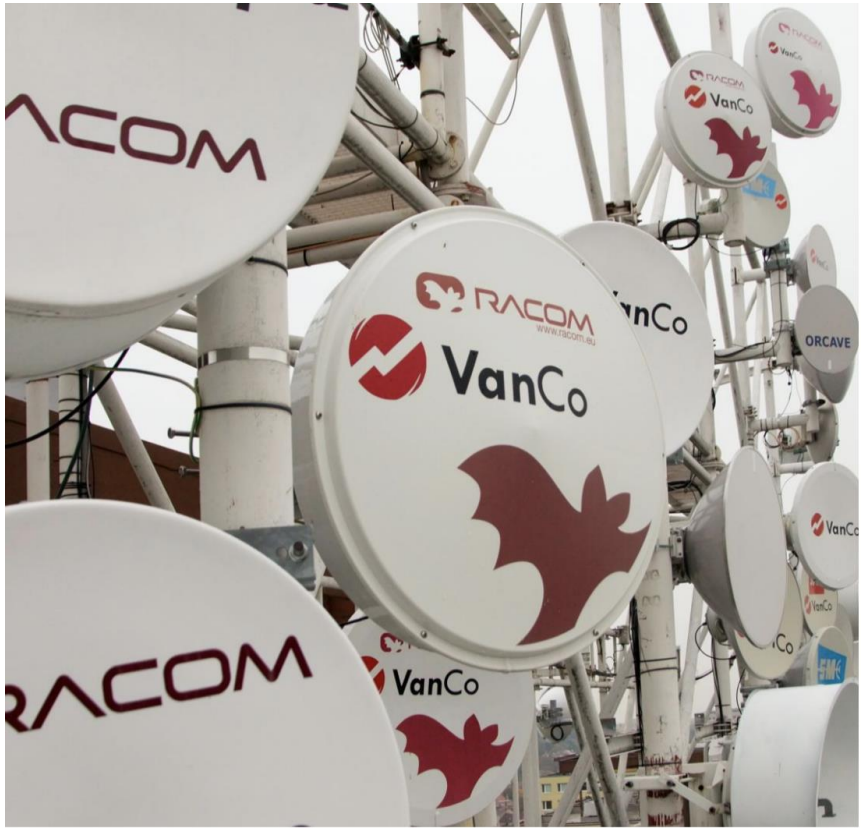
- Connectivity needed – factors to be considered:
  - Capacity
  - Distance
  - Reliability
  - Price
  - Deployment speed



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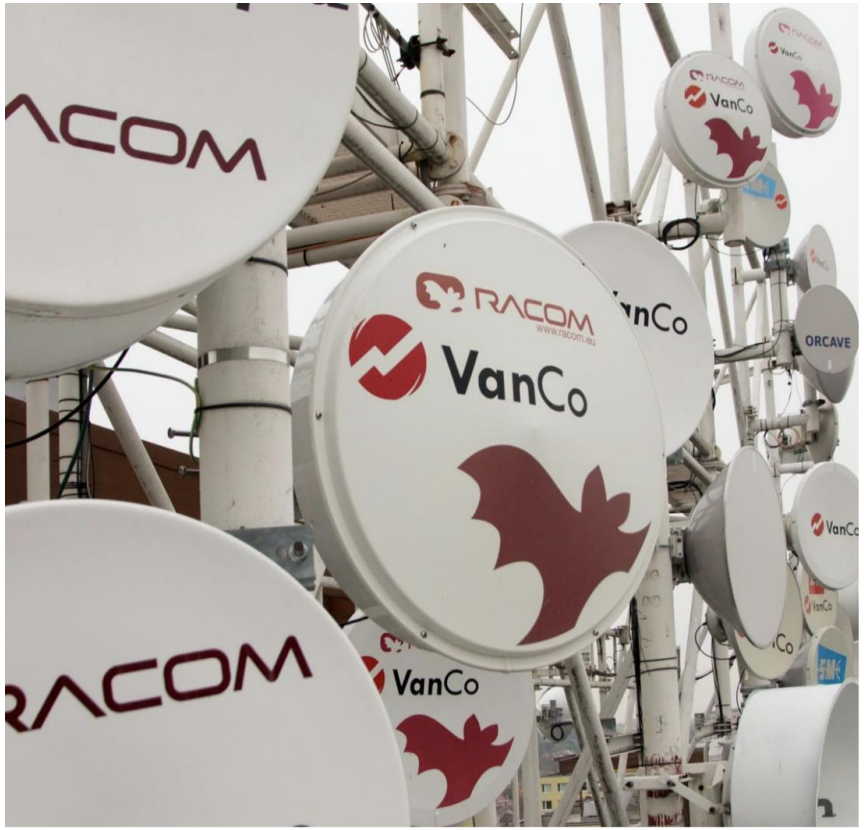


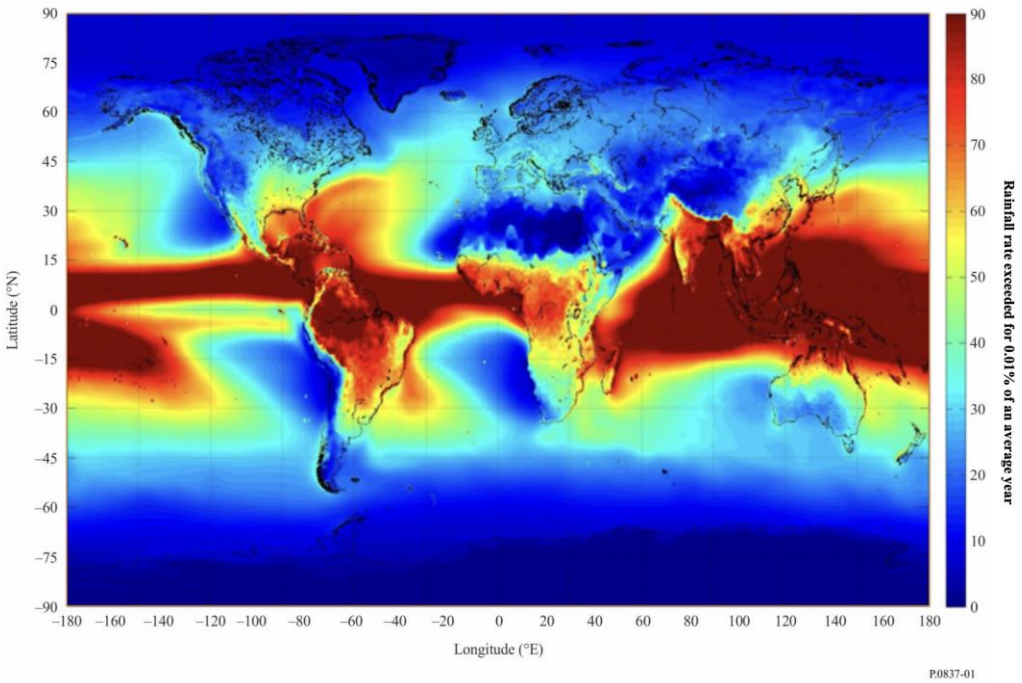
Let‘s look closer: **Reliability**

- Calculation methodologies based on the recommendations ITU-R P.837-7 and ITU-R P.453.
- Counts with:
  - Atmospheric attenuation
  - Rain attenuation and rain probability
  - Multipath, Atmosphere refractivity

- No problem to achieve 2 Gbps / 20 km link

with 99.997% availability (14 mins/year)

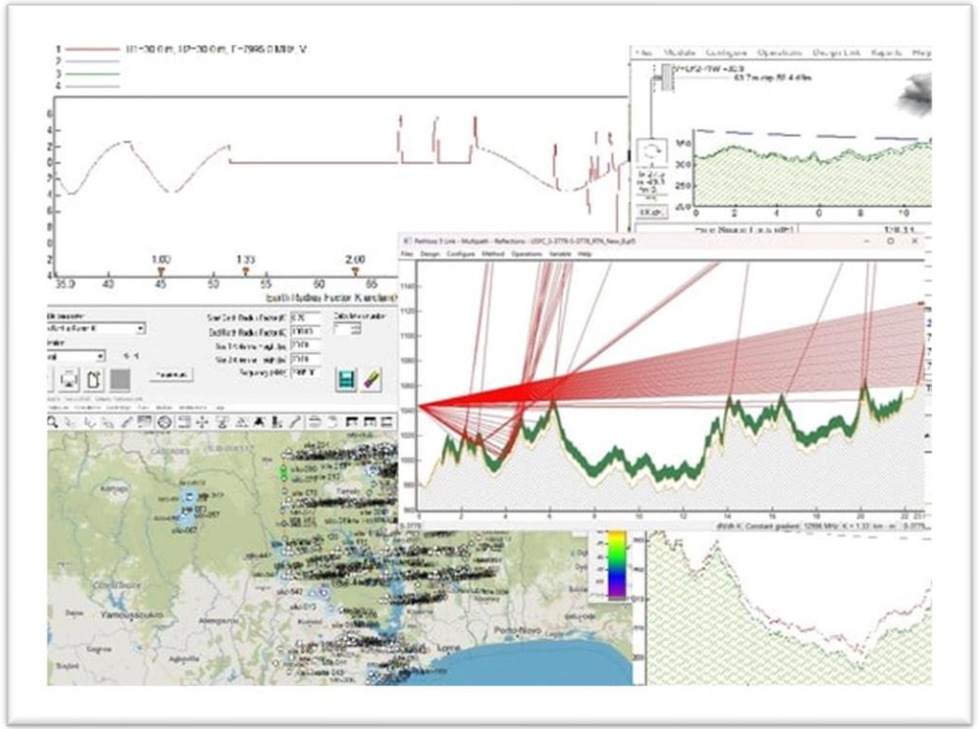
- Complicated? No way! Use calc tools!



Use calculators!

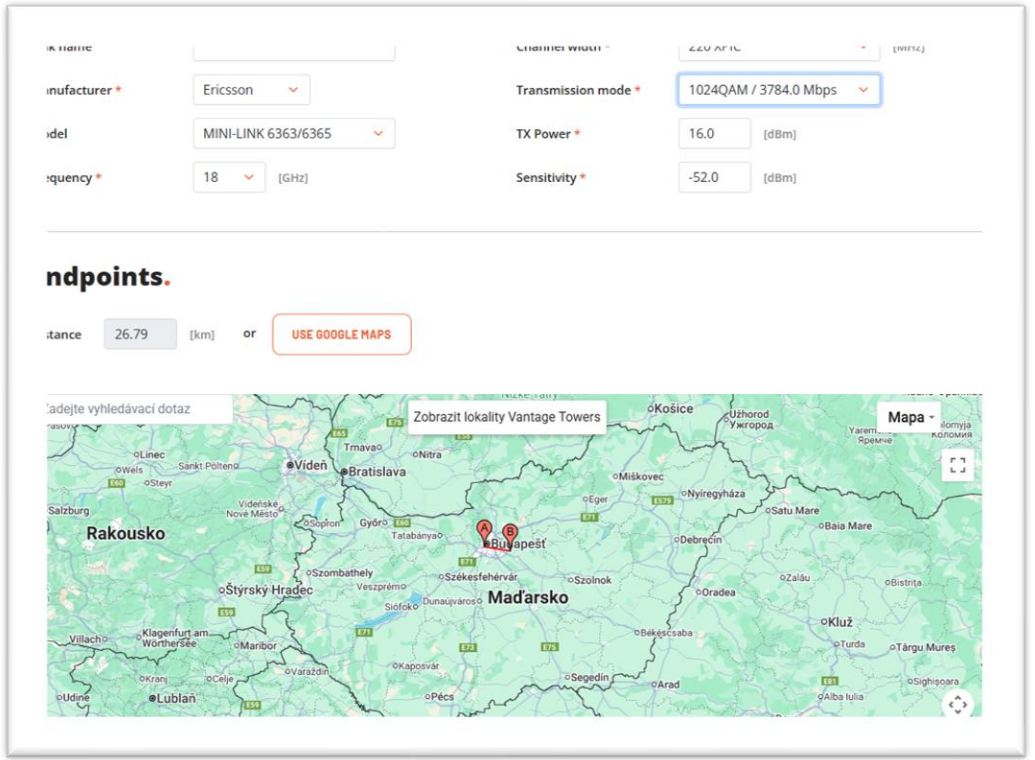
- For hardcore professionals:

Pathloss



- For fast, simple, free and accurate results:

VanCo Link Calculator



Let‘s look closer: **Capacity**

- 1 Gbps? 10 Gbps? 100 Gbps? It‘s just about the right technology!

- Wider channels
- Higher modulations
- Multiple streams

… and a lot of math ☺

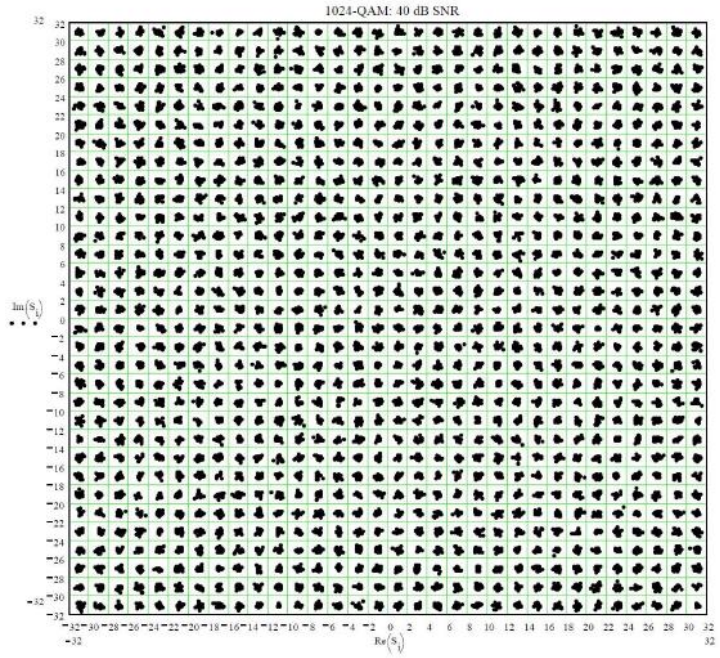


Figure 3 – 1024-QAM at SNR = 40 dB

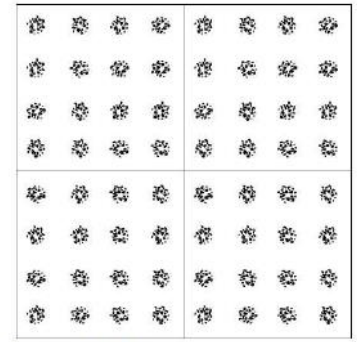


Fig. 1B CW Interference

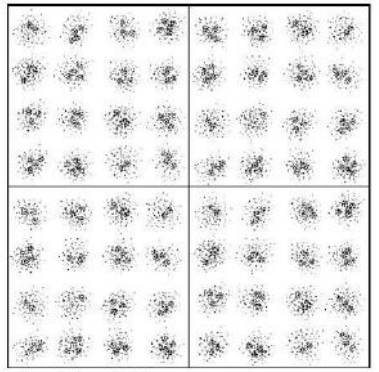
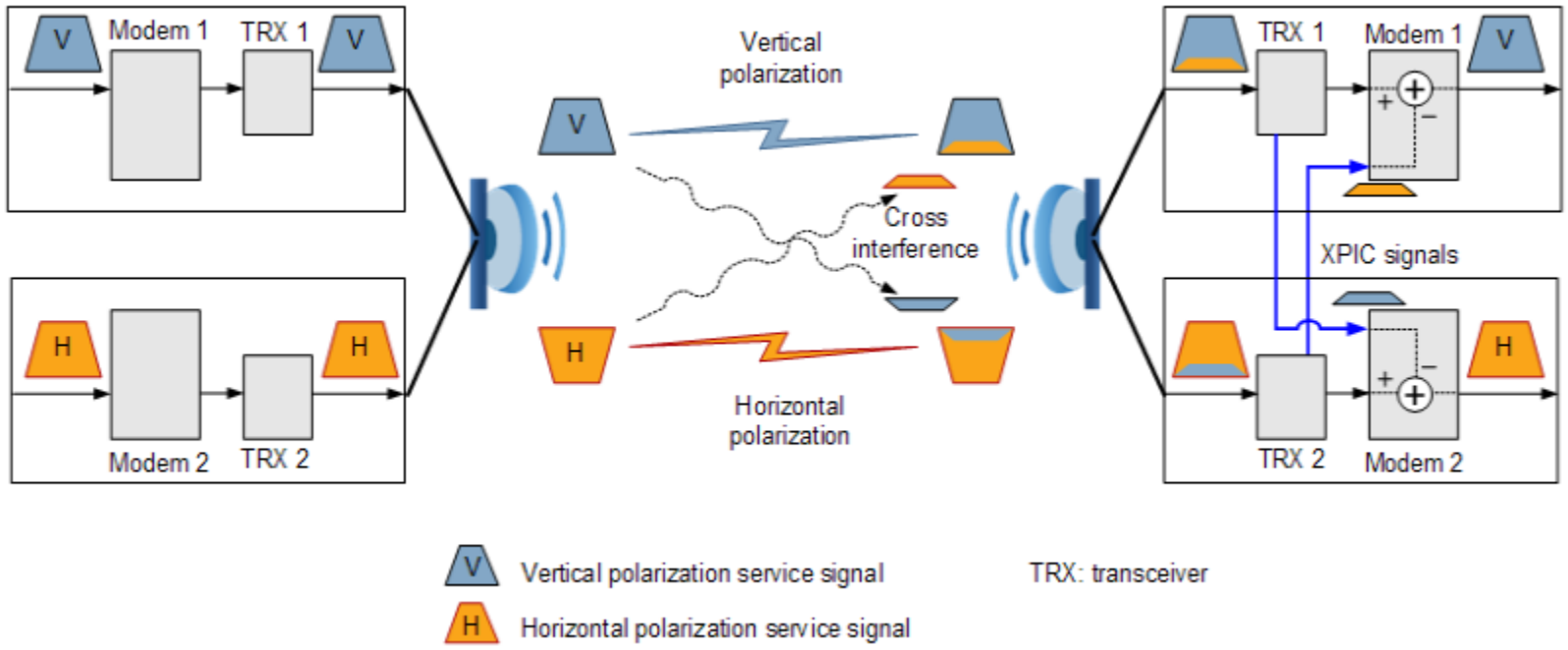


Fig. 1A Noise

XPIC

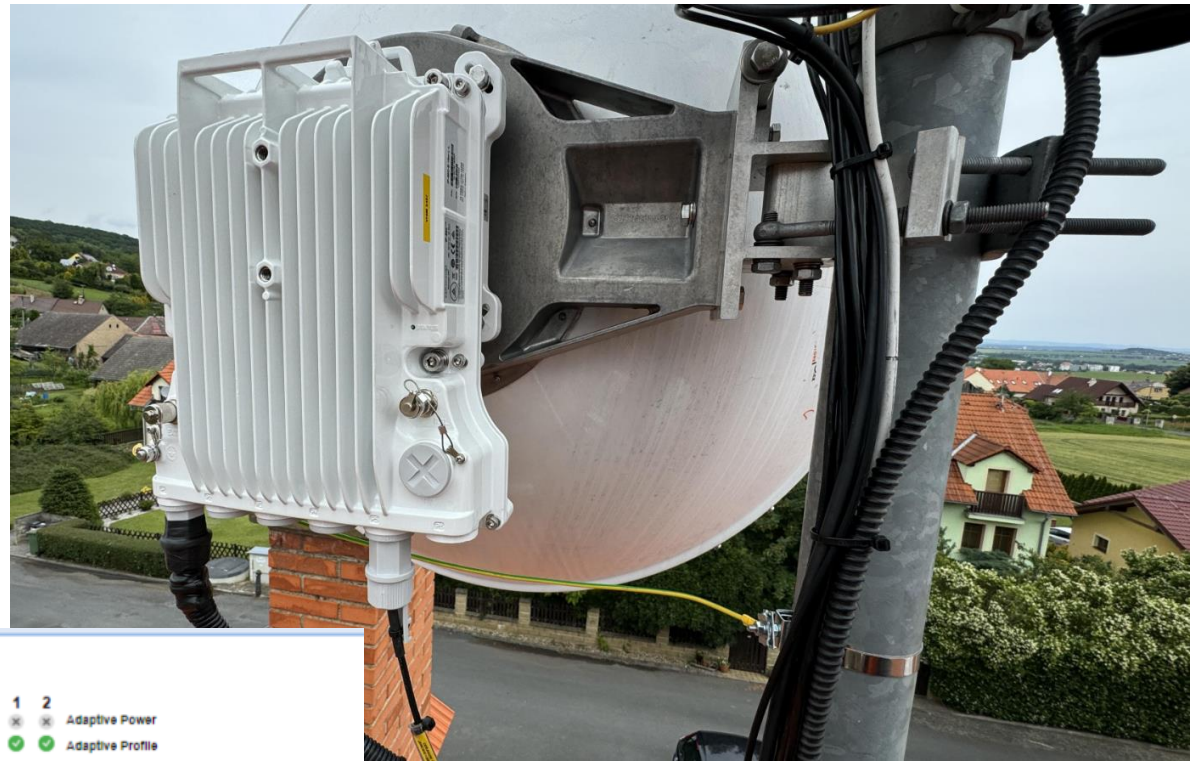
- Cross-Polarization Interference Cancelling
- Two signals on the same frequency but with different polarizations

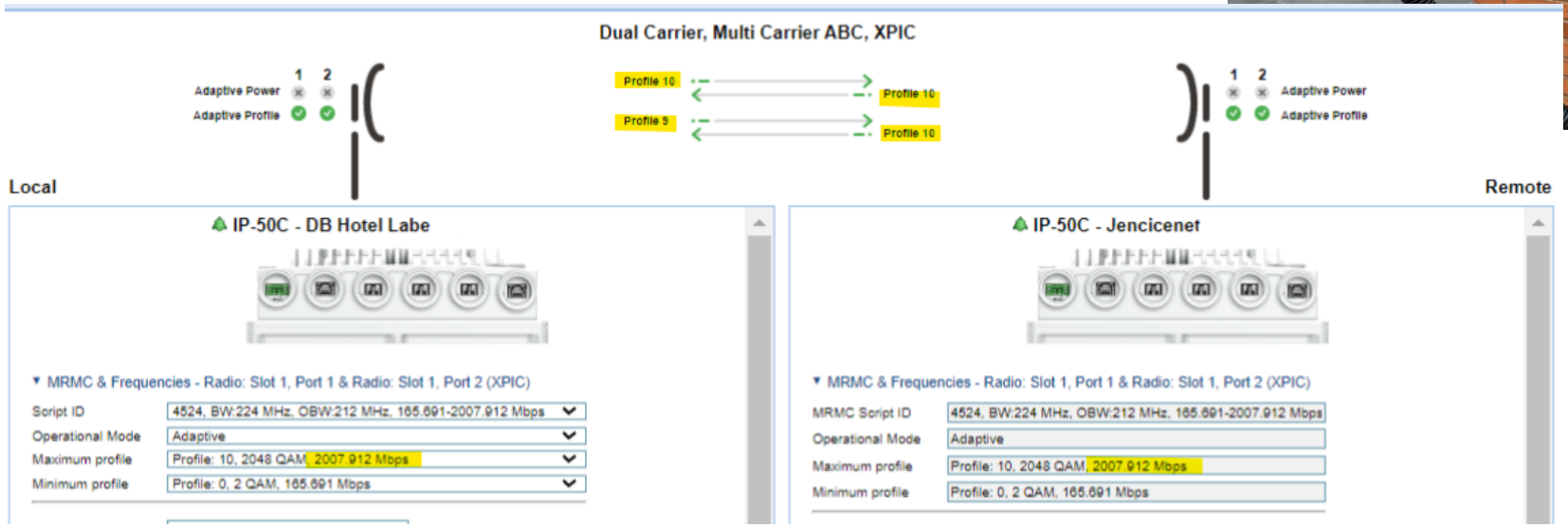


XPIC – real use cases

- Compact, easy to deploy
- Link distance - 12 km
- Deployed as 2 Gbps,

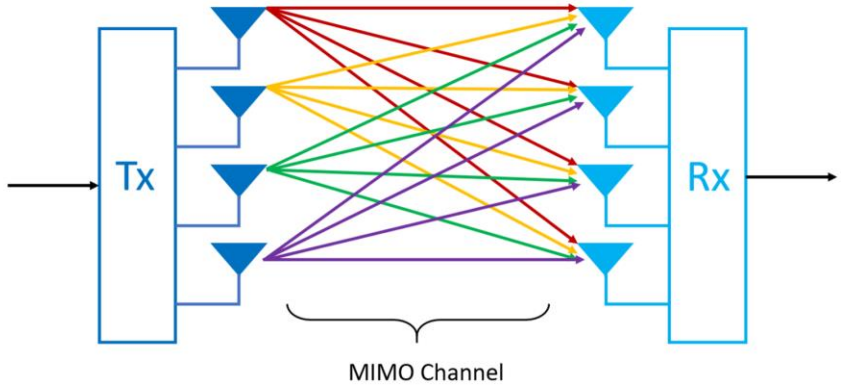
instant upgrade to 4 Gbps

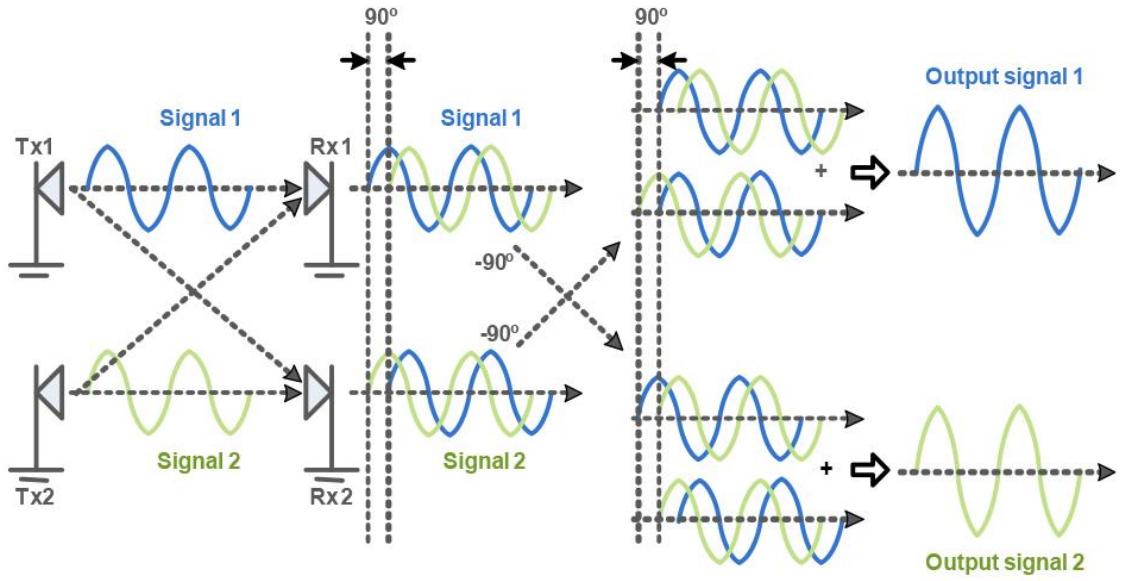




MIMO

- Multiple Input Multiple Output
- Based on several (typically 2) streams with the same frequency and multiple antennas with exact space separation
- Uses the principle of multipath propagation of radio signals and known phase shift





MIMO – real use cases

- 2x Ceragon IP-20C, 28 MHz, MIMO 4x4 (2x XPIC link in LoS MIMO configuration)

$\Rightarrow$**1 Gbps capacity in 28 MHz channel**

MIMO – real use cases

- E-Band setup
- 8x Ericsson MINI-LINK 6352
- 4x dual pol antenna
- 2.5 GHz channel / 18 dBm
- Link distance 1.5 km
- Linc calc for 100 Gbps … 99.9995%

Let‘s look closer: **Distance**

- 20 Gbps link for 10 km with only 60cm antennas?

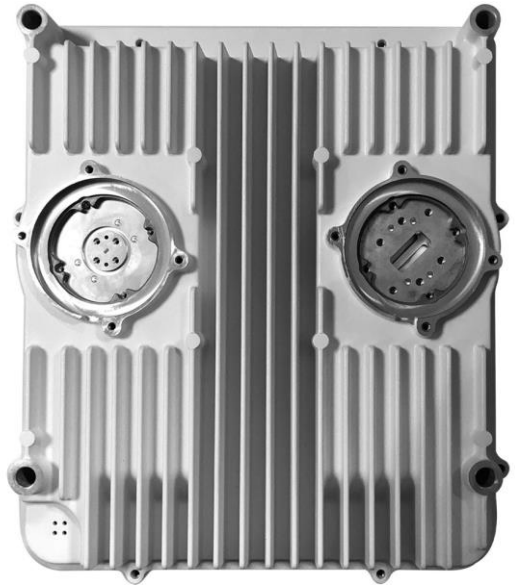
Total adaptive availability

Modulation Link 1	Modulation Link 2	Total Capacity	Availability
4QAM_strong	-	151 Mbps	100 %
4QAM_std	-	176 Mbps	99.99984 %
16QAM_strong	-	302 Mbps	99.99953 %
16QAM_std	-	352 Mbps	99.99939 %
32QAM_std	-	441 Mbps	99.99888 %
64QAM_std	-	553 Mbps	99.99791 %
128QAM_std	-	654 Mbps	99.99628 %
256QAM_std	-	754 Mbps	99.99159 %
512QAM_std	-	855 Mbps	99.97011 %
512QAM_std	BPSK_2_strong	1257 Mbps	99.95377 %
512QAM_std	BPSK_2_std	1538 Mbps	99.90644 %
512QAM_std	BPSK_std	2220 Mbps	99.88303 %
512QAM_std	4QAM_std	3586 Mbps	99.85689 %
1024QAM_std	-	946 Mbps	99.84965 %
1024QAM_std	16QAM_strong	4165 Mbps	99.75981 %
1024QAM_std	16QAM_std	6408 Mbps	99.68109 %
2048QAM_std	-	983 Mbps	99.44091 %
2048QAM_std	32QAM_std	7811 Mbps	99.33404 %
2048QAM_std	64QAM_std	9176 Mbps	98.23614 %
2048QAM_std	128QAM_std	10542 Mbps	80.99599 %

Average capacity: 10229 Mbps

Multiband

- Combination of E-band (80 GHz) with lower frequency
- One dual-freq antenna or two antennas next to each other



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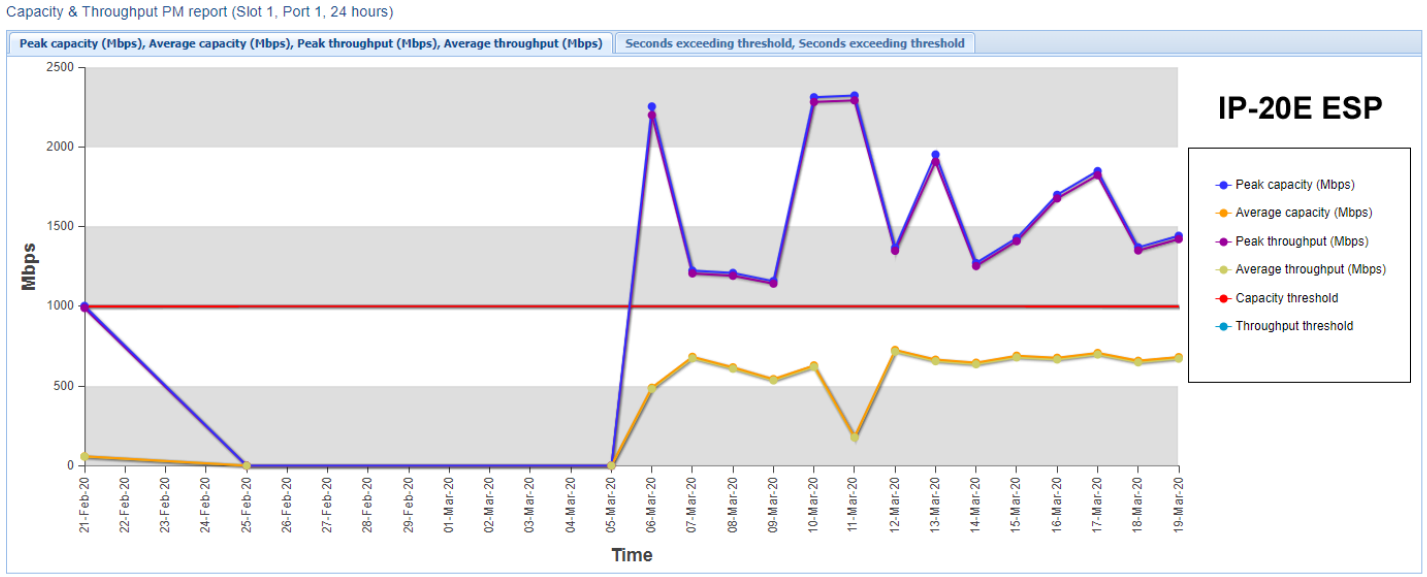
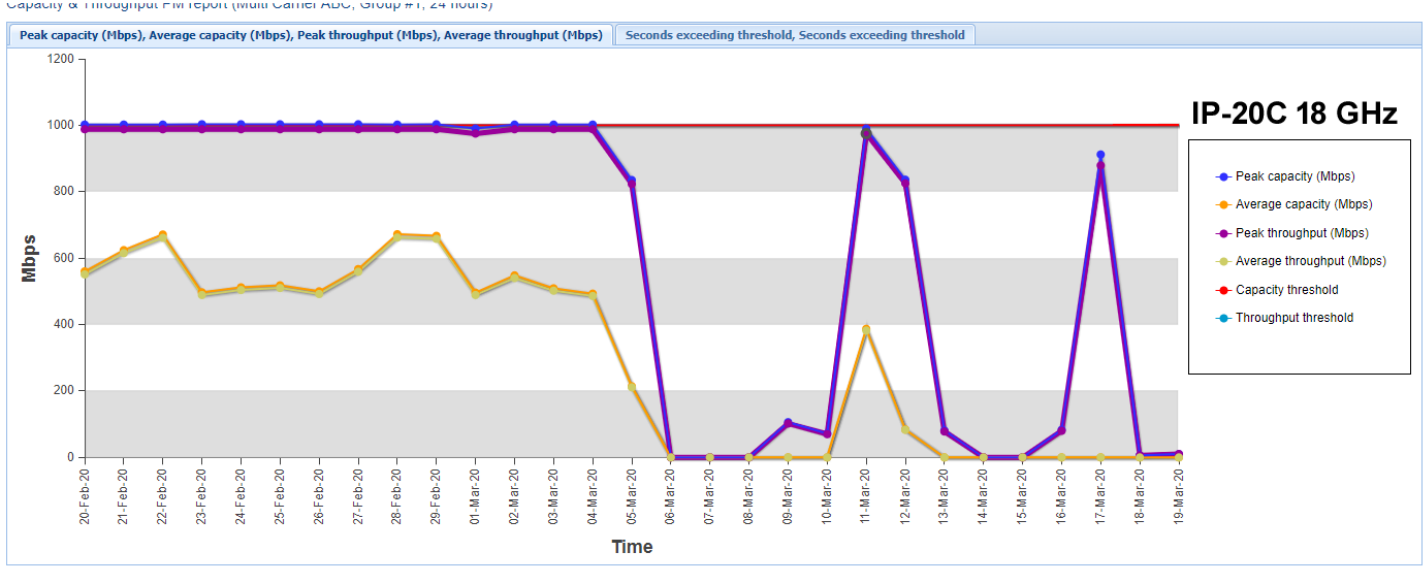
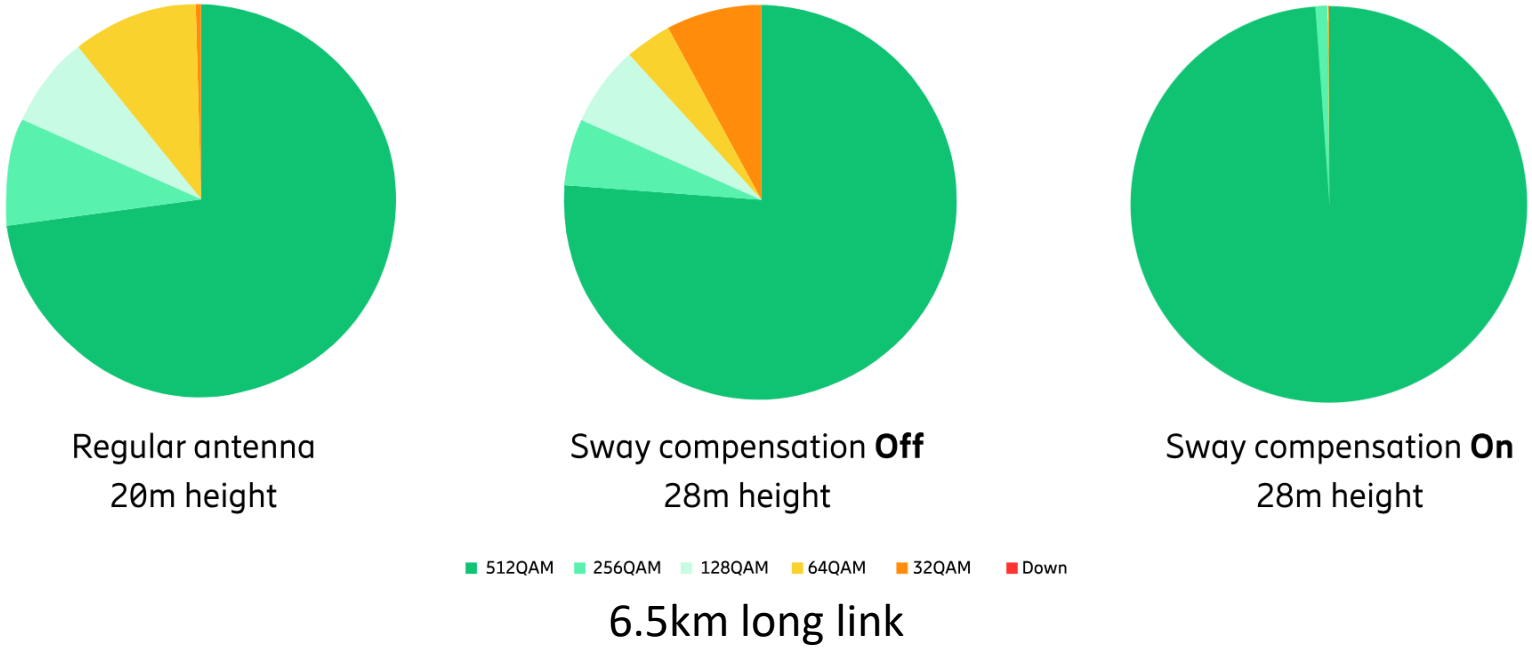




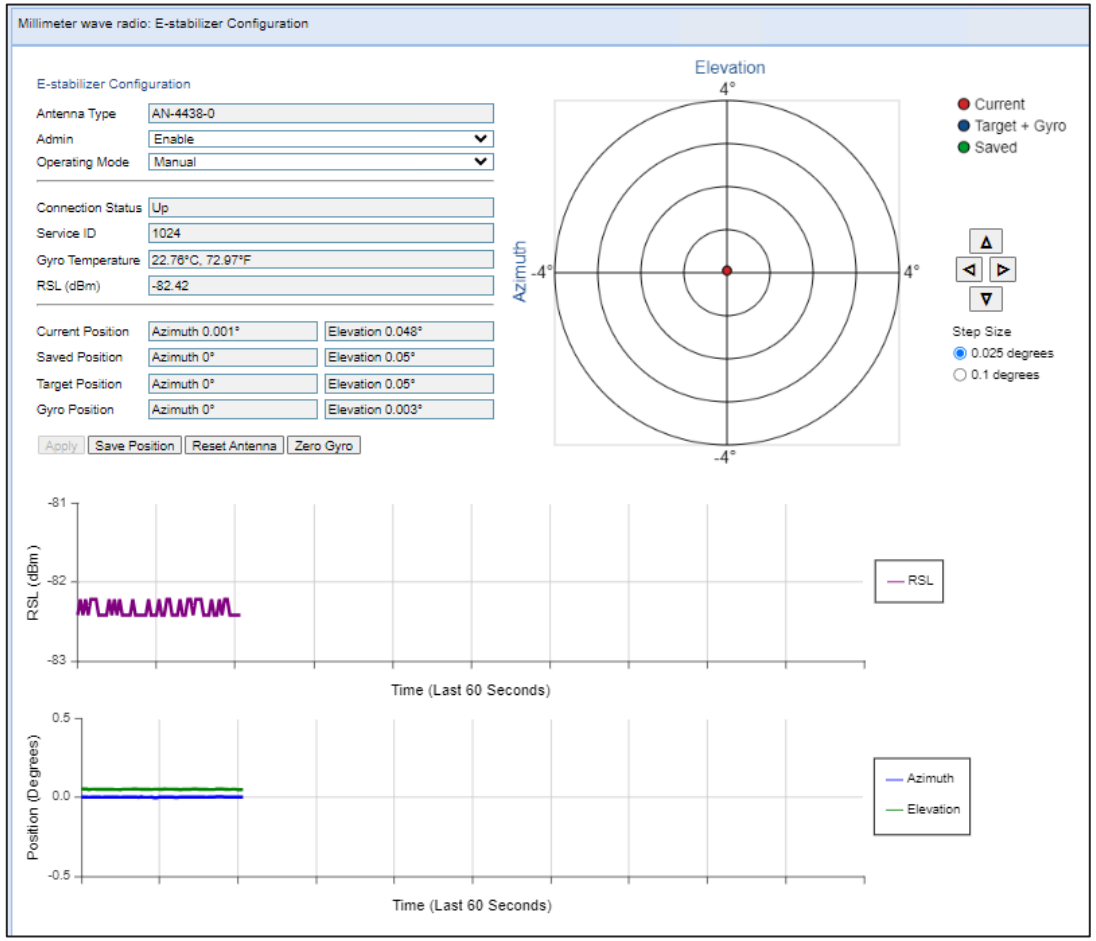
Stabilized antennas

- For 80 GHz band
- Mechanically stabilized feeder
- Enabling long hops with higher capacity



Stabilized antennas

- Compensates for movements in any direction (both Vertical and Horizontal)
- Pole swing and sway in rates of up to 10 Hz
- Deflection of up to 4º



Conclusion

- MW link = still fastest and cheapest way how to get a connectivity
- Over the past years smoothly moved from hundreds Mbps to 10 Gbps as typical deployment
- New technology and signal processing algorithms can:
  - Increase the distance
  - Boost the capacity
  - Lower the fees for frequency use

- New frequency bands (D-band, W-band) are on the way!

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Thank you!

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