Visible Light Communications – Li-Fi

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RF spectrum shortage

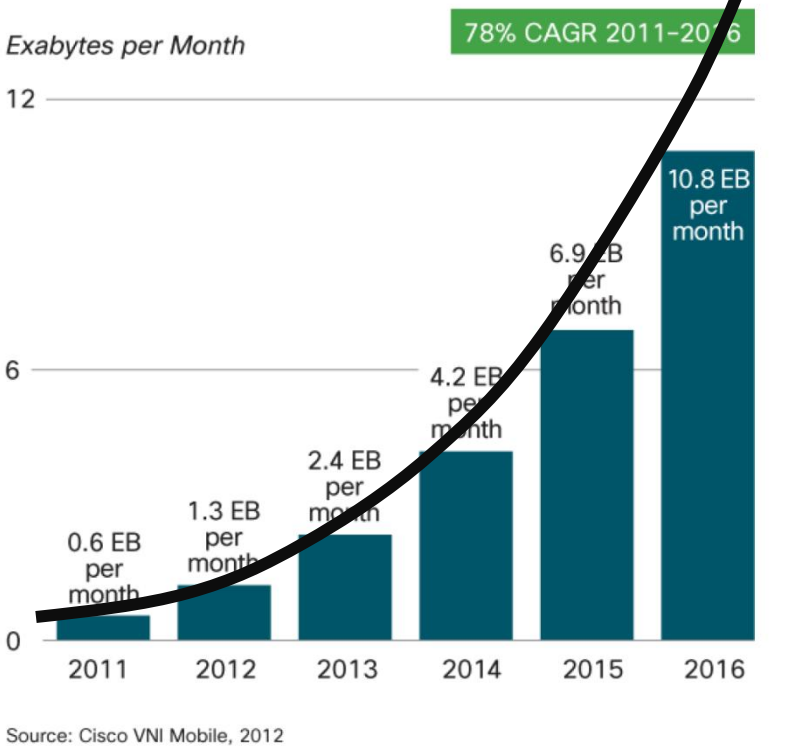
Accessibility

CO_2 reduction

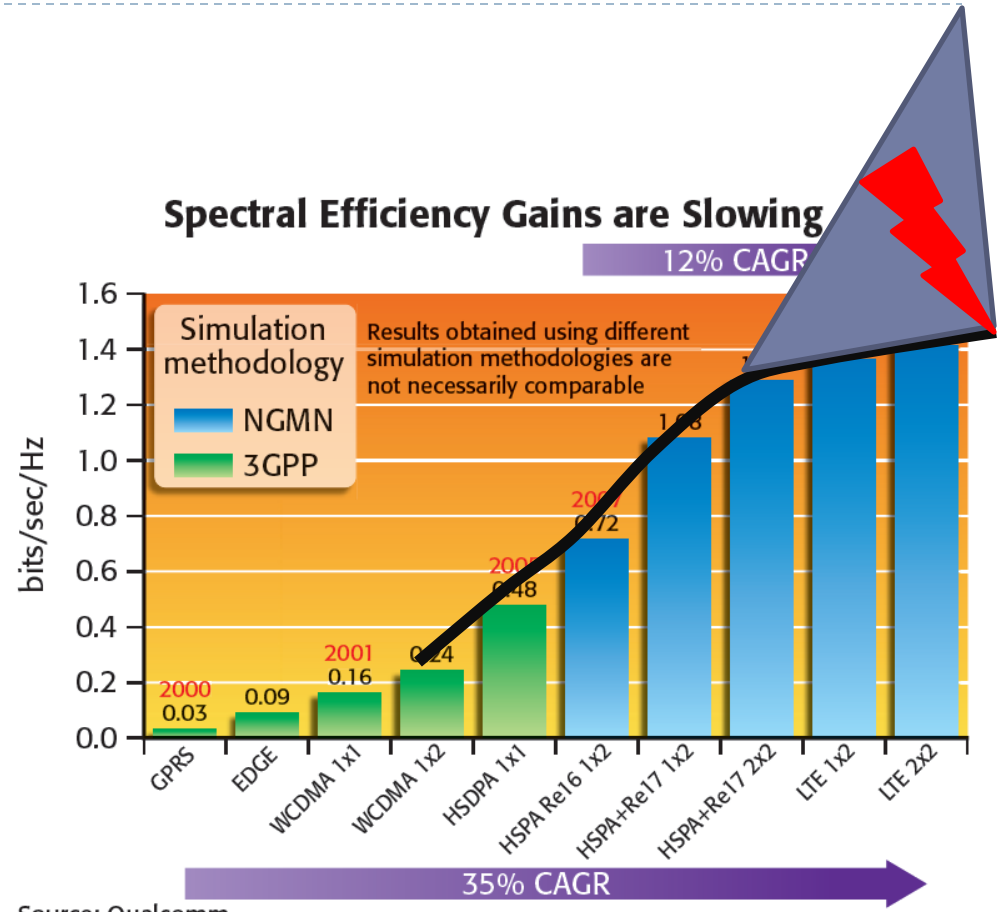
Secure communica-tions

RF Spectrum Shortage

Global Mobile Data Traffic

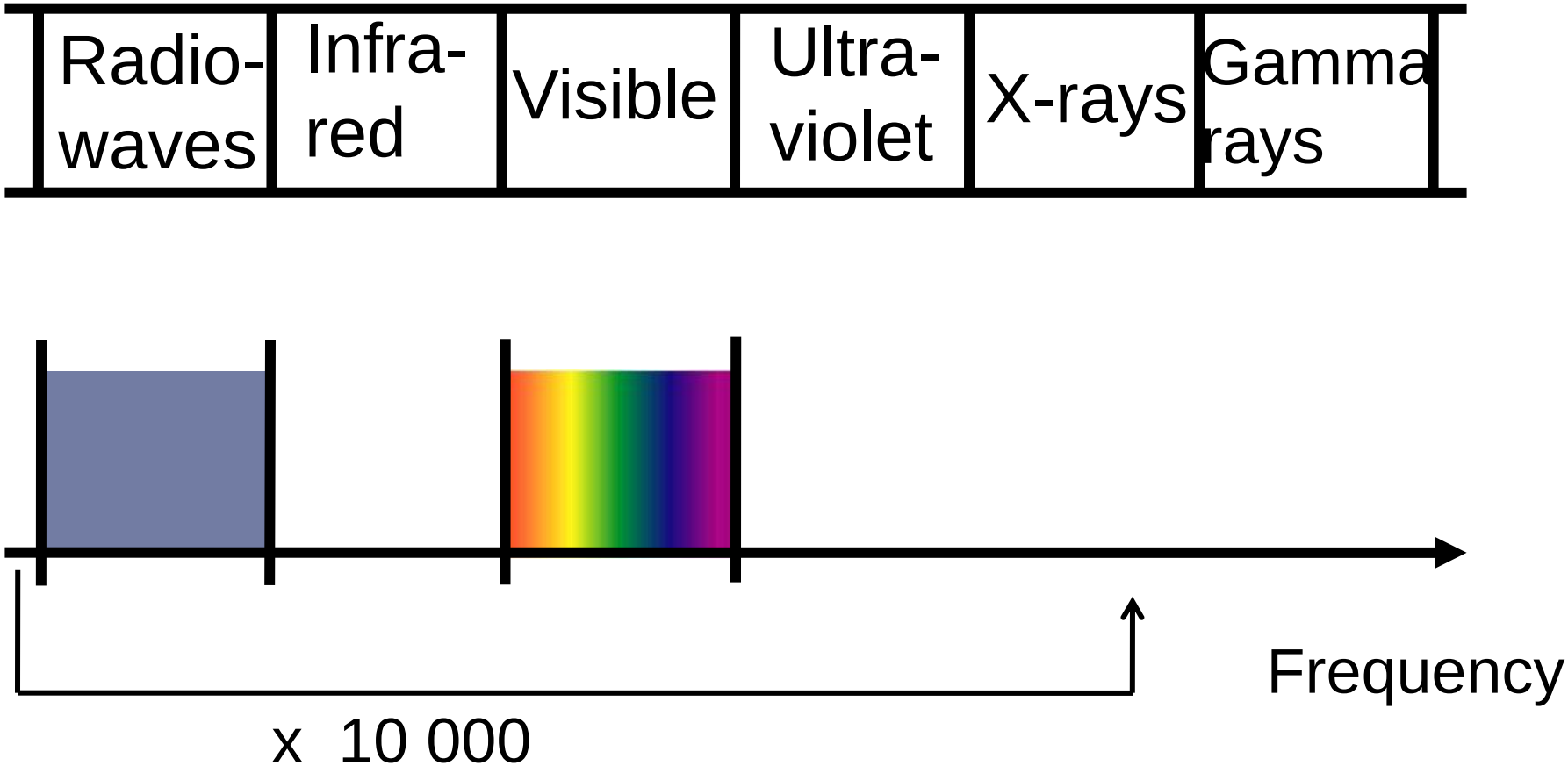


Source: Cisco VNI Mobile, 2012

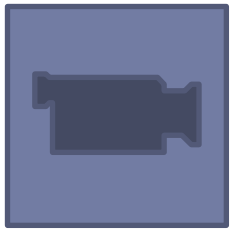


Source: Qualcomm

The electromagnetic spectrum



HD Video from an off-the-shelf LED

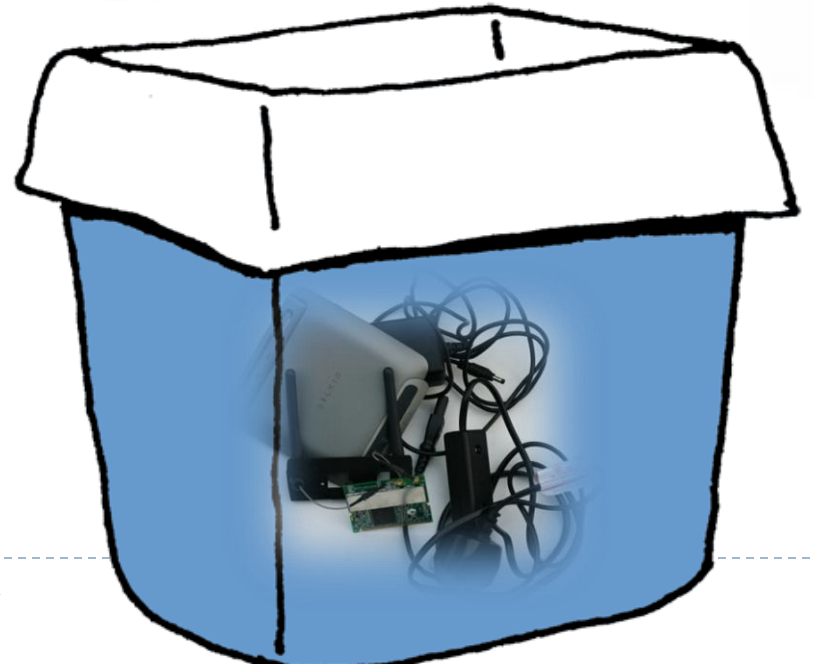


http://bit.ly/tedvlc

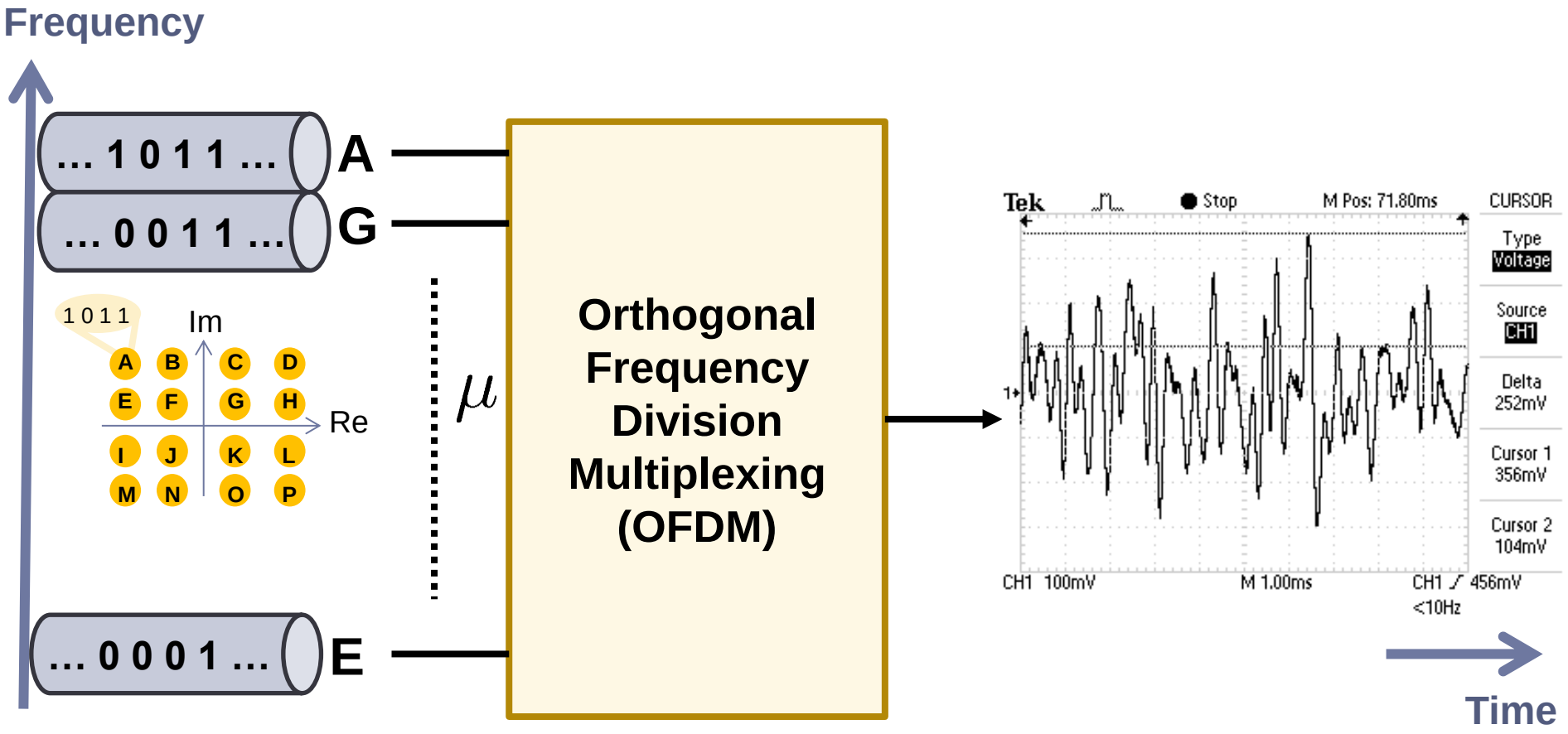
Common Misconceptions

- You cannot dim the lights.
- The lights flicker.
- This is for one direction only.
- There will be interference from sunlight.
- Lights need to be on so this is inefficient.
- You must have line-of-sight.
- This is a disruptive technology.

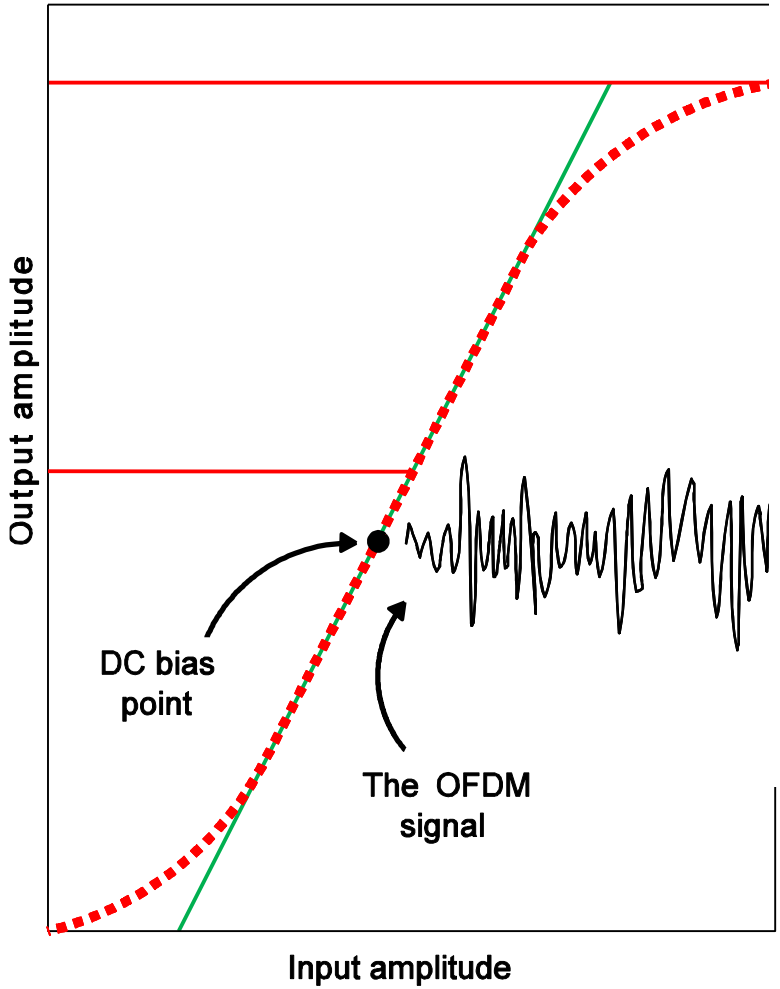

MICROCHIP
BELKIN

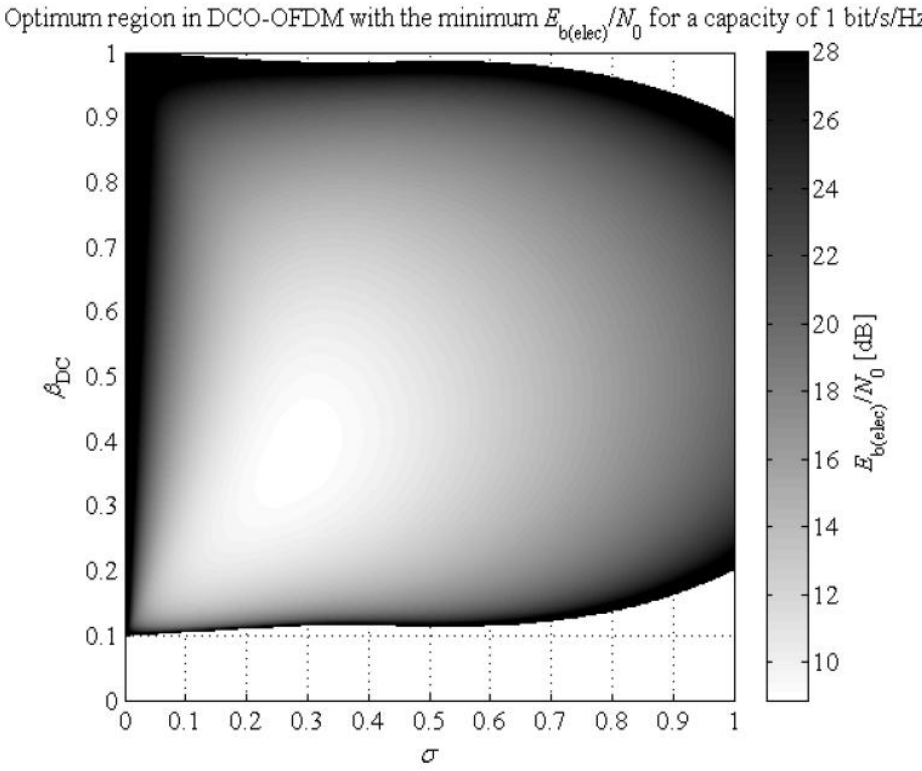


Digital Data Encoding (1)



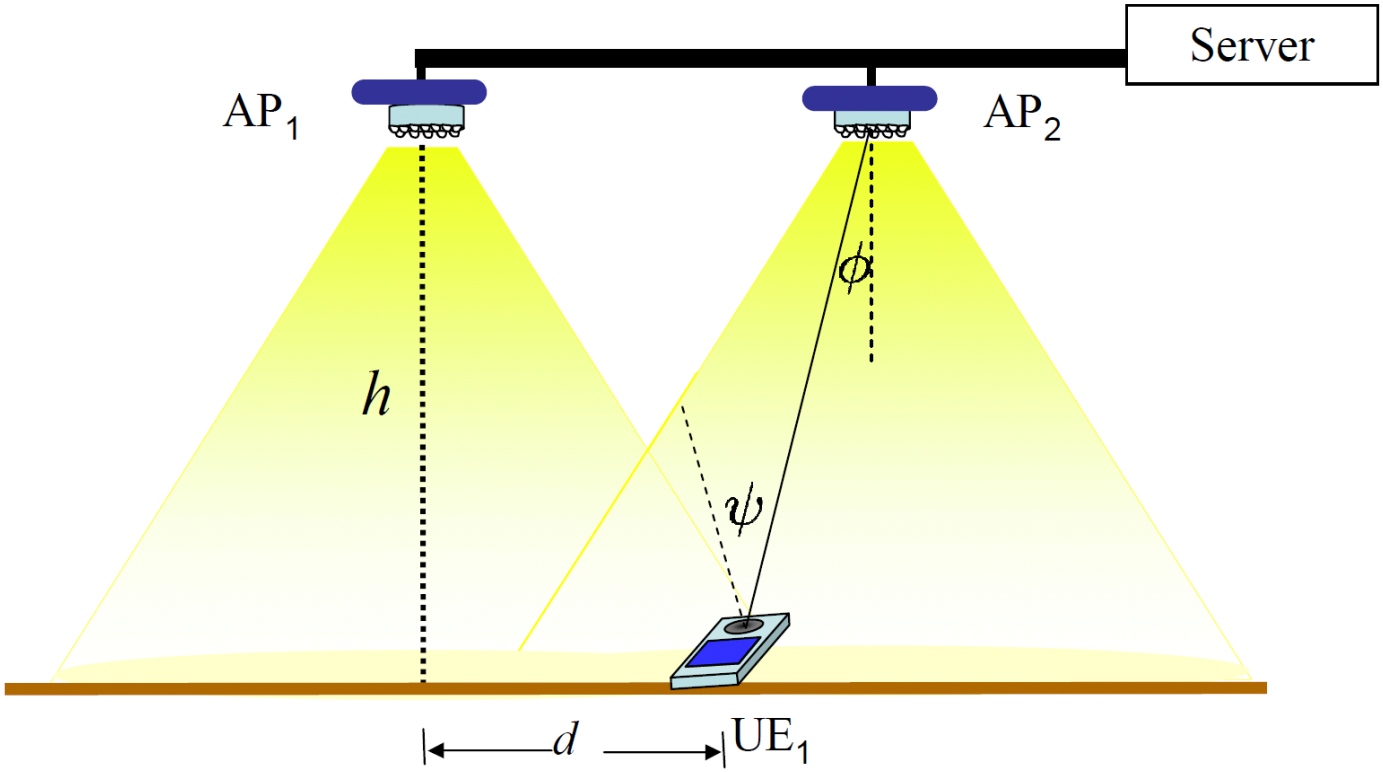
Digital Data Encoding (2)





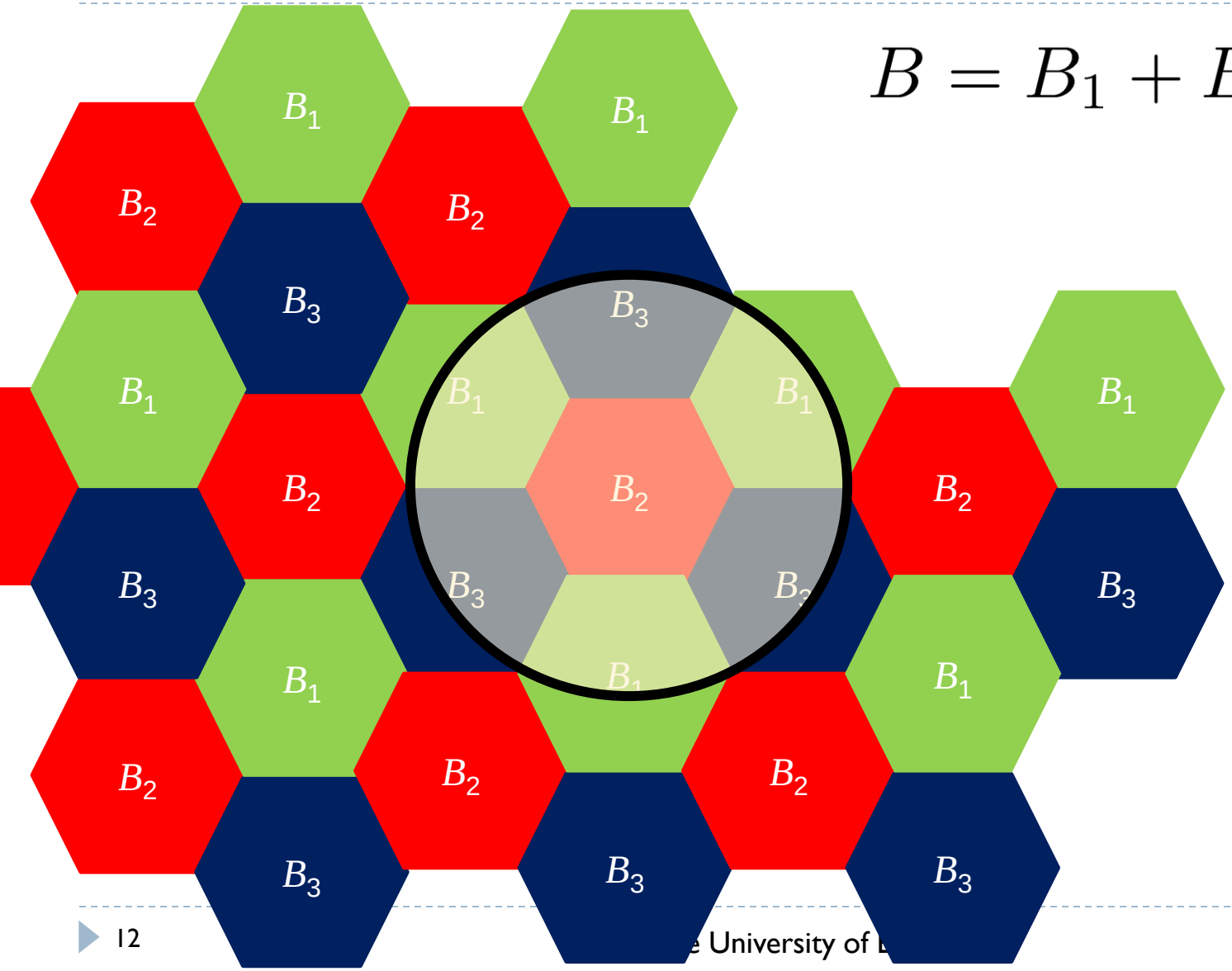
130 Mbps real-time and from off-the-shelf LED

Optical Cellular Networks

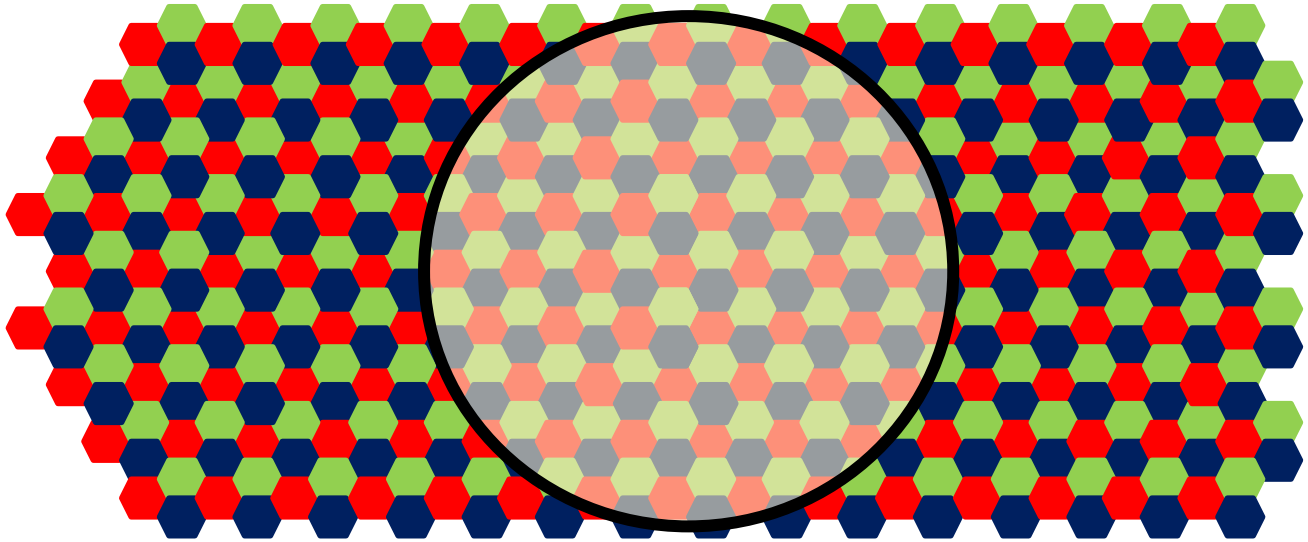


„Simple“ frequency reuse concept

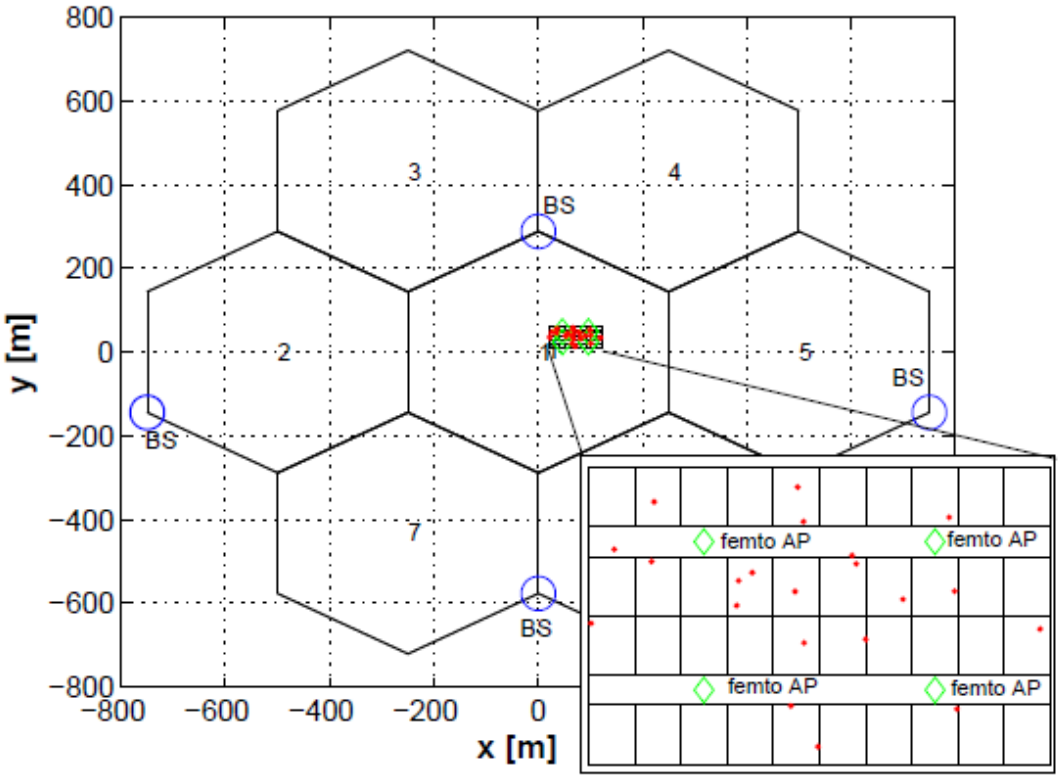
$$B = B_1 + B_2 + B_3$$



„Simple“ frequency reuse concept



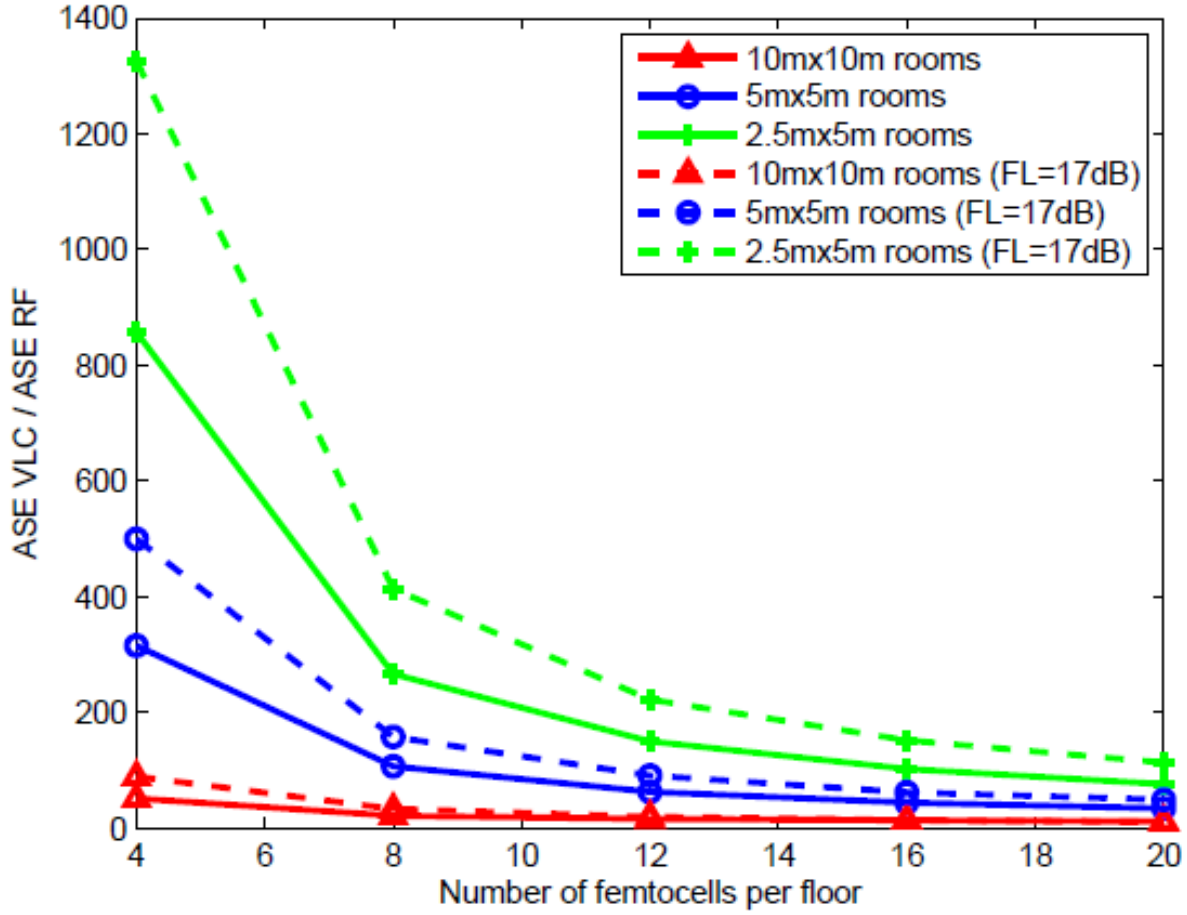
Area Spectral Efficiency



Rooms: 10 x 10 x 3 m
Corridors: 5 x 100 x 3 m

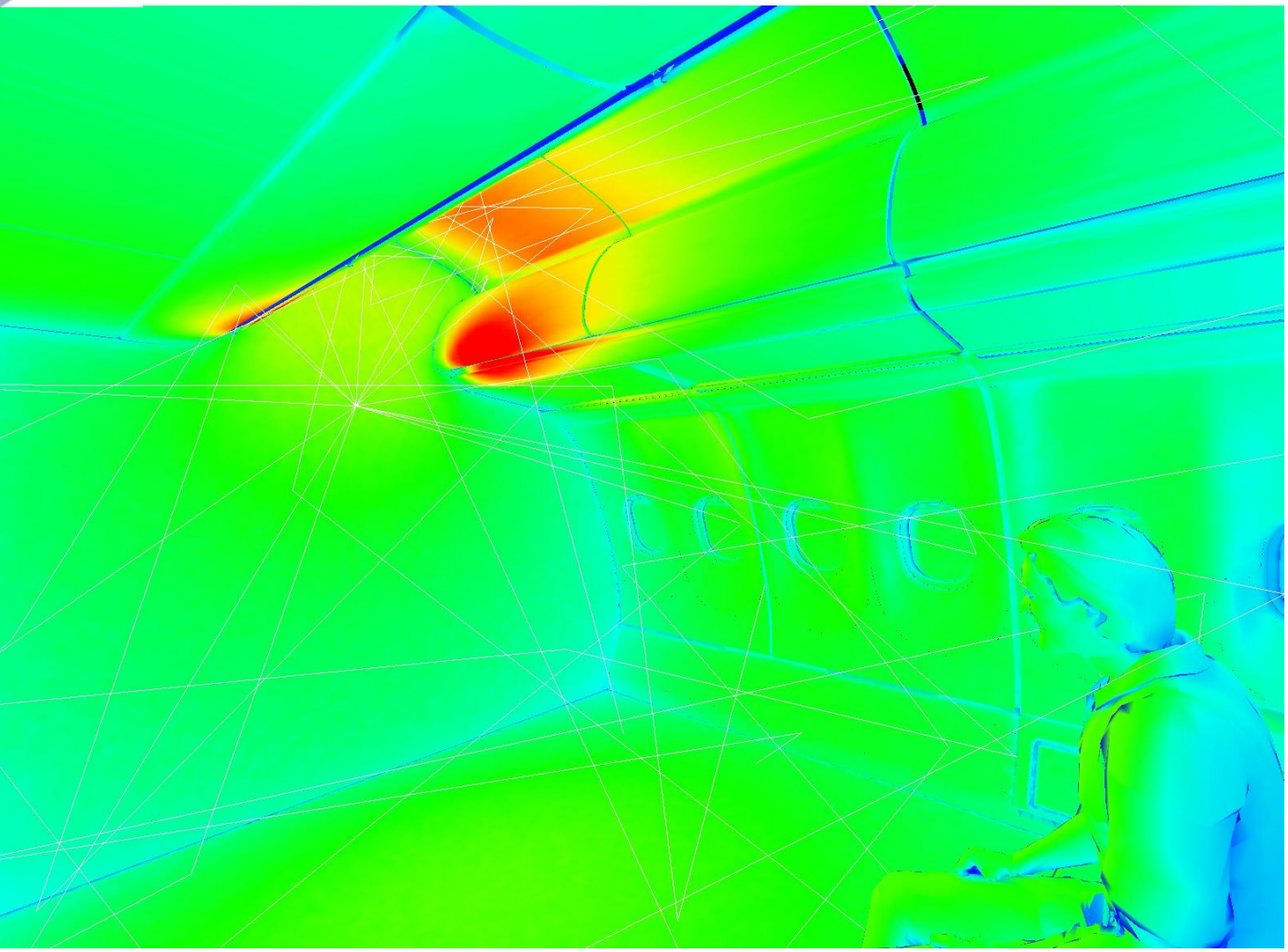
- Indoor users
- Femto Access Point (AP)
- Macrocell Base Station (BS)

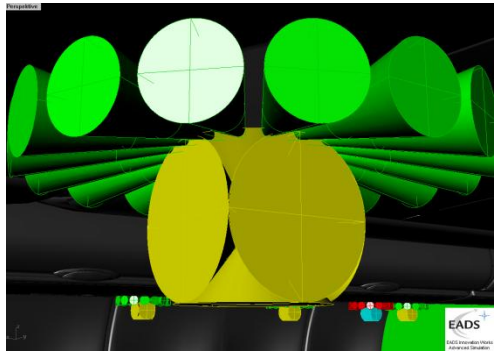
„Simple“ frequency reuse concept

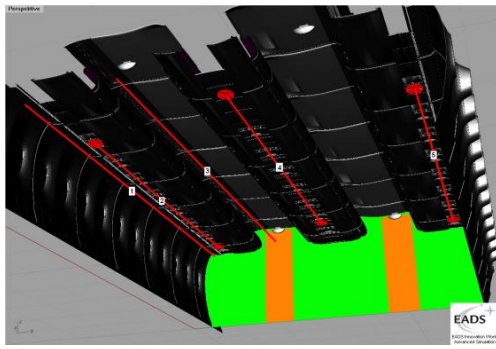


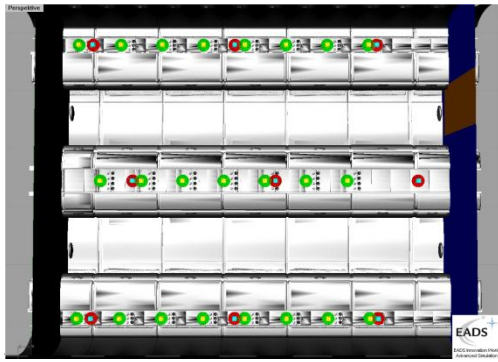
I. Stefan, et al., “Area Spectral Efficiency Performance Comparison between VLC and RF Femtocell Networks, ICC 2013

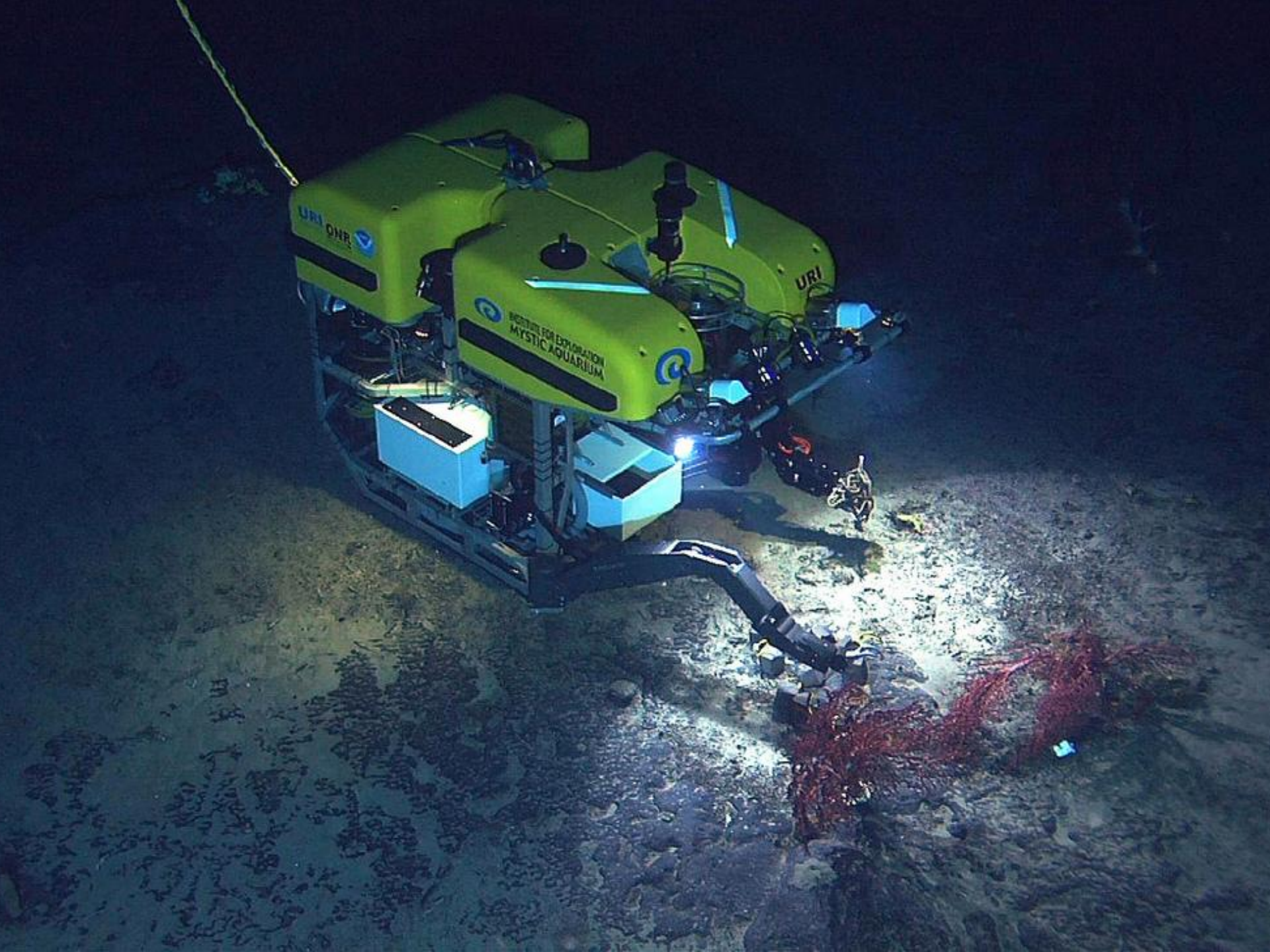
Signal propagation in aircraft cabin







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Concluding Remarks

- Li-Fi harnesses unregulated, unused and vast amount of electromagnetic spectrum for high speed wireless communication
- Li-Fi enables wireless communication in areas RF does not work
- Can Li-Fi enable the Internet of Things and machine-to-machine (M2M) communication?
- Will Li-Fi together with RF form the kernel of 5G?