



pureLiFi

# Standardization of LiFi and Beyond

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# Agenda

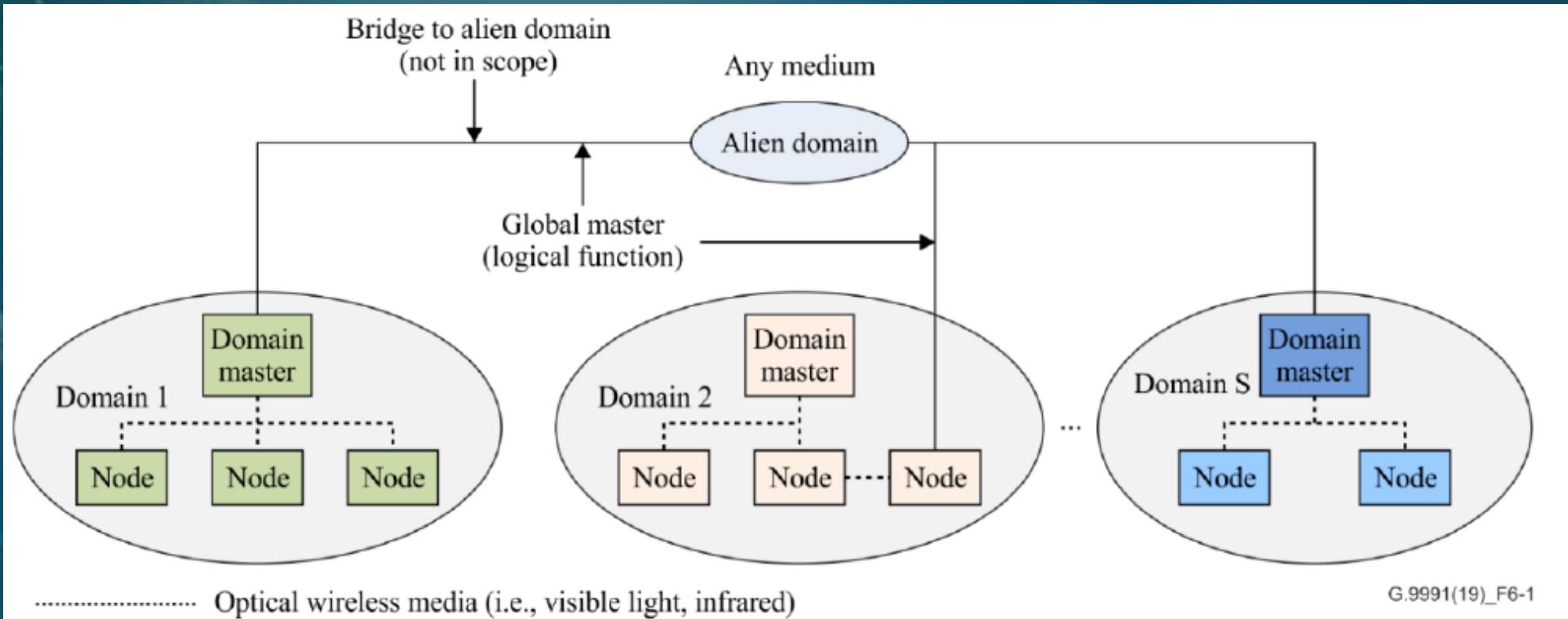
- Overview of existing LiFi standards
- Motivation for ITU-T G.9991
  - Operational Concept
  - Implementation Options
- Motivation for IEEE 802.11bb
  - Operational Concept
  - Implementation Options
- So what?
- Next steps

# Motivation for ITU-T G.9991

- ITU-T G.9961 (G.hn) is the leading standard for powerline communications and various other last mile connectivity
  - Millions of units shipped globally across a range of verticals
  - Established market and open standards have created a competitive ecosystem of devices.
- G.9991 (G.vlc) systems leverage existing G.hn chipsets to extract maximum performance from the optical link with existing systems
- G.9991 chipsets offer a straight-forward integration route with the opportunity to easily connect various devices



# Operational Concept for ITU-T G.9991



**Figure 6-1 – ITU-T G.9991 home network architecture reference model**

# Implementation Options for ITU-T G.9991



- G.vlc systems can use readily available chipsets with simple amplifier circuits to make their transmission and detection systems
  - The same chipsets are used for the AP and the dongle
- Thousands of G.vlc systems have been deployed across the world in a range of use cases

# Motivation for IEEE 802.11bb

- IEEE 802.11 is the world's most common communications standard
  - Over 3.8 billion Wi-Fi chipsets were shipped globally in 2021 in everything from smartphones, TVs, CCTV cameras, baby monitors, etc.
  - The large established market and open standards have created a highly competitive, vibrant ecosystem of devices, testing facilities, etc.



# Motivation for IEEE 802.11bb



- Deploying LiFi on a global scale requires reducing the barrier to entry for anyone looking to produce interoperable systems
- IEEE 802.11 offers the simplest integration route with the highest number of possible device integration options



# Operational Concept for IEEE 802.11bb

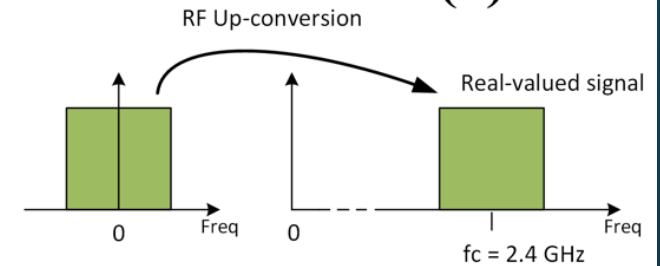
Existing chip sets can easily be extended to operate in the light spectrum.

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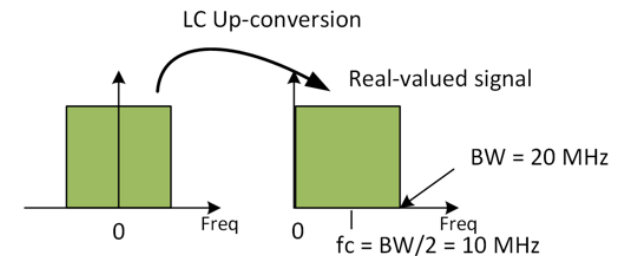
doc.: IEEE 802.11-19/0388r0

## Using existing 802.11 PHYs for LC (2)

- RF frontend up-converts baseband signals onto e.g.  $f_c = 2.4$  GHz.



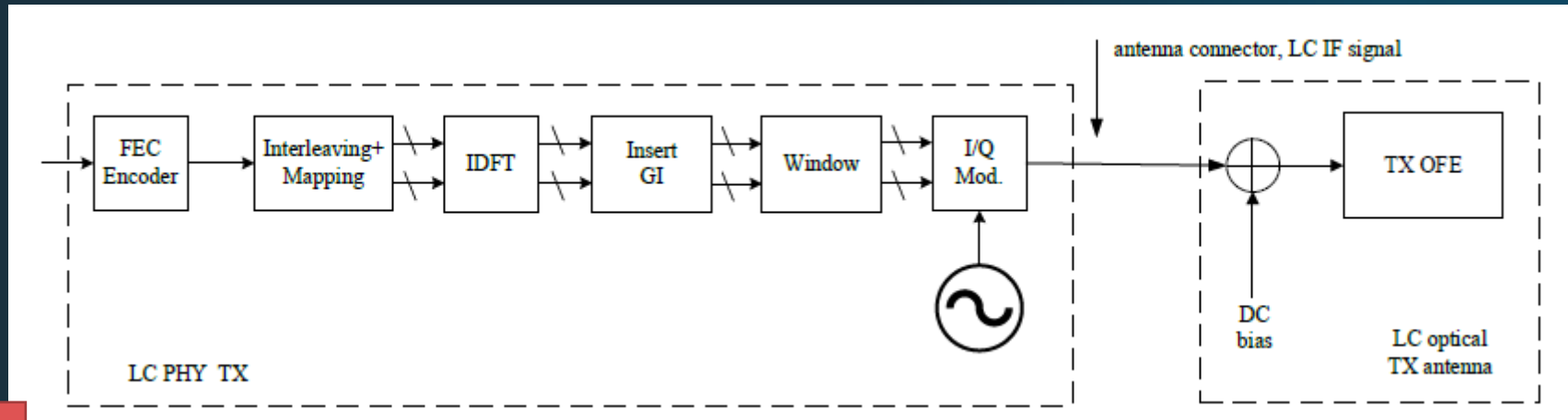
- LC frontend up-converts baseband onto low IF e.g.  $f_c = BW/2 + \Delta$ .



- $\Delta$  is to be agreed depending on signal mask design.
- This way, any complex-valued baseband signal (i.e. any existing IEEE 802.11 PHY) can be used to facilitate LC.

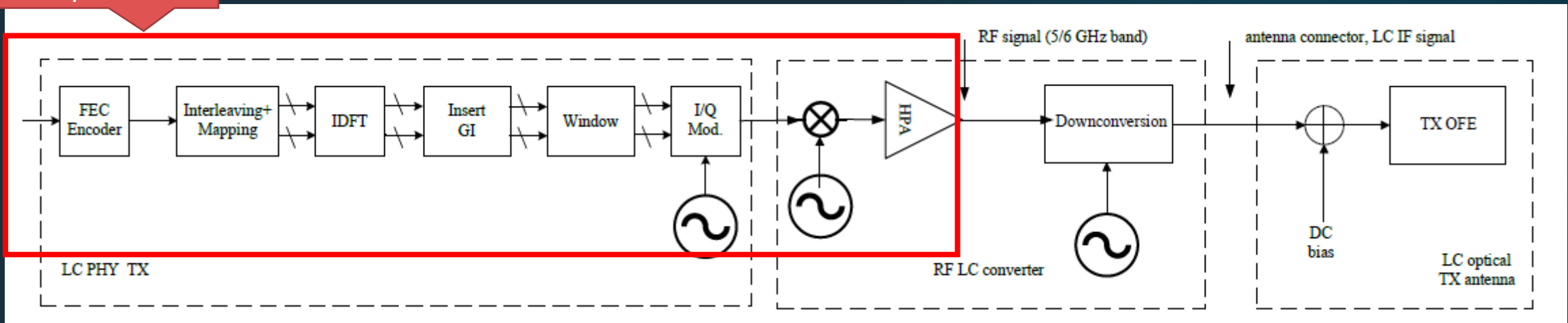


# Implementation options for IEEE 802.11bb



Direct Conversion

Existing Wi-Fi chipsets



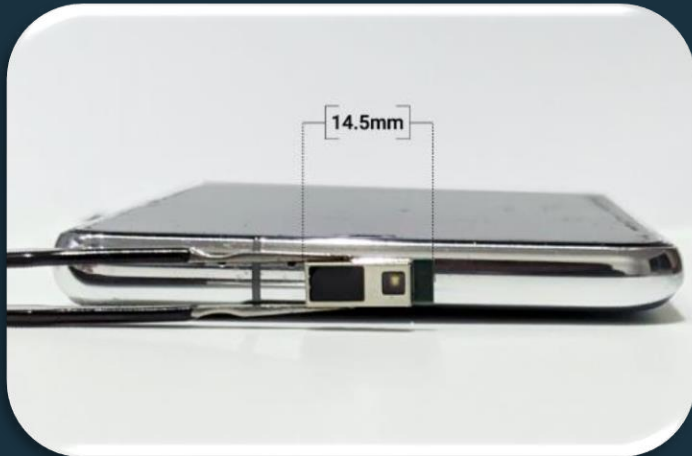
Up/Down Conversion from RF

# What's next?

- Continued improvement of the existing standards is necessary and should be worked through the relevant Standards Development Organizations (ITU-T and IEEE)
- Starting yet another standard on LiFi would need to have a compelling justification – how would yet another standard help?
- Generating sufficient demand to increase the interest from chipset vendors is critical to support the next generation of LiFi systems

# First 802.11bb Compliant Devices.

pureLiFi are ready with a variety of 802.11bb compliant devices to support wider adoption of LiFi in a range of markets including enterprise and consumer.



## Light Antenna ONE™

Qualified Light Antenna Ready to Integrate at Scale.



## LiFi@Home™

Use Case Vision to put LiFi in Every Hand and Every Home



## LiFi Cube™

Plug and play LiFi gateway for on the move.

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# So what?

- There are currently 2 market relevant standards with their unique benefits for various use-cases and integration pathways
- A certification programme is available for G.vlc-based products and a certification pathway is being considered for 802.11bb-based products
- Market development and real deployments are the critical next steps
- Everyone can now build standardized LiFi products and deploy them!

# Next Steps

- Support for continued education on the benefits of LiFi!
  - Join the Light Communications Alliance
  - <http://lightcommunications.org/>
- Help to define the certification programme!
- Reach out to manufacturers of LiFi products!
- Continue to push the boundaries in research and academia!



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Thank you!