

PEAK PERFORMANCE MICROWAVE SOURCES

**SIVERSIMA**



# 60, 70, and 80 GHz front-end modules for multi-Gbps wireless communication

Sten E. Gunnarsson, Christer Stojj, Staffan Bruce,  
Rolf Persson, Anette Brandt, Olle Westblom  
Sivers IMA AB, Torshamnsgatan 9, 16429 Kista, Sweden.  
Email: [sten.gunnarsson@siversima.com](mailto:sten.gunnarsson@siversima.com)

**SIVERSIMA**

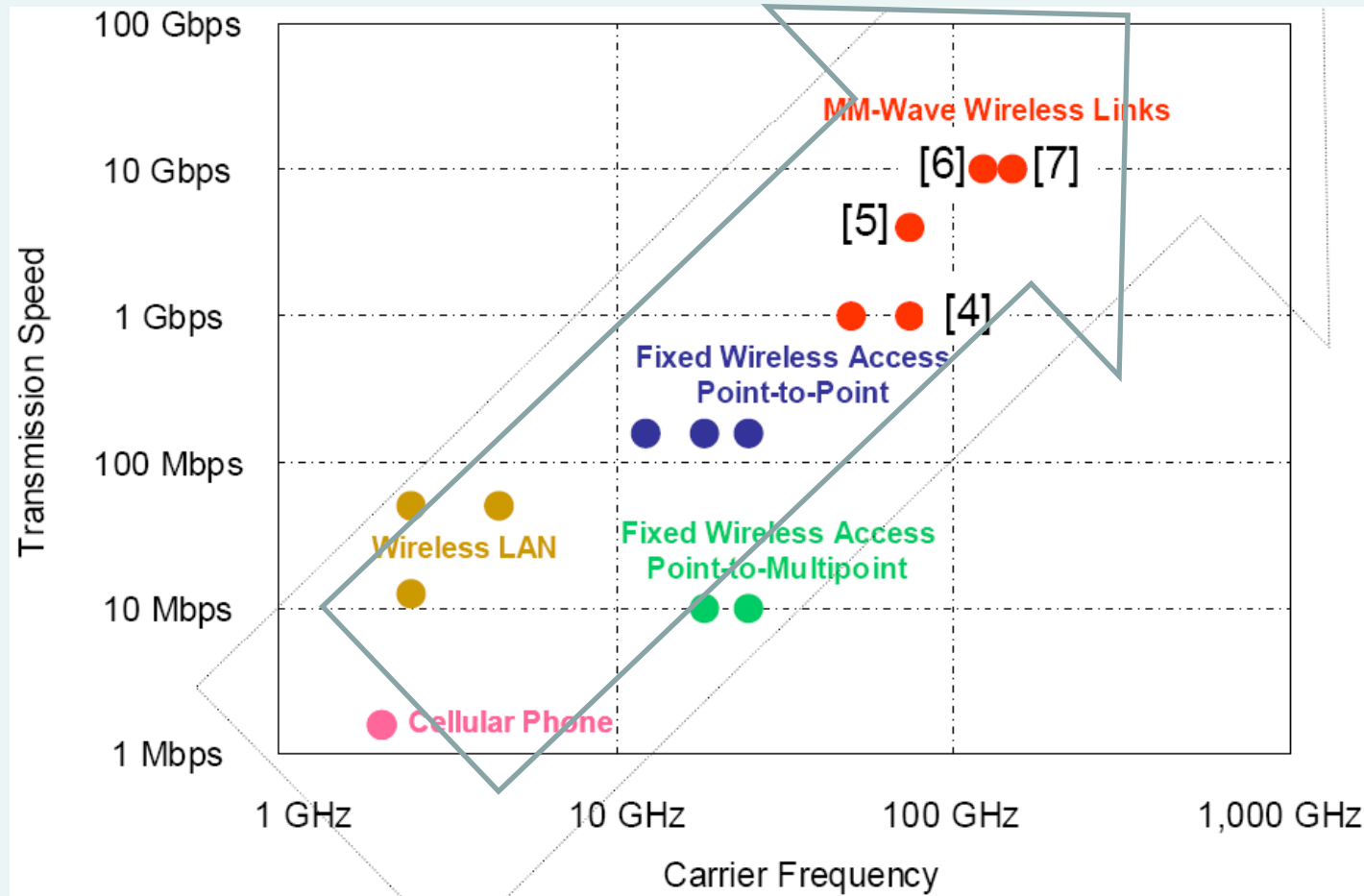


# Outline

- Motivation / Background
- 60 GHz converter designed by Sivers IMA
- E-band (71-86 GHz) converter designed by Sivers IMA
- Future work
- Acknowledgement



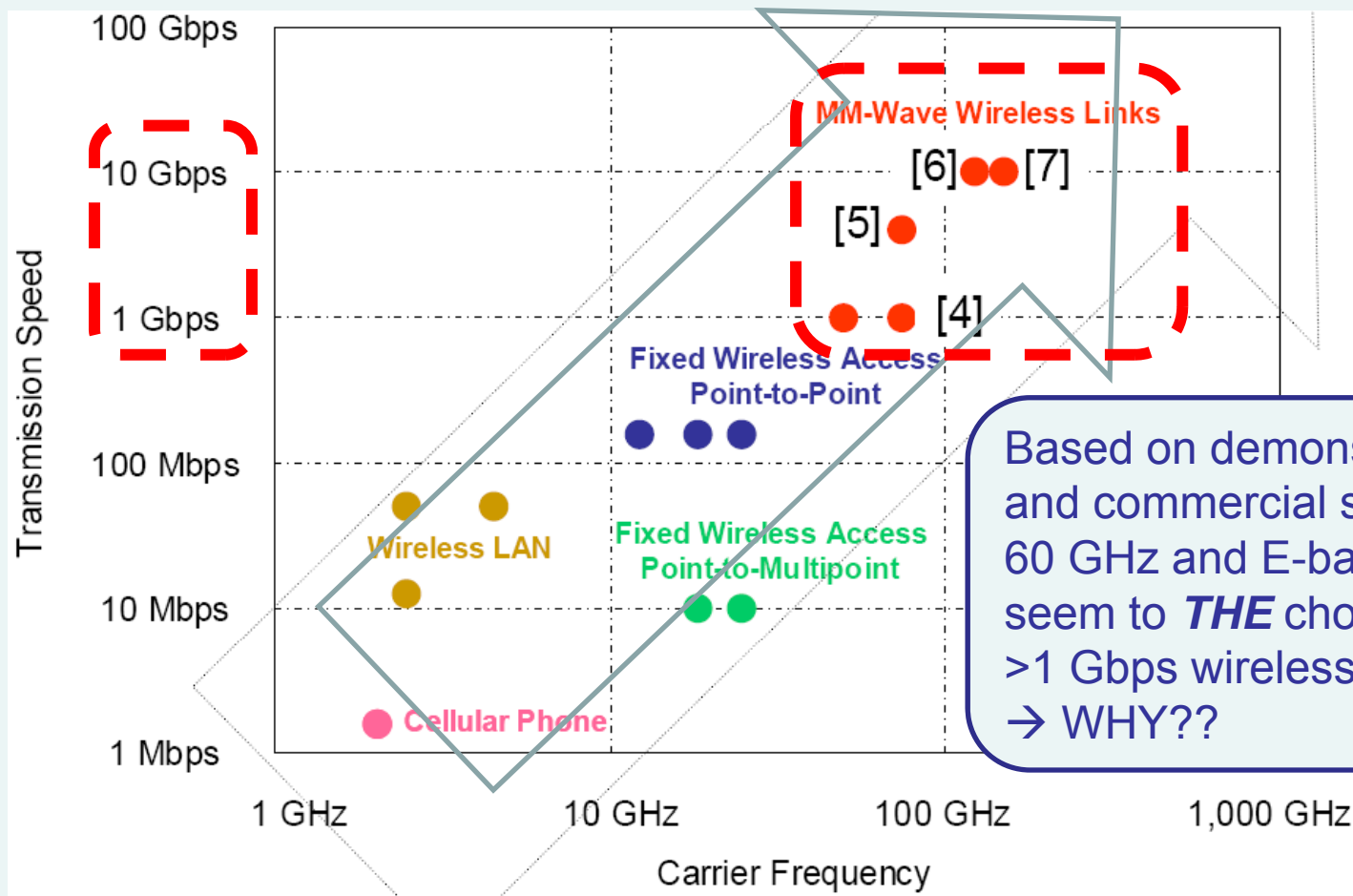
## Motivation / Background: Why 60 GHz and E-band (71-86 GHz)? - Empirical approach



[J. Wells, "Faster than fiber - The future of multi-Gbps wireless", IEEE Microwave Mag., May 2009]



# Motivation / Background: Why 60 GHz and E-band (71-86 GHz)? - Empirical approach

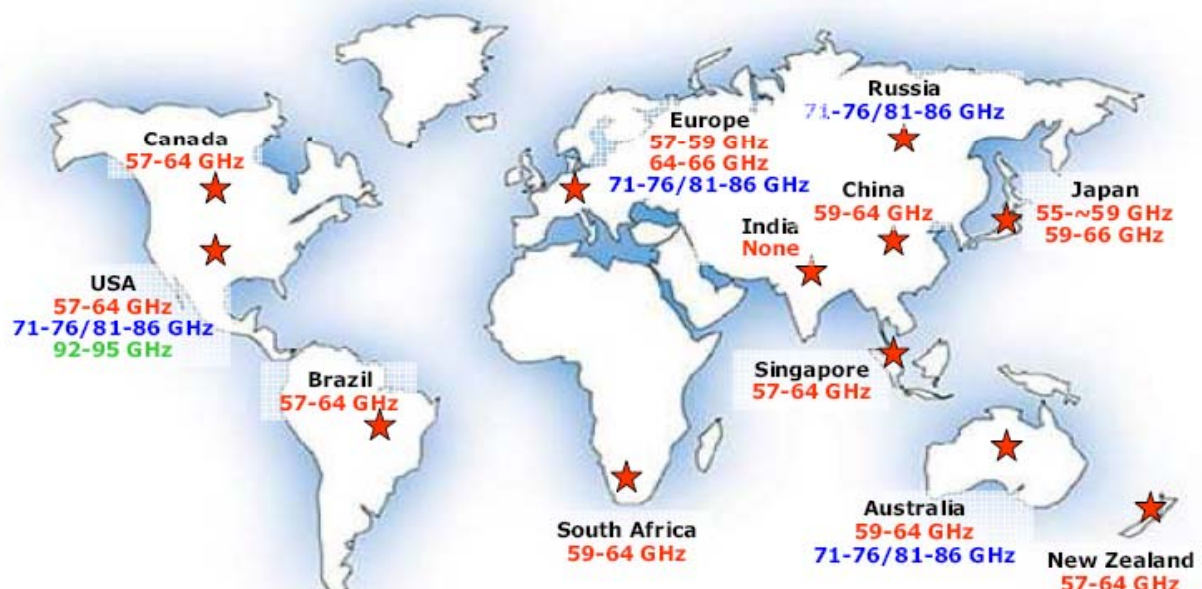
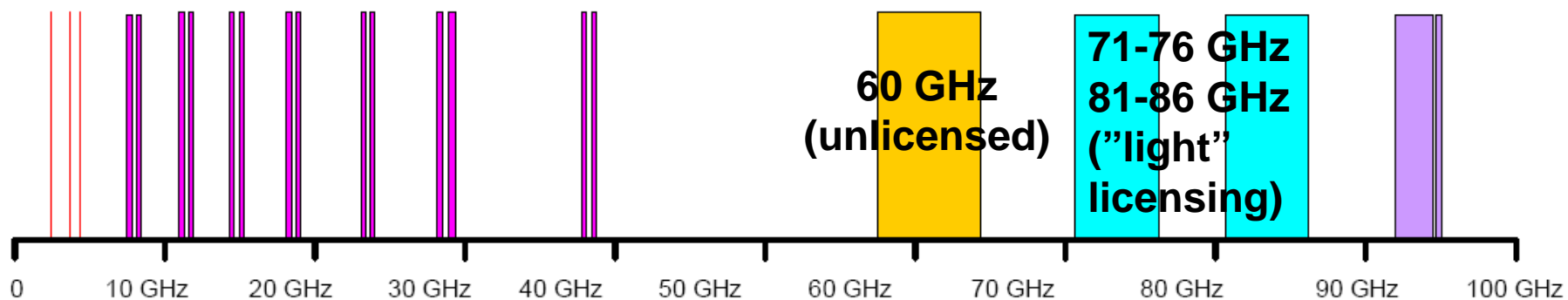


Based on demonstrators and commercial systems, 60 GHz and E-band seem to **THE** choice for >1 Gbps wireless links!!  
→ WHY??

[J. Wells, "Faster than fiber - The future of multi-Gbps wireless", IEEE Microwave Mag., May 2009]



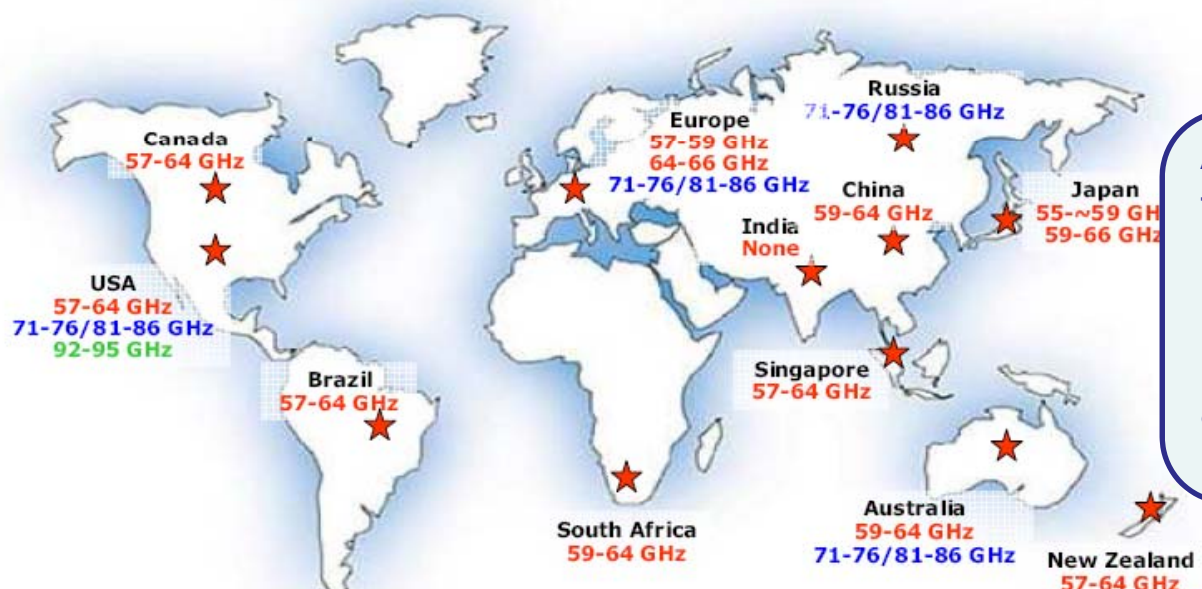
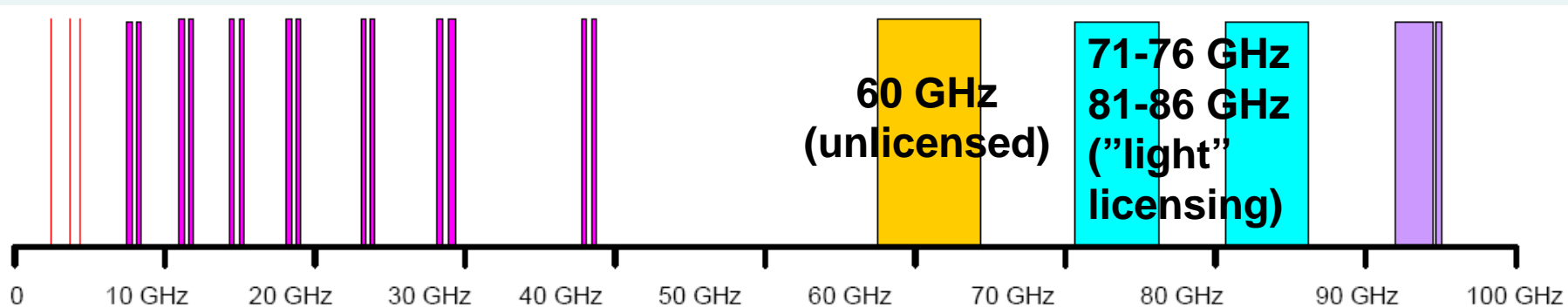
# It's all about spectrum!!



[J. Wells, "Faster than fiber - The future of multi-Gbps wireless", IEEE Microwave Mag., May 2009]



# It's all about spectrum!!

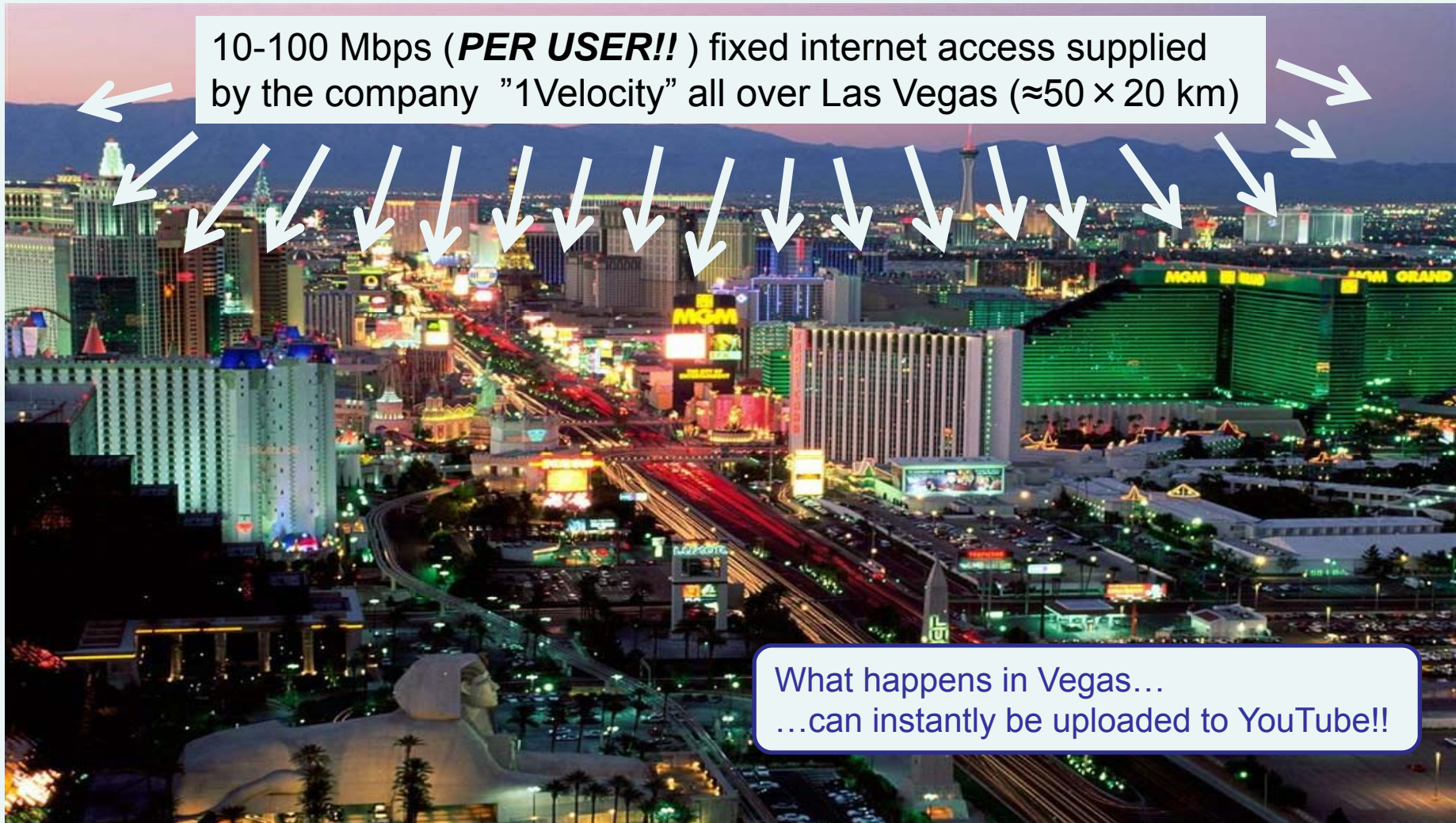


Although possible to design multi-Gbps system at lower frequencies, it is **MORE EASY** at 60 GHz and beyond!!



## Las Vegas – also a E-band playground

10-100 Mbps (**PER USER!!**) fixed internet access supplied by the company "1Velocity" all over Las Vegas ( $\approx 50 \times 20$  km)



What happens in Vegas...  
...can instantly be uploaded to YouTube!!



## Las Vegas – also a E-band playground

10-100 Mbps (**PER USER!!**) fixed internet access supplied by the company "1Velocity" all over Las Vegas ( $\approx 50 \times 20$  km)



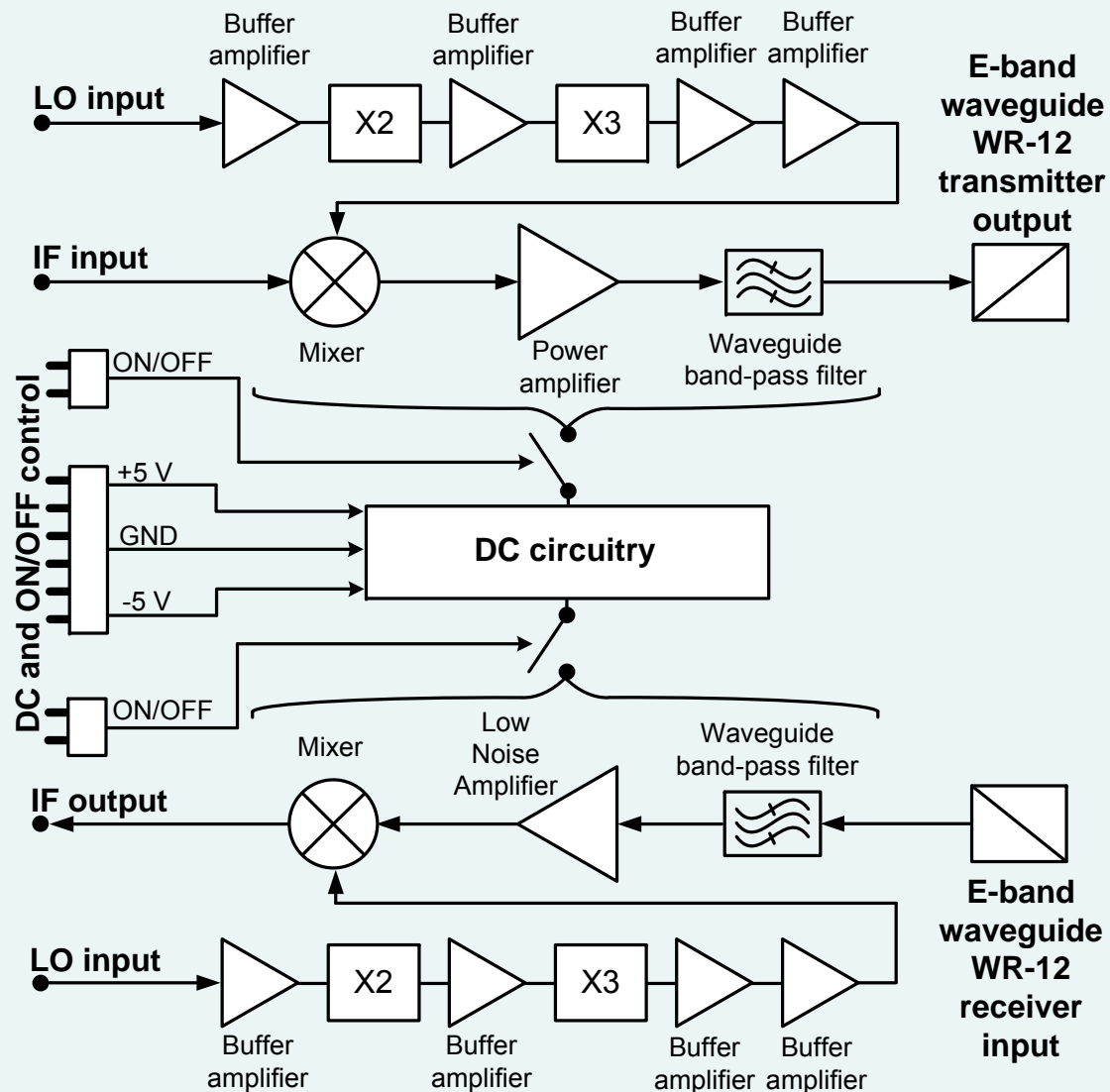
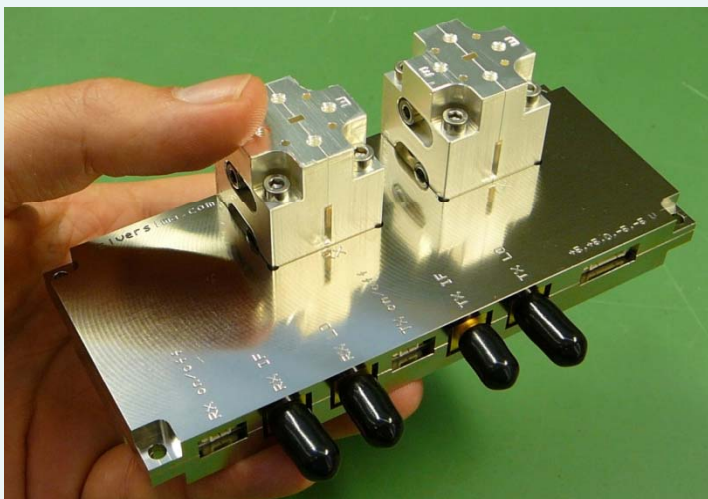
**Estimate of total cost for the backhaul:**

- Fiber optic: 75 MUSD
- E-band radio: 5 MUSD (actual cost!!!)

What happens in Vegas...  
...can instantly be uploaded to YouTube!!

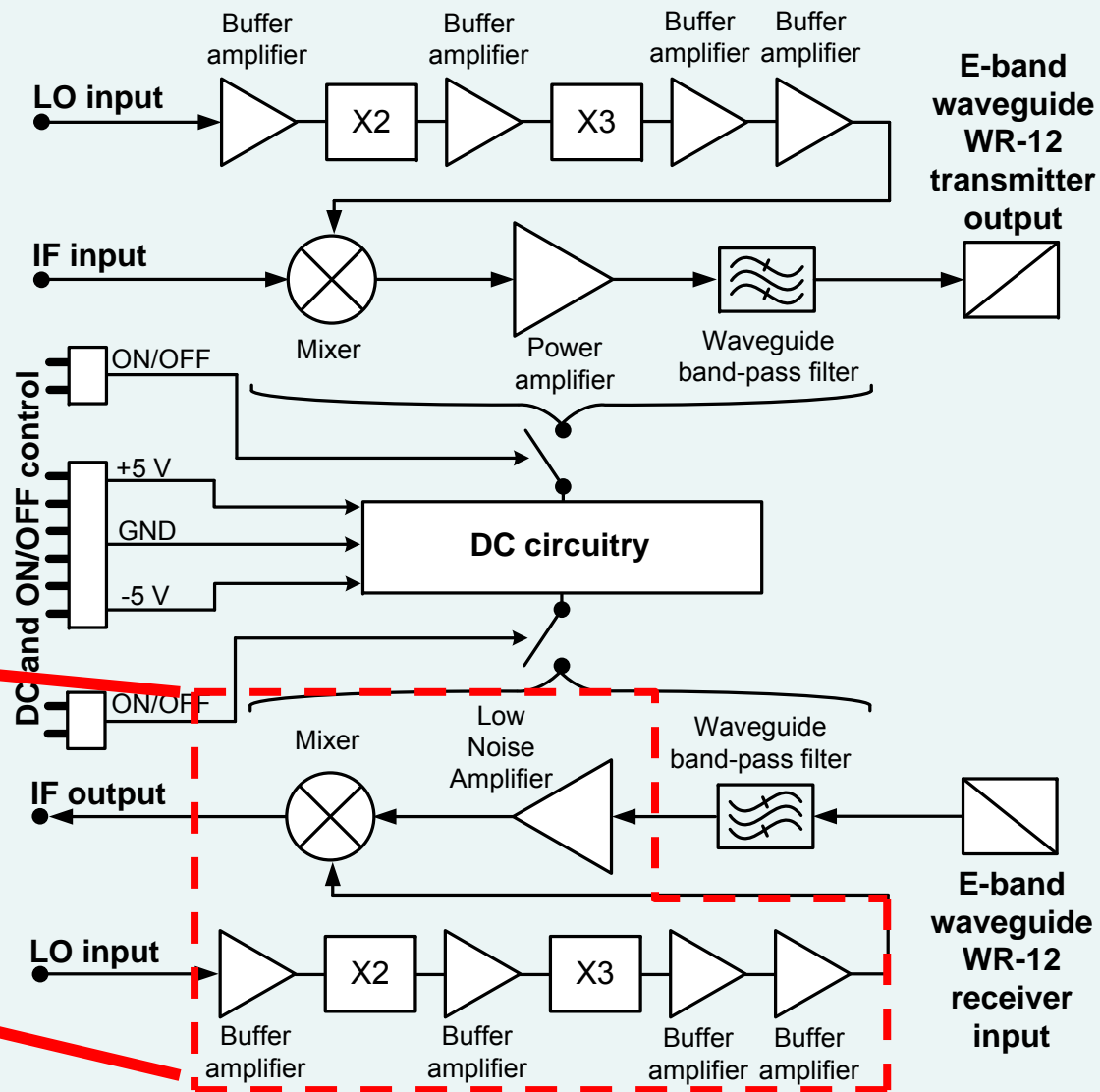
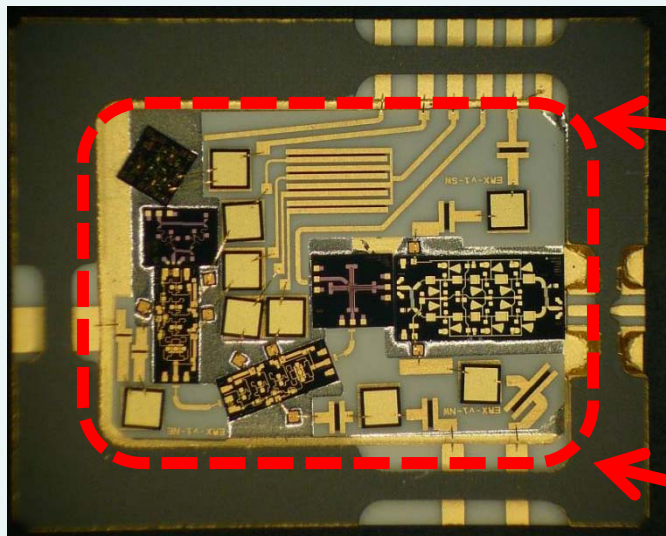
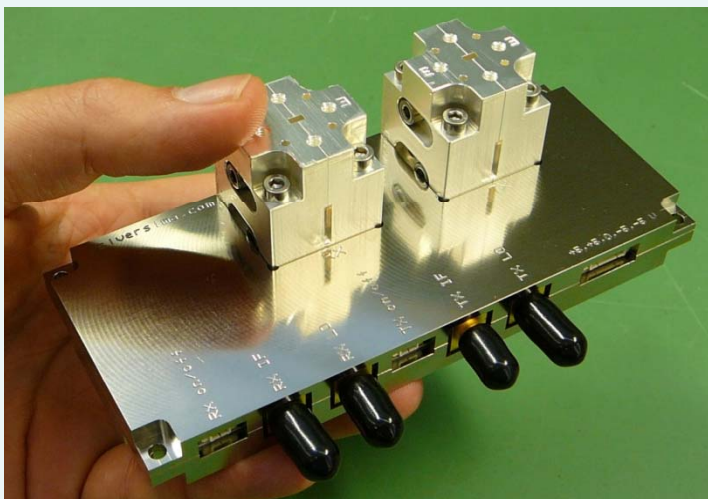


# Sivers IMA E-band module - overview



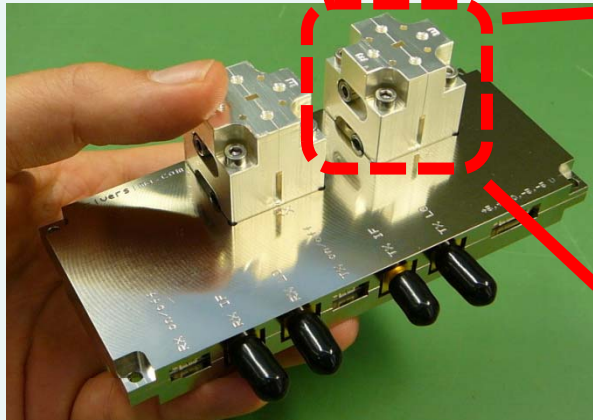


# Sivers IMA E-band module - overview



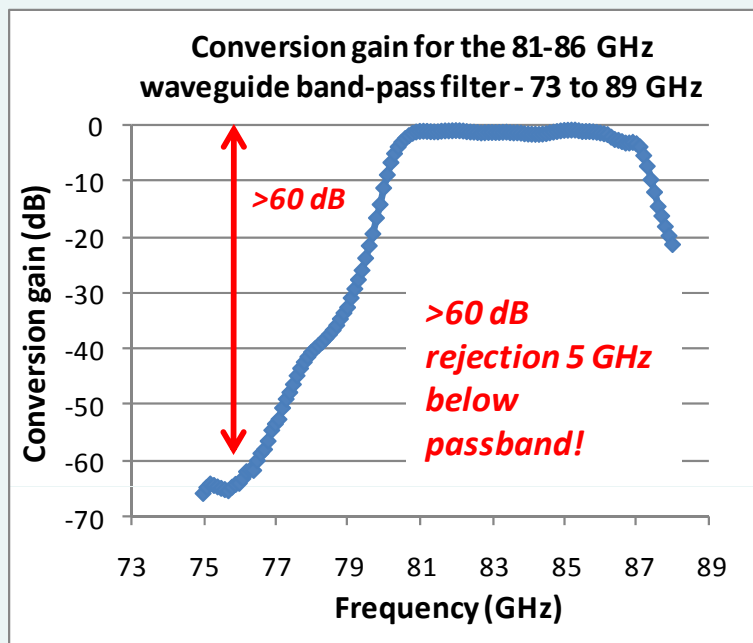
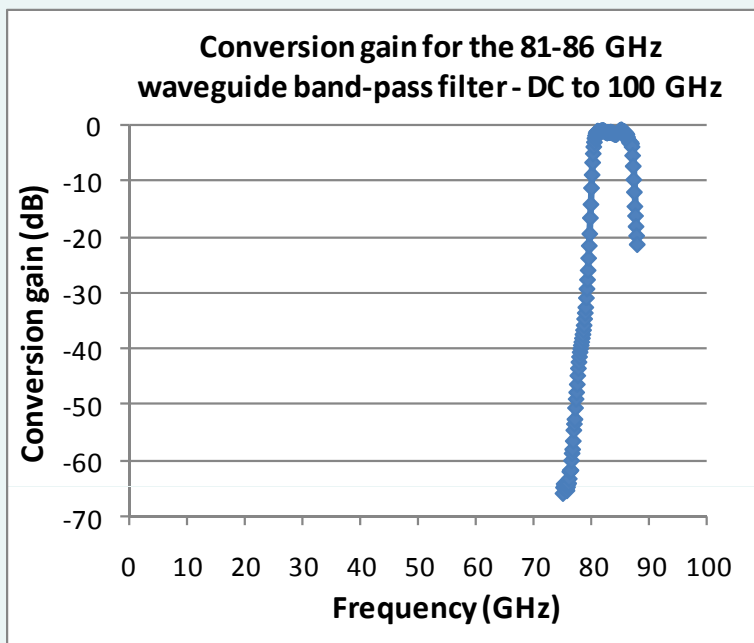
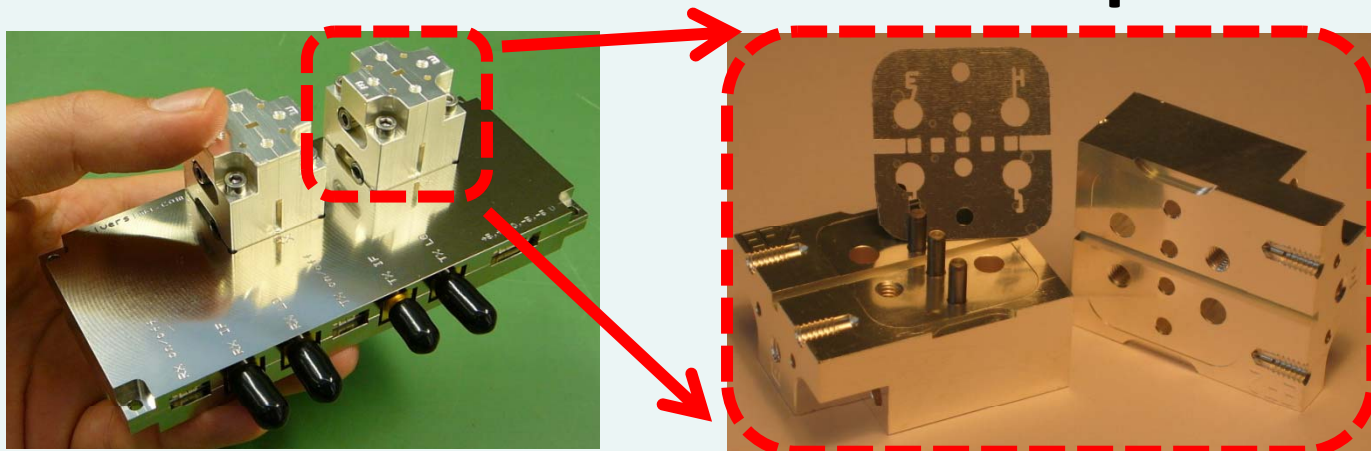


## Sivers IMA E-band module – bandpass filters



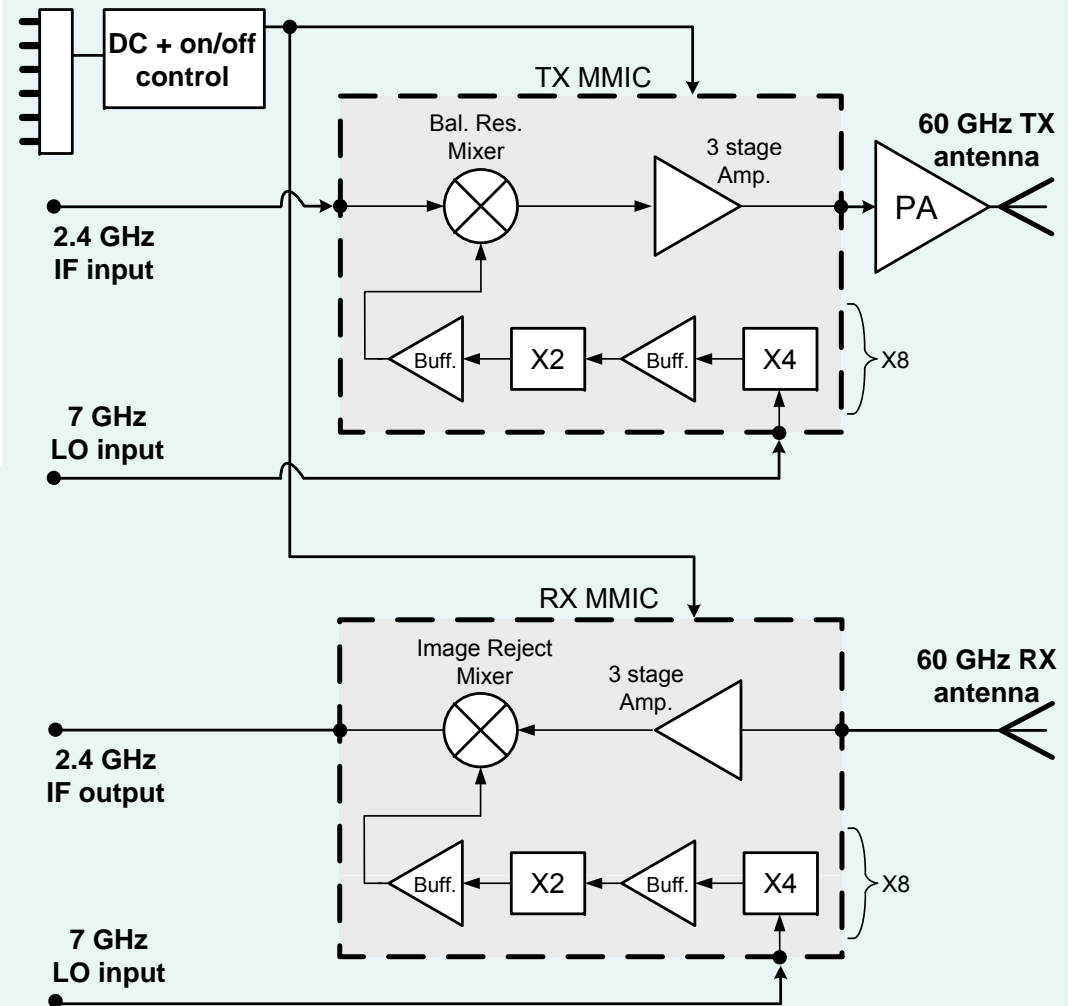
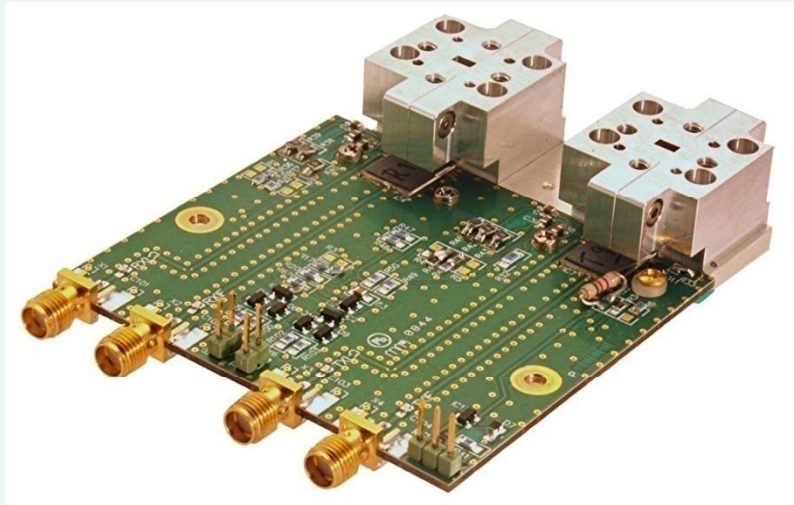


# Sivers IMA E-band module – bandpass filters



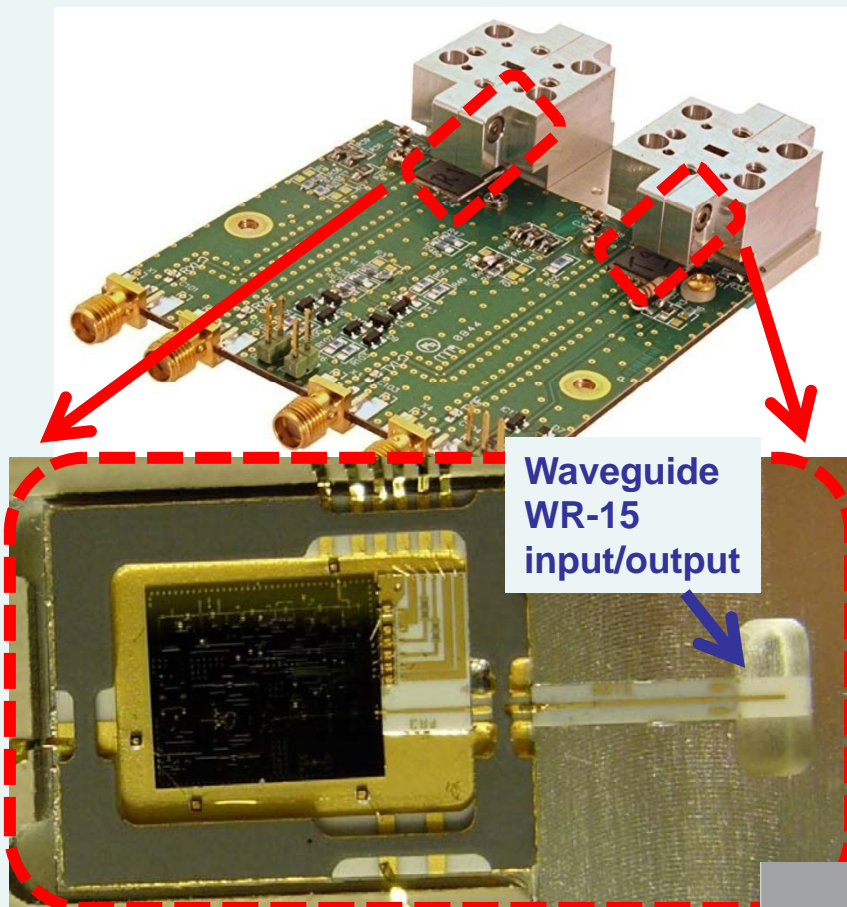


# Sivers IMA 60 GHz module - overview

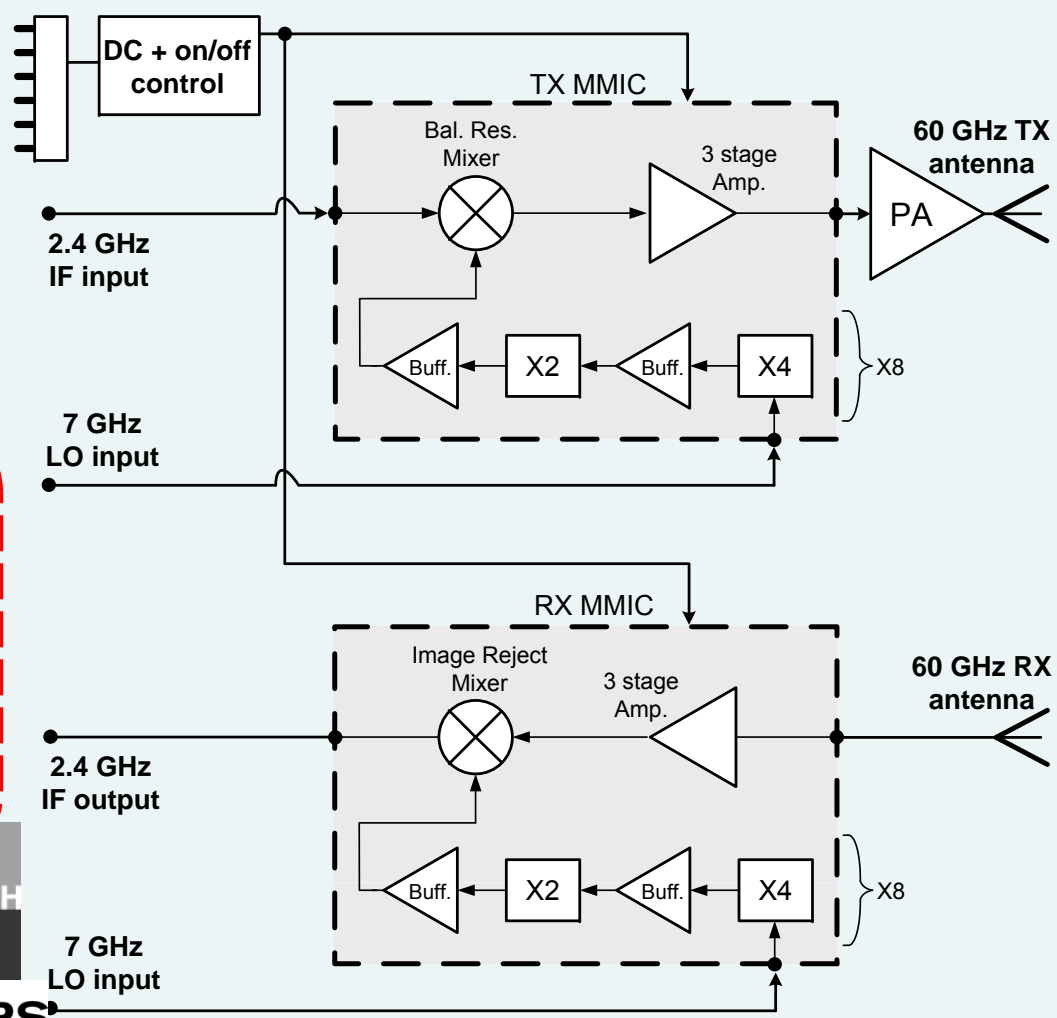




# Sivers IMA 60 GHz module - overview

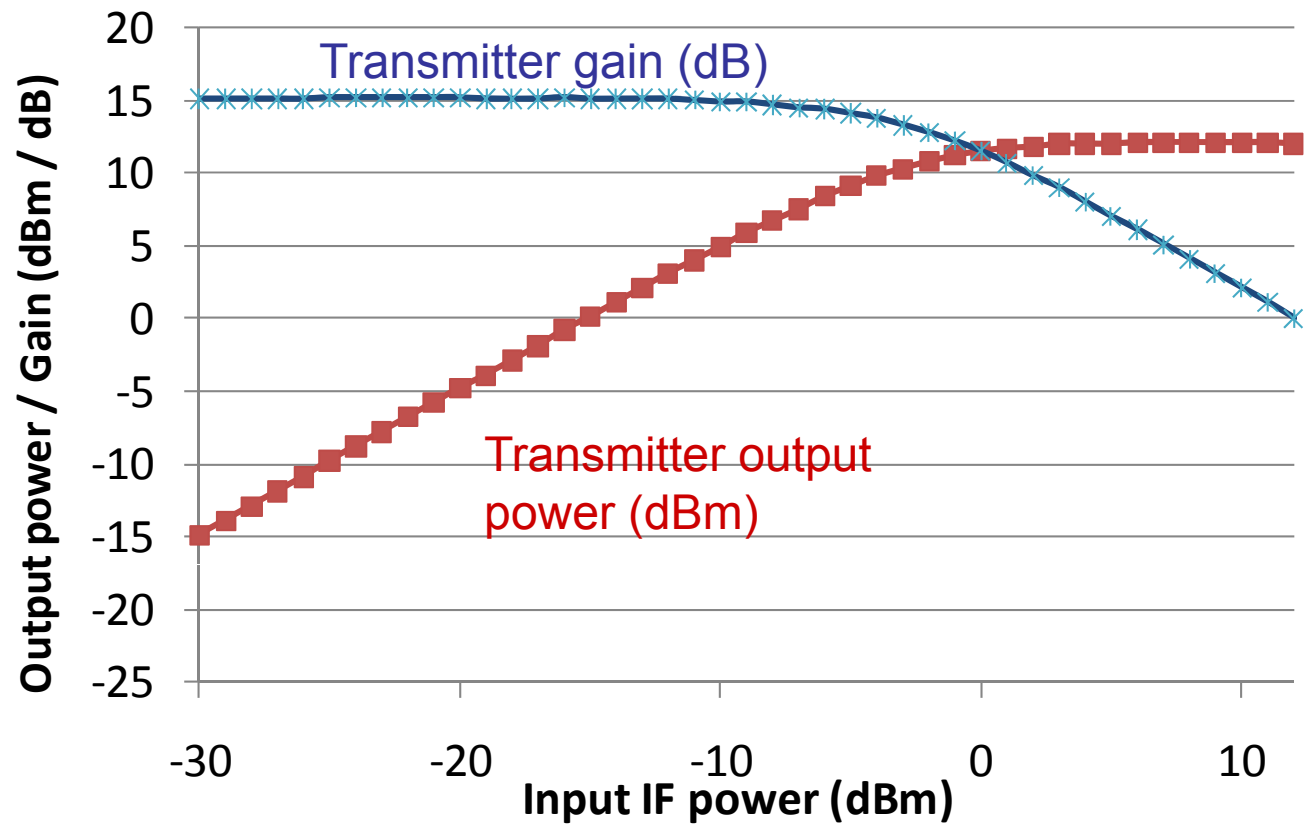
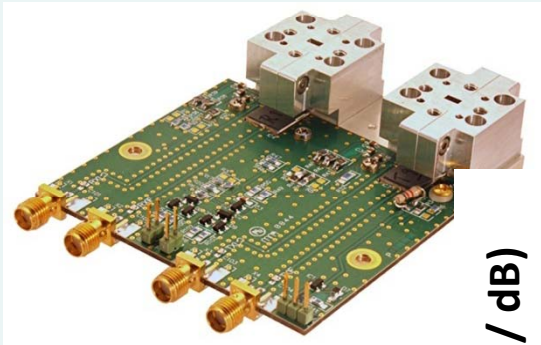


Waveguide WR-15 input/output





## Sivers IMA 60 GHz module – results





**Future work:**  
**Cost, cost, and *COST*!!**



# Acknowledgement



Through "Forska & Vax"



## APPENDIX: attenuation in air vs. frequency

