# IC1301 -WiPE

## Vivaldi Antenna for Radio Frequency Energy Harvesting Systems

WIPE
COST IC1301

**Ján Schneider**

Technical University of Kosice

EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

# Introduction

- Objectives of STSM – UWB antenna for RF energy harvesting:
  - cover the largest amount of important frequency bands
  - compact dimensions, of simple fabrication and low cost
- The Vivaldi antenna

# Antenna Design

» For design, optimization and simulation the CST Microwave studio was used.

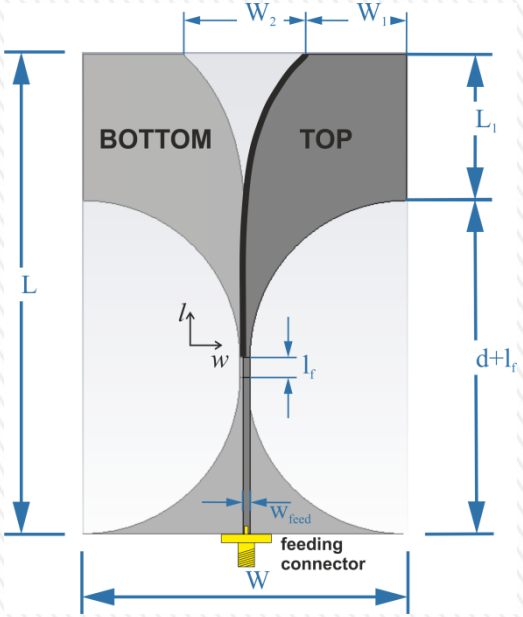
» Antenna was designed with use of analytical curves (lines, quarter circles, exponential curves)

» ARLON 600 substrate:

> dielectric constant $\varepsilon_r = 6.15$,

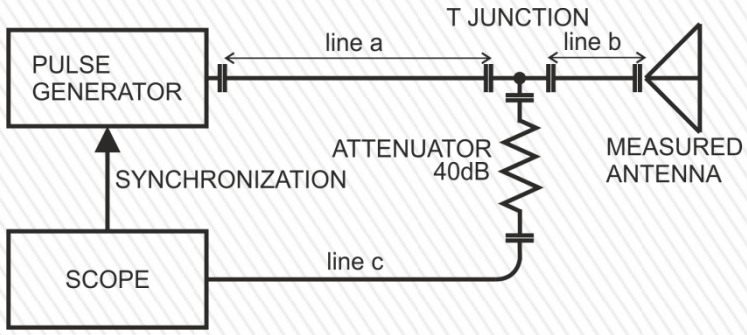
> Tangent loss tan $\delta = 0.003$ ,

> Thickness h=1.575mm.



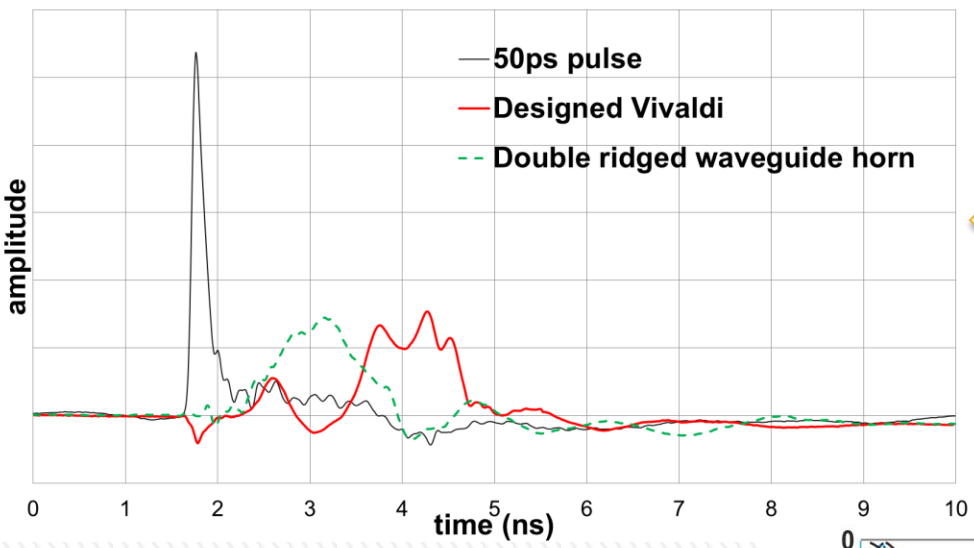
# Measurements of the antenna

- UWB impulse radar – more compact and cheaper option for verification of the properties of the antenna
- The measuring system consists:
  - *pulse generator*,
  - *Scope window*,
  - *measured antenna*,
  - *microwave coupling elements* and *cables*



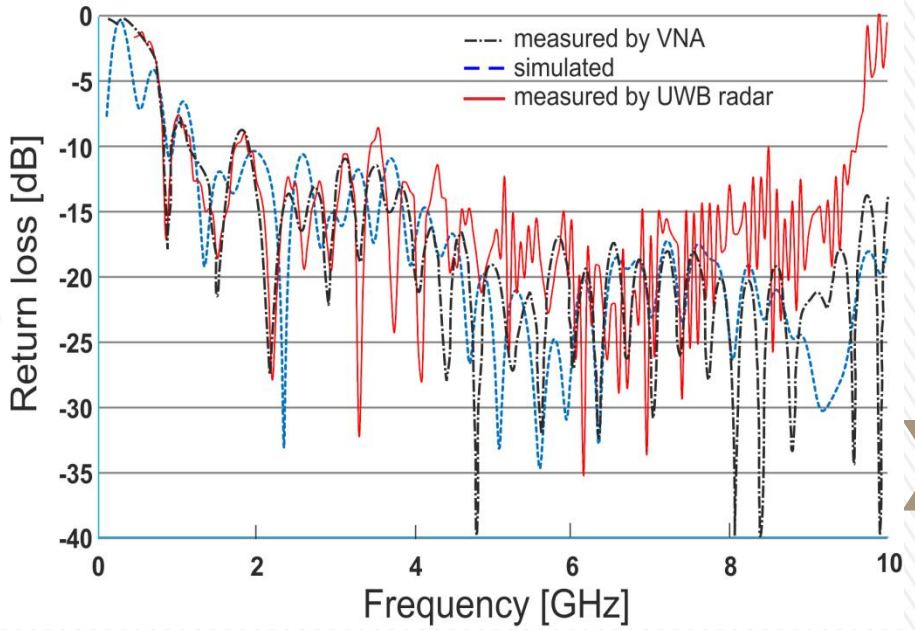

- The impulse UWB radar transmits a narrow pulse
- Reflected signals were acquired from the antenna after adjusting of observation window of the scope according to the lengths of line a and b

# Simulated and Measured Results

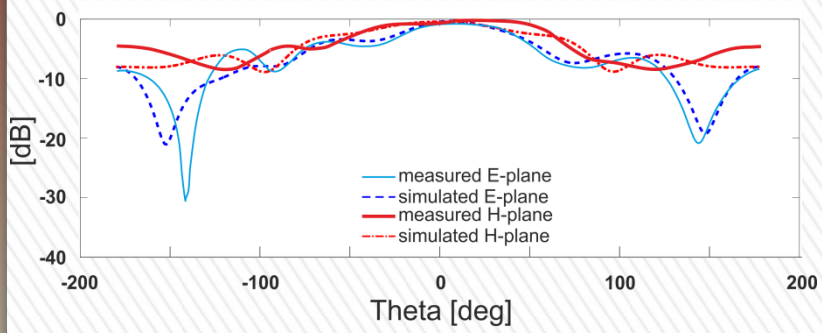



Reflected response of the Vivaldi antenna compared with Double ridged waveguide horn antenna

Simulated and measured (by VNA and UWB radar)
return loss of the Vivaldi antenna

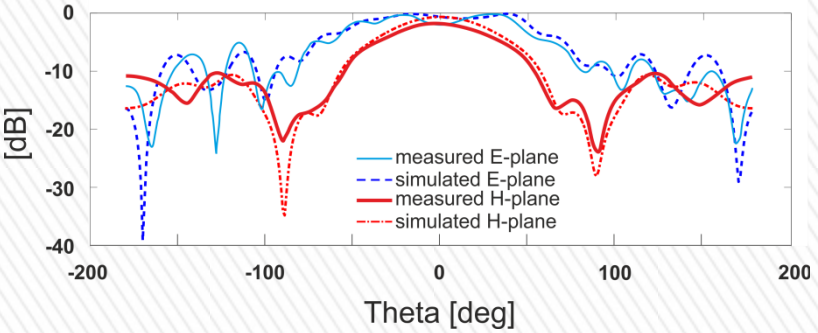


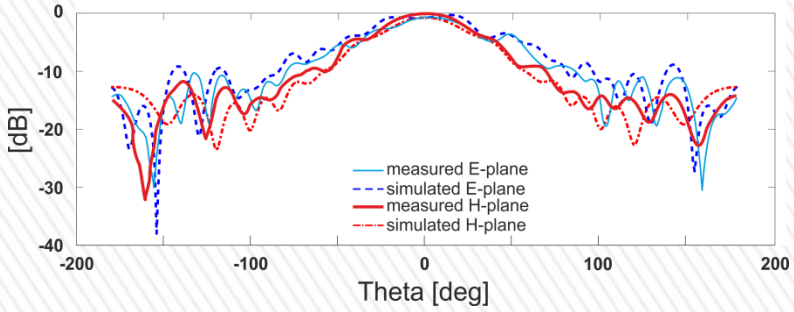
# Simulated and Measured Results




2 GHz

4 GHz




6 GHz

# Conclusion

- The antenna operates in the frequency band from **0.81 GHz to 10 GHz** with average gain 6.32 dBi and fractional bandwidth BW=163%.
- The antenna covers the frequency bands of multiple wireless communication systems.
- The reflected impulse responses of the designed Vivaldi antenna have satisfied the frequency character in the wide bandwidth applications.
- Positive feedback from the time-domain measurements is that the antenna has a very low ringing in comparison with commercially available antenna (Double ridged waveguide horn antenna).
- Wide bandwidth of the designed antenna and its relatively small size with low cost fabrication provide appropriate properties for the **use in energy harvesting**.
- The antenna might be used as an element of the antenna array to obtain a high gain and preserve a very high frequency bandwidth.
- The results presented above predestinates this antenna not only for the RF energy harvesting but also for applications sensitive to the changes in group delay receiving and transmitting signal e.g. for UWB radars.


many
Thanks!