



Designing Positioning Systems for Public Protection and Disaster Relief Applications

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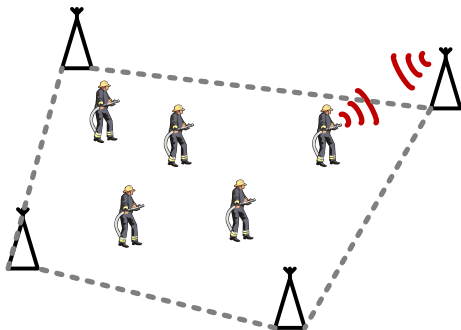
- improve security of rescue personnel
- support decision taking process

Demands for Localization in PPDR Scenarios

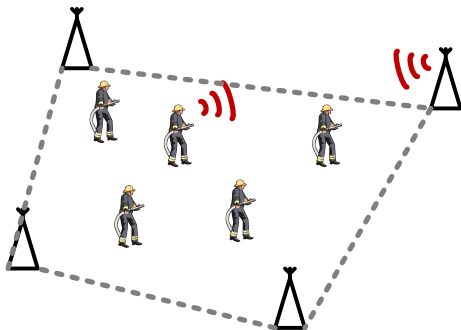
- improve security of rescue personnel
- support decision taking process

- high accuracy
- high update rate
- high (unlimited) number of users
- in-building coverage

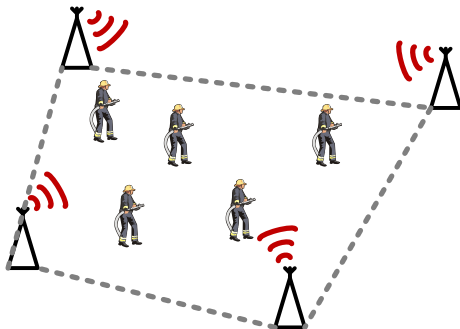
Positioning scheme



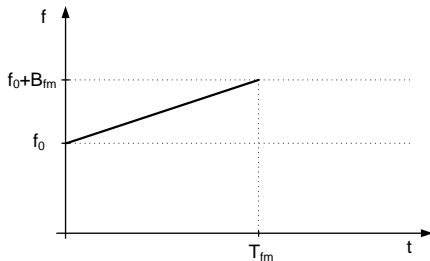
Positioning scheme



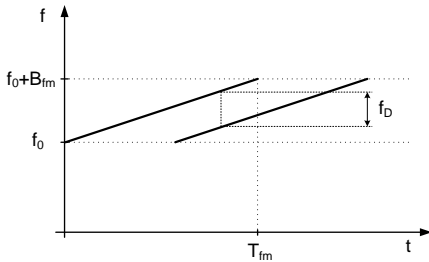
Time-difference-of-arrival (TdoA)



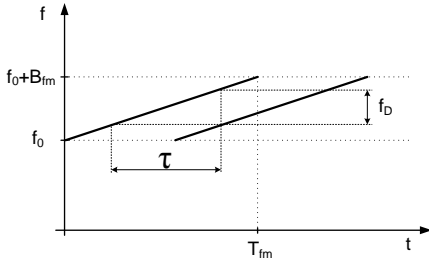
Frequency Modulated Continuous Wave



Frequency Modulated Continuous Wave

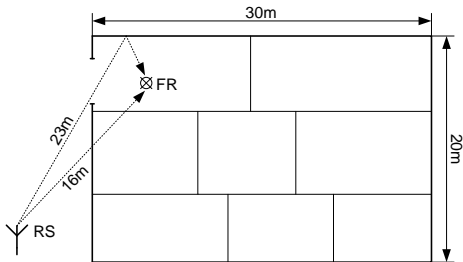


Frequency Modulated Continuous Wave

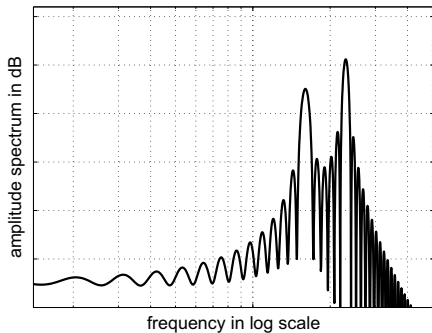


$$d = f_D \cdot \frac{c}{2\mu}$$

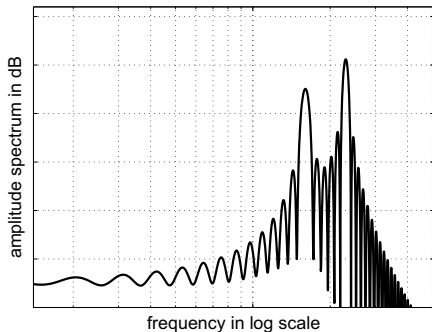
Multipath Propagation



Multipath Propagation



Multipath Propagation



- new detector
- use antenna diversity

Dual Band Localization

- ISM bands: interferers
- multipath propagation: wavelength dependent

Dual Band Localization

- ISM bands: interferers
- multipath propagation: wavelength dependent

→ dual band frontend

Conclusion

- taped out & measured VGA with differential regulation
→ accepted at EUMW 2014

Conclusion

- taped out & measured VGA with differential regulation
→ accepted at EUMW 2014
- propose method to analyze differential regulation
- apply method to attenuator and VGA
→ submitted to TMTT

Thank you for your attention!

6 References

- [1] B.-W. Min and G. Rebeiz, "A 10-50-ghz cmos distributed step attenuator with low loss and low phase imbalance," *IEEE Journal of Solid-State Circuits*, vol. 42, no. 11, pp. 2547–2554, Nov 2007
- [2] U. Mayer, F. Ellinger, and R. Eickhoff, "Analysis and reduction of phase variations of variable gain amplifiers verified by CMOS implementation at C-band," *IET Circuits, Devices Systems*, vol. 4, no. 5, pp. 433–439, Sep. 2010.
- [3] H. D. Lee, K.-A. Lee, and S. Hong, "A Wideband CMOS Variable Gain Amplifier With an Exponential Gain Control," *IEEE Transactions on Microwave Theory and Techniques*, vol. 55, no. 6, pp. 1363–1373, June 2007.