

# Geolocation of Wireless and Radio Emitters in Real Time

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Radio-Frequency emitters can be actively geolocated within wireless network, when base station and emitter cooperate. When network is destroyed by catastrophic events, rescue and recovery must geolocate emitters by passive means. Can any wireless emitter be geolocated without two-way communication? This project has attempted to prove that a single receiver can locate unknown emitter without network assistance and in real time. Engineering Design: A single receiver with two antennas separated by maximum of 10m was considered. Two designs were considered: Time-of-Arrival-Difference (TDOA) and Correlative Receiver (CR). Model for both receiver types was first developed in order to downselect final implementation. Testing and Downselection: Physical receiver model was developed and used to evaluate performance of TDOA receiver type. After simulations, it was determined that TDOA receiver cannot geolocate emitter in real time. Redesign: New physical model was devised to evaluate performance of CR type. It was found that the receiver can passively geolocate remote emitter in real time with sufficient accuracy. Results and Evaluation: Experimental CR was assembled and operated below 3GHz range. Testing has shown that correlative receiver can geolocate emitter in real time but strictly depends on a) antenna separation, b) number of signal acquisitions and b) emitter bandwidth. Result confirm that a single, localized receiver can locate unknown emitter in real time. Measurements indicate that unknown emitter position can be acquired with directional accuracy that is better than  $\pm 3$  degrees and with range accuracy that is better than 5%.

## Awards Won:

King Abdulaziz &

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