

Category B. Localization of RF Sources

Goal

Design and build a system for the localization of RF sources.

Specifications

- The system must be able to measure the transmitted RF signals and localize their positions by methods of your choice.
- The system must not have transmit function. Teams can use an RF system on the market such as Software Defined Radio receiver. The teams can also use a spectrum analyzer that the symposium organizer will prepare. The RF cable and connector for the spectrum analyzer will NOT be prepared.
- The system must be able to operate on a battery or 100V AC, 60Hz. (The organizer prepares Type-A sockets.)
- Total dimensions of the system (sum of width, height, length) must not exceed 200cm, excluding an external computer (if needed).
- The finalists must engage in an on-site “RF localization competition” at the symposium venue to determine the locations of actually hidden transmitters using their system.
- In the competition, the transmitters are hidden in an area of 3m x 3m. The finalists will measure the transmitted signals in the measurement area (see Fig. 1), and determine the locations (X and Y coordinates) of the hidden transmitters within a specified time. At most two teams will engage in a competition simultaneously.

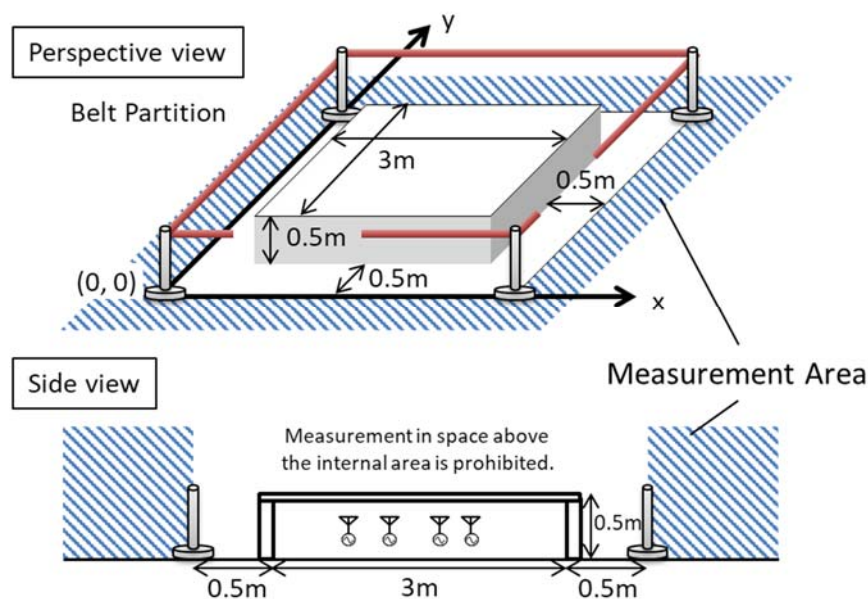


Figure 1 Setup of the transmitters and measurement area.

Specifications of Transmitters

- There will be multiple transmitters.
- Some transmitters will be located on the floor, and a cover of styrene foam will hide them.
- The system should have a capable of tuning to any frequencies within the specified frequency bands.
- The details of the transmitters are shown in the table 1.

Table 1 Specification of transmitters.

Transmitters	A	B	C
Frequency Band	300 – 320 MHz	2.402 - 2.480 GHz	5.012 - 5.025GHz
Output Power (Setting value)	-50dBm	0dBm	10dBm
Transmitter Antenna	$\lambda / 2$ Dipole antenna	Small antenna	Monopole antenna
Polarization	Horizontal	Unknown	Vertical
Number of transmitters	1 to 3	1 to 3	1 or 2
Type of transmitted signal	CW	Bluetooth Low Energy Beacon (Ch. 37 - 39)	CW

Application and Review Process

- All teams must submit an application form. The document should include the following information:
 - A description of the preliminary design of the localization system.
 - A description of the localization method in your system.
 - A description of the system setup to be build.
- The SDC committee will select finalists based on the above application form. The finalists must submit a document about their final design in the final design submission. The document should include the following information:
 - A detailed description of the system and localization method in your system.
 - A detailed description of the system’s performance.
 - Photos of the system.
 - A list of parts in the system setup.
- The finalists must engage in an on-site “RF localization competition” at the symposium venue to determine the locations of actually hidden transmitters using their system. The finalists also have to briefly explain their system before the competition.
- The score will be assigned to the designs based on the following criteria. The Team with the highest score will win the award.
 - Accuracy of the estimated locations of the hidden transmitters. The localization accuracy figure of merit is evaluated by formula to be determined.
 - Originality and the justification of the system and localization method.
 - Quality of the system.
 - Quality of the written materials.