

# P25 Coverage Mapping of a Shopping Mall

## Introduction:

This white paper details the process and equipment used for conducting a signal strength survey of a public safety radio system within a large shopping mall. CSI Telecommunications, Inc. of Novato, California commissioned this survey. The project involved the utilization of an Anritsu S412E LMR Master in conjunction with the TRX Neon In-building mapping software. The objective was to comprehensively map the P25 coverage inside the shopping mall.



*Shopping mall floor plan overlaid on the street map for mall*

## Survey Methodology:

### 1. Equipment Setup:

- The survey team employed an Anritsu S412E spectrum analyzer along with the TRX Neon In-building mapping software.
- The Neon Command PC software was used to overlay the floor plan map precisely on the street map for the mall.
- A cart was used to mount the equipment.
- A unity gain receive antenna, positioned just above head level, minimized shadowing from the surveyors' bodies.

### 2. Signal Filtering:

- To reduce interference from Wi-Fi and cellular signals, a bandpass filter was placed between the antenna and the Anritsu S412E.
- The filter's loss and cable characteristics were taken into account by entering this information into the S412E's offset menu.

### 3. Control Channel Measurement:

- The Anritsu S412E was configured to measure the control channel signal of the trunked P25 system.
- The P25 system was simulcast so the S412E was set to use the CQPSK demodulator. The display on the S412E showed 0 MER (Modulation Error Rate) and FER (Frame Error Rate).
- Measurements commenced at an RSSI level of -68 dBm.

#### 4. Data Collection:

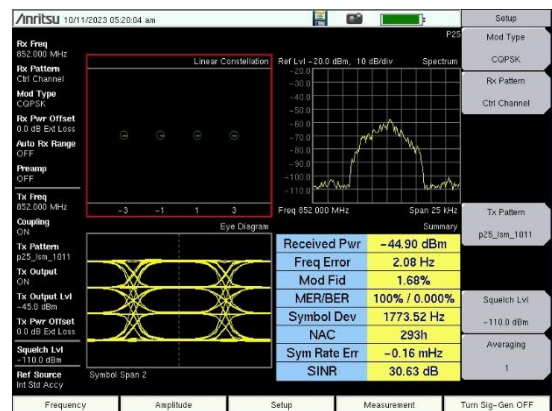
- The TRX Neon system utilized an Android tablet to display the mall's floor plan and measurements as the surveyors walked.
- Measurements included RSSI (Received Signal Strength Indicator), BER (Bit Error Rate), Mod Fidelity, and SINR (Signal-to-Interference plus Noise Ratio).
- Surveyors could customize the data displayed on the tablet during the walk.
- The Neon Command PC software allowed further customization of the summary map reports.

#### 5. Geolocation and Mapping:

- The tablet obtained location data via Bluetooth from a hip-mounted sensor and measurement data from the S412E via cable or Wi-Fi.
- An NFPA grid was set up on the Neon Mapper software, with an RSSI pass/fail threshold of -95 dBm used to color the grid squares.
- The surveyors covered each grid square on the mall's second floor, with measurements recorded approximately every 3 to 4 seconds.
- Initial training was conducted, with only a few updates necessary as the survey progressed.



*Cart to hold equipment and unity gain antenna above our heads*



*850 MHz P25 control channel measurement on Anritsu S412E*



Neon Tracker on belt



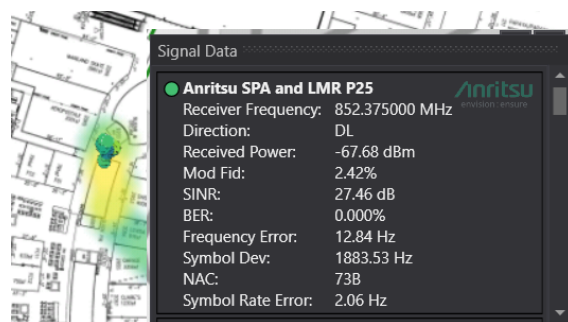
Neon Tracker



Bandpass (Minicircuits high and low pass filter)



Android tablet running Neon software



-68 dBm RSSI as we started mapping

## Challenges and Solutions:

### 1. **Interference in Store Entrances:**

- In certain store entrances, the signal from security tag readers overloaded the S412E. These readers likely operated in the 900 MHz ISM band near the survey's measurement frequency.

### 2. **Battery Life:**

- The S412E battery had a 2-hour lifespan, which was sufficient for completing the second-floor walk.
- Measurements were stored locally on the Android tablet and later uploaded to the TRX Neon cloud.
- Battery replacement allowed the surveyors to cover the first floor and upload the results to the TRX Neon cloud.

## Conclusion:

The survey effectively mapped the P25 coverage within the shopping mall, with the vast majority of grid squares meeting the required RSSI levels. This successful endeavor was made possible by the collaboration of the survey team, and special thanks go to Toan Vo of Anritsu for assisting with the TRX Neon software setup and Bill Ruck of CSI Telecommunications for aiding with the cart setup and measurements.

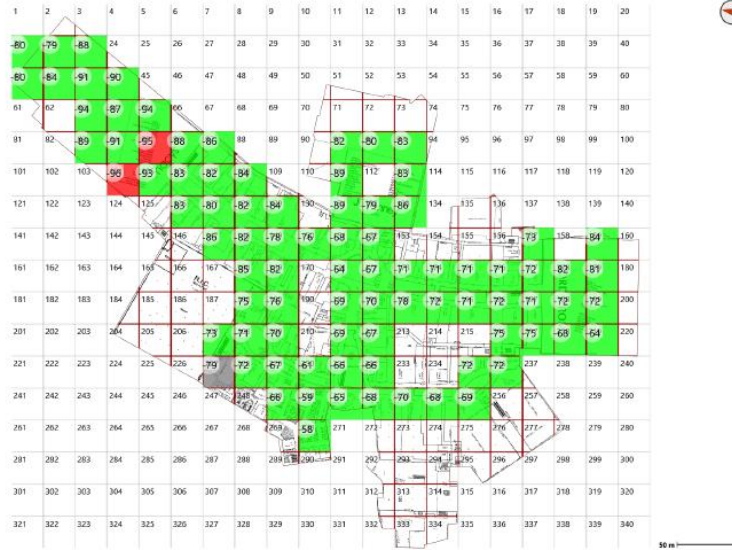


*Neon Command 3D display of measurements showing good coverage on the second floor*

Floor Result: **Pass**

Grids Tested: 86  
Passing Grids: 84 (98%)  
Result: **PASS**

**Floor 2**  
10/2/2023  
Grids Tested: 86  
Passing Grids: 84 (98%)  
Result: **PASS**  
**Anritsu SPA and LMR**  
P25  
Receiver Frequency:  
352 MHz  
Direction: DL  
**Received Power**  
dBm  
0.00  
-95.00  
-120.00  
Generated by NEON



### Grid Statistics

*Our measurements showed passing RSSI levels in all but a few locations.*

References:

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