

## Ruckus CBRS TDD Timing

### Application Note

#### INTRODUCTION

The US CBRS band operates in time-division duplex (TDD) mode, where each access point transmits for part of the time while the client devices receive, and then reverse the link direction the other part of the time. Because this requires devices to quickly switch from transmit to receive mode, access to accurate timing becomes critical to the performance of a CBRS network.

The satellite-based global positioning system (GPS) was built to provide accurate location information, but it also happens to provide very accurate timing. Therefore, every Ruckus CBRS access point includes a built-in GPS receiver and antenna to get accurate timing information for TDD mode.

#### GETTING TIMING INDOORS

GPS is notoriously difficult to get indoors. Roof, ceiling and wall materials, along with newer high-efficiency metallic e-glass all conspire to virtually block GPS signals coming from satellites into buildings. For that reason, Ruckus CBRS access points also include the ability for one access point to “share” its GPS timing information with up to 32 other Ruckus CBRS access points on the same local area network (LAN), with up to 5 switches between access points. This mechanism is described as IEEE 1588v2 PTP mode.

Ruckus Cloud management software enables the network manager to designate up to 6 access points that are known to have a good GPS signal as a “timing master”. A Ruckus CBRS access points can usually get good a GPS signal when placed within 10 feet of an exterior window. However, given the proliferation of e-glass in commercial buildings, what if no access point can get GPS?

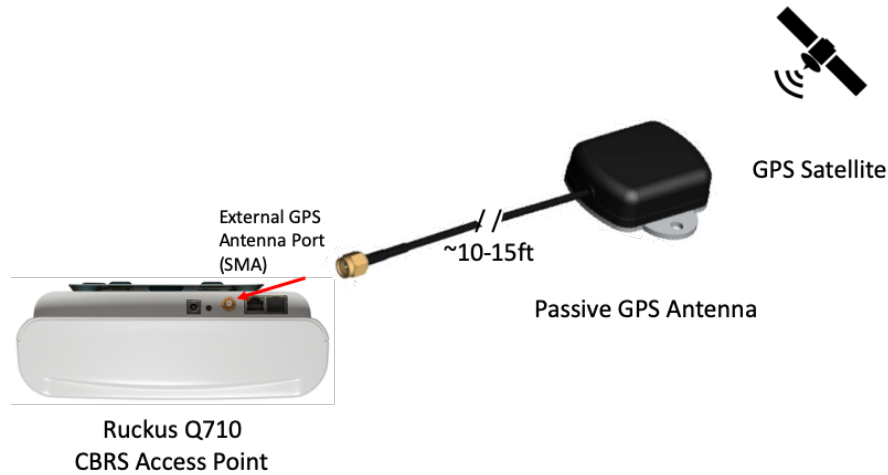
#### Q710 WITH EXTERNAL GPS ANTENNA

One option is to use the external GPS antenna port on the Ruckus Q710 CBRS access point to extend the GPS antenna closer to the window or even outdoors<sup>1</sup>. The Q710 uses a standard SMA connector that automatically detects when an external cable is connected to it. This port can accept any *passive* GPS antenna on the market. Notice that active GPS antennas will not work as this port does not provide power to the antenna. A good passive GPS antenna that would work for this application is the Jinchang Electronics JCA205 Active Antenna (P/N: JCA205-LA-R/A N-3’rgl74). A similar GPS antenna can be found here: <https://www.ebay.com/itm/GPS-ANTENNA-PASSIVE-72009002-Rev-B-/112564352582>

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<sup>1</sup> If the external GPS antenna is placed outdoors, proper engineering practices for lightning protection and grounding must be followed. See <https://lightning.org/lightning-protection-overview/> for additional information.

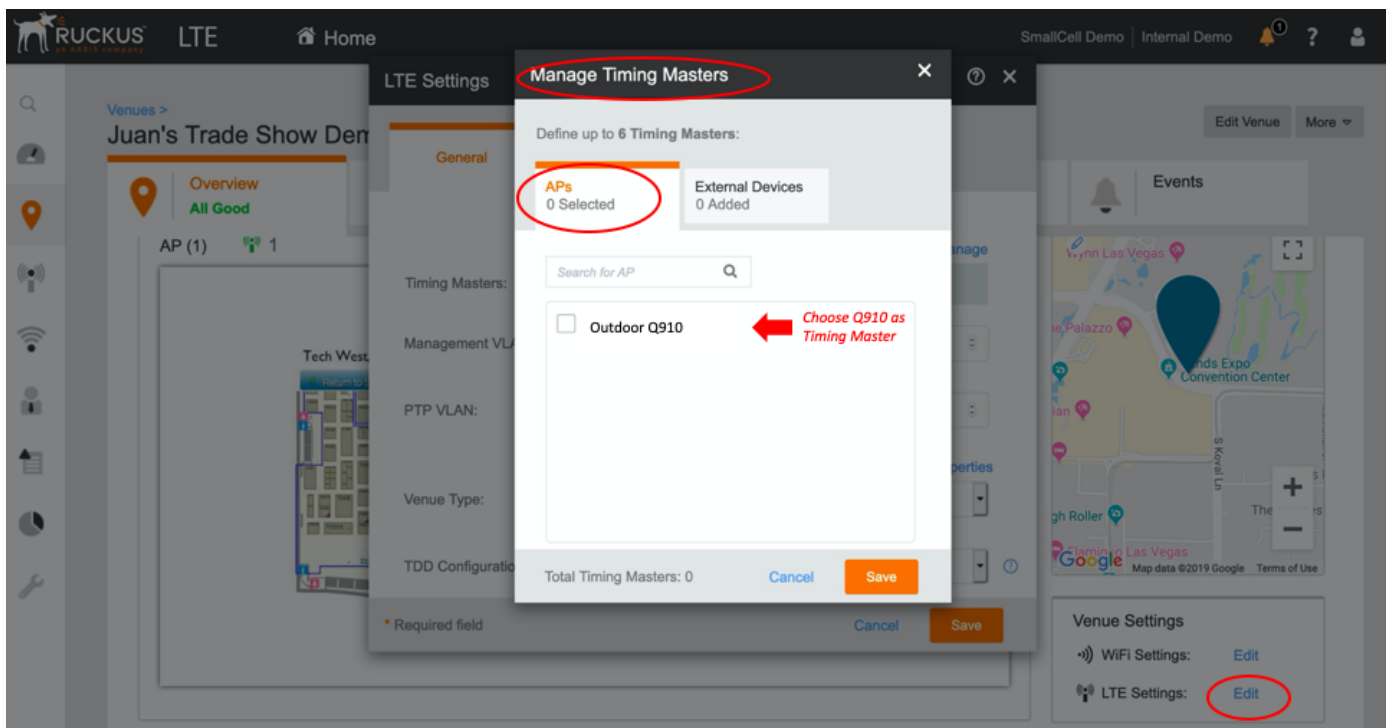
The connection from the Q710 to the external GPS antenna is illustrated below:



### Q910 AS A GPS RECEIVER

Another option is to add a Q910 Ruckus CBRS access point outdoors or at any other location with a clear view of the sky, even if no coverage is required at that location. As long as the Q910 is in the same LAN as the Ruckus CBRS access points inside the building, the network manager can designate that Q910 as a timing master and all the other access points indoors will get their timing from it.

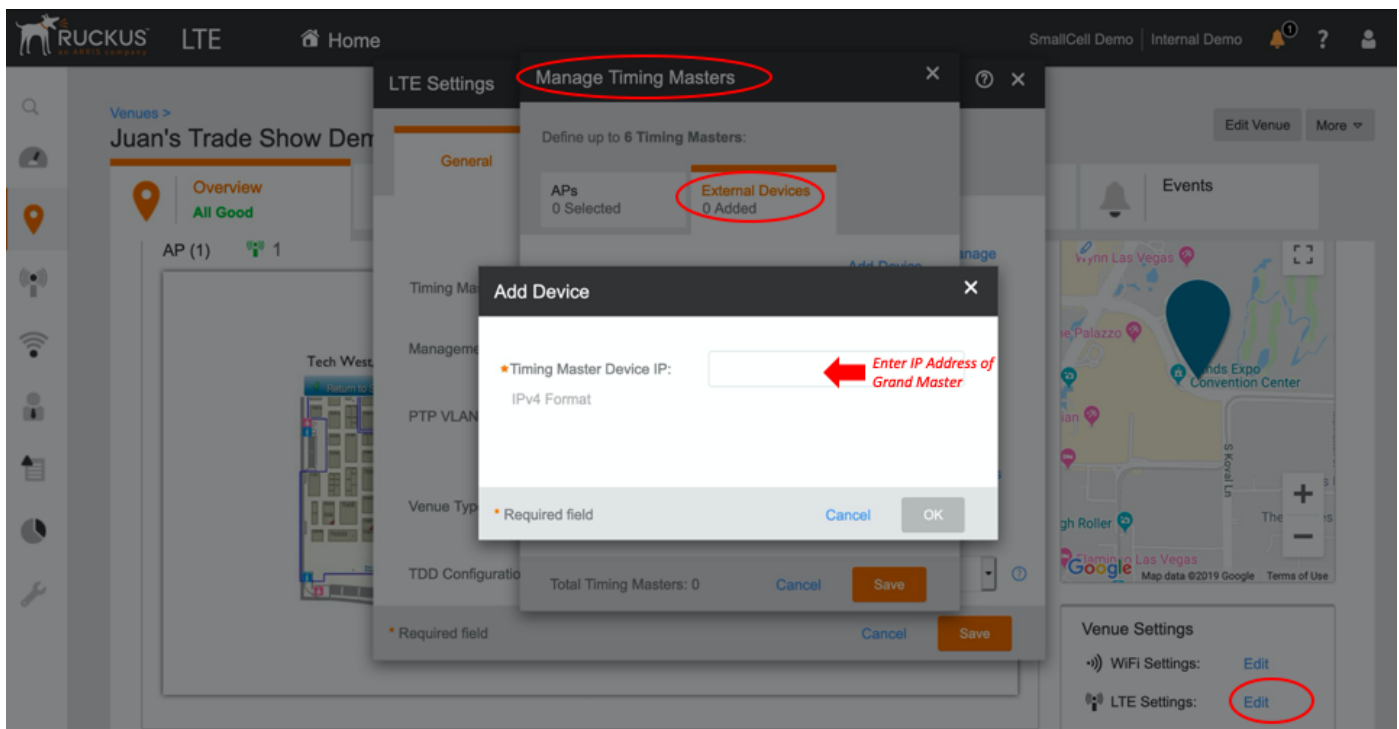
The following illustrates how to assign an outdoor Q910 as a timing master in a venue:



### COMMERCIAL-GRADE TIMING MASTERS

If all else fails, the last option is to add a commercial-grade timing master, also called “Grand Masters”, in the building. Although it highly varies with cost, commercially available Grand Masters will tend to offer high-quality GPS receiver electronics, active high-gain antennas and a high-stability oscillator to provide the most accurate timing possible. Grand Masters plug into the LAN and provide the same IEEE 1588v2 PTP timing as the Ruckus CBRS access points. In fact, to use a Grand Master for timing the network manager simply adds its IP address to the venue configuration in the Ruckus Cloud management software. All Ruckus CBRS Access Points in that venue will then get their timing from the Grand Master.

The following illustrates how to add a Grand Master to a venue:



### CONCLUSION

TDD-based bands like CBRS present some challenges when installing indoors, when GPS signals may not be available. The Ruckus CBRS access points provide both ease of install when GPS signals are available, as well as various options for getting accurate timing from GPS to deliver the most reliable, high-performance CBRS network possible when GPS is not available.

## About Ruckus Networks

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