

Salient Points Regarding CBRS (OnGo Alliance)

New methodology for providing cellular enhancement indoors through lower cost technology using shared 3.5 GHz spectrum.

Tipping point for public mobile cellular adoption projected to be 2021/2022.

Operating costs and mechanisms for public mobile cellular lack final definition (SAS, ESC, EPC, etc.)

Advantages to CBRS include:

- * Can provide private LTE (broadband) in-building communications capabilities, replacing two-way radios
- * Can be converged with WLAN “backplane” for low cost of implementation or can be planned into DAS
- * Enables the secure deployment of wireless IoT devices
- * May lead to carrier revenue share opportunities for for portfolios
- * User analytics in hands of CBRS network owner, not carriers



1: Casino—High Density, Mobile, High Security Concern

ISSUES:

- Current 3G DAS no longer providing acceptable service
- 4G DAS upgrade costly, with no guarantee of carrier participation with current 3PO revenue mod
- Need to add network and IoT devices (such as CCTV cameras) but must have very secure connection
- Extremely interested in customer analytics, usage and traffic patterns, etc.
- Have additional BoH two-way radio needs
- Needing WLAN upgrade also
- Would like carrier revenue share if possible

SOLUTION:

- Early adoption of commercial CBRS system (Q3, 2019) for private LTE with prototype of mobile capabilities, adoption as soon as viable



#2: Outdoor Concert Venue—High Density, High Volume

ISSUES:

- Need to provide WiFi for venue concession as well as customer use
- No cellular coverage in rural area
- Cannot afford DAS
- Want to drive all cell traffic through venue portal for capturing eyeballs
- Very interested in customer analytics
- No particular interest in IoT, but appreciate the upgrade possibilities
- No expectation of carrier revenue share

SOLUTION:

- Immediate implementation of WLAN with CBRS upgrade capability
- Deployment of carrier COW until CBRS “tipping point”



#3: High Rise Apartment Complex—Low Density, Fixed

ISSUES:

- Expectation to provide common area WiFi
- Want to provide cellular continuity in garage and other facility areas outside of residential unit, within residential unit if can be done at minimal additional cost
- ERRCS required, but no synergies with CBRS
- Implementing multiple wireless networks for new IoT technologies, seeking way to collapse and converge into fewer or one network
- No interest in customer analytics
- No expectation of carrier revenue share
- Very tight budget constraints

SOLUTION:

- Case by case basis depending upon characteristics of property, timing, but very interested in converged network solution
- Deploying ERRCS with DAS cabling, common area WiFi with CBRS upgrade capability—wait and see



Keys to Success for Multifamily Industry

DATA POINTS:

- Cellular coverage makes difference in a venue's leasable-ness
- Low-E glass creates RF dead zones, but actual coverage is not known until 85% completion
- DAS is expensive (approximately \$1/ft)
- CBRS won't be able to satisfy cellular enhancement needs until 2021/2022
- ERRCS is more rigidly enforced and a necessary budget line item (IFC 2018)
- Common area WiFi (WLAN) is *de rigueur*
- More IoT devices require more wireless networks to support them

RECOMMENDATIONS:

- Budget today for ERRCS and DAS design and cabling only
- Implement WLAN with IoT and CBRS convergence/upgrade capabilities
- Implement DAS if necessary at 85% completion, otherwise await CBRS tipping point (2021/2022)
- Convert DAS and/or WLAN to CBRS when economically viable (revenue share, analytics, etc.)

