C-Band and CBRS Frequency Asked Questions

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What is C-band?

The 3.7 GHz Service is a new flexible-use service recently approved by the FCC for terrestrial commercial use. It will be deployed in the 3700-3980 MHz band, which is currently used by the fixed-satellite service for space-to-ground communications. This band will be referred to here as C-band. The fixed-satellite service stations will be moved out of C-band to make way for the 3.7 GHz Service. For the new flexible-use 3.7 GHz Service, the C-band has been divided into 14 unpaired 20-MHz license blocks, and therefore is expected to be used for TDD transmissions.

Why is C-band relevant to CBRS?

The C-band spectrum adjoins the top end of the CBRS band. The CBRS band covers 3550-3700 MHz, while C-band is 3700 - 3980 MHz. Because the two bands are immediately adjacent to each other, there is a risk of adjacent band effects from independent or uncoordinated deployments across the two bands.

What kind of effects might happen?

When a radio system such as a base station or a mobile device attempts to receive a signal in the presence of a much stronger interfering signal on a nearby frequency, the stronger signal may degrade the weaker signal. This can result in reduced data throughput or other effects. As a hypothetical example, a data connection might drop from 100 megabits per seconds (Mbps) to 95 Mbps in a relatively minor case of interference. Such an impact would hardly be noticeable to the user. If the interference got stronger in relation to the strength of the desired signal, the effect would become more pronounced with further reductions in data speeds. For example, the 100 Mbps data signal might drop more significantly, to 50 or even 10 Mbps. In extreme cases, no connection at all might be possible.

What types of devices could this Impact?

To the extent that interference actually occurs, it could be between and among all elements of the CBRS and C-band ecosystem. CBRS base stations could interfere with C-band base stations, and vice-versa. C-band mobiles could interfere with CBRS mobiles, and vice-versa. In unsynchronized systems or even partially synchronized cases, mobiles and base stations could suffer from mutual interference. Indeed, interference could occur between CBRS base stations or between C-band base stations.

Filters can easily solve the problem, right?

A filter is a device that allows desired signals to pass through while suppressing undesired signals in nearby bands. While receive filters can certainly help, they require a transition region, or guard band, between the desired band and the undesired band to allow their suppression effects to “kick in.” A practical filter cannot immediately transition from allowing signals to pass through (say, below 3700 MHz) while providing significant suppression in the immediately adjacent band (say, above 3700 MHz). Typically, a base station filter, for example, would require up to 20 MHz of separation (very roughly, depending on base station type) to provide significant signal attenuation. So, a CBRS base station receive filter might do well at suppressing signals above 3720 MHz, but less well between 3710-3720 MHz, and would have only a small effect on signals between 3700-3710 MHz.

Filters on the transmit side can also help to reduce interference, but, like receive filters, they require a transition region (or guard band) to be effective.

The discussion above applies to base stations. Filtering of mobile receivers and customer premise equipment is more complicated because of size, weight, and power constraints.

Any two networks that occupy immediately adjacent frequencies, with no guard band in-between, create a challenge if strong signals are encountered by either network. Note that even within the CBRS band, and within the C-band, there may be no filtering, so intra-CBRS and intra-C-band interference could be an issue when uncoordinated systems in the same band are in close proximity. Performance will vary depending on vendor implementation.

So what's the exact impact of C-band on CBRS and vice-versa?

The impact of C-band deployments on CBRS and the impact of CBRS deployments on C-band are entirely situation dependent. It is not possible to quantify the specific impacts without extensive details on network deployments combined with highly accurate propagation models, neither of which exist. While simulations using, for example, population-weighted random deployments of base stations, customer premise equipment, and mobile devices (i.e., Monte Carlo simulations) can be run, and can provide useful overall assessments of possible data loss due to mutual interference, such simulations do not predict the actual impact on a specific device at a specific time. Actual impacts depend on the relative strengths of desired and undesired signals, which in turn depend on detailed site-specific considerations such as clutter (buildings and foliage).

Is a ballpark estimate of the impacts possible?

An estimate on the degree of impact depends on what the definition of impact is. For example, wireless standards that govern 4G LTE and 5G NR systems often define impact in laboratory tests in terms of a reduction in data throughput of 5% when receiving a very weak desired signal. It is difficult to translate such tests into a predicted impact distance due to the dynamic nature of the deployment environment. Simple models that consider various mitigating factors (see below) might predict the impact distance to be 100-250 m. The actual impact distance is very situation-dependent and further complicated by the fact that cellular networks are planned to be operated in largely interference-limited environments. Manufacturers may provide information on hardware and software features they use in their equipment to overcome interference impacts.

What are some of the mitigating factors?

There is a large number of mitigating factors that can lessen the impact of interference between C-band and CBRS in real deployment scenarios:

1. One way to significantly reduce interference between C-band and CBRS systems would be to time and phase synchronize their uplink and downlink transmissions, as is commonly done in intra-band TDD network coordination.
2. Many of the worst-case estimates of impact to CBRS from C-band assume that C-band base stations will run at maximum allowed power (hundreds of kilowatts). In reality, most macrocellular-type systems do not operate anywhere near maximum power.
3. CBRS and C-band systems will typically downtilt their antennas, or otherwise not have their antennas pointed directly at one another.
4. C-band deployments (and eventually CBRS deployments) will likely be 5G, which typically uses dynamic beamforming antennas. Such antenna beams will typically not dwell on an interferer in receive mode, and victims will not constantly be in the transmitted beam.
5. Significant propagation loss from the interfering signal to the victim receiver will often occur due to the presence of clutter along the path. Propagation measurements in the 3.5 GHz band have shown that such clutter losses can reach 40-60 dB over distances of just 1 km in real-world urban environments. This single factor could reduce the impact considerably.
6. The use of a user-noticeable impact (for example, 20% data throughput loss when receiving a medium-strength desired signal) will further reduce the size of the impact zone.
7. C-band and CBRS signals farther away from the 3700 MHz boundary will have less of an impact because filters will have more frequency separation to kick in.
8. A variety of vendor-specific features may also be used to further mitigate impacts, including filtering, scheduling, rate adaption, sub carrier/slot assignment, etc.

Can a SAS control interference from C-band into CBRS?

C-band systems are not under Spectrum Access Systems (SAS) control. SASs only apply to CBRS. Hence, SAS systems cannot directly manage C-band interference into CBRS.

When will C-band base stations be deployed?

The FCC will begin auctioning C-band licenses in December 2020. The band is to be cleared of existing incumbent operations in 2 phases:

- Phase 1 - Lower 100 MHz cleared in 46 of the top 50 PEAs (metro areas) by December 2021
- Phase 2 – Full 280 MHz cleared nationally by December 2023

Early deployments of C-band systems by license winners may occur beginning in early 2021 if incumbents relocate ahead of the clearing deadline. Large-scale deployments in the top 46 metro areas could exist in late 2021 and are likely in 2022. National scale deployments are not expected until the 2023/2024 timeframe.

Is the FCC doing anything about potential interference between C-band and CBRS?

The FCC did not require coordination between C-band and CBRS in its C-band Order (see paragraphs 396-397), but a subsequent petition for reconsideration requested that the FCC revisit the issue. Resolution of that petition is pending. Outside of the regulatory process, there are technical groups addressing the issue and developing best practices for mitigation. One resulting study has been filed with the FCC.

How does C-band interference to CBRS differ from CBRS interfering with itself?

Although SASs manage interference from GAA into PALs, and between PALs, they do not have a mandate to manage interference among GAA devices. Therefore, uncoordinated GAA systems interfere with each other in the same fashion that C-band could interfere with CBRS. Although C-band systems are allowed more transmit power, the received interference power from one nearby CBRS transmitter to another CBRS receiver could be much stronger than the interference from a more distant C-band interference source, because propagation losses help attenuate C-band signal strength with distance. Additionally, the CBRS networks operate intra-band and do not have filters on the transmitters that isolate the networks from one another.

Does this impact GAA more than PAL, because the top end of the CBRS band is GAA-only?

In CBRS, PALs must operate in the 3550-3650 MHz segment, while the segment from 3650-3700 MHz (i.e., closest to C-band) is reserved for GAA only. By rule, all CBRS systems must be interoperable over the entire CBRS band. Therefore, their band filters must cover the entire 3550-3700 MHz band. In practice, depending on the architecture of a CBSD or EUD, additional filtering may be employed to isolate just the channel or channels on which the device is currently operating. Device manufacturers can more accurately assess the potential interference impacts as a function of CBRS channel. Additionally, while 3650-3700 MHz is reserved for GAA only, GAA can use any frequencies in the 3550-3700 MHz range to help reduce interference from C-Band, subject to protecting incumbents and PALs.

What if I suspect my CBRS system is receiving interference from C-band?

Due to the timescale before significant deployments of C-band occur (beyond late 2021), interference received by CBRS before that time is much more likely to be from other sources, not C-band.

If harmful interference is encountered, attempt to understand what type of interference is impacting your network and investigate your CBRS neighbors first. The SAS administrators can help with information regarding neighboring CBRS deployments. For example, choosing another set of frequencies may solve the interference problem. Or you may try to coordinate cell phase and TDD patterns, if this has not already been done.

If after mutual investigation with your CBRS neighbors the interference is likely not originating from within the CBRS band, the next step would be to investigate if out-of-band interference is the source. Mitigation may be carried out in consultation with the C-band operator to determine if deployment parameters for either system, such as antenna orientation or power levels, can be altered without compromising mission objectives for either system.

If after that time you cannot resolve interference issues we recommend you contact the Federal Communications Commission's Enforcement Bureau.

Updates to this FAQ

This document will be updated from time to time as more information comes to light.

If you have additional questions or comments, please contact

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