



Your Questions Answered: Dynamic Spectrum Sharing (DSS)

Andreas Roessler, Technology Manager, Rohde & Schwarz

Dynamic Spectrum Sharing (DSS) is a key technology that dynamically allocates spectrum resources between LTE and 5G NR within the same frequency band. This flexibility allows mobile operators the ability to optimize their limited frequency resources based on user demand; e.g., deploy 5G NR within existing LTE spectrum.



Q

Is Dynamic Spectrum Sharing being deployed to non-standalone (NSA) 5G networks today?

A

Indeed, initial trials for Dynamic Spectrum Sharing were carried out in non-standalone mode 5G network deployments. NSA mode requires an LTE anchor carrier for the exchange of control and signaling information. Dual connectivity allows the 5G-capable device to connect to the 5G radio access network (RAN). With proper configuration, the 5G carrier can coexist with the LTE carrier, sharing the same frequency band. The 5G device will receive that configuration via the LTE signaling connection.

A

Yes, it does. The goal is to enable an operator to transition from 4G LTE towards 5G NR smoothly. Today, the majority of sub-6 GHz based LTE network deployments use frequency division duplex (FDD). One option for a service provider is to re-farm those bands, which is expensive, requires spectrum clearing and impacts network performance and system capacity. The more efficient way to transition from LTE to 5G is through the use of dynamic spectrum sharing. A typical deployment strategy is to re-farm one frequency band at a lower frequency to provide a coverage layer for 5G NR. Next, the network operator enables DSS for LTE frequency bands at mid-band spectrum (i.e., around 2 GHz). These bands are combined via carrier aggregation to create a wider data pipe for 5G NR and increase system capacity that way. The dynamic aspects of spectrum sharing allow the coexistence of LTE subscribers and 5G NR subscribers using the same frequency band by utilizing smart scheduling algorithms that balance the resources between both technologies in frequency and time.

Q

Does 5G standalone work with DSS too? Is DSS a transition technology?



Q

Why does dual connectivity boost coverage on Mid-band?

A

TDD bands tend to be using higher frequencies (2.6 GHz, 3.5 GHz). These higher mid-band frequencies provide uplink coverage challenges. Non-standalone mode usually combines a low band LTE FDD carrier via dual connectivity with a 5G NR carrier using the 3.5 GHz TDD band (n77, n78). Based on intelligent network configuration, where the uplink data is routed via split bearer concept of dual connectivity data can now be sent via the low band spectrum, which corresponds to a coverage increase compared to 5G NR network deployment using 3.5 GHz only.

A

Yes, 5G NR supports dual connectivity with LTE and NR, but also with NR and NR. From a technology perspective, there could be a 5G NR standalone mode carrier (carrier #1) and another NR carrier (#2) that shares the spectrum with an LTE carrier via Dynamic Spectrum Sharing. Both carriers could be combined via NR-NR dual connectivity.

Q

Could dual connectivity and DSS happen at the same time?



Q

Does DSS use LTE numerology for 5G REs?

A

Yes, the initial deployments where DSS will be using the same numerology as LTE does. That is a subcarrier spacing of 15 kHz.

A

According to announcements made by leading network equipment vendors, it is a software update only.

Q

Is dynamic spectrum sharing obtained with Sw upgrade only?



Q

Which 3GPP Rel. will support for dynamic spectrum sharing?

A

Dynamic Spectrum Sharing takes advantage of the combination of different fundamental features within 3GPP Release 15. But with the rate matching algorithm, intended explicitly for LTE's cell-specific reference signals, it also adds unique features to enable spectrum sharing with 4G LTE. Some additional functionality is added with 3GPP Release 16, namely an extension of PDSCH mapping type B and the support of multiple LTE CRS rate matching patterns compared to Release 15.

A

Dynamic Spectrum Sharing works between 4G LTE and 5G.

Q

Does dynamic spectrum sharing include 3G or 2G in dynamic sharing, or is it just 4G and 5G?



Q

When should we expect DSS on TDD, and what would be the main differences when compared to FDD?

A

The majority of today's 5G deployments below 6 GHz are using TDD frequency bands already today. They were underutilized or not available for LTE. Thus there is generally speaking not (yet) a great demand for DSS for TD-LTE. That may change in the future, though, and technologically DSS will work for TDD too.

A

MBSFN works from a technology perspective in both modes, LTE FDD and TD-LTE. The majority of sub-6 GHz LTE network deployments use FDD.

Q

Is MBSFN configuration valid for FDD bands as well (or only for TDD bands)?



Q

How will the UE understand when to check for reference signals for LTE and when to check for 5G and perform measurements or for initial access?

A

We need to distinguish between legacy LTE devices and 5G devices. Due to the MBSFN subframe configuration being broadcasted by SIB Type 2 in the LTE network, a legacy LTE device knows to ignore these subframes for any signal quality measurement such as RSRP, RSRQ based on LTE's cell-specific reference signals (CRS) as they are not present in these subframes.
A 5G device that access the same spectrum is configured via signaling to know the MBSFN subframe configuration and will therefore find synchronization signals for the initial access. When using standard LTE subframes for 5G NR transmissions the device is configured to avoid LTE CRS with the appropriate LTE CRS rate matching pattern. In 5G NR itself, there are no signals like LTE CRS. Instead tracking signals are used by the device's receiver to track time and frequency. In a typical scenario, these tracking reference signals are transmitted in MBSFN subframes. Their configuration is also signaled to the device. Therefore a 5G NR device knows precisely where and when to look for these reference signals.

A

Technologically, this is possible. However, the TDD spectrum was underutilized by the LTE technology. Almost all initial 5G NR deployments across the globe are using the C-Band spectrum (around 3.5 GHz), which was not available for LTE. Therefore, there is no need to enable DSS on those carriers.

Q

Can DSS be applied not only to LTE FDD but also to LTE TDD?

Q

Will DSS be implemented in eNBs, gNBs, or both?

A

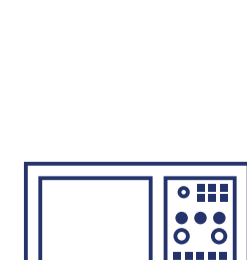
Yes, a software update will enable DSS on both.

A

That is one of the tests for legacy LTE devices that network operators carry out as part of their device test strategy. In this video, you demonstrate this capability: <https://youtu.be/k6i0sc8xKKs>

Q

Is there any concern that some LTE legacy devices may not be able to handle MBSFN subframes properly?



Presentation:
5G NR Evolution - What is Dynamic Spectrum Sharing



Webinar:
Dynamic Spectrum Sharing Driving 5G to Scale



Questions?
Click here for contact.

