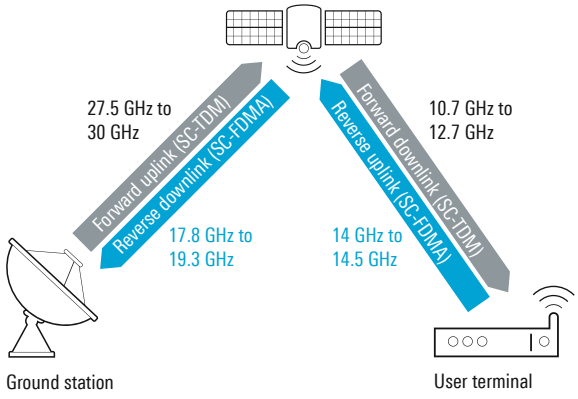
Generate OneWeb-compliant signals for receiver tests

The OneWeb satellite constellation provides global broadband data access to almost every user. Via user terminals, the satellite connects the remote users to the ground station, which has access to the terrestrial broadband network. Receivers and RF equipment in the OneWeb ground stations and the user terminals need to handle high-speed microwave data links.

System overview



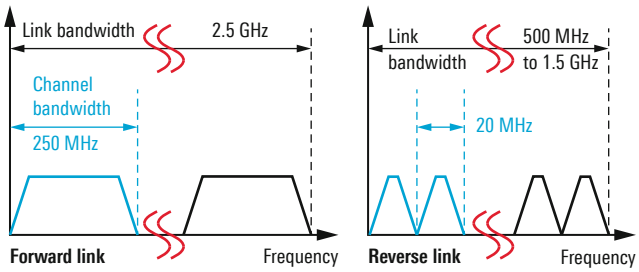
Introduction

Modern high-speed microwave satellite links must be flexible and robust to handle multiple users and high signal quality at the same time. OneWeb uses a single-carrier time division multiplexing scheme (SC-TDM) for the forward link. Short time intervals are continuously allocated to different users over the full bandwidth so that many users can share the link resource over time. The reverse link must handle user requests to the broadband terrestrial network via ground stations and gateways. The reverse link uses a single-carrier signal with a frequency division multiple access scheme (SC-FDMA) based on the LTE standard. Frequency slots are shared among the user over one time interval (subframe).

Link constellations

The forward link can consist of up to eight channels covering up to 2.5 GHz total bandwidth. Each channel is occupied by a single-carrier signal with up to 250 MHz bandwidth. The reverse link offers up to 1.5 GHz total bandwidth. This link is organized in channels with six single-carrier signals per channel. Each carrier has a bandwidth of 20 MHz, which results in a 120 MHz channel bandwidth (see figure below).

Supported signal constellation



Your task

Engineers need a flexible, fast and simple solution to configure and generate OneWeb-compliant signals in the microwave frequency range. Typically, they need to test receivers and RF equipment such as converters, power amplifiers and RF frontends in ground stations, user terminals and in the satellite payload.

T&M solution

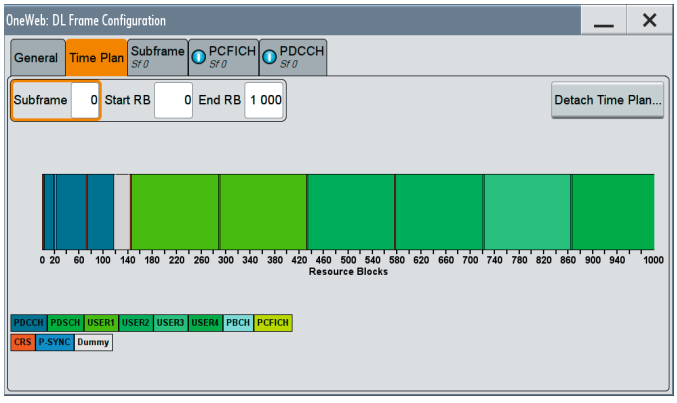
Rohde&Schwarz offers two options for generating OneWeb-compliant signals with the R&S®SMW200A vector signal generator:

- The R&S®SMW-K355 OneWeb reference signals option to select and use predefined reference waveforms (include all parameters). This is the perfect solution if only physical layer tests with the correct modulation format and signal shape must be executed, e.g. for component testing of power amplifiers

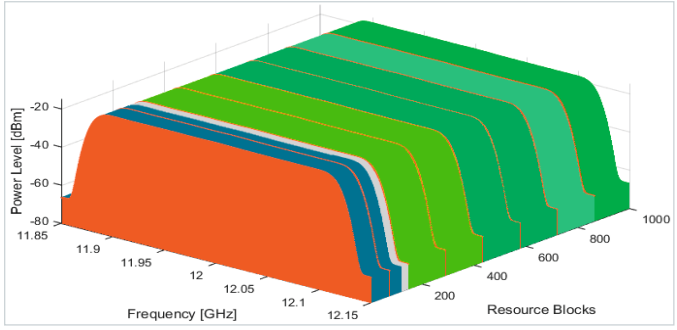
The R&S®SMW-K130 OneWeb user-defined signal generation option to freely configure forward and reverse link signals. With this option, users can define single-carrier scenarios for the forward link. Multi-carrier scenarios can be configured by using the multi-carrier feature of the ARB. For the reverse link, users can configure single-carrier or multi-carrier scenarios by using the carrier aggregation feature implemented in this option. Users have access to all setting parameters for the forward and reverse link such as number of subframes, resource block configuration, number of users, cell ID and modulation format. The parameters are displayed in summary tables.

Forward link

The R&S®SMW-K130 option can generate a single-carrier signal that is formatted in frames, subframes and resource blocks. The number of resource blocks defines the time interval that a user has active access to the link. The full bandwidth is allocated to one user during the time interval defined by the RBs. The time plan gives a graphical overview over the scheduled resource blocks.



Example time plan for subframe 0: 1000 resource blocks with assignments to four different users (individual users indicated in different shades of green are active in different time slots).



Resulting single-carrier spectrum: to test e.g. a user terminal with a forward link signal at 12 GHz.

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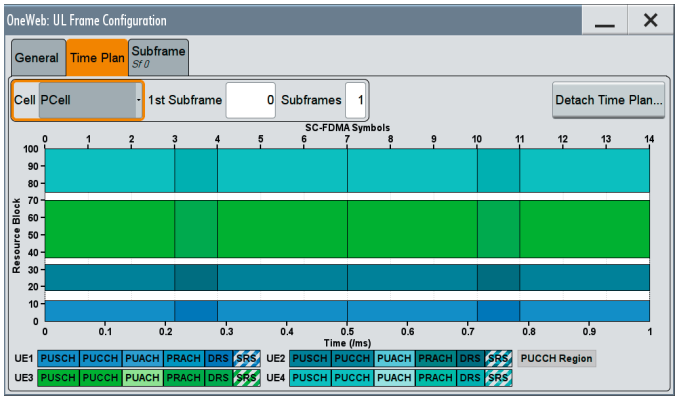
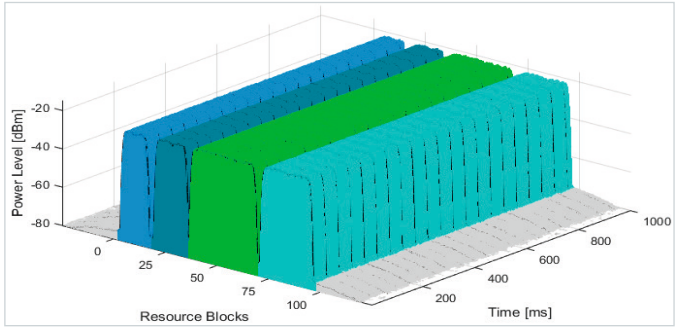
Reverse link

Every reverse carrier signal is formatted in frames and subframes in the time domain and in resource blocks in the frequency domain. Users can freely configure the RBs to define various test cases for testing RF equipment and receivers in the ground station.



Time plan for one subframe: Four users (indicated in different colors) share the RBs. Each user occupies a different number of RBs. White spaces between the users show free RBs.

The configured resource block allocation translates into the spectrum of the signal. The occupied spectrum per user is wider or narrower depending on the number of allocated RBs.



RF signal at 14.2 GHz resulting from the configuration of the time plan in the previous figure: Free RBs appear as notches in the spectrum.

Summary

With the R&S®SMW-K130 and the R&S®SMW-K355 options, the R&S®SMW200A is the perfect solution for generating OneWeb-compliant signals for forward and reverse links. The configuration allows flexible and fast signal generation for conclusive receiver tests and gives an intuitive overview of the link constellation and access to all relevant link parameters.

See also

https://www.rohde-schwarz.com/product/smw200a

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