Department: Electronics and Telecommunication Engineering

Course: Mobile Communication System (MCS)

Semester: VII Div: A & B

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EXPERIMENT NO.9

Aim: To Generate 5G Wireless Communication Waveform system using MATLAB

Theory:

5G is the 5th generation mobile network. It is a new global wireless standard after 1G, 2G, 3G, and 4G networks. It enables a new kind of network that is designed to connect virtually everyone and everything together including machines, objects, and devices. Internet speeds in the high-band spectrum of 5G has been tested to be as high as 20 Gbps (gigabits per second), while, in most cases, the maximum internet data speed in 4G has been recorded at 1 Gbps.

5G mainly works in 3 bands**,** namely low, mid and high frequency spectrum — all of which have their own uses as well as limitations.

1. Low Band Spectrum: In terms of coverage and speed of Internet and data exchange, the maximum speed is limited to 100 Mbps (Megabits per second).
   This means that telecom companies can use and install it for commercial cellphone users

2. Mid Band Spectrum: It offers higher speeds compared to the low band, but has limitations in terms of coverage area and penetration of signals. This band may be used by industries and specialized factory units for building captive networks
3. High Band Spectrum: It offers the highest speed of all the three bands, but has extremely limited coverage and signal penetration strength. This band greatly enhances futuristic 5G technology applications like Internet of Things (IoT) and smart technology but will require considerable infrastructure.

Following channels are supported by 5G NR wireless system.

Downlink channels: PDSCH (DL shared channel), PBCH (Broadcast channel), PDCCH (DL control channel)
Uplink channels: PRACH (Random Access Channel), PUSCH (UL shared channel), PUCCH (UL control channel).

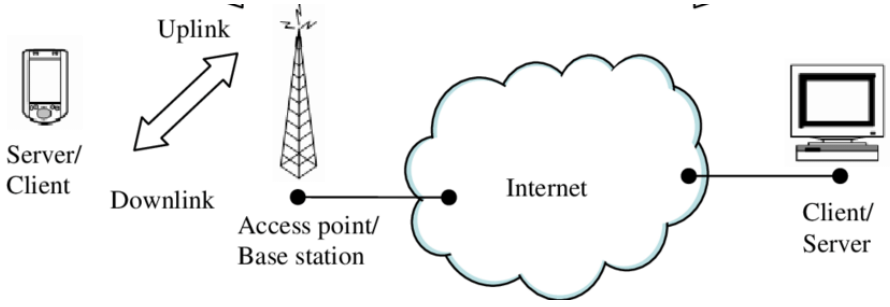


Fig.1. Uplink and Downlink Scenario

Overall Procedure for Waveform Generation

Following illustration (based on 38.300 - 5.1) shows overall flow of waveform generation for downlink and uplink. The biggest difference between NR and LTE is that NR can use CP-OFDM for Uplink as well as DFT-s-OFDM depending on use case.

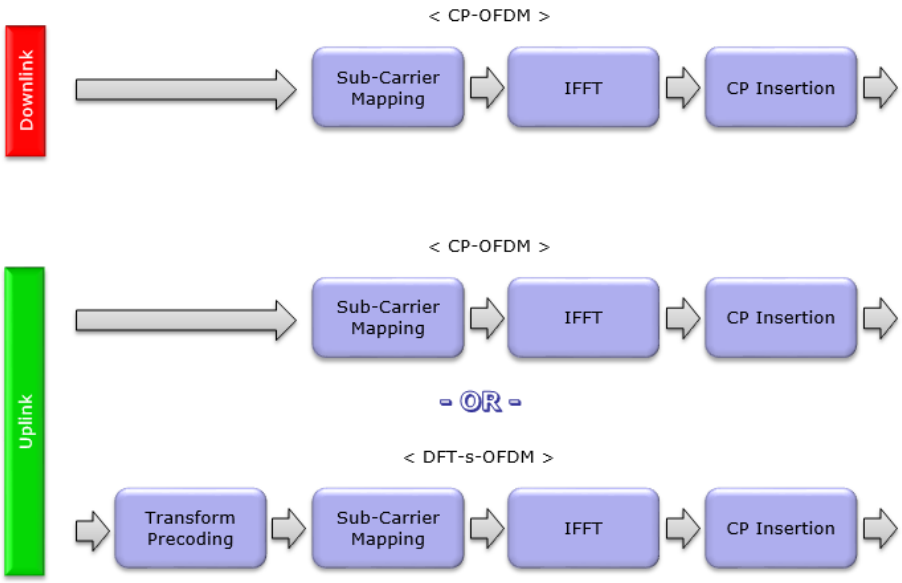


Fig.2

Result: Fig.3.Downlink

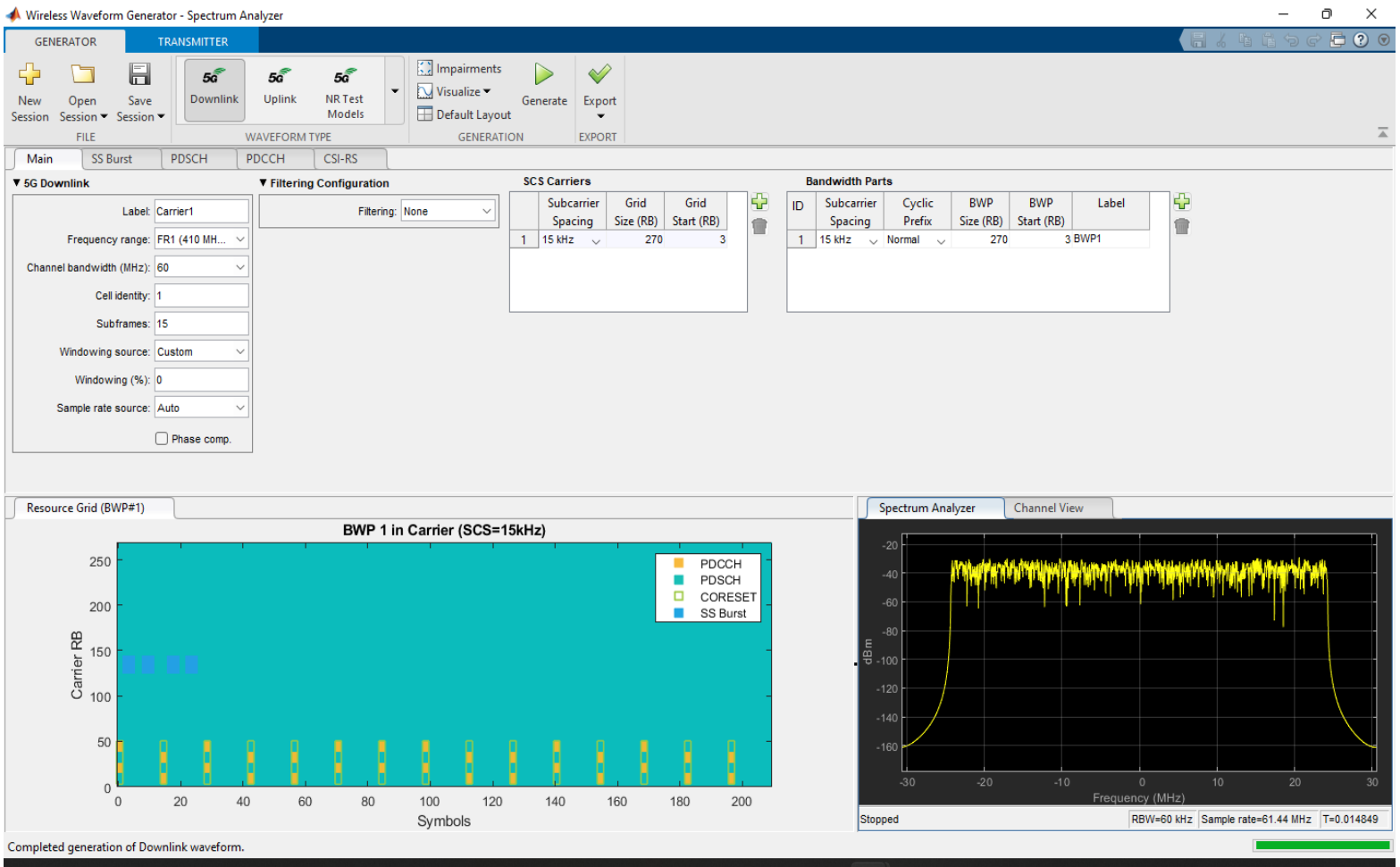
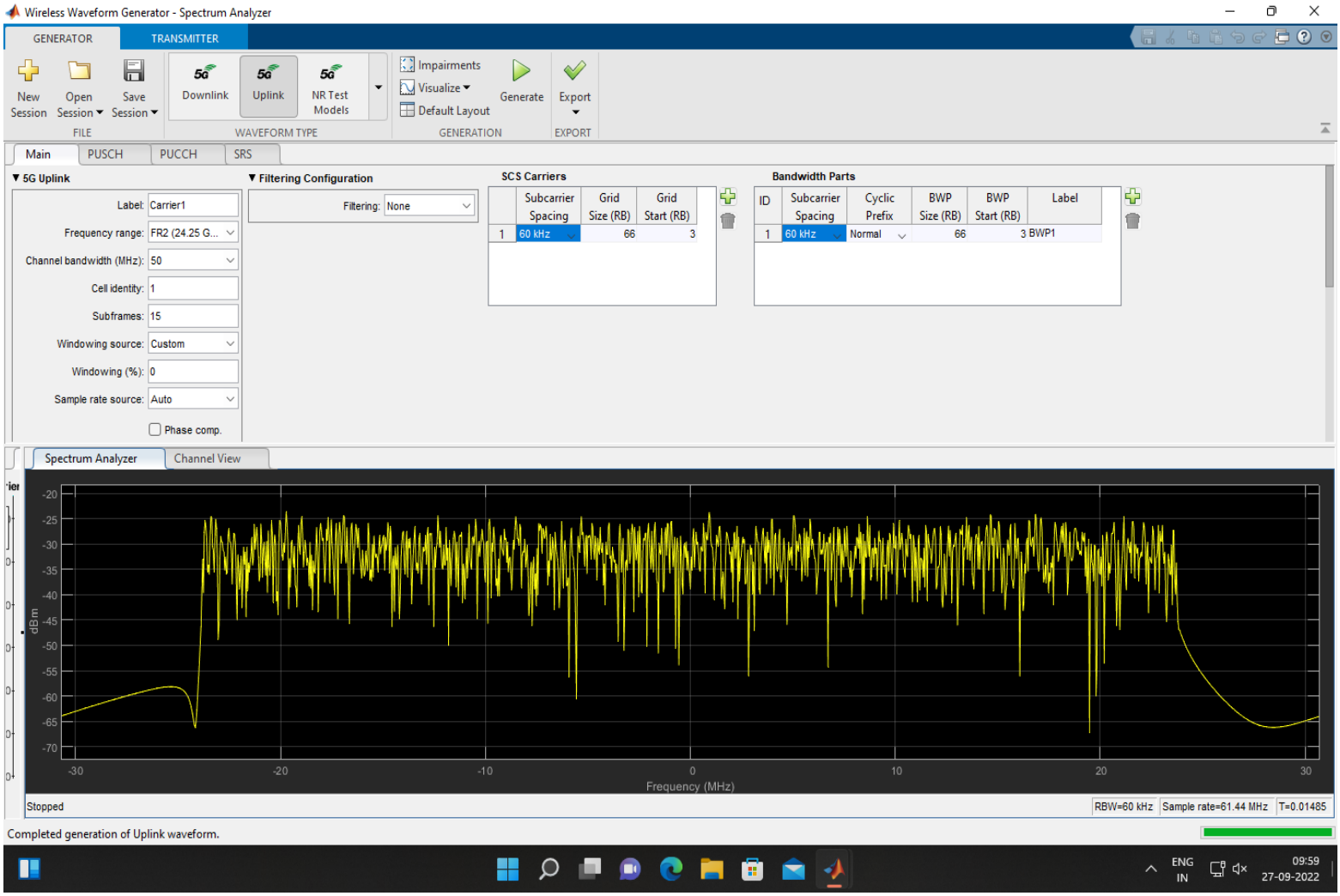


Fig.4. Uplink



Conclusion: Thus, we simulated and tested generation of 5G waveform using MATLAB