B.Tech. Mini Project Synopsis Presentation on

SIMULATION OF TRANSMITTING AUDIO/VIDEO OVER 5G IN ROBOTIC TELESURGERY SYSTEM

Presented by

PULIGOWNI.PAVAN KALYAN
ELIKE.HARI KIRAN BABU
Group no.37

Under the Supervision of

Dr.RABINDRANATH BERA
Designation

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
SIKKIM MANIPAL INSTITUTE OF TECHNOLOGY

SMIT SIKKIM MANIPAL UNIVERSITY
SIKKIM MANIPAL INSTITUTE OF TECHNOLOGY

1

ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT

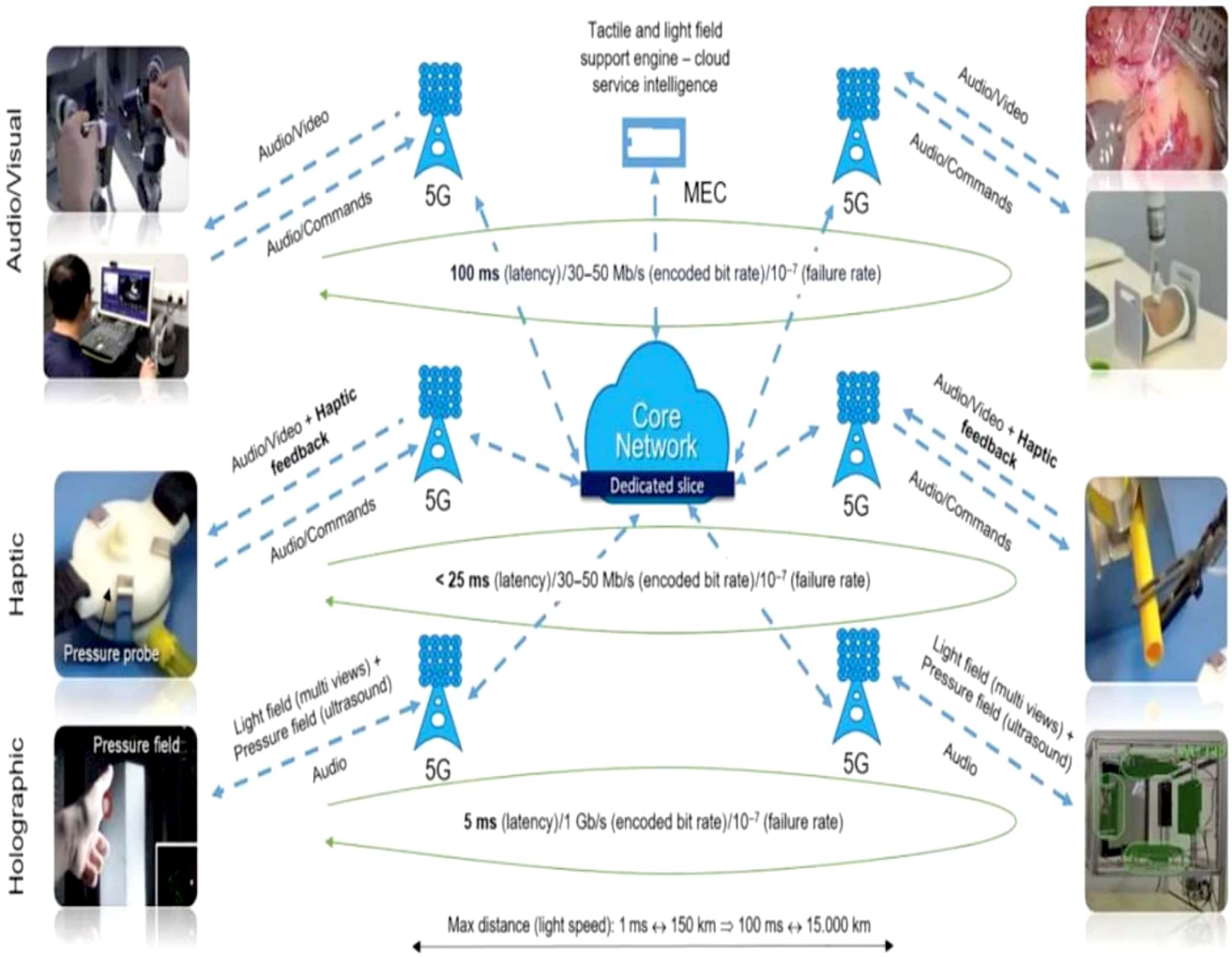
ORGANIZATION OF PRESENTATION

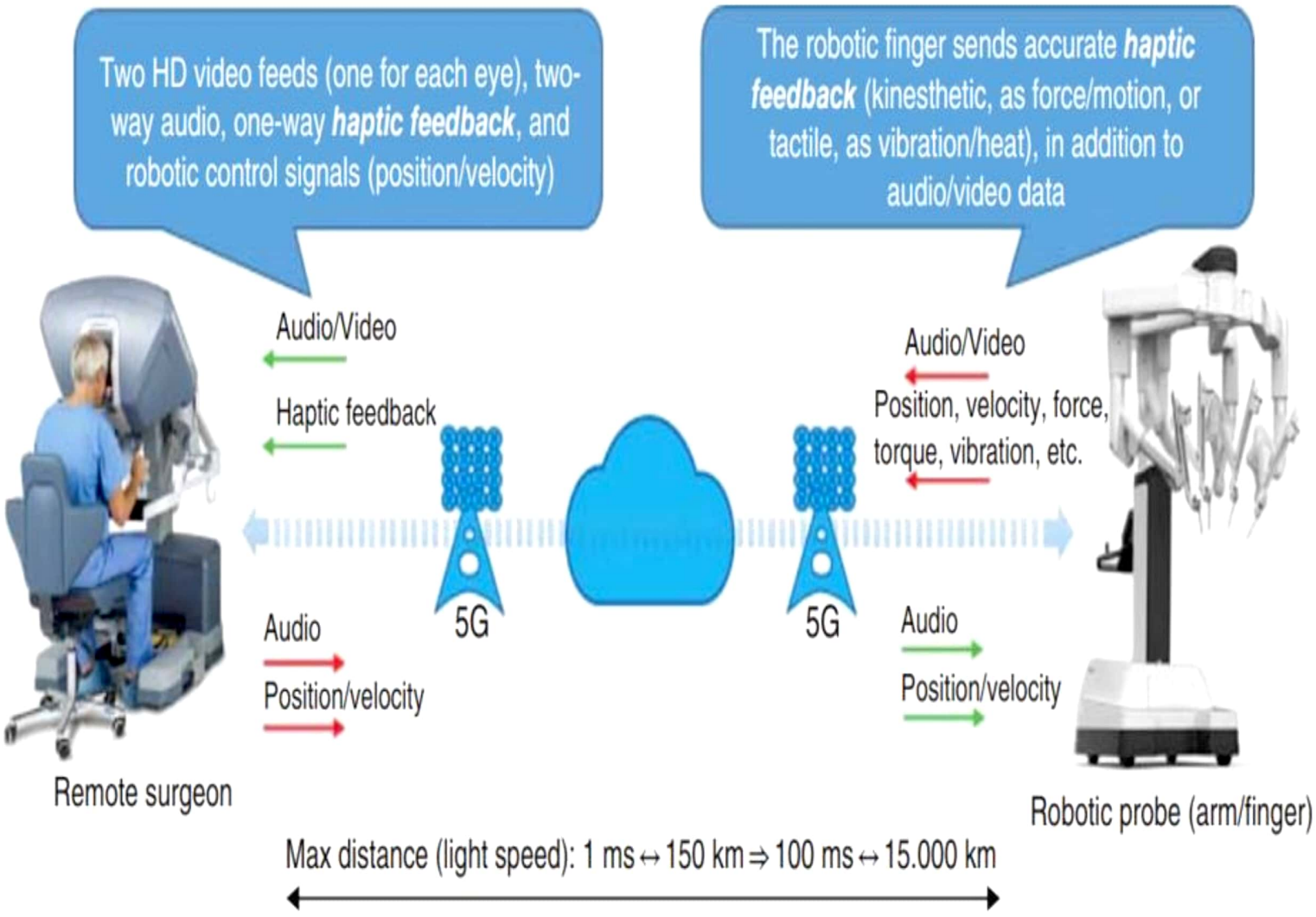
INTRODUCTION

- "Telesurgery" is an innovative trend of surgery which promises to replace or help supportively the conventional method of surgery operation.
- Telesurgery makes use of wireless technologies and robotic systems so as to allow surgeons to operate on patients from distance .
- New emerging technologies, such as Internet of Things (IoT), Wireless Sensor Networks (WSN), 5G Networks, Tactile Robotics, Artificial Intelligence (AI) and novel Video Compressing techniques for a better quality of visualization and lower latency, can be evaluated for successful telesurgery operation.

MOTIVATION

- Robotic surgery reduces hospitalisation time , pain and discomfort and recovery time; it infers smaller incisions, reduced risk of infection reduced blood loss and transfusions, minimal scaring.
- With 5G , a specialist could examine operate on a patient at a different geographic location and the system could potentially remove barriers to healthcare provisions in developing countries.





ACTIVITIES IN WTS:

ACTIVITY 1: HD Video and Audio over 5G network i,e , Remote Surgeons will be able to see the distant patient and also the Robotic Hands

[This is the aim of this Mini Project using Simulation]

ACTIVITY 2: As Step 2 activity, Surgeon will be able to position the Knife within the Robotic Probe over the point of operation on the body of the Patient. This is too Crucial and can be achieved using haptic Feedback .

[It is the future Scope of the Project]

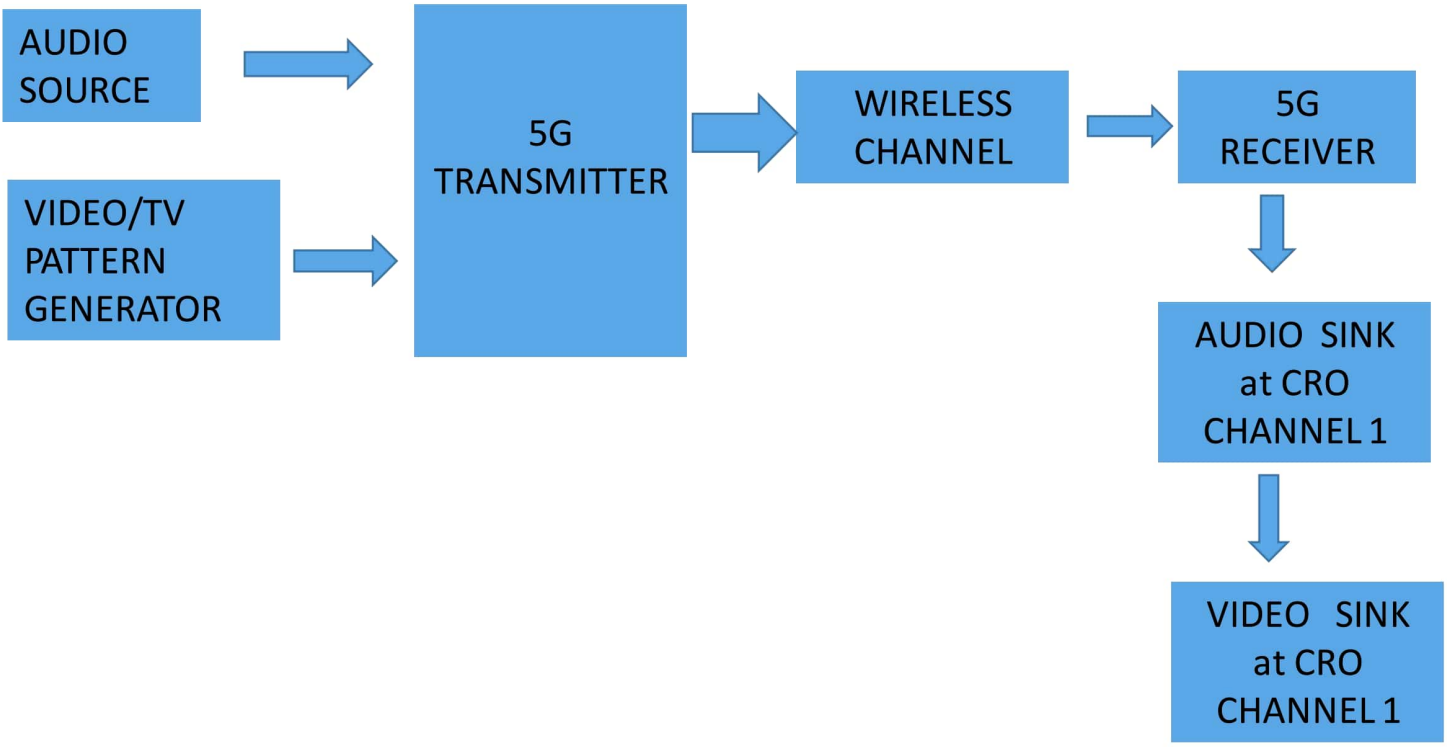
Activity 3: The final operation. [Not to be Considered in this project]

Out of the above 3 folded Activities, Activity 1 will be executed in this Project

OBJECTIVE

To design and develop a simulation of transmitting audio/video over 5G in robotic telesurgery system.

BLOCK DIGAGRAM:



Huawei 5G Supports World's First Telesurgery

A surgeon in China successfully finished the world's first telesurgery using 5G technology, the tech provider Huawei said on Jan.10. As 5G enters the healthcare industry, patients will benefit from a wider access of remote nursing, diagnostics and operations.

"My personal experience operating with 5G and the high-definition videos it provided are almost the same as what I can get from fiber-optic transmission," said the surgeon.

The doctor, in a research institute in southeast China, performed an hour-long hepatic lobectomy on an animal 32 miles away via a surgical robot and real-time transmission over 5G network.

LITERATURE SURVEY

S.NO	AUTHOR	TITLE	YEAR	FINDINGS	RELEVANCE TO THE PROJECT
1.	YUSUF ABDUL REHAMAN SAMBO,MOHAMMAD ALI IMRAN,QAMMAER H.ABBASI	ENABLING 5G COMMUNICATION SYSTEM TO SUPPORT 5G	2019	With 5G , a specialist could examine operate on a patient at a different geographic location and the system could potentially remove barriers to healthcare provisions in developing countries.	Telesurgery enables 1) visual guidance during surgeries, 2) augmented reality (AR), helpful for the surgery team, and 3) the assistance of robots that greatly reduce surgery invasiveness, thus making patient recovery faster. Data rates higher
2.	D.SOLADANI	5G MOBILE SYSTEMS FOR HEALTHCARE	2017	fifth generation (5G) mobile communication for ultra-reliable low-latency communications. With the expected superior performance to the	5G communication system are used to support new and diverse scenarios like 5G

PROBLEM DEFINITION AND PROPOSED SOLUTION

- Telesurgery requires access by the surgeon's side to High Definition (HD), such as 2K or 4K screens, and to tactile equipment, such as arms, robotic systems and wireless sensors.

- Therefore, for absolute accuracy, it is necessary for the surgeon to have excellent image quality . This means that we need high bitrate which has the advantage to accommodate higher image quality in the video output. However, 2K and 4K resolutions are not possible through 4G networks, due to the fact that in this case the average download speed reaches 35Mbps in urban areas .

- The solution in this concern is the introduction of 5G networks, which offer significantly improved bandwidth and notable lower latency

PLANNING AND METHODOLOGY

Model Development Phase:

STEP 1: 5G Transmitter to be modeled in Systemvue with
i) OFDM as waveform ii) Smart antenna

STEP 2: 5G Channel to be modeled having flexibility in varying the distance between transmitter and receiver

STEP 3: 5G Receiver to be designed with Smart antenna

STEP 4: AUDIO and VIDEO sources to be interfaced at the transmitter

STEP 5: AUDIO/VIDEO sink to be added as CRO channel 1 and channel 2 for the display

Performance TESTING PHASE :-

STEP 1: Waveform to be visualized at different stages of the Model using CRO and Spectrum Analyzer

STEP 2: SMART antenna operation to be tested

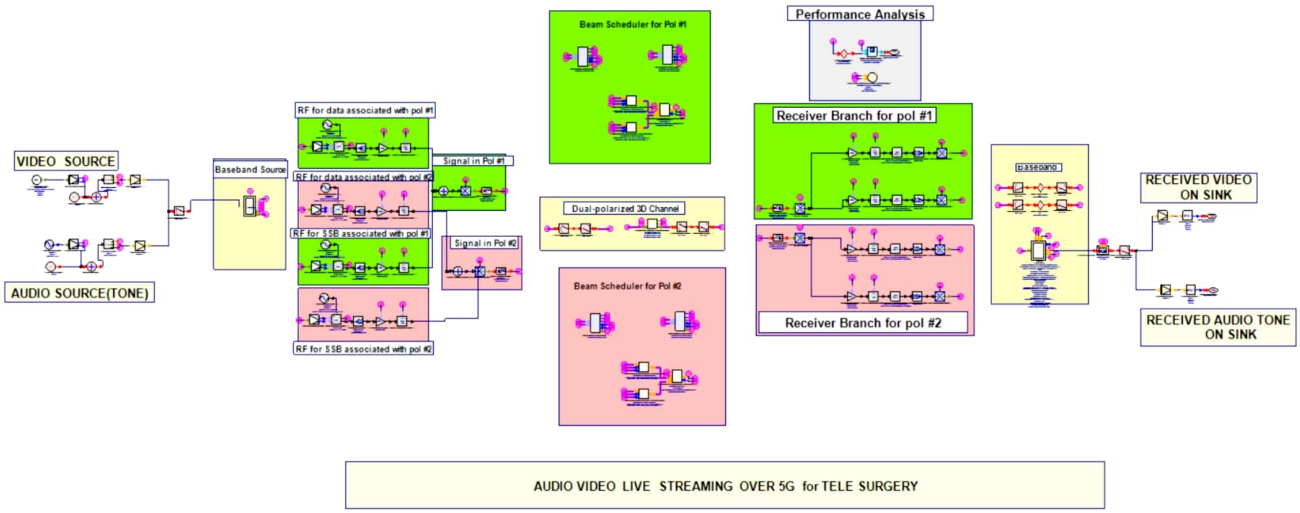
Step 3: BER and Throughput to be measured

Final Outcome testing

Step 1: 5G Communication system to be tested for 1 KHZ audio tone,

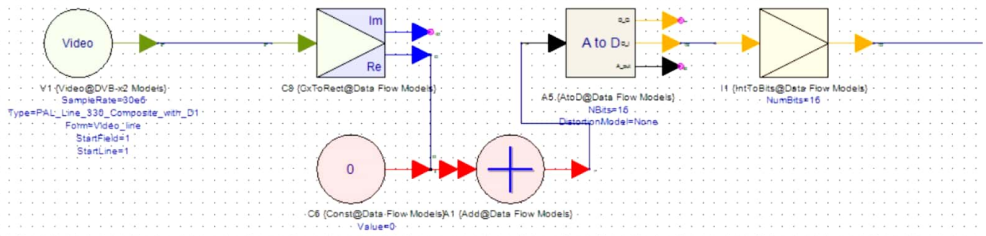
Step 2: Short duration voice reception can be tested in OFF LINE mode

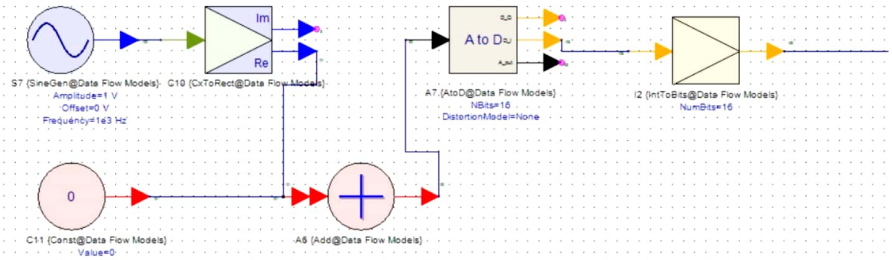
Step 3: 5G Communication system to be tested for VIDEO PATTERN for it faithful reception



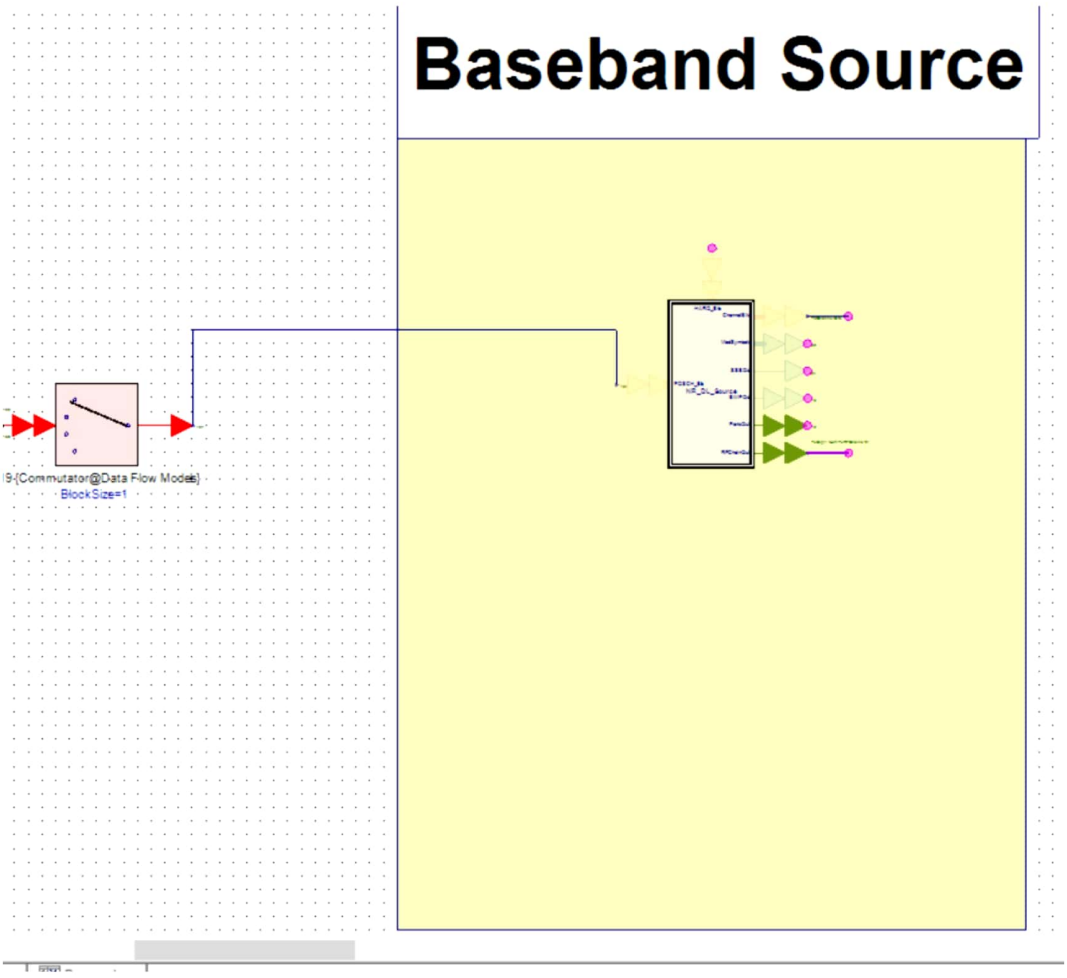
circuit

VIDEO SOURCE

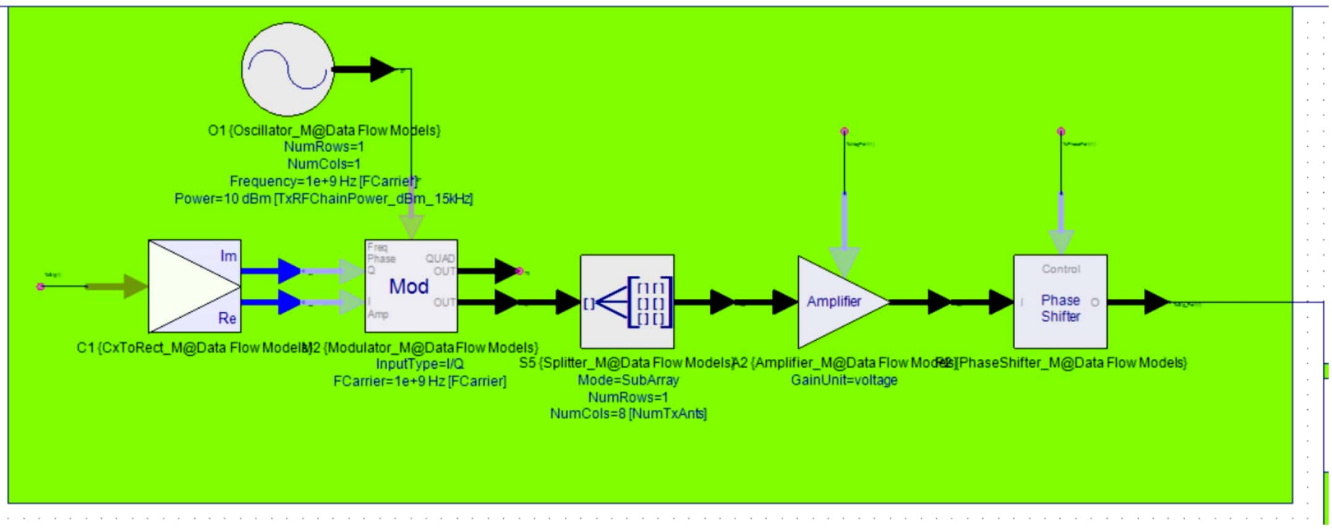




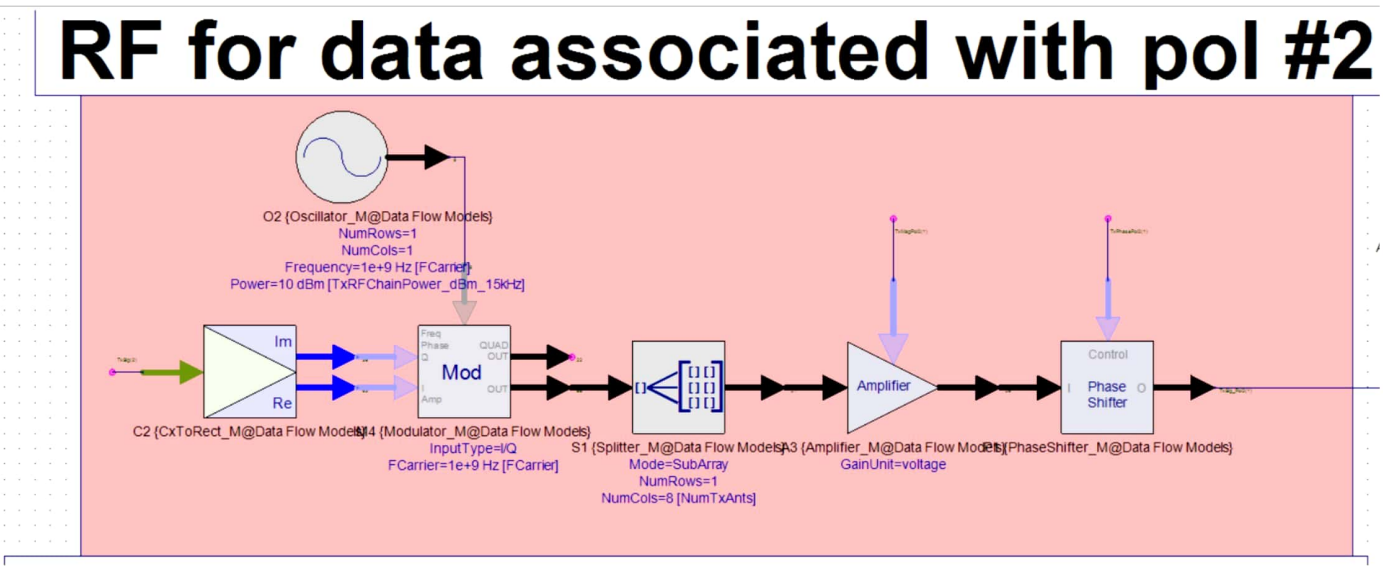
AUDIO SOURCE(TONE)



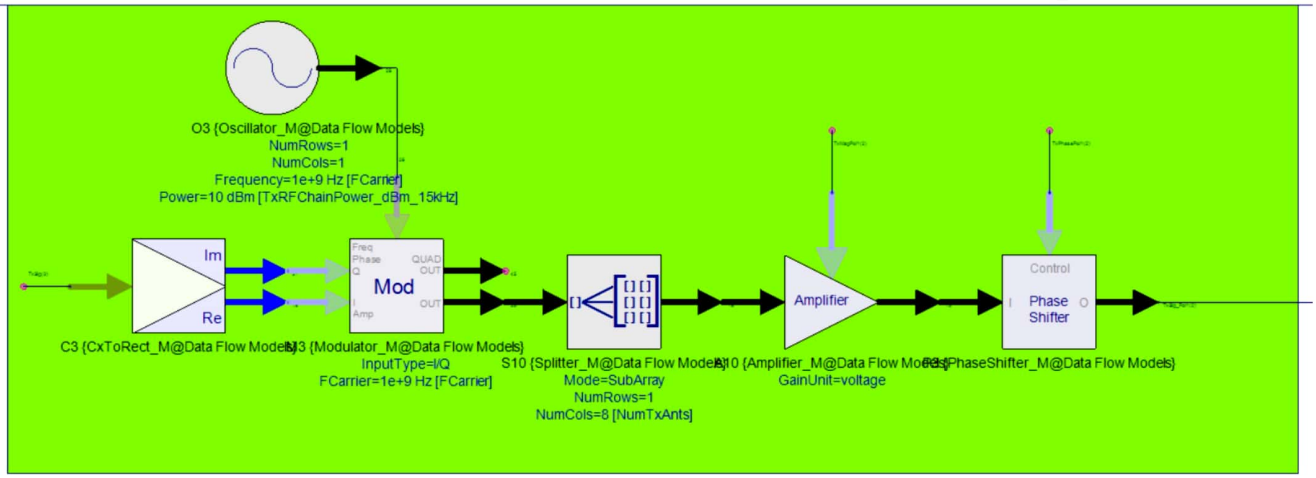
RF for data associated with pol #1

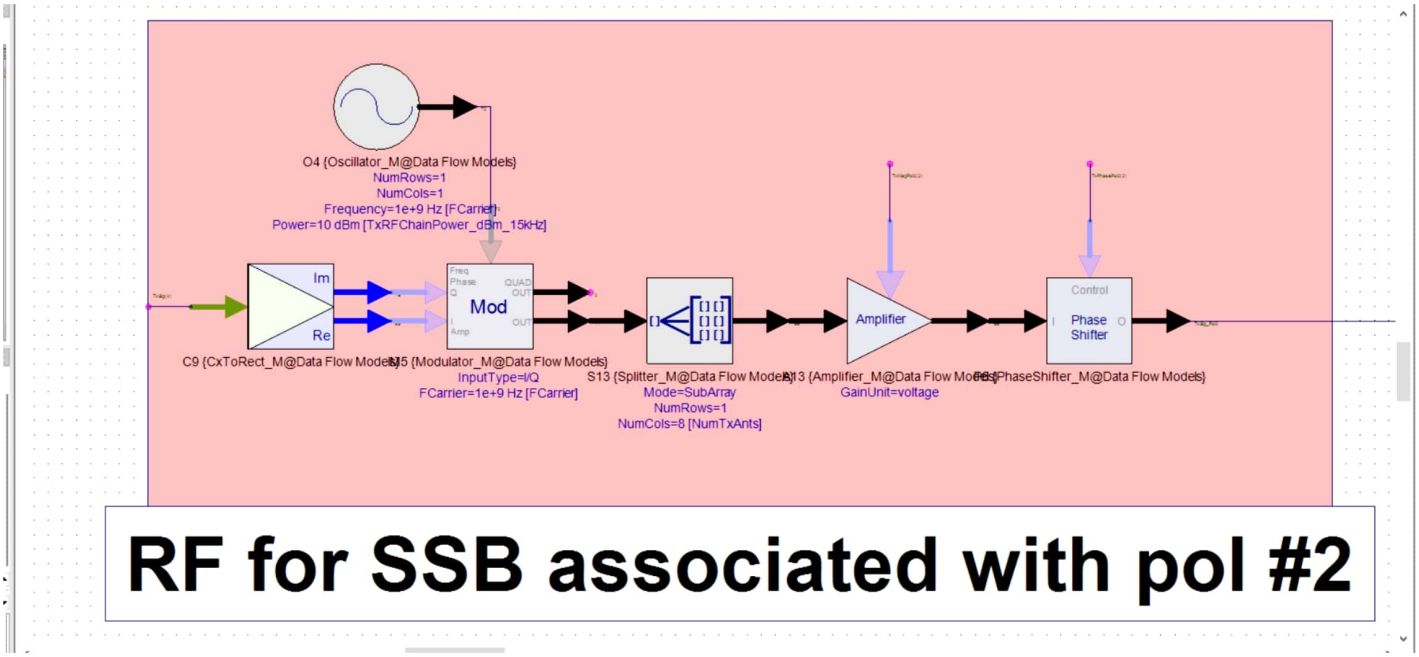


RF for data associated with pol #2

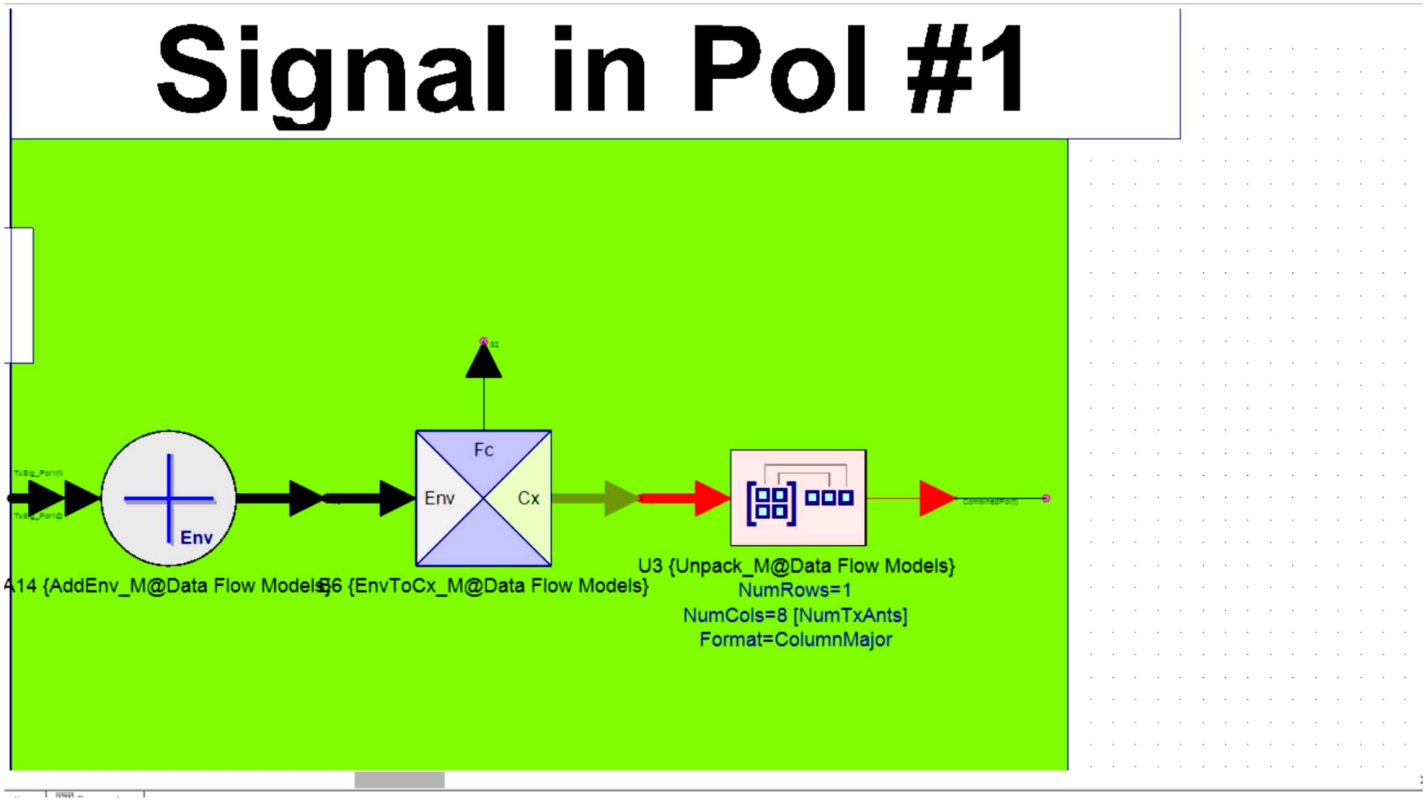


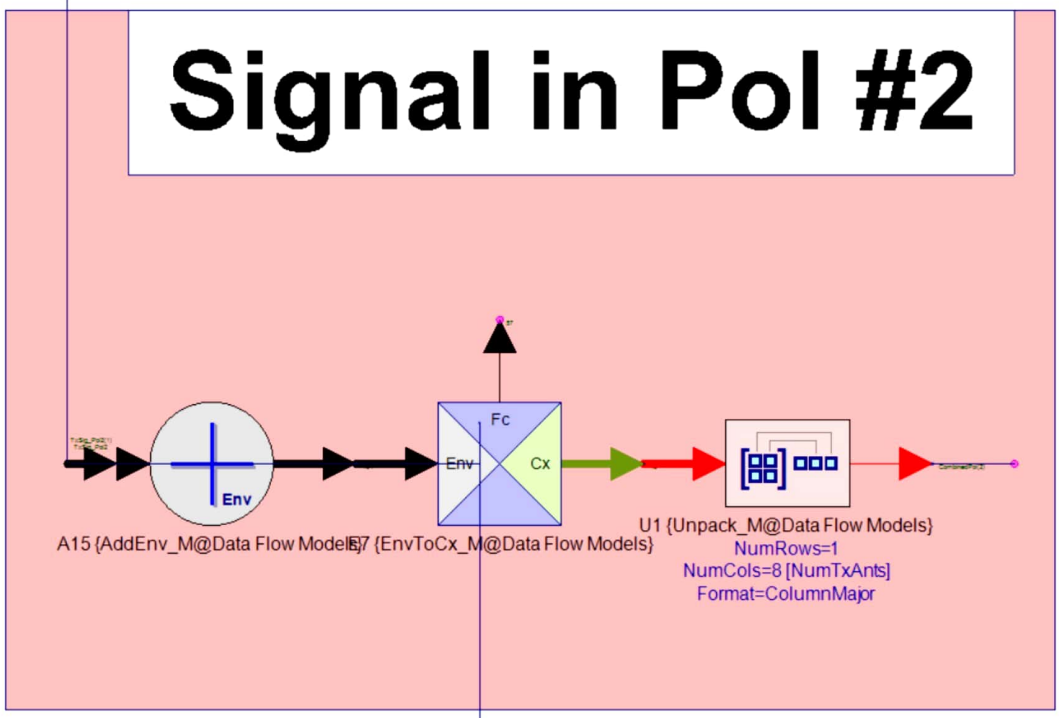
RF for SSB associated with pol #1



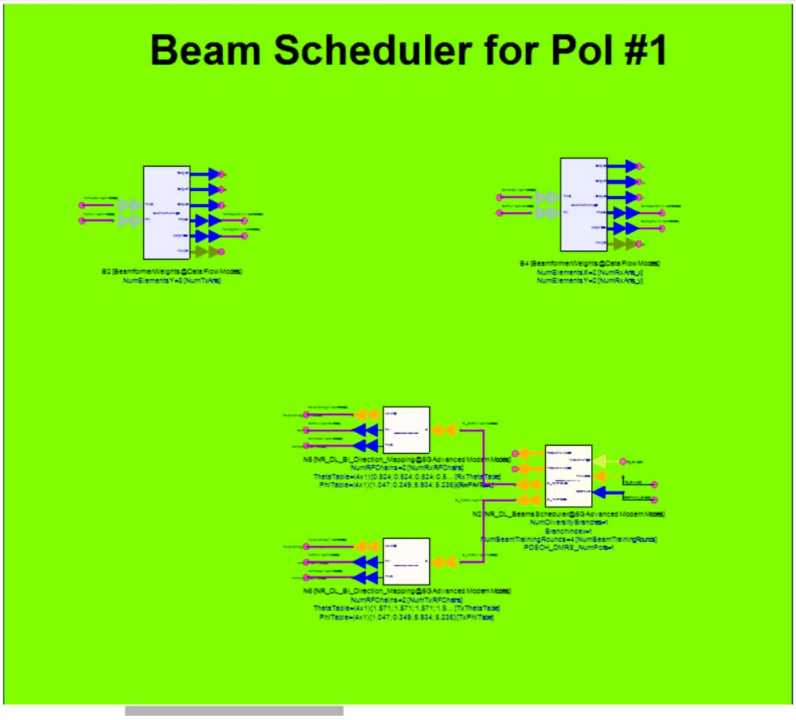


RF for SSB associated with pol #2

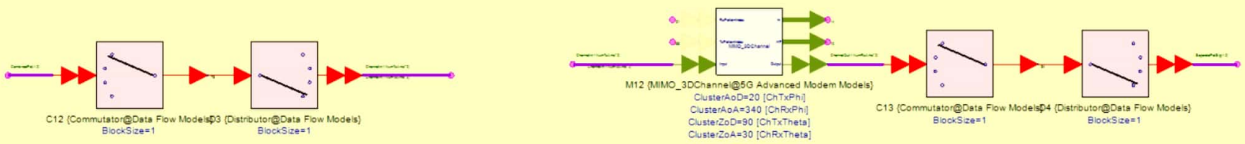




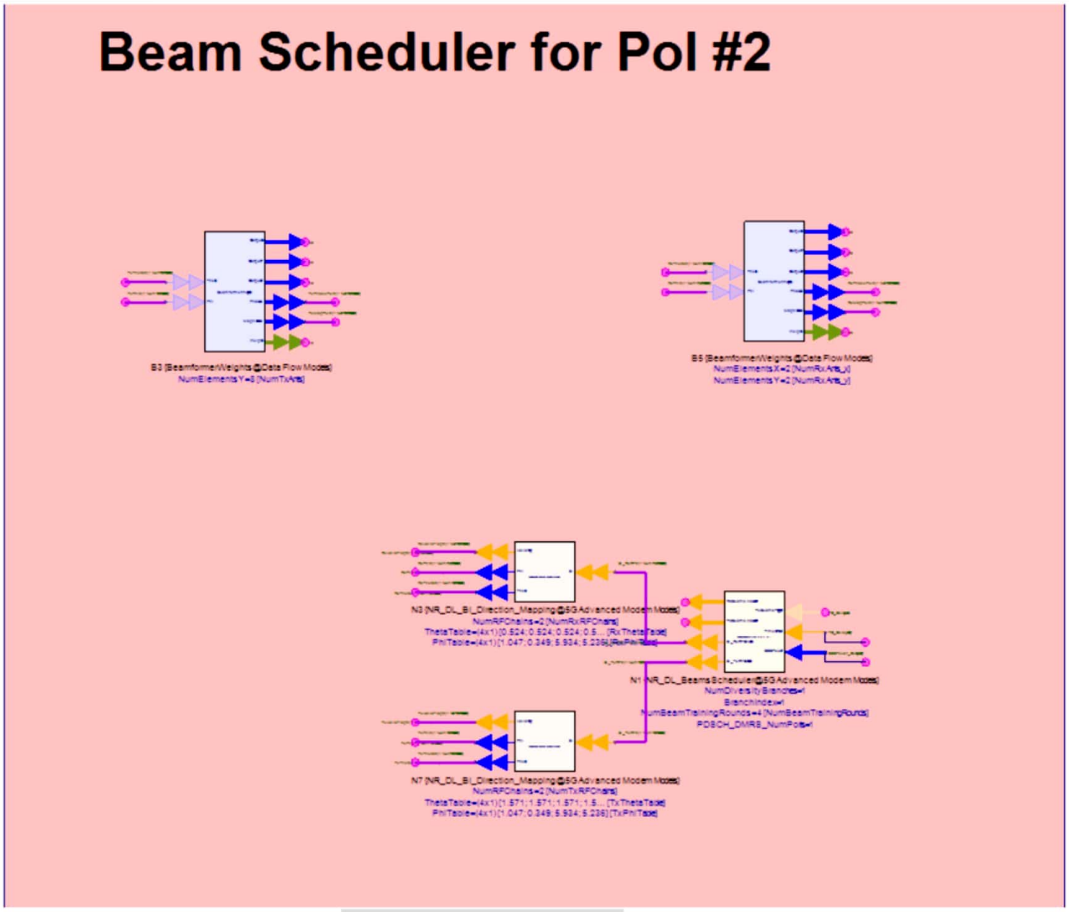
Beam Scheduler for Pol #1



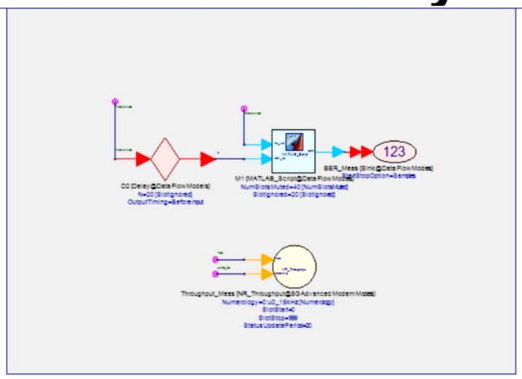
Dual-polarized 3D Channel

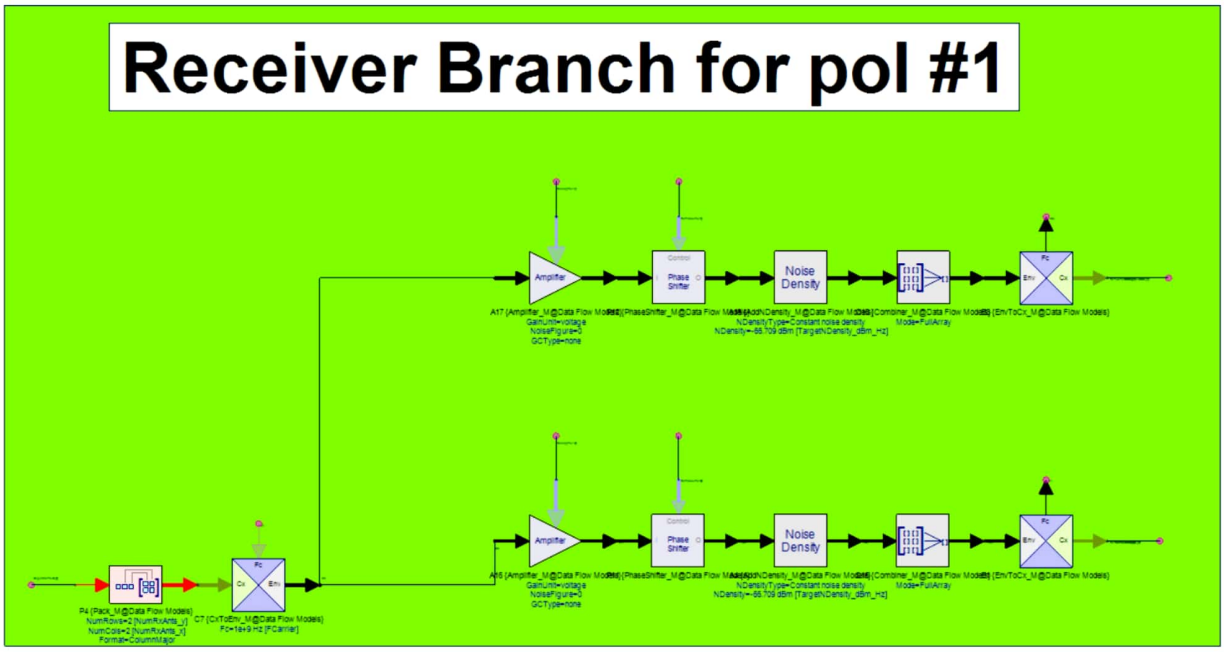


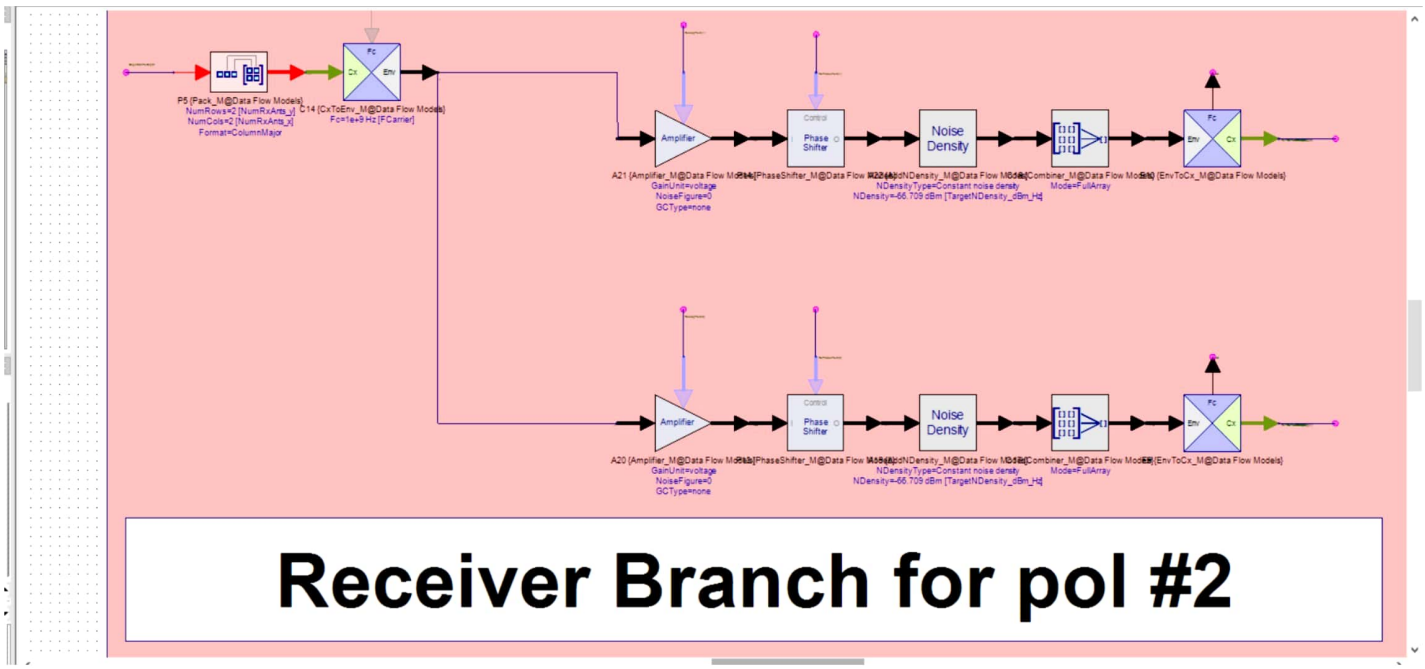
Beam Scheduler for Pol #2

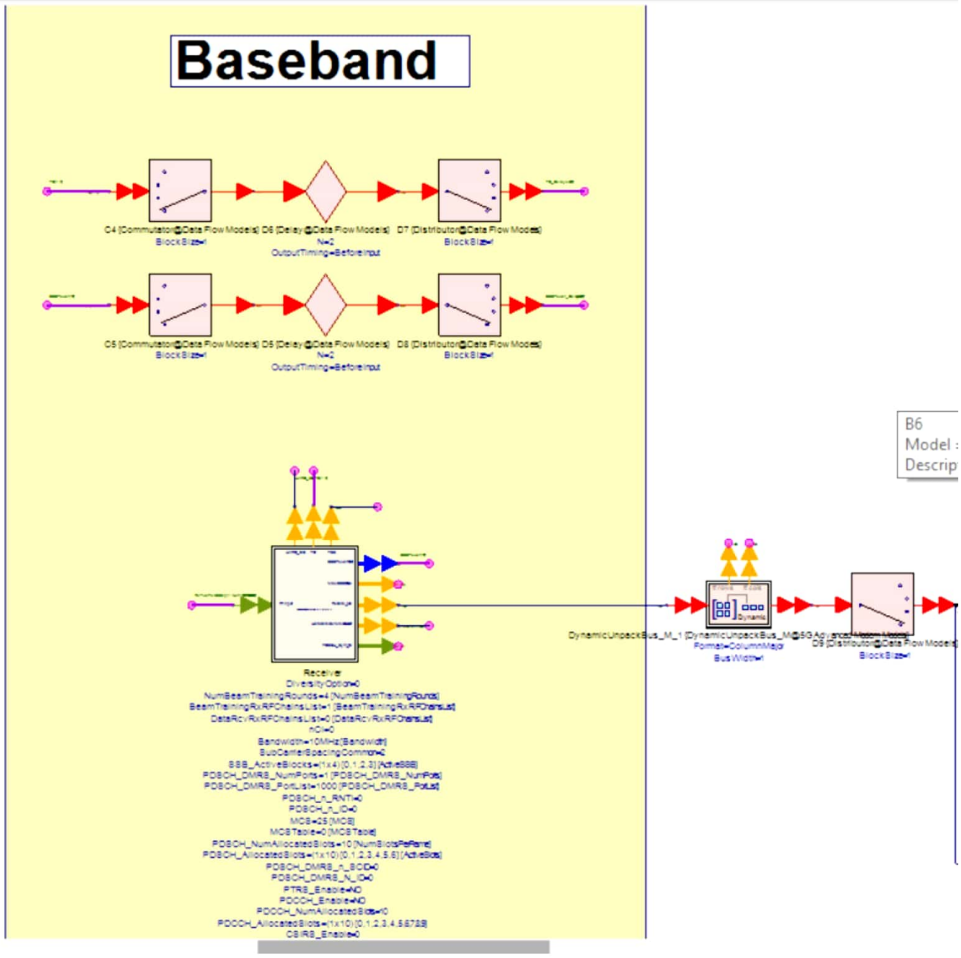


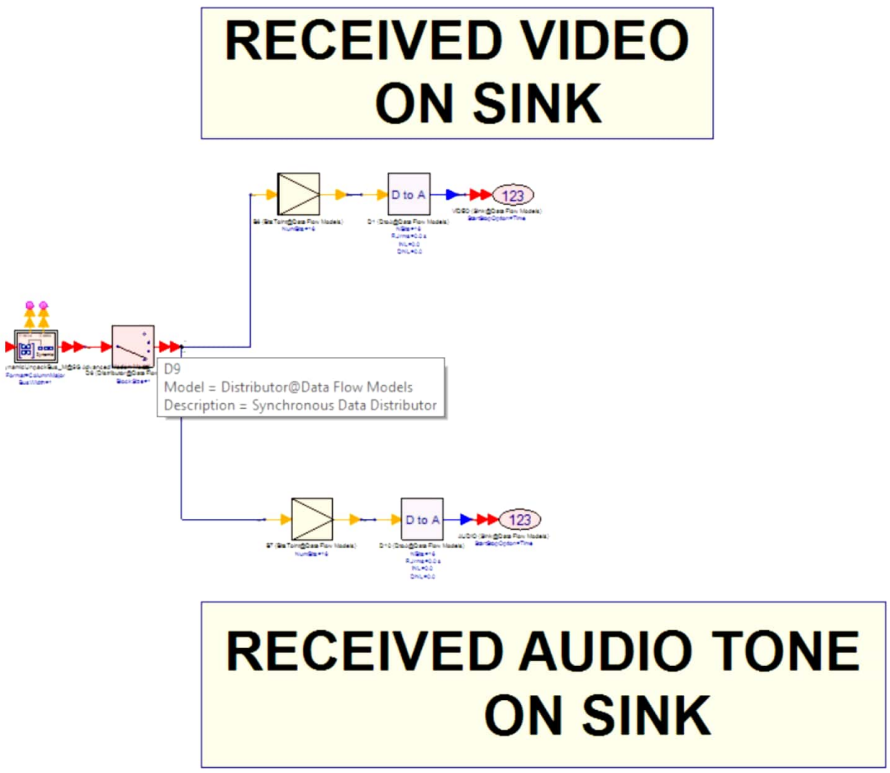
Performance Analysis







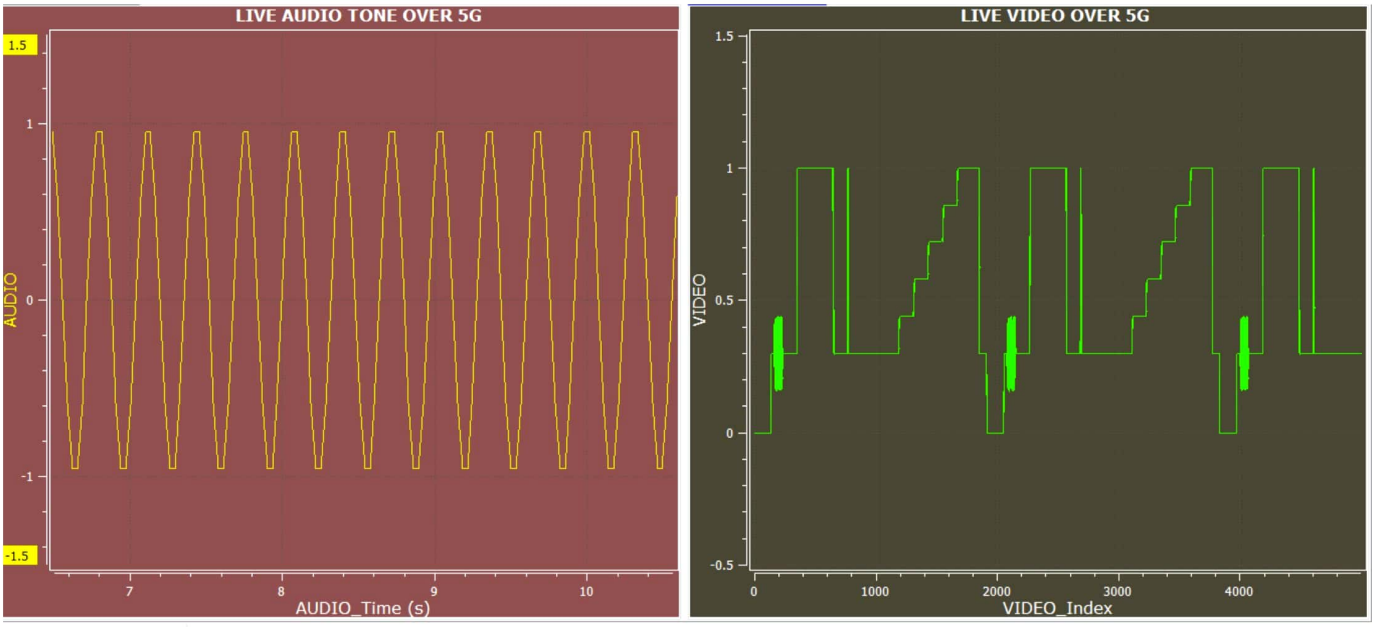




FINAL RESULT:

- We have designed the circuit for **audio video** live streaming over 5G for telesurgery .
- We have used the systemvue software for designing the circuit and simulation process.
- In previous progress we have completed the video part in this circuit, now we have introduced the commutator and distributor for making audio part and multiplexing the audio sink and video sink.
- The final outcome will be graph of showing the outcomes of live audio tone over 5G and live video tone over 5G . This is the completion of our mini project.

Final outcome:



REFERENCES

1.NGMN Alliance. NGMN 5G white paper. February , 2015.

2. ITU-T Rec. Y.3101. Requirements of the IMT-2020 network. January, 2018.

3. 3rd Generation Partnership Project. Study on scenarios and requirements for next generation access technologies. 3GPP TR 38.913, v.14.3.0

4. D. Soldani, et al. 5G mobile systems for healthcare. Vehicular Technology Conference (VTC Spring), Sydney, June 4– 7, 2017.

5. J. Marescaux, J. Leroy, F. Rubino, M. Smith, M. Vix, M. Simone, D. Mutter. Transcontinental robot-assisted remote telesurgery: Feasibility and potential application. Advances in Surgical Technique, 235(4):487–492, 2002.

6. S. E. Butner, M. Ghodoussi. Transforming a surgical robot for human telesurgery. IEEE Transactions on Robotics and Automation, 19(5):818–824, 2003.

THANK YOU