

# A CO-ORDINATED INTERFERENCE CANCELLATION METHOD FOR MIMO FOR SELF-INTERFERENCE MITIGATION

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DOI: 10.47750/pnr.2022.13.S01.64

## Abstract

In 5G/6G mobile communication systems, MIMO or MASSIVE MIMO is the most promising evolving technology for implementation in recent times. Due to this scenario, it is bound to lead drastic interference circumstance, the most common Interference being Self Interference. In 3G/4G base stations, this situation may also arise in the existing mobile communication networks. Our Algorithm will address this severe Interference issue, thereby improving the QOS of the overall system. Each and Every step in our algorithm is being tested and integrated in a single flow, which is supported by Matlab simulation results and hardware implementation using GNU radio with SRS LTE emulation.

**Keywords:** MIMO or MASSIVE MIMO, QOS, GNU radio.

## I. INTRODUCTION

With the increasing population of wireless devices, there is a enormous amount of traffic load on the telecommunication network systems . Many MIMO transmitters communicates at a same or similar frequency resulting in a special type of interference , namely Self Interference . Self-Interference, to the receiver is simply a particular type of noise which degrades the received signal to noise ratio (SNR). In general, the transmitter signal is about 100 db stronger than the reference sensitivity level of the receiver .

Self-Interference cancellation is a signal processing technique that enables a radio transceiver to simultaneously transmit and receive on a single channel, a pair of partially –overlapping channels, or any pair of channels in the same frequency band. Thus, it is very much necessary for the telecommunication network to employ a Self efficient & self sufficient interference mitigation algorithm technique. In our Algorithm, we are encoding the digital signal with WALSH-HADAMARD Code at transmitter of Massive MIMO and decode with WALSH-HADAMARD Code at receiver of Massive MIMO to reduce the Self-Interference .WALSH Code is a algorithm that generates statistically unique sets of numbers for use in encryption and cellular communications known as “pseudo random noise codes “.These codes are used in Direct Sequence Spread Spectrum (DSSS) systems such as QUALCOMM’S CDMA.

They are also used in Frequency hopping spread spectrum (FHSS) systems to select the target frequency for the next hop. We will understand every step flow in the further sections.

## II RELATED WORKS:

There are many works which have been employed in mitigating interference in many different operating domains.

Coverage & Capacity Self Optimization:

In this paper, the author has organized a flow algorithm which detects cell with distorted signal to noise ratio and calculates the deficient key parameter indicators such as Normalized Cell Average throughput, Spectral efficiency, Average Energy per bit, Resource block occupancy and estimates the improved values for these parameters in order to enhance the signal to noise ratio of target cell.

Handover scheme with Enode- preselection & parameter Self optimization:

In this paper, the author has evolved Enode B pre selection method, which high traffic loads are routed to Macro e NB ‘S and low traffic loads are routed to Pico e NB’S. This paper also analyses through simulation results of mobility data, ping-pong ratio, handover failure ratio, speed of UE’ s.

**Multi Cell Load Balancing:-**

In this paper , the author has represented a novel approach of autonomic load balancing using machine learning algorithm where the traffic load parameters of e NB ‘s & the UE ‘ s are used for developing a priority map for balancing the load appropriately in the coverage cells .

**Adaptive Root Cause Analysis:-**

In this paper, the author is explaining the implementation of automated root cause analysis, the solution works on Bayesian network theory to perform it. Since, this approach is based on probabilistic Bayesian classifier, it can also give a good estimate with incomplete data and compute distinct probability permutations.

**III SYSTEM MODEL:**

Depiction through figures for Self-Interference mitigation:

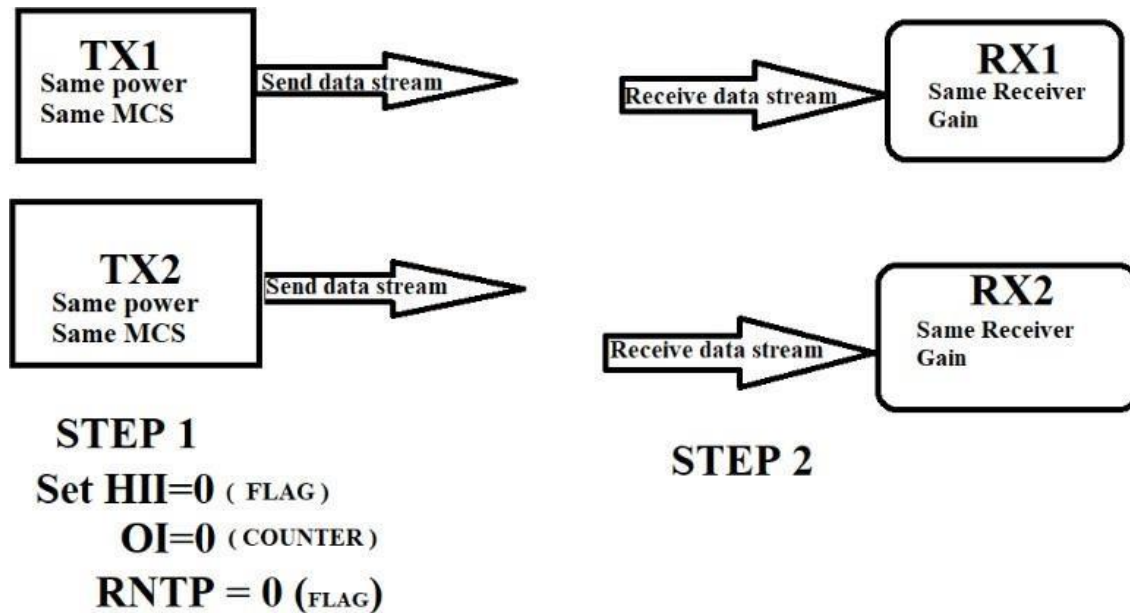


Fig 1.

Send 2 streams from 2 TX antennas at the same power and at same MCS schemes. Set HII=0, OI =0 (counter), RNTP = 0

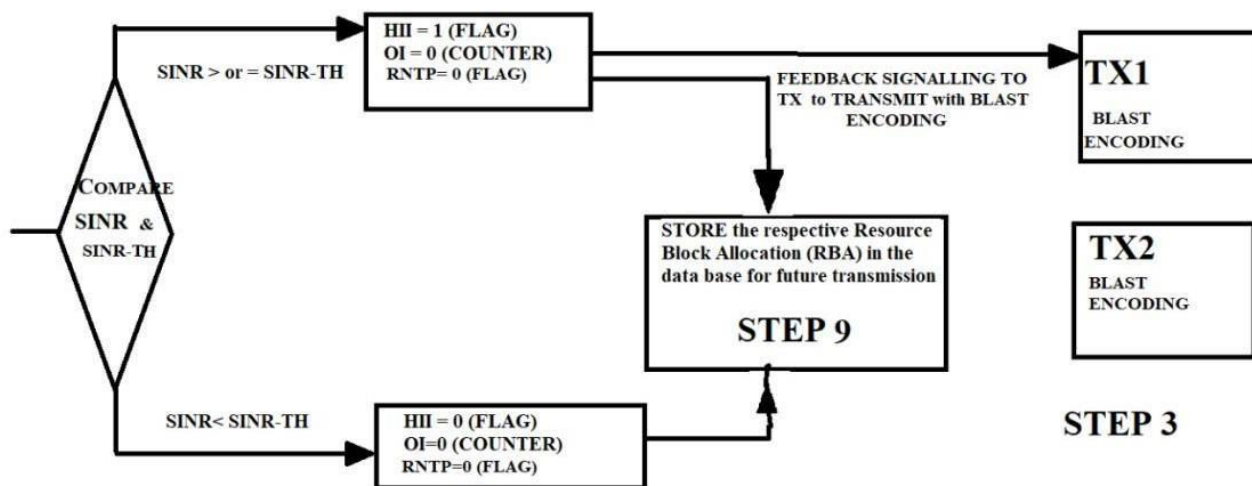
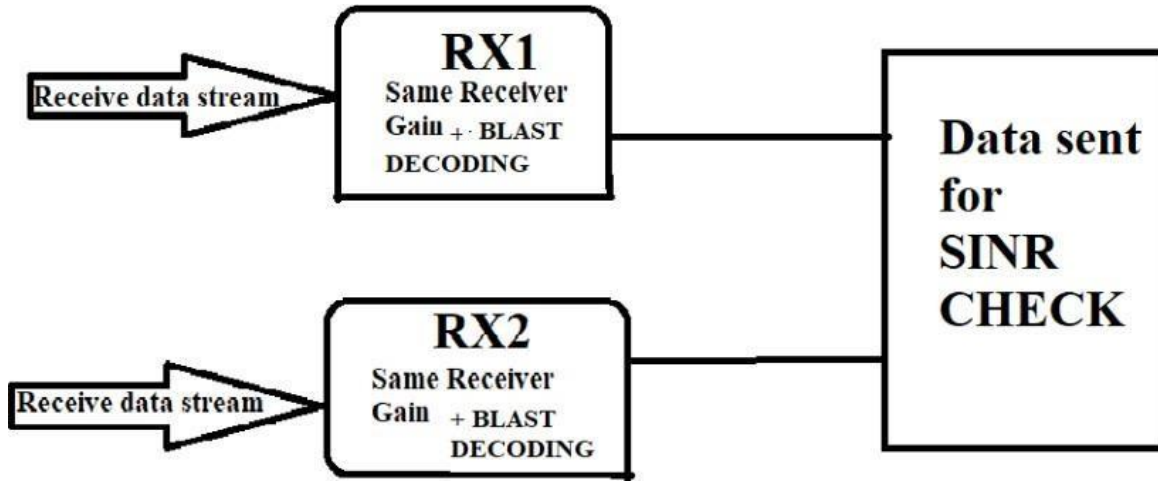


Fig 2.

Receive it at same gain at 2 receiver channels. If  $SINR \geq SINR\_threshold$  Then set  $HII = 1$ ,  $RNTP = 0$ ,  $OI=0$  (COUNTER).  
Else

HII=0, RNTP=0, OI=0.

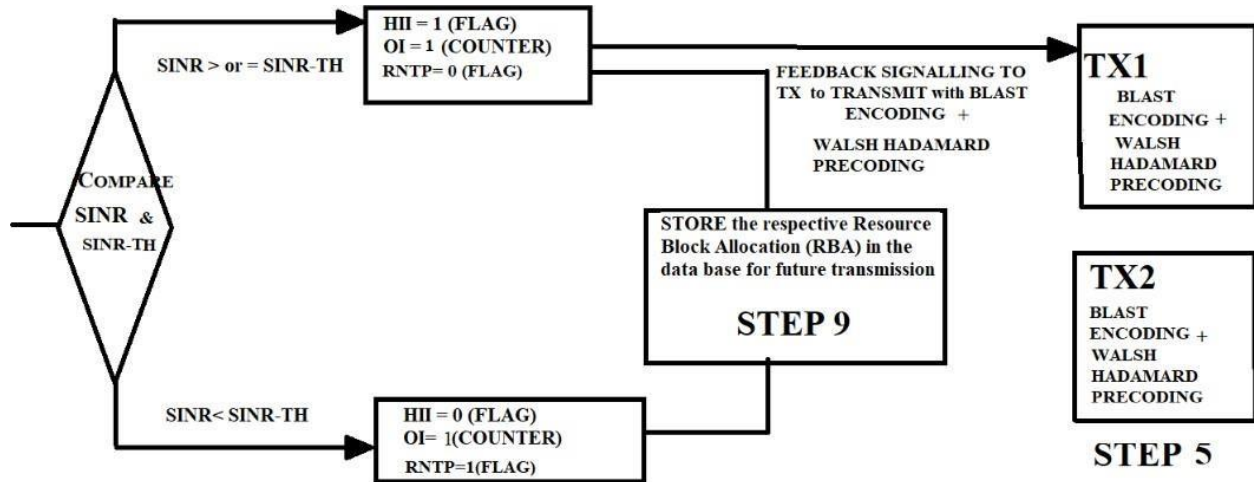
Store the respective RBA in data base for future transmission of pattern of RBA (Resource Block Area).



### STEP 4

Fig 3-Step

Send feedback / signaling to TX to transmit with BLAST encoding.



### STEP 4 CONTD

Fig 4-Step

Repeat Step 4.1 with BLAST DECODING If  $SINR \geq SINR\_threshold$  Then set HII=1, OI= 1(counter), RNTP =0.

ELSE

HII=0, RNTP=0, OI=1.

Store the respective RBA in data base for future transmission of pattern of RBA (Resource Block Area).

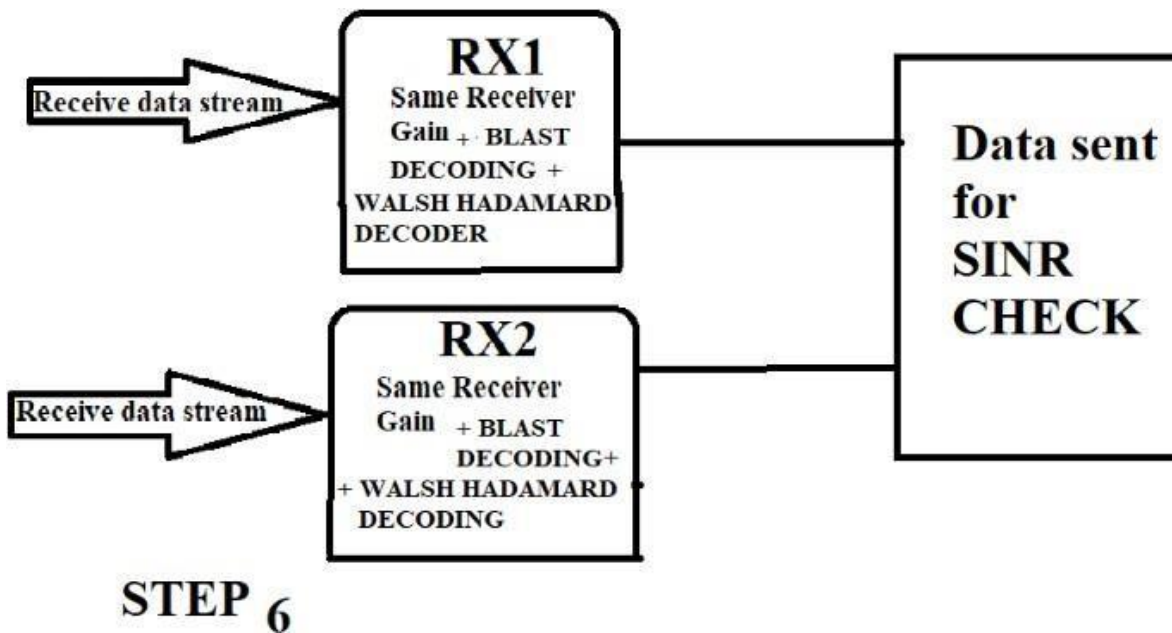


Fig 5-Step

Send feedback signaling to TX to transmit with WALSH HADAMARD + BLAST ENCODING

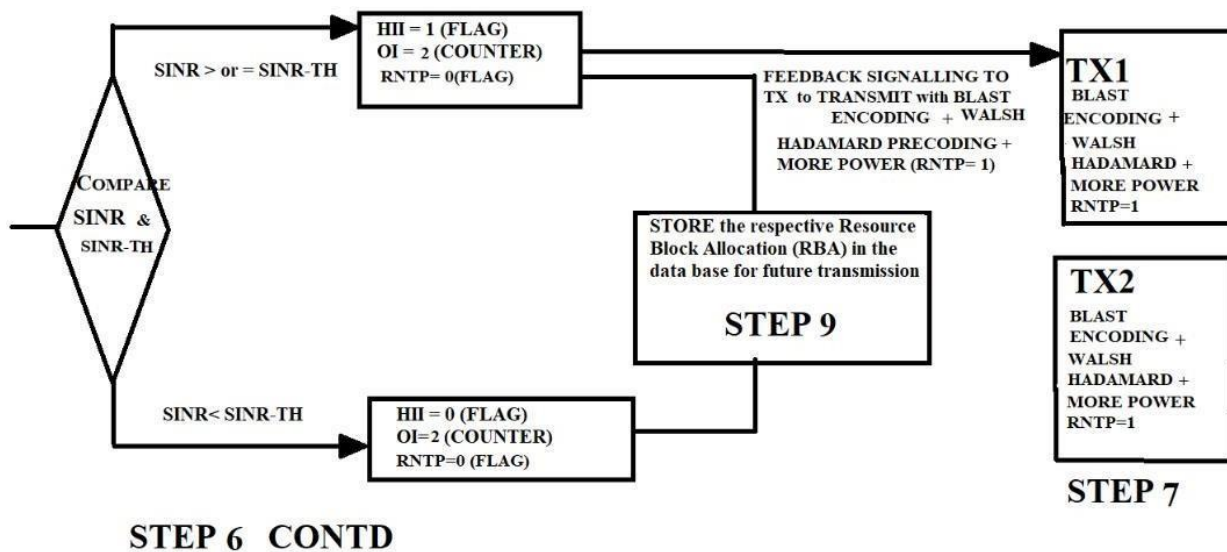


Fig 6-Step

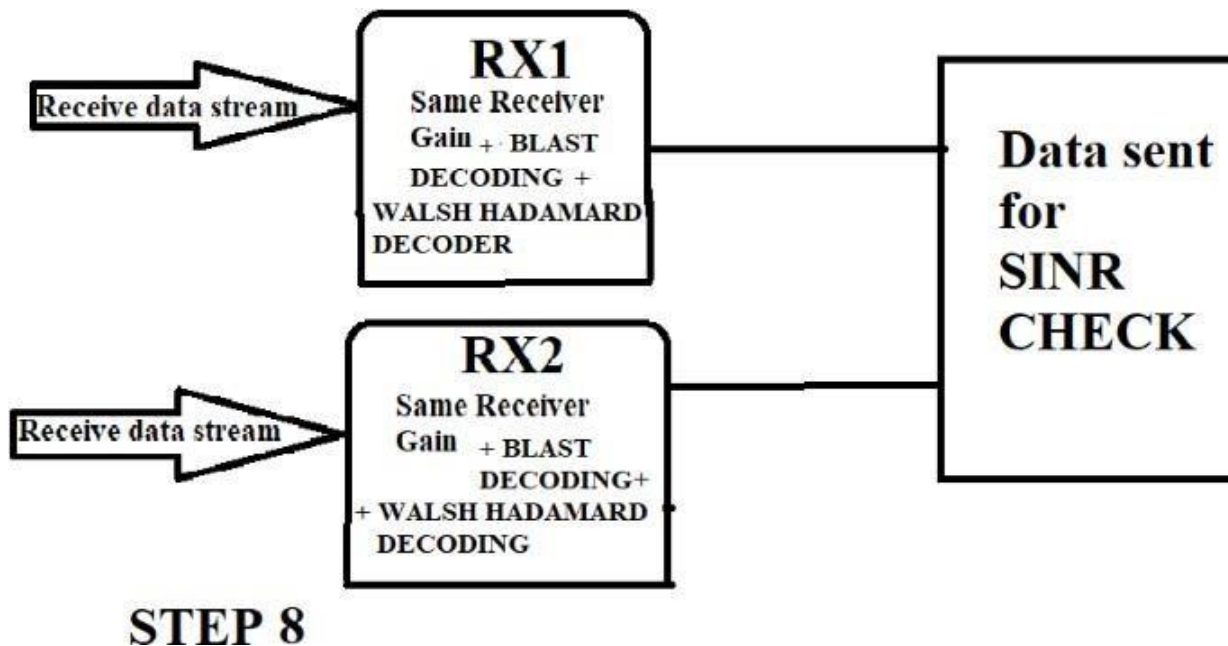
REPEAT Step4.1 with WALSHHADAMARD DECODER + BLAST DECODER

If  $SINR \geq SINR\_threshold$

Then set  $HII=1, OI=2(\text{counter}), RNTP = 0$ . ELSE

$HII=0, RNTP=0, OI=2$ .

Store the respective RBA in data base for future transmission of pattern of RBA (Resource Block Area).



FigB.7-Step

SEND feedback signaling to TX to transmit with more power + BLAST ENCODING + WALSH HADAMARD ENCODING. RNTP =1.

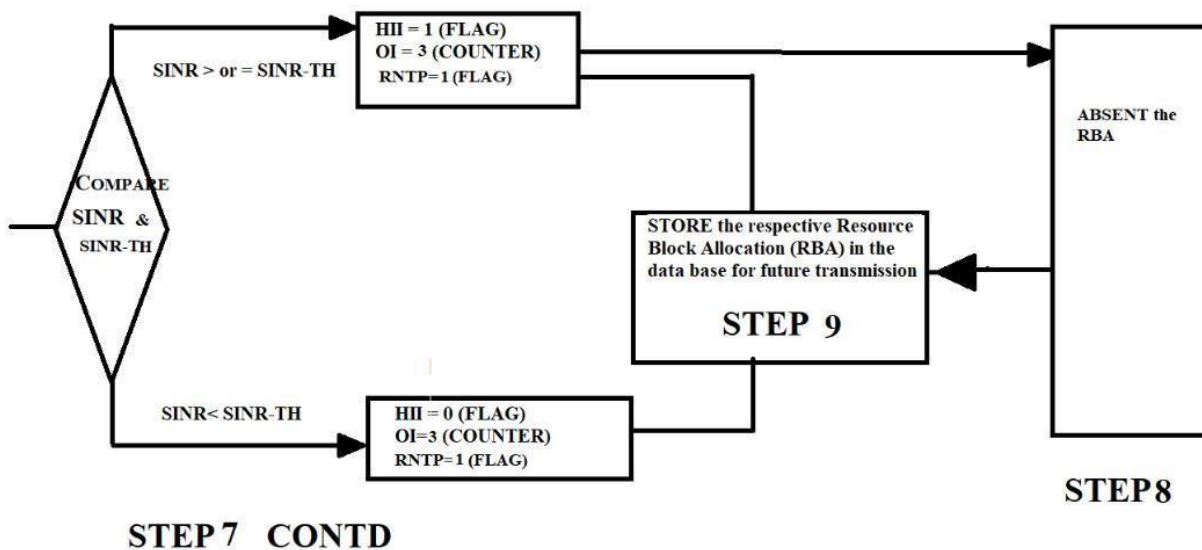


Fig 8-Step

Repeat Step 4.1 with Walsh hadamard decoding + blast decoding. If  $SINR \geq SINR\_threshold$  Then set  $RNTP = 1, HII = 1, OI = 3$ . ( counter ) Else  $HII = 0, RNTP = 0, OI = 3$ . Store the respective RBA in data base for future transmission of pattern of RBA (Resource Block Area). ABSENT the RBA Store the respective RBA in data base for future transmission of pattern of RBA (Resource Block Area).

#### IV Algorithm for SELF INTERFERENCE:- Step-4.1:

INITIAL STATE 0 i.e. S0

Receive the stream with same receiver gain at two receiver channels and perform SINR check.

If  $SINR \geq SINR\_threshold$

Then set  $HII=1$  and  $OI=0$  (counter) Else  $HII=0$  and  $OI=0$

Store the respective RBA in data base for future transmission of pattern of RBA (Resource Block Area).

Step-4.2:

Send feedback / signaling to TX to transmit with BLAST encoding.

Check the SINR is increasing, then proceed to next step in Algorithm otherwise start with next RBA

Step-4.3:

Repeat step 4.2 with BLAST decoding . If  $SINR \geq SINR\_threshold$

Then set  $HII=1$  and  $OI=1$  ( counter) Else  $HII=0$  and  $OI=1$

Store the respective RBA in data base for future transmission of pattern of RBA (Resource Block Area).

Step-4.4:

Send feedback / signaling to Tx to transmit with BLAST encoding with two different MCS schemes AT 2 TX antennas.

Check the SINR is increasing, then proceed to next step in Algorithm otherwise start with next RBA

Step-4.5:

Repeat step 4.2 with BLAST decoding with 2 different MCS decoding at 2 different RX antennas.

If  $SINR \geq SINR\_threshold$

Then set  $HII=1$  and  $OI=2$  (counter) Else  $HII=0$  and  $OI=2$

Store the respective RBA in data base for future transmission of pattern of RBA (Resource Block Area).

Step-4.6:

Send feedback / signaling to Tx to transmit with BLAST encoding with two different MCS schemes AT 2 TX antennas.

Check the SINR is increasing, then proceed to next step in Algorithm otherwise start with next RBA

Step-4.7:

At RX antennas, BLAST DECODING + 2 different MCS DECODING +Duplex Filter.

If  $SINR \geq SINR\_threshold$

Then set  $HII=1$  and  $OI=3$  (counter) . Else  $HII=0$  and  $OI=3$

Store the respective RBA in data base for future transmission of pattern of RBA (Resource Block Area).

Step-4.8:

. Send signaling / feedback to TX to encode the data with BLAST + two different MCS schemes + KASAMI ENCODING at precoder .

10. Repeat step 2 with BLAST decoding + two different types mcs decoding + KASAMI DECODER +DUPLEX FILTER

If  $SINR \geq SINR\_threshold$

Then set  $HII=1$  and  $OI=4$  (Counter) Else  $HII=0$  and  $OI=4$ .

Store the respective RBA in data base for future transmission of pattern of RBA (Resource Block Area).

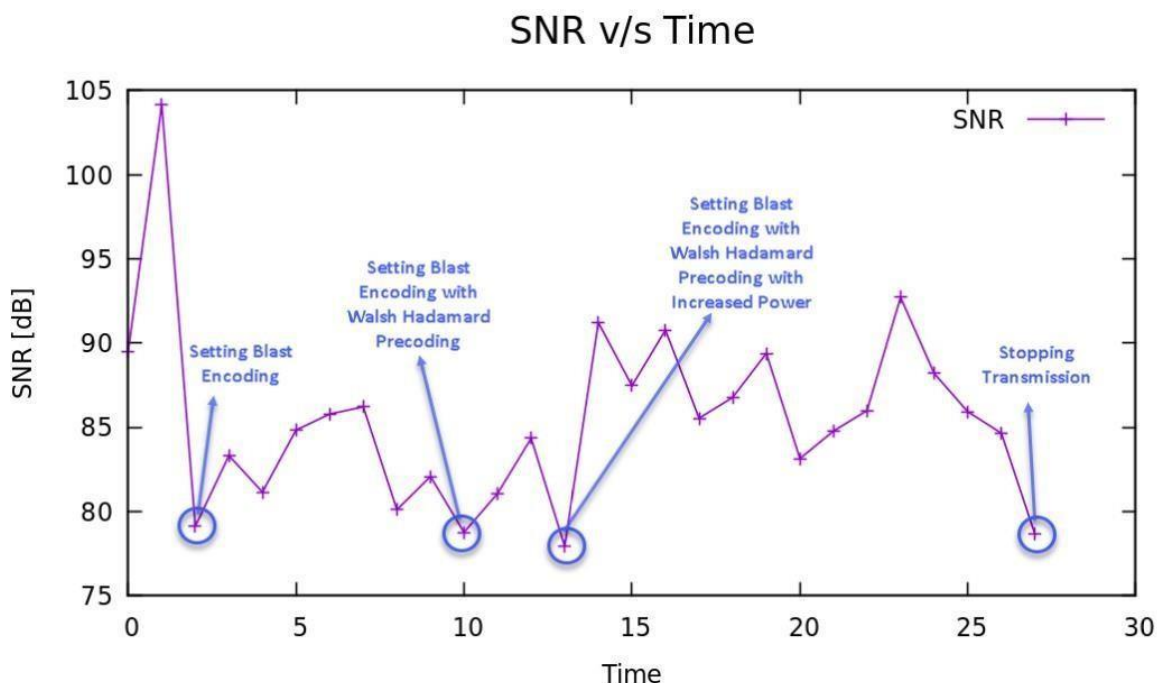
Step-4.9:

Absent the Resource Block Allocation. (RBA).

Step-4.10:

Store the respective RBA in data base for future transmission of pattern of RBA (Resource Block Area)

## V Results with Conclusion:



The Scenario is for 2\*2 MIMO Transmitter and Receiver for 2 port receiver wherein we are continuously increasing the Self-Interference.

Here we found that even we are linearly increasing the Self-Interference along with time there is increase in SNR once we apply BLAST Coding, Walsh Hadamard precoding and RNTTP increase and finally when SNR reaches non bearable extend we will stop the data from sending through RBA(Resource Block Allocation).

We are maintaining the Pattern of RBA, antenna Configuration and power levels applied as records which can used to determine and control the Self-Interference in future when similar conditions happens.

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