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Dynamic Cooperative Multi-Cell Selection using Time Difference of Arrival in LTE network

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***Abstract*—In recent (4G) and next generation (5G) of wireless cellular networks it has been observed since 2020 that the applications are notably different from earlier days. The important areas which focus on improving the 5G networks are flexibility, capabilities, and efficiency. There is a requirement that support for various users, services, and applications. To accomplish the need of next generation wireless networks, the densification and multicell cooperation are the most important approaches. In the dense deployment cellular network, we need to study in-depth the components such as density of macrocells (eNBs), interference issue, transmission power and mode of eNBs such as active or idle. In addition to these issues, there is a need to address mobility management for Co-operative Multipoint (CoMP) operation in the heterogeneous networks. In dense network the User Equipments (UEs) may face problem of signal quality due to the limited resources at backhaul. Even though the users are stationary they may need to perform handover to another cell due to less signal strength received from the current access point. In these kinds of situations, the efficient way of performing handover becomes the soft handover or cooperative handover. In cooperative handover the UE is served by more than one base station. In dense network, UE faces the interference issue from multiple cells, which need to handle efficiently using cooperative mechanism. Hence in this paper we proposed the Dynamic Cell Selection mechanism to address the above-mentioned issues. To search nearby cells, we used the Time Difference of Arrival (TDOA) mechanism for computing the distance between source and receiver. Our proposed mechanism is "Dynamic Cooperative Multi-Cell Selection using Time Difference of Arrival in LTE network".**

Keywords — Cellular networks, Coordinated Multipoint (CoMP), Time Difference of Arrival (TDOA), interference, throughput, 4G, LTE.

I. INTRODUCTION

The existing wireless cellular networks have come across various challenges because of the huge increase in mobile data traffic, demand for larger data rates, sufficient user coverage, minimizing signaling overhead and low latency. In accordance to overcome above mentioned challenges. Upcoming cellular networks will be required to adopt a multi-cellular cooperative design architecture [1]. In multi-cellular cooperative architecture, a user equipment (UE) estimates the channel state information (CSI) which is a feedback, provided to the scheduler of base station (BS) for performing adaptive resource management. This mechanism increases the signaling overhead as well as feedback latency of the cooperative networks. Hence in the coordinated multi-point (CoMP) operation the latency and signaling overhead are important issues [1].

Long Term Evolution (LTE) is the latest mobile standards (4G) deployed over the world. LTE is compatible to the earlier infrastructure, supporting increasing data rate, due to continuous increasing demand of societal connectivity. LTE standard supports data download rate up to 1Gbps to non-mobile devices, which is tenfold faster as compare to most of Ethernet networks speed. LTE offer long term benefits to a statistical multiplexing technique called Orthogonal Frequency Division Multiple Access (OFDMA). It provides multiple access connectivity through time division and frequency division for assigning resources to each user, so that it can provide the highest and efficient throughput. The Transmitter (Tx) as well as Receiver (Rx) channels for LTE signals are used at 800, 900, 1800 and 2600MHz in Europe, and at some other frequencies over the globe. The LTE channels can occupy various bandwidths from 1.4 MHz to 20MHz in the spectrum. LTE channels also have the ability to aggregate together and reach even greater bandwidths [5][8].

In the dense deployment of femtocells network, the UEs may face problem of signal quality due to the scarce resources shared by multiple users. Even though the users are stationary they may need to perform handover to another cell due to less signal strength received from the current access point. In these situations, the efficient way of performing handover becomes the soft handover or cooperative handover. In cooperative handover the UE is served by more than one base station in cooperative manner to reduce the interference. Hence, we use the dynamic cell selection method satisfying the threshold value of signal which results in increased user throughput. To search nearby cells, we used the Time Difference of Arrival (TDOA) mechanism for computing the distance between source and receiver. The TDOA helps in reducing the delay and improve the throughput of the user. We considered handover between Macrocell-to-Macrocell for a user. To study and improve the performance of cooperative cell selection mechanism, we use the single user multicell scenario. Since our objective is to do the seamless handover of a user in order to improve the user throughput, and reduce delay, we proposed the mechanism "Dynamic Cooperative Multi-Cell Selection using Time Difference of Arrival in LTE network".

II. LITERATURE REVIEW

In the paper [1] authors examined the protocols for cooperative communications of control plane. They designed architecture for coordination and improved the multi-cell performance of the cooperative networks. The authors observed the performance by implementing CoMP coordination architecture for various homogeneous as well as heterogeneous scenarios. They mentioned in their result that coordination mechanism can minimize the overhead of signals and the latency of feedback[1]. The authors of [2] propose approximate message passing algorithm for sparse device activity detection in cellular communications using

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nonorthogonal signatures. They compared cooperative multiple-input multiple-output (MIMO) architectures with massive (MIMO), overcoming intercell interference. Authors consider architecture of massive MIMO where, every BS detects the users by its own cell and noise is considered as inter-cell interference. The user detection results are forwarded as log-likelihood ratio (LLR) to a central unit to make final decision. Authors in [3] proposed multi-cellular cooperative architecture in which the UE estimates the channel state information (CSI), which is considered as a feed back for making adaptive resource management to the scheduler of BS. This mechanism leads in increasing signalling overhead plus latency in the cooperative networks. Hence authors identified challenges of coordinated multi-point (CoMP) operation as the overhead and latency. They suggested mmWave communication mechanism to overcome the bandwidth requirement for ultra-dense heterogeneous networks (UDHetNets) to satisfy users demand [3]. The paper [4] focus on the study of cooperative beamforming schemes. They considered full-dimensional (FD), multi-user, multi-cellular, massive MIMO networks. The base stations (BSs) work together in a network to point their beams towards the user equipment. This beamforming minimized the inter-cell interference. Every user (UE) is allocated by a beam from one BS using user association. Authors propose method for optimizing the user association factors (UAFs) and the beamforming vectors in order to maximize the network capacity. To optimize the UAFs, authors proposed belief propagation (BP) algorithm for parallel UAFs at UE level. In the result author mentioned that cooperative beamforming outperforms than the state-of-the work.

III. TIME DIFFERENCE OF ARRIVAL (TDOA)

In Time Difference of Arrival method, a position is identified by measuring the travel times difference between the source and receiver sensor of the same signal. Information regarding time to travel between receiver sensor and the source sensor is used for calculating the distance between them in Time of Arrival (TOA) method. The time-stamped is use for transmitted signal and accurate TOA is computed at receiver. For the signal to travel, required travel time is considered as direct measure for the travelled distance. At this time the sensors at source and receiver need to synchronize in order to overcome errors such as errors in circuit delay , delay in hardware or offsets of clock. To avoid this type of synchronization, roundtrip of TOA is used. Thus, the distance parameter is calculated as TOA multiplied by the speed of light as follows (1).

$$D = Tm\ (tr - t) * V \tag{1}$$

Where D is the distance in the receiver sensor and source sensor. At receiver (t_r) and at source time t, the Tm is difference in the arrival time. The variable V represents the speed of light.

The three-dimension Pythagoras theorem is used to calculate the distance between location of receiver at points (x_r, y_r, z_r) and location at source (x, y, z) as follows (2).

$$V * (tr - t) = sqrt(xr - x\ )^2 + sqrt(yr - y\ )^2 + sqrt(zr - z\ )^2 \tag{2}$$

We can use two-dimension equation as given by (3).

$$V * (tr - t) = sqrt(xr - x\ )^2 + sqrt(yr - y\ )^2 \tag{3}$$

The multiple receivers are located at different distances at known locations. These multiple receivers receive the same signal at different times. Then the TOA measurement represents a circle or spheres such that receiver is at its center while source is over circumference of the circle in a two-dimensional space. Then we determine a different point of intersection of the circles using the multilateration mechanism as shown in Fig. 1. The source localization using TOA can be formulated as (4). The intersection point of location is the location of the source as shown in Fig. 1.

$$Mvr = Nfspx + Zmnv \tag{4}$$

Where *Mvr* is the Measurement vector at receiver. The parameter *Nfspx* represents Nonlinear function for the source sensor at location x and *Zmnv* is noise vector for zero mean.

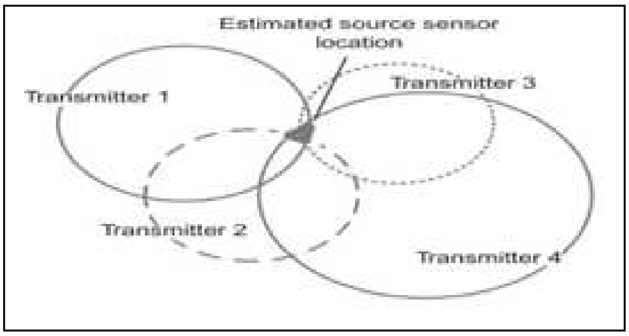

Fig. 1. TOA positioning system using multilateration

In the TDOA mechanism the source sensor is considered at known location and emits multiple reference signals so the measurements are done at receiver by receiving the value at sensor R. The job of synchronizer is to make sure that sources of reference signal are synchronized as shown in Fig. 2.

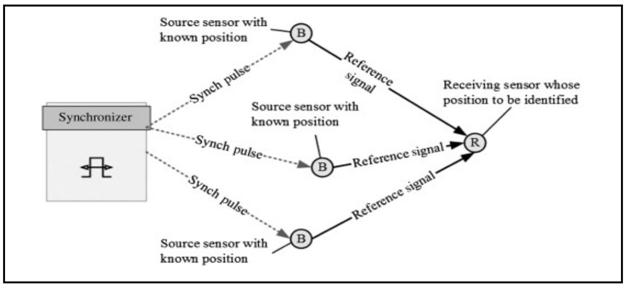

Fig.2. Time difference of arrival scheme.

Following Fig. 3 shows TDOA broadcast scheme. In TDOA mechanism, reference signals are broadcasted by a sensor R. The broadcasted signals are received by different sensors at receiver with a delay τ_r, which depends on the distance between every receiver and the source. The direct computation of delay τ_r is not possible. The TOA estimation is performed at receiver and then TDOA is computed[10].

Analysis of correlation is used to estimate a time delay $\tau_{rA} - \tau_{rB}$ depending the difference between reference signal path and the receiver path r_A and r_B respectively. The cross-correlation is the method used to estimate time difference, which is more simple method. In cross-correlation, the arriving signals at the receiver sensors is cross-correlated[11]. The cross-correlation of received signals $r_A(t)$ from receiver r_A and $r_B(t)$, from receiver r_B, is given by (5) below:

Where T represents the interval for observation. In case of no errors, the peak of τ *is* considered as the value of TDOA. The time differences between arrival of signal times of the both receivers gives points set. These sets are interpreted as a hyperbola geometrically. We can compute more than one hyperbolic function that intersects at a unique point. This point of intersection is nothing but the estimated location of the source sensor.

$$R_{A,B}(\tau) = \frac{1}{T}\int_0^T r_A(t) r_B(t+\tau)dt \tag{5}$$

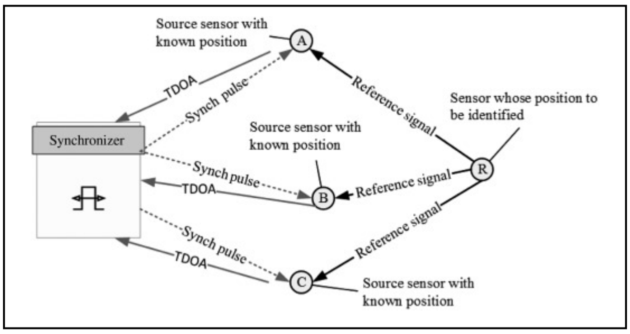

Fig. 3. Time difference of arrival broadcast scheme.

IV. PROPOSED WORK

In the dense deployment of cellular network, the UEs may face problem of signal quality due to the limited resources which are shared by many users. The stationary users may face less signal strength issue, received from the current access point. Hence UE need to perform handover to another cell to continue communication. In these situations, the suitable mechanism can be soft handover or cooperative handover. In cooperative handover the UE is served by more than one base station in cooperative manner in order to reduce the interference. In multiple cell scenario, there is a need to select most efficient cell for communication. To solve this issue, we use the dynamic cell selection method satisfying the threshold value of signal which results in increased user throughput. To study and improve the performance of cooperative cell selection mechanism, we use the single user multicell scenario and proposed the dynamic efficient cell selection handover mechanism. Our proposed method is explained in detailed in next section.

A. Coperative Multi-Cell Selection using Time Difference of Arrival in LTE network

At the cell edge, the long-term channel characteristics favour the serving cell while short term characteristics may favour another cooperating cell. In such situation we suggest the cooperative cell selection method to increase the throughput. In Cooperative multicell selection, group of base stations dynamically cooperates to reduce the interference among them. The purpose of Cooperative Multicell Selection is to improve the backhaul capacity and reduce latency among these cells. Hence the data for User Equipment (UE) is available at one or more cooperative base stations and it is transmitted from one of the cooperating cells (eNodeB) at a time. The transmission decision at cell is based on Channel Quality Indicator (CQI) reports from the User Equipment (UE). The network uses Channel State Information (CSI) received from UE to make cooperative multipoint transmission decision. The transmitting cell named as Transmission Point (TP) may change subframe-by-subframe for best transmission of user data with varying channel conditions. The UE creates multiple reports using CSI process configuration, each of which corresponds to different hypotheses. The CSI process contains resource as CSI Reference Signal (CSI-RS). It also includes a CSI interference Measurement resource (CSI-IM) mechanism and the mechanism for reporting. In case of each CSI process, UE calculates and report the CSI indicator as requested by the network. In our proposed work TDOA location is identified by travel time of the same signal, which is received at multiple locations by sensors. We considered average of signals received through multiple paths at a particular location as a Received Signal Strength (RSS). This RSS parameter represents the received signal power and it is also considered as a function for distance in transmitter and receiver. Due to different in-path interferences, a receiving device gets impacted.

In the scenario we have created five eNodeBs and one UE. All eNodeBs detects the UE in the network by using the Positioning Reference Signal to calculate UE position. The Position of UE is calculated by Time Difference of Arrival Positioning approach. All eNodeBs transmit data to UE which is combining with delays and received power to form a waveform. Transmission of eNodeB consists of Positioning Reference Signal (PRS), Cell-specific Reference Signal (Cell RS), Primary and Secondary Synchronization Signal (PSS and SSS). After receiving waveform, the UE device performs correlation with Positioning Reference Signal to estimate the delay from every eNodeB and delay difference in all eNodeB pairs. The delay differences are used to know the positions of eNodeB and intersect at the position of UE. Position of UE is considered as (0, 0), and eNodeBs are placed at random. UE performs multi-cell search to establish cell identity of each eNodeB. The physical parameters such as duplex modes, cyclic prefix lengths are assumed as known and are equal for each eNodeBs.

If the search cells meet a minimum RSRQ threshold (-20 dB) they are considered as detected cells by UE. Other cells having RSRQ less than threshold are neglected because they do not satisfy the RSRQ requirement to serve the UE. The signal arrival times from each eNodeB are estimated at the UE by correlating a local PRS generated with the cell identity of each eNodeB with the incoming signal. The UE cannot use an absolute arrival time to calculate its position since it has no idea of eNodeB positions. UE only have the knowledge of difference in arrival times, hence the peak correlation for each eNodeB is used as a delay estimate for comparison. After detecting the feasible eNodeBs their measurement parameters are extracted such as RSRQ, RSRP, and RSSI. These parameters are used to select the efficient eNodeBs for camp on and handover operations.

Here we used the dynamic cell search method, which selects the cell for transmission of UE data depending on the ratio of RSRQ/RSRP. Our approach of using the ratio of RSRQ/RSRP, optimizes the dynamic cell selection procedure. We have implemented the state-of-art method RSRQ and RSRP, and compare them with our ratio method (RSRQ/RSRP). The reason for selecting the ratio of quality to the power is to reduce the power and at the same time maintain the good quality of the signal. The cells are considered according to the ratio of RSRQ/RSRP in non-increasing order. Using this order of cells, we achieved optimized cell selection criteria with respective to good quality and less consumption of power parameters. After selecting the suitable cell for handover, the cooperative multipoint selection procedure is used to perform actual transmission for the UE by the eNodeBs. From the detected cells, we choose two most efficient cells, which work for transmission in cooperative manner. Here we use two-point cooperative transmissions in order to improve the computation speed for frequently switching between more transmission points.

The processes are executed depending on the CQI report of the UE calculated using the received SINR. Processes are programmed such that it increases the throughput, while minimizing the bit error rate and avoiding the intercell interference during transmission to the user. In cooperative cell selection procedure, the constraints are put on transmission of the cells. It is assumed that the first selected cell is the cell to which UE is attached initially. Then depending on the signal power among two cells, one of the cells having more power than the other is selected for transmission. To avoid the interference between these cells, the cell which is not transmitting is muted at that instance. The procedure for Dynamic Co-operative Quality to Power Ratio Handover (QPR-HO) is given in Algorithm1 below.

Algorithm1: Dynamic Co-operative QPR-HO

```
//Consider n random eNodeBs eNB1, …, eNBn and a UE at position (0,0).
1.  Each eNodeB finds the position of UE, using PRS (by TDOA).
2.  Establish delay from each eNodeB at UE by receiving waveform.
3.  Measure the RSRP of all n eNodeBs at UE.
4.  Among all detected n eNodeBs (eNB1, ..., eNBn), select good quality (m) cells such that their RSRP > -20dB.
5.  Measure the RSRQ of these m selected eNodeBs.
6.  Find the ratio of RSRQ to RSRP and for each m eNodeB (QPR) as RNBs1, ..., RNBsm.
7.  Sort these m eNodeBs in non-increasing order of QPR into qprlist. //qprlist is a list of eNodeBs in sorted order.
8.  From qprlist choose first two eNodeBs as RNBs1 and RNBs2.
9.  Call Cooperative Multicell Selection (CMS) Mechanism: call CMS (RNBs1, RNBs2).
10. Perform transmission of PDSCH by RNBs1 or RNBs2 subframe-by-subframe using the CQI value of transmission point.
11. If all subframes are transmitted
12.   Plot the transmission point selection for all sub frames.
13.   Calculate throughput of UE.
14. Repeat step 1 after each time interval T.
    //Measurement interval time T sec.
15. End QPR-HO
```

B. *Dynamic Cooperative Multicell Selection (DCMS) Mechanism*

The Channel State Information (CSI) collected from UEs is used to make transmission decision among multiple cells. The UE is configured for CSI process to provide a report. The CSI process includes variables as a reporting mechanism, CSI Reference Signal (CSI-RS) resource and the CSI interference measurement (CSI-IM) resource. The CSI indicators for each CSI process are requested by the network, which are calculated by UE. The CSI indicators include Precoder Matrix Indicator (PMI), Rank Indicator (RI) and Channel Quality Indicator (CQI). In case of two Dynamic Co-operative Multicell Selection, the transmission of PDSCH can be perform from either eNBs1 or eNBs2. If the PDSCH transmission is done by eNBs1, there are two alternatives of transmission for the another eNodeB (eNBs2). The first option is to provide service to other UEs with the help of same resource; hence it interferes with the transmission of PDSCH from eNBs1. The other way is muting transmission in these resources so that they do not interfere with the transmission of PDSCH of eNBs2. We can group these hypothesis options into transmission hypothesis as in table I. Among these hypothesis, PDSCH transmission made to the UE are only consistent with hypothesis 2 or 3.

TABLE I. TRANSMISSION HYPOTHESIS

	eNBs1 Hypothesis	**eNBs2 Hypothesis**
Hypoth 0:	Transmission of PDSCH	Muted
Hypoth 1:	Muted	Transmission of PDSCH
Hypoth 2:	Transmission of PDSCH	Interfering
Hypoth 3:	Interfering	Transmission of PDSCH

There are three resources of CSI-IM and two CSI-RS resources configured at the UE for this transmission hypothesis in order to provide the network by CSI. The CSI processes use CSI-RS as well as CSI-IM resources for each hypothesis to report CSI.

Configuration of resources and CSI processes is handled as below:

1. Resources CSI-RS - Each cooperative cell transmits a unique CSI-RS resource. The UE configuration is based on both resources CSI-RS in order to estimate the channel quality for every transmission cell:

   CSI-RS 0: is a Transmission parameter from eNBs1
   CSI-RS 1: is a Transmission parameter from eNBs2

   The CSI-RS is defined using CSI-RS scrambling identity, configuration, and a period. The total transmit antennas is equal to the number of CSI reference ports. During the simulation, a period of CSI-IM and CSI-RS resources should be same.
2. Resources CSI-IM – Set of Resource Elements (REs) resources are described to measured average power of the UE. Using these parameter measurements, estimation of the interference calculation for CSI is done. when transmission cell is transmitting three different CSI-IM are needed to measure interference:

   CSI-IM 0: is a background noise, measure when both eNBs are muted.
   CSI-IM 1: is a eNB2 interference measurement parameter
   CSI-IM 2: is a eNB1 interference measurement parameter

   Every CSI-IM is described using a configuration and the respective period. For these configurations the periods are the same but these configurations are different than CSI-RS configurations.
3. CSI process- For testing the transmission hypothesis four processes need to configured as shown in table II. These resources CSI-RS as well as CSI-IM are as described above.

TABLE II. CSI PROCESSES

	eNBs1 Hypoth	**eNBs2 Hypoth**	**CSI-RS**	**CSI-IM**
Proc 0:	Transmission of PDSCH	Muted	CSI-RS 0	CSI-IM 0
Proc 1:	Muted	Transmission of PDSCH	CSI-RS 1	CSI-IM 0

Proc 2:	Transmission of PDSCH	Interfering	CSI-RS 0	CSI-IM 1
Proc 3:	Interfering	Transmission of PDSCH	CSI-RS 1	CSI-IM 2

The reporting mode such as resources CSI-RS and CSI-IM are used to defined process. The PMI and RI reporting is not required because CSI and PMI reporting mode and restriction of codebook subset to every process limits selection of PMI and use a single PMI. The network can implements only two hypotheses out of four hypotheses during simulation. The transmission of PDSCH is performed by either eNBs1 or eNBs2 while other transmission cell is interfering. Therefore, for making decision about transmission CSI feedback from only processes 2 and 3 is used.

V. SIMULATION

In simulation we consider multiple cells and single user. The user is provided with services using multipoint selection mechanism. Working of our scenario is based on parameters of UE for the estimation of CSI and reporting of CSI. To represent CSI-RS, CSI-IM and CSI processes we use structure arrays at the UE. In the structure array of UE every element configures processes or a single resource. These structure arrays are created using the CSI-RS and CSI-IM resource configuration. There is one structure array for parameterization of CSI-RS resource. Which is dependent on the parameters and are configured for the appropriate resource utilization according to simulation settings. The other structure array is created for CSI-IM resource parameters. This structure array is dependent on the serving cell parameters. Whereas the parameters CSI-IM are configured for appropriate resource utilization mentioned in the settings of simulation. The CSI-IM resource is configured as a ZP CSI-RS, its corresponding period parameter is set to 'off' hence to measure interference only ZP CSI-RS REs are used. The different structure array is created for the parameterization of CSI process based on the serving cell parameters. There are special parameters for calculating CSI and indexing resources CSI-RS and CSI-IM. In the simulation settings for every process, reporting modes are configured. The CQI report from the UE is selected using the Signal to Interference plus Noise Ratio (SINR) for each CSI process estimation. For each CSI process, vector of SINR is used for parameterization of the CQI selection. Simulation Parameters for our proposed mechanism are given in table III below.

TABLE III. CSI PROCESSES SIMULATION PARAMETERS FOR PROPOSED METHOD

Parameter	**Value**	**Parameter**	**Value**
No. of eNodeB	5	Noc	-98
No. of UEs	1	No. of transmit Antenna	2
Sampling rate	3840000	Doppler Frequency	5
Nfft	256	Model Type	GMEDS
Windowing	0	InitPhase	Random
Cyclic Prefix lengths	14	Frequency Window	1
Channel	Fading channel	Time window	2
Delay profile	EPA	InterpType	Cubic

The complete working of Cooperative Multicell is given in following procedure:

The simulation is executed one-by-one subframe and every subframe follows the steps mentioned below:

1. Initialise rxwaveform variable with noise and add received waveform from eNBs1 and eNBs2.
2. Select PDSCH transmission cell reported by the UE based on wideband CQI.
3. Generate a subfarme for each cell and do OFDM modulation of two subframes.
4. AT UE perform OFDM and PDSCH demodulation of received waveform.
5. Generate eNBs1 and eNBs2 transmissions.
6. For each eNB [enbIdx = 1:2]
7. for every transmission, update subframe number
8. From eNBs1 or eNBs2 transmission is performed to UE.
9. Perform selection of modulation scheme and the transport block size using CQI for transmission.
10. Perform PDSCH transmission by selecting highest CQI subband.
11. Select MCS according to CQI.
12. Determine TBs and modulation order
13. For non-zero transport block size, prepare PDSCH and do PDSCH mapping.
14. Generate DL-SCH data and PDSCH symbols of serving cell for the current scrambling
15. Create UE specific DMRS configuration then Map PDSCH and DMRS.
16. Perform OFDM modulation, pass it through a fading channel, add existing receive waveform and scale SNR.
17. Perform Synchronization of receiver and the demodulation of OFDM.
18. For the serving cell (eNBs1) synchronization and OFDM demodulation used PSS or SSS.
19. Compute the estimates of CSI-RS and generate channel estimates for CSI-RS resources configured at the UE.
20. Calculate interference and the energy in resource elements.

VI. RESULT AND ANALYSIS

The positions of UE is identified by different cells using TDOA mechanism, the simulation result is shown in following Fig. 4. In this figure detected cells are represented, which satisfies the threshold value of RSRP. So in the simulation there are 5 eNBs and a central UE shown in Fig. 4.

After detection of the cells the Cooperative multicell Selection procedure is invoked, we used two points for this simulation. Hence before calling Cooperative Multicell Selection procedure we are selecting most efficient two cells. Then the transmission is done between these two cells frame-by-frame based on wideband CQI. The result of CQI during the simulation for each CSI process is shown in Fig. 5 for our proposed method. The reported CQI of proc 0 and proc 1 represents the channel conditions which favour eNBs1 otherwise eNBs2, when the reported CQI exceeds than that of eNBs1. The CQI report is lower for proc 0 and 1 because these processes assumed added interference from the transmission cells. Similarly, the result of CQI for each CSI process for RSRQ (quality) method is shown in Fig. 6 and RSRP (power) in Fig 7.

The Fig. 8 shows plots for the transmission of PDSCH selected cell and wideband CQI of the two processes, which is used for decision making of transmission point. This figure represents that during the simulation cell 2 (eNBs2) is selected for the PDSCH transmission according to the CQI report of this transmission cell.

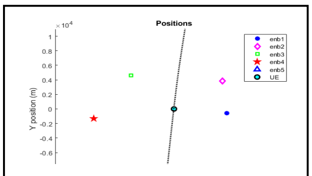

Figure 4. UE position identified by cells using TDOA method

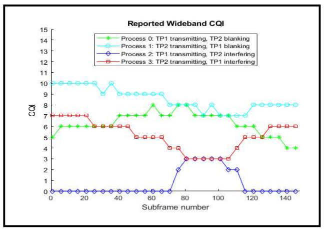

Figure 5. wideband CQI-ratio-method

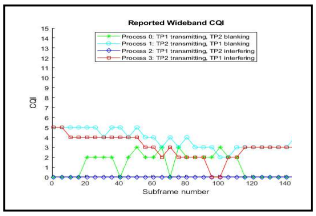

Figure 6. Wideband CQI for RSRQ (Quality)

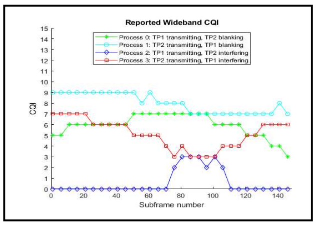

Figure 7. Wideband CQI for RSRP (power)

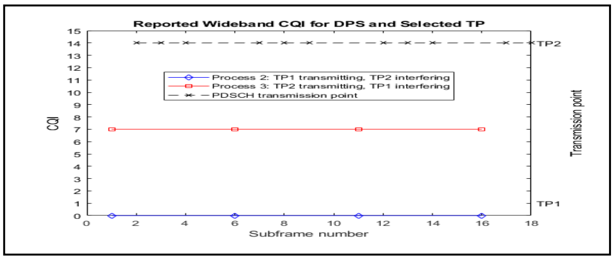

Figure 8. Selected Transmission point using DPS

The comparison of the three simulations as RSRP, RSRQ and ratio (RSRQ/RSRP) for cell selection and transmission is shown in table IV. The comparison is done with various parameters such as throughput, BLER, Power and Delay. In case of throughput our ratio method is better than only power and quality methods. For the power and BLER parameters our ratio method is utilizing the moderate power and BLER as compare to other two methods. Comparison of Cooperative Multicell methods using power, quality and our ratio (RSRQ/RSPR) parameters is detailed in table IV.

VII. CONCLUSION

Our proposed Dynamic Cooperative Multicell Selection (DCMS) Mechanism shows that how feedback is provided by multiple CSI processes. For the randomly placed multiple macrocells and single UE, we use TDOA mechanism for finding the suitable neighbouring cells of centralised UE. Using the ratio (RSRQ/RSRP) parameters we selected the most efficient two cells among suitable neighbouring cells for handover. Using cooperative transmission mechanism, based on the report of wideband CQI, UE transmit data from any one of the two cooperating eNodeBs. We perform the simulation for cell-edge scenario where our DCMS mechanism achieves a throughput gain for the UE. We compare our results with the scenario for RSRQ and RSRP measurement parameters separately. The result shows that our Dynamic Co-operative QPR mechanism performed better than both the method, RSRQ and RSRP. Our proposed mechanism can be extended for more than two co-operative multi-points.

TABLE IV. COMPARISON OF CO-OPERATIVE MULTI CELL SELECTION USING POWER, QUALITY, RATIO METHODS

Parameters\ Methodology	**highest RSRP**	**RSRQ/RSRP ratio**	**With RSRQ**
Throughput (kbps)	420 kbps	420.4167 kbps	149.5833 kbps
BLER (target 0.1)	0.011111	0.022222	0.34444
Power (db) (cell1 and cell2)	p1 = -119.1148 p2 = -119.4305	p1 = -129.2693 p2 = -128.1087	p1 = -18.6359 p2 = -19.0151
Delay (msec) (cell1 and cell2)	delay1 = 76 delay2 = 78	delay1 = 101 delay2 = 130	delay1 = 76 delay2 = 78
Selected Cell-ID for HO	CellID1 = 3 CellID2 = 0	CellID1 = 6 CellID2 = 12	CellID1 = 3 CellID2 = 0
Sequence of Cells by Cell-ID	IP = 2-1-4-5-3 Sequence of cells by RSRP	IR = 3-5-4-1-2 Sequence of cells by Ratio (RSRQ/RSRP)	IQ = 2-1-4-5-3 Sequence of cells by RSRQ

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