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Enhancement of data transmission using optimized multi-cell approach in 5G backhaul wireless mesh network

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Article Info	ABSTRACT
	The millimeter wave (mmWave) band and its usage has taken an attention in this 5G creation as its implementation can provide ultra-high speed data transmission in wireless network. This is much better than the centimeter wave-band as it has limitations on the bandwidth usage. While considering the 5G networking with the backhaul-topologies, the network and user-equipment performance depends on the selection of serving receiving nodes (RNs) of the user-equipment (UE). Therefore, the algorithms that reduces the complexity of the UE association and the backhaul traffic-routing must be chosen, which thereby maximizes the efficiency of the spectrum and energy of network. The modifications are done to the Multicellular local solution (McLS) approach, which leads to our proposed algorithm that is, improved against the channel information estimation-errors. The optimized multi-cell approach (OMcA) is formed by combining the improved-parameter, the pre-coder, mean square error (MSE) weighted-variable and receive filter. The proposed OMcA is compared with some other existing technique in order to evaluate the performance in terms of sum rate (SR). *Copyright © 2019 Institute of Advanced Engineering and Science.* *All rights reserved.*

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1.   INTRODUCTION

The Wireless network concentrates on the development of next generation technology which is the fifth-generation (5G). The main directions of development by the telecommunication industry is this fifth-generation and this implementation is expected by 2020. The increase in throughput due to the increase in amount of transmitted information and the ability to provide large number of connections with the emerging technological advancements like the IoT (Internet-of-Things) [1], [2]. VANET (Vehicular Ad-Hoc-Network), the improvement in the quality and provision of new services makes this class of network significant from the previous generations of wireless networks. The E-band (71 to 76GHz) is the millimeter Wave-band. Its usage has taken an attention in this 5G creation as its implementation can provide ultra-high speed data transmission in wireless network of about 50 GB/sec as this provides the allocation of broader bandwidth of up to 10GHz. This is much better than the centimeter wave-band as it has limitations on the bandwidth usage. There are several other advantages of using the mm-Wave data-transmission like: the interference of different signal sources is decreased due to the narrow directionality of antenna-system by the creation of miniature antenna-system. This in turn simplifies the frequency planning task as it has optimal reuse of the spatial-frequencies which also increases the spectral efficiency. This type of data-transmission provides secure communications by un-detectable nature, provides tolerance to jamming problems and is resistant to

unauthorized connections thereby providing the integrity property. These advantages bring in a lot of research works and the related papers on building of 5G network in mm-Wave band [3]-[5].

The higher path-loss that occurs when using the higher frequencies can be reduced while using the mm-Wave. The reason is that mm-Wave has higher spectrum availability and higher capacity links. Higher antenna-gains giving high directional link is obtained even with the smaller mm-Wave wavelength [6]. In case of backhaul link failure [7], the self-forming and self-healing in the mesh-networking will result in increase of reliability and redundancies. While considering the 5G networking with the backhaul-topologies, the network and UE performance depends on the selection of serving RNs of the UE. Therefore, the algorithms that reduces the complexity of the UE association and the backhaul traffic-routing must be chosen which thereby maximizes the efficiency of the spectrum and energy of network. Access-networks are the links between the user-associations (UAs) and the corresponding serving RNs. Figure 1 shows the wireless mesh network, where dotted lines show the mesh connection at various RNs. The algorithms proposed until now will only concentrate on the optimization of the performance of these access-networks. LTE-Advanced (LTE-A) has two metrics: the reference-signaling received-power (RSRP) and the reference-signaling received-quality (RSRQ) [8]. The best signal to noise ratio (SNR) algorithm will connect the UE to its corresponding BS with the highest received power. This criteria though maximizes the efficiency of the spectrum, it will not increase the throughput of the network because of the connection of few UE to small cells. To overcome this, the bias is applied for the signals originated from bysmall cells and this is called the range-expansion (RE) [9].
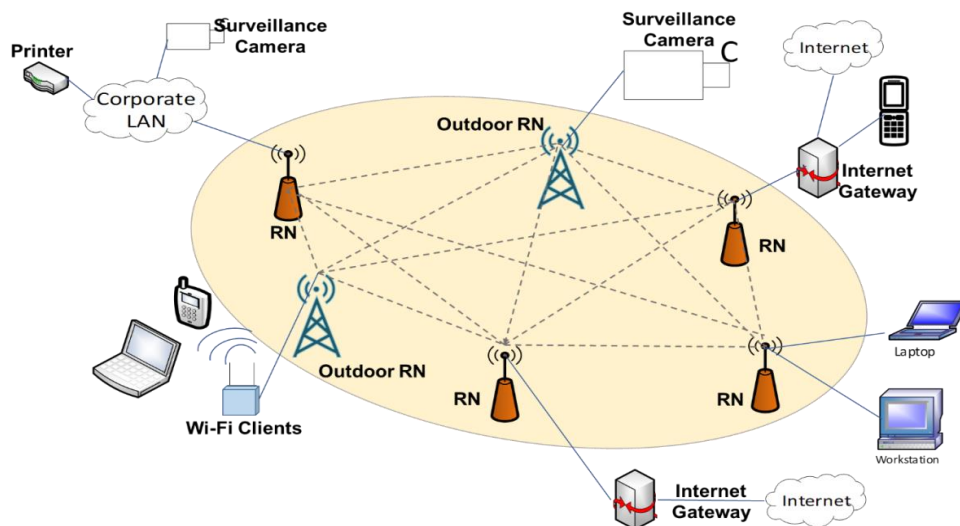

Figure 1. Wireless Mesh-Network

The disadvantage in the MSE transmission in backhaul mesh-network can be solved by the up-link and down-link channel assignments. This can be resolved by the distributed informative channel acquisition (DICA) resources according to the time-division-duplex process [10] [11]. The advantage of this is that, the signals can be transmitted in multiple directions without the access point (AP) antenna. Radio-allocation separation balancing must be originated in up-link, down-link and the backhaul mesh-network. The 5G network is expected to provide high speed data-rates. The time for the download and the upload will be very less. Therefore, the wireless-mesh-network will have traffic burdens. The resource allocation [10] is proposed for the changes in the traffic conditions. Adapting the resource-allocation (RA) is important as it can resolve the changing traffic conditions. The distributed weighted-sum-rate can be optimized by the RA based algorithm called the McLS approach [13], which will provide the low complexity in each iteration and tractable-form.

The optimization is carried out for the worst-case sense [14]. Here the pre-coders must be designed. The design must be such that all possible channels correspondent to uncertain regions has definite performance. The quality-of-service ('QoS') and robust fairness are the constraints that are generally hard to resolve. In order to overcome this problem, the OMcA is proposed and this is combined with the DICA in order to provide effective allocation of channel. The modifications are done to the McLS approach, which

leads to our proposed algorithm that is improved against the channel information estimation-errors. The OMcA is formed by combining the improved-parameter, the pre-coder, MSE weighted-variable and receive filter. The resource-allocation requires the DICA and this is used to solve the transmission-MSE. The proposed OMcA will maximize the average sum-rate (SR) and this will compared with some other existing technique in order to evaluate the performance. The rest of the paper is organized as follows: In section 2, the Existing works related to the proposed scheme are presented. In Section3, we show the problem formulation and propose the OMcA to solve the problem. Finally, simulation results are given in Section4, and a conclusion is drawn in Section5.

2. LITERATURE SURVEY

There is an increase in the small cells in the network as the demand on the number of connected devices and the demand on the capacity has become more. The deployment of these small cells has becomes one of the major problem. The paper [15] highlights the problems faced in the small cell deployment in which the survey was conducted over 65 mobile network operator. From the survey, it was understood that the backhauling of the small cells was the major barrier. The infrastructure cost is reduced by the wireless backhauling. In the small-cell deployment topologies [16], the backhauling challenges are related to the constraints of the used spectrum and the distance. The antenna-gain, the transmitting-power addresses these challenges. The network management becomes more complicated if the wireless-backhauling is not self-optimized, self-configured etc. The usage of mmWave links is suggested for the backhauling of small-cells [17].

The mmWave transmission has more advantages. The capacity growth problem [18]-[20] can be solved by using high frequency bands of about 60Hz, 71-76Hz, 81-86Hz , both for the access and the backhaul. Larger spectrum is available in the mmWave which is much more than the traditional fixed wireless network services of microwave-band (i.e., 6 to 38 GHz). The bandwidths of about 10Gbps/100Gbps fiber connections that can be provided through a lower level of latency. The example include ITU-R Reference F.2006 [21] for the 71 to 76, 81 to 86 GHz band which has the channel spacing of about 5GHz which enables multi-gigabit (Multi-GB) of data transmission in a channel per every link. High frequency reuse is possible in the mm-Wave-band because of the narrow radiating beams. These mm-wave-bands are sub- band free. When compared to the microwave frequency band, lower total cost of ownership (TCO) and cost per each 'transmitted bit' is obtained by the light spectrum licensing-scheme.

The 5G cellular network offers different services and is an infrastructure provider and key enabler in the IT-industry. The services include: the enhanced mobile-broadband (eMBB) with the requirements of the throughput-driving and bandwidth-consuming. There are new services that are provided which include the ultra-reliable lower latency communication (URLLC), the massive/huge machine-type communications (mMTC). The massive 'multiple-input multiple-output' (MIMO) is required to boost up the capacity in this 5G networks but these are cost-ineffective even if they are deployed. The 5G network will revolutionize first in order to boost the spectrum-efficiency (SE) and the energy efficiency (EE). Alternative options are provided by this 5G technology for the radio-resource management (RRM), and mobility-management (MM). They provide the service provisioning management (SPM) mechanism. Therefore, it is not necessary to provide for each of the services, any dedicated networks. The example for this is the railway-communication-network, GSM. The development of the 5G network makes it more feasible in order to provide the end-to-end network slices (NS) [22]. This provides different services, which include 'URLLC' and, provides ultra-higher throughput at eMBB. Overall, the 5G network will have different mechanisms for various services and thereby give a better way for its application under the complete intelligence technique. Even with all these advantages, it is also challenging and it consumes more time for these 'network operators' to resolve the increasing configuration-issues. It is difficult to satisfy the evolving service requirements. This is due to the reason that the 5g network merely possess more of technical options in them.

The science of making the machines to become as intelligent as that of humans is known as the artificial intelligence (AI). This is applied for the optimization of the communication networks in a diverse of configurations [23]. The AI is divided into 2 levels. The first level is the basic level in which a machine must provide many pre-defined options and must be able to respond to the environment in a deterministic way. While considering the 5G network, it will permit and allow-free transmission for the eMBB and eMTC services. Here, the system will intelligently regulate the configuration when it detects some of the pre-defined service indicator, moreover, the second level entity will possess the capacity to fully interact with the environment. When there are different scenarios or tasks, the machine must be able to make an appropriate response.

Complementary 'metal-oxide' semiconductor ('$CMOS$') radio frequency (RF) integrated circuits [24] give the mode for the electronic products in mm-Wave band service. Several standards have

been defined for this indoor personal wireless network areas 'or' the wireless local-area-network. The examples for these include, ECMA-387 [25], IEEE standard 802.15.3c [26], and IEEE standard 802.11ad [27]. These will increase the evolvement in the cellular networking and the outdoor-mesh network topology in the mm-Wave-band [28], [29]. There are certain challenges faced in the 5G wireless networking. These challenges are being faced by the physical layer, medium-access-control and, communicating routing layers. This makes the mm-wave communications differ from the existing other communicating systems that are operating in microwave (μ-wave) band which is of 2.4 GHz and of 5 GHz. Added with this, there are lot more challenges faced like the higher propagation loss, blockage sensitivity, dynamics due to the mobility of the mm-wave communications. These challenges must be solved by bringing new insights in the architectures and the protocols.

3. PROPOSED METHODOLOGY

In general, the communication between two nodes requires both uplink and downlink data transmission. To optimize the process of data transmission, here we are focusing more on the downlink streams due to the vast traffic presence. Moreover, this proposed methodology can be applied on an uplink side also and the multiuser interaction has defined by the non-interface Mesh nodes (MNs) at downlink operation. In order to solve the MSE during transmission a optimize resource allocation technique is required, here we are considering an mm-wave cellular network (CN) as a system model. In this scenario, the MNs is represented by A_t that serves the each of (A_c) user equipment (UE), where the UE act as the transmitting nodes and the base station behaves like the RNs. Therefore, UEs can be computed as;

$$A_r = A_t A_c \tag{1}$$

Data is served to UE from one RN and coordinate precoding approach is used in our proposed system model. Here, we use distributed implementation to provide multi-cell processing and whenever the value of A_c is greater or equal 2 then the non-interface MNs can be observed. The relay nodes contains the B_t antennas and UEs contains the B_r antennas, also it provide data stream that denoted by C_S. In that our model can perform easily with serving several numbers of UEs individually in data transmission.

Here, we assume data signal from individual user, u^{th} served the UE of RNi indexed through the indices pair (i, u) and torepresent in a compact view it's denote by i_u, moreover we can formulate it as;

$$D_{i_u} \sim EF(0, G) \tag{2}$$

Where, G is a complex symmetric function, 0 refers to zero mean value and $EF(0, G)$ is a Gaussian distribution function. Moreover, the linearly pre-coded user-data is written as;

$$H_{i_u} \in E^{B_t \times C_S} \tag{3}$$

I is an expectation matrix and the received signal on a UE (i_u) is;

$$J_{i_u} = I_{i_u i} H_{i_u} D_{i_u} + \sum_{(j,m) \neq (i,u)} I_{i_u j} H_{jm} D_{jm} + L_{i_u} \tag{4}$$

Where, L_{i_u} represents the white Gaussian noise and that is related to $L_{iu} \sim EF\left(0, M_r^2 N_{B_r}\right)$, also the signals of D_{i_u} and L_{i_u} varies according to the users. The major consideration of this work to provide mutual uplink channel. Moreover, the uplink UE channel (jm) to the iRN is given by $\overleftarrow{I}_{jmi} = I_{jmi}^D$. The signal transmitted from UE (i_u) at uplink channel is given as;

$$\overleftarrow{D}_{i_u}^* \sim EF\left(0, \overleftarrow{P}_{i_u}\right) \tag{5}$$

The uplink data transmission via interfering the multiple 'access channel' and the RN received signal at i given through;

$$\overleftarrow{J}_i^* = \sum_{u=1}^{A_c} I_{jui}^D \overleftarrow{D}_{i_u}^* + \sum_{j \neq i}^{A_t} \sum_{m=1}^{A_c} I_{jmi}^D \overleftarrow{D}_{j_m}^* + \overleftarrow{L}_i^* \tag{6}$$

Where, $\overleftarrow{L}_i^*$ function is:

$$\overleftarrow{L}_i^* \sim EF\left(0, M_t^2 N_{B_t}\right) \tag{7}$$

In order to obtain the most suitable complex conjugate, the received signal are generally depends upon complex conjugate and modeled uplink signal can be written as;

$$\overleftarrow{J}_i = (\overleftarrow{J}_i^*)^* = \sum_{u=1}^{A_c} I_{jui}^O \overleftarrow{D}_{i_u} + \sum_{j \neq i}^{A_t} \sum_{m=1}^{A_c} I_{jmi}^O \overleftarrow{D}_{j_m} + \overleftarrow{L}_i \tag{8}$$

Information of channel state acquisition is recommended for allocation of resources that can be used to resolve the transmission-MSE issues they proposed at paper [30] in order to increase the sum-rate (SR). The UEs data-rate can be allocate through $Q_{i_u} \in [0,1], \nabla_{i_u}$, and the weighted-SR can be written as;

$$\sum_{(i,u)} Q_{i_u} R_{i_u} \tag{9}$$

Where, R_{i_u} is the user rate of i_u user and the variable Q_{iu} is selected as per the priority based solution via uniform fair function [31]. Therefore, the weights can be chosen by the selected base station and we assume that S_i is the sum power constraint at i RNs with the enhanced pre-coder variable H_{i_u}. The below equation represent the difficulty at weighted-SR optimization.

$$\begin{array}{l} maximize \\ \{H_{i_u}\} \end{array} \qquad \sum_{(i,u)} Q_{i_u} R_{i_u} \tag{10}$$

$$subject\, to \qquad \sum_{u=1}^{A_c} \mathcal{TR}\left(H_{i_u} H_{i_u}^O\right) \leq S_i, i = 1, \ldots., \qquad A_t.$$

This can be used to solve a "non-convex" problem that is why we need to get an optimal local solution through considering the bunch of optimize variables such as weighted variable of MSE (T_{i_u}) and in paper [28], they consider the similar optimal solution that has obtained by the McLS approach.

$$\begin{array}{l} minimize \\ \{U_{i_u}\}, \{H_{i_u}\} \\ \{T_{i_u} > 0\} \end{array} \qquad \sum_{(i,u)} Q_{i_u} \left(\mathcal{TR}\left(T_{i_u} V_{i_u}\right) - \log det\left(T_{i_u}\right)\right) \tag{11}$$

This subject is related to equation (10), where the linear filters at receiver side is (U_{iu}) and the matrix MSE function at i_u UEs is given by;

$$\begin{aligned} T_{iu} &= I\left(\left(D_{i_u} - U_{i_u}^O J_{i_u}\right)\left(D_{i_u} - U_{i_u}^O J_{i_u}\right)^O\right) \\ &= N - U_{i_u}^O I_{i_u i} H_{i_u} - U_{i_u} I_{i_u i}^O H_{i_u}^O + U_{i_u}^O W_{i_u} U_{i_u} \end{aligned} \tag{12}$$

At i_u UE, the received signal W_{iu} with the noise interference is given through,

$$W_{i_u} = H_{i_u}^O I_{i_u i}^O I_{i_u i} H_{iu} - W_{iu}^{i+n} \tag{13}$$

Here, the optimization problem at equation (11) is the non-convex at a set of $\{U_{iu}, H_{iu}, T_{iu}\}$.

Distributed informative channel acquisition (DICA) is used to acquire the information and this channel estimation methodology describes the reciprocity of networks, furthermore its uses the pilot transmission at both uplink and downlink transmission. Moreover, the alteration in McLS approach iteration will help to achieve the efficient channel. Here, the channel estimator [32] is generally used to characterize

the channel statistic and that use to predict the channel operation, which changes in every McLS iteration process. It is complicated to achieve the operative statistical characteristics of channels.

Therefore, here we adopt the efficient resource allocation, in which the proposed channel acquisition is fully distributed in every UE but not fully distributed in backhaul RN. Here the optimize uplink channel estimation is consider to maximize the transmission power. Let's, assume that the UE i_u feedbacks the T_{i_u} to its RNs and the UE transmit the signal $(\overleftarrow{D}_{i_u})$,

$$\overleftarrow{D}_{i_u} = \frac{\sqrt{S_r}}{\left\| X_{i_u} \right\|_Y} X_{i_u} \overleftarrow{\mathbb{P}}_{i_u} \tag{14}$$

Where, the orthogonal pilots is $\overleftarrow{\mathbb{P}}_{i_u}$, and the maximum transmit power at UEs is denote by S_r. The effective uplink receiving signal at receiving node is;

$$\overleftarrow{J}_i = \sqrt{S_r} \sum_{j,m} \frac{1}{\left\| X_{jm} \right\|_Y} I_{jm}^O X_{jm} \overleftarrow{\mathbb{P}}_{jm} + \overleftarrow{L}_i \tag{15}$$

Moreover, the assumed $\left\| X_{i_u} \right\|_Y$ scaling factor is given feedback through the UEs to the operating RN. Also it shares over all backhaul-RN networks, thereafter the iRN can be estimated by efficient channel with jm UE as;

$$\hat{Z}_{jmi} = \frac{\left\| X_{jm} \right\|_Y}{\sqrt{S_r} C_{p,S}} \overleftarrow{J}_i \overleftarrow{\mathbb{P}}_{jm}^O \tag{16}$$

More simplifying equation (16) can be written as;

$$\hat{Z}_{jmi} = I_{i_u j}^O X_{jm} + \frac{\left\| X_{jm} \right\|_Y}{\sqrt{S_r} C_{p,S}} \overleftarrow{L}_i \overleftarrow{\mathbb{P}}_{jm}^O \tag{17}$$

In order to obtain the efficient downlink channel here we use synchronous pilot-transmission and the orthogonal pilot can be transmitted via using RNs, which can be given as per user as;

$$\overleftarrow{\mathbb{P}}_{i_u} \in E^{C_S \times C_{p,S}} \tag{18}$$

The received signal at i_u UE is given by

$$J_{i_u} = I_{i_u i} H_{i_u} \mathbb{P}_{i_u} + \sum_{(j,m) \neq (i,u)} I_{i_u j} H_{jm} \mathbb{P}_{i_u} + L_{i_u} \tag{19}$$

Where, $\overleftarrow{J}_{i_u} \in E^{B_r \times C_{p,S}}$ as per UE, assuming the i_u UE for the selected pilot $\mathbb{P}_{i_u}$, and the effective downlink channel can be estimated by $\vartheta_{i_u} \in E^{B_r \times C_S}$, from [30] it can be written as;

$$\hat{\vartheta}_{i_u} = \frac{1}{C_{p,S}} J_{i_u} \mathbb{P}_{i_u}^O = I_{i_u i} H_{i_u} + \frac{1}{C_{p,S}} L_{i_u} \mathbb{P}_{i_u}^O \tag{20}$$

3.1. Optimized Multi-cell Approach (OMcA)

In order to provide some enhancement in the existing McLS approach, here we considering the OMcA, which will be robustifying at the channel information errors. Moreover, we also add some of the necessary improved parameters such as; MSE weighted variable, improved receiver filter and the improved pre-coder. Our proposed is added with the DICA to get the efficient channel allocation.

Firstly we are applying the improved pre-coder, in that some local optimization processes are presented at RN, which generally added up with channel phase estimation at uplink. To solve this problem, we provide the upper bounding to optimize the inner problem using process defined in [36] and [33]. Moreover, the optimize improved pre-coder at i_u UE is,

$$H_{i_u}^J = \sqrt{Q_{i_u}} \left(\hat{\delta}_i^{s+i} + \left(\varepsilon_i^{(RN)} + \frac{\sigma_{i_u}^{(RN)}}{\left\| H_{i_u}^J \right\|_{\mathbb{Z}}} + \varpi_i \right) N \right)^{-1} \hat{Z}_{i_u} T_{i_u}^{0.5} \tag{21}$$

The improved pre-coder at (21) is diagonally load via a constant factor $(\varepsilon_i^{(RN)})$, ϖ_i denotes the Lagrange multiplier and $\sigma_{i_u}^{(RN)} / \left\| H_{i_u}^J \right\|_Y$ denotes the data dependency factor and $\hat{\delta}_i^{s+i}$ denotes the statistics of co-variance error that depend upon filter at RN side. Furthermore, we use an approach related to data dependency for selecting the diagonal parameters [30], where the improved pre-coder in OMcA approach can be given through;

$$H_{i_u} = \sqrt{Q_{i_u}} \left(\delta_i^{n+s+i} + \varpi_i N \right)^{-1} \hat{Z}_{i_u} T_{i_u}^{0.5} \tag{22}$$

The solution of improved factor ϖ_i and the diagonal loading quantity can be obtain through $\hat{Z}_{i_u}, T_{i_u}^{0.5}, S_i$ and $\hat{\delta}_i^{s+i+n}$.

The problem optimization for the receive filter [34] at i_u UE is;

$$U_{iu}^J = \left(\widehat{W}_{iu} + \left(\varepsilon_i^{(UE)} + \frac{\sigma_{iu}^{(UE)}}{\left\| T_{iu}^{0.5} U_{iu}^J \right\|_Y} \right) N \right)^{-1} \hat{\vartheta}_{iu} \tag{23}$$

Afterwards, the resultant improved-weighted MSE can be written as;

$$T_{iu}^J = \left(N - \hat{\vartheta}_{iu}^O \left(\widehat{W}_{iu} + \left(\varepsilon_i^{(UE)} + \frac{\varepsilon_{iu}^{(UE)}}{\left\| T_{iu}^{0.5} U_{iu}^J \right\|_Y} \right) N \right)^{-1} \vartheta_{iu} \right) \tag{24}$$

At OMcA approach, we generally impose the constraint on UE side with the imperfect acquisition of channel information in order to enhance the estimation process. The OMcA solution for individual UEs can be solve via optimize receive filter U_{iu}^{op} and the optimized weighted variable that denoted by T_{iu}^{op}.

$$U_{iu}^{op} = \left(\widehat{W}_{iu} + H_{iu}^{op} N \right)^{-1} \hat{\vartheta}_{iu} \tag{25}$$

$$T_{iu}^{op} = \left(N - \hat{\vartheta}_{iu}^O \left(\widehat{W}_{iu} + H_{iu}^{op} N \right)^{-1} \hat{\vartheta}_{iu} \right)^{-1} \tag{26}$$

The optimized parameters such as receive filter (RF) (U_{iu}^{op}), optimized weighted variable (T_{iu}^{op}) and improved weighted variable (T_{iu}^J) are different with respect to the RF (U_{iu}^J), which do not depends at the unknown parameters value. Therefore, the U_{iu}^{op} and T_{iu}^{op} is apply to get the reliable proxies for U_{iu}^J and T_{iu}^J in a proposed OMcA.

4. RESULTS

The performance analysis of our proposed model can be studied in this section and it is based on the 'numerical simulation' that is simulating under the MatLab 2016b environment. The system configuration is 8GB RAMi5 Intel processor, 1TB Hard disk, 2 GB NVidias Graphics card and work under Windows 10 operating system. Here, we are considering three test cases such as scenario-A, scenario-B and scenario-C. At scenario-A, the considered number of transmitter antenna at RN is represented by B_t that is7, number of receiver antenna at UE $B_r = 3$, number of UE $A_c = 2$, and number of transmitter is given by $A_t = 3$, and therefore, the total number of receiver can be given through $A_r = A_c A_t$. At scenario-B, the considered number of transmitter antenna at RN is $B_t = 11$, and other antenna number is consider same as scenario-A. At scenario-C, the considered number of transmitter antenna at RN is $B_t = 15$, and other antenna number is consider same as scenario-A. The RNs power of transmission is S_i for all RNs and S_t for all UEs. At considered RN, the OMcA power scaling is set as $\partial = \min \left(\frac{s_r / \sigma_t^2}{s_t / \sigma_r^2}, 1 \right)$ and data-rate weights at UE is $Q_{iu} = 1$ (i.e., at all UEs). Additionally, considering the sub-band from 28GHz frequency allows more comparison of UE/RN

antennas to earlier used cellular frequencies, because of same kind of receiver/transmitter array scheme (i.e., due to antenna spacing becoming lesser at present generation network system). In the simulation process the curves is averaged at the 1000 channel realization and also we considering 10 iteration of algorithm. The proposed OMcA is combined with DICA in order to generate effective allocation of channel.

4.1. Scenario-A

In scenario-A the considered number of transmitter antenna at RN is 7. Figure 2 shows the OMcA at different Uplink-SNR (dB), where we can see as the SNR value increases the Sum-Rate also increases. Figure 3, shows the Sum-Rate (b/s/Hz) with respect to downlink SNR (dB) at uplink SNR of 10 dB, where the different existing approach has performed under the same scenario of our proposed approach and from that, we can see difference in sum-rate. Here, we are considering existing approach such as; MAX-SINR [35], uncoordinated [35] and max-DLT [33] that is plotted against our proposed OMcA.
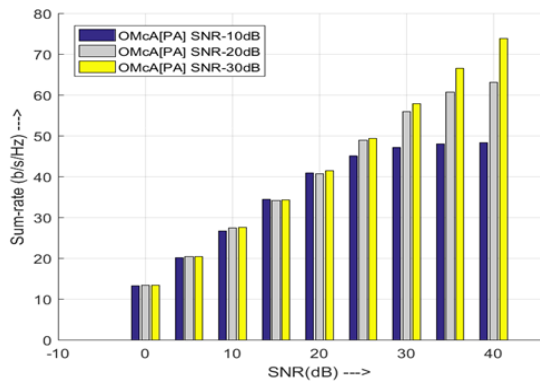
Figure 2. OMcA at different Uplink-SNR (dB)
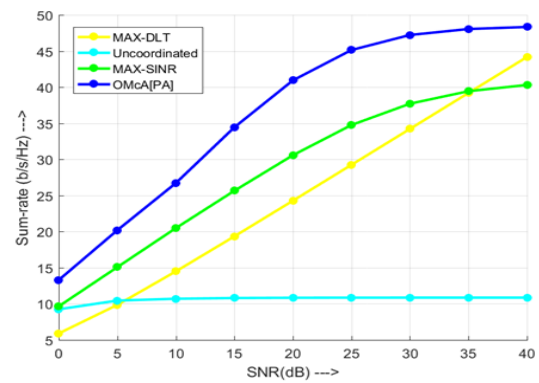
Figure 3. Sum-Rate (b/s/Hz) vs downlink SNR (dB) at uplink SNR of 10 dB

Figure 4, shows the Sum-Rate (b/s/Hz) with respect to downlink SNR (dB) at uplink SNR of 20dB, where the different existing approach has performed under the same scenario of our proposed approach and from that, we can see difference in sum-rate. Here, we are considering existing approach such as; MAX-SINR [35], uncoordinated [35] and max-DLT [33] that is plotted against our proposed OMcA.
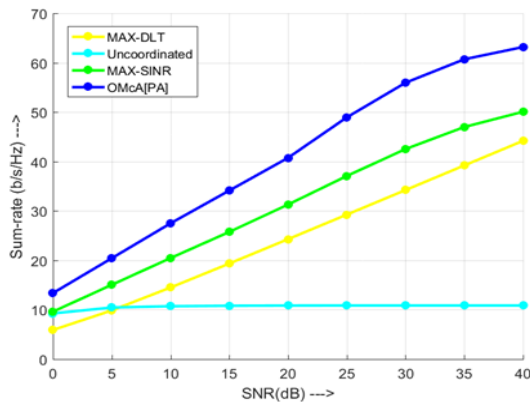

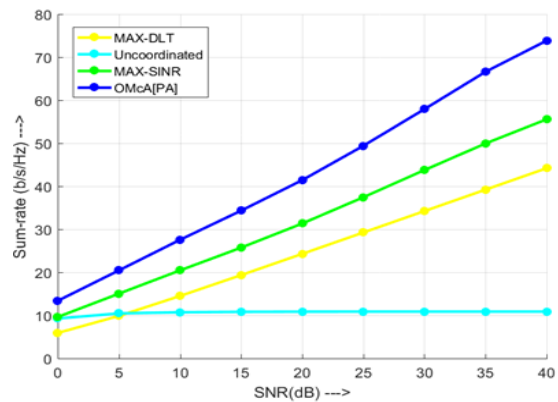Figure 4. Sum-Rate (b/s/Hz) vs downlink SNR (dB) at uplink SNR of 20 dB

Figure 5. Sum-Rate (b/s/Hz) vs downlink SNR (dB) at uplink SNR of 30 dB

Figure 5, shows the Sum-Rate (b/s/Hz) with respect to downlink SNR (dB) at uplink SNR of 30 dB, where the different existing approach has performed under the same scenario of our proposed approach and from that, we can see difference in sum-rate. Here, we are considering existing approach such as; MAX-SINR [35], uncoordinated [35] and max-DLT [33] that is plotted against our proposed OMcA.

4.2. Scenario-B

In scenario-B the considered number of transmitter antenna at RN is 11. Figure 6 shows the OMcA at different Uplink-SNR (dB), where we can see as the SNR value increases the Sum-Rate also increases. Figure 7, shows the Sum-Rate (b/s/Hz) with respect to downlink SNR (dB) at uplink SNR of 10 dB, where the different existing approach has performed under the same scenario of our proposed approach and from that, we can see difference in sum-rate. Here, we are considering existing approach such as; MAX-SINR [35], uncoordinated [35] and max-DLT [33] that is plotted against our proposed OMcA.
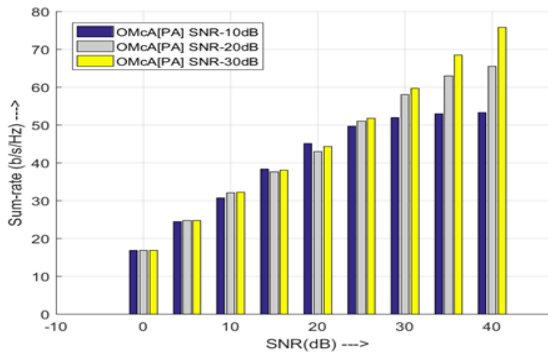
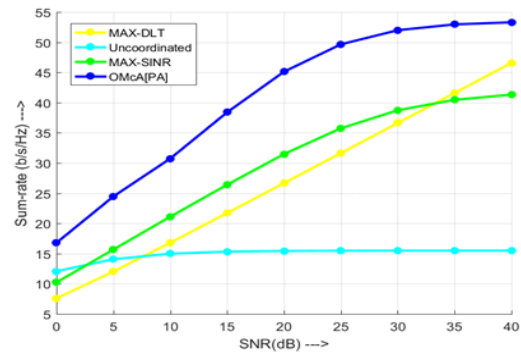Figure 6. OMcA at different Uplink-SNR (dB)

Figure 7. Sum-Rate (b/s/Hz) vs downlink SNR (dB) at uplink SNR of 10 dB

Figure 8 shows the Sum-Rate (b/s/Hz) with respect to downlink SNR (dB) at uplink SNR of 20 dB, where the different existing approach has performed under the same scenario of our proposed approach and from that, we can see difference in sum-rate. Here, we are considering existing approach such as; MAX-SINR [35], uncoordinated [35] and max-DLT [33] that is plotted against our proposed OMcA. Figure 9 shows the Sum-Rate (b/s/Hz) with respect to downlink SNR (dB) at uplink SNR of 30 dB, where the different existing approach has performed under the same scenario of our proposed approach and from that, we can see difference in sum-rate. Here, we are considering existing approach such as; MAX-SINR [35], uncoordinated [35] and max-DLT [33] that is plotted against our proposed OMcA.
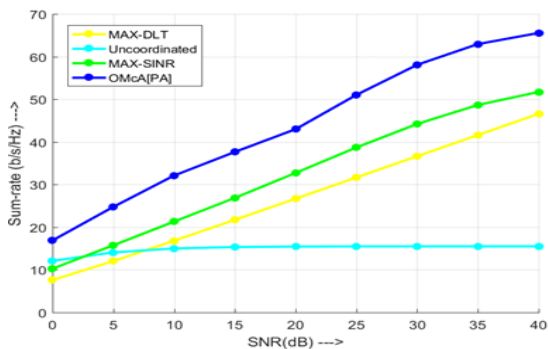

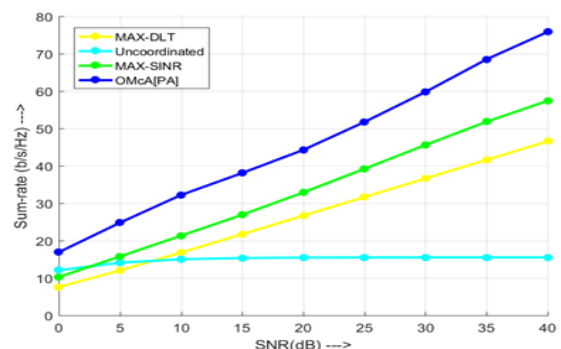Figure 8. Sum-Rate (b/s/Hz) vs downlink SNR (dB) at uplink SNR of 20 dB

Figure 9. Sum-Rate (b/s/Hz) vs downlink SNR (dB) at uplink SNR of 30 dB

4.3. Scenario-C

In scenario-C the considered number of transmitter antenna at RN is 15. Figure 10 shows the OMcA at different Uplink-SNR (dB), where we can see as the SNR value increases the Sum-Rate also increases. Figure 11 shows the Sum-Rate (b/s/Hz) with respect to downlink SNR (dB) at uplink SNR of 10 dB, where the different existing approach has performed under the same scenario of our proposed approach and from that, we can see difference in sum-rate. Here, we are considering existing approach such as; MAX-SINR [35], uncoordinated [35] and max-DLT [33] that is plotted against our proposed OMcA.
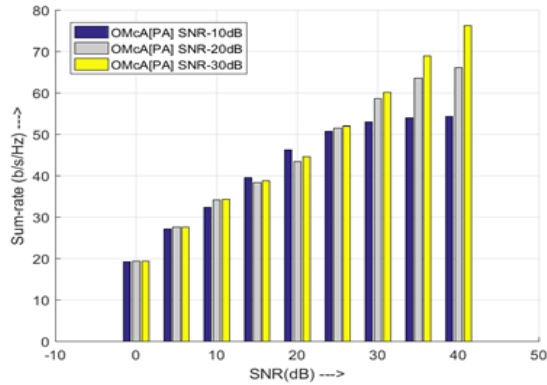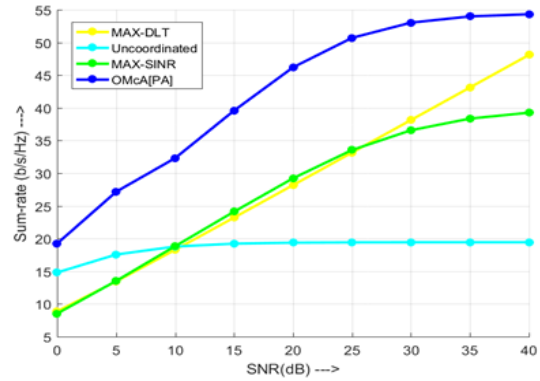
Figure 10.OMcA at different Uplink-SNR (dB)

Figure 11. Sum-Rate (b/s/Hz) vs downlink SNR (dB) at uplink SNR of 10 dB

Figure 12 shows the Sum-Rate (b/s/Hz) with respect to downlink SNR (dB) at uplink SNR of 20 dB, where the different existing approach has performed under the same scenario of our proposed approach and from that, we can see difference in sum-rate. Here, we are considering existing approach such as; MAX-SINR [35], uncoordinated [35] and max-DLT [33] that is plotted against our proposed OMcA. Figure 13 shows the Sum-Rate (b/s/Hz) with respect to downlink SNR (dB) at uplink SNR of 30 dB, where the different existing approach has performed under the same scenario of our proposed approach and from that, we can see difference in sum-rate. Here, we are considering existing approach such as; MAX-SINR [35], uncoordinated [35] and max-DLT [33] that is plotted against our proposed OMcA.
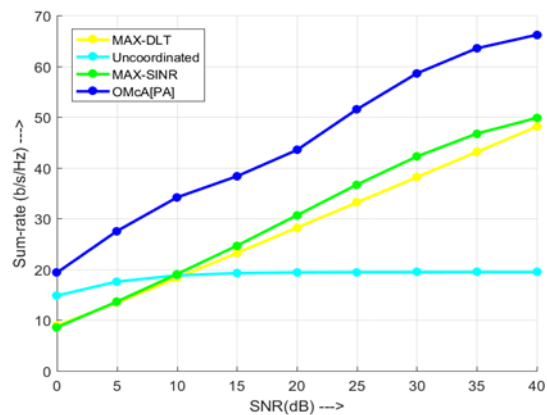

Figure 12. Sum-Rate (b/s/Hz) vs downlink SNR (dB) at uplink SNR of 20 dB
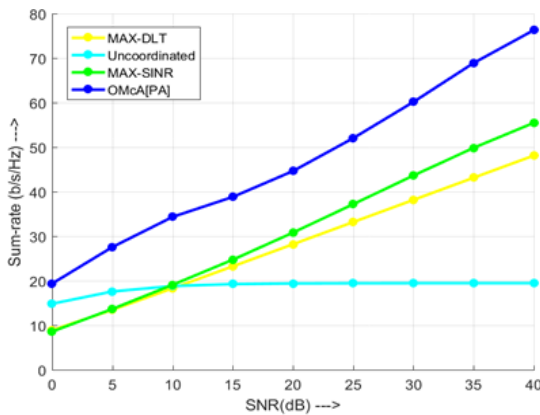

Figure 13. Sum-Rate (b/s/Hz) vs downlink SNR (dB) at uplink SNR of 30 dB

5. CONCLUSION

In order to provide enhancement in the existing McLS approach, here we are considering the OMcA, which will be robustifying at the channel information errors. Our proposed is added with the DICA to get the efficient channel allocation. To analyze the performance, we are considering three test cases such as scenario-A, scenario-B and scenario-C. Moreover, at each scenario the considered number of transmitter antenna at RN is 7, 11 and 15. Considered 30dB uplink SNR in above scenario-C, our proposed model achieved 76.29 b/s/Hz sum-rate that is 36.93% more with respect to MAX-DLT, 74% more sum-rate with respect to uncoordinated approach and 27.3% more sum-rate with respect to MAX-SINR. Through analyzing the above result, we can say that increasing number of transmitting antenna at RNs and SNR can maximize the sum-rate of signal. Our combined proposed approach has performed considerably well with respect to other considered methodology in every scenario.

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