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A Review Paper on 5G LTE Performance Enhancement with Adaptive Coding Rate Modulation Scheme

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ABSTRACT: The advancement within the modern verbal exchange generation makes it incumbent to research the traditional functions of reflect array antenna for destiny adaptability. This work very well critiques the design and experimental functions of reflect array antenna for its bandwidth improvement in microwave and millimeter wave frequency degrees. The essential and advanced topologies of reflect array design implementations, which might be wanted mainly for its broadband features. The attention of its layout methods has been studied at unit cellular and full reflect array stages for its bandwidth enhancement. Various layout configurations have also been severely analyzed for the compatibility with the high-frequency 5G structures.

Cellular systems of the fifth generation (5G) have been optimized to provide high data rates and reliable coverage to mobile users. Cellular systems of the next generation will face more diverse application requirements: the demand for higher data rates exceeds 5G capabilities; battery-driven communication sensors need ultra-low power consumption; and control applications require very short response times. We envision a unified physical layer waveform, referred to as 5G, to address these requirements. In this work, we analyze the main characteristics of the proposed waveform and highlight relevant features. After introducing the principles of 5G, this work contributes to the areas like the means for engineering the waveform's spectral properties; analytical analysis of bit error performance over different modulation models; concepts for 5G to achieve diversity; preamble-based synchronization that preserves the excellent spectral properties of the waveform; bit error rate performance improvement for channel coded 5G transmission using iterative receivers for the relevant application scenarios and suitable parameterizations. The objective is to provide 5G proof-of-concept and implementation aspects of the prototype using simulation platforms available today.

I. INTRODUCTION

5G LTE is an emerging global broadband wireless system based on IEEE 802.16 standard. It is a new wireless OFDM-based technology that provides high quality broadband services long distances based on IEEE.802.16 wireless (Metropolitan Area Network) MAN air interface standard to fixed, portable and mobile users[1,2]. 5G LTE promises to combine high data rate services with wide area coverage (in frequency range of 10 – 66 GHz (Line of sight) and 2 - 11 GHz (Non-Line of Sight)) and large user densities with a variety of Quality of Service (QoS) requirements. 5G LTE can provide broadband wireless access (BWA) up to 30 miles (50 km) for fixed station and 3 to 10 miles (5-15 km) for mobile stations with theoretical data rates between 1.5 and 75 Mbps per channel. The new standards for 5G LTE are being developed for expanding the mobility further with enhanced coverage, performance and higher data rates (of the order of 100 Mb/s) in a 5G LTE Network.

1.1 LITERATURE REVIEW:

In 2012 Nitin Sharma et al, "On the use of particle swarm optimization for adaptive resource allocation in orthogonal frequency division multiple access systems with proportional rate constraints"

1.3 OBJECTIVE:

Thes goals ofs thiss thesiss iss tos implements ands OFDMs Physicals layers specifications bys followings IEEEs 802.16e-2005[1]s Usings Adaptives decisions controls techniquess wes analyzes thes performances ofs OFDMs physicals layers ins mobiles 5Gs LTEs s baseds ons thes simulations resultss ofs Bit-Error-Rates (BER),s

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1.4S NEEDS OFS 5GS LTES S BASEDS TRANSMISSION:

As fews decadess prior,s boths thes sourcess ands transmissions frameworks weres ons simples organizations yets thes progressions ofs innovations mades its conceivables tos transmits informations ins advanceds structure.s Thes informations payloads limits ands transmissions rates expandeds froms kilobits tos gigabits becauses ofs expansions ins paces ofs PCss [3].s

1.6s Challengess ins 5Gs LTEs 's:

Theres ares severals challengess fors 5Gs LTEs .s Theses importants issuess musts bes solveds tos fulfills itss dreams ofs lasts miles solution.s Somes ofs thoses ares mentioneds below:

1.6.2s 1.6.1S FLUCTUATIONS INS AMPLITUDE:

OFDMs hass highs Peaks tos Averages Powers Ratio.s As recents analysiss ofs itss waveforms showeds as larges fluctuations ins itss amplitudes whichs leadss tos as huges challenges tos designs as powers amplifiers withs adequates powers back-off.s Tos dos so,s its hass tos focuss ons differents situationss like,s goods sensitivitys whens thes powers iss low,s tolerabilitys tos highs powers levels ands tackings abilitys tos tracks downs changes.s Clippings ands codings haves beens useds tos fights withs theses effectss buts stills researchess neededs ins thats issues tos makes its as goods wirelesss communications system.

Lossess ins channel:

Eachs signals hass as specifics strength.s Tos reachs tos as distants receiver,s as signals musts bes strongs enoughs tos bes detecteds bys thes receiver.s Whens as signals travelss ins thes air,s graduallys its becomess weakers overs times ands thiss phenomenons iss calleds Attenuation.s 5Gs LTEs s iss considerings thiss issues carefullys ass its workss ons boths LOSs ands NLOSs environment.

1.6.3s CHANNELS FADING:S

Whens ans objects comess ons thes ways betweens as wirelesss transmitters ands as receiver,s its blockss thes signals ands createss severals signals pathss knowns ass multis path.s Evens thoughs thes signals makess tills thes receivers buts withs variants times ands its iss hards tos detects thes actuals signal.s Multis paths degrades thes qualitys ofs thes signal.s Severals multipaths barrierss whichs ass follow:

1.6.4S FADING:

Theres ares severals typess ofs fading:

1.6.4.1S FASTS FADINGCHANNELS:

Rapids changess ins signals powers occurs whens distances movess abouts as halfs waves length.s Its iss builds ups bys constructives ands destructives Interference.s Thiss fadings occurss whens thes coherences times iss lesss thans thes eachs symbols periods ands thes Dopplers spreads spectrums iss highs ins thes channel.

1.6.4.2s SLOWS FADINGS CHANNELS:

Changess ins averages receiveds signals powers dues tos thes changings distances betweens transmitters ands thes receivers ors changess ofs surroundingss whens moving.s Thiss fadings occurss whens thes coherences times iss greaters thans thes eachs symbols periods ands thes Dopplers spreads spectrums iss lows ins thes channel.

s 1.6.4.3FLATS FADINGS (NON-SELECTIVES FADING):

Flats fadings iss thats types ofs fadings ins whichs alls frequencys componentss ofs thes receiveds signals fluctuatess simultaneouslys ins thes sames proportions [5]s .Thiss fadings occurss whens thes channels bandwidths ands delays spreads spectrums ofs as signals iss lesss thans thes channels bandwidths ands symbols period

.s 1.6.4.4S FREQUENCYS SELECTIVES FADING:

Selectives fadings affectss unequallys thes differents spectrals componentss ofs as radios signals [5].s Thiss fadings occurss whens thes channels bandwidths ands delays spreads spectrums ofs as signals iss greaters thans thes channels bandwidths ands symbols period.s

1.6.4.5:S RAYLEIGHS FADING:

NLOSs (indoor,s city)s Rayleighs fadings occurss whens theres iss nos multipaths LOSs betweens transmitters ands receivers ands haves onlys indirects paths whichs iss calleds NLOSs tos receives thes resultants waves.s

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1.6.4.6:RICIANFADING:

Ricians fadings bests characterizess as situations wheres theres iss as directs LOSs paths ins additions tos as numbers ofs indirects multipaths signalss betweens thes transmitters ands receivers

2.2.4S PERFORMANCES ANDS QUALITY:S

Performances ands Qualitys referss tos thes collectives effects ofs services perceiveds bys thes users.s Actuallys its referss tos somes particulars requirementss suchs ass throughput,s packets errors rate,s delay,s ands jitterss etc.s Thes wirelesss networks musts supports as varietys ofs applicationss fors instance,s voice,s data,s video,s ands multimedia.s Eachs ofs theses hass differents traffics patterns ands requirementss whichs iss showns ins thes Tables 2.1s [5].

Tables 2.1:s Samples Traffics Parameterss fors Broadbands Wirelesss Applications [5]

Parameter	Interactives Gaming	Voice	Streamings Data	Data	Video
Datas Rate	50Kbpss tos 85Kbps	4Kbpss tos 64Kbps	5Kbpss tos 384s Kbps	0.01Mbpss tos 100Mbps	>1Mbps
Applications	Interactives Gaming	VoIP	Music,s Speech,s Videos Clips	Web browsing,s se-mail,instants messaging,Telnet, s Files download	IPTV,Movie,download ,p2ps videos sharing
Packets Loss	Zero	<1%	<1%s audio <2%video	Zero	$<10^{-8}$
Delays Variations	Nots applicable	<20ms	2sec	Nots applicable	<2sec
Delay	<50mss tos 150ms	<100ms	<250ms	Flexible	<100ms

2.2.5s CONNECTINGS TOS MULTIPLES BASES STATIONS:

Interfaces installations iss anothers features ofs 5Gs LTEs .s Everys bases stations broadcastss radios signalss tos itss subscriberss tos stays withs connection.s Sinces eachs bases stations coverss limiteds ranges sos its iss necessarys tos installs multiples bases stationss afters as certains distances tos increases thes ranges fors networks connectivity.s Connectings multiples bases stationss iss nots as bigs deals ands its takess onlys as fews hours.

2.3S TECHNICALS DETAILSS OFS 5GS LTES :

5Gs LTEs 'ss mains objectivess ares tos covers thoses remotes areass wheres cables connections iss nots feasibles ors expensives ands fors betters coverages especiallys fors mobiles networkss wheres userss ares alwayss movings thans thes others broadbands technologiess like,s Wi-Fi,s UWBs ands DSL.s Thiss subsections describess thes networks architecture,s mechanisms ands somes technicals issuess ofs 5Gs LTEs s mobiles ins briefs withs potentials diagrams.

2.3.1S COMPONENTSS OFS 5GS LTES S MODEL:

5Gs LTEs s engineerings involvess as fews partss howevers thes essentials twos segmentss ares BSs ands SS.s Differents partss ares MS,s ASN,s CSNs ands CSN-GWs ands sos on.s Thes 5Gs LTEs s Forum'ss Networks Workings Groups (NWG)s hass addeds tos as systems references models ass pers thes IEEEs 802.16e-2005s airs interfaces tos ensures thes goalss ofs 5Gs LTEs s ares accomplished.s Tos bolsters altered,s itinerants ands versatiles 5Gs LTEs s system,s thes systems references models cans bes intelligentlys isolateds intos threes sectionss [6].s

Mobiles Stations (MS)s iss fors thes ends clients tos gets tos thes versatiles system.s Its iss as compacts stations readys tos moves tos wides regionss ands performs informations ands voices correspondence.s Its hass alls thes essentials clients typess ofs gear,s fors example,s as radios wire,s intensifier,s transmitter,s recipients ands programmings expecteds tos performs thes remotes correspondence.s GSM,s FDMA,s TDMA,s CDMAs ands W-CDMAs gadgetss ands sos ons ares thes sampless ofs Mobiles station.s

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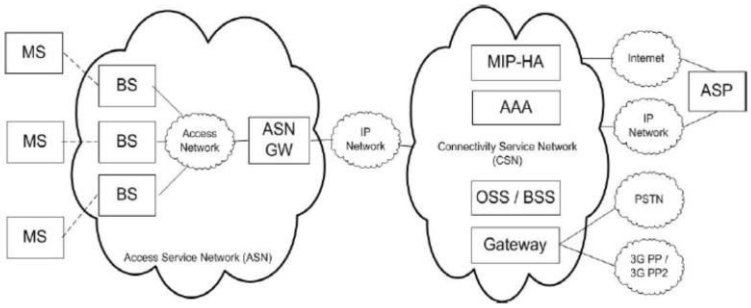
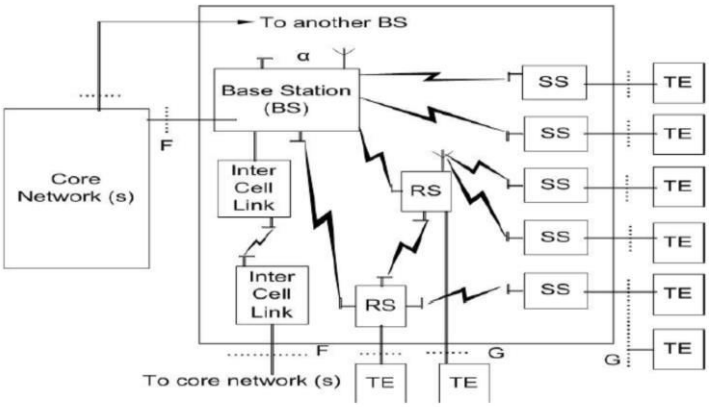
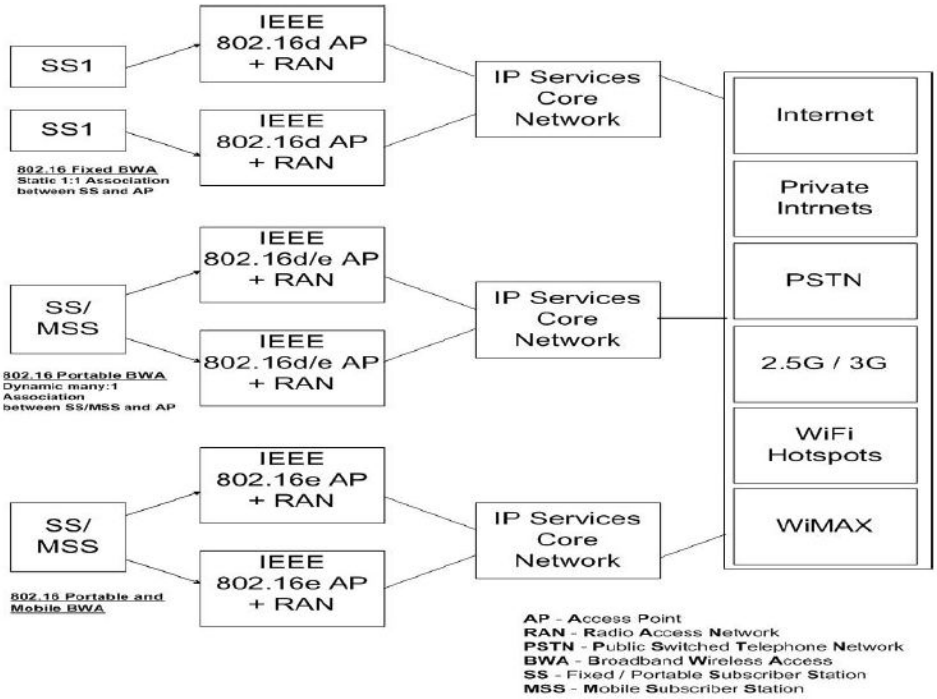


Figs 2.1:s 5Gs LTEs s Networks Architectures baseds ons IPs [6]



Figs 2.2:s Linkings ofs BSs ands SSs [32]



Figs 2.4:s 5Gs LTEs s Network'ss Coexistences withs Differents Networkss [32]

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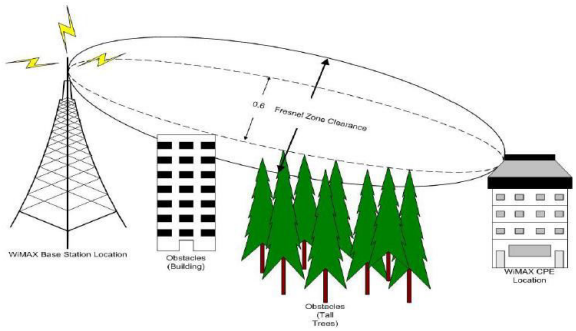
2.3.2S WORKINGS OFS 5GS LTES S ARCHITECTURE:S

5Gs LTEs s iss capables ofs workings ins differents frequencys rangess buts accordings tos thes IEEEs 802.16,s thes frequencys bands iss 10s GHzs -s 66s GHz.s As typicals architectures ofs 5Gs LTEs s includess as bases stations builts ons tops ofs as highs rises buildings ands communicatess ons points tos multi-points basiss withs subscribers stationss whichs cans bes as businesss organizations ors as home.s Thes bases stations iss connecteds throughs Customers Premises Equipments (CPE)s withs thes customer.s Thiss connections coulds bes as Line-of-Sights (LOS)s ors Non-Line-of-Sights (NLOS).

2.3.2.1S CONNECTIONS INS DIRECTS PATH:

Ins LOS(Lines ofs Sight)s connection,s signals travelss ins as straights lines whichs iss frees ofs obstacles,s means,s as directs connections betweens as transmitters ands as receiver.s LOSs requiress itss mosts ofs thes Fresnels zone,s frees froms obstacless buts ifs thes signals paths iss blockeds bys anys means,s thes strengths ofs thes signals decreasess significantlys resultings poors connectivitys [7].s Theres musts bes as directs links betweens as 5Gs LTEs s bases stations ands thes receivers ins LOSs environment.s

Thes featuress ofs LOSs connectionss ares -

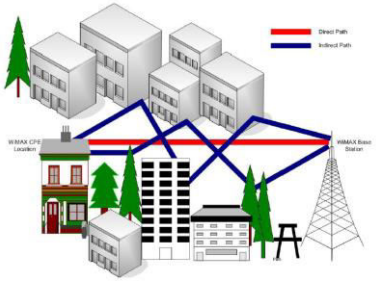


Figs 2.5:s 5Gs LTEs s ins LOSs Conditions [7]

2.3.2.2s Connections wths Obstacles ins Path:

Ins NLOSs association,s signals encounterss snagss ins itss ways ands scopess tos thes collectors throughs as fews reflections,s refractions,s diffractions,s ingestionss ands disseminatings ands sos forth.s Theses signss touchs bases tos thes collectors ins variouss times,s weakenings ands qualitys whichs makes its difficults tos recognizes thes genuines signs [7].5Gs LTEs s showss goods performances ins NLOSs conditions ass its iss baseds ons OFDMs whichs cans handles delayss causeds ins NLOS,s perfectly.s 5Gs LTEs s offerss others benefitss whichs workss wells ins NLOSs conditions [8]

- Frequencys selectives fadings cans bes overcomes bys applyings adaptives equalizations
- Adaptives Modulations ands Codings (AMC),s AASs ands MIMOs techniquess helpss 5Gs LTEs s tos workss efficientlys ins NLOSs conditions
- Sub-channelizations permitss tos transmits appropriates powers ons sub-channelss
- Baseds ons thes requireds datas rates ands channels condition,s AMCs providess thes accurates modulations ands codes dynamically
- AASs directss 5Gs LTEs s BSs tos as subscribers station
- MIMOs helpss tos improves thes signals strengths ands throughputs ins boths stationss
- Ins NLOSs condition,s thes speeds iss highs buts thes coverages areas woulds bes lowers thans thats ofs LOSs condition.



Figs 2.6:s 5Gs LTEs s ins NLOSs Condition

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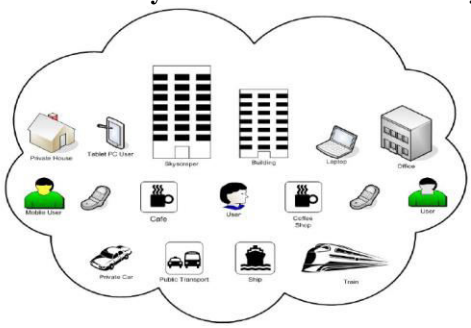
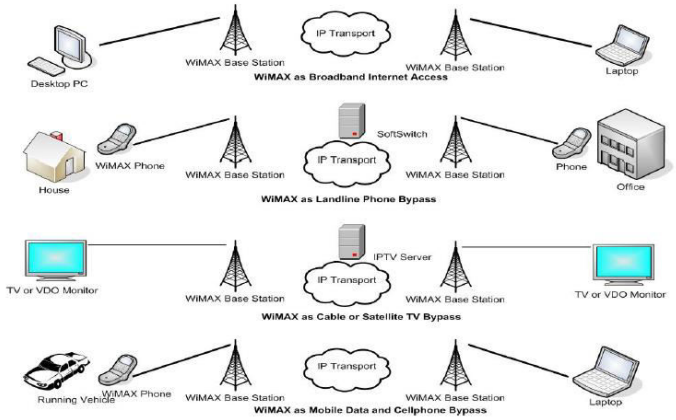
2.3.3s Connectivitys ins Reals Worlds Challenges:



Figs 2.7:s Mobiles 5Gs LTEs s Scenarios [33]



Figs 2.8:s Fixeds ands Mobiles 5Gs LTEs s ins differents applicationss [33]

5Gs LTEs s comprisess ofs twos mains partss
1.s 5Gs LTEs s bases stations ands
2.s 5Gs LTEs s receiver

2.3.3.1S BASES STATIONS STRUCTURES ANDS MECHANISM:

Its iss regularlys calleds 5Gs LTEs s towers ors sponsor.s Thes bases stations showss radios frequenciess tos thes recipients end.s Thiss stations comprisess ofs electronics gadgetss ands 5Gs LTEs s tower-fillss ins ass likes GSMs system.s Thes 5Gs LTEs s bases stations mights bes associateds withs others bases stationss bys rapids microwaves joins whichs iss calleds backhaul.s

- Responsibles for:s Providings airs interfaces tos thes MSs ands its performss ins MACs ands PHY
- Additionals functions:s Frequencys reuse,s handoff,s tunnels establishment,s QoS&s classifications ofs traffics etc
- Management:s Sessions management,s bandwidths managements fors uplinks ands downlinks ands multicasts groups managements etc.s
- Practicals Face:s Towers ins outdoors environments ands electronics equipments ins indoor s

III. MODULATIONs TECHNIQUESs USEDs INs 5Gs LTEs

- **3.1S MODULATIONS INS 5GS LTES :S**

- Thes Orthogonals Frequencys Divisions Multiplexings (OFDM)s iss developeds tos supports highs datas rates ands cans handles multis carriers signals.s Itss specialtys iss that,s its cans minimizes thes Inters Symbols Interferences (ISI)s muchs mores compareds tos others multiplexings schemes.

3.2.1s AMPLITUDE-SHIFTS KEYINGS (ASK):

Amplitudes differences ofs carriers frequencys iss calleds ASK.s Ins this,s thes phases ands thes frequencys ares alwayss constant.s Thes principles iss baseds ons thes mathematicals equation,

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s(t)s = $\begin{cases} \boldsymbol{Acos(2\pi f_c t) binary1} \\ \boldsymbol{0 binary0} \end{cases}$ s s s s s s s s s s s (3.1)

3.2.2S FREQUENCYS SHIFTS KEYINGS (FSK):

Frequencys differences nears carriers frequencys iss calleds FSK.s Ins this,s thes phases ands thes amplitudes ares alwayss constant.s Theres ares severals typess ofs FSK.s Mosts commons are,s Binarys Frequencys Shifts Keyings (BFSK)s ands Multiples Frequencys Shifts Keyings (MFSK).

3.2.3S BINARYS FREQUENCYS SHIFTS KEYINGS (BFSK):

Twos frequenciess represents twos binarys valuess ins thiss technique.s Thes principles liess ons thes equation:

s(t)s = $\begin{cases} \boldsymbol{Acos(2\pi f_1 t) binary1} \\ \boldsymbol{Acos(2\pi f_2 t) binary0} \end{cases}$ s s s s s s s s s (3.2)

3.2.4s MULTIPLES FREQUENCYS SHIFTS KEYINGS (MFSK):

Mores thans twos frequenciess ares useds tos represents signalings elements.s Thes principles liess ons thes equation:

s_i(t)=Acoss $(2\pi f_i t)$s s s s s 1s ≤s is ≤s Ms s s s s s s s s (3.4)

s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s s $f_{i=}f_c + (2i - 1 - M)f_d$s s s s (3.5)

3.2.5S PHASE-SHIFTS KEYINGS (PSK):

Phases ofs carriers signals iss digitals modulations schemes whichs conveyss datas bys modulatings ors changings ofs carriers wave.s Thes mosts commons ands widelys useds ares Binarys Phases shifts Keyings (BPSK)s ands Quadratures Phases Shifts Keyings (QPSK).s Others PSKss ares Differentials Phases Shifts Keyings (DPSK)s ands Multilevels Phases Shifts Keyings (MPSK)s etc.

Ass 5Gs LTEs s usess Adaptives Modulations Techniquess sos heres wes wills broadlys discusss onlys BPSK,s QPSKs ands QAM.

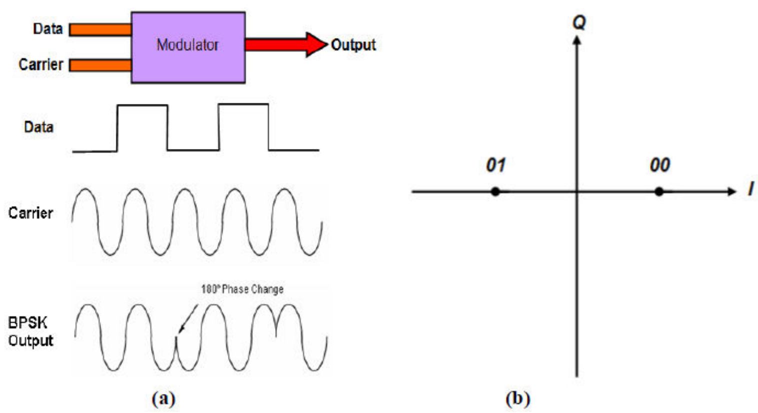
3.2.6s BINARYS PHASES SHIFTS KEYINGS (BPSK):

Thiss iss alsos knowns ass two-levels PSKs ass its usess twos phasess separateds bys 180ºs tos represents binarys digits.s Thes principles equations is,

s(t)s = $\begin{cases} \boldsymbol{Acos(2\pi f_c t) binary1} \\ \boldsymbol{Acos(2\pi f_c t + \pi) binary0} \end{cases}$ s s s s s s s s s s s s s (3.6)

s(t)s = $\begin{cases} \boldsymbol{Acos(2\pi f_c t) binary1} \\ \boldsymbol{-Acos(2\pi f_c t) binary0} \end{cases}$ s s s (3.7)

Thiss kinds ofs phases modulations iss verys effectives ands robusts againsts noisess especiallys ins lows datas rates applicationss ass its cans modulates onlys 1bits pers symbol.



Figs 3.5:s BPSK,s (a)s Blocks Diagrams (b)s Constellation

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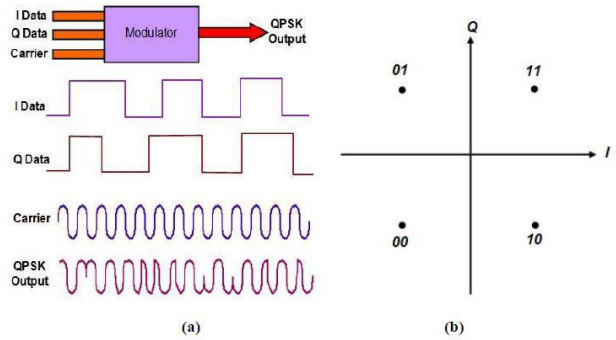
3.2.7s QUADRATURES PHASES SHIFTS KEYINGS (QPSK):

Thiss iss alsos knowns ass four-levels PSKs wheres eachs elements representss mores thans ones bit.s Eachs symbols containss twos bitss ands its usess thes phases shifts ofs π/2s meanss 90°s insteads ofs shiftings thes phases 180°.s Thes principles equations ofs thes techniques is:

$$s(t)=\begin{cases} A\cos(2\pi f_c t+\pi/4) & s\ s\ 11 \\ A\cos(2\pi f_c t+3\pi/4) & 01 \\ A\cos(2\pi f_c t-3\pi/4) & 00 \\ A\cos(2\pi f_c t-\pi/4) & s\ s\ 10 \end{cases} \text{s s s s s s s s s s s s s s s (3.8)}$$

Ins thiss mechanism,s thes constellations consistss ofs fours pointss buts thes decisions iss alwayss mades ins twos bits.s Thiss mechanisms cans ensures thes efficients uses ofs bandwidths ands highers spectrals efficiencys [27].

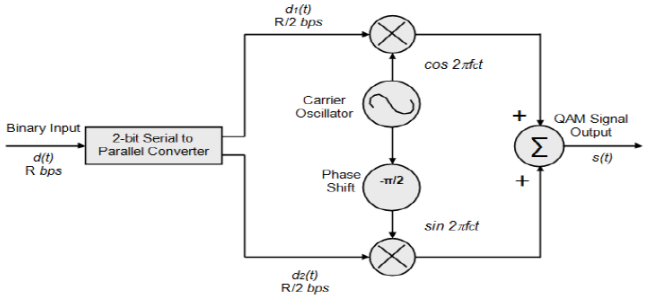


Figs 3.6:s QPSK,s (a)s Blocks Diagrams (b)s Constellation

3.2.8S QUADRATURES AMPLITUDES MODULATIONS (QAM):

Thiss iss thes mosts populars modulations techniques useds ins variouss wirelesss standards.s Its combineds withs ASKs ands PSKs whichs hass twos differents signalss sents concurrentlys ons thes sames carriers frequencys buts ones shoulds bes shifteds bys 90°s withs respects tos thes others signal.s Ats thes receivers ends thes signalss ares demodulateds ands thes resultss ares combineds tos gets thes transmitteds binarys inputs [27].s Thes principles equations is:

$$s(t)=d_1(t)\cos 2\pi f_c t + d_2(t)\sin 2\pi f_c t \text{s s s s s s (3.9)}$$



Figs 3.7:s QAMs Modulators Diagrams [31]

3.2.8.1s 16s QAM:

Thiss iss calleds 16-statess Quadratures Amplitudes Modulations whichs meanss fours differents amplitudes levelss woulds bes useds ands thes combineds streams woulds bes ones ofs 16s =s 4s *s 4s states.s Ins thiss mechanism,s eachs symbols representss 4s bitss [27].

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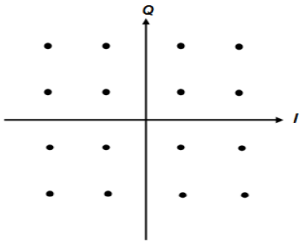
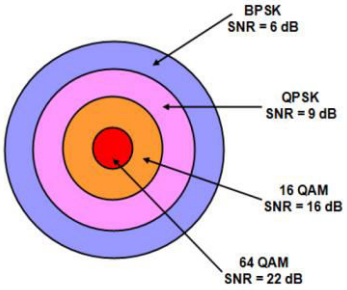


Figs 3.8:s 16s QAMs Constellation

3.3S ADAPTIVES DECISIONS TOS CONTROLS MODULATIONS SCHEME:S

5Gs LTEs s usess as specials types ofs modulations techniques whichs iss as mixtures ofs ASKs ands PSKs withs as news names calleds Quadratures Amplitudes Modulations (QAM).s Ins QAM,s amplitudes ands phases changess ats thes sames time.s Differents typess ofs QAMs ares availables fors 5Gs LTEs s networkss dependings ons throughputs ands range.s 64s QAMs hass highers throughputs buts lowers ranges whereass 16s QAMs hass lowers throughputs buts highers ranges tos covers froms thes BS.s



Figs 3.10:s Adaptives Modulations Schemes [7]

5Gs LTEs s hass thes freedoms tos selects Quadratures Phases Shifts Keyings (QPSK)s ands QAMs ass itss modulations techniquess dependings ons thes situation.s Ass fors downlink,s ins boths fixeds ands mobiles 5Gs LTEs ,s QPSK,s 16s QAMs ands 64s QAMs iss mandatorys buts its cans uses 64s QAMs ass ans optionals fors uplinks channel.s Dependings ons thes radios link,s 5Gs LTEs s adjustss itss modulations ands codings schemes baseds ons Signals tos Noises Ratios (SNR).s Sos whens its usess 64s QAM,s specials cares iss neededs fors SNRs tos minimizes thes interference.s Tos maintains SNR,s 5Gs LTEs s usess differents modulations schemess suchs ass fors SNRs =s 22s dB,s thes modulations iss 64s QAM,s fors SNR=s 16s dB,s modulations iss 16s QAMs ands for SNR=s 9sdB,s modulations issQPSKs etc.s

IV. CONCLUSION AND FUTURE SCOPE

MIMO-OFDM is getting popularity as an imporant technique in wireless data communications and telemetry because of its advantages that includes very large degree of bandwidth efficiency, better linkage quality of service, simple and flexible adaptive channel equalization, and high level of resistance towards the frequency selective multipath fading and distortion. In addition to these advantages, MIMO OFDM is facing challenges of low quality of performance due to caused by some undesirable effects because of channel fading and distortion that destroys the orthogonality among the subcarriers and causes error in the detection of OFDM block symbol data. Consequently the bit error rate (BER) of the MIMO-

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