EE45GS Project

1500 word report with recommendations on 5G system implementation and design trade-offs

The objective of the project work is to evaluate and critically reflect on current research to discuss possible solutions to a 5G system design problem.

Task: design, analyse and compare GFDM and OFDM Modulation Formats for 5G systems.

(i) Create a user-friendly signal processing algorithm, which generates GFDM and OFDM signals within a flexible range of parameters (enabling any user to define parameters in easy and simple manner). The algorithm should include quantitative assessment metrics, such as SER, BER and Q-factor. The user of the code should be able to receive results, such as spectrum, eye-diagram, constellation diagrams and performance metrics in a clear user-friendly manner.
(ii) There will be many different ways to design the code but you should optimise your design to give as low complexity as possible within a fixed system parameters. Reflect how your design choices affect spectral efficiency.
(iii) A user manual should be created containing clear manual on how the code can be used, including any potential bugs or unrealistic parameters. The manual should include description of the system components and their representation in the algorithm.
(iv) Create a written report presenting analysis of pros and cons of different approaches and give recommendations on trade-offs between energy efficiency and implementation complexity for two formats in question. The report should include a thorough and comprehensive analysis of the anticipated system performance and potential applications; incorporate critical analysis of the appropriate literature and state-of-the-art signal formats in 5G. Relate your work to 5G standards, aims and implementation challenges.

Submissions will be electronic on Blackboard & you should submit a single PDF file comprising (total length limit - 10 pages):

1) **an algorithm including manual**
2) **a written report**

Marking Scheme

	<50%	50-69%	70-84%	85%+ Outstanding
Performance metrics (20%) A clear analysis of the complexity and performance metrics and comparison to existing standards	Performance metrics are not clearly related to complexity of the methods Gains are not analysed Methodology for complexity estimations is not correct The relation to 5G system design is not clearly communicated	Methodology for complexity estimations is correct The relation to 5G system design is not clearly communicated The analysis of gain vs complexity is not performed Complexity of the design is calculated, comparison to the other standard designs is not performed	All performance metrics are well understood and interpreted in relation to 5G system design and components The analysis of gain vs complexity is not performed Complexity of the design is calculated, comparison to the other standard designs is not performed	All performance metrics are well understood and interpreted in relation to 5G system design and components Comprehensive analysis of gain vs complexity is performed Complexity of the design is calculated and discussed in comparison of the standard design
Background and Summary (20%) A description of the physical effects affecting signal transmission in a network. A deep understanding of the physical layer should be demonstrated. The analysis of the major outcomes and limitations of the system are anticipated.	A description of the physical effects affecting signal transmission in a network is not full and demonstrates a lack of understanding of physical layer	A description of the physical effects affecting signal transmission in a network is comprehensive An understanding of the physical layer is limited The analysis of the major outcomes and limitations of the system is not full	A description of the physical effects affecting signal transmission in a network A deep understanding of the physical layer The analysis of the major outcomes and limitations of the system is not full	A comprehensive description of the physical effects affecting signal transmission in a network. A deep understanding of the physical layer should be demonstrated. The comprehensive analysis of the major outcomes and limitations of the system
Methodology (30%) List of the components and devices used. A diagram and description of the system setup. A critical description of the relationship between components. A description of the software algorithms required for the signal analysis. A short discussion of the sources of signal distortions.	List of the components and devices lacks major components A diagram and description of the system setup is not correct A critical description of the relationship between components, A description of the software algorithms required for the signal analysis, A short discussion of the sources of signal distortions – is absent	List of the components and devices used, but may miss a few components A diagram and description of the system setup, but may lack a few parts A description of the relationship between components Is not comprehensive A description of the software algorithms required for the signal analysis – is not comprehensive A discussion of the sources of signal distortions – is not comprehensive	List of the components and devices used is thorough A diagram and description of the system setup is complete A critical description of the relationship between components, lacks deep analysis A description of the software algorithms required for the signal analysis lacks analysis A short discussion of the sources of signal distortions does not demonstrate deep knowledge of physical processes	Comprehensive list of the components and devices used in a network. A comprehensive diagram and description of the system setup. A critical description of the relationship between components. A detailed description of the software algorithms required for the signal analysis. A short but deep discussion of the sources of signal distortions, demonstrating knowledge of physical layer and its relation to system design
Results and analysis. (30%) A comprehensive analysis of the anticipated system performance, identification and analysis of weaknesses in the system.	A superficial analysis of the system performance, Weaknesses in the system are not correctly identified There is no literature analysis present.	A superficial analysis of the system performance Weaknesses are named but their impact is not analysed Superficial literature analysis.	A detailed analysis of the system performance Some weaknesses in the system are not foreseen Detailed literature analysis.	A thorough and comprehensive analysis of the anticipated system performance, Thorough identification and analysis of weaknesses in the system