



Faculty of Engineering & Technology
Electrical & Computer Engineering Department
Wireless and Mobile Networks, ENCS5323

Course Project

Online Calculator for Wireless and Mobile Networks

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Home Page:

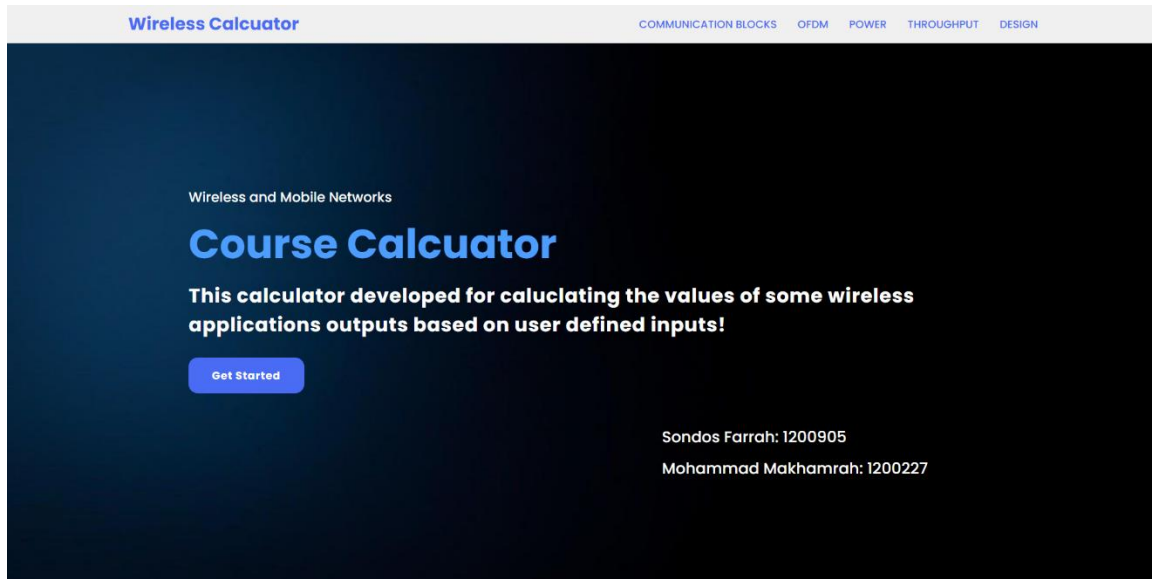


Figure 1: Home Page

This Project was implemented using HTML, CSS and JavaScript.

You can find the web page in this URL:

<https://mohammadmakhamreh.github.io/WirelessCaluculator/>

and the project source files in this GitHub link:

[mohammadmakhamrah/WirelessCaluculator \(github.com\)](https://github.com/mohammadmakhamrah/WirelessCaluculator)

1. Communication Blocks Calculator

Wireless Calculator

COMMUNICATION BLOCKS OFDM POWER THROUGHPUT DESIGN

Communication Blocks Calculator

Bandwidth (KHz):
4

Quantizer Levels/Bits:
8 Bits

Source Encoder
Compression Ratio:
0.25

Channel Encoder Rate:
0.5

Interleaver bits:
1024

Calculate

Levels : 256
Sampling Frequency: 8 KHz
Input Source Bit Rate: 64 Bit/sec
Output Source Bit Rate: 16 Bit/Sec
Output Channel Encoder Bit Rate: 32 Kbps
Output Bit Rate at the interleaver: 32 kbps

Figure 2: Test Case 1.1

Wireless Calculator

COMMUNICATION BLOCKS OFDM POWER THROUGHPUT DESIGN

Communication Blocks Calculator

Bandwidth (KHz):
4

Quantizer Levels/Bits:
256 Levels

Source Encoder
Compression Ratio:
0.25

Channel Encoder Rate:
0.5

Interleaver bits:
1024

Calculate

Bits : 8
Sampling Frequency: 8 KHz
Input Source Bit Rate: 64 Bit/sec
Output Source Bit Rate: 16 Bit/Sec
Output Channel Encoder Bit Rate: 32 Kbps
Output Bit Rate at the interleaver: 32 Kbps

Figure 3: Test Case 1.2

Wireless Calculator

COMMUNICATION BLOCKS
OFDM
POWER
THROUGHPUT
DESIGN

Communication Blocks Calculator

Bandwidth (KHz):

8

Quantizer Levels/Bits:

3

Bits

Source Encoder Compression Ratio:

0.5

Channel Encoder Rate:

0.8

Interleaver bits:

256

Calculate

Levels : 8

Sampling Frequency: 16 KHz

Input Source Bit Rate: 48 Bit/sec

Output Source Bit Rate: 24 Bit/Sec

Output Channel Encoder Bit Rate: 30 Kbps

Output Bit Rate at the interleaver: 30 Kbps

Figure 4: Test Case 1.3

2. OFDM Calculator

Wireless Calculator

COMMUNICATION BLOCKS
OFDM
POWER
THROUGHPUT
DESIGN

OFDM Calculator

Bandwidth of each resource block:

180

KHz

Subcarrier Spacing:

15

KHz

Resource Block Duration:

0.5

msec

Select QAM number:

1024

Number of OFDM:

7

Number of parallel resource blocks for a user:

4

Calculate

Number of bits per resource element: 10

Number of OFDM symbols: 120

Number of bits per OFDM resource block: 840

Maximum transmission rate for the user: 6720000 bits/second

Figure 5: Test Case 2.1

Wireless Calculator

COMMUNICATION BLOCKS
OFDM
POWER
THROUGHPUT
DESIGN

OFDM Calculator

Bandwidth of each resource block:

100

KHz

Subcarrier Spacing:

15

KHz

Resource Block Duration:

0.5

msec

Select QAM number:

1024

Number of OFDM:

7

Number of parallel resource blocks for a user:

4

Calculate

The result of bandwidth divided by subcarrier spacing must be a whole number.

Figure 6: Test Case 2.2

Wireless Calculator

COMMUNICATION BLOCKS
OFDM
POWER
THROUGHPUT
DESIGN

OFDM Calculator

Bandwidth of each resource block:

150

KHz

Subcarrier Spacing:

10

KHz

Resource Block Duration:

0.5

msec

Select QAM number:

256

Number of OFDM:

4

Number of parallel resource blocks for a user:

1

Calculate

Number of bits per resource element: 8
Number of OFDM symbols: 120
Number of bits per OFDM resource block: 480
Maximum transmission rate for the user: 960000 bits/second

Figure 7: Test Case 2.3

3. Power Calculator

Wireless Calculator

COMMUNICATION BLOCKS OFDM POWER THROUGHPUT DESIGN

Power Calculator

Frequency:	Modulation Technique:	Fade Margin:
900	8-PSK	8 dB
Path Loss:	Other Losses:	Transmit Antenna Gain:
140 dB	20 dB	8 dB
Receive Antenna Gain:	Transmit Amplifier Gain:	Receive Amplifier Gain:
0 dB	0 dB	24 dB
Data Rate:	Noise Temperature:	Link Margin:
9.6 kbps	290 kelvin	8 dB
Antenna Feed Line Loss:	Noise Figure Total:	BER:
12 dB	6 dB	0.0001

Calculate Power transmitted

Power Transmitted (dB): 9.85
Power Transmitted (Watt): 9.65

Figure 8: Test Case 3.1

Wireless Calculator

COMMUNICATION BLOCKS OFDM POWER THROUGHPUT DESIGN

Power Calculator

Frequency:	Modulation Technique:	Fade Margin:
900	8-PSK	8 dB
Path Loss:	Other Losses:	Transmit Antenna Gain:
130 dB	20 dB	8 dB
Receive Antenna Gain:	Transmit Amplifier Gain:	Receive Amplifier Gain:
0 dB	5 watt	5 watt
Data Rate:	Noise Temperature:	Link Margin:
9.6 kbps	290 kelvin	8 dB
Antenna Feed Line Loss:	Noise Figure Total:	BER:
12 watt	6 dB	0.0001

Calculate Power transmitted

Power Transmitted (dB): 8.66
Power Transmitted (Watt): 7.34

Figure 9: Test Case 3.2

Wireless Calculator
COMMUNICATION BLOCKS
OFDM
POWER
THROUGHPUT
DESIGN

Power Calculator

Frequency:	900	Modulation Technique:	16-PSK	Fade Margin:	8 dB
Path Loss:	130 dB	Other Losses:	20 dB	Transmit Antenna Gain:	8 dB
Receive Antenna Gain:	0 dB	Transmit Amplifier Gain:	5 watt	Receive Amplifier Gain:	5 watt
Data Rate:	9.6 kbps	Noise Temperature:	290 kelvin	Link Margin:	8 dB
Antenna Feed Line Loss:	12 watt	Noise Figure Total:	6 dB	BER:	0.0001

Calculate Power transmitted

Power Transmitted (dB): 8.66
Power Transmitted (Watt): 7.34

Figure 10: Test Case 3.3

4. Throughput Calculator

Throughput Calculator

Bandwidth (Mbps):	20	Multiple Access Technique:	Unslotted Nonpersistent
Propagation Time:	40	Frame Size (kbit):	10
		Frame Rate (Ktps):	5

Calculate Throughput

Unslotted Nonpersistent Throughput: 67.22%

Figure 11: Test Case 4.1

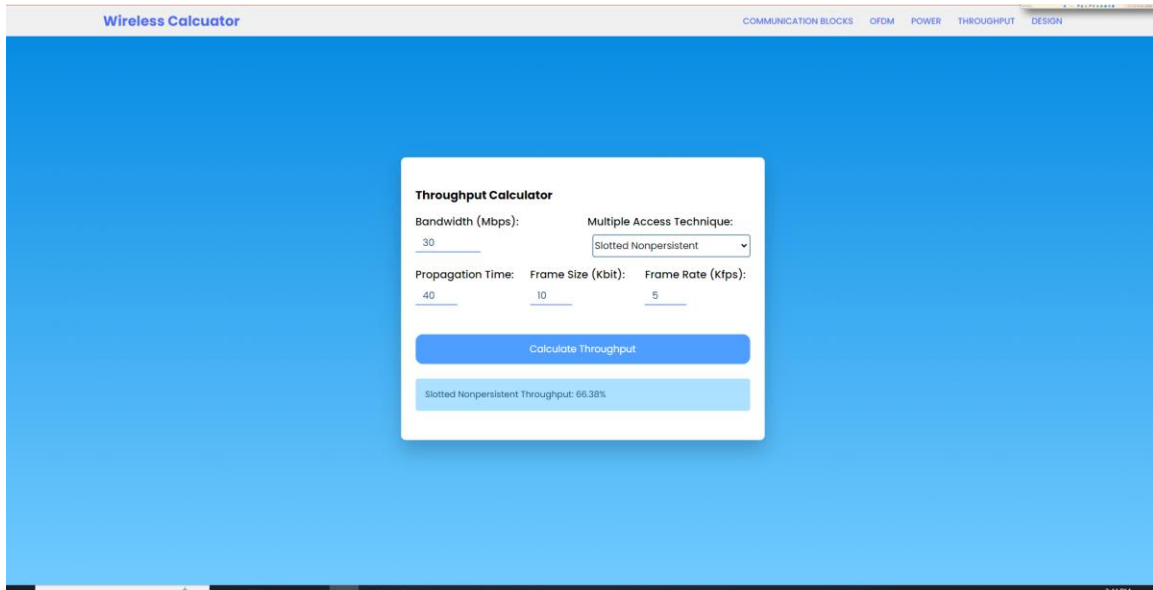


Figure 12: Test Case 4.2

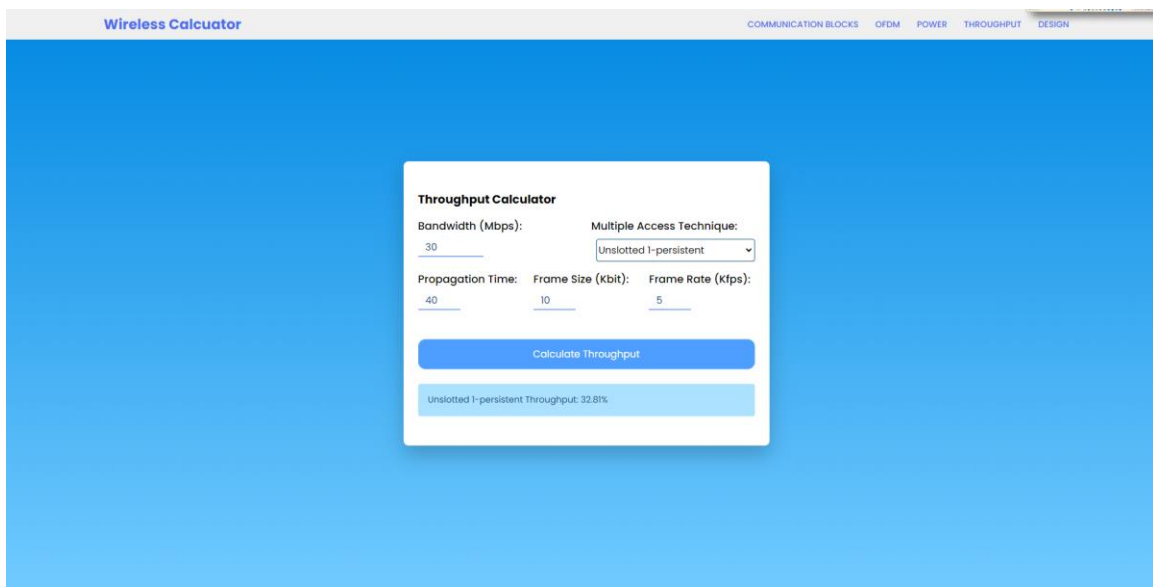


Figure 13: Test Case 4.3

Wireless Calculator
COMMUNICATION BLOCKS
OFDM
POWER
THROUGHPUT
DESIGN

Throughput Calculator

Bandwidth (Mbps):
30

Multiple Access Technique:
Slotted 1-persistent

Propagation Time:
40

Frame Size (kbit):
10

Frame Rate (Ktps):
5

Calculate Throughput

Slotted 1-persistent Throughput: 35.04%

Figure 14: Test Case 4.4

5. Design Calculator

Wireless Calculator
COMMUNICATION BLOCKS
OFDM
POWER
THROUGHPUT
DESIGN

Design Calculator

Area (Km²):
4

Number of subscribers:
80000

Minimum SIR (dB):
13

Average call duration (minutes):
3

Reference distance (meters):
10

Average calls per day per subscriber:
8

Reference power (dB):
-22

Call drop probability:
0.02

Path loss exponent:
3

Receiver sensitivity (μW):
7

Timeslots per carrier:
8

Calculate

Maximum distance between transmitter and receiver for reliable communication: 96.60 meters
Maximum cell size assuming hexagonal cells: 24243.01 square meters
Number of cells in the service area: 165.00
Traffic load in the whole cellular system: 1333.333 Erlangs
Traffic load in each cell: 8.081 Erlangs
Number of cells in each cluster: 9
Minimum number of carriers needed to achieve the required Quality of Service: 2 Carriers

Figure 15: Test Case 5.1

Wireless Calculator
COMMUNICATION BLOCKS
OFDM
POWER
THROUGHPUT
DESIGN

Design Calculator

Area (Km ²):	Number of subscribers:	Minimum SIR (dB):
4	80000	13
Average call duration (minutes):	Reference distance (meters):	Average calls per day per subscriber:
5	10	9
Reference power (dB):	Call drop probability:	Path loss exponent:
-22	0.02	4
Receiver sensitivity (μW):	Timeslots per carrier:	
7	8	

Calculate

Maximum distance between transmitter and receiver for reliable communication: 54.79 meters

Maximum cell size assuming hexagonal cells: 7800.15 square meters

Number of cells in the service area: 512.81

Traffic load in the whole cellular system: 2500.000 Erlangs

Traffic load in each cell: 4.875 Erlangs

Number of cells in each cluster: 4

Minimum number of carriers needed to achieve the required Quality of Service: 2 Carriers

Figure 16: Test Case 5.2

Wireless Calculator
COMMUNICATION BLOCKS
OFDM
POWER
THROUGHPUT
DESIGN

Design Calculator

Area (Km ²):	Number of subscribers:	Minimum SIR (dB):
4	80000	13
Average call duration (minutes):	Reference distance (meters):	Average calls per day per subscriber:
3	10	8
Reference power (dB):	Call drop probability:	Path loss exponent:
-22	0.5	3
Receiver sensitivity (μW):	Timeslots per carrier:	
7	8	

Calculate

Maximum distance between transmitter and receiver for reliable communication: 98.60 meters

Maximum cell size assuming hexagonal cells: 24243.01 square meters

Number of cells in the service area: 165.00

Traffic load in the whole cellular system: 1333.333 Erlangs

Traffic load in each cell: 8.000 Erlangs

Number of cells in each cluster: 9

Minimum number of carriers needed to achieve the required Quality of Service: 1 Carriers

Figure 17: Test Case 5.3