



Faculty of Engineering & Technology
Electrical & Computer Engineering Department

WIRELESS AND MOBILE NETWORKS: ENCS5323

Project: Online Calculator

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Section: 1

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Main Page

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Application1

Validation

Digital Communication System Design and Analysis.

Bandwidth:

Must be a non-negative number.

Number of bits for quantizer:

Must be a non-negative integer (no decimals).

Source encoder rate:

Must be between 0 and 1.

Channel encoder rate:

Must be between 0 and 1.

Number of bits for interleaver:

Must be a non-negative integer (no decimals) and a power of 2.

CALCULATE

Number of bits for interleaver:

Must be a non-negative integer (no decimals) and a power of 2.

CALCULATE

BACK

There is no output.

Scenario1 (midterm)

Digital Communication System Design and Analysis.

Bandwidth:

4000

Number of bits for quantizer:

8

Source encoder rate:

0.25

Channel encoder rate:

0.5

Number of bits for interleaver:

1024

CALCULATE

BACK

The Sampling Frequency = 8000 Samples/s

The Number of Quantization Levels = 256 Levels

The Bit Rate at the Output of the Source Encoder = 16000 bits/s

The Bit Rate at the Output of the Channel Encoder = 32000 bits/s

The Bit Rate at the Output of the Interleaver = 32000 bits/s

Scenario2

Digital Communication System Design and Analysis.

Bandwidth:

1200

Number of bits for quantizer:

7

Source encoder rate:

0.4

Channel encoder rate:

0.3

Number of bits for interleaver:

512

CALCULATE

BACK

The Sampling Frequency = **2400** Samples/s

The Number of Quantization Levels = **128** Levels

The Bit Rate at the Output of the Source Encoder = **6720** bits/s

The Bit Rate at the Output of the Channel Encoder = **22400** bits/s

The Bit Rate at the Output of the Interleaver = **22400** bits/s

Scenario3

Digital Communication System Design and Analysis.

Bandwidth:

3000

Number of bits for quantizer:

6

Source encoder rate:

0.8

Channel encoder rate:

0.6

Number of bits for interleaver:

256

CALCULATE

BACK

The Sampling Frequency = **6000** Samples/s

The Number of Quantization Levels = **64** Levels

The Bit Rate at the Output of the Source Encoder = **28800** bits/s

The Bit Rate at the Output of the Channel Encoder = **48000** bits/s

The Bit Rate at the Output of the Interleaver = **48000** bits/s

Application2

Validation

4G LTE OFDM Transmission Rate Calculator

Bandwidth (kHz):

Bandwidth and subcarrier spacing must be positive numbers, and bandwidth should be divisible by subcarrier spacing.

Subcarrier Spacing (kHz):

Number of OFDM Symbols:

Number of OFDM symbols must be a positive integer.

Duration of the Resource Block (ms):

Duration of the resource block must be a non-negative number.

Number of QAM Bits:

Number of QAM bits must be a non-negative power of 2 (e.g., 16, 32, 1024).

Number of Parallel Resource Blocks:

Number of parallel resource blocks must be a positive integer.

CALCULATE

BACK

Please enter valid inputs for calculations.

There is no output.

Scenario1 (midterm)

4G LTE OFDM Transmission Rate Calculator

Bandwidth (kHz):

180

Subcarrier Spacing (kHz):

15

Number of OFDM Symbols:

7

Duration of the Resource Block (ms):

0.5

Number of QAM Bits:

1024

Number of Parallel Resource Blocks:

4

CALCULATE

BACK

Bits per Resource Element: 10

Bits per OFDM Symbol: 120

Bits per OFDM Resource Block: 840

Maximum Transmission Rate: 6720000 bits/s

Scenario2

4G LTE OFDM Transmission Rate Calculator

Bandwidth (kHz):

200

Subcarrier Spacing (kHz):

10

Number of OFDM Symbols:

8

Duration of the Resource Block (ms):

1

Number of QAM Bits:

64

Number of Parallel Resource Blocks:

3

CALCULATE

BACK

Bits per Resource Element: 6

Bits per OFDM Symbol: 120

Bits per OFDM Resource Block: 960

Maximum Transmission Rate: 2880000 bits/s

Scenario3

4G LTE OFDM Transmission Rate Calculator

Bandwidth (kHz):

300

Subcarrier Spacing (kHz):

50

Number of OFDM Symbols:

10

Duration of the Resource Block (ms):

0.8

Number of QAM Bits:

128

Number of Parallel Resource Blocks:

2

CALCULATE

BACK

Bits per Resource Element: 7

Bits per OFDM Symbol: 42

Bits per OFDM Resource Block: 420

Maximum Transmission Rate: 1050000 bits/s

Application3

Validation

Frequency (MHz):

-9

Frequency must be a non-negative number.

Transmit Antenna Gain:

dB ▼

Receive Antenna Gain:

dB ▼

Data Rate (kbps):

-8

Data Rate must be a non-negative number.

Scenario1 (midterm)

Transmit Power Calculator

Path Loss:

dB ▾

140

Frequency (MHz):

900

Transmit Antenna Gain:

dB ▾

8

Receive Antenna Gain:

dB ▾

0

Data Rate (kbps):

9.6

Antenna Feed Line Loss:

dB ▾

12

Other Losses:

dB ▾

20

Fade Margin:

dB ▾

8

Receiver Amplifier Gain:

dB ▾

24

Noise Figure:

dB ▾

6

Noise Temperature (K):

290

Link Margin:

dB ▾

8

Modulation Type:

8-PSK ▾

Maximum bit error rate [0.1, 0.01, 0.001, 0.0001, 0.00001, 0.000001, 0.0000001] any other value consider as zero Eb/No

0.0001

CALCULATE

BACK

Required Transmit Power in dB: 9.65 dB

Required Transmit Power in watt: 9.22 watt

Required Transmit Power in dBm: 39.65 dBm

Scenario2

Transmit Power Calculator

Path Loss:

dB ▾

160

Frequency (MHz):

700

Transmit Antenna Gain:

dB ▾

6

Receive Antenna Gain:

dB ▾

1

Data Rate (kbps):

8

Antenna Feed Line Loss:

dB ▾

14

Other Losses:

dB ▾

25

Fade Margin:

dB ▾

9

Receiver Amplifier Gain:

dBm ▾

50

Noise Figure:

dBm ▾

37

Noise Temperature (K):

300

Link Margin:

Watt ▾

20

Modulation Type:

16-PSK ▾

Maximum bit error rate [0.1, 0.01, 0.001, 0.0001, 0.00001, 0.000001, 0.0000001] any other value consider as zero Eb/No

0.01

CALCULATE

BACK

Required Transmit Power in dB: 47.51 dB

Required Transmit Power in watt: 56379.38 watt

Required Transmit Power in dBm: 77.51 dBm

Scenario3

Transmit Power Calculator

Path Loss:

dBm ▾

200

Frequency (MHz):

5000

Transmit Antenna Gain:

Watt ▾

200

Receive Antenna Gain:

Watt ▾

100

Data Rate (kbps):

11

Antenna Feed Line Loss:

dBm ▾

40

Other Losses:

dBm ▾

35

Fade Margin:

dB ▾

12

Receiver Amplifier Gain:

dB ▾

12

Noise Figure:

dB ▾

24

Noise Temperature (K):

300

Link Margin:

dB ▾

23

Modulation Type:

BPSK/QPSK ▾

Maximum bit error rate [0.1, 0.01, 0.001, 0.0001, 0.00001, 0.000001, 0.0000001] any other value consider as zero Eb/No

0.001

CALCULATE

BACK

Required Transmit Power in dB: 32.57 dB

Required Transmit Power in watt: 1808.69 watt

Required Transmit Power in dBm: 62.57 dBm

Appliation4

Validation

Network Throughput Calculator

Data Transmission Bandwidth (Mbps):

-20

Data transmission bandwidth must be a non-negative number.

Protocol Type:

Pure ALOHA

Maximum Signal Propagation Delay (μsec):

-6

Maximum time propagation delay must be non-negative number.

Frame Size (Kbits):

-9

Frame size must be non-negative number.

Frame Rate (Kfps):

-5

Frame rate must be a non-negative number.

CALCULATE

BACK

Invalid inputs. Please check the errors above and correct them.

Scenario1: Pure ALOHA

Network Throughput Calculator

Data Transmission Bandwidth (Mbps):

10

Protocol Type:

Pure ALOHA

Maximum Signal Propagation Delay (μsec):

30

Frame Size (Kbits):

7

Frame Rate (Kfps):

5

CALCULATE

BACK

T: 0.0007 second

G: 3.5000

alpha: 0.0429 second

Throughput (S): 0.002438024364268783

Throughput (S): 0.24%

Scenario2: Slotted ALOHA

Network Throughput Calculator

Data Transmission Bandwidth (Mbps):

15

Protocol Type:

Slotted ALOHA

Maximum Signal Propagation Delay (μsec):

65

Frame Size (Kbits):

12

Frame Rate (Kfps):

13

CALCULATE

BACK

T: 0.0008 second

G: 10.4000

alpha: 0.0812 second

Throughput (S): 0.008251064768218934

Throughput (S): 0.83%

Scenario3: Unslotted Nonpersistent CSMA (midterm)

Network Throughput Calculator

Data Transmission Bandwidth (Mbps):

20

Protocol Type:

Unslotted Nonpersistent CSMA ▼

Maximum Signal Propagation Delay (μsec):

40

Frame Size (Kbits):

10

Frame Rate (Kfps):

5

CALCULATE

BACK

T: 0.0005 second

G: 2.5000

alpha: 0.0800 second

Throughput (S): 0.6722186073650828

Throughput (S): 67.22%

Scenario4: Slotted Nonpersistent CSMA

Network Throughput Calculator

Data Transmission Bandwidth (Mbps):

Protocol Type:

Slotted Nonpersistent CSMA

Maximum Signal Propagation Delay (μsec):

Frame Size (Kbits):

Frame Rate (Kfps):

CALCULATE

BACK

T: 0.0001 second

G: 2.4000

alpha: 0.3000 second

Throughput (S): 0.8852593913626363

Throughput (S): 88.53%

Scenario5: Unslotted 1-persistent CSMA

Network Throughput Calculator

Data Transmission Bandwidth (Mbps):

Protocol Type:

Unslotted 1-persistent CSMA ▼

Maximum Signal Propagation Delay (µsec):

Frame Size (Kbits):

Frame Rate (Kfps):

CALCULATE

BACK

T: 0.0001 second

G: 2.3497

alpha: 0.2741 second

Throughput (S): 0.10886894015691631

Throughput (S): 10.89%

Scenario6: Slotted 1-persistent CSMA

Network Throughput Calculator

Data Transmission Bandwidth (Mbps):

211

Protocol Type:

Slotted 1-persistent CSMA ▼

Maximum Signal Propagation Delay (µsec):

54

Frame Size (Kbits):

123

Frame Rate (Kfps):

2

CALCULATE

BACK

T: 0.0006 second

G: 1.1659

alpha: 0.0926 second

Throughput (S): 0.4616480850312269

Throughput (S): 46.160000000000004%

Application5

Validation

Cellular System Calculator

Number of timeslots per carrier

8.5

Area of the city (m²):

-4000000

Number of subcarriers:

70000.8

Number of calls per day:

-9

Average call duration (minutes):

-3

Call drop probability: (0.1%, 0.2%, 0.5%, 1% ,1.2% ,1.3%, 1.5%, 2%, 3%, 5%, 7%, 10%, 15%, 20%, 30%)

-8

Minimum SIR needed:

dB ▾

Distance from base station (m):

-10

Power measured at reference distance:

dB ▾

Path loss exponent:

Receiver sensitivity (μW):

CALCULATE

BACK

Area, Calls Per Day, Call Duration, Base Station Distance, Time Slots, and Call Drop Probability must be non-negative numbers, and Time Slots must be an integer.
Subcarriers must be a non-negative integer and not a decimal number.

Scenario1 (worksheet2)

Cellular System Calculator

Number of timeslots per carrier

8

Area of the city (m²):

4000000

Number of subcarriers:

80000

Number of calls per day:

8

Average call duration (minutes):

3

Call drop probability: (0.1%, 0.2%, 0.5%, 1% ,1.2% ,1.3%, 1.5%, 2%, 3%, 5%, 7%, 10%, 15%, 20%, 30%)

0.02

Minimum SIR needed:

dB ▾

13

Distance from base station (m):

10

Power measured at reference distance:

dB ▾

-22

Path loss exponent:

3

Receiver sensitivity (μW):

7

CALCULATE

BACK

a) Maximum distance between transmitter and receiver: 96.598 meters

b) Maximum cell size: 24243.009 square meters

c) Number of cells in the service area: 164.996

d) Total traffic in the system: 1333.333 Erlangs

e) Traffic load per cell: 8.081 Erlangs

f) Number of cells in each cluster: 8.097 which is 9

g) Minimum number of carriers needed: 1.750

Scenario2

Cellular System Calculator

Number of timeslots per carrier

9

Area of the city (m²):

4500000

Number of subcarriers:

70000

Number of calls per day:

7

Average call duration (minutes):

4

Call drop probability: (0.1%, 0.2%, 0.5%, 1% ,1.2% ,1.3%, 1.5%, 2%, 3%, 5%, 7%, 10%, 15%, 20%, 30%)

0.05

Minimum SIR needed:

dBm ▾

40

Distance from base station (m):

15

Power measured at reference distance:

dBm ▾

5

Path loss exponent:

4

Receiver sensitivity (μW):

9

CALCULATE

BACK

a) Maximum distance between transmitter and receiver: **64.943** meters

b) Maximum cell size: **10957.542** square meters

c) Number of cells in the service area: **410.676**

d) Total traffic in the system: **1361.111** Erlangs

e) Traffic load per cell: **3.314** Erlangs

f) Number of cells in each cluster: **2.582** which is 3

g) Minimum number of carriers needed: **0.778**

Scenario3

Cellular System Calculator

Number of timeslots per carrier

7

Area of the city (m²):

40000000

Number of subcarriers:

75000

Number of calls per day:

8

Average call duration (minutes):

5

Call drop probability: (0.1%, 0.2%, 0.5%, 1%, 1.2%, 1.3%, 1.5%, 2%, 3%, 5%, 7%, 10%, 15%, 20%, 30%)

0.1

Minimum SIR needed:

dBm

50

Distance from base station (m):

14

Power measured at reference distance:

dB

-20

Path loss exponent:

2

Receiver sensitivity (μW):

10

CALCULATE

BACK

a) Maximum distance between transmitter and receiver: **442.719** meters

b) Maximum cell size: **509222.937** square meters

c) Number of cells in the service area: **78.551**

d) Total traffic in the system: **2083.333** Erlangs

e) Traffic load per cell: **26.522** Erlangs

f) Number of cells in each cluster: **200.000** which is **201**

g) Minimum number of carriers needed: **4.143**

GitHub Link

[Main Page \(mohammadabushams02.github.io\)](https://mohammadabushams02.github.io)