Appendix

Appendix A:

Visual basic code

Private Sub Command1_Click()
    Dim w, r, g, d, x As Double
    w = 1250000
    r = 19530
    g = 2.55
    d = 0.4
    n = 2
    x = w / (r * ((n - 1) * d / g))
    While x > 3.98107
        x = w / (r * ((n - 1) * d / g))
        n = n + 1
    Wend
    T1.Text = n
    Text1.Text = x
End Sub
Appendix B:

MATLAB CODE

```matlab
sim_time=3600;
number_of_mobile =10000;
average_interarrival=10; % its the average time between calls in second
interarrival=poissrnd(average_interarrival,number_of_mobile,1);
plot(interarrival)
xlabel('mobile index')
ylabel('interarrival time [second]')
grid
figure
hist(interarrival,100)
xlabel('interarrival time [second]')
ylabel('number of mobile')
grid
arrival_time=cumsum(interarrival)
figure
plot(arrival_time)
xlabel('mobile index')
ylabel('arrival time [second]')
grid
figure
hist(interarrival,100)
xlabel('arrival time [second]')
ylabel('number of mobile')
```

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grid
call_duration=exprnd(180,number_of_mobile,1)
    count_user=103
tt=call_duration+arrival_time
for t=1:sim_time
    if (arrival_time<t)&(tt<t)
        count_user=count_user+1
    end
    if (arrival_time<t)&(tt>t)
        %count_user=count_user-1
    end
end
energy_per_noise=1250000/(19530*((count_user-1)*0.4/2.55))
if energy_per_noise >=3.98
    status='this suitable spectral efficiency ' 
end
end
Appendix C:

**Spectral efficiency**

\(G = 1, d = 1, E_b/N_0 = 8 \text{ dB} = 6.31, W = 1.25 \text{ MHz}, R = 19.5 \text{ kHz} \text{ and } n/S = 0\)

\(N = 11.1\)

This gives a spectral efficiency of only:

\[\frac{111 \times 19530}{125 \times 10^8} = 0.0173 \text{ bits/Hz}\]

\(G = 2.55, d = 0.4, E_b/N_0 = 8 \text{ dB} = 6.31, W = 1.25 \text{ MHz}, R = 19.5 \text{ kHz} \text{ and } n/S = 0\)

\(N = 65.7\)

The spectral efficiency is thus

\[\frac{65.7 \times 19.53 \times 10^3}{1.25 \times 10^6} = 1.026 \text{ bit/Hz}\]