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

```
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')
```

```
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, $\mathbf{E_b/N_o}$ = 8 dB = 6.31, **W** = 1.25 MHz, **R** = 19.5 kHz and **n/S** = 0

N = 11.1

This gives a spectral efficiency of only:

$$= \frac{11.1 \times 19530}{1.25 \times 10^6} = 0.173 bits / Hz$$

G = 2.55, **d** = 0.4, $\mathbf{E_b/N_o}$ = 8 dB = 6.31, **W** = 1.25 MHz, **R** = 19.5 kHz and **n/S** = 0

N = 65.7

The spectral efficiency is thus

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