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```
%Simulation window parameters
r = [1 10 20 30 40 50 60 70 80 90 100] ; %radius of disk

ht = 30;          %height of BS
hr = 3;           %height of receiver


fc = 900; %freq = 900 MHz

P_r_avg1 = zeros(1,length(r));
SNR_avg1 = zeros(1,length(r));
```

PPP

```
for i = 1:length(r)

xx0=0; yy0=0; %centre of disk
areaTotal=pi*r(i)^2; %area of disk

lambda=2; %density
%Simulate Poisson point process
numbPoints=poissrnd(areaTotal*lambda);%Poisson number of points
theta=2*pi*(rand(numbPoints,1)); %angular coordinates
rho=r(i)*sqrt(rand(numbPoints,1)); %radial coordinates

%Convert from polar to Cartesian coordinates
[xx,yy]=pol2cart(theta,rho); %x/y coordinates of Poisson points
%Shift centre of disk to (xx0,yy0)

xx=xx+xx0;
yy=yy+yy0;
```

Urban PL

```
a_hr_f = (3.2*(log10(11.75*hr))^2 - 4.97);
C = 3;      %urban region

PL = [];
```

```matlab
for ind = 1:length(xx)
    d = sqrt((xx(i)-xx0)^2 + (yy(i)-yy0)^2)/1000;
    PL = [PL 46.3 + 33.9*log10(fc) - 13.82*log10(ht) - a_hr_f + ...
        (44.9 - 6.55*log10(ht))*log10(d) + C];
end

Pt_1 = 0*ones(1,length(PL));        %dBW (transmit power = 1W)
Pt_2 = 6.9897*ones(1,length(PL));   %5W

Pr1 = Pt_1 - PL;
P_r_avg1(i) = mean(Pr1);

Pr2 = Pt_2 - PL;
P_r_avg2(i) = mean(Pr2);
```
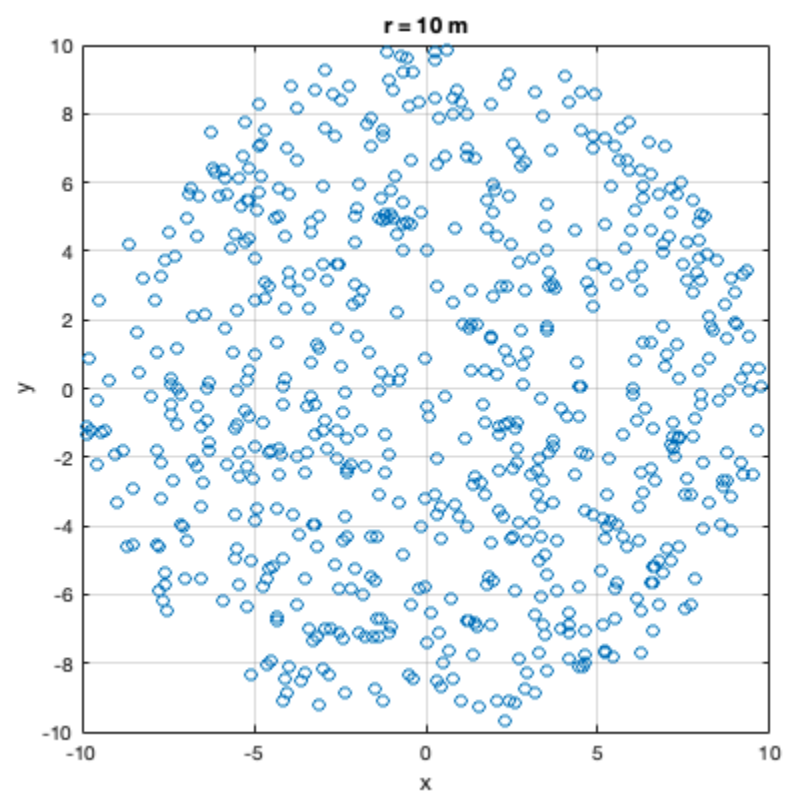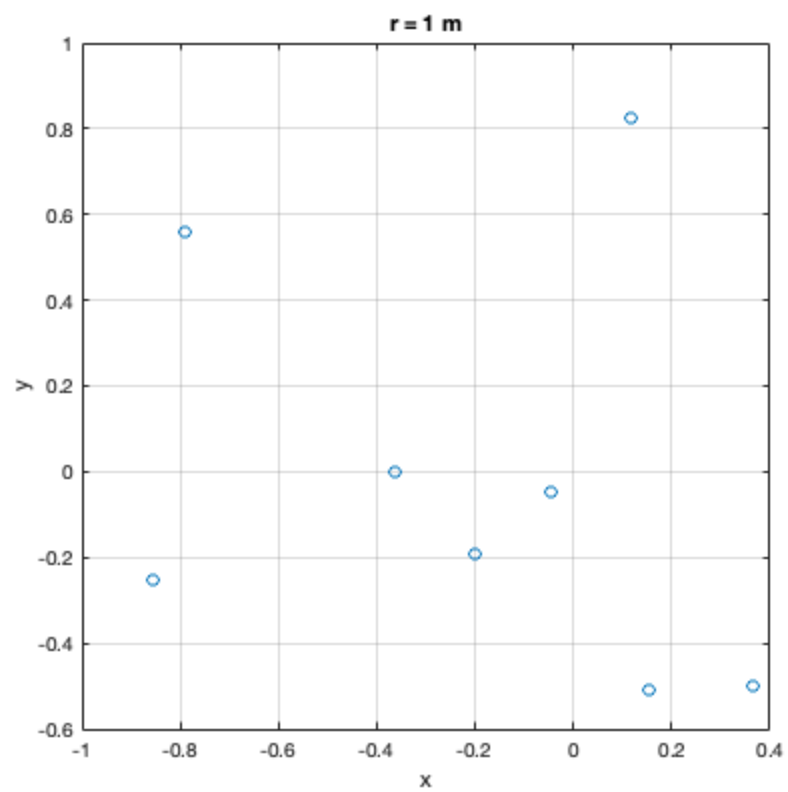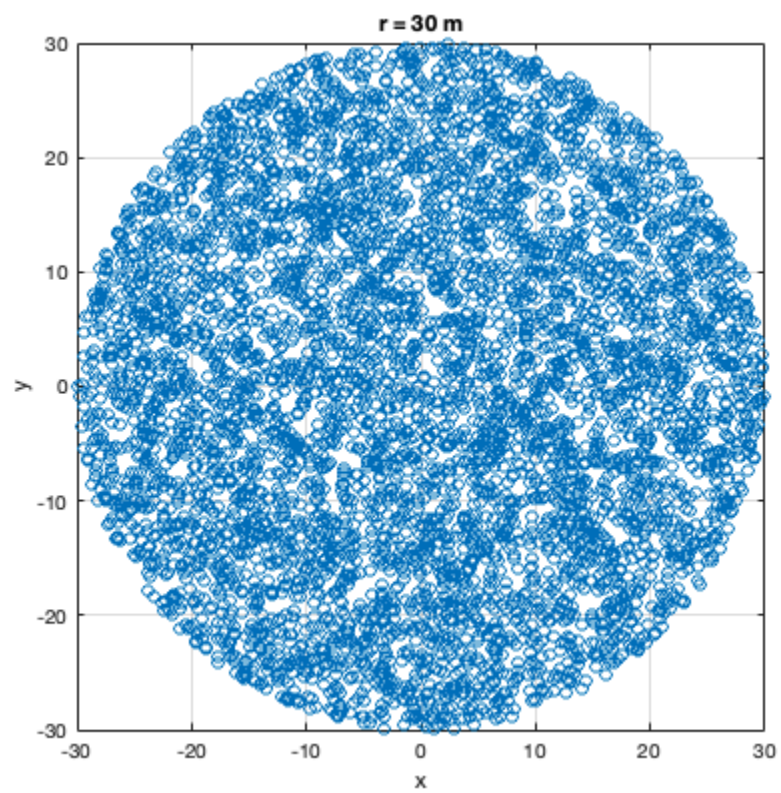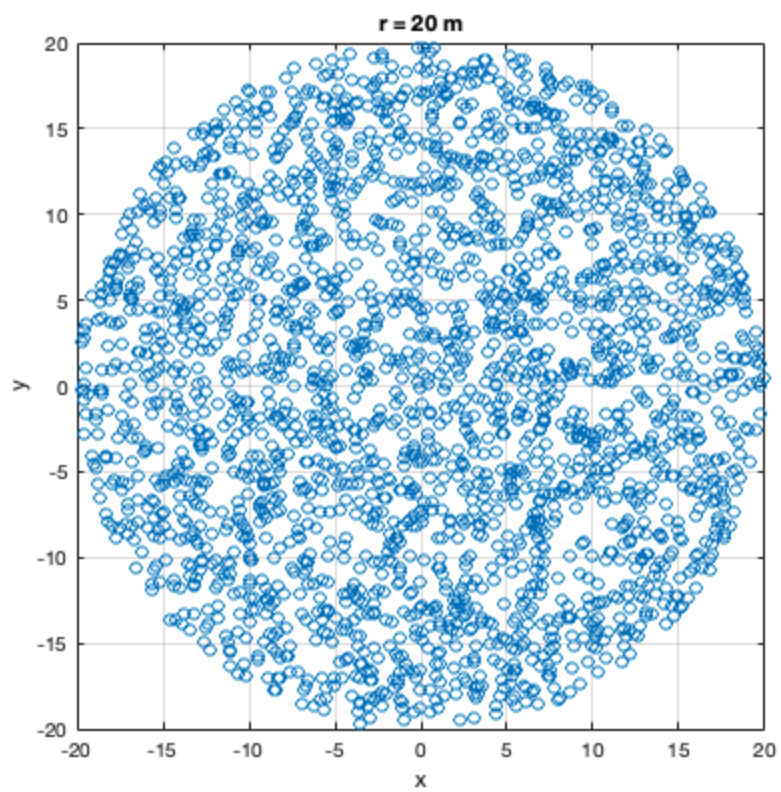
SNR

```matlab
N0 = -204; %dBW

SNR1 = Pr1 - N0;
SNR_avg1(i) = mean(SNR1);

SNR2 = Pr2 - N0;
SNR_avg2(i) = mean(SNR2);
```
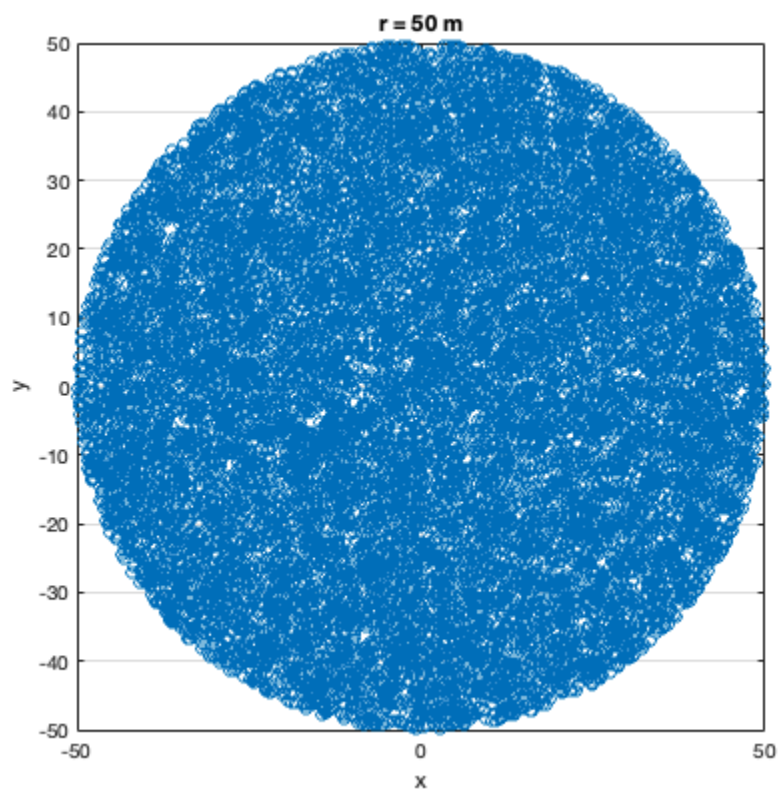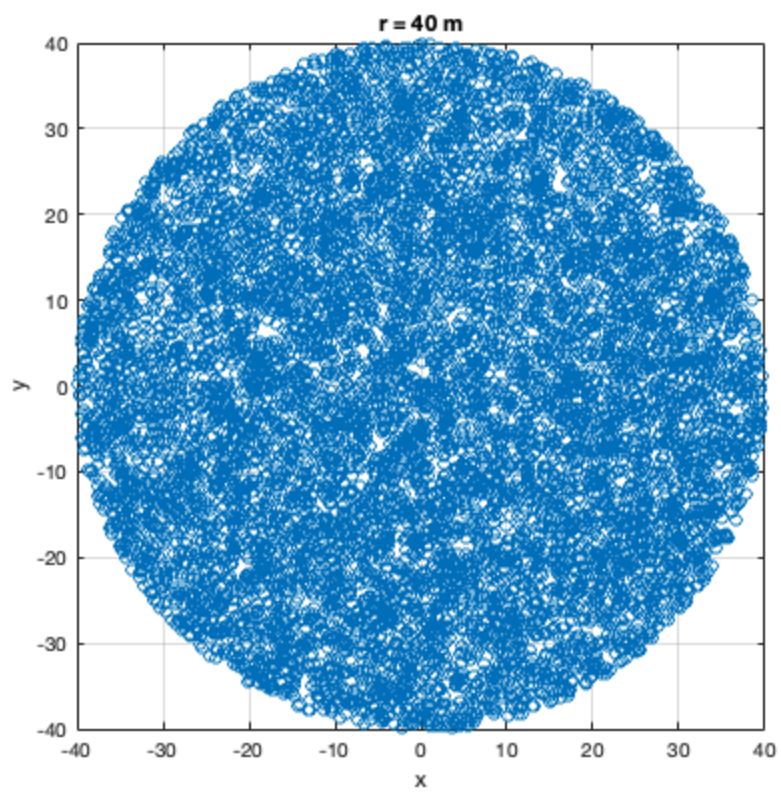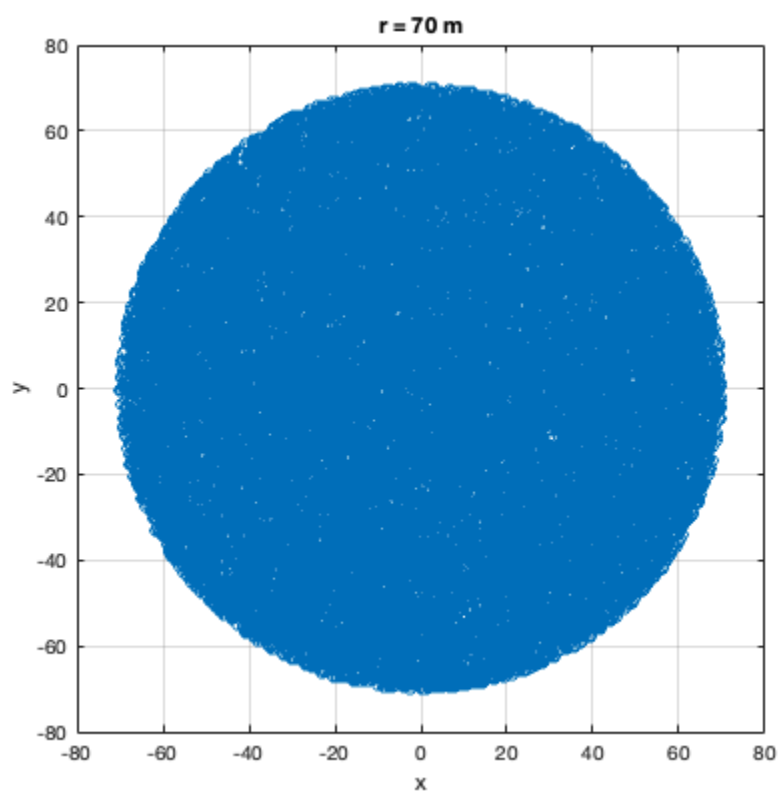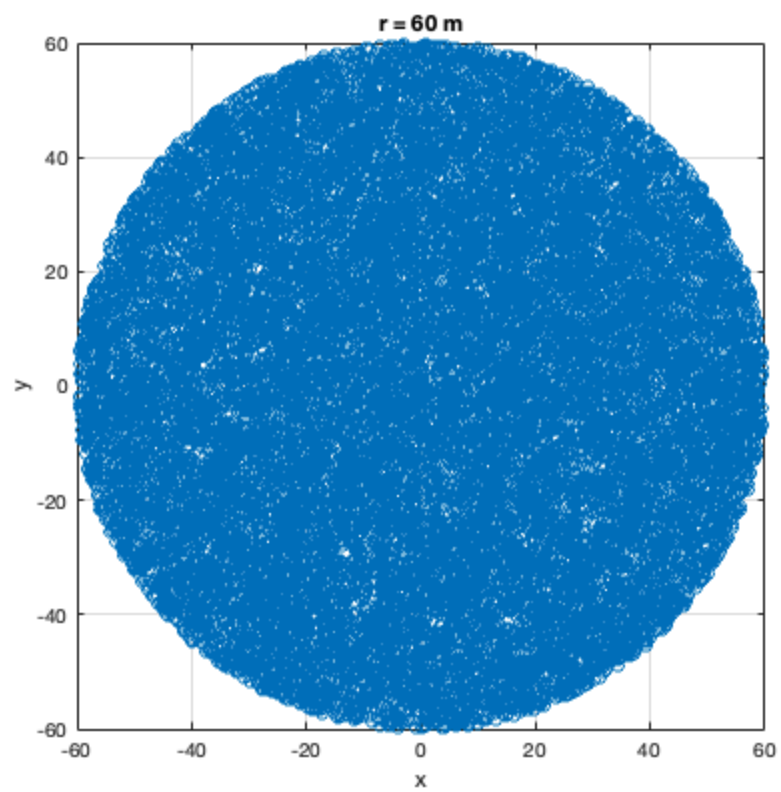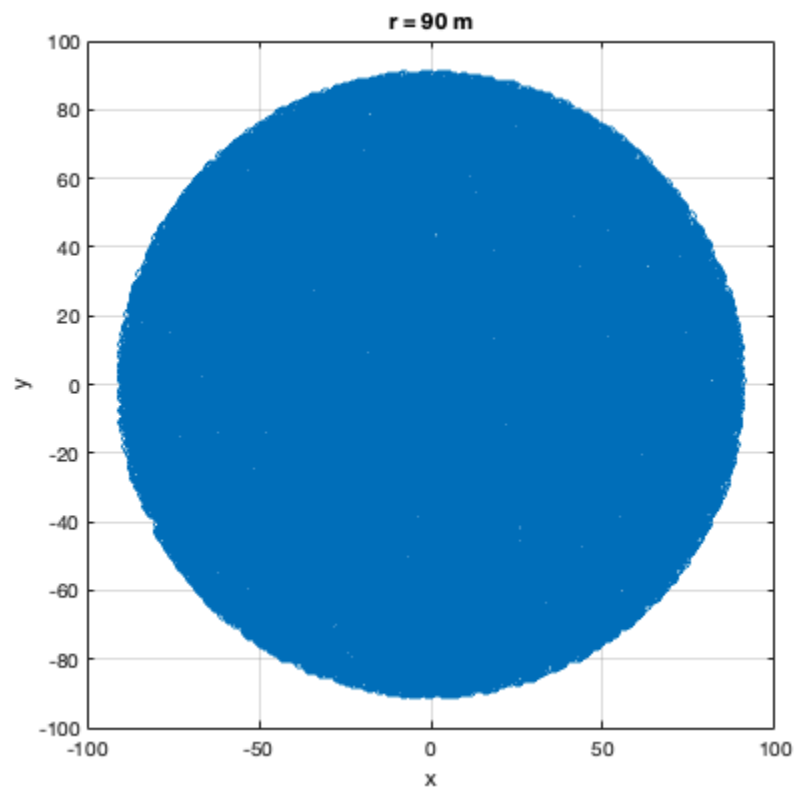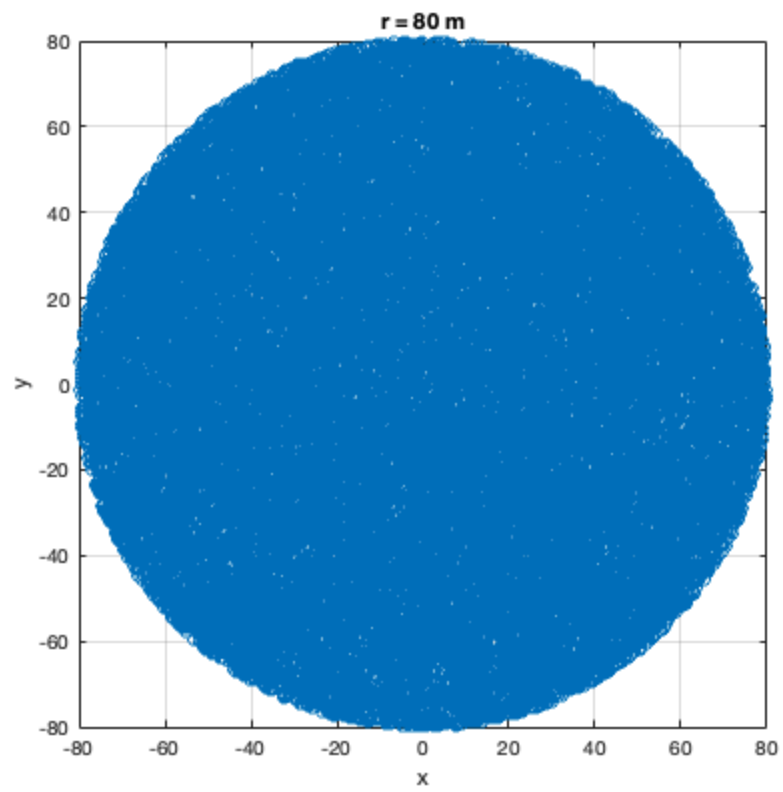
UE Plots

```matlab
figure(i)
plot(xx,yy,'o');
hold on;
title("r = " + r(i) + " m");
xlabel('x'); ylabel('y');
axis square;
grid on;
```

r = 1 m

r = 10 m

r = 20 m

r = 30 m

r = 40 m

r = 50 m

r = 60 m
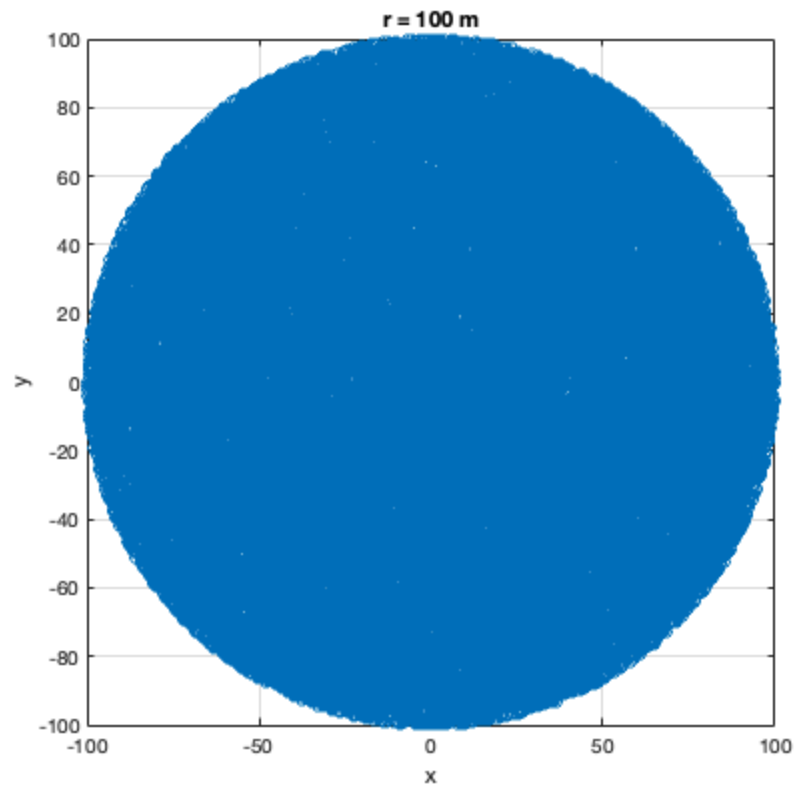
r = 70 m

r = 80 m

r = 90 m

r = 100 m

```
end
```

P_r and SNR plots

```
figure;
plot(r, P_r_avg1,'linewidth',2);
hold on;
title("Received Power v/s radius size, P_t = 1W");
xlabel("Radius (m)"); ylabel("Power(dBW)");
grid on;

figure;
plot(r, SNR_avg1,'linewidth',2);
hold on;
title("SNR v/s radius size, P_t = 1W" );
xlabel("Radius (m)"); ylabel("SNR(dB)");
grid on;

figure;
plot(r, P_r_avg2,'linewidth',2);
hold on;
title("Received Power v/s radius size, P_t = 5W");
xlabel("Radius (m)"); ylabel("Power(dBW)");
grid on;

figure;
```
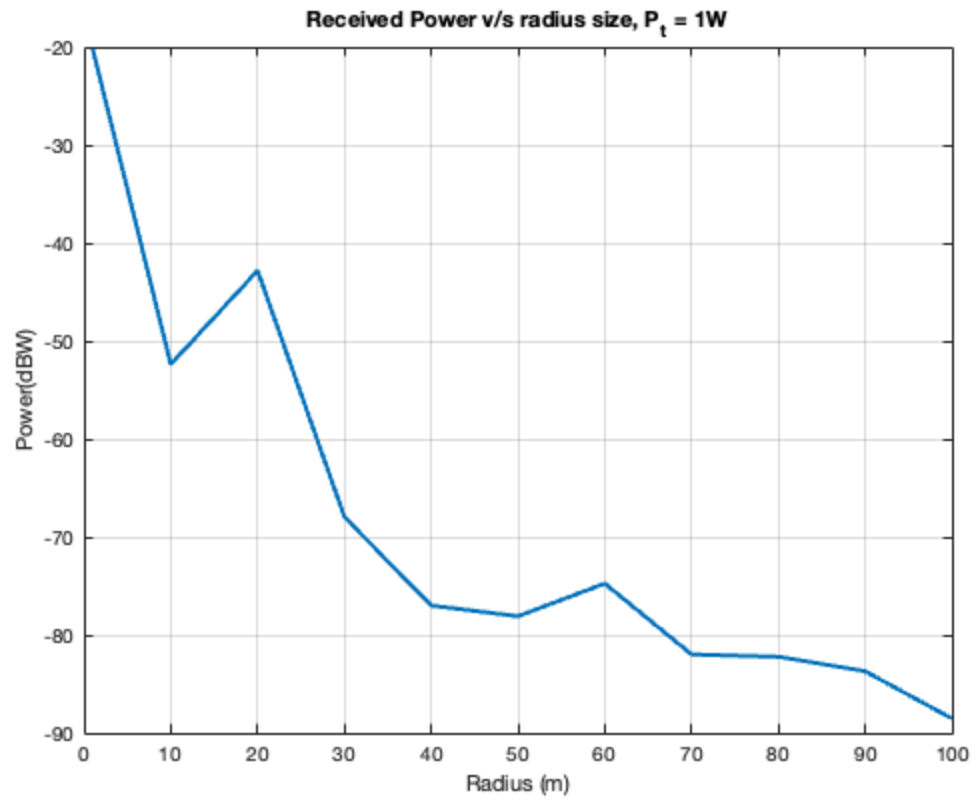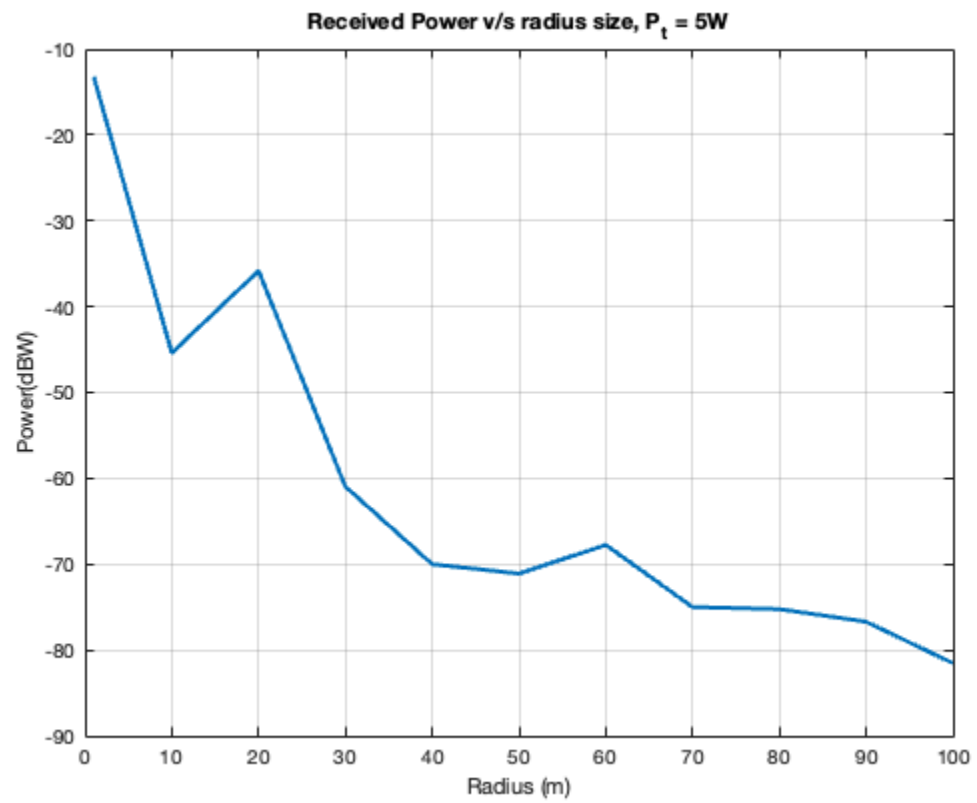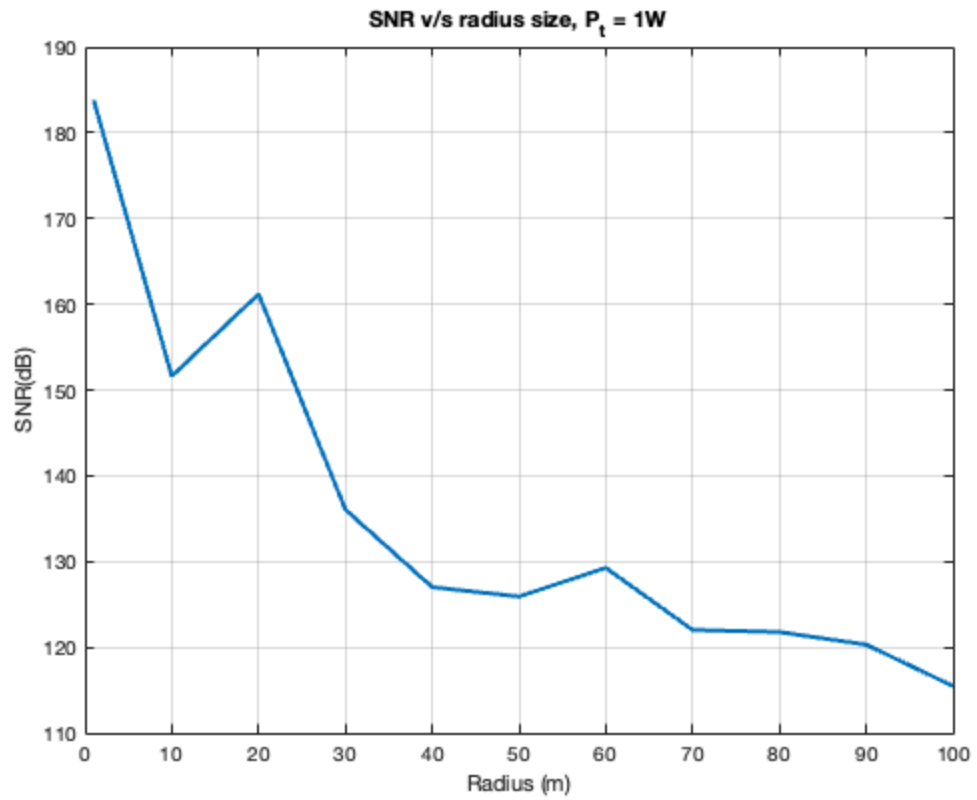
```
plot(r, SNR_avg2,'linewidth',2);
hold on;
title("SNR v/s radius size, P_t = 5W" );
xlabel("Radius (m)"); ylabel("SNR(dB)");
grid on;
```
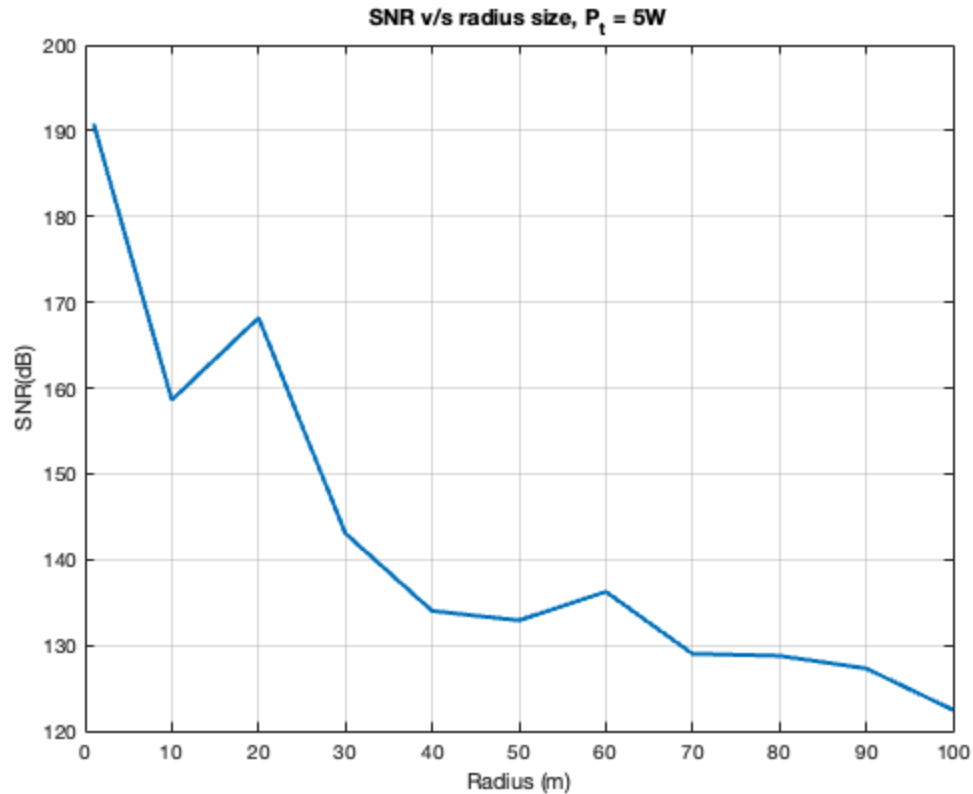
Received Power v/s radius size, P_t = 1W

SNR v/s radius size, P_t = 1W

Received Power v/s radius size, P_t = 5W

SNR v/s radius size, P_t = 5W

Observations:

It is very clear from the plots that as the radius size increases, the path loss and the SNR (averaged over UEs) decreases. When the transmit power is increased from 1W to 5W, the received power increases by around 6.9897 dBW. Similarly, the SNR also increases when the transmit power is increased to 5W.

```
%references:
% for PPP: https://in.mathworks.com/matlabcentral/answers/300022-
i-want-to-spatially-distribute-1000-mobile-devices-in-a-network-
according-to-poisson-point-process
% for Urban PL: L. M. Correia, "A view of the COST 231-Bertoni-Ikegami
 model," 2009 3rd European Conference on Antennas and Propagation,
 Berlin, 2009, pp. 1681-1685.
```

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