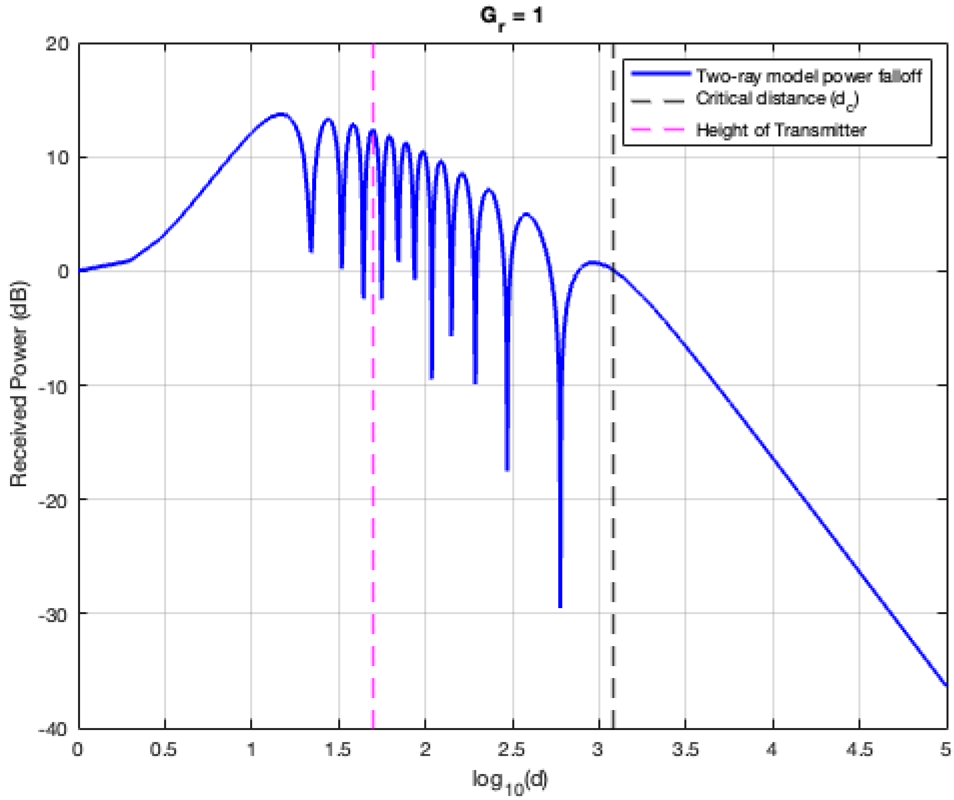
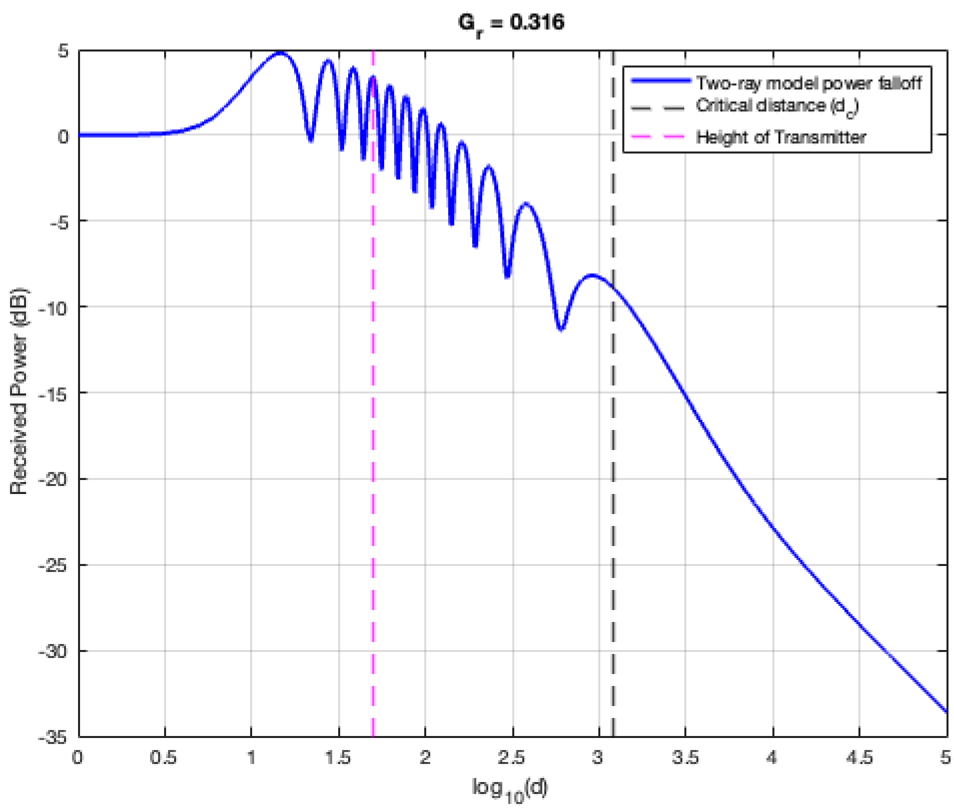
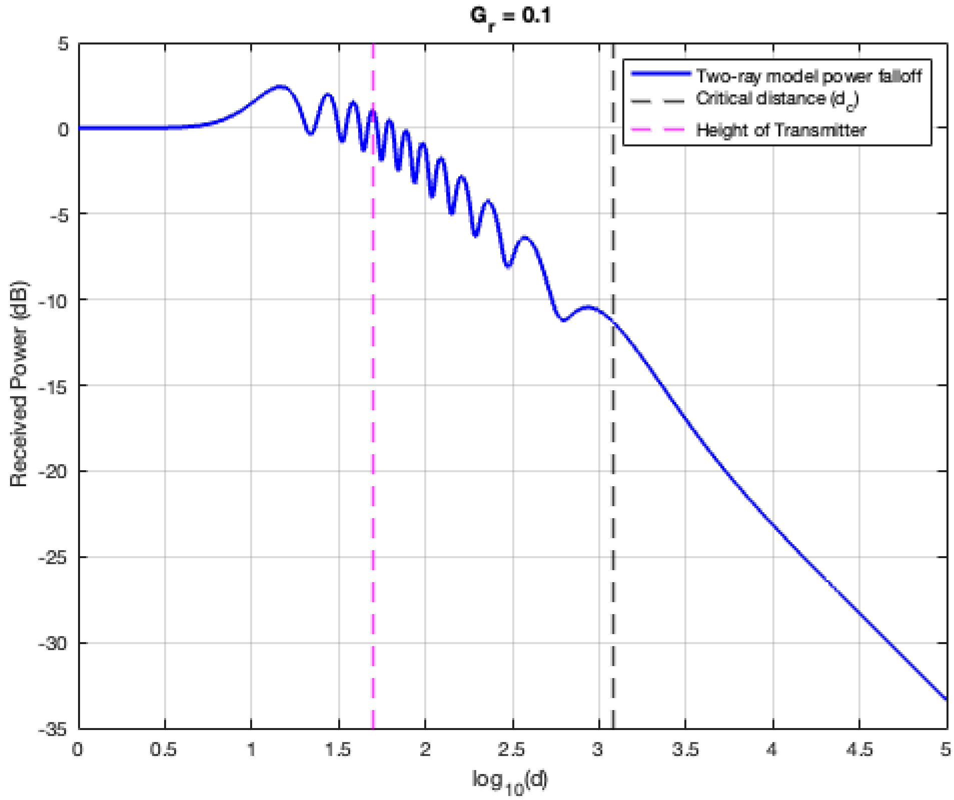
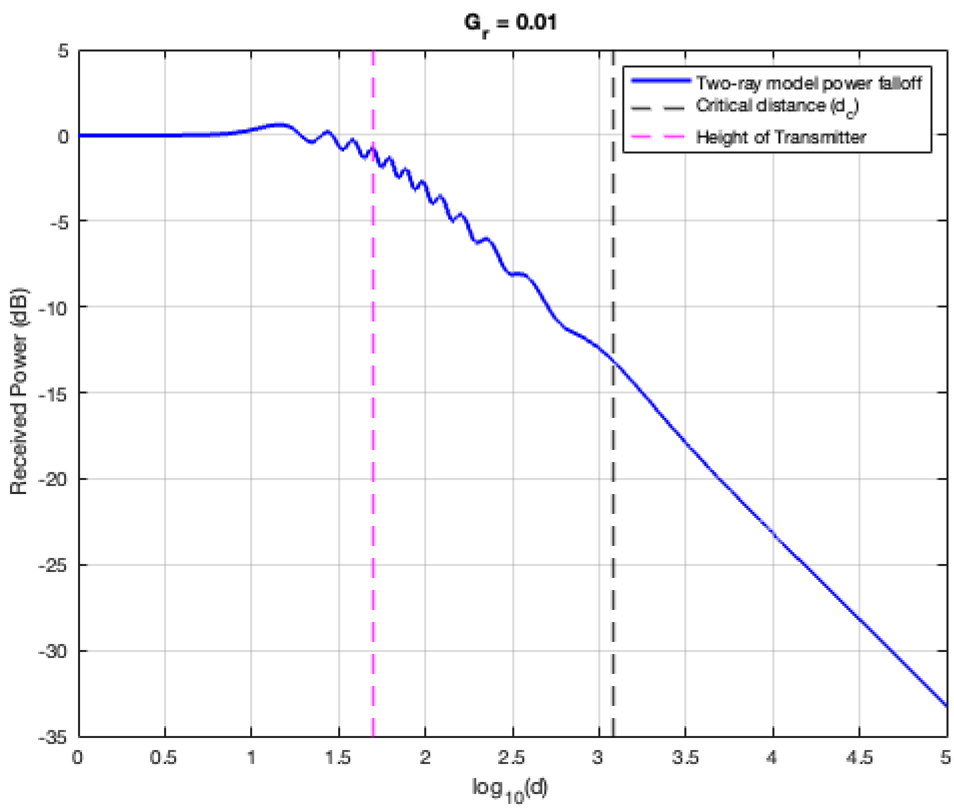
```
f = 900*10^6;
lambda = 3*10^8/f;
R = -1;
h_t = 50; h_r = 2;
G_l = 1;
d = 1:1:100000;
G_r = [1 0.316 0.1 0.01];
x_l = sqrt((h_t+h_r)^2 + d.^2) - sqrt((h_t-h_r)^2+d.^2);
phi = 2*pi*x_l/(lambda);

d_axis = log10(d);
P_t = 1;

for i = 1:4
P_r = P_t*(lambda/(4*pi))^2* abs(sqrt(G_l)./sqrt((h_t-h_r)^2+d.^2)...
    + R*sqrt(G_r(i))*exp(-1j*phi)./(sqrt((h_t+h_r)^2 + d.^2)));
% P_r = (sqrt(G_l)*h_t*h_r./(d_axis.^2)).^2*P_t;

P_r = P_r/P_r(1);

d_c = 4*h_t*h_r/lambda;
d_c = log10(d_c);
p_d_c = ones(1,length(d_c))*d_c;

figure(i);
plot(d_axis, 10*log10(P_r),'b','linewidth',2);
hold on;
grid on;
title("G_r = " + G_r(i));
xline(d_c,'k--','linewidth',1.5);
xline(log10(h_t),'m--','linewidth',1.5)
legend('Two-ray model power falloff', 'Critical distance (d_c)',...
    'Height of Transmitter');
xlabel('log_1_0(d)'); ylabel('Received Power (dB)');

end

%As the receiver gain increases, the power is proportional to the
 distance
%squared. For small distances, the rays add constructively and path
 loss is
%slowly increasing. For distances > h_t, upto critical distance d_c,
 the
%signal experiences constructive as well as destructive itnerference
 of the
%two rays and thus oscillates. For d > d_c, the signal is a result of
%destructive interference and hence the rapid falloff.
```


G_r = 1
Two-ray model power falloff
Critical distance (d_c)
Height of Transmitter
Received Power (dB)
$\log_{10}(d)$
20
10
0
-10
-20
-30
-40
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5


G_r = 0.316
Two-ray model power falloff
Critical distance (d_c)
Height of Transmitter
Received Power (dB)
$\log_{10}(d)$
5
0
-5
-10
-15
-20
-25
-30
-35
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5


G_r = 0.1
Two-ray model power falloff
Critical distance (d_c)
Height of Transmitter
Received Power (dB)
$\log_{10}(d)$


G_r = 0.01
Two-ray model power falloff
Critical distance (d_c)
Height of Transmitter
Received Power (dB)
$\log_{10}(d)$

Published with MATLAB® R2021a