Date:

1. The two function performed by an antenna are transmission: radiating electromagnetic ~~eng~~ energy into spacer and reception: collecting electromagnetic energy from space.

2. A radiation pattern is a graphical representation of the radiation properties of an antenna, depicted as a two-dimensional cross section.

3. An isotropic antenna is an idealized antenna that radiates power equally in all directions.

4. Beam width, or half power beam width, is measure of an antenna.

5. Types of antennas include:
- Isotropic antenna
- Dipole antenna
- parabolic reflective antenna

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6. $C = 3\times10^8$, $f = 1\,Hz$

a.) $\lambda = \frac{c}{f}$. $\lambda = \frac{3\times10^8\,m/s}{1\,Hz}$, $\lambda = \frac{300000000}{4} = 75000000\,m$

b.) $\lambda = \frac{c}{f}$, $f = (3\times10^8)/(4 * 0.8522) \approx 88,308,518.18\,Hz$

$\approx 88.30852\,KHz$

c.) $\lambda = \frac{c}{f}$, $\lambda = \frac{3\times10^8\,m/s}{1000\,Hz}$ = $\lambda = \frac{300000}{2} = 150000\,m$

7. The optimum wavelength for a half-wave dipole is twice the length of the dipole. Therefor, the optimum wavelength is $10\,m \times 2 = 20\,m$. The frequency can be calculated using the formula: Frequency = (Speed of light / wavelength) $= (3\times10^8\,m/s) / 20\,m = 15\times10^6\,Hz = 15\,MHz$.

8. Antenna gain is the power output in a particular direction compared to that produced in any direction by a perfect omnidirectional antenna (isotropic antenna). The beam width and antenna gain are related, where a narrower beam width usually corresponds to a higher antenna gain.

9. The propagation modes are:
- Ground wave propagation
- Sky Wave Propagation
- Line of sight propagation

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10. $dm = \sqrt{2Rh_T} + \sqrt{2Rh_R}$. $R = 6.4 \times 10^6$

a.) $dm = \sqrt{2 \times 6.4 \times 10^6 \times 100} + \sqrt{2 \times 6.4 \times 10^6 \times 0} = 35777\ m$

[redacted] $dm = 35.777 \times 10^3\ m = 35.777\ Km$

b.) $1000\ m = 1\ Km$:.

$dm = \sqrt{2 \times 6.4 \times 10^6 \times 1000} + \sqrt{2 \times 6.4 \times 10^6 \times 100} = 148914\ m$

$dm = 148.914 \times 10^3\ m = 148.914\ Km$

c.) $dm = \sqrt{2 \times 6.4 \times 10^6 \times 120} + \sqrt{2 \times 6.4 \times 10^6 \times 1000} = 152328$

$dm = 152.328 \times 10^3\ m = 152.328\ Km$

11:

- Attenuation and attenuation distortion
- Free space loss
- Noise
- Atmospheric absorption
- multipath
- Refraction
- Thermal noise

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13. we can use the formula: Noise power density KT (W/Hz) where K is Boltzmann's constant (1.3803×10^{-23} J/K) and T is the temperature in Kelvins.

Temperature in Kelvins = 17 + 273.15 = 290 ~~K~~

Noise power density = (1.3803×10^{-23} J/K) * 290 ~~K~~ K
$= 4 \times 10^{-21}$ W/Hz = -204 dBW/Hz

12.

Free Space loss (in dB) = 20 log10 (d) + 20 log (f) - 147.55

convert distance to meters: 35.863 Km = 35.863.000 meters

d = 35.863.000 meters

f = 4 GHz = 4000.000.000 Hz

free space loss = 20 log10 (35.863.000) + 20 log10 (4.000.000.000)
- 147.55 ≈ 20 X 7.5534 ≈ (151.068) dB and 20 X 9.6021 ≈
(192.042) dB ∴ Free space loss ≈ 151.068 + 192.042 = 195.56 dB

Free space loss (with antenna gain) =
195.56 dB - (44 dB + 48 dB) = 195.56 dB - 92 dB = 103.56 dB

10. Los distance = $\sqrt{2*h1*h2}$

a. h1 = 100m, h2 = at the ground = 0
Los distance = $\sqrt{2*100*0}$ = 0 . So max distance = 0 m

Case for a. h1 = (Max Distance^2) / (2*h2)

h1 = (0^2)/(2*10) = 0 m

b. h1 = 1 Km, h2 = 100 m

Max Distance = $\sqrt{2*1000*100}$ ≈ 447.21 m

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density kT (W/Hz)

3 x 10^{-23} J/K) and T

) * 290 K

20 log(f) - 147.55

= 35.863.000 meters

o log10 (4.000.000.000)

and 20 X 9.6021 ≈

+ 192.042 = 195.56 dB

- 92 dB = 103.56 dB

distance = 0 m

+ h2)

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Case for b. h1 = (447.21^2)/(2*0) ≈ 10,024.05 m

c. h1 = 120 m , h2 = 1 km

Max Distance = $\sqrt{2 * 120 * 1000}$ = 489.90 m

Case for c. h1 = (489.90^2) / (2*10) = 11.848.05 m

MASCO