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SISTEMAS DE RADIOCOMUNICACION – IRRATI-KOMUNIKAZIOKO SISTEMAK

Examen Final. 1er parcial. 23/Mayo/2016

Azterketa Finala. 1. Partziala. 23/Maiatza/2016

TEST

1. b. 2. b. 3. d. 4. c. 5. d.

TEORIA

Coding, Interleaving and Modulation: Interleaving

Interleaving

- In some systems to improve the performance of the channel coding an interleaving stage is added after coding.
- The interleaving mixes the coded bits in the transmitter and rearrange them in the receiver.
- The effect is that errors occurred during short period of time are distributed along longer time, and erroneous bits are more uniformly distributed, which helps to error detection and correction algorithms in the receiver.
- The drawback is a latency time, because the receiver has to wait until all the bits needed for decoding are received.
- Interleaving is one of the reasons for the delay of the voice in GSM, and for long zapping times in some digital radio and TV systems.

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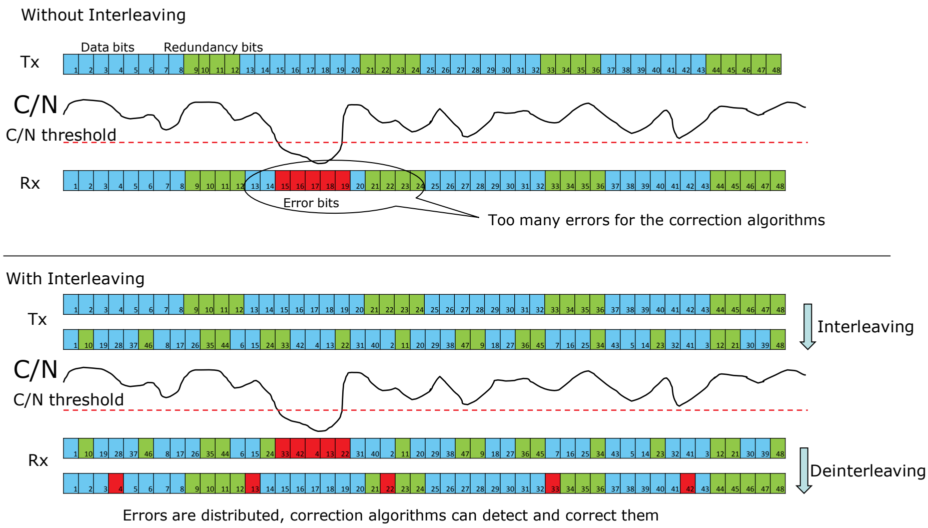
Coding, Interleaving and Modulation: Interleaving



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PROBLEMA 1 (3.5 puntos)

1) $Prad = \eta \cdot Pin \Rightarrow Prad = 10 * \log(0.9 \cdot 10^{1.3}) = 12.54\ dBm$
   $Rrad = \eta \cdot Rin \Rightarrow Rrad = 0.9 \cdot 50 = 45\ ohm$
   $g = \eta \cdot D(lineal) \Rightarrow G(dBi) = D(dBi) + 10\log(0.9) = 11.54\ dBi$

2) $Prad = P + 10\log\left[1 - \left(\frac{50-75}{50+75}\right)^2\right] = 13\ dBm - 0.177dB = 12.82\ dBm$

3) $\left.\begin{matrix} Zantena = 50\ ohm\ (matching) \\ Prad = 13\ dBm \end{matrix}\right\} \Rightarrow Vg \approx 2\ V$

   $\left.\begin{matrix} Zantena = 50 + j10 \\ \eta = 0.9 \Rightarrow Rrad = 45\ ohm \\ Vg \approx 2\ V \end{matrix}\right\} \Rightarrow Prad = \frac{Vg^2}{|Zantena + 50|^2} \cdot 45 \approx 0.0178 \Rightarrow Prad \approx 12.5\ dBm$

4) $Prad = P - 10\log\left[1 - \left(\frac{50-75}{50+75}\right)^2\right] = 10\log(10^{-6} \cdot 10^3) + 0.17 = -29.83dBm \Rightarrow 10^{(-2.983+3)} = 1.041\ \mu W$

5) $g = \eta \cdot D(lineal) \Rightarrow D(dBi) = G(dBi) - 10\log(\eta) = 10 - 10\log(0.8) = 10.969\ dBi$

PROBLEMA 2 (3.5 puntos)

$a)\ Reflection\ point\ x = 500\ m$

$$k = \frac{157}{157 - 39} = 1.33$$

$$Bulge\ f(x) = \frac{500 \cdot 500}{2kR_o} = 0.0147\ m$$

$h = cota + f(x) - 10 = -4.98 \Rightarrow \nu = h\sqrt{\frac{2}{\lambda}\left(\frac{1}{500} + \frac{1}{500}\right)} = -1.41 < -0.781 \Rightarrow L_D(\nu) = 0\text{ dB}$

b)

$$\left.\begin{matrix} \nu \leq -0.781 \Rightarrow L_D(\nu) = 0\text{ dB} \\ \nu = h\sqrt{\frac{2}{\lambda}\left(\frac{1}{500} + \frac{1}{500}\right)} \end{matrix}\right\} \Rightarrow h \leq -2.736$$

$h = cota + f(x) - 10 \leq -2.736 \Rightarrow cota \leq -2.736 + 10 - f(x) = 7.22\text{ m}$

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SISTEMAS DE RADIOCOMUNICACION – IRRATI-KOMUNIKAZIOKO SISTEMAK

Examen Final. 2º parcial. 23/Mayo/2016.

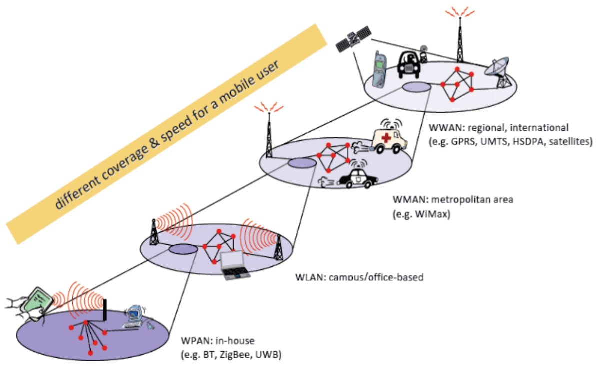
Azterketa Finala. 2. Partziala. 23/Maiatza/2016

TEST

1. a. 2. b. 3. d. 4. c. 5.a. b.

TEORIA

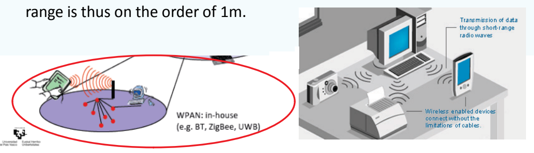
Applications



Applications

WPAN, Wireless Personal Area Networks :

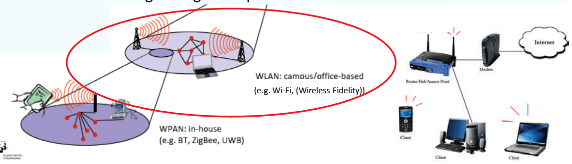
- Personal Area Networks include networks that achieve distances of up to or about 10 m, covering the "personal space" of one user.
- Examples are networks linking components of computers and home entertainment systems. Due to the small range, the number of devices within a PAN is small. That makes cell planning and multiple access much simpler.
- Body Area Networks (BANs) are often subsumed into PANs. BANs cover the communication between different devices attached to one body – e.g., from a cellphone in a hip holster to a headset attached to the ear. The range is thus on the order of 1m.



Applications

WLAN, Wireless Local Area Networks :

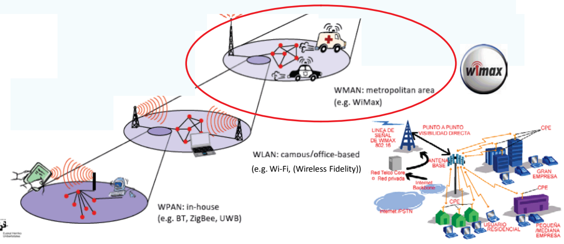
- The functionality of Wireless Local Area Networks (WLANs) is very similar to that of cordless phones – connecting a single mobile user device to a public landline system, allowing mobility. The "mobile user device" in this case is usually a laptop computer and the public landline system is the Internet.
- Wireless LANs can even be useful for connecting fixed-location computers (desktops) to the Internet, as they save the costs for laying cables to the desired location of the computer.
- WLANs cover still larger ranges of up to hundreds of meters.



Applications

WMAN, Wireless Metropolitan Area Networks :

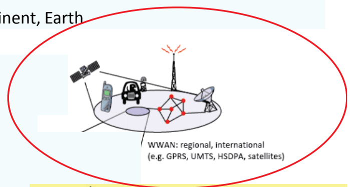
- Metropolitan area network represents an evolution of the concept of local area network to a broader range, covering larger areas even a regional coverage



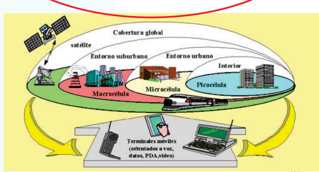
Applications

WWAN: Wireless Wide Area Network:

- Global Coverage: country, continent, Earth
- Cellular networks
- They can also be classified as public or private networks.



- Standards referred 3GPP: 2G (GSM), 2.5G (GPRS, EDGE) 3G (CDMA2000, UMTS), 4G (LTE, LTE Advance), ...
- Could also include the IEEE Standards: WiMAX and Wi-Fi and LMDS technology promoted by ETSI.



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PROBLEMA 1 (3.5 puntos)

1) $Pr = Pt + Gt + Gr - L1 - L2 - L3$

$2.a)\ EIRP = P_{REG1A} + Ga - L1 - L2 + Gant \Rightarrow P_{REG1A} = EIRP - Ga + L1 + L2 - Gant = -29\ dBm$

$2.b) Pr = EIRP + Gr - L3$

$$L3 = L_{FSL} = 20\log\left(\frac{4\pi d}{\lambda}\right) = 102.49\ dB \Rightarrow Pr = EIRP + Gr - L3 = -58.49\ dBm$$

2.c) $Vmin = 45\ dBuV \Rightarrow Pr = \frac{Vmin^2}{75} \Rightarrow Pr = -63.75\ dBm$

$$Pr = EIRP + Gr - L_{FSL} \Rightarrow L_{FSL} = 107.75\ dB \Longrightarrow d = 10.994\ km$$

2.d) $L_{FSL1} = L_{FSL2} \Rightarrow \frac{d1}{\lambda 1} = \frac{d2}{\lambda 2} \Rightarrow \frac{d1}{d2} = 0.68$

PROBLEMA 2 (3.5 puntos)

a)

$$\frac{G}{Te} = 20\ dBK^{-1} \Rightarrow G - 10logTe = 20$$

$$no = KTe \Rightarrow No = -204.286\ \text{dBmHz}^{-1} = 10logK + 10logTe \Longrightarrow 10logTe = -5.686 \Rightarrow G = 14.31\ dBi$$

$$Prx = EIRP - L_{FSL} - L_{atm} - L_{coupling} + G = -72.096\ dBm$$

b)

$$\frac{eb}{no} = \frac{c \cdot Tb}{no} \Rightarrow \frac{Eb}{No} = C(dBm) + 10\log\left(\frac{1}{Vb}\right) - No = 52.19\ dB$$

$$\frac{c}{n} = \frac{c}{no \cdot B} = \frac{c}{no \cdot Vsymbol} = \frac{c \cdot m}{no \cdot Vb} \Rightarrow \frac{C}{N} = C(dBm) - No + 10\log\left(\frac{m}{Vb}\right) = 58.2\ dB$$

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