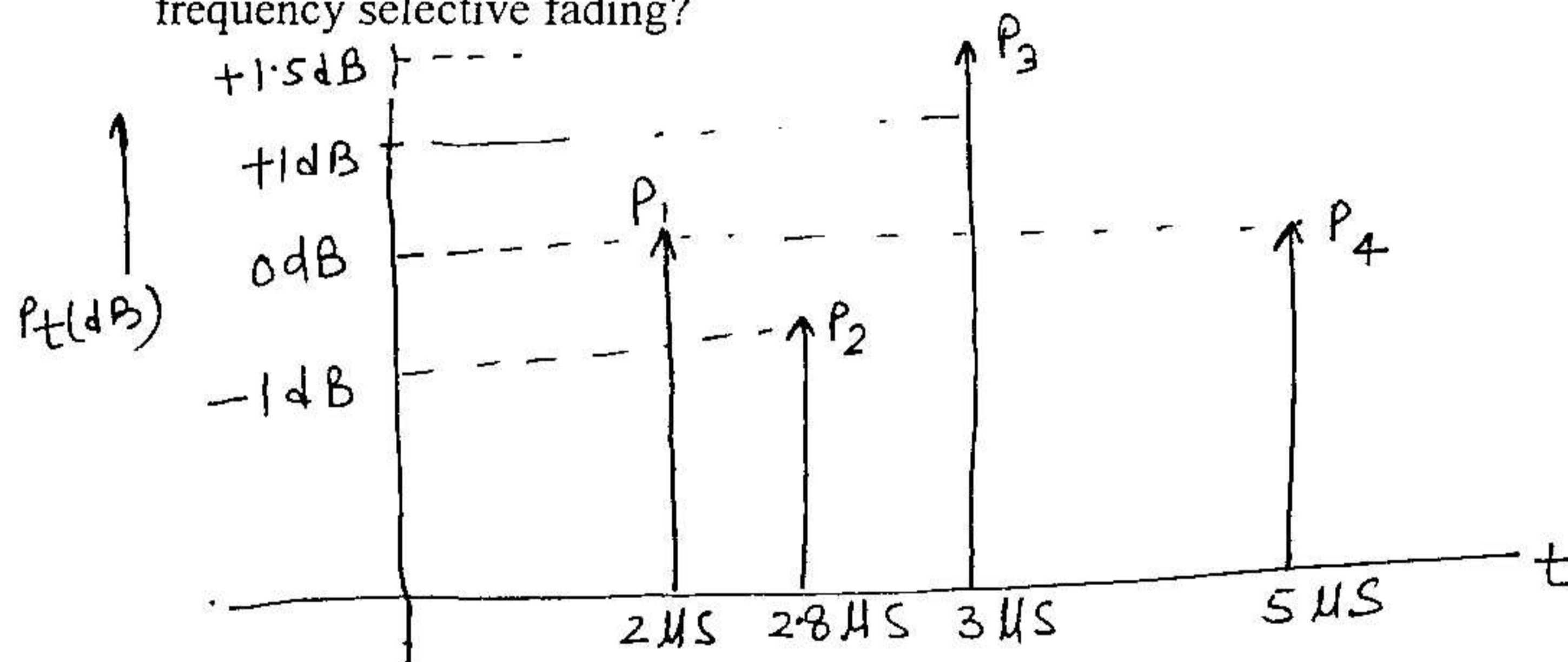


- Attempt all Questions, maintain the serial order.
- Assume missing data, if any.

Q1. Suppose a transmitting base station emits an EIRP of 100W. The handset receiver has a sensitivity of -90dBm. What is the maximum range for the mobile unit given the following selecting antennas: a dipole having a gain of 2.15 dBi and an omni directional having a gain of 0 dBi? The operating frequency is 860 MHz. Neglect system losses. [4]

Q2. The following figure shows the power delay spread for a particular multipath channel. The transmitter and receiver both are stationary. Determine the RMS delay spread and the coherence bandwidth. If a communication signal using this channel has a bandwidth of 30 kHz, will the signal experience flat fading or frequency selective fading? [4]



- Q3. Answer the following: [1 x 6]
- How is a subscriber authenticated in the GSM network and why is it necessary?
  - Name and describe very shortly, the most important components of the GSM Network Subsystem (NSS) as per their tasks.
  - Name and describe very shortly, the most important components of the GSM radio network (BSS) as per their tasks.
  - Which steps are necessary in order to digitize a speech signal in a mobile phone before it can be sent over the GSM air interface?
  - What is a handover and which network components are involved?
  - How is the current location of a subscriber determined for a mobile terminated call and how is the call forwarded through the network?

BITS, PILANI – DUBAI  
Academic City, Dubai

Semester I 2009 – 2010  
IV Year (EEE/EIE)-Elective  
Comprehensive Examination

Course No.: EA C452

Course Title: Mobile Telecommunication Networks

Date: 28.12.2009

Time: 03 hrs

M.M. = 40 (40 %)

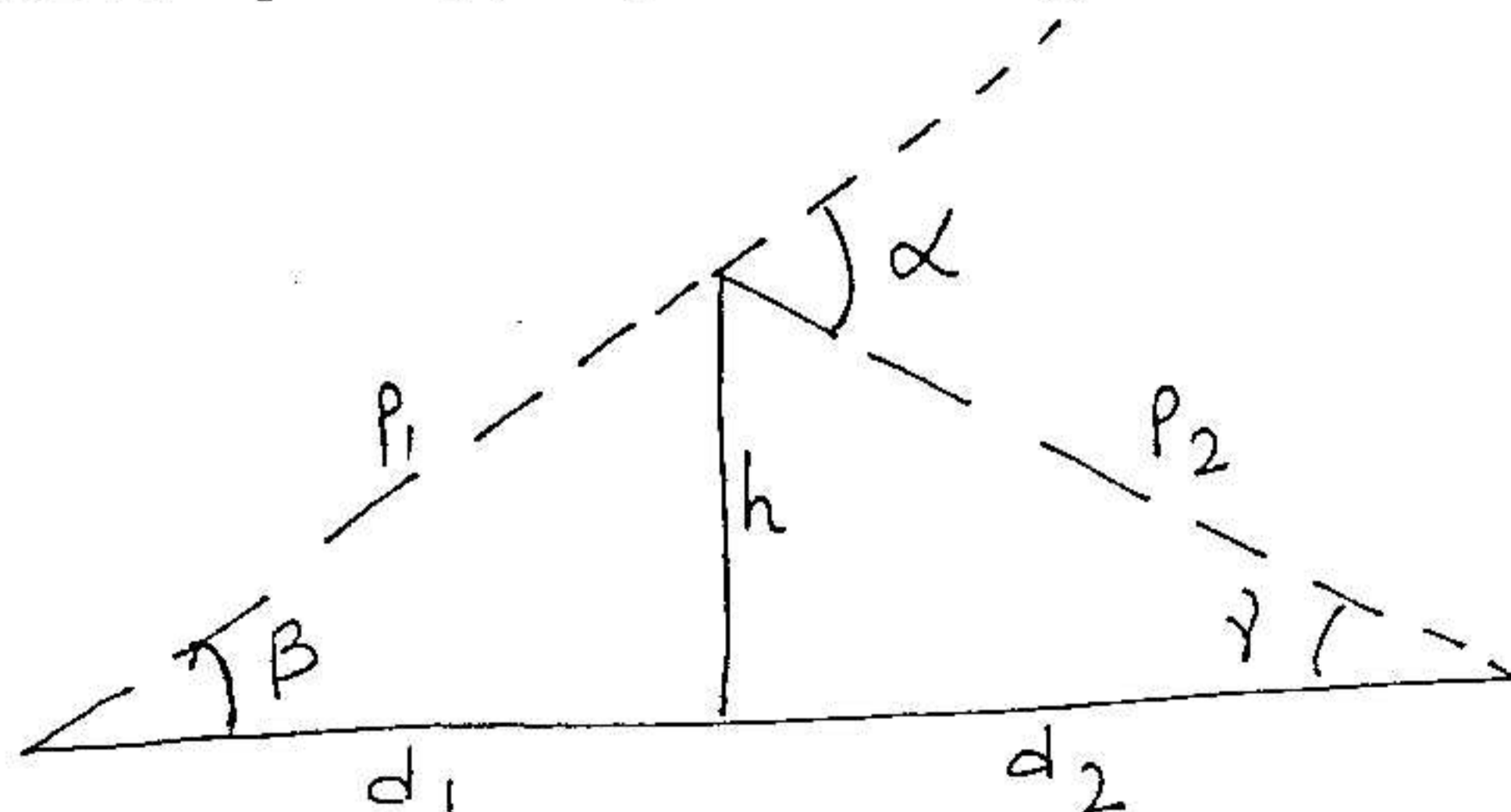
- Q4.** Answer the following: [1 x 6]
- A. What are the maximum speeds that can be achieved by Bluetooth and what do they depend upon?
  - B. What is the FHSS and which enhance functionalities are available with Bluetooth 1.2 in this regard?
  - C. What is the difference between inquiry and paging?
  - D. What kind of power saving mechanisms exists for Bluetooth devices?
  - E. What are the tasks of the link manager?
  - F. How can several services use the RFCOMM layer simultaneously?

- Q5.**
- A. Draw the frame structure for GSM? [4]
  - B. Write a technical note on the Signal Processing in GSM networks. [4]

- Q6.**
- A. How does the near –far effect influence TDMA systems and CDMA systems? What are the countermeasures taken for this effect? [4]
  - B. If  $W=1.25$  MHz,  $R = 9600$  bps and a minimum acceptable  $E_b/N_0$  is found to be 10 dB, determine the maximum number of users that can be supported in a single cell CDMA system using (a) omni directional base station antennas and no voice detection and (b) three sectors at the base station and activity detection with  $\alpha = 3/8$ . Assume the system is interference limited. [4]

- Q7.** From the knife edge geometry as shown in the figure, show that [4]

$$\Phi = 2\pi\Delta / \lambda = [2\pi / \lambda] [h^2/2(d_1 + d_2/d_1*d_2)]$$



# BITS, PILANI – DUBAI

Semester I 2009 – 2010  
IV Year (EEE/EIE)-Elective

## Test -2 (Open Book)

Course No.: EA C 452  
Date: 13.12.2009

Course Title: Mobile Telecommunication Networks  
Time: 50Minutes  
M.M. = 20 (20 %)

- **Attempt all questions, maintain the Serial Order.**
- **Only Text Book and Hand written class notes are allowed.**

- Q1. The Bit Sequence 1011101011 is to be transmitted using following formats:  
a. Unipolar RZ and NRZ  
b. Bipolar RZ and NRZ  
Draw all the waveforms neatly and clearly [4]
- Q2. A Total of 24 MHz of BW is allocated to a particular FDD Cellular System that uses two 30 kHz Simplex channels to provide full duplex voice and control channels. Assume each cell phone user generates 0.1 Erlang of traffic. Assume Erlang B is used. Find: [6]  
a. Number of channels in each cell for a four cell reuse system  
b. If each cell is to offer capacity that is 90% of perfect scheduling, find the maximum number of users that can be supported/cell where omni directional antennas are used at each base station.  
c. What is the blocking probability of the system in (b) when the maximum numbers of users are available in the user pool?  
d. If each new cell now uses 120 degree sectoring instead of omni directional for each base station, what is the new total number of users that can be supported/cell for the same blocking probability as in (c).  
e. If each cell cover five square kilometers, then how many subscribers could be supported in an urban market that is 50 Km x 50 Km for the case of omni directional antennas?
- Q3. (a) What limits the number of simultaneous users in a TDM/FDM system compared to CDM system? What happens to the transmission quality of connections if the load gets higher in a cell? [2]  
(b) For a Rayleigh fading signal, compute the positive going level crossing rate for  $\rho=1$ , when the maximum Doppler frequency is 20 Hz. What is the maximum velocity of the mobile for this Doppler frequency if the carrier frequency is 900 MHz? [2]
- Q4. (a) Discuss ground reflection (Two ray) model for reflection in mobile radio propagation. [2]  
(b) A mobile is located 5 km away from a base station and uses a vertical  $\lambda/4$  monopole antenna with a gain of 2.55 dB to receive radio signals. The E field at 1 km from the transmitter is measured to be 0.001V/m. The carrier frequency used in this system is 900 MHz.  
i. Find the length and the effective aperture of the receiving antenna. [2]  
ii. Find the received power at the mobile using 2 ray ground model assuming the height of the transmitting antenna is 50 m and the receiving antenna is 1.5 m above the ground. [2]

# BITS, PILANI – DUBAI

Semester I 2009 – 2010  
IV Year (EEE/EIE)-Elective

## Test -1 (Closed Book)

Course No.: EA C 452

Course Title: Mobile telecommunication Networks

Date: 25.10.2009

Time: 50Minutes

M.M. = 20 (20 %)

### Expected Answers:

1. Paging systems are designed to provide ultra reliable coverage, even inside building. Since buildings can attenuate radio signals by 20 or 30 dB, to maximize the signal to noise ratio at each paging receiver, we need to reduce the noise level. This can be achieved by reducing the RF Bandwidth to which the noise level is proportional. The small RF bandwidth thus results in low data rate.

In a paging system, the signal level in a receiver degrades when the distance between the receiver and the base station becomes large. If the coverage of a paging system is defined by the coverage area at which the S/N ratio is above a certain threshold. For a lower data rate, the noise level in the receiver will be smaller, thus for a fixed threshold, the coverage will be larger.

*Refer text book, fig no 1.3, chapter no 1.*

2.
  - i. **Base Station:** A fixed station in a mobile radio system used for radio communication with the mobile stations. Base stations are located at the center or edge of a coverage region. They consist of radio channels and transmitter and receiver antennas mounted on top of a tower.
  - ii. **Full Duplex Systems:** Communication systems which allow simultaneous two-way communication. Transmission and reception is typically on two different channels (FDD).
  - iii. **Half Duplex Systems:** Communication Systems which allow two-way communication by using the same radio channel for both transmission and reception. At any given time, the user can either transmit or receive information.
  - iv. **Roamer:** A mobile station which operates in a service area (market) other than that from which service has been subscribed.
  - v. **Transceiver:** A device capable of simultaneously transmitting and receiving radio signals.

NAME: \_\_\_\_\_

ID NO: \_\_\_\_\_

**EA C 452: MOBILE TELECOM NETWORKS**

**FIRST SEM 2009-2010**

**FOURTH YEAR - EEE/EIE (ELECTIVE)**

**QUIZ NO 2**

**TIME: 25 MIN**

**Date: 16/11/2009**

**MM: 10(10%)**

1. Write down the factors that influences small scale fading in mobile communications: [2]

1.

2.

3.

4.

2. Write down the Friis free space equation:

[1]

3. If a close in mobile is 20 times as close to the base station as another mobile and has energy spill out of its pass band, the S/I ratio at the base station for the weak mobile is app.: (Ad. Channel interference) [1]

S/I =

4. In hexagonal cell structures, the number of cells /cluster must satisfy the equation given by: [1]

5. A signal undergoes flat fading if (write both conditions): [1]
6. A signal undergoes ~~flat~~ <sup>fast</sup> fading if (write both conditions): [1]
7. Find the far field distance for an antenna with maximum dimension of 2 m and operating frequency of 900 MHz. [1]
8. In free space, the power flux density  $P_d$  expressed in  $W/m^2$  is given by: [1]
9. Calculate the Brewster Angle for a wave impinging on ground having a permittivity of  $\epsilon_r = 4$ . [1]

**BITS, PILANI – DUBAI**  
**FIRST SEMESTER 2009 – 2010**  
**FOURTH YEAR-EEE/EIE**

Course Code: EA C452  
Course Title: MTN  
Duration: 20 minutes

Date: 12.10.09  
Max Marks: 10  
Weightage: 10%

*Quiz - 1*

Name: .....	ID No: .....
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Instructions: 1. Attempt all questions.
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1. Write the full forms the following abbreviations with reference to Mobile

Communications: [2]

- 1. NACK - \_\_\_\_\_
- 2. MIN - \_\_\_\_\_
- 3. OSI - \_\_\_\_\_
- 4. PCN - \_\_\_\_\_

2. COMPLETE the following Table: [2]

Feature	Second Generation N/W	2.5 G Networks	3 G networks
Data Rates			
Roaming			

2. Each Bluetooth radio channel has a \_\_\_\_\_ MHz bandwidth and hops at a rate of app. \_\_\_\_\_ hops/sec.
3. \_\_\_\_\_ Standards committee has been formed to provide an international forum for developing Bluetooth.
4. Each cellular base station is allocated a group of radio channels to be used within a small geographical area called a \_\_\_\_\_.
5. When mobile moves into a different cell while a conversation is in progress, the MSC automatically transfers the call to a new channel belonging to a new base station. This operation is known as \_\_\_\_\_.
6. AMPS is the example of \_\_\_\_\_ generation network.
7. For a cluster size of 12, the co channel reuse ration is \_\_\_\_\_.