CORDLESS TELEPHONY
(CT1, CT2, DECT)

ECE 525E – MOBILE COMMUNICATIONS

Monday, 02 March 2026

REVISITED – CORDLESS TELEPHONE GENERATION ONE – CT1

1. **Cordless Telephone Gen 1 (CT1) were developed at around 1980** to provide for limited mobility of telephone users in the fixed telephone network.

2. CT1 uses two radio frequency bands and analogue technology to provide a full duplex speech path between the handset and the cordless base station.

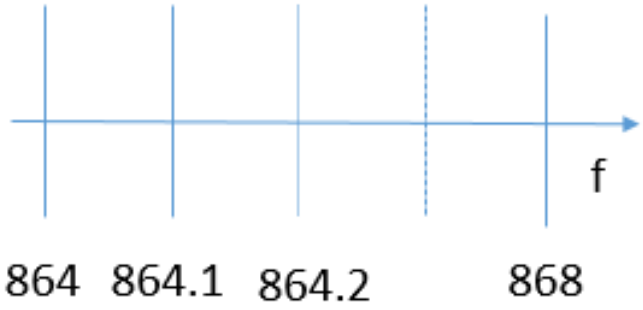
3. The two frequency bands are spaced well apart.

   a) In the direction **Base Station to handset** the transmit frequency is **around 1.7 MHz**, and
   b) In the direction **Handset to base Station** the transmit frequency is **around 47 MHz**.

REVISITED – CORDLESS TELEPHONE GENERATION TWO – CT2

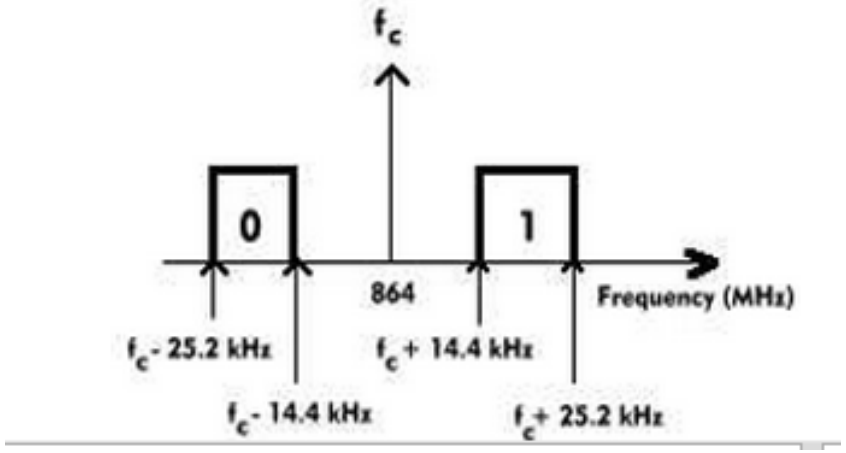
1. **Cordless Telephone Gen 2 (CT2),** uses a digital speech path in any one of the **forty (40)** , **100 kHz wide RF channels** in the frequency band **864-868 MHz.**

$$N = \frac{868 - 864}{0.1} = 40\ Channels$$



2. Each handset has up to **11 unique identity codes** loaded in at manufacture.

3. This enables each base station to be programmed to recognize up to eight separate handset identities that it is able to deal with simultaneously thus providing PABX function with little risk of privacy invasion.



MODULATION

1. The modulation method that is employed is two-level FSK with frequency deviations of:
2.
   a) **14.4 to 25.2 kHz** above the carrier frequency representing binary 1
   b) **14.4 to 25.2 kHz** deviation below the carrier frequency indicating binary 0.

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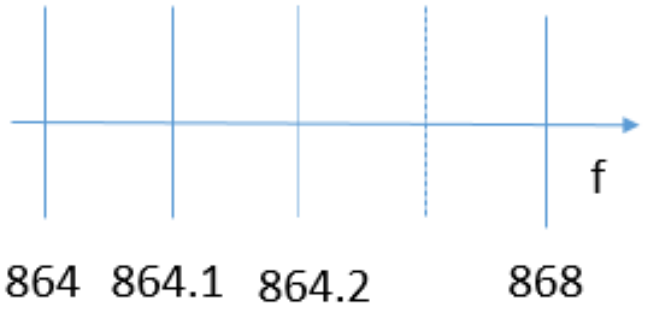
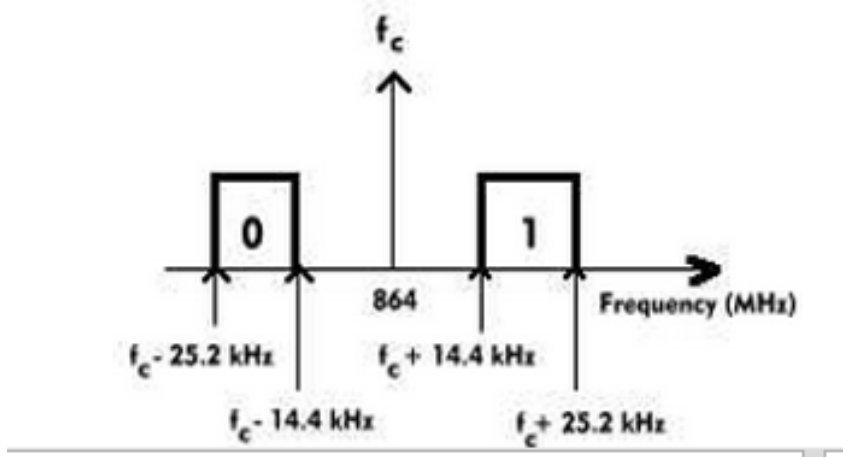




DIGITAL ENHANCED CORDLESS TELECOMMUNICATIONS (DECT)

1. **Digital Enhanced Cordless Telecommunications** usually known by the acronym DECT, is a standard primarily used for creating cordless telephone systems.
2. It originated in Europe, where it is the universal standard, replacing earlier cordless phone standards, i.e CT1 and CT2.
3. The DECT standard was developed by **European Telecommunication Standards Institute (ETSI)** in several phases, the first of that took place between 1988 and 1992.
4. Adoption of DECT in North America was delayed because the original DECT was developed based on ITU Region 1 (Europe/Africa/Russia and the Middle East) frequency regulations which are different from those in Region 2 (South and North America).
5. Eventually it was adopted as a variant variation of DECT, called DECT 6.0, using a slightly different frequency range.

MODERN CORDLESS PHONES ON SALE

FEATURES OF DECT

DECT (Digital Enhanced Cordless Telecommunication) (previously: Digital European Cordless Telephone) (Japanese alternative: PHS = Personal Handy phone System)

- Has more features than a simple cordless terminal system!
- 4 basic applications (cordless system, PABX extension, WLL connection, CTM)
- Uses Time Division Duplex (TDD) structure
- DECT forum: https://www.dect.org

FOUR APPLICATIONS OF DECT

1. **Residential:** narrowband voice services;
2. **Enterprise:** Includes PBXs and associated telephones, headsets, intercom systems, conferencing systems);
3. **Wireless Sensor networks using ULE**(Ultra Low Energy - a 100% DECT compatible technology standard for battery powered devices using the DECT radio spectrum. Typical applications include Home Automation Networks
4. **Machine to machine or machine to man wireless communications** (e.g. sensors, alarms, monitoring and metering devices)

Click here to read more

DECT STANDARD PRINCIPLES

The DECT standard have been designed to meet the following objectives:

1. Provide high capacity cellular structured network access
2. Allowing for network wide mobility
3. Provide flexible identities and addressing
4. Have high spectrum efficiency
5. Provide reliable high quality and secure wireless access
6. Provide speech transmission quality comparable to the wired telephony service
7. Enable cost efficient implementations of system components
8. Support a wide variety of terminals like e.g. small pocket handsets
9. Provide bandwidth on demand for such applications as ISDN and Internet

DIGITAL ENHANCED CORDLESS TELECOMMUNICATION (DECT) APPLICATION

Public Switched Telephone Network (PSTN)
DECT is developed to extend PSTN services to an enterprise environment

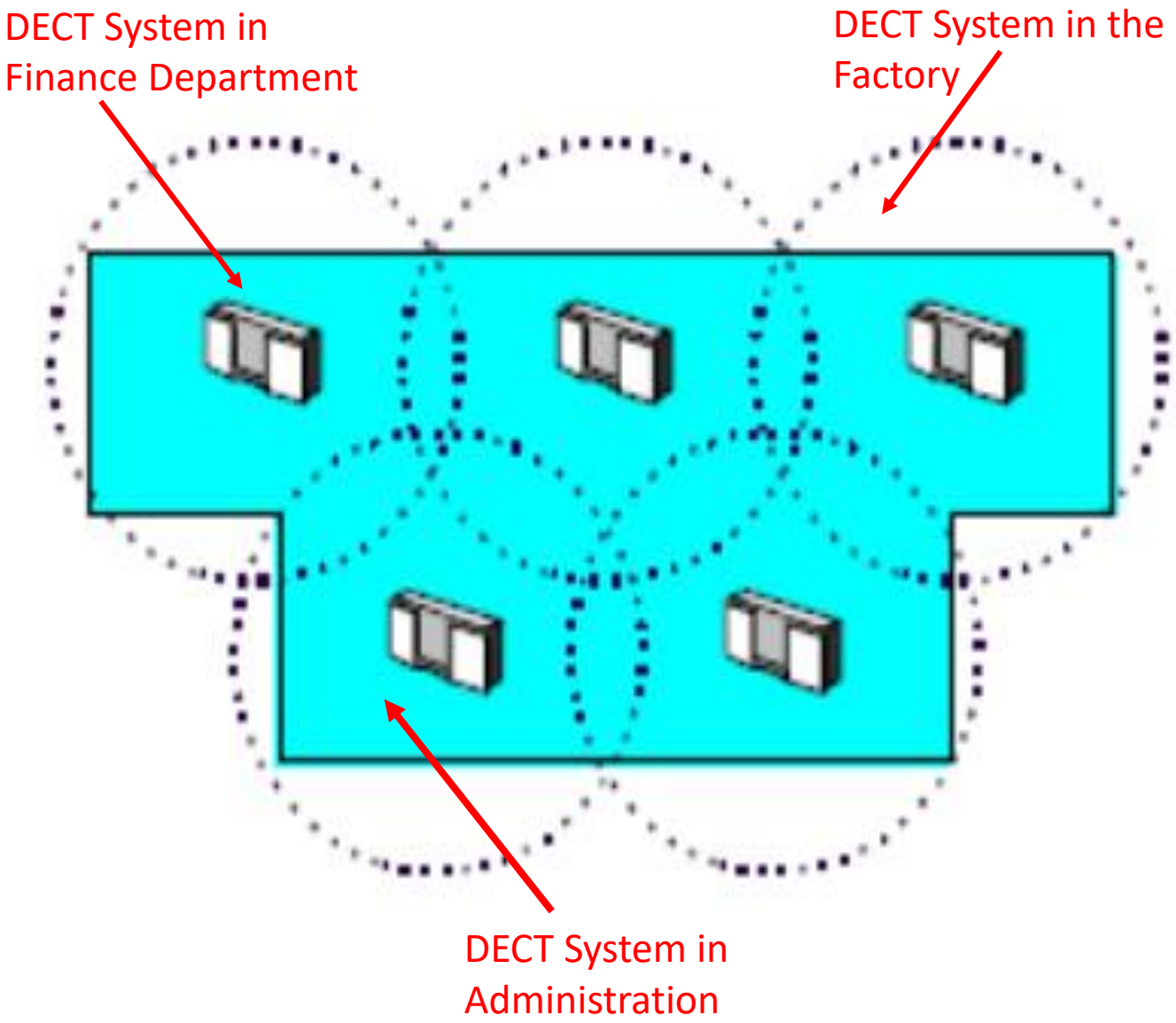
DECT Terminals
Wireless Terminals issued to employees

Voice Over IP
DECT supports VoIP services supported by this server.

FAX Machine
DECT was developed to support the analogue fax standard

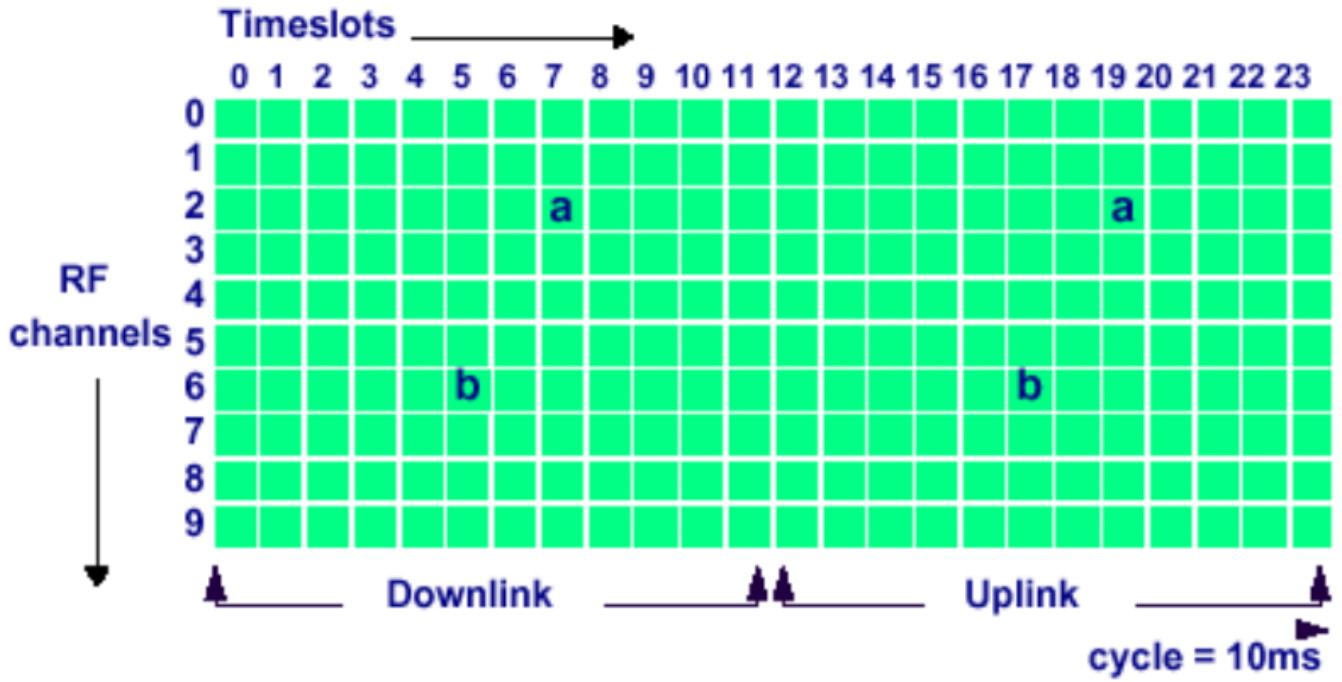
MOBILITY IN DECT SYSTEMS

1. Wireless users with authorised access to the network can make and receive calls at any location covered by the DECT infrastructure.
2. When the radio signal from a given base station is lower than a neighbour, there is seamless handover from cell to cell.
3. **Mobility functions in the DECT protocol uses a pico-cellular infrastructure** of DECT base stations.



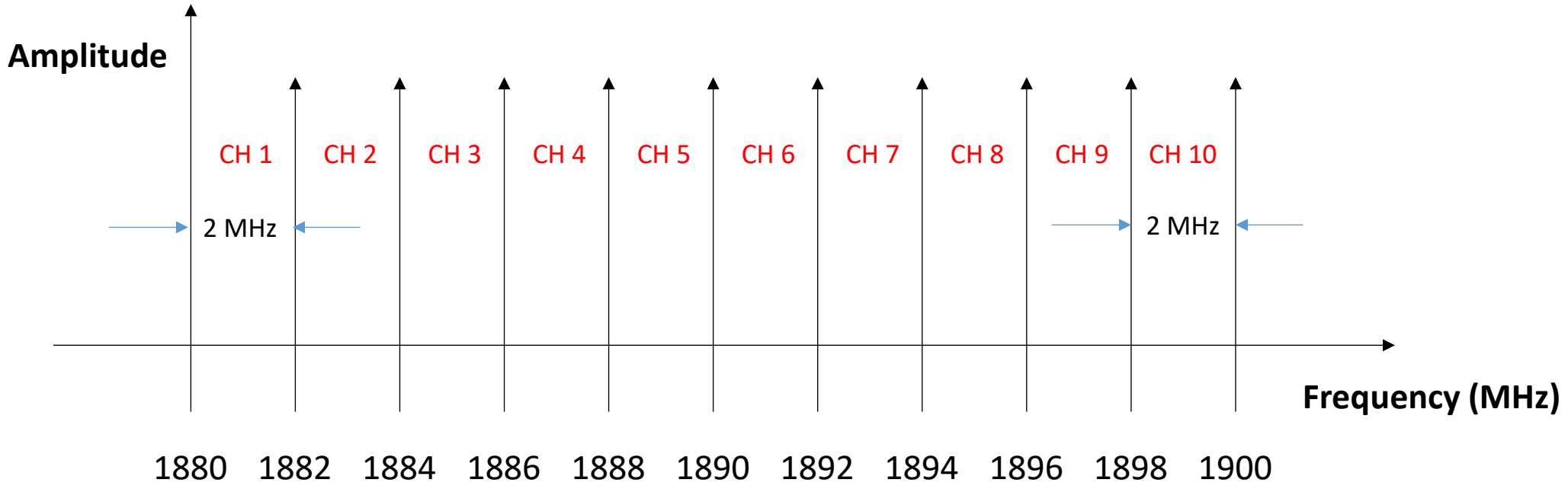
DECT RADIO ACCESS METHODOLOGY

1. **The DECT radio interface** is based on the Multi Carrier (FDM), Time Division Multiple Access, Time Division Duplex (MC/TDMA/TDD) radio access methodology.
2. **DECT frequency allocation** uses 10 carrier frequencies (Multiple Carriers (MC)) in the 1880 to 1900 MHz range.
3. **Each frequency channel** is subdivided into timeframes repeating every 10 ms.
4. **Each time frame** consists of 24 timeslots which are individually accessible (TDMA) and are used for either transmission or reception.



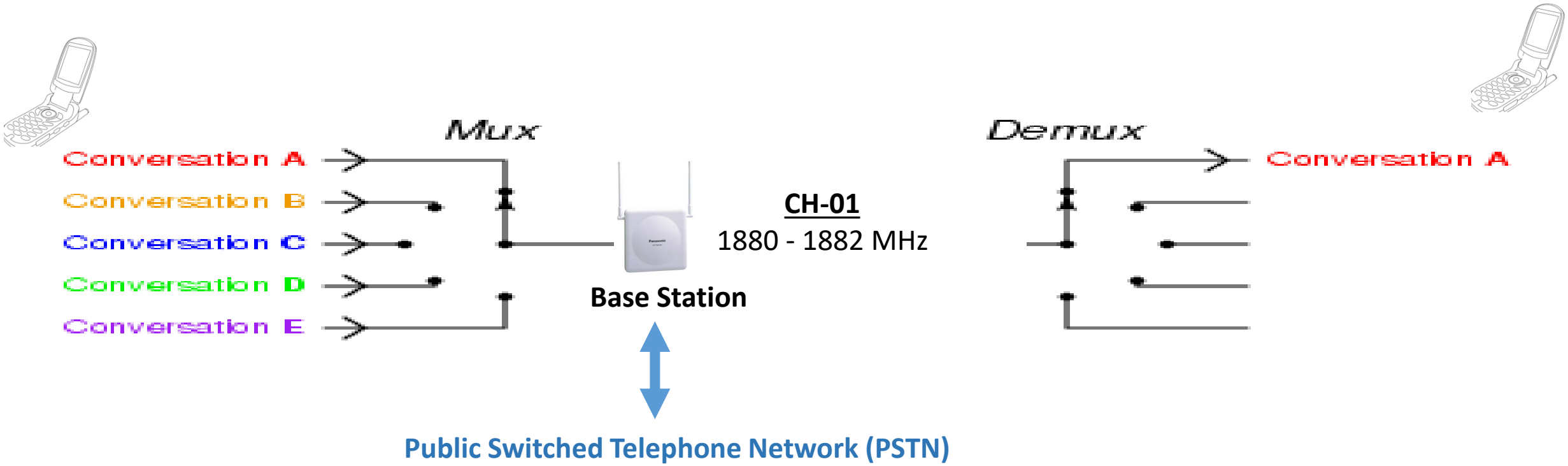
DECT MULTICARRIER (MC) SYSTEM

- The DECT multicarrier(MC) feature uses 10 carrier frequencies in the 1880 to 1900 MHz range.
- Each FDM channel has therefore a bandwidth of $\frac{1900-1880}{10}$= 2 MHz.



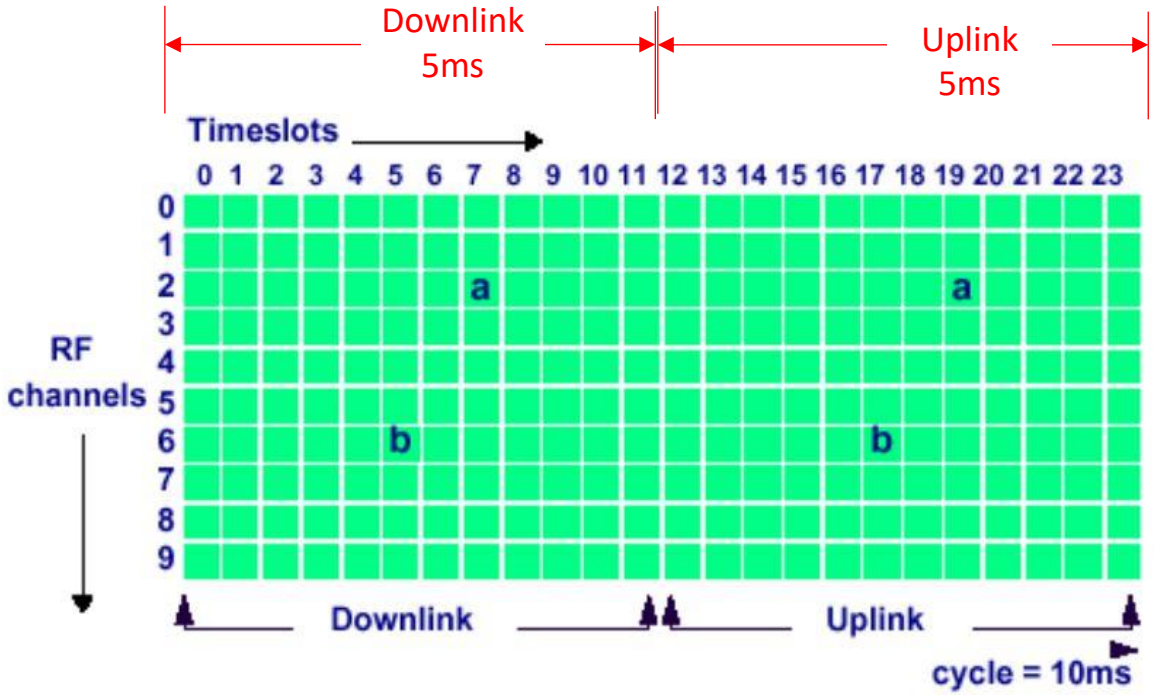
TIME DIVISION MULTIPLE ACCESS (1)

- The signal in each FDM channel is further subdivided into timeframes repeating every 10 ms.
- Each frame consists of 24 timeslots which are each individually accessible by Time Division Multiple Access(TDMA) that may be used for either transmission or reception.



TIME DIVISION MULTIPLE ACCESS (2)

1. For duplex speech service two timeslots - with 5 ms separation - are paired to provide bearer capacity for typically 32 kbit/s full duplex connections.
2. To simplify implementations the 10 ms time-frame was split in two halves (TDD) as follows:
   a) 12 timeslots are used by the Fixed Part (FP) transmissions (downlink)
   b) 12 are used for Portable Part (PP) transmissions (uplink).



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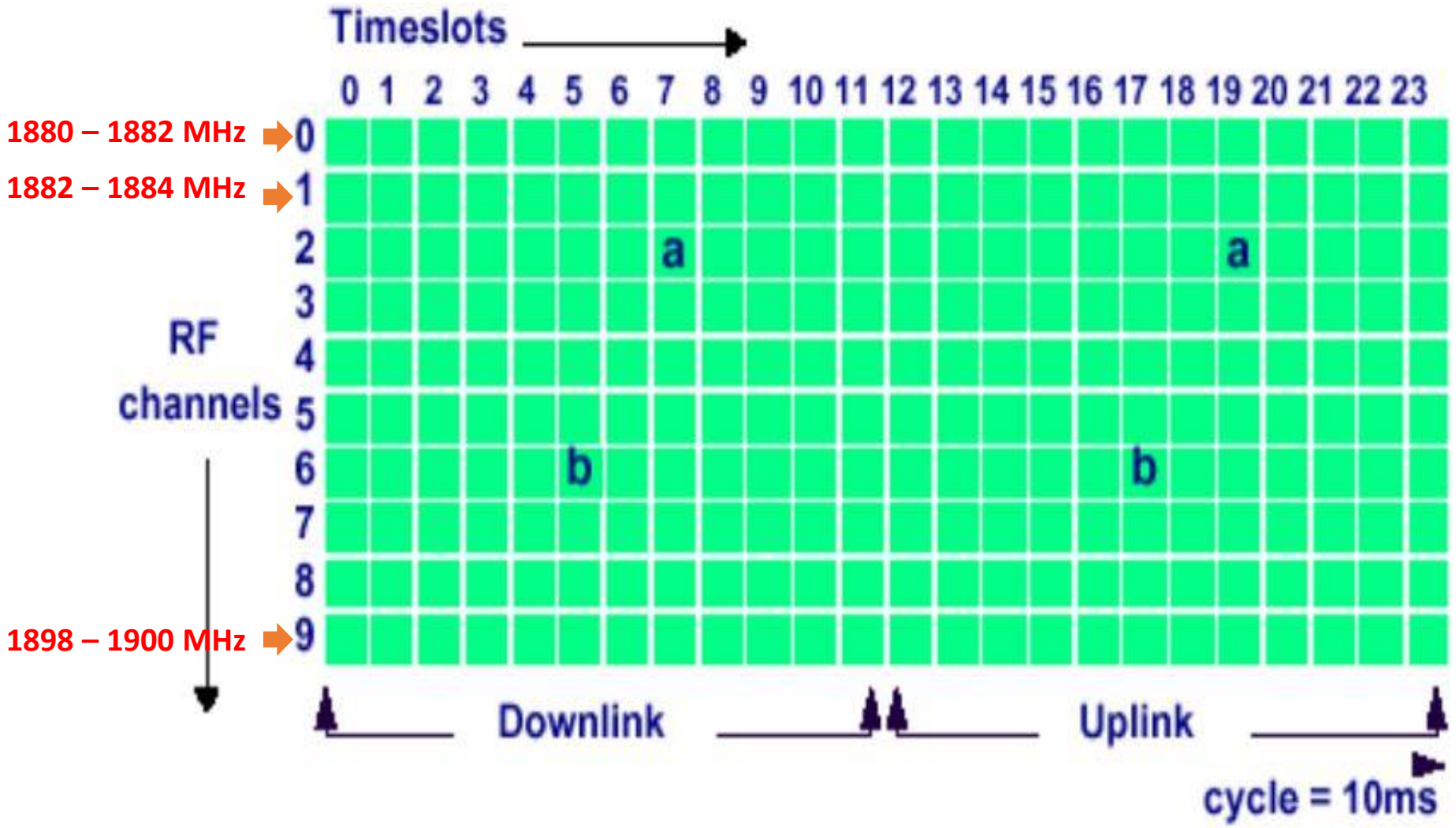


DECT VOICE & DATA CAPABILITY

1. The 24 slots are divided into two groups of 12 slots. One group is employed in uplink transmission and the other in downlink transmission.
2. Channel data rate is 32kbps.

VOICE SERVICE

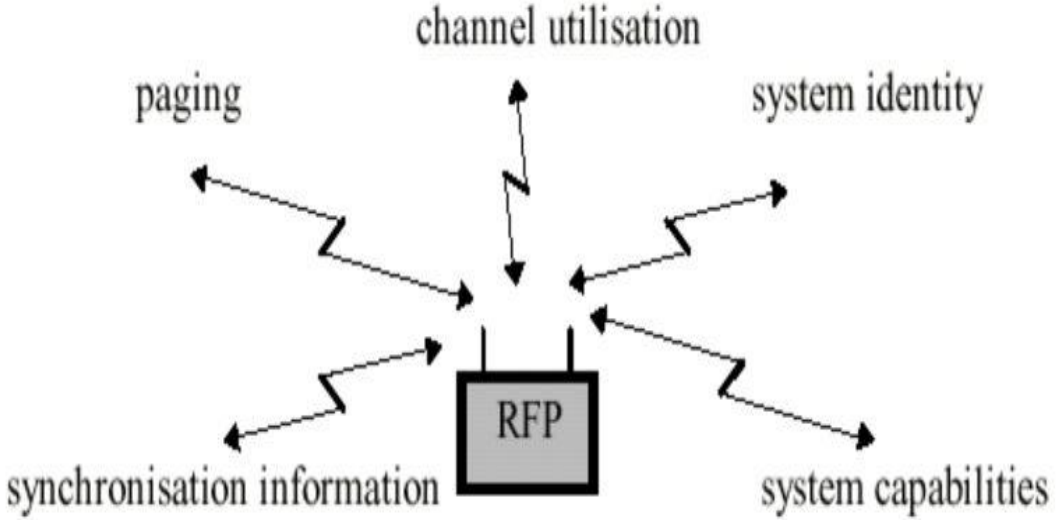
1. Voice service is provided by Adaptive Pulse Code Modulation(ADPCM) for voice communication uses the 32kbps.

DATA SERVICE

1. For data transmission, a CRC is introduced and only 24kbps, per channel is available.
2. Multiple channels are used to improve data rate. Using symmetric connections 12 channels (12×24 = 288kbps) is the limit.
3. To attain higher data rates, asymmetric connections can be used. Using asymmetric connections, at least one slot is necessary to receive acknowledgements. In this situation, using 23 asymmetric slots, 23×24 = 532kbps can be achieved.

CONTINUOUS BROADCAST SERVICE

1. A DECT base station continuously transmits on - at least - one channel, thus providing a beacon function for DECT portables to lock-on to.
2. The base station's beacon transmission carries broadcast information - in a multi-frame multiplexed structure - on **base station identity, system capabilities, RFP status and paging information for incoming call set-up.**
3. Portables locked-on to a beacon transmission will analyze the broadcast information to find out if it has access rights to the system.
4. Only portables with access rights are allowed to set-up a communication link.



DYNAMIC CHANNEL SELECTION AND ALLOCATION

- DECT uses continuous Dynamic Channel Selection and Allocation.
- All DECT equipment is obliged to regularly scan their local radio environment at least once every 30 seconds.
- During scanning the terminal measures local RF signal strength on all idle channels.
- Scanning is done as a background process and produces a list of free and occupied channels and their Received Signal Strength Indication(RSSI).

PORTABLE USER ORIGINATED CALL SET-UP

- The Portable selects (using its Dynamic Channel Selection) the best channel available for set-up, and accesses the fixed part on this channel.
- To be able to detect the PP's set-up attempts the Fixed Part (FP) must be receiving on the channel when the Portable transmits its access request.
- To allow portables to use all 10 DECT RF carriers, the fixed part continuously scans its idle receive channels for portable setup attempts in a sequential manner.
- The Portables synchronise to this transmissions using the information transmitted through the FP continuous broadcast service.

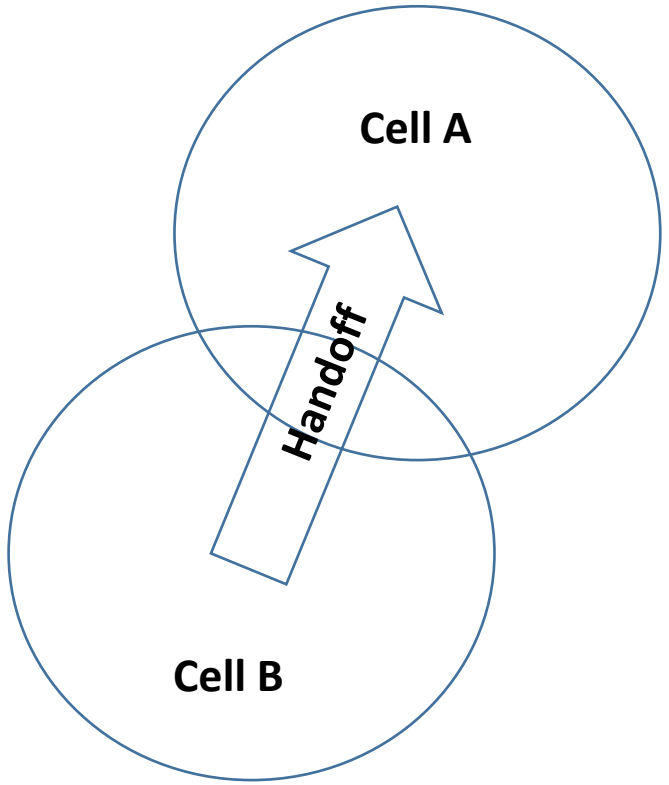
NETWORK ORIGINATED CALL SET-UP

- When a call comes in for a DECT portable, the base station will page the portable by sending a page message - containing the Portable’s identity - through its continuous broadcast service.

- A portable receiving a paging message with its identity included will set-up a radio link - to serve the incoming call - using the same procedure used when originating a call.

CELLULAR HANDOFF

- Portables can escape from an interfered radio connection by establishing a second radio link - on a newly selected channel - to either the same base station **(intracell handover) or to another to base station (intercell handover).**
- The two radio links are temporarily maintained in parallel with identical speech information being carried across while the quality of the links is being analysed.
- After some time the base station determines which radio link has the best quality and releases the other link.



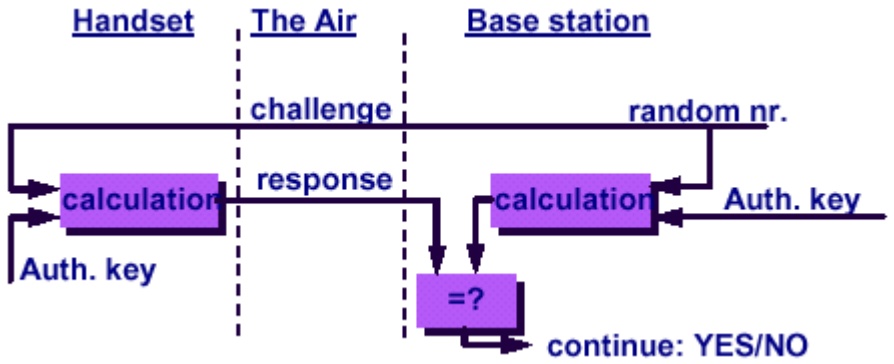
(a) Inter-cell Handoff

ANTENNA SPACE DIVERSITY

- Handover in DECT is a mechanism to escape from interfered or channels with low signal level. Handover is however not sufficiently fast to counteract fast fading situations.
- For this purpose the DECT base station are usually equipped with antenna diversity. A signaling protocol is available in the standard to control FP antenna diversity from the portable.

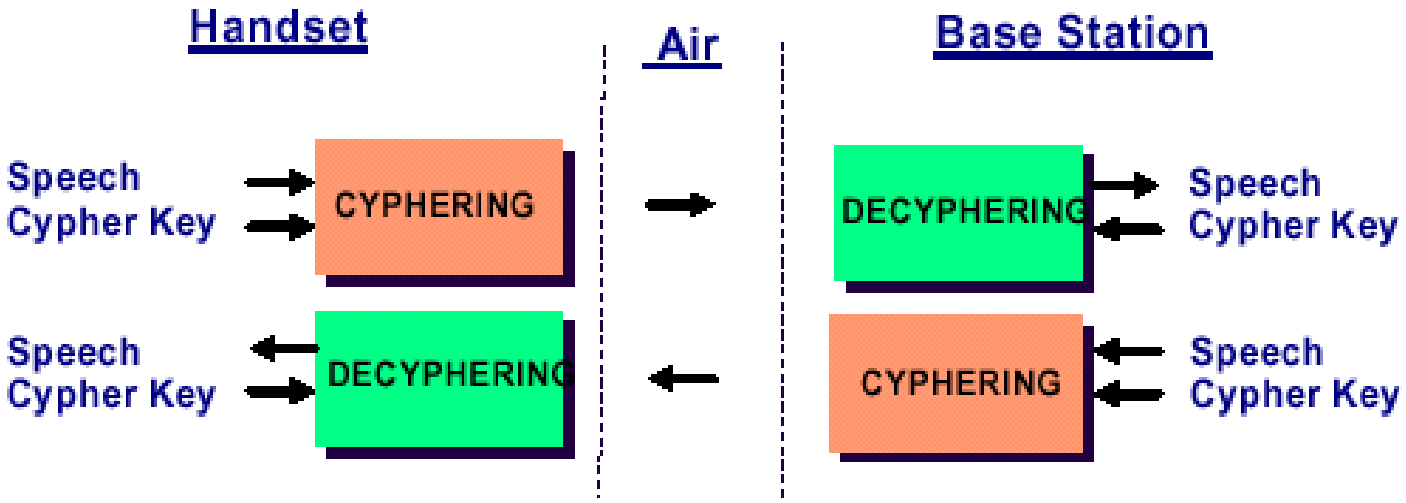
DECT AUTHENTICATION

1. The FP (base station) sends a random number to the Mobile Terminal that is called the ‘challenge’.
2. The Mobile Terminal calculates a ‘response’ by combining it’s authentication key with the random information and transmits the ‘response’ to the base station.
3. The base station also calculates the expected ‘response’ using the same random number and compares it with the received ‘response’.
4. If the result matches with the response then the Portable is authenticated.



DECT ENCRYPTION

1. During authentication, both sides also calculate a cipher key. This key is used to cipher the data sent over the air.
2. At the receiving side the same key is used to decipher the information



APPLICATIONS OF DECT

DECT is used in the following applications:

1. **Domestic cordless telephony**, using a single base station to connect one or more handsets to the public telecommunications network.
2. **Enterprise premises cordless PABXs and wireless LANs**, using many base stations for coverage. Calls continue as users move between different coverage cells after handover. Calls can be both within the system and to the public telecommunications network.
3. **Public access**, using large numbers of base stations to provide high capacity building or urban area coverage as part of a public telecommunications network.

SUMMARY OF DECT FEATURES

FEATURE	DETAILS
RF Carrier frequency	1.88 to 1.9GHz
Access	TDD/TDMA/FDMA
Cell radius	25 to 100 meters
Channel Spacing	1.728 MHz
No. of carriers	10
No. of channels per carrier	12
Speech codec	ADPCM with 32kbps speech rate
Modulation techniques supported in DECT	Gaussian, FSK, 4PSK, 8PSK, 16-QAM, 64-QAM
Bit rate	32 Kbps
Time slots	2 x 12 (upstream, downstream)
Channel Allocation Method	Dynamic
Traffic density	10,000 Erlangs/Km^2

NATIONAL FREQUENCY ALLOCATION IN KENYA FOR DECT

1710.00 □1920	FIXED	Fixed links (New fixed links prohibited) Fixed Wireless Access

	MOBILE *K136 K137* *K138 K139*	Public cellular mobile / IMT- terrestrial systems Cordless PABX (DECT) in band 1880-1900 MHz TKL shut down all WLL DECT systems in Nairobi, Mombasa & Ksm