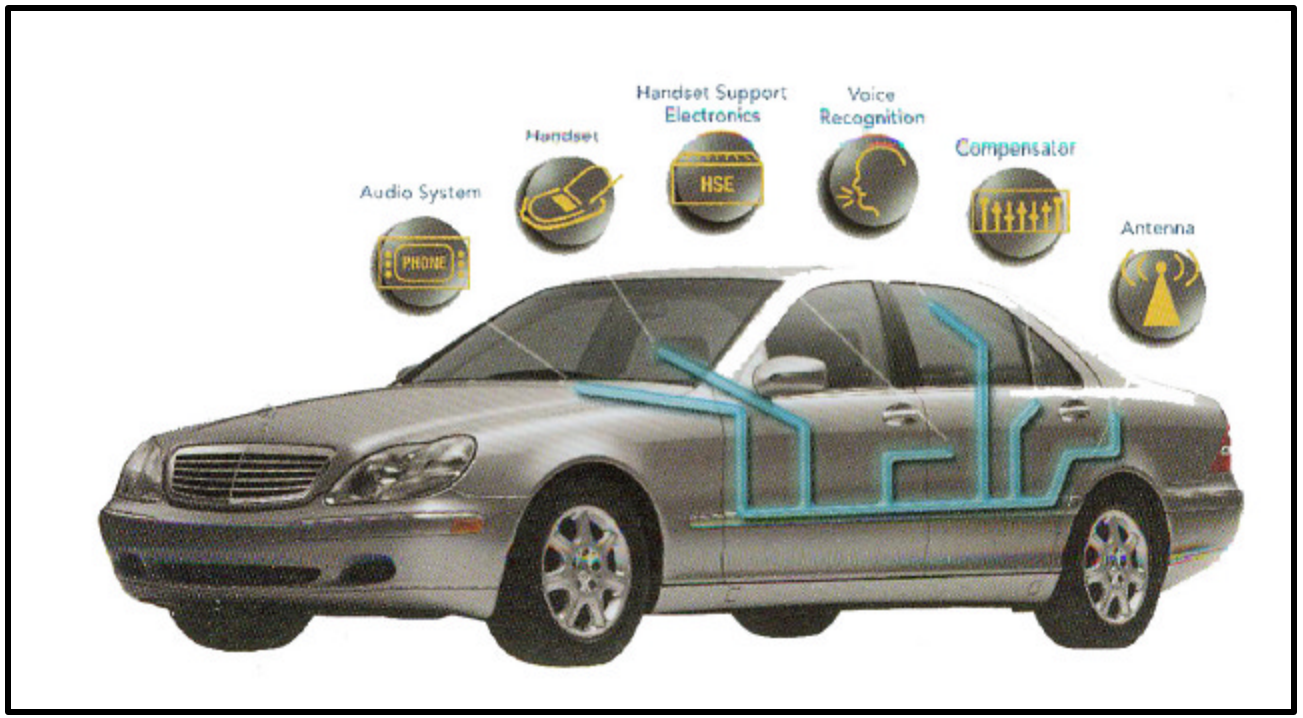
Mercedes-Benz

Integrated Cell Phones



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WIS document numbers shown apply to WIS Version USA/CDN at date of writing.

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Analog

Basic system is known as **A**dvanced **M**obile **P**hone **S**ystem (AMPS)
and only operates in the 800 MHz frequency range

Basic Analog Cell System

- In 1983, Federal Communications Commission (FCC) allocated frequency range 824 - 894 MHz (30 kHz spacing)

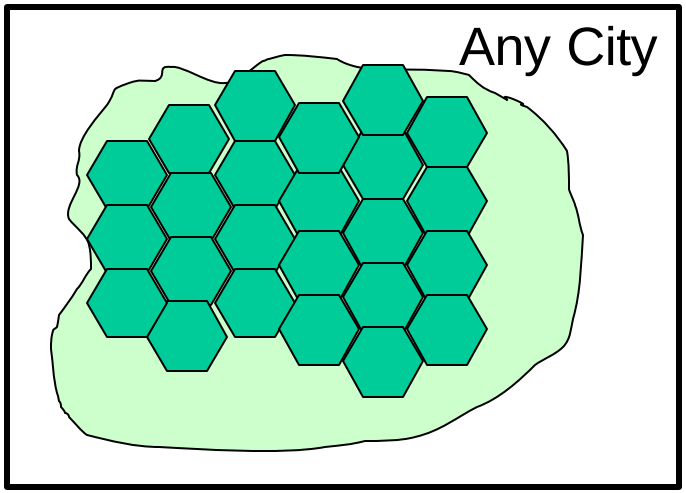
- 2 carriers known as A or B where mandated to promote competition

- Each carrier has 832 frequencies: 790 for voice 42 for control data

- A pair of frequencies are used to create each:
  - voice channel (1 for transmit - 1 for receive)
  - data channel (1 for transmit - 1 for receive)

- Each carrier would have 395 voice channels & 21 control data channels

- To allow reusing the same frequencies by many users, a low power cellular system was developed dividing a city or area into 'cells'

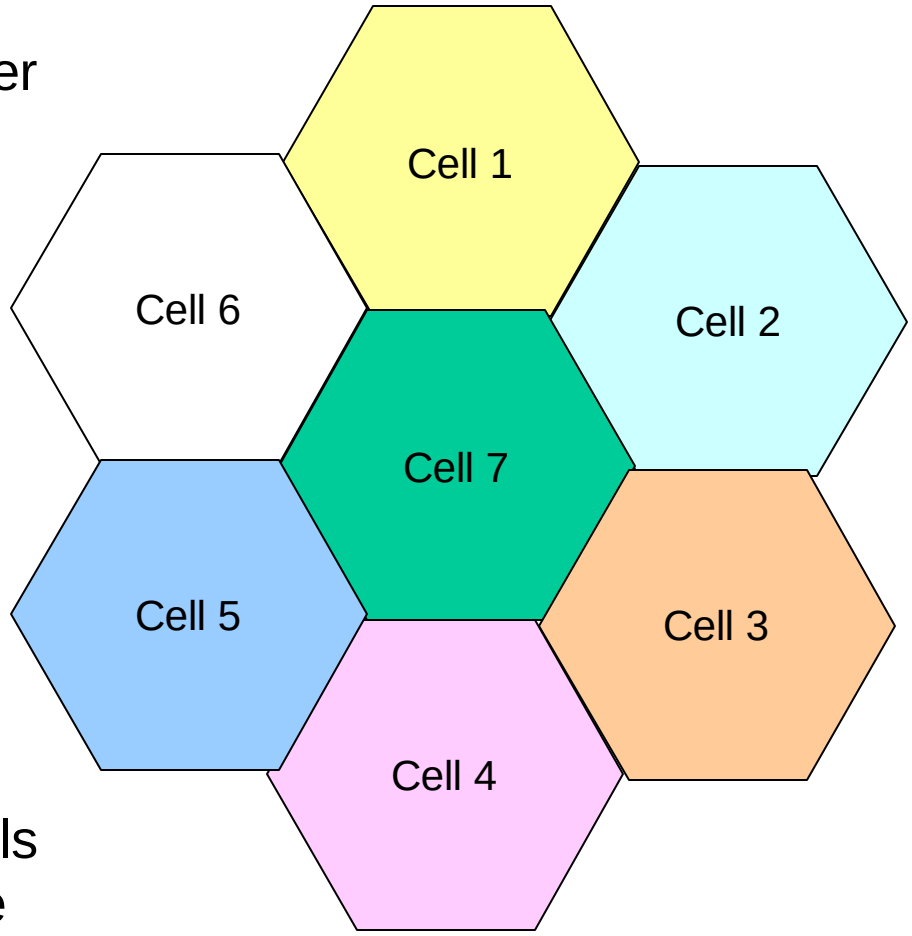


Basic Analog Cell System

- Each cell site contains transmit / receive antennas, switching boxes and connections to land based telephone system
- These cell site antennas are usually shared and can be large, small or even disguised like this one in Pennsylvania

Basic Analog Cell System

- Each cell uses only 1/7 of total frequencies allocated to prevent bleed over from one cell to another
- No two adjacent cells use the same voice channel frequencies
- This results in a total of 56 voice channels in each cell



Note: The number of voice channels increases with digital service

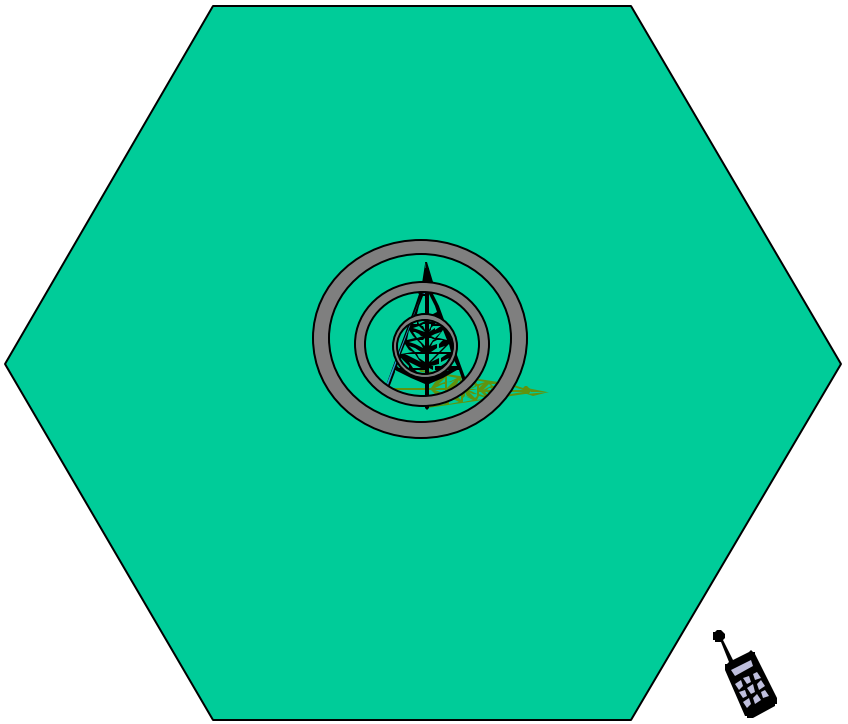
Basic Analog Cell System

- Each cell phone has a unique serial number known as:
  Electronic Serial Number (ESN)

- When the cell phone service is activated the carrier will assign additional numbers
  - Mobile Identification Number (MIN) (derived from cell phone number)
  - System Identification Number (SID) (identifies carrier)

- When the cell phone is switched on it listens for the SID # on one of the control data frequencies

- If no SID # is received cell phone will display “NO SERVICE”



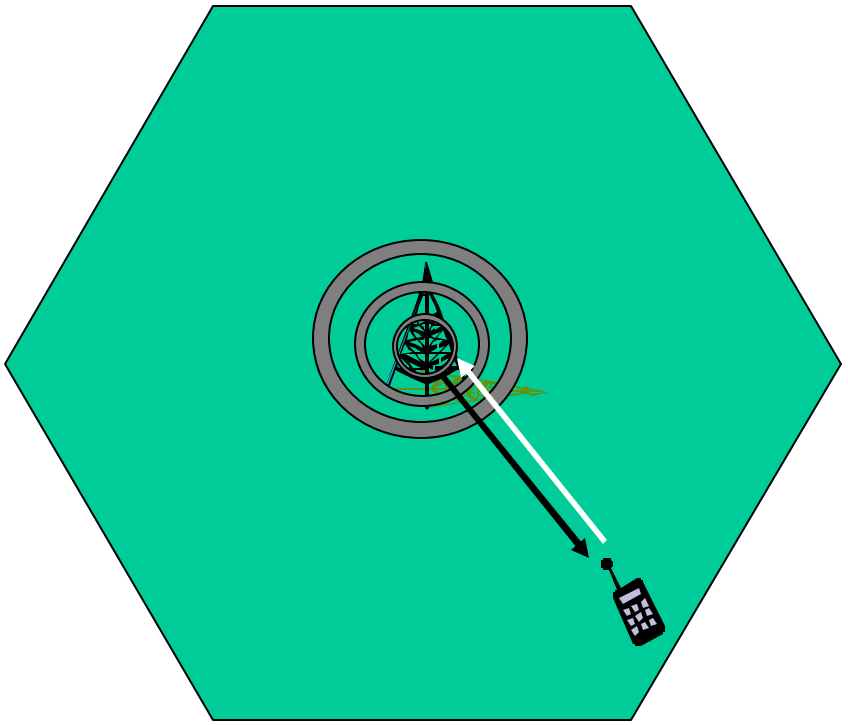
Basic Analog Cell System

- If SID # is received cell phone will compare with programmed SID #
  - if matches = ‘HOME’ carrier
  - if it does not match = ‘ROAM’

- Cell phone will send MIN to be registered on system

- Carrier registers cell phone and cell site receiving signal in system database

- Once registered, system periodically checks for presence of cell phone and also monitors signal strength



- If cell phone is switched off, a ‘sign off’ message is sent and carrier database is updated

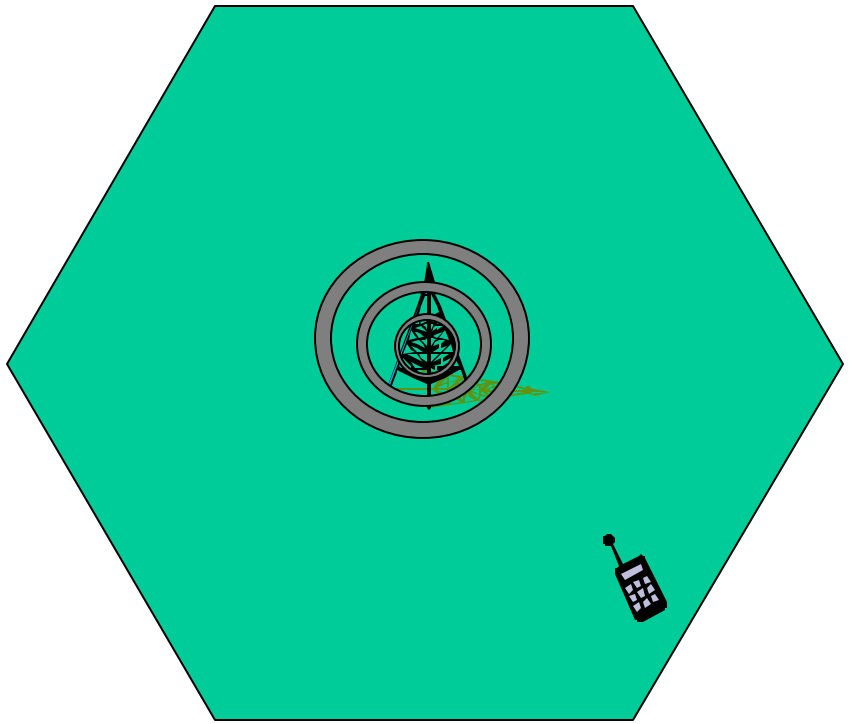
Basic Analog Cell System

- When a call comes in to the carrier from another user, database is searched and once cell phone is located, carrier assigns frequencies to be used

- Frequency information is sent to cell phone over control data frequency channel by cell site it is currently registered in

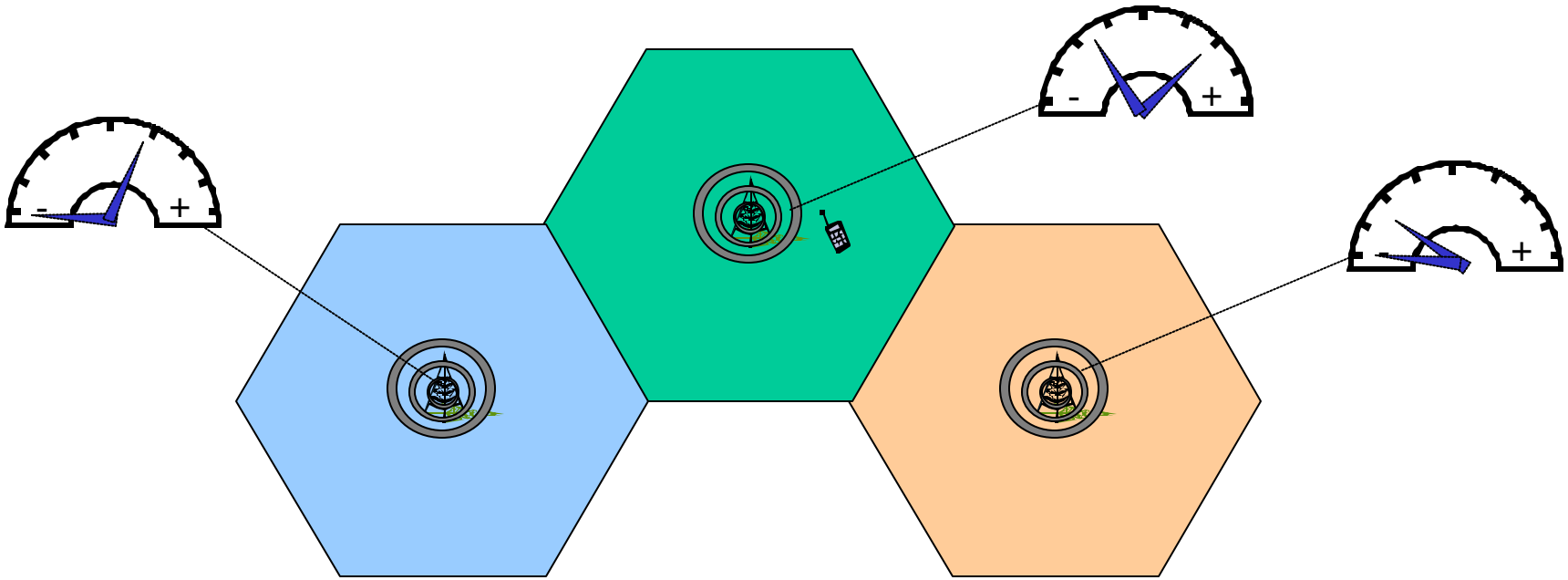
- Cell phone now uses assigned frequencies for voice channels and call is connected

- During call, cell phone continues to monitor control data frequency in case a switch to another pair of voice frequencies is required



Basic Analog Cell System

- As the cell phone moves across or within cells, signal strength will change
- This change in signal strength is used along with signal strength values from adjoining cells to know when to switch to another cell site
- New frequencies are transmitted over control data channel and a seamless ‘handover’ or ‘handoff’ to the next cell occurs



Basic Analog Cell System

- 8 power levels are used up to a maximum of 3 watts
  - power level is determined by cell site and transmitted to cell phone

- Analog voice transmission (FM)
  - all sound ‘picked up’ by the cell phones microphone is transmitted

- Existing analog system is expected to be phased out in 2008*

- Analog system was primarily only used in USA

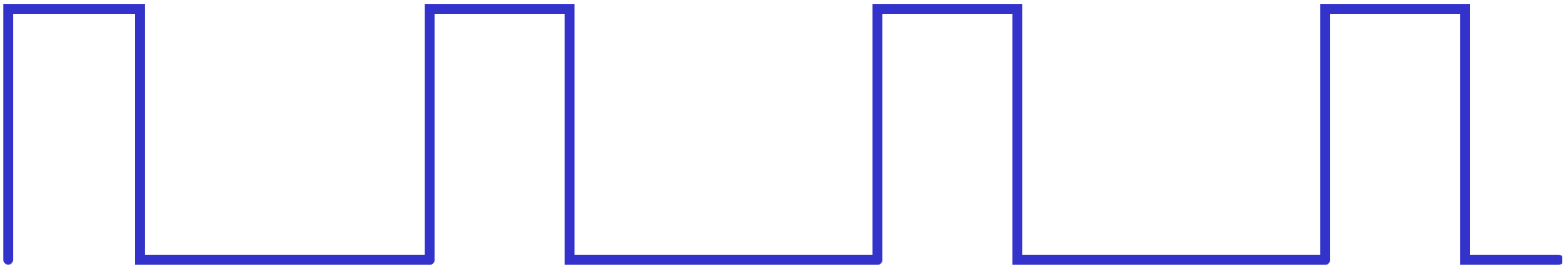
- A variation of this system known as **N**arrowband **A**dvanced **M**obile **P**hone **S**ystem (NAMPS) was also used, basically increasing the number of voice channels by using a channel spacing of 10 kHz, but still an analog system

* ***Analog Service***

The FCC Commission's rules require that all cellular carriers provide analog service that is compatible with the Advanced Mobile Phone Service (AMPS) standard. This requirement is scheduled to sunset in 2008.

Digital

00110011 110011100 00011001 00001110



Analog system has one standard for technology, digital has many standards including:

Time **D**ivision **M**ultiple **A**ccess (TDMA)

Code **D**ivision **M**ultiple **A**ccess (CDMA)

Global **S**ystem for **M**obile Communication (GSM)

Frequencies have been expanded over the past few years to include:
800, 900, 1800 & 1900 MHz

Why Change to Digital?

- Number of cellular users have overloaded analog system capacity
- Static and background noise
- Short standby and talk time due to analog power consumption
- Increasing demand for latest features like:
  - text messaging
  - internet access
  - email
  - graphics / images
  - data information / ring tones
  - etc…
- A digital system can address all the above and more by converting and /or carrying the information in a digitally compressed format

Vocoding

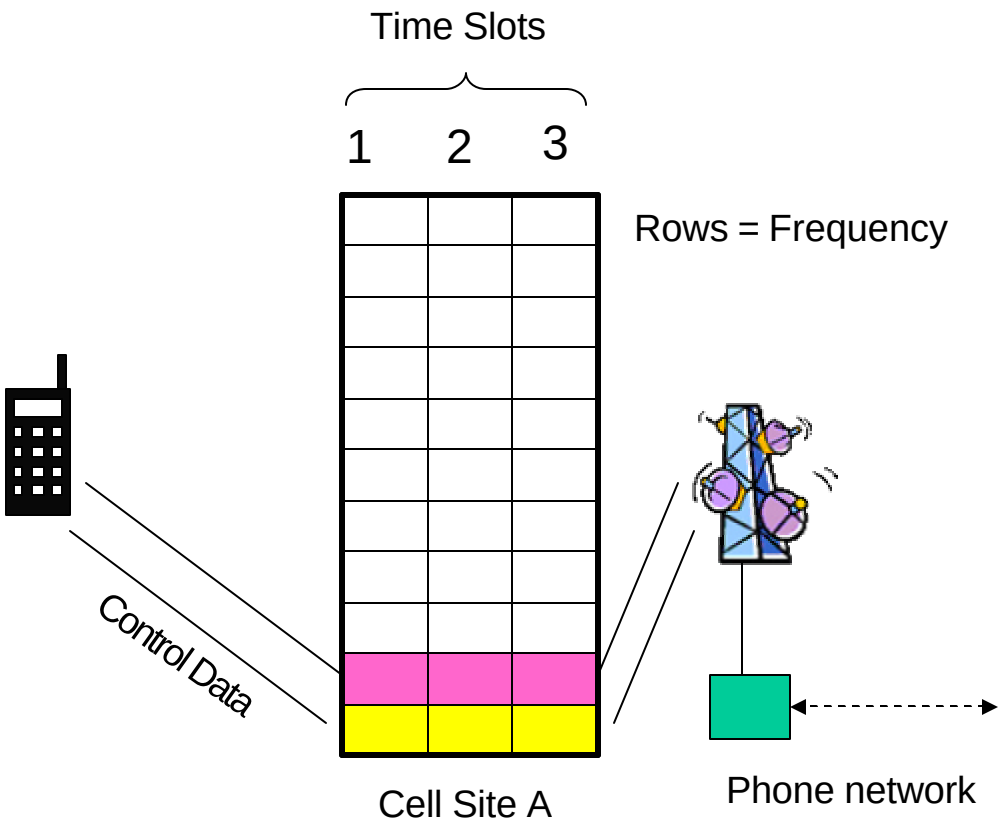
- Digital does not transmit analog audio, instead it transmits digital audio
- Utilizes a process of voice coding commonly referred to as Vocoding
- Human speech is only about 35~40% efficient. In other words, 60~65% of the time a conversation has no meaningful data (non-information; silence, pauses, repetitive sounds)
- There are various Vocoding methods and standards but they all essentially do the same thing; convert your voice into binary information (digital) & then compress it
- Current standards approximate human speech with a library of unique and distinctive sounds:

  e.g. ‘Hello’ may be converted to 1001110 1110001
- This conversion and compression of speech assists in providing 3 - 10 times the number of users for a frequency, compared to analog

CDMA vs. TDMA

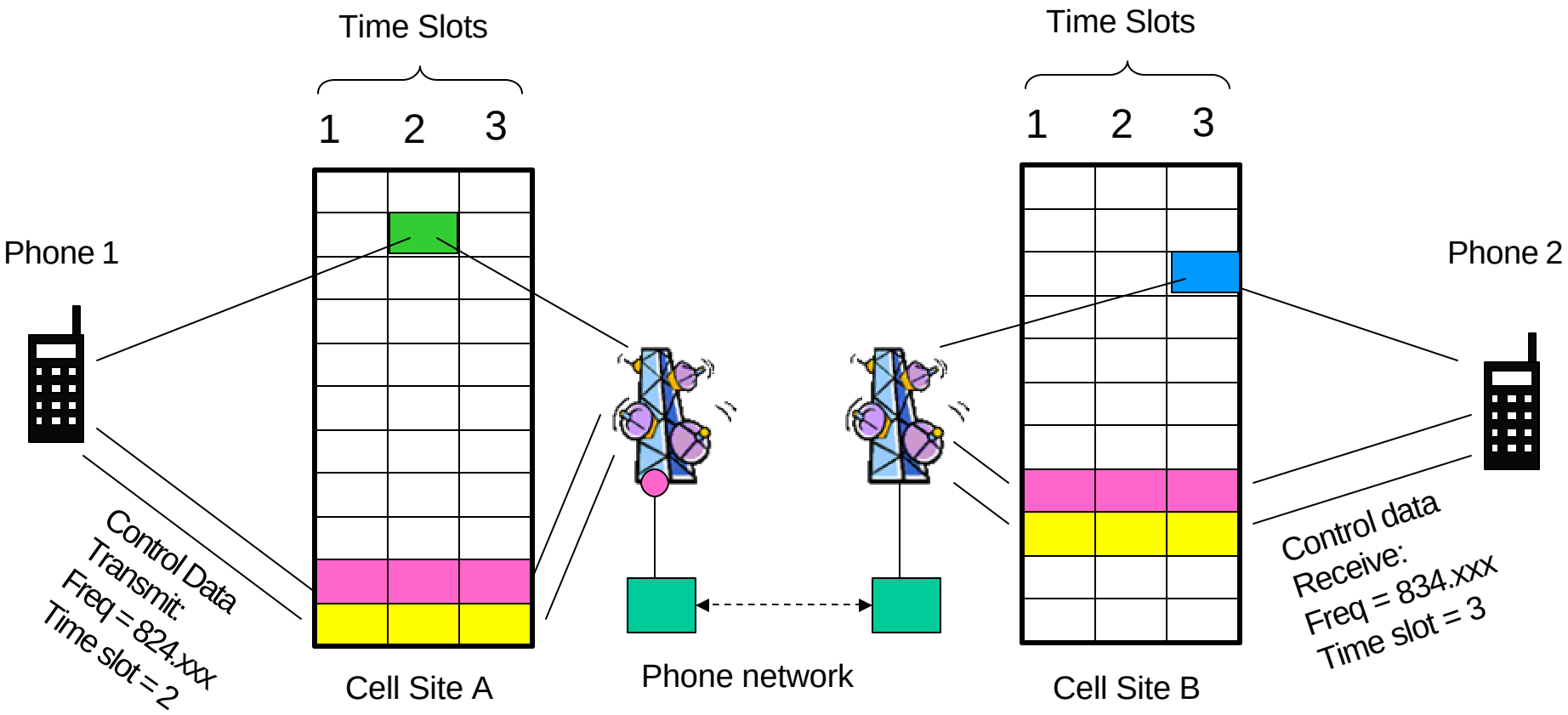
- These formats were developed primarily for the USA as a replacement for analog system (will not work in many other countries)
- These digital systems send and receive digital information
- Information is decoded or encoded by the carrier and your cell phone
- Features of the cell phone can vary depending on whether it uses CDMA or TDMA technology (carrier for your area may only use one format)

Time Division Multiple Access (TDMA)



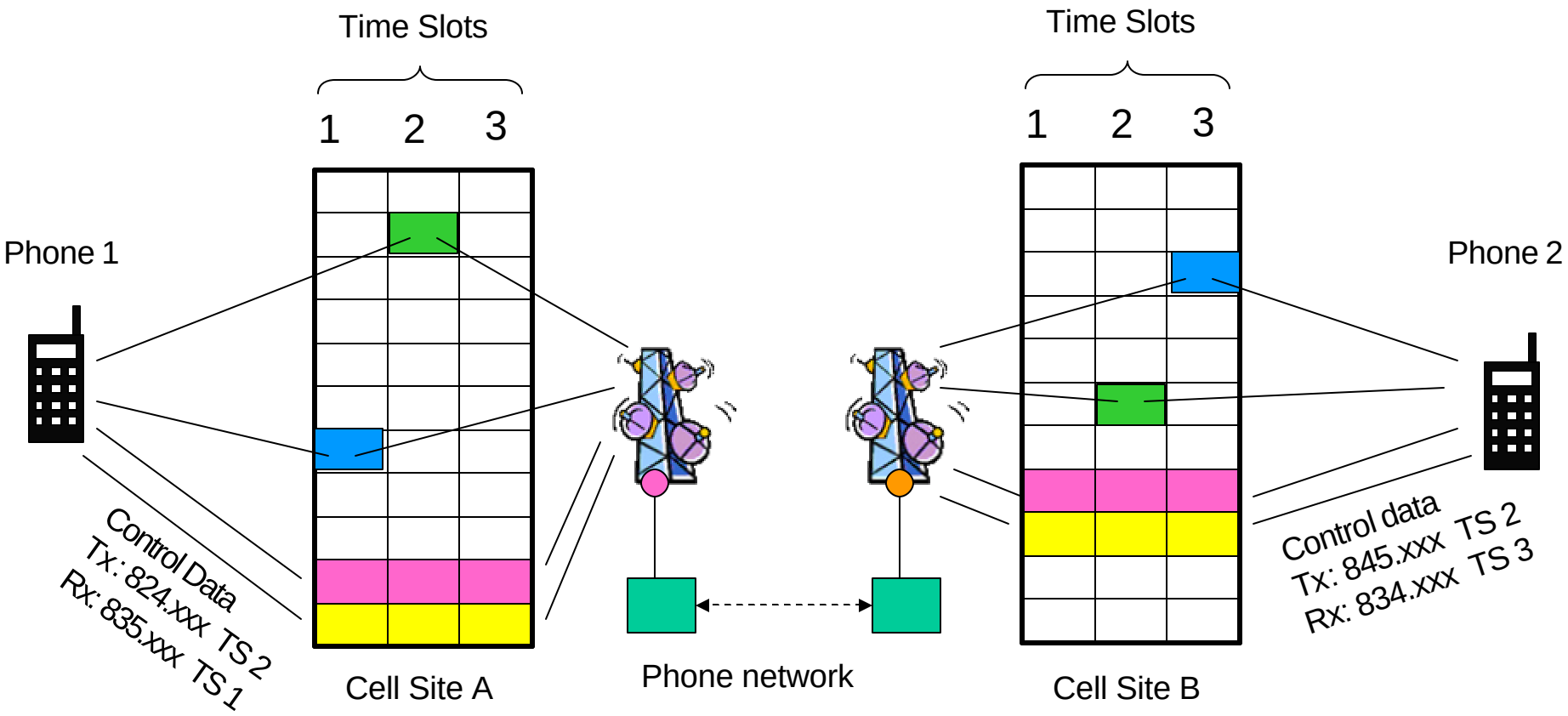
- Uses 800 MHz or 1900 MHz frequency band
- Frequencies are separated by 30 kHz
- Frequency is divided up into 3 time slots each 6.7 ms long
- Certain frequencies at each cell site are reserved for control data information
- Control data informs cell phone of correct frequency and time slot to use for transmit and receive

Time Division Multiple Access (TDMA)



- Message burst from cell phone 1 is broadcast on a specific frequency and time slot (6.7 ms long)
- Cell site A transfers the message via phone network to recipient
- Message burst from cell site B is broadcast on a specific frequency and time slot to cell phone 2

Time Division Multiple Access (TDMA)



- This example shows the complete communication links between two TDMA phones
- Each cell phone uses 4 frequencies, 2 for voice (transmit, receive), 2 for control data (transmit, receive)

Time Division Multiple Access (TDMA)

- The bandwidth used on TDMA system is 30 kHz.
  Bandwidth = a spread of given frequency range. This means that when the phone broadcast on a specific frequency, the message burst is spread out over a range of 30 kHz

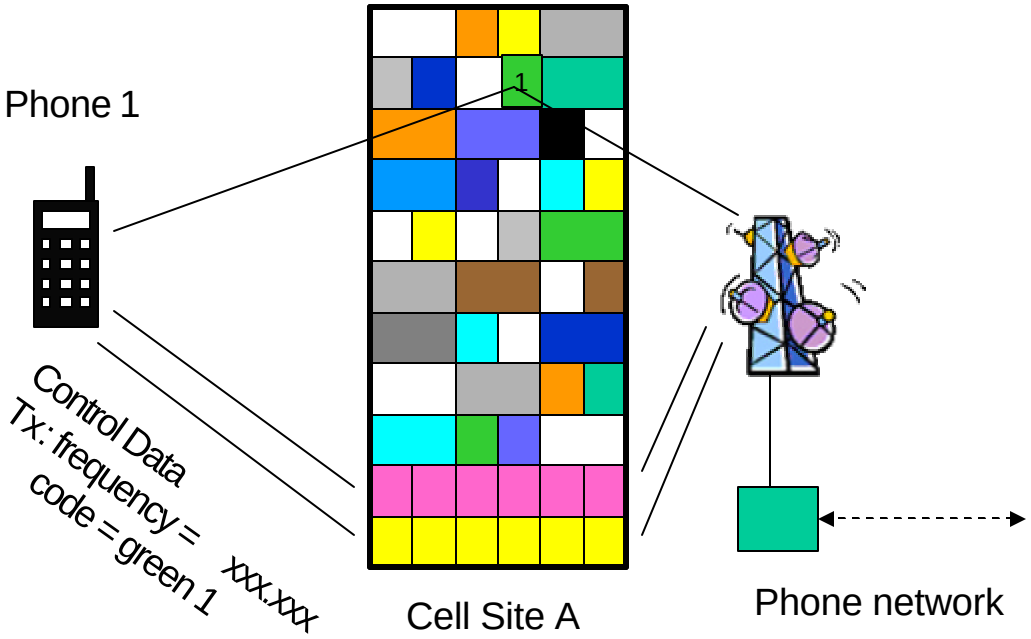
- Each individual time slot is 6.7 ms long. The maximum bits of information in each time slot is 324 bits, which means there is a maximum transmission rate of 48.6 Kbits/s

- If the information sent is less than 324 bits, it will still take up the complete time slot, as these time slots are a fixed period of time

- A separation of at least 45 kHz between the transmitting and receiving frequencies is needed to prevent cross talk.

- A TDMA phone puts 3 calls on the same frequency compared to only 1 call with the AMPS system

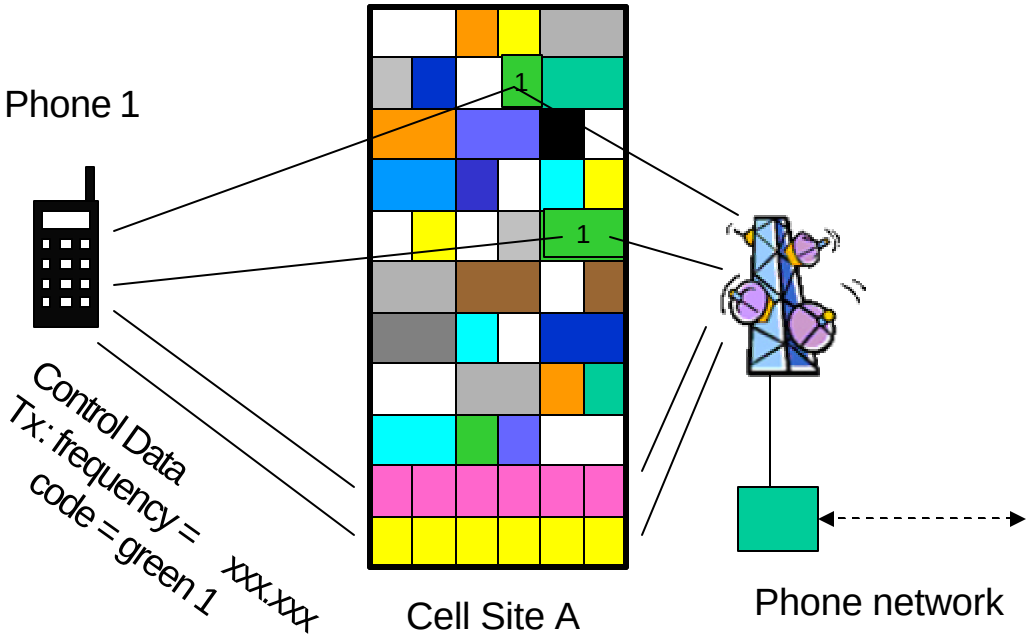
Code Division Multiple Access (CDMA)



- Uses 800 MHz or 1900 MHz frequency band
- Frequencies are separated by 1200 kHz
- Certain frequencies at each cell site are reserved for control data information

- An identifying code (e.g. green 1) is assigned to the message along with a time stamp
- Control data informs cell phone and cell site of current frequency and code to use for transmit and receive
- Cell phone / cell site monitors specified frequency and looks for assigned message code and assembles message according to time stamp

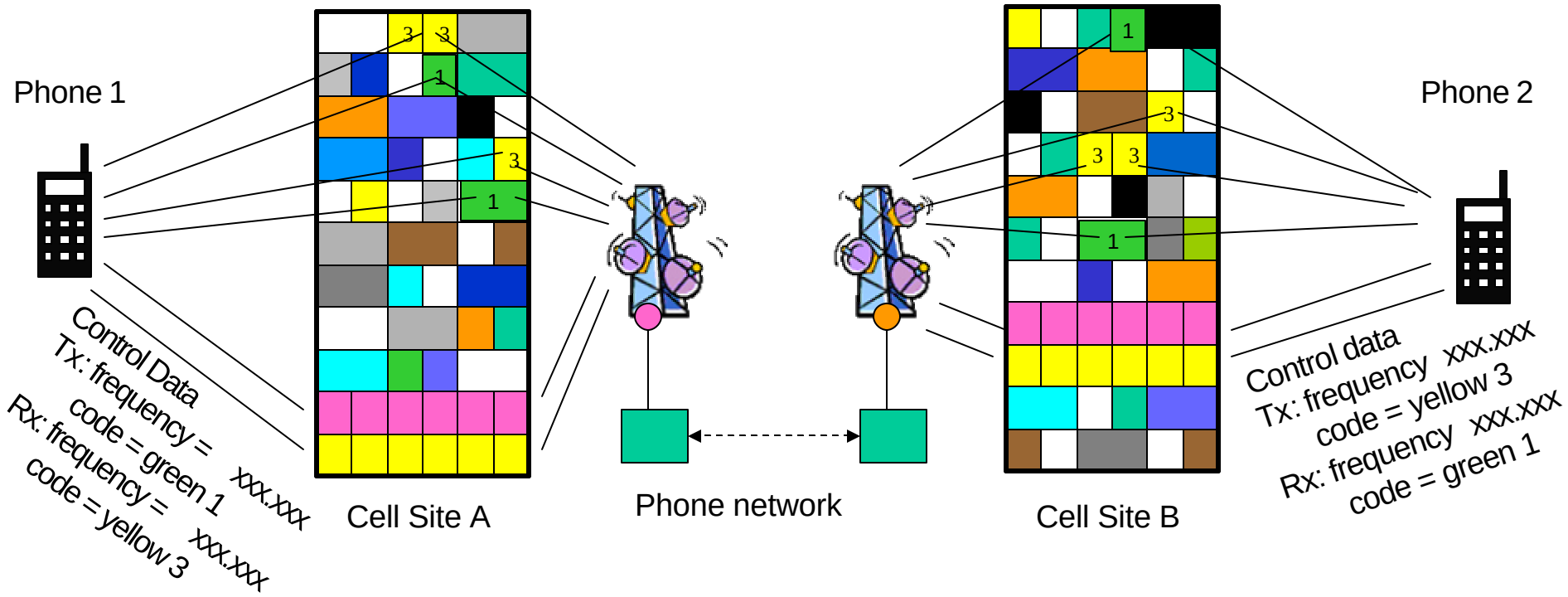
Code Division Multiple Access (CDMA)



- The next piece of the message will be on a different frequency and may consist of more or less data, but the code (e.g. green 1) will still be the same

- Control data informs cell phone and cell site of next available frequency to use, this is constantly changing
- This system requires a very accurate clock to assemble the data according to the time stamp, so the GPS satellite radio signal for time is monitored by the cell phone and site to be used

Code Division Multiple Access (CDMA)



- This example shows the complete communication links between two CDMA phones
- Each cell phone still uses 4 frequencies, 2 for voice, 2 for control data, however the voice frequencies are used more efficiently

Code Division Multiple Access (CDMA)

- “Spread Spectrum” technology is used to allow the call (message bits) to broadcast over the entire frequency band depending upon which frequency has available time on it to broadcast the message bits

- CDMA uses a system called Voice Activated Detection (VAD). When a user talks, the phone digitizes the voice (vocoding) usually at 9600 bits/s and it is then broadcast at 1.23Mbits/s. When the user stops talking, the vocoder idles at 1200bits/s so that background noise can still heard, however this little bit of information is still broadcast out at 1.23 Mbits/s. This way very little space is used on the frequency spectrum allowing more calls on the same frequency.

Code Division Multiple Access (CDMA)

In general, CDMA offers the following advantages:

- Capacity is: 8 to 10 times that of an AMPS analog system
  4 to 5 times that of a TDMA system
- Full use of all frequencies in every cell site through the use of coding technology, results in simplified frequency planning
- Enhanced privacy due to the coding and wide bandwidths
- More users per cell site through efficient use of frequencies, allows for the possibility of fewer cell sites

However, there are some disadvantages as well:

- The technology is more complex
- Equipment cost for cell site operations is much higher compared to TDMA system (CDMA = $300,000 TDMA = $80,000)
- Incompatible with GSM technology

Analog vs. CDMA vs. TDMA

Description	Analog	Digital CDMA	Digital TDMA
Frequency	800 MHz	800 MHz 1900 MHz	800 MHz 1900 MHz
Power	3 watt max.	0.6 watt max.	0.6 watt max.
Power levels	8 (Assigned by cell)	256 (Assigned by cell phone)	6 (assigned by cell)
Available Channels	~832 (AMPS) ~2412 (NAMPS)	~ 4096	~2412 (3 x 832) ~4824 (6 x 832)
Frequency spacing	30 kHz (AMPS) 10 kHz (NAMPS)	1200 kHz	30 kHz
Audio transmission	True analog (FM)	Digital Vocoding / CODEC	Digital vocoding / CODEC

DTMF Tone Generation

- Dual Tone Multiple Frequency (DTMF) tones, more commonly known as ‘Touch-Tones’

- Play an integral role in communications

- Generation of these tones are handled differently by each of the cellular technologies

ANALOG **Tones are generated within cell phone and are broadcast in analog to receiver**
DIGITAL **CDMA - Cell phone requests network to generate required tone. Cell phone will send requests to network and will do so as fast as you can dial them.**
TDMA - Cell phone requests network to generate required tone. Cell phone will send requests to network and must wait for acknowledgement before sending the next tone. Perceived as lag in dialing.

Handoff - CDMA vs. TDMA

☹ TDMA utilizes what is known as a ‘hard handoff’ when switching from one cell site to another

- this means cell site informs cell phone to stop transmitting & receiving on current frequency pair and to start transmitting & receiving on new frequency pair (audio feed is lost for 10 – 100 ms, can result in a dropped call!)

☺ CDMA utilizes what is known as a ‘soft handoff’ when switching from one cell site to another

- as data is coded it can be transmitted on two or more alternate handoff sites at the same time. Cell phone can pick, choose or combine data between different sources to ease transition to next cell site (reduces possibility of dropped call)

.....

☺ TDMA can ‘handoff’ to an analog system and switch back to digital

☹ CDMA can only ‘handoff’ to an analog system, cannot switch back to digital

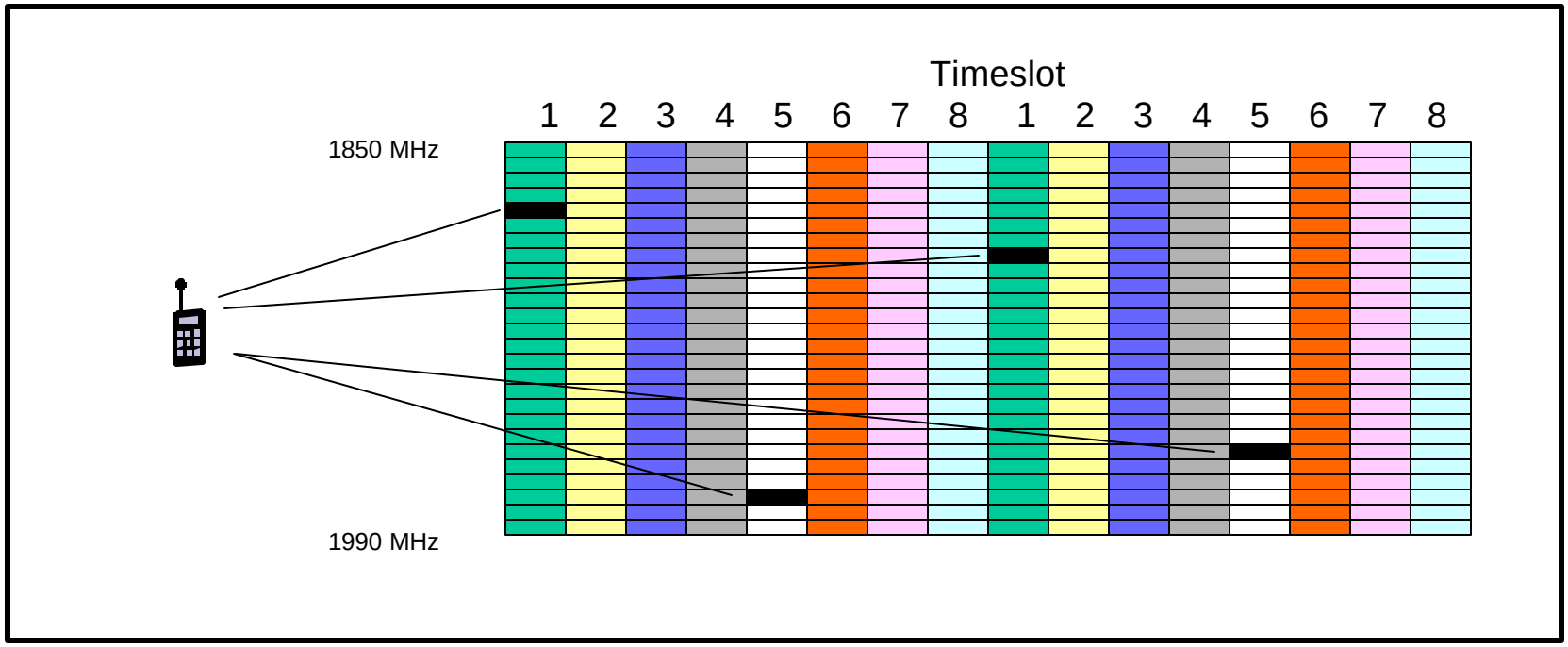
Global System for Mobile Communication (GSM)

- In Europe, numerous cellular systems were developed in the early 80's and were incompatible with each other
- With a growing market a study group was formed in 1982 to study and develop a pan-European public land mobile system, this group was called 'Groupe Spécial Mobile' (GSM)
- In 1990 phase 1 of the GSM specifications were approved and by mid 1991 commercial services begun
- An unproven digital system was chosen that with advancements in compression and digital signal processing showed it would meet the specifications set down by the group
- GSM exists in every continent today and is growing fast in USA

GSM

- GSM uses TDMA technology to access the network

- 8 time slots with a channel separation of 200 kHz
  - capable of frequency hopping for full usage of available channels, but still using same time slot



GSM

- Operates in 850 MHz, 900 MHz, 1800 MHz and 1900 MHz range
- GSM system has been improved over the years to provide more digital services like text messaging, internet browsing etc…
- GSM version or release is sometimes known as:
  - 1G = 1st Generation
  - 2G = 2nd Generation
  - 2.5G = 2nd Generation upgrade
  - 3G = 3rd Generation
- Encryption process is incompatible with TDMA system
- Encryption also provides more secure phone calls
- Transmit power can be regulated up to the maximum for it's class (known classes are: 0.8, 2, 5, 8 and 20 watts)
- Many USA carriers now support GSM however not all are compatible with GSM systems existing in other countries

GSM SIM Card

- GSM cell phones incorporate a unique card called Subscriber Identity Module (SIM), often referred to as a SIM card

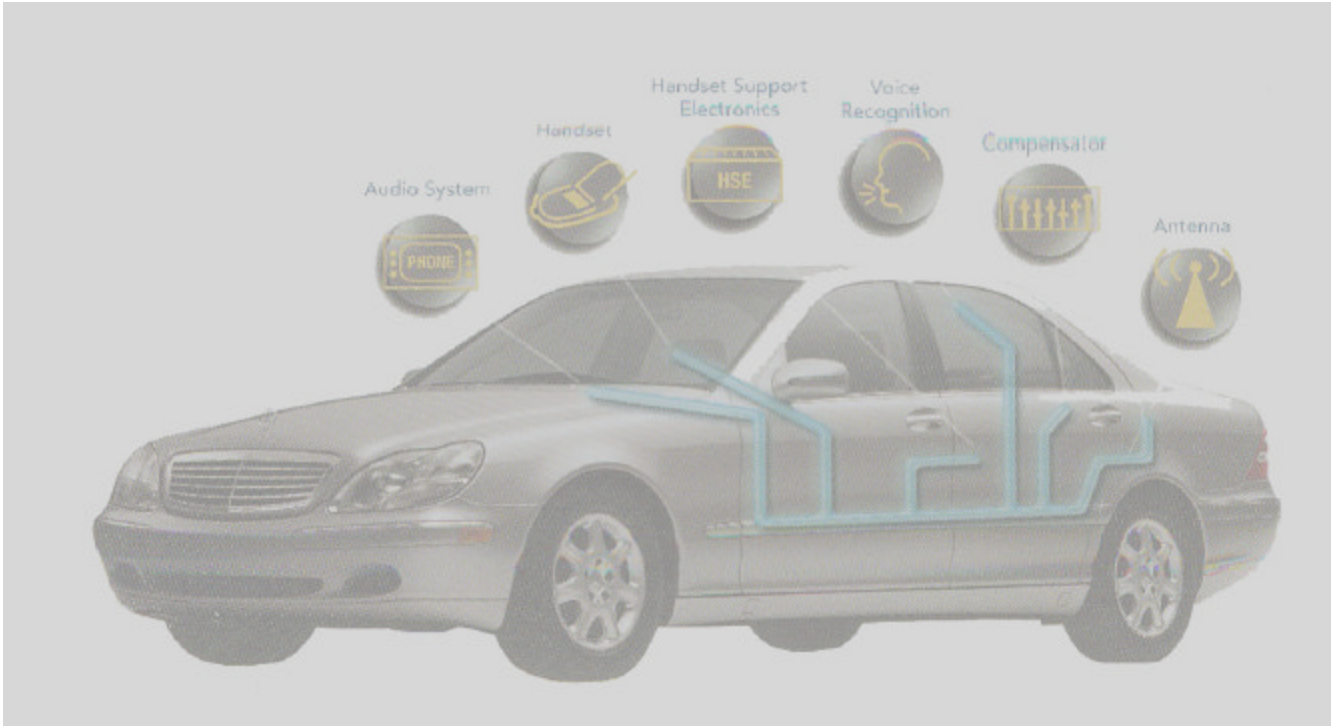
- Basically SIM card is a memory card that contains:
  - internal serial number
  - subscribers phone number
  - phone book
  - prepaid airtime minutes
  - SMS messages
  - etc …

European Siemens M50 shown

- SIM card can be removed and installed in another GSM cell phone (provided it is ‘SIM unlocked’)

- Some GSM phones in USA are ‘SIM locked’
  - this means the carrier has locked the SIM card to the cell phone

Integrated Cell Phone



It's not just a phone …

It's an integrated communication system!

Telephone Timeline

Analog	Analog / Digital	Analog / Dual Digital
800 MHz	800 / 800 MHz	800 / 800 & 1900 MHz

1990 ➔	1999 ➔	2001 ➔

OKI
- Fixed
- Portable

Motorola
- Fixed
- MicroTAC

Motorola
- StarTAC

Motorola
- TimePort

- V60 series

Why Are MB Integrated Phones Unique?

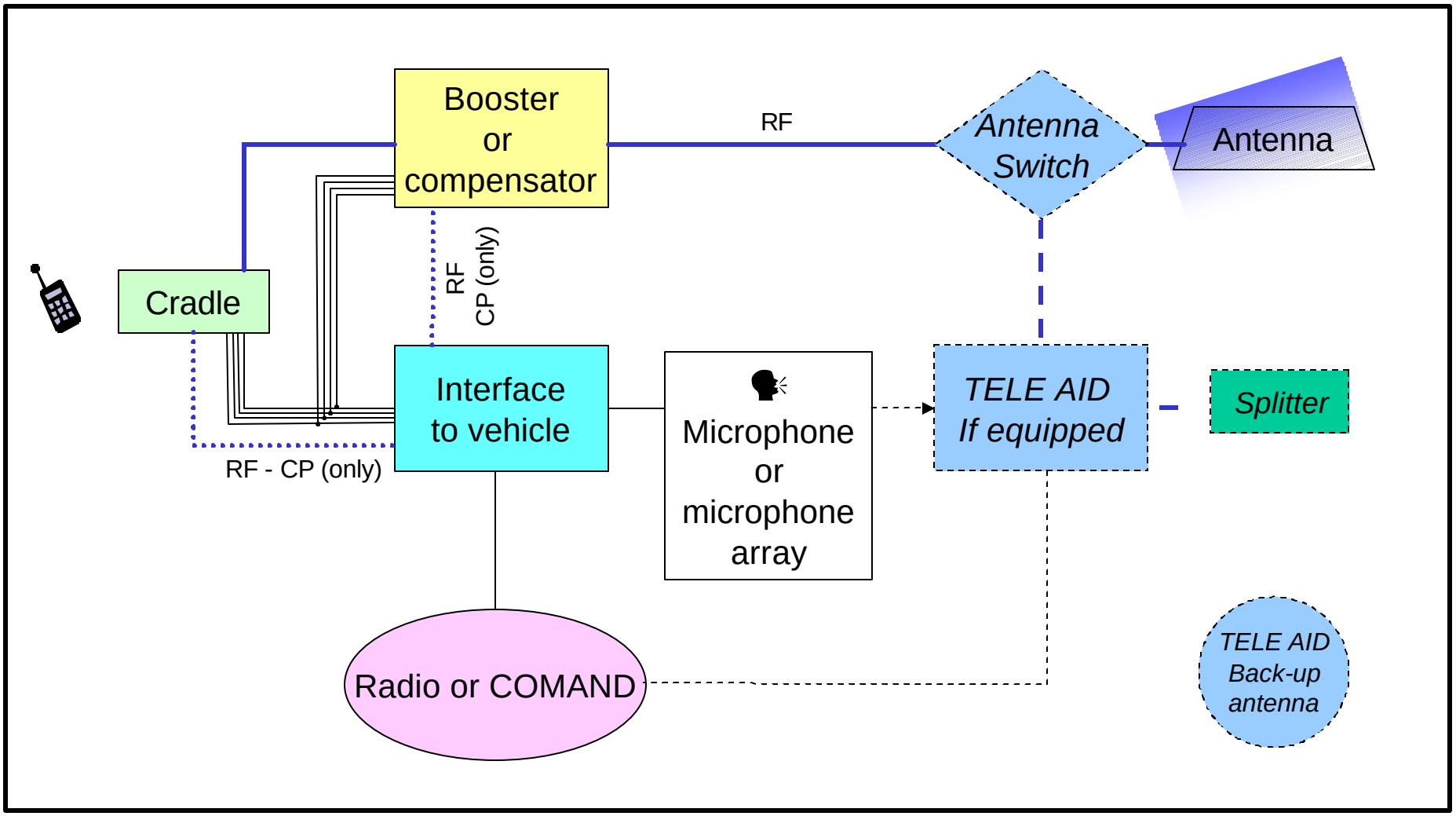
- Cell phone is integrated into vehicle communication system
- Hands-free operation using interior microphone and sound system speakers
- Microphone optimized for driver voice input
- Background noise elimination for superior sound quality
- Integrated antenna and compensator - improving reception
- Steering wheel buttons provides common phone features without moving your hands from steering wheel

(cont’d)

Why Are MB Integrated Phones Unique?

- Sound system automatically mutes when accepting or making a call
- Meets hands-free legislation
- DCAG crash tested
- Data download to vehicle system for convenient viewing either in radio or multi-function display
  e.g. - Phone book - Call log - Text messages
- Voice commands possible with optional voice control system
- Handset cradle attractively blends into interior

Components



Generic overview of components (always use correct wiring diagram for diagnosis)

Cradle

- Connection between cell phone and vehicle

- Cradle design allows cell phone to be used in privacy mode as well as hands-free mode
  - automatically switches when cell phone is ‘flipped’ open or closed

- Provides power for charging cell phone battery *(incorporates protection circuit)*
  - rapid charging when not on a call
  - trickle charging during a call

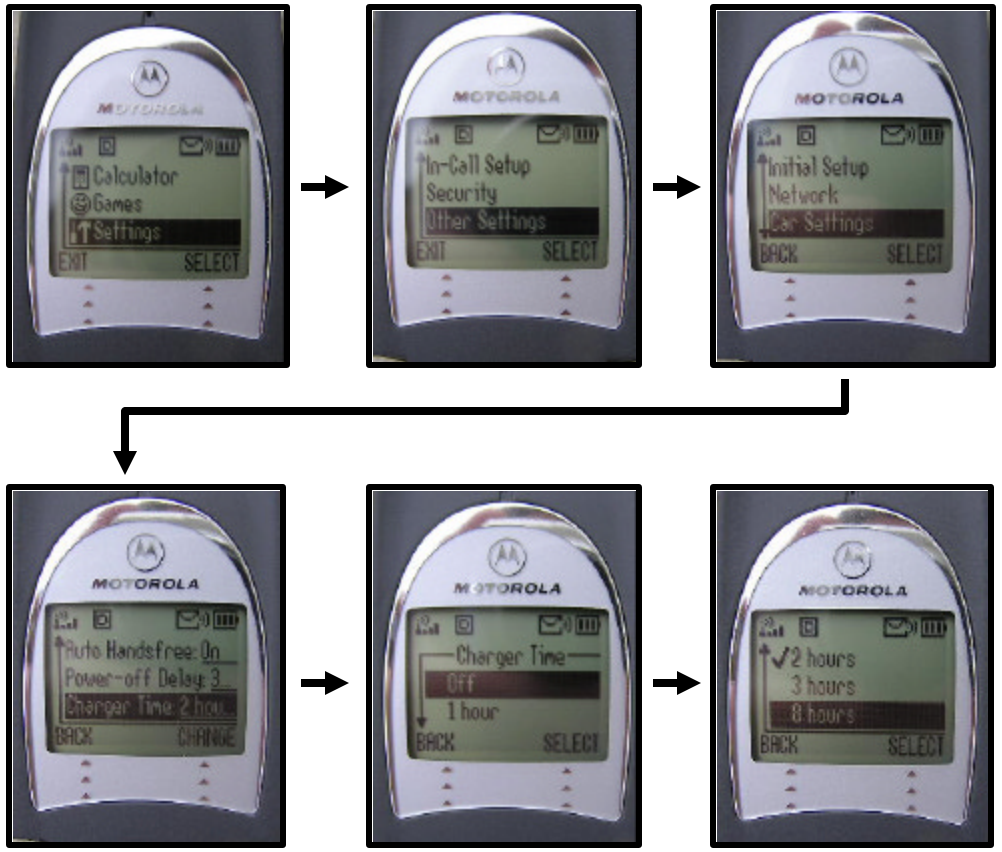
  Charge time dependant on many factors

- Always use correct cradle for specific cell phone

Cell Phone Battery Charging

- Battery charging time while docked with ignition OFF can be changed in phone settings
- If charging time is set to OFF or a short period of time, battery may not be completely charged while docked
- This may lead to dead battery complaint during a long call after ignition switched ON even though it is connected to a power supply
- Before replacing components for this complaint, check phone settings

  Main menu ➔ Settings ➔ Other settings ➔ Car settings ➔ Charger time



Note: Other settings under “Car Settings”:
Auto answer – ON / OFF
Auto Handsfree – ON / OFF
Power-off Delay – 0 / 15 / 30 / 60 mins / Continuous

Refer to owners manual for list of specific phone settings

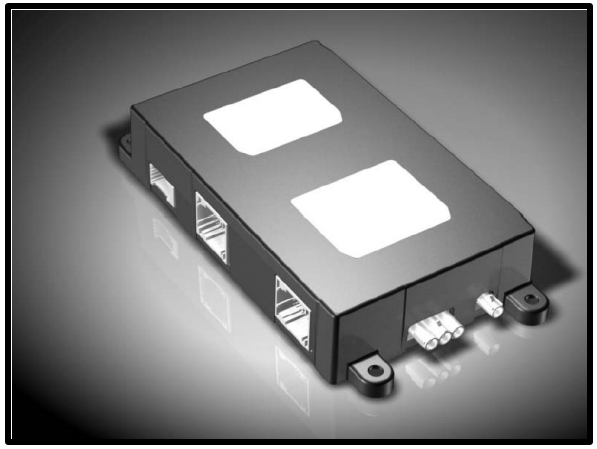
Interface to Vehicle

PSE - Portable Support Electronics (D2B)
HSE - Handset support Electronics (D2B)

CP - Communications Platform (MOST)
(also incorporates TELE AID & Bluetooth connection)

PSE / HSE

- Provides connection to vehicle communication system
- Provides charging circuit for cell phone
- ON / OFF control for compensator
- Optical ring component



CP

Booster / Compensator

- When cell phone is connected to vehicle there will be a signal loss due to extra wiring and antenna connections

- To counteract this on early systems (analog only) a booster was installed (max. output 3 watts)
  - contained logic circuit boards to ensure correct transmit power was used, as directed by cell site - smart device

Booster

- Later systems (analog / digital) use a linear compensator
  - which gave a 10 dB gain to transmit power from cell phone - dumb device

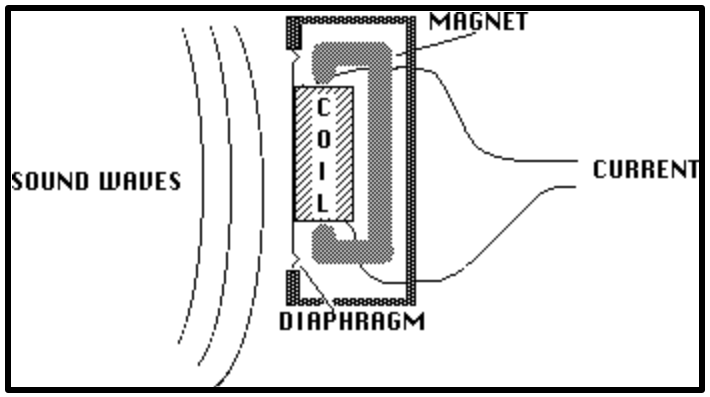
- Not on optical ring

Linear Compensator

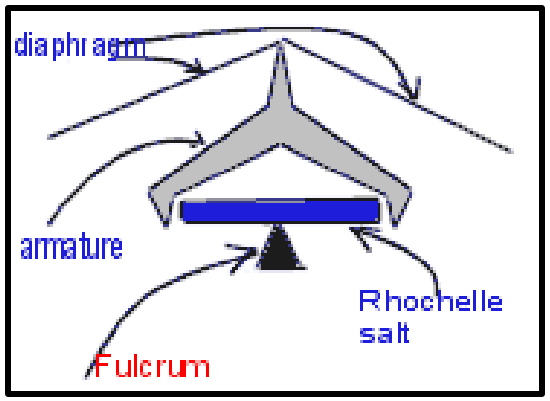
Note: Ensure antenna cables IN and OUT are not reversed

Microphone

- Converts sound waves into electrical signals
- All microphone types basically consist of a diaphragm which moves as the sound waves strike it
- Diaphragm movement is translated into an electrical signal by numerous methods
  (e.g. Carbon, Dynamic, Crystal, Ceramic, Condenser, Ribbon)



Dynamic microphone:
Diaphragm is connected to the coil which moves next to the magnet induces change in current.

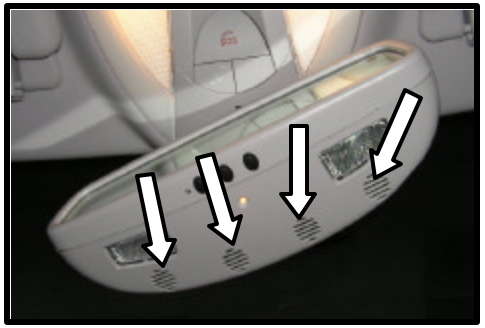


Crystal microphone:
Diaphragm movement forces the armature to flex the crystal that is supported on a fixed fulcrum. This flexing changes the current produced

Microphone

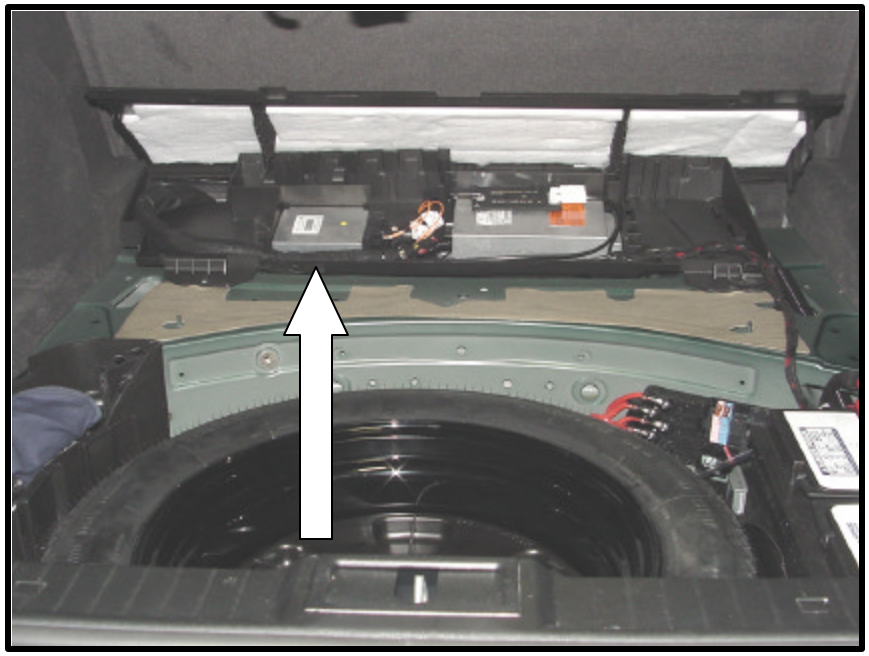
- Microphone for telephone use may have to be installed on early vehicles or later vehicles not equipped with TELE AID

- Microphone may be a stand alone unit mounted in the head lining
  or
  Microphone incorporated in overhead control panel / rear view mirror
  or
  Several microphones incorporated in a microphone array



- Microphone may be connected directly to phone system or via a MOST control module called Hands-Free Module (HFM) or optional Voice Control System (VCS)

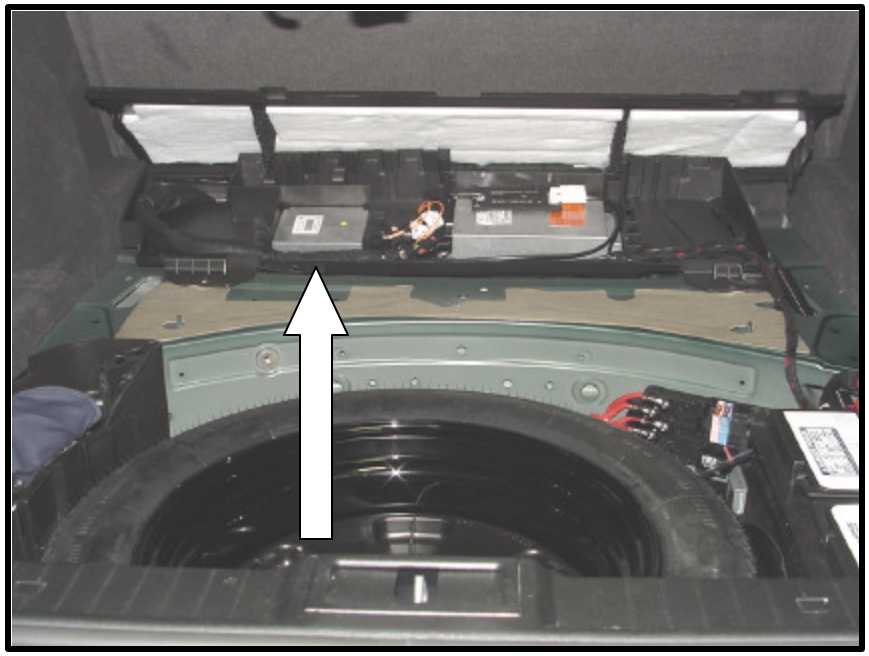
Hands-Free Module (A35/1)



W211 Location: In front of spare tire in trunk

- Currently installed as basic equipment with TELE AID installed
- Used for TELE AID and Cellular phone communication
- Same physical appearance as Voice Control System module
- HFM is replaced with VCS module when voice control option installed

Voice Control System - (A35/11)



W211 Location: In front of spare tire in trunk

- Used for TELE AID & Cellular phone communication
- Needed for voice control of audio / telematics
- Accompanied by an operation lever on right side of steering column
- Same physical appearance as Hands-Free Module

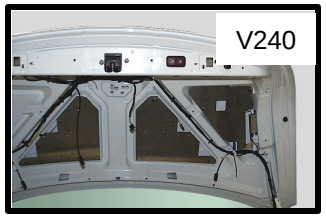
Antennas

- Some antennas are specifically designed for receiving or for transmitting. Others are designed for receiving and transmitting.

- Many variants depending on model:
  - electric retractable antenna, usually identified by black upper stem section

    (antenna had additional signal wire so antenna could extend if radio off)
-
  - ‘stick’ antenna on rear quarter panel
  - bumper antenna (TELE AID back-up)
  - separate antenna mounted on or near roof & may be combined with GPS antenna
  - antenna mounted under composite body panel

Note: Some antennas do not support all telephone frequencies



MY00 Antenna Application Matrix

Part Numbers and Mounting Locations

FJD 29-Oct-99 Rev. -

Information subject to change

Vehicle	AM/FM/WB	GPS	GPS Splitter	Tele Aid Antennas		Phone
				Primary	Back-Up	
R129	129 820 16 75	129 820 19 75		129 820 21 75	129 820 16 75	129 820 16 75
	Pwr Ant. Mast ❶	Trunk Lid	n/a	Bumper	Pwr Ant. Mast ❶❷	Pwr Ant. Mast ❶❷
M163		163 820 06 75 ❹				163 827 00 01 ❸ 163 820 06 75 ❹
	Rear Glass	Roof Top	n/a	n/a	n/a	Roof Top
R170						202 820 22 75
	Fender Mast	n/a	n/a	n/a	n/a	Bumper
W202		210 820 13 75		210 820 13 75		202 820 22 75
	Rear Glass	Roof Top ❺	n/a	Roof Top ❺	Under Hat Shelf	Bumper
A208		129 820 19 75	210 820 24 89		202 820 22 75	202 820 22 75
	Fender Mast ❶	Trunk Lid	Left Rear Wheel Well	Fender Mast ❶	Bumper ❻	Bumper ❻
C208		210 820 13 75	210 820 24 89	210 820 13 75	210 820 14 75	202 820 22 75
	Rear Glass	Roof Top ❺	Right Rear Longitudinal Chassis Member	Roof Top ❺	Under Hat Shelf	Bumper
W210		210 820 13 75	210 820 24 89	210 820 13 75	210 820 14 75	202 820 22 75
	Rear Glass	Roof Top ❺	C-Pillar Passenger Compartment	Roof Top ❺	Under Hat Shelf	Bumper
S210		210 820 13 75	210 820 24 89	210 820 13 75	202 820 22 75	202 820 22 75
	Left Rear Side Glass	Roof Top ❺	C-Pillar Passenger Compartment	Roof Top ❺	Bumper ❻	Bumper ❻
C215		215 820 11 75	210 820 24 89	215 820 12 75	202 820 22 75	215 820 11 75
	Rear Glass	Trunk Lid ❺ (inside - left)	Right Rear Quarter Panel	Trunk Lid (inside-right)	Bumper	Trunk Lid ❺ (inside - left)
V220	220 820 17 89	220 820 13 75	210 820 24 89	220 820 13 75	210 820 18 75	210 820 18 75
	Rear Glass	Shark Fin	Right Rear Quarter Panel	Shark Fin	Bumper ❻	Bumper ❻

❶ Integrated AM/FM/WB/800 Mhz Cellular Antenna

❷ Cellular mast antenna is shared. When telephone is installed RF switch Q 6 82 0430 is required.

❸ Cellular antenna only

❹ Integrated GPS and cellular antenna. Uses same vehicle coax ; signal is split at splitter 163 820 12 89 in radio compartment

❺ Integrated GPS and cellular antenna.

❻ When telephone is installed, bumper antenna is shared. RF switch Q 6 82 0430 is required.

Antenna (RF) Switch

- Telephone & TELE AID antennas are shared
- RF switch is required when a telephone is installed on vehicles equipped with TELE AID
- Switch will change input when signaled via hardwire connection to TELE AID & phone

Note: RF switch is part of TELE AID system and therefore constitutes as a safety component. Use EXTREME care when connecting this device to ensure that all connections are secure.

Recent & Future Changes

E911 Compliant Phones

Cradle Changes

New ‘Smart’ Cradle Phone System
(aka Universal Handy Interface (UHI)
or
Universal Portable CTEL Interface (UPCI))

V600 GSM Phone

V710 CDMA Phone

E911

Some days are better than others !!!

E911

- In most countries an emergency phone number has been established for the general public to call in the case of an emergency - 911 for USA
- 911 emergency phone number was first used in Alabama 1968
- Over the years the land based 911 service has been enhanced to give the 911 operator the callers phone number and street address - this is often referred to as E911
- Cellular phones are portable therefore registered address information may not be the current location!
- FCC mandated that cellular carriers provide 911 operators with position of cell phone making 911 call - in other words E911 compliant
- A two phase approach was proposed in 1996 and revised in 1999

E911

Phase I:

- Cellular carrier to provide 911 operators upon appropriate request with telephone number of wireless caller and location of the antenna receiving the call

Phase II:

- as above but more precise location information
    - 1996 specifications
        - within 100 meters (328 ft) for 67% of wireless 911 calls
        - within 300 meters (984 ft) for 95% of wireless 911 calls

    - 1999 specifications (this was amended due to technology advances)
        - within 50 meters (164 ft) for 67% of wireless 911 calls
        - within 150 meters (492 ft) for 95% of wireless 911 calls

E911

- Phase I was to be implemented by April 1998 and was not difficult to accomplish as the receiving antenna was already known.
- Phase II is scheduled to be implemented in a four year rollout that begun October 2001 and to be completed by December 31st 2005
- Phase II requirements have necessitated that phone equipment incorporate a method to meet the requirements
- Method used to achieve phase II compliance for TDMA networks is different than those used by CDMA networks

TDMA

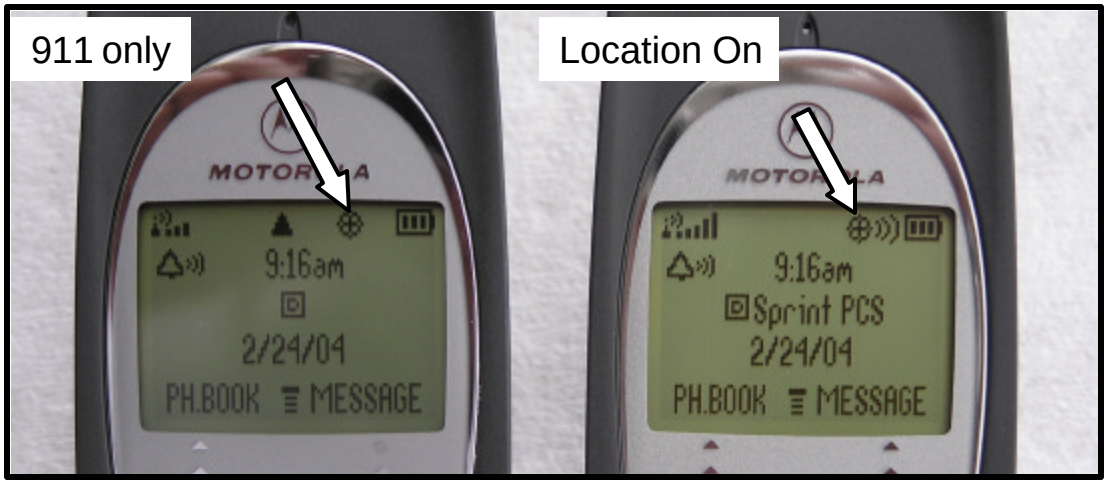
- Signal strength to current and adjacent cell sites is reported to the cellular carrier
- Cellular carrier calculates exact position by triangulating the signals and forwards the position to 911 operator

CDMA

- GPS signals used for time information are collected and reported to the cellular carrier
- Cellular carrier calculates exact position from the signals and forwards the position to 911 operator

E911 Locator Symbol on CDMA only

- 911 only
  - Inactive sending state
  - Becomes active if 911 call is made
- Location On
  - Active sending state
  - Continuously sends location to cellular carrier



- To change this setting:

➔ “Settings”

➔ “Location”

then select either: - “Location On” or “911 only”

E911 Phones

- As of January 1st 2004, many carriers will not sign up new subscription for phones that are not E911 compliant.

- Current V60i TDMA phone already E911 compliant

V60i

- V60i CDMA phone was replaced with either the V60x or V60s (depending on carrier)

- V60x CDMA basically same as V60i CDMA except:
  - E911 compliant
  - battery charging different (requires new cradle)

  Note: This phone will fit existing V60i cradle but will not charge battery.

V60x

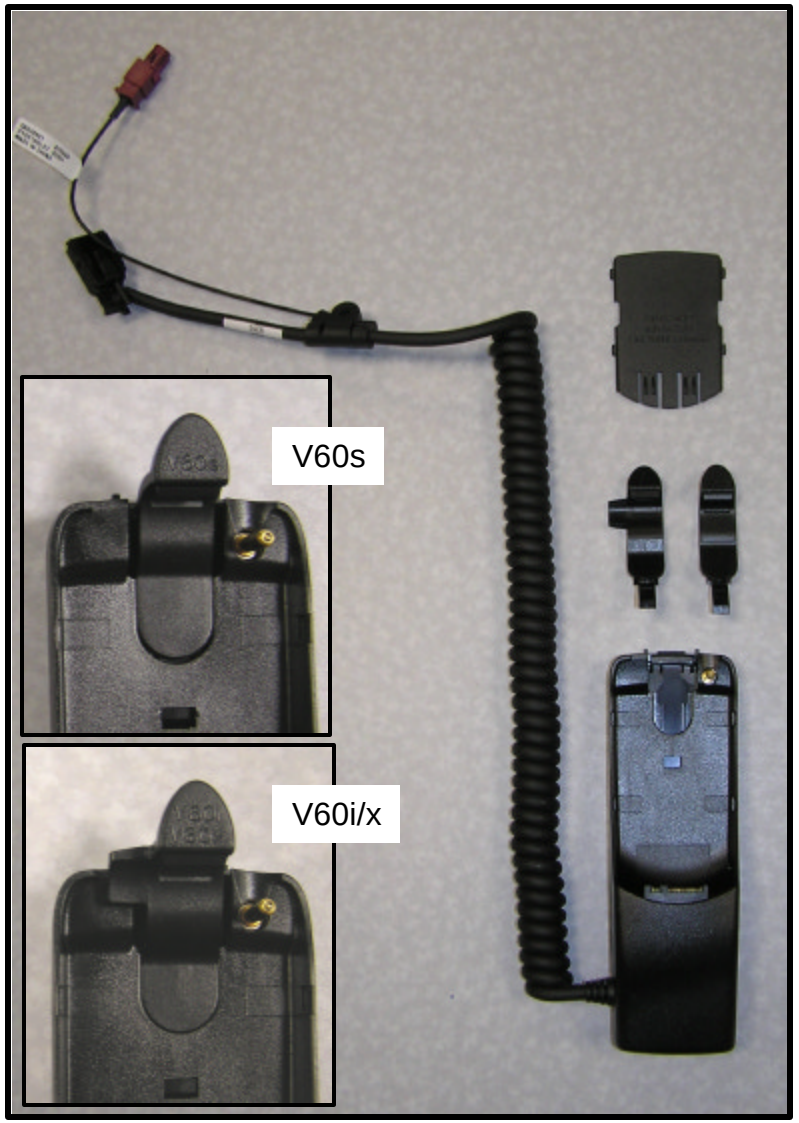
- V60s CDMA basically same as V60i CDMA except:
  - E911 compliant
  - speaker phone function (extra circuit board inside)
  - overall thickness is greater (requires new cradle)

  Note: Damage to connector if fitted into current V60i cradle.

V60s

Cradle Changes

- New cradle supports V60i/s/x
- Custom release latch for specific phone
  - i / x latch
  - s latch
- Incorrect latch / phone combination could lead to no antenna connection or damage to pin connectors

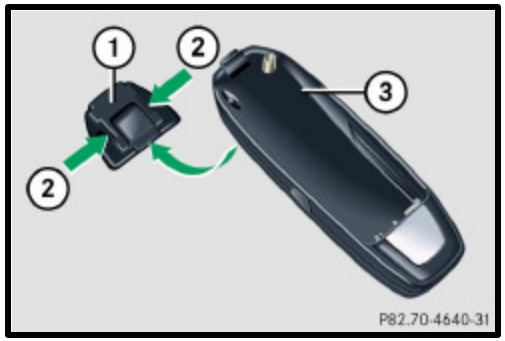


V60s CDMA

- Can be mistaken for V60p
- PTT button (aftermarket phones) is used only for phonebook menu activation
- Power button combined with end call button
- Speaker button located on top of phone

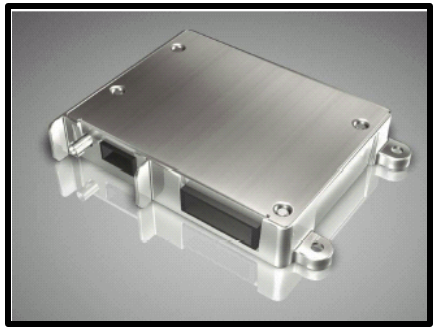
Smart Cradle Telephone System

- Expected to be launched with MY 2005 vehicles
  (NOT Maybach)
- New phone system on MOST ring with a standard mounting plate
- Standard mounting plate ① is installed in designated mounting position for model
- Phone cradle ③ is then clipped into mounting plate ①
- Currently 3 phone cradles are expected to be available for USA to support the following MB phones:
  - Motorola V60i/x TDMA / CDMA
  - Motorola V600 GSM (June / July 2004)
  - Motorola V710 CDMA (late 2004)
- Does not support privacy mode while docked



Smart Cradle

- Provides the physical connection to the mounting plate
- Contains the necessary software to translate Motorola (or other) cell phone language into a standard language that phone interface control module understands
- Incorporates software to enhance voice sound quality
- Can be replaced to match future MB phones allowing flexible, easier, cost effective upgrades without having to replace other phone components

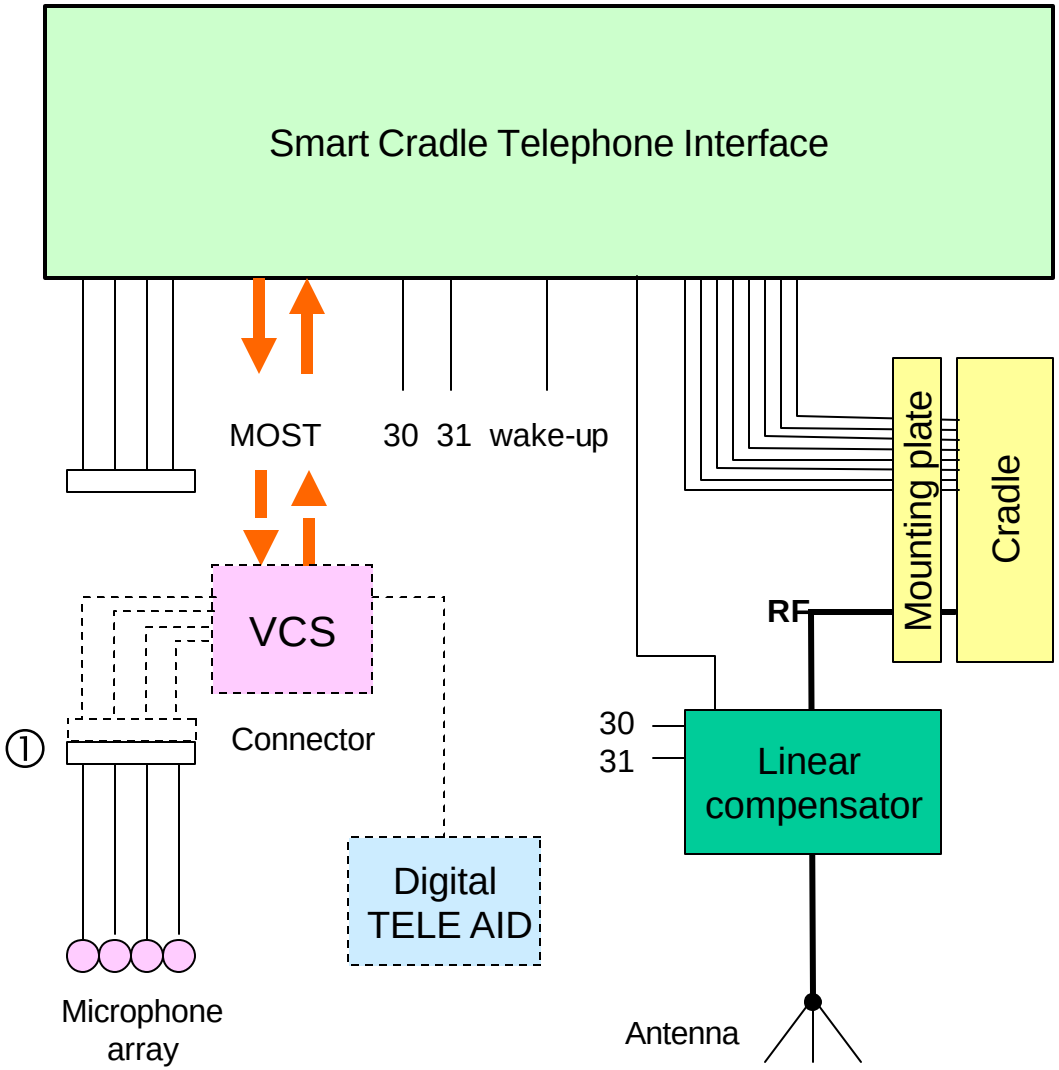


Smart Cradle Components

① Microphone array connector plugged into Smart Cradle Telephone Interface harness if no Voice Control System (VCS) installed.

If VCS installed, microphone array connector is plugged into VCS module harness and voice input transferred over MOST network.

Note:
If digital TELE AID is installed as well, then additional hard wire connection for microphone input to TELE AID control module from VCS control module
(RF circuit will also be different depending on model).



Note: Refer to wiring diagram for specific vehicle

V600 GSM *(expected June 2004)*

Information subject to change

Product Specifications:

Form factor:	Clamshell
Finish:	Metal, chrome details
Bands/Mode:	GSM QB:850/900/1800/1900
Size:	71 - 73 cc
Weight:	< 95 g
Dimensions:	45 x 87 x 21 - 22 mm
Antenna:	External
Talk time:	375 Min.
Standby time:	285 Hrs.

Key Features:

- Sleek, compact design
- Metal housing with postponable options
- Large active color display (128x160. 64k TFT)
- External CLI display (96x32, Mono)
- Advanced messaging: Text, Graphics, sound
- Embedded Bluetooth
- Games (Embedded & Downloadable)
- PDA (PIM) functionality
- Downloadable themes, ringers, images
- 22 KHz Polyphonic speaker
- Accessory digital camera

V710 CDMA *(expected 2nd half of 2004)*

Information subject to change

Product Specifications:

Form factor:	Clamshell
Finish:	Sophisticated style
Bands/Mode:	CDMA 1xDB w/ AGPS
Size:	> 80 cc
Weight:	< 90 g
Dimensions:	~ 20 mm thick
Antenna:	External
Talk time:	> 150 Min.
Standby time:	> 300 Hrs.

Key Features:

- Large active color display (176 x 220. 260k TFT)
- 4 line color CLI display (96 x 94, cirque technology)
- Integrated Camera
- Email personal / Corp. secure (incl VPN)
- Integrated Bluetooth with suite of accessories
- Personal entertainment, video clip player, games
- PDA (PIM) functionality & OTA synchronization
- Voice recognition, annotation and voice reply
- MFT speaker - 48 level MIDI / polyphonic
- Memory: 128Mb/32Mb
- Attachment viewer - TBD

Diagnostic Resources

SDS / DAS

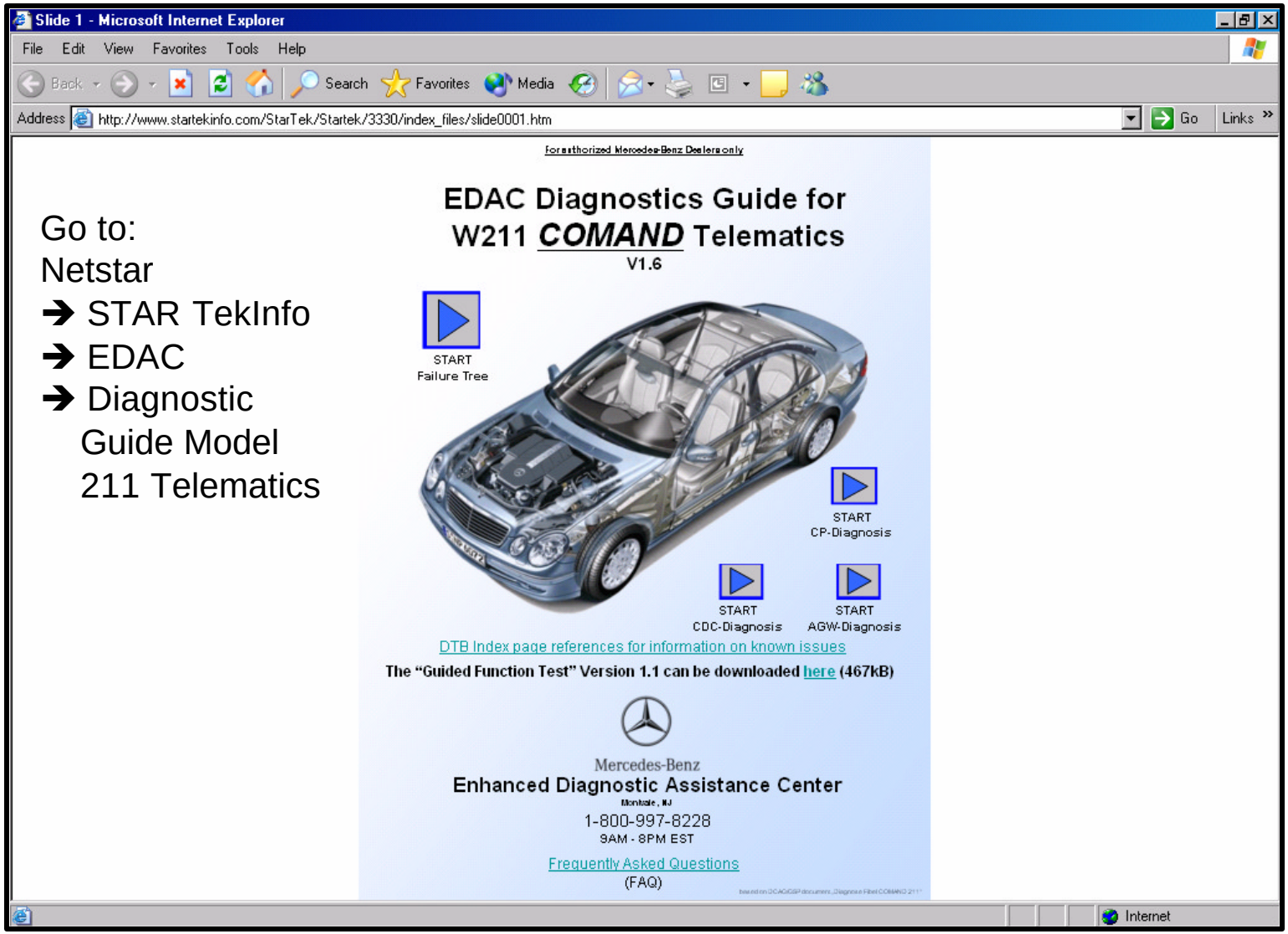
EDAC Diagnostic Resources

DTB’s

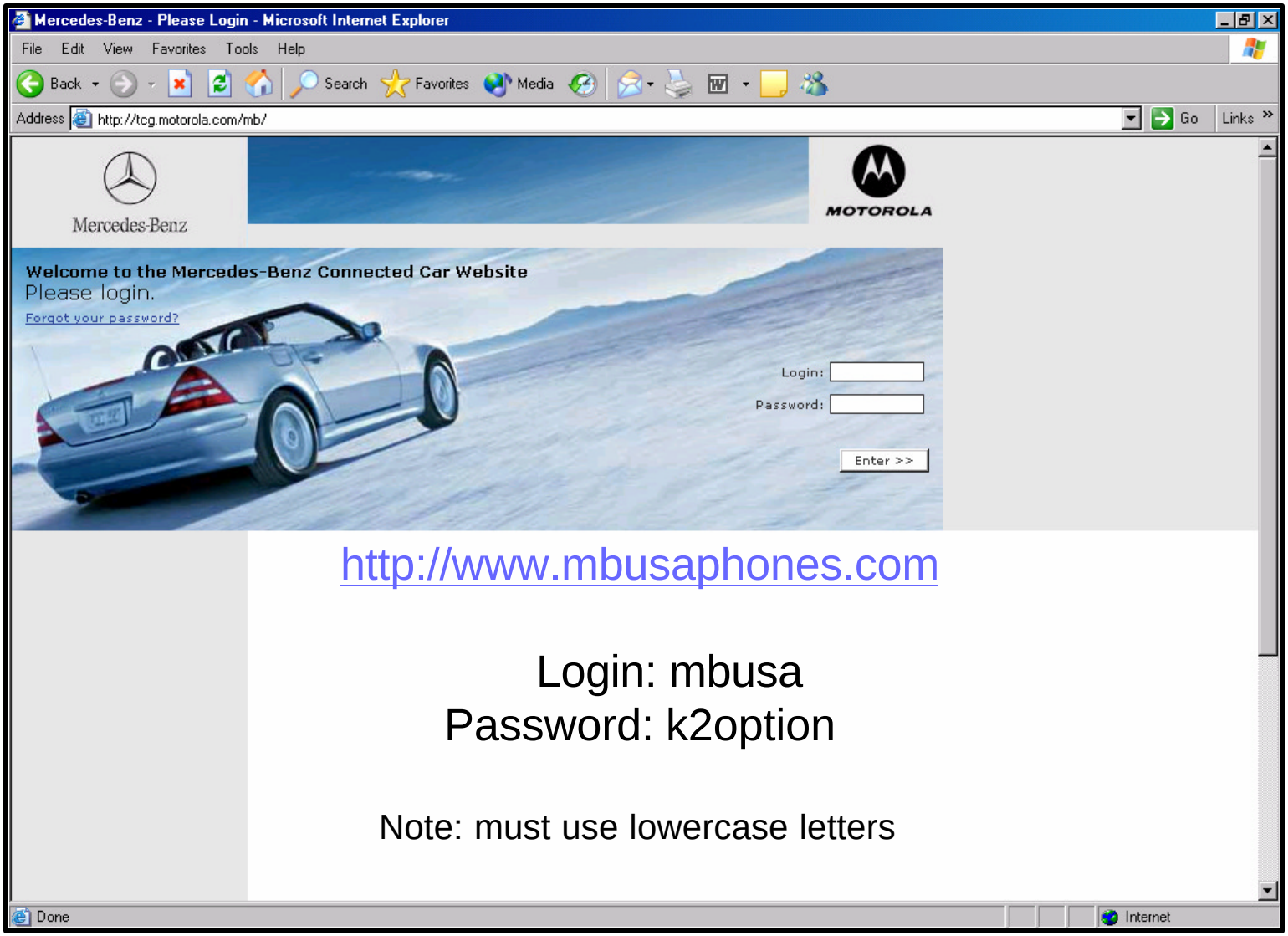
Mercedes-Benz Connected Car Website

EDAC

Go to:
Netstar
➔ STAR TekInfo
➔ EDAC
➔ Diagnostic Guide Model 211 Telematics



Mercedes-Benz Connected Car Website



http://www.mbusaphones.com

Login: mbusa
Password: k2option

Note: must use lowercase letters

Appendix

AMPS	- Advanced Mobile Phone Service.
CDMA	- Code Division Multiple Access
CLI	- Calling Line Identification (i.e. Caller ID)
CP	- Communication Platform
dB	- Decibel
DTMF	- Dual Tone Multi Frequency.
ESN	- Electronic Serial Number.
FCC	- Federal Communications Commission
FM	- Frequency Modulation
GPS	- Global Positioning System
GSM	- Global System for Mobile communication (formally the acronym for Group Special Mobile)
HFM	- Hands-Free Module
MIN	- Mobile Identification Number. Unit phone number until Nov 2003; due to new FCC mandate in affect on Nov 24, 2003- wireless providers will have to assign new number to MIN called Mobile Device Number (MDN). MDN will act as the device phone#, the MDN will be used to register cell phone on the network
NAMPS	- Narrow Advanced Mobile Phone Service
PDA	- Personnel Digital Assistant (also referred to as PIM – Personnel Information Manager)
RF	- Radio Frequency
SID	- System Identification Number
SIM	- System Identification Module
SMS	- Short Message Service (i.e. text messaging)
TDMA	- Time Division Multiple Access
VCS	- Voice control system
WAP	- Wireless Application Protocol

CDMA vs. TDMA *(circa 2001)*

Overview	
Phone Book (TDMA)	Holds up to 99 names and numbers with up to 32 digits per entry
Phone Book (CDMA)	Holds up to 99 names and 4 numbers for each name. In one location you can store home, mobile, work and fax numbers for a single contact. Note that the display in the vehicle will only access the first number.
Data Capabilities	
Data Cable Hook-Up* / ** (CDMA)	You can hook up your computer to a compatible computer and send and receive faxes, e-mail and access the Internet.
Mini-Browser* (CDMA)	With a subscription and wireless service, you can retrieve sports scores, weather and traffic reports, stock prices and more. You can also Bookmark your favorite sites.
Short Message Service* (SMS) (TDMA)	Send and receive short alpha-numeric text messages. Up to 15 messages, 80 characters in length.
Text Messaging (CDMA)	Allows your phone to act like a pager for sending and receiving text messages.
True Sync (CDMA)	Software that allows the exchange of information between your phone and a compatible computer. Contact names and numbers are an example of the kind of information that can be exchanged.
Indicators/Alerts	
Message Banner (CDMA)	You can create your own message banner for the phone to displaywhen it is idle.
Message Waiting Indicator (TDMA)	The Short Messaging Service (SMS) Message Waiting Indicator is displayed when the phone receives a message. You can set the phone to use a VibraCall alert, an audible beep or no alert.
Message Waiting Indicator (CDMA)	If your phone is on and you receive a voice mail, MiniBrowser alert or an alpha-numeric message, your phone will beep or vibrate three times and you will see a Message Icon displayed. You can also set the phone to use one beep or no alert.
Real Time Clock (CDMA)	The clock is always displayed and is continuously updated with the local time wherever you are.
Memory Features	
Last Number Recall (TDMA)	This option can be used to redial any of the last 30 phone numbers you have called.
Last Number Recall (CDMA)	This option can be used to redial any of the last 10 phone numbers you have called.
Review Dialed Calls (TDMA)	When looking at the option called "Dialed Calls", the number of calls you've dialed shows up in the display. You can see up to the last 20 calls you've dialed.
Recent Call Menu's (TDMA)	Allows you to review previous calls that you have received or dialed. The phone can store the telephone numbers and names of the last 30 incoming calls. If you subscribe to call waiting and receive a call while another call is in progress, you hear a call alert beep.

V60 CDMA FEATURES
Dual display: internal 96x64 pixel; external 96x16 pixel
WAP 1.1/ PDC 4.1 microbrowser3
Voice activation
Voice Note voice recorder2
iTAP™ software for predictive text entry
VibraCall® alert
Integrated headset jack
Improved user navigation
Anodized aluminum housing
Date book and phone book with TrueSync® support4
USB support

SPECIFICATIONS (with standard battery*)
Bands: CDMA 800/1900 AMPS 800 MHz
Size: 73 cc
Weight: 109 g
Dimensions (mm): 86.8 x 45 x 24.2
Digital Talk Time1: up to 150 minutes
Digital Standby Time1: up to 6 days

**500 mAh LiIon battery*
1 All talk and standby times are approximate and depend on network configuration, signal strength, and features selected. Talk times and standby times will be lower when in analog mode.
2 Use of this function may be subject to varying State and Federal laws regarding privacy and recording of phone conversations.
3 Network and subscription dependent feature. Not available in all areas.
4 Designed to synchronize with basic features of the initial release of many popular Personal Information Management (PIM) software and hardware products.

V60 TDMA FEATURES
Dual display: Internal 96x64 pixel; external 96x16 pixel
WAP 1.1/PDC 4.1 microbrowser3
Voice activation
Voice Note voice recorder2
iTAP™ software for predictive text entry
VibraCall® alert
Integrated headset jack
Improved user navigation
Anodized aluminum housing
Date book, message center and phone book with TrueSync® capability4
RS-232/USB, IS-136 Compliance
32 unique ringer and VibraCall® alerts and 32 composable ringer alerts

SPECIFICATIONS (with standard battery*)
Bands: TDMA 800/1900 MHz AMPS 800 MHz
Size: 83 cc
Weight: 121 g
Dimensions (mm): 86.8 x 45 x 24.2
Digital Talk Time1: up to 240 minutes
Digital Standby Time1: 6-8 days

**800 mAh LiIon battery*
1 All talk and standby times are approximate and depend on network configuration, signal strength, and features selected. Talk times and standby times will be lower when in analog mode.
2 Use of this function may be subject to varying State and Federal laws regarding privacy and recording of phone conversations.
3 Network and subscription dependent feature. Not available in all areas.
4 Designed to synchronize with basic features of the initial release of many popular Personal Information Management (PIM) software and hardware products