Wireless Medium Access Control and CDMA, 3G and 4G Communication

Lesson 18

IS-95 (CdmaOne) Channels

I and Q pilots for carrier Identification and Synchronization

- I- in-phase Component and Q- Quadrature phase Component)
- Walsh coded signal spread after scrambling of user symbols with long PN codes
- Pilots modulated after the spread with a pseudo-noise code of 15 symbols with 2^{15} chip period sequences in the I-and Q-pilot channels

QPSK MODULATOR

- Gets inputs from both the channels and then transmits with a bandwidth of 1.25 MHz for each carrier
- The efficiency of transmission = (1.2288 Mcps/1.25 MHz) . 100 = 0.98 . 100 = 98%.

Traffic channels and multiple user data channels

- Spread by Walsh codes to enable their distinct identification at the receiver
- Coded traffic channel data transmitted by PN long code sequencing to synchronize multiple channels

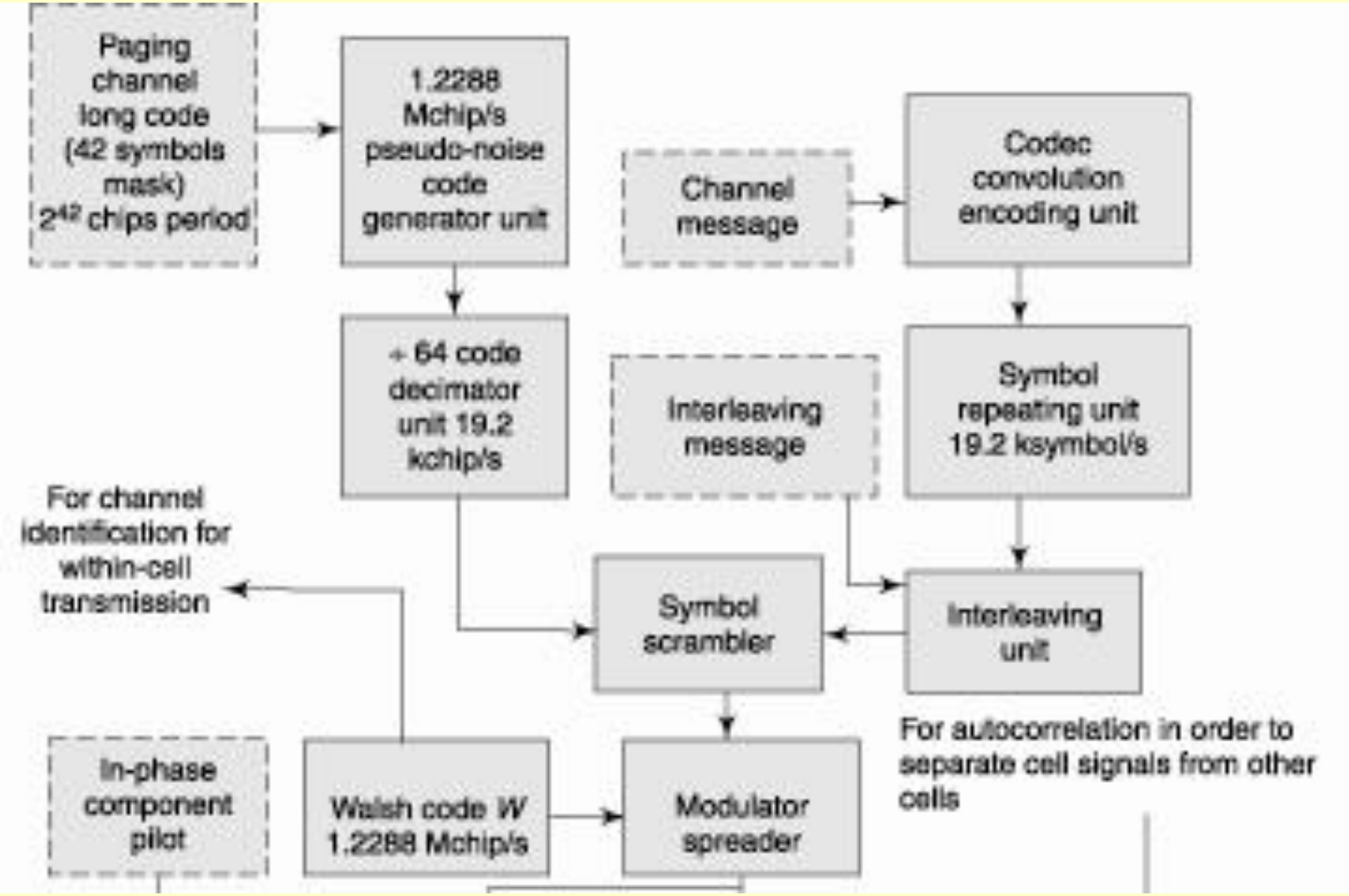
Traffic channels and multiple user data channels

- PN short code sequencing of I and Q pilots to synchronize the multiple transmitter carriers (the short code is used to identify the multiple transmitter carriers at the receiver

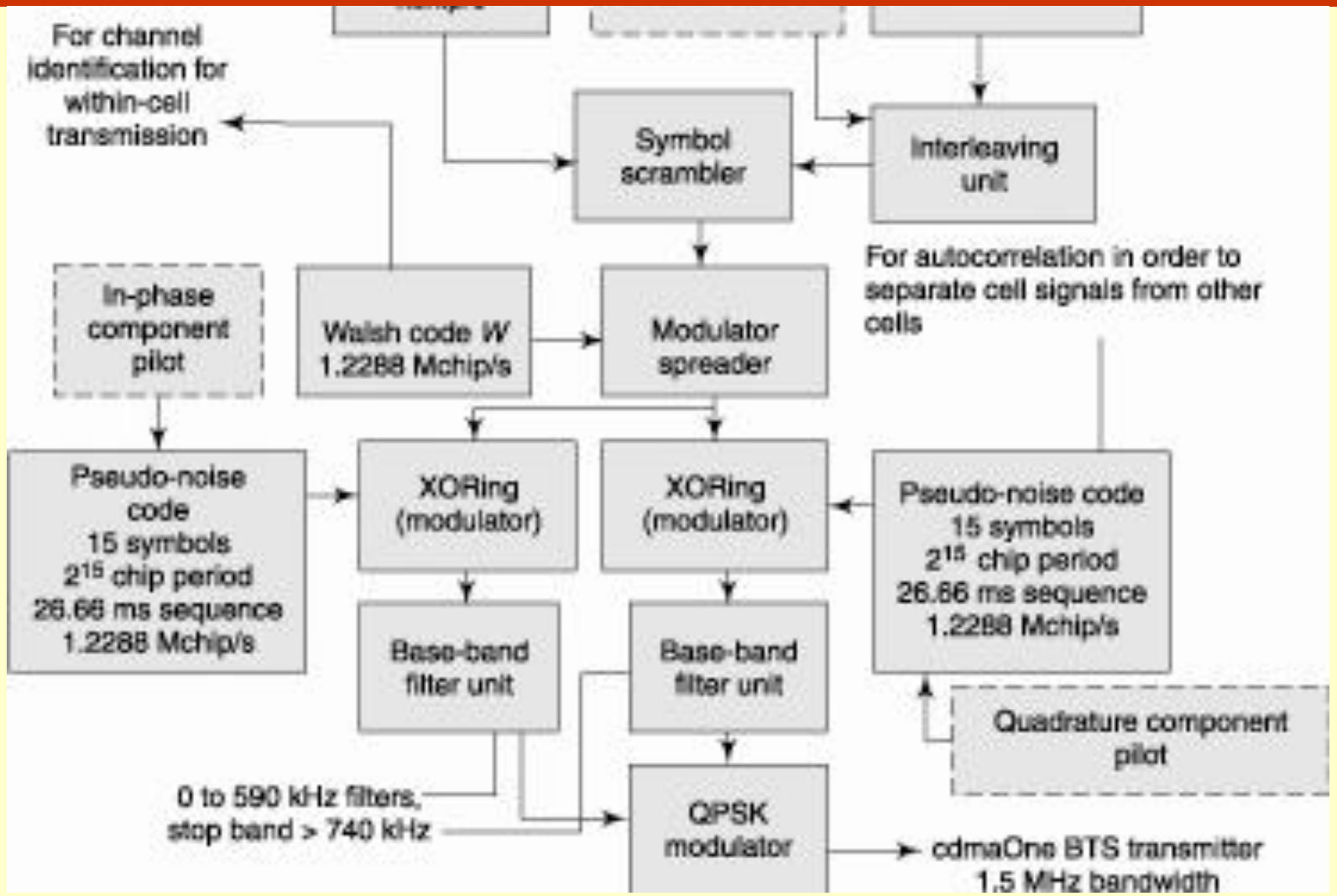
Paging Channel Data

- Base-band transmission of the paging messages and paging mask
- The paging channel sends the TMSI (temporary mobile subscriber ID), information about the traffic channel, response of MS access request during call setup, and information about the adjacent cell base station and its PN offsets
- One or more paging channels can be used
- Each paging channel uses a distinct Walsh code

Processing units for paging channel message and paging channel long code



Processing units for paging channel message and paging channel long code



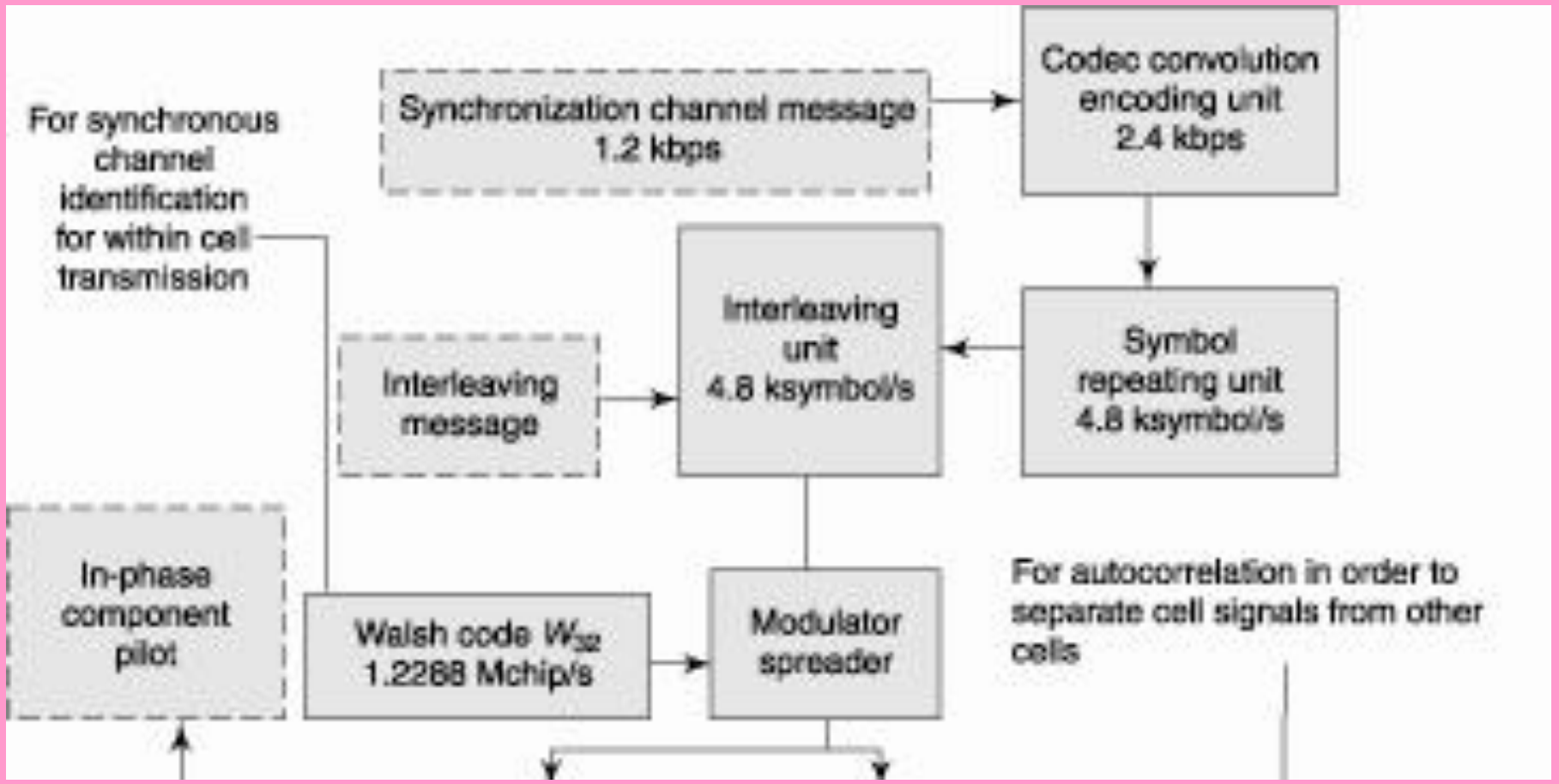
Synchronous Channel Data

- Base-band transmission of synchronous channel data at 1.2 kbps
- The synchronous channel message is used for synchronization of chip sequences at the MS
- Its messages include the system identification (SID), network identification (NID), system time, PN short sequence offset, and PN long sequence codes state

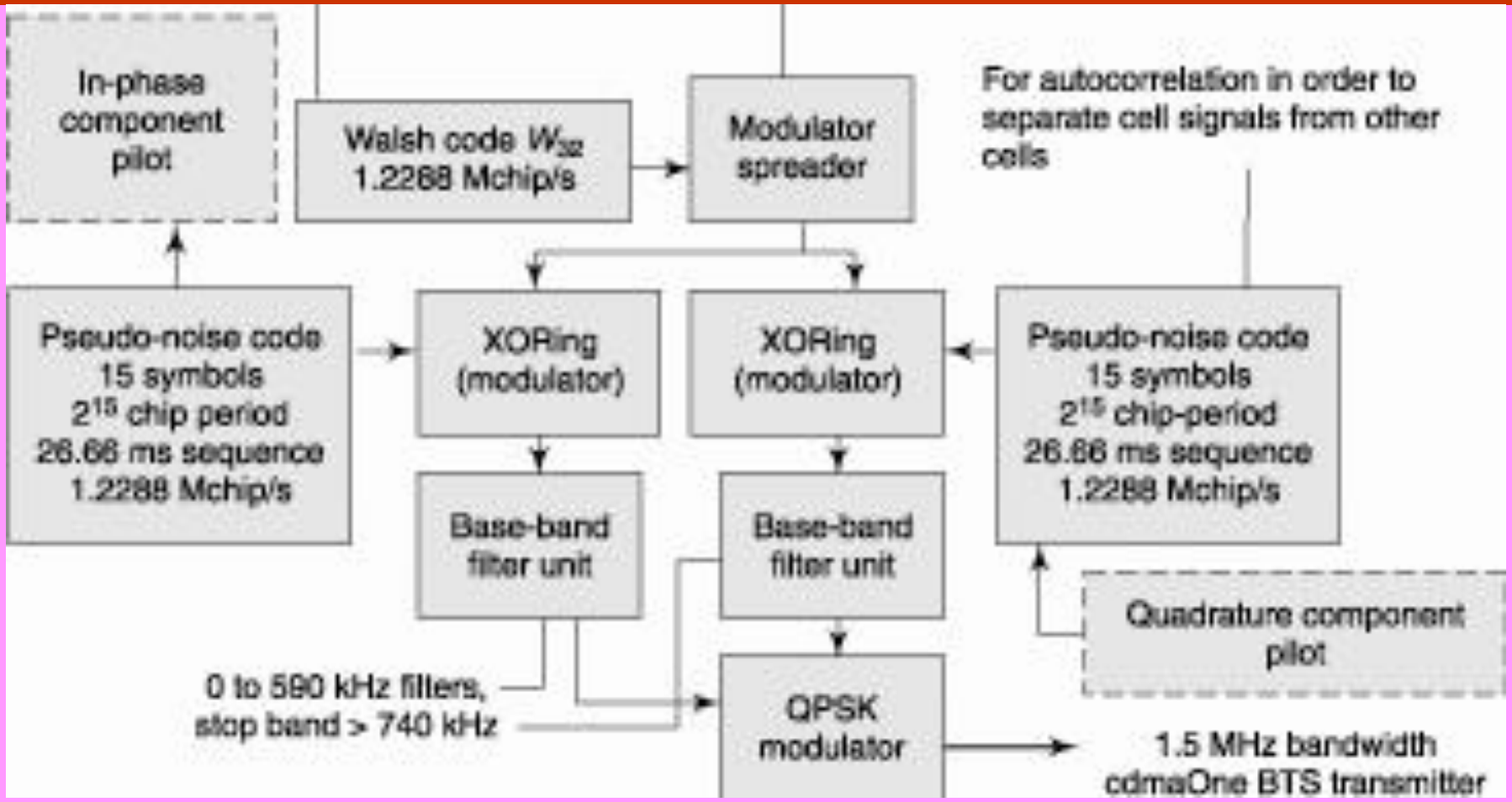
Synchronous Channel Data

- After passing through the synchronizing symbol repetition unit, the signal data burst will become 4.8 ksymbol/s
- After going through a block-interleaving 4.8 ksymbol/s coded at a rate of 1.2288 Mchip/s
- The synchronization channel uses Walsh code *W*32 and PN_Q and PN_I pilot channels

Processing units for base-band transmission of synchronous channel message



Processing units for base-band transmission of synchronous channel message



Base Transceiver Forward Transmission

- IS-95 forward transmission has a bandwidth of 1.25 MHz
- Pilot (coded with Walsh code *W*0)
- Synchronizing channel (coded with Walsh code *W*32)
- Paging channels 1–7 (coded with Walsh codes *W*1–7)

IS-95 cdmaOne Reverse channel

- Include fundamental mode traffic channels and access channels (for access message transmission)
- 64-symbol orthogonal spreader links directly to a PN long sequence spreader in case of the access channel
- Processing units differ from the forward channel

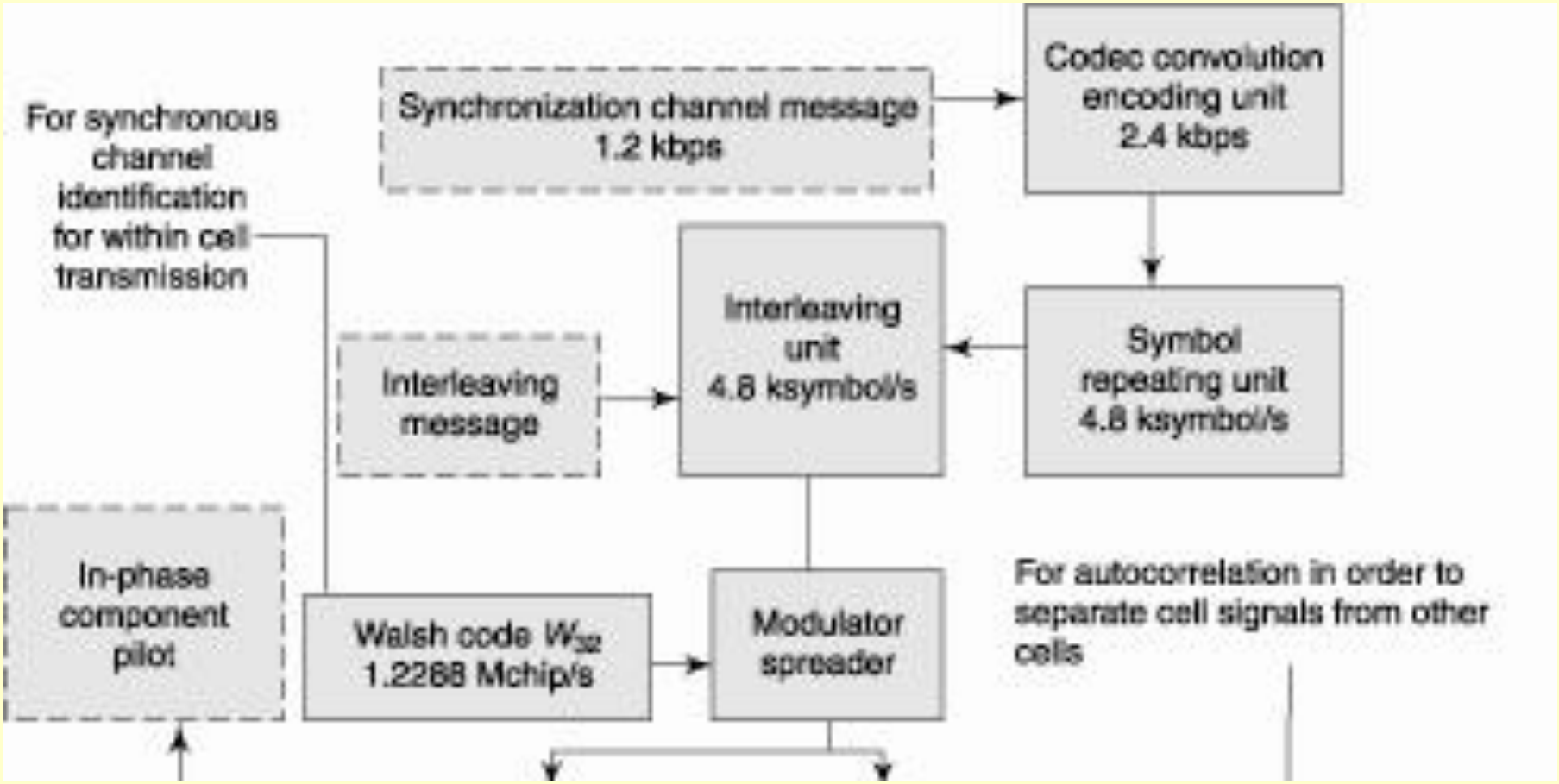
IS-95 cdmaOne Reverse channel

- Reverse channel 64-symbol orthogonal modulation performed directly (not after the PN long M-sequence coding) on the user data (voice or access channel data)
- The user-signal waveform mapped with the orthogonal Walsh codes

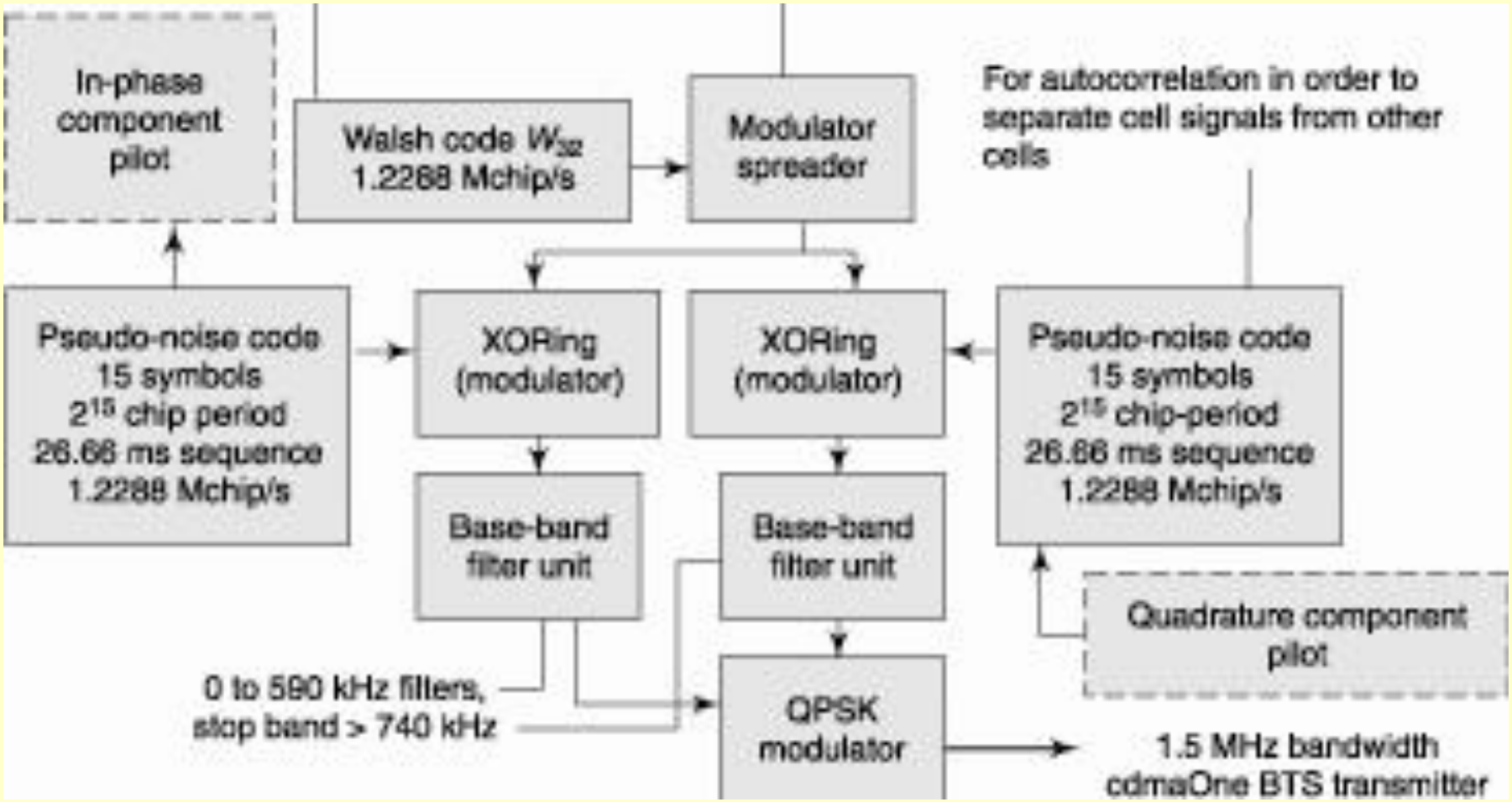
IS-95 cdmaOne Reverse channel

- User-signal waveform encoding is to reduce the bit error rates at the receiver
- Orthogonal spreading modulation used to identify the user data
- The signal also spreads by long pseudo-noise coding (for scrambling later with the orthogonal channelization codes), but at the next stage after orthogonal coding modulation

Processing units used in base-band transmission of reverse channel access



Processing units used in base-band transmission of reverse channel access



Transmission

- The access and reverse traffic channels
- Bandwidth of 1.25 MHz
- A preamble transmits before each access channel message
- The preamble contains the information regarding message bits so that the receiver can decode that information to process the succeeding message bits appropriately

Transmission

- No spreading of symbols with orthogonal codes
- The orthogonal codes used only for encoding the waveform

Combining circuit

- Identical to the forward channels
- Combines the PN_Q and PN_I base-band channel outputs from the 64 reverse traffic and access channels
- The OQPSK modulator modulates the signals in reverse link

Frames

- The frame structures in the forward channel of the cdmaOne system
- Traffic 14.4 kbps RS2 frame consists of a sequence of 267 user symbols, 12 CRC bits, and 9 tail plus reserved bits
- Paging channel half frame of 9.6 kbps consists of 8 slots of 10 ms

Frames

- 1-bit SCI (synchronization capsule indicator) preceding 95 paging bits in a 10 ms half frame
- There can be 8 slots in a paging message
- SCI = 0 indicates the end of one message and the start of another message in a slot

Frames

- SCI = 1 indicates continuation of the message
- Paging channel 4.6 kbps consists of 8 slots of 10 ms with 47 bits after the SCI bit in each slot for the paging message
- Synchronous channel 9.6 kbps consists of 96 bits

Frames

- A start of message (SOM) bit is indicated as 1 for first sub-frame of the message and as 0 for the successive extension of the message

Frames

- Sequence is SOM bit, 31 data bits, SOM bit, 31 data bits, SOM bit, and 31 data bits. A frame is combined with other frames into a superframe
- Each message consists of message length at the beginning, followed by data, error checking codes, and padding bits

Summary

- Pilot channel (coded with W_0)
- Synchronizing channel (coded with W_{32})
- Paging channels 1–7 (coded Walsh codes $W_{1–7}$)
- Traffic channels forward channels
- QPSK modulation
- Access and Reverse channels
- OQPSK modulation

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...Summary

- Forward channel Traffic RS2, RS1, paging and synchronous channel frame structures
- Reverse channel Traffic, traffic-Power control and access channel frame structures

End of Lesson 18

IS-95 (CdmaOne) Channels