Reverse Logical Channels

The IS-95 CDMA reverse logical channels exist between the subscriber devices and the CDMA base station. As mentioned previously, the encoding of digital information on the reverse channels is performed differently than on the forward channels. The data to be transmitted is not initially spread by a Walsh codes; instead, the data is mapped into Walsh codes that are then transmitted. Since there are sixty-four, 64-bit Walsh codes, every 6 bits of data to be transmitted may be mapped to a particular Walsh code. This technique yields an over tenfold increase in bandwidth since 64 bits are now transmitted for every 6 bits of data; however, the system error rate is reduced in the process. The mapping of groups of 6 data bits to a Walsh code is very straightforward since there exists a one-to-one relationship between the two.

Each reverse channel is spread by a long PN sequence code and scrambled by the short PN sequence code. The long PN sequence code is derived from the subscriber device's 32-bit electronic serial number (ESN) and therefore provides the means by which the user is uniquely identified within the CDMA system. There are basically two types of reverse CDMA channels: access channels and reverse traffic/control channels. These logical channels will be further described in the next sections.

Access Channels

The CDMA access channels are used by the mobile to answer pages and to transmit control information for the purpose of call setup and tear down. Figure 6–18 shows the access channel processing for a IS-95 CDMA system. As shown in the figure, an access message at 4.8 kbps undergoes the familiar convolutional encoding, symbol repetition, and block interleaving that raises the data rate to 28.8 kbps. At this point, the orthogonal modulation subsystem processes the signal by encoding every 6 bits into a 64-bit Walsh code. This process raises the signal rate to 307.2 kcps. The reader should note the use at this time of chips per second (cps) instead of bits per second. This is standard notation within the CDMA industry when referring to the signal spreading process. Next, the long PN code spreads the signal by a factor of 4 that yields a chip rate of 1.2288 mcps. The signal is further scrambled by the short PN sequence codes. The long PN code is used by the system to differentiate the thirty-two possible access channels.

data walsh code

I Channel Pilot PN
at 1.2288 mcps

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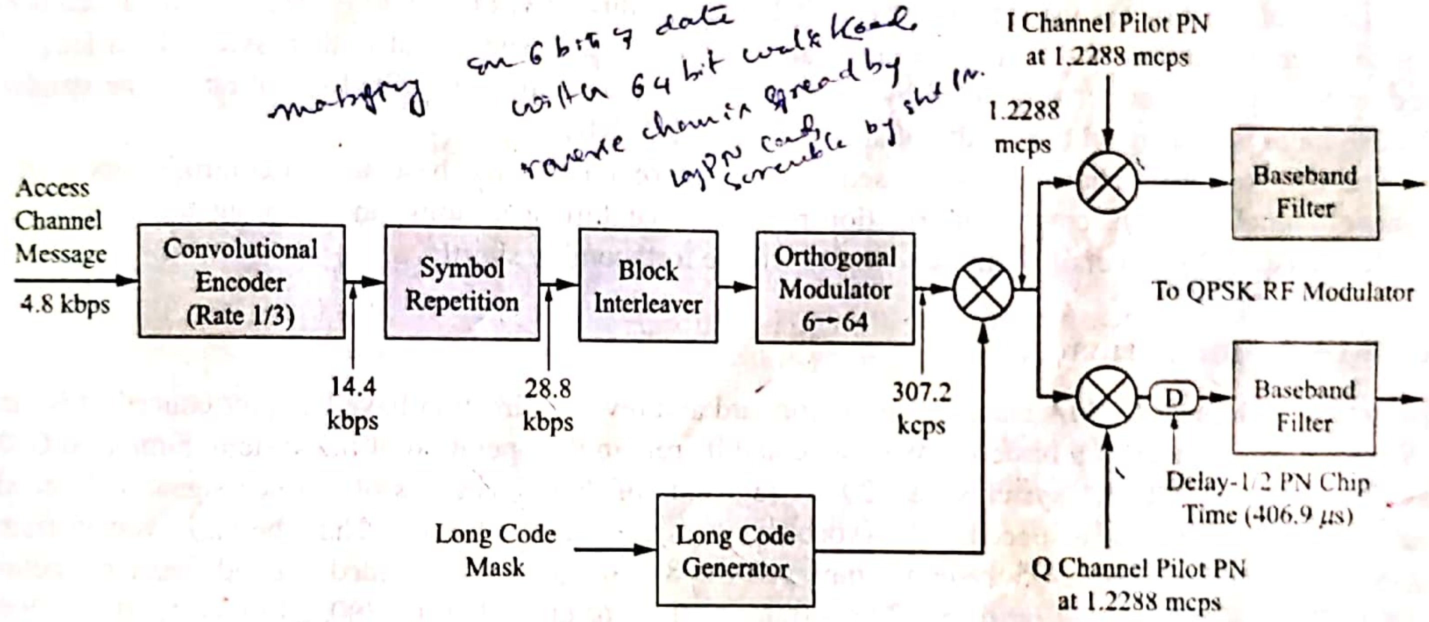

Figure 6–18 Generation of the CDMA reverse access channel.

At this point, the CDMA signal is applied to an RF quadrature modulator subsystem or IC. However, for the reverse channels, the form of modulation used to produce the final UHF passband signal is slightly different than for the forward channels. In this case, offset QPSK (OQPSK) is used instead of straight QPSK as in the case of the forward channels. Note the delay block of one-half of a PN chip (406.9 ns) used in the Q path to implement the OQPSK modulation. This form of modulation allows for a more power efficient and linear implementation by the subscriber device's RF electronics. As noted previously, any type of power savings technique that can lengthen battery life is usually employed when designing a mobile subscriber device.

Traffic/Power Control Channels

The IS-95 CDMA reverse traffic/power control channels support both voice and data at the two rate sets (RS1 and RS2) previously introduced. Figure 6–19 depicts the generation of a reverse traffic channel. In

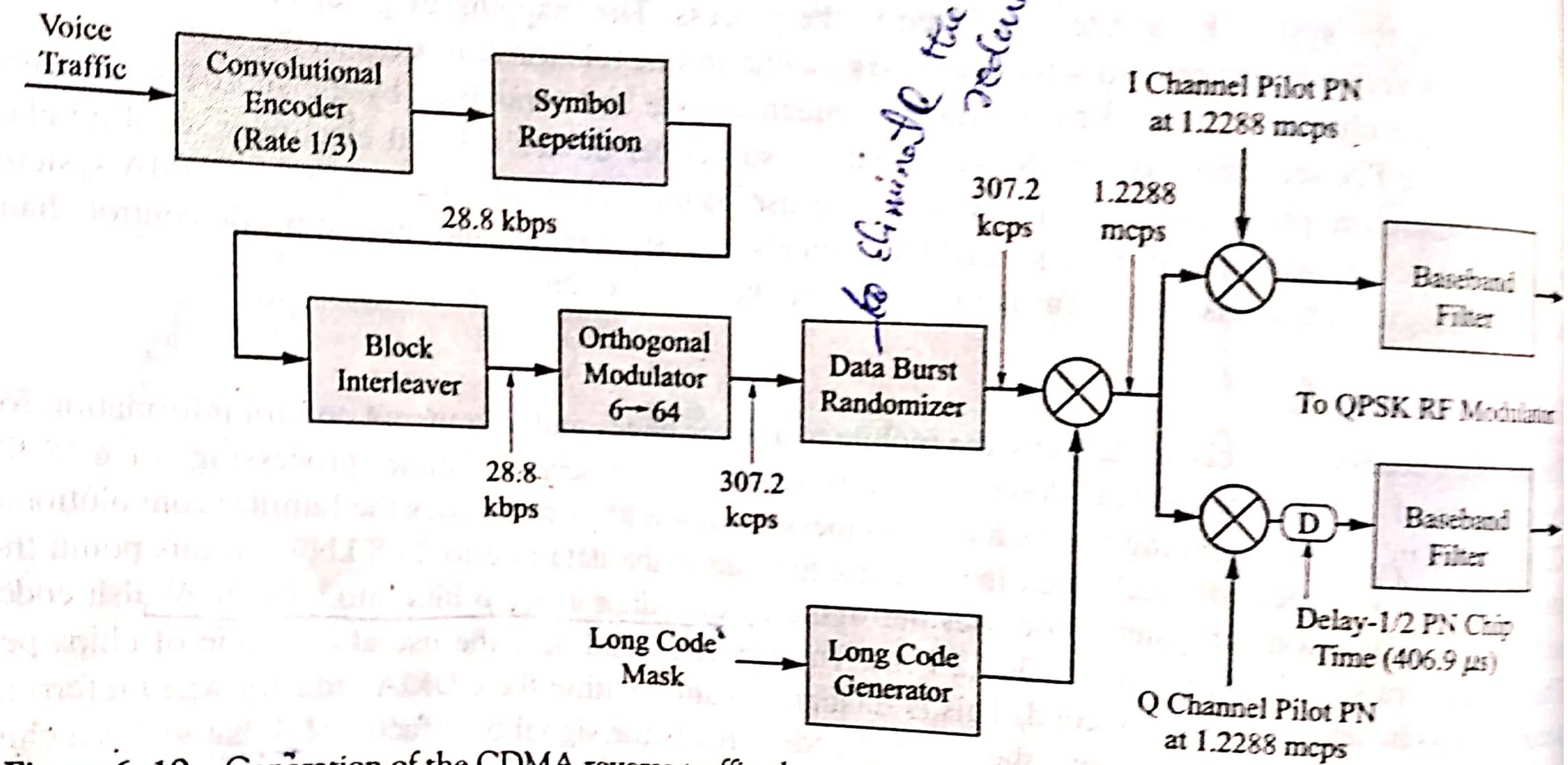

Figure 6–19 Generation of the CDMA reverse traffic channel.

either rate set case, the data rate at the input to the orthogonal modulator subsystem will be 28.8 kbps. At the output of this process the signal rate is 307.2 kcps. At this point the signal is processed by a data burst randomizer that in essence is used to eliminate redundant data. The signal is then spread by a long PN sequence code and further scrambled by the short PN sequence code. The final signal rate is the standard 1.2288 mcps with a signal bandwidth of approximately 1.25 MHz.

The reverse traffic channel is also used to send information to the base station controller about pilot channel signal strength, control information regarding handoff operations, and ongoing frame error rate (FER) statistics. More detail about these topics will be forthcoming shortly.