Technical Specification Group, Radio Access Network
Meeting #4, Miami, 17-19 June 1999

***TSGR#4(99)400***

**Source:** **Golden Bridge Technology**

**Title:** **CPICH for acquisition purposes**

**Document for:** **discussion/decision**

**Agenda Item:**

**Abstract**

GBT would like to propose the following change to the text R199-677 document "Impact of OHG harmonization recommendation on UTRA/FDD and UTRA/TDD," so that the possibility of using the CPICH for acquisition purposes is not eliminated. Various modulating sequences could be used to serve as the second step in the acquisition process. The modulated CPICH channel could also be used to establish quick frame reference without going through the three step process as well.

**Proposed change to Tdoc R199-677**

Current text:

"Common Pilot Channel (CPICH)

The CPICH is a new unmodulated (SF=256) down-link physical channel used by the terminal equipment to perform searching and identification (3rd step) as well as channel tracking and channel estimation. The frame structure of the CPICH is illustrated in Figure 2. The CPICH is transmitted continuously (100% duty cycle).

The base station always transmits one CPICH using a unique pre-defined OVSF. The base station may transmit additional CPICH to be used in support of transmit antenna diversity techniques or spot beams. Note that the current scrambling principle and synchronization procedure remain unchanged (i.e. different codes for different cell). In particular the 3rd step of synchronization procedure (determination of long code) is preserved."

# Fast Acquisition based on CPICH

# Recommendation

Use the CPICH for acquisition purpose by:

1. Removing the scrambling code
2. Using the Gold codes as short codes
3. Block scrambling the CPICH by using two sequences.
4. Modify the CPICH section of $T_{doc}$ 677

# Potential Advantages

- Faster acquisition due to 100% duty cycle and the use of block scrambled short codes
- The faster acquisition provides the following advantages:
  - Faster Handoff performance
  - Better HO performance at cell edge
  - Better Sleep/standby mode operation and longer battery life
  - Less data Interference as compared to the current UTRA method

# Goals of introducing this method

- Develop another option to aid acquisition process; not to replace the current UTRA method
- Enhancing the harmonization effort by adding to CPICH functionality to improve acquisition performance
- Remain in line with the harmonization objectives

# Current UTRA 3-step acquisition process:
# No Common Pilot Channel

- Objective: Determine one of 512 scrambling codes associated with the best cell and acquire the code, lock to the cell and BCCH.
- Step 1: To establish slot timing. Primary SCH Channel identical in all cells. 10% duty cycle.
- Step 2: Secondary SCH modulated with 16 different symbols to establish frame timing and code group. 10% duty cycle.
- Step 3: Identify one of 32 scrambling codes by using CPICH and read system information from BCCH. [Figure 1]

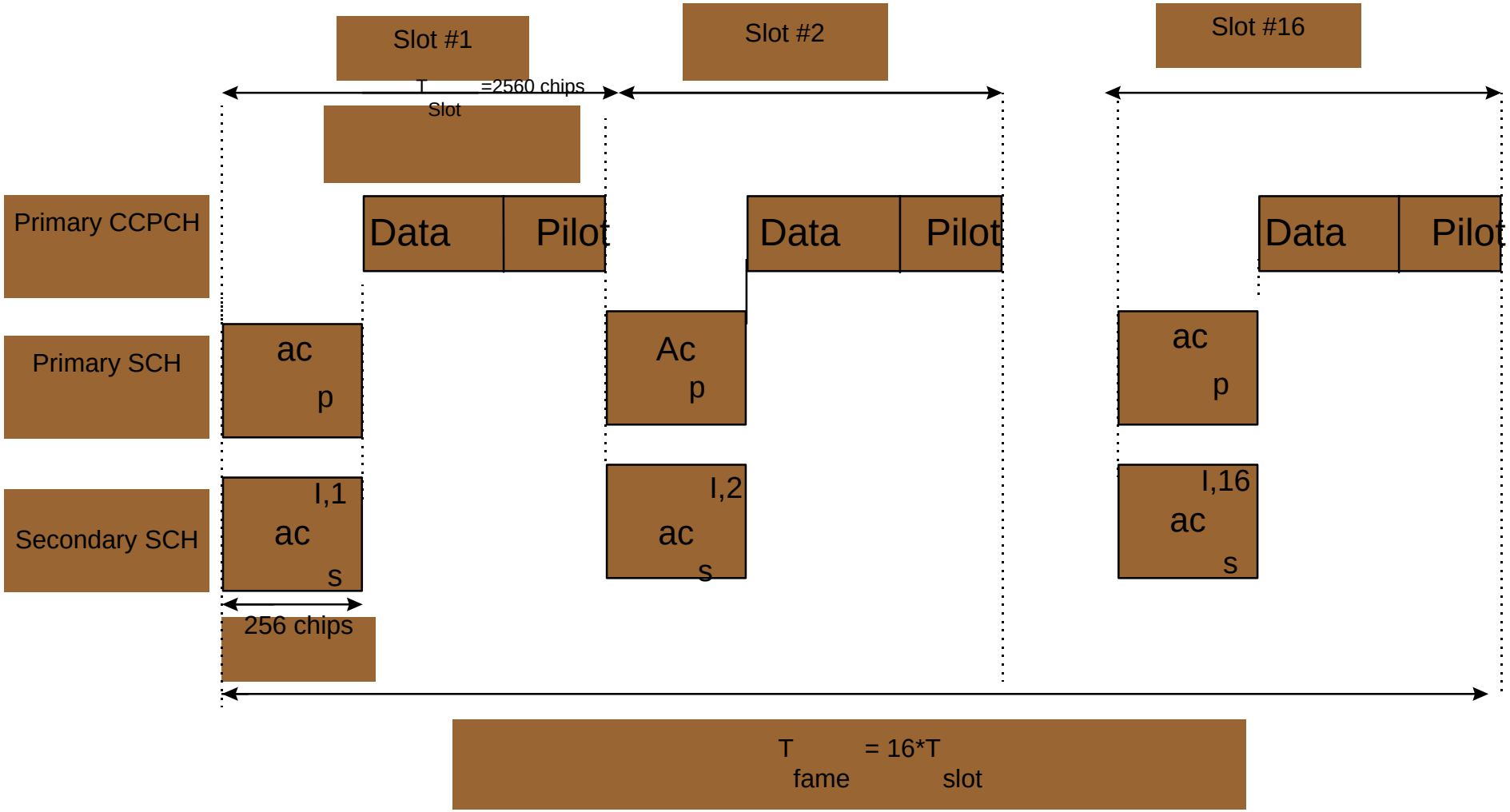


**Figure 1: Structure of Synchronization Channel (SCH)**

# Current CPICH Channel Structure with OHG's input: With Common Pilot Channel

- CPICH used for channel tracking, estimation and third step in cell search. Short OVSF code spread by long scrambling code, but unmodulated.
- SCH1 and SCH2 used for first and second step. SCH1 is unmodulated and not spread. SCH2 is modulated but not spread.

- Traffic Channels are scrambled with the same code per cell. [Figure 2]

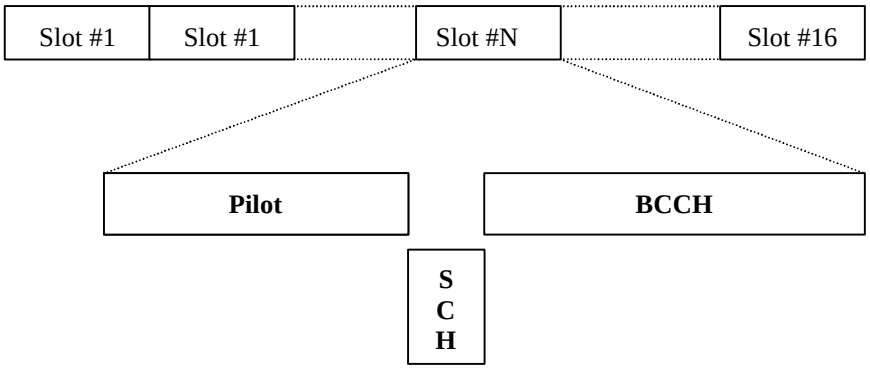


**Figure 2: Proposed structure of Primary CCPCH with code- multiplexed common pilot.**

# Use of CPICH for Acquisition purpose as well as channel tracking and estimation

- Traffic Channel is spread by the scrambling code to provide orthogonality
- SCH1 (unmodulated, not spread) and SCH2 (modulated and not spread) stay intact.
- CPICH is proposed not to be spread by the scrambling code, Gold codes are used as short codes, Gold codes are block scrambled by a 10-symbol long sequence to span a slot. The slot-long sequence is block scrambled by a 15-symbol long sequence to span a 10 ms frame. [Figure 3]

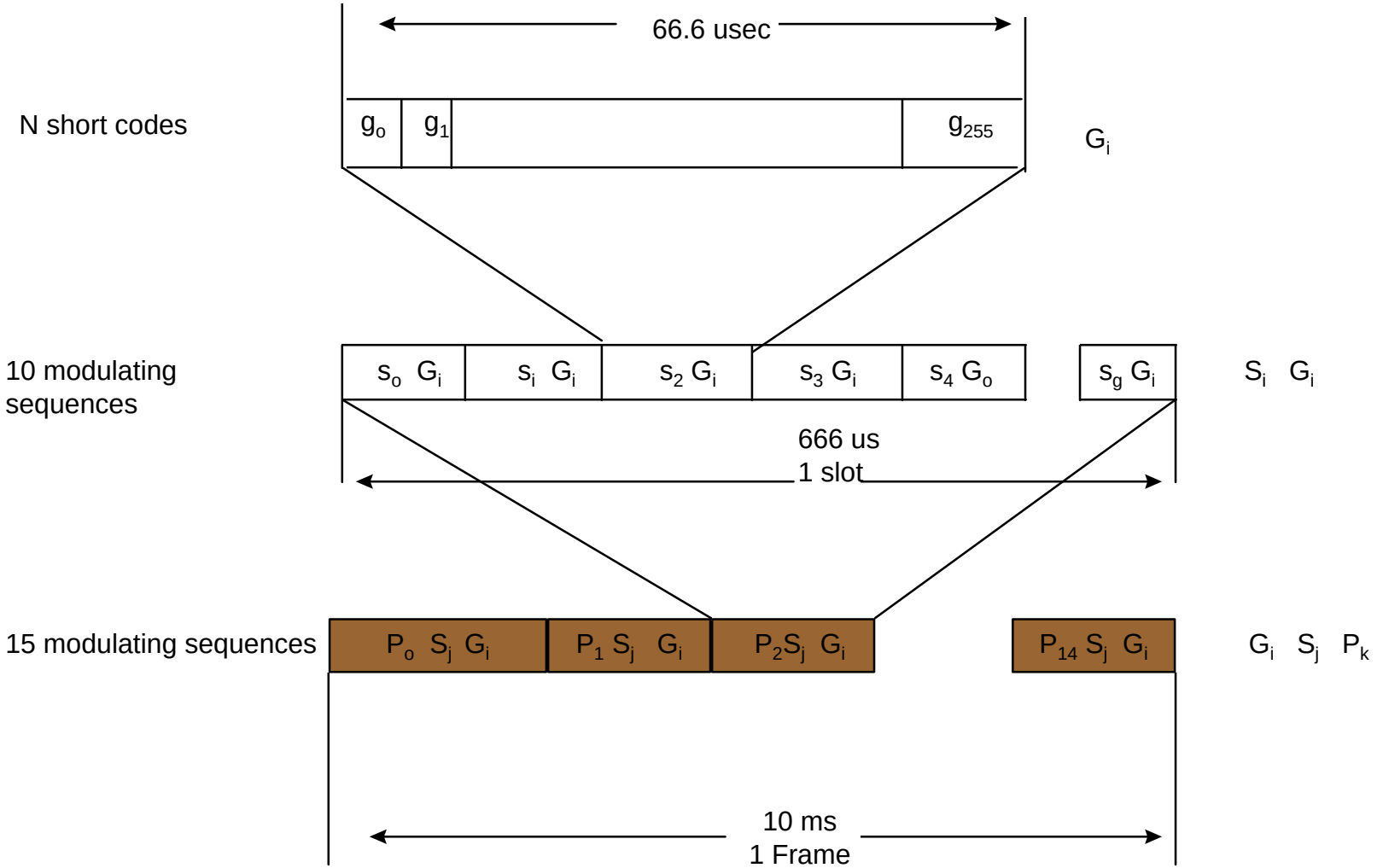


**Figure 3: CPICH Modulation to Aid Acquisition**

# Potential issues

- Complexity; RACH like receiver, use of N codes to separate cells (Not different from the receiver for 3-step process)
- Using Matched Filter implementation, the complexity will be the same.

# Potential Issues (Cont.)

- Code planning (N=4 -16)
- Power consumption in the receiver in the UE (100% duty cycle).
  - Faster acquisition time implies less processing time/ more codes implies more processing. The power consumption remains approximately the same when comparing this method with the existing UTRA scheme.
- Meeting the R’99 timeline.

# Performance advantages

- Faster acquisition due to 100% duty cycle and the use of short codes
- Faster Handoff performance
- Better HO performance at cell edge
- Better sleep/standby mode operation and longer battery life
- Less data interference as compared to the current UTRA method

# Conclusion

- We propose to slightly modify the CPICH section of $T_{doc}$ 677 to include the possibility of using this channel to aid acquisition.
- Changes: Block scramble the CPICH, rather than symbol scramble the CPICH; use Gold codes as the base block codes