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| Re: | IEEE 802.16m-08/042 “Call for Contributions on Project 802.16m Draft Amendment Content” |
| Abstract | Proposed Text of Base Station and Relay Station Frame Structure for the IEEE 802.16m Amendment |
| Purpose | We propose 16m base station and relay station frame structure |
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# Proposed Text of Base Station and Relay Station Frame Structure for the IEEE 802.16m Amendment

Kanchei (Ken) Loa, Yi-Hsueh Tsai, Chun-Yen Hsu, Youn-Tai Lee, Chih-Wei Su, Yi-Ting Lin, Tsung-Yu Tsai, Chiu-Wen Chen, Jiun-Je Jian, Yung-Ting Lee, Hua-Chiang Yin, Shiann-Tsong Sheu

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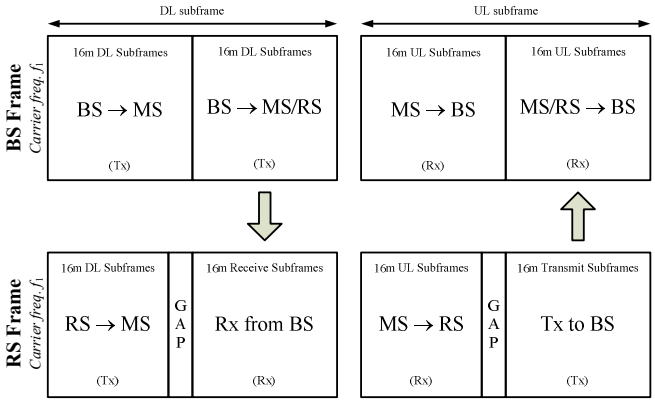
## Introduction

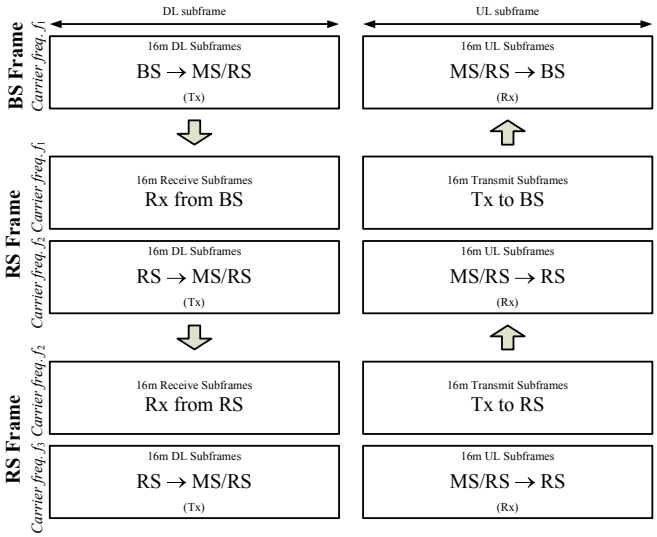
In SDD there are two options defined for the RS frame structure namely option 1 and option 2. For the 2-hop relay system, the RS frame structure for option 1 and option 2 are identical. Therefore, we propose a 2-hop TTR RS frame structure.

For 3+-hop relay system, there are two options of frame structures defined in current SDD: (1) Unidirectional relay zone (option 1) and (2) Bidirectional relay zone (option 2). Option 1 has been studied extensively in 16j. Option 2 has the benefits of scheduling efficiency, but it requires detail technical design to resolve interference and power management issues. We suggested adopting both options in SDD. However, in order to avoid the complexity of coexistence, we suggested that they must not coexist in a 16m relay network.

In addition, the STR RS has been studied extensively in 16j for multi-hop relay system operation, thus, we also propose a STR RS frame structure.




(a) 2-hop TTR frame structure




(b) STR frame structure

Figure 1 Base Station and Relay Station Frame Structure

We propose a contribution include BS frame structure, 2-hop TTR RS frame structure, and STR frame structure for both TDD and FDD operation mode.

# Proposed Changes

*[Insert the following definitions as indicated:]*

**3. Definitions**

**3.10 base station (BS)**: A generalized equipment set providing connectivity, management, and control of the subscriber station (SS). See also: **active base station (BS), anchor base station (BS), neighbor base station (BS), serving base station (BS), target base station (BS)**.

**3.33 frame**: A structured data sequence of fixed duration used by some physical layer (PHY) specifications. A frame may contain both an uplink (UL) subframe and a downlink (DL) subframe. A frame consists of eight subframes for Advanced air interface.

**3.46 mobile station (MS)**: A station in the mobile service intended to be used while in motion or during halts at unspecified points. An MS is always a subscriber station (SS) unless specifically excepted otherwise in this standard.

**3.77 subscriber station (SS)**: A generalized equipment set providing connectivity between subscriber equipment and a base station (BS).

**3.97 access station**: A station that provides a point of access into the network for an MS or RS. An access station can be a BS, RS, or MR-BS.

**3.109 relay station (RS)**: A generalized equipment set, dependent on a multihop relay base station (MR-BS) providing connectivity, to other RSs or subscriber stations (SS). An RS may also provide management and control of subordinate RSs or SSs. The air interface between an RS and an SS is identical to the air interface between a BS and an SS. See also: multihop relay base station (MR-BS), base station (BS), subscriber station (SS).

**3.119 simultaneous transmit and receive (STR) relay**: a relay mechanism where transmission to subordinate station(s) and reception from the superordinate station, or transmission to the superordinate station and reception from subordinate station(s) are performed simultaneously.

**3.121 time-division transmit and receive (TTR) relay**: a relay mechanism where transmission to subordinate station(s) and reception from the superordinate station, or transmission to the superordinate station and reception from subordinate station(s) is separated in time.

**3.xx Bi-directional transmit subframe (BiTx SF)**: TBD

**3.xx Bi-directional receive subframe (BiRx SF)**: TBD

**3.xx DL subframe (DL SF)**: A subframe that an access station can transmit to its subordinate stations (i.e., RSs or SSs) for Advanced air interface.

**3.xx idle symbol**: a OFDMA symbol reserved for receive-to-transmit turnaround gap (RTG) or transmit-to-receive turnaround gap (TTG) for Advanced air interface.

**3.xx idle time**: a time interval reserved for receive-to-transmit turnaround gap (RTG) and transmit-to-receive turnaround gap (TTG) for Advanced air interface.

**3.xx receive subframe (Rx SF)**: a subframe located in an RS frame that the RS can receive from its superordinate station (i.e., BS or RS) for Advanced air interface.

**3.xx switching point**: a point is defined as a change of directionality, i.e., from DL to UL or from UL to DL, in the TDD system for Advanced air interface.

**3.xx subframe (SF)**: a structured data sequence of fixed duration used by Advanced air interface Each one shall be assigned for either DL or UL transmission, and some of symbols may be idle symbols.

**3.xx superframe (SU)**: a structured data sequence of fixed duration used by Advanced air interface. A frame

shall contain four equally-sized 5 ms radio frames.

**3.xx transmit subframe (Tx SF)**: A subframe located in an RS frame that the RS can transmit to its superordinate station (i.e., BS or RS) for Advanced air interface.

**3.xx type-1 subframe**: a subframe consists of six OFDM symbols with CP length of 1/8 useful OFDM symbol time for Advanced air interface.

**3.xx type-2 subframe**: a subframe consists of seven OFDM symbols with CP length of 1/16 useful OFDM symbol time for Advanced air interface.

**3.xx UL subframe (UL SF)**: a subframe that an access station can receive from its subordinate stations (i.e., RSs or SSs) for Advanced air interface.

**3.xx uplink-only RS**: a relay only relays the uplink traffic from subordinate SSs to its access station, and does not transmit in the DL subframe for Advanced air interface.

*[Insert the following subclause as indicated:]*

**15. Advanced air interface**

**15.3 Physical layer**

**15.3.4 Frame structure**

The basic frame structure, illustrated in Figure 308a, shall be applied to FDD and TDD duplexing schemes, including H-FDD MS operation. Each 20 ms superframe shall be divided into four 5 ms frames. Each frame shall consist of eight subframes when using the OFDMA parameters defined in Table xxx with the channel bandwidth of 5 MHz, 10 MHz, or 20 MHz. Each subframe shall be assigned for either DL or UL transmission.

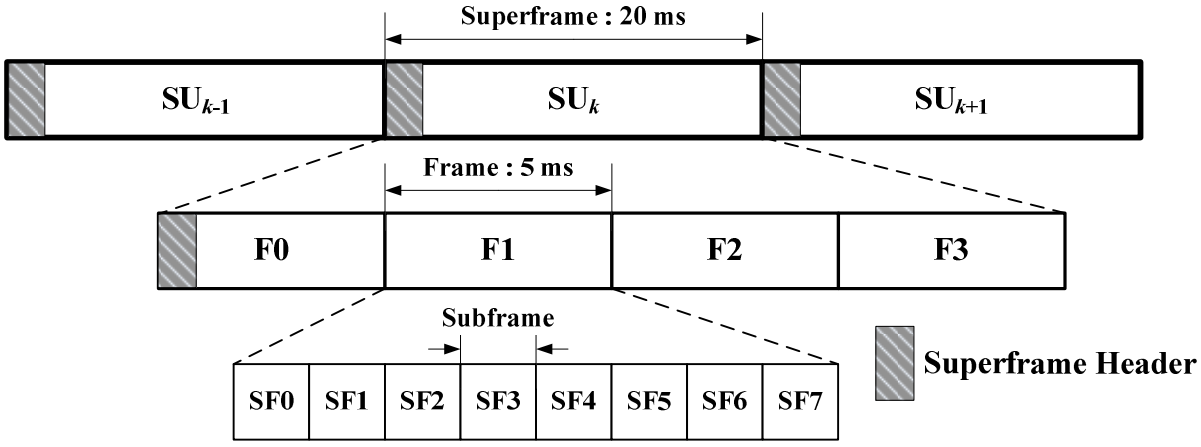



Figure 308a Basic frame structure

**15.3.4.1 TDD frame structure**

**15.3.4.1.1 BS frame structure**

In TDD systems, the number of switching points in each radio frame is either two or four. Figure 308b illustrates an example of BS frame structure with a DL to UL ratio of 5:3, where OFDM symbol duration is 102.857μs, CP length is 1/8 useful OFDM symbol time, and the length of type-1 subframe is 0.617 ms. The last DL subframe, i.e., DL SF4, is a type-1 subframe whose last OFDM symbol is an idle symbol to accommodate the gap required to switch from DL to UL. Figure 308c illustrates an example of BS frame structure with a DL to UL ratio of 5:3, where OFDM symbol duration is 97.143 μs, CP length is 1/16 useful OFDM symbol time, and the lengths of type-1 and type-2 subframes are 0.583 ms and 0.680 ms respectively.

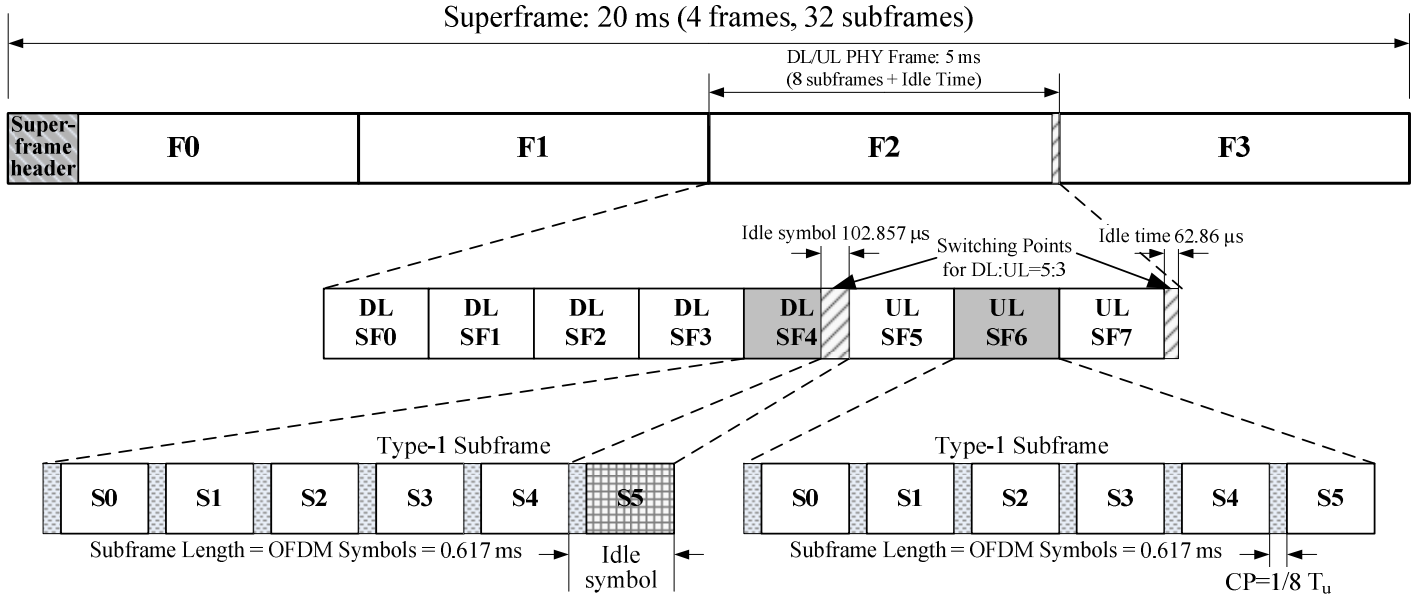



Figure 308b BS Frame structure in TDD mode (CP of 1/8 useful OFDM symbol time and DL to UL ratio of 5:3)

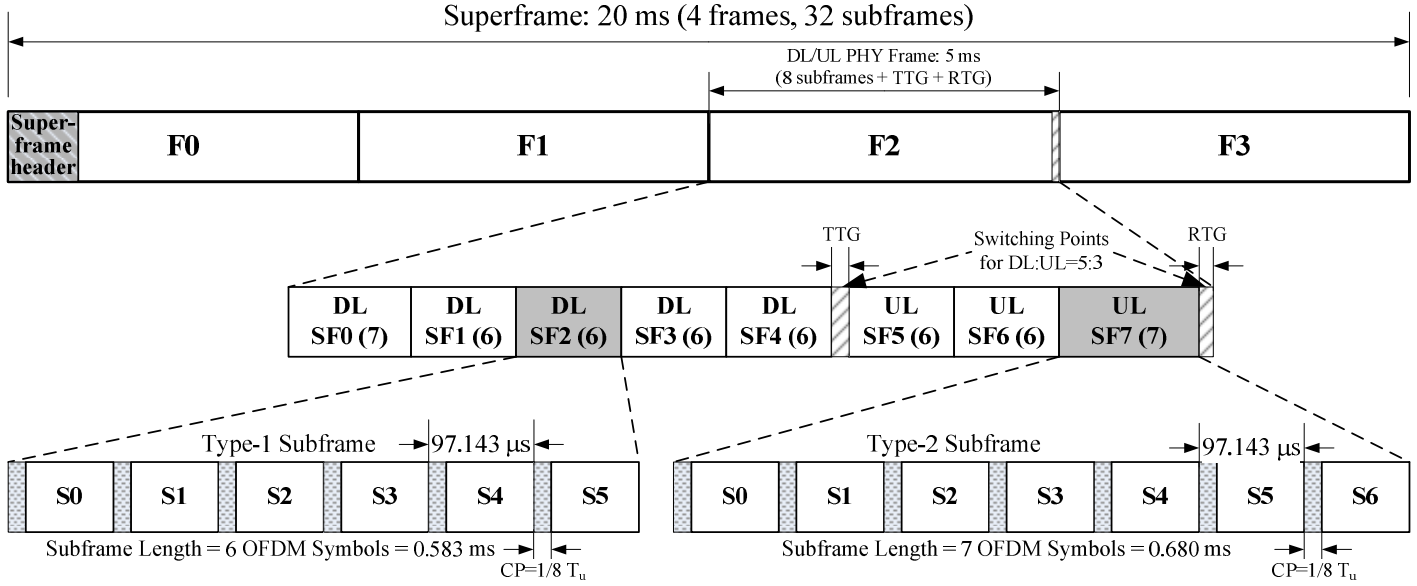



Figure 308c BS Frame Structure in TDD mode (CP of 1/16 useful OFDM symbol time and DL to UL ratio of 5:3)

### 15.3.4.1.2 STR RS frame structure

The STR RS frame structure is the same as the frame structure defined in 15.3.4.1.1 on the second carrier of the RS. The STR RS shall receive data in the DL subframes and transmit data in the UL subframes on the first carrier as a SS. The arrangement of signaling shall be the same as that described in 15.3.4.1.1 except that it is possible that the RS frame be configured such that the RS is both transmitting and receiving at the same time but transmission and reception of the RS shall not be used on the same carrier when the interference induced by the transmitter operating in STR mode causes a link adaptation degradation of the link performance related to the STR receiver.

### 15.3.4.1.3 TTR RS frame structure

For the 2-hop relay system, the TTR RS frame may include DL subframes, or receive subframes, or UL subframes, or transmit subframes. The BS shall not schedule any traffic for the RS except the uplink-only RS in the first DL subframe of the first frame of the superframe since it contains broadcasting management messages, such as superframe header.

For the 3-or-more-hop relay system, the TTR RS frame structure is TBD.

Two examples of TTR RS frame structure for 2-hop relay system with DL to UL ratio of 5:3 is illustrated in Figure 308d and Figure 308e, where OFDM symbol durations are 102.857μs and 97.143 μs respectively, and CP lengths are 1/8 useful OFDM symbol time and 1/16 useful OFDM symbol time respectively.

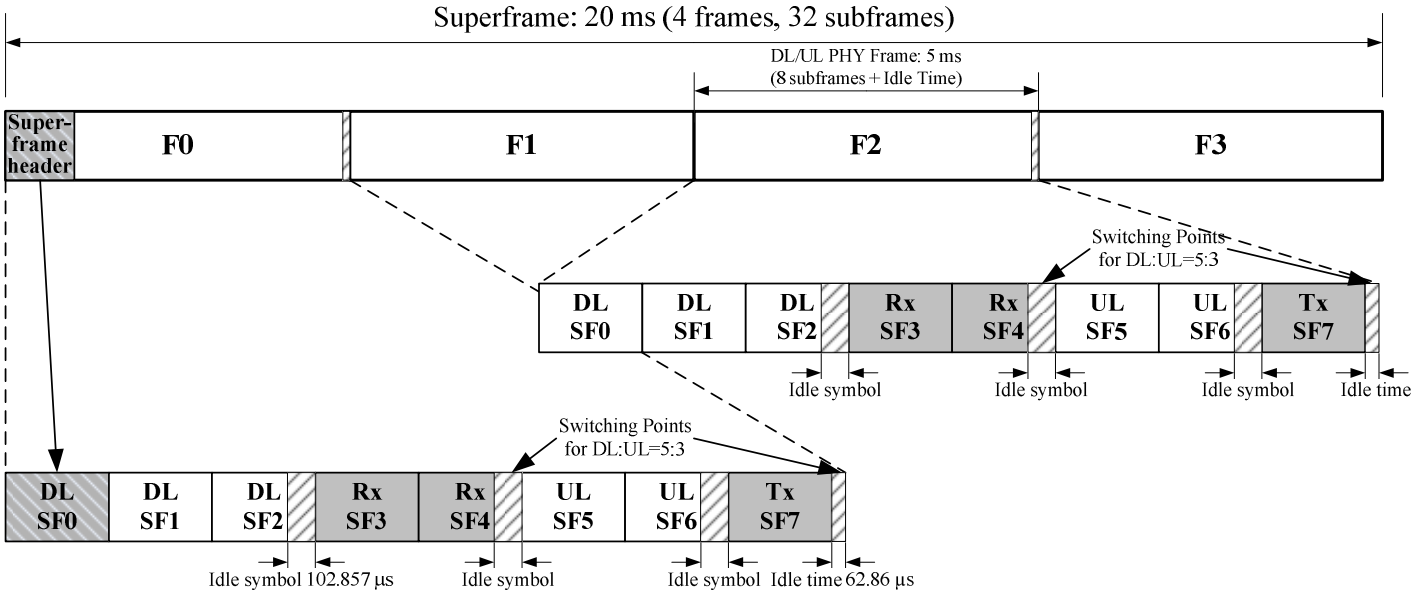



Figure 308d TTR RS Frame Structure in TTR TDD mode (CP of 1/8 useful OFDM symbol time and DL to UL ratio of 3)

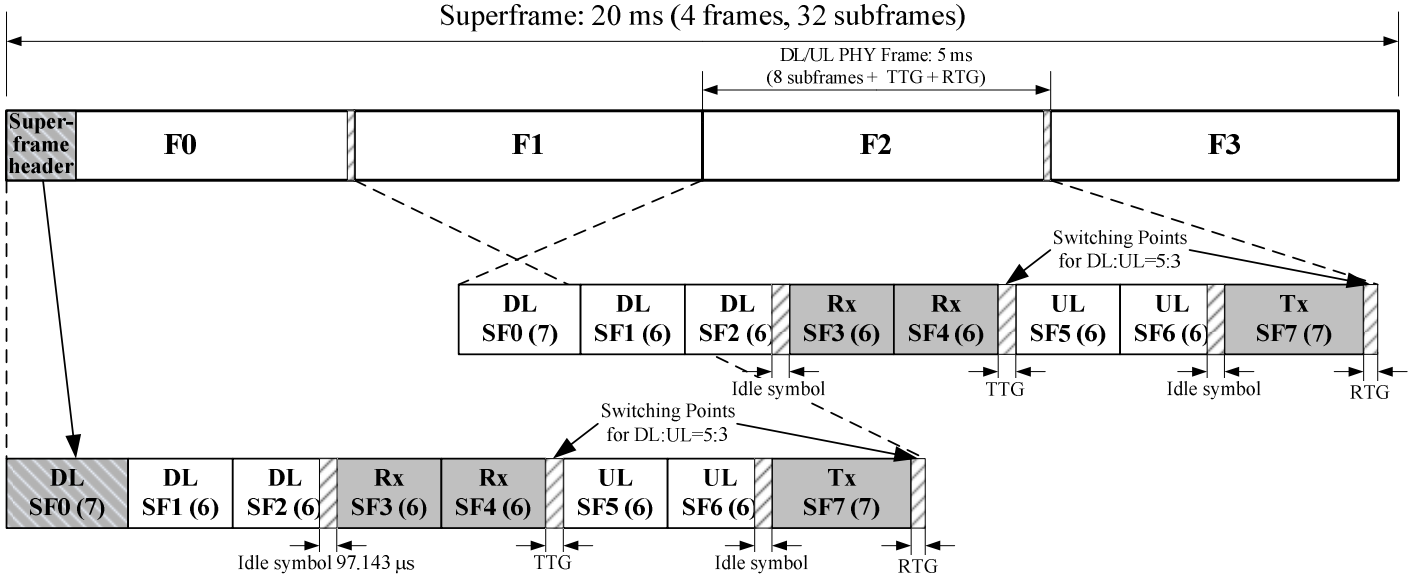



Figure 308e TTR RS Frame Structure in TDD mode (CP of 1/16 useful OFDM symbol time and DL to UL ratio of 5:3)

### 15.3.4.1.4 STR RS frame structure coexisting with TTR RS

**TBD**

### 15.3.4.2 FDD frame structure

### 15.3.4.2.1 BS frame structure

In an FDD system, when H-FDD mobile stations are included, the frame structure from the point of view of the H-FDD mobile station is similar to the TDD frame structure; however, the DL and UL transmissions occur in two separate frequency bands. The transmission gaps between DL and UL (and vice versa) are required to allow switching the TX and RX circuitry. Figure 308f shows an example of BS frame structure, where OFDM symbol duration is 102.857μs, CP length is 1/8 useful OFDM symbol time, and the length of type-1 subframe is 0.617 ms. Figure 308g illustrates an example of BS frame structure, where OFDM symbol duration is 97.143 μs, CP length is 1/16 useful OFDM symbol time, and the lengths of type-1 and type-2 subframes are 0.583 ms and 0.680 ms respectively.

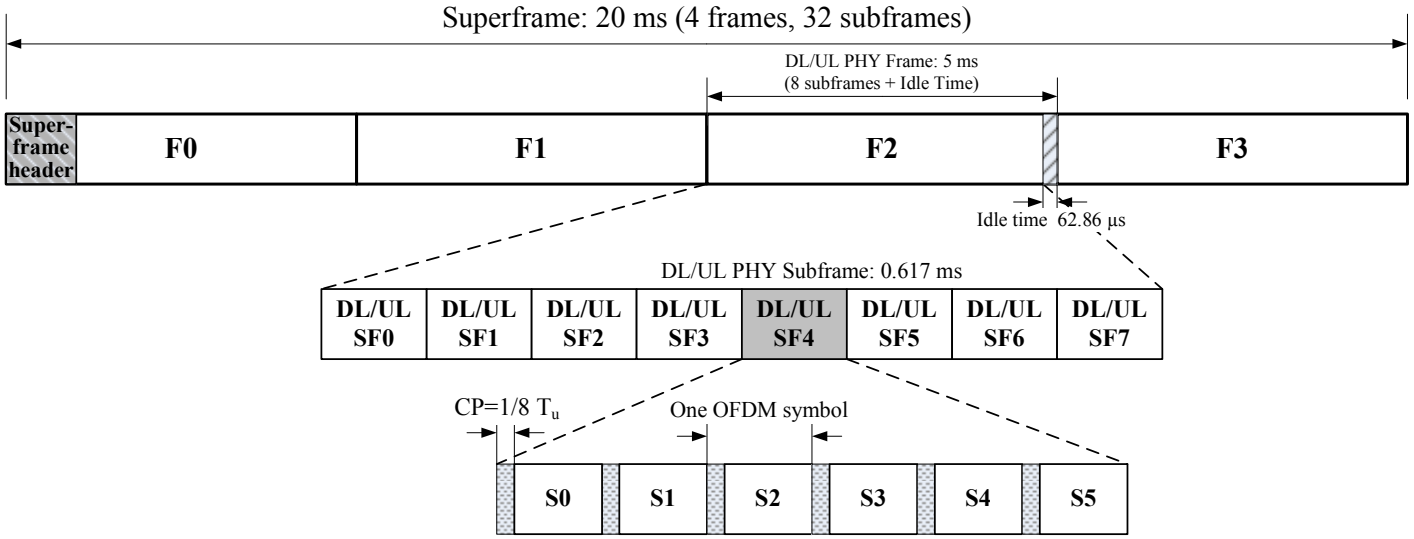



Figure 308f BS frame structure in FDD mode (CP of 1/8 useful OFDM symbol time)

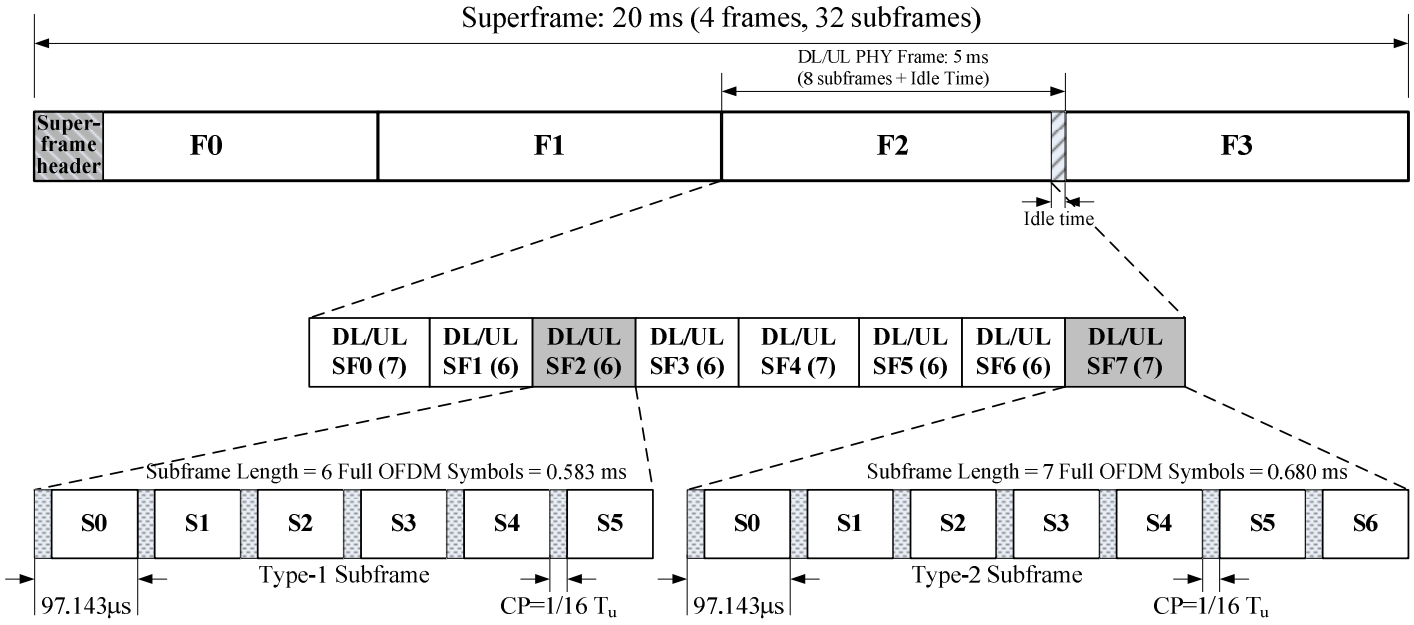



Figure 308g BS Frame Structure in FDD mode (CP of 1/16 useful OFDM symbol time)

### 15.3.4.2.2 STR RS Frame structure

The STR RS frame structure is the same as the frame structure defined in 15.3.4.2.1 on the RS second DL and UL carriers. The STR RS shall communicate with the serving access station on the RS first DL and UL carriers as the SS. The arrangement of signaling shall be the same as that described in 15.3.4.2.1 except that it is possible that the RS frame be configured such that the RS is both transmitting and receiving at the same time

but transmission and reception of the RS shall not be used on the same carrier when the interference induced by the transmitter operating in STR mode causes a link adaptation degradation of the link performance related to the STR receiver.

### 15.3.4.2.3 TTR RS Frame structure

For the 2-hop relay system, the TTR RS DL frame may include DL subframes or receive subframes, and the TTR RS UL frame may include UL subframes or transmit subframes. The BS shall not schedule any traffic for the RS except the uplink-only RS in the first DL subframe of the first frame of the superframe since it contains broadcasting management messages, such as superframe header.

For the 3-or-more-hop relay system, the TTR RS frame structure is TBD.

A examples of TTR RS frame structure for 2-hop relay system with DL to UL ratio of 5:3 is illustrated in Figure 308h.

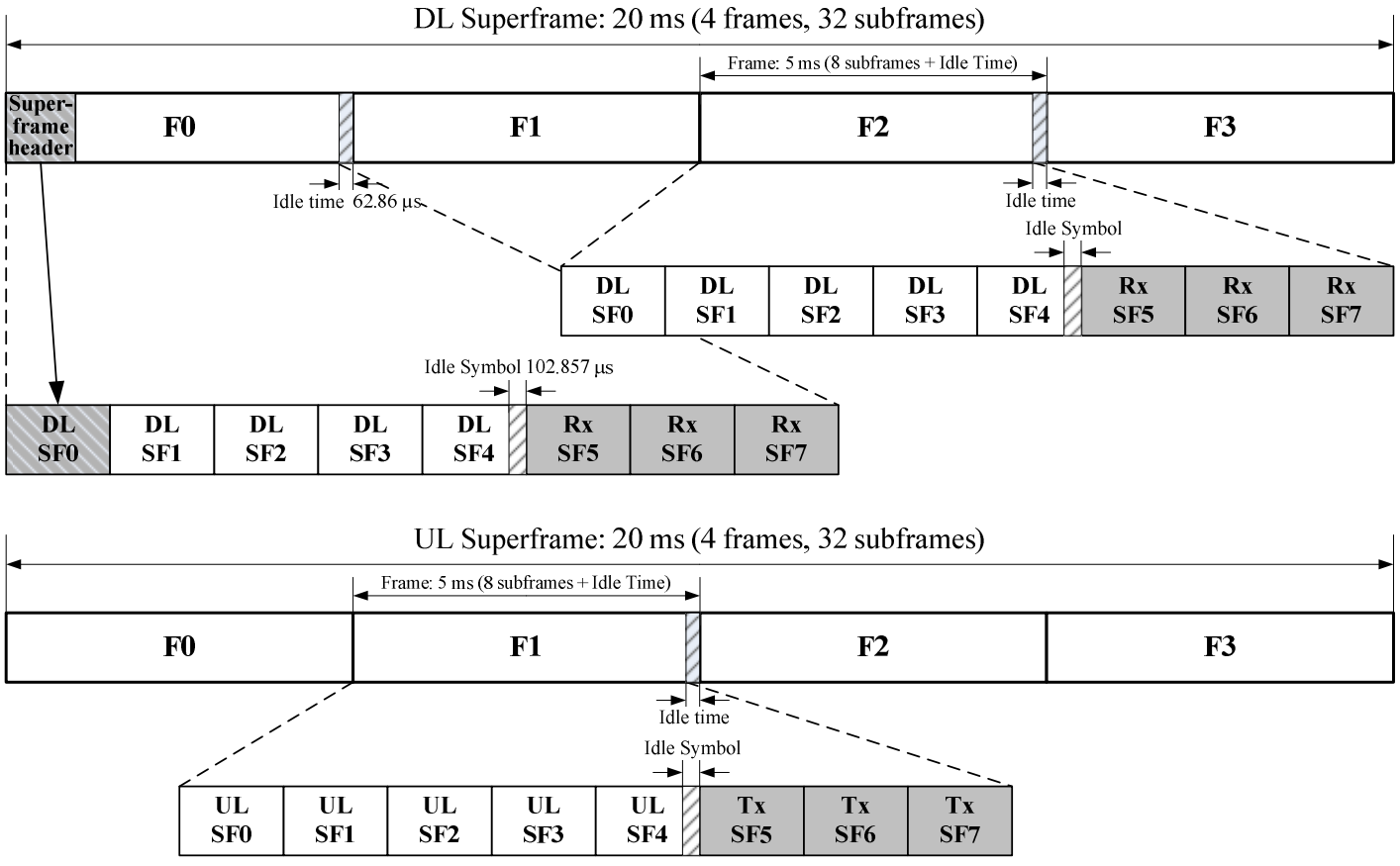



Figure 308h TTR RS Frame Structure in FDD mode

### 15.3.4.2.4 STR RS frame structure coexisting with TTR RS

**TBD**