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Re:	802.16 Rev2 Sponsor Ballot	
Abstract	This contribution proposes a few changes into the 802.16 Rev2/D6 that will provide the required supports to improve the system performance of MBS services for the 802.16e OFDMA PHY based systems.	
Purpose	To be discussed and adopted by 802.16 Rev2.	
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Performance enhancement with efficient mapping of outer-coded MBS streams

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1 Introduction

In order for the current MBS solution in 802.16 to achieve packet error rates that are viable for broadcast video and audio applications, a network must use overly robust and inefficient MCS or must somehow employ a retransmission scheme such as would be used to transfer a file rather than for real time consumption of the MBS service.

By adding optional outer-coding that adds significant time-diversity, we can operate at a higher MCS and achieve roughly a 45% increase in MBS throughput (or a corresponding reduction in bandwidth taken away from unicast services) in a typical 1 to 1.5 km cell while not impacting any existing implementations of the existing MBS. While different outer-codes have different performances under different circumstances, we need a standardized solution for at least one basic outer-code to avoid the emergence of incompatible proprietary solutions.

Further improvements in the throughput may be achieved by fixing the transmission interval for the outer-coded data blocks. This allows for efficient and robust signaling of the mapping of the outer-coded data to allocations in the OFDMA frames, which, combined with the outer coding, results in an increase in throughput of 60% compared to current MBS in 802.16e. This contribution introduces a new MAP message, called the OCTI_MAP message, which specifies the mapping of outer-coded data blocks transmitted in the next outer-coding interval.

2 Overview of the Proposed Solution

The proposed solution in this contribution is to introduce a new OCTI_MAP message to signal the mapping of outer-coded data blocks that is significantly more robust and efficient than the current MBS_MAP message. The proposal will:

- require no PHY changes;
- co-exist with the current 16e bi-directional data services and MBS services, and have no impact on them;

The benefits of this proposal are:

- The OCTI_MAP message does not rely on the DL-MAP message or the “daisy-chaining” mechanism, but is rather transmitted at configurable a-priori known locations;
- The OCTI_MAP message provides the mapping information for an entire outer-coding interval, rather than for one frame at a time, and thereby encodes the mapping information more efficiently;

- The OCTI_MAP message specifies the MAC PDU delineation, thereby enabling the suppression of the MAC PDU headers;

- The OCTI_MAP message may optionally be re-transmitted one or more times during the outer-coding interval, and thereby, become even more robust;

- The OCTI_MAP message specifies MCS and allocations in a manner that complements the outer-coding in an optimized way;

- The OCTI_MAP message provides support for sub-streams, thereby allowing for unequal protection of the application packets belonging to the same MBS stream.

Figure 1 shows an overview of OCTI_MAP related concepts. The OCTIs form a sequence of adjacent frame intervals, each containing a fixed number of frames. The OCTI sequence is MBS zone specific; each outer-coded block of each stream that is transmitted in an MBS zone shall be transmitted over the air within one OCTI. The typical duration of the OCTI is on the order of hundreds of milliseconds. The OCTI_MAP message is transmitted one or more times during an OCTI and defines the mapping of the data that is transmitted in the next OCTI. The OCTI Numbering System (OCTINS) is a system for numbering a subset of the symbols of one OCTI. This subset is referred to as the OCTINS domain. All allocations for the MBS streams in the MBS zone are within the OCTINS domain, but not every symbol and every slot in the OCTINS domain needs to be allocated for MBS data. Leftover resources may be allocated for other purposes. The symbols in the OCTINS domain follow a regular pattern defined by the OCTI_MAP message transmitted in the previous OCTI.

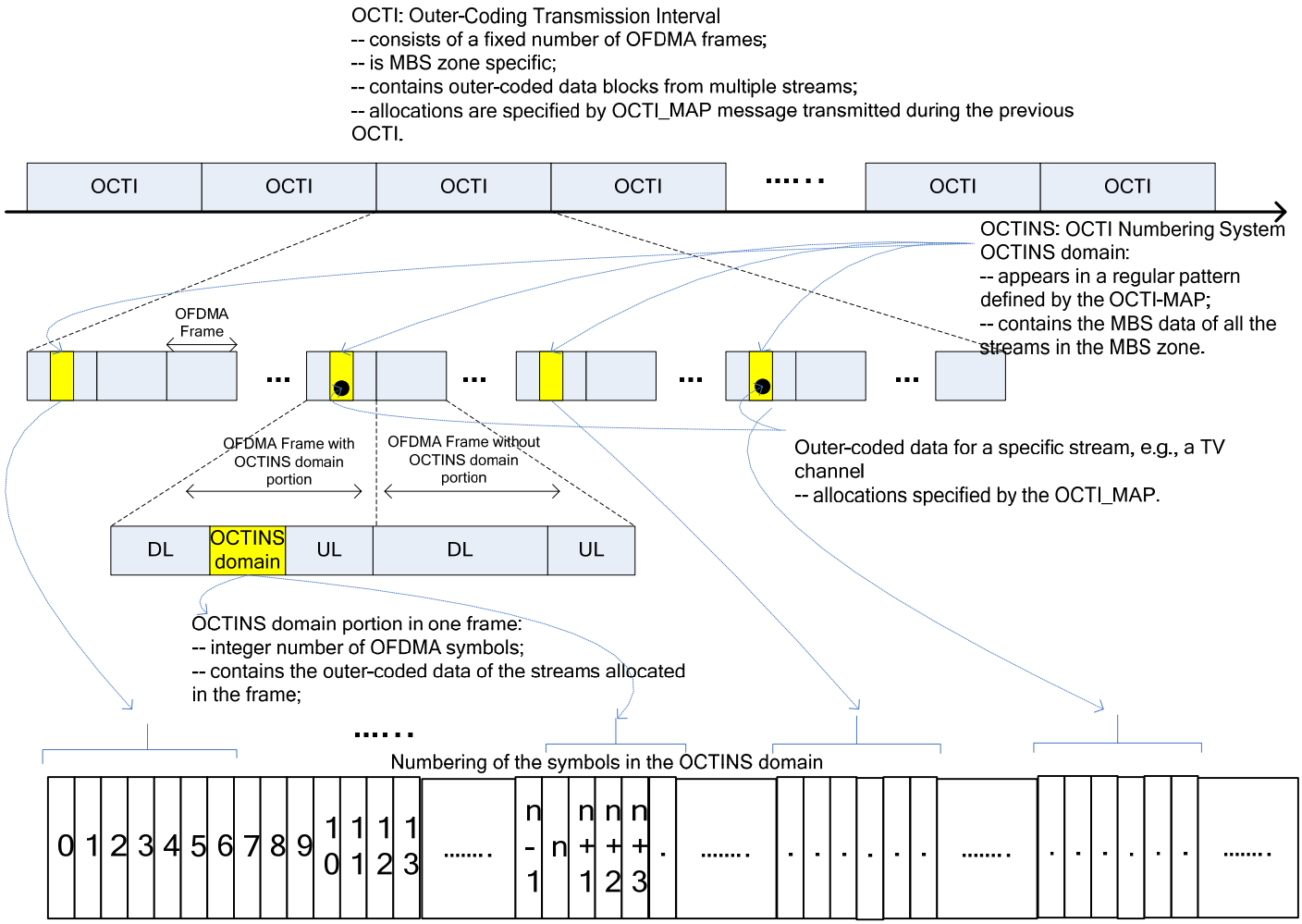


Figure 1 An Overview of OCTI_MAP related concepts

For each MBS zone, some of the parameters related to the OCTI structure are static in nature. These are:

- The MBS Zone ID
- The fixed length of the OCTIs
- A reference start frame for one OCTI; subsequent OCTIs occur at integer multiples of the fixed OCTI length after that frame
- The number and locations of the OCTI_MAP messages transmitted during an OCTI
- The maximum number of symbols that the OCTI_MAP may occupy (The exact number depends on the amount of data that the OCTI_MAP message needs to map)
- The MCS and the permutation type (PUSC or FUSC) used to encode the OCTI_MAP message

These parameters may be configured at the SS. When and how these parameters are configured at the SS is not in the scope of the standard. The proposed changes show these parameters in the SS's MIB, thereby providing the interface between the upper layer (NCMS) and the 802.16 entity to configure these parameters. Although MBS Zone IDs may be reused, i.e., two non-adjacent and non-overlapping zones may be identified by the same

MBS Zone ID, it is assumed that the MBS Zone IDs are allocated to MBS zones in such a way that within any geographic area of adequate size for which the SS may be configured, each MBS zone ID identifies at most one MBS zone.

A reference start frame for one OCTI is specified using an *adjusted reference* to overcome the problem that BSs within an MBS zone may not have their frame numbering synchronized. An adjusted reference works as follows: Let *T* be the frame number wrap-around period, i.e., $T = 2^{24} \times 5\,\text{ms}$, and let $N_b(t)$ denote the frame number transmitted at a given BS *b* at time *t*, where *t* is an integer multiple of 5 ms with reference to GPS time 0 (i.e., midnight of January 6th, 1980, GMT). Assume each BS *b* transmits (e.g., in the DCD) the number $N_b(0)$, which is the number of the frame that the BS *b* transmitted at GPS time 0 or at any integer number of frame number wrap-around periods since GPS time 0. Note that at any given two BSs *b* and *b'* and frame transmission time *t*, $(N_b(t) - N_b(0)) \bmod 2^m = (N_{b'}(t) - N_{b'}(0)) \bmod 2^m$, for $0 < m \leq 24$, i.e., the *m* least significant bits of $N_b(t) - N_b(0)$ at any time *t* are identical at all BSs *b*. This allows for using a number *K*, where $0 \leq K < 2^m$, to uniquely identify at any BS a frame within an interval of 2^m frames. The frame number mod 2^m of this frame at BS *b* is $(K + N_b(0)) \bmod 2^m$.

The OCTI_MAP message relies on the concept of a Stream ID. It is assumed that an operator allocates Stream IDs in such a way that every (MBS Zone ID, Stream ID) identifies a stream and that the mapping of (MBS Zone IDs, Stream IDs) to streams within a geographic area of adequate size is available at the application layer at the SS. The OCTI_MAP message also allows for streams to comprise several sub-streams. The sub-streams are encoded into separate outer-code data blocks. A sub-stream may be a subset of the stream's application packets which requires a different (e.g., a more robust) outer-coding. A sub-stream may also contain the information required for extracting the application packets from all the decoded outer-code data blocks (such as the application packet delineation information) of a particular stream.

3 Suggested Changes in Rev2/D6a

3.1 Remedy - Part 1

Add new definitions.

[In Section 3, page 20, line 31, add the following definitions:]

3.95 Stream: A stream is a flow of information which in its entirety carries information for a media stream such as a video stream or an audio stream or a combination of video, audio and hypertext. A Stream may be composed of several sub-streams.

3.96 Sub-stream: A stream may be composed of several sub-streams. During the course of an OCTI (see 3.97), each sub-stream carries packets that shall be identically modulated, shall be encoded at the same inner code rate and shall be encoded by the same outer code.

3.97 Outer-coding Transmission Interval: An outer-coding transmission interval is an interval of *N* consecutive OFDMA frames recurring every *N* OFDMA frames. The sequence of OCTIs is specific to an MBS zone and is specified in terms of the OCTI length (i.e., the number of frames in each OCTI) and a start frame of each OCTI. When specified, each outer coded data block shall be transmitted within one OCTI.

3.98 OCTI Numbering System (OCTINS): A system for referencing and numbering a subset of symbols in

the frames transmitted during one OCTI.

3.99 OCTINS Domain: The set of symbols within an OCTI that are referenced by the OCTINS.

3.2 Remedy - Part 2

Add a new convergence sub-layer for outer-coded data.

[Apply Remedy – Part 1 in contribution C802.16maint-08/293.]

3.3 Remedy - Part 3

Add a new OCTI_MAP message.

[On page 84, Table 38, add new row and adjust the reserved values for the Type field as follows:]

Type	Message name	Message description	Connection
68	SII-ADV	Service Identity Information Advertisement broadcast message	Fragmentable broadcast
69	LBS-ADV	Location information broadcast for LBS	broadcast
70	**OCTI_MAP**	**OCTI_MAP message**	broadcast
7~~0~~1–255	—	Reserved	—

[On page 271, line 13, insert a new section as follows:]

6.2.2.3.60 OCTI_MAP (outer-coding transmission interval map) message

The OCTI_MAP message contains information describing the mapping of streams in an MBS Zone. It is transmitted one or more times during an OCTI at pre-determined locations. The OCTI_MAP message received in one OCTI contains information that enables an SS to successfully receive the content of any stream transmitted in the identified MBS Zone in the following OCTI.

The OCTI_MAP message shall be transmitted in a MAC PDU that contains a CRC-32. If an SS receives an OCTI_MAP message that contains errors, the SS may still be able to correctly decode all parts of the message that pertain to the streams in which the user of that SS is interested. These parts are protected by CRC-16 to allow the SS to verify their correctness.

The operation of the OCTI_MAP message is specified in 6.2.22.6.

Table XX3 – OCTI_MAP message

Syntax	Size (bit)	Notes
OCTI_MAP Message format (){		

Management Message Type	8	70 (See Table 38)
MBS Zone ID	7	Identifies the MBS Zone.
Reserved	4	—
Next OCTI Map message width	5	This field specifies the number of symbols that the OCTI_MAP message occupies in the next OCTI, including the message type field.
OCTINS vector length	8	—
For (i=0; i<N; i++) {		N = OCTINS vector length
OCTINS vector element	8	See 6.2.22.6
}		
Number of streams	8	The number of streams transmitted in the MBS Zone. This number is greater than or equal to 1.
For (i=1; i<=L; i++) {		L = Number of streams
Stream ID	12	
Length of the stream specific mapping information	12	This parameter specifies the number of bytes used in this message to specify the allocations for the stream.
}		
For (i=1; i<=N; i++) {		N = Number of Streams
Number of sub-streams	4	The number of sub-streams that the stream is composed of. This number is greater than or equal to 1.
Reserved	4	
For (i=1; i<=M; i++) {		M = Number of sub-streams.
Number of OC-segment patterns	4	The number of OC-segment patterns. This number is greater than or equal to 1.
Reserved	4	
For (i=1; i<=K; i++) {		K = Number of OC-segment allocation patterns.
OC-segment pattern starting offset	16	The first symbol of the first OC-segment of the OC-segment pattern.
OC-segment sub-channel offset	6	The sub-channel number that the first slot of the OC-segment occupies.
OC-segment number of slots	14	The total number of slots in each OC-segment

OC-segment count	5	The number of OC-segment occurrences in this OC-segment pattern in the OCTI. A value of 0b00000 shall be interpreted as 32.
OC-segment period	15	The number of symbols separating the first symbol of two consecutive OC-segments of this OC-segment pattern in the OCTINS domain. If the OC-segment does not repeat, a value of zero shall be used.
}		End of OC-segment pattern description
DIUC	4	The DIUC used for all allocations for the current sub-stream
Repetition coding indication	2	0b00 – No repetition coding 0b01 – Repetition coding of 2 used 0b10 – Repetition coding of 4 used 0b11 – Repetition coding of 6 used
HARQ packet CRC	1	0b0 – No CRC 0b1 – CRC-16
Number of padding bytes	10	The number of fill bytes carried at the end of the last OC-segment of the sub-stream in the OCTI.
HARQ packet size indicator	12	A bitmap of allowed HARQ packet sizes
Outer-coding Mode	5	Specifies the outer-coding mode to use. See table 609b in section 11.22.1.1
Outer-coding parameter set length	8	Length, in bytes of the Outer-Coding parameter set
Outer-coding parameter set	*Variable*	The outer code parameters that apply to the outer coding of this sub-stream.
Reserved	*Variable*	1-7 bits to ensure byte-alignment
}		End of sub-stream specific parameters
CRC-16	16	The CRC computed over all bytes that pertain to the current stream (i.e., starting with the "Number of sub-streams" field.
}		End of stream specific parameters
TLV encoded information	*Variable*	TLV specific
}		

Next OCTI_MAP message width

If this value is set to zero, the number of symbols occupied by the OCTI_MAP message in the next OCTI shall not be inferred from the current OCTI_MAP.

OCTINS vector length

This field specifies the number of elements in the OCTINS vector.

OCTINS vector element

The value of this field is an element of the OCTINS vector. Refer to 6.2.22.6.

Stream ID

The ID used to identify the stream. This identifier allows the SS to selectively decode the allocations of the streams that the user is interested in. The allocations for the streams shall be specified in the same order in this OCTI_MAP message as their corresponding Stream IDs appear in this part of the message.

Length of the stream specific mapping information

The value of this field is the number of bytes in the part of this message that is used to specify the allocations for the stream. This part begins with the "Number of sub-streams" field and ends with the CRC-16.

OC-segment pattern starting offset

The first symbol of the first OC-segment of the OC-segment pattern. The symbol location shall be given with reference to the current OCTINS domain.

OC-segment sub-channel offset

This field specifies the sub-channel that the first slot of the OC-segment occupies. If this parameter is set to 0x00, there is no slot offset and the first symbol (in the case of a FUSC permutation) or the first symbol pair (in the case of a PUSC permutation) is fully occupied by the OC-segment.

OC-segment number of slots

The total number of slots occupied by each OC-segment of this OC-segment pattern.

OC-segment count

The number of OC-segment occurrences in this OC-segment pattern in the OCTI. A value of 0b00000 shall be interpreted as 32. Zero is not a valid number of occurrences.

OC-segment period

The number of OCTINS domain symbols separating the first symbols of two consecutive OC-segments of this OC-segment pattern in the OCTI. The OC-segment period parameter shall be an even number for MBS Zones with PUSC permutation.

DIUC

This parameter specifies the channel modulation and coding used for encoding the content of each allocation.

Repetition coding indication

Indicates the repetition code used inside each allocation.

HARQ packet CRC

This parameter specifies whether FEC blocks of this sub-stream include a CRC field.

Number of padding bytes

This field indicates the number of padding bytes carried at the end of the last OC-segment of the sub-stream in the OCTI. Padding bytes shall be discarded by the receiver when passing the MAC PDU content to the higher layer. Only the last OC-segment instance of a sub-stream may contain padding bytes. All padding bytes shall be 0xFF.

HARQ packet size indicator

This parameter is a bitmap of allowed FEC block sizes.

Outer-coding parameter set

This field contains the outer code parameters that apply to this sub-stream in the next OCTI. The length is an integer number of bytes. See 11.22.1.1.

A CRC-32 shall be included at the end of the MAC PDU that carries this message.

3.4 Remedy - Part 4

Add a feature description.

[On page 483, line 57; add a new section as follows:]

6.2.22.6 Performance enhancement with efficient mapping of outer-coded MBS streams

When outer-coding is applied to streams in such a manner that the length in play-back time of the portion of the stream that is encoded into each outer-coded data block is fixed, and this length is identical for all streams transmitted in an MBS zone, more robust and efficient signaling of the mapping information may be applied. Each outer-coded data block is transmitted in a fixed-length interval of OFDMA frames called an Outer-Coded Transmission Interval (OCTI). The sequence of OCTIs is MBS zone specific and is specified in terms of start frame and number of frames. This sequence is configured in the SS via the MIB; see 13.2.6. The mapping information for all streams in an MBS zone that applies to one OCTI is specified in an OCTI_MAP message transmitted one or more times during the preceding OCTI; see 6.2.2.3.60. The locations of the OCTI_MAP messages with respect to the OCTI, as well as the permutation type and DIUC, are also static in nature and configurable at the SS.

The OCTI_MAP message allows for streams to comprise several sub-streams. The sub-streams are encoded into separate outer-code data blocks. A sub-stream may be a subset of the stream's application packets which requires a different treatment (e.g., a more robust error protection). A sub-stream may also contain the information required for extracting the application packets from all the decoded outer-code data blocks (such as the application packet delineation information, see section 6.2.22.5.1 for more details) of a particular stream.

The OCTI_MAP message specifies the allocations for each stream using the OCTI Numbering System (OCTINS). The OCTINS is used to index a subset of all symbols in all DL sub-frames that are transmitted during one OCTI. This subset of symbols is referred to as the *OCTINS domain*, see Figure YY1. The BS shall schedule all the streams that belong to the MBS zone within the subset of symbols that constitute the OCTINS domain.

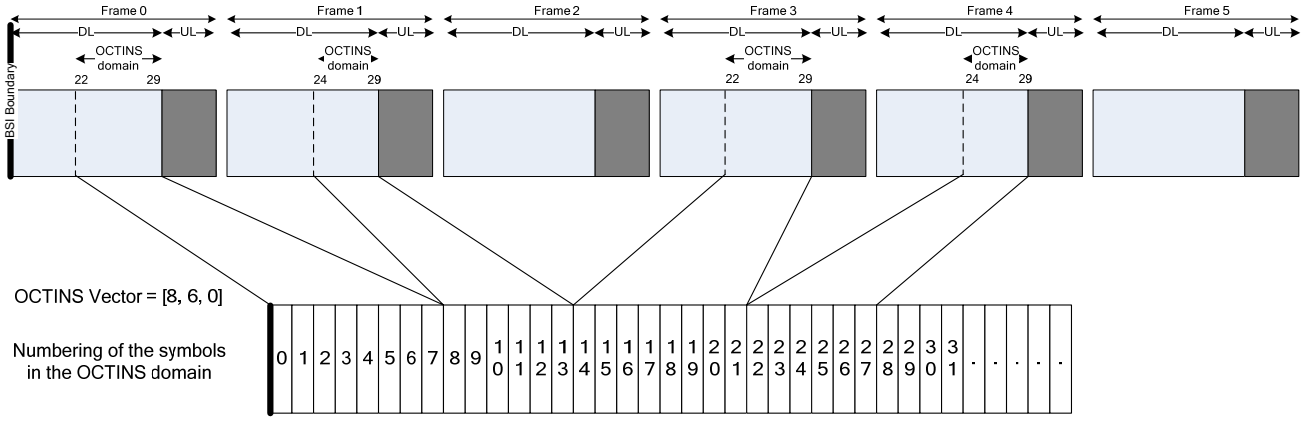


Figure YY1 – Location of OFDMA symbols in the OCTINS domain

The OCTINS domain is specified by the OCTINS vector, whose length N is less than or equal to the number of frames of the OCTI and each element is a non-negative integer less than or equal to the total number of symbols of the DL sub-frame. The OCTINS vector signals the number of symbols in each frame that are contained in the OCTINS domain. If V is the OCTINS vector, B the number of frames in the OCTI, and k is the number of a frame within the OCTI, i.e., $0 \le k < B$, then the OCTINS domain contains the $V(k \bmod N)$ last symbols of the k^{th} DL sub-frame. The symbols in the OCTINS domain are numbered in increasing order starting with 0. The BS signals the OCTINS vector in the OCTI_MAP message, which enables the SS to determine which frame k and which symbol s in frame k a given number m references and, thereby, interpret the mapping information in that message.

Informative: It follows from the above description that the number of symbols that are referenced by the OCTINS in DL sub-frames 0, N, $2N$, ... is $V(0)$, the number of symbols that are referenced by the OCTINS in DL sub-frames 1, N+1, $2N$+1, ... is $V(1)$, etc. Given an OCTINS domain symbol number m, the SS can identify which symbol s in which DL sub-frame k (where the first symbol of a DL sub-frame is numbered 0) the number m references. The following steps may be used to calculate k and s given m.

1. Let $a = \lfloor m/S \rfloor$ and $r = m \mod S$, where $S = \sum_{i=0}^{N-1} V(i)$
2. Let $j \ge 0$ be the smallest integer such that $\sum_{i=0}^{j} V(i) > r$
3. Then, $k = aN + j$ and $s = |DL| - \sum_{i=0}^{j} V(i) + r$, where $|DL|$ is the number of symbols in the DL sub-frame.

End of informative section.

When the BS receives data for a sub-stream from the upper layer, the BS shall schedule transmissions within the OCTINS domain. A consecutive set of slots in the OCTINS domain is referred to as an *OC-segment*. The OCTI_MAP message specifies the allocations for a sub-stream in terms of segments. The OCTI_MAP specifies the OC-segments of a sub-stream using a set of OC-segment patterns. An OC-segment pattern is a periodic

pattern of OC-segments with the same first slot offset and number of slots, which may be occur a number of times with a fixed period in the OCTINS domain. Although each OC-segment is a consecutive set of slots in the OCTINS domain, an OC-segment may "straddle" multiple OFDMA frames and, therefore, may correspond to multiple allocations across multiple OFDMA frames (see Figure YY2).

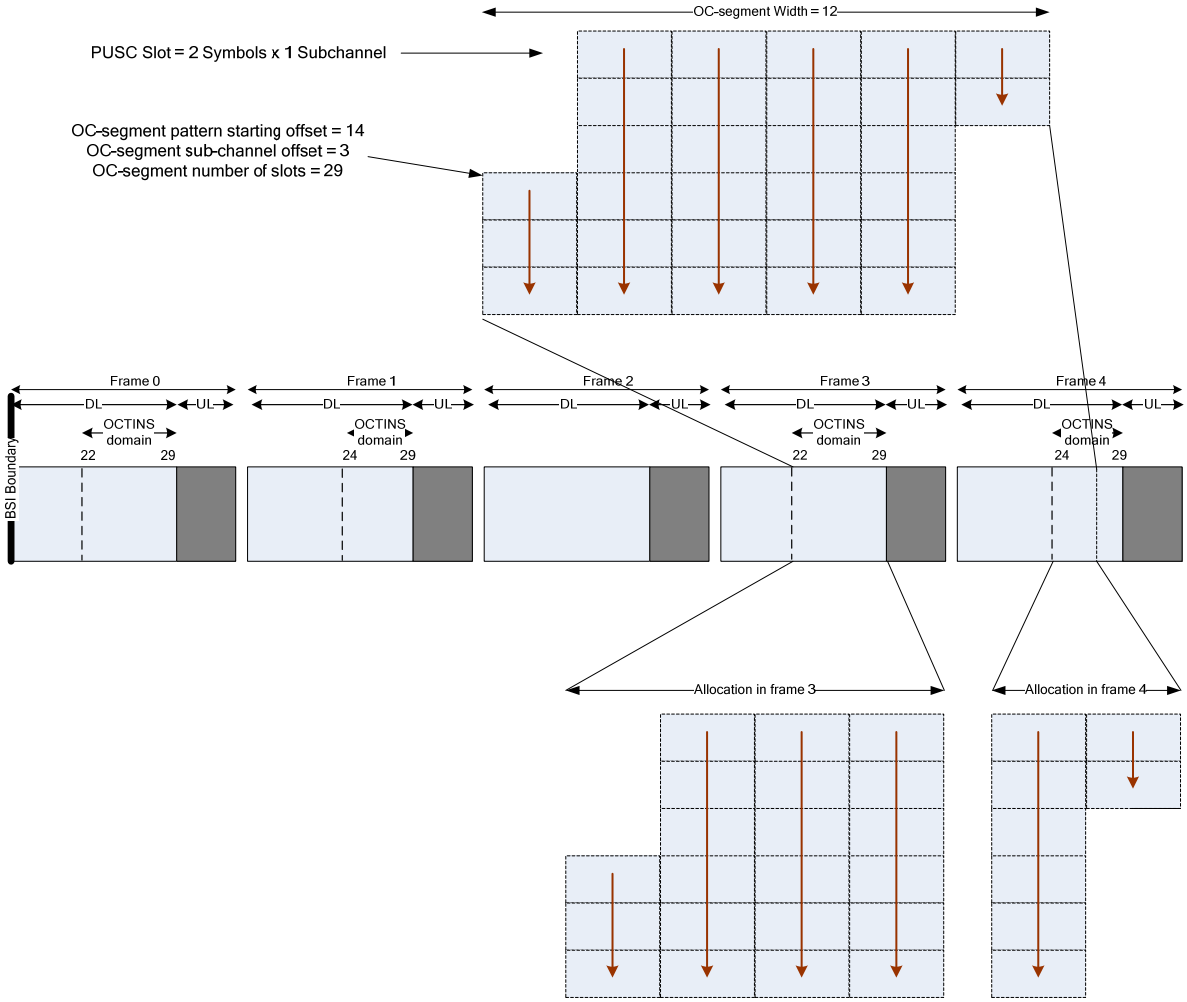


Figure YY2 – Example of an OC-segment divided into two allocations

Each OC-segment belonging to a sub-stream maps to one or more allocations, where each allocation is in a separate OFDMA frame. From the information in the OCTI_MAP, the SS can determine the number of slots of each allocation, and from the DIUC it can determine the number of bytes that fit in each allocation.

Symbols in the OCTINS domain that are not allocated to any stream may be used for other allocations, e.g., allocations for unicast transport connections.

The GMH in MAC PDUs that are allocated to OC-segments shall be suppressed. The OCTI_MAP message specifies the sizes of the sub-bursts in each allocation and the BS shall fill each sub-burst with a single PDU, which allows the SS to determine the MAC PDU delineation. Only the sub-bursts in the last OC-segment of each sub-stream may contain padding bytes as specified by the "Number of padding bytes" field in the OCTI_MAP message.

6.2.22.6.1 Allocations

The BS shall specify the set of allowed HARQ packet sizes by setting the HARQ packet size indicator field in

the OCTI_MAP message to the bit-wise 'AND' of the HARQ Bitmap Indicator values in Table XX4.

Table XX4 – Size of allowed HARQ packet sizes

HARQ Bitmap Indicator	HARQ packet size (Bits)
0b000000000001	48
0b000000000010	96
0b000000000100	144
0b000000001000	192
0b000000010000	288
0b000000100000	384
0b000001000000	480
0b000010000000	960
0b000100000000	1920
0b001000000000	2880
0b010000000000	3840
0b100000000000	4800

Each allocation shall contain the maximum number of the largest allowed HARQ packets that fit in the allocation. When no more HARQ packets of the largest allowed size can be contained in the allocation, the next largest allowed size shall be used and the maximum number of HARQ packets of this size shall be fit in the allocation. This process continues until no more of the smallest allowed HARQ packets can be fit in the allocation. Leftover slots in the allocation are not used. If no HARQ packet fits in an allocation, the allocation may be discarded by the receiver.

3.5 Remedy - Part 5

Add a new TLV in the DCD message for *'Adjusted frame reference number'*, to enable configuration of the OCTI start frame.

[On page 1194, line 43, insert the following row to Table 567:]

***Table 567- DCD channel encoding (*continued)**

Name	Type (1 byte)	Length	Value (variable length)	PHY scope
Adjusted frame reference number	xxx	3	An integer number *N*, set to the frame number of the frame transmitted at time t_0, where t_0 is	OFDMA

			expressed with reference to GPS time and is such that $t_0 \bmod (2^{24} \times T_f) = 0$ ms, where T_f is the frame duration.	

3.6 Remedy – Part 6

Add a description of one outer-coding mode.

[Apply Remedy – part 4 in contribution C802.16maint-08/293.]

3.7 Remedy – Part 7

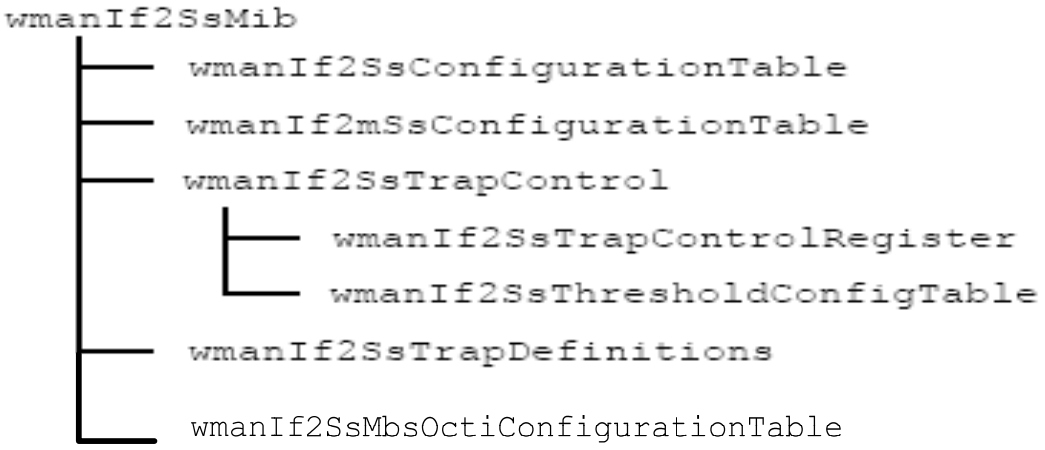
Add the structure of the Outer-coding parameter set.

[On page 1333, line 31, add a new section 11.22.1.1. as in Remedy – part 5 in contribution C802.16maint-08/293.]

3.8 Remedy – Part 8

Add a new table in the IF2-SS-MIB for configuration of the OCTI_MAP related parameters.

[On page 1394, line 3, Figure 338, modify figure to include a new node named wmanIf2SsMbsOctiConfigurationTable *as follows:]*



[On page 1394, line 47, insert a new section as follows:]

13.1.6.5 wmanIf2SsMbsOctiConfigurationTable

wmanIf2SsMbsOctiConfigurationTable contains the definitions of OCTIs for a set of associated MBS zones in a geographic area.

[On page 1759, line 23, insert the following text:]

```
-- optional group
GROUP wmanIf2SsMibOctiConfigGroup
DESCRIPTION
     "This group is optional for the subscriber station."
```

[On page 1762, line 5, insert the following text:]

```
wmanIf2SsMibOctiConfigGroup OBJECT-GROUP
   OBJECTS {-- SS OCTI configuration
               wmanIf2SsMbsOctiStartFrame,
               wmanIf2SsMbsOctiLength,
               wmanIf2SsMbsOctiMapFrameOffset,
               wmanIf2SsMbsOctiMapSymbolOffset,
               wmanIf2SsMbsOctiMapRepetitionCount,
               wmanIf2SsMbsOctiMapRepetitionPeriod,
               wmanIf2SsMbsOctiMapMcs,
               wmanIf2SsMbsOctiMapPermutationType }
    STATUS current
    DESCRIPTION
        "This group contains objects for OCTI configuration
         at the subscriber station."
    ::= { wmanIf2SsMibGroups 5 }


wmanIf2SsMbsOctiConfigurationTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF WmanIf2SsMbsOctiEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "This table contains OCTI information in a geographic area."
        REFERENCE
             "Subclause 6.2.22.6 in IEEE Std 802.16-2008"
        ::= { wmanIf2SsMib 10 }

wmanIf2SsMbsOctiEntry OBJECT-TYPE
        SYNTAX      WmanIf2SsMbsOctiEntry
```

```
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Each entry specifies the attributes of an OCTI"
        INDEX     { wmanIf2SsMbsZoneId }
        ::= { wmanIf2SsMbsOctiConfigurationTable 1 }

WmanIf2SsMbsOctiEntry ::= SEQUENCE {
        wmanIf2SsMbsZoneId                      Integer32,
        wmanIf2SsMbsOctiStartFrame              Integer32,
        wmanIf2SsMbsOctiLength                  Integer32,
        wmanIf2SsMbsOctiMapFrameOffset          Integer32,
        wmanIf2SsMbsOctiMapSymbolOffset         Integer32,
        wmanIf2SsMbsOctiMapRepetitionCount      Integer32,
        wmanIf2SsMbsOctiMapRepetitionPeriod     Integer32,
        wmanIf2SsMbsOctiMapMcs                  Integer32,
        wmanIf2SsMbsOctiMapRepCode              Integer32,
        wmanIf2SsMbsOctiMapPermutationType      Integer32 }


wmanIf2SsMbsZoneId OBJECT-TYPE
        SYNTAX      Integer32 ( 0..127)
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The identifier of the MBS zone identified by the
             MBS Zone Id."
        ::= { wmanIf2SsMbsOctiEntry 1 }

wmanIf2SsMbsOctiStartFrame OBJECT-TYPE
        SYNTAX      Integer32 ( 0 .. 1023 )
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "An adjusted frame reference to the first frame of an OCTI."
        REFERENCE
             "Subclause 6.2.22.6, in IEEE Std 802.16-2008"
        ::= { wmanIf2SsMbsOctiEntry 2 }

wmanIf2SsMbsOctiLength OBJECT-TYPE
```

```
        SYNTAX      INTEGER (0..1023)
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The number of frames in each OCTI. This number is shall be
             a power of 2."
        REFERENCE
             "Subclause 6.2.22.6, in IEEE Std 802.16-2008"
         ::= { wmanIf2SsMbsOctiEntry 3 }


wmanIf2SsMbsOctiMapFrameOffset OBJECT-TYPE
        SYNTAX      INTEGER (0..1023)
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The frame offset of the location of the first instance
             of the OCTI_MAP message from the beginning of the OCTI ."
        REFERENCE
             "Subclause 6.2.22.6, in IEEE Std 802.16-2008"
        ::= { wmanIf2SsMbsOctiEntry 4 }

wmanIf2SsMbsOctiMapSymbolOffset  OBJECT-TYPE
        SYNTAX      INTEGER (0..64)
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The symbol offset of the location of the OCTI_MAP message
             within frames that contain the OCTI_MAP message."
        REFERENCE
             "Subclause 6.2.22.6, in IEEE Std 802.16-2008"
        ::= { wmanIf2SsMbsOctiEntry 5 }



wmanIf2SsMbsOctiMapRepetitionCount OBJECT-TYPE
        SYNTAX      INTEGER (0..64)
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
```

```
            "The number of times that the OCTI_MAP message is transmitted during an OCTI."
        REFERENCE
             "Subclause 6.2.22.6, in IEEE Std 802.16-2008"
        ::= { wmanIf2SsMbsOctiEntry 6 }


wmanIf2SsMbsOctiMapRepetitionPeriod  OBJECT-TYPE
        SYNTAX      INTEGER (0..1023)
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "If the OCTI_MAP message repetition count is larger than 0,
             this is the period of repetition in number of OFDMA frames. "
        REFERENCE
             "Subclause 6.2.22.6, in IEEE Std 802.16-2008"
        ::= { wmanIf2SsMbsOctiEntry 7 }


wmanIf2SsMbsOctiMapMcs   OBJECT-TYPE
        SYNTAX      INTEGER (0..256)
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The modulation and coding of the OCTI_MAP message."
        REFERENCE
             "Subclause 6.2.22.6, in IEEE Std 802.16-2008, and
              Subclause 11.4.2, in IEEE Std 802.16-2008,
               Table 572 in IEEE Std 802.16-2008"
        ::= { wmanIf2SsMbsOctiEntry 8 }


wmanIf2SsMbsOctiMapRepCode   OBJECT-TYPE
        SYNTAX      INTEGER (0, 2, 4, 6)
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The repetition coding used for the OCTI_MAP message."
        REFERENCE
             "Subclause 8.3.9.5, in IEEE Std 802.16-2008"
        ::= { wmanIf2SsMbsOctiEntry 8 }
```

```
wmanIf2SsMbsOctiMapPermutationType   OBJECT-TYPE
        SYNTAX      INTEGER (0..1)
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The permutation of the entire MBS Zone
             identified by the MBS Zone ID. A value of 0 is used for FUSC,
             and a value of 1 is used for PUSC."
        REFERENCE
             "Subclause 6.2.22.6, in IEEE Std 802.16-2008"
        ::= { wmanIf2SsMbsOctiEntry 9 }
```