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Title	**Structure and notation enhancements to IEEE P802.16h/D3**	
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Re:	Letter Ballot #29 of IEEE P802.16h/D3.	
Abstract	There are a number of structural and notional enhancements that should be applied to the IEEE P802.16h/D3 draft.	
Purpose	Ensuring the readability of the draft IEEE P802.16h/D3.	
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Structure and notation enhancements to IEEE P802.16h/D3

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1. Introduction

This document covers structure and notation enhancements to IEEE P802.16h/D3. The document covers:

- The addition of a new designation WirelessMAN-UCP.
- Restoration of the WirelessHUMAN designation.
- Removal of unnecessary and redundant features.
- Improvements to FRS.

2. Scope of structure and notation enhancements

Structure and notation enhancements to IEEE P802.16h/D3 are presented in this clause. This introduces the motivation for the editing changes that follow in clause 3.

2.1. Designation rationalization

Some definitions:

- **A designation WirelessMAN-UCP**: A designation specifically defined to draw on the family of features defined by UCP.
- **UCP (Uncoordinated Coexistence Protocol)**: A collective term for a family of features designed to provide uncoordinated (*passive cognitive radio*) coexistence with asynchronous systems, such as 802.11. UCP is not band specific but can be made band specific with appropriate choice of operational parameters.
- **UCP** consists of the **DCS (Dynamic Channel Selection)** and **LBT (Listen-Before-Talk)** features. Specifically LBT uses a **DMA (Dynamic Medium Acquisition)** algorithm to provide optimal co-channel sharing.

This is shown in diagrammatically in Figure 1.

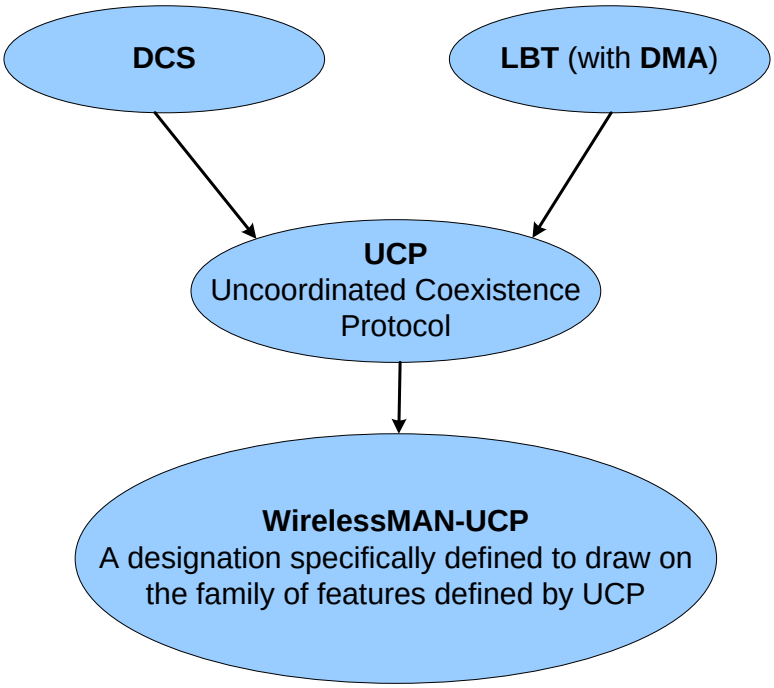


Figure 1 A diagrammatic representation of the features that underpin the *WirelessMAN-UCP* designation.

2.2. Removal of additional features applied to WirelessHUMAN

Given there is a new designation of WirelessMAN-UCP then the additional features previously applied to WirelessHUMAN can be removed. It is necessary to remove any material previously added to WirelessHUMAN and move it instead to WirelessMAN-UCP.

2.3. Removal of unnecessary and redundant features

Review of [1] reveals a number of subclauses containing redundant features:

- 6.4.1.1 *Capability Negotiation*
- 6.4.2.3.3 *Enhanced Measurement and Reporting for Non-Exclusively Assigned or Non-exclusively Licensed Bands*
- 8.5.1.2 *Extended channel numbering for other non-exclusively licensed bands below 6 GHz*
- 11.12 *REP-RSP management message encodings*

2.3.1. Subclause 6.4.1.1 Capability Negotiation

Not required. This is due to the fact this text is informative in nature, is in many ways factually incorrect, and does not provide any additional information that is already included in the amendment in other sections.

2.3.2. Subclause 6.4.2.3.3 Enhanced Measurement and Reporting…

Not required. The enhanced report has been de-scoped such over a number of rounds of commenting that there is now minimal differentiation with that which is already covered by specification in the draft.

2.3.3. Subclause 8.5.1.2 Extended channel numbering for other non-exclusively licensed bands below 6 GHz

Not required. Channel numbering can be handled via a mechanism such as *FA_Index*. Furthermore remove all references to ExChNr.

2.3.4. Subclause 11.12 REP-RSP management message encodings

The ‘extended report type’ does not add any additional value over the ‘basic report type’. Remove ‘extended report type’.

It is also necessary to fix the backwards compatibility issue in the REP-RSP message for the *Basic Report*.

2.4. Miscellaneous

2.4.1. Improvements to FRS

Simulation results indicate that a FRS transmission to protect the downlink is required in addition to transmission to protect the uplink (as currently specified). Detailed below in clause 3 are text and figure enhancements to support these findings.

2.4.2. Frame structure and frame allocation methodology

Given that the regulation of the 3.65GHz band requires the registration of base station and fixed subscribers it is therefore possible to use administrative means to allocate frames to 802.16 systems. Text is presented in clause 3 to accomplish this.

3. Specific editing changes

Blue underlined text represents specific editorial additions.

~~Red strikethrough~~ text is to be deleted.

Black text is text already in the draft.

Bold italic text is editorial instructions to the editor.

Make the following changes to subclause 1.3.3 in [1].

~~A summary of some applicable bands is given in *15.7.*~~

Modify the following row of Table 1 in [1] accordingly:

Designation	**Applicability**	**PHY**	**Options**	**Duplexing alternative**
WirelessHUMAN™	~~Below 11 GHz license-exempt bands~~ Bands below 11 GHz subject to *non-exclusive assignment* or *non-exclusive licensing*	~~license-exempt~~ [8.2, 8.3 or 8.4] and 8.5	AAS (6.3.7.6) ARQ (6.3.4) Mesh (6.3.6.6) (with 8.3 only) STC (8.2.1.4.3/8.3.8/8.4.8) DFS (6.3.15)	TDD

Add the following rows in Table 1 in [1 replacing the existing defintion of WirelessMAN-CX].

Designation	**Applicability**	**PHY**	**Options**	**Duplexing alternative**
WirelessMAN-CX	Bands below 11 GHz subject to *non-exclusive assignment* or *non-exclusive licensing*	8.2, 8.3, or 8.4] and 8.5	AAS (6.3.7.6, 8.4.4.6) ARQ (6.3.4) HARQ (6.3.17) STC (8.4.8) *Coordinated*	TDD

			coexistence mechanisms (15)	
WirelessMAN-UCP	Bands below 11 GHz subject to *non-exclusive assignment* or *non-exclusive licensing*	8.4	AAS (6.3.7.6, 8.4.4.6) ARQ (6.3.4) HARQ (6.3.17) STC (8.4.8) *Uncoordinated coexistence mechanisms* (6.4)	TDD

Adopt the following changes to the paragraph in subclause 1.3.4 [1].

Implementations of this standard for ~~license-exempt~~ frequencies subject to *non-exclusive assignment* or *non-exclusive licensing* below 11 GHz ~~(such as those listed in B.1)~~ use the designations WirelessHUMAN, WirelessMAN-CX and WirelessMAN-UCP, and shall, where appropriate, comply with the WirelessMAN-SCa PHY as described in 8.2, the WirelessMAN-OFDM PHY as described in 8.3, or the WirelessMAN-OFDMA PHY as described in 8.4. WirelessHUMAN shall further comply with the DFS protocols (6.4.2.3.2) (where mandated by regulation) as described in 8.5. WirelessMAN-UCP provides *uncoordinated coexistence mechanisms* (6.4) and WirelessMAN-CX provides *coordinated coexistence mechanisms* (15). ~~They shall further comply with the DFS protocols (6.3.15) (where mandated by regulation) and with 8.5.~~

Make the following changes to clause 3 in [1]: 'Definitions'.

3.138 Wireless~~HUMAN~~MAN-UCP: The designation used to describe the realization that adds *uncoordinated coexistence* mechanisms to systems operating below 11 GHz in *non-exclusively assigned* or *non-exclusively licensed* bands.

Add the following definition to clause 4 in [1]: 'Abbreviations and Acronyms'.

CMA	Clear Medium Assessment
DMA	Dynamic Medium Acquisition
FRS	Frame Reservation Signal
FRST	Frame Reservation Start Time
WirelessMAN-UCP	Wireless Metropolitan Access Network – Uncoordinated Coexistence Protocol

Replace 6.3.2.3.23 and 6.3.2.3.24 in [1], page 10, line 1 with the following:

6.3.2.3.23 SS Basic Capability Request (SBC-REQ) message

[add the following text at the end of 6.3.2.3.23:]

The following TLV shall only be included by WirelessMAN-UCP capable devices:

WirelessMAN-UCP feature support (see *11.8.3.8.1*)

The following TLV shall only be included by WirelessMAN-CX capable devices:

WirelessMAN-CX feature support (see *11.8.3.9.1*)

6.3.2.3.24 SS Basic Capability Response (SBC-RSP) message

[add the following text at the end of 6.3.2.3.24:]

The following TLV shall only be included by WirelessMAN-UCP capable devices:

WirelessMAN-UCP feature support (see *11.8.3.8.1*)

The following TLV shall only be included by WirelessMAN-CX capable devices:

WirelessMAN-CX feature support (see *11.8.3.9.1*)

Make the following changes to subclause 6.4.2.3.2 'Dynamic Channel Selection', Page 30, line 58:

An example of a DCS solution is provided in *Figure h 6* in which interference detection results in a channel change. *Figure h 6* (a) indicates the events that occur following interference detection at the BS. The DCS algorithm has a choice to either vacate the channel or overcome the interference by using a more robust modulation scheme. The DCD/UCD, containing a reference to the ExChNr ~~(*8.5.1.2*)~~, is used to make the channel change. A similar procedure is followed for interference detection at the SS, illustrated in *Figure h 6* (b), however in this case the REP-RSP, sent by the SS in an unsolicited manner, initializes the response by the BS.

Change the title of 6.4.2.3.4 [1], page 33, line 39, 'Claiming a Master Frame Sequence' to 'Frame structure and frame allocation'.

Replace the first paragraph at the beginning of 6.4.2.3.4 [1], page 33, line 39 with the following.

Co-channel coexistence between multiple 802.16 systems is achievable by the sharing of frames whereby advantage is derived from the synchronous behavior of 802.16. This sharing is reliant upon a known frame allocation and network synchronization. The mechanism for co-channel coexistence at the frame level is related to the band of operation, but all BS must be synchronized to GPS or NTP if GPS is not available. Situations exist where frames may be assigned to 802.16 systems by administrative means within the context of a 4 frame structure. This administrative provisioning eliminates the need to support a discovery protocol, and an a priori knowledge of frame allocation patterns. Such situations occur, for example, in bands where a regulatory requirement demands device registration together with information on device location. It is therefore possible to make use of this location information and make informed decisions on which systems should be assigned to which frames. Administrative provisioning shall therefore be used if sufficient information is available, otherwise a discovery protocol or standardized frame structure shall be used.

For the case of administrative provisioning and coexistence with asynchronous non-802.16 systems, 802.16 systems operating in a particular geographical area shall share all frames among all the 802.16 systems. The final decision to use a particular frame or not is based on channel measurements and ongoing fair sharing requirements as described in subclause 6.4.2.3.7. The remainder of this subclause describes the case where administrative provisioning is not possible. This scenario allows sharing in time of the channel by up to three different uncoordinated 802.16 systems using a four frame sequence.

In subclause 6.4.2.3.7 'Listen-Before-Talk (LBT)', Page 39, line 58 replace all references to 'WirelessMAN-CX' with 'WirelessMAN-UCP'.

Make the following changes to subclause 6.4.2.3.7 'Listen-Before-Talk (LBT)', Page 41, line 58:

MAXFRST - the maximum value of FRST. Band dependent. ~~For example, in the 3.65 GHz band in the US 4 ms is a reasonable value since any 802.11 burst in this band would be shorter and could fit before the start of the 802.16 frame.~~

Add the following changes to subclause 6.4.2.3.7 'Listen-Before-Talk (LBT)', Page 42, line 28:

The relationship between frames boundaries and the DMA algorithm is shown in *Figure h x1x*; t~~T~~he DMA algorithm timing parameters are applied as shown in *Figure h 19.*

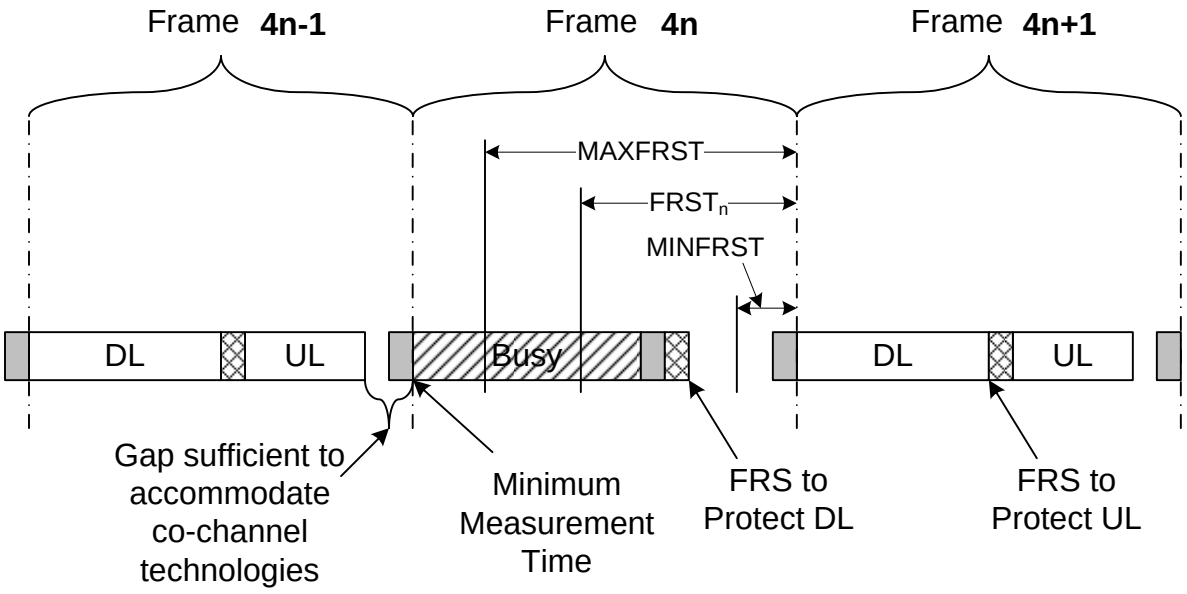
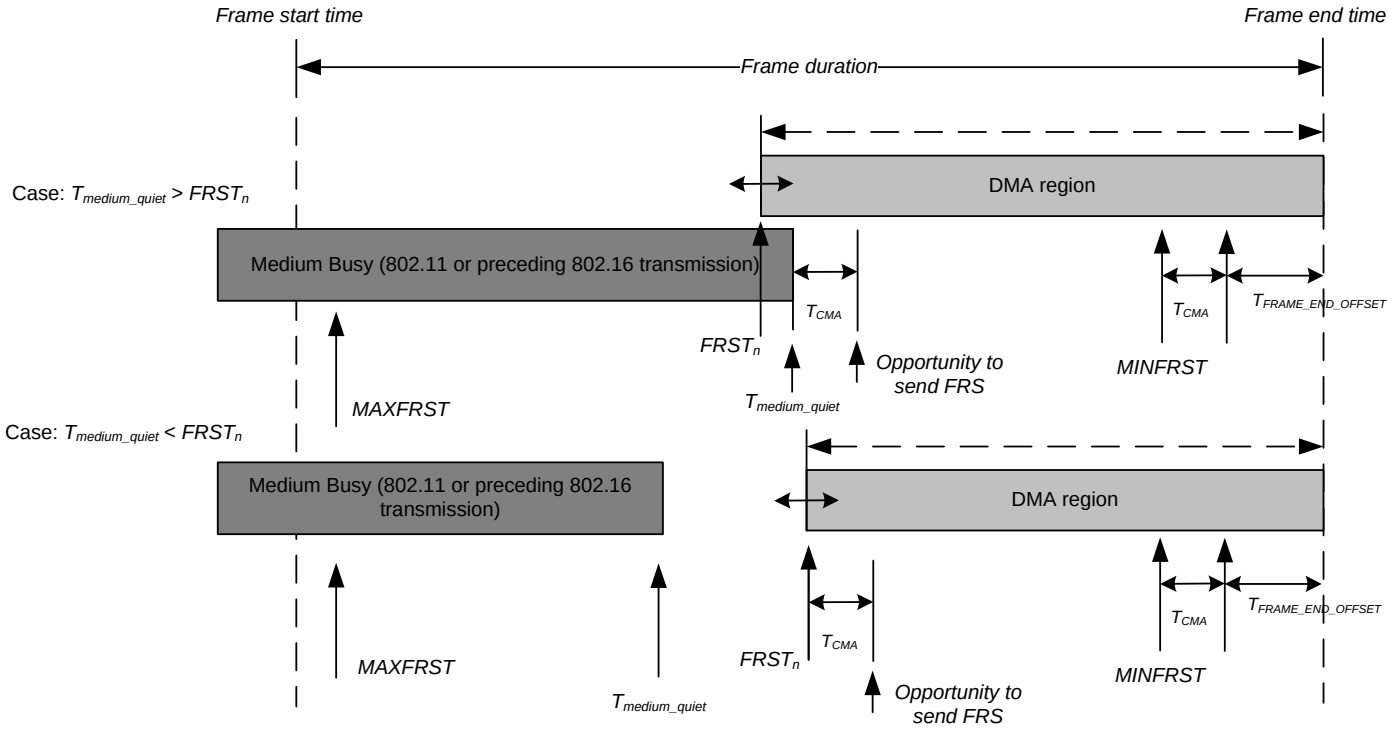


Figure h x1x—The relationship between frame boundaries and the DMA algorithm

Replace Figure h19 in [1] 'Reclaiming the Medium' with the following. Also make the caption changes as shown.



$MINFRST = T_{CMA} + T_{FRAME\_END\_OFFSET}$

Figure h19—~~Reclaiming the Medium~~Timing parameters of the DMA algorithm

Replace subclause 8.4.5.3.30 'Extended Channel Measurement IE format' at Page 47, line 21 of [1] with:

An Extended IE with an extended DIUC value of 0x0C is issued by the BS to request a channel measurement report. The IE includes a 16bit Extended Channel Number (ExChNr) center frequency value.

Table 286ac—Extended Channel Measurement IE

Syntax	Size	Notes
Extended_Channel_Measurement_IE() {		
Extended DIUC	4 bits	Extended_Channel_Measurement_IE = 0x0C
Length	4 bits	Length = 0x05
ExChNr	16 bits	Center frequency in kHz (WirelessMAN-UCP and WirelessMAN-CX)
OFDMA symbol offset	8 bits	
CID	16 bits	Basic CID of the SS for which the Extended Channel Measurement IE is directed
}		

Delete all changes to clause 8.5 in [1]: 'WirelessHUMAN specific components'.

Replace subclause 11.8.3.8, 'WirelessHUMAN specific parameters' from [1], page 52, line 48.

11.8.3.8 WirelessMAN-UCP specific parameters

11.8.3.8.1 WirelessMAN-UCP feature support

This field indicates the different WirelessMAN-UCP capabilities supported by an SS. A bit value of 0 indicates "not supported" while a bit value of 1 indicates "supported".

Type (1 byte)	Length (1 byte)	Value	Scope
164	1	Bit #0: Support of UCP (*6.4.2.3.4*)	SBC-REQ (see *6.3.2.3.23*)

		Bit #1–7: *Reserved*; shall be set to zero	SBC-RSP (see *6.3.2.3.24*)

Make the following changes to the second table in 11.11 'REP-REQ management message encodings' at Page 54, line 9 of [1].

Channel number	1.2	1	Physical channel number (see 8.5.1) to be reported on. (~~license exempt bands only~~WirelessHUMAN only)
ExChNr	1.10	2	Extended Channel Number center frequency to be reported on (WirelessMAN-UCP and WirelessMAN-CX only)
~~Extended report type (WirelessMAN-CX only)~~	~~1.11~~	~~1~~	~~Bit #0 = 1: Include summary extended report~~ ~~Bit #1 = 1: Include full extended report~~ ~~Bit #2 = 1: *Specific Spectrum User* extended report~~ ~~Bits #3 - #7: Reserved~~

Delete the following row in the first table in 11.12 'REP-RSP management message encodings' at Page 54, line 28 of [1].

~~Extended report type~~	~~8~~	~~variable~~	~~Compound~~

Make the following changes in the second table in 11.12 'REP-RSP management message encodings' at Page 54, line 34 of [1].

REP-REQ Report type	**Name**	**Type**	**Length**	**Value**
Bit #0 = 1	Channel number	1.1	1	Physical channel number (see 8.5.1) to be reported on (WirelesssHUMAN only)
Bit #0 = 1	Basic report	1.4	1	Bit #0: ~~WirelessHUMAN~~IEEE 802.16 system detected on the channel Bit #1: Unknown transmissions detected on the channel Bit #2: *Specific Spectrum User* detected on the channel

				(type #1) Bit #3: Unmeasured. Channel not measured Bit #4: *Specific Spectrum User* detected on the channel (type #2) Bit #5: *Specific Spectrum User* detected on the channel (type #3) Bit #6: *Specific Spectrum User* detected on the channel (type #4) Bit #7: IEEE 802.11 system detected on the channel
Bit #0 = 1	ExChNr	1.7	2	Center Extended Channel Number reported on (WirelessMAN-UCP and WirelessMAN-CX only)

Delete table with top left cell containing text 'REP-REQ Extended report type' in subclause 11.12 at Page 55, line 27 of [1].

Make the following changes to subclause 6.4.2.3.7 'Listen-Before-Talk (LBT)' on page 43 of [1].

When using any carrier sense protocol, such as LBT, in a wireless environment the hidden node problem cannot be 100% avoided. It can only be mitigated. Additionally, in bands such as 3.65 GHz in the US, there is an aggravated hidden node problem due to the distinctly lower transmit power allowed for mobile devices compared to fixed, registered devices. The mobiles are more often geographically disadvantaged due to this transmit power disparity. Fixed, registered client devices can also be geographically disadvantaged (the classical hidden node problem), although not as often. To remedy this the BS transmits a Frame Reservation Signal (FRS) at the end of the DL subframe to reserve the subsequent UL subframe (or used portion, thereof) for the subscriber stations. The BS also transmits an FRS in the DMA region at the time a decision is made to claim the medium. The form of the FRS is band dependent and should be structured to be receivable by other technologies that may be co-channel. For instance, in bands where 802.11 would be a typical co-channel asynchronous system, the 802.11 CTS transmitted using the appropriate 802.11 burst structure would suffice. The reservation of the DL and UL subframe by the BTS precludes the need for the SS to also perform LBT. ~~The use of~~ An example of using the FRS to protect the DL and UL is shown in *Figure h 21*.

Replace figure h21 with the following.

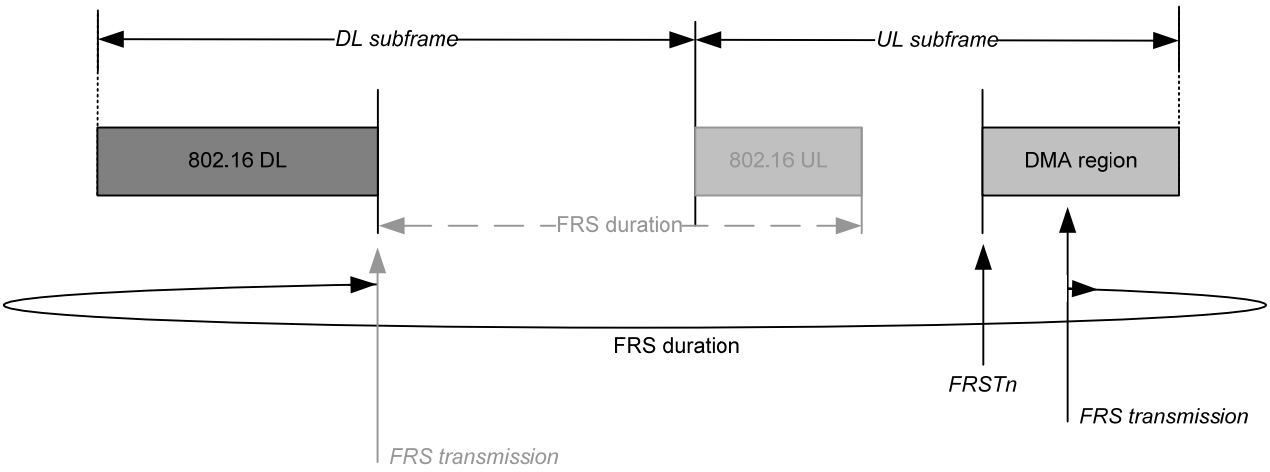


Figure h21 (a) Downlink FRS

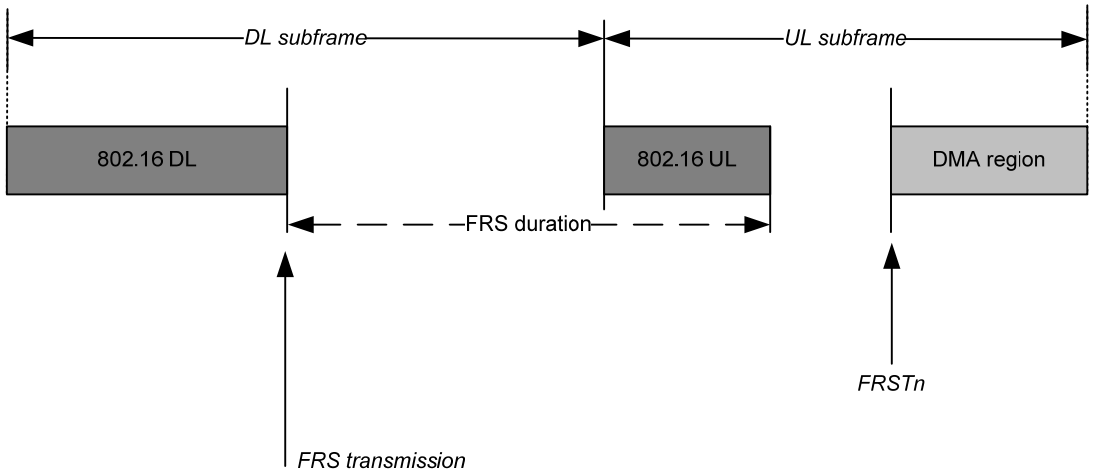


Figure h21 (b) Uplink FRS

4. References

[1] IEEE P802.16h/D3: *Air Interface for Fixed Broadband Wireless Access Systems Improved Coexistence Mechanisms for License-Exempt Operation*, Draft Standard.