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Purpose	Adoption
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Stuff, the sequel

Nico van Waes
Nokia Wireless Routers

Change paragraph on page 2, line 9:

Additional MAC features are also introduced, such as ARQ on a per-connection basis to deal with the inherent lossy behavior of the wireless medium, and the support of mesh topologies.

Change paragraph on page 2, line 18:

The physical environment for the 2-11 GHz license-exempt bands is similar to that of 2-11 GHz licensed bands as described in 1.2.2. However, the license-exempt nature introduces additional interference and co-existence issues, whereas regulatory constraints limit the allowed radiated power. In addition to the features described in 1.2.2, the PHY and MAC introduce mechanisms such as DFS to detect and avoid interference. ~~and support for Mesh topologies.~~

Change Table 0a

Table 0a—Air Interface Nomenclature

Designation	Applicability	PHY specification	Additional MAC requirements	Options	Duplexing alternative
WirelessMAN-SC	10-66 GHz	8.2			TDD FDD
WirelessMAN-SCa	2-11 GHz licensed bands	8.3		AAS (6.2.7.7) ARQ (6.2.4) STC (8.3.3)	TDD FDD
WirelessMAN-OFDM	2-11 GHz licensed bands	8.4		AAS (6.2.7.7) ARQ (6.2.4) Mesh (6.2.6.7) STC (8.4.8)	TDD FDD
WirelessMAN-OFDMA	2-11 GHz licensed bands	8.5		AAS (6.2.7.7) ARQ (6.2.4) STC (8.5.8)	TDD FDD
WirelessHUMAN	2-11 GHz license-exempt bands	REF 8.3, 8.4 or 8.5 and 8.6	DFS (6.2.14)	AAS (6.2.7.7 ARQ (6.2.4) Mesh (6.2.6.7) STC (8.3.x.x/ 8.4.8/8.5.8)	TDD

change paragraph on page 3, line 6:

Implementations of this standard for license-exempt frequencies between 2 and 11 GHz (such as those listed in B.1) shall comply with the WirelessMAN-SCa PHY as described in 8.3, the WirelessMAN-OFDM PHY as described in

8.4, or the WirelessMAN-OFDMA PHY as described in 8.5. They shall further comply with the DFS protocols (6.2.14) and with REF 8.6.

Add on page 53, line 49:

When *ARQ_TX_WINDOW_START* has been advanced by either of the above methods and acknowledgement of reception has already been received for the fragment with the FSN value now assigned to *ARQ_TX_WINDOW_START*, the value of *ARQ_TX_WINDOW_START* shall be incremented until an FSN value is reached for which no acknowledgement has been received.

Change paragraph on page 56, line 61

~~For each ARQ fragment received without errors (including duplicates), an acknowledgment message may be sent to the transmitter. Acknowledgments may be either for specific ARQ fragments (i.e. contain information on the acknowledged ARQ fragment numbers), or cumulative (i.e. contain the highest ARQ fragment number below which all ARQ fragments have been received correctly) or a combination of both (i.e., cumulative with selective).~~ For each ARQ fragment received, an acknowledgment shall be sent to the transmitter. Acknowledgment for fragments outside the sliding window shall be cumulative. Acknowledgments for fragments within the sliding window may be either for specific ARQ fragments (i.e. contain information on the acknowledged ARQ fragment numbers), or cumulative (i.e. contain the highest ARQ fragment number below which all ARQ fragments have been received correctly) or a combination of both (i.e., cumulative with selective). Acknowledgments shall be sent in the order of the ARQ fragment numbers they acknowledge. The frequency of acknowledgement generation is not specified here and is implementation dependent.

Insert under Tabe 56k

Table 56l—MSH-NCFG Channel Information Element

Syntax	Size	Notes
MSH-NCFG_Channel_IE() {		for licensed channels
for (i=0; i< Channels; ++i) {		
Physical Channel center frequency	24 bits	Positive integer in kHz
Physical Channel width	8 bits	Positive integer in 100 kHz
}		
Channel Re-use	3 bits	Minimum number of hops of separation between links, before a channel can be re-used by the centralized scheduling algorithm. Range is 1 hop to 7 hops, 0 for no re-use.
Reserved	5 bits	
}		

Replace 6.2.10.2 up to 6.2.10.2.1 with:

The WirelessMAN-OFDMA PHY specifies a Ranging Subchannel and a set of special pseudo-noise Ranging Codes. Subsets of codes shall be allocated in the UCD Channel Encoding for Initial Ranging, Periodic Ranging and BW Requests, such that the BS can determine the purpose of the received code by the subset to which the code belongs. An example of Ranging channel in OFDMA frame structure is specified in REF Figure 128ax.

SSs that wish to perform one of the aforementioned operations shall select, with equal probability, one of the codes of the appropriate subset, modulate it onto the Ranging Subchannel and subsequently transmit in a with equal probability selected (pair of) OFDM symbol(s) within the appropriate UL allocation. Details on the modulation and Ranging Codes are specified in REF 8.5.7.

Amend Page 71 Lines 43 - 48 to read:

If this is the case, the SS can continue with the network entry process just like the non-AAS case, and the BS will get the chance to tune the adaptive array to it during the ranging process.

Alternatively, an AAS SS may use the following procedure to alert the BS to its presence, so the BS can adapt its antenna array to the SS position.

Copy 8.4.4.2.2 (or the new 8.4.6.2.2) to and insert above 8.3.1.4.5.3:

When a channel measurement report is needed (see 6.2.14), the extended DIUC = 15 is used with the sub-code 0x00 and with 8-bit Channel Nr value as shown in REF Table 116aq. The Report_IE shall be followed by the Null IE (DIUC=14). When used, the CID of the DL-MAP_IE() shall be set to the broadcast CID.

Table 56m—SCa Channel measurement Information Element format

Syntax	Size	Notes
Report_Information_Element() {		
extended DIUC	4 bits	DFS = 0x00
Channel Nr	8 bits	Channel number (see Table 116cm) Set to 0x00 for licensed bands
Offset	12 bits	
Reserved	4 bits	
}		

replace in 8.3.1.4.5.1:

Allocation_Start_Time

Effective start time of the downlink allocation defined by the DL-MAP in units of PSs. This start time is relative to the start of the frame in which the DL-MAP message is transmitted. The minimum value specified for this parameter shall correspond to one frame duration

Change Table 116 aa:

Table 116aa—OFDM Symbol Parameters

Parameter	Value
N_{FFT}	256
N_{used}	200
F_s/BW	licensed channel bandwidths which are multiples of 1.75 MHz and license-exempt: 8/7 any other bandwidth: 7/6
(T_g/T_b)	1/4, 1/8, 1/16, 1/32
Number of lower frequency guard carriers	28
Number of higher frequency guard carriers	27
Frequency offset indices of guard carriers	-128,-127...,-101 +101,+102,...,127
Frequency offset indices of BasicFixedLocationPilots	-84,-60,-36,-12,12,36,60,84
Subchannel number: Allocated frequency offset indices of carriers	1:{-88,...,-76},{-50,...,-39},{1,...,13},{64,...,75} 2:{-63,…,-51},{-25,...,-14},{26,...,38},{89,...,100} 3:{-100,…,-89},{-38,...,-26},{14,...,25},{51,...,63} 4:{-75,…,-64},{-13,...,-1},{39,...,50},{76,...,88}

Change Table 116 ab:

Table 116ab—The inner Convolutional code with Puncturing Configuration

	Code Rates			
Rate	1/2	2/3	3/4	5/6
d_{free}	10	6	5	4
X	1	10	101	10101
Y	1	11	110	11010
XY	X_1Y_1	$X_1Y_1Y_2$	$X_1Y_1Y_2X_3$	$X_1Y_1Y_2X_3Y_4X_5$

add at end of line 2, page 144:

minus one byte, which shall be reserved for the introduction of a 0x00 tail byte by the FEC.

Replace paragraph on page 144, line 62 with:

The encoding is performed by first passing the data in block format through the RS encoder and then passing it through a zero-terminating convolutional encoder.

Replace paragraph on page 146, line 28 with:

The encoding is performed by first passing the data in block format through the RS encoder and then passing it through a convolutional encoder. A single 0x00 tail byte is appended to the end of each allocation. This tail byte shall be appended after scrambling. In the RS encoder, the redundant bits are sent before the input bits, keeping the 0x00 tail byte at the end of the allocation.

Add under Table 116ac:

When sub-channelization is active (see REF 8.4.4.3.5), the FEC shall bypass the RS encoder and use the Overall Coding Rate as indicated in Table 116ac as CC Code Rate. The Uncoded Block Size and Coded Block size may be computed by dividing the values listed in REF Table 116ac by 4 and 2 for 1 and 2 sub-channel allocations respectively.

Add in Table 116af:

Q=6
Q=6
Q=4
Q=4
Q=5
Q=5

Add at end of 8.4.3.6:

The following preamble vectors are used in conjunction with subchannelization transmissions. The preamble carriers that do not fall within the subchannels allocated shall not be transmitted:

P_{s0x1}(-88:-76,-50:-39,1:13,64:75) = { -1 0 1 0 1 0 -1 0 -1 0 -1 0 1 0 1 0 1 0 -1 0 1 0 -1 0 0 1 0 -1 0 1 0 1 0 -1 0 -1 0
0 -1 0 -1 0 -1 0 -1 0 1 0 -1 0 }*2

P_{s0x2}(-63:-51,-25:-14,25:38,89:100) = { -1 0 -1 0 -1 0 1 0 -1 0 1 0 1 -1 0 1 0 -1 0 -1 0 1 0 -1 0 -1 1 0 -1 0 -1 0 1 0 1 0 1 0
1 0 -1 0 1 0 1 0 1 0 -1 0 }*2

P_{s0x3}(-100:-89,-38:-26,14:25,51:63) = { 0 -1 0 -1 0 1 0 -1 0 -1 0 -1 0 -1 0 1 0 -1 0 -1 0 1 0 1 -1 0 1 0 1 0 1 0 -1 0 -1 0 -1
-1 0 1 0 1 0 1 0 1 0 -1 0 1 }*2

P_{s0x4}(-75:-64,-13:-1,39:50,76:88) = { 0 -1 0 1 0 1 0 -1 0 -1 0 -1 0 0 1 0 1 0 1 0 -1 0 1 0 -1 0 0 1 0 -1 0 1 0 1 0 -1 0 -1
0 -1 0 -1 0 -1 0 -1 0 1 0 -1 }*2

P_{s0x5}(-88:-76,-63:-51,-50:-39,-25:-14,1:13,25:38,64:75,89:100) = { -1 0 1 0 1 0 -1 0 1 0 -1 0 0 -1 0 1 0 1 0 1 0 1 0 1
1 0 1 0 1 0 -1 0 -1 0 -1 0 0 -1 0 1 0 1 0 -1 0 -1 0 -1 0 1 0 1 0 1 0 -1 0 1 0 1 0
-1 0 1 0 1 0 -1 0 1 0 1 0 -1 0 1 0 1 0 -1 0 1 0 -1 0 1 0 -1 0 -1 0 -1 0 1 0 -1 0 -1 0 -1}*2

P_{s0x6}(-100:-89,-75:-64,-38:-26,-13:-1,14:25,39:50,51:63,76:88) = { -1 0 -1 0 1 0 -1 0 1 0 -1 0 1 0 -1 0 1 0 -1 0 1 0 -1 0 1 0 -1 0
-1 0 -1 0 1 0 1 0 -1 0 1 0 -1 0 -1 0 1 0 -1 0 1 0 1 0 -1 0 1 0 1 0 1 0 -1 0 1 0 1 0
0 1 0 1 0 -1 0 -1 0 1 0 1 1 0 -1 0 -1 0 -1 0 1 0 -1 0 0 1 0 1 0 1 0 -1 0 -1 0 -1}*2

Change Table 116 am:

Table 116am—OFDM Frame duration (T_F ms) codes

Code(N)	PMP	Code(N)	Mesh
0-4	round((*N*/2+3)/T_s)*T_s	0-8	round((2*N*+4)/T_s)*T_s
5-6	round((*N*+2)/T_s)*T_s		
7-12	round((2*N*-4)/T_s)*T_s		
13-255	Reserved	9-255	Reserved

Delete sentence on page 161, line 58-59. Add on page 164, line 27:

The subsequent DL allocations shall span an even number of OFDM symbols.

Change Table 116 at:

Table 116at—OFDM UL-MAP information element format

Syntax	Size	Notes
UL-MAP_information_element() {		
CID	16 bits	
UIUC	4 bits	
if (UIUC == 4)		
Focused_contention_IE()	28 bits	
else if (UIUC == 15)		

Table 116at—OFDM UL-MAP information element format

Syntax	Size	Notes
Extended UIUC dependent IE	variable	Power_Control_IE() or AAS_UL_IE()
else {		
if (subchannelization[a]) {		
Subchannel Index		0x1 Sub-channel 1 0x5 Sub-channel 1 and 2 0x2 Sub-channel 2 0x6 Sub-channel 3 and 4 0x3 Sub-channel 3 0x0 Reserved 0x4 Sub-channel 4 0x7 Reserved
Duration	5 bits	in OFDM symbols
Reserved		
Duration	12 bits	in OFDM symbols
}		
}		

a.When sub-channelization is active (see REF 8.4.4.3.5), only UIUC's 5 through 13 shall be used.

replace in 8.4.4.1:

Allocation_Start_Time

Effective start time of the DL allocation defined by the DL-MAP in units of PSs. This start time is relative to the start of the frame in which the DL-MAP message is transmitted. The minimum value specified for this parameter shall correspond to the length of the DL-MAP.

Insert 8.4.4.3.5

8.4.4.3.5 UL-MAP sub-channelization IE Format

Within a frame, the BS may allocate a portion of the UL allocations to sub-channelized traffic.

The UL Subchannelization_IE implicitly indicates the start of the allocation and explicitly indicates the Duration and the Number of Allocations. A SS not capable of sub-channelization shall skip the next Number of Allocations UL-

MAP_IEs in the UL-MAP and resume interpreting the UL-MAP afterwards with the start of the next allocation Duration OFDM symbols after the last allocation ended.

Table 116ay—OFDM sub-channelization information element format

Syntax	Size	Notes
sub-channelization_Information_element() {		
extended UIUC	4 bits	AAS = 0x0x
Duration	12 bits	
Number of allocations	12 bits	
}		

A SS capable of sub-channelization shall decode the sub-channelized allocations, whereby the 12 bit Duration field in non-sub-channelized UL-MAP messages is replaced by a 3 bit Subchannel Index field, a 5 bit Duration field and 4 reserved bits as shown in REF Table 116at. A sub-channelized allocation shall start when all preceding allocations to the allocated sub-channels have terminated.

and above Table 116ay:

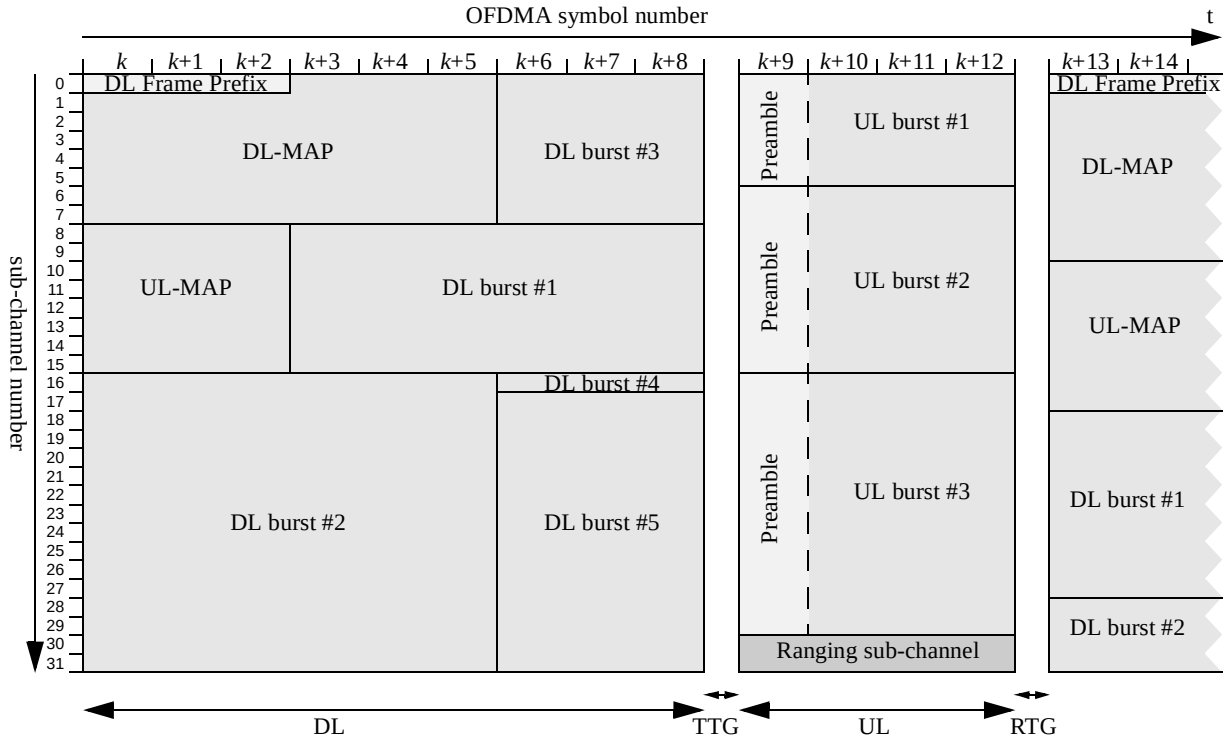
If the BS supports subchannelization, the last C_{SE} contention codes shall only be used by subchannelization-enabled SSs that wish to receive a sub-channelized allocation. In response, the BS may provide the requested allocation as a sub-channelized allocation, may provide the requested allocation as a full (default) allocation, or may provide no allocation in at all. The value of C_{SE} is transmitted in the UCD channel encoding TLV messages. The default value of C_{SE} is 0.

Rename 8.4.11.1 to 8.6 WirelessHUMAN specific components

Rename 8.4.11.2.1 to Mesh frame structure and insert as 8.4.5.

Delete 8.4.11.2.2 header and move text, minus first sentence to 8.4.3.6.

Replace Figure 128ax with:



In Table 116bi, delete mesh column and change values:

0x00	N/A	AAS-only gap up to 200 ms following (see 8.5.6.3)
0x01	2 ms	
0x02	3.5 ms	
0x03	5 ms	
0x04	7 ms	
0x05	10 ms	
0x06	14 ms	
0x07	15 ms	
0x08	20 ms	
0x09-0xFF	N/A	Reserved

Also change 5 to 7 in the formula in Table 116bi

Replace the paragraph below Table 116bi with:

In an FDD case, the frame duration shall be an integer multiple of three OFDM symbols duration, such that the actual frame duration listed in Table 116bi. In a TDD case, the frame duration shall be an integer multiple of one OFDM symbol duration, such that the actual frame duration is listed in REF Table 116bi, plus a RTG and TTG guard interval. Both RTG and TTG shall be no less than 5 µs in duration.

Add above STC_IE format (see comment 324):

The subsequent DL allocations shall span a multiple of 6 OFDM symbols in time.

Replace Table 116bz with:

Table 116az—Optional Channel Coding per Modulation

Modulation	Data Block Size (Bytes)	Coded Block Size (Bytes)	Overall Coding Rate	Efficiency bit/s/Hz	Constituent Codes	Code Parameters
QPSK	16	36	~1/2	0.9	(32,26)(16,11)	I_x=11,I_y=2,B=6,Q=7
QPSK	25	36	~2/3	1.4	(8,7)(64,57)	I_x=2,I_y=16,B=0,Q=5
16 QAM	40	72	~3/5	2.2	(32,26)(32,26)	I_x=8,I_y=8,B=0,Q=4
16 QAM	56	72	~4/5	3.1	(16,15)(64,57)	I_x=4,I_y=16,B=0,Q=3
64 QAM	68	108	~5/8	3.8	(32,26)(32,26)	I_x=0,I_y=5,B=0,Q=2
64 QAM	88	108	~4/5	4.9	(16,15)(64,57)	I_x=0,I_y=10,B=0,Q=1

Insert at Page 203 Line 17 (part of 8.5.6.1.2):

On initialization, a SS must search for the DL preamble for each possible value of the permutation index to determine the actual index being used for the cell. An AAS-enabled SS may additionally search for preambles based on the permutations (distribruted, adjacent or both) it is capable of using for AAS traffic. However, an SS shall perform this search if it intends to initiate AAS-based initial ranging (see REF 6.2.7.7.4). Note that an AAS-enabled SS, which does not provision the same permutation (distributed or adjacent) for AAS traffic selected by the BS for this purpose, is not capable of using its AAS capabilities with this BS.

Insert at Page 206, insert for current text in section

8.5.6.3 Optional Permutations for AAS.

A BS using the AAS option may change from the "distributed carrier permutation" described in REF 8.5.6.1 and REF 8.5.6.2 to the adjacent carrier permutation when changing from non-AAS to AAS-enabled traffic to support AAS adjacent carrier user traffic in the cell. After this change, the BS shall only transmit / receive AAS-enabled traffic using the adjacent carrier permutation until the end of the frame. The BS shall always return to the distributed carrier permutation for the broadcast (non-AAS) traffic.

While the BS does not have any SSs registered which are not capable of using the AAS permutation selected by the BS, the BS may employ the AAS superframe structure. Otherwise it shall always return to the distributed carrier permutation at the end of each frame and provision broadcast traffic at the start of each frame.

The AAS superframe shall have the following structure:

1) The BS shall start each superframe with no less than 20 consequtive frames, which contain both DL and UL broadcast OFDM symbols. Each of these frames shall provision DCD, UCD, DL-MAP and UL-MAP messages, as well as at least one initial ranging opportunity. The frame duration code in each frame except the last one shall be set to the actual frame duration used. The frame duration code in the last frame shall be set to 0x00
2) Subsequently, the BS shall transmit up to 200 ms of AAS only frames, followed by at least one frame containing at least one DL broadcast OFDM symbol, which shall provision DCD, UCD and DL-MAP messages. The frame duration code shall be set to 0x00.
3) The BS shall repeat step 2, up to the AAS superframe duration, which shall be no more than 1s.

Delete 8.5.15

Add under header 10.1 Global values:

Change "SS UL-MAP processing time" and insert additional rows shown in Table 118 as shown in Table 118a

Table 118a—Parameters and constants

System	Name	Time reference	Minimum value	Default value	Maximum value
BS	SS UL-MAP processing tme (WirelessMAN-SC only)	Time provided between arrival of the last bit of a UL-MAP at an SS and effectiveness of that map.			200 μ s
SS, BS	T17	Wait for ARQ-Reset			0.5 s
mesh node	T18	Network Entry: Detect network	1 s		
mesh node	T19	Network Entry: Accumulate MSH-NCFG messages		120 s	
mesh node	T20	Network Entry: Wait for MSH-NENT / MSH-NCFG		1 s	

replace in 8.5.5.1:

Allocation_Start_Time
Effective start time of the downlink allocation defined by the DL-MAP in units of PSs. This start time is relative to the start of the frame in which the DL-MAP message is transmitted. The minimum value specified for this parameter shall correspond to one FEC block.

change 10.3.2.1, 10.3.3.1 and 10.3.4.1

10.3.2.1 UL Allocation Start Time

Unit of Allocation Start Time shall be PSs from the start of the DL frame in which the UL-MAP message occurred. The minimum value specified for this parameter shall correspond to one frame duration.

10.3.3.1 UL Allocation Start Time

Unit of Allocation Start Time shall be PSs from the start of the DL frame in which the UL-MAP message occurred. The minimum value specified for this parameter shall correspond to a point in the frame 200 μ s after the last symbol of the UL-MAP.

10.3.4.1 UL Allocation Start Time

Unit of Allocation Start Time shall be PSs from the start of the DL frame in which the UL-MAP message occurred. The minimum value specified for this parameter shall correspond to 1 FEC block.

In Table 122, add

Name= Subchannelization focused contention code
Type=18
Length=1
Value= Number of contention codes (C_{SE}) that shall only be used to request a sub-channelized allocation. Default value 0. Allowed values 0-48
PHY scope = OFDM

Change Type 10 Value in Table 124 to:

DL channel number as defined in REF 8.6. Used for license-exempt operation only.

and change scope to:

SCa, OFDM, OFDMA

In 11.4.1.6, add

bit #3=0: No OFDM subchannelization support
bit #3=1: OFDM subchannelization support