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Re:	Task Group Review
Abstract	~~Summary of the Ad-Hoc activity~~Text consolidation
Purpose	Approval
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Proposed changes to clause 15.1.3

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Alvarion Ltd, Hisilicon Tech. Co.Ltd, Huawei, Apple

Summary of the relevant comments and proposed actions

Comments from data-base IEEE 802.16h-07/14r3

Comment 40 by David:

Referred text:

Similarly to the channel allocation, the IBS will then first try to find a vacant sub-frame in the potential channels using the information of the distributed database; if it fails the IBS will then try to vacate an exclusive existing sub-frame by sub-frame distribution optimization, if supported. **If an exclusive existing subframe is not available, the IBS will then try to negotiate with the systems inside the community to create a new sub-frame.** If all these attempts fail, the IBS will not be able to get any interference free resource for operation.

Figure h 16 shows the initialization procedures for the WirelessMAN-CX BSs. **Note, that the procedures that the BS uses to create a Master slot or channel switching are also applicable for the operating stage**. The detailed negotiation and update procedures are described in section *15.5.1* and *15.4.1.2*.

Comment:

Creation of sub-frame is no more considered given the new CX Frame structure.

- Suggested Remedy

1) Remove following sentences:
- "If an exclusive existing subframe is not available, the IBS will then try to negotiate with the systems inside the community to create a new sub-frame."
- "Note, that the procedures that the BS uses to create a Master slot or channel switching are also applicable for the operating stage.
2) Update accordingly the Figure h16 (fig. h23 in D2c)

Comment 41 by Ken:

Referred text:

Otherwise (the country/region database is not available):
o **The control channel CX_CMI_D/U(n) and the CSI method, to be described below, offer time ~~slots~~allocations in which none of the members of the existing community transmits any signal. A new BS uses CSI or CMI to broadcast the message containing the contact request and/or the coexistence signal carrying the IP address**
o A SS in the common coverage area, identifying the new BS signals, will forward the information to its operating base station using REP-RSP message or BS_CCID_RSP message
o The operating BS updates its database and sends feedback information to the IBS, using

the IP network
o The new BS learns the IP identifier of the coexistence neighbor BS from the message sent by the coexistence neighbor BS via the IP network
— Build the local image of the relevant information in the community BS's, by copying the info from those BSs
— Listen on multiple frequencies
o Identify the level of interference on each frequency channel;
— Decide the working frequency (ACS – Adaptive Channel Selection process);
o **If no interference detected on some channels, select one randomly as working channel;**
o If interference detected by the IBS or the OBS system on all the channels, then the IBS should decide whether an optimized channel distribution, as described in section *15.4.1.1*, can allocate an exclusive channel for each BS, including the IBS, in the community.
o If every BS in the community can be allocated an exclusive channel without interfering with the others, that means default interference-free Master slot is available for this initializing BS.
— If available, select an interference-free Master sub-frame; if not, use the procedure for creating new Master sub-frames;
— Search the Base Station data base for finding the BSs using the selected Master sub-frame;
— Request those Base Stations, by sending IP unicast messages, to listen during the BS_entry slot in order to evaluate the interference from the new Base Station;
— Use the allocated ~~slots~~allocations for transmitting the "radio signature" at intended operating or maximum allowed EIRP, whichever is less, and in all the used directions;
— Ask for permission of the Base Stations, using the sub-frame as Masters, to operate in parallel and use the same sub-frames;
— If all of them acknowledge, the Base Station acquires a "temporary community entry" status; the final status will be achieved after admission of the SSs;
— If no free Master slot sub-frame is found, use the procedure for creating new Master slot subframes.

Listening on multiple frequencies (line 33) and deciding the working frequency (line 37) should happen before the interaction on the control channel (lines 15-29)

- Suggested Remedy

Rearrange so the steps are in the correct order

Comment 42 by Ken:

Referred text:

If available, select an interference-free Master sub-frame; if not, use the procedure for creating new Master sub-frames;

Comment:

The portion of the bullet after the semicolon ";" is redundant with the last bullet at the top of page 64. The one at the top of page 64 is in a better place in the order of events.

- Suggested Remedy

Delete "if not, use the procedure for creating new Master sub-frames;"

Proposed general approach

There is lot of redundant text, which appears at the beginning of each clause. A better document will result if every mechanism will have its own clause and all the related ones will be just mentioned, instead to be

described again. Here down is the proposed rationalization, providing instructions to 802.16h Editor.

- 15.1.3 Procedure flow
  - To be reduced to the description of how it works, not of how to be implemented; to use references the procedures described in 15.3 (Community entry) and 15.4 (interference avoidance during operation)

Proposed reorganization and text changes

Existing clause	Title	Text	
15.1.3	Procedure flow	This chapter is highly redundant and some times not consistent with text in 15.3 and 15.4 Instead of a long description is better to refer procedures in 15.3 and 15.4 For SSU refer procedures in clause 6; the situation is difficult because the existing clause numbering in 6.3.15 is changed in 16h and a mix of old and new clauses appear in 6.4 Make the changes proposed below	P65/r35 … p72/r22 See below

Proposed text changes to 15.1.3

15.1.3 Procedure ~~flow~~ in WirelessMAN-CX

15.1.3.1 Procedure ~~flow~~ for BS

In general, coexistence detection, avoidance and resolution are performed in two stages, the initialization stage and the operating stage. ~~In both stages, i~~In bands where SSUs are present~~s, need to be followed~~ the procedures described in clause 6.3.15 ~~(or 6.4.2.2?) need to~~ shall be followed.~~in both initialization and operating stages.~~

(1) *Initialization stage*

~~In the initialization stage the BSs may avoid the co-channel or adjacent channel interference by scanning the available frequencies (even those frequencies allocated for BS transmission only in FDD cases)~~

A~~The~~ Base Station that is operating in the initialization stage shall~~ould~~ perform~~follow the~~ passive scanning using procedures~~rocedures~~ described in 15.3.2 in order to ~~chose an~~assess ~~the~~ the INR of

each candidate frequency channel and potential Master sub-frame. ~~operating channel.~~ ~~But~~ However, ~~these procedures this method only~~ passive scanning does not address~~may not be able to~~cannot ~~avoid~~ the hidden neighbor system problem, i.e. ~~the~~a neighboring BS that cannot be heard directly by the initializing BS ~~but~~ may have ~~overlapping service coverage and~~ harmful interference with at least one SS of the initializing system~~s SSs~~. In order to mitigate this problem~~Thus~~, the initializing BS can acquire ~~with the~~ knowledge of its coexistence neighbor topology, which~~available,~~ for example may be available~~,~~ from a central country/region database. This knowledge allows~~,~~ the Initializing Base Station (IBS) ~~can~~may be able to take the potentially hidden neighbor systems into account ~~and can~~, and therefore~~,~~ avoid ~~the~~ possible interference from those neighbors.

~~Alternatively,~~[h1] ~~if the such a database is not available in this stage, i~~In addition to~~of the passive scanning~~ scanning~~approach of the CCA/CMFA~~[mg2], the initializing BS ~~will~~ may use ~~the~~ active scanning ~~approach the initialization coexistence signaling/messaging~~ within CXCC to broadcast its BSID and relative ~~contact~~ information to its ~~coverage area potential~~ neighboring SSs using its maximum capable and allowed operating EIRP. In so doing~~this way~~, a potential victim SS~~s susceptible to interference from the new BS will receive the signaling~~ can measure ~~the~~ the interference that is caused by the initializing BS and retrieve~~get~~ the information broadcast within ~~the singalingsignaling/messaging in~~ CXCC. ~~–~~This information is then ~~and~~ forwarded ~~the contact information~~ to the~~ir~~ serving BS of the potential victim SSs. After each~~the~~ neighbor BS~~s~~ get~~obtains~~ the address of the initializing BS from ~~via~~ the SS~~s'~~ reports, they will contact their new ~~coming~~ neighbor via the IP network and both the initializing BS and the neighbor BS will update their respective database ~~on both sides~~. ~~Thus, in an ad-hoc fashion, the procedure will solve the hidden neighbor problem by the SSs in the neighbor systems.~~ Therefore, using the information that the IBS has received from its neighbors over the IP network, the IBS can learn about~~get the information of the~~ coordinated systems in a potential community.

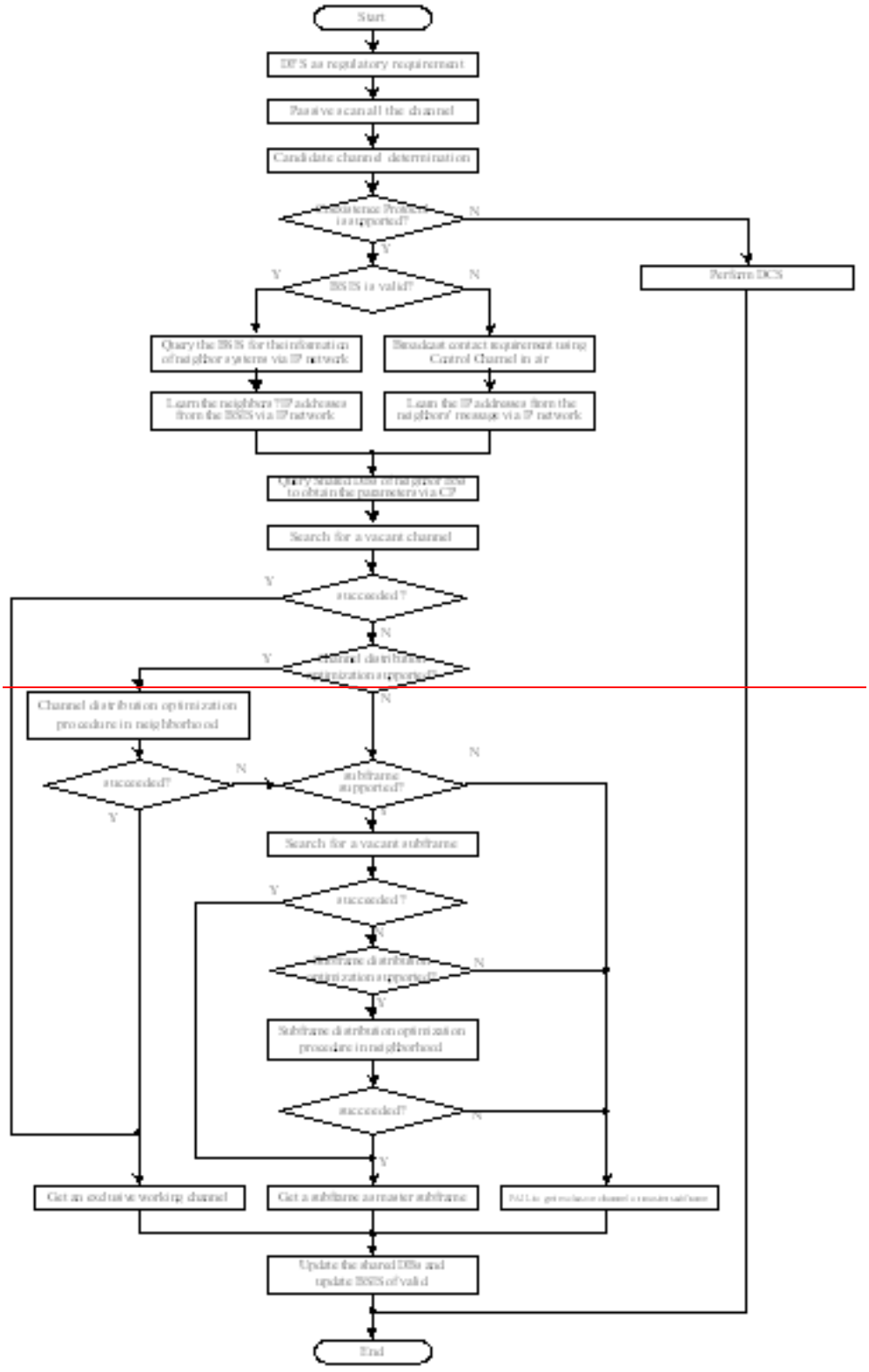
In conclusion, a BS should use all ~~the~~ available information in order to choose a first operating channel and Master sub-frame.

If the IBS finds that there is no ~~“free”~~available channel for operation ~~neither to be interference victim nor source~~, the information in its local~~the distributed~~ database can be used to determine~~figure out which system it should negotiate with~~ the ~~scheme of the~~ channel allocation scheme~~optimization of~~in its neighborhood. If ~~the~~ channel optimization ~~feature~~ is supported within the neighborhood, ~~The~~the IBS ~~may decide~~ should determine~~find out~~ whether an available ~~free~~ channel can be ~~vacant vacated made available~~ created by channel reallocation within the community. If a suitable~~it is found a suitable the~~ channel reallocation scheme can be found ~~is figured out the IBS can figure out an optimized channel distribution in the community,~~ that~~which enables~~ will provide every system ~~member~~ ~~–~~within the ~~community~~neighborhood ~~to~~with ~~occupy~~ an exclusive channel~~s~~, the IBS ~~can~~ should contact the BSs in the neighborhood (the candidate BSs) ~~community, which~~ that need to reallocate their channels. ~~–~~This in turn could potentially cause these BSs ~~(the candidate BS's) and~~ to negotiate with their~~m~~ relative neighbor systems ~~for the~~ to reallocate their channels~~ion~~. After receiving ~~the~~ confirmation ~~by~~from all candidate BSs, the IBS should send a CXP message ~~to the candidate BSs to indicate~~ acknowledging ~~the~~ a successful ~~and the final~~ channel allocation.~~,~~ ~~all the candidate BS~~ The BSs in the neighborhood should then ~~continue~~ operate~~ion~~ on the new set of channels. ~~allocation.~~ Otherwise, if the channel reallocation attempt fails, ~~the IBS can't get a “free” frequency succeed after the effort of reallocation,~~ the IBS should try to share a channel ~~frequency~~ with ~~some of its~~ one of its ~~proper~~ neighbor~~ing BSs~~. The automatic channel reallocation procedures aim to replace ~~the~~ operator coordination, which can be a problematic process, with an automatic equipment procedure based on

interference measurement.

Similarly to ~~the~~ channel allocation, the IBS should ~~will then first~~ try to find a vacant master sub-frame allocation in the potential channels using the information contained in~~of~~ its~~the~~ local~~distributed~~ database.~~;~~ ~~–l~~if it fails, the IBS ~~will~~ should then try to vacate an ~~exclusive~~ existing master sub-frame allocation by master sub-frame ~~distribution~~ allocation optimization, if supported. If all these attempts fail, the IBS ~~will~~ may not be able to get any interference free resource for operation.

Error! Reference source not found. shows the initialization procedures for the WirelessMAN-CX BSs. The detailed negotiation and updating~~e~~ procedures are described in section ***Error! Reference source not found.*** and ***Error! Reference source not found.***. Scan here is ~~just~~ an action taken on the each candidate channel sequentially. The detail of different type of scanning is described in 15.3.2. (*[the following statement moved into section addressing CCA/CMFA at the end of its first paragraph.]The basic distinction between passive scan and active scan is in the specific action of scanning. Passive scan means measurement or monitoring of the potential channels, without any transmission. Active scan leads to signal transmission on each potential channel, and waiting for the responses.*)


Start
DFS as regulatory requirement
Passive scan all the channel
Candidate channel determination
Interference Profiles is supported?
N
Y
Perform DCS
Y
BSIS is valid?
N
Query the BSIS for the information of neighbor systems via IP network
Broadcast contact requirement using Control Channel in air
Learn the neighbors' IP addresses from the BSIS via IP network
Learn the IP addresses from the neighbors' message via IP network
Query detailed info of neighbor BS to obtain the parameters via C2
Search for a vacant channel
Y
succeeded?
N
Y
Channel distribution optimization supported?
N
Channel distribution optimization procedure in neighborhood
succeeded?
N
Y
subframe supported?
N
Y
Search for a vacant subframe
Y
succeeded?
Y
Subframe distribution optimization supported?
N
Y
Subframe distribution optimization procedure in neighborhood
succeeded?
N
Y
Get an exclusive working channel
Get a subframe as master subframe
Update the shared DBs and update BSIS of valid
End

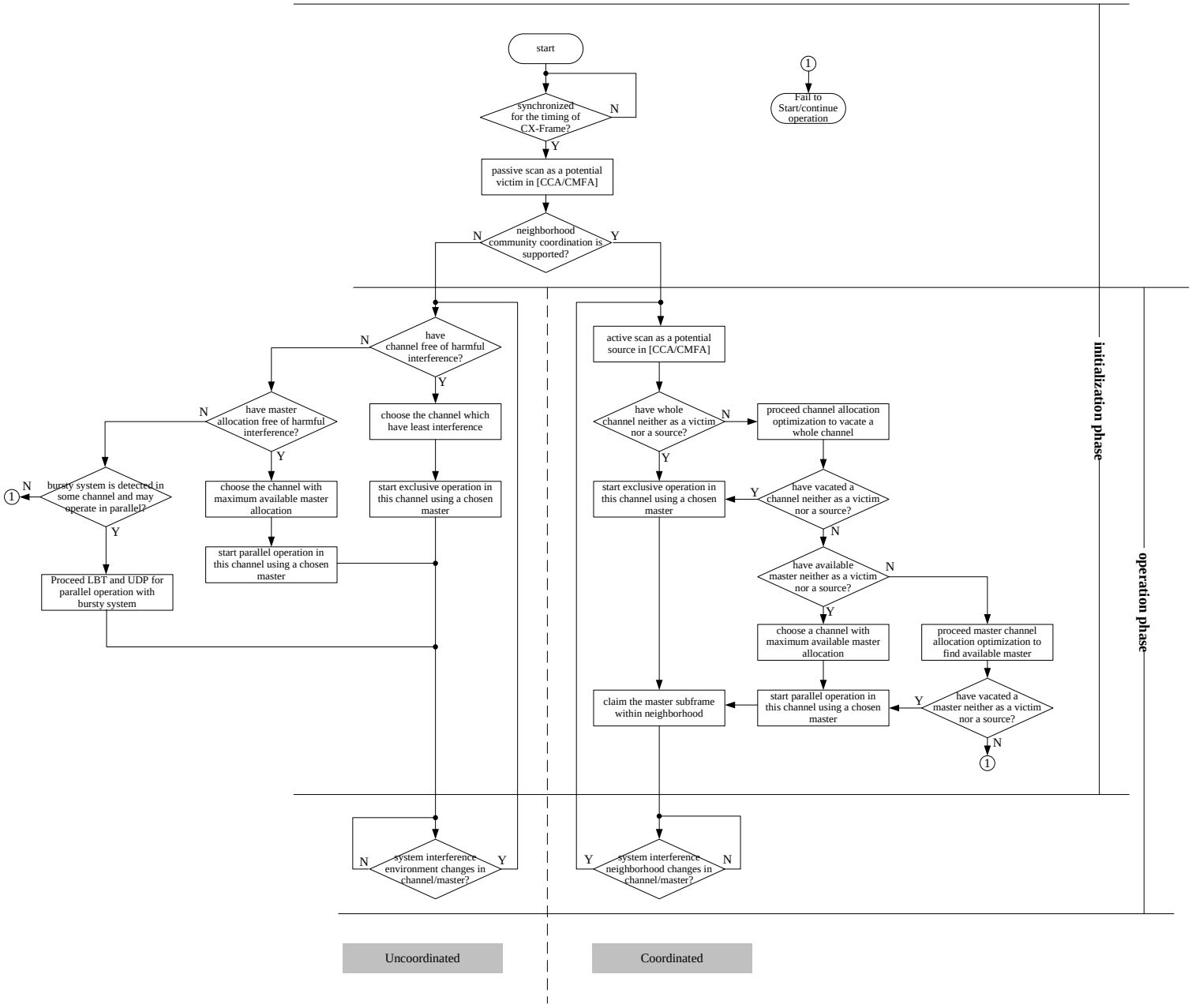


Figure h23—~~Initialization~~ brief procedures of BS initialization and operation for coexistence— BS[mg3][h4]

~~[Note: the following text needs further consideration]~~

- ~~The first phase of the Community Entry is to determine the availability~~ existence of the country/region database. ~~if~~ If the country/region database is available: ~~*[TBD: what's mean available?]*~~exists:
  - ~~Get the information from the data base maintained by BSIS via the Coexistence Protocol;~~

- Identify which Base Stations might create interference, based on the location information;
- The IBS learns the IP identifiers of those Base Stations;

Otherwise (the country/region database is not available):

- The control channel CX_CMI_D/U(n) and the CSI method, to be described below, offer time slots in which none of the members of the existing community transmits any signal. A new BS uses CSI or CMI to broadcast the message containing the contact request and/or the coexistence signal carrying the IP address
- A SS in the common coverage area, identifying the new BS signals, will forward the information to its operating base station using REP-RSP message or BS_CCID_RSP message
- The operating BS updates its database and sends feedback information to the IBS, using the IP network
- The new BS learns the IP identifier of the coexistence neighbor BS from the message sent by the coexistence neighbor BS via the IP network

Build the local image of the relevant information in the community BS's, by copying the info from those BSs

Listen on multiple frequencies

- Identify the level of interference on each frequency channel;Cose the candidate channel and the candidate Master sub-frame for operation according to procedures in clause 15.3.2 and information provided by the BSIS;

Decide the working frequency (ACS – Adaptive Channel Selection process);

- If no interference detected on some channels, select one randomly as working channel;
- If interference detected by the IBS or the OBS system on all the channels, then the IBS should decide whether an optimized channel distribution, as described in section *15.4.1.1*, can allocate an exclusive channel for each BS, including the IBS, in the community.
- If every BS in the community can be allocated an exclusive channel without interfering with the others, that means default interference-free Master slot is available for this initializing BS.

If available, select an interference-free Master sub-frame; if not, use the procedure for creating new Master sub-frames;

Search the Base Station data base for finding the BSs using the selected Master sub-frame;

Request those Base Stations, by sending IP unicast messages, to listen during the BS_entry slot in order to evaluate the interference from the new Base Station;

Use the allocated slotsallocations during the CXCC sub-channel 4 (see clause 15.3.1) for transmitting the "radio signature" at intended operating or maximum allowed EIRP, whichever is less, and in all the used directions;

- If the IP connectivity between the BSs inside the Coexistence Community is established, Askask for permission of the Base Stations, using the sub-frame as Masters, to operate in parallel and use the same sub-frames;
- If all of them acknowledge, the Base Station acquires a “temporary community entry” status; the final status will be achieved after admission of the SSs;
- If no free Master slot sub-frame is found, use the procedure for creating new Master slot sub-frames.try the Master sub-frame optimization procedures.

(2) *Operating stage*

In the operating stage, the BS has SSs associated with it. ; however, until the operating system parameters are determined, the co-channel or adjacent channel interference from WirelessMAN-CX BSs of different systems may still occur due to the detection of interference from *Specific Spectrum Users* (which may cause the neighbor BS to switch to an interfering channel). Channel switching of coexistence neighbor systems or the entry of new coexistence neighbor BS might make the community so crowded that there are not enough channels. If the WirelessMAN-CX BS finds that there is no “free” channel at that moment, working channels may be reallocated, or the coexistence neighbor topology provides the guidelines of with whom it should negotiate to share the channel.

In the operating stage, system The BS and its serving SSs should monitor the channel status of on its own the working channel and other the non-working channels and update its interference status in the information table (*15.5.5.1*). If interference status varies, the system shall update its resource allocation to get an interference free wireless resource, and at the same time, use the free bandwidth efficiently once more bandwidth is available. The changes inof the interference status changes shall be triggered when may include a primary user is detected, or when a new free channel is found, or when the number of interference neighbor systems varies.. System may use quiet period, such as slave sub-frame, extended quiet period and quiet period in CX CCH slot for sensing and identification. System will perform corresponding operation according to the result of channel measurement and interference interferer identity.

If a new free channel is detected and the working channel of the system is too crowded, a system may switch to the new free channel. A Ssystem may request its coexistence neighbors to delete it from their coexistence neighbor list using Delete Coexistence Neighbor Request message (15.5.1.7) through the IP backhaul networkvia backbone or over the air. And tThe coexistence neighbor may also occupy the released resource to improve the bandwidth efficiency.

If a system has no interference neighbor and finds a new free channel, it should just records the new free channel as its alternative channel in the information table. The alternative channel may be used for the optimization of channel distribution or fast channel switching when a primary user is detected on the working channel.

BS in the operating stage should accumulate the channel measurement and interference situation detected by itself or by associated SS and update its interference status in the information table (*15.5.5.1*). BS should allocate resource according to the interference status so that every SS associated it can get interference free slot for transmission and receiving.

~~If a new free channel is detected and the working channel of system is too crowded, system may switch to the new free channel. System may request its coexistence neighbors to delete it from their coexistence neighbor list using CXP message. And the coexistence neighbor may update their frame structure after system switching to another free channel.~~

~~If, after a system in operating stage finds a channel with fewer systems and switches to it, the new working channel does not become more congested than the original working channel, the system may switch its working channel to the channel with fewer systems. The switching system may request its coexistence neighbors to delete it from their coexistence neighbor list by using CXP message. The switching system shall also negotiate with the systems working in the new working channel about the new frame structure, OCSI. The switching system may also update its neighbors with its new working channel, OCSI after it joins the new community.~~

~~If a system has no interference neighbor and finds a new free channel, it just records the new free channel as its alternative channel in the information table.~~

If a primary user is detected on current working channel and a system ~~may not~~is not allowed to share the same channel with this user, the system shall stop working on that channel at the required switching time. ~~And at~~At the same time, a system should try to find free working bandwidth for itself, as a free channel and/or a free master sub-frame, following the procedures ~~described~~described for the initialization stage~~. If system has alternative channel, system should switch to its alternative channel as soon as possible. If system has no alternative channel, system may ask its neighbor systems optimize the channel distribution to get free channel (15.4.1.2). If the optimization of channel distribution fails, system shall try to find free subframe. If no free subframe exists, system may ask its neighbor system optimize the subframe distribution to get free subframe (15.4.2.2).~~[mg5]

There are two reasons for ~~the number of interference system varying~~changes in the interference status. ~~–~~They are the addition of a new uncoordinated interference system~~, is added~~ and~~or~~ the release of an interference neighbor system~~. in the interference community is released~~. If a new interference BS or SS is identified, a system should negotiate with the corresponding interference neighbor to mitigate the~~get~~ interference ~~free~~. For example, in the case of an interfering SS, the interfering SS ~~the interference SS~~ should be allocated resources for ~~the~~ SS operation during its serving BS's master subframe. If an interference relationship is released, the system should use the released resource effectively to improve frequency efficiency. ~~For~~As an example, the SS which has released the interference relation may operate ~~be allocated resource~~ during its serving BS's ~~master~~slave subframe. Or a BS may borrow the subframe released by the interference neighbor to another system. ~~this~~ system must switch to another channel as quickly as possible, using the CCD (see 15.3.2 procedures. System may follow procedure same as the initialization of BS to get interference free resource.

~~If a new interference victim SS is reported and the neighbor BS interfering it is a new un-coordinated neighbor, system should negotiate with this neighbor to get interference free for the victim SS. If a new interference victim SS is reported and the neighbor interfering it has already been in the community, then system just records it in the information table and allocates this interference victim SS an interference free sub-frame.~~

~~If a new interfering SS associated an un-coordinated BS is detected by BS, BS should negotiate with~~

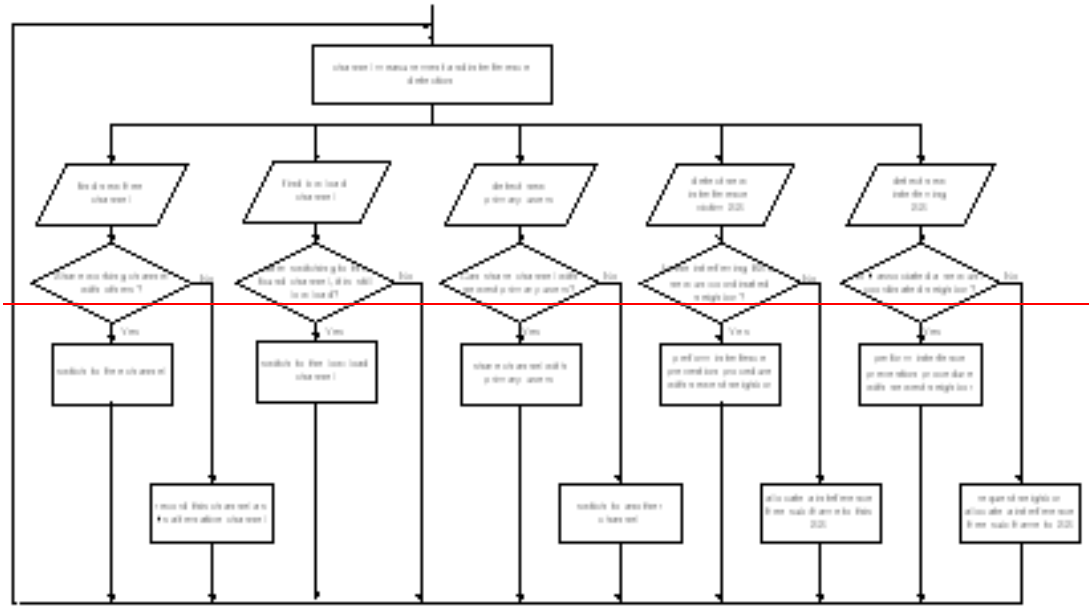
~~this neighbor BS to get interference free. If a new interfering SS associated with the neighbor already in the community, BS may request neighbor system to allocate a sub-frame which couldn't cause interference to this SS.~~

~~If the interference to a victim SS is released, e.g. if victim SS powers off or leaves interference area, BS will check if all interference with one neighbor is released, that is, the number of victim SS interfered by the neighbor is zero and the number of interfering SS which causes interference to the system is zero. If not, system just updates the resource allocation to this SS. If all interference with one neighbor is released, system may delete this neighbor in its coexistence neighbor list and update frame structure according to new neighborhood.~~

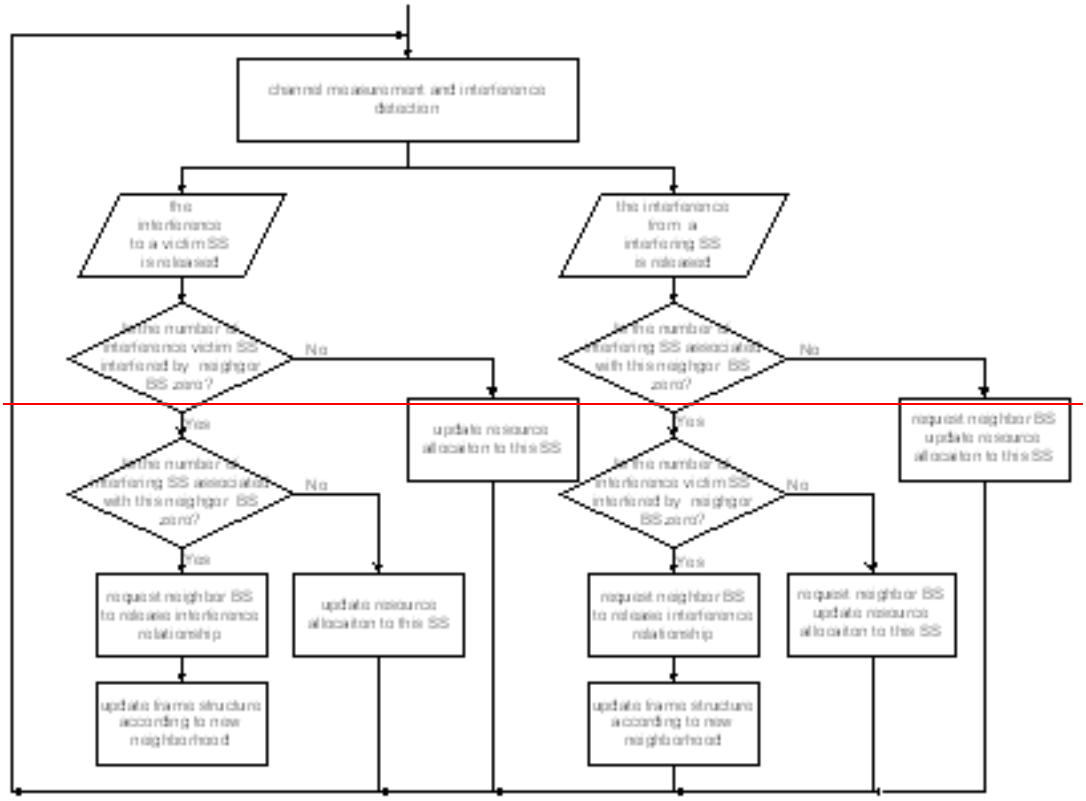
~~If the interference from a interfering SS is released, e.g. if interfering SS powers off or leaves interference area, BS will check if all interference with one neighbor is released, that is, the number of victim SS interfered by the neighbor is zero and the number of interfering SS which causes interference to the system is zero. If not, system may request its neighbor updates the resource allocation to this SS. If all interference with one neighbor is released, system may delete this neighbor in its coexistence neighbor list and update frame structure according to new neighborhood.~~

~~The higher priorities (smaller waiting periods) are given to the systems in more congested channels. The Systems with 3 (maximal value) overlapping neighbors working in the same channel has the smaller waiting window. The Systems with 2 overlapping neighbors working in the same channel has the larger waiting window. The systems trying to switch to a new channel select a random numbers from the waiting windows. A BS will generate a waiting period before it tries to switch its working channel to an idle channel or a channel with fewer systems working in it. During the waiting procedure, the BS and its associated SSs shall allocate more resource to measure the channel that it tries to switch to. In case another BS switch to that channel, the BS shall stop the waiting procedure. If the channel is still a sparsely used channel, the BS may start another waiting procedure or keep stay in the original working channel.~~

~~*Figure h 24 – Figure h 25* shows the procedure for the WirelessMAN-CX BS in operating stage.~~



~~Figure h24—procedure in the operating stage(A)~~



~~Figure h25—procedure in the operating stage(B)~~

15.1.3.2 Procedure~~s flow~~ for SS

The procedure~~s forofnfor~~ system and community entry for a new SS in WirelessMAN-CX ~~is~~are ~~–~~ shown below:

— The new SS starts ~~listening and synchronizing to the BS;~~the network entry procedures using the UL Master sub-frame

— The new SS listens to the Coexistence Control Channel (CXCC) ~~slots~~allocations to detect interference ~~sources~~ (see ***Error! Reference source not found.***)

~~— The new SS waits for the Base Station community entry and start of operation (see *15.1.3.1*);~~

~~***[Editor's notes: the text below in this section is still waiting for the resolution of the adhoc about CXCC(John) and CXP air forwarding(David);]***~~

— At BS request, the new SS reports to the BS the results of the CXCC measurements

— At BS command, the new SS transmits CMI at the appropriate ~~slots~~allocations in the CXCC

— If an operating Neighbor Base Station (OBS) perceives interference from the new SSs, it will ask the new Base Station to find another channel/sub-frame for that SS operation ~~via the CXP~~;

15.1.3.2.1 Channel Measurement in the Operating Stage

A BS may request an SS to measure one or more channels on its behalf in the operating stage. A BS should schedule the available measurement interval for SS via periodic_channel_measurement_IE (8.4.5.3.5). During a scheduled measurement interval, the BS shall not transmit MAC PDUs to that SS or request any uplink transmission from any SSs. ~~–~~The BS should schedule the measurement interval properly in such a way that there is~~so that~~ no effect on normal traffic transmission between the BS and SS. The channel measurement may be scheduled to cover the CXCC measurements.

Upon receiving a measurement requirement, a SS shall start to measure the indicated channel during the scheduled measurement intervals. A SS shall continue to measure the indicated channel during the scheduled measurement intervals until the measurement interval ends or serving BS schedules SS to receive and/or send signal during measurement interval.

A BS may schedule one or more measurement patterns for an SS. ~~–~~The m~~M~~easurement interval of different measurement patterns shall not be overlapped. Measurement patterns are identified by a measurement_request_index parameter in a periodic_channel_measurement_IE. The SS should report its measurement result corresponding to each measurement request from the BS.