Project	**IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**>**	
Title	**Proposed changes to clause 15.1.3**	
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Re:	Task Group Review	
Abstract	Summary of the Ad-Hoc activity	
Purpose	Approval	
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Proposed changes to clause 15.1.3

Mariana, etc.
Alvarion Ltd, etc

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 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 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, initialization stage and operating stage. In both stages, in bands where SSU are presents, need to be followed the procedures described in clause 6.3.15 (or 6.4.2.2?) 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)~~

The Base Station should follow the procedures described in 15.3.2 in order to chose an operating channel. ~~But~~ However, these procedures ~~this method~~ cannot avoid the hidden neighbor system problem, i.e. the BS that cannot be heard directly by the initializing BS but may have overlapping service coverage and interfere with the initializing system SSs. Thus, with the knowledge of coexistence neighbor topology, available, for example, from a central country/region database, the Initializing Base Station (IBS) can take the potentially hidden neighbor systems into account and can, therefore, avoid the possible interference from those neighbors.

Alternatively, if the such a database is not available in this stage, the initializing BS will use the initialization coexistence signaling/messaging within CXCC to broadcast its contact information to its coverage area using its maximum capable and allowed operating EIRP. In this way, SSs susceptible to interference from the new BS will receive the signaling and forward the contact information to their serving BSs. After the neighbor BSs get the address via the SSs' reports, they will contact their new coming neighbor via the IP network and update the 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, the IBS can get the information of the coordinated systems in a potential community.

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

If the IBS finds that there is no “free” channel, the information in the distributed database can be used to figure out which system it should negotiate with. The IBS may decide whether a free channel can be made available by channel reallocation within the community. If the IBS can figure out an optimized channel distribution in the community, which enables every member in the community to occupy exclusive channels, the IBS can contact the BSs in the community, which need to reallocate the channels (the candidate BS's) and negotiate with them the reallocation. After receiving the confirmation by all candidate BSs, the IBS should send a CXP message to the candidate BSs to indicate the success, all the candidate BS should then continue operation on the new set of channels. Otherwise, if the IBS can't get a “free” frequency after the effort of reallocation, the IBS should try to share a frequency with some of its neighbors.

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 all these attempts fail, the IBS will 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 update 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 channel sequentially. 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.

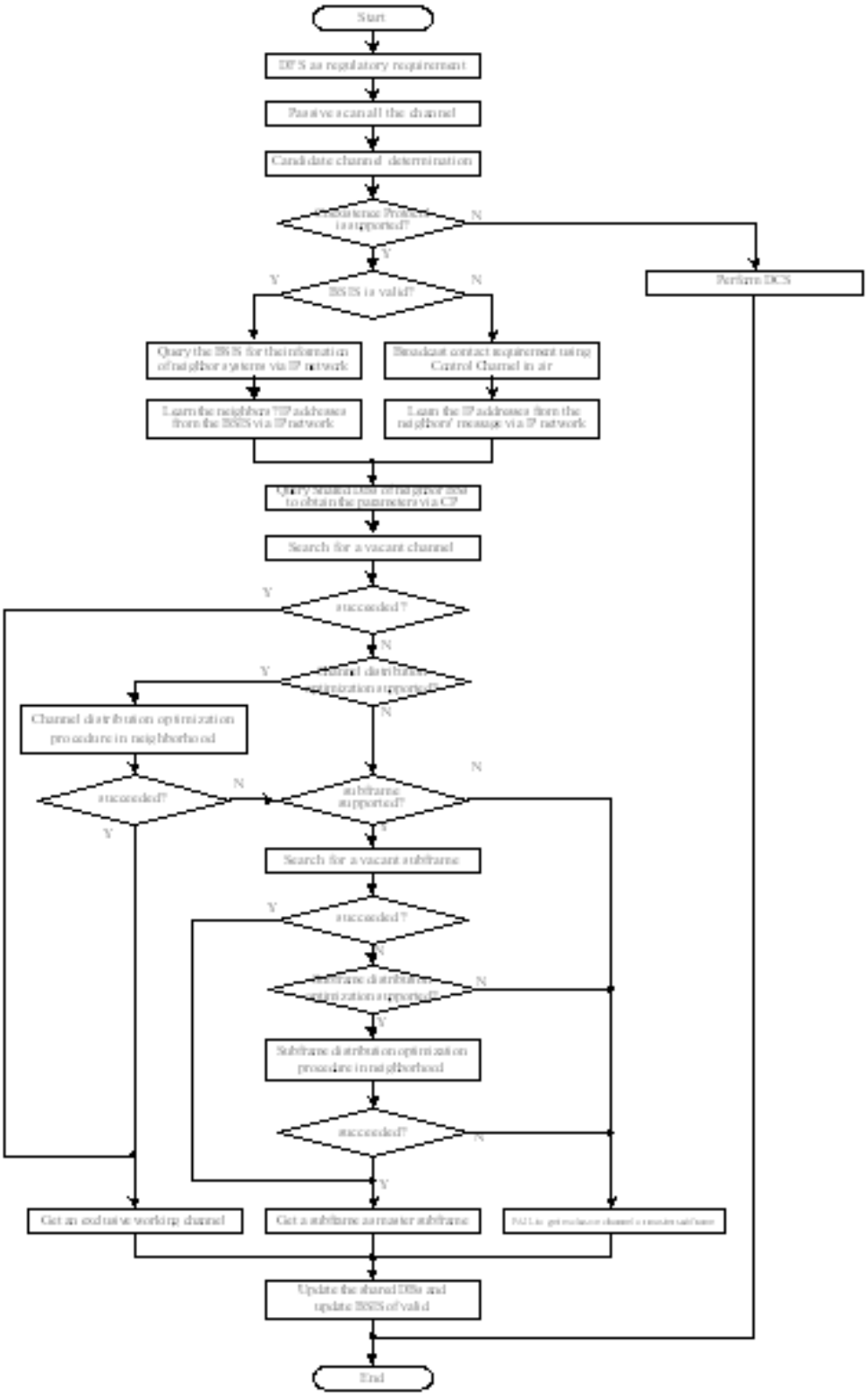

Figure h23—Initialization procedures — BS

[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 slots~~allocations 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, ~~Ask~~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 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 should monitor the channel status of its own working channel and other channels. ~~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.

~~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 share same channel with this user, 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.~~

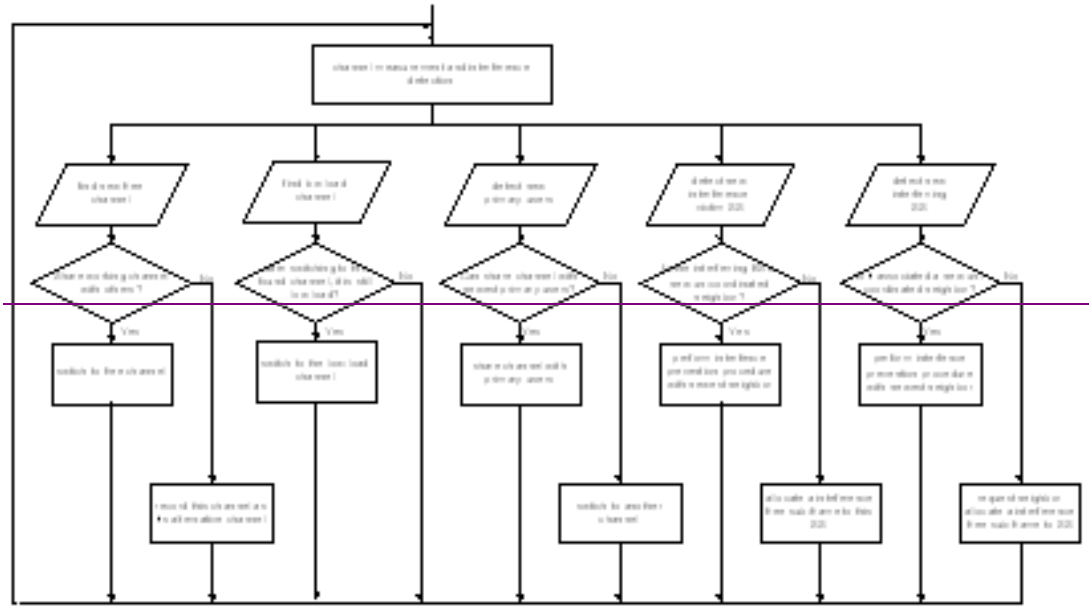

Figure h24—procedure in the operating stage(A)

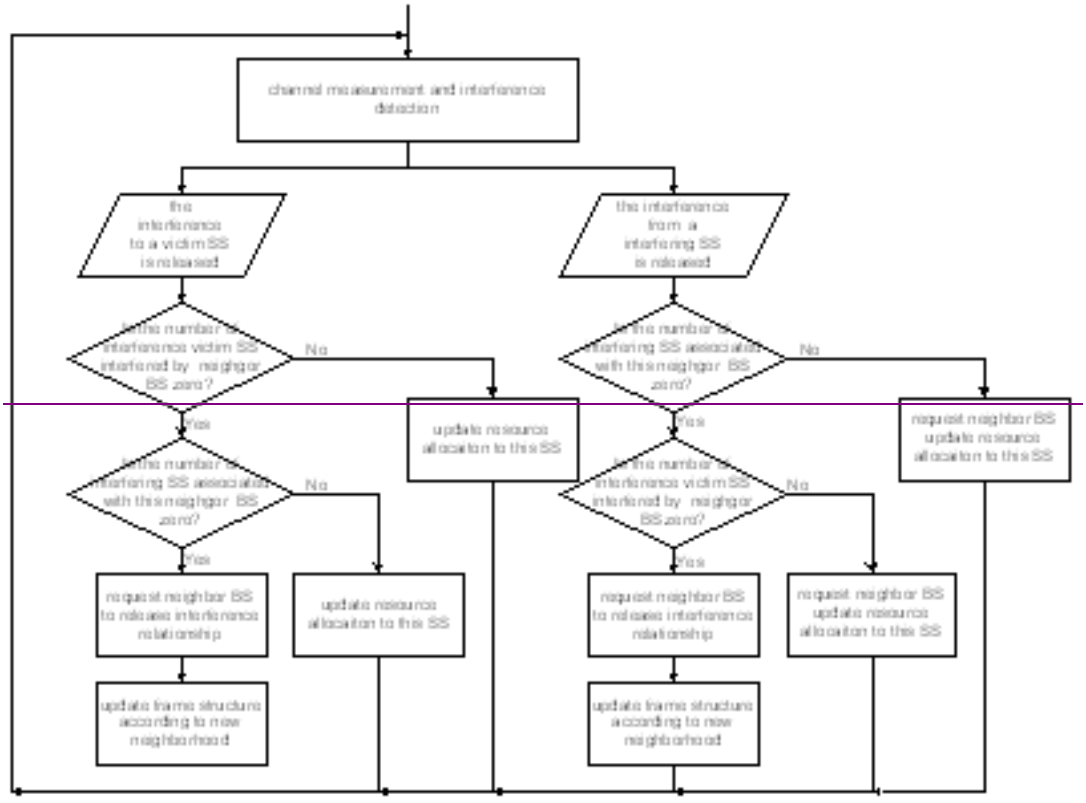

Figure h25—procedure in the operating stage(B)

15.1.3.2 Procedure flow for SS

The procedure of system and community entry for a new SS in WirelessMAN-CX is 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 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 in the CXCC
- If an operating Base Station (OBS) perceives interference from the new SSs, it will ask the new Base Station to find another sub-frame for that SS operation via the CXP;

15.1.3.2.1 Channel Measurement in the Operating Stage

BS may request SS to measure one or more channels on its behalf in the operating stage. BS should schedule available measurement interval for SS via periodic_channel_measurement_IE (8.4.5.3.5). During scheduled measurement interval, BS shall not transmit MAC PDUs to that SS or request any uplink transmission from SSs. BS should schedule measurement interval properly so that no effect on normal traffic transmission between BS and SS.

Upon receiving a measurement requirement, SS shall start to measure the indicated channel during the scheduled measurement intervals. 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.

BS may schedule one or more measurement pattern for SS. Measurement interval of different measurement pattern shall not be overlapped. Measurement patterns are identified by measurement_request_index parameter in periodic_channel_measurement_IE. SS should report measurement result corresponding to each measurement request from BS.