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Title	**message reported by SSs and share DB updating for neighbor discovery**
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Abstract	Define the messages for the SS report and the database content for the SS interference info
Purpose	Consolidate the mechanism of neighbor discovery
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message reported by SSs and share DB updating for neighbor discovery

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Overview

In current working document 2.1.1, we now have a possible simple approach to make the initializing BS to get in touch with its neighbors, without any centralized server involved in this phase. That is, initializing BS can use the coexistence time slot to broadcast its IP address to the reachable SS which belong to other serving BS, and let the serving BS to contact the initializing BS using the IP network.

We need to define some message for the SSs to report the information to their serving OBS, when they have received from the IBS_IPBC broadcasted by IBS. This contribution will propose some message features added in the REP_REQ/RSP, and descript some updating work need to be done after the serving OBS receives the reporting message.

Acronyms

IBS – Initializing Base Station

OBS – Operating Base Station

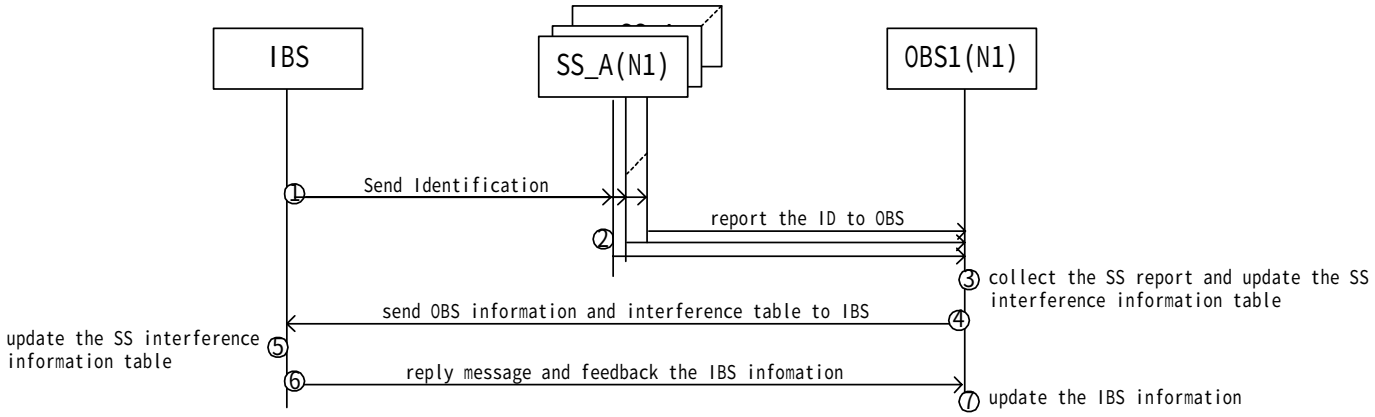
IPBC – IP address Broadcast

Reference:

[1] *IEEE802.16-2004: IEEE standard for Local and metropolitan area networks Part16: Air Interface for Fixed Broadband Wireless Access Systems 2004-10-01*

[2] *IEEE 802.16-05/017: working document Amendment for Improved Coexistence Mechanisms for License-Exempt Operation 2005-08-15*

Description of concept



Please see to the chart above shown the neighbor discovery procedure:

The initializing BS (IBS) use the coexistence time slot to broadcast its IP address to the reachable SSs in the neighbor network(N1) belong to its serving BS(OBS1).

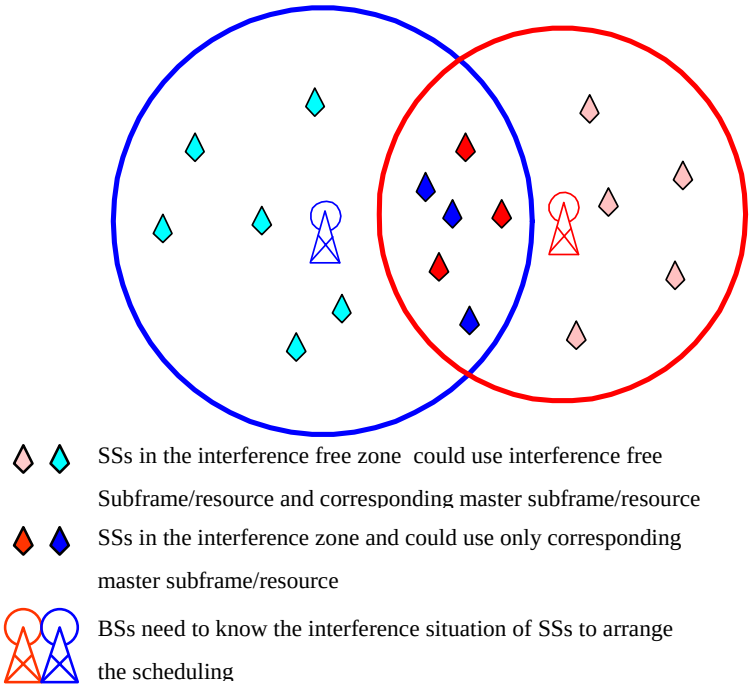
The SSs then report to their serving BS (OBS1) one by one unsolicitedly<1>, they will report the information of IBS and the interference status that they record in the process of receiving the IPBC message signal.

The OBS1 will get all the information from the related SSs and saved the useful content to their database<2>. After that, the OBS1 will contact IBS using the IP address reported by the SS and transfer the parameter of its own to IBS after the negotiation and authorization, and got the parameter and other corresponding information from the IBS too.

There are 2 points in this procedure to be concerned with in this paper:

<1> We need a message type for the SSs to carry the parameter reported to their serving BS;

<2> We need to define the content in the database for gathering the SSs interference status and sources. The interference source and status information for each SS related to the decision by the serving BS for their traffic scheduling. So the serving BS need to maintain a table inside there database and update the table in time.



Message for SS report

We could choose existing message REP_RSP for the interference reporting by the SSs for issue<1>, since the REP_RSP have already defined and used as RSSI/CINR measurement reports, we could add only some features fit for the IPBC report in the neighbor discovery stage. In the existing description, we can find the characteristic of this message that already meet the requirement:

” *Where regulation mandates detection of specific signals by the SS, the SS shall also send a REP-RSP in an unsolicited fashion upon detecting such signals on the channel it is operating in, if mandated by regulatory*

requirements. The SS may also send a REP-RSP containing channel measurement reports, in an unsolicited fashion, or when other interference is detected above a threshold value."

We proposed some text changing in related section to clarify this feature:

[insert the following text into the WD 2.1.3]

[change the 6.3.2.3.33 into the following text in 802.16 primary standard]

6.3.2.3.33 Channel measurement Report Request/Response (REP-REQ/RSP)

If the BS, operating in bands below 11 GHz, requires RSSI and CINR channel measurement reports, or requires neighbor detection reports, it shall send the channel measurements Report Request message. The Report Request message shall additionally be used to request the results of the measurements the BS has previously scheduled. Table 62 shows the REP-REQ message.

The channel measurement Report Response message shall be used by the SS to respond to the channel measurements listed in the received Report Requests. Where regulation mandates detection of specific signals by the SS, the SS shall also send a REP-RSP in an unsolicited fashion upon detecting such signals on the channel it is operating in, if mandated by regulatory requirements. The SS may also send a REP-RSP containing channel measurement reports, in an unsolicited fashion, or when other interference is detected above a threshold value. In cases where specific signal detection by an SS is not mandated by regulation, the SS may indicate 'Unmeasured. Channel not measured.' (see 11.12) in the REP-RSP message when responding to the REP-REQ message from the BS. Especially for coexistence network, when SS have detected the IP broadcasting message from the coexistence neighbor BS, the SS need to use REP_RSP to report the information to its serving BS unsolicitedly. Table 63 shows the REP-RSP message.

[insert the following entry in the second table of 11.11]

Neighbor Interference Report	*1.9*	*1*	*Bit #0: 1-include IP address received in IPBC* *Bit #1: 1-include RSSI of CTS symbols(only valid when bit#0 is set to one)* *Bit #2: 1-include FSN that start to receive IPBC* *Bit #3~7: reserved, shall be set to zero*

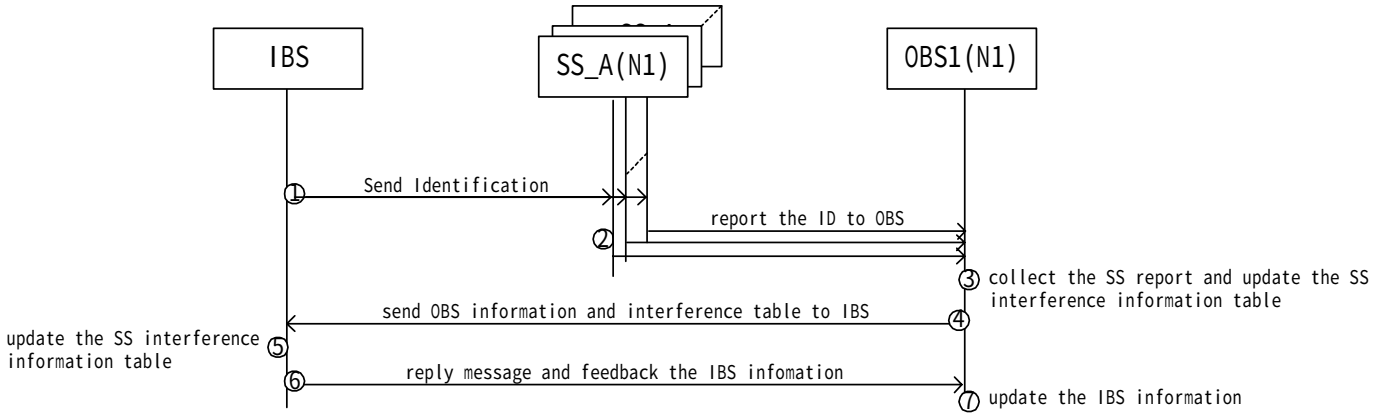
[insert the following entry in the first table of 11.12]

Neighbor Report	*7*	*variable*	*Compound*

[insert the following table into 11.12 as indicates:]

***Neighbor Interference Report** type*	*Name*	*Type*	*Length*	*Value*
all	*Neighbor count /New NDS*	*7.1*	*1*	*Bit #0:1-New Neighbor Discovered by IPBC received* *Bit #1-7:The number of neighbor that interference to this SS*
bit #0=1	*Neighbor IP address*	*7.2*	*4*	*4bytes IP address of neighbor interference to this SS,* *255. 255. 255. 255 indicate the fail of CRC check.*
bit #1=1	*Neighbor IP address with RSSI*	*7.3*	*2*	*1byte RSSI mean (see also 8.2.2, 8.3.9, 8.4.11) for details)* *1byte standard deviation*
Bit #2=1	*Starting Frame Serial Number of IPBC*	*7.4*	*2*	*Bit# 0-10: FSN of IPBC starting frame* *Bit#11-15: reserved*

[Change the figure10 as indicated]



Complement of the database

For the point <2>, we need to clarify some content in the BS database as inputs to support the BS to schedule the traffic of each SS. And these information needs to be updated when any BS startup in the coexistence neighborhood.

[insert the entries into the first paragraph of page 19 as indicates:]

The BS data base will include:

……

For every active SS: SSID and its attenuation relative to radio-signature power, in the used subframes, in the interval between two Master sub-frames.

For every neighbor BS: the BSID, the IP address of the neighbor and other profile information, and the SSs it interfered to, (and the SSs belong to it that interfered by the database owner BS.tbd.)

For every BS in the same community: the contact IP address and the interference situation between this BS and other BS, including the interference situation with the DB owner.

For every SS registered: the interference situation, the number of interference source, the IP address and RSSI of each source detected by the SS.

[Change the first the section 2.1.5 as indicates:]

2.1.5 BS regular operation

- Schedule SS traffic

The traffic of each served SS should be schedule into corresponding sub-frame/resource based on the SSs' interference situation. Traffic of SSs in the interference free zone could be scheduled into any available sub-frame/resource of the serving BS, and traffic of SSs in the interference zone should take only corresponding master subframe/resource of the serving BS.

- Set Tx power levels, such to use minimum power levels for both BS and SSs;

- Maintain it own database when other BSs join the network.

The BS need to keep updating the information of all the BS in the community including the neighbor BS, and the information of the served SSs in the own network. The information include the profile and the interference situation of the stations. The interference situation information include the interference status, the interference source and corresponding RSSI, the interference victims founded. Etc.

[change the section 2.1.8.3 as indicates:]

2.1.8.3 Interference to SS

Report to BS about experienced interference

List of frame_number, sub-frame, offset, *IP address of source BS (if detected)*

BS start process for interference reduction with feedback from the SS.

[change the first line3-14 in page 25 as indicates:]

The first phase of the Community Entry is to judge the validity of country/region data base. If the country/region database is valid, process uses the country/region (FCC) data base::

- Read the Regional/country (FCC) data base;
- Identify which Base Stations might create interference, based on the location information;
- Learn the IP identifier for those Base Stations;

Otherwise:

- New BS uses the interference free slot to broadcast the contact request
- The SS in the common coverage will forward the information to its operating base station *using REP_RSP message*.
- The operating ~~neighbor~~ BS *update its database and* send feedback information using IP network
- learn the IP identifier By the message from neighbor BS via IP network

To support the functionality, the content of database needs to be refined and standardized.

[Tables proposed to be inserted in the working document as indicated:]

Syntax	***Size***	***Notes***
This BS information table(){		
BSID	*48bits*	
Operator ID	*?bits*	
IP address	*32bits*	*IPv4 address*
Master resource ID	*8bits*	*Sub-frame number*
Negotiation status	*8bits*	*Bit0: get communication in the IP network* *Bit1: be registered in* *Bit2: registered to*

		Bit3: done for resource sharing(if neighboring) *Bit4-7: tbc.*
CTS parameter(){		*Regulated by region/country*
Tcts_start	*16bits*	*In microseconds*
Tcts_duration	*8bits*	*In microseconds*
Period of frames	*8bits*	*frames*
Starting frames offset	*16bits*	*frame serial number of the first frame that CTS presented*
Length of Symbols	*8bits*	*In microseconds, need to be 1/n of Tcts_duration*
}		
Neighboring	*1bit*	*Neighbor with this BS?* *1-yes* *0-no*
If (Neighbor){		
Number of victim SSs	*16bits*	*The number of victim SSs of this neighbor, in this network*
for (I = 1; I <= n; i++) {		
SSID	*48bits*	
RSSI	*16bits*	*1byte RSSI mean (see also 8.2.2, 8.3.9, 8.4.11) for details)* *1byte standard deviation*
(tbc.)	*(tbc.)*	*(tbc.)*
}		
}		
Profile(){		
Band		
PHY mode(){		
Modulation		
(Tbc.)		
}		
Maximum power	*8 bits*	*dbm*
Number of registered SS	*12bits*	
for (I = 1; I <= n; i++) {		
SSID	*48bits*	
(tbc.)	*(tbc.)*	*(tbc.)*
}		
(tbc.)	*(tbc.)*	*(tbc.)*
}		
}		

Syntax	***Size***	***Notes***
BS information table(){		
Index	*16bits*	
BSID	*48bits*	
Operator ID	*?bits*	
IP address	*32bits*	*IPv4 address*
Sector ID	*8bits*	
Master resource ID	*8bits*	*Sub-frame number*
Negotiation status	*8bits*	*Bit0: get communication in the IP network*

		Bit1: be registered in *Bit2: registered to* *Bit3: done for resource sharing(if neighboring)* *Bit4-7: tbc.*
Neighboring	*1bit*	*Neighbor with this BS?* *1-yes* *0-no*
If (Neighbor){		
Number of victim SSs	*16bits*	*The number of victim SSs of this neighbor, in this network*
for (i = i; i <= n; i++) {		
SSID	*48bits*	
RSSI	*16bits*	*1byte RSSI mean (see also 8.2.2, 8.3.9, 8.4.11) for details)* *1byte standard deviation*
}		
(Tbc.)	*(Tbc.)*	*(Tbc.)*
}		
Number of Neighbors	*8bits*	*The number of neighbors of this BS*
for (i= 1; i <= m; i++) {		
BSID	*48bits*	
(Tbc.)	*(Tbc.)*	*(Tbc.)*
}		
Profile(){		
Band		
PHY mode(){		
Modulation		
(Tbc.)		
}		
Maximum power	*8 bits*	*dbm*
Number of registered SS	*12bits*	
(tbc.)	*(tbc.)*	*(tbc.)*
}		
(tbc.)	*(tbc.)*	*(tbc.)*
}		

Syntax	***Size***	***Notes***
SS information table(){		
Index	*16bits*	
SSID	*48bits*	
Interference status	*1bit*	*Interfered by neighbor?* *1-yes* *0-no*
If (Interfered){		
Number of source BSs	*8bits*	*The number of interference source of neighbor*
for (I = 1; I <= n; i++) {		
BSID	*48bits*	

IBS_IPBC detected	*1bits*	*1-yes 0-no*
If (IBS_IPBC detected){		
IP address	*32bits*	*If the IBS_IPBC message detected, the IP address report by the SS will add here, and updating the bit above*
Sector ID	*?bits*	*Reported by SS*
FSN	*16bits*	*Reported by SS*
(tbc.)	*(tbc.)*	*(tbc.)*
}		
RSSI	*16bits*	*1byte RSSI mean (see also 8.2.2, 8.3.9, 8.4.11) for details)* *1byte standard deviation*
(tbc.)	*(tbc.)*	*(tbc.)*
}		
(tbc.)	*(tbc.)*	*(tbc.)*
}		
(tbc.)	*(tbc.)*	*(tbc.)*
}		