Abstract

To consolidate the procedure on dealing with the error report from the SSs that fail to receive the whole message of IBS_IPBC, the OBS can judge the interference source by comparing the frame number in the report message.

Purpose

To consolidate the coexistence neighbor discovery procedure

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Treatment by OBS on error report in IBS_IPBC procedure
Wu Xuyong, Zhao Quanbo,
Huawei

Background[2]

Coexistence Time Slot
CTS (Coexistence Time Slot): a predefined time slot for the coexistence protocol signaling purpose, especially for the initializing BS to contact its coexistence neighbor operating BS through one or more coexistence neighbor SSs in the common coverage area.

CTS must not be used for other purpose by all the BSs, so that it will be an interference free slot for the coexistence neighbor discovery purpose. Initializing BS (IBS) shall use this slot to broadcast its IP identifier, by sending a message and/or by cognitive radio signaling, so that the coexistence neighbor operating BS (OBS) could find the new coexistence neighbor in IP network after the SS report the message. Then the IBS and OBS begin further negotiation for coexistence protocol.

Not to break the downlink PDU, and to prevent overhead of more preamble and gaps. CTS slots shall be located before RTG/TTG in TTD frame structure or before the preamble of downlink frame in FDD frame structure. To unify the location in these two kind of duplexing frame, CTS slots in FDD frame shall be put into the downlink structure right before the preamble, and shall be located right before RTG in TDD frame.

The broadcasting procedure is unidirectional, only from the IBS to the SSs in IBS/OBS’s common coverage, and the SSs shall report all the useful information to their OBSs they registered to. If the message will be forward correctly to the OBSs, the OBSs will then find the IBS in the IP network, and go further signaling using IP network.

figure: CTS usage example- IBS broadcasting IP address to coexistence neighbor’s SS

Reference:
Considering on current procedure

Usually there are more than one SS existing in the common coverage area between IBS and OBS. It may happen that some SS in this area can decode the whole IPBC message and some does not, e.g., because of disturbance by other signal, some old SS can not decode the CTS symbol, or the other reason. So some SSs can not correctly report the message to its operating BS (OBS), and the OBSs can not collect these interference status in the IBS_IPBC procedure.

Assumption:
All the Base Stations forming a community will have synchronized MAC frames and frame number.

The SS will report different information based on the result they got from the receiving of the IBS_IPBC:

When SSs success in receiving the broadcasting message and pass the checking, it means SS got the right information of the interference source, and will report to the IP address of IBS and the frame number of the time it start receiving the IBS_IPBC message to OBS using REP_RSP message.

When SSs got IBS_IPBC like interference in CTS but fail to decoding the message or verify the CRC checking for the message. The SSs can only report the error status and the frame number in which frame that it got interfered. The error status may indicate as some of the case below and so on:

- not capable to decode the energ Pulse Symbol;
- not able to find the eligible <SOF>;
- not able to find the eligible <EOF>;
- not able to pass the CRC check for message;

OBS got all the interference victim SSs’ report, some of SSs have the right IP address in the report and others will report the error they have met in the IBS_IPBC receiving. By checking the frame number in the report, OBS can find that these SSs have the same interference source, and got the IP address of the interference source (IBS) from the SSs that report the right IP address.

Proposed Text changes in working document:

[change the 5th bullet of the first paragraph in 15.2.1.1.3 into the following]

- All the Base Stations forming a community will have synchronized MAC frames and frame number

[change the forth paragraph of 15.2.1.1.3 into the following section]
The broadcasting procedure is unidirectional, only from the IBS to the SSs in IBS/OBS’s common coverage, and the SSs shall report all the useful information to their OBSs they registered to. The SSs that succeed in receiving the message should report the IP address of IBS and the frame number of the starting frame of IBS IPBC, the SSs failed to received the broadcasting message but got IBS IPBC like interference in the CTS should report the error status and the starting frame number of receiving the CTS interference. If the message will be forward correctly to the OBSs, By the IBS IP address reported from the SSs, the OBSs will then find the IBS in the IP network, and go further signaling using IP network. And by checking the frame number in the report, OBS need to find out if the SSs that report the error status in IBS IPBC receiving have got the same interference source, then OBS will update the database and reply to the SSs which send the error report.

[change the figure h10 to the following]

![Figure h10: CTS usage example- IBS broadcasting IP address to coexistence neighbor’s SS](image)

[change the tables in 15.2.2.4 to the following (editorial)]

<table>
<thead>
<tr>
<th>Syntax</th>
<th>Size</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>This BS information table()</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BSID</td>
<td>48bits</td>
<td></td>
</tr>
<tr>
<td>Operator ID</td>
<td>7bits</td>
<td></td>
</tr>
<tr>
<td>IP address</td>
<td>32bits IPv4 address</td>
<td></td>
</tr>
<tr>
<td>Master resource ID</td>
<td>8bits Sub-frame number</td>
<td></td>
</tr>
<tr>
<td>Negotiation status</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>CTS parameter()</td>
<td>Regulated by region/country</td>
<td></td>
</tr>
</tbody>
</table>
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

Coexistence neighboring 1bit Coexistence neighbor with this BS?
1-yes
0-no

Number of victim SSs 16bits The number of victim SSs of this CoNBR, 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
}

Number of CoNBRs 8bits m:The number of coexistence neighbors of this BS
for (i = 1; i <= m; i++) {
BSID 48bits
(Tbc.) (Tbc.) (Tbc.)
}

Profile(){
Band
PHY mode(){
Modulation
(Tbc.)
}
}

Maximum power 8bits dbm
Number of registered SS 12bits n
for (i = 1; i <= n; i++) {
SSID 48bits
(tbc.) (tbc.) (tbc.)
}
(tbc.) (tbc.) (tbc.)
}

Table h3. BS information table

<table>
<thead>
<tr>
<th>Syntax</th>
<th>Size</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS information table(){}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index</td>
<td>16bits</td>
<td></td>
</tr>
<tr>
<td>BSID</td>
<td>48bits</td>
<td></td>
</tr>
<tr>
<td>Operator ID</td>
<td>7bits</td>
<td>IPv4 address</td>
</tr>
<tr>
<td>IP address</td>
<td>32bits</td>
<td>IPv4 address</td>
</tr>
<tr>
<td>Sector ID</td>
<td>8bits</td>
<td></td>
</tr>
<tr>
<td>Master resource ID</td>
<td>8bits</td>
<td>Sub-frame number</td>
</tr>
<tr>
<td>Negotiation status</td>
<td>8bits</td>
<td>Bit0: get communication in the IP network Bit1: be registered in Bit2: registered to Bit3: done for resource sharing(if coexistence</td>
</tr>
</tbody>
</table>
Table h4. SS information table

<table>
<thead>
<tr>
<th>Syntax</th>
<th>Size</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS information table()</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index</td>
<td>16bits</td>
<td></td>
</tr>
<tr>
<td>SSID</td>
<td>48bits</td>
<td></td>
</tr>
<tr>
<td>Interference status</td>
<td>1bit</td>
<td>Interfered by coexistence neighbor? 1-yes 0-no</td>
</tr>
<tr>
<td>If (Interfered)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of source BSs</td>
<td>8bits</td>
<td>( n ): The number of interference source of coexistence neighbor</td>
</tr>
<tr>
<td>for (i = 1; i &lt;= n; i++)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BSD</td>
<td>48bits</td>
<td></td>
</tr>
<tr>
<td>IBS IPBC detected</td>
<td>1bit</td>
<td>1-yes 0-no</td>
</tr>
<tr>
<td>If (IBS IPBC detected)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IP address</td>
<td>32bits</td>
<td>If the IBS IPBC message detected, the IP address report by the SS will add here, and updating the bit above</td>
</tr>
<tr>
<td>Sector ID</td>
<td>?bits</td>
<td>Reported by SS</td>
</tr>
<tr>
<td>FSN Frame number</td>
<td>1624bits</td>
<td>Reported by SS</td>
</tr>
<tr>
<td>Error Status</td>
<td>?bits</td>
<td>0-no error</td>
</tr>
</tbody>
</table>
1 - not capable to decode the energy pulse symbol;
2 - not able to find the eligible <SOF>;
3 - not able to find the eligible <EOF>;
4 - not able to pass the CRC check for message;

RSSI 16bits 1byte RSSI mean (see also 8.2.2, 8.3.9, 8.4.11 for details)
1byte standard deviation

[change the tables in 15.2.2.4 to the following (editorial)]

**11.11 REP-REQ management message encodings**

insert the following entry in the second table of 11.11:

<table>
<thead>
<tr>
<th>Coexistence neighbor Interference Report</th>
<th>1.9</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit #0: 1-include IP address received in IPBC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bit #1: 1-include RSSI of CTS symbols (only valid when bit #0 is set to one)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bit #2: 1-include Frame number that start to receive IPBC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bit #3-7: reserved, shall be set to zero</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**11.12 REP-RSP management message encodings**

insert the following entry in the first table of 11.12:

<table>
<thead>
<tr>
<th>Coexistence neighbor Report</th>
<th>7</th>
<th>variable</th>
<th>Compound</th>
</tr>
</thead>
</table>

**11.12 REP-REQ management message encodings**

insert the following table into 11.12 as indicates:

<table>
<thead>
<tr>
<th>Coexistence neighbor Interference Report type</th>
<th>Name</th>
<th>Type</th>
<th>Length</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>all CoNBR count</td>
<td>CoNBR count</td>
<td>7.1</td>
<td>1</td>
<td>Bit #0:1-New CoNBR Discovered by IPBC</td>
</tr>
<tr>
<td>Bit #0=1</td>
<td>CoNBR IP address</td>
<td>7.2</td>
<td>4</td>
<td>4bytes IP address of CoNBR interference to this SS, 255, 255, 255, 255 indicate the fail of CRC check.</td>
</tr>
<tr>
<td>----------------</td>
<td>------------------</td>
<td>-----</td>
<td>---</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Bit #1=1</td>
<td>CoNBR IP address with RSSI</td>
<td>7.3</td>
<td>2</td>
<td>1byte RSSI mean (see also 8.2.2, 8.3.9, 8.4.11) for details) 1byte standard deviation</td>
</tr>
<tr>
<td>Bit #2=1</td>
<td>Starting Frame Serial Number of IPBC</td>
<td>7.4</td>
<td>2.3</td>
<td>Bit# 0-1024: FSN Frame number of IPBC starting frame Bit#11-15: reserved</td>
</tr>
</tbody>
</table>