IEEE P802.22
Wireless RANs

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| LB2 Recirculation Comment Resolutions |
| Date: 2014-10-23 |
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|  |  |  |  |  |

Abstract

This document provides comment resolutions for LB2 re-circulation.

R0: initial version of this document

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# I. Introduction

This document provides resolutions for comments made by Ranga Reddy during LB2 re-circulation balloting. Each section here will be referenced by a comment in balloter’s LB2 re-ciruclation ballot. For potential resolution of issues brought up in each section, editorial instructions for modifying the draft are give in ***bold and italics***, and additional text modifications are enclosed between ***<Start of Modification>*** and ***<End of Modification>*** wrappers.

# II. Modifications to Clause 10, Section 10.7 in LB3

As noted in LB2 re-circulation balloting instructions sent out by 802.22 WG chair, the LB2 re-circulation ballot comments can only refer to sections/text that are colored and marked up.

Much of the text that represents Clause 10 and Section 10.7 has the following issues:

* Most of the 10/10.7 text was new added in LB3, and was colored, but not marked-up.
* As per IEEE Std 802.22a-2014, clause 10.7 no longer exists in the standard. All the Cognitive Radio Capability primitives have been moved to section 14.2.1.4

Therefore, the proposal here is to delete the changes in 10/10.7 of LB3 and move them to the proper sections/subsection of Clause 14. The required changes are listed in this section of this document.

***Remove modifications to Clause 10.7 in the LB3 draft***

***Modify the first paragraph in Section 14.2.1.4 as follows***

***<Start of Modification>***

The BS SM occasionally sends the available channel list to its higher layers for additional channel classification. The available channel list can be presented to its higher layers to have channels classified as disallowed. The classification of an operating channel by the BS is also performed by its higher layers. The M-SAP is an interface that provides a means of exchanging information between the SM and the higher layers in the BS. Table 299 summarizes the primitives supported by the SM to pass the available channel list and to receive disallowed channel classifications and the selected operating channel/channels through the M-SAP interface. The primitives are discussed in the subclauses referenced in the table.

***<End of Modification>***

***Modify the Table 299 in IEEE Std 802.22a-2014 as follows***

***<Start of Modification>***

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Request** | **Indication** | **Confirm** |
| M-AVAIL-TV-CH-REPORT | 14.2.1.4.1 | 14.2.1.4.2 |  |
| M-DISALLOWED-TV-CHS |  |  | 14.2.1.4.3 |
| M-OPERATING-TV-CH |  |  | 14.2.1.4.4 |
| M-OPERATING-TV-CHS |  |  | 14.2.1.4.5 |

***<End of Modification>***

***Modify Table 300 as follows***

***<Start of Modification>***

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Length** | **Description** |
| Number of Available Channels | Integer | 1 | Number of channels provided |
| For(i=0;i<Number of Available Channels;i++) { |  |  |  |
| Channel Start Frequency | Integer | 8 | Channel Start Frequency in Hz |
| Channel End Frequency | Integer | 8 | Channel End Frequency in Hz |
| Maximum Allowed EIRP | Integer | 1 | Maximum allowed EIRP on channel “TV ChannelNumber”, defined on the range –64 dBm to+63.5 dBm in 0.5 dB steps. |
| } |  |  |  |
| Mode | Integer | 1 | The expected response from the higher layers:0x00 = Test0x01 = Request for disallowed channelclassification0x02 = Request for selection of operating channel0x03 = Request for selection of operating channels in multi-channel operation mode0x0~~3~~4–0xFF = Reserved |
| Timestamp | Character String | 20 Characters | Timestamp of the present request at time oftransmission. Time format defined in 14.1.5. |

***<End of Modification>***

***Modify section 14.2.1.4.1.6 as follows***

***<Start of Modification>***

The M-AVAIL-TV-CH-REPORT-REQUEST primitive is generated by the BS SM and issued to the higher layers (depending on the mode) to request either disallowed channel classification or the selection of an operating channel or selection of operating channels in multi-channel operation mode during BS initialization as described in 7.14.1.

***<End of Modification>***

***Modify section 14.2.1.4.2.7 as follows***

***<Start of Modification>***

When the SM of a CPE/BS receives the M-AVAIL-TV-CH-REPORT-INDICATION primitive, it expects, depending on the mode, the higher layers to return nothing, an M-DISALLOWED-TV-CHS-CONFIRMATION primitive with classified disallowed channels, or an M-OPERATING-TV-CH-CONFIRMATION with the selected channel or M-OPERATING-TV-CHS-CONFIRMATION with the selected channels while operating in multi-channel mode.

***<End of Modification>***

***Add a new section 14.2.1.4.5 “M-OPERATING-TV-CHS-CONFIRMATION” after 14.2.1.4.4 in IEEE Std 802.22a-2014***

***<Start of Modification>***

**14.2.1.4.5 M-OPERATING-TV-CHS-CONFIRMATION**

**14.2.1.4.5.1 Purpose**

The M-OPERATING-TV-CHS-CONFIRMATION primitive is used by the higher layers to return the selected operating channels in multi-channel operation mode on the available channel list to the SM per its request. Table 303a specifies the parameters for the M-OPERATING-TV-CHS-CONFIRMATION primitive.

**14.2.1.4.5.2 SAP Type**

M-SAP

**14.2.1.4.5.2 Operation Type**

Information Confirmation

**14.2.1.4.5.4 Destination**

BS SM

**14.2.1.4.5.5 Data**

**Table 303a – M-OPERATING-TV-CHS-CONFIRMATION parameters**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Length** | **Description** |
| Number of channels in multi-channel operation | Integer | 1 byte | Number of channels selected for multi-channel operation |
| For (i=1; i≤ Number ofChannelsinMulti-channelOperation; i++) { |  |  |  |
| Channel Start Frequency | Integer | 8 bytes | Channel start frequency in Hz |
| Channel End Frequency | Integer | 8 bytes | Channel end frequency in Hz |
| } |  |  |  |
| Timestamp | Character String | 20 characters | Copied from the timestamp in the M-AVAIL-TVCH-REPORT-REQUEST. Time format defined in 14.1.5. |

**14.2.1.4.5.6 When generated**

The M-OPERATING-TV-CHS-CONFIRMATION primitive is generated by the higher layers and issued to the BS SM to indicate the selected operating channels in multi-channel operation mode from the available channel list.

**14.2.1.4.5.7 Effect of receipt**

When the SM receives the M-OPERATING-TV-CHS-CONFIRMATION it will identify whether the response to its request for the higher layers to select the operating channels in multi-channel operation mode from the available channel list was successfully received by the higher layers, in which case, the SM will obtain the selected operating channels and the BS will continue to commence multi-channel operation on the selected channels. If the response is not successful the SM may decide to issue another request.

***<End of Modification>***

***Modify the first paragraph of 14.2.1.5 as follows***

***<Start of Modification>***

The selection of WRAN service or WRAN services by the CPE is performed by its higher layers. The M-SAP is an interface that provides a means of exchanging information between the SA and the higher layers. Table 304 summarizes the primitives supported by the SM to pass the available WRAN services list and the selected WRAN service or WRAN services through the M-SAP interface. The primitives are discussed in the subclauses referenced in the table.

***<End of Modification>***

***Modify Table 304 in IEEE Std 802.22a-2014***

***<Start of Modification>***

**Table 304 – Available WRAN services list primitives supported by the M-SAP**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Request** | **Indication** | **Confirm** |
| M-WRAN-SERVICE-REPORT | 14.2.1.5.1 |  | 14.2.1.5.3 |
| M-WRAN-SERVICE-INDICATION |  | 14.2.1.5.2 |  |
| M-WRAN-SERVICES-INDICATION |  | 14.2.1.5.4 |  |

***<End of Modification>***

***Add a new section 14.2.1.5.4 “M-WRAN-SERVICES-INDICATION” after 14.2.1.5.3 in IEEE Std 802.22a-2014***

***<Start of Modification>***

**14.2.1.5.4 M-WRAN-SERVICES-INDICATION**

**14.2.1.5.4.1 Purpose**

The M-WRAN-SERVICES-INDICATION primitive is used by the higher layers to return selected WRAN channels from the available WRAN service list to the SA per its request, when engaged in multi-channel operation mode. Table 307a specifies the parameters for the M-WRAN-SERVICES-INDICATION primitive.

**14.2.1.5.4.2 SAP Type**

M-SAP

**14.2.1.5.4.2 Operation Type**

Event Indication

**14.2.1.5.4.4 Destination**

CPE SA

**14.2.1.5.4.5 Data**

**Table 307a – M-WRAN-SERVICES-INDICATION parameters**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Length** | **Description** |
| Number of channels in multi-channel operation | Integer | 1 byte | Number of channels selected for multi-channel operation |
| For (i=1; i≤ Number ofChannelsinMulti-channelOperation; i++) { |  |  |  |
| Channel Start Frequency | Integer | 8 bytes | Channel start frequency in Hz |
| Channel End Frequency | Integer | 8 bytes | Channel end frequency in Hz |
| } |  |  |  |
| Timestamp | Character String | 20 characters | Copied from the timestamp in the M-SERVICE-REPORT-REQUEST. Time format defined in 14.1.5. |

**14.2.1.5.4.6 When generated**

The M-WRAN-SERVICES-INDICATION primitive is generated by the higher layers and issued to the CPE SA to indicate the selected channels from the available WRAN service list.

**14.2.1.5.4.7 Effect of receipt**

When the SA receives the M-WRAN-SERVICES-INDICATION it will identify whether the response to its request for the higher layers to select channels from the available WRAN service list was successfully received by the higher layers, in which case, the SA will obtain the selected channels and CPE will continue to the following steps of initialization. If the response is not successful the SA may decide to issue another query.

***<End of Modification>***

# III. MAC Management Message Transaction ID

Most, if not all of the other MAC management processes in the base standard utilitze MAC management messages that have a 16bit “Transaction ID” field. The purpose of this is to allow the BS/A-BS and CPE to map a RSP/ACK to the REQ-type message that’s it’s related to. To conform with the other MAC management messages that have been defined and that use a REQ/RSP, MSG/ACK, or similar exchange, it is suggested that we add this “Transaction ID” field to the following messages.

***Modify MAC management messages definitions in Sections 7.7.25.1, 7.7.25.2, 7.7.26, 7.7.26.1, 7.7.27.1, 7.7.27.2, 7.7.29.1, 7.7.30.1, and 7.7.30.2 to add a 16bit “Transaction ID” field***

# IV. MAC Management Message Confirmation Codes

Most, if not all MAC management process in the base standard that use some sort of –RSP/-ACK construct in a message exchange that have a 8bit “Confirmation Code” field. Given the extensive mesageing related to relay and multi-channel operations, several confirmation codes should have been added to the table in section 7.24. Currently, only one negative code for “reject-RS-not-supported-parameter-value” has been added.

The following modifications to “Confirmation code” data in 7.24 and various MAC management messages are as follows:

***Modify 4th row in Table AA1 Local Cell Update ACK as follows***

***<Start of Modification>***

|  |  |  |
| --- | --- | --- |
| Confirmation Code | ~~2~~8 bits | See 7.7.24~~00: Success~~~~01: Unknown Message~~~~10: Failed~~~~11: Reserved~~ |

***<End of Modification>***

***Modify 4th row in Table AD1 Container Message ACK format***

***<Start of Modification>***

|  |  |  |
| --- | --- | --- |
| Confirmation Code | ~~2~~8 bits | See 7.7.24~~00: Success~~~~01: Unknown Message~~~~10: Failed~~~~11: Reserved~~ |

***<End of Modification>***

***Modify 3rd row in Table AH1 DTT-RSP Information Element***

***<Start of Modification>***

|  |  |  |  |
| --- | --- | --- | --- |
| ~~Status~~Confirmation Code | 2 | ~~2~~8 bits | See 7.7.24~~0: not allowed~~~~1: success~~ |

***<End of Modification>***

***Modify 2nd row in Table AL1 DTT-CFM Information Element***

***<Start of Modification>***

|  |  |  |  |
| --- | --- | --- | --- |
| Confirmation Code | 1 | ~~6~~8 bits | See 7.7.24~~0: Not allowed to transit~~~~1: need to retest~~~~2: allowed~~ |

***<End of Modification>***

***Modify the last 2 rows in Table 173 in 7.7.24 to cover for these new confirmation conditions as follows***

***<Start of Modification>***

|  |  |
| --- | --- |
| 0x13 | reject-~~RS~~A-CPE-not-supported-parameter-value |
| 0x14~~-0xFF~~ | ~~Reserved~~reject-unknown-sid |
| 0x15 | reject-invalid-container-pdu-length |
| 0x16 | reject-invalid-container-pdu-type |
| 0x17 | reject-dtt-not-allowed |
| 0x18 | reject-dtt-rpt-not-allowed-to-transmit |
| 0x19 | reject-dtt-rpt-need-to-retest |
| 0x20 | reject-failed-cam-stp |
| 0x21 | reject-failed-cam-swh |
| 0x22-0xFF | Reserved |

***<End of Modification>***

# V. Encapuslated PDU length in CON-MSG

In CON-MSG, we can encapsulate MPDUs between exchanged between A-BS and S-CPE through A-CPEs. Given the current definition of the CON-MSG, one must parse the encapsulated MPDU and read the PDU length out of the MPDUs GMH to get the MPDU length. When considering the possibility of packing/fragmentation by the distributed A-CPE in US/DS, having to parse each MPDU to get it’s length will become a tedious and time consuming process. Suggestion is to add a PDU length field to the CON-MSG.

***Modify table AC1 Container message format, to add a “MAC PDU length” field/row after the “MAC PDU Type” field***

# VI. CBP MAC PDU for PHY-OM2

In the current draft, modifications to CBP authentication processes were updated to make refernces to A-BS ID, that is to be included in CBP authentication. These changes are listed in section 8.6.2.4.1, pg 223, lines 13/17/26/41/46 of the current draft.

In the legacy/base standard, the BS ID and other parameters in the CBP MAC PDU, are carried in the SCH data that is copied into the CBP MAC PDU header that is defined in Table 8 of the base standard. In the current draft, the A-BS ID comes from the FCH PHY-OM2, while most of the other parameters come from the ExtFCH.

The “SCH data” field of Table 8 only accommodates the legacy structure of the coexistence parameters, and doesn’t accommodate how this data is spread over the FCH PHY-OM2 and/or ExtFCH. No specific resolution is provided in this section.

We can go one of two ways to resolve this issue:

* ***Modify “SCH Data” field of Table 8 to accommodate the relevant data as structured in SCH, FCH PHY-OM2, and/or FCH PHY-OM2+ExtFCH.***

***--or--***

* ***Add a second/new CBP MAC PDU format, that is exclusive for use by A-BS, A-CPE, and newer S-CPEs that reflects the relevant data that is spread over FCH PHY-OM2 and ExtFCH***

# VII. Security issues relate to multi-channel operation

In 22-14/120r0, a couple of text modifications are proposed to address security issues related to multi-channel operation. The security issues related to multi-channel operation were originally laid out in section 3 of 22-14/82r0.

In slide 3 and 4 of 22-14/120r0, the following statement is made to address issues 3.1/3.2 from 22-14/82r0:

 Add the following sentence in the 7.24:

**Multi-channel operation and Multi-hop relay operation are mutually exclusive.**

Upon reviewing the current draft, no statement to the exclusivity between relay and multi-channel operation occurs in the text for section 7.24 of the current draft.

***Add the statements suggested in slides 3, 4 of 22-14/120r0 to the text in 7.24 of the current draft***

There were other security issues related to multi-channel operation, brought up in 22-14/82r0, that were not addressed in 22-14/120r0. Issues 3.3 and 3.4 are interdependent on each other. Copied from 22-14/82r0, 3.3 and 3.4 are listed below:

3.3: Define process by which aggregation type is setup is fixed, or statically managed for a period of time. This implies that only one aggregation type can be engaged in the MR-BS cell at a given time.

3.4: Updated text in 8.4.2.1.1 in 802.22-2011 regarding how PN # is to be treated.

As indicated by the Channel Aggregation subheader, there are two types of CA operation, “Transmit Diversity” and “Bulk Transmit Mode”. However, nowhere in section 7.24 is there a description of how either mode works, nor how the subheader is manipulated. So, regarding issue 3.3, the following recommendations are to:

***Add text in section 7.24 to define how channel aggregation modes are configured when CA is enabled***

***Add/modify text in section 7.24 to clarify the difference between trasnsmitting in “Transmit Diversity” or “Bulk Transmission Mode” when CA is enable***

Knowing how these two modes work important regarding how the A-BS/S-CPE manipulate and process the PN counter value attached to MAC PDUs. The PN counter is use to authenticate/decrypt MAC PDUs that are sent between the A-BS and S-CPE, when security is enabled. On either side of the connection (e.g. US/DS) the device monitors the PN values of MAC PDUs its received and decrypting. If those values fall outside of the PN window, the CPE will reject the MPDU.

This is why its critical to know how MPDUs are transmitted given the channel aggregation, if we don’t know this, we can’t properly define how the PN value is treated on MPDUs exchanged during multi-channel operation for S-CPEs that have security enabled. Note, that once the technical problems elated to supporting issue 3.3 form 22-14/82r0 are enable it will be easier to follow through on solving issue 3.4 from 22-14/82r0, which requires the following:

***Add/modify text in section 8.4.2.1.1/8.4.2.3 to clarify how the PN values of MPDUs are to be treated given whether “Transmit Diversity” or “Bulk Transmission Mode” is enabled for multi-channel operation***

The remaining multi-cahnnel/security issues from 22-14/82r0, e.g. 3.5 and 3.6, are reproduced below:

3.5: Need clarification on what constitutes a “ID” for a BS/CPE-CHU. If each CHU needs to be uniquely identified, and that the required identity includes MAC Address/FCC ID/Serial #, then any CPEs engaged in channel aggregation will require to only be authenticated and no protection for user data will be afforded. This is still problematic, because each CPE-CHU would required its own credential, given the design of credentials in the existing base standard. A new authentication credential could be design, specific to channel aggregation operations. This isn’t desirable because other systems like Wave2 WiMAX or LTE-Advanced accommodate channel aggregation without these requirements.

3.6: Clarification on the ID type for each CHU with regard to the following procedures as defined int the base-standard: registration (REG-REQ/RSP), TVWS databse device registration, and TVWS channel querying have to also be taken into consideration.

No clarification has been received regarding how BS-/CPE-CHUs are uniquely identified. To summarize, understanding this affects how CPE authentication is executed, how CPE credentials are managed, and how CPE security associations are maintained. Having said that, once CHU identification has been clarified, the following may need to be done.

***Add/modify text in Section 8.2 regarding authentication, security setup, and security association management***