Multiple BSSID (MBSSID) Application Note

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Document History

Version	Date	Description	Note
1.0	2019.10.4	Initial version for MT7621+MT7915D mtk-openwrt-lede-v4.1.1.0-20190611-4cdf0725-v1.tar.xz MT7621-MT7915-V7000-MPv7.0-2019-1004	

Multiple BSSID (MBSSID)

- **Introduction**

  The Multiple BSSID (MBSSID) function is a feature providing additional virtual WLANs which look like real WLANs to users.

  Its common application is to create one Main and several Guest Networks simultaneously.
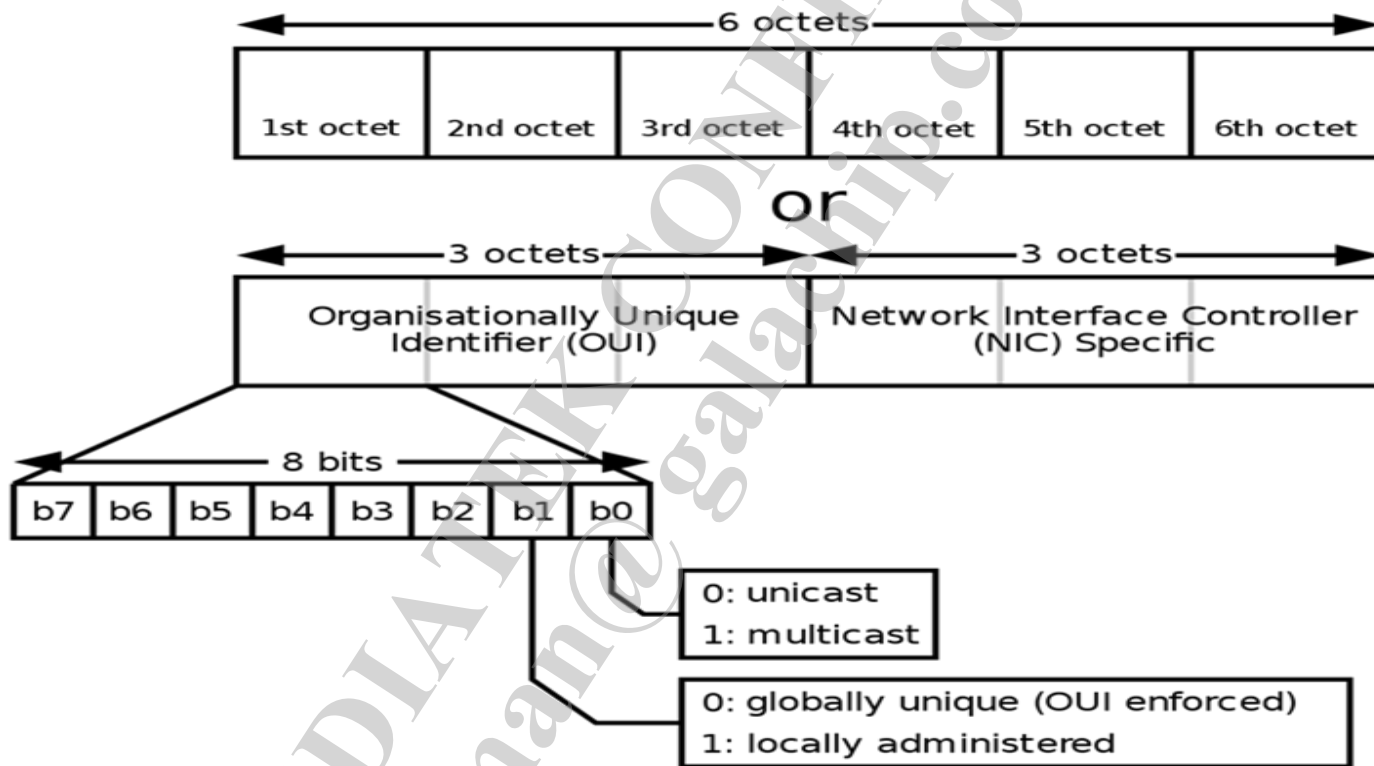
- **The MT7915 Rule of generating MAC Address in MBSS**
  - Rule1: MTK Proprietary Mac Address Extension
  - Rule2: Follow WFA 802.11v Spec.

- **Important Note**
  - Profile (.dat) has the highest priority even the rule of MAC Address in MBSS.
    - Ex: MacAddress, MacAddress1~MacAddress15, ApCliMacAddress

MAC Address Format

Estimated MBSS Mac Address – Rule 1 (MTK proprietary Mac Address Extension)

- From mainly Mac address (ra0) to other Mac address
- Set **local bit to 1**
- From MBSS number(=Band 0 + Band 1) to calculate bit mask range, and use **3rd byte**
- Example:

| b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |

  - MBSS number is 3 (<= 2^2, bit mask:2), using b5, b4
  - MBSS number is 8 (<= 2^3, bit mask:3), using b6, b5, b4
  - MBSS number is 15 (<= 2^4, bit mask:4), using b7, b6, b5, b4
  - MBSS number is 18 (<= 2^5, bit mask:5), using b0, b7, b6, b5, b4

BSS Idx	Phy Mode	IF_addr Group [max:16]
0	G/gN/ax_24g	00-aa-76-31-79-16
1	G/gN/ax_24g	02-aa-76-11-79-16
2	G/gN/ax_24g	02-aa-76-21-79-16
3	G/gN/ax_24g	02-aa-76-31-79-16
4	G/gN/ax_24g	02-aa-76-41-79-16
5	G/gN/ax_24g	02-aa-76-51-79-16
6	G/gN/ax_24g	02-aa-76-61-79-16
7	G/gN/ax_24g	02-aa-76-71-79-16
8	A/aN/AC/ax_5g	02-aa-76-81-79-16
9	A/aN/AC/ax_5g	02-aa-76-91-79-16
10	A/aN/AC/ax_5g	02-aa-76-a1-79-16
11	A/aN/AC/ax_5g	02-aa-76-b1-79-16
12	A/aN/AC/ax_5g	02-aa-76-c1-79-16
13	A/aN/AC/ax_5g	02-aa-76-d1-79-16
14	A/aN/AC/ax_5g	02-aa-76-e1-79-16
15	A/aN/AC/ax_5g	02-aa-76-f1-79-16

Estimated MBSS Mac Address – Rule 2 (WFA 802.11v Spec.)

- Spec. 9.4.2.46 Multiple BSSID element

The Max BSSID Indicator field contains a value assigned to n, where 2^n is the maximum number of BSSIDs in the multiple BSSID set, including the reference BSSID (see 11.11.14). The actual number of BSSIDs in the multiple BSSID set is not explicitly signaled. The BSSID(i) value corresponding to the ith BSSID in the multiple BSSID set is derived from a reference BSSID (REF_BSSID) as follows:

$$BSSID(i) = BSSID\_A \mid BSSID\_B$$

where

BSSID_A is a BSSID with $(48-n)$ MSBs equal to the $(48-n)$ MSBs of the REF_BSSID and n LSBs equal to 0

BSSID_B is a BSSID with $(48-n)$ MSBs equal to 0 and n LSBs equal to $[(n \text{ LSBs of REF\_BSSID}) + i] \bmod 2^n$

When the Multiple BSSID element is transmitted in a Beacon, DMG Beacon, or Probe Response frame, the reference BSSID is the BSSID of the frame. More than one Multiple BSSID element can be included in a Beacon or DMG Beacon frame. The AP or DMG STA determines the number of Multiple BSSID elements. The AP or DMG STA does not fragment a nontransmitted BSSID profile subelement for a single BSSID across two Multiple BSSID elements unless the length of the nontransmitted BSSID profile subelement exceeds 255 octets. When the Multiple BSSID element is transmitted as a subelement in a Neighbor Report element, the reference BSSID is the BSSID field in the Neighbor Report element.

Estimated MBSS Mac Address – Rule 2 (WFA 802.11v Spec.)

- From mainly Mac address (ra0) to other Mac address
- Band 1 Mac Address
  - Set local bit to 1
- Example: Band 0 set 4 MBSS (= 2 bit mask), and Band 1 set 12 MBSS (= 4 bit mask)

BSS Idx	Phy Mode	IF_addr Group [max:16]	
0	G/gN/ax_24g	00-aa-76-31-79-16	Band 0
1	G/gN/ax_24g	00-aa-76-31-79-17	
2	G/gN/ax_24g	00-aa-76-31-79-14	
3	G/gN/ax_24g	00-aa-76-31-79-15	
4	A/aN/AC/ax_5g	02-aa-76-31-79-16	Band 1
5	A/aN/AC/ax_5g	02-aa-76-31-79-17	
6	A/aN/AC/ax_5g	02-aa-76-31-79-18	
7	A/aN/AC/ax_5g	02-aa-76-31-79-19	
8	A/aN/AC/ax_5g	02-aa-76-31-79-1a	
9	A/aN/AC/ax_5g	02-aa-76-31-79-1b	
10	A/aN/AC/ax_5g	02-aa-76-31-79-1c	
11	A/aN/AC/ax_5g	02-aa-76-31-79-1d	
12	A/aN/AC/ax_5g	02-aa-76-31-79-1e	
13	A/aN/AC/ax_5g	02-aa-76-31-79-1f	
14	A/aN/AC/ax_5g	02-aa-76-31-79-10	
15	A/aN/AC/ax_5g	02-aa-76-31-79-11	

Customize MAC Address from Profile

- Profile setting have the highest priority
- Example:
  - Mainly Mac address (ra0) = 00-aa-76-31-79-16 (from EEPROM & Efuse)
  - Enable 8 MBSS (2^3= 3 bit bit mask)

Adopt WFA 802.11v Spec Rule

Index	Band 0 Ra0 MAC	Band 0 MBSS MAC
0	00-aa-76-31-79-11	
1		00-aa-76-31-79-1**2**
2		00-aa-76-31-79-1**3**
3		00-aa-76-31-79-1**4**
4		00-aa-76-31-79-1**5**
5		00-aa-76-31-79-1**6**
6		00-aa-76-31-79-1**7**
7		00-aa-76-31-79-1**0**

Profile (.dat)

```
MacAddress=
MacAddress1=
MacAddress2=
MacAddress3=00-11-22-33-44-55
MacAddress4=
MacAddress5=
MacAddress6=00-aa-bb-cc-dd-ee
MacAddress7=
```

Final Table

Index	Band 0 Ra0 MAC	Band 0 MBSS MAC
0	00-aa-76-31-79-11	
1		00-aa-76-31-79-1**2**
2		00-aa-76-31-79-1**3**
3		~~00-aa-76-31-79-1**4**~~ **00-11-22-33-44-55**
4		00-aa-76-31-79-1**5**
5		00-aa-76-31-79-1**6**
6		~~00-aa-76-31-79-1**7**~~ **00-aa-bb-cc-dd-ee**
7		00-aa-76-31-79-1**0**

Normal Startup – Config/Profile

- **Profile location**
    a. /etc/wireless/mediatek/mt7915.dbdc.b0.dat (for BAND0)
    b. /etc/wireless/mediatek/mt7915.dbdc.b1.dat (for BAND1)

- **Key parameters in profile (mt7915.dbdc.bX.dat)**
    a. **BssidNum=4**
        - This is pre-band setting and the maximum is 16 in each band
    b. **SSID1/SSID2…./SSID4**
        - This is pre-BSS setting, the number of SSIDs shall be same with BssidNum
    c. **Dot11vMbssid=0;0;0;0**
        - This is pre-BSS setting, separate by ";", shall be same with BssidNum
        - 0: MTK proprietary rule (default)
        - 1: WFA 802.11v Spec, indicate it's Non-Transmitted-BSSID

    > **Note : If one of the Dot11vMbssid is enabled, the whole MBSSID will follow the 802.11v Spec.**

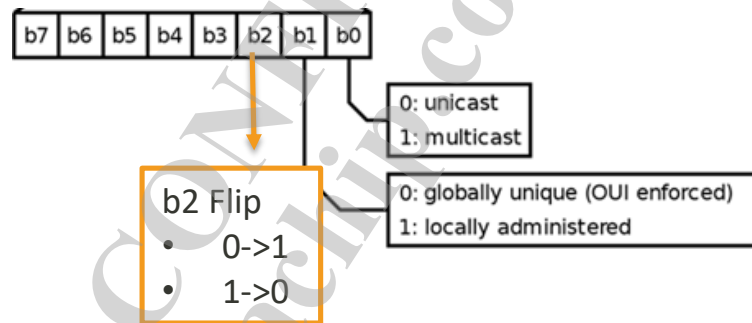- **Set customize MAC address "MacAddress1~MacAddress15" from profile**

    > **Note: Profile setting have the highest priority**
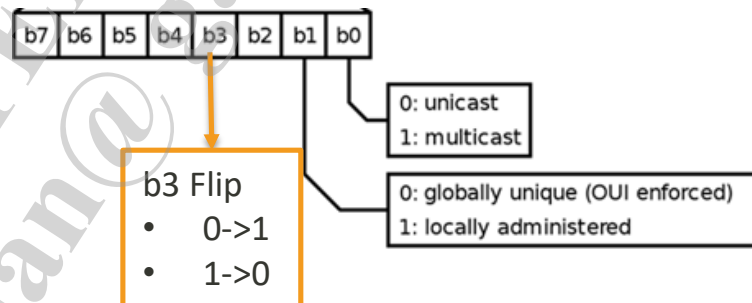
Important Note

- Only **<u>MTK proprietary rule</u>** can meet different security mode between multiple BSS.

- Key parameter in profile

    - AuthMode=OPEN;OPEN;OPEN;WPA2PSK

        - This is pre-BSS setting, separate by ";", shall be same with BssidNum

    - WPAPSK<x> should be set if AuthMode != OPEN

Estimated Apcli Mac Address (MTK Proprietary Rule)

- Band 0 apcli
  - Set local bit to 1
  - Bit 2 flip

| b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |

0: unicast
1: multicast

b2 Flip
- 0->1
- 1->0

0: globally unique (OUI enforced)
1: locally administered

- Band 1 apcli
  - Set local bit to 1
  - Bit 3 flip

| b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |

0: unicast
1: multicast

b3 Flip
- 0->1
- 1->0

0: globally unique (OUI enforced)
1: locally administered

Example 1: MBSS & Apcli

- Mainly Mac Address (ra0)
  - 1st priority: Profile:MacAddress parameter
  - 2st priority: EEPROM & Efuse 0x04~0x09
- Adopt WFA 802.11v Spec Rule

Band 0 Ra0 MAC	Band 0 MBSS MAC	Band 0 Apcli MAC	Band 1 Rax0 MAC	Band 1 MBSS MAC	Band 1 Apcli MAC
Example 1. (b2,b3)=(0,0) 00-aa-76-31-79-16	00-aa-76-31-79-**XX**	06-aa-76-31-79-16 (b1=1, b2: 0->1)	02-aa-76-31-79-16 (b1=1)	02-aa-76-31-79-**XX** (b1=1)	0a-aa-76-31-79-16 (b1=1, b3: 0->1)
Example 2. (b2,b3)=(1,1) 0c-aa-76-31-79-16	0c-aa-76-31-79-**XX**	0a-aa-76-31-79-16 (b1=1, b2: 1->0)	0e-aa-76-31-79-16 (b1=1)	0e-aa-76-31-79-**XX** (b1=1)	06-aa-76-31-79-16 (b1=1, b3: 1->0)
Example 3. (b2,b3)=(0,1) 08-aa-76-31-79-16	08-aa-76-31-79-**XX**	0e-aa-76-31-79-16 (b1=1, b2: 0->1)	0a-aa-76-31-79-16 (b1=1)	0a-aa-76-31-79-**XX** (b1=1)	02-aa-76-31-79-16 (b1=1, b3: 0->1)
Example 4. (b2,b3)=(1,0) 04-aa-76-31-79-16	04-aa-76-31-79-**XX**	02-aa-76-31-79-16 (b1=1, b2: 1->0)	06-aa-76-31-79-16 (b1=1)	06-aa-76-31-79-**XX** (b1=1)	0e-aa-76-31-79-16 (b1=1, b3: 1->0)

Verification

```
root@LEDE:/# iwpriv ra0 show  mbss
[   56.168047]
[   56.168047] BssidNum=8
[   56.172092] [B0]: BssidNum= 4, max_bssid_indicator=2, bitmap=0x0000000f, trans_bss_idx=0
[   56.180286] [B1]: BssidNum= 4, max_bssid_indicator=2, bitmap=0x0000000f, trans_bss_idx=4
[   56.188477]
[   56.188477] BSS Idx      Phy Mode        IF_addr            grp [max:16]
[   56.195020] 0       G/gN/ax_24g       00-0c-43-49-76-f2    0    (ra0)  (11vT)
[   56.201059] 1       G/gN/ax_24g       00-0c-43-49-76-f3    1    (ra1)  (11vNT)
[   56.207161] 2       G/gN/ax_24g       00-0c-43-49-76-f0    2    (ra2)  (11vNT)
[   56.213284] 3       G/gN/ax_24g       00-0c-43-49-76-f1    3    (ra3)  (11vNT)
[   56.219412] 4       A/aN/AC/ax_5g      02-0c-43-49-76-f2    0    (rax0) (11vT)
[   56.225514] 5       A/aN/AC/ax_5g      02-0c-43-49-76-f3    1    (rax1) (11vNT)
[   56.231725] 6       A/aN/AC/ax_5g      02-0c-43-49-76-f0    2    (rax2) (11vNT)
[   56.237914] 7       A/aN/AC/ax_5g      02-0c-43-49-76-f1    3    (rax3) (11vNT)
```

Transmitted

Non-Transmitted

everyday genius