OBU-201U Quick Start Guide

HW Version: 0B
U-Boot: 1.3.3
SDK: 4.11.0-sc
Stack: US, 914

V1.0

Table of Contents

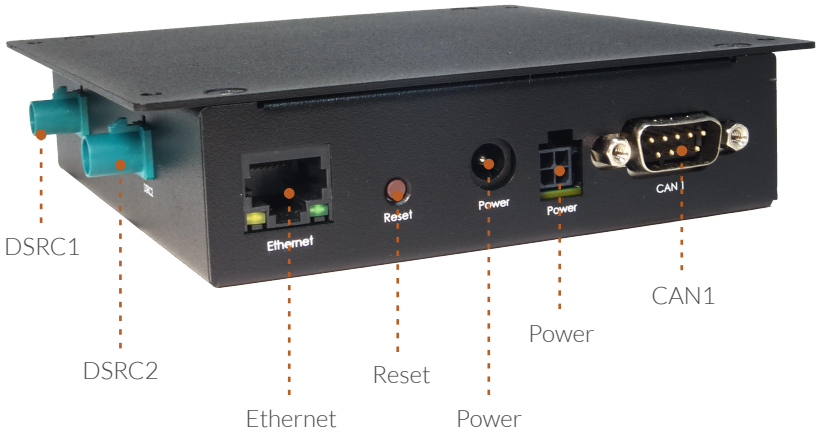
Abbreviations

DSRC	Dedicated Short Range Communication
CCH	Control Channel
SCH	Service Channel
PSC	Provider Service Context
PSID	Provider Service Identifier
WAVE	Wireless Access in Vehicular Environments
WSA	WAVE Service Advertisements
WSMP	WAVE Short Message Protocol
WME	WAVE Management Entity
BSM	Basic Safety Message
SPAT	Signal Phase And Timing Message
MAP	Map Data
TIM	Traveler Information Message
RSA	Road Side Alert
RTCM	Radio Technical Commission For Maritime Services
CSR	Common Safety Request Message

NMEA	National Marine Electronics Association
ICA	Intersection Collision Alert Message
EVA	Emergency Vehicle Alert Message
PDM	Probe Data Message
SSM	Signal Status Message
SRM	Signal Request Message
PVD	Probe Vehicle Data Message
PSM	Pedestrian Safety Message

1. OBU at a Glance

Front View:



Rear View:

Accessories

Following accessories are included with OBU-201:

1. Round jack power adapter:

2. 4-pin automotive power connector:

3. GPS antenna:

4. DSRC antennas:

2. Get Started – Environment Setup

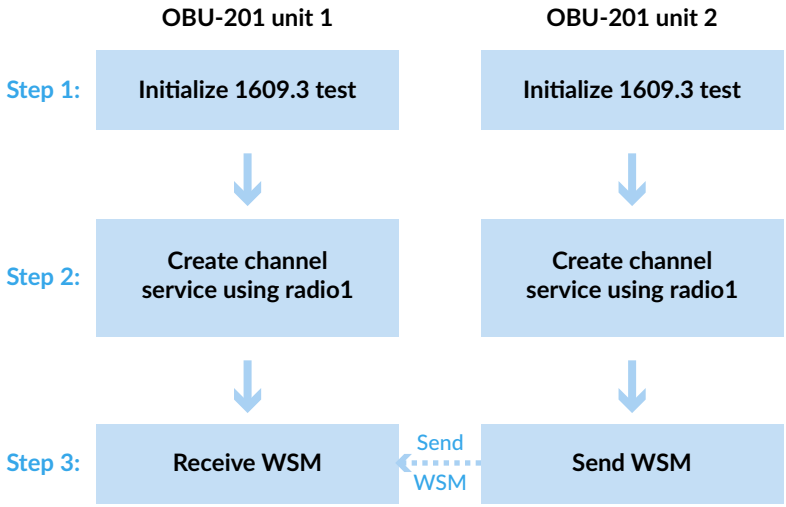
Prerequisites:

1. Terminal emulator program (Example: PuTTy, Speed: 115200 bits per second)
2. PL2303 Prolific Driver
3. Connect the key components (DSRC antenna, GPS antenna, USB to serial adapter and power adapter) as shown in figure below.

Note: For application flexibility in lab and vehicle, two kinds of power cables are provided. One is the round jack power adapter and the other one is 4-pin automotive power connector. It is recommended to use any ONE of the power cables at one time.

3. WSM – Tx & Rx Demo (Using Channel & WSM services)

Overview:



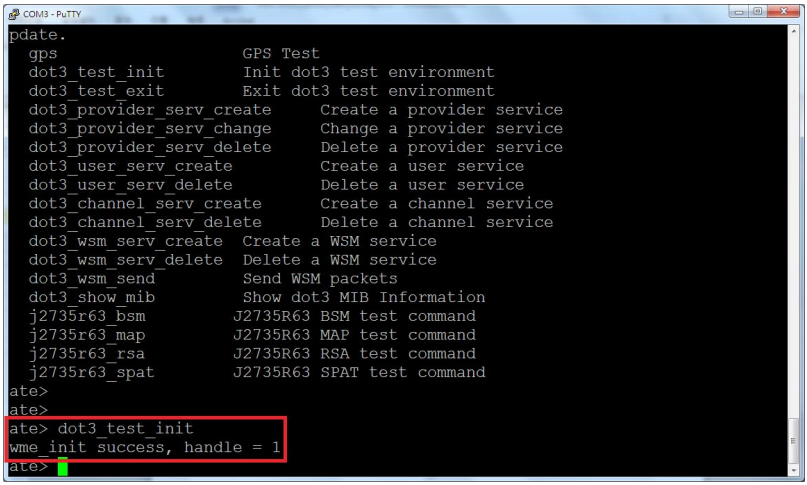
Note: This demo requires configuring two OBU-201 units. Only radio number 1 is used. For detailed command description, check section 8 (Appendix).

Step 1: On OBU-201 unit 1, initialize 1609.3 test environment

Example: *dot3_test_init*

Description: This command will get a handler id from 1609.3 to register other services such as: Provider, User, Channel, WSM

Sample snapshot:



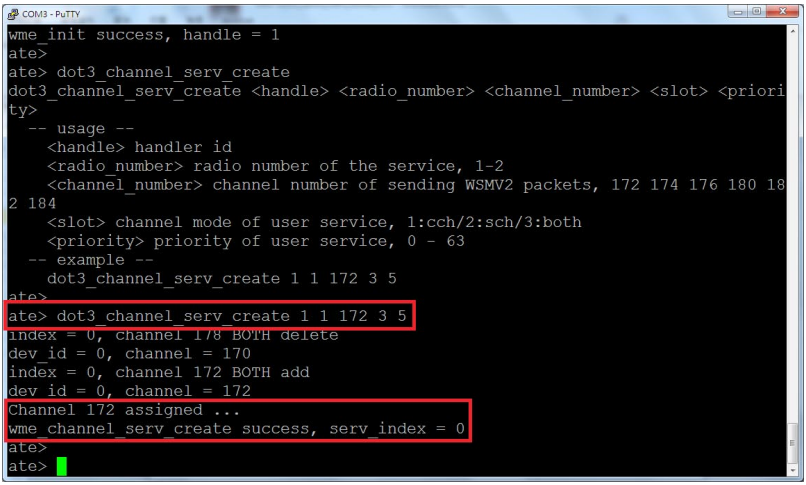
Similarly, on OBU-201 unit 2, initialize 1609.3 test environment (as shown in step 1).

Step 2: On OBU-201 unit 1, create a channel service to receive WSM

Example: *dot3_channel_serv_create 1 1 172 3 5*

Description: This command creates a channel service on Channel 172 using radio number 1.

Sample snapshot:



Similarly, on OBU-201 unit 2, create a channel service to send WSM (as shown in step 2).

Note: A channel service can be deleted using <handle> and <serv_index>.

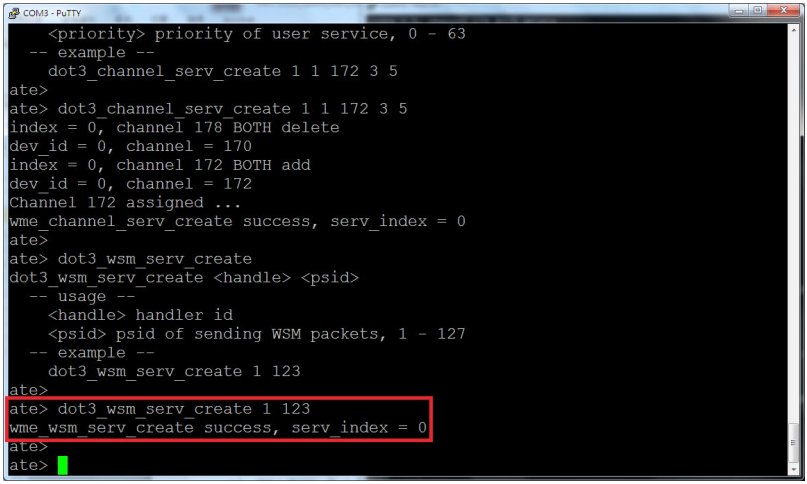
Example: *dot3_channel_serv_delete 1 0*

Step 3: On OBU-201 unit 1, create a WSM service

Example: *dot3_wsm_serv_create 1 123*

Description: This command cwill receive all WSM packets with PSID 123

Sample snapshot:



Note: A WSM service can also be deleted using <handle> and <serv_index>.

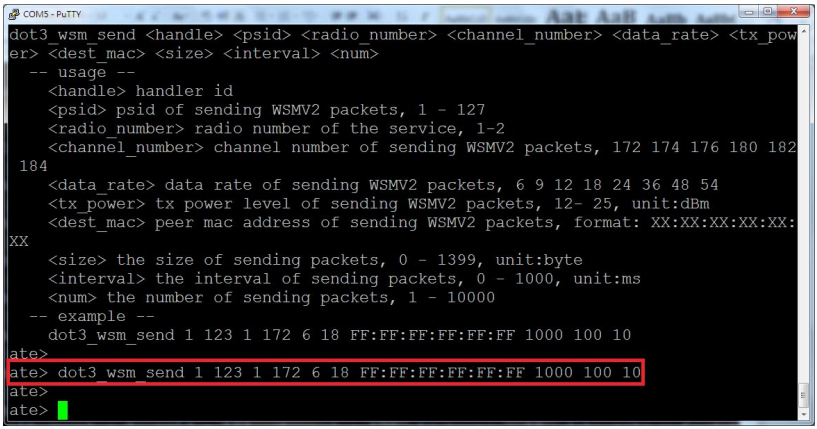
Example: *dot3_wsm_serv_delete 1 0*

On OBU-201 unit 2, send WSM packets using radio number 1

Example: dot3_wsm_send 1 123 1 172 6 18 FF:FF:FF:FF:FF:FF 1000 100 10

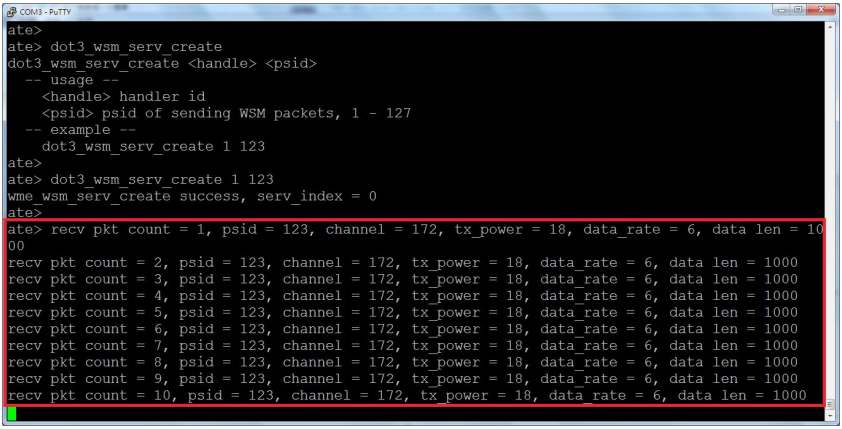
Description: This command sends 10 WSM packets with PSID 123 on Channel 172 using radio number 1.

Sample snapshot:



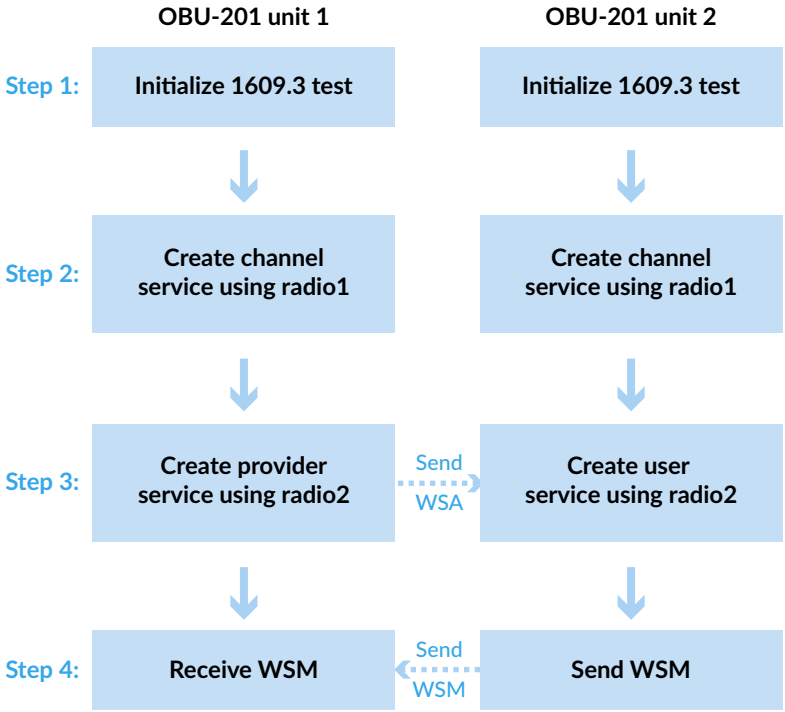
After execution of above steps, 10 WSM packets are successfully received on OBU-201 unit 1, as shown below

(*recv pkt count = 10*):



4. WSM – Tx & Rx Demo (Using Channel, Provider, User, WSM services)

Overview:



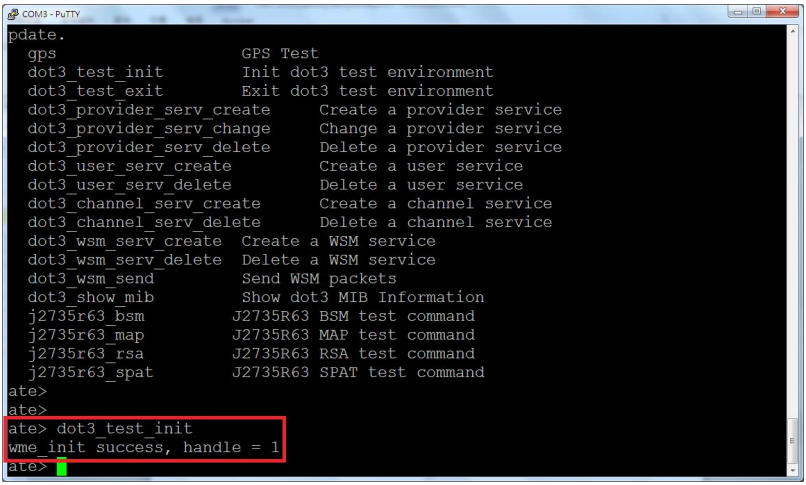
Note: This demo requires configuring two OBU-201 units. Both radio number 1 and 2 are used. For detailed command description, check section 8 (Appendix).

Step 1: On OBU-201 unit 1, initialize 1609.3 test environment

Example: *dot3_test_init*

Description: This command will get a handler id from 1609.3 to register other services such as: Provider, User, Channel, WSM

Sample snapshot:



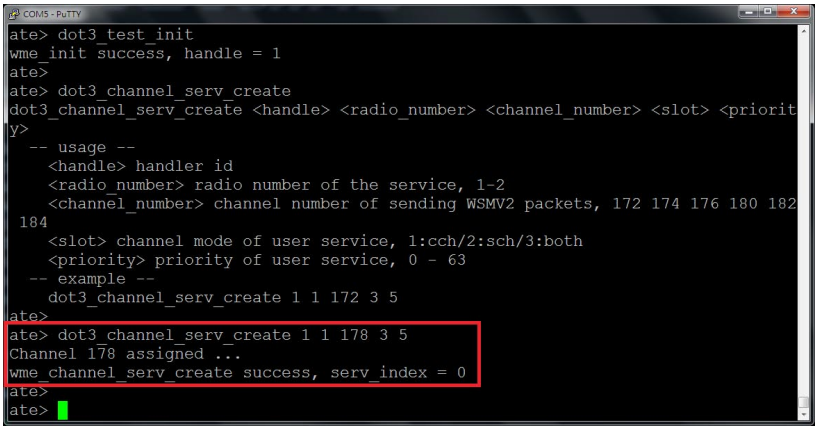
Similarly, on OBU-201 unit 2, initialize 1609.3 test environment (as shown in step 1).

Step 2: On OBU-201 unit 1, create a channel service to send WSA

Example: *dot3_channel_serv_create 1 1 178 3 5*

Description: This command creates a channel service on Channel 178 using radio number 1.

Sample snapshot:



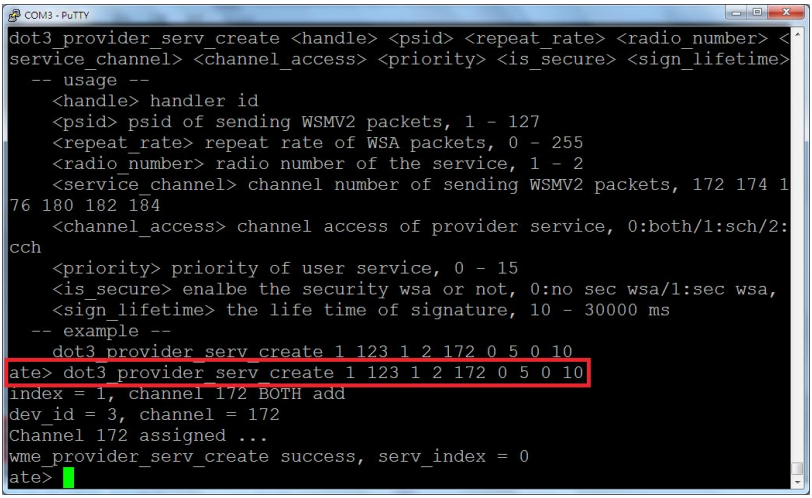
On OBU-201 unit 2, create a channel service to receive WSA (as shown in step 2).

Step 3: On OBU-201 unit 1, create a Provider service to send WSA

Example: *dot3_provider_serv_create 1 123 1 2 172 0 5 0 10*

Description: This command will send WSA on channel 178 and configure channel 172 to receive WSM using radio number 2.

Sample snapshot:

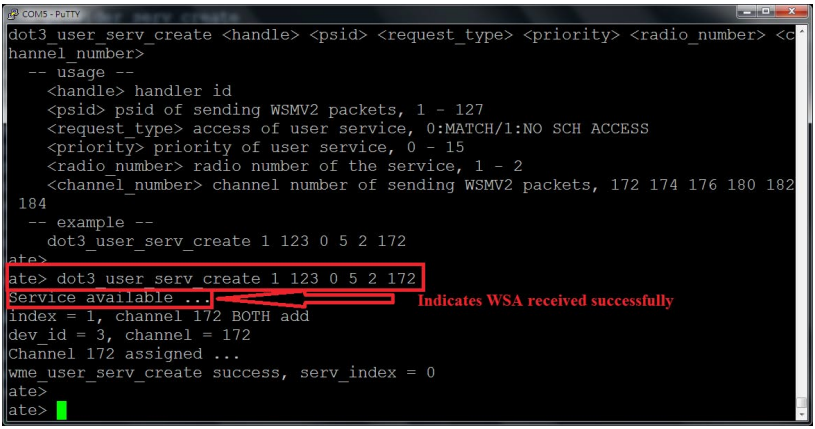


On OBU-201 unit 2, create a User service to receive WSA

Example: *dot3_user_serv_create 1 123 0 5 2 172*

Description: This command will receive WSA (if PSID & channel number match) and configure channel 172 to send WSM using radio number 2.

Sample snapshot:

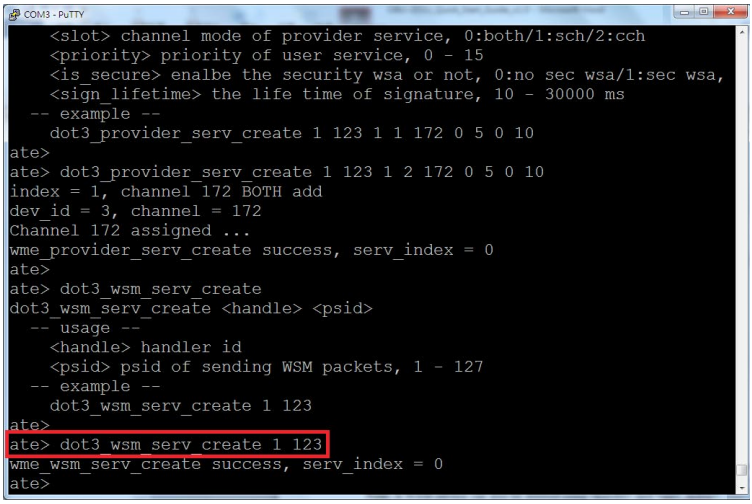


Step 4: On OBU-201 unit 1, create a WSM service

Example: *dot3_wsm_serv_create 1 123*

Description: This command will receive all WSM packets with PSID 123

Sample snapshot:

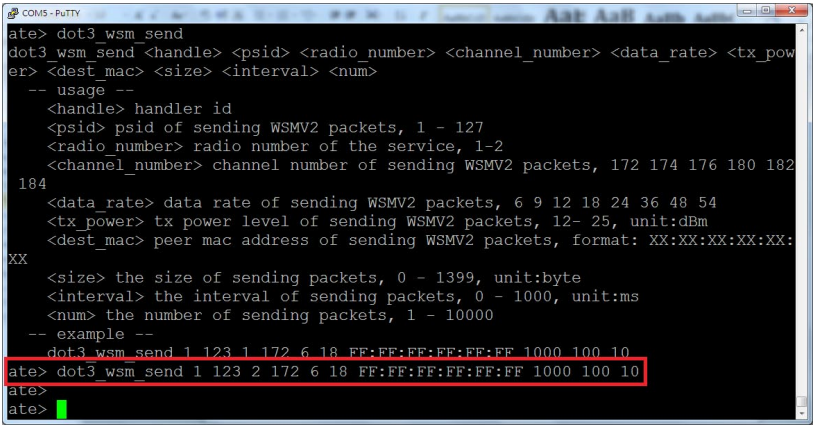


On OBU-201 unit 2, send WSM packets using radio number 2

Example: *dot3_wsm_send 1 123 2 172 6 18 FF:FF:FF:FF:FF:FF 1000 100 10*

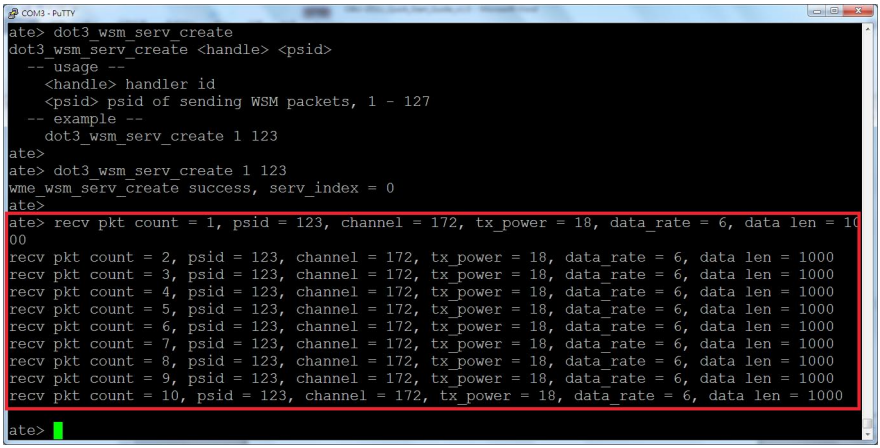
Description: This command sends 10 WSM packets with PSID 123 on Channel 172 using radio number 2.

Sample snapshot:



After execution of above steps, 10 WSM packets are successfully received on OBU-201 unit 1, as shown below

(*recv pkt count = 10*):



5. Checking MIB status

To retrieve MIB setting, we have the following primitive:

dot3_show_mib

Illustration:

On OBU, initialize 1609.3 test and create a channel service

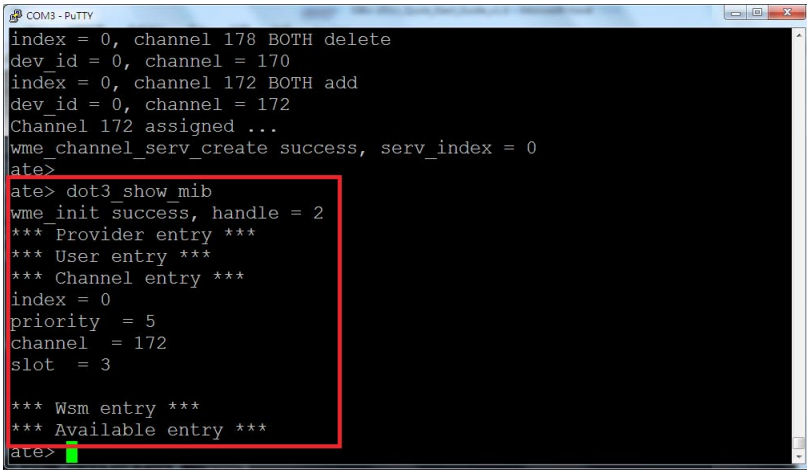
```
ate> dot3_test_init

wme_init success, handle = 1

ate> dot3_channel_serv_create 1 1 172 3 5

index = 0, channel 178 BOTH delete

dev_id = 0, channel = 170

index = 0, channel 172 BOTH add

dev_id = 0, channel = 172

Channel 172 assigned ...

wme_channel_serv_create success, serv_index = 0

ate>
```

View MIB status:

```
ate> dot3_show_mib

wme_init success, handle = 2

*** Provider entry ***

*** User entry ***

*** Channel entry ***

index = 0

priority  = 5

channel  = 172

slot  = 3


*** Wsm entry ***

*** Available entry ***

ate>
```

As shown above, we can see a Channel entry in MIB.

Sample snapshot:



6. BSM – Tx & Rx Demo

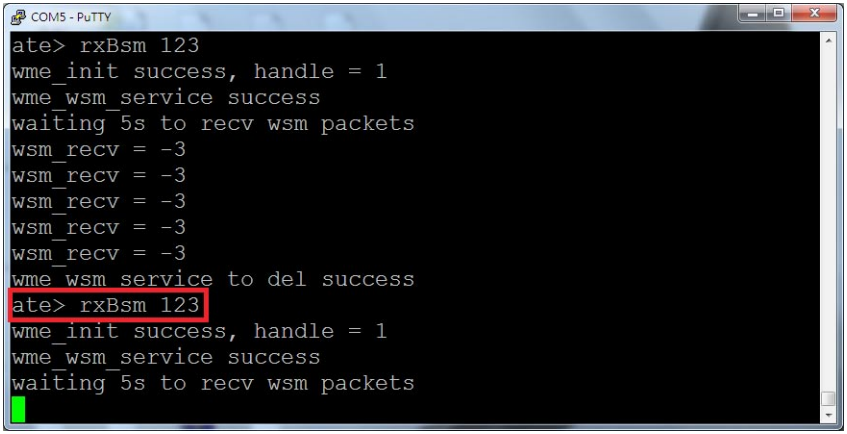
Note: This demo requires configuring two OBU-201 units. For detailed command description, check section 8 (Appendix) and for acronyms used, check abbreviations on Page 2.

Step 1: On OBU-201 unit 1, receive BSM packets

Example: *`rxBsm 123`*

Description: This command will start to receive BSM packets with matching PSID (for 5 seconds)

Sample snapshot:

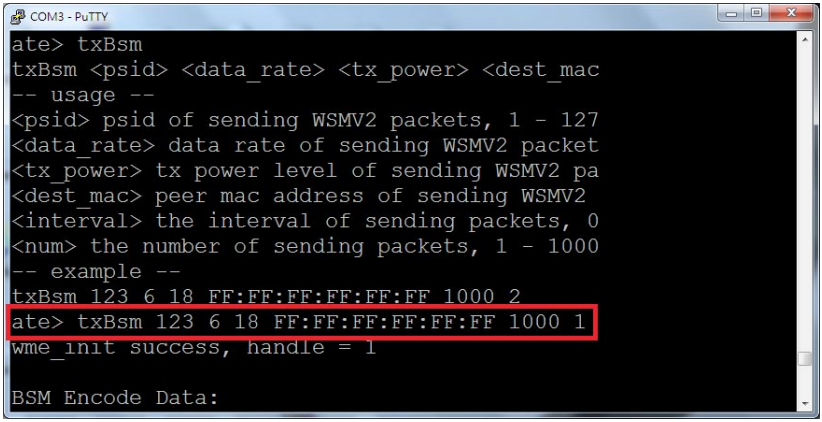


Step 2: On OBU-201 unit 2, send BSM packets

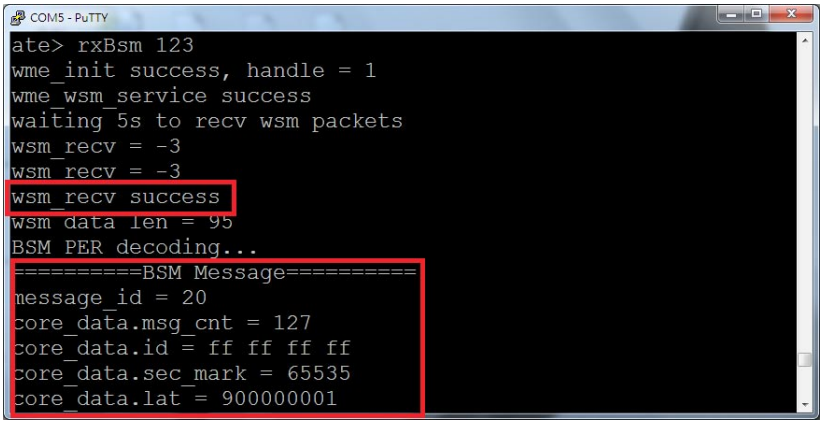
Example: *txBsm 123 6 18 FF:FF:FF:FF:FF:FF 1000 1*

Description: This command will send 1 BSM packet with PSID 123

Sample snapshot:



After execution of step 1 and step 2, we have successfully received BSM packet:



Similarly, we have all the other J2735 message sets following the same syntax, viz.:

SPAT/MAP/TIM/RSA/RTCM/CSR/NMEA/ICA/EVA/PDM/SSM/SRM/PVD/PSM.

7. Firmware Upgrade

1. Setup a serial connection to the OBU-201 unit
2. Ensure that the unit is connected to an Ethernet LAN. Also ensure that PC and unit are on the same subnet
3. Reset the unit and enter U-Boot console by pressing any key during the 3 second countdown. You should see the U-Boot console prompt:

   ```
   U-Boot>
   ```

4. To check the IP address of the unit:

   ```
   U-Boot> printenv (look for ipaddr field)
   ```

5. To modify the IP address:

   ```
   U-Boot>  setenv ipaddr 10.10.10.x
   ```

6. We will assume the IP address of your TFTP server is 10.10.10.10. Perform ping test

   ```
   U-Boot> ping 10.10.10.10
   ```

7. If the ping was successful, you should see output similar to:

   ```
   Link: UP

   Duplex: FULL

   Speed 100BASE-X
   ```

```
Using device

host 10.10.0.10 is alive
```

8. Configure the TFTP server's IP address & gateway ip address:

```
U-Boot> setenv serverip 10.10.10.10

U-Boot> setenv gatewayip 10.10.10.254
```

9. We will assume that the image you would like to boot is served by the TFTP server under the name uImage. Issue the following command to load the image via TFTP:

```
U-Boot> tftp uImage
```

10. Erasing flash memory is done differently depending on flash size. When using a 8 MB flash device:

```
U-Boot> protect off 80000 7fffff

U-Boot> erase 80000 7fffff
```

11. When using a 32 MB flash device:

```
U-Boot> mw.l 0x41016850 0x001f0000

U-Boot> protect off 80000 1fdffff

U-Boot> erase 80000 1fdffff
```

12. Replace existing firmware image with the new one:

```
U-Boot> cp.b ${fileaddr} 80000 ${filesize}
```

```
U-Boot> setenv bootcmd cp.b 80000 50000000
${filesize}\; bootm

U-Boot> saveenv
```

13. You should see output similar to:

```
U-Boot> tftp uImage

Link: UP

Duplex: FULL

Speed 100BASE-X

Using device

TFTP from server 10.10.0.10; our IP address is
10.10.0.50

Filename 'uImage'.

Load address: 0x50000000

Loading: TftpRemotePort=69

################################################
##################

##########################################

done

Bytes transferred = 552100 (86ca4 hex)
```

```
U-Boot> protect off 80000 7fffff

.........................................
..................... done

Un-Protected 120 sectors

U-Boot> erase 80000 7fffff

.........................................
..................... done

Erased 120 sectors

U-Boot> cp.b ${fileaddr} 80000 ${filesize}

Copy to Flash... done

U-Boot> setenv bootcmd cp.b 80000 50000000
${filesize}\; bootm

U-Boot> saveenv

Saving Environment to Flash...

.. done

Un-Protected 2 sectors

Erasing Flash...

.. done
```

```
Erased 2 sectors

Writing to Flash... done

.. done

Protected 2 sectors

Done
```

14. Reset the unit via the command:

```
U-Boot> reset
```

8. Appendix

A: Channel service

To create a channel service, we have the following primitive:

dot3_channel_serv_create

Syntax: *dot3_channel_serv_create <handle>*

<radio_number> <channel_number> <slot>
<priority>

The parameters are described in the following table:

Parameter	Valid Range	Description
handle	0 ~ 255	Handler id
radio_number	1 - 2	the radio number
channel_number	172 174 176 178 180 182 184	The channel that users want to reserve
slot	1: CCH 2: SCH 3: BOTH	The time slot for the desired channel

priority	0 ~ 15	Priority of user service. Lower value has higher priority

Example: *dot3_channel_serv_create 1 1 172 3 5*

To delete a channel service, we have the following primitive:

dot3_channel_serv_delete

Syntax: *dot3_channel_serv_delete <handle>*

<serv_index>

NOTE: The parameters <handle> and <serv_index> are assigned by the system and are not configurable by the user.

Example: *dot3_channel_serv_delete 1 0*

B: Provider service

To create a provider service, we have the following primitive:

dot3_provider_serv_create

Syntax: *dot3_provider_serv_create <handle> <psid> <repeat_rate> <radio_number> <service_channel> <channel_access> <priority> <is_secure> <sign_lifetime>*

The parameters are described in the following table:

Parameter	Valid Range	Description
handle	0 ~ 255	Handler id
psid	1 ~ 127	psid of desired service
repeat rate	0 ~ 255	repeat rate of WSA packets
radio_number	1 - 2	radio number of the service
service_channel	172 174 176 180 182 184	Channel number of desired service
channel_access	1: CCH 2: SCH 3: BOTH	The time slot for the desired channel
priority	0 ~ 15	Priority of user service. Lower value has higher priority
is_secure	0: no secured WSA 1: secured WSA	Security enabling status
sign_lifetime	10 ~ 30000 ms	life time of signature

Example: *dot3_provider_serv_create 1 123 1 1 172 0 5 0 10*

To delete a provider service, we have the following primitive:

dot3_provider_serv_delete

Syntax: *dot3_provider_serv_ delete <handle> <serv_index>*

NOTE: The parameters <handle> and <serv_index> are assigned by the system and are not configurable by the user.

Example: *dot3_provider_serv_delete 1 0*

C: User service

To create a user service, we have the following primitive:

dot3_user_serv_create

Syntax: *dot3_user_serv_create <handle> <psid> <request_type> <priority> <radio_number> <channel_number>*

The parameters are described in the following table:

Parameter	Valid Range	Description
handle	0 ~ 255	Handler id
psid	1 ~ 127	psid of desired service
repeat rate	0: MATCH 1: NO SCH Access	Access mode of user service
priority	0 ~ 15	Priority of user service. Lower value has higher priority
radio_number	1 - 2	radio number of the service
channel_number	172 174 176 180 182 184	Channel number of desired service

Example: *dot3_user_serv_create 1 123 0 5 2 172*

To delete a user service, we have the following primitive:

dot3_user_serv_delete

Syntax: *dot3_user_serv_delete <handle> <serv_index>*

NOTE: The parameters <handle> and <serv_index> are assigned by the system and are not configurable by the user.

Example: *dot3_user_serv_delete 1 0*

D: WSM service

To create a WSM service, we have the following primitive:

dot3_wsm_serv_create

Syntax: *dot3_wsm_serv_create <handle> <psid>*

The parameters are described in the following table:

Parameter	Valid Range	Description
handle	0 ~ 255	Handler id
psid	1 ~ 127	psid of desired service

Example: *dot3_wsm_serv_create 1 123*

To delete a wsm service, we have the following primitive:

dot3_wsm_serv_delete

E: BSM Tx & Rx

To send a BSM packet, we have the following primitive: *txBsm*

Syntax: *txBsm <psid> <data_rate> <tx_power> <dest_mac> <interval> <num>*

The parameters are described in the following table:

Parameter	Valid Range	Description
psid	1 ~ 127	psid of desired service
data_rate	6 9 12 18 24 36 48 54	data rate of sending WSM packets
tx_power	12- 25, unit:dBm	tx power level of sending WSM packets
dest_mac	format: XX:XX:XX:XX:XX:XX	peer mac address of sending WSM packets
interval	0 - 1000, unit:ms	the interval of sending packets
num	1 - 10000	the number of sending packets

Example: *`txBsm 123 6 18 FF:FF:FF:FF:FF:FF 1000 1`*

To receive BSM packets, we have the following primitive: *`rxBsm`*

Syntax: *`rxBsm <psid>`*

Example: *`rxBsm 123`*

Note: Syntax is the same for other J2735 message sets which are:

SPAT/MAP/TIM/RSA/RTCM/CSR/NMEA/ICA/EVA/PDM/SSM/SRM/PVD/PSM.

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