

# User Manual

## DA16200 DA16600 DPM Dynamic Period Setting

UM-WI-030

### Abstract

*This document describes the DPM Dynamic Period Setting (DDPS) feature of the DA16200 (DA16600).*

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## 1 Terms and Definitions

DPM	Dynamic Power save Module
DDPS	DPM Dynamic Period Setting
BSS	Basic Service Set
AP	Access Point
SSID	Service Set Identifier
RTOS	Real Time Operating System
TIM	Traffic Indicator Module
BUFP	Buffering Probe
UC	Unicast Packet

## 2 References

- [1] UM-WI-023, DA16200 EVK User Manual, Renesas Electronics.

## DA16200 DA16600 DPM Dynamic Period Setting

### 3 Introduction

DA16200 (DA16600) has a DPM Dynamic Period Setting (DDPS) function.

Access Points (AP) with Wi-Fi BSS (Basic Server Set) provides a method to configure the power saving options of each connected station device. To support a station's power saving feature, the AP must maintain the packets for that station when the station is in a power saving state. The DDPS algorithm checks the buffering time required for the DPM operation of the AP that the DA16200 (DA16600) station is connected to and calculates the optimal TIM wake up period (interval) for a DPM operation based on the APs buffer size and buffering time.

### 4 Operation Scenario

The DDPS configuration and operation has the following sequence:

1. During provisioning, DDPS is enabled when configuring the DPM mode.
2. Once DDPS is enabled, the DDPS will start triggering in DPM state and enter DPM when connecting to the AP.
3. When DDPS execution is completed the inspection cycle value is compared to the rx maximum number of beacons and to the number of inspection Probe conditions to determine if the DDPS check condition is satisfied.
  - If the DDPS check condition is satisfied, then the TIM Wakeup Interval is set to 3 seconds.
  - If the DDPS check condition is not satisfied, then the DPM interval set to 1 second
4. DDPS as well as DPM and related operational services will be terminated.

### 5 Enable DDPS

When using the `setup` console command, DDPS can be enabled during the DPM configuration as shown below:

```
Dialog DPM (Dynamic Power Management) ? [Yes/No/Quit] : y
DPM factors : Defaults ? [Yes/No/Quit] : n
DDPS Enable : Default ? [No/Yes/Quit] : y
DPM Keep Alive Time(0~600000 ms) ? [Quit] (Default 30000 ms) :
DPM User Wakeup Time(0~86400 Sec.) ? [Quit] (Default 0 Sec.) :
DPM TIM Wakeup Count(1~65535 dtim) ? [Quit] (Default 10) :
=====
DPM MODE           : Enable
Dynamic Period Set : Enable
Keep Alive Time    : 30000 ms
User Wakeup Time   : 0 sec.
TIM Wakeup Count   : 10 dtim
=====
DPM CONFIGURATION CONFIRM ? [Yes/No/Quit] : y
```

For more information on the `setup` console command, see the DA16200 (DA16600) EVK User Manual [1].

### 5.1 DPM API

The following API is called after the above setup command to save the configuration to NVRAM.

User application can call API to change DPM parameters.

<pre>unsigned char setup_apply_dpm(unsigned char dpm_mode,     unsigned char dpm_Dynamic_Period_Set,     int dpm_KeepAlive_time,     int dpm_User_Wakeup_time,     int dpm_TIM_wakeup_count)</pre>		
Parameter	dpm_mode	Enable/Disable DPM MODE
	dpm_Dynamic_Period_Set	Enable/Disable Dynamic Period Set
	dpm_KeepAlive_time	Keep Alive time(0~600000 ms) default: 30000ms Time to wake up periodically to sync with the AP
	dpm_User_Wakeup_time	User Wakeup Time(0~86400 Sec) default : 0sec This is used when the user needs to wakeup periodically.
	dpm_TIM_wakeup_count	TIM Wakeup Count(1~65535 dtim) default : 10dtim This is the interval to check the AP's beacon. It is recommended to use 30 when using DDPS.
Return	E_ERROR(254) : Error	
	Others(E_CONTINUE) : Success	

```
void easy_setup(void)
{
    ...
    /* DPM MODE */
    ret = setup_apply_dpm(e_dpm_mode,
        #ifdef __SUPPORT_DPM_DYNAMIC_PERIOD_SET__
            e_dpm_Dynamic_Period_Set,
        #endif // __SUPPORT_DPM_DYNAMIC_PERIOD_SET__
            e_dpm_KeepAlive_time,
            e_dpm_User_Wakeup_time,
            e_dpm_TIM_wakeup_count);

    switch (ret)
    {
        case E_ERROR:
            goto CMD_ERROR;
        case E_CONTINUE:
            default:
                break;
    }
    ...
    /* reboot */
    reboot_func(SYS_REBOOT);
    return;
    ...
}
```

## 6 BUFP

The buffering probe (BUFP) state starts when DDPS is enabled and RTOS goes into a sleep state. Figure 1 shows the state change during BUFP.

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6.1 BUFP State Diagram

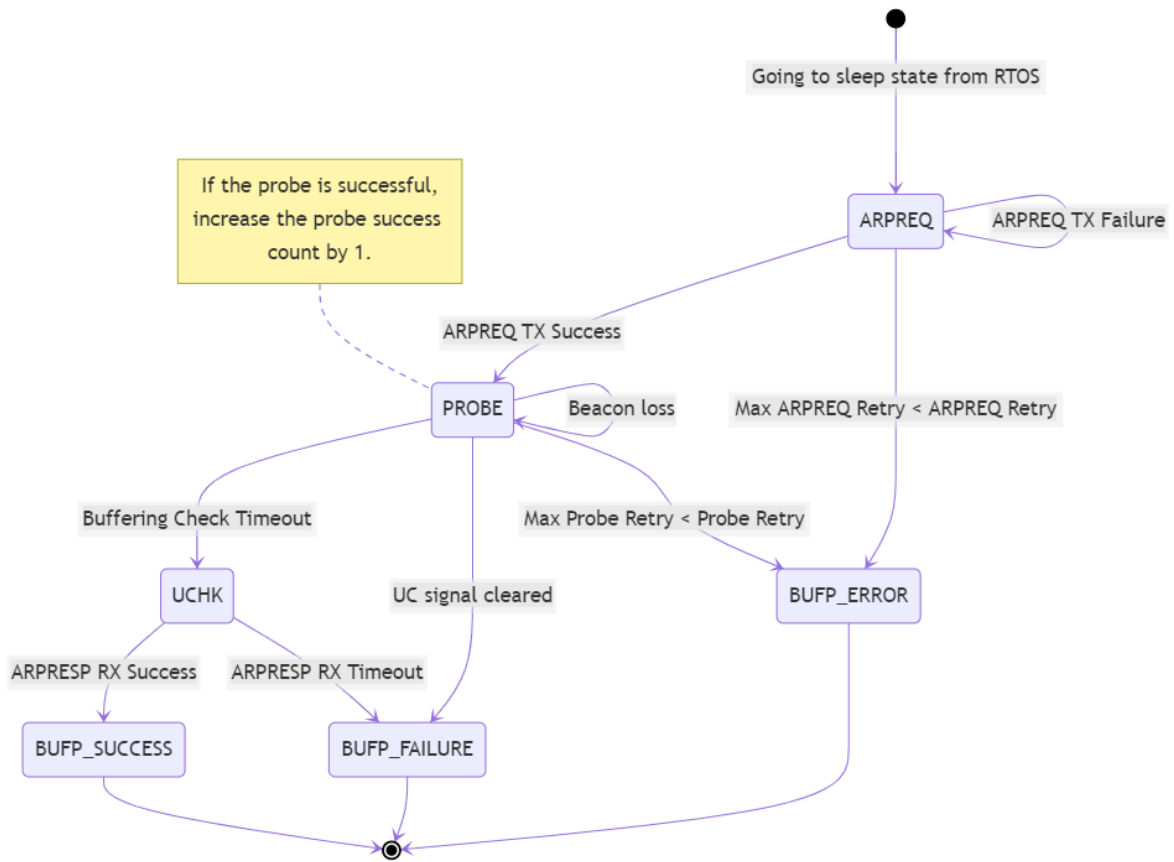


Figure 1: DDPS BUFP Block Diagram

Table 1: BUFP Main States

State	Description
ARPREQ	<ul style="list-style-type: none"> <li>State where the station transmits ARP request data to the AP</li> <li>Success when ACK is received from the AP</li> <li>If there is no ACK from the AP, retry ARPREQ data transmission</li> </ul>
PROBE	<ul style="list-style-type: none"> <li>State where BUFP measures the AP UC buffering time</li> <li>Success when the AP's UC signal is maintained until the probe times out</li> <li>If the AP's UC signal is cleared during the probe state, the probe fails</li> <li>If the beacon is not continuously received from the AP, then retry the probe again</li> </ul>
UCHK	<ul style="list-style-type: none"> <li>State where the station waits for ARP REPLY data from the AP</li> <li>Success when ARP reply data is received from the AP until the UCHK timeout</li> </ul>
BUFP_SUCCESS	<ul style="list-style-type: none"> <li>State where BUFP was successful</li> </ul>
BUFP_FAILURE	<ul style="list-style-type: none"> <li>State where BUFP failed</li> <li>The probe failed or ARPRESP data was not received</li> </ul>
BUFP_ERROR	<ul style="list-style-type: none"> <li>BUFP error state</li> <li>When the ARPREQ retry count has reached the maximum ARPREQ frame transmission count</li> <li>When the probe retry count has reached the maximum probe retry count</li> </ul>

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### 6.2 When DDPS Changes the Sleep Time to 1 Second

When the BUFP fails 4 out of 5 times, DDPS estimates that the AP's UC buffering time is less than 3 seconds and changes the sleep time to 1 second.

## 7 AP Test Report for DDPS

Table 2 shows the test results for each AP model that the DDPS functionality was tested on. Each AP was tested 100 times.

**Table 2: DDPS Result**

AP Model	DDPS 1s	PROBE MAX	PROBE MIN
360 F5C		5	5
360 F5S		5	4
360 P1		5	4
360 P4		5	5
360 V5S		5	5
AMPED ALLY-0091K		5	5
ANTIBANG A3		5	4
ASUS ACRH13		5	5
ASUS RT-AC1200GU	1s	0	0
ASUS RT-AC1750		5	5
ASUS RT-AC3200		5	5
ASUS RT-AC51UPLUS	1s	0	0
ASUS RT-AC5300		5	5
ASUS RT-AC58U		5	5
ASUS RT-AC66U		5	5
ASUS RT-AC87U		5	5
ASUS RT-AC88U		5	5
ASUS RT-N14UHP		5	5
ASUS TM-AC1900		5	5
BELKIN F7D6301		5	4
BELKIN F9K1002		5	3
BUFFALO WHR-300HP2D		4	2
BUFFALO WSR-1166DHP3		5	5
BUFFALO WSR-2533DHPL		5	4
CISCO RV110W-ECN		5	5
DLINK 605L		5	5
DLINK 616		5	5
DLINK 619L		5	5
DLINK 822		5	5
DLINK DIR-806A		5	5
DLINK DIR-820L		5	4

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AP Model	DDPS 1s	PROBE MAX	PROBE MIN
DLINK DIR-822P		5	5
DLINK DIR-823PRO		5	4
DLINK DIR-828		5	5
DLINK DIR-842		5	5
DLINK DIR850LW		5	4
DLINK DIR-880L		5	5
DLINK DIR-890L		5	5
ELECOM WRC-1167GEBKS		5	5
EZVIZ CS-X3C-8E		5	5
FASTCOM FAC1200R		5	4
FASTCOM FAC2100R	1s	0	0
FASTCOM FW313R		5	4
FASTCOM FW450R		5	5
FASTCOM FWR200		5	4
H3CMAGIC R100		5	5
H3CMAGIC R300		5	5
HIWIFI E30		5	4
HIWIFI HC5861B		5	4
HUAWEI GLORY-ROUTINGPRO		5	5
HUAWEI HONOR-X2		5	5
HUAWEI WS5100		5	5
HUAWEI WS5102		5	5
HUAWEI WS5200		5	5
HUAWEI WS550		5	4
HUAWEI WS832		5	5
HUAWEI WS851		5	5
HUMAX QUANTUM-T3Av2		5	5
HUMAX T10X		5	4
IODATA WNAC583R	1s	0	0
IODATA WNAC733GR	1s	0	0
IODATA WNAX1167	1s	0	0
IODATA WNPR2600G		5	5
IPTIME A1004	1s	0	0
IPTIME A2004NSR		5	4
IPTIME A300NS-BCM		5	5
IPTIME A7004M		5	4
IPTIME A3004NS-BCM		5	5
IPTIME A3004NS-BCM		5	5
IPTIME A8004ITL		5	4



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AP Model	DDPS 1s	PROBE MAX	PROBE MIN
IPTIME A804NS		5	4
IPTIME N604		5	4
IPTIME A604R		5	5
IPTIME N702BCM		5	5
IPTIME N704BCM		5	4
IPTIME N804V		5	5
LBLINK BL-AC1200D		5	4
LBLINK WR9000		5	4
LBLINK WR4000		5	4
LINKSYS E1200		5	4
LINKSYS EA6900		5	5
LINKSYS EA7500		5	5
LINKSYS EA8300		5	5
LINKSYS WRT1900AC		5	5
LINKSYS WRT300N		5	5
LINKSYS WRT3200ACM		5	4
LINKSYS WRT54GL		5	5
MERCURY C12G	1s	0	0
MERCURY D196G		5	5
MERCURY D19G		5	4
MERCURY D26GPro		5	5
MERCURY MW300R		5	4
MERCURY MW313R		5	4
MERCURY MW316R		5	5
MIKROTIK RB751U-2H	1s	2	0
MOTOROLA MR1900		5	1
MERCURY RUSH-1537N		5	5
NETCORE 360_P2		5	5
NETGEAR JWNR2000v2		5	5
NETGEAR ORBI		5	5
NETGEAR R6120		5	4
NETGEAR R6220		5	3
NETGEAR R7000		5	4
NETGEAR R8000		5	4
NETGEAR RAX120		5	5
NETGEAR RAX40		5	4
NETGEAR RAX80		5	5
NETGEAR WNDR3400v3		5	1
NETGEAR X10		5	5

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AP Model	DDPS 1s	PROBE MAX	PROBE MIN
NETIS M3200N		5	5
NETIS MF1200AC		5	5
NETIS WF2770	1s	0	0
NETIS WF2785		5	5
NETIS WF302		5	4
NEXT 504N		5	5
NEXT 7004N		5	5
NEXT 8004N		5	4
PHICOMM PSG1218	1s	0	0
PIXLINK WR07		5	4
SAMSUNG SWW3100BG		5	3
SAMSUNG SWW-3400RW		5	5
SAMSUNG ET-WV525		5	5
SEMA SAP-H310SR	1s	1	0
SYNOLOGY MR2200AC		5	5
SYNOLOGY RT2600AC		5	5
TENDA AC15		5	5
TENDA FH304		5	5
TENDA N318		5	3
TOTOLINK A2500R		5	5
TOTOLINK A3100R		5	5
TOTOLINK A780R		5	4
TOTOLINK A800R		5	5
TOTOLINK A850R		5	5
TOTOLINK N350RP		5	5
TOTOLINK N600R		5	5
TPLINK AD7200		5	4
TPLINK ARCHER-AX10		5	4
TPLINK ARCHER-C2600		5	5
TPLINK TL-WAR1200L		5	5
TPLINK TL-WDR8610		5	5
TPLINK TL-WDR8690		5	5
TPLINK WDR5600		5	4
TPLINK WDR5660		5	5
TPLINK WDR6500		5	5
TPLINK WDR7660		5	4
TPLINK WR2041		5	5
TPLINK WR842N		5	4
TPLINK WR880N		5	5

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AP Model	DDPS 1s	PROBE MAX	PROBE MIN
TPLINK WR940N		5	5
TRENDNET TEW-812DRU		5	1
TRENDNET TEW-827DRU		5	4
UNICORN AW		5	4
UTT A310	1s	0	0
UTT A655W	1s	0	0
UTT A755W		5	4
VOLANS G1		5	5
WAVLINK A33		0	0
WAVLINK N300		5	4
WAVLINK WN521N2A		0	0
WEVO 11AC-NASROUTER		5	4
WEVO HI1200AC		5	3
XIAOMI DVB4218CN		5	4
XIAOMI MIWIFI3	1s	1	0
XIAOMI MIWIFIPRO		5	5
XIAOMI R1CM	1s	0	0
XIAOMI R3AC		5	5
ZIO 2520N		5	5
ZIO 5500AC		5	5
ZIO FREEZIO		5	5

## Revision History

Revision	Date	Description
1.3	27-Sep-2022	Update DPM API
1.2	28-Mar-2022	Update logo, disclaimer, copyright.
1.1	25-Nov-2021	Title was changed.
1.0	29-Oct-2020	Initial version.

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**Status Definitions**

Status	Definition
DRAFT	The content of this document is under review and subject to formal approval, which may result in modifications or additions.
APPROVED or unmarked	The content of this document has been approved for publication.

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