



# Synchronization of Scan Activity to Cellular Host Wake-Up BRF6300 Application Note

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## Abstract

This document describes the synchronization between the BRF6300 Bluetooth scan activity and the external host wake-up activity to minimize power consumption.

## Revision Control

| Author Name | Description          | Revision | Date             | Approved By | Date |
|-------------|----------------------|----------|------------------|-------------|------|
| Dana Ram    | Creation             | 0.1      | December 4, 2005 |             |      |
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|             |                      |          |                  |             |      |

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## 1. Overview

When both BRF6300 and the cellular host are in standby, synchronization of the BRF6300 and cellular host wake up events can save a significant amount of power. This is especially true in systems that use a clock request scheme that requires the host to wake up whenever the BRF6300 needs the fast clock.

This section describes the method of synchronizing the BRF6300 scan activities (Page and/or Inquiry) to the cellular host wake-up events. The synchronization process consolidates the wake-up period of both the BRF6300 and the host by allowing the BRF6300 to adjust the occurrence of the majority of its wake up events to coincide with the host wake-up events.

## 2. Description

Normally, Page and Inquiry scans occur at a fixed interval determined by a value in a BRF6300 timer, and independently of the host's own wake up requirements. With the Synchronization Mode option, however, synchronization is achieved by giving up the independent periodicity of the BRF6300 scans and, instead, scanning with a variable period that is determined by the host wake up intervals.

The key requirement for synchronization is that the BRF6300 should know when the host has woken up and the fast clock has been enabled. This is achieved by means of a "Scan Synchronization to Host" signal (SCAN\_SYNC) from the host informing the BRF6300 that the fast clock is available. This signal can be provided from an I/O on the host and is connected to the BRF6300 as shown in Figure 1.

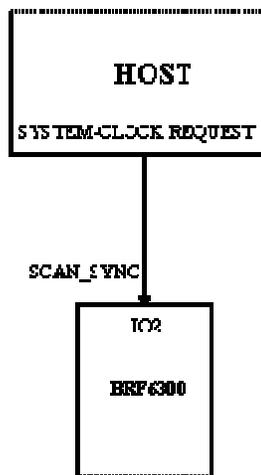


Figure 1: Synchronization to cellular host

SCAN\_SYNC can be connected to IO2 of the BRF6300. IO2 needs to be configured as an interrupt, so that assertion of the SCAN\_SYNC signal will wake up the BRF6300 every time the host wakes up. There is a requirement that the SCAN\_SYNC signal should be asserted for at least **64 uSsec** (i.e. >2 slow clock cycles) so that the interrupt is generated. IO2 is the default pin for connecting SCAN\_SYNC, however if for some reason this pin cannot be used IO5 can be the alternative.

The *HCI\_VS\_Write\_GSM\_Configuration* command is used to change the default from IO2 to IO5.

The scans are scheduled by the BRF6300 ensuring that there will be no degradation in the connection/ discovery performance. The scan activity parameters, however, remain the responsibility of the host - it is the host's responsibility to change these parameters if it requires different scan activity when the Synchronization Mode is enabled (e.g. for power saving).

***Synchronization Mode is not activated by default and is enabled using the HCI\_VS\_Write\_GSM\_Configuration command (see 3.1).***

### 3. Scan activity scheduling

Two parameters are used:

- a. Max\_Inquiry\_Scan\_Interval - default = 2.56s.
- b. Max\_Page\_Scan\_Interval - default = 1.28s.

These parameters can be changed by the HCI\_Write\_Inquiry\_Scan\_Activity and the HCI\_Write\_Page\_Scan\_Activity commands.

Two additional parameters are internally set by the BRF6300:

- a. Min\_Inquiry\_Scan\_Interval
- b. Min\_Page\_Scan\_Interval

These are set by BRF6300 to determine the minimum period between scans in order to not waste power by unnecessary scanning if the host wakes up frequently. These parameters are determined via the *HCI\_VS\_Write\_GSM\_Configuration* command.

Every time the BRF6300 is woken up by the SCAN\_SYNC line it checks the amount of time that has passed since the last scan activity.

If the time is  $< \text{Min\_Inquiry\_Scan\_Interval}$  then there is no need to scan and the BRF6300 will go back to sleep.

If the time is  $\geq \text{Min\_Inquiry\_Scan\_Interval}$  then the BRF6300 will perform the required scans.

Every time an Inquiry scan is performed an internal timer gets set to Max\_Inquiry\_Scan\_Interval. If the host doesn't wake up for Max\_Inquiry\_Scan\_Interval seconds, then a timer interrupt event occurs and BRF6300 will wake up, request the clock and perform the scans.

Similarly for Page Scans. This way Bluetooth connection and/or discovery performance is guaranteed.

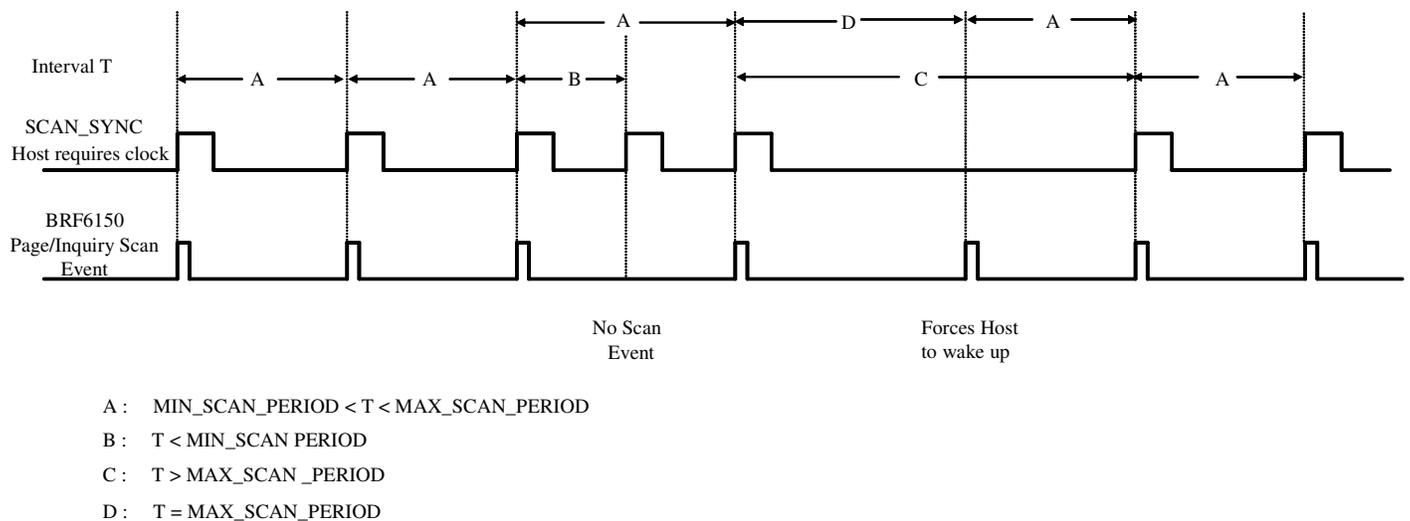


Figure 2 : Example of scan activity scheduling

### 3.1 HCI\_VS\_Write\_GSM\_Configuration (0xFD19)

| Command                        | Opcode | Command Parameters   | Return Parameters |
|--------------------------------|--------|--|-------------------|
| HCI_VS_Write_GSM_Configuration | 0xFD19 | Scan_Sync_Enable<br>Clock_is_active_pull_enable<br>Minimum page scan interval<br>Minimum inquiry scan interval |                   |

**Description:**

This command enables or disables the feature of synchronizing the Bluetooth scans to the cellular host wake-up instances, when the host is in standby mode.

In systems where the host wakes up every time the Bluetooth needs a clock, it is possible to synchronize the Bluetooth scan activities (Page and Inquiry scans) to the cellular host wake-up instances (network synchronization), when the host is in standby mode. This feature can save significant amount of power since it consolidates most of the wake up events in the system (the cellular host and the Bluetooth) during standby mode (when both are in standby).

Synchronization is achieved by giving up the periodicity of the Bluetooth scans, and scanning in a variable period that is determined by the host wake up intervals.

**Command Parameters :**

| Scan_Sync_Enable: |   | 1 Byte        |
|-------------------|---|---------------|
| Value             | Parameter Description   | Default Value |
| 0x0               | Enable scan synchronization, SCAN_SYNC line is connected to IO2 | 0             |
| 0x1               | Reserved.   |               |
| 0x2               | Enable scan synchronization, SCAN_SYNC line is connected to IO5 |               |
| 0x3               | Disable scan synchronization                                    |               |

| SCAN_SYNC pull enable | 1 Byte  |               |
|-----------------------|---|---------------|
| Value                 | Parameter Description   | Default Value |
| 0x0                   | Input pull (on selected input IO) is disabled while SCAN_SYNC is active | 0xFF          |
| 0x1                   | Input pull (on selected input IO) is enabled while SCAN_SYNC is active  |               |
| 0xFF                  | Do not Change   |               |

| Minimum page scan interval | 2 Byte   |               |
|----------------------------|--|---------------|
| Value                      | Parameter Description                                      | Default Value |
| 0x0012 – 0x1000            | The minimum value between the page scans in baseband slots | 0x0800        |

| Minimum inquiry scan interval | 2 Byte  |               |
|-------------------------------|---|---------------|
| Value                         | Parameter Description   | Default Value |
| 0x0012 – 0x1000               | The minimum value between the inquiry scans in baseband slots | 0x0800        |

**Return Parameters:**

| Status:   | Size: 1 Byte   |
|-----------|--|
| Value     | Parameter Description                                |
| 0x00      | Command Succeeded.                                   |
| 0x01-0xFF | Command failed. See error codes table in BT-SW-0029. |

**Events Generated:**

Command Complete Event

## 4. Reference Documents

| Document                        | Reference  |
|---------------------------------|------------|
| BRF6300 Product Review Rev 0.41 | BT-DS-0023 |
| BRF3000 Clock Sharing AN        | BT-AN-0055 |
| BRF6300 HCI VS command Rev      | BT-SW-0029 |

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