

LiteFi™ Driver

User Manual for Windows

Version 1.2

March 2013

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1 Introduction

The document describes how to configure and use the client driver for nLink™ series modules RS9110-N-11-02 and RS9110-N-11-03 in Windows XP, Windows7 and WinCE 5.0/6.0/7.0 platforms. The end user has control over various settings such as RTS threshold, bgscan and power save configurations, etc. The document describes the usage of various registry settings commands.

2 Configuring using Registry settings

This section describes the usage of various registry entries, which will be used to change the settings of LiteFi driver.

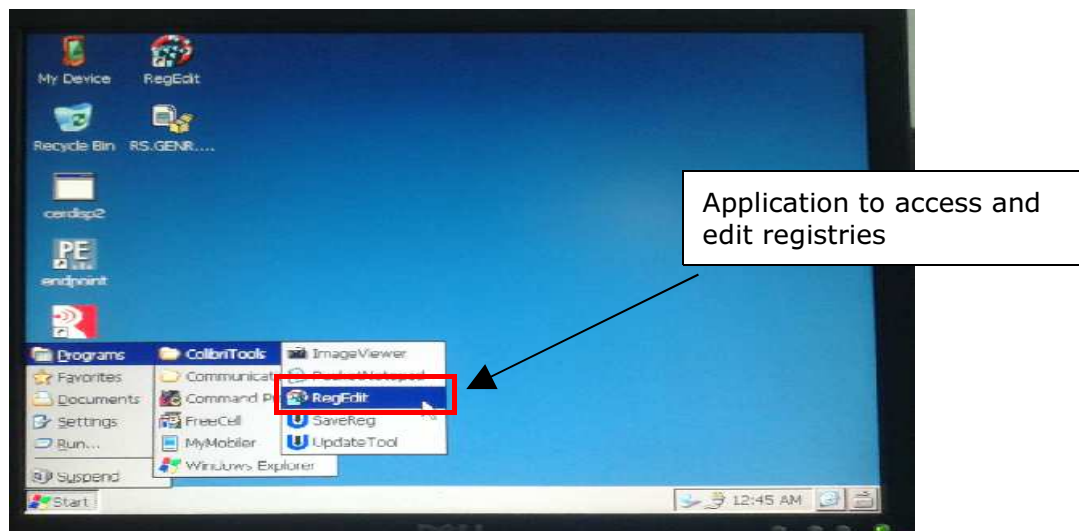
2.1.1 Registry Path for Windows CE 5/6/7.

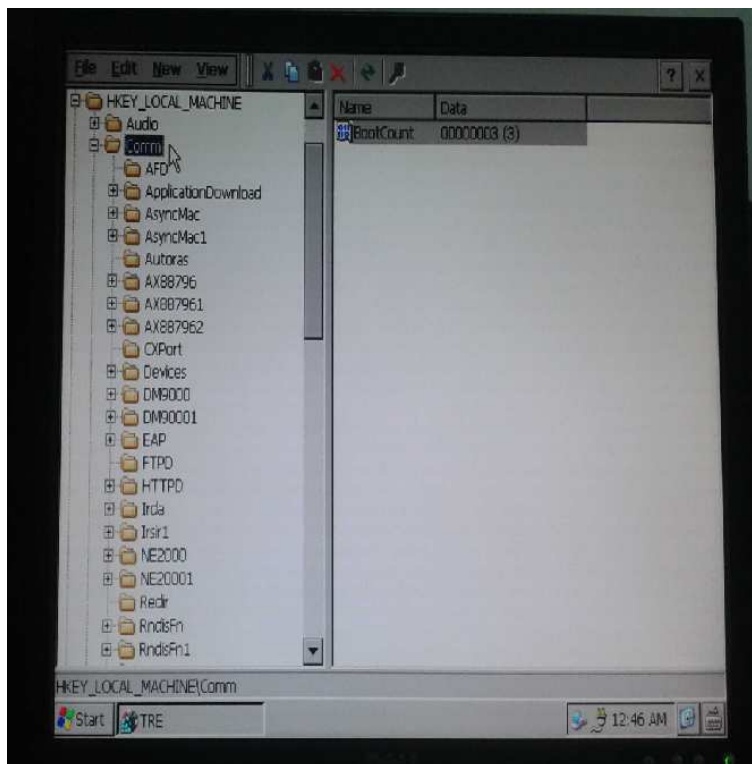
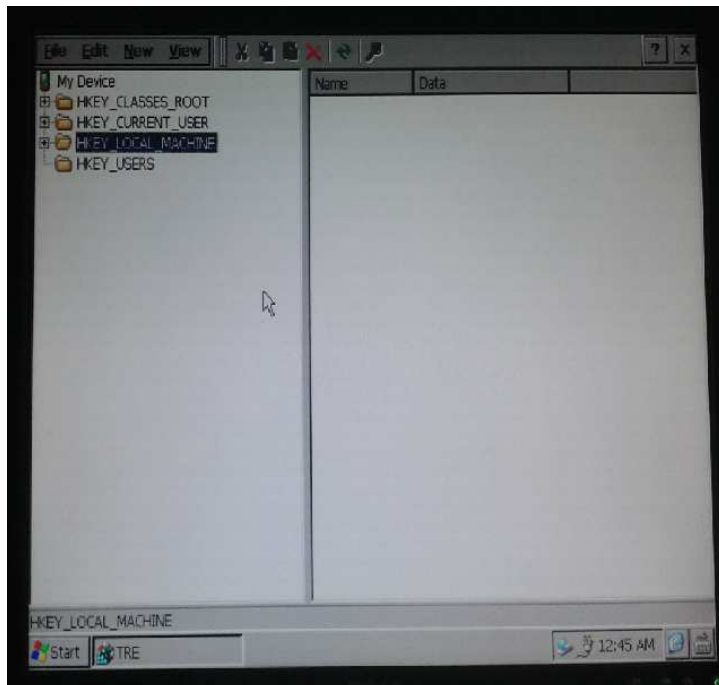
LiteFi Driver parameters will be saved under the following path of WindowsCE registry:

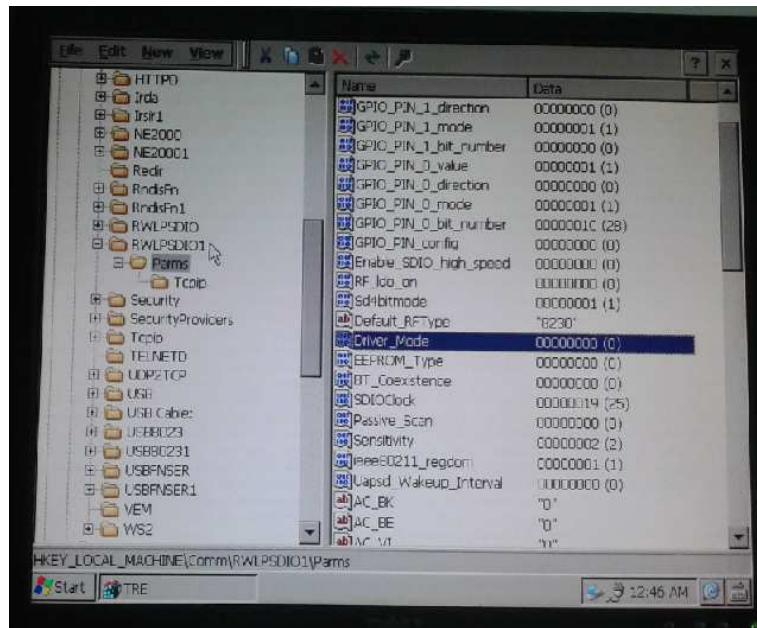
HKEY_LOCAL_MACHINE\Comm\RWLPSDIO1\Parms\.. The user would require a platform specific registry editor application to edit the Windows registry. This application may vary across platforms based on the architecture.

For each modification in the following registry parameters, it is required to power cycle of the device/driver, because these registry entries are read during the driver initialization.

Some sample snapshots are shown with WinCE6.0 over an ARM based platform.

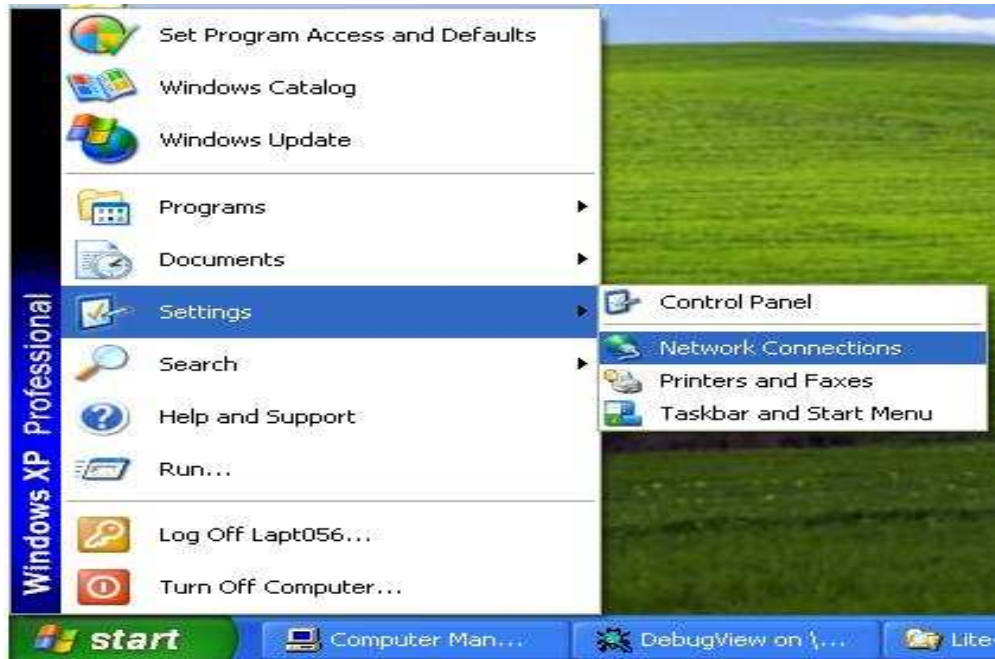




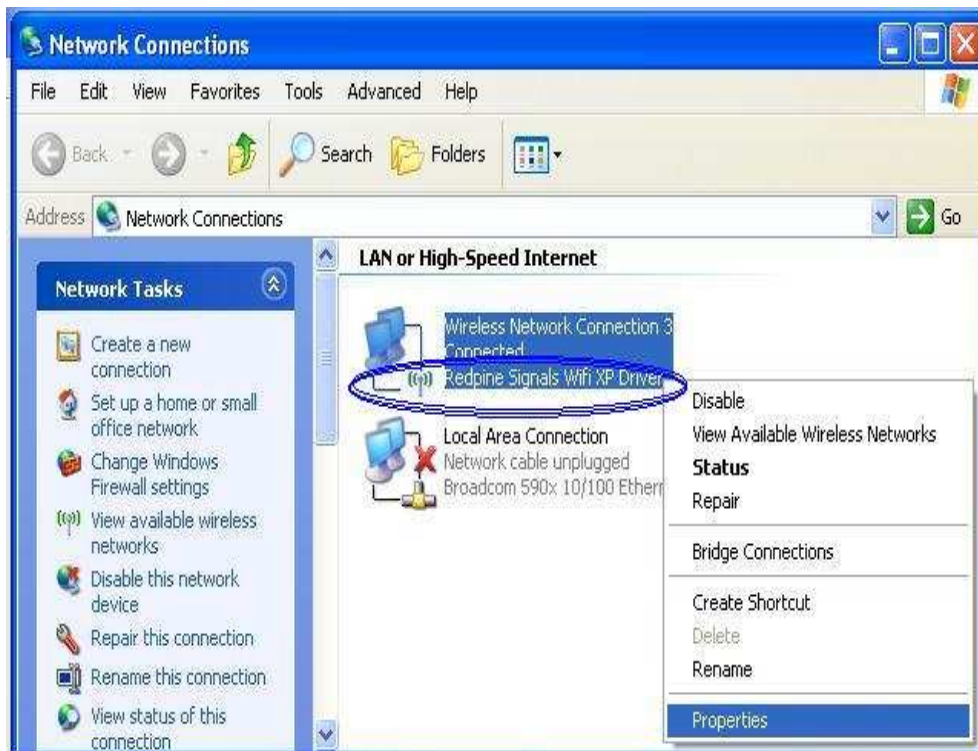


2.1.2 Adapter settings for Windows XP/7.

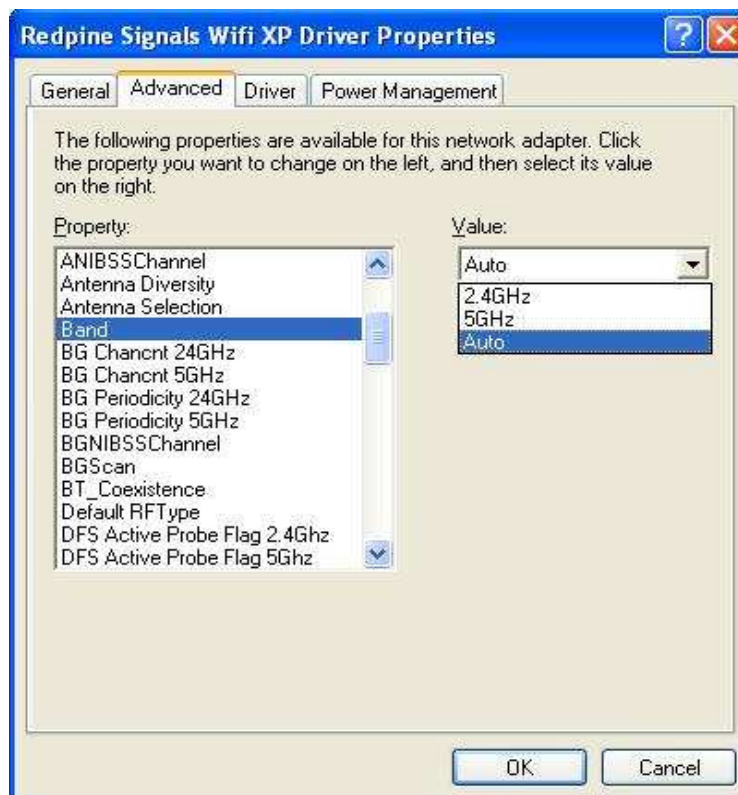
Click on Start Button -> Settings -> Network Connections as shown below.



This will display all available network adapters. Right click on Redpine wlan Adapter as shown below to get the property windows of the adapter.



Click on the **Configure** buttons as shown below which displays the properties of the wlan adapter and go to advanced tab to modify the driver parameters.



2.1.3 Listen Interval

Reg Entry	ListenInterval
Description	<p>This value requests the Lite-Fi™ device to configure the listen interval setting. Listen interval is the maximum number of beacon intervals between instances when the station wakes up to receive buffered traffic. The value of this setting will be in multiples of beacon intervals.</p> <p>The value configured by the user for this value, serves a dual purpose. Besides informing the AP of the listen interval setting it also configures the wakeup interval at the station side. Lite-Fi™ device can be configured to wakeup either at the listen interval or at the AP advertised DTIM interval to receive Rx traffic.</p> <p>Irrespective of the power save mode configured Lite-Fi™ always wakes up at the DTIM/listen interval, whichever is configured.</p> <p>When the user changes this value and sets a non-zero value to the listen interval, Lite-Fi™ communicates the same value to the AP and also performs listen interval wakeups.</p> <p>When the user changes this value and sets a value of zero to the listen interval, Lite-Fi™ performs DTIM interval wakeups and communicates a default value of '0' to the AP.</p> <p>When configured to wakeup at every listen interval, there are chances that this interval may/may not be aligned to the DTIM interval, in which case the station may/may not receive broadcast/multicast traffic. It is recommended that the user configure Lite-Fi™ for listen interval wakeups when there are no requirements for broadcast/multicast traffic for his/her application.</p>
Default value	0. By default, Lite-Fi™ wakes up at the DTIM interval to receive buffered Rx traffic, when in power save mode.

2.1.4 Fragmentation Threshold

Reg Entry	FragThresh
Description	<p>This value sets the MAC layer fragmentation threshold value in the Lite-Fi™ device. Transmit data frames of payload size greater than the fragmentation threshold are fragmented and transmitted. The value entered for this field should lie within the range of 64 (Minimum Ethernet frame size) to 2300 (Max MSDU size). Any value entered, is adjusted to be a multiple of 4. Upon enabling fragmentation, Lite-Fi™ disables aggregation (A-MSDU and A-MPDU).</p>

Default value	2346
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2.1.5 RTS/CTS Threshold

Reg Entry	RTSThresh
Description	This value sets the RTS/CTS threshold of the Lite-Fi™ device. If the payload size of the transmit data frame (or MSDU) is greater than this threshold, Lite-Fi™ station triggers the RTS/CTS handshake. Else, the frames are transmitted immediately. The value entered for this field should lie within the range of 64 (Minimum Ethernet frame size) to 2300 (Max MSDU size). Any value entered, is adjusted to be a multiple of 4.
Default value	2346

2.1.6 Tx Rate

Reg Entry	TxRate																												
Description	<p>This value sets the bit rate for transmitted data packets (in infrastructure mode only). User can choose either the auto rate algorithm or a fixed rate as input. By default, auto rate algorithm is enabled in the Lite-Fi™ device.</p> <p>If the user chooses a fixed rate, Lite-Fi™ applies this bit rate depending upon its and the connected AP's current mode of operation. For ex: if the station is connected to an AP in 'B' mode, only B rates are accepted as input. If the user enters any other rate, Lite-Fi™ defaults to auto rate.</p> <p>The mapping between the values for various rates and the rates are as follows:</p> <table> <tr><td>1</td><td>- 1 Mbps</td></tr> <tr><td>2</td><td>- 2 Mbps</td></tr> <tr><td>3</td><td>- 5.5 Mbps</td></tr> <tr><td>4</td><td>- 11 Mbps</td></tr> <tr><td>5</td><td>- 6 Mbps</td></tr> <tr><td>6</td><td>- 9 Mbps</td></tr> <tr><td>7</td><td>- 12 Mbps</td></tr> <tr><td>8</td><td>- 18 Mbps</td></tr> <tr><td>9</td><td>- 24 Mbps</td></tr> <tr><td>10</td><td>- 36 Mbps</td></tr> <tr><td>11</td><td>- 48 Mbps</td></tr> <tr><td>12</td><td>- 54 Mbps</td></tr> <tr><td>13</td><td>- MCS0</td></tr> <tr><td>14</td><td>- MCS1</td></tr> </table>	1	- 1 Mbps	2	- 2 Mbps	3	- 5.5 Mbps	4	- 11 Mbps	5	- 6 Mbps	6	- 9 Mbps	7	- 12 Mbps	8	- 18 Mbps	9	- 24 Mbps	10	- 36 Mbps	11	- 48 Mbps	12	- 54 Mbps	13	- MCS0	14	- MCS1
1	- 1 Mbps																												
2	- 2 Mbps																												
3	- 5.5 Mbps																												
4	- 11 Mbps																												
5	- 6 Mbps																												
6	- 9 Mbps																												
7	- 12 Mbps																												
8	- 18 Mbps																												
9	- 24 Mbps																												
10	- 36 Mbps																												
11	- 48 Mbps																												
12	- 54 Mbps																												
13	- MCS0																												
14	- MCS1																												

	15 - MCS2 16 - MCS3 17 - MCS4 18 - MCS5 19 - MCS6 20 - MCS7
Default value	auto

2.1.7 IBSS 11a Channel

Reg Entry	ANIBSSChannel
Description	<p>This value allows the user to set the channel in which the Lite-Fi™ station creates a network in IBSS mode. Lite-Fi™ device supports all channels of the UNII-low, UNII-mid, UNII-high, and UNII-worldwide bands in 5 GHz band.</p> <p>By default (when IBSS mode is enabled), Lite-Fi™ is configured to create a network in channel 11 in 2.4 GHz band and channel 36 in 5 GHz band. When dual band scan is enabled, Lite-Fi™ creates a network in channel 11 in 2.4 GHz band.</p> <p>After changing this value, Lite-Fi™ performs a band switch (if required) to create a network on the specified channel.</p>
Default Value	36

2.1.8 IBSS 11bg Channel

Reg Entry	BGNIBSSChannel
Description	<p>This value allows the user to set the channel in which the Lite-Fi™ station creates a network in IBSS mode. Lite-Fi™ device supports channels 1 – 14 in 2.4 GHz</p> <p>By default (when IBSS mode is enabled), Lite-Fi™ is configured to create a network in channel 11 in 2.4 GHz band and channel 36 in 5 GHz band. When dual band scan is enabled, Lite-Fi™ creates a network in channel 11 in 2.4 GHz band.</p> <p>After changing this value, Lite-Fi™ performs a band switch (if required) to create a network on the specified channel.</p>
Default Value	11

2.1.9 Band

Reg Entry	Band
Description	<p>This value requests the Lite-Fi™ device to set the specified band of operation.</p> <p>0 – Auto 1 – 2.4GHz 2 – 5GHz</p>
Default Value	<p>By default, Lite-Fi™ RS9110-N-11-03 station performs dual band scan and operates in mixed B/G/N mode (when in 2.4 GHz band) and mixed A/N mode (when in 5 GHz band).</p> <p>By default, Lite-Fi™ RS9110-N-11-02 station operates in mixed B/G/N mode.</p>

2.1.10 ED Threshold

Reg Entry	Sensitivity
Description	<p>This value sets the ED threshold. This is to enable the indication of a 'channel busy' condition - CCA_ED, when an incoming signal is stronger than the threshold value set. This is used to back-off transmissions when a non-WLAN signals with a level higher than the threshold is seen in the receiver.</p> <p>High Level: Set ED for signals stronger than -70dBm Medium Level: Set ED for signals stronger than -60dBm Low Level: Set ED for signals stronger than -50dBm</p> <p>0 – Low level 1 – Mid level 2 – High level</p> <p>After changing this value, Lite-Fi™ driver re-initializes the Baseband and the RF.</p>
Default Value	3 – High Level

2.1.11 Antenna Diversity

Reg Entry	AntennaDiversity
Description	<p>This value requests the Lite-Fi™ device to enable/disable Antenna diversity feature. Antenna diversity improves the quality and reliability of a wireless link by selecting the better of the available antennas (for both transmit and receive) depending upon the current operating conditions. This value is applicable for RS9110-N-11-03 module only.</p> <p>Input size: 1 byte (unsigned Int)</p> <p>1 – Enable Antenna Diversity</p> <p>0 – Disable Antenna Diversity</p>
Default Value	0 – Antenna Diversity disabled

2.1.12 Antenna

Reg Entry	Antenna
Description	<p>Through this value, user has control, to choose one of the antennas (Antenna-1 or Antenna-2) for both transmit and receive, when Antenna-diversity is turned off. This value is applicable for RS9110-N-11-03 module only.</p> <p>The acceptable inputs for this value are:</p> <p>1 – Antenna 1</p> <p>2 – Antenna 2</p>
Default Value	By default, Lite-Fi™ uses Antenna-1.

2.1.13 Powersave mode

Reg Entry	PWR_SAVE_MOD
Description	This parameter is used to configure power save mode.
Default value	Enable

2.1.14 Aggregation

Reg Entry	Aggregation
Description	Through this value, user has control over transmit A-MSDU/ A-MPDU configurations in the Lite-Fi™ device. IEEE 802.11n specification defines aggregation modes A-MSDU and A-

	<p>MPDU.</p> <p>This value accepts a single byte as input, the description of which as follows:</p> <p>enable – 2 - Enable A-MSDU feature 1 - Enable A-MPDU feature 0 - Disable A-MSDU feature</p>
Default Value	By default, transmit aggregation is disabled.
Input Parameter	Input size: 1 byte (unsigned Int)

2.1.15 U-APSD Parameters

Reg Entries	<p>UAPSD</p> <p>AC_VO</p> <p>AC_VI</p> <p>AC_BE</p> <p>AC_BK</p> <p>Uapsd_Wakeup_Interval</p>
Description	<p>This value requests the Lite-Fi™ device to enable U-APSD or Mimic APSD feature, as well as, to set the type of wakeup, when either of this is enabled (in infrastructure node only).</p> <p>U-APSD is a power save procedure defined in IEEE802.11e to improve the QoS performance of multimedia applications and is most appropriate for media streams such as VoIP.</p> <p>Mimic APSD refers to a feature implemented in Lite-Fi™, where in, it tries to mimic the APSD feature. In APs, which do not support U-APSD, Mimic APSD ensures faster retrieval of downlink traffic and is based on Lite-Fi™ device polling the AP to get data.</p> <p>The following structure declaration describes the input expected:</p> <pre>typedef struct { UINT8 enable; UINT8 ac_vo; UINT8 ac_vi; UINT8 ac_be; UINT8 ac_bk; UINT8 wakeup_period;</pre>

	<pre> UINT8 use_mimic_apsd; } wmm_pwr_save_t; </pre> <p>The description of the various parameters is as follows:</p> <p>enable – Enable/Disable U-APSD. If 'enable' is set to 0, Lite-Fi™ driver disables U-APSD on all the four ACs, irrespective of the user setting. If 'enable' is set to 1, and U-APSD is not set on any of the 4 ACs, Lite-Fi™ driver enables U-APSD on all the 4 ACs.</p> <p>ac_vo – A value of '1' for this field, configures the Voice AC as both trigger and delivery enable and a value of '0' configures it as neither trigger nor delivery enabled.</p> <p>ac_vi – A value of '1' for this field, configures the Video AC as both trigger and delivery enable and a value of '0' configures it as neither trigger nor delivery enabled.</p> <p>ac_be – A value of '1' for this field, configures the Best-Effort AC as both trigger and delivery enable and a value of '0' configures it as neither trigger nor delivery enabled.</p> <p>ac_bk – A value of '1' for this field, configures the Background AC as both trigger and delivery enable and a value of '0' configures it as neither trigger nor delivery enabled.</p> <p>wakeup_period – This field specifies the type of wakeup the station needs to perform. The minimum wakeup time for the station should be 10msecs.</p> <p>A value of 0 for wakeup_period, implies that Tx triggered U-APSD/Mimic APSD is to be set. With this setting as on, Lite-Fi™ performs a wakeup on every Tx frame as well as at every DTIM or listen interval (whichever is configured by the end user).</p> <p>A non-zero value implies the wakeup interval in msecs. When a non-zero value is set, Lite-Fi™ station periodically wakes up at the configured interval and tries to transmit and retrieve buffered data from the AP. It also wakes up at every DTIM or listen interval (which ever is configured by the end user). User can configure the wakeup interval only for the case, where in he configures all the ACs for U-APSD operation or when he enables Mimic APSD feature.</p> <p>use_mimic_apsd: Enable/Disable Mimic APSD feature.</p> <p>Lite-Fi™ driver enables U-APSD feature if 'enable' is set and if the AP supports the U-APSD feature.</p> <p>Lite-Fi™ device enables Mimic-APSD feature if 'use_mimic_apsd' field is set.</p> <p>If the end user had enabled both U-APSD and Mimic APSD features, Lite-Fi™ driver enables one of the two features, depending upon the AP's configuration. If the AP to which the user intends to connect to, supports U-APSD, it enables U-APSD else the driver enables Mimic APSD.</p>
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Default Value	By default, U-APSD feature is disabled.
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2.1.16 BGSCAN parameters

Reg Entries	BGScan RSSIToleranceThreshold_24 RSSILowerThreshold_24 RSSIUpperThreshold_24 BG_Periodicity_24 BG_Chancnt_24 BG_Channels_24 RSSIToleranceThreshold_5 RSSILowerThreshold_5 RSSIUpperThreshold_5 BG_Periodicity_5 BG_Chancnt_5 BG_Channels_5
Description	<p>Through this value, user has control to enable or disable the background scan feature as well as to modify any of the background scan/roaming parameters in the Lite-Fi™ device. Enabling/modifying background scan/roaming parameters is applicable only for the Infrastructure mode. (While operating in IBSS mode, it is required that the end-user disable roaming and background scan features.)</p> <p>If background scan is enabled, Lite-Fi™ device periodically performs a scan (after connection) on the set of configured channels, when the RSSI falls below a threshold (RSSIUpperThreshold).</p> <p>The following structure declaration describes the various background scan parameters:</p> <pre>typedef struct bgscan_params { UINT8 Band; UINT8 Enable; UINT8 snd_multi_probe_req; UINT8 dfs_active_probe_flag; UINT16 non_dfs_scan_time; UINT16 dfs_scan_time; UINT8 snd_multi_probe_req; UINT16 RSSIUpperThreshold; UINT16 RSSILowerThreshold; UINT16 RSSIToleranceThreshold; }</pre>


```

UINT16 Periodicity;
UINT8 Channel_cnt;
UINT8 Channels2Scan[MAX_NUM_OF_CHANNELS];
} BGSCAN_PARAMS, *PBGSCAN_PARAMS;

```

The description of the various parameters is as follows:

Band: 0 - 2.4 GHz band

1 - 5 GHz band

Enable: 0 - disable background scan

1 - enable background scan

Snd_multi_probe_req: This field specifies whether to send a multiple probe requests with in a channel. Enabling this feature will send two probe requests one with a SSID and another with NULL SSID.

0 – Disable sending multi probe request

1 – Enable sending multi probe request

dfs_active_probe_flag: flag to enable/disable active probing in dfs channels.

non_dfs_scan_time: the scan time for non-dfs channels, default is 20.

dfs_scan_time: the scan time for dfs channels, default is 110.

RSSIUppperThreshold/Background scan threshold: At every background scan interval (configured via Periodicity), Lite-Fi™ takes a decision whether to initiate background scan or not, depending upon the connected AP's RSSI. Lite-Fi™ initiates a background scan if the RSSI of the connected AP falls below this threshold.

RSSILowerThreshold/Roaming threshold: Once the RSSI of the connected AP falls below this threshold, Lite-Fi™ initiates a roam to the best RSSI AP. The chosen value of the RSSILowerThreshold or Roaming threshold should always be lesser than the RSSIUppperThreshold to ensure that background scan takes place before the station roams to another AP.

RSSIToleranceThreshold: This is the RSSIthreshold value of the AP that the station can accept and if the value falls below that value, roaming is initiated.

Periodicity: Interval between each instance of background scan in units of seconds.

Channel_cnt: Total number of channels on which background scan will be performed.

Channel2Scan: Channel numbers in which the device has to perform background scan. The set of valid channel numbers for 2.4 GHz includes channels within the range 1 – 14. For 5

	<p>GHz band, the set of available channels are mentioned in the section 2.2.24.</p> <p>MAX_NUM_OF_CHANNELS: 25</p> <p>Upon issuing this value, Lite-Fi™ driver validates the entered list of channels, to ensure that background scan is performed only on the valid set of channels (defined as per the regulatory domain setting). If none of the channels mentioned are valid and if background scan is enabled, driver uses the default set (1, 6 and 11 in 2.4 GHz band and non-DFS channels in 5 GHz band).</p> <p>Note: If the user enables background scan operation in any of the channels belonging to the DFS band, the Lite-Fi™ device does a passive background scan in that channel. For all the other non-DFS channels, it performs an active scan.</p>
Default values	<p>By default, the following are the background scan parameters configured in the Lite-Fi™ station.</p> <p>Enable: 1</p> <p>Non_dfs_scan_time: 20</p> <p>Dfs_scan_time: 110</p> <p>RSSIUpperThreshold: -40 dBm</p> <p>RSSILowerThreshold: -65 dBm</p> <p>RSSIToleranceThreshold: -10 dBm</p> <p>Channels2Scan: 1, 6, 11 in the 2.4GHz Band and non-DFS channels in the 5 GHz band</p> <p>Periodicity: 30 seconds</p>

2.1.17BG Scan SSID

Reg Entry	BG_Scan_SSID
Description	<p>With this value, user has control to either send a directed (unicast) SSID or a broadcast SSID probe request when the station performs a background scan(s).</p> <p>Wireless access points when configured in hidden SSID mode do not respond to broadcast SSID probe requests, neither do they advertise their SSID in the beacons. These APs conceal their SSIDs by sending out beacons with the SSID set to NULL.</p> <p>If the network to which the user intends to connect has APs configured in hidden SSID mode, he can configure Lite-Fi™ to transmit Unicast SSID probe requests, with this value.</p>
Default value	By default, Lite-Fi™ broadcasts NULL SSID field in the related probe request related to background scan.

2.1.18GPIO Config

Reg Entries	GPIO_PIN_config GPIO_PIN_0_bit_number GPIO_PIN_0_mode GPIO_PIN_0_direction GPIO_PIN_0_value GPIO_PIN_1_bit_number GPIO_PIN_1_mode GPIO_PIN_1_direction GPIO_PIN_1_value
Description	<p>This value can be used to set the gpio pin configuration. The following structure declaration describes the various GPIO Configuration parameters:</p> <pre>typedef struct _gpio_config{ UINT8 gpio_bit_no; UINT8 gpio_mode UINT8 gpio_dir; UINT8 gpio_val; }GPIO_CONFIG; gpio_bit_no – This is the gpio bit number which ranges from 0 to 31 gpio_mode – This indicates the mode 1-gpio mode 0 – alternate mode gpio_dir – 1- Input direction 0 – Output direction gpio_val – 1 –high 0 - low</pre>
Default value	Not Applicable

2.1.19Lite-Fi Release Version

Reg Entry	Lite-Fi_Release_Version
Description	This Registry will give the information about the driver version used.

2.1.20 Driver Mode

Reg Entry	Driver_Mode
Description	Lite-Fi™ driver is capable of operating in the WiFi mode or in the RF Evaluation mode. With this parameter, user can configure the driver's mode of operation.
Default value	1 (WiFi mode)
Input	The valid values for this field are: 1 – WiFi mode 2 – RF Evaluation mode

2.1.21 SDIO Clock

Reg Entry	sdio_clock
Description	This parameter is used to configure SDIO clock. Appropriate value in units of MHz is to be entered.
Default value	Default maximum
Input	Frequency to set the SDIO clock to

2.1.22 BT Coexistence

Reg Entry	BT_Coexistence
Description	This parameter is used to enable/disable BT (Bluetooth) coexistence feature in the Lite-Fi™ device, when operating in 2.4 GHz band.
Default value	0 (disable)
Input	The valid values for this field are: 1 – Enable BT Coexistence 0 – Disable BT Coexistence

2.1.23 Enable SDIO High Speed

Reg Entry	Enable_SDIO_high_speed
Description	This parameter is used to enable/disable SDIO high-speed operation.
Default value	0 (Disable)
Input	The valid values for this field are:

	1 – Enable SDIO high speed 0 – Disable SDIO high speed
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2.1.24 FalseCCA Params

Reg Entries	falsecca_ignore falsecca_threshold
Description	<p>If falsecca_ignore value is 1, a falseCCA indication from firmware is ignored by driver and FalseCCA threshold value is ignored. If falsecca_ignore value is 0, falseCCA indication is handled by driver based on configured falsecca_threshold value.</p> <p>falsecca_threshold is the threshold count for FalseCCA after which firmware gives an indication to driver. falsecca_threshold value is considered for period of every consecutive 8 beacon intervals.</p>
Default value	0 (falsecca_ignore Disabled) and falsecca_threshold is set to 4000.

2.1.25 Protocol Type

Reg Entry	ProtocolType
Description	This parameter is used to set the specified mode and band of operation.
Default value	<p>By default, Lite-Fi™ RS9110-N-11-03 station performs dual band scan and operates in mixed B/G/N mode (when in 2.4 GHz band) and mixed A/N mode (when in 5 GHz band).</p> <p>By default, Lite-Fi™ RS9110-N-11-02 station operates in mixed B/G/N mode.</p>
Input	<p>The valid values for this field are 0 to 5:</p> <p>0. Dual Band: This mode implies perform dual band scan and operate in mixed 802.11b/g/n mode when in 2.4 GHz band and mixed 802.11a/n mode when in 5 GHz band.</p> <p>1. 802.11B</p> <p>2. 802.11G (Mixed B/G mode)</p> <p>3. 802.11N (Mixed B/G/N mode)</p> <p>4. 802.11A</p> <p>5. 802.11N/A (Mixed A/N mode)</p>

2.1.26 Scan Parameters

Reg Entries	Number_of_Probes Active_Scan_timeout Passive_Scan_timeout
Description	1) Number_of_Probes - Number of probe requests to be sent while active scanning when trying to connect to a hidden SSID AP. It will send back to back probe requests. Maximum threshold is 3. 2) Active_Scan_timeout - Time to do active scanning while trying to connect to a hidden SSID AP. Maximum threshold is 300ms. 3) Passive_Scan_timeout - Time to do passive scanning. Maximum threshold is 600ms.
Default value	Number_of_Probes – 1(One probe request) Active_Scan_timeout – 100ms Passive_Scan_timeout – 400ms

2.1.27 Transmit Power Level

Reg Entries	TxPowerLevel
Description	<p>TxPowerLevel – Transmit power level can be configured using this value.</p> <p>The valid values for this field are 1 to 3:</p> <p>1 – Low</p> <p>2 – Medium</p> <p>3 - High</p>
Default value	TxPowerLevel – 3(High)

Document History:

Rev.	Ver. No.	Date	Changes
1.	1.00	29 Jan, 2013	First version created
2	1.1	4th Feb, 2013	Added section 2.1.28 and modified 2.1.26
3	1.2	6 th Mar, 2013	Removed Regulatory Domain section
