**Date Submitted: 12/02/18**

**Task 01: Building and loading the collector example**

The purpose of this task is to import the example project that has been included within the Resource Explorer view pane. This was done by accessing Resource Explorer, finding the needed project under Software -> SimpleLink CC13x0 SDK … and finding the “collector” project and clicking “import to IDE”.

After importing the project. Ensure the next step was to update the definition within the line that says: CONFIG\_CHANNEL\_MASK within the file “config.h” this can be found within the project > Applications > subg > config.h. This is shown below:

**Modified Code:**

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

@file config.h

@brief TI-15.4 Stack configuration parameters for Collector applications

Group: WCS LPC

Target Device: CC13xx

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**#ifndef** CONFIG\_H

**#define** CONFIG\_H

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Includes

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

**#include** "api\_mac.h"

**#ifdef** \_\_cplusplus

**extern** "C"

{

**#endif**

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Constants and definitions

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\* config parameters \*/

/\*! Security Enable - set to true to turn on security \*/

**#define** CONFIG\_SECURE **true**

/\*! PAN ID \*/

**#define** CONFIG\_PAN\_ID 0xFFFF

/\*! Coordinator short address \*/

**#define** CONFIG\_COORD\_SHORT\_ADDR 0xAABB

/\*! FH disabled as default \*/

**#define** CONFIG\_FH\_ENABLE **false**

/\*! maximum beacons possibly received \*/

**#define** CONFIG\_MAX\_BEACONS\_RECD 200

/\*! maximum devices in association table \*/

**#define** CONFIG\_MAX\_DEVICES 50

/\*!

Setting beacon order to 15 will disable the beacon, 8 is a good value for

beacon mode

\*/

**#define** CONFIG\_MAC\_BEACON\_ORDER 15

/\*!

Setting superframe order to 15 will disable the superframe, 8 is a good value

for beacon mode

\*/

**#define** CONFIG\_MAC\_SUPERFRAME\_ORDER 15

/\*! Setting for Phy ID \*/

**#define** CONFIG\_PHY\_ID (APIMAC\_STD\_US\_915\_PHY\_1)

**#if** ((CONFIG\_PHY\_ID >= APIMAC\_MRFSK\_STD\_PHY\_ID\_BEGIN) && (CONFIG\_PHY\_ID <= APIMAC\_MRFSK\_STD\_PHY\_ID\_END))

/\*! Setting for channel page \*/

**#define** CONFIG\_CHANNEL\_PAGE (APIMAC\_CHANNEL\_PAGE\_9)

**#elif** ((CONFIG\_PHY\_ID >= APIMAC\_MRFSK\_GENERIC\_PHY\_ID\_BEGIN) && (CONFIG\_PHY\_ID <= APIMAC\_MRFSK\_GENERIC\_PHY\_ID\_END))

/\*! Setting for channel page \*/

**#define** CONFIG\_CHANNEL\_PAGE (APIMAC\_CHANNEL\_PAGE\_10)

**#else**

**#error** "PHY ID is wrong."

**#endif**

/\*! MAC Parameter \*/

/\*! Min BE - Minimum Backoff Exponent \*/

**#define** CONFIG\_MIN\_BE 3

/\*! Max BE - Maximum Backoff Exponent \*/

**#define** CONFIG\_MAX\_BE 5

/\*! MAC MAX CSMA Backoffs \*/

**#define** CONFIG\_MAC\_MAX\_CSMA\_BACKOFFS 4

/\*! macMaxFrameRetries - Maximum Frame Retries \*/

**#define** CONFIG\_MAX\_RETRIES 3

/\*! Application traffic profile \*/

**#if** (((CONFIG\_PHY\_ID >= APIMAC\_MRFSK\_STD\_PHY\_ID\_BEGIN) && (CONFIG\_PHY\_ID <= APIMAC\_MRFSK\_GENERIC\_PHY\_ID\_BEGIN)) || \

((CONFIG\_PHY\_ID >= APIMAC\_GENERIC\_US\_915\_PHY\_132) && (CONFIG\_PHY\_ID <= APIMAC\_GENERIC\_ETSI\_863\_PHY\_133)))

/\*!

Reporting Interval - in milliseconds to be set on connected devices using

configuration request messages

\*/

**#define** CONFIG\_REPORTING\_INTERVAL 90000

/\*!

Polling interval in milliseconds to be set on connected devices using

configuration request messages. Must be greater than or equal to default

polling interval set on sensor devices

\*/

**#define** CONFIG\_POLLING\_INTERVAL 6000

/\*!

Time interval in ms between tracking message intervals

\*/

**#define** TRACKING\_DELAY\_TIME 60000

**#else**

/\*!

Reporting Interval - in milliseconds to be set on connected devices using

configuration request messages

\*/

**#define** CONFIG\_REPORTING\_INTERVAL 300000

/\*!

Polling interval in milliseconds to be set on connected devices using

configuration request messages. Must be greater than or equal to default

polling interval set on sensor devices

\*/

**#define** CONFIG\_POLLING\_INTERVAL 60000

/\*!

Time interval in ms between tracking message intervals

\*/

**#define** TRACKING\_DELAY\_TIME 300000

**#endif**

/\*! scan duration

\* scan type = MAC\_MPM\_SCAN\_NBPAN (see mac\_api.h):

\* scan duration = aBaseSlotDuration \* 2 \* CONFIG\_SCAN\_DURATION

\*

\* scan type = MAC\_MPM\_SCAN\_BPAN (see mac\_api.h):

\* scan duration = aBaseSuperframeDuration \* 2 \* CONFIG\_SCAN\_DURATION

\* other types

\* scan duration = aBaseSuperframeDuration \* (1 + 2 \* CONFIG\_SCAN\_DURATION)

\*/

**#define** CONFIG\_SCAN\_DURATION 5

/\*!

Range Extender Mode setting.

The following modes are available.

APIMAC\_NO\_EXTENDER - does not have PA/LNA

APIMAC\_HIGH\_GAIN\_MODE - high gain mode

To enable CC1190, use

#define CONFIG\_RANGE\_EXT\_MODE APIMAC\_HIGH\_GAIN\_MODE

\*/

**#define** CONFIG\_RANGE\_EXT\_MODE APIMAC\_NO\_EXTENDER

/\*!

High PA Mode setting.

The following modes are available.

APIMAC\_DEFAULT\_PA - does not have High PA

APIMAC\_HIGH\_PA - High PA

To enable PA, use

#define CONFIG\_PA\_TYPE APIMAC\_HIGH\_PA

\*/

**#define** CONFIG\_PA\_TYPE APIMAC\_DEFAULT\_PA

/\*! Setting Default Key\*/

**#define** KEY\_TABLE\_DEFAULT\_KEY {0x12, 0x34, 0x56, 0x78, 0x9a, 0xbc, 0xde, 0xf0,\

0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00}

/\*!

Channel mask used when CONFIG\_FH\_ENABLE is false.

Each bit indicates if the corresponding channel is to be scanned

First byte represents channels 0 to 7 and the last byte represents

channels 128 to 135.

For byte zero in the bit mask, LSB representing Ch0.

For byte 1, LSB represents Ch8 and so on.

e.g., 0x01 0x10 represents Ch0 and Ch12 are included.

The default of 0x0F represents channels 0-3 are selected.

APIMAC\_STD\_US\_915\_PHY\_1 (50kbps/2-FSK/915MHz band) has channels 0 - 128.

APIMAC\_STD\_ETSI\_863\_PHY\_3 (50kbps/2-FSK/863MHz band) has channels 0 - 33.

APIMAC\_GENERIC\_CHINA\_433\_PHY\_128 (50kbps/2-FSK/433MHz band) has channels 0 - 6.

\*/

**#define** CONFIG\_CHANNEL\_MASK { 0x00, 0x05, 0x00, 0x00, 0x00, 0x00, \

0x00, 0x00, 0x00, 0x00, 0x00, 0x00, \

0x00, 0x00, 0x00, 0x00, 0x00 }

/\*!

Channel mask used when CONFIG\_FH\_ENABLE is true.

Represents the list of channels on which the device can hop.

The actual sequence used shall be based on DH1CF function.

It is represented as a bit string with LSB representing Ch0.

e.g., 0x01 0x10 represents Ch0 and Ch12 are included.

\*/

**#define** CONFIG\_FH\_CHANNEL\_MASK { 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, \

0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, \

0xFF, 0xFF, 0xFF, 0xFF, 0xFF }

/\*!

List of channels to target the Async frames

It is represented as a bit string with LSB representing Ch0

e.g., 0x01 0x10 represents Ch0 and Ch12 are included

It should cover all channels that could be used by a target device in its

hopping sequence. Channels marked beyond number of channels supported by

PHY Config will be excluded by stack. To avoid interference on a channel,

it should be removed from Async Mask and added to exclude channels

(CONFIG\_CHANNEL\_MASK).

\*/

**#define** FH\_ASYNC\_CHANNEL\_MASK { 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, \

0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, \

0xFF, 0xFF, 0xFF, 0xFF, 0xFF }

/\* FH related config variables \*/

/\*!

The number of non sleepy channel hopping end devices to be supported.

It is to be noted that the total number of non sleepy devices supported

must be less than 50. Stack will allocate memory proportional

to the number of end devices requested.

\*/

**#define** FH\_NUM\_NON\_SLEEPY\_HOPPING\_NEIGHBORS 5

/\*!

The number of non sleepy fixed channel end devices to be supported.

It is to be noted that the total number of non sleepy devices supported

must be less than 50. Stack will allocate memory proportional

to the number of end devices requested.

\*/

**#define** FH\_NUM\_NON\_SLEEPY\_FIXED\_CHANNEL\_NEIGHBORS 5

/\*!

Dwell time: The duration for which the collector will

stay on a specific channel before hopping to next channel.

\*/

**#define** CONFIG\_DWELL\_TIME 250

/\*!

FH Application Broadcast Msg generation interval in ms.

Value should be set at least greater than 200 ms,

\*/

**#define** FH\_BROADCAST\_INTERVAL 10000

/\*! FH Broadcast dwell time. If set to 0, it shall disable broadcast hopping and

\* broadcast message transmissions in FH Mode \*/

**#define** FH\_BROADCAST\_DWELL\_TIME 100

**#if** (((CONFIG\_PHY\_ID >= APIMAC\_MRFSK\_STD\_PHY\_ID\_BEGIN) && (CONFIG\_PHY\_ID <= APIMAC\_MRFSK\_GENERIC\_PHY\_ID\_BEGIN)) || \

((CONFIG\_PHY\_ID >= APIMAC\_GENERIC\_US\_915\_PHY\_132) && (CONFIG\_PHY\_ID <= APIMAC\_GENERIC\_ETSI\_863\_PHY\_133)))

/\*!

The minimum trickle timer window for PAN Advertisement,

and PAN Configuration frame transmissions.

Recommended to set this to half of PAS/PCS MIN Timer

\*/

**#define** CONFIG\_TRICKLE\_MIN\_CLK\_DURATION 3000

/\*!

The maximum trickle timer window for PAN Advertisement,

and PAN Configuration frame transmissions.

\*/

**#define** CONFIG\_TRICKLE\_MAX\_CLK\_DURATION 6000

**#else**

/\*!

The minimum trickle timer window for PAN Advertisement,

and PAN Configuration frame transmissions.

Recommended to set this to half of PAS/PCS MIN Timer

\*/

**#define** CONFIG\_TRICKLE\_MIN\_CLK\_DURATION 30000

/\*!

The maximum trickle timer window for PAN Advertisement,

and PAN Configuration frame transmissions.

\*/

**#define** CONFIG\_TRICKLE\_MAX\_CLK\_DURATION 60000

**#endif**

/\*!

To enable Doubling of PA/PC trickle time,

useful when network has non sleepy nodes and

there is a requirement to use PA/PC to convey updated

PAN information. Note that when using option the CONFIG\_TRICKLE\_MIN\_CLK\_DURATION

and CONFIG\_TRICKLE\_MAX\_CLK\_DURATION should be set to a sufficiently large value.

Recommended values are 1 min and 16 min respectively.

\*/

**#define** CONFIG\_DOUBLE\_TRICKLE\_TIMER **false**

/\*! value for ApiMac\_FHAttribute\_netName \*/

**#define** CONFIG\_FH\_NETNAME {"FHTest"}

/\*!

Value for Transmit Power in dBm

For US and ETSI band, Default value is 10, allowed values are

-10, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 and 14dBm.

For China band, allowed values are 6, 10, 13, 14 and 15dBm.

For CC1190, allowed values are between 18, 23, 25, 26 and 27dBm.

When the nodes in the network are close to each other

lowering this value will help reduce saturation \*/

**#ifndef** CC13X2R1\_LAUNCHXL

**#if** CONFIG\_RANGE\_EXT\_MODE

**#define** CONFIG\_TRANSMIT\_POWER 26

**#else**

**#if** ((CONFIG\_PHY\_ID == APIMAC\_GENERIC\_CHINA\_433\_PHY\_128) || (CONFIG\_PHY\_ID == APIMAC\_GENERIC\_CHINA\_LRM\_433\_PHY\_130))

**#define** CONFIG\_TRANSMIT\_POWER 14

**#else**

**#define** CONFIG\_TRANSMIT\_POWER 12

**#endif**

**#endif**

**#else** /\* CC13X2R1\_LAUNCHXL \*/

**#if** CONFIG\_PA\_TYPE

**#define** CONFIG\_TRANSMIT\_POWER 20

**#else**

**#define** CONFIG\_TRANSMIT\_POWER 12

**#endif**

**#endif**

**#ifndef** CC13X2R1\_LAUNCHXL

**#if** CONFIG\_RANGE\_EXT\_MODE

**#if** (CCFG\_FORCE\_VDDR\_HH == 1)

**#error** "CCFG\_FORCE\_VDDR\_HH should be 0"

**#endif**

**#else**

**#if** ((CONFIG\_PHY\_ID == APIMAC\_GENERIC\_CHINA\_433\_PHY\_128) || (CONFIG\_PHY\_ID == APIMAC\_GENERIC\_CHINA\_LRM\_433\_PHY\_130))

**#if** (CCFG\_FORCE\_VDDR\_HH == 0)

**#if** (CONFIG\_TRANSMIT\_POWER >= 15)

**#error** "CONFIG\_TRANSMIT\_POWER should be less than 15"

**#endif**

**#else**

**#if** (CONFIG\_TRANSMIT\_POWER < 15)

/\* In 433 MHz band when CCFG\_FORCE\_VDDR\_HH = 1, only possible value of transmit power is 15 \*/

**#error** "CONFIG\_TRANSMIT\_POWER should be 15"

**#endif**

**#endif**

**#else**

**#if** (CCFG\_FORCE\_VDDR\_HH == 0)

**#if** (CONFIG\_TRANSMIT\_POWER >= 14)

**#error** "CONFIG\_TRANSMIT\_POWER should be less than 14"

**#endif**

**#else**

**#if** (CONFIG\_TRANSMIT\_POWER < 14)

/\* In US and ETSI band when CCFG\_FORCE\_VDDR\_HH = 1, only possible value of transmit power is 14 \*/

**#error** "CONFIG\_TRANSMIT\_POWER should be 14"

**#endif**

**#endif**

**#endif**

**#endif**

**#else**

**#if** CONFIG\_PA\_TYPE

**#if** (CONFIG\_TRANSMIT\_POWER > 20)

**#error** "CONFIG\_TRANSMIT\_POWER should be less than or equal to 20"

**#endif**

**#else**

**#if** (CCFG\_FORCE\_VDDR\_HH == 0)

**#if** (CONFIG\_TRANSMIT\_POWER >= 14)

**#error** "CONFIG\_TRANSMIT\_POWER should be less than 14"

**#endif**

**#else**

**#if** (CONFIG\_TRANSMIT\_POWER < 14)

/\* In US and ETSI band when CCFG\_FORCE\_VDDR\_HH = 1, only possible value of transmit power is 14 \*/

**#error** "CONFIG\_TRANSMIT\_POWER should be 14"

**#endif**

**#endif**

**#endif**

**#endif**

/\*!

\* Enable this mode for certfication.

\* For FH certification, CONFIG\_FH\_ENABLE should

\* also be enabled.

\*/

**#define** CERTIFICATION\_TEST\_MODE **false**

**#ifdef** POWER\_MEAS

/\*! Size of RAMP Data to be sent when POWER Test is enabled \*/

**#define** COLLECTOR\_TEST\_RAMP\_DATA\_SIZE 20

/\*!

Power profile to be used when Power MEAS is enabled.

Profile 1 - POLL\_ACK - Polling Only

Profile 2 - DATA\_ACK - 20 byte application data + ACK from sensor to collector

Profile 3 - POLL\_DATA - Poll + received Data from collector

Profile 4 - SLEEP - No Poll or Data. In Beacon mode, beacon RX would occur

\*/

**#define** POWER\_TEST\_PROFILE DATA\_ACK

**#endif**

/\* Check if all the necessary parameters have been set for FH mode \*/

**#if** CONFIG\_FH\_ENABLE

**#if** !defined(FEATURE\_ALL\_MODES) && !defined(FEATURE\_FREQ\_HOP\_MODE)

**#error** "Do you want to build image with frequency hopping mode? \

Define either FEATURE\_FREQ\_HOP\_MODE or FEATURE\_ALL\_MODES in features.h"

**#endif**

**#endif**

/\* Check if stack level security is enabled if application security is enabled \*/

**#if** CONFIG\_SECURE

**#if** !defined(FEATURE\_MAC\_SECURITY)

**#error** "Define FEATURE\_MAC\_SECURITY or FEATURE\_ALL\_MODES in features.h to \

be able to use security at application level"

**#endif**

**#endif**

/\* Set beacon order and superframe order to 15 for FH mode to avoid user error \*/

**#if** CONFIG\_FH\_ENABLE

**#if** (CONFIG\_MAC\_BEACON\_ORDER != 15) && (CONFIG\_MAC\_SUPERFRAME\_ORDER != 15)

**#error** "Do you want to build image with frequency hopping mode? \

If yes, CONFIG\_MAC\_BEACON\_ORDER and CONFIG\_MAC\_SUPERFRAME\_ORDER \

should both be set to 15"

**#endif**

**#endif**

**#if** (CONFIG\_PA\_TYPE == APIMAC\_HIGH\_PA) && (CONFIG\_RANGE\_EXT\_MODE == APIMAC\_HIGH\_GAIN\_MODE)

**#error** "Do you want to build image with a PA enabled? \

If yes, select one of either CONFIG\_RANGE\_EXT\_MODE or CONFIG\_PA\_TYPE as the amplifier type.

**#endif**

**#ifdef** \_\_cplusplus

}

**#endif**

**#endif** /\* CONFIG\_H \*/

**Task 02: Building and loading the Sensor Example**

The purpose of this task is to implement the same steps as Task 01 but instead of the controller project the other Launchpad being used will be implemented with the Sensor Project found in the resource explorer.

**Modified Code:**

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

@file config.h

@brief TI-15.4 Stack configuration parameters for Sensor applications

Group: WCS LPC

Target Device: CC13xx

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**#ifndef** CONFIG\_H

**#define** CONFIG\_H

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Includes

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

**#include** "api\_mac.h"

**#ifdef** \_\_cplusplus

**extern** "C"

{

**#endif**

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Constants and definitions

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\* config parameters \*/

/\*! Security Enable - set to true to turn on security \*/

**#define** CONFIG\_SECURE **true**

/\*! PAN ID \*/

**#define** CONFIG\_PAN\_ID 0xFFFF

/\*! FH disabled as default \*/

**#define** CONFIG\_FH\_ENABLE **false**

/\*! link quality \*/

**#define** CONFIG\_LINKQUALITY 1

/\*! percent filter \*/

**#define** CONFIG\_PERCENTFILTER 0xFF

/\*!

Beacon order, value of 15 indicates non beacon mode,

8 is a good value for beacon mode

\*/

**#define** CONFIG\_BEACON\_ORDER 15

/\*!

Superframe order, value of 15 indicates non beacon mode,

8 is a good value for beacon mode

\*/

**#define** CONFIG\_SUPERFRAME\_ORDER 15

/\*! Maximum number of message failure, to indicate sync loss \*/

**#define** CONFIG\_MAX\_DATA\_FAILURES 3

/\*!

Maximum number of attempts for association in FH mode

after reception of a PAN Config frame

\*/

**#define** CONFIG\_FH\_MAX\_ASSOCIATION\_ATTEMPTS 3

/\* Interval for scan backoff \*/

**#define** CONFIG\_SCAN\_BACKOFF\_INTERVAL 5000

/\* Interval for delay between orphan notifications \*/

**#define** CONFIG\_ORPHAN\_BACKOFF\_INTERVAL 300000

/\*! Setting for Phy ID \*/

**#define** CONFIG\_PHY\_ID (APIMAC\_STD\_US\_915\_PHY\_1)

/\*! MAC Parameter \*/

/\*! Min BE - Minimum Backoff Exponent \*/

**#define** CONFIG\_MIN\_BE 3

/\*! Max BE - Maximum Backoff Exponent \*/

**#define** CONFIG\_MAX\_BE 5

/\*! MAC MAX CSMA Backoffs \*/

**#define** CONFIG\_MAC\_MAX\_CSMA\_BACKOFFS 4

/\*! macMaxFrameRetries - Maximum Frame Retries \*/

**#define** CONFIG\_MAX\_RETRIES 3

**#if** ((CONFIG\_PHY\_ID >= APIMAC\_MRFSK\_STD\_PHY\_ID\_BEGIN) && (CONFIG\_PHY\_ID <= APIMAC\_MRFSK\_STD\_PHY\_ID\_END))

/\*! Setting for channel page \*/

**#define** CONFIG\_CHANNEL\_PAGE (APIMAC\_CHANNEL\_PAGE\_9)

**#elif** ((CONFIG\_PHY\_ID >= APIMAC\_MRFSK\_GENERIC\_PHY\_ID\_BEGIN) && (CONFIG\_PHY\_ID <= APIMAC\_MRFSK\_GENERIC\_PHY\_ID\_END))

/\*! Setting for channel page \*/

**#define** CONFIG\_CHANNEL\_PAGE (APIMAC\_CHANNEL\_PAGE\_10)

**#else**

**#error** "PHY ID is wrong."

**#endif**

/\*! scan duration in seconds\*/

**#define** CONFIG\_SCAN\_DURATION 5

/\*!

Coordinator Short Address When Operating with FH Enabled.

\*/

**#define** FH\_COORD\_SHORT\_ADDR 0xAABB

/\*!

Range Extender Mode setting.

The following modes are available.

APIMAC\_NO\_EXTENDER - does not have PA/LNA

APIMAC\_HIGH\_GAIN\_MODE - high gain mode

To enable CC1190, use

#define CONFIG\_RANGE\_EXT\_MODE APIMAC\_HIGH\_GAIN\_MODE

\*/

**#define** CONFIG\_RANGE\_EXT\_MODE APIMAC\_NO\_EXTENDER

/\*!

High PA Mode setting.

The following modes are available.

APIMAC\_DEFAULT\_PA - does not have High PA

APIMAC\_HIGH\_PA - High PA

To enable PA, use

#define CONFIG\_PA\_TYPE APIMAC\_HIGH\_PA

\*/

**#define** CONFIG\_PA\_TYPE APIMAC\_DEFAULT\_PA

/\*! Setting Default Key\*/

**#define** KEY\_TABLE\_DEFAULT\_KEY {0x12, 0x34, 0x56, 0x78, 0x9a, 0xbc, 0xde, 0xf0,\

0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00}

/\*!

Channel mask used when CONFIG\_FH\_ENABLE is false.

Each bit indicates if the corresponding channel is to be scanned

First byte represents channels 0 to 7 and the last byte represents

channels 128 to 135.

For byte zero in the bit mask, LSB representing Ch0.

For byte 1, LSB represents Ch8 and so on.

e.g., 0x01 0x10 represents Ch0 and Ch12 are included.

The default of 0x0F represents channels 0-3 are selected.

APIMAC\_STD\_US\_915\_PHY\_1 (50kbps/2-FSK/915MHz band) has channels 0 - 128.

APIMAC\_STD\_ETSI\_863\_PHY\_3 (50kbps/2-FSK/863MHz band) has channels 0 - 33.

APIMAC\_GENERIC\_CHINA\_433\_PHY\_128 (50kbps/2-FSK/433MHz band) has channels 0 - 6.

\*/

**#define** CONFIG\_CHANNEL\_MASK { 0x00, 0x05, 0x00, 0x00, 0x00, 0x00, \

0x00, 0x00, 0x00, 0x00, 0x00, 0x00, \

0x00, 0x00, 0x00, 0x00, 0x00 }

/\*!

Channel mask used when CONFIG\_FH\_ENABLE is true.

Represents the list of channels on which the device can hop.

When CONFIG\_RX\_ON\_IDLE is true, the actual sequence will

be based on DH1CF function. When it is set to false, the sequence

shall be a linear hopping over available channels in ascending order and

shall be used to change channel during the join phase.

It is represented as a bit string with LSB representing Ch0.

e.g., 0x01 0x10 represents Ch0 and Ch12 are included.

\*/

**#define** CONFIG\_FH\_CHANNEL\_MASK { 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, \

0xFF, 0x00, 0x00, 0x00, 0x00, 0x00, \

0x00, 0x00, 0x00, 0x00, 0x00,}

/\* FH related config variables \*/

/\*!

List of channels to target the Async frames

It is represented as a bit string with LSB representing Ch0

e.g., 0x01 0x10 represents Ch0 and Ch12 are included

It should cover all channels that could be used by a target device in its

hopping sequence. Channels marked beyond number of channels supported by

PHY Config will be excluded by stack. To avoid interference on a channel,

it should be removed from Async Mask and added to exclude channels

(CONFIG\_CHANNEL\_MASK).

\*/

**#define** FH\_ASYNC\_CHANNEL\_MASK { 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, \

0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, \

0xFF, 0xFF, 0xFF, 0xFF, 0xFF }

/\*! Rx on when idle, false for sleepy device, true for non sleepy device \*/

**#define** CONFIG\_RX\_ON\_IDLE **false**

/\*!

The number of non sleepy channel hopping end devices to be supported.

It is to be noted that the total number of non sleepy devices supported

must be less than 50. Stack will allocate memory proportional

to the number of end devices requested.

\*/

**#define** FH\_NUM\_NON\_SLEEPY\_HOPPING\_NEIGHBORS 2

/\*!

The number of non sleepy fixed channel end devices to be supported.

It is to be noted that the total number of non sleepy devices supported

must be less than 50. Stack will allocate memory proportional

to the number of end devices requested.

\*/

**#define** FH\_NUM\_NON\_SLEEPY\_FIXED\_CHANNEL\_NEIGHBORS 2

/\*!

Dwell Time: The duration for which a non sleepy end device shall

stay on a specific channel before hopping to next channel.

\*/

**#define** CONFIG\_DWELL\_TIME 250

**#if** (((CONFIG\_PHY\_ID >= APIMAC\_MRFSK\_STD\_PHY\_ID\_BEGIN) && (CONFIG\_PHY\_ID <= APIMAC\_MRFSK\_GENERIC\_PHY\_ID\_BEGIN)) || \

((CONFIG\_PHY\_ID >= APIMAC\_GENERIC\_US\_915\_PHY\_132) && (CONFIG\_PHY\_ID <= APIMAC\_GENERIC\_ETSI\_863\_PHY\_133)))

/\*! Default Polling interval in milliseconds. It will get updated upon reception

of a config request message \*/

**#define** CONFIG\_POLLING\_INTERVAL 6000

/\*! PAN Advertisement Solicit trickle timer duration in milliseconds \*/

**#define** CONFIG\_PAN\_ADVERT\_SOLICIT\_CLK\_DURATION 6000

/\*! PAN Config Solicit trickle timer duration in milliseconds \*/

**#define** CONFIG\_PAN\_CONFIG\_SOLICIT\_CLK\_DURATION 6000

/\*! Default Reporting Interval - in milliseconds. It will get updated upon

reception of a config request message \*/

**#define** CONFIG\_REPORTING\_INTERVAL 500

**#else**

/\*! Default Polling interval in milliseconds. It will get updated upon reception

of a config request message \*/

**#define** CONFIG\_POLLING\_INTERVAL 60000

/\*! PAN Advertisement Solicit trickle timer duration in milliseconds \*/

**#define** CONFIG\_PAN\_ADVERT\_SOLICIT\_CLK\_DURATION 60000

/\*! PAN Config Solicit trickle timer duration in milliseconds \*/

**#define** CONFIG\_PAN\_CONFIG\_SOLICIT\_CLK\_DURATION 60000

/\*! Default Reporting Interval - in milliseconds. It will get updated upon

reception of a config request message \*/

**#define** CONFIG\_REPORTING\_INTERVAL 600000

**#endif**

/\*! FH Poll/Sensor msg start time randomization window \*/

**#define** CONFIG\_FH\_START\_POLL\_DATA\_RAND\_WINDOW 10000

/\*! If enabled, the periodic sensor message shall be sent as a fixed size

\* packet of specified size. If set to 0, the periodic sensor message shall be

\* of type sensor data specified in smsgs.h

\*/

**#define** SENSOR\_TEST\_RAMP\_DATA\_SIZE 0

/\*! value for ApiMac\_FHAttribute\_netName \*/

**#define** CONFIG\_FH\_NETNAME {"FHTest"}

/\*! Range Extender is not supported in uBLE project \*/

**#ifdef** FEATURE\_UBLE

**#if** CONFIG\_RANGE\_EXT\_MODE

**#error** "CONFIG\_RANGE\_EXT\_MODE should be APIMAC\_NO\_EXTENDER"

**#endif**

**#endif**

/\*!

Value for Transmit Power in dBm

For US and ETSI band, Default value is 10, allowed values are

-10, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 and 14dBm.

For China band, allowed values are 6, 10, 13, 14 and 15dBm.

For CC1190, allowed values are between 18, 23, 25, 26 and 27dBm.

When the nodes in the network are close to each other

lowering this value will help reduce saturation \*/

**#ifndef** CC13X2R1\_LAUNCHXL

**#if** CONFIG\_RANGE\_EXT\_MODE

**#define** CONFIG\_TRANSMIT\_POWER 26

**#else**

**#if** ((CONFIG\_PHY\_ID == APIMAC\_GENERIC\_CHINA\_433\_PHY\_128) || (CONFIG\_PHY\_ID == APIMAC\_GENERIC\_CHINA\_LRM\_433\_PHY\_130))

**#define** CONFIG\_TRANSMIT\_POWER 14

**#else**

**#define** CONFIG\_TRANSMIT\_POWER 12

**#endif**

**#endif**

**#else** /\* CC13X2R1\_LAUNCHXL \*/

**#if** CONFIG\_PA\_TYPE

**#define** CONFIG\_TRANSMIT\_POWER 20

**#else**

**#define** CONFIG\_TRANSMIT\_POWER 12

**#endif**

**#endif**

**#ifndef** CC13X2R1\_LAUNCHXL

**#if** CONFIG\_RANGE\_EXT\_MODE

**#if** (CCFG\_FORCE\_VDDR\_HH == 1)

**#error** "CCFG\_FORCE\_VDDR\_HH should be 0"

**#endif**

**#else**

**#if** ((CONFIG\_PHY\_ID == APIMAC\_GENERIC\_CHINA\_433\_PHY\_128) || (CONFIG\_PHY\_ID == APIMAC\_GENERIC\_CHINA\_LRM\_433\_PHY\_130))

**#if** (CCFG\_FORCE\_VDDR\_HH == 0)

**#if** (CONFIG\_TRANSMIT\_POWER >= 15)

**#error** "CONFIG\_TRANSMIT\_POWER should be less than 15"

**#endif**

**#else**

**#if** (CONFIG\_TRANSMIT\_POWER < 15)

/\* In 433 MHz band when CCFG\_FORCE\_VDDR\_HH = 1, only possible value of transmit power is 15 \*/

**#error** "CONFIG\_TRANSMIT\_POWER should be 15"

**#endif**

**#endif**

**#else**

**#if** (CCFG\_FORCE\_VDDR\_HH == 0)

**#if** (CONFIG\_TRANSMIT\_POWER >= 14)

**#error** "CONFIG\_TRANSMIT\_POWER should be less than 14"

**#endif**

**#else**

**#if** (CONFIG\_TRANSMIT\_POWER < 14)

/\* In US and ETSI band when CCFG\_FORCE\_VDDR\_HH = 1, only possible value of transmit power is 14 \*/

**#error** "CONFIG\_TRANSMIT\_POWER should be 14"

**#endif**

**#endif**

**#endif**

**#endif**

**#else**

**#if** CONFIG\_PA\_TYPE

**#if** (CONFIG\_TRANSMIT\_POWER > 20)

**#error** "CONFIG\_TRANSMIT\_POWER should be less than or equal to 20"

**#endif**

**#else**

**#if** (CCFG\_FORCE\_VDDR\_HH == 0)

**#if** (CONFIG\_TRANSMIT\_POWER >= 14)

**#error** "CONFIG\_TRANSMIT\_POWER should be less than 14"

**#endif**

**#else**

**#if** (CONFIG\_TRANSMIT\_POWER < 14)

/\* In US and ETSI band when CCFG\_FORCE\_VDDR\_HH = 1, only possible value of transmit power is 14 \*/

**#error** "CONFIG\_TRANSMIT\_POWER should be 14"

**#endif**

**#endif**

**#endif**

**#endif**

/\*!

\* Enable this mode for certfication.

\* For FH certification, CONFIG\_FH\_ENABLE should

\* also be enabled

\*/

**#define** CERTIFICATION\_TEST\_MODE **false**

**#ifdef** POWER\_MEAS

/\*!

Power profile to be used when Power MEAS is enabled.

Profile 1 - POLL\_ACK - Polling Only

Profile 2 - DATA\_ACK - 20 byte application data + ACK from sensor to collector

Profile 3 - POLL\_DATA - Poll + received Data from collector

Profile 4 - SLEEP - No Poll or Data. In Beacon mode, beacon RX would occur

\*/

**#define** POWER\_TEST\_PROFILE DATA\_ACK

**#endif**

/\* Check if all the necessary parameters have been set for FH mode \*/

**#if** CONFIG\_FH\_ENABLE

**#if** !defined(FEATURE\_ALL\_MODES) && !defined(FEATURE\_FREQ\_HOP\_MODE)

**#error** "Do you want to build image with frequency hopping mode? \

Define either FEATURE\_FREQ\_HOP\_MODE or FEATURE\_ALL\_MODES in features.h"

**#endif**

**#endif**

/\* Check if stack level security is enabled if application security is enabled \*/

**#if** CONFIG\_SECURE

**#if** !defined(FEATURE\_MAC\_SECURITY)

**#error** "Define FEATURE\_MAC\_SECURITY or FEATURE\_ALL\_MODES in features.h to \

be able to use security at application level"

**#endif**

**#endif**

/\* Set beacon order and superframe order to 15 for FH mode to avoid user error \*/

**#if** CONFIG\_FH\_ENABLE

**#if** (CONFIG\_BEACON\_ORDER != 15) && (CONFIG\_SUPERFRAME\_ORDER != 15)

**#error** "Do you want to build image with frequency hopping mode? \

If yes, CONFIG\_BEACON\_ORDER and CONFIG\_SUPERFRAME\_ORDER \

should both be set to 15"

**#endif**

**#if** (FH\_NUM\_NON\_SLEEPY\_HOPPING\_NEIGHBORS < 2) || (FH\_NUM\_NON\_SLEEPY\_FIXED\_CHANNEL\_NEIGHBORS < 2)

**#error** "You have an invalid value for FH neighbors. Set the values \

for FH\_NUM\_NON\_SLEEPY\_HOPPING\_NEIGHBORS and FH\_NUM\_NON\_SLEEPY\_FIXED\_CHANNEL\_NEIGHBORS to at least 2"

**#endif**

**#endif**

**#if** (CONFIG\_PA\_TYPE == APIMAC\_HIGH\_PA) && (CONFIG\_RANGE\_EXT\_MODE == APIMAC\_HIGH\_GAIN\_MODE)

**#error** "Do you want to build image with a PA enabled? \

If yes, select one of either CONFIG\_RANGE\_EXT\_MODE or CONFIG\_PA\_TYPE as the amplifier type.

**#endif**

**#ifdef** \_\_cplusplus

}

**#endif**

**#endif** /\* CONFIG\_H \*/

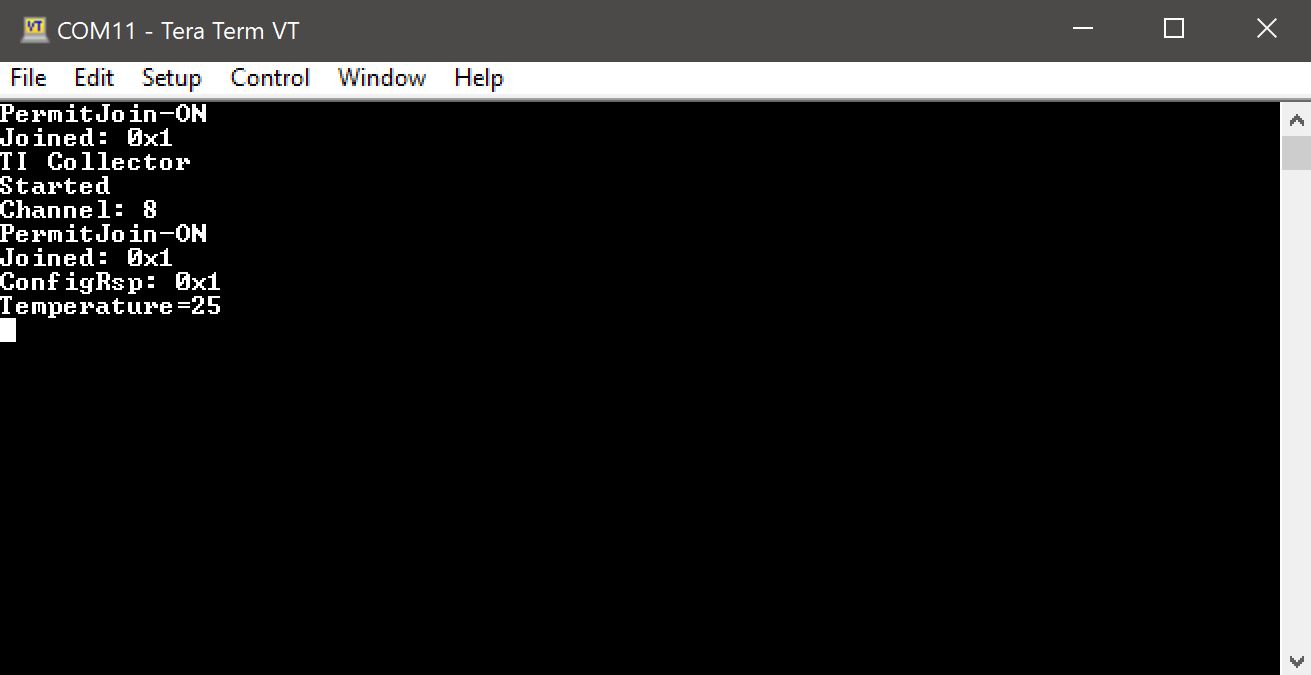
**Task 03: Using the Collector and Sensor**

Youtube Link: <https://www.youtube.com/watch?v=s_N_Kl5P-P0>

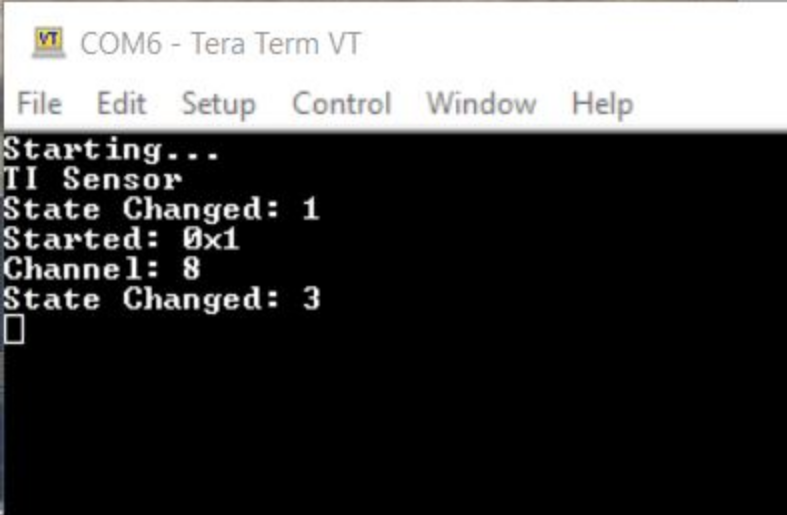
Youtube Link: <https://www.youtube.com/watch?v=p4NWb2UQmuA>

Task 03 is responsible for ensuring that the two LaunchPads can communicate efficiently. After loading the programs to each Launchpad, we ensured to remove the USB connection and re-plug the connection to make sure UART is activated. Also made sure that no other terminals or CCS were using the COM port as well.

Collector:



Sensor:



**Task 04: Updating the Sensor’s reporting rate**

**Youtube Link:** [**https://www.youtube.com/watch?v=4j2TunKKwas**](https://www.youtube.com/watch?v=4j2TunKKwas)

The purpose of Task 04 is to increase the rate of the Sensor transmitting information to the collector. Previously, the sensor would report data in about a three-minute interval. With Task 04 being implemented the report rate should be about every 1 second.

Modified Code:

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

@file config.h

@brief TI-15.4 Stack configuration parameters for Collector applications

Group: WCS LPC

Target Device: CC13xx

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

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\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Release Name: simplelink\_cc13x0\_sdk\_2\_30\_00\_

Release Date: 2018-09-21 11:39:46

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

**#ifndef** CONFIG\_H

**#define** CONFIG\_H

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Includes

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

**#include** "api\_mac.h"

**#ifdef** \_\_cplusplus

**extern** "C"

{

**#endif**

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Constants and definitions

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\* config parameters \*/

/\*! Security Enable - set to true to turn on security \*/

**#define** CONFIG\_SECURE **true**

/\*! PAN ID \*/

**#define** CONFIG\_PAN\_ID 0xFFFF

/\*! Coordinator short address \*/

**#define** CONFIG\_COORD\_SHORT\_ADDR 0xAABB

/\*! FH disabled as default \*/

**#define** CONFIG\_FH\_ENABLE **false**

/\*! maximum beacons possibly received \*/

**#define** CONFIG\_MAX\_BEACONS\_RECD 200

/\*! maximum devices in association table \*/

**#define** CONFIG\_MAX\_DEVICES 50

/\*!

Setting beacon order to 15 will disable the beacon, 8 is a good value for

beacon mode

\*/

**#define** CONFIG\_MAC\_BEACON\_ORDER 15

/\*!

Setting superframe order to 15 will disable the superframe, 8 is a good value

for beacon mode

\*/

**#define** CONFIG\_MAC\_SUPERFRAME\_ORDER 15

/\*! Setting for Phy ID \*/

**#define** CONFIG\_PHY\_ID (APIMAC\_STD\_US\_915\_PHY\_1)

**#if** ((CONFIG\_PHY\_ID >= APIMAC\_MRFSK\_STD\_PHY\_ID\_BEGIN) && (CONFIG\_PHY\_ID <= APIMAC\_MRFSK\_STD\_PHY\_ID\_END))

/\*! Setting for channel page \*/

**#define** CONFIG\_CHANNEL\_PAGE (APIMAC\_CHANNEL\_PAGE\_9)

**#elif** ((CONFIG\_PHY\_ID >= APIMAC\_MRFSK\_GENERIC\_PHY\_ID\_BEGIN) && (CONFIG\_PHY\_ID <= APIMAC\_MRFSK\_GENERIC\_PHY\_ID\_END))

/\*! Setting for channel page \*/

**#define** CONFIG\_CHANNEL\_PAGE (APIMAC\_CHANNEL\_PAGE\_10)

**#else**

**#error** "PHY ID is wrong."

**#endif**

/\*! MAC Parameter \*/

/\*! Min BE - Minimum Backoff Exponent \*/

**#define** CONFIG\_MIN\_BE 3

/\*! Max BE - Maximum Backoff Exponent \*/

**#define** CONFIG\_MAX\_BE 5

/\*! MAC MAX CSMA Backoffs \*/

**#define** CONFIG\_MAC\_MAX\_CSMA\_BACKOFFS 4

/\*! macMaxFrameRetries - Maximum Frame Retries \*/

**#define** CONFIG\_MAX\_RETRIES 3

/\*! Application traffic profile \*/

**#if** (((CONFIG\_PHY\_ID >= APIMAC\_MRFSK\_STD\_PHY\_ID\_BEGIN) && (CONFIG\_PHY\_ID <= APIMAC\_MRFSK\_GENERIC\_PHY\_ID\_BEGIN)) || \

((CONFIG\_PHY\_ID >= APIMAC\_GENERIC\_US\_915\_PHY\_132) && (CONFIG\_PHY\_ID <= APIMAC\_GENERIC\_ETSI\_863\_PHY\_133)))

/\*!

Reporting Interval - in milliseconds to be set on connected devices using

configuration request messages

\*/

**#define** CONFIG\_REPORTING\_INTERVAL 1000

/\*!

Polling interval in milliseconds to be set on connected devices using

configuration request messages. Must be greater than or equal to default

polling interval set on sensor devices

\*/

**#define** CONFIG\_POLLING\_INTERVAL 100

/\*!

Time interval in ms between tracking message intervals

\*/

**#define** TRACKING\_DELAY\_TIME 60000

**#else**

/\*!

Reporting Interval - in milliseconds to be set on connected devices using

configuration request messages

\*/

**#define** CONFIG\_REPORTING\_INTERVAL 300000

/\*!

Polling interval in milliseconds to be set on connected devices using

configuration request messages. Must be greater than or equal to default

polling interval set on sensor devices

\*/

**#define** CONFIG\_POLLING\_INTERVAL 60000

/\*!

Time interval in ms between tracking message intervals

\*/

**#define** TRACKING\_DELAY\_TIME 300000

**#endif**

/\*! scan duration

\* scan type = MAC\_MPM\_SCAN\_NBPAN (see mac\_api.h):

\* scan duration = aBaseSlotDuration \* 2 \* CONFIG\_SCAN\_DURATION

\*

\* scan type = MAC\_MPM\_SCAN\_BPAN (see mac\_api.h):

\* scan duration = aBaseSuperframeDuration \* 2 \* CONFIG\_SCAN\_DURATION

\* other types

\* scan duration = aBaseSuperframeDuration \* (1 + 2 \* CONFIG\_SCAN\_DURATION)

\*/

**#define** CONFIG\_SCAN\_DURATION 5

/\*!

Range Extender Mode setting.

The following modes are available.

APIMAC\_NO\_EXTENDER - does not have PA/LNA

APIMAC\_HIGH\_GAIN\_MODE - high gain mode

To enable CC1190, use

#define CONFIG\_RANGE\_EXT\_MODE APIMAC\_HIGH\_GAIN\_MODE

\*/

**#define** CONFIG\_RANGE\_EXT\_MODE APIMAC\_NO\_EXTENDER

/\*!

High PA Mode setting.

The following modes are available.

APIMAC\_DEFAULT\_PA - does not have High PA

APIMAC\_HIGH\_PA - High PA

To enable PA, use

#define CONFIG\_PA\_TYPE APIMAC\_HIGH\_PA

\*/

**#define** CONFIG\_PA\_TYPE APIMAC\_DEFAULT\_PA

/\*! Setting Default Key\*/

**#define** KEY\_TABLE\_DEFAULT\_KEY {0x12, 0x34, 0x56, 0x78, 0x9a, 0xbc, 0xde, 0xf0,\

0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00}

/\*!

Channel mask used when CONFIG\_FH\_ENABLE is false.

Each bit indicates if the corresponding channel is to be scanned

First byte represents channels 0 to 7 and the last byte represents

channels 128 to 135.

For byte zero in the bit mask, LSB representing Ch0.

For byte 1, LSB represents Ch8 and so on.

e.g., 0x01 0x10 represents Ch0 and Ch12 are included.

The default of 0x0F represents channels 0-3 are selected.

APIMAC\_STD\_US\_915\_PHY\_1 (50kbps/2-FSK/915MHz band) has channels 0 - 128.

APIMAC\_STD\_ETSI\_863\_PHY\_3 (50kbps/2-FSK/863MHz band) has channels 0 - 33.

APIMAC\_GENERIC\_CHINA\_433\_PHY\_128 (50kbps/2-FSK/433MHz band) has channels 0 - 6.

\*/

**#define** CONFIG\_CHANNEL\_MASK { 0x00, 0x05, 0x00, 0x00, 0x00, 0x00, \

0x00, 0x00, 0x00, 0x00, 0x00, 0x00, \

0x00, 0x00, 0x00, 0x00, 0x00 }

/\*!

Channel mask used when CONFIG\_FH\_ENABLE is true.

Represents the list of channels on which the device can hop.

The actual sequence used shall be based on DH1CF function.

It is represented as a bit string with LSB representing Ch0.

e.g., 0x01 0x10 represents Ch0 and Ch12 are included.

\*/

**#define** CONFIG\_FH\_CHANNEL\_MASK { 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, \

0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, \

0xFF, 0xFF, 0xFF, 0xFF, 0xFF }

/\*!

List of channels to target the Async frames

It is represented as a bit string with LSB representing Ch0

e.g., 0x01 0x10 represents Ch0 and Ch12 are included

It should cover all channels that could be used by a target device in its

hopping sequence. Channels marked beyond number of channels supported by

PHY Config will be excluded by stack. To avoid interference on a channel,

it should be removed from Async Mask and added to exclude channels

(CONFIG\_CHANNEL\_MASK).

\*/

**#define** FH\_ASYNC\_CHANNEL\_MASK { 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, \

0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, \

0xFF, 0xFF, 0xFF, 0xFF, 0xFF }

/\* FH related config variables \*/

/\*!

The number of non sleepy channel hopping end devices to be supported.

It is to be noted that the total number of non sleepy devices supported

must be less than 50. Stack will allocate memory proportional

to the number of end devices requested.

\*/

**#define** FH\_NUM\_NON\_SLEEPY\_HOPPING\_NEIGHBORS 5

/\*!

The number of non sleepy fixed channel end devices to be supported.

It is to be noted that the total number of non sleepy devices supported

must be less than 50. Stack will allocate memory proportional

to the number of end devices requested.

\*/

**#define** FH\_NUM\_NON\_SLEEPY\_FIXED\_CHANNEL\_NEIGHBORS 5

/\*!

Dwell time: The duration for which the collector will

stay on a specific channel before hopping to next channel.

\*/

**#define** CONFIG\_DWELL\_TIME 250

/\*!

FH Application Broadcast Msg generation interval in ms.

Value should be set at least greater than 200 ms,

\*/

**#define** FH\_BROADCAST\_INTERVAL 10000

/\*! FH Broadcast dwell time. If set to 0, it shall disable broadcast hopping and

\* broadcast message transmissions in FH Mode \*/

**#define** FH\_BROADCAST\_DWELL\_TIME 100

**#if** (((CONFIG\_PHY\_ID >= APIMAC\_MRFSK\_STD\_PHY\_ID\_BEGIN) && (CONFIG\_PHY\_ID <= APIMAC\_MRFSK\_GENERIC\_PHY\_ID\_BEGIN)) || \

((CONFIG\_PHY\_ID >= APIMAC\_GENERIC\_US\_915\_PHY\_132) && (CONFIG\_PHY\_ID <= APIMAC\_GENERIC\_ETSI\_863\_PHY\_133)))

/\*!

The minimum trickle timer window for PAN Advertisement,

and PAN Configuration frame transmissions.

Recommended to set this to half of PAS/PCS MIN Timer

\*/

**#define** CONFIG\_TRICKLE\_MIN\_CLK\_DURATION 3000

/\*!

The maximum trickle timer window for PAN Advertisement,

and PAN Configuration frame transmissions.

\*/

**#define** CONFIG\_TRICKLE\_MAX\_CLK\_DURATION 6000

**#else**

/\*!

The minimum trickle timer window for PAN Advertisement,

and PAN Configuration frame transmissions.

Recommended to set this to half of PAS/PCS MIN Timer

\*/

**#define** CONFIG\_TRICKLE\_MIN\_CLK\_DURATION 30000

/\*!

The maximum trickle timer window for PAN Advertisement,

and PAN Configuration frame transmissions.

\*/

**#define** CONFIG\_TRICKLE\_MAX\_CLK\_DURATION 60000

**#endif**

/\*!

To enable Doubling of PA/PC trickle time,

useful when network has non sleepy nodes and

there is a requirement to use PA/PC to convey updated

PAN information. Note that when using option the CONFIG\_TRICKLE\_MIN\_CLK\_DURATION

and CONFIG\_TRICKLE\_MAX\_CLK\_DURATION should be set to a sufficiently large value.

Recommended values are 1 min and 16 min respectively.

\*/

**#define** CONFIG\_DOUBLE\_TRICKLE\_TIMER **false**

/\*! value for ApiMac\_FHAttribute\_netName \*/

**#define** CONFIG\_FH\_NETNAME {"FHTest"}

/\*!

Value for Transmit Power in dBm

For US and ETSI band, Default value is 10, allowed values are

-10, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 and 14dBm.

For China band, allowed values are 6, 10, 13, 14 and 15dBm.

For CC1190, allowed values are between 18, 23, 25, 26 and 27dBm.

When the nodes in the network are close to each other

lowering this value will help reduce saturation \*/

**#ifndef** CC13X2R1\_LAUNCHXL

**#if** CONFIG\_RANGE\_EXT\_MODE

**#define** CONFIG\_TRANSMIT\_POWER 26

**#else**

**#if** ((CONFIG\_PHY\_ID == APIMAC\_GENERIC\_CHINA\_433\_PHY\_128) || (CONFIG\_PHY\_ID == APIMAC\_GENERIC\_CHINA\_LRM\_433\_PHY\_130))

**#define** CONFIG\_TRANSMIT\_POWER 14

**#else**

**#define** CONFIG\_TRANSMIT\_POWER 12

**#endif**

**#endif**

**#else** /\* CC13X2R1\_LAUNCHXL \*/

**#if** CONFIG\_PA\_TYPE

**#define** CONFIG\_TRANSMIT\_POWER 20

**#else**

**#define** CONFIG\_TRANSMIT\_POWER 12

**#endif**

**#endif**

**#ifndef** CC13X2R1\_LAUNCHXL

**#if** CONFIG\_RANGE\_EXT\_MODE

**#if** (CCFG\_FORCE\_VDDR\_HH == 1)

**#error** "CCFG\_FORCE\_VDDR\_HH should be 0"

**#endif**

**#else**

**#if** ((CONFIG\_PHY\_ID == APIMAC\_GENERIC\_CHINA\_433\_PHY\_128) || (CONFIG\_PHY\_ID == APIMAC\_GENERIC\_CHINA\_LRM\_433\_PHY\_130))

**#if** (CCFG\_FORCE\_VDDR\_HH == 0)

**#if** (CONFIG\_TRANSMIT\_POWER >= 15)

**#error** "CONFIG\_TRANSMIT\_POWER should be less than 15"

**#endif**

**#else**

**#if** (CONFIG\_TRANSMIT\_POWER < 15)

/\* In 433 MHz band when CCFG\_FORCE\_VDDR\_HH = 1, only possible value of transmit power is 15 \*/

**#error** "CONFIG\_TRANSMIT\_POWER should be 15"

**#endif**

**#endif**

**#else**

**#if** (CCFG\_FORCE\_VDDR\_HH == 0)

**#if** (CONFIG\_TRANSMIT\_POWER >= 14)

**#error** "CONFIG\_TRANSMIT\_POWER should be less than 14"

**#endif**

**#else**

**#if** (CONFIG\_TRANSMIT\_POWER < 14)

/\* In US and ETSI band when CCFG\_FORCE\_VDDR\_HH = 1, only possible value of transmit power is 14 \*/

**#error** "CONFIG\_TRANSMIT\_POWER should be 14"

**#endif**

**#endif**

**#endif**

**#endif**

**#else**

**#if** CONFIG\_PA\_TYPE

**#if** (CONFIG\_TRANSMIT\_POWER > 20)

**#error** "CONFIG\_TRANSMIT\_POWER should be less than or equal to 20"

**#endif**

**#else**

**#if** (CCFG\_FORCE\_VDDR\_HH == 0)

**#if** (CONFIG\_TRANSMIT\_POWER >= 14)

**#error** "CONFIG\_TRANSMIT\_POWER should be less than 14"

**#endif**

**#else**

**#if** (CONFIG\_TRANSMIT\_POWER < 14)

/\* In US and ETSI band when CCFG\_FORCE\_VDDR\_HH = 1, only possible value of transmit power is 14 \*/

**#error** "CONFIG\_TRANSMIT\_POWER should be 14"

**#endif**

**#endif**

**#endif**

**#endif**

/\*!

\* Enable this mode for certfication.

\* For FH certification, CONFIG\_FH\_ENABLE should

\* also be enabled.

\*/

**#define** CERTIFICATION\_TEST\_MODE **false**

**#ifdef** POWER\_MEAS

/\*! Size of RAMP Data to be sent when POWER Test is enabled \*/

**#define** COLLECTOR\_TEST\_RAMP\_DATA\_SIZE 20

/\*!

Power profile to be used when Power MEAS is enabled.

Profile 1 - POLL\_ACK - Polling Only

Profile 2 - DATA\_ACK - 20 byte application data + ACK from sensor to collector

Profile 3 - POLL\_DATA - Poll + received Data from collector

Profile 4 - SLEEP - No Poll or Data. In Beacon mode, beacon RX would occur

\*/

**#define** POWER\_TEST\_PROFILE DATA\_ACK

**#endif**

/\* Check if all the necessary parameters have been set for FH mode \*/

**#if** CONFIG\_FH\_ENABLE

**#if** !defined(FEATURE\_ALL\_MODES) && !defined(FEATURE\_FREQ\_HOP\_MODE)

**#error** "Do you want to build image with frequency hopping mode? \

Define either FEATURE\_FREQ\_HOP\_MODE or FEATURE\_ALL\_MODES in features.h"

**#endif**

**#endif**

/\* Check if stack level security is enabled if application security is enabled \*/

**#if** CONFIG\_SECURE

**#if** !defined(FEATURE\_MAC\_SECURITY)

**#error** "Define FEATURE\_MAC\_SECURITY or FEATURE\_ALL\_MODES in features.h to \

be able to use security at application level"

**#endif**

**#endif**

/\* Set beacon order and superframe order to 15 for FH mode to avoid user error \*/

**#if** CONFIG\_FH\_ENABLE

**#if** (CONFIG\_MAC\_BEACON\_ORDER != 15) && (CONFIG\_MAC\_SUPERFRAME\_ORDER != 15)

**#error** "Do you want to build image with frequency hopping mode? \

If yes, CONFIG\_MAC\_BEACON\_ORDER and CONFIG\_MAC\_SUPERFRAME\_ORDER \

should both be set to 15"

**#endif**

**#endif**

**#if** (CONFIG\_PA\_TYPE == APIMAC\_HIGH\_PA) && (CONFIG\_RANGE\_EXT\_MODE == APIMAC\_HIGH\_GAIN\_MODE)

**#error** "Do you want to build image with a PA enabled? \

If yes, select one of either CONFIG\_RANGE\_EXT\_MODE or CONFIG\_PA\_TYPE as the amplifier type.

**#endif**

**#ifdef** \_\_cplusplus

}

**#endif**

**#endif** /\* CONFIG\_H \*/