

TUTORIAL 8 – Sensor Tag RF Tutorial

This tutorial shows how to get RSSI readings from incoming IEEE154 packets, set the transmit power levels and set the RF channel, using the sensor tags.

Introduction

RSSI is an acronym for Received Signal Strength Indication. It is a measure of the signal power on the radio link, usually in the units of **dBm**, while a message is being received. It can be used for estimating node connectivity and node distance (although the relation between distance and RSSI is noisy and not straightforward), among other things.

Another usage of RSSI is to sample the channel power when no node is transmitting to estimate the background noise, also known as noise floor. The RSSI values given by uIP are usually in dBm units, and should be converted by the platform-specific relation to get meaningful data out of it.

Reading RSSI Values

RSSI is platform-specific and we provide a hands-on tute to explain how to get RSSI readings from incoming packets. The uIP will automatically record the RSSI of any incoming IEEE154 packets. The RSSI is stored in the Packet Buffer Attribute and be accessed as shown below, whenever a new packet is received.

```
if(uip_newdata()) {  
    printf( "RSSI %d", (signed short)  
        packetbuf_attr(PACKETBUF_ATTR_RSSI));  
}
```

The RSSI attribute value is of type signed short. The UDP client and server examples in `contiki-examples/networking/udp-ipv6` show how the RSSI attribute can be accessed, when a new packet is received.

Interpretation

The RSSI attribute value is given in dBm units (p1506, CC2650 reference manual). The dynamic RSSI range is 100dB, with an accuracy of +/- 4dB (CC2650 datasheet).

Transmit Power Levels

The transmit power level can affect the RSSI values of receiving sensortags. The transmit power level for the sensortag can be changed using the `set_value` function (in dBm). Example below shows setting the TX Power level to 5dBm

```
NETSTACK_RADIO.set_value(RADIO_PARAM_TXPOWER, 5);
```

Valid TX power levels are: 5, 4, 3, 2, 1, 0, -3, -6, -9, -12, -15, -18, -21

RF Channel

The RF channel can also affect the RSSI of receiving sensortags. The RF channel can be set using the `set_value` function (p1521, CC2650 reference manual). The example below sets the RF channel to 11.

```
NETSTACK_RADIO.set_value(RADIO_PARAM_CHANNEL, 11);
```

Use existing channel: 11 – 26:

For IEEE 802.15.4 channel, that is frequency is $(2405 + 5 \times (\text{channel} - 11))$ MHz

60–207: Frequency is $(2300 + \text{channel})$ MHz

Others: reserved

Makefile RF Channel setting

Alternatively, you can set the RF channel by adding or modifying the `CFLAGS` variable in the makefile

```
CFLAGS += -DRF_CORE_CONF_CHANNEL=26
```

References

1. CC2650 Datasheet
2. CC2650 Reference Manual
3. Contiki uIP Doxygen help documentation.