Remote Implementation Example

for RWC5020x FW V1.320 or higher

LoRaWAN End Device RF Performance
EU863-870 V1.2.1

RedwoodComm

Initialization

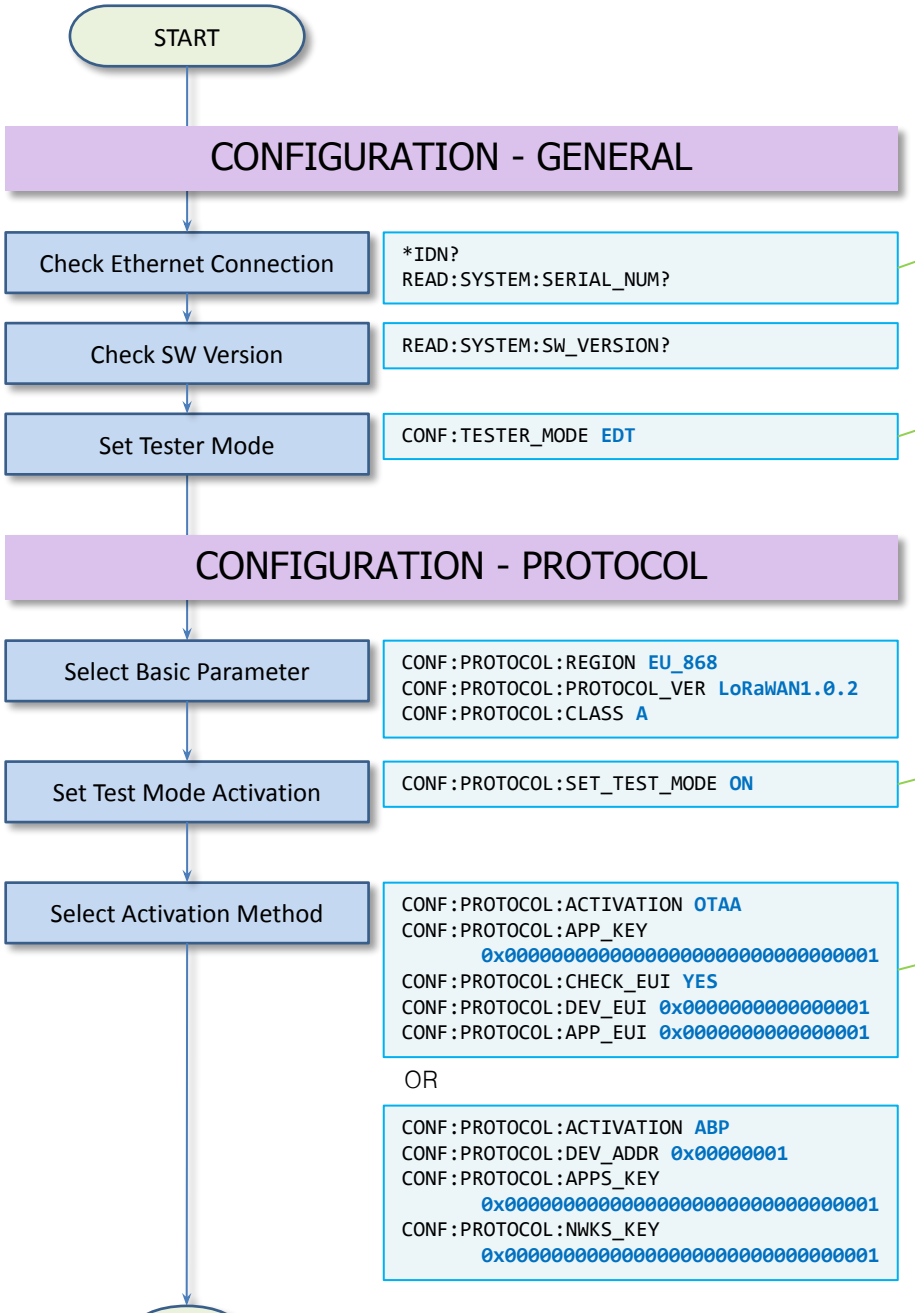
- CONFIGURATION - GENERAL
- CONFIGURATION - PROTOCOL
- CONFIGURATION - RF
- Activation

TX Measurements

- POWER MEASUREMENT – [Part 1] 3D Pattern for MaxEIRP
  - **Method 1**
  - **Method 2**
- POWER MEASUREMENT – [Part 2] Meas. at Best Position for Non MaxEIRP

RX Measurements

- RX SENSITIVITY MEASUREMENT – RX1 Window
- RX SENSITIVITY MEASUREMENT – RX2 Window



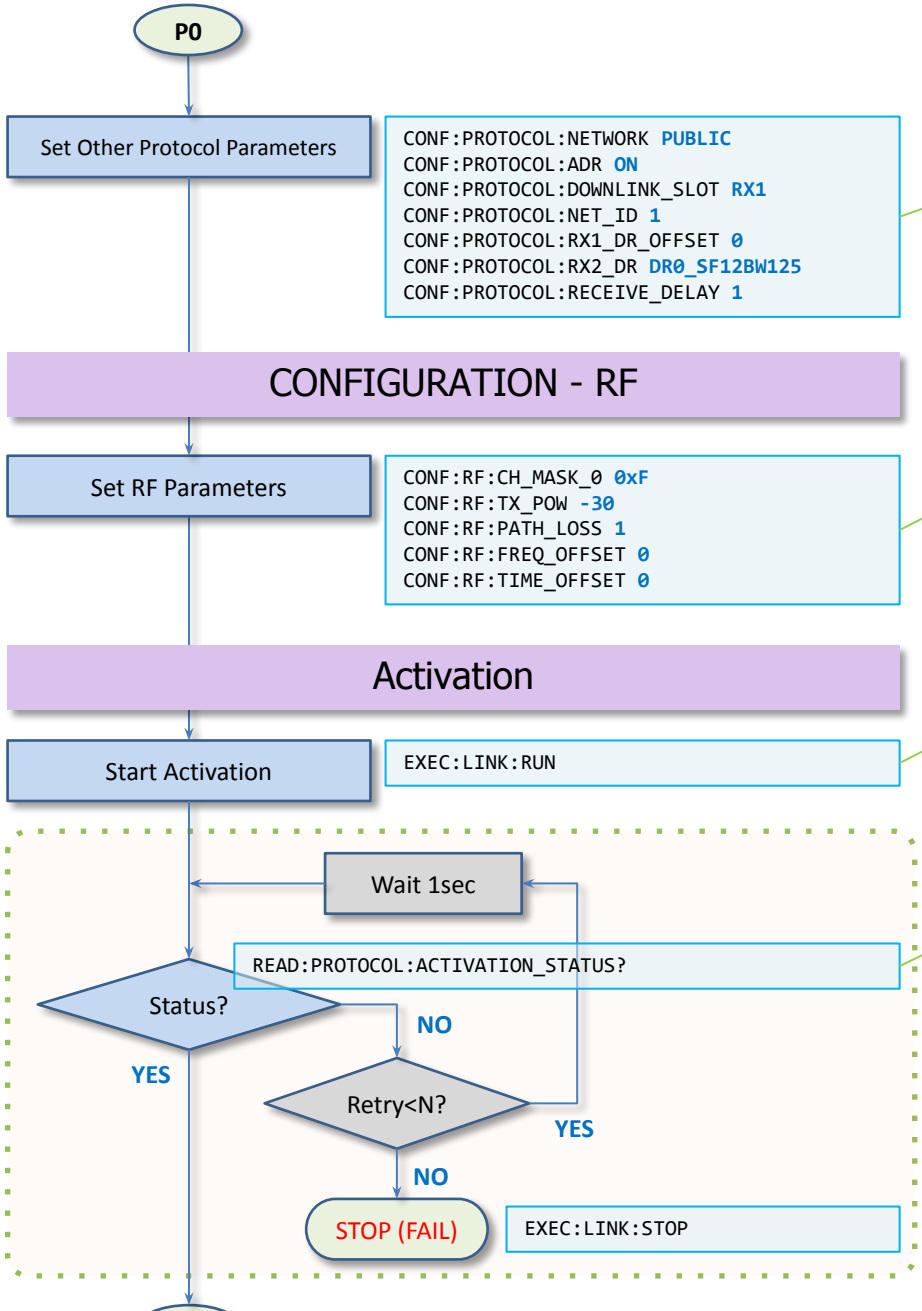
Please be sure that the Ethernet setup with IP configuration has been completed prior to starting this example. You may refer to the User Manual or Application Note of RWC5020A for further information.

Check the connection to the tester via Ethernet.

Set the operating mode for testing an end-device, EDT.

If this is ON, the tester will issue *Activate Test Mode* command immediately after receiving the first uplink message from DUT.

Select the activation method to be used; OTAA or ABP. Depending on it, other relevant parameters must be configured as listed.



Set other protocol parameters as default. Any parameter can be changed according to Users' test purpose.

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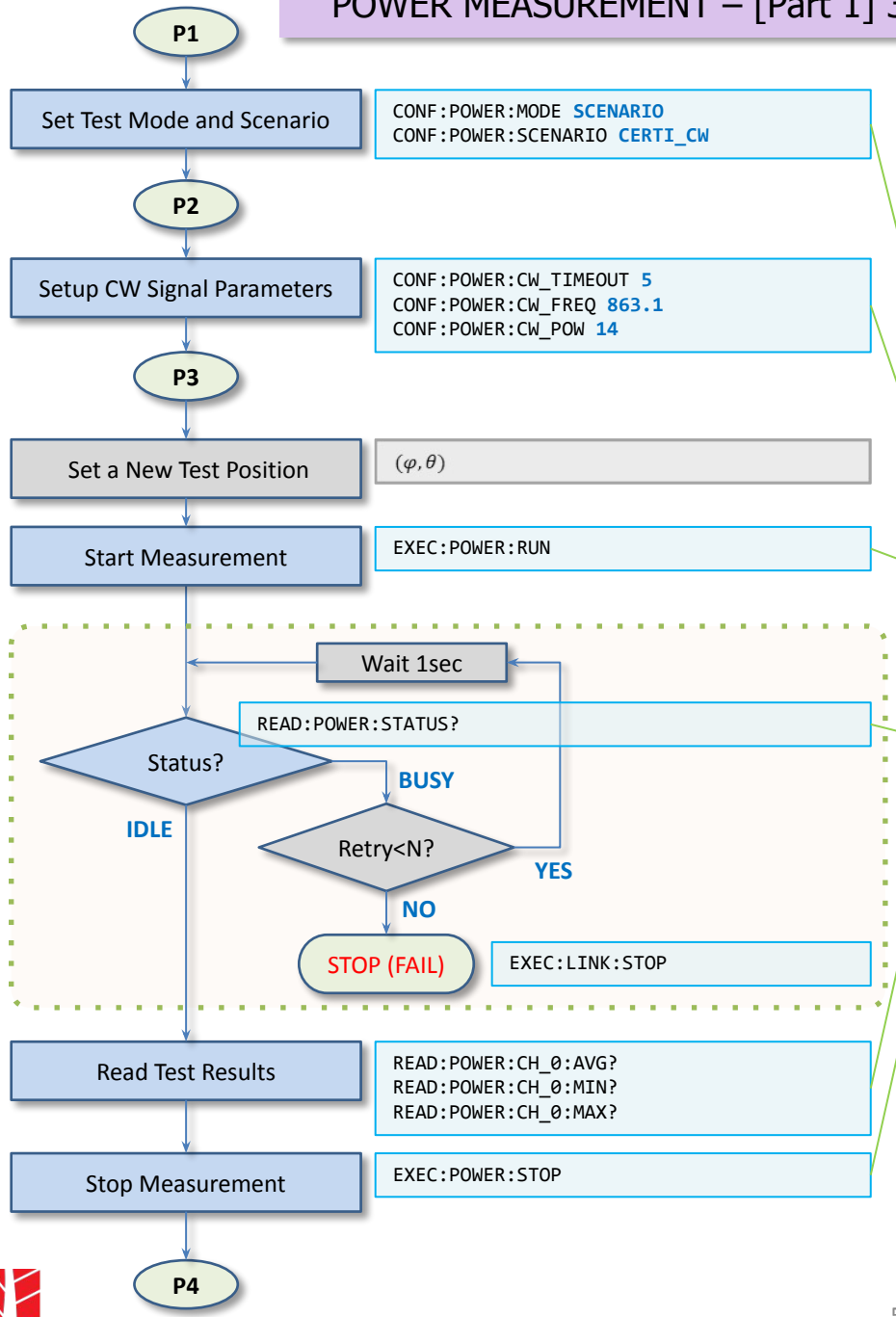
Let the tester start running in the mode of a Gateway and a network server, and waiting for an uplink message from DUT. Uplink messages are expected in different ways according to the selection of activation method.

Read the status of activation procedure by polling a command. Most likely at this point, DUT needs to be initiated to send its first message; *JoinRequest* command for OTAA or usual uplink message for ABP. Users need to set up a timeout value for waiting the first message from DUT, in order to avoid falling into an infinite loop.

POWER MEASUREMENT – [Part 1] 3D Pattern for MaxEIRP : **Method 1**



We propose two different methods in implementing measurement of 3D pattern of TX power;

1) Method 1 – issue a *EnableCWMode* command at each position of DUT and the tester measure the power.
2) Method 2 – issue a *EnableCWMode* command once to force DUT to send CW signal for a long time until full 3D measurement completes and the tester will measure the power at each position.

Set the power measurement mode to SENARIO and set SENARIO to CERTI_CW, in which the tester will force DUT to transmit CW signal for specified timeout and measure the power of CW signal.

These are parameters for *EnableCWMode* command. The power must be MaxEIRP for 3D pattern measurement.

Start the TX power measurement.

Wait until the TX power measurement finishes by checking its status. Users need to stop checking after CW timeout expires, in order to avoid falling into an infinite loop.

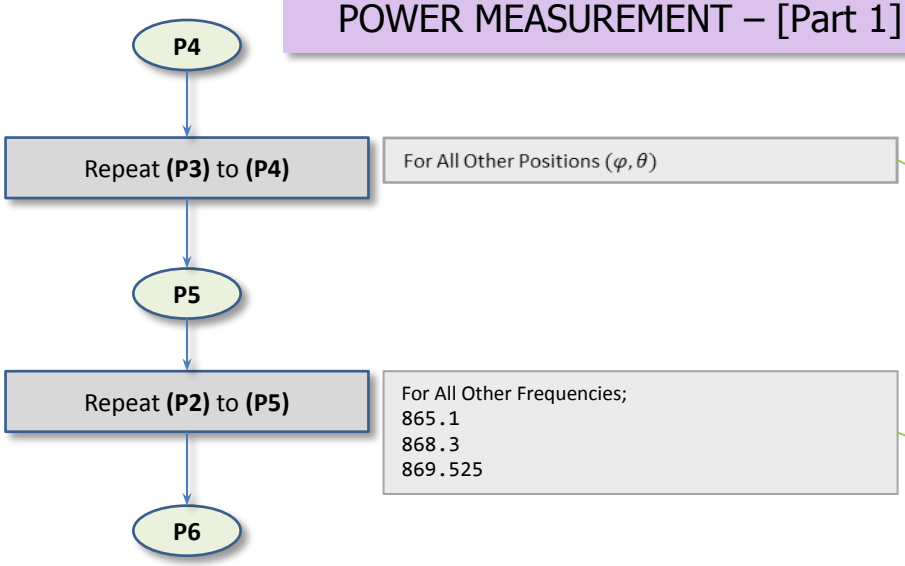
Read the result values for the current position.

Stop the TX power measurement.

3D Pattern for MaxEIRP – Method 1

	Configuration			Channels			
Test	Data rate	Tx Power revA (LW1.0.1)	Tx Power revB (LW1.0.2)	**863.1 MHz**	**865.1 MHz**	**868.3 MHz**	**869.525 MHz**
TRP / **15° step**	SF12	1 (14 dBm)	0 (MaxEIRP)	x	x	x	x
EIRP/ERP 1 measurement Best position	SF12	3 (8 dBm)	3 (MaxEIRP - 6 dB)	x	x	x	-
EIRP/ERP 1 measurement Best position	SF12	5 (2 dBm)	6 (MaxEIRP - 12 dB)	x	x	x	-

POWER MEASUREMENT – [Part 1] 3D Pattern for MaxEIRP : **Method 1**



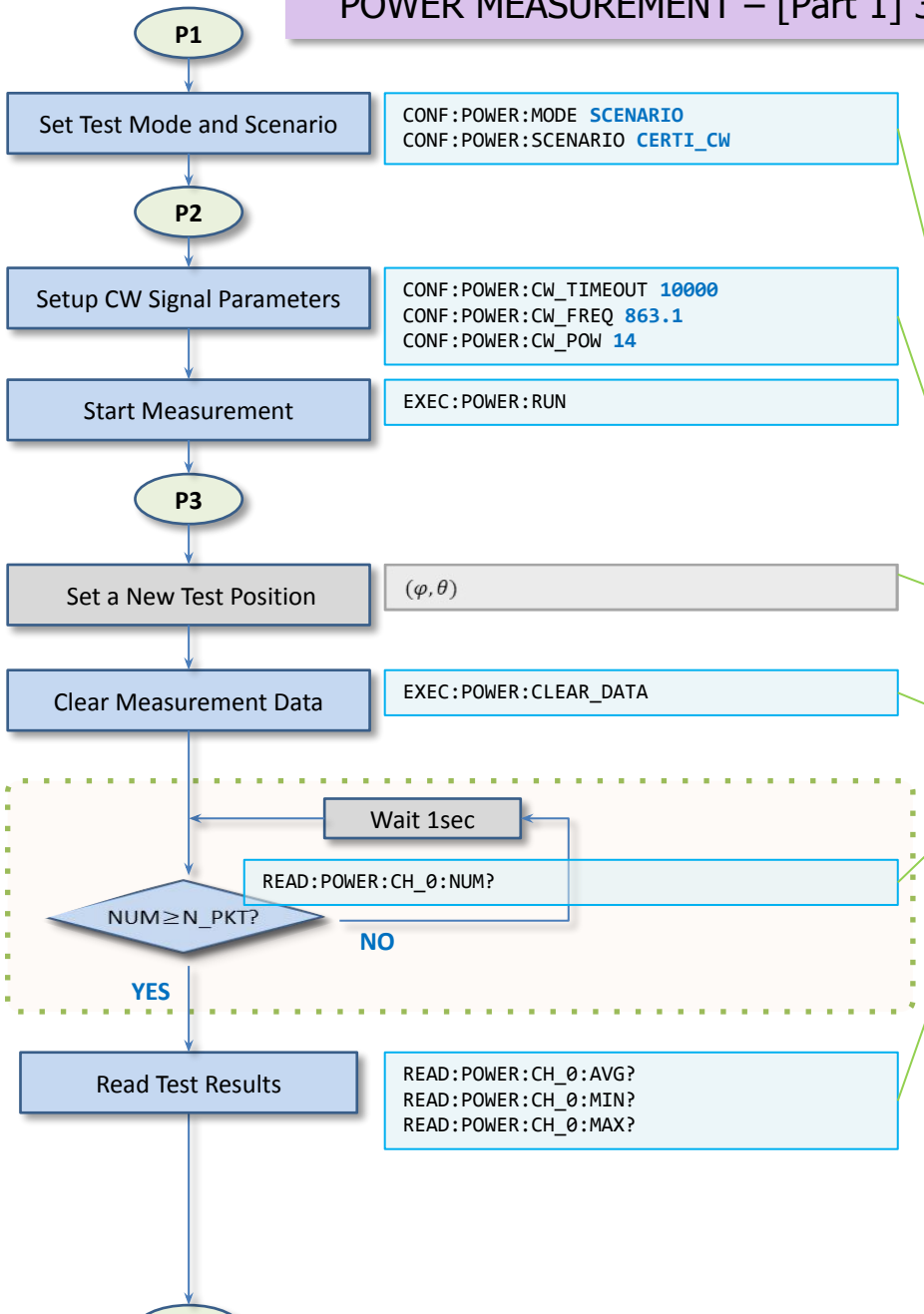
Change the position of DUT and repeat the measurement. This must be repeated to complete 3D pattern measurement.

Repeat the 3D pattern measurement for all other specified frequencies.

3D Pattern for MaxEIRP – Method 1

	Configuration			Channels			
Test	Data rate	Tx Power revA (LW1.0.1)	Tx Power revB (LW1.0.2)	**863.1 MHz**	**865.1 MHz**	**868.3 MHz**	**869.525 MHz**
TRP / **15° step**	SF12	1 (14 dBm)	0 (MaxEIRP)	x	x	x	x
EIRP/ERP 1 measurement Best position	SF12	3 (8 dBm)	3 (MaxEIRP - 6 dB)	x	x	x	-
EIRP/ERP 1 measurement Best position	SF12	5 (2 dBm)	6 (MaxEIRP - 12 dB)	x	x	x	-

POWER MEASUREMENT – [Part 1] 3D Pattern for MaxEIRP : **Method 2**



We propose two different methods in implementing measurement of 3D pattern of TX power;

1) Method 1 – issue a *EnableCWMode* command at each position of DUT and the tester measure the power.
2) Method 2 – issue a *EnableCWMode* command once to force DUT to send CW signal for a long time until full 3D measurement completes and the tester will measure the power at each position.

Set the power measurement mode to SENARIO and set SENARIO to CERTI_CW, in which the tester will force DUT to transmit CW signal for specified timeout and measure the power of CW signal.

These are parameters for *EnableCWMode* command. The CW TIMEOUT value must be estimated properly to consider the time required for measurement of all test positions. The power must be MaxEIRP for 3D pattern measurement.

Start the TX power measurement.

Clear the previous data for the next measurement.

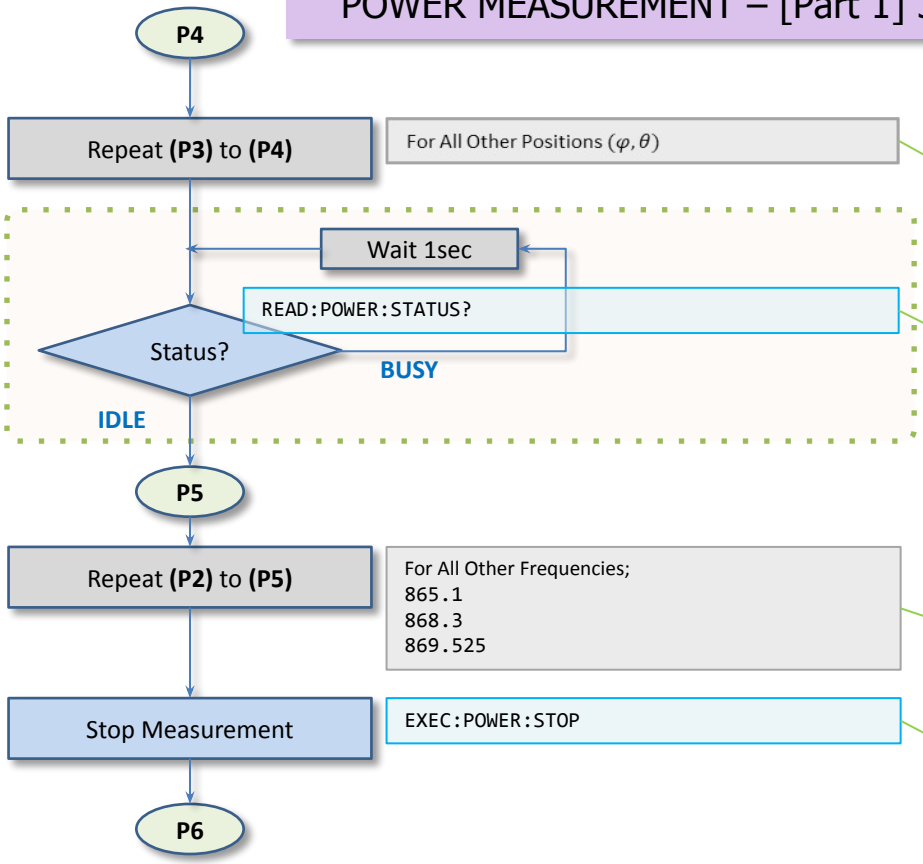
Check if the measurement data is ready for reading; read the number of packets received and compare with N_PKT, which means how many times the power will be measured at the current position, defined by users.

Read the result values for the current position.

3D Pattern for MaxEIRP – Method 2

	Configuration			Channels			
Test	Data rate	Tx Power revA (LW1.0.1)	Tx Power revB (LW1.0.2)	**863.1 MHz**	**865.1 MHz**	**868.3 MHz**	**869.525 MHz**
TRP / **15° step**	SF12	1 (14 dBm)	0 (MaxEIRP)	x	x	x	x
EIRP/ERP 1 measurement Best position	SF12	3 (8 dBm)	3 (MaxEIRP - 6 dB)	x	x	x	-
EIRP/ERP 1 measurement Best position	SF12	5 (2 dBm)	6 (MaxEIRP - 12 dB)	x	x	x	-

POWER MEASUREMENT – [Part 1] 3D Pattern for MaxEIRP : **Method 2**



Change the position of DUT and repeat the measurement. This must be repeated to complete 3D pattern measurement.

After measured for all test positions, check the status of the power measurement to complete the test.

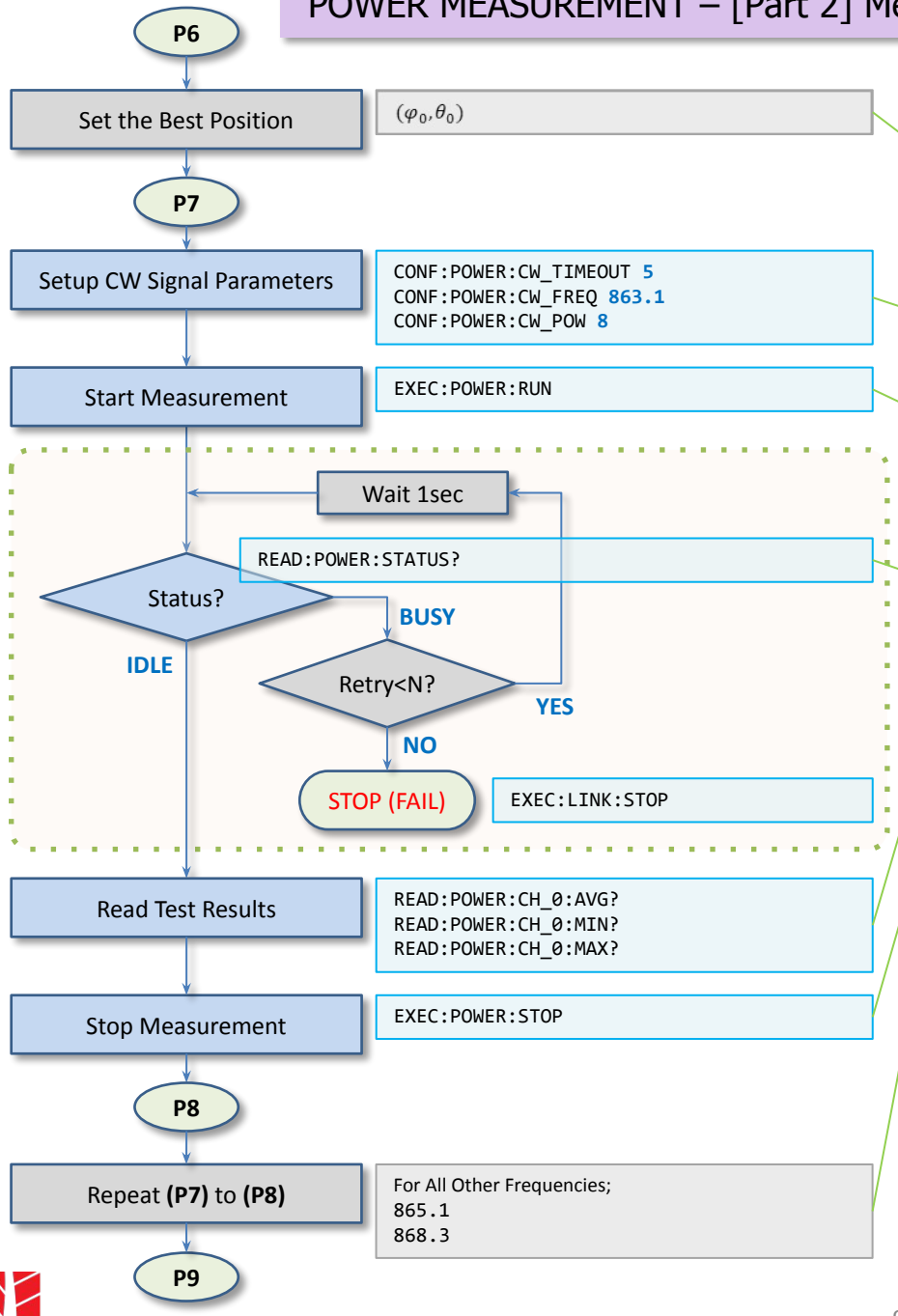
Repeat the 3D pattern measurement for all other specified frequencies.

Stop the TX power measurement.

3D Pattern for MaxEIRP – Method 2

	Configuration			Channels			
Test	Data rate	Tx Power revA (LW1.0.1)	Tx Power revB (LW1.0.2)	**863.1 MHz**	**865.1 MHz**	**868.3 MHz**	**869.525 MHz**
TRP / **15° step**	SF12	1 (14 dBm)	0 (MaxEIRP)	x	x	x	x
EIRP/ERP 1 measurement Best position	SF12	3 (8 dBm)	3 (MaxEIRP - 6 dB)	x	x	x	-
EIRP/ERP 1 measurement Best position	SF12	5 (2 dBm)	6 (MaxEIRP - 12 dB)	x	x	x	-

POWER MEASUREMENT – [Part 2] Meas. at Best Position for Non MaxEIRP



Set the best position of DUT.

These are parameters for *EnableCWMode* command. The power must be MaxEIRP-6 for measurement at the best position.

Start the TX power measurement.

Wait until the TX power measurement finishes by checking its status. Users need to stop checking after CW timeout expires, in order to avoid falling into an infinite loop.

Read the result values for the current position.

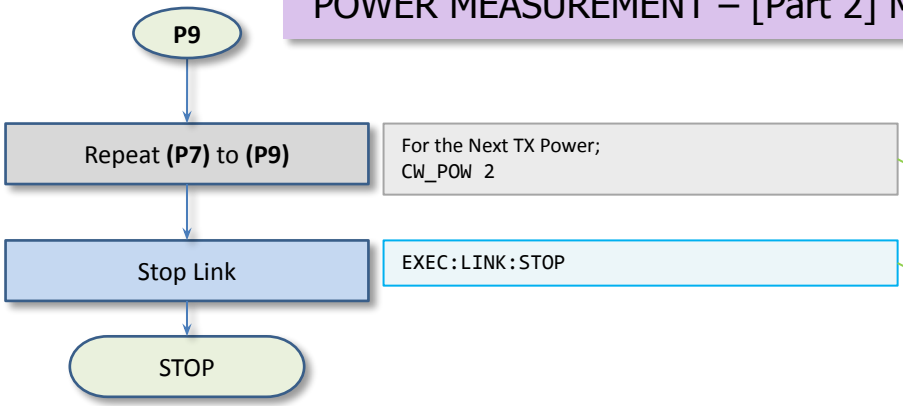
Stop the TX power measurement.

Repeat the power measurement for all other specified frequencies.

Best Position for Non MaxEIRP

	Configuration			Channels			
Test	Data rate	Tx Power revA (LW1.0.1)	Tx Power revB (LW1.0.2)	**863.1 MHz**	**865.1 MHz**	**868.3 MHz**	**869.525 MHz**
TRP / **15° step**	SF12	1 (14 dBm)	0 (MaxEIRP)	x	x	x	x
EIRP/ERP 1 measurement Best position	SF12	3 (8 dBm)	3 (MaxEIRP - 6 dB)	x	x	x	-
EIRP/ERP 1 measurement Best position	SF12	5 (2 dBm)	6 (MaxEIRP - 12 dB)	x	x	x	-

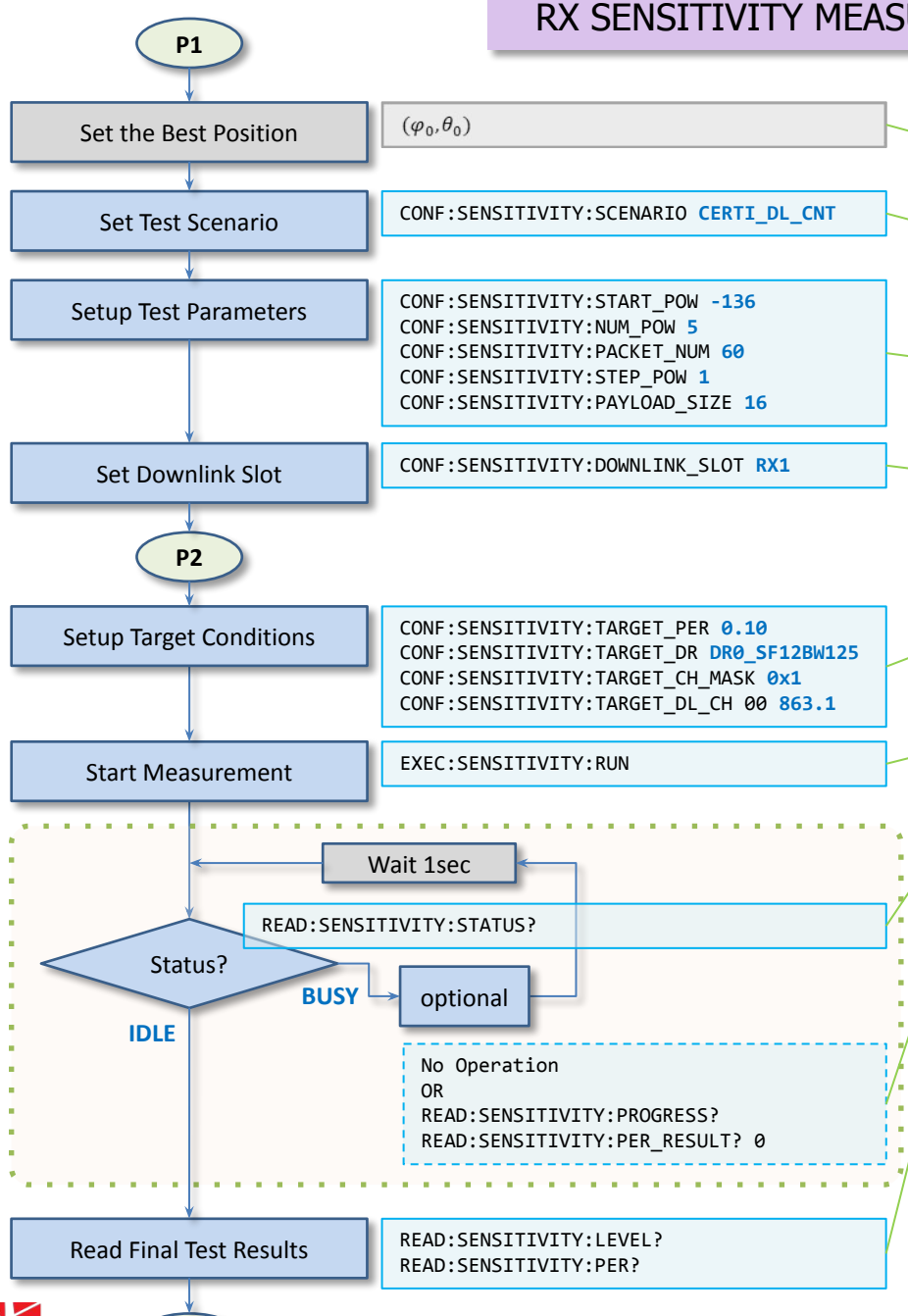
POWER MEASUREMENT – [Part 2] Meas. at Best Position for Non MaxEIRP



Best Position for Non MaxEIRP

	Configuration			Channels			
Test	Data rate	Tx Power revA (LW1.0.1)	Tx Power revB (LW1.0.2)	**863.1 MHz**	**865.1 MHz**	**868.3 MHz**	**869.525 MHz**
TRP / **15° step**	SF12	1 (14 dBm)	0 (MaxEIRP)	x	x	x	x
EIRP/ERP 1 measurement Best position	SF12	3 (8 dBm)	3 (MaxEIRP - 6 dB)	x	x	x	-
EIRP/ERP 1 measurement Best position	SF12	5 (2 dBm)	6 (MaxEIRP - 12 dB)	x	x	x	-

RX SENSITIVITY MEASUREMENT – RX1 Window



Set the best position of DUT.

Set the SCENARIO to CERTI_DL_CNT, in which downlink_counter packets will be used for sensitivity measurement.

Determine the range of power to test the receiver sensitivity. The number of packets is recommended as 60.

This is the receiver sensitivity test for RX1 window.

The default target PER is 10%.
The test frequency can be configured by using the target channel mask and the corresponding channel frequency.

Start the sensitivity measurement.

Wait until the sensitivity measurement finishes by checking its status.

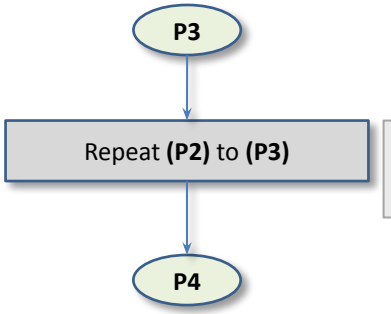
Users may read the progress or read the PER result with power index while the measurement is running.

Read the result values for the current position.

Sensitivity for RX1 Window

		Channels			
Test	Datarate	**863.1 MHz**	**865.1 MHz**	**868.3 MHz**	**869.525 MHz**
EIS / 10% PER (60 packets per step) Best position	SF12	Rx1	Rx1	Rx1	Rx2
EIS / 10% PER (60 packets per step) Best position	SF7	-	-	-	Rx2

RX SENSITIVITY MEASUREMENT – RX1 Window



For All Other Frequencies;
865.1
868.3

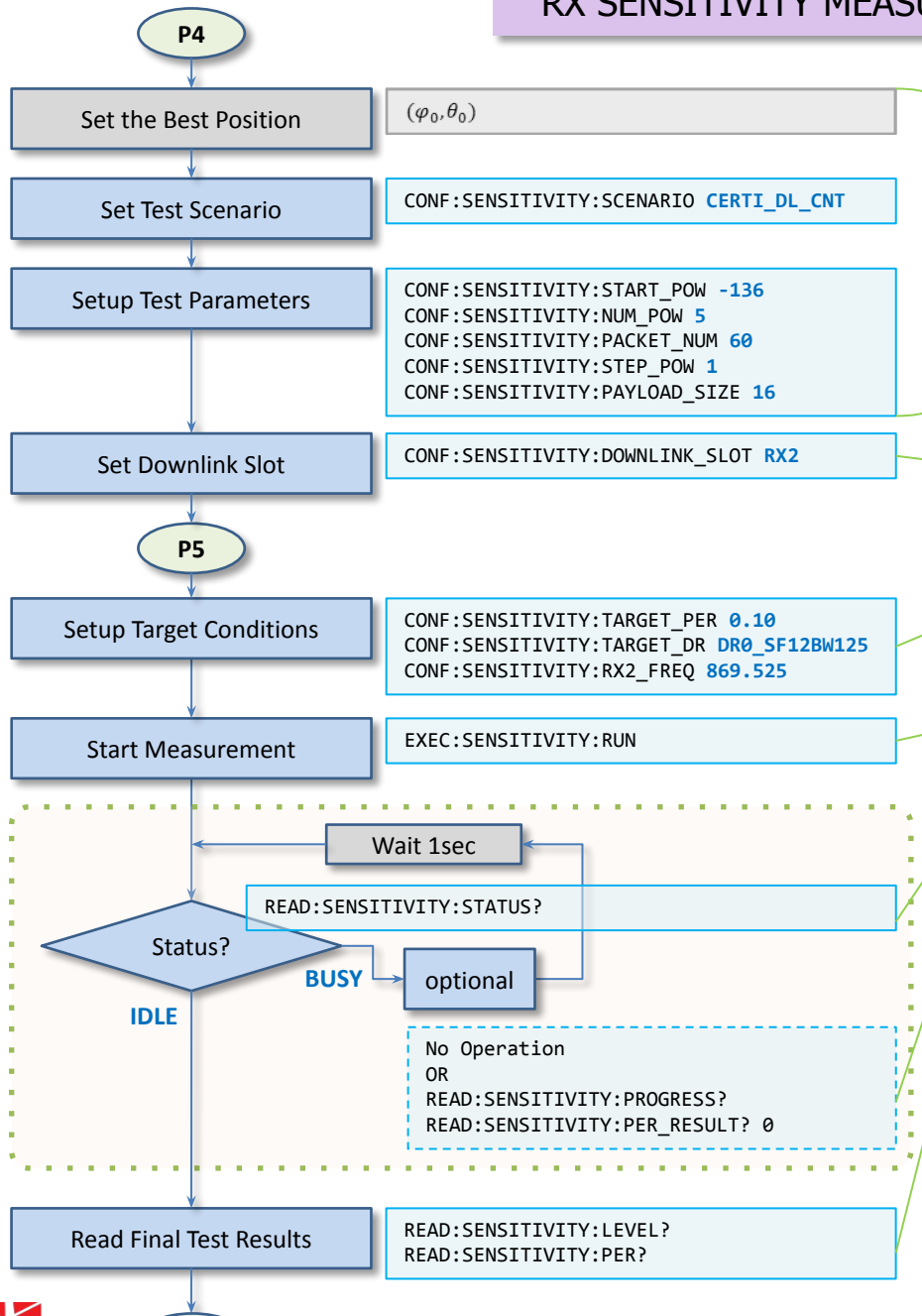
Repeat the sensitivity measurement for all other specified frequencies.

The sensitivity measurement automatically ends after the sensitivity level is found at which the PER exceeds the target PER or all the power values in the range are tested.

Sensitivity for RX1 Window

		Channels			
Test	Datarate	**863.1 MHz**	**865.1 MHz**	**868.3 MHz**	**869.525 MHz**
EIS / 10% PER (60 packets per step) Best position	SF12	Rx1	Rx1	Rx1	Rx2
EIS / 10% PER (60 packets per step) Best position	SF7	-	-	-	Rx2

RX SENSITIVITY MEASUREMENT – RX2 Window



Can be skipped because already done in RX1 test.

This is the receiver sensitivity test for RX2 window.

The default target PER is 10%.
The test frequency can be configured by using the target channel mask and the corresponding channel frequency.

Start the sensitivity measurement.

Wait until the sensitivity measurement finishes by checking its status.

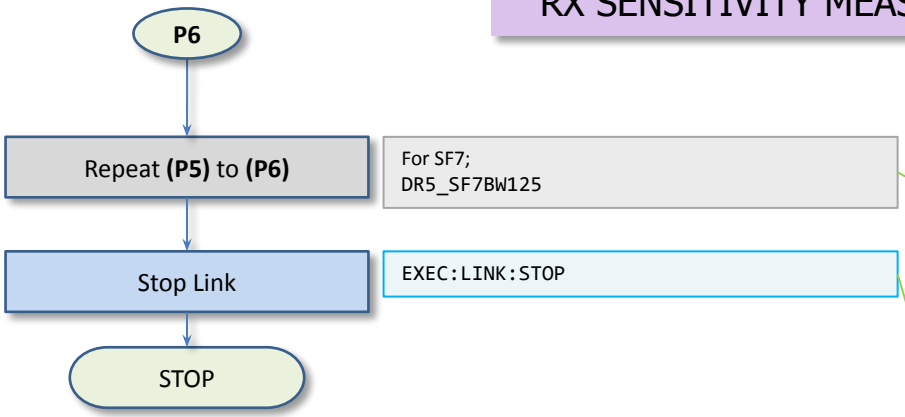
Users may read the progress or read the PER result with power index while the measurement is running.

Read the result values for the current position.

Sensitivity for RX2 Window

		Channels			
Test	Datarate	**863.1 MHz**	**865.1 MHz**	**868.3 MHz**	**869.525 MHz**
EIS / 10% PER (60 packets per step) Best position	SF12	Rx1	Rx1	Rx1	Rx2
EIS / 10% PER (60 packets per step) Best position	SF7	-	-	-	Rx2

RX SENSITIVITY MEASUREMENT – RX2 Window



Sensitivity for RX2 Window

		Channels			
Test	Datarate	**863.1 MHz**	**865.1 MHz**	**868.3 MHz**	**869.525 MHz**
EIS / 10% PER (60 packets per step) Best position	SF12	Rx1	Rx1	Rx1	Rx2
EIS / 10% PER (60 packets per step) Best position	SF7	-	-	-	Rx2