

Remote Implementation Example

for RWC5020x FW V1.320 or higher

LoRaWAN End Device RF Performance
Measurement for All Regions V1.0;
EU863-870

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 RWC5020x for further information.

START

CONFIGURATION - GENERAL

Check Ethernet Connection
*IDN?
READ:SYSTEM:SERIAL_NUM?

Check the connection to the tester via Ethernet.

Check SW Version
READ:SYSTEM:SW_VERSION?

Set Tester Mode
CONF:TESTER_MODE EDT

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

CONFIGURATION - PROTOCOL

Select Basic Parameter
CONF:PROTOCOL:REGION EU_868
CONF:PROTOCOL:PROTOCOL_VER LoRaWAN1.0.4
CONF:PROTOCOL:CLASS A

Set Test Mode Activation
CONF:PROTOCOL:SET_TEST_MODE ON

If this is ON, the tester sends a **TxPerChangeReq(5-sec)** command immediately after receiving the first uplink message from the DUT, so that the DUT sends a UL packet every 5 seconds.

Select Activation Method
CONF:PROTOCOL:ACTIVATION OTAA
CONF:PROTOCOL:APP_KEY
0x00000000000000000000000000000001
CONF:PROTOCOL:CHECK_EUI YES
CONF:PROTOCOL:DEV_EUI 0x0000000000000001
CONF:PROTOCOL:APP_EUI 0x0000000000000001

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

OR

CONF:PROTOCOL:ACTIVATION ABP
CONF:PROTOCOL:DEV_ADDR 0x00000001
CONF:PROTOCOL:APPS_KEY
0x00000000000000000000000000000001
CONF:PROTOCOL:NWKS_KEY
0x00000000000000000000000000000001

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Set Other Protocol Parameters

```

CONF:PROTOCOL:NETWORK PUBLIC
CONF:PROTOCOL:ADR ON
CONF:PROTOCOL:DOWNLINK_SLOT RX1
CONF:PROTOCOL:NET_ID 1
CONF:PROTOCOL:RX1_DR_OFFSET 0
CONF:PROTOCOL:RX2_DR DR0_SF12BW125
CONF:PROTOCOL:RECEIVE_DELAY 1

```

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

CONFIGURATION - RF

Set RF Parameters

```

CONF:RF:CH_MASK_0 0xF
CONF:RF:TX_POW -30
CONF:RF:PATH_LOSS 1
CONF:RF:FREQ_OFFSET 0
CONF:RF:TIME_OFFSET 0

```

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

Activation

Start Activation

EXEC:LINK:RUN

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.

Wait 1sec

READ:PROTOCOL:ACTIVATION_STATUS?

Status?

YES

NO

Retry<N?

YES

NO

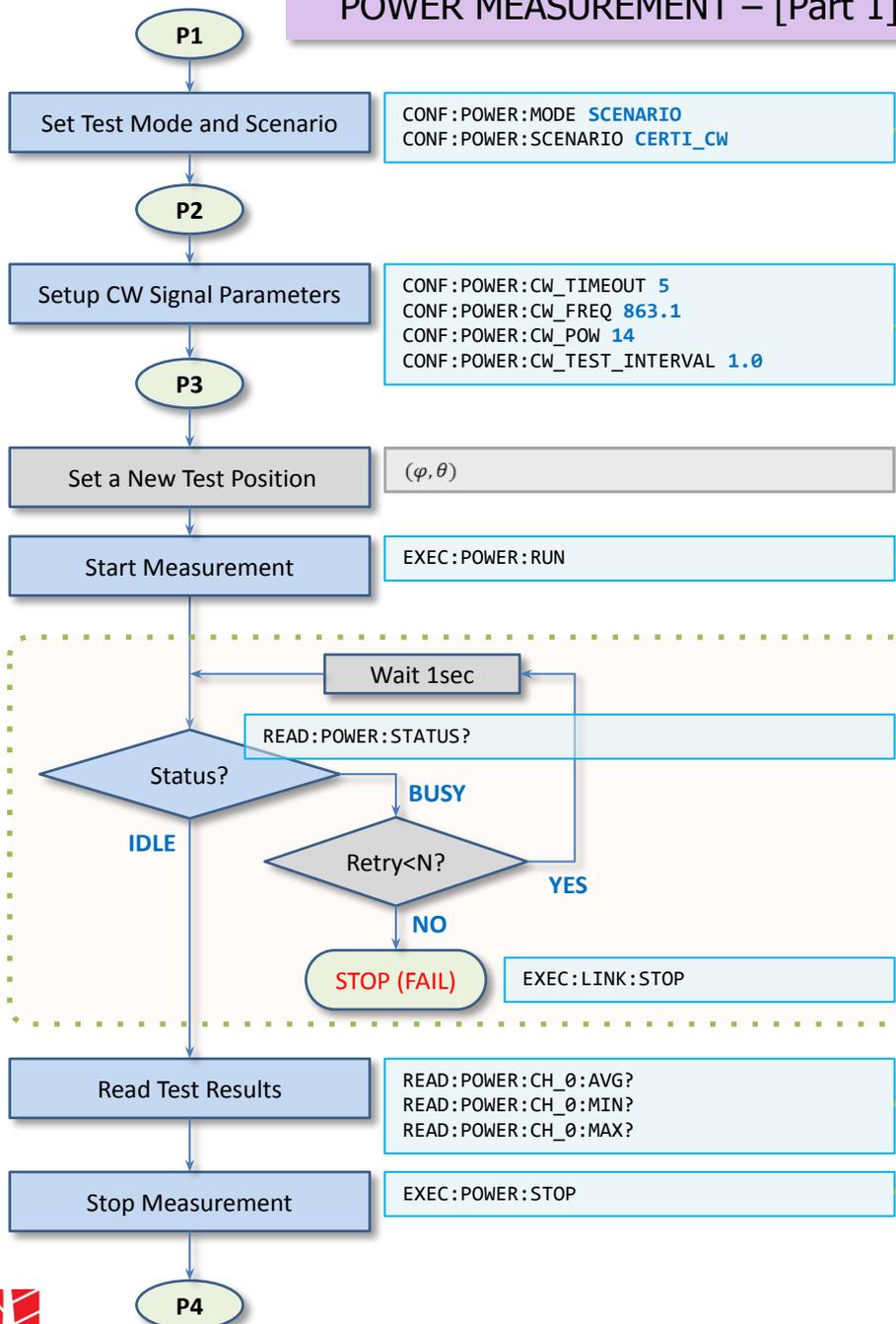
STOP (FAIL)

EXEC:LINK:STOP

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.

P1

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 **TxCwReq** command at each position of DUT and the tester measure the power.
- 2) Method 2 – issue a **TxCwReq** 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 SCENARIO and the SCENARIO 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 **TxCwReq** 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.

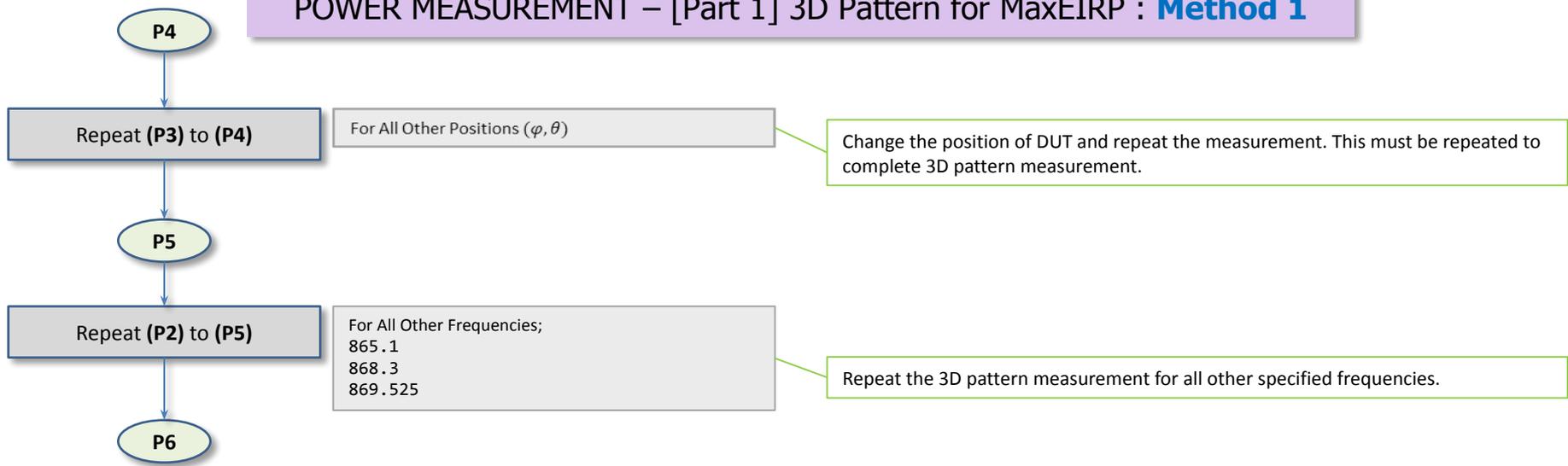
Read the result values for the current position.

Stop the TX power measurement.

3D Pattern for MaxEIRP – Method 1

Test	Configuration			Channels *			
	Data rate	Tx Power for FC plan devices	Tx Power for DC plan devices	Low freq channel	Mid freq channel	Default freq channel	High freq channel
TRP / 15° step	MinDR	Max output power	0 (MaxEIRP)	x	x	x	X
EIRP/ERP 1 measurement Best position	MinDR	Max output power	3 (MaxEIRP - 6 dB)	x	x	x	-
EIRP/ERP 1 measurement Best position	MinDR	Max output power	6 (MaxEIRP - 12 dB)	x	x	x	-

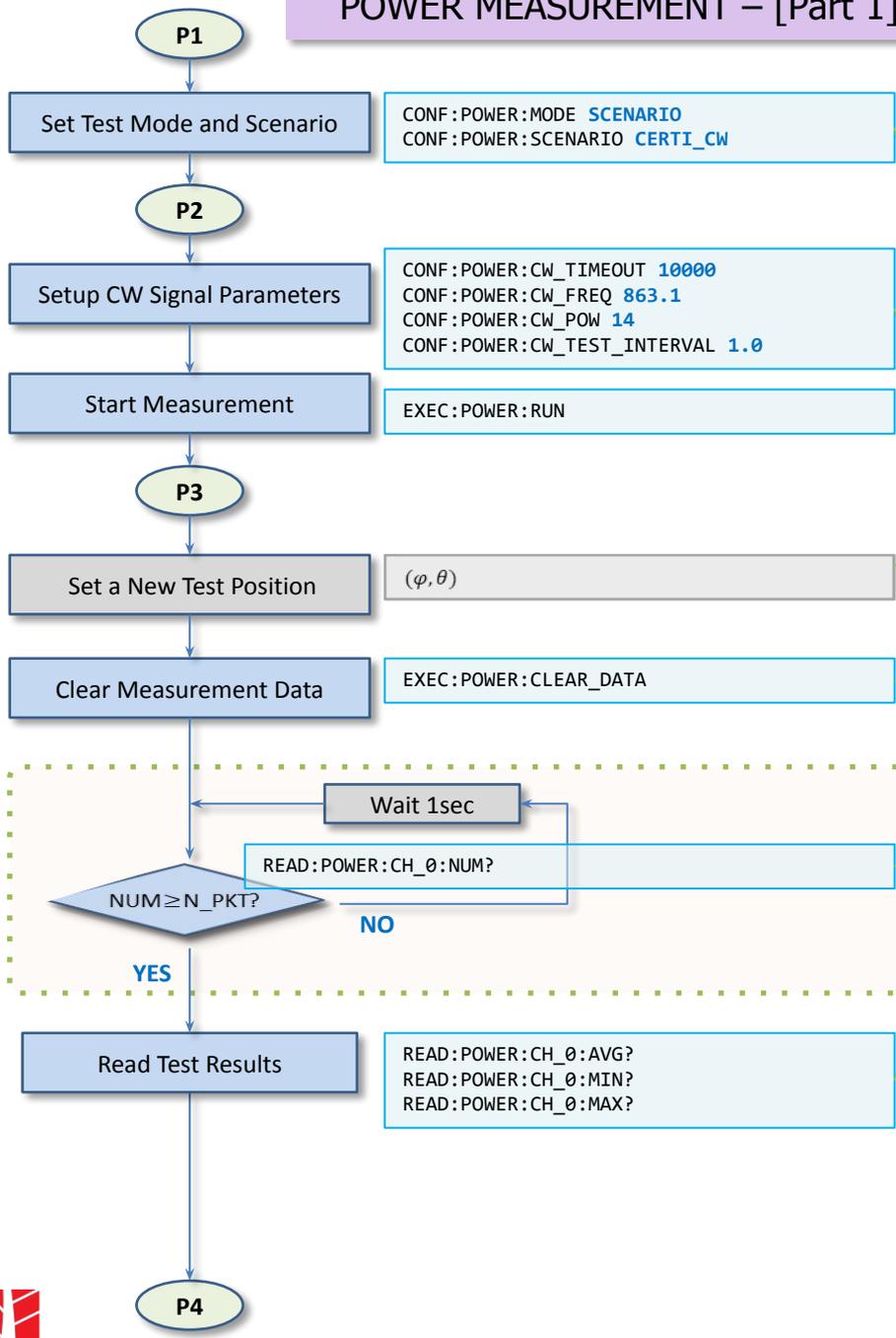
POWER MEASUREMENT – [Part 1] 3D Pattern for MaxEIRP : **Method 1**



3D Pattern for MaxEIRP – Method 1

Test	Configuration			Channels *			
	Data rate	Tx Power for FC plan devices	Tx Power for DC plan devices	Low freq channel	Mid freq channel	Default freq channel	High freq channel
TRP / 15° step	MinDR	Max output power	0 (MaxEIRP)	x	x	x	X
EIRP/ERP 1 measurement Best position	MinDR	Max output power	3 (MaxEIRP - 6 dB)	x	x	x	-
EIRP/ERP 1 measurement Best position	MinDR	Max output power	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 **TxCwReq** command at each position of DUT and the tester measure the power.
- 2) Method 2 – issue a **TxCwReq** 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 SCENARIO and the SCENARIO 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 **TxCwReq** 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.

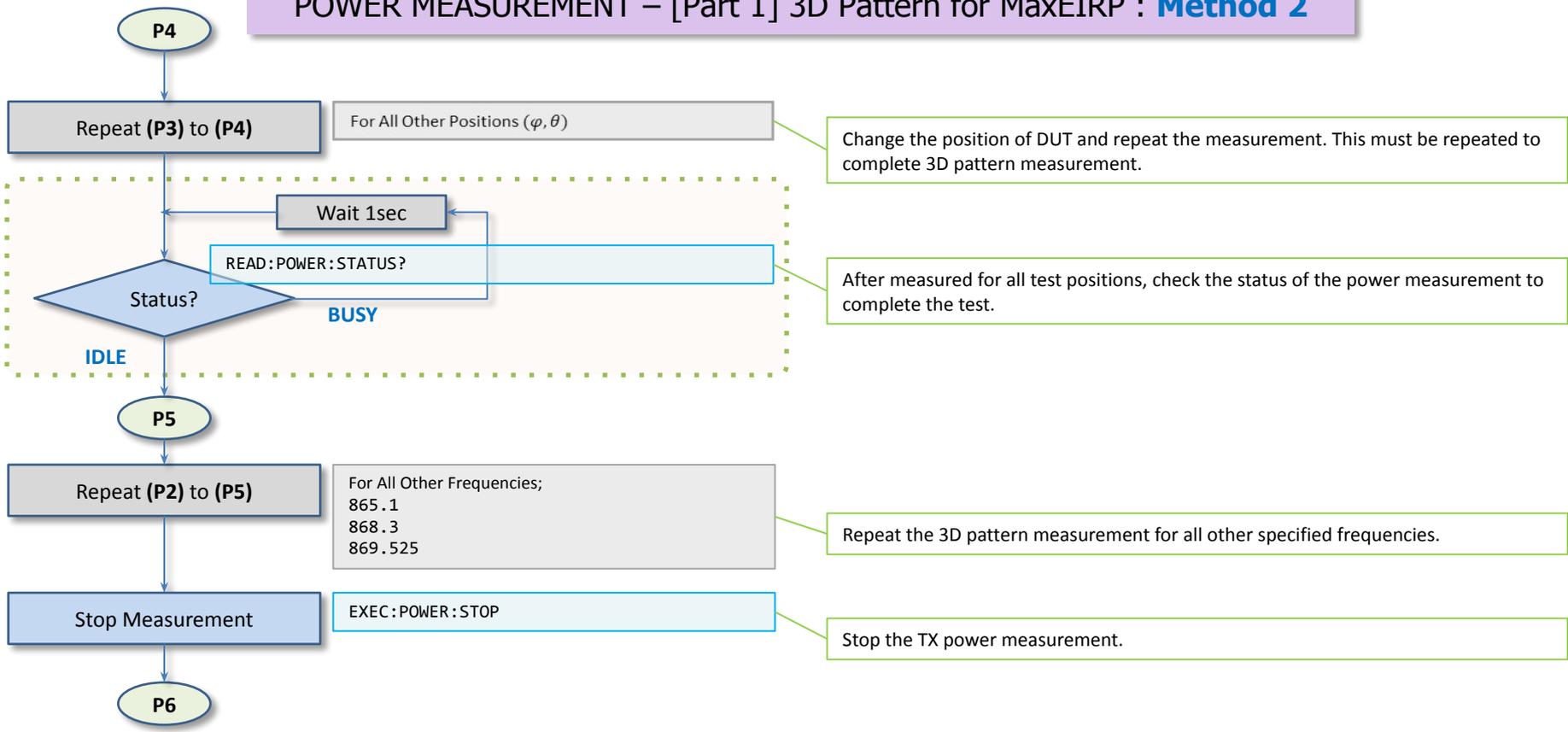
Check if the measurement data is ready for reading; read the number of packets received and compare with N_PKT, which means how many times the power will be measured at the current position, defined by users.

Read the result values for the current position.

3D Pattern for MaxEIRP – Method 2

Test	Configuration			Channels *			
	Data rate	Tx Power for FC plan devices	Tx Power for DC plan devices	Low freq channel	Mid freq channel	Default freq channel	High freq channel
TRP / 15° step	MinDR	Max output power	0 (MaxEIRP)	x	x	x	X
EIRP/ERP 1 measurement Best position	MinDR	Max output power	3 (MaxEIRP - 6 dB)	x	x	x	-
EIRP/ERP 1 measurement Best position	MinDR	Max output power	6 (MaxEIRP - 12 dB)	x	x	x	-

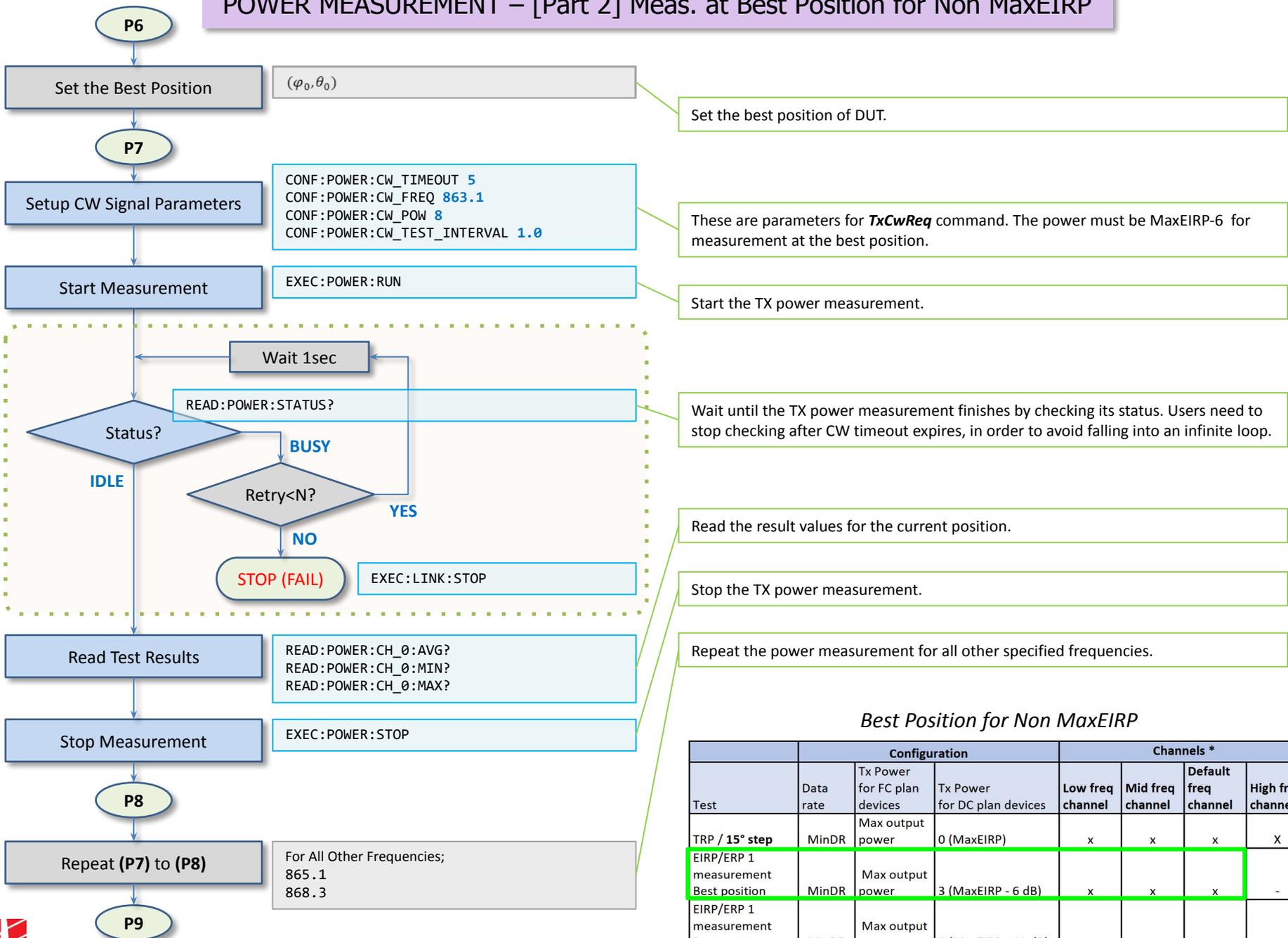
POWER MEASUREMENT – [Part 1] 3D Pattern for MaxEIRP : Method 2



3D Pattern for MaxEIRP – Method 2

Test	Configuration			Channels *			
	Data rate	Tx Power for FC plan devices	Tx Power for DC plan devices	Low freq channel	Mid freq channel	Default freq channel	High freq channel
TRP / 15° step	MinDR	Max output power	0 (MaxEIRP)	x	x	x	X
EIRP/ERP 1 measurement Best position	MinDR	Max output power	3 (MaxEIRP - 6 dB)	x	x	x	-
EIRP/ERP 1 measurement Best position	MinDR	Max output power	6 (MaxEIRP - 12 dB)	x	x	x	-

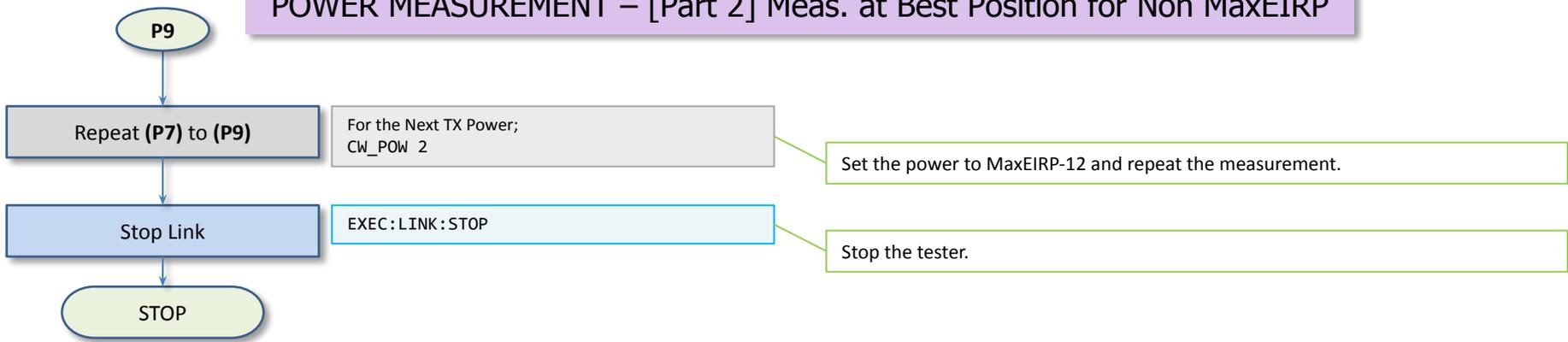
POWER MEASUREMENT – [Part 2] Meas. at Best Position for Non MaxEIRP



Best Position for Non MaxEIRP

Test	Configuration			Channels *			
	Data rate	Tx Power for FC plan devices	Tx Power for DC plan devices	Low freq channel	Mid freq channel	Default freq channel	High freq channel
TRP / 15° step	MinDR	Max output power	0 (MaxEIRP)	x	x	x	X
EIRP/ERP 1 measurement Best position	MinDR	Max output power	3 (MaxEIRP - 6 dB)	x	x	x	-
EIRP/ERP 1 measurement Best position	MinDR	Max output power	6 (MaxEIRP - 12 dB)	x	x	x	-

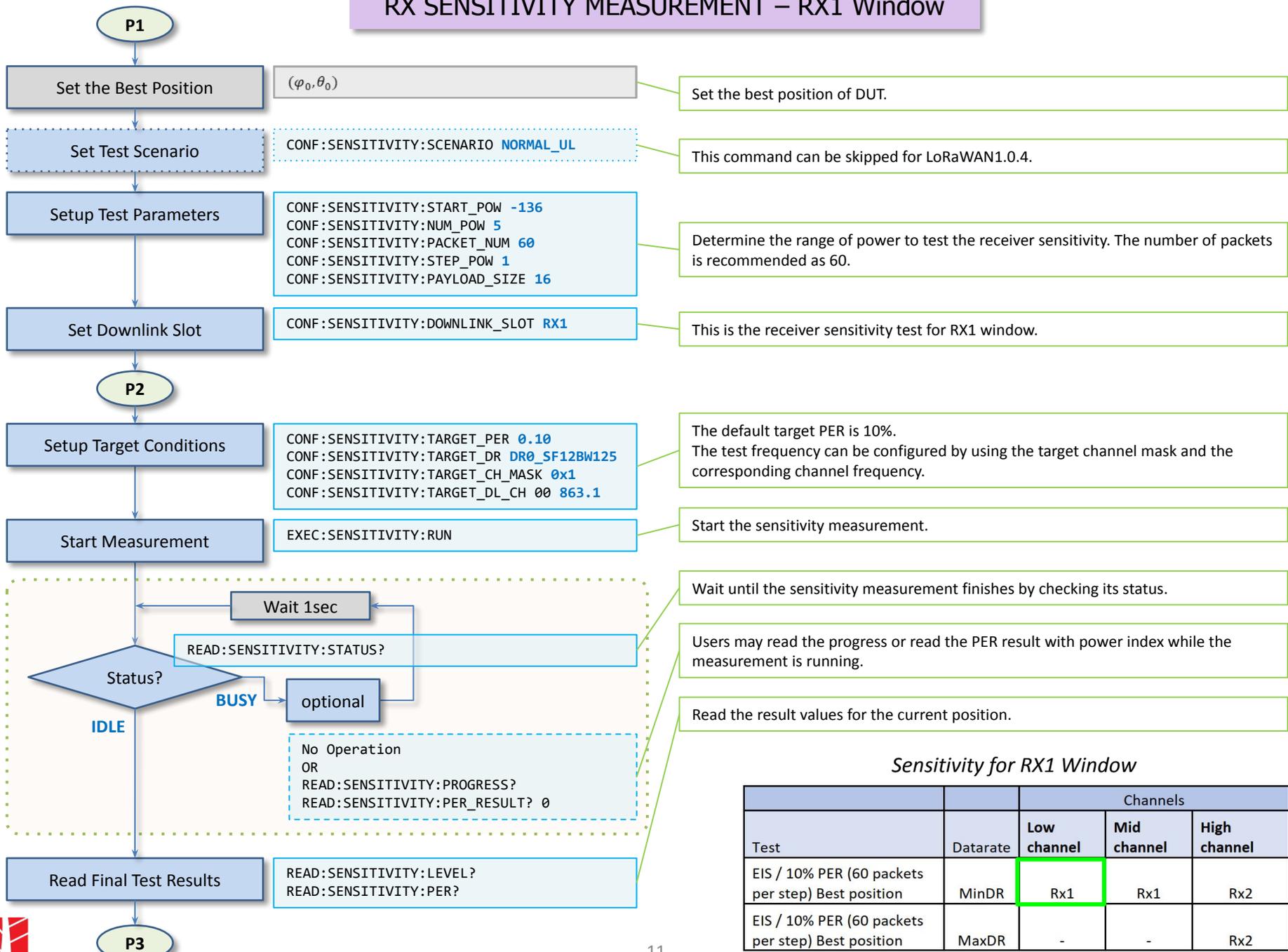
POWER MEASUREMENT – [Part 2] Meas. at Best Position for Non MaxEIRP



Best Position for Non MaxEIRP

Test	Configuration			Channels *			
	Data rate	Tx Power for FC plan devices	Tx Power for DC plan devices	Low freq channel	Mid freq channel	Default freq channel	High freq channel
TRP / 15° step	MinDR	Max output power	0 (MaxEIRP)	x	x	x	X
EIRP/ERP 1 measurement Best position	MinDR	Max output power	3 (MaxEIRP - 6 dB)	x	x	x	-
EIRP/ERP 1 measurement Best position	MinDR	Max output power	6 (MaxEIRP - 12 dB)	x	x	x	-

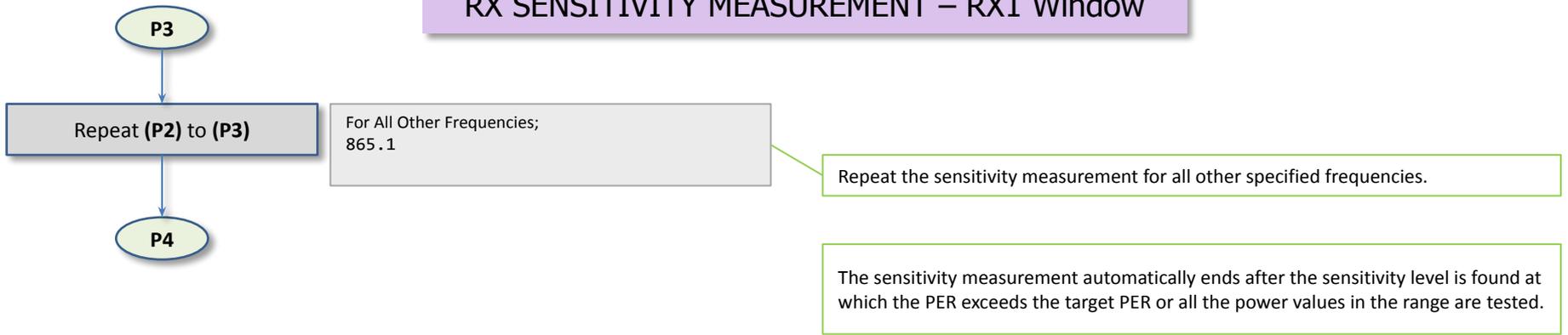
RX SENSITIVITY MEASUREMENT – RX1 Window



Sensitivity for RX1 Window

Test	Datarate	Channels		
		Low channel	Mid channel	High channel
EIS / 10% PER (60 packets per step) Best position	MinDR	Rx1	Rx1	Rx2
EIS / 10% PER (60 packets per step) Best position	MaxDR	-	-	Rx2

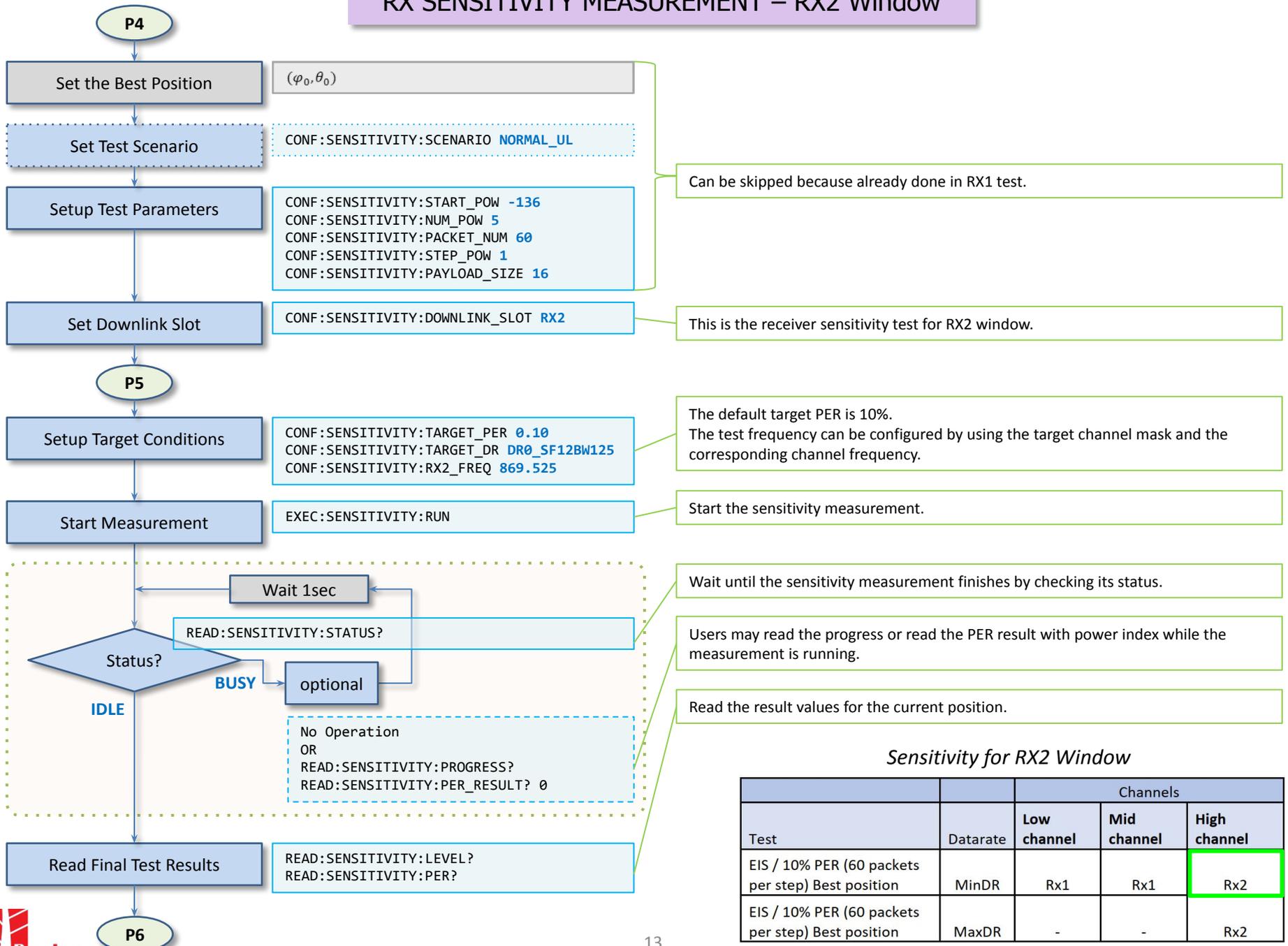
RX SENSITIVITY MEASUREMENT – RX1 Window



Sensitivity for RX1 Window

Test	Datarate	Channels		
		Low channel	Mid channel	High channel
EIS / 10% PER (60 packets per step) Best position	MinDR	Rx1	Rx1	Rx2
EIS / 10% PER (60 packets per step) Best position	MaxDR	-	-	Rx2

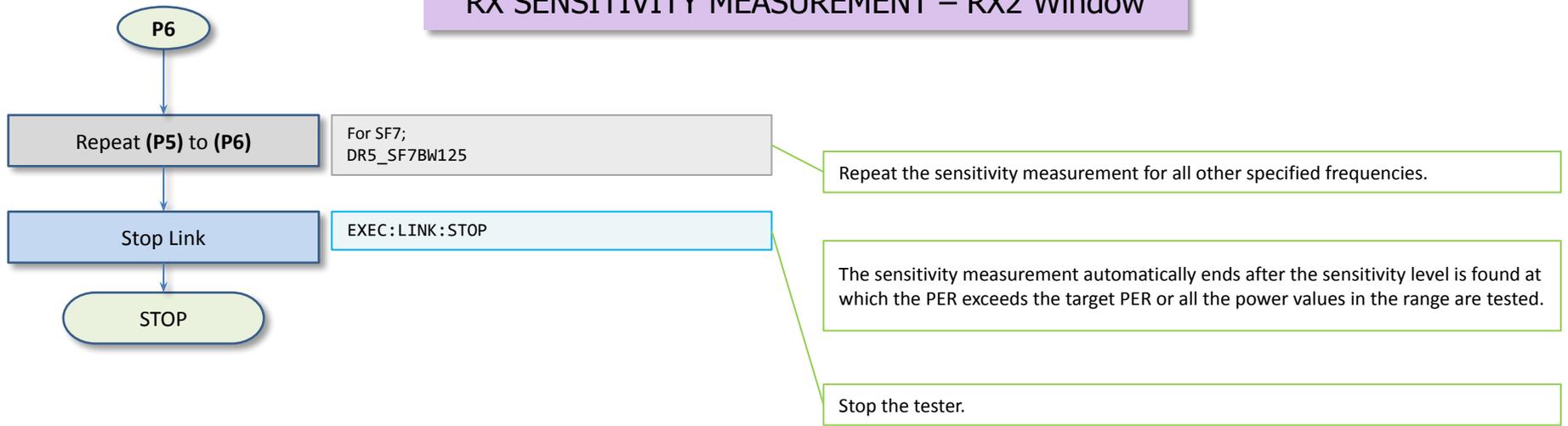
RX SENSITIVITY MEASUREMENT – RX2 Window



Sensitivity for RX2 Window

Test	Datarate	Channels		
		Low channel	Mid channel	High channel
EIS / 10% PER (60 packets per step) Best position	MinDR	Rx1	Rx1	Rx2
EIS / 10% PER (60 packets per step) Best position	MaxDR	-	-	Rx2

RX SENSITIVITY MEASUREMENT – RX2 Window



Sensitivity for RX2 Window

Test	Datarate	Channels		
		Low channel	Mid channel	High channel
EIS / 10% PER (60 packets per step) Best position	MinDR	Rx1	Rx1	Rx2
EIS / 10% PER (60 packets per step) Best position	MaxDR	-	-	Rx2