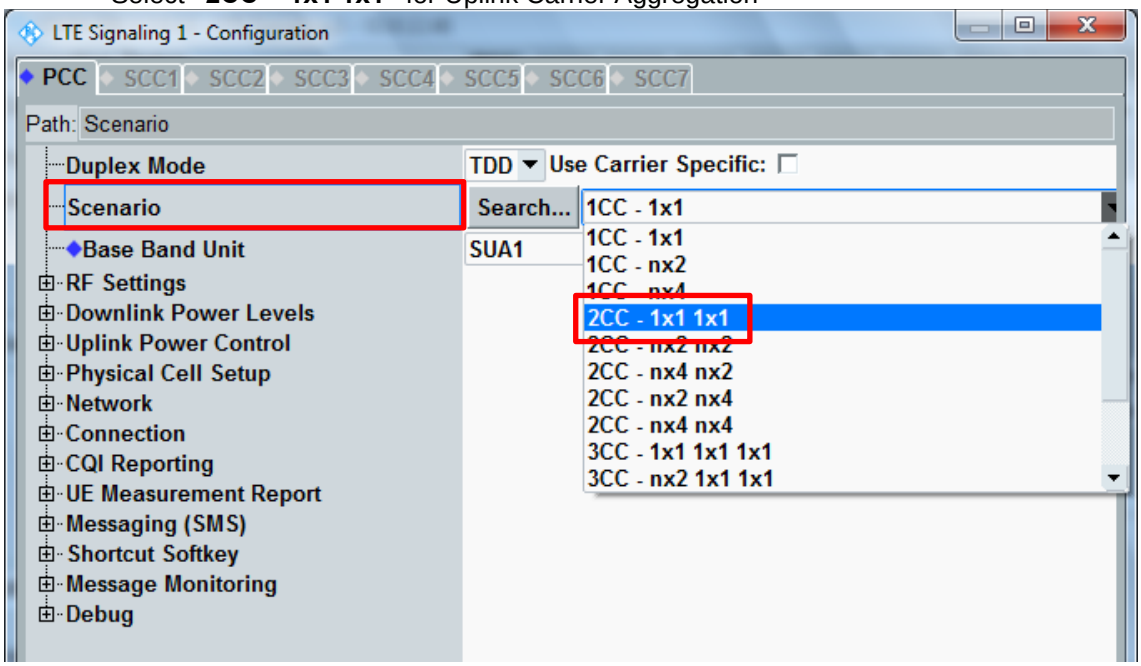
LTE Downlink Carrier Aggregation configurations

1. DL Intra Band(contiguous)

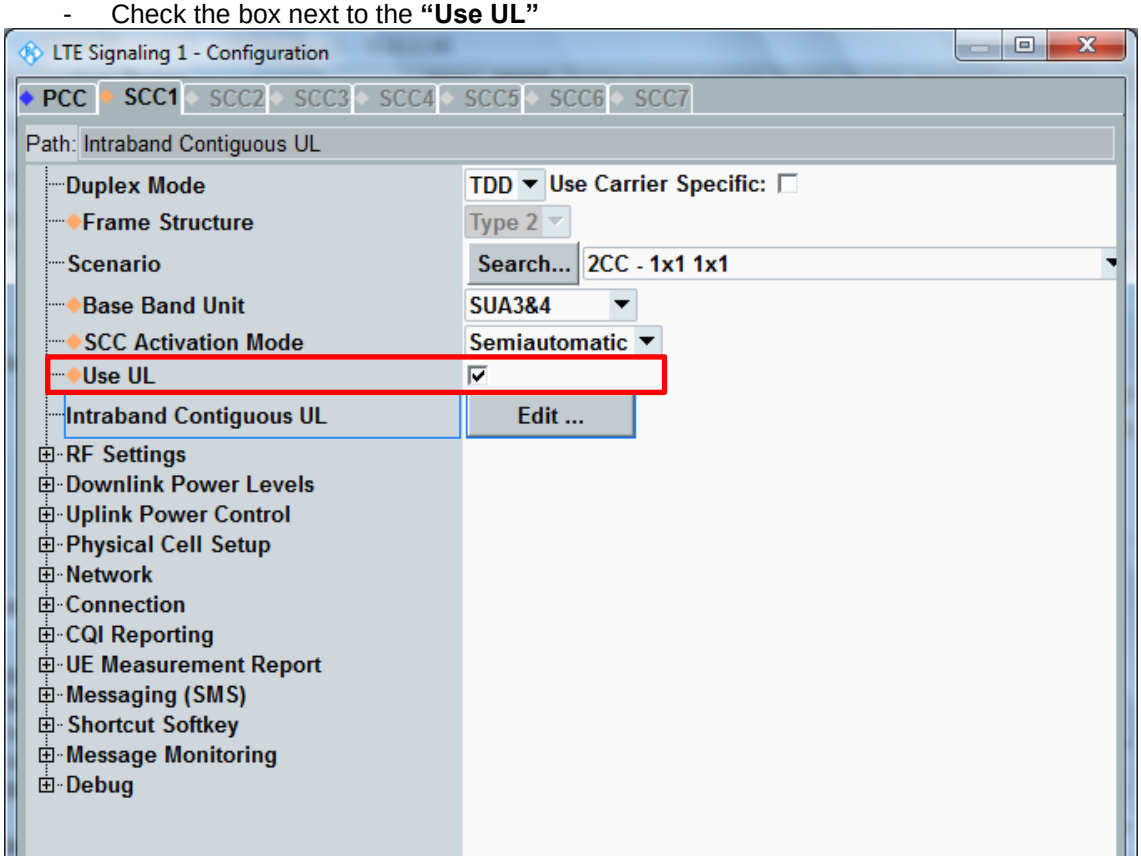
E-UTRA CA configuration	Bandwidth Combination	E-UTRA Band	Allowed Channel BW Per Carrier (MHz)					Max Aggregated BW
			1st Carrier	2nd Carrier	3rd Carrier	4th Carrier	5th Carrier	
41C	(0)	Band 41	10	20				40
			15	15, 20				
			20	10, 15, 20				
	(1)	Band 41	5, 10	20				40
			15	15, 20				
			20	5, 10, 15, 20				
	(2)	Band 41	10	15, 20				40
			15	10, 15, 20				
			20	10, 15, 20				
	(3)	Band 41	10	20				40
			20	20				
41D	(0)	Band 41	10	20	15			60
			10	15, 20	20			
			15	20	10, 15			
			15	10, 15, 20	20			
			20	15, 20	10			
			20	10, 15, 20	15, 20			

LTE Uplink Carrier Aggregation – Output Power measurement procedures

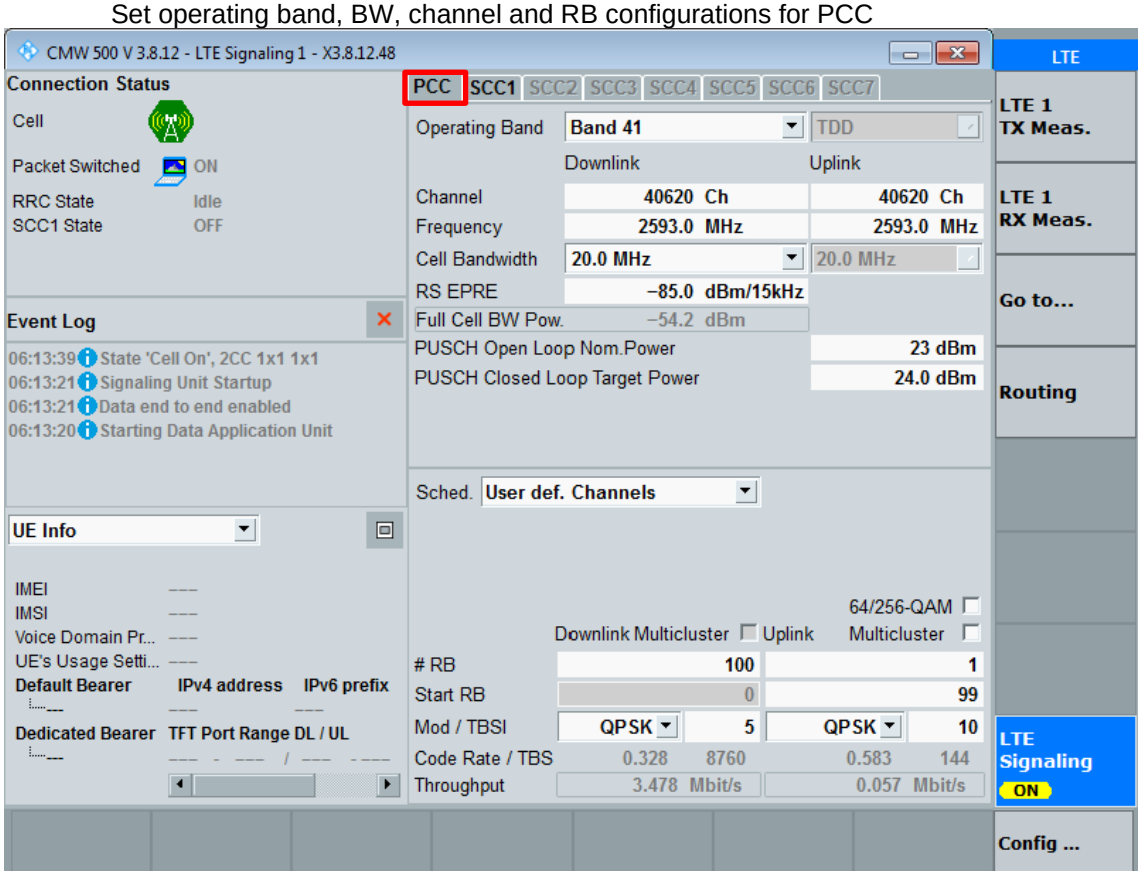
- Change the Scenario in the Configuration of LTE Signaling
  Select **"2CC – 1x1 1x1"** for Uplink Carrier Aggregation



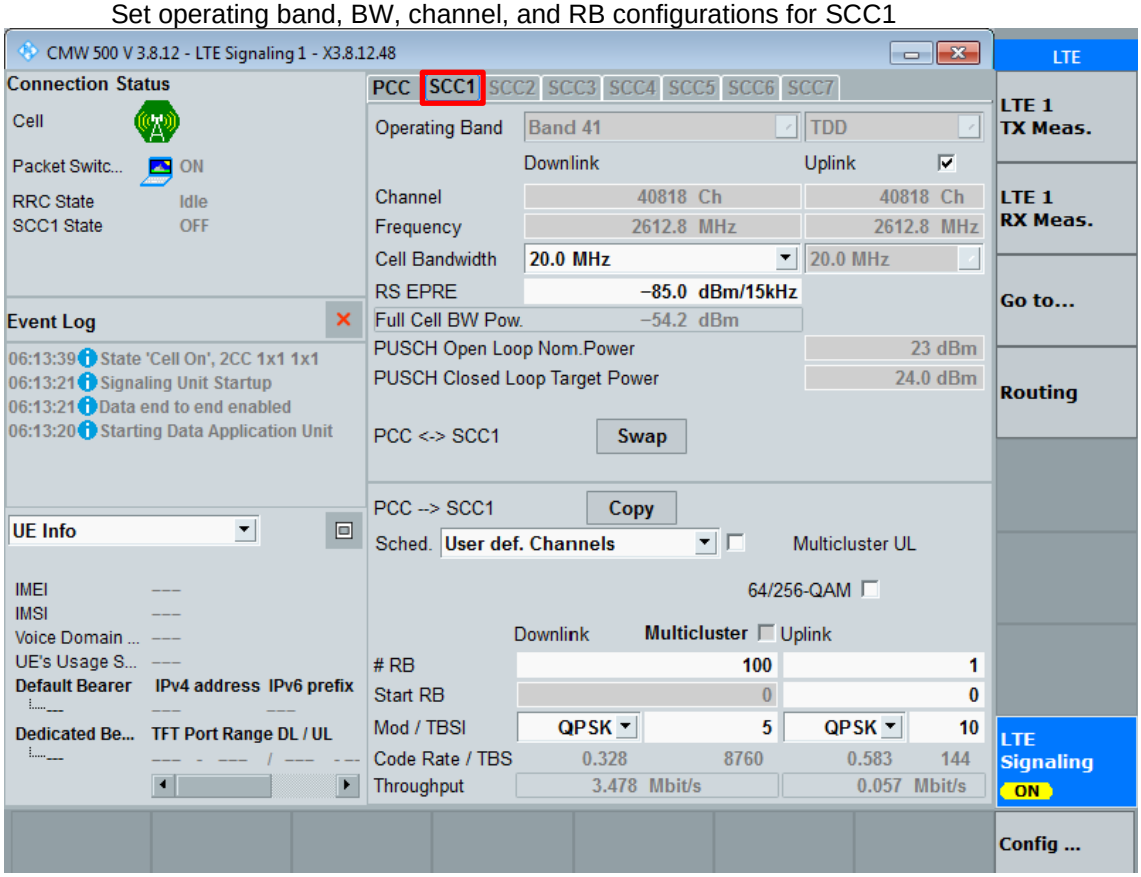
- Check the box next to the **"Use UL"**



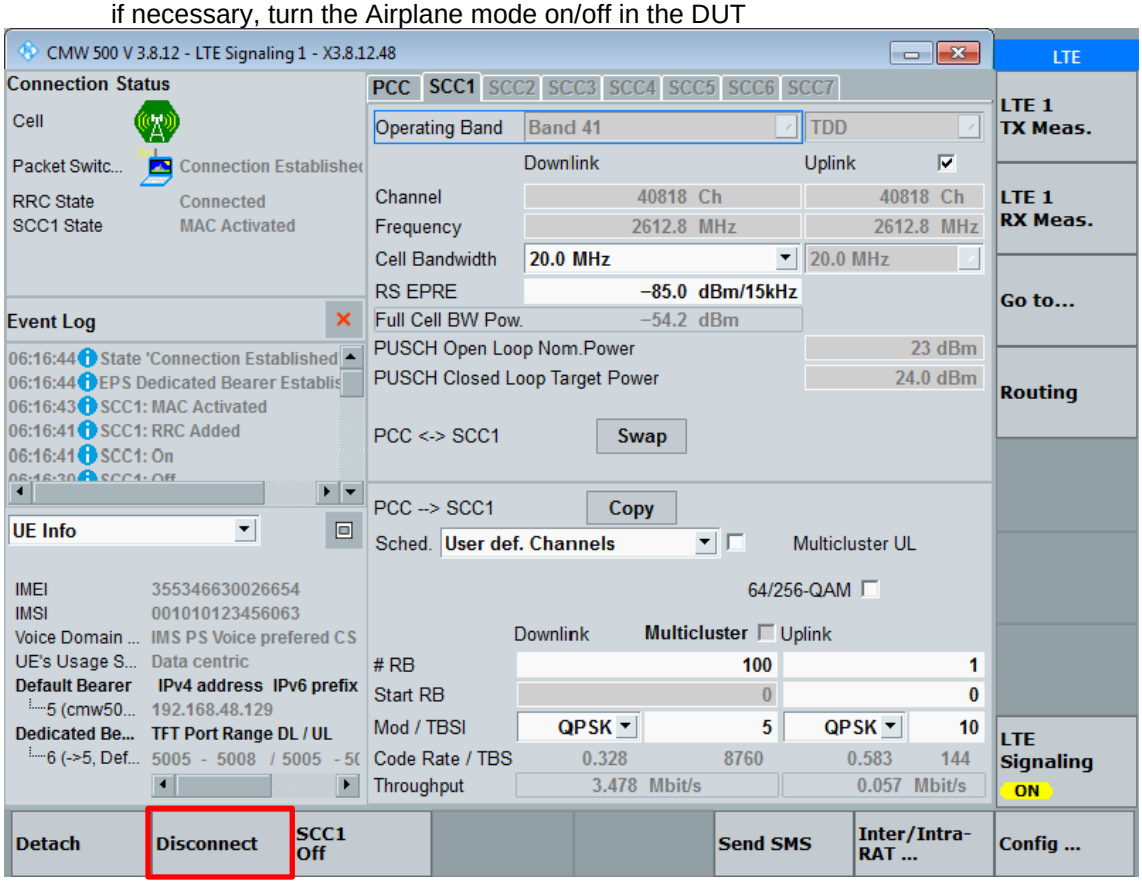
- Back to the LTE Signal screen, and then select the PCC tab,
  Set operating band, BW, channel and RB configurations for PCC



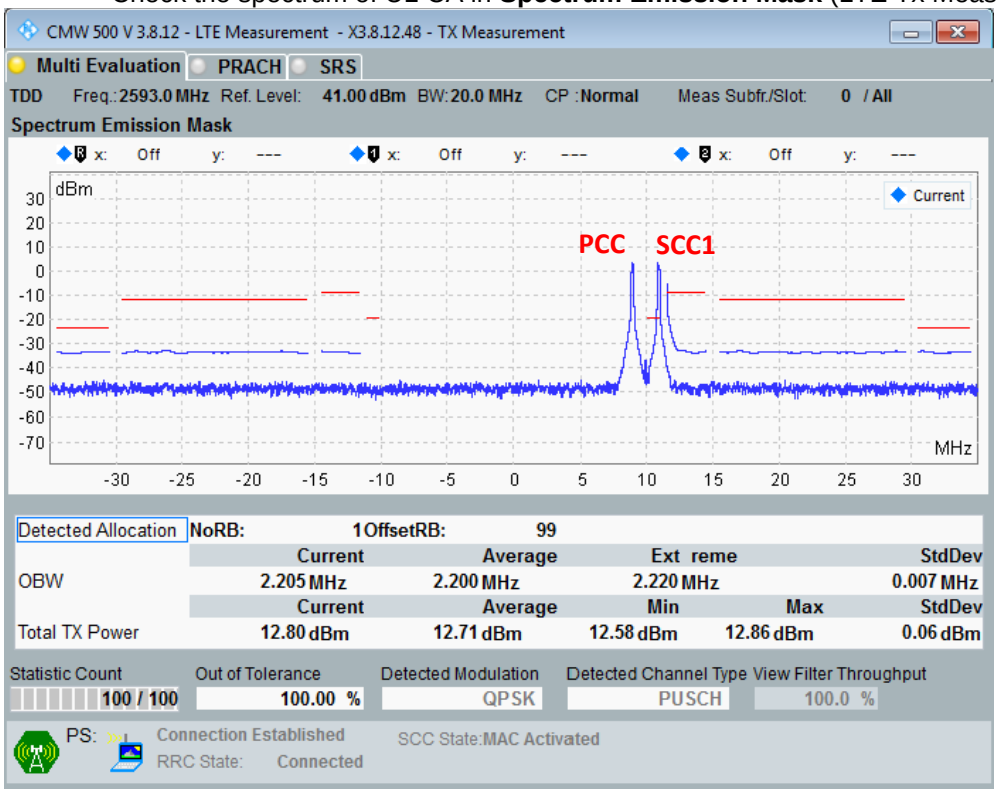
- Select the SCC1 tab,
  Set operating band, BW, channel, and RB configurations for SCC1



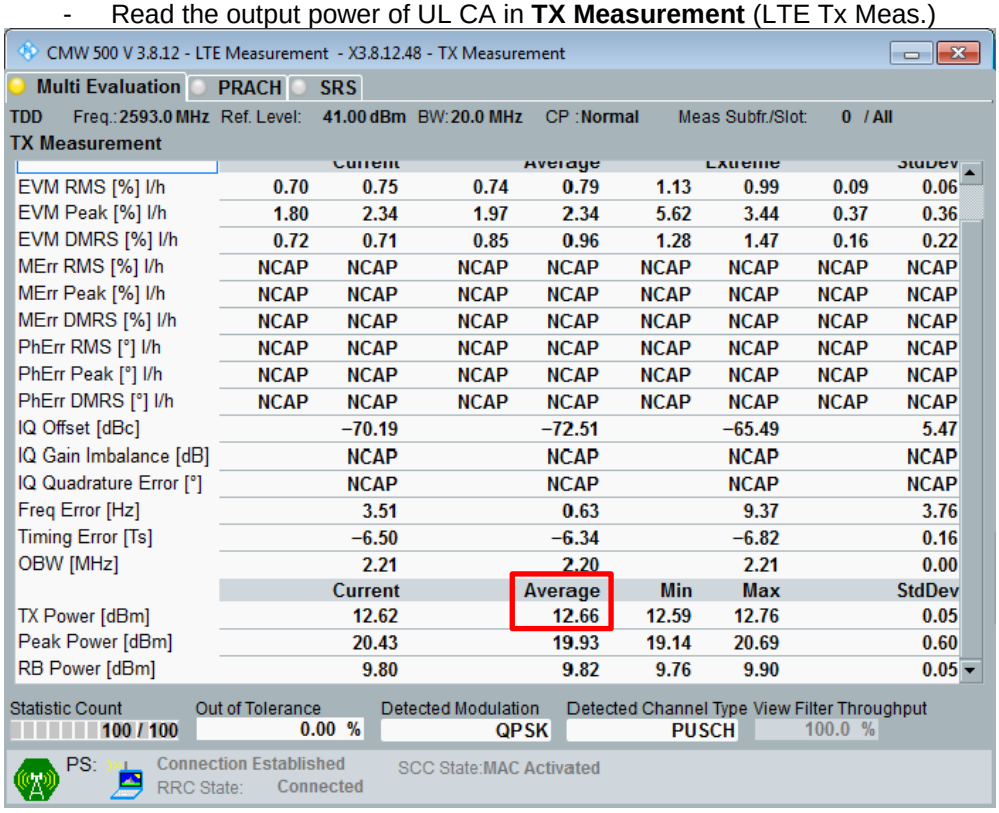
- Click the **"Connect"** button at the bottom of the screen, if necessary, turn the Airplane mode on/off in the DUT



- Check the spectrum of UL CA in **Spectrum Emission Mask** (LTE Tx Meas.)

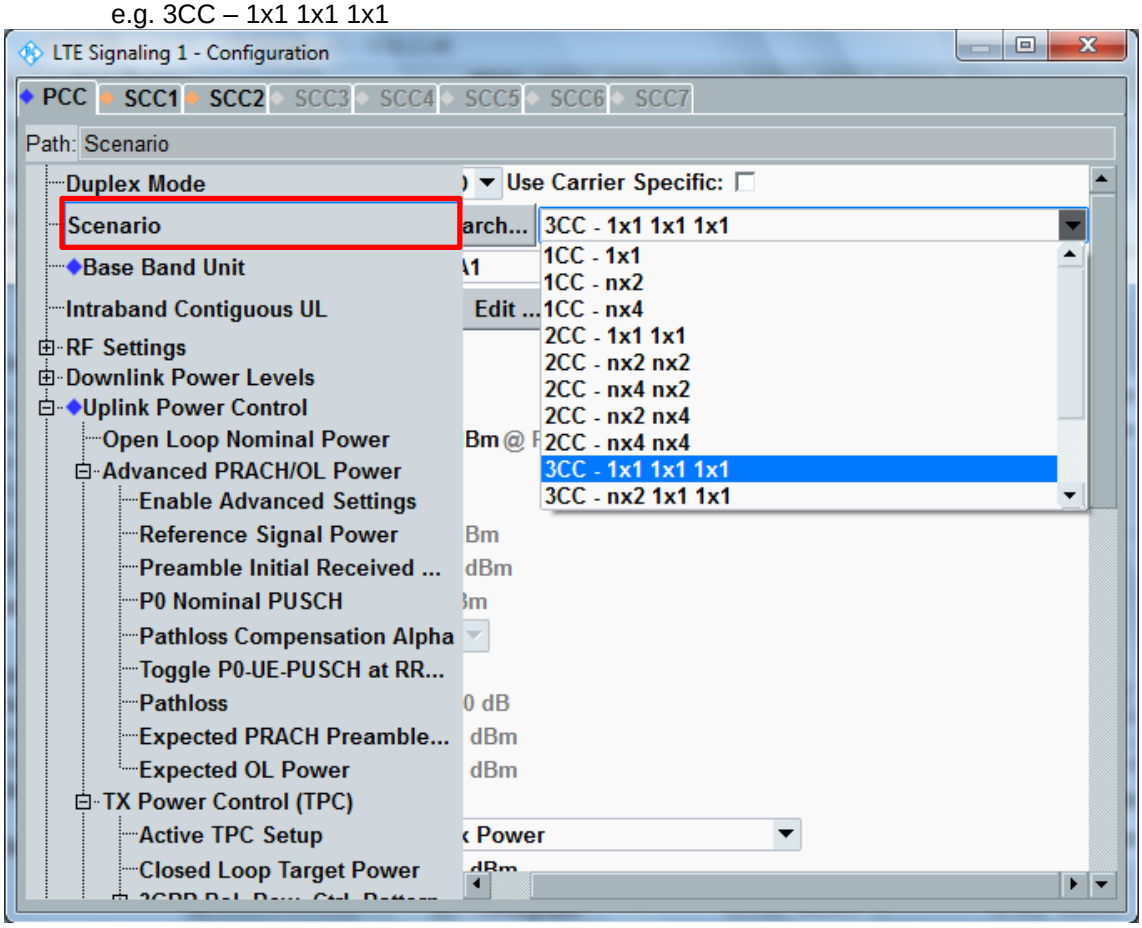


- Read the output power of UL CA in **TX Measurement** (LTE Tx Meas.)



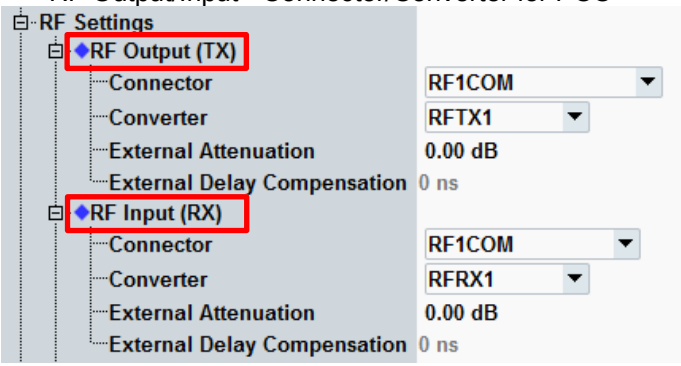
LTE Downlink Carrier Aggregation - Output Power measurement procedures

- Change the Scenario in the Configuration of LTE Signaling
  e.g. 3CC – 1x1 1x1 1x1

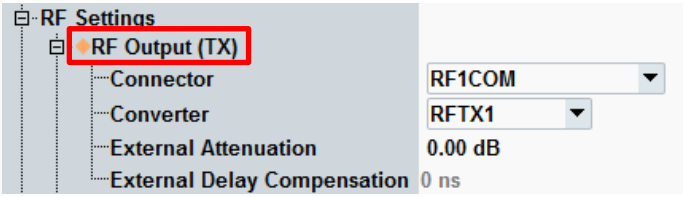


- Set the RF Output/Input Connector and Converter for PCC/SCC1/SCC2 in each tab.

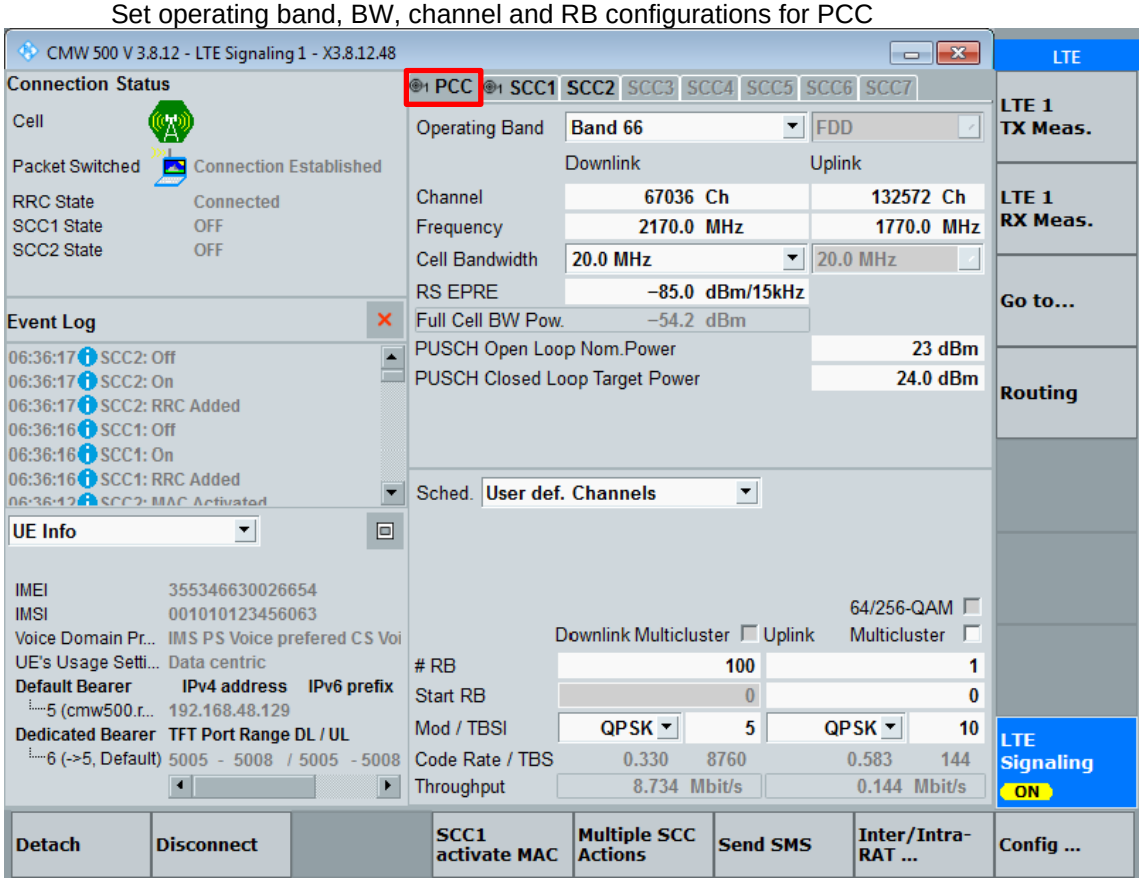
<RF Output/Input - Connector/Converter for PCC>



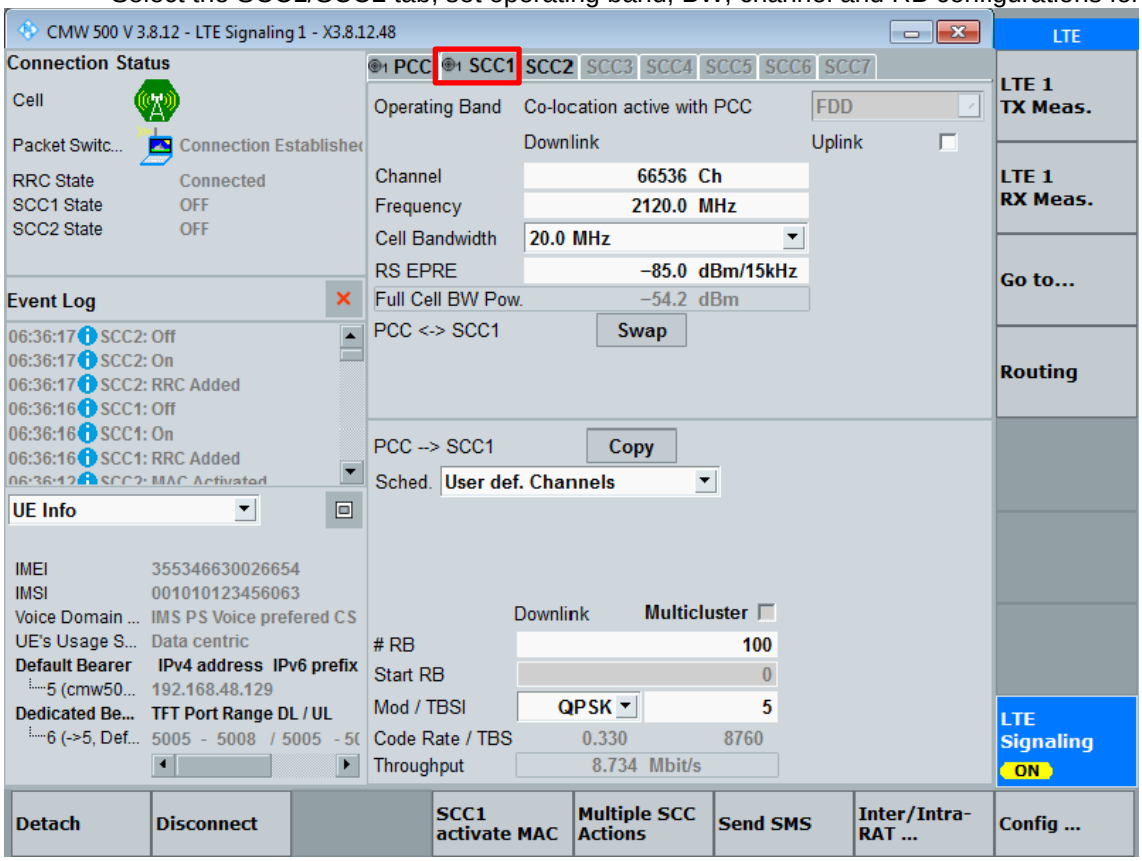
<RF Output – Connector/Converter for SCC1/SCC2>

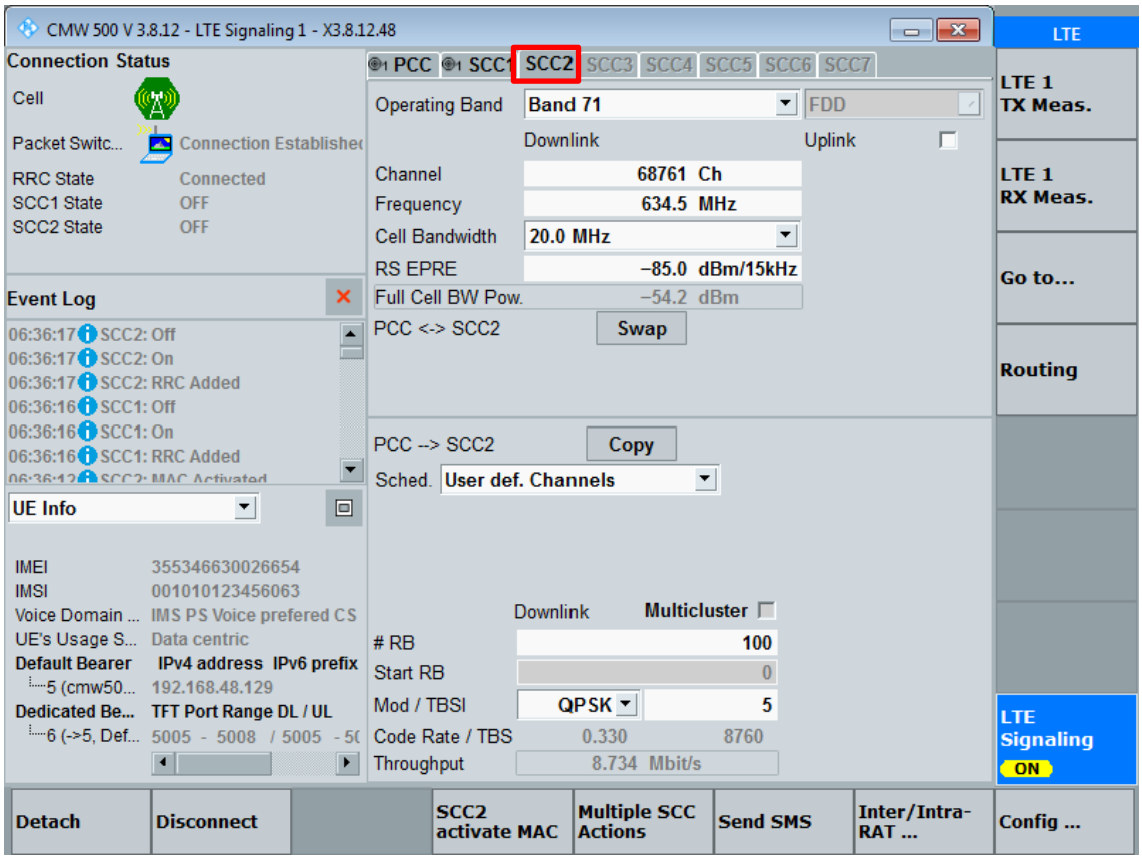


- Back to the LTE Signal screen, and then select the PCC tab,
  Set operating band, BW, channel and RB configurations for PCC

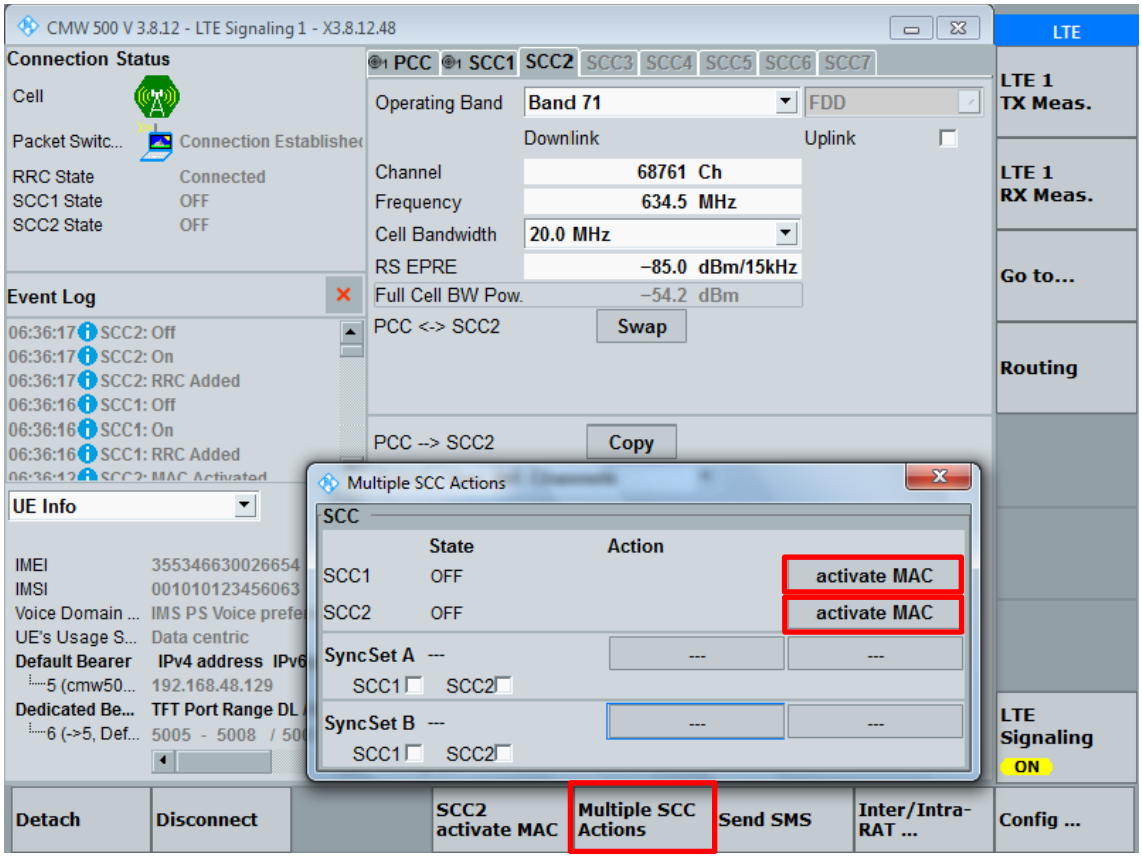


- Select the SCC1/SCC2 tab, set operating band, BW, channel and RB configurations for SCC1/SCC2

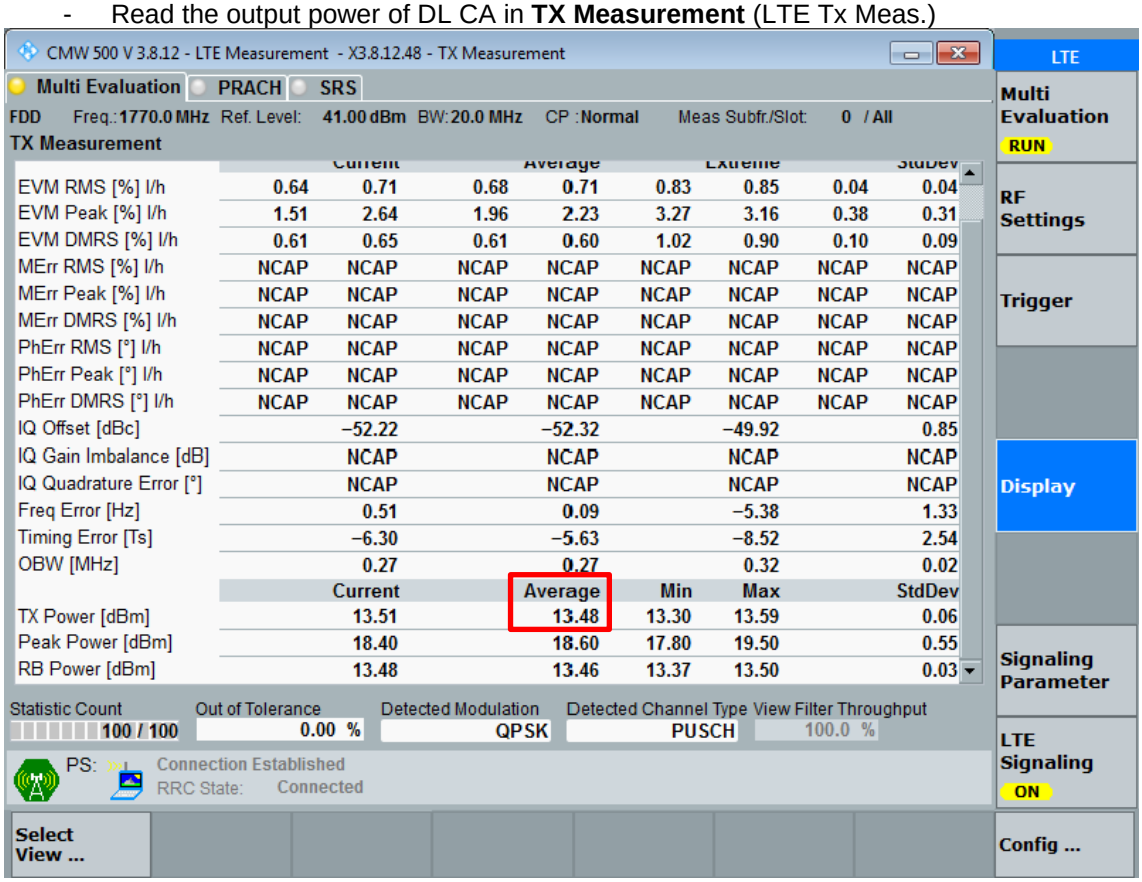




- Connect and Activate MAC for all SCCs

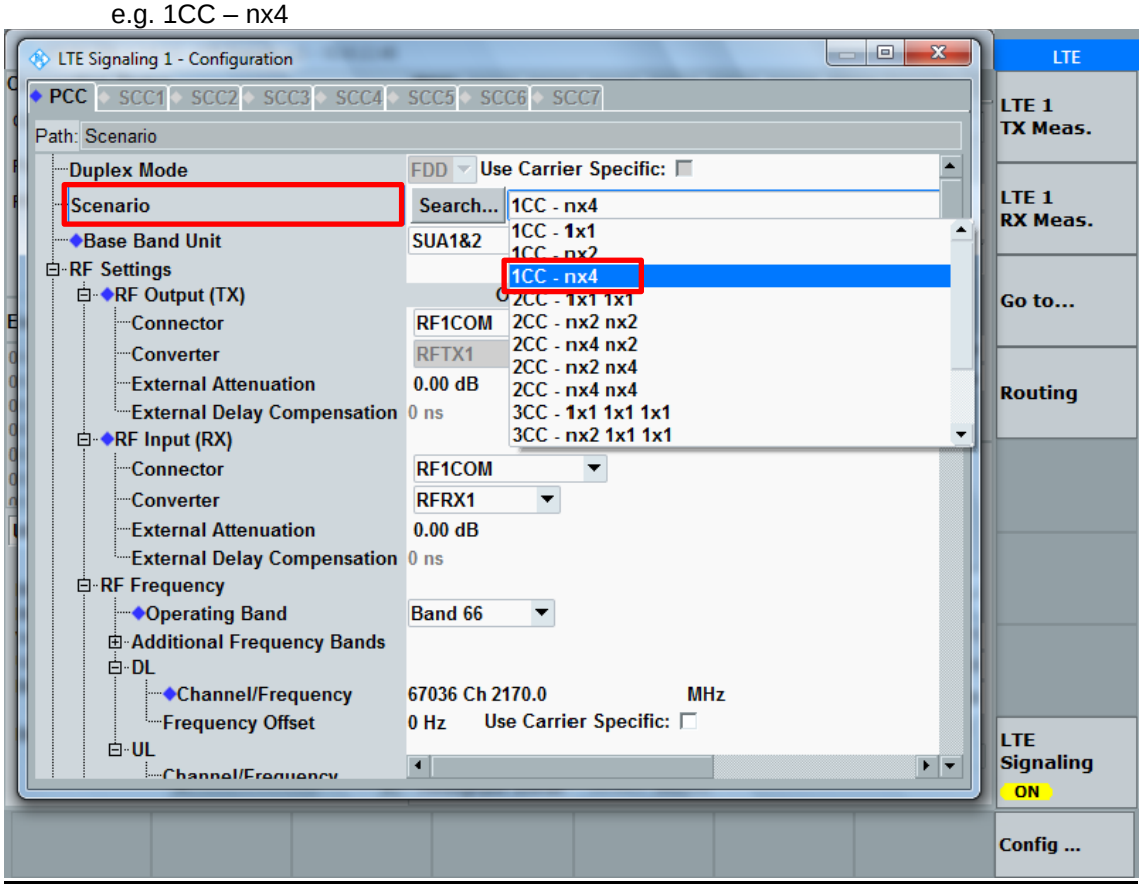


- Read the output power of DL CA in **TX Measurement** (LTE Tx Meas.)

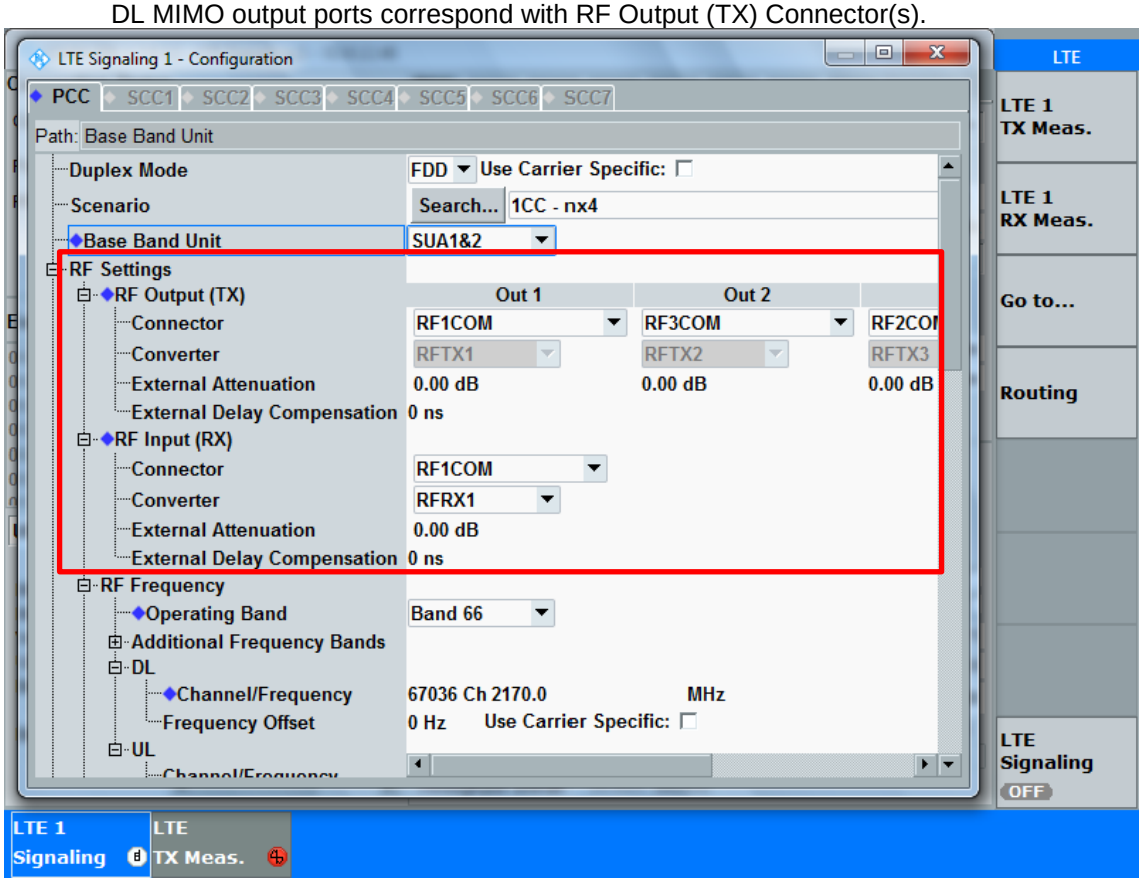


LTE Downlink 4x4 MIMO - Output Power measurement procedures

- Change the Scenario in the Configuration of LTE Signaling
  e.g. 1CC – nx4

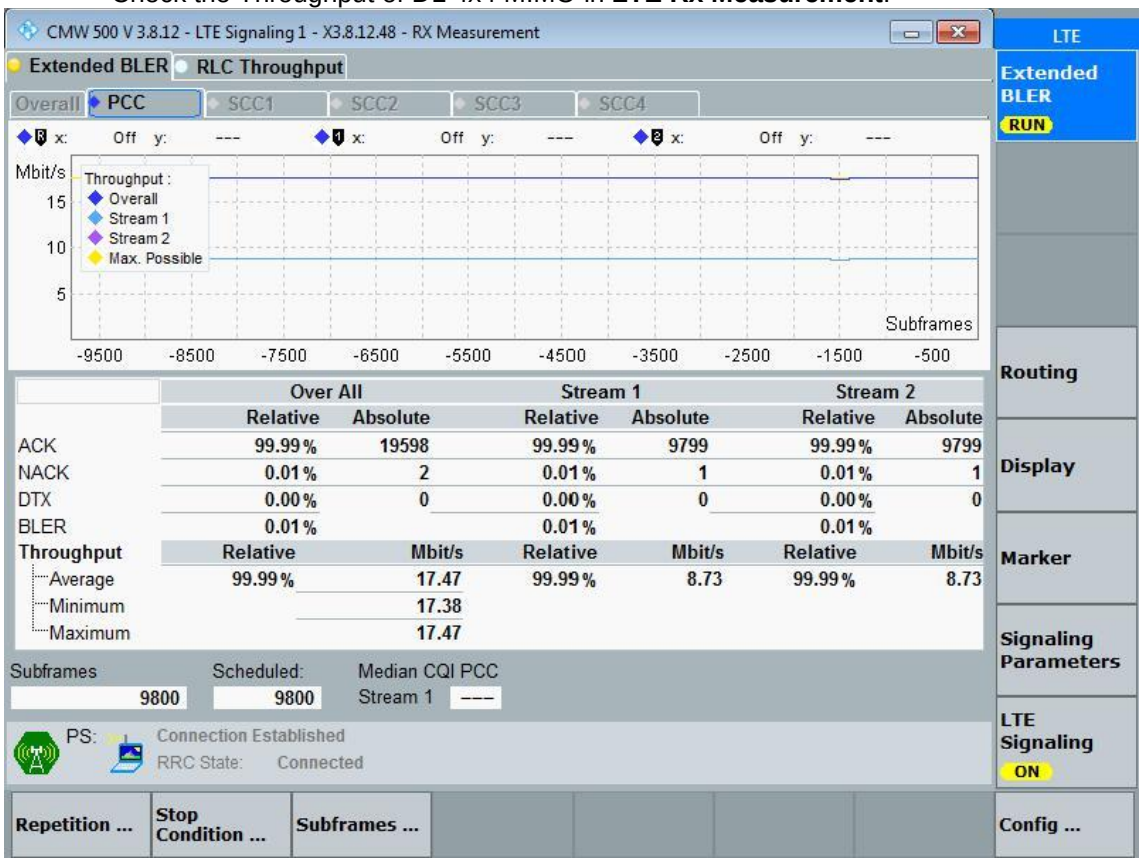


- Set the RF Output/Input Connector and Converter for PCC.
  DL MIMO output ports correspond with RF Output (TX) Connector(s).

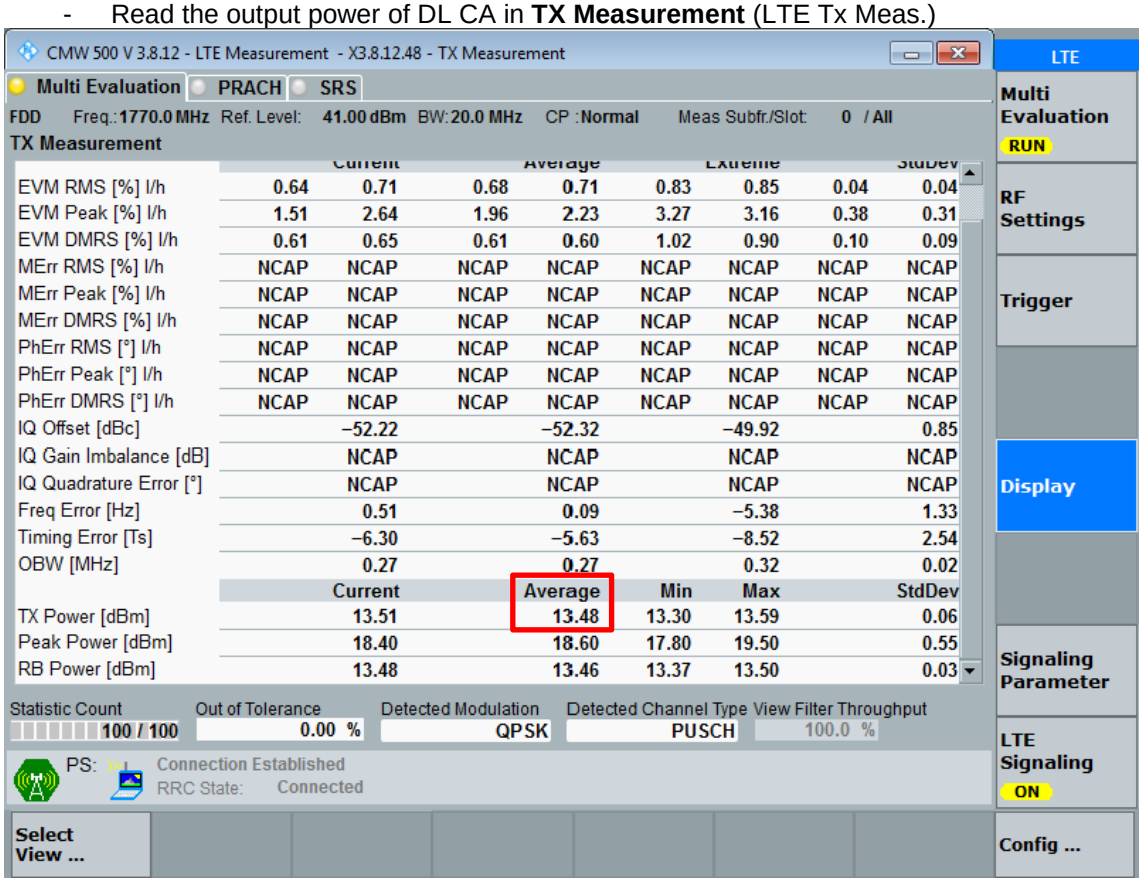


- Back to the LTE Signal screen, set operating band, BW, channel and RB configurations for PCC

- Check the Throughput of DL 4x4 MIMO in **LTE Rx Measurement**.



- Read the output power of DL CA in **TX Measurement** (LTE Tx Meas.)



LTE Downlink Carrier Aggregation Combinations

The DL CA power measurement conditions for various CC's combinations were determined according LTE DL CA SAR Test Exclusion guidance in TCB workshop note (April 2018). Only yellow highlighted cells need power measurement. The following power measurements were performed with a single carrier uplink; CA for this particular project only supports one (1) uplink and up to four (4) downlinks.

LTE Release 10 Carrier Aggregation

Index	2CC	Restriction	Completely Covered by Measurement Superset
2CC#1	41C		

Index	3CC	Restriction	Completely Covered by Measurement Superset
3CC#1	41D		

LTE Release 10 Carrier Aggregation with 4x4 MIMO

Index	2CC	Restriction	Completely Covered by Measurement Superset
2CC#1	[41C]		

Index	3CC	Restriction	Completely Covered by Measurement Superset
3CC#1	[41D]		

Single Carrier Downlink 4x4 MIMO output power results

LTE Bands	Modulation	BW (MHz)	Channel	Freq. (MHz)	RB/Offset	LTE Rel 8 Tx. Power [dBm]	DL 4x4 MIMO Tx. Power [dBm]	Delta
41	QPSK	20	40620	2593	1/99	24.35	24.26	-0.09

Note:

According to LTE Test Conditions in TCB workshop (May, 2017), SAR is excluded for LTE downlink 4x4 MIMO operation when uplink output with DL MIMO does not exceed highest uplink output power configuration without DL MIMO by more than 1/4 dB. And for DL MIMO with carrier aggregation, the same SAR test exclusion procedure is considered.

DL CA output power results

E-UTRA CA configutation (BCS)	Bands				UL							DL													LTE Rel 8 Tx. Power [dBm]	LTE Rel 10 Tx. Power [dBm]	Delta
	PCC	SCC1	SCC2	SCC3	PCC							PCC			SCC1				SCC2				SCC3						
	1st	2nd	3rd	4th	Band	Mode	BW (MHz)	Channel	Freq. (MHz)	RB Allocatio	RB offset	Band	BW (MHz)	Channel	Freq. (MHz)	Band	BW (MHz)	Channel	Freq. (MHz)	Band	BW (MHz)	Channel	Freq. (MHz)	Band	BW (MHz)	Channel	Freq. (MHz)			
41C	41C	41C			41	QPSK	20	40620	2593	1	99	41	20	40620	2593	41	20	40818	2612.8									24.35	24.27	-0.08
41D	41D	41D	41D		41	QPSK	20	40620	2593	1	99	41	20	40620	2593	41	20	40818	2612.8	41	20	41016	2632.6					24.35	24.36	0.01

Note:

1. Per KDB 941225 D05A LTE Rel. 10 KDB Inquiry Sheet: SAR is excluded for Carrier Aggregation when measured power does not exceed LTE Release 8 by more than a 1/4 dB.
2. When the same frequency band is used for both contiguous and non-contiguous in DL CA Intra band, power was measured using the configuration with the largest aggregated bandwidth and maximum output power among the contiguous and non-contiguous in DL CA Intra band configurations.

DL CA with 4x4 MIMO output power results

E-UTRA CA configutation (BCS)	Bands				UL							DL																LTE Rel 8 Tx. Power [dBm]	LTE Rel 10 Tx. Power [dBm]	Delta
	PCC	SCC1	SCC2	SCC3	PCC							PCC				SCC1				SCC2				SCC3						
	1st	2nd	3rd	4th	Band	Mode	BW (MHz)	Channel	Freq. (MHz)	RB Allocatio	RB offset	Band	BW (MHz)	Channel	Freq. (MHz)	Band	BW (MHz)	Channel	Freq. (MHz)	Band	BW (MHz)	Channel	Freq. (MHz)	Band	BW (MHz)	Channel	Freq. (MHz)			
[41C]	[41C]	[41C]			[41]	QPSK	20	40620	2593	1	99	[41]	20	40620	2593	[41]	20	40818	2612.8									24.35	24.31	-0.04
[41D]	[41D]	[41D]	[41D]		[41]	QPSK	20	40620	2593	1	99	[41]	20	40620	2593	[41]	20	40818	2612.8	[41]	20	41016	2632.6					24.35	24.40	0.05

Note:

1. Per KDB 941225 D05A LTE Rel. 10 KDB Inquiry Sheet: SAR is excluded for Carrier Aggregation when measured power does not exceed LTE Release 8 by more than a 1/4 dB.
2. When the same frequency band is used for both contiguous and non-contiguous in DL CA Intra band, power was measured using the configuration with the largest aggregated bandwidth and maximum output power among the contiguous and non-contiguous in DL CA Intra band configurations.

- END -