

LTE Downlink Carrier Aggregation configurations

1. DL Inter Band(2CC)

E-UTRA CA configuration	Bandwidth Combination Set	E-UTRA Band	Bandwidth						Max Aggregated BW
			1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
2A-4A	(0)	Band 2	Yes	Yes	Yes	Yes	Yes	Yes	40
		Band 4			Yes	Yes	Yes	Yes	
	(1)	Band 2			Yes	Yes			20
		Band 4			Yes	Yes			
(2)	Band 2			Yes	Yes	Yes	Yes	40	
	Band 4			Yes	Yes	Yes	Yes		
2A-5A	(0)	Band 2			Yes	Yes	Yes	Yes	30
		Band 5			Yes	Yes			
2A-12A	(0)	Band 2			Yes	Yes	Yes	Yes	30
		Band 12			Yes	Yes			
	(1)	Band 2			Yes	Yes	Yes	Yes	30
		Band 12		Yes					
(2)	Band 2			Yes	Yes			20	
	Band 12			Yes	Yes				
2A-13A	(0)	Band 2			Yes	Yes	Yes	Yes	30
		Band 13				Yes			
	(1)	Band 2			Yes	Yes			20
		Band 13				Yes			
(2)	Band 2			Yes	Yes	Yes	Yes	20	
	Band 13			Yes	Yes				
2A-17A	(0)	Band 2			Yes	Yes			20
		Band 17			Yes	Yes			
2A-26A	(0)	Band 2			Yes	Yes	Yes	Yes	35
		Band 26			Yes	Yes	Yes	Yes	
2A-66A	(0)	Band 2	Yes	Yes	Yes	Yes	Yes	Yes	40
		Band 66			Yes	Yes	Yes	Yes	
	(1)	Band 2			Yes	Yes			20
		Band 66			Yes	Yes			
(2)	Band 2			Yes	Yes	Yes	Yes	40	
	Band 66			Yes	Yes	Yes	Yes		
4A-5A	(0)	Band 4			Yes	Yes			20
		Band 5			Yes	Yes			
	(1)	Band 4			Yes	Yes	Yes	Yes	30
		Band 5			Yes	Yes			

1. DL Inter Band(2CC)

E-UTRA CA configuration	Bandwidth Combination Set	E-UTRA Band	Bandwidth						Max Aggregated BW
			1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
4A-12A	(0)	Band 4	Yes	Yes	Yes	Yes			20
		Band 12			Yes	Yes			
	(1)	Band 4	Yes	Yes	Yes	Yes	Yes	Yes	30
		Band 12			Yes	Yes			
	(2)	Band 4			Yes	Yes	Yes	Yes	30
		Band 12		Yes	Yes	Yes			
	(3)	Band 4			Yes	Yes			20
		Band 12			Yes	Yes			
(4)	Band 4			Yes	Yes	Yes	Yes	30	
	Band 12			Yes	Yes				
(5)	Band 4			Yes	Yes	Yes		20	
	Band 12			Yes					
4A-13A	(0)	Band 4			Yes	Yes	Yes	Yes	30
	(1)	Band 13			Yes	Yes			20
4A-17A	(0)	Band 4			Yes	Yes			20
5A-41A	(0)	Band 5			Yes	Yes			30
		Band 41					Yes		
5A-66A	(0)	Band 5			Yes	Yes			30
		Band 66			Yes	Yes	Yes	Yes	
12A-25A	(0)	Band 12			Yes	Yes	Yes	Yes	30
		Band 25			Yes	Yes	Yes	Yes	
12A-66A	(0)	Band 12			Yes	Yes			20
		Band 66	Yes	Yes	Yes	Yes			
	(1)	Band 12			Yes	Yes			30
		Band 66	Yes	Yes	Yes	Yes	Yes	Yes	
	(2)	Band 12		Yes	Yes	Yes	Yes		30
		Band 66			Yes	Yes	Yes	Yes	
	(3)	Band 12			Yes	Yes			20
		Band 66			Yes	Yes			
(4)	Band 12			Yes	Yes			30	
	Band 66			Yes	Yes	Yes	Yes		
(5)	Band 12			Yes				20	
	Band 66			Yes	Yes	Yes			
26A-41A	(0)	Band 26			Yes	Yes	Yes		35
		Band 41			Yes	Yes	Yes	Yes	

2. DL Inter Band(3CC)

E-UTRA CA configuration	Bandwidth Combination Set	E-UTRA Band	Bandwidth						Max Aggregated BW
			1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
2A-2A-12A	(0)	Band 2	2A-2A BCS 0						50
		Band 12			Yes	Yes			
2A-4A-5A	(0)	Band 2			Yes	Yes	Yes	Yes	50
		Band 4			Yes	Yes	Yes	Yes	
		Band 5			Yes	Yes			
2A-4A-13A	(0)	Band 2			Yes	Yes	Yes	Yes	50
		Band 4			Yes	Yes	Yes	Yes	
2A-5A-66A	(0)	Band 2			Yes	Yes	Yes	Yes	50
		Band 5			Yes	Yes			
2A-66A-66A	(0)	Band 2			Yes	Yes	Yes	Yes	60
		Band 66			66A-66A BCS 0				
4A-4A-5A	(0)	Band 4	4A-4A BCS 0						50
		Band 5			Yes	Yes			
4A-4A-12A	(0)	Band 4	4A-4A BCS 0						50
		Band 12			Yes	Yes			
5A-66A-66A	(0)	Band 5			Yes	Yes			50
		Band 66			66A-66A BCS 0				
5A-66C	(0)	Band 5			Yes	Yes			50
		Band 66			66C BCS 0				
12A-66A-66A	(0)	Band 12			Yes	Yes			50
		Band 66			66A-66A BCS 0				
26A-41C	(0)	Band 26			Yes	Yes	Yes		55
		Band 41			41C BCS 1				

LTE Downlink Carrier Aggregation configurations (Continued)

3. DL Intra Band(non-contiguous)

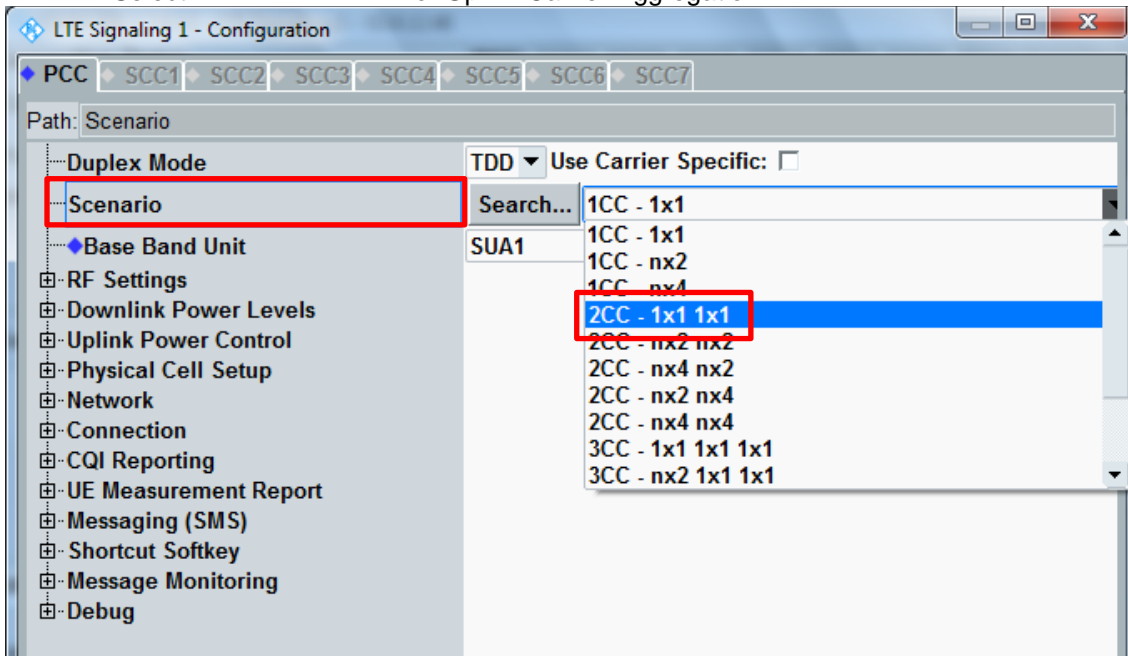
E-UTRA CA configuration	Bandwidth Combination Set	E-UTRA Band	Allowed Channel BW Per Carrier (MHz)				Max Aggregated BW
			1st Carrier	2nd Carrier	3rd Carrier	4th Carrier	
2A-2A	(0)	Band 2	5, 10, 15, 20	5, 10, 15, 20			40
4A-4A	(0)	Band 4	5, 10, 15, 20	5, 10, 15, 20			40
	(1)	Band 4	5, 10	5, 10			20
41A-41A	(0)	Band 41	10, 15, 20	10, 15, 20			40
	(1)	Band 41	5, 10, 15, 20	5, 10, 15, 20			40
66A-66A	(0)	Band 66	5, 10, 15, 20	5, 10, 15, 20			40
41A-41C	(0)	Band 41	5, 10, 15, 20	41C BCS 1			60
			41C BCS 1		5, 10, 15, 20		
41A-41D	(0)	Band 41	5, 10, 15, 20	41D BCS 1			80
			41D BCS 0		5, 10, 15, 20		
41C-41C	(0)	Band 41	41C BCS 0		41C BCS 0		80

4. DL Intra Band(contiguous)

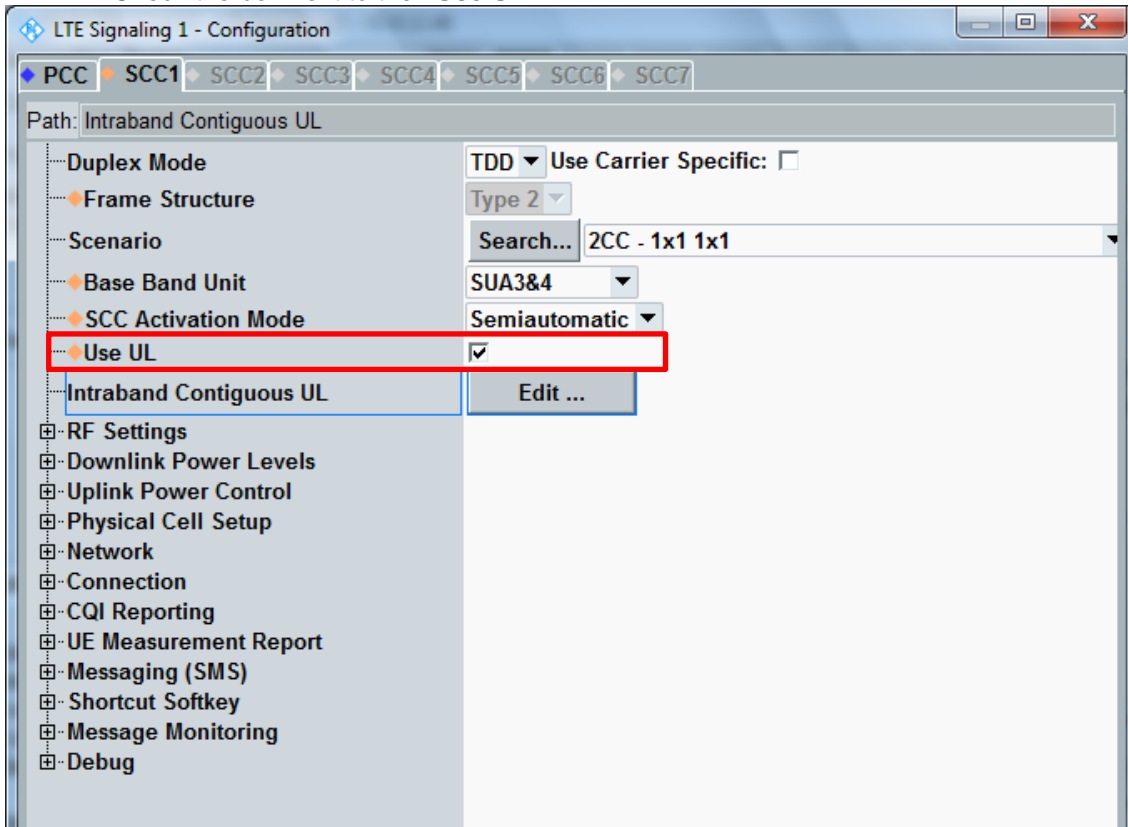
E-UTRA CA configuration	Bandwidth Combination Set	E-UTRA Band	Allowed Channel BW Per Carrier (MHz)				Max Aggregated BW	
			1st Carrier	2nd Carrier	3rd Carrier	4th Carrier		
2C	(0)	Band 2	5	20			40	
			10	15,20				
			15	10,15,20				
			20	5,10,15,20				
41C	(0)	Band 41	10	20			40	
			15	15, 20				
			20	10, 15, 20				
			5, 10	20				
	(1)	Band 41	15	15, 20			40	
			20	5, 10, 15, 20				
			10	15, 20				
		(2)	Band 41	15	10, 15, 20			40
				20	10, 15, 20			
				10	20			
(3)	Band 41	10	20			40		
		20	20					
66B	(0)	Band 66	5	5, 10, 15		20		
		Band 66	10	5, 10				
		Band 66	15	5				
66C	(0)	Band 66	5	20		40		
		Band 66	10	15,20				
		Band 66	15	10,15,20				
		Band 66	20	5,10,15,20				
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			
41E	(0)	Band 41	15, 20	15, 20	15, 20	20	80	

**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

CMW 500 V 3.8.12 - LTE Signaling 1 - X3.8.12.48

Connection Status: **PCC** | SCC1 | SCC2 | SCC3 | SCC4 | SCC5 | SCC6 | SCC7

Cell:

Packet Switched: ON

RRC State: Idle

SCC1 State: OFF

Event Log: 06:13:39 State 'Cell On', 2CC 1x1 1x1; 06:13:21 Signaling Unit Startup; 06:13:21 Data end to end enabled; 06:13:20 Starting Data Application Unit

UE Info: IMEI, IMSI, Voice Domain Pr..., UE's Usage Setti..., Default Bearer, Dedicated Bearer

Operating Band: Band 41 | TDD

	Downlink	Uplink
Channel	40620 Ch	40620 Ch
Frequency	2593.0 MHz	2593.0 MHz
Cell Bandwidth	20.0 MHz	20.0 MHz
RS EPRE	-85.0 dBm/15kHz	
Full Cell BW Pow.	-54.2 dBm	
PUSCH Open Loop Nom.Power	23 dBm	
PUSCH Closed Loop Target Power	24.0 dBm	

Sched. User def. Channels

	Downlink	Uplink
# RB	100	1
Start RB	0	99
Mod / TBSI	QPSK 5	QPSK 10
Code Rate / TBS	0.328 8760	0.583 144
Throughput	3.478 Mbit/s	0.057 Mbit/s

64/256-QAM  Multicenter

LTE Signaling: ON

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

CMW 500 V 3.8.12 - LTE Signaling 1 - X3.8.12.48

Connection Status: PCC | **SCC1** | SCC2 | SCC3 | SCC4 | SCC5 | SCC6 | SCC7

Cell:

Packet Switc...: ON

RRC State: Idle

SCC1 State: OFF

Event Log: 06:13:39 State 'Cell On', 2CC 1x1 1x1; 06:13:21 Signaling Unit Startup; 06:13:21 Data end to end enabled; 06:13:20 Starting Data Application Unit

UE Info: IMEI, IMSI, Voice Domain ..., UE's Usage S..., Default Bearer, Dedicated Be...

Operating Band: Band 41 | TDD

	Downlink	Uplink
Channel	40818 Ch	40818 Ch
Frequency	2612.8 MHz	2612.8 MHz
Cell Bandwidth	20.0 MHz	20.0 MHz
RS EPRE	-85.0 dBm/15kHz	
Full Cell BW Pow.	-54.2 dBm	
PUSCH Open Loop Nom.Power	23 dBm	
PUSCH Closed Loop Target Power	24.0 dBm	

PCC <-> SCC1 [Swap]

PCC -> SCC1 [Copy]

Sched. User def. Channels | Multicenter UL

	Downlink	Uplink
# RB	100	1
Start RB	0	0
Mod / TBSI	QPSK 5	QPSK 10
Code Rate / TBS	0.328 8760	0.583 144
Throughput	3.478 Mbit/s	0.057 Mbit/s

64/256-QAM  Multicenter

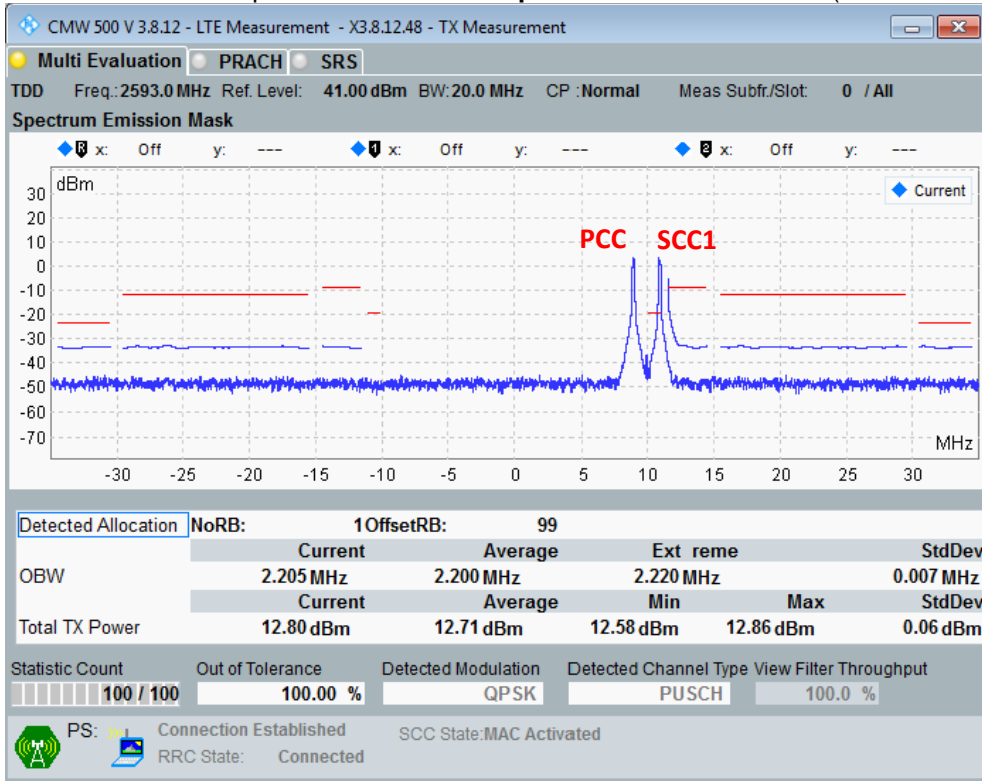
LTE Signaling: ON

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

The screenshot displays the CMW 500 V 3.8.12 - LTE Signaling 1 - X3.8.12.48 interface. The main window is titled "LTE" and shows the following sections:

- Connection Status:** Shows "Connection Established", "RRC State: Connected", and "SCC1 State: MAC Activated".
- Event Log:** Lists events such as "State 'Connection Established'", "EPS Dedicated Bearer Established", "SCC1: MAC Activated", "SCC1: RRC Added", "SCC1: On", and "SCC1: Off".
- UE Info:** Displays details like IMEI (355346630026654), IMSI (001010123456063), Voice Domain (IMS PS Voice preferred CS), UE's Usage (Data centric), Default Bearer (IPv4 address 192.168.48.129), and Dedicated Bearer (TFT Port Range DL / UL: 5005 - 5008 / 5005 - 5008).
- Configuration:** Shows "Operating Band: Band 41", "Downlink: 40818 Ch", "Uplink: 40818 Ch", "Frequency: 2612.8 MHz", "Cell Bandwidth: 20.0 MHz", "RS EPRE: -85.0 dBm/15kHz", "Full Cell BW Pow.: -54.2 dBm", "PUSCH Open Loop Nom.Power: 23 dBm", and "PUSCH Closed Loop Target Power: 24.0 dBm".
- Buttons:** Includes "Swap", "Copy", "Send SMS", "Inter/Intra-RAT ...", and "Config ...".
- Bottom Bar:** Contains "Detach", "Disconnect" (highlighted with a red box), "SCC1 Off", and "Send SMS".

- 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.)

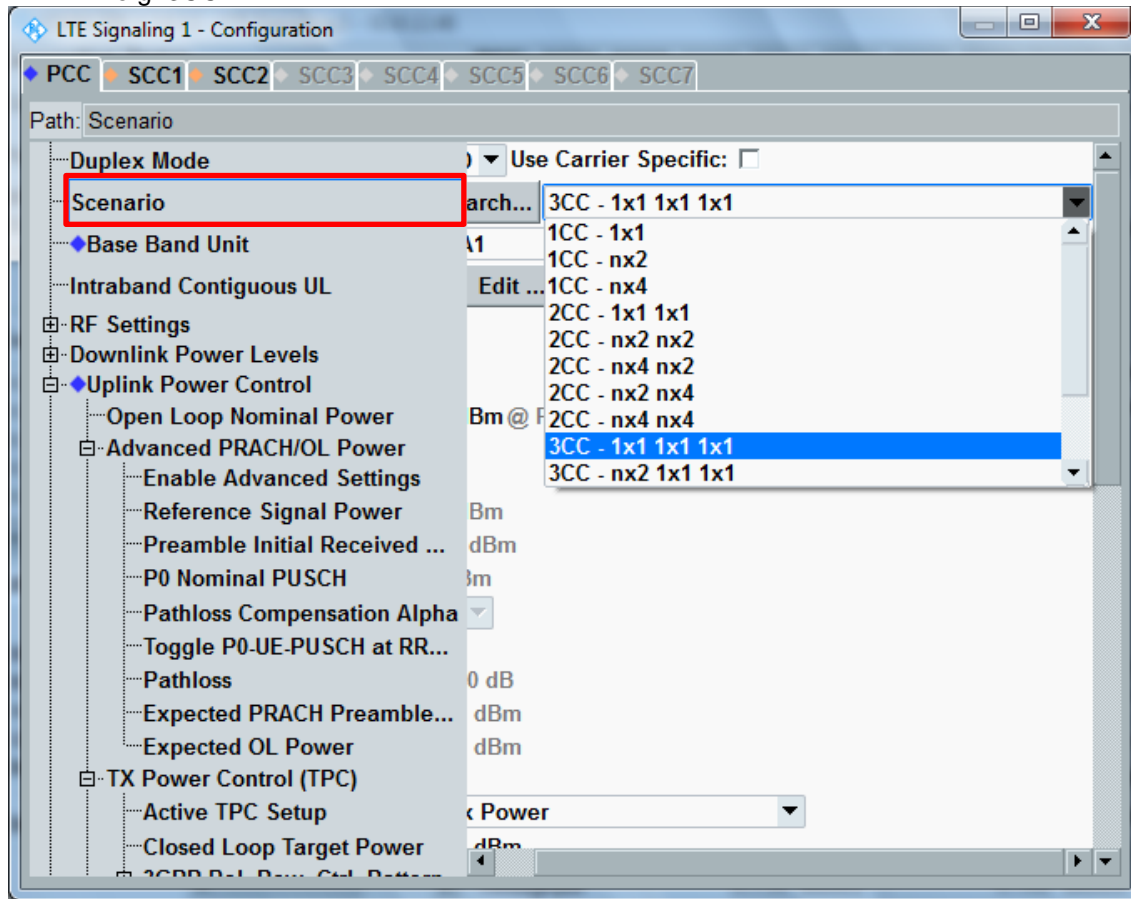
**TX Measurement**

	Current	Average	Extreme	StdDev
EVM RMS [%] I/h	0.70	0.75	0.74	0.79
EVM Peak [%] I/h	1.80	2.34	1.97	2.34
EVM DMRS [%] I/h	0.72	0.71	0.85	0.96
MErr RMS [%] I/h	NCAP	NCAP	NCAP	NCAP
MErr Peak [%] I/h	NCAP	NCAP	NCAP	NCAP
MErr DMRS [%] I/h	NCAP	NCAP	NCAP	NCAP
PhErr RMS [°] I/h	NCAP	NCAP	NCAP	NCAP
PhErr Peak [°] I/h	NCAP	NCAP	NCAP	NCAP
PhErr DMRS [°] I/h	NCAP	NCAP	NCAP	NCAP
IQ Offset [dBc]	-70.19	-72.51	-65.49	5.47
IQ Gain Imbalance [dB]	NCAP	NCAP	NCAP	NCAP
IQ Quadrature Error [°]	NCAP	NCAP	NCAP	NCAP
Freq Error [Hz]	3.51	0.63	9.37	3.76
Timing Error [Ts]	-6.50	-6.34	-6.82	0.16
OBW [MHz]	2.21	2.20	2.21	0.00
	Current	Average	Min	Max
TX Power [dBm]	12.62	12.66	12.59	12.76
Peak Power [dBm]	20.43	19.93	19.14	20.69
RB Power [dBm]	9.80	9.82	9.76	9.90

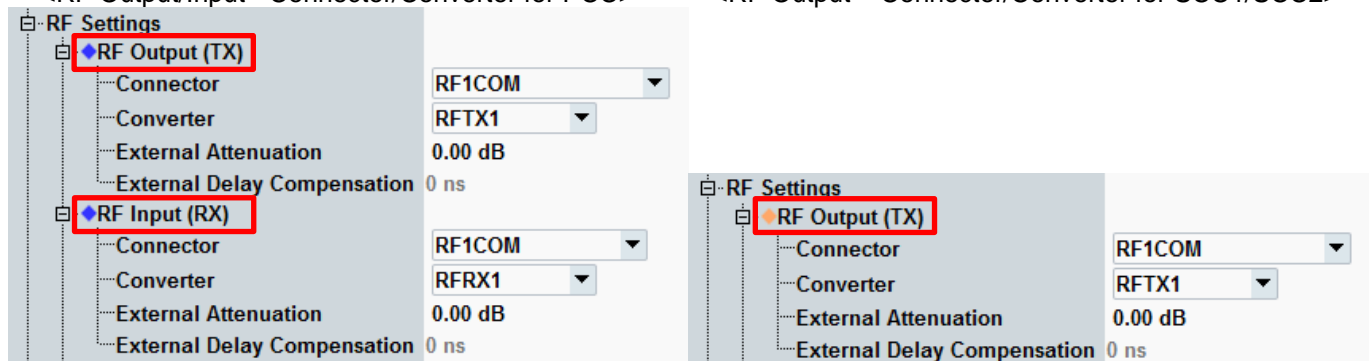
Statistic Count: 100 / 100  
 Out of Tolerance: 0.00 %  
 Detected Modulation: QPSK  
 Detected Channel Type: PUSCH  
 View Filter Throughput: 100.0 %

**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

The screenshot displays the LTE Signal configuration interface for CMW 500 V 3.8.12. The PCC tab is selected and highlighted with a red box. The interface is divided into several sections:

- Connection Status:** Shows RRC State as Connected, SCC1 and SCC2 states as OFF.
- Event Log:** Lists recent events such as SCC2 On/Off and RRC Added.
- UE Info:** Displays IMEI (355346630026654), IMSI (001010123456063), and other UE details.
- Configuration Parameters:**
  - Operating Band: Band 66 (FDD)
  - Channel: 67036 Ch (Downlink), 132572 Ch (Uplink)
  - Frequency: 2170.0 MHz (Downlink), 1770.0 MHz (Uplink)
  - Cell Bandwidth: 20.0 MHz (both)
  - RS EPRE: -85.0 dBm/15kHz
  - Full Cell BW Pow.: -54.2 dBm
  - PUSCH Open Loop Nom.Power: 23 dBm
  - PUSCH Closed Loop Target Power: 24.0 dBm
  - Sched.: User def. Channels
  - # RB: 100 (Downlink), 1 (Uplink)
  - Start RB: 0 (Downlink), 0 (Uplink)
  - Mod / TBSI: QPSK (Downlink), 5 (Downlink), QPSK (Uplink), 10 (Uplink)
  - Code Rate / TBS: 0.330 / 8760 (Downlink), 0.583 / 144 (Uplink)
  - Throughput: 8.734 Mbit/s (Downlink), 0.144 Mbit/s (Uplink)
- Buttons:** Detach, Disconnect, SCC1 activate MAC, Multiple SCC Actions, Send SMS, Inter/Intra-RAT, Config ...



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

CMW 500 V 3.8.12 - LTE Signaling 1 - X3.8.12.48

**Connection Status**

Cell: Connection Established

RRC State: Connected  
 SCC1 State: OFF  
 SCC2 State: OFF

**Event Log**

06:36:17 SCC2: Off  
 06:36:17 SCC2: On  
 06:36:17 SCC2: RRC Added  
 06:36:16 SCC1: Off  
 06:36:16 SCC1: On  
 06:36:16 SCC1: RRC Added  
 06:36:12 SCC2: MAC Activated

**UE Info**

IMEI: 355346630026654  
 IMSI: 001010123456063  
 Voice Domain: IMS PS Voice preferred CS  
 UE's Usage S...: Data centric  
 Default Bearer: IPv4 address IPv6 prefix  
 5 (cmw50...): 192.168.48.129  
 Dedicated Be...: TFT Port Range DL / UL  
 6 (->5, Def...): 5005 - 5008 / 5005 - 5008

**Configuration (SCC1):**

Operating Band: Co-location active with PCC FDD  
 Downlink: [ ] Uplink: [ ]  
 Channel: 66536 Ch  
 Frequency: 2120.0 MHz  
 Cell Bandwidth: 20.0 MHz  
 RS EPRE: -85.0 dBm/15kHz  
 Full Cell BW Pow.: -54.2 dBm

PCC <-> SCC1 [Swap]  
 PCC -> SCC1 [Copy]  
 Sched.: User def. Channels

# RB: 100  
 Start RB: 0  
 Mod / TBSI: QPSK 5  
 Code Rate / TBS: 0.330 8760  
 Throughput: 8.734 Mbit/s

**Buttons:** Detach, Disconnect, SCC1 activate MAC, Multiple SCC Actions, Send SMS, Inter/Intra-RAT ..., Config ...

**Right Panel:** LTE, LTE 1 TX Meas., LTE 1 RX Meas., Go to..., Routing, LTE Signaling ON

CMW 500 V 3.8.12 - LTE Signaling 1 - X3.8.12.48

**Connection Status**

Cell: Connection Established

RRC State: Connected  
 SCC1 State: OFF  
 SCC2 State: OFF

**Event Log**

06:36:17 SCC2: Off  
 06:36:17 SCC2: On  
 06:36:17 SCC2: RRC Added  
 06:36:16 SCC1: Off  
 06:36:16 SCC1: On  
 06:36:16 SCC1: RRC Added  
 06:36:12 SCC2: MAC Activated

**UE Info**

IMEI: 355346630026654  
 IMSI: 001010123456063  
 Voice Domain: IMS PS Voice preferred CS  
 UE's Usage S...: Data centric  
 Default Bearer: IPv4 address IPv6 prefix  
 5 (cmw50...): 192.168.48.129  
 Dedicated Be...: TFT Port Range DL / UL  
 6 (->5, Def...): 5005 - 5008 / 5005 - 5008

**Configuration (SCC2):**

Operating Band: Band 71 FDD  
 Downlink: [ ] Uplink: [ ]  
 Channel: 68761 Ch  
 Frequency: 634.5 MHz  
 Cell Bandwidth: 20.0 MHz  
 RS EPRE: -85.0 dBm/15kHz  
 Full Cell BW Pow.: -54.2 dBm

PCC <-> SCC2 [Swap]  
 PCC -> SCC2 [Copy]  
 Sched.: User def. Channels

# RB: 100  
 Start RB: 0  
 Mod / TBSI: QPSK 5  
 Code Rate / TBS: 0.330 8760  
 Throughput: 8.734 Mbit/s

**Buttons:** Detach, Disconnect, SCC2 activate MAC, Multiple SCC Actions, Send SMS, Inter/Intra-RAT ..., Config ...

**Right Panel:** LTE, LTE 1 TX Meas., LTE 1 RX Meas., Go to..., Routing, LTE Signaling ON

- Connect and Activate MAC for all SCCs

Multiple SCC Actions

SCC	State	Action
SCC1	OFF	activate MAC
SCC2	OFF	activate MAC

Multiple SCC Actions

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

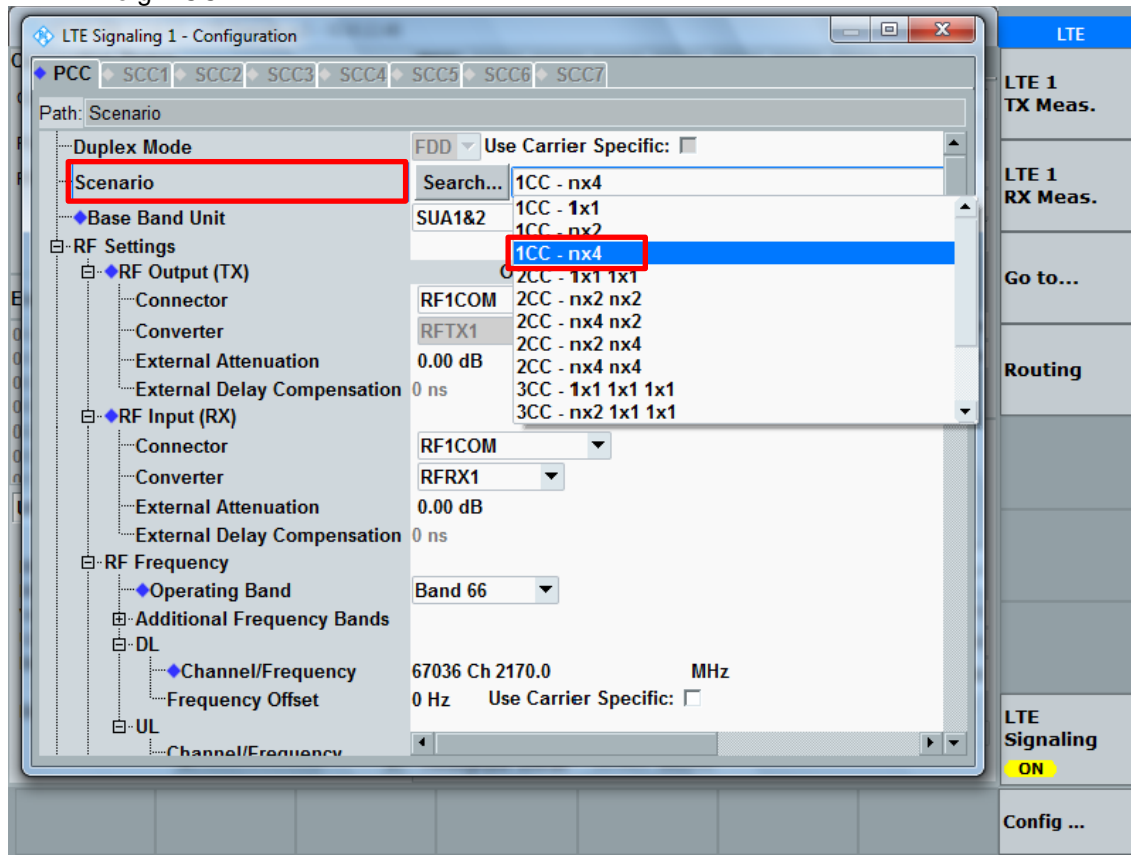
TX Measurement

	Current	Average	Extreme	StdDev
EVM RMS [%] I/h	0.64	0.71	0.68	0.71
EVM Peak [%] I/h	1.51	2.64	1.96	2.23
EVM DMRS [%] I/h	0.61	0.65	0.61	0.60
MErr RMS [%] I/h	NCAP	NCAP	NCAP	NCAP
MErr Peak [%] I/h	NCAP	NCAP	NCAP	NCAP
MErr DMRS [%] I/h	NCAP	NCAP	NCAP	NCAP
PhErr RMS [°] I/h	NCAP	NCAP	NCAP	NCAP
PhErr Peak [°] I/h	NCAP	NCAP	NCAP	NCAP
PhErr DMRS [°] I/h	NCAP	NCAP	NCAP	NCAP
IQ Offset [dBc]	-52.22	-52.32	-49.92	0.85
IQ Gain Imbalance [dB]	NCAP	NCAP	NCAP	NCAP
IQ Quadrature Error [°]	NCAP	NCAP	NCAP	NCAP
Freq Error [Hz]	0.51	0.09	-5.38	1.33
Timing Error [Ts]	-6.30	-5.63	-8.52	2.54
OBW [MHz]	0.27	0.27	0.32	0.02
	Current	Average	Min	Max
TX Power [dBm]	13.51	13.48	13.30	13.59
Peak Power [dBm]	18.40	18.60	17.80	19.50
RB Power [dBm]	13.48	13.46	13.37	13.50

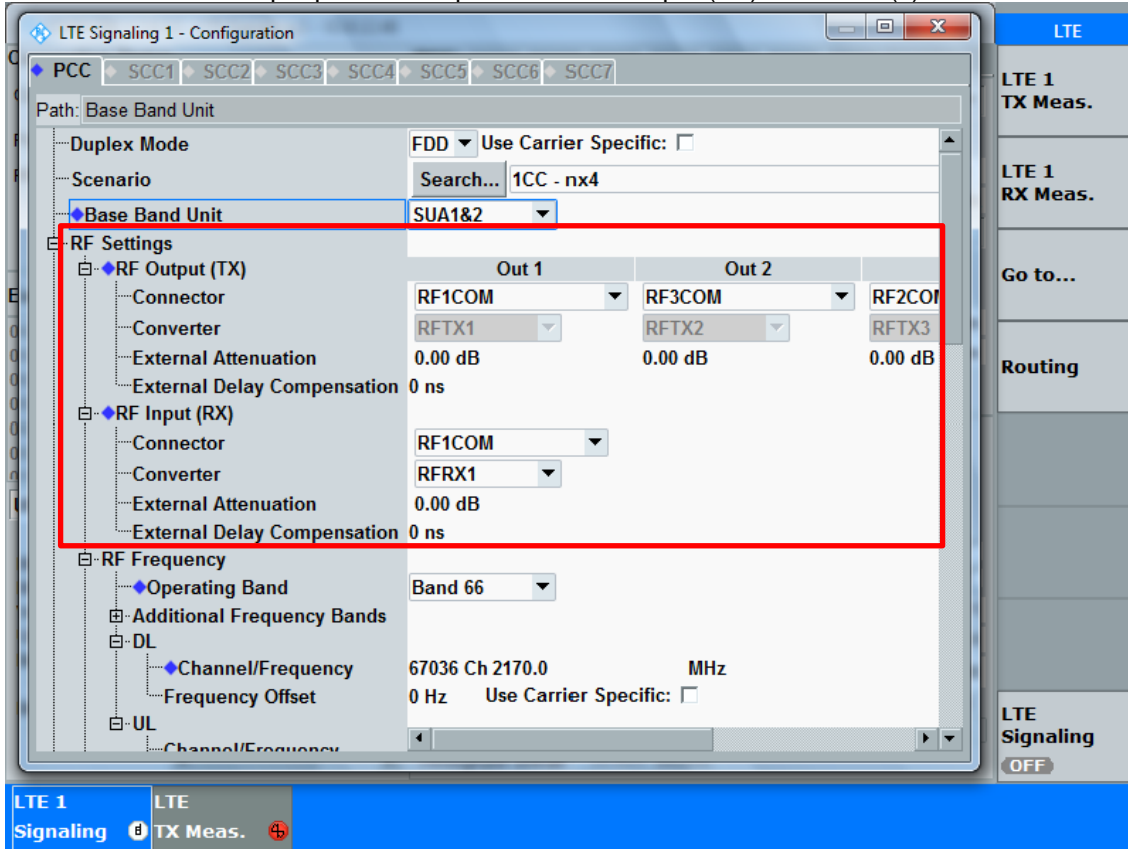
Multi Evaluation: RUN

**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.

CMW 500 V 3.8.12 - LTE Signaling 1 - X3.8.12.48 - RX Measurement

Extended BLER | RLC Throughput

Overall | PCC | SCC1 | SCC2 | SCC3 | SCC4

Throughput (Mbit/s) vs Subframes

	Over All		Stream 1		Stream 2	
	Relative	Absolute	Relative	Absolute	Relative	Absolute
ACK	99.99%	19598	99.99%	9799	99.99%	9799
NACK	0.01%	2	0.01%	1	0.01%	1
DTX	0.00%	0	0.00%	0	0.00%	0
BLER	0.01%		0.01%		0.01%	
<b>Throughput</b>	<b>Relative</b>	<b>Mbit/s</b>	<b>Relative</b>	<b>Mbit/s</b>	<b>Relative</b>	<b>Mbit/s</b>
Average	99.99%	17.47	99.99%	8.73	99.99%	8.73
Minimum		17.38				
Maximum		17.47				

Subframes: 9800 | Scheduled: 9800 | Median CQI PCC: Stream 1

PS: Connection Established | RRC State: Connected

Repetition ... | Stop Condition ... | Subframes ...

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

CMW 500 V 3.8.12 - LTE Measurement - X3.8.12.48 - TX Measurement

Multi Evaluation | PRACH | SRS

FDD Freq.: 1770.0 MHz Ref. Level: 41.00 dBm BW: 20.0 MHz CP: Normal Meas Subfr/Slot: 0 / All

TX Measurement

	Current	Average	Extreme	StdDev
EVM RMS [%] I/h	0.64	0.71	0.68	0.71
EVM Peak [%] I/h	1.51	2.64	1.96	2.23
EVM DMRS [%] I/h	0.61	0.65	0.61	0.60
MErr RMS [%] I/h	NCAP	NCAP	NCAP	NCAP
MErr Peak [%] I/h	NCAP	NCAP	NCAP	NCAP
MErr DMRS [%] I/h	NCAP	NCAP	NCAP	NCAP
PhErr RMS [°] I/h	NCAP	NCAP	NCAP	NCAP
PhErr Peak [°] I/h	NCAP	NCAP	NCAP	NCAP
PhErr DMRS [°] I/h	NCAP	NCAP	NCAP	NCAP
IQ Offset [dBc]	-52.22	-52.32	-49.92	0.85
IQ Gain Imbalance [dB]	NCAP	NCAP	NCAP	NCAP
IQ Quadrature Error [°]	NCAP	NCAP	NCAP	NCAP
Freq Error [Hz]	0.51	0.09	-5.38	1.33
Timing Error [Ts]	-6.30	-5.63	-8.52	2.54
OBW [MHz]	0.27	0.27	0.32	0.02
	Current	Average	Min	Max
TX Power [dBm]	13.51	13.48	13.30	13.59
Peak Power [dBm]	18.40	18.60	17.80	19.50
RB Power [dBm]	13.48	13.46	13.37	13.50

Statistic Count: 100 / 100 | Out of Tolerance: 0.00% | Detected Modulation: QPSK | Detected Channel Type: PUSCH | View Filter Throughput: 100.0%

PS: Connection Established | RRC State: Connected

Select View ...

**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	2A-2A		3CC#1
2CC#2	2C		
2CC#3	2A-4A		3CC#2
2CC#4	2A-5A		3CC#2
2CC#5	2A-12A		3CC#1
2CC#6	2A-13A		3CC#3
2CC#7	2A-17A		
2CC#8	2A-26A		
2CC#9	2A-66A		3CC#4
2CC#10	4A-4A		3CC#6
2CC#11	4A-5A		3CC#6
2CC#12	4A-12A		3CC#7
2CC#13	4A-13A		3CC#3
2CC#14	4A-17A	17A SCC only	
2CC#15	5A-41A	41A SCC only	
2CC#16	5A-66A		3CC#4
2CC#17	12A-25A		
2CC#18	12A-66A		3CC#10
2CC#19	26A-41A	41A SCC only	
2CC#20	41A-41A		
2CC#21	41C		3CC#12
2CC#22	66A-66A		3CC#5
2CC#23	66B		
2CC#24	66C		3CC#9

Index	3CC	Restriction	Completely Covered by Measurement Superset
3CC#1	2A-2A-12A		
3CC#2	2A-4A-5A		
3CC#3	2A-4A-13A		
3CC#4	2A-5A-66A		
3CC#5	2A-66A-66A		
3CC#6	4A-4A-5A		
3CC#7	4A-4A-12A		
3CC#8	5A-66A-66A		
3CC#9	5A-66C		
3CC#10	12A-66A-66A		
3CC#11	26A-41C	41C SCC only	
3CC#12	41A-41C		
3CC#13	41D		4CC#1

Index	4CC	Restriction	Completely Covered by Measurement Superset
4CC#1	41A-41D		
4CC#2	41C-41C		
4CC#3	41E		

**Note:**

Only yellow highlight cells need power measurement according to LTE DL CA SAR test Exclusion in TCB workshop (April.2018).

**LTE Release 10 Carrier Aggregation with 4x4 MIMO**

Index	2CC	Restriction	Completely Covered by Measurement Superset	Index	3CC	Restriction	Completely Covered by Measurement Superset	Index	4CC	Restriction	Completely Covered by Measurement Superset
2CC#1	2A-[4A]		3CC#1	3CC#1	2A-[4A]-5A			4CC#1	[41A]-41D		
2CC#2	2A-[66A]		3CC#3	3CC#2	2A-[4A]-13A			4CC#2	[41C]-41C		
2CC#3	[4A]-4A		3CC#6	3CC#3	2A-5A-[66A]						
2CC#4	[4A]-[4A]		3CC#7	3CC#4	2A-[66A]-66A						
2CC#5	[4A]-5A		3CC#1	3CC#5	2A-[66A]-[66A]						
2CC#6	[4A]-12A		3CC#8	3CC#6	[4A]-4A-5A						
2CC#7	[4A]-13A		3CC#2	3CC#7	[4A]-[4A]-5A						
2CC#8	[4A]-17A	17A SCC only		3CC#8	[4A]-[4A]-12A						
2CC#9	5A-[41A]	41A SCC only		3CC#9	[4A]-[4A]-12A						
2CC#10	5A-[66A]		3CC#3	3CC#10	5A-[66A]-66A						
2CC#11	12A-[66A]		3CC#13	3CC#11	5A-[66A]-[66A]						
2CC#12	26A-[41A]			3CC#12	5A-[66C]						
2CC#13	[41A]-41A			3CC#13	12A-[66A]-66A						
2CC#14	[41A]-[41A]			3CC#14	12A-[66A]-[66A]						
2CC#15	[41C]		3CC#17	3CC#15	26A-[41C]	41C SCC only					
2CC#16	[66A]-66A		3CC#4	3CC#16	[41A]-41C						
2CC#17	[66A]-[66A]		3CC#5	3CC#17	41A-[41C]						
2CC#18	[66B]			3CC#18	[41A]-[41C]						
2CC#19	[66C]		3CC#12	3CC#19	[41D]						

**Note:**

Only yellow highlight cells need power measurement according to LTE DL CA SAR test Exclusion in TCB workshop (April.2018).

**LTE Uplink Carrier Aggregation Combinations****Maximum Output Power (Tune-up Limit) for LTE UL Carrier Aggregation**

E-UTRA CA configurations	Pwr back-off	Antenna	Bands		UL																
			PCC		PCC							SCC									
			1st	2nd	Mode	BW	Ch.	Freq. (MHz)	RB	offset	Tune-up Limit (dBm)	Rel.10 Tx. PWR (dBm)	Mode	BW	Ch.	Freq. (MHz)	RB	offset	Tune-up Limit (dBm)	Rel.10 Tx. PWR (dBm)	
CA_2A-4A	Pmax	Main.1+Sub.2	2A	4A	QPSK	20	19100	1900	1	49	24	22.51	QPSK	20	20175	1732.5	1	49	24	23.41	
		Main.1+Sub.2	4A	2A	QPSK	20	20175	1732.5	1	49	24	23.41	QPSK	20	19100	1900	1	49	24	22.51	
CA_4A-5A	Pmax	Main.1	4A	5A	QPSK	20	20175	1732.5	1	49	24	23.41	QPSK	10	20525	836.5	1	0	25	23.44	
		Main.1	5A	4A	QPSK	10	20525	836.5	1	0	25	23.44	QPSK	20	20175	1732.5	1	49	24	23.41	
CA_4A-12A	Pmax	Main.1	4A	12A	QPSK	20	20175	1732.5	1	49	24	23.41	QPSK	10	23095	707.5	1	0	24	22.81	
		Main.1	12A	4A	QPSK	10	23095	707.5	1	0	24	22.81	QPSK	20	20175	1732.5	1	49	24	23.41	
CA_5A-66A	Pmax	Main.1	5A	66A	QPSK	10	20525	836.5	1	0	25	23.44	QPSK	20	132322	1745	1	49	24	23.12	
		Main.1	66A	5A	QPSK	20	132322	1745	1	49	24	23.12	QPSK	10	20525	836.5	1	0	25	23.44	
CA_12A-66A	Pmax	Main.1	12A	66A	QPSK	10	23095	707.5	1	0	24	22.81	QPSK	20	132322	1745	1	49	24	23.12	
		Main.1	66A	12A	QPSK	20	132322	1745	1	49	24	23.12	QPSK	10	23095	707.5	1	0	24	22.81	

**Note:**

1. For ULCA inter band, Each PCC and SCC has same target power in standalone mode.
2. All PCC and SCC result are within standalone target power.



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
4	QPSK	20	20175	1732.5	1/49	23.54	23.49	-0.05
41	QPSK	20	41490	2680	1/99	24.68	24.61	-0.07
66	QPSK	20	132322	1745	1/49	23.23	23.24	0.01

**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 configuration (BCS)	Bands				UL										DL										LTE Rel 8 Tx. Power [dBm]	LTE Rel 10 Tx. Power [dBm]	Delta		
	PCC		SCC1		SCC2		SCC3		PCC					SCC1					SCC2			SCC3							
	1st	2nd	3rd	4th	Mode	BW (MHz)	Channel	Freq. (MHz)	RB Allocation	RB offset	BW (MHz)	Channel	Freq. (MHz)	BW (MHz)	Channel	Freq. (MHz)	BW (MHz)	Channel	Freq. (MHz)	BW (MHz)	Channel	Freq. (MHz)	BW (MHz)	Channel				Freq. (MHz)	
2C	2C	2C			QPSK	20	19100	1900	1	49	20	1100	1980	20	902	1960.2										22.66	22.84	0.18	
2A-17A	2A	17A			QPSK	10	19150	1905	1	49	10	1150	1985	10	5790	740											22.73	22.52	-0.21
2A-17A	17A	2A			QPSK	10	23790	710	1	0	10	5790	740	10	900	1960											23.49	23.38	-0.11
2A-26A	2A	26A			QPSK	20	19100	1900	1	49	20	1100	1980	15	8865	876.5											22.66	22.80	0.14
2A-26A	26A	2A			QPSK	15	26865	831.5	1	0	15	8865	876.5	20	900	1960											23.77	23.69	-0.08
4A-17A	4A	17A			QPSK	10	20350	1750	1	25	10	2350	2150	10	5790	740											23.23	23.41	0.18
5A-41A	5A	41A			QPSK	10	20525	836.5	1	0	10	2525	881.5	20	41490	2680											23.54	23.67	0.13
12A-25A	12A	25A			QPSK	10	23095	707.5	1	0	10	5095	737.5	20	8590	1985											22.96	22.76	-0.20
12A-25A	25A	12A			QPSK	20	26590	1905	1	49	20	8590	1985	10	5095	737.5											23.12	23.03	-0.09
26A-41A	26A	41A			QPSK	15	26865	831.5	1	0	15	8865	876.5	20	41490	2680											23.77	23.88	0.11
41A-41A	41A	41A			QPSK	20	40620	2593	1	99	20	41490	2680	20	40620	2593											23.69	23.51	-0.18
66B	66B	66B			QPSK	15	132322	1745	1	49	15	66786	2145	5	66879	2154.3											23.23	23.20	-0.03
2A-2A-12A	2A	2A	12A		QPSK	20	19100	1900	1	49	20	1100	1980	20	902	1960.2	10	5095	737.5								22.66	22.84	0.18
2A-2A-12A	12A	2A	2A		QPSK	10	23095	707.5	1	0	10	5095	737.5	20	1100	1980	20	902	1960.2								22.96	23.05	0.09
2A-4A-5A	2A	4A	5A		QPSK	20	19100	1900	1	49	20	1100	1980	20	2175	2132.5	10	2525	881.5								22.66	22.80	0.14
2A-4A-5A	4A	2A	5A		QPSK	20	20175	1732.5	1	49	20	2175	2132.5	20	1100	1980	10	2525	881.5								23.54	23.72	0.18
2A-4A-5A	5A	2A	4A		QPSK	10	20525	836.5	1	0	10	2525	881.5	20	1100	1980	20	2175	2132.5								23.54	23.52	-0.02
2A-4A-13A	2A	4A	13A		QPSK	20	19100	1900	1	49	20	1100	1980	20	2175	2132.5	10	5230	751								22.66	22.74	0.08
2A-4A-13A	4A	2A	13A		QPSK	20	20175	1732.5	1	49	20	2175	2132.5	20	1100	1980	10	5230	751								23.54	23.52	-0.02
2A-4A-13A	13A	2A	4A		QPSK	10	23230	782	1	0	10	5230	751	20	1100	1980	20	2175	2132.5								23.49	23.42	-0.07
2A-5A-66A	2A	5A	66A		QPSK	20	19100	1900	1	49	20	1100	1980	10	2525	881.5	20	66786	2145								22.66	22.71	0.05
2A-5A-66A	5A	2A	66A		QPSK	10	20525	836.5	1	0	10	2525	881.5	20	1100	1980	20	66786	2145								23.54	23.69	0.15
2A-5A-66A	66A	2A	5A		QPSK	20	132322	1745	1	49	20	66786	2145	20	1100	1980	10	2525	881.5								23.23	23.09	-0.14
2A-66A-66A	2A	66A	66A		QPSK	20	19100	1900	1	49	20	1100	1980	20	66536	2120	20	67036	2170								22.66	22.75	0.09
2A-66A-66A	66A	66A	2A		QPSK	20	132072	1720	1	49	20	66536	2120	20	67036	2170	20	1100	1980								23.13	23.24	0.11
4A-4A-5A	4A	4A	5A		QPSK	20	20050	1720	1	49	20	2050	2120	20	2300	2145	10	2525	881.5								23.23	23.17	-0.06
4A-4A-5A	5A	4A	4A		QPSK	10	20525	836.5	1	0	10	2525	881.5	20	2050	2120	20	2300	2145								23.54	23.67	0.13
4A-4A-12A	4A	4A	12A		QPSK	20	20050	1720	1	49	20	2050	2120	20	2300	2145	10	5095	737.5								23.23	23.14	-0.09
4A-4A-12A	12A	4A	4A		QPSK	10	23095	707.5	1	0	10	5095	737.5	20	2050	2120	20	2300	2145								22.96	22.85	-0.11
5A-66A-66A	5A	66A	66A		QPSK	10	20525	836.5	1	0	10	2525	881.5	20	66536	2120	20	67036	2170								23.54	23.36	-0.18
5A-66A-66A	66A	66A	5A		QPSK	20	132072	1720	1	49	20	66536	2120	20	67036	2170	10	2525	881.5								23.13	23.05	-0.08
5A-66C	5A	66C	66C		QPSK	10	20525	836.5	1	0	10	2525	881.5	20	66786	2145	20	66588	2125.2								23.54	23.36	-0.18
5A-66C	66C	66C	5A		QPSK	20	132322	1745	1	49	20	66786	2145	20	66588	2125.2	10	2525	881.5								23.23	23.41	0.18
12A-66A-66A	12A	66A	66A		QPSK	10	23095	707.5	1	0	10	5095	737.5	20	66536	2120	20	67036	2170								22.96	22.89	-0.07
12A-66A-66A	66A	66A	12A		QPSK	20	132072	1720	1	49	20	66536	2120	20	67036	2170	10	5095	737.5								23.13	22.94	-0.19
26A-41C	26A	41C	41C		QPSK	15	26865	831.5	1	0	15	8865	876.5	20	41490	2680	20	41292	2660.2								23.77	23.62	-0.15
41A-41C	41A	41C	41C		QPSK	20	41490	2680	1	99	20	41490	2680	20	40620	2593	20	40422	2573.2								24.68	24.78	0.10
41A-41C	41C	41C	41A		QPSK	20	41490	2680	1	99	20	41490	2680	20	41292	2660.2	20	40185	2549.5								24.68	24.79	0.11
41A-41D	41A	41D	41D	41D	QPSK	20	41490	2680	1	99	20	41490	2680	20	39750	2506	20	39948	2525.8	20	40146	2545.6				24.68	24.59	-0.09	
41A-41D	41D	41D	41D	41A	QPSK	20	41490	2680	1	99	20	41490	2680	20	41292	2660.2	20	41094	2640.4	20	40620	2593				24.68	24.48	-0.20	
41C-41C	41C	41C	41C	41C	QPSK	20	41490	2680	1	99	20	41490	2680	20	41292	2660.2	20	40185	2549.5	20	40383	2569.3				24.68	24.70	0.02	
41E	41E	41E	41E	41E	QPSK	20	41490	2680	1	99	20	41490	2680	20	41292	2660.2	20	41094	2640.4	20	40896	2620.6				24.68	24.57	-0.11	

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.

