Appendix H. – Power reduction verification

Per the May 2017 TCBC Workshop notes, demonstration of proper functioning of the power reduction mechanism is required to support the corresponding SAR Configurations.

The verification process was divided into two parts:

1). Evaluation of output power levels for individual triggering mechanism

2) Evaluation of the triggering distances for proximity-based sensors.

1. Power Reduction Verification for Main Ant

The Power verification was performed according to the following procedure:

1. A base station simulator was used to establish a conducted RF connection and output power was monitored. The Power measurements were conformed to be within expected tolerances for all states before and after a power reduction mechanism was triggered.
2. Step 1 was repeated for all relevant modes and frequency bands for the mechanism being investigated.
3. Step 1 and 2 were repeated for all individual power reduction mechanism and combinations thereof. For the combination cases, one mechanism was switched to a “triggered” state at a time; powers were conformed to be within tolerance after each additional mechanism was activated.

Main Antenna Verification Summary

Mechanism(s)	Mode/Band	Power reduction Mechanism		
		Un-triggered (Max Power)	Triggered (Reduced Power)	Triggered (Reduced Power)
Grip	GSM 1900 GPRS 1Tx	30.71	27.76	
Grip	GSM 1900 GPRS 2Tx	27.81	24.48	
Grip	GSM 1900 GPRS 3Tx	26.12	23.47	
Grip	GSM 1900 GPRS 4Tx	24.95	20.81	
Grip	WCDMA B2	22.87	19.28	
Grip	WCDMA B4	23.17	19.78	
Grip	LTE Band 2	22.58	18.97	
Grip	LTE Band 4	22.97	19.79	
Grip	LTE Band 25	22.7	19.16	
Grip	LTE Band 41(Class 3)	24.09	23.37	
Grip	LTE Band 41(Class 2)	25.17	23.23	
Grip	LTE Band 66	23.17	20.02	
Hotspot On	GSM 1900 GPRS 1Tx	30.71	27.72	
Hotspot On	GSM 1900 GPRS 2Tx	27.81	24.44	
Hotspot On	GSM 1900 GPRS 3Tx	26.12	23.42	
Hotspot On	GSM 1900 GPRS 4Tx	24.95	20.73	
Hotspot On	WCDMA B2	22.87	19.24	
Hotspot On	WCDMA B4	23.17	19.64	
Hotspot On	LTE Band 2	22.58	19.11	
Hotspot On	LTE Band 4	22.97	19.98	
Hotspot On	LTE Band 25	22.7	19.15	
Hotspot On	LTE Band 41(Class 3)	24.09	23.24	
Hotspot On	LTE Band 41(Class 2)	25.17	23.26	
Hotspot On	LTE Band 66	23.17	20.07	
Hotspot On, Then Grip	GSM 1900 GPRS 1Tx	30.71	27.72	27.68
Hotspot On, Then Grip	GSM 1900 GPRS 2Tx	27.81	24.44	24.47
Hotspot On, Then Grip	GSM 1900 GPRS 3Tx	26.12	23.42	23.45
Hotspot On, Then Grip	GSM 1900 GPRS 4Tx	24.95	20.73	20.89
Hotspot On, Then Grip	WCDMA B2	22.87	19.24	19.28
Hotspot On, Then Grip	WCDMA B4	23.17	19.64	19.78
Hotspot On, Then Grip	LTE Band 2	22.58	19.11	18.97
Hotspot On, Then Grip	LTE Band 4	22.97	19.98	19.79
Hotspot On, Then Grip	LTE Band 25	22.7	19.15	19.16
Hotspot On, Then Grip	LTE Band 41(Class 3)	24.09	23.24	23.37
Hotspot On, Then Grip	LTE Band 41(Class 2)	25.17	23.26	23.23
Hotspot On, Then Grip	LTE Band 66	23.17	20.07	20.02
Grip, then Hotspot On	GSM 1900 GPRS 1Tx	30.71	27.68	27.68
Grip, then Hotspot On	GSM 1900 GPRS 2Tx	27.81	24.47	24.47
Grip, then Hotspot On	GSM 1900 GPRS 3Tx	26.12	23.45	23.45
Grip, then Hotspot On	GSM 1900 GPRS 4Tx	24.95	20.89	20.89
Grip, then Hotspot On	WCDMA B2	22.87	19.28	19.24
Grip, then Hotspot On	WCDMA B4	23.17	19.78	19.78
Grip, then Hotspot On	LTE Band 2	22.58	18.97	18.97
Grip, then Hotspot On	LTE Band 4	22.97	19.79	19.79
Grip, then Hotspot On	LTE Band 25	22.7	19.16	19.16
Grip, then Hotspot On	LTE Band 41(Class 3)	24.09	23.37	23.37
Grip, then Hotspot On	LTE Band 41(Class 2)	25.17	23.23	23.23
Grip, then Hotspot On	LTE Band 66	23.17	20.02	20.02

1.1. Distance Verification Procedure

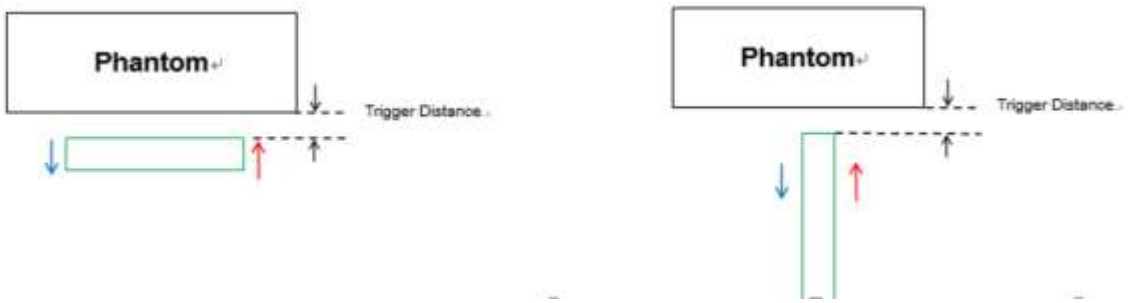
Procedures for determining proximity sensor triggering distances

(KDB 616217D04v01r02§6.2)

The distance verification procedure was performed according to the following procedure:

1. A base station simulator was used to establish an RF connection and to monitor the power levels. The device being tested was placed below the relevant section of the phantom with the relevant side or edge of the device facing toward the phantom.
2. The device was moved toward and away from the phantom to determine the distance at which the mechanism triggers and the output power is reduced per KDB Publication 616217 D04v01r02 .Each applicable test position was evaluated. The distance were conformed to be the same or larger (more conservative) than the minimum distances provided by the manufacturer.
3. Step 1 and 2 were repeated for the relevant modes, as appropriate
4. Steps1 through 3 were repeated for all distance-based power reduction mechanisms.

For detailed measurement conducted power results, please refer to the Section .11



Proximity Sensor Trigger Distance Assessment KDB 616217 D04§6.2

LEGEND

→ Direction of DUT travel for determination of power reduction triggering point

→ Direction of DUT travel for determination of full power resumption triggering point

Main Ant

Tissue simulating liquid	Triggering Distance					
	Rear		Front		Bottom	
	Moving toward phantom [mm]	Moving away from phantom [mm]	Moving toward phantom [mm]	Moving away from phantom [mm]	Moving toward phantom [mm]	Moving away from phantom [mm]
1800MHz Tissue	9	10	7	8	13	14
1900MHz Tissue	9	10	7	8	13	14
2600MHz Tissue	9	10	7	8	13	14

Distance Measurement verification for Proximity sensor

Rear side – EUT Moving toward (trigger) to the Phantom

Mode	Distance to DUT Output power (dBm)									
	14[mm]	13[mm]	12[mm]	11[mm]	10[mm]	9[mm]	8[mm]	7[mm]	6[mm]	5[mm]
GSM 1900 GPRS 1Tx	30.79	30.70	30.79	30.67	30.63	27.84	27.87	27.68	27.84	27.8
GSM 1900 GPRS 2Tx	27.80	27.73	27.82	27.89	27.74	24.58	24.48	24.47	24.48	24.53
GSM 1900 GPRS 3Tx	26.12	26.16	26.10	26.16	26.06	23.06	23.44	23.20	23.47	23.34
GSM 1900 GPRS 4Tx	24.88	24.94	24.88	25.01	24.86	20.8	20.92	20.89	20.77	20.8
WCDMA B2	22.83	22.85	22.96	22.9	22.88	19.24	19.2	19.26	19.23	19.27
WCDMA B4	23.09	23.27	23.23	23.25	23.13	19.78	19.68	19.77	19.82	19.7
LTE Band 2	22.65	22.63	22.55	22.68	22.48	18.87	18.99	18.9	19.04	18.96
LTE Band 4	22.91	22.96	22.87	22.95	22.91	19.72	19.69	19.77	19.81	19.7
LTE Band 25	22.77	22.67	22.76	22.63	22.75	19.16	19.12	19.16	19.07	19.09
LTE Band 41(Class 3)	24.08	24.02	24.13	24.11	24.14	23.20	22.92	23.17	23.07	23.05
LTE Band 41(Class 2)	25.19	25.23	25.12	25.16	25.11	22.87	22.82	22.91	23.06	22.88
LTE Band 66	23.27	23.23	23.08	23.22	23.23	20.06	20.03	19.99	20.02	20.03

Rear side – EUT Moving away (Release) from the Phantom

Mode	Distance to DUT Output power (dBm)									
	6[mm]	7[mm]	8[mm]	9[mm]	10[mm]	11[mm]	12[mm]	13[mm]	14[mm]	15[mm]
GSM 1900 GPRS 1Tx	27.78	27.81	27.76	27.81	27.82	30.77	30.70	30.81	30.67	30.63
GSM 1900 GPRS 2Tx	24.43	24.37	24.46	24.43	24.52	27.85	27.79	27.79	27.84	27.80
GSM 1900 GPRS 3Tx	23.37	23.27	23.29	23.43	23.39	26.15	26.13	26.18	26.14	26.02
GSM 1900 GPRS 4Tx	20.84	20.79	20.8	20.76	20.92	24.85	24.95	25.02	24.97	24.90
WCDMA B2	19.22	19.33	19.19	19.33	19.2	22.88	22.92	22.84	22.83	22.82
WCDMA B4	19.8	19.87	19.7	19.71	19.88	23.24	23.18	23.14	23.13	23.17
LTE Band 2	18.93	19.02	18.88	18.97	18.89	22.67	22.54	22.54	22.53	22.68
LTE Band 4	19.81	19.78	19.81	19.85	19.79	22.98	22.95	22.95	22.92	23
LTE Band 25	19.22	19.26	19.21	19.24	19.17	22.71	22.66	22.74	22.71	22.6
LTE Band 41(Class 3)	23.11	22.96	22.95	23.07	23.05	24.05	24.19	24.05	24.19	24.09
LTE Band 41(Class 2)	22.96	22.89	22.89	22.97	22.94	25.2	25.26	25.24	25.19	25.24
LTE Band 66	20.09	20.1	19.95	20.08	20	23.07	23.12	23.15	23.08	23.1

Based on the most conservative measured triggering distance of 9mm, additional Phablet SAR measurements were required at 8mm from rear side for the above modes.

Front side – EUT Moving toward (trigger) to the Phantom

Mode	Distance to DUT Output power (dBm)									
	12[mm]	11[mm]	10[mm]	9[mm]	8[mm]	7[mm]	6[mm]	5[mm]	4[mm]	3[mm]
GSM 1900 GPRS 1Tx	30.78	30.82	30.69	30.77	30.65	27.85	27.73	27.72	27.76	27.77
GSM 1900 GPRS 2Tx	27.89	27.87	27.76	27.73	27.85	24.53	24.49	24.41	24.33	24.46
GSM 1900 GPRS 3Tx	26.07	26.19	26.19	26.17	26.07	23.18	23.23	23.28	23.20	23.29
GSM 1900 GPRS 4Tx	24.89	24.89	24.90	24.89	24.93	20.87	20.74	20.75	20.73	20.87
WCDMA B2	22.97	22.83	22.94	22.88	22.93	19.38	19.38	19.27	19.28	19.28
WCDMA B4	23.25	23.21	23.08	23.12	23.15	19.83	19.77	19.8	19.77	19.7
LTE Band 2	22.52	22.67	22.48	22.59	22.55	19.07	19.01	18.98	18.98	18.97
LTE Band 4	22.9	23.07	22.89	22.9	22.93	19.87	19.85	19.7	19.7	19.75
LTE Band 25	22.71	22.8	22.72	22.6	22.62	19.11	19.13	19.26	19.24	19.23
LTE Band 41(Class 3)	24.19	23.99	24.14	24.16	24.04	23.15	22.98	23.08	23.15	23.02
LTE Band 41(Class 2)	25.2	25.14	25.07	25.15	25.19	23.10	22.99	22.91	22.96	22.79
LTE Band 66	23.11	23.07	23.18	23.21	23.1	20.05	19.94	20.03	19.96	19.95

Front side – EUT Moving away (Release) from the Phantom

Mode	Distance to DUT Output power (dBm)									
	4[mm]	5[mm]	6[mm]	7[mm]	8[mm]	9[mm]	10[mm]	11[mm]	12[mm]	13[mm]
GSM 1900 GPRS 1Tx	27.73	27.7	27.82	27.69	27.85	30.67	30.71	30.73	30.76	30.80
GSM 1900 GPRS 2Tx	24.39	24.5	24.48	24.43	24.34	27.80	27.77	27.75	27.73	27.72
GSM 1900 GPRS 3Tx	23.38	23.36	23.30	23.28	23.25	26.05	26.19	26.08	26.03	26.19
GSM 1900 GPRS 4Tx	20.74	20.87	20.87	20.77	20.81	24.88	25.03	24.90	24.87	24.95
WCDMA B2	19.18	19.33	19.36	19.31	19.23	22.96	22.92	22.8	22.95	22.86
WCDMA B4	19.79	19.86	19.84	19.83	19.79	23.14	23.22	23.14	23.1	23.21
LTE Band 2	18.94	19.05	18.97	19.04	18.98	22.62	22.55	22.68	22.62	22.48
LTE Band 4	19.77	19.75	19.86	19.82	19.8	22.97	23.01	23	23.04	23.05
LTE Band 25	19.22	19.14	19.1	19.25	19.21	22.65	22.73	22.63	22.75	22.7
LTE Band 41(Class 3)	23.12	23.11	23.06	22.88	23.09	24.01	24.19	24.17	24.14	24
LTE Band 41(Class 2)	22.87	23.10	23.09	22.81	22.92	25.2	25.14	25.18	25.23	25.12
LTE Band 66	19.94	20.05	19.98	19.96	19.96	23.2	23.07	23.18	23.21	23.19

Based on the most conservative measured triggering distance of 7mm, additional Phablet SAR measurements were required at 6mm from Front side for the above modes

Bottom side – EUT Moving toward (trigger) to the Phantom

Mode	Distance to DUT Output power (dBm)									
	18[mm]	17[mm]	16[mm]	15[mm]	14[mm]	13[mm]	12[mm]	11[mm]	10[mm]	9[mm]
GSM 1900 GPRS 1Tx	30.80	30.68	30.73	30.76	30.80	27.78	27.69	27.7	27.79	27.88
GSM 1900 GPRS 2Tx	27.75	27.78	27.78	27.79	27.81	24.39	24.39	24.44	24.43	24.33
GSM 1900 GPRS 3Tx	26.14	26.09	26.05	26.11	26.21	23.25	23.30	23.17	23.37	23.35
GSM 1900 GPRS 4Tx	24.99	24.96	24.96	24.99	24.94	20.9	20.73	20.75	20.75	20.87
WCDMA B2	22.95	22.96	22.89	22.81	22.89	19.33	19.22	19.24	19.2	19.21
WCDMA B4	23.13	23.17	23.17	23.22	23.09	19.88	19.73	19.88	19.87	19.75
LTE Band 2	22.52	22.59	22.58	22.48	22.56	18.92	18.88	18.99	18.89	18.96
LTE Band 4	23.05	23.07	22.98	22.92	22.87	19.76	19.78	19.8	19.79	19.88
LTE Band 25	22.64	22.73	22.73	22.63	22.78	19.09	19.1	19.07	19.1	19.14
LTE Band 41(Class 3)	23.99	24.19	24.02	24.08	24.12	23.06	23.14	23.15	23.12	23.01
LTE Band 41(Class 2)	25.1	25.24	25.2	25.14	25.12	22.88	22.99	22.96	22.78	22.91
LTE Band 66	23.22	23.08	23.1	23.11	23.25	19.96	19.95	19.92	20.11	20.02

Bottom side – EUT Moving away (Release) from the Phantom

Mode	Distance to DUT Output power (dBm)									
	10[mm]	11[mm]	12[mm]	13[mm]	14[mm]	15[mm]	16[mm]	17[mm]	18[mm]	19[mm]
GSM 1900 GPRS 1Tx	27.75	27.85	27.69	27.84	27.76	30.80	30.69	30.71	30.73	30.77
GSM 1900 GPRS 2Tx	24.53	24.35	24.53	24.34	24.48	27.86	27.82	27.79	27.87	27.75
GSM 1900 GPRS 3Tx	23.21	23.20	23.38	23.21	23.36	26.05	26.19	26.13	26.06	26.08
GSM 1900 GPRS 4Tx	20.89	20.85	20.84	20.82	20.78	24.85	24.85	25.02	24.94	24.92
WCDMA B2	19.29	19.26	19.18	19.2	19.31	22.89	22.8	22.96	22.96	22.9
WCDMA B4	19.87	19.69	19.81	19.76	19.75	23.21	23.15	23.17	23.21	23.27
LTE Band 2	18.96	19.07	19.06	19.03	18.9	22.48	22.51	22.49	22.48	22.66
LTE Band 4	19.86	19.89	19.8	19.86	19.86	22.94	23.07	23.01	22.98	22.98
LTE Band 25	19.14	19.09	19.22	19.25	19.09	22.62	22.61	22.78	22.79	22.62
LTE Band 41(Class 3)	23.12	23.25	22.89	23.17	23.08	24.06	24.05	24.18	24.16	24.12
LTE Band 41(Class 2)	22.95	22.94	22.92	22.87	23.04	25.16	25.07	25.23	25.07	25.22
LTE Band 66	20.05	20.03	20.05	19.93	20.1	23.23	23.19	23.18	23.16	23.08

Based on the most conservative measured triggering distance of 13mm, additional Phablet SAR measurements were required at 12mm from bottom side for the above modes

1.2 Proximity Sensor Coverage for SAR measurements

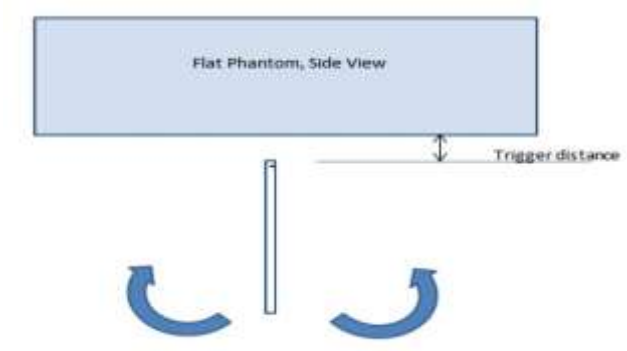
(KDB 616217 D04v01r02§6.3)

As there is no spatial offset between the antenna and the proximity sensor element, proximity sensor coverage did not need to be assessed.

1.3 Proximity Sensor Tilt Angle Assessment

(KDB 616217 D04v01r02 §6.4)

The DUT was positioned directly below the flat phantom at the minimum measured trigger distance with Bottom side parallel to the base of the flat phantom for each band.The EUT was rotated about Bottom side for angles up to ±45°. If the output power increased during the rotation the DUT was moved 1mm toward the phantom and the rotation repeated. This procedure was repeated until the power remained reduced for all angles up±45°.



Proximity sensor tilt angle assessment (Bottom side) KDB 616217 §6.4

Summary of Tablet Tilt Angle influence to Proximity Sensor Triggering (Bottom side)

Tissue	Minimum distance At which power reduction was maintained over-45°	Power reduction status										
		-45°	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	45°
1800 MHz Tissue	13mm	On	On	On	On	On	On	On	On	On	On	On
1900 MHz Tissue	13mm	On	On	On	On	On	On	On	On	On	On	On
2600 MHz Tissue	13mm	On	On	On	On	On	On	On	On	On	On	On

1.4 Resulting test positions for Phablet SAR measurements

Wireless technologies	Position	§6.2 Triggering Distance [mm]	§6.3 Coverage	§6.4 Tilt Angle	Worst case distance for Phablet SAR [mm]
WWAN (GSM1900/WCDMA B2/B4 /LTEB2/B4/B25 / B41(Class3) /B41(Class2)/B66)	Rear	9	N/A	N/A	8
	Front	7	N/A	N/A	6
	Bottom	13	N/A	N/A	12

Note:FCC KDB Publication 616217 D04v01r02 Section 6 was used as a guideline for selecting SAR test distances for this device when being used in phablet use conditions

2. Power reduction Verification for WLAN Ant

This device uses a power reduction mechanism for SAR compliance for WLAN operations during voice or VoIP held to ear scenarios.

When a user makes or receives a WLAN voice or WLAN VOIP call for WLAN Ant the audio of the call is sent through the Receiver at the top of the device will trigger the Power reduction for WLAN Ant (i.e. reducing output power for Head SAR compliance)

Detailed descriptions of the power reduction mechanism are included in the Main operational description document

Power Measurement Verification for WLAN

Condition For Power reduction	Wireless Technologies	Conducted Power[dBm]			
		Un-Triggered (Max Power)		Triggered (Reduced Power)	
		Ant1	Ant2	Ant1	Ant2
RCV-on	2.4GHz 802.11b (Exclude 12/13ch)	19.05	19.45	15.67	16.02
RCV-on	5GHz 802.11a	17.82	17.47	14.34	12.95
RCV-on	5GHz 802.11n 20MHz	17.75	17.47	14.31	12.94
RCV-on	5GHz 802.11n 40MHz	16.94	16.98	14.69	13.38
RCV-on	5GHz 802.11ac 20MHz	17.83	17.53	14.33	12.90
RCV-on	5GHz 802.11ac 40MHz	16.91	16.96	14.68	13.39
RCV-on	5GHz 802.11ac 80MHz	15.92	15.79	14.53	13.17

Appendix I. – DL CA Power Measurement Results

1. LTE Down-link Carrier Aggregation Conducted Powers

SAR test exclusion for LTE downlink Carrier Aggregation is determined by power measurements according to the number component carriers(CCs) supported by test product implementation. For those configurations required by April 2018 TCBC Workshop notes, conducted power measurements with LTE Carrier Aggregation(CA) (downlink only) active are made in accordance to KDB Publication 941225 D05Av01r02. The RRC connection is only handled by one cell, the primary component carrier (PCC) for downlink and uplink communications. After making a data connection to the PCC, the UE device adds secondary component carrier(s)(SCC) on the downlink only.

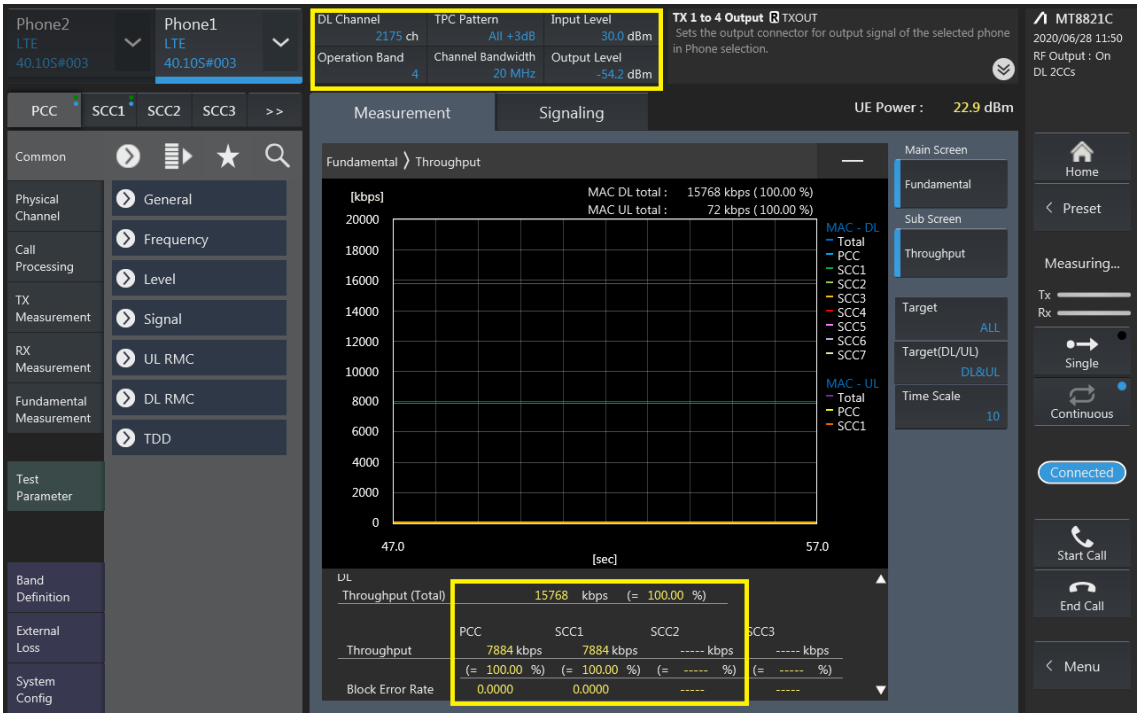
Downlink Carrier aggregation:

1. This device only supports downlink carrier aggregation. For every supported combination of downlink carrier aggregation, power measurements were performed with the downlink carrier aggregation active for the configuration with highest measured maximum conducted power with downlink carrier aggregation inactive measured among the channel bandwidth, modulation, and RB combinations in each frequency band.
2. All control and acknowledge data is sent on uplink channels that operate identical to specifications when downlink carrier aggregation is inactive.
3. Per FCC KDB publication 941225 D05A v01r02, Section C)3)b)ii), PCC uplink channel was selected at downlink carrier aggregation combinations. The downlink PCC channel was paired with the selected PCC uplink channel according to normal configurations without carrier aggregation.
4. For continuous intra-band carrier aggregation, the downlink channel spacing between the component carriers was set to multiple of 300kHz less than the nominal channel spacing defined in section 5.4.1A of 3GPP TS 36.521.
5. For non-continuous intra-band carrier aggregation, the downlink channel spacing between the component carriers was set to be larger than the nominal channel spacing and provided maximum separation between the component carriers.
6. All selected downlink channels remained fully within the downlink transmission band of the respective component carrier.

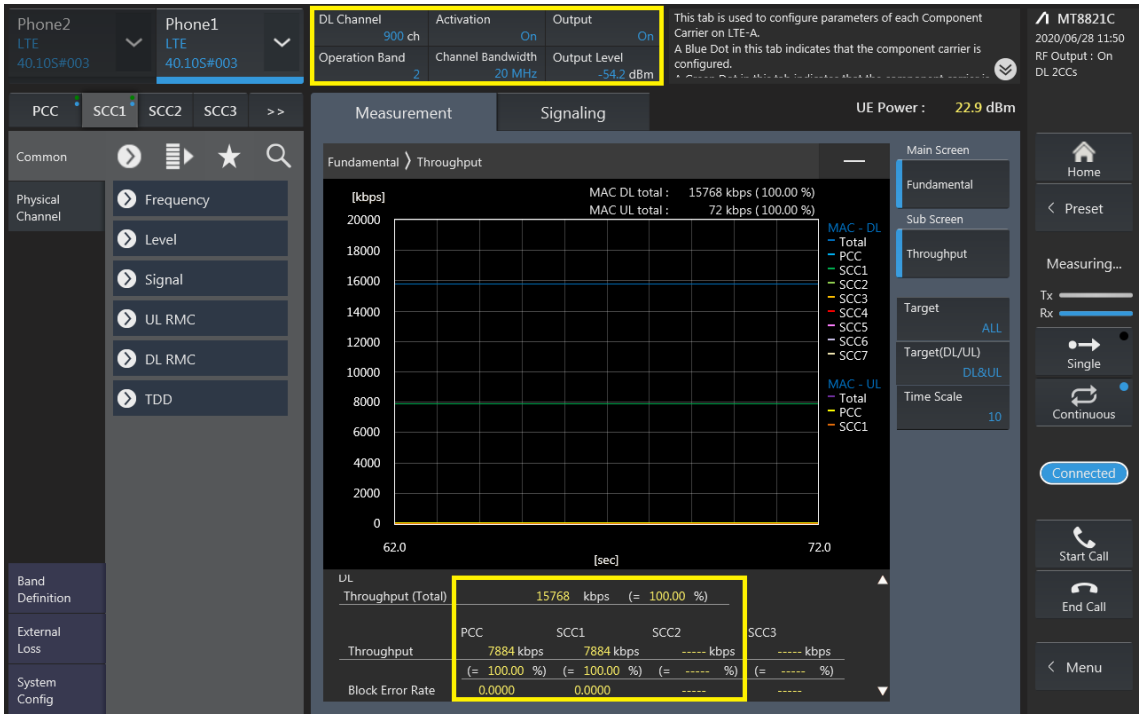
Power Measurement setup

LTE Down Link 2CA Call Setup

PCC Setting Channel/ RB/ BW/ Modulation



SCC Setting : Channel/ RB/ BW/ Modulation and call Connection



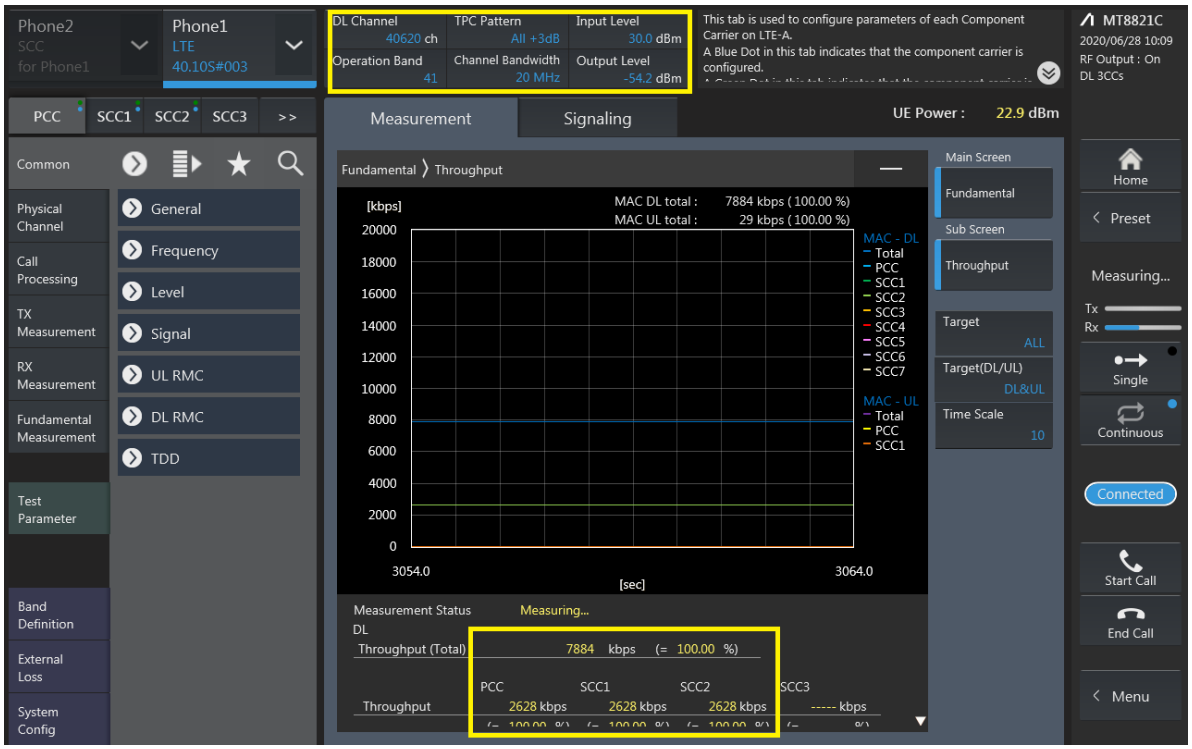
2CA Downlink Carrier aggregation conducted Powers

LTE Downlink 2CA Maximum Conducted Power

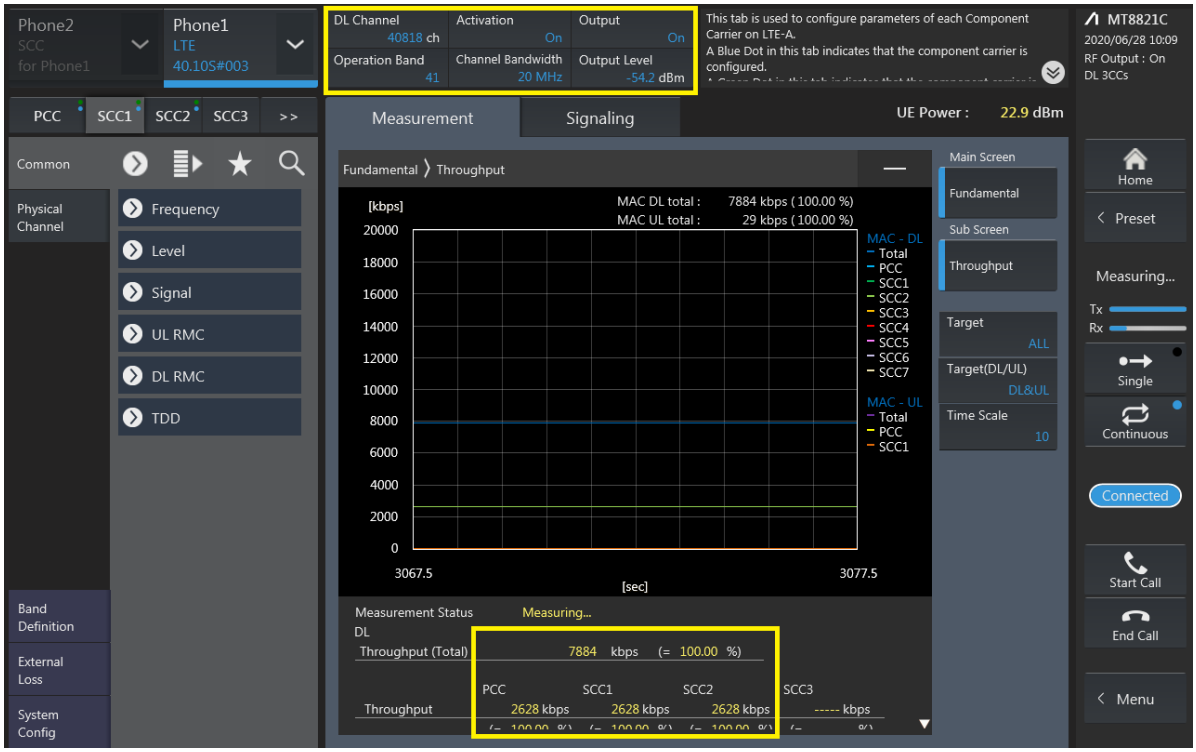
Combination	PCC									SCC				Tx Power		
	Band	BW	PCC UL Channel	PCC UL Frequency	PCC DL Channel	PCC DL Frequency	Modulation	RB	offset	Band	BW	SCC DL Channel	SCC DL Frequency	LTE Single Carrier Tx Power (dBm) (1)	LTE Tx Power with DL CA Enabled(dBm) (2)	Deviaion (2)-(1)
2A-2A	2	15	19125	1902.5	1125	1982.5	QPSK	1	0	2	20	700	1940	22.64	22.65	0.01
2C	2	15	19125	1902.5	1125	1982.5	QPSK	1	0	2	20	954	1965.4	22.64	22.73	0.09
2A-4A(0,2)	2	15	19125	1902.5	1125	1982.5	QPSK	1	0	4	20	2175	2132.5	22.64	22.67	0.03
2A-4A(1)	2	10	19150	1905	1150	1985	QPSK	1	24	4	10	2175	2132.5	22.62	22.59	-0.03
2A-4A(0,2)	4	10	20000	1715	2000	2115	QPSK	1	49	2	20	900	1960	23.39	23.46	0.07
2A-4A(1)	4	10	20000	1715	2000	2115	QPSK	1	49	2	10	900	1960	23.39	23.39	0.00
2A-5A(0)	2	15	19125	1902.5	1125	1982.5	QPSK	1	0	5	10	2525	881.5	22.64	22.69	0.05
2A-5A(1)	2	10	19150	1905	1150	1985	QPSK	1	24	5	10	2525	881.5	22.62	22.66	0.04
2A-5A(0)	5	10	20525	836.5	2525	881.5	QPSK	1	0	2	20	900	1960	24.73	24.75	0.02
2A-5A(1)	5	10	20525	836.5	2525	881.5	QPSK	1	0	2	10	900	1960	24.73	24.80	0.07
2A-12A(0,1)	2	15	19125	1902.5	1125	1982.5	QPSK	1	0	12	10	5095	737.5	22.64	22.62	-0.02
2A-12A(2)	2	10	19150	1905	1150	1985	QPSK	1	24	12	10	5095	737.5	22.62	22.70	0.08
2A-12A(0,1)	12	5	23035	701.5	5035	731.5	QPSK	1	0	2	20	900	1960	24.31	24.40	0.09
2A-12A(2)	12	5	23035	701.5	5035	731.5	QPSK	1	0	2	10	900	1960	24.31	24.30	-0.01
2A-13A(0)	2	15	19125	1902.5	1125	1982.5	QPSK	1	0	13	10	5230	751	22.64	22.57	-0.07
2A-13A(1)	2	10	19150	1905	1150	1985	QPSK	1	24	13	10	5230	751	22.62	22.66	0.04
2A-13A(0)	13	10	23230	782	5230	751	QPSK	1	49	2	20	900	1960	24.11	24.06	-0.05
2A-13A(1)	13	10	23230	782	5230	751	QPSK	1	49	2	10	900	1960	24.11	24.08	-0.03
2A-17A	2	10	19150	1905	1150	1985	QPSK	1	24	17	10	5790	740	22.62	22.59	-0.03
2A-17A	17	10	23790	710	5790	740	QPSK	1	0	2	10	900	1960	24.12	24.06	-0.06
2A-66A(0,2)	2	15	19125	1902.5	1125	1982.5	QPSK	1	0	66	20	66786	2145	22.64	22.58	-0.06
2A-66A(1)	2	10	19150	1905	1150	1985	QPSK	1	24	66	10	66786	2145	22.62	22.64	0.02
2A-66A(0,2)	66	10	132022	1715	66486	2115	QPSK	1	49	2	20	900	1960	23.23	23.26	0.03
2A-66A(1)	66	10	132022	1715	66486	2115	QPSK	1	49	2	10	900	1960	23.23	23.17	-0.06
4A-4A(0)	4	10	20000	1715	2000	2115	QPSK	1	49	4	20	2300	2145	23.39	23.48	0.09
4A-4A(1)	4	10	20000	1715	2000	2115	QPSK	1	49	4	10	2350	2150	23.39	23.47	0.08
4A-5A(0,1)	4	10	20000	1715	2000	2115	QPSK	1	49	5	10	2525	881.5	23.39	23.46	0.07
4A-5A(0)	5	10	20525	836.5	2525	881.5	QPSK	1	0	4	10	2175	2132.5	24.73	24.75	0.02
4A-5A(1)	5	10	20525	836.5	2525	881.5	QPSK	1	0	4	20	2175	2132.5	24.73	24.67	-0.06
4A-12A(0,1,2,3,4)	4	10	20000	1715	2000	2115	QPSK	1	49	12	10	5095	737.5	23.39	23.49	0.10
4A-12A(5)	4	10	20000	1715	2000	2115	QPSK	1	49	12	5	5095	737.5	23.39	23.38	-0.01
4A-12A(0,3)	12	5	23035	701.5	5035	731.5	QPSK	1	0	4	10	2175	2132.5	24.31	24.41	0.10
4A-12A(1,2,4)	12	5	23035	701.5	5035	731.5	QPSK	1	0	4	20	2175	2132.5	24.31	24.35	0.04
4A-12A(5)	12	5	23035	701.5	5035	731.5	QPSK	1	0	4	15	2175	2132.5	24.31	24.31	0.00
4A-13A(0,1)	4	10	20000	1715	2000	2115	QPSK	1	49	13	10	5230	751	23.39	23.47	0.08
4A-13A(0)	13	10	23230	782	5230	751	QPSK	1	49	4	20	2175	2132.5	24.11	24.14	0.03
4A-13A(1)	13	10	23230	782	5230	751	QPSK	1	49	4	10	2175	2132.5	24.11	24.01	-0.10
4A-17A	4	10	20000	1715	2000	2115	QPSK	1	49	17	10	5790	740	23.39	23.45	0.06
4A-17A	17	10	23790	710	5790	740	QPSK	1	0	4	10	2175	2132.5	24.12	24.03	-0.09
5A-41A	5	10	20525	836.5	2525	881.5	QPSK	1	0	41	20	40620	40620	24.73	24.70	-0.03
5A-66A	5	10	20525	836.5	2525	881.5	QPSK	1	0	66	20	66786	2145	24.73	24.67	-0.06
5A-66A	66	10	132022	1715	66486	2115	QPSK	1	49	5	10	2525	881.5	23.23	23.22	-0.01
12A-66A(0,3)	12	5	23035	701.5	5035	731.5	QPSK	1	0	66	10	66786	2145	24.31	24.29	-0.02
12A-66A(1,2,4)	12	5	23035	701.5	5035	731.5	QPSK	1	0	66	20	66786	2145	24.31	24.38	0.07
12A-66A(5)	12	5	23035	701.5	5035	731.5	QPSK	1	0	66	15	66786	2145	24.31	24.24	-0.07
12A-66A(0,3)	66	10	132022	1715	66486	2115	QPSK	1	49	12	10	5095	737.5	23.23	23.26	0.03
12A-66A(1,2,4)	66	10	132022	1715	66486	2115	QPSK	1	49	12	10	5095	737.5	23.23	23.31	0.08
12A-66A(5)	66	15	132047	1717.5	66511	2117.5	QPSK	1	74	12	5	5095	737.5	23.22	23.23	0.01
26A-41A	26	15	26865	831.5	8865	876.5	QPSK	1	0	41	20	40620	2593	24.15	24.08	-0.07
41A-41A(PC3)	41	5	39750	2506	39750	2506	QPSK	1	24	41	20	41490	2680	24.14	24.11	-0.03
41A-41A(PC2)	41	20	41490	2680	41490	2680	QPSK	1	0	41	20	39750	2506	25.17	25.18	0.01
41C(PC3)	41	5	39750	2506	39750	2506	QPSK	1	24	41	20	39867	2517.7	24.14	24.13	-0.01
41C(PC2)	41	20	41490	2680	41490	2680	QPSK	1	0	41	20	41292	2660.2	25.17	25.23	0.06
66A-66A	66	10	132022	1715	66486	2115	QPSK	1	49	66	20	67236	2190	23.23	23.27	0.04
66B	66	10	132022	1715	66486	2115	QPSK	1	49	66	10	66585	2124.9	23.23	23.20	-0.03
66C	66	10	132022	1715	66486	2115	QPSK	1	49	66	20	66630	2129.4	23.23	23.33	0.10

LTE Down Link 3CA Call Setup

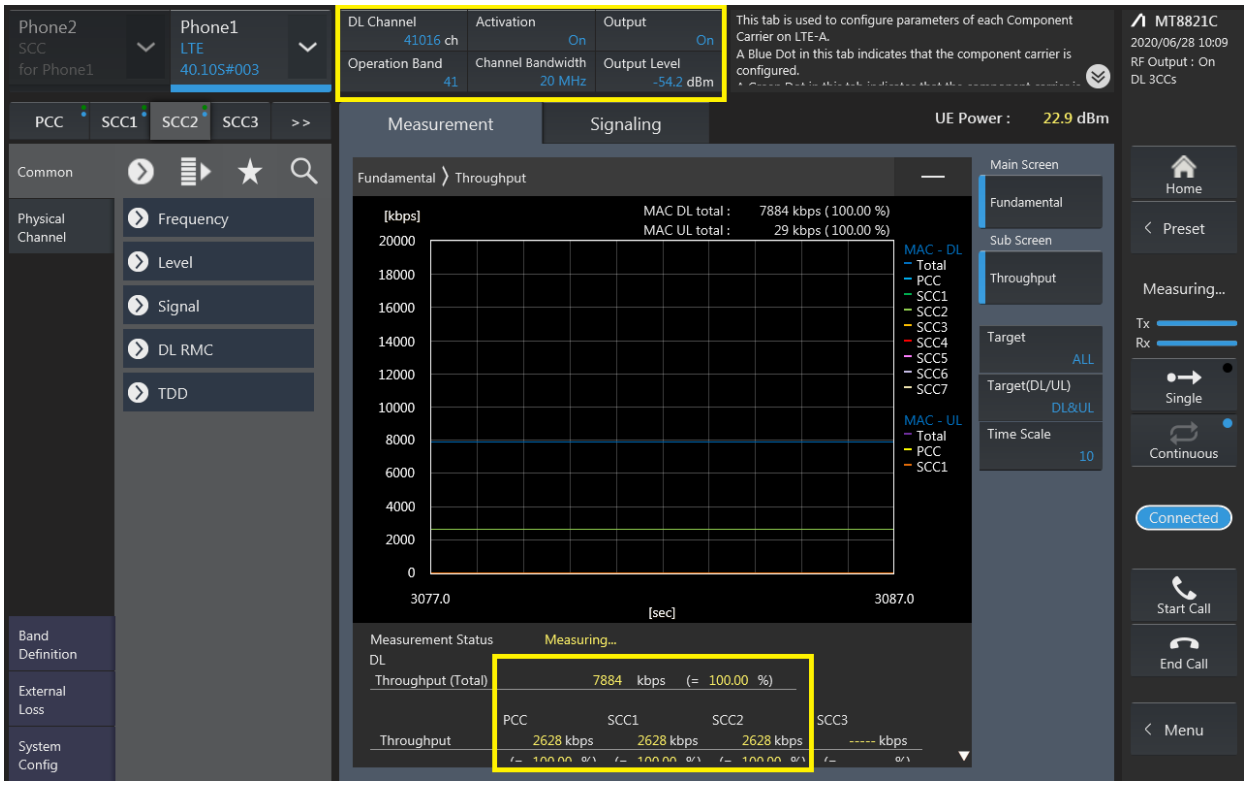
PCC Setting: Channel /RB/BW/Modulation



SCC1 Setting : Channel /RB/BW/Modulation



SCC2 Setting (Channel /RB/BW/Modulation and call Connection



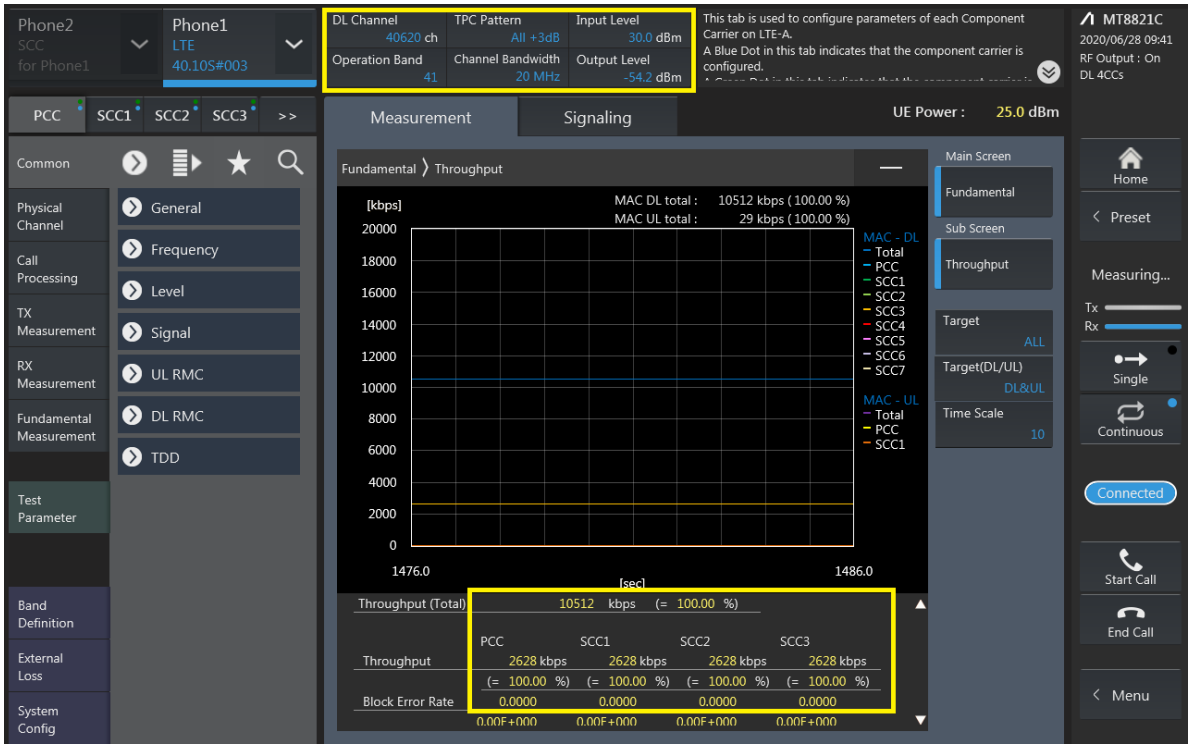
3CA Downlink Carrier aggregation conducted Powers

LTE Downlink 3CA Maximum Conducted Power

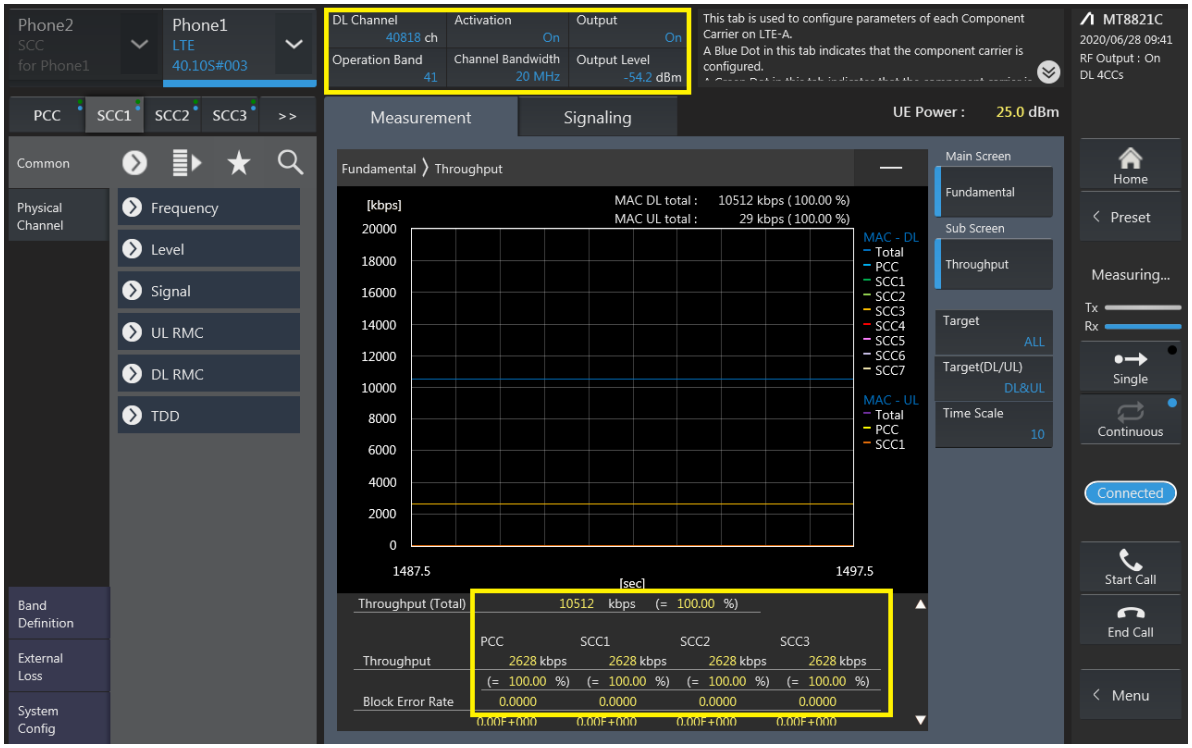
Combination	PCC									SCC				SCC				Tx Power		
	Band	BW	PCC UL Channel	PCC UL Frequency	PCC DL Channel	PCC DL Frequency	Modulation	RB	offset	Band	BW	SCC DL Channel	SCC DL Frequency	Band	BW	SCC DL Channel	SCC DL Frequency	LTE Single Carrier Tx Power (dBm) (1)	LTE Tx Power with DL CA Enabled(dBm) (2)	Deviaion (2)-(1)
2A-4A-5A	2	15	19125	1902.5	1125	1982.5	QPSK	1	0	4	20	2175	2132.5	5	10	2525	881.5	22.64	22.54	-0.10
2A-4A-5A	4	10	20000	1715	2000	2115	QPSK	1	49	2	20	900	1960	5	10	2525	881.5	23.39	23.43	0.04
2A-4A-5A	5	10	20525	836.5	2525	881.5	QPSK	1	0	2	20	900	1960	4	20	2175	2132.5	24.73	24.79	0.06
2A-4A-13A	2	15	19125	1902.5	1125	1982.5	QPSK	1	0	4	20	2175	2132.5	13	10	5230	751	22.64	22.58	-0.06
2A-4A-13A	4	10	20000	1715	2000	2115	QPSK	1	49	2	20	900	1960	13	10	5230	751	23.39	23.43	0.04
2A-4A-13A	13	10	23230	782	5230	751	QPSK	1	49	2	20	900	1960	4	20	2175	2132.5	24.11	24.01	-0.10
4A-4A-12A	4	10	20000	1715	2000	2115	QPSK	1	49	4	20	2300	2145	12	10	5095	737.5	23.39	23.46	0.07
4A-4A-12A	12	5	23035	701.5	5035	731.5	QPSK	1	0	4	20	2175	2132.5	4	10	2350	2150	24.31	24.36	0.05
4A-4A-17A	4	10	20000	1715	2000	2115	QPSK	1	49	4	20	2300	2145	17	10	5790	740	23.39	23.44	0.05
4A-4A-17A	17	10	23790	710	5790	740	QPSK	1	0	4	20	2175	2132.5	4	10	2350	2150	24.12	24.08	-0.04
5A-66A-66A	5	10	20525	836.5	2525	881.5	QPSK	1	0	66	20	66786	2145	66	20	67236	2190	24.73	24.82	0.09
5A-66A-66A	66	10	132022	1715	66486	2115	QPSK	1	49	66	20	67236	2190	5	10	2525	881.5	23.23	23.18	-0.05
12A-66A-66A	12	5	23035	701.5	5035	731.5	QPSK	1	0	66	20	66786	2145	66	20	67236	2190	24.31	24.37	0.06
12A-66A-66A	66	10	132022	1715	66486	2115	QPSK	1	49	66	20	67236	2190	12	10	5095	737.5	23.23	23.29	0.06
41A-41C(PC3)	41	5	39750	2506	39750	2506	QPSK	1	24	41	20	41292	2660.2	41	20	41490	2680	24.14	24.24	0.10
41A-41C(PC3)	41	5	39750	2506	39750	2506	QPSK	1	24	41	20	39867	2517.7	41	20	41490	2680	24.14	24.12	-0.02
41A-41C(PC2)	41	20	41490	2680	41490	2680	QPSK	1	0	41	20	39948	2525.8	41	20	39750	2506	25.17	25.08	-0.09
41A-41C(PC2)	41	20	41490	2680	41490	2680	QPSK	1	0	41	20	41292	2660.2	41	20	39750	2506	25.17	25.13	-0.04
41D(PC3)	41	5	39750	2506	39750	2506	QPSK	1	24	41	20	39867	2517.7	41	20	40065	2537.5	24.14	24.22	0.08
41D(PC2)	41	20	41490	2680	41490	2680	QPSK	1	0	41	20	41292	2660.2	41	20	41094	2640.4	25.17	25.14	-0.03

LTE Down Link 4CA Call Setup

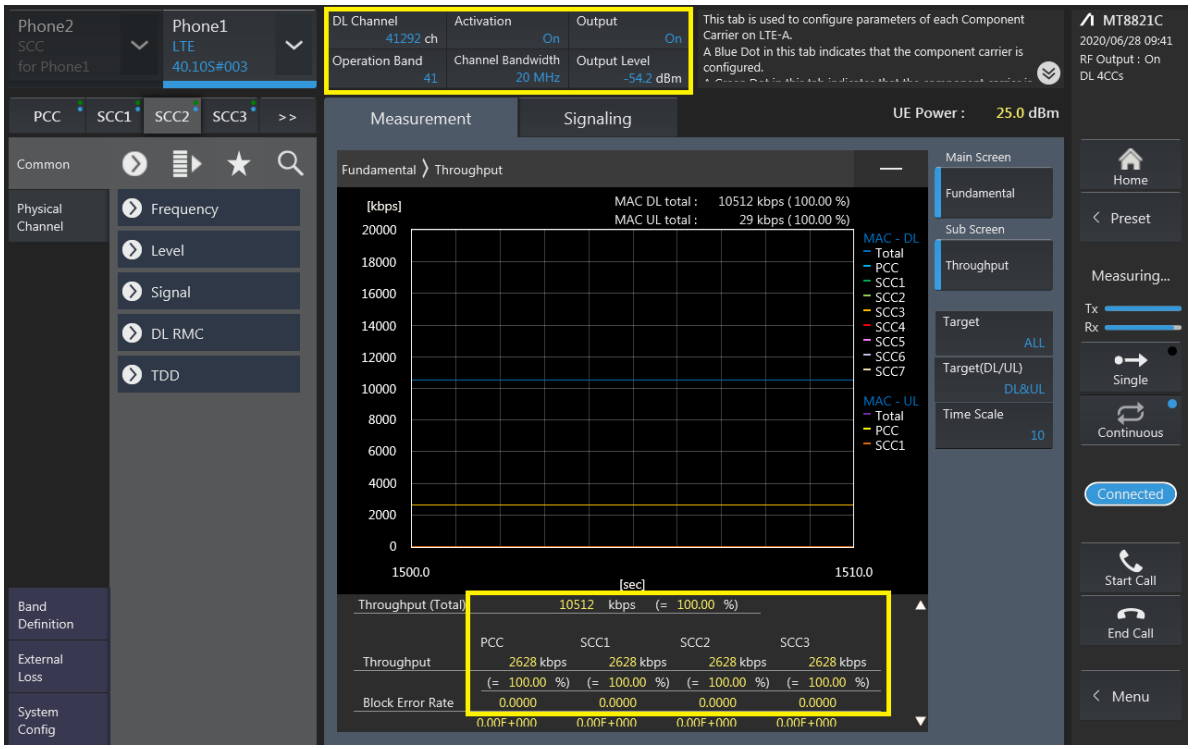
PCC Setting: Channel /RB/BW/Modulation



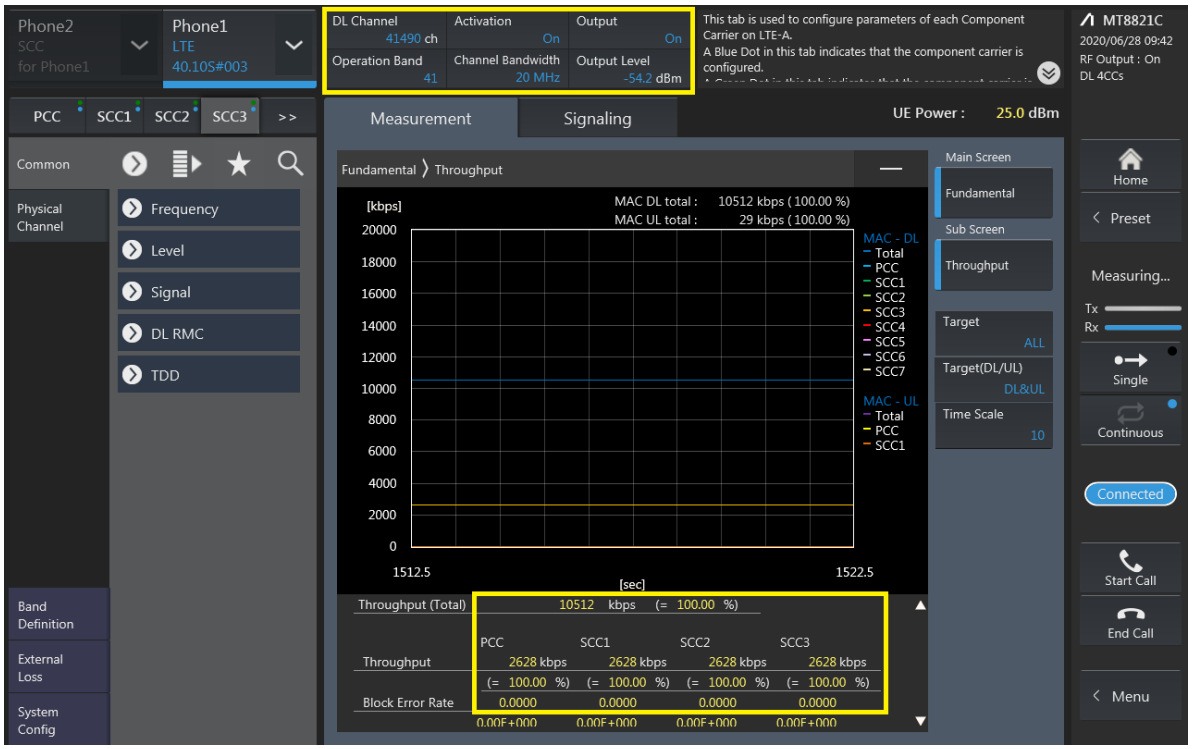
SCC1 Setting (Channel /RB/BW/Modulation and call Connection



SCC2 Setting (Channel /RB/BW/Modulation and call Connection



SCC3 Setting (Channel /RB/BW/Modulation and call Connection

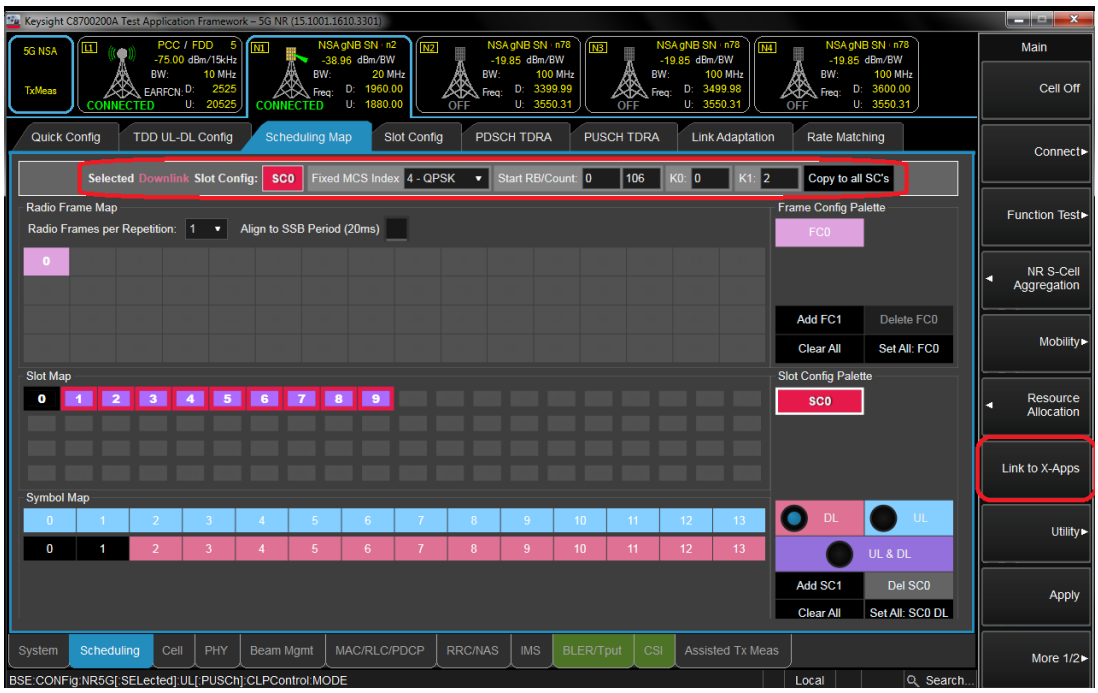


4CA Downlink Carrier aggregation conducted Powers

LTE Downlink 4CA Maximum Conducted Power

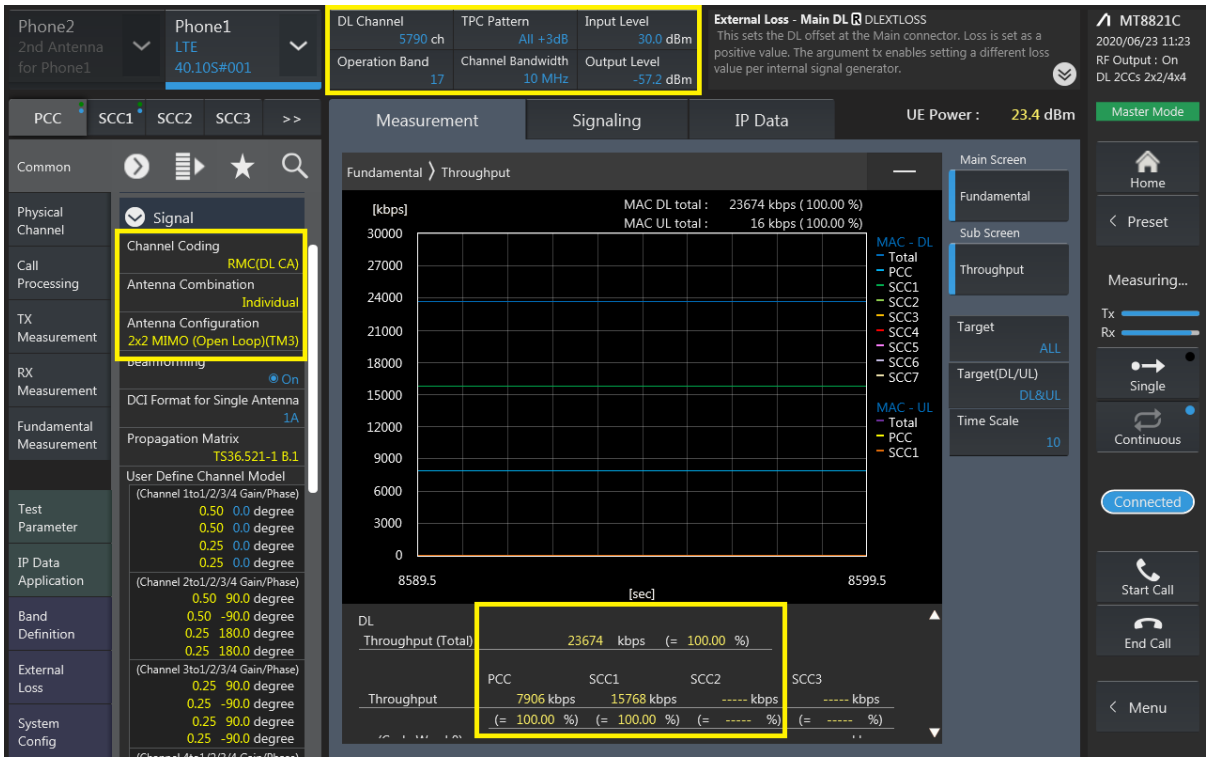
Combination	PCC									SCC				SCC				SCC				Tx Power		
	Band	BW	PCC UL Channel	PCC UL Frequency	PCC DL Channel	PCC DL Frequency	Modulation	RB	offset	Band	BW	SCC DL Channel	SCC DL Frequency	Band	BW	SCC DL Channel	SCC DL Frequency	Band	BW	SCC DL Channel	SCC DL Frequency	LTE Single Carrier Tx Power (dBm) (1)	LTE Tx Power with DL CA Enabled(dBm) (2)	Deviaion (2)-(1)
41C-41C(PC3)	41	5	39750	2506	39750	2506	QPSK	1	24	41	20	39867	2517.7	41	20	41292	2660.2	41	20	41490	2680	24.14	24.16	0.02
41C-41C(PC2)	41	20	41490	2680	41490	2680	QPSK	1	0	41	20	41292	2660.2	41	20	39948	2525.8	41	20	39750	2506	25.17	25.07	-0.1
41A-41D(PC3)	41	5	39750	2506	39750	2506	QPSK	1	24	41	20	41094	2640.4	41	20	41292	2660.2	41	20	41490	2680	24.14	24.07	-0.07
41A-41D(PC3)	41	5	39750	2506	39750	2506	QPSK	1	24	41	20	39867	2517.7	41	20	40065	2537.5	41	20	41490	2680	24.14	24.23	0.09
41A-41D(PC2)	41	20	41490	2680	41490	2680	QPSK	1	0	41	20	40146	2545.6	41	20	39948	2525.8	41	20	39750	2506	25.17	25.25	0.08
41A-41D(PC2)	41	20	41490	2680	41490	2680	QPSK	1	0	41	20	41292	2660.2	41	20	41094	2640.4	41	20	39750	2506	25.17	25.15	-0.02
41E(PC3)	41	5	39750	2506	39750	2506	QPSK	1	24	41	20	39867	2517.7	41	20	40065	2537.5	41	20	40263	2557.3	24.14	24.22	0.08
41E(PC2)	41	20	41490	2680	41490	2680	QPSK	1	0	41	20	41292	2660.2	41	20	41094	2640.4	41	20	40896	2620.6	25.17	25.13	-0.04

LTE 4X4 MIMO Downlink Standalone Conducted Power(Per TCBC Workshop note May 2017)
SAR test exclusion for LTE DL 4x4 MIMO should be determined by
–UL power measurements with and without DL MIMO
–using the highest UL output power configuration without DL MIMO to confirm that UL output with DL MIMO is < ¼ dB higher
–for DL MIMO with carrier aggregation, the same SAR test exclusion procedure should be considered

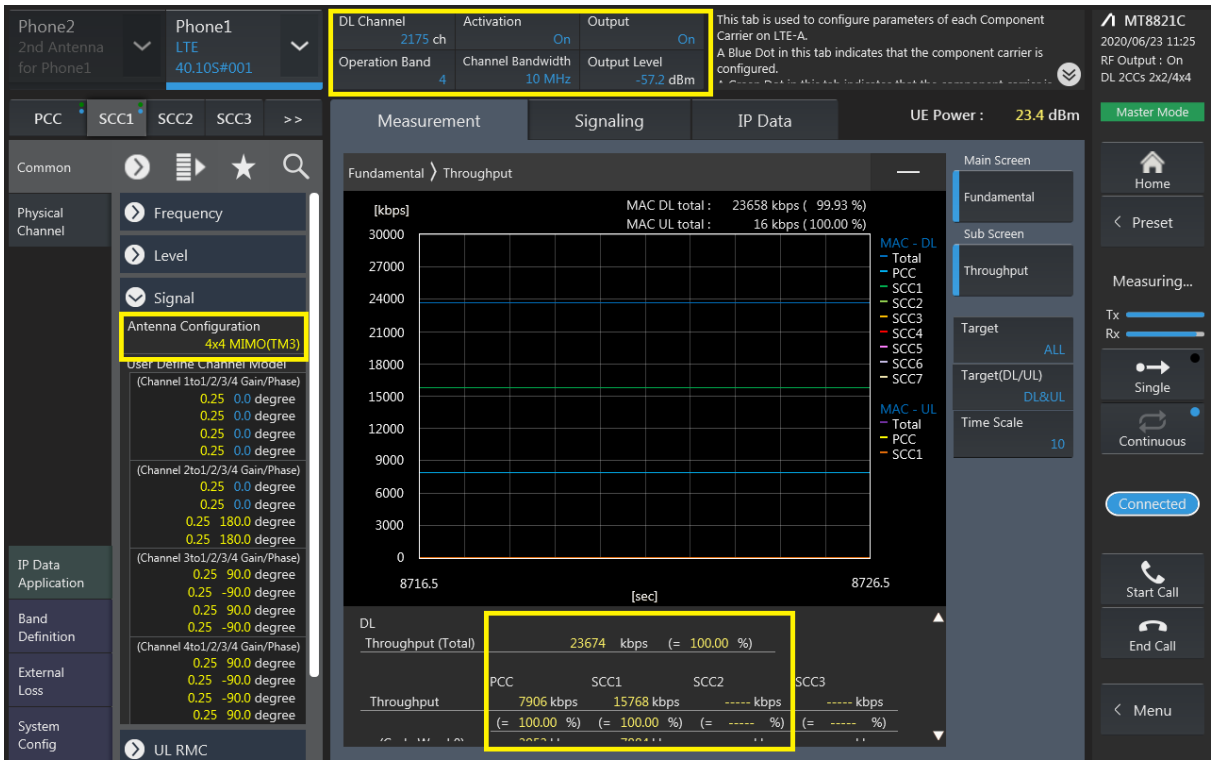


LTE Down Link 2CA 4x4 MIMO Call Setup

PCC Setting : Channel/ RB/ BW/ Modulation



SCC Setting Channel/ RB/ BW/ Modulation and call Connection

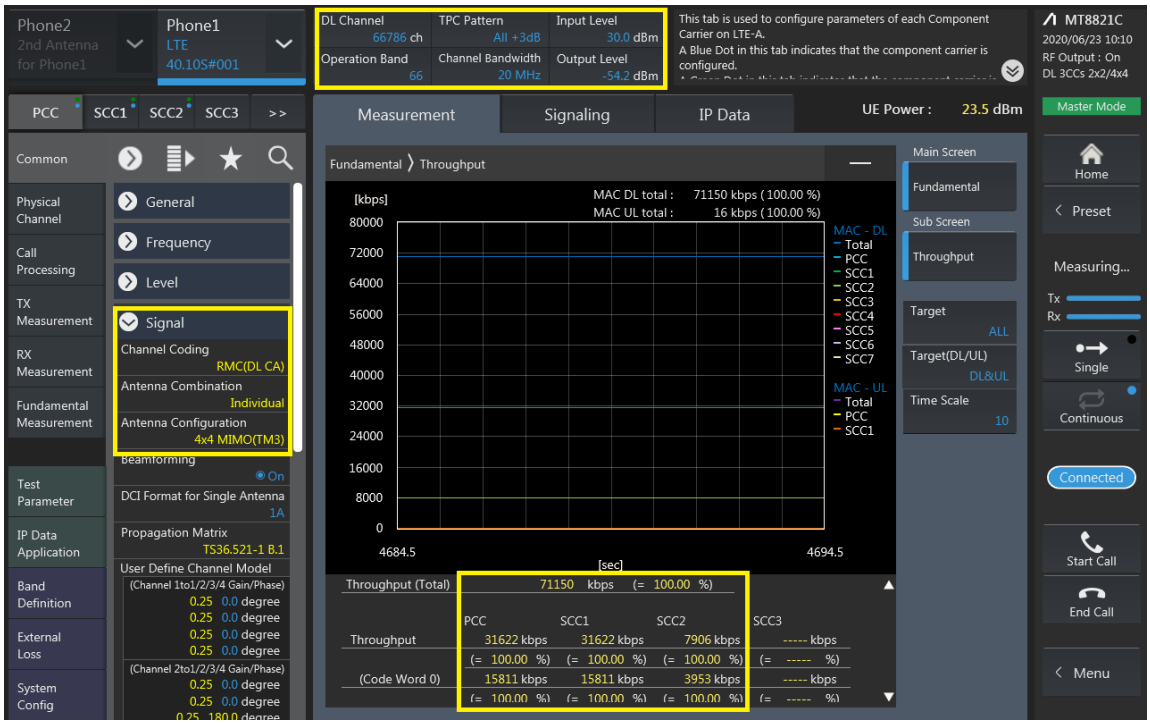


LTE Downlink 2CA 4X4 MIMO Maximum Conducted Power

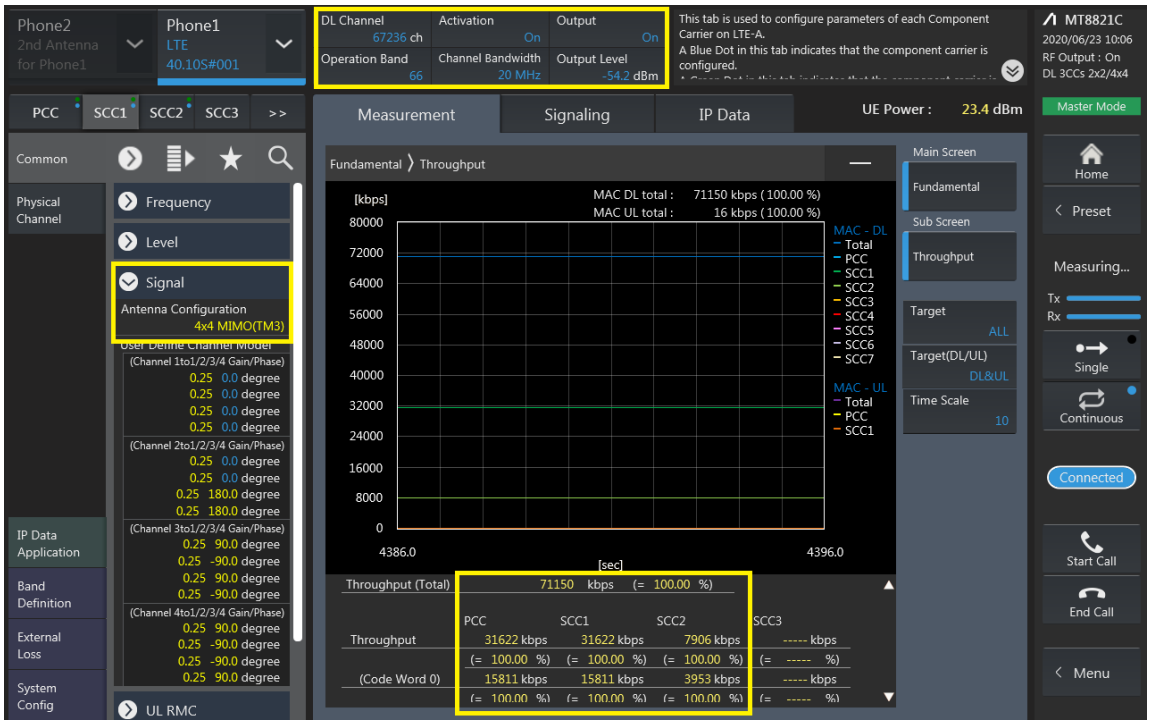
Combination	PCC									SCC				Tx Power		
	Band	BW	PCC UL Channel	PCC UL Frequency	PCC DL Channel	PCC DL Frequency	Modulation	RB	offset	Band	BW	SCC DL Channel	SCC DL Frequency	LTE Single Carrier Tx Power (dBm) (1)	LTE Tx Power with DL CA Enabled(dBm) (2)	Deviaion (2)-(1)
2A-[4A](0,2)	2	15	19125	1902.5	1125	1982.5	QPSK	1	0	4	20	2175	2132.5	22.64	22.68	0.04
2A-[4A](1)	2	10	19150	1905	1150	1985	QPSK	1	24	4	10	2175	2132.5	22.62	22.61	-0.01
2A-[4A](0,2)	4	10	20000	1715	2000	2115	QPSK	1	49	2	20	900	1960	23.39	23.45	0.06
2A-[4A](1)	4	10	20000	1715	2000	2115	QPSK	1	49	2	10	900	1960	23.39	23.44	0.05
2A-[66A](0,2)	2	15	19125	1902.5	1125	1982.5	QPSK	1	0	66	20	66786	2145	22.64	22.54	-0.10
2A-[66A](1)	2	10	19150	1905	1150	1985	QPSK	1	24	66	10	66786	2145	22.62	22.53	-0.09
2A-[66A](0,2)	66	10	132022	1715	66486	2115	QPSK	1	49	2	20	900	1960	23.23	23.21	-0.02
2A-[66A](1)	66	10	132022	1715	66486	2115	QPSK	1	49	2	10	900	1960	23.23	23.27	0.04
4A-[4A](0)	4	10	20000	1715	2000	2115	QPSK	1	49	4	20	2300	2145	23.39	23.44	0.05
4A-[4A](1)	4	10	20000	1715	2000	2115	QPSK	1	49	4	10	2350	2150	23.39	23.49	0.10
[4A]-4A(0)	4	10	20000	1715	2000	2115	QPSK	1	49	4	20	2300	2145	23.39	23.37	-0.02
[4A]-4A(1)	4	10	20000	1715	2000	2115	QPSK	1	49	4	10	2350	2150	23.39	23.43	0.04
[4A]-[4A](0)	4	10	20000	1715	2000	2115	QPSK	1	49	4	20	2300	2145	23.39	23.42	0.03
[4A]-[4A](1)	4	10	20000	1715	2000	2115	QPSK	1	49	4	10	2350	2150	23.39	23.4	0.01
[4A]-5A(0,1)	4	10	20000	1715	2000	2115	QPSK	1	49	5	10	2525	881.5	23.39	23.3	-0.09
[4A]-5A(0)	5	10	20525	836.5	2525	881.5	QPSK	1	0	4	10	2175	2132.5	24.73	24.82	0.09
[4A]-5A(1)	5	10	20525	836.5	2525	881.5	QPSK	1	0	4	20	2175	2132.5	24.73	24.72	-0.01
[4A]-12A(0,1,2,3,4)	4	10	20000	1715	2000	2115	QPSK	1	49	12	10	5095	737.5	23.39	23.44	0.05
[4A]-12A(5)	4	10	20000	1715	2000	2115	QPSK	1	49	12	5	5095	737.5	23.39	23.29	-0.10
[4A]-12A(0,3)	12	5	23035	701.5	5035	731.5	QPSK	1	0	4	10	2175	2132.5	24.31	24.37	0.06
[4A]-12A(1,2,4)	12	5	23035	701.5	5035	731.5	QPSK	1	0	4	20	2175	2132.5	24.31	24.25	-0.06
[4A]-12A(5)	12	5	23035	701.5	5035	731.5	QPSK	1	0	4	15	2175	2132.5	24.31	24.25	-0.06
[4A]-13A(0,1)	4	10	20000	1715	2000	2115	QPSK	1	49	13	10	5230	751	23.39	23.33	-0.06
[4A]-13A(0)	13	10	23230	782	5230	751	QPSK	1	49	4	20	2175	2132.5	24.11	24.05	-0.06
[4A]-13A(1)	13	10	23230	782	5230	751	QPSK	1	49	4	10	2175	2132.5	24.11	24.11	0.00
[4A]-17A	4	10	20000	1715	2000	2115	QPSK	1	49	17	10	5790	740	23.39	23.36	-0.03
[4A]-17A	17	10	23790	710	5790	740	QPSK	1	0	4	10	2175	2132.5	24.12	24.2	0.08
5A-[66A]	5	10	20525	836.5	2525	881.5	QPSK	1	0	66	20	66786	2145	24.73	24.73	0.00
5A-[66A]	66	10	132022	1715	66486	2115	QPSK	1	49	5	10	2525	881.5	23.23	23.14	-0.09
12A-[66A](0,3)	12	5	23035	701.5	5035	731.5	QPSK	1	0	66	10	66786	2145	24.31	24.34	0.03
12A-[66A](1,2,4)	12	5	23035	701.5	5035	731.5	QPSK	1	0	66	20	66786	2145	24.31	24.36	0.05
12A-[66A](5)	12	5	23035	701.5	5035	731.5	QPSK	1	0	66	15	66786	2145	24.31	24.33	0.02
12A-[66A](0,3)	66	10	132022	1715	66486	2115	QPSK	1	49	12	10	5095	737.5	23.23	23.31	0.08
12A-[66A](1,2,4)	66	10	132022	1715	66486	2115	QPSK	1	49	12	10	5095	737.5	23.23	23.24	0.01
12A-[66A](5)	66	15	132047	1717.5	66511	2117.5	QPSK	1	74	12	5	5095	737.5	23.22	23.18	-0.04
66A-[66A]	66	10	132022	1715	66486	2115	QPSK	1	49	66	20	67236	2190	23.23	23.33	0.10
[66A]-66A	66	10	132022	1715	66486	2115	QPSK	1	49	66	20	67236	2190	23.23	23.17	-0.06
[66A]-[66A]	66	10	132022	1715	66486	2115	QPSK	1	49	66	20	67236	2190	23.23	23.27	0.04

LTE Down Link 3CA 4x4 MIMO Call Setup

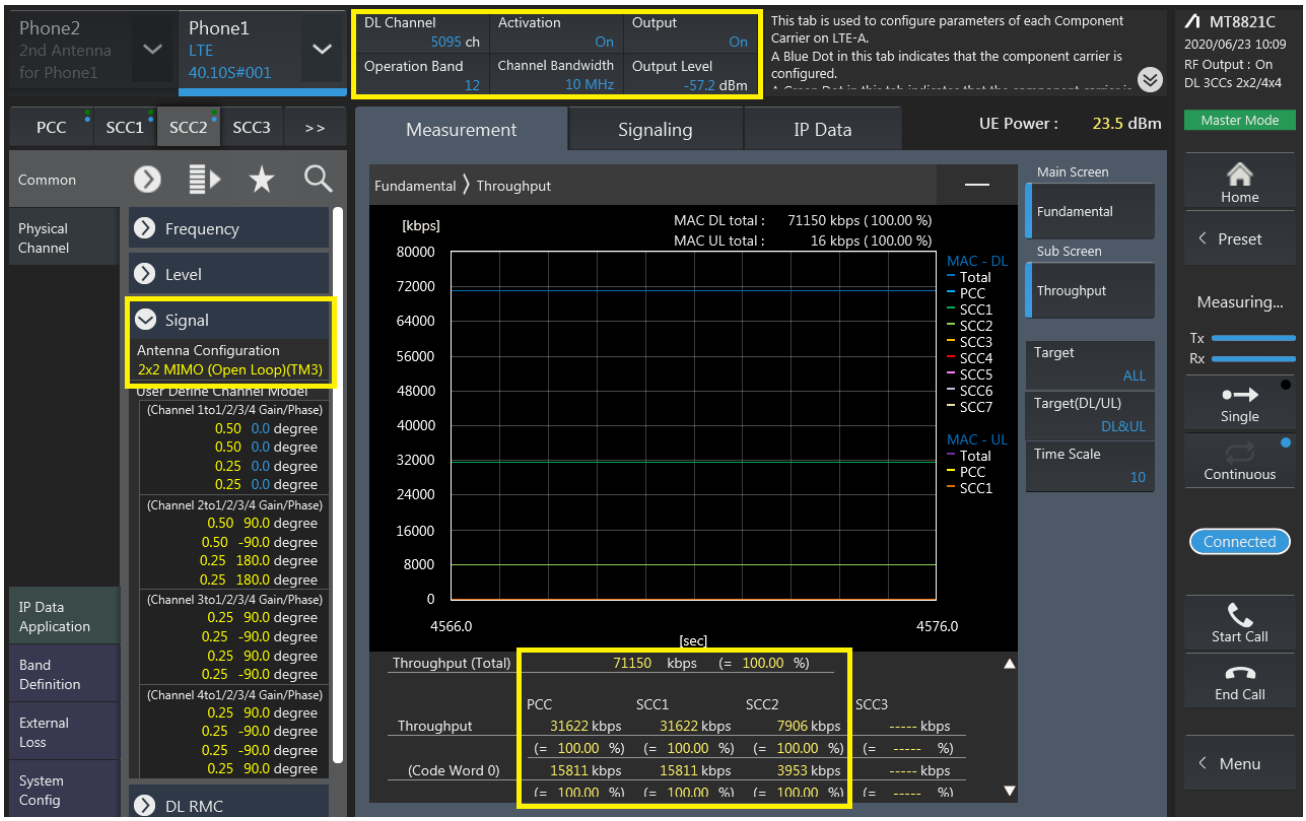
PCC Setting: Channel /RB/BW/Modulation



SCC1 Setting : Channel /RB/BW/Modulation



SCC2 Setting (Channel /RB/BW/Modulation and call Connection



LTE Downlink 3CA 4X4 MIMO Maximum Conducted Power

Combination	PCC									SCC				SCC				Tx Power		
	Band	BW	PCC UL Channel	PCC UL Frequency	PCC DL Channel	PCC DL Frequency	Modulation	RB	offset	Band	BW	SCC DL Channel	SCC DL Frequency	Band	BW	SCC DL Channel	SCC DL Frequency	LTE Single Carrier Tx Power (dBm) (1)	LTE Tx Power with DL CA Enabled(dBm) (2)	Deviaion (2)-(1)
2A-[4A]-5A	2	15	19125	1902.5	1125	1982.5	QPSK	1	0	4	20	2175	2132.5	5	10	2525	881.5	22.64	22.63	-0.01
2A-[4A]-5A	4	10	20000	1715	2000	2115	QPSK	1	49	2	20	900	1960	5	10	2525	881.5	23.39	23.32	-0.07
2A-[4A]-5A	5	10	20525	836.5	2525	881.5	QPSK	1	0	2	20	900	1960	4	20	2175	2132.5	24.73	24.82	0.09
2A-[4A]-13A	2	15	19125	1902.5	1125	1982.5	QPSK	1	0	4	20	2175	2132.5	13	10	5230	751	22.64	22.64	0.00
2A-[4A]-13A	4	10	20000	1715	2000	2115	QPSK	1	49	2	20	900	1960	13	10	5230	751	23.39	23.32	-0.07
2A-[4A]-13A	13	10	23230	782	5230	751	QPSK	1	49	2	20	900	1960	4	20	2175	2132.5	24.11	24.01	-0.10
5A-66A-[66A]	5	10	20525	836.5	2525	881.5	QPSK	1	0	66	20	66786	2145	66	20	67236	2190	24.73	24.81	0.08
5A-[66A]-66A	5	10	20525	836.5	2525	881.5	QPSK	1	0	66	20	66786	2145	66	20	67236	2190	24.73	24.71	-0.02
5A-[66A]-[66A]	5	10	20525	836.5	2525	881.5	QPSK	1	0	66	20	66786	2145	66	20	67236	2190	24.73	24.64	-0.09
5A-66A-[66A]	66	10	132022	1715	66486	2115	QPSK	1	49	66	20	67236	2190	5	10	2525	881.5	23.23	23.14	-0.09
5A-[66A]-66A	66	10	132022	1715	66486	2115	QPSK	1	49	66	20	67236	2190	5	10	2525	881.5	23.23	23.26	0.03
5A-[66A]-[66A]	66	10	132022	1715	66486	2115	QPSK	1	49	66	20	67236	2190	5	10	2525	881.5	23.23	23.17	-0.06
12A-66A-[66A]	12	5	23035	701.5	5035	731.5	QPSK	1	0	66	20	66786	2145	66	20	67236	2190	24.31	24.27	-0.04
12A-[66A]-66A	12	5	23035	701.5	5035	731.5	QPSK	1	0	66	20	66786	2145	66	20	67236	2190	24.31	24.28	-0.03
12A-[66A]-[66A]	12	5	23035	701.5	5035	731.5	QPSK	1	0	66	20	66786	2145	66	20	67236	2190	24.31	24.29	-0.02
12A-66A-[66A]	66	10	132022	1715	66486	2115	QPSK	1	49	66	20	67236	2190	12	10	5095	737.5	23.23	23.21	-0.02
12A-[66A]-66A	66	10	132022	1715	66486	2115	QPSK	1	49	66	20	67236	2190	12	10	5095	737.5	23.23	23.21	-0.02
12A-[66A]-[66A]	66	10	132022	1715	66486	2115	QPSK	1	49	66	20	67236	2190	12	10	5095	737.5	23.23	23.29	0.06