

Appendix I. – Down-link CA Power Measurement / 5G NR Call Box Setup

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:

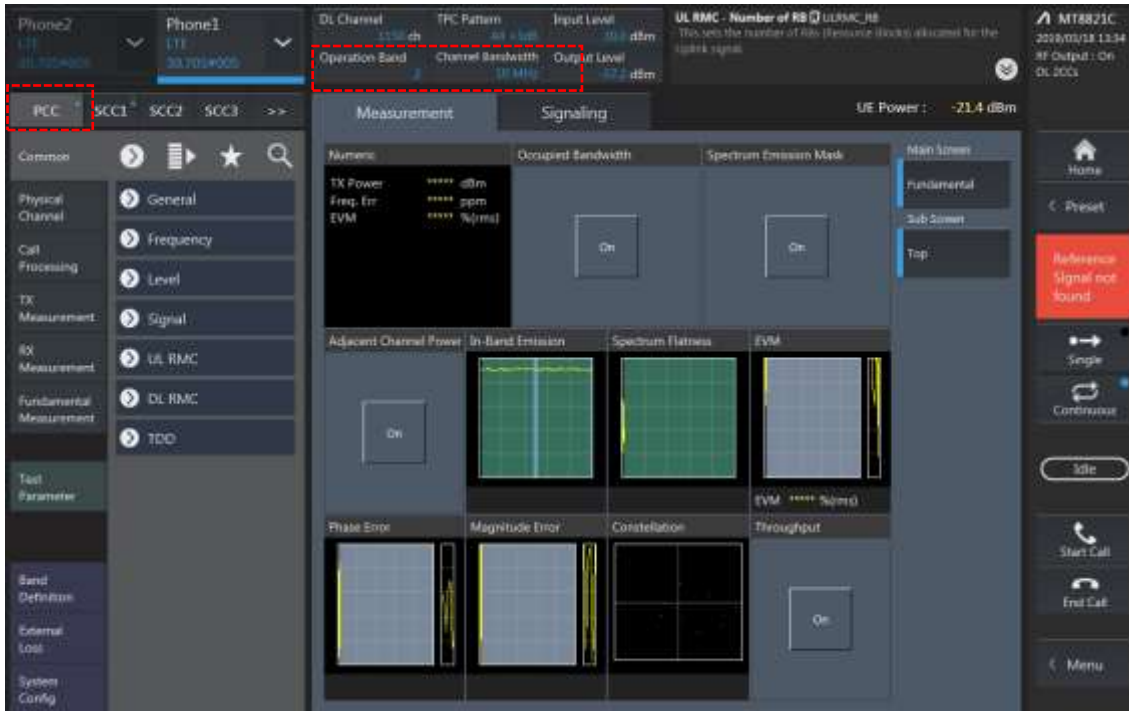
1. This device only supports downlink carrier aggregation. For every supported combination of downlink carrier aggregation, power measurements were performed with the downlink carrier aggregation active for the configuration with highest measured maximum conducted power with downlink carrier aggregation 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.



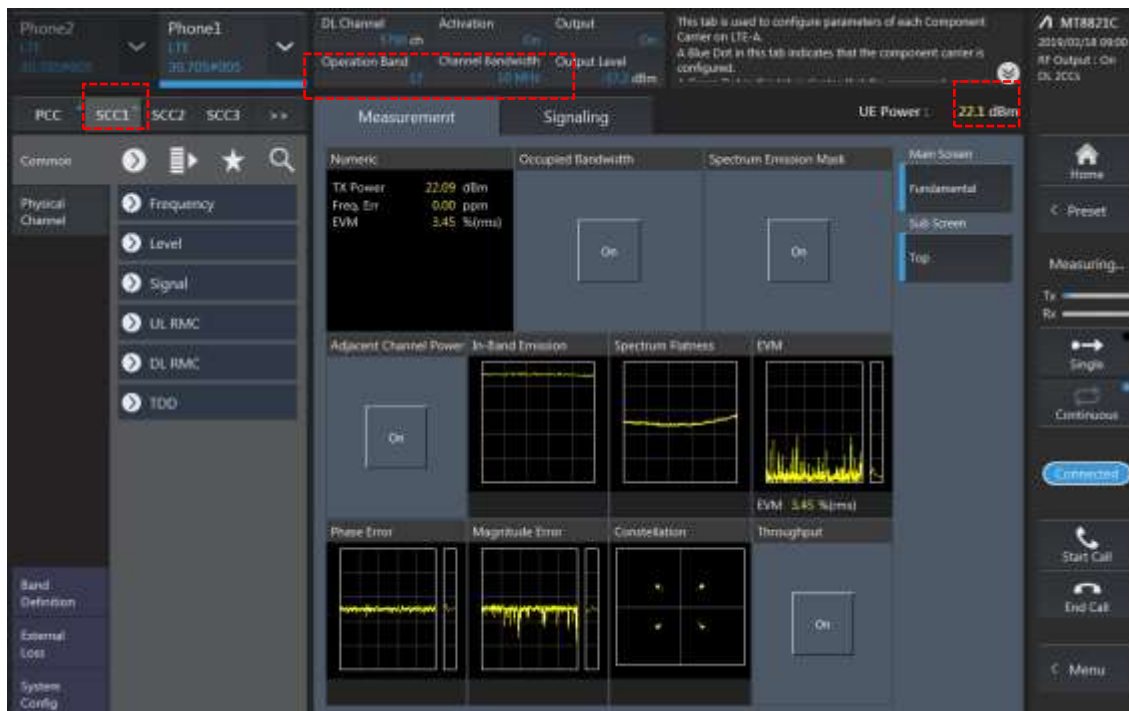
Power Measurement setup

LTE Down Link 2CA Call Setup

PCC Setting : Channel/ RB/ BW/ Modulation



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

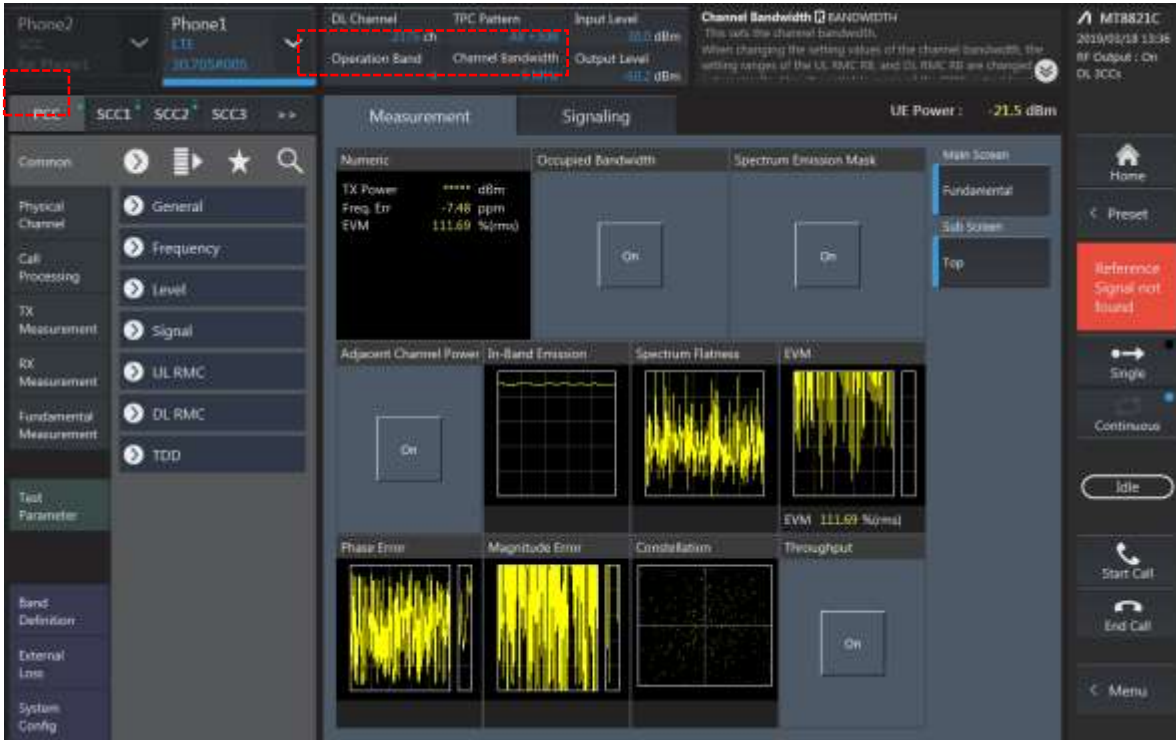


2CA Downlink Carrier aggregation Maximum conducted Powers

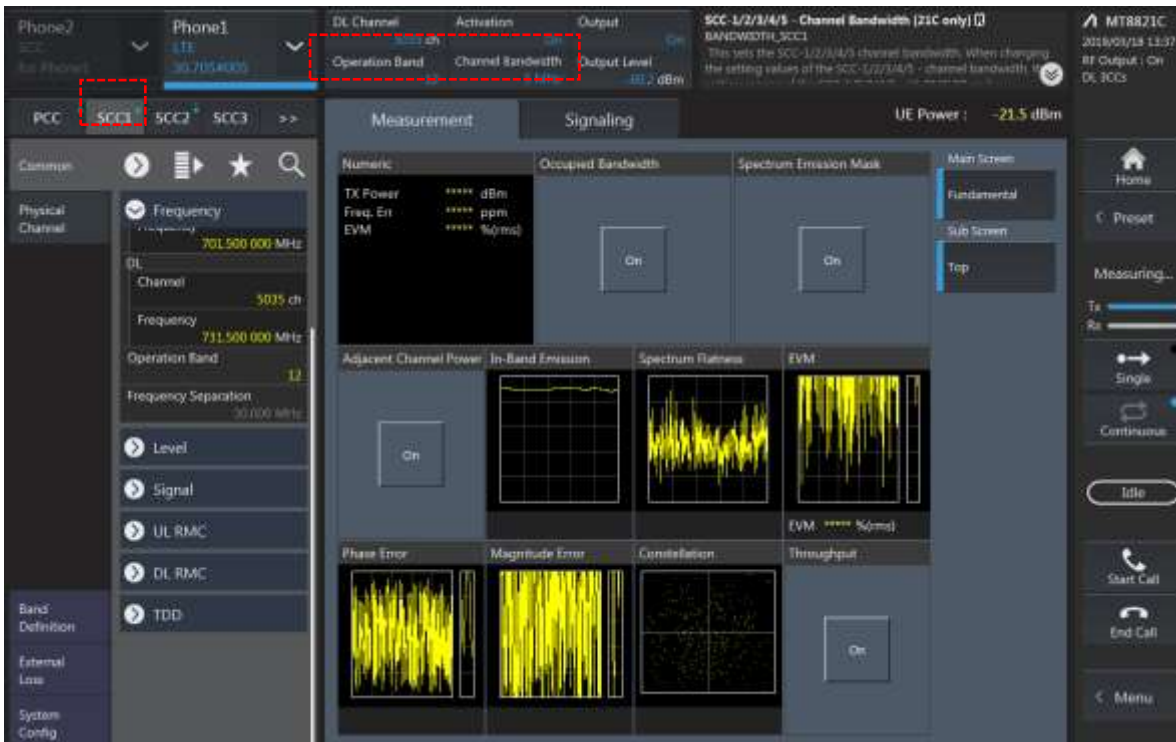
Combination	PCC									SCC				LTE Tx Power		
	Band	BW	UL Ch.	UL Freq.	DL Ch.	DL Freq.	Mod.	RB	H	Band	BW	DL Ch.	DL Freq.	Single Carrier (dBm)	Power with DL CA Enabled (dBm)	Deviation
2A-2A	2	10	19150	1905	1150	1985	QPSK	1	24	2	20	700	1940	24.32	24.35	0.03
2C	2	10	19150	1905	1150	1985	QPSK	1	24	2	20	1006	1970.6	24.32	24.25	-0.07
2A-4A(0,2)	2	10	19150	1905	1150	1985	QPSK	1	24	4	20	2175	2132.5	24.32	24.33	0.01
2A-4A(1)	2	10	19150	1905	1150	1985	QPSK	1	24	4	10	2175	2132.5	24.32	24.31	-0.01
2A-4A(0,2)	4	10	20350	1750	2350	2150	QPSK	1	24	2	20	900	1960	24.3	24.15	-0.15
2A-4A(1)	4	10	20350	1750	2350	2150	QPSK	1	24	2	10	900	1960	24.3	24.25	-0.05
2A-5A(0,1)	2	10	19150	1905	1150	1985	QPSK	1	24	5	10	2525	881.5	24.32	24.3	-0.02
2A-5A(0)	5	10	20600	844	2600	889	QPSK	1	0	2	20	900	1960	24.86	24.79	-0.07
2A-5A(1)	5	10	20600	844	2600	889	QPSK	1	0	2	10	900	1960	24.86	24.84	-0.02
2A-12A(0,1,2)	2	10	19150	1905	1150	1985	QPSK	1	24	12	10	5095	737.5	24.32	24.3	-0.02
2A-12A(0,1)	12	5	23155	707.5	5155	743.5	QPSK	1	0	2	20	900	1960	24.01	24	-0.01
2A-12A(2)	12	5	23155	707.5	5155	743.5	QPSK	1	0	2	10	900	1960	24.01	24.12	0.11
2A-17A	2	10	19150	1905	1150	1985	QPSK	1	24	17	10	5790	740	24.32	24.29	-0.03
2A-17A	17	5	23825	713.5	5825	743.5	QPSK	1	12	2	10	900	1960	23.96	23.88	-0.08
2A-66A(0,2)	2	10	19150	1905	1150	1985	QPSK	1	24	66	20	66786	2145	24.32	24.31	-0.01
2A-66A(1)	2	10	19150	1905	1150	1985	QPSK	1	24	66	10	66786	2145	24.32	24.3	-0.02
2A-66A(0,2)	66	5	132647	1777.5	67111	2177.5	QPSK	1	12	2	20	900	1960	24.23	24.15	-0.08
2A-66A(1)	66	5	132647	1777.5	67111	2177.5	QPSK	1	12	2	10	900	1960	24.23	24.18	-0.05
4A-4A(0)	4	10	20350	1750	2350	2150	QPSK	1	24	4	20	2050	2120	24.3	24.18	-0.12
4A-4A(1)	4	10	20350	1750	2350	2150	QPSK	1	24	4	10	2000	2115	24.3	24.18	-0.12
4A-5A(0,1)	4	10	20350	1750	2350	2150	QPSK	1	24	5	10	2525	881.5	24.3	24.25	-0.05
4A-5A(0)	5	10	20600	844	2600	889	QPSK	1	0	4	10	2175	2132.5	24.86	24.88	0.02
4A-5A(1)	5	10	20600	844	2600	889	QPSK	1	0	4	20	2175	2132.5	24.86	24.87	0.01
4A-12A(0,1,2,3,4)	4	10	20350	1750	2350	2150	QPSK	1	24	12	10	5095	737.5	24.3	24.32	0.02
4A-12A(5)	4	10	20350	1750	2350	2150	QPSK	1	24	12	5	5095	737.5	24.3	24.28	-0.02
4A-12A(0,3)	12	5	23155	707.5	5155	743.5	QPSK	1	0	4	10	2175	2132.5	24.01	24.05	0.04
4A-12A(1,2,4)	12	5	23155	707.5	5155	743.5	QPSK	1	0	4	20	2175	2132.5	24.01	23.97	-0.04
4A-12A(5)	12	5	23155	707.5	5155	743.5	QPSK	1	0	4	15	2175	2132.5	24.01	24.05	0.04
4A-17A	4	10	20350	1750	2350	2150	QPSK	1	24	17	10	5790	740	24.3	24.28	-0.02
4A-17A	17	5	23825	713.5	5825	743.5	QPSK	1	12	4	10	2175	2132.5	23.96	23.89	-0.07
5A-41A	5	10	20600	844	2600	889	QPSK	1	0	41	20	40620	40620	24.86	24.85	-0.01
5A-66A	5	10	20600	844	2600	889	QPSK	1	0	66	20	66786	2145	24.86	24.88	0.02
5A-66A	66	5	132647	1777.5	67111	2177.5	QPSK	1	12	5	10	2525	881.5	24.23	24.21	-0.02
12A-66A(0,3)	12	5	23155	707.5	5155	743.5	QPSK	1	0	66	10	66786	2145	24.01	24.05	0.04
12A-66A(1,2,4)	12	5	23155	707.5	5155	743.5	QPSK	1	0	66	20	66786	2145	24.01	24.09	0.08
12A-66A(5)	12	5	23155	707.5	5155	743.5	QPSK	1	0	66	15	66786	2145	24.01	24.15	0.14
12A-66A(0,1,2,3,4)	66	5	132647	1777.5	67111	2177.5	QPSK	1	12	12	10	5095	737.5	24.23	24.15	-0.08
12A-66A(5)	66	5	132647	1777.5	67111	2177.5	QPSK	1	12	12	5	5095	737.5	24.23	24.11	-0.12
26A-41A	26	10	26865	831.5	8865	876.5	QPSK	1	0	41	20	40620	2593	24.57	24.55	-0.02
41A-41A	41	5	40620	2593	40620	2593	QPSK	1	12	41	20	41490	2680	24.11	24.15	0.04
41C	41	5	40620	2593	40620	2593	QPSK	1	12	41	20	40818	2612.8	24.11	24.08	-0.03
66A-66A	66	5	132647	1777.5	67111	2177.5	QPSK	1	12	66	20	66536	2170	24.23	24.15	-0.08
66B	66	5	132647	1777.5	67111	2177.5	QPSK	1	12	66	5	67061	2172.5	24.23	24.21	-0.02
66C	66	5	132647	1777.5	67111	2177.5	QPSK	1	12	66	20	66994	2185.6	24.23	24.22	-0.01

LTE Down Link 3CA Call Setup

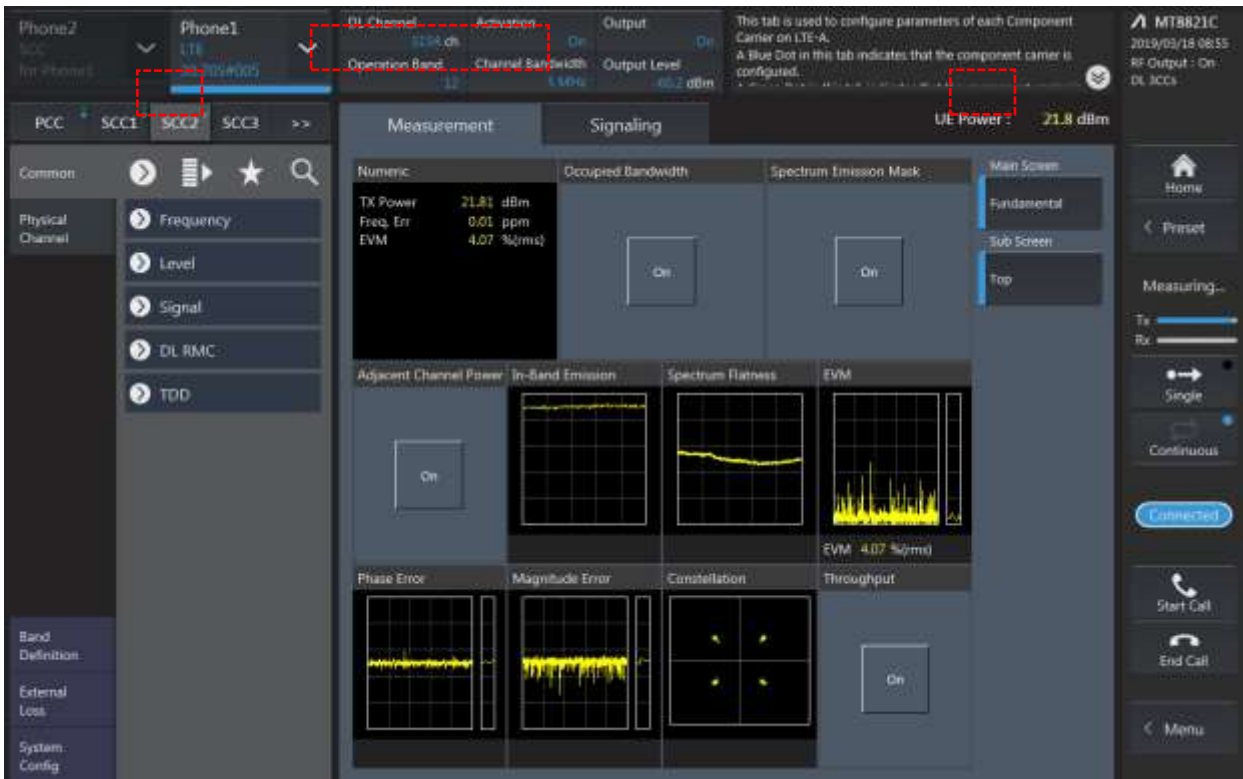
1) PCC Setting: Channel /RB/BW/Modulation



2) SCC1 Setting : Channel /RB/BW/Modulation



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



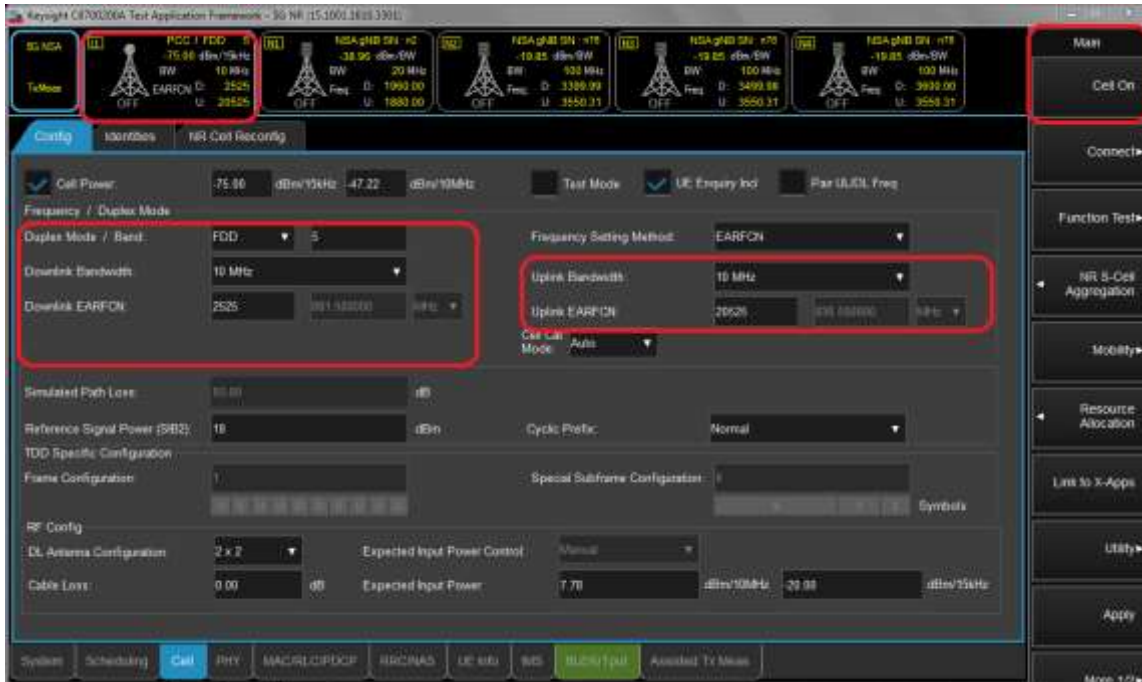
3CA Downlink Carrier aggregation Maximum conducted Powers

Combination	PCC									SCC				SCC				Tx Power		Delta (2)-(1)
	Band	BW	PCC UL Ch.	PCC UL Freq.	PCC DL Ch.	PCC DL Freq.	Modulation	RB	RB offset	Band	BW	SCC DL Ch.	SCC DL Freq.	Band	BW	SCC DL Ch.	SCC DL Freq.	LTE Single Carrier Tx Power (dBm) (1)	LTE Tx Power with DL CA Enabled (dBm) (2)	
2A-4A-5A	2	10	19150	1905	1150	1985	QPSK	1	24	4	20	2175	2132.5	5	10	2525	881.5	24.32	24.35	0.03
2A-4A-5A	4	10	20350	1750	2350	2150	QPSK	1	24	2	20	900	1960	5	10	2525	881.5	24.3	24.15	-0.15
2A-4A-5A	5	10	20600	844	2600	889	QPSK	1	0	2	20	900	1960	4	20	2175	2132.5	24.86	24.77	-0.09
4A-4A-12A	4	10	20350	1750	2350	2150	QPSK	1	24	4	20	2050	2120	12	10	5095	737.5	24.3	24.15	-0.15
4A-4A-12A	12	5	23155	707.5	5155	743.5	QPSK	1	0	4	10	2350	2150	4	20	2050	2120	24.01	24.05	0.04
5A-66A-66A	5	10	20600	844	2600	889	QPSK	1	0	66	20	66786	2145	66	20	66536	2120	24.86	24.84	-0.02
5A-66A-66A	66	5	132647	1777.5	67111	2177.5	QPSK	1	12	66	20	66536	2120	5	10	2525	881.5	24.23	24.25	0.02
12A-66A-66A	12	5	23155	707.5	5155	743.5	QPSK	1	0	66	20	66786	2145	66	20	66536	2120	24.01	24	-0.01
12A-66A-66A	66	5	132647	1777.5	67111	2177.5	QPSK	1	12	66	20	66536	2120	12	10	5095	737.5	24.23	24.15	-0.08
26A-41C	26	10	26865	831.5	8865	876.5	QPSK	1	0	41	20	40620	2593	41	20	40818	2612.8	24.57	24.44	-0.13
41A-41C(PC3)	41	5	40620	2593	40620	2593	QPSK	1	12	41	20	41490	2680	41	20	41292	2660.2	24.11	24.15	0.04
41A-41C(PC3)	41	5	40620	293	40620	2593	QPSK	1	12	41	20	40503	2581.3	10	20	41490	2680	24.11	24.15	0.04
41A-41A-41A	41	5	40620	293	40620	2593	QPSK	1	12	41	20	41490	2680	41	20	39750	2506	24.11	24.12	0.01
41D(PC3)	41	20	40185	2549.5	40185	2549.5	QPSK	1	0	41	20	40383	2569.3	41	20	40581	2589.1	23.82	23.85	0.03

2. 5G NR Call Box Setup

Procedure used to establish output Power measurement for NR Bands
Select operating band, BW and Channel.

- Click Cell on button in the right of Test application screen.
- Turn the LTE Cell On using “ON/OFF” Key.



- Turn the Airplane Mode On and then turn the Airplane mode off.
- Select All down bits for UL Power control Mode in LTE.

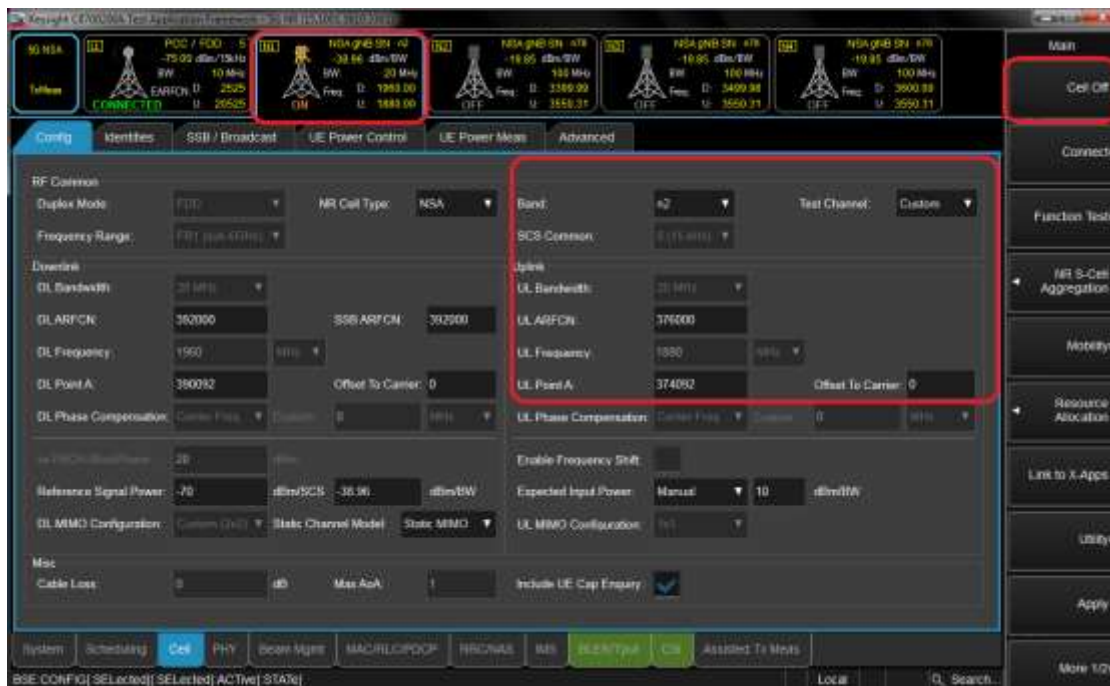


Setup for NR Band

- Select waveform for Setting NR Band (PHY->PUSCH->Enable Transform Precoder)
 - Enable : DFT-s-OFDM, Disable : CP-OFDM

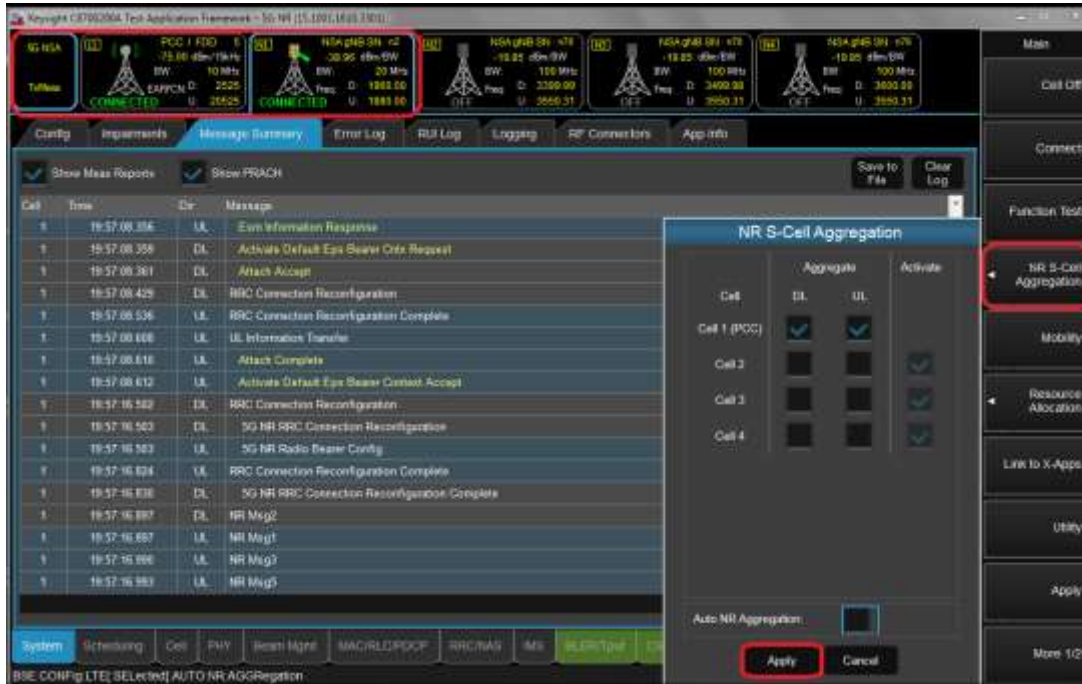


- Select operating band, BW, SCS and Channel.
- Turn the NR Cell On using “ON/OFF” Key.



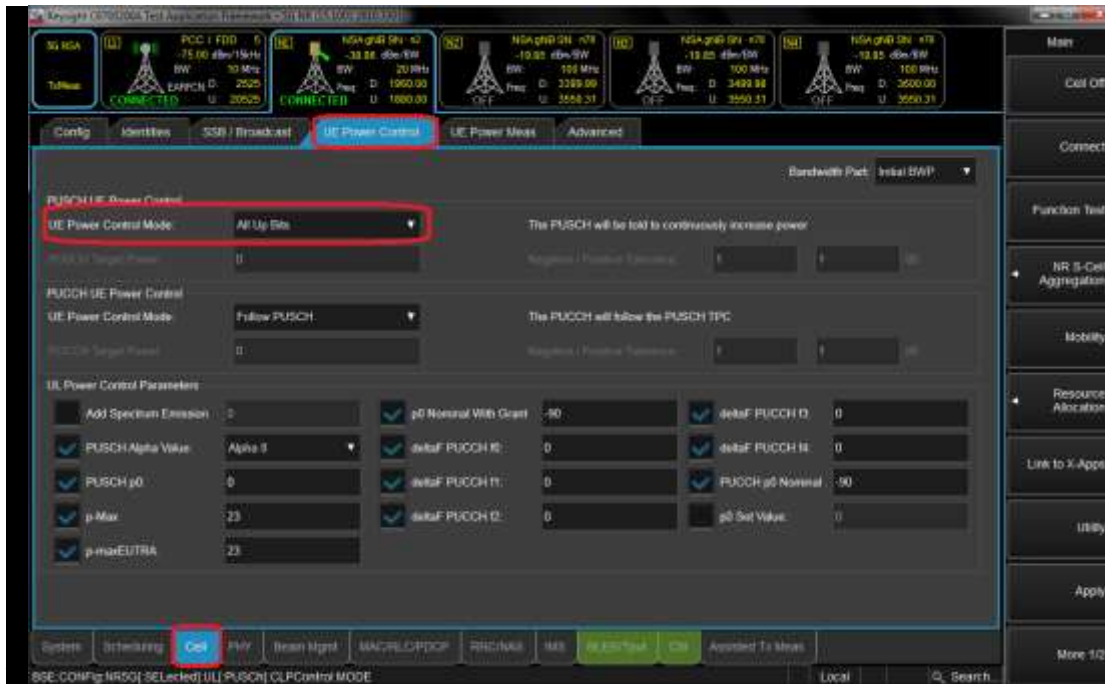
Connect NR S-Cell Aggregation

- Click NR S-Cell Aggregation
- Check the Cell 1's DL and UL box(PCC) and than Click Apply.
- Check the message summary If message shows NR Msg 5, It is connected.



Max Power setting

- Click "Cell in the bottom of screen.
- Click "UE Power control" than change UE Power control mode to All Up bits.



Selecting Start RB/Count/MCS

- Select the each test configuring (Start RB, Count, MCS).



View Tx Power

- Click “Link to X-Apps.”(Please refer to Figure-7)
- Select “Channel Power”.

