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.

A Base station simulator was used to establish a conducted RF connection and output power was monitored. The power measurements were confirmed to be within expected tolerance for all DSI. before and after a power reduction mechanism was triggered. For the combination cases, one mechanism was switched to a 'triggered' state at a time; powers were confirmed to be within tolerances after each additional mechanism was activated

1. Power Reduction Verification for Main ANT

This device utilizes a power reduction mechanism for some wireless modes under DSI(Device State Index).

For this device DSI = 0 is configured when the device cannot detect the use conditions, and DSI = 3 is configured when Hotspot mode activated. DSI = 2 is configured when receiver mode on.

Table 1.1 Power Reduction Verification for Antenna A

Mechanism		Band	Device State Index(DSI)		
1st	2nd		Free state	Mechanism-1st	Mechanism-2nd
RCV ON	Hotspot On	GSM 850 GPRS/EDGE	0	2	2
Hotspot On	RCV ON	GSM 850 GPRS/EDGE	0	3	2
RCV ON	Hotspot On	GSM 1900 GPRS/EDGE	0	2	2
Hotspot On	RCV ON	GSM 1900 GPRS/EDGE	0	3	2
RCV ON	Hotspot On	UMTS Band 5	0	2	2
Hotspot On	RCV ON	UMTS Band 5	0	3	2
RCV ON	Hotspot On	LTE Band 12	0	2	2
Hotspot On	RCV ON	LTE Band 12	0	3	2
RCV ON	Hotspot On	LTE Band 13	0	2	2
Hotspot On	RCV ON	LTE Band 13	0	3	2
RCV ON	Hotspot On	LTE Band 5	0	2	2
Hotspot On	RCV ON	LTE Band 5	0	3	2
RCV ON	Hotspot On	LTE Band 66	0	2	2
Hotspot On	RCV ON	LTE Band 66	0	3	2
RCV ON	Hotspot On	LTE Band 4	0	2	2
Hotspot On	RCV ON	LTE Band 4	0	3	2
RCV ON	Hotspot On	LTE Band 2	0	2	2
Hotspot On	RCV ON	LTE Band 2	0	3	2
RCV ON	Hotspot On	NR Band n5	0	2	2
Hotspot On	RCV ON	NR Band n5	0	3	2
RCV ON	Hotspot On	NR Band n66	0	2	2
Hotspot On	RCV ON	NR Band n66	0	3	2

Table 1.2 Power Reduction Verification for Antenna B

Mechanism		Band	DSI		
#1	#2		FREE	#1	#2
RCV ON	Hotspot On	LTE Band 41	0	2	2
Hotspot On	RCV ON	LTE Band 41	0	3	2
RCV ON	Hotspot On	NR Band n41	0	2	2
Hotspot On	RCV ON	NR Band n41	0	3	2

Table 1.3 Power Reduction Verification for Antenna I

Mechanism		Band	DSI		
#1	#2		FREE	#1	#2
RCV ON	Hotspot On	LTE Band 2	0	2	2
Hotspot On	RCV ON	LTE Band 2	0	3	2
RCV ON	Hotspot On	LTE Band 4	0	2	2
Hotspot On	RCV ON	LTE Band 4	0	3	2
RCV ON	Hotspot On	LTE Band 41	0	2	2
Hotspot On	RCV ON	LTE Band 41	0	3	2
RCV ON	Hotspot On	LTE Band 66	0	2	2
Hotspot On	RCV ON	LTE Band 66	0	3	2
RCV ON	Hotspot On	NR Band n41	0	2	2
Hotspot On	RCV ON	NR Band n41	0	3	2
RCV ON	Hotspot On	NR Band n66	0	2	2
Hotspot On	RCV ON	NR Band n66	0	3	2

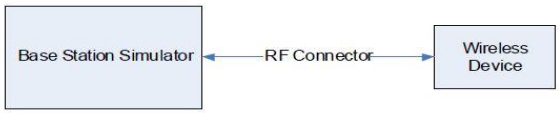
Appendix I. – Down-link CA Power Measurement / 5G NR Call Box Setup

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:

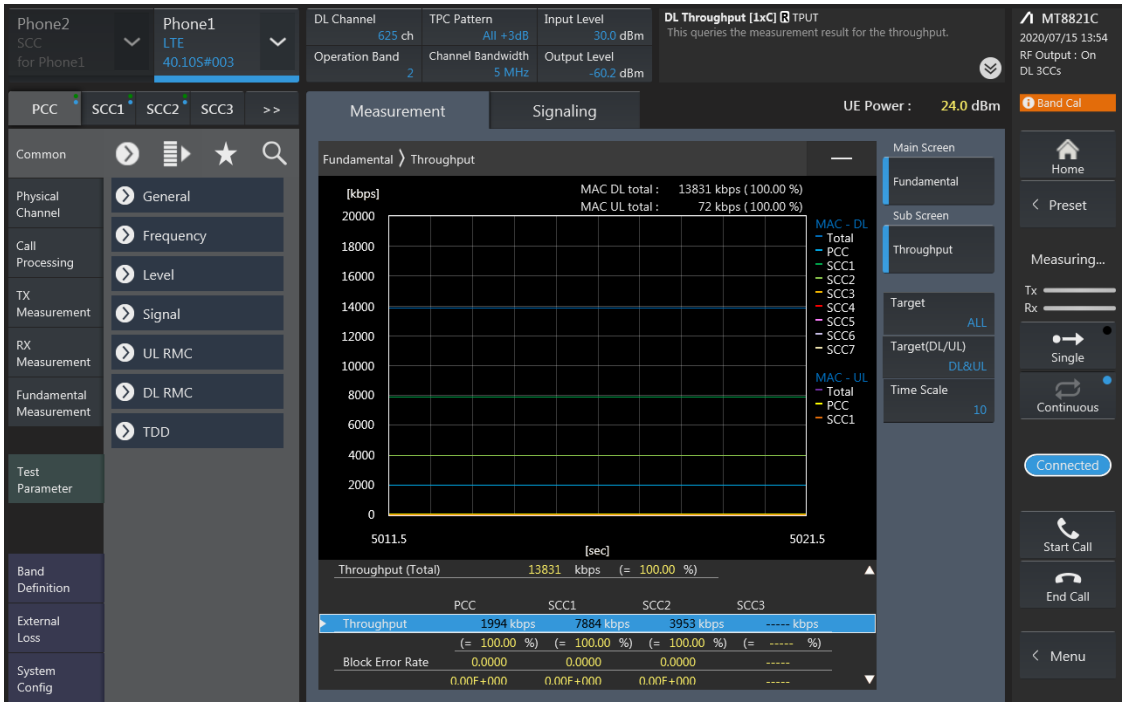
1. This device only supports downlink carrier aggregation. For every supported combination of downlink carrier aggregation, power measurements were performed with the downlink carrier aggregation active for the configuration with highest measured maximum conducted power with downlink carrier aggregation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



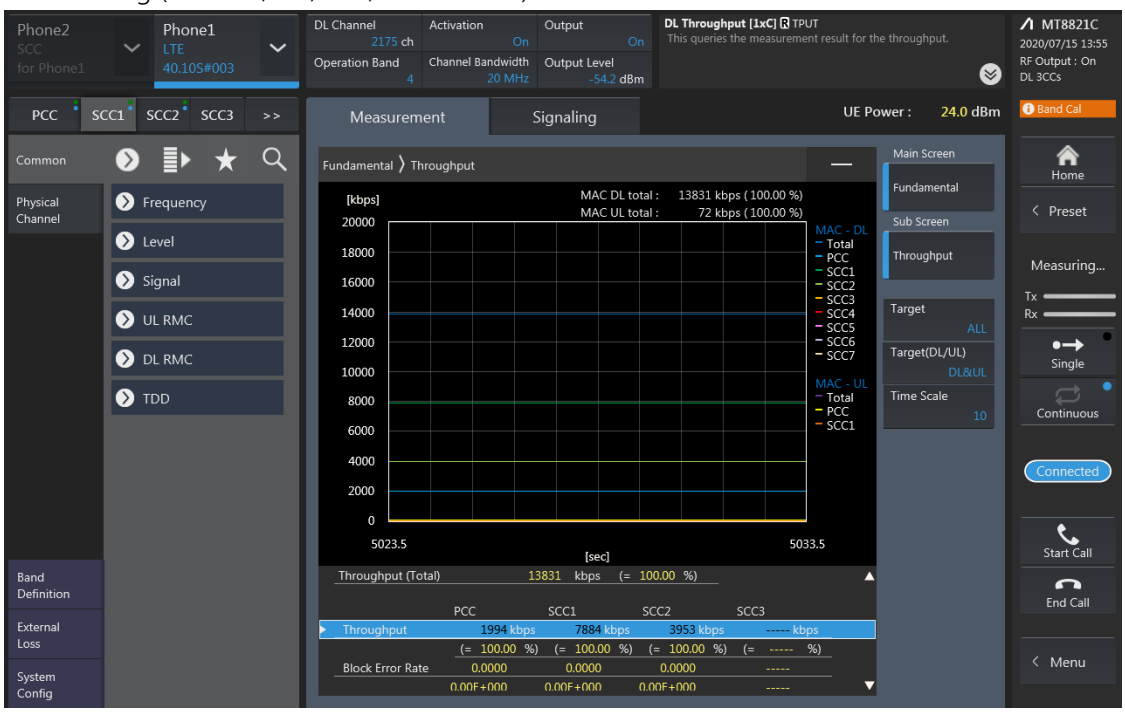
Power Measurement setup

LTE Down Link 3CA Call Setup

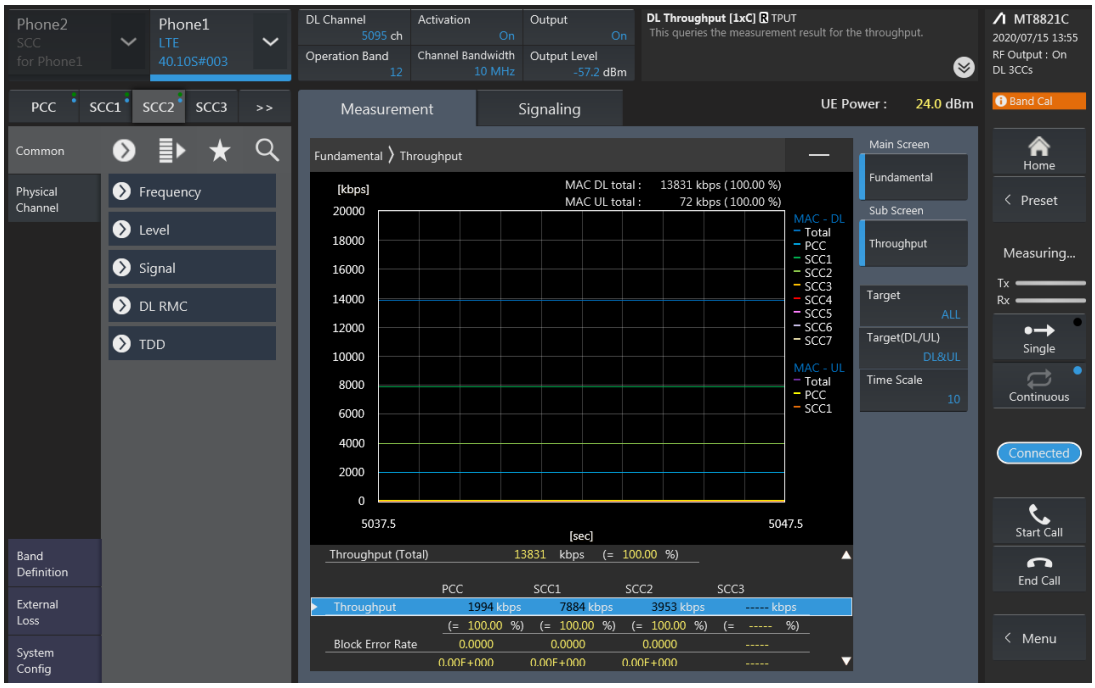
PCC Setting (Channel/ RB/ BW/ Modulation)



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



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



Single 3CA Downlink Carrier aggregation 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 (dB) (2)-(1)
41D	41	20	39750	2506	39750	2506	QPSK	1	0	41	20	39948	2525.8	41	20	40146	2545.6	20.77	20.68	-0.09

4x4 MIMO 3CA Downlink Carrier aggregation conducted Power

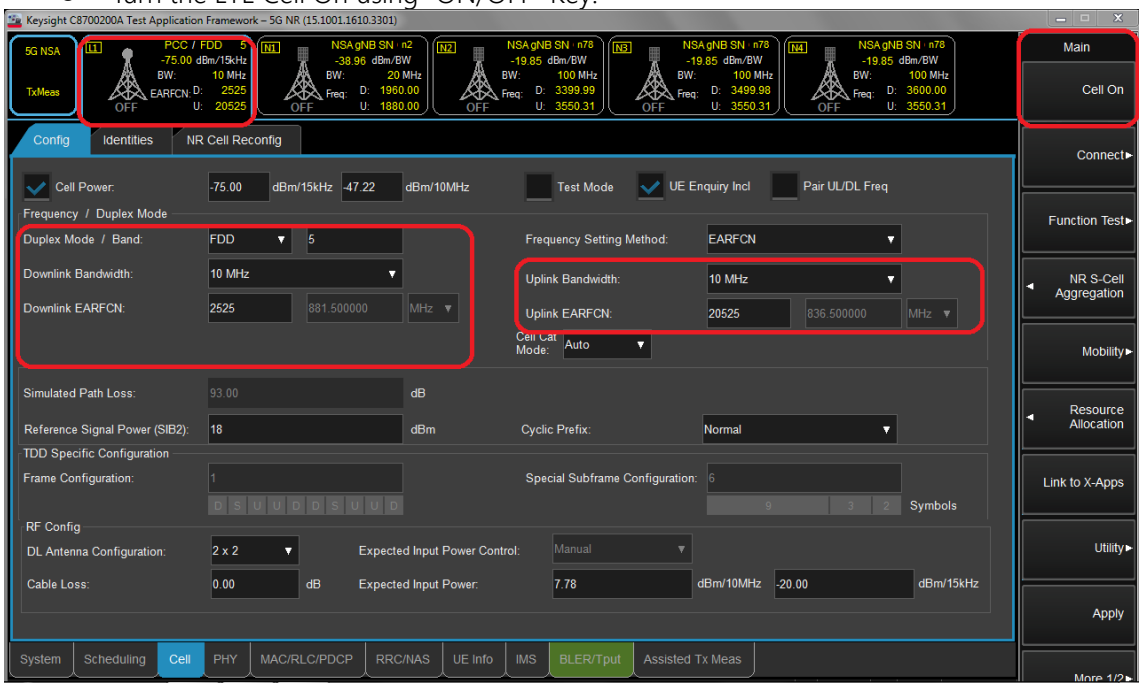
Combination	PCC									SCC				SCC				Tx Power		
	Band	BW	PCC UL Channel	PCC UL Frequency	PCC DL Channel	PCC DL Frequency	Modulation	RB	offset	Band	BW	SCC DL Channel	SCC DL Frequency	Band	BW	SCC DL Channel	SCC DL Frequency	LTE Single Carrier Tx Power (dBm) (1)	LTE Tx Power with DL CA Enabled (dBm) (2)	Deviaion (dB) (2)-(1)
[41D]	41	20	39750	2506	39750	2506	QPSK	1	49	41	20	39948	2525.8	41	20	40146	2545.6	20.77	20.70	-0.07

2. 5G NR Call Box Setup

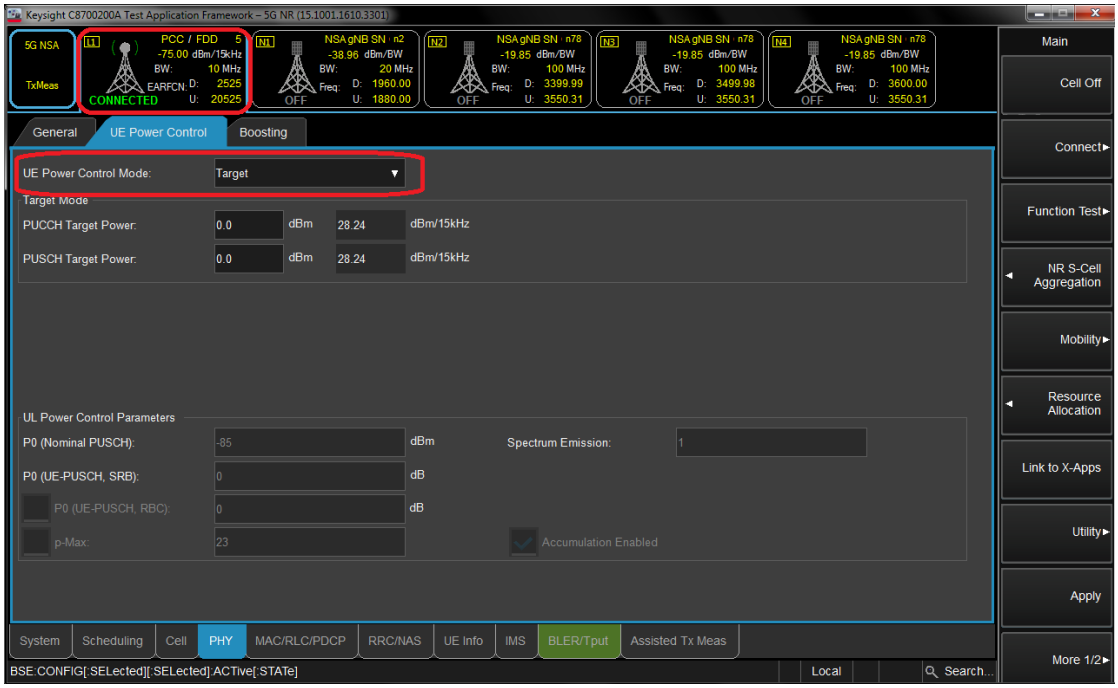
Procedure used to establish output Power measurement for NR Bands

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.

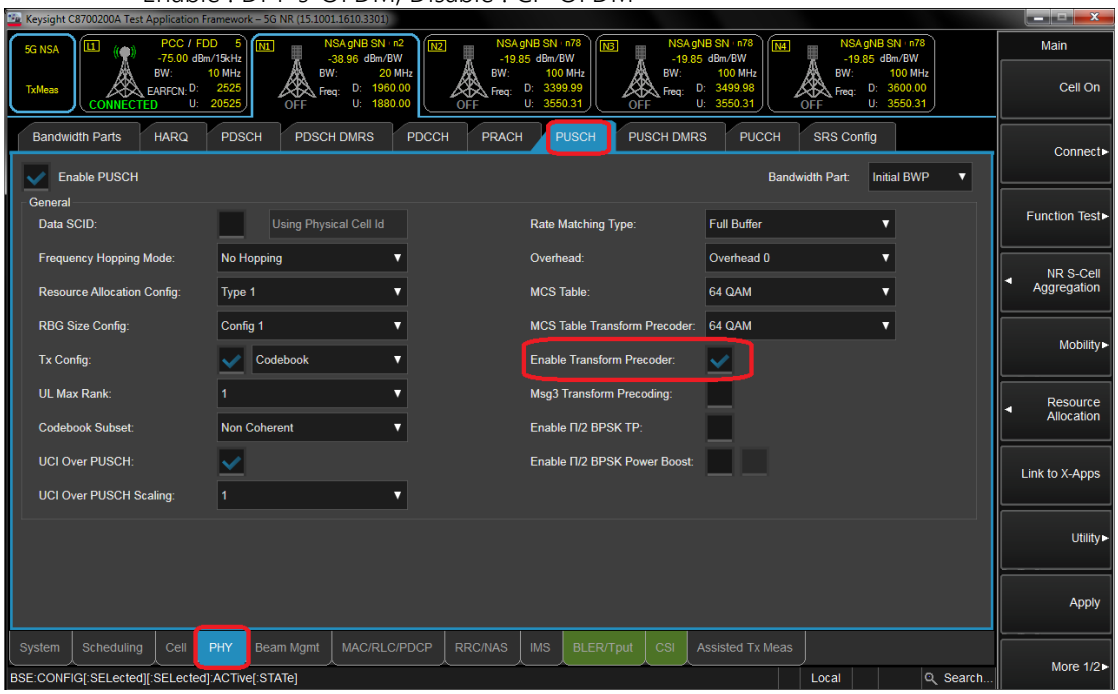


- Turn the Airplane Mode On and then turn the Airplane mode off.
- Select All down bits for UL Power control Mode in LTE.

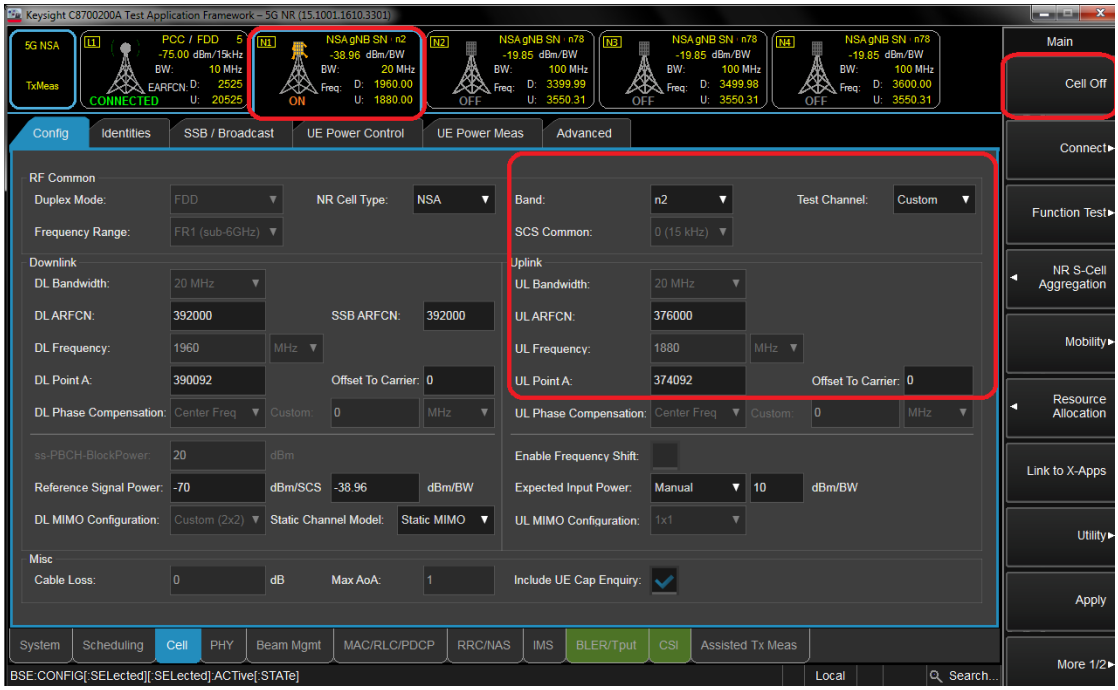


Setup for NR Band

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

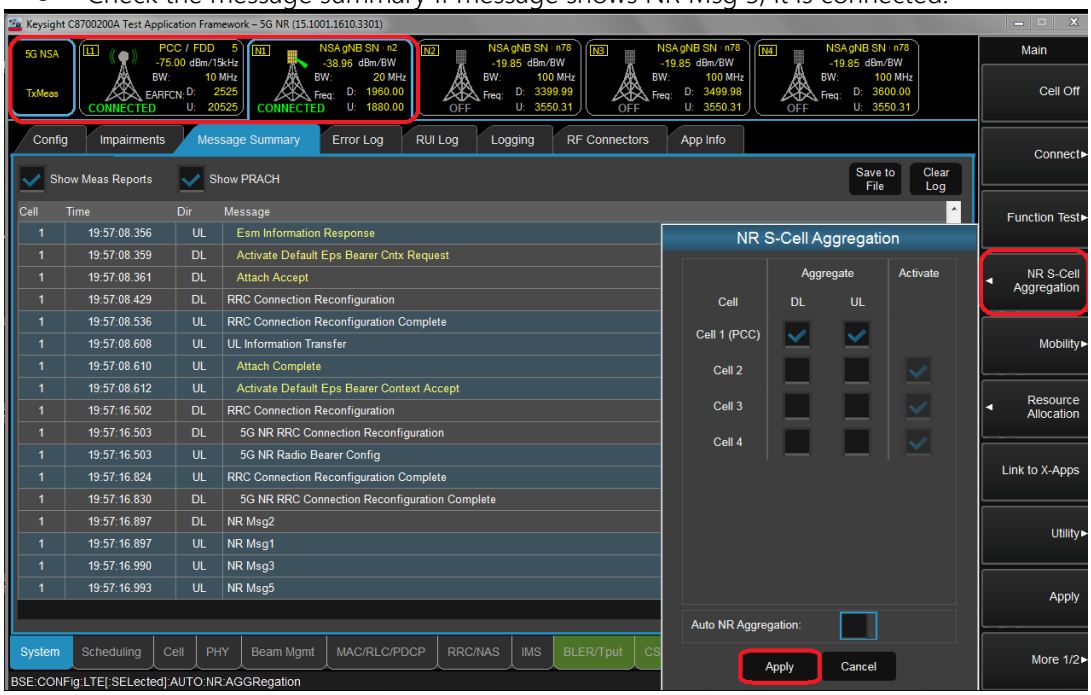


- Select operating band, BW, SCS and Channel.
- Turn the NR Cell On using “ON/OFF” Key.



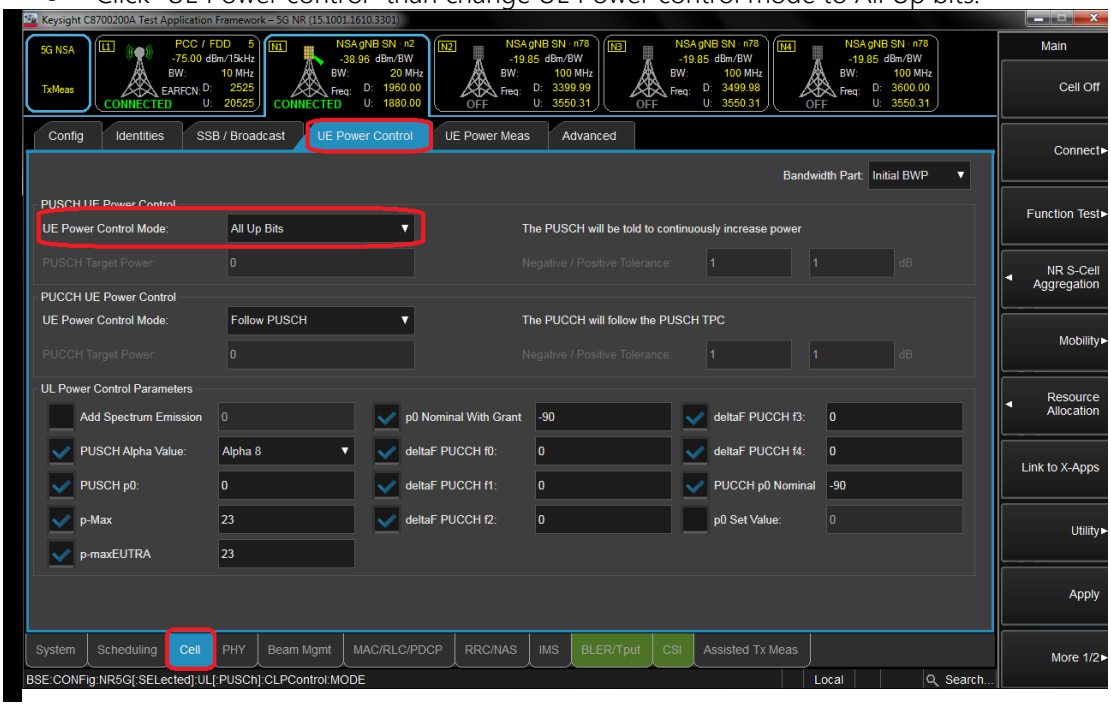
Connect NR S-Cell Aggregation

- 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 configurating (Start RB, Count, MCS).

View Tx Power

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