

LTE Uplink / Downlink Carrier Aggregation Intra-band configurations**1. 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	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			

Note:

LTE CA_41C is supported in both Uplink and Downlink, other CA configurations are supported only Downlink

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

UL CA shall be tested based on the worst-case SAR configuration determined from non-CA SAR testing result. The channel BW, channel number, RB Allocation, etc. would be selected to allow contiguous CA of PCC and SCC. Uplink output power for UL CA is the total power measured across the PCC and SCC.

UL CA power measurements were performed with QPSK modulation based on the worst-case standalone SAR. The tune-up limits are provided in table below. The UL CA mode power measurements represent the total power across both carriers. Measurements were made for all supported PCC bandwidths using the channel/RB combination resulting in the highest standalone output power at the least MPR (0 dB). SCCs were set to use configurations similar to the PCC to establish conservative or worst case equivalent SAR test conditions (highest maximum power with MPR of 0 dB).

The standalone power measurement is the power for the PCC in the non-CA mode (i.e. single carrier power). In all cases the UL CA power is less than or equal to the standalone power, which is in accordance with the tune-up limits in table below.

According to November 2017 TCB workshop, Uplink CA SAR Test Guidance as follows;

- a) When the maximum output for UL CA is $\leq$ standalone LTE mode (without CA)
 - PCC is configured according to the highest standalone SAR configuration tested
 - SCC and subsequent CCs are configured according to procedures used for power measurement and parameters (BW, RB etc.) similar to that used for the PCC.
- b) When the Reported SAR for UL CA configuration, described above, is > 1.2 W/kg, UL CA SAR is also required for all required test channels (PCC based).
- c) UL CA SAR is also required for standalone SAR configurations > 1.2 W/kg when they are scaled to the UL CA power level.

SAR measurement is not required for the 16QAM and 64QAM. When the highest maximum output power for 16QAM and 64QAM is ≤ 0.25 dB higher than the QPSK or when the reported SAR for the QPSK configuration is ≤ 1.45 W/kg.

E-UTRA CA configurations	RF exposure conditions	Antenna	Bands		UL																
			PCC	SCC	PCC						SCC						MPR	PCC + SCC			
			1st	2nd	Mode	RB	Offset	BW	Freq	Ch	Mode	RB	Offset	BW	Freq	Ch		Aggregated BW	Tune-up Limit (dBm)	CA power (total PCC+SCC) (dBm)	3GPP Rel.#
CA_41C(0)(1)(2)(3)	Head	Ant. B	41C	41C	QPSK	1	0	20	2636.5	41055	QPSK	1	99	20	2616.7	40857	0	40	25	24.14	15
CA_41C(0)(1)(2)(3)	body (Closed)	Ant. B	41C	41C	QPSK	50	0	20	2680	41490	QPSK	50	50	20	2660.2	41292	0	40	20	19.23	15
CA_41C(0)(1)(2)(3)	body (Opened)	Ant. B	41C	41C	QPSK	1	0	20	2593	40620	QPSK	1	99	20	2573.2	40422	0	40	20	19.12	15
CA_41C(0)(1)(2)(3)	Head	Ant. F	41C	41C	QPSK	1	0	20	2680	41490	QPSK	1	99	20	2660.2	41292	0	40	25	24.33	15
CA_41C(0)(1)(2)(3)	body (Closed)	Ant. F	41C	41C	QPSK	1	0	20	2680	41490	QPSK	1	99	20	2660.2	41292	0	40	22	21.49	15
CA_41C(0)(1)(2)(3)	body (Opened) 1-g	Ant. F	41C	41C	QPSK	50	0	20	2680	41490	QPSK	50	50	20	2660.2	41292	0	40	22	21.56	15
CA_41C(0)(1)(2)(3)	body (Opened) 10-g	Ant. F	41C	41C	QPSK	1	0	20	2680	41490	QPSK	1	99	20	2660.2	41292	0	40	22	21.49	15

Note:

Standalone output power values are referenced from Sec.9.3 in the SAR Part.1 Test Report.

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 three (3) 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]		

Note:

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

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
LTE B41	QPSK	20MHz	41055	2636.5	1/0	23.8	23.9	0.16

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	LTE Rel	Delta
	PCC	SCC1	SCC2	PCC					PCC			SCC1			SCC2			8 Tx.	10	
	1st	2nd	3rd	Mode	BW (MHz)	Channel	Freq. (MHz)	RB/Offs et	BW (MHz)	Channel	Freq. (MHz)	BW (MHz)	Channel	Freq. (MHz)	BW (MHz)	Channel	Freq. (MHz)	Power [dBm]	Tx. Power	
41C	41C	41C		QPSK	20MHz	41055	2636.5	1/0	20MHz	41055	2636.5	20MHz	40857	2616.7				23.78	23.64	-0.14
41D	41D	41D	41D	QPSK	20MHz	41055	2636.5	1/0	20MHz	41055	2636.5	20MHz	40857	2616.7	20MHz	40659	2596.9	23.78	23.81	0.03

DL CA with 4x4 MIMO output power results

E-UTRA CA configuration (BCS)	Bands			UL					DL									LTE Rel	LTE Rel	Delta
	PCC	SCC1	SCC2	PCC					PCC			SCC1			SCC2			8 Tx.	10	
	1st	2nd	3rd	Mode	BW (MHz)	Channel	Freq. (MHz)	RB/Offs et	BW (MHz)	Channel	Freq. (MHz)	BW (MHz)	Channel	Freq. (MHz)	BW (MHz)	Channel	Freq. (MHz)	Power [dBm]	Tx. Power	
[41C]	[41C]	[41C]		QPSK	20MHz	41055	2636.5	1/0	20MHz	41055	2636.5	20MHz	40857	2616.7				23.78	23.69	-0.09
[41D]	[41D]	[41D]	[41D]	QPSK	20MHz	41055	2636.5	1/0	20MHz	41055	2636.5	20MHz	40857	2616.7	20MHz	40659	2596.9	23.78	23.58	-0.20

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.

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