

FCC 47 CFR § 2.1093 IEEE Std 1528-2013

SAR EVALUATION REPORT (Class II permissive change)

FOR

WCDMA/LTE/5G NR Tablet + BT/BLE, DTS/UNII a/b/g/n/ac/ax

MODEL NUMBER: SM-X518U

FCC ID: A3LSMX518U

REPORT NUMBER: 4790982779-S1V2

ISSUE DATE: 9/5/2023

Prepared for SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA

Prepared by

UL Korea, Ltd.

26th floor, 152, Teheran-ro, Gangnam-gu Seoul, 06236, Korea

Suwon Test Site: UL Korea, Ltd. Suwon Laboratory 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433



Testing Laboratory

TL-637

Revision History

Rev.	Date	Revisions	Revised By
V1	8/29/2023	Initial Issue	
V2	9/5/2023	Revised n78 frequency in Sec 6.2	Jeongyeon Won

Page 1 of 47

Table of Contents

1.	Attestation of Test Results	4
1.	Test Specification, Methods and Procedures	5
2.	Facilities and Accreditation	5
3.	SAR Measurement System & Test Equipment	6
3.1.	SAR Measurement System	6
3.2.	SAR Scan Procedures	8
3.3.	Test Equipment	10
4.	Measurement Uncertainty	11
4.1.	DECISION RULE	. 11
5.	Device Under Test (DUT) Information	11
5.1.	DUT Description	11
5.2.	Wireless Technologies	12
5.3.	Time-Averaging feature	13
5.4.	Maximum Allowed Output Power	15
5.5.	RSI (Radio SAR Index) Scenarios	15
5.6.	NR (Sub 6GHz) SAR Test and Reporting Considerations	16
6.	RF Exposure Conditions (Test Configurations)	17
6.1.	Standalone SAR Test Exclusion Considerations	17
6.2.	Estimated SAR	17
6.3.	Required Test configurations	19
7.	Dielectric Property Measurements & System Check	20
7.1.	Dielectric Property Measurements	20
7.2.	System Check	22
8.	Conducted Output Power Measurements	25
8.1.	NR (Sub 6GHz)	25
9.	Measured and Reported (Scaled) SAR Results	38
9.1.	NR Band n77(SRS2) (100MHz Bandwidth)	40
10.	SAR Measurement Variability	41
11.	Simultaneous Transmission SAR Analysis	42
11.	-	
Appe	ndixes	46
••	0982779-S1 FCC Report SAR_App A_Photos & Ant. Locations	

Page 2 of 47

4790982779-S1 FCC Report SAR_App B_Highest SAR Test Plots	46
4790982779-S1 FCC Report SAR_App C_System Check Plots	46
4790982779-S1 FCC Report SAR_App D_SAR Tissue Ingredients	46
4790982779-S1 FCC Report SAR_App E_Probe Cal. Certificates	46
4790982779-S1 FCC Report SAR_App F_Dipole Cal. Certificates	46
4790982779-S1 FCC Report SAR_App G_Proximity Sensor feature	46

Page 3 of 47

1. Attestation of Test Results

Applicant Name	SAMSUNG ELEC	SAMSUNG ELECTRONICS CO.,LTD.						
FCC ID	A3LSMX518U							
Model Number	SM-X518U	SM-X518U						
Applicable Standards	FCC 47 CFR § 2.1093 IEEE Std 1528-2013							
	Published RF exposure KDB procedures							
	SAR Limits (W/Kg)							
Exposure Category	Peak spatial-average (1g of tissue)							
General population / Uncontrolled exposure	1.6							
RF Exposure Conditions	Equipm	ient Class - The Hig	phest Reported SAF	R (W/kg)				
	PCB	DTS	NII	DSS				
Standalone	0.06	0.77	0.87	<0.01				
Simultaneous TX	0.94 0.83 0.94 0.94							
Date Tested	8/28/2023 to 8/28/2023							
Test Results	Pass							
This report is a report due to the addition	on of an additional s	eparation distance	to Sub.4 ant.					

All other matters are the same as the original Report 4790841154-S1V3 FCC Report SAR.

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released By:	Prepared By:		
flast	원정면		
Justin Park	Jeongyeon Won		
Operations Leader	Laboratory Engineer		
UL Korea, Ltd. Suwon Laboratory	UL Korea, Ltd. Suwon Laboratory		

Page 4 of 47

1. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528-2013, ANSI C63.26-2015 the following FCC Published RF exposure <u>KDB</u> procedures:

- o 447498 D04 Interim General RF Exposure Guidance v01
- \circ ~ 616217 D04 SAR for laptop and tablets v01r02 ~
- o 690783 D01 SAR Listings on Grants v01r03
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- 865664 D02 RF Exposure Reporting v01r02
- 941225 D06 Hotspot Mode v02r01
- o 971168 D01 Power Meas License Digital System v03r01

In addition to the above, the following information was used:

- o TCB workshop October, 2016; RF Exposure Procedures (DUT Holder Perturbations)
- o <u>TCB workshop</u> April, 2019; RF Exposure Procedures (Tissue Simulating Liquids (TSL))
- <u>TCB workshop</u> November, 2019 Page 5, RF Exposure Procedures (SPLSR Hotspot Combination)
- o TCB workshop April, 2022; RF Exposure Procedures (5G NR FR1 Measurement)

2. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at

Suwon SAR 2 Room

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637.

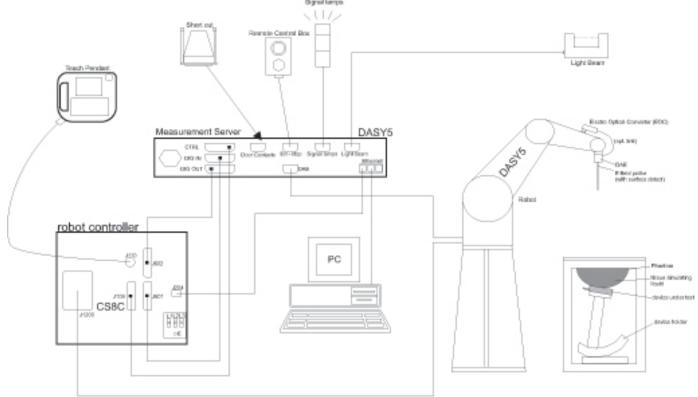
The full scope of accreditation can be viewed at <u>https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf.</u>

Page 5 of 47

3. SAR Measurement System & Test Equipment

3.1. SAR Measurement System

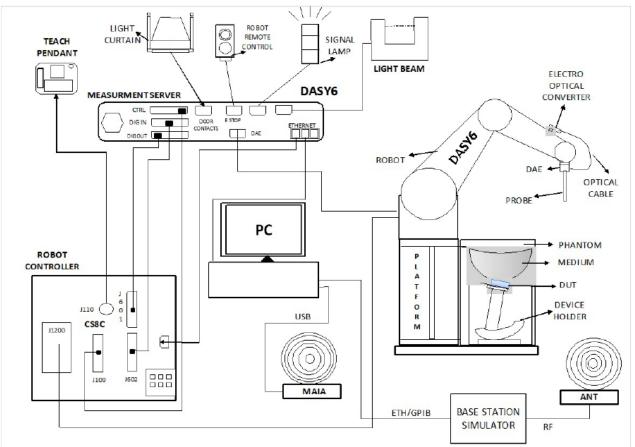
The DASY5 system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

Page 6 of 47





- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win10 and the DASY6 or 8 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

3.2. SAR Scan Procedures

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

1	Area Scan Pa	rameters	extracted from	n KDB	865664	D01	SAR I	Measuren	nent 100	MHz	z to 6 GH	Z
- [

	\leq 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	$5 \pm 1 \text{ mm}$	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5 \text{ mm}$
Maximum probe angle from probe axis to phantom surface normal at the measurement location	$30^{\circ} \pm 1^{\circ}$	$20^\circ\pm1^\circ$
	\leq 2 GHz: \leq 15 mm 2 - 3 GHz: \leq 12 mm	$\begin{array}{l} 3-4 \ \mathrm{GHz:} \leq 12 \ \mathrm{mm} \\ 4-6 \ \mathrm{GHz:} \leq 10 \ \mathrm{mm} \end{array}$
Maximum area scan spatial resolution: Δx_{Area} , Δy_{Area}	When the x or y dimension o measurement plane orientation the measurement resolution r x or y dimension of the test d measurement point on the test	on, is smaller than the above, must be \leq the corresponding levice with at least one

Page 8 of 47

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

			\leq 3 GHz $>$ 3 GHz			
Maximum zoom scan spatial resolution: Δx_{Zoom} , Δy_{Zoom}			$\leq 2 \text{ GHz: } \leq 8 \text{ mm}$ $3 - 4 \text{ GHz: } \leq 5$ $2 - 3 \text{ GHz: } \leq 5 \text{ mm}^*$ $4 - 6 \text{ GHz: } \leq 4$			
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		\leq 5 mm	$3 - 4$ GHz: ≤ 4 mm $4 - 5$ GHz: ≤ 3 mm $5 - 6$ GHz: ≤ 2 mm		
	$\begin{array}{ c c c c } graded \\ grid \\ \hline & \Delta z_{Zoom}(1): \ between \\ 1^{st} \ two \ points \ closest \\ to \ phantom \ surface \\ \hline & \Delta z_{Zoom}(n > 1): \\ between \ subsequent \\ points \\ \hline \end{array}$		\leq 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm		
			$\leq 1.5 \cdot \Delta z_{\text{Zoom}}(n-1)$			
Minimum zoom scan volume x, y, z		$ \begin{array}{c} 3 - 4 \text{ GHz:} \geq 28 \text{ mm} \\ \geq 30 \text{ mm} \\ \begin{array}{c} 4 - 5 \text{ GHz:} \geq 25 \text{ mm} \\ 5 - 6 \text{ GHz:} \geq 22 \text{ mm} \end{array} \end{array} $				
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.						

When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

Page 9 of 47

3.3. Test Equipment

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Netw ork Analyzer	Agilent	E5071C	MY 46522054	7-24-2024
Dielectric Assessment Kit	SPEAG	DAK-3.5	1196	7-17-2024
Shorting block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	LKM	DTM3000	3851	7-25-2024

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
MXG Analog Signal Generator	Aglient	N5181A	MY 50145882	7-26-2024
Pow er Sensor	KEY SIGHT	U2000A	MY61200006	1-5-2024
Pow er Sensor	KEY SIGHT	U2000A	MY61010010	7-25-2024
Pow er Amplifier	EXODUS	AMP2027	1410025-AMP2027-10003	11-2-2023
Directional Coupler	Aglient	772D	MY 52180193	7-25-2024
Low Pass Filter	MICROLAB	LA-60N	3942	7-25-2024
Attenuator	KEY SIGHT	8491B/003	MY 39272277	7-24-2024
Attenuator	KEY SIGHT	8491B/010	MY 39271981	7-24-2024
Attenuator	KEY SIGHT	8491B/020	MY 39272302	7-24-2024
E-Field Probe	SPEAG	EX3DV4	7645	11-15-2023
Data Acquisition Electronics	SPEAG	DA E4	1591	3-22-2024
System Validation Dipole	SPEAG	D3700V2	1036	5-19-2024
System Validation Dipole	SPEAG	D3500V2	1121	4-20-2024
System Validation Dipole	SPEAG	D3900V2	1069	4-21-2024
Thermometer	Lutron	MHB-382SD	AH.50215	1-9-2024

Note(s):

1. For System Validation Dipole, Calibration interval applied every 2 years according to referencing KDB 865664 guidance.

2. All equipments were used until Cal.Due data.

4. Measurement Uncertainty

Measurement Uncertainty of 100MHz to 6GHz

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be \leq 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

4.1. DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 2, Clause 4.4.3 in IEC Guide 115:2021.

5. Device Under Test (DUT) Information

5.1. DUT Description

Device Dimension	Refer t	Refer to Appendix A.							
Back Cover	🛛 The	⊠ The Back Cover is not removable.							
Battery Options	🛛 The	rechargeable battery is	not user accessible						
Accessory	Keybo	Keyboard							
Wireless Router (Hotspot)	🛛 Mot	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. ⊠ Mobile Hotspot (Wi-Fi 2.4 GHz) ⊠ Mobile Hotspot (Wi-Fi 5.8 GHz)							
Wi-Fi Direct	⊠ Wi-l	Wi-Fi Direct enabled devices transfer data directly between each other ⊠ Wi-Fi Direct (Wi-Fi 2.4 GHz) ⊠ Wi-Fi Direct (Wi-Fi 5.2 GHz UNII-1, Wi-Fi 5.8 GHz UNII-3)							
Test Sample Information	No.	No. S/N Notes No. S/N Notes							
	1	R32W500QS8H	SAR						

Page 11 of 47

5.2. Wireless Technologies

Wireless technologie s	Frequency bands	Operating mode	Duty Cycle used for SAR testing
W-CDMA (UMTS)	Band II Band IV Band V	UMTS Rel. 99 (Voice & Data) HSDPA (Category 24) HSUPA (Category 6) DC-HSDPA (Category 24) HSPA+ (DL only)	100%
LTE	FDD Band 2 FDD Band 4 FDD Band 5 FDD Band 7 FDD Band 7 FDD Band 12 FDD Band 13 FDD Band 14 FDD Band 25 FDD Band 26 FDD Band 26 FDD Band 30 TDD Band 41 – Power Class 2 TDD Band 41 – Power Class 3 FDD Band 66 FDD Band 71 <u>Uplink intra-band-contiguous</u> <u>Carrier Aggregation(2CC)</u> CA_5B/ 41C/ 66B/ 66C Does this device support SV-LTE (QPSK 16QAM 64QAM 256QAM Rel. 16 Carrier Aggregation (2 Uplinks and 4 Downlinks)	100% (FDD) 63.3% (TDD) Power Class 3 43.3% (TDD) Power Class 2
NR (Sub 6)	FDD Band n2 FDD Band n5 FDD Band n12 FDD Band n25 FDD Band n30 FDD Band n66 FDD Band n71 TDD Band n41– Power Class 2 TDD Band n41– Power Class 3 TDD Band n77– Power Class 2 TDD Band n77– Power Class 3 TDD Band n77– Power Class 3 TDD Band n78	DFT-s-ODFM: ■ π/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM CP-ODFM: ■ QPSK, 16QAM, 64QAM, 256QAM	100% (FDD Bands) 100% (TDD Bands)
Wi-Fi	2.4 GHz 5 GHz Does this device support bands 5.6	802.11b, 802.11g 802.11n (HT20), 802.11ax 802.11a 802.11n (HT20) & (HT40) 802.11ac (VHT20) & (VHT40) & (VHT80) 802.11ax (HE20) & (HE40) & (HE80) 60 ~ 5.65 GHz2 ⊠ Yes □ No	SISO : 98.7% (802.11b) MIMO : 98.9% (802.11b) SISO : 96.9% (802.11a), 94.9% (802.11ac (VHT80 MIMO 97.1% (802.11a) 91.1% (802.11ac (VHT80
	Does this device support bands 5.0		
Bluetooth	2.4 GHz	Version 5.3 LE	76.9% (BDR DH5) 77.1% (EDR DH5)

Notes

 The Bluetooth protocol is considered source-based averaging. Bluetooth Max power GFSK (DH5) was verified to have the highest duty cycle of 76.9% and Reduce power EDR (DH5) was verified to have the highest duty cycle of 77.1% was considered and used for SAR Testing.

2. Measured duty cycle plots are in Section.9.

3. This device supports Power Class 2(HPUE) and Power Class 3 for LTE Band 41 & NR Band n41 & NR Band n77

4. NR TDD Band n41 and n77/n78 has support SRS(0,1,2,3) modes.

5. This device supports LTE UL CA intra-band Contiguous.

Page 12 of 47

5.3. Time-Averaging feature

The equipment under test (EUT) contains the Samsung S.LSI chipset supporting 4G technologies and 5G NR bands Sub.6. these chipset is enabled with TAS (Time Average SAR) algorithm to control and manage transmitting power in real time and to ensure at all times the time-averaged RF exposure is in compliance with the FCC requirement.

The TAS (Time Average SAR) algorithm maintains the time-averaged transmit power, in turn, timeaveraged RF exposure of *SAR_design_target*, below the predefined time-average power limit, for each characterized technology and band.

TAS (Time Average SAR) algorithm allows the device to transmit at higher power instantaneously as high as P_{max} , when needed, but enforces power limiting to maintain time-averaged transmit power to P_{Limit} . Below table shows P_{Limit} NV settings and maximum tune up output power P_{max} configured for this EUT for various transmit conditions (RSI=Radio SAR Index).

The purpose of this SAR report is to demonstrate that the EUT meets FCC SAR limits when transmitting in static transmission scenario at maximum allowable time-averaged power levels.

Exposure condition Spatial-average		Standalone with Sensor Off 1g	Standalone with Sensor On 1g	· Pmax (dBm)
Test distance (mm)		Refer to sec.6.3	in Part.0 report.	(ubiii)
RSI:		0	1	
RF Air Interface	Antenna	Plimit correspond	ling to 1.0 W/kg	
WCDMA 2	Main.1	25.91	13.50	23.50
WCDMA 4	Main.1	26.29	12.50	24.00
WCDMA 5	Main.1	24.99	16.50	23.50
LTE B5	Main.1	26.05	14.00	24.00
LTE B7	Main.1	28.00	12.00	24.00
LTE B7	Sub.2	27.96	9.50	23.00
LTE B12	Main.1	29.29	15.50	24.00
LTE B13	Main.1	26.12	15.50	24.00
LTE B14	Main.1	26.33	15.50	24.00
LTE B25(2)	Main.1	26.48	12.50	24.00
LTE B25(2)	Sub.2	27.64	10.00	23.00
LTE B26	Main.1	26.20	14.00	24.00
LTE B30	Main.1	28.10	12.50	22.00
LTE B41(PC3)	Main.1	29.34	12.00	22.00
LTE B41(PC2)	Main.1	33.13	10.40	22.40
LTE B66(4)	Main.1	25.99	12.00	23.50
LTE B66(4)	Sub.2	27.36	10.00	23.00
LTE B71	Main.1	32.22	19.00	24.00
NR Band n5	Main.1	26.37	14.00	24.00
NR Band n12	Main.1	29.02	15.50	24.00
NR Band n25(2)	Main.1	26.57	12.50	24.00
NR Band n30	Main.1	28.55	12.50	22.50
NR Band n66	Main.1	25.97	12.00	24.00
NR Band n71	Main.1	30.48	19.00	24.00
NR Band n41-(PC2/PC3)	Main.1	20.50 / 18.00	13.00	26.50 / 24.00
NR Band n41 SRS1-(PC2/PC3)	Sub.2	19.00 / 16.50	13.00	25.00 / 22.50
NR Band n41 SRS2-(PC2/PC3)	Sub.4	19.00 / 17.00	13.00	25.00 / 23.00
NR Band n41 SRS3-(PC2/PC3)	Sub.1	16.50	13.00	21.00 / 21.00
NR Band n77-(PC2/PC3)	Main.2	21.00 / 18.00	9.00	27.00 / 24.00
NR Band n77 SRS1-(PC2/PC3)	Sub.2	21.00 / 17.50	9.00	27.00 / 23.50
NR Band n77 SRS2-(PC2/PC3)	Sub.4	18.00	9.00	24.00 / 24.00
NR Band n77 SRS3-(PC2/PC3)	Sub.3	17.00 / 16.50	7.00	21.50 / 21.00
NR Band n78	Main.2	18.00	9.00	24.00
NR Band n78 SRS1	Sub.2	17.00	9.00	23.00
NR Band n78 SRS2	Sub.4	15.50	9.00	21.50
NR Band n78 SRS3	Sub.3	13.50	7.00	19.50

Notes:

1. If Plimit is higher than Pmax for some modes/bands, The modes/bands will operate at a power level up to Pmax.

2. Pmax (Maximum tune-up power) is specified in tune-up document. The maximum allowed power is equal to maximum tune up power + 1 dB device design uncertainty.

3. All Plimit NV and maximum tune up output Pmax levels entered in above Table correspond to average power levels after accounting for duty cycle in the case of LTE TDD modulation schemes.

4. For NR FR1 TDD Bands, Plimit listed averaged power level, and Pmax listed burst power level.

5. For PC2/PC3 of NR Band n41/n77, PC2 Plimit is higher than PC3 Plimit in RSI=0. So Plimit calculation is based on PC2's Plimit. So PC3' Plimit is always within SAR design target.

6. NR Band n78's Plimit is same or lower than NR Band n77's Plimit in All RSI's scenarios. Therefore, NR Band n77 was tested as a representative.

Page 14 of 47

5.4. Maximum Allowed Output Power

Maximum allowed output power means that Pmax or PLimit + 1dB device uncertainty for each RSI.

			Maximur	m allow ed output pow e	er (dBm)
RF Air interface	Antenna	Mode	Pmax	RSI = 0 (Proximity sensor Off)	RSI = 1 (Proximity sensor On)
NR Band n77-SRS2	Sub.4 Ant.	SRS CW	25.00	19.00	10.00
NR Band n78-SRS2	Sub.4 Ant.	SRS CW	22.50	16.50	10.00

Note(s):

- 1. Detail of RSI(Radio SAR Index) conditions, please refer to Sec.6.5.
- 2. NR Bands support SA and NSA mode as same target power.

5.5. RSI (Radio SAR Index) Scenarios

This device supports multiple RSI Scenarios and Each RSIs operate to each RF exposure Conditions.

Please below table;

RF exposure Conditions	Technologuies Supported	RSI conditions	Description
Standalone	All WWAN bands	RSI = 0	1. free 2. Hand use conditions for Handset and proximity sensor is not active.
Standalone	All WWAN bands	RSI = 1	1. Hand use conditions for Handset and proximity sensor is active.

Note(s):

RSI Scenarios priority: RSI=1 → RSI=0

5.6. NR (Sub 6GHz) SAR Test and Reporting Considerations

NR (Sub 6GHz) SAR Test and Reporting Considerations

Item	Description													
Frequency range,	Deed = 77(= 70)						Frequency	/ range: 3450 -	3550 MHz					
Channel Bandwidth,	Band n77(n78) -DoD-						Ch	nannel Bandwid	ith					
Numbers and Frequencues		100 MHz	90 MHz	80 MHz	70 MHz	60 MHz	50 MHz	40 MHz	30 MHz	25 MHz	20 MHz	15 MHz	10 MHz	5 MHz
	Low						631668/ 3475.02	631334/ 3470.01	631000/ 3465	630866/ 3462.99	630668/ 3460.02	630500/ 3457.5	630334/ 3455.01	
	Mid	633334 /3500.01	633334 /3500.01	633334 /3500.01	633334 /3500.01	633334 /3500.01			633334 /3500.01	633334 /3500.01	633334 /3500.01	633334 /3500.01	633334 /3500.01	
-	High						635000/ 3525	635332/ 3529.98	635666/ 3534.99	635800 3537	636000/ 3540	636166/ 3542.49	636332/ 3544.98	
							Frequency	/ range: 3700 -	3980 MHz					
	Band n77(n78) -DoD-						Cł	nannel Bandwid	ith					
	000	100 MHz	90 MHz	80 MHz	70 MHz	60 MHz	50 MHz	40 MHz	30 MHz	25 MHz	20 MHz	15 MHz	10 MHz	5 MHz
	Low	650000	649668	649334	649000/ 3735	648668 /3730.02	648334 /3725.01	648000 /3720	647668/ 3715.02	647500/ 3712.5	647334 /3710.01	647168/ 3707.52	647000/ 3705	
	Low-Mid	/3750	/3745.02	/3740.01	653666/ 3804.99	653556 /3803.34	652166 /3782.49	651200 /3768	651000/ 3765	650900/ 3763.5	650800 /3762	650700/ 3760.5	650600/ 3759	
	Mid-A		656000	656000			656000	654400 /3816	654334/ 3815.01	654300/ 3814.5	654266 /3813.99	654234/ 3813.51	654200/ 3813	
	Mid-B		/3840	/3840			/3840	657600 /3864	657666/ 3864.99	657700/ 3814.5	657734 /3866.01	657766/ 3866.49	657800/ 3867	
	Mid-High	662000	662332	662666	658334/ 3875.01	658444 /3876.66	659834 /3897.51	660800 /3912	661000/ 3915	661100/ 3916.5	661200 /3918	661300/ 3919.5	661400/ 3921	
	High	/3930	/3934.98	/3939.99	663000/ 3945	663332 /3949.98	663666 /3954.99	664000 /3960	664332/ 3964.98	664500/ 3967.5	664666 /3969.99	664832/ 3972.48	665000/ 3975	
SCS					١	NR FDD Ban	ds : 15 kHz,	NR TDD Ba	nds : 30kHz					
Modulations Supported in UL			DFT-s-	-OFDM: π/2	BPSK, QPS	K, 16QAM, 6	64QAM, 256	QAM & CP-	OFDM: QPS	K, 16QAM,	64QAM, 256	QAM		
A-MPR (Additional MPR) disabled for SAR Testing?							Ye	S						
EN-DC Carrier Aggregation Possible C	Combinations													
LTE Anchor Bands for NR Band n77						LTE	Band 2/5/7/	(12/13/14/30)/66					
LTE Anchor Bands for NR Band n78						LTE	Band 2/4/5	/7/12/13/66	/71					

Notes:

SAR test for NR bands and LTE anchor Bands were performed separately due to limitations in SAR probe calibration factors. And, Due to test setup limitations, SAR testing for NR was performed using test mode software to establish the connection. 1.

2. NR configurations of SAR test were determined according to Section 5.2 of KDB 941225 D05.

Page 16 of 47

6. RF Exposure Conditions (Test Configurations)

Refer to Appendix A for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

6.1. Standalone SAR Test Exclusion Considerations

Tablet device's each positions (Rear/Edge1/Edge2/Edge3/Edge4) consider SAR test exclusion according to Appendix B.4 of KDB 447498 D04 Interim General RF exposure guide. If Each antenna operate to between 0.3GHz to 6GHz, and Antenna to DUT surface's distance are within 0.5 cm to 40cm, then below Formula can use for SAR test exclusion;

$$P_{\rm th} (\rm mW) = ERP_{20 \,\rm cm} (\rm mW) = \begin{cases} 2040f & 0.3 \,\rm GHz \le f < 1.5 \,\rm GHz \\ 3060 & 1.5 \,\rm GHz \le f \le 6 \,\rm GHz \end{cases}$$
(B. 1)
$$P_{\rm th} (\rm mW) = \begin{cases} ERP_{20 \,\rm cm} (d/20 \,\rm cm)^x & d \le 20 \,\rm cm \\ ERP_{20 \,\rm cm} & 20 \,\rm cm < d \le 40 \,\rm cm \end{cases}$$
(B. 2)

where

$$x = -\log_{10}\left(\frac{60}{ERP_{20}\operatorname{cm}\sqrt{f}}\right)$$

and f is in GHz, d is the separation distance (cm), and $ERP_{20\text{cm}}$ is per Formula (B.1). The example values shown in Table B.2 are for illustration only.

6.2. Estimated SAR

When an antenna qualifies for test exemption in single transmitter/antenna mode of each test positions, its actual SAR value may not be available, because it was not required to be measured. In this case, the SAR contribution of that antenna to simultaneous transmission must be estimated relative to the SAR based exemption criteria, by multiplying the corresponding ratio by the SAR limit of 1.6 W/kg for 1-g SAR. This is referred to as estimated SAR.

For instance, a given antenna may qualify for a SAR-based exemption according to Appendix B.4 of KDB 447498 D04, with $P_{ant} < P_{th}$, where P_{ant} is maximum time-averaged power, and P_{th} is defined in Section 7.1. Then, per the preceding paragraph, the estimated SAR is computed as SAR_{est} = 1.6 * P_{ant} / P_{th} [W/kg].

Page 17 of 47

SAR Test Exclusion Calculation for WWAN

Antenna	Тх	Frequency	Output	Power		Separ	ation Distance	s (mm)			Estimate	d 1-g SAR Valu	ue (W/kg)	
Antenna	Interface	(MHz)	dBm	mW	Rear	Тор	R_Left	Bottom	R_Right	Rear	Тор	R_Left	Bottom	R_Right
		Full	l Power, Proxi	nity Sensor Of	f. A sensor trig	gering of 20 m	m is included	for Rear, Left,	Right and Botte	om. 23mm is ir	ncluded for Top	p.		
Sub 4	NR Band n77 SRS2	3980	25.00	316	19	250.33	0	19	0	-Measure-	0.105	-Measure-	-Measure-	-Measure-
Sub 4	NR Band n78 SRS2	3800	25.00	316	19	250.33	0	19	0	-Measure-	0.106	-Measure-	-Measure-	-Measure-
						Power Back	off, Proximity	Sensor On						
	NR Band n77		10.00											

Sub 4 NR Band n77 RSR2 3980 10.00 10 0 0 0 0 Measure Measure <thm< th=""><th></th><th></th><th></th><th></th><th></th><th>I OWEI Dack</th><th>on, i roxinity</th><th></th><th></th><th></th><th></th><th></th><th></th></thm<>						I OWEI Dack	on, i roxinity						
	Sub 4	3980	10.00	10	0		0	0	0	-Measure-	-Measure-	-Measure-	-Measure-
	Sub 4	3800	14.50	28	0		0	0	0	-Measure-	-Measure-	-Measure-	-Measure-

Note(s):

When some device surfaces has Standalone SAR test Exclusion according to Section 7.1, Estimated SAR were calculated to the surfaces according to Section 7.2.

6.3. Required Test configurations

The table below identifies the standalone test configurations required for this device accordant to the findings in SAR Test Exclusion Calculation table.

Antenna	Tx Interface	Proximity sensor (On/Off)	Rear	Тор	R/Left	Bottom	R/Right
Sub.4	SRS mode	OFF	Yes	No	Yes	Yes	Yes
Sub.4	SRS IIDde	ON	Yes	N/A	N/A	Yes	N/A

Note(s):

1. Yes = Testing is required. No = Testing is not required.

2. N/A = Power back-off is not implemented in certain position using proximity sensor active.

3. The laptop configuration with the accessory keyboard connected was not evaluated as this was considered to be covered by the R/Right tests.

Page 19 of 47

7. Dielectric Property Measurements & System Check

7.1. Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18° C to 25° C and within $\pm 2^{\circ}$ C of the temperature when the tissue parameters are characterized.

The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The Tissue Dielectric parameters (100MHz to 6GHz) should be re-measured after each 3 - 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

For The Tissue Dielectric parameters (4MHz to 30MHz). The parameters must be measured before 24 hours.

Body Head Target Frequency (MHz) σ (S/m) σ (S/m) ε, 8 150 52.3 0.76 61.9 0.80 0.92 300 45.3 0.87 58.2 450 43.5 0.87 56.7 0.94 41.5 0.97 835 0.90 55.2 900 41.5 0.97 55.0 1.05 915 41.5 0.98 55.0 1.06 1450 1.20 1.30 40.5 54.0 40.3 1.40 1610 1.29 53.8 1800 - 2000 40.0 1.40 53.3 1.52 2450 39.2 1.80 52.7 1.95 3000 38.5 2.40 52.0 2.73 5000 36.2 4.45 49.3 5.07 5100 36.1 4.55 49.1 5.18 5200 36.0 4.66 49.0 5.30 5300 35.9 4.76 48.9 5.42 5400 35.8 4.86 48.7 5.53 5500 35.6 4.96 48.6 5.65 5600 35.5 5.07 48.5 5.77 5700 5.17 48.3 5.88 35.4 5800 35.3 5.27 48.2 6.00

1. Tissue Dielectric Parameters (100MHz to 6GHz)

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

SAR test were performed in All RF exposure conditions using Head tissue according to TCB workshop note of April. 2019.

IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

Dielectric Property Measurements Results:

SAR 2 Room

Date	Freq. (MHz)		Lie	quid Parameters	Measured	Target	Delta (%)	Limit ±(%)
	Head 3500	e'	39.5500	Relative Permittivity (ɛ,):	39.55	37.93	4.27	5
	Head 3500	e"	14.9500	Conductivity (o):	2.91	2.91	-0.07	5
	Head 3600	e'	39.4000	Relative Permittivity (ε _r):	39.40	37.82	4.19	5
	Head 3000	e"	15.0500	Conductivity (o):	3.01	3.01	-0.04	5
	Head 3700	e'	39.2200	Relative Permittivity (ɛ,):	39.22	37.70	4.03	5
2023-08-28	Tieau 3700	e"	15.1500	Conductivity (o):	3.12	3.12	0.02	5
2023-00-20	Head 3800	e'	39.0400	Relative Permittivity (c _r):	39.04	37.59	3.86	5
	Tieau 3000	e"	15.2500	Conductivity (o):	3.22	3.22	0.11	5
	Head 3900	e'	38.8600	Relative Permittivity (ɛ,):	38.86	37.47	3.70	5
	Head 3900	e"	15.3500	Conductivity (o):	3.33	3.32	0.24	5
	Head 3980	e'	38.7000	Relative Permittivity (ɛ,):	38.70	37.38	3.53	5
	Tieau 3900	e"	15.4300	Conductivity (o):	3.41	3.40	0.35	5

UL Korea, Ltd. Suwon Laboratory This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

7.2. System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification of 100MHZ to 6GHz frequency range should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements. For The System verification of 4MHz to 30MHz frequency range, The System verification must be performed before 24 hours.

System Performance Check Measurement Conditions (100MHz to 6GHz):

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm for measurements > 3 GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
 For 5 GHz band The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube was chosen for the cube.
- Distance between probe sensors and phantom surface was set to 2.5 mm.
 For 5 GHz band Distance between probe sensors and phantom surface was set to 1.4 mm
- The dipole input power (forward power) was 100 mW.
- The results are normalized to 1 W input power.

System Performance Check Measurement Conditions (4MHz to 30MHz):

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements
- The DASY system with an E-Field Probe was used for the measurements.
- The CLA(Confined Loop Antennas) was mounted on the small tripod so that the CLA feed point was positioned below the center marking of the flat phantom section and the CLA was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 0 mm separation distance from CLA center to the Phantom surface.
- The CLA input power (forward power) was 100 mW.
- The results are normalized to 1 W input power.

Reference Target SAR Values

The reference SAR values can be obtained from the calibration certificate of system validation dipoles.

System Dipole	Serial No.	Cal. Date	Cal. Due Date	Target SAR V	alues (W/kg)
System Dipole	Senarivo.	Cal. Date	Cal. Due Date	1g/10g	Head
D3500V2	1075	5-19-2023	5-19-2025	1g	65.50
D3500V2	1075	5-19-2023	5-19-2025	10g	24.70
D3700V2	1036	5-19-2023	5-19-2025	1g	67.80
D3700V2	1050	5-19-2025	5-19-2025	10g	24.50
D3900V2	1069	4-21-2023	4-21-2025	1g	69.40
0390072	1009	4-21-2023	4-21-2025	10g	24.00

Note(s):

For System Validation Dipole, Calibration interval applied every 2 years according to referencing KDB 865664 guidance.
 All equipments were used until Cal.Due data.

Page 23 of 47

System Check Results

The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within 10% of the manufacturer calibrated dipole SAR target.

SAR 2 Room

	System	Dipole	т	S.	Measure	d Results	Target	Delta	
Date Tested	Туре	Serial #		juid	Zoom Scan to 100 mW	Normalize to 1 W	(Ref. Value)	±10 %	Plot No.
2023-08-28	D3500V2	1121	Head	1g	7.13	71.3	66.60	7.06	1
2023-00-20	D3300V2	1121	Tieau	10g	2.70	27.0	25.10	7.57	
2023-08-28	D3700V2	1036	Head	1g	6.31	63.1	67.80	-6.93	
2023-00-20	D3700V2	1030	Tieau	10g	2.30	23.0	24.50	-6.12	1
2023-08-28	D3900V2	1069	Head	1g	6.83	68.3	69.40	-1.59	
2023-00-20	D3900v2	1009	Tieau	10g	2.42	24.2	24.00	0.83	1

8. Conducted Output Power Measurements

8.1. NR (Sub 6GHz)

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS 138.521-1 specification.

UE Power Class: 3 (23 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS138.521-1.

Modulation		MPR (dB)	
	Edge RB allocations	Outer RB allocations	Inner RB allocations
DET-s-OEDM PI/2 BPSK	≤ 3.5 ¹	≤ 1.2 ¹	≤ 0.2 ¹
DET-S-OFDM PV2 BP5K	≤ 0	0.5 ²	0 ²
DFT-s-OFDM QPSK	5	1	0
DFT-s-OFDM 16 QAM	≤	2	≤ 1
DFT-s-OFDM 64 QAM		≤ 2.5	
DFT-s-OFDM 256 QAM		≤ 4.5	
CP-OFDM QPSK	5	3	≤ 1.5
CP-OFDM 16 QAM	5	3	≤ 2
CP-OFDM 64 QAM		≤ 3.5	
CP-OFDM 256 QAM		≤ 6.5	
1 and 40 % or les	pability powerBoosting-pi	2BPSK and if the IE power used for UL transmission f	BoostPi2BPSK is set to
NOTE 2: Applicable for UE n78 and n79 and	operating in FDD mode, if the IE powerBoostPi2B		than 40% of slots in

The allowed A-MPR values specified below in Table 6.2.3.3.1-1 of 3GPP TS138.521-1 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signaling Value of "NS 01"

Table 6.2.3.3.1-1: Additional maximum power reduction (A-MPR)

Network Signalling label	Requirements (subclause)	NR Band	Channel bandwidth (MHz)	Resources Blocks (<i>N</i> RB)	A-MPR (dB)
NS_01		Table 5.2-1	5, 10, 15, 20, 25, 30, 40, 50, 60, 80, 90, 100	Table 5.3.2-1	N/A

Uplink RB allocations were used to Table 6.1-1 of the 3GPP TS 138.521-1.

						RB all	location			
Channel Bandwidth	SCS(kHz)	OFDM	Edge_Full_Left	Edge_Full_Right	Edge_1RB_Left	Edge_1RB_Right	Outer_Full	Inner_Full	Inner_1RB_Left	Inner_1RB_Right
	15	DFT-s CP	2@0 2@0	2@23 2@23	1@0 1@0	1@24 1@24	25@0 25@0	12@6 13@6	1@1 1@1	1@23 1@23
5MHz	30	DFT-s CP	2@0 2@0	2@9	1@0	1@10	10@0 11@0	5@21 5@21	1@1	1@9
	60	DFT-s CP	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
	15	DFT-s CP	2@0 2@0	2@50 2@50	1@0	1@51	50@0 52@0	25@12 26@13	1@1	1@50
10MHz	30	DFT-s CP	2@0 2@0	2@22	1@0	1@23	24@0 24@0	12@6 12@6	1@1	1@22 1@22
	60	DFT-s CP	2@0 2@0	2@9 2@9	1@0 1@0	1@10 1@10	10@0 11@0	5@21 5@21	1@1 1@1	1@9 1@9
	15	DFT-s CP	2@0 2@0	2@77 2@77	1@0 1@0	1@78 1@78	75@0 79@0	36@18 39@19 ¹	1@1 1@1	1@77 1@77
15MHz	30	DFT-s CP	2@0 2@0	2@36 2@36	1@0	1@37 1@37	36@0 38@0	18@9 19@9	1@1	1@38
	60	DFT-s CP	2@0 2@0	2@16 2@16	1@0	1@17	18@0 18@0	9@4 9@4	1@1	1@16
	15	DFT-s CP	2@0 2@0	2@104 2@104	1@0	1@105 1@105	100@0 106@0	50@25 53@26	1@1	1@104
20MHz	30	DFT-s CP	2@0 2@0	2@49 2@49	1@0	1@50	50@0 51@0	25@12 25@12 ¹	1@1	1@49
	60	DFT-s CP	2@0 2@0 2@0	2@22 2@22	1@0	1@23	24@0 24@0	12@6	1@1	1@22

Page 25 of 47

Procedures used to establish power measurement for NR Bands

Switching to NSA mode or SA mode

- Click the "Utility" button in the right of Test application screen •
- Select "5G NR NSA" in the "TA Mode Switch" for NSA mode •
- Select "5G NR Standalone" in the "TA Mode Switch" for SA mode •

Keysigin C8700200A Test Applica	011 Platflework = 3G NR (13.20.4.4121)		
BW: EARFCN:	FED 56 Bm/15/Hr 20 Hag 20 Hag 20 Hag 20 Hag 20 Hag 1 520	Hz 1 BW: 100 MHz Freq: D: 3450.00	NSA TDD n78 -19.85 dBm/BW W: 100 MHz preq: D: 3549.99 U: 3549.99 OF
Config Identities N	R Cell Reconfig		Connect
Cell Power: Frequency / Duplex Mode	-60.00 dBm/15kHz 29.21 dBm/20MHz Test M		Freq Function Test
Duplex Mode / Band: Downlink Bandwidth:	FDD • 66 Frequency S 20 MHz • Uplink Band	Width: 20 MHz	▼ NR S-Cell Aggregation
Downlink EARFCN:	66786 2145.000000 MHz v Uplink EARF		
Simulated Path Loss:	78.00 dB		Mobility
Reference Signal Power (SIB2):	18 dBm Cyclic Prefix:	Normal	Resource Allocation
TDD Specific Configuration Frame Configuration:	1 Special Sub	frame Configuration: 6	2 Symbols
RF Config DL Antenna Configuration:	1 x 1 Expected Input Power Control: Auto	▼ RFIO Group 0	Utility•
Static Channel Model:			Apply
System Scheduling Cell BSE:CONFig:LTE[:SELected]:RR(Assisted Tx Meas	More 1/2
	(Figure	1-1)	
🖀 Keysight C8700200A Test Applicat	on Framework – 5G NR (15.26.4.4121)		- 🗆 X
NR SA INI SA BW: Freq: D: OFF U:	CC 073 REZ SA SCC 073 RES SA SCC 073 MovBW -19.85 dBm/SW -19.85 dBm/SW -19.85 dBm/SW -19.85 dBm/SW BW 100 MHz 3350.01 OFF 0.338.001 OFF 00 FF 0.338.001 OFF 00 FF 0.338.001 00 FF 00 SF	1 Freq: D: 3350.01	Utility Export / Import SCPI
Config Impairments		App Info	
Config Mode: Manual 🔻			
5G Cell 1 (P Duplex Mode TDD Freq Range / Band FR1 / n78	CC) 5G Cell 2 5G Cell 3 5G Cell 4 TDD TDD TDD TDD TDD FR1/n78 FR1/n78 FR1/n78 FR1/n78 FR1/n78		Preset
DL Bandwidth 100 MHz SCS Common 1 (30 kHz)	Y 100 MHz Y 100 MHz Y 100 MHz Y Y 1 (30 kHz) Y 1 (30 kHz) Y 1 (30 kHz) Y		◄ Preferences
DLARFCN 623334 DL Freq (MHz) ▼	L 623334 L 623334 L 623334 L 3350.01 3350.01 3350.01		Path Loss
DL Power BW ▼ -19.85 Input Power -33 DL MIMO Config Custom (2x2	-19.85 -19.85 -19.85 -30 -30 -30 ▼ Custom (2x2) ▼ Custom (2x2) ▼ Custom (2x2) ▼		ode Switch
UL MIMO Config UL MIMO Config Cell On	Custom (x4) Custom (x4) Custom (x4) Custom (x4) Custom (x4) Custom (x4) Custom (x4) Custom (x4) Cell On Cell On Cell On	Mode you w Apply.	ant, then click
			TA Mode
	NR Cell Locations:	Test Applica	Switch
بــــــــــــــــــــــــــــــــــــ	NR Cell Locations:		Switch
⊢	+4		ion Mode: Switch Search Start License Manager
	+4 100 MHz	5G NR NSA 5G NR NSA 5G NR NSA 5G NR L1 Te	ion Mode: Switch Search st alone Start License Manager

(Figure 1-2)

NSA Mode

• Select operating band, BW and Channel for LTE (LTE -> Cell -> Config)

Keysight C8700200A Test Applicati	on Framework – 5G NR (15.26.4.4121)			– 🗆 ×
-60.00 d BW: EARFCN:D:	EDD 66 bm/15kHz 20 MHz 66786 132322 UFF U: 18300	NSA TDD n78 1985 dbm/8W BW: 100 MHz Freq: D: 3350.01 Freq: FF U: U: 3450.00	NSA TDD n78 -19.85 dBm/BW BW: 10.00 MHz Freq: D: 3549.99 OFF U: 3549.99	Main Cell On
	Cell Reconfig		_	Connect►
Cell Power: Frequency / Duplex Mode —— Duplex Mode / Band:	-60.00 dBm/15kHz -29.21 dBm/20MHz	Test Mode VE Enquiry Incl	Pair UL/DL Freq	Function Test►
Downlink Bandwidth:	20 MHz 🔻	Uplink Bandwidth: 20 MHz		■ NR S-Cell Aggregation
Downlink EARFCN:	66786 2145.000000 MHz 🔻	Uplink EARFCN: 132322 Cell Cat Mode: Auto	1745.000000 MHz 🔻	Mobility►
Simulated Path Loss:	78.00 dB	Outin Destin		■ Resource Allocation
Reference Signal Power (SIB2): TDD Specific Configuration Frame Configuration:	18 dBm	Cyclic Prefix: Normal Special Subframe Configuration: 6		
RF Config		o special outmaine configuration.	3 2 Symbols	Link to X-Apps
DL Antenna Configuration: Static Channel Model:	1 x 1 The second seco	Control: Auto 🔻 RFIO Group	0	Utility►
]	Apply
System Scheduling Cell BSE:CONFig:LTE[:SELected]:RRC	PHY MAC/RLC/PDCP RRC/NAS UE II PMAXEUTRA:VALue	nfo IMS BLER/Tput Assisted Tx Meas	Local Q. Search	More 1/2►

(Figure 2-1)

• Select operating band, SCS, BW and Channel for NR (NR -> Cell -> Config)

Keysight C8700200A Test A	pplication Framework -	- 5G NR (15.26.4.4121)						– 🗆 X
	PCC / FDD 66 60.00 dBm/15kHz W: 20 MHz	SCC / FDD -60.00 dBm/15 BW: 10 M	(Hz 🖷 .	NSA FDD n5 -28.96 dBm/BW N: 20 MHz	NSA TDD n78 -19.85 dBm/BW BW: 100 MHz	A -19.85 dB	DD n78 3m/BW 100 MHz	Main
	RFCN: D: 66786 U: 132322		00 K Fre		Freq: D: 3450.00	Freq: D: 1	3549.99 3549.99 0F	Cell On
Config Identities	SSB / Broadcast	t UE Power Contro	UE Power M	easurements Advance	ed			Connect►
RF Common		_						
Duplex Mode:	FDD T	NR Cell Type:	NSA 🔻	Band:	n5 ▼	Test Channel:	Mid 🔻	Function Test
Frequency Range:	FR1 (sub-6GHz)	•		SCS Common:	0 (15 kHz) ▼			
Downlink				Uplink				NR S-Cell
DL Bandwidth:	20 MHz 🔻			UL Bandwidth:				Aggregation
DLARFCN:	176300 M	SSB ARFCN:	174770	ULARFCN:	167300			
DL Frequency:	881.5	MHz 🔻		UL Frequency:	836.5 MHz	•		Mobility►
DL Point A:	170720	Offset To Car	rier: 102	UL Point A:	147248	Offset To Carrie	r: 504	. Resource
DL Phase Compensation	Center Freq 🔻			UL Phase Compensation:	Center Freq Custo		MHz 🔻	Allocation
ss-PBCH-BlockPower:	0 0	dBm		Enable Frequency Shift:				Link to X-Apps
Reference Signal Power:	-60 c	dBm/SCS -28.96	dBm/BW	Expected Input Power:	Auto 🔻 -32	dBm/BW		Link to A-Apps
DL MIMO Configuration:	1x1 🔻 [DL Antenna Configuratior	: 1x1 ▼	UL MIMO Configuration:	1x1 ▼			Utility►
Misc								
RFIO Group:	0	Max AoA:	1	Include UE Cap Enquiry:	<u>~</u>			
								Apply
System Scheduling	Cell PHY Bea	am Mgmt MAC/RLC/		S IMS BLER/Tput	CSI Assisted Tx M	eas		More 1/2
BSE:CONFig:NR5G[:SELect	ed]:DL:MIMO:CONFi	ig				Local	Q Search	NOIC INEP

(Figure 2-2)

 Select "UL RMC (TX tests, TS 38.521)" for maximum power RB scheduling (NR -> Scheduling -> Quick Config)

🧱 Keysight C8700200A Test A	pplication Framework – 5G	NR (15.26.4.4121)		– 🗆 ×
	PCC / FDD 66	SCC / FDD 1	NSA FDD n5	Main
	N: 20 MHz	BW: 10 MHz EARFCN: D: 300	2019 Common Network 7530 <th7530< th=""> <th7530< th=""> 7530<td>Cell On</td></th7530<></th7530<>	Cell On
Quick Config TDD	UL-DL Config Sche	eduling Map Slot Conf	ig DL TDRA UL TDRA Link Adaptation Rate Matching	Connect►
Scheduling Quick Configur	ation		Clear Log	Connectr
Scenario:	UL RMC (TX tests, TS 3	38.521) ▼	Log:	
PDSCH - PUSCH Ratio:	Basic Scheduler		[2021/12/14 01:02:17.195] Cell 1: No enabled UESS configured with DCI Format 0_1 and 1_1. Ena	Function Test►
SSB Configuration:	DL RMC (RX tests, TS		[2021/12/14 01:02:17.500] Cell 2: No enabled UESS configured with DCI Format 0_1 and 1_1. En:	
	UL RMC (TX tests, TS 3	38.521)	[2021/12/14 01:02:17.504] Cell 3: No enabled UESS configured with DCI Format 0_1 and 1_1. Ena	 NR S-Cell Aggregation
Direction:	Full Throughput		[2021/12/14 01:02:17:508] Cell 4: No enabled UESS configured with DCI Format 0_1 and 1_1. Ena	
BWP ID:	0	0	[2021/12/14 01:02:29.552] Configured basic scheduler.	Mobility►
Transform Precoding:		Disabled v	[2021/12/14 01:02:29.929] Configuring scheduling on all MU1 cell(s): N1, N2, N3, N4	incomey -
DCI Format:	Format 1 1 ▼	Format 0 1	[2021/12/14 01:02:30.316] Configured Scheduler successfully.	Resource
PRB Allocation Type:	 TYPE1 ▼	 TYPE1 ▼	[2021/12/14 01:05:36.579] Configured basic scheduler.	 Allocation
Type 0 RBG Allocation:	1FFFF	1FFFF		
<i>"</i>				Link to X-Apps
PRB Start / Count:	0 273	0 273		
MCS Table:	64 QAM 🛛 🔻	64 QAM 🛛		Utility►
MCS:	4 - QPSK 🛛 🔻	2 - QPSK 🔻		
Auto-apply: 0ff	Apply to	all Cells		Apply
System Scheduling			RRC/NAS IMS BLER/Tput CSI Assisted Tx Meas	More 1/2►
BSE:CONFig:NR5G:SCHedu	ling:QCONFig:SCENario)	Local Q Search	More 1/2

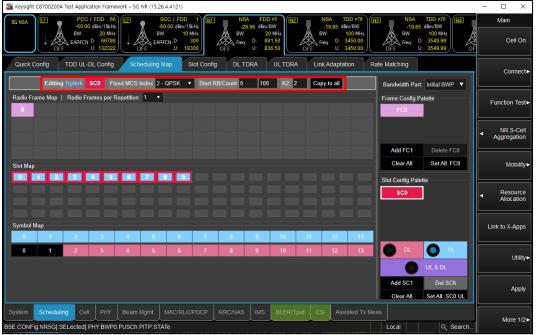
(Figure 2-3)

- To set waveform for NR Band (NR -> PHY -> PUSCH)
 - Select highest modulation in the MCS Table and MCS Table Transform Precoder
 - Enable Transform Precoder: DFT-s-OFDM / disable for CP-OFDM
 - Enable pi/2 BPSK TP: DFT-s-OFDM, pi/2 BPSK modulation

Keysight C8700200A Test Application	Framework – 5G NR (15.26.4.4121)				– 🗆 ×
	/15kHz 20 MHz 66786	BW: 20 MHz BW: Freq: D: 881.50 Freq:	85 dBm/BW 100 MHz D: 3450.00 -19.85 dB BW: 1 Freq: D: 3	DD n78 m/BW 100 MHz 549.99 549.99	Main Cell On
Bandwidth Parts HARQ	PDSCH PDSCH DMRS PDC	CH PRACH PUSCH PUSCH DM		al BWP 🔻	Connect►
General Data SCID:	Not signaled from higher layers	Rate Matching Type:	Full Buffer 🔻		Function Test►
Frequency Hopping Mode: Resource Allocation Config:	No Hopping Type 1	Overhead: MCS Table:	Overhead 0 64 QAM		NR S-Cell Aggregation
RBG Size Config: Tx Config:	Config 1 V Codebook V	MCS Table Transform Precoder Enable Transform Precoder:	r: 64 QAM v		Mobility►
UL Max Rank: Codebook Subset:	1 ▼ Non Coherent ▼	Msg3 Transform Precoding: Enable П/2 BPSK TP:	 ✓		Resource Allocation
UCI Over PUSCH: UCI Over PUSCH Scaling:	✓ 1 ▼	П/2 BPSK Power Boost: Frequency Hopping Offset Lists	False v		Link to X-Apps
					Utility►
	k				Apply
System Scheduling Cell BSE:CONFig:NR5G[:SELected]:PHY:	PHY Beam Mgmt MAC/RLC/PDCP BWP0:PUSCh:TPENabled	RRC/NAS IMS BLER/Tput CSI	Assisted Tx Meas	Q Search	More 1/2►

(Figure 2-4)

• Select Uplink Modulation and RB setting (NR -> Scheduling -> Scheduling Map)



(Figure 2-5)

Page 29 of 47

- Click "Cell On" button in the right of Test application screen in the LTE tab
- If necessary, turn the Airplane Mode on/off in the DUT

🚈 Keysight C8700200A Test Applica	on Framework – 5G NR (15.26.4.4121)			- 🗆 X
	FDD 66	NSA FDD n5	6A TDD n78 19.85 dBm/BW	D n78 Main
BW: EARFCN.	20 MHz 66786 U EARFCN: D: 300	-28.90 c0MHz BW: 20 MHz Freq: D: 881.50 FF U: 836.50 OFF	: 100 MHz D: 3450.00 BW: 10 Freq: D: 35	00 MHz
	Cell Reconfig			Connect►
Cell Power:	-60.00 dBm/15kHz -29.21 dBm/20MHz		Pair UL/DL Freq	
Frequency / Duplex Mode				Function Test
Duplex Mode / Band:		Frequency Setting Method:	EARFCN T	
Downlink Bandwidth:		Uplink Bandwidth:		. NR S-Cell
Downlink EARFCN:	66786 2145.000000 MHz 🔻			▲ Aggregation
DOWININK EAR ON.		Uplink EARFCN: Cell Cat	132322 1745.000000 M	/Hz 🔻
		Mode: Auto V		Mobility►
Simulated Path Loss:	78.00 dB			Resource
Reference Signal Power (SIB2):	18 dBm	Cyclic Prefix:		 Allocation
TDD Specific Configuration				
Frame Configuration:		Special Subframe Configuration:		Link to X-Apps
			9 3 2 S	Symbols
RF Config				
DL Antenna Configuration:	1 x 1 T Expected Input Powe	Control: Auto 🔻 I	RFIO Group 0	Utility►
Static Channel Model:				
				Apply
System Scheduling Cell	PHY MAC/RLC/PDCP RRC/NAS UE	Info IMS BLER/Tput Assisted T	Tx Meas	
BSE:CONFIG[:SELected][:SELect	di ACTivel STATel		Local	More 1/2►
DOL: CONFICTOR OF CELECIED II. SELECT			Local	St Octaren

(Figure 2-6)

- Click "Cell On" button in the right of Test application screen in the NR tab
 - Click "NR S-Cell Aggregation" and "Apply" to aggregate NR band

	00 0				00 0							
🤷 Keysight C8700200A Test Aj	pplication Framework	c – 5G NR (15	.26.4.4121)									$ \Box$ \times
	PCC / FDD 66	2 💧	SCC / FDD 1 -60.00 dBm/15kHz	NI II	NSA FDD n5		NSA TDD n78 -19.85 dBm/BW	NB 🔳	NSA -19.85	TDD n78		Main
BW AN BW			BW: 10 MHz		3W: 20 MHz freq: D: 881.50	B F	-19.85 dBm/BW W: 100 MHz ireq: D: 3450.00 U: 3450.00	OFF	BW: Freg: D:	100 MHz	A Contraction of the second se	Cell Off
Config Identities	SSB / Broadca	st UE	Power Control	UE Power I	Measurements Advance	ced						
75.0												Connect►
RF Common Duplex Mode:			R Cell Type:		Band:	n5	•	Test C		Mid 🔻		
Duplex Mode:		V N	R Cell Type:		Dano:							Function Test►
Frequency Range:					SCS Common:	0 (S-Cell A	uggrega	luon		
Downlink					Uplink			Aggr	egate	Activate		NR S-Cell
DL Bandwidth:					UL Bandwidth:	20	Cell	DL	UL			Aggregation
DLARFCN:	176300 M		SSB ARFCN:	174770	UL ARFCN:	167	Cell 1					
				L			Cell 1	 ✓ 	<u>~</u>			Mobility
DL Frequency:	881.5	MHz 🔻			UL Frequency:	836	Cell 2					
DL Point A:	170720		Offset To Carrier:	102	UL Point A:	147						
DL Phase Compensation:					UL Phase Compensation	Ce	Cell 3	_				 Resource Allocation
· · · · · · · · · · · · · · · · · · ·							Cell 4					
ss-PBCH-BlockPower:	0	dBm			Enable Frequency Shift:							
Reference Signal Power:	-60	dBm/SCS	-28 96	dBm/BW	Expected Input Power:	Au						Link to X-Apps
, i i i i i i i i i i i i i i i i i i i						H						
DL MIMO Configuration:		DL Antenna	a Configuration:	1x1 ▼	UL MIMO Configuration:	Cu						Utility►
Misc												
RFIO Group:	0		Max AoA:		Include UE Cap Enquiry:							
												Apply
							Auto NR Agg	regation:				
System Scheduling	Cell PHY B				AS IMS BLER/Tput	С		_				
BSE:CONFig:NR5G[:SELecte	ed]:UL[:PUSCh]:Cl	LPControl:M	IODE	^		~		Apply	Back			More 1/2►

(Figure 2-7)

 Select "All Down Bits" of UL Power control Mode in LTE tab for NR maximum power (LTE -> PHY -> UE Power Control)

St MA FCC / FDC / FD	🧧 Keysight C8700200A Test Application Framework – 5G NR (15.26.4.4121)		- 🗆	×
Content D 9300 Content from 0 9349.99 Content from 0 3349.99 Content from 0 3349.99 Content from 0 State of the field of the	93 NSA 🙀 7 -60.00 dBm/15kHz - 9.85 dBm/8W		Main	
UE Power Control Mode: Target Mode PUCCH Target Power: 0 0 dBm PUSCH Target Power: 0 0 dBm UL Power Control Parameters P0 (Normal PUSCH): 9 (UE-PUSCH, SRB): 0 (UE-PUSCH, SRB):	BW: 20 MHz BW: 10 MHz American Display 20 MHz 20 MHz BW: 100 MHz 100 MHz 100 MHz 100 MHz		Cell C	Off
Target Mode PUCCH Target Power: 0.0 dBm PUSCH Target Power: 0.0 dBm UL Power Control Parameters P0 (Memna PUSCH): 85 dBm Spectrum Emission: 1 P0 (UE-PUSCH, SRB): 0 0 dB P0 (UE-PUSCH, SRB): 0 0 dB P0 (UE-PUSCH, SRB): 0 dB P0 (UE-PUSCH, RBC): 0 dB Vullity- Apply System Scheduling Cell PHY More 112- BSE-CONFig LTE(SELected): UL-CLPControl:MODE	General UE Power Control Boosting		Conne	ect⊳
PUCCH Target Power: 0.0 dBm Function Test- PUSCH Target Power: 0.0 dBm MR S-Cell Aggregation Mobility- VL Power Control Parameters Mobility- P0 (Memna PUSCH): 85 dBm Spectrum Emission: 1 P0 (UE-PUSCH, SRB): 0 dB P0 (UE-PUSCH, SRB): 0 dB P0 (UE-PUSCH, SRB): 0 dB P0 (UE-PUSCH, RBC): 0 dB VUIIIty- 24 Accumulation Enabled System Scheduling Cell Scheduling Cell PHY More 112- Local Q. Search	UE Power Control Mode: All Down Bits			
PUSCH Target Power: 0.0 dBm PUSCH Target Power: 0.0 dBm UL Power Control Parameters P0 (Nominal PUSCH): 85 dBm Spectrum Emission: 1 P0 (UE-PUSCH, SRB): 0 dB P0 (UE-PUSCH, SRB): 0 dB P0 (UE-PUSCH, SRB): 0 dB P0 (UE-PUSCH, SRB): 0 dB Utility- System Scheduling Cell PHY MAC/RLC/PDCP RRC/NAS UE into INIS BLER/Tput Assisted Tx Meas BSE CONFig LTE['SELected]: UL-CLPControl:MODE Local Q Search More 1/2-			Function Te	est►
UL Power Control Parameters P0 (Nomina PUSCH): 85 dBin Spectrum Emission: 1 P0 (UE-PUSCH, SRB): 0 0 dBin Spectrum Emission: 1 P0 (UE-PUSCH, SRB): 0 dBin Spectrum Emission: 1 P0 (UE-PUSCH, SRB): 0 dBin Accumulation Enabled System Scheduling Cell More 112+ BSE-CONFig LTE(: SELected; UL-CLPControl:MODE				
UL Power Control Parameters P0 (Normal PUSCH): 85 dBm Spectrum Emission: 1 P0 (UE-PUSCH, SRB): 0 dB P0 (UE-PUSCH, SRB): 0 dB Utility- Link to X-Apps Utility- Link to X-Apps Utility- System Scheduling Cell PHY MAC/RLC/PDCP RRC/NAS UE Info MS BLER/Tput Assisted Tx Meas BSE-CONFig LTE[SELected]: UL-CLPControl:MODE Local Q Search	PUSCH Target Power: 0.0 dBm			
UL Power Control Parameters P0 (Nominal PUSCH): 45 6 6 6 7 90 (UE-PUSCH, SRB): 0 6 6 7 90 (UE-PUSCH, SRD): 0 6 7 90 (UE-PUSCH, SRC): 0 6 7 9 7 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
UL Power Control Parameters P0 (Nominal PUSCH): 85 dBm Spectrum Emission: 1 P0 (UE-PUSCH, SRB): 0 dB P0 (UE-PUSCH, RBC): 0 dB Utility- pmux/EUTRA 24 Accumulation Enabled Utility- System Scheduling Cell PHY MAC/RLC/PDCP RRC/NAS UE Info INS BLER/Tput Assisted Tx Meas BSE CONFig LTE['SELected] UL-CLPControl MODE Local Q Search More 1/2+			Mobil	lity►
OL Power Control Parameters P0 (Nominal PUSCH): 45 dBm Spectrum Emission: 1 Image: Control Parameters P0 (UE-PUSCH, SRB): 0 0 dB P0 (UE-PUSCH, SRB): 0 0 dB P0 (UE-PUSCH, SRB): 0 0 dB P0 (UE-PUSCH, RBC): 0 0 dB P1 (UE-PUSCH, RBC): 0 0 dB P0 (UE-PUSCH, RBC): 0 0 dB P0 (UE-PUSCH, RBC): 0 0 dB P0 (UE-PUSCH, RBC): 0 0 dB System Scheduling Cell PHY More 1/2+ BSE CONFig LTE(: SELected): UL-CLPControl: MODE Local Q. Search				
P0 (UE-PUSCH, SRB); 0 dB P0 (UE-PUSCH, SRB)			AllOcau	UII
PO (UE-PUSCH, RBC): 0 dB Phile: 24 privareUTRA 24 Accumulation Enabled System Scheduling Cell PHY MAC/RLC/PDCP RRC/NAS UE Info INIS BLER/Tput Assisted Tx Meas BSE CONFig LTE['SELected] UL.CLPControl MODE Local Q Search More 1/2+			Link to X-Ap	ps
Image: System Scheduling Cell PHY MAC/RLC/PDCP RRC/NAS UE Info IMS BLER/Tput Assisted Tx Meas More 1/2+ BSE CONFig LTE[SELected] UL/CLPControl MODE Local Q. Search More 1/2+				
System Scheduling Cell PHY MAC/RLC/PDCP RRC/NAS UE Info IMS BLER/Tput Assisted Tx Meas More 1/2+ BSE/CONFig LTE(SELected):UL:CLPControl:MODE Local Q. Search More 1/2+			Util	lity►
System Scheduling Cell PHY MAC/RLC/PDCP RRC/NAS UE Info IMS BLER/Tput Assisted Tx Meas More 1/2+ BSE.CONFig.LTE[/SELected]/UL/CLPControl MODE Local Q. Search More 1/2+				
BSE:CONFig.LTE[SELected] UL.CLPControl MODE Nore 1/2			Apr	ply
BSE CONFig LTE[SELected] UL-CLPControl:MODE Local Q. Search	System Scheduling Cell PHY MAC/RLC/PDCP RRC/NAS UE Info IMS BLER/Tput Assisted Tx Meas		More 1	1/2
	BSE:CONFig.LTE[:SELected]:UL:CLPControl:MODE	h	More I	

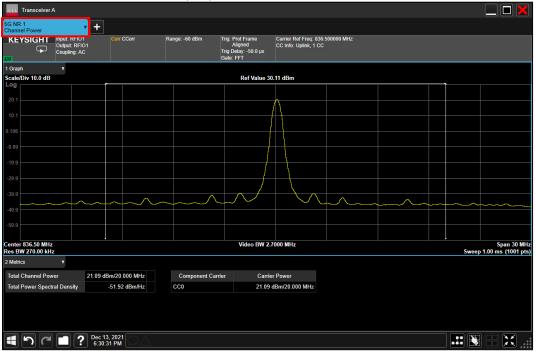
(Figure 2-8)

- Select "All Up Bits" of UL Power control Mode in NR tab for NR maximum power (NR -> Cell -> UE Power Control)
- To read the output power, click the "Link to X-Apps"

Keysight C8700200A Test Application Framework – 5G NR (15.26.4.4121)	- 🗆 X
5G NSA T1 PCC / FDD 66 SCC / FDD 1 IN1 NSA FD 5G NSA -60.00 dBm/19kHz -60.00 dBm/19kHz 1 -28.96 dBm -28.96 dBm	3W -19.85 dBm/BW -19.85 dBm/BW -19.85 dBm/BW
EARFCN: D: 66786 EARFCN: D: 300 Freg: D: 6	MHrz 10 0FF U: 345000 0FF U: 345000 0FF U: 345000 0FF U: 3549.99 0F 0F 0F 0F 0F 0F
Config Identities SSB / Broadcast UE Power Control UE Power Measureme	ts Advanced Connect
	Bandwidth Part: Initial BWP V
PUSCH UE Power Control	Function Test
UE Power Control Mode: All Up Bits The PU	CH will be told to continuously increase power
	/ Positive Tolerance: 1 1 dB NR S-Cell Aggregation
PUCCH UE Power Control UE Power Control The PU The PU	CH will follow the PUSCH TPC
	Mobility
PUCCH Target Power: 0 Negativ	/ Positive Tolerance: 1 dB
UL Power Control Parameters	Resource
Add Spectrum Emission 0 VUSCH Alpha Value: Alph	
v p-Max 24 v PUSCH p0: 0	deltaF PUCCH f1: 0
▶ p_NR_FR1: 24 ▶ p0 Nominal With Grant -90	deltaF PUCCH f2: 0
PUCCH p0 Nominal -90	deltaF PUCCH f3: 0 Utility
PUCCH p0: 0	deltaF PUCCH f4: 0
	Арру
System Scheduling Cell PHY Beam Mgmt MAC/RLC/PDCP RRC/NAS IMS	BLER/Tput CSI Assisted Tx Meas
BSE:CONFIg:NR5G[:SELected]:UL[:PUSCh]:CLPControl:MODE	Local Q Search

(Figure 2-9)

• Select "Channel Power" for NR output power



(Figure 2-10)

• Select "Channel Power" for LTE output power

.I.I.I. Transceiver	A									
LTE & LTE-A FDD Channel Power	•	+								
	Input: RFIO8 Output: RFIO1 Coupling: AC				Trig: Prot Frame Aligned Gate: FFT	Carrier Ref Freq: 1.745 Avg Hold: 26/200 CC Info: Uplink, 1 CC	000000 GHz			
1 Graph										
Scale/Div 10.0 dB					Ref Value 30	.00 dBm		 _		
20.0										
10.0										
0.00								 		
								1		
-10.0			{					Ì		
-20.0			/							
-30.0	~~~~									
-40.0										
-50.0										
-60.0										
Center 1.74500 GH	17				Video BW 2.7	000 MHz				Span 30 MHz
Res BW 270.00 kH	z								Sweep	1.00 ms (1001 pts)
2 Metrics	T									
Total Channel F			m/20.000 MHz	Component		arrier Power				
Total Power Sp	ectral Density		-50.05 dBm/Hz	CC0		.96 dBm/20.000 MHz				
1 20	?	Dec 13, 2 6:23:58 I								
		0.20.001						_		

(Figure 2-11)

SA Mode

• Select operating band, SCS, BW and Channel for NR (NR -> Cell -> Config)

Keysight C8700200A Test A	pplication Framewo		26.4.4121)						<u></u>	/		-	- ×
NR SA	33.96 dBm/BW : 20 MHz	A D	A SCC n78 -19.85 dBm/BW N: 100 MHz eq: D: 3350.01 U: 3350.01	N3 OFF	-19.85 dBm/BW /: 100 MHz			/ IHz 01				N	lain Cell On
Config NR Procs	Identities	SSB / Broa	dcast UE Pow	er Control	UE Power Meas	urements	Advanced	L					
RF Common Duplex Mode:	FDD	▼ NF	R Cell Type: SA	•	Band:	n66	•	Te	st Channel:	Mid	•		
Frequency Range:	FR1 (sub-6GHz	:) ▼			SCS Common:	0 (1	5 kHz) ▼						
Downlink					Uplink								
DL Bandwidth:	20 MHz	-			UL Bandwidth:							Fun	ction Test►
DLARFCN:	429000	м	SSB ARFCN: 42	27470	UL ARFCN:	3490	000						
DL Frequency:	2145	MHz 🔻			UL Frequency:	174	5	MHz ▼					Mobility►
DL Point A:	423420		Offset To Carrier: 10	02	UL Point A:	328	948		Offset To Carr	ier: 504			
DL Phase Compensation:	Center Freq	Custom:			UL Phase Compe	nsation: Cen	ter Freq 🔻				•		Resource Allocation
ss-PBCH-BlockPower:	0	dBm			Enable Frequenc	r Shift:						l ink f	o X-Apps
Reference Signal Power:	-65	dBm/SCS	-33.96 d	IBm/BW	Expected Input P	ower: Auto	ס ד	-27	dBm/BW				
DL MIMO Configuration:	Custom (1x1)	DL Antenna	Configuration: 1	x1 ▼	UL MIMO Configu	ration: Cus	tom (1x1) ▼						Utility►
Misc			-										
RFIO Group:	0		Max AoA: 1										Apply
System Scheduling	Cell PHY					s BLER/		Assisted					
BSE:CONFig:NR5G:SCHedu	lling:QCONFig:S	CENario							Local	ৎ ১	earch		More 1/2►

(Figure 3-1)

 Select "UL RMC (TX tests, TS 38.521)" for maximum power RB scheduling (NR -> Scheduling -> Quick Config)

Keysight C8700200A Test A	Application Framework – 5G	NR (15.26.4.4121)						- 0	×
NR SA	33.96 dBm/BW /: 20 MHz q: D: 2145.00	SA SCC n78 -19.85 dBm/BW BW: 100 MHz Freq: D: 3350.01 FF U: 3350.01	-19.8 BW: Freq:	SCC n78 5 dBm/BW 100 MHz 0: 3350.01 J: 3350.01	-19.85 d BW: Freq: D:	100 MHz		Main	ell On
Quick Config TDD	UL-DL Config Sch	eduling Map Slot Conf	ig RNTI	DL TDRA	UL TDRA	Link Adaptation	Rate Matching		
- Scheduling Quick Configur	ation						Clear Log		
Scenario:	UL RMC (TX tests, TS	38.521) 🔻	Log:						
PDSCH - PUSCH Ratio:									
SSB Configuration:	Single SSB	•							
Direction:	Downlink	Uplink						Function	n Test►
BWP ID:	0	0						м	lobility►
Transform Precoding:		Disabled 🗸							
DCI Format:	Format_1_1 ▼	Format_0_1 ▼							ource
PRB Allocation Type:	TYPE1 🔻	TYPE1 🔻						Alloc	ation
Type 0 RBG Allocation:	1FFFF	1FFFF						Link to X-	Appe
PRB Start / Count:	0 273	0 273							прро
MCS Table:	64 QAM 🔻	64 QAM 🔻							Utility►
MCS:	4 - QPSK 🛛 🔻	2 - QPSK 🛛 🔻							Otanty -
Auto-apply: III Off	Apply to	all Cells							Apply
System Scheduling						CSI Assisted Tx N			re 1/2►
BSE:CONFIG[:SELected][:S	ELected]:ACTive[:STATe	1				Loca	Q Search		re 1/2►

(Figure 3-2)

- To set waveform for NR Band (NR -> PHY -> PUSCH) •
 - Select highest modulation in the MCS Table and MCS Table Transform Precoder -
 - Enable Transform Precoder: DFT-s-OFDM / disable for CP-OFDM --
 - Enable pi/2 BPSK TP: DFT-s-OFDM, pi/2 BPSK modulation

Keysight C8700200A Test Application Framework – 5G NR (15.26.4.412)		loudiation		- 🗆 ×
-19.85 d BW: 20 MHz Freq: D: 2145.00	SC n78 Am/BW SA SC n78 +19.85 dBm/BW 100 MHz 3350.01 BW: 100 MHz 3350.01 OFF U: 3350.01	SA SCC n78 -19.85 dBm/8W BW: 100 MHz Freq: D: 3350.01 OFF U: 3350.01		Main Cell On
Bandwidth Parts HARQ PDSCH PDSCH DMR8	m Data Matchias T	PUSCH DMRS PUCCH SRS Co Bandwidth Part pe: Full Buffer	Initial BWP V	
Frequency Hopping Mode: No Hopping Resource Allocation Config. Type 1	Overhead: MCS Table:	Overhead 0 64 QAM	•	Function Test►
RBG Size Config: Config 1 Tx Config: Codebook UL Max Rank: 1	MCS Table Trans Enable Transform Msg3 Transform 1	Precoder:	Y	Mobility►
Codebook Subset: Non Coherent	▼ Enable Π/2 BPSK	(TP: 🔽		Allocation
UCI Over PUSCH Scaling: 1	▼ Frequency Hoppi			Link to X-Apps
				Utility
System Scheduling Cell PHY Beam Mgmt MAC	RLC/PDCP RRC/NAS IMS BLER/T	ut CSI Assisted Tx Meas		Apply
BSE:CONFig:NR5G:SCHeduling:QCONFig:SCENario		Local	Q Search	More 1/2►

(Figure 3-3)

Select Uplink Modulation and RB setting (NR -> Scheduling -> Scheduling Map)

🊈 Keysight	C8700200A	Test Applicat	tion Frame	work – 5G	NR (15.26	6.4.4121)											– 🗆 ×
NR SA	Reference of the second	-33.96 BW: Freq: D:	PCC n66 dBm/BW 20 MHz 2145.00 1745.00	ß	SA -1 BW: FF	SCC 9.85 dBm/B 100 D: 3350 U: 3350	W MHz		SCC n 9.85 dBm/BW 100 M D: 3350.0 U: 3350.0	Hz D1		-19.85 d W: ea: D:	ICC n78 IBm/BW 100 MH 3350.01 3350.01	iz 1			Main Cell On
Quick (Config	TDD UL-D	L Config	Sch	eduling I	Лар з	Slot Confi	g RNTI	DL TI	DRA	UL TDR	A	Link Ad	aptation Ra	ate Ma	atching	
	Editing	Uplink S		ced MCS I	_	QPSK •	Start	RB/Count 0	100	K2: 2	Сор	y to all				t Initial BWP 🔻	
- Radio Fr	ате мар Т	Radio Frai	mes per H	(epetition:										Frame Co		'alette	
																	Function Test►
														Add F	C1	Delete FC0	
Slot Map	,													Clear	All	Set All: FC0	Mobility►
	1 2		1 5		<u> </u>	8 9								- Slot Confi	-	ette	
														SC	0		 Resource Allocation
- Symbol I	Man																Link to X-Apps
0	1	2	3	4	5	6	7	8	9	10	11	12	1	3			Link to A-Apps
0	1	2	3	4	5	6	7	8	9	10	11	12	1:	3		0 .	Utility►
																UL & DL	
														Add S Clear		Del SC6 Set All: SC0 UL	Apply
Quatam	Cabodulia	ng Cell	PHY	Beam M	tamt	MAC/RLC		RRC/NAS	UE Info	IMS	BLER/			Assisted Tx Me		Set Air: SC0 UL	
System	Schedulin	Č.	\bot	ι	<u> </u>	MAC/RLC		RRC/NAS							as	0.000	More 1/2►
BSE:CONF	ig:NR5G:SC	Heating:		SCENario)									Local		Q Search	

(Figure 3-4)

Page 34 of 47

- Click "Cell On" button in the right of Test application screen
- If necessary, turn the Airplane Mode on/off in the DUT
- Select "All Up Bits" of UL Power control Mode (Cell -> UE Power Control)
- To read the output power, click the "Link to X-Apps"

Keysight C8700200A Test Application Framework – 5G NR (15.26.4.4121)	– 🗆 ×
NR SA SA PCC n²6 SA SCC n²8 BB3 SA SCC n²8 BB4 SA SCC n²8 SC SA SCC n²8 SC SA SCC n²8 SC SC SC SC SC SC SC n²8 SC	Main Cell Off
Config NR Procs Identities SSB / Broadcast UE Power Control UE Power Measurements Advanced	
Bandwidth Part Initial BWP 🔻	Ī
PUSCH UE Power Control UE Power Control Mode: All Up Bits The PUSCH will be told to continuously increase power	
PUSCH Target Power: 1 dB	Function Test►
PUCCH UE Power Control	
UE Power Control Mode: All Up Bits The PUCCH will be told to continuously increase power	Mobility
PUCCH Target Power: 30 Negative / Positive Tolerance: 1 dB	WOOlinty
UL Power Control Parameters	. Resource
🗸 Add Spectrum Emission 0 VISCH Alpha Value: Alpha 8 V 🗸 deltaF PUCCH 10: 0	Allocation
→ p-Max 24 → PUSCH p0: 0 → deltaF PUCCH f1: 0	
	Link to X-Apps
✓ p_NR_FR1: 24 ✓ p0 Nominal With Grant -90 ✓ deltaF PUCCH f2: 0	
Add p-Max 23 VUCCH p0 Nominal -90 V deltaF PUCCH f3: 0	Utility►
V PUCCH p0: -1 V deltaF PUCCH f4: 0	
	Apply
System Scheduling Cell PHY Beam Mgmt MAC/RLC/PDCP RRC/NAS UE Info IMS BLER/Tput CSI Assisted Tx Meas	
RSF_CONFIGESELectedItSELectedItSELectedItADDIY	More 1/2►

(Figure 3-5)

• Select "Channel Power"



(Figure 3-6)

NR Band n77 (Sub.4 SRS2) - Lower Band- Measured Results

				N	laximum	Allowed A	verage Powe	er (dBm)			
BW (MHz)	Mode			DSI =0					DSI =1		
, , , , , , , , , , , , , , , , , , ,		Me	asured Pw r (d 633334 3500.01 MHz	IBm)	MPR	Tune-up Limit	Me	asured Pwr (c 633334 3500.01 MHz	IBm)	MPR	Tune-u Limit
100 MHz	SRS CW		18.8		0.0	19.0		9.8		0.0	10.0
BW (MHz)	Mode	Me	asured Pw r (d 633334 3500.01 MHz	IBm)	MPR	Tune-up Limit	Me	asured Pw r (c 633334 3500.01 MHz	IBm)	MPR	Tune-u Limit
90 MHz	SRS CW		18.7		0.0	19.0		9.6		0.0	10.0
BW (MHz)	Mode	Me	asured Pw r (d 633334 3500.01 MHz	IBm) //634000 //3510/MHz//	MPR	Tune-up Limit	Me	asured Pw r (c 633334 3500.01 MHz	IBm) //634000 //3510/MHz/	MPR	Tune- Limit
80 MHz	SRS CW		18.6		0.0	19.0		9.6		0.0	10.0
BW (MHz)	Mode	Me	asured Pw r (d 633334 3500.01 MHz	IBm) //634332/// 3514.98/MHz	MPR	Tune-up Limit	Me ///632334 3485/01/MHz	asured Pwr (c 633334 3500.01 MHz	IBm) //634332/// 3514/98/MHz/	MPR	Tune- Limit
70 MHz	SRS CW		18.7		0.0	19.0		9.4		0.0	10.0
BW (MHz)	Mode	Me	asured Pw r (d 633334 3500.01 MHz	IBm) //634666 ///	MPR	Tune-up Limit	Me	asured Pw r (c 633334 3500.01 MHz	IBm) //634666/// 35/19/99/MHz/	MPR	Tune- Limit
60 MHz	SRS CW		18.5		0.0	19.0		9.4		0.0	10.0
BW (MHz)	Mode	Me 631668 3475.02 MHz	asured Pwr (d //633334// 3506/01/MHz	Bm) 635000 3525 MHz	MPR	Tune-up Limit	Me 631668 3475.02 MHz	asured Pwr (c //633334/ 3500/01/MHz	IBm) 635000 3525 MHz	MPR	Tune- Limit
50 MHz	SRS CW	18.7		18.8	0.0	19.0	9.3		9.8	0.0	10.0
BW (MHz)	Mode	Me 631334 3470.01 MHz	asured Pwr (d //633334 //////////////////////////////	Bm) 635332 3529.98 MHz	MPR	Tune-up Limit	Me 631334 3470.01 MHz	asured Pwr (c 633334 3500.01 MHz	IBm) 635332 3529.98 MHz	MPR	Tune- Limit
40 MHz	SRS CW	18.2		18.5	0.0	19.0	9.2		9.9	0.0	10.0
BW (MHz)	Mode	Me 631000 3465 MHz	asured Pw r (d 633334 3500.01 MHz	Bm) 635666 3534.99 MHz	MPR	Tune-up Limit	Me 631000 3465 MHz	asured Pw r (c 633334 3500.01 MHz	635666	MPR	Tune- Limit
30 MHz	SRS CW	18.1	18.4	18.7	0.0	19.0	9.2	9.3	9.9	0.0	10.0
BW (MHz)	Mode	630668	asured Pw r (d 633334 3500.01 MHz	Bm) 636000 3540 MHz	MPR	Tune-up Limit	Me 630668 3460.02 MHz	asured Pw r (c 633334 3500.01 MHz	IBm) 636000 3540 MHz	MPR	Tune- Limit
25 MHz	SRS CW	17.9	18.5	18.9	0.0	19.0	9.8	9.6	9.9	0.0	10.0
BW (MHz)	Mode	630668	asured Pw r (d 633334 3500.01 MHz	Bm) 636000 3540 MHz	MPR	Tune-up Limit	Me 630668 3460.02 MHz	asured Pwr (c 633334 3500.01 MHz	IBm) 636000 3540 MHz	MPR	Tune- Limit
20 MHz	SRS CW	17.4	17.6	17.9	0.0	19.0	9.4	9.6	9.9	0.0	10.0
BW (MHz)	Mode	Me 630500 3457.5 MHz	asured Pw r (d 633334 3500.01 MHz	636166	MPR	Tune-up Limit	Me 630500 3457.5 MHz	asured Pwr (c 633334 3500.01 MHz	IBm) 636166 3542.49 MHz	MPR	Tune- Limit
15 MHz	SRS CW	17.1	17.2	17.7	0.0	19.0	9.4	9.6	9.9	0.0	10.0
BW (MHz)	Mode	630334	asured Pw r (d 633334 3500.01 MHz	636332	MPR	Tune-up Limit	630334	asured Pwr (c 633334 3500.01 MHz	636332	MPR	Tune- Limit
10 MHz	SRS CW	17.1	17.2	17.8	0.0	19.0	9.4	9.6	9.9	0.0	10.0

Notes:

NR Band n77 (SRS2) were measured output power through FTM mode provided by manufacturer.

Page 36 of 47

NR Band n77 (Sub.4 SRS2) - Upper Band- Measured Results

							N	laximum /	Allowed A	verage Powe	er (dBm)						
BW (MHz)	Mode				DSI =0	I							DSI =1	I			
				100000	lPwr(dBm)				Tune-up			******	Pwr(dBm)				Tune
		650000 3750 MHz		656000 3840 MHz		662000 3930 MHz		MPR	Limit	650000 3750 MHz		656000 3840 MHz		662000 3930 MHz		MPR	Lim
100 MHz	SRS CW	18.5				18.9		0.0	19.0	8.6				8.8		0.0	10.
BW					Pwr (dBm)				Tune-up				Pwr(dBm)	1			Tune
(MHz)	Mode	649668 3745.02 MHz		656000 3840 MHz		662332 3934.98 MHz		MPR	Limit	649668 3745.02 MHz		656000 3840 MHz		662332 3934.98 MHz		MPR	Lin
90 MHz	SRS CW	18.9		18.8		18.9		0.0	19.0	8.7		8.0		8.6		0.0	10
BW	Mode	649334		Measured 656000	Pwr (dBm)	662666		MPR	Tune-up	649334		Measured 656000	Pwr (dBm)	662666		MPR	Tune
(MHz)	mode	3740.01 MHz		3840 MHz		3939.99 MHz		in it	Limit	3740.01 MHz		3840 MHz		3939.99 MHz			Lin
80 MHz	SRS CW	18.9		18.7		18.8		0.0	19.0	8.9		8.0		8.7		0.0	10
BW	Mode	649000	653666	Measured	Pwr (dBm)	658334	663000	MPR	Tune-up Limit	649000	653666	Measured	Pwr(dBm)	658334	663000	MPR	Tune
(MHz)		3735 MHz	3804.99 MHz			3875.01 MHz	3945 MHz		Limit	3735 MHz	3804.99 MHz			3875.01 MHz	3945 MHz		Lin
70 MHz	SRS CW	19.0	18.8			18.8	18.9	0.0	19.0	9.0	7.9			8.3	8.6	0.0	10
DW			I	Measured	Pwr(dBm)				Turner		I	Measured	Pwr(dBm)	a	1		
BW (MHz)	Mode	648668	653556			658444	663332	MPR	Tune-up Limit	648668	653556			658444	663332	MPR	Tun Lir
60 MHz	SRS CW	3730.02 MHz 18.9	3803.34 MHz 18.7			3876.66 MHz 18.9	3949.98 MHz 18.9	0.0	19.0	3730.02 MHz 9.1	3803.34 MHz 7.8			3876.66 MHz 8.4	3949.98 MHz 8.7	0.0	10
BW			I	Measured	Pwr(dBm)				Tune-up		I	Measured	Pwr(dBm)		1		Tune
(MHz)	Mode	648334	652166	656000		659834	663666	MPR	Limit	648334	652166	656000		659834	663666 3954.99 MHz	MPR	Lir
50 MHz	SRS CW	3725.01 MHz 18.8	3782.49 MHz 18.8	3840 MHz 18.7		3897.51 MHz 18.7	3954.99 MHz 18.8	0.0	19.0	3725.01 MHz 9.0	3782.49 MHz 7.8	3840 MHz 8.0		3897.51 MHz 8.3	8.6	0.0	10
BW					IPwr(dBm)				Tune-up				Pwr(dBm)				Tun
(MHz)	Mode	648000 3720 MHz	651200 3768 MHz	654400 3816 MHz	657600 3864 MHz	660800 3912 MHz	664000 3960 MHz	MPR	Limit	648000 3720 MHz	651200 3768 MHz	654400 3816 MHz	657600 3864 MHz	660800 3912 MHz	664000 3960 MHz	MPR	Lir
40 MHz	SRS CW	18.5	18.8	18.6	18.9	19.0	18.9	0.0	19.0	7.7	8.0	7.7	8.2	8.3	8.5	0.0	10
BW				-	l Pwr(dBm)				Tune-up				Pwr(dBm)				Tun
(MHz)	Mode	647668 3715.02 MHz	651000 3765 MHz	654334 3815.01 MHz	657666 3864.99 MHz	661000 3915 MHz	664332 3964.98 MHz	MPR	Limit	647668 3715.02 MHz	651000 3765 MHz	654334 3815.01 MHz	657666 3864.99 MHz	661000 3915 MHz	664332 3964.98 MHz	MPR	Lir
30 MHz	SRS CW	18.5	18.6	18.4	18.9	18.7	18.9	0.0	19.0	7.7	8.0	7.7	8.2	8.3	8.5	0.0	10
BW	Mode	0.1700.1	050000		Pwr (dBm)	004000	004000	MPR	Tune-up	0.1700.4	050000		Pwr(dBm)	004000		MPR	Tun
(MHz)	Wode	647334 3710.01 MHz	650800 3762 MHz	654266 3813.99 MHz	657734 3866.01 MHz	661200 3918 MHz	664666 3969.99 MHz	IVIEIX	Limit	647334 3710.01 MHz	650800 3762 MHz	654266 3813.99 MHz	657734 3866.01 MHz	661200 3918 MHz	664666 3969.99 MHz	INFIX	Lir
25 MHz	SRS CW	18.5	18.6	16.6	18.9	18.8	18.9	0.0	19.0	9.2	8.1	8.1	8.1	8.6	8.7	0.0	10
BW	Mode	647334	650800	Measured 654266	Pwr (dBm) 657734	661200	664666	MPR	Tune-up	647334	650800	Measured 654266	Pw r (dBm) 657734	661200	664666	MPR	Tun
(MHz)		3710.01 MHz	3762 MHz	3813.99 MHz		3918 MHz	3969.99 MHz		Limit	3710.01 MHz	3762 MHz	3813.99 MHz	3866.01 MHz		3969.99 MHz		Lir
20 MHz	SRS CW	18.5	18.6	18.6	19.0	18.8	18.9	0.0	19.0	9.2	8.1	8.1	8.1	8.6	8.6	0.0	1(
BW	Mode	647168	650700	Measured 654234	Pwr (dBm) 657766	661300	664832	MPR	Tune-up	647168	650700	Measured 654234	Pw r (dBm) 657766	661300	664832	MPR	Tun
(MHz)	moue	3707.52 MHz	3760.5 MHz		3866.49 MHz	3919.5 MHz	3972.48 MHz	WEX	Limit	3707.52 MHz	3760.5 MHz		3866.49 MHz			WPIX	Lir
15 MHz	SRS CW	18.3	18.3	18.2	18.6	18.4	18.6	0.0	19.0	9.2	8.2	8.1	8.1	8.6	8.6	0.0	10
BW	Mode	647000	650600	Measured 654200	Pwr (dBm)	661400	665000	MPR	Tune-up	647000	650600	Measured 654200	Pwr (dBm)	661400	665000	MPR	Tun
	Mode	047000			657800			WPR	Limit				657800		665000	WIT	Lin
(MHz)		3705 MHz	3759 MHz	3813 MHz	3867 MHz	3921 MHz	3975 MHz			3705 MHz	3759 MHz	3813 MHz	3867 MHz	3921 MHz	3975 MHz		

Notes:

NR Band n77 (SRS2) were measured output power through FTM mode provided by manufacturer

9. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

- Reported SAR(W/kg) for WWAN= Measured SAR *Tune-up Scaling Factor
- Reported SAR(W/kg) for Wi-Fi and Bluetooth= Measured SAR * Tune-up scaling factor * Duty Cycle scaling factor
- Duty Cycle scaling factor = 1 / Duty cycle (%)

KDB 447498 D01 General RF Exposure Guidance:

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- \leq 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is \leq 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- \leq 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is \geq 200 MHz

KDB 648474 D04 Handset SAR:

With headset attached, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

KDB 648474 D04 Handset SAR (Phablet Only):

For smart phones, with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm.

When hotspot mode does not apply, 10-g extremity SAR is required for all surfaces and edges with an antenna located at < 25mm

From that surface or edge in direct contact with a flat phantom, to address interactive hand use exposure conditions. When hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg;

However, when power reduction applies to hotspot mode the measured SAR must be scaled to the maximum output power, Including tolerance, allowed for phablet modes to compare with the 1.2 W/kg SAR test reduction threshold.

Additional 1-g SAR testing at 5 mm is not required when hotspot mode 10-g extremity SAR is not required for the surfaces and edges; since all 1-g reported SAR < 1.2 W/kg.

KDB 941225 D01 SAR test for 3G devices:

When the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq \frac{1}{4}$ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

KDB 941225 D05 SAR for LTE Devices:

SAR test reduction is applied using the following criteria:

- Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB, and 50% RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge. middle and lower edge of each required test channel.
- When the reported SAR is > 0.8 W/kg, testing for other Channels is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.
- Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are > 0.8 W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg.
- Testing for 16-QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of QPSK.
- Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.
- For LTE bands that do not support at least three non-overlapping channels in certain channel bandwidths, test the available non-overlapping channels instead. When a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing; therefore, the requirement for H, M and L channels may not fully apply.

KDB 248227 D01 SAR meas for 802.11:

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the *initial test position(s)* by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The *initial test position(s)* is measured using the highest measured maximum output power channel in the required wireless mode test configuration(s). When the *reported* SAR for the *initial test position* is:

- ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- > 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the <u>initial test position</u> to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the <u>reported</u> SAR is ≤ 0.8 W/kg or all required test positions are tested.
 - For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
 - When it is unclear, all equivalent conditions must be tested.
- For all positions/configurations tested using the *initial test position* and subsequent test positions, when the *reported* SAR is > 0.8 W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the *reported* SAR is ≤ 1.2 W/kg or all required test channels are considered.
 - The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.
- When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.
- When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is ≤ 1.2 W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR.

To determine the *initial test position*, Area Scans were performed to determine the position with the *Maximum Value of SAR* (*measured*). The position that produced the highest *Maximum Value of SAR* is considered the worst case position; thus used as the *initial test position*.

Page 39 of 47

NR Band n77(SRS2) (100MHz Bandwidth) 9.1.

							Pow er	(dBm)	1-g SAF	R (W/kg)	
Antenna	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Tune-up limit	Meas.	Meas.	Scaled	Plot No.
Sub.4	Standalone	SRS	19	R/Right	662000	3930.0	19.00	18.94	0.014	0.014	
-SRS2-	Standalone	CW	0	R/Right	662000	3930.0	10.00	8.81	0.047	0.062	1

Note(s): 1. NR Band n77 (SRS2) tested using FTM mode.

10. SAR Measurement Variability

In accordance with published RF Exposure KDB 865664 D01 SAR measurement 100 MHz to 6 GHz. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

- 1) Repeated measurement is not required when the original highest measured SAR is <0.8 or 2 W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is ≥ 0.8 or 2 W/kg (1-g or 10-g respectively), repeat that measurement once.
- 3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 or 3.6 W/kg (~ 10% from the 1-g or 10-g respective SAR limit).
- 4) Perform a third repeated measurement only if the original, first, or second repeated measurement is ≥ 1.5 or 3.75 W/kg (1-g or 10-g respectively) and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	Repeated Measured SAR (W/kg)	Largest to Smallest SAR Ratio
3700	NR Band n77	Standalone	R/Right	No	0.047	N/A	N/A

Peak spatial-average (1g of tissue)

Note(s):

1. In above table, Only some bands above 0.8 or 2.0 W/kg (1-g or 10-g Measured SAR) were listed.

2. Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not > 1.20.

Page 41 of 47

11. Simultaneous Transmission SAR Analysis

Simultaneous Transmission Condition

RF Exposure Condition	ltem			Capable Transr	mit Configu	irations	
	1	WWAN (3G/LTE/NR)	+	DTS Ant.1			
	2	WWAN (3G/LTE/NR)	+	DTS MIMO			
	3	WWAN (3G/LTE/NR)	+	UNII Ant.2			
	4	WWAN (3G/LTE/NR)	+	UNII MIMO			
	5	WWAN (3G/LTE/NR)	+	BT Ant.1			
	6	WWAN (3G/LTE/NR)	+	UNII Ant.2	+	BT Ant.1	
Standalone	7	WWAN (3G/LTE/NR)	+	UNII MIMO	+	BT Ant.1	
Stanualone	8	ENDC(LTE+NR)	+	DTS Ant.1			
	9	ENDC(LTE+NR)	+	DTS MIMO			
	10	ENDC(LTE+NR)	+	UNII Ant.2			
	11	ENDC(LTE+NR)	+	UNII MIMO			
	12	ENDC(LTE+NR)	+	BT Ant.1			
	13	ENDC(LTE+NR)	+	UNII Ant.2	+	BT Ant.1	
	14	ENDC(LTE+NR)	+	UNII MIMO	+	BT Ant.1	

Notes:

1. DTS supports Wi-Fi Direct, Hotspot and VolP.

2. U-NII supports Wi-Fi Direct, Hotspot and VolP.

3. W-CDMA, LTE, NR supports Hotspot and VoIP

4. U-NII Radio can transmit simultaneously with Bluetooth Radio in certain scenario

5. NR Radio support to both SA and NSA(ENDC) Radio.

Note(s):

For EN-DC mode, LSI TAS algorithm in WWAN adds directly the time-averaged RF exposure from 4G(LTE) and time-averaged RF exposure from 5G NR. LSI TAS algorithm controls the total RF exposure from both 4G and 5G NR to not exceed the RF exposure from each 4G or 5G individually. Therefore, simultaneous transmission compliance between 4G+5G NR operation is demonstrated in the TAS validation Report during algorithm validation. In this SAR Report, simultaneous transmission compliance was evaluated individually with other Radios (WLAN or BT) using one of 4G or 5G NR.

Page 42 of 47

Simultaneous transmission SAR test exclusion considerations

KDB 447498 D01 General RF Exposure Guidance provides two procedures for determining simultaneous transmission SAR test exclusion: Sum of SAR and SAR to Peak Location Ratio (SPLSR)

Sum of SAR

To qualify for simultaneous transmission SAR test exclusion based upon Sum of SAR the sum of the reported standalone SARs for all simultaneously transmitting antennas shall be below the applicable standalone SAR limit. If the sum of the SARs is above the applicable limit then simultaneous transmission SAR test exclusion may still apply if the requirements of the SAR to Peak Location Ratio (SPLSR) evaluation are met.

SAR to Peak Location Separation Ratio (SPLSR)

KDB 447498 D01 General RF Exposure Guidance explains how to calculate the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

SPLSR = (SAR1 + SAR2)1.5/Ri

Where:

SAR¹ is the highest reported or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

SAR² is the highest reported or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

Ri is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of

$[(x_1-x_2)_2 + (y_1-y_2)_2 + (z_1-z_2)_2]$

In order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

$(SAR_1 + SAR_2)_{1.5}/Ri \leq 0.04$

When an individual antenna transmits at on two bands simultaneously, the sum of the highest *reported* SAR for the frequency bands should be used to determine **SAR**₁.or **SAR**₂. When SPLSR is necessary, the smallest distance between the peak SAR locations for the antenna pair with respect to the peaks from each antenna should be used.

The antennas in all antenna pairs that do not qualify for simultaneous transmission SAR test exclusion must be tested for SAR compliance, according to the enlarged zoom scan and volume scan post-processing procedures in KDB Publication 865664 D01

The antennas for the unlicensed transmitters are closely situated. As a result, the associated SAR hotspots are also closely situated. Some of the sum of SAR calculations yielded results over 1.6 W/kg. The SPSLR calculations for these situations were performed by treating the unlicensed SAR values as a single transmitter. The most conservative distance between all the unlicensed hotspots to the licensed hotspot was used for the value of *d* in the SPSLR calculation.

Simultaneous transmission SAR measurement

When simultaneous transmission SAR measurements are required in different frequency bands not covered by a single probe calibration point then separate tests for each frequency band are performed. The tests are performed using enlarged zoom scans which are processed, by means of superposition, using the DASY5 volume scan postprocessing procedures to determine the 1-g SAR for the aggregate SAR distribution.

The spatial resolution used for all enlarged zoom scans is the same as used for the most stringent zoom scans. I.E. the scan parameters required for the highest frequency assessed are used for all enlarged zoom scans. The scans cover the complete area of the device to ensure all transmitting antennas and radiating structures are assessed.

DASY5 provides the ability to perform Multiband Evaluations according to the latest standards using the Volume Scan job as well as appropriate routines for the Post-processing.

In order to extract and process measurements within different frequency bands, the SEMCAD X Post-processor performs the combination and subsequent superposition of these measurement data via DASY5= Combined MultiBand Averaged SAR.

Combined Multi Band Averaged SAR allows - in addition to the data extraction - an evaluation of the 1 g, 10 g and/or arbitrary averaged mass SAR.

Power Scaling Factor is used to allow the volume scans to be scaled by a value other than "1", this is important when the results need to be scaled to different maximum power levels. The Power Scaling Factor is applied to each individual point of the scan. When power scaling is used in multi-band combinations the scaling factor is applied to each individual point of the first scan, the second factor is then applied to each individual point of the second scan and so on. The scans are then combined.

SPLSR Hotspot Combination

Per November 2019 TCB Workshop Notes, SPLSR Hotspot Combination procedure can be applied to evaluate to simultaneous transmission SAR analysis.

Hybrid SPLSR and enlarged zoom scan (Volume scan) can be applied when Simultaneous transmission SAR is over 1.6 or 4.0 W/kg (1-g or 10-g respectively), it does not meet SPLSR criteria, and antenna pair is co-located. Antenna co-location means that SAR distributions overlap because the antennas are not significantly spatially separated.

Test procedure

- Step.1 Perform enlarged zoom scan (Volume scan) on the co-located antenna pair to determine 1g/10g aggregate SAR.
- **Step.2** Apply SPLSR procedure for the spatially separated antenna and aggregate SAR distribution of the colocated antenna pair.

Sum to Peak Location Separation Ratio

Instead of doing a small volume scan over a co-located antenna pair (Hybrid SPLSR guide), Simultaneous transmission SAR test exclusion may algebraically sum the SAR values of the co-located pair and use that value in SPLSR calculation;

-In the calculation Separation distance must use the minimum distance between the spatially separated antenna and the closest antenna of the co-located antenna pair to be conservative.

11.1. Sum of the SAR for WWAN(Standalone) & Wi-Fi & BT in (R/Right) position

	FExposure Test WWAN Anter					Standalone	SAR (W/kg)					Sur	n of SAR (W/I	kg)		
RF Exposure	Test Position	WWAN Bands	Antenna	WWAN	DTS Ant.1	DTS MIMO	WiFi & BT UNII Ant.2	UNII MIMO	BT Ant.1	WWAN + DTS Ant.1	WWAN + DTS MIMO	WWAN + UNII Ant.2	WWAN + UNII MIMO	WWAN + BT Ant.1	WWAN + UNII Ant.2 +	
				1-1	2	3	4	5	6	1+2	1+3	1+4	1+5	1+6	BT Ant.1 1+4+6	BT Ant.1 1+5+6
Standalone	R/Right	NR Band n77-SRS2	Sub.4 Ant.	0.062	0.143	0.772	0.873	0.753	0.003	0.205	0.834	0.935	0.815	0.065	0.938	0.818

Note(s):

All Sum results are below FCC limit (1.6 W/kg). So additional evaluation are not required. 1.

Green value is estimated SAR according to calculate of KDB 447498 D04. Please refer to Section.7.
 WiFi&BT data refer to Original model(4790841154-S1V3 FCC Report SAR).

Page 45 of 47

Appendixes

Refer to separated files for the following appendixes.

4790982779-S1 FCC Report SAR_App A_Photos & Ant. Locations

4790982779-S1 FCC Report SAR_App B_Highest SAR Test Plots

4790982779-S1 FCC Report SAR_App C_System Check Plots

4790982779-S1 FCC Report SAR_App D_SAR Tissue Ingredients

4790982779-S1 FCC Report SAR_App E_Probe Cal. Certificates

4790982779-S1 FCC Report SAR_App F_Dipole Cal. Certificates

4790982779-S1 FCC Report SAR_App G_Proximity Sensor feature

END OF REPORT