FCC 47 CFR § 2.1093
IEEE Std 1528-2013

SAR EVALUATION REPORT
(Part 1 : Test in Static Transmission Condition)

FOR

GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac and NFC

MODEL NUMBER: SM-A256E/DSN, SM-A256E/N

FCC ID: A3LSMA256E

REPORT NUMBER: 4791131433-S1V2

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Prepared for
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TL-637

Revision History

Rev.	Date	Revisions	Revised By
V1	1/9/2024	Initial Issue	--
V2	3/15/2024	Revised Sec 10.1 Revised Appendix B	Jeongyeon Won

Table of Contents

1. Attestation of Test Results

Applicant Name		SAMSUNG ELECTRONICS CO.,LTD.			
FCC ID		A3LSMA256E			
Model Number		SM-A256E/DEN, SM-A256E/N			
Applicable Standards		FCC 47 CFR § 2.1093 IEEE Std 1528-2013 Published RF exposure KDB procedures			
Exposure Category		SAR Limits (W/Kg)			
		Peak spatial-average (1g of tissue)			
General population / Uncontrolled exposure		1.6			
RF Exposure Conditions		Equipment Class - The Highest Reported SAR (W/kg)			
		PCE	DTS	NII	DSS
Head		0.10	0.10	0.47	0.06
Body-worn		0.16	0.13	0.39	0.02
Hotspot		0.36	0.34	0.67	0.08
Simultaneous TX	Head	0.60	0.19	0.60	0.60
	Body-worn	0.57	0.30	0.57	0.57
	Hotspot	1.06	0.68	1.06	1.06
Date Tested		12/29/2023 to 1/4/2024			
Test Results		Pass			

This supplementary report is a report evaluating the bandwidth of NR Band n66 up to 40MHz, which is not covered in 14938215-S1V5 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:
	
Justin Park Operations Leader UL Korea, Ltd. Suwon Laboratory	Jeongyeon Won Laboratory Engineer UL Korea, Ltd. Suwon Laboratory

2. 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 KDB procedures:

- 447498 D04 Interim General RF Exposure Guidance v01
- 648474 D04 Handset SAR v01r03
- 690783 D01 SAR Listings on Grants v01r03
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- 865664 D02 RF Exposure Reporting v01r02
- 941225 D05 SAR for LTE Devices v02r05
- 941225 D06 Hotspot Mode v02r01
- 971168 D01 Power Meas License Digital System v03r01

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

- TCB workshop October, 2016; RF Exposure Procedures (DUT Holder Perturbations)
- TCB workshop April, 2019; RF Exposure Procedures (Tissue Simulating Liquids (TSL))
- TCB workshop October, 2020; 5G RFX Policies (Intra-band and Inter-band NSA-EN-DC evaluation)
- TCB workshop April, 2022; RF Exposure Procedures (5G NR FR1 Measurement)

3. Facilities and Accreditation

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

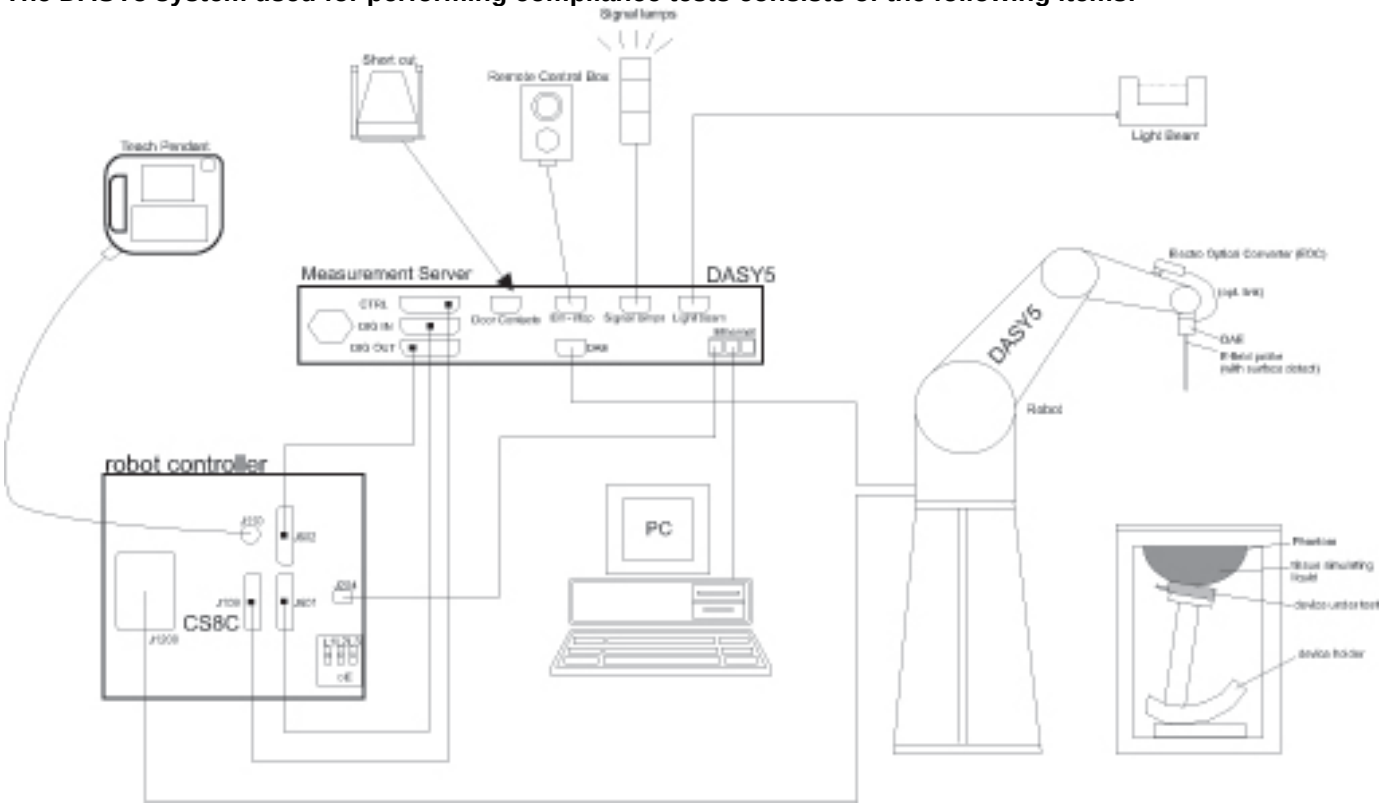
Suwon
SAR 8 Room

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637.
The full scope of accreditation can be viewed at https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf.

4. SAR Measurement System & Test Equipment

4.1. 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.

4.2. 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.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

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.

Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

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 *reported* 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.

Step 5: Z-Scan (FCC only)

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be larger than the step size in Z-direction.

4.3. 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
Network Analyzer	Agilent	E5071C	MY46522054	7-24-2024
Dielectric Assessment Kit	SPEAG	DAK-12	1158	9-20-2024
Shorting block	SPEAG	DAK-12 Short	SM DAK 220 AD	N/A
Thermometer	LKM	DTM3000	3851	7-25-2024
Thermometer	LKM	DTM3000	3862	7-25-2024

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
MXG Analog Signal Generator	Keysight	N5173B	MY59101083	7-27-2024
Power Sensor	KEYSIGHT	U2000A	MY60490008	7-25-2024
Power Sensor	KEYSIGHT	U2000A	MY60160004	7-25-2024
Power Amplifier	EXODUS	AMP2027ADB	10002	1-6-2024
Directional Coupler	KRYTAR	100318010	215542	1-5-2024
Low Pass Filter	SPEAG	WLKX10-11000-13640-21000-60TS	1	7-25-2024
Attenuator	KEYSIGHT	8491B/010	MY39272011	7-25-2024
Attenuator	KEYSIGHT	8491B/020	MY39272302	7-24-2024
Attenuator	KEYSIGHT	8491B/003	MY39272275	7-25-2024
E-Field Probe	SPEAG	EX3DV4	7645	9-20-2024
Data Acquisition Electronics	SPEAG	DAE4	1468	8-24-2024
System Validation Dipole	SPEAG	D1750V2	1125	**11-30-2024**
Thermometer	Lutron	MHB-382SD	AK.12102	7-31-2024

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
UXM 5G Wireless Test Platform	KEYSIGHT	E7515B	MY57510596	7-27-2024
Radio Communication Test Station	Anritsu	MT8000A	6272466165	10-18-2024
Radio Communication Analyzer	Anritsu	MT8821C	6161094351	11-30-2024

Note(s):

1. For System Validation Dipole, Calibration interval applied every 2 years according to referencing KDB 865664 guidance.
2. Refer to Appendix F that mentioned about justification for Extended SAR Dipole Calibrations. (for blue box items)
3. All equipments were used until Cal.Due data.

5. Measurement Uncertainty

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 ≤ 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.

5.1. DECISION RULE

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

6. Device Under Test (DUT) Information

6.1. DUT Description

Device Dimension	Refer to Appendix A.
Back Cover	☒ The Back Cover is not removable.
Battery Options	☒ The rechargeable battery is not user accessible
Wireless Router (Hotspot)	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 5.2 GHz , Wi-Fi 5.8 GHz)
Wi-Fi Direct	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. S/N Notes** 1 R3CW50B175N WWAN Conducted 2 RZCWB07LW5E SAR 3 RZCWB07LY6Z SAR

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode		Duty Cycle used for SAR testing
GSM	850 1900	Voice (GMSK) GPRS (GMSK) EGPRS (8PSK)	GPRS Multi-Slot Class: ☐ Class 8 - 1 Up, 4 Down ☐ Class 10 - 2 Up, 4 Down ☐ Class 12 - 4 Up, 4 Down ☒ Class 33 - 4 Up, 5 Down	GSM Voice: 12.5% (E)GPRS: 1 Slot: 12.5% 2 Slots: 25% 3 Slots: 37.5% 4 Slots: 50%
	Does this device support DTM (Dual Transfer Mode)? ☐ Yes ☒ No			
W-CDMA (UMTS)	Band II Band IV Band V	UMTS Rel. 99 (Voice & Data) HSDPA (Rel. 5) HSUPA (Rel. 6) DC-HSDPA (Rel. 8) HSPA+ (Rel.7) DL only		100%
LTE	FDD Band 2 FDD Band 4 FDD Band 5 FDD Band 12 FDD Band 13 FDD Band 17 FDD Band 26 TDD Band 41[1] FDD Band 66	QPSK 16QAM 64QAM 256QAM Rel. 15 Carrier Aggregation (1 Uplink and 4 Downlinks)		100% (FDD) 63.3% (TDD)
	Does this device support SV-LTE (1xRTT-LTE)? ☐ Yes ☒ No			
5G NR (Sub 6)	NR Band n5 NR Band n26 NR Band n41 NR Band n66 NR Band n77	DFT-s-ODFM: ■ π/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM CP-ODFM: ■QPSK, 16QAM, 64QAM, 256QAM		100%
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20) 802.11ac (VHT20)		97.36% (802.11b)
	5 GHz	802.11a 802.11n (HT20), 802.11n (HT40) 802.11ac (VHT20), 802.11ac (VHT40) 802.11ac (VHT80)		90.94% (802.11a) 89.13% (802.11n 40MHz BW) 92.05% (802.11ac 80MHz BW)
	Does this device support bands 5.60 ~ 5.65 GHz? ☒ Yes ☐ No			
	Does this device support Band gap channel(s)? ☒ Yes ☐ No			
Bluetooth	2.4 GHz	Version 5.3 LE		77.50%
NFC	13.56 MHz	Type A/B/F and ISO15693		100%

Notes:

1. The Bluetooth protocol is considered source-based averaging. Bluetooth GFSK (DH5) was verified to have the highest duty cycle of 77.5% and was considered and used for SAR Testing.
2. Measured Duty Cycle is not required due to SAR test exemption.

6.3. Nominal and Maximum Output Power

KDB 447498 sec.4.1. at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit

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

NR-Sub6 Bands

RF Air interface	Antenna	Mode	Maximum allowed output power (dBm)					
			Pmax	Plimit				
				RSI = 0 (Free)	RSI = 1 (Earjack)	RSI = 2 (Grip)	RSI = 3 (Hotspot)	RSI = 4 (RCV)
NR Band n66	Ant.B	DFT-s-OFDM QPSK	**24.50**	**22.00**	**22.00**	**22.00**	**22.00**	**22.00**

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

Item	Description												
Frequency range, Channel Bandwidth, Numbers and Frequencues	Band n66	Frequency range: 1710 - 1780 MHz											
		Channel Bandwidth											
		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							346000/ 1730	345000/ 1725	344500/ 1722.5	344000 /1720	343500 /1717.5	343000 /1715	342500 /1712.5
	Mid							349000/ 1745	349000/ 1745	349000/ 1745	349000/ 1745	349000/ 1745	349000/ 1745	349000/ 1745
	High							352000/ 1760	353000/ 1765	353500/ 1767.5	354000 /1770	354500 /1772.5	355000 /1775	355500 /1777.5
SCS	NR FDD Bands : 15 kHz													
Modulations Supported in UL	DFT-s-OFDM: π/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM & CP-OFDM: QPSK, 16QAM, 64QAM, 256QAM													
A-MPR (Additional MPR) disabled for SAR Testing?	Yes													
EN-DC Carrier Aggregation Possible Combinations														
LTE Anchor Bands for NR Band n66	LTE Band 2/5/12/13													

Notes:

1. 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.
2. NR configurations of SAR test were determined according to Section 5.2 of KDB 941225 D05.

7. RF Exposure Conditions (Test Configurations)

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

Wireless technologies	RF Exposure Conditions	Antenaa	DUT-to-User Separation	Test Position	Antenna-to-edge/surface	SAR Required	Note
WWAN	Head	All Antennas	0 mm	Left Touch	N/A	Yes	
				Left Tilt (15°)	N/A	Yes	
				Right Touch	N/A	Yes	
				Right Tilt (15°)	N/A	Yes	
	Body-worn & Hotspot	All Antennas	15 mm	Rear	N/A	Yes	
				Front	N/A	Yes	
	Hotspot	Ant.B	10 mm	Rear	< 25 mm	Yes	
				Front	< 25 mm	Yes	
				Top	> 25 mm	No	1
				Left	< 25 mm	Yes	
				Bottom	< 25 mm	Yes	
				Right	> 25 mm	No	1
	Product Specific 10-g	All Main Antennas	0 mm	Rear	Refer to notes 2 & 3		
				Front			
				Top			
				Left			
				Bottom			
				Right			

Note(s):

1. SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR.
2. For Phablet devices: When hotspot mode applies, Product specific 10-g SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.
3. For Phablet devices: When hotspot mode applies and power reduction applies to hotspot mode, Product specific 10-g SAR is required for each test position that has and adjusted SAR to maximum power that is > 1.2 W/kg.

8. Dielectric Property Measurements & System Check

8.1. Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°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 parameters 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.

Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
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	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

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 8 Room

Date	Freq. (MHz)				Measured	Target	Delta (%)	Limit ±(%)
2024-01-02	Head 1750	e'	40.9000	Relative Permittivity (ε_r):	40.90	40.08	2.03	5
		e"	13.7200	Conductivity (σ):	1.34	1.37	-2.48	5
	Head 1710	e'	40.9100	Relative Permittivity (ε_r):	40.91	40.15	1.90	5
		e"	13.8300	Conductivity (σ):	1.31	1.35	-2.33	5
	Head 1780	e'	40.8800	Relative Permittivity (ε_r):	40.88	40.04	2.10	5
		e"	13.6700	Conductivity (σ):	1.35	1.39	-2.38	5

8.2. 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 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.

System Performance Check Measurement Conditions:

- 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.

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 Values (W/kg)	
				1g/10g	Head
D1750V2	1125	11-30-2022	11-30-2024	1g	37.40
				10g	19.70

Note(s):

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

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 8 Room

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
1-2-2024	D1750V2	1125	Head	1g	3.72	37.2	37.40	-0.53	1
				10g	2.05	20.5	19.70	4.06	

9. Conducted Output Power Measurements

9.1. 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.

Table 6.2.2.3-1: Maximum Power Reduction (MPR) for Power 3

Modulation	MPR (dB)		
	Edge RB allocations	Outer RB allocations	Inner RB allocations
DFT-s-OFDM PI/2 BPSK	≤ 3.5[1]	≤ 1.2[1]	≤ 0.2[1]
	≤ 0.5[2]		0[2]
DFT-s-OFDM QPSK	≤ 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	≤ 3		≤ 1.5
CP-OFDM 16 QAM	≤ 3		≤ 2
CP-OFDM 64 QAM	≤ 3.5		
CP-OFDM 256 QAM	≤ 6.5		

NOTE 1: Applicable for UE operating in TDD mode with PI/2 BPSK modulation and UE indicates support for UE capability *powerBoosting-pi2BPSK* and if the IE *powerBoostPi2BPSK* is set to 1 and 40 % or less slots in radio frame are used for UL transmission for bands n40, n41, n77, n78 and n79. The reference power of 0dB MPR is 26dBm.

NOTE 2: Applicable for UE operating in FDD mode, or in TDD mode in bands other than n40, n41, n77, n78 and n79 and if the IE *powerBoostPi2BPSK* is set to 0 and if more than 40% of slots in radio frame are used for UL transmission for bands n40, n41, n77, n78 and n79.

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 (N_{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.

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

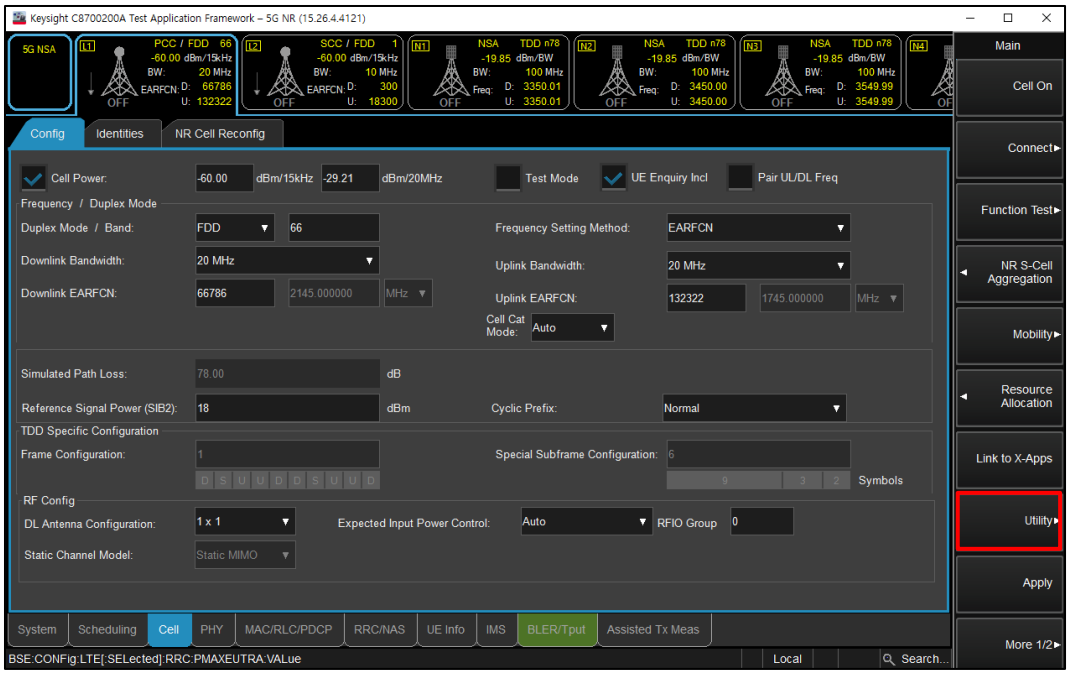
SAR test exclusion can be applied for testing overlapping NR bands as follows:

a) The maximum output power, including tolerance, for the smaller band must be ≤ the larger band to qualify for the SAR test exclusion.
b) The channel bandwidth and other operating parameters for the smaller band must be fully supported by the larger band.

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

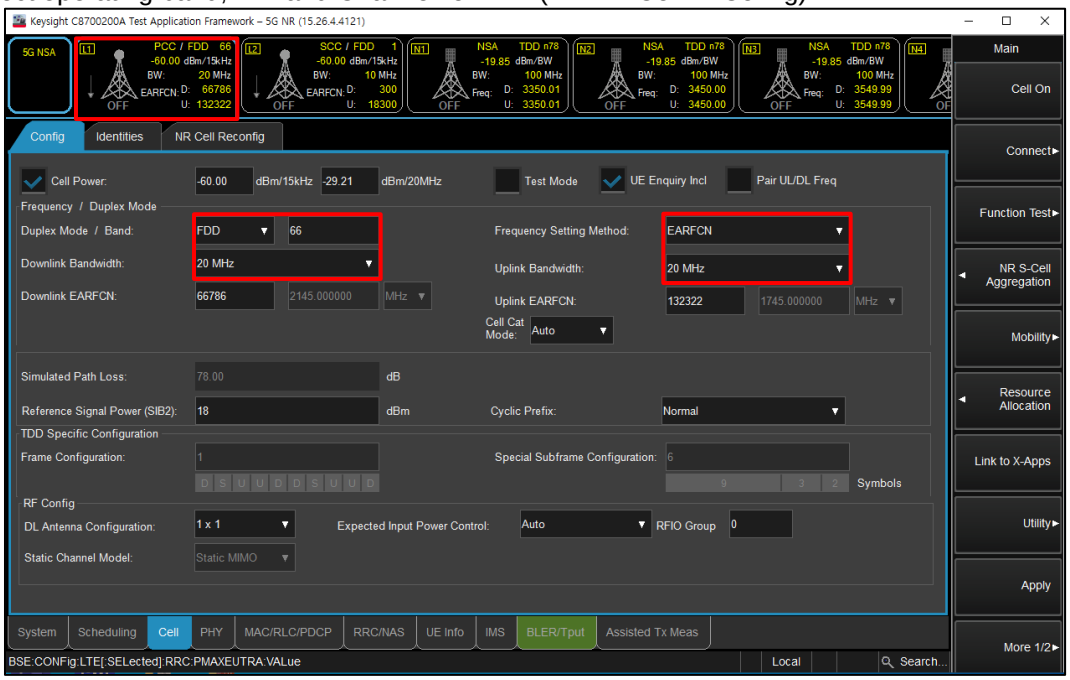


(Figure 1-1)

(Figure 1-2)

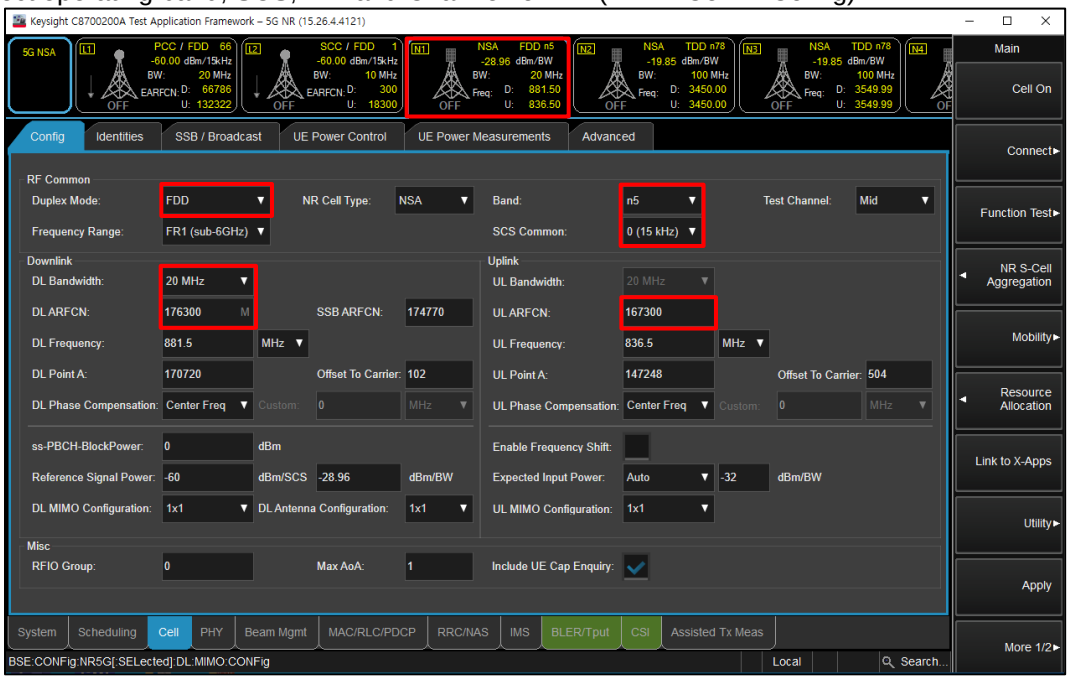
NSA Mode

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



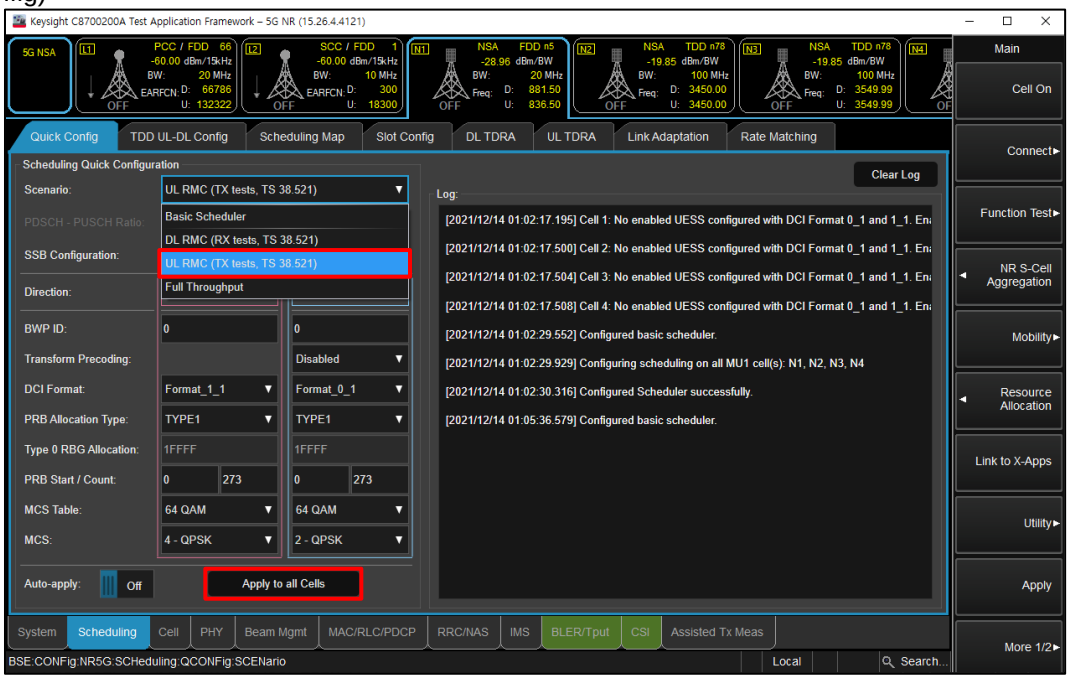
(Figure 2-1)

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



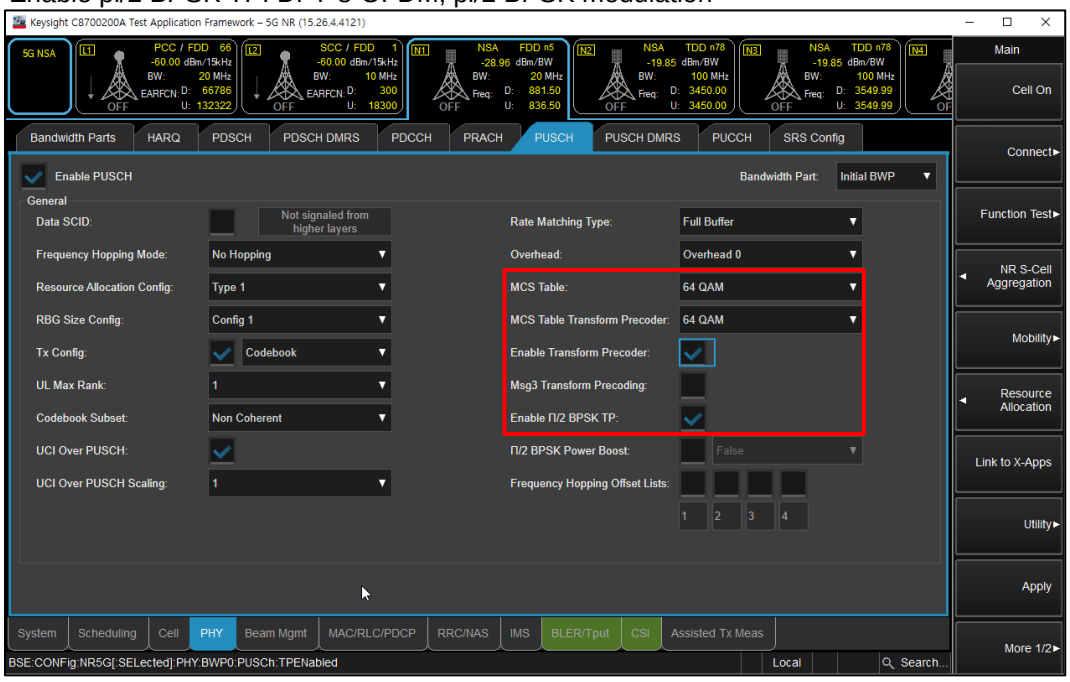
(Figure 2-2)

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



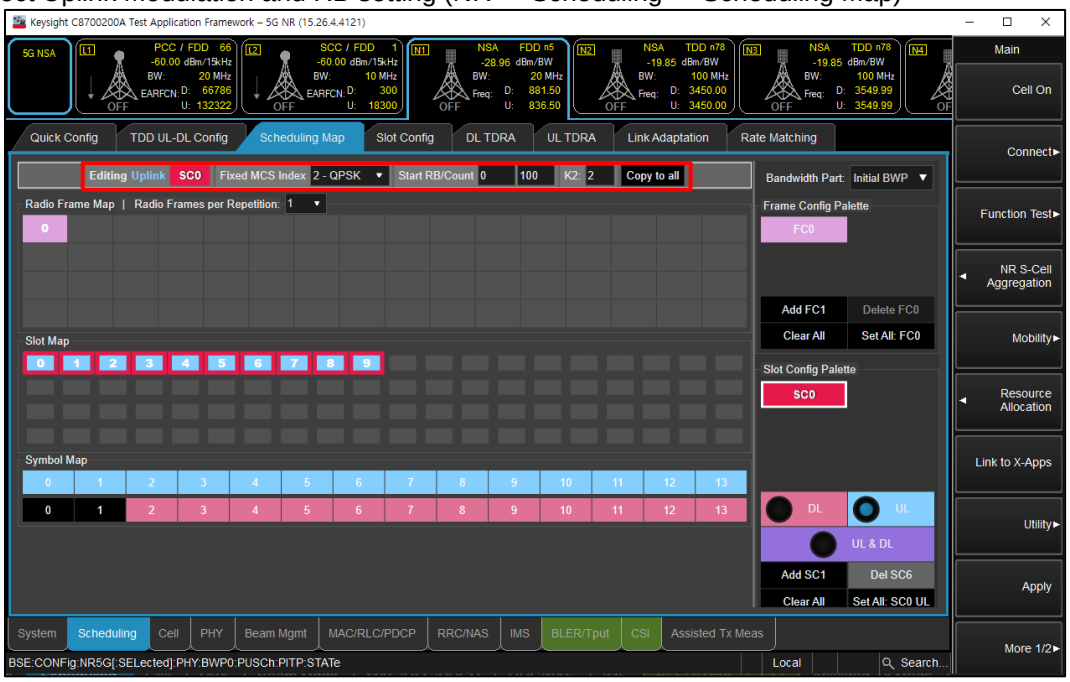
(Figure 2-3)

- 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



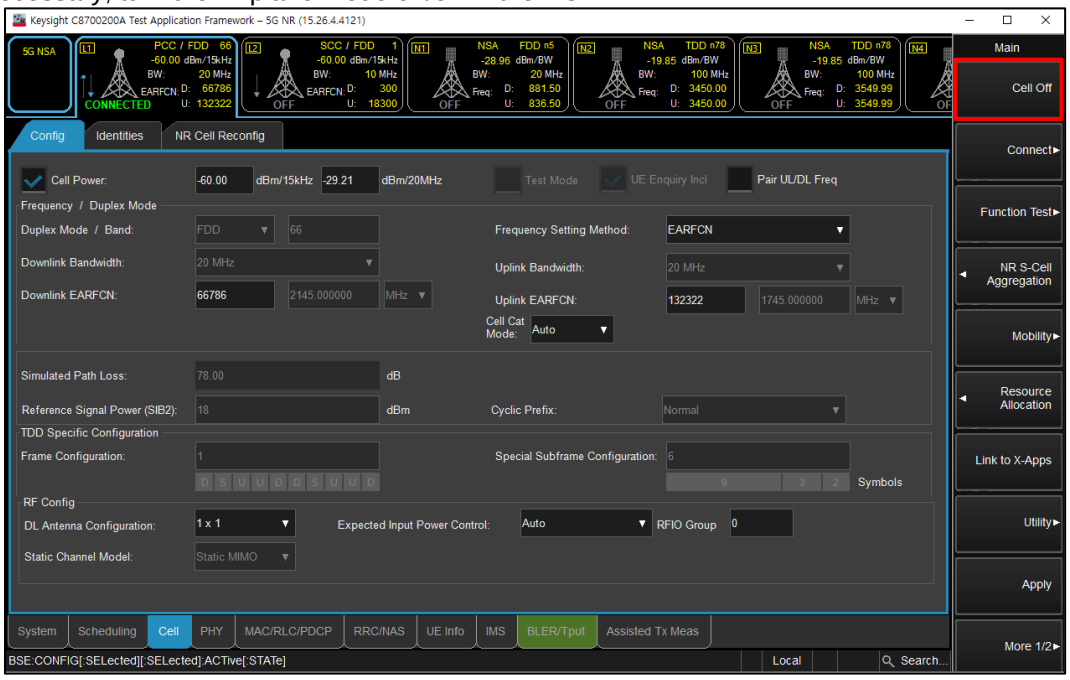
(Figure 2-4)

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



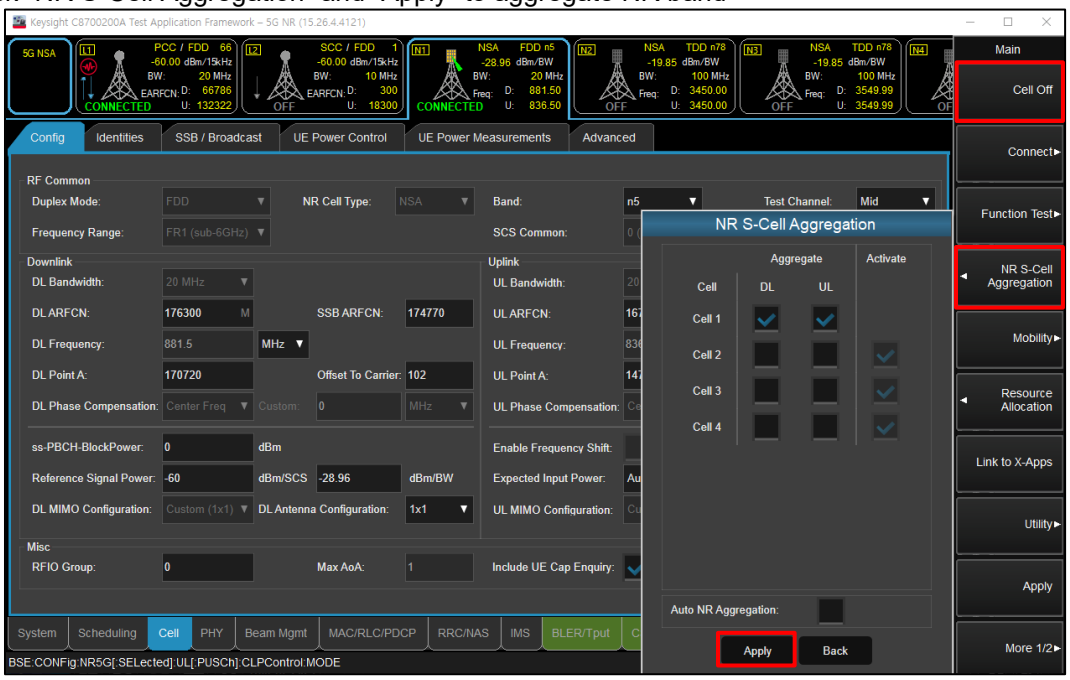
(Figure 2-5)

- 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



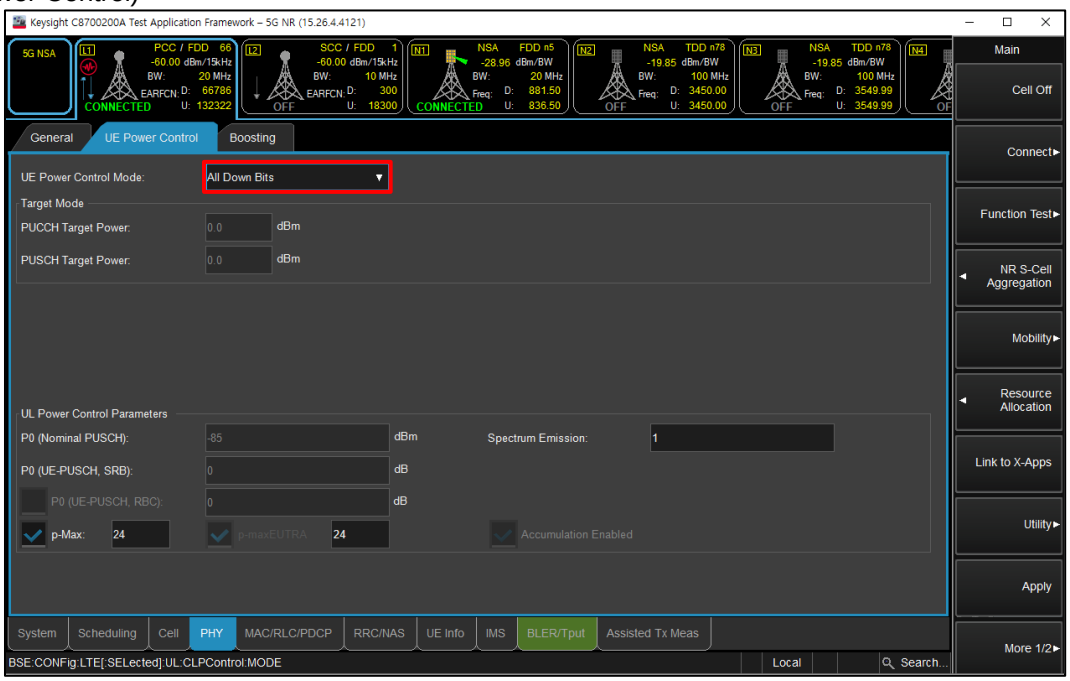
(Figure 2-6)

- 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



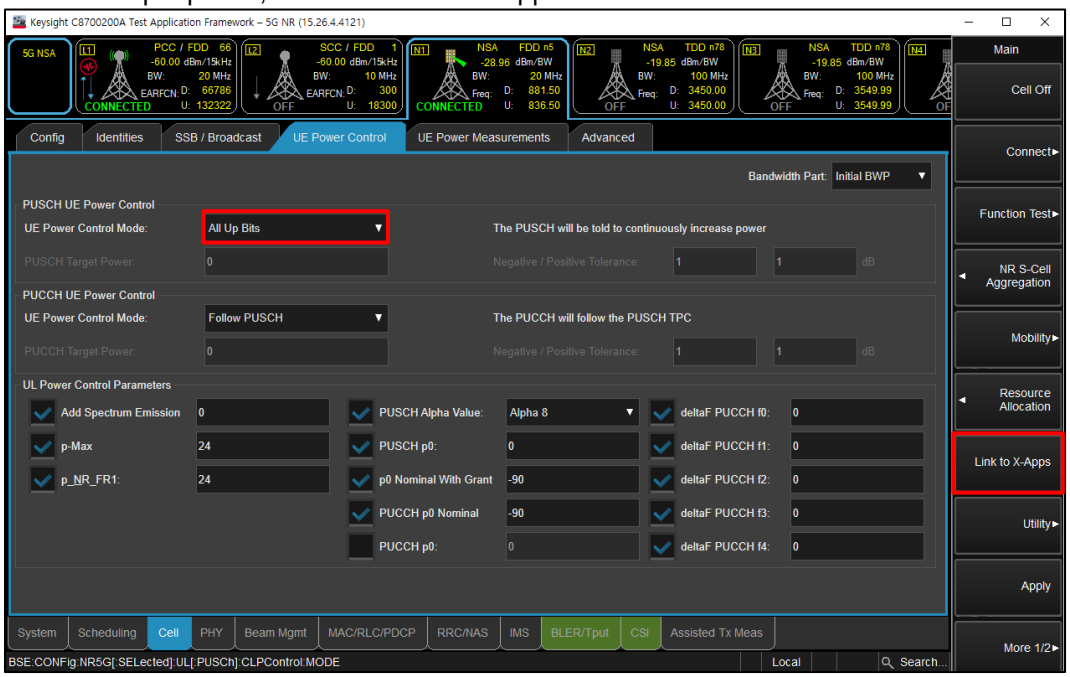
(Figure 2-7)

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



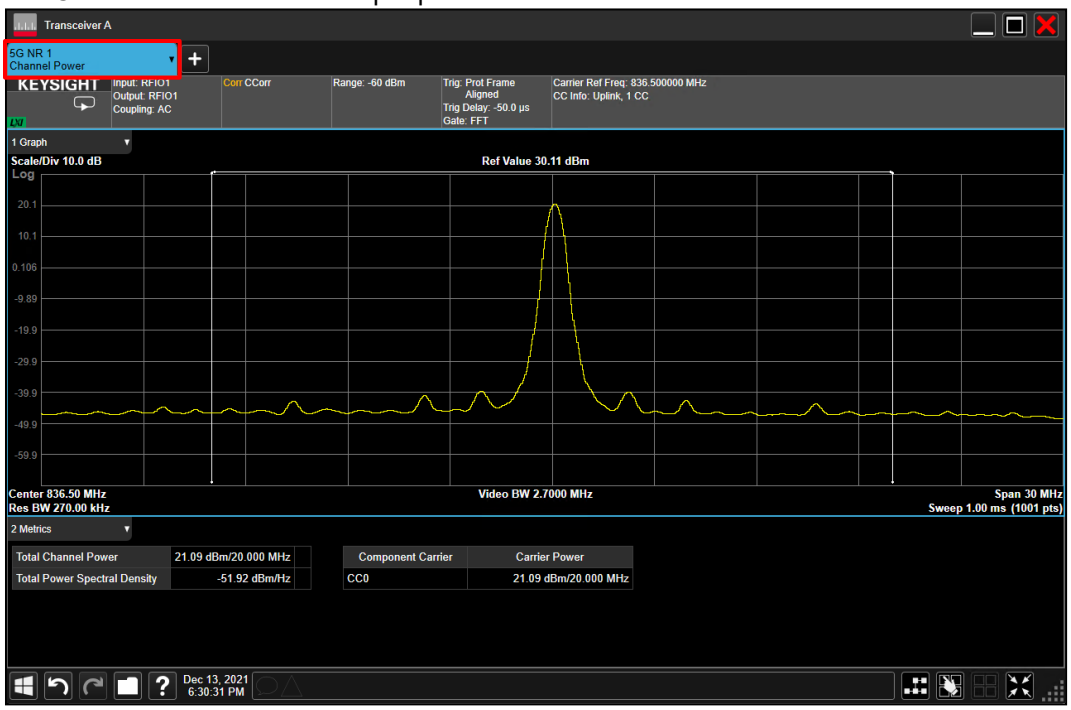
(Figure 2-8)

- 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”



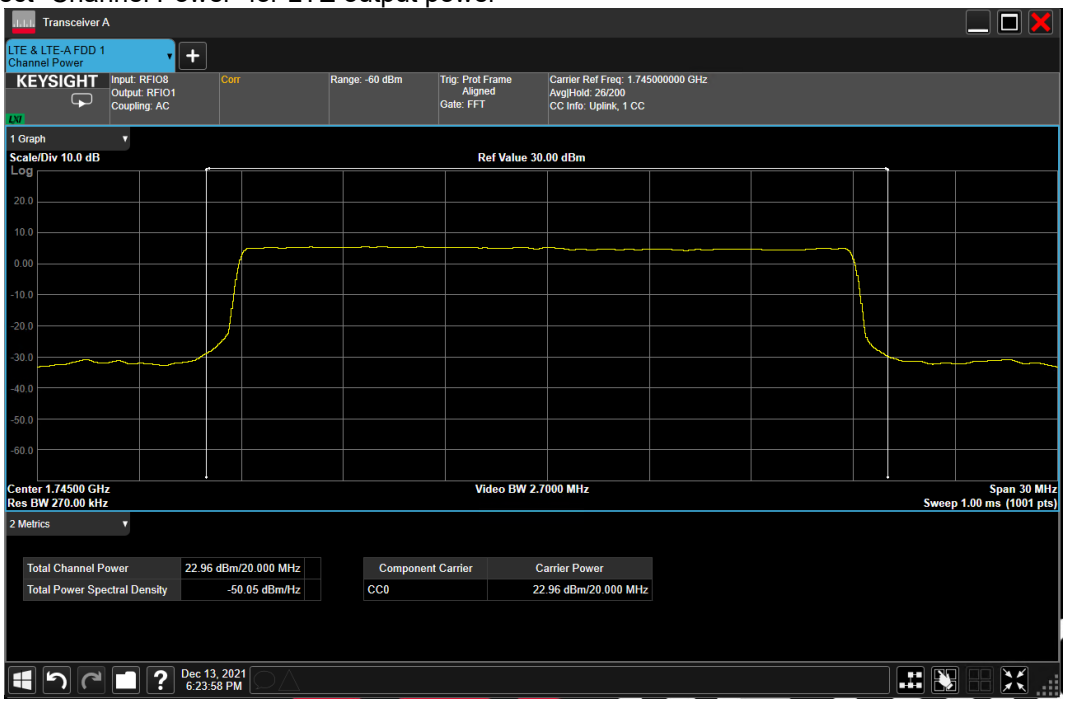
(Figure 2-9)

- Select “Channel Power” for NR output power



(Figure 2-10)

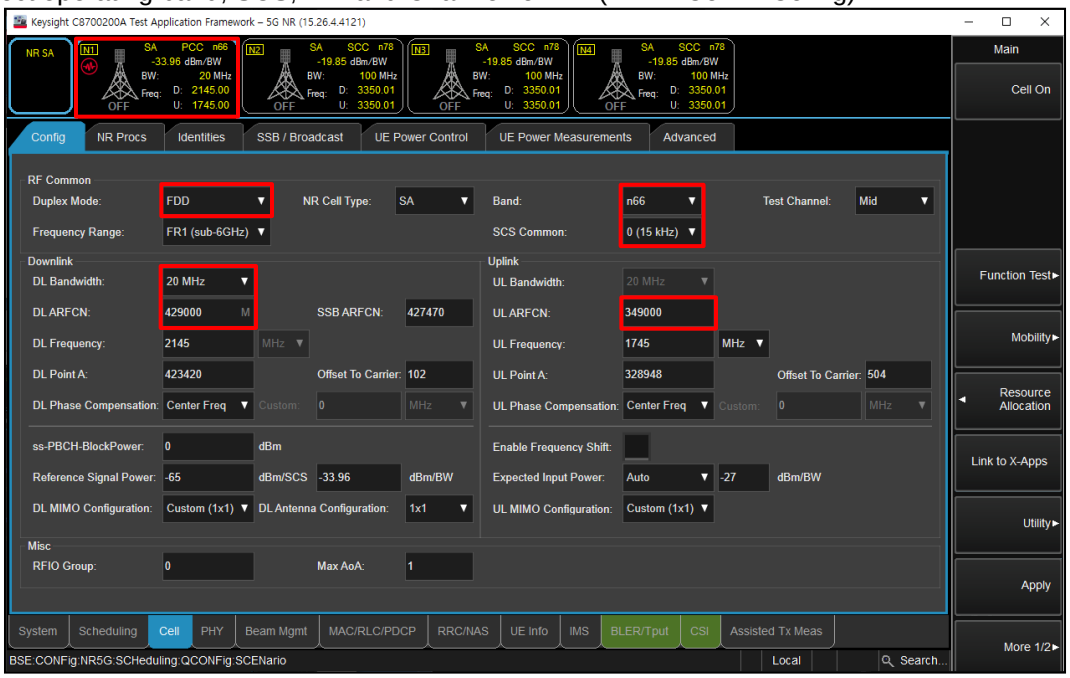
- Select “Channel Power” for LTE output power



(Figure 2-11)

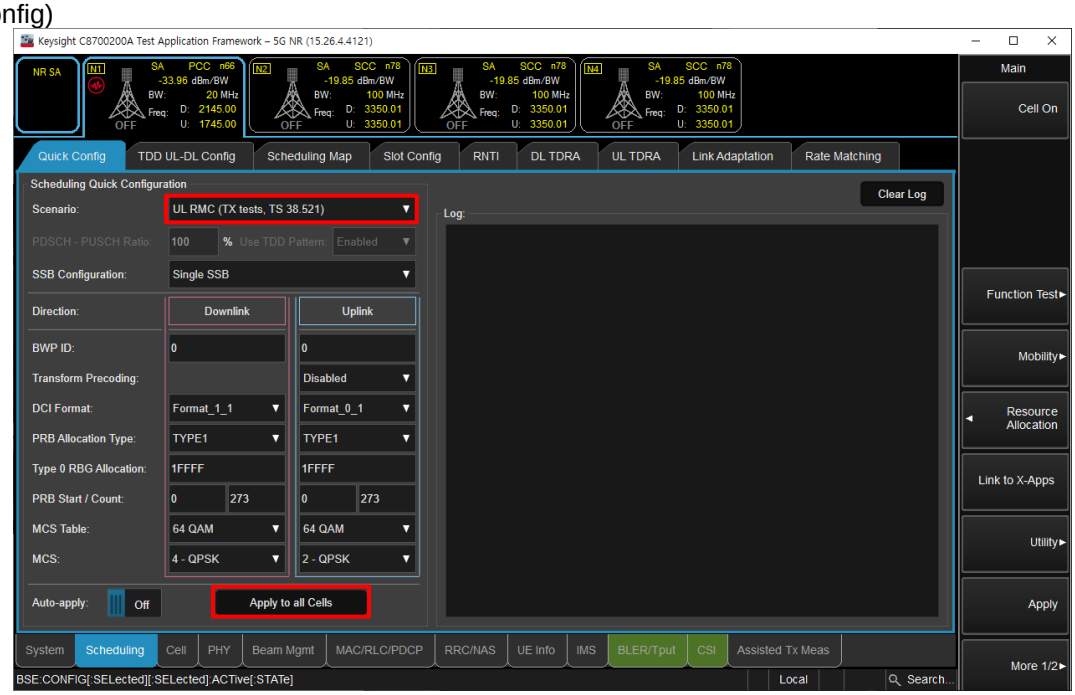
SA Mode

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



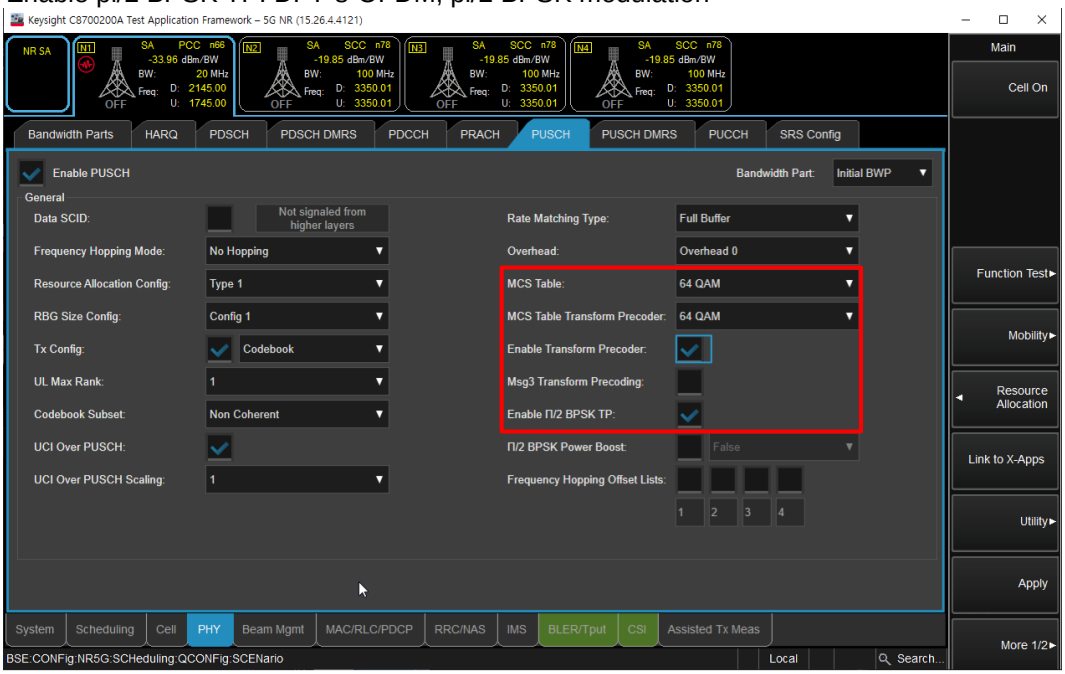
(Figure 3-1)

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



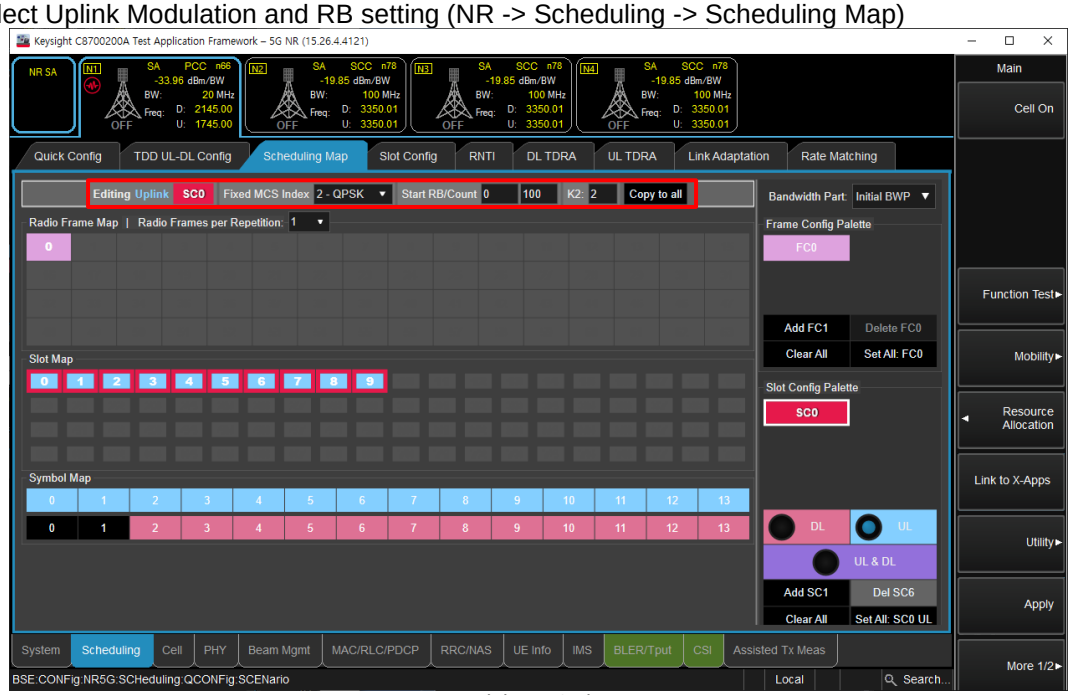
(Figure 3-2)

- 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



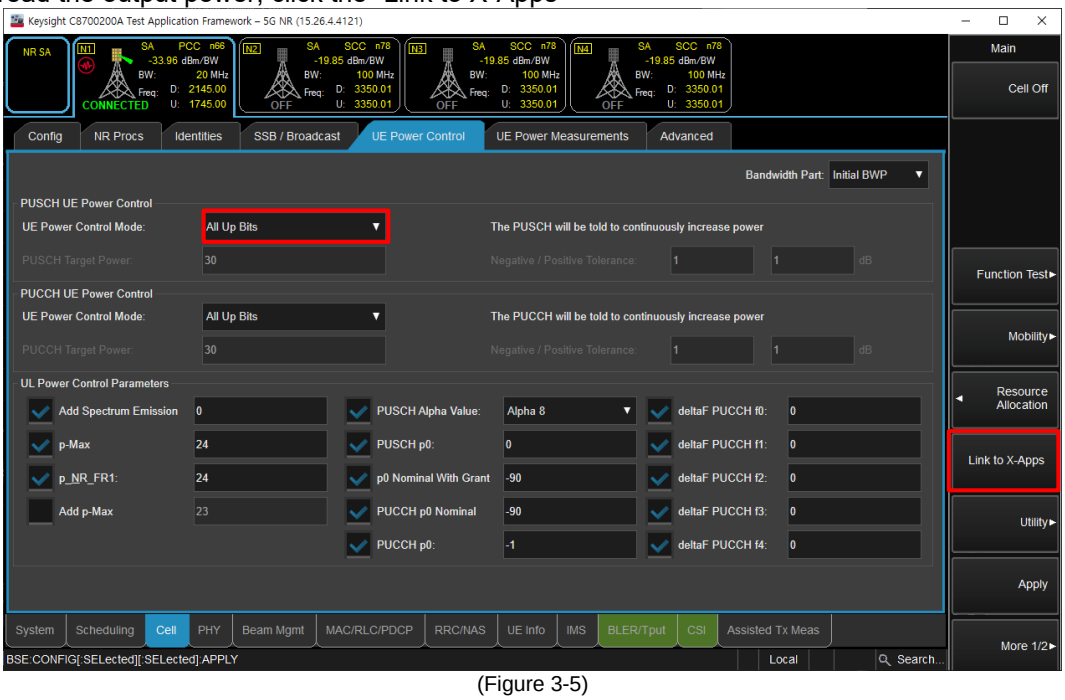
(Figure 3-3)

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



(Figure 3-4)

- 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”



(Figure 3-5)

- Select “Channel Power”

NR Band n66 Measured Results

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Maximum Allowed Average Power (dBm)				
					RSI = 0, 1, 2, 3, 4				
					Measured Pwr (dBm)			MPR	Tune-up Limit
					346000	349000	352000		
					1730 MHz	1745 MHz	1760 MHz		
40 MHz	DFT-s-OFDM	π/2 BPSK	1	1		20.32		0.00	22.00
			1	108		20.54		0.00	22.00
			1	214		20.12		0.00	22.00
			108	0		20.21		0.00	22.00
			108	54		20.68		0.00	22.00
			108	108		20.52		0.00	22.00
			216	0		20.60		0.00	22.00
		QPSK	1	1		20.20		0.00	22.00
			1	108		20.75		0.00	22.00
			1	214		20.34		0.00	22.00
			108	0		20.38		0.00	22.00
			108	54		20.72		0.00	22.00
			108	108		20.56		0.00	22.00
			216	0		20.64		0.00	22.00
		16QAM	1	1		20.31		0.00	22.00
			1	108		20.90		0.00	22.00
			1	214		20.46		0.00	22.00
		64QAM	1	1		20.27		0.00	22.00
		256QAM	1	1		18.34		2.00	20.00
	CP-OFDM	QPSK	1	1		20.20		0.50	21.50
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					345000.00	349000.00	353000.00		
					1725 MHz	1745 MHz	1765 MHz		
30 MHz	DFT-s-OFDM	π/2 BPSK	1	1		19.95		0.00	22.00
			1	80		20.53		0.00	22.00
			1	158		20.22		0.00	22.00
			80	0		20.24		0.00	22.00
			80	40		20.49		0.00	22.00
			80	80		20.43		0.00	22.00
			160	0		20.44		0.00	22.00
		QPSK	1	1		19.94		0.00	22.00
			1	80		20.53		0.00	22.00
			1	158		20.21		0.00	22.00
			80	0		20.25		0.00	22.00
			80	40		20.47		0.00	22.00
			80	80		20.43		0.00	22.00
			160	0		20.44		0.00	22.00
		16QAM	1	1		19.98		0.00	22.00
		64QAM	1	1		20.00		0.00	22.00
		256QAM	1	1		18.59		2.00	20.00
	CP-OFDM	QPSK	1	1		19.93		0.50	21.50

NR Band n66 Measured Results_(Continued)

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					344500.00	349000.00	353500.00		
					1722.5 MHz	1745 MHz	1767.5 MHz		
25 MHz	DFT-s-OFDM	π/2 BPSK	1	1		20.01		0.00	22.00
			1	67		20.40		0.00	22.00
			1	131		20.26		0.00	22.00
			64	0		20.29		0.00	22.00
			64	35		20.48		0.00	22.00
			64	69		20.46		0.00	22.00
			128	0		20.45		0.00	22.00
		QPSK	1	1		20.03		0.00	22.00
			1	67		20.40		0.00	22.00
			1	131		20.28		0.00	22.00
			64	0		20.30		0.00	22.00
			64	35		20.49		0.00	22.00
			64	69		20.45		0.00	22.00
			128	0		20.45		0.00	22.00
		16QAM	1	1		19.99		0.00	22.00
		64QAM	1	1		20.05		0.00	22.00
		256QAM	1	1		18.56		2.00	20.00
	CP-OFDM	QPSK	1	1		20.01		0.50	21.50

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					344000.00	349000.00	354000.00		
					1720 MHz	1745 MHz	1770 MHz		
20 MHz	DFT-s-OFDM	π/2 BPSK	1	1	20.11	20.59	20.20	0.00	22.00
			1	53	20.61	20.93	20.34	0.00	22.00
			1	104	20.52	20.76	20.38	0.00	22.00
			50	0	20.48	20.75	20.25	0.00	22.00
			50	28	20.63	20.89	20.31	0.00	22.00
			50	56	20.66	20.87	20.34	0.00	22.00
			100	0	20.61	20.85	20.31	0.00	22.00
		QPSK	1	1	20.41	20.55	20.23	0.00	22.00
			1	53	20.75	20.96	20.38	0.00	22.00
			1	104	20.55	20.74	20.38	0.00	22.00
			50	0	20.49	20.78	20.26	0.00	22.00
			50	28	20.65	20.88	20.33	0.00	22.00
			50	56	20.66	20.89	20.33	0.00	22.00
			100	0	20.62	20.87	20.30	0.00	22.00
		16QAM	1	1	20.48	20.53	20.26	0.00	22.00
		64QAM	1	1	20.34	20.59	20.23	0.00	22.00
		256QAM	1	1	18.52	18.74	18.72	2.00	20.00
	CP-OFDM	QPSK	1	1	20.18	20.19	20.20	0.50	21.50

NR Band n66 Measured Results_(Continued)

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					343500.00	349000.00	354500.00		
					1717.5 MHz	1745 MHz	1772.5 MHz		
15 MHz	DFT-s-OFDM	π/2 BPSK	1	1	19.99	20.29	20.22	0.00	22.00
			1	40	20.11	20.42	20.25	0.00	22.00
			1	77	20.24	20.46	20.38	0.00	22.00
			36	0	20.05	20.39	20.27	0.00	22.00
			36	22	20.18	20.48	20.31	0.00	22.00
			36	43	20.27	20.50	20.32	0.00	22.00
			75	0	20.17	20.46	20.29	0.00	22.00
		QPSK	1	1	20.00	20.29	20.22	0.00	22.00
			1	40	20.09	20.42	20.25	0.00	22.00
			1	77	20.27	20.46	20.40	0.00	22.00
			36	0	20.08	20.41	20.27	0.00	22.00
			36	22	20.19	20.49	20.30	0.00	22.00
			36	43	20.28	20.51	20.31	0.00	22.00
			75	0	20.16	20.48	20.29	0.00	22.00
		16QAM	1	1	19.94	20.25	20.31	0.00	22.00
		64QAM	1	1	20.02	20.29	20.18	0.00	22.00
		256QAM	1	1	18.60	18.82	18.79	2.00	20.00
	CP-OFDM	QPSK	1	1	20.07	20.28	20.27	0.50	21.50
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					343000.00	349000.00	355000.00		
					1715 MHz	1745 MHz	1775 MHz		
10 MHz	DFT-s-OFDM	π/2 BPSK	1	1	20.08	20.41	20.33	0.00	22.00
			1	26	20.29	20.57	20.39	0.00	22.00
			1	50	20.30	20.52	20.44	0.00	22.00
			25	0	20.11	20.44	20.34	0.00	22.00
			25	14	20.14	20.49	20.37	0.00	22.00
			25	27	20.19	20.50	20.42	0.00	22.00
			50	0	20.14	20.47	20.35	0.00	22.00
		QPSK	1	1	20.08	20.40	20.32	0.00	22.00
			1	26	20.29	20.57	20.41	0.00	22.00
			1	50	20.30	20.51	20.44	0.00	22.00
			25	0	20.10	20.42	20.34	0.00	22.00
			25	14	20.15	20.50	20.37	0.00	22.00
			25	27	20.20	20.51	20.42	0.00	22.00
			50	0	20.14	20.48	20.35	0.00	22.00
		16QAM	1	1	19.96	20.48	20.40	0.00	22.00
		64QAM	1	1	20.12	20.37	20.32	0.00	22.00
		256QAM	1	1	18.54	18.90	18.82	2.00	20.00
	CP-OFDM	QPSK	1	1	20.09	20.46	20.28	0.50	21.50
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					342500.00	349000.00	355500.00		
					1712.5 MHz	1745 MHz	1777.5 MHz		
5 MHz	DFT-s-OFDM	π/2 BPSK	1	1	19.97	20.46	20.31	0.00	22.00
			1	13	19.94	20.40	20.29	0.00	22.00
			1	23	20.06	20.51	20.41	0.00	22.00
			12	0	20.02	20.45	20.33	0.00	22.00
			12	7	20.05	20.48	20.38	0.00	22.00
			12	13	20.05	20.48	20.39	0.00	22.00
			25	0	20.04	20.47	20.37	0.00	22.00
		QPSK	1	1	19.97	20.47	20.32	0.00	22.00
			1	13	19.94	20.42	20.29	0.00	22.00
			1	23	20.06	20.52	20.40	0.00	22.00
			12	0	20.02	20.46	20.35	0.00	22.00
			12	7	20.05	20.48	20.40	0.00	22.00
			12	13	20.05	20.49	20.40	0.00	22.00
			25	0	20.05	20.48	20.38	0.00	22.00
		16QAM	1	1	20.02	20.46	20.37	0.00	22.00
		64QAM	1	1	20.05	20.52	20.31	0.00	22.00
		256QAM	1	1	18.56	18.99	18.94	2.00	20.00
	CP-OFDM	QPSK	1	1	20.02	20.39	20.35	0.50	21.50

10. 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
- Wi-Fi Duty Cycle scaling factor = 1 / Duty cycle (%)
- BT Duty Cycle scaling factor = Maximum Duty cycle / 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:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 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
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 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.

When the separation distance required for body-worn accessory testing is greater than or equal to that tested for hotspot mode, using the same wireless mode test configuration for voice and data, the hotspot SAR data may be used to support body-worn accessory SAR compliance for that particular configuration.

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 ≤ ¼ 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.

10.1. NR Band n66 (40MHz Bandwidth)

Antenna	RF Exposure Conditions	Modulation	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offest	Power (dBm)		1-g SAR (W/kg)		Plot No.
										Tune-up limit	Meas.	Meas.	Scaled	
Ant.(B)	Head	DFT-s-OFDM	π/2 BPSK	0	Left Touch	349000	1745.0	1	108	22.00	20.54	0.061	0.085	
								108	54	22.00	20.68	0.070	0.095	1
					Left Tilt	349000	1745.0	1	108	22.00	20.54	0.041	0.057	
								108	54	22.00	20.68	0.047	0.064	
					Right Touch	349000	1745.0	1	108	22.00	20.54	0.049	0.069	
								108	54	22.00	20.68	0.044	0.060	
					Right Tilt	349000	1745.0	1	108	22.00	20.54	0.025	0.035	
								108	54	22.00	20.68	0.026	0.035	
		CP-OFDM	QPSK	0	Left Touch	349000	1745.0	1	1	22.00	20.20	0.061	0.092	
	Body-worn & Hotspot	DFT-s-OFDM	π/2 BPSK	10	Rear	349000	1745.0	1	108	22.00	20.54	0.117	0.164	2
								108	54	22.00	20.68	0.119	0.161	
					Front	349000	1745.0	1	108	22.00	20.54	0.116	0.162	
								108	54	22.00	20.68	0.117	0.159	
		CP-OFDM	QPSK	10	Rear	349000	1745.0	1	1	22.00	20.20	0.101	0.153	
	Hotspot	DFT-s-OFDM	π/2 BPSK	10	Rear	349000	1745.0	1	108	22.00	20.54	0.246	0.344	
								108	54	22.00	20.68	0.250	0.339	
					Front	349000	1745.0	1	108	22.00	20.54	0.189	0.265	
								108	54	22.00	20.68	0.218	0.295	
					Left	349000	1745.0	1	108	22.00	20.54	0.160	0.224	
								108	54	22.00	20.68	0.162	0.220	
					Bottom	349000	1745.0	1	108	22.00	20.54	0.259	0.362	3
								108	54	22.00	20.68	0.262	0.355	
		CP-OFDM	QPSK	10	Bottom	349000	1745.0	1	1	22.00	20.20	0.222	0.336	

Note(s):

CP-OFDM mode were evaluated at worst configuration of DFT-s-OFDM in each exposure conditions.

11. 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.

All measured SAR results are below 0.8 W/kg. So Repeated SAR test is not required.

12. Simultaneous Transmission SAR Analysis

Simultaneous Transmission Condition

RF Exposure Condition	Item	Capable Transmit Configurations
Head Body-worn Hotspot	1	WWAN (ENDC(LTE+NR) + DTS
	2	WWAN (ENDC(LTE+NR) + NII
	3	WWAN (ENDC(LTE+NR) + BT
	4	WWAN (ENDC(LTE+NR) + NII + BT
Extremity	5	WWAN (ENDC(LTE+NR) + DTS + NFC
	6	WWAN (ENDC(LTE+NR) + NII + NFC
	7	WWAN (ENDC(LTE+NR) + BT + NFC
	8	WWAN (ENDC(LTE+NR) + NII + BT + NFC

Notes:

1. DTS supports Wi-Fi Direct, Hotspot and VoIP.
2. U-NII supports Wi-Fi Direct, Hotspot and VoIP.
3. LTE, NR supports Hotspot and VoIP
4. U-NII Radio can transmit simultaneously with Bluetooth Radio.
5. DTS Radio cannot transmit simultaneously with Bluetooth Radio
6. NR Radio support to NSA(ENDC) Radio.
7. BT tethering is considered about each RF exposure conditions.

Note(s):

For EN-DC mode, S.LSI Smart Transmit algorithm in WWAN adds directly the time-averaged RF exposure from 4G(LTE) and time-averaged RF exposure from 5G NR. Smart Transmit algorithm controls the total RF exposure from both 4G and 5G NR to not exceed FCC limit. Therefore, simultaneous transmission compliance between 4G+5G NR operation is demonstrated in the Part 2 Report during algorithm validation. In Part 1 Report, simultaneous transmission compliance was evaluated individually with other Radios (WLAN or BT) using one of 4G or 5G NR.

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.

12.1. Simultaneous transmission analysis

12.1.1. Sum of the SAR for WWAN ANT B & Wi-Fi & BT

RF Exposure	Test Position	Standalone SAR (W/kg)				Sum of SAR (W/kg)			
		WWAN	DTS	UNII	BT	WWAN + DTS	WWAN + UNII	WWAN + BT	WWAN + BT + UNII
		1	2	3	4	1 + 2	1 + 3	1 + 4	1 + 3 + 4
		Ant B	Ant H	Ant H	Ant H				
Head (1-g SAR)	Left Touch	0.095	0.095	0.466	0.034	0.190	0.561	0.129	0.595
	Left Tlit	0.064	0.095	0.466	0.035	0.159	0.530	0.099	0.565
	Right TouchH	0.069	0.095	0.466	0.057	0.164	0.535	0.126	0.592
	Right Tlit	0.035	0.095	0.390	0.061	0.130	0.425	0.096	0.486
Body-Worn (1-g SAR)	Rear	0.164	0.133	0.389	0.017	0.297	0.553	0.181	0.570
	Front	0.162	0.133	0.389	0.006	0.295	0.551	0.168	0.557
Hotspot (1-g SAR)	Rear	0.344	0.339	0.667	0.047	0.683	1.011	0.391	1.058
	Front	0.295	0.339	0.667	0.011	0.634	0.962	0.306	0.973
	Edge Top		0.339	0.648	0.076				0.724
	Edge Right								
	Edge Bottom	0.362							
	Edge Left	0.224				0.224	0.224	0.224	0.224

Note(s):

1. Main&WiFi&BT data refer to Original model(14938215-S1V5 FCC Report SAR part 1)..

Conclusion:

Simultaneous Transmission SAR analysis results is satisfied the FCC Limit requirement according to follow procedures with "Sum of SAR"

Appendixes

Refer to separated files for the following appendixes.

4791131433-S1 FCC Report SAR_App A_Photos & Ant. Locations

4791131433-S1 FCC Report SAR_App B_Highest SAR Test Plots

4791131433-S1 FCC Report SAR_App C_System Check Plots

4791131433-S1 FCC Report SAR_App D_SAR Tissue Ingredients

4791131433-S1 FCC Report SAR_App E_Probe Cal. Certificates

4791131433-S1 FCC Report SAR_App F_Dipole Cal. Certificates

END OF REPORT