

**FCC 47 CFR § 2.1093
IEC/IEEE Std 63195-1: 2022**

**POWER DENSITY EVALUATION REPORT
(Part 1 : Test in Static Transmission Condition)**

FOR

GSM/WCDMA/LTE/NR/NTN Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax/be, NFC, UWB and WPT

MODEL NUMBER: SM-S947U, SM-S947U1

FCC ID: A3LSMS947U

REPORT NUMBER: S-4791921958-S2V1

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Testing Laboratory

TL-637

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1. Attestation of Test Results

Applicant Name	SAMSUNG ELECTRONICS CO.,LTD.	
FCC ID	A3LSMS947U	
Model Name	SM-S947U, SM-S947U1	
Applicable Standards	FCC 47 CFR § 2.1093 IEC/IEEE Std 63195-1: 2022	
Exposure Category	Power Density Limit (mW/cm²)	
General population / Uncontrolled exposure	1.0	
RF exposure Conditions	Power Density Results (mW/cm²)	
	Measured psPD	Reported psPD
NR Band n258	0.52	0.93
NR Band n261	0.56	0.93
NR Band n260	0.59	0.93
TER (Total Exposure Ratio)	0.94	
Date Tested	2025-11-23 to 2025-12-03	
Test Results	Pass	
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. This report is written to support regulatory compliance of the applicable standards stated above.		
Approved & Released By:		Prepared By:
		
Justin Park Operations Leader UL Korea, Ltd. Suwon Laboratory		Seungyeon Kim Laboratory Engineer UL Korea, Ltd. Suwon Laboratory

2. Introduction

The equipment under test (EUT) is a Phone, model SM-S947U, SM-S947U1 (FCC ID: A3LSMS947U), it contains Qualcomm modems supporting Sub6(2G/3G/4G/5G technologies and WLAN bands(with BT)) and 5G-NR mmW technology.

The device uses Qualcomm Smart Transmit (GEN2) to dynamically manage transmit power in real time, ensuring that time-averaged RF exposure always complies with FCC requirements.

The purpose of this PD Part 1 report is to demonstrate that this EUT complies with FCC RF exposure limits at maximum time-averaged transmit power limits for 5G NR_mmW technology.

- Time-averaged RF exposure of PD design target, which predefined time-averaged power limit (Input.power.limit for 5G mmW NR), for each characterized mmW bands. (please refer to PD Part.0 report)
- Smart Transmit enables the device to transmit at higher instantaneous power when necessary, while dynamically managing power to ensure that the time-averaged transmit power does not exceed the input.power.limit.
- To demonstrate that the EUT complies with FCC Power Density (PD) limits when transmitting under static transmission conditions at the maximum allowable time-averaged power level defined by input.power.limit.
- Demonstrate compliance in simultaneous transmission scenarios involving both supported TAS Sub6 techs and Non-supported TAS External Ratio techs(UWB and NFC), where Sub6 techs exposure is assessed based on time-averaged transmit power limits in Part 2, and External Ratio exposure are assessed separately in Part.1.

By following the above steps, this report demonstrates that this EUT complies with FCC RF exposure limits for FCC equipment authorization of FCC ID: A3LSMS947U.

The *input.power.limit* used in this report are determined and listed in PD Part 0 report.

Refer to compliance Summary report for product description and terminology used in this report.

3. Measurement setup and General Information

The SAR measurement are recorded in UL FCC Report_SAR_Part.1 (Report No. S-4791921958-S1). This section provides the detail of the test setup used for PD measurement.

3.1. Power density measurement system

The power density measurement system is constructed based on the DASY8 platform by SPEAG. The DASY8 with EummmWV2 and 5G software module can measure the RF exposure (power density) up to 110GHz as close as 2mm from any transmitter.

3.1.1. Power density probe

The EummmWV2 probe is used in the power density measurement. It is designed for precise near-field measurements in the mm-wave range by Schmid & Partner Engineering AG of Zurich, Switzerland. The specifications are:

- Frequency range: 0.75 ~ 110 GHz
- Dynamic range: <50 – 3000 V/m (up to 10000 V/m with additional PRE-10 voltage divider)
- Linearity: < ±0.2 dB
- Supports sensor model calibration (SMC)
- ISO 17025 accredited calibration

3.1.2. Power density measurement system verification

The power density system verification is performed using the SPEAG verification device. It consists of a ka-band horn antenna with a corresponding gun oscillator packaged within a cube-shaped housing.

The specification of the verification device is:

- Calibrated frequency: 30GHz at 10 mm from the case surface
- Frequency accuracy: ± 100MHz
- E-field polarization: linear
- Harmonics: -20 dBc (typ)
- Total radiated power: 14 dBm (typ)
- Power stability: 0.05 dB
- Power consumption: 5 W (max)
- Size: 100 x 100 x 100 mm
- Weight: 1kg

Table 2-1 shows the verification test results. The measured power density (PD) value is within 10% of target level. Note that the uncertainty of 5G verification source is 1.4dB (k=2).

3.2. Test Specification, Methods and Procedures

Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEC/IEEE 63195-1:2022, IEC TR 63170:2018 the following FCC Published RF exposure KDB procedures:

- 447498 D04 Interim General RF Exposure Guidance v01

In addition to the above, [TCB workshop](#) information was used.

- [TCB workshop](#) November, 2017; Page 19 - 25, RF Exposure Procedures (Power Density Evaluation)
- [TCB workshop](#) October, 2018; Page 3 - 5, RF Exposure Procedures (Millimeter Wave guidance)
- [TCB workshop](#) April, 2019; Page 3, RF Exposure Procedures (Millimeter Wave RF Exposure Evaluation)
- [TCB workshop](#) November, 2019; Page 14, RF Exposure Procedures (Millimeter Wave Scan Requirements)
- SPEAG, DASY6/8 Module mmWave Manual, April 2023

3.3. Facilities and Accreditation

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

Suwon
SAR 8

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. Test Condition, Configuration, and Assessment

4.1. Qualcomm Smart Transmit parameters

The input parameters described are required for functionality of Qualcomm Smart Transmit algorithm.

These parameters are entered through the *Embedded File System* (EFS) and cannot be accessed by the end-user.

Part 0 report documents determination of P_{limit} for sub-6 WWAN bands, and *input.power.limit* for 5G mmW NR bands using the below design targets and device related uncertainty:

- SAR_design_target of 1.0 W/kg for 1g SAR and sub-6 device design related uncertainty of 1.0 dB.
- PD_design_target of 0.724 mW/cm² and mmW device design related uncertainty of 1.4 dB.

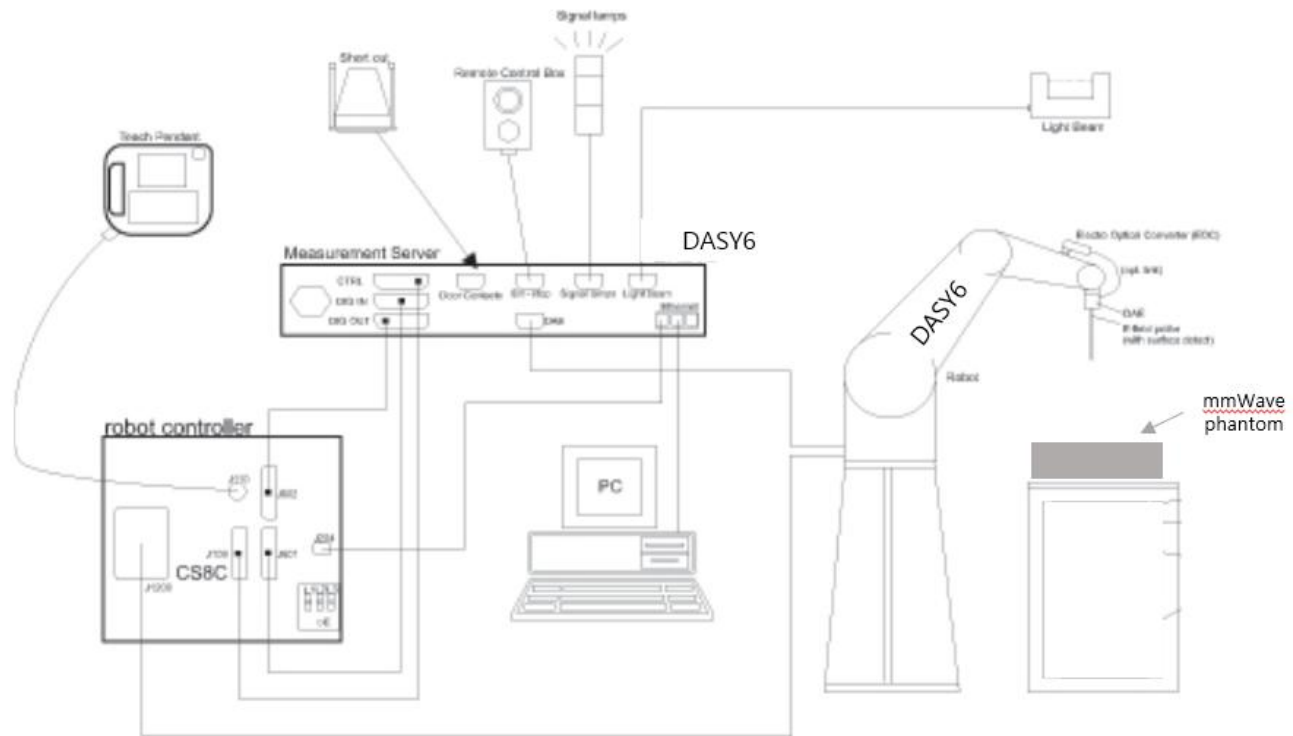
4.2. Qualcomm Smart Transmit parameters for the 5G mmW NR

The *input.power.limit* parameter for 5G mmW NR radio determined in Section 7.5 of this report are populated via EFS entry into the EUT.

5. Measurement System & Test Equipment

5.1. Measurement System

The DASY6 & 8 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).
- The EUmmWVx probe is based on the pseudo-vector probe design, which not only measures the field magnitude but also derives its polarization ellipse.
- 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 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom which is specialized for 5G other accessories according to the targeted measurement.

5.2. EUmmWVx / 5G Probe

E-Field mm-Wave Probe for General Near-Field Measurements



Two dipoles optimally arranged to obtain pseudo-vector information
 Minimum 3 measurements/point, 120° rotated around probe axis
 Sensors (0.8mm length) printed on glass substrate protected by high density foam
 Low perturbation of the measured field
 Requires positioner which can do accurate probe rotation

Frequency Range
Dynamic Range
Position Precision

750 MHz – 110 GHz
 < 20 V/m - 10'000 V/m with PRE-10 (min < 50 V/m - 3000 V/m)
 < 0.2 mm (DASY6)

Dimensions

Overall length: 337 mm (tip: 20 mm)
 Tip diameter: encapsulation 8 mm (internal sensor < 1mm)
 Distance from probe tip to dipole centers: < 2 mm
 Sensor displacement to probe's calibration point: < 0.3 mm

Applications

E-field measurements of 5G devices and other mm-wave transmitters operating above 10GHz in < 2 mm distance from device (free-space)
 Power density, H-field and far-field analysis using total field reconstruction (cDASY6 5G or ICEy-mmW module required)

Compatibility

cDASY6 + 5G-Module SW1.0 and higher

5.3. Data Acquisition Electronics(DAE)



Serial optical link for communication with DASY4/5 embedded system (fully remote controlled) Two-step probe touch detector for mechanical surface detection and emergency robot stop

Measurement Range

-100 – +300 mV (16 bit resolution and two range settings: 4 mV, 400 mV)

Input Offset Voltage

<5 µV (with auto zero)

Input Resistance

200 Mohm

Input Bias Current

<50 fA

Battery Power

>10 hours of operation (with two 9.6 V NiMH batteries)

Dimensions (L × W × H)

60 × 60 × 68 mm

6. Measurement Procedures

6.1. System Verification/DUT Scan Procedures

cDASY6/8 5G Module supports “5G Scan”, a fine resolution scan performed on two different planes which is used to reconstruct the E- and H-fields as well as the power density; the average power density is derived from this measurement.

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 device under test.

Step 2: 5G Scan

The steps in the X, Y, and Z directions are specified in terms of fractions of the signal wavelength, λ . Area Scan Parameters extracted from SPEAG, 5G Module Application Note.

Recommended settings for measurement of verification sources

Frequency [GHz]	Grid step	Grid extent X/Y [mm]	Measurement points
10	$0.125 (\frac{\lambda}{8})$	60/60	18 × 18
30	$0.25 (\frac{\lambda}{4})$	60/60	26 × 26
45	$0.25 (\frac{\lambda}{4})$	42/42	28 × 28
60	$0.25 (\frac{\lambda}{4})$	32.5/32.5	28 × 28
90	$0.25 (\frac{\lambda}{4})$	30/30	38 × 38

The minimum distance of probe sensors to verification source surface, horn antenna, is 10 mm.

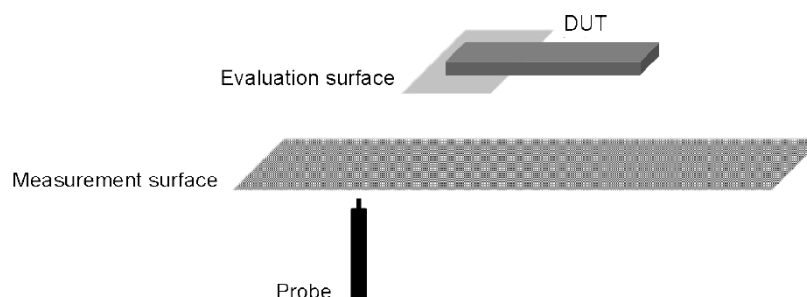
In other case, distance is determined as $\lambda / 5$, details are shown in section 6.2.

Step 3: 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. When the drift is larger than $\pm 5\%$, test is repeated from step1.

6.2. Total Field and Power Flux Density Reconstruction(measurement distance)

Reconstruction algorithms are used to project or transform the measured fields from the measurement surface to the evaluation surface (below fig) in order to determine power density or to compute spatial-average and/or local power density with known uncertainty. Manufacture has developed a reconstruction approach based on the Gerchberg-Saxton algorithm, which benefits from the availability of the E-field polarization ellipse information obtained with the EUmmWVx probe. This reconstruction algorithm, together with the ability of the probe to measure extremely close to the source without perturbing the field, permits reconstruction of the E- and H-fields, as well as of the power density, on measurement planes located as near as $\lambda / 5$ away.



6.3. 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.

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
5G probe	SPEAG	EummmVV4	9536	2026-02-20
Data Acquisition Electronics	SPEAG	DAE4	1343	2026-07-09
Verification kit	SPEAG	5G verification source_30GHz	1082	2026-02-21
Thermometer	Lutron	MHB-382SD	AK.12102	2025-07-24

6.4. Measurement Uncertainty

Measurement Uncertainty for cDASY6 Module mmWave						
Error Description	Uncertainty value ($\pm$ dB)	Probe Dist.	Divisor	(Ci)	Std. Unc. ($\pm$ dB)	(Vi)
Uncertainty terms dependent on the measurement system						
Calibration	0.49	Normal	1	1	0.49	Infinity
Probe correction	0.00	Rectangular	1.73	1	0.00	Infinity
Frequency response (BW $\leq$ 1 GHz)	0.20	Rectangular	1.73	1	0.12	Infinity
Sensor cross coupling	0.00	Rectangular	1.73	1	0.00	Infinity
Isotropy	0.50	Rectangular	1.73	1	0.29	Infinity
Linearity	0.20	Rectangular	1.73	1	0.12	Infinity
Probe scattering	0.00	Rectangular	1.73	1	0.00	Infinity
Probe positioning offset	0.30	Rectangular	1.73	1	0.17	Infinity
Probe positioning repeatability	0.04	Rectangular	1.73	1	0.02	Infinity
Sensor mechanical offset	0.00	Rectangular	1.73	1	0.00	Infinity
Probe spatial resolution	0.00	Rectangular	1.73	1	0.00	Infinity
Field impedance dependence	0.00	Rectangular	1.73	1	0.00	Infinity
Measurement drift	0.05	Rectangular	1.73	1	0.03	Infinity
Amplitude and phase noise	0.04	Rectangular	1.73	1	0.02	Infinity
Measurement area truncation	0.10	Rectangular	1.73	1	0.06	Infinity
Data acquisition	0.03	Normal	1.00	1	0.03	Infinity
Sampling	0.00	Rectangular	1.73	1	0.00	Infinity
Field reconstruction	0.60	Rectangular	1.73	1	0.35	Infinity
Signal-to-Noise Ratio	0.00	Rectangular	1.73	1	0.00	Infinity
FTE/MEO	0.00	Rectangular	1.73	1	0.00	Infinity
Power density scaling	0.00	Rectangular	1.73	1	0.00	Infinity
Spatial averaging	0.10	Rectangular	1.73	1	0.06	Infinity
Uncertainty terms dependent on the DUT and environmental factors						
Probe coupling with DUT	0.00	Rectangular	1.73	1	0.00	Infinity
Modulation response	0.40	Rectangular	1.73	1	0.23	Infinity
Integration time	0.00	Rectangular	1.73	1	0.00	Infinity
Response time	0.00	Rectangular	1.73	1	0.00	Infinity
Device holder influence	0.10	Rectangular	1.73	1	0.06	Infinity
DUT alignment	0.00	Rectangular	1.73	1	0.00	Infinity
RF ambient conditions	0.04	Rectangular	1.73	1	0.02	Infinity
Laboratory Temperature	0.05	Rectangular	1.73	1	0.03	Infinity
Laboratory Reflections	0.04	Rectangular	1.73	1	0.02	Infinity
Immunity / secondary reception	0.00	Rectangular	1.73	1	0.00	Infinity
Drift of the DUT	0.20	Rectangular	1.73	1	0.12	Infinity
Combined Std. Uncertainty					0.76	
Expanded Standard Uncertainty (95%)					1.53	

6.5. DECISION RULE

Measurement Uncertainty is not applied when providing statements of conformity in accordance with IEC Guide 115:2023, 4.3.3.

7. DUT Information

7.1. 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.		
Test sample information	No.	S/N	Notes
	1	R3CY90LRJXE	mmWave Radiated
	2	R3CY90LRHXB	mmWave Radiated

7.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
5G NR mmW	NR Band n258 NR Band n261 NR Band n260	DFT-s-OFDM : QPSK, 16QAM, 64QAM CP-OFDM : QPSK, 16QAM, 64QAM	100%

7.3. 5G NR mmWave PD Test and Reporting Considerations

Item	Description	
Frequency range, Channel Bandwidth, Numbers and Frequencies	Band 258	Frequency range: 24250 – 24450 MHz, 24750 – 25250 MHz
		Channel Bandwidth
		100MHz
		50MHz
		MHz / Channel
		MHz / Channel
	Low	24350.04 / 2018333
	Mid	24800.04 / 2025833
	High	25200.00 / 2032499
	Band 261	Frequency range: 27500 – 28350 MHz
		Channel Bandwidth
		100MHz
		50MHz
		MHz / Channel
		MHz / Channel
	Low	27550.08 / 2071677
	Mid	27924.96 / 2077915
	High	28299.96 / 2084165
	Band 260	Frequency range: 37000 – 40000 MHz
		Channel Bandwidth
		100MHz
		50MHz
		MHz / Channel
		MHz / Channel
	Low	37050.00 / 2229999
	Mid	38499.96 / 2254165
	High	39949.92 / 2278331
Sub carrier Spacing	120 kHz	
Total Number of Supported Uplink CCs (SISO)	4	
Total Number of Supported Uplink CCs (MIMO)	4	
LTE Anchor Bands	n258:2/5/12/66/71 n260:2/5/12/13/14/30/48/66 n261:2/5/12/13/48/66	
NR FR1 Anchor Bands	n258:25/41/48/66/77 n261:2/5/25/41/48/66/71/77 n260:2/5/14/25/30/41/48/66/71/77	
Duplex Type (mmWave)	TDD	

7.4. Time-Averaging Algorithm for RF Exposure Compliance

The equipment under test(EUT) are supporting 2G/3G/4G/5G NR and WLAN(with BT) technologies through Qualcomm® modem. Qualcomm® modem is enabled with Qualcomm® Smart Transmit feature. This feature performs time averaging algorithm in real time to control and manage transmitting power and ensure the time-averaged RF exposure is in compliance with FCC requirements all the time. Refer to Compliance Summary document for detailed description of Qualcomm® Smart Transmit feature.

The Smart Transmit algorithm maintains the time-averaged transmit power, in turn, time-averaged RF exposure of *SAR_design_target* or *PD_design_target*, below the predefined time-averaged power limit (i.e., P_{limit} for sub-6 radio, and *input.power.limit* for 5G mmW NR), for each characterized technology and band. Smart Transmit allows the device to transmit at higher power instantaneously when needed. but manages power limiting to maintain time-averaged transmit power to *input.power.limit* listed in Section 7.5.

The purpose of this report (Part 1 test) is to demonstrate that the EUT meets FCC PD limits when transmitting in static transmission scenario at maximum allowable time-averaged power level given by *input.power.limit*.

7.5. Input Power Limit

All power density measurements for this device were performed at the *input.power.limit* given in below tables. Input power is per antenna element and polarization for each antenna module.

5G NR mmW L Patch Input Power Limit

Antenna	NR Band n258			NR Band n261			NR Band n260		
	Beam ID_1	Beam ID_2	input.power.limit (dBm)	Beam ID_1	Beam ID_2	input.power.limit (dBm)	Beam ID_1	Beam ID_2	input.power.limit (dBm)
Ant.M (Patch L)	0		11.2	0		10.6	0		9.7
	1		12.1	1		13.3	1		9.6
	2		11.7	2		10.9	2		9.7
	3		12.2	3		11.6	3		10.4
	4		11.4	4		11.6	4		10.3
	5		8.7	5		9.9	5		6.3
	6		7.9	6		8.4	6		7.1
	7		8.6	7		8.9	7		7.0
	8		8.3	8		9.3	8		6.5
	9		8.2	9		9.0	9		6.8
	10		8.6	10		10.8	10		7.4
	11		8.2	11		10.5	11		6.6
	12		5.2	12		8.0	12		3.0
	13		4.3	13		5.0	13		3.1
	14		4.6	14		3.8	14		4.2
	15		5.4	15		4.1	15		4.2
	16		3.8	16		6.0	16		2.7
	17		5.3	17		6.3	17		3.0
	18		4.1	18		4.2	18		3.8
	19		4.0	19		3.6	19		4.1
	20		3.8	20		4.8	20		3.5
	256		9.8	256		10.3	256		12.3
	257		9.3	257		9.0	257		11.0
	258		9.7	258		9.0	258		10.4
	259		9.3	259		9.3	259		10.4
	260		10.0	260		9.9	260		11.7
	261		6.9	261		6.2	261		7.7
	262		6.4	262		5.6	262		7.4
	263		4.8	263		5.3	263		8.2
	264		5.1	264		6.1	264		8.7
	265		6.0	265		6.0	265		7.4
	266		5.0	266		6.0	266		8.8
	267		4.9	267		5.6	267		8.0
	268		2.4	268		1.8	268		4.8
	269		1.6	269		1.5	269		4.5
	270		1.5	270		1.9	270		4.4
	271		1.3	271		1.7	271		4.7
	272		1.4	272		1.4	272		5.5
	273		1.9	273		1.7	273		4.2
	274		1.2	274		1.9	274		5.0
	275		1.5	275		1.9	275		3.8
	276		1.2	276		1.5	276		5.3
	0	256	7.0	0	256	7.1	0	256	7.4
	1	257	6.7	1	257	7.1	1	257	7.0
	2	258	7.1	2	258	6.8	2	258	6.6
	3	259	7.1	3	259	7.1	3	259	7.2
	4	260	7.2	4	260	7.3	4	260	7.6
	5	261	4.5	5	261	4.8	5	261	3.3
	6	262	4.0	6	262	3.4	6	262	3.7
	7	263	3.0	7	263	3.4	7	263	4.5
	8	264	3.1	8	264	4.0	8	264	4.1
	9	265	3.3	9	265	5.5	9	265	4.4
	10	266	2.9	10	266	4.7	10	266	4.2
	11	267	3.2	11	267	4.2	11	267	4.1
	12	268	-1.0	12	268	-0.1	12	268	0.2
	13	269	-1.0	13	269	-0.5	13	269	0.0
	14	270	-0.9	14	270	-0.5	14	270	0.9
	15	271	-0.4	15	271	-0.7	15	271	0.6
	16	272	-1.2	16	272	-0.7	16	272	0.0
	17	273	-1.0	17	273	-0.1	17	273	-0.2
	18	274	-1.0	18	274	-0.5	18	274	0.3
	19	275	-0.8	19	275	-0.8	19	275	0.5
	20	276	-1.1	20	276	-0.8	20	276	0.9

8. RF Exposure Conditions (Test Configurations)

8.1. Operating mode(s)

5G NR mmW band were tested Power density through FTM(Factory Test Mode) provided by manufacturer.

8.2. Test position Configurations

Power density evaluated at worst-surfaces according to test results of Power density Part.0 report.

Band	Antenna	Rear	Front	Top	Bottom	Right	Left
n258	Ant.M (Patch L)	Yes	No	No	No	No	No
n261	Ant.M (Patch L)	Yes	No	No	No	No	Yes
n260	Ant.M (Patch L)	Yes	No	No	No	No	Yes

Please refer to Appendix A for Antenna's location.

9. Dielectric Property & System Check

9.1. Dielectric Property

Media is air so Relative Permittivity (ϵ_r) and Conductivity (σ) is 1.

9.2. System Check

Per Nov 2017, TCB Workshop note,

System Check should be verified with 24 hours before DUT's PD test.

System check is verified using 5G verification source provide by the equipment manufacturer.

- the same spatial resolution and measurement region used in the waveguide calibration should be applied to system check
- 4 cm² spatial averaging have been used according to FCC requirement.
- power density distribution should also be verified, both spatially (shape) and numerically (level) through visual inspection for noticeable differences.
- the measured results should be within 10% of the calibrated target.
- The SPEAG software requires a setting of '5.55mm' for the correct set up.

SAR 8 Room

SAR Lab	Date	Sorce SN	Sorce Cal. Due Data	Measured Total psPD for 4cm ² (W/m ²)	Target (Ref. Value) (W/m ²)	Delta $\pm 10\%$ (within 0.66dB)	visual inspection	Plot No.
SAR 8	2025-11-23	1082	2026-02-21	51.5	51.6	-0.19	confirmed	
SAR 8	2025-11-24	1082	2026-02-21	51.7	51.6	0.19	confirmed	
SAR 8	2025-11-25	1082	2026-02-21	52.5	51.6	1.74	confirmed	
SAR 8	2025-12-02	1082	2026-02-21	53.7	51.6	4.07	confirmed	1
SAR 8	2025-12-03	1082	2026-02-21	53.5	51.6	3.68	confirmed	

Note(s):

psPD value used the $p_{S_{tot}}$ avg value of test result plot.

10. Measured Power Density Results

Both Normal psPD and Total psPD are record in test results according to TCB workshop October 2018 note . But only Total psPD level are considered according to FCC requirement.

PD Measurement options for the PD verification test

The PD measurement test is time-consuming. Therefore, two options are recommened.

-.Option 1: hybrid approach using electromagnetic(EM) simulation in combination with the measurement as validation for PD characterization.

-.Option 2: Theoretical calculation based on the FCC mmW RF exposure requirement of 1mW/cm² over any 4cm² area.

Among two options, We choose option 1 (using electromagnetic(EM) simulation).

- PD is assessed for all bands and beams, the three channels, and identified surfaces of the EUT through the validated simulation approach in *QRD SAR Char and PD Char for Qualcomm® Smart Transmit, Using Combination of Simulation and Measurement* ('80-W2112-2).
- The QRD assessment is made against the *PD_design_target* to account for all design related uncertainties to determine the maximum input power for the beams.

Beam selection criteria for the PD verification test

- Select at least one single beam (antenna array config) per antenna type and module
 - The single beam containing highest number of active antenna ports.

Since the worst-case surface dictates the compliance, the PD measurement can be made only on the worst surfaces and for the worst channel as determined through EM simulations.

EM Simulation Results

Band	Position	Low			Mid			High			input.power. limit
		Beam ID 1	Beam ID 2	Sim.Value	Beam ID 1	Beam ID 2	Sim.Value	Beam ID 1	Beam ID 2	Sim.Value	
n261	Rear	19		1.425	19		1.447	19		1.422	3.6
	Rear		272	2.350		272	2.358		272	2.395	3.6
	Rear	19	275	3.943	19	275	3.924	19	275	3.911	1.4
	Left	19		0.847	19		0.850	19		0.724	1.8
	Left		269	1.038		268	1.163		268	1.219	-0.8
	Left	19	275	2.346	19	275	2.395	19	275	2.286	-0.8
n260	Rear	16		1.320	16		1.473	17		1.376	2.7
	Rear		275	1.095		275	1.134		273	1.039	2.7
	Rear	19	275	2.343	16	272	2.736	17	273	2.869	3.8
	Left	16		0.798	16		0.911	13		0.781	3.8
	Left		275	0.676		275	0.696		273	0.602	-0.2
	Left	12	268	1.526	12	268	1.527	12	268	1.675	0.2
n258	Rear	20		1.127	20		1.101	16		1.145	3.8
	Rear		271	1.843		276	1.942		276	2.067	1.2
	Rear	16	272	3.588	16	272	3.507	20	276	4.130	-1.1

Note(s):

The blue box represents the worst EM simulation values of among the channels for each bands.

Through this EM simulation, we can identify the worst-case surface, beam number, channel and determine the input.power.limit.
(Please refer to the Part.0 Report.)

Part.1 (sec.10.1~10.3) measured the Power Density measurements under these identified worst-case conditions.

10.1. NR Band n261 Test Results

Antenna	Dist. (mm)	Test Position	Freq. (MHz)	Ch.	Beam ID1	Beam ID2	input.power. limit (dBm)	Tested Signal	Duty Cycle	Power Drift	Normal psPD (mW/cm ²)	Total psPD (mW/cm ²)	Plot No.
					V	H					Meas.	Meas.	
V patch	2 mm	Rear	27924.96	Mid	19		3.6	CW	100.0%	0.00	0.502	0.562	1
	2 mm	Left	27924.96	Mid	19		3.6	CW	100.0%	0.08	0.210	0.317	
	2 mm	Rear	28299.96	High		272	1.4	CW	100.0%	0.02	0.352	0.465	
	2 mm	Left	28299.96	High		268	1.8	CW	100.0%	-0.09	0.217	0.257	
	2 mm	Rear	27550.08	Low	19	275	-0.8	CW	100.0%	-0.04	0.445	0.515	
	2 mm	Left	27924.96	Mid	19	275	-0.8	CW	100.0%	-0.02	0.165	0.253	

10.2. NR Band n260 Test Results

Antenna	Dist. (mm)	Test Position	Freq. (MHz)	Ch.	Beam ID1	Beam ID2	input.power. limit (dBm)	Tested Signal	Duty Cycle	Power Drift	Normal psPD (mW/cm ²)	Total psPD (mW/cm ²)	Plot No.
					V	H					Meas.	Meas.	
L patch	2 mm	Rear	38499.96	Mid	16		2.7	CW	100.0%	-0.02	0.300	0.401	
	2 mm	Left	38499.96	Mid	16		2.7	CW	100.0%	0.06	0.222	0.229	
	2 mm	Rear	38499.96	Mid		275	3.8	CW	100.0%	0.07	0.531	0.589	2
	2 mm	Left	38499.96	Mid		275	3.8	CW	100.0%	-0.04	0.121	0.183	
	2 mm	Rear	39949.92	High	17	273	-0.2	CW	100.0%	0.02	0.233	0.278	
	2 mm	Left	39949.92	High	12	268	0.2	CW	100.0%	0.06	0.189	0.216	

10.3. NR Band n258 Test Results

Antenna	Dist. (mm)	Test Position	Freq. (MHz)	Ch.	Beam ID1	Beam ID2	input.power. limit (dBm)	Tested Signal	Duty Cycle	Power Drift	Normal psPD (mW/cm ²)	Total psPD (mW/cm ²)	Plot No.
					V	H					Meas.	Meas.	
L patch	2 mm	Rear	25200.00	High	16		3.8	CW	100.0%	0.01	0.230	0.348	
	2 mm	Rear	25200.00	High		276	1.2	CW	100.0%	0.03	0.411	0.523	3
	2 mm	Rear	25200.00	High	20	276	-1.1	CW	100.0%	0.20	0.310	0.378	

Note(s):

1. $10 \text{ W/m}^2 = 1.0 \text{ mW/cm}^2$
2. PD_design_target of 0.724 mW/cm^2 was used with mmW device design related uncertainty of 1.4 dB.
3. $Input.power.limit$ parameter for 5G mmW NR radio was calculated in Power Density Part 0 test report.
4. The device was configured to transmit CW wave signal for testing. Additional testing was not evaluated for different modulations, RB configurations, component carriers, channel configurations since the smart transmit algorithm monitors powers on a per symbol basis, which is independent of these signal characteristics.

11. TER(Total Exposure Ratio) Conditions

Per FCC guidance for devices enabled with Qualcomm® Smart Transmit feature, simultaneous transmission analysis is evaluated by combining the exposure the NFC/UWB antenna.

The simultaneous transmission scenario for 5G mmW NR FR2, NFC/UWB antenna. Is evaluated under the Total Exposure Ratio (TER).

Exposure scaling for mmW radios

i. On the worst-case surface/position (dominant): PD exposure should correspond to reported input.power.limit, i.e., PD exposure should be equal to $Reported\_psPD = (PD\_design\_target + device\ uncertainty)$ if at least one beam has input.power.limit $\leq$ NV setting Pmax, PD exposure should be equal to PD design target.

ii. For all other surfaces/positions (non-dominant): it is exposure ratio (of evaluated surface/position to worst-case surface/position for a given Tx Power) multiplied by scaled PD exposure on the worst-case surface as computed above.

Note: If manufacturer applies Permanent back-off, it is reflected in $Reported\ psPD$ (PD design_target + device uncertainty). The formula is as follows;

$$Reported\_psPD = (PD\_design\_target + device\ uncertainty) \times 10^{(-Permanent\ back-off\ in\ dB/10)}$$

Permanent back-off is mentioned in the PD Part.0 report.

PD(Reported psPD) ER for TER analysis – 2mm

Antenna	NR Band	Surface	Evaluation Distance (mm)	Adjustment Factor due to Simulation	Adjusted Reported psPD (mW/cm2)	Measured psPD (mW/cm2)	Final Reported psPD (mW/cm2)
Ant.M L patch	n258	Rear	2	1.000	0.933	0.523	0.933
	n258	Front	2	0.103	0.096	-	0.096
	n258	Top	2	0.284	0.265	-	0.265
	n258	Left	2	0.575	0.536	-	0.536
	n258	Bottom	2	0.027	0.025	-	0.025
	n258	Right	2	0.191	0.178	-	0.178
	n261	Rear	2	1.000	0.933	0.562	0.933
	n261	Front	2	0.124	0.116	-	0.116
	n261	Top	2	0.307	0.286	-	0.286
	n261	Left	2	0.610	0.569	0.317	0.569
	n261	Bottom	2	0.034	0.032	-	0.032
	n261	Right	2	0.079	0.074	-	0.074
	n260	Rear	2	1.000	0.933	0.589	0.933
	n260	Front	2	0.064	0.060	-	0.060
	n260	Top	2	0.370	0.345	-	0.345
	n260	Left	2	0.723	0.675	0.229	0.675
	n260	Bottom	2	0.026	0.024	-	0.024
	n260	Right	2	0.071	0.066	-	0.066

Note(s):

1. Reported psPD was calculated by reflecting Permanent back-off (0.3dB) according to Part.0 report.
2. The 'Final reported psPD' results was applied to the TER evaluation with a higher value by comparing the measured psPD result to the adjusted psPD result.

PD(Reported psPD) ER for TER analysis (Continued) – 5mm

Antenna	NR Band	Surface	Evaluation Distance (mm)	Adjustment Factor due to Simulation	Adjusted Reported psPD (mW/cm ²)	Final Reported psPD (mW/cm ²)
Ant.M L patch	n258	Rear	5	0.849	0.792	0.792
	n258	Front	5	0.056	0.052	0.052
	n261	Rear	5	0.856	0.799	0.799
	n261	Front	5	0.061	0.057	0.057
	n260	Rear	5	0.841	0.785	0.785
	n260	Front	5	0.049	0.046	0.046

PD(Reported psPD) ER for TER analysis – 10mm

Antenna	NR Band	Surface	Evaluation Distance (mm)	Adjustment Factor due to Simulation	Adjusted Reported psPD (mW/cm ²)	Final Reported psPD (mW/cm ²)
Ant.M L patch	n258	Rear	10	0.675	0.630	0.630
	n258	Front	10	0.039	0.036	0.036
	n258	Top	10	0.179	0.167	0.167
	n258	Left	10	0.276	0.258	0.258
	n258	Bottom	10	0.022	0.021	0.021
	n258	Right	10	0.161	0.150	0.150
	n261	Rear	10	0.670	0.625	0.625
	n261	Front	10	0.029	0.027	0.027
	n261	Top	10	0.210	0.196	0.196
	n261	Left	10	0.290	0.271	0.271
	n261	Bottom	10	0.026	0.024	0.024
	n261	Right	10	0.056	0.052	0.052
	n260	Rear	10	0.651	0.607	0.607
	n260	Front	10	0.033	0.031	0.031
	n260	Top	10	0.247	0.230	0.230
	n260	Left	10	0.294	0.274	0.274
	n260	Bottom	10	0.025	0.023	0.023
	n260	Right	10	0.065	0.061	0.061

Note(s):

Reported psPD was calculated by reflecting Permanent back-off (0.3dB) according to Part.0 report.

Head (DSI=1) exposure Analysis**PD + ER summation results**

RF exposure	Test position	PD	Test position	UWB	
		Adjusted psPD		Measured SAR	
Head	Front	0.116	Head All	0.008	
	Test position	Adjusted ER	Test position	Measured ER	PD + ER
	Front	0.116	Head All	0.005	0.121

Body-worn & Hotspot (DSI=0) exposure Analysis**PD + ER summation results**

RF exposure	Test position	PD	UWB	
		Adjusted psPD	Measured SAR	
Body-worn & Hotspot	Rear	0.799	0.000	
	Front	0.057	0.008	
	Top	0.230		
	Left	0.274	0.002	
	Bottom	0.024		
	Right	0.150		
	Test position	Adjusted ER	Measured ER	PD + ER
	Rear	0.799	0.000	0.799
	Front	0.057	0.005	0.062
	Top	0.230	0.000	0.230
	Left	0.274	0.001	0.275
	Bottom	0.024	0.000	0.024
	Right	0.150	0.000	0.150

Note(s):

PD TER calculation of Head/Body-worn/Hotspot performed with ER (UWB).
Additional evaluation is not required due to below TER limit

Product Specific 10-g (DSI=0) exposure Analysis**PD + ER summation results**

RF exposure	Test position	PD	NFC	UWB	
		Adjusted psPD	Measured SAR	Measured SAR	
Product Specific 10-g	Rear	0.933	0.019	0.000	
	Front	0.116	0.000	0.000	
	Top	0.345	0.000		
	Left	0.675	0.000	0.000	
	Bottom	0.032			
	Right	0.178			
	Test position	Adjusted ER	Measured ER	Measured ER	PD + ER
	Rear	0.933	0.005	0.000	0.938
	Front	0.116	0.000	0.000	0.116
	Top	0.345	0.000	0.000	0.345
	Left	0.675	0.000	0.000	0.675
	Bottom	0.032	0.000	0.000	0.032
	Right	0.178	0.000	0.000	0.178

Note(s):

PD TER calculation of Product Specific 10-g performed with ER (NFC & UWB).
Additional evaluation is not required due to below TER limit.

Conclusion

Simultaneous transmission analysis results is satisfied the FCC TER limit requirement (1.0).

Appendixes

Refer to separated files for the following appendixes.

S-4791921958-S2 FCC Report PD_App A_Photos & Ant. Locations

S-4791921958-S2 FCC Report PD_App B_Highest PD test Plots

S-4791921958-S2 FCC Report PD_App C_System Check Plots

S-4791921958-S2 FCC Report PD_App D_Probe Cal. Certificates

S-4791921958-S2 FCC Report PD_App E_Source Cal. Certificates

END OF REPORT